

# Temperature Compensated Crystal Oscillators [ TCXO " M " and VCTCXO " VM " ]



| TCXO  |       |       | VCTCXO |        |        | Min. | Max.  |
|-------|-------|-------|--------|--------|--------|------|-------|
| MQF_T | MQF_P | MQF_D | VMQF_T | VMQF_P | VMQF_D | 10   | 1,500 |
| CMOS  | PECL  | LVDS  | CMOS   | PECL   | LVDS   | MHz  | MHz   |

### Features

- Wide frequency range : 10 ~ 1500 MHz
- RMS Jitter (12 kHz ~ 20MHz) : 1.0 ps typ. ( at 156.250 MHz)
- Package size : 3.2 x 2.5 x 1.6mm and 7.0 x 5.0 x 2.5mm
- Next-Day sample for prototypes

**1.0 pS Phase Jitter ( typical )**


### General specifications , at Ta=+25°C

| Model                                   | (V)MQF326T<br>(V)MQF574T , (V)MQF576T  | (V)MQF326P<br>(V)MQF576P   | (V)MQF326D<br>(V)MQF576D   |
|---|--|--|--|
| Output Logic                            | CMOS   | PECL   | LVDS   |
| Supply Voltage V <sub>DD</sub> ( code ) | + 2.5 V ± 5% ( voltage code " 25 " )<br>+ 3.3 V ± 5% ( voltage code " 33 " ) | + 2.5 V ± 5% ( voltage code " 25 " )<br>+ 3.3 V ± 5% ( voltage code " 33 " ) | + 2.5 V ± 5% ( voltage code " 25 " )<br>+ 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  | 50 Ω into V <sub>cc</sub> - 2V or  | 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. )  |
| ( V <sub>DD</sub> = + 2.5V )            | 50 MHz : 34 mA   | 156 MHz : 46 mA  | 156 MHz : 32 mA  |
| Current Consumption ( max. )            | 125 MHz : 38 mA  | 600 MHz : 50 mA  | 600 MHz : 38 mA  |
|   | 200 MHz : 40 mA  | 1,000 MHz : 60 mA  | 1,000 MHz : 44 mA  |
| ( V <sub>DD</sub> = + 3.3V )            | 50 MHz : 36 mA   | 156 MHz : 50 mA  | 156 MHz : 35 mA  |
| Current Consumption ( max. )            | 125 MHz : 40mA   | 600 MHz : 55 mA  | 600 MHz : 40 mA  |
|   | 200 MHz : 44 mA  | 1,000 MHz : 62 mA  | 1,000 MHz : 46 mA  |
| Current with Output Disabled            | 18 mA ( Typ. )   | 18 mA ( Typ. )   | 18 mA ( Typ. )   |
| 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. ) , 0.4 nsec. ( max. )<br>Tr / Tf : 20% → 80% waveform      |

|                                   |  |   |        |       |        |         |       |        |
|-----------------------------------|--|---|--------|-------|--------|---------|-------|--------|
| Initial Calibration Tolerance     | ±1.0 ppm ( max. ) at +25°C±2°C ( at the shipment ) for Package Size ( 3.2 * 2.5 mm )<br>±2.0 ppm ( max. ) at +25°C±2°C ( at the shipment ) for Package Size ( 5.0 * 7.0 mm ) |   |        |       |        |         |       |        |
| Frequency Stability Codes         | Temperature ( refer to +25°C )   | ± 2.0 ppm over -40°C to +85°C ( default for Quick - Turn )<br>± 1.0 ppm over -40°C to +85°C ( available ) |        |       |        |         |       |        |
|                                   | Aging at Ta = +25°C  | ± 2.0 ppm ( max. ) first year ; ± 10 ppm ( max. ) over 10 years   |        |       |        |         |       |        |
|                                   | Voltage Change   | ± 0.2 ppm ( max. ) , for a ±5% input voltage change.  |        |       |        |         |       |        |
|                                   | Load Change  | ± 0.2 ppm ( max. ) , for a ±10% load condition change.  |        |       |        |         |       |        |
|                                   | Reflow   | ± 1.0 ppm ( max. ) , 1 reflow and measured 24 hours afterwards.   |        |       |        |         |       |        |
| Duty Cycle                        | 50 % ± 5%  |   |        |       |        |         |       |        |
| Start-up Time                     | 5 msec. ( max. )   |   |        |       |        |         |       |        |
| Storage Temperature               | -55°C to + 125°C   |   |        |       |        |         |       |        |
| RMS Jitter [ 12 kHz ~ 20 MHz ]    | 1.0 psec ( typ. )  |   |        |       |        |         |       |        |
| Phase Noise [ dBc / Hz ( typ. ) ] | Offset   | 10 Hz   | 100 Hz | 1K Hz | 10K Hz | 100K Hz | 1M Hz | 10M Hz |
|                                   | 156.250 MHz  | -65   | -92    | -108  | -114   | -117    | -139  | -147   |
|                                   | 212.500 MHz  | -61   | -90    | -106  | -110   | -112    | -133  | -142   |
|                                   | 312.500 MHz  | -51   | -79    | -97   | -102   | -103    | -125  | -134   |

