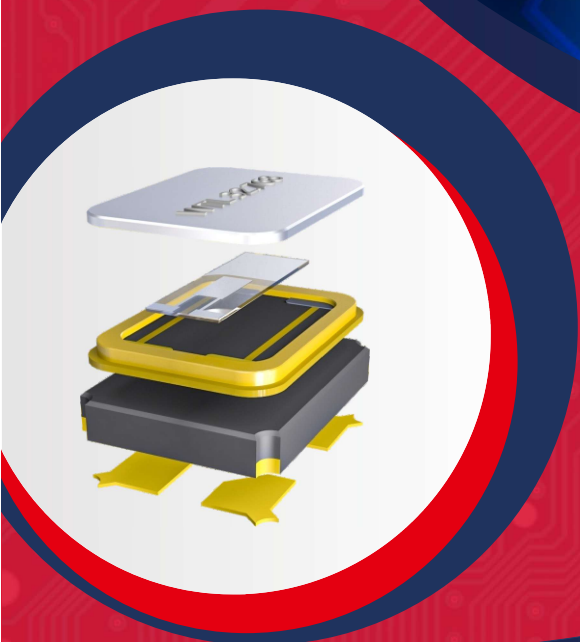


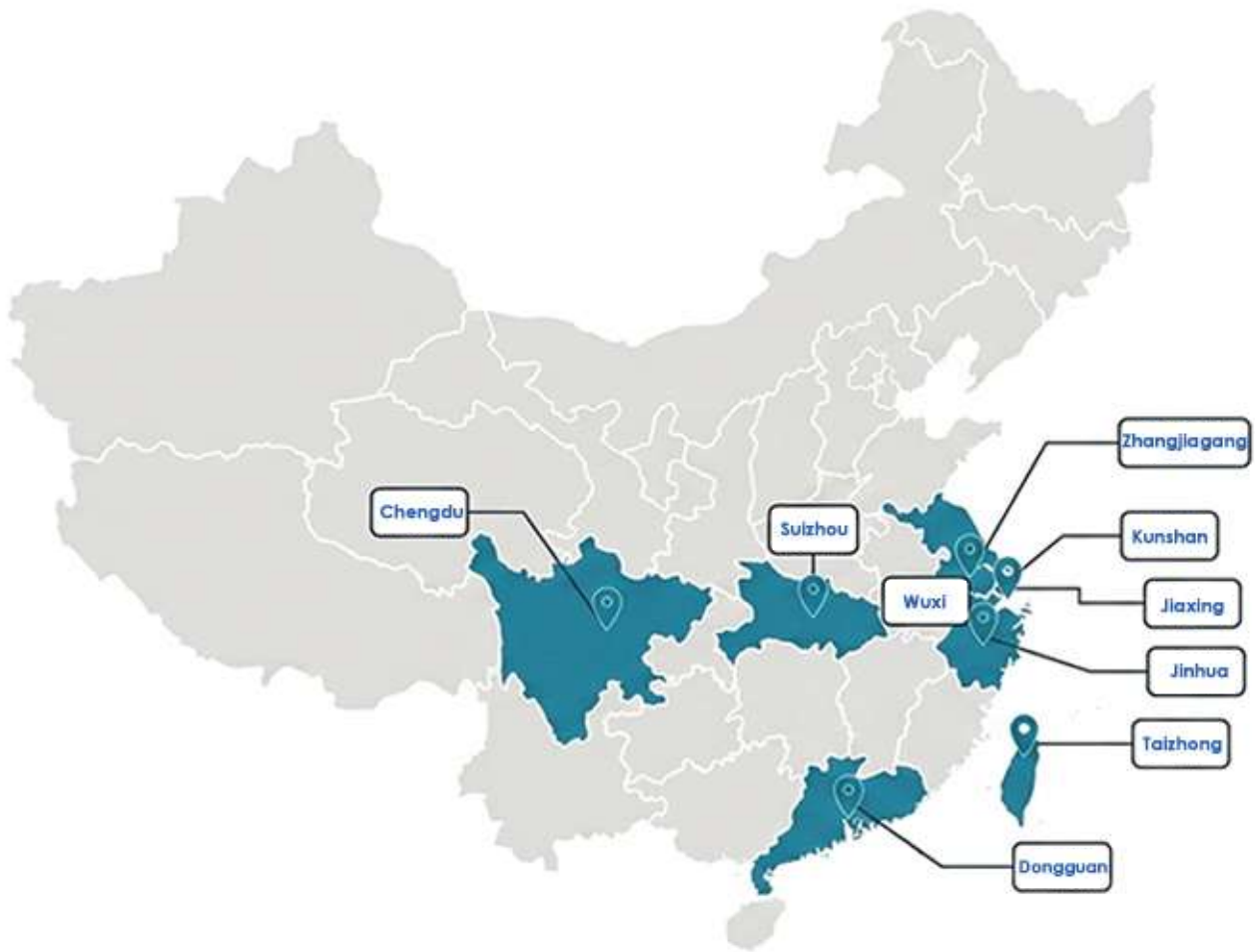


*Quartz Crystal  
Always WTL*

Edition 7



# Manufacturing Footprint Map



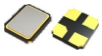
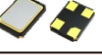
WTL has deeply established its expertise in electronic components, with five production bases strategically located across nine cities in five provinces in China. Our facilities are situated in key industrial hubs across South China, East China, Central China, Southwest China, as well as Taiwan, leveraging a coordinated multi-base production network to integrate a full spectrum of product resources.

Backed by a well-structured production layout and robust supply chain capabilities, WTL offers a comprehensive product portfolio, complete specifications, and ample production capacity. We are fully equipped to meet diverse industry needs and application scenarios through one-stop procurement and customized solutions, while delivering stable, diversified, and end-to-end integrated solutions to our customers.

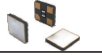
***Rooted in China, Serving the Globe***



## Quartz Crystal

| Page | Series | Dimension(mm)                  | Frequency     | PAD | Picture                                                                             |
|------|--------|--------------------------------|---------------|-----|-------------------------------------------------------------------------------------|
| 1    | TX9    | 1.2 x 1.0 x 0.33               | 32MHz-96MHz   | 4   |  |
| 2    | TX8    | 1.6 x 1.2 x 0.35               | 20MHz-66MHz   | 4   |  |
| 3    | TX1    | 2.0 x 1.6 x 0.5                | 16MHz-96MHz   | 4   |  |
| 4    | TX2    | 2.5 x 2.0 x 0.55               | 12MHz-54MHz   | 4   |  |
| 5    | TX3    | 3.2 x 2.5 x 0.7                | 8MHz-104MHz   | 4   |  |
| 6    | TX5    | 5.0 x 3.2 x 0.9                | 8MHz-100MHz   | 4   |  |
| 7    | TX7    | 7.0 x 5.0 x 1.1                | 6MHz-110MHz   | 4   |  |
| 8    | TG5    | 5.0 x 3.2 x 1.2                | 8MHz-80MHz    | 2   |  |
| 9    | WX6    | HC-49S<br>11.05 x 4.7 x 3.68   | 3.2MHz-100MHz | 2   |  |
| 10   | WX7    | HC-49S SMD<br>12.7 x 4.8 x 3.8 | 3.2MHz-100MHz | 2   |  |

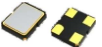
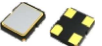
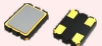
## Thermistor Quartz Crystal

| Page | Series | Dimension(mm)    | Frequency               | PAD | Picture                                                                               |
|------|--------|------------------|-------------------------|-----|---------------------------------------------------------------------------------------|
| 11   | TR8    | 1.6 x 1.2 x 0.65 | 26-76.8MHz              | 4   |  |
| 12   | TR1    | 2.0 x 1.6 x 0.65 | 19.2MHz, 26MHz, 38.4MHz | 4   |  |
| 13   | TR2    | 2.5 x 2.0 x 1.0  | 19.2MHz, 26MHz          | 4   |  |

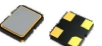
## Tuning fork Crystal

| Page | Series | Dimension(mm)    | Frequency    | PAD | Picture                                                                               |
|------|--------|------------------|--------------|-----|---------------------------------------------------------------------------------------|
| 14   | TS7    | 1.2 x 1.0 x 0.5  | 32.768kHz    | 2   |  |
| 15   | TS8    | 1.6 x 1.0 x 0.5  | 32.768kHz    | 2   |  |
| 16   | TS9    | 2.0 x 1.2 x 0.6  | 32.768kHz    | 2   |  |
| 17   | WX1    | 3.2 x 1.5 x 0.75 | 32.768kHz    | 2   |  |
| 18   | WX3    | 3.8 x 8.0 x 2.5  | 30kHz-350kHz | 4   |  |
| 19   | WX4    | 6.9 x 1.4 x 1.3  | 32.768kHz    | 4   |  |
| 20   | WX2    | Φ2 x 6           | 30kHz-350kHz | 2   |  |
| 21   | WT8    | Φ3 x 8           | 30kHz-350kHz | 2   |  |
| 22   | WA4    | Φ2 x 6/SMD       | 32.768kHz    | 2   |  |
| 23   | WX8    | Φ2 x 6 /SMD      | 30kHz-350kHz | 2   |  |

## Crystal Oscillator(CMOS)

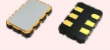
| Page | Series | Dimension(mm)     | Frequency                                              | PAD | Picture                                                                               |
|------|--------|-------------------|--------------------------------------------------------|-----|---------------------------------------------------------------------------------------|
| 24   | TK2    | 2.5 x 2.0 x 0.81  | 32.768kHz                                              | 4   |    |
| 25   | TK3    | 3.2 x 2.5 x 0.95  | 32.768kHz                                              | 4   |    |
| 26   | TK4    | 2.5 x 2.0 x 0.81  | 32.768kHz<br>Low Current Consumption                   | 4   |    |
| 27   | TK5    | 3.2 x 2.5 x 0.95  | 32.768kHz<br>Low Current Consumption                   | 4   |    |
| 28   | Tc8    | 1.6x 1.2 x 0.8    | 2.0MHz-80.0MHz                                         | 4   |    |
| 29   | TC1    | 2.0 x 1.6 x 0.75  | 1.5MHz-50MHz                                           | 4   |    |
| 30   | TC2    | 2.5 x 2.0 x 0.81  | 1.25MHz-125MHz                                         | 4   |    |
| 31   | TC3    | 3.2 x 2.5 x 0.95  | 1.25MHz-125MHz                                         | 4   |    |
| 32   | TC5    | 5.0 x 3.2 x 1.2   | 13.7kHz-160MHz                                         | 4   |    |
| 33   | TC7    | 7.0 x 5.0 x 1.3   | 13.7kHz-166MHz                                         | 4   |    |
| 34   | TU2    | 2.5 x 2.0 x 0.81  | 1MHz-50MHz<br>Ultra Low Power                          | 4   |    |
| 35   | TU3    | 3.2 x 2.5 x 0.95  | 1MHz-50MHz<br>Ultra Low Power                          | 4   |  |
| 36   | TW2    | 2.5 x 2.0 x 0.81  | 1.25MHz-100MHz<br>Extended Operating Temperature Range | 4   |  |
| 37   | TW3    | 3.2 x 2.5 x 0.95  | 1.25MHz-100MHz<br>Extended Operating Temperature Range | 4   |  |
| 38   | TN2    | 2.5 x 2.0 x 0.81  | 20MHz-60MHz<br>Ultra Low Noise                         | 4   |  |
| 39   | TN3    | 3.2 x 2.5 x 0.95  | 20MHz-60MHz<br>Ultra Low Noise                         | 4   |  |
| 40   | LO1    | 20.8 x 12.46 x 5  | 0.25MHz-180MHz                                         | 4   |  |
| 41   | LO2    | 12.46 x 12.46 x 5 | 0.25MHz-180MHz                                         | 4   |  |

## FASTXO Crystal Oscillator(CMOS)

| Page | Series | Dimension(mm)      | Frequency                        | PAD | Picture                                                                               |
|------|--------|--------------------|----------------------------------|-----|---------------------------------------------------------------------------------------|
| 42   | TB1    | 2.05 x 1.65 x 0.75 | 1MHz-200MHz                      | 4   |  |
| 43   | TB2    | 2.5 x 2.0 x 0.81   | 1MHz-200MHz                      | 4   |  |
| 44   | TB3    | 3.2 x 2.5 x 0.95   | 1MHz-200MHz                      | 4   |  |
| 45   | TB5    | 5.0 x 3.2 x 1.2    | 1MHz-200MHz                      | 4   |  |
| 46   | TB7    | 7.0 x 5.0 x 1.3    | 1MHz-200MHz                      | 4   |  |
| 47   | TL2    | 3.2 x 2.5 x 0.90   | 10MHz-250MHz<br>Low Phase Jitter | 6   |  |
| 48   | TL4    | 5.0 x 3.2 x 1.25   | 10MHz-250MHz<br>Low Phase Jitter | 6   |  |
| 49   | TL6    | 7.0 x 5.0 x 1.45   | 10MHz-250MHz<br>Low Phase Jitter | 6   |  |



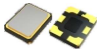
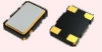
## Crystal Oscillator(LVPECL/LVDS/HCSL/CML)

| Page | Series | Dimension(mm)    | Frequency                              | PAD | Picture                                                                             |
|------|--------|------------------|----------------------------------------|-----|-------------------------------------------------------------------------------------|
| 50   | TL3    | 3.2 x 2.5 x 0.90 | 10MHz-1500MHz                          | 6   |  |
| 51   | TL5    | 5.0 x 3.2 x 1.25 | 10MHz-1500MHz                          | 6   |  |
| 52   | TL7    | 7.0 x 5.0 x 1.45 | 10MHz-1500MHz                          | 6   |  |
| 53   | TP3    | 3.2 x 2.5 x 0.90 | 10MHz-250MHz<br>Low Phase Jitter       | 6   |  |
| 54   | TP5    | 5.0 x 3.2 x 1.25 | 10MHz-320MHz<br>Low Phase Jitter       | 6   |  |
| 55   | TP7    | 7.0 x 5.0 x 1.45 | 10MHz-320MHz<br>Low Phase Jitter       | 6   |  |
| 56   | TN7    | 7.0 x 5.0 x 1.45 | 70MHz-170MHz<br>Ultra Low Phase Jitter | 6   |  |
| 57   | TQ7    | 7.0 x 5.0 x 1.45 | 25MHz-75MHz<br>HCSL                    | 6   |  |

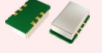
## VCXO

| Page | Series | Dimension(mm)                          | Frequency                                             | PAD | Picture                                                                               |
|------|--------|----------------------------------------|-------------------------------------------------------|-----|---------------------------------------------------------------------------------------|
| 58   | PV3    | 3.2 x 2.5 x 0.9                        | 10MHz-250MHz                                          | 6   |  |
| 59   | PV5    | 5.0 x 3.2 x 1.25                       | 10MHz-250MHz                                          | 6   |  |
| 60   | PV7    | 7.0 x 5.0 x 1.75                       | 10MHz-250MHz                                          | 6   |  |
| 61   | PL3    | 3.2 x 2.5 x 0.9                        | 10MHz-1500MHz<br>Differential Output                  | 6   |  |
| 62   | PL5    | 5.0 x 3.2 x 1.25                       | 10MHz-1500MHz<br>Differential Output                  | 6   |  |
| 63   | PL7    | 7.0 x 5.0 x 1.75                       | 10MHz-1500MHz<br>Differential Output                  | 6   |  |
| 64   | CL5    | 5.0 x 3.2 x 1.25                       | 30MHz-250MHz<br>Low Phase Jitter                      | 6   |  |
| 65   | CL7    | 7.0 x 5.0 x 1.75                       | 1.5MHz-200MHz<br>Low Phase Jitter                     | 6   |  |
| 66   | CV5    | 5.0 x 3.2 x 1.25                       | 1.5MHz-170MHz<br>Extended Operating Temperature Range | 6   |  |
| 67   | CV7    | 7.0 x 5.0 x 1.75                       | 1.5MHz-170MHz<br>Extended Operating Temperature Range | 6   |  |
| 68   | CV8    | 14.2 x 9.3 x 5.4                       | 30MHz-250MHz                                          | 6   |  |
| 69   | LV1    | 20.3 x 12.6 x 5.0<br>12.6 x 12.6 x 5.0 | 1MHz-80MHz                                            | 4   |  |
| 70   | LV2    | 13.9 x 9.1 x 3.6                       | 50MHz-125MHz                                          | 4   |  |

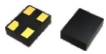
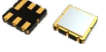
## TCXO/VCTCXO

| Page | Series | Dimension(mm)     | Frequency                                               | PAD | Picture                                                                               |
|------|--------|-------------------|---------------------------------------------------------|-----|---------------------------------------------------------------------------------------|
| 71   | VC1    | 2.0 x 1.6 x 0.7   | 10MHz-52MHz                                             | 4/6 |    |
| 72   | VC2    | 2.5 x 2.0 x 0.7   | 10MHz-52MHz                                             | 4   |    |
| 73   | VC3    | 3.2 x 2.5 x 0.9   | 10MHz-52MHz                                             | 4   |    |
| 74   | VC5    | 5.0 x 3.2 x 1.1   | 10MHz-52MHz                                             | 4   |    |
| 75   | VC7    | 7.0 x 5.0 x 1.9   | 5MHz-52MHz                                              | 4   |    |
| 76   | VC8    | 14.3 x 8.7 x 4.9  | 5MHz-40MHz                                              | 6   |    |
| 77   | VP3    | 3.2 x 2.5 x 1.6   | 10MHz-1500MHz<br>High Frequency Temperature Compensated | 6   |    |
| 78   | VW5    | 5.0 x 3.2 x 1.55  | 10MHz-52MHz<br>High Precision                           | 4   |    |
| 79   | VA7    | 7.0 x 5.0 x 1.9   | 5MHz-52MHz<br>High Precision                            | 4   |    |
| 80   | VS7    | 7.0 x 5.0 x 1.9   | 5MHz-52MHz<br>Stratum 3                                 | 4   |   |
| 81   | VT7    | 7.0 x 5.0 x 1.9   | 10MHz-52MHz<br>High Precision and High Temperature      | 4   |  |
| 82   | VF2    | 20.4 x 12.8 x 7.8 | 10MHz-52MHz                                             | 4   |  |
| 83   | WT1    | 18.5x12 to 91x56  | 1MHz-1500MHz                                            | 4/5 |  |

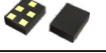
## OCXO

| Page | Series | Dimension(mm)      | Frequency                                         | PAD | Picture                                                                               |
|------|--------|--------------------|---------------------------------------------------|-----|---------------------------------------------------------------------------------------|
| 84   | OC9    | 9.7 x 7.5 x 4.1    | 10MHz-40MHz                                       | 4   |  |
| 85   | OC8    | 14.3 x 9.3 x 6.5   | 10MHz-40MHz                                       | 6   |  |
| 86   | OCH    | 20.3 x 12.7 x 11.0 | 5MHz-40MHz                                        | 4   |  |
| 87   | OCW    | 20.6 x 20.6 x 11.0 | 5MHz-40MHz                                        | 5   |  |
| 88   | OSD    | 25.4 x 22.1 x 11.0 | 5MHz-40MHz                                        | 7   |  |
| 89   | OLH    | 25.4 x 25.4 x 12.7 | 5MHz-40MHz                                        | 5   |  |
| 90   | OCN    | 25.4 x 25.4 x 12.7 | 10MHz-40MHz<br>Low Phase Noise, Low G-Sensitivity | 5   |  |
| 91   | OSH    | 36.3 x 27.2 x 12.7 | 5MHz-40MHz                                        | 5   |  |
| 92   | OCD    | 36.3 x 27.2 x 18.7 | 10MHz<br>DOCXO                                    | 5   |  |

## SAW Resonator

| Page | Series | Dimension(mm)    | Frequency      | PAD | Picture                                                                             |
|------|--------|------------------|----------------|-----|-------------------------------------------------------------------------------------|
| 93   | SR1    | 2.0 x 1.6 x 1.0  | 154MHz-1000MHz | 4   |  |
| 94   | SR3    | 3.0 x 3.0 x 1.25 | 154MHz-1000MHz | 6   |  |
| 95   | SR4    | 3.8 x 3.8 x 1.5  | 154MHz-1000MHz | 6   |  |
| 96   | SR5    | 5.0 x 5.0 x 1.5  | 154MHz-1000MHz | 8   |  |
| 97   | SR6    | 5.0 x 3.5 x 1.4  | 154MHz-1000MHz | 4   |  |

## SAW Filter

| Page | Series | Dimension(mm)    | Frequency      | PAD | Picture                                                                               |
|------|--------|------------------|----------------|-----|---------------------------------------------------------------------------------------|
| 98   | SF0    | 1.1 x 0.9 x 0.5  | 800MHz-2605MHz | 5   |    |
| 99   | SF1    | 1.4 x 1.1 x 0.6  | 800MHz-2605MHz | 5   |    |
| 100  | SF2    | 2.0 x 1.5 x 0.6  | 800MHz-2605MHz | 4   |   |
| 101  | SF3    | 3.0 x 3.0 x 1.25 | 300MHz-2605MHz | 6   |  |
| 102  | SF4    | 3.8 x 3.8 x 1.5  | 100MHz-1000MHz | 6   |  |
| 103  | SF5    | 5.0 x 5.0 x 1.5  | 100MHz-1000MHz | 8   |  |

## Dielectric Antenna

| Page | Series | Dimension(mm)                  | Frequency         | PAD | Picture                                                                               |
|------|--------|--------------------------------|-------------------|-----|---------------------------------------------------------------------------------------|
| 104  | DA1    | 10 x 10 to 45 x 45             | 1568/1575/1590MHz | -   |  |
| 105  | DA2    | 8 x 8 to 25 x 25               | 1568/1575/1590MHz | -   |  |
| 106  | DA3    | 12 x 12 to 25 x 25             | BDS-B1/GPS-L1     | -   |  |
| 107  | DA4    | 43 x 37 x 13.6<br>61 x 61 x 18 | BDS-B1/GPS-L1     | -   |  |
| 108  | DA5    | Φ6 X 5 to 30 x 30              | 915MHz/5810MHz    | -   |  |

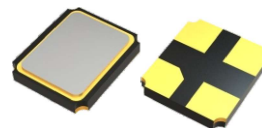


## SMD Seam Sealed Crystals

### 1.2×1.0×0.33 mm

#### Feature

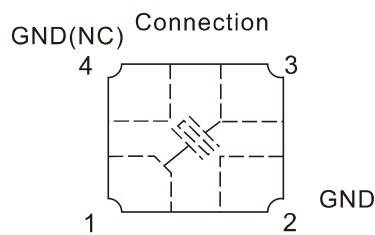
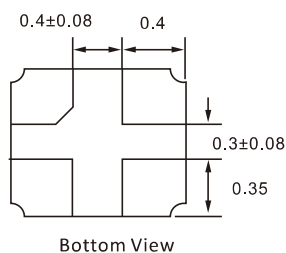
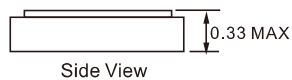
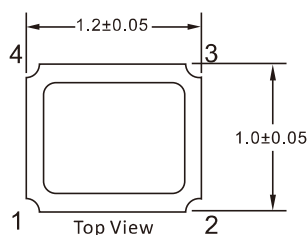
- Size 1.2 × 1.0, ultra miniature and lightweight SMD crystal with a low profile of 0.33mm
- Seam with vacuum Sealed for Ultra-small size
- High precision and high reliability
- Automatic mounting is possible
- Reflow is possible
- RoHS Compliant / Pb Free



#### Electrical Specifications

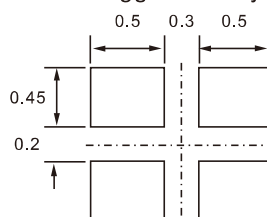
| Item                                                 | Specifications             |       |
|------------------------------------------------------|----------------------------|-------|
| Frequency Range(MHz)                                 | 32~40                      | 40~96 |
| Mode                                                 | AT/Fundamental             |       |
| Load Capacitance (CL)                                | 8pF, 10pF, 12pF or Specify |       |
| Frequency Tolerance( at 25°C )                       | ±10ppm~±30ppm or specify   |       |
| Operating Temperature Range                          | -20~+70°C or Specify       |       |
| Frequency Stability Over Operating Temperature Range | ±10ppm ~ ±30ppm or specify |       |
| Equivalent Series Resistance (ESR) max.              | 150Ω                       | 100Ω  |
| Storage Temperature Range                            | -55~+125°C                 |       |
| Shunt Capacitance( C <sub>0</sub> )                  | 3pF Max                    |       |
| Drive Level (Typical)                                | 50μW max                   |       |
| Aging @25°C 1st Year (Max)                           | ±2 ppm, ±5ppm              |       |

#### Dimension(mm)



# 4pin connect to GND.NC is Open

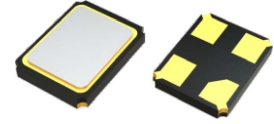
#### Suggested Layout



## SMD Seam Sealed Crystals 1.6×1.2×0.35 mm

### Feature

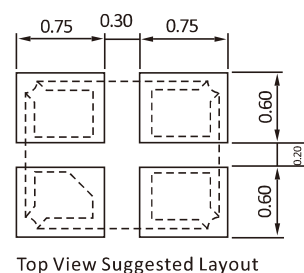
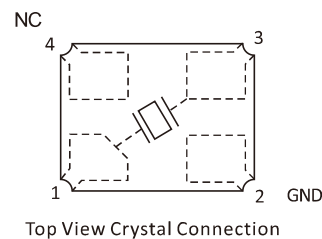
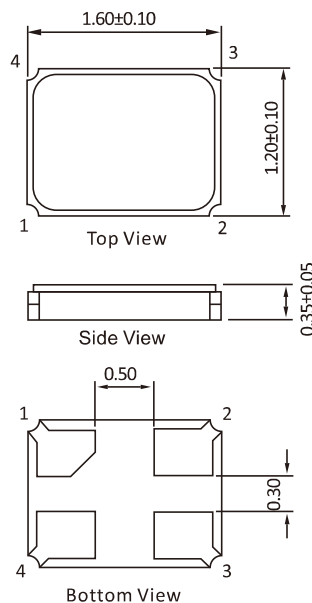
- Size 1.6 × 1.2 , Ultra thin , thickness 0.35mm
- High precision and high frequency stability
- Designed for automatic mounting and reflow soldering
- RoHS Compliant /Pb Free



### Electrical Specifications

| Item                                                 | Specifications             |       |       |
|------------------------------------------------------|----------------------------|-------|-------|
| Frequency Range(MHz)                                 | 20~24                      | 24~30 | 30~66 |
| Mode                                                 | AT/Fundamental             |       |       |
| Load Capacitance (CL)                                | 8pF, 10pF, 12pF or Specify |       |       |
| Frequency Tolerance( at 25°C )                       | ±10ppm~±30ppm or specify   |       |       |
| Operating Temperature Range                          | -20~+70°C or Specify       |       |       |
| Frequency Stability Over Operating Temperature Range | ±10ppm ~ ±30ppm or specify |       |       |
| Equivalent Series Resistance (ESR) max.              | 150Ω                       | 100Ω  | 80Ω   |
| Storage Temperature Range                            | -55~+125°C                 |       |       |
| Shunt Capacitance( C <sub>0</sub> )                  | 3pF Max                    |       |       |
| Drive Level (Typical)                                | 1 ~ 200μW (50μW typical)   |       |       |
| Aging @25 °C 1st Year (Max)                          | ±3 ppm/year                |       |       |

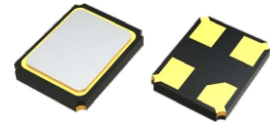
### Dimension(mm)



## SMD Seam Sealed Crystals 2.0×1.6×0.5 mm

### Feature

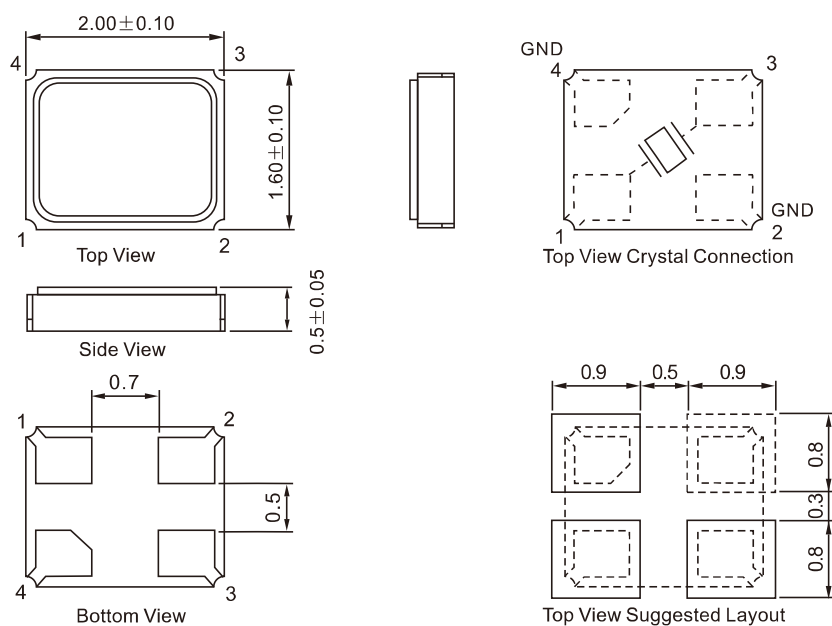
- Size 2.0 × 1.6 , Ultra thin , thickness 0.5mm
- High precision and high frequency stability
- Excellent heat resistance and environmental characteristics
- Designed for automatic mounting and reflow soldering
- RoHS Compliant / Pb Free



### Electrical Specifications

| Item                                                 | Specifications             |         |       |
|------------------------------------------------------|----------------------------|---------|-------|
| Frequency Range(MHz)                                 | 16~19.2                    | 19.2~30 | 30~96 |
| Mode                                                 | AT/Fundamental             |         |       |
| Load Capacitance (CL)                                | 8pF, 10pF, 12pF or Specify |         |       |
| Frequency Tolerance( at 25°C )                       | ±10ppm ~ ±30ppm or specify |         |       |
| Operating Temperature Range                          | -20~+70°C or Specify       |         |       |
| Frequency Stability Over Operating Temperature Range | ±10ppm ~ ±30ppm or specify |         |       |
| Equivalent Series Resistance (ESR) max.              | 200Ω                       | 100Ω    | 80Ω   |
| Storage Temperature Range                            | -55~+125°C                 |         |       |
| Shunt Capacitance( C <sub>0</sub> )                  | 3pF Max                    |         |       |
| Drive Level (Typical)                                | 1 ~ 200μW (50μW typical)   |         |       |
| Aging @25°C 1st Year (Max)                           | ±3 ppm/year                |         |       |

### Dimension(mm)

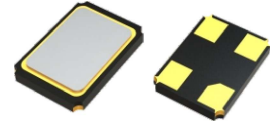


## SMD Seam Sealed Crystals

### 2.5×2.0×0.55 mm

#### Feature

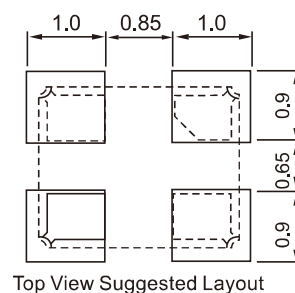
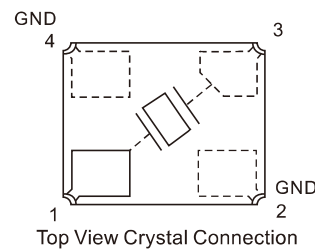
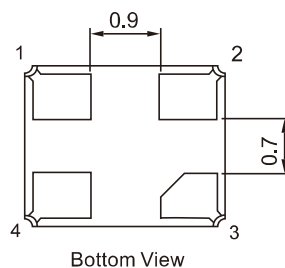
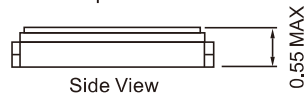
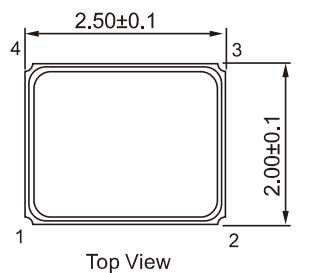
- Size 2.5 × 2.0 , Ultra thin , thickness 0.55mm
- High precision and high frequency stability
- Excellent heat resistance and environmental characteristics
- Designed for automatic mounting and reflow soldering
- RoHS Compliant / Pb Free



#### Electrical Specifications

| Item                                                 | Specifications             |       |
|------------------------------------------------------|----------------------------|-------|
| Frequency Range(MHz)                                 | 12~24                      | 24~54 |
| Mode                                                 | AT/Fundamental             |       |
| Load Capacitance (CL)                                | 8pF, 10pF, 12pF or Specify |       |
| Frequency Tolerance( at 25°C )                       | ±10ppm ~ ±30ppm or specify |       |
| Operating Temperature Range                          | -20~+70°C or Specify       |       |
| Frequency Stability Over Operating Temperature Range | ±10ppm ~ ±50ppm or specify |       |
| Equivalent Series Resistance (ESR) max.              | 80Ω                        | 60Ω   |
| Storage Temperature Range                            | -55~+125°C                 |       |
| Shunt Capacitance( C <sub>0</sub> )                  | 3pF Max                    |       |
| Drive Level (Typical)                                | 1 ~100 μW (10μW typical)   |       |
| Aging @ 25°C 1st Year (Max)                          | ±3 ppm/year                |       |

#### Dimension(mm)

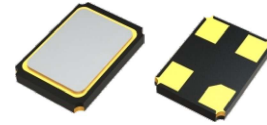




## SMD Seam Sealed Crystals 3.2×2.5×0.7 mm

### Feature

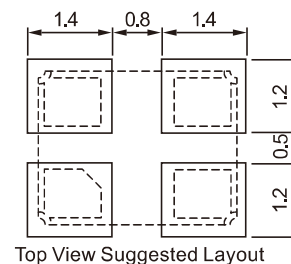
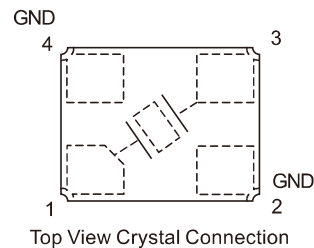
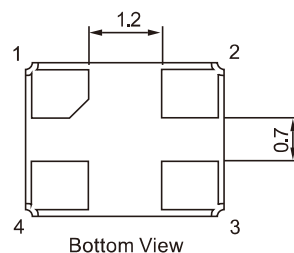
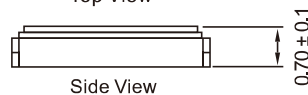
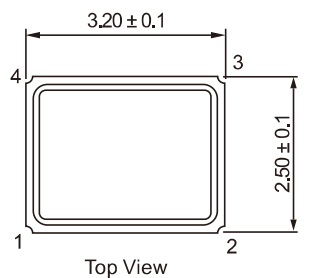
- Size 3.2×2.5, Ultra thin , thickness 0.7mm
- High precision and high frequency stability
- Excellent heat resistance and environmental characteristics
- Designed for automatic mounting and reflow soldering
- RoHS Compliant /Pb Free



### Electrical Specifications

| Item                                                 | Specifications                               |       |        |
|------------------------------------------------------|----------------------------------------------|-------|--------|
| Frequency Range(MHz)                                 | 8~10                                         | 10~24 | 24~104 |
| Mode                                                 | AT/Fundamental                               |       |        |
| Load Capacitance (CL)                                | 8pF, 9pF, 10pF, 12pF, 18pF, 20pF, or Specify |       |        |
| Frequency Tolerance( at 25°C )                       | ±10ppm ~ ±30ppm or specify                   |       |        |
| Operating Temperature Range                          | -20~+70°C or Specify                         |       |        |
| Frequency Stability Over Operating Temperature Range | ±10ppm ~ ±30ppm or specify                   |       |        |
| Equivalent Series Resistance (ESR) max.              | 200Ω                                         | 80Ω   | 60Ω    |
| Storage Temperature Range                            | -55~+125°C                                   |       |        |
| Shunt Capacitance( C0 )                              | 3pF Max                                      |       |        |
| Drive Level (Typical)                                | 1~ 100 μW (50μW typical)                     |       |        |
| Aging @25°C 1st Year (Max)                           | ±3 ppm/year max                              |       |        |

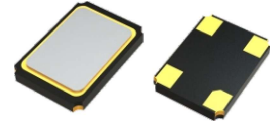
### Dimension(mm)



## SMD Seam Sealed Crystals 5.0×3.2×0.9 mm

### Feature

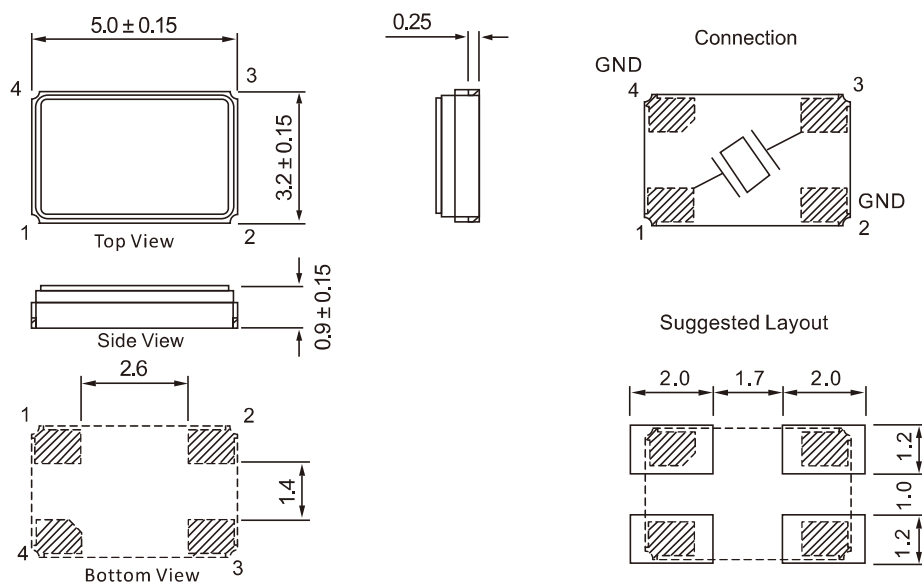
- Size 5.0×3.2, thickness 0.9mm
- High precision and high frequency stability
- Excellent heat resistance and environmental characteristics
- Designed for automatic mounting and reflow soldering
- RoHS Compliant / Pb Free



### Electrical Specifications

| Item                                                 | Specifications                    |       |        |        |
|------------------------------------------------------|-----------------------------------|-------|--------|--------|
| Frequency Range(MHz)                                 | 8~12                              | 12~48 | 40~60  | 60~100 |
| Mode                                                 | AT/Fundamental                    |       | AT/3RD |        |
| Load Capacitance (CL)                                | 8pF, 16pF, 20pF, 30pF, or Specify |       |        |        |
| Frequency Tolerance( at 25°C )                       | ±10ppm ~ ±30ppm or specify        |       |        |        |
| Operating Temperature Range                          | -20~+70°C or Specify              |       |        |        |
| Frequency Stability Over Operating Temperature Range | ±10ppm ~ ±30ppm or specify        |       |        |        |
| Equivalent Series Resistance (ESR) max.              | 60Ω                               | 45Ω   | 120Ω   | 80Ω    |
| Storage Temperature Range                            | -55~+125°C                        |       |        |        |
| Shunt Capacitance( C <sub>0</sub> )                  | 5pF Max                           |       |        |        |
| Drive Level (Typical)                                | 1 ~ 100 μW (10μW typical)         |       |        |        |
| Aging @25 °C 1st Year (Max)                          | ±3 ppm/year                       |       |        |        |

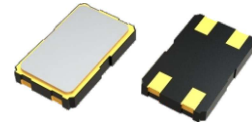
### Dimension(mm)



## SMD Seam Sealed Crystals 7.0×5.0×1.1 mm

### Feature

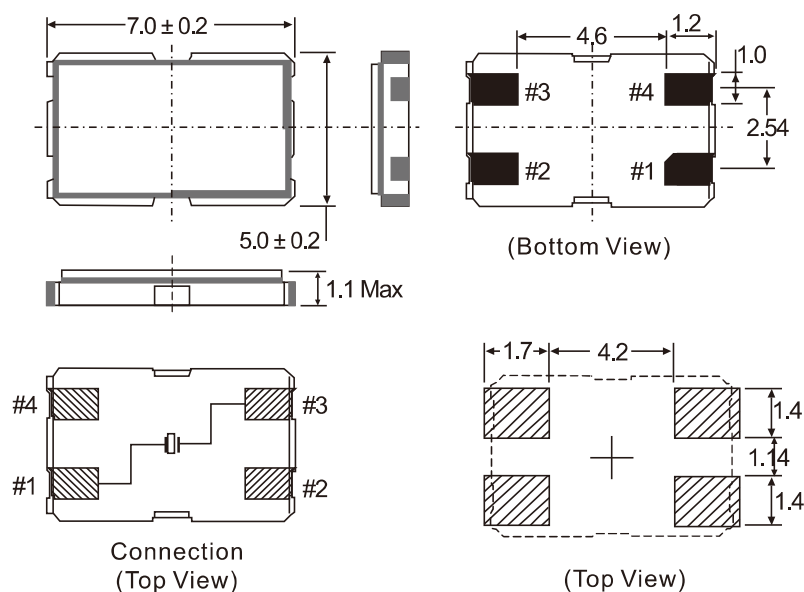
- SMD type crystal units
- High precision and high frequency stability
- Excellent heat resistance and environmental characteristics
- Designed for automatic mounting and reflow soldering
- RoHS Compliant / Pb Free



### Electrical Specifications

| Item                                                 | Specifications                    |      |        |
|------------------------------------------------------|-----------------------------------|------|--------|
| Frequency Range(MHz)                                 | 6~8                               | 8~48 | 32~110 |
| Mode                                                 | AT/Fundamental                    |      | AT/3RD |
| Load Capacitance (CL)                                | 8pF, 16pF, 20pF, 30pF, or Specify |      |        |
| Frequency Tolerance( at 25°C )                       | ±10ppm ~ ±30ppm or specify        |      |        |
| Operating Temperature Range                          | -20~+70°C or Specify              |      |        |
| Frequency Stability Over Operating Temperature Range | ±10ppm ~ ±30ppm or specify        |      |        |
| Equivalent Series Resistance (ESR) max.              | 100Ω                              | 60Ω  | 80Ω    |
| Storage Temperature Range                            | -55~+125°C                        |      |        |
| Shunt Capacitance( C <sub>0</sub> )                  | 5pF Max                           |      |        |
| Drive Level (Typical)                                | 1~100 μW                          |      |        |
| Aging @ 25°C 1st Year (Max)                          | ±3 ppm/year                       |      |        |

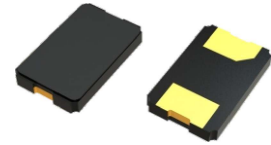
### Dimension(mm)



## SMD Glass Sealed Ceramic 5.0×3.2×1.2 mm

### Feature

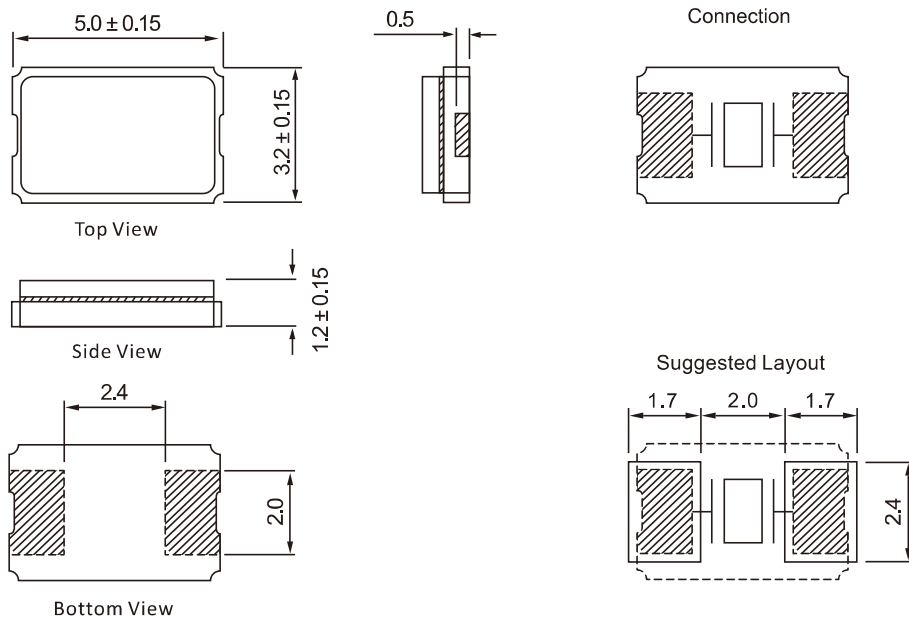
- 2 pads SMD glass sealed crystal units
- High reliable environmental performance
- Tight tolerance and stability parts are available
- Designed for automatic mounting and reflow soldering
- Contains Pb in sealing glass exempted by RoHS directive



### Electrical Specifications

| Item                                                 | Specifications                    |       |        |
|------------------------------------------------------|-----------------------------------|-------|--------|
| Frequency Range(MHz)                                 | 8~12                              | 12~54 | 40~80  |
| Mode                                                 | AT/Fundamental                    |       | AT/3RD |
| Load Capacitance (CL)                                | 10pF, 20pF, 30pF, 32pF or Specify |       |        |
| Frequency Tolerance( at 25°C )                       | ±10ppm ~ ±30ppm or specify        |       |        |
| Operating Temperature Range                          | -20~+70°C or Specify              |       |        |
| Frequency Stability Over Operating Temperature Range | ±10ppm ~ ±30ppm or specify        |       |        |
| Equivalent Series Resistance (ESR) max.              | 60Ω                               | 40Ω   | 100Ω   |
| Storage Temperature Range                            | -55~+125°C                        |       |        |
| Shunt Capacitance( C <sub>0</sub> )                  | 5pF Max                           |       |        |
| Drive Level (Typical)                                | 1~200μW (100μW typical)           |       |        |
| Aging @25°C 1st Year (Max)                           | ±3 ppm/year                       |       |        |

### Dimension(mm)

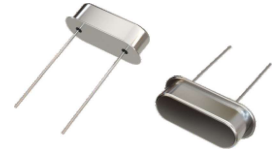


## Resistance Welded HC-49S

### 11.05×4.7×3.68 mm

#### Feature

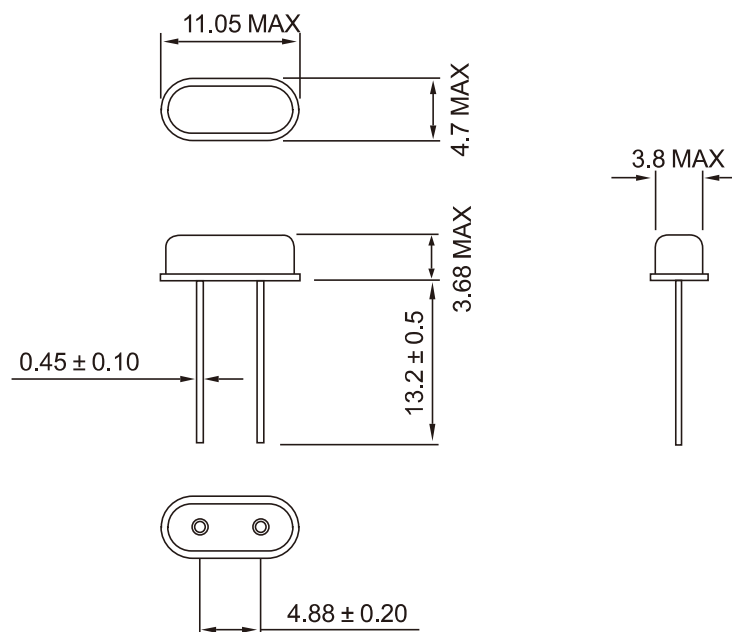
- Resistance welded type crystal units
- A great number of standard frequencies
- Higher frequency available and lower equivalent series resistance
- Lower cost and highly mass production capability
- RoHS Compliant / Pb Free



#### Electrical Specifications

| Item                                                 | Specifications             |     |      |       |        |        |
|------------------------------------------------------|----------------------------|-----|------|-------|--------|--------|
| Frequency Range(MHz)                                 | 3.2~6                      | 6~8 | 8~16 | 16~54 | 30~50  | 50~100 |
| Mode                                                 | AT/Fundamental             |     |      |       | AT/3RD | AT/3RD |
| Load Capacitance (CL)                                | 8pF, 10pF, 12pF or Specify |     |      |       |        |        |
| Frequency Tolerance( at 25°C )                       | ±10ppm ~ ±30ppm or Specify |     |      |       |        |        |
| Operating Temperature Range                          | -20~+70°C or Specify       |     |      |       |        |        |
| Frequency Stability Over Operating Temperature Range | ±10ppm ~ ±30ppm or Specify |     |      |       |        |        |
| Equivalent Series Resistance (ESR) max.              | 150Ω                       | 60Ω | 50Ω  | 30Ω   | 80Ω    | 60Ω    |
| Storage Temperature Range                            | -55~+125°C                 |     |      |       |        |        |
| Shunt Capacitance( C <sub>0</sub> )                  | 7.0 pF Max                 |     |      |       |        |        |
| Drive Level (Typical)                                | 1 μW~100 μW (10μW typical) |     |      |       |        |        |
| Aging @25 °C 1st Year (Max)                          | ±3 ppm/year or ±5 ppm/year |     |      |       |        |        |

#### Dimension(mm)





## Resistance Welded HC-49SMD

12.7×4.8×3.8 mm

### Feature

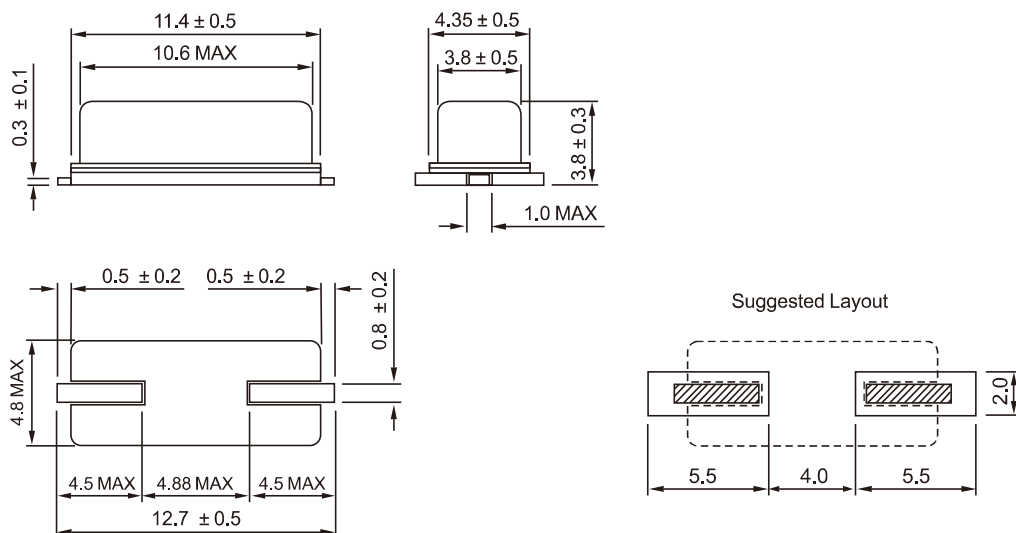
- Surface mount type crystal units.
- A great number of standard frequencies.
- Higher frequency available and lower equivalent series resistance.
- Lower cost and highly mass production capability.
- RoHS Compliant / Pb Free



### Electrical Specifications

| Item                                                 | Specifications              |     |      |       |        |        |
|------------------------------------------------------|-----------------------------|-----|------|-------|--------|--------|
| Frequency Range(MHz)                                 | 3.2~6                       | 6~8 | 8~16 | 16~54 | 30~50  | 50~100 |
| Mode                                                 | AT/Fundamental              |     |      |       | AT/3RD | AT/3RD |
| Load Capacitance (CL)                                | 8pF, 10pF, 12pF or Specify  |     |      |       |        |        |
| Frequency Tolerance( at 25°C )                       | ±10ppm ~ ±30ppm or specify  |     |      |       |        |        |
| Operating Temperature Range                          | -20~+70°C or Specify        |     |      |       |        |        |
| Frequency Stability Over Operating Temperature Range | ±10ppm ~ ±30ppm or specify  |     |      |       |        |        |
| Equivalent Series Resistance (ESR) max.              | 150Ω                        | 60Ω | 50Ω  | 30Ω   | 80Ω    | 60Ω    |
| Storage Temperature Range                            | -55~+125°C                  |     |      |       |        |        |
| Shunt Capacitance( C <sub>0</sub> )                  | 7.0 pF Max                  |     |      |       |        |        |
| Drive Level (Typical)                                | 1 μW~500 μW (100μW typical) |     |      |       |        |        |
| Aging @25 °C 1st Year (Max)                          | ±3 ppm/year or ±5 ppm/year  |     |      |       |        |        |

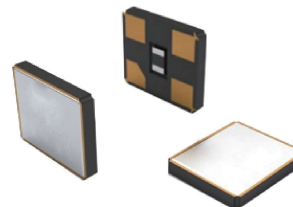
### Dimension(mm)



## Thermistor quartz crystal 1.6 x 1.2 x 0.65mm series

### Feature

- Ultra-small size: 1.6 x 1.2 x 0.65 mm
- Ceramic seam welding package
- High stability and low aging
- Pb Free and RoHS compliant



### Electrical Specifications

| Item/Type                                      | Specifications    |
|------------------------------------------------|-------------------|
| Frequency Range(MHz)                           | 26~76.8MHz        |
| Frequency Tolerance( at 25°C )                 | ±10ppm,or specify |
| Frequency stability over Operating Temperature | ±12ppm,or specify |
| Operating Temperature Range                    | -30~+85°C         |
| Shunt Capacitance( C <sub>0</sub> )            | 3pF Max.          |
| Drive Level                                    | 10μW (100μW Max.) |
| Load Capacitance(CL)                           | 7pF,or specify    |
| Aging(at 25°C)                                 | ±1 ppm/year Max.  |
| Storage Temperature Range                      | -40~+85°C         |

### Equivalent Series Resistance(ESR)

| Frequency                        | Resistance |
|----------------------------------|------------|
| 26MHz≤f <sub>nom</sub> < 40MHz   | 80Ω Max.   |
| 40MHz≤f <sub>nom</sub> ≤ 52MHz   | 60Ω Max.   |
| 52MHz<f <sub>nom</sub> ≤ 76.8MHz | 40Ω Max.   |

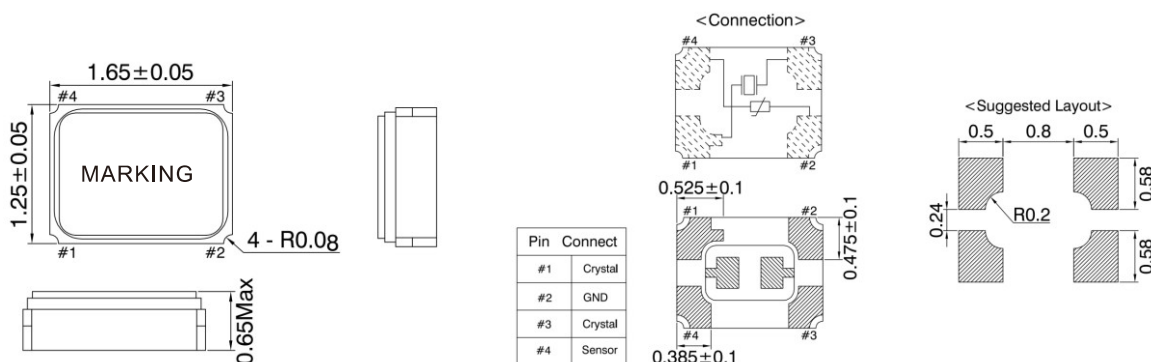
### Freq.Stability vs.Temp. Range

| Temp.(°C) | PPM | ± 12 |
|-----------|-----|------|
| -30~+85   |     | ○    |

\*O:Available Δ :Condition X: Not available

Note: not all combination of options are available.Other specifications may be available upon request.

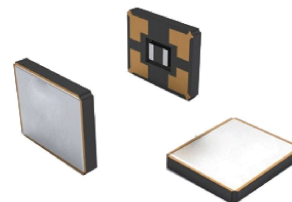
### Dimension(mm)



## Thermistor quartz crystal 2.0 x 1.6 x 0.65mm series

### Feature

- Ultra-small size: 2.0 x 1.6 x 0.65 mm
- Low aging
- Excellent shock and vibration performance
- Thermally coupled temperature sensor



### Electrical Specifications

| Item/Type                                            | Specifications        |
|------------------------------------------------------|-----------------------|
| Frequency Range(MHz)                                 | 19.2MHz,26MHz,38.4MHz |
| Frequency Tolerance( at 25°C )                       | ±10ppm,or specify     |
| Frequency stability over Operating Temperature Range | ±12ppm,or specify     |
| Operating Temperature Range                          | -30~+85°C,or specify  |
| Shunt Capacitance( C <sub>0</sub> )                  | 3pF Max.              |
| Drive Level                                          | 100μW(typical)        |
| Load Capacitance(CL)                                 | 7pF,or specify        |
| Aging(at 25°C)                                       | ±1 ppm/year Max.      |
| Storage Temperature Range                            | -40~+85°C             |

### Equivalent Series Resistance(ESR)

| Frequency             | Resistance |
|-----------------------|------------|
| 19.2MHz,26MHz,38.4MHz | 80Ω Max.   |

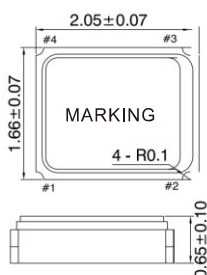
### Freq.Stability vs.Temp. Range

| Temp.(°C) | PPM | ± 12 |
|-----------|-----|------|
| -30~+85   |     | ○    |

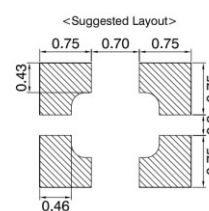
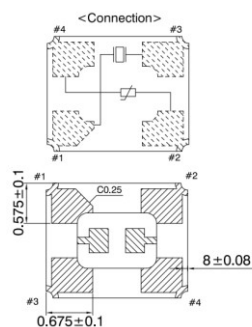
\*O:Available Δ :Condition X: Not available

Note: not all combination of options are available.Other specifications may be available upon request.

### Dimension(mm)



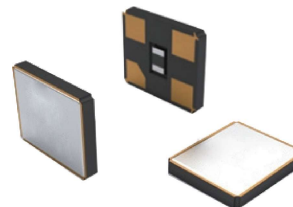
| Pin | Connect |
|-----|---------|
| #1  | Crystal |
| #2  | GND     |
| #3  | Crystal |
| #4  | Sensor  |



## Thermistor quartz crystal 2.5 x 2.0 x 1.0mm series

### Feature

- Ultra-small size: 2.5 x 2.0 x 1.0 mm
- Low aging
- Excellent shock and vibration performance
- Thermally coupled temperature sensor



### Electrical Specifications

| Item/Type                                            | Specifications       |
|------------------------------------------------------|----------------------|
| Frequency Range(MHz)                                 | 19.2MHz,26MHz        |
| Frequency Tolerance( at 25°C )                       | ±10ppm,or specify    |
| Frequency stability over Operating Temperature Range | ±12ppm,or specify    |
| Operating Temperature Range                          | -30~+85°C,or specify |
| Shunt Capacitance( C <sub>0</sub> )                  | 3pF Max.             |
| Drive Level                                          | 100μW(typical)       |
| Load Capacitance(CL)                                 | 7pF,or specify       |
| Aging(at 25°C)                                       | ±1 ppm/year Max.     |
| Storage Temperature Range                            | -40~+85°C            |

### Equivalent Series Resistance(ESR)

| Frequency     | Resistance |
|---------------|------------|
| 19.2MHz,26MHz | 50Ω Max.   |

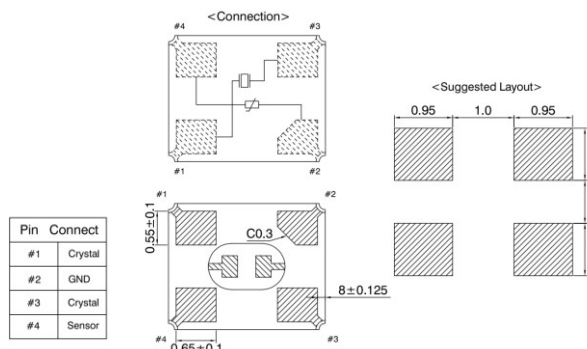
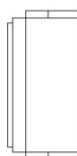
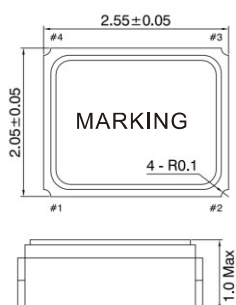
### Freq.Stability vs.Temp. Range

| Temp.(°C) | PPM | ± 12 |
|-----------|-----|------|
| -30~+85   |     | ○    |

\*O:Available Δ :Condition X: Not available

Note: not all combination of options are available.Other specifications may be available upon request.

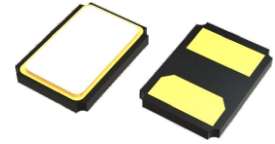
### Dimension(mm)



## 1.2 x 1.0 x 0.5 mm SMD Package

### FEATURE

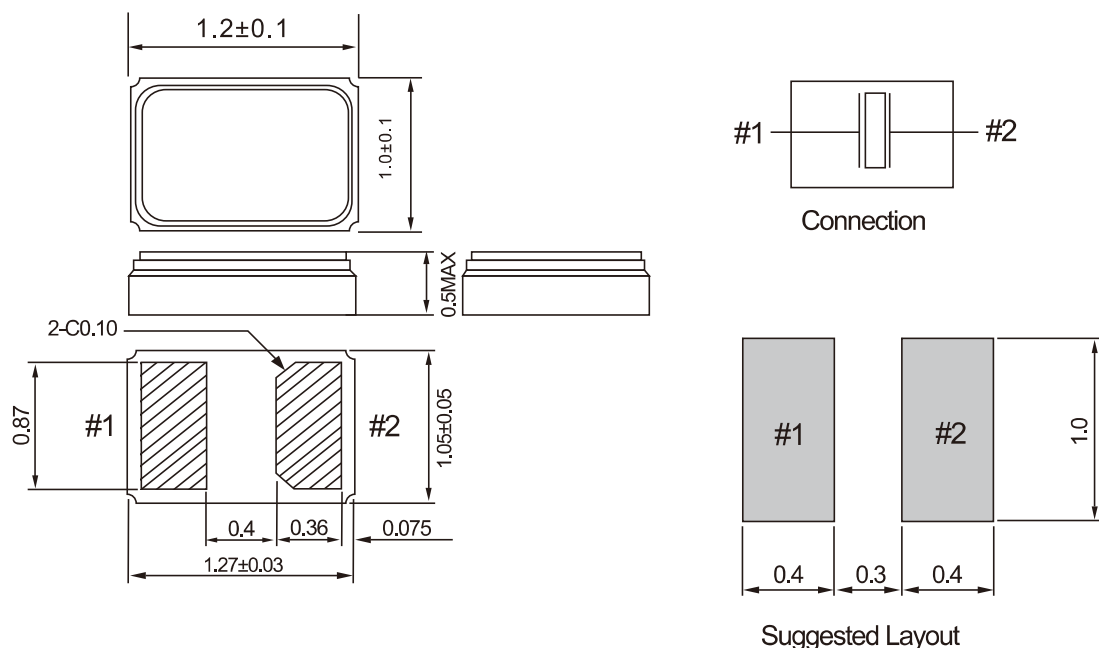
- Ultra small size 1.2x1.0x0.5 mm
- High reliability environmental performance
- High frequency stability and high precision
- Designed for automatic mounting and reflow soldering
- RoHS Compliant / Pb Free



### ELECTRICAL SPECIFICATIONS

| Item                                    | Specifications                                        |
|-----------------------------------------|-------------------------------------------------------|
| Frequency                               | 32.768kHz                                             |
| Load Capacitance (CL)                   | 6pF, 7pF, 9pF, 12.5pF                                 |
| Frequency Tolerance( at 25°C )          | ±20ppm                                                |
| Operating Temperature Range             | -40~+85°C                                             |
| Turnover Temperature                    | 25 ± 5°C                                              |
| Frequency Temperature Curve             | $(-0.036 \pm 10\%) \times 10^{-6} / ^\circ\text{C}^2$ |
| Equivalent Series Resistance (ESR) max. | 90kΩ                                                  |
| Drive Level (Typical)                   | 0.1μW                                                 |
| Drive Level(Max)                        | 0.3μW                                                 |
| Shunt Capacitance( C <sub>0</sub> )     | 1.4pF Typ.                                            |
| Insulation Resistance                   | More than 500Mohms at DC100V                          |
| Storage Temperature Range               | -55°C~+125°C                                          |
| Aging @25°C 1st Year (Max)              | ±3ppm/year                                            |

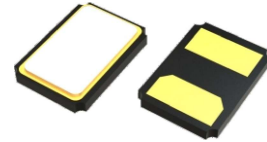
### DIMENSION(mm)



## 1.6 x 1.0 x 0.5 mm SMD Package

### Feature

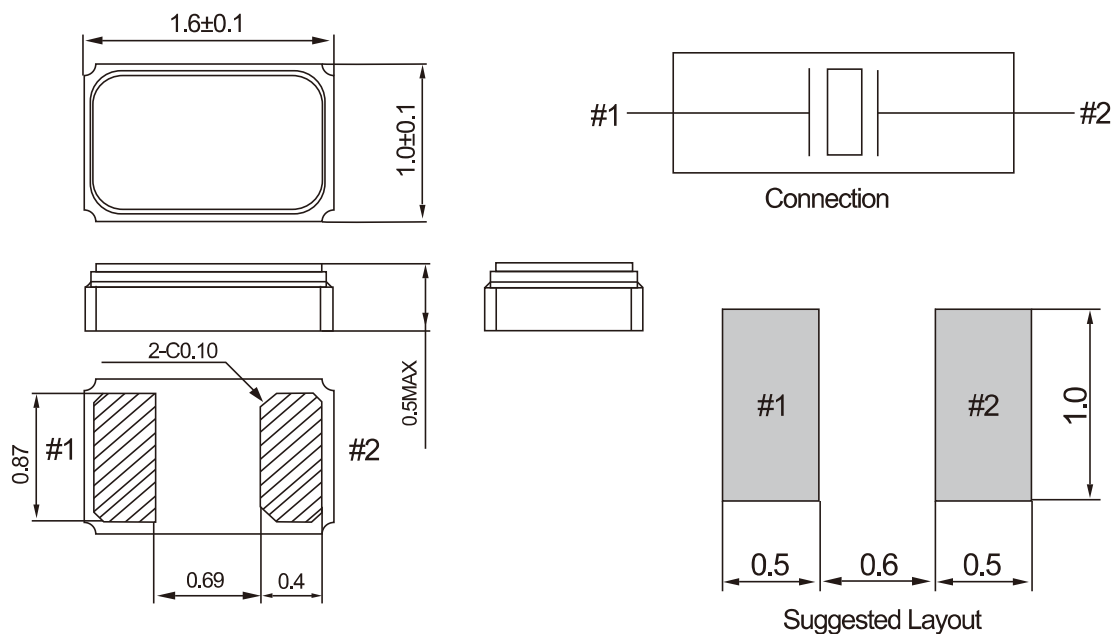
- Ultra small size 1.6x1.0x0.5 mm
- High reliability environmental performance
- High frequency stability and high precision
- Designed for automatic mounting and reflow soldering
- RoHS Compliant / Pb Free



### Electrical Specifications

| Item                                    | Specifications                                        |
|-----------------------------------------|-------------------------------------------------------|
| Frequency                               | 32.768kHz                                             |
| Load Capacitance (CL)                   | 6pF, 7pF, 9pF, 12.5pF                                 |
| Frequency Tolerance( at 25°C )          | ±20ppm                                                |
| Operating Temperature Range             | -40~+85°C                                             |
| Turnover Temperature                    | 25 ± 5°C                                              |
| Frequency Temperature Curve             | $(-0.036 \pm 10\%) \times 10^{-6} / ^\circ\text{C}^2$ |
| Equivalent Series Resistance (ESR) max. | 90kΩ                                                  |
| Drive Level (Typical)                   | 0.1μW                                                 |
| Drive Level(Max)                        | 0.5μW                                                 |
| Shunt Capacitance( C <sub>0</sub> )     | 1.2pF Typ.                                            |
| Insulation Resistance                   | More than 500Mohms at DC100V                          |
| Storage Temperature Range               | -55°C~+125°C                                          |
| Aging @25 °C 1st Year (Max)             | ±3ppm/year                                            |

### Dimension(mm)

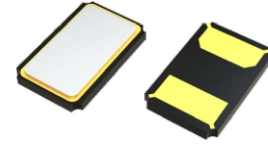




## 2.0 x 1.2 x 0.6 mm SMD Package

### Feature

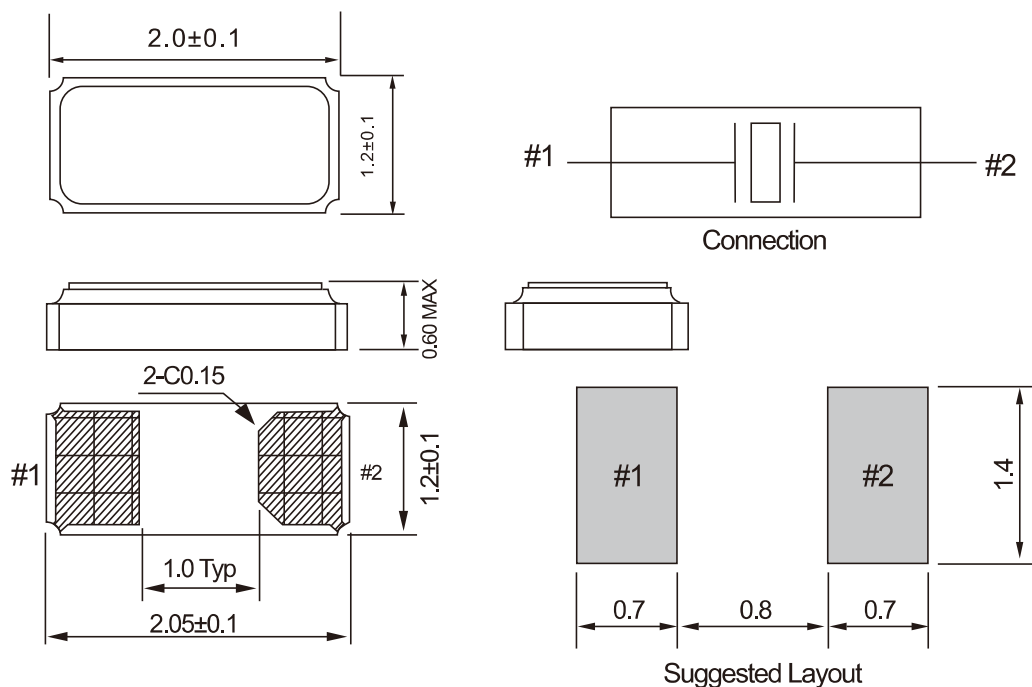
- Ultra small size 2.0\*1.2\*0.6 mm
- High reliability environmental performance.
- High frequency stability and high precision.
- Designed for automatic mounting and reflow soldering
- RoHS Compliant / Pb Free



### Electrical Specifications

| Item                                    | Specifications                                        |
|-----------------------------------------|-------------------------------------------------------|
| Frequency                               | 32.768kHz                                             |
| Load Capacitance (CL)                   | 6pF, 7pF, 9pF, 12.5pF                                 |
| Frequency Tolerance( at 25°C )          | ±20ppm                                                |
| Operating Temperature Range             | -40~+85°C                                             |
| Turnover Temperature                    | 25 ± 5°C                                              |
| Frequency Temperature Curve             | $(-0.030 \pm 10\%) \times 10^{-6} / ^\circ\text{C}^2$ |
| Equivalent Series Resistance (ESR) max. | 90kΩ                                                  |
| Drive Level (Typical)                   | 0.1μW                                                 |
| Drive Level(Max)                        | 1.0μW                                                 |
| Shunt Capacitance( C <sub>0</sub> )     | 1.3pF Typ.                                            |
| Insulation Resistance                   | More than 500Mohms at DC100V                          |
| Storage Temperature Range               | -55°C~+125°C                                          |
| Aging @25°C 1st Year (Max)              | ±3ppm/year                                            |

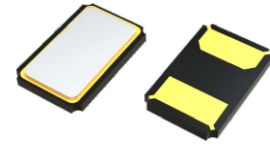
### Dimension(mm)



## 3.2 x 1.5 x 0.75 mm SMD Package

### Feature

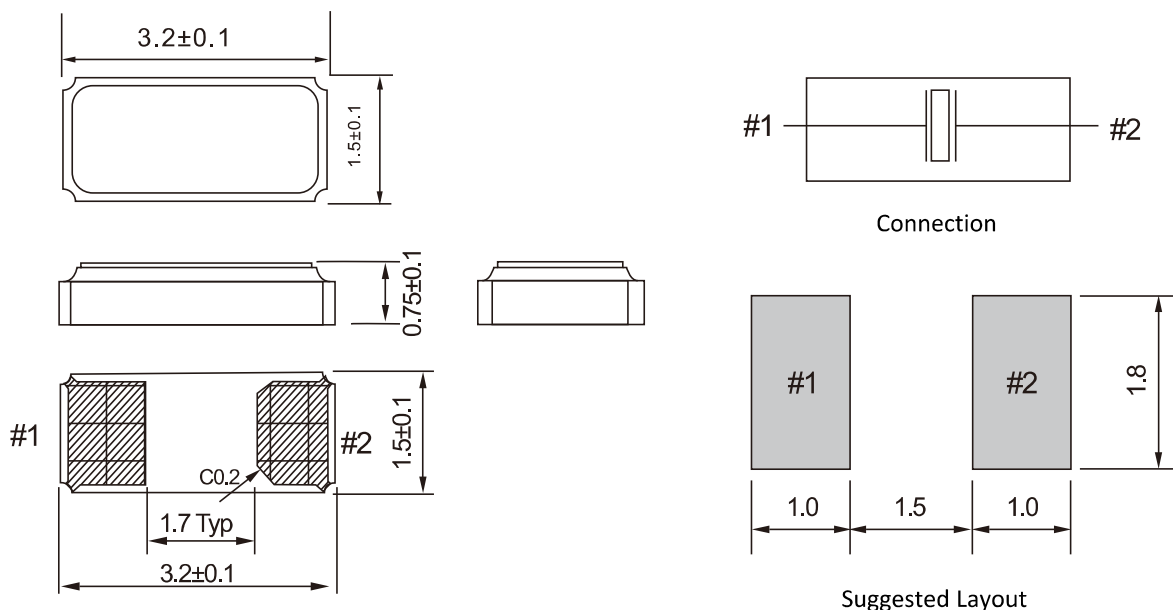
- Ultra small size 3.2\*1.5\*0.75 mm
- High reliability environmental performance.
- High frequency stability and high precision.
- Designed for automatic mounting and reflow soldering
- RoHS Compliant / Pb Free



### Electrical Specifications

| Item                                    | Specifications                                        |
|-----------------------------------------|-------------------------------------------------------|
| Frequency                               | 32.768kHz                                             |
| Load Capacitance (CL)                   | 6pF, 7pF, 9pF, 12.5pF                                 |
| Frequency Tolerance( at 25°C )          | ±20ppm                                                |
| Operating Temperature Range             | -40~+85°C                                             |
| Turnover Temperature                    | 25 ± 5°C                                              |
| Frequency Temperature Curve             | $(-0.033 \pm 10\%) \times 10^{-6} / ^\circ\text{C}^2$ |
| Equivalent Series Resistance (ESR) max. | 70kΩ                                                  |
| Drive Level (Typical)                   | 0.1μW                                                 |
| Drive Level(Max)                        | 1.0μW                                                 |
| Shunt Capacitance( C <sub>0</sub> )     | 1.0pF Typ.                                            |
| Insulation Resistance                   | More than 500Mohms at DC100V                          |
| Storage Temperature Range               | -55°C~+125°C                                          |
| Aging @25°C 1st Year (Max)              | ±3ppm/year                                            |

### Dimension(mm)



## 3.8 x 8.0 x 2.5 mm SMD Package

### Feature

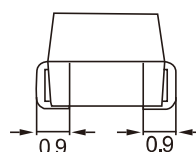
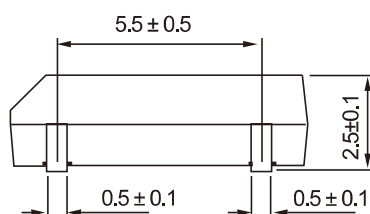
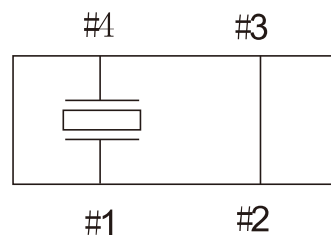
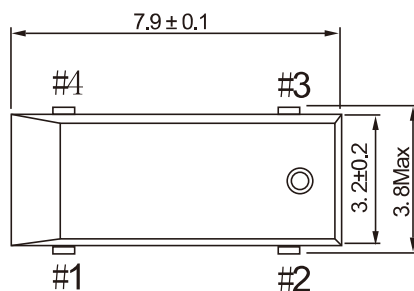
- Wide frequency range
- Designed for automatic mounting and reflow soldering
- Higher frequency available and lower equivalent series resistance
- RoHS Compliant / Pb Free



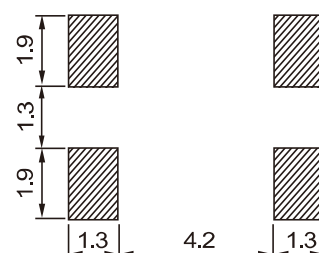
### Electrical Specifications

| Item                                    | Specifications                             |       |       |        |         |
|-----------------------------------------|--------------------------------------------|-------|-------|--------|---------|
| Frequency Range (kHz)                   | 30~40                                      | 40~60 | 60~70 | 70~200 | 200~350 |
| Load Capacitance (CL)                   | 6~12.5pF, or specify                       |       |       |        |         |
| Frequency Tolerance (at 25°C)           | ±5ppm ~ ±100ppm                            |       |       |        |         |
| Operating Temperature Range             | -10~+60°C, -20~+70°C, -40~+85°C or specify |       |       |        |         |
| Turnover Temperature                    | 25 ± 5°C                                   |       |       |        |         |
| Frequency Temperature Curve             | $(-0.034 \pm 10\%) \times 10^{-6} / \pm^2$ |       |       |        |         |
| Equivalent Series Resistance (ESR) Max. | 40kΩ                                       | 30kΩ  | 25kΩ  | 22kΩ   | 20kΩ    |
| Drive Level (Typical)                   | 0.1μW                                      |       |       |        |         |
| Drive Level(Max)                        | 1μW                                        |       |       |        |         |
| Shunt Capacitance (C <sub>0</sub> )     | 2.0pF Typ.                                 |       |       |        |         |
| Insulation Resistance                   | More than 500Mohms at DC100V               |       |       |        |         |
| Storage Temperature Range               | -55°C~+125°C                               |       |       |        |         |
| Aging @25 °C 1st Year (Max)             | ±3ppm/year, ±5 ppm/year,                   |       |       |        |         |

### Dimension(mm)



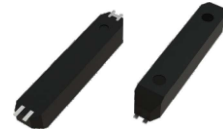
#### SOLDER PATTERN



## 6.9 x 1.4 x 1.3 mm SMD Package

### Feature

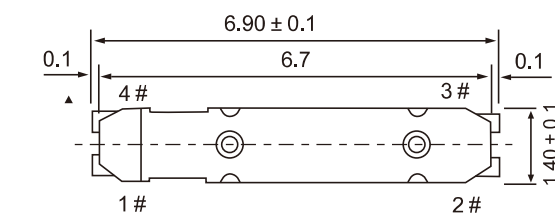
- Ultra small size 6.9x1.4x1.3 mm
- High reliability environmental performance
- High frequency stability and high precision
- Designed for automatic mounting and reflow soldering
- RoHS Compliant / Pb Free



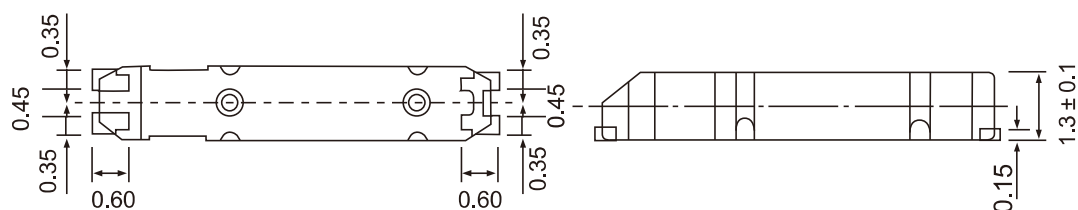
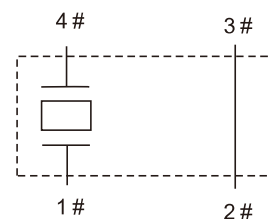
### Electrical Specifications

| Item                                    | Specifications                                        |
|-----------------------------------------|-------------------------------------------------------|
| Frequency                               | 32.768kHz                                             |
| Load Capacitance (CL)                   | 6pF, 7pF, 9pF, 12.5pF                                 |
| Frequency Tolerance( at 25°C )          | ±5ppm, ±10ppm, ±20ppm                                 |
| Operating Temperature Range             | -40~+85°C                                             |
| Turnover Temperature                    | 25 ± 5°C                                              |
| Frequency Temperature Curve             | $(-0.033 \pm 10\%) \times 10^{-6} / ^\circ\text{C}^2$ |
| Equivalent Series Resistance (ESR) max. | 65kΩ                                                  |
| Drive Level (Typical)                   | 0.1μW                                                 |
| Drive Level(Max)                        | 1μW                                                   |
| Shunt Capacitance( C <sub>0</sub> )     | 0.9pF Typ.                                            |
| Insulation Resistance                   | More than 500Mohms at DC100V                          |
| Storage Temperature Range               | -55°C~+125°C                                          |
| Aging @25 °C 1st Year (Max)             | ±3ppm/year                                            |

### Dimension(mm)



### Electrode Arrangement



## Φ2 x 6mm DIP Crystal

### Feature

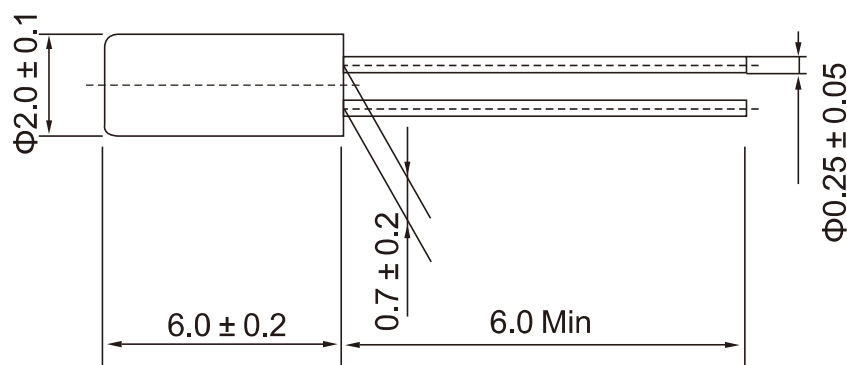
- Small size Φ2 x 6mm
- A great number of standard frequencies
- Higher frequency available and lower equivalent series resistance
- The best choice of Clock
- RoHS Compliant / Pb Free



### Electrical Specifications

| Item                                    | Specifications                                        |       |       |        |         |
|-----------------------------------------|-------------------------------------------------------|-------|-------|--------|---------|
| Frequency Range (kHz)                   | 30~40                                                 | 40~60 | 60~70 | 70~200 | 200~350 |
| Load Capacitance (CL)                   | 6~12.5pF, or specify                                  |       |       |        |         |
| Frequency Tolerance (at 25°C)           | ±5ppm ~ ±100ppm                                       |       |       |        |         |
| Operating Temperature Range             | -20~+70°C or specify                                  |       |       |        |         |
| Turnover Temperature                    | 25 ± 5°C                                              |       |       |        |         |
| Frequency Temperature Curve             | $(-0.034 \pm 10\%) \times 10^{-6} / ^\circ\text{C}^2$ |       |       |        |         |
| Equivalent Series Resistance (ESR) Max. | 40kΩ                                                  | 30kΩ  | 25kΩ  | 22kΩ   | 20kΩ    |
| Drive Level (Typical)                   | 0.1μW                                                 |       |       |        |         |
| Drive Level(Max)                        | 1μW                                                   |       |       |        |         |
| Shunt Capacitance (C <sub>0</sub> )     | 1.5 pF Typ.                                           |       |       |        |         |
| Insulation Resistance                   | More than 500Mohms at DC100V                          |       |       |        |         |
| Storage Temperature Range               | -40°C~+85°C                                           |       |       |        |         |
| Aging @25 °C 1st Year (Max)             | ±3ppm/year, ±5 ppm/year,                              |       |       |        |         |

### Dimension(mm)



## Φ3 x 8mm DIP Crystal

### Feature

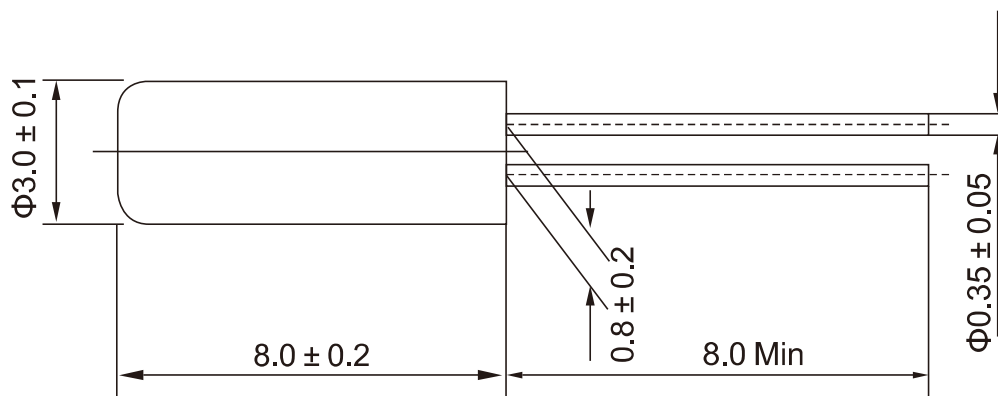
- Small size Φ3 x 8mm
- A great number of standard frequencies
- Higher frequency available and lower equivalent series resistance
- Lower cost and highly mass production capability
- The best choice of PC and Clock
- RoHS Compliant / Pb Free



### Electrical Specifications

| Item                                    | Specifications                                        |       |       |        |         |
|-----------------------------------------|-------------------------------------------------------|-------|-------|--------|---------|
| Frequency Range (kHz)                   | 30~40                                                 | 40~60 | 60~70 | 70~200 | 200~350 |
| Load Capacitance (CL)                   | 6~12.5pF, or specify                                  |       |       |        |         |
| Frequency Tolerance( at 25°C )          | ±5ppm ~ ±100ppm                                       |       |       |        |         |
| Operating Temperature Range             | -20~+70°C or specify                                  |       |       |        |         |
| Turnover Temperature                    | 25 ± 5°C                                              |       |       |        |         |
| Frequency Temperature Curve             | $(-0.034 \pm 10\%) \times 10^{-6} / ^\circ\text{C}^2$ |       |       |        |         |
| Equivalent Series Resistance (ESR) Max. | 40kΩ                                                  | 30kΩ  | 25kΩ  | 22kΩ   | 20kΩ    |
| Drive Level (Typical)                   | 0.1μW                                                 |       |       |        |         |
| Drive Level (Max)                       | 1μW                                                   |       |       |        |         |
| Shunt Capacitance ( C <sub>0</sub> )    | 1.8 pF Typ.                                           |       |       |        |         |
| Insulation Resistance                   | More than 500Mohms at DC100V                          |       |       |        |         |
| Storage Temperature Range               | -40°C ~ +85°C                                         |       |       |        |         |
| Aging @25°C 1st Year (Max)              | ±5 ppm/year,                                          |       |       |        |         |

### Dimension(mm)



## Φ2 x 6mm With Jacket Crystal

## Feature

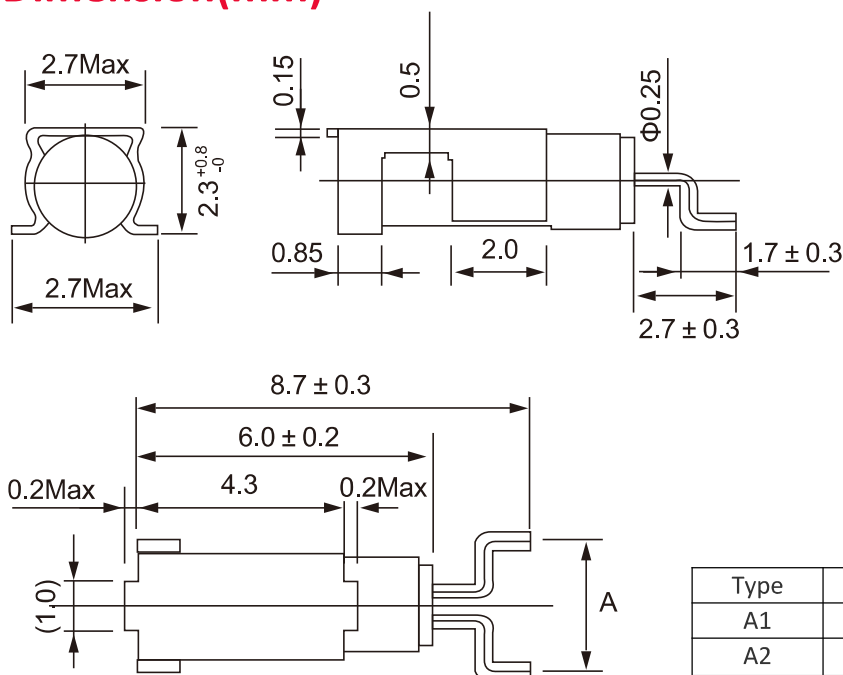
- Small size  $\Phi 2 \times 6\text{mm}$  SMD with Jacket
- Excellent frequency stability
- Designed for automatic mounting and reflow soldering
- RoHS Compliant / Pb Free



## Electrical Specifications

| Item                                    | Specifications                                   |
|-----------------------------------------|--------------------------------------------------|
| Frequency                               | 30~100kHz                                        |
| Load Capacitance (CL)                   | 6pF, 7pF, 9pF , 12.5pF or specify                |
| Frequency Tolerance( at 25°C )          | ±20ppm or Specify                                |
| Operating Temperature Range             | -40~+85°C                                        |
| Turnover Temperature                    | 25 ± 5°C                                         |
| Frequency Temperature Curve             | (-0.030±10%) x 10 <sup>-6</sup> /°C <sup>2</sup> |
| Equivalent Series Resistance (ESR) max. | 50kΩ                                             |
| Driver Level (Typical)                  | 0.1μW                                            |
| Driver Level(Max)                       | 1.0μW                                            |
| Shunt Capacitance( C <sub>0</sub> )     | 1.5pF Max.                                       |
| Insulation Resistance                   | More than 500Mohms at DC100V                     |
| Storage Temperature Range               | -40°C ~+85°C                                     |
| Aging @25 °C 1st Year (Max)             | ±5 ppm/year                                      |

 **Dimension(mm)**



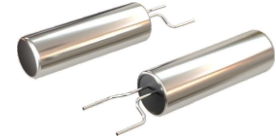
| Type | H(mm)    |
|------|----------|
| A1   | 2.54±0.3 |
| A2   | 1.27±0.3 |



## Φ2 x 6mm SMD Crystal

### Feature

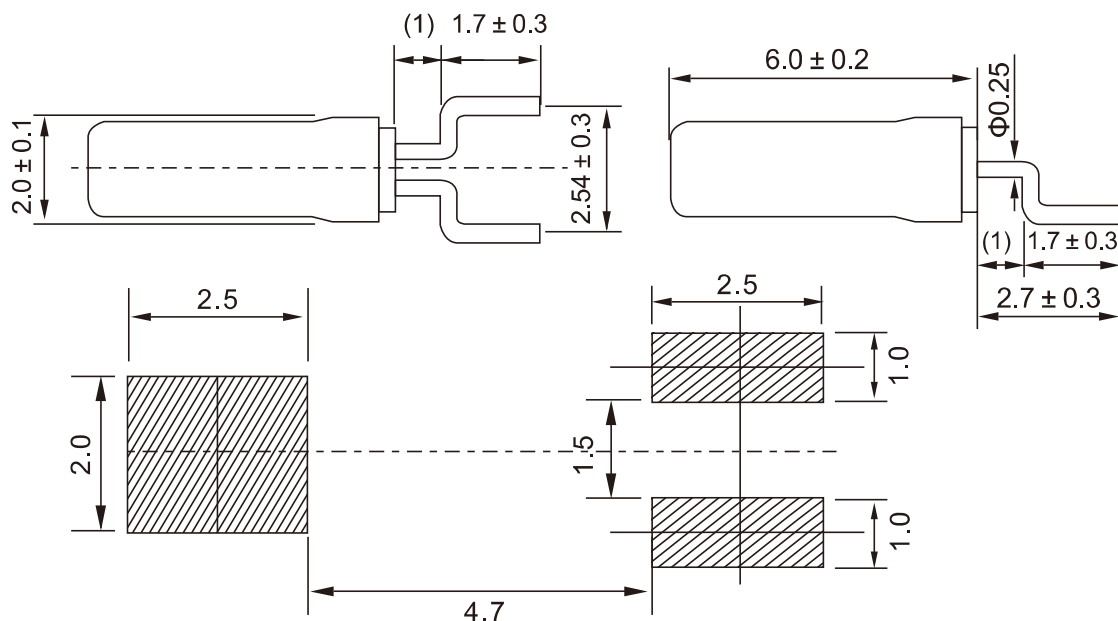
- Small size Φ2 x 6mm
- Wide frequency range: 30kHz~350kHz
- High reliability and high frequency stability
- Suited for automatic mounting and reflow soldering
- Environmentally friendly products, RoHS certified



### Electrical Specifications

| Item                                    | Specifications                                        |       |       |        |         |
|-----------------------------------------|-------------------------------------------------------|-------|-------|--------|---------|
| Frequency Range (kHz)                   | 30~40                                                 | 40~60 | 60~70 | 70~200 | 200~350 |
| Load Capacitance (CL)                   | 6~12.5pF, or specify                                  |       |       |        |         |
| Frequency Tolerance (at 25°C)           | ±5ppm ~ ±100ppm                                       |       |       |        |         |
| Operating Temperature Range             | -20~+70°C or specify                                  |       |       |        |         |
| Turnover Temperature                    | 25 ± 5°C                                              |       |       |        |         |
| Frequency Temperature Curve             | $(-0.035 \pm 10\%) \times 10^{-6} / ^\circ\text{C}^2$ |       |       |        |         |
| Equivalent Series Resistance (ESR) Max. | 40kΩ                                                  | 30kΩ  | 25kΩ  | 22kΩ   | 20kΩ    |
| Driver Level (Typical)                  | 0.1μW                                                 |       |       |        |         |
| Driver Level(Max)                       | 1μW                                                   |       |       |        |         |
| Shunt Capacitance (C <sub>0</sub> )     | 1.45 pF Typ.                                          |       |       |        |         |
| Insulation Resistance                   | More than 500Mohms at DC100V                          |       |       |        |         |
| Storage Temperature Range               | -40°C~+85°C                                           |       |       |        |         |
| Aging @25 °C 1st Year (Max)             | ±5 ppm/year                                           |       |       |        |         |

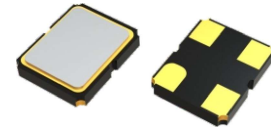
### Dimension(mm)



## 2.5 × 2.0 mm 32.768kHz SMD Crystal Oscillator

### Feature

- Typical 2.5 x 2.0 x 0.81 mm SMD package.
- Tight symmetry (45 to 55%) available.
- Operation voltage: 1.8V, 2.5V, 3.3V
- Tri-state enable/disable
- Built-in ASIC enables reduction of current consumption



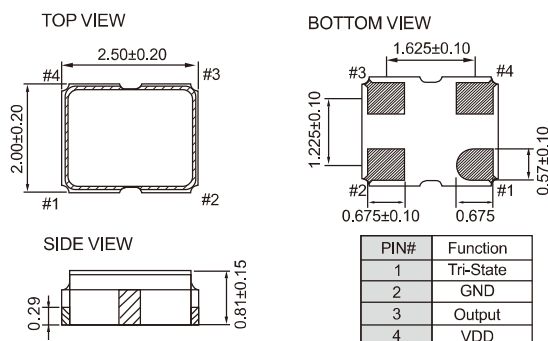
### Electrical Specifications

| Parameter                        |                                   | 3.3V |      | 2.5V |      | 1.8V |      | Unit |
|----------------------------------|-----------------------------------|------|------|------|------|------|------|------|
|                                  |                                   | Min. | Max. | Min. | Max. | Min. | Max. |      |
| Supply Voltage Variation         |                                   | 2.97 | 3.63 | 2.25 | 2.75 | 1.62 | 1.98 | V    |
| Supply Current                   | @ 15pF Load                       | -    | 70   | -    | 66   | -    | 63   | uA   |
|                                  | @ no load                         | -    | 65   | -    | 62   | -    | 60   |      |
| Duty Cycle                       |                                   | 45   | 55   | 45   | 55   | 45   | 55   | %    |
| Transition Time : Rise/Fall Time |                                   | -    | 50   | -    | 50   | -    | 50   | nSec |
| Output Level                     | Out High (Logic "1")              | 2.97 |      | 2.25 |      | 1.62 |      | V    |
|                                  | Out Low (Logic "0")               |      | 0.33 |      | 0.25 |      | 0.18 |      |
| Startup Time                     |                                   | -    | 2    | -    | 2    | -    | 2    | mSec |
| Tri-State<br>(Input to Pin 1)    | Enable (High Voltage or floating) | 2.31 | -    | 1.75 | -    | 1.26 | -    | V    |
|                                  | Disable (Low Voltage or GND)      | -    | 0.99 | -    | 0.75 | -    | 0.54 |      |
| Aging (@ 25 1st year)            |                                   | -    | ±3   | -    | ±3   | -    | ±3   | ppm  |
| Storage Temp. Range              |                                   | -55  | 125  | -55  | 125  | -55  | 125  | °C   |

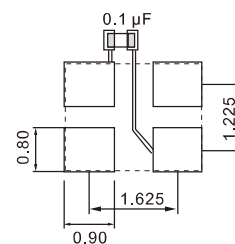
Standard frequencies are frequencies which the crystal has been designed and does not imply a stock position

.+ Transition times are measured between 10% and 90% of VDD, with an output load of 15pF.

### Dimension(mm)



### Solder Pad Layout(mm)



To ensure optimal oscillator performance, place a by-pass capacitor of 0.1 µF as close to the part as possible between Vdd and GND pads.

