MERCURY
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瑪居禮電波

MERCURY ELECTRONIC

Catalog

Crystal Oscillators
Crystal Units / Crystal Filters
Frequency Control Products

Contents

Specifications

Crystal Units

Clock Oscillators [Product Code " H " Including CMOS , Differential Type : (LVPECL , LVDS , HCSL , LPHCSL and CML) Output] 15

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Mercury Company Profile

Taiwan Plant

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- Established in 1973.
- Proud to be a pioneer of the crystal industry in Taiwan.
- Corporate headquarters and volume production facility.
- IATF 16949 + ISO9001 and 14001certified.

Kunshan Office

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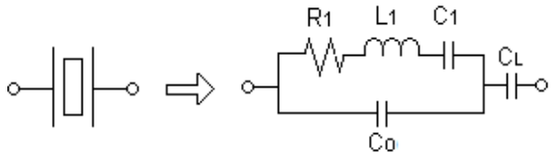
- Established in 2002.
- The Sales Office.

How To Specify A Quartz Crystal



C_O : Shunt Capacitance
C_1 : Motional Capacitance
L_1 : Motional Inductance
R_1 : Equivalent Series Resistance
C_L : Load Capacitance

Holder Type

SMD Type

unit : mm

- ☐ X11 (1.65*1.25*0.30)
- ☐ X21 (2.05*1.65*0.50)
- ☐ X22 (2.55*2.05*0.60)
- ☐ X32 (3.2*2.5*0.7)
- ☐ MJ (5.0*3.2*0.8)
- ☐ X2012 (2.05*1.2*0.55)
- ☐ X3215 (3.2*1.5*0.8)

unit : mm

- ☐ MQ (7.0*5.0*1.0)
- ☐ M49 (12.4*4.5*4.0)
- ☐ ML49 (12.4*4.5*3.0)
- ☐ MP4 (12.9*4.5*4.0)
- ☐ MP5 (12.9*4.5*5.0)
- ☐ MP24 (11.4*5.0*4.0)
- ☐ MP25 (11.4*5.0*5.0)

Thru - Hole Type

unit : mm

- ☐ H49 (10.7*4.5*13.2)
- ☐ HUS (10.7*4.3*3.5)
- ☐ HUSL (10.7*4.3*4.3)
- ☐ U1 (7.8*3.2*8.0)
- ☐ U5 (7.8*3.2*6.0)
- ☐ T38 (3.0ϕ*8.0)
- ☐ T26 (2.0ϕ*6.0)

A Basic Spec. must be specified

A-1 : Holder type: _____ ☐ Thru-Hole type ☐ SMD Leadless
A-2 : Frequency : _____MHz or _____ KHz
A-3 : Circuit Condition : ☐ Series ☐ Parallel
If ***Series*** resonance : Assign " **S** " as circuit load .
If ***Parallel*** : Specify CL (Load Capacitance) _____ pF (Typical range is 8 to 32 pF) .
A-4 : Calibration Tolerance: ± _____ ppm (max.) at 25°C
A-5 : Frequency Stability: ± _____ ppm (max.) over _____°C to _____ °C
A-6 : Maximum Equivalent Series Resistance (ESR): _____ ohms (max.)

B Other Spec. If not specified MEC standards will be applied.

B-1 : Shunt Capacitance (Co) : _____ pF (max.)
B-2 : Motional Capacitance (C1) :_____ fF ± _____ %
B-3 : Motional Inductance (L1) : _____ mH ± _____ %
B-4 : Capacitance Ratio (Co/C1) : _____ ± _____ %
B-5 : Trim Sensitivity : _____ ppm / pF
B-6 : Frequency Pull Ability : When CL= _____ pF, _____ ppm (max.) ; When CL= _____ pF, _____ ppm (min.)
B-7 : Drive Level : _____ micro Watts (uW) (max.).
B-8 : Crystal cutting angle type : ☐ AT - cut ☐ SL - cut ☐ XT - cut
B-9 : Mode of Oscillation : ☐ Fundamental mode ☐ 3rd overtone ☐ 5th overtone
B-10 : Spurious: _____ dB (or ohms) (min.) in ± _____ kHz range of the main mode
B-11 : Crystal Q: _____ (min.)
B-12 : Aging: _____ ppm per year (max.)
B-13 : Shock: _____ ; Vibration: _____

Part Number Format and Example

Example: X32 - 16.000 - 10 - 15 / 20 / -30+75 /100R ✎ = User to specify

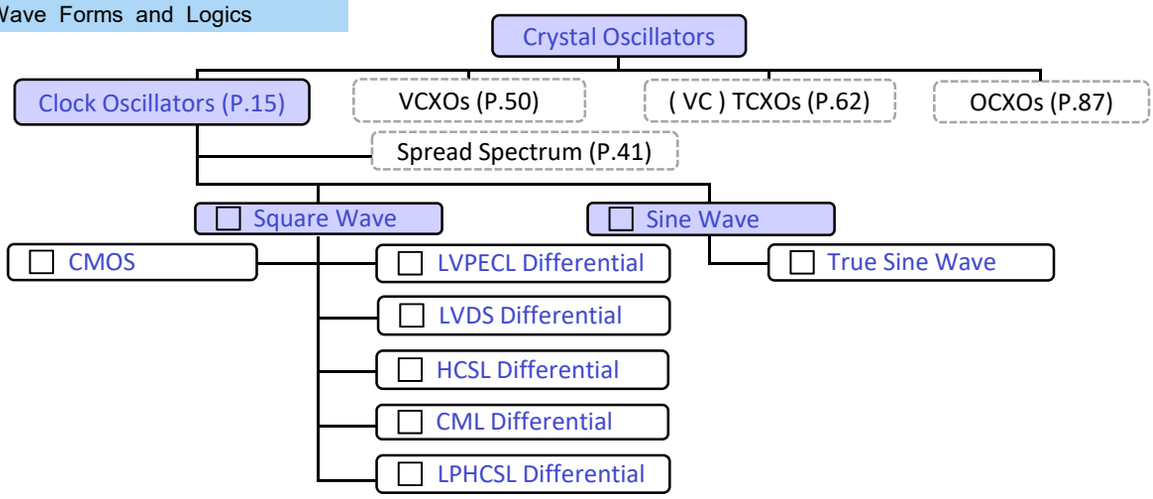
✎		✎		✎		✎		✎		✎		✎	
X32	-	16.000	-	10	-	15	/	20	/	-30+75	/	100R	
(1)		(2)		(3)		(4)		(5)		(6)		(7)	

(1) Package code ; (2) Frequency in MHz ; (3) Load Capacitance in pF or "**S**" for series resonance ; (4) Frequency tolerance at 25°C ; (5) Frequency stability ;

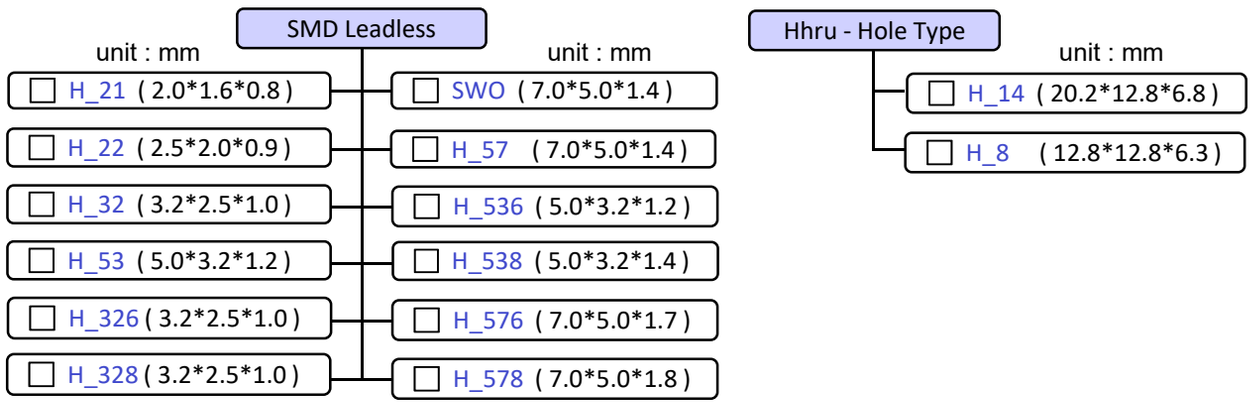
(6) Operating temperature range -30°C to +75°C in this example. Use " **X** " for -10°C ~ 60°C ; Use " **Y** " for -20°C ~ 70°C ; Use " **I** " for -40°C ~ 85°C' ; (7) ESR max.

How To Specify A Crystal Oscillator

Output Wave Forms and Logics



Part Number Format : " H " - - - for Oscillators
" _ " - - - represents PRODUCT SERIES selections in table 1and 2 below .



Basic Spec. must be specified

1 : Holder type with output wave : _____ ☐ Thru-Hole type ☐ SMD type

Table 1 - - - Square Wave

Output Wave	General Clock Oscillators	Switchable Output
☐ CMOS	H_, SWO, HA, HM, HTF, HU, HW, HTJFN	HCTQF
☐ LVPECL	HPK , HPQN , HPQF , HPJK , HPEK , HPRK , HPJFN	HCPQF
☐ LVDS	HDK , HDQN , HDQF , HDJK , HDEK , HDRK , HDJFN	HCDQF
☐ HCSL	HCK , HCJK , HCEK , HCRK , HCJFN	
☐ CML	HQJF , HQJFN	
☐ LPHCSL	HCLK	

Table 2 - - - Sine Wave

Output Wave	Product Series
☐ True Sine Wave	HS

2 : Frequency : _____ MHz or _____ KHz

3 : Input Voltage : ☐ +5.0V ☐ +3.3V ☐ +3.0V ☐ +2.5V ☐ +1.8V ☐ +1.2V ☐ +1.0V ☐ others : _____

4 : Frequency Stability :

Stability / Temp .	Commercial: -20°C ~ +70°C	Industrial: -40°C ~ +85°C	Extended Industrial: -40°C ~ +105°C
± 25ppm	☐ A	☐ D	---
± 50ppm	☐ B	☐ E	☐ H
± 100ppm	☐ C	☐ F	☐ J
☐ Custom (± _____ ppm over _____ to _____ ℃)			

5 : Output Logic " 1 " _____ V (min.) ; Output Logic " 0 " _____ V (max.)
6 : Rise time (Tr) and Fall time (Tf) : _____ nano seconds (max.)
7 : Start-up time : _____ mini seconds (max.)
8 : Current Consumption : _____ mA (max.) or _____ uA (max.)
9 : Symmetry (Duty Cycle) : ☐ Standard (50%±10%) ☐Option (50%±5%) [Add " S " at the end of part number]
10 : Pin 1 options : ☐ No Connection ☐ Tri - state (Output Enable) ☐ Power-down (Note : Tri-state is standard for SWO , H53 and H32 series)

Part Number Format and Example

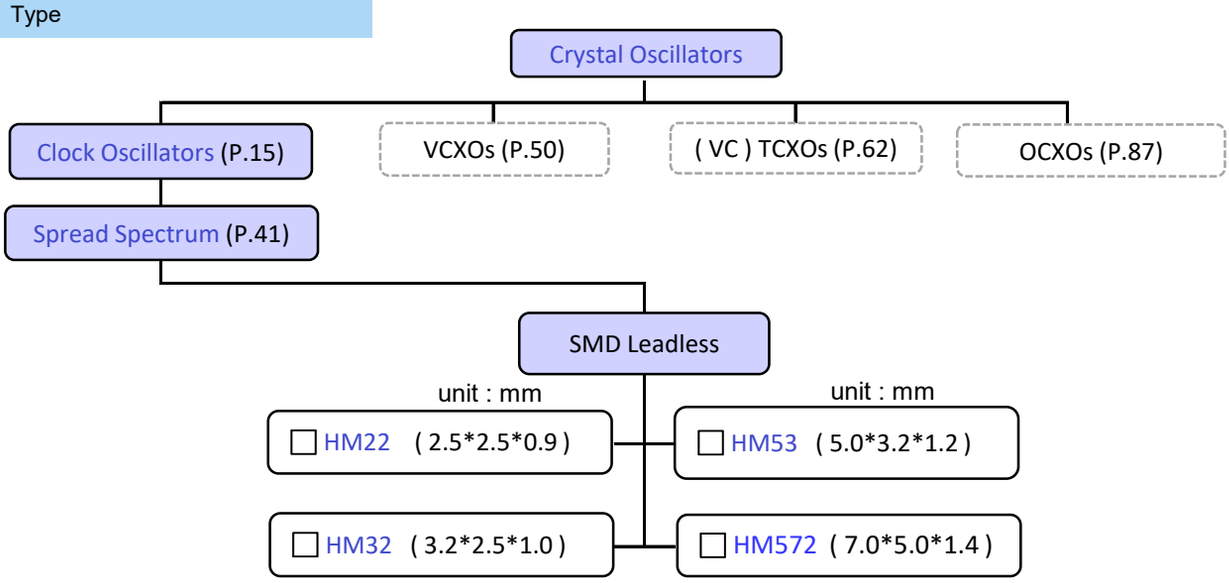
Example: 3H14 - DT - 33.000 - S ✎ = User to specify ★ = Option

✎	✎		✎	★		✎		★
3	H14	-	D	T	-	33.000	-	S
(1)	(2)		(3)	(4)		(5)		(6)

(1) Supply voltage code : " 3 " for +3.3V ; " 5 " for +5.0V ;
(2) Package code ; (3) Frequency Stability ; (4) Tri-state option. Omit " T " if not required
(5) Center Frequency in MHz ; (6) Add " S " for 50% ± 5% duty cycle . Omit " S " if not required .

How To Specify A EMI Reduction Spread Spectrum Clock Oscillator

Holder Type



Basic Spec. must be specified

1 : Holder type: _____ ☐ Thru-Hole type ☐ SMD type

2 : Frequency : _____ MHz

3 : Input Voltage : ☐ +1.8V , ☐ +2.5V , ☐ +3.3V

4 : Output Wave : Square Wave (CMOS)

5 : Frequency Stability :
(Exclude frequency modulation)

Stability / Temp .	Commercial -20°C ~ +70 °C	Industrial -40°C ~ +85 °C
± 25ppm	☐ A	☐ D
± 50ppm	☐ B	☐ E
± 100ppm	☐ C	☐ F
☐ Custom (± _____ ppm over _____ to _____℃)		

6 : Group & Spread type :

(1) ☐ Group B

☐ Center spread : ☐ ±0.125 % ☐ ±0.375 % ☐ ±0.625 % ☐ ±0.875 % ☐ ±1.125 % ☐ ±1.375 % ☐ ±1.625 %
☐ ±0.875 % ☐ ±1.125 % ☐ ±1.375 % ☐ ±1.625 % ☐ ±1.875 % ☐ ±2.0 %

☐ Down spread : ☐ -0.25 % ☐ -0.75 % ☐ -1.25 % ☐ -1.75 % ☐ -2.25 % ☐ -2.75 % ☐ -3.25 %
☐ -3.75 % ☐ -4.0 %

(2) ☐ Group C

☐ Center spread : ☐ C0.25 : ± 0.25 % ☐ C0.75 : ± 0.75 % ☐ C1.0 : ± 1.0 %

☐ Down spread : ☐ D0.5 : -0.5 % ☐ D1.5 : - 1.5 % ☐ D2.0 : -2.0 %

Part Number Format and Example

Examples of Low EMI Oscillator : 3HM572-DT-33.000B-C0.5 = User to specify ★ = Option

✎	✎		✎	★		✎	✎		✎	
3	HM572	-	D	T	-	33.000	B	-	C0.5	
(1)	(2)		(4)	(5)		(6)	(7)		(8)	

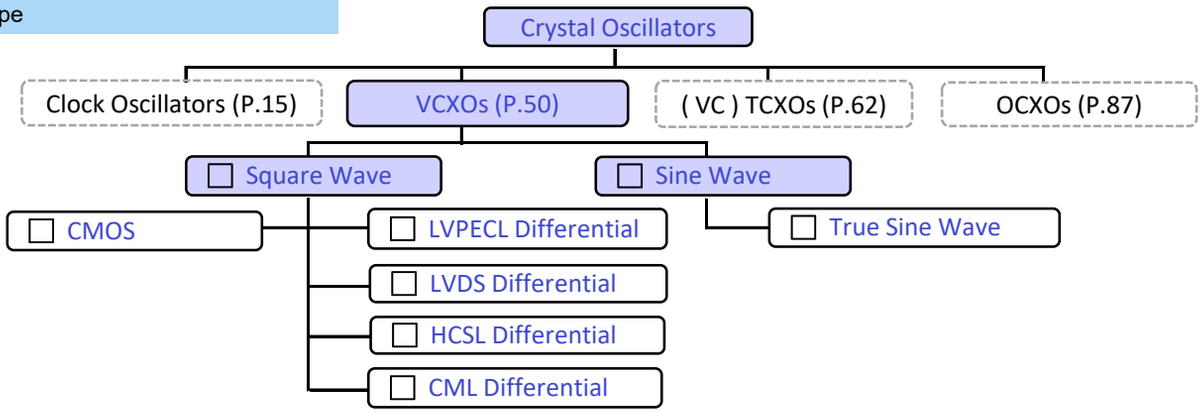
(1) Supply voltage code : " 3 " for +3.3V ; (2) Package code ; (3) RoHS compliance. Omit " G " is not required. ; (4) Frequency stability ;

(5) Tri-state ; (6) Frequency in MHz ; (7) Group ;

(8) Spread type & percentage : " C " for center spread , " D " for down spread. C0.5 represents center spread ± 0.5% (total 1%).

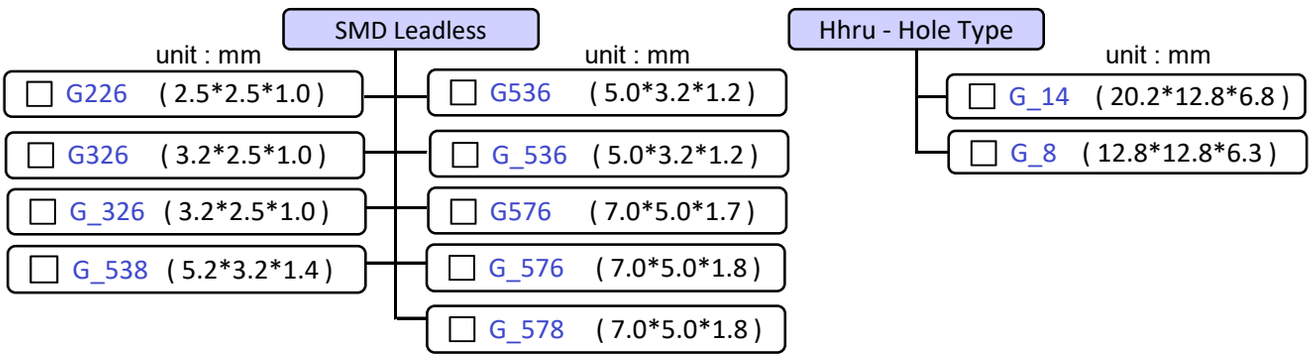
How To Specify A VCXO

Holder Type



Part Number Format : " G " - - - for VCXO

" _ " - - - represents PRODUCT SERIES selections in table 1and 2 below .



Basic Spec. must be specified

1 : Holder type : _____ ☐ Thru-Hole type ☐ Leadless SMD type

Table 1 - - - Square Wave		
Output Wave	General VCXOs	Switchable Output
☐ CMOS	G_ , GTQN , GTQF , GTJFN	GCTQF
☐ LVPECL	GPQN , GPQF , GPJFN	GCPQF
☐ LVDS	GDQN , GDQF , GDJFN	GCDQF
☐ HCSL	GCJFN	GCPQF
☐ CML	GQJFN	GCDQF

Table 2 - - - Sine Wave	
Output Wave	Product Series
☐ True Sine Wave	GS

2 : Frequency : _____ MHz

3 : Input Voltage :	☐ +3.3V	☐ +1.8V
4 : Control Voltage center and range :	+1.65V ± 1.35V (0.3V ~ 3.0V)	+0.9V ± 0.9V (0V ~ 1.8V)

5 : Frequency Stability :

Stability / Temp .	Commercial: -20°C ~ +70°C	Industrial: -40°C ~ +85°C	Extended Industrial: -40°C ~ +105°C
± 25ppm	☐ A	☐ D	---
± 50ppm	☐ B	☐ E	☐ H
± 100ppm	☐ C	☐ F	☐ J
☐ Custom (± _____ ppm over _____ to _____ °C)			

6 : Frequency deviation range : ± _____ ppm ☐ min. ☐ max. ☐ typical (± 20%) .

7 : Linearity : _____ % (max.)

8 : Input Impedance : _____ KΩ (min.)

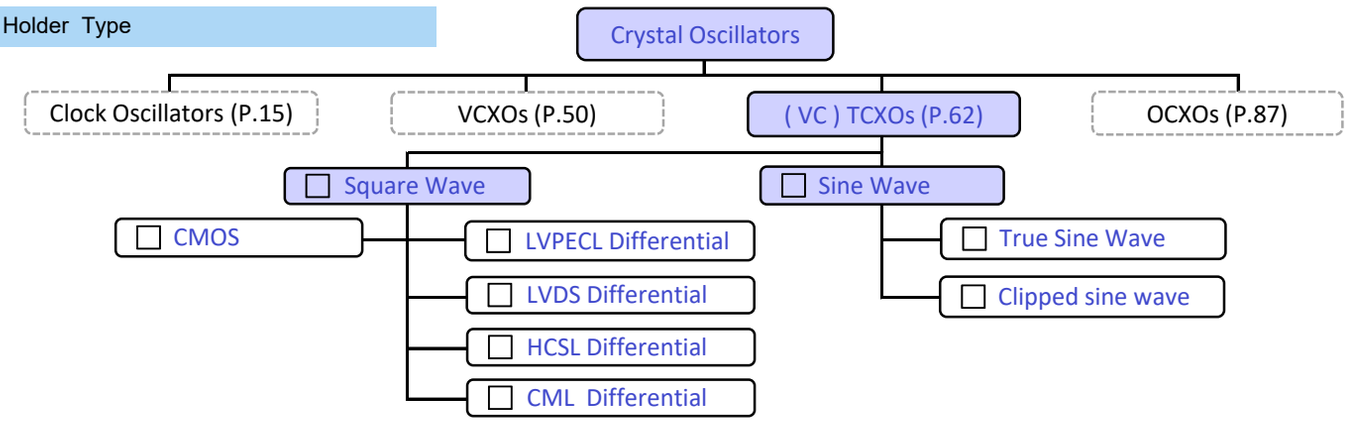
9 : Modulation band width : ± _____ KHz (min.)

Part Number Format and Example

Examples of VCXO : 3G576 - D - 150M - 27.000							= User to specify
✎	✎		✎		✎		✎	
3	G576	-	D	-	150M	-	27.000	
(1)	(2)		(3)		(4)		(5)	
(1) Supply Voltage code : " 18 " for +1.8V , " 3 " for +3.3V ; (2) Package code ; (3) Frequency stability ;								
(4) Pulling range in ppm (" N " : minimum , " M " : maximum , " T " : typical) ; (5) Center Frequency in MHz								

How To Specify A (VC)TCXO

Holder Type



Part Number Format : " M " for TCXO ; " VM " for VCTCXO (TCXO with voltage control function)

" _ " - - - represents PRODUCT SERIES selections in table 1and 2 below .

SMD Leadless

unit : mm

- ☐ (V)M21 (2.0*1.6*0.7)
- ☐ (V)M22 (2.5*2.0*0.8)
- ☐ (V)M32 (3.2*2.5*1.2)
- ☐ (V)M53 (5.0*3.2*1.3)
- ☐ (V)M_326 (3.2*2.5*1.6)

unit : mm

- ☐ (V)M57 (7.0*5.0*2.0)
- ☐ (V)M572 (7.0*5.0*2.3)
- ☐ (V)M_538 (5.0*3.2*1.4)
- ☐ (V)M_574 (7.0*5.0*2.5)
- ☐ (V)M_576 (7.0*5.0*2.5)

Thru - Hole Type

unit : mm

- ☐ (V)M_8 (12.8*12.8*6.3)
- ☐ (V)M_9 (12.8*12.8*6.3)
- ☐ (V)M_39 (18.4*11.7*4.7)
- ☐ (V)M_14 (20.2*12.8*7.8)
- ☐ (V)M_15 (20.2*12.8*7.8)

Basic Spec. must be specified

1 : ☐ TCXO (code " M " series) ☐ VCTCXO (code " VM " series)

2 : Holder type: _____ ☐ Thru-Hole type ☐ SMD type

Output Wave type :

Clipped Sine Wave	
TCXO	VCTCXO
M _ S	VM _ S

Square Wave		
Output Wave	Product Series	
	TCXO - - - " M "	VCTCXO - - - " VM "
☐ CMOS	M_T , MTF_T , ME_T , MQN_T , MQF_T	VM_T , VMTF_T , VMQN_T , VMQF_T
☐ PECL	MQN_P , MQF_P , MJF_P	VMQN_P , VMQF_P , VMJF_P
☐ LVDS	MQN_D , MQF_D , MJF_D	VMQN_D , VMQF_D , VMJF_D
☐ HCSL	MJF_C	VMJF_C
☐ CML	MJF_Q	VMJF_Q

3 : Frequency : _____ MHz or _____ KHz

4 : Input Voltage : ☐ +3.3V ☐ +3.0V ☐ +2.5V ☐ +1.8V ☐ others : _____

5 : Frequency Stability :

☐ ± 1.0ppm	☐ ± 1.5ppm	☐ ± 2.0ppm
☐ ± 2.5ppm	☐ ± 3.0ppm	☐ ± 5.0ppm

6 : Operating Temp. :

☐ 0 °C ~ +60 °C	☐ 0 °C ~ +70 °C	☐ -10 °C ~ +60 °C	☐ -20 °C ~ +70 °C
☐ -30 °C ~ +60 °C	☐ -30 °C ~ +70 °C	☐ -40 °C ~ +85 °C	

7 : ● [" ***T*** " series , Square Wave] : Output Voltage " 1 ": _____ V (min.) ; Output Voltage " 0 ": _____ V (max.)

● [" ***S*** " series , Clipped Sine Wave] : Output Voltage Level : _____ Vp-p (min.)

8 : Start-up time : _____ mini seconds (max.) .

9 : Current Consumption : _____ mA (max.)

10 : ● Mechanical frequency tuning (MFT) range : ± _____ ppm (min.). For TCXOs and VCTCXOs.

● Electrical frequency tuning range (EFT) : ± _____ ppm (min.). For VCTCXOs only.

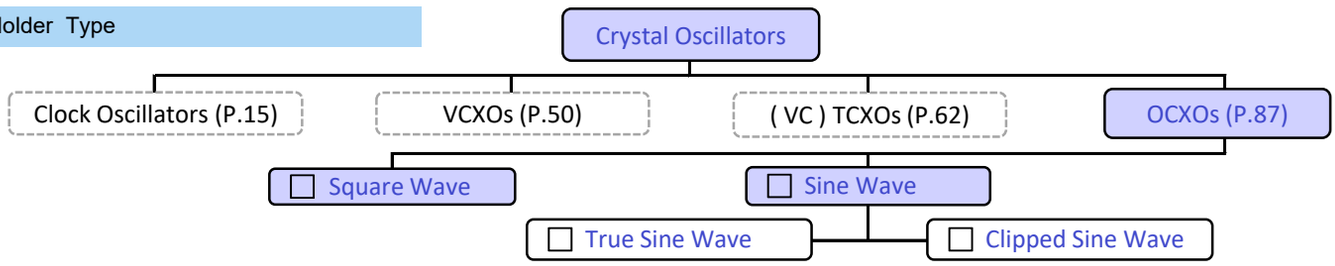
● Control voltage center and range : ***1.5V ± 1.0V*** is standard for 3.3V, 1.5V supply voltages .

Part Number Format and Example

Examples of VCTCXO : VM32S33-12.800-2.5/-30+85									= User to specify	
										customer to specify
V	M32	S	33	-	12.800	-	2.5	/	-30+85	
(1)	(2)	(3)	(4)		(5)		(6)		(7)	
(1) " *V* " for VCTCXO ; Omit ' V " if TCXO ; (2) Package code										
(3) Wave form code " *S* " for clipped sine wave ; (4) Supply voltage code : " 25 " for +2.5V ; " *3* " for +3.0V , " *33* " for +3.3V										
(5) Frequency in MHz ; (6) Frequency stability in ±ppm ; (7) Operating temperature range in °C. "-30+85" represents -30°C to +85°C operating temperature range.										

How To Specify A OCXO

Holder Type



Part Number Format : " OC " for OCXO

unit : mm

SMD Leadless

- ☐ OC12 (25.4*22.1*11.0)
- ☐ OC41 (14.5*9.6*6.5)
- ☐ OC51 (9.7*7.5*4.1)

Thru - Hole Type

unit : mm

- ☐ OC13 (25.4*25.4*12.7)
- ☐ OC14 (20.3*12.7*11.0)
- ☐ OC18 (20.6*20.6*11.0)
- ☐ OC19 (20.6*20.6*11.0)
- ☐ OC32 (36.3*27.2*12.7)

Basic Spec. must be specified

1 : Holder type: _____ ☐ SMD type ☐ Thru-Hole type

2 : Frequency : _____ MHz

3 : Input Voltage : ☐ +3.3V ☐ +5.0V

4 : Frequency Stability :

☐ ± 3.0ppm	☐ ± 5.0ppm	☐ ± 10.0ppm	
☐ ± 20.0ppm	☐ ± 30.0ppm	☐ ± 50.0ppm	☐ ± 100.0ppm

5 : Operating Temp. :

☐ 0 °C ~ +70 °C	☐ -20 °C ~ +70 °C	☐ -30 °C ~ +70 °C	☐ -40 °C ~ +85 °C

6 : ● [" ***T*** " series , Square Wave] : Output Voltage " 1 ": _____ V (min.) ; Output Voltage " 0 ": _____ V (max.)

● [" ***E*** " series , True Sine Wave] : Output Voltage Level : _____ dBm (typ.)

● [" ***S*** " series , Clipped Sine Wave] : Output Voltage Level : _____ Vp-p (min.)

8 : Power Dissipation : _____ Watts (max.) at Steady-State ; _____ mA (max.) at Turn-On

9 : Electrical frequency tuning range (EFT) : ± _____ ppm (min.).

Part Number Format and Example

Examples of OCXO : OC51T3-10.000-20/-40+85 = User to specify

✎	✎	✎	✎		✎		✎		✎	✎ customer to specify
OC	51	T	3	-	10.000	-	20	/	-40+85	
(1)	(2)	(3)	(4)		(5)		(6)		(7)	

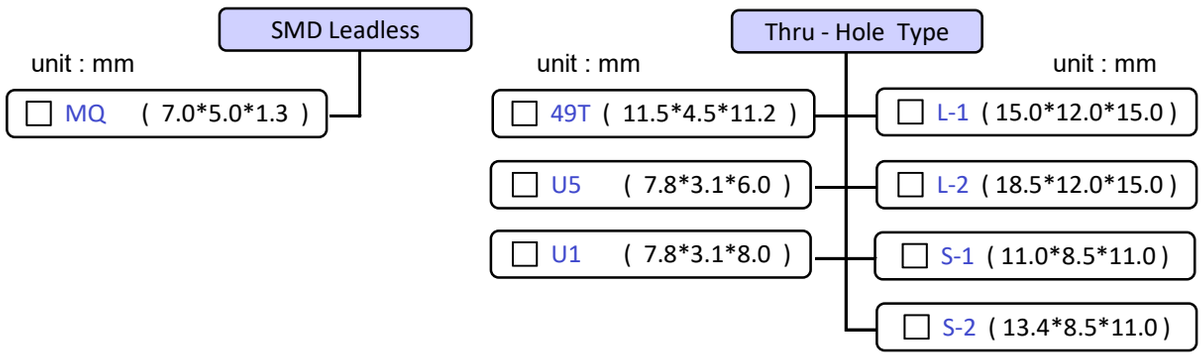
(1) " OC " for OCXO ; (2) Package code ; (3) Wave form code " T " for square wave

(4) Supply voltage code : " *3* " for +3.3V ; (5) Frequency in MHz

(6) Frequency stability in ±ppb ; (7) Operating temperature range in °C. "-40+85" represents -40°C to +85°C operating temperature range.

How To Specify A Monolithic Crystal Filter

Holder Type



Basic Spec. must be specified

A-1 : Holder type: _____ ☐ SMD Leadless ☐ Thru-Hole type

A-2 : Frequency : _____ MHz ☐ 10.7 MHz (10.5 MHz ~ 11.000 MHz available only in 49T series)

☐ 21.400 MHz ☐ 21.700 MHz ☐ 45.000 MHz ☐ 50.850 MHz

A-3 : No. of poles : ☐ 2 poles ☐ 4 poles ☐ 6 poles ☐ 8 poles

A-4 : Pass Bandwidth : ☐ ±3.75 KHz ☐ ±6.0 KHz ☐ ±7.5 KHz ☐ ±15.0 KHz min at 3 dB

A-5 : Stop Bandwidth : ± _____ KHz max at _____ dB and ± _____ KHz max at _____ dB

A-6 : Ripple : _____ dB (max.)

A-7 : Insertion Loss : _____ dB (max.)

A-8 : Guaranteed Attenuation : fo + _____ KHz to fo - _____ KHz min. at _____ dB

A-9 : Terminating Impedance : _____ Ω // _____ pF

A-10 : Operating Temperature : _____ °C to _____ °C

Part Number Format and Example

Examples of quartz crystal : 21.7M15DU5 = User to specify ★ = Option

								User to specify
21.7 M		15		D		U5		
(1)		(2)		(3)		(4)		

(1) Frequency code ;

(2) Pass Bandwidth code (" 7.5 " for ±3.75 KHz band width , " 15 " for ±7.5 KHz band width , " 30 " for ±15.0 KHz band width) ;

(3) No. of poles (" *A* " for 2 poles , " *B* " for 4 poles , " *C* " for 6 poles , " *D* " for 8 poles) ;

(4) Package code

Quartz Crystals

X11	X21	X22	X32	Surface Mount	X11 , X21 , X22 , X32	X22 , X32
1.65 * 1.25 * 0.30	2.05 * 1.65 * 0.50	2.55 * 2.05 * 0.60	3.20 * 2.50 * 0.70		Fundamental	3rd Overtone

Features

Specifications

- The entire package can be grounded via the top metal lid and the two bottom pads
- Small footprint. Ideal for space constrained applications
- Exhibits extremely low aging with a high shock & vibration resistance

General Specifications

Item / Type	X11	X21	X22	X32
Package Dimensions	(1.65 * 1.25 * 0.30 mm)	(2.05 * 1.65 * 0.50 mm)	(2.55 * 2.05 * 0.60 mm)	(3.20 * 2.50 * 0.70 mm)
Frequency Range	24.0 ~ 96.0 MHz (Fund.)	16.0 ~ 64.0 MHz (Fund.)	12.0 ~ 80.0 MHz (Fund.)	8 ~ 96.0 MHz (Fund.)
			50 ~ 200 MHz (3rd Overtone)	50 ~ 200 MHz (3rd Overtone)
Crystal Cut // Load Capacitance	AT - Cut // Series or Parallel (8 to 32 pF) resonance			
Drive Level	10 μW (typ.) 100 μW (max.)			
Frequency Tolerance	± 10 ppm , ± 20 ppm or ± 30 ppm (max.) at 25°C			
Aging	△F / F : ± 3 ppm / year (max.)			
Storage Temperature Range	- 50°C to 125°C			

ESR (Equivalent Series Resistance)

X11		X21		X22			X32		
Frequency Range	E. S. R.	Frequency Range	E. S. R.	Frequency Range	E. S. R.	Oscillator Mode	Frequency Range	E. S. R.	Oscillator Mode
24.0 ~ 29.9 MHz	120 Ω max.	16.0 ~ 23.9 MHz	120 Ω max.	12.0 ~ 15.9 MHz	150 Ω max.	Fund. Mode	8.0 ~ 9.9 MHz	500 Ω max.	Fund. Mode
30.0 ~ 39.9 MHz	100 Ω max.	24.0 ~ 29.9 MHz	100 Ω max.	16.0 ~ 29.9 MHz	80 Ω max.		10.0 ~ 11.9 MHz	200 Ω max.	
40.0 ~ 96.0 MHz	80 Ω max.	30.0 ~ 37.9 MHz	80 Ω max.	30.0 ~ 80.0 MHz	60 Ω max.		12.0 ~ 29.9 MHz	80 Ω max.	
		38.0 ~ 64.0 MHz	60 Ω max.	50.0 ~ 200.0 MHz	80 Ω max.	3rd Overtone	30.0 ~ 96.0 MHz	40 Ω max.	
							50.0 ~ 200.0 MHz	60 Ω max.	3rd Overtone

Frequency stability Vs Operating temperature range

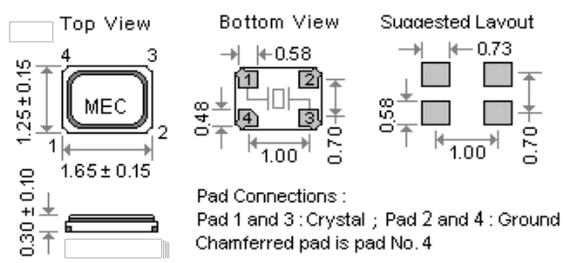
Frequency stability Vs Operating temperature range							
Stability code	Temp. (°C) \ ppm	± 5	± 10	± 15	± 20	± 25	± 30
X	-10 to 60°C	▲	○	○	○	○	○
Y	-20 to 70°C		○	○	○	○	○
I	-40 to 85°C			○	○	○	○

○ : available

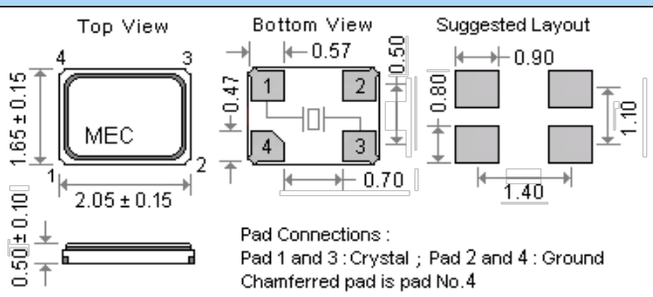
▲ : contact Mercury

Outline Dimensions (Unit : mm)

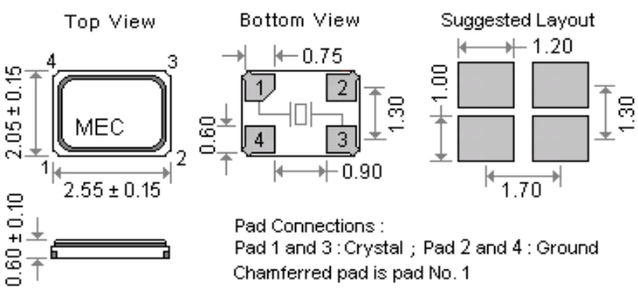
X11



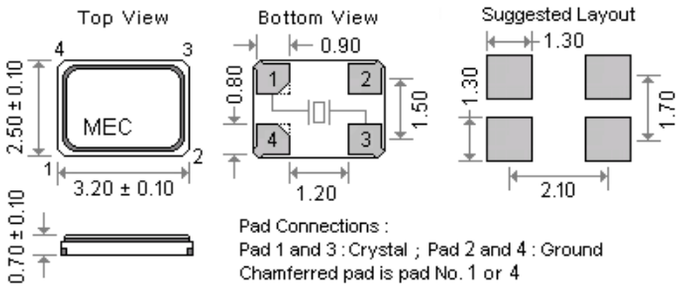
X21



X22



X32



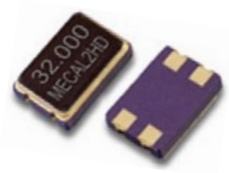
Quartz Crystals

MJ	MQ	Surface Mount	MJ , MQ	MJ , MQ
5.0 * 3.2 * 0.8	7.0 * 5.0 * 1.0		Fundamental	3rd Overtone

Features

Specifications

- Exhibits extremely low aging with a high shock and vibration resistance
- The entire package can be grounded via the top metal lid and the two bottom pads
- This low 0.7mm package height is ideal for height constrained applications



General Specifications

Item / Type	**MJ** series	**MQ** series
Package Dimensions	(5.0 * 3.2 * 0.8 mm)	(7.0 * 5.0 * 1.0 mm)
Frequency Range	8.0 ~ 52.0 MHz (Fund.)	6.0 ~ 50.0 MHz (Fund.)
	50.0 ~ 200.0 MHz (3rd)	45.0 ~ 200.0 MHz (3rd)
Crystal Cut	AT - Cut ; 3rd overtone	
Load Capacitance	Series or Parallel (8 to 32 pF) resonance	
Drive Level	10 μW (typ.) 100 μW (max.)	
Frequency Tolerance	± 10 ppm , ± 20 ppm or ± 30 ppm (max.) at 25°C	
Aging	△F / F : ± 3 ppm / year (max.)	
Storage Temp. Range	- 50°C to 125°C	

ESR (Equivalent Series Resistance)

MJ			MQ		
Freq. (MHz)	E.S.R.	Mode	Freq. (MHz)	E.S.R.	Mode
8.0 ~ 9.9	100 Ω	Fund.	6.0 ~ 8.0	80 Ω	Fund.
10.0 ~ 14.9	60 Ω		8.1 ~ 11.0	60 Ω	
15.0 ~ 19.9	50 Ω		11.1 ~ 14.0	50 Ω	
20.0 ~ 52.0	40 Ω		14.1 ~ 50.0	40 Ω	
50.0 ~ 200.0	80 Ω	3rd	40.1 ~ 45.0	60 Ω	3rd
			45.1 ~ 200.0	80 Ω	