| Control Voltage Function on Pad 1 |   | Output Enable Function on pad 2   |  |
|-----------------------------------|---|-----------------------------------|--|
| Control Voltage Center and Range  | +1.5V ± 1.0V for both V <sub>DD</sub> = 2.5V and 3.3V | OE Control on Pad 2               | 70% of V <sub>DD</sub> ( min. ) to enable output.<br>( Open connection prohibit. ) |
| Frequency Pulling Range           | ± 8 ppm ( min. )                                      |                                   | 30% of V <sub>DD</sub> ( max. ) to disable output.                                 |
| Linearity                         | 1% ( typ. ) ; 10% ( max. )                            |                                   |  |
| Transfer Function                 | Positive Transfer                                     | Output Enable Time / Disable Time | 200 nsec. ( max. ) / 50 nsec. ( max. )   |
| Absolute Voltage                  | 4.0 V ( max. )  |                                   |  |
| Input Impedance                   | 770 KΩ ( typ. )                                       |                                   |  |

# Temperature Compensated Crystal Oscillators [ TCXO " M " and VCTCXO " VM " ]

| TCXO  |       |       | VCTCXO |        |        | F<br>series | SMD | 2.5 V | 3.3 V | Min.<br>10<br>MHz | Max.<br>1,500<br>MHz |
|-------|-------|-------|--------|--------|--------|-------------|-----|-------|-------|-------------------|----------------------|
| MQF_T | MQF_P | MQF_D | VMQF_T | VMQF_P | VMQF_D |             |     |       |       |                   |                      |
| CMOS  | PECL  | LVDS  | CMOS   | PECL   | LVDS   |             |     |       |       |                   |                      |

## Part Number Format and Example

|             |              |               |                |   |                  |   |                     |   |                       |
|-------------|--------------|---------------|----------------|---|------------------|---|---------------------|---|-----------------------|
| [ 1 ]       | [ 2 ]        | [ 3 ]         | [ 4 ]          | - | [ 5 ]            | - | [ 6 ]               | / | [ 7 ]                 |
| Holder Type | Package Code | Waveform Code | Supply Voltage |   | Center Frequency |   | Frequency Stability |   | Operating Temp. Range |

|          |     |      |     |   |    |   |         |   |     |   |        |
|----------|-----|------|-----|---|----|---|---------|---|-----|---|--------|
| Examples | (1) | MQF  | 326 | D | 25 | - | 622.080 | - | 2.0 | / | -40+85 |
|          | (2) | VMQF | 576 | P | 33 | - | 120.000 | - | 2.5 | / | -40+85 |

Ex (1) : MQF326D25 - 622.080 - 2.0 / -40+85 [ TCXO , MQF326 type , LVDS , +2.5V , 622.080MHz , ±2.0ppm from -40°C to 85°C ]

Ex (2) : VMQF576P33 - 120.000 - 2.5 / -40+85 [ VCTCXO , VMQF576 type , PECL , +3.3V , 120.000MHz , ±2.5ppm from -40°C to 85°C ]