### FREQ. STABILITY vs. TEMP. RANGE

| Temp. (°C) \ ppm | ±20 | ±25 | ±40 | ±50 |
|------------------|-----|-----|-----|-----|
| -10 ~ +60        | ○   | ○   | ○   | ○   |
| -20 ~ +70        | △   | ○   | ○   | ○   |
| -40 ~ +85        | X   | △   | ○   | ○   |
| -40 ~ +125       | X   | X   | △   | ○   |

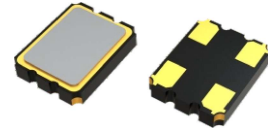
○: Available △: Conditional X: Not available

Inclusive of calibration @ 25 °C, operating temperature range, input voltage variation, load variation, aging (1st year), shock, and vibration load variation

## 3.2 × 2.5 mm 32.768kHz SMD Crystal Oscillator

### Feature

- Typical 3.2 x 2.5 x 0.95 mm SMD package.
- Tight symmetry (45 to 55%) available.
- Operation voltage: 1.8V, 2.5V, 3.3V
- Tri-state enable/disable
- Built-in ASIC enables reduction of current consumption



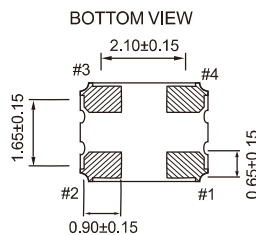
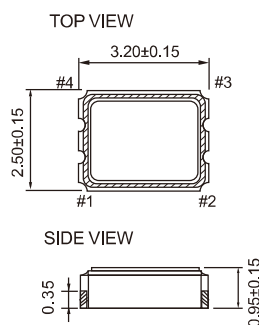
### Electrical Specifications

| Parameter                       |                                  | 3.3V |      | 2.5V |      | 1.8V |      | Unit |
|---------------------------------|----------------------------------|------|------|------|------|------|------|------|
|                                 |                                  | Min. | Max. | Min. | Max. | Min. | Max. |      |
| Supply Voltage Variation        |                                  | 2.97 | 3.63 | 2.25 | 2.75 | 1.62 | 1.98 | V    |
| Supply Current                  | @ 15pF Load                      | -    | 70   | -    | 66   | -    | 63   | uA   |
|                                 | @ no load                        | -    | 65   | -    | 62   | -    | 60   |      |
| Duty Cycle                      |                                  | 45   | 55   | 45   | 55   | 45   | 55   | %    |
| Transition Time :Rise/Fall Time |                                  | -    | 50   | -    | 50   | -    | 50   | nSec |
| Output Level                    | Out High(Logic"1")               | 2.97 |      | 2.25 |      | 1.62 |      | V    |
|                                 | Out Low(Logic"0")                |      | 0.33 |      | 0.25 |      | 0.18 |      |
| Start Time                      |                                  | -    | 2    | -    | 2    | -    | 2    | mSec |
| Tri-State<br>(Input to Pin 1)   | Enable(High Voltage or floating) | 2.31 | -    | 1.75 | -    | 1.26 | -    | V    |
|                                 | Disable(Low Voltage or GND)      | -    | 0.99 | -    | 0.75 | -    | 0.54 |      |
| Aging(@25 1st year)             |                                  | -    | ±3   | -    | ±3   | -    | ±3   | ppm  |
| Storage Temp. Range             |                                  | -55  | 125  | -55  | 125  | -55  | 125  | °C   |

Standard frequencies are frequencies which the crystal has been designed and does not imply a stock position

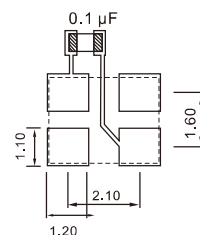
.+ Transition times are measured between 10% and 90% of VDD, with an output load of 15pF.

### Dimension(mm)



| PIN# | Function  |
|------|-----------|
| 1    | Tri-State |
| 2    | GND       |
| 3    | Output    |
| 4    | VDD       |

### Solder Pad Layout(mm)



To ensure optimal oscillator performance, place a by-pass capacitor of 0.1 µF as close to the part as possible between Vdd and GND pads.

### FREQ. STABILITY vs. TEMP. RANGE

| Temp. (°C) \ ppm | ±20 | ±25 | ±40 | ±50 |
|------------------|-----|-----|-----|-----|
| -10 ~ +60        | ○   | ○   | ○   | ○   |
| -20 ~ +70        | △   | ○   | ○   | ○   |
| -40 ~ +85        | X   | △   | ○   | ○   |
| -40 ~ +125       | X   | X   | △   | ○   |

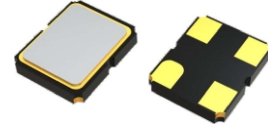
○: Available △: Conditional X: Not available

Inclusive of calibration @ 25 °C, operating temperature range, input voltage variation, load variation, aging (1st year), shock, and vibration load variation

## 2.5 × 2.0 mm 32.768kHz Low Current Consumption SMD Oscillator

### Feature

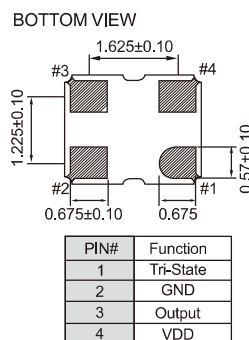
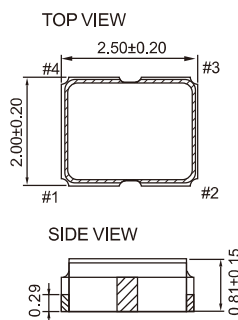
- Typical 2.5 x 2.0 x 0.81 mm SMD package.
- Low Power Supply Voltage: 3.3V, 2.5V, 1.8V
- Singled-end Output: CMOS
- Frequency: 32.768kHz
- Low Current Consumption: 18uA Max
- Temperature Range: -40 to 85 °C Operation
- Pb-free/RoHS Compliant



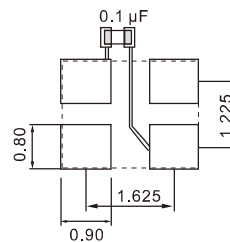
### Electrical Specifications

| Parameter                       | 3.3V               |      | 2.5V |      | 1.8V |      | Unit |
|---------------------------------|--------------------|------|------|------|------|------|------|
|                                 | Min.               | Max. | Min. | Max. | Min. | Max. |      |
| Supply Voltage Variation        | 2.97               | 3.63 | 2.25 | 2.75 | 1.62 | 1.98 | V    |
| Supply Current(no load)         | -                  | 18   | -    | 18   | -    | 18   | uA   |
| Duty Cycle                      | 45                 | 55   | 45   | 55   | 45   | 55   | %    |
| Transition Time :Rise/Fall Time | -                  | 15   | -    | 15   | -    | 15   | nSec |
| Output Level                    | Out High(Logic"1") | 2.97 | 2.25 | 1.62 |      |      | V    |
|                                 | Out Low(Logic"0")  | 0.33 | 0.25 | 0.18 |      |      |      |
| Startup Time                    | -                  | 20   | -    | 20   | -    | 20   | mSec |
| Standby Current                 | -                  | 3    | -    | 3    | -    | 3    | uA   |
| Output Loading(CMOS)            | -                  | 15   | -    | 15   | -    | 15   | pF   |
| Tri-State<br>(Input to Pin 2)   | Enable             | 2.31 | -    | 1.75 | 1.26 | -    | V    |
|                                 | Disable            | -    | 0.99 | 0.75 | -    | 0.54 |      |
| Aging(@25 1st year)             | -                  | ±3   | -    | ±3   | -    | ±3   | ppm  |
| Storage Temp. Range             | -55                | 125  | -55  | 125  | -55  | 125  | °C   |

### Dimension(mm)



### Solder Pad Layout(mm)



To ensure optimal oscillator performance, place a by-pass capacitor of 0.1 µF as close to the part as possible between Vdd and GND pads.

### FREQ. STABILITY vs. TEMP. RANGE

| Temp. (°C) \ ppm | ±20 | ±25 | ±50 |
|------------------|-----|-----|-----|
| -10 ~ +60        | ○   | ○   | ○   |
| -20 ~ +70        | ○   | ○   | ○   |
| -40 ~ +85        | △   | ○   | ○   |

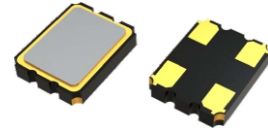
○: Available △: Conditional X: Not available

Inclusive of calibration @ 25 °C, operating temperature range, input voltage variation, load variation, aging (1st year), shock, and vibration

## 3.2 × 2.5 mm 32.768kHz Low Current Consumption SMD Oscillator

### Feature

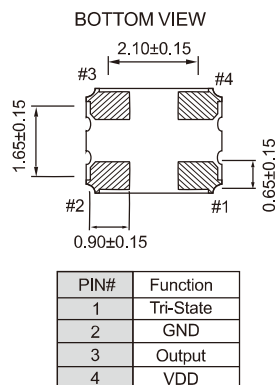
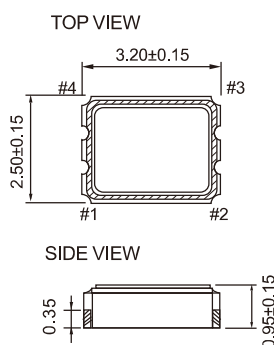
- Typical 3.2 x 2.5 x 0.95 mm SMD package.
- Low Power Supply Voltage: 3.3V, 2.5V, 1.8V
- Singled-end Output: CMOS
- Frequency: 32.768kHz
- Low Current Consumption: 10uA Max
- Temperature Range: -40 to 125 °C Operation
- Pb-free/RoHS Compliant



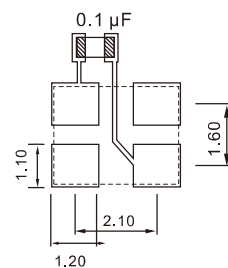
### Electrical Specifications

| Parameter                        | 3.3V                 |                      | 2.5V                |                     | 1.8V                |                     | Unit |
|----------------------------------|----------------------|----------------------|---------------------|---------------------|---------------------|---------------------|------|
|                                  | Min.                 | Max.                 | Min.                | Max.                | Min.                | Max.                |      |
| Supply Voltage Variation         | V <sub>DD</sub> -10% | V <sub>DD</sub> +10% | V <sub>DD</sub> -5% | V <sub>DD</sub> +5% | V <sub>DD</sub> -5% | V <sub>DD</sub> +5% | V    |
| Supply Current(no load)          | -                    | 18                   | -                   | 18                  | -                   | 18                  | uA   |
| Duty Cycle                       | 45                   | 55                   | 45                  | 55                  | 45                  | 55                  | %    |
| Transition Time : Rise/Fall Time | -                    | 15                   | -                   | 15                  | -                   | 15                  | nSec |
| Output Level                     | Out High(Logic"1")   | 2.97                 | 2.25                | 1.62                |                     |                     | V    |
|                                  | Out Low(Logic"0")    | 0.33                 | 0.25                | 0.18                |                     |                     |      |
| Startup Time                     | -                    | 20                   | -                   | 20                  | -                   | 20                  | mSec |
| Standby Current                  | -                    | 3                    | -                   | 3                   | -                   | 3                   | uA   |
| Output Loading(CMOS)             | -                    | 15                   | -                   | 15                  | -                   | 15                  | pF   |
| Tri-State<br>(Input to Pin 2)    | Enable               | 2.31                 | -                   | 1.75                | -                   | 1.26                | V    |
|                                  | Disable              | -                    | 0.99                | -                   | 0.75                | -                   |      |
| Aging(@25 1st year)              | -                    | ±3                   | -                   | ±3                  | -                   | ±3                  | ppm  |
| Storage Temp. Range              | -55                  | 125                  | -55                 | 125                 | -55                 | 125                 | °C   |

### Dimension(mm)



### Solder Pad Layout(mm)



To ensure optimal oscillator performance, place a by-pass capacitor of 0.1 µF as close to the part as possible between Vdd and GND pads.

### FREQ. STABILITY vs. TEMP. RANGE

| Temp. (°C) \ ppm | ±20 | ±25 | ±30 | ±50 |
|------------------|-----|-----|-----|-----|
| -10 ~ +60        | o   | o   | o   | o   |
| -20 ~ +70        | Δ   | o   | o   | o   |
| -40 ~ +85        | X   | Δ   | o   | o   |
| -40 ~ +105       | X   | X   | Δ   | o   |
| -40 ~ +125       | X   | X   | X   | o   |

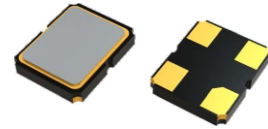
o: Available Δ: Conditional X: Not available

Inclusive of calibration @ 25 °C, operating temperature range, input voltage variation, load variation, aging (1st year), shock, and vibration

## SMD Crystal Oscillator 1.6 × 1.2 mm

### Feature

- Typical 1.65 x 1.25 x 0.8 mm SMD package.
- Tight symmetry (45 to 55%) available.
- Operation voltage: 1.8V, 2.5V, 3.3V
- Tri-state enable/disable
- RoHS compliant/Pb-free



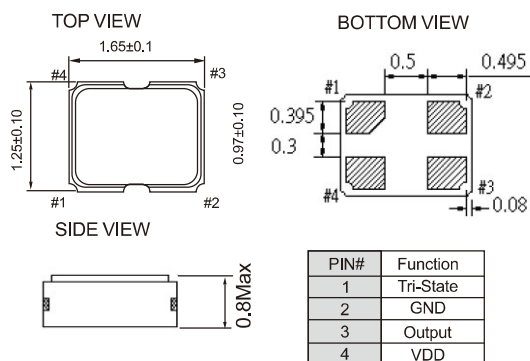
### Electrical Specifications

| Parameter                     |                                  | 3.3V        |      | 2.5V |      | 1.8V |      | Unit |
|-------------------------------|----------------------------------|-------------|------|------|------|------|------|------|
|                               |                                  | Min.        | Max. | Min. | Max. | Min. | Max. |      |
| Supply Voltage Variation      |                                  | 2.97        | 3.63 | 2.25 | 2.75 | 1.62 | 1.98 | V    |
| Frequency Range               |                                  | 2           | 80   | 2    | 80   | 2    | 80   | MHz  |
| Standard Frequency            |                                  | 24,26,32,40 |      |      |      |      |      | MHz  |
| Supply Current                |                                  | -           | 20   | -    | 20   | -    | 20   | mA   |
| Duty Cycle                    |                                  | 45          | 55   | 45   | 55   | 45   | 55   | %    |
| Rise/Fall Time                |                                  | -           | 10   | -    | 10   | -    | 10   | nSec |
| Output Level<br>(CMOS)        | Output High(Logic“1”)            | 2.97        |      | 2.25 |      | 1.62 |      | V    |
|                               | Output Low(Logic“0”)             |             | 0.33 |      | 0.25 |      | 0.18 |      |
| Start Time                    |                                  | -           | 2    | -    | 2    | -    | 2    | mSec |
| Tri-State<br>(Input to Pin 1) | Enable(High Voltage or floating) | 2.31        | -    | 1.75 | -    | 1.26 | -    | V    |
|                               | Disable(Low Voltage or GND)      | -           | 0.99 | -    | 0.75 | -    | 0.54 |      |
| Aging(@25 1st year)           |                                  | -           | ±3   | -    | ±3   | -    | ±3   | ppm  |
| Storage Temp. Range           |                                  | -55         | 125  | -55  | 125  | -55  | 125  | °C   |

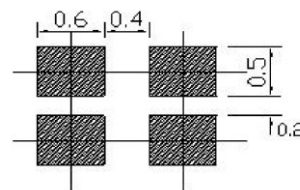
Standard frequencies are frequencies which the crystal has been designed and does not imply a stock position

.+ Transition times are measured between 10% and 90% of VDD, with an output load of 15pF.

### Dimension(mm)



### Solder Pad Layout(mm)



### FREQ. STABILITY vs. TEMP. RANGE

| Temp. (°C) \ ppm | ±20 | ±25 | ±50 |
|------------------|-----|-----|-----|
| -10 ~ +60        | ○   | ○   | ○   |
| -20 ~ +70        | △   | ○   | ○   |
| -40 ~ +85        | X   | ○   | ○   |
| -40 ~ +125       | X   | X   | ○   |

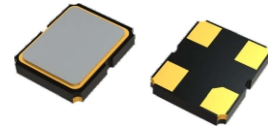
○: Available △: Conditional X: Not available

Inclusive of calibration @ 25 °C, operating temperature range, input voltage variation, load variation, aging (1st year), shock, and vibration

## SMD Crystal Oscillator 2.0 × 1.6 mm

### Feature

- Typical 2.05 x 1.65 x 0.75 mm SMD package.
- Tight symmetry (45 to 55%) available.
- Operation voltage: 1.8V, 2.5V, 3.3V
- Tri-state enable/disable
- RoHS compliant/Pb-free



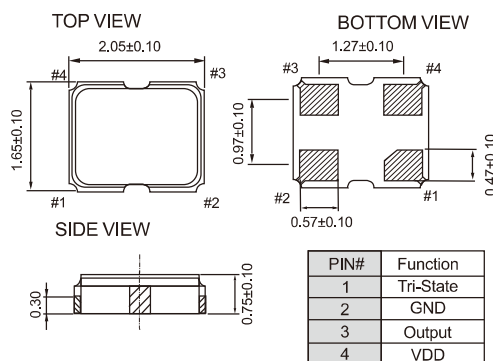
### Electrical Specifications

| Parameter                                    | 3.3V                             |         | 2.5V |         | 1.8V |         | Unit         |
|----------------------------------------------|----------------------------------|---------|------|---------|------|---------|--------------|
|                                              | Min.                             | Max.    | Min. | Max.    | Min. | Max.    |              |
| Supply Voltage Variation                     | 2.97                             | 3.63    | 2.25 | 2.75    | 1.62 | 1.98    | V            |
| Frequency Range                              | 1.5                              | 50      | 1.5  | 50      | 1.5  | 50      | MHz          |
| Standard Frequency                           | 24,26,32,40                      |         |      |         |      |         | MHz          |
| Supply Current                               | -                                | 15      | -    | 10      | -    | 7       | mA           |
| Duty Cycle                                   | 45                               | 55      | 45   | 55      | 45   | 55      | %            |
| Transition Time :<br>Rise/Fall Time          | 1.5 MHz $\leq$ FO < 20MHz        | -       | 4    | -       | 4    | -       | 5            |
|                                              | 20 MHz $\leq$ FO < 50MHz         | -       | 3    | -       | 3    | -       | 4            |
| Output Level<br>(CMOS)                       | Output High(Logic"1")            | 2.97    |      | 2.25    |      | 1.62    | V            |
|                                              | Output Low(Logic"0")             |         | 0.33 |         | 0.25 | 0.18    |              |
| Start Time                                   | -                                | 2       | -    | 2       | -    | 2       | mSec         |
| Tri-State<br>(Input to Pin 1)                | Enable(High Voltage or floating) | 2.31    | -    | 1.75    | -    | 1.26    | V            |
|                                              | Disable(Low Voltage or GND)      | -       | 0.99 | -       | 0.75 | -       | 0.54         |
| Period Jitter (Pk-Pk)                        | -                                | 40      | -    | 40      | -    | 40      | pSec         |
| RMS Phase Jitter (integrated 12kHz to 20MHz) | -                                | 1       | -    | 1       | -    | 1       | pSec         |
| Standby Current                              | -                                | 10      | -    | 10      | -    | 10      | $\mu$ A      |
| Aging(@25 1st year)                          | -                                | $\pm 3$ | -    | $\pm 3$ | -    | $\pm 3$ | ppm          |
| Storage Temp. Range                          | -55                              | 125     | -55  | 125     | -55  | 125     | $^{\circ}$ C |

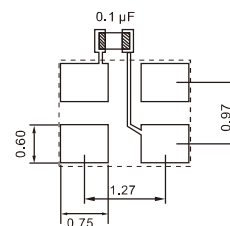
Standard frequencies are frequencies which the crystal has been designed and does not imply a stock position

.+ Transition times are measured between 10% and 90% of VDD, with an output load of 15pF.

### Dimension(mm)



### Solder Pad Layout(mm)



To ensure optimal oscillator performance, place a by-pass capacitor of 0.1  $\mu$ F as close to the part as possible between Vdd and GND pads.

### FREQ. STABILITY vs. TEMP. RANGE

| Temp. ( $^{\circ}$ C) \ ppm | $\pm 20$ | $\pm 25$ | $\pm 50$ |
|-----------------------------|----------|----------|----------|
| -10 ~ +60                   | o        | o        | o        |
| -20 ~ +70                   | $\Delta$ | o        | o        |
| -40 ~ +85                   | x        | o        | o        |
| -40 ~ +125                  | x        | x        | o        |

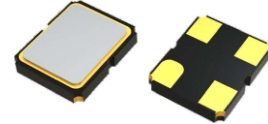
o: Available  $\Delta$ : Conditional x: Not available

Inclusive of calibration @ 25  $^{\circ}$ C, operating temperature range, input voltage variation, load variation, aging (1st year), shock, and vibration

## SMD Crystal Oscillator 2.5 × 2.0 mm

### Feature

- Typical 2.5 × 2.0 × 0.81 mm SMD package.
- Tight symmetry (45 to 55%) available.
- Operation voltage: 1.8V, 2.5V, 3.3V
- Tri-state enable/disable
- RoHS compliant/Pb-free



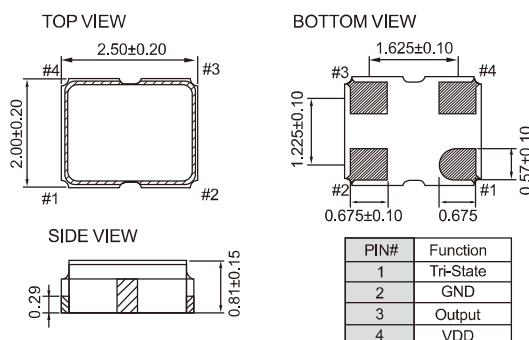
### Electrical Specifications

| Parameter                                    | 3.3V                             |       | 2.5V  |       | 1.8V |      | Unit |
|----------------------------------------------|----------------------------------|-------|-------|-------|------|------|------|
|                                              | Min.                             | Max.  | Min.  | Max.  | Min. | Max. |      |
| Supply Voltage Variation                     | 3.135                            | 3.465 | 2.375 | 2.625 | 1.71 | 1.89 | V    |
| Frequency Range                              | 1.25                             | 125   | 1.25  | 125   | 1.25 | 125  | MHz  |
| Standard Frequency                           | 24,26,30,40                      |       |       |       |      |      | MHz  |
| Supply Current( At 15pF Load)                | -                                | 15    | -     | 10    | -    | 7    | mA   |
| Duty Cycle                                   | 45                               | 55    | 45    | 55    | 45   | 55   | %    |
| Transition Time :<br>Rise/Fall Time          | 1.25 MHz ≤ FO < 10MHz            | -     | 3     | -     | 4    | -    | 5    |
|                                              | 10 MHz ≤ FO < 125MHz             | -     | 3     | -     | 3    | -    | 4    |
| Output Level                                 | Out High                         | 2.97  | 2.25  | 1.62  | 0.18 |      | V    |
|                                              | Out Low                          | 0.33  | 0.25  | 0.18  |      |      |      |
| Start Time                                   | -                                | 2     | -     | 2     | -    | 2    | mSec |
| Tri-State<br>(Input to Pin 1)                | Enable(High Voltage or floating) | 2.31  | -     | 1.75  | -    | 1.26 | -    |
|                                              | Disable(Low Voltage or GND)      | -     | 0.99  | -     | 0.75 | -    | 0.54 |
| Period Jitter (Pk-Pk)                        | -                                | 40    | -     | 40    | -    | 40   | pSec |
| RMS Phase Jitter (integrated 12kHz to 20MHz) | -                                | 1     | -     | 1     | -    | 1    | pSec |
| Standby Current(@-40 to 85°C)                | -                                | 10    | -     | 10    | -    | 10   | μA   |
| Standby Current(@-40 to 125°C)               | -                                | 20    | -     | 20    | -    | 20   | μA   |
| Aging(@25 1st year)                          | -                                | ±3    | -     | ±3    | -    | ±3   | ppm  |
| Storage Temp. Range                          | -55                              | 125   | -55   | 125   | -55  | 125  | °C   |

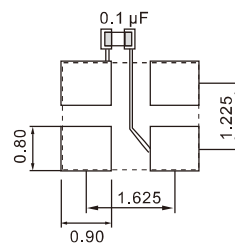
Standard frequencies are frequencies which the crystal has been designed and does not imply a stock position

.+ Transition times are measured between 10% and 90% of VDD, with an output load of 15pF.

### Dimension(mm)



### Solder Pad Layout(mm)



To ensure optimal oscillator performance, place a by-pass capacitor of 0.1 μF as close to the part as possible between Vdd and GND pads.

### FREQ. STABILITY vs. TEMP. RANGE

| ppm<br>Temp. (°C) | ±20 | ±25 | ±50 |
|-------------------|-----|-----|-----|
| -10 ~ +60         | o   | o   | o   |
| -20 ~ +70         | Δ   | o   | o   |
| -40 ~ +85         | x   | o   | o   |
| -40 ~ +125        | x   | x   | o   |

o: Available Δ: Conditional X: Not available

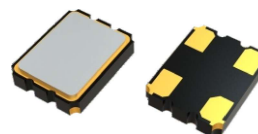
Inclusive of calibration @ 25 °C, operating temperature range, input voltage variation, load variation, aging (1st year), shock, and vibration load variation



## 3.2 × 2.5 mm SMD Crystal Oscillator

### Feature

- Typical 3.2 x 2.5 x 0.95mm SMD package.
- Tight symmetry (45 to 55%) available.
- Operation voltage: 1.8V, 2.5V, 3.3V
- Tri-state enable/disable
- RoHS compliant/Pb-free



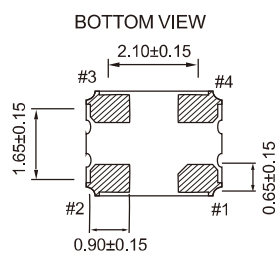
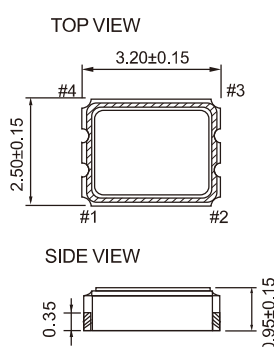
### Electrical Specifications

| Parameter                                    |                                  | 3.3V             |       | 2.5V  |       | 1.8V |      | Unit |
|----------------------------------------------|----------------------------------|------------------|-------|-------|-------|------|------|------|
|                                              |                                  | Min.             | Max.  | Min.  | Max.  | Min. | Max. |      |
| Supply Voltage Variation                     |                                  | 3.135            | 3.465 | 2.375 | 2.625 | 1.71 | 1.89 | V    |
| Frequency Range                              |                                  | 1.25             | 125   | 1.25  | 125   | 1.25 | 125  | MHz  |
| Standard Frequency                           |                                  | 4,24,26,32,38,40 |       |       |       |      |      | MHz  |
| Supply Current(At 15pF Load)                 |                                  | -                | 15    | -     | 10    | -    | 7    | mA   |
| Duty Cycle                                   |                                  | 45               | 55    | 45    | 55    | 45   | 55   | %    |
| Transition Time :<br>Rise/Fall Time          | 1.25 MHz ≤ FO < 10MHz            | -                | 3     | -     | 4     | -    | 5    | nSec |
|                                              | 10 MHz ≤ FO < 125MHz             | -                | 3     | -     | 3     | -    | 4    |      |
| Output Level                                 | Out High(Logic"1")               | 2.97             |       | 2.25  |       | 1.62 |      | V    |
|                                              | Out Low(Logic"0")                |                  | 0.33  |       | 0.25  |      | 0.18 |      |
| Start Time                                   |                                  | -                | 2     | -     | 2     | -    | 2    | mSec |
| Tri-State<br>(Input to Pin 1)                | Enable(High Voltage or floating) | 2.31             | -     | 1.75  | -     | 1.26 | -    | V    |
|                                              | Disable(Low Voltage or GND)      | -                | 0.99  | -     | 0.75  | -    | 0.54 |      |
| Period Jitter (Pk-Pk)                        |                                  | -                | 40    | -     | 40    | -    | 40   | pSec |
| RMS Phase Jitter (integrated 12kHz to 20MHz) |                                  | -                | 1     | -     | 1     | -    | 1    | pSec |
| Standby Current(@-40 to 85°C)                |                                  | -                | 10    | -     | 10    | -    | 10   | μA   |
| Standby Current(@-40 to 125°C)               |                                  | -                | 20    | -     | 20    | -    | 20   | μA   |
| Aging(@25 1st year)                          |                                  | -                | ±3    | -     | ±3    | -    | ±3   | ppm  |
| Storage Temp. Range                          |                                  | -55              | 125   | -55   | 125   | -55  | 125  | °C   |

Standard frequencies are frequencies which the crystal has been designed and does not imply a stock position

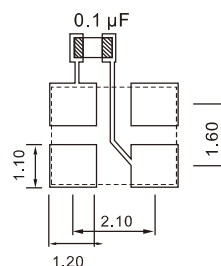
.+ Transition times are measured between 10% and 90% of VDD, with an output load of 15pF.

### Dimension(mm)



| PIN# | Function  |
|------|-----------|
| 1    | Tri-State |
| 2    | GND       |
| 3    | Output    |
| 4    | VDD       |

### Solder Pad Layout(mm)



To ensure optimal oscillator performance, place a by-pass capacitor of 0.1 μF as close to the part as possible between Vdd and GND pads.

### FREQ. STABILITY vs. TEMP. RANGE

| Temp. (°C) \ ppm | ±20 | ±25 | ±50 |
|------------------|-----|-----|-----|
| -10 ~ +60        | o   | o   | o   |
| -20 ~ +70        | Δ   | o   | o   |
| -40 ~ +85        | X   | o   | o   |
| -40 ~ +125       | X   | X   | o   |

o: Available Δ: Conditional X: Not available

Inclusive of calibration @ 25 °C, operating temperature range, input voltage variation, load variation, aging (1st year), shock, and vibration load variation

## 5.0 × 3.2 mm SMD Crystal Oscillator

### Feature

- Typical 5.0 × 3.2 × 1.2mm ceramic SMD package
- Tight symmetry (45 to 55%) available
- Operation voltage: 1.8V, 2.5V, 3.3V
- Realize the standby function with Tri-State
- RoHS compliant/Pb-free

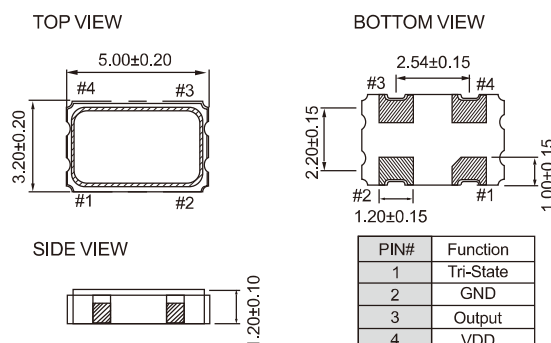


### Electrical Specifications

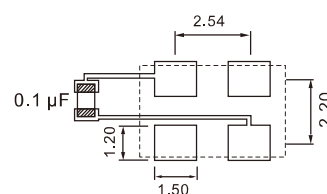
| Parameter                                    |                                  | 3.3V                             |      | 2.5V   |      | 1.8V   |      | Unit |
|----------------------------------------------|----------------------------------|----------------------------------|------|--------|------|--------|------|------|
|                                              |                                  | Min.                             | Max. | Min.   | Max. | Min.   | Max. |      |
| Supply Voltage Variation                     |                                  | 2.97                             | 3.63 | 2.25   | 2.75 | 1.62   | 1.98 | V    |
| Frequency Range                              |                                  | 0.0137                           | 160  | 0.0137 | 160  | 0.0137 | 135  | MHz  |
| Standard Frequency                           |                                  | 2.048,25,26,27,50,66.667,100,125 |      |        |      |        |      | MHz  |
| Supply Current                               | 13.7kHz ≡ FO< 93kHz              | -                                | 1    | -      | 1    | -      | 1    | mA   |
|                                              | 0.3125MHz ≡ FO<50MHz             | -                                | 10   | -      | 8    | -      | 7    |      |
|                                              | 40 MHz ≡ FO<75MHz                | -                                | 20   | -      | 18   | -      | 15   |      |
|                                              | 75 MHz ≡ FO<135MHz               | -                                | 35   | -      | 30   | -      | 25   |      |
|                                              | 135 MHz ≡ FO                     | -                                | 45   | -      | 40   | -      | -    |      |
| Transition Time :<br>Rise/Fall Time          | 13.7kHz ≡ FO< 93kHz              | -                                | 50   | -      | 50   | -      | 50   | nSec |
|                                              | 0.3125 MHz ≡ FO<100MHz           | -                                | 5    | -      | 5    | -      | 5    |      |
|                                              | 100 MHz ≡ FO                     | -                                | 3    | -      | 3    | -      | 3    |      |
| Output Level (CMOS)                          | Out High(Logic"1")               | 2.97                             |      | 2.25   |      | 1.62   |      | V    |
|                                              | Out Low(Logic"0")                |                                  | 0.33 |        | 0.25 |        | 0.18 |      |
| Start Time                                   |                                  | -                                | 5    | -      | 5    | -      | 5    | mSec |
| Tri-State<br>(Input to Pin 1)                | Enable(High Voltage or floating) | 2.31                             | -    | 1.75   | -    | 1.26   | -    | V    |
|                                              | Disable(Low Voltage or GND)      | -                                | 0.99 | -      | 0.75 | -      | 0.54 |      |
| Period Jitter (Pk-Pk)                        |                                  | -                                | 40   | -      | 40   | -      | 40   | pSec |
| RMS Phase Jitter (integrated 12kHz to 20MHz) |                                  | -                                | 1    | -      | 1    | -      | 1    | pSec |
| Standby Current                              |                                  | -                                | 10   | -      | 10   | -      | 10   | μA   |
| Aging(@25 1st year)                          |                                  | -                                | ±3   | -      | ±3   | -      | ±3   | ppm  |
| Storage Temp. Range                          |                                  | -55                              | 125  | -55    | 125  | -55    | 125  | °C   |

Standard frequencies are frequencies which the crystal has been designed and does not imply a stock position  
 .+ Transition times are measured between 10% and 90% of VDD, with an output load of 15pF.

### Dimension(mm)



### Solder Pad Layout(mm)



To ensure optimal oscillator performance, place a by-pass capacitor of 0.1  $\mu$ F as close to the part as possible between Vdd and GND pads.

### FREQ. STABILITY vs. TEMP. RANGE

| ppm<br>Temp. (°C) | $\pm 20$ | $\pm 25$ | $\pm 50$ |
|-------------------|----------|----------|----------|
| 10 ~ +60          | o        | o        | o        |
| -20 ~ +70         | $\Delta$ | o        | o        |
| -40 ~ +85         | $\Delta$ | o        | o        |
| -40 ~ +125        | x        | x        | o        |

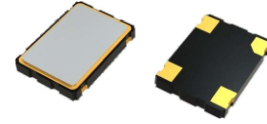
o: Available  $\Delta$ : Conditional X: Not available

Inclusive of calibration @ 25 °C, operating temperature range, input voltage variation, load variation, aging (1st year), shock, and vibration

## 7.0 × 5.0 mm SMD Crystal Oscillator

### Feature

- Typical 7.0 x 5.0 x 1.3mm SMD package.
- Operation voltage: 1.8V, 2.5V, 3.3V
- Tri-state enable/disable
- Output frequency up to 166MHz
- RoHS compliant/Pb-free



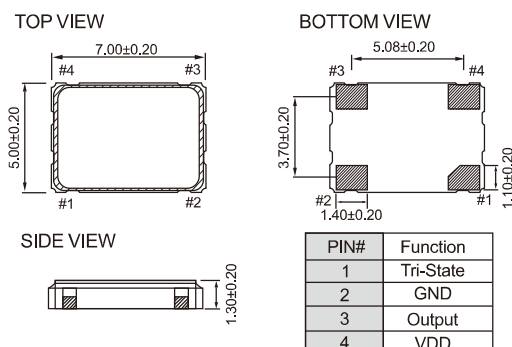
### Electrical Specifications

| Parameter                                    |                                  | 3.3V                                     |      | 2.5V   |      | 1.8V   |      | Unit |
|----------------------------------------------|----------------------------------|------------------------------------------|------|--------|------|--------|------|------|
|                                              |                                  | Min.                                     | Max. | Min.   | Max. | Min.   | Max. |      |
| Supply Voltage Variation                     |                                  | 2.97                                     | 3.63 | 2.25   | 2.75 | 1.62   | 1.98 | V    |
| Frequency Range                              |                                  | 0.0137                                   | 166  | 0.0137 | 133  | 0.0137 | 125  | MHz  |
| Standard Frequency                           |                                  | 2.048, 25, 26, 27, 50, 66, 667, 100, 125 |      |        |      |        |      | MHz  |
| Supply Current                               | 13.7kHz ≤ FO < 70kHz             | -                                        | 1    | -      | 1    | -      | 1    | mA   |
|                                              | 0.312MHz ≤ FO < 35.328MHz        | -                                        | 10   | -      | 8    | -      | 7    |      |
|                                              | 40 MHz ≤ FO < 75MHz              | -                                        | 20   | -      | 18   | -      | 15   |      |
|                                              | 75 MHz ≤ FO < 135MHz             | -                                        | 35   | -      | 30   | -      | 25   |      |
|                                              | 135 MHz ≤ FO                     | -                                        | 45   | -      | 40   | -      | -    |      |
| Transition Time :<br>Rise/Fall Time          | 13.7kHz ≤ FO < 93kHz             | -                                        | 50   | -      | 50   | -      | 50   | nSec |
|                                              | 0.312 MHz ≤ FO < 100MHz          | -                                        | 5    | -      | 5    | -      | 5    |      |
|                                              | 100 MHz ≤ FO                     | -                                        | 3    | -      | 3    | -      | 3    |      |
| Output Level<br>(CMOS)                       | Output High(Logic"1")            | 2.97                                     |      | 2.25   |      | 1.62   |      | V    |
|                                              | Output Low(Logic"0")             |                                          | 0.33 |        | 0.25 |        | 0.18 |      |
| Start Time                                   |                                  | -                                        | 5    | -      | 5    | -      | 5    | mSec |
| Tri-State<br>(Input to Pin 1)                | Enable(High Voltage or floating) | 2.31                                     | -    | 1.75   | -    | 1.26   | -    | V    |
|                                              | Disable(Low Voltage or GND)      | -                                        | 0.99 | -      | 0.75 | -      | 0.54 |      |
| Period Jitter (Pk-Pk)                        |                                  | -                                        | 40   | -      | 40   | -      | 40   | pSec |
| RMS Phase Jitter (Integrated 12kHz to 20MHz) |                                  | -                                        | 1    | -      | 1    | -      | 1    | pSec |
| Standby Current                              |                                  | -                                        | 10   | -      | 10   | -      | 10   | μA   |
| Aging(@25 1st year)                          |                                  | -                                        | ±3   | -      | ±3   | -      | ±3   | ppm  |
| Storage Temp. Range                          |                                  | -55                                      | 125  | -55    | 125  | -55    | 125  | °C   |

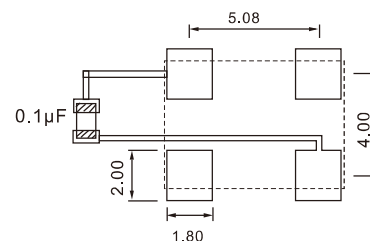
Standard frequencies are frequencies which the crystal has been designed and does not imply a stock position

.+ Transition times are measured between 10% and 90% of VDD, with an output load of 15pF.

### Dimension(mm)



### Solder Pad Layout(mm)



To ensure optimal oscillator performance, place a by-pass capacitor of 0.1 μF as close to the part as possible between Vdd and GND pads.

### FREQ. STABILITY vs. TEMP. RANGE

| ppm<br>Temp. (°C) | ±20 | ±25 | ±50 |
|-------------------|-----|-----|-----|
| 10 ~ +60          | ○   | ○   | ○   |
| -20 ~ +70         | △   | ○   | ○   |
| -40 ~ +85         | △   | ○   | ○   |
| -40 ~ +125        | X   | X   | ○   |

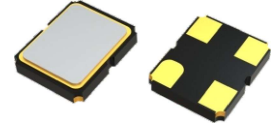
○: Available △: Conditional X: Not available

Inclusive of calibration @ 25 °C, operating temperature range, input voltage variation, load variation, aging (1st year), shock, and vibration

## 2.5 × 2.0 mm Ultra Low Power SMD Crystal Oscillator

### Feature

- Typical 2.5 x 2.0 x 0.81 mm SMD package
- Singled-end Output: CMOS
- Ultra Low Power Supply Voltage: 0.9V, 1.2V, 1.5V
- Low Noise Typical: 0.3ps at 12kHz to 20MHz Frequency Offsets
- Temperature Range: -40 to 85°C Operation
- Pb-free/RoHS Compliant



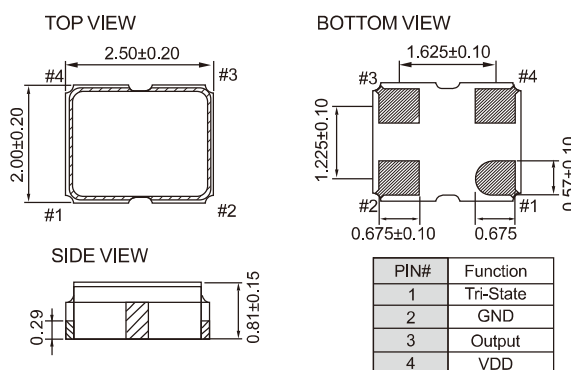
### Electrical Specifications

| Parameter                                    |                   | 0.9V                |                     | 1.2V                |                     | 1.5V                |                     | Unit   |
|----------------------------------------------|-------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|--------|
|                                              |                   | Min.                | Max.                | Min.                | Max.                | Min.                | Max.                |        |
| Supply Voltage Variation                     |                   | V <sub>DD</sub> -5% | V <sub>DD</sub> +5% | V <sub>DD</sub> -5% | V <sub>DD</sub> +5% | V <sub>DD</sub> -5% | V <sub>DD</sub> +5% | V      |
| Frequency Range                              |                   | 1                   | 50                  | 1                   | 50                  | 1                   | 50                  | MHz    |
| Supply Current(At 15pF Load)                 |                   | -                   | 1.5                 | -                   | 2                   | -                   | 3                   | mA     |
| Duty Cycle                                   |                   | 45                  | 55                  | 45                  | 55                  | 45                  | 55                  | %      |
| Transition Time :<br>Rise/Fall Time          | 1 MHz ≦ FO<10MHz  | -                   | 4                   | -                   | 3                   | -                   | 3                   | nSec   |
|                                              | 10 MHz ≦ FO<20MHz | -                   | 3                   | -                   | 3                   | -                   | 3                   |        |
|                                              | 20 MHz ≦ FO<50MHz | -                   | 2                   | -                   | 2                   | -                   | 2                   |        |
| Output Level                                 | Out High          | 0.9V <sub>DD</sub>  |                     | 0.9V <sub>DD</sub>  |                     | 0.9V <sub>DD</sub>  |                     | V      |
|                                              | Out Low           |                     | 0.1V <sub>DD</sub>  |                     | 0.1V <sub>DD</sub>  |                     | 0.1V <sub>DD</sub>  |        |
| Startup Time                                 |                   | -                   | 4                   | -                   | 4                   | -                   | 4                   | mSec   |
| Tri-State<br>(Input to Pin 1)                | Enable            | 0.7V <sub>DD</sub>  |                     | 0.7V <sub>DD</sub>  |                     | 0.7V <sub>DD</sub>  |                     | V      |
|                                              | Disable           |                     | 0.3V <sub>DD</sub>  |                     | 0.3V <sub>DD</sub>  |                     | 0.3V <sub>DD</sub>  |        |
| Period Jitter (Pk-Pk)                        |                   | -                   | 40                  | -                   | 40                  | -                   | 40                  | pSec   |
| RMS Phase Jitter (integrated 12kHz to 20MHz) |                   | -                   | 1                   | -                   | 1                   | -                   | 1                   | pSec   |
| Phase Noise @24MHz @100kHz                   |                   | -148                |                     | -150                |                     | -150                |                     | dBc/Hz |
| Standby Current                              |                   | -                   | 100                 | -                   | 100                 | -                   | 100                 | μA     |
| Aging(@25 1st year)                          |                   | -                   | ±3                  | -                   | ±3                  | -                   | ±3                  | ppm    |
| Storage Temp. Range                          |                   | -55                 | 125                 | -55                 | 125                 | -55                 | 125                 | °C     |

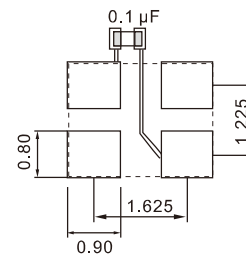
Standard frequencies are frequencies which the crystal has been designed and does not imply a stock position

+ Transition times are measured between 10% and 90% of VDD, with an output load of 15pF.

### Dimension(mm)



### Solder Pad Layout(mm)



To ensure optimal oscillator performance, place a by-pass capacitor of 0.1 μF as close to the part as possible between Vdd and GND pads.

### FREQ. STABILITY vs. TEMP. RANGE

| Temp. (°C) \ ppm | ±25 | ±50 |
|------------------|-----|-----|
| -10 ~ +60        | ○   | ○   |
| -20 ~ +70        | ○   | ○   |
| -40 ~ +85        | △   | ○   |

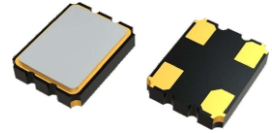
○: Available △: Conditional X: Not available

Inclusive of calibration @ 25 °C, operating temperature range, input voltage variation, load variation, aging (1st year), shock, and vibration load variation

## 3.2 × 2.5 mm Ultra Low Power SMD Crystal Oscillator

### Feature

- Typical 3.2 × 2.5 × 0.95 mm SMD package
- Singled-end Output: CMOS
- Ultra Low Power Supply Voltage: 0.9V, 1.2V, 1.5V
- Low Noise Typical: 0.3ps at 12kHz to 20MHz Frequency Offsets
- Temperature Range: -40 to 85°C Operation
- Pb-free/RoHS Compliant



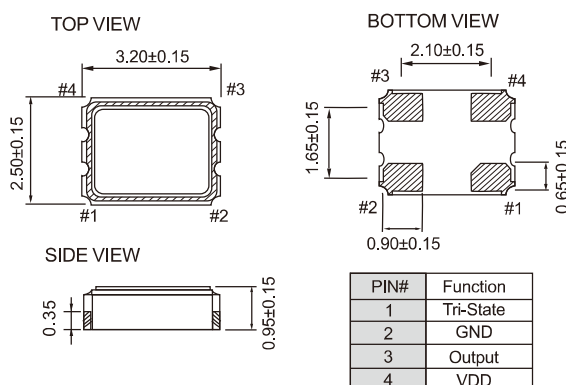
### Electrical Specifications

| Parameter                                    |                   | 0.9V                |                     | 1.2V                |                     | 1.5V                |                     | Unit   |
|----------------------------------------------|-------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|--------|
|                                              |                   | Min.                | Max.                | Min.                | Max.                | Min.                | Max.                |        |
| Supply Voltage Variation                     |                   | V <sub>DD</sub> -5% | V <sub>DD</sub> +5% | V <sub>DD</sub> -5% | V <sub>DD</sub> +5% | V <sub>DD</sub> -5% | V <sub>DD</sub> +5% | V      |
| Frequency Range                              |                   | 1                   | 50                  | 1                   | 50                  | 1                   | 50                  | MHz    |
| Supply Current(At 15pF Load)                 |                   | -                   | 1.5                 | -                   | 2                   | -                   | 3                   | mA     |
| Duty Cycle                                   |                   | 45                  | 55                  | 45                  | 55                  | 45                  | 55                  | %      |
| Transition Time :<br>Rise/Fall Time          | 1 MHz ≦ FO<10MHz  | -                   | 4                   | -                   | 3                   | -                   | 3                   | nSec   |
|                                              | 10 MHz ≦ FO<20MHz | -                   | 3                   | -                   | 3                   | -                   | 3                   |        |
|                                              | 20 MHz ≦ FO<50MHz | -                   | 2                   | -                   | 2                   | -                   | 2                   |        |
| Output Level                                 | Out High          | 0.9V <sub>DD</sub>  |                     | 0.9V <sub>DD</sub>  |                     | 0.9V <sub>DD</sub>  |                     | V      |
|                                              | Out Low           |                     | 0.1V <sub>DD</sub>  |                     | 0.1V <sub>DD</sub>  |                     | 0.1V <sub>DD</sub>  |        |
| Startup Time                                 |                   | -                   | 4                   | -                   | 4                   | -                   | 4                   | mSec   |
| Tri-State<br>(Input to Pin 1)                | Enable            | 0.7V <sub>DD</sub>  |                     | 0.7V <sub>DD</sub>  |                     | 0.7V <sub>DD</sub>  |                     | V      |
|                                              | Disable           |                     | 0.3V <sub>DD</sub>  |                     | 0.3V <sub>DD</sub>  |                     | 0.3V <sub>DD</sub>  |        |
| Period Jitter (Pk-Pk)                        |                   | -                   | 40                  | -                   | 40                  | -                   | 40                  | pSec   |
| RMS Phase Jitter (integrated 12kHz to 20MHz) |                   | -                   | 1                   | -                   | 1                   | -                   | 1                   | pSec   |
| Phase Noise @24MHz @100kHz                   |                   | -148                |                     | -150                |                     | -150                |                     | dBc/Hz |
| Standby Current                              |                   | -                   | 100                 | -                   | 100                 | -                   | 100                 | μA     |
| Aging(@25 1st year)                          |                   | -                   | ±3                  | -                   | ±3                  | -                   | ±3                  | ppm    |
| Storage Temp. Range                          |                   | -55                 | 125                 | -55                 | 125                 | -55                 | 125                 | °C     |

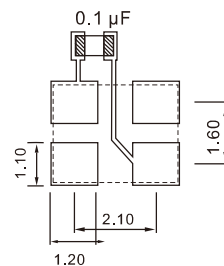
Standard frequencies are frequencies which the crystal has been designed and does not imply a stock position

.+ Transition times are measured between 10% and 90% of VDD, with an output load of 15pF.

### Dimension(mm)



### Solder Pad Layout(mm)



To ensure optimal oscillator performance, place a by-pass capacitor of 0.1  $\mu$ F as close to the part as possible between Vdd and GND pads.

### FREQ. STABILITY vs. TEMP. RANGE

| Temp. ( $^{\circ}$ C) | $\pm 25$ | $\pm 50$ |
|-----------------------|----------|----------|
| -10 ~ +60             | o        | o        |
| -20 ~ +70             | o        | o        |
| -40 ~ +85             | $\Delta$ | o        |

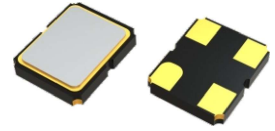
o: Available  $\Delta$ : Conditional X: Not available

Inclusive of calibration @ 25  $^{\circ}$ C, operating temperature range, input voltage variation, load variation, aging (1st year), shock, and vibration load variation

## 2.5 × 2.0 mm Extended Operating Temperature Range SMD Crystal Oscillator

### Feature

- Typical 2.5 x 2.0 x 0.81 mm SMD package.
- Extended Industrial Operating Temperature Range -55~+125°C
- Low jitter and phase noise(25ps Pk-Pk Period jitter, typical)
- Tight symmetry(45 to 55%) available.
- Operation voltage : 1.8V, 2.5V, 3.3V.
- Tri-state enable/disable.



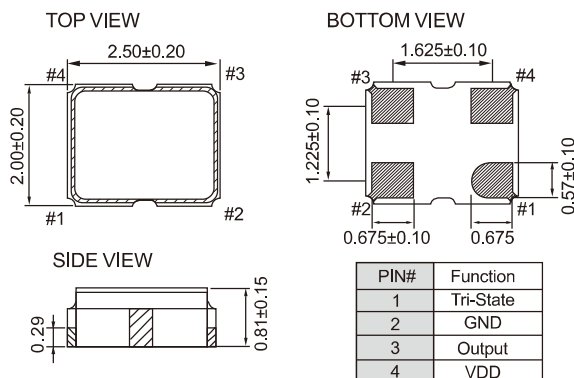
### Electrical Specifications

| Parameter                                    |                                  | 3.3V |      | 2.5V |      | 1.8V |      | Unit |
|----------------------------------------------|----------------------------------|------|------|------|------|------|------|------|
|                                              |                                  | Min. | Max. | Min. | Max. | Min. | Max. |      |
| Supply Voltage Variation                     |                                  | 2.97 | 3.63 | 2.25 | 2.75 | 1.62 | 1.98 | V    |
| Frequency Range                              |                                  | 1.25 | 100  | 1.25 | 100  | 1.25 | 100  | MHz  |
| Supply Current                               | FO<80MHz                         | -    | 10   | -    | 8    | -    | 5    | mA   |
|                                              | 80 MHz ≤ FO                      | -    | 15   | -    | 10   | -    | 8    | mA   |
| Duty Cycle                                   |                                  | 45   | 55   | 45   | 55   | 45   | 55   | %    |
| Transition Time : Rise/Fall Time             |                                  | -    | 3    | -    | 4    | -    | 5    | nSec |
| Output Level (CMOS)                          | Output High(Logic"1")            | 2.97 |      | 2.25 |      | 1.62 |      | V    |
|                                              | Output Low(Logic"0")             |      | 0.33 |      | 0.25 |      | 0.18 |      |
| Start Time                                   |                                  | -    | 2    | -    | 2    | -    | 2    | mSec |
| Tri-State (Input to Pin 1)                   | Enable(High Voltage or floating) | 2.31 | -    | 1.75 | -    | 1.26 | -    | V    |
|                                              | Disable(Low Voltage or GND)      | -    | 0.99 | -    | 0.75 | -    | 0.54 |      |
| Period Jitter (Pk-Pk)                        |                                  | -    | 40   | -    | 40   | -    | 40   | pSec |
| RMS Phase Jitter (integrated 12kHz to 20MHz) |                                  | -    | 1    | -    | 1    | -    | 1    | pSec |
| Aging(@25 1st year)                          |                                  | -    | ±3   | -    | ±3   | -    | ±3   | ppm  |
| Storage Temp. Range                          |                                  | -55  | 125  | -55  | 125  | -55  | 125  | °C   |

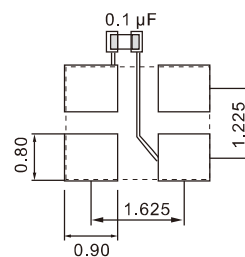
Standard frequencies are frequencies which the crystal has been designed and does not imply a stock position

.+ Transition times are measured between 10% and 90% of VDD, with an output load of 15pF.

### Dimension(mm)



### Solder Pad Layout(mm)



To ensure optimal oscillator performance, place a by-pass capacitor of 0.1 µF as close to the part as possible between Vdd and GND pads.

### FREQ. STABILITY vs. TEMP. RANGE

| Temp. (°C) \ ppm | ±30 | ±40 | ±50 | ±100 |
|------------------|-----|-----|-----|------|
| -40 ~ +85        | ○   | ○   | ○   | ○    |
| -40 ~ +105       | △   | ○   | ○   | ○    |
| -40 ~ +125       | X   | △   | ○   | ○    |
| -55 ~ +125       | X   | X   | △   | ○    |

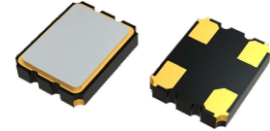
○: Available △: Conditional X: Not available

Inclusive of calibration @ 25 °C, operating temperature range, input voltage variation, load variation, aging (1st year), shock, and vibration

## 3.2 × 2.5 mm Extended Operating Temperature Range SMD Crystal Oscillator

### Feature

- Typical 3.2 x 2.5 x 0.95 mm SMD package.
- Extended Industrial Operating Temperature Range -55~+125°C
- Low jitter and phase noise(25ps Pk-Pk Period jitter, typical)
- Tight symmetry(45 to 55%) available.
- Operation voltage : 1.8V, 2.5V, 3.3V.
- Tri-state enable/disable.



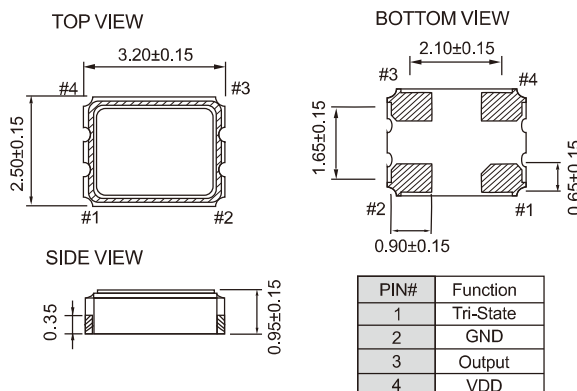
### Electrical Specifications

| Parameter                                    |                                   | 3.3V |      | 2.5V |      | 1.8V |      | Unit |
|----------------------------------------------|-----------------------------------|------|------|------|------|------|------|------|
|                                              |                                   | Min. | Max. | Min. | Max. | Min. | Max. |      |
| Supply Voltage Variation                     |                                   | 2.97 | 3.63 | 2.25 | 2.75 | 1.62 | 1.98 | V    |
| Frequency Range                              |                                   | 1.25 | 100  | 1.25 | 100  | 1.25 | 100  | MHz  |
| Supply Current                               | FO<80MHz                          | -    | 10   | -    | 8    | -    | 5    | mA   |
|                                              | 80 MHz ≤ FO                       | -    | 15   | -    | 10   | -    | 8    | mA   |
| Duty Cycle                                   |                                   | 45   | 55   | 45   | 55   | 45   | 55   | %    |
| Transition Time : Rise/Fall Time             |                                   | -    | 3    | -    | 4    | -    | 5    | nSec |
| Output Level (CMOS)                          | Output High (Logic "1")           | 2.97 |      | 2.25 |      | 1.62 |      | V    |
|                                              | Output Low (Logic "0")            |      | 0.33 |      | 0.25 |      | 0.18 |      |
| Start Time                                   |                                   | -    | 2    | -    | 2    | -    | 2    | mSec |
| Tri-State (Input to Pin 1)                   | Enable (High Voltage or floating) | 2.31 | -    | 1.75 | -    | 1.26 | -    | V    |
|                                              | Disable (Low Voltage or GND)      | -    | 0.99 | -    | 0.75 | -    | 0.54 |      |
| Period Jitter (Pk-Pk)                        |                                   | -    | 40   | -    | 40   | -    | 40   | pSec |
| RMS Phase Jitter (integrated 12kHz to 20MHz) |                                   | -    | 1    | -    | 1    | -    | 1    | pSec |
| Aging (@25 1st year)                         |                                   | -    | ±3   | -    | ±3   | -    | ±3   | ppm  |
| Storage Temp. Range                          |                                   | -55  | 125  | -55  | 125  | -55  | 125  | °C   |

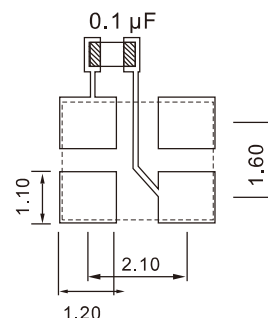
Standard frequencies are frequencies which the crystal has been designed and does not imply a stock position

.+ Transition times are measured between 10% and 90% of VDD, with an output load of 15pF.

### Dimension(mm)



### Solder Pad Layout(mm)



To ensure optimal oscillator performance, place a by-pass capacitor of 0.1 µF as close to the part as possible between Vdd and GND pads.

### FREQ. STABILITY vs. TEMP. RANGE

| Temp. (°C) \ ppm | ±30 | ±40 | ±50 | ±100 |
|------------------|-----|-----|-----|------|
| -40 ~ +85        | ○   | ○   | ○   | ○    |
| -40 ~ +105       | △   | ○   | ○   | ○    |
| -40 ~ +125       | X   | △   | ○   | ○    |
| -55 ~ +125       | X   | X   | △   | ○    |

○: Available △: Conditional X: Not available

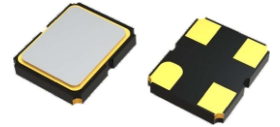
Inclusive of calibration @ 25 °C, operating temperature range, input voltage variation, load variation, aging (1st year), shock, and vibration



## 2.5 × 2.0 mm Ultra Low Noise SMD Crystal Oscillator

### Feature

- Typical 2.5 x 2.0 x 0.81 mm SMD package.
- Ultra Low Phase Noise designed specifically for Hi-Resolution Audio (HiFi, HD Audio)
- F=45.1584MHz(@1.8V,25°C):typical low close-in phase noise of-100dBc/Hz@10Hz-offset, -127dBc/Hz@100Hz-offset,and a noise floor of-157dBc/Hz
- F=49.152MHz(@1.8V,25°C):typical low close-in phase noise of-100dBc/Hz@10Hz-offset, -128dBc/Hz@100Hz-offset,and a noise floor of-157dBc/Hz
- Wide operating temperature range:-40°C~+105°C

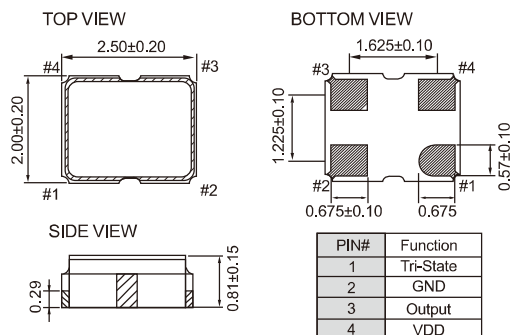


### Electrical Specifications

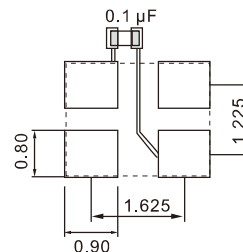
| Parameter                                    |                                  | 3.3V    |      | 2.5V    |      | 1.8V    |      | Unit   |
|----------------------------------------------|----------------------------------|---------|------|---------|------|---------|------|--------|
|                                              |                                  | Min.    | Max. | Min.    | Max. | Min.    | Max. |        |
| Supply Voltage Variation                     |                                  | 2.97    | 3.63 | 2.25    | 2.75 | 1.62    | 1.98 | V      |
| Frequency Range                              |                                  | 20      | 60   | 20      | 60   | 20      | 60   | MHz    |
| Supply Current                               |                                  | -       | 8    | -       | 7    | -       | 5    | mA     |
| Duty Cycle                                   |                                  | 45      | 55   | 45      | 55   | 45      | 55   | %      |
| Transition Time :Rise/Fall Time              |                                  | -       | 6    | -       | 6    | -       | 6    | nSec   |
| Output Level (CMOS)                          | Out High(Logic"1")               | 2.97    |      | 2.25    |      | 1.62    |      | V      |
|                                              | Out Low(Logic"0")                |         | 0.33 |         | 0.25 |         | 0.18 |        |
| Start Time                                   |                                  | -       | 2    | -       | 2    | -       | 2    | mSec   |
| Tri-State (Input to Pin 1)                   | Enable(High Voltage or floating) | 2.31    | -    | 1.75    | -    | 1.26    | -    | V      |
|                                              | Disable(Low Voltage or GND)      | -       | 0.99 | -       | 0.75 | -       | 0.54 |        |
| RMS Phase Jitter (Integrated 12kHz to 20MHz) |                                  | -       | 0.5  | -       | 0.5  | -       | 0.5  | pSec   |
| Phase Noise (TYP.)                           |                                  | F=20MHz |      | F=40MHz |      | F=60MHz |      | dBc/Hz |
| 1.8V, 25°C                                   | 1kHz offset                      | -147    |      | -143    |      | -139    |      | dBc/Hz |
|                                              | 100kHz offset                    | -156    |      | -154    |      | -150    |      | dBc/Hz |
| 2.5 to 3.3V, 25°C                            | 1kHz offset                      | -151    |      | -148    |      | -142    |      | dBc/Hz |
|                                              | 100kHz offset                    | -157    |      | -156    |      | -156    |      | dBc/Hz |
| Aging(@25°C 1st year)                        |                                  | -       | ±3   | -       | ±3   | -       | ±3   | ppm    |
| Storage Temp. Range                          |                                  | -55     | 125  | -55     | 125  | -55     | 125  | °C     |

Standard frequencies are frequencies which the crystal has been designed and does not imply a stock position  
 .+ Transition times are measured between 10% and 90% of VDD, with an output load of 15pF.

### Dimension(mm)



### Solder Pad Layout(mm)



To ensure optimal oscillator performance, place a by-pass capacitor of 0.1 μF as close to the part as possible between Vdd and GND pads.

### FREQ. STABILITY vs. TEMP. RANGE

| ppm<br>Temp. (°C) | ±20 | ±25 | ±30 | ±50 |
|-------------------|-----|-----|-----|-----|
| -10 ~ +60         | ○   | ○   | ○   | ○   |
| -20 ~ +70         | △   | ○   | ○   | ○   |
| -40 ~ +85         | X   | ○   | ○   | ○   |
| -40 ~ +105        | X   | X   | △   | ○   |

○: Available △:Conditional X: Not available

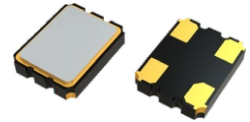
Inclusive of calibration @ 25 °C, operating temperature range, input voltage variation, load variation, aging (1st year), shock, and vibration



## 3.2 × 2.5 mm Ultra Low Noise SMD Crystal Oscillator

### Feature

- Typical 3.2 x 2.5 x 0.95 mm SMD package.
- Ultra Low Phase Noise designed specifically for Hi-Resolution Audio ( HiFi , HD Audio)
- F=45.1584MHz(@1.8V,25°C):typical low close-in phase noise of-100dBc/Hz@10Hz-offset, -127dBc/Hz@100Hz-offset,and a noise floor of-157dBc/Hz
- F=49.152MHz(@1.8V,25°C):typical low close-in phase noise of-100dBc/Hz@10Hz-offset, -128dBc/Hz@100Hz-offset,and a noise floor of-157dBc/Hz
- Wide operating temperature range:-40°C~+105°C

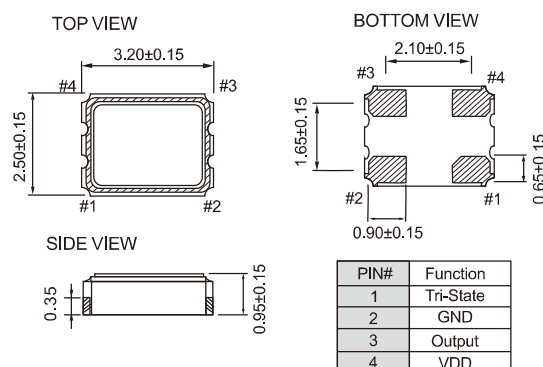


### Electrical Specifications

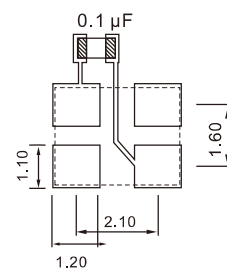
| Parameter                                    |                                  | 3.3V    |      | 2.5V    |      | 1.8V    |      | Unit   |
|----------------------------------------------|----------------------------------|---------|------|---------|------|---------|------|--------|
|                                              |                                  | Min.    | Max. | Min.    | Max. | Min.    | Max. |        |
| Supply Voltage Variation                     |                                  | 2.97    | 3.63 | 2.25    | 2.75 | 1.62    | 1.98 | V      |
| Frequency Range                              |                                  | 20      | 60   | 20      | 60   | 20      | 60   | MHz    |
| Supply Current                               |                                  | -       | 8    | -       | 7    | -       | 5    | mA     |
| Duty Cycle                                   |                                  | 45      | 55   | 45      | 55   | 45      | 55   | %      |
| Transition Time :Rise/Fall Time              |                                  | -       | 6    | -       | 6    | -       | 6    | nSec   |
| Output Level (CMOS)                          | Out High(Logic"1")               | 2.97    |      | 2.25    |      | 1.62    |      | V      |
|                                              | Out Low(Logic"0")                |         | 0.33 |         | 0.25 |         | 0.18 |        |
| Start Time                                   |                                  | -       | 2    | -       | 2    | -       | 2    | mSec   |
| Tri-State (Input to Pin 1)                   | Enable(High Voltage or floating) | 2.31    | -    | 1.75    | -    | 1.26    | -    | V      |
|                                              | Disable(Low Voltage or GND)      | -       | 0.99 | -       | 0.75 | -       | 0.54 |        |
| RMS Phase Jitter (Integrated 12kHz to 20MHz) |                                  | -       | 0.5  | -       | 0.5  | -       | 0.5  | pSec   |
| Phase Noise (TYP.)                           |                                  | F=20MHz |      | F=40MHz |      | F=60MHz |      | dBc/Hz |
| 1.8V, 25°C                                   | 1kHz offset                      | -147    |      | -143    |      | -139    |      | dBc/Hz |
|                                              | 100kHz offset                    | -156    |      | -154    |      | -150    |      | dBc/Hz |
| 2.5 to 3.3V, 25°C                            | 1kHz offset                      | -151    |      | -148    |      | -142    |      | dBc/Hz |
|                                              | 100kHz offset                    | -157    |      | -156    |      | -156    |      | dBc/Hz |
| Aging(@25°C 1st year)                        |                                  | -       | ±3   | -       | ±3   | -       | ±3   | ppm    |
| Storage Temp. Range                          |                                  | -55     | 125  | -55     | 125  | -55     | 125  | °C     |

Standard frequencies are frequencies which the crystal has been designed and does not imply a stock position  
 .+ Transition times are measured between 10% and 90% of VDD, with an output load of 15pF.

### Dimension(mm)



### Solder Pad Layout(mm)



To ensure optimal oscillator performance, place a by-pass capacitor of 0.1 µF as close to the part as possible between Vdd and GND pads.

### FREQ. STABILITY vs. TEMP. RANGE

| Temp. (°C) \ ppm | ±20 | ±25 | ±30 | ±50 |
|------------------|-----|-----|-----|-----|
| -10 ~ +60        | ○   | ○   | ○   | ○   |
| -20 ~ +70        | △   | ○   | ○   | ○   |
| -40 ~ +85        | X   | ○   | ○   | ○   |
| -40 ~ +105       | X   | X   | △   | ○   |

○: Available △:Conditional X: Not available  
 Inclusive of calibration @ 25 °C, operating temperature range, input voltage variation, load variation, aging (1st year), shock, and vibration

## 20.8 x 12.46 DIP14 FULL Size Crystal Oscillator

### Feature

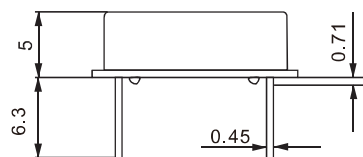
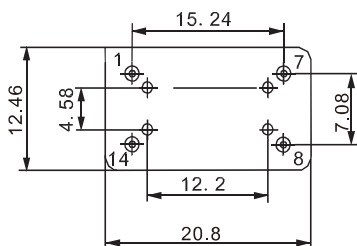
- Typical 20.8 x 12.46 x 5 mm
- Tight symmetry (45 to 55%) available.
- Operation voltage: 5V, 3.3V
- Tri-state enable/disable



### Electrical Specifications

| Parameter                           |                     | 3.3V                           |      | 5.0V       |         | Unit |
|-------------------------------------|---------------------|--------------------------------|------|------------|---------|------|
|                                     |                     | Min.                           | Max. | Min.       | Max.    |      |
| Fan out Type                        |                     | CMOS                           |      | TTL/CMOS   |         |      |
| Supply Voltage Variation            |                     | 3.0                            | 3.6  | 4.5        | 5.5     | V    |
| Frequency Range                     |                     | 0.25                           | 180  | 0.25       | 180     | MHz  |
| Frequency Stability                 |                     | ±25, ±50, ±100 or specify      |      |            |         | PPM  |
| Operating Temperature               |                     | 0~70,-20~70, -40~85 or specify |      |            |         | °C   |
| Supply Current                      | 0.25 MHz ≡ FO<20MHz | -                              | 10   | -          | 15      | mA   |
|                                     | 20 MHz ≡ FO<50MHz   | -                              | 30   | -          | 40      | mA   |
|                                     | 50 MHz ≡ FO<180MHz  | -                              | 40   | -          | 50      | mA   |
| Duty Cycle                          |                     | 45                             | 55   | 45         | 55      | %    |
| Transition Time :<br>Rise/Fall Time | 0.25 MHz ≡ FO<20MHz | -                              | 10   | -          | 8       | nSec |
|                                     | 20 MHz ≡ FO<50MHz   | -                              | 6    | -          | 5       |      |
|                                     | 50 MHz ≡ FO<180MHz  | -                              | 5    | -          | 4       |      |
| Input Voltage                       | Vol (Max)           | -                              | 0.33 | -          | 0.4/0.5 | V    |
|                                     | 2.4V/4.5V           | 2.4/2.5                        | -    | 3.0        | -       |      |
| Driving Ability                     | CMOS load max       | 15                             |      | 15/50      |         | pF   |
|                                     | TTL load max        |                                |      | 10TTL      |         |      |
| Start Time                          |                     | 5 ms max(15pF)/ 10 ms (50pF)   |      |            |         | mSec |
| E/D Function                        | #1 OPEN             | Pin#8 Open                     |      | Pin#8 Open |         |      |
|                                     | #1 >=2.2V           | Pin#8 Open                     |      | Pin#8 Open |         |      |
|                                     | #1 <=0.8V           | Pin#8 High                     |      | Pin#8 High |         |      |
| Aging(@25°C 1st year)               |                     | ±3                             | ±5   | ±3         | ±5      | ppm  |
| Storage Temp. Range                 |                     | -55                            | 125  | -55        | 125     | °C   |

### Dimension(mm)



| Pin | Function     |
|-----|--------------|
| 1   | Tri-State/NC |
| 7   | GND          |
| 8   | Output       |
| 14  | Vdd          |

## 12.46 x 12.46 DIP8 Half Size Crystal Oscillator

### Feature

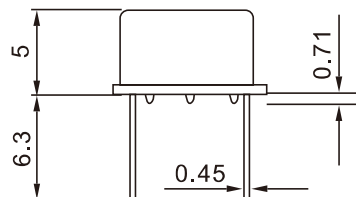
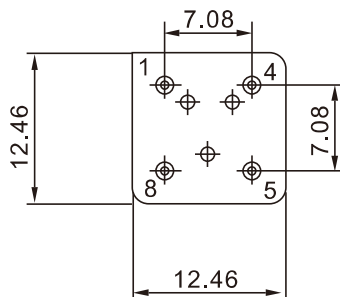
- Typical 12.46 x 12.46 x 5 mm
- Tight symmetry (45 to 55%) available.
- Operation voltage: 5V, 3.3V
- Tri-state enable/disable



### Electrical Specifications

| Parameter                           |                     | 3.3V                         |      | 5.0V       |         | Unit |
|-------------------------------------|---------------------|------------------------------|------|------------|---------|------|
|                                     |                     | Min.                         | Max. | Min.       | Max.    |      |
| Fan out Type                        |                     | CMOS                         |      | TTL/CMOS   |         |      |
| Supply Voltage Variation            |                     | 3.0                          | 3.6  | 4.5        | 5.5     | V    |
| Frequency Range                     |                     | 0.25                         | 180  | 0.25       | 180     | MHz  |
| Frequency Stability                 |                     | ±25, ±50, ±100               |      |            |         | PPM  |
| Operating Temperature               |                     | 0~70,-20~70, -40~85          |      |            |         | °C   |
| Supply Current                      | 0.25 MHz ≦ FO<20MHz | -                            | 10   | -          | 15      | mA   |
|                                     | 20 MHz ≦ FO<50MHz   | -                            | 30   | -          | 40      | mA   |
|                                     | 50 MHz ≦ FO<180MHz  | -                            | 40   | -          | 50      | mA   |
| Duty Cycle                          |                     | 45                           | 55   | 45         | 55      | %    |
| Transition Time :<br>Rise/Fall Time | 0.25 MHz ≦ FO<20MHz | -                            | 10   | -          | 8       | nSec |
|                                     | 20 MHz ≦ FO<50MHz   | -                            | 6    | -          | 5       |      |
|                                     | 50 MHz ≦ FO<180MHz  | -                            | 5    | -          | 4       |      |
| Input Voltage                       | Vol (Max)           | -                            | 0.33 | -          | 0.4/0.5 | V    |
|                                     | 2.4V/4.5V           | 2.4/2.5                      | -    | 3.0        | -       |      |
| Driving Ability                     | CMOS load max       | 15                           |      | 15/50      |         | pF   |
|                                     | TTL load max        |                              |      | 10TTL      |         |      |
| Start Time                          |                     | 5 ms max(15pF)/ 10 ms (50pF) |      |            |         | mSec |
| E/D Function                        | #1 OPEN             | Pin#5 Open                   |      | Pin#5 Open |         |      |
|                                     | #1 >=2.2V           | Pin#5 Open                   |      | Pin#5 Open |         |      |
|                                     | #1 <=0.8V           | Pin#5 High                   |      | Pin#5 High |         |      |
| Aging (@25°C 1st year)              |                     | ±3                           | ±5   | ±3         | ±5      | ppm  |
| Storage Temp. Range                 |                     | -55                          | 125  | -55        | 125     | °C   |

### Dimension(mm)

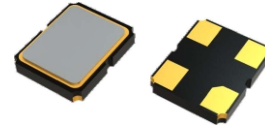


| Pin | Function     |
|-----|--------------|
| 1   | Tri-State/NC |
| 4   | GND          |
| 5   | Output       |
| 8   | Vdd          |

## FASTXO 2.0 x 1.6 mm SMD Crystal Oscillator

### Feature

- Typical 2.05 x 1.65 x 0.75 mm ceramic SMD package
- Operation supply voltage: 1.8V, 2.5V and 3.3V
- FASTXO series, Fast delivery at any frequency
- Tri-State Enable/Disable
- Frequency Stability  $\pm 25$ ppm over -40 °C to 85 °C
- RoHS compliant/Pb-free



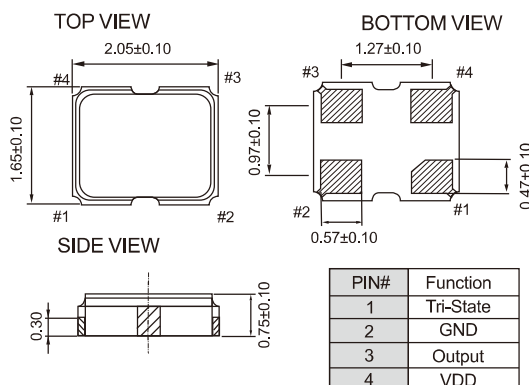
### Electrical Specifications

| Parameter                             | 3.3V               |              | 2.5V         |              | 1.8V         |              | Unit |
|---------------------------------------|--------------------|--------------|--------------|--------------|--------------|--------------|------|
|                                       | Min.               | Max.         | Min.         | Max.         | Min.         | Max.         |      |
| Supply Voltage Variation              | $V_{DD}-5\%$       | $V_{DD}+5\%$ | $V_{DD}-5\%$ | $V_{DD}+5\%$ | $V_{DD}-5\%$ | $V_{DD}+5\%$ | V    |
| Frequency Range                       | 1                  | 200          | 1            | 200          | 1            | 125          | MHz  |
| Supply Current                        | -                  | 30           | -            | 28           | -            | 20           | mA   |
| Duty Cycle                            | 45                 | 55           | 45           | 55           | 45           | 55           | %    |
| Output Level<br>(CMOS)                | Out High(Logic"1") | 2.97         | -            | 2.25         | -            | 1.62         | V    |
|                                       | Out Low(Logic"0")  | -            | 0.33         | -            | 0.25         | 0.18         |      |
| Start Time                            | -                  | 8            | -            | 8            | -            | 8            | mSec |
| Transition Time :Rise/Fall Time       | -                  | 2            | -            | 2            | -            | 3            | nSec |
| Tri-State                             | Output Enable      | 2.31         | -            | 1.75         | -            | 1.26         | V    |
|                                       | Output Disable     | -            | 0.99         | -            | 0.75         | 0.54         |      |
| Stand by current(@PD mode)            | -                  | 400          | -            | 400          | -            | 400          | uA   |
| Stand by current(@OE mode)            | -                  | 20           | -            | 20           | -            | 20           | mA   |
| Output Loading Jitter(12KHz)          | 15                 |              | 15           |              | 15           |              |      |
| RMS Phase Jitter(12kHz to 20MHz)@3.3V | -                  | 1            | -            | 1            | -            | 1            | pSec |
| Aging(@25 1st year)                   | -                  | $\pm 3$      | -            | $\pm 3$      | -            | $\pm 3$      | ppm  |
| Storage Temp. Range                   | -55                | 125          | -55          | 125          | -55          | 125          | °C   |

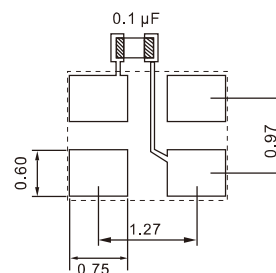
Standard frequencies are frequencies which the crystal has been designed and does not imply a stock position.

+ Transition times are measured between 10% and 90% of VDD, with an output load of 15pF.

### Dimension(mm)



### Solder Pad Layout(mm)



To ensure optimal oscillator performance, place a by-pass capacitor of 0.1  $\mu$ F as close to the part as possible between Vdd and GND pads.

### FREQ. STABILITY vs. TEMP. RANGE

| ppm<br>Temp. (°C) | $\pm 15$ | $\pm 20$ | $\pm 25$ | $\pm 50$ |
|-------------------|----------|----------|----------|----------|
| -20 ~ +70         | o        | o        | o        | o        |
| -40 ~ +85         | x        | $\Delta$ | o        | o        |
| -40 ~ +105        | x        | x        | $\Delta$ | o        |

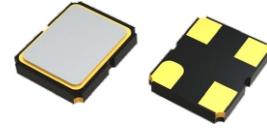
o: Available  $\Delta$ : Conditional X: Not available

Inclusive of calibration @ 25 °C, operating temperature range, input voltage variation, load variation, aging (1st year), shock, and vibration

## FASTXO 2.5 × 2.0 mm SMD Crystal Oscillator

### Feature

- Typical 2.5 x 2.0 x 0.81 mm ceramic SMD package.
- Operation supply voltage: 1.8V, 2.5V and 3.3V
- FASTXO series, Fast delivery at any frequency
- Tri-State Enable/Disable
- Frequency Stability  $\pm 25$ ppm over -40 °C to 85 °C
- RoHS compliant/Pb-free



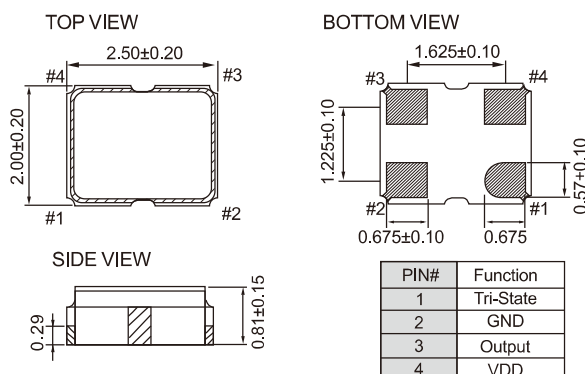
### Electrical Specifications

| Parameter                             | 3.3V               |              | 2.5V         |              | 1.8V         |              | Unit |
|---------------------------------------|--------------------|--------------|--------------|--------------|--------------|--------------|------|
|                                       | Min.               | Max.         | Min.         | Max.         | Min.         | Max.         |      |
| Supply Voltage Variation              | $V_{DD}-5\%$       | $V_{DD}+5\%$ | $V_{DD}-5\%$ | $V_{DD}+5\%$ | $V_{DD}-5\%$ | $V_{DD}+5\%$ | V    |
| Frequency Range                       | 1                  | 200          | 1            | 200          | 1            | 125          | MHz  |
| Supply Current                        | -                  | 30           | -            | 28           | -            | 20           | mA   |
| Duty Cycle                            | 45                 | 55           | 45           | 55           | 45           | 55           | %    |
| Output Level (CMOS)                   | Out High(Logic"1") | 2.97         | -            | 2.25         | -            | 1.62         | V    |
|                                       | Out Low(Logic"0")  | -            | 0.33         | -            | 0.25         | 0.18         |      |
| Start Time                            | -                  | 8            | -            | 8            | -            | 8            | mSec |
| Transition Time :Rise/Fall Time       | -                  | 2            | -            | 2            | -            | 3            | nSec |
| Tri-State                             | Output Enable      | 2.31         | -            | 1.75         | -            | 1.26         | V    |
|                                       | Output Disable     | -            | 0.99         | -            | 0.75         | 0.54         |      |
| Stand by current(@PD mode)            | -                  | 400          | -            | 400          | -            | 400          | uA   |
| Stand by current(@OE mode)            | -                  | 20           | -            | 20           | -            | 20           | mA   |
| Output Loading                        | 15                 |              | 15           |              | 15           |              |      |
| RMS Phase Jitter(12kHz to 20MHz)@3.3V | -                  | 1            | -            | 1            | -            | 1            | pSec |
| Aging(@25 1st year)                   | -                  | $\pm 3$      | -            | $\pm 3$      | -            | $\pm 3$      | ppm  |
| Storage Temp. Range                   | -55                | 125          | -55          | 125          | -55          | 125          | °C   |

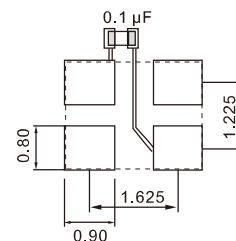
Standard frequencies are frequencies which the crystal has been designed and does not imply a stock position.

+ Transition times are measured between 10% and 90% of VDD, with an output load of 15pF.

### Dimension(mm)



### Solder Pad Layout(mm)



To ensure optimal oscillator performance, place a by-pass capacitor of 0.1 µF as close to the part as possible between Vdd and GND pads.

### FREQ. STABILITY vs. TEMP. RANGE

| Temp. (°C) \ ppm | ±15 | ±20 | ±25 | ±50 |
|------------------|-----|-----|-----|-----|
| -20 ~ +70        | Δ   | ○   | ○   | ○   |
| -40 ~ +85        | x   | Δ   | ○   | ○   |
| -40 ~ +105       | x   | x   | Δ   | ○   |

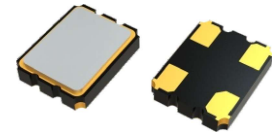
○: Available Δ: Conditional X: Not available

Inclusive of calibration @ 25 °C, operating temperature range, input voltage variation, load variation, aging (1st year), shock, and vibration

## FASTXO 3.2 × 2.5 mm SMD Crystal Oscillator

### Feature

- Typical 3.2 x 2.5 x 0.95 mm ceramic SMD package.
- Operation supply voltage: 1.8V, 2.5V and 3.3V
- FASTXO series, Fast delivery at any frequency
- Tri-State Enable/Disable
- Frequency Stability  $\pm 25$ ppm over -40 °C to 85 °C
- RoHS compliant/Pb-free



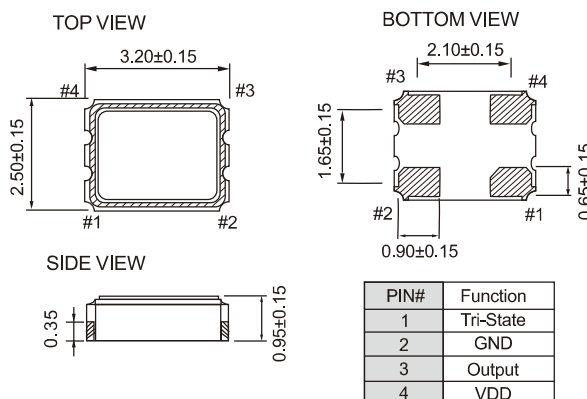
### Electrical Specifications

| Parameter                             |                    | 3.3V         |              | 2.5V         |              | 1.8V         |              | Unit |
|---------------------------------------|--------------------|--------------|--------------|--------------|--------------|--------------|--------------|------|
|                                       |                    | Min.         | Max.         | Min.         | Max.         | Min.         | Max.         |      |
| Supply Voltage Variation              |                    | $V_{DD}-5\%$ | $V_{DD}+5\%$ | $V_{DD}-5\%$ | $V_{DD}+5\%$ | $V_{DD}-5\%$ | $V_{DD}+5\%$ | V    |
| Frequency Range                       |                    | 1            | 200          | 1            | 200          | 1            | 125          | MHz  |
| Supply Current                        |                    | -            | 30           | -            | 28           | -            | 20           | mA   |
| Duty Cycle                            |                    | 45           | 55           | 45           | 55           | 45           | 55           | %    |
| Output Level (CMOS)                   | Out High(Logic"1") | 2.97         | -            | 2.25         | -            | 1.62         | -            | V    |
|                                       | Out Low(Logic"0")  | -            | 0.33         | -            | 0.25         | -            | 0.18         |      |
| Start Time                            |                    | -            | 8            | -            | 8            | -            | 8            | mSec |
| Transition Time : Rise/Fall Time      |                    | -            | 2            | -            | 2            | -            | 3            | nSec |
| Tri-State                             | Output Enable      | 2.31         | -            | 1.75         | -            | 1.26         | -            | V    |
|                                       | Output Disable     | -            | 0.99         | -            | 0.75         | -            | 0.54         |      |
| Stand by current(@PD mode)            |                    | -            | 400          | -            | 400          | -            | 400          | uA   |
| Stand by current(@OE mode)            |                    | -            | 20           | -            | 20           | -            | 20           | mA   |
| Output Loading                        |                    | 15           |              | 15           |              | 15           |              |      |
| RMS Phase Jitter(12kHz to 20MHz)@3.3V |                    | -            | 1            | -            | 1            | -            | 1            | pSec |
| Aging(@25 1st year)                   |                    | -            | $\pm 3$      | -            | $\pm 3$      | -            | $\pm 3$      | ppm  |
| Storage Temp. Range                   |                    | -55          | 125          | -55          | 125          | -55          | 125          | °C   |

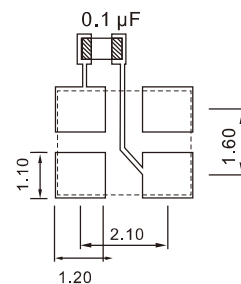
Standard frequencies are frequencies which the crystal has been designed and does not imply a stock position.

+ Transition times are measured between 10% and 90% of VDD, with an output load of 15pF.

### Dimension(mm)



### Solder Pad Layout(mm)



To ensure optimal oscillator performance, place a by-pass capacitor of 0.1  $\mu$ F as close to the part as possible between Vdd and GND pads.

### FREQ. STABILITY vs. TEMP. RANGE

| ppm<br>Temp. (°C) | $\pm 15$ | $\pm 20$ | $\pm 25$ | $\pm 50$ |
|-------------------|----------|----------|----------|----------|
| -20 ~ +70         | o        | o        | o        | o        |
| -40 ~ +85         | x        | $\Delta$ | o        | o        |
| -40 ~ +105        | x        | x        | $\Delta$ | o        |

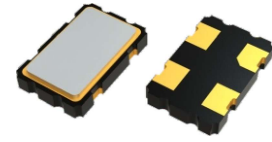
o: Available  $\Delta$ : Conditional X: Not available

Inclusive of calibration @ 25 °C, operating temperature range, input voltage variation, load variation, aging (1st year), shock, and vibration

## FASTXO 5.0 × 3.2 mm SMD Crystal Oscillator

### Feature

- Typical 5.0 x 3.2 x 1.2 mm ceramic SMD package.
- Operation supply voltage: 1.8V, 2.5V and 3.3V
- FASTXO series, Fast delivery at any frequency
- Tri-State Enable/Disable
- Frequency Stability  $\pm 25$ ppm over -40 °C to 85 °C
- RoHS compliant/Pb-free



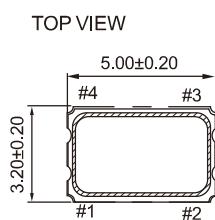
### Electrical Specifications

| Parameter                                |                      | 3.3V         |              | 2.5V         |              | 1.8V         |              | Unit |
|------------------------------------------|----------------------|--------------|--------------|--------------|--------------|--------------|--------------|------|
|                                          |                      | Min.         | Max.         | Min.         | Max.         | Min.         | Max.         |      |
| Supply Voltage Variation                 |                      | $V_{DD}-5\%$ | $V_{DD}+5\%$ | $V_{DD}-5\%$ | $V_{DD}+5\%$ | $V_{DD}-5\%$ | $V_{DD}+5\%$ | V    |
| Frequency Range                          |                      | 1            | 200          | 1            | 200          | 1            | 125          | MHz  |
| Supply Current                           |                      | -            | 30           | -            | 28           | -            | 20           | mA   |
| Duty Cycle                               |                      | 45           | 55           | 45           | 55           | 45           | 55           | %    |
| Output Level (CMOS)                      | Out High (Logic "1") | 2.97         | -            | 2.25         | -            | 1.62         | -            | V    |
|                                          | Out Low (Logic "0")  | -            | 0.33         | -            | 0.25         | -            | 0.18         |      |
| Start Time                               |                      | -            | 8            | -            | 8            | -            | 8            | mSec |
| Transition Time : Rise/Fall Time         |                      | -            | 2            | -            | 2            | -            | 3            | nSec |
| Tri-State                                | Output Enable        | 2.31         | -            | 1.75         | -            | 1.26         | -            | V    |
|                                          | Output Disable       | -            | 0.99         | -            | 0.75         | -            | 0.54         |      |
| Stand by current (@PD mode)              |                      | -            | 400          | -            | 400          | -            | 400          | uA   |
| Stand by current (@OE mode)              |                      | -            | 20           | -            | 20           | -            | 20           | mA   |
| Output Loading                           |                      | 15           |              | 15           |              | 15           |              |      |
| RMS Phase Jitter (12kHz to 20MHz) @ 3.3V |                      | -            | 1            | -            | 1            | -            | 1            | pSec |
| Aging (@25 1st year)                     |                      | -            | $\pm 3$      | -            | $\pm 3$      | -            | $\pm 3$      | ppm  |
| Storage Temp. Range                      |                      | -55          | 125          | -55          | 125          | -55          | 125          | °C   |

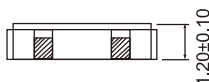
Standard frequencies are frequencies which the crystal has been designed and does not imply a stock position.

+ Transition times are measured between 10% and 90% of VDD, with an output load of 15pF.

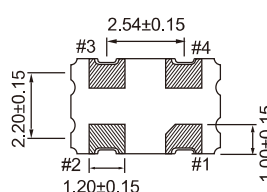
### Dimension(mm)



SIDE VIEW

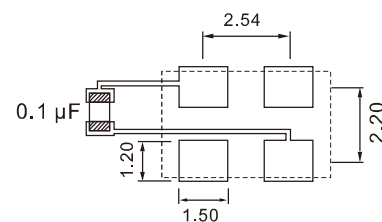


BOTTOM VIEW



| PIN# | Function  |
|------|-----------|
| 1    | Tri-State |
| 2    | GND       |
| 3    | Output    |
| 4    | VDD       |

### Solder Pad Layout(mm)



To ensure optimal oscillator performance, place a by-pass capacitor of 0.1  $\mu$ F as close to the part as possible between Vdd and GND pads.

### FREQ. STABILITY vs. TEMP. RANGE

| ppm<br>Temp.(°C) | $\pm 15$ | $\pm 20$ | $\pm 25$ | $\pm 50$ |
|------------------|----------|----------|----------|----------|
| -20 ~ +70        | o        | o        | o        | o        |
| -40 ~ +85        | x        | $\Delta$ | o        | o        |
| -40 ~ +105       | x        | x        | $\Delta$ | o        |

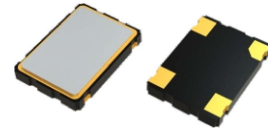
o: Available  $\Delta$ : Conditional X: Not available

Inclusive of calibration @ 25 °C, operating temperature range, input voltage variation, load variation, aging (1st year), shock, and vibration

## FASTXO 7.0 × 5.0 mm SMD Crystal Oscillator

### Feature

- Typical 7.0 x 5.0 x 1.3 mm ceramic SMD package
- Operation supply voltage: 1.8V, 2.5V and 3.3V
- FASTXO series, Fast delivery at any frequency
- Tri-State Enable/Disable
- Frequency Stability  $\pm 25$ ppm over -40 °C to 85 °C
- RoHS compliant/Pb-free



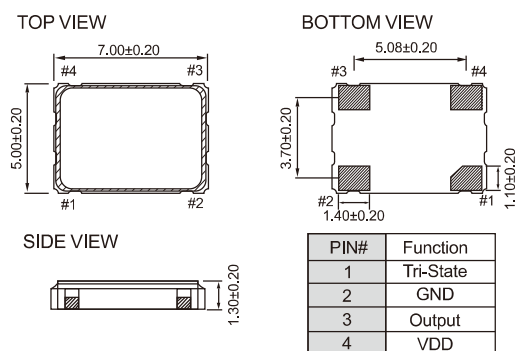
### Electrical Specifications

| Parameter                                | 3.3V               |              | 2.5V         |              | 1.8V         |              | Unit |
|------------------------------------------|--------------------|--------------|--------------|--------------|--------------|--------------|------|
|                                          | Min.               | Max.         | Min.         | Max.         | Min.         | Max.         |      |
| Supply Voltage Variation                 | $V_{DD}-5\%$       | $V_{DD}+5\%$ | $V_{DD}-5\%$ | $V_{DD}+5\%$ | $V_{DD}-5\%$ | $V_{DD}+5\%$ | V    |
| Frequency Range                          | 1                  | 200          | 1            | 200          | 1            | 125          | MHz  |
| Supply Current                           | -                  | 30           | -            | 28           | -            | 20           | mA   |
| Duty Cycle                               | 45                 | 55           | 45           | 55           | 45           | 55           | %    |
| Output Level (CMOS)                      | Out High(Logic"1") | 2.97         | -            | 2.25         | -            | 1.62         | V    |
|                                          | Out Low(Logic"0")  | -            | 0.33         | -            | 0.25         | -            |      |
| Start Time                               | -                  | 8            | -            | 8            | -            | 8            | mSec |
| Transition Time : Rise/Fall Time         | -                  | 2            | -            | 2            | -            | 3            | nSec |
| Tri-State                                | Output Enable      | 2.31         | -            | 1.75         | -            | 1.26         | V    |
|                                          | Output Disable     | -            | 0.99         | -            | 0.75         | -            |      |
| Stand by current (@PD mode)              | -                  | 400          | -            | 400          | -            | 400          | uA   |
| Stand by current (@OE mode)              | -                  | 20           | -            | 20           | -            | 20           | mA   |
| Output Loading                           | 15                 |              | 15           |              | 15           |              |      |
| RMS Phase Jitter (12kHz to 20MHz) @ 3.3V | -                  | 1            | -            | 1            | -            | 1            | pSec |
| Aging (@25 1st year)                     | -                  | $\pm 3$      | -            | $\pm 3$      | -            | $\pm 3$      | ppm  |
| Storage Temp. Range                      | -55                | 125          | -55          | 125          | -55          | 125          | °C   |

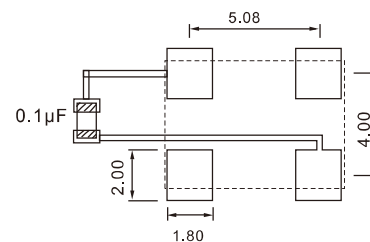
Standard frequencies are frequencies which the crystal has been designed and does not imply a stock position.

+ Transition times are measured between 10% and 90% of VDD, with an output load of 15pF.

### Dimension(mm)



### Solder Pad Layout(mm)



To ensure optimal oscillator performance, place a by-pass capacitor of 0.1  $\mu$ F as close to the part as possible between Vdd and GND pads.