Frequency stability Vs Operating temperature range

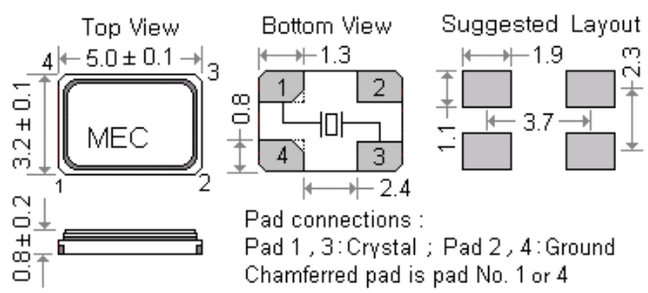
Frequency stability vs Operating temperature range							
Stability code	Temp. (ºC) \ ppm	± 5	± 10	± 15	± 20	± 25	± 30
X	-10 to 60°C	○	○	○	○	○	○
Y	-20 to 70°C	▲	○	○	○	○	○
I	-40 to 85°C			○	○	○	○

○ : available

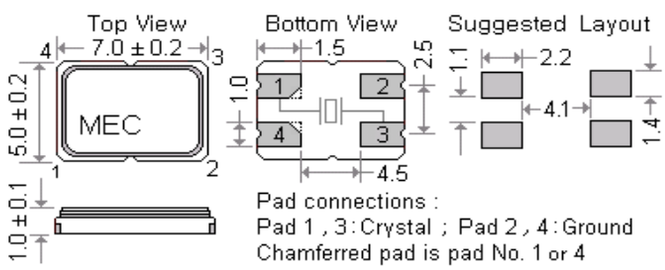
▲ : contact Mercury

Outline Dimensions (Unit : mm)

MJ



MQ



Quartz Crystals

M49 , ML49	MP4 , MP5	MP24 , MP25	SMD	Fundamental	3rd Overtone	Min.	Max.
12.4 * 4.5 * 4.0 (3.0) mm	12.9 * 4.5 * 5.0 (4.0) mm	11.4 * 5.0 * 5.0 (4.0) mm				3.2 MHz	100 MHz

Features

Specifications

- Withstands solder reflow and available in EIA-481A tape and reel
- AT-strip crystal inside. Optimized for low spurious.
- Lowest cost among all Mercury SMD crystals
- Designed for top board assembly and an one time solder reflow only
- Do not mount with the metal housing downward

General Specifications

Item / Type	**M49** (12.4 * 4.5 * 4.0 mm) series	**MP4** (12.9 * 4.5 * 4.0 mm) series	**MP5** (12.9 * 4.5 * 5.0 mm) series
	ML49 (12.4 * 4.5 * 3.0 mm) series	**MP24** (11.4 * 5.0 * 4.0 mm) series	**MP25** (11.4 * 5.0 * 5.0 mm) series
Frequency Range & Crystal Cut	3.200 ~ 48.000 MHz , AT-cut , Fundamental Mode (see Table 1) 30.000 ~ 100.000 MHz , AT-cut , 3rd overtone (see Table 1)		
Load Capacitance	Series or Parallel (8 to 32 pF) resonance		
Drive Level	100 µW (typ.) 500 µW (max.)		
Frequency Tolerance	± 10 ppm , ± 20 ppm or ± 30 ppm (max.) at 25°C		
Frequency Stability	See Table 2		
Aging	△F / F : ±3 ppm / year (max.)		
Storage Temperature Range	- 50°C to 105°C		

Table 1

ESR (Equivalent Series Resistance)					
Freq.(MHz)	E.S.R.	Osc. Mode	Freq.(MHz)	E.S.R.	Osc. Mode
3.2 ~ 3.4	300 Ω	AT , Fund.	30.1 ~ 50.0	100 Ω	AT , 3rd
3.5 ~ 6.0	120 Ω		50.1 ~ 100.0	80 Ω	
6.1 ~ 10.0	60 Ω				
10.1 ~ 48.0	40 Ω				

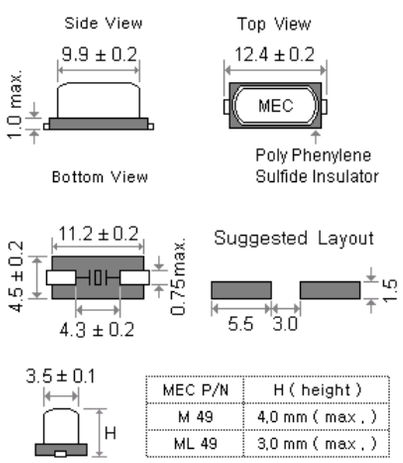
Table 2

Frequency stability Vs Operating temperature range						
Stability code	Temp. (ºC) \ ppm	± 10	± 15	± 20	± 25	± 30
X	-10 to 60°C	○	○	○	○	○
Y	-20 to 70°C	▲	○	○	○	○
I	-40 to 85°C		○	○	○	○

○ : available ; ▲ : contact Mercury

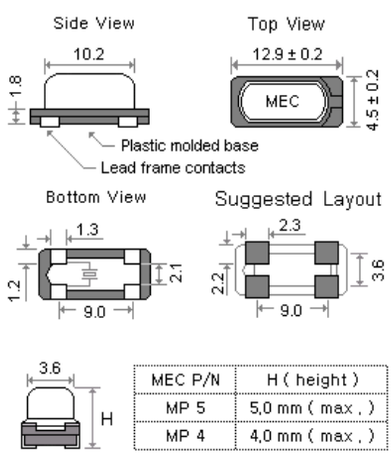
Outline Dimensions (Unit : mm)

[M49] ; [ML49]



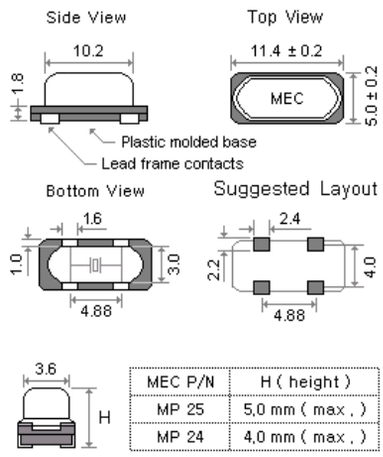
MEC P/N	H (height)
M 49	4,0 mm (max ,)
ML 49	3,0 mm (max ,)

[MP4] ; [MP5]



MEC P/N	H (height)
MP 5	5,0 mm (max ,)
MP 4	4,0 mm (max ,)

[MP24] ; [MP25]



MEC P/N	H (height)
MP 25	5,0 mm (max ,)
MP 24	4,0 mm (max ,)

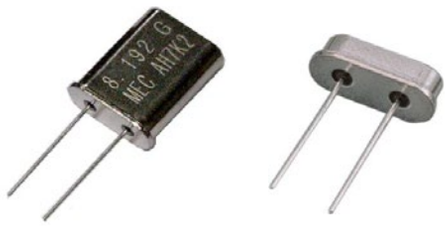
Quartz Crystals

H49	HUS	HUSL	Thru - Hole	Fund.	3rd O.T.	Min.	Max.
10.7 * 4.5 * 13.2 mm	10.7 * 4.3 * 3.5 mm	10.7 * 4.3 * 2.5 mm				1.8 MHz	100 MHz

Features

Specifications

- Tight tolerance and stability. Ideal for communication equipment
- RoHS complian
- H49 (13.2mm height) & HUS (3.5mm height) & HUSL (2.5mm height)
- Low cost and light weight



General Specifications

Item / Type	H49 (10.7 * 4.5 * 13.2 mm) series	HUS (10.7 * 4.3 * 3.5 mm) series	HUSL (10.7 * 4.3 * 2.5 mm) series
Frequency Range & Crystal Cut	1.8432 ~ 100.000 MHz (see Table 1)	3.200 ~ 48.000 MHz , AT-cut , Fundamental Mode (see Table 2) 30.000 ~ 100.000 MHz , AT-cut , 3rd overtone (see Table 2)	
	For specific details , please feel free to contact us.		
Load Capacitance	Series or Parallel (8 to 32 pF) resonance		
Drive Level	100 µW (typ.) 500 µW (max.)		
Frequency Tolerance	± 10 ppm , ± 20 ppm or ± 30 ppm (max.) at 25°C		
Frequency Stability	See Table 3		
Aging	△F / F : ± 5 ppm & ± 3 ppm year (max.)		
Storage Temperature Range	- 55°C to 125°C		

Table 1

H49 ESR (Equivalent Series Resistance)

Freq.(MHz)	E.S.R.	Osc. Mode	Freq.(MHz)	E.S.R.	Osc. Mode
1.8 ~ 1.9	650 Ω	AT , Fund.	4.0 ~ 4.9	70 Ω	AT , Fund.
2.0 ~ 2.4	450 Ω		5.0 ~ 7.9	60 Ω	
2.5 ~ 2.9	350 Ω		8.0 ~ 9.9	30 Ω	
3.0 ~ 3.9	90 Ω		10.0 ~ 50.0	30 Ω	
			30.0 ~ 100.0	60 Ω	AT , 3rd

Table 2

HUS & **HUSL** ESR (Equivalent Series Resistance)

Freq.(MHz)	E.S.R.	Osc. Mode	Freq.(MHz)	E.S.R.	Osc. Mode
3.2 ~ 3.4	300 Ω	AT , Fund.	30.0 ~ 50.0	100 Ω	AT , 3rd
3.5 ~ 6.0	120 Ω		50.1 ~ 100.0	80 Ω	
6.1 ~ 10.0	60 Ω				
10.1 ~ 48.0	40 Ω				

Table 3

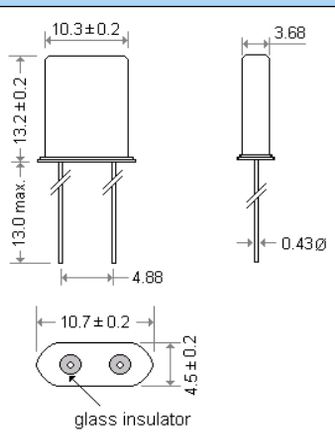
Frequency stability vs Operating temperature range

Stability code	Temp. (ºC) \ ppm	± 5	± 10	± 15	± 20	± 25	± 30	± 50
X	-10 to 60°C	○	○	○	○	○	○	○
Y	-20 to 70°C	▲	○	○	○	○	○	○
I	-40 to 85°C		▲	○	○	○	○	○

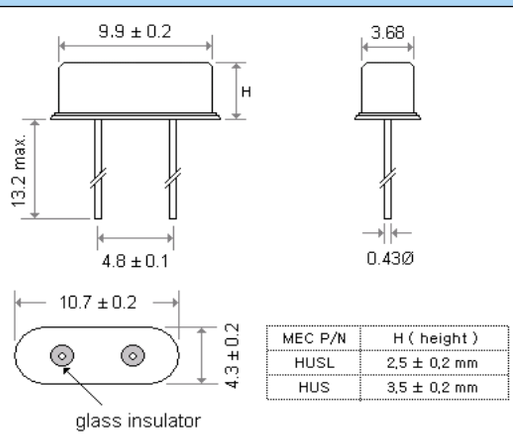
○ : available ; ▲ : contact Mercury

Outline Dimensions (Unit : mm)

H49



HUS / HUSL



MEC P/N	H (height)
HUSL	2,5 ± 0,2 mm
HUS	3,5 ± 0,2 mm

Quartz Crystals

U1	U5	Thru - Hole	Fund.	3rd O.T.	Min.	Max.
7.8 * 3.2 * 8.0 mm	7.8 * 3.2 * 6.0 mm				3.2 MHz	100 MHz

Features

Specifications

- Round shaped AT-Cut crystal plate inside
- Annealed and pre-aged for low frequency drift over long-term operation

General Specifications

Item / Type	U1	U5
Frequency Range	3.2 ~ 100 MHz	8.0 ~ 100 MHz
Load Capacitance	Series or Parallel (8 to 32 pF) resonance	
Drive Level	100 μW (typ.) 500 μW (max.)	
Frequency Tolerance	AT-cut : ± 10 ppm , ± 20 ppm or ± 30 ppm (max.) at 25°C	
Frequency Stability	See Table 2	
Aging	△F / F : ±3 ppm / year (max.)	
Storage Temperature Range	- 55°C to 125°C	

Table 1

U1 ESR (Equivalent Series Resistance)		
Freq.(MHz)	E.S.R.	Osc. Mode
3.2 ~ 10.0	50 Ω	AT , Fund.
10.1 ~ 50.0	30 Ω	
30.0 ~ 100.0	40 Ω	AT , 3rd

U5 ESR (Equivalent Series Resistance)		
Freq.(MHz)	E.S.R.	Osc. Mode
8.0 ~ 45.0	30 Ω	AT , Fund.
45.1 ~ 74.125	60 Ω	
30.0 ~ 100.0	40 Ω	AT , 3rd

Table 2

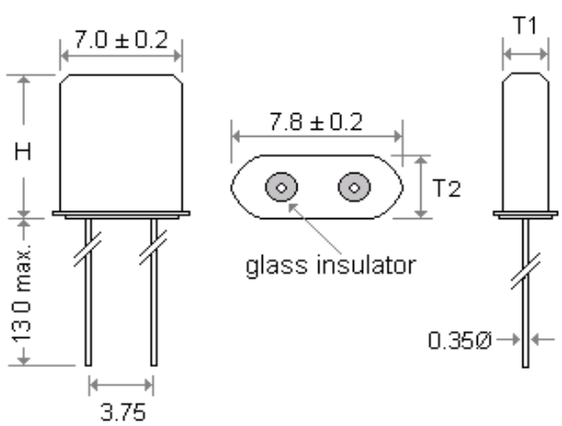
Frequency stability vs Operating temperature range								
Stability code	Temp. (ºC) \ ppm	± 5	± 10	± 15	± 20	± 25	± 30	± 50
X	-10 to 60°C	○	○	○	○	○	○	○
Y	-20 to 70°C	▲	○	○	○	○	○	○
I	-40 to 85°C		▲	○	○	○	○	○

○ : available

▲ : contact Mercury

Outline Dimensions (Unit : mm)

Thru - Hole type (U1 , U5)



	H	T1	T2
U1	8.0 ± 0.2	2.2 ± 0.2	3.2 ± 0.2
U5	6.0 ± 0.2	2.2 ± 0.2	3.2 ± 0.2

Quartz Crystals

Surface Mount		Thru - Hole type			Frequency Tolerance options		
X2012	**X3215**	**T26**	**T38**	**32.768 KHz**	**± 5 ppm**	**± 10 ppm**	**± 20 ppm**
[2.05 * 1.2 * 0.55 mm]	[3.2 * 1.5 * 0.8 mm]	[2.0ø * 6.0 mm]	[3.0ø * 8.0 mm]				

Features

Specifications

Ultra compact, thin, and light weight tuning fork crystal unit

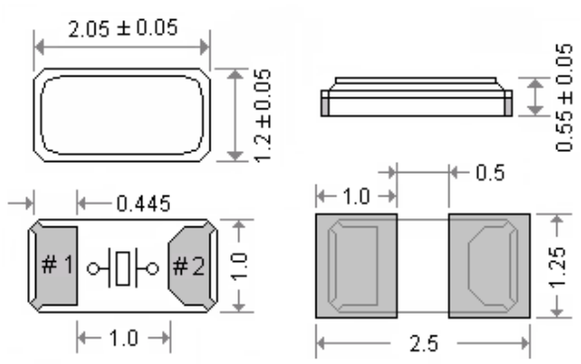
- Excellent heat resistance and environmental characteristics
- Excellent electrical performance optimum for mobile communications, OA (office automation) and AV (audiovisual) applications
- RoHS Comlipiant. Meets the re-flow profiling requirements using lead-free solder

General Specifications

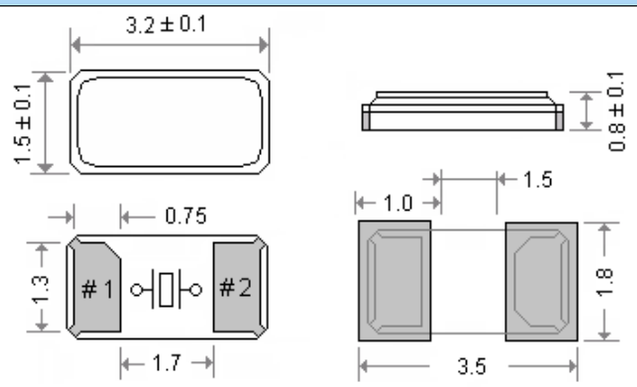
Frequency Range	32.768 KHz			
Hold type	Surface Mount Type		Thru - Hole Type	
Item / Type	**X2012**	**X3215**	**T26**	**T38**
Package sizes	[2.05 * 1.2 * 0.55 mm]	[3.2 * 1.5 * 0.8 mm]	[2.0ø * 6.0 mm]	[3.0ø * 8.0 mm]
Shunt Capacitance	1.3 pF (typ.) / 1.5 pF (max.)	1.0 pF (typ.) / 1.6 pF (max.)	1.5 pF (max.)	0.9 pF (max.)
Equivalent series resistance	80 KΩ (max.)		40 KΩ (max.)	35 KΩ (max.)
Temperature coefficient	- 0.04 x 10^{-6} / °C^2 (max.)		- 0.035 x 10^{-6} / °C^2 (max.)	
Drive Level	0.1 µW (typ.) 0.5 µW (max.)		1.0 µW (typ.)	
Operating Temperature Range	- 40 °C to 85 °C		- 10 °C to 60 °C	
Storage Temperature Range	- 40 °C to 125 °C		- 40 °C to 85 °C	
Crystal Cut	XT - Cut			
Load Capacitance	7 pF , 9 pF or 12.5 pF			
Frequency Tolerance	± 5 ppm , ± 10 ppm , ± 20 ppm (max.) at 25°C			
Turning POINT	+ 25 °C ± 5 °C			
Insulation resistance	500 MΩ min.			

Outline Dimensions (Unit : mm)

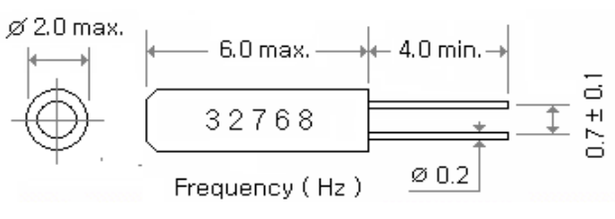
X2012



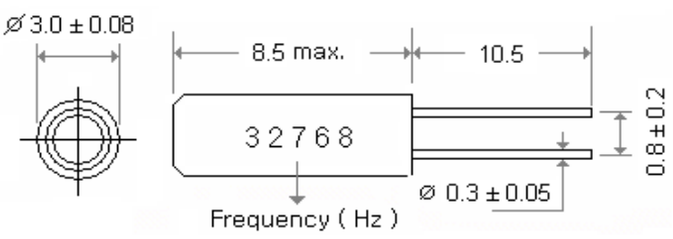
X3215



T26



T38



Mercury Crystal Oscillators (XOs) Products Lineup

General Clock Oscillators Selection Guide

Output Wave Output Logic	Product Series	Supply Voltage	Frequency Range	Product Description / Features
Square Wave **CMOS**	H (SMD)	1.8 V / 2.5 V / 3.3 V / 5.0 V	0.05 ~ 160 MHz	General Purpose Clock Oscillators.
	H (Dip)			
	HA	1.8 V / 2.5 V / 3.3 V / 5.0 V	27.3 ~ 100.0 KHz	Standard Frequncy 32.768 KHz , uA Current Consumption
	HEA	1.8 V / 2.5 V / 3.3 V	32.768 KHz	Ultra Low Current Consumption
	HU	1.0 V / 1.2 V	0.625 ~ 50 MHz	Low Supply Voltage
	HY	1.8 V / 2.5 V / 3.3 V	1.25 ~ 50 MHz	Wide Operating Temperature Over : -40 °C to +125 °C
	HJN	1.8 V / 2.5 V / 3.3 V	0.625 ~ 60 MHz	Ultra Low Jitter
	HTF	1.8 V / 2.5 V / 3.3 V	1.0 ~ 200 MHz	Programmable Quick Turn XO
	HTQN	2.5 V / 3.3 V	50 ~ 250 MHz	Low Jitter Oscillators , RMS Jitter : 0.6 psec (typ.)
	HTQF	2.5 V / 3.3 V	10 ~ 250 MHz	Quick - Turn Clock Oscillators , RMS Jitter : 0.8 psec (typ.)
	HTJFN	1.8 V / 2.5 V / 3.3 V	50 ~ 250 MHz	Quick - Turn Oscillators , Ultra Low Jitter : 150 fsec (typ.)
	HM B	2.5 V / 3.3 V	3.0 ~ 200 MHz	Spread Spectrum Oscillators , Programmable Quick Turn XO
	HM C	1.8 V / 2.5 V / 3.3 V	16 ~ 40 MHz	Spread Spectrum Oscillators , Reduce EMI More Than 3 dB
	HCTQF	2.5 V / 3.3 V	10 ~ 250 MHz	2 Frequency Switchablel Oscillators
	HCTJFN	1.8 V / 2.5 V / 3.3 V	15 ~ 250 MHz	4 Frequencies Switchable Oscillators
Square Wave **PECL**	HPK	2.5 V / 3.3 V	13.5 ~ 220 MHz	Differential XO with NO PLL , RMS Jitter : 0.2 psec (typ.)
	HPRK	2.5 V / 3.3 V	100 ~ 250 MHz	Differential XO with NO PLL , RMS Jitter : 0.1 psec (typ.)
	HPEK	3.3 V	13.5 ~ 220 MHz	Superb phase noise Differential XO , RMS Jitter : 98 fsec (typ.)
	HPJK	2.5 V / 3.3 V	100 ~ 250 MHz	Ultra Low Jitter Differential XO , RMS Jitter : 50 fsec (typ.)
	HPQN	2.5 V / 3.3 V	50 ~ 1,500 MHz	Low Jitter Oscillators , RMS Jitter : 0.6 psec (typ.)
	HPQF	2.5 V / 3.3 V	10 ~ 1,500 MHz	Quick - Turn Clock Oscillators , RMS Jitter : 0.8 psec (typ.)
	HPJFN	2.5 V / 3.3 V	50 ~ 2,100 MHz	Quick - Turn Oscillators , Ultra Low Jitter : 150 fsec (typ.)
	HCPQF	2.5 V / 3.3 V	10 ~ 1,500 MHz	2 Frequencies Switchable XO
	HCPJFN	2.5 V / 3.3 V	15 ~ 2,100 MHz	4 Frequencies Switchable XO
Square Wave **LVDS**	HDK	1.8 V / 2.5 V / 3.3 V	13.5 ~ 220 MHz	Differential XO with NO PLL , RMS Jitter : 0.2 psec (typ.)
	HDRK	1.8 V / 2.5 V / 3.3 V	100 ~ 250 MHz	Differential XO with NO PLL , RMS Jitter : 0.1 psec (typ.)
	HDEK	2.5 V / 3.3 V	13.5 ~ 220 MHz	Superb phase noise Differential XO , RMS Jitter : 98 fsec (typ.)
	HDJK	1.8 V / 2.5 V / 3.3 V	100 ~ 250 MHz	Ultra Low Jitter Differential XO , RMS Jitter : 50 fsec (typ.)
	HDQN	2.5 V / 3.3 V	50 ~ 1,500 MHz	High Frequency Oscillators , RMS Jitter : 0.6 psec (typ.)
	HDQF	2.5 V / 3.3 V	10 ~ 1,500 MHz	Quick - Turn Clock Oscillators , RMS Jitter : 0.8 psec (typ.)
	HDJFN	1.8 V / 2.5 V / 3.3 V	50 ~ 2,100 MHz	Quick - Turn Oscillators , Ultra Low Jitter : 150 fsec (typ.)
	HCDQF	2.5 V / 3.3 V	10 ~ 1,500 MHz	2 Frequencies Switchable XO
	HCDJFN	1.8 V / 2.5 V / 3.3 V	15 ~ 2,100 MHz	4 Frequencies Switchable XO
Square Wave **HCSL**	HCK	1.8 V / 2.5 V / 3.3 V	13.5 ~ 220 MHz	Differential XO with NO PLL , RMS Jitter : 0.2 psec (typ.)
	HCRK	1.8 V / 2.5 V / 3.3 V	20 ~ 200 MHz	Differential XO with NO PLL , RMS Jitter : 0.1 psec (typ.)
	HCEK	2.5 V / 3.3 V	13.5 ~ 220 MHz	Superb phase noise Differential XO , RMS Jitter : 98 fsec (typ.)
	HCJK	1.8 V / 2.5 V / 3.3 V	100 ~ 175 MHz	Ultra Low Jitter Differential XO , RMS Jitter : 50 fsec (typ.)
	HCJFN	1.8 V / 2.5 V / 3.3 V	50 ~ 700 MHz	Quick - Turn Oscillators , Ultra Low Jitter : 150 fsec (typ.)
	HCCJFN	1.8 V / 2.5 V / 3.3 V	15 ~ 700 MHz	4 Frequencies Switchable XO
Low Power **HCSL**	HCLK	1.8 V / 2.5 V / 3.3 V	95 ~ 180 MHz	Differential XO with NO PLL , RMS Jitter : 0.2 psec (typ.)
Square Wave **CML**	HQJFN	1.8 V / 2.5 V / 3.3 V	50 ~ 2,100 MHz	Quick - Turn Oscillators , Ultra Low Jitter : 150 fsec (typ.)
	HCQJFN	1.8 V / 2.5 V / 3.3 V	15 ~ 2,100 MHz	4 Frequencies Switchable XO
Sine Wave	HS	3.3 V	10 ~ 200 MHz	Output level is greater than 0 dBm into 50 Ω load .
		5.0 V	10 ~ 156 MHz	Output level is greater than 0 dBm into 50 Ω load .

Crystal Oscillators — CMOS Output

Surface Mount type

H21	H22	H32	H53	SWO
2.0 * 1.6 * 0.8	2.5 * 2.0 * 0.9	3.2 * 2.5 * 1.0	5.0 * 3.2 * 1.2	7.0 * 5.0 * 1.4

CMOS	1.8 V	3.3 V	2.5 V	5.0 V	Min.	Max.
					50 KHz	160 MHz

Applications

- CPU , Graphics , Multimedia A / V clocks
- MPEG / DVD / HDTV clocks
- Laser engine pixel / set - top clocks
- SONET / SDH / ATM clocks
- Fast Ethernet and Gigabit Ethernet clocks
- NTSC / PAL encoder / decoder clocks
- PLL / synthesizer clocks
- Fibre channel and ADSL clocks

General Specifications [Ta = +25°C , V_{DD}= at specified voltage , Load : 15 pF]

Model	" H21 " ; " H22 " ; " H32 " ; " H53 " and " SWO " series				
Type	" H21 " series	" H22 " series	" H32 " series	" H53 " series	" SWO " series
Dimensions	2.0 x 1.6 x 0.8 mm	2.5 x 2.0 x 0.9 mm	3.2 x 2.5 x 1.0 mm	5.0 x 3.2 x 1.2 mm	7.0 x 5.0 x 1.4 mm
Available Frequency Range by Voltage — 1.8 V	1 MHz ~ 60 MHz	0.0625 MHz ~ 160 MHz	0.0625 MHz ~ 160 MHz	0.05 MHz ~ 160 MHz	0.05 MHz ~ 160 MHz
2.5 V					
3.3 V					
5.0 V	- - - -	1 MHz ~ 50 MHz	1 MHz ~ 50 MHz	0.05 MHz ~ 135 MHz	0.05 MHz ~ 135 MHz

Supply Voltage (V_{DD})		+1.8 V ± 10%	+2.5 V ± 10%	+3.3 V ± 10%	+5.0 V ± 10%
		code is " 18 "	code is " 25 "	code is " 3 "	code is " 5 "
Output Logic " High " , " 1 "		1.62 V (min.)	2.25 V (min.)	2.97 V (min.)	4.5 V (min.)
Output Logic " Low " , " 0 "		0.18 V (max.)	0.25 V (max.)	0.33 V (max.)	0.5 V (max.)
Current Consumption	< 25 MHz	5 mA (max.)	5 mA (max.)	5 mA (max.)	5 mA (max.)
	25 ~ 50 MHz	8 mA (max.)	10 mA (max.)	12 mA (max.)	16 mA (max.)
	51 ~ 100 MHz	10 mA (max.)	15 mA (max.)	30 mA (max.)	30 mA (max.)
	101 ~ 160 MHz	15 mA (max.)	20 mA (max.)	40 mA (max.)	40 mA (max.)
Rise Time (Tr) / Fall Time (Tf)		6 nsec. (max.)			
		Measured between 10% ⟷ 90% of wave form (CL = 15pF)			

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 " For example : " C20 " ± 20 ppm over -20°C to +70°C ; " 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 Load	15 pF ; (30 pF and 50 pF load are also available for +3.3V and +5.0V V_{DD})
Duty Cycle	Standard: 50% ± 10% ; Option: 50% ± 5%. Please add "**-S**" at the end of the part number for ± 5% .
Start -up Time	1.0 ~ 32.0 MHz : 5 msec. (max.) ; 32.1 ~ 160.0 MHz : 10 msec. (max.)
Storage Temperature	-55°C to +125°C
Aging at Ta=+25°C	± 3 ppm per year (max.)
Output Enable / Disable Function	70% of V_{DD} (min.) to enable output.
	30% of V_{DD} (max.) to disable output.
	Disable current : 10 uA max. for OE ≦ 0.3V

Crystal Oscillators — CMOS Output

Thru - Hole								
H8	H14	CMOS	1.8 V	2.5 V	3.3 V	5.0 V	Min.	Max.
12.8 * 12.8 * 6.3	20.2 * 12.8 * 5.8						50 KHz	160 MHz

Applications

- CPU , Graphics , Multimedia A / V clocks
- MPEG / DVD / HDTV clocks
- Laser engine pixel / set - top clocks
- SONET / SDH / ATM clocks
- Fast Ethernet and Gigabit Ethernet clocks
- NTSC / PAL encoder / decoder clocks
- PLL / synthesizer clocks
- Fibre channel and ADSL clocks

General Specifications [Ta = +25°C]

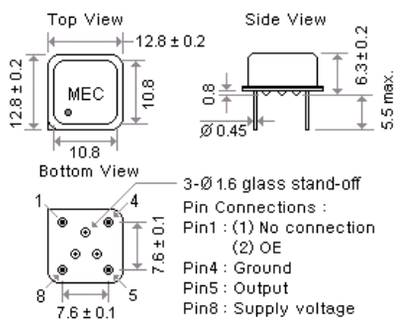
Type		Thru - Hole type			
Model (Dimensions)		H8 (12.8 * 12.8 * 6.3 mm)		H14 (20.2 * 12.8 * 5.8 mm)	
Supply Voltage (V_{DD})		+ 1.8 V ± 10%	+ 2.5 V ± 10%	+ 3.3 V ± 10%	+ 5.0 V ± 10%
		code is " 18 "	code is " 25 "	code is " 3 "	code is " 5 "
Frequency Range		0.05 ~ 160 MHz	0.05 ~ 160 MHz	0.05 ~ 160 MHz	0.05 ~ 135 MHz
Output Logic " High " , " 1 "		1.62 V (min.)	2.25 V (min.)	2.97 V (min.)	4.5 V (min.)
Output Logic " Low " , " 0 "		0.18 V (max.)	0.25 V (max.)	0.33 V (max.)	0.5 V (max.)
Current Consumption	< 25 MHz	5 mA (max.)	5 mA (max.)	5 mA (max.)	5 mA (max.)
	50 MHz	8 mA (max.)	10 mA (max.)	12 mA (max.)	16 mA (max.)
	100 MHz	10 mA (max.)	15 mA (max.)	30 mA (max.)	30 mA (max.)
	160 MHz	15 mA (max.)	20 mA (max.)	40 mA (max.)	40 mA (max.)
Disable Current		10 uA (max.) at OE ≦ 0.3V			

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 " For example : " C20 " ± 20 ppm over -20°C to +70°C ; " 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	

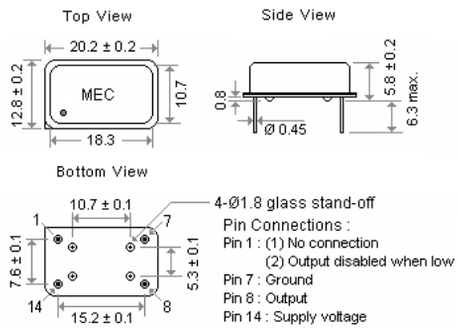
Output Load	15 pF (max). ; 30 pF load for frequencies up to 70 MHz ; Contact Mercury for 50 pF load
Rise Time (Tr)	10 nsec.(max.) ; 3 nsec.(typ.) . Measured between 10% to 90% waveform (CL=15pF)
Fall Time (Tf)	10 nsec.(max.) ; 3 nsec.(typ.) . Measured between 10% to 90% waveform (CL=15pF)
Duty Cycle	50% ± 10 % of waveform [50% ± 5% is also available , add " S " at the end of the part number]
Start - Up Time	10 msec. (max.) ; 5 msec. (typ.)
Storage Temperature	-55°C to +125°C
Aging at Ta=+25°C	± 5.0 ppm per year (max.)
Output Enable / Disable Function on pin1	70% of V_{DD} (min.) to enable output.
	30% of V_{DD} (max.) to disable output.
	Add " T " in part number for OE option

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

[H8 ; H_8]



[H14 ; H_14]



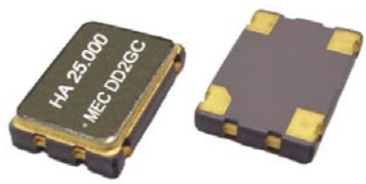
Crystal Oscillators [32.768 KHz , 27.3 ~ 100.0 KHz]

CMOS Output

HA _ _	32.768 KHz uA Current Consumption	SMD	CMOS	1.8 V	2.5 V 3.3 V	5.0 V	Min. 27.3 KHz	Max. 100.0 KHz

Features

- Features an AT-Cut crystal for high frequency stability, while providing a low micro Amp (μA) current consumption that would normally only be available from an X-Cut tuning fork crystal
- 32.768 KHz is popular for Real Time Clocks and other timing applications
- For even tighter frequency stability (± 5 ppm over -40 to 85 °C) and lower current consumption (1.2 uA at 3.3V) , please contact Mercury



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

Type	" HA " series [SMD Type]			
Model	**HA22**	**HA32**	**HA53**	**HA57**
Dimensions	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 Output Range	32.768 KHz (standard)			
	27.3 KHz ~ 100 KHz	27.3 KHz ~ 100 KHz	27.3 KHz ~ 100 KHz	27.3 KHz ~ 52 KHz
Supply Voltage	1.8 V ± 10% Voltage code is " 18 "	2.5 V ± 10% Voltage code is " 25 "	3.3 V ± 10% Voltage code is " 3 "	5.0 V ± 10% Voltage code is " 5 "
Current Consumption (32.768 KHz , Load 15pF)	32 uA (typ.) 50 uA (max.)	32 uA (typ.) 50 uA (max.)	33 uA (typ.) 50 uA (max.)	36 uA (typ.) 60 uA (max.)
Output Logic " High " , " 1 "	1.62 V (min.)	2.25 V (min.)	2.97 V (min.)	4.5 V (min.)
Output Logic " Low " , " 0 "	0.18 V (max.)	0.25 V (max.)	0.33 V (max.)	0.5 V (max.)
Rise Time (Tr) / Fall Time (Tf) (10 % ⟷ 90 % waveform)	20 nsec (max.)	20 nsec (max.)	12 nsec (max.)	12 nsec (max.)

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 " For example : " C20 " ± 20 ppm over -20°C to +70°C ; " 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 Load	15 pF
Start-up Time	1.0 msec. (typ.) ; 5.0 msec. (max.)
Duty Cycle	50% ± 5%
Output Enable / Disable Function	70% of V_{DD} (min.) to enable output.
	30% of V_{DD} (max.) to disable output.
	Disable current : 3 uA (max.) for OE ≦ 0.3V
Storage Temperature	-55°C to +125°C
Aging at Ta=+25ºC	± 3 ppm (max.) first year ; ± 2 ppm (max.) per year thereafter

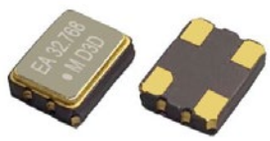
Ultra Low Current Crystal Oscillators [32.768 KHz]

CMOS Output

HEA _ _	32.768 KHz Ultra Low Current Consumption	SMD	CMOS	15pF	1.8 V	2.5 V	3.3 V

Features

- Suitable for wearable devices, clock counting use.
- Small package size for 2.5 x 2.0 mm
- If you require products with lower current consumption, please contact Mercury.



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

Type	" HEA " series [SMD Type]			
Model	**HEA22**	**HEA32**	**HEA53**	**HEA57**
Dimensions	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 Output	32.768 KHz		
Supply Voltage	1.8 V ± 10% Voltage code is " 18 "	2.5 V ± 10% Voltage code is " 25 "	3.3 V ± 10% Voltage code is " 3 "
Current Consumption (32.768 KHz , No Load)	6 uA (typ.) 10 uA (max.)	6 uA (typ.) 10 uA (max.)	6 uA (typ.) 10 uA (max.)
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 (Tr) / Fall Time (Tf) (10 % ⟷ 90 % waveform)	7 nsec (typ.) 20 nsec (max.)	7 nsec (typ.) 20 nsec (max.)	6 nsec (typ.) 20 nsec (max.)

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 " For example : " C20 " ± 20 ppm over -20°C to +70°C ; " 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 Load	15 pF
Start-up Time	5.0 msec. (typ.) ; 10.0 msec. (max.)
Duty Cycle	50% ± 5%
Output Enable / Disable Function	70% of V_{DD} (min.) to enable output.
	30% of V_{DD} (max.) to disable output.
	Disable current : 5 uA (max.) for OE = GND
Storage Temperature	-55°C to +150°C
Aging at Ta=+25ºC	± 3 ppm (max.) first year ; ± 2 ppm (max.) per year thereafter

Low Supply Voltage Crystal Oscillators — CMOS Output

HU _ _	Low Supply Voltage	SMD	CMOS	1.0 V	1.2 V	Min. 0.625 MHz	Max. 50 MHz

Features

- Low 1.0V to 1.2V supply voltage
- Low current consumption
- 2.5 x 2.0 mm small size package

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

Model [Output Logic]	" HU " series [CMOS]			
Type	HU22	HU32	HU53	HU57
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	0.625 ~ 50.0 MHz			

Supply Voltage (V_{DD})	+1.0 V ± 5%	+1.2 V ± 5%
	Voltage code is " 10 "	Voltage code is " 12 "
Current Consumption	1.0 mA (typ.) ; 3.0 mA (max.)	1.3 mA (typ.) ; 3.0 mA (max.)
Current With Output Disable	10 uA (max.)	10 uA (max.)
Output Logic " High " , " 1 "	0.8 V (min.)	0.96 V (min.)
Output Logic " Low " , " 0 "	0.2 V (max.)	0.24 V (max.)
Rise Time (Tr) / Fall Time (Tf)	8.0 nsec. (max.)	6.0 nsec. (max.)
	Measured between 20 % ⟷ 80 % of V_{DD}	

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 " For example : " C20 " ± 20 ppm over -20°C to +70°C ; " 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*	

Supply Voltage vs Freq. Sensitivity	± 1.0 ppm (max.)
Output Load	15 pF
Start-up Time	0.8 msec (typ.) ; 5.0 msec (max.)
Duty Cycle	50% ± 5%
Output Enable / Disable Function on pin1	70% of V_{DD} (min.) to enable output.
	30% of V_{DD} (max.) to disable output.
Enable / Disable Time	Enable : 5.0 msec. (max.)
	Disable : 100 nsec. (max.)
Storage Temperature	-55°C to +150°C
Aging at Ta=+25ºC	± 3 ppm (max.) first year
RMS Jitter [12 kHz ~ 20 MHz]	0.75 ps (typ.)