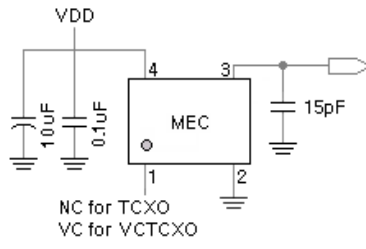
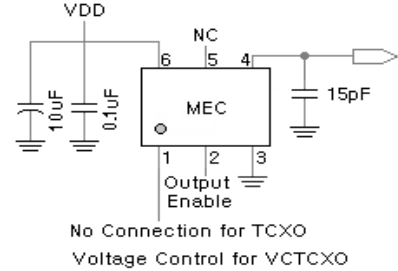
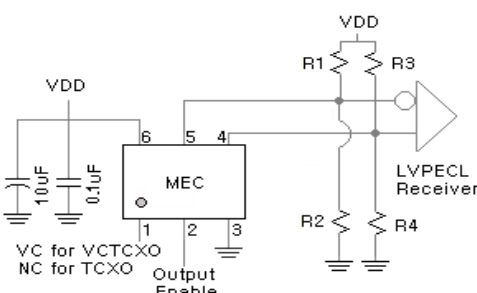
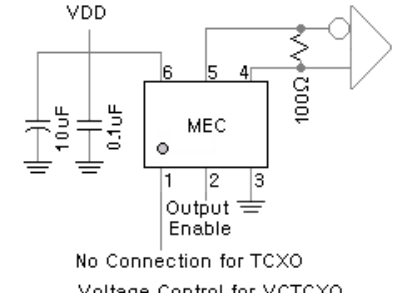
|       |  |
|-------|--|
| [ 1 ] | Holder Type : " MQF " stands for TCXO ; " VMQF " stands for VCTCXO   |
| [ 2 ] | Package Code : " 326 " stands for 3.2 x 2.5 x 1.6 mm 6pad ; " 576 " stands for 5.0 x 7.0 x 2.5 mm 6pad       |
| [ 3 ] | Output Waveform Code : " T " stands for CMOS ; " P " stands for PECL ; " D " stands for LVDS                 |
| [ 4 ] | Supply Voltage : " 25 " stands for +2.5V ; " 33 " stands for +3.3V   |
| [ 5 ] | Center Frequency in MHz  |
| [ 6 ] | Frequency Stability in ± _ ppm ; ex 1 : ± 2.0ppm --- 2.0 , ex 2 : ± 2.5ppm --- 2.5                           |
| [ 7 ] | Operating Temperature Range in °C<br>ex 1 : -40 °C to 85°C ----- -40+85 ; ex 2 : -40 °C to 85°C ----- -40+85 |

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

| [ (V)MQF574T ]   | [ (V)MQF326T ] , [ (V)MQF326P ] , [ (V)MQF326D ]   |
|--|--|
| <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> <p>Top View</p> </div> <div style="text-align: center;"> <p>Bottom View</p> </div> <div style="text-align: center;"> <p>Land Pattern</p> </div> </div> <div style="margin-top: 10px;"> <p>Side View</p> </div> <p>Pad Connections :</p> <ul style="list-style-type: none"> <li>Pad 1 : Make no connection if TCXO ; Control voltage if VCTCXO</li> <li>Pad 2 : Ground</li> <li>Pad 3 : Output</li> <li>Pad 4 : Supply voltage</li> </ul>   | <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> <p>Top View</p> </div> <div style="text-align: center;"> <p>Bottom View</p> </div> <div style="text-align: center;"> <p>Land Pattern</p> </div> </div> <div style="margin-top: 10px;"> <p>Side View</p> </div> <p>Pad Connections :</p> <ul style="list-style-type: none"> <li>Pad 1 : No Connection for TCXO ; Voltage Control for VCTCXO</li> <li>Pad 2 : Output Enable</li> <li>Pad 3 : Ground</li> <li>Pad 4 : CMOS : Output ; PECL / LVDS : Differential</li> <li>Pad 5 : CMOS : No Connection ; PECL / LVDS : Complementary</li> <li>Pad 6 : Supply Voltage</li> </ul> |
| [ (V)MQF576T ] , [ (V)MQF576P ] , [ (V)MQF576D ]   |  |
| <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> <p>Top View</p> </div> <div style="text-align: center;"> <p>Bottom View</p> </div> <div style="text-align: center;"> <p>Land Pattern</p> </div> </div> <div style="margin-top: 10px;"> <p>Side View</p> </div> <p>Pad Connections :</p> <ul style="list-style-type: none"> <li>Pad 1 : No Connection for TCXO ; Voltage Control for VCTCXO</li> <li>Pad 2 : Output Enable</li> <li>Pad 3 : Ground</li> <li>Pad 4 : CMOS : Output ; PECL / LVDS : Differential</li> <li>Pad 5 : CMOS : No Connection ; PECL / LVDS : Complementary</li> <li>Pad 6 : Supply Voltage</li> </ul> |  |