### FREQ. STABILITY vs. TEMP. RANGE

| ppm<br>Temp. (°C) | $\pm 15$ | $\pm 20$ | $\pm 25$ | $\pm 50$ |
|-------------------|----------|----------|----------|----------|
| -20 ~ +70         | o        | o        | o        | o        |
| -40 ~ +85         | x        | $\Delta$ | o        | o        |
| -40 ~ +105        | x        | x        | $\Delta$ | o        |

o: Available  $\Delta$ : Conditional x: Not available

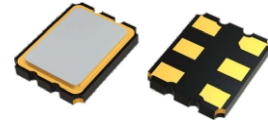
Inclusive of calibration @ 25 °C, operating temperature range, input voltage variation, load variation, aging (1st year), shock, and vibration



# FASTXO 3.2 × 2.5 mm SMD CMOS Output Crystal Oscillator

## Feature

- Low power supply voltage: 3.3, 2.5 supply options
- Singled-end output : CMOS
- Frequency support from 10MHz to 250MHz
- Low noise typical: 0.8 ps at 12kHz to 20MHz frequency offsets
- Temperature range: -40 to 85 °C operation
- Fast delivery

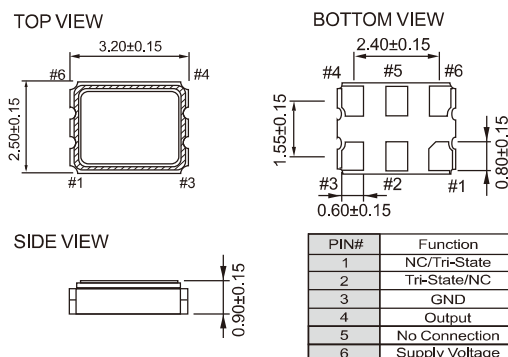


## Electrical Specifications

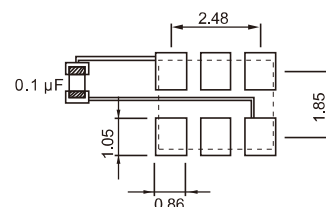
| Parameter                                  |             | 3.3V |      | 2.5V  |       | Unit   |
|--------------------------------------------|-------------|------|------|-------|-------|--------|
|                                            |             | Min. | Max. | Min.  | Max.  |        |
| Supply Voltage Variation                   |             | 2.97 | 3.63 | 2.375 | 2.625 | V      |
| Frequency Range                            |             | 10   | 250  | 10    | 250   | MHz    |
| Supply Current                             |             | -    | 50   | -     | 45    | mA     |
| Output level                               | Output High | 2.97 | -    | 2.25  | -     | V      |
|                                            | Output Low  | -    | 0.33 | -     | 0.25  |        |
| Transition Time : Rise/Fall Time           |             | -    | 1.0  | -     | 1.0   | nSec   |
| Start Time                                 |             | -    | 10   | -     | 10    | mSec   |
| Tri-State(Input to Pin 1/2)                | Enable      | 2.31 | -    | 1.75  | -     | V      |
|                                            | Disable     | -    | 0.99 | -     | 0.75  |        |
| Stand by current                           |             | -    | 18   | -     | 18    | mA     |
| Output Loading (10MHz to 200MHz)           |             | -    | 15   | -     | 15    | pF     |
| Output Loading (200MHz to 250MHz)          |             | -    | 5    | -     | 5     | pF     |
| RMS Phase Jitter(integrated 12kHz ~ 20MHz) |             | 0.8  | 1.5  | 0.8   | 1.5   | pSec   |
| Phase Noise @125MHz                        | 1kHz        | -107 |      | -107  |       | dBc/Hz |
|                                            | 10kHz       | -111 |      | -111  |       |        |
|                                            | 100kHz      | -114 |      | -114  |       |        |
|                                            | 1MHz        | -125 |      | -125  |       |        |
|                                            | 20MHz       | -147 |      | -147  |       |        |
| Aging(@25 1st year)                        |             | -    | ±3   | -     | ±3    | ppm    |
| Storage Temp. Range                        |             | -55  | 125  | -55   | 125   | °C     |

.+ Transition times are measured between 20% and 80% of VDD.

## Dimension(mm)



## Solder Pad Layout(mm)



To ensure optimal oscillator performance, place a by-pass capacitor of 0.1 µF as close to the part as possible between Vdd and GND pads.

## FREQ. STABILITY vs. TEMP. RANGE

| ppm<br>Temp. (°C) | ±25 | ±50 |
|-------------------|-----|-----|
| -10 ~ +60         | o   | o   |
| -20 ~ +70         | o   | o   |
| -40 ~ +85         | Δ   | o   |

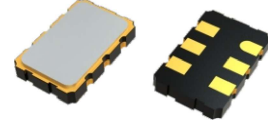
o: Available Δ: Conditional X: Not available

Inclusive of calibration @ 25 °C, operating temperature range, input voltage variation, load variation, aging (1st year), shock, and vibration

## FASTXO 5.0 × 3.2 mm SMD CMOS Crystal Oscillator

### Feature

- Typical 5.0 x 3.2 ceramic SMD package
- Very low phase jitter : < 1 ps (0.6ps, typ.) RMS
- Any frequency between 10 MHz and 250 MHz
- Tri-state enable/disable
- Fast delivery

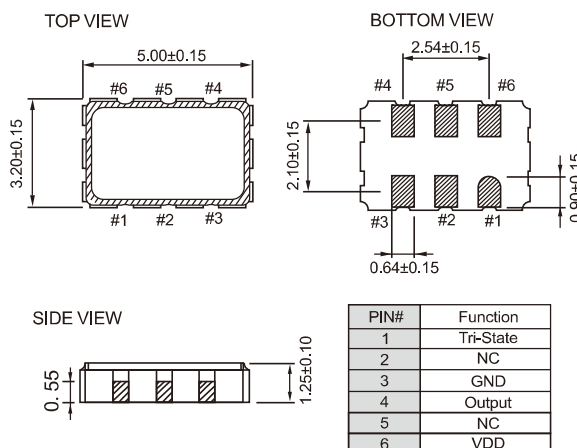


### Electrical Specifications

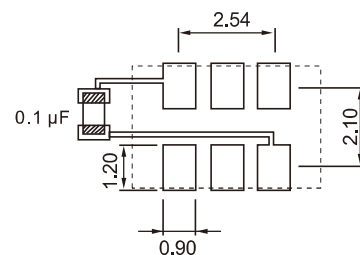
| Parameter                                  |             | CMOS                                       |       |       |       | Unit   |
|--------------------------------------------|-------------|--------------------------------------------|-------|-------|-------|--------|
|                                            |             | 3.3V                                       |       | 2.5V  |       |        |
|                                            |             | Min.                                       | Max.  | Min.  | Max.  |        |
| Supply Voltage Variation                   |             | 3.135                                      | 3.465 | 2.375 | 2.625 | V      |
| Frequency Range                            |             | 10                                         | 250   | 10    | 250   | MHz    |
| Standard Frequency                         |             | 106.25,125,133.33,150,155.52,156.25, 212.5 |       |       |       | MHz    |
| Supply Current 10 MHz ≤ FO<250MHz          |             | -                                          | 30    | -     | 30    | mA     |
| Output level                               | Output High | 2.97                                       | -     | 2.25  | -     | V      |
|                                            | Output Low  | -                                          | 0.33  | -     | 0.25  |        |
| Transition Time : Rise/Fall Time           |             | -                                          | 1.5   | -     | 1.5   | nSec   |
| Start Time                                 |             | -                                          | 10    | -     | 10    | mSec   |
| Tri-State<br>(Input to Pin 1/2)            | Enable      | 2.31                                       | -     | 1.75  | -     | V      |
|                                            | Disable     | -                                          | 0.99  | -     | 0.75  |        |
| RMS Phase Jitter(integrated 12kHz ~ 20MHz) |             |                                            | 1.0   | -     | 1.0   | pSec   |
| Phase Noise<br>@125MHz                     | 100Hz       | -75                                        |       | -75   |       | dBc/Hz |
|                                            | 1kHz        | -105                                       |       | -105  |       |        |
|                                            | 10kHz       | -120                                       |       | -120  |       |        |
| Aging(@25 1st year)                        |             | -                                          | ±3    | -     | ±3    | ppm    |
| Storage Temp. Range                        |             | -55                                        | 125   | -55   | 125   | °C     |

.+ Transition times are measured between 20% and 80% of VDD.

### Dimension(mm)



### Solder Pad Layout(mm)



To ensure optimal oscillator performance, place a by-pass capacitor of 0.1 μF as close to the part as possible between Vdd and GND pads.

### FREQ. STABILITY vs. TEMP. RANGE

| ppm<br>Temp. (°C) | ±25 | ±50 |
|-------------------|-----|-----|
| -10 ~ +60         | o   | o   |
| -20 ~ +70         | o   | o   |
| -40 ~ +85         | Δ   | o   |

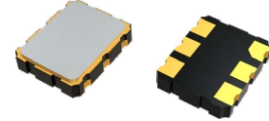
o: Available Δ: Conditional X: Not available

Inclusive of calibration @ 25 °C, operating temperature range, input voltage variation, load variation, aging (1st year), shock, and vibration

# FASTXO 7.0 × 5.0 mm SMD CMOS Crystal Oscillator

## Feature

- Typical 7.0 x 5.0 SMD package
- Very low phase jitter : < 1 ps (0.6ps, typ.) RMS
- Any frequency between 10 MHz and 250 MHz
- Tri-state enable/disable
- Fast delivery



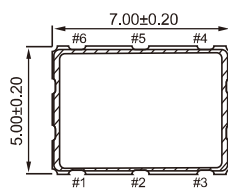
## Electrical Specifications

| Parameter                                  |             | CMOS                                            |       |       |       | Unit   |
|--------------------------------------------|-------------|-------------------------------------------------|-------|-------|-------|--------|
|                                            |             | 3.3V                                            |       | 2.5V  |       |        |
|                                            |             | Min.                                            | Max.  | Min.  | Max.  |        |
| Supply Voltage Variation                   |             | 3.135                                           | 3.465 | 2.375 | 2.625 | V      |
| Frequency Range                            |             | 10                                              | 250   | 10    | 250   | MHz    |
| Standard Frequency                         |             | 106.25,125,133.33,150,155.52,156.25,187.5,212.5 |       |       |       | MHz    |
| Supply Current 10 MHz ≤ FO<250MHz          |             | -                                               | 30    | -     | 30    | mA     |
| Output level                               | Output High | 2.97                                            | -     | 2.25  | -     | V      |
|                                            | Output Low  | -                                               | 0.33  | -     | 0.25  |        |
| Transition Time : Rise/Fall Time           |             | -                                               | 1.5   | -     | 1.5   | nSec   |
| Start Time                                 |             | -                                               | 10    | -     | 10    | mSec   |
| Tri-State<br>(Input to Pin 1/2)            | Enable      | 2.31                                            | -     | 1.75  | -     | V      |
|                                            | Disable     | -                                               | 0.99  | -     | 0.75  |        |
| RMS Phase Jitter(integrated 12 kHz~ 20MHz) |             |                                                 | 1     | -     | 1     | pSec   |
| Phase Noise<br>@125MHz                     | 100Hz       | -75                                             |       | -75   |       | dBc/Hz |
|                                            | 1kHz        | -105                                            |       | -105  |       |        |
|                                            | 10kHz       | -120                                            |       | -120  |       |        |
| Aging(@25 1st year)                        |             | -                                               | ±3    | -     | ±3    | ppm    |
| Storage Temp. Range                        |             | -55                                             | 125   | -55   | 125   | °C     |

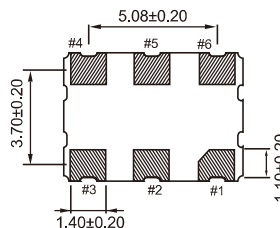
.+ Transition times are measured between 20% and 80% of VDD.

## Dimension(mm)

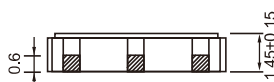
TOP VIEW



BOTTOM VIEW

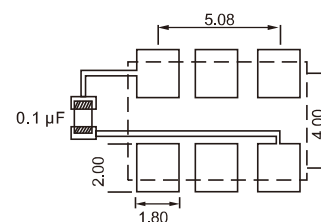


SIDE VIEW



| PIN# | Function     |
|------|--------------|
| 1    | NC/Tri-State |
| 2    | Tri-State/NC |
| 3    | GND          |
| 4    | Output       |
| 5    | Comp Output  |
| 6    | VDD          |

Solder Pad Layout(mm)



To ensure optimal oscillator performance, place a by-pass capacitor of 0.1 μF as close to the part as possible between Vdd and GND pads.

## FREQ. STABILITY vs. TEMP. RANGE

| ppm<br>Temp. (°C) | ±25 | ±50 |
|-------------------|-----|-----|
| -10 ~ +60         | ○   | ○   |
| -20 ~ +70         | ○   | ○   |
| -40 ~ +85         | △   | ○   |

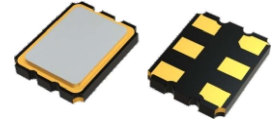
○: Available △: Conditional X: Not available

Inclusive of calibration @ 25 °C, operating temperature range, input voltage variation, load variation, aging (1st year), shock, and vibration

## 3.2 × 2.5mm SMD Differential Output Oscillator

### Feature

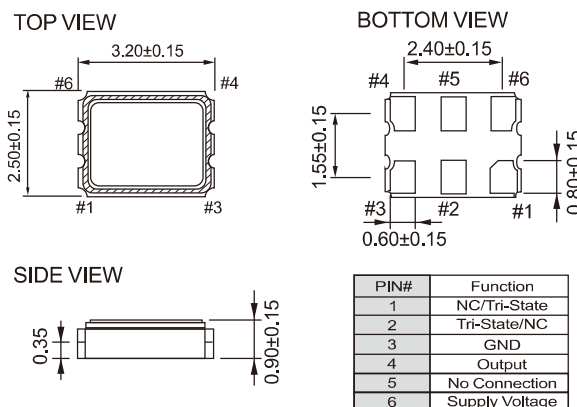
- Low power supply voltage: 3.3, 2.5 supply options
- Differential output : LVPECL, LVDS
- Frequency support from 10MHz to 1.5GHz
- Low noise typical: 0.8 ps at 12kHz to 20MHz frequency offsets
- Temperature range: -40 to 85 °C operation
- Fast delivery



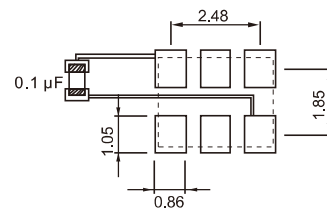
### Electrical Specifications

| Parameter                                |             | LVPECL |       |       |       | LVDS  |       |       |       | Unit   |
|------------------------------------------|-------------|--------|-------|-------|-------|-------|-------|-------|-------|--------|
|                                          |             | 3.3V   |       | 2.5V  |       | 3.3V  |       | 2.5V  |       |        |
|                                          |             | Min.   | Max.  | Min.  | Max.  | Min.  | Max.  | Min.  | Max.  |        |
| Supply Voltage Variation                 |             | 3.135  | 3.465 | 2.375 | 2.625 | 3.135 | 3.465 | 2.375 | 2.625 | V      |
| Frequency Range                          |             | 10     | 1500  | 10    | 1500  | 10    | 1500  | 10    | 1500  | MHz    |
| Supply Current                           |             | -      | 50    | -     | 50    | -     | 50    | -     | 50    | mA     |
| Output level                             | Output High | 2.275  | 2.7   | 1.475 | 1.9   | -     | 1.6   | -     | 1.6   | V      |
|                                          | Output Low  | 1.45   | 1.68  | 0.65  | 0.88  | 0.9   | -     | 0.9   | -     |        |
| Transition Time : Rise/Fall Time         |             | -      | 1.0   | -     | 1.0   | -     | 1.0   | -     | 1.0   | nSec   |
| Start Time                               |             | -      | 10    | -     | 10    | -     | 10    | -     | 10    | mSec   |
| Tri-State<br>(Input to Pin 1/2)          | Enable      | 2.31   | -     | 1.75  | -     | 2.31  | -     | 1.75  | -     | V      |
|                                          | Disable     | -      | 0.99  | -     | 0.75  | -     | 0.99  | -     | 0.75  |        |
| RMS Phase Jitter(integrated12kHz~ 20MHz) |             |        | 1.5   | -     | 1.5   | -     | 1.5   | -     | 1.5   | pSec   |
| Phase Noise<br>@250MHz<br>VDD=3.3v       | 1kHz        | -107   |       | -107  |       | -107  |       | -107  |       | dBc/Hz |
|                                          | 10kHz       | -111   |       | -111  |       | -111  |       | -111  |       |        |
|                                          | 100kHz      | -114   |       | -114  |       | -114  |       | -114  |       |        |
|                                          | 1MHz        | -125   |       | -125  |       | -125  |       | -125  |       |        |
|                                          | 20MHz       | -147   |       | -147  |       | -147  |       | -147  |       |        |
| Aging(@25 1st year)                      |             | -      | ±3    | -     | ±3    | -     | ±3    | -     | ±3    | ppm    |
| Storage Temp. Range                      |             | -55    | 125   | -55   | 125   | -55   | 125   | -55   | 125   | °C     |

### Dimension(mm)



### Solder Pad Layout(mm)



To ensure optimal oscillator performance, place a by-pass capacitor of 0.1 μF as close to the part as possible between Vdd and GND pads.

### FREQ. STABILITY vs. TEMP. RANGE

| Temp. (°C) \ ppm | ±25 | ±50 |
|------------------|-----|-----|
| -10 ~ +60        | ○   | ○   |
| -20 ~ +70        | ○   | ○   |
| -40 ~ +85        | Δ   | ○   |

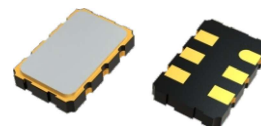
○: Available Δ: Conditional X: Not available

Inclusive of calibration @ 25 °C, operating temperature range, input voltage variation, load variation, aging (1st year), shock, and vibration

## 5.0 × 3.2mm SMD LVPECL /LVDS Crystal Oscillator

### Feature

- Industry Standard 5.0 x 3.2 x 1.25 hermetically sealed package
- Very low phase jitter : < 1 ps (0.6ps, typ.) RMS
- Any frequency between 10 MHz and 1500 MHz
- Tri-state enable/disable
- Fast delivery

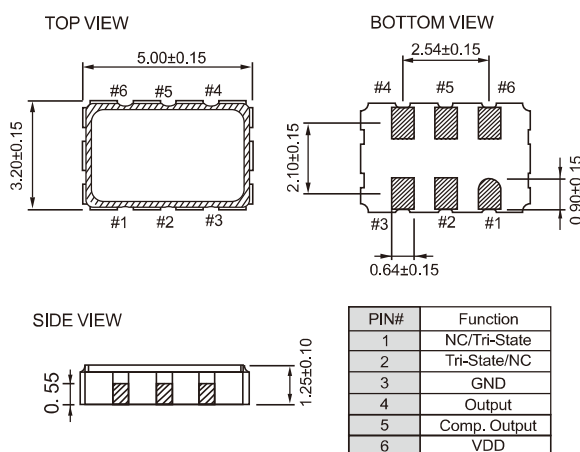


### Electrical Specifications

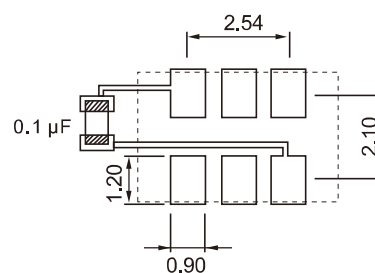
| Parameter                                |             | LVPECL                                                       |       |       |       | LVDS  |       |       |       | Unit   |
|------------------------------------------|-------------|--------------------------------------------------------------|-------|-------|-------|-------|-------|-------|-------|--------|
|                                          |             | 3.3V                                                         |       | 2.5V  |       | 3.3V  |       | 2.5V  |       |        |
|                                          |             | Min.                                                         | Max.  | Min.  | Max.  | Min.  | Max.  | Min.  | Max.  |        |
| Supply Voltage Variation                 |             | 3.135                                                        | 3.465 | 2.375 | 2.625 | 3.135 | 3.465 | 2.375 | 2.625 | V      |
| Frequency Range                          |             | 10                                                           | 1500  | 10    | 1500  | 10    | 1500  | 10    | 1500  | MHz    |
| Standard Frequency                       |             | 106.25,125,133.33,150,155.52,156.25,187.5,212.5,312.5,622.08 |       |       |       |       |       |       |       | MHz    |
| Supply Current 10 MHz≦FO<1500MHz         |             | -                                                            | 50    | -     | 50    | -     | 50    | -     | 50    | mA     |
| Output level                             | Output High | 2.275                                                        | -     | 1.475 | -     | -     | 1.6   | -     | 1.6   | V      |
|                                          | Output Low  | -                                                            | 1.68  | -     | 0.88  | 0.9   | -     | 0.9   | -     |        |
| Transition Time : Rise/Fall Time         |             | -                                                            | 1.0   | -     | 1.0   | -     | 1.0   | -     | 1.0   | nSec   |
| Start Time                               |             | -                                                            | 10    | -     | 10    | -     | 10    | -     | 10    | mSec   |
| Tri-State<br>(Input to Pin 1/2)          | Enable      | 2.31                                                         | -     | 1.75  | -     | 2.31  | -     | 1.75  | -     | V      |
|                                          | Disable     | -                                                            | 0.99  | -     | 0.75  | -     | 0.99  | -     | 0.75  |        |
| RMS Phase Jitter(integrated12kHz~ 20MHz) |             |                                                              | 1     | -     | 1     | -     | 1     | -     | 1     | pSec   |
| Phase Noise<br>@156.25MHz                | 100Hz       | -85                                                          |       | -85   |       | -85   |       | -85   |       | dBc/Hz |
|                                          | 1kHz        | -105                                                         |       | -105  |       | -105  |       | -105  |       |        |
|                                          | 10kHz       | -115                                                         |       | -115  |       | -115  |       | -115  |       |        |
| Aging(@25 1st year)                      |             | -                                                            | ±3    | -     | ±3    | -     | ±3    | -     | ±3    | ppm    |
| Storage Temp. Range                      |             | -55                                                          | 125   | -55   | 125   | -55   | 125   | -55   | 125   | °C     |

.\* Transition times are measured between 20% and 80% of VDD.

### Dimension(mm)



### Solder Pad Layout(mm)



To ensure optimal oscillator performance, place a by-pass capacitor of 0.1 µF as close to the part as possible between Vdd and GND pads.

### FREQ. STABILITY vs. TEMP. RANGE

| Temp. (°C) \ ppm | ±25 | ±50 |
|------------------|-----|-----|
| -10 ~ +60        | ○   | ○   |
| -20 ~ +70        | ○   | ○   |
| -40 ~ +85        | △   | ○   |

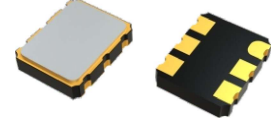
○: Available △: Conditional X: Not available

Inclusive of calibration @ 25 °C, operating temperature range, input voltage variation, load variation, aging (1st year), shock, and vibration

## 7.0 × 5.0 mm SMD LVPECL /LVDS Crystal Oscillator

### Feature

- Typical 7.0 x 5.0 x 1.75 ceramic SMD package
- Very low phase jitter : < 1 ps (0.6ps, typ.) RMS
- Any frequency between 10 MHz and 1500 MHz
- Tri-state enable/disable
- Fast delivery



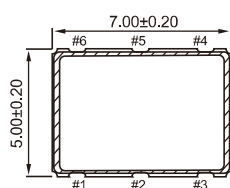
### Electrical Specifications

| Parameter                                |             | LVPECL                                                       |       |       |       | LVDS  |       |       |       | Unit   |
|------------------------------------------|-------------|--------------------------------------------------------------|-------|-------|-------|-------|-------|-------|-------|--------|
|                                          |             | 3.3V                                                         |       | 2.5V  |       | 3.3V  |       | 2.5V  |       |        |
|                                          |             | Min.                                                         | Max.  | Min.  | Max.  | Min.  | Max.  | Min.  | Max.  |        |
| Supply Voltage Variation                 |             | 3.135                                                        | 3.465 | 2.375 | 2.625 | 3.135 | 3.465 | 2.375 | 2.625 | V      |
| Frequency Range                          |             | 10                                                           | 1500  | 10    | 1500  | 10    | 1500  | 10    | 1500  | MHz    |
| Standard Frequency                       |             | 106.25,125,133.33,150,155.52,156.25,187.5,212.5,312.5,622.08 |       |       |       |       |       |       |       | MHz    |
| Supply Current 10 MHz ≤ FO<1500MHz       |             | -                                                            | 50    | -     | 50    | -     | 50    | -     | 50    | mA     |
| Output level                             | Output High | 2.275                                                        | -     | 1.475 | -     | -     | 1.6   | -     | 1.6   | V      |
|                                          | Output Low  | -                                                            | 1.68  | -     | 0.88  | 0.9   | -     | 0.9   | -     |        |
| Transition Time : Rise/Fall Time         |             | -                                                            | 1.0   | -     | 1.0   | -     | 1.0   | -     | 1.0   | nSec   |
| Start Time                               |             | -                                                            | 10    | -     | 10    | -     | 10    | -     | 10    | mSec   |
| Tri-State<br>(Input to Pin 1/2)          | Enable      | 2.31                                                         | -     | 1.75  | -     | 2.31  | -     | 1.75  | -     | V      |
|                                          | Disable     | -                                                            | 0.99  | -     | 0.75  | -     | 0.99  | -     | 0.75  |        |
| RMS Phase Jitter(integrated12kHz~ 20MHz) |             |                                                              | 1     | -     | 1     | -     | 1     | -     | 1     | pSec   |
| Phase Noise<br>@156.25MHz                | 100Hz       | -94                                                          |       | -94   |       | -94   |       | -94   |       | dBc/Hz |
|                                          | 1kHz        | -113                                                         |       | -113  |       | -113  |       | -112  |       |        |
|                                          | 10kHz       | -122                                                         |       | -122  |       | -122  |       | -122  |       |        |
| Aging(@25 1st year)                      |             | -                                                            | ±3    | -     | ±3    | -     | ±3    | -     | ±3    | ppm    |
| Storage Temp. Range                      |             | -55                                                          | 125   | -55   | 125   | -55   | 125   | -55   | 125   | °C     |

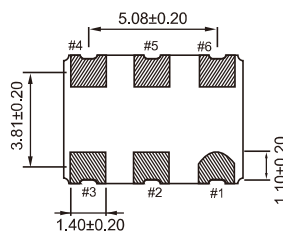
± Transition times are measured between 20% and 80% of VDD.

### Dimension(mm)

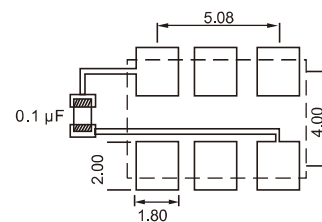
TOP VIEW



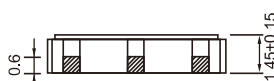
BOTTOM VIEW



Solder Pad Layout(mm)



SIDE VIEW



| PIN# | Function     |
|------|--------------|
| 1    | NC/Tri-State |
| 2    | Tri-State/NC |
| 3    | GND          |
| 4    | Output       |
| 5    | Comp Output  |
| 6    | VDD          |

To ensure optimal oscillator performance, place a by-pass capacitor of 0.1 µF as close to the part as possible between Vdd and GND pads.

### FREQ. STABILITY vs. TEMP. RANGE

| Temp. (°C) \ ppm | ±25 | ±50 |
|------------------|-----|-----|
| -10 ~ +60        | ○   | ○   |
| -20 ~ +70        | ○   | ○   |
| -40 ~ +85        | △   | ○   |

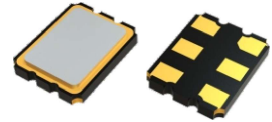
○: Available △: Conditional X: Not available

Inclusive of calibration @ 25 °C, operating temperature range, input voltage variation, load variation, aging (1st year), shock, and vibration

## 3.2 × 2.5 mm SMD LVPECL /LVDS Crystal Oscillator

### Feature

- Typical 3.2 x 2.5 x 0.9mm SMD package.
- Very low jitter performance: typical 0.1 pS RMS from 12 kHz-20 MHz
- Fundamental/3rd overtone crystal design
- Output frequency up to 250 MHz
- Tri-state enable/disable
- Up to 125°C operating temperature range



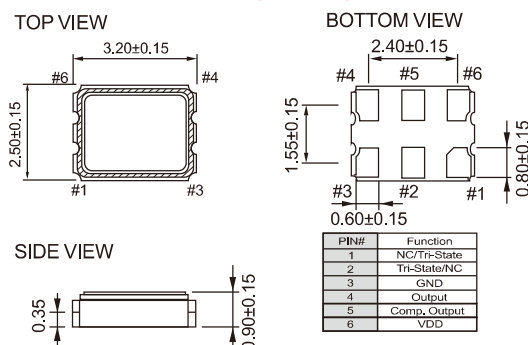
### Electrical Specifications

| Parameter                                         |                          | LVPECL                              |         |       |         | LVDS  |         |       |         | Unit   |
|---------------------------------------------------|--------------------------|-------------------------------------|---------|-------|---------|-------|---------|-------|---------|--------|
|                                                   |                          | 3.3V                                |         | 2.5V  |         | 3.3V  |         | 2.5V  |         |        |
|                                                   |                          | Min.                                | Max.    | Min.  | Max.    | Min.  | Max.    | Min.  | Max.    |        |
| Supply Voltage Variation                          |                          | 3.135                               | 3.465   | 2.375 | 2.625   | 3.135 | 3.465   | 2.375 | 2.625   | V      |
| Frequency Range                                   |                          | 10                                  | 250     | 10    | 250     | 10    | 250     | 10    | 250     | MHz    |
| Standard Frequency                                |                          | 25,106.25,125,156.25,161.1328,212.5 |         |       |         |       |         |       |         | MHz    |
| Supply Current                                    | 10 MHz $\leq$ FO<160MHz  | -                                   | 75      | -     | 75      | -     | 50      | -     | 50      | mA     |
|                                                   | 160 MHz $\leq$ FO<250MHz | -                                   | 100     | -     | 100     | -     | 50      | -     | 50      |        |
| Output level                                      | Output High              | 2.275                               | -       | 1.475 | -       | -     | 1.6     | -     | 1.6     | V      |
|                                                   | Output Low               | -                                   | 1.68    | -     | 0.88    | 0.9   | -       | 0.9   | -       |        |
| Transition Time : Rise/Fall Time                  |                          | -                                   | 1.0     | -     | 1.0     | -     | 1.0     | -     | 1.0     | nSec   |
| Start Time                                        |                          | -                                   | 10      | -     | 10      | -     | 10      | -     | 10      | mSec   |
| Tri-State<br>(Input to Pin 1/2)                   | Enable                   | 2.31                                | -       | 1.75  | -       | 2.31  | -       | 1.75  | -       | V      |
|                                                   | Disable                  | -                                   | 0.99    | -     | 0.75    | -     | 0.99    | -     | 0.75    |        |
| RMS Phase Jitter<br>(integrated 12kHz<br>~ 20MHz) | FO<80MHz                 | -                                   | 1       | -     | 1       | -     | 1       | -     | 1       | pSec   |
|                                                   | 80 MHz $\leq$ FO<125MHz  | -                                   | 0.5     | -     | 0.5     | -     | 0.5     | -     | 0.5     |        |
|                                                   | 125 MHz $\leq$ FO<170MHz | -                                   | 0.3     | -     | 0.3     | -     | 0.3     | -     | 0.3     |        |
|                                                   | 170 MHz $\leq$ FO<200MHz | -                                   | 0.5     | -     | 0.5     | -     | 0.5     | -     | 0.5     |        |
|                                                   | 200 MHz $\leq$ FO        | -                                   | 0.3     | -     | 0.3     | -     | 0.3     | -     | 0.3     |        |
| Phase Noise<br>@156.25MHz                         | 100Hz                    | -95                                 |         | -90   |         | -90   |         | -90   |         | dBc/Hz |
|                                                   | 1kHz                     | -125                                |         | -125  |         | -120  |         | -120  |         |        |
|                                                   | 10kHz                    | -140                                |         | -140  |         | -140  |         | -140  |         |        |
| Aging(@25 1st year)                               |                          | -                                   | $\pm$ 3 | -     | $\pm$ 3 | -     | $\pm$ 3 | -     | $\pm$ 3 | ppm    |
| Storage Temp. Range                               |                          | -55                                 | 125     | -55   | 125     | -55   | 125     | -55   | 125     | °C     |

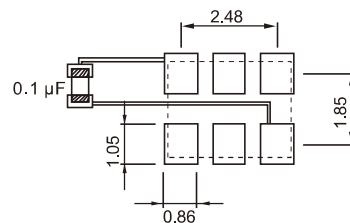
Standard frequencies are frequencies which the crystal has been designed and does not imply a stock position

+ Transition times are measured between 10% and 90% of VDD, with an output load of 15pF.

### Dimension(mm)



### Solder Pad Layout(mm)



To ensure optimal oscillator performance, place a by-pass capacitor of 0.1 μF as close to the part as possible between Vdd and GND pads.

### FREQ. STABILITY vs. TEMP. RANGE

| Temp. (°C) \ ppm | ±25 | ±50 |
|------------------|-----|-----|
| -10 ~ +60        | ○   | ○   |
| -20 ~ +70        | ○   | ○   |
| -40 ~ +85        | △   | ○   |
| -40 ~ +125       | X   | ○   |

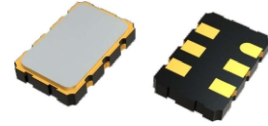
○: Available △: Conditional X: Not available

Inclusive of calibration @ 25 °C, operating temperature range, input voltage variation, load variation, aging (1st year), shock, and vibration

## 5.0 × 3.2 mm SMD LVPECL /LVDS Crystal Oscillator

### Feature

- Typical 5.0 x 3.2 x 1.25mm ceramic SMD package.
- Very low jitter performance: typical 0.3 pS RMS from 12 k - 20 MHz
- Output frequency up to 320 MHz.
- Operating temperature up to 125°C
- Tri-state enable/disable



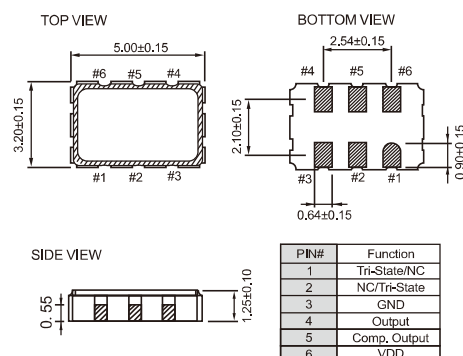
### Electrical Specifications

| Parameter                                        |                     | LVPECL                               |       |       |       | LVDS  |       |       |       | Unit   |
|--------------------------------------------------|---------------------|--------------------------------------|-------|-------|-------|-------|-------|-------|-------|--------|
|                                                  |                     | 3.3V                                 |       | 2.5V  |       | 3.3V  |       | 2.5V  |       |        |
|                                                  |                     | Min.                                 | Max.  | Min.  | Max.  | Min.  | Max.  | Min.  | Max.  |        |
| Supply Voltage Variation                         |                     | 3.135                                | 3.465 | 2.375 | 2.625 | 3.135 | 3.465 | 2.375 | 2.625 | V      |
| Frequency Range                                  |                     | 10                                   | 320   | 10    | 320   | 10    | 320   | 10    | 320   | MHz    |
| Standard Frequency                               |                     | 25,106.25,125, 156.25,161.1328,212.5 |       |       |       |       |       |       |       | MHz    |
| Supply Current                                   | 10 MHz ≤ FO<160MHz  | -                                    | 75    | -     | 75    | -     | 50    | -     | 50    | mA     |
|                                                  | 160 MHz ≤ FO<250MHz | -                                    | 100   | -     | 100   | -     | 50    | -     | 50    |        |
|                                                  | 250 MHz ≤ FO<320MHz | -                                    | 100   | -     | 100   | -     | 65    | -     | 65    |        |
| Output level                                     | Output High         | 2.275                                | -     | 1.475 | -     | -     | 1.6   | -     | 1.6   | V      |
|                                                  | Output Low          | -                                    | 1.68  | -     | 0.88  | 0.9   | -     | 0.9   | -     |        |
| Transition Time : Rise/Fall Time                 |                     | -                                    | 1.0   | -     | 1.0   | -     | 1.0   | -     | 1.0   | nSec   |
| Start Time                                       |                     | -                                    | 10    | -     | 10    | -     | 10    | -     | 10    | mSec   |
| Tri-State<br>(Input to Pin 1/2)                  | Enable              | 2.31                                 | -     | 1.75  | -     | 2.31  | -     | 1.75  | -     | V      |
|                                                  | Disable             | -                                    | 0.99  | -     | 0.75  | -     | 0.99  | -     | 0.75  |        |
| RMS Phase<br>Jitter(integrated<br>12kHz ~ 20MHz) | FO<80MHz            | -                                    | 1     | -     | 1     | -     | 1     | -     | 1     | pSec   |
|                                                  | 80 MHz ≤ FO<125MHz  | -                                    | 0.5   | -     | 0.5   | -     | 0.5   | -     | 0.5   |        |
|                                                  | 125 MHz ≤ FO<170MHz | -                                    | 0.3   | -     | 0.3   | -     | 0.3   | -     | 0.3   |        |
|                                                  | 170 MHz ≤ FO<200MHz | -                                    | 0.5   | -     | 0.5   | -     | 0.5   | -     | 0.5   |        |
|                                                  | 200 MHz ≤ FO        | -                                    | 0.3   | -     | 0.3   | -     | 0.3   | -     | 0.3   |        |
| Phase Noise<br>@156.25MHz                        | 100Hz               | -95                                  |       | -90   |       | -90   |       | -90   |       | dBc/Hz |
|                                                  | 1kHz                | -125                                 |       | -125  |       | -120  |       | -120  |       |        |
|                                                  | 10kHz               | -140                                 |       | -140  |       | -140  |       | -140  |       |        |
| Aging(@25 1st year)                              |                     | -                                    | ±3    | -     | ±3    | -     | ±3    | -     | ±3    | ppm    |
| Storage Temp. Range                              |                     | -55                                  | 125   | -55   | 125   | -55   | 125   | -55   | 125   | °C     |

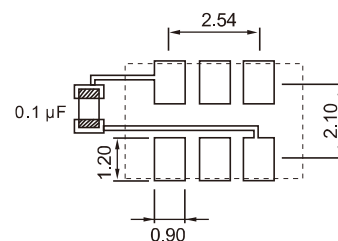
Standard frequencies are frequencies which the crystal has been designed and does not imply a stock position

± Transition times are measured between 10% and 90% of VDD, with an output load of 15pF.

### Dimension(mm)



### Solder Pad Layout(mm)



To ensure optimal oscillator performance, place a by-pass capacitor of 0.1 µF as close to the part as possible between Vdd and GND pads.

### FREQ. STABILITY vs. TEMP. RANGE

| Temp. (°C) \ ppm | ±25 | ±50 |
|------------------|-----|-----|
| -10 ~ +60        | ○   | ○   |
| -20 ~ +70        | ○   | ○   |
| -40 ~ +85        | △   | ○   |
| -40 ~ +125       | x   | ○   |

○: Available △: Conditional X: Not available

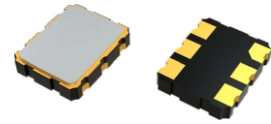
Inclusive of calibration @ 25 °C, operating temperature range, input voltage variation, load variation, aging (1st year), shock, and vibration



## 7.0 × 5.0 mm SMD LVPECL /LVDS Crystal Oscillator

### Feature

- Typical 7.0 × 5.0 × 1.45mm ceramic SMD package
- Very low jitter performance: typical 0.3 pS RMS from 12k - 20MHz
- Output frequency up to 320 MHz
- Operating temperature up to 125°C
- Tri-state enable/disable



### Electrical Specifications

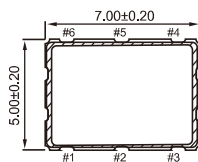
| Parameter                                       |                     | LVPECL                                           |       |       |       | LVDS  |       |       |       | Unit   |
|-------------------------------------------------|---------------------|--------------------------------------------------|-------|-------|-------|-------|-------|-------|-------|--------|
|                                                 |                     | 3.3V                                             |       | 2.5V  |       | 3.3V  |       | 2.5V  |       |        |
|                                                 |                     | Min.                                             | Max.  | Min.  | Max.  | Min.  | Max.  | Min.  | Max.  |        |
| Supply Voltage Variation                        |                     | 3.135                                            | 3.465 | 2.375 | 2.625 | 3.135 | 3.465 | 2.375 | 2.625 | V      |
| Frequency Range                                 |                     | 10                                               | 320   | 10    | 320   | 10    | 320   | 10    | 320   | MHz    |
| Standard Frequency                              |                     | 77.76,106.25,125,155.52,156.25,187.5,212.5,312.5 |       |       |       |       |       |       |       | MHz    |
| Supply Current                                  | 10 MHz ≤ FO<160MHz  | -                                                | 75    | -     | 75    | -     | 50    | -     | 50    | mA     |
|                                                 | 160 MHz ≤ FO<250MHz | -                                                | 100   | -     | 100   | -     | 50    | -     | 50    |        |
|                                                 | 250 MHz ≤ FO<320MHz | -                                                | 100   | -     | 100   | -     | 65    | -     | 65    |        |
| Output level                                    | Output High         | 2.275                                            | -     | 1.475 | -     | -     | 1.6   | -     | 1.6   | V      |
|                                                 | Output Low          | -                                                | 1.68  | -     | 0.88  | 0.9   | -     | 0.9   | -     |        |
| Transition Time : Rise/Fall Time                |                     | -                                                | 1.0   | -     | 1.0   | -     | 1.0   | -     | 1.0   | nSec   |
| Start Time                                      |                     | -                                                | 10    | -     | 10    | -     | 10    | -     | 10    | mSec   |
| Tri-State<br>(Input to Pin 1/2)                 | Enable              | 2.31                                             | -     | 1.75  | -     | 2.31  | -     | 1.75  | -     | V      |
|                                                 | Disable             | -                                                | 0.99  | -     | 0.75  | -     | 0.99  | -     | 0.75  |        |
| RMS Phase<br>Jitter(integrated<br>12kHz~ 20MHz) | FO<80MHz            | -                                                | 1     | -     | 1     | -     | 1     | -     | 1     | pSec   |
|                                                 | 80 MHz ≤ FO<125MHz  | -                                                | 0.5   | -     | 0.5   | -     | 0.5   | -     | 0.5   |        |
|                                                 | 125 MHz ≤ FO<170MHz | -                                                | 0.3   | -     | 0.3   | -     | 0.3   | -     | 0.3   |        |
|                                                 | 170 MHz ≤ FO<200MHz | -                                                | 0.5   | -     | 0.5   | -     | 0.5   | -     | 0.5   |        |
|                                                 | 200 MHz ≤ FO        | -                                                | 0.3   | -     | 0.3   | -     | 0.3   | -     | 0.3   |        |
| Phase Noise<br>@156.25MHz                       | 100Hz               | -100                                             |       | -100  |       | -100  |       | -100  |       | dBc/Hz |
|                                                 | 1kHz                | -130                                             |       | -130  |       | -130  |       | -130  |       |        |
|                                                 | 10kHz               | -145                                             |       | -145  |       | -145  |       | -145  |       |        |
| Aging(@25 1st year)                             |                     | -                                                | ±3    | -     | ±3    | -     | ±3    | -     | ±3    | ppm    |
| Storage Temp. Range                             |                     | -55                                              | 125   | -55   | 125   | -55   | 125   | -55   | 125   | °C     |

Standard frequencies are frequencies which the crystal has been designed and does not imply a stock position

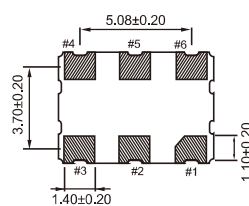
.+ Transition times are measured between 20% and 80% of VDD.

### Dimension(mm)

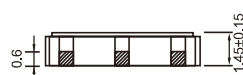
TOP VIEW



BOTTOM VIEW

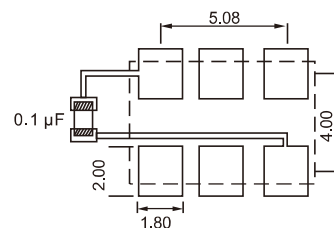


SIDE VIEW



| PIN# | Function     |
|------|--------------|
| 1    | NC/Tri-State |
| 2    | Tri-State/NC |
| 3    | GND          |
| 4    | Output       |
| 5    | Comp Output  |
| 6    | VDD          |

### Solder Pad Layout(mm)



To ensure optimal oscillator performance, place a by-pass capacitor of 0.1 µF as close to the part as possible between Vdd and GND pads.

### FREQ. STABILITY vs. TEMP. RANGE

| Temp. (°C) \ ppm | ±25 | ±50 |
|------------------|-----|-----|
| -10 ~ +60        | ○   | ○   |
| -20 ~ +70        | ○   | ○   |
| -40 ~ +85        | Δ   | ○   |
| -40 ~ +125       | x   | ○   |

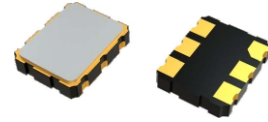
○: Available Δ: Conditional X: Not available

Inclusive of calibration @ 25 °C, operating temperature range, input voltage variation, load variation, aging (1st year), shock, and vibration

## 7.0 × 5.0 mm Ultra Low Phase Jitter LVPECL SMD Crystal Oscillator

### Feature

- Typical 7.0 x 5.0 x 1.45 mm 6 pads SMD package
- Ultra low jitter performance: < 100 fs RMS from 12kHz-20MHz
- Tight symmetry (45 to 55%) available
- Complementary output



### Electrical Specifications

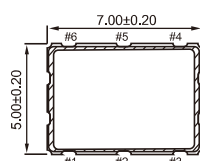
| Parameter                                  |              | LVPECL                |       |       |       | Unit   |
|--------------------------------------------|--------------|-----------------------|-------|-------|-------|--------|
|                                            |              | 3.3V                  |       | 2.5V  |       |        |
|                                            |              | Min.                  | Max.  | Min.  | Max.  |        |
| Supply Voltage Variation                   |              | 3.135                 | 3.465 | 2.375 | 2.625 | V      |
| Frequency Range                            |              | 70                    | 170   | 100   | 160   | MHz    |
| Standard Frequency                         |              | 100,125,155.52,156.25 |       |       |       | MHz    |
| Supply Current                             |              | -                     | 75    | -     | 75    | mA     |
| Transition Time :Rise/Fall Time            |              | -                     | 1     | -     | 1     | nSec   |
| Output Level                               | Output High  | 2.275                 |       | 1.475 |       | V      |
|                                            | Output Low   |                       | 1.68  |       | 1.095 |        |
| Start Time                                 |              | -                     | 10    | -     | 10    | mSec   |
| Tri-State<br>(Input to Pin 1 or Pin 2)     | Enable       | 2.31                  | -     | 1.75  | -     | V      |
|                                            | Disable      | -                     | 0.99  | -     | 0.75  |        |
| RMS Phase Jitter (Integrated12kHzto 20MHz) |              | -                     | 0.1   | -     | 0.1   | pSec   |
| Phase Noise @156.25MHz                     | 100Hz offset | -100                  |       | -100  |       | dBc/Hz |
|                                            | 1kHz offset  | -130                  |       | -130  |       | dBc/Hz |
|                                            | 10kHzoffset  | -150                  |       | -150  |       | dBc/Hz |
| Aging(@25°C 1st year)                      |              | -                     | ±3    | -     | ±3    | ppm    |
| Storage Temp. Range                        |              | -55                   | 125   | -55   | 125   | °C     |

Standard frequencies are frequencies which the crystal has been designed and does not imply a stock position

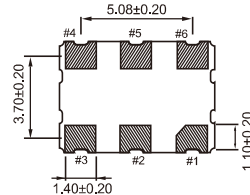
.+ Transition times are measured between 20% and 80% of VDD,

### Dimension(mm)

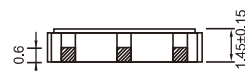
TOP VIEW



BOTTOM VIEW

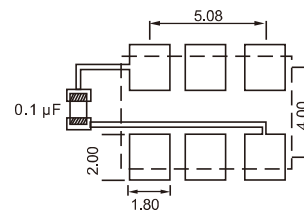


SIDE VIEW



| PIN# | Function     |
|------|--------------|
| 1    | NC/Tri-State |
| 2    | Tri-State/NC |
| 3    | GND          |
| 4    | Output       |
| 5    | Comp Output  |
| 6    | VDD          |

### Solder Pad Layout(mm)



To ensure optimal oscillator performance, place a by-pass capacitor of 0.1 µF as close to the part as possible between Vdd and GND pads.

### FREQ. STABILITY vs. TEMP. RANGE

| Temp. (°C) \ ppm | ±25 | ±50 |
|------------------|-----|-----|
| -10 ~ +60        | Δ   | ○   |
| -20 ~ +70        | Δ   | ○   |
| -40 ~ +85        | X   | ○   |

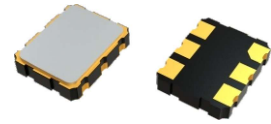
○: Available Δ: Conditional X: Not available

Inclusive of calibration @ 25 °C, operating temperature range, input voltage variation, load variation, aging (1st year), shock, and vibration

## 7.0 × 5.0 mm SMD HCSL Crystal Oscillator

### Feature

- Typical 7.0 x 5.0 x 1.45 mm hermetically sealed ceramic package
- Very low jitter performance: Max. 0.5 pS RMS from 12kHz-20MHz
- Tight symmetry (45 to 55%) available
- Tri-state enable/disable
- High-speed current steering logic (HCSL) output



### Electrical Specifications

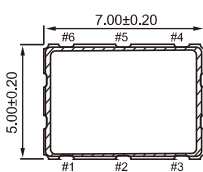
| Parameter                                 |             | HCSL  |       |       |       | Unit |
|-------------------------------------------|-------------|-------|-------|-------|-------|------|
|                                           |             | 3.3V  |       | 2.5V  |       |      |
|                                           |             | Min.  | Max.  | Min.  | Max.  |      |
| Supply Voltage Variation                  |             | 3.135 | 3.465 | 2.375 | 2.625 | V    |
| Frequency Range                           |             | 25    | 175   | 25    | 175   | MHz  |
| Standard Frequency                        |             | 100   |       |       |       | MHz  |
| Supply Current                            |             | -     | 50    | -     | 50    | mA   |
| Output level                              | Output High | 0.6   | -     | 0.58  | -     | V    |
|                                           | Output Low  | -     | 0.15  | -     | 0.15  |      |
| Transition Time : Rise/Fall Time          |             | -     | 0.5   | -     | 0.5   | nSec |
| Start Time                                |             | -     | 10    | -     | 10    | mSec |
| Tri-State<br>(Input to Pin 1/2)           | Enable      | 2.31  | -     | 1.75  | -     | V    |
|                                           | Disable     | -     | 0.99  | -     | 0.75  |      |
| RMS Phase Jitter(integrated 12 kHz~20MHz) |             | -     | 0.5   | -     | 0.5   | pSec |
| Aging(@25 1st year)                       |             | -     | ±3    | -     | ±3    | ppm  |
| Storage Temp. Range                       |             | -55   | 125   | -55   | 125   | °C   |

Standard frequencies are frequencies which the crystal has been designed and does not imply a stock position

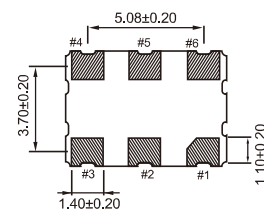
.+ Transition times are measured between 20% and 80% of VDD.

### Dimension(mm)

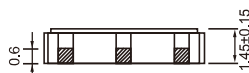
TOP VIEW



BOTTOM VIEW

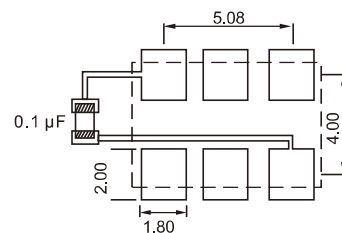


SIDE VIEW



| PIN# | Function     |
|------|--------------|
| 1    | NC/Tri-State |
| 2    | Tri-State/NC |
| 3    | GND          |
| 4    | Output       |
| 5    | Comp Output  |
| 6    | VDD          |

### Solder Pad Layout(mm)



To ensure optimal oscillator performance, place a by-pass capacitor of 0.1 µF as close to the part as possible between Vdd and GND pads.

### FREQ. STABILITY vs. TEMP. RANGE

| Temp. (°C) | ppm | ±25 | ±50 |
|------------|-----|-----|-----|
| -10 ~ +60  |     | o   | o   |
| -20 ~ +70  |     | o   | o   |
| -40 ~ +85  |     | Δ   | o   |
| -40 ~ +125 |     | x   | o   |

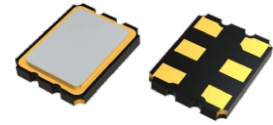
o: Available Δ: Conditional X: Not available

Inclusive of calibration @ 25 °C, operating temperature range, input voltage variation, load variation, aging (1st year), shock, and vibration

## 3.2 x 2.5 mm SMD CMOS Output Voltage Controlled Crystal Oscillator

### Feature

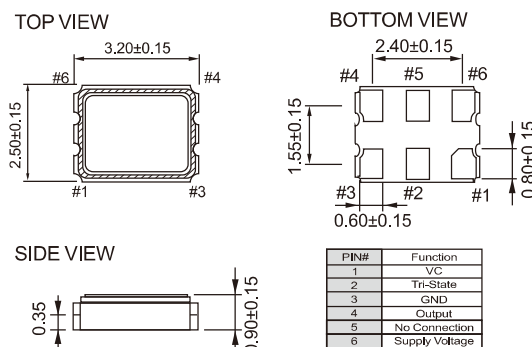
- Low power supply voltage: 3.3, 2.5 supply options.
- Frequency support from 10MHz to 250MHz.
- Low phase jitter typical: 0.8ps RMS from 12kHz TO 20MHz.
- Wide frequency control range. Tri-state enable/disable function
- Temperature range: -40 to 85°C operation
- Pb-free/ RoHS compliant



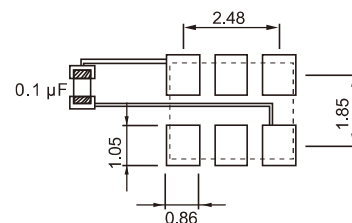
### Electrical Specifications

| Parameter                                      |               | CMOS    |         |        |        | Unit   |
|------------------------------------------------|---------------|---------|---------|--------|--------|--------|
|                                                |               | 3.3V    |         | 2.5V   |        |        |
|                                                |               | Min.    | Max.    | Min.   | Max.   |        |
| Supply Voltage Variation(VDD)                  |               | VDD-10% | VDD+10% | VDD-5% | VDD+5% | V      |
| Frequency Range                                |               | 10      | 250     | 10     | 250    | MHz    |
| Supply Current                                 |               | -       | 50      | -      | 45     | mA     |
| Output Level                                   | Output High   | 2.97    | -       | 2.25   | -      | V      |
|                                                | Output Low    | -       | 0.33    | -      | 0.25   |        |
| Transition Time ( 10% ~ 90% ) Rise/Fall Time + |               | -       | 1.0     | -      | 1.0    | nSec   |
| Duty Cycle                                     |               | 45      | 55      | 45     | 55     | %      |
| Start Time                                     |               | -       | 10      | -      | 10     | mSec   |
| Tri-State (input to Pin 2)                     |               |         |         |        |        | V      |
| Enable                                         |               | 70%VDD  | -       | 70%VDD | -      |        |
| Disable                                        |               | -       | 30%VDD  | -      | 30%VDD |        |
| Stand by Current                               |               | -       | 18      | -      | 18     | mA     |
| Output Loading ( 10MHz to 200MHz )             |               | -       | 15      | -      | 15     | pf     |
| Output Loading ( 200MHz to 250MHz )            |               | -       | 5       | -      | 5      | pf     |
| Phase Noise                                    |               | Typ.    | Max.    | Typ.   | Max.   | dBc/Hz |
| At VDD=3.3V,fout=250MHz                        | 1kHz offset   | -107    | -       | -107   | -      |        |
|                                                | 10kHz offset  | -111    | -       | -111   | -      |        |
|                                                | 100kHz offset | -114    | -       | -114   | -      |        |
|                                                | 1MHz offset   | -125    | -       | -125   | -      |        |
|                                                | 20MHz offset  | -147    | -       | -147   | -      |        |
| RMS Phase Jitter (12 kHz~20 MHz)               |               | 0.8     | 1.5     | 0.8    | 1.5    | pSec   |
| Control Voltage Center                         |               | 1.65    |         | 1.25   |        | V      |
| Control Voltage Range                          |               | 0.3     | 3       | 0.25   | 2.25   | V      |
| Frequency Pulling Range                        |               | ± 50    | ± 150   | ± 50   | ± 150  | ppm    |

### Dimension(mm)



### Solder Pad Layout(mm)



To ensure optimal oscillator performance, place a by-pass capacitor of 0.1 µF as close to the part as possible between Vdd and GND pads.

### FREQ. STABILITY vs. TEMP. RANGE

| ppm<br>Temp. (°C) | ±25 | ±50 |
|-------------------|-----|-----|
| -10 ~ +60         | O   | O   |
| -20 ~ +70         | O   | O   |
| -40 ~ +85         | △   | O   |

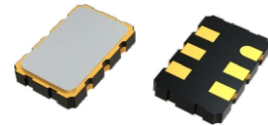
○: Available △: Conditional X: Not available

Inclusive of calibration @ 25 °C, operating temperature range, input voltage variation, load variation, aging (1 st year), shock, and vibration

## 5.0 x 3.2 mm SMD Voltage Controlled Crystal Oscillator

### Feature

- Typical 5.0 x 3.2 x 1.25 mm 6 pads ceramic SMD package
- Tight symmetry (45 to 55%) available
- Output frequency up to 250 MHz
- Tri-state enable/disable
- Pb-free/ RoHS compliant



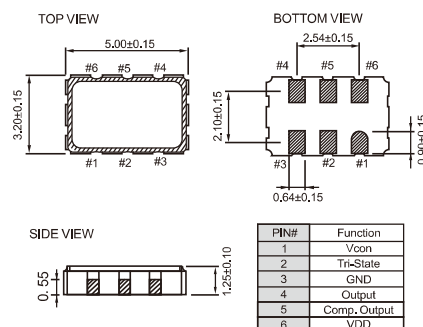
### Electrical Specifications

| Parameter                                      |                         | 2.5V / 3.3V |        | Unit   |
|------------------------------------------------|-------------------------|-------------|--------|--------|
|                                                |                         | Min.        | Max.   |        |
| Supply Voltage Variation(VDD)                  |                         | VDD-5%      | VDD+5% | V      |
| Frequency Range                                |                         | 10          | 250    | MHz    |
| Absolute Pulling Range (APR)                   |                         | ±50         | -      | ppm    |
| Control Voltage Range                          |                         | 0.3         | 3.0    | V      |
| Supply Current                                 | 10 MHz ≧ Fo <160 MHz    | -           | 40     | mA     |
|                                                | 160 MHz ≧ Fo ≧ 250 MHz  | -           | 50     |        |
| Output Level (CMOS)                            | Output High (Logic"1" ) | 2.97        | 0.33   | V      |
|                                                | Output Low (Logic"0" )  |             |        |        |
| Transition Time ( 10% ~ 90% ) Rise/Fall Time + |                         | -           | 2      | nSec   |
| Duty Cycle                                     |                         | 45          | 55     | %      |
| Start Time                                     |                         | -           | 2      | mSec   |
| Tri-State (input to Pin 2)                     | Enable                  | 2.31        | -      | V      |
|                                                | Disable                 | -           | 0.99   |        |
| Period Jitter (Pk-Pk)                          |                         | -           | 150    | pSec   |
| RMS Phase Jitter (Integrated 12kHz~20MHz)      |                         | -           | 1      | pSec   |
| Linearity                                      |                         | -           | 10     | %      |
| Modulation Bandwidth (BW)                      |                         | 10          | -      | kHz    |
| Input Impedance                                |                         | 1000        | -      | kΩ     |
| Phase Noise@155.52MHz                          | 100 Hz                  | -75         |        | dBc/Hz |
|                                                | 1 kHz                   | -105        |        |        |
|                                                | 10kHz                   | -125        |        |        |
| Aging ( @ 25℃ 1st year)                        |                         | -           | ±3     | ppm    |
| Storage Temp. Range                            |                         | -55         | 125    | ℃      |

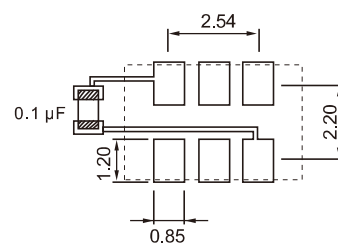
Standard frequencies are frequencies which the crystal has been designed and does not imply a stock position.

+ Transition times are measured between 10% and 90% of V DD , with an output load of 15pF.

### Dimension(mm)



### Solder Pad Layout(mm)



To ensure optimal oscillator performance, place a by-pass capacitor of 0.1 μF as close to the part as possible between VDD and GND pads.

### FREQ. STABILITY vs. TEMP. RANGE

| Temp. (°C) | ppm | ±25 | ±50 |
|------------|-----|-----|-----|
| -10 ~ +60  |     | O   | O   |
| -20 ~ +70  |     | O   | O   |
| -40 ~ +85  |     | Δ   | O   |

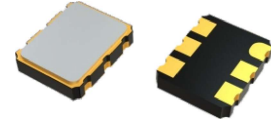
O: Available Δ: Conditional X: Not available

Inclusive of calibration @ 25 °C, operating temperature range, input voltage variation, load variation, aging (1 st year), shock, and vibration

## 7.0 x 5.0 mm SMD Voltage Controlled Crystal Oscillator

### Feature

- Typical 7.0 x 5.0 x 1.75 mm 6 pads ceramic SMD package.
- Tight symmetry (45 to 55%) available.
- Output frequency up to 250 MHz.
- Tri-state enable/disable
- Pb-free/ RoHS compliant



### Electrical Specifications

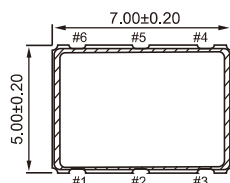
| Parameter                                                   |                         | 2.5V / 3.3V |        | Unit   |
|-------------------------------------------------------------|-------------------------|-------------|--------|--------|
|                                                             |                         | Min.        | Max.   |        |
| Supply Voltage Variation(VDD)                               |                         | VDD-5%      | VDD+5% | V      |
| Frequency Range                                             |                         | 10          | 250    | MHz    |
| Absolute Pulling Range (APR)                                |                         | ±50         | -      | ppm    |
| Control Voltage Range                                       |                         | 0.3         | 3.0    | V      |
| Supply Current                                              | 10 MHz ≦ Fo <160 MHz    | -           | 40     | mA     |
|                                                             | 160 MHz ≦ Fo ≦250 MHz   | -           | 50     |        |
| Output Level (CMOS)                                         | Output High (Logic“1” ) | 2.97        | 0.33   | V      |
|                                                             | Output Low (Logic“0” )  |             |        |        |
| Transition Time ( 10% ~ 90% ) Rise/Fall Time +              |                         | -           | 2      | nSec   |
| Start Time                                                  |                         | -           | 2      | mSec   |
| Tri-State (input to Pin 2)                                  | Enable                  | 2.31        | -      | V      |
|                                                             | Disable                 | -           | 0.99   |        |
| Period Jitter (Pk-Pk)                                       |                         | -           | 150    | pSec   |
| RMS Phase Jitter (Integrated 12kHz~20MHz) (At Integer Mode) |                         | -           | 1      | pSec   |
| Linearity                                                   |                         | -           | 10     | %      |
| Modulation Bandwidth (BW)                                   |                         | 10          | -      | kHz    |
| Input Impedance                                             |                         | 1000        | -      | kΩ     |
| Phase Noise@155.52MHz                                       | 100 Hz                  | -75         |        | dBc/Hz |
|                                                             | 1 kHz                   | -105        |        |        |
|                                                             | 10kHz                   | -125        |        |        |
| Aging ( @ 25℃ 1st year)                                     |                         | -           | ±3     | ppm    |
| Storage Temp. Range                                         |                         | -55         | 125    | ℃      |

Standard frequencies are frequencies which the crystal has been designed and does not imply a stock position.

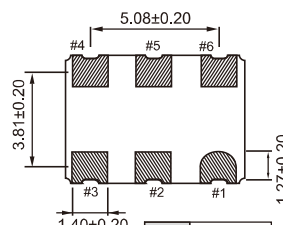
+ Transition times are measured between 10% and 90% of V DD , with an output load of 15pF.

### Dimension(mm)

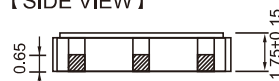
【 TOP VIEW 】



【 BOTTOM VIEW 】

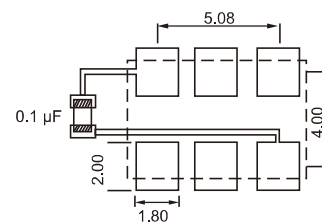


【 SIDE VIEW 】



| Pin# | Function  |
|------|-----------|
| 1    | Vcc       |
| 2    | Tri-State |
| 3    | GND       |
| 4    | Output    |
| 5    | NC        |
| 6    | VDD       |

### Solder Pad Layout(mm)



To ensure optimal oscillator performance, place a by-pass capacitor of 0.1 μF as close to the part as possible between Vdd and GND pads.

### FREQ. STABILITY vs. TEMP. RANGE

| ppm / Temp. (°C) | ±25 | ±50 |
|------------------|-----|-----|
| -10 ~ +60        | O   | O   |
| -20 ~ +70        | O   | O   |
| -40 ~ +85        | Δ   | O   |

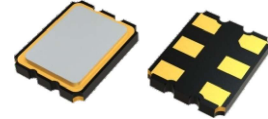
o: Available Δ: Conditional X: Not available

Inclusive of calibration @ 25 °C, operating temperature range, input voltage variation, load variation, aging (1 st year), shock, and vibration

## High Frequency up to 1.5GHz 3.2 x 2.5 mm SMD Differential Output Voltage Controlled Crystal Oscillator

### Feature

- Low power supply voltage: 3.3V, 2.5V supply options
- Differential output :LVPECL, LVDS
- Frequency support from 10MHz to 1.5GHz
- Low phase jitter typical: 0.8 ps RMS from 12kHz to 20MHz
- Wide frequency control range
- Pb-free/RoHS compliant

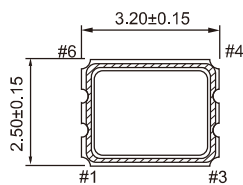


### Electrical Specifications

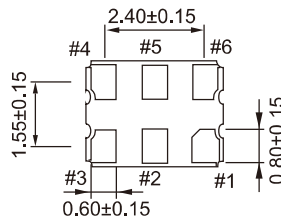
| Parameter                                   |                                  | LVPECL                       |                     |                    |                     | LVDS               |                     |                    |                     | Unit |
|---------------------------------------------|----------------------------------|------------------------------|---------------------|--------------------|---------------------|--------------------|---------------------|--------------------|---------------------|------|
|                                             |                                  | 3.3V                         |                     | 2.5V               |                     | 3.3V               |                     | 2.5V               |                     |      |
|                                             |                                  | Min.                         | Max.                | Min.               | Max.                | Min.               | Max.                | Min.               | Max.                |      |
| Supply Voltage Variation                    |                                  | VDD-10%                      | VDD+10%             | VDD-5%             | VDD+5%              | VDD-10%            | VDD+10%             | VDD-5%             | VDD+5%              | V    |
| Frequency Range                             |                                  | 10                           | 1500                | 10                 | 1500                | 10                 | 1500                | 10                 | 1500                | MHz  |
| Supply Current                              |                                  | -                            | 50                  | -                  | 45                  | -                  | 45                  | -                  | 35                  | mA   |
| Duty Cycle                                  |                                  | 45                           | 55                  | 45                 | 55                  | 45                 | 55                  | 45                 | 55                  | %    |
| Transition Time : Rise/Fall Time            |                                  | -                            | 1.0                 | -                  | 1.0                 | -                  | 1.0                 | -                  | 1.0                 | nSec |
| Output Level                                | Out High(Logic"1")               | 2.27                         | 2.7                 | 1.47               | 1.9                 | 1.6                |                     | 1.6                |                     | V    |
|                                             | Out Low(Logic"0")                | 1.45                         | 1.7                 | 0.65               | 0.9                 |                    |                     | 0.9                |                     |      |
| Start Time                                  |                                  | -                            | 10                  | -                  | 10                  | -                  | 10                  | -                  | 10                  | mSec |
| Tri-State<br>(Input to Pin 2)               | Enable(High Voltage or floating) | 0.7V <sub>DD</sub>           | -                   | 0.7V <sub>DD</sub> | -                   | 0.7V <sub>DD</sub> | -                   | 0.7V <sub>DD</sub> | -                   | V    |
|                                             | Disable(Low Voltage or GND)      | -                            | 0.3 V <sub>DD</sub> | -                  | 0.3 V <sub>DD</sub> | -                  | 0.3 V <sub>DD</sub> | -                  | 0.3 V <sub>DD</sub> |      |
| Standby by Current                          |                                  | -                            | 18                  | -                  | 18                  | -                  | 18                  | -                  | 18                  | mA   |
| Output Loading                              |                                  | 50Ω into V <sub>DD</sub> -2V |                     |                    |                     | 100Ω               |                     |                    |                     |      |
| RMS Phase Jitter (integrated12kHz to 20MHz) |                                  | 0.8                          | 1.5                 | 0.8                | 1.5                 | 0.8                | 1.5                 | 0.8                | 1.5                 | pSec |
| Control Voltage Function on Pin1            |                                  |                              |                     |                    |                     |                    |                     |                    |                     |      |
| Control Voltage Center                      |                                  | 1.65                         |                     | 1.25               |                     | 1.65               |                     | 1.25               |                     | V    |
| Control Voltage Range                       |                                  | 0.3                          | 3                   | 0.3                | 3                   | 0.3                | 3                   | 0.3                | 3                   | V    |
| Absolute Pulling Range (APR)                |                                  | ±50                          | ±150                | ±50                | ±150                | ±50                | ±150                | ±50                | ±150                | ppm  |
| Linearity                                   |                                  | 5                            | 10                  | 5                  | 10                  | 5                  | 10                  | 5                  | 10                  | %    |
| Modulation Bandwidth                        |                                  | 10                           | -                   | 10                 | -                   | 10                 | -                   | 10                 | -                   | kHz  |
| VC Input Impedance                          |                                  | 1                            | -                   | 1                  | -                   | 1                  | -                   | 1                  | -                   | MΩ   |

### Dimension(mm)

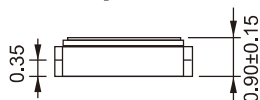
【 TOP VIEW 】



【 BOTTOM VIEW 】

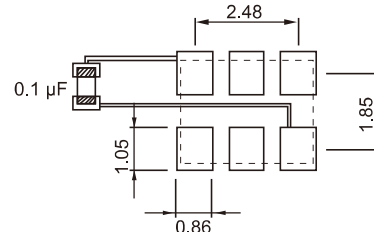


【 SIDE VIEW 】



| PIN# | Function       |
|------|----------------|
| 1    | VC             |
| 2    | Tri-State      |
| 3    | GND            |
| 4    | Output         |
| 5    | Comp. Output   |
| 6    | Supply Voltage |

### Solder Pad Layout(mm)



To ensure optimal oscillator performance, place a by-pass capacitor of 0.1 μF as close to the part as possible between Vdd and GND pads.

### FREQ. STABILITY vs. TEMP. RANGE

| Temp. (°C) | ±25 | ±50 |
|------------|-----|-----|
| -10 ~ +60  | O   | O   |
| -20 ~ +70  | O   | O   |
| -40 ~ +85  | Δ   | O   |

O: Available Δ: Conditional X: Not available

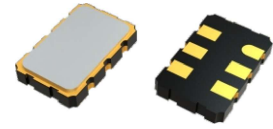
Inclusive of calibration @ 25 °C, operating temperature range, input voltage variation, load variation, aging (1 st year), shock, and vibration



## 5.0 x 3.2 mm SMD Differential Output Voltage Controlled Crystal Oscillator

### Feature

- Differential output: VPECL, LVDS
- Frequency support from 10MHz to 1.5GHz
- Low phase jitter typical: <1ps RMS from 12kHz to 20MHz
- Wide frequency control range
- Pb-free/RoHS compliant



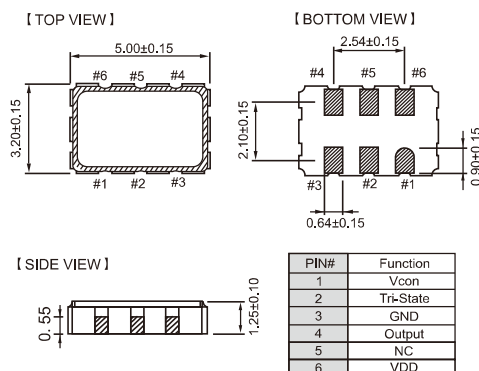
### Electrical Specifications

| Parameter                                    |                                  | LVPECL             |                     |                    |                     | LVDS               |                     |                    |                     | Unit |
|----------------------------------------------|----------------------------------|--------------------|---------------------|--------------------|---------------------|--------------------|---------------------|--------------------|---------------------|------|
|                                              |                                  | 3.3V               |                     | 2.5V               |                     | 3.3V               |                     | 2.5V               |                     |      |
|                                              |                                  | Min.               | Max.                | Min.               | Max.                | Min.               | Max.                | Min.               | Max.                |      |
| Supply Voltage Variation                     |                                  | VDD-5%             | VDD+5%              | VDD-5%             | VDD+5%              | VDD-5%             | VDD+5%              | VDD-5%             | VDD+5%              | V    |
| Frequency Range                              |                                  | 10                 | 1500                | 10                 | 1500                | 10                 | 1500                | 10                 | 1500                | MHz  |
| Supply Current                               | 10MHz ≡ F0<160MHz                | -                  | 75                  | -                  | 75                  | -                  | 50                  | -                  | 50                  | mA   |
|                                              | 160MHz ≡ FO<1500MHz              | -                  | 100                 |                    | 100                 |                    | 75                  |                    | 75                  |      |
| Duty Cycle                                   |                                  | 45                 | 55                  | 45                 | 55                  | 45                 | 55                  | 45                 | 55                  | %    |
| Transition Time : Rise/Fall Time             |                                  | -                  | 1.0                 | -                  | 1.0                 | -                  | 1.0                 | -                  | 1.0                 | nSec |
| Output Level                                 | Out High(Logic"1")               | 2.27               |                     | 2.27               |                     | 1.6                |                     | 1.6                |                     | V    |
|                                              | Out Low(Logic"0")                |                    | 1.7                 |                    | 1.7                 | 0.9                |                     | 0.9                |                     |      |
| Start Time                                   |                                  | -                  | 10                  | -                  | 10                  | -                  | 10                  | -                  | 10                  | mSec |
| Tri-State<br>(Input to Pin 2)                | Enable(High Voltage or floating) | 0.7V <sub>DD</sub> | -                   | 0.7V <sub>DD</sub> | -                   | 0.7V <sub>DD</sub> | -                   | 0.7V <sub>DD</sub> | -                   | V    |
|                                              | Disable(Low Voltage or GND)      | -                  | 0.3 V <sub>DD</sub> | -                  | 0.3 V <sub>DD</sub> | -                  | 0.3 V <sub>DD</sub> | -                  | 0.3 V <sub>DD</sub> |      |
| RMS Phase Jitter (integrated 12kHz to 20MHz) |                                  |                    | 1                   |                    | 1                   |                    | 1                   |                    | 1                   | pSec |
| Control Voltage Function on Pin1             |                                  |                    |                     |                    |                     |                    |                     |                    |                     |      |
| Control Voltage Center                       |                                  | 1.65               |                     | 1.25               |                     | 1.65               |                     | 1.25               |                     | V    |
| Control Voltage Range                        |                                  | 0.3                | 3                   | 0.3                | 3                   | 0.3                | 3                   | 0.3                | 3                   | V    |
| Absolute Pulling Range (APR)                 |                                  | ±50                |                     | ±50                |                     | ±50                |                     | ±50                |                     | ppm  |
| Linearity                                    |                                  |                    | 10                  |                    | 10                  |                    | 10                  |                    | 10                  | %    |
| Modulation Bandwidth                         |                                  | 10                 | -                   | 10                 | -                   | 10                 | -                   | 10                 | -                   | kHz  |
| VC Input Impedance                           |                                  | 1                  | -                   | 1                  | -                   | 1                  | -                   | 1                  | -                   | MΩ   |
| Aging (@25 1st year)                         |                                  | -                  | ±3                  | -                  | ±3                  | -                  | ±3                  | -                  | ±3                  | ppm  |
| Storage Temp. Range                          |                                  | -55                | 125                 | -55                | 125                 | -55                | 125                 | -55                | 125                 | °C   |

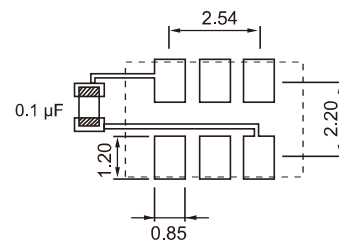
Standard frequencies are frequencies which the crystal has been designed and does not imply a stock position

+ Transition times are measured between 20% and 80% of V<sub>DD</sub>.

### Dimension(mm)



### Solder Pad Layout(mm)



To ensure optimal oscillator performance, place a by-pass capacitor of 0.1 μF as close to the part as possible between V<sub>DD</sub> and GND pads.

### FREQ. STABILITY vs. TEMP. RANGE

| Temp. (°C) \ ppm | ±25 | ±50 |
|------------------|-----|-----|
| -10 ~ +60        | O   | O   |
| -20 ~ +70        | Δ   | O   |
| -40 ~ +85        | Δ   | O   |

O: Available Δ: Conditional X: Not available

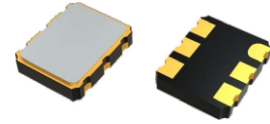
Inclusive of calibration @ 25 °C, operating temperature range, input voltage variation, load variation, aging (1 st year), shock, and vibration



## 7.0 x 5.0 mm SMD Differential Output Voltage Controlled Crystal Oscillator

### Feature

- Differential output :VPECL, LVDS
- Frequency support from 10MHz to 1.5GHz
- Low phase jitter typical:<1ps RMS from 12kHz to 20MHz
- Wide frequency control range
- Pb-free/RoHS compliant

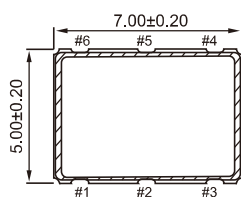


### Electrical Specifications

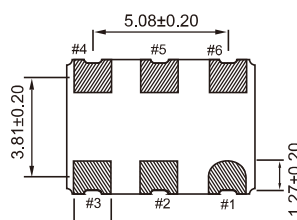
| Parameter                                   |                                  | LVPECL             |                     |                    |                     | LVDS               |                     |                    |                     | Unit |
|---------------------------------------------|----------------------------------|--------------------|---------------------|--------------------|---------------------|--------------------|---------------------|--------------------|---------------------|------|
|                                             |                                  | 3.3V               |                     | 2.5V               |                     | 3.3V               |                     | 2.5V               |                     |      |
|                                             |                                  | Min.               | Max.                | Min.               | Max.                | Min.               | Max.                | Min.               | Max.                |      |
| Supply Voltage Variation                    |                                  | VDD-10%            | VDD+10%             | VDD-5%             | VDD+5%              | VDD-10%            | VDD+10%             | VDD-5%             | VDD+5%              | V    |
| Frequency Range                             |                                  | 10                 | 1500                | 10                 | 1500                | 10                 | 1500                | 10                 | 1500                | MHz  |
| Supply Current                              | 10MHz ≦ FO<160MHz                | -                  | 75                  | -                  | 75                  | -                  | 50                  | -                  | 50                  | mA   |
|                                             | 160MHz ≦ FO<1500MHz              | -                  | 100                 |                    | 100                 |                    | 75                  |                    | 75                  |      |
| Duty Cycle                                  |                                  | 45                 | 55                  | 45                 | 55                  | 45                 | 55                  | 45                 | 55                  | %    |
| Transition Time : Rise/Fall Time            |                                  | -                  | 1.0                 | -                  | 1.0                 | -                  | 1.0                 | -                  | 1.0                 | nSec |
| Output Level                                | Out High(Logic“1”)               | 2.27               |                     | 2.27               |                     |                    | 1.6                 |                    | 1.6                 | V    |
|                                             | Out Low(Logic“0”)                |                    | 1.7                 |                    | 1.7                 | 0.9                |                     | 0.9                |                     |      |
| Start Time                                  |                                  | -                  | 10                  | -                  | 10                  | -                  | 10                  | -                  | 10                  | mSec |
| Tri-State<br>(Input to Pin 2)               | Enable(High Voltage or floating) | 0.7V <sub>DD</sub> | -                   | 0.7V <sub>DD</sub> | -                   | 0.7V <sub>DD</sub> | -                   | 0.7V <sub>DD</sub> | -                   | V    |
|                                             | Disable(Low Voltage or GND)      | -                  | 0.3 V <sub>DD</sub> | -                  | 0.3 V <sub>DD</sub> | -                  | 0.3 V <sub>DD</sub> | -                  | 0.3 V <sub>DD</sub> |      |
| RMS Phase Jitter (integrated12kHz to 20MHz) |                                  |                    | 1                   |                    | 1                   |                    | 1                   |                    | 1                   | pSec |
| Control Voltage Function on Pin1            |                                  |                    |                     |                    |                     |                    |                     |                    |                     |      |
| Control Voltage Center                      |                                  | 1.65               |                     | 1.25               |                     | 1.65               |                     | 1.25               |                     | V    |
| Control Voltage Range                       |                                  | 0.3                | 3                   | 0.3                | 3                   | 0.3                | 3                   | 0.3                | 3                   | V    |
| Absolute Pulling Range (APR)                |                                  | ±50                |                     | ±50                |                     | ±50                |                     | ±50                |                     | ppm  |
| Linearity                                   |                                  |                    | 10                  |                    | 10                  |                    | 10                  |                    | 10                  | %    |
| Modulation Bandwidth                        |                                  | 10                 | -                   | 10                 | -                   | 10                 | -                   | 10                 | -                   | kHz  |
| VC Input Impedance                          |                                  | 1                  | -                   | 1                  | -                   | 1                  | -                   | 1                  | -                   | MΩ   |
| Aging(@25 1st year)                         |                                  | -                  | ±3                  | -                  | ±3                  | -                  | ±3                  | -                  | ±3                  | ppm  |
| Storage Temp. Range                         |                                  | -55                | 125                 | -55                | 125                 | -55                | 125                 | -55                | 125                 | °C   |

### Dimension(mm)

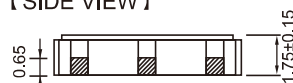
【 TOP VIEW 】



【 BOTTOM VIEW 】

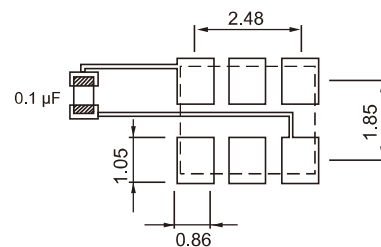


【 SIDE VIEW 】



| PIN# | Function    |
|------|-------------|
| 1    | Vcon        |
| 2    | Tri-State   |
| 3    | GND         |
| 4    | Output      |
| 5    | Comp.Output |
| 6    | VDD         |

### Solder Pad Layout(mm)



To ensure optimal oscillator performance, place a by-pass capacitor of 0.1 μF as close to the part as possible between Vdd and GND pads.

### FREQ. STABILITY vs. TEMP. RANGE

| Temp. (°C) \ ppm | ±25 | ±50 |
|------------------|-----|-----|
| -10 ~ +60        | O   | O   |
| -20 ~ +70        | Δ   | O   |
| -40 ~ +85        | Δ   | O   |

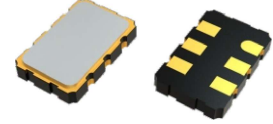
O: Available Δ: Conditional X: Not available

Inclusive of calibration @ 25 °C, operating temperature range, input voltage variation, load variation, aging (1 st year), shock, and vibration

## 5.0 x 3.2mm SMD LVPECL/LVDS Voltage Controlled Crystal Oscillator

### Feature

- Typical 5.0 x 3.2 x 1.25 mm 6 pads ceramic SMD package.
- Tight symmetry (45 to 55%) available.
- Tri-state enable/disable

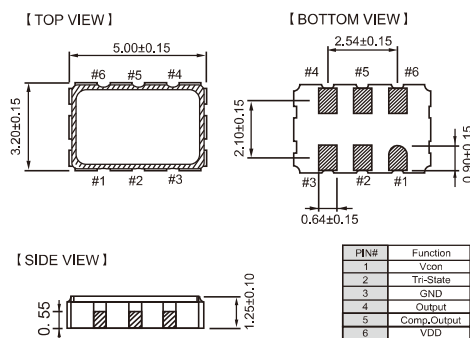


### Electrical Specifications

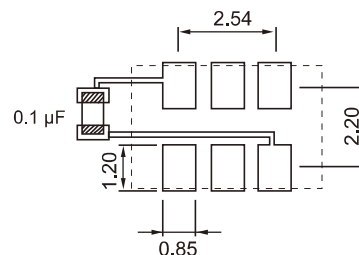
| Parameter                         |                                   | LVPECL 3.3V                |        | LVDS 3.3V |        | Unit   |
|-----------------------------------|-----------------------------------|----------------------------|--------|-----------|--------|--------|
|                                   |                                   | Min.                       | Max.   | Min.      | Max.   |        |
| Supply Voltage Variation(VDD)     |                                   | VDD-5%                     | VDD+5% | VDD-5%    | VDD+5% | V      |
| Frequency Range                   |                                   | 30                         | 250    | 30        | 250    | MHz    |
| Standard Frequency                |                                   | 122.88,153.6,155.52,156.25 |        |           |        | MHz    |
| Absolute Pulling Range (APR)      |                                   | ±50                        |        | ±50       | -      | ppm    |
| Control Voltage Range             |                                   | 0.3                        | 3.0    | 0.3       | 3.0    | V      |
| Supply Current 30MHz Fo 250 MHz   |                                   |                            | 100    |           | 75     | mA     |
| Output Level                      | Output High (logic "1")           | 2.275                      | -      |           | 1.6    | V      |
|                                   | Output Low (logic "0")            |                            | 1.68   | 0.9       |        |        |
| Transition Time: Rise/Fall Time + |                                   |                            | 1.0    |           | 1.0    | nSec   |
| Start Time                        |                                   |                            | 3      |           | 3      | mSec   |
| Tri-State (input to Pin 2)        | Enable (High voltage or floating) | 2.31                       |        | 2.31      |        | V      |
|                                   | Disable (Low voltage or GND)      |                            | 0.99   |           | 0.99   |        |
| Linearity                         |                                   |                            | 10     |           | 10     | %      |
| Modulation Bandwidth (BW)         |                                   | 20                         |        | 20        |        | kHz    |
| Input Impedance                   |                                   | 1                          |        | 1         |        | MΩ     |
| RMS Phase Jitter                  | F0 < 100 MHz                      |                            | 1.0    |           | 1.0    | pSec   |
|                                   | 100 MHz ≤ F0 < 125 MHz            |                            | 0.7    |           | 0.7    |        |
|                                   | 125 MHz ≤ F0 < 150 MHz            |                            | 0.5    |           | 0.5    |        |
|                                   | 150 MHz ≤ F0 < 250 MHz            |                            | 0.3    |           | 0.3    |        |
| Phase Noise @122.88MHz            | 100 Hz                            |                            | -105   |           | -105   | dBc/HZ |
|                                   | 1kHz                              |                            | -128   |           | -128   |        |
|                                   | 10kHz                             |                            | -145   |           | -145   |        |
| Aging (@ 25°C 1st year)           |                                   |                            | ±3     |           | ±3     | ppm    |
| Storage Temp. Range               |                                   | -55                        | 125    | -55       | 125    | °C     |

Standard frequencies are frequencies which the crystal has been designed and does not imply a stock position  
+ Transition times are measured between 20% and 80% of VDD.

### Dimension(mm)



### Solder Pad Layout(mm)



To ensure optimal oscillator performance, place a by-pass capacitor of 0.1 μF as close to the part as possible between Vdd and GND pads.

### FREQ. STABILITY vs. TEMP. RANGE

| Temp. (°C) \ ppm | ±25 | ±50 |
|------------------|-----|-----|
| -10 ~ +60        | O   | O   |
| -20 ~ +70        | O   | O   |
| -40 ~ +85        | X   | O   |

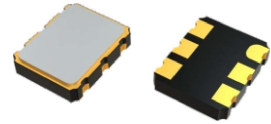
O: Available Δ: Conditional X: Not available

Inclusive of calibration @ 25 °C, operating temperature range, input voltage variation, load variation, aging (1 st year), shock, and vibration

## 7.0 x 5.0 mm SMD LVPECL/LVDS Voltage Controlled Crystal Oscillator

### Feature

- Typical 7.0 x 5.0 x 1.75 mm 6 pads ceramic SMD package.
- Very low jitter performance: typical 0.3 pS RMS from 12kHz-20MHz.
- Wide frequency control range.
- Complementary Output.
- Tri-state enable/disable.



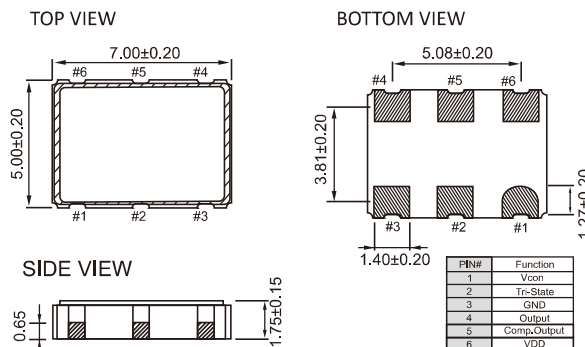
### Electrical Specifications

| Parameter                                          |                                   |  | LVPECL                                    |        |        |        | LVDS   |        |        |        | Unit   |
|----------------------------------------------------|-----------------------------------|--|-------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|
|                                                    |                                   |  | 3.3 V                                     |        | 2.5 V  |        | 3.3 V  |        | 2.5 V  |        |        |
|                                                    |                                   |  | Min.                                      | Max.   | Min.   | Max.   | Min.   | Max.   | Min.   | Max.   |        |
| Supply Voltage Variation(VDD)                      |                                   |  | VDD-5%                                    | VDD+5% | VDD-5% | VDD+5% | VDD-5% | VDD+5% | VDD-5% | VDD+5% | V      |
| Frequency Range                                    |                                   |  | 1.5                                       | 200    | 65     | 200    | 1.5    | 200    | 65     | 200    | MHz    |
| Standard Frequency                                 |                                   |  | 77.76,106.25,122.88,125,155.52,156.25,200 |        |        |        |        |        |        |        | MHz    |
| Absolute Pulling Range (APR)                       |                                   |  | ±50                                       | —      | ±50    | —      | ±50    | —      | ±50    | —      | ppm    |
| Control Voltage Range                              |                                   |  | 0.3                                       | 3.0    | 0      | 2.5    | 0.3    | 3.0    | 0      | 2.5    | V      |
| Supply Current                                     | 1.5 MHz ≤ F0 < 65 MHz             |  | —                                         | 75     | —      | 75     | —      | 45     | —      | 45     | mA     |
|                                                    | 65 MHz ≤ F0 < 200 MHz             |  | —                                         | 100    | —      | 100    | —      | 80     | —      | 80     |        |
| Output Level                                       | Output High                       |  | 2.275                                     | —      | 1.475  | —      | —      | 1.6    | —      | 1.6    | V      |
|                                                    | Output Low                        |  | —                                         | 1.68   | —      | 1.095  | 0.9    | —      | 0.9    | —      |        |
| Transition Time: Rise/Fall Time +                  |                                   |  | —                                         | 1.0    | —      | 1.0    | —      | 1.0    | —      | 1.0    | nSec   |
| Start Time                                         |                                   |  | 3                                         |        | 3      |        | 3      |        | 3      |        | mSec   |
| Tri-State<br>(input to PIN 2)                      | Enable (High voltage or floating) |  | 2.31                                      | —      | 1.75   | —      | 2.31   | —      | 1.75   | —      | V      |
|                                                    | Disable (Low voltage or GND)      |  | —                                         | 0.99   | —      | 0.75   | —      | 0.99   | —      | 0.75   |        |
| Linearity                                          |                                   |  | —                                         | 10     | —      | 10     | —      | 10     | —      | 10     | %      |
| Modulation Bandwidth (BW)                          |                                   |  | 15                                        | —      | 15     | —      | 15     | —      | 15     | —      | kHz    |
| Input Impedance                                    |                                   |  | 1                                         | —      | 1      | —      | 1      | —      | 1      | —      | Mhz    |
| RMS Phase<br>Jitter<br>(Integrated<br>12kHz~20MHz) | F0 < 100 MHz                      |  | —                                         | 1.0    | —      | 1.0    | —      | 1.0    | —      | 1.0    | pSec   |
|                                                    | 100 MHz ≤ F0 < 125 MHz            |  | —                                         | 0.7    | —      | 0.7    | —      | 0.7    | —      | 0.7    |        |
|                                                    | 125 MHz ≤ F0 < 150 MHz            |  | —                                         | 0.5    | —      | 0.5    | —      | 0.5    | —      | 0.5    |        |
|                                                    | 150 MHz ≤ F0                      |  | —                                         | 0.3    | —      | 0.3    | —      | 0.3    | —      | 0.3    |        |
| Phase Noise<br>@ 153.6 MHz                         | 100 Hz                            |  | -85                                       |        | -85    |        | -85    |        | -85    |        | dBc/Hz |
|                                                    | 1kHz                              |  | -115                                      |        | -115   |        | -115   |        | -115   |        |        |
|                                                    | 10kHz                             |  | -130                                      |        | -130   |        | -130   |        | -130   |        |        |
| Aging (@ 25 C 1st year)                            |                                   |  | —                                         | ±3     | —      | ±3     | —      | ±3     | —      | ±3     | ppm    |
| Storage Temp. Range                                |                                   |  | -55                                       | 125    | -55    | 125    | -55    | 125    | -55    | 125    | °C     |

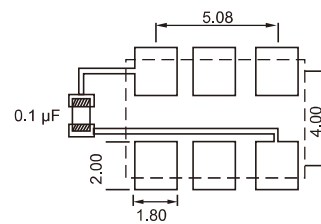
Standard frequencies are frequencies which the crystal has been designed and does not imply a stock position

+ Transition times are measured between 20% and 80% of VDD.

### Dimension(mm)



### Solder Pad Layout(mm)



To ensure optimal oscillator performance, place a by-pass capacitor of 0.1 µF as close to the part as possible between Vdd and GND pads.

### FREQ. STABILITY vs. TEMP. RANGE

| ppm / Temp. (°C) | ±25 | ±50 |
|------------------|-----|-----|
| -10 ~ +60        | △   | O   |
| -20 ~ +70        | △   | O   |
| -40 ~ +85        | X   | O   |

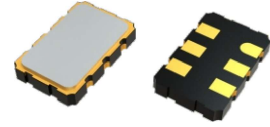
o: Available △: Conditional X: Not available

Inclusive of calibration @ 25 °C, operating temperature range, input voltage variation, load variation, aging (1 st year), shock, and vibration

## 5.0 x 3.2mm SMD Voltage Controlled Crystal Oscillator

### Feature

- Typical 5.0 x 3.2 x 1.25 mm 6 pads ceramic SMD package.
- Tight symmetry (45 to 55%) available.
- Operating temperature up to 105°C.
- Tri-state enable/disable.



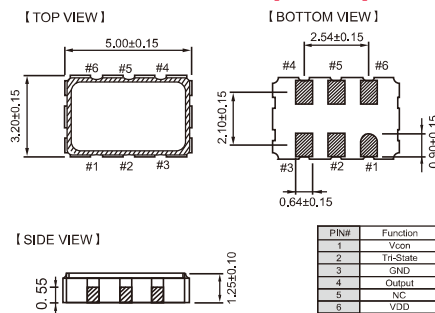
### Electrical Specifications

| Parameter                                     | 3.3V                              |        | Unit   |
|-----------------------------------------------|-----------------------------------|--------|--------|
|                                               | Min.                              | Max.   |        |
| Supply Voltage Variation(VDD)                 | VDD-5%                            | VDD+5% | V      |
| Frequency Range                               | 1.5                               | 170    | MHz    |
| Standard Frequency                            | 19.44, 38.4                       |        | MHz    |
| Absolute Pulling Range (APR)                  | ±50                               |        | ppm    |
| Control Voltage Range                         | 0.3                               | 3.0    | V      |
| Supply Current                                | 1.5MHz ≤ F0 < 20 MHz              | 10     | mA     |
|                                               | 20MHz ≤ F0 < 50 MHz               | 20     |        |
|                                               | 50MHz ≤ F0 ≤ 170 MHz              | 30     |        |
| Output Level                                  | Output High                       | 2.97   | V      |
|                                               | Output Low                        | 0.33   |        |
| Transition Time:<br>Rise/Fall Time +          | 1.5 MHz ≤ F0 < 20 MHz             | 5      | nSec   |
|                                               | 20 MHz ≤ F0 < 50 MHz              | 4      |        |
|                                               | 50 MHz ≤ F0 ≤ 170 MHz             | 3      |        |
| Start Time                                    | -                                 | 2      | mSec   |
| Tri-State (input to<br>Pin 2)                 | Enable (High voltage or floating) | 2.31   | V      |
|                                               | Disable (Low voltage or GND)      | -      |        |
| Linearity                                     |                                   | 10     | %      |
| Modulation Bandwidth (BW)                     | 15                                | -      | kHz    |
| Input Impedance                               | 10                                | -      | MΩ     |
| Period Jitter (Pk-Pk)                         | -                                 | 40     | pSec   |
| RMS Phase Jitter (Integrated 12 kHz ~ 20 MHz) | -                                 | 1      | pSec   |
| Phase Noise<br>@38.4MHz                       | 100 Hz                            | -100   | dBc/Hz |
|                                               | 1kHz                              | -133   |        |
|                                               | 10kHz                             | -140   |        |
| Aging (@ 25°C 1st year)                       |                                   | ±3     | Ppm    |
| Storage Temp. Range                           | -55                               | 125    | °C     |

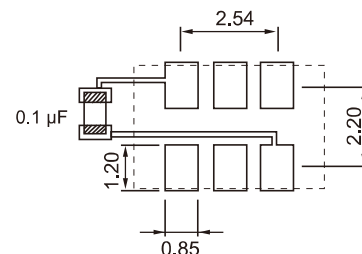
Standard frequencies are frequencies which the crystal has been designed and does not imply a stock position

+ Transition times are measured between 20% and 80% of VDD.

### Dimension(mm)



### Solder Pad Layout(mm)



To ensure optimal oscillator performance, place a by-pass capacitor of 0.1 µF as close to the part as possible between Vdd and GND pads.