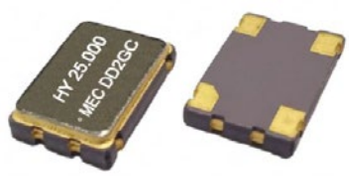
SSB Phase Noise	Offset	10 Hz	100 Hz	1 KHz	10 KHz	100 KHz	1 MHz	5 MHz	20 MHz
25.000MHz [1.0V]	dBc/Hz (typ.)	-75	-107	-128	-138	-141	-149	-153	---
50.000MHz [1.2V]	dBc/Hz (typ.)	-83	-112	-136	-140	-147	-155	-155	-156

Crystal Oscillators [Wide Operating Temperature] CMOS Output

HY _ _	Wide Operating Temperature	SMD	CMOS	1.8V	2.5V	3.3V	Min.	Max.
	Over - 40°C to +125 °C						1.25 MHz	50.0 MHz

Features

- Femtosecond RMS phase jitter. 150 fs typical (12 KHz ~ 5 MHz)
- Superior phase noise: -155 dBc/Hz at 10 KHz and -160 dBc/Hz at 100 KHz offset
- Wide Operating Temperature range from -40 °C to +125 °C

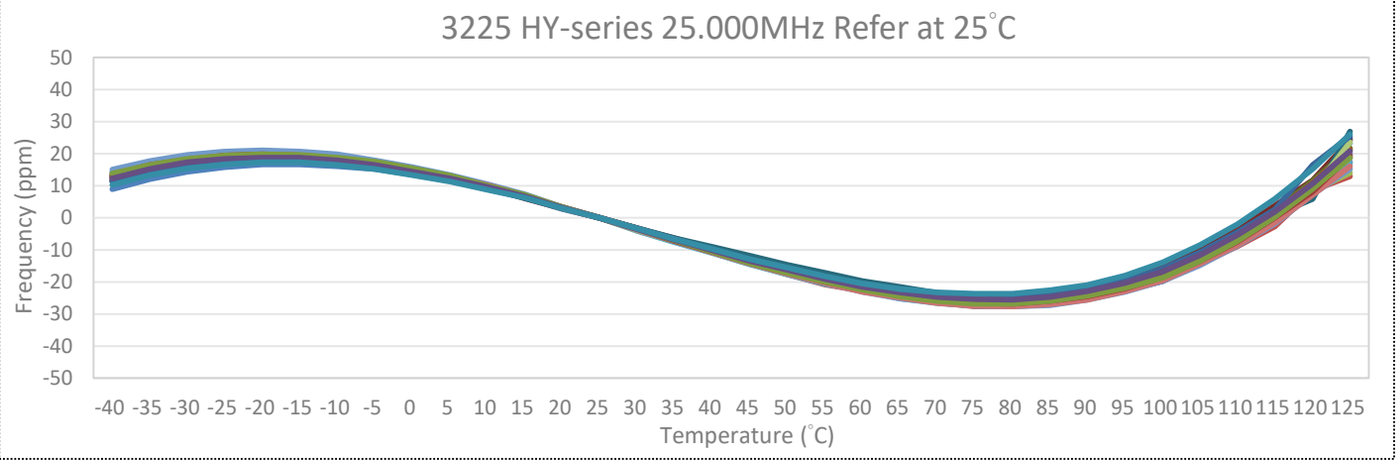


General specifications of all available packages , at Ta=+25°C , CL=15pF

Model [Output Logic]		" HY " series [CMOS]			
Type		HY22	HY32	HY53	HY57
Dimensions		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
Available Frequency Range		1.25 ~ 50.0 MHz			
Supply Voltage (V_{DD})		+1.8 V ± 10%	+2.5 V ± 10%	+3.3 V ± 10%	
Supply Voltage Code		" 18 "	" 25 "	" 3 "	
Current Consumption [15pF load]	1.25 ~ 19.99 MHz	2.0 mA (max.)	3.0 mA (max.)	4.0 mA (max.)	
	20.0 ~ 50.00 MHz	4.0 mA (max.)	5.0 mA (max.)	6.0 mA (max.)	
Frequency Stability Codes		Frequency Stability over	± 25 ppm	± 50 ppm	± 100 ppm
		Car Grade (-40°C to +125°C)	---	*K50*	*K100*
Rise Time (Tr) / Fall Time (Tf)		10 nsec. (max.)			
		Measured between 10% ↔ 90% of waveform (CL = 15pF)			
Output Load		15 pF			
Start-up Time		5.0 msec. (max.)			
Duty Cycle		Standard: 50% ± 10%; Option: 50% ± 5%. Please add "-S" at the end of the part number for ± 5% .			
Output Enable / Disable Function		70% of V_{DD} (min.) to Enable Output.			
		30% of V_{DD} (max.) to Disable Output.			
Phase Jitter (RMS) [26 MHz , 3.3V]		150 fsec (typ.) [12 KHz to 5 MHz integated]			

SSB Phase Noise	Offset	10 Hz	100 Hz	1 KHz	10 KHz	100KHz	1 MHz	5 MHz
[26 MHz , 3.3V]	dBc / Hz (typ.)	-94	-127	-142	-156	-161	-163	-163

Storage Temperature	-65°C to + 150°C
Aging at Ta=+25ºC	± 2 ppm (max.) for first year



Crystal Oscillators [0.625 ~ 60.0 MHz]

CMOS Output

HJN _ _	Ultra Low Jitter	SMD	CMOS	1.8 V	2.5 V	3.3 V	Min. 0.625 MHz	Max. 60 MHz

Features

- The HJN series is Low jitter crystal oscillators.
- Compared with standard oscillator, Mercury's HJN series has much better phase noise and jitter. HJN series with output frequency 49.152MHz has phase jitter 57 fsec (RMS, 12 KHz to 20 MHz) when V_{DD} at 3.3V.

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

Model [Output Logic]	" HJN " series [CMOS]			
Type	**HJN22**	**HJN32**	**HJN53**	**HJN57**
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

Supply Voltage (V_{DD})	1.8 V ± 10% Voltage code is " 18 "	2.5 V ± 10% Voltage code is " 25 "	3.3 V ± 10% Voltage code is " 3 "
Frequency Range	0.625 ~ 50.0 MHz	0.625 ~ 60.0 MHz	0.625 ~ 60.0 MHz
Current Consumption	2 mA (typ.) ; 5 mA (max.)	3 mA (typ.) ; 7 mA (max.)	5 mA (typ.) ; 10 mA (max.)
Current With Output Disable	20 uA (max.)	20 uA (max.)	20 uA (max.)
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 (Tr) / Fall Time (Tf) (10 % ⟷ 90 % waveform)	2.0 nsec. (typ.) 5.0 nsec. (max.)	1.0 nsec. (typ.) 4.0 nsec. (max.)	1.0 nsec. (typ.) 3.0 nsec. (max.)

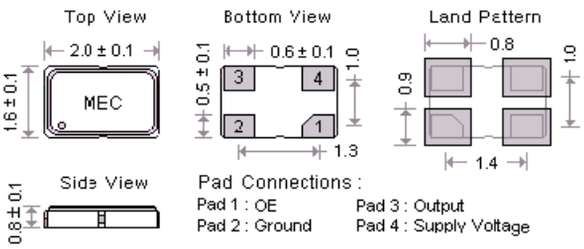
Frequency Stability Codes	Frequency Stability over Operating Temperature Range	± 25 ppm	± 50 ppm	± 100 ppm	If non-standard , please enter the desired stability after the " C " or " F " For example : " C20 " ± 20 ppm over -20°C to +70°C ; " F30 " ± 30 ppm over -40°C to +85°C
	Commercial (*-20°C to +70°C*)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

Output Load	15 pF
Start-up Time	0.4 msec (typ.) ; 1.0 msec (max.)
Duty Cycle	50% ± 5%
Output Enable / Disable Function on pin1	70% of V_{DD} (min.) to enable output.
	30% of V_{DD} (max.) to disable output.
Enable / Disable Time	Enable : 1.0 msec. (max.)
	Disable : 200 nsec. (max.)
Storage Temperature	-55°C to +150°C
Aging at Ta=+25ºC	± 3 ppm (max.) first year
RMS Jitter [12 kHz ~ 20 MHz]	57 fsec (typ.) @ 3.3V , 49.152MHz

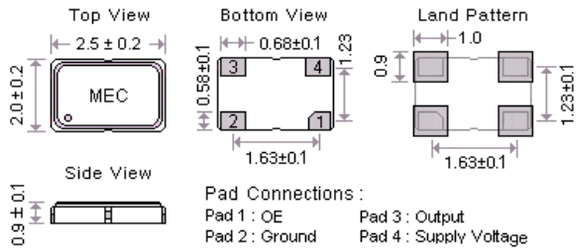
SSB Phase Noise	Offset	10 Hz	100 Hz	1 KHz	10 KHz	100 KHz	1 MHz	5 MHz	20 MHz
24.000MHz [3.3V]	dBc/Hz (typ.)	-78	-111	-142	-154	-167	-171	-171	---
49.152MHz [3.3V]	dBc/Hz (typ.)	-83	-113	-137	-151	-166	-171	-171	-171

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

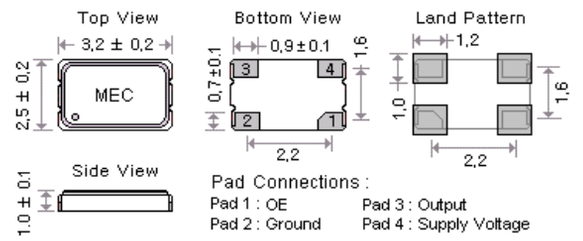
[H21]



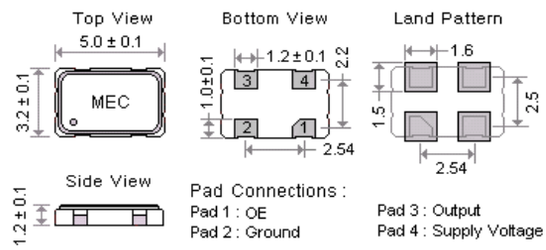
[H22 ; H_22]



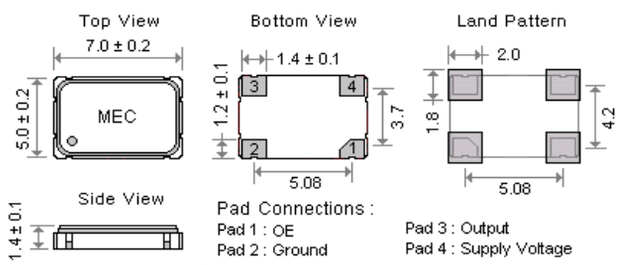
[H32 ; H_32]



[H53 ; H_53]



[SWO ; H_57]



Crystal Oscillators [CMOS] — CMOS Output

Part Number Format and Examples

	[1] Supply Voltage	[2] Holder Type	-	[3] Frequency Stability	[4] OE Function	-	[5] Center Frequency
Examples (1)	3	SWO	-	D	T	-	25.000
(2)	3	HY32	-	K50	T	-	24.000
(3)	18	HA32	-	B	T	-	32.768K
(4)	3	H22	-	E	T	-	49.152

Ex (1) : 3SWO - DT - 25.000 [3.3V , H seires 7050 type , ±25ppm from -40°C to +85°C , OE Function , 25.000MHz]

Ex (2) : 3HY32 - K50T - 24.000 [3.3V , HY seires 3225 type , ±50ppm from -40°C to +125°C , OE Function , 24.000MHz]

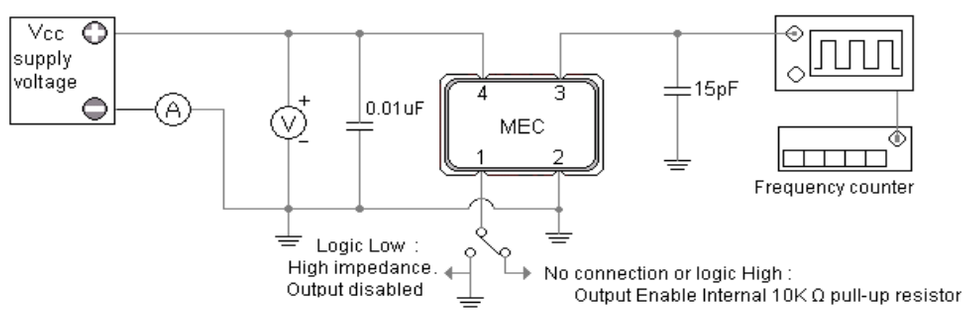
Ex (3) : 18HA32 - BT - 32.768K [1.8V , HA seires 3225 type , ±50ppm from -20°C to +70°C , OE Function , 32.768KHz]

Ex (4) : 3H22 - ET - 49.152 [3.3V , H seires 2520 type , ±50ppm from -40°C to +85°C , OE Function , 49.152 MHz]

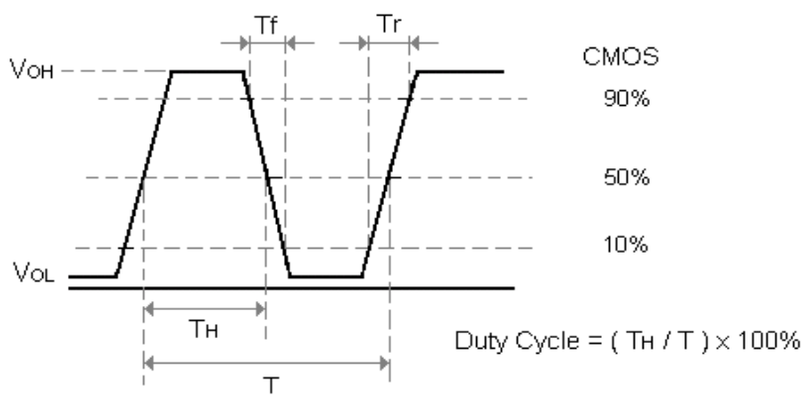
[1]	Supply voltage " 10 " for +1.0V ; " 12 " for +1.2V ; " 18 " for +1.8V ; " 25 " for +2.5V ; " 3 " for +3.3V ; " 5 " for +5.0V	
[2]	Holder Type	
[3]	-20°C ~ 70°C	" A " ± 25ppm ; " B " ± 50ppm ; " C " ± 100ppm ;
		If non-standard please enter the desired stability after " C " , example " C15 " : represents ±15ppm over -20 to +70°C
	-40°C ~ 85°C	" D " ± 25ppm ; " E " ± 50ppm ; " F " ± 100ppm ;
		If non-standard please enter the desired stability after " F " , example " F30 " : represents ± 30ppm over -40 to +85°C
[4]	" T " for OE Function , Leave this space blank if no connection on pad 1.	
[5]	Frequency in MHz	

Test Circuit & Test Waveform

H ; H_ - series CMOS Test Circuit



CMOS Output Waveform



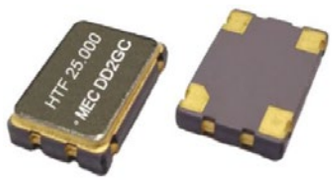
Crystal Oscillators [Programmable Quick Turn]

HTF _ _	Quick - Turn Clock Oscillators	SMD	CMOS	1.8 V	2.5 V	3.3 V	Min. 1.0 MHz	Max. 200 MHz

Features

0.9 ps Phase Jitter (typical)

- Short lead time. From 1 day to 1 week
- Low jitter , RMS jitter is 0.9 ps typical
- Custom frequencies can easily be configured
- 1.8V, 2.5V or 3.3V supply voltages.



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

Model [Output Logic]	" HTF " series [CMOS]				
Type	**HTF21**	**HTF22**	**HTF32**	**HTF53**	**HTF57**
Dimensions	2.0 * 1.6 * 0.8 mm	2.5 * 2.0 * 0.8 mm	3.2 * 2.5 * 1.0 mm	5.0 * 3.2 * 1.2 mm	7.0 * 5.0 * 1.3 mm

Supply Voltage (V_{DD})	+1.8 V ± 5%	+2.5 V ± 10%	+3.3 V ± 10%
Available Frequency Range	1.0 ~ 125.0 MHz	1.0 ~ 200.0 MHz	1.0 ~ 200.0 MHz
Current Consumption	20 mA (typ.) 30 mA (max.)	28 mA (typ.) 35 mA (max.)	30 mA (typ.) 40 mA (max.)
Rise Time (Tr) / Fall Time (Tf) 10% ⟷ 90% Waveform	2.0 ns (typ.) 5.0 ns (max.)	1.4 ns (typ.) 3.0 ns (max.)	1.1 ns (typ.) 3.0 ns (max.)

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. For example : " C20 " ± 20 ppm over -20°C to +70°C ; " 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 Logic " High " , " 1 "	V_{DD} - 0.4V (min.)							
Output Logic " Low " , " 0 "	0.4V (max.)							
Duty Cycle	1 MHz to 150 MHz : 50% ± 5% 151 MHz to 200 MHz : 50% ± 10%							
Output Load	15 pF							
Start-up Time	4.5 msec (typ.) ; 10 msec (max.)							
Storage Temperature	-55°C to +150°C							
Aging at Ta=+25ºC	± 3 ppm (max.) first year ; ± 2 ppm (max.) per year thereafter							
SSB Phase Noise	Offset	10 Hz	100 Hz	1 kHz	10 kHz	100 kHz	1 MHz	10 MHz
125.000 MHz @ 3.3 V	dBc/Hz	-61	-89	-110	-119	-119	-142	-149
RMS Jitter (12kHz ~ 20 MHz)	0.9 psec (typ.)							

Output Enable / Disable Function		
Output Enable / Disable		70% of V_{DD} (min.) to Enable.
		30% of V_{DD} (max.) to Disable.
Pad 1 Options	Power Down Mode (code : PD)	Disable Current : 300 uA (typ.) ; 400 uA (max.)
		Output Enable Time : 4.5 msec. (typ.) ; 10 msec. (max.)
	OE Mode. High Enable (code : OE)	Disable Current : 18 mA (typ.) ; 22 mA (max.)
		Output Enable Time : 10 nsec. (max.)

Crystal Oscillators [Programmable Quick Turn]

HTF _ _	Quick - Turn Clock Oscillators	SMD	CMOS	1.8 V	2.5 V	3.3 V	Min. 1.0 MHz	Max. 200 MHz

0.9 ps Phase Jitter (typical)

Part Number Format and Examples

	[1] Supply Voltage	[2] Holder Type	-	[3] Frequency Stability	[4] T	-	[5] Center Frequency	-	[6] Disable Options
Examples (1)	18	HTF57	-	B	T	-	25.000	-	PD
(2)	25	HTF53	-	C30	T	-	100.000	-	OE
(3)	3	HTF32	-	E	T	-	200.000	-	PD

Ex (1) : 18HTF57 - BT - 25.000 - PD [1.8V , HTF57 type , ±50ppm @ -20°C to +70°C , E/D , 25.000MHz , Power Down Mode]

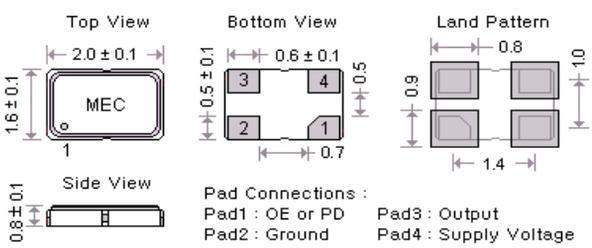
Ex (2) : 25HTF53 - C30T - 100.000 - OE [2.5V , HTF53 type , ±30ppm @ -20°C to +70°C , E/D , 100.000MHz , OE Mode]

Ex (3) : 3HTF32 - ET - 200.000 - PD [3.3V , HTF32 type , ±50ppm @ -40°C to +85°C , E/D , 200.000MHz , Power Down Mode]

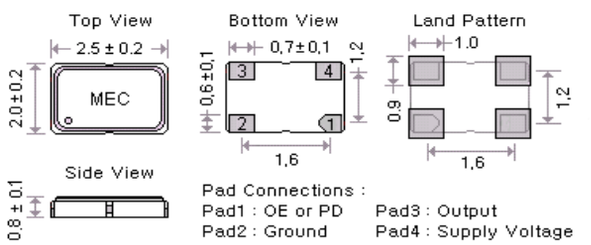
[1]	Supply voltage , " 18 " for +1.8V ; " 25 " for +2.5V ; " 3 " for +3.3V	
[2]	Holder Type	
[3]	-20°C ~ 70°C	" A " ± 25ppm ; " B " ± 50ppm ; " C " ± 100ppm ;
		If non-standard please enter the desired stability after " C " ; example " C15 " : represents ±15ppm over -20 to +70°C
	-40°C ~ 85°C	" D " ± 25ppm ; " E " ± 50ppm ; " F " ± 100ppm ;
		If non-standard please enter the desired stability after " F " ; example " F30 " : represents ± 30ppm over -40 to +85°C
[4]	" T " for Output Enable/Disable Function	
[5]	Frequency in MHz	
[6]	Pad 1 Options , " PD " Power Down Mode ; " OE " OE Mode. High Enable	

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

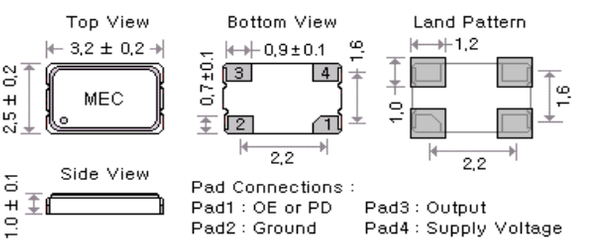
HTF21



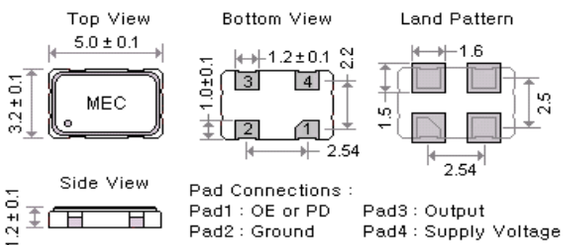
HTF22



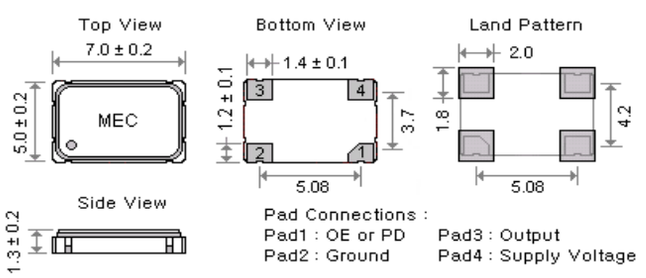
HTF32



HTF53



HTF57



Differential Crystal Oscillators with No PLL

Differential

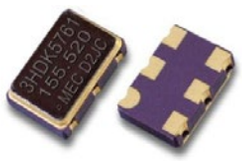
HPK	HDK	HCK	HCLK
LVPECL Differential	**LVDS** Differential	**HCSL** Differential	**LPHCSL** Differential

SMD	1.8 V	2.5 V	3.3 V	Min.	Max.
				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) unit : mm	HPK2261 (2.5 * 2.0 * 1.0) HPK3261 (3.2 * 2.5 * 1.0) HPK5361 (5.0 * 3.2 * 1.2) HPK5761 (7.0 * 5.0 * 1.7)	HDK2261 (2.5 * 2.0 * 1.0) HDK3261 (3.2 * 2.5 * 1.0) HDK5361 (5.0 * 3.2 * 1.2) HDK5761 (7.0 * 5.0 * 1.7)	HCK2261 (2.5 * 2.0 * 1.0) HCK3261 (3.2 * 2.5 * 1.0) HCK5361 (5.0 * 3.2 * 1.2) HCK5761 (7.0 * 5.0 * 1.7)	HCLK2261 (2.5 * 2.0 * 1.0) HCLK3261 (3.2 * 2.5 * 1.0) HCLK5361 (5.0 * 3.2 * 1.2) 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_{DD})	--	+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 (V_{DD} = + 3.3V)	30 mA (typ.) 50 mA (max.)	16 mA (typ.) 27 mA (max.)	17 mA (typ.) 30 mA (max.)	11 mA (typ.) 20 mA (max.)
Output Logic " High " , " 1 "	V_{DD} - 1.03 (min.) V_{DD} - 0.6 (max.)	1.4 V (typ.) 1.6 V (max.)	550 mV (min.) 850 mV (max.)	550 mV (min.) 900 mV (max.)
Output Logic " Low " , " 0 "	V_{DD} - 1.85 (min.) V_{DD} - 1.6 (max.)	0.9 V (min.) 1.1 V (typ.)	-150 mV (min.) 150 mV (max.)	-150 mV (min.) 150 mV (max.)
Rise Time / Fall Time (20%↔80% of waveform)	0.3 nsec. (typ.) 0.6 nsec. (max.)	0.3 nsec. (typ.) 0.5 nsec. (max.)	0.3 nsec. (typ.) 0.6 nsec. (max.)	0.4 nsec. (typ.) 0.7 nsec. (max.)
Output Voltage Swing	595 mV (min.) , 750 mV (typ.) , 930 mV (max.)	250 mV (min.) , 350 mV (typ.) , 450 mV (max.)	400 mV (min.)	550 mV (min.)
Output Load	50 Ω into Vcc - 2V or Thevenin equivalent	100 Ω between output and complimentary output	50 Ω to ground on 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 . For example : " C20 " ± 20 ppm over -20°C to +70°C ; " 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 / Disable Function		
	Enable	When 70% min. of V_{DD} to Enable Output. Enable time : 10 msec (max.)
	Disable	When 30% max. of V_{DD} to Disable Output. Disable current : 10 uA (max.)(OE≦0.3V) , Disable time : 0.2 usec. (max.)

Differential Crystal Oscillators with No PLL

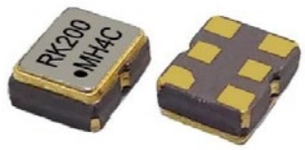
Differential

HPRK	HDRK	HCRK	SMD	1.8 V	2.5 V	3.3 V	Min.	Max.
LVPECL Differential	LVDS Differential	HCSL Differential					10.0 MHz	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)



General specifications , at Ta=+25°C

Model	HPRK	HDRK		HCRK
Output Logic	LVPECL	LVDS		HCSL
Package (dimensions) unit : mm	HPRK2261 (2.5 * 2.0 * 1.0) HPRK3261 (3.2 * 2.5 * 1.0) HPRK5361 (5.0 * 3.2 * 1.2) HPRK5761 (7.0 * 5.0 * 1.7)	HDRK2261 (2.5 * 2.0 * 1.0) HDRK3261 (3.2 * 2.5 * 1.0) HDRK5361 (5.0 * 3.2 * 1.2) HDRK5761 (7.0 * 5.0 * 1.7)		HCRK2261 (2.5 * 2.0 * 1.0) HCRK3261 (3.2 * 2.5 * 1.0) HCRK5361 (5.0 * 3.2 * 1.2) HCRK5761 (7.0 * 5.0 * 1.7)
Available Frequency Range	10 MHz ~ 250 MHz	10 MHz ~ 250 MHz	120 MHz ~ 250 MHz	20 MHz ~ 50 MHz 100 MHz ~ 200 MHz
Supply Voltage (V_{DD})	--	--	+1.8 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%
Current Consumption (V_{DD} = + 3.3V)	32 mA (typ.) 60 mA (max.)	10 mA (typ.) 25 mA (max.)	8 mA (typ.) 16 mA (max.)	17 mA (typ.) 25 mA (max.)
Output Logic " High " , " 1 "	V_{DD} - 1.03 (min.) V_{DD} - 0.6 (max.)	1.4 V (typ.) 1.6 V (max.)	0.8 V (typ.) 1.0 V (max.)	550 mV (min.) 1.0 V (max.)
Output Logic " Low " , " 0 "	V_{DD} - 1.85 (min.) V_{DD} - 1.6 (max.)	0.9 V (min.) 1.1 V (typ.)	0.3 V (min.) 0.5 V (typ.)	-150 mV (min.) 150 mV (max.)
Rise Time / Fall Time (20%↔80% of waveform)	0.3 nsec. (typ.) 0.5 nsec. (max.)	0.2 nsec. (typ.) 0.35 nsec. (max.)	0.2 nsec. (typ.) 0.35 nsec. (max.)	0.2 nsec. (typ.) 0.35 nsec. (max.)
Output Voltage Swing	500 mV (min.) , 750 mV (typ.)	300 mV (min.) , 400 mV (typ.) , 480 mV (max.)	200 mV (min.) , 300 mV (typ.) , 400 mV (max.)	500 mV (min.)
Output Load	50 Ω into Vcc - 2V or Thevenin equivalent	100 Ω between output and complimentary output		50 Ω to ground on each 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 Ta = +25°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 " C " or " F " represents . For example : " C20 " ± 20 ppm over -20°C to +70°C ; " 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 / Disable Function		
	Enable	When 70% min. of V_{DD} to Enable Output. Enable time : 2 msec (max.)
	Disable	When 30% max. of V_{DD} to Disable Output. Disable current : 30 uA (max.)(OE≦0.3V) , Disable time : 0.2 usec. (max.)

Superb phase noise differential oscillators

Differential

HPEK	HDEK	HCEK	SMD	2.5 V	3.3 V	Min.	Max.
LVPECL	LVDS	HCSL				13.5 MHz	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 90 MHz ~ 220 MHz	13.5 MHz ~ 60 MHz 90 MHz ~ 220 MHz	13.5 MHz ~ 60 MHz 90 MHz ~ 220 MHz
Supply Voltage (V_{DD})	---	+ 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_{DD} - 2.0V or Thevenin equivalent	100 Ω between output and complimentary output	50 Ω to ground on each output
Rise Time / Fall Time (20%↔80% of waveform)	0.2 nsec (typ.) 0.4 nsec (max.)	0.2 nsec (typ.) 0.4 nsec (max.)	0.5 nsec (typ.) 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_{DD} - 1.03 (min.) , V_{DD} - 0.88 (max.)	1.4 V (typ.) , 1.6 V (max.)	0.5 V (min.) , 0.9 V (max.)
Output Logic " Low " , " 0 "	V_{DD} - 1.81 (min.) , V_{DD} - 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 Operating Temperature Range	± 25 ppm	± 50 ppm	± 100 ppm	If non-standard , please enter the desired stability after the " C " or " F " represents . For example : " C20 " ± 20 ppm over -20°C to +70°C ; " 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 (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 [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 Function	Enable	70% (min.) of V_{DD} to enable output. Enable time : 5 msec (max.)					
	Disable	30% (max.) of V_{DD} to disable output. Disable current : 10 uA (max.) [OE≦0.3V] , Disable time : 0.2 usec (max.)					

Ultra Low Jitter Differential Oscillator

Differential

HPJK	HDJK	HCJK	SMD	1.8 V	2.5 V	3.3 V	Min.	Max.
LVPECL Differential	LVDS Differential	HCSL Differential					100 MHz	250 MHz

Features

Jitter 50 fsec (typical)

- 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

General specifications , at Ta=+25°C

Model		HPJK	HDJK	HCJK
Output Logic		LVPECL	LVDS	HCSL
Available Frequency Range by Voltage (V_{DD})	1.8 V ± 5%	--	100 MHz ~ 175 MHz	100 MHz ~ 175 MHz
	2.5 V ± 10%	100 MHz ~ 250 MHz	100 MHz ~ 250 MHz	100 MHz ~ 175 MHz
	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_{DD} - 2.0V or Thevenin equivalent	100 Ω between output and complimentary output	50 Ω to ground on each output
Rise Time / Fall Time (20%↔80% of waveform)		0.15 nsec (typ.) 0.4 nsec (max.)	0.15 nsec (typ.) 0.3 nsec (max.)	0.2 nsec (typ.) 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_{DD} - 1.085 (min.) , V_{DD} - 0.86 (max.)	1.4 V (typ.) , 1.6 V (max.)	0.55 V (min.) , 1.0 V (max.)
Output Logic " Low " , " 0 "		V_{DD} - 1.81 (min.) , V_{DD} - 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 Operating Temperature Range	± 25 ppm	± 50 ppm	± 100 ppm	If non-standard , please enter the desired stability after the " C " or " F " represents . For example : " C20 " ± 20 ppm over -20°C to +70°C ; " 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 ; ± 2 ppm (max.) per year thereafter						
RMS Jitter (12 KHz to 20 MHz)	50 fsec (typ.) , 300 fsec (max.) [For 156.250 MHz , LVDS , 3.3V]						
Phase Noise [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_{DD} to enable output. Enable time : 10 msec (max.)					
	Disable	30% (max.) of V_{DD} to disable output. 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

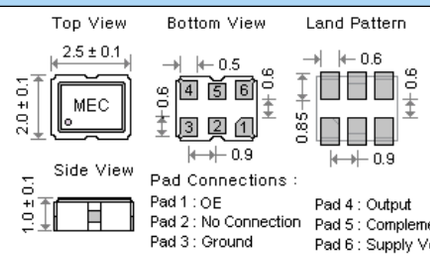
Ex (1) : 25HCK5361 - C15 - 125.000 [+2.5V , HCK type , HCSL output , 5.0 x 3.2 mm size , OE on pad 1 , ±15 ppm from -20°C to 70°C , 125.000MHz]

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]

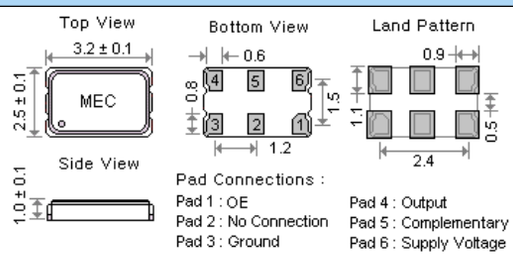
[1]	Supply voltage , " 18 " for +1.8V ; " 25 " for +2.5V ; " 3 " for +3.3V	
[2]	Holder Type	
[3]	" 1 " : OE function on pad # 1 , " 2 " : OE function on pad # 2	
[4]	-20°C ~ 70°C	" A " ± 25ppm ; " B " ± 50ppm ; " C " ± 100ppm ; If non-standard please enter the desired stability after " C " , for example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

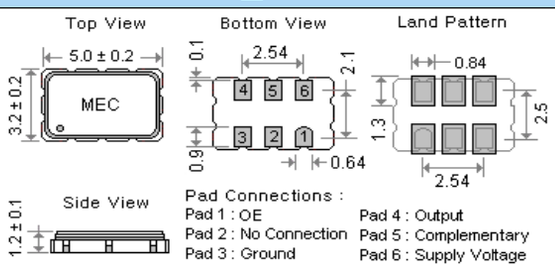
H__K226



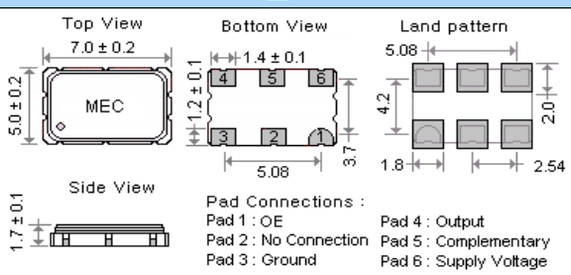
H__K326



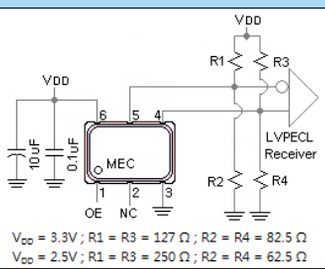
H__K536



H__K576



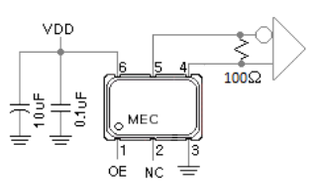
LVPECL Test Circuit



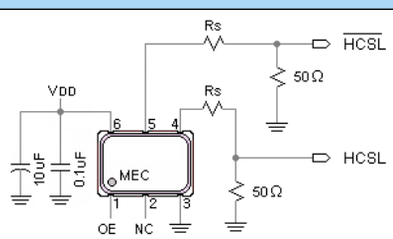
V_{DD} = 3.3V ; R1 = R3 = 127 Ω ; R2 = R4 = 82.5 Ω

V_{DD} = 2.5V ; R1 = R3 = 250 Ω ; R2 = R4 = 62.5 Ω

LVDS Test Circuit

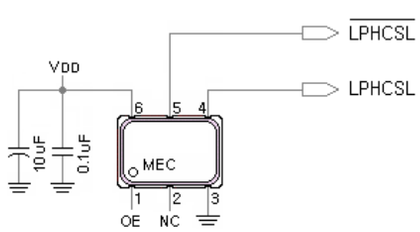


HCSL Test Circuit



Rs = 0 to 33Ω to minmize ringing in application.

LPHCSL Test Circuit for HCLK only

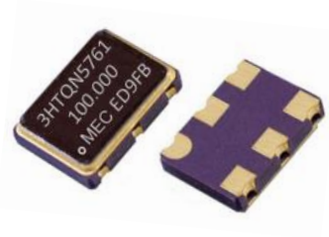


Low Jitter Crystal Oscillators

HTQN	HPQN	HDQN	0.6 ps RMS Jitter	SMD	2.5 V	3.3 V	Min.	Max.
CMOS Waveform	**PECL** Differential	**LVDS** Differential					50 MHz	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_{DD} (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 Vcc - 2V or Thevenin equiralent	100 Ω
Output Logic " High " , " 1 "	90 % V_{DD}	V_{DD} - 1.03 (min.) , V_{DD} - 0.6 (max.)	1.4 V (typ.) , 1.6 V (max.)
Output Logic " Low " , " 0 "	10 % V_{DD}	V_{DD} - 1.85 (min.) , V_{DD} - 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.) (V_{DD} = + 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.) Tr / Tf : 10% ↔ 90% waveform	0.2 nsec. (typ.) , 0.5 nsec. (max.) Tr / Tf : 20% ↔ 80% waveform	0.2 nsec. (Typ.) , 0.5 nsec. (max.) 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 ; ± 2 ppm (max.) per year thereafter	± 3 ppm (max.) first year ; ± 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 . For example : " C20 " ± 20 ppm over -20°C to +70°C ; " 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 / Disable Function		
	Enable	When 70% (min.) of V_{DD} to Enable Output. Enable time : 200 nsec. (max.)
	Disable	When 30% (max.) of V_{DD} to Disable Output. Disable current : 16 mA (max.) , Disable time : 50 nsec. (max.)