# Temperature Compensated Crystal Oscillators [ TCXO " M " and VCTCXO " VM " ]

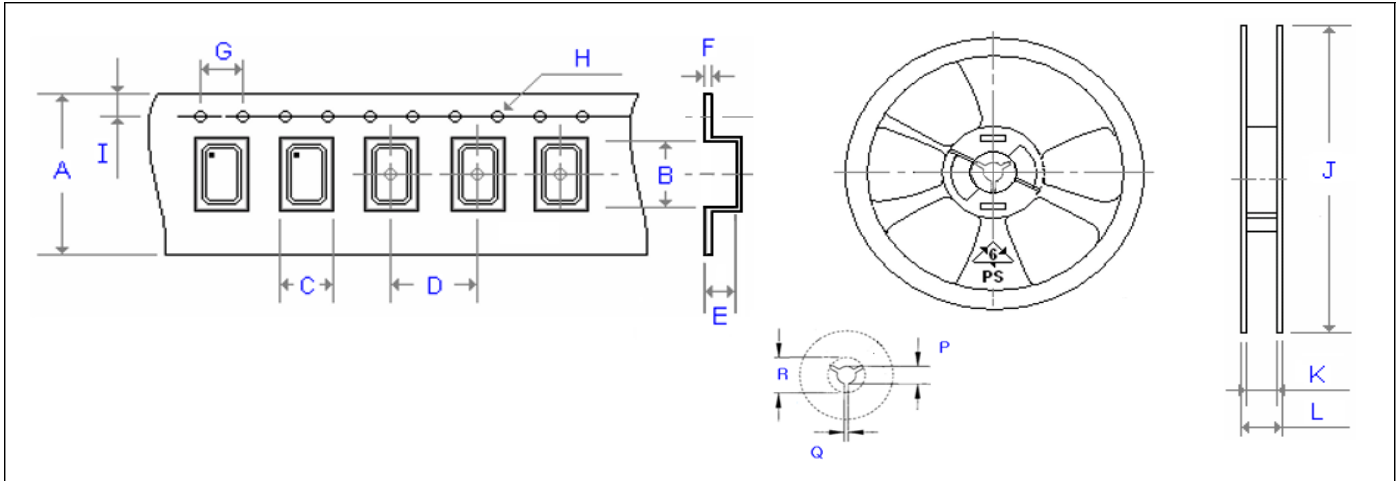
## Test Circuits and Output Waveforms

| CMOS for 4pad package  | CMOS for 6pad package   |
|--|---|
|  <p style="text-align: center;">                 NC for TCXO<br/>                 VC for VCTCXO             </p>  |  <p style="text-align: center;">                 No Connection for TCXO<br/>                 Voltage Control for VCTCXO             </p>  |
| PECL   | LVDS  |
|  <p style="text-align: center;">                 VC for VCTCXO<br/>                 NC for TCXO<br/>                 Output Enable             </p> <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> |  <p style="text-align: center;">                 No Connection for TCXO<br/>                 Voltage Control for VCTCXO             </p> |

## Emboss Taping and Reel Specifications

[ VCXO ]

[ ( VC )TCXO ]