### FREQ. STABILITY vs. TEMP. RANGE

| Temp. (°C) | ppm | ±25 | ±50 |
|------------|-----|-----|-----|
| -10 ~ +60  |     | O   | O   |
| -20 ~ +70  |     | O   | O   |
| -40 ~ +85  |     | X   | O   |
| -40 ~ +105 |     | X   | O   |

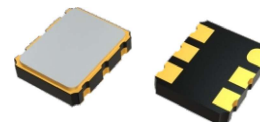
O: Available Δ: Conditional X: Not available

Inclusive of calibration @ 25 °C, operating temperature range, input voltage variation, load variation, aging (1 st year), shock, and vibration

## 7.0 x 5.0 mm SMD Voltage Controlled Crystal Oscillator

### Feature

- Typical 7.0 x 5.0 x 1.75 mm 6 pads ceramic SMD package.
- Tight symmetry (45 to 55%) available.
- Operating temperature up to 105°C.
- Tri-state enable/disable



### Electrical Specifications

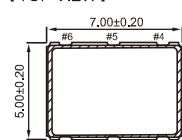
| Parameter                                    | 3.3V                                                |        | Unit   |
|----------------------------------------------|-----------------------------------------------------|--------|--------|
|                                              | Min.                                                | Max.   |        |
| Supply Voltage Variation(VDD)                | VDD-5%                                              | VDD+5% | V      |
| Frequency Range                              | 1.5                                                 | 170    | MHz    |
| Standard Frequency                           | 10,20,25,27,32.768,35.328,38.88,61.44,122.88, 153.6 |        | MHz    |
| Absolute Pulling Range (APR)                 | ±50                                                 |        | ppm    |
| Control Voltage Range                        | 0.3                                                 | 3.0    | V      |
| Supply Current                               | 1.5MHz ≦ F0 < 20 MHz                                | 10     | mA     |
|                                              | 20MHz ≦ F0 < 50 MH                                  | 20     |        |
|                                              | 50MHz ≦ F0 ≦ 80 MHz                                 | 30     |        |
|                                              | 80MHz ≦ F0 ≦ 160 MHz                                | 40     |        |
|                                              | 160MHz ≦ F0 ≦ 170 MHz                               | 50     |        |
| Output Level                                 | Output High                                         | 2.97   | V      |
|                                              | Output Low                                          | 0.33   |        |
| Transition Time:<br>Rise/Fall Time +         | 1.5 MHz ≦ F0 < 20 MHz                               | -      | nSec   |
|                                              | 20 MHz ≦ F0 < 50 MHz                                | 4      |        |
|                                              | 50 MHz ≦ F0 ≦ 80 MHz                                | 3      |        |
|                                              | 80 MHz ≦ F0 ≦ 170 MHz                               | 2      |        |
| Start Time                                   | -                                                   | 5      | mSec   |
| Tri-State (input to<br>Pin 2)                | Enable (High voltage or floating)                   | 2.31   | V      |
|                                              | Disable (Low voltage or GND)                        | 0.99   |        |
| Linearity                                    |                                                     | 10     | %      |
| Modulation Bandwidth (BW)                    | 15                                                  | -      | kHz    |
| Input Impedance                              | 10                                                  | -      | MΩ     |
| Period Jitter (Pk-Pk)                        | -                                                   | 40     | pSec   |
| RMS Phase Jitter (Integrated 12kHz ~ 20 MHz) | -                                                   | 1      | pSec   |
| Phase Noise<br>@38.4MHz                      | 100 Hz                                              | -115   | dBc/HZ |
|                                              | 1kHz                                                | -135   |        |
|                                              | 10kHz                                               | -150   |        |
| Aging (@ 25°C 1st year)                      |                                                     | ±3     | Ppm    |
| Storage Temp. Range                          | -55                                                 | 125    | °C     |

Standard frequencies are frequencies which the crystal has been designed and does not imply a stock position

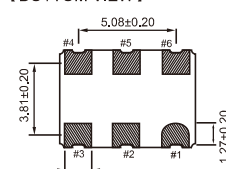
+ Transition times are measured between 10% and 90% of VDD, with an output load of 15pF.

### Dimension(mm)

[ TOP VIEW ]



[ BOTTOM VIEW ]

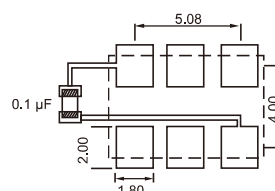


[ SIDE VIEW ]



| Pin# | Function |
|------|----------|
| 1    | Vcon     |
| 2    | TriState |
| 3    | GND      |
| 4    | Output   |
| 5    | VCC      |
| 6    | VDD      |

### Solder Pad Layout(mm)



To ensure optimal oscillator performance, place a by-pass capacitor of 0.1 μF as close to the part as possible between Vdd and GND pads.

### FREQ. STABILITY vs. TEMP. RANGE

| Temp. (°C) | ±25 | ±50 |
|------------|-----|-----|
| -10 ~ +60  | O   | O   |
| -20 ~ +70  | O   | O   |
| -40 ~ +85  | X   | O   |
| -40 ~ +105 | X   | O   |

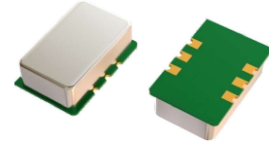
O: Available Δ: Conditional X: Not available

Inclusive of calibration @ 25 °C, operating temperature range, input voltage variation, load variation, aging (1 st year), shock, and vibration

# 14.2 x9.3 mm SMD LVPECL/LVDS Voltage Controlled Crystal Oscillator

## Feature

- Typical 14.2 x 9.3 x 5.4 mm 6 pads ceramic SMD package
- Tight symmetry (45 to 55%) available
- Wide frequency control range
- Complementary Output
- Low phase jitter (Max:0.5 pSec)



## Electrical Specifications

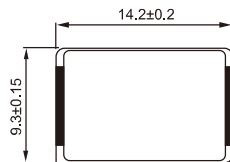
| Parameter                                       |                                   | LVPECL                                    |         |        |         | LVDS   |         |        |         | Unit       |      |
|-------------------------------------------------|-----------------------------------|-------------------------------------------|---------|--------|---------|--------|---------|--------|---------|------------|------|
|                                                 |                                   | 3.3V                                      |         | 2.5V   |         | 3.3V   |         | 2.5V   |         |            |      |
|                                                 |                                   | Min.                                      | Max.    | Min.   | Max.    | Min.   | Max.    | Min.   | Max.    |            |      |
| Supply Voltage Variation(VDD)                   |                                   | VDD-5%                                    | VDD+5 % | VDD-5% | VDD+5 % | VDD-5% | VDD+5 % | VDD-5% | VDD+5 % | v          |      |
| Frequency Range                                 |                                   | 30                                        | 250     | 30     | 250     | 30     | 250     | 30     | 250     | MHz        |      |
| Standard Frequency                              |                                   | 77.76,106.25,122.88,125,155.52,156.25,200 |         |        |         |        |         |        |         |            | MHz  |
| Absolute Pulling Range (APR)                    |                                   | ±50                                       | -       | ±50    | -       | ±50    | -       | ±50    | -       | ppm        |      |
| Control Voltage Range                           |                                   | 0.3                                       | 3.0     | 0      | 2.5     | 0.3    | 3.0     | 0      | 2.5     | V          |      |
| Supply Current                                  | 1.5 MHz ≧ F0 < 65 MHz             | -                                         | 75      | -      | 75      | -      | 45      | -      | 45      | mA         |      |
|                                                 | 65 MHz ≧ F0<250 MHz               | -                                         | 100     | -      | 100     | -      | 80      | -      | 80      |            |      |
| Output Level                                    | Output High                       | 2.275                                     | -       | 1.475  | -       | -      | 1.6     | -      | 1.6     | V          |      |
|                                                 | Output Low                        | -                                         | 1.68    | -      | 1.095   | 0.9    | -       | 0.9    | -       |            |      |
| Transition Time: Rise/Fall Time +               |                                   | -                                         | 1.0     | -      | 1.0     | -      | 1.0     | -      | 1.0     | nSec       |      |
| Start Time                                      |                                   | 3                                         |         |        | 3       |        |         | 3      |         |            | mSec |
| Tri-State<br>(input to Pin 2)                   | Enable (High voltage or floating) | -                                         | 0.99    | -      | 0.75    | -      | 0.99    | -      | 0.75    | V          |      |
|                                                 | Disable (Low voltage or GND)      | 2.31                                      | -       | 1.75   | -       | 2.31   | -       | 1.75   | -       |            |      |
| Linearity                                       |                                   | -                                         | 10      | -      | 10      | -      | 10      | -      | 10      | %          |      |
| Modulation Bandwidth (BW)                       |                                   | 15                                        | -       | 15     | -       | 15     | -       | 15     | -       | kHz        |      |
| Input Impedance                                 |                                   | 10                                        | -       | 10     | -       | 10     | -       | 10     | -       | M Ω        |      |
| RMS Phase Jitter<br>(Integrated<br>12kHz~20MHz) | F0 < 100 MHz                      | -                                         | 1.0     | -      | 1.0     | -      | 1.0     | -      | 1.0     | pSec       |      |
|                                                 | 100 MHz ≧ F0 < 125 MHz            | -                                         | 0.7     | -      | 0.7     | -      | 0.7     | -      | 0.7     |            |      |
|                                                 | 125 MHz ≧ F0 < 150 MHz            | -                                         | 0.5     | -      | 0.5     | -      | 0.5     | -      | 0.5     |            |      |
|                                                 | 150 MHz ≧ F0                      | -                                         | 0.3     | -      | 0.3     | -      | 0.3     | -      | 0.3     |            |      |
| Phase Noise<br>@155.52MHz                       | 100 Hz                            | -85                                       |         | -85    |         | -85    |         | -85    |         | dBc/H<br>z |      |
|                                                 | 1kHz                              | -115                                      |         | -115   |         | -115   |         | -115   |         |            |      |
|                                                 | 10kHz                             | -130                                      |         | -130   |         | -130   |         | -130   |         |            |      |
| Aging (@ 25°C 1st year)                         |                                   | -                                         | ±3      | -      | ±3      | -      | ±3      | -      | ±3      | Ppm        |      |
| Storage Temp. Range                             |                                   | -55                                       | 125     | -55    | 125     | -55    | 125     | -55    | 125     | ℃          |      |

Standard frequencies are frequencies which the crystal has been designed and does not imply a stock position

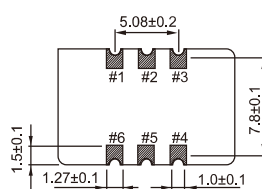
+ Transition times are measured between 20% and 80% of VDD.

## Dimension(mm)

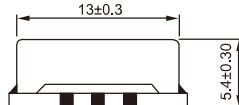
[ TOP VIEW ]



[ BOTTOM VIEW ]

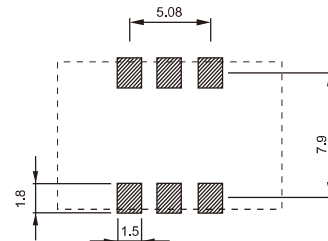


[ SIDE VIEW ]



| Pin# | Function       |
|------|----------------|
| 1    | Vcon           |
| 2    | Tri-State/NC   |
| 3    | GND            |
| 4    | Output         |
| 5    | Comp. Output   |
| 6    | Supply Voltage |

## Solder Pad Layout(mm)



To ensure optimal oscillator performance, place a by-pass capacitor of 0.1 μF as close to the part as possible between VDD and GND pads.

## FREQ. STABILITY vs. TEMP. RANGE

| Temp. (°C) \ ppm | ±25 | ±50 |
|------------------|-----|-----|
| -10 ~ +60        | △   | O   |
| -20 ~ +70        | △   | O   |
| -40 ~ +85        | X   | O   |

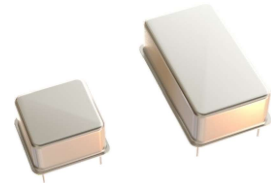
O: Available △ :Conditional X: Not available

Inclusive of calibration @ 25 °C, operating temperature range, input voltage variation, load variation, aging (1 st year), shock, and vibration

## Voltage Controlled Crystal Oscillator Full/Half Size(VCXO)

### Feature

- Size 20.3x12.6mm and 12.6x12.6mm
- Hybrid IC Circuit Construction
- CMOS compatible output
- All metal, hermetically sealed welded package



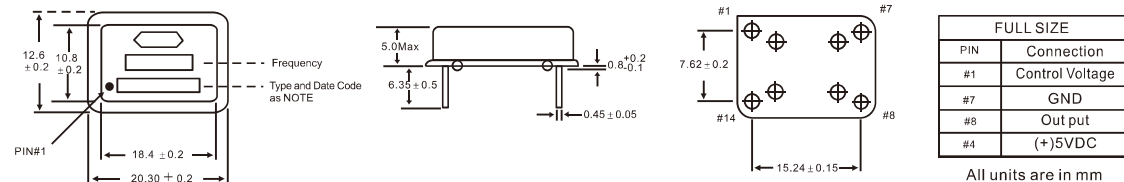
### Electrical Specifications

| Item                  | Specifications                                |                                           |
|-----------------------|-----------------------------------------------|-------------------------------------------|
| Frequency Range       | 1MHz~80MHz                                    |                                           |
| Frequency Stability   | ±25, ±50, ±100ppm                             |                                           |
| Operating temperature | 0-70°C, -20-70°C, -40-85°C                    |                                           |
| Fan Out Type          | HCMOS Square wave                             |                                           |
| Load                  | 15pF                                          | 15pF                                      |
| Voltage Voh           | 4.5V Minimum                                  | 3.0V Minimum                              |
| Voltage Vol           | 0.4V Maximum                                  | 0.3V Maximum                              |
| Duty Cycle            | 40/60 Maximum                                 | 40/60 Maximum                             |
| Rise/Fall Time        | 5ns                                           | 5ns                                       |
| Frequency Control     | Positive Transfer Characteristics             |                                           |
|                       | Pullability                                   | ±50ppm, ±100ppm, ±150ppm, ±200ppm Minimum |
|                       | Control Voltage                               | 0.5Vdc to 4.5Vdc      0.3Vdc to 3.0Vdc    |
|                       | Center Frequency                              | 2.5 Vdc      1.65 Vdc                     |
|                       | Monotonic Linearity                           | < ± 15%      < ± 15%                      |
|                       | Input impedance                               | 50 Kohms Normal      50 Kohms Normal      |
| Supply Voltage        | +5Vdc +/-5% or 3.3V +/-5%                     | +3.3V                                     |
| Supply Current        | 60mA Max                                      | 40mA Max                                  |
| Package               | All metal, hermetically sealed welded package |                                           |

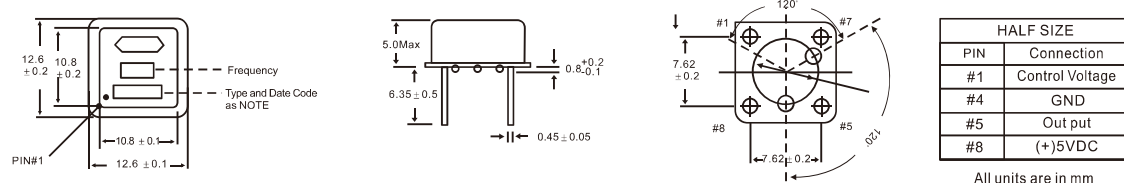
\*Please consult our sales representative for other specifications.

### Dimension(mm)

#### Full Size VCXO



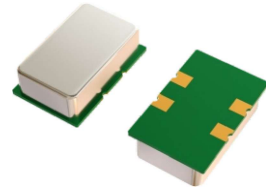
#### Half Size VCXO



# 14 X9 mm High Frequency Very Low Noise/Low g-Sensitivity CXO

## Feature

- Typical 14 x 9 x 3.6mm SMD package
- High frequency high performance VCXO
- High frequency and very low phase noise/Low g-Sensitivity
- Low Power Consumption

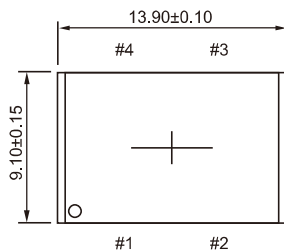


## Electrical Specifications

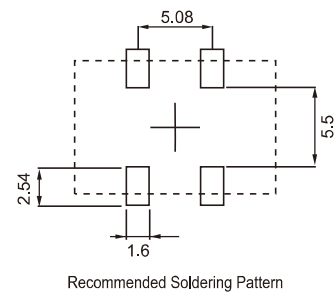
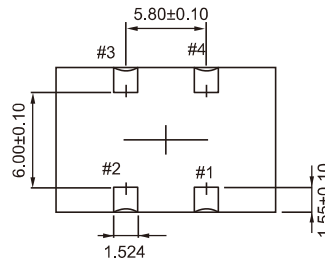
| Parameter                         |                 | 5.0V                         |      | 3.3V          |       | Unit   |      |
|-----------------------------------|-----------------|------------------------------|------|---------------|-------|--------|------|
|                                   |                 | Min.                         | Max. | Min.          | Max.  |        |      |
| Supply Voltage Variation(VDD)     |                 | 4.75                         | 5.25 | 3.135         | 3.465 | V      |      |
| Frequency Range                   |                 | 50                           | 125  | 50            | 125   | MHz    |      |
| Frequency Stability (Overall)     |                 | -25                          | +25  | -25           | +25   | ppm    |      |
| Standard Frequency                |                 | 100,122.88,125               |      |               |       | MHz    |      |
| Absolute Pulling Range (APR)      |                 | ±30                          |      | ±25           | -     | ppm    |      |
| Control Voltage Range             |                 | 0                            | 5.0  | 0             | 3.3   | V      |      |
| Waveform                          |                 | Sine Wave                    |      | CMOS          |       |        |      |
| Level (CMOS)                      | V <sub>oL</sub> | For CMOS                     |      |               | 0.5   | V      |      |
|                                   | V <sub>oH</sub> |                              |      | 4.5           |       |        |      |
| Duty Cycle                        |                 |                              |      | 45            | 55    | %      |      |
| Transition Time: Rise/Fall Time + |                 |                              |      |               |       | 3      | nSec |
| Load                              |                 |                              |      |               |       | 15     | pF   |
| Level(Sine Wave)                  |                 | 10                           |      | For Sine Wave |       | dbm    |      |
| Load                              |                 | 50                           |      |               |       | ohms   |      |
| Harmonics                         |                 |                              | -30  |               |       | dBc    |      |
| Current                           |                 |                              | 30   |               | 30    | mA     |      |
| Phase Noise @122.88MHz            | 100 Hz          | -117                         |      | -115          |       | dBc/HZ |      |
|                                   | 1kHz            | -144                         |      | -140          |       |        |      |
|                                   | 10kHz           | -165                         |      | -160          |       |        |      |
|                                   | 100kHz          | -172                         |      | -168          |       |        |      |
|                                   | 1MHz            | -175                         |      | -170          |       |        |      |
| Operating Temperature Range       |                 | -20℃ ~ + 70℃ or -40℃ ~ + 85℃ |      |               |       | ℃      |      |
| Storage Temp. Range               |                 | -45                          | 90   | -45           | 90    | ℃      |      |

## Dimension(mm)

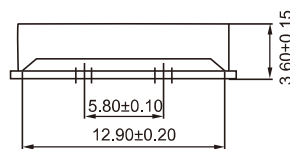
【 TOP VIEW 】



【 BOTTOM VIEW 】



【 SIDE VIEW 】



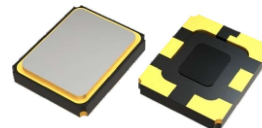
| Pin | Function |
|-----|----------|
| #1  | Vcon     |
| #2  | GND      |
| #3  | Output   |
| #4  | VDD      |



## 2.0 x 1.6 mm SMD Voltage Controlled Temperature Compensated Crystal Oscillator

### Feature

- Typical 2.0 x 1.6 x 0.7 mm SMD package
- Compactness and lightweight
- VCTCXO available
- Miniature size and low profile



### Electrical Specifications

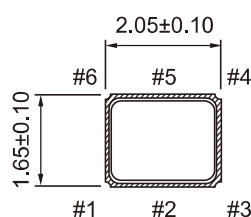
| Parameter                        | 3.3/3.0/2.8V                    |       | 2.5V       |       | 1.8V       |      | Unit             |
|----------------------------------|---------------------------------|-------|------------|-------|------------|------|------------------|
|                                  | Min.                            | Max.  | Min.       | Max.  | Min.       | Max. |                  |
| Supply Voltage Variation         | 2.66                            | 3.465 | 2.375      | 2.625 | 1.71       | 1.89 | V                |
| Frequency Range                  | 10                              | 52    | 10         | 52    | 10         | 52   | MHz              |
| Standard Frequency               | 16.369, 19.2, 26, 38.4          |       |            |       |            |      | MHz              |
| Frequency Tolerance*             | -                               | ±2.0  | -          | ±2.0  | -          | ±2.0 | ppm              |
| Frequency stability              | VS Supply V(±5%) change         | -     | ±0.2       | -     | ±0.2       | -    | ±0.2             |
|                                  | VS Load(±10%) change            | -     | ±0.2       | -     | ±0.2       | -    | ±0.2             |
|                                  | VS Aging(@1 <sup>st</sup> year) | -     | ±1.0       | -     | ±1.0       | -    | ±1.0             |
| Supply Current                   | 10MHz ≤ FO < 26MHz              | -     | 1.5        | -     | 1.5        | -    | 1.5              |
|                                  | 26 MHz ≤ FO < 52MHz             | -     | 2.0        | -     | 2.0        | -    | 2.0              |
| Output Level (Clipped sine wave) | 0.8                             | -     | 0.8        | -     | 0.8        | -    | V <sub>p-p</sub> |
| Load                             | 10kΩ//10pF                      |       | 10kΩ//10pF |       | 10kΩ//10pF |      |                  |
| Control Voltage Range(VCTCXO)    | 0.5                             | 2.5   | 0.4        | 2.4   | 0.3        | 1.5  | V                |
| Pulling Range (VCTCXO)           | ±5                              | -     | ±5         | -     | ±5         | -    | ppm              |
| Vc Input Impedance(VCTCXO)       | 500                             | -     | 500        | -     | 500        | -    | kΩ               |
| Phase Noise @19.2MHz             | 100Hz                           | -115  |            | -115  |            | -115 |                  |
|                                  | 1kHz                            | -135  |            | -135  |            | -135 |                  |
|                                  | 10kHz                           | -148  |            | -148  |            | -148 |                  |
| Start Time                       | -                               | 2     | -          | 2     | -          | 2    | mSec             |
| Storage Temp. Range              | -55                             | 125   | -55        | 125   | -55        | 125  | °C               |

Standard frequencies are frequencies which the crystal has been designed and does not imply a stock position

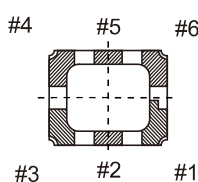
\* Frequency at 25°C, 1 hour after reflow.

### Dimension(mm)

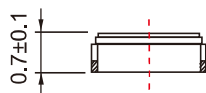
【 TOP VIEW 】



【 BOTTOM VIEW 】

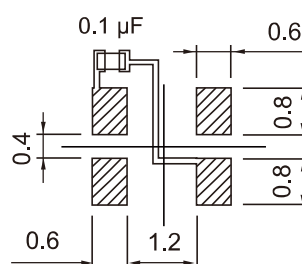


【 SIDE VIEW 】



| PIN# | Function                 |
|------|--------------------------|
| 1    | Vcon:VC-TCXO<br>GND:TCXO |
| 2    | No Connection            |
| 3    | GND                      |
| 4    | Output                   |
| 5    | No Connection            |
| 6    | VDD                      |

### Solder Pad Layout(mm)



To ensure optimal oscillator performance, place a by-pass capacitor of 0.1 μF as close to the part as possible between Vdd and GND pads.

### FREQ. STABILITY vs. TEMP. RANGE

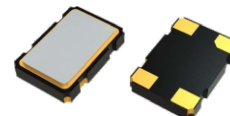
| Temp. (°C) \ ppm | ±0.5 | ±1.0 | ±1.5 | ±2.0 | ±2.5 |
|------------------|------|------|------|------|------|
| -20 ~ +70        | ○    | ○    | ○    | ○    | ○    |
| -30 ~ +85        | ○    | ○    | ○    | ○    | ○    |
| -40 ~ +85        | ○    | ○    | ○    | ○    | ○    |

○: Available △: Conditional X: Not available

## 2.5 x2.0 mm SMD Voltage Controlled Temperature Compensated Crystal Oscillator

### Feature

- Typical 2.5 x 2.0 x 0.7 mm SMD package.
- Compactness and lightweight
- VCTCXO available
- Low thickness



### Electrical Specifications

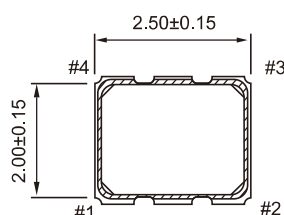
| Parameter                        |                                 | 3.3/3.0/2.8V        |       | 2.5V       |       | 1.8V       |      | Unit             |
|----------------------------------|---------------------------------|---------------------|-------|------------|-------|------------|------|------------------|
|                                  |                                 | Min.                | Max.  | Min.       | Max.  | Min.       | Max. |                  |
| Supply Voltage Variation         |                                 | 2.66                | 3.465 | 2.375      | 2.625 | 1.71       | 1.89 | V                |
| Frequency Range                  |                                 | 10                  | 52    | 10         | 52    | 10         | 52   | MHz              |
| Standard Frequency               |                                 | 16.369,19.2,26,38.4 |       |            |       |            |      | MHz              |
| Frequency Tolerance*             |                                 | -                   | ±2.0  | -          | ±2.0  | -          | ±2.0 | ppm              |
| Frequency stability              | VS Supply V(±5%) change         | -                   | ±0.2  | -          | ±0.2  | -          | ±0.2 | ppm              |
|                                  | VS Load(±10%) change            | -                   | ±0.2  | -          | ±0.2  | -          | ±0.2 |                  |
|                                  | VS Aging(@1 <sup>st</sup> year) | -                   | ±1.0  | -          | ±1.0  | -          | ±1.0 |                  |
| Supply Current                   | 10MHz ≦ FO<26MHz                | -                   | 1.5   | -          | 1.5   | -          | 1.5  | mA               |
|                                  | 26 MHz ≦ FO<52MHz               | -                   | 2.0   | -          | 2.0   | -          | 2.0  |                  |
| Output Level (Clipped sine wave) |                                 | 0.8                 | -     | 0.8        | -     | 0.8        | -    | V <sub>p-p</sub> |
| Load                             |                                 | 10kΩ//10pF          |       | 10kΩ//10pF |       | 10kΩ//10pF |      |                  |
| Control Voltage Range(VCTCXO)    |                                 | 0.5                 | 2.5   | 0.4        | 2.4   | 0.3        | 1.5  | V                |
| Pulling Range (VCTCXO)           |                                 | ±5                  | -     | ±5         | -     | ±5         | -    | ppm              |
| Vc Input Impedance(VCTCXO)       |                                 | 500                 | -     | 500        | -     | 500        | -    | kΩ               |
| Phase Noise @19.2MHz             | 100Hz                           | -115                |       | -115       |       | -115       |      | dBc/Hz           |
|                                  | 1kHz                            | -135                |       | -135       |       | -135       |      |                  |
|                                  | 10kHz                           | -148                |       | -148       |       | -148       |      |                  |
| Start Time                       |                                 | -                   | 2     | -          | 2     | -          | 2    | mSec             |
| Storage Temp. Range              |                                 | -55                 | 125   | -55        | 125   | -55        | 125  | °C               |

Standard frequencies are frequencies which the crystal has been designed and does not imply a stock position

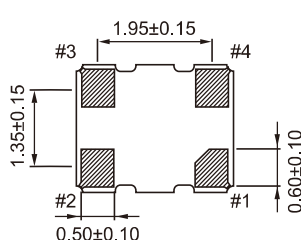
\*. Frequency at 25°C, 1 hour after reflow.

### Dimension(mm)

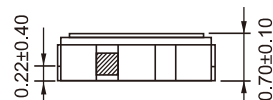
[ TOP VIEW ]



[ BOTTOM VIEW ]

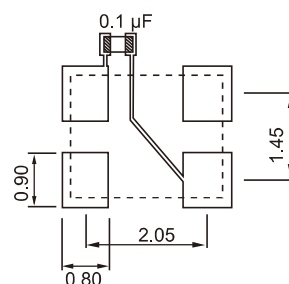


[ SIDE VIEW ]



| PIN# | Function                    |
|------|-----------------------------|
| 1    | VCON:VC-TCXO<br>GND/NC:TCXO |
| 2    | GND                         |
| 3    | Output                      |
| 4    | VDD                         |

### Solder Pad Layout(mm)



To ensure optimal oscillator performance, place a by-pass capacitor of 0.1 µF as close to the part as possible between Vdd and GND pads.

### FREQ. STABILITY vs. TEMP. RANGE

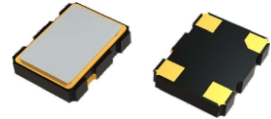
| Temp. (°C) \ ppm | ±0.5 | ±1.0 | ±1.5 | ±2.0 | ±2.5 |
|------------------|------|------|------|------|------|
| -20 ~ +70        | ○    | ○    | ○    | ○    | ○    |
| -30 ~ +85        | ○    | ○    | ○    | ○    | ○    |
| -40 ~ +85        | ○    | ○    | ○    | ○    | ○    |

○: Available △: Conditional X: Not available

## 3.2 x2.5 mm SMD Voltage Controlled Temperature Compensated Crystal Oscillator

### Feature

- Typical 3.2 x 2.5 x 0.9 mm SMD package
- Compactness and lightweight
- VCTCXO available
- Low thickness



### Electrical Specifications

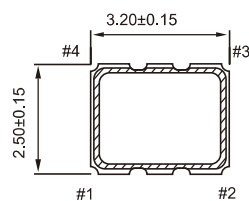
| Parameter                        | 3.3/3.0/2.8V                                                          |       | 2.5V       |       | 1.8V       |      | Unit   |
|----------------------------------|-----------------------------------------------------------------------|-------|------------|-------|------------|------|--------|
|                                  | Min.                                                                  | Max.  | Min.       | Max.  | Min.       | Max. |        |
| Supply Voltage Variation         | 2.66                                                                  | 3.465 | 2.375      | 2.625 | 1.71       | 1.89 | V      |
| Frequency Range                  | 10                                                                    | 52    | 10         | 52    | 10         | 52   | MHz    |
| Standard Frequency               | 10,12,8,13,16,367667,16.368,16.369,19.2, 20,25,26,27,30,30.72,32,38.4 |       |            |       |            |      | MHz    |
| Frequency Tolerance*             | -                                                                     | ±2.0  | -          | ±2.0  | -          | ±2.0 | ppm    |
| Frequency stability              | VS Supply V(±5%) change                                               | ±0.2  | -          | ±0.2  | -          | ±0.2 | ppm    |
|                                  | VS Load(±10%) change                                                  | ±0.2  | -          | ±0.2  | -          | ±0.2 |        |
|                                  | VS Aging(@1 <sup>st</sup> year)                                       | ±1.0  | -          | ±1.0  | -          | ±1.0 |        |
| Supply Current                   | 10MHz ≤ FO < 26MHz                                                    | 1.5   | -          | 1.5   | -          | 1.5  | mA     |
|                                  | 26 MHz ≤ FO < 52MHz                                                   | 2.0   | -          | 2.0   | -          | 2.0  |        |
| Output Level (Clipped sine wave) | 0.8                                                                   | -     | 0.8        | -     | 0.8        | -    | Vp-p   |
| Load                             | 10KΩ//10pF                                                            |       | 10KΩ//10pF |       | 10KΩ//10pF |      |        |
| Control Voltage Range(VCTCXO)    | 0.5                                                                   | 2.5   | 0.4        | 2.4   | 0.3        | 1.5  | V      |
| Pulling Range (VCTCXO)           | ±5                                                                    | -     | ±5         | -     | ±5         | -    | ppm    |
| Vc Input Impedance(VCTCXO)       | 500                                                                   | -     | 500        | -     | 500        | -    | kΩ     |
| Phase Noise @19.2MHz             | 100Hz                                                                 | -115  | -115       | -115  | -115       | -115 | dBc/Hz |
|                                  | 1kHz                                                                  | -135  | -135       | -135  | -135       | -135 |        |
|                                  | 10kHz                                                                 | -148  | -148       | -148  | -148       | -148 |        |
| Start Time                       | -                                                                     | 2     | -          | 2     | -          | 2    | mSec   |
| Storage Temp. Range              | -55                                                                   | 125   | -55        | 125   | -55        | 125  | °C     |

Standard frequencies are frequencies which the crystal has been designed and does not imply a stock position

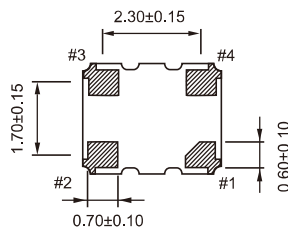
\* Frequency at 25°C, 1 hour after reflow.

### Dimension(mm)

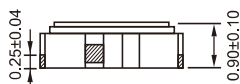
【 TOP VIEW 】



【 BOTTOM VIEW 】

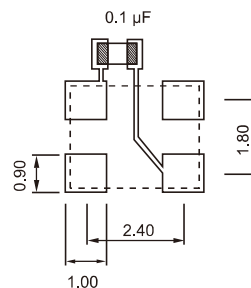


【 SIDE VIEW 】



| PIN# | Function                    |
|------|-----------------------------|
| 1    | VCON:VC-TCXO<br>GND/NC:TCXO |
| 2    | GND                         |
| 3    | Output                      |
| 4    | VDD                         |

### Solder Pad Layout(mm)



To ensure optimal oscillator performance, place a by-pass capacitor of 0.1 µF as close to the part as possible between Vdd and GND pads.

### FREQ. STABILITY vs. TEMP. RANGE

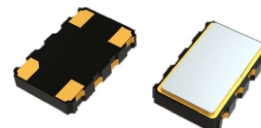
| ppm<br>Temp. (°C) | ±0.5 | ±1.0 | ±1.5 | ±2.0 | ±2.5 |
|-------------------|------|------|------|------|------|
| -20 ~ +70         | ○    | ○    | ○    | ○    | ○    |
| -30 ~ +85         | ○    | ○    | ○    | ○    | ○    |
| -40 ~ +85         | ○    | ○    | ○    | ○    | ○    |

○: Available △ :Conditional X: Not available

## 5.0 x3.2 mm SMD Voltage Controlled Temperature Compensated Crystal Oscillator

### Feature

- Typical 5.0 x 3.2 x 1.1 mm SMD package
- CMOS and Clipped Sine Wave output optional
- Compactness and lightweight
- Voltage control TCXO available



### Electrical Specifications

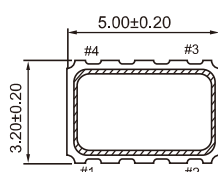
| Parameter                             |                                 | 3.3/3.0/2.8V                                                     |                    | 2.5V               |                    | 1.8V               |                    | Unit             |
|---------------------------------------|---------------------------------|------------------------------------------------------------------|--------------------|--------------------|--------------------|--------------------|--------------------|------------------|
|                                       |                                 | Min.                                                             | Max.               | Min.               | Max.               | Min.               | Max.               |                  |
| Supply Voltage Variation              |                                 | 2.66                                                             | 3.465              | 2.375              | 2.625              | 1.71               | 1.89               | V                |
| Frequency Range                       |                                 | 10                                                               | 52                 | 10                 | 52                 | 10                 | 52                 | MHz              |
| Standard Frequency                    |                                 | 10,12.8,13,16.368,16.369,19.2,19.44,20.25,26.27,30.30.72,32,38.4 |                    |                    |                    |                    |                    | MHz              |
| Frequency Tolerance*                  |                                 | -                                                                | ±2.0               | -                  | ±2.0               | -                  | ±2.0               | ppm              |
| Frequency stability                   | VS Supply V(±5%) change         | -                                                                | ±0.2               | -                  | ±0.2               | -                  | ±0.2               | ppm              |
|                                       | VS Load(±10%) change            | -                                                                | ±0.2               | -                  | ±0.2               | -                  | ±0.2               |                  |
|                                       | VS Aging(@1 <sup>st</sup> year) | -                                                                | ±1.0               | -                  | ±1.0               | -                  | ±1.0               |                  |
| Supply Current (Clipped Sine)         | 10MHz ≦ FO<26MHz                | -                                                                | 1.5                | -                  | 1.5                | -                  | 1.5                | mA               |
|                                       | 26 MHz ≦ FO<52MHz               | -                                                                | 2.0                | -                  | 2.0                | -                  | 2.0                |                  |
| Supply Current(CMOS) 10MHz ≦ FO<52MHz |                                 | -                                                                | 10                 | -                  | 5                  | -                  | 7                  | mA               |
| Clipped sine wave                     | Output Level                    | 0.8                                                              | -                  | 0.8                | -                  | 0.8                | -                  | V <sub>p-p</sub> |
|                                       | Load                            | 10kΩ//10pF                                                       |                    | 10kΩ//10pF         |                    | 10kΩ//10pF         |                    |                  |
| CMOS                                  | Output High                     | 0.9V <sub>DD</sub>                                               | -                  | 0.9V <sub>DD</sub> | -                  | 0.9V <sub>DD</sub> | -                  | V                |
|                                       | Output Low                      | -                                                                | 0.1V <sub>DD</sub> | -                  | 0.1V <sub>DD</sub> | -                  | 0.1V <sub>DD</sub> | V                |
|                                       | Load                            | -                                                                | 15                 | -                  | 15                 | -                  | 15                 | pF               |
| Control Voltage Range(VCTCXO)         |                                 | 0.5                                                              | 2.5                | 0.4                | 2.4                | 0.3                | 1.5                | V                |
| Pulling Range (VCTCXO)                |                                 | ±5                                                               | -                  | ±5                 | -                  | ±5                 | -                  | ppm              |
| Vc Input Impedance(VCTCXO)            |                                 | 500                                                              | -                  | 500                | -                  | 500                | -                  | kΩ               |
| Phase Noise @19.2MHz Clipped Sine     | 100Hz                           | -115                                                             |                    | -115               |                    | -115               |                    | dBc/Hz           |
|                                       | 1kHz                            | -135                                                             |                    | -135               |                    | -135               |                    |                  |
|                                       | 10kHz                           | -148                                                             |                    | -148               |                    | -148               |                    |                  |
| Start Time                            |                                 | -                                                                | 2                  | -                  | 2                  | -                  | 2                  | mSec             |
| Storage Temp. Range                   |                                 | -55                                                              | 125                | -55                | 125                | -55                | 125                | °C               |

Standard frequencies are frequencies which the crystal has been designed and does not imply a stock position

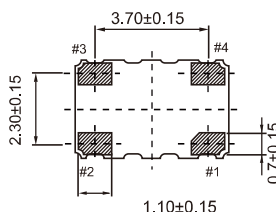
\* Frequency at 25°C, 1 hour after reflow.

### Dimension(mm)

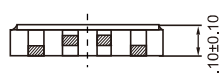
【 TOP VIEW 】



【 BOTTOM VIEW 】

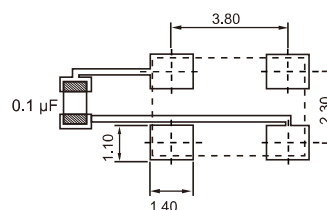


【 SIDE VIEW 】



| PIN# | Function                    |
|------|-----------------------------|
| 1    | VCON:VC-TCXO<br>GND/NC:TCXO |
| 2    | GND                         |
| 3    | Output                      |
| 4    | VDD                         |

### Solder Pad Layout(mm)



To ensure optimal oscillator performance, place a by-pass capacitor of 0.1 μF as close to the part as possible between Vdd and GND pads.

### FREQ. STABILITY vs. TEMP. RANGE

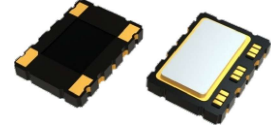
| ppm<br>Temp. (°C) | ±0.5 | ±1.0 | ±1.5 | ±2.0 | ±2.5 |
|-------------------|------|------|------|------|------|
| -20 ~ +70         | ○    | ○    | ○    | ○    | ○    |
| -30 ~ +85         | ○    | ○    | ○    | ○    | ○    |
| -40 ~ +85         | ○    | ○    | ○    | ○    | ○    |

○: Available Δ :Conditional X: Not available

## 7.0 x5.0 mm SMD Voltage Controlled Temperature Compensated Crystal Oscillator

### Feature

- Typical 7.0 x 5.0 x 1.9 mm ceramic package
- Compactness and light weight
- Low power consumption
- VCTCXO available



### Electrical Specifications

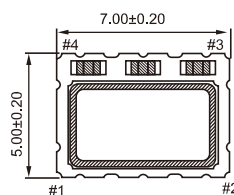
| Parameter                         |                                 | 3.3/3.0                                          |                     | 2.5V                |                     | Unit             |
|-----------------------------------|---------------------------------|--------------------------------------------------|---------------------|---------------------|---------------------|------------------|
|                                   |                                 | Min.                                             | Max.                | Min.                | Max.                |                  |
| Supply Voltage Variation          |                                 | V <sub>DD</sub> -5%                              | V <sub>DD</sub> +5% | V <sub>DD</sub> -5% | V <sub>DD</sub> +5% | V                |
| Frequency Range                   |                                 | 5                                                | 52                  | 5                   | 52                  | MHz              |
| Standard Frequency                |                                 | 5,6,4,8,8.192,10,12.5,12.8,16,16.384,19.44,25,26 |                     |                     |                     | MHz              |
| Frequency Tolerance*              |                                 | -                                                | ±2.0                | -                   | ±2.0                | ppm              |
| Frequency stability               | VS Supply V(±5%) change         | -                                                | ±0.1                | -                   | ±0.1                | ppm              |
|                                   | VS Load(±10%) change            | -                                                | ±0.2                | -                   | ±0.2                |                  |
|                                   | VS Aging(@1 <sup>st</sup> year) | -                                                | ±1.0                | -                   | ±1.0                |                  |
| Supply Current(Clippled Sine)     |                                 | -                                                | 3.5                 | -                   | 3.5                 | mA               |
| Supply Current(CMOS)              |                                 | -                                                | 6                   | -                   | 6                   | mA               |
| Clipped sine wave                 | Output Level                    | 0.8                                              | -                   | 0.8                 | -                   | V <sub>P-P</sub> |
|                                   | Load                            | 10kΩ//10pF                                       |                     | 10kΩ//10pF          |                     |                  |
| CMOS                              | Output High                     | 0.9V <sub>DD</sub>                               | -                   | 0.9V <sub>DD</sub>  | -                   | V                |
|                                   | Output Low                      | -                                                | 0.1V <sub>DD</sub>  | -                   | 0.1V <sub>DD</sub>  | V                |
|                                   | Load                            | 15                                               |                     | 15                  |                     | pF               |
|                                   | Duty                            | 45                                               | 55                  | 45                  | 55                  | %                |
| Control Voltage Range(VCTCXO)     |                                 | 0.5                                              | 2.5                 | 0.4                 | 2.4                 | V                |
| Pulling Range (VCTCXO)            |                                 | ±5                                               | ±12                 | ±5                  | ±12                 | ppm              |
| Vc Input Impedance(VCTCXO)        |                                 | 100                                              | -                   | 100                 | -                   | kΩ               |
| Phase Noise @19.2MHz Clipped Sine | 100Hz                           | -115                                             |                     | -115                |                     | dBc/Hz           |
|                                   | 1kHz                            | -135                                             |                     | -135                |                     |                  |
|                                   | 10kHz                           | -148                                             |                     | -148                |                     |                  |
| Start Time                        |                                 | -                                                | 2                   | -                   | 2                   | mSec             |
| Storage Temp. Range               |                                 | -55                                              | 125                 | -55                 | 125                 | °C               |

Standard frequencies are frequencies which the crystal has been designed and does not imply a stock position

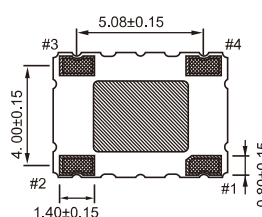
\* Frequency at 25°C, 1 hour after reflow.

### Dimension(mm)

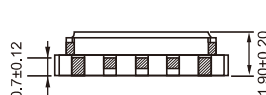
【 TOP VIEW 】



【 BOTTOM VIEW 】

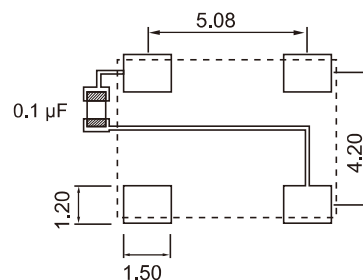


【 SIDE VIEW 】



| PIN# | Function                    |
|------|-----------------------------|
| 1    | VCON:VC-TCXO<br>GND:NC:TCXO |
| 2    | GND                         |
| 3    | Output                      |
| 4    | VDD                         |

### Solder Pad Layout(mm)



To ensure optimal oscillator performance, place a by-pass capacitor of 0.1  $\mu$ F as close to the part as possible between Vdd and GND pads.

### FREQ. STABILITY vs. TEMP. RANGE

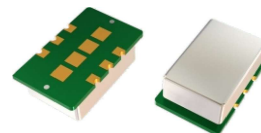
| Temp. (°C) \ ppm | $\pm 0.5$ | $\pm 1.0$ |
|------------------|-----------|-----------|
| -20 ~ +70        | ○         | ○         |
| -30 ~ +85        | ○         | ○         |
| -40 ~ +85        | ○         | ○         |

○: Available  $\Delta$ : Conditional X: Not available

## 14.3 x 8.7mm SMD Voltage Controlled Temperature Compensated Crystal Oscillator

### Feature

- Typical 14.3 x 8.7 x 4.9 mm
- Metal cover, FR-4 PCB based.
- Output: TTL/CMOS or Clipped Sine Wave
- Low current option (2mA or Clipped Sine Wave o/p)
- VCTCXO available



### Electrical Specifications

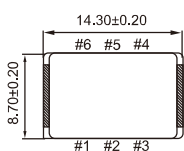
| Parameter                             |                                 | 3.3/3.0                                                      |                     | 5.0V                |                     | Unit             |     |
|---------------------------------------|---------------------------------|--------------------------------------------------------------|---------------------|---------------------|---------------------|------------------|-----|
|                                       |                                 | Min.                                                         | Max.                | Min.                | Max.                |                  |     |
| Supply Voltage Variation              |                                 | V <sub>DD</sub> -5%                                          | V <sub>DD</sub> +5% | V <sub>DD</sub> -5% | V <sub>DD</sub> +5% | V                |     |
| Frequency Range                       |                                 | 5                                                            | 40                  | 5                   | 40                  | MHz              |     |
| Standard Frequency (for CMOS)         |                                 | 5, 6.4 ,8 , 8.192, 10, 12.5, 12.8, 16, 16.384, 19.44, 20, 25 |                     |                     |                     |                  | MHz |
| Standard Frequency (for Clipped Sine) |                                 | 8.192, 10, 12.5, 12.8, 16, 16.384, 19.44, 20, 25             |                     |                     |                     |                  | MHz |
| Frequency Tolerance*                  |                                 | -                                                            | ±2.0                | -                   | ±2.0                | ppm              |     |
| Frequency stability                   | VS Supply V(±5%) change         | -                                                            | ±0.2                | -                   | ±0.2                | ppm              |     |
|                                       | VS Load(±10%) change            | -                                                            | ±0.2                | -                   | ±0.2                |                  |     |
|                                       | VS Aging(@1 <sup>st</sup> year) | -                                                            | ±1.0                | -                   | ±1.0                |                  |     |
| Supply Current(Clipped Sine)          |                                 | -                                                            | 3.5                 | -                   | 3.5                 | mA               |     |
| Supply Current(CMOS)                  |                                 | -                                                            | 6                   | -                   | 6                   | mA               |     |
| Clipped sine wave                     | Output Level                    | 0.8                                                          | -                   | 0.8                 | -                   | V <sub>p-p</sub> |     |
|                                       | Load                            | 10kΩ//10pF                                                   |                     | 10kΩ//10pF          |                     |                  |     |
| CMOS                                  | Output High                     | 0.9V <sub>DD</sub>                                           | -                   | 0.9V <sub>DD</sub>  | -                   | V                |     |
|                                       | Output Low                      | -                                                            | 0.1V <sub>DD</sub>  | -                   | 0.1V <sub>DD</sub>  | V                |     |
|                                       | Load                            | 15                                                           |                     | 15                  |                     | pF               |     |
|                                       | Duty                            | 45                                                           | 55                  | 45                  | 55                  | %                |     |
| Control Voltage Range(VCTCXO)         |                                 | 0.5                                                          | 2.5                 | 0.5                 | 2.5                 | V                |     |
| Pulling Range (VCTCXO)                |                                 | ±5                                                           | -                   | ±5                  | -                   | ppm              |     |
| Vc Input Impedance(VCTCXO)            |                                 | 100                                                          | -                   | 100                 | -                   | kΩ               |     |
| Phase Noise @12.8MHz                  | 100Hz                           | -120                                                         |                     | -120                |                     | dBc/Hz           |     |
|                                       | 1kHz                            | -140                                                         |                     | -140                |                     |                  |     |
|                                       | 10kHz                           | -148                                                         |                     | -148                |                     |                  |     |
| Start Time                            |                                 | -                                                            | 2                   | -                   | 2                   | mSec             |     |
| Tri-State(option)                     | Disable                         | -                                                            | 0.99                | -                   | 1.5                 | V                |     |
|                                       | Enable                          | 2.31                                                         | -                   | 3.5                 | -                   | V                |     |
| Storage Temp. Range                   |                                 | -55                                                          | 125                 | -55                 | 125                 | °C               |     |

Standard frequencies are frequencies which the crystal has been designed and does not imply a stock position

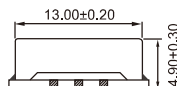
\* Frequency at 25°C, 1 hour after reflow.

### Dimension(mm)

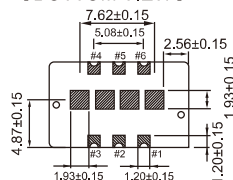
【 TOP VIEW 】



【 SIDE VIEW 】

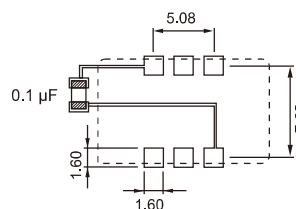


【 BOTTOM VIEW 】



| PIN# | Function                |
|------|-------------------------|
| 1    | V <sub>DD</sub> /VC-TXO |
| 2    | GND/NC-TXO              |
| 3    | Tri-State / NC          |
| 4    | GND & Case              |
| 5    | Output                  |
| 6    | NC                      |
| 7    | V <sub>DD</sub>         |

### Solder Pad Layout(mm)



To ensure optimal oscillator performance, place a by-pass capacitor of 0.1 μF as close to the part as possible between V<sub>DD</sub> and GND pads.

### FREQ. STABILITY vs. TEMP. RANGE

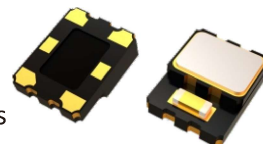
| Temp. (°C) \ ppm | ±0.05 | ±0.1 | ±0.14 | ±0.2 | ±0.28 | ±0.37 | ±0.5 |
|------------------|-------|------|-------|------|-------|-------|------|
| -10 ~ +60        | ○     | ○    | ○     | ○    | ○     | ○     | ○    |
| -20 ~ +70        | ○     | ○    | ○     | ○    | ○     | ○     | ○    |
| -40 ~ +85        | X     | X    | X     | Δ    | ○     | ○     | ○    |

○: Available Δ: Conditional X: Not available

## 3.2x2.5mm High Frequency Temperature Compensated Crystal Oscillator

### Feature

- Low power supply voltage: 3.3V and 2.5V options
- Clock output: CMOS, LVPECL, LVDS options
- CMOS output frequency support from 10MHz TO 250MHz
- Differential output frequency supports from 10MHz to 1.5GHz
- Low Phase Jitter typical 0.8 pS RMS at 12kHz to 20MHz frequency offsets
- Low current consumption, Pbfree/RoHS compliant
- Frequency Stability  $\pm 2.0$ ppm over  $-40^{\circ}\text{C}$  to  $85^{\circ}\text{C}$



### Electrical Specifications

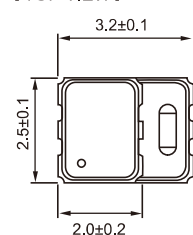
| Parameter                              |               | LVPECL                      |              | LVDS         |              | CMOS         |              | Unit   |
|----------------------------------------|---------------|-----------------------------|--------------|--------------|--------------|--------------|--------------|--------|
|                                        |               | Min.                        | Max.         | Min.         | Max.         | Min.         | Max.         |        |
| Supply Voltage                         |               | 3.3V or 2.5V                |              |              |              |              |              | V      |
| Supply Voltage Variation               |               | $V_{DD}-5\%$                | $V_{DD}+5\%$ | $V_{DD}-5\%$ | $V_{DD}+5\%$ | $V_{DD}-5\%$ | $V_{DD}+5\%$ |        |
| Frequency Range                        |               | 10                          | 1500         | 10           | 1500         | 10           | 250          | MHz    |
| Supply Current                         |               | -                           | 54           | -            | 45           | -            | 40           | mA     |
| Output Level                           | Output High   | $V_{DD}-1.03$               | $V_{DD}-0.6$ | -            | 1.6          | $90\%V_{DD}$ | -            | V      |
|                                        | Output Low    | $V_{DD}-1.85$               | $V_{DD}-1.6$ | 0.9          | -            | -            | $10\%V_{DD}$ |        |
| Transition Time(Rise/ Fall Time)       |               | -                           | 0.5(20-80%)  | -            | 1.0(20-80%)  | -            | 3.0(20-80%)  | nSec   |
| Duty Cycle                             |               | 45                          | 55           | 45           | 55           | 45           | 55           | %      |
| Start time                             |               | -                           | 5            | -            | 5            | -            | 5            | mSec   |
| Tri-State mode<br>(input to pin 2)     | Enable        | $70\%V_{DD}$                | -            | $70\%V_{DD}$ | -            | $70\%V_{DD}$ | -            |        |
|                                        | Disable       | -                           | $30\%V_{DD}$ | -            | $30\%V_{DD}$ | -            | $30\%V_{DD}$ |        |
| Stand by Current                       |               | -                           | 20           | -            | 20           | -            | 20           | mA     |
| Output Loading                         |               | $50\Omega$ into $V_{DD}-2V$ |              | $100\Omega$  |              | $15pF$       |              |        |
| Phase Noise                            |               | Typ.                        | Max.         | Typ.         | Max.         | Typ.         | Max.         |        |
| At $V_{DD}=3.3V$ ,<br>$F_{out}=250MHz$ | 1kHz offset   | -107                        | -            | -107         | -            | -107         | -            | dBc/Hz |
|                                        | 10kHz offset  | -111                        | -            | -111         | -            | -111         | -            |        |
|                                        | 100kHz offset | -114                        | -            | -114         | -            | -114         | -            |        |
|                                        | 1MHz offset   | -125                        | -            | -125         | -            | -125         | -            |        |
|                                        | 20MHz offset  | -147                        | -            | -147         | -            | -147         | -            |        |
| RMS Phase Jitter(12kHz to 20MHz)       |               | 0.8                         | 1.5          | 0.8          | 1.5          | 0.8          | 1.5          | pSec   |

### Dimension(mm)

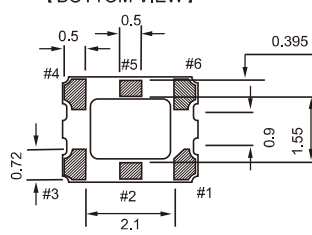
### PIN Assignments

### Solder Pad Layout(mm)

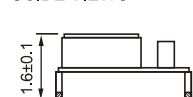
【 TOP VIEW 】



【 BOTTOM VIEW 】

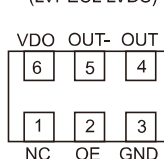


【 SIDE VIEW 】

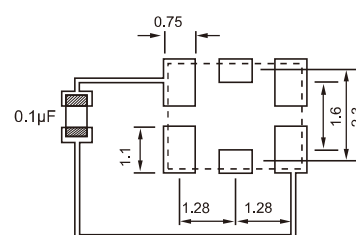
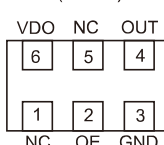


| Type | CMOS                | Differential  |
|------|---------------------|---------------|
| Pad  | Function            | Function      |
| 1    | No Connection       | No Connection |
| 2    | Tri-State           | Tri-State     |
| 3    | GND                 |               |
| 4    | Output              | Output        |
| 5    | No Connection       | Comp. Output  |
| 6    | Supply Voltage(VDD) |               |

(LVPECL LVDS)



(CMOS)



To ensure optimal oscillator performance, place a by-pass capacitor of 0.1  $\mu F$  as close to the part as possible between VDD and GND pads.

### FREQ. STABILITY vs. TEMP. RANGE

| Temp. ( $^{\circ}\text{C}$ ) \ ppm | $\pm 1.0$ | $\pm 2.0$ | $\pm 2.5$ |
|------------------------------------|-----------|-----------|-----------|
| -30 ~ +85                          | ○         | ○         | ○         |
| -40 ~ +85                          | △         | ○         | ○         |

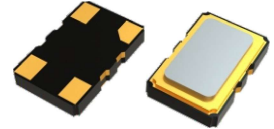
Inclusive of calibration @  $25^{\circ}\text{C}$ , operating temperature load variation, aging (1st year), shock, and vibration



## 5.0 x 3.2 mm SMD High Precision VCTC Crystal Oscillator

### Feature

- Typical 5.0 x 3.2 x 1.55 mm ceramic SMD package.
- $\pm 0.28\text{ppm}$ ,  $-40^{\circ}\text{C} \sim +85^{\circ}\text{C}$ ;  $\pm 0.05\text{ppm}$ ,  $-10^{\circ}\text{C} \sim +70^{\circ}\text{C}$
- CMOS and Clipped Sine wave (without DC-cut capacitor) output optional



### Electrical Specifications

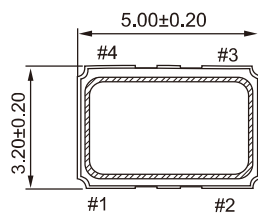
| Parameter                        |                                 | 5.0V                           |         | 3.3V       |         | Unit   |
|----------------------------------|---------------------------------|--------------------------------|---------|------------|---------|--------|
|                                  |                                 | Min.                           | Max.    | Min.       | Max.    |        |
| Supply Voltage Variation         |                                 | VDD-5%                         | VDD+5%  | VDD-5%     | VDD+5%  | V      |
| Frequency Range                  |                                 | 10                             | 52      | 10         | 52      | MHz    |
| Standard Frequency               |                                 | 10,12.8,13,19.2,20,25,26,30.72 |         |            |         | MHz    |
| Frequency Tolerance*             |                                 | -                              | ± 2.0   | -          | ± 2.0   | ppm    |
| Frequency stability              | Vs Supply Voltage( ± 5%) change | -                              | ± 0.3   | -          | ± 0.3   | ppm    |
|                                  | Vs Load( ± 10%) change          | -                              | ± 0.2   | -          | ± 0.2   |        |
|                                  | Vs Aging (@1st year)            | -                              | ± 0.1   | -          | ± 0.1   |        |
| Supply Current                   | CMOS 10MHz ≧ F0 ≧ 40MHz         | -                              | 6       | -          | 6       | mA     |
|                                  | CMOS 40MHz > F0 ≧ 52MHz         | -                              | 8       | -          | 8       |        |
|                                  | Clipped Sine Wave               | -                              | 3.5     | -          | 3.5     |        |
| Output Level (CMOS)              | Output High                     | 90% VDD                        | -       | 90% VDD    | -       | V      |
|                                  | Output Low                      |                                | 10% VDD |            | 10% VDD |        |
|                                  | Duty                            | 45                             | 55      | 45         | 55      |        |
| Output Level (Clipped Sine Wave) |                                 | 0.8                            | -       | 0.8        | -       | Vp-p   |
| Load                             | CMOS                            | 15pF                           |         | 15pF       |         |        |
|                                  | Clipped Sine Wave               | 10kΩ//10pF                     |         | 10kΩ//10pF |         |        |
| Control Voltage Range(VCTCXO)    |                                 | 0.5                            | 2.5     | 0.5        | 2.5     | V      |
| Pulling Range (VCTCXO)           |                                 | ±5                             | -       | ±5         | -       | ppm    |
| Vc Input Impedance(VCTCXO)       |                                 | 100                            | -       | 100        | -       | kΩ     |
| Phase                            | 100Hz                           | -125                           |         |            |         | dBc/Hz |
| Noise                            | 1kHz                            | -145                           |         |            |         |        |
| @10.0MHz                         | 10kHz                           | -150                           |         |            |         |        |
| Start Time                       |                                 | -                              | 2       | -          | 2       | mSec   |
| Storage Temp.Range               |                                 | -55                            | 125     | -55        | 125     | °C     |

Standard frequencies are frequencies which the crystal has been designed and does not imply a stock position.

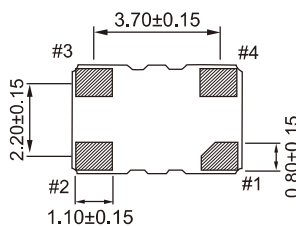
\*Frequency at  $25^{\circ}\text{C}$ , 1 hour after reflow.

### Dimension(mm)

[ TOP VIEW ]



[ BOTTOM VIEW ]

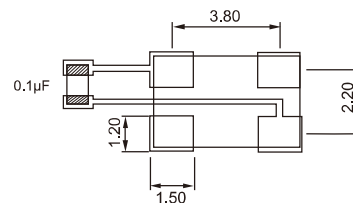


[ SIDE VIEW ]



| PIN# | Function                    |
|------|-----------------------------|
| 1    | VCON:VC-TCXO<br>GND/NC:TCXO |
| 2    | GND                         |
| 3    | Output                      |
| 4    | VDD                         |

### Solder Pad Layout(mm)



To ensure optimal oscillator performance, place a by-pass capacitor of 0.1  $\mu\text{F}$  as close to the part as possible between Vdd and GND pads.

### FREQ. STABILITY vs. TEMP. RANGE

| Temp. ( $^{\circ}\text{C}$ ) \ ppm | $\pm 0.05$ | $\pm 0.1$ | $\pm 0.2$ | $\pm 0.28$ | $\pm 0.5$ |
|------------------------------------|------------|-----------|-----------|------------|-----------|
| -10 ~ +70                          | o          | o         | o         | o          | o         |
| 20 ~ +70                           | X          | o         | o         | o          | o         |
| -40 ~ +85                          | X          | X         | $\Delta$  | o          | o         |

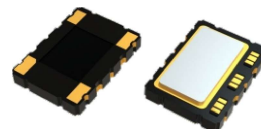
o: Available  $\Delta$ : Conditional X: Not available



## 7.0x5.0 mm SMD Voltage Controlled Temperature Compensated Crystal Oscillator

### Feature

- Typical 7.0 x5.0 x1.9 mm ceramic SMD package
- High Precision for -40°C~+85°C, ±0.28ppm, -40°C~+105°C, ±2ppm
- CMOS and Clipped Sine wave(without DC-cut capacitor)output optional



### Electrical Specifications

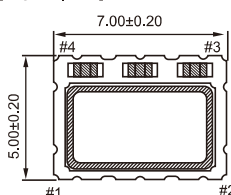
| Parameter                        |                                 | 5.0V                               |         | 3.3V       |         | Unit   |
|----------------------------------|---------------------------------|------------------------------------|---------|------------|---------|--------|
|                                  |                                 | Min.                               | Max.    | Min.       | Max.    |        |
| Supply Voltage Variation         |                                 | VDD-5%                             | VDD+5%  | VDD-5%     | VDD+5%  | V      |
| Frequency Range                  |                                 | 5                                  | 52      | 5          | 52      | MHz    |
| Standard Frequency               |                                 | 10,12.8,16.384,19.2,19.44,20,25,26 |         |            |         | MHz    |
| Frequency Tolerance*             |                                 | -                                  | ±2.0    | -          | ±2.0    | ppm    |
| Frequency stability              | VS Supply V(±5%) change         | -                                  | ±0.1    | -          | ±0.05   | ppm    |
|                                  | VS Load(±10%) change            | -                                  | ±0.05   | -          | ±0.05   |        |
|                                  | VS Aging(@1 <sup>st</sup> year) | -                                  | ±1.0    | -          | ±1.0    |        |
| Supply Current                   | CMOS output                     | -                                  | 6       | -          | 6       | mA     |
|                                  | Clipped Sine Wave               | -                                  | 3.5     | -          | 3.5     |        |
| Output Level (CMOS)              | Output High                     | 90% VDD                            | -       | 90% VDD    | -       | V      |
|                                  | Output Low                      |                                    | 10% VDD |            | 10% VDD |        |
|                                  | Duty                            | 45                                 | 55      | 45         | 55      | %      |
| Output Level (Clipped Sine Wave) |                                 | 0.8                                | -       | 0.8        | -       | Vp-p   |
| Load                             | CMOS                            | 15pF                               |         | 15pF       |         |        |
|                                  | Clipped Sine Wave               | 10kΩ//10pF                         |         | 10kΩ//10pF |         |        |
| Control Voltage Range(VCTCXO)    |                                 | 0.5                                | 2.5     | 0.5        | 2.5     | V      |
| Pulling Range (VCTCXO)           |                                 | ±5                                 | -       | ±5         | -       | ppm    |
| Vc Input Impedance(VCTCXO)       |                                 | 100                                | -       | 100        | -       | kΩ     |
| Phase Noise @10.0MHz             | 100Hz                           | -130                               |         | -130       |         | dBc/Hz |
|                                  | 1kHz                            | -145                               |         | -145       |         |        |
|                                  | 10kHz                           | -154                               |         | -154       |         |        |
| Start Time                       |                                 | -                                  | 2       | -          | 2       | mSec   |
| Storage Temp. Range              |                                 | -55                                | 125     | -55        | 125     | °C     |

Standard frequencies are frequencies which the crystal has been designed and does not imply a stock position

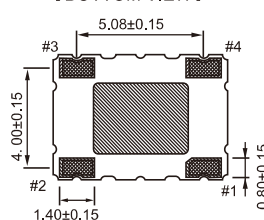
\*. Frequency at 25°C, 1 hour after reflow.

### Dimension(mm)

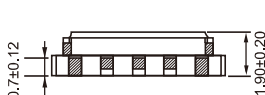
【 TOP VIEW 】



【 BOTTOM VIEW 】

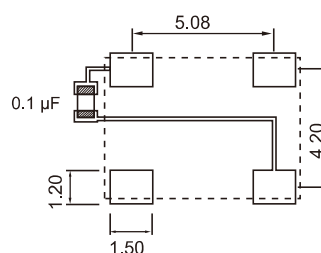


【 SIDE VIEW 】



| PIN# | Function                    |
|------|-----------------------------|
| 1    | VCON-VC-TCXO<br>GND/NC:TCXO |
| 2    | GND                         |
| 3    | Output                      |
| 4    | VDD                         |

### Solder Pad Layout(mm)



To ensure optimal oscillator performance, place a by-pass capacitor of 0.1 μF as close to the part as possible between Vdd and GND pads.

### FREQ. STABILITY vs. TEMP. RANGE

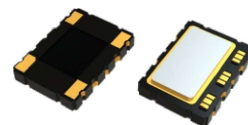
| Temp. (°C) \ ppm | ±0.05 | ±0.1 | ±0.14 | ±0.2 | ±0.28 | ±0.5 | ±2 |
|------------------|-------|------|-------|------|-------|------|----|
| -10 ~ +70        | ○     | ○    | ○     | ○    | ○     | ○    | ○  |
| -20 ~ +70        | X     | ○    | ○     | ○    | ○     | ○    | ○  |
| -40 ~ +85        | X     | X    | X     | △    | ○     | ○    | ○  |
| -40 ~ +95        | X     | X    | X     | X    | X     | △    | ○  |
| -40 ~ +105       | X     | X    | X     | X    | X     | X    | ○  |

○: Available △: Conditional X: Not available

## 7.0x5.0mm SMD Voltage Controlled Temperature Compensated Crystal Oscillator

### Feature

- Typical 7.0 x 5.0 x 1.9 mm SMD package
- Stratum 3 (Overall  $\pm 4.6$ ppm including 20 years aging)
- CMOS and Clipped Sine wave (without DC-cut capacitor) output optional



### Electrical Specifications

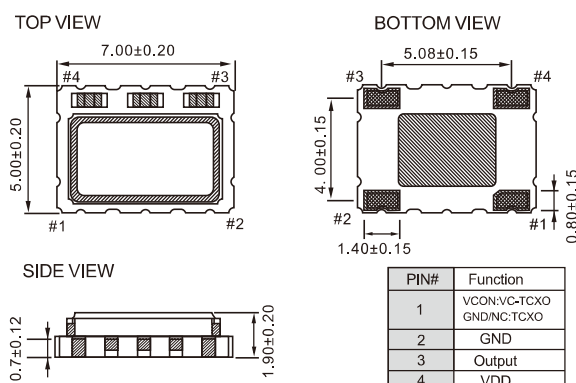
| Parameter                                                     |                   | 5.0V                               |                  | 3.3V       |                  | Unit   |
|---------------------------------------------------------------|-------------------|------------------------------------|------------------|------------|------------------|--------|
|                                                               |                   | Min.                               | Max.             | Min.       | Max.             |        |
| Supply Voltage Variation                                      |                   | VDD-5%                             | VDD+5%           | VDD-5%     | VDD+5%           | V      |
| Frequency Range                                               |                   | 5                                  | 52               | 5          | 52               | MHz    |
| Standard Frequency                                            |                   | 10,12.8,16.384,19.2,19.44,20,25,26 |                  |            |                  | MHz    |
| Operating Temp. Range                                         |                   | -20~+70 / -40~ +85                 |                  |            |                  | ℃      |
| Frequency stability (Overall, 20 Years)*                      |                   | -                                  | ±4.6             | -          | ±4.6             | ppm    |
| Frequency Stability Vs Temp. Range<br>(Ref. to (FMAX+Fmin)/2) |                   | -                                  | ±0.14 (-20~+70℃) | -          | ±0.14 (-20~+70℃) | ppm    |
|                                                               |                   | -                                  | ±0.28 (-40~+85℃) | -          | ±0.28 (-40~+85℃) |        |
| Holdover Stability +                                          |                   | -                                  | ±0.32            | -          | ±0.32            | ppm    |
| Supply Current                                                | CMOS output       | -                                  | 6                | -          | 6                | mA     |
|                                                               | Clipped Sine Wave | -                                  | 3.5              | -          | 3.5              |        |
| Output Level<br>(CMOS)                                        | Output High       | 90% VDD                            | -                | 90% VDD    | -                | V      |
|                                                               | Output Low        |                                    | 10% VDD          |            | 10% VDD          |        |
|                                                               | Duty              | 45                                 | 55               | 45         | 55               | %      |
| Output Level (Clipped Sine Wave)                              |                   | 0.8                                | -                | 0.8        | -                | Vp-p   |
| Load                                                          | CMOS              | 15pF                               |                  | 15pF       |                  |        |
|                                                               | Clipped Sine Wave | 10kΩ//10pF                         |                  | 10kΩ//10pF |                  |        |
| Control Voltage Range(VCTCXO)                                 |                   | 0.5                                | 2.5              | 0.5        | 2.5              | V      |
| Pulling Range (VCTCXO)                                        |                   | ±5                                 | -                | ±5         | -                | ppm    |
| Vc Input Impedance(VCTCXO)                                    |                   | 100                                | -                | 100        | -                | kΩ     |
| Phase Noise<br>@10.0MHz                                       | 100Hz             | -130                               |                  |            |                  | dBc/Hz |
|                                                               | 1kHz              | -145                               |                  |            |                  |        |
|                                                               | 10kHz             | -154                               |                  |            |                  |        |
| Start Time                                                    |                   | -                                  | 2                | -          | 2                | mSec   |
| Storage Temp. Range                                           |                   | -55                                | 125              | -55        | 125              | ℃      |

Standard frequencies are frequencies which the crystal has been designed and does not imply a stock position.

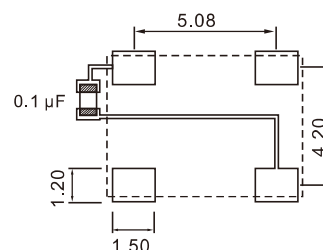
\* Including calibration @ 25°C, supply voltage VDD  $\pm 5\%$ , load  $\pm 10\%$ , reflow soldering, 20 years aging and frequency stability over temperature.

+ Including 24hours aging, supply voltage VDD  $\pm 5\%$  and frequency stability over temperature.

### Dimension(mm)



### Solder Pad Layout(mm)

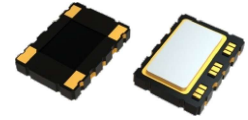


To ensure optimal oscillator performance, place a by-pass capacitor of 0.1  $\mu$ F as close to the part as possible between Vdd and GND pads.

## 7.0 x 5.0 mm SMD Voltage Controlled Temperature Compensated Crystal Oscillator

### Feature

- Typical 7.0 x 5.0 x 1.9 mm SMD package
- High Precision and High Temperature for -40 ~ +95°C  
±0.1ppm, -40 ~ +105°C, ±0.2ppm
- CMOS and Clipped Sine wave (without DC-cut capacitor) output optional



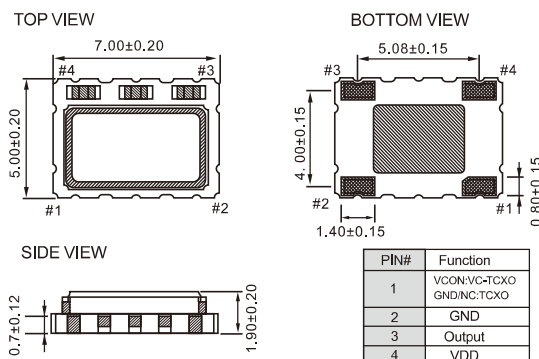
### Electrical Specifications

| Parameter                          |                                 | 3.3V                |                     | 2.5V                |                     | Unit     |
|------------------------------------|---------------------------------|---------------------|---------------------|---------------------|---------------------|----------|
|                                    |                                 | Min.                | Max.                | Min.                | Max.                |          |
| Supply Voltage Variation           |                                 | V <sub>DD</sub> -5% | V <sub>DD</sub> +5% | V <sub>DD</sub> -5% | V <sub>DD</sub> +5% | V        |
| Frequency Range                    |                                 | 10                  | 52                  | 10                  | 52                  | MHz      |
| Standard Frequency                 |                                 | 10,19,2,20          |                     |                     |                     | MHz      |
| Frequency Tolerance*               |                                 | -                   | ±1.5                | -                   | ±1.5                | ppm      |
| Frequency stability                | VS Supply V(±5%) change         | -                   | ±0.1                | -                   | ±0.05               | ppm      |
|                                    | VS Load(±10%) change            | -                   | ±0.05               | -                   | ±0.05               |          |
|                                    | VS Aging(@1 <sup>st</sup> year) | -                   | ±1.0                | -                   | ±1.0                | ppm/year |
| Supply Current (Clipped Sine Wave) |                                 | -                   | 5.0                 | -                   | 4.5                 | mA       |
| Supply Current (CMOS output)       |                                 | -                   | 7.5                 | -                   | 7                   | mA       |
| Load                               | CMOS                            | 15pF                |                     |                     |                     |          |
|                                    | (Clipped Sine Wave)             | 10kΩ//10pF          |                     | 10kΩ//10pF          |                     |          |
| Output Level CMOS                  | Output High                     | 0.9V <sub>DD</sub>  | -                   | 0.9V <sub>DD</sub>  | -                   | V        |
|                                    | Output Low                      | -                   | 0.1V <sub>DD</sub>  | -                   | 0.1V <sub>DD</sub>  | V        |
|                                    | Duty                            | 45                  | 55                  | 45                  | 55                  | %        |
| Control Voltage Range(VCTCXO)      |                                 | 0.5                 | 2.5                 | 0.5                 | 2.5                 | V        |
| Pulling Range (VCTCXO)             |                                 | ±5                  | -                   | ±5                  | -                   | ppm      |
| Vc Input Impedance(VCTCXO)         |                                 | 100                 | -                   | 100                 | -                   | kΩ       |
| Phase Noise                        | 100Hz                           | -130                |                     |                     |                     | dBc/Hz   |
| @20MHz                             | 1kHz                            | -148                |                     |                     |                     |          |
| Clipped Sine                       | 10kHz                           | -156                |                     |                     |                     |          |
| Start Time                         |                                 | -                   | 2                   | -                   | 2                   | mSec     |
| Storage Temp.Range                 |                                 | -55                 | 125                 | -55                 | 125                 | °C       |

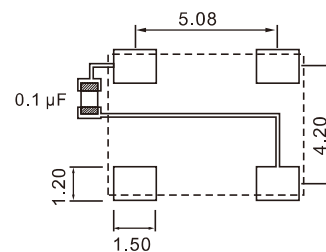
Standard frequencies are frequencies which the crystal has been designed and does not imply a stock position

\* Frequency at 25°C, 1 hour after reflow.

### Dimension(mm)



### Solder Pad Layout(mm)



To ensure optimal oscillator performance, place a by-pass capacitor of 0.1 μF as close to the part as possible between Vdd and GND pads.

### FREQ. STABILITY vs. TEMP. RANGE

| ppm<br>Temp. (°C) | ±0.05 | ±0.1 | ±0.2 | ±0.28 | ±0.5 | ±2 |
|-------------------|-------|------|------|-------|------|----|
| -40 ~ +85         | △     | ○    | ○    | ○     | ○    | ○  |
| -40 ~ +95         | △     | △    | ○    | ○     | ○    | ○  |
| -40 ~ +105        | X     | △    | ○    | ○     | ○    | ○  |

○: Available △:Conditional X: Not available

## 20.4 x12.8mm DIP Voltage Controlled Temperature Compensated Crystal Oscillator

### Feature

- Typical 20.4 x12.8 x 7.8 mm
- Hermetically Sealed 14 PIN DIP Package
- Double sealed metal case and high reliability
- VCTCXO available



### Electrical Specifications

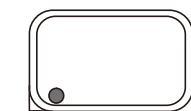
| Parameter                         |                                 | Clipped Sine Wave |       |      |      | CMOS                       |                    |                    |                    | Unit             |
|-----------------------------------|---------------------------------|-------------------|-------|------|------|----------------------------|--------------------|--------------------|--------------------|------------------|
|                                   |                                 | 3.3V              |       | 2.8V |      | 3.3V                       |                    | 2.8V               |                    |                  |
|                                   |                                 | Min.              | Max.  | Min. | Max. | Min.                       | Max.               | Min.               | Max.               |                  |
| Supply Voltage Variation(VDD) ±5% |                                 | 3.135             | 3.465 | 2.66 | 2.94 | 3.135                      | 3.465              | 2.66               | 2.94               | V                |
| Frequency Range                   |                                 | 10                | 52    | 10   | 52   | 1.25                       | 52                 | 1.25               | 52                 | MHz              |
| Frequency Tolerance*              |                                 | -                 | ±2.0  | -    | ±2.0 | -                          | ±2.0               | -                  | ±2.0               | ppm              |
| Frequency stability               | VS Supply V(±5%) change         | -                 | ±0.2  | -    | ±0.2 | -                          | ±0.2               | -                  | ±0.2               | ppm              |
|                                   | VS Load(±10%) change            | -                 | ±0.2  | -    | ±0.2 | -                          | ±0.2               | -                  | ±0.2               |                  |
|                                   | VS Aging(@1 <sup>st</sup> year) | -                 | ±1.0  | -    | ±1.0 | -                          | ±1.0               | -                  | ±1.0               |                  |
| Supply Current                    | 10MHz ≡ FO<15MHz                | -                 | 2.0   | -    | 2.0  | Only for clipped sine wave |                    |                    |                    | mA               |
|                                   | 15 MHz ≡ FO<26MHz               | -                 | 3.0   | -    | 3.0  |                            |                    |                    |                    |                  |
|                                   | 26 MHz ≡ FO<52MHz               | -                 | 4.0   | -    | 4.0  |                            |                    |                    |                    |                  |
| Output Level                      |                                 | 0.8               | -     | 0.8  | -    |                            |                    |                    |                    | V <sub>p-p</sub> |
| Supply Current                    | 1.25MHz ≡ FO<10MHz              | Only for CMOS     |       |      |      | -                          | 10                 | -                  | 7                  | mA               |
|                                   | 10MHz ≡ FO<15MHz                |                   |       |      |      | -                          | 15                 | -                  | 10                 |                  |
|                                   | 15 MHz ≡ FO<26MHz               |                   |       |      |      | -                          | 20                 | -                  | 15                 |                  |
|                                   | 26 MHz ≡ FO<52MHz               |                   |       |      |      | -                          | 25                 | -                  | 20                 |                  |
| CMOS                              | Output High                     |                   |       |      |      | 0.9V <sub>dd</sub>         | -                  | 0.9V <sub>dd</sub> | -                  | V                |
|                                   | Output Low                      |                   |       |      |      | -                          | 0.1V <sub>dd</sub> | -                  | 0.1V <sub>dd</sub> | %                |
|                                   | Duty                            |                   |       |      |      | 40                         | 60                 | 40                 | 60                 |                  |
| Control Voltage Range(VCTCXO)     |                                 | 0.5               | 2.5   | 0.5  | 2.5  | 0.5                        | 2.5                | 0.5                | 2.5                | V                |
| Pulling Range (VCTCXO)            |                                 | ±5                |       | ±5   |      | ±5                         |                    | ±5                 | -                  | ppm              |
| Vc Input Impedance(VCTCXO)        |                                 | 100               | -     | 100  | -    | 100                        | -                  | 100                | -                  | kΩ               |
| Phase Noise @13MHz                | 100Hz                           | -115              |       | -115 |      | -115                       |                    | -120               |                    | dBc/Hz           |
|                                   | 1kHz                            | -135              |       | -135 |      | -135                       |                    | -140               |                    |                  |
|                                   | 10kHz                           | -148              |       | -148 |      | -148                       |                    | -148               |                    |                  |
| Start Time                        |                                 | -                 | 2     | -    | 2    | -                          | 2                  | -                  | 2                  | mSec             |
| Storage Temp. Range               |                                 | -55               | 125   | -55  | 125  | -55                        | 125                | -55                | 125                | °C               |

Standard frequencies are frequencies which the crystal has been designed and does not imply a stock position

\* Frequency at 25°C, 1 hour after reflow.

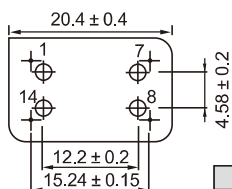
### Dimension(mm)

TOP VIEW

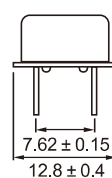
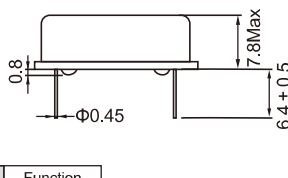


PIN 1 Symbol

BOTTOM VIEW



SIDE VIEW



Recommended soldering pattern

| PIN# | Function  |
|------|-----------|
| 1    | Vcon / NC |
| 7    | GND       |
| 8    | Output    |
| 14   | VDD       |

### FREQ. STABILITY vs. TEMP. RANGE

| Temp. (°C) | ppm               |      |      |      |
|------------|-------------------|------|------|------|
|            | Clipped sine wave | CMOS | ±0.5 | ±1.0 |
| -20 ~ +70  | ○                 | ○    | ○    | ○    |
| -40 ~ +85  | △                 | ○    | △    | ○    |

○: Available △: Conditional X: Not available

" Pulling Range < 10 ppm available

## 18.5x12 mm to 91x56 mm DIP Temperature Compensated Crystal Oscillator

### Feature

- Mobile communication, Avionics, Test Equipment, Electronic instruments

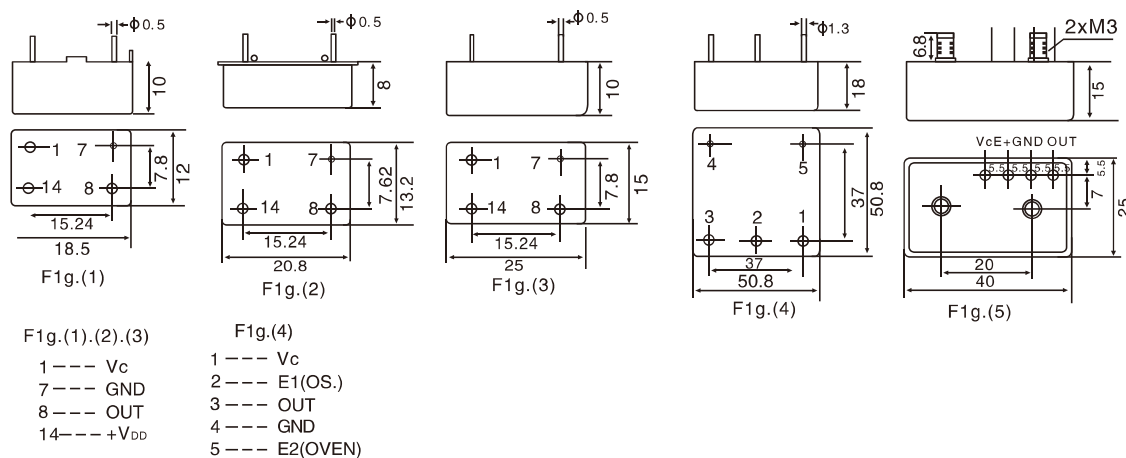


### Electrical Specifications

| Items                     |              | TFT210                                                                                       | TFT230 | TFT250              | TFT270  | TFT300   |
|---------------------------|--------------|----------------------------------------------------------------------------------------------|--------|---------------------|---------|----------|
| Frequency Range(MHz)      |              | 1~32                                                                                         | 30~95  | 90~155              | 150~210 | 200~1500 |
| F-T stability(ppm)        |              | ±0.5~±5                                                                                      |        |                     | ±1~±10  |          |
| Operating Temperature(°C) |              | -10~60 0~70 -20~+70 -40~+70 -50~+85                                                          |        |                     |         |          |
| Storage Temperature(°C)   |              | -55~+120                                                                                     |        |                     |         |          |
| Power                     | Voltage(Vdc) | +3.3 +5.0 +12                                                                                |        |                     |         |          |
|                           | Current(mA)  | 2~20                                                                                         |        |                     |         |          |
| Output                    | Waveform     | Sine/Pulse                                                                                   |        | Sine                |         |          |
|                           | Impedance    | 50Ω /100Ω                                                                                    |        | 50Ω                 |         |          |
|                           | Level        | (Pulse):TTL/HCMOS                                                                            |        | (Sine):≥1.5vP-P/50Ω |         |          |
|                           | Type         | (pins):SMA                                                                                   |        | SMA                 |         |          |
| Aging/Year(ppm)           |              | ±1 ~ ±3                                                                                      |        |                     |         |          |
| Frequency trim(ppm)       |              | ±1 ~ ±5/(mechanical or electrical)                                                           |        |                     |         |          |
| F-V Stability             |              | (3~5)x10 - 7(3.3V ± 5%, 5V ± 10%, 12V ± 10%)                                                 |        |                     |         |          |
| Dimension(mm)             |              | 18.5x12x(8~10) 20.8x13.2x(8~10) 25x15x10 30x20x10<br>40x25x15 44x27x19 50 8x50 8x18 91x56x20 |        |                     |         |          |

\*Please consult our sales representative for other specifications.

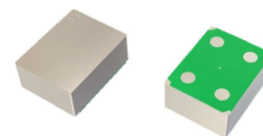
### Dimension(mm)



## 9.7 x7.5mm Oven Controlled Crystal Oscillator

### Feature

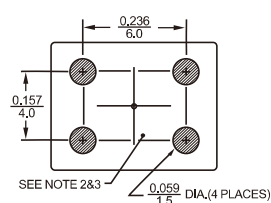
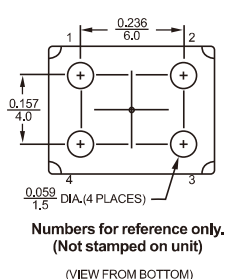
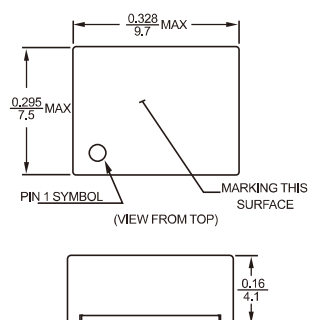
- Dimension 9.7 x 7.5 x 4.1mm, miniaturized 4-Pad SMD package
- $\pm 20$  ppb stability over -40 to +85°C
- Stratum 3 (Overall  $\pm 4.6$  ppm including 20 years aging)
- Low power consumption and high reliability



### Electrical Specifications

| Parameter                                           |                                 | Min.                      | Type                  | Max.  | Unit   |     |
|-----------------------------------------------------|---------------------------------|---------------------------|-----------------------|-------|--------|-----|
| OUTPUT (PIN = "R.F. OUTPUT")                        |                                 |                           |                       |       |        |     |
| Frequency                                           |                                 | 10                        |                       | 40    | MHz    |     |
| Output Level:                                       | Output High                     | 2.4                       |                       |       | V      |     |
|                                                     | Output Low                      |                           |                       | 0.4   | V      |     |
| Waveform:                                           |                                 | Rectangular/ Clipped Sine |                       |       |        |     |
| Load(Rectangular/ Clipped sine)                     |                                 | 15pF / 10K ohm//10pF      |                       |       | pF     |     |
| Duty(Rectangular)                                   |                                 | 45                        | 50                    | 55    | %      |     |
| Frequency stability                                 |                                 |                           |                       |       |        |     |
| Frequency stability                                 | Ambient (-20~+70°C / -40~+85°C) |                           | ±5, ±10,±20, ±30, ±50 |       | ppb    |     |
|                                                     | Daily                           |                           | -3.0                  |       | +3.0   | ppb |
|                                                     | Yearly                          |                           | -0.6                  |       | +0.6   | ppm |
|                                                     | 10 Years                        |                           | -3.0                  |       | +3.0   | ppm |
|                                                     | Voltage(±5% change)             |                           | -5.0                  |       | +5.0   | ppb |
|                                                     | Load(±5% change)                |                           | -5.0                  |       | +5.0   | ppb |
|                                                     | Warm-up                         |                           | -100                  |       | +100   | ppb |
| Phase Noise                                         | 10Hz                            |                           | -98                   | -92   | dBc/Hz |     |
|                                                     | 100Hz                           |                           | -126                  | -120  |        |     |
|                                                     | 1kHz                            |                           | -145                  | -140  |        |     |
|                                                     | 10kHz                           |                           | -152                  | -150  |        |     |
| ELECTRICAL FREQUENCY ADJUSTMENT (PIN = "VCO INPUT") |                                 |                           |                       |       |        |     |
| Tuning Range                                        | VCO @ 0 V                       |                           |                       | -5.0  | ppm    |     |
|                                                     | VCO @ 3.3V                      |                           | +5.0                  |       | ppm    |     |
| Control Voltage                                     |                                 | 0                         | 1.65                  | 3.3   | V      |     |
| INPUT POWER (PIN = "+VDC")                          |                                 |                           |                       |       |        |     |
| Voltage                                             |                                 | 3.135                     | 3.3                   | 3.465 | V      |     |
| Current                                             |                                 |                           |                       | 350   | mA     |     |
| Steady State                                        |                                 |                           | 0.3                   | 0.4   | W      |     |
| Storage Temperature                                 |                                 | -55                       |                       | +125  | °C     |     |

### Dimension(mm)



#### RECOMMENDED SOLDER PAD LAYOUT

Note 1. If the specification does not specify parameters for PIN 1 then PIN1 must remain unconnected.

Note 2. Copper in this area should be kept to a minimum to reduce heat loss from OCXO.

| PIN CONNECTIONS   |                                  |
|-------------------|----------------------------------|
| PIN               | FUNCTION                         |
| 1<br>(See Note 1) | VCO INPUT<br>OR<br>NOT CONNECTED |
| 2                 | 0 VOLTS & CASE                   |
| 3                 | R. F. OUTPUT                     |
| 4                 | +VDC                             |

Note 3. Bottom side reflow is forbidden unless specified in the oscillator specification.

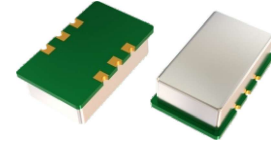
Note 4. Aqueous cleaning is FORBIDDEN

Note 5. Test condition : A 0.1uF and 10uF X7R decoupling capacitor is required close to the unit.

# 14.3 x9.3 mm Oven Controlled Crystal Oscillator

## Feature

- Dimension 14.3 x 9.3 x 6.5 mm typical
- 6-PIN SMD package
- Frequency Range , 10 MHz to 40MHz
- $\pm 30$  ppb stability over -40 to +85 °C
- Stratum 3 (Overall  $\pm 4.6$  ppm including 20 years aging.)

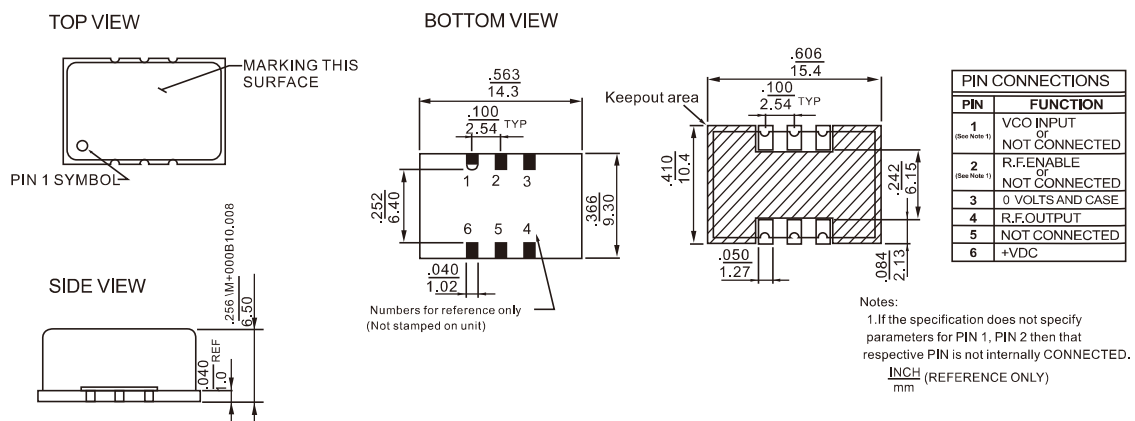


## Electrical Specifications

| Parameter                                           |                                | Min.        | Type              | Max.  | Unit   |
|-----------------------------------------------------|--------------------------------|-------------|-------------------|-------|--------|
| OUTPUT (PIN = “R.F. OUTPUT”)                        |                                |             |                   |       |        |
| Frequency                                           |                                | 10          |                   | 40    | MHz    |
| Output Level:<br>HCMOS                              | Output High                    | 2.4         |                   |       | V      |
|                                                     | Output Low                     |             |                   | 0.4   | V      |
| Waveform:                                           |                                | Rectangular |                   |       |        |
| Load                                                |                                | 15          |                   |       | pF     |
| Duty(Rectangular)                                   |                                | 45          | 50                | 55    | %      |
| Frequency stability                                 |                                |             |                   |       |        |
| Frequency stability                                 | Ambient (-20~+70°C /-40~+85°C) |             | ±10,±20, ±30, ±50 |       | ppb    |
|                                                     | Daily                          |             | -2.0              | +2.0  | ppb    |
|                                                     | Yearly                         |             | -0.4              | +0.4  | ppm    |
|                                                     | 10 Years                       |             | -2.0              | +2.0  | ppm    |
|                                                     | Voltage(±5% change)            |             | -5.0              | +5.0  | ppb    |
|                                                     | Load(±5% change)               |             | -10.0             | +10.0 | ppb    |
|                                                     | Warm-up                        |             | -0.1              | +0.1  | ppm    |
| Phase Noise                                         | 10Hz                           |             | -98               | -92   | dBc/Hz |
|                                                     | 100Hz                          |             | -126              | -120  |        |
|                                                     | 1kHz                           |             | -145              | -140  |        |
|                                                     | 10kHz                          |             | -152              | -150  |        |
| ELECTRICAL FREQUENCY ADJUSTMENT (PIN = “VCO INPUT”) |                                |             |                   |       |        |
| Tuning Range                                        | VCO @ 0 V                      |             |                   | -5.0  | ppm    |
|                                                     | VCO @ 3.3V                     |             | +5.0              |       | ppm    |
| Control Voltage                                     |                                | 0           | 1.65              | 3.3   | V      |
| INPUT POWER (PIN = “+VDC”)                          |                                |             |                   |       |        |
| Voltage                                             |                                | 3.135       | 3.3               | 3.465 | V      |
| Current                                             |                                |             | 500               | 600   | mA     |
| Steady State                                        |                                |             | 0.5               | 0.6   | W      |
| Storage Temperature                                 |                                | -55         |                   | +125  | °C     |

## Dimension(mm)

## Solder Pad Layout(mm)



# 20.3 x12.7 mm Oven Controlled Crystal Oscillator

## Feature

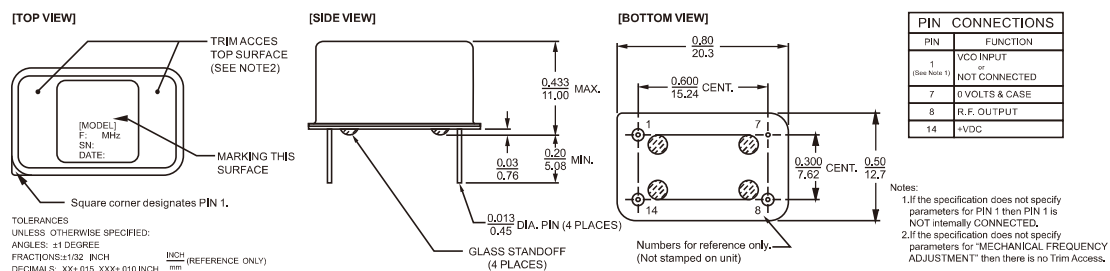
- Dimension 20.3 x 12.7 x 11.0 mm typical
- Stratum 3 (Overall  $\pm 4.6$  ppm including 10 years aging.)