Crystal Oscillators

HTQN — **CMOS** Waveform
HPQN — **LVPECL** Differential
HDQN — **LVDS** Differential
0.6 ps RMS Jitter | **SMD** | **2.5 V** | **3.3 V**

Part Number Format and Example

	[1] Supply Voltage	[2] Holder Type	[3] 1 or 2	-	[4] Frequency Stability	-	[5] Center Frequency
Example (1)	25	HPQN576	2	-	D	-	622.080
(2)	3	HPQN326	1	-	A	-	100.000

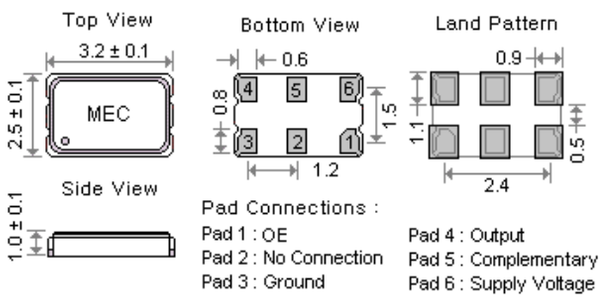
Ex (1) : 25HPQN5762 - D - 622.080 [+2.5V , H_ _ 576 type , LVPECL output , QN series , OE on pad # 2 , ±25 ppm from -40°C to 85°C , 622.080MHz]

Ex (2) : 3HPQN3261 - A - 100.000 [+3.3V , H_ _ 326 type , LVPECL output , QN series , OE on pad # 1 , ±25 ppm from -20°C to 70°C , 100.000MHz]

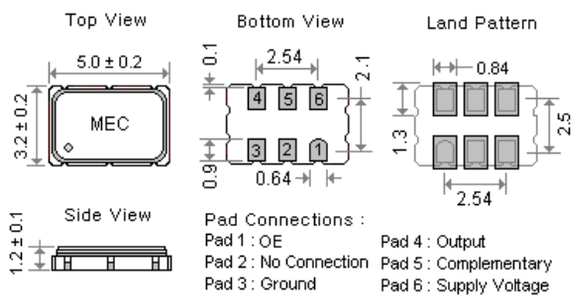
[1]		Supply voltage , " 2.5 " for +2.5V ; " 3 " for +3.3V
[2]		Holder Type
[3]		" 1 " : OE function on pad # 1 , " 2 " : OE function on pad # 2
[4]	-20°C ~ 70°C	" A " ± 25ppm ; " B " ± 50ppm ; " C " ± 100ppm ; If non-standard please enter the desired stability after " C " , for example " C15 " : represents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

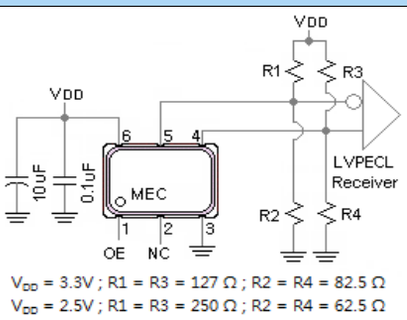
[H_QN326]



[H_QN536]

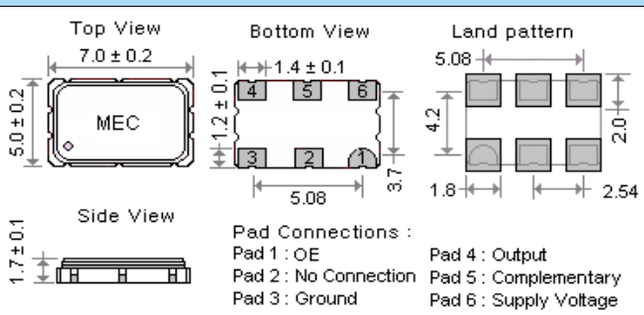


LVPECL Test Circuit

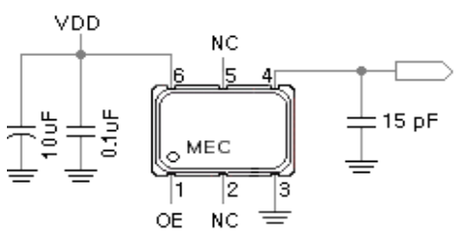


V_{DD} = 3.3V ; R1 = R3 = 127 Ω ; R2 = R4 = 82.5 Ω
V_{DD} = 2.5V ; R1 = R3 = 250 Ω ; R2 = R4 = 62.5 Ω

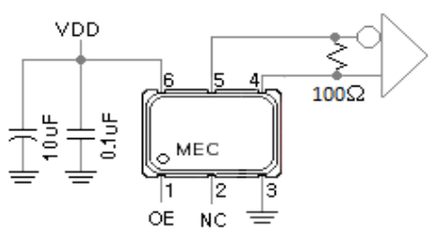
[H_QN576]



CMOS Test Circuit



LVDS Test Circuit

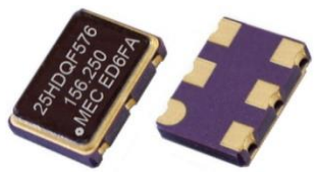


Crystal Oscillators [Quick - Turn Clock Oscillators , 10 ~ 1500 MHz]

HTQF	HPQF	HDQF	Q family / F series	SMD	2.5 V / 3.3 V	Min.	Max.
CMOS Waveform	LVPECL Differential	LVDS Differential				10 MHz	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_{DD} (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 Vcc - 2V or Thevenin equiralent	100 Ω
Output Logic " High " , " 1 "	90 % V_{DD}	V_{DD} - 1.03 (min.) , V_{DD} - 0.6 (max.)	1.4 V (typ.) , 1.6 V (max.)
Output Logic " Low " , " 0 "	10 % V_{DD}	V_{DD} - 1.85 (min.) , V_{DD} - 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.) (V_{DD} = + 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.) Tr / Tf : 10% ↔ 90% waveform	0.2 nsec. (typ.) , 0.5 nsec. (max.) Tr / Tf : 20% ↔ 80% waveform	0.2 nsec. (typ.) , 0.4 nsec. (max.) 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 [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 . For example : " C20 " ± 20 ppm over -20°C to +70°C ; " 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_{DD} (min.) to enable output. (Open connection prohibit.)
	30% of V_{DD} (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	HPQF	HDQF	Q family / F series	SMD	Min.	Max.
CMOS Waveform	LVPECL Differential	LVDS Differential			10 MHz	1,500 MHz

Quick - Turn Clock Oscillators | **0.8 ps Phase Jitter (typical)**

Part Number Format and Example

	[1] Supply Voltage	[2] Holder Type	[3] 1 or 2		[4] Frequency Stability		[5] Center Frequency
Example (1)	3	HTQF536	1	–	B	–	200.000
Example (2)	25	HPQF576	1	–	D	–	622.080
Example (3)	3	HDQF326	1	–	A	–	100.000

Ex (1) : 3HTQF5361 - B - 200.000 [+3.3V , H_ _ 536 type , CMOS output , QF series , OE on pad # 1 , ±50 ppm from -20°C to 70°C , 200.000MHz]

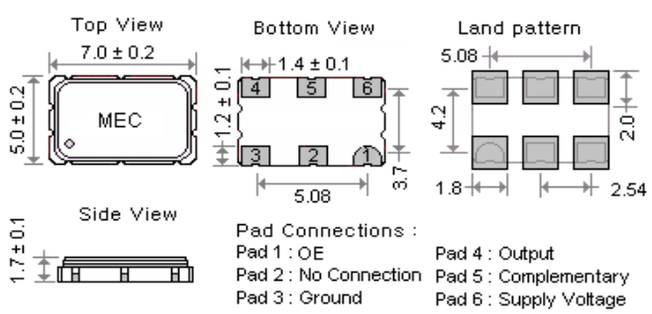
Ex (2) : 25HPQF5761 - D - 622.080 [+2.5V , H_ _ 576 type , LVPECL output , QF series , OE on pad # 1 , ±25 ppm from -40°C to 85°C , 622.080MHz]

Ex (3) : 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]

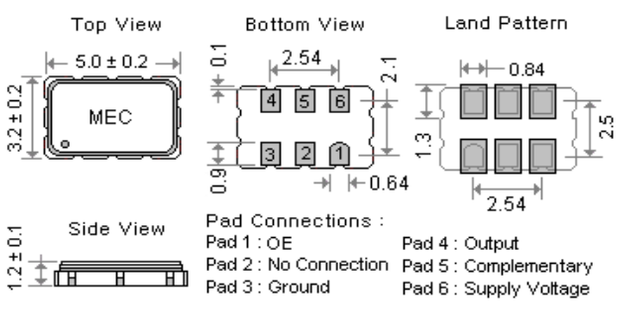
[1]	Supply voltage , " 25 " for +2.5V ; " 3 " for +3.3V	
[2]	Holder Type	
[3]	" 1 " : OE function on pad # 1 ; " 2 " : OE function on pad # 2	
[4]	-20°C ~ 70°C	" A " ± 25ppm ; " B " ± 50ppm ; " C " ± 100ppm ; If non-standard please enter the desired stability after " C " , for example " C15 " : represents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

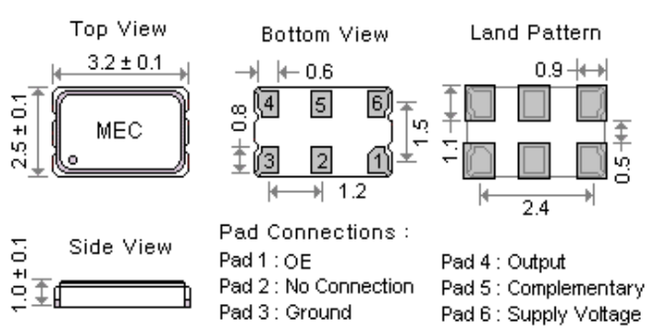
H_QF576



H_QF536



H_QF326



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

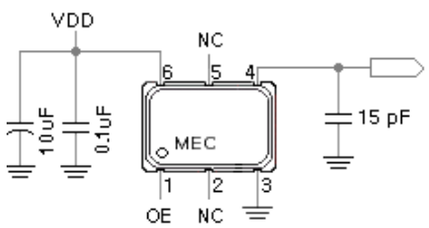
HTQF	HPQF	HDQF	Q family / F series	SMD	Min.	Max.
CMOS Waveform	**LVPECL** Differential	**LVDS** Differential			10 MHz	1,500 MHz

Test Circuits

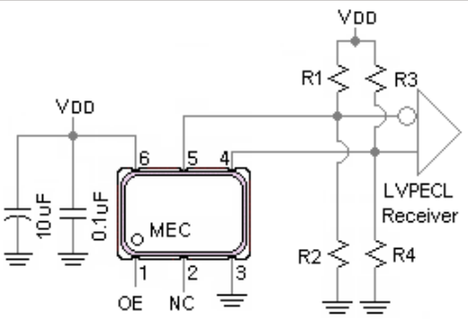
Quick - Turn Clock Oscillators

0.8 ps Phase Jitter (typical)

CMOS Test Circuit



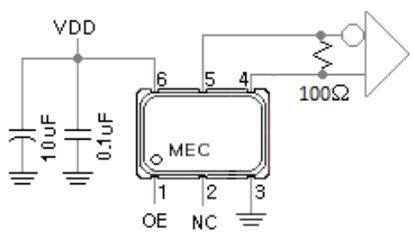
LVPECL Test Circuit



V_{DD} = 3.3V ; R1 = R3 = 127 Ω ; R2 = R4 = 82.5 Ω

V_{DD} = 2.5V ; R1 = R3 = 250 Ω ; R2 = R4 = 62.5 Ω

LVDS Test Circuit

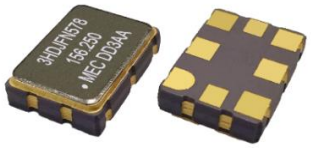


High Frequency Ultra-low Jitter Crystal Oscillators [Quick - Turn Oscillators , 50 ~ 2,100 MHz]

H_JFN	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
CMOS / Differential								

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_{DD})	+ 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	50 Ω into V_{DD} - 2V or Thevenin equivalent	100 Ω	50 Ω to GND	50 Ω to V_{DD}
Output Logic " High " , " 1 "	90% V_{DD} (min.)	V_{DD} - 1.165 V (min.) V_{DD} - 0.8 V (max.)	V_{DD} : 1.4 V (typ.) V_{DD} : 1.6 V (max.)	V_{DD} : 0.66 V (min.) V_{DD} : 1.15 V (max.)	V_{DD} - 0.085 V (min.) V_{DD} = (max.)
Output Logic " Low " , " 0 "	10% V_{DD} (max.)	V_{DD} - 2.0 V (min.) V_{DD} - 1.55 V (max.)	V_{DD} : 1.1 V (typ.) V_{DD} : 0.9 V (min.)	V_{DD} : - 0.15 V (min.) V_{DD} : 0.15 V (max.)	V_{DD} - 0.6 V (min.) V_{DD} - 0.32 V (max.)
Output Voltage Swing	---	595 mV (min.) 930 mV (max.)	250 mV (min.) 450 mV (max.)	450 mV (min.) 700 mV (typ.)	200 mV (min.) 600 mV (max.)
Current Consumption (V_{DD} = + 3.3 V)	75 mA (typ.) 90 mA (max.)	100 mA (typ.) 120 mA (max.)	75 mA (typ.) 90 mA (max.)	94 mA (typ.) 115 mA (max.)	70 mA (typ.) 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.) (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.) (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_{DD} (min.) to enable output.
	20% of V_{DD} (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.

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

H_JFN	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
CMOS / Differential								

Part Number Format and Example

	[1] Supply Voltage	[2] OSC Type	[3] Output Waveform	[4] Series	[5] Package Size	[6] OE Function	–	[7] Frequency Stability	–	[8] Center Frequency
Example (1)	3	H	P	JFN	328	1	–	D	–	250.000
Example (2)	3	H	D	JFN	578	1	–	E	–	644.530

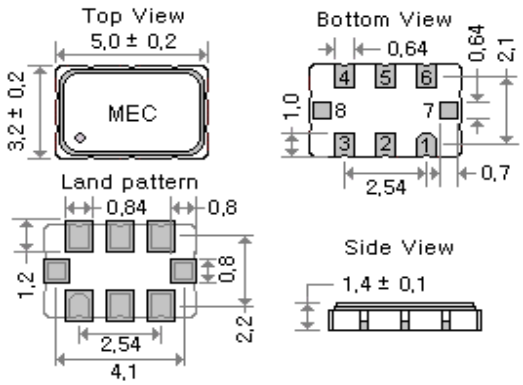
EX (1) : 3HPJFN3281 - D - 250.000 [+3.3V , HPJFN type , PECL output , 3.2x2.5mm 8pad , OE on pad1 , ±25ppm from -40 to +85°C , 250.000 MHz]

EX (2) : 3HDJFN5781 - E - 644.530 [+3.3V , HDJFN type , LVDS output , 7.0x5.0mm 8pad , OE on pad1 , ±50ppm from -40 to +85°C , 644.530 MHz]

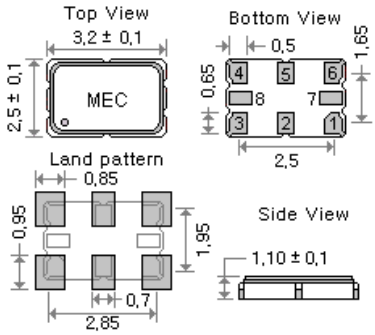
[1]	Supply voltage , " 18 " for +1.8V ; " 25 " for +2.5V ; " 3 " for +3.3V	
[2]	OSC Type , " H " : XO	
[3]	Output Waveform , " T " : CMOS ; " P " : LVPECL ; " D " : LVDS ; " C " : HCSL ; " Q " : CML	
[4]	JFN Series	
[5]	Package Size , " 328 " : 3.2 x 2.5 mm 8pad ; " 538 " : 5.0 x 3.2 mm 8pad ; " 578 " : 7.0 x 5.0 mm 8pad	
[6]	" 1 " : OE function on pad # 1	
[7]	-20°C ~ 70 °C	" A " ± 25ppm ; " B " ± 50ppm ; " C " ± 100ppm
	-40°C ~ 85 °C	" D " ± 25ppm ; " E " ± 50ppm ; " F " ± 100ppm
	-40°C ~ 105 °C	" H " ± 50ppm ; " J " ± 100ppm
[8]	Frequency in MHz	

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

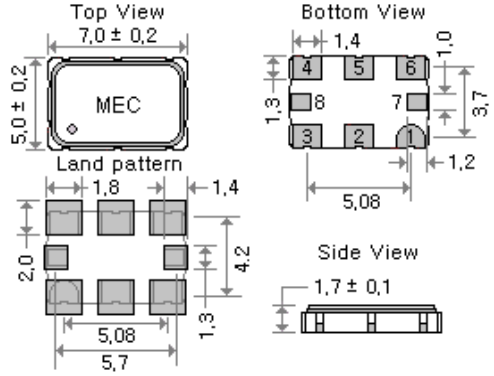
H_JFN538



H_JFN328



H_JFN578



Pad Connections :

Pad 1 : Output Enable

Pad 2 : No Connection

Pad 3 : Ground

Pad 4 : CMOS : Output , Differential : Output

Pad 5 : CMOS : No Connection , Differential : Complementary Output

Pad 6 : Supply Voltage

Pad 7 : Do Not Connect

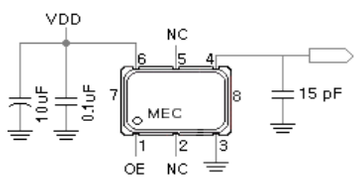
Pad 8 : Do Not Connect

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

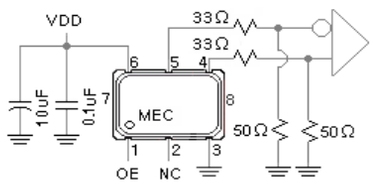
H_JFN	Quick - Turn Clock Oscillators	150 fsec RMS Jitter	SMD	1.8 V	2.5 V	3.3 V	Min. 50 MHz	Max. 2,100 MHz
CMOS / Differential								

Test Circuits

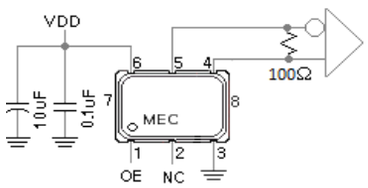
CMOS



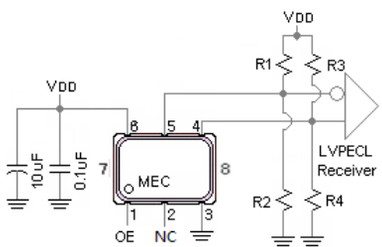
HCSL



LVDS Test Circuits for 2.5V and 3.3V

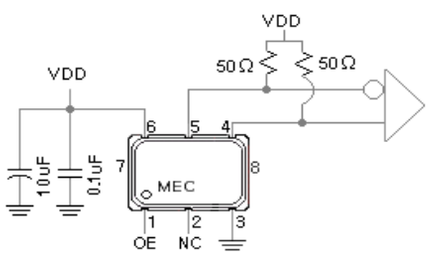


LVPECL

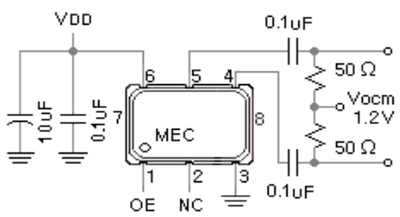


V_{DD} = 3.3V ; R1 = R3 = 127 Ω ; R2 = R4 = 82.5 Ω
V_{DD} = 2.5V ; R1 = R3 = 250 Ω ; R2 = R4 = 62.5 Ω

CML

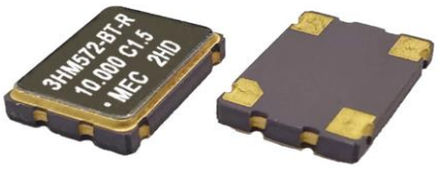


LVDS Test Circuits for 1.8V only (*2)



EMI Reduction Spread Spectrum Clock Oscillators

A Drop-in Replacement Solution For Your EMI / EMC Compliance Problem



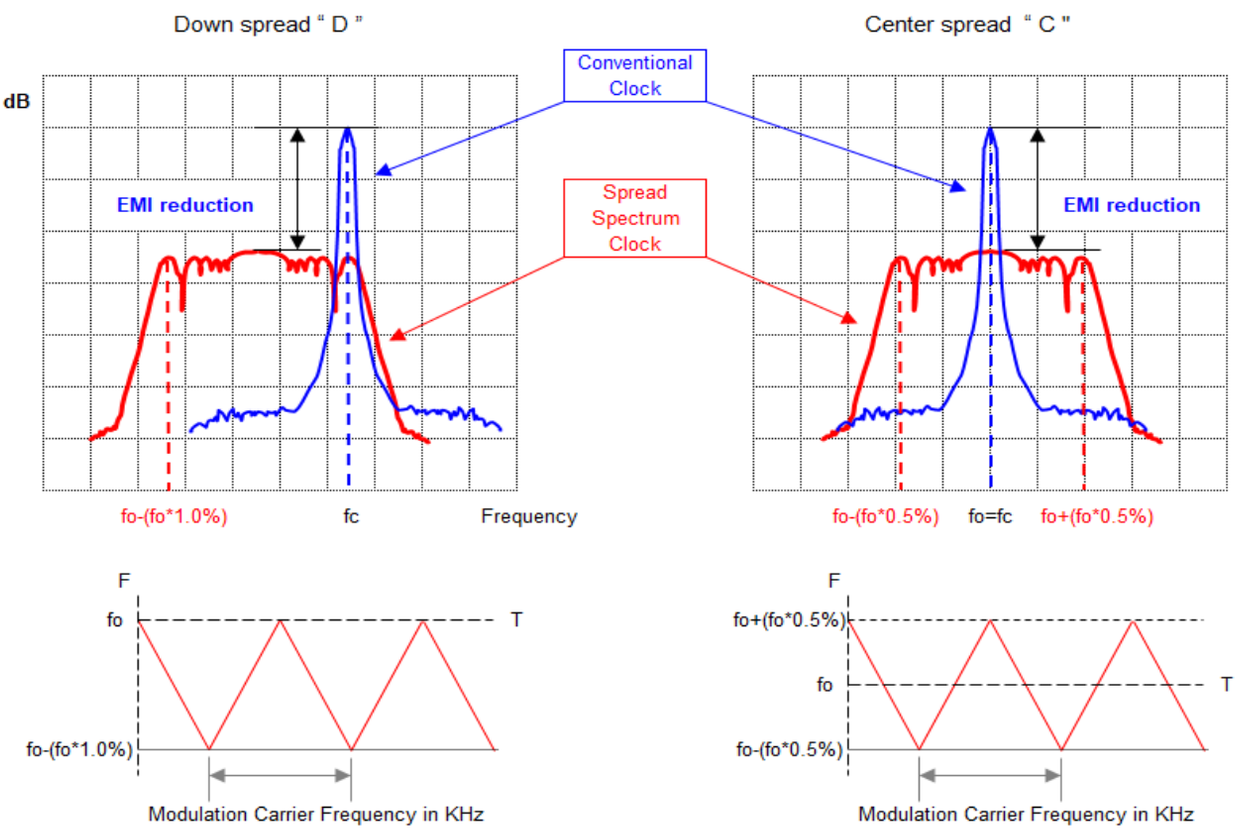
The principle sources of the EMI problems come from the system clocks. Therefore, rather than patching the problem with ferrite beads, EMI filters, ground plane and metal shielding, the most efficient and economical way to reduce the peak radiation energy is to use a spread spectrum clock oscillator .

Compared with conventional clock oscillator , Mercury's HM series spread spectrum (dithered) clock oscillator can reduce EMI as much as 12dB.
The beauty is that it is a drop-in replacement for your existing 7 x 5mm , 5 x 3.2mm clock oscillator.
No need to re-spin the board.

Applications :

- Printers; Multiple function printers (MPCs)
- Digital copiers; PDAs
- Networking; LAN / WAN; Routers
- Storage systems (CD-ROM, VCD, DVD and HDD)
- Scanner; Modems; projectors
- Hand-held ID readers
- Embedded systems; Electrical musical instrument
- Automotive; GPS car navigation systems
- LCD PC monitors / LCD TVs
- ADSL; PCMCIA
- Still Digital cameras (SDCs)

Modulation Types : [Output amplitude (dB) vs frequency span (MHz)]



Spread Spectrum Clock (SSC) :

Unlike a conventional clock, the mode energy of a spread spectrum clock is spread over a wider bandwidth, resulting from the **frequency modulation** technique.

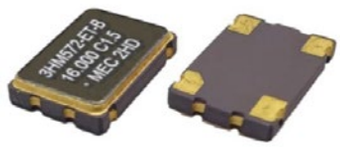
The modulation carrier frequency is in the KHz range which makes the modulation process transparent to the oscillator frequency.

The controlled modulation process can be all on one side of the nominal frequency (**down spread**) or 50% higher and 50% lower (**center spread**) of the nominal frequency. Down spread is preferred if over-clocking is a problem to the system.

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=15pF

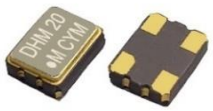
Group	B group	
Available Packages	**HM53** (5.0 * 3.2 * 1.2 mm)	**HM572** (7.0 * 5.0 * 1.4 mm)
Output Waveform	CMOS (square wave)	
Supply Voltage (V_{DD})	+ 2.5 V ± 10%	+ 3.3 V ± 10%
Frequency Range	3.0 MHz ~ 166 MHz	3.0 MHz ~ 200 MHz
Output Logic High " 1 "	2.25 V (min.)	2.97 V (min.)
Output Logic Low " 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 (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. (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_{DD} to Enable Output.		
	Disable	30% (max.) of V_{DD} 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			
	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_{DD})	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 [10% V_{DD} ↔ 90% V_{DD}]	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. (Dither rate)	20.9 KHz (min.) ; 52.4 KHz (max.) 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_{DD} to Enable Output. (Open connection prohibit.)
	Disable	When 30% (max.) of V_{DD} to Disable Output.
	Output Enable Time : 5.0 msec. (max.) / Output Disable Time: 100 nsec. (max.)	
Frequency Stability Code (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

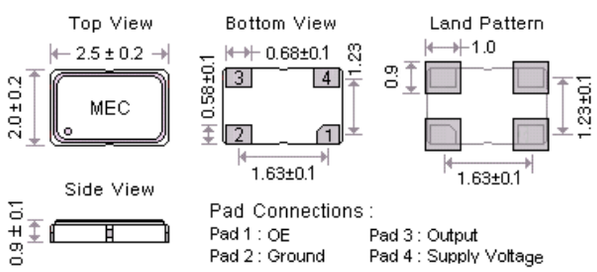
Ex (1) : 25HM53 - FT - 75.000B - C2.0 [+2.5V, HM-series, HM53 type, ±100ppm from -40°C to +85°C, OE Function, 75.000MHz, B Group, 2.0% center spread]

Ex (2) : 18HM32 - ET - 25.000C - D1.0 [+1.8V, HM-series, HM32 type, ±50ppm from -40°C to +85°C, OE Function, 25.000MHz, C Group, 1.0% down spread]

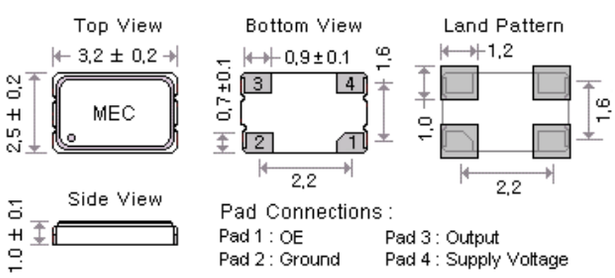
[1]	Supply voltage code : " 18 " for +1.8V , " 25 " for +2.5V , " 3 " for +3.3V	
[2]	Holder Type (HM53 , HM32)	
[3]	-20°C ~ 70 °C	" A " ± 25ppm ; " B " ± 50ppm ; " C " ± 100ppm
	-40°C ~ 85 °C	" D " ± 25ppm ; " E " ± 50ppm ; " F " ± 100ppm
[4]	" T " for OE Function	
[5]	Frequency in MHz	
[6]	Group " B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

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

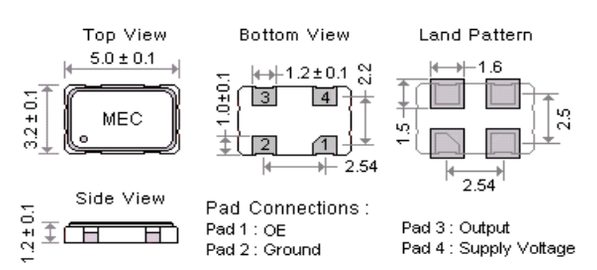
[HM22] For group : **C**



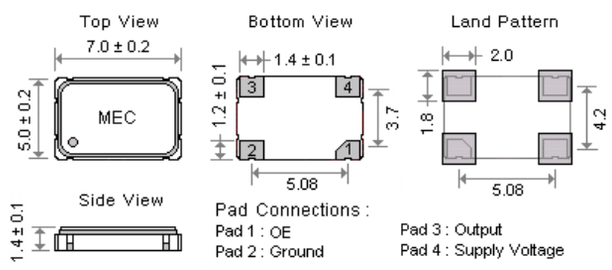
[HM32] For group : **C**



[HM53] For group : **B** **C**



[HM572] For group : **B** **C**

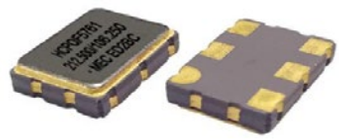


Frequency Switchable Crystal Oscillators [10 ~ 1,500 MHz]

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_{DD} (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_{DD}	V_{DD} - 1.03 (min.) , V_{DD} - 0.6 (max.)	1.4 V (typ.) , 1.6 V (max.)
Output Logic " Low " , " 0 "	10 % V_{DD}	V_{DD} - 1.85 (min.) , V_{DD} - 1.6 (max.)	1.1 V (typ.) , 0.9 V (min.)
Current Consumption (V_{DD} = + 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 (V_{DD} = + 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.) Tr / Tf : 10% ↔ 90% waveform	0.5 nsec. (max.) Tr / Tf : 20% ↔ 80% waveform	0.4 nsec. (max.) 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 . For example : " C20 " ± 20 ppm over -20°C to +70°C ; " 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_{DD} (min.) to enable output. (Open connection prohibit.)				
	30% of V_{DD} (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) When FSEL = 1 (V_{DD}) , Output frequency is Freq.2 (f 2)				Default FSEL pin has internal pull-up resistor
FSEL on Pad 2	70% of V_{DD} (min.) For FSEL = 1 , Output frequency is Freq.2 (f2)				
	30% of V_{DD} (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	Q family	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
CMOS / Differential	F series								

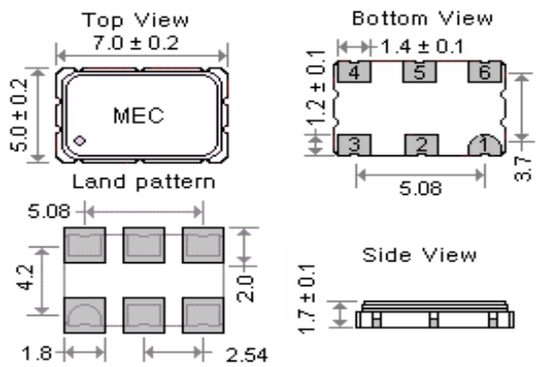
Part Number Format and Example

Example : 3HCTQF576 - E - 30.000 / 120.000

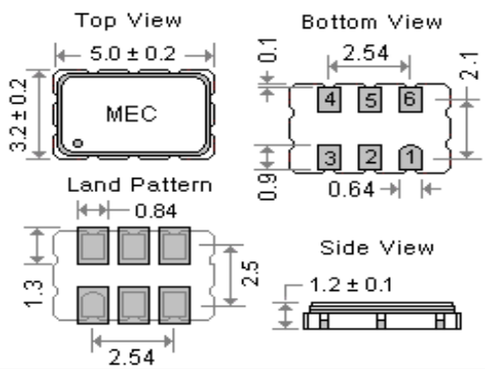
3	HCTQF	576	-	E	-	30.000	/	120.000
Supply Voltage " **3** " for 3.3V " **25** " for 2.5V	HCTQF : CMOS HCPQF : LVPECL HCDQF : LVDS	Package Size " **576** ": 7 x 5 mm " **536** ": 5 x 3.2 mm " **326** ": 3 x 2.5 mm	-	Frequency Stability Code " **E** ": ±50 ppm over -40 to +85°C. Other frequency stabilities are available.	-	Custom Frequency 1 FSEL = 0 (MHz)	/	Custom Frequency 2 FSEL = 1 (MHz)

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

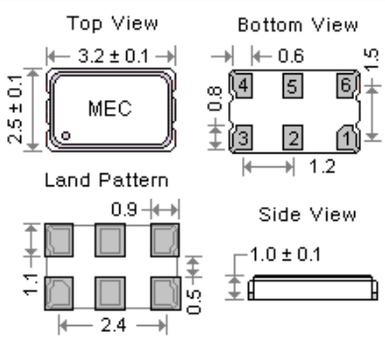
HC_QF576



HC_QF536



HC_QF326



Pad Connections

Pad 1 : OE

Pad 2 : Frequency Selection [FSEL = 0 (f 1) , FSEL =1 (f 2)]

Pad 3 : Ground

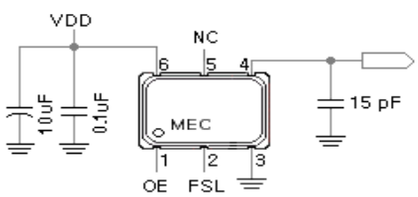
Pad 4 : [CMOS : Output , PECL or LVDS : Differential]

Pad 5 : [CMOS : NC , PECL or LVDS : Complementary] Output

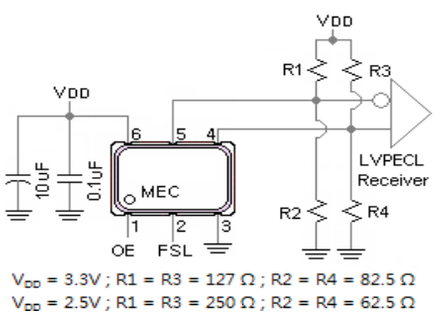
Pad 6 : Supply Voltage

Test Circuits

CMOS

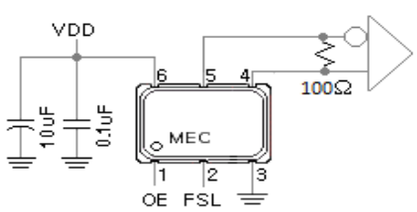


LVPECL



V_{DD} = 3.3V ; R1 = R3 = 127 Ω ; R2 = R4 = 82.5 Ω
V_{DD} = 2.5V ; R1 = R3 = 250 Ω ; R2 = R4 = 62.5 Ω

LVDS



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

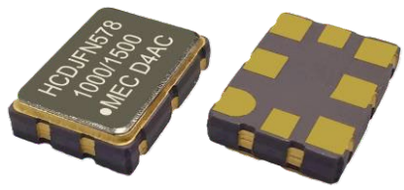
HC_JFN — CMOS / Differential

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, PECL, 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_{DD} (code)	+ 1.8 V ± 5%	--	+ 1.8 V ± 5% (*)	+ 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	50 Ω into V_{DD} - 2V or Thevenin equivalent	100 Ω between output and complimentary output	50 Ω to GND	50 Ω to V_{DD}
Output Logic " High " , " 1 "	90% V_{DD} (min.)	V_{DD} - 1.03 V (min.) V_{DD} - 0.6 V (max.)	1.4 V (typ.) 1.6 V (max.)	V_{DD} : 0.66V (min.) V_{DD} : 1.15V (max.)	V_{DD} - 0.085V (min.) V_{DD} = (max.)
Output Logic " Low " , " 0 "	10% V_{DD} (max.)	V_{DD} - 1.85 V (min.) V_{DD} - 1.6 V (max.)	1.1 V (typ.) 0.9 V (min.)	V_{DD} : - 0.15V (min.) V_{DD} : 0.15V (max.)	V_{DD} - 0.6V (min.) V_{DD} - 0.32V (max.)
Output Voltage Swing	---	595 mV (min.) 930 mV (max.)	250 mV (min.) 450 mV (max.)	450 mV (min.) 700 mV (typ.)	200 mV (min.) 600 mV (max.)
Current Consumption (V_{DD} = + 3.3 V)	75 mA (typ.) 90 mA (max.)	100 mA (typ.) 120 mA (max.)	75 mA (typ.) 90 mA (max.)	80 mA (typ.) 100 mA (max.)	70 mA (typ.) 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.) (10% to 90% Waveform)	0.4 nsec (max.) (20% to 80% Waveform)	0.4 nsec (max.) (20% to 80% Waveform)	0.4 nsec (max.) (20% to 80% Waveform)	0.4 nsec (max.) (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_{DD} min. to logic Level " 1 "
	30% V_{DD} max. to logic Level " 0 "
FS1 Control on Pad 2	70% V_{DD} min. to logic Level " 1 "
	30% V_{DD} max. to logic Level " 0 "
Frequency Select Timing ; t_{FS}	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.

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.	Max.
15 MHz	**2,100 MHz**

150 fs Phase Jitter (typ.)

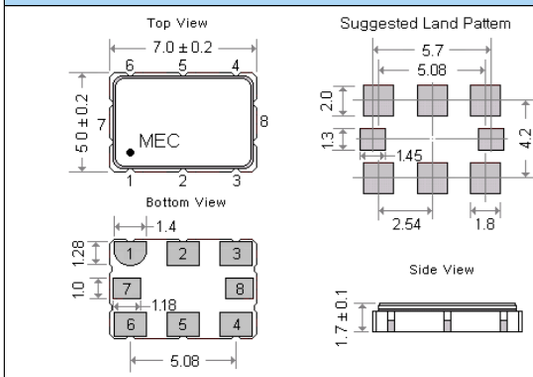
Part Number Format and Example

Example : 3HCTJFN578 - E - 156 / 250 / 622 / 1024

3	HCTJFN	578	-	E	-	156	/	250	/	622	/	1024
Supply Voltage " **3** " for 3.3V " **25** " for 2.5V " **18** " for 1.8V	HC**T**JFN : **CMOS** HC**P**JFN : **PECL** HC**D**JFN : **LVDS** HC**C**JFN : **HCSL** HC**Q**JFN : **CML**	Package Size " **578** " (7.0 * 5.0 mm) 8pad	-	Freq. Stability Code **E** : ±50 ppm over -40 to +85℃ Other temperature stabilities are available.	-	156.250 Freq. 1 (MHz)	/	250.000 Freq. 2 (MHz)	/	622.080 Freq. 3 (MHz)	/	1024.00 Freq. 4 (MHz)

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

HC_JFN578



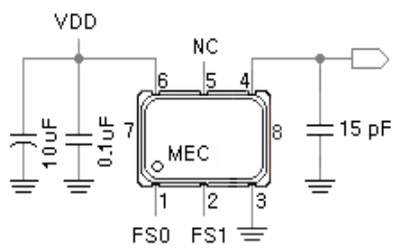
Pad Connection :
Pad 1 : FS0 Control
Pad 2 : FS1 Control
Pad 3 : Ground
Pad 4 : CMOS : Output
Differential : Output
Pad 5 : CMOS : No Used For CMOS
Differential : Complementary Output
Pad 6 : Supply Voltage
Pad 7 : Do Not Connect
Pad 8 : Do Not Connect

Frequency selection configurations

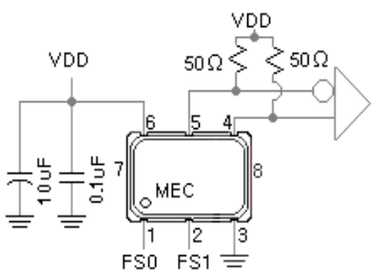
FS1	FS0	Freq. output
0	0	Freq. 1
0	1	Freq. 2
1	0	Freq. 3
1	1	Freq. 4

Table 1

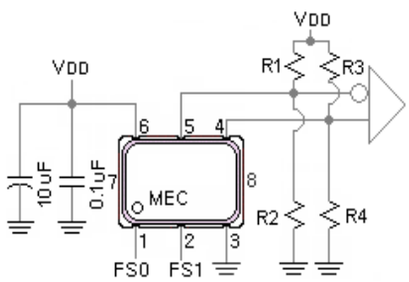
CMOS Test Circuits



CML Test Circuits

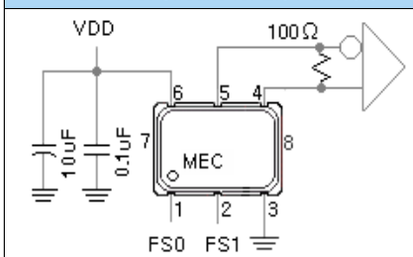


LVPECL Test Circuits

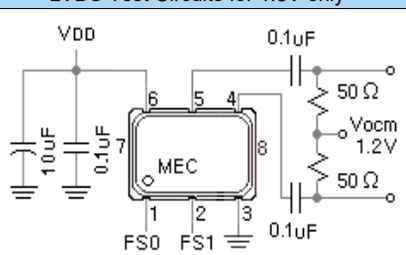


V_{DD} = 3.3 V : R1 = R3 = 127 Ω ; R2 = R4 = 82.5 Ω
V_{DD} = 2.5 V : R1 = R3 = 250 Ω ; R2 = R4 = 62.5 Ω

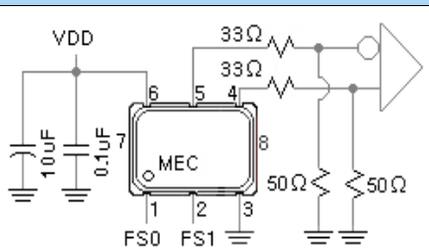
LVDS Test Circuits for 2.5V and 3.3V



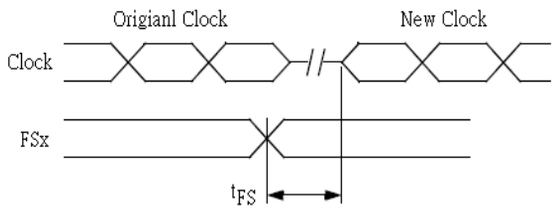
LVDS Test Circuits for 1.8V only (*)



HCSL Test Circuits



Frequency Select Timing



Oscillators

True Sine Wave Clock Oscillators [HS series]

HS _ _	True Sine Wave	Thru-Hole	3.3V	5.0V	Min. 10 MHz	Max. 160 MHz

Features

- High purity and low total harmonic distortion. Ideal for audio modulation applications.
- For VCXOs with a Sine Wave output, please refer to "GS" series

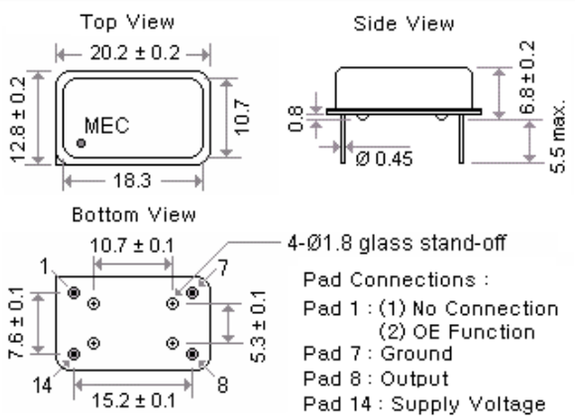
General specifications of all available packages , at Ta=+25°C

Model	" HS " series			
Package Dimensionss , unit : mm	Thru - Hole **HS14** (20.2 * 12.8 * 6.8)			Gull - Wing **HS24** (20.2 * 12.8 * 7.8)
Output Waveform	True Sine Wave			
Output Load	50Ω. (Internally AC coupled)			
Supply Voltage (V_{DD})	+3.3V ± 10%			+5.0V ± 10%
Frequency Range	10.000 ~ 160.000 MHz			10.000 ~ 156.250 MHz
Output Level	Standard: +3.0 dBm (min.) Tolerance: ± 1 dBm Maximum Power: +7 dBm (User to specify)			Standard: +5.0 dBm (min.) Tolerance: ± 1 dBm Maximum Power: +13 dBm (User to specify)
Current Consumption	10 MHz : 9 mA (typ.)			10 MHz : 18 mA (typ.)
	100 MHz : 18 mA (typ.)			100 MHz : 34 mA (typ.)
	150 MHz : 19 mA (typ.)			150 MHz : 36 mA (typ.)
Harmonics	< - 30dBc (frequency dependent)			< - 25dBc (frequency dependent)
Start-up Time	5.0 msec. (max.)			
Storage Temperature	-50°C to +125°C			
Aging at Ta=+25°C	± 5 ppm per year (max.)			
Pin 1 option	OE Function ; No OE Function option			
Output Enable / Disable Function (OE Function)	70% of V_{DD} (min.) to enable output.			
	30% of V_{DD} (max.) to disable output.			
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*

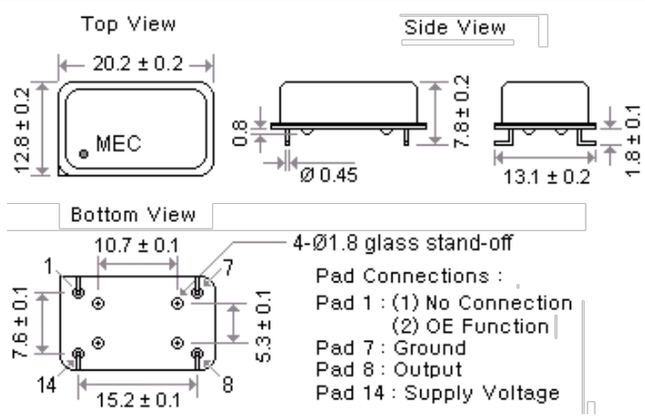
If non-standard please enter the desired stability after the " C " or " F " represents .
For example :
" C20 " : ± 20 ppm over -20°C to +70°C
" F30 " : ± 30 ppm over -40°C to +85°C

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

[HS14]



[HS24]



True Sine Wave Clock Oscillators [HS series]

Part Number Format and Example

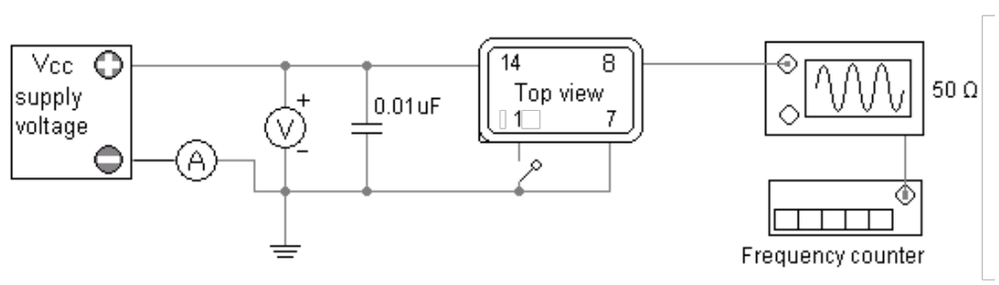
[1]	[2]		[3]	[4]		[5]		[6]
Supply Voltage	Holder Type	–	Frequency Stability	Pin 1 option	–	Center Frequency	–	Output Power [HS series only]
Example	3	HS14	–	A		–	100.000	–	5
	5	HS24	–	D	**T**	–	24.000	–	10

Ex(1) : 3HS14 - A - 100.000 - 5 [+3.3V , True Sine wave , ±25ppm from -20°C to 70°C , No OE Function , 100.000MHz , Output power is 5dBm ±1dB]

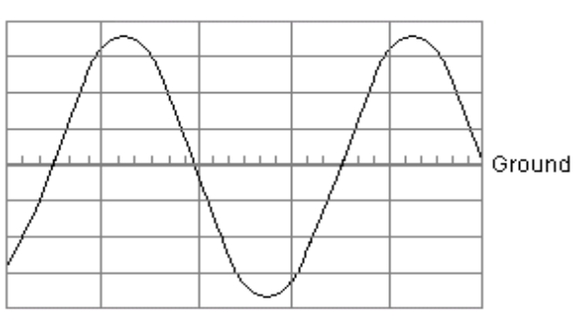
Ex(2) : 5HS24 - DT - 24.000 - 10 [+5.0V , True Sine wave , ±25ppm from -40°C to 85°C , OE Function , 24.000MHz , Output power is 10dBm ±1dB]

[1]	Supply voltage , " 3 " for +3.3V ; " 5 " for +5.0V	
[2]	Holder Type	
[3]	-20°C ~ 70°C	" A " ± 25ppm ; " B " ± 50ppm ; " C " ± 100ppm ; 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 ; If non-standard please enter the desired stability after " F " , for example " F20 " : represents ±20ppm over -40 to +85°C
[4]	" T " for Pin 1 option , Leave this space blank if no connection on pad 1.	
[5]	Frequency in MHz	
[6]	Output power in dBm	

HS - series test circuit



True Sine Waveform



Mercury Crystal Oscillator Products Lineup

General VCXOs Selection Guide [Square Wave Output]				
Output Wave Output Logic	Product Series	Supply Voltage	Frequency Range	Product Description / Features
CMOS	G (SMD)	1.8 V / 3.3 V	1.25 ~ 50 MHz	General purpose VCXOs.
	G (Dip)			
	GTQN	2.5 V / 3.3 V	10 ~ 250 MHz	0.6 psec Phase Jitter (typ.)
	GTQF	2.5 V / 3.3 V	10 ~ 250 MHz	1.2 psec Phase Jitter (typ.)
	GCTQF	2.5 V / 3.3 V	10 ~ 250 MHz	Frequency Switchable , 1.5 psec Phase Jitter (typ.)
	GTJFN	1.8 V / 2.5 V / 3.3 V	15 ~ 250 MHz	150 fsec Phase Jitter (typ.)
PECL	GPQN	2.5 V / 3.3 V	10 ~ 1,500 MHz	0.6 psec Phase Jitter (typ.)
	GPQF	2.5 V / 3.3 V	10 ~ 1,500 MHz	1.2 psec Phase Jitter (typ.)
	GCPQF	2.5 V / 3.3 V	10 ~ 1,500 MHz	Frequency Switchable , 1.5 psec Phase Jitter (typ.)
	GPJFN	2.5 V / 3.3 V	15 ~ 2,100 MHz	150 fsec Phase Jitter (typ.)
LVDS	GDQN	2.5 V / 3.3 V	10 ~ 1,500 MHz	0.6 psec Phase Jitter (typ.)
	GDQF	2.5 V / 3.3 V	10 ~ 1,500 MHz	1.2 psec Phase Jitter (typ.)
	GCDQF	2.5 V / 3.3 V	10 ~ 1,500 MHz	Frequency Switchable , 1.5 psec Phase Jitter (typ.)
	GDJFN	1.8 V / 2.5 V / 3.3 V	15 ~ 2,100 MHz	150 fsec Phase Jitter (typ.)
CML	GQJFN	1.8 V / 2.5 V / 3.3 V	15 ~ 2,100 MHz	150 fsec Phase Jitter (typ.)
HCSL	GCJFN	2.5 V / 3.3 V	15 ~ 700 MHz	150 fsec Phase Jitter (typ.)