Carrier Type Dimensions ( unit : mm ) ±0.3mm

|              | A     | B     | C     | D     | E    | F    | G    | H      | I    | pcs / reel |
|--------------|-------|-------|-------|-------|------|------|------|--------|------|------------|
| G_226        | 8.00  | 2.80  | 2.25  | 4.00  | 1.10 | 0.30 | 4.00 | ∅ 1.50 | 1.75 | 3000       |
| G_326        | 8.00  | 3.40  | 2.70  | 4.00  | 1.40 | 0.25 | 4.00 | ∅ 1.50 | 1.75 | 3000       |
| G_536        | 12.00 | 5.30  | 3.60  | 8.00  | 1.40 | 0.30 | 4.00 | ∅ 1.50 | 1.75 | 1000       |
| G_576        | 16.00 | 7.30  | 5.30  | 8.00  | 1.90 | 0.32 | 4.00 | ∅ 1.50 | 1.75 | 1000       |
| G_538        | 12.00 | 5.40  | 3.60  | 8.00  | 1.70 | 0.30 | 4.00 | ∅ 1.50 | 1.75 | 1000       |
| G_578        | 16.00 | 7.30  | 5.30  | 8.00  | 1.90 | 0.32 | 4.00 | ∅ 1.50 | 1.75 | 1000       |
| (V)M21       | 8.00  | 2.30  | 1.90  | 4.00  | 0.90 | 0.25 | 4.00 | ∅ 1.50 | 1.75 | 3000       |
| ME21         | 8.00  | 2.30  | 1.50  | 4.00  | 1.35 | 0.25 | 4.00 | ∅ 1.50 | 1.75 | 3000       |
| (V)M22       | 8.00  | 2.80  | 2.25  | 4.00  | 1.10 | 0.30 | 4.00 | ∅ 1.50 | 1.75 | 3000       |
| (V)M_32      | 8.00  | 3.71  | 2.80  | 4.00  | 1.75 | 0.25 | 4.00 | ∅ 1.50 | 1.75 | 3000       |
| (V)M_326     | 12.00 | 3.60  | 2.90  | 4.00  | 1.70 | 0.30 | 4.00 | ∅ 1.50 | 1.75 | 1000       |
| (V)M_53      | 12.00 | 5.30  | 3.60  | 8.00  | 1.40 | 0.30 | 4.00 | ∅ 1.50 | 1.75 | 1000       |
| (V)M_538     | 12.00 | 5.40  | 3.60  | 8.00  | 1.70 | 0.30 | 4.00 | ∅ 1.50 | 1.75 | 1000       |
| (V)M_57(2)   | 16.00 | 7.40  | 5.50  | 8.00  | 2.80 | 0.35 | 4.00 | ∅ 1.50 | 1.75 | 500        |
| (V)M_43 (63) | 24.00 | 11.80 | 10.00 | 16.00 | 5.00 | 0.30 | 4.00 | ∅ 1.50 | 1.75 | 500        |

Reel Dimensions ( unit : mm ) ±2mm

|              | J      | K     | L     | P     | Q    | R     | pcs / reel |
|--------------|--------|-------|-------|-------|------|-------|------------|
| G_226        | 180.00 | 8.40  | 11.40 | 13.00 | 2.50 | 20.20 | 3000       |
| G_326        | 180.00 | 9.00  | 12.00 | 13.00 | 2.50 | 20.20 | 3000       |
| G_536        | 180.00 | 13.00 | 16.00 | 13.00 | 2.50 | 20.20 | 1000       |
| G_576        | 180.00 | 17.20 | 19.30 | 13.00 | 2.50 | 20.20 | 1000       |
| G_538        | 180.00 | 13.00 | 16.00 | 13.00 | 2.50 | 20.20 | 1000       |
| G_578        | 180.00 | 17.20 | 19.30 | 13.00 | 2.50 | 20.20 | 1000       |
| (V)M21       | 180.00 | 8.40  | 11.40 | 13.00 | 2.50 | 20.20 | 3000       |
| ME21         | 180.00 | 9.00  | 12.00 | 13.00 | 2.50 | 20.20 | 3000       |
| (V)M22       | 180.00 | 8.40  | 11.40 | 13.00 | 2.50 | 20.20 | 3000       |
| (V)M_32      | 180.00 | 9.00  | 11.40 | 13.00 | 2.50 | 20.20 | 3000       |
| (V)M_326     | 180.00 | 13.00 | 16.00 | 13.00 | 2.50 | 20.20 | 1000       |
| (V)M_53      | 180.00 | 13.00 | 16.00 | 13.00 | 2.50 | 20.20 | 1000       |
| (V)M_538     | 180.00 | 13.00 | 16.00 | 13.00 | 2.50 | 20.20 | 1000       |
| (V)M_57(2)   | 180.00 | 17.20 | 19.30 | 13.00 | 2.50 | 20.20 | 500        |
| (V)M_43 (63) | 330.00 | 24.50 | 29.10 | 13.00 | 2.50 | 20.20 | 500        |