## Electrical Specifications

| Parameter                                           |                                        | Min.        | Type           | Max. | Unit   |     |
|-----------------------------------------------------|----------------------------------------|-------------|----------------|------|--------|-----|
| OUTPUT (PIN = “R.F. OUTPUT”)                        |                                        |             |                |      |        |     |
| Frequency                                           |                                        | 5           | 10             | 40   | MHz    |     |
| Output Level:                                       | Output High                            | 2.4         |                |      | V      |     |
|                                                     | Output Low                             |             |                | 0.5  | V      |     |
| Waveform:                                           |                                        | Rectangular |                |      |        |     |
| Load                                                |                                        | 15          |                |      | pF     |     |
| Duty(Rectangular)                                   |                                        | 45          | 50             | 55   | %      |     |
| Frequency stability                                 |                                        |             |                |      |        |     |
| Frequency stability                                 | Ambient (0~+70°C/-30~+70°C /-40~+85°C) |             | ±50,±100, ±200 |      | ppb    |     |
|                                                     | Daily                                  |             | -5.0           |      | +5.0   | ppb |
|                                                     | Yearly                                 |             | -0.5           |      | +0.5   | ppm |
|                                                     | 10 Years                               |             | -3.0           |      | +3.0   | ppm |
|                                                     | Voltage(±5% change)                    |             | -50            |      | +50    | ppb |
|                                                     | Load(±5% change)                       |             | -50            |      | +50    | ppb |
|                                                     | Warm-up                                |             | -0.1           |      | +0.1   | ppm |
|                                                     | Aging                                  |             | -5.0           |      | +5.0   | ppb |
| Phase Noise                                         | 10Hz                                   |             |                | -105 | dBc/Hz |     |
|                                                     | 100Hz                                  |             |                | -130 |        |     |
|                                                     | 1kHz                                   |             |                | -140 |        |     |
|                                                     | 10kHz                                  |             |                | -150 |        |     |
| ELECTRICAL FREQUENCY ADJUSTMENT (PIN = “VCO INPUT”) |                                        |             |                |      |        |     |
| Tuning Range                                        | VCO @ 0 V                              |             |                | -5.0 | ppm    |     |
|                                                     | VCO @ 5.0V                             |             | +5.0           |      | ppm    |     |
| Control Voltage                                     |                                        | 0           | 2.5            | 5.0  | V      |     |
| INPUT POWER (PIN = “+VDC”)                          |                                        |             |                |      |        |     |
| Voltage                                             |                                        | 4.75        | 5.0            | 5.25 | V      |     |
| Current                                             |                                        |             |                | 400  | mA     |     |
| Steady State                                        |                                        |             |                | 0.8  | W      |     |
| Storage Temperature                                 |                                        | -55         |                | +125 | °C     |     |

## Dimension(mm)





# 20.6 x20.6mm Oven Controlled Crystal Oscillator

## Feature

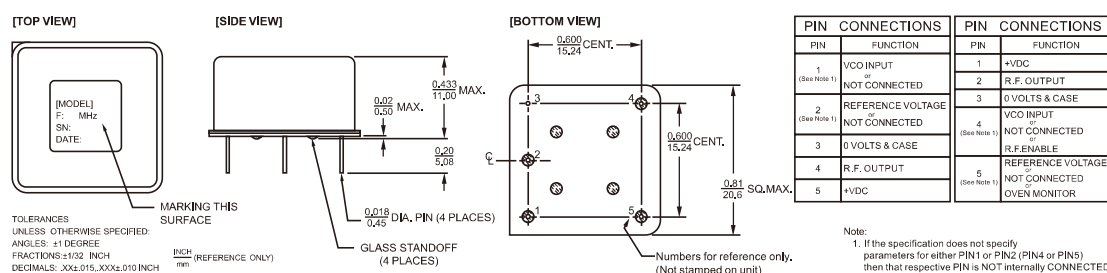
- Dimension 20.6 x 20.6 x 11.0 mm typical
- SC Cut crystal



## Electrical Specifications

| Parameter                                           |                                        | Min.        | Type        | Max. | Unit   |
|-----------------------------------------------------|----------------------------------------|-------------|-------------|------|--------|
| OUTPUT (PIN = “R.F. OUTPUT”)                        |                                        |             |             |      |        |
| Frequency                                           |                                        | 5           | 10          | 40   | MHz    |
| Output Level:                                       | Output High                            | 3.5         |             |      | V      |
| HCMOS                                               | Output Low                             |             |             | 0.5  | V      |
| Waveform:                                           |                                        | Rectangular |             |      |        |
| Load                                                |                                        | 15          |             |      | pF     |
| Duty(Rectangular)                                   |                                        | 45          | 50          | 55   | %      |
| Frequency stability                                 |                                        |             |             |      |        |
| Frequency stability                                 | Ambient (0~70°C/ -30~+70°C /-40~+85°C) |             | ±5,±10, ±20 |      | ppb    |
|                                                     | Daily                                  |             | -0.5        | +0.5 | ppb    |
|                                                     | Yearly                                 |             | -50         | +50  | ppb    |
|                                                     | 10 Years                               |             | -0.3        | +0.3 | ppm    |
|                                                     | Voltage(±5% change)                    |             | -0.5        | +0.5 | ppb    |
|                                                     | Load(±5% change)                       |             | -0.5        | +0.5 | ppb    |
|                                                     | Warm-up                                |             | -50         | 50   | ppb    |
| Phase Noise                                         | Aging                                  |             | -0.5        | +0.5 | ppb    |
|                                                     | 10Hz                                   |             |             | -115 | dBc/Hz |
|                                                     | 100Hz                                  |             |             | -135 |        |
|                                                     | 1kHz                                   |             |             | -145 |        |
|                                                     | 10kHz                                  |             |             | -150 |        |
| ELECTRICAL FREQUENCY ADJUSTMENT (PIN = “VCO INPUT”) |                                        |             |             |      |        |
| Tuning Range                                        | VCO @ 0 V                              |             |             | -0.5 | ppm    |
|                                                     | VCO @ 4.0V                             |             | +0.5        |      | ppm    |
| Control Voltage                                     |                                        | 0           | 2           | 4.0  | V      |
| INPUT POWER (PIN = “+VDC”)                          |                                        |             |             |      |        |
| Voltage                                             |                                        | 4.75        | 5.0         | 5.25 | V      |
| Current                                             |                                        |             |             | 500  | mA     |
| Steady State                                        |                                        |             |             | 1.0  | W      |
| Reference Voltage                                   |                                        |             |             |      |        |
| Voltage                                             |                                        | 3.8         | 4.0         | 4.2  | V      |
| Storage Temperature                                 |                                        | -55         |             | +125 | °C     |

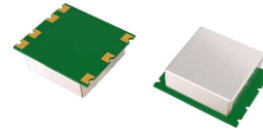
## Dimension(mm)



# 25.4 x22.1 mm Oven Controlled Crystal Oscillator

## Feature

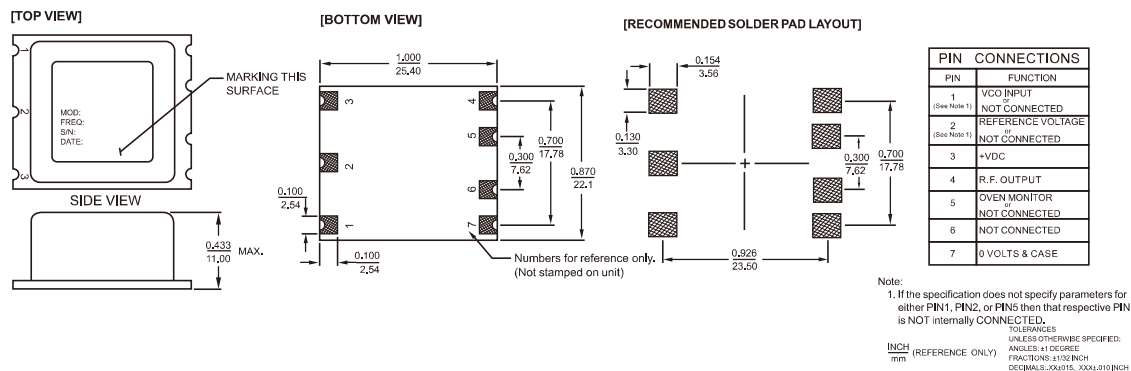
- Dimension 25.4 x 22.1 x 11.0 mm typical
- SC Cut crystal



## Electrical Specifications

| Parameter                                           |                                        | Min.        | Type | Max.  | Unit   |
|-----------------------------------------------------|----------------------------------------|-------------|------|-------|--------|
| OUTPUT (PIN = “R.F. OUTPUT”)                        |                                        |             |      |       |        |
| Frequency                                           |                                        | 5           | 10   | 40    | MHz    |
| Output Level:                                       | Output High                            | 2.4         |      |       | V      |
|                                                     | Output Low                             |             |      | 0.4   | V      |
| Waveform:                                           |                                        | Rectangular |      |       |        |
| Load                                                |                                        | 15          |      |       | pF     |
| Duty(Rectangular)                                   |                                        | 45          | 50   | 55    | %      |
| Frequency stability                                 |                                        |             |      |       |        |
| Frequency stability                                 | Ambient (0~70°C/ -30~+70°C /-40~+85°C) | ±5,±10, ±20 |      |       | ppb    |
|                                                     | Aging                                  | -0.5        |      | +0.5  | ppb    |
|                                                     | Daily                                  | -0.5        |      | +0.5  | ppb    |
|                                                     | Yearly                                 | -50         |      | +50   | ppb    |
|                                                     | 10 Years                               | -0.4        |      | +0.4  | ppm    |
|                                                     | Voltage(±5% change)                    | -0.5        |      | +0.5  | ppb    |
|                                                     | Load(±5% change)                       | -0.5        |      | +0.5  | ppb    |
|                                                     | Warm-up                                | -10         |      | 10    | ppb    |
| Phase Noise                                         | 10Hz                                   |             |      | -115  | dBc/Hz |
|                                                     | 100Hz                                  |             |      | -130  |        |
|                                                     | 1kHz                                   |             |      | -140  |        |
|                                                     | 10kHz                                  |             |      | -150  |        |
| ELECTRICAL FREQUENCY ADJUSTMENT (PIN = “VCO INPUT”) |                                        |             |      |       |        |
| Tuning Range                                        | VCO @ 0 V                              |             |      | -0.5  | ppm    |
|                                                     | VCO @ 2.8V                             | +0.5        |      |       | ppm    |
| Control Voltage                                     |                                        | 0           | 1.4  | 2.8   | V      |
| INPUT POWER (PIN = “+VDC”)                          |                                        |             |      |       |        |
| Voltage                                             |                                        | 3.135       | 3.3  | 3.465 | V      |
| Current                                             |                                        |             |      | 1000  | mA     |
| Steady State                                        |                                        |             |      | 1.2   | W      |
| Reference Voltage                                   |                                        |             |      |       |        |
| Voltage                                             |                                        | 2.7         | 2.8  | 2.9   | V      |
| Storage Temperature                                 |                                        | -55         |      | +125  | °C     |

## Dimension(mm)



## 25.4 x25.4mm Oven Controlled Crystal Oscillator

### Feature

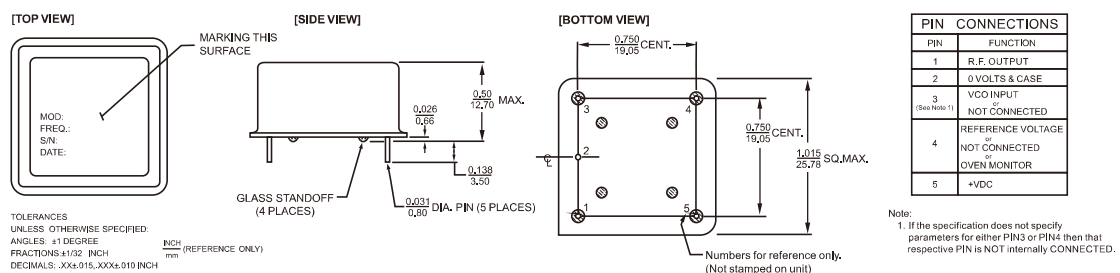
- Typical 25.4 x25.4 x 12.7 mm
- Hermetically Sealed DIP Package
- Low power consumption and high reliability
- SC Cut Crystal



### Electrical Specifications

| Parameter                                           |                                           | 3.3V                 |       |        | 5.0V                 |      |       | Unit   |
|-----------------------------------------------------|-------------------------------------------|----------------------|-------|--------|----------------------|------|-------|--------|
|                                                     |                                           | Min.                 | Type  | Max.   | Min.                 | Type | Max.  |        |
| OUTPUT (PIN = “R.F. OUTPUT”)                        |                                           |                      |       |        |                      |      |       |        |
| Frequency                                           |                                           | 5                    |       | 40     | 5                    |      | 40    | MHz    |
| Output Level:<br>LV TTL                             | Output High                               | 2.4                  |       |        | 2.4                  |      |       | V      |
|                                                     | Output Low                                |                      |       | 0.4    |                      |      | 0.4   | V      |
| Waveform:                                           |                                           | Rectangular          |       |        | Rectangular          |      |       |        |
| Load                                                |                                           |                      | 15    |        |                      | 15   |       | pF     |
| Duty                                                |                                           | 45                   | 50    | 55     | 45                   | 50   | 55    | %      |
| Frequency stability                                 |                                           |                      |       |        |                      |      |       |        |
| Frequency stability                                 | Ambient (0~+70°C/-30~+70°C<br>/-40~+85°C) | ±0.5, ±1,±3, ±5, ±10 |       |        | ±0.5, ±1,±3, ±5, ±10 |      |       | ppb    |
|                                                     | Daily                                     | -0.5                 |       | +0.5   | -0.5                 |      | +0.5  | ppb    |
|                                                     | Yearly                                    | -50                  |       | +50    | -50                  |      | +50   | ppb    |
|                                                     | 10 Years                                  | -0.3                 |       | +0.3   | -0.3                 |      | +0.3  | ppm    |
|                                                     | Voltage(±5% change)                       | -0.5                 |       | +0.5   | -0.5                 |      | +0.5  | ppb    |
|                                                     | Short term                                |                      |       | 0.05   |                      |      | 0.05  | ppb/s  |
|                                                     | Load(±5% change)                          | -0.5                 |       | +0.5   | -0.5                 |      | +0.5  | ppb    |
| Warm-up                                             |                                           | -10                  |       | +10    | -10                  |      | +10   | ppb    |
| Phase Noise                                         | 1Hz                                       |                      | -95   | -90    |                      | -95  | -90   | dBc/Hz |
|                                                     | 10Hz                                      |                      | -125  | -120   |                      | -125 | -120  |        |
|                                                     | 100Hz                                     |                      | -140  | -135   |                      | -140 | -135  |        |
|                                                     | 1kHz                                      |                      | -148  | -145   |                      | -148 | -145  |        |
|                                                     | 10kHz                                     |                      | -156  | -155   |                      | -156 | -155  |        |
| 100kHz                                              |                                           |                      | -158  | -155   |                      | -158 | -155  |        |
| ELECTRICAL FREQUENCY ADJUSTMENT (PIN = “VCO INPUT”) |                                           |                      |       |        |                      |      |       |        |
| Tuning Range                                        | VCO @ Min. Voltage                        |                      |       | -0.5   |                      |      | -0.5  | ppm    |
|                                                     | VCO @ Max. Voltage                        | +0.5                 |       |        | +0.5                 |      |       | ppm    |
| Control Voltage                                     | Ordering Information                      | 0                    | +1.65 | +3.3   | 0                    | +2.5 | +5.0  | V      |
|                                                     |                                           | 0                    | +1.4  | +2.8   | 0                    | +2.0 | +4.0  | V      |
| INPUT POWER (PIN = “+VDC”)                          |                                           |                      |       |        |                      |      |       |        |
| Voltage                                             |                                           | +3.135               | +3.3  | +3.465 | +4.75                | +5.0 | +5.25 | V      |
| Current                                             |                                           |                      |       | 1000   |                      |      | 800   | mA     |
| Steady State                                        |                                           |                      |       | 1.3    |                      |      | 1.3   | W      |
| REFERENCE VOLTAGE (PIN = "REFERENCE VOLTAGE")       |                                           |                      |       |        |                      |      |       |        |
| Voltage                                             |                                           | +2.7                 | +2.8  | +2.9   | +3.8                 | +4.0 | +4.2  | V      |
| Storage Temperature                                 |                                           | -55                  |       | +125   | -55                  |      | +125  | °C     |

### DIMENSION(mm)



## Feature

- 

| Parameter                                           |                               | 12V                           |      |       | 5.0V            |      |       | Unit   |
|-----------------------------------------------------|-------------------------------|-------------------------------|------|-------|-----------------|------|-------|--------|
|                                                     |                               | Min.                          | Type | Max.  | Min.            | Type | Max.  |        |
| OUTPUT (PIN = "R.F. OUTPUT")                        |                               |                               |      |       |                 |      |       |        |
| Frequency                                           |                               |                               | 10   |       |                 | 100  |       | MHz    |
| Initial Accuracy                                    |                               | -0.1                          |      | +0.1  | -0.3            |      | +0.3  | ppm    |
| Waveform:                                           |                               | Sine Wave                     |      |       | Rectangular     |      |       |        |
| Frequency stability                                 |                               |                               |      |       |                 |      |       |        |
| Frequency stability                                 | Ambient(-20~+70°C /-40~+85°C) | ± 5, ±10, ±20, ±30, ±50, ±100 |      |       | ± 20, ±50, ±100 |      |       | ppb    |
|                                                     | Daily                         | -0.5                          |      | +0.5  | -5              |      | +5    | ppb    |
|                                                     | Yearly                        | -50                           |      | +50   | -500            |      | +500  | ppb    |
|                                                     | 10 Years                      | -0.3                          |      | +0.3  | -2              |      | +2    | ppm    |
|                                                     | Voltage(±5% change)           | -1.0                          |      | +1.0  | -5              |      | +5    | ppb    |
|                                                     | Short term                    |                               |      | 0.002 |                 |      | 0.05  | ppb/s  |
|                                                     | Load(±5% change)              | -1.0                          |      | +1.0  | -5              |      | +5    | ppb    |
| Warm-up                                             |                               | -50                           |      | +50   | -50             |      | +50   | ppb    |
| G-Sensitivity(each axis)                            |                               |                               |      | -     |                 |      | 1     | Ppb/g  |
| Phase Noise                                         | 10Hz                          |                               | -140 | -142  |                 | -97  | -100  | dBc/Hz |
|                                                     | 100Hz                         |                               | -155 | -155  |                 | -130 | -135  |        |
|                                                     | 1kHz                          |                               | -165 | -165  |                 | -160 | -162  |        |
|                                                     | 10kHz                         |                               | -170 | -170  |                 | -173 | -170  |        |
|                                                     | 100kHz                        |                               | -170 | -170  |                 | -175 | -172  |        |
|                                                     | 1MHz                          |                               | -170 | -170  |                 | -178 | -175  |        |
| ELECTRICAL FREQUENCY ADJUSTMENT (PIN = "VCO INPUT") |                               |                               |      |       |                 |      |       |        |
| Tuning Range                                        | VCO @ Min. Voltage            | ± 0.4                         |      |       | ± 3             |      |       | ppm    |
| Control Voltage                                     | Ordering Information          | 0.5                           | 5.0  | +9.5  | 0               | 5.0  | +10.0 | V      |
| INPUT POWER (PIN = "+VDC")                          |                               |                               |      |       |                 |      |       |        |
| Voltage                                             |                               | +11.4                         | +12  | +12.6 | +11.4           | +12  | +12.6 | V      |
| Current                                             |                               |                               |      | 500   |                 |      | 380   | mA     |
| Steady State                                        |                               |                               |      | 2.0   |                 |      | 2.0   | W      |
| REFERENCE VOLTAGE (PIN = "REFERENCE VOLTAGE")       |                               |                               |      |       |                 |      |       |        |
| Voltage                                             |                               | +9.25                         | +9.5 | +9.75 | +9.5            | +10  | +10.5 | V      |
| Storage Temperature                                 |                               | -55                           |      | +125  | -55             |      | +125  | °C     |

**[TOP VIEW]**

MOD.  
FREQ.  
SN.  
DATE.

MARKING THIS SURFACE

**[SIDE VIEW]**

0.50  
12.70 MAX.  
0.028  
0.06  
0.138  
3.50  
0.031 DIA. PIN (5 PLACES)

GLASS STANDOFF (4 PLACES)

**[BOTTOM VIEW]**

0.750 CENT.  
19.05  
0.750 CENT.  
19.05  
1.015  
25.78  
1.015  
25.78 SQ. MAX.

Numbers for reference only.  
(Not stamped on unit)

TOLERANCES  
UNLESS OTHERWISE SPECIFIED:  
ANGLES: ±1 DEGREE  
FRACTIONS: ±1/32 INCH  
DECIMALS: .XX±0.02, .XXX±0.010 INCH

INCH  
mm (REFERENCE ONLY)

| PIN CONNECTIONS   |                                                                |
|-------------------|----------------------------------------------------------------|
| PIN               | FUNCTION                                                       |
| 1                 | R. F. OUTPUT                                                   |
| 2                 | 0 VOLTS & CASE                                                 |
| 3<br>(See Note 1) | VCO INPUT<br>or<br>NOT CONNECTED                               |
| 4<br>(See Note 1) | REFERENCE VOLTAGE<br>or<br>NOT CONNECTED<br>or<br>OVEN MONITOR |
| 5                 | +VDC                                                           |

Note:

1. If the specification does not specify parameters for either PIN3 or PIN4 then that respective PIN is NOT internally CONNECTED

# 36.3x27.2mm Oven Controlled Crystal Oscillator

## FEATURE

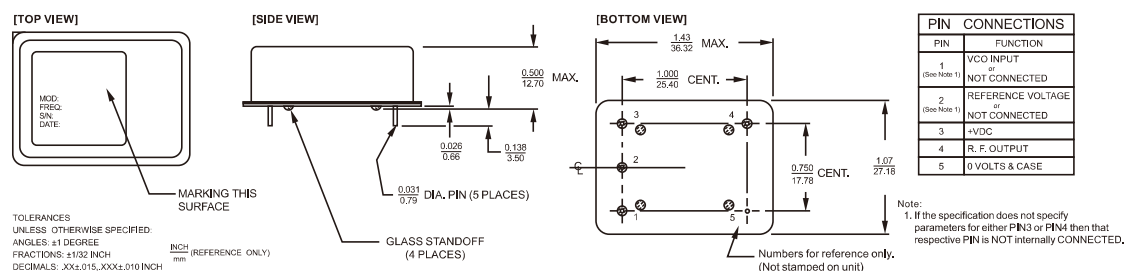
- Typical 36.3 x 27.2 x 12.7 mm.
- SC Cut crystal



## Electrical Specifications

| Parameter                                           |                                             | 12V         |      |       | 5.0V        |      |       | Unit   |
|-----------------------------------------------------|---------------------------------------------|-------------|------|-------|-------------|------|-------|--------|
|                                                     |                                             | Min.        | Type | Max.  | Min.        | Type | Max.  |        |
| OUTPUT (PIN = “R.F. OUTPUT”)                        |                                             |             |      |       |             |      |       |        |
| Frequency                                           |                                             | 5           | 10   | 40    | 5           | 10   | 40    | MHz    |
| Output Level:                                       | Output High                                 | 2.6         |      |       | 2.4         |      |       | V      |
|                                                     | Output Low                                  |             |      | 0.4   |             |      | 0.4   | V      |
| Waveform:                                           |                                             | Rectangular |      |       | Rectangular |      |       |        |
| Load                                                |                                             |             | 15   |       |             | 15   |       | pF     |
| Duty                                                |                                             | 45          | 50   | 55    | 45          | 50   | 55    | %      |
| Frequency stability                                 |                                             |             |      |       |             |      |       |        |
| Frequency stability                                 | Ambient<br>(0~70°C / -30~+70°C / -40~+85°C) | ±3, ±5, ±10 |      |       | ±3, ±5, ±10 |      |       | ppb    |
|                                                     | Aging                                       | -0.5        |      | +0.5  | -0.5        |      | +0.5  | ppb    |
|                                                     | Daily                                       | -0.5        |      | +0.5  | -0.5        |      | +0.5  | ppb    |
|                                                     | Yearly                                      | -50         |      | +50   | -50         |      | +50   | ppb    |
|                                                     | 10 Years                                    | -0.3        |      | +0.3  | -0.3        |      | +0.3  | ppm    |
|                                                     | Voltage(±5% change)                         | -0.5        |      | +0.5  | -0.5        |      | +0.5  | ppb    |
|                                                     | Load(±5% change)                            | -0.5        |      | +0.5  | -0.5        |      | +0.5  | ppb    |
| Phase Noise                                         | Warm-up                                     | -10         |      | +10   | -10         |      | +10   | ppb    |
|                                                     | 10Hz                                        |             | -125 | -120  |             | -125 | -120  | dBc/Hz |
|                                                     | 100Hz                                       |             | -140 | -135  |             | -140 | -135  |        |
|                                                     | 1kHz                                        |             | -148 | -145  |             | -148 | -145  |        |
| 10kHz                                               |                                             | -156        | -155 |       | -156        | -155 |       |        |
| ELECTRICAL FREQUENCY ADJUSTMENT (PIN = “VCO INPUT”) |                                             |             |      |       |             |      |       |        |
| Tuning Range                                        | VCO @ Min. Voltage                          |             |      | -0.5  |             |      | -0.5  | ppm    |
|                                                     | VCO @ Max. Voltage                          | +0.5        |      |       | +0.5        |      |       | ppm    |
| Control Voltage                                     | Ordering Information                        | 0           | +2.5 | +5.0  | 0           | +2.5 | +5.0  | V      |
|                                                     |                                             | 0           | +2.0 | +4.0  | 0           | +2.0 | +4.0  | V      |
| INPUT POWER (PIN = “+VDC”)                          |                                             |             |      |       |             |      |       |        |
| Voltage                                             |                                             | +11.4       | +12  | +12.6 | +4.75       | +5.0 | +5.25 | V      |
| Current                                             |                                             |             |      | 1000  |             |      | 850   | mA     |
| Steady State                                        |                                             |             |      | 1.3   |             |      | 1.3   | W      |
| REFERENCE VOLTAGE (PIN = "REFERENCE VOLTAGE")       |                                             |             |      |       |             |      |       |        |
| Voltage                                             |                                             | +4.75       | +5.0 | +5.25 | +3.8        | +4.0 | +4.2  | V      |
| Storage Temperature                                 |                                             | -55         |      | +125  | -55         |      | +125  | °C     |

## Dimension(mm)



# 36.3 x27.2mm Double Oven Controlled Crystal Oscillator

## Feature

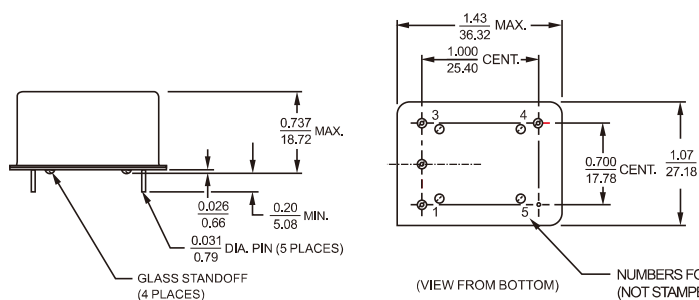
- Typical 36.3 x27.2 x 18.7mm.
- Hermetically Sealed Package
- Low power consumption and high reliability



## Electrical Specifications

| Parameter                                           |                              | 3.3V        |      |        | 5.0V        |      |       | Unit   |
|-----------------------------------------------------|------------------------------|-------------|------|--------|-------------|------|-------|--------|
|                                                     |                              | Min.        | Type | Max.   | Min.        | Type | Max.  |        |
| OUTPUT (PIN = “R.F. OUTPUT”)                        |                              |             |      |        |             |      |       |        |
| Frequency                                           |                              |             | 10   |        |             | 10   |       | MHz    |
| Initial Accuracy                                    |                              | -0.1        |      | +0.1   | -0.1        |      | +0.1  | ppm    |
| Output Level:                                       | Output High                  | 2.4         |      |        | 4.4         |      |       | V      |
|                                                     | Output Low                   |             |      | 0.3    |             |      | 0.3   | V      |
| Waveform:                                           |                              | Rectangular |      |        | Rectangular |      |       |        |
| Frequency stability                                 |                              |             |      |        |             |      |       |        |
| Frequency stability                                 | Ambient (0~+70°C /-30~+70°C) | ±0.2, ±0.5  |      |        | ±0.2, ±0.5  |      |       | ppb    |
|                                                     | Daily                        | ±0.1, ±0.3  |      |        | ±0.1, ±0.3  |      |       | ppb    |
|                                                     | Yearly                       | ±20, ±50    |      |        | ±20, ±50    |      |       | ppb    |
|                                                     | 10 Years                     | ±0.1, ±0.2  |      |        | ±0.1, ±0.2  |      |       | ppm    |
|                                                     | Voltage(±5% change)          | -0.2        |      | +0.2   | -0.2        |      | +0.2  | ppb    |
|                                                     | Short term                   |             |      | 0.007  |             |      | 0.007 | ppb/s  |
|                                                     | Load(±5% change)             | -0.2        |      | +0.2   | -0.2        |      | +0.2  | ppb    |
|                                                     | Warm-up                      | -20         |      | +20    | -20         |      | +20   | ppb    |
| Phase Noise                                         | 10Hz                         |             |      | -120   |             |      | -120  | dBc/Hz |
|                                                     | 100Hz                        |             |      | -138   |             |      | -138  |        |
|                                                     | 1kHz                         |             |      | -148   |             |      | -148  |        |
|                                                     | 10kHz                        |             |      | -155   |             |      | -155  |        |
|                                                     | 100kHz                       |             |      | -158   |             |      | -158  |        |
| ELECTRICAL FREQUENCY ADJUSTMENT (PIN = “VCO INPUT”) |                              |             |      |        |             |      |       |        |
| Tuning Range                                        | VCO @ Min. Voltage           | -0.8        |      | -0.35  | -0.8        |      | -0.35 | ppm    |
|                                                     | VCO @ Max. Voltage           | +0.35       |      | +0.8   | +0.35       |      | +0.8  | ppm    |
| Control Voltage                                     | Ordering Information         | 0           | +1.4 | +2.8   | 0           | +1.4 | +2.8  | V      |
| INPUT POWER (PIN = “+VDC”)                          |                              |             |      |        |             |      |       |        |
| Voltage                                             |                              | +3.135      | +3.3 | +3.465 | +4.75       | +5.0 | +5.25 | V      |
| Current                                             |                              |             |      | 2.5    |             |      | 1.75  | A      |
| Steady State                                        |                              |             |      | 2.5    |             |      | 2.5   | W      |
| REFERENCE VOLTAGE (PIN = "REFERENCE VOLTAGE")       |                              |             |      |        |             |      |       |        |
| Voltage                                             |                              | +2.66       | +2.8 | +2.94  | +3.8        | +4.0 | +4.2  | V      |
| Storage Temperature                                 |                              | -40         |      | +85    | -40         |      | +85   | °C     |

## Dimension(mm)



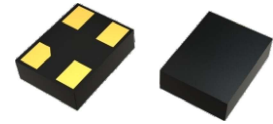
| PIN CONNECTIONS   |                                                                |
|-------------------|----------------------------------------------------------------|
| PIN               | FUNCTION                                                       |
| 1<br>(See Note 1) | VCO INPUT<br>or<br>NOT CONNECTED                               |
| 2<br>(See Note 1) | REFERENCE VOLTAGE<br>or<br>OVEN MONITOR<br>or<br>NOT CONNECTED |
| 3                 | +VDC                                                           |
| 4                 | R. F. OUTPUT                                                   |
| 5                 | 0 VOLTS & CASE                                                 |

Note 1. If the specification does not specify parameters for either PIN1 or PIN2 then that respective PIN is NOT internally CONNECTED.

## 2.0x1.6 mm SMD SAW Resonator

### Feature

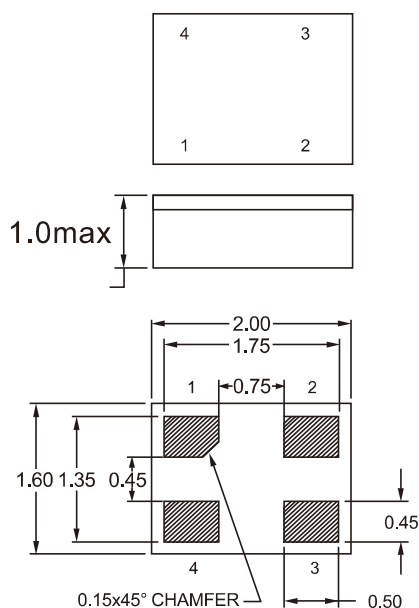
- Small size 2.0x1.6x1.0mm
- The optional frequency can be customized
- High transmit and receive sensitivity
- High temperature resistance and impact resistance
- Good power and reliability
- RoHS compliant



### Electrical Specifications

| Item                                          |                                      |              | Minimum                              | Typical   | Maximum | Unit   |
|-----------------------------------------------|--------------------------------------|--------------|--------------------------------------|-----------|---------|--------|
| Frequency Range                               |                                      | $f_c$        | 154~1000MHz                          |           |         | MHz    |
| Standard Frequency                            |                                      | $f_c$        | 303,315,390,433.92,435,72            |           |         | MHz    |
| Frequency Tolerance(at 25°C)                  |                                      | $\Delta f_c$ | $\pm 50, \pm 75, \pm 150$ or specify |           |         | kHz    |
| Insertion Loss (in 50ohm system, min)         |                                      | IL           | 1.0,1.3,1.4, 1.5 or specify          |           |         | dB     |
| Temperature Stability                         | Turnover Temperature                 | $T_0$        | 25                                   | 40        | 55      | °C     |
|                                               | Turnover Frequency                   | $f_0$        |                                      | $f_c$     |         |        |
|                                               | Frequency Temperature Coefficient    | FTC          |                                      | 0.037     |         | ppm/°C |
| Frequency Aging                               | Absolute Value during the First Year | $ f_A $      |                                      | $\leq 10$ |         | ppm/yr |
| DC Insulation Resistance between Any Two Pins |                                      |              | 1.0                                  |           |         | MΩ     |
| Operating Temperature Range                   |                                      |              | -40~+85                              |           |         | °C     |
| Storage Temperature Range                     |                                      |              | -40~+85                              |           |         | °C     |

### Dimension(mm)

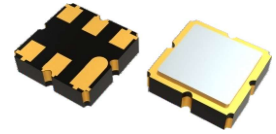


| Pin No. | Description   |
|---------|---------------|
| 1       | Input/ Output |
| 3       | Output/ Input |
| 2,4     | Ground        |

## 3.0x3.0 mm SMD SAW Resonator

### Feature

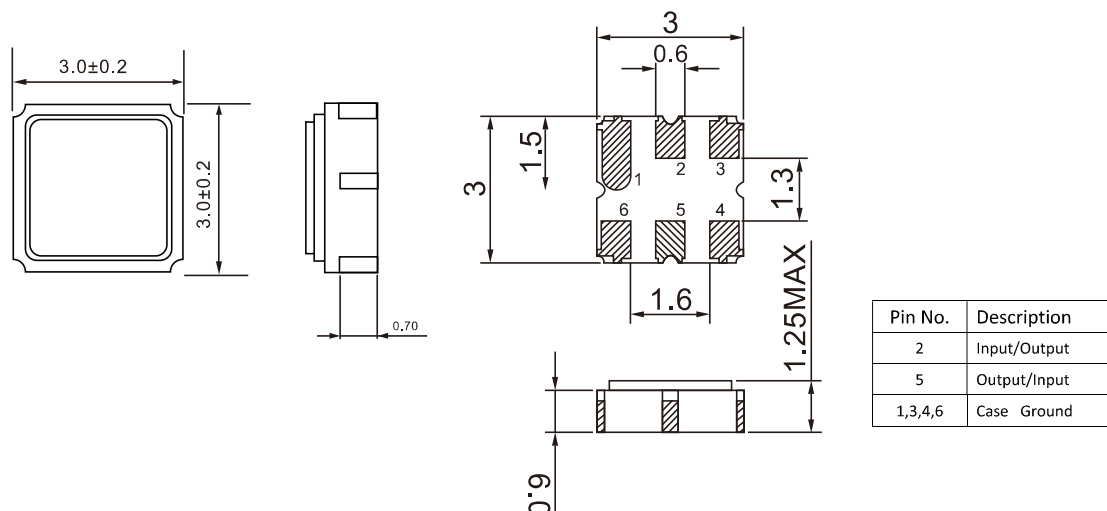
- Small size 3.0x3.0x1.3mm
- The optional frequency can be customized
- High transmit and receive sensitivity
- High temperature resistance and impact resistance
- Good power and reliability
- RoHS compliant



### Electrical Specifications

| Item                                          |                                      |              | Minimum                              | Typical   | Maximum | Unit   |
|-----------------------------------------------|--------------------------------------|--------------|--------------------------------------|-----------|---------|--------|
| Frequency Range                               |                                      | $f_c$        | 154~1000MHz                          |           |         | MHz    |
| Standard Frequency                            |                                      |              | 315,330, 370,433.92,868,915          |           |         | MHz    |
| Frequency Tolerance(at 25°C)                  |                                      | $\Delta f_c$ | $\pm 50, \pm 75, \pm 150$ or specify |           |         | kHz    |
| Insertion Loss (in 50ohm system, min)         |                                      | IL           | 1.0,1.3,1.4, 1.5 or specify          |           |         | dB     |
| Temperature Stability                         | Turnover Temperature                 | $T_0$        | 25                                   | 40        | 55      | °C     |
|                                               | Turnover Frequency                   | $f_0$        |                                      | $f_c$     |         |        |
|                                               | Frequency Temperature Coefficient    | FTC          |                                      | 0.032     |         | ppm/°C |
| Frequency Aging                               | Absolute Value during the First Year | $ f_A $      |                                      | $\leq 10$ |         | ppm/yr |
| DC Insulation Resistance between Any Two Pins |                                      |              | 1.0                                  |           |         | MΩ     |
| Operating Temperature Range                   |                                      |              | -40~+85                              |           |         | °C     |
| Storage Temperature Range                     |                                      |              | -55~+125                             |           |         | °C     |

### Dimension(mm)

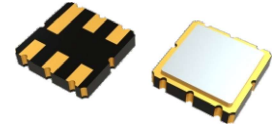




## 3.8x3.8 mm SMD SAW Resonator

### Feature

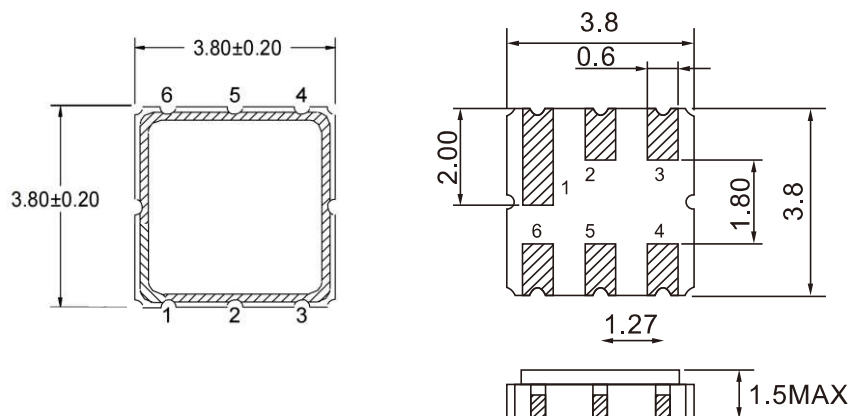
- Small size 3.8x3.8x1.5 mm
- The optional frequency can be customized
- High transmit and receive sensitivity
- High temperature resistance and impact resistance
- Good power and reliability
- RoHS compliant



### Electrical Specifications

| Item                                          |                                      |              | Minimum                              | Typical   | Maximum | Unit   |
|-----------------------------------------------|--------------------------------------|--------------|--------------------------------------|-----------|---------|--------|
| Frequency Range                               |                                      | $f_c$        | 154~1000MHz                          |           |         | MHz    |
| Standard Frequency                            |                                      |              | 315,330, 370,433.92,868,915          |           |         | MHz    |
| Frequency Tolerance(at 25°C)                  |                                      | $\Delta f_c$ | $\pm 50, \pm 75, \pm 150$ or specify |           |         | kHz    |
| Insertion Loss (in 50ohm system, min)         |                                      | IL           | 1.0,1.3,1.4, 1.5 or specify          |           |         | dB     |
| Temperature Stability                         | Turnover Temperature                 | $T_0$        | 25                                   | 40        | 55      | °C     |
|                                               | Turnover Frequency                   | $f_0$        |                                      | $f_c$     |         |        |
|                                               | Frequency Temperature Coefficient    | FTC          |                                      | 0.032     |         | ppm/°C |
| Frequency Aging                               | Absolute Value during the First Year | $ f_A $      |                                      | $\leq 10$ |         | ppm/yr |
| DC Insulation Resistance between Any Two Pins |                                      |              | 1.0                                  |           |         | MΩ     |
| Operating Temperature Range                   |                                      |              | -40~+85                              |           |         | °C     |
| Storage Temperature Range                     |                                      |              | -55~+125                             |           |         | °C     |

### Dimension(mm)

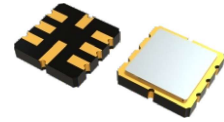


| Pin No. | Description  |
|---------|--------------|
| 2       | Input/Output |
| 5       | Output/Input |
| 1,3,4,6 | Case Ground  |

## 5.0×5.0 mm SMD SAW Resonator

### Feature

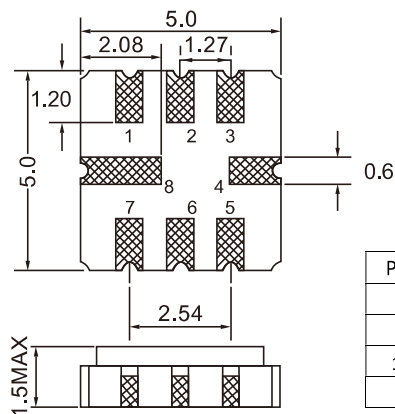
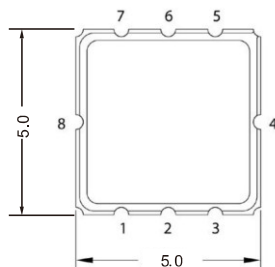
- Size 5.0x5.0x1.5 mm
- The optional frequency can be customized
- High transmit and receive sensitivity
- High temperature resistance and impact resistance
- Good power and reliability
- RoHS compliant



### Electrical Specifications

| Item                                          |                                      |              | Minimum                              | Typical   | Maximum | Unit   |
|-----------------------------------------------|--------------------------------------|--------------|--------------------------------------|-----------|---------|--------|
| Frequency Range                               |                                      | $f_c$        | 154~1000MHz                          |           |         | MHz    |
| Standard Frequency                            |                                      |              | 315,330, 370,433.92,868,915          |           |         | MHz    |
| Frequency Tolerance(at 25°C)                  |                                      | $\Delta f_c$ | $\pm 50, \pm 75, \pm 150$ or specify |           |         | kHz    |
| Insertion Loss (min)                          |                                      | IL           | 1.0,1.3,1.4, 1.5 or specify          |           |         | dB     |
| Temperature Stability                         | Turnover Temperature                 | $T_0$        | 25                                   | 40        | 55      | °C     |
|                                               | Turnover Frequency                   | $f_0$        |                                      | $f_c$     |         |        |
|                                               | Frequency Temperature Coefficient    | FTC          |                                      | 0.032     |         | ppm/°C |
| Frequency Aging                               | Absolute Value during the First Year | $ f_A $      |                                      | $\leq 10$ |         | ppm/yr |
| DC Insulation Resistance between Any Two Pins |                                      |              | 1.0                                  |           |         | MΩ     |
| Operating Temperature Range                   |                                      |              | -40~+85                              |           |         | °C     |
| Storage Temperature Range                     |                                      |              | -55~+125                             |           |         | °C     |

### Dimension(mm)

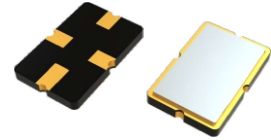


| Pin No. | Description    |
|---------|----------------|
| 2       | Input/Output   |
| 6       | Output/Input   |
| 1,3,5,7 | To be grounded |
| 4,8     | Case Ground    |

## 5.0x3.5 mm SMD SAW Resonator

### Feature

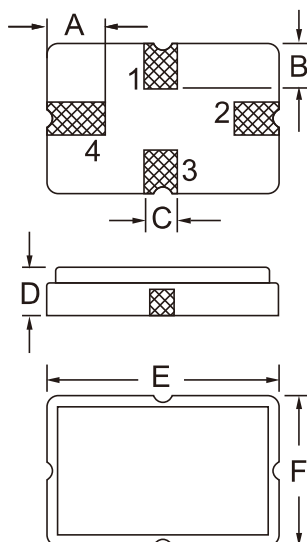
- Size 5.0x3.5x1.5 mm
- The optional frequency can be customized
- High transmit and receive sensitivity
- High temperature resistance and impact resistance
- Good power and reliability
- RoHS compliant



### Electrical Specifications

| Item                                          |                                      |              | Minimum                              | Typical   | Maximum | Unit   |
|-----------------------------------------------|--------------------------------------|--------------|--------------------------------------|-----------|---------|--------|
| Frequency Range                               |                                      | $f_c$        | 154~1000MHz                          |           |         | MHz    |
| Standard Frequency                            |                                      |              | 315,330, 370,433.92,868,915          |           |         | MHz    |
| Frequency Tolerance(at 25°C)                  |                                      | $\Delta f_c$ | $\pm 50, \pm 75, \pm 150$ or specify |           |         | kHz    |
| Insertion Loss (min)                          |                                      | IL           | 1.0,1.3,1.4, 1.5 or specify          |           |         | dB     |
| Temperature Stability                         | Turnover Temperature                 | $T_0$        | 25                                   | 40        | 55      | °C     |
|                                               | Turnover Frequency                   | $f_0$        |                                      | $f_c$     |         |        |
|                                               | Frequency Temperature Coefficient    | FTC          |                                      | 0.032     |         | ppm/°C |
| Frequency Aging                               | Absolute Value during the First Year | $ f_A $      |                                      | $\leq 10$ |         | ppm/yr |
| DC Insulation Resistance between Any Two Pins |                                      |              | 1.0                                  |           |         | MΩ     |
| Operating Temperature Range                   |                                      |              | -40~+85                              |           |         | °C     |
| Storage Temperature Range                     |                                      |              | -55~+125                             |           |         | °C     |

### Dimension(mm)



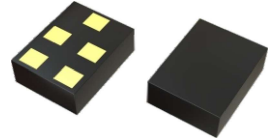
| Sign | Data (unit: mm) | Sign | Data (unit: mm) |
|------|-----------------|------|-----------------|
| A    | $1.2 \pm 0.1$   | D    | $1.4 \pm 0.1$   |
| B    | $0.8 \pm 0.1$   | E    | $5.0 \pm 0.1$   |
| C    | 0.5             | F    | $3.5 \pm 0.1$   |

| Pin No. | Description  |
|---------|--------------|
| 1       | Input/Output |
| 3       | Output/Input |
| 2,4     | Case Ground  |

## 1.1x0.9 mm SMD SAW Filter

### Feature

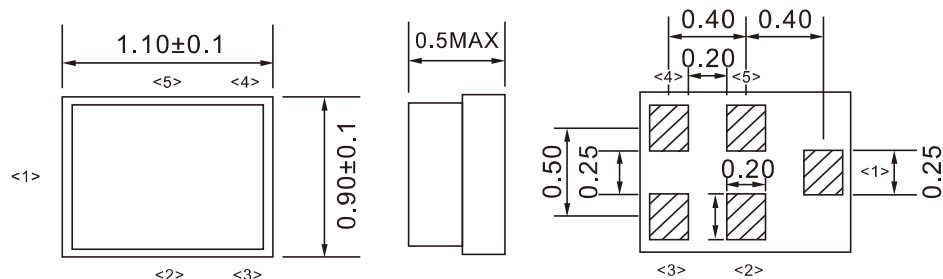
- Small size 1.1x 0.9, Ultra thin , thickness 0.5mm
- CSP process with chip scale package
- Standardization of small size
- Good stability and high reliability
- Mainly used in GPS navigation
- TDD/FDD communication and artificial intelligence chips
- RoHS compliant



### Electrical Specifications

| Item                        |       | Specifications                | Unit |
|-----------------------------|-------|-------------------------------|------|
| Frequency Range             | $f_c$ | 800~2605MHz                   | MHz  |
| Standard Frequency          |       | 1575.42, 1582.4, 1568         | MHz  |
| Useful Band Width           |       | 3, 18, 48 or specify          | MHz  |
| Insertion Loss ( min)       | IL    | 0.9, 1.3, 1.8, 2.2 or specify | dB   |
| VSWR(max)                   |       | 2.0                           | dB   |
| Operating Temperature Range |       | -40~+85                       | °C   |
| Storage Temperature Range   |       | -40~+85                       | °C   |

### Dimension(mm)

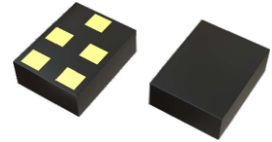


| Pin No. | Description    |
|---------|----------------|
| 1       | Input          |
| 4       | Output         |
| 2,3,5   | To be grounded |

## 1.4x1.1 mm SMD SAW Filter

### Feature

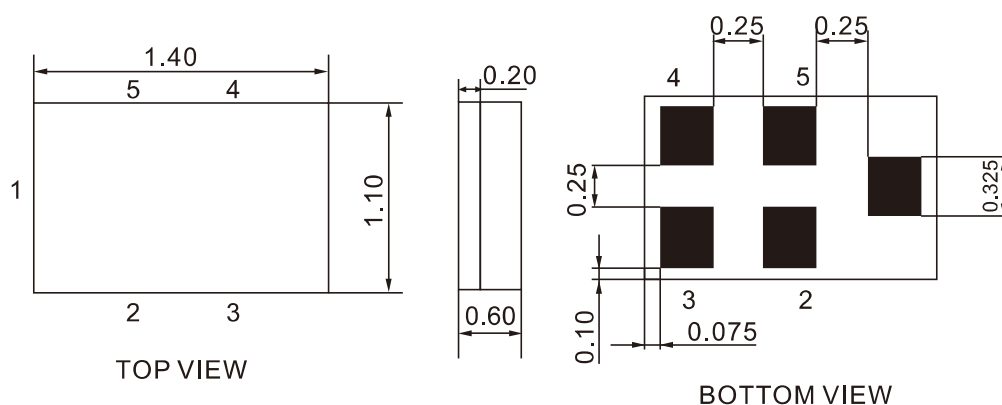
- Small size 1.4x 1.1
- CSP process with chip scale package
- Standardization of small size
- Good stability and high reliability
- Mainly used in GPS navigation
- TDD/FDD communication and artificial intelligence chips
- RoHS compliant



### Electrical Specifications

| Item                        |       | Specifications                | Unit |
|-----------------------------|-------|-------------------------------|------|
| Frequency Range             | $f_c$ | 800~2605MHz                   | MHz  |
| Standard Frequency          |       | 868.5, 1575.42, 1582.4, 1568  | MHz  |
| Useful Band Width           |       | 3, 18, 48 or specify          | MHz  |
| Insertion Loss (min)        | IL    | 0.9, 1.3, 1.8, 2.2 or specify | dB   |
| VSWR(max)                   |       | 2.0                           | dB   |
| Operating Temperature Range |       | -40~+85                       | °C   |
| Storage Temperature Range   |       | -40~+85                       | °C   |

### Dimension(mm)

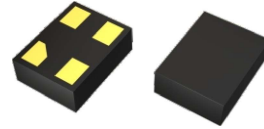


| Pin No. | Description    |
|---------|----------------|
| 1       | Input          |
| 4       | Output         |
| 2,3,5   | To be grounded |

## 2.0 x 1.5 mm SMD SAW Filter

### Feature

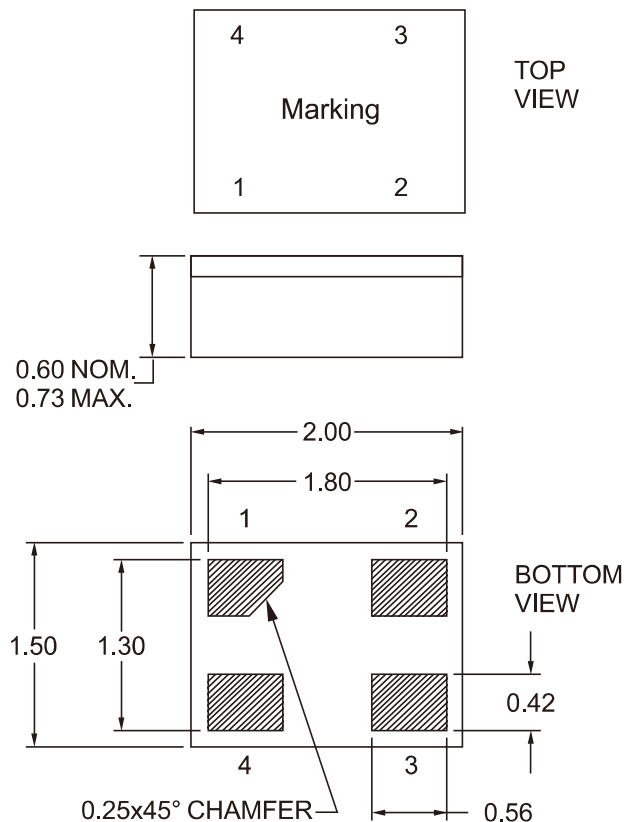
- Small size 2.0x1.5x0.6mm
- CSP process with chip scale package
- Standardization of small size
- Good stability and high reliability
- Mainly used in GPS navigation
- TDD/FDD communication and artificial intelligence chips
- RoHS compliant



### Electrical Specifications

| Item                        |       | Specifications         | Unit |
|-----------------------------|-------|------------------------|------|
| Frequency Range             | $f_c$ | 800~2605MHz            | MHz  |
| Standard Frequency          |       | 861,915, 921.5,2345    | MHz  |
| Useful Band Width           |       | 5,25,40,50 or specify  | MHz  |
| Insertion Loss ( min)       | IL    | 1.5,2.5,3.2 or specify | dB   |
| Operating Temperature Range |       | -40~+85                | °C   |
| Storage Temperature Range   |       | -40~+85                | °C   |

### Dimension(mm)

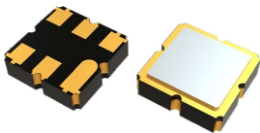


| Pin No. | Description |
|---------|-------------|
| 1       | Input       |
| 3       | Output      |
| 2,4     | Case Ground |

3.0 x 3.0 mm SMD SAW Filter

 Feature

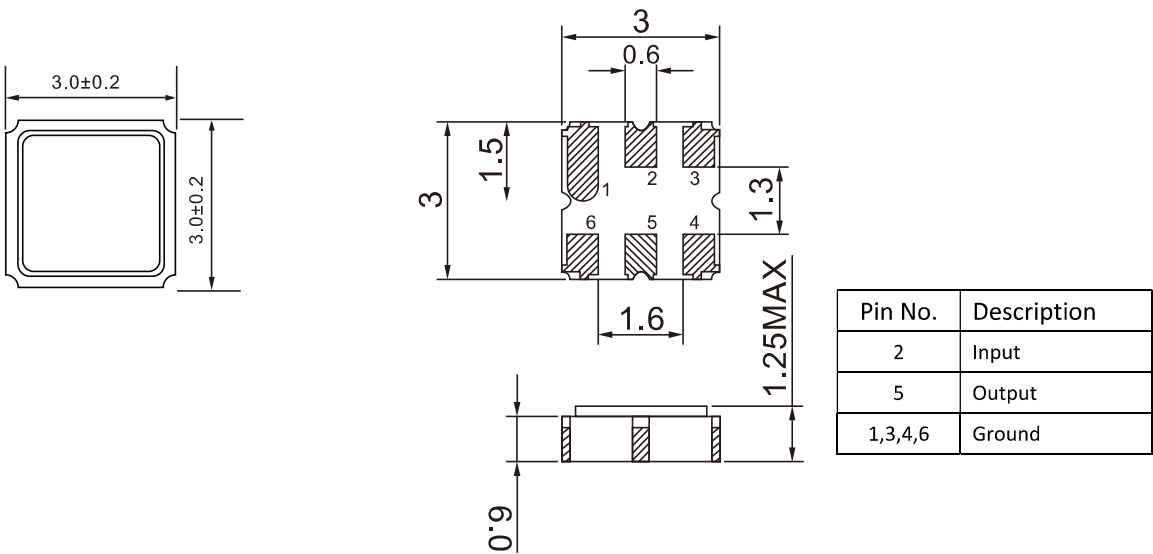
- Small size 3.0x3.0x1.25mm
- Welding can be done with automatic mounting
- Low-loss SAW component
- Low amplitude ripple
- Sharp rejections at both out-bands
- RoHS Compliant



 Electrical Specifications

| Item                        |       | Specifications                                                                            | Unit |
|-----------------------------|-------|-------------------------------------------------------------------------------------------|------|
| Frequency Range             | $f_c$ | 300~2605MHz                                                                               | MHz  |
| Standard Frequency          | $f_c$ | 433.92,861,915,1575.42,1582.4,2492<br>Band1,2,3,5,6,8,12,13,16,17,20,27,28,34,38,39,40,41 | MHz  |
| Band Width                  |       | 6, 10, 15,50 or specify                                                                   | MHz  |
| Insertion Loss ( min)       | IL    | 1.0,1.5,3.0, 6.5 or specify                                                               | dB   |
| Operating Temperature Range |       | -40~+85                                                                                   | °C   |
| Storage Temperature Range   |       | -55~+125                                                                                  | °C   |

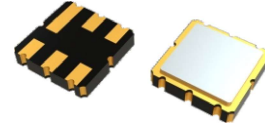
 Dimension(mm)



## 3.8×3.8 mm SMD SAW Filter

### Feature

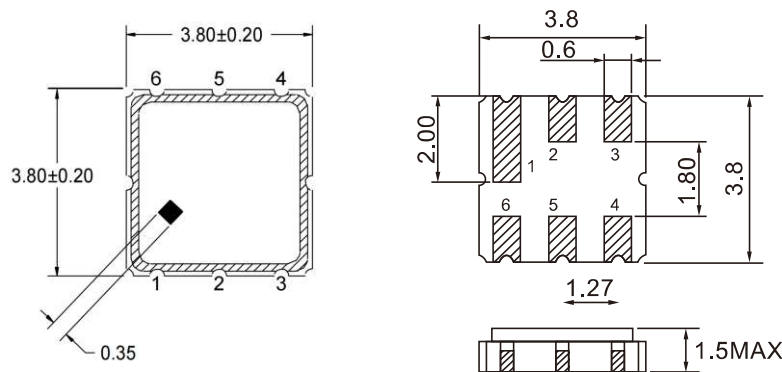
- Small size 3.8x3.8x1.5mm
- Welding can be done with automatic mounting
- Low-loss SAW component
- Low amplitude ripple
- Sharp rejections at both out-bands
- RoHS Compliant



### Electrical Specifications

| Item                        |       | Specifications                     | Unit |
|-----------------------------|-------|------------------------------------|------|
| Frequency Range             | $f_c$ | 100~1000MHz                        | MHz  |
| Standard Frequency          | $f_c$ | 315,433.92,480,500,866.5           | MHz  |
| Band Width                  |       | 2, 3, 5, 10, 20, 40, or specify    | MHz  |
| Insertion Loss ( min)       |       | 1.5, 1.8, 2.0, 3.0, 6.5 or specify | dB   |
| Operating Temperature Range | IL    | -40~+85                            | °C   |
| Storage Temperature Range   |       | -55~+125                           | °C   |

### Dimension(mm)



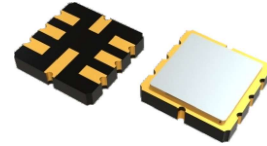
| Pin No. | Description  |
|---------|--------------|
| 2       | Input/Output |
| 5       | Output/Input |
| 1,3,4,6 | Case Ground  |



## 5.0×5.0 mm SMD SAW Filter

### Feature

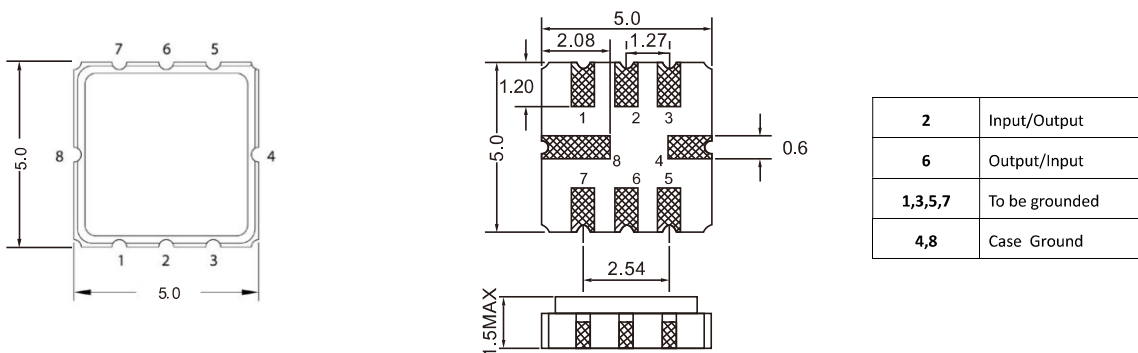
- Small size 5.0x5.0x1.5mm
- Welding can be done with automatic mounting
- Low-loss SAW component
- Low amplitude ripple
- Sharp rejections at both out-bands
- RoHS Compliant



### Electrical Specifications

| Item                        |       | Specifications                | Unit |
|-----------------------------|-------|-------------------------------|------|
| Frequency Range             | $f_c$ | 100~1000MHz                   | MHz  |
| Standard Frequency          | $f_c$ | 110,315,433.92                | MHz  |
| Band Width                  |       | 2, 3, 5, 10, 20 or specify    | MHz  |
| Insertion Loss ( min)       |       | 1.8, 2.2, 3.0, 6.5 or specify | dB   |
| Operating Temperature Range | IL    | -40~+85                       | °C   |
| Storage Temperature Range   |       | -55~+125                      | °C   |

### Dimension(mm)



## DIP Dielectric Antenna

### Feature

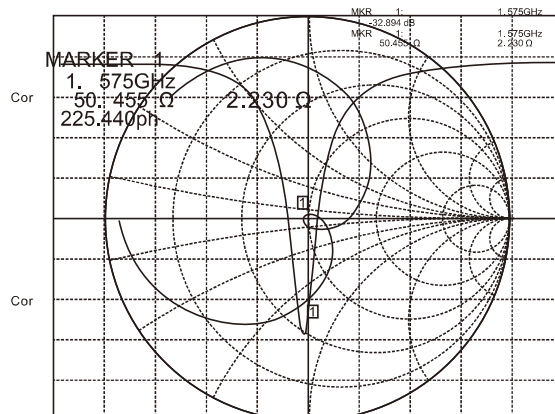
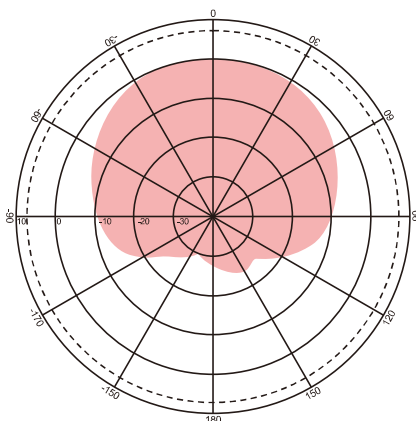
- Various Applications: GPS, BD+GPS, GPS+COMPASS and Multimode
- Various sizes: 10x10mm to 45x45mm
- High quality dielectric ceramics
- Excellent Radiation Pattern



### Electrical Specifications

| Model                         | Frequency                                               | Gain                         | Output VSWR | Size                | Polarization |
|-------------------------------|---------------------------------------------------------|------------------------------|-------------|---------------------|--------------|
| SPATB1L1G1364<br>BL5456_JHS04 | GPS L1/L5<br>BDS B1/B2a<br>GLONASS G1<br>GALILEO E1/E5a | 3.5@B1L1E1G1<br>3.0@L5E5aB2a | ≤2.0        | 45*45*6mm+36*36*4mm | RHCP         |
| SPATL1364BL54<br>08_G003      | GPS L1/L5<br>BDS B1<br>GLONASS G1<br>GALILEO E1/E5a     | 3.5@B1L1E1G1<br>2.5@L5E5a    | ≤2.0        | 40*40*8mm+36*36*4mm | RHCP         |
| SPATL1364BL53<br>66_G002      | GPS L1/L5<br>BDS B1<br>GLONASS G1<br>GALILEO E1/E5a     | 3.0@B1L1E1G1<br>1.5@L5E5a    | ≤2.0        | 36*36*6mm+36*36*4mm | RHCP         |
| GGL5-36H325H<br>4-JHY06       | GPS L1/L5<br>GLONASS G1<br>GALILEO E1/E5a               | 3.0                          | ≤1.5        | 36*36*3mm+25*25*4mm | RHCP         |
| SPATL1254BL5<br>334_G001      | GPS L1/L5<br>BDS B1<br>GLONASS G1<br>GALILEO E1/E5a     | 1.0@B1L1E1G1<br>1.0@L5E5a    | ≤2.0        | 33*33*4mm+25*25*4mm | RHCP         |
| SPATL1182BL5<br>254_J7002     | GPS L1/L5<br>GALILEO E1/E5a                             | 2.5                          | ≤2.0        | 25*25*4mm+18*18*2mm | RHCP         |
| DAS1582R36D<br>36-3F          | GPS L1<br>BDS B1<br>GALILEO E1<br>GLONASS G1            | 4                            | ≤1.5        | 36*36*6mm           | RHCP         |
| DAS1595R25Y<br>14_70          | GPS L1<br>GLONASS G1                                    | 2.5                          | ≤1.5        | 25*25*4mm           | RHCP         |
| DAS1575R25C<br>12_70          | GPS L1                                                  | 3.0                          | ≤1.5        | 25*25*2mm           | RHCP         |
| DAS1575R20C<br>14_50          | GPS L1                                                  | 3.0                          | ≤1.5        | 20*20*4mm           | RHCP         |
| DAS1575R18C<br>14_Y5003       | GPS L1                                                  | 2.5                          | ≤1.5        | 18*18*4mm           | RHCP         |
| DAS1575R15C<br>14_30          | GPS L1                                                  | 0.5                          | ≤1.5        | 15*15*4mm           | RHCP         |
| DAS1575R12C<br>14_Y2001       | GPS L1                                                  | -2.0                         | ≤1.5        | 12*12*4mm           | RHCP         |
| DAS1575R10C<br>14_20          | GPS L1                                                  | -4.0                         | ≤1.5        | 10*10*4mm           | RHCP         |

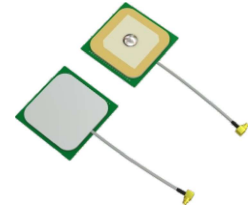
### Radiation Pattern & Directional Diagram Example



## SMD Dielectric Antenna

### Feature

- Various Applications: GPS+GLONASS, GPS+COMPASS and Multimode;
- Various sizes: 8x8mm to 25x25mm;
- High quality dielectric ceramics
- Excellent Radiation Pattern

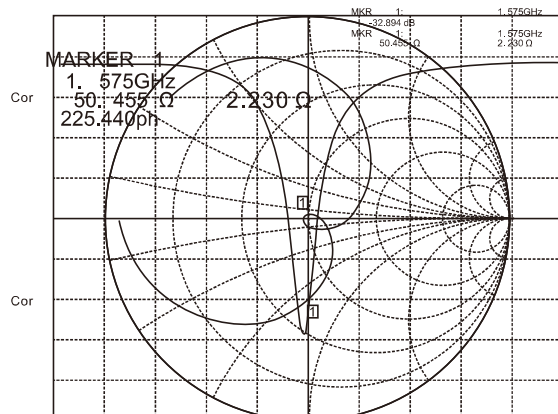
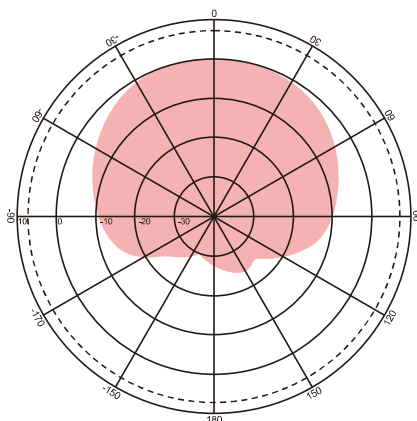


### Electrical Specifications

| Part Number | Size(mm) | Frequency (MHz) | -10dB Bandwidth (MHz) min. | VSWR (in BW) max. | Ground Plane Size(mm) | Applications |
|-------------|----------|-----------------|----------------------------|-------------------|-----------------------|--------------|
| DAS1568R25  | 25X25    | 1561-1575       | 20.0                       | 2.0               | 50X50                 | BD+GPS       |
| DAS1568R20  | 20X20    | 1561-1575       | 15.0                       | 2.0               | 50X50                 |              |
| DAS1568R18  | 18X18    | 1561-1575       | --                         | --                | 50X50                 |              |
| DAS1568R15  | 15X15    | 1561-1575       | --                         | --                | 50X50                 |              |
| DAS1568R12  | 12X12    | 1561-1575       | --                         | --                | 50X50                 |              |
| DAS1568R10  | 10X10    | 1561-1575       | --                         | --                | 50X50                 |              |
| DAS1568R09  | 9X9      | 1561-1575       | --                         | --                | 50X50                 |              |
| DAS1568R08  | 8X8      | 1561-1575       | --                         | --                | 50X50                 |              |
| DAS1575R25  | 25X25    | 1575.42         | 15.0                       | 2.0               | 50X50                 | GPS          |
| DAS1575R20  | 20X20    | 1575.42         | 10.0                       | 2.0               | 50X50                 |              |
| DAS1575R18  | 18X18    | 1575.42         | 8.0                        | 2.0               | 50X50                 |              |
| DAS1575R15  | 15X15    | 1575.42         | 8.0                        | 2.0               | 50X50                 |              |
| DAS1575R12  | 12X12    | 1575.42         | 7.0                        | 2.0               | 50X50                 |              |
| DAS1575R10  | 10X10    | 1575.42         | 6.0                        | 2.0               | 50X50                 |              |
| DAS1575R09  | 9X9      | 1575.42         | 6.0                        | 2.0               | 50X50                 |              |
| DAS1575R08  | 8X8      | 1575.42         | 5.0                        | 2.0               | 50X50                 |              |
| DAS1590R25  | 25X25    | 1575-1610       | --                         | --                | 50X50                 | GPS+GLONASS  |
| DAS1590R20  | 20X20    | 1575-1610       | --                         | --                | 50X50                 |              |
| DAS1590R18  | 18X18    | 1575-1610       | --                         | --                | 50X50                 |              |
| DAS1590R15  | 15X15    | 1575-1610       | --                         | --                | 50X50                 |              |
| DAS1590R12  | 12X12    | 1575-1610       | --                         | --                | 50X50                 |              |
| DAS1590R10  | 10X10    | 1575-1610       | --                         | --                | 50X50                 |              |
| DAS1590R09  | 9X9      | 1575-1610       | --                         | --                | 50X50                 |              |
| DAS1590R08  | 8X8      | 1575-1610       | --                         | --                | 50X50                 |              |

**Note:** 1. Antenna thickness can be customized according to actual requirements;  
 2. Beidou I, Beidou II, GLONASS and GNSS can be customized;  
 3. Antenna pads can be customized according to requirements.

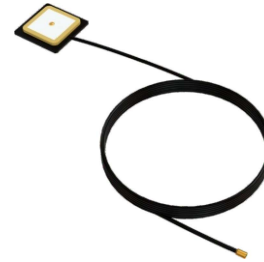
### Radiation Pattern & Directional Diagram Example



## GPS, GLONASS, Built-in navigation antenna

### Feature

- Various Frequency: GPS-L1, BDS-B1
- Various sizes: 12x12mm to 25x25mm
- High quality dielectric ceramics
- Excellent Radiation Pattern
- Application: Positioning, navigation, timing



### Electrical Specifications

| Part Number  | Size (mm) | Frequency (MHz)   | Antenna Gain (dB) | Axial Ratio (dB) | VSW R | Noise Figure (dB) | LNA Gain (dB) | Output Impedance (Ω) | Working Voltage (V) | Working Current (mA) |
|--------------|-----------|-------------------|-------------------|------------------|-------|-------------------|---------------|----------------------|---------------------|----------------------|
| WGPI2540P062 | 25X25X4   | GPS-L1            | 2.5               | 3                | 2.0:1 | 2.2               | 26            | 50                   | 3±0.5               | 11.5±1               |
| WGPI2520P062 | 25X25X2   | GPS-L1            | 1.5               | 3                | 2.0:1 | 2.2               | 26            | 50                   | 3±0.5               | 11.5±1               |
| WGPI2540P251 | 25X25X4   | GPS-L1            | 2.5               | 3                | 2.0:1 | 1.1               | 19            | 50                   | 3±0.5               | 4.5±1                |
| WGPI2540P272 | 25X25X4   | GPS-L1            | 2.5               | 3                | 2.0:1 | 1.2               | 30            | 50                   | 3±0.5               | 8.5±1                |
| WGPI2540P271 | 25X25X4   | GPS-L1            | 2.5               | 3                | 2.0:1 | 1.2               | 32            | 50                   | 3±0.5               | 8.5±1                |
| WGPI2520P271 | 25X25X2   | GPS-L1            | 1.5               | 3                | 2.0:1 | 1.2               | 32            | 50                   | 3±0.5               | 8.5±1                |
| WGPI2040P053 | 20X20X4   | GPS-L1            | 2.0               | 3                | 2.0:1 | 1.5               | 26            | 50                   | 3±0.3               | 10.0±1               |
| WGPI2020P053 | 20X20X2   | GPS-L1            | 1.0               | 3                | 2.0:1 | 1.5               | 26            | 50                   | 3±0.3               | 10.0±1               |
| WGPI1840P185 | 18X18X4   | GPS-L1            | 2.0               | 3                | 2.0:1 | 1.2               | 32            | 50                   | 3±0.5               | 8.5±1                |
| WGPI1820P185 | 18X18X2   | GPS-L1            | 1.0               | 3                | 2.0:1 | 1.2               | 32            | 50                   | 3±0.5               | 8.5±1                |
| WGPI1840P186 | 18X18X4   | GPS-L1            | 2.0               | 3                | 2.0:1 | 1.2               | 19            | 50                   | 3±0.5               | 4.2±1                |
| WGPI1540P045 | 15X15X4   | GPS-L1            | 1.5               | 3                | 2.0:1 | 1.5               | 16            | 50                   | 3±0.5               | 4.5±1                |
| WGPI1540P151 | 15X15X4   | GPS-L1            | 1.5               | 3                | 2.0:1 | 1.5               | 42            | 50                   | 3±0.5               | 8.5±1                |
| WGPI1540P152 | 15X15X4   | GPS-L1            | 1.5               | 3                | 2.0:1 | 1.2               | 22            | 50                   | 3±0.5               | 4.2±1                |
| WGBI2040P053 | 20X20X4   | GPS-L1/<br>BDS-B1 | 2.0               | 6                | 2.0:1 | 1.5               | 26            | 50                   | 3±0.3               | 10.0±1               |
| WGBI2020P053 | 20X20X2   | GPS-L1/<br>BDS-B1 | 1.0               | 6                | 2.0:1 | 1.5               | 26            | 50                   | 3±0.3               | 10.0±1               |
| WGBI1840P185 | 18X18X4   | GPS-L1/<br>BDS-B1 | 2.0               | 6                | 2.0:1 | 1.2               | 32            | 50                   | 3±0.5               | 8.5±1                |
| WGBI1820P185 | 18X18X2   | GPS-L1/ BD-<br>B1 | 1.0               | 6                | 2.0:1 | 1.2               | 32            | 50                   | 3±0.5               | 8.5±1                |
| WGBI1840P186 | 18X18X4   | GPS-L1/<br>BDS-B1 | 2.0               | 6                | 2.0:1 | 1.2               | 19            | 50                   | 3±0.5               | 4.2±1                |
| WGBI1540P045 | 15X15X4   | GPS-L1/<br>BDS-B1 | 1.5               | 6                | 2.0:1 | 1.5               | 16            | 50                   | 3±0.5               | 4.5±1                |
| WGBI1540P151 | 15X15X4   | GPS-L1/<br>BDS-B1 | 1.5               | 6                | 2.0:1 | 1.5               | 42            | 50                   | 3±0.5               | 8.5±1                |
| WBDI1540P152 | 15X15X4   | BDS-B1            | 1.5               | 3                | 2.0:1 | 1.2               | 22            | 50                   | 3±0.5               | 4.2±1                |
| WBDI1540P155 | 15X15X4   | BDS-B1            | 1.5               | 3                | 2.0:1 | 1.5               | 25            | 50                   | 3±0.5               | 8.5±1                |
| WBDI1520P152 | 15X15X2   | BDS-B1            | 0.5               | 3                | 2.0:1 | 1.2               | 22            | 50                   | 3±0.5               | 4.2±1                |
| WBDI1520P154 | 15X15X2   | GPS-L1/<br>BDS-B1 | 0.5               | 3                | 2.0:1 | 1.2               | 19            | 50                   | 3±0.5               | 4.2±1                |
| WBDI1340P033 | 13X13X4   | BDS-B1            | 0.5               | 3                | 2.0:1 | 1.5               | 16            | 50                   | 3±0.5               | 4.5±1                |
| WBDI1220P121 | 12X12X2   | BDS-B1            | 0.5               | 3                | 2.0:1 | 1.5               | 19            | 50                   | 3±0.5               | 4.2±1                |

## GPS, GLONASS, Built-in navigation antenna

### FEATURE

- Various Dimension: 43X37x13.6/61x61x18mm
- Various Frequency: GPS-L1, BDS-B1
- High quality dielectric ceramics
- Excellent Radiation Pattern
- Application: Positioning, navigation, timing



### ELECTRICAL SPECIFICATIONS

| Part Number | Frequency (MHz) | Axial Ratio Max | Antenna Gain dBi | Noise Figure max | VSWR | Current @3V | LNA Gain dB | In-band Flatness dB | Size(mm)   |            |
|-------------|-----------------|-----------------|------------------|------------------|------|-------------|-------------|---------------------|------------|------------|
| DA001       | GPS-L1          | 3dB             | 2.5dBi           | 2.2dB            | 2.0  | 11.2mA      | 26dB        | ±2dB                | 43X37X13.6 | RG-174+SMA |
| DA002       | GPS-L1/ BDS-B1  | 6dB             | 2.5dBi           | 2.2dB            | 2.0  | 11.2mA      | 26dB        | ±2dB                |            |            |
| DA003       | GPS-L1          | 8dB             | 2.0dBi           | 2.2dB            | 2.0  | 11.2mA      | 26dB        | ±2dB                |            |            |
| DA004       | GL-L1           | 10dB            | 1.5dBi           | 2.2dB            | 2.0  | 11.2mA      | 26dB        | ±2dB                |            |            |
| DA005       | GPS-L1          | 3dB             | 2.5dBi           | 1.2dB            | 2.0  | 8.4mA       | 32dB        | ±2dB                | 43X37X13.6 | RG-174+SMA |
| DA006       | GPS-L1/ BDS-N1  | 6dB             | 2.5dBi           | 1.2dB            | 2.0  | 8.4mA       | 32dB        | ±2dB                |            |            |
| DA007       | GPS-L1          | 8dB             | 2.0dBi           | 1.2dB            | 2.0  | 8.4mA       | 32dB        | ±2dB                |            |            |
| DA008       | GL-L1           | 10dB            | 1.5dBi           | 1.2dB            | 2.0  | 8.4mA       | 32dB        | ±2dB                |            |            |
| DA009       | GPS-L1          | 3dB             | 5.0dBi           | 2.2dB            | 2.0  | 11.2mA      | 26dB        | ±2dB                | 61X61X18   | RG-174+SMA |
| DA010       | GPS-L1/BDS-B1   | 3dB             | 5.0dBi           | 2.2dB            | 2.0  | 11.2mA      | 26dB        | ±2dB                |            |            |
| DA011       | GPS-L1          | 6dB             | 5.0dBi           | 2.2dB            | 2.0  | 11.2mA      | 26dB        | ±2dB                |            |            |
| DA012       | GL-L1           | 8dB             | 5.0dBi           | 2.2dB            | 2.0  | 11.2mA      | 26dB        | ±2dB                |            |            |
| DA001       | GPS-L1          | 3dB             | 5.0dBi           | 1.2dB            | 2.0  | 8.4mA       | 32dB        | ±2dB                | 61X61X18   | RG-174+SMA |
| DA002       | GPS-L1/BDS-N1   | 3dB             | 5.0dBi           | 1.2dB            | 2.0  | 8.4mA       | 32dB        | ±2dB                |            |            |
| DA001       | GPS-L1          | 8dB             | 5.0dBi           | 1.2dB            | 2.0  | 8.4mA       | 32dB        | ±2dB                |            |            |
| DA002       | GL-L1           | 10dB            | 5.0dBi           | 1.2dB            | 2.0  | 8.4mA       | 32dB        | ±2dB                |            |            |
| DA001       | BDS-B1          | 3dB             | 5.0dBi           | 1.2dB            | 2.0  | 8.4mA       | 32dB        | ±2dB                | 61X61X18   | RG-174+SMA |
| DA002       | GLONASS-L1      | 3dB             | 5.0dBi           | 1.2dB            | 2.0  | 8.4mA       | 32dB        | ±2dB                |            |            |
| DA001       | BDS-B1/GPS-L1   | 3dB             | 3.0dBi           | 1.2dB            | 2.0  | 8.4mA       | 32dB        | ±2dB                |            |            |
| DA002       | GLONASS-L1      | 3dB             | 2.5dBi           | 1.2dB            | 2.0  | 8.4mA       | 32dB        | ±2dB                |            |            |

## RFID, ETC, DSRC Dielectric Antenna

### Feature

- Various Dimension
- Stabilized Temperature Factor
- High quality dielectric ceramics
- Excellent Radiation Pattern



### Electrical Specifications

#### RFID

| Part Number | Size(mm) | Frequency(MHz) | Ground Plane Size | Applications |
|-------------|----------|----------------|-------------------|--------------|
| DAR915X3030 | 30X30    | 902-928        | 150X150           | RFID         |
| DAR915X2509 | 25X9     | 902-928        | 150X150           |              |
| DAR915X1309 | 13X9     | 902-928        | 150X150           |              |
| DAR915X1307 | 13X7     | 902-928        | 150X150           |              |
| DAR915X1207 | 12X7     | 902-928        | 150X150           |              |
| DAR915X1103 | 11X3     | 902-928        | 150X150           |              |
| DAR915X0605 | φ6X5     | 902-928        | 150X150           |              |

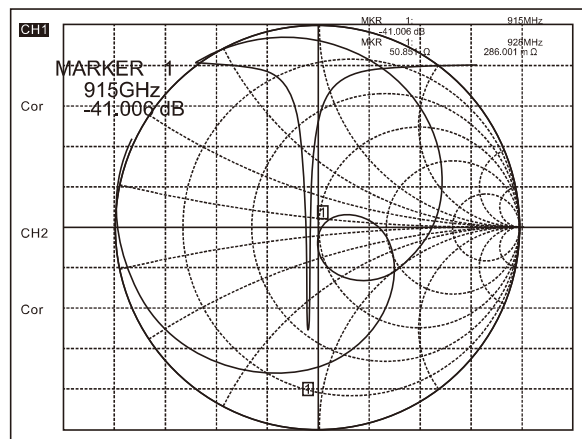
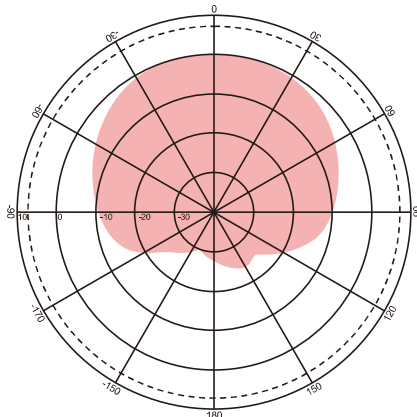
**Note:** The application frequency band of 868MHz is also applicable

#### RF Antenna

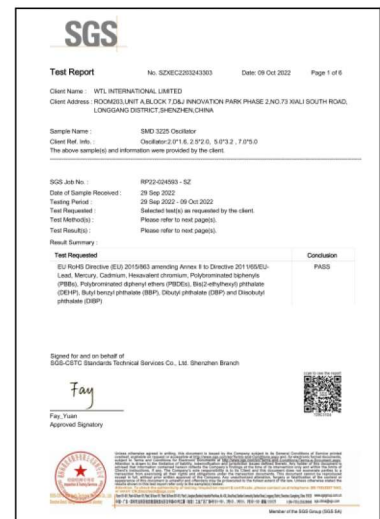
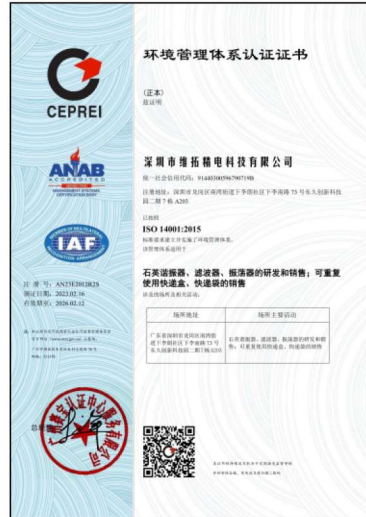
| Part Number   | Size(mm)  | Frequency(MHz) | -10dB Bandwidth (MHz) min. | VSWR (in BW) max. | Ground Plane Size | Applications   |
|---------------|-----------|----------------|----------------------------|-------------------|-------------------|----------------|
| DAE915R7880A  | 78.5X78.5 | 902-928        | 26.0                       | 2.0               | 95X95             | RFID/ETC/DS RC |
| DAE915R6150A  | 61.5X61.5 | 902-928        | 8.0                        | 2.0               | 95X95             |                |
| DAE915R4060A  | 40X40     | 902-928        | 5.0                        | 2.0               | 70X70             |                |
| DAE915R3540C  | 35.5X35.5 | 902-928        | 3.0                        | 2.0               | 40X40             |                |
| DAE915R2540J  | 25X25     | 902-928        | 2.0                        | 2.0               | 40X40             |                |
| DAE915R1840G  | 18X18     | 902-928        | 2.0                        | 2.0               | 40X40             |                |
| DAE5810R1330C | 13X13     | 5725-5850      | 400.0                      | 2.0               | 40X40             |                |

**Note:** The application frequency band of 868MHz is also applicable

### Radiation Pattern & Directional Diagram Example









# *Other Product Lines*



# Differential Crystal Oscillators with No PLL

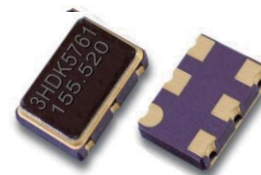
Differential

| HPK                 | HDK               | HCK               | HCLK                | SMD | 1.8 V | 2.5 V | 3.3 V | Min.     | Max.    |
|---------------------|-------------------|-------------------|---------------------|-----|-------|-------|-------|----------|---------|
| LVPECL Differential | LVDS Differential | HCSL Differential | LPHCSL Differential |     |       |       |       | 13.5 MHz | 220 MHz |

## Features

Jitter 0.2 pS ( typical )

- Femtosecond integrated phase jitter ( 200 fs ( typ. ) , 12 KHz to 20 MHz )
- Superior phase noise ( -138 dBc/Hz at 10 KHz and -144 dBc/Hz at 100 KHz offset )



General specifications , at Ta=+25°C

| Model                                               | HPK                                                                                                                      | HDK                                                                                                                      | HCK                                                                                                                      | HCLK                                                                                                                         |
|-----------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------|
| Output Logic                                        | LVPECL                                                                                                                   | LVDS                                                                                                                     | HCSL                                                                                                                     | LPHCSL                                                                                                                       |
| Package ( dimensions )<br>unit : mm                 | HPK2261 ( 2.5 * 2.0 * 1.0 )<br>HPK3261 ( 3.2 * 2.5 * 1.0 )<br>HPK5361 ( 5.0 * 3.2 * 1.2 )<br>HPK5761 ( 7.0 * 5.0 * 1.7 ) | HDK2261 ( 2.5 * 2.0 * 1.0 )<br>HDK3261 ( 3.2 * 2.5 * 1.0 )<br>HDK5361 ( 5.0 * 3.2 * 1.2 )<br>HDK5761 ( 7.0 * 5.0 * 1.7 ) | HCK2261 ( 2.5 * 2.0 * 1.0 )<br>HCK3261 ( 3.2 * 2.5 * 1.0 )<br>HCK5361 ( 5.0 * 3.2 * 1.2 )<br>HCK5761 ( 7.0 * 5.0 * 1.7 ) | HCLK2261 ( 2.5 * 2.0 * 1.0 )<br>HCLK3261 ( 3.2 * 2.5 * 1.0 )<br>HCLK5361 ( 5.0 * 3.2 * 1.2 )<br>HCLK5761 ( 7.0 * 5.0 * 1.7 ) |
| Available Frequency Range                           | 13.5 MHz ~ 220 MHz                                                                                                       | 13.5 MHz ~ 220 MHz                                                                                                       | 13.5 MHz ~ 220 MHz                                                                                                       | 95 MHz ~ 180.0 MHz                                                                                                           |
| Supply Voltage ( V <sub>DD</sub> )                  | --                                                                                                                       | +1.8 V ± 5%                                                                                                              | +1.8 V ± 5%                                                                                                              | +1.8 V ± 5%                                                                                                                  |
|                                                     | +2.5 V ± 5%                                                                                                              | +2.5 V ± 5%                                                                                                              | +2.5 V ± 5%                                                                                                              | +2.5 V ± 5%                                                                                                                  |
|                                                     | +3.3 V ± 10%                                                                                                             | +3.3 V ± 10%                                                                                                             | +3.3 V ± 10%                                                                                                             | +3.3 V ± 10%                                                                                                                 |
| Current Consumption<br>( V <sub>DD</sub> = + 3.3V ) | 30 mA ( typ. )<br>50 mA ( max. )                                                                                         | 16 mA ( typ. )<br>27 mA ( max. )                                                                                         | 17 mA ( typ. )<br>30 mA ( max. )                                                                                         | 11 mA ( typ. )<br>20 mA ( max. )                                                                                             |
| Output Logic " High " , " 1 "                       | V <sub>DD</sub> - 1.03 ( min. )<br>V <sub>DD</sub> - 0.6 ( max. )                                                        | 1.4 V ( typ. )<br>1.6 V ( max. )                                                                                         | 550 mV ( min. )<br>850 mV ( max. )                                                                                       | 550 mV ( min. )<br>900 mV ( max. )                                                                                           |
| Output Logic " Low " , " 0 "                        | V <sub>DD</sub> - 1.85 ( min. )<br>V <sub>DD</sub> - 1.6 ( max. )                                                        | 0.9 V ( min. )<br>1.1 V ( typ. )                                                                                         | -150 mV ( min. )<br>150 mV ( max. )                                                                                      | -150 mV ( min. )<br>150 mV ( max. )                                                                                          |
| Rise Time / Fall Time<br>( 20%↔80% of waveform )    | 0.3 nsec. ( typ. )<br>0.6 nsec. ( max. )                                                                                 | 0.3 nsec. ( typ. )<br>0.5 nsec. ( max. )                                                                                 | 0.3 nsec. ( typ. )<br>0.6 nsec. ( max. )                                                                                 | 0.4 nsec. ( typ. )<br>0.7 nsec. ( max. )                                                                                     |
| Output Voltage Swing                                | 595 mV ( min. ) ,<br>750 mV ( typ. ) ,<br>930 mV ( max. )                                                                | 250 mV ( min. ) ,<br>350 mV ( typ. ) ,<br>450 mV ( max. )                                                                | 400 mV ( min. )                                                                                                          | 550 mV ( min. )                                                                                                              |
| Output Load                                         | 50 Ω into Vcc - 2V or<br>Thevenin equivalent                                                                             | 100 Ω between output and<br>complimentary output                                                                         | 50 Ω to ground on<br>each output                                                                                         | None                                                                                                                         |

|                                       |                                                                                             |                                                                                                                                    |          |          |           |                                                                                                 |       |
|---------------------------------------|---------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------|----------|----------|-----------|-------------------------------------------------------------------------------------------------|-------|
| Start-up Time                         | 5.0 msec. ( typ. ) , 10 msec. ( max. )                                                      |                                                                                                                                    |          |          |           |                                                                                                 |       |
| Duty Cycle                            | 50% ± 5%                                                                                    |                                                                                                                                    |          |          |           |                                                                                                 |       |
| Storage Temperature                   | -55°C to +150°C                                                                             |                                                                                                                                    |          |          |           |                                                                                                 |       |
| Aging at Ta = +25°C                   | ± 3 ppm ( max. ) first year ; ± 2 ppm ( max. ) per year thereafter                          |                                                                                                                                    |          |          |           |                                                                                                 |       |
| RMS Jitter ( 12 KHz to 20 MHz )       | 0.2 psec ( typ. ) ; 0.5 psec ( max. ) [ For 156.250 MHz ] ; 0.18 psec ( typ. ) [ For HCLK ] |                                                                                                                                    |          |          |           |                                                                                                 |       |
| SSB Phase Noise [ dBc / Hz ( typ. ) ] | Offset                                                                                      | 10 Hz                                                                                                                              | 100 Hz   | 1 KHz    | 10 KHz    | 100 KHz                                                                                         | 1 MHz |
|                                       | 62.5 MHz                                                                                    | -50                                                                                                                                | -82      | -116     | -138      | -144                                                                                            | -149  |
|                                       | 156.250 MHz                                                                                 | -50                                                                                                                                | -80      | -115     | -135      | -142                                                                                            | -147  |
| Frequency Stability Codes             | Frequency Stability over Operating Temperature Range                                        |                                                                                                                                    | ± 25 ppm | ± 50 ppm | ± 100 ppm | If non-standard , please enter the desired stability after the " C " or " F " represents .      |       |
|                                       | Commercial ( -20°C to +70°C )                                                               |                                                                                                                                    | A        | B        | C         | For example :<br>" C20 " ± 20 ppm over -20°C to +70°C ;<br>" F30 " ± 30 ppm over -40°C to +85°C |       |
|                                       | Industrial ( -40°C to +85°C )                                                               |                                                                                                                                    | D        | E        | F         |                                                                                                 |       |
| Output Enable / Disable Function      | Enable                                                                                      | When 70% min. of V <sub>DD</sub> to Enable Output.<br>Enable time : 10 msec ( max.)                                                |          |          |           |                                                                                                 |       |
|                                       | Disable                                                                                     | When 30% max. of V <sub>DD</sub> to Disable Output.<br>Disable current : 10 uA ( max.)(OE≤0.3V) , Disable time : 0.2 usec. ( max.) |          |          |           |                                                                                                 |       |

# Superb phase noise differential oscillators

Differential

**HPEK**

**LVPECL**

**HDEK**

**LVDS**

**HCEK**

**HCSL**

**SMD**

**2.5 V**

**3.3 V**

**Min.**

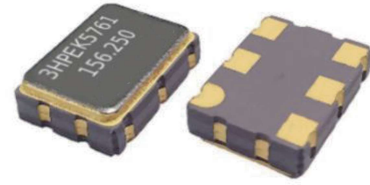
**13.5 MHz**

**Max.**

**220 MHz**

## Features

- Noise improved version for H\_EK-series
- Femtosecond integrated phase jitter ( 98 fs typical , 12 KHz to 20 MHz )
- Superior phase noise ( -149 dBc/Hz at 100 KHz and -157 dBc/Hz at 10 MHz offset )



General specifications , at Ta=+25°C

| Model                                            | HPEK                                                              | HDEK                                             | HCEK                                  |
|--------------------------------------------------|-------------------------------------------------------------------|--------------------------------------------------|---------------------------------------|
| Output Logic                                     | LVPECL                                                            | LVDS                                             | HCSL                                  |
| Available Frequency Range                        | 13.5 MHz ~ 60 MHz<br>90 MHz ~ 220 MHz                             | 13.5 MHz ~ 60 MHz<br>90 MHz ~ 220 MHz            | 13.5 MHz ~ 60 MHz<br>90 MHz ~ 220 MHz |
| Supply Voltage ( V <sub>DD</sub> )               | ---                                                               | + 2.5 V ± 10%                                    | + 2.5 V ± 10%                         |
|                                                  | + 3.3 V ± 10%                                                     | + 3.3 V ± 10%                                    | + 3.3 V ± 10%                         |
| Output Load                                      | 50 Ω into V <sub>DD</sub> - 2.0V<br>or Thevenin equivalent        | 100 Ω between output<br>and complimentary output | 50 Ω to ground on each output         |
| Rise Time / Fall Time<br>( 20%↔80% of waveform ) | 0.2 nsec ( typ. )                                                 | 0.2 nsec ( typ. )                                | 0.5 nsec ( typ. )                     |
|                                                  | 0.4 nsec ( max. )                                                 | 0.4 nsec ( max. )                                | 0.8 nsec ( max. )                     |
| Current Consumption                              | 38 mA ( typ. ) , 60 mA ( max. )                                   | 15 mA ( typ. ) , 35 mA ( max. )                  | 32 mA ( typ. ) , 40 mA ( max. )       |
| Output Logic " High " , " 1 "                    | V <sub>DD</sub> - 1.03 ( min. ) , V <sub>DD</sub> - 0.88 ( max. ) | 1.4 V ( typ. ) , 1.6 V ( max. )                  | 0.5 V ( min. ) , 0.9 V ( max. )       |
| Output Logic " Low " , " 0 "                     | V <sub>DD</sub> - 1.81 ( min. ) , V <sub>DD</sub> - 1.62 ( max. ) | 0.9 V ( min. ) , 1.1 V ( typ. )                  | - 0.15 V ( min. ) , 0.15 V ( max. )   |
| Output Swing ( single-end )                      | 400 mV ( min. )                                                   | 250 mV ( min. )                                  | 500 mV ( min. )                       |

|                           |                                                         |          |          |           |                                                                                                                                                                                                      |
|---------------------------|---------------------------------------------------------|----------|----------|-----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Frequency Stability Codes | Frequency Stability over<br>Operating Temperature Range | ± 25 ppm | ± 50 ppm | ± 100 ppm | If non-standard , please enter the desired<br>stability after the " C " or " F " represents .<br><br>For example :<br>" C20 " ± 20 ppm over -20°C to +70°C ;<br>" F30 " ± 30 ppm over -40°C to +85°C |
|                           | Commercial ( -20°C to +70°C )                           | A        | B        | C         |                                                                                                                                                                                                      |
|                           | Industrial ( -40°C to +85°C )                           | D        | E        | F         |                                                                                                                                                                                                      |

|                                      |                                                                         |                                                                                                                                         |       |        |         |       |        |
|--------------------------------------|-------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|-------|--------|---------|-------|--------|
| Start-up Time                        | 1.0 msec. ( typ. ) , 5.0 msec ( max. )                                  |                                                                                                                                         |       |        |         |       |        |
| Duty Cycle                           | 50% ± 5%                                                                |                                                                                                                                         |       |        |         |       |        |
| Storage Temperature                  | -55°C to +150°C                                                         |                                                                                                                                         |       |        |         |       |        |
| Aging at Ta = +25°C                  | ± 3 ppm ( max. ) first year                                             |                                                                                                                                         |       |        |         |       |        |
| RMS Jitter<br>( 12 KHz to 20 MHz )   | Freq. output < 100MHz : 350 fsec ( typ. ) , [ 50MHz , 3.3V , LVDS ]     |                                                                                                                                         |       |        |         |       |        |
|                                      | Freq. output > 100MHz : 98 fsec ( typ. ) , [ 156.250MHz , 3.3V , LVDS ] |                                                                                                                                         |       |        |         |       |        |
| Phase Noise<br>[ dBc / Hz ( typ. ) ] | Offset                                                                  | 100 Hz                                                                                                                                  | 1 KHz | 10 KHz | 100 KHz | 1 MHz | 10 MHz |
|                                      | 50 MHz                                                                  | -104                                                                                                                                    | -134  | -147   | -153    | -152  | -157   |
|                                      | 156.250 MHz                                                             | -93                                                                                                                                     | -123  | -140   | -149    | -152  | -157   |
| Output Enable / Disable<br>Function  | Enable                                                                  | 70% ( min. ) of V <sub>DD</sub> to enable output.<br>Enable time : 5 msec ( max. )                                                      |       |        |         |       |        |
|                                      | Disable                                                                 | 30% ( max. ) of V <sub>DD</sub> to disable output.<br>Disable current : 10 uA ( max. ) [ OE ≤ 0.3V ] , Disable time : 0.2 usec ( max. ) |       |        |         |       |        |

# Ultra Low Jitter Differential Oscillator

Differential

**HPJK**

LVPECL Differential

**HDJK**

LVDS Differential

**HCJK**

HCSL Differential

SMD

1.8 V

2.5 V

3.3 V

Min.