Frequency Switchable VCXOs [Select f1 or f2 by Toggling Pin 1] [Square Wave Output]				
Output Wave Output Logic	Product Series	Supply Voltage	Frequency Range	Product Description / Features
CMOS	GCTQF	2.5 V / 3.3 V	10 ~ 250 MHz	Switchable output Oscillators , 1.5 psec Phase Jitter (typ.)
PECL	GCPQF	2.5 V / 3.3 V	10 ~ 1,500 MHz	Switchable output Oscillators , 1.5 psec Phase Jitter (typ.)
LVDS	GCDQF	2.5 V / 3.3 V	10 ~ 1,500 MHz	Switchable output Oscillators , 1.5 psec Phase Jitter (typ.)

VCXO " G "	CMOS	Thru-Hole	SMD	1.8 V	3.3 V	Min. 1.25 MHz	Max. 50.0 MHz

Unlike regular clock oscillators that have a fixed output frequency, the output frequency of VCXOs (also known as " frequency modulators ") can be tuned ± 50 ~ ± 200ppm up or down from the nominal frequency, by varying the control voltage on the voltage control pin. A varactor and a voltage variable capacitance tuning diode, is used to achieve this function. Applications include (PLL) phase lock loop, SONET / ATM, set -top boxes, MPEG, audio -video modulations, video game consoles and HDTV sets, ONET, 10GbE, Fibre Channel, wireless repeaters, transponders, HDTV, FPGAs, data acquisition.

General Specifications of " G " series , [TA = +25°C , V_{DD}= at specified voltage , Load : 15 pF]

Model	" G " series		
Output Waveform	CMOS		
Type	SMD Type		Thru - Hole Type
Pads / Pins	6 pads		4 pins
Models (Dimensions) , Unit : mm	**G226** (2.5 * 2.0 * 1.0)	**G576** (7.0 * 5.0 * 1.7)	**G8** (12.8 * 12.8 * 6.3)
	G326 (3.2 * 2.5 * 1.0)	**G536** (5.0 * 3.2 * 1.2)	**G14** (20.2 * 12.8 * 6.8)

Supply Voltage (V_{DD})	+1.8V ± 5%	+3.3V ± 10%
Frequency Range	16.0 MHz ~ 50.0 MHz	1.25 MHz ~ 50.0 MHz
Initial Freq. Accuracy (at 25 °C)	with Vc = 0.9V	with Vc = 1.65V
Output Logic High " 1 "	1.62 V (min.)	2.97 V (min.)
Output Logic Low " 0 "	0.18 V (max.)	0.33 V (max.)
Frequency Deviation Range	Standard : ± 80 ppm (min.)	Standard : ± 80 ppm (min.)
Control Voltage Center and Range	0.9 V ± 0.9 V	1.65 V ± 1.35 V

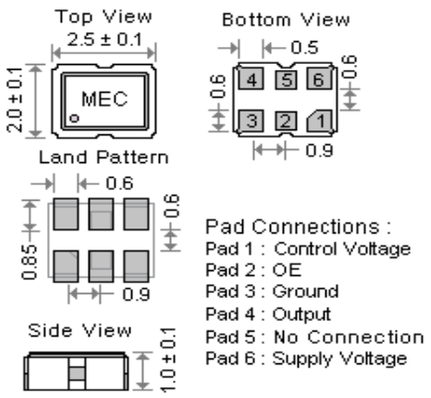
Frequency Stability Codes	Frequency Stability over Operating Temperature Range	± 25 ppm	± 50 ppm	± 100 ppm	If non-standard please enter the desired stability after the " C " or " F "
	Commercial (*-20°C to +70°C*)	*A*	*B*	*C*	For example : " C20 " : ± 20 ppm over -20°C to +70°C ; " F30 " : ± 30 ppm over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

Output Load		15 pF						
Rise Time (Tr) / Fall Time (Tf)		4 nsec.(typ.) ; 6 nsec.(max.) Measured between 10% to 90% of waveform						
Duty Cycle		50% ± 10% (standard) , 50% ± 5% (optional, add " ***- S*** " as suffix to part number)						
RMS Jitter (12 KHz to 20 MHz)		1.0 psec (max.)						
Phase Noise	Offset	10 Hz	100 Hz	1K Hz	10K Hz	100K Hz	1 MHz	
[27MHz , 3.3V]	dBc/Hz (typ.)	-40 dBc/Hz	-104 dBc/Hz	-132 dBc/Hz	-147 dBc/Hz	-152 dBc/Hz	-150 dBc/Hz	
Start-up Time		10 msec. (max.)						
Current Consumption		10 ~ 45 mA (Frequency dependent). For 27 MHz: 10 mA (typ.) at +3.3 V_{DD}						
Linearity		6% (typ.) ; 10% (max.)						
Modulation Bandwidth		10 KHz (min.) Measured at -3 dB						
Input Impedance		5 MΩ (typ.)						
Slope Polarity (Transfer Function)		Monotonic and Positive : Increasing control voltage always increases output frequency ,						
Storage Temperature		-55°C to +125°C						
Aging at Ta = +25℃		± 3 ppm per year (max.)						
Output Enable / Disable Function		Enable	When 70% (min.) of V_{DD} to Enable Output. ; Enable time : 2 msec (max.)					
		Disable	When 30% (max.) of V_{DD} to Disable Output. ; Disable time : 100 nsec (max.)					

Voltage Controlled Crystal Oscillators — CMOS Output

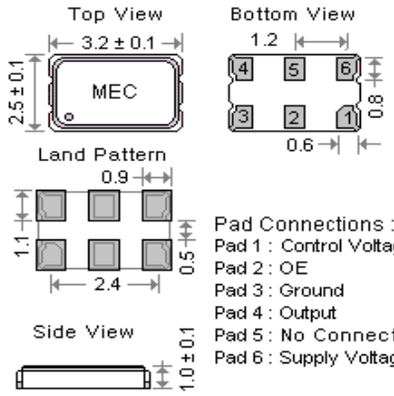
Outline Dimensions (Unit : mm) , Suggested pad Layout for SMDs

[G226]



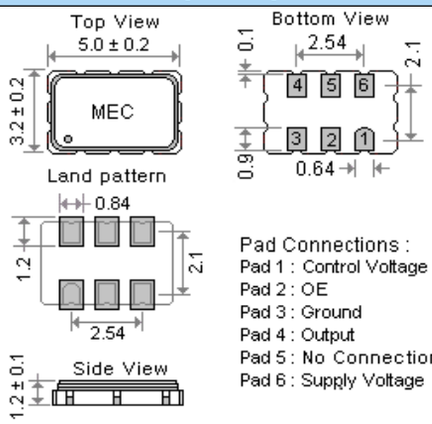
Pad Connections :
Pad 1 : Control Voltage
Pad 2 : OE
Pad 3 : Ground
Pad 4 : Output
Pad 5 : No Connection
Pad 6 : Supply Voltage

[G326]



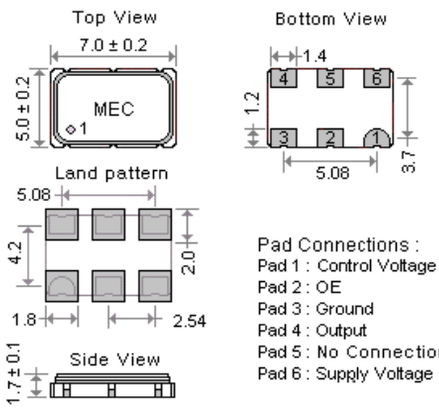
Pad Connections :
Pad 1 : Control Voltage
Pad 2 : OE
Pad 3 : Ground
Pad 4 : Output
Pad 5 : No Connection
Pad 6 : Supply Voltage

[G536]



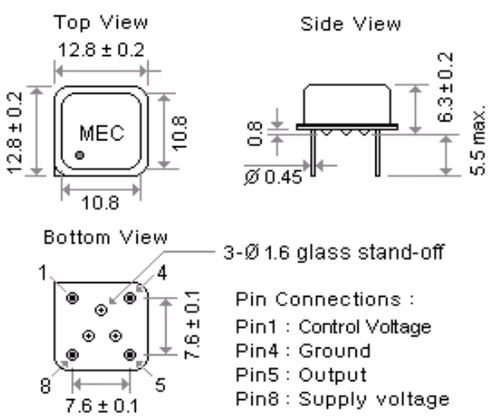
Pad Connections :
Pad 1 : Control Voltage
Pad 2 : OE
Pad 3 : Ground
Pad 4 : Output
Pad 5 : No Connection
Pad 6 : Supply Voltage

[G576]



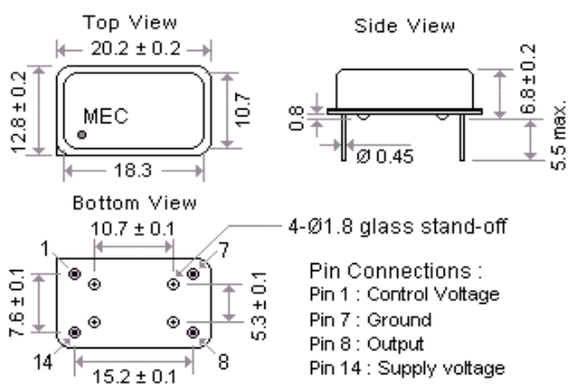
Pad Connections :
Pad 1 : Control Voltage
Pad 2 : OE
Pad 3 : Ground
Pad 4 : Output
Pad 5 : No Connection
Pad 6 : Supply Voltage

[G8]



Pin Connections :
Pin1 : Control Voltage
Pin4 : Ground
Pin5 : Output
Pin8 : Supply voltage

[G14]



Pin Connections :
Pin 1 : Control Voltage
Pin 7 : Ground
Pin 8 : Output
Pin 14 : Supply voltage

Part Number Format and Examples

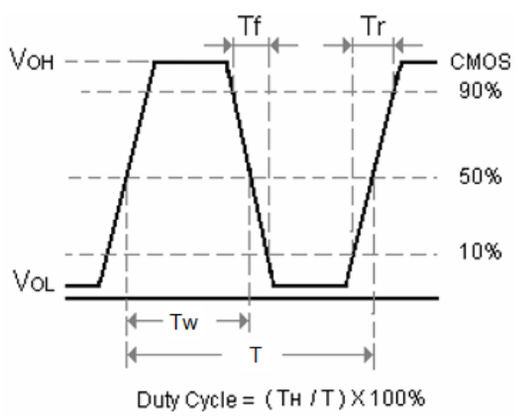
[1]	[2]		[3]		[4]	[5]		[6]
Supply Voltage	Holder Type	–	Frequency Stability	–	Pulling Range	Range Code	–	Center Frequency
Examples (1)	18	G14	–	B	–	100	N	–	35.328
(2)	3	G576	–	D	–	80	T	–	27.000

Ex (1) : 18G14 - B - 100N - 35.328 [+1.8V , full size 4 pin Dip type , ±50ppm (-20°C to 70°C) , pulling : ±100 ppm (min.) , 35.328 MHz]

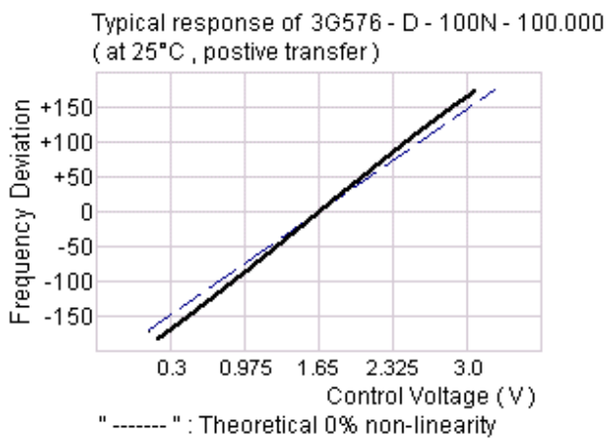
Ex (2) : 3G576 - D - 80T - 27.000 [+3.3V , G576 type , ±25ppm (-40°C to 85°C) , pulling : ±80 ppm (typ.) , 27.000 MHz]

[1]	Supply voltage , " 18 " for +1.8V ; " 3 " for +3.3V		
[2]	Holder Type		
[3]	-20°C ~ 70°C	" A " ± 25ppm ; " B " ± 50ppm ; " C " ± 100ppm ;	
		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 ;	
		If non-standard please enter the desired stability after " F " , for example " F20 ": represents ±20ppm over -40 to +85°C	
[4]	Freqency Pulling Range	3.3V	From ±30ppm ~ ±150ppm , control Voltage range : 0.3V ~ 3.0 ; control voltage center : ± 1.65 V
		5.0V	From ±70ppm ~ ±200ppm , control Voltage range : 0.5V ~ 4.5V ; control voltage center : ± 2.5 V
[5]	Pulling Range Code	" M " stands for maximum ; " N " stands for minimum ; " T " stands for typical (tolerance is ± 20%)	
[6]	Center Frequency in MHz		

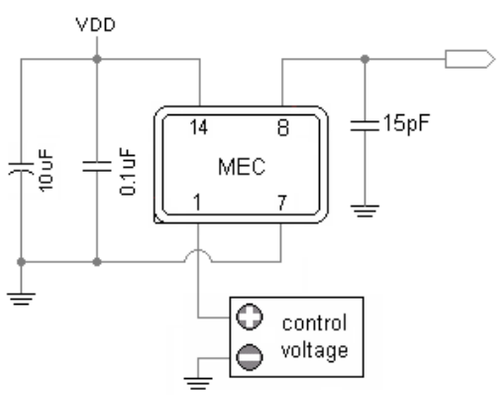
CMOS Output Waveform



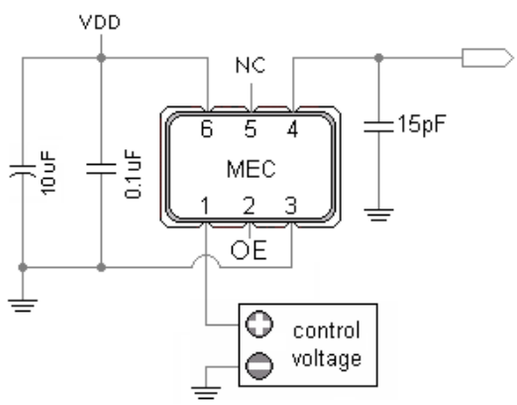
Transfer Function



[Thru - Hole Tpye] CMOS Square Wave Test Circuit



[SMD 6 pads] CMOS Square Wave Test Circuit

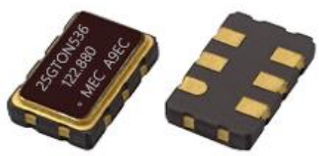


Low Jitter Voltage Controlled Crystal Oscillators — CMOS Output

GTQN	GPQN	GDQN	0.6 ps RMS Jitter	SMD	2.5 V / 3.3 V	Min.	Max.
CMOS Waveform	**PECL** Differential	**LVDS** Differential				10 MHz	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**	**PECL**	**LVDS**
Supply Voltage V_{DD} (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_{DD}-2.0V). See test circuit below.	100 Ω between OUT and OUTN
Output Logic " High " , " 1 "	90 % V_{DD}	V_{DD} - 1.03 (min.) , V_{DD} - 0.6 (max.)	1.4 V (Typ.) , 1.6 V (max.)
Output Logic " Low " , " 0 "	10 % V_{DD}	V_{DD} - 1.85 (min.) , V_{DD} - 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 (V_{DD} = + 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.) Tr / Tf : 10% ↔ 90% waveform	0.5 nsec. (max.) Tr / Tf : 20% ↔ 80% waveform	0.4 nsec. (max.) 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 Over Operating Temperature Range	± 25 ppm	± 50 ppm	± 100 ppm	If non-standard , please enter the desired Stability after the " C " or " F " represents . For example : " C20 " ± 20 ppm over -20°C to +70°C ; " 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_{DD} = +2.5 V ; Vcon Center = +1.25V	V_{DD} = +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_{DD} (min.) to enable output. (Open connection prohibit)	
	30% of V_{DD} (max.) to disable output.	
Output Enable Time / Disable Time	200 nsec. (max.) / 50 nsec. (max.)	

Voltage Controlled Crystal Oscillators

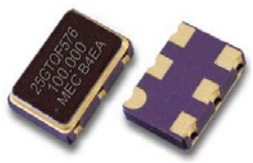
GTQF — **CMOS** Waveform
GPQF — **PECL** Differential
GDQF — **LVDS** Differential
Q family / F series
SMD
2.5 V **3.3 V**
Min. **10 MHz**
Max. **1,500 MHz**

Features

Quick - Turn Clock Oscillators

1.2 pS Phase Jitter (typical)

- The GTQF, GPQF and GDQF Series are members of Mercury's Q-Family Quick-Turn crystal oscillators
- Output frequency range : 10 MHz to 1500 MHz
- Low RMS jitter 1.2 ps typical (12KHz to 20MHz)
- Package size : 3.2x2.5mm , 5.0x3.2mm , 7.0x5.0mm
- Next-day samples for prototypes



General specifications , at Ta=+25°C

Model	GTQF	GPQF	GDQF
Output Logic	**CMOS**	**PECL**	**LVDS**
Supply Voltage V_{DD} (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 VDD - 2V or Thevenin equivalent	100 Ω between OUT and OUTN
Output Logic " High " , " 1 "	90 % V_{DD}	V_{DD} - 1.03 (min.) , V_{DD} - 0.6 (max.)	1.4 V (Typ.) , 1.6 V (max.)
Output Logic " Low " , " 0 "	10 % V_{DD}	V_{DD} - 1.85 (min.) , V_{DD} - 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 (V_{DD} = + 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.) Tr / Tf : 10% ↔ 90% waveform	0.2 nsec. (Typ.) , 0.5 nsec. (max.) Tr / Tf : 20% ↔ 80% waveform	0.2 nsec. (Typ.) , 0.4 nsec. (max.) 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 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 . For example : " C20 " ± 20 ppm over -20°C to +70°C ; " 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]	1.2 psec (typ.)							
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
	491.52 MHz	-61	-86	-100	-105	-105	-126	-137
Control Voltage Function on Pad 1								
Supply Voltage	V_{DD} = +2.5 V ; Vcon Center = +1.25V				V_{DD} = +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_{DD} (min.) to enable output. (Open connection prohibit)							
	30% of V_{DD} (max.) to disable output.							
Output Enable Time / Disable Time	200 nsec. (max.) / 50 nsec.(max.)							

Voltage Controlled Crystal Oscillators [VCXO]

GTQN , GTQF [CMOS Waveform] | GPQN , GPQF [PECL Differential] | GDQN , GDQF [LVDS Differential]

Part Number Format and Example

	[1] Supply Voltage	[2] Holder Type	–	[3] Frequency Stability	–	[4] Pulling Range	[5] Range Code	–	[6] Center Frequency
Examples (1)	3	GTQN576	–	C20	–	150	M	–	200.000
(2)	25	GDQF536	–	D	–	100	N	–	135.000

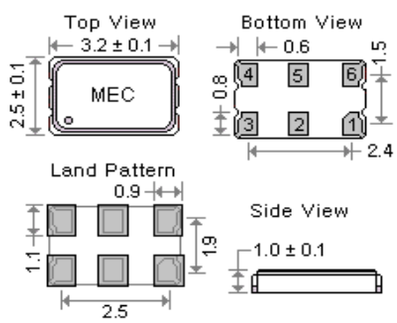
Ex (1) : 3GTQN576 - C20 - 150M - 200.000 [+3.3V , GTQN576 type , ±20ppm (-20°C to 70°C) , Pulling : ±150ppm (max.) , 200.000 MHz]

Ex (2) : 25GDQF536 - D - 100N - 135.000 [+2.5V , GDQF536 type , ±25ppm (-40°C to 85°C) , Pulling : ±100 ppm (min.) , 135.000 MHz]

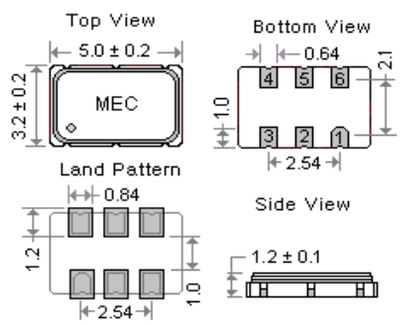
[1]	Supply voltage , " 25 " for +2.5V ; " 3 " for +3.3V	
[2]	Holder Type	
[3]	-20°C ~ 70°C	" A " ± 25ppm ; " B " ± 50ppm ; " C " ± 100ppm ;
		If non-standard please enter the desired stability after " C " , for example " C20 " : represents ±20ppm over -20 to +70°C
	-40°C ~ 85°C	" D " ± 25ppm ; " E " ± 50ppm ; " F " ± 100ppm ;
		If non-standard please enter the desired stability after " F " , for example " F20 " : represents ±20ppm over -40 to +85°C
[4]	Freqency Pulling Range	
[5]	Pulling Range Code	" M " stands for maximum ; " N " stands for minimum ; " T " stands for typical (tolerance is ± 20%)
[6]	Center Frequency in MHz	

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

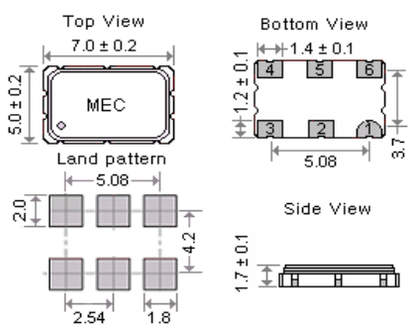
G_QN326 , G_QF326



G_QN536 , G_QF536



G_QN576 , G_QF576

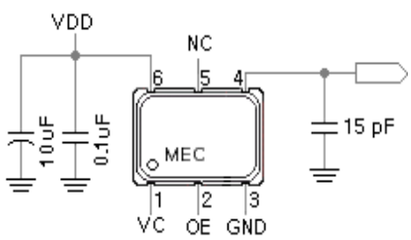


Pad Connections :

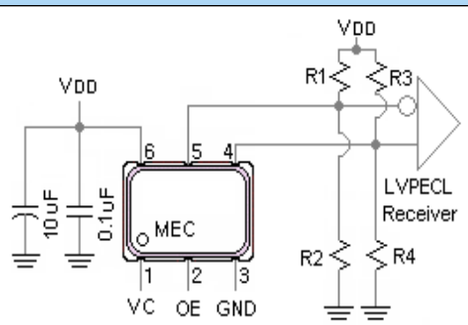
Pad 1 : VCXO	**Pad 2** : OE: High Enable	**Pad 3** : Ground
Pad 4 : [CMOS : Output , PECL or LVDS : Differential]	**Pad 5** : [CMOS : NC , PECL or LVDS : Complementary]	**Pad 6** : Supply Voltage

Test Circuits and Output Waveforms

CMOS Test Circuit



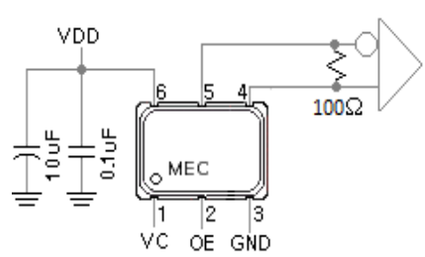
PECL Test Circuit



V_{DD} = 3.3V ; R1 = R3 = 127 Ω ; R2 = R4 = 82.5 Ω

V_{DD} = 2.5V ; R1 = R3 = 250 Ω ; R2 = R4 = 62.5 Ω

LVDS Test Circuit



Switchable Output Crystal Oscillators

GCTQF	GCPQF	GCDQF	Frequency Switchable	SMD	2.5 V	3.3 V	Min.	Max.
CMOS Waveform	**PECL** Differential	**LVDS** Differential					10 MHz	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**	**PECL**	**LVDS**
Supply Voltage V_{DD} (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_{DD}	V_{DD} - 1.03 (min.) , V_{DD} - 0.6 (max.)	1.4 V (Typ.) , 1.6 V (max.)
Output Logic " Low " , " 0 "	10 % V_{DD}	V_{DD} - 1.85 (min.) , V_{DD} - 1.6 (max.)	1.1 V (Typ.) , 0.9 V (min.)
Current Consumption (V_{DD} : + 2.5 V)	10 ~ 100 MHz : 30 mA (max.) 101 ~ 250 MHz : 40 mA (max.)	10 ~ 600 MHz : 45 mA (max.) 601 ~ 1,500 MHz : 55 mA (max.)	10 ~ 600 MHz : 30 mA (max.) 601 ~ 1,500 MHz : 35 mA (max.)
Current Consumption (V_{DD} : + 3.3 V)	10 ~ 100 MHz : 35 mA (max.) 101 ~ 250 MHz : 40 mA (max.)	10 ~ 600 MHz : 50 mA (max.) 601 ~ 1,500 MHz : 60 mA (max.)	10 ~ 600 MHz : 35 mA (max.) 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.) Tr / Tf : 10% ↔ 90% waveform	0.5 nsec. (max.) Tr / Tf : 20% ↔ 80% waveform	0.4 nsec. (max.) 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 . For example : " C20 " ± 20 ppm over -20°C to +70°C ; " 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_{DD} = +2.5 V ; Vcon Center = +1.25V			V_{DD} = +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_{DD} (min.) For FSEL = 1 , Output frequency is Freq.2 (f2)				
	30% of V_{DD} (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	GCPQF	GCDQF	Frequency Switchable	SMD	2.5 V	3.3 V	Min.	Max.
CMOS Waveform	PECL Differential	LVDS Differential					10 MHz	1,500 MHz

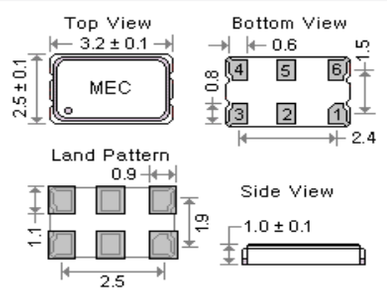
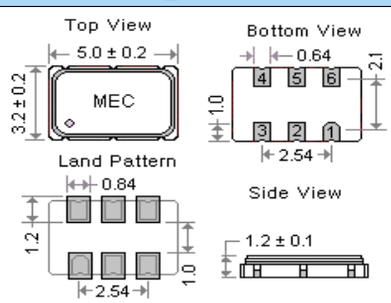
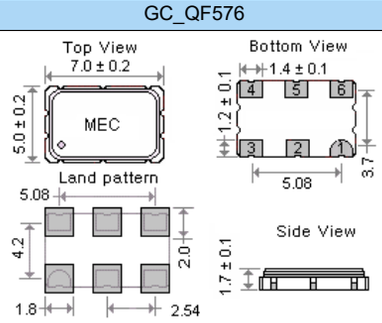
Part Number Format and Example

Quick - Turn Clock Oscillators

Example : 3GCTQF576 - E - 80N - 30.000 / 120.000

3	GCTQN	576	-	E	-	80N	-	30.000	/	120.000
Supply Voltage " **3** " for 3.3V " **25** " for 2.5V	GCTQF : CMOS GCPQF : PECL GCDQF : LVDS	Package Size " **576** ": 7 x 5 mm " **536** ": 5 x 3.2 mm " **326** ": 3 x 2.5 mm	-	Frequency Stability Code " **E** ": ±50 ppm over -40 to +85°C. Other frequency stabilities are available.	-	±80 ppm (min.) frequency pulling range.	-	Custom Frequency 1 FSEL = 0 (MHz)	-	Custom Frequency 2 FSEL = 1 (MHz)

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

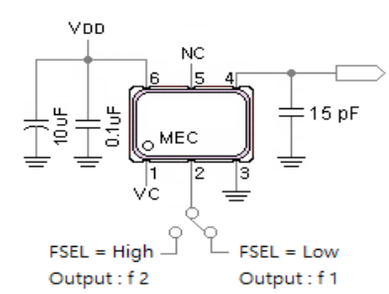
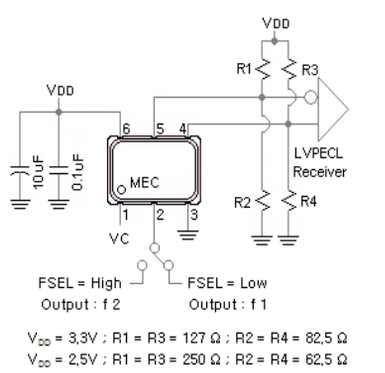
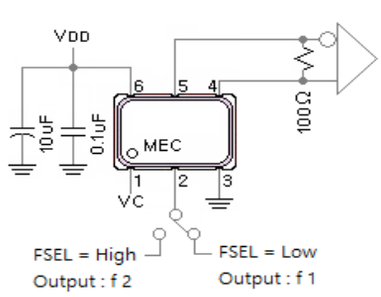
GC_QF326	GC_QF536	GC_QF576
		

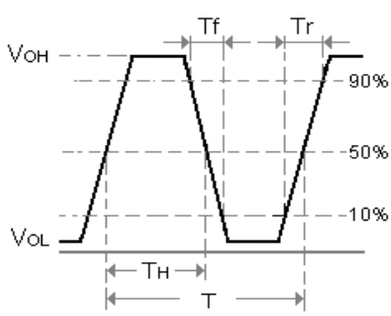
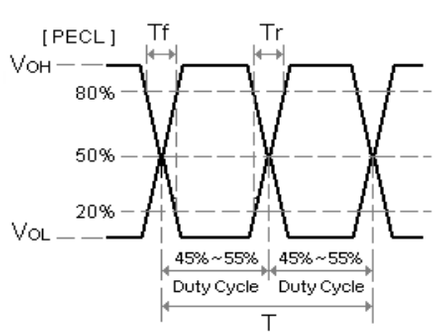
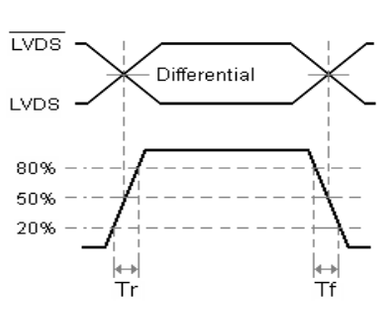
Pad Connections :

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

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

Test Circuits and Output Waveforms

CMOS Test Circuit	PECL Test Circuit	LVDS Test Circuit
		

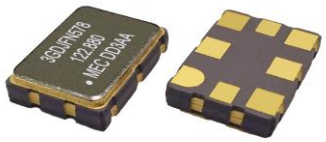
CMOS Output Waveform	PECL Output Waveform	LVDS Output Waveform
		

High Frequency Ultra-low Jitter Voltage Controlled Crystal Oscillators [Quick - Turn VCXO , 15 ~ 2,100 MHz]

G_JFN	Quick - Turn Clock Oscillators	150 fsec RMS Jitter	SMD	1.8 V	2.5 V	3.3 V	Min. 15 MHz	Max. 2,100 MHz
CMOS / Differential								

Features

- High Frequency Range : 15 ~ 2,100 MHz
- Ultra-low RMS Jitter : 150 fsec (typ.) @ 3.3V , 156.250 MHz
- Package Size : 5.0 x 3.2mm and 7.0 x 5.0mm
- Next-Day sample for Prototypes



General specifications , at Ta=+25°C

Model	GTJFN	GPJFN	GDJFN	GCJFN	GQJFN
Output Logic	CMOS	LVPECL	LVDS	HCSL	CML
Supply Voltage V_{DD}	+ 1.8 V ± 5%	---	+ 1.8 V ± 5% (*1)	+ 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	15pF (max.)	50 Ω into V_{DD} - 2V or Thevenin equivalent	100 Ω between OUT and OUTN	50 Ω to GND	50 Ω to V_{DD}
Output Logic " High " , " 1 "	V_{DD} - 0.4 V (min.)	V_{DD} - 1.165 V (min.) V_{DD} - 0.8 V (max.)	V_{DD} : 1.4 V (typ.) V_{DD} : 1.6 V (max.)	V_{DD} : 0.66 V (min.) V_{DD} : 1.15 V (max.)	V_{DD} - 0.085 V (min.) V_{DD} = (max.)
Output Logic " Low " , " 0 "	V_{DD} x 0.1 V (max.) 0.3V (max.) for 1.8V only	V_{DD} - 2.0 V (min.) V_{DD} - 1.55 V (max.)	V_{DD} : 1.1 V (typ.) V_{DD} : 0.9 V (min.)	V_{DD} : - 0.15 V (min.) V_{DD} : 0.15 V (max.)	V_{DD} - 0.6 V (min.) V_{DD} - 0.32 V (max.)
Output Voltage Swing	---	595 mV (min.) 930 mV (max.)	250 mV (min.) 450 mV (max.)	450 mV (min.) 700 mV (typ.)	200 mV (min.) 600 mV (max.)
Current Consumption (V_{DD} = + 3.3 V)	75 mA (typ.) 90 mA (max.)	100 mA (typ.) 120 mA (max.)	75 mA (typ.) 90 mA (max.)	80 mA (typ.) 100 mA (max.)	70 mA (typ.) 85 mA (max.)
Current with Output Disabled	62 mA (typ.)	99 mA (typ.)	74 mA (typ.)	79 mA (typ.)	69 mA (typ.)
Rise Time / Fall Time (20% to 80% Waveform)	5.0 nsec (max.) (10% to 90% Waveform)	0.4 nsec (max.)	0.4 nsec (max.)	0.4 nsec (max.)	0.4 nsec (max.)

RMS Jitter [12 KHz ~ 20 MHz]	156.250 MHz : 159 fsec (typ.) ; 491.520 MHz : 155 fsec (typ.) ; 644.530 MHz : 151 fsec (typ.) ; 2.000 MHz : 163 fsec (typ.)			
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% ; 50 % ± 10% for CMOS 1.8V only			
Start-up Time	5 msec. (typ.) ; 10 msec. (max.)			
Aging at Ta = +25°C	± 3 ppm (max.) for first year ; ± 2 ppm (max .) per year thereafter			
Storage Temperature	-55°C to +150°C			
Control Voltage Function on Pad 1				
Vcontrol Center	+ 0.9 V for V_{DD} = + 1.8 V	+ 1.25 V for V_{DD} = + 2.5 V	+ 1.65 V for V_{DD} = + 3.3 V	
Vcontrol Range	+ 0.0 V ~ + 1.8 V	+ 0.25 V ~ + 2.25 V	+ 0.3 V ~ + 3.0 V	
Frequency Pulling Range	± 100 ppm (min.) ± 200 ppm (available)	± 100 ppm (min.) ± 200 ppm (available)	± 100 ppm (min.) ± 200 ppm (available)	
Linearity	1% (typ.) ; 10% (max.)			
Transfer Function	Positive Transfer			
Input Impedance	5 MΩ (min.)			
Bandwidth	10 KHz (typ.) Measured at -3 dB			
Output Enable Function on Pad 2				
Output Enable / Disable Function	80% of V_{DD} (min.) to enable output.			
	20% of V_{DD} (max.) to disable output.			
Output Enable Time / Disable Time	2.5 msec (max.) / 10 usec (max.)			

Note ∗1 : This needs AC coupling (100-nF series capacitor). Please check the test circuit.