100 MHz

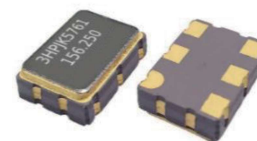
Max.

250 MHz

## Features

- Femtosecond integrated phase jitter ( 50 fs typical , 12 KHz to 20 MHz )
- Superior phase noise ( -157 dBc/Hz at 100 KHz and -164 dBc/Hz at 10 MHz offset )
- Small size for 2.5 x 2.0 mm package

Jitter 50 fsec ( typical )



General specifications , at Ta=+25°C

| Model                                            |                                                                          | HPJK                                                                   |                                                                                                                                        | HDJK                                             |          |           | HCJK                                                                                          |        |
|--------------------------------------------------|--------------------------------------------------------------------------|------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------|----------|-----------|-----------------------------------------------------------------------------------------------|--------|
| Output Logic                                     |                                                                          | LVPECL                                                                 |                                                                                                                                        | LVDS                                             |          |           | HCSL                                                                                          |        |
| Available                                        | 1.8 V ± 5%                                                               | --                                                                     |                                                                                                                                        | 100 MHz ~ 175 MHz                                |          |           | 100 MHz ~ 175 MHz                                                                             |        |
| Frequency Range                                  | 2.5 V ± 10%                                                              | 100 MHz ~ 250 MHz                                                      |                                                                                                                                        | 100 MHz ~ 250 MHz                                |          |           | 100 MHz ~ 175 MHz                                                                             |        |
| by Voltage ( V <sub>DD</sub> )                   | 3.3 V ± 10%                                                              | 100 MHz ~ 250 MHz                                                      |                                                                                                                                        | 100 MHz ~ 250 MHz                                |          |           | 100 MHz ~ 175 MHz                                                                             |        |
|                                                  | If you have frequency requirements below 100MHz, please contact Mercury. |                                                                        |                                                                                                                                        |                                                  |          |           |                                                                                               |        |
| Output Load                                      |                                                                          | 50 Ω into V <sub>DD</sub> - 2.0V<br>or Thevenin equivalent             |                                                                                                                                        | 100 Ω between output<br>and complimentary output |          |           | 50 Ω to ground on each output                                                                 |        |
| Rise Time / Fall Time<br>( 20%↔80% of waveform ) |                                                                          | 0.15 nsec ( typ. )<br>0.4 nsec ( max. )                                |                                                                                                                                        | 0.15 nsec ( typ. )<br>0.3 nsec ( max. )          |          |           | 0.2 nsec ( typ. )<br>0.6 nsec ( max. )                                                        |        |
| Current Consumption                              |                                                                          | 52 mA ( typ. ) , 65 mA ( max. )                                        |                                                                                                                                        | 22 mA ( typ. ) , 30 mA ( max. )                  |          |           | 38 mA ( typ. ) , 48 mA ( max. )                                                               |        |
| Output Logic " High " , " 1 "                    |                                                                          | V <sub>DD</sub> - 1.085 ( min. ) , V <sub>DD</sub> - 0.86 ( max. )     |                                                                                                                                        | 1.4 V ( typ. ) , 1.6 V ( max. )                  |          |           | 0.55 V ( min. ) , 1.0 V ( max. )                                                              |        |
| Output Logic " Low " , " 0 "                     |                                                                          | V <sub>DD</sub> - 1.81 ( min. ) , V <sub>DD</sub> - 1.62 ( max. )      |                                                                                                                                        | 0.9 V ( min. ) , 1.1 V ( typ. )                  |          |           | - 0.15 V ( min. ) , 0.15 V ( max. )                                                           |        |
| Output Swing ( single-end )                      |                                                                          | 400 mV ( min. )                                                        |                                                                                                                                        | 200 mV ( min. )                                  |          |           | 450 mV ( min. )                                                                               |        |
| Frequency Stability Codes                        |                                                                          | Frequency Stability over<br>Operating Temperature Range                |                                                                                                                                        | ± 25 ppm                                         | ± 50 ppm | ± 100 ppm | If non-standard , please enter the desired<br>stability after the " C " or " F " represents . |        |
|                                                  |                                                                          | Commercial ( -20°C to +70°C )                                          |                                                                                                                                        | A                                                | B        | C         | For example :<br>" C20 " ± 20 ppm over -20°C to +70°C ;                                       |        |
|                                                  |                                                                          | Industrial ( -40°C to +85°C )                                          |                                                                                                                                        | D                                                | E        | F         | " F30 " ± 30 ppm over -40°C to +85°C                                                          |        |
| Start-up Time                                    |                                                                          | 1.0 msec. ( typ. ) , 5.0 msec. ( max. )                                |                                                                                                                                        |                                                  |          |           |                                                                                               |        |
| Duty Cycle                                       |                                                                          | 50% ± 5%                                                               |                                                                                                                                        |                                                  |          |           |                                                                                               |        |
| Storage Temperature                              |                                                                          | -55°C to +150°C                                                        |                                                                                                                                        |                                                  |          |           |                                                                                               |        |
| Aging at Ta = +25°C                              |                                                                          | ± 3 ppm ( max. ) first year ; ± 2 ppm ( max. ) per year thereafter     |                                                                                                                                        |                                                  |          |           |                                                                                               |        |
| RMS Jitter<br>( 12 KHz to 20 MHz )               |                                                                          | 50 fsec ( typ. ) , 300 fsec ( max. ) [ For 156.250 MHz , LVDS , 3.3V ] |                                                                                                                                        |                                                  |          |           |                                                                                               |        |
| Phase Noise<br>[ dBc / Hz ( typ. ) ]             |                                                                          | Offset                                                                 | 100 Hz                                                                                                                                 | 1 KHz                                            | 10 KHz   | 100 KHz   | 1 MHz                                                                                         | 10 MHz |
|                                                  |                                                                          | 125.0 MHz                                                              | -114                                                                                                                                   | -135                                             | -147     | -157      | -163                                                                                          | -164   |
|                                                  |                                                                          | 156.250 MHz                                                            | -108                                                                                                                                   | -132                                             | -141     | -152      | -160                                                                                          | -161   |
| Output Enable / Disable Function                 |                                                                          | Enable                                                                 | 70% ( min. ) of V <sub>DD</sub> to enable output.<br>Enable time : 10 msec ( max. )                                                    |                                                  |          |           |                                                                                               |        |
|                                                  |                                                                          | Disable                                                                | 30% ( max. ) of V <sub>DD</sub> to disable output.<br>Disable current : 30 uA ( max. ) [ OE = GND ] , Disable time : 0.2 usec ( max. ) |                                                  |          |           |                                                                                               |        |

# Crystal Oscillators

|                           |                         |                         |                            |
|---------------------------|-------------------------|-------------------------|----------------------------|
| HP_ [LVPECL Differential] | HD_ [LVDS Differential] | HC_ [HCSL Differential] | HCL_ [LPHCSL Differential] |
|---------------------------|-------------------------|-------------------------|----------------------------|

## Part Number Format and Example

|                |             |        |   |                     |   |                  |
|----------------|-------------|--------|---|---------------------|---|------------------|
| [ 1 ]          | [ 2 ]       | [ 3 ]  | - | [ 4 ]               | - | [ 5 ]            |
| Supply Voltage | Holder Type | 1 or 2 |   | Frequency Stability |   | Center Frequency |

|         |       |    |         |   |   |     |   |         |
|---------|-------|----|---------|---|---|-----|---|---------|
| Example | ( 1 ) | 25 | HCK536  | 1 | - | C15 | - | 125.000 |
|         | ( 2 ) | 18 | HDJK576 | 2 | - | D   | - | 156.250 |

Ex ( 1 ) : 25HCK5361 - C15 - 125.000 [ +2.5V , HCK type , HCSL output , 5.0 x 3.2 mm size , OE on pad 1 , ±15 ppm from -20°C to 70°C , 125.000MHz ]

Ex ( 2 ) : 18HDJK5762 - D - 156.250 [ +1.8V , HDJK type , LVDS output , 7.0 x 5.0 mm size , OE on pad 2 , ±25 ppm from -40°C to 85°C , 156.250MHz ]

|       |                                                                        |                                                                                                                                                                                 |  |
|-------|------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| [ 1 ] | Supply voltage , " 18 " for +1.8V ; " 25 " for +2.5V ; " 3 " for +3.3V |                                                                                                                                                                                 |  |
| [ 2 ] | Holder Type                                                            |                                                                                                                                                                                 |  |
| [ 3 ] | " 1 " : OE function on pad # 1 , " 2 " : OE function on pad # 2        |                                                                                                                                                                                 |  |
| [ 4 ] | -20°C ~ 70°C                                                           | " A " ± 25ppm ; " B " ± 50ppm ; " C " ± 100ppm ;<br>If non-standard please enter the desired stability after " C " , for example " C15 " : represents ±15ppm over -20 to +70°C  |  |
|       | -40°C ~ 85°C                                                           | " D " ± 25ppm ; " E " ± 50ppm ; " F " ± 100ppm ;<br>If non-standard please enter the desired stability after " F " , for example " F30 " : represents ± 30ppm over -40 to +85°C |  |
| [ 5 ] | Frequency in MHz                                                       |                                                                                                                                                                                 |  |

## Outline Dimensions ( Unit : mm ) , Suggested pad Layout for SMDs , Test Circuits

|                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                        |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p><b>H_K226</b></p> <p>Top View: 2.5 ± 0.1, 2.0 ± 0.1, 1.0 ± 0.1</p> <p>Bottom View: 0.5, 0.6, 0.9, 0.85, 0.6</p> <p>Land Pattern: 0.6, 0.9, 0.6</p> <p>Side View: 1.0 ± 0.1</p> <p>Pad Connections :<br/>Pad 1 : OE<br/>Pad 2 : No Connection<br/>Pad 3 : Ground<br/>Pad 4 : Output<br/>Pad 5 : Complementary<br/>Pad 6 : Supply Voltage</p>         | <p><b>H_K326</b></p> <p>Top View: 3.2 ± 0.1, 2.5 ± 0.1, 1.0 ± 0.1</p> <p>Bottom View: 0.6, 0.8, 1.2, 1.5, 0.5</p> <p>Land Pattern: 0.9, 2.4, 0.5</p> <p>Side View: 1.0 ± 0.1</p> <p>Pad Connections :<br/>Pad 1 : OE<br/>Pad 2 : No Connection<br/>Pad 3 : Ground<br/>Pad 4 : Output<br/>Pad 5 : Complementary<br/>Pad 6 : Supply Voltage</p>          |
| <p><b>H_K536</b></p> <p>Top View: 5.0 ± 0.2, 3.2 ± 0.2, 1.2 ± 0.1</p> <p>Bottom View: 2.54, 2.1, 0.9, 0.64, 1.2, 1.0</p> <p>Land Pattern: 0.84, 2.54, 1.0</p> <p>Side View: 1.2 ± 0.1</p> <p>Pad Connections :<br/>Pad 1 : OE<br/>Pad 2 : No Connection<br/>Pad 3 : Ground<br/>Pad 4 : Output<br/>Pad 5 : Complementary<br/>Pad 6 : Supply Voltage</p> | <p><b>H_K576</b></p> <p>Top View: 7.0 ± 0.2, 5.0 ± 0.2, 1.7 ± 0.1</p> <p>Bottom View: 1.4 ± 0.1, 3.7, 5.08, 1.1</p> <p>Land Pattern: 5.08, 2.0, 1.8, 2.54</p> <p>Side View: 1.7 ± 0.1</p> <p>Pad Connections :<br/>Pad 1 : OE<br/>Pad 2 : No Connection<br/>Pad 3 : Ground<br/>Pad 4 : Output<br/>Pad 5 : Complementary<br/>Pad 6 : Supply Voltage</p> |
| <p><b>LVPECL Test Circuit</b></p> <p>V<sub>DD</sub> = 3.3V ; R<sub>1</sub> = R<sub>3</sub> = 127 Ω ; R<sub>2</sub> = R<sub>4</sub> = 82.5 Ω<br/>V<sub>DD</sub> = 2.5V ; R<sub>1</sub> = R<sub>3</sub> = 250 Ω ; R<sub>2</sub> = R<sub>4</sub> = 62.5 Ω</p>                                                                                             | <p><b>LVDS Test Circuit</b></p>                                                                                                                                                                                                                                                                                                                        |
| <p><b>HCSL Test Circuit</b></p> <p>Rs = 0 to 33Ω to minimize ringing in application.</p>                                                                                                                                                                                                                                                               | <p><b>LPHCSL Test Circuit for HCLK only</b></p>                                                                                                                                                                                                                                                                                                        |

# Differential Crystal Oscillators with No PLL

Differential

**HPRK**

LVPECL Differential

**HDRK**

LVDS Differential

**HCRK**

HCSL Differential

SMD

1.8 V

2.5 V

3.3 V

Min.

10.0 MHz

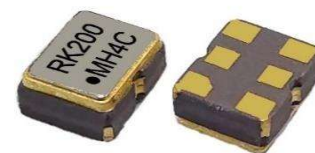
Max.

250 MHz

Features

Jitter 0.1 pS ( typical )

- Femtosecond integrated phase jitter ( 84 fs ( typ. ) , 12 KHz to 20 MHz )
- Superior phase noise ( -139 dBc/Hz at 10 KHz and -148 dBc/Hz at 100 KHz offset )
- Package size : 2.5x2.0mm , 3.2x2.5mm , 5.0x3.2mm , 7.0x5.0mm



General specifications , at Ta=+25°C

| Model                                               | HPRK                                                              | HDRK                                                      |                                                           | HCRK                                      |                   |
|-----------------------------------------------------|-------------------------------------------------------------------|-----------------------------------------------------------|-----------------------------------------------------------|-------------------------------------------|-------------------|
| Output Logic                                        | LVPECL                                                            | LVDS                                                      |                                                           | HCSL                                      |                   |
| Available Frequency Range                           | 10 MHz ~ 250 MHz                                                  | 10 MHz ~ 250 MHz                                          | 10 MHz ~ 160 MHz<br>180 MHz ~ 250 MHz                     | 20 MHz ~ 50 MHz<br>60 MHz ~ 220 MHz       | 100 MHz ~ 160 MHz |
| Supply Voltage ( V <sub>DD</sub> )                  | --                                                                | --                                                        | +1.8 V ± 5%                                               | --                                        | +1.8 V ± 5%       |
|                                                     | +2.5 V ± 10%                                                      | +2.5 V ± 10%                                              | --                                                        | +2.5 V ± 10%                              | --                |
|                                                     | +3.3 V ± 10%                                                      | +3.3 V ± 10%                                              | --                                                        | +3.3 V ± 10%                              | --                |
| Current Consumption<br>( V <sub>DD</sub> = + 3.3V ) | 32 mA ( typ. )<br>60 mA ( max. )                                  | 10 mA ( typ. )<br>25 mA ( max. )                          | 8 mA ( typ. )<br>16 mA ( max. )                           | 17 mA ( typ. )<br>35 mA ( max. )          |                   |
| Output Logic " High " , " 1 "                       | V <sub>DD</sub> - 1.03 ( min. )<br>V <sub>DD</sub> - 0.6 ( max. ) | 1.4 V ( typ. )<br>1.6 V ( max. )                          | 0.8 V ( typ. )<br>1.0 V ( max. )                          | 550 mV ( min. )<br>1.0 V ( max. )         |                   |
| Output Logic " Low " , " 0 "                        | V <sub>DD</sub> - 1.85 ( min. )<br>V <sub>DD</sub> - 1.6 ( max. ) | 0.9 V ( min. )<br>1.1 V ( typ. )                          | 0.3 V ( min. )<br>0.5 V ( typ. )                          | -150 mV ( min. )<br>150 mV ( max. )       |                   |
| Rise Time / Fall Time<br>( 20%↔80% of waveform )    | 0.3 nsec. ( typ. )<br>0.5 nsec. ( max. )                          | 0.2 nsec. ( typ. )<br>0.35 nsec. ( max. )                 | 0.2 nsec. ( typ. )<br>0.35 nsec. ( max. )                 | 0.2 nsec. ( typ. )<br>0.35 nsec. ( max. ) |                   |
| Output Voltage Swing                                | 500 mV ( min. )<br>750 mV ( typ. )                                | 300 mV ( min. ) ,<br>400 mV ( typ. ) ,<br>480 mV ( max. ) | 200 mV ( min. ) ,<br>300 mV ( typ. ) ,<br>400 mV ( max. ) | 500 mV ( min. )                           |                   |
| Output Load                                         | 50 Ω into Vcc - 2V or<br>Thevenin equivalent                      | 100 Ω between output and<br>complimentary output          |                                                           | 50 Ω to ground oneach output              |                   |

|                                       |                                                                    |                                                                                                                                        |          |          |           |                                                                                                   |       |
|---------------------------------------|--------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|----------|----------|-----------|---------------------------------------------------------------------------------------------------|-------|
| Start-up Time                         | 0.75 msec. ( typ. ) , 2.0 msec. ( max. )                           |                                                                                                                                        |          |          |           |                                                                                                   |       |
| Duty Cycle                            | 50% ± 5%                                                           |                                                                                                                                        |          |          |           |                                                                                                   |       |
| Storage Temperature                   | -55°C to +150°C                                                    |                                                                                                                                        |          |          |           |                                                                                                   |       |
| Aging at T <sub>e</sub> C             | ± 3 ppm ( max. ) first year ; ± 2 ppm ( max. ) per year thereafter |                                                                                                                                        |          |          |           |                                                                                                   |       |
| RMS Jitter ( 12 KHz to 20 MHz )       | 84 fsec ( typ. ) ; For 156.250 MHz , LVPECL 3.3V                   |                                                                                                                                        |          |          |           |                                                                                                   |       |
| SSB Phase Noise [ dBc / Hz ( typ. ) ] | Offset                                                             | 10 Hz                                                                                                                                  | 100 Hz   | 1 KHz    | 10 KHz    | 100 KHz                                                                                           | 1 MHz |
|                                       | 156.250 MHz                                                        | -63                                                                                                                                    | -97      | -134     | -139      | -148                                                                                              | -153  |
| Frequency Stability Codes             | Frequency Stability over Operating Temperature Range               |                                                                                                                                        | ± 25 ppm | ± 50 ppm | ± 100 ppm | If non-standard , please enter the desired stability after the                                    |       |
|                                       | Commercial ( -20°C to +70°C )                                      |                                                                                                                                        | A        | B        | C         | " C " ; " F " ; " J " represents .                                                                |       |
|                                       | Industrial ( -40°C to +85°C )                                      |                                                                                                                                        | D        | E        | F         | For example :<br>" C20 " ± 20 ppm over -20°C to +70°C ;<br>" F30 " ± 30 ppm over -40°C to +85°C ; |       |
|                                       | Extended Industrial ( -40°C to +105°C )                            |                                                                                                                                        | G        | H        | J         | " J40 " ± 40 ppm over -40°C to +105°C                                                             |       |
| Output Enable / Disable Function      | Enable                                                             | When 70% min. of V <sub>DD</sub> to Enable Output.<br>Enable time : 2 msec ( max. )                                                    |          |          |           |                                                                                                   |       |
|                                       | Disable                                                            | When 30% max. of V <sub>DD</sub> to Disable Output.<br>Disable current : 30 uA ( max. )(OE ≤ 0.3V) , Disable time : 0.2 usec. ( max. ) |          |          |           |                                                                                                   |       |



#### Part Number Format and Example

|         | [ 1 ]          | [ 2 ]       | [ 3 ]  | - | [ 4 ]               | - | [ 5 ]            |
|---------|----------------|-------------|--------|---|---------------------|---|------------------|
|         | Supply Voltage | Holder Type | 1 or 2 |   | Frequency Stability |   | Center Frequency |
| Example | ( 1 ) 25V3     | HDRK576     | 1      | - | E                   | - | 100.000          |
|         | ( 2 ) 18       | HPRK326     | 1      | - | D                   | - | 156.250          |

Ex ( 1 ) : **25V3HDRK5761 - E - 100.000** [ +2.5 ~ +3.3V, HDRK type, LVDS output, 7.0 x 5.0mm size, OE on pad 1, ±50 ppm from -40°C to 85°C, 100.000MHz ]

Ex ( 2 ) : **18HPRK3261 - D - 156.250** [ +1.8V, HPRK type, LVPECL output, 3.2 x 2.5mm size, OE on pad 1, ±25 ppm from -40°C to 85°C, 156.250MHz ]

|       |                                                                                                         |                                                                                                                                                                                 |  |
|-------|---------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| [ 1 ] | Supply Voltage , " 18 " for +1.8V ; " 25 " for +2.5V ; " 3 " for +3.3V ; " 25V3 " for +2.5 ~ +3.3V ±10% |                                                                                                                                                                                 |  |
| [ 2 ] | Holder Type                                                                                             |                                                                                                                                                                                 |  |
| [ 3 ] | " 1 " : OE function on pad # 1 , " 2 " : OE function on pad # 2                                         |                                                                                                                                                                                 |  |
| [ 4 ] | -20°C ~ 70°C                                                                                            | " A " ± 25ppm ; " B " ± 50ppm ; " C " ± 100ppm ;<br>If non-standard please enter the desired stability after " C " , for example " C20 " : represents ±20ppm over -20 to +70°C  |  |
|       | -40°C ~ 85°C                                                                                            | " D " ± 25ppm ; " E " ± 50ppm ; " F " ± 100ppm ;<br>If non-standard please enter the desired stability after " F " , for example " F30 " : represents ±30ppm over -40 to +85°C  |  |
|       | -40°C ~ 105°C                                                                                           | " G " ± 25ppm ; " H " ± 50ppm ; " J " ± 100ppm ;<br>If non-standard please enter the desired stability after " J " , for example " J40 " : represents ±40ppm over -40 to +105°C |  |
| [ 5 ] | Frequency in MHz                                                                                        |                                                                                                                                                                                 |  |

#### Outline Dimensions ( Unit : mm ) , Suggested pad Layout for SMDs , Test Circuits

|                                                                                                                                                                                                                                                    |  |                                                                                                                     |  |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|---------------------------------------------------------------------------------------------------------------------|--|
| <h4>H_RK226</h4>                                                                                                                                                                                                                                   |  | <h4>H_RK326</h4>                                                                                                    |  |
| <h4>H_RK536</h4>                                                                                                                                                                                                                                   |  | <h4>H_RK576</h4>                                                                                                    |  |
| <h4>LVPECL Test Circuit</h4> <p> <math>V_{DD} = 3.3V</math> ; <math>R1 = R3 = 127 \Omega</math> ; <math>R2 = R4 = 82.5 \Omega</math><br/> <math>V_{DD} = 2.5V</math> ; <math>R1 = R3 = 250 \Omega</math> ; <math>R2 = R4 = 62.5 \Omega</math> </p> |  | <h4>LVDS Test Circuit</h4>                                                                                          |  |
|                                                                                                                                                                                                                                                    |  | <h4>HCSL Test Circuit</h4> <p><math>R_s = 0</math> to <math>33\Omega</math> to minimize ringing in application.</p> |  |

# Low Jitter Crystal Oscillators

## HTQN

CMOS Waveform

## HPQN

LVPECL Differential

## HDQN

LVDS Differential

0.6 ps  
RMS Jitter

SMD

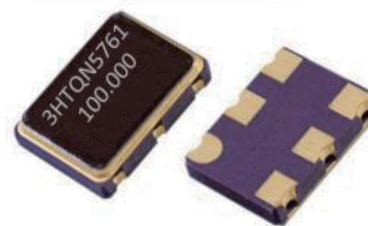
2.5 V 3.3 V

Min.  
50 MHz

Max.  
1,500 MHz

### Features

- The HTQN, HPQN and HDQN Series are members of Mercury's Low Jitter Crystal Oscillators
- Output frequency range : 50 MHz to 1,500 MHz
- Low RMS Jitter 0.6 ps typical ( 12kHz to 20MHz )
- Package size : 3.2x2.5mm , 5.0x3.2mm , 7.0x5.0mm



General specifications , at Ta=+25°C

| Model                                                        | HTQN                                                                    |                                                                                                                                | HPQN                                                                    |          |           |                                                                                                 | HDQN                                                                    |        |  |
|--------------------------------------------------------------|-------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------|----------|-----------|-------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------|--------|--|
| Output Logic                                                 | CMOS                                                                    |                                                                                                                                | LVPECL                                                                  |          |           |                                                                                                 | LVDS                                                                    |        |  |
| Supply Voltage V <sub>DD</sub> ( code )                      | + 2.5 V ± 5% ( voltage code " 25 " )                                    |                                                                                                                                | + 2.5 V ± 5% ( voltage code " 25 " )                                    |          |           |                                                                                                 | + 2.5 V ± 5% ( voltage code " 25 " )                                    |        |  |
|                                                              | + 3.3 V ± 10% ( voltage code " 3 " )                                    |                                                                                                                                | + 3.3 V ± 10% ( voltage code " 3 " )                                    |          |           |                                                                                                 | + 3.3 V ± 10% ( voltage code " 3 " )                                    |        |  |
| Available Frequency Range                                    | 50 ~ 250 MHz                                                            |                                                                                                                                | 50 ~ 1,500 MHz                                                          |          |           |                                                                                                 | 50 ~ 1,500 MHz                                                          |        |  |
| Output Load                                                  | 15 pF                                                                   |                                                                                                                                | 50 Ω into V <sub>cc</sub> - 2V or Thevenin equivalent                   |          |           |                                                                                                 | 100 Ω                                                                   |        |  |
| Output Logic " High " , " 1 "                                | 90 % V <sub>DD</sub>                                                    |                                                                                                                                | V <sub>DD</sub> - 1.03 ( min. ) , V <sub>DD</sub> - 0.6 ( max. )        |          |           |                                                                                                 | 1.4 V ( typ. ) , 1.6 V ( max. )                                         |        |  |
| Output Logic " Low " , " 0 "                                 | 10 % V <sub>DD</sub>                                                    |                                                                                                                                | V <sub>DD</sub> - 1.85 ( min. ) , V <sub>DD</sub> - 1.6 ( max. )        |          |           |                                                                                                 | 1.1 V ( typ. ) , 0.9 V ( min. )                                         |        |  |
| Current with Output Disable                                  | 16 mA ( typ. )                                                          |                                                                                                                                | 16 mA ( typ. )                                                          |          |           |                                                                                                 | 16 mA ( typ. )                                                          |        |  |
| Current Consumption ( max. )<br>( V <sub>DD</sub> = + 3.3V ) | 50 ~ 100 MHz : 30 mA                                                    |                                                                                                                                | 150 ~ 250 MHz : 50 mA                                                   |          |           |                                                                                                 | 150 ~ 250 MHz : 30 mA                                                   |        |  |
|                                                              | 101 ~ 150 MHz : 38 mA                                                   |                                                                                                                                | 251 ~ 750 MHz : 55 mA                                                   |          |           |                                                                                                 | 251 ~ 750 MHz : 34 mA                                                   |        |  |
|                                                              | 151 ~ 200 MHz : 43 mA                                                   |                                                                                                                                | 751 ~ 1000 MHz : 57 mA                                                  |          |           |                                                                                                 | 751 ~ 1,000 MHz : 38 mA                                                 |        |  |
|                                                              | 201 ~ 250 MHz : 48 mA                                                   |                                                                                                                                | 1001 ~ 1500 MHz : 60 mA                                                 |          |           |                                                                                                 | 1001 ~ 1,500 MHz : 40 mA                                                |        |  |
| Rise Time / Fall Time                                        | 1.5 nsec. ( typ. ) , 3.0 nsec. ( max. )<br>Tr / Tf : 10% ↔ 90% waveform |                                                                                                                                | 0.2 nsec. ( typ. ) , 0.5 nsec. ( max. )<br>Tr / Tf : 20% ↔ 80% waveform |          |           |                                                                                                 | 0.2 nsec. ( Typ. ) , 0.5 nsec. ( max. )<br>Tr / Tf : 20% ↔ 80% waveform |        |  |
| Start-up Time                                                | 10 msec. ( max. )                                                       |                                                                                                                                | 5.0 msec. ( typ. ) , 10 msec. ( max. )                                  |          |           |                                                                                                 | 5.0 msec. ( typ. ) , 10 msec. ( max. )                                  |        |  |
| Aging at Ta = +25°C                                          | ± 5 ppm ( max. ) for first year                                         |                                                                                                                                | ± 3 ppm ( max. ) first year ;<br>± 2 ppm ( max. ) per year thereafter   |          |           |                                                                                                 | ± 3 ppm ( max. ) first year ;<br>± 2 ppm ( max. ) per year thereafter   |        |  |
| Duty Cycle                                                   | 50% ± 5%                                                                |                                                                                                                                |                                                                         |          |           |                                                                                                 |                                                                         |        |  |
| Storage Temperature                                          | -55°C to +150°C                                                         |                                                                                                                                |                                                                         |          |           |                                                                                                 |                                                                         |        |  |
| RMS Jitter ( 12 KHz to 20 MHz )                              | 0.6 psec ( typ. )                                                       |                                                                                                                                |                                                                         |          |           |                                                                                                 |                                                                         |        |  |
| SSB Phase Noise [ dBc / Hz ( typ. ) ]                        | Offset                                                                  | 10 Hz                                                                                                                          | 100 Hz                                                                  | 1 KHz    | 10 KHz    | 100 KHz                                                                                         | 1 MHz                                                                   | 10 MHz |  |
|                                                              | 156.250 MHz                                                             | -55                                                                                                                            | - 85                                                                    | -109     | -116      | -118                                                                                            | -139                                                                    | -146   |  |
|                                                              | 622.08 MHz                                                              | -48                                                                                                                            | - 85                                                                    | -101     | -102      | -103                                                                                            | -124                                                                    | -133   |  |
| Frequency Stability Codes                                    | Frequency Stability over Operating Temperature Range                    |                                                                                                                                | ± 25 ppm                                                                | ± 50 ppm | ± 100 ppm | If non-standard , please enter the desired stability after the " C " or " F " represents .      |                                                                         |        |  |
|                                                              | Commercial ( -20°C to +70°C )                                           |                                                                                                                                | A                                                                       | B        | C         | For example :<br>" C20 " ± 20 ppm over -20°C to +70°C ;<br>" F30 " ± 30 ppm over -40°C to +85°C |                                                                         |        |  |
|                                                              | Industrial ( -40°C to +85°C )                                           |                                                                                                                                | D                                                                       | E        | F         |                                                                                                 |                                                                         |        |  |
| Output Enable / Disable . condition                          | Enable                                                                  | When 70% ( min. ) of V <sub>DD</sub> to Enable Output.<br>Enable time : 200 msec ( max. )                                      |                                                                         |          |           |                                                                                                 |                                                                         |        |  |
|                                                              | Disable                                                                 | When 30% ( max. ) of V <sub>DD</sub> to Disable Output.<br>Disable current : 16 mA ( max. ) , Disable time : 50 nsec. ( max. ) |                                                                         |          |           |                                                                                                 |                                                                         |        |  |

# Crystal Oscillators

HTQN [ CMOS Waveform ]

HPQN [ LVPECL Differential ]

HDQN [ LVDS Differential ]

## Part Number Format and Example

|         | [ 1 ]          | [ 2 ]       | [ 3 ]  |   | [ 4 ]               |   | [ 5 ]            |
|---------|----------------|-------------|--------|---|---------------------|---|------------------|
|         | Supply Voltage | Holder Type | 1 or 2 | - | Frequency Stability | - | Center Frequency |
| Example | ( 1 ) 25       | HPQN576     | 2      | - | D                   | - | 622.080          |
|         | ( 2 ) 3        | HDQN326     | 1      | - | A                   | - | 100.000          |

Ex (1) : **25HPQN5762 - D - 622.080** [ +2.5V , H\_ 576 type , LVPECL output , QN series , OE on pad # 2 ,  $\pm 25$  ppm from  $-40^{\circ}\text{C}$  to  $85^{\circ}\text{C}$  , 622.080MHz ]

Ex (2) : **3HDQN3261 - A - 100.000** [ +3.3V , H\_ 326 type , LVDS output , QN series , OE on pad # 1 ,  $\pm 25$  ppm from  $-20^{\circ}\text{C}$  to  $70^{\circ}\text{C}$  , 100.000MHz ]

|       |                                                                 |                                                                                                                                                                                 |  |
|-------|-----------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| [ 1 ] | Supply voltage , " 2.5 " for +2.5V ; " 3 " for +3.3V            |                                                                                                                                                                                 |  |
| [ 2 ] | Holder Type                                                     |                                                                                                                                                                                 |  |
| [ 3 ] | " 1 " : OE function on pad # 1 , " 2 " : OE function on pad # 2 |                                                                                                                                                                                 |  |
| [ 4 ] | -20°C ~ 70°C                                                    | " A " ± 25ppm ; " B " ± 50ppm ; " C " ± 100ppm ;<br>If non-standard please enter the desired stability after " C " , for example " C15 " : represents ±15ppm over -20 to +70°C  |  |
|       | -40°C ~ 85°C                                                    | " D " ± 25ppm ; " E " ± 50ppm ; " F " ± 100ppm ;<br>If non-standard please enter the desired stability after " F " , for example " F30 " : represents ± 30ppm over -40 to +85°C |  |
| [ 5 ] | Frequency in MHz                                                |                                                                                                                                                                                 |  |

Outline Dimensions ( Unit : mm ) , Suggested pad Layout for SMDs ; Test Circuit

|                              |  |                                                                                                                                                                                                                                                                       |  |
|------------------------------|--|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| <b>H_QN326</b><br>           |  | <b>H_QN536</b><br>                                                                                                                                                                                                                                                    |  |
| <b>H_QN576</b><br>           |  | <b>Pad Connections :</b><br>Pad 1 : Output Enable<br>Pad 2 : No Connection<br>Pad 3 : Ground<br>Pad 4 : CMOS : Output , Differential : Output<br>Pad 5 : CMOS : No Connection , Differential : Complementary Output<br>Pad 6 : Supply Voltage                         |  |
| <b>CMOS Test Circuit</b><br> |  | <b>LVPECL Test Circuit</b><br><p> <math>V_{DD} = 3.3\text{V}</math> ; <math>R1 = R3 = 127\ \Omega</math> ; <math>R2 = R4 = 82.5\ \Omega</math><br/> <math>V_{DD} = 2.5\text{V}</math> ; <math>R1 = R3 = 250\ \Omega</math> ; <math>R2 = R4 = 62.5\ \Omega</math> </p> |  |
|                              |  | <b>LVDS Test Circuit</b><br>                                                                                                                                                                                                                                          |  |



# Crystal Oscillators [ Quick - Turn Clock Oscillators , 10 ~ 1500 MHz ]

## HTQF

CMOS Waveform

## HPQF

LVPECL Differential

## HDQF

LVDS Differential

Q family

F series

SMD

2.5 V

3.3 V

Min.

10 MHz

Max.

1,500 MHz

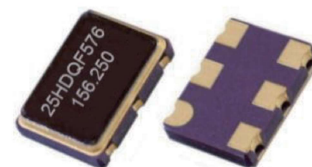
Features

Quick - Turn Clock Oscillators

0.8 ps Phase Jitter ( typical )

- The HTQF, HPQF and HDQF Series are members of Mercury's Q-Family Quick-Turn crystal oscillators
- Output frequency range : 10 MHz to 1,500 MHz
- Package size : 3.2 x 2.5mm , 5.0 x 3.2mm , 7.0 x 5.0mm
- Next-day samples for prototypes

General specifications , at Ta=+25°C



| Model                                                        | HTQF                                                          |       |        | HPQF                                                             |        |         | HDQF                                    |        |
|--------------------------------------------------------------|---------------------------------------------------------------|-------|--------|------------------------------------------------------------------|--------|---------|-----------------------------------------|--------|
| Output Logic                                                 | CMOS                                                          |       |        | LVPECL                                                           |        |         | LVDS                                    |        |
| Supply Voltage V <sub>DD</sub> ( code )                      | + 2.5 V ± 5% ( voltage code " 25 " )                          |       |        | + 2.5 V ± 5% ( voltage code " 25 " )                             |        |         | + 2.5 V ± 5% ( voltage code " 25 " )    |        |
|                                                              | + 3.3 V ± 10% ( voltage code " 3 " )                          |       |        | + 3.3 V ± 10% ( voltage code " 3 " )                             |        |         | + 3.3 V ± 10% ( voltage code " 3 " )    |        |
| Available Frequency Range                                    | 10 ~ 250 MHz                                                  |       |        | 10 ~ 1,500 MHz                                                   |        |         | 10 ~ 1,500 MHz                          |        |
| Load                                                         | 15 pF                                                         |       |        | 50 Ω into V <sub>CC</sub> - 2V or Thevenin equivalent            |        |         | 100 Ω                                   |        |
| Output Logic " High " , " 1 "                                | 90 % V <sub>DD</sub>                                          |       |        | V <sub>DD</sub> - 1.03 ( min. ) , V <sub>DD</sub> - 0.6 ( max. ) |        |         | 1.4 V ( typ. ) , 1.6 V ( max. )         |        |
| Output Logic " Low " , " 0 "                                 | 10 % V <sub>DD</sub>                                          |       |        | V <sub>DD</sub> - 1.85 ( min. ) , V <sub>DD</sub> - 1.6 ( max. ) |        |         | 1.1 V ( typ. ) , 0.9 V ( min. )         |        |
| Current with Output Disable                                  | 16 mA ( typ. )                                                |       |        | 16 mA ( typ. )                                                   |        |         | 16 mA ( typ. )                          |        |
| Current Consumption ( Max. )<br>( V <sub>DD</sub> = + 3.3V ) | 10 ~ 50 MHz : 30 mA                                           |       |        | 10 ~ 250 MHz : 50 mA                                             |        |         | 10 ~ 250 MHz : 30 mA                    |        |
|                                                              | 51 ~ 150 MHz : 38 mA                                          |       |        | 251 ~ 750 MHz : 55 mA                                            |        |         | 251 ~ 750 MHz : 34 mA                   |        |
|                                                              | 151 ~ 250 MHz : 48 mA                                         |       |        | 751 ~ 1,500 MHz : 60 mA                                          |        |         | 751 ~ 1,500 MHz : 40 mA                 |        |
| Rise Time / Fall Time                                        | 1.5 nsec. ( typ. ) , 3.0 nsec. ( max. )                       |       |        | 0.2 nsec. ( typ. ) , 0.5 nsec. ( max. )                          |        |         | 0.2 nsec. ( typ. ) , 0.4 nsec. ( max. ) |        |
|                                                              | Tr / Tf : 10% ↔ 90% waveform                                  |       |        | Tr / Tf : 20% ↔ 80% waveform                                     |        |         | Tr / Tf : 20% ↔ 80% waveform            |        |
| Duty Cycle                                                   | 50% ± 5%                                                      |       |        |                                                                  |        |         |                                         |        |
| Start-up Time                                                | 10 msec. ( max. )                                             |       |        |                                                                  |        |         |                                         |        |
| Aging at Ta = +25°C                                          | ± 2 ppm ( max. ) first year ; ± 10 ppm ( max. ) over 10 years |       |        |                                                                  |        |         |                                         |        |
| Storage Temperature                                          | -55°C to +150°C                                               |       |        |                                                                  |        |         |                                         |        |
| RMS Jitter ( 12 KHz to 20 MHz )                              | 0.8 psec ( typ. )                                             |       |        |                                                                  |        |         |                                         |        |
| SSB Phase Noise<br>[ dBc / Hz ( typ. ) ]                     | Offset                                                        | 10 Hz | 100 Hz | 1 KHz                                                            | 10 KHz | 100 KHz | 1 MHz                                   | 10 MHz |
|                                                              | 156.250 MHz                                                   | -55   | -85    | -109                                                             | -116   | -118    | -139                                    | -146   |
|                                                              | 622.08 MHz                                                    | -48   | -85    | -101                                                             | -102   | -103    | -124                                    | -133   |

|                           |                                                      |          |          |           |                                                                                                                                                                                                   |
|---------------------------|------------------------------------------------------|----------|----------|-----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Frequency Stability Codes | Frequency Stability over Operating Temperature Range | ± 25 ppm | ± 50 ppm | ± 100 ppm | If non-standard , please enter the desired stability after the " C " or " F " represents .<br><br>For example :<br>" C20 " ± 20 ppm over -20°C to +70°C ;<br>" F30 " ± 30 ppm over -40°C to +85°C |
|                           | Commercial ( -20°C to +70°C )                        | A        | B        | C         |                                                                                                                                                                                                   |
|                           | Industrial ( -40°C to +85°C )                        | D        | E        | F         |                                                                                                                                                                                                   |

### Output Enable Function

|                                   |                                                                                 |
|-----------------------------------|---------------------------------------------------------------------------------|
| OE Control on Pad 1               | 70% of V <sub>DD</sub> ( min. ) to enable output. ( Open connection prohibit. ) |
|                                   | 30% of V <sub>DD</sub> ( max. ) to disable output.                              |
| Output Enable Time / Disable Time | 200 nsec. ( max. ) / 50 nsec. ( max. )                                          |

# Crystal Oscillators [ Quick - Turn Clock Oscillators , 10 ~ 1500 MHz ]

HTQF [ CMOS Waveform ]

HPQF [ LVPECL Differential ]

HDQF [ LVDS Differential ]

## Part Number Format and Example

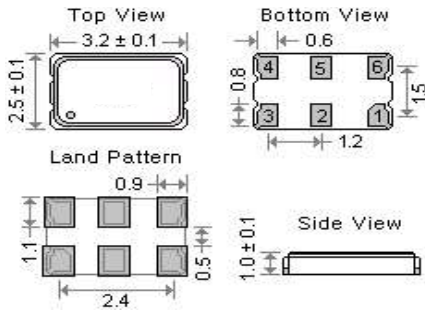
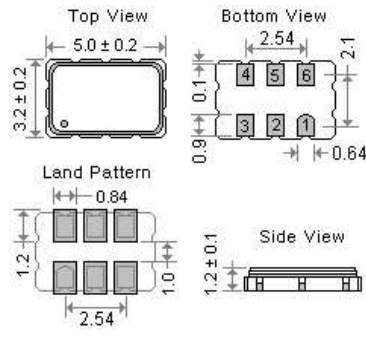
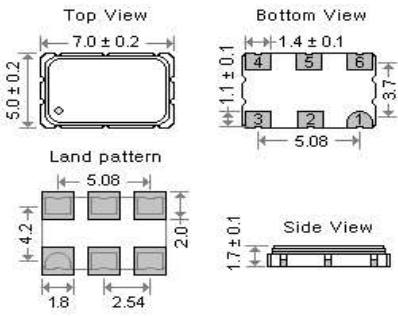
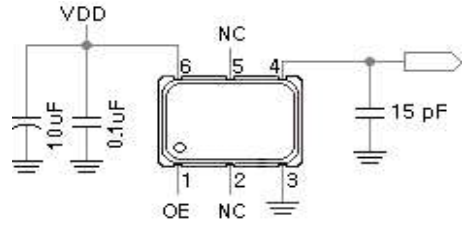
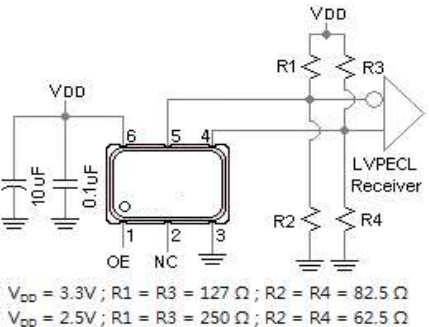
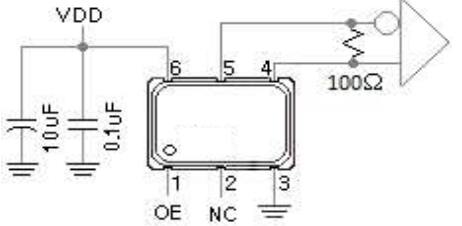
|         | [ 1 ]          | [ 2 ]       | [ 3 ]  |   | [ 4 ]               |   | [ 5 ]            |
|---------|----------------|-------------|--------|---|---------------------|---|------------------|
|         | Supply Voltage | Holder Type | 1 or 2 | - | Frequency Stability | - | Center Frequency |
| Example | (1) 3          | HTQF536     | 2      | - | B                   | - | 200.000          |
|         | (2) 3          | HDQF326     | 1      | - | A                   | - | 100.000          |

Ex (1) : **3HTQF5362 - B - 200.000** [ +3.3V , H\_ 536 type , CMOS output , QF series , OE on pad # 2 , ±50 ppm from -20°C to 70°C , 200.000MHz ]

Ex (2) : **3HDQF3261 - A - 100.000** [ +3.3V , H\_ 326 type , LVDS output , QF series , OE on pad # 1 , ±25 ppm from -20°C to 70°C , 100.000MHz ]

|       |                                                                 |                                                                                                                                                                                 |  |
|-------|-----------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| [ 1 ] | Supply voltage , " 25 " for +2.5V ; " 3 " for +3.3V             |                                                                                                                                                                                 |  |
| [ 2 ] | Holder Type                                                     |                                                                                                                                                                                 |  |
| [ 3 ] | " 1 " : OE function on pad # 1 ; " 2 " : OE function on pad # 2 |                                                                                                                                                                                 |  |
| [ 4 ] | -20°C ~ 70°C                                                    | " A " ± 25ppm ; " B " ± 50ppm ; " C " ± 100ppm ;<br>If non-standard please enter the desired stability after " C " , for example " C15 " : represents ±15ppm over -20 to +70°C  |  |
|       | -40°C ~ 85°C                                                    | " D " ± 25ppm ; " E " ± 50ppm ; " F " ± 100ppm ;<br>If non-standard please enter the desired stability after " F " , for example " F30 " : represents ± 30ppm over -40 to +85°C |  |
| [ 5 ] | Frequency in MHz                                                |                                                                                                                                                                                 |  |

## Outline Dimensions ( Unit : mm ) , Suggested pad Layout for SMDs ; Test Circuit

|                                                                                                                |  |                                                                                                                                                                                                                                                                                      |  |
|----------------------------------------------------------------------------------------------------------------|--|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| <b>H_QF326</b><br>           |  | <b>H_QF536</b><br>                                                                                                                                                                                |  |
| <b>H_QF576</b><br>          |  | <b>Pad Connections :</b><br>Pad 1 : Output Enable<br>Pad 2 : No Connection<br>Pad 3 : Ground<br>Pad 4 : CMOS : Output , Differential : Output<br>Pad 5 : CMOS : No Connection , Differential : Complementary Output<br>Pad 6 : Supply Voltage                                        |  |
| <b>CMOS Test Circuit</b><br> |  | <b>LVPECL Test Circuit</b><br> <p> <math>V_{DD} = 3.3V ; R1 = R3 = 127 \Omega ; R2 = R4 = 82.5 \Omega</math><br/> <math>V_{DD} = 2.5V ; R1 = R3 = 250 \Omega ; R2 = R4 = 62.5 \Omega</math> </p> |  |
|                                                                                                                |  | <b>LVDS Test Circuit</b><br>                                                                                                                                                                    |  |

# High Frequency Ultra-low Jitter Crystal Oscillators [ Quick - Turn Oscillators , 50 ~ 2,100 MHz ]

## H\_JFN

CMOS / Differential

**Quick - Turn  
Clock Oscillators**

**150 fsec  
RMS Jitter**

**SMD**

**1.8 V**

**2.5 V**

**3.3 V**

**Min.**

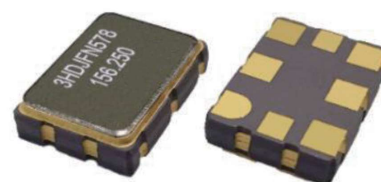
**50 MHz**

**Max.**

**2,100 MHz**

### Features

- High Frequency Range : 50 ~ 2,100 MHz
- Ultra-low RMS Jitter : 150 fsec ( typ. ) @ 3.3V , 156.250 MHz
- Package Size : 3.2 x 2.5mm and 5.0 x 3.2mm and 7.0 x 5.0mm
- Next-Day sample for Prototypes



General specifications , at Ta = +25°C

| Model                                             | HTJFN                                                                                           | HPJFN                                                                  | HDJFN                                                                | HCJFN                                                                    | HQJFN                                                                 |
|---------------------------------------------------|-------------------------------------------------------------------------------------------------|------------------------------------------------------------------------|----------------------------------------------------------------------|--------------------------------------------------------------------------|-----------------------------------------------------------------------|
| Output Logic                                      | CMOS (*1)                                                                                       | LVPECL                                                                 | LVDS                                                                 | HCSL                                                                     | CML                                                                   |
| Supply Voltage ( V <sub>DD</sub> )                | + 1.8 V ± 5%                                                                                    | ---                                                                    | + 1.8 V ± 5% (*2)                                                    | + 1.8 V ± 5%                                                             | + 1.8 V ± 5%                                                          |
|                                                   | + 2.5 V ± 10%                                                                                   | + 2.5 V ± 10%                                                          | + 2.5 V ± 10%                                                        | + 2.5 V ± 10%                                                            | + 2.5 V ± 10%                                                         |
|                                                   | + 3.3 V ± 10%                                                                                   | + 3.3 V ± 10%                                                          | + 3.3 V ± 10%                                                        | + 3.3 V ± 10%                                                            | + 3.3 V ± 10%                                                         |
| Available Frequency Range                         | 50 ~ 250 MHz                                                                                    | 50 ~ 2,100 MHz                                                         | 50 ~ 2,100 MHz                                                       | 50 ~ 700 MHz                                                             | 50 ~ 2,100 MHz                                                        |
| Output Load                                       | 15 pF ( max. )                                                                                  | 50 Ω into V <sub>DD</sub> - 2V or Thevenin equivalent                  | 100 Ω                                                                | 50 Ω to GND                                                              | 50 Ω to V <sub>DD</sub>                                               |
| Output Logic " High " , " 1 "                     | V <sub>DD</sub> - 0.4 V ( min. )                                                                | V <sub>DD</sub> - 1.165 V ( min. )<br>V <sub>DD</sub> - 0.8 V ( max. ) | V <sub>DD</sub> : 1.4 V ( typ. )<br>V <sub>DD</sub> : 1.6 V ( max. ) | V <sub>DD</sub> : 0.66 V ( min. )<br>V <sub>DD</sub> : 1.15 V ( max. )   | V <sub>DD</sub> - 0.085 V ( min. )<br>V <sub>DD</sub> = ( max. )      |
| Output Logic " Low " , " 0 "                      | V <sub>DD</sub> x 0.1 V ( max. )<br>0.3V (max.) for 1.8V only                                   | V <sub>DD</sub> - 2.0 V ( min. )<br>V <sub>DD</sub> - 1.55 V ( max. )  | V <sub>DD</sub> : 1.1 V ( typ. )<br>V <sub>DD</sub> : 0.9 V ( min. ) | V <sub>DD</sub> : - 0.15 V ( min. )<br>V <sub>DD</sub> : 0.15 V ( max. ) | V <sub>DD</sub> - 0.6 V ( min. )<br>V <sub>DD</sub> - 0.32 V ( max. ) |
| Output Voltage Swing                              | ---                                                                                             | 595 mV ( min. )                                                        | 250 mV ( min. )                                                      | 450 mV ( min. )                                                          | 200 mV ( min. )                                                       |
|                                                   |                                                                                                 | 930 mV ( max. )                                                        | 450 mV ( max. )                                                      | 700 mV ( typ. )                                                          | 600 mV ( max. )                                                       |
| Current Consumption ( V <sub>DD</sub> = + 3.3 V ) | 75 mA ( typ. )                                                                                  | 100 mA ( typ. )                                                        | 75 mA ( typ. )                                                       | 94 mA ( typ. )                                                           | 70 mA ( typ. )                                                        |
|                                                   | 90 mA ( max. )                                                                                  | 120 mA ( max. )                                                        | 90 mA ( max. )                                                       | 115 mA ( max. )                                                          | 85 mA ( max. )                                                        |
| Disable Current                                   | 62 mA ( typ. )                                                                                  | 99 mA ( typ. )                                                         | 74 mA ( typ. )                                                       | 93 mA ( typ. )                                                           | 69 mA ( typ. )                                                        |
| Rise Time / Fall Time ( 20% to 80% Waveform )     | 5.0 nsec. ( max. )<br>( 10% to 90% )                                                            | 0.4 nsec. ( max. )                                                     | 0.4 nsec. ( max. )                                                   | 0.4 nsec. ( max. )                                                       | 0.4 nsec. ( max. )                                                    |
| Frequency Stability Codes                         | Frequency Stability Over Operating Temperature Range                                            |                                                                        | ± 25 ppm                                                             | ± 50 ppm                                                                 | ± 100 ppm                                                             |
|                                                   | Commercial ( -20°C to +70°C )                                                                   |                                                                        | A                                                                    | B                                                                        | C                                                                     |
|                                                   | Industrial ( -40°C to +85°C )                                                                   |                                                                        | D                                                                    | E                                                                        | F                                                                     |
|                                                   | Extended Industrial ( -40°C to +105°C )                                                         |                                                                        | ---                                                                  | H                                                                        | J                                                                     |
| Duty Cycle                                        | 50% ± 5%                                                                                        |                                                                        |                                                                      |                                                                          |                                                                       |
| Start-up Time                                     | 5 msec ( typ. ) ; 10 msec ( max. )                                                              |                                                                        |                                                                      |                                                                          |                                                                       |
| RMS Jitter ( typ. )<br>( 12 KHz to 20 MHz )       | 156.250 MHz : 159 fsec ; 491.520 MHz : 155 fsec ; 644.530 MHz : 151 fsec ; 2,000 MHz : 163 fsec |                                                                        |                                                                      |                                                                          |                                                                       |
| Storage Temperature                               | -55°C to +150°C                                                                                 |                                                                        |                                                                      |                                                                          |                                                                       |
| Aging at Ta = +25°C                               | ± 3 ppm ( max. ) for first year ; ± 2 ppm ( max. ) per year thereafter                          |                                                                        |                                                                      |                                                                          |                                                                       |
| Enable / Disable Function on Pad1                 | 80% of V <sub>DD</sub> ( min. ) to enable output.                                               |                                                                        |                                                                      |                                                                          |                                                                       |
|                                                   | 20% of V <sub>DD</sub> ( max. ) to disable output.                                              |                                                                        |                                                                      |                                                                          |                                                                       |
| Enable / Disable Time                             | 2.5 msec ( max. ) / 10 usec ( max. )                                                            |                                                                        |                                                                      |                                                                          |                                                                       |

Note \* 1 : For CMOS output , only 7.0x5.0mm and 5.0x3.2mm packages are available.

Note \* 2 : This needs AC coupling (100-nF series capacitor). Please check the test circuit.

# EMI Reduction Spread Spectrum Clock Oscillators [ Programmable Quick Turn ]

## HM \_ B

**Quick - Turn  
Clock Oscillators**

**B group**

**SMD**

**CMOS**

**2.5V**

**3.3V**

**Min.**

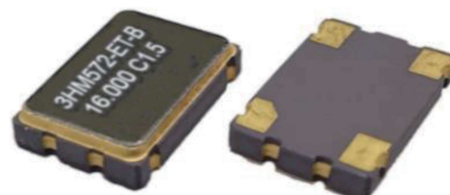
**3.0 MHz**

**Max.**

**200 MHz**

- Reduces electromagnetic Interference ( EMI ) by approx. 12 dB to 18 dB .
- Drop-In Replacement for Conventional Oscillators
- No Need to Re-Spin the Board or Solder Pad Layout
- Operates with a +2.5V or 3.3V Supply Voltage
- 5.0 x 3.2 , 7.0 x 5.0 mm package size

General specifications of all available packages , at Ta=+25°C , CL=15p



| Group                                               | B group                                                                    |                                                    |                                    |           |
|-----------------------------------------------------|----------------------------------------------------------------------------|----------------------------------------------------|------------------------------------|-----------|
| Available Packages                                  | HM53<br>( 5.0 * 3.2 * 1.2 mm )                                             |                                                    | HM572<br>( 7.0 * 5.0 * 1.4 mm )    |           |
| Output Waveform                                     | CMOS ( square wave )                                                       |                                                    |                                    |           |
| Supply Voltage ( V <sub>DD</sub> )                  | + 2.5 V ± 10%                                                              |                                                    | + 3.3 V ± 10%                      |           |
| Frequency Range                                     | 3.0 MHz ~ 166 MHz                                                          |                                                    | 3.0 MHz ~ 200 MHz                  |           |
| Output Logic High " 1 "                             | 2.25 V ( min.)                                                             |                                                    | 2.97 V ( min.)                     |           |
| Output Logic Low " 0 "                              | 0.25 V ( max.)                                                             |                                                    | 0.33 V ( max.)                     |           |
|                                                     |                                                                            |                                                    |                                    |           |
| Spread Type                                         | Spread Percentage EMI Reduction Rate                                       |                                                    |                                    |           |
| Center Spread ( “ C ” )                             | ± 0.125 % ( C0.125 ) to ± 2.0 % ( C2.0 ) in ± 0.125 % steps                |                                                    |                                    |           |
| Down Spread ( “ D ” )                               | - 0.25 % ( D0.25 ) to - 4.0 % ( D4.0 ) in 0.25 % steps                     |                                                    |                                    |           |
| Frequency Stability Codes<br>( exclude modulation ) | Frequency Stability over Operating Temperature Range                       | ± 25 ppm                                           | ± 50 ppm                           | ± 100 ppm |
|                                                     | Commercial ( -20°C to +70°C )                                              | A                                                  | B                                  | C         |
|                                                     | Industrial ( -40°C to +85°C )                                              | D                                                  | E                                  | F         |
| Modulation Carrier Freq.<br>( Dither rate )         | 30 KHz ( min. ) ; 40.0 KHz ( max. ) Frequency dependent. Call for details. |                                                    |                                    |           |
| Current Consumption                                 | 3 MHz ~ 100 MHz : 20 mA ( max. )                                           |                                                    | 101 MHz ~ 200 MHz : 30 mA ( max. ) |           |
| Rise Time / Fall Time                               | 5.0 nsec ( max. ) , 10% ↔ 90% waveform                                     |                                                    |                                    |           |
| Output Load                                         | 15 pF                                                                      |                                                    |                                    |           |
| Start-up Time                                       | 3.0 msec. ( typ. ) ; 5 msec. ( max. )                                      |                                                    |                                    |           |
| Duty Cycle                                          | 50% ± 10%                                                                  |                                                    |                                    |           |
| Aging at Ta = +25°C                                 | ± 5 ppm per year ( max. )                                                  |                                                    |                                    |           |
| Storage Temperature                                 | -55°C to + 125°C                                                           |                                                    |                                    |           |
| Output Enable / Disable Function                    | Enable                                                                     | 70% ( min. ) of V <sub>DD</sub> to Enable Output.  |                                    |           |
|                                                     | Disable                                                                    | 30% ( max. ) of V <sub>DD</sub> to Disable Output. |                                    |           |
|                                                     | Output enable / disable time : 100 nsec. ( max. )                          |                                                    |                                    |           |

# EMI Reduction Spread Spectrum Clock Oscillators

HM \_ C

EMI Reduction Spread Spectrum Clock Oscillators

C group

SMD

CMOS

1.8V

2.5V

3.3V

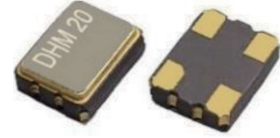
Min.

16 MHz

Max.

40 MHz

- Reduce electromagnetic interference (EMI) by approx. 3 dB to 12 dB
- Operates with +1.8V to +3.3V supply voltage
- 2.5 x 2.0 , 3.2 x 2.5 , 5.0 x 3.2 , 7.0 x 5.0 mm package size



General specifications of all available packages , at Ta=+25°C , CL=15pF

| Group                                                                  | C Group                                                                                          |                                                                                    |                    |                    |
|------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|--------------------|--------------------|
| Type                                                                   | HM22                                                                                             | HM32                                                                               | HM53               | HM572              |
| Dimemsions                                                             | 2.5 * 2.0 * 0.9 mm                                                                               | 3.2 * 2.5 * 1.0 mm                                                                 | 5.0 * 3.2 * 1.2 mm | 7.0 * 5.0 * 1.4 mm |
| Frequency Range                                                        | 16 ~ 40 MHz                                                                                      |                                                                                    |                    |                    |
| Supply Voltage ( V <sub>DD</sub> )                                     | 1.8 V ± 10%                                                                                      | 2.5 V ± 10%                                                                        | 3.3 V ± 10%        |                    |
| Output Logic " High ", "1 "                                            | 1.62 V ( min. )                                                                                  | 2.25 V ( min. )                                                                    | 2.97 V ( min. )    |                    |
| Output Logic " Low ", " 0 "                                            | 0.18 V ( max. )                                                                                  | 0.25 V ( max. )                                                                    | 0.33 V ( max. )    |                    |
| Rise Time / Fall Time<br>[ 10% V <sub>DD</sub> ↔ 90% V <sub>DD</sub> ] | 10 nsec. ( max. )                                                                                | 7 nsec. ( max. )                                                                   | 7 nsec. ( max. )   |                    |
| Current Consumption                                                    | 4 mA ( max. )                                                                                    | 5 mA ( max. )                                                                      | 6 mA ( max. )      |                    |
| Spread Type                                                            | Total%                                                                                           | Down Spread                                                                        | Center Spread      |                    |
| Spread Percentage                                                      | 2.0%                                                                                             | -2.0% ( D2.0 )                                                                     | ± 1.0% ( C1.0 )    |                    |
|                                                                        | 1.5%                                                                                             | -1.5% ( D1.5 )                                                                     | ± 0.75% ( C0.75 )  |                    |
|                                                                        | 1.0%                                                                                             | -1.0% ( D1.0 )                                                                     | ± 0.5% ( C0.5 )    |                    |
| EMI Reduction                                                          | 3 dB to 12 dB ( typ. ) for the main mode                                                         |                                                                                    |                    |                    |
| Modulation Carrier Freq.<br>( Dither rate )                            | 20.9 KHz ( min. ) ; 52.4 KHz ( max. )<br>Frequency dependent . Call for details                  |                                                                                    |                    |                    |
| Duty Cycle                                                             | 50% ± 10%                                                                                        |                                                                                    |                    |                    |
| Output Waveform                                                        | CMOS                                                                                             |                                                                                    |                    |                    |
| Output Load                                                            | 15pF                                                                                             |                                                                                    |                    |                    |
| Start-up Time                                                          | 1.0 msec. ( typ. ) ; 5 msec. ( max. )                                                            |                                                                                    |                    |                    |
| Storage Temperature                                                    | - 55°C to + 125°C                                                                                |                                                                                    |                    |                    |
| Aging at Ta = +25°C                                                    | ± 5 ppm per year ( max. )                                                                        |                                                                                    |                    |                    |
| Output Enable Function                                                 | Enable                                                                                           | When 70% ( min. ) of V <sub>DD</sub> to Enable Output. (Open connection prohibit.) |                    |                    |
|                                                                        | Disable                                                                                          | When 30% ( max. ) of V <sub>DD</sub> to Disable Output.                            |                    |                    |
|                                                                        | Output Enable Time : 5.0 msec. ( max. ) / Output Disable Time: 100 nsec. ( max. )                |                                                                                    |                    |                    |
| Frequency Stability Code<br>( exclude modulation )                     | Freq. Stability over Operating Temperature Range: ± 50 ppm from -40°C to +85°C ( Code is " E " ) |                                                                                    |                    |                    |

# EMI Reduction Spread Spectrum Clock Oscillators

## Part Number Format and Example

| [ 1 ]          | [ 2 ]       | - | [ 3 ]               | [ 4 ]       | - | [ 5 ]            | [ 6 ]      | - | [ 7 ]                  |
|----------------|-------------|---|---------------------|-------------|---|------------------|------------|---|------------------------|
| Supply Voltage | Holder Type |   | Frequency Stability | OE Function |   | Center Frequency | Group Type |   | Spread type Percentage |

|          |     |    |      |   |   |   |   |        |   |   |      |
|----------|-----|----|------|---|---|---|---|--------|---|---|------|
| Examples | (1) | 25 | HM53 | - | F | T | - | 75.000 | B | - | C2.0 |
|          | (2) | 18 | HM32 | - | E | T | - | 25.000 | C | - | D1.0 |

Ex (1) : 25HM53 - FT - 75.000B - C2.0 [ +2.5V, HM-series, HM53 type,  $\pm 100$ ppm from  $-40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$ , OE Function, 75.000MHz, B Group, 2.0% center spread ]

Ex (2) : 18HM32 - ET - 25.000C - D1.0 [ +1.8V, HM-series, HM32 type,  $\pm 50$ ppm from  $-40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$ , OE Function, 25.000MHz, C Group, 1.0% down spread ]

|       |                                                                                                                                                                                                                                                                 |
|-------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| [ 1 ] | Supply voltage code : " 18 " for +1.8V , " 25 " for +2.5V , " 3 " for +3.3V                                                                                                                                                                                     |
| [ 2 ] | Holder Type ( HM53 , HM32 )                                                                                                                                                                                                                                     |
| [ 3 ] | <div>-20°C ~ 70 °C</div> <div>" A " <math>\pm 25</math>ppm ; " B " <math>\pm 50</math>ppm ; " C " <math>\pm 100</math>ppm</div> <div>-40°C ~ 85 °C</div> <div>" D " <math>\pm 25</math>ppm ; " E " <math>\pm 50</math>ppm ; " F " <math>\pm 100</math>ppm</div> |
| [ 4 ] | " T " for OE Function                                                                                                                                                                                                                                           |
| [ 5 ] | Frequency in MHz                                                                                                                                                                                                                                                |
| [ 6 ] | Group " B " , " C "                                                                                                                                                                                                                                             |
| [ 7 ] | Spread type & percentage ; " C " for center spread , " D " for down spread                                                                                                                                                                                      |

## Outline Dimensions ( Unit : mm ) , Suggested pad Layout for SMDs

| [ HM22 ] | For group : | C |   | [ HM32 ]  | For group : | C |   |
|----------|-------------|---|---|-----------|-------------|---|---|
|          |             |   |   |           |             |   |   |
| [ HM53 ] | For group : | B | C | [ HM572 ] | For group : | B | C |
|          |             |   |   |           |             |   |   |



# Frequency Switchable Crystal Oscillators [ 10 ~ 1,500 MHz ]

## HC\_QF

CMOS / Differential

Q family

F series

Frequency

Switchable

Quick - Turn  
Clock Oscillators

1.5 psec  
RMS Jitter

SMD

2.5 V

3.3 V

Min.

10

MHz

Max.

1,500

MHz

### Features

- The HCTQF, HCPQF and HCDQF Series are members of Mercury's Q-Family Quick-Turn crystal oscillators
- Output frequency range : 10 MHz to 1,500 MHz
- Package size : 3.2 x 2.5mm , 5.0 x 3.2mm , 7.0 x 5.0mm
- Next-day samples for prototypes



General specifications , at Ta = + 25°C

| Model                                                | HCTQF                                                                                                                                       |          | HCPQF                                                            |           |                                                                                                                                                                                                   | HCDQF                                |
|------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|----------|------------------------------------------------------------------|-----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|
| Output Logic                                         | CMOS                                                                                                                                        |          | LVPECL                                                           |           |                                                                                                                                                                                                   | LVDS                                 |
| Supply Voltage V <sub>DD</sub> ( code )              | + 2.5 V ± 5% ( voltage code " 25 " )                                                                                                        |          | + 2.5 V ± 5% ( voltage code " 25 " )                             |           |                                                                                                                                                                                                   | + 2.5 V ± 5% ( voltage code " 25 " ) |
|                                                      | + 3.3 V ± 5% ( voltage code " 3 " )                                                                                                         |          | + 3.3 V ± 5% ( voltage code " 3 " )                              |           |                                                                                                                                                                                                   | + 3.3 V ± 5% ( voltage code " 3 " )  |
| Available Frequency Range                            | 10 ~ 250 MHz                                                                                                                                |          | 10 ~ 1,500 MHz                                                   |           |                                                                                                                                                                                                   | 10 ~ 1,500 MHz                       |
| Output Load                                          | 15 pF                                                                                                                                       |          | 50 Ω into Vcc - 2V or Thevenin equivalent                        |           |                                                                                                                                                                                                   | 100 Ω                                |
| Output Logic " High " , " 1 "                        | 90 % V <sub>DD</sub>                                                                                                                        |          | V <sub>DD</sub> - 1.03 ( min. ) , V <sub>DD</sub> - 0.6 ( max. ) |           |                                                                                                                                                                                                   | 1.4 V ( typ. ) , 1.6 V ( max. )      |
| Output Logic " Low " , " 0 "                         | 10 % V <sub>DD</sub>                                                                                                                        |          | V <sub>DD</sub> - 1.85 ( min. ) , V <sub>DD</sub> - 1.6 ( max. ) |           |                                                                                                                                                                                                   | 1.1 V ( typ. ) , 0.9 V ( min. )      |
| Current Consumption<br>( V <sub>DD</sub> = + 2.5 V ) | 10 ~ 150 MHz : 30 mA ( max.)                                                                                                                |          | 10 ~ 750 MHz : 50 mA ( max.)                                     |           |                                                                                                                                                                                                   | 10 ~ 750 MHz : 32 mA ( max. )        |
|                                                      | 151 ~ 250 MHz : 40 mA ( max.)                                                                                                               |          | 751 ~ 1,500 MHz : 55 mA ( max.)                                  |           |                                                                                                                                                                                                   | 751 ~ 1,500 MHz : 35 mA ( max. )     |
| Current with Output Disabie                          | 18 mA ( typ. )                                                                                                                              |          | 18 mA ( typ. )                                                   |           |                                                                                                                                                                                                   | 18 mA ( typ. )                       |
| Current Consumption<br>( V <sub>DD</sub> = + 3.3 V ) | 10 ~ 150 MHz : 38 mA ( max. )                                                                                                               |          | 10 ~ 750 MHz : 55 mA ( max. )                                    |           |                                                                                                                                                                                                   | 10 ~ 750 MHz : 34 mA ( max. )        |
|                                                      | 151 ~ 250 MHz : 48 mA ( max. )                                                                                                              |          | 751 ~ 1,500 MHz : 60 mA ( max. )                                 |           |                                                                                                                                                                                                   | 751 ~ 1,500 MHz : 40 mA ( max. )     |
| Rise Time / Fall Time                                | 10.0 nsec. ( max. )                                                                                                                         |          | 0.5 nsec. ( max. )                                               |           |                                                                                                                                                                                                   | 0.4 nsec. ( max. )                   |
|                                                      | Tr / Tf : 10% ↔ 90% waveform                                                                                                                |          | Tr / Tf : 20% ↔ 80% waveform                                     |           |                                                                                                                                                                                                   | Tr / Tf : 20% ↔ 80% waveform         |
| RMS Jitter [ 12 kHz ~ 20 MHz ]                       | 1.5 psec. ( typ. )                                                                                                                          |          |                                                                  |           |                                                                                                                                                                                                   |                                      |
| Frequency Stability Codes                            | Frequency Stability over Operating Temperature Range                                                                                        | ± 25 ppm | ± 50 ppm                                                         | ± 100 ppm | If non-standard , please enter the desired stability after the " C " or " F " represents .<br><br>For example :<br>" C20 " ± 20 ppm over -20°C to +70°C ;<br>" F30 " ± 30 ppm over -40°C to +85°C |                                      |
|                                                      | Commercial ( -20°C to +70°C )                                                                                                               | A        | B                                                                | C         |                                                                                                                                                                                                   |                                      |
|                                                      | Industrial ( -40°C to +85°C )                                                                                                               | D        | E                                                                | F         |                                                                                                                                                                                                   |                                      |
| Duty Cycle                                           | 50% ± 5%                                                                                                                                    |          |                                                                  |           |                                                                                                                                                                                                   |                                      |
| Start-up Time                                        | 10 msec. ( max. )                                                                                                                           |          |                                                                  |           |                                                                                                                                                                                                   |                                      |
| Aging at Ta = +25°C                                  | ± 5 ppm ( max. ) for first year                                                                                                             |          |                                                                  |           |                                                                                                                                                                                                   |                                      |
| Storage Temperature                                  | -55°C to +150°C                                                                                                                             |          |                                                                  |           |                                                                                                                                                                                                   |                                      |
| Output Enable Function on Pad 1                      |                                                                                                                                             |          |                                                                  |           |                                                                                                                                                                                                   |                                      |
| Output Enable / Disable Function                     | 70% of V <sub>DD</sub> ( min. ) to enable output. ( Open connection prohibit. )                                                             |          |                                                                  |           |                                                                                                                                                                                                   |                                      |
|                                                      | 30% of V <sub>DD</sub> ( max. ) to disable output                                                                                           |          |                                                                  |           |                                                                                                                                                                                                   |                                      |
| Output Enable Time / Disable Time                    | 200 nsec. ( max. ) / 50 nsec. ( max. )                                                                                                      |          |                                                                  |           |                                                                                                                                                                                                   |                                      |
| Frequency Selection Function on Pad 2                |                                                                                                                                             |          |                                                                  |           |                                                                                                                                                                                                   |                                      |
| Frequency Selection ( FSEL )                         | When FSEL = 0 ( 0 V or GND ) , Output frequency is Freq.1 ( f 1 )<br>When FSEL = 1 ( V <sub>DD</sub> ) , Output frequency is Freq.2 ( f 2 ) |          |                                                                  |           | Default FSEL pin has internal pull-up resistor                                                                                                                                                    |                                      |
| FSEL on Pad 2                                        | 70% of V <sub>DD</sub> ( min. ) For FSEL = 1 , Output frequency is Freq.2 ( f2 )                                                            |          |                                                                  |           |                                                                                                                                                                                                   |                                      |
|                                                      | 30% of V <sub>DD</sub> ( max.) For FSEL = 0 , Output frequency is Freq.1 ( f1 )                                                             |          |                                                                  |           |                                                                                                                                                                                                   |                                      |
|                                                      | Frequency switching time : 60 us ( typ. )                                                                                                   |          |                                                                  |           |                                                                                                                                                                                                   |                                      |

# Frequency Switchable Crystal Oscillators [ 10 ~ 1,500 MHz ]

**HC\_QF**

CMOS / Differential

**Q family**

**F series**

**Frequency  
Switchable**

**Quick - Turn  
Clock Oscillators**

**1.5 psec  
RMS Jitter**

**SMD**

**2.5 V**

**3.3 V**

**Min.  
10  
MHz**

**Max.  
1,500  
MHz**

## Part Number Format and Example

Example : 3HCTQF576 - E - 30,000 / 120,000

| 3                                               | HCTQF                                          | 576                                                                       | - | E                                                                                                         | - | 30,000                                       | / | 120,000                                      |
|-------------------------------------------------|------------------------------------------------|---------------------------------------------------------------------------|---|-----------------------------------------------------------------------------------------------------------|---|----------------------------------------------|---|----------------------------------------------|
| Supply Voltage<br>"3" for 3.3V<br>"25" for 2.5V | HCTQF : CMOS<br>HCPQF : LVPECL<br>HCDQF : LVDS | Package Size<br>"576": 7 x 5 mm<br>"536": 5 x 3.2 mm<br>"326": 3 x 2.5 mm | - | Frequency Stability Code "E":<br>±50 ppm over -40 to +85°C.<br>Other frequency stabilities are available. | - | Custom<br>Frequency 1<br>FSEL = 0<br>( MHz ) | / | Custom<br>Frequency 2<br>FSEL = 1<br>( MHz ) |

## Outline Dimensions ( Unit : mm ) , Suggested pad Layout for SMDs

| HC_QF576 | HC_QF536                                                                                                                                                                                                                                                                               |
|----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|          |                                                                                                                                                                                                                                                                                        |
| HC_QF326 | Pad Connections                                                                                                                                                                                                                                                                        |
|          | <p>Pad 1 : OE</p> <p>Pad 2 : Frequency Selection [ FSEL = 0 ( f 1 ) , FSEL = 1 ( f 2 ) ]</p> <p>Pad 3 : Ground</p> <p>Pad 4 : [ CMOS : Output , LVPECL or LVDS : Differential ]</p> <p>Pad 5 : [ CMOS : NC , LVPECL or LVDS : Complementary ] Output</p> <p>Pad 6 : Supply Voltage</p> |

## Test Circuits

| CMOS | LVPECL                                                                                                                                                                                                                | LVDS |
|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|
|      | <p> <math>V_{DD} = 3.3V</math> ; <math>R1 = R3 = 127 \Omega</math> ; <math>R2 = R4 = 82.5 \Omega</math><br/> <math>V_{DD} = 2.5V</math> ; <math>R1 = R3 = 250 \Omega</math> ; <math>R2 = R4 = 62.5 \Omega</math> </p> |      |



## 4 Frequencies Switchable Crystal Oscillators [ 15 ~ 2,100 MHz ]

# HC\_JFN

CMOS / Differential

**4 Frequencies  
Switchable**

**Quick - Turn  
Clock Oscillators**

**SMD**

**1.8 V**

**2.5 V**

**3.3 V**

Min.  
**15  
MHz**

Max.  
**2,100  
MHz**

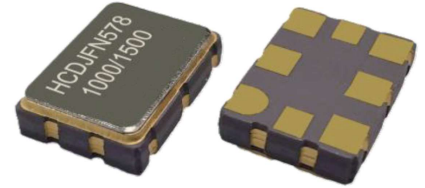
Features

**150 fs Phase Jitter ( typ. )**

Mercury's 4 Frequencies switchable crystal oscillators that can be delivered in days  
An integrated phase jitter performance of 150 fs RMS.

Supports all popular formats: CMOS, LVPECL, LVDS, HCSL and CML

Gaining its precision frequency control market position by providing engineers with  
next-day samples for prototypes.



General specifications , at Ta = + 25°C

| Model                                                | HCTJFN                                                                                                                              | HCPJFN                                                                | HCDJFN                                        | HCCJFN                                                                 | HCQJFN                                                              |
|------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------|-----------------------------------------------|------------------------------------------------------------------------|---------------------------------------------------------------------|
| Output Logic                                         | CMOS                                                                                                                                | LVPECL                                                                | LVDS                                          | HCSL                                                                   | CML                                                                 |
| Supply Voltage V <sub>DD</sub> ( code )              | + 1.8 V ± 5%                                                                                                                        | --                                                                    | + 1.8 V ± 5% <sup>(*)</sup>                   | + 1.8 V ± 5%                                                           | + 1.8 V ± 5%                                                        |
|                                                      | + 2.5 V ± 10%                                                                                                                       | + 2.5 V ± 10%                                                         | + 2.5 V ± 10%                                 | + 2.5 V ± 10%                                                          | + 2.5 V ± 10%                                                       |
|                                                      | + 3.3 V ± 10%                                                                                                                       | + 3.3 V ± 10%                                                         | + 3.3 V ± 10%                                 | + 3.3 V ± 10%                                                          | + 3.3 V ± 10%                                                       |
| Available Frequency Range                            | 15 ~ 250 MHz                                                                                                                        | 15 ~ 2,100 MHz                                                        | 15 ~ 2,100 MHz                                | 15 ~ 700 MHz                                                           | 15 ~ 2,100 MHz                                                      |
| Output Load                                          | 15 pF ( max. )                                                                                                                      | 50 Ω into V <sub>DD</sub> - 2V or Thevenin equivalent                 | 100 Ω between output and complimentary output | 50 Ω to GND                                                            | 50 Ω to V <sub>DD</sub>                                             |
| Output Logic " High " , " 1 "                        | V <sub>DD</sub> - 0.4 V ( min. )                                                                                                    | V <sub>DD</sub> - 1.03 V ( min. )<br>V <sub>DD</sub> - 0.6 V ( max. ) | 1.4 V ( typ. )<br>1.6 V ( max. )              | V <sub>DD</sub> : 0.66V ( min. )<br>V <sub>DD</sub> : 1.15V ( max. )   | V <sub>DD</sub> - 0.085V ( min. )<br>V <sub>DD</sub> = ( max. )     |
| Output Logic " Low " , " 0 "                         | V <sub>DD</sub> x 0.1 V ( max. )<br>0.3V (max.) for 1.8V only                                                                       | V <sub>DD</sub> - 1.85 V ( min. )<br>V <sub>DD</sub> - 1.6 V ( max. ) | 1.1 V ( typ. )<br>0.9 V ( min. )              | V <sub>DD</sub> : - 0.15V ( min. )<br>V <sub>DD</sub> : 0.15V ( max. ) | V <sub>DD</sub> - 0.6V ( min. )<br>V <sub>DD</sub> - 0.32V ( max. ) |
| Output Voltage Swing                                 | ---                                                                                                                                 | 595 mV ( min. )<br>930 mV ( max. )                                    | 250 mV ( min. )<br>450 mV ( max. )            | 450 mV ( min. )<br>700 mV ( typ. )                                     | 200 mV ( min. )<br>600 mV ( max. )                                  |
| Current Consumption<br>( V <sub>DD</sub> = + 3.3 V ) | 75 mA ( typ. )<br>90 mA ( max. )                                                                                                    | 100 mA ( typ. )<br>120 mA ( max. )                                    | 75 mA ( typ. )<br>90 mA ( max. )              | 80 mA ( typ. )<br>100 mA ( max. )                                      | 70 mA ( typ. )<br>85 mA ( max. )                                    |
| Current with Output Disabie                          | 62 mA ( typ. )                                                                                                                      | 99 mA ( typ. )                                                        | 74 mA ( typ. )                                | 79 mA ( typ. )                                                         | 69 mA ( typ. )                                                      |
| Rise Time / Fall Time                                | 5.0 nsec ( max. )<br>( 10% to 90% Waveform )                                                                                        | 0.4 nsec ( max. )<br>( 20% to 80% Waveform )                          | 0.4 nsec ( max. )<br>( 20% to 80% Waveform )  | 0.4 nsec ( max. )<br>( 20% to 80% Waveform )                           | 0.4 nsec ( max. )<br>( 20% to 80% Waveform )                        |
| Frequency Stability Codes                            | Frequency Stability over Operating Temperature Range                                                                                |                                                                       | ± 25 ppm                                      | ± 50 ppm                                                               | ± 100 ppm                                                           |
|                                                      | Commercial ( -20°C to +70°C )                                                                                                       |                                                                       | A                                             | B                                                                      | C                                                                   |
|                                                      | Industrial ( -40°C to +85°C )                                                                                                       |                                                                       | D                                             | E                                                                      | F                                                                   |
|                                                      | Extended Industrial ( -40°C to +105°C )                                                                                             |                                                                       | ---                                           | H                                                                      | J                                                                   |
| Duty Cycle                                           | 50% ± 5%                                                                                                                            |                                                                       |                                               |                                                                        |                                                                     |
| Start-up Time                                        | 5 msec ( typ. ) ; 10 msec. ( max. )                                                                                                 |                                                                       |                                               |                                                                        |                                                                     |
| RMS Jitter [ 12 kHz ~ 20 MHz ]                       | 156.250 MHz : 148 fsec ( typ. ) ; 312.500 MHz : 147 fsec ( typ. ) ; 644.530 MHz : 141 fsec ( typ. ) ; 2,000 MHz : 155 fsec ( typ. ) |                                                                       |                                               |                                                                        |                                                                     |
| Aging at Ta = +25°C                                  | ± 3 ppm ( max. ) for first year at 25°C                                                                                             |                                                                       |                                               |                                                                        |                                                                     |
| Storage Temperature                                  | -55°C to +150°C                                                                                                                     |                                                                       |                                               |                                                                        |                                                                     |
| Frequency Selection Function                         |                                                                                                                                     |                                                                       |                                               |                                                                        |                                                                     |
| FS0 Control on Pad 1                                 | 70% V <sub>DD</sub> min. to logic Level " 1 "                                                                                       |                                                                       |                                               |                                                                        |                                                                     |
|                                                      | 30% V <sub>DD</sub> max. to logic Level " 0 "                                                                                       |                                                                       |                                               |                                                                        |                                                                     |
| FS1 Control on Pad 2                                 | 70% V <sub>DD</sub> min. to logic Level " 1 "                                                                                       |                                                                       |                                               |                                                                        |                                                                     |
|                                                      | 30% V <sub>DD</sub> max. to logic Level " 0 "                                                                                       |                                                                       |                                               |                                                                        |                                                                     |
| Frequency Select Timing : t <sub>FS</sub>            | 10.0 msec. ( max. )                                                                                                                 |                                                                       |                                               |                                                                        |                                                                     |
| Frequency Configurations                             | The frequency output 1 ~ 4 setting is done based on the logic levels in the Table 1.                                                |                                                                       |                                               |                                                                        |                                                                     |

Note (※) : This needs AC coupling (100-nF series capacitor). Please check the test circuit.

## GTQN

CMOS Waveform

## GPQN

LVPECL Differential

## GDQN

LVDS Differential

0.6 ps  
RMS Jitter

SMD

2.5 V

3.3 V

Min.  
10 MHz

Max.  
1,500 MHz

### Features

- Output frequency range : 10 MHz to 1500 MHz
- Low RMS Jitter 0.6 ps typical ( 12KHz to 20MHz )
- Package size : 3.2x2.5mm , 5.0x3.2mm , 7.0x5.0mm
- If you need lower rms jitter, please refer to the "G\_JFN" series (150 fsec typ. @ 12KHz to 20MHz)

General specifications , at Ta=+25°C , CL=15pF



| Model                                               | GTQN                                                                           |       |        | GPQN                                                             |          |                                                 | GDQN                                                                                                                                                                                                 |        |  |
|-----------------------------------------------------|--------------------------------------------------------------------------------|-------|--------|------------------------------------------------------------------|----------|-------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|--|
| Output Logic                                        | CMOS                                                                           |       |        | LVPECL                                                           |          |                                                 | LVDS                                                                                                                                                                                                 |        |  |
| Supply Voltage V <sub>DD</sub> ( code )             | + 2.5 V ± 5% ( voltage code " 25 " )                                           |       |        | + 2.5 V ± 5% ( voltage code " 25 " )                             |          |                                                 | + 2.5 V ± 5% ( voltage code " 25 " )                                                                                                                                                                 |        |  |
|                                                     | + 3.3 V ± 5% ( voltage code " 33 " )                                           |       |        | + 3.3 V ± 5% ( voltage code " 33 " )                             |          |                                                 | + 3.3 V ± 5% ( voltage code " 33 " )                                                                                                                                                                 |        |  |
| Available Frequency Range                           | 10 ~ 250 MHz                                                                   |       |        | 10 ~ 1,500 MHz                                                   |          |                                                 | 10 ~ 1,500 MHz                                                                                                                                                                                       |        |  |
| Output Load                                         | 15 pF                                                                          |       |        | RL = 50 Ω to (V <sub>DD</sub> -2.0V). See test circuit below.    |          |                                                 | 100 Ω between OUT and OUTN                                                                                                                                                                           |        |  |
| Output Logic " High " , " 1 "                       | 90 % V <sub>DD</sub>                                                           |       |        | V <sub>DD</sub> - 1.03 ( min. ) , V <sub>DD</sub> - 0.6 ( max. ) |          |                                                 | 1.4 V ( Typ. ) , 1.6 V ( max. )                                                                                                                                                                      |        |  |
| Output Logic " Low " , " 0 "                        | 10 % V <sub>DD</sub>                                                           |       |        | V <sub>DD</sub> - 1.85 ( min. ) , V <sub>DD</sub> - 1.6 ( max. ) |          |                                                 | 1.1 V ( Typ. ) , 0.9 V ( min. )                                                                                                                                                                      |        |  |
| Current with Output Disable                         | 16 mA ( typ. )                                                                 |       |        | 16 mA ( typ. )                                                   |          |                                                 | 16 mA ( typ. )                                                                                                                                                                                       |        |  |
| Current Consumption<br>( V <sub>DD</sub> = + 3.3V ) | 10 ~ 50 MHz : 30 mA                                                            |       |        | 10 ~ 250 MHz : 50 mA                                             |          |                                                 | 10 ~ 250 MHz : 30 mA                                                                                                                                                                                 |        |  |
|                                                     | 51 ~ 150 MHz : 38 mA                                                           |       |        | 251 ~ 750 MHz : 55 mA                                            |          |                                                 | 251 ~ 750 MHz : 34 mA                                                                                                                                                                                |        |  |
|                                                     | 151 ~ 250 MHz : 48 mA                                                          |       |        | 751 ~ 1,500 MHz : 60 mA                                          |          |                                                 | 751 ~ 1,500 MHz : 40 mA                                                                                                                                                                              |        |  |
| Rise Time / Fall Time                               | 10 nsec. ( max. )                                                              |       |        | 0.5 nsec. ( max. )                                               |          |                                                 | 0.4 nsec. ( max. )                                                                                                                                                                                   |        |  |
|                                                     | Tr / Tf : 10% ↔ 90% waveform                                                   |       |        | Tr / Tf : 20% ↔ 80% waveform                                     |          |                                                 | Tr / Tf : 20% ↔ 80% waveform                                                                                                                                                                         |        |  |
| Duty Cycle                                          | 50% ± 5%                                                                       |       |        |                                                                  |          |                                                 |                                                                                                                                                                                                      |        |  |
| Start-up Time                                       | 10 msec. ( max. )                                                              |       |        |                                                                  |          |                                                 |                                                                                                                                                                                                      |        |  |
| Aging at Ta = +25°C                                 | ± 5 ppm ( max. ) for first year                                                |       |        |                                                                  |          |                                                 |                                                                                                                                                                                                      |        |  |
| Storage Temperature                                 | -55°C to +150°C                                                                |       |        |                                                                  |          |                                                 |                                                                                                                                                                                                      |        |  |
| Frequency Stability Codes                           | Frequency Stability<br>Over Operating Temperature Range                        |       |        | ± 25 ppm                                                         | ± 50 ppm | ± 100 ppm                                       | If non-standard , please enter the desired<br>Stability after the " C " or " F " represents .<br><br>For example :<br>" C20 " ± 20 ppm over -20°C to +70°C ;<br>" F20 " ± 20 ppm over -40°C to +85°C |        |  |
|                                                     | Commercial ( -20°C to +70°C )                                                  |       |        | A                                                                | B        | C                                               |                                                                                                                                                                                                      |        |  |
|                                                     | Industrial ( -40°C to +85°C )                                                  |       |        | D                                                                | E        | F                                               |                                                                                                                                                                                                      |        |  |
| RMS Jitter [ 12 KHz ~ 20 MHz ]                      | 0.6 psec ( typ. )                                                              |       |        |                                                                  |          |                                                 |                                                                                                                                                                                                      |        |  |
| Phase Noise [ dBc / Hz ( typ. ) ]                   | Offset                                                                         | 10 Hz | 100 Hz | 1 KHz                                                            | 10 KHz   | 100 KHz                                         | 1 MHz                                                                                                                                                                                                | 10 MHz |  |
|                                                     | 125 MHz                                                                        | -63   | -94    | -113                                                             | -122     | -126                                            | -137                                                                                                                                                                                                 | -156   |  |
|                                                     | 212.5 MHz                                                                      | -55   | -85    | -108                                                             | -117     | -120                                            | -132                                                                                                                                                                                                 | -156   |  |
| Control Voltage Function on Pad 1                   |                                                                                |       |        |                                                                  |          |                                                 |                                                                                                                                                                                                      |        |  |
| Supply Voltage                                      | V <sub>DD</sub> = +2.5 V ; Vcon Center = +1.25V                                |       |        |                                                                  |          | V <sub>DD</sub> = +3.3 V ; Vcon Center = +1.65V |                                                                                                                                                                                                      |        |  |
| Vcontrol Range                                      | + 0.25V ~ +2.25V                                                               |       |        |                                                                  |          | + 0.3V ~ +3.0V                                  |                                                                                                                                                                                                      |        |  |
| Frequency Pulling Range                             | ± 80 ppm ( min. )                                                              |       |        |                                                                  |          | ± 80 ppm ( min. )                               |                                                                                                                                                                                                      |        |  |
|                                                     | Up to ± 200 ppm ( min. ) is also available. Please contact Mercury.            |       |        |                                                                  |          |                                                 |                                                                                                                                                                                                      |        |  |
| Linearity                                           | 5% ( typ. ) ; 10% ( max. )                                                     |       |        |                                                                  |          |                                                 |                                                                                                                                                                                                      |        |  |
| Transfer Function                                   | Positive Transfer                                                              |       |        |                                                                  |          |                                                 |                                                                                                                                                                                                      |        |  |
| Input Impedance                                     | 1 MΩ ( typ. )                                                                  |       |        |                                                                  |          |                                                 |                                                                                                                                                                                                      |        |  |
| Bandwidth                                           | 10 KHz ( min. ) Measured at -3 dB                                              |       |        |                                                                  |          |                                                 |                                                                                                                                                                                                      |        |  |
| Output Enable Function on Pad 2                     |                                                                                |       |        |                                                                  |          |                                                 |                                                                                                                                                                                                      |        |  |
| OE Control on Pad 2                                 | 70% of V <sub>DD</sub> ( min. ) to enable output. ( Open connection prohibit ) |       |        |                                                                  |          |                                                 |                                                                                                                                                                                                      |        |  |
|                                                     | 30% of V <sub>DD</sub> ( max. ) to disable output.                             |       |        |                                                                  |          |                                                 |                                                                                                                                                                                                      |        |  |
| Output Enable Time / Disable Time                   | 200 nsec. ( max. ) / 50 nsec. ( max. )                                         |       |        |                                                                  |          |                                                 |                                                                                                                                                                                                      |        |  |

# Switchable Output Crystal Oscillators

**GCTQF**

CMOS Waveform

**GCPQF**

LVPECL Differential

**GCDQF**

LVDS Differential

Frequency  
Switchable

SMD

2.5 V

3.3 V

Min.

10 MHz

Max.

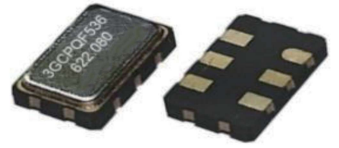
1,500 MHz

Features

Quick - Turn Clock Oscillators

- The GCTQF, GCPQF and GCDQF Series are members of Mercury's Q-Family Quick-Turn crystal oscillators
- Output frequency range : 10 MHz to 1500 MHz
- Package size : 3.2x2.5mm , 5.0x3.2mm , 7.0x5.0mm
- Next-day samples for prototypes

General specifications , at Ta = + 25°C



| Model                                             | GCTQF                                                                            | GCPQF                                                             |          |                                                 | GCDQF                                                                                                                                                                                         |
|---------------------------------------------------|----------------------------------------------------------------------------------|-------------------------------------------------------------------|----------|-------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Output Logic                                      | CMOS                                                                             | LVPECL                                                            |          |                                                 | LVDS                                                                                                                                                                                          |
| Supply Voltage V <sub>DD</sub> ( code )           | + 2.5 V ± 5% ( voltage code " 25 " )                                             | + 2.5 V ± 5% ( voltage code " 25 " )                              |          |                                                 | + 2.5 V ± 5% ( voltage code " 25 " )                                                                                                                                                          |
|                                                   | + 3.3 V ± 5% ( voltage code " 3 " )                                              | + 3.3 V ± 5% ( voltage code " 3 " )                               |          |                                                 | + 3.3 V ± 5% ( voltage code " 3 " )                                                                                                                                                           |
| Available Frequency Range                         | 10 ~ 250 MHz                                                                     | 10 ~ 1,500 MHz                                                    |          |                                                 | 10 ~ 1,500 MHz                                                                                                                                                                                |
| Output Load                                       | 15 pF                                                                            | 50 Ω into Vcc - 2V or Thevenin equivalent                         |          |                                                 | 100 Ω between output and complimentary output                                                                                                                                                 |
| Output Logic " High " , " 1 "                     | 90 % V <sub>DD</sub>                                                             | V <sub>DD</sub> - 1.03 ( min. ) , V <sub>DD</sub> - 0.6 ( max. )  |          |                                                 | 1.4 V ( Typ. ) , 1.6 V ( max. )                                                                                                                                                               |
| Output Logic " Low " , " 0 "                      | 10 % V <sub>DD</sub>                                                             | V <sub>DD</sub> - 1.85 ( min. ) , V <sub>DD</sub> - 1.6 ( max. )  |          |                                                 | 1.1 V ( Typ. ) , 0.9 V ( min. )                                                                                                                                                               |
| Current Consumption ( V <sub>DD</sub> : + 2.5 V ) | 10 ~ 100 MHz : 30 mA ( max. )<br>101 ~ 250 MHz : 40 mA ( max. )                  | 10 ~ 600 MHz : 45 mA ( max. )<br>601 ~ 1,500 MHz : 55 mA ( max. ) |          |                                                 | 10 ~ 600 MHz : 30 mA ( max. )<br>601 ~ 1,500 MHz : 35 mA ( max. )                                                                                                                             |
| Current Consumption ( V <sub>DD</sub> : + 3.3 V ) | 10 ~ 100 MHz : 35 mA ( max. )<br>101 ~ 250 MHz : 40 mA ( max. )                  | 10 ~ 600 MHz : 50 mA ( max. )<br>601 ~ 1,500 MHz : 60 mA ( max. ) |          |                                                 | 10 ~ 600 MHz : 35 mA ( max. )<br>601 ~ 1,500 MHz : 40 mA ( max. )                                                                                                                             |
| Current with Output Disabie                       | 18 mA ( Typ. )                                                                   | 18 mA ( Typ. )                                                    |          |                                                 | 18 mA ( Typ. )                                                                                                                                                                                |
| Rise Time / Fall Time                             | 10.0 nsec. ( max. )<br>Tr / Tf : 10% ↔ 90% waveform                              | 0.5 nsec. ( max. )<br>Tr / Tf : 20% ↔ 80% waveform                |          |                                                 | 0.4 nsec. ( max. )<br>Tr / Tf : 20% ↔ 80% waveform                                                                                                                                            |
| RMS Jitter [ 12 KHz ~ 20 MHz ]                    | 1.5 psec ( typ. )                                                                |                                                                   |          |                                                 |                                                                                                                                                                                               |
| Duty Cycle                                        | 50% ± 5%                                                                         |                                                                   |          |                                                 |                                                                                                                                                                                               |
| Start-up Time                                     | 10 msec. ( max. )                                                                |                                                                   |          |                                                 |                                                                                                                                                                                               |
| Aging at Ta = +25°C                               | ± 2 ppm ( max. ) first year at 25°C ; ± 10 ppm ( max. ) over 10 years            |                                                                   |          |                                                 |                                                                                                                                                                                               |
| Storage Temperature                               | -55°C to +150°C                                                                  |                                                                   |          |                                                 |                                                                                                                                                                                               |
| Frequency Stability Codes                         | Frequency Stability over Operating Temperature Range                             | ± 25 ppm                                                          | ± 50 ppm | ± 100 ppm                                       | If non-standard , please enter the desired stability after the " C " or " F " represents .<br>For example :<br>" C20 " ± 20 ppm over -20°C to +70°C ;<br>" F20 " ± 20 ppm over -40°C to +85°C |
|                                                   | Commercial ( -20°C to +70°C )                                                    | A                                                                 | B        | C                                               |                                                                                                                                                                                               |
|                                                   | Industrial ( -40°C to +85°C )                                                    | D                                                                 | E        | F                                               |                                                                                                                                                                                               |
| Control Voltage Function on Pad 1                 |                                                                                  |                                                                   |          |                                                 |                                                                                                                                                                                               |
| Supply Voltage                                    | V <sub>DD</sub> = +2.5 V ; Vcon Center = +1.25V                                  |                                                                   |          | V <sub>DD</sub> = +3.3 V ; Vcon Center = +1.65V |                                                                                                                                                                                               |
| Vcontrol Range                                    | + 0.25V ~ +2.25V                                                                 |                                                                   |          | + 0.3V ~ +3.0V                                  |                                                                                                                                                                                               |
| Frequency Pulling Range                           | ± 80 ppm ( min. )                                                                |                                                                   |          | ± 80 ppm ( min. )                               |                                                                                                                                                                                               |
|                                                   | Up to ± 200 ppm ( min. ) is also available. Please contact Mercury.              |                                                                   |          |                                                 |                                                                                                                                                                                               |
| Linearity                                         | 5% ( typ. ) ; 10% ( max. )                                                       |                                                                   |          |                                                 |                                                                                                                                                                                               |
| Transfer Function                                 | Positive Transfer                                                                |                                                                   |          |                                                 |                                                                                                                                                                                               |
| Input Impedance                                   | 1 MΩ ( typ.)                                                                     |                                                                   |          |                                                 |                                                                                                                                                                                               |
| Bandwidth                                         | 10 KHz ( min. ) Measured at -3 dB                                                |                                                                   |          |                                                 |                                                                                                                                                                                               |
| Frequency Selection Function on Pad 2             |                                                                                  |                                                                   |          |                                                 |                                                                                                                                                                                               |
| FSEL on pad2                                      | 70% of V <sub>DD</sub> ( min. ) For FSEL = 1 , Output frequency is Freq.2 ( f2 ) |                                                                   |          |                                                 |                                                                                                                                                                                               |
|                                                   | 30% of V <sub>DD</sub> ( max. ) For FSEL = 0 , Output frequency is Freq.1 ( f1 ) |                                                                   |          |                                                 |                                                                                                                                                                                               |
|                                                   | Default FSEL pin has internal pull-up resistor .                                 |                                                                   |          |                                                 |                                                                                                                                                                                               |
|                                                   | Frequency switching time : 60 us ( typ. )                                        |                                                                   |          |                                                 |                                                                                                                                                                                               |

# Switchable Output Crystal Oscillators

**GCTQF**

CMOS Waveform

**GCPQF**

LVPECL Differential

**GCDQF**

LVDS Differential

Frequency  
Switchable

SMD

2.5 V

3.3 V

Min.

10 MHz

Max.

1,500 MHz

Part Number Format and Example

Quick - Turn Clock Oscillators

Example : 3GCTQF576 - E - 80N - 30,000 / 120,000

| 3                                               | GCTQN                                          | 576                                                                       | - | E                                                                                                         | - | 80N                                        | - | 30,000                                       | / | 120,000                                      |
|-------------------------------------------------|------------------------------------------------|---------------------------------------------------------------------------|---|-----------------------------------------------------------------------------------------------------------|---|--------------------------------------------|---|----------------------------------------------|---|----------------------------------------------|
| Supply Voltage<br>"3" for 3.3V<br>"25" for 2.5V | GCTQF : CMOS<br>GCPQF : LVPECL<br>GCDQF : LVDS | Package Size<br>"576": 7 x 5 mm<br>"536": 5 x 3.2 mm<br>"326": 3 x 2.5 mm | - | Frequency Stability Code "E":<br>±50 ppm over -40 to +85°C.<br>Other frequency stabilities are available. | - | ±80 ppm (min.)<br>frequency pulling range. | - | Custom<br>Frequency 1<br>FSEL = 0<br>( MHz ) | - | Custom<br>Frequency 2<br>FSEL = 1<br>( MHz ) |

Outline Dimensions ( Unit : mm ) , Suggested pad Layout for SMDs

| GC_QF326 | GC_QF536 | GC_QF576 |
|----------|----------|----------|
|          |          |          |

Pad Connections :

Pad 1 : Control Voltage ; Pad 2 : Frequency Selection [ FSEL = 0 ( f1 ) , FSEL = 1 ( f2 ) ] ; Pad 3 : Ground

Pad 4 : [ CMOS : Output , LVPECL or LVDS : Differential ] ; Pad 5 : [ CMOS : NC , LVPECL or LVDS : Complementary ] ; Pad 6 : Supply Voltage

Test Circuits and Output Waveforms

| CMOS Test Circuit                                         | LVPECL Test Circuit                                                                                                                                                                        | LVDS Test Circuit                                         |
|-----------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------|
| <p>FSEL = High Output : f2<br/>FSEL = Low Output : f1</p> | <p>V<sub>DD</sub> = 3.3V ; R1 = R3 = 127 Ω ; R2 = R4 = 82.5 Ω<br/>V<sub>DD</sub> = 2.5V ; R1 = R3 = 250 Ω ; R2 = R4 = 62.5 Ω</p> <p>FSEL = High Output : f2<br/>FSEL = Low Output : f1</p> | <p>FSEL = High Output : f2<br/>FSEL = Low Output : f1</p> |
| CMOS Output Waveform                                      | LVPECL Output Waveform                                                                                                                                                                     | LVDS Output Waveform                                      |
|                                                           |                                                                                                                                                                                            |                                                           |

## Part Number Format and Example

| Dip Type Part Number Format |       |            |            |             |
|-----------------------------|-------|------------|------------|-------------|
| [ 1 ]                       | [ 2 ] | [ 3 ]      | [ 4 ]      | [ 5 ]       |
| Frequency Code              | M     | Width Code | Poles Code | Holder Type |

|          |    |   |    |   |    |
|----------|----|---|----|---|----|
| Examples | 21 | M | 15 | D | U5 |
|----------|----|---|----|---|----|

|       |                                                                                                                                                                                                 |
|-------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| [ 1 ] | Freq. code : " 10 " for 10.700MHz , " 21 " for 21.400MHz , " 45 " for 45.000MHz , " 50.85 " for 50.850MHz<br>Freq. code : If none standard freq. please show frequency with one decimal point . |
| [ 2 ] | " M " Dip Type series ,                                                                                                                                                                         |
| [ 3 ] | Pass band width ( 3dB ) ( min. )<br>" 7.5 " for $\pm 3.75$ KHz , " 12 " for $\pm 6.0$ KHz , " 15 " for $\pm 7.5$ KHz , " 30 " for $\pm 15$ KHz ,                                                |
| [ 4 ] | No. of poles<br>" A " for 2 poles , " B " for 4 poles , " C " for 6 poles , " D " for 8 poles                                                                                                   |
| [ 5 ] | Dip type holder type                                                                                                                                                                            |
| [ 6 ] | Standard operating temperature range is -20°C to 70°C ,<br>If non-standard please enter the desired temp. range after " / " , for example " / -30+70 " : -30°C to 70°C                          |

## Package Dimensions ( unit : mm )

| [ U 1 ]                                                                                                                                        | [ U 5 ]                                                                                                                                                                                                                                                                                                                                                         |     |   |   |       |      |     |       |      |     |
|------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|---|---|-------|------|-----|-------|------|-----|
| <p>7.0 ± 0.2</p> <p>8.0 ± 0.2</p> <p>3.75</p> <p>15.0 max</p> <p>2.3</p> <p>0.35Ø</p> <p>7.8 ± 0.2</p> <p>3.1 ± 0.2</p> <p>glass insulator</p> | <p>7.0 ± 0.2</p> <p>6.0 ± 0.2</p> <p>3.75</p> <p>15.0 max</p> <p>2.3</p> <p>0.35Ø</p> <p>7.8 ± 0.2</p> <p>3.1 ± 0.2</p> <p>glass insulator</p>                                                                                                                                                                                                                  |     |   |   |       |      |     |       |      |     |
| 4 pole M.C.F. ( Paired packages , Tandem set )                                                                                                 | [ S - 1 ] , [ S - 2 ]                                                                                                                                                                                                                                                                                                                                           |     |   |   |       |      |     |       |      |     |
| <p>Color dots for pair orientation match</p> <p>User to provide Cc</p>                                                                         | <p>L</p> <p>11.0 ± 0.2</p> <p>4.0</p> <p>0.3Ø</p> <p>1.5</p> <p>7.0 max</p> <p>8.5 ± 0.2</p> <p>P</p> <p>2.0</p> <p>0.3</p> <p>Pin 1 : Output<br/>Pin 2 : Ground<br/>Pin 3 : Ground<br/>Pin 4 : Input</p> <table><tr><th></th><th>L</th><th>P</th></tr><tr><td>S - 1</td><td>11.0</td><td>7.4</td></tr><tr><td>S - 2</td><td>13.4</td><td>9.8</td></tr></table> |     | L | P | S - 1 | 11.0 | 7.4 | S - 2 | 13.4 | 9.8 |
|                                                                                                                                                | L                                                                                                                                                                                                                                                                                                                                                               | P   |   |   |       |      |     |       |      |     |
| S - 1                                                                                                                                          | 11.0                                                                                                                                                                                                                                                                                                                                                            | 7.4 |   |   |       |      |     |       |      |     |
| S - 2                                                                                                                                          | 13.4                                                                                                                                                                                                                                                                                                                                                            | 9.8 |   |   |       |      |     |       |      |     |



# FREQUENCY CONTROL PRODUCTS FOR AUTOMOTIVE AEC-Q100/AEC-Q200

KHz Crystal  
(SMD)

MHz Crystal  
(SMD)

Thermistor  
Quartz Crystal

Oscillator SPXO  
(CMOS/LVPECL/  
LVDS/HCSL Output)

TCXO

## QUARTZ CRYSTAL CRYSTAL OSCILLATOR TCXO TIMING MODULE

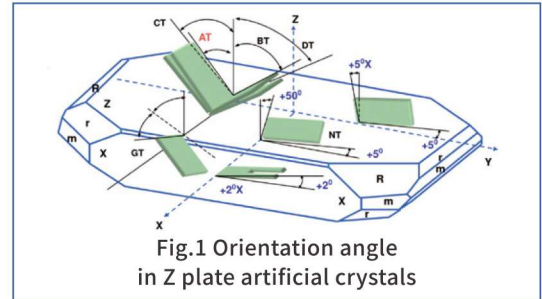
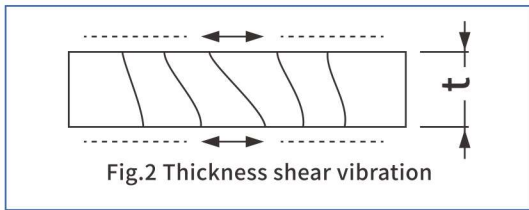


Global Leader in Communication Frequency Control Devices

# INTRODUCTION >>>

## 1.Vibration Modes and Orientation Angles

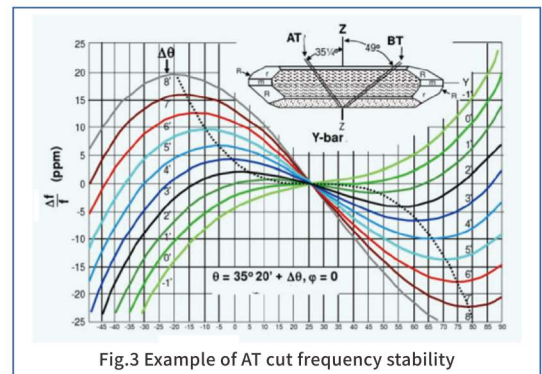
Regarding the vibration mode of the AT cut, the orientation angle at which the primary coefficient of the frequency temperature characteristics near room temperature reaches zero is indicated in Fig.1



And the mode of thickness shear vibration is shown virtually in Fig.2.

## 2.Frequency-temperature characteristics

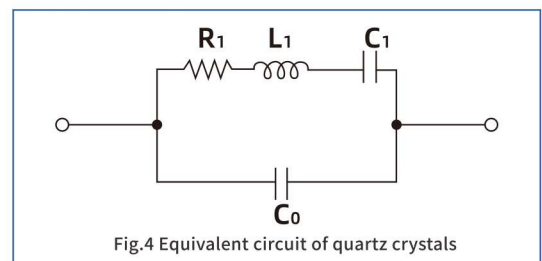
The frequency-temperature characteristics of a crystal are categorized into two types according to its shape of curve. One is a tertiary curve and the other is a quadratic curve. The typical frequency-temperature characteristics of AT cut are shown in Fig.3 , respectively. AT cut crystal units are most widely used because they produce smaller frequency changes in response to temperature changes in the room temperature range.



## 3. Equivalent circuit and various constants

The equivalent circuit of quartz crystal near the resonance frequency is represented by the arrangements shown in Fig.4.

- R<sub>1</sub>:Series Resistance
- L<sub>1</sub>: Motional Inductance
- C<sub>1</sub>: Motional Capacitance
- C<sub>0</sub>: Shunt Capacitance



$$\text{Series resonance frequency } f_s = \frac{1}{2\pi\sqrt{L_1 C_1}}$$

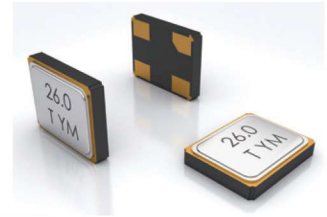
$$\text{Parallel resonance frequency } f_p = \frac{1}{2\pi\sqrt{L \frac{C_0 * C_1}{C_0 + C_1}}} = \frac{1}{2\pi\sqrt{L_1 C_1}} \sqrt{1 + \frac{C_1}{C_0}}$$



# MHz Crystal (SMD)

## 2.1 M3225

### Metal Can Type Crystals M3225 Series



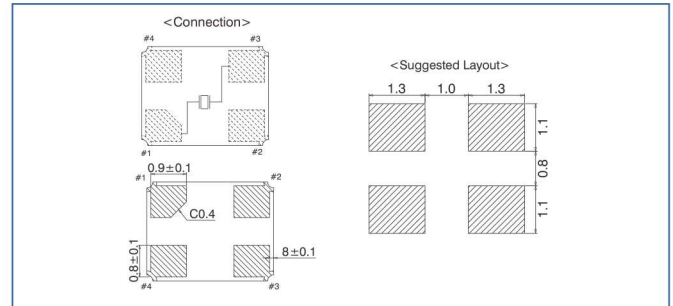
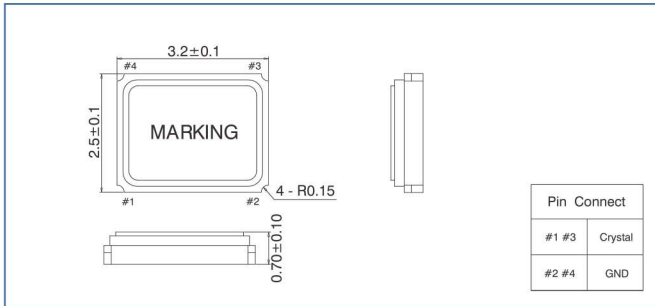
#### FEATURES

- Reflow resistance type crystal units
- Higher frequency pullability and lower equivalent series resistance
- Lower cost and highly mass production capability
- RoHS Compliant/Pb Free
- AEC-Q200 Compliant

#### TYPICAL APPLICATION

Automotive Connectivity  
Infotainment and Internet Platform  
Navigation, Camera, Radar, RKE, PEPS  
Adaptive Light, Blind Spot Detection, Windows and Mirrors Control

#### DIMENSIONS



#### ELECTRICAL SPECIFICATION

| Item/Type                     | M3225                                     |
|-------------------------------|-------------------------------------------|
| Frequency Range               | 8 ~ 54 MHz                                |
| Frequency Tolerance (at 25°C) | ± 20 ppm, or specify                      |
| Operating Temperature Range   | -40~+125°C, or specify                    |
| Shunt Capacitance ( $C_0$ )   | 3pF Max.                                  |
| Drive Level                   | 100μW (typical)                           |
| Load Capacitance              | Series, 6pF, 10pF, 12pF, 16pF, or specify |
| Aging (at 25°C)               | ± 3 ppm/year Max.                         |
| Storage Temperature Range     | -40 ~ +125°C                              |

#### EQUIVALENT SERIES RESISTANCE(ESR)

| Frequency             | Resistance |
|-----------------------|------------|
| 8MHz< $F_0$ <10MHz    | 300 Ω Max. |
| 10MHz≤ $F_0$ <15MHz   | 150 Ω Max. |
| 15MHz≤ $F_0$ <19.5MHz | 80 Ω Max.  |
| 19.5MHz≤ $F_0$ <27MHz | 60 Ω Max.  |
| 27MHz≤ $F_0$ <54MHz   | 50 Ω Max.  |

#### FREQ. STABILITY vs. TEMP. RANGE

| ppm<br>Temp.(°C) | ± 20 | ± 30 | ± 50 |
|------------------|------|------|------|
| -40~+85          | ○    | ○    | ○    |
| -40~+105         | △    | ○    | ○    |
| -40~+125         | ×    | ×    | ○    |

\*○: Available △: Condition X: Not available

Note: not all combination of options are available. Other specifications may be available upon request.





# Thermistor Quartz Crystal

## 3.1 T2016

### Thermistor Quartz Crystals T2016 Series



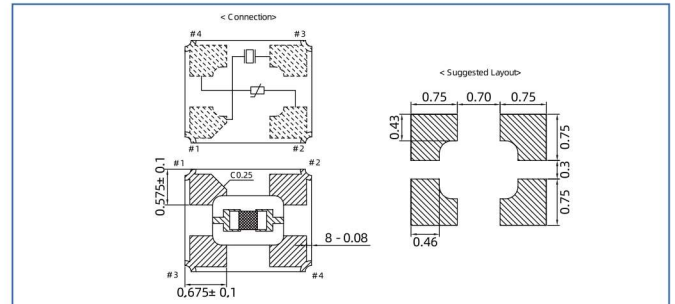
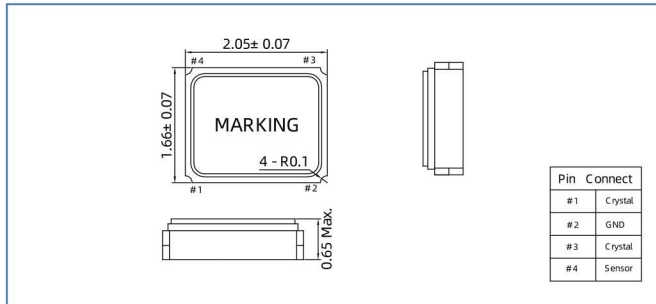
#### FEATURES

- Low aging
- Excellent shock and vibration performance
- Thermally coupled temperature sensor
- RoHS Compliant/Pb Free
- AEC-Q200 Compliant

#### TYPICAL APPLICATION

Automotive Telematics BOX(T-BOX)  
Automotive UWB  
Automotive GPS

#### DIMENSIONS



#### ELECTRICAL SPECIFICATION

| Item/Type                     | M2016                         |
|-------------------------------|-------------------------------|
| Frequency Range               | 19.2MHz,26MHz,38.4MHz,55.2MHz |
| Frequency Tolerance (at 25°C) | ±10ppm,or specify             |
| Operating Temperature Range   | -40~+105°C,or specify         |
| Shunt Capacitance ( $C_0$ )   | 3pF Max.                      |
| Drive Level                   | 100μW (typical)               |
| Load Capacitance              | 7pF,8pF or specify            |
| Aging (at 25°C)               | ±1 ppm/year Max.              |
| Storage Temperature Range     | -40 ~ +125°C                  |

#### EQUIVALENT SERIES RESISTANCE(ESR)

| Frequency             | Resistance |
|-----------------------|------------|
| 19.2MHz               | 80 Ω Max.  |
| 26MHz,38.4MHz,55.2MHz | 50 Ω Max.  |

#### FREQ. STABILITY vs. TEMP. RANGE

| Temp.(°C) | ppm | ±12 | ±12 |
|-----------|-----|-----|-----|
| -30~+85   | ○   | ○   | ○   |
| -40~+105  | ×   | ○   | ○   |

\*○: Available Δ: Condition X: Not available

Note: not all combination of options are available. Other specifications may be available upon request.



# Oscillator (CMOS/LVPECL/LVDS/HCSL Output)

## 4.1 XO3225

3.2 x 2.5 mm SMD  
Crystal Oscillator



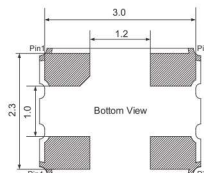
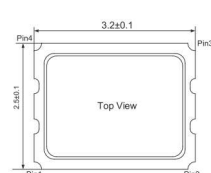
### FEATURES

- Typical 3.2 x 2.5 x 1.0mm Ceramic SMD Package
- Tight Symmetry (45 to 55%) Available
- Operation Voltage: 1.62-3.63V
- Tri-State Enable/Disable Operation
- AEC-Q100 Compliant

### TYPICAL APPLICATION

- Camera ,Vehicular Radar ,Car Navigation ,  
Tachograph ,Automotive Gateway ,T-BOX ,  
Monitor for car , Ntelligent Vehicle  
Communication Terminal Projec

### DIMENSIONS



Pin Connection

| Name  | Connection  |
|-------|-------------|
| pin 1 | Tri - State |
| pin 2 | GND         |
| pin 3 | Fout        |
| pin 4 | Vdd         |

### ELECTRICAL SPECIFICATION

| Parameter                                  |                                                            | 3.3V           |         | 2.5V    |         | 1.8V    |         | Unit |
|--------------------------------------------|------------------------------------------------------------|----------------|---------|---------|---------|---------|---------|------|
|                                            |                                                            | Min.           | Max.    | Min.    | Max.    | Min.    | Max.    |      |
| Supply Voltage Variation (VDD)             |                                                            | VDD-10%        | VDD+10% | VDD-10% | VDD+10% | VDD-10% | VDD+10% | V    |
| Frequency Range                            |                                                            | 1              | 125     | 1       | 125     | 1       | 125     | MHz  |
| Standard Frequency                         |                                                            | 24, 26, 30, 40 |         |         |         |         |         | MHz  |
| Supply Current                             | At 15pF Load                                               | —              | 25      | —       | 25      | —       | 20      | mA   |
|                                            | No Load Condition, $1\text{MHz} \leq F_o < 10\text{MHz}$   | —              | 15      | —       | 15      | —       | 15      | mA   |
|                                            | No Load Condition, $10\text{MHz} \leq F_o < 20\text{MHz}$  | —              | 15      | —       | 15      | —       | 15      | mA   |
|                                            | No Load Condition, $20\text{MHz} \leq F_o < 80\text{MHz}$  | —              | 15      | —       | 15      | —       | 15      | mA   |
|                                            | No Load Condition, $80\text{MHz} \leq F_o < 125\text{MHz}$ | —              | 15      | —       | 15      | —       | 15      | mA   |
| Duty Cycle                                 |                                                            | 45             | 55      | 45      | 55      | 45      | 55      | %    |
| Output Level                               | Output High                                                | 2.97           | —       | 2.25    | —       | 1.62    | —       | V    |
|                                            | Output Low                                                 | —              | 0.33    | —       | 0.25    | —       | 0.18    |      |
| Transition Time:<br>Rise/Fall Time+        | $1.25\text{MHz} \leq F_o < 10\text{MHz}$                   | —              | 8       | —       | 9       | —       | 10      | nSec |
|                                            | $10\text{MHz} \leq F_o < 20\text{MHz}$                     | —              | 8       | —       | 9       | —       | 10      | nSec |
|                                            | $20\text{MHz} \leq F_o < 80\text{MHz}$                     | —              | 8       | —       | 9       | —       | 10      | nSec |
|                                            | $80\text{MHz} \leq F_o < 125\text{MHz}$                    | —              | 6       | —       | 7       | —       | 8       | nSec |
| Startup Time                               |                                                            | —              | 5       | —       | 5       | —       | 5       | mSec |
| Tri-State<br>(Input to Pin2 or Pin1)       | Enable (High Voltage or Floating)                          | 2.31           | —       | 1.75    | —       | 1.26    | —       | V    |
|                                            | Disable (Low Voltage or GND)                               | —              | 0.99    | —       | 0.75    | —       | 0.54    |      |
| Output Loading                             |                                                            | 15             |         | 15      |         | 15      |         | pF   |
| Stand by Current                           | -40~85°C                                                   | —              | 10      | —       | 10      | —       | 10      | uA   |
|                                            | -40~125°C                                                  | —              | 20      | —       | 20      | —       | 20      | uA   |
| Aging (@25°C, 1st Year)                    |                                                            | —              | ±3      | —       | ±3      | —       | ±3      | ppm  |
| Storage Temp. Range                        |                                                            | -55            | 125     | -55     | 125     | -55     | 125     | °C   |
| RMS Phase Jitter(Integrated 12KHz ~ 20MHz) |                                                            | —              | 1       | —       | 1       | —       | 1       | pSec |

## Oscillator (CMOS/LVPECL/LVDS/HCSL Output)

### FREQ. STABILITY vs. TEMP. RANGE

| Temp.(°C) \ ppm | ±20 | ±25 | ±50 | ±100 |
|-----------------|-----|-----|-----|------|
| -10 ~ +60       | ○   | ○   | ○   | ○    |
| -20 ~ +70       | △   | ○   | ○   | ○    |
| -40 ~ +85       | ×   | △   | ○   | ○    |
| -40 ~ +125      | ×   | ×   | △   | ○    |

\*○: Available △: Condition ×: Not available

\*Inclusive of calibration @ 25 °C, operating temperature range, input voltage variation, load variation, aging (1st year), shock, and vibration.

Note: not all combination of options are available. Other specifications may be available upon request.  
Specifications subject to change without notice.

# Oscillator (CMOS/LVPECL/LVDS/HCSL Output)

## 4.2 XO2520

2.5 x 2.0mm SMD CMOS Output  
Crystal Oscillator



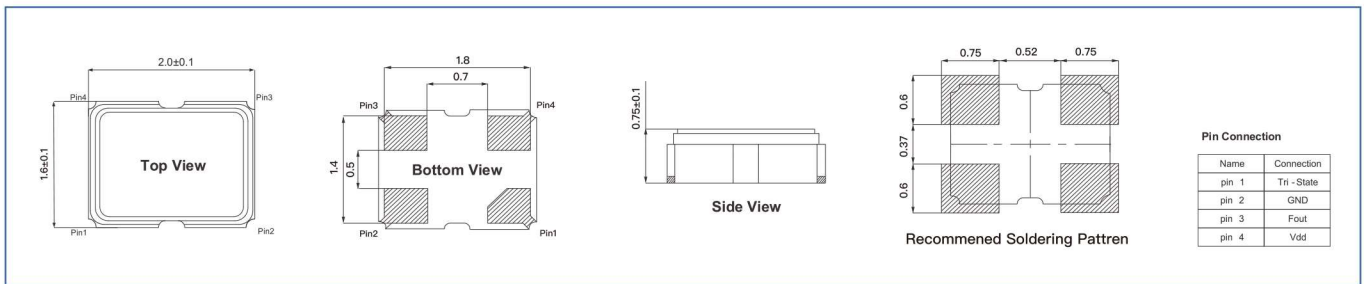
### FEATURES

- Ultra Low Power Supply Voltage: 1.62-3.63V
- Low Noise Typical: 1 pS at 12 kHz ~ 20 MHz  
Supply Options Frequency Offsets
- Singled-end Output: CMOS
- Temperature Range: -40 ~ 125°C Operation
- Pb-free/RoHS Compliant
- AEC-Q100 Compliant

### TYPICAL APPLICATION

- Camera ,Vehicular Radar ,Car Navigation  
Tachograph ,Automotive Gateway ,T-BOX  
Monitor for car , Ntelligent Vehicle Communication  
Terminal Projec

### DIMENSIONS



### ELECTRICAL SPECIFICATION

| Parameter                            |                                                 | 3.3V    |         | 2.5V    |         | 1.8V    |         | Unit |
|--------------------------------------|-------------------------------------------------|---------|---------|---------|---------|---------|---------|------|
|                                      |                                                 | Min.    | Max.    | Min.    | Max.    | Min.    | Max.    |      |
| Supply Voltage Variation (VDD)       |                                                 | VDD-10% | VDD+10% | VDD-10% | VDD+10% | VDD-10% | VDD+10% | V    |
| Frequency Range                      |                                                 | 1       | 125     | 1       | 125     | 1       | 125     | MHz  |
| Supply Current                       | At 15pF Load                                    | —       | 25      | —       | 25      | —       | 20      | mA   |
|                                      | No Load Condition, 1MHz≤F <sub>o</sub> <10MHz   | —       | 15      | —       | 15      | —       | 15      | mA   |
|                                      | No Load Condition, 10MHz≤F <sub>o</sub> <20MHz  | —       | 15      | —       | 15      | —       | 15      | mA   |
|                                      | No Load Condition, 20MHz≤F <sub>o</sub> <80MHz  | —       | 15      | —       | 15      | —       | 15      | mA   |
|                                      | No Load Condition, 80MHz≤F <sub>o</sub> <125MHz | —       | 15      | —       | 15      | —       | 15      | mA   |
| Duty Cycle                           |                                                 | 45      | 55      | 45      | 55      | 45      | 55      | %    |
| Output Level                         | Output High                                     | 2.97    | —       | 2.25    | —       | 1.62    | —       | V    |
|                                      | Output Low                                      | —       | 0.33    | —       | 0.25    | —       | 0.18    |      |
| Transition Time:<br>Rise/Fall Time+  | 1.25MHz≤F <sub>o</sub> <10MHz                   | —       | 8       | —       | 9       | —       | 10      | nSec |
|                                      | 10MHz≤F <sub>o</sub> <20MHz                     | —       | 8       | —       | 9       | —       | 10      | nSec |
|                                      | 20MHz≤F <sub>o</sub> ≤80MHz                     | —       | 8       | —       | 9       | —       | 10      | nSec |
| Startup Time                         |                                                 | —       | 5       | —       | 5       | —       | 5       | mSec |
| Tri-State<br>(Input to Pin2 or Pin1) | Enable (High Voltage or Floating)               | 0.7VDD  | —       | 0.7VDD  | —       | 0.7VDD  | —       | V    |
|                                      | Disable (Low Voltage or GND)                    | —       | 0.3VDD  | —       | 0.3VDD  | —       | 0.3VDD  |      |



# Oscillator (CMOS/LVPECL/LVDS/HCSL Output)

## ELECTRICAL SPECIFICATION

| Parameter                                 | 3.3V |      | 2.5V |      | 1.8V |      | Unit |
|-------------------------------------------|------|------|------|------|------|------|------|
|                                           | Min. | Max. | Min. | Max. | Min. | Max. |      |
| Output Loading                            | 15   |      | 15   |      | 15   |      | pF   |
| Stand by Current                          | —    | 20   | —    | 100  | —    | 100  | uA   |
| Aging (@25°C, 1st Year)                   | —    | ±3   | —    | ±3   | —    | ±3   | ppm  |
| Storage Temp. Range                       | -55  | 125  | -55  | 125  | -55  | 125  | °C   |
| RMS Phase Jitter(Intergrated 12KHz~20MHz) | —    | 1    | —    | 1    | —    | 1    | pSec |

Standard frequencies are frequencies which the crystal has been designed and does not imply a stock position.

+ Transition times are measured between 20% and 80% of VDD.

## FREQ. STABILITY vs. TEMP. RANGE

| Temp.(°C) \ ppm | ± 20 | ± 25 | ± 20 | ± 25 |
|-----------------|------|------|------|------|
| -10 ~ +60       | ○    | ○    | ○    | ○    |
| -20 ~ +70       | △    | ○    | ○    | ○    |
| -40 ~ +85       | ×    | △    | ○    | ○    |
| -40 ~ +125      | ×    | ×    | △    | ○    |

\*○: Available △: Condition X: Not available

\*Inclusive of calibration @ 25 °C, operating temperature range, input voltage variation, load variation, aging (1st year), shock, and vibration.

Note: not all combination of options are available. Other specifications may be available upon request.

Specifications subject to change without notice.

# Oscillator (CMOS/LVPECL/LVDS/HCSL Output)

## 4.3 XO2016

2.0 x 1.6 mm  
CMOS Crystal Oscillator



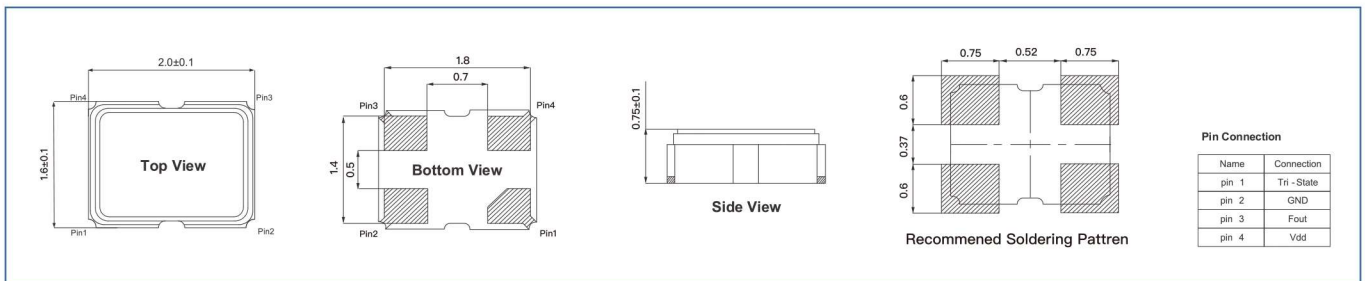
### FEATURES

- External Dimensions: 2.0x1.6x0.75 mm
- Small Size, High Reliability
- Wide Supply Voltage: 1.62-3.63V
- AEC-Q100 Compliant

### TYPICAL APPLICATION

- Camera, Vehicular Radar, Car Navigation, Tachograph, Automotive Gateway, T-BOX, Monitor for car, Intelligent Vehicle Communication Terminal Project

### DIMENSIONS



### ELECTRICAL SPECIFICATION

| Specifications                             |                                                                   | 3.3V    |         | 2.5V    |         | 1.8V    |         | Unit |
|--------------------------------------------|-------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|------|
|                                            |                                                                   | Min.    | Max.    | Min.    | Max.    | Min.    | Max.    |      |
| Operating Voltage(VDD)                     |                                                                   | VDD-10% | VDD+10% | VDD-10% | VDD+10% | VDD-10% | VDD+10% | V    |
| Output Frequency                           |                                                                   | 1       | 125     | 1       | 125     | 1       | 125     | MHz  |
| Supply Current                             | At 15pF Load                                                      | —       | 25      | —       | 25      | —       | 20      | mA   |
|                                            | When no load is provided, $1\text{MHz} \leq F_o < 10\text{MHz}$   | —       | 15      | —       | 15      | —       | 15      | mA   |
|                                            | When no load is provided, $10\text{MHz} \leq F_o < 20\text{MHz}$  | —       | 15      | —       | 15      | —       | 15      | mA   |
|                                            | When no load is provided, $20\text{MHz} \leq F_o < 80\text{MHz}$  | —       | 15      | —       | 15      | —       | 15      | mA   |
|                                            | When no load is provided, $80\text{MHz} \leq F_o < 125\text{MHz}$ | —       | 15      | —       | 15      | —       | 15      | mA   |
| Duty Cycle                                 |                                                                   | 45      | 55      | 45      | 55      | 45      | 55      | %    |
| Output Level                               | VoH                                                               | 2.97    | —       | 2.25    | —       | 1.62    | —       | V    |
|                                            | VoL                                                               | —       | 0.33    | —       | 0.25    | —       | 0.18    |      |
| Transition Time: Rise/Fall Time+           | $1.25\text{MHz} \leq F_o < 10\text{MHz}$                          | —       | 8       | —       | 9       | —       | 10      | nSec |
|                                            | $10\text{MHz} \leq F_o < 20\text{MHz}$                            | —       | 8       | —       | 9       | —       | 10      | nSec |
|                                            | $20\text{MHz} \leq F_o < 80\text{MHz}$                            | —       | 8       | —       | 9       | —       | 10      | nSec |
| Start-up time                              |                                                                   | —       | 5       | —       | 5       | —       | 5       | mSec |
| Tri-State (Input to Pin2 or Pin1)          | On(High Level or Floating)                                        | 0.7VDD  | —       | 0.7VDD  | —       | 0.7VDD  | —       | V    |
|                                            | Off(Low Level or Ground)                                          | —       | 0.3VDD  | —       | 0.3VDD  | —       | 0.3VDD  |      |
| Output Load                                |                                                                   | 15      |         | 15      |         | 15      |         | pF   |
| Standby Current                            |                                                                   | —       | 20      | —       | 20      | —       | 20      | uA   |
| Aging(@25°C, the first year)               |                                                                   | —       | ±3      | —       | ±3      | —       | ±3      | ppm  |
| Storage Temperature                        |                                                                   | -55     | 125     | -55     | 125     | -55     | 125     | °C   |
| Phase jitter Root-mean-square(12KHz~20MHz) |                                                                   | —       | 1       | —       | 1       | —       | 1       | pSec |

# Oscillator (CMOS/LVPECL/LVDS/HCSL Output)

## FREQ. STABILITY vs. TEMP. RANGE

| Temp.(°C) \ ppm | ±20 | ±25 | ±50 | ±100 |
|-----------------|-----|-----|-----|------|
| -10 ~ +60       | ○   | ○   | ○   | ○    |
| -20 ~ +70       | △   | ○   | ○   | ○    |
| -40 ~ +85       | ×   | △   | ○   | ○    |
| -40 ~ +125      | ×   | ×   | △   | ○    |

\*○: Available △: Condition X: Not available

\*Inclusive of calibration @ 25 °C, operating temperature range, input voltage variation, load variation, aging (1st year), shock, and vibration.

Note: not all combination of options are available. Other specifications may be available upon request.  
Specifications subject to change without notice.

KHz Crystal  
(SMD)

MHz Crystal  
(SMD)

Thermistor  
Quartz Crystal

Oscillator SPXO  
(CMOS/LVPECL/  
LVDS/HCSL Output)

TCXO

OCXO

# Quartz Crystal Crystal Oscillator TCXO OCXO Timing Module



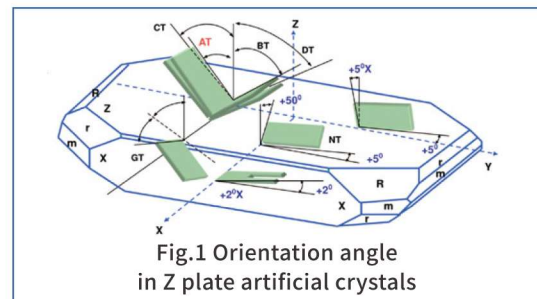
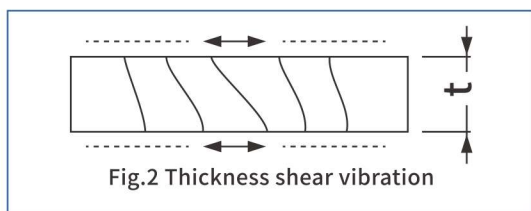
Global Leader in Communication Frequency Control Devices



# INTRODUCTION >>>

## 1.Vibration Modes and Orientation Angles

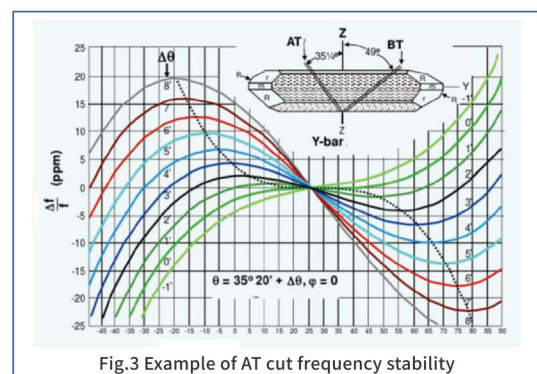
Regarding the vibration mode of the AT cut, the orientation angle at which the primary coefficient of the frequency temperature characteristics near room temperature reaches zero is indicated in Fig.1



And the mode of thickness shear vibration is shown virtually in Fig.2.

## 2.Frequency-temperature characteristics

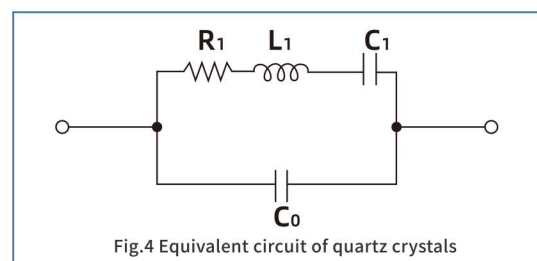
The frequency-temperature characteristics of a crystal are categorized into two types according to its shape of curve. One is a tertiary curve and the other is a quadratic curve. The typical frequency-temperature characteristics of AT cut are shown in Fig.3 , respectively. AT cut crystal units are most widely used because they produce smaller frequency changes in response to temperature changes in the room temperature range.



## 3. Equivalent circuit and various constants

The equivalent circuit of quartz crystal near the resonance frequency is represented by the arrangements shown in Fig.4.

- R<sub>1</sub>:Series Resistance
- L<sub>1</sub>: Motional Inductance
- C<sub>1</sub>: Motional Capacitance
- C<sub>0</sub>: Shunt Capacitance



Series resonance frequency  $f_s = \frac{1}{2\pi\sqrt{L_1 C_1}}$

Parallel resonance frequency  $f_p = \frac{1}{2\pi\sqrt{L \frac{C_0 * C_1}{C_0 + C_1}}} = \frac{1}{2\pi\sqrt{L_1 C_1}} \sqrt{1 + \frac{C_1}{C_0}}$

# KHz Crystal (SMD)

## 1.1 M8

### Metal Can Type Crystals M8 Series



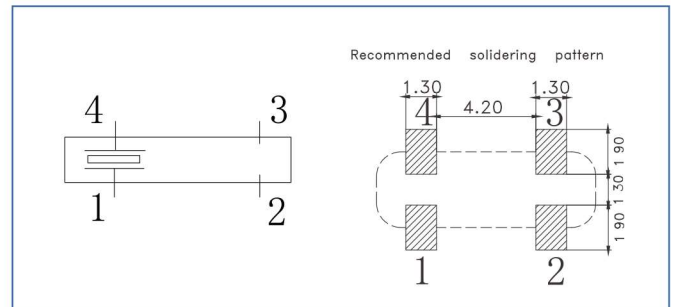
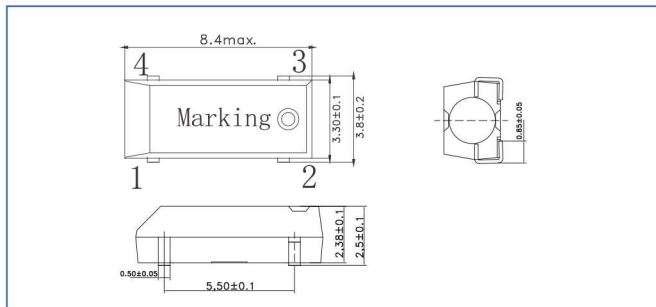
#### FEATURES

- Size: 8.0\*3.8\*2.5 mm
- Reflow resistance type crystal units
- Lower cost and highly mass production capability
- RoHS Compliant/Pb Free

#### TYPICAL APPLICATION

- The best choice of Notebook Computer  
TV, STB, LCDM and Cable Modem

#### DIMENSIONS



#### ELECTRICAL SPECIFICATION

| Item/Type                     | M8                                   |
|-------------------------------|--------------------------------------|
| Frequency Range               | 32.768KHz                            |
| Frequency Tolerance (at 25°C) | ±20ppm, or specify                   |
| Operating Temperature Range   | -40 ~ +85°C                          |
| Shunt Capacitance ( $C_0$ )   | 2.0pF Max.                           |
| Drive Level                   | 1.0μW typical                        |
| Load Capacitance              | Series, 7pF, 9pF, 12.5pF, or specify |
| Aging (at 25°C)               | ±5 ppm First year Max.               |
| Storage Temperature Range     | -55 ~ +125°C                         |
| Turnover Temperature          | 25±5°C                               |
| Temperature Coefficient       | (-0.036±0.005) ppm/°C <sup>2</sup>   |
| Insulation Resistance         | 500MΩ@DC 100±10V                     |

#### EQUIVALENT SERIES RESISTANCE(ESR)

| Frequency | Resistance |
|-----------|------------|
| 32.768KHz | 50KΩ Max.  |

# KHz Crystal (SMD)

## 1.2 M6

### Metal Can Type Crystals M6 Series



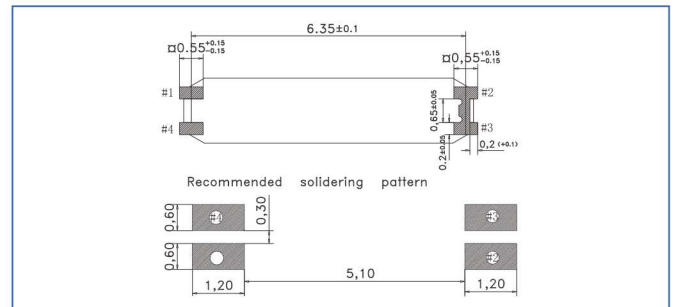
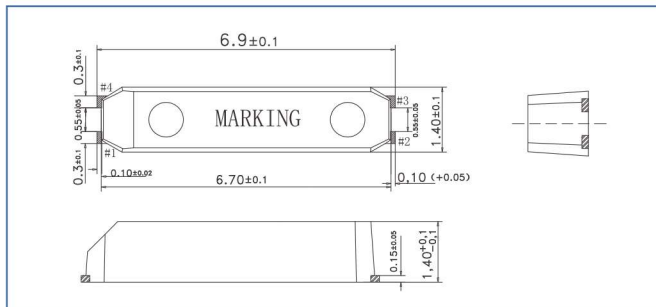
#### FEATURES

- Size: 7.0\*1.5\*1.5 mm
- Reflow resistance type crystal units
- Lower cost and highly mass production capability
- RoHS Compliant/Pb Free

#### TYPICAL APPLICATION

- The best choice of Notebook Computer  
TV, STB, LCDM and Cable Modem

#### DIMENSIONS



#### ELECTRICAL SPECIFICATION

| Item/Type                     | M6                                   |
|-------------------------------|--------------------------------------|
| Frequency Range               | 32.768KHz                            |
| Frequency Tolerance (at 25°C) | ±20ppm, or specify                   |
| Operating Temperature Range   | -40 ~ +85°C                          |
| Shunt Capacitance ( $C_0$ )   | 1.0pF Max.                           |
| Drive Level                   | 1.0μW typical                        |
| Load Capacitance              | Series, 7pF, 9pF, 12.5pF, or specify |
| Aging (at 25°C)               | ±5 ppm First year Max.               |
| Storage Temperature Range     | -55 ~ +125°C                         |
| Turnover Temperature          | 25±5°C                               |
| Temperature Coefficient       | (-0.036±0.005) ppm/°C <sup>2</sup>   |
| Insulation Resistance         | 500MΩ@DC 100±10V                     |

#### EQUIVALENT SERIES RESISTANCE(ESR)

| Frequency | Resistance |
|-----------|------------|
| 32.768KHz | 65KΩ Max.  |



# KHz Crystal (SMD)

## 1.3 K3215

### Metal Can Type Crystals M5 Series



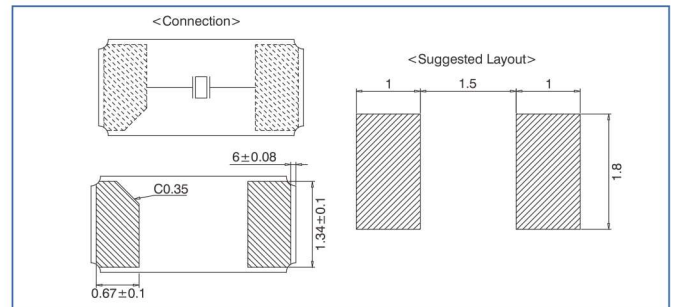
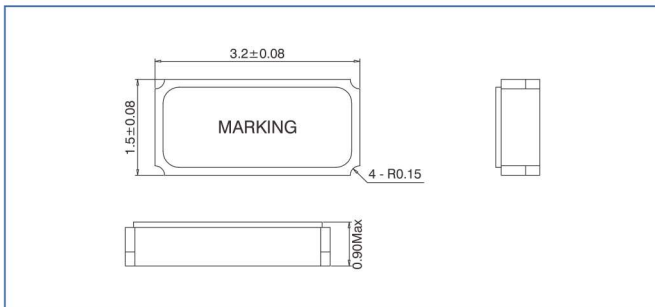
#### FEATURES

- Size: 3.2\*1.5\*0.9 mm
- Reflow resistance type crystal units
- Lower cost and highly mass production capability
- RoHS Compliant/Pb Free

#### TYPICAL APPLICATION

- The best choice of Notebook Computer  
TV, STB, LCDM and Cable Modem

#### DIMENSIONS



#### ELECTRICAL SPECIFICATION

| Item/Type                     | M5                                   |
|-------------------------------|--------------------------------------|
| Frequency Range               | 32.768KHz                            |
| Frequency Tolerance (at 25°C) | ±20ppm, or specify                   |
| Operating Temperature Range   | -40 ~ +85°C                          |
| Shunt Capacitance ( $C_0$ )   | 1.5pF Max.                           |
| Drive Level                   | 0.1μW typical, 0.5μW Max.            |
| Load Capacitance              | Series, 7pF, 9pF, 12.5pF, or specify |
| Aging (at 25°C)               | ±3 ppm First year Max.               |
| Storage Temperature Range     | -55 ~ +125°C                         |
| Turnover Temperature          | 25±5°C                               |
| Temperature Coefficient       | (-0.036±0.005) ppm/°C <sup>2</sup>   |
| Insulation Resistance         | 500MΩ@DC 100±10V                     |

#### EQUIVALENT SERIES RESISTANCE(ESR)

| Frequency | Resistance |
|-----------|------------|
| 32.768KHz | 70KΩ Max.  |

# KHz Crystal (SMD)

## 1.4 K2012

### Metal Can Type Crystals M3 Series



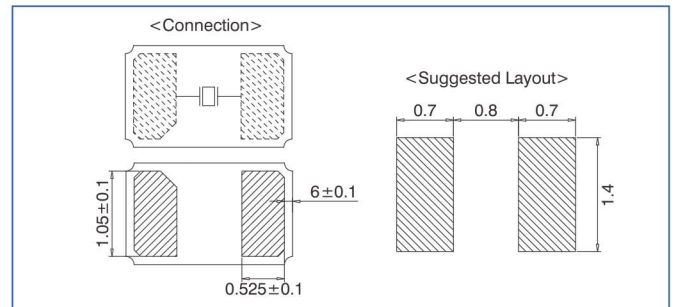
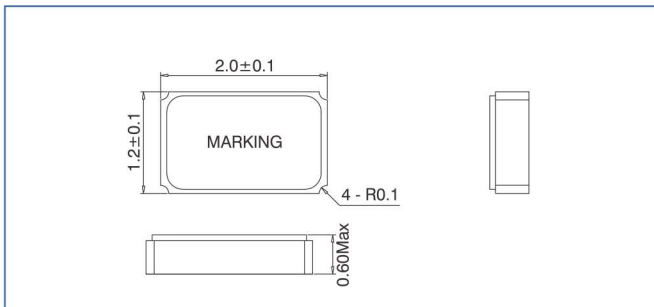
#### FEATURES

- Size: 2.0\*1.2\*0.6 mm
- Reflow resistance type crystal units
- Lower cost and highly mass production capability
- RoHS Compliant/Pb Free

#### TYPICAL APPLICATION

- The best choice of Notebook Computer  
TV, STB, LCDM and Cable Modem

#### DIMENSIONS



#### ELECTRICAL SPECIFICATION

| Item/Type                     | M3                                   |
|-------------------------------|--------------------------------------|
| Frequency Range               | 32.768KHz                            |
| Frequency Tolerance (at 25°C) | ±20ppm, or specify                   |
| Operating Temperature Range   | -40 ~ +85°C                          |
| Shunt Capacitance ( $C_0$ )   | 1.5pF Max.                           |
| Drive Level                   | 0.1μW typical, 0.5μW Max.            |
| Load Capacitance              | Series, 7pF, 9pF, 12.5pF, or specify |
| Aging (at 25°C)               | ±3 ppm First year Max.               |
| Storage Temperature Range     | -55 ~ +125°C                         |
| Turnover Temperature          | 25±5°C                               |
| Temperature Coefficient       | (-0.036±0.005) ppm/°C <sup>2</sup>   |
| Insulation Resistance         | >500MΩ@DC 100±10V                    |

#### EQUIVALENT SERIES RESISTANCE(ESR)

| Frequency | Resistance |
|-----------|------------|
| 32.768KHz | 90KΩ Max.  |

# KHz Crystal (SMD)

## 1.5 K1610

### Metal Can Type Crystals TF 1610



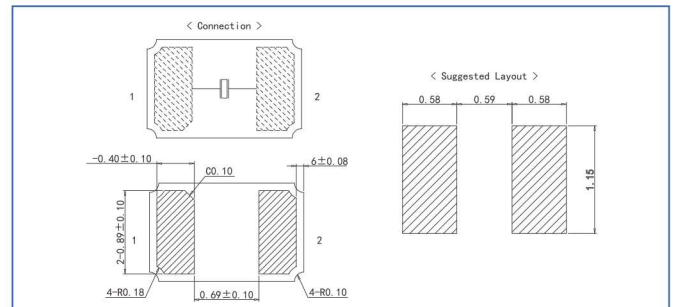
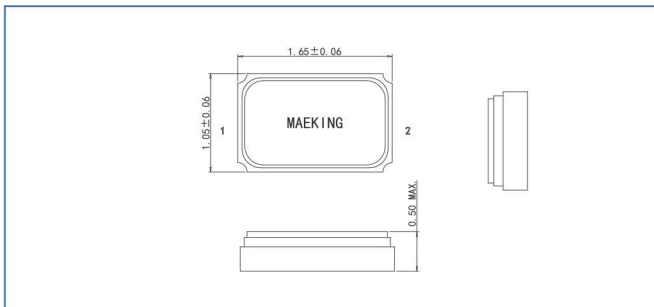
#### FEATURES

- Ultra-small size: 1.6 x1.0x0.5 mm
- Ceramic seam welding package
- High stability
- Pb Free and RoHS compliant

#### TYPICAL APPLICATION

- Small wireless device, Wireless module, IoT, Wearable device, TWS
- Health care equipment, Small consumer equipment etc

#### DIMENSIONS



#### ELECTRICAL SPECIFICATION

| Item/Type                     | TF1610                               |
|-------------------------------|--------------------------------------|
| Frequency Range               | 32.768KHz                            |
| Frequency Tolerance (at 25°C) | ±20ppm                               |
| Operating Temperature Range   | -40 ~ +85°C                          |
| Shunt Capacitance ( $C_0$ )   | 2.0pF Max.                           |
| Drive Level                   | 0.1μW(0.5μW Max.)                    |
| Load Capacitance              | Series, 7pF, 9pF, 12.5pF, or specify |
| Aging(at 25°C)                | ±5 ppm First year Max.               |
| Storage Temperature Range     | -40 ~ +125°C                         |
| Turnover Temperature          | 25±5°C                               |
| Temperature Coefficient       | (-0.036±0.005) ppm/°C <sup>2</sup>   |
| Insulation Resistance         | 500MΩ@DC 100±10V                     |

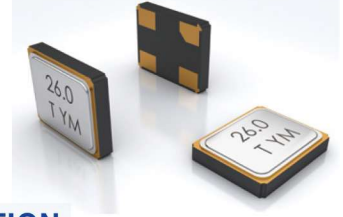
#### EQUIVALENT SERIES RESISTANCE(ESR)

| Frequency | Resistance |
|-----------|------------|
| 32.768KHz | 90KΩ Max.  |

# MHz Crystal (SMD)

## 2.1 M3225

### Metal Can Type Crystals M3225 Series



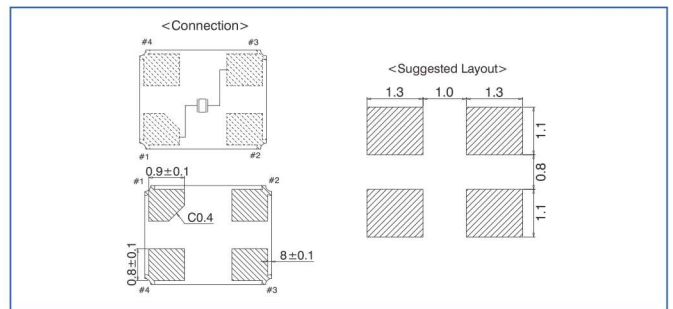
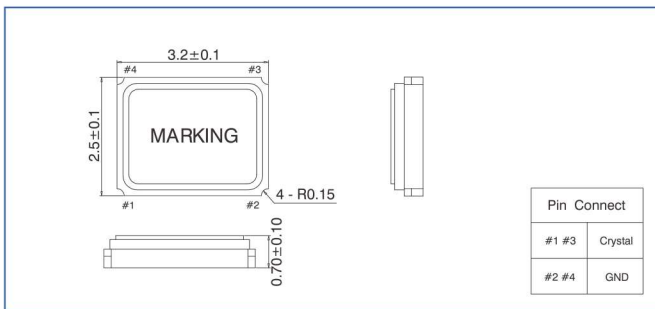
#### FEATURES

- Reflow resistance type crystal units
- Higher frequency pullability and lower equivalent series resistance
- Lower cost and highly mass production capability
- RoHS Compliant/Pb Free

#### TYPICAL APPLICATION

- The best choice of Notebook Computer  
TV, STB, LCDM and Cable Modem

#### DIMENSIONS



#### ELECTRICAL SPECIFICATION

| Item/Type                                            | M3225                                     |
|------------------------------------------------------|-------------------------------------------|
| Frequency Range                                      | 8 ~ 54 MHz                                |
| Frequency Tolerance (at 25°C)                        | ±10 ppm, or specify                       |
| Frequency Stability Over Operating Temperature Range | ±10 ppm, or specify                       |
| Operating Temperature Range                          | -10 ~ +60°C, or specify                   |
| Shunt Capacitance (C <sub>0</sub> )                  | 3pF Max.                                  |
| Drive Level                                          | 100μW (typical)                           |
| Load Capacitance                                     | Series, 6pF, 10pF, 12pF, 16pF, or specify |
| Aging (at 25°C)                                      | ±3 ppm/year Max.                          |
| Storage Temperature Range                            | -40 ~ +125°C                              |

#### EQUIVALENT SERIES RESISTANCE(ESR)

| Frequency                        | Resistance |
|----------------------------------|------------|
| 8MHz ≤ F <sub>0</sub> < 10MHz    | 300 Ω Max. |
| 10MHz ≤ F <sub>0</sub> < 15MHz   | 150 Ω Max. |
| 15MHz ≤ F <sub>0</sub> < 19.5MHz | 80 Ω Max.  |
| 19.5MHz ≤ F <sub>0</sub> < 27MHz | 60 Ω Max.  |
| 27MHz ≤ F <sub>0</sub> < 54MHz   | 50 Ω Max.  |

#### FREQ. STABILITY vs. TEMP. RANGE

| ppm<br>Temp.(°C) | ±10 | ±15 | ppm<br>Temp.(°C) | ±20 | ±30 | ±50 |
|------------------|-----|-----|------------------|-----|-----|-----|
| -10 ~ +60        | ○   | ○   | -40 ~ +105       | △   | ○   | ○   |
| -20 ~ +70        | ○   | ○   | -40 ~ +125       | ×   | ×   | ○   |
| -40 ~ +85        | ×   | △   |                  |     |     |     |

\*○: Available △: Condition ×: Not available

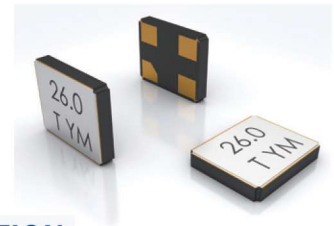
Note: not all combination of options are available. Other specifications may be available upon request.



# MHz Crystal (SMD)

## 2.2 M2520

### Metal Can Type Crystals M2520 Series



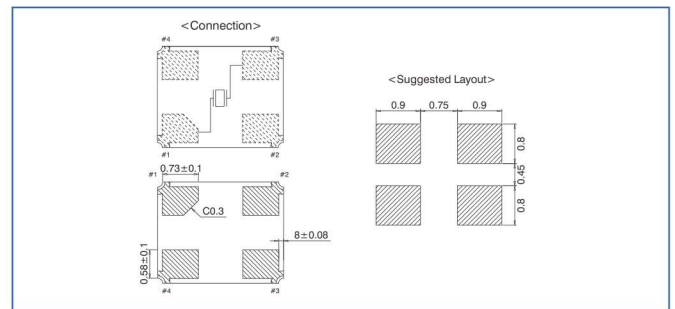
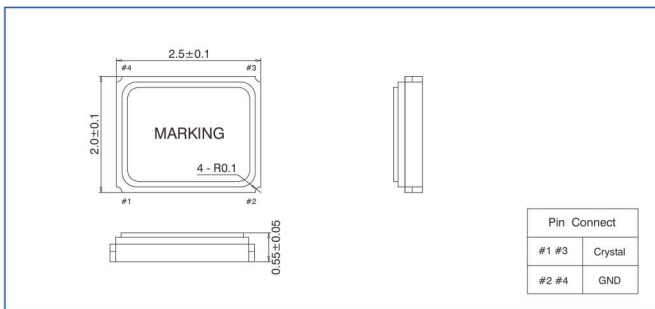
#### FEATURES

- Reflow resistance type crystal units
- Higher frequency pullability and lower equivalent series resistance
- Lower cost and highly mass production capability
- RoHS Compliant/Pb Free

#### TYPICAL APPLICATION

- The best choice of Notebook Computer  
TV, STB, LCDM and Cable Modem

#### DIMENSIONS



#### ELECTRICAL SPECIFICATION

| Item/Type                                            | M2520                               |
|------------------------------------------------------|-------------------------------------|
| Frequency Range                                      | 12 ~ 54 MHz                         |
| Frequency Tolerance (at 25°C)                        | ±10 ppm, or specify                 |
| Frequency Stability Over Operating Temperature Range | ±10 ppm, or specify                 |
| Operating Temperature Range                          | -10 ~ +60°C, or specify             |
| Shunt Capacitance (C <sub>0</sub> )                  | 3pF Max.                            |
| Drive Level                                          | 10μW (100μW Max.)                   |
| Load Capacitance                                     | Series, 6pF, 12pF, 16pF, or specify |
| Aging (at 25°C)                                      | ±3 ppm/year Max.                    |
| Storage Temperature Range                            | -40 ~ +125°C                        |

#### EQUIVALENT SERIES RESISTANCE(ESR)

| Frequency                   | Resistance |
|-----------------------------|------------|
| 12MHz≤F <sub>0</sub> <20MHz | 150 Ω Max. |
| 20MHz≤F <sub>0</sub> ≤30MHz | 80 Ω Max.  |
| 30MHz<F <sub>0</sub> <54MHz | 60Ω Max.   |

#### FREQ. STABILITY vs. TEMP. RANGE

| ppm<br>Temp.(°C) | ±5 | ±10 | ±15 | ppm<br>Temp.(°C) | ±15 | ±20 | ±30 | ±50 |
|------------------|----|-----|-----|------------------|-----|-----|-----|-----|
| -10 ~ +60        | △  | ○   | ○   | -40 ~ +105       | △   | ○   | ○   | ○   |
| -20 ~ +70        | ×  | △   | ○   | -40 ~ +125       | ×   | ×   | ×   | ○   |
| -40 ~ +85        | ×  | ×   | △   |                  |     |     |     |     |

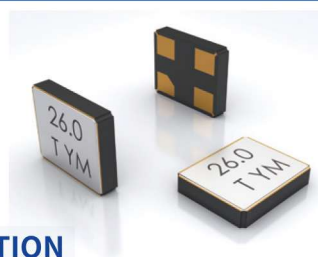
\*o: Available △: Condition X: Not available

Note: not all combination of options are available. Other specifications may be available upon request.

## MHz Crystal (SMD)

## 2.3 M2016

## Metal Can Type Crystals M2016 Series



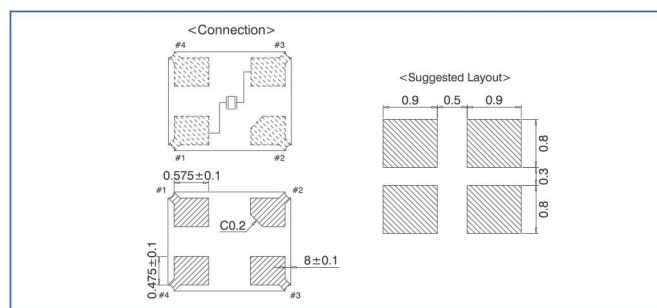
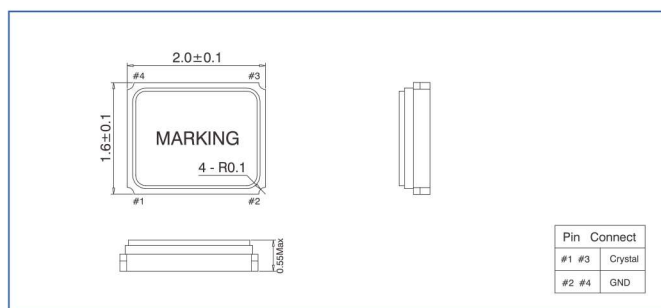
## FEATURES

- Reflow resistance type crystal units
- Higher frequency pullability and lower equivalent series resistance
- Lower cost and highly mass production capability
- RoHS Compliant/Pb Free

## TYPICAL APPLICATION

- The best choice of Notebook Computer  
TV, STB, LCDM and Cable Modem

## DIMENSIONS



## ELECTRICAL SPECIFICATION

| Item/Type                                            | M2016                               |
|------------------------------------------------------|-------------------------------------|
| Frequency Range                                      | 16 ~ 54 MHz                         |
| Frequency Tolerance (at 25°C)                        | ±10 ppm, or specify                 |
| Frequency Stability Over Operating Temperature Range | ±10 ppm, or specify                 |
| Operating Temperature Range                          | -10 ~ +60°C, or specify             |
| Shunt Capacitance (C <sub>0</sub> )                  | 3pF Max.                            |
| Drive Level                                          | 10μW (100μW Max.)                   |
| Load Capacitance                                     | Series, 6pF, 12pF, 16pF, or specify |
| Aging (at 25°C)                                      | ±3 ppm/year Max.                    |
| Storage Temperature Range                            | -40 ~ +125°C                        |

### EQUIVALENT SERIES RESISTANCE(ESR)

| Frequency                              | Resistance        |
|----------------------------------------|-------------------|
| $16\text{MHz} \leq F_o < 20\text{MHz}$ | 150 $\Omega$ Max. |
| $20\text{MHz} \leq F_o < 30\text{MHz}$ | 100 $\Omega$ Max. |
| $30\text{MHz} \leq F_o < 60\text{MHz}$ | 80 $\Omega$ Max.  |
| $60\text{MHz} \leq F_o < 96\text{MHz}$ | 60 $\Omega$ Max.  |

## FREQ. STABILITY vs. TEMP. RANGE

| ppm<br>Temp.(°C) | ±5 | ±10 | ±15 |
|------------------|----|-----|-----|
| -10 ~ +60        | △  | ○   | ○   |
| -20 ~ +70        | ×  | △   | ○   |
| -40 ~ +85        | ×  | ×   | △   |

| ppm<br>Temp.(°C) | ±15 | ±20 | ±30 | ±50 |
|------------------|-----|-----|-----|-----|
| -40 ~ +105       | △   | ○   | ○   | ○   |
| -40 ~ +125       | ×   | ×   | ×   | ○   |

\*o: Available    Δ: Condition    X: Not available

Note: not all combination of options are available. Other specifications may be available upon request.

# MHz Crystal (SMD)

## 2.4 M1612

### SMD AT cut crystal unit M1612 series

#### FEATURES

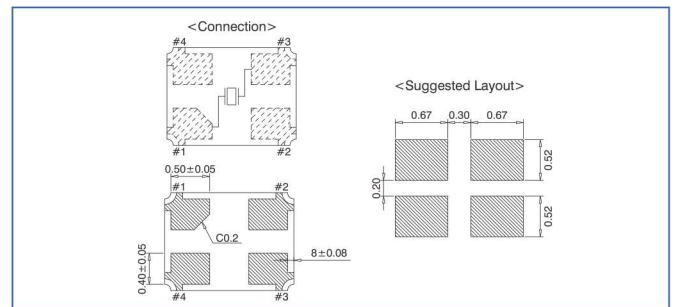
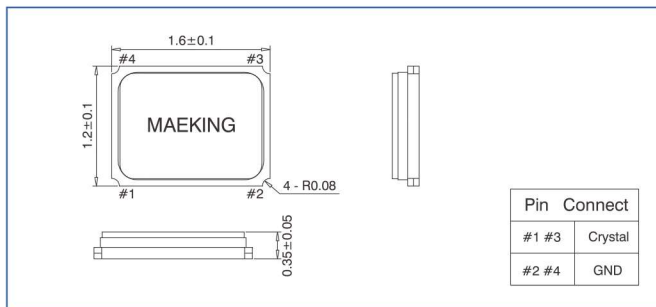
- Ultra-small size: 1.6 × 1.2 × 0.35 mm
- Ceramic seam welding package
- High stability and low aging
- Pb Free and RoHS compliant



#### TYPICAL APPLICATION

- Small wireless device, Wireless module, IoT, Wearable device, TWS
- Health care equipment, Small consumer equipment etc

#### DIMENSIONS



#### ELECTRICAL SPECIFICATION

| Item/Type                                            | M1612                         |
|------------------------------------------------------|-------------------------------|
| Frequency Range                                      | 24 ~ 96MHz                    |
| Frequency Tolerance (at 25°C)                        | ±10 ppm, or specify           |
| Frequency Stability Over Operating Temperature Range | ±10ppm, ±15ppm, or specify    |
| Operating Temperature Range                          | -40 ~ +85°C                   |
| Shunt Capacitance (C <sub>0</sub> )                  | 3pF Max.                      |
| Drive Level                                          | 10μW (100μW Max.)             |
| Load Capacitance                                     | Series, 8pF, 10pF, or specify |
| Aging (at 25°C)                                      | ±3 ppm/year Max.              |
| Storage Temperature Range                            | -40 ~ +125°C                  |

#### EQUIVALENT SERIES RESISTANCE(ESR)

| Frequency                      | Resistance |
|--------------------------------|------------|
| 24MHz ≤ F <sub>0</sub> < 32MHz | 120 Ω Max. |
| 32MHz ≤ F <sub>0</sub> < 52MHz | 80Ω Max.   |
| 52MHz ≤ F <sub>0</sub> ≤ 96MHz | 50 Ω Max.  |

#### FREQ. STABILITY vs. TEMP. RANGE

| ppm<br>Temp.(°C) | ±5 | ±10 | ±15 | ppm<br>Temp.(°C) | ±15 | ±20 | ±30 | ±50 |
|------------------|----|-----|-----|------------------|-----|-----|-----|-----|
| -10 ~ +60        | △  | ○   | ○   | -40 ~ +105       | △   | ○   | ○   | ○   |
| -20 ~ +70        | ×  | △   | ○   | -40 ~ +125       | ×   | ×   | ×   | ○   |
| -40 ~ +85        | ×  | ×   | △   |                  |     |     |     |     |

\*○: Available △: Condition X: Not available

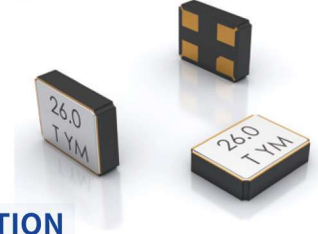
Note: not all combination of options are available. Other specifications may be available upon request.



# MHz Crystal (SMD)

## 2.5 M1210

SMD AT cut crystal unit  
M1210 series



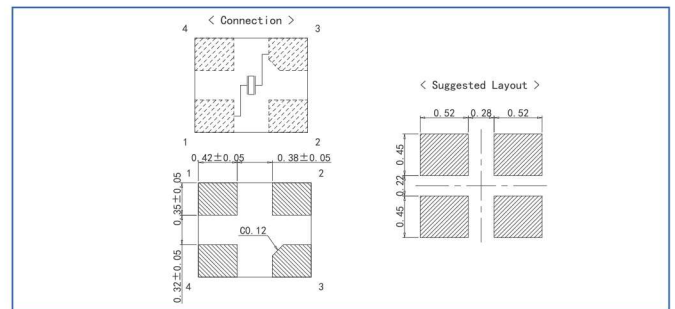
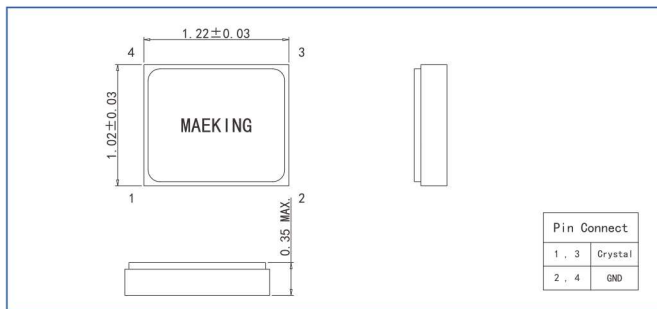
### FEATURES

- Ultra-small size: 1.2 × 1.0 × 0.3 mm
- Sealing with gold-tin preform ceramic package
- High stability and low aging
- Pb Free and RoHS compliant

### TYPICAL APPLICATION

- Small wireless device, Wireless module, IoT, Wearable device, TWS
- Health care equipment, Small consumer equipment etc

### DIMENSIONS



### ELECTRICAL SPECIFICATION

| Item/Type                                            | M1210                         |
|------------------------------------------------------|-------------------------------|
| Frequency Range                                      | 32 ~ 96MHz                    |
| Frequency Tolerance (at 25°C)                        | ±10 ppm, or specify           |
| Frequency Stability Over Operating Temperature Range | ±10 ppm, or specify           |
| Operating Temperature Range                          | -40 ~ +85°C                   |
| Shunt Capacitance (C <sub>0</sub> )                  | 3.0pF Max.                    |
| Drive Level                                          | 10μW (100μW Max.)             |
| Load Capacitance                                     | Series, 8pF, 10pF, or specify |
| Aging (at 25°C)                                      | ±3 ppm/year Max.              |
| Storage Temperature Range                            | -40 ~ +125°C                  |

### EQUIVALENT SERIES RESISTANCE(ESR)

| Frequency                      | Resistance |
|--------------------------------|------------|
| 32MHz ≤ F <sub>0</sub> ≤ 48MHz | 80Ω Max.   |
| 48MHz ≤ F <sub>0</sub> ≤ 96MHz | 100Ω Max.  |

### FREQ. STABILITY vs. TEMP. RANGE

| ppm<br>Temp.(°C) | ±5 | ±10 | ±15 | ppm<br>Temp.(°C) | ±15 | ±20 | ±30 | ±50 |
|------------------|----|-----|-----|------------------|-----|-----|-----|-----|
| -10 ~ +60        | △  | ○   | ○   | -40 ~ +105       | △   | ○   | ○   | ○   |
| -20 ~ +70        | ×  | △   | ○   | -40 ~ +125       | ×   | ×   | ×   | ○   |
| -40 ~ +85        | ×  | ×   | △   |                  |     |     |     |     |

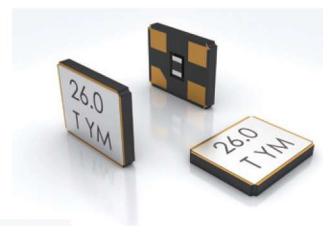
\*○: Available △: Condition X: Not available

Note: not all combination of options are available. Other specifications may be available upon request.

# Thermistor Quartz Crystal

## 3.1 T2520

### Thermistor Quartz Crystals T2520 Series



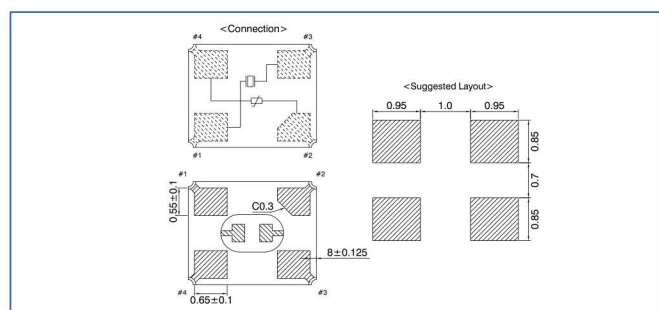
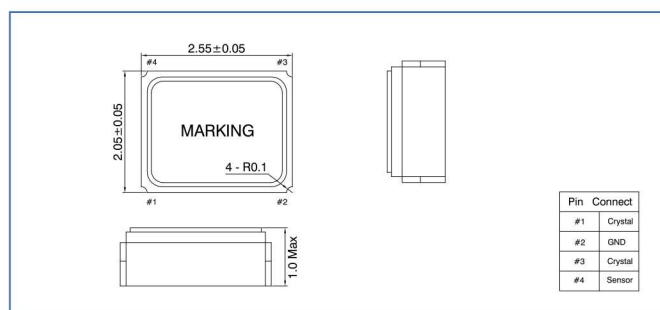
#### FEATURES

- Low aging
- Excellent shock and vibration performance
- Thermally coupled temperature sensor

#### TYPICAL APPLICATION

- The best choice of Automotive, Communications GPS, Wifi and Mobile phones

#### DIMENSIONS



#### ELECTRICAL SPECIFICATION

| Item/Type                                            | T2520                   |
|------------------------------------------------------|-------------------------|
| Frequency Range                                      | 19.2MHz, 26MHz          |
| Frequency Tolerance (at 25°C)                        | ±10ppm, or specify      |
| Frequency Stability Over Operating Temperature Range | ±12ppm, or specify      |
| Operating Temperature Range                          | -30 ~ +85°C, or specify |
| Shunt Capacitance ( $C_0$ )                          | 3pF Max.                |
| Load Capacitance                                     | 7pF, or specify         |
| Drive Level                                          | 100μW (typical)         |
| Aging(at 25°C)                                       | ±1 ppm/year Max.        |
| Storage Temperature Range                            | -40 ~ +85°C             |

#### EQUIVALENT SERIES RESISTANCE(ESR)

| Frequency       | Resistance |
|-----------------|------------|
| 19.2MHz , 26MHz | 50Ω Max.   |

#### FREQ. STABILITY vs. TEMP. RANGE

| Temp.(°C) | ppm | ±12 |
|-----------|-----|-----|
| -30 ~ +85 |     | ○   |

\*o: Available Δ: Condition X: Not available

Note: not all combination of options are available. Other specifications may be available upon request.

# Thermistor Quartz Crystal

## 3.2 T2016

### Thermistor Quartz Crystals T2016 Series



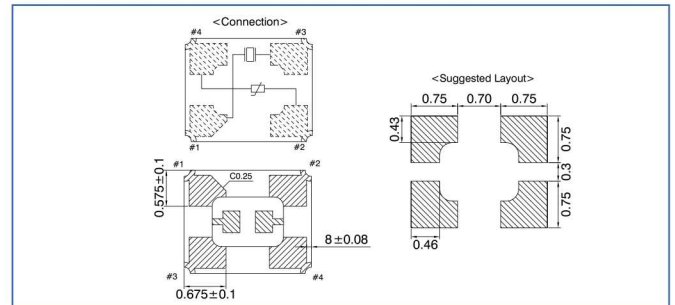
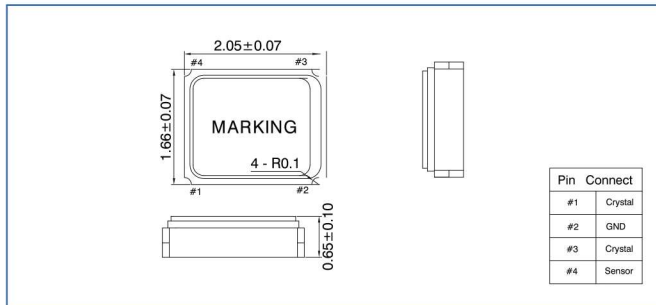
#### FEATURES

- Low aging
- Excellent shock and vibration performance
- Thermally coupled temperature sensor

#### TYPICAL APPLICATION

- The best choice of Automotive, Communications GPS, Wifi and Mobile phones

#### DIMENSIONS



#### ELECTRICAL SPECIFICATION

| Item/Type                                            | T2016                   |
|------------------------------------------------------|-------------------------|
| Frequency Range                                      | 19.2MHz, 26MHz, 38.4MHz |
| Frequency Tolerance (at 25°C)                        | ±10ppm, or specify      |
| Frequency Stability Over Operating Temperature Range | ±12ppm, or specify      |
| Operating Temperature Range                          | -30 ~ +85°C, or specify |
| Shunt Capacitance ( $C_0$ )                          | 3pF Max.                |
| Load Capacitance                                     | 7pF, or specify         |
| Drive Level                                          | 100µW (typical)         |
| Aging(at 25°C)                                       | ±1 ppm/year Max.        |
| Storage Temperature Range                            | -40 ~ +85°C             |

#### EQUIVALENT SERIES RESISTANCE(ESR)

| Frequency               | Resistance |
|-------------------------|------------|
| 19.2MHz, 26MHz, 38.4MHz | 80Ω Max.   |

#### FREQ. STABILITY vs. TEMP. RANGE

| Temp.(°C) | ppm | ±12 |
|-----------|-----|-----|
| -30 ~ +85 |     | ○   |

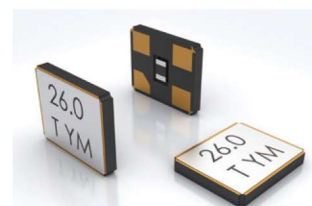
\*o: Available Δ: Condition X: Not available

Note: not all combination of options are available. Other specifications may be available upon request.

# Thermistor Quartz Crystal

## 3.3 T1612

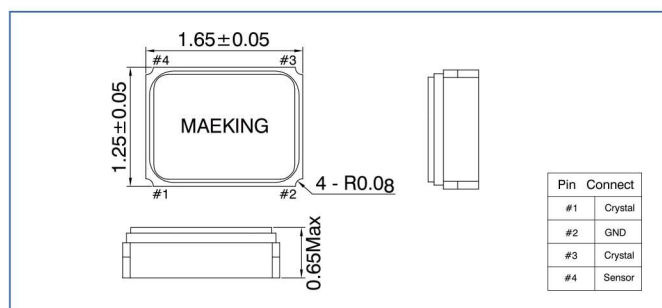
### Thermistor quartz crystal T1612 series



#### FEATURES

- Ultra-small size: 1.6 × 1.2 × 0.65 mm
- Ceramic seam welding package
- High stability and low aging
- Pb Free and RoHS compliant

#### DIMENSIONS



#### TYPICAL APPLICATION

- Small wireless device, Wireless module, IoT, Wearable device, TWS
- Health care equipment, Small consumer equipment etc

#### ELECTRICAL SPECIFICATION

| Item/Type                                      | T1612              |
|------------------------------------------------|--------------------|
| Frequency Range                                | 26 ~ 76.8MHz       |
| Frequency Tolerance (at 25°C)                  | ±10ppm, or specify |
| Frequency stability over Operating Temperature | ±12ppm, or specify |
| Operating Temperature Range                    | -30 ~ +85°C        |
| Shunt Capacitance (C <sub>0</sub> )            | 3pF Max.           |
| Drive Level                                    | 10μW (100μW Max.)  |
| Load Capacitance                               | 7pF, or specify    |
| Aging(at 25°C)                                 | ±1 ppm/year Max.   |
| Storage Temperature Range                      | -40 ~ +85°C        |

#### EQUIVALENT SERIES RESISTANCE(ESR)

| Frequency                          | Resistance |
|------------------------------------|------------|
| 26MHz ≤ f <sub>nom</sub> < 40MHz   | 80Ω Max.   |
| 40MHz ≤ f <sub>nom</sub> ≤ 52MHz   | 60Ω Max.   |
| 52MHz < f <sub>nom</sub> ≤ 76.8MHz | 40Ω Max.   |

#### FREQ. STABILITY vs. TEMP. RANGE

| Temp.(°C) | ppm | ±12 |
|-----------|-----|-----|
| -30 ~ +85 |     | ○   |

\*o: Available Δ: Condition X: Not available

Note: not all combination of options are available. Other specifications may be available upon request.



# Oscillator (CMOS/LVPECL/LVDS/HCSL Output)

## 4.1 XO3225

3.2 x 2.5 mm SMD  
Crystal Oscillator



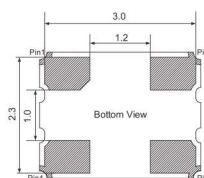
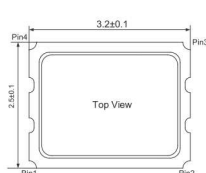
### FEATURES

- Typical 3.2 x 2.5 x 1.0mm Ceramic SMD Package
- Tight Symmetry (45 to 55%) Available
- Operation Voltage: 1.35-5.5V
- Tri-State Enable/Disable Operation

### TYPICAL APPLICATION

- SDH/SONET/WiMAX
- LTE and base station

### DIMENSIONS



Pin Connection

| Name  | Connection  |
|-------|-------------|
| pin 1 | Tri - State |
| pin 2 | GND         |
| pin 3 | Fout        |
| pin 4 | Vdd         |

### ELECTRICAL SPECIFICATION

| Parameter                                  |                                                            | 3.3V           |        | 2.5V   |        | 1.8V   |        | Unit |
|--------------------------------------------|------------------------------------------------------------|----------------|--------|--------|--------|--------|--------|------|
|                                            |                                                            | Min.           | Max.   | Min.   | Max.   | Min.   | Max.   |      |
| Supply Voltage Variation (VDD)             |                                                            | VDD-5%         | VDD+5% | VDD-5% | VDD+5% | VDD-5% | VDD+5% | V    |
| Frequency Range                            |                                                            | 1              | 125    | 1      | 125    | 1      | 125    | MHz  |
| Standard Frequency                         |                                                            | 24, 26, 30, 40 |        |        |        |        |        | MHz  |
| Supply Current                             | At 15pF Load                                               | —              | 25     | —      | 25     | —      | 20     | mA   |
|                                            | No Load Condition, $1\text{MHz} \leq F_o < 10\text{MHz}$   | —              | 1.0    | —      | 1.0    | —      | 0.75   | mA   |
|                                            | No Load Condition, $10\text{MHz} \leq F_o < 20\text{MHz}$  | —              | 1.0    | —      | 1.0    | —      | 0.75   | mA   |
|                                            | No Load Condition, $20\text{MHz} \leq F_o < 80\text{MHz}$  | —              | 1.3    | —      | 1.3    | —      | 1.0    | mA   |
|                                            | No Load Condition, $80\text{MHz} \leq F_o < 125\text{MHz}$ | —              | 6      | —      | 6      | —      | 3      | mA   |
| Duty Cycle                                 |                                                            | 45             | 55     | 45     | 55     | 45     | 55     | %    |
| Output Level                               | Output High                                                | 2.97           | —      | 2.25   | —      | 1.62   | —      | V    |
|                                            | Output Low                                                 | —              | 0.33   | —      | 0.25   | —      | 0.18   |      |
| Transition Time:<br>Rise/Fall Time+        | $1.25\text{MHz} \leq F_o < 10\text{MHz}$                   | —              | 3      | —      | 4      | —      | 5      | nSec |
|                                            | $10\text{MHz} \leq F_o < 20\text{MHz}$                     | —              | 3      | —      | 3      | —      | 4      | nSec |
|                                            | $20\text{MHz} \leq F_o < 80\text{MHz}$                     | —              | 3      | —      | 3      | —      | 4      | nSec |
|                                            | $80\text{MHz} \leq F_o < 125\text{MHz}$                    | —              | 3      | —      | 3      | —      | 4      | nSec |
| Startup Time                               |                                                            | —              | 2      | —      | 2      | —      | 2      | mSec |
| Tri-State<br>(Input to Pin2 or Pin1)       | Enable (High Voltage or Floating)                          | 2.31           | —      | 1.75   | —      | 1.26   | —      | V    |
|                                            | Disable (Low Voltage or GND)                               | —              | 0.99   | —      | 0.75   | —      | 0.54   |      |
| Output Loading                             |                                                            | 15             |        | 15     |        | 15     |        | pF   |
| Stand by Current                           | (@-40 ~ 85°C)                                              | —              | 10     | —      | 10     | —      | 10     | uA   |
|                                            | (@-40 ~ 125°C)                                             | —              | 20     | —      | 20     | —      | 20     | uA   |
| Aging (@25°C, 1st Year)                    |                                                            | —              | ±3     | —      | ±3     | —      | ±3     | ppm  |
| Storage Temp. Range                        |                                                            | -55            | 125    | -55    | 125    | -55    | 125    | °C   |
| Period Jitter(Pk-Pk)                       |                                                            | —              | 40     | —      | 40     | —      | 40     | pSec |
| RMS Phase Jitter(Integrated 12KHz ~ 20MHz) |                                                            | —              | 1      | —      | 1      | —      | 1      | pSec |

# Oscillator (CMOS/LVPECL/LVDS/HCSL Output)

## FREQ. STABILITY vs. TEMP. RANGE

| Temp.(°C) | ppm | ±20 | ±25 | ±50 |
|-----------|-----|-----|-----|-----|
| -10 ~ +60 |     | ○   | ○   | ○   |
| -20 ~ +70 |     | △   | ○   | ○   |
| -40 ~ +85 |     | ×   | ○   | ○   |

\*○: Available △: Condition ×: Not available

\*Inclusive of calibration @ 25 °C, operating temperature range, input voltage variation, load variation, aging (1st year), shock, and vibration.

Note: not all combination of options are available. Other specifications may be available upon request.  
Specifications subject to change without notice.

# Oscillator (CMOS/LVPECL/LVDS/HCSL Output)

## 4.2 XO2520

### 2.5 x 2.0mm SMD CMOS Output Crystal Oscillator



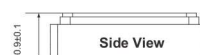
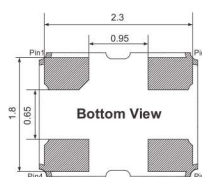
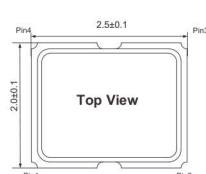
#### FEATURES

- Ultra Low Power Supply Voltage: 1.35-5.5V
- Low Noise Typical: 0.3 pS at 12 kHz ~ 20 MHz
- Supply Options Frequency Offsets
- Singled-end Output: CMOS
- Temperature Range: -40 ~ 85°C Operation
- Frequency Support from 1 MHz to 50MHz
- Pb-free/RoHS Compliant

#### TYPICAL APPLICATION

- IoT
- Game Console
- Smartphone
- Wearable Device
- Digital Camera
- Digital Consumer Electronics

#### DIMENSIONS



Pin Connection

| Name  | Connection  |
|-------|-------------|
| pin 1 | Tri - State |
| pin 2 | GND         |
| pin 3 | Fout        |
| pin 4 | Vdd         |

#### ELECTRICAL SPECIFICATION

| Parameter                            |                                                            | 3.3V   |        | 2.5V   |        | 1.8V   |        | Unit |
|--------------------------------------|------------------------------------------------------------|--------|--------|--------|--------|--------|--------|------|
|                                      |                                                            | Min.   | Max.   | Min.   | Max.   | Min.   | Max.   |      |
| Supply Voltage Variation (VDD)       |                                                            | VDD-5% | VDD+5% | VDD-5% | VDD+5% | VDD-5% | VDD+5% | V    |
| Frequency Range                      |                                                            | 1      | 125    | 1      | 125    | 1      | 125    | MHz  |
| Supply Current                       | At 15pF Load                                               | —      | 25     | —      | 25     | —      | 20     | mA   |
|                                      | No Load Condition, $1\text{MHz} \leq F_o < 10\text{MHz}$   | —      | 1.0    | —      | 1.0    | —      | 0.75   | mA   |
|                                      | No Load Condition, $10\text{MHz} \leq F_o < 20\text{MHz}$  | —      | 1.0    | —      | 1.0    | —      | 0.75   | mA   |
|                                      | No Load Condition, $20\text{MHz} \leq F_o < 80\text{MHz}$  | —      | 1.3    | —      | 1.3    | —      | 1.0    | mA   |
|                                      | No Load Condition, $80\text{MHz} \leq F_o < 125\text{MHz}$ | —      | 6      | —      | 6      | —      | 3      | mA   |
| Duty Cycle                           |                                                            | 45     | 55     | 45     | 55     | 45     | 55     | %    |
| Output Level                         | Output High                                                | 2.97   | —      | 2.25   | —      | 1.62   | —      | V    |
|                                      | Output Low                                                 | —      | 0.33   | —      | 0.25   | —      | 0.18   |      |
| Transition Time:<br>Rise/Fall Time+  | $1.25\text{MHz} \leq F_o < 10\text{MHz}$                   | —      | 4      | —      | 3      | —      | 3      | nSec |
|                                      | $10\text{MHz} \leq F_o < 20\text{MHz}$                     | —      | 3      | —      | 3      | —      | 3      | nSec |
|                                      | $20\text{MHz} \leq F_o < 80\text{MHz}$                     | —      | 2      | —      | 2      | —      | 2      | nSec |
| Startup Time                         |                                                            | —      | 4      | —      | 4      | —      | 4      | mSec |
| Tri-State<br>(Input to Pin2 or Pin1) | Enable (High Voltage or Floating)                          | 0.7VDD | —      | 0.7VDD | —      | 0.7VDD | —      | V    |
|                                      | Disable (Low Voltage or GND)                               | —      | 0.3VDD | —      | 0.3VDD | —      | 0.3VDD |      |



# Oscillator (CMOS/LVPECL/LVDS/HCSL Output)

## ELECTRICAL SPECIFICATION

| Parameter                                  |                | 3.3V |      | 2.5V |      | 1.8V |      | Unit   |
|--------------------------------------------|----------------|------|------|------|------|------|------|--------|
|                                            |                | Min. | Max. | Min. | Max. | Min. | Max. |        |
| Output Loading                             |                | 15   |      | 15   |      | 15   |      | pF     |
| Stand by Current                           |                | —    | 100  | —    | 100  | —    | 100  | uA     |
| Aging (@25°C, 1st Year)                    |                | —    | ±3   | —    | ±3   | —    | ±3   | ppm    |
| Storage Temp. Range                        |                | -55  | 125  | -55  | 125  | -55  | 125  | °C     |
| Phase Noise(Typ.)                          |                | Typ. | Max. | Typ. | Max. | Typ. | Max. |        |
| At VDD=1.2V,<br>Fout=24MHz                 | 1 kHz offset   | -130 | —    | -133 | —    | -135 | —    | dBc/Hz |
|                                            | 10 kHz offset  | -140 | —    | -143 | —    | -143 | —    |        |
|                                            | 100 kHz offset | -148 | —    | -150 | —    | -150 | —    |        |
|                                            | 1 MHz offset   | -152 | —    | -155 | —    | -155 | —    |        |
| Period Jitter(Pk-Pk)                       |                | —    | 40   | —    | 40   | —    | 40   | pSec   |
| RMS Phase Jitter(Integrated 12KHz ~ 20MHz) |                | —    | 1    | —    | 1    | —    | 1    | pSec   |

Standard frequencies are frequencies which the crystal has been designed and does not imply a stock position.

+ Transition times are measured between 20% and 80% of VDD.

## FREQ. STABILITY vs. TEMP. RANGE

| Temp.(°C) | ppm | ±20 | ±25 |
|-----------|-----|-----|-----|
| -10 ~ +60 |     | ○   | ○   |
| -20 ~ +70 |     | ○   | ○   |
| -40 ~ +85 |     | △   | ○   |

\*○: Available △: Condition X: Not available

\*Inclusive of calibration @ 25 °C, operating temperature range, input voltage variation, load variation, aging (1st year), shock, and vibration.

Note: not all combination of options are available. Other specifications may be available upon request.  
Specifications subject to change without notice.

# Oscillator (CMOS/LVPECL/LVDS/HCSL Output)

## 4.3 XO2016

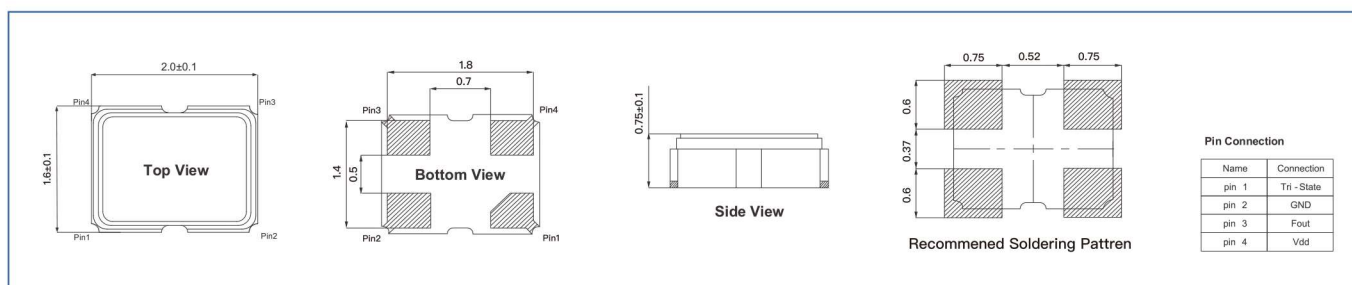
2.0x1.6mm  
CMOS Crystal Oscillator



### FEATURES AND APPLICATIONS

- External Dimensions: 2.0x1.6x0.75 mm
- Small Size, High Reliability
- Wide Supply Voltage: 1.7-3.6V
- Widely applied in industrial communication, navigation, radar, and other fields
- AEC-Q100&AEC-Q200 compliant

### DIMENSIONS



### ELECTRICAL SPECIFICATION

| Specifications                             |                                                        | 3.3V   |        | 2.5V   |        | 1.8V   |        | Unit |
|--------------------------------------------|--------------------------------------------------------|--------|--------|--------|--------|--------|--------|------|
|                                            |                                                        | Min.   | Max.   | Min.   | Max.   | Min.   | Max.   |      |
| Operating Voltage(VDD)                     |                                                        | VDD-5% | VDD+5% | VDD-5% | VDD+5% | VDD-5% | VDD+5% | V    |
| Output Frequency                           |                                                        | 1      | 125    | 1      | 125    | 1      | 125    | MHz  |
| Supply Current                             | At 15pF Load                                           | —      | 25     | —      | 25     | —      | 20     | mA   |
|                                            | When no load is provided, 1MHz≤F <sub>o</sub> <10MHz   | —      | 1.0    | —      | 1.0    | —      | 0.75   | mA   |
|                                            | When no load is provided, 10MHz≤F <sub>o</sub> <20MHz  | —      | 1.0    | —      | 1.0    | —      | 0.75   | mA   |
|                                            | When no load is provided, 20MHz≤F <sub>o</sub> <80MHz  | —      | 1.3    | —      | 1.3    | —      | 1.0    | mA   |
|                                            | When no load is provided, 80MHz≤F <sub>o</sub> <125MHz | —      | 6      | —      | 6      | —      | 3      | mA   |
|                                            | Duty Cycle                                             | 45     | 55     | 45     | 55     | 45     | 55     | %    |
| Output Level                               | VoH                                                    | 2.97   | —      | 2.25   | —      | 1.62   | —      | V    |
|                                            | VoL                                                    | —      | 0.33   | —      | 0.25   | —      | 0.18   |      |
| Transition Time:<br>Rise/Fall Time+        | 1.25MHz≤F <sub>o</sub> <10MHz                          | —      | 4      | —      | 5      | —      | 6      | nSec |
|                                            | 10MHz≤F <sub>o</sub> <20MHz                            | —      | 4      | —      | 5      | —      | 6      | nSec |
|                                            | 20MHz≤F <sub>o</sub> <80MHz                            | —      | 4      | —      | 5      | —      | 6      | nSec |
| Start-up time                              |                                                        | —      | 5      | —      | 5      | —      | 5      | mSec |
| Tri-state<br>(connect to Pin1)             | On (High Level or Floating)                            | 0.7VDD | —      | 0.7VDD | —      | 0.7VDD | —      | V    |
|                                            | Off (Low Level or Ground)                              | —      | 0.3VDD | —      | 0.3VDD | —      | 0.3VDD |      |
| Output Load                                |                                                        | 15     |        | 15     |        | 15     |        | pF   |
| Standby Current                            |                                                        | —      | 100    | —      | 100    | —      | 100    | uA   |
| Aging(@25°C, the first year)               |                                                        | —      | ±3     | —      | ±3     | —      | ±3     | ppm  |
| Storage Temperature                        |                                                        | -55    | 125    | -55    | 125    | -55    | 125    | °C   |
| Jitter(Vp-p)                               |                                                        | —      | 40     | —      | 40     | —      | 40     | pSec |
| Phase jitter Root-mean-square(12KHz~20MHz) |                                                        | —      | 1      | —      | 1      | —      | 1      | pSec |

## Oscillator (CMOS/LVPECL/LVDS/HCSL Output)

### FREQ. STABILITY vs. TEMP. RANGE

| Temp.(°C)  | ppm | ±20 | ±25 | ±50 |
|------------|-----|-----|-----|-----|
| -10 ~ +60  |     | ○   | ○   | ○   |
| -20 ~ +70  |     | ○   | ○   | ○   |
| -40 ~ +85  |     | △   | ○   | ○   |
| -40 ~ +125 |     | ×   | ×   | ○   |

\*○: Available △: Available on condition X: Unavailable

Note: Not all components are available. We can supply other specifications on demand.