High Frequency Ultra-low Jitter Voltage Controlled Crystal Oscillators [Quick - Turn VCXO , 15 ~ 2,100 MHz]

G_JFN	Quick - Turn Clock Oscillators	150 fsec RMS Jitter	SMD	1.8 V	2.5 V	3.3 V	Min. 15 MHz	Max. 2,100 MHz
CMOS / Differential								

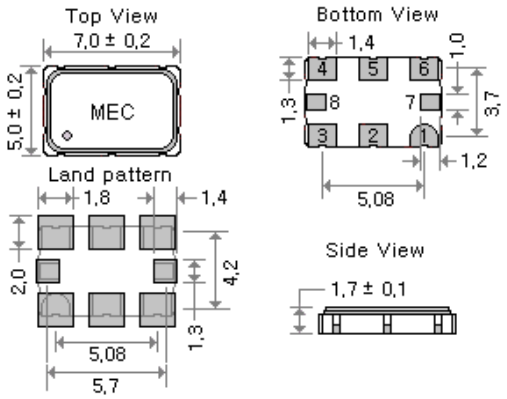
Part Number Format and Example

Example : 3GPJFN578-E-150N-644.530

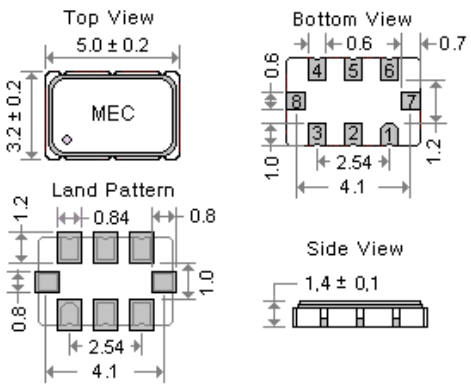
3	G	P	JFN578	-	E	-	150N	-	644.530
Supply Voltage Code : " **3** " for 3.3V " **25** " for 2.5V " **18** " for 1.8V	" **G** " : for Voltage Controlled Crystal Oscillators	Output Code : " **T** " : COMS " **P** " : LVPECL " **D** " : LVDS " **C** " : HCSL " **Q** " : CML	" **JFN** " : Product Series " **578** " : Package Code 7.0 * 5.0 _ 8 Pad " **538** " : Package Code 5.0 * 3.2 _ 8 Pad	-	Freq. Stability Code : " **E** " : ±50 ppm over -40 to +85 C Other frequency stabilities are available.	-	Freq. Pulling Range : " **150** " : ±150ppm " **M** " : Maximum " **N** " : Minimum " **T** " : Typical	-	Frequency (MHz)

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

G_JFN578



G_JFN538



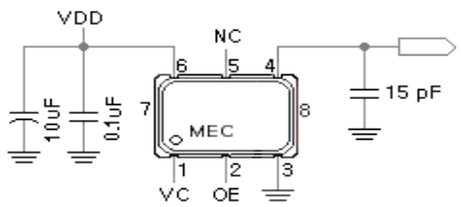
Pad Connections :

Pad 1 : Control Voltage	**Pad 2** : Output Enable	**Pad 3** : Ground	**Pad 4** : CMOS : Output , Differential : Output
Pad 5 : CMOS : No Connection , Differential : Complementary Output		**Pad 6** : Supply Voltage	**Pad 7 , Pad 8** : Do Not Connect

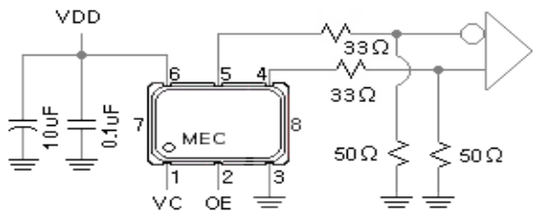
G_JFN	Quick - Turn Clock Oscillators	150 fsec RMS Jitter	SMD	1.8 V	2.5 V	3.3 V	Min. 15 MHz	Max. 2,100 MHz
CMOS / Differential								

Test Circuits

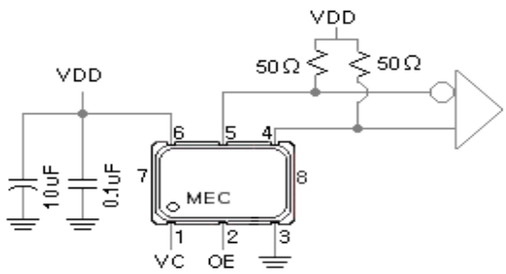
CMOS Test Circuits



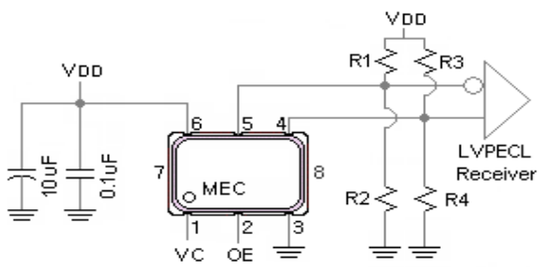
HCSL Test Circuits



CML Test Circuits



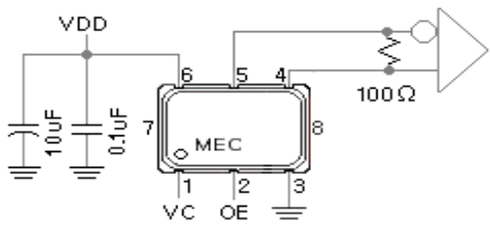
LVPECL Test Circuits



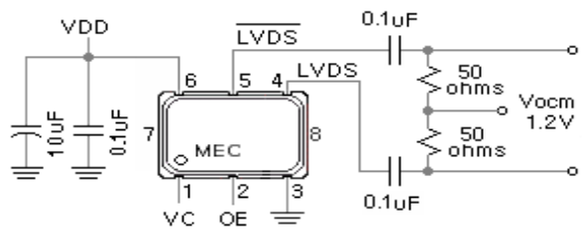
V_{DD} = 3.3V ; R1 = R3 = 127 Ω ; R2 = R4 = 82.5 Ω

V_{DD} = 2.5V ; R1 = R3 = 250 Ω ; R2 = R4 = 62.5 Ω

LVDS Test Circuits for 2.5V and 3.3V



LVDS Test Circuits for 1.8V only (*2)



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

Output Waveform : Clipped Sine Wave " S "

Product Summary :

Product Selection Guide

TCXO	VCTCXO	Available Freq. Range	RoHS Compliant Equivalent Model		Package Description	
● Leadless Surface Mount Types						
M21S _	VM21S _	10.0 ~ 52.0 MHz	Same		4 pad ceramic substrate SMD. (2.05 x 1.65 x 0.70 mm)	
M22S _	VM22S _	10.0 ~ 52.0 MHz	Same		4 pad ceramic substrate SMD. (2.5 x 2.0 x 0.8 mm)	
M32S _	VM32S _	8.192 ~ 52.0 MHz	Same		4 pad ceramic substrate SMD. (3.2 x 2.5 x 1.2 mm)	
M53S _	VM53S _	6.4 ~ 52.0 MHz	Same		4 pad ceramic substrate SMD. (5.0 x 3.2 x 1.3 mm)	
M53S _AB	VM53S _AB	10.0 ~ 52.0 MHz	M53S _AB	VM53S _AB	4 pad FR4 substrate SMD. (5.0 x 3.2 x 1.3 mm)	
M57S _	VM57S _	6.4 ~ 52.0 MHz	Same		4 pad ceramic substrate SMD. (7.0 x 5.0 x 2.0 mm)	
M57S _AB	VM57S _AB	6.4 ~ 52.0 MHz	M57S _AB	VM57S _AB	4 pad FR4 substrate SMD. (7.0 x 5.0 x 1.4 mm)	
M572S _	VM572S _	6.4 ~ 52.0 MHz	Same		4 pad ceramic substrate SMD. (7.0 x 5.0 x 2.3 mm)	
● Thru - hole Types						
M39S _	VM39S _	6.4 ~ 52.0 MHz	M39S_	VM39S_	Dip Type	4 pins for VCTCXOs 3 pins for TCXOs
M14S _	VM14S _	6.4 ~ 52.0 MHz	M14S_	VM14S_	Dip Type (4 pins) , Hermetically Sealed	
M15S _	VM15S _	6.4 ~ 52.0 MHz	M15S_	VM15S_	Dip Type (4 pins) , With Trimmer	
M8S _	VM8S _	6.4 ~ 52.0 MHz	M8S_	VM8S_	Dip Type (4 pins) , Half size , Hermetically Sealed	
M9S _	VM9S _	6.4 ~ 52.0 MHz	M9S_	VM9S_	Dip Type (4 pins) , With Trimmer	

● " _ " is voltage code. Please see the table on next page.

Note: Frequency tuning by the built-in mechanical trimmer is standard for all models except for (V)M57S, (V)M53S and (V)M32S.

Product Options :

● No mechanical trimmer models are available to allow for aqueous washing cycles . To order such option

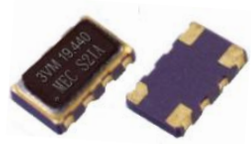
Note: Non-hermetically sealed (VC)TCXO products are not subject to the washing cycles as the solvent will degrade the trimmer capacitor . If cleaning is mandatory please choose hermetically sealed packages or no-trimmer option.

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

Clipped Sine Wave ; Waveform Code " S " [SMD Type]

Features

- Frequency stability as tight as ± 0.5 ppm over -30 °C to 85 °C
- Frequency stability as tight as ± 1.0 ppm over -40 °C to 85 °C



General Specifications [TA = +25°C , V_{DD}= at specified voltage , Load : 10K ohms//10 pF]

Output Waveform	Clipped Sine wave . Waveform code is " S "			
Suggested package	**M21S , VM21S**	**M22S , VM22S**	**M32S , VM32S**	**M53S , VM53S**
Package size	2.05 x 1.65 x 0.70 mm	2.5 x 2.0 x 0.8 mm	3.2 x 2.5 x 1.2 mm	5.0 x 3.2 x 1.3 mm
Supply voltage (V_{DD}) [unit : V]	1.8 , 2.5 , 2.8 , 3.0 , 3.3	1.8 , 2.5 , 2.8 , 3.0 , 3.3	1.8 , 2.5 , 3.0 , 3.3	1.8 , 2.5 , 2.8 , 3.0 , 3.3
Frequency Range	10.0 ~ 52.0 MHz	10.0 ~ 52.0 MHz	8.192 ~ 52.0 MHz	6.4 ~ 52.0 MHz

Suggested package	**M57S , VM57S**	**M572S , VM572S**	**M53S-AB , VM53S-AB**	**M57S-AB , VM57S-AB**
Package size	7.0 x 5.0 x 2.0 mm	7.0 x 5.0 x 2.3 mm	5.0 x 3.2 x 1.3 mm	7.0 x 5.0 x 1.4 mm
Supply voltage (V_{DD}) [unit : V]	2.5 , 3.0 , 3.3	1.8 , 2.5 , 2.8 , 3.0 , 3.3	1.8 , 2.5 , 2.8 , 3.0 , 3.3	1.8 , 2.5 , 2.8 , 3.0 , 3.3
Frequency Range	6.4 ~ 52.0 MHz	6.4 ~ 52.0 MHz	10.0 ~ 52.0 MHz	10.0 ~ 52.0 MHz

Standard Frequency (Partial list) [MHz]	10.000	12.800	13.000	14.400	14.7456	15.360	16.367667
	16.384	19.200	19.440	20.000	25.000	26.000	27.000
Initial Calibration Tolerance	< ± 1 ppm. at + 25°C ± 2°C						
Frequency Stability (ppm)	± 0.5 ppm	± 1.0 ppm	± 1.5 ppm	± 2.0 ppm	± 2.5 ppm	± 3.0 ppm	○ : available △ : contact us X : not available
Frequency Stability vs Temperature (examples) 0°C to 50°C	○	○	○	○	○	○	
-10°C to 60°C	△	○	○	○	○	○	
-20°C to 70°C	△	○	○	○	○	○	
-30°C to 75°C	△	○	○	○	○	○	
-30°C to 85°C	△	○	○	○	○	○	
-40°C to 85°C	△	△	○	○	○	○	

Frequency Stability	vs Aging at Ta = +25°C	± 1.0 ppm / year (max.)
	vs Voltage Change	± 0.2 ppm (max.) , for a ±5% input voltage change .
	vs Load Change	± 0.2 ppm (max.) , for a ±10% load condition change .
	vs Reflow (SMD type)	± 1.0 ppm (max.) , 1 reflow and measured 24 hours afterwards .
Output Voltage Level (peak to peak)		0.8 V p-p (min.)
Current Consumption. (max.)		10.0 ~ 15 MHz: 1.5 mA ; 15.1 ~ 26.0 MHz : 2.0 mA ; 26.1 ~ 52.0 MHz : 3.5 mA

Electrical Frequency Tuning (EFC) by external Control Voltage	Control Voltage Center	1.8 V	2.5 V	3.0 V / 3.3V
		0.9 V ± 0.6 V	1.4 V ± 1.0 V	1.5 V ± 1.0 V
	Frequency Deviation Range	± 5.0 ppm (min.)		
	Slope Polarity (Transfer Function)	Positive slope. Positive voltage for positive frequency shift.		
		Input Impedance : 1.0M Ω (min.)	Modulation Bandwidth : 3 KHz (min.)	Linearity : ± 10 % (max.)
Start-Up Time	2.0 msec. (typ.) , 5.0 msec. (max.) (reach 90% amplitude and at +25°C ± 2°C)			
Output Load	10 KΩ // 10 pF ± 10%			
Output Format	DC block , AC coupled. EX : (V) M53 and (V) M32 model.			

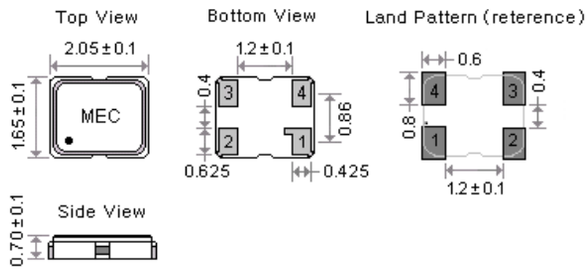
Phase Noise [dBc / Hz ; (typ.)]	Offset	10 Hz	100 Hz	1 KHz	10 KHz	100 KHz
	13.000 MHz	-80	-115	-135	-148	-148
Storage Temperature	-40°C to +85°C or -55°C to +125°C (package dependent)					

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

Clipped Sine Wave Output Code " S " [SMD Type]

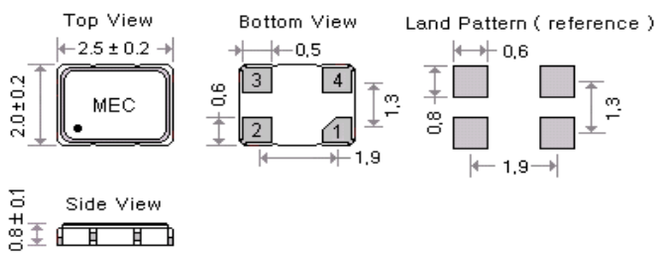
Outline Dimensions (Unit : mm) , Suggested pad Layout for SMDs

[M21S _ _] ; [VM21S _ _]



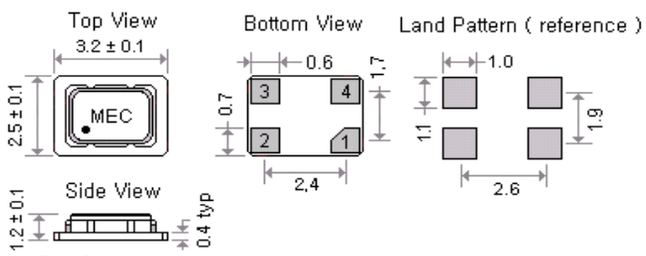
Pad Connections :
Pad 1 : Control voltage for VCTCXO ; Ground for TCXO .
Pad 2 : Ground ; Pad 3 : Output ; Pad 4 : Supply Voltage

[M22S _ _] ; [VM22S _ _]



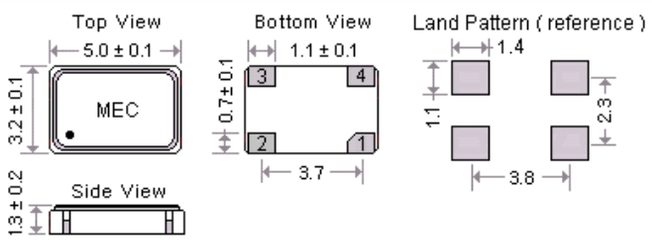
Pad Connections :
Pad 1 : Control voltage for VCTCXO ; Ground for TCXO .
Pad 2 : Ground ; Pad 3 : Output ; Pad 4 : Supply Voltage

[M32S _ _] ; [VM32S _ _]



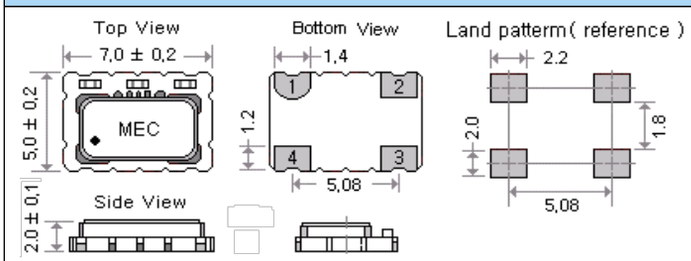
Pad Connections :
Pad 1 : Control voltage for VCTCXO ; Ground for TCXO .
Pad 2 : Ground ; Pad 3 : Output ; Pad 4 : Supply Voltage

[M53S _ _] ; [VM53S _ _]



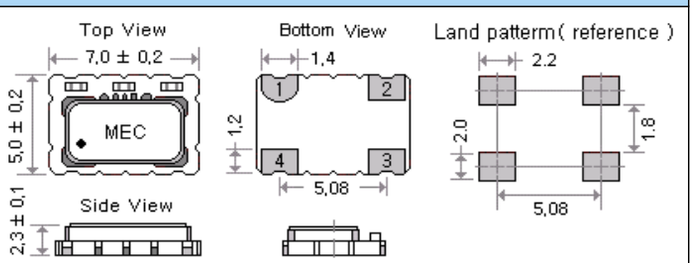
Pad Connections :
Pad 1 : Control voltage for VCTCXO ; Ground for TCXO .
Pad 2 : Ground ; Pad 3 : Output ; Pad 4 : Supply Voltage

[M57S _ _] ; [VM57S _ _]



Pad Connections :
Pad 1 : Control voltage for VCTCXO ; Ground for TCXO .
Pad 2 : Ground ; Pad 3 : Output ; Pad 4 : Supply Voltage

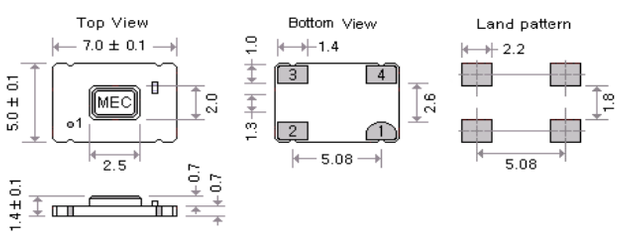
[M572S _ _] ; [VM572S _ _]



Pad Connections :
Pad 1 : Control voltage for VCTCXO ; Ground for TCXO .
Pad 2 : Ground ; Pad 3 : Output ; Pad 4 : Supply Voltage

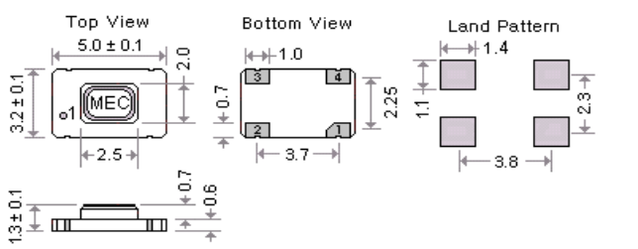
Outline Dimensions (Unit : mm) , Adapter Board Type

[M57S _ _ AB] ; [VM57S _ _ AB]



Pad Connections :
Pad 1 : Control voltage for VCTCXO ; No connection for TCXO
Pad 2 : Ground ; Pad 3 : Output ; Pad 4 : Supply Voltage
White marker is pad1 on PCB

[M53S _ _ AB] ; [VM53S _ _ AB]



Pad Connections :
Pad 1 : Control voltage for VCTCXO ; No connection for TCXO
Pad 2 : Ground ; Pad 3 : Output ; Pad 4 : Supply Voltage
White marker is pad1 on PCB

TCXOs

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

Clipped Sine Wave ; Waveform Code " **S** " [Dip Type]

Features

- Frequency stability as tight as ± 0.5 ppm over -30 °C to 85 °C
- Frequency stability as tight as ± 1.0 ppm over -40 °C to 85 °C

General Specifications [TA = +25°C , V_{DD}= at specified voltage , Load : 10K ohms//10 pF]

Output Waveform	Clipped Sine Wave . Waveform code is " ***S*** "				
Suggested package (Dip type)	**M8S , VM8S**	**M9S , VM9S**	**M14S , VM14S**	**M15S , VM15S**	**M39S , VM39S**
Model with Trimmer	- - - - -	with Trimmer	- - - - -	with Trimmer	with Trimmer
Package size (mm)	12.8 x 12.8 x 6.3	12.8 x 12.8 x 6.3	20.2 x 12.8 x 7.8	20.2 x 12.8 x 7.8	18.4 x 11.7 x 4.7
Supply voltage (V_{DD}) [unit : V]	1.8 , 2.5 , 3.0 , 3.3	1.8 , 2.5 , 3.0 , 3.3	1.8 , 2.5 , 3.0 , 3.3	1.8 , 2.5 , 3.0 , 3.3	1.8 , 2.5 , 3.0 , 3.3
Frequency Range	6.4 ~ 52.0 MHz	6.4 ~ 52.0 MHz	6.4 ~ 52.0 MHz	6.4 ~ 52.0 MHz	6.4 ~ 52.0 MHz

Standard Frequency (Partial list) [MHz]		10.000	12.800	13.000	14.400	14.7456	15.360	16.367667
		16.384	19.200	19.440	20.000	25.000	26.000	27.000
Initial Calibration Tolerance		< ± 1 ppm. at + 25°C ± 2°C for model with trimmer						
		< ± 2 ppm. at + 25°C ± 2°C for model without trimmer						
Frequency Stability (ppm)		± 0.5 ppm	± 1.0 ppm	± 1.5 ppm	± 2.0 ppm	± 2.5 ppm	± 3.0 ppm	○ : available △ : contact us X : not available
Frequency Stability vs Temperature (examples)	0°C to 50°C	○	○	○	○	○	○	
	-10°C to 60°C	△	○	○	○	○	○	
	-20°C to 70°C	△	○	○	○	○	○	
	-30°C to 75°C	△	○	○	○	○	○	
	-30°C to 85°C	△	○	○	○	○	○	
	-40°C to 85°C	△	△	○	○	○	○	
Frequency Stability	vs Aging at Ta = +25°C	± 1.0 ppm / year (max.)						
	vs Voltage Change	± 0.2 ppm (max.) , for a ±5% input voltage change .						
	vs Load Change	± 0.2 ppm (max.) , for a ±10% load condition change .						
	vs Reflow (SMD type)	± 1.0 ppm (max.) , 1 reflow and measured 24 hours afterwards .						
Output Voltage Level (peak to peak)		0.8 V p-p (min.)						
Current Consumption. (max.)		10.0 ~ 15 MHz: 1.5 mA ; 15.1 ~ 26.0 MHz : 2.0 mA ; 26.1 ~ 52.0 MHz : 3.5 mA						

Electrical Frequency Tuning (EFC) by external Control Voltage	Control Voltage Center	1.8 V	2.5 V	3.0 V / 3.3V
		0.9 V ± 0.6 V	1.4 V ± 1.0 V	1.5 V ± 1.0 V
	Frequency Deviation Range	± 5.0 ppm (min.)		
	Slope Polarity (Transfer Function)	Positive slope. Positive voltage for positive frequency shift.		
		Input Impedance : 1.0M Ω min.	Modulation Bandwidth : 3 KHz min.	Linearity : ± 10 % max.
Start-Up Time.	2.0 msec. (typ.) , 5.0 msec. (max.) (reach 90% amplitude and at +25°C ± 2°C)			
Output Load	10 KΩ // 10 pF ± 10%			

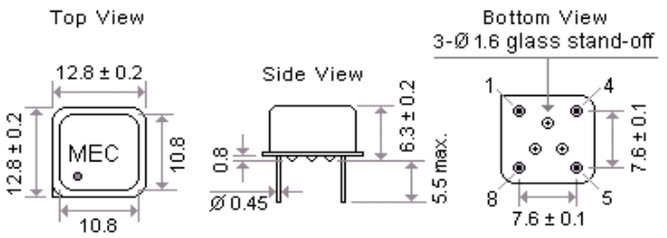
Phase Noise [dBc / Hz ; (typ.)]	Offset	10 Hz	100 Hz	1 KHz	10 KHz	100 KHz
	13.000 MHz	-80	-115	-135	-148	-148
Storage Temperature	-40°C to +85°C or -55°C to +125°C (package dependent)					

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

Clipped Sine Wave Output Code " **S** " [Dip Type]

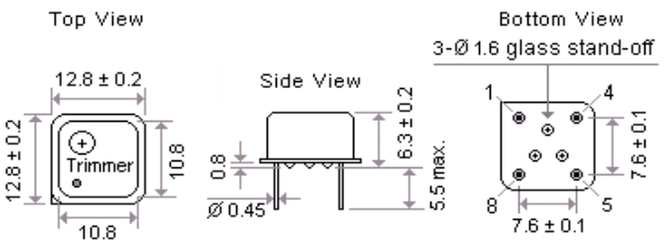
Outline Dimensions (Unit : mm) , Suggested pin Layout for SMDs

[M8S _ _] ; [VM8S _ _]



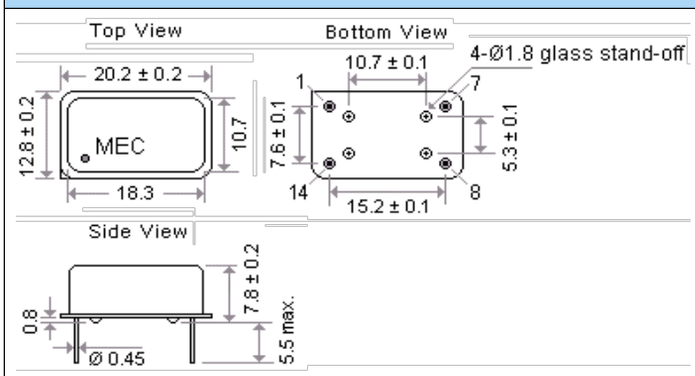
Pin Connections :
Pin 1 : Control voltage for VCTCXO ; No connection for TCXO.
Pin 4 : Ground ; Pin 5 : Output ; Pin 8 : Supply Voltage

[M9S _ _] ; [VM9S _ _]



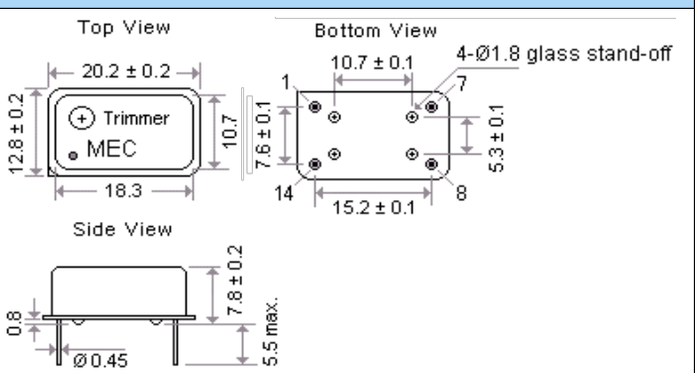
Pin Connections :
Pin 1 : Control voltage for VCTCXO ; No connection for TCXO.
Pin 4 : Ground ; Pin 5 : Output ; Pin 8 : Supply Voltage

[M14S _ _] ; [VM14S _ _]



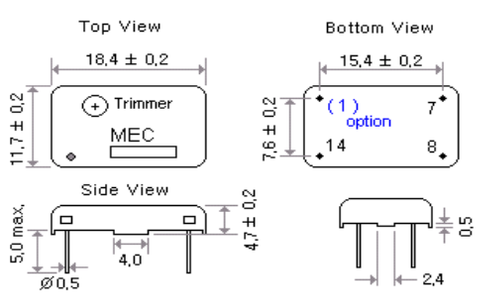
Pin Connections :
Pin 1 : Control voltage for VCTCXO ; No connection for TCXO.
Pin 7 : Ground ; Pin 8 : Output ; Pin 14 : Supply Voltage

[M15S _ _] ; [VM15S _ _]



Pin Connections :
Pin 1 : Control voltage for VCTCXO ; No connection for TCXO.
Pin 7 : Ground ; Pin 8 : Output ; Pin 14 : Supply Voltage

[M39S _ _] ; [VM39S _ _]



Pin Connections :
Pin 1 : Control voltage for VCTCXO
[No physical pin 1 for TCXO. (3 pins only)]
Pin 7 : Ground ; Pin 8 : Output ; Pin 14 : Supply Voltage

TCXOs

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

Clipped Sine Wave Output Code " S "

Part Number Format and Example

	[1]	[2]	[3]	-	[4]	-	[5]	/	[6]	-	[7]
	Holder Type	Output Wave	Supply Voltage		Center Frequency		Frequency Stability		Operating Temp. Range		Adapter Board
Examples	(1) VM21	S	3	-	10.000	-	1.5	/	-20+70		
	(2) M32	S	18	-	20.000	-	2.5	/	-30+75		
	(3) VM57	S	33	-	10.000	-	1.0	/	-20+70	-	AB
	(4) M53	S	18	-	16.384	-	2.5	/	-40+85	-	AB

Ex (1) : VM21S3 - 10.000 - 1.5 / -20+70 [VCTCXO , VM21 type , Clipped Sine Wave, 3.0V , 10.000MHz , ±1.5ppm from -20°C to 70°C]

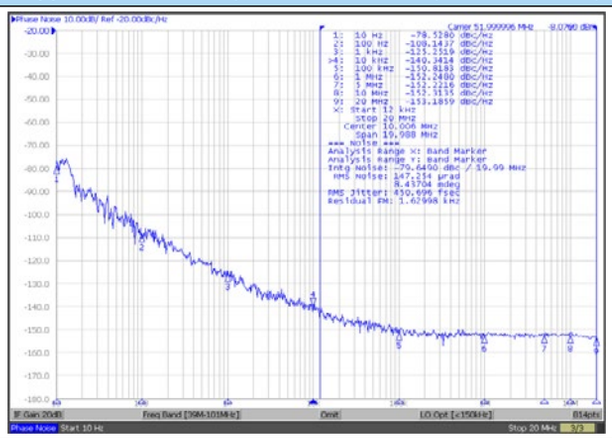
Ex (2) : M32S18 - 20.000 - 2.5 / -30+75 [TCXO , M32 type , Clipped Sine Wave , 1.8V , 20.000MHz , ±2.5ppm from -30°C to 75°C]

Ex (3) : VM57S33 - 10.000 - 1.0 / -20+70 - AB [VCTCXO , VM57 type , Clipped Sine Wave , 3.3V , 10.000MHz , ±1.0ppm from -20°C to 70°C , Adapter Board]

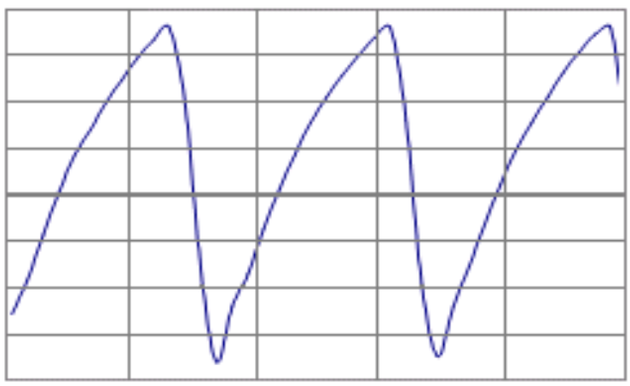
Ex (4) : M53S18 - 16.384 - 2.5 / -40+85 - AB [TCXO , M53 type , Clipped Sine Wave , 1.8V , 16.384MHz , ±2.5ppm from -40°C to 85°C , Adapter Board]

[1]	Holder Type
	" M " stands for TCXO , " VM " stands for VCTCXO
[2]	" S " stands for Clipped Sine Wave
[3]	Supply voltage , " 18 " stands for +1.8V ; " 25 " stands for +2.5V ; " 28 " stands for +2.8V ; " 3 " stands for +3.0V ; " 33 " stands for +3.3V
[4]	Center Frequency in MHz
[5]	Frequency stability in ± _ ppm ; ex 1 : ± 1.5ppm --- 1.5 , ex 2 : ± 2.5ppm --- 2.5 , ex 3 : ± 1.0ppm --- 1.0 , ex 4 : ± 2.5ppm --- 2.5
[6]	Operating temperature range in °C
	ex 1 : -20 °C to 70°C ----- -20+70 ; ex 2 : -30 °C to 75°C ----- -30+75 ; ex 3 : -20 °C to 70°C ----- -20+70 ; ex 4 : -40 °C to 85°C ----- -40+85
[7]	Adapter Board Type ----- AB

Clipped Sine Wave Typical Phase Noise (M22S33-52.000)

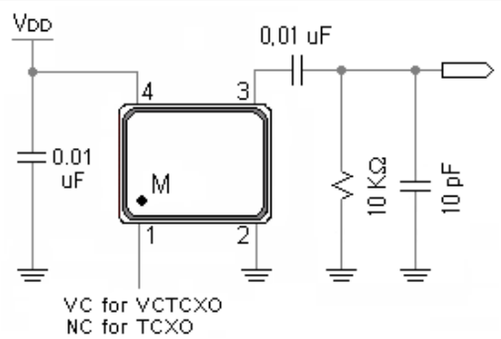


Clipped Sine Wave , " S " series

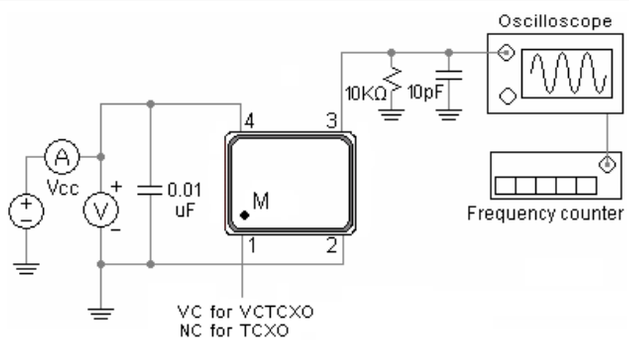


Test Circuits

(VC)TCXO with clipped sine wave Test Circuits



(VC)TCXO with clipped sine wave Test Circuits
For [(V)M57S] ; [(V)M572S] ; [(V)M57S _ _ AB] ; DIP Type



TCXOs

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

Output Waveform : CMOS " T " , PECL " P " , LVDS " D " , HCSL " C " , CML " Q "

Product Summary :

Product Selection Guide

CMOS output waveform , " T " series

TCXO	VCTCXO	Available Freq. Range	RoHS Compliant Equivalent Model		Package Description
● Leadless Surface Mount Types					
M211T _	- - - - -	10 ~ 52 MHz	Same		4 pad ceramic substrate . (2.05 x 1.65 x 0.70 mm)
M221T _	- - - - -	9.5 ~ 60 MHz	Same		4 pad ceramic substrate . (2.5 x 2.0 x 0.8 mm)
M32T _	VM32T _	8.192 ~ 40 MHz	Same		4 pad ceramic substrate . (3.2 x 2.5 x 1.0 mm)
M321T _	- - - - -	9.5 ~ 60 MHz	Same		4 pad ceramic substrate . (3.2 x 2.5 x 1.2 mm)
M531T _AB	- - - - -	9.5 ~ 60 MHz	Same		4 pad FR4 substrate . (5.0 x 3.2 x 1.3 mm)
MTF326T _	VMTF326T _	1 ~ 200 MHz	Same		6 pad ceramic substrate . (3.2 x 2.5 x 1.6 mm)
M53T _	VM53T _	6.4 ~ 40 MHz	Same		4 pad ceramic substrate . (5.0 x 3.2 x 1.3 mm)
MTF538T _	VMTF538T _	1 ~ 200 MHz	Same		8 pad ceramic substrate . (5.0 x 3.2 x 1.4 mm)
M571T _AB	- - - - -	9.5 ~ 60 MHz	Same		4 pad FR4 substrate . (7.0 x 5.0 x 1.4 mm)
M572T _	VM572T _	32.768 KHz , 1.25 ~ 52 MHz	Same		4 pad ceramic substrate . (7.0 x 5.0 x 2.3 mm)
ME21T _	- - - - -	32.768 KHz	Same		4 pad ceramic substrate . (2.1 x 1.3 x 1.1 mm)
ME32T _	- - - - -	32.768 KHz	Same		4 pad ceramic substrate . (3.2 x 2.5 x 1.4 mm)
MQN326T _	VMQN326T _	10 ~ 250 MHz	Same		6 pad ceramic substrate . (3.2 x 2.5 x 1.6 mm)
MQN574T _	VMQN574T _				4 pad ceramic substrate . (7.0 x 5.0 x 2.5 mm)
MQF326T _	VMQF326T _	10 ~ 250 MHz	Same		6 pad ceramic substrate . (3.2 x 2.5 x 1.6 mm)
MQF574T _	VMQF574T _				4 pad ceramic substrate . (7.0 x 5.0 x 2.5 mm)
● Thru - Hold Types					
M39T _	VM39T _	6.4 ~ 52.0 MHz	M39T _	VM39T _	3 pin if TCXO. Package height = 4.7 mm
M14T _	VM14T _		M14T _	VM14T _	4 pin if TCXO. Package height = 7.8 mm
M15T _	VM15T _		M15T _	VM15T _	Dip Type (4 pins) , With Trimmer
M8T _	VM8T _		M8T _	VM8T _	Dip Type (4 pins) , Half size , Hermetically Sealed
M9T _	VM9T _		M9T _	VM9T _	Dip Type (4 pins) , With Trimmer

Differential output waveform , PECL " P " series , LVDS " D " series , HCSL " C " series , CML " Q " series

● Leadless Surface Mount Types				
MQN326P _	VMQN326P _	10 ~ 1,500 MHz	Same	6 pad ceramic substrate . (3.2 x 2.5 x 1.6 mm)
MQN576P _	VMQN576P _			6 pad ceramic substrate . (7.0 x 5.0 x 2.5 mm)
MQF326P _	VMQF326P _	10 ~ 1500 MHz	Same	6 pad ceramic substrate . (3.2 x 2.5 x 1.6 mm)
MQF576P _	VMQF576P _			6 pad ceramic substrate . (7.0 x 5.0 x 2.5 mm)
MJF326P_	VMJF326P_	15 ~ 2,100 MHz	Same	6 pad ceramic substrate . (3.2 x 2.5 x 1.6 mm)
MJF538P_	VMJF538P_	15 ~ 2,100 MHz	Same	8 pad ceramic substrate . (5.0 x 3.2 x 1.4 mm)
MQN326D _	VMQN326D _	10 ~ 1,500 MHz	Same	6 pad ceramic substrate . (3.2 x 2.5 x 1.6 mm)
MQN576D _	VMQN576D _			6 pad ceramic substrate . (7.0 x 5.0 x 2.5 mm)
MQF326D _	VMQF326D _	10 ~ 1500 MHz	Same	6 pad ceramic substrate . (3.2 x 2.5 x 1.6 mm)
MQF576D _	VMQF576D _			6 pad ceramic substrate . (7.0 x 5.0 x 2.5 mm)
MJF326D_	VMJF326D_	15 ~ 2,100 MHz	Same	6 pad ceramic substrate . (3.2 x 2.5 x 1.6 mm)
MJF538D_	VMJF538D_	15 ~ 2,100 MHz	Same	8 pad ceramic substrate . (5.0 x 3.2 x 1.4 mm)
MJF326C_	VMJF326C_	15 ~ 700 MHz	Same	6 pad ceramic substrate . (3.2 x 2.5 x 1.6 mm)
MJF538C_	VMJF538C_	15 ~ 700 MHz	Same	8 pad ceramic substrate . (5.0 x 3.2 x 1.4 mm)
MJF326Q_	VMJF326Q_	15 ~ 2,100 MHz	Same	6 pad ceramic substrate . (3.2 x 2.5 x 1.6 mm)
MJF538Q_	VMJF538Q_	15 ~ 2,100 MHz	Same	8 pad ceramic substrate . (5.0 x 3.2 x 1.4 mm)

" _ " is voltage code. Please see the table in next page.

Note: Frequency tuning by built-in mechanical trimmer is standard for all models except for (V)M572T,(V)M572P,(V)M572D .

Note: Non-hermetically sealed (VC)TCXO products are not subject to the washing cycles as the solvent will degrade the trimmer capacitor . If cleaning is mandatory please choose hermetically sealed packages or no-trimmer option.

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

TCXO	VCTCXO	KHz range	CMOS	SMD	15pF	3.3V	32.768 KHz
M _ T	VM _ T						

Features

- Wide frequency range : [32.768 KHz]
- Frequency stability as tight as ± 0.5 ppm over 0 °C to 50 °C
- Frequency stability as tight as ± 1.0 ppm over -40°C to 85°C

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

Output Waveform		Square Wave [CMOS] . Waveform Wode is " T "						
Suggested Package (Size)	Type	SMD						
	Demensions	**(V)M572T** (7.0 x 5.0 x 2.3 mm)						
Frequency Range		32.768 KHz [From KHz with divider. mA current consumption.]						
Supply Voltage V_{DD} (code)		+3.3 V ± 5% (voltage code is " 33 ")						
Output Logic Levels	Logic High " 1 "	2.97 V_{DD} (min.)						
	Logic Low " 0 "	0.33 V_{DD} (max.)						
Current Consumption. (max.) (Over operating temperature range .)		8.0 mA (max.) for 32.768 KHz at +3.3V						
Initial Calibration Tolerance		< ± 2.0 ppm at +25°C ± 2°C.						
Frequency Stability (ppm)		± 0.5 ppm	± 1.0 ppm	± 1.5 ppm	± 2.0 ppm	± 2.5 ppm	± 3.0 ppm	○ : available △ : contact us X : not available
Frequency Stability vs Temperature (examples)	0°C to 50°C	○	○	○	○	○	○	
	-10°C to 60°C	△	○	○	○	○	○	
	-20°C to 70°C	X	○	○	○	○	○	
	-30°C to 75°C	X	○	○	○	○	○	
	-30°C to 85°C	X	○	○	○	○	○	
	-40°C to 85°C	X	△	○	○	○	○	
Frequency Stability	vs Aging at Ta = +25°C	± 1.0 ppm / year (max.)						
	vs Voltage Change	± 0.3 ppm (max.) , for a ±5% input voltage change .						
	vs Load Change	± 0.3 ppm (max.) , for a ±10% load condition change .						
	vs Reflow (SMD type)	± 1.0 ppm (max.) , 1 reflow and measured 24 hours afterwards .						
Rise and Fall Time	10.0 nsec. (max.) Measured at 20% ↔ 80% of the waveform							
Electrical Frequency Tuning (EFC) by external Control Voltage	Control Voltage Center	1.5 V ± 1.0 V (3.3V)						
	Frequency Deviation Range	± 5.0 ppm (min.)						
	Slope Polarity (Transfer Function	Positive slope. Positive voltage for positive frequency shift.						
		Input Impedance : 1.0M Ω (min.)	Modulation Bandwidth : 3 KHz (min.)	Linearity : ± 10 % (max.)				
Start-Up Time.	5.0 msec. (typ.) , 10.0 msec. (max.) (reach 90% amplitude and at+25°C±2°C)							
Duty Cycle	50 % ± 5%							
Output Load	15 pF							
Storage Temperature	-40°C to +85°C or -55°C to +125°C (package dependent)							

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

CMOS Wave Output Code " T "

Part Number Format and Example

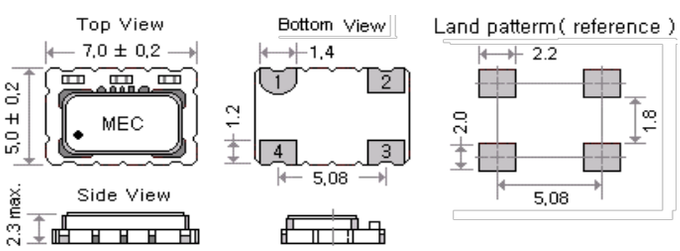
[1]	[2]	[3]	-	[4]	-	[5]	/	[6]
Holder Type	Output Wave	Supply Voltage		Center Frequency		Frequency Stability		Operating Temp. Range
Examples	M572	T	33	-	32.768K	-	1.5	/	-30+85

Ex : M572T33 - 32.768K - 1.5 / -30+85 [TCXO , M572 type , CMOS output , 3.3V , 32.768KHz , ±1.5ppm from -30°C to 85°C]

[1]	Holder Type
	" M " stands for TCXO , " VM " stands for VCTCXO
[2]	" T " stands for Square Wave
	ex : M572T --- TCXO , M572 pcakage , CMOS output
[3]	Supply voltage , " 33 " stands for +3.3V
[4]	Center Frequency in KHz
[5]	Frequency stability in ± _ ppm ; ex : ± 1.5ppm --- 1.5
[6]	Operating temperature range in °C
	ex : -30 °C to 85°C ----- -30+85

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

[(V) M572T_ _]

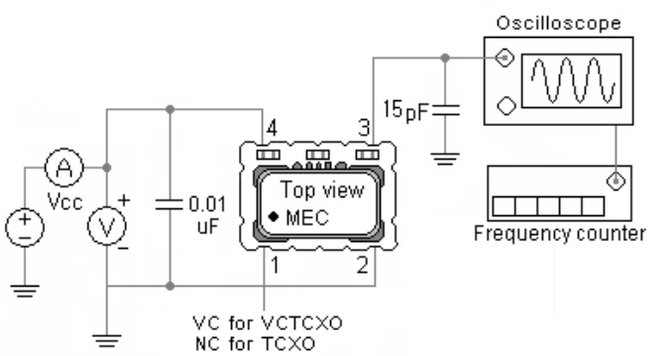


Pad Connections :

Pad 1 : NC - - - TCXO ; Vcon - - - VCTCXO

Pad 2 : Ground ; Pad 3 : Output , Pad 4 : Supply Voltage

(VC)TCXO with CMOS output wave test Circuit



TCXOs

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

TCXO	VCTCXO	MHz range	CMOS	SMD	15pF	1.8 V	2.5 V	3.0 V	3.3 V	Min.	Max.
M _ T	VM _ T									6.4 MHz	52.0 MHz

Features

- Wide frequency range : [6.4 MHz ~ 52.0 MHz]
- Frequency stability as tight as ± 0.5 ppm over 0°C to 50°C
- Frequency stability as tight as ± 1.0 ppm over -40°C to 85°C

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

Output Waveform	Square wave [CMOS] . Waveform code is " T "		
Type	M32T , VM32T	M53T , VM53T	M572T , VM572T
Package size (mm)	3.2 x 2.5 x 1.0	5.0 x 3.2 x 1.3	7.0 x 5.0 x 2.3
Frequency Range	8.192 ~ 40.0 MHz	6.4 ~ 40.0 MHz	6.4 ~ 52.0 MHz

Supply Voltage V_{DD} (code)			+1.8 V ± 5% (code is " 18 ")	+2.5 V ± 5% (code is " 25 ")	+3.0 V ± 5% (code is " 3 ")	+3.3 V ± 5% (code is " 33 ")
Current Consumption. (max.) (Over operating temperature range .)	Package	M32T	6 mA	6 mA	6 mA	6 mA
		M53T	6 mA	6 mA	6 mA	6 mA
		M572T	10 mA	10 mA	13 mA	13 mA
Output Logic Levels	Logic High " 1 " (min.)		1.62 V	2.25 V	2.7 V	2.97 V
	Logic Low " 0 " (max.)		0.25 V	0.25 V	0.3 V	0.33 V

Standard Frequency (Partial list) [MHz]	10.000	12.800	13.000	14.7456	16.000	16.384
	19.200	19.440	19.680	20.000	25.000	27.000
Initial Calibration Tolerance	Models with mechanical trimmer : < ± 1.0 ppm. +25°C ± 2°C. Models without mechanical trimmer : < ± 2.0 ppm at +25°C ± 2°C.					

Frequency Stability (ppm)		± 0.5 ppm	± 1.0 ppm	± 1.5 ppm	± 2.0 ppm	± 2.5 ppm	± 3.0 ppm
Frequency Stability vs Temperature (examples)	0°C to 50°C	○	○	○	○	○	○
	-10°C to 60°C	△	○	○	○	○	○
	-20°C to 70°C	X	○	○	○	○	○
	-30°C to 75°C	X	○	○	○	○	○
	-30°C to 85°C	X	○	○	○	○	○
	-40°C to 85°C	X	△	△	△	○	○

○ : available △ : contact us X : not available

Frequency Stability	vs Aging at Ta = +25°C	± 1.0 ppm / year (max.)		
	vs Voltage Change	± 0.3 ppm (max.) , for a ±5% input voltage change .		
	vs Load Change	± 0.3 ppm (max.) , for a ±10% load condition change .		
	vs Reflow (SMD type)	± 1.0 ppm (max.) , 1 reflow and measured 24 hours afterwards .		
Electrical Frequency Tuning (EFC) by external Control Voltage	Control Voltage Center	0.9 V ± 0.6 V (1.8 V) ; 1.4 V ± 1.0 V (2.5V) ; 1.5 V ± 1.0 V (3.0V / 3.3V)		
	Frequency Deviation Range	± 5.0 ppm (min.)		
	Slope Polarity (Transfer Function)	Positive slope. Positive voltage for positive frequency shift.		
		Input Impedance : 1.0M Ω (min.)	Modulation Bandwidth : 20 KHz (min.)	Linearity : ± 10 % (max.)
Output Load	15 pF			
Duty Cycle	Standard: 50 % ± 10 % ; Option: 50 % ± 5 %			
Storage Temperature	-40°C to +85°C or -55°C to +125°C (package dependent)			

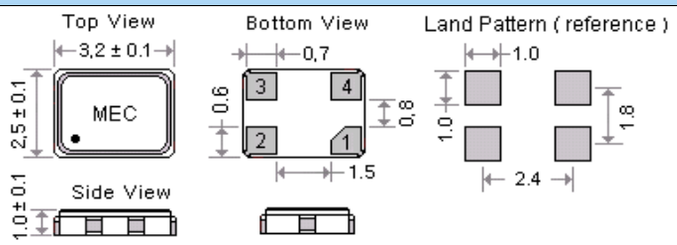
Phase Noise [dBc / Hz (typ.)]	Offset	10 Hz	100 Hz	1 KHz	10 KHz	100 KHz
	M572T33 - 10.000	-96 dBc / Hz	-122 dBc / Hz	-138 dBc / Hz	-145 dBc / Hz	-150 dBc / Hz

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

CMOS Wave Output Code " T "

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

[(V) M32T_ _]

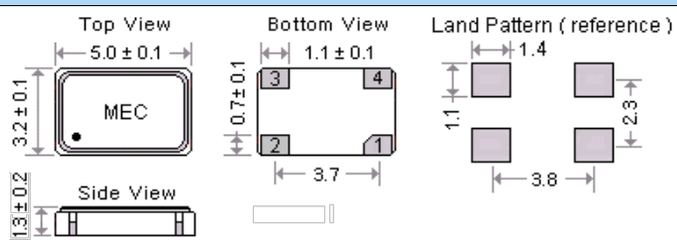


Pad Connections :

Pad 1 : Control voltage for VCTCXO ; Ground for TCXO .

Pad 2 : Ground ; Pin 3 : Output , Pin 4 : Supply Voltage

[(V) M53T_ _]

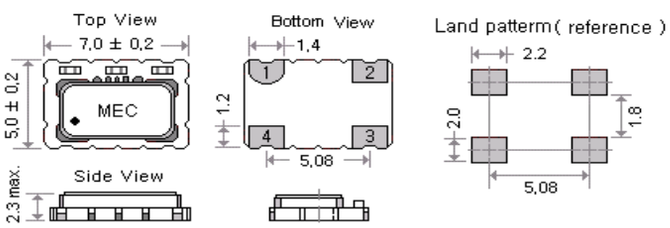


Pad Connections :

Pad 1 : Control voltage for VCTCXO ; Ground for TCXO .

Pad 2 : Ground ; Pad 3 : Output , Pad 4 : Supply Voltage

[(V) M572T_ _]



Pad Connections :

Pad 1 : NC - - - TCXO ; Vcon - - - VCTCXO

Pad 2 : Ground ; Pad 3 : Output , Pad 4 : Supply Voltage

TCXOs

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

TCXO	VCTCXO	MHz range	CMOS	DIP	15pF	1.8 V	2.5 V	3.0 V	3.3 V	Min.	Max.
M _ T	VM _ T									6.4 MHz	52.0 MHz

Features

- Wide frequency range : [6.4 ~ 52.0 MHz]
- Frequency stability as tight as ± 0.5 ppm over 0°C to 50°C
- Frequency stability as tight as ± 1.0 ppm over -40°C to 85°C

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

Output Waveform			Square wave [CMOS] . Waveform code is " T "			
Suggested package (Dip type)			M8T , VM8T	M9T , VM9T	M14T , VM14T	M15T , VM15T	M39T , VM39T
Model with Trimmer			- - - - -	with Trimmer	- - - - -	with Trimmer	with Trimmer
Package size (mm)			12.8 x 12.8 x 6.3	12.8 x 12.8 x 6.3	20.2 x 12.8 x 7.8	20.2 x 12.8 x 7.8	18.4 x 11.7 x 4.7
Supply voltage (V_{DD}) [unit : V]			1.8 , 2.5 , 3.0 , 3.3	1.8 , 2.5 , 3.0 , 3.3	1.8 , 2.5 , 3.0 , 3.3	1.8 , 2.5 , 3.0 , 3.3	1.8 , 2.5 , 3.0 , 3.3
Frequency Range			6.4 ~ 52.0 MHz	6.4 ~ 52.0 MHz	6.4 ~ 52.0 MHz	6.4 ~ 52.0 MHz	6.4 ~ 52.0 MHz
Supply Voltage V_{DD} (code)				+1.8 V ± 5% (code is " 18 ")	+2.5 V ± 5% (code is " 25 ")	+3.0 V ± 5% (code is " 3 ")	+3.3 V ± 5% (code is " 33 ")
Current Consumption. (max.) (Over operating temperature range .)	Package	M8T		5 mA	7 mA	- - - - -	10 mA
		M9T		6 mA	6 mA	6 mA	6 mA
		M14T		10 mA	10 mA	13 mA	13 mA
		M15T		10 mA	10 mA	13 mA	13 mA
		M39T		- - - - -	10 mA	13 mA	13 mA
Output Logic Levels	Logic High " 1 " (min.)			1.62 V	2.25 V	2.7 V	2.97 V
	Logic Low " 0 " (max.)			0.25 V	0.25 V	0.3 V	0.33 V

Standard Frequency (Partial list) [MHz]	10.000	12.800	13.000	14.7456	16.000	16.384
	19.200	19.440	19.680	20.000	25.000	27.000
Initial Calibration Tolerance	Models with mechanical trimmer : < ± 1.0 ppm. +25°C ± 2°C. Models without mechanical trimmer : < ± 2.0 ppm at +25°C ± 2°C.					

Frequency Stability (ppm)		± 0.5 ppm	± 1.0 ppm	± 1.5 ppm	± 2.0 ppm	± 2.5 ppm	± 3.0 ppm
Frequency Stability vs Temperature (examples)	0°C to 50°C	○	○	○	○	○	○
	-10°C to 60°C	△	○	○	○	○	○
	-20°C to 70°C	X	○	○	○	○	○
	-30°C to 75°C	X	○	○	○	○	○
	-30°C to 85°C	X	○	○	○	○	○
	-40°C to 85°C	X	△	△	△	○	○

○ : available △ : contact us X : not available

Frequency Stability	vs Aging at Ta = +25°C	± 1.0 ppm / year (max.)		
	vs Voltage Change	± 0.3 ppm (max.) , for a ±5% input voltage change .		
	vs Load Change	± 0.3 ppm (max.) , for a ±10% load condition change .		
	vs Reflow (SMD type)	± 1.0 ppm (max.) , 1 reflow and measured 24 hours afterwards .		
Electrical Frequency Tuning (EFC) by external Control Voltage	Control Voltage Center	0.9 V ± 0.6 V (1.8 V) ; 1.4 V ± 1.0 V (2.5V) ; 1.5 V ± 1.0 V (3.0V / 3.3V)		
	Frequency Deviation Range	± 5.0 ppm (min.)		
	Slope Polarity (Transfer Function)	Positive slope. Positive voltage for positive frequency shift.		
		Input Impedance : 1.0M Ω (min.)	Modulation Bandwidth : 20 KHz (min.)	Linearity : ± 10 % (max.)
Output Load	15 pF			
Rise and Fall Time	10.0 nsec. (max.) Measured at 20% ↔ 80% of the waveform			
Start-Up Time.	5.0 msec. (typ.) , 10.0 msec. (max.) (reach 90% amplitude and at+25°C±2°C)			
Duty Cycle	Standard: 50 % ± 10 % ; Option: 50 % ± 5 %			
Storage Temperature	-40°C to +85°C or -55°C to +125°C (package dependent)			

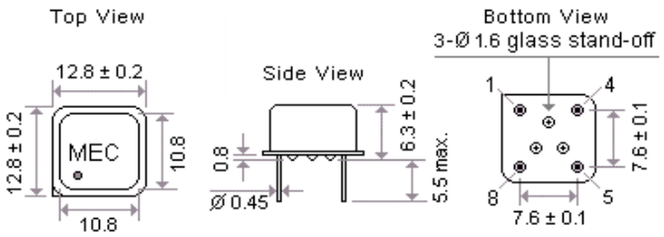
Phase Noise [dBc / Hz (typ.)]	Offset	10 Hz	100 Hz	1 KHz	10 KHz	100 KHz
	M572T33 - 10.000	-96 dBc / Hz	-122 dBc / Hz	-138 dBc / Hz	-145 dBc / Hz	-150 dBc / Hz

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

CMOS Wave Output Code " T "

Outline Dimensions (Unit : mm) , Suggested pin Layout

[(V) M_8T_ _] - - - Gull - wing SMD is also available .

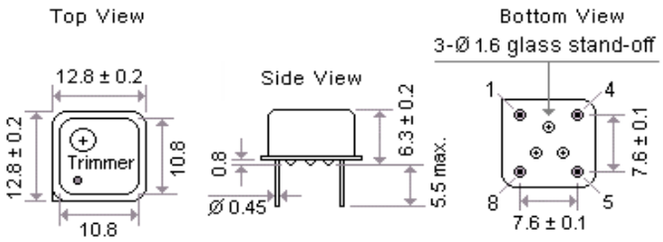


Pad Connections :

Pin 1 : Control voltage for VCTCXO ; No connection for TCXO.

Pin 4 : Ground ; Pin 5 : Output ; Pin 8 : Supply Voltage

[(V) M_9T_ _] - - - with mechanical trimmer

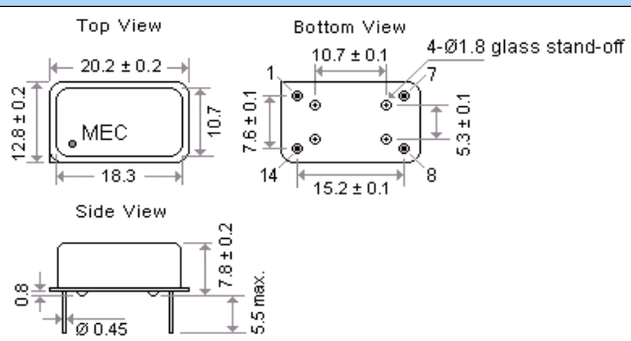


Pad Connections :

Pin 1 : Control voltage for VCTCXO ; No connection for TCXO.

Pin 4 : Ground ; Pin 5 : Output ; Pin 8 : Supply Voltage

[(V) M_14T_ _] - - - Gull - wing SMD is also available .

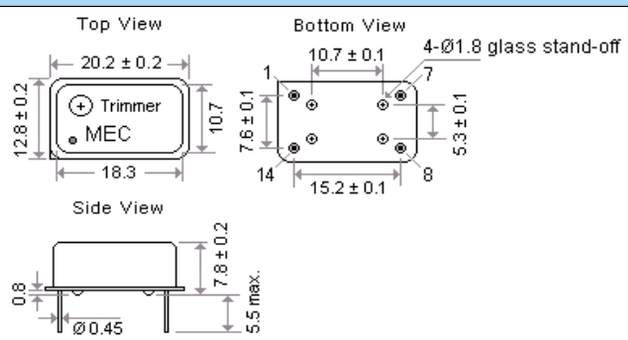


Pad Connections :

Pin 1 : Control voltage for VCTCXO ; No connection for TCXO.

Pin 7 : Ground ; Pin 8 : Output ; Pin 14 : Supply Voltage

[(V) M_15T_ _] - - - with mechanical trimmer

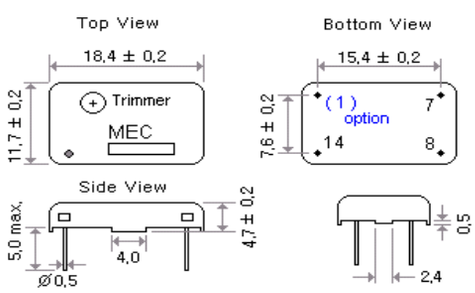


Pad Connections :

Pin 1 : Control voltage for VCTCXO ; No connection for TCXO.

Pin 7 : Ground ; Pin 8 : Output ; Pin 14 : Supply Voltage

[(V) M_39T_ _]



Pad Connections :

Pin 1 : Control voltage for VCTCXO

[No physical pin 1 for TCXO. (3 pins only)]

Pin 7 : Ground ; Pin 8 : Output ; Pin 14 : Supply Voltage

TCXOs

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

CMOS Wave Output Code " T "

Part Number Format and Example

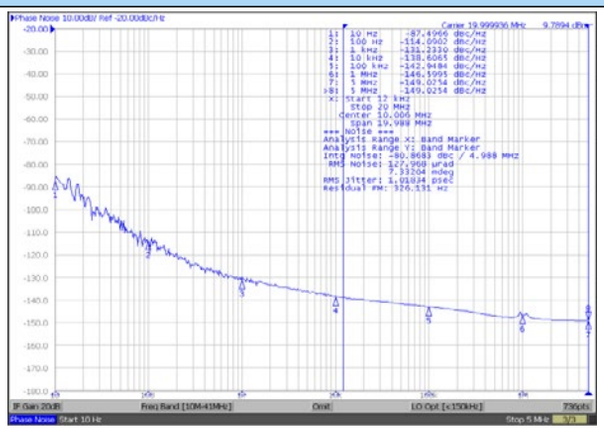
	[1] Holder Type	[2] Output Wave	[3] Supply Voltage	-	[4] Center Frequency	-	[5] Frequency Stability	/	[6] Operating Temp. Range
Examples (1)	VM32	T	3	-	10.000	-	1.5	/	-20+70
(2)	M572	T	3	-	20.000	-	2.5	/	-30+85

Ex (1) : VM32T3 - 10.000 - 1.5 / -20+70 [VCTCXO , VM32 type , CMOS output , 3.0V , 10.000MHz , ±1.5ppm from -20°C to 70°C]

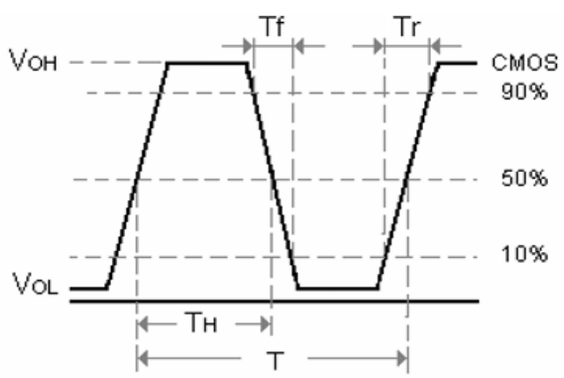
Ex (2) : M572T3 - 20.000 - 2.5 / -30+85 [TCXO , M572 type , CMOS output , 3.0V , 20.000MHz , ±2.5ppm from -30°C to 85°C]

[1]	Holder Type
	" M " stands for TCXO , " VM " stands for VCTCXO
[2]	" T " stands for Square Wave
	ex 1 : VM32T --- VCTCXO , VM32 pcakage , CMOS Output ; ex 2 : M572T --- TCXO , M572 pcakage , CMOS Output
[3]	Supply voltage , " 18 " stands for +1.8V ; " 25 " stands for +2.5V ; " 3 " stands for +3.0V ; " 33 " stands for +3.3V
[4]	Center Frequency in MHz
[5]	Frequency stability in ± _ ppm ; ex 1 : ± 1.5ppm --- 1.5 , ex 2 : ± 2.5ppm --- 2.5
[6]	Operating temperature range in °C
	ex 1 : -20 °C to 70°C ----- -20+70 ; ex 2 : -30 °C to 85°C ----- -30+85

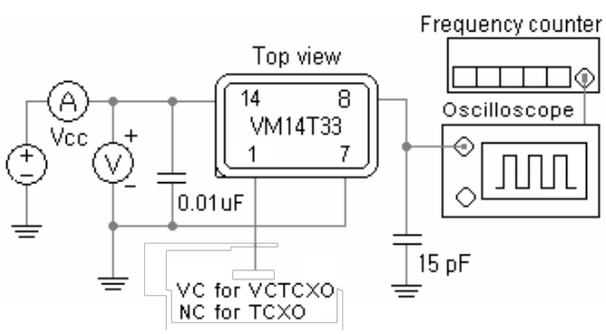
CMOS Typical Phase Noise (M572T33-20.000)



CMOS Output Wave , " T " series



(VC)TCXO with CMOS square wave: Ex. VM14T33



Temperature Compensated Crystal Oscillators [TCXO " M "]

CMOS Output

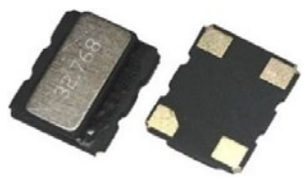
TCXO							
ME _ T	uA Current	± 8 ppm	CMOS	SMD	15 pF	1.8V	2.5V
	32.768 KHz	-40 to +105 °C				3.0V	3.3V

Features

- CMOS 32.768 KHz TCXO with a maximum frequency stability of ± 5 ppm (±2.62 minutes / year) over -40 to +85°C, providing a much better timekeeping accuracy than the competition
- A proprietary temp. compensation technique is applied to the built-in 32.768 KHz tuning fork crystal & temp. sensor
- A 1.5 µA typical current consumption makes it ideal for battery-operated devices
- Samall ceramic SMD package, ideal for new miniaturizing applications

Applications:

- Frequency reference for real time clocks (RTCs)
- Portable instruments
- Timing synchronization for networks, servers, hubs, routers and switches
- Smart metering, data loggers
- GPS receivers. Telematics.



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

Output Waveform		Square wave [CMOS] , Waveform code is " **T** "	
Model		**ME21T**	**ME32T**
Package size		2.1 x 1.3 x 1.1 mm	3.2 x 2.5 x 1.4 mm
Standard Supply Voltages		1.8V , 2.5V , 3.0V , 3.3V	
Start-up Time		0.5 sec (max.)	
Nominal Frequency		32.768 KHz	
Initial Calibration Tolerance (at +25° C ± 3° C)		± 2.5 ppm (max.)	
Current Consumption (With No Load)		1.0 uA (typ.) , 2.0 uA (max.)	
Frequency Stability over Temperature (max.)		± 5.0 ppm (-40°C to +85°C)	
		± 8.0 ppm (-40°C to +105°C)	
Timing error over time [± 5 ppm (-40°C to +85°C)]		± 0.432 sec/day ; ± 12.960 sec/month ; ± 2.628 minutes / year , w.r.t fo at +25°C.	
Frequency Stability	vs Aging	± 3.0 ppm / year (max.) first year at +25° C	
	vs Load Change	± 0.2 ppm (max.) for a ± 10 % loading condition change	
	vs Reflow	± 3.0 ppm (max.) 1 reflow and measured 24 hours afterwards	
	vs Supply Voltage Delta Freq / V	± 1.0 ppm / V (max.)	
Output Load		15 pF	
Output Voltage Level	V_{OH}	90% V_{DD} (min.)	
	V_{OL}	10% V_{DD} (max.)	
Rise Time and Fall Time		100 ns (max.) Measured at 20% ⟷ 80% of the waveform	
Duty Cycle		50% ±10%	
Output Enable / Disable Function		V_{DD} of 80% (min.) to enable output	
		V_{DD} of 20% (max.) to disable output	

Temperature Compensated Crystal Oscillators [TCXO " M "]

CMOS Output

Part Number Format and Example

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

Examples	(1)	ME32	T	33	-	32.768 K	-	8.0	/ -40+105
	(2)	ME21	T	18	-	32.768 K	-	5.0	/ -40+85

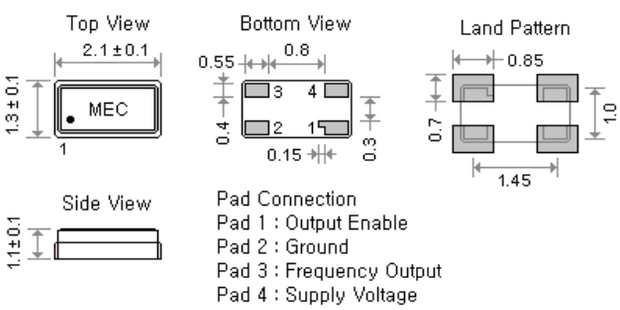
Ex (1) : ME32T33 - 32.768K - 8.0 / -40+105 [ME series 3225 type , CMOS , 3.3V , 32.768 KHz , ± 8.0 ppm from -40°C to +105°C]

Ex (2) : ME21T18 - 32.768K - 5.0 / -40+85 [ME series 2113 type , CMOS , 1.8V , 32.768 KHz , ± 5.0 ppm from -40°C to +85°C]

[1]	Holder Type
	" ME32 " stands for TCXO 3225 type ; " ME21 " stands for TCXO 2113 type
[2]	" T " stands for CMOS waveform
[3]	Supply voltage , " 18 " stands for +1.8V ; " 25 " stands for +2.5V ; " 3 " stands for +3.0V ; " 33 " stands for +3.3V
[4]	Nominal Frequency , " K " stands for KHz
[5]	Frequency stability in ± _ ppm ; ex 1 : ± 8.0ppm --- 8.0 , ex 2 : ± 5.0ppm --- 5.0
[6]	Operating temperature range in °C
	ex 1 : -40 °C to +105°C ----- -40+105 ; ex 2 : -40 °C to +85°C ----- -40+85

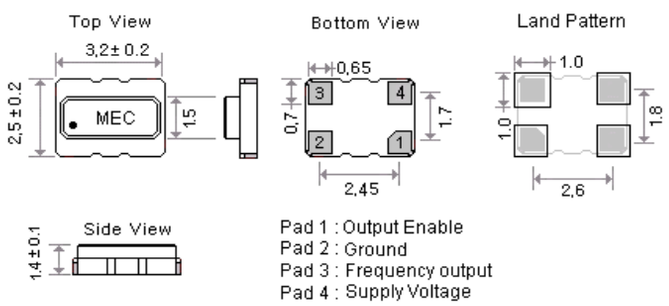
Package Dimensions (Unit : mm)

[ME21T]



Pad Connection
Pad 1 : Output Enable
Pad 2 : Ground
Pad 3 : Frequency Output
Pad 4 : Supply Voltage

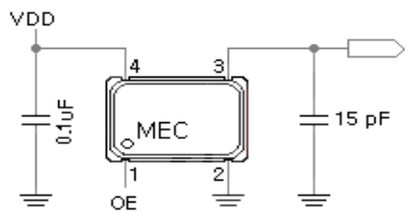
[ME32T]



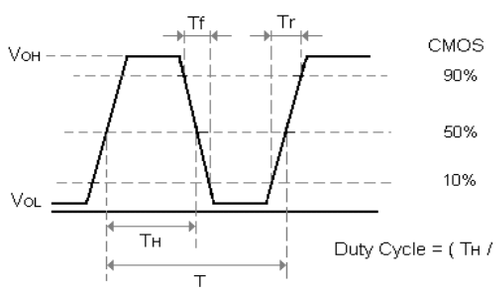
Pad 1 : Output Enable
Pad 2 : Ground
Pad 3 : Frequency output
Pad 4 : Supply Voltage

Test Circuit and Output Waveform

Test Circuit



CMOS Output Waveform



Duty Cycle = (TH / T) x 100%

TCXOs

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

TCXO			VCTCXO			N series	SMD	2.5V	3.3V	Min.	Max.
MQN _ T	MQN _ P	MQN _ D	VMQN _ T	VMQN _ P	VMQN _ D					10 MHz	1,500 MHz
CMOS	PECL	LVDS	CMOS	PECL	LVDS						

Features

0.8 pS Phase Jitter (typical)

- Wide frequency range : 10 ~ 1500 MHz
- RMS Jitter (12 kHz ~ 20MHz) : 0.8 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
- Single end output : CMOS , Differential output : LVPECL or LVDS

General specifications , at Ta=+25°C

Model	(V)MQN326T , (V)MQN574T	(V)MQN326P , (V)MQN576P	(V)MQN326D , (V)MQN576D
Output Logic	**CMOS**	**PECL**	**LVDS**
Supply Voltage V_{DD} (code)	+ 2.5 V_{DD} ± 5% (voltage code " 25 ")	+ 2.5 V_{DD} ± 5% (voltage code " 25 ")	+ 2.5 V_{DD} ± 5% (voltage code " 25 ")
	+ 3.3 V_{DD} ± 5% (voltage code " 33 ")	+ 3.3 V_{DD} ± 5% (voltage code " 33 ")	+ 3.3 V_{DD} ± 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 Vcc - 2V or Thevenin equiralent	100 Ω
Output Logic " High " , " 1 "	90 % V_{DD}	V_{DD} - 1.03 (min.) , V_{DD} - 0.6 (max.)	1.4 V (typ.) , 1.6 V (max.)
Output Logic " Low " , " 0 "	10 % V_{DD}	V_{DD} - 1.85 (min.) , V_{DD} - 1.6 (max.)	1.1 V (typ.) , 0.9 V (min.)
(V_{DD} = + 2.5V) Current Consumption (max.)	50 MHz : 34 mA	156 MHz : 46 mA	156 MHz : 32 mA
	125 MHz : 38 mA	600 MHz : 50 mA	800 MHz : 40 mA
	200 MHz : 40 mA	1,000 MHz : 60 mA	1,000 MHz : 44 mA
(V_{DD} = + 3.3V) Current Consumption (max.)	50 MHz : 36 mA	156 MHz : 50 mA	156 MHz : 35 mA
	125 MHz : 40mA	600 MHz : 55 mA	800 MHz : 40 mA
	200 MHz : 44 mA	1,000 MHz : 62 mA	1,000 MHz : 44 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.) Tr / Tf : 10% ↔ 90% waveform	0.2 nsec. (typ.) , 0.5 nsec. (max.) Tr / Tf : 20% ↔ 80% waveform	0.2 nsec. (typ.) , 0.4 nsec. (max.) Tr / Tf : 20% ↔ 80% waveform

Initial Calibration Tolerance	± 1.0 ppm. (max.) at +25°C±2°C. (upon shipment) for Package Size (3.2 * 2.5 mm)							
	± 2.0 ppm. (max.) at +25°C±2°C. (upon shipment) for Package Size (5.0 * 7.0 mm)							
Frequency Stability Codes	Temperature (ref to +25°C)	± 2.0 ppm over -40°C to +85°C (default)						
		± 1.0 ppm over -40°C to +85°C (available)						
	Aging at Ta = +25°C	± 1.0 ppm max . , per year at 25°C						
	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	5.0 msec. (max.)							
RMS Jitter [12 kHz ~ 20 MHz]	0.8 psec (typ.)							
Phase Noise [dBc / Hz (typ.)]	Offset	10 Hz	100 Hz	1K Hz	10K Hz	100K Hz	1M Hz	10M Hz
	125 MHz	-51	-93	-111	-123	-125	-135	-155
	212.5 MHz	-42	-87	-105	-115	-118	-130	-151
Storage Temperature	-55°C to + 125°C							

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

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

TCXO			VCTCXO			F	SMD	2.5V	3.3V	Min.	Max.
MQF _ T	MQF _ P	MQF _ D	VMQF _ T	VMQF _ P	VMQF _ D	series				10 MHz	1,500 MHz
CMOS	PECL	LVDS	CMOS	PECL	LVDS						

Features

Quick - Turn Clock Oscillators

1.0 pS Phase Jitter (typical)

- 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

General specifications , at Ta=+25°C

Model	(V)MQF326T , (V)MQF574T	(V)MQF326P , (V)MQF576P	(V)MQF326D , (V)MQF576D
Output Logic	**CMOS**	**PECL**	**LVDS**
Supply Voltage V_{DD} (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	50 Ω into Vcc - 2V or Thevenin equiralent	100 Ω
Output Logic " High " , " 1 "	90 % V_{DD}	V_{DD} - 1.03 (min.) , V_{DD} - 0.6 (max.)	1.4 V (Typ.) , 1.6 V (max.)
Output Logic " Low " , " 0 "	10 % V_{DD}	V_{DD} - 1.85 (min.) , V_{DD} - 1.6 (max.)	1.1 V (Typ.) , 0.9 V (min.)
(V_{DD} = + 2.5V) Current Consumption (max.)	50 MHz : 34 mA	156 MHz : 46 mA	156 MHz : 32 mA
	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_{DD} = + 3.3V) Current Consumption (max.)	50 MHz : 36 mA	156 MHz : 50 mA	156 MHz : 35 mA
	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.) Tr / Tf : 10% ↔ 90% waveform	0.2 nsec. (Typ.) , 0.5 nsec. (max.) Tr / Tf : 20% ↔ 80% waveform	0.2 nsec. (Typ.) , 0.4 nsec. (max.) 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)							
	± 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)						
		± 1.0 ppm over -40°C to +85°C (available)						
	Aging at Ta = +25°C	± 1.0 ppm (max.) first year						
	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_{DD} = 2.5V and 3.3V	OE Control on Pad 2	70% of V_{DD} (min.) to enable output. (Open connection prohibit.)
Frequency Pulling Range	± 8 ppm (min.)		30% of V_{DD} (max.) to disable output.
Linearity	1% (typ.) ; 10% (max.)		
Transfer Function	Positive Transfer		
Absolute Voltage	4.0 V (max.)	Output Enable Time / Disable Time	200 nsec. (max.) / 50 nsec. (max.)
Input Impedance	770 KΩ (typ.)		

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

Part Number Format and Example

	[1] Holder Type	[2] Package Code	[3] Waveform Code	[4] Supply Voltage	-	[5] Center Frequency	-	[6] Frequency Stability	/	[7] Operating Temp. Range
Examples (1)	MQN	326	D	25	-	622.080	-	1.0	/	-40+85
(2)	VMQF	576	P	33	-	120.000	-	2.0	/	-40+85

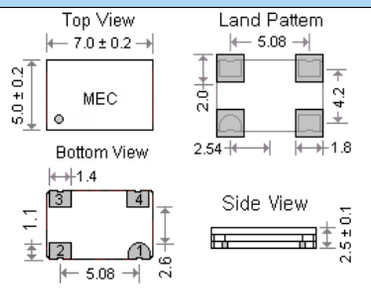
Ex (1) : MQN326D25 - 622.080 - 1.0 / -40+85 [TCXO , MQN326 type , LVDS , +2.5V , 622.080MHz , ±1.0ppm from -40°C to 85°C]

Ex (2) : VMQF576P33 - 120.000 - 2.0 / -40+85 [VCTCXO , VMQF576 type , PECL , +3.3V , 120.000MHz , ±2.0ppm from -40°C to 85°C]

[1]	Holder Type : " MQN " , " MQF " stands for TCXO ; " VMQN " , " 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 : ± 1.0ppm --- 1.0 , ex 2 : ± 2.0ppm --- 2.0
[7]	Operating Temperature Range in °C ex : -40 °C to 85°C ----- -40+85

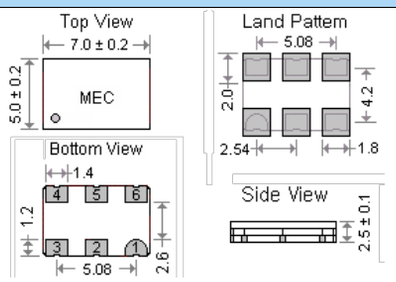
Outline Dimensions (Unit : mm) , Suggested pad Layout for SMDs

[(V)MQ _ 574T]



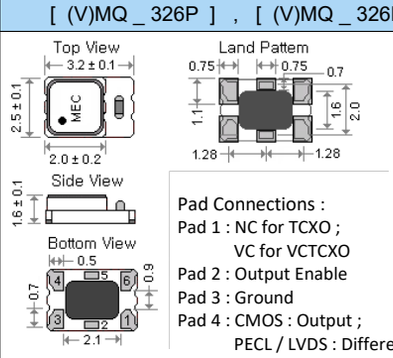
Pad Connections :
Pad 1 : NC for TCXO ;
VC for VCTCXO
Pad 2 : Ground
Pad 3 : Output
Pad 4 : Supply Voltage

[(V)MQ _ 576P] , [(V)MQ _ 576D]



Pad Connections :
Pad 1 : NC for TCXO ;
VC for VCTCXO
Pad 2 : Output Enable
Pad 3 : Ground
Pad 4 : Output
Pad 5 : Complementary
Pad 6 : Supply Voltage

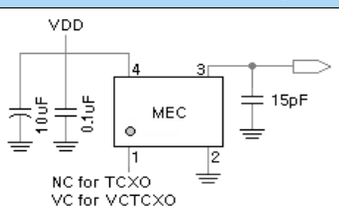
[(V)MQ _ 326T] , [(V)MQ _ 326P] , [(V)MQ _ 326D]



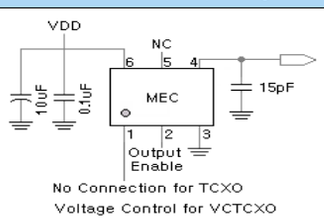
Pad Connections :
Pad 1 : NC for TCXO ;
VC for VCTCXO
Pad 2 : Output Enable
Pad 3 : Ground
Pad 4 : CMOS : Output ;
PECL / LVDS : Differential
Pad 5 : CMOS : No Connection ;
PECL / LVDS : Complementary
Pad 6 : Supply Voltage

Test Circuits and Output Waveforms

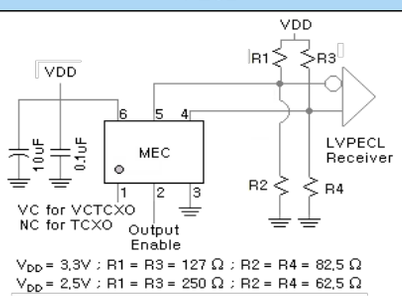
CMOS for 4pad package



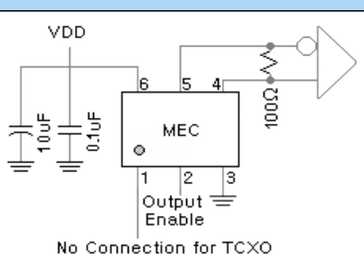
CMOS for 6pad package



PECL



LVDS

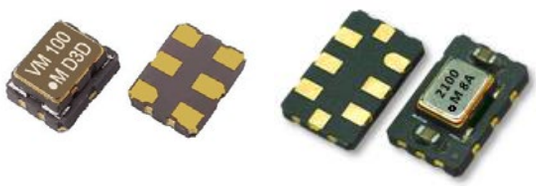


Temperature Compensated Crystal Oscillators [TCXO " M " and VCTCXO " VM "]

TCXO	VCTCXO								
MJF_	VMJF_	Quick - Turn Clock Oscillators	250 fsec RMS Jitter	SMD	1.8 V	2.5 V	3.3 V	Min. 15 MHz	Max. 2,100 MHz

Features

- Wide frequency range : 15 ~ 2100 MHz
- RMS jitter (12KHz ~ 20MHz) : 250 fsec typ. (at 156.250MHz , 3.3V)
- Next-Day sample for Prototypes
- package size : 5.0 x 3.2mm and 3.2 x 2.5mm



General specifications , at Ta = + 25°C

Model	(V)MJF326P , (V)MJF538P	(V)MJF326D , (V)MJF538D	(V)MJF326C , (V)MJF538C	(V)MJF326Q , (V)MJF538Q
Output Logic	PECL	LVDS	HCSL	CML
Supply Voltage V_{DD}	--	+ 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 ± 5%	+ 3.3 V ± 5%	+ 3.3 V ± 5%	+ 3.3 V ± 5%
Available Frequency Range	15 ~ 2,100 MHz	15 ~ 2,100 MHz	15 ~ 700 MHz	15 ~ 2,100 MHz
Output Load	50 Ω into V_{DD} - 2V or Thevenin equivalent	100 Ω between output and complimentary output	50 Ω to GND	50 Ω to V_{DD}
Output Logic " High " , " 1 "	V_{DD} - 1.03 V (min.) V_{DD} - 0.6 V (max.)	1.4 V (Typ.) 1.6 V (max.)	V_{DD} : 0.66 V (min.) V_{DD} : 1.15 V (max.)	V_{DD} - 0.085 V (min.) V_{DD} = (max.)
Output Logic " Low " , " 0 "	V_{DD} - 1.85 V (min.) V_{DD} - 1.6 V (max.)	1.1 V (Typ.) 0.9 V (min.)	V_{DD} : - 0.15 V (min.) V_{DD} : 0.15 V (max.)	V_{DD} - 0.6 V (min.) V_{DD} - 0.32 V (max.)
Output Voltage Swing	595 mV (min.) 930 mV (max.)	250 mV (min.) 450 mV (max.)	620 mV (min.) 700 mV (typ.)	200 mV (min.) 600 mV (typ.)
Current Consumption (V_{DD} = + 3.3 V)	100 mA (typ.) 120 mA (max.)	75 mA (typ.) 90 mA (max.)	80 mA (typ.) 100 mA (max.)	70 mA (typ.) 85 mA (max.)
Current with Output Disabie	99 mA (typ.)	74 mA (typ.)	79 mA (typ.)	69 mA (typ.)
Rise Time / Fall Time (20% to 80% Waveform)	0.4 nsec. (max.)	0.4 nsec. (max.)	0.4 nsec.(max.)	0.4 nsec. (max.)