# Oscillator (CMOS/LVPECL/LVDS/HCSL Output)

## 4.4 LV3225

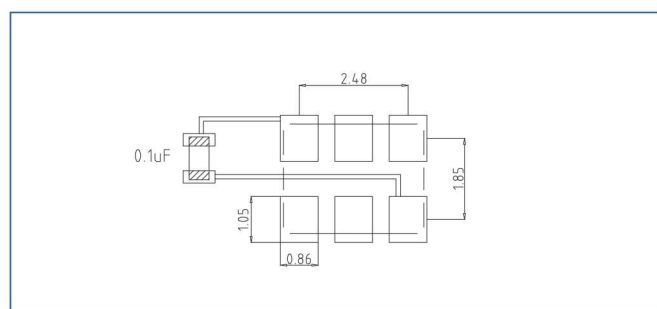
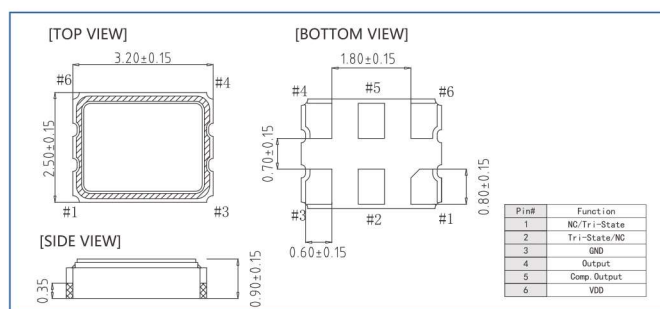
### 3.2 x 2.5 mm SMD LVPECL/LVDS/ HCSL Crystal Oscillator



#### FEATURES

- Industry Standard 3.2 x 2.5 x 0.9 hermetically sealed ceramic package
- Very low jitter performance: typical 0.1 pS RMS from 12 kHz ~ 20 MHz
- Fundamental/3rd overtone crystal design
- Output frequency up to 250 MHz
- Tri-state enable/disable
- Up to 125°C operating temperature range

#### DIMENSIONS



#### ELECTRICAL SPECIFICATION

| Parameter                                        |                                      | LVPECL                                   |        |        |        | LVDS   |        |        |        | Unit   |
|--------------------------------------------------|--------------------------------------|------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|
|                                                  |                                      | 3.3V                                     |        | 2.5V   |        | 3.3V   |        | 2.5V   |        |        |
|                                                  |                                      | Min.                                     | Max.   | Min.   | Max.   | Min.   | Max.   | Min.   | Max.   |        |
| Supply Voltage Variation (VDD)                   |                                      | VDD-5%                                   | VDD+5% | VDD-5% | VDD+5% | VDD-5% | VDD+5% | VDD-5% | VDD+5% | V      |
| Frequency Range                                  |                                      | 10                                       | 250    | 10     | 250    | 10     | 250    | 10     | 250    | MHz    |
| Standard Frequency                               |                                      | 25, 106.25, 125, 156.25, 161.1328, 212.5 |        |        |        |        |        |        |        |        |
| Supply Current                                   | 10MHz≤F <sub>o</sub> <160MHz         | —                                        | 75     | —      | 75     | —      | 50     | —      | 50     | mA     |
|                                                  | 160MHz≤F <sub>o</sub> <250MHz        | —                                        | 100    | —      | 100    | —      | 50     | —      | 50     |        |
| Output Level                                     | Output High                          | 2.275                                    | —      | 1.475  | —      | —      | 1.6    | —      | 1.6    | V      |
|                                                  | Output Low                           | —                                        | 1.68   | —      | 0.88   | 0.9    | —      | 0.9    | —      |        |
| Transition Time: Rise/Fall Time+                 |                                      | —                                        | 1      | —      | 1      | —      | 1      | —      | 1      | nSec   |
| Startup Time                                     |                                      | —                                        | 10     | —      | 10     | —      | 10     | —      | 10     | mSec   |
| Tri-State<br>(Input to Pin2 or Pin1)             | Enable<br>(High Voltage or Floating) | 2.31                                     | —      | 1.75   | —      | 2.31   | —      | 1.75   | —      | V      |
|                                                  | Disable<br>(Low Voltage or GND)      | —                                        | 0.99   | —      | 0.75   | —      | 0.99   | —      | 0.75   |        |
| Aging (@25°C, 1st Year)                          |                                      | —                                        | ±3     | —      | ±3     | —      | ±3     | —      | ±3     | ppm    |
| Storage Temp. Range                              |                                      | -55                                      | 125    | -55    | 125    | -55    | 125    | -55    | 125    | °C     |
| Phase Noise<br>@ 156.25 MHz                      | 100 Hz                               | -95                                      |        | -90    |        | -90    |        | -90    |        | dBc/Hz |
|                                                  | 1 kHz                                | -125                                     |        | -125   |        | -120   |        | -120   |        |        |
|                                                  | 10 kHz                               | -140                                     |        | -140   |        | -140   |        | -140   |        |        |
| RMS Phase Jitter<br>(Intergrated 12 KHz ~ 20MHz) | F <sub>o</sub> <80MHz                | —                                        | 1      | —      | 1      | —      | 1      | —      | 1      | pSec   |
|                                                  | 80MHz≤F <sub>o</sub> <125MHz         | —                                        | 0.5    | —      | 0.5    | —      | 0.5    | —      | 0.5    |        |
|                                                  | 125MHz≤F <sub>o</sub> <170MHz        | —                                        | 0.3    | —      | 0.3    | —      | 0.3    | —      | 0.3    |        |
|                                                  | 170MHz≤F <sub>o</sub> <200MHz        | —                                        | 0.5    | —      | 0.5    | —      | 0.5    | —      | 0.5    |        |
|                                                  | 200MHz≤F <sub>o</sub>                | —                                        | 0.3    | —      | 0.3    | —      | 0.3    | —      | 0.3    |        |

# Oscillator (CMOS/LVPECL/LVDS/HCSL Output)

| Parameter                                       |                                          | HCSL   |        |        |        | Unit |
|-------------------------------------------------|------------------------------------------|--------|--------|--------|--------|------|
|                                                 |                                          | 3.3V   |        | 2.5V   |        |      |
|                                                 |                                          | Min.   | Max.   | Min.   | Max.   |      |
| Supply Voltage Variation(VDD)                   |                                          | VDD-5% | VDD+5% | VDD-5% | VDD+5% | V    |
| Frequency Range                                 |                                          | 25     | 175    | 25     | 175    | MHz  |
| Standard Frequency                              |                                          | 100    |        |        |        |      |
| Supply Current                                  | $25\text{MHz}\leq F_o\leq 175\text{MHz}$ | —      | 50     | —      | 50     | mA   |
| Output Level                                    | Output High                              | 0.6    | —      | 0.58   | —      | V    |
|                                                 | Output Low                               | —      | 0.15   | —      | 0.15   |      |
| Transition Time: Rise/Fall Time+                |                                          | —      | 0.5    | —      | 0.5    | nSec |
| Startup Time                                    |                                          | —      | 10     | —      | 10     | mSec |
| Tri-State<br>(Input to Pin2 or Pin1)            | Enable<br>(High Voltage or Floating)     | 0.7VDD | —      | 0.7VDD | —      | V    |
|                                                 | Disable<br>(Low Voltage or GND)          | —      | 0.3VDD | —      | 0.3VDD |      |
| Aging (@25°C, 1st Year)                         |                                          | —      | ±3     | —      | ±3     | ppm  |
| Storage Temp. Range                             |                                          | -55    | 125    | -55    | 125    | °C   |
| RMS Phase Jitter<br>(Intergrated 12KHz ~ 20MHz) | $25\text{MHz}\leq F_o\leq 175\text{MHz}$ | —      | 0.5    | —      | 0.5    | pSec |

Standard frequencies are frequencies which the crystal has been designed and does not imply a stock position.

+ Transition times are measured between 20% and 80% of VDD.

## FREQ. STABILITY vs. TEMP. RANGE

| Temp.(°C)  | ppm | $\pm 25$ | $\pm 50$ |
|------------|-----|----------|----------|
| -10 ~ +60  |     | ○        | ○        |
| -20 ~ +70  |     | ○        | ○        |
| -40 ~ +85  |     | △        | ○        |
| -40 ~ +125 |     | ×        | ○        |

\*○: Available △: Condition X: Not available

\*Inclusive of calibration @ 25 °C, operating temperature range, input voltage variation, load variation, aging (1st year), shock, and vibration.

Note: not all combination of options are available. Other specifications may be available upon request.

Specifications subject to change without notice.



# Oscillator (CMOS/LVPECL/LVDS/HCSL Output)

## 4.5 LV5032

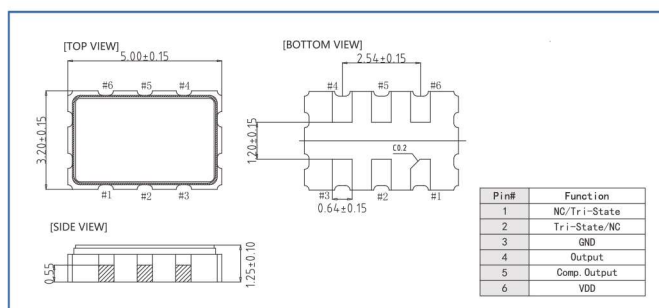
### 5.0 x 3.2 mm SMD LVPECL/LVDS/ HCSL Crystal Oscillator



#### FEATURES

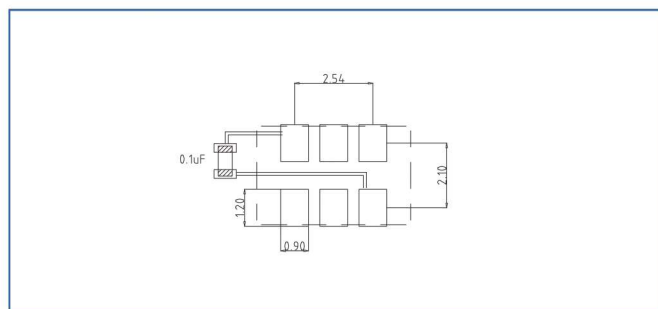
- Typical 5.0 x 3.2 x 1.25 mm hermetically sealed ceramic package
- Very low jitter performance: typical 0.3 pS RMS from 12 kHz ~ 20 MHz
- Fundamental/3rd overtone crystal design
- Output frequency up to 320 MHz
- Operating temperature up to 125°C
- Tri-state enable/disable

#### DIMENSIONS



#### TYPICAL APPLICATION

- 10 Gbit Ethernet, Fiber Channel, Storage Area Network, SONET
- Enterprise Servers, Reference clocks for ADC and DAC
- Telecom



#### ELECTRICAL SPECIFICATION

| Parameter                                        |                                      | LVPECL                                   |        |        |        | LVDS   |        |        |        | Unit   |
|--------------------------------------------------|--------------------------------------|------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|
|                                                  |                                      | 3.3V                                     |        | 2.5V   |        | 3.3V   |        | 2.5V   |        |        |
|                                                  |                                      | Min.                                     | Max.   | Min.   | Max.   | Min.   | Max.   | Min.   | Max.   |        |
| Supply Voltage Variation (VDD)                   |                                      | VDD-5%                                   | VDD+5% | VDD-5% | VDD+5% | VDD-5% | VDD+5% | VDD-5% | VDD+5% | V      |
| Frequency Range                                  |                                      | 10                                       | 320    | 10     | 320    | 10     | 320    | 10     | 320    | MHz    |
| Standard Frequency                               |                                      | 25, 106.25, 125, 156.25, 161.1328, 212.5 |        |        |        |        |        |        |        |        |
| Supply Current                                   | 10MHz≤F <sub>o</sub> <160MHz         | —                                        | 75     | —      | 75     | —      | 50     | —      | 50     | mA     |
|                                                  | 160MHz≤F <sub>o</sub> <250MHz        | —                                        | 100    | —      | 100    | —      | 50     | —      | 50     |        |
|                                                  | 250MHz≤F <sub>o</sub> <320MHz        | —                                        | 100    | —      | 100    | —      | 65     | —      | 65     |        |
| Output Level                                     | Output High                          | 2.275                                    | —      | 1.475  | —      | —      | 1.6    | —      | 1.6    | V      |
|                                                  | Output Low                           | —                                        | 1.68   | —      | 0.88   | 0.9    | —      | 0.9    | —      |        |
| Transition Time: Rise/Fall Time+                 |                                      | —                                        | 1      | —      | 1      | —      | 1      | —      | 1      | nSec   |
| Startup Time                                     |                                      | —                                        | 10     | —      | 10     | —      | 10     | —      | 10     | mSec   |
| Tri-State<br>(Input to Pin2 or Pin1)             | Enable<br>(High Voltage or Floating) | 2.31                                     | —      | 1.75   | —      | 2.31   | —      | 1.75   | —      | V      |
|                                                  | Disable<br>(Low Voltage or GND)      | —                                        | 0.99   | —      | 0.75   | —      | 0.99   | —      | 0.75   |        |
| Aging (@25°C, 1st Year)                          |                                      | —                                        | ±3     | —      | ±3     | —      | ±3     | —      | ±3     | ppm    |
| Storage Temp. Range                              |                                      | -55                                      | 125    | -55    | 125    | -55    | 125    | -55    | 125    | °C     |
| Phase Noise<br>@ 156.25 MHz                      | 100 Hz                               | -95                                      |        | -90    |        | -90    |        | -90    |        | dBc/Hz |
|                                                  | 1 kHz                                | -125                                     |        | -125   |        | -120   |        | -120   |        |        |
|                                                  | 10 kHz                               | -140                                     |        | -140   |        | -140   |        | -140   |        |        |
| RMS Phase Jitter<br>(Intergrated 12 KHz ~ 20MHz) | F <sub>o</sub> <80MHz                | —                                        | 1      | —      | 1      | —      | 1      | —      | 1      | pSec   |
|                                                  | 80MHz≤F <sub>o</sub> <125MHz         | —                                        | 0.5    | —      | 0.5    | —      | 0.5    | —      | 0.5    |        |
|                                                  | 125MHz≤F <sub>o</sub> <170MHz        | —                                        | 0.3    | —      | 0.3    | —      | 0.3    | —      | 0.3    |        |
|                                                  | 170MHz≤F <sub>o</sub> <200MHz        | —                                        | 0.5    | —      | 0.5    | —      | 0.5    | —      | 0.5    |        |
|                                                  | 200MHz≤F <sub>o</sub>                | —                                        | 0.3    | —      | 0.3    | —      | 0.3    | —      | 0.3    |        |



# Oscillator (CMOS/LVPECL/LVDS/HCSL Output)

| Parameter                                       |                                      | HCSL   |        |        |        | Unit |
|-------------------------------------------------|--------------------------------------|--------|--------|--------|--------|------|
|                                                 |                                      | 3.3V   |        | 2.5V   |        |      |
|                                                 |                                      | Min.   | Max.   | Min.   | Max.   |      |
| Supply Voltage Variation(VDD)                   |                                      | VDD-5% | VDD+5% | VDD-5% | VDD+5% | V    |
| Frequency Range                                 |                                      | 25     | 175    | 25     | 175    | MHz  |
| Standard Frequency                              |                                      | 100    |        |        |        |      |
| Supply Current                                  | 25MHz≤F <sub>o</sub> ≤175MHz         | —      | 50     | —      | 50     | mA   |
| Output Level                                    | Output High                          | 0.6    | —      | 0.58   | —      | V    |
|                                                 | Output Low                           | —      | 0.15   | —      | 0.15   |      |
| Transition Time: Rise/Fall Time+                |                                      | —      | 0.5    | —      | 0.5    | nSec |
| Startup Time                                    |                                      | —      | 10     | —      | 10     | mSec |
| Tri-State<br>(Input to Pin2 or Pin1)            | Enable<br>(High Voltage or Floating) | 0.7VDD | —      | 0.7VDD | —      | V    |
|                                                 | Disable<br>(Low Voltage or GND)      | —      | 0.3VDD | —      | 0.3VDD |      |
| Aging (@25°C, 1st Year)                         |                                      | —      | ±3     | —      | ±3     | ppm  |
| Storage Temp. Range                             |                                      | -55    | 125    | -55    | 125    | °C   |
| RMS Phase Jitter<br>(Intergrated 12KHz ~ 20MHz) | 25MHz≤F <sub>o</sub> ≤175MHz         | —      | 0.5    | —      | 0.5    | pSec |

Standard frequencies are frequencies which the crystal has been designed and does not imply a stock position.

+ Transition times are measured between 20% and 80% of VDD.

## FREQ. STABILITY vs. TEMP. RANGE

| Temp.(°C)  | ppm | ±25 | ±50 |
|------------|-----|-----|-----|
| -10 ~ +60  |     | ○   | ○   |
| -20 ~ +70  |     | ○   | ○   |
| -40 ~ +85  |     | △   | ○   |
| -40 ~ +125 |     | ×   | ○   |

\*○: Available △: Condition X: Not available

\*Inclusive of calibration @ 25 °C, operating temperature range, input voltage variation, load variation, aging (1st year), shock, and vibration.

Note: not all combination of options are available. Other specifications may be available upon request.

Specifications subject to change without notice.

# Oscillator (CMOS/LVPECL/LVDS/HCSL Output)

## 4.6 TLV5032

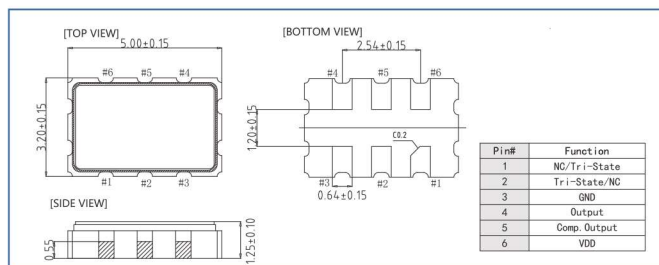
5.0 x 3.2 mm SMD LVPECL/LVDS  
Crystal Oscillator



### FEATURES

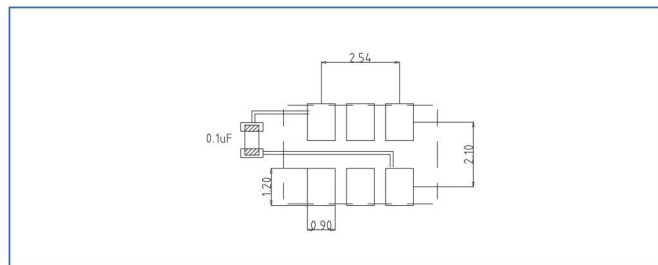
- Industry Standard 5.0 x 3.2 x 1.25 mm hermetically sealed ceramic package
- Very low phase jitter: < 1 pS (0.6 pS, typ.) RMS
- Tri-state enable/disable
- Fast delivery

### DIMENSIONS



### TYPICAL APPLICATION

- High-Speed Gigabit Ethernet, Fiber Channel, Storage Area Network, SONET
- Enterprise Server, SAS/SATA
- Microprocessors/DSP/FPGA
- Broadband Access
- Smart Grid



### ELECTRICAL SPECIFICATION

| Parameter                                   |                                      | LVPECL                                                                |        |        |        | LVDS   |        |        |        | Unit   |
|---------------------------------------------|--------------------------------------|-----------------------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|
|                                             |                                      | 3.3V                                                                  |        | 2.5V   |        | 3.3V   |        | 2.5V   |        |        |
|                                             |                                      | Min.                                                                  | Max.   | Min.   | Max.   | Min.   | Max.   | Min.   | Max.   |        |
| Supply Voltage Variation (VDD)              |                                      | VDD-5%                                                                | VDD+5% | VDD-5% | VDD+5% | VDD-5% | VDD+5% | VDD-5% | VDD+5% | V      |
| Frequency Range                             |                                      | 10                                                                    | 1500   | 10     | 1500   | 10     | 1500   | 10     | 1500   | MHz    |
| Standard Frequency                          |                                      | 106.25, 125, 133.33, 150, 155.52, 156.25, 187.5, 212.5, 312.5, 622.08 |        |        |        |        |        |        |        |        |
| Supply Current                              | 10MHz≤F <sub>o</sub> <1500MHz        | —                                                                     | 50     | —      | 50     | —      | 50     | —      | 50     | mA     |
| Output Level                                | Output High                          | 2.275                                                                 | —      | 1.475  | —      | —      | 1.6    | —      | 1.6    | V      |
|                                             | Output Low                           | —                                                                     | 1.68   | —      | 0.88   | 0.9    | —      | 0.9    | —      |        |
| Transition Time: Rise/Fall Time+            |                                      | —                                                                     | 1      | —      | 1      | —      | 1      | —      | 1      | nSec   |
| Startup Time                                |                                      | —                                                                     | 10     | —      | 10     | —      | 10     | —      | 10     | mSec   |
| Tri-State<br>(Input to Pin2 or Pin1)        | Enable<br>(High Voltage or Floating) | 2.31                                                                  | —      | 1.75   | —      | 2.31   | —      | 1.75   | —      | V      |
|                                             | Disable<br>(Low Voltage or GND)      | —                                                                     | 0.99   | —      | 0.75   | —      | 0.99   | —      | 0.75   |        |
| Aging (@25°C, 1st Year)                     |                                      | —                                                                     | ±3     | —      | ±3     | —      | ±3     | —      | ±3     | ppm    |
| Storage Temp. Range                         |                                      | -55                                                                   | 125    | -55    | 125    | -55    | 125    | -55    | 125    | °C     |
| Phase Noise<br>@ 156.25 MHz                 | 100 Hz                               | -85                                                                   |        | -85    |        | -85    |        | -85    |        | dBc/Hz |
|                                             | 1 kHz                                | -105                                                                  |        | -105   |        | -105   |        | -105   |        |        |
|                                             | 10 kHz                               | -115                                                                  |        | -115   |        | -115   |        | -115   |        |        |
| RMS Phase Jitter(Intergrated 12KHz ~ 20MHz) |                                      | —                                                                     | 1.5    | —      | 1.5    | —      | 1.5    | —      | 1.5    | pSec   |

+ Transition times are measured between 20% and 80% of VDD.

### FREQ. STABILITY vs. TEMP. RANGE

| Temp.(°C) | ppm | ±25 | ±50 |
|-----------|-----|-----|-----|
| -10 ~ +60 |     | ○   | ○   |
| -20 ~ +70 |     | ○   | ○   |
| -40 ~ +85 |     | ×   | ○   |

\*o: Available Δ: Condition X: Not available

\*Inclusive of calibration @ 25 °C, operating temperature range, input voltage variation, load variation, aging (1st year), shock, and vibration.

Note: not all combination of options are available. Other specifications may be available upon request.

Specifications subject to change without notice.

# Oscillator (CMOS/LVPECL/LVDS/HCSL Output)

## 4.7 LV7050

### 7.0 x 5.0 mm SMD LVPECL/LVDS/HCSL Crystal Oscillator



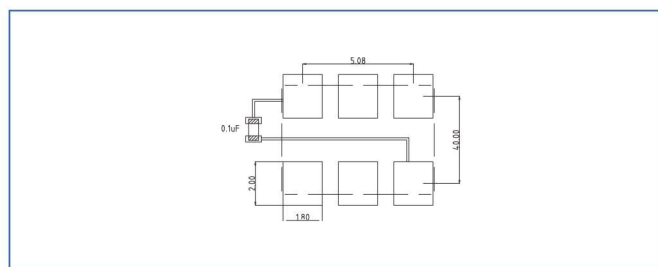
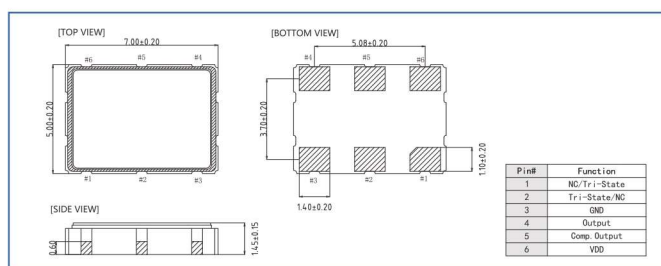
#### FEATURES

- Typical 7.0 x 5.0 x 1.45 mm hermetically sealed ceramic package
- Very low jitter performance: typical 0.3 pS RMS from 12 kHz ~ 20 MHz
- Fundamental/3rd overtone crystal design
- Output frequency up to 320 MHz
- Operating temperature up to 125°C
- Tri-state enable/disable

#### TYPICAL APPLICATION

- 10 Gbit Ethernet, Fiber Channel, Storage Area Network, SONET
- Enterprise Servers, Reference clocks for ADC and DAC
- Telecom

#### DIMENSIONS



#### ELECTRICAL SPECIFICATION

| Parameter                                      |                                      | LVPECL                                                  |        |        |        | LVDS   |        |        |        | Unit   |
|------------------------------------------------|--------------------------------------|---------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|
|                                                |                                      | 3.3V                                                    |        | 2.5V   |        | 3.3V   |        | 2.5V   |        |        |
|                                                |                                      | Min.                                                    | Max.   | Min.   | Max.   | Min.   | Max.   | Min.   | Max.   |        |
| Supply Voltage Variation (VDD)                 |                                      | VDD-5%                                                  | VDD+5% | VDD-5% | VDD+5% | VDD-5% | VDD+5% | VDD-5% | VDD+5% | V      |
| Frequency Range                                |                                      | 10                                                      | 320    | 10     | 320    | 10     | 320    | 10     | 320    | MHz    |
| Standard Frequency                             |                                      | 77.76, 106.25, 125, 155.52, 156.25, 187.5, 212.5, 312.5 |        |        |        |        |        |        |        |        |
| Supply Current                                 | 10MHz≤F <sub>o</sub> <160MHz         | —                                                       | 75     | —      | 75     | —      | 50     | —      | 50     | mA     |
|                                                | 160MHz≤F <sub>o</sub> <250MHz        | —                                                       | 100    | —      | 100    | —      | 50     | —      | 50     |        |
|                                                | 250MHz≤F <sub>o</sub> <320MHz        | —                                                       | 100    | —      | 100    | —      | 65     | —      | 65     |        |
| Output Level                                   | Output High                          | 2.275                                                   | —      | 1.475  | —      | —      | 1.6    | —      | 1.6    | V      |
|                                                | Output Low                           | —                                                       | 1.68   | —      | 0.88   | 0.9    | —      | 0.9    | —      |        |
| Transition Time: Rise/Fall Time+               |                                      | —                                                       | 1      | —      | 1      | —      | 1      | —      | 1      | nSec   |
| Startup Time                                   |                                      | —                                                       | 10     | —      | 10     | —      | 10     | —      | 10     | mSec   |
| Tri-State<br>(Input to Pin2 or Pin1)           | Enable<br>(High Voltage or Floating) | 2.31                                                    | —      | 1.75   | —      | 2.31   | —      | 1.75   | —      | V      |
|                                                | Disable<br>(Low Voltage or GND)      | —                                                       | 0.99   | —      | 0.75   | —      | 0.99   | —      | 0.75   |        |
| Aging (@25°C, 1st Year)                        |                                      | —                                                       | ±3     | —      | ±3     | —      | ±3     | —      | ±3     | ppm    |
| Storage Temp. Range                            |                                      | -55                                                     | 125    | -55    | 125    | -55    | 125    | -55    | 125    | °C     |
| Phase Noise<br>@ 156.25 MHz                    | 100 Hz                               | -100                                                    |        | -100   |        | -100   |        | -100   |        | dBc/Hz |
|                                                | 1 kHz                                | -130                                                    |        | -130   |        | -130   |        | -130   |        |        |
|                                                | 10 kHz                               | -145                                                    |        | -145   |        | -145   |        | -145   |        |        |
| RMS Phase Jitter<br>(Integrated 12KHz ~ 20MHz) | F <sub>o</sub> <80MHz                | —                                                       | 1      | —      | 1      | —      | 1      | —      | 1      | pSec   |
|                                                | 80MHz≤F <sub>o</sub> <125MHz         | —                                                       | 0.5    | —      | 0.5    | —      | 0.5    | —      | 0.5    |        |
|                                                | 125MHz≤F <sub>o</sub> <170MHz        | —                                                       | 0.3    | —      | 0.3    | —      | 0.3    | —      | 0.3    |        |
|                                                | 170MHz≤F <sub>o</sub> <200MHz        | —                                                       | 0.5    | —      | 0.5    | —      | 0.5    | —      | 0.5    |        |
|                                                | 200MHz≤F <sub>o</sub>                | —                                                       | 0.3    | —      | 0.3    | —      | 0.3    | —      | 0.3    |        |

# Oscillator (CMOS/LVPECL/LVDS/HCSL Output)

| Parameter                                       |                                      | HCSL   |        |        |        | Unit |
|-------------------------------------------------|--------------------------------------|--------|--------|--------|--------|------|
|                                                 |                                      | 3.3V   |        | 2.5V   |        |      |
|                                                 |                                      | Min.   | Max.   | Min.   | Max.   |      |
| Supply Voltage Variation(VDD)                   |                                      | VDD-5% | VDD+5% | VDD-5% | VDD+5% | V    |
| Frequency Range                                 |                                      | 25     | 175    | 25     | 175    | MHz  |
| Standard Frequency                              |                                      | 100    |        |        |        |      |
| Supply Current                                  | 25MHz≤F <sub>o</sub> ≤175MHz         | —      | 50     | —      | 50     | mA   |
| Output Level                                    | Output High                          | 0.6    | —      | 0.58   | —      | V    |
|                                                 | Output Low                           | —      | 0.15   | —      | 0.15   |      |
| Transition Time: Rise/Fall Time+                |                                      | —      | 0.5    | —      | 0.5    | nSec |
| Startup Time                                    |                                      | —      | 10     | —      | 10     | mSec |
| Tri-State<br>(Input to Pin2 or Pin1)            | Enable<br>(High Voltage or Floating) | 0.7VDD | —      | 0.7VDD | —      | V    |
|                                                 | Disable<br>(Low Voltage or GND)      | —      | 0.3VDD | —      | 0.3VDD |      |
| Aging (@25°C, 1st Year)                         |                                      | —      | ±3     | —      | ±3     | ppm  |
| Storage Temp. Range                             |                                      | -55    | 125    | -55    | 125    | °C   |
| RMS Phase Jitter<br>(Intergrated 12KHz ~ 20MHz) | 25MHz≤F <sub>o</sub> ≤175MHz         | —      | 0.5    | —      | 0.5    | pSec |

Standard frequencies are frequencies which the crystal has been designed and does not imply a stock position.

+ Transition times are measured between 20% and 80% of VDD.

## FREQ. STABILITY vs. TEMP. RANGE

| Temp.(°C)  | ppm | ±25 | ±50 |
|------------|-----|-----|-----|
| -10 ~ +60  |     | ○   | ○   |
| -20 ~ +70  |     | ○   | ○   |
| -40 ~ +85  |     | △   | ○   |
| -40 ~ +125 |     | ×   | ○   |

\*○: Available △: Condition X: Not available

\*Inclusive of calibration @ 25 °C, operating temperature range, input voltage variation, load variation, aging (1st year), shock, and vibration

Note: not all combination of options are available. Other specifications may be available upon request.

Specifications subject to change without notice.



# Oscillator (CMOS/LVPECL/LVDS/HCSL Output)

## 4.8 TLV7050

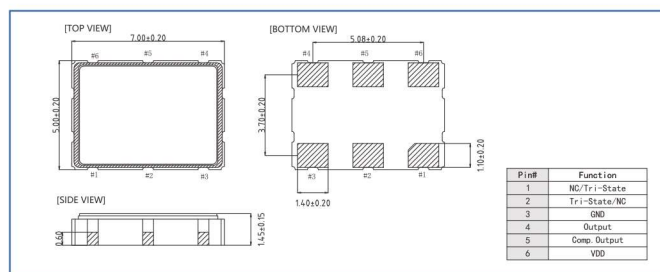
7.0 x 5.0 mm SMD LVPECL/LVDS  
Crystal Oscillator



### FEATURES

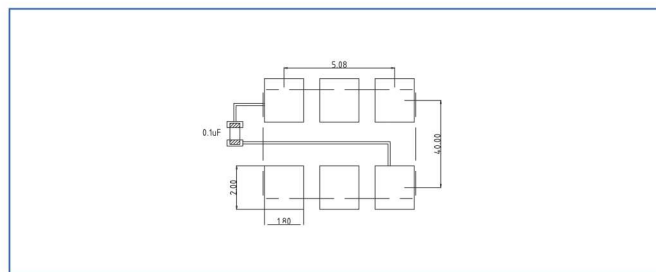
- Typical 7.0 x 5.0 x 1.45 mm hermetically sealed ceramic package
- Very low phase jitter : < 1 pS(0.6 pS, typ.) RMS
- Any frequency between 10 MHz and 1500 MHz
- Fast deliver
- Tri-state enable/disable

### DIMENSIONS



### TYPICAL APPLICATION

- High-Speed Gigabit Ethernet, Fiber Channel, Storage Area Network, SONET
- Enterprise Server, SAS/SATA
- Microprocessors/DSP/FPGA
- Broadband Access
- Smart Grid



### ELECTRICAL SPECIFICATION

| Parameter                                   |                                      | LVPECL                                                                |        |        |        | LVDS   |        |        |        | Unit   |
|---------------------------------------------|--------------------------------------|-----------------------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|
|                                             |                                      | 3.3V                                                                  |        | 2.5V   |        | 3.3V   |        | 2.5V   |        |        |
|                                             |                                      | Min.                                                                  | Max.   | Min.   | Max.   | Min.   | Max.   | Min.   | Max.   |        |
| Supply Voltage Variation (VDD)              |                                      | VDD-5%                                                                | VDD+5% | VDD-5% | VDD+5% | VDD-5% | VDD+5% | VDD-5% | VDD+5% | V      |
| Frequency Range                             |                                      | 10                                                                    | 1500   | 10     | 1500   | 10     | 1500   | 10     | 1500   | MHz    |
| Standard Frequency                          |                                      | 106.25, 125, 133.33, 150, 155.52, 156.25, 187.5, 212.5, 312.5, 622.08 |        |        |        |        |        |        |        |        |
| Supply Current                              | 10MHz≤F <sub>o</sub> <1500MHz        | —                                                                     | 50     | —      | 50     | —      | 50     | —      | 50     | mA     |
| Output Level                                | Output High                          | 2.275                                                                 | —      | 1.475  | —      | —      | 1.6    | —      | 1.6    | V      |
|                                             | Output Low                           | —                                                                     | 1.68   | —      | 0.88   | 0.9    | —      | 0.9    | —      |        |
| Transition Time: Rise/Fall Time+            |                                      | —                                                                     | 1      | —      | 1      | —      | 1      | —      | 1      | nSec   |
| Startup Time                                |                                      | —                                                                     | 10     | —      | 10     | —      | 10     | —      | 10     | mSec   |
| Tri-State<br>(Input to Pin2 or Pin1)        | Enable<br>(High Voltage or Floating) | 2.31                                                                  | —      | 1.75   | —      | 2.31   | —      | 1.75   | —      | V      |
|                                             | Disable<br>(Low Voltage or GND)      | —                                                                     | 0.99   | —      | 0.75   | —      | 0.99   | —      | 0.75   |        |
| Aging (@25°C, 1st Year)                     |                                      | —                                                                     | ±3     | —      | ±3     | —      | ±3     | —      | ±3     | ppm    |
| Storage Temp. Range                         |                                      | -55                                                                   | 125    | -55    | 125    | -55    | 125    | -55    | 125    | °C     |
| Phase Noise<br>@ 156.25 MHz                 | 100 Hz                               | -85                                                                   |        | -85    |        | -85    |        | -85    |        | dBc/Hz |
|                                             | 1 kHz                                | -105                                                                  |        | -105   |        | -105   |        | -105   |        |        |
|                                             | 10 kHz                               | -115                                                                  |        | -115   |        | -115   |        | -115   |        |        |
| RMS Phase Jitter(Intergrated 12KHz ~ 20MHz) |                                      | —                                                                     | 1.5    | —      | 1.5    | —      | 1.5    | —      | 1.5    | pSec   |

### FREQ. STABILITY vs. TEMP. RANGE

| Temp.(°C) | ppm | ±25 | ±50 |
|-----------|-----|-----|-----|
| -10 ~ +60 |     | ○   | ○   |
| -20 ~ +70 |     | ○   | ○   |
| -40 ~ +85 |     | ×   | ○   |

\*○: Available Δ: Condition X: Not available

\*Inclusive of calibration @ 25 °C, operating temperature range, input voltage variation, load variation, aging (1st year), shock, and vibration.

Note: not all combination of options are available. Other specifications may be available upon request.

Specifications subject to change without notice.

# TCXO

## 5.1 TC1612

**1.6x1.2mm**  
**Temperature Compensated**  
**Crystal Oscillator**

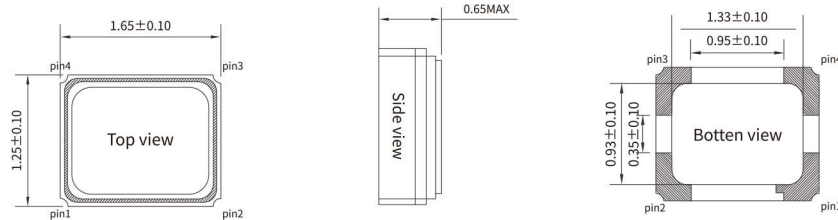


### FEATURES AND APPLICATIONS

- External Dimensions:1.6×1.2×0.65mm
- Small size, light weightiness,low power consumption
- Widely applied in consumer electronics

- H-structure
- Output Frequency Range:26MHz to 52MHz
- AEC-Q100&AEC-Q200 compliant

### DIMENSIONS



### ELECTRICAL SPECIFICATION

| Specifications                           |                                  | 3.3/3.0/2.8V   |       | 2.5V         |       | 1.8V         |       | Unit   |
|------------------------------------------|----------------------------------|----------------|-------|--------------|-------|--------------|-------|--------|
|                                          |                                  | Min.           | Max.  | Min.         | Max.  | Min.         | Max.  |        |
| Operating Voltage(VDD)                   |                                  | 2.66           | 3.465 | 2.375        | 2.625 | 1.71         | 1.89  | V      |
| Output Frequency                         |                                  | 26             | 52    | 26           | 52    | 26           | 52    | MHz    |
| Nominal Frequency                        |                                  | 26.0, 38.4, 52 |       |              |       |              |       |        |
| Frequency Accuracy (25°C)                |                                  | —              | ±1.5  | —            | ±1.5  | —            | ±1.5  | ppm    |
| Frequency Stability                      | Vs Supply Voltage(±5%)           | ±0.1           | ±0.2  | ±0.1         | ±0.2  | ±0.1         | ±0.2  | ppm    |
|                                          | Vs Load(±10%)                    | ±0.1           | ±0.2  | ±0.1         | ±0.2  | ±0.1         | ±0.2  |        |
|                                          | Vs Aging(@the first year)        | —              | ±1.0  | —            | ±1.0  | —            | ±1.0  |        |
| Operating Current                        | 26 MHz < F <sub>o</sub> ≤ 52 MHz | —              | 2.0   | —            | 2.0   | —            | 2.0   |        |
| Output Level (Clipped sine wave)         |                                  | 0.8            | —     | 0.8          | —     | 0.8          | —     | Vp-p   |
| Load                                     |                                  | 10KΩ // 10pF   |       | 10KΩ // 10pF |       | 10KΩ // 10pF |       |        |
| Voltage Control Range(VCTCXO)            |                                  | 0.5            | 2.5   | 0.4          | 2.4   | 0.3          | 1.5   | V      |
| Pull Range(VCTCXO)                       |                                  | ±5.0           | ±17.0 | ±5.0         | ±17.0 | ±5.0         | ±17.0 | ppm    |
| Voltage Control Input Resistance(VCTCXO) |                                  | 500            | —     | 500          | —     | 500          | —     | KΩ     |
| Phase Noise @ 26 MHz                     | 100 Hz                           | -110           |       | -110         |       | -110         |       | dBc/Hz |
|                                          | 1 KHz                            | -130           |       | -130         |       | -130         |       |        |
|                                          | 10 KHz                           | -145           |       | -145         |       | -145         |       |        |
| Start-up time                            |                                  | —              | 2     | —            | 2     | —            | 2     | mSec   |
| Storage temperature range                |                                  | -40            | 125   | -40          | 125   | -40          | 125   | °C     |

### FREQ. STABILITY vs. TEMP. RANGE

| Temp.(°C) \ ppm | ±0.5 | ±1.0 | ±1.5 | ±2.0 | ±2.5 |
|-----------------|------|------|------|------|------|
| -20 ~ +70       | ○    | ○    | ○    | ○    | ○    |
| -30 ~ +85       | ○    | ○    | ○    | ○    | ○    |
| -40 ~ +85       | ○    | ○    | ○    | ○    | ○    |

Standard frequencies are frequencies which the crystal has been designed and does not imply a stock position.  
 \*Frequency at 25°C, 1 hour after reflow.

\*o: Available Δ: Condition X: Not available

Note: not all combination of options are available.  
 Other specifications may be available upon request.  
 Specifications subject to change without notice.



# TCXO

## 5.2 TC2016

### 2.0 x 1.6 mm SMD Voltage Controlled Temperature Compensated Crystal Oscillator



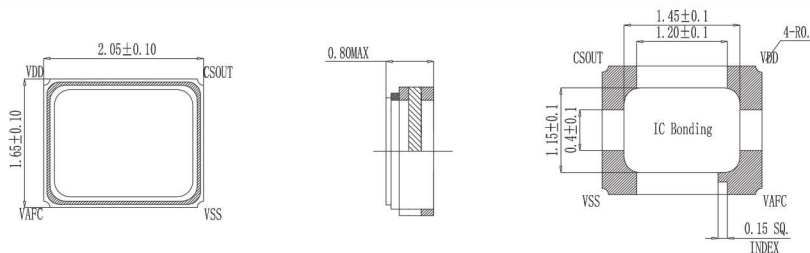
#### FEATURES

- Typical 2.0 x 1.6 x 0.8 mm ceramic SMD package
- H Type Package
- Compactness and lightweight
- VCTCXO available
- Miniature size and low profile

#### TYPICAL APPLICATION

- GPS/GNSS
- WiMAX, WLAN
- Mobile Phone
- IoT, wearable Electronics

#### DIMENSIONS



#### ELECTRICAL SPECIFICATION

| Parameter                        |                                  | 3.3/3.0/2.8V           |       | 2.5V         |       | 1.8V         |       | Unit   |
|----------------------------------|----------------------------------|------------------------|-------|--------------|-------|--------------|-------|--------|
|                                  |                                  | Min.                   | Max.  | Min.         | Max.  | Min.         | Max.  |        |
| Supply Voltage Variation (VDD)   |                                  | 2.66                   | 3.465 | 2.375        | 2.625 | 1.71         | 1.89  | V      |
| Frequency Range                  |                                  | 10                     | 52    | 10           | 52    | 10           | 52    | MHz    |
| Standard Frequency               |                                  | 19.2, 26.0, 32.0, 38.4 |       |              |       |              |       |        |
| Frequency Tolerance (at 25°C)    |                                  | —                      | ±1.5  | —            | ±1.5  | —            | ±1.5  | ppm    |
| Frequency stability              | Vs Supply Voltage (±5%) change   | ±0.1                   | ±0.2  | ±0.1         | ±0.2  | ±0.1         | ±0.2  | ppm    |
|                                  | Vs Load (±10%) change            | ±0.1                   | ±0.2  | ±0.1         | ±0.2  | ±0.1         | ±0.2  |        |
|                                  | Vs Aging (@1st year)             | —                      | ±1.0  | —            | ±1.0  | —            | ±1.0  |        |
| Supply Current                   | 10 MHz ≤ F <sub>o</sub> ≤ 26 MHz | —                      | 1.5   | —            | 1.5   | —            | 1.5   | mA     |
|                                  | 26 MHz < F <sub>o</sub> ≤ 52 MHz | —                      | 2.0   | —            | 2.0   | —            | 2.0   |        |
| Output Level (Clipped sine wave) |                                  | 0.8                    | —     | 0.8          | —     | 0.8          | —     | Vp-p   |
| Load                             |                                  | 10KΩ // 10pF           |       | 10KΩ // 10pF |       | 10KΩ // 10pF |       |        |
| Control Voltage Range (VCTCXO)   |                                  | 0.5                    | 2.5   | 0.4          | 2.4   | 0.3          | 1.5   | V      |
| Pulling Range (VCTCXO)           |                                  | ±5.0                   | ±17.0 | ±5.0         | ±17.0 | ±5.0         | ±17.0 | ppm    |
| Vc Input Impedance (VCTCXO)      |                                  | 500                    | —     | 500          | —     | 500          | —     | KΩ     |
| Phase Noise @ 19.2 MHz           | 100 Hz                           | -115                   |       | -115         |       | -115         |       | dBc/Hz |
|                                  | 1 KHz                            | -135                   |       | -135         |       | -135         |       |        |
|                                  | 10 KHz                           | -148                   |       | -148         |       | -148         |       |        |
| Start time                       |                                  | —                      | 2     | —            | 2     | —            | 2     | mSec   |
| Storage Temp. Range              |                                  | -55                    | 125   | -55          | 125   | -55          | 125   | °C     |

#### FREQ. STABILITY vs. TEMP. RANGE

| Temp.(°C) \ ppm | ±0.5 | ±1.0 | ±1.5 | ±2.0 | ±2.5 |
|-----------------|------|------|------|------|------|
| -20 ~ +70       | ○    | ○    | ○    | ○    | ○    |
| -30 ~ +85       | ○    | ○    | ○    | ○    | ○    |
| -40 ~ +85       | ○    | ○    | ○    | ○    | ○    |

Standard frequencies are frequencies which the crystal has been designed and does not imply a stock position.  
\*Frequency at 25°C, 1 hour after reflow.

\*o: Available Δ: Condition X: Not available

Note: not all combination of options are available.  
Other specifications may be available upon request.  
Specifications subject to change without notice.

# TCXO

## 5.3 TC2520

### 2.5 x 2.0 mm SMD Voltage Controlled Temperature Compensated Crystal Oscillator



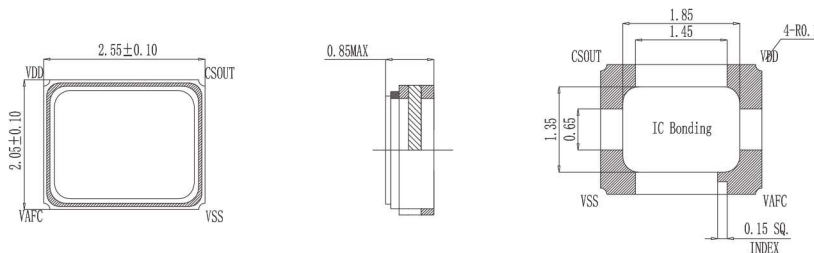
#### FEATURES

- Typical 2.5 x 2.0 x 0.85 mm ceramic SMD package
- H Type Package
- Compactness and lightweight
- VCTCXO available
- Low thickness

#### TYPICAL APPLICATION

- GPS/GNSS
- WiMAX, WLAN
- Mobile Phone

#### DIMENSIONS



#### ELECTRICAL SPECIFICATION

| Parameter                        |                                  | 3.3/3.0/2.8V           |       | 2.5V         |       | 1.8V         |       | Unit   |
|----------------------------------|----------------------------------|------------------------|-------|--------------|-------|--------------|-------|--------|
|                                  |                                  | Min.                   | Max.  | Min.         | Max.  | Min.         | Max.  |        |
| Supply Voltage Variation (VDD)   |                                  | 2.66                   | 3.465 | 2.375        | 2.625 | 1.71         | 1.89  | V      |
| Frequency Range                  |                                  | 10                     | 52    | 10           | 52    | 10           | 52    | MHz    |
| Standard Frequency               |                                  | 19.2, 26.0, 32.0, 38.4 |       |              |       |              |       |        |
| Frequency Tolerance (at 25°C)    |                                  | —                      | ±1.5  | —            | ±1.5  | —            | ±1.5  | ppm    |
| Frequency stability              | Vs Supply Voltage (±5%) change   | ±0.1                   | ±0.2  | ±0.1         | ±0.2  | ±0.1         | ±0.2  | ppm    |
|                                  | Vs Load (±10%) change            | ±0.1                   | ±0.2  | ±0.1         | ±0.2  | ±0.1         | ±0.2  |        |
|                                  | Vs Aging (@1st year)             | —                      | ±1.0  | —            | ±1.0  | —            | ±1.0  |        |
| Supply Current                   | 10 MHz ≤ F <sub>o</sub> ≤ 26 MHz | —                      | 1.5   | —            | 1.5   | —            | 1.5   | mA     |
|                                  | 26 MHz < F <sub>o</sub> ≤ 52 MHz | —                      | 2.0   | —            | 2.0   | —            | 2.0   |        |
| Output Level (Clipped sine wave) |                                  | 0.8                    | —     | 0.8          | —     | 0.8          | —     | Vp-p   |
| Load                             |                                  | 10KΩ // 10pF           |       | 10KΩ // 10pF |       | 10KΩ // 10pF |       |        |
| Control Voltage Range (VCTCXO)   |                                  | 0.5                    | 2.5   | 0.4          | 2.4   | 0.3          | 1.5   | V      |
| Pulling Range (VCTCXO)           |                                  | ±5.0                   | ±17.0 | ±5.0         | ±17.0 | ±5.0         | ±17.0 | ppm    |
| Vc Input Impedance (VCTCXO)      |                                  | 500                    | —     | 500          | —     | 500          | —     | KΩ     |
| Phase Noise @ 19.2 MHz           | 100 Hz                           | -115                   |       | -115         |       | -115         |       | dBc/Hz |
|                                  | 1 KHz                            | -135                   |       | -135         |       | -135         |       |        |
|                                  | 10 KHz                           | -148                   |       | -148         |       | -148         |       |        |
| Start time                       |                                  | —                      | 2     | —            | 2     | —            | 2     | mSec   |
| Storage Temp. Range              |                                  | -55                    | 125   | -55          | 125   | -55          | 125   | °C     |

#### FREQ. STABILITY vs. TEMP. RANGE

| Temp.(°C) \ ppm | ±0.5 | ±1.0 | ±1.5 | ±2.0 | ±2.5 |
|-----------------|------|------|------|------|------|
| -20 ~ +70       | ○    | ○    | ○    | ○    | ○    |
| -30 ~ +85       | ○    | ○    | ○    | ○    | ○    |
| -40 ~ +85       | ○    | ○    | ○    | ○    | ○    |

Standard frequencies are frequencies which the crystal has been designed and does not imply a stock position.  
\*Frequency at 25°C, 1 hour after reflow.

\*o: Available Δ: Condition X: Not available

Note: not all combination of options are available.  
Other specifications may be available upon request.  
Specifications subject to change without notice.

# TCXO

## 5.4 TC3225

### 3.2 x 2.5 mm SMD Voltage Controlled Temperature VCTCXO Compensated Crystal Oscillator



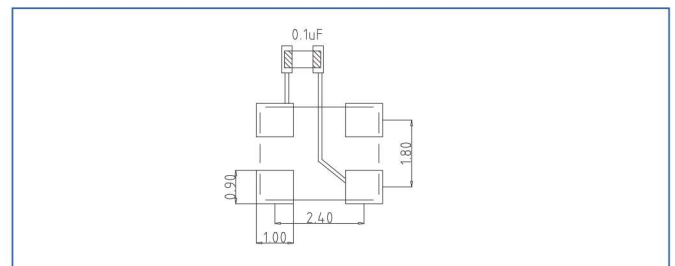
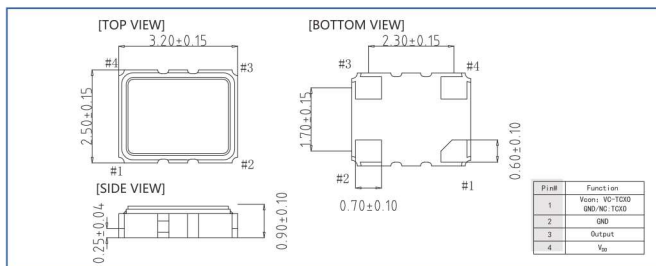
#### FEATURES

- Typical 3.2 x 2.5 x 0.9 mm SMD
- Compactness and lightweight
- VCTCXO available
- For automatic assembly
- Low power consumption
- Low thickness

#### TYPICAL APPLICATION

- GPS
- WiMAX, WLAN
- Mobile Phone

#### DIMENSIONS



#### ELECTRICAL SPECIFICATION

| Parameter                        |                                  | 3.3/3.0/2.8V                                                                                |       | 2.5V         |       | 1.8V         |      | Unit   |
|----------------------------------|----------------------------------|---------------------------------------------------------------------------------------------|-------|--------------|-------|--------------|------|--------|
|                                  |                                  | Min.                                                                                        | Max.  | Min.         | Max.  | Min.         | Max. |        |
| Supply Voltage Variation (VDD)   |                                  | 2.66                                                                                        | 3.465 | 2.375        | 2.625 | 1.71         | 1.89 | V      |
| Frequency Range                  |                                  | 10                                                                                          | 52    | 10           | 52    | 10           | 52   | MHz    |
| Standard Frequency               |                                  | 10, 12.8, 13, 16.367667, 16.368, 16.369, 19.2<br>19.44, 20, 25, 26, 27, 30, 30.72, 32, 38.4 |       |              |       |              |      |        |
| Frequency Tolerance (at 25°C)    |                                  | —                                                                                           | ±2.0  | —            | ±2.0  | —            | ±2.0 |        |
| Frequency stability              | Vs Supply Voltage (±5%) change   | —                                                                                           | ±0.2  | —            | ±0.2  | —            | ±0.2 | ppm    |
|                                  | Vs Load (±10%) change            | —                                                                                           | ±0.2  | —            | ±0.2  | —            | ±0.2 | ppm    |
|                                  | Vs Aging (@1st year)             | —                                                                                           | ±1.0  | —            | ±1.0  | —            | ±1.0 | ppm    |
| Supply Current                   | 10 MHz ≤ F <sub>o</sub> ≤ 26 MHz | —                                                                                           | 1.5   | —            | 1.5   | —            | 1.5  | mA     |
|                                  | 26 MHz < F <sub>o</sub> ≤ 52 MHz | —                                                                                           | 2.0   | —            | 2.0   | —            | 2.0  |        |
| Output Level (Clipped sine wave) |                                  | 0.8                                                                                         | —     | 0.8          | —     | 0.8          | —    | Vp-p   |
| Load                             |                                  | 10KΩ // 10pF                                                                                |       | 10KΩ // 10pF |       | 10KΩ // 10pF |      |        |
| Control Voltage Range (VCTCXO)   |                                  | 0.5                                                                                         | 2.5   | 0.4          | 2.4   | 0.3          | 1.5  | V      |
| Pulling Range (VCTCXO)           |                                  | ±5.0                                                                                        | —     | ±5.0         | —     | ±5.0         | —    | ppm    |
| Vc Input Impedance (VCTCXO)      |                                  | 500                                                                                         | —     | 500          | —     | 500          | —    | KΩ     |
| Phase Noise @ 19.2 MHz           | 100 Hz                           | -115                                                                                        |       | -115         |       | -115         |      | dBc/Hz |
|                                  | 1 KHz                            | -135                                                                                        |       | -135         |       | -135         |      |        |
|                                  | 10 KHz                           | -148                                                                                        |       | -148         |       | -148         |      |        |
| Start time                       |                                  | —                                                                                           | 2     | —            | 2     | —            | 2    | mSec   |
| Storage Temp. Range              |                                  | -40                                                                                         | 85    | -40          | 85    | -40          | 85   | °C     |

#### FREQ. STABILITY vs. TEMP. RANGE

| Temp.(°C) | ppm | ±0.5 | ±1.0 | ±1.5 | ±2.0 | ±2.5 |
|-----------|-----|------|------|------|------|------|
| -20 ~ +70 |     | ○    | ○    | ○    | ○    | ○    |
| -30 ~ +85 |     | ○    | ○    | ○    | ○    | ○    |
| -40 ~ +85 |     | ○    | ○    | ○    | ○    | ○    |

Standard frequencies are frequencies which the crystal has been designed and does not imply a stock position.  
\*Frequency at 25°C, 1 hour after reflow.

\*o: Available Δ: Condition X: Not available

Note: not all combination of options are available.  
Other specifications may be available upon request.  
Specifications subject to change without notice.





# TCXO

| Parameter                                      |         | 3.3V   |        | 2.5V   |        | Unit   |
|------------------------------------------------|---------|--------|--------|--------|--------|--------|
|                                                |         | Min.   | Max.   | Min.   | Max.   |        |
| Tri-State Control                              | Enable  | 80%Vdd | —      | 80%Vdd | —      | V      |
|                                                | Disable | —      | 20%Vdd | —      | 20%Vdd |        |
| Startup time                                   |         | —      | 5      | —      | 5      | mS ec  |
| Control Voltage Range(VCTCXO)                  |         | 0.5    | 2.5    | 0.5    | 2.5    | V      |
| Pulling Range(VCTCXO)                          |         | ±5.0   | —      | ±5.0   | —      | ppm    |
| Vc Input Impedance                             |         | 100    | —      | 100    | —      | KΩ     |
| Phase Noise @TCXO<br>VDD=3.3 V,<br>Fout=20 MHz | 100 Hz  | -122   |        | -122   |        | dBc/Hz |
|                                                | 1 kHz   | -142   |        | -142   |        |        |
|                                                | 10 kHz  | -154   |        | -154   |        |        |
|                                                | 100 kHz | -157   |        | -157   |        |        |
|                                                | 1 MHz   | -159   |        | -159   |        |        |

Standard frequencies are frequencies which the crystal has been designed and does not imply a stock position.

\*Frequency at 25°C, 1 hour after reflow.

## FREQ. STABILITY vs. TEMP. RANGE

| Temp.(°C) \ ppm | ±0.05 | ±0.1 | ±0.2 | ±0.28 | ±0.5 |
|-----------------|-------|------|------|-------|------|
| -10 ~ +60       | ○     | ○    | ○    | ○     | ○    |
| -20 ~ +70       | ○     | ○    | ○    | ○     | ○    |
| -40 ~ +85       | △     | ○    | ○    | ○     | ○    |
| -40 ~ +95       | △     | △    | ○    | ○     | ○    |
| -40 ~ +105      | ×     | △    | ○    | ○     | ○    |

\*○: Available △: Condition X: Not available

Note: not all combination of options are available. Other specifications may be available upon request.  
Specifications subject to change without notice.

# TCXO

## 5.6 TC7050

### 7.0 x 5.0 mm SMD Voltage Controlled Temperature Compensated Crystal Oscillator



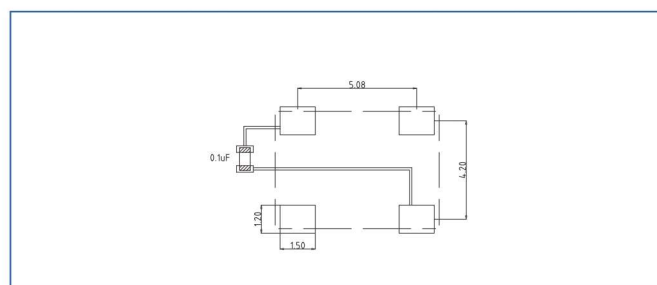
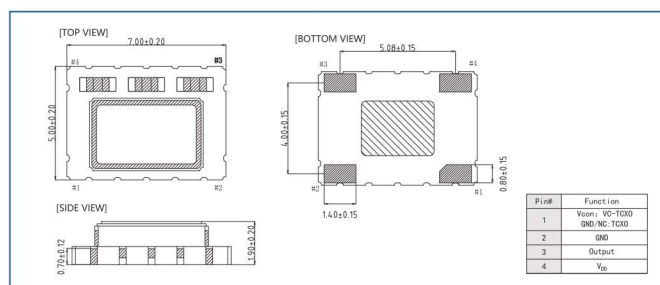
#### FEATURES

- Typical 7.0 x 5.0 x 1.9 mm ceramic SMD package
- High Precision for -40 ~ +85°C,  $\pm 0.28\text{ppm}$ ,  
-40 ~ +105°C,  $\pm 2\text{ppm}$
- CMOS and Clipped Sine wave (without DC-cut capacitor) output optional

#### TYPICAL APPLICATION

- Femtocell, Base Stations
- WLAN/WiMAX/WIFI, Wireless Communications

#### DIMENSIONS



#### ELECTRICAL SPECIFICATION

| Parameter                        |                                | 5.0V                                      |        | 3.3V         |        | Unit   |
|----------------------------------|--------------------------------|-------------------------------------------|--------|--------------|--------|--------|
|                                  |                                | Min.                                      | Max.   | Min.         | Max.   |        |
| Supply Voltage Variation (VDD)   |                                | Vdd-5%                                    | Vdd+5% | Vdd-5%       | Vdd+5% | V      |
| Frequency Range                  |                                | 5                                         | 52     | 5            | 52     | MHz    |
| Standard Frequency(for COMS)     |                                | 10, 12.8, 16.384, 19.2, 19.44, 20, 25, 26 |        |              |        |        |
| Frequency Tolerance (at 25°C)    |                                | —                                         | ±2.0   | —            | ±2.0   | ppm    |
| Frequency stability              | Vs Supply Voltage (±5%) change | —                                         | ±0.1   | —            | ±0.05  | ppm    |
|                                  | Vs Load (±10%) change          | —                                         | ±0.05  | —            | ±0.05  |        |
|                                  | Vs Aging (@1st year)           | —                                         | ±1.0   | —            | ±1.0   | ppm    |
| Supply Current(CMOS output)      |                                | —                                         | 6      | —            | 6      | mA     |
| Output Level (Clipped sine wave) |                                | —                                         | 3.5    | —            | 3.5    |        |
| Output Level(CMOS)               | Output High                    | 90%Vdd                                    | —      | 90%Vdd       | —      | V      |
|                                  | Output Low                     | —                                         | 10%Vdd | —            | 10%Vdd |        |
| CMOS                             | Duty                           | 45                                        | 55     | 45           | 55     | %      |
| Output Level(Clipped sine)       |                                | 0.8                                       | —      | 0.8          | —      | Vp-p   |
| Load(CMOS)                       |                                | 15pF                                      |        | 15pF         |        | pF     |
| Load(Clipped sine)               |                                | 10KΩ // 10pF                              |        | 10KΩ // 10pF |        |        |
| Control Voltage Range(VCTCXO)    |                                | 0.5                                       | 2.5    | 0.5          | 2.5    | V      |
| Pulling Range(VCTCXO)            |                                | ±5.0                                      | —      | ±5.0         | —      | ppm    |
| Vc Input Impedance               |                                | 100                                       | —      | 100          | —      | KΩ     |
| Phase Noise @ 19.2 MHz           | 100 Hz                         | -130                                      |        | -130         |        | dBc/Hz |
|                                  | 1 KHz                          | -145                                      |        | -145         |        |        |
|                                  | 10 KHz                         | -154                                      |        | -154         |        |        |
| Start time                       |                                | —                                         | 2      | —            | 2      | mSec   |
| Storage Temp. Range              |                                | -55                                       | 125    | -55          | 125    | °C     |

Standard frequencies are frequencies which the crystal has been designed and does not imply a stock position.



# TCXO

## FREQ. STABILITY vs. TEMP. RANGE

| Temp.(°C) \ ppm | ±0.05 | ±0.1 | ±0.14 | ±0.2 | ±0.28 | ±0.5 | ±2 |
|-----------------|-------|------|-------|------|-------|------|----|
| -10 ~ +70       | ○     | ○    | ○     | ○    | ○     | ○    | ○  |
| -20 ~ +85       | ×     | ○    | ○     | ○    | ○     | ○    | ○  |
| -40 ~ +85       | ×     | ×    | ×     | △    | ○     | ○    | ○  |
| -40 ~ +95       | ×     | ×    | ×     | ×    | ×     | △    | ○  |
| -40 ~ +105      | ×     | ×    | ×     | ×    | ×     | ×    | ○  |

\*○: Available △: Condition ×: Not available

Note: not all combination of options are available. Other specifications may be available upon request.  
Specifications subject to change without notice.

# OCXO

## 6.1 TOC2020

### 20.6 x 20.6 mm Oven Controlled Crystal Oscillator



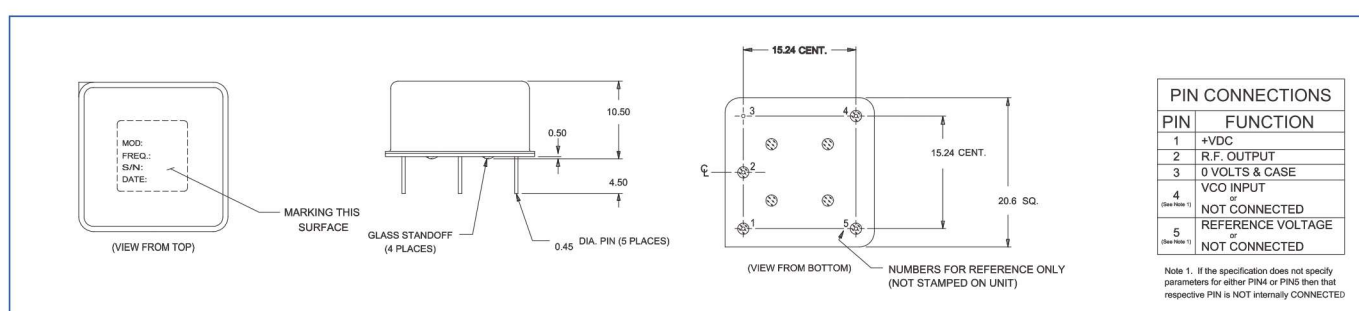
#### FEATURES

- Dimension 20.6 x 20.6 x 11.0 mm typical
- SC Cut Crystal

#### TYPICAL APPLICATION

- SDH/SONET, Telecommunication base station
- Test and measurement equipment
- Synthesizer, Digital switch, Reference Timing Circuit

#### DIMENSIONS



#### ELECTRICAL SPECIFICATION

| Parameter           |            | Min. | Typ.        | Max. | Unit.  | Test Condition                                                                                                             |
|---------------------|------------|------|-------------|------|--------|----------------------------------------------------------------------------------------------------------------------------|
| Output Frequency    |            | —    | 10          | —    | MHz    | Available frequency range is from 5MHz to 40MHz. Standard frequencies are 10, 12.8, 13, 15.36, 16.384, 19.2, 20 and 25MHz. |
| Waveform            |            | —    | Rectangular | —    | —      | Sine wave output is available. Consult factory for more information.                                                       |
| Level (HCMOS)       | "1" Level  | 3.5  | —           | —    | V      |                                                                                                                            |
|                     | "0" Level  | —    | —           | 0.5  |        |                                                                                                                            |
|                     | Load       | —    | 15          | —    | pF     |                                                                                                                            |
|                     | Duty Cycle | 45   | 50          | 55   | %      | @+2.0V                                                                                                                     |
|                     | Spurious   | —    | —           | -60  | dBc    |                                                                                                                            |
| Frequency Stability | Ambient    | -10  | —           | +10  | ppb    | -30 ~ +70°C, referenced to +25°C<br>Refer to Freq. Stability Vs Temp. Range table.                                         |
|                     | Aging      | -0.5 | —           | +0.5 | ppb    | Per day, at time of shipment.                                                                                              |
|                     | Daily      | -0.5 | —           | +0.5 | ppb    | after 30 days                                                                                                              |
|                     | Yearly     | -50  | —           | +50  | ppb    |                                                                                                                            |
|                     | 10 years   | -0.3 | —           | +0.3 | ppm    |                                                                                                                            |
|                     | Voltage    | -0.5 | —           | +0.5 | ppb    | ±5% Change                                                                                                                 |
|                     | Warm-up    | -50  | —           | +50  | ppb    | In 3 minutes @ +25°C, referenced to 1 hour.                                                                                |
| Phase Noise         |            | —    | —           | -115 | dBc/Hz | @10 Hz                                                                                                                     |
|                     |            | —    | —           | -135 |        | @100 Hz                                                                                                                    |
|                     |            | —    | —           | -145 |        | @1 kHz                                                                                                                     |
|                     |            | —    | —           | -150 |        | @10 kHz                                                                                                                    |

# OCXO

| Parameter                       |                 | Min. | Typ.     | Max. | Unit. | Test Condition                                                                         |
|---------------------------------|-----------------|------|----------|------|-------|----------------------------------------------------------------------------------------|
| Electrical Frequency Adjustment | Range           | —    | —        | -0.5 | ppm   | VCO@ 0V                                                                                |
|                                 |                 | 0.5  | —        | —    |       | VCO@4.0V                                                                               |
|                                 | Control         | 0    | 2        | 4    | V     |                                                                                        |
|                                 | Slope           | —    | Positive | —    |       |                                                                                        |
|                                 | Input impedance | 100  | —        | —    | kΩ    |                                                                                        |
| Input Power                     | Voltage         | 4.75 | 5.0      | 5.25 | V     | 3.3V input voltage is available. Consult factory for control voltage and output level. |
|                                 | Current         | —    | —        | 500  | mA    | @ turn on                                                                              |
|                                 | Steady state    | —    | —        | 1.0  | W     | @ +25°C                                                                                |
| Reference Voltage               | Voltage         | 3.8  | 4.0      | 4.2  | V     |                                                                                        |
|                                 | Load            | 9    | —        | —    | kΩ    |                                                                                        |

## FREQ. STABILITY vs. TEMP. RANGE

| Temp.(°C) \ ppb | ±5 | ±10 | ±20 |
|-----------------|----|-----|-----|
| 0 ~ +70         | ○  | ○   | ○   |
| -30 ~ +70       | △  | ○   | ○   |
| -40 ~ +85       | △  | ○   | ○   |

\*○: Available △: Condition X: Not available

Note: not all combination of options are available. Other specifications may be available upon request.  
Specifications subject to change without notice.

# OCXO

## 6.2 TOC2522

### 25.4 x 22.1 mm Oven Controlled Crystal Oscillator



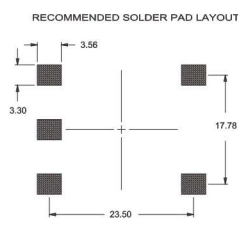
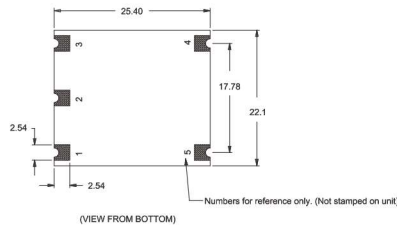
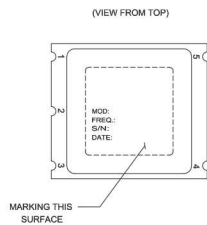
#### FEATURES

- Dimension 25.4 x 22.1 x 11.0 mm typical
- SC Cut Crystal

#### DIMENSIONS

#### TYPICAL APPLICATION

- SDH/SONET, Telecommunication base station
- Test and measurement equipment
- Synthesizer, Digital switch, Reference Timing Circuit



| PIN CONNECTIONS   |                                    |
|-------------------|------------------------------------|
| PIN               | FUNCTION                           |
| 1<br>(See Note 1) | VCO INPUT<br>NOT CONNECTED         |
| 2<br>(See Note 1) | REFERENCE VOLTAGE<br>NOT CONNECTED |
| 3                 | +VDC                               |
| 4                 | R. F. OUTPUT                       |
| 5                 | 0 VOLTS & CASE                     |

Note 1: If the specification does not specify parameters for either PIN1 or PIN2 then that respective PIN is NOT internally CONNECTED

#### ELECTRICAL SPECIFICATION

| Parameter           |            | Min. | Typ.        | Max. | Unit.  | Test Condition                                                                                                         |
|---------------------|------------|------|-------------|------|--------|------------------------------------------------------------------------------------------------------------------------|
| Output Frequency    |            | —    | 10          | —    | MHZ    | Available frequency range is from 5MHz to 40MHz. Standard frequencies are 10, 12.8, 15.36, 16.384, 19.2, 20 and 25MHz. |
| Waveform            |            | —    | Rectangular | —    | —      | Sine wave output is available. Consult factory for more information.                                                   |
| Level (HCMOS)       | "1" Level  | 2.4  | 3.3         | —    | V      | @+1.4V                                                                                                                 |
|                     | "0" Level  | —    | —           | 0.4  |        |                                                                                                                        |
|                     | Load       | —    | 15          | —    | pF     |                                                                                                                        |
|                     | Duty Cycle | 45   | 50          | 55   | %      |                                                                                                                        |
|                     | Spurious   | —    | —           | -60  | dBc    |                                                                                                                        |
| Frequency Stability | Ambient    | -10  | —           | +10  | ppb    | -30 ~ +70°C, referenced to +25°C Refer to Freq. Stability Vs Temp. Range table.                                        |
|                     | Aging      | -0.5 | —           | +0.5 | ppb    | Per day, at time of shipment.                                                                                          |
|                     | Daily      | -0.5 | —           | +0.5 | ppb    | after 30 days                                                                                                          |
|                     | Yearly     | -50  | —           | +50  | ppb    |                                                                                                                        |
|                     | 10 years   | -0.4 | —           | +0.4 | ppm    |                                                                                                                        |
|                     | Voltage    | -0.5 | —           | +0.5 | ppb    | ±5% Change                                                                                                             |
|                     | Warm-up    | -10  | —           | +10  | ppb    | In 2 minutes @ +25°C, referenced to 1 hour.                                                                            |
| Phase Noise @ 20MHz |            | —    | —           | -115 | dBc/Hz | @10 Hz                                                                                                                 |
|                     |            | —    | —           | -130 |        | @100 Hz                                                                                                                |
|                     |            | —    | —           | -140 |        | @1k Hz                                                                                                                 |
|                     |            | —    | —           | -150 |        | @10k Hz                                                                                                                |

# OCXO

| Parameter                       |                 | Min.  | Typ.     | Max.  | Unit. | Test Condition                                                                         |
|---------------------------------|-----------------|-------|----------|-------|-------|----------------------------------------------------------------------------------------|
| Electrical Frequency Adjustment | Range           | —     | —        | -0.5  | ppm   | VCO@ 0V                                                                                |
|                                 |                 | 0.5   | —        | —     |       | VCO@2.8V                                                                               |
|                                 | Control         | 0     | 1.4      | 2.8   | V     |                                                                                        |
|                                 | Slope           | —     | Positive | —     |       |                                                                                        |
|                                 | Input impedance | 100   | —        | —     | kΩ    |                                                                                        |
| Input Power                     | Voltage         | 3.135 | 3.3      | 3.465 | V     | 5.0V input voltage is available. Consult factory for control voltage and output level. |
|                                 | Current         | —     | —        | 1000  | mA    | @ turn on                                                                              |
|                                 | Steady state    | —     | —        | 1.2   | W     | @ +25°C                                                                                |
| Reference Voltage               | Voltage         | 2.7   | 2.8      | 2.9   | V     |                                                                                        |
|                                 | Load            | 9     | —        | —     | kΩ    |                                                                                        |

## FREQ. STABILITY vs. TEMP. RANGE

| Temp.(°C) \ ppb | ±5 | ±10 | ±20 |
|-----------------|----|-----|-----|
| 0 ~ +70         | ○  | ○   | ○   |
| -30 ~ +70       | △  | ○   | ○   |
| -40 ~ +85       | △  | ○   | ○   |

\*○: Available △: Condition X: Not available

Note: not all combination of options are available. Other specifications may be available upon request.  
Specifications subject to change without notice.

# OCXO

## 6.3 TOC2525

### 25.4 x 25.4 mm Oven Controlled Crystal Oscillator



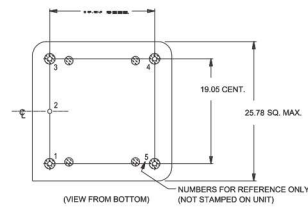
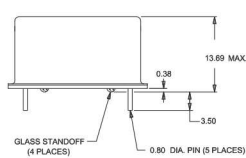
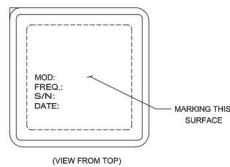
#### FEATURES

- Dimension 25.4 x 25.4 x 12.7 mm typical
- SC Cut Crystal

#### TYPICAL APPLICATION

- SDH/SONET, Telecommunication base station
- Test and measurement equipment
- Synthesizer, Digital switch, Reference Timing Circuit

#### DIMENSIONS



| PIN CONNECTIONS |                   |
|-----------------|-------------------|
| PIN             | FUNCTION          |
| 1               | R. F. OUTPUT      |
| 2               | 0 VOLTS & CASE    |
| 3               | VCO INPUT         |
| 4               | REFERENCE VOLTAGE |
| 5               | +VDC              |

Note 1. If the specification does not specify parameters for either PIN3 or PIN4 then that respective PIN is NOT internally CONNECTED.

#### ELECTRICAL SPECIFICATION

| Parameter           |          | Min. | Typ.        | Max. | Unit.  | Test Condition                                                                                                        |
|---------------------|----------|------|-------------|------|--------|-----------------------------------------------------------------------------------------------------------------------|
| Output Frequency    |          | —    | 10          | —    | MHz    | Available frequency range is from 5Hz to 40MHz. Standard frequencies are 10, 12.8, 13, 15.36, 19.2, 20, 25, 38.88MHz. |
| Waveform            |          | —    | Rectangular | —    | —      | Sine wave output is available. Consult factory for more information.                                                  |
| Level               |          | —    | LVTTL       | —    | —      |                                                                                                                       |
| "1" Level           |          | 2.4  | —           | —    | V      |                                                                                                                       |
| "0" Level           |          | —    | —           | 0.4  |        |                                                                                                                       |
| Load                |          | —    | 15          | —    | pF     |                                                                                                                       |
| Duty Cycle          |          | 45   | 50          | 55   | %      | @+1.4V                                                                                                                |
| Spurious            |          | —    | —           | -60  | dBc    |                                                                                                                       |
| Frequency Stability | Ambient  | -10  | —           | +10  | ppb    | -30 ~ +70°C, referenced to +25°C<br>Refer to Freq. Stability Vs Temp. Range table.                                    |
|                     | Aging    | —    | —           | —    | —      |                                                                                                                       |
|                     | Daily    | -0.5 | —           | +0.5 | ppb    | after 30 days                                                                                                         |
|                     | Yearly   | -50  | —           | +50  | ppb    |                                                                                                                       |
|                     | 10 years | -0.3 | —           | +0.3 | ppm    |                                                                                                                       |
|                     | Voltage  | -5.0 | —           | +5.0 | ppb    | ±5% Change                                                                                                            |
|                     | Warm-up  | -10  | —           | +10  | ppb    | In 10 minutes @ +25°C, referenced to 1 hour.                                                                          |
| Phase Noise @ 20MHz |          | —    | —           | -120 | dBc/Hz | @10 Hz                                                                                                                |
|                     |          | —    | —           | -135 |        | @100 Hz                                                                                                               |
|                     |          | —    | —           | -145 |        | @1 kHz                                                                                                                |
|                     |          | —    | —           | -150 |        | @10 kHz                                                                                                               |



# OCXO

| Parameter                       |                 | Min.  | Typ.     | Max.  | Unit. | Test Condition                                                                         |
|---------------------------------|-----------------|-------|----------|-------|-------|----------------------------------------------------------------------------------------|
| Electrical Frequency Adjustment | Range           | —     | —        | -0.5  | ppm   | VCO@ 0V                                                                                |
|                                 |                 | +0.5  | —        | —     |       | VCO@3.3V                                                                               |
|                                 | Control         | 0     | 1.65     | 3..3  | V     |                                                                                        |
|                                 | Slope           | —     | Positive | —     |       |                                                                                        |
|                                 | Input impedance | 100   | —        | —     | kΩ    |                                                                                        |
| Input Power                     | Voltage         | 3.135 | 3.3      | 3.465 | V     | 5.0V input voltage is available. Consult factory for control voltage and output level. |
|                                 | Current         | —     | —        | 1000  | mA    | @ turn on                                                                              |
|                                 | Steady state    | —     | —        | 1.3   | W     | @ +25°C                                                                                |

## FREQ. STABILITY vs. TEMP. RANGE

| Temp.(°C) \ ppb | ±3 | ±5 | ±10 |
|-----------------|----|----|-----|
| 0 ~ +70         | ○  | ○  | ○   |
| -30 ~ +70       | △  | ○  | ○   |
| -40 ~ +85       | △  | ○  | ○   |

\*○: Available △: Condition X: Not available

Note: not all combination of options are available. Other specifications may be available upon request.  
Specifications subject to change without notice.

# OCXO

## 6.4 TOC3627

### 36.3 x 27.2 mm Oven Controlled Crystal Oscillator



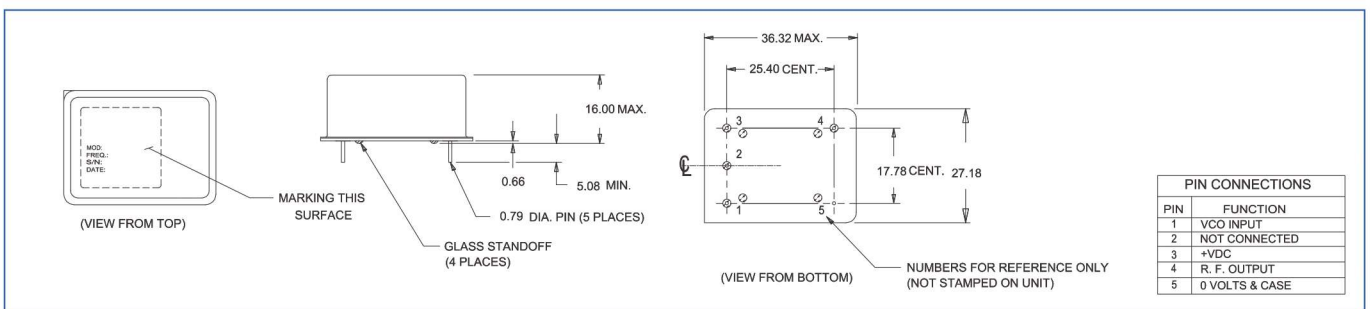
#### FEATURES

- Dimension 36.3 x 27.2 x 12.7 mm typical
- SC Cut Crystal

#### TYPICAL APPLICATION

- SDH/SONET, Telecommunication base station
- Test and measurement equipment
- Synthesizer, Digital switch, Reference Timing Circuit

#### DIMENSIONS



#### ELECTRICAL SPECIFICATION

| Parameter           |            | Min. | Typ.        | Max. | Unit.  | Test Condition                                                                                                            |
|---------------------|------------|------|-------------|------|--------|---------------------------------------------------------------------------------------------------------------------------|
| Output Frequency    |            | —    | 10          | —    | MHz    | Available frequency range is from 5MHz to 40MHz. Standard frequencies are 10, 12.8, 13, 15.36, 19.2, 20, 25 and 38.88MHz. |
| Waveform            |            | —    | Rectangular | —    | —      | Since wave output is available. Consult factory for more information.                                                     |
| Level (LVTTTL)      | "1" Level  | 2.4  | —           | —    | V      | @+1.4V                                                                                                                    |
|                     | "0" Level  | —    | —           | 0.4  |        |                                                                                                                           |
|                     | Load       | —    | 15          | —    | pF     |                                                                                                                           |
|                     | Duty Cycle | 45   | 50          | 55   | %      |                                                                                                                           |
|                     | Spurious   | —    | —           | -60  | dBc    |                                                                                                                           |
| Frequency Stability | Ambient    | -5.0 | —           | +5.0 | ppb    | -40 ~ +85°C, referenced to +25°C<br>Refer to Freq. Stability Vs Temp. Range table.                                        |
|                     | Aging      | -0.5 | —           | +0.5 | ppb    |                                                                                                                           |
|                     | Daily      | -0.5 | —           | +0.5 | ppb    | after 30 days                                                                                                             |
|                     | Yearly     | -50  | —           | +50  | ppb    |                                                                                                                           |
|                     | 10 years   | -0.3 | —           | +0.3 | ppm    |                                                                                                                           |
|                     | Voltage    | -0.5 | —           | +0.5 | ppb    | ±5% Change                                                                                                                |
|                     | Warm-up    | -10  | —           | +10  | ppb    | In 10 minutes @ +25°C, referenced to 1 hour.                                                                              |
| Phase Noise         |            | —    | —           | -120 | dBc/Hz | @10 Hz                                                                                                                    |
|                     |            | —    | —           | -135 |        | @100 Hz                                                                                                                   |
|                     |            | —    | —           | -145 |        | @1 kHz                                                                                                                    |
|                     |            | —    | —           | -150 |        | @10 kHz                                                                                                                   |

# OCXO

| Parameter                       |                 | Min. | Typ.     | Max. | Unit. | Test Condition                                                                         |
|---------------------------------|-----------------|------|----------|------|-------|----------------------------------------------------------------------------------------|
| Electrical Frequency Adjustment | Range           | —    | —        | -0.5 | ppm   | VCO@ 0V                                                                                |
|                                 |                 | 0.5  | —        | —    |       | VCO@5.0V                                                                               |
|                                 | Control         | 0    | 2.5      | 5.0  | V     |                                                                                        |
|                                 | Slope           | —    | Positive | —    |       |                                                                                        |
|                                 | Input impedance | 100  | —        | —    | kΩ    |                                                                                        |
| Input Power                     | Voltage         | 4.75 | 5.0      | 5.25 | V     | 3.3V input voltage is available. Consult factory for control voltage and output level. |
|                                 | Current         | —    | —        | 850  | mA    | @ turn on                                                                              |
|                                 | Steady state    | —    | —        | 1.3  | W     | @ +25°C                                                                                |

## FREQ. STABILITY vs. TEMP. RANGE

| Temp.(°C) \ ppb | ±3 | ±5 | ±10 |
|-----------------|----|----|-----|
| 0 ~ +70         | ○  | ○  | ○   |
| -30 ~ +70       | △  | ○  | ○   |
| -40 ~ +85       | △  | ○  | ○   |

\*○: Available △: Condition X: Not available

Note: not all combination of options are available. Other specifications may be available upon request.  
Specifications subject to change without notice.

# RTC Modules (Real Time Clocks)

## 7.1 TR8010

Real Time Clock(I<sup>2</sup>C-Bus )  
Low current consumption

Pb-Free



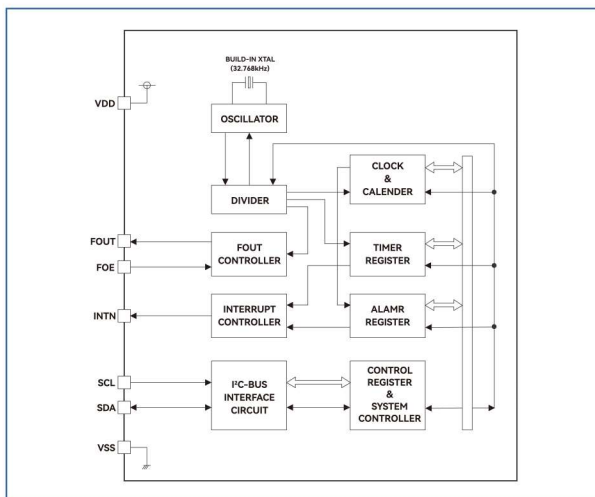
RoHS  
compliant

### FEATURES AND APPLICATIONS

- Built-in 32.768kHz Crystal Unit
- Operating Voltage:1.8~5.5 V
- Low current consumption:2.2μA@3V (typical)
- Multiple functions such as calendar, alarms and time keeping.
- In accordance with SOP8 standard
- Interface Type:I<sup>2</sup>C(400kHz)
- Clock Circuit Voltage:1.8~5.5 V
- Frequency Output Function:CMOS Output or Open Drain Output
- Automotive Leap Year Adjustment



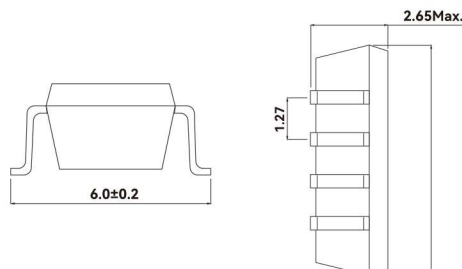
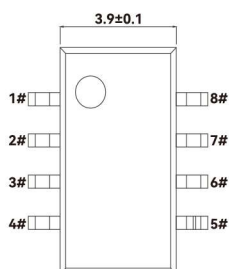
### STRUCTURE



### OVERVIEW

- ◆ InterfaceType:High-speed I<sup>2</sup>C-bus standards (400kHz)
- ◆ Frequency Output Function: CMOS output and open drain output available;output frequency: 32.768kHz, 1024Hz, 1Hz available
- ◆ Timer: Setting range between 1/4096s to 65535 hours;Timing period: 1 hour, 1 minute, 64Hz, and 4096Hz
- ◆ Alarm: Week, day, hour, minute

### EXTERNAL DIMENSIONS



| Pin | I/ O             | Function                                                                                                               |
|-----|------------------|------------------------------------------------------------------------------------------------------------------------|
| 1#  | NC               | —<br>No connection, keep floating state                                                                                |
| 2#  | FOE              | Input<br>FOUT output enable                                                                                            |
| 3#  | INTN             | Output<br>Interrupt output, N-channel open-drain output                                                                |
| 4#  | VSS              | GND<br>Supply voltage ground connection                                                                                |
| 5#  | SDA              | Input/Output<br>I <sup>2</sup> C-Bus communication data transfer, N-channel open-drain output                          |
| 6#  | SDL              | Input<br>I <sup>2</sup> C-Bus serial interface clock input                                                             |
| 7#  | F <sub>OUT</sub> | Output<br>32.768kHz frequency output controlled by FOE. Output 32.768kHz when FOE=1; output high resistance when FOE=0 |
| 8#  | V <sub>DD</sub>  | Power<br>Supply voltage positive polarity connection                                                                   |

# RTC Modules (Real Time Clocks)

## FREQUENCY CHARACTERISTICS

| Item                | Symbol           | Conditions                                 | Min.  | Typ. | Max. | Unit. |
|---------------------|------------------|--------------------------------------------|-------|------|------|-------|
| Frequency Tolerance | $\Delta f/f$     | Ta=25°C<br>V <sub>DD</sub> =3.0V           | 5±23※ |      |      | ppm   |
| Start-up Time       | t <sub>STA</sub> | Ta=25°C<br>V <sub>DD</sub> =1.8V           |       |      | 0.9  | s     |
|                     |                  | Ta=40°C~85°C<br>V <sub>DD</sub> =1.8V~5.5V |       |      | 2.0  | s     |

※ Equals to a monthly tolerance of ±1 minute per month

## CURRENT CONSUMPTION CHARACTERISTICS

| Item                | Symbol           | Condition                                                     | Minimum             | Typical | Maximum | Unit. |
|---------------------|------------------|---------------------------------------------------------------|---------------------|---------|---------|-------|
| Current Consumption | I <sub>DD1</sub> | FOE=GND<br>F <sub>out</sub> =Hi-Z                             | V <sub>DD</sub> =5V |         | 2.6     | μA    |
|                     | I <sub>DD2</sub> |                                                               | V <sub>DD</sub> =3V |         | 2.5     |       |
|                     | I <sub>DD3</sub> | FOE=V <sub>DD</sub><br>F <sub>out</sub> =32.768kHz<br>CL=0pF  | V <sub>DD</sub> =5V |         | 3.6     |       |
|                     | I <sub>DD4</sub> |                                                               | V <sub>DD</sub> =3V |         | 3.0     |       |
|                     | I <sub>DD5</sub> | FOE=V <sub>DD</sub><br>F <sub>out</sub> =32.768kHz<br>CL=30pF | V <sub>DD</sub> =5V |         | 7.5     |       |
|                     | I <sub>DD6</sub> |                                                               | V <sub>DD</sub> =3V |         | 6.2     |       |

# RTC Modules (Real Time Clocks)

## 7.2 TR8804

RTC Modules(I<sup>2</sup>C-Bus)  
Time stamp and digital temperature  
compensation(Automotive Grade)

Pb-Free

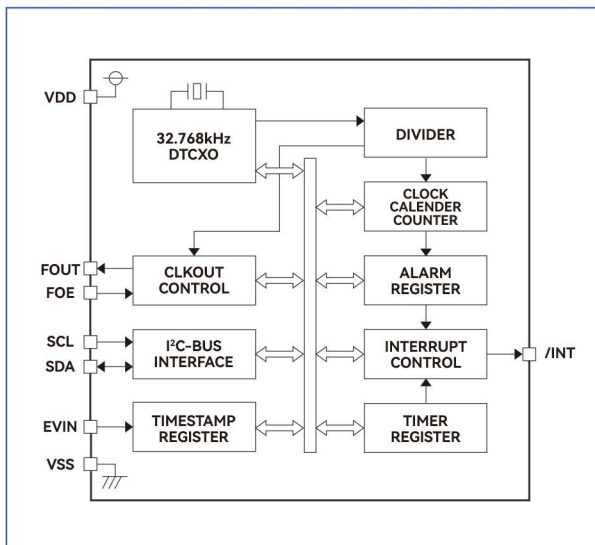
RoHS  
compliant



### FEATURES AND APPLICATIONS

- Built-in 32.768kHz DTCXO
- Interface Type: I<sup>2</sup>C
- I<sup>2</sup>C-Bus Voltage: 1.5--5.5V
- Fixed-cycle Timer Interrupt Function
- Time update interrupt Function
- AEC-Q100&AEC-Q200 compliant
- Support High Speed I<sup>2</sup>C-Bus Agreement(400KHz)
- Clock Output Voltage: 1.6--5.5V
- Temperature Compensation Voltage: 1.5--5.5V
- Alarming interrupt for week, day, hour, and minute
- Temperature compensation signal output of 32.768kHz

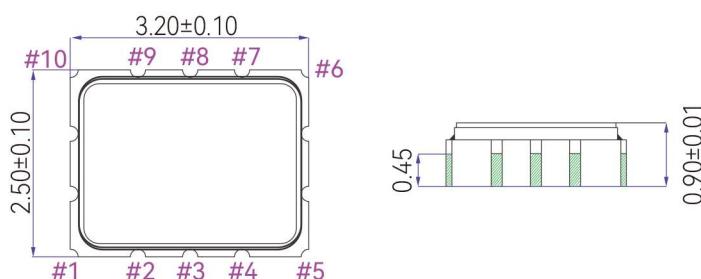
### STRUCTURE



### OVERVIEW

- ◆ Interface Type: 400kHz High-speed I<sup>2</sup>C-Bus
- ◆ Clock Output: Frequency 32768Hz, 1024Hz, 1Hz available, CMOS output controlled by FOE
- ◆ Fixed-cycle timer: Maximum counting cycle as long as 32 years available, source clock 1/60Hz, 1Hz, 64Hz, 4096Hz, /INT output interrupt signal available
- ◆ Time Stamp: Time stamp counting from year to second, triggered by EVIN input, able to be monitored by I<sup>2</sup>C
- ◆ Fixed-cycle arouse function: alarm interrupt output from day to minute
- ◆ Time update interrupt: Interrupt every second or minute
- ◆ Self-monitor: Interrupt, voltage falling test

### EXTERNAL DIMENSIONS



| Pin | I/ O | Function                                                                                                                       |
|-----|------|--------------------------------------------------------------------------------------------------------------------------------|
| 1#  | FOE  | I<br>The enable pin of FOUT. FOUT is the clock output when FOE is HIGH and high impedance when FOE is LOW                      |
| 2#  | VDD  | —<br>Supply voltage positive polarity connection                                                                               |
| 3#  | EMIN | I<br>Time stamp,psignal input                                                                                                  |
| 4#  | FOUT | O<br>CMOS Clock Output                                                                                                         |
| 5#  | SCL  | I<br>I <sup>2</sup> C-bus serial interface clock input                                                                         |
| 6#  | SOUT | O<br>Internal register special status flag output                                                                              |
| 7#  | SDA  | I/O<br>I <sup>2</sup> C-bus communication data transfer terminal                                                               |
| 8#  | TEST | I<br>For internal testing, no connection required                                                                              |
| 9#  | VSS  | —<br>Supply voltage ground connection                                                                                          |
| 10# | /INT | O<br>1Hz signal, alarm interrupt signal, timed interrupt signal, and time update interrupt signal, N-channel open-drain output |



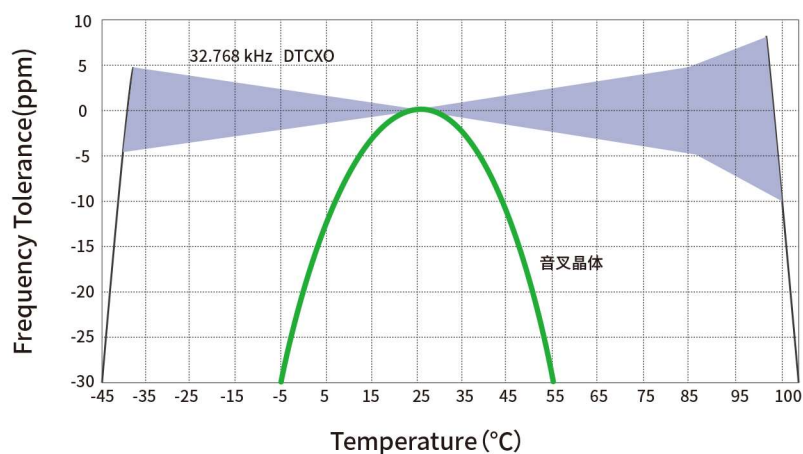
# RTC Modules (Real Time Clocks)

## FREQUENCY CHARACTERISTICS

| Parameter             |                  | Conditions                                                             | Min.   | Typ. | Max. | Unit.            |
|-----------------------|------------------|------------------------------------------------------------------------|--------|------|------|------------------|
| Operating Voltage     | VDD              | —                                                                      | 1.6    | 3.0  | 5.5  | V                |
| Operating Temperature | Ta               | —                                                                      | -40    | 25   | 105  | °C               |
| Frequency Tolerance   | $\Delta f/f$     | Ta=-40°C~85°C<br>VDD=3.0V                                              | —      | —    | ±5   | 10 <sup>-6</sup> |
|                       |                  | Ta=-40°C~105°C<br>VDD=3.0V                                             | —      | —    | ±8   | 10 <sup>-6</sup> |
| Start-up Time         | Tsta             | Ta=-40°C~85°C<br>VDD=1.6~5.5V                                          |        |      | TBD  | s                |
| Current Consumption   | I <sub>DD1</sub> | SCL=SDA=/INT=VDD<br>FOE=VSS<br>2s Temperature<br>Compensation Interval | VDD=5V |      | TBD  | μA               |
|                       | I <sub>DD2</sub> |                                                                        | VDD=3V |      | TBD  |                  |

## FREQUENCY TEMPERATURE CHARACTERISTICS

32.768kHz DTCXO Frequency Temperature Characteristics(Instance)





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