Initial Calibration Tolerance	± 1.0 ppm (max.) at +25°C ± 2°C.	
Frequency Stability	Temperature (ref to +25°C)	± 1.5 ppm over -40°C to +85°C (default)
		± 1.0 ppm over -40°C to +85°C (available)
	Aging at Ta = +25°C	± 1.0 ppm (max.) , per year
	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 (typ.) ; 10 msec (max.)	
Storage Temperature	-55°C to +150°C	
RMS Jitter (typ.) (12 KHz to 20 MHz)	15 MHz ~ 50 MHz : 500 fsec (typ.) , 51MHz ~ 1,200 MHz : 250 fsec (typ.)	

Control Voltage Function on Pad 1		Output Enable Function on pad 2	
Control Voltage Center and Range	+ 1.5V ± 1.0V for both V_{DD} = 2.5V and 3.3V	Output Enable / Disable Function	70% of V_{DD} (min.) to enable output.
	+ 0.9V ± 0.6V for both V_{DD} = 1.8V		30% of V_{DD} (max.) to disable output
Frequency Pulling Range	± 8 ppm (min.)	Output Enable Time	2.5 msec (max.)
Linearity	1% (typ.) ; 10% (max.)		
Transfer Function	Positive Transfer	Output Disable Time	10 usec (max.)
Input Impedance	5 MΩ (typ.)		

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

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

TCXO	VCTCXO								
MJF_	VMJF_	Quick - Turn Clock Oscillators	250 fsec RMS Jitter	SMD	1.8 V	2.5 V	3.3 V	Min. 15 MHz	Max. 2,100 MHz

Part Number Format and Example

[1] Holder Type	[2] Package Code	[3] Waveform Code	[4] Supply Voltage	-	[5] Center Frequency	-	[6] Frequency Stability	/	[7] Operating Temp. Range
Examples (1)	MJF	326	D	33	-	156.250	-	1.0	/	-20+70
(2)	VMJF	538	C	18	-	100.000	-	1.5	/	-40+85

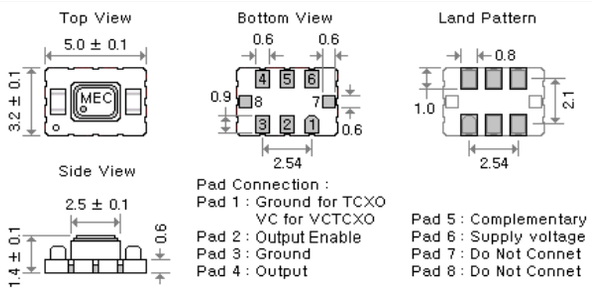
Ex (1) : MJF326D33 - 156.250 - 1.0 / -20+70 [TCXO , MJF326 type , LVDS , +3.3V , 156.250MHz , ±1.0ppm from -20°C to 70°C]

Ex (2) : VMJF538C18 - 100.000 - 1.5 / -40+85 [VCTCXO , VMJF538 type , HCSL , +1.8V , 100.000MHz , pulling：±8ppm min. , ±1.5ppm from -40°C to 85°C]

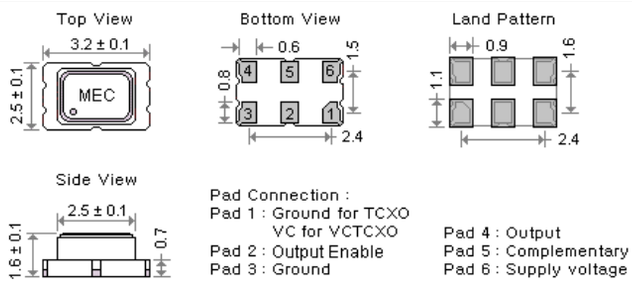
[1]	Holder Type : " MJF " stands for TCXO ; " VMJF " stands for VCTCXO
[2]	Package Code : " 326 " stands for 3.2 x 2.5 x 1.6 mm 6pad ; " 538 " stands for 5.0 x 3.2 x 1.4 mm 8pad
[3]	Output Waveform Code : " P " stands for LVPECL ; " D " stands for LVDS ; " C " stands for HCSL ; " Q " stands for CML
[4]	Supply Voltage : " 18 " stands for +1.8V ; " 25 " stands for +2.5V ; " 33 " stands for +3.3V
[5]	Center Frequency in MHz
[6]	Frequency Stability in ± _ ppm ; ex 1 : ± 1.0ppm --- 1.0 , ex 2 : ± 1.5ppm --- 1.5
[7]	Operating Temperature Range in °C ex 1 : -20 °C to 70°C ----- -20+70 ; ex 2 : -40 °C to 85°C ----- -40+85

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

MJF538_ , VMJF538_

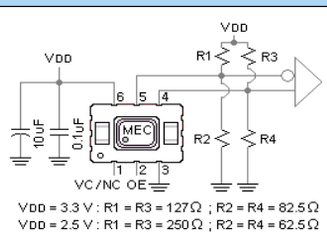


MJF326_ , VMJF326_

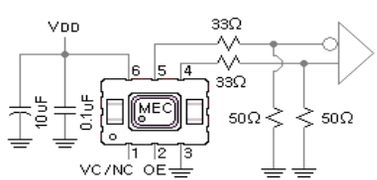


Test Circuits

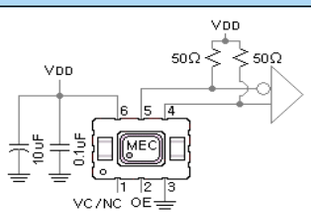
PECL Test Circuit



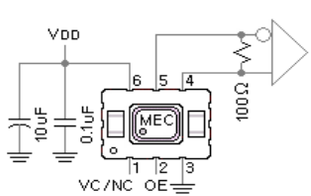
HCSL Test Circuit



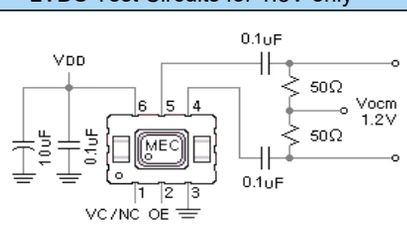
CML Test Circuit



LVDS Test Circuit for 2.5V and 3.3V



LVDS Test Circuits for 1.8V only (*)



Note * : The 50-ohm termination resistors along with the bias voltage (Vocm) is required to be set at the destination circuit as shown in the figure.

Temperature Compensated Crystal Oscillators [TCXO " M "]

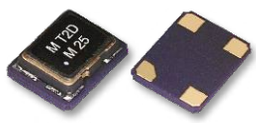
CMOS Output

CMOS Wave Output Code " T " [SMD Type]

TCXO										
M _1T	Output Enable / Disable	-40 to +85 ℃	CMOS	SMD	15pF	1.8 V	2.5 V	3.3 V	Min. 9.5 MHz	Max. 60 MHz

Features

- Wide frequency range : [9.5 MHz ~ 60.0 MHz]
- Frequency stability as tight as ± 2.5 ppm over -40°C to 85°C
- Frequency stability as tight as ± 5.0 ppm over -40°C to 105°C (available)



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

Output Waveform	Square wave [CMOS] . Waveform code is " T "		
Type	**M211T**	**M221T**	**M321T**
Package (Size)	2.05 x 1.65 x 0.70 mm	2.5 x 2.0 x 0.8 mm	3.2 x 2.5 x 1.2 mm
Frequency Range	10.0 ~ 52.0 MHz	9.5 ~ 60.0 MHz	9.5 ~ 60.0 MHz

Output Waveform	Adapter Board Type	
Type	**M531T-AB**	**M571T-AB**
Package (Size)	5.0 x 3.2 x 1.3 mm	7.0 x 5.0 x 1.4 mm
Frequency Range	9.5 ~ 60.0 MHz	9.5 ~ 60.0 MHz

Supply Voltage Range		+ 1.8 V (code is " 18 ")	+ 2.5 V (code is " 25 ")	+ 3.3 V (code is " 33 ")	
Current Consumption		6 mA (max.)	7 mA (max.)	8 mA (max.)	
Standard Frequency [MHz]		12.000 , 20.000 , 24.000 , 25.000 , 26.000 , 40.000 , 50.000 , 60.000			
Initial Calibration Tolerance		± 2.0 ppm (max.) at +25°C ± 2°C. after reflow			
Frequency Stability		± 2.5 ppm	± 5.0 ppm	± 10.0 ppm	X : not available
Frequency Stability vs Temperature	- 40°C to + 85°C	○	○	○	△ : please contact us
	- 40°C to + 105°C	△	△	○	○ : available
Frequency Stability	vs Aging at Ta= + 25°C	± 1.0 ppm (max.) , per year			
	vs Voltage Change	± 0.3 ppm (max.) , for a ± 5% input voltage change .			
	vs Load Change	± 0.3 ppm (max.) , for a ± 10% load condition change .			
Output Logic High " 1 "		V_{DD} of 80% (min.)			
Output Logic Low " 0 "		V_{DD} of 20% (max.)			
Rise Time and fall time		10.0 nsec. (max.) ; 10% ↔ 90% of the waveform			
Duty Cycle		50 % ± 5 %			
Start-Up Time.		5.0 msec. (max.)			
Output Load		15 pF			
Output Enable / Disable Function on Pad1 (Don't use in the OPEN condition)		V_{DD} of 80% (min.) to enable output			
		V_{DD} of 20% (max.) to disable output			
RMS Jitter (12KHz ~ 20MHz)		0.3 psec (typ.) , 1.0 psec (max.)			
Phase Noise Offset / dBc / Hz [typ.]	50MHz as example	10 Hz	100 Hz	1 KHz	10 KHz	100 KHz
		-85 dBc / Hz	-111 dBc / Hz	-133 dBc / Hz	-149 dBc / Hz	-154 dBc / Hz
Storage Temperature		-55°C to +125°C				

Temperature Compensated Crystal Oscillators [TCXO " M "]

CMOS Wave Output Code " T " [SMD Type]

Part Number Format and Exmple

	[1]	[2]	[3]	[4]	-	[5]	-	[6]	/	[7]	-	[8]
	Holder Type	Enable/Disable Function	Output Wave	Supply Voltage		Center Frequency		Frequency Stability		Operating Temp. Range		Adapter Board
Examples	(1)	M32	1	T	33	-	40.000	-	5.0	/	-40+105		
	(2)	M57	1	T	33	-	10.000	-	2.5	/	-40+85	-	AB

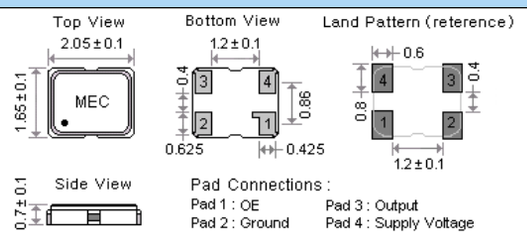
Ex (1) : M321T33 - 40.000 - 5.0 / -40+105 [TCXO , 3225 SMD package , OE on pad1 , CMOS output , 3.3V , 40.000MHz , ±5.0ppm from -40°C to 105°C]

Ex (2) : M571T33 - 10.000 - 2.5 / -40+85 - AB [TCXO , 7050 SMD package , OE on pad1 , CMOS output , 3.3V , 10.000MHz , ±2.5ppm from -40°C to 85°C , Adapter Boar

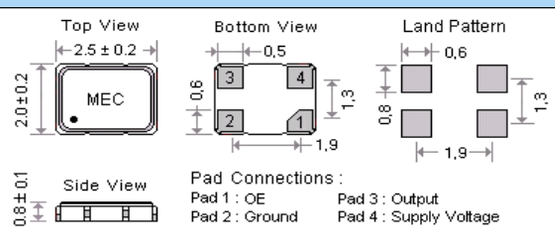
[1]	Holder Type
	" M " stands for TCXO
[2]	Enable / Disable Function on pad1 , ex M321 --- OE on pad1
[3]	" T " stands for Square Wave
	ex : M321T --- TCXO , 3225 SMD pcakage , CMOS output
[4]	Supply voltage , " 18 " stands for +1.8V ; " 25 " stands for +2.5V ; " 33 " stands for +3.3V
[5]	Center Frequency in MHz
[6]	Frequency stability in ± _ ppm ; ex 1 : ± 2.5ppm --- 2.5 , ex 2 : ± 5.0ppm --- 5.0
[7]	Operating temperature range in °C
	ex 1 : -40 °C to 105°C ----- -40+105 ; ex 2 : -40 °C to 85°C ----- -40+85
[8]	Adapter Board Type ----- AB

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

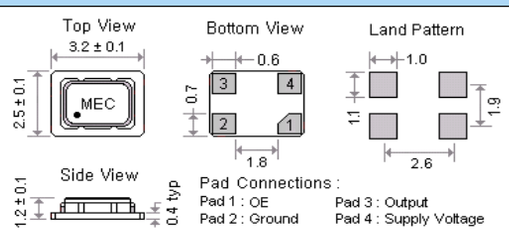
[M211T]



[M221T]

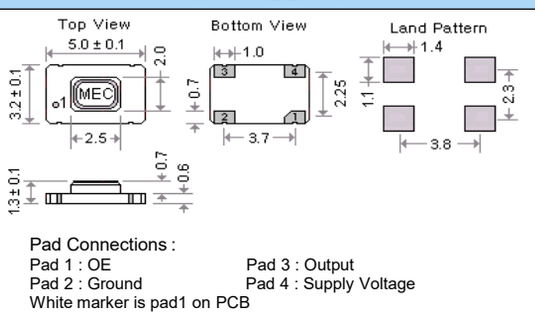


[M321T]

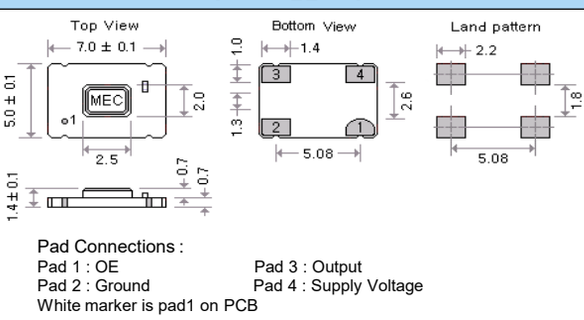


Outline Dimensions (Unit : mm) , Adapter Board Type

[M531T _ _ AB]



[M571T _ _ AB]



TCXOs

Temperature Compensated Crystal Oscillators [TCXO " M "]

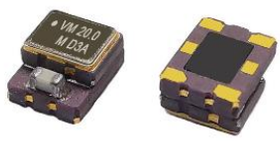
CMOS Output

TCXO	VCTCXO							
MTF_T	VMTF_T	Quick - Turn Clock Oscillators	CMOS	1.8 V	2.5 V	3.3 V	Min. 1 MHz	Max. 200 MHz

Features

1.2 pS Phase Jitter (typical)

- Programmable low cost CMOS TCXO
- High frequency range : [1 MHz ~ 200 MHz]
- Frequency stability as tight as ± 2.0 ppm over -40°C to 85°C



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

Output Waveform	Square wave [CMOS] . Waveform code is " T "	
Type	**MTF326 , VMTF326**	**MTF538 , VMTF538**
Package Size	3.2 x 2.5 x 1.6 mm	5.0 x 3.2 x 1.4 mm

Supply Voltage (V_{DD})		+ 1.8 V (code is " 18 ")	+ 2.5 V (code is " 25 ")	+ 3.3 V (code is " 33 ")
Available Frequency Range		1 ~ 125 MHz	1 ~ 200 MHz	1 ~ 200 MHz
Current Consumption		30 mA (max.)	35 mA (max.)	40 mA (max.)
Initial Calibration Tolerance		± 2.0 ppm at +25°C ± 2°C. (Default for Quick - Turn)		
Frequency Stability	vs Temperature	± 2.0 ppm (max.) at -40°C to 85°C (Default for Quick - Turn)		
	vs Aging at Ta= + 25 °C	± 1.0 ppm (max.) , per year		
	vs Voltage Change	± 0.3 ppm (max.) , for a ± 5% input voltage change .		
	vs Load Change	± 0.3 ppm (max.) , for a ± 10% load condition change .		
	vs Reflow	± 1.0 ppm (max.) , 1 reflow and measured 24 hours afterwards .		
Output Logic High " 1 "		V_{DD} - 0.4 V (min.)		
Output Logic Low " 0 "		0.4 V (max.)		
Rise Time and Fall Time		10.0 nsec (max.) ; 10% ↔ 90% of the waveform		
Duty Cycle		1 ~ 150MHz : 50 % ± 5 %		
		150 ~ 200MHz : 50 % ± 10 %		
Start-Up Time		5.0 msec. (typ.) , 10.0 msec. (max.)		
Output Load		15 pF		
Electrical Frequency Tuning (EFC) by external Control Voltage	Control Voltage Center	1.8 V	2.5 V	3.3 V
		0.9 V ± 0.6 V	1.4 V ± 1.0 V	1.5 V ± 1.0 V
	Frequency Deviation Range	± 5.0 ppm (min.)		
	Slope Polarity (Transfer Function)	Positive slope. Positive voltage for positive frequency shift.		
		Input Impedance : 1.0M Ω (min.)	Modulation Bandwidth : 3 KHz (min.)	Linearity : ± 10 % (max.)
Output Enable / Disable Function		70% of V_{DD} (min.) to enable.		
		30% of V_{DD} (max.) to disable.		
		Disable Current : 0.2 mA (typ.) , 1.0 mA (max.)		
RMS Jitter (12KHz ~ 20MHz)	100MHz as example	1.2 psec (typ.)		

Phase Noise	10 Hz	100 Hz	1 KHz	10 KHz	100 KHz
Offset / dBc / Hz (typ.)	-72 dBc / Hz	-101 dBc / Hz	-115 dBc / Hz	-121 dBc / Hz	-119 dBc / Hz

Storage Temperature	-55°C to +150°C

Temperature Compensated Crystal Oscillators [TCXO " M "]

CMOS Wave Output Code " T "

Part Number Format and Exmple

	[1] Holder Type	[2] Output Wave	[3] Supply Voltage	–	[4] Center Frequency	–	[5] Frequency Stability	/	[6] Operating Temp. Range
Examples	(1) MTF538	T	33	-	133.330	-	1.0	/	-40+85
	(2) VMTF326	T	18	-	100.000	-	2.0	/	-10+60

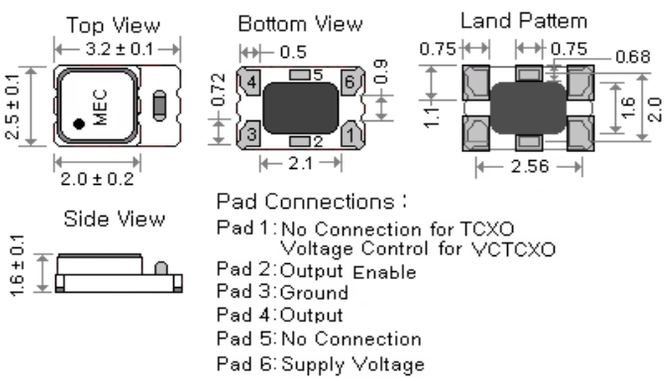
Ex (1) : MTF538T33 - 133.330 - 1.0 / -40+85 [TCXO , 5032 SMD package , CMOS , 3.3V , 133.330MHz , ±1.0ppm from -40°C to 85°C]

Ex (2) : VMTF326T18 - 100.000 - 2.0 / -10+60 [VCTCXO , 3225 SMD package , CMOS , 1.8V , 100.000 MHz , ±2.0ppm from -10°C to 60°C]

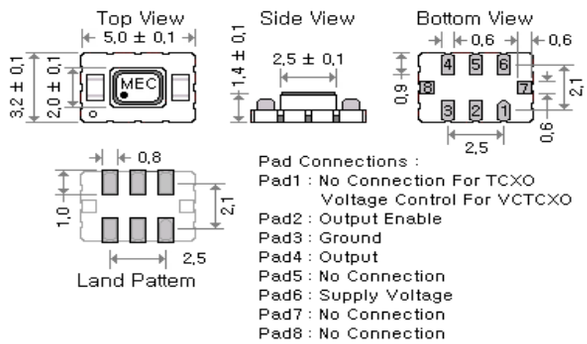
[1]	Holder Type
	" MTF " stands for TCXO ; " VMTF " stands for VCTCXO
[2]	" T " stands for Square Wave
[3]	Supply voltage : " 18 " stands for +1.8V ; " 25 " stands for +2.5V ; " 33 " stands for +3.3V
[4]	Center Frequency in MHz
[5]	Frequency stability in ± _ ppm ; ex 1 : ± 1.0ppm --- 1.0 , ex 2 : ± 2.0ppm --- 2.0
[6]	Operating temperature range in °C
	ex 1 : -40 °C to 85°C ----- -40+85 ; ex 2 : -10 °C to 60°C ----- -10+60

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

[(V) MTF326T]



[(V) MTF538T]



TCXOs

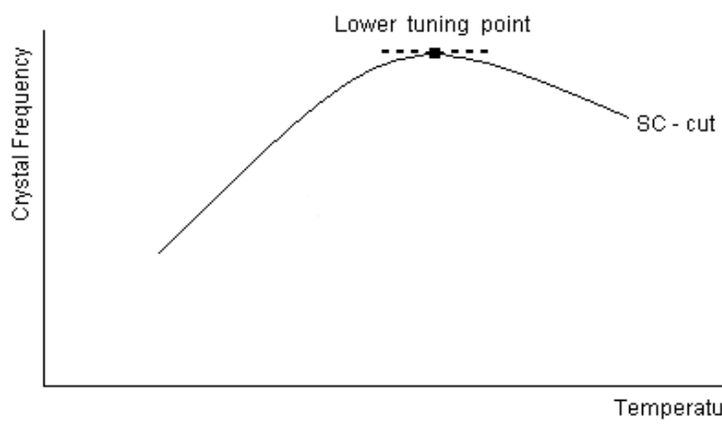
" OCXO " [Oven Controlled Crystal Oscillators]		
" OC_ _ E " series (True Sine Wave)	**" OC_ _ S "** series (Clipped Sine Wave)	**" OC_ _ T "** series (Square Wave)

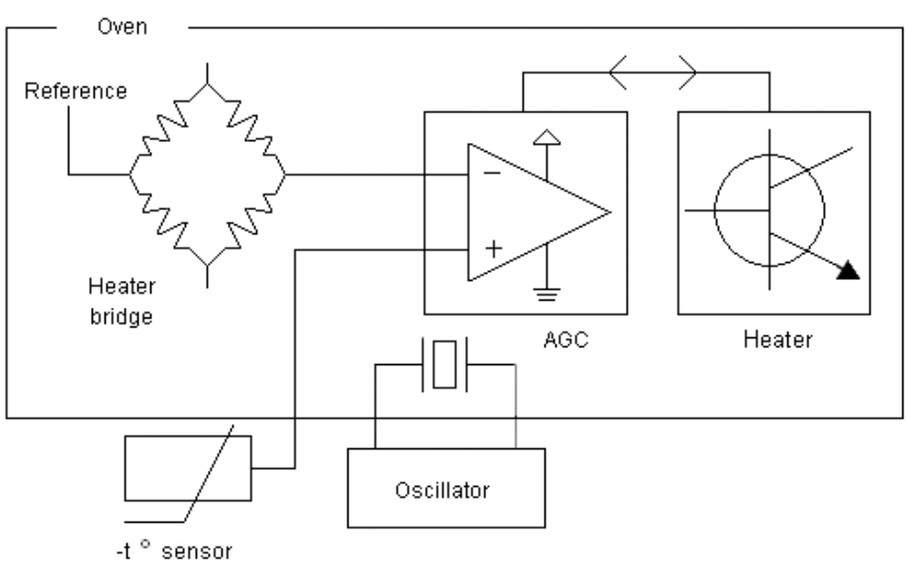
What is an OCXO ?

Relatively speaking , an OCXO perform in the ± 0.01 ~ ± 0.1ppm range , a TCXO performs in the ± 1.0 ~ ± 5.0ppm range while a non - compensated clock oscillator performs in the ±25 with ±50ppm range .

A TCXO relies upon on a resistor / capacitor compensation network to counter the crystal's temperature - dependent frequency behavior . An OCXO has a crystal that is " ovenized " . This means the crystal " sees " a constant temperature regardless of the ambient temperature condition . The oven consists of a proportional heater (power transistor) and an automatic gain control (AGC) circuit . Also , a thermister monitors the oven temperature and sends an offset signal to the AGC which then turns the power transistor on and off accordingly . Thermal gradient and heat loss are carefully controlled to minimize the set point fluctuation of the oven . The oven temperature is normally set near the upper tuning point (UPT) of the crystal's freq. - temp. curve . At the UPT , the slope is zero and ideally there is no frequency change if the crystal " sees " a constant temperature .

Applications for OCXOs include satellite radio beacons , Stratum 3 systems , PCS / GMS base stations , SONET clocks , frequency synthesizers and instrumentation .



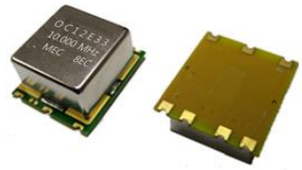


" OCXO " [Oven Controlled Crystal Oscillators]

OC12T	OC12E	Best stability	Standard OCXO Series	SMD	3.3V	5.0V	Min.	Max.
Square Wave	True Sine Wave	± 10 ppb					5 MHz	40 MHz

Applications

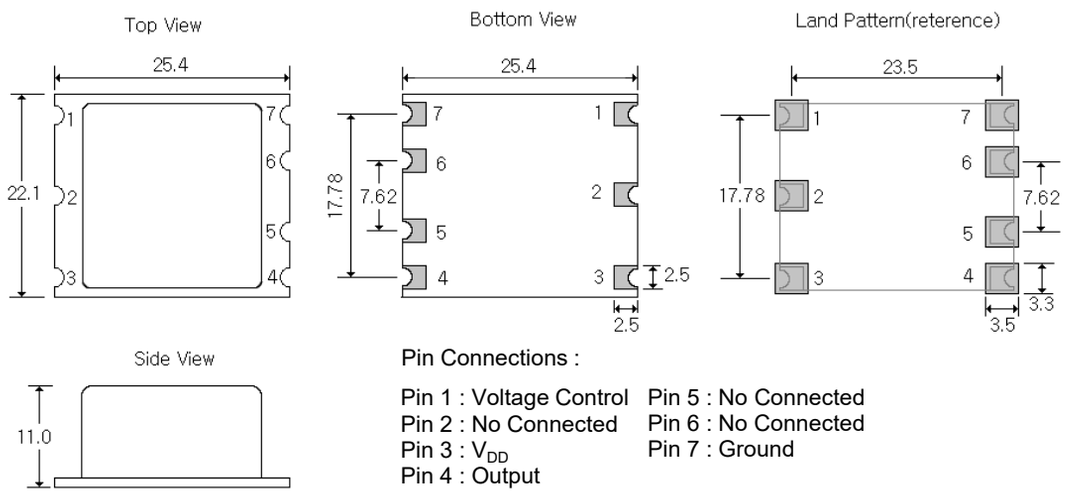
- OC12_ (25.4 * 22.1 * 11.0 mm)
- +3.3V , +5.0V Supply Voltages
- Voltage control (Electronic Frequency Tuning) is standard .



General Specifications (at+25°C and specified input voltage)

Output Waveform		Square wave. Waveform code is " T "		True Sine Wave. Waveform code is " E "	
Supply Voltage		+3.3 V	+5.0 V	+3.3 V	+5.0 V
Supply Voltage range , " Voltage code "		+3.3V ± 5% , " 3 "	+5.0V ± 5% , " 5 "	+3.3V ± 5% , " 3 "	+5.0V ± 5% , " 5 "
Frequency Range		5 ~ 40.0 MHz		5 ~ 40.0 MHz	
Initial Calibration Tolerance		± 200 ppb (max.)	± 200 ppb (max.)	± 200 ppb (max.)	± 200 ppb (max.)
		Vcon = +1.65 V	Vcon = +2.5 V	Vcon = +1.65 V	Vcon = +2.5 V
Type of Crystal Cut Used		" SC - cut " crystal or " IT - cut " crystal			
Frequency Stability	vs Temperature (refer to +25°C)	± 5 ppb (max.) over 0°C to +70°C			
		± 10 ppb (max.) over -30°C to +70°C			
		± 10 ppb (max.) over -40°C to +85°C			
	vs Voltage Change	± 0.5 ppb (max.) , for a ± 5% input voltage change .			
	vs Warm-up time (+25°C)	10 minute (max.) Within ± 10 ppb of its reference frequency.			
	vs Aging	± 0.5 ppb (max.) / after 30 days ; ± 50 ppb(max.) / first year ; ± 400 ppb (max.) over 10 years.			
Voltage Control On pin 1 (EFC) (Electronic Freq. Tuning)	Freq. Deviation Range	± 0.5 ppm (min.) , ±5 ppm (max.) Reference to fo at +25°C and over operating temperature range.			
	Control Voltage Range	+1.65V ± 1.65V	+2.5V ± 2.5V	+1.65V ± 1.65V	+2.5V ± 2.5V
	Transfer Function	Positive : Increasing control voltage increases output frequency .			
	Input Impedance	50 K ohms (min.)			
	EFC Linearity	± 10 % (max.)			
Power	Power Dissipation (at +25°C)	1.2 Watts (max.) at steady-state; 1000 mA (max.) at turn-on.			
Output	Output Level (for True Sine)	---	---	+8 dBm (typ.) , +10 dBm (max.)	
	Harmonic (for True Sine)	---	---	-30 dBc (max.)	
	Spurious (for True Sine)	---	---	-60 dBc (max.)	
	Load	15pF		50 Ω	
	Output Logic High (V_{OH})	+2.4 V (min.)	+2.4 V (min.)	---	---
	Output Logic Low (V_{OL})	+ 0.4 V (max.)	+ 0.4 V (max.)	---	---
	Duty Cycle (V_{DD})	50 % ± 5% @ +1.4V			
	Rise and Fall Time	7 nsec. (max.) (20% → 80% of waveform)			
	Phase Noise Offset [10.0 MHz] (typ.)	1 Hz	10 Hz	1 KHz	10 KHz
		-98 dBc	-126 dBc	-145 dBc	-152 dBc

Outline Dimensions (Unit : ±0.2 mm)



Pin Connections :

Pin 1 : Voltage Control
Pin 2 : No Connected
Pin 3 : V_{DD}
Pin 4 : Output
Pin 5 : No Connected
Pin 6 : No Connected
Pin 7 : Ground

OCXOs

" OCXO " [Oven Controlled Crystal Oscillators]

OC13T	OC13E	Best stability	Standard OCXO Series	DIP	3.3V	5.0V	Min.	Max.
Square Wave	True Sine Wave	± 5.0 ppb					5 MHz	40 MHz

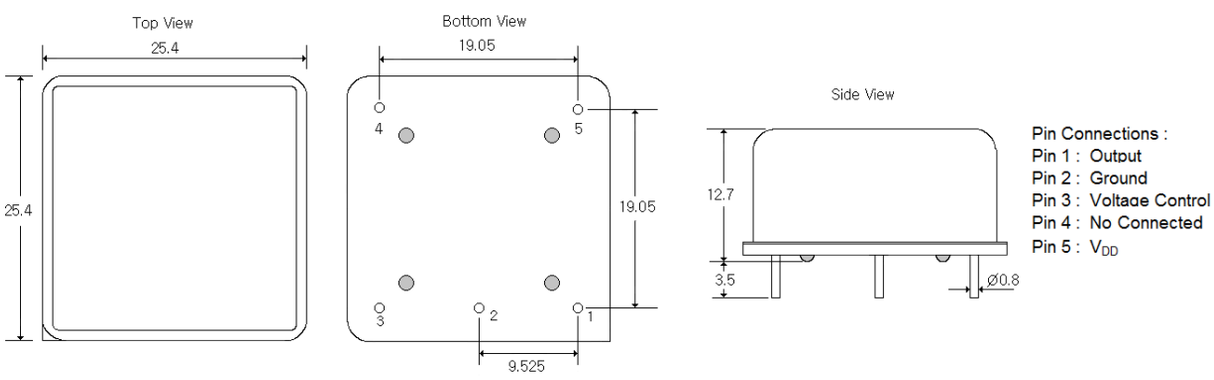
Applications

- OC13_ (25.4 * 25.4 * 12.7 mm)
- Full Size 5 pin dip full metal package
- +3.3V , +5.0V Supply Voltages
- Voltage control (Electronic Frequency Tuning) is standard .

General Specifications (at+25°C and specified input voltage)

Output Waveform		Square wave. Waveform code is " T "		True Sine Wave. Waveform code is " E "	
Supply Voltage		+3.3 V	+5.0 V	+3.3 V	+5.0 V
Supply Voltage range , " Voltage code "		+3.3V ± 5% , " 3 "	+5.0V ± 5% , " 5 "	+3.3V ± 5% , " 3 "	+5.0V ± 5% , " 5 "
Frequency Range		5 ~ 40.0 MHz		5 ~ 40.0 MHz	
Initial Calibration Tolerance		± 100 ppb (max.)	± 100 ppb (max.)	± 100 ppb (max.)	± 100 ppb (max.)
		Vcon = +1.65 V	Vcon = +2.5 V	Vcon = +1.65 V	Vcon = +2.5 V
Type of Crystal Cut Used		" SC - cut " crystal or " IT - cut " crystal			
Frequency Stability	vs Temperature (refer to +25°C)	± 3 ppb (max.) over 0°C to +70°C			
		± 5.0 ppb (max.) over -30°C to +70°C			
		± 5.0 ppb (max.) over -40°C to +85°C			
	vs Voltage Change	± 1.0ppb (max.) , for a ± 5% input voltage change .			
	vs Warm-up time (+25°C)	10 minute (max.) Within ± 10 ppb of its reference frequency.			
	vs Aging	± 0.5 ppb (max.) / after 30 days ; ± 50 ppb (max.) / first year ; ± 300 ppb (max.) over 10 years.			
Voltage Control On pin 1 (EFC) (Electronic Freq. Tuning)	Freq. Deviation Range	± 0.5 ppm (min.) , ± 5 ppm (max.) Reference to fo at +25°C and over operating temperature range.			
	Control Voltage Range	+1.65V ± 1.65V	+2.5V ± 2.5V	+1.65V ± 1.65V	+2.5V ± 2.5V
	Transfer Function	Positive : Increasing control voltage increases output frequency .			
	Input Impedance	50 K ohms (min.)			
	EFC Linearity	± 10 % (max.)			
Power	Power Dissipation (at +25°C)	1.3 Watts (max.) at steady-state; 1000 mA (max.) at turn-on.			
Output	Output Level (for True Sine)	---	---	+8 dBm (typ.) , +10 dBm (max.) into 50Ω load .	
	Harmonic (for True Sine)	---	---	-30 dBc (min.)	
	Spurious (for True Sine)	---	---	-60 dBc (min.)	
	Load	15pF		50 Ω	
	Output Logic High (V_{OH})	+2.4 V (min.)	+2.4 V (min.)	---	---
	Output Logic Low (V_{OL})	+ 0.4 V (max.)	+ 0.4 V (max.)	---	---
	Duty Cycle (V_{DD})	50 % ± 5% @ +1.4V		---	---
	Rise and Fall Time	7 nsec. (max.) (20% → 80% of waveform)		---	---
	Phase Noise Offset [10.0 MHz] (typ.)	10 Hz	100 Hz	1 KHz	10 KHz
		-120 dBc	-135 dBc	-145 dBc	-150 dBc

Outline Dimensions (Unit : ±0.2 mm)



OCXOs

" OCXO " [Oven Controlled Crystal Oscillators]

OC14T	Best stability	Voltage Control	DIP	3.3V	5.0V	Min.	Max.
Square Wave	± 30 ppb					5 MHz	40 MHz

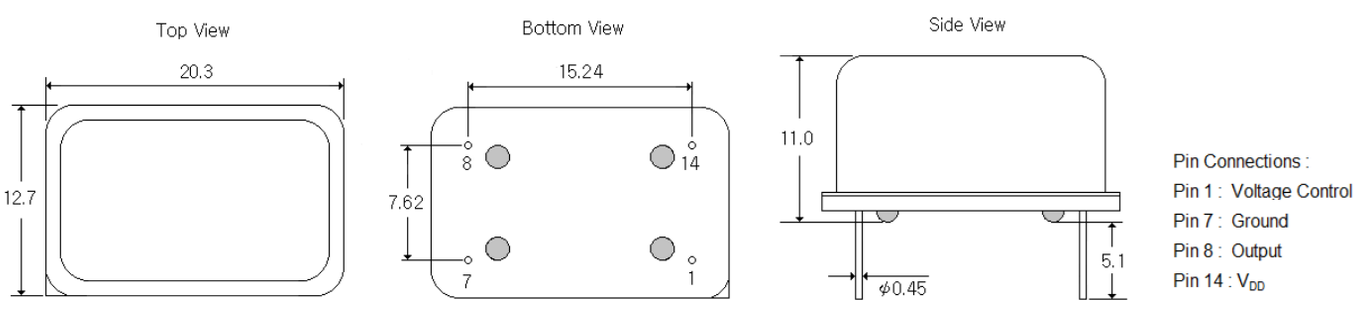
Applications

- OC14_ (20.3 * 12.7 * 11.0 mm)
- +3.3V , +5.0V Supply Voltages
- Voltage control (Electronic Frequency Tuning) is standard .

General Specifications (at+25°C and specified input voltage)

Output Waveform		Square wave . Waveform code is " T "			
Supply Voltage		+3.3 V		+5.0 V	
Supply Voltage range , " Voltage code "		+3.3V ± 5% , " 3 "		+5.0V ± 5% , " 5 "	
Frequency Range		5 ~ 40.0 MHz Standard Frequency : 10.0 MHz		5 ~ 40.0 MHz Standard Frequency : 10.0 MHz	
Initial Calibration Tolerance		± 500 ppb (max.) Vcon = +1.65 V		± 500 ppb (max.) Vcon = +2.5 V	
Type of Crystal Cut Used		" SC - cut " crystal or " IT - cut " crystal			
Frequency Stability	vs Temperature (refer to +25°C)	± 50 ppb (max.) over 0°C to +70°C			
		± 100 ppb (max.) over -30°C to +70°C			
		± 100 ppb (max.) over -40°C to +85°C			
	vs Voltage Change	± 50ppb (max.) , for a ± 5% input voltage change .			
	vs Warm-up time (+25°C)	10 minute max. Within ± 100 ppb of its reference frequency.			
	vs Aging	± 5 ppb max./after 30 days ; ± 500 ppb max./first year ; ± 3 ppm max.over 10 years.			
Voltage Control On pin 1 (EFC) (Electronic Freq. Tuning)	Freq. Deviation Range	> ± 5 ppm Reference to fo at +25°C and over operating temperature range.			
	Control Voltage Range	+1.65V ± 1.65V		+2.5V ± 2.5V	
	Transfer Function	Positive : Increasing control voltage increases output frequency .			
	Input Impedance	50 K ohms min.			
	EFC Linearity	± 10 % (max.)			
Power	Power Dissipation (at +25°C)	0.8 Watts max. at steady-state; 600 mA max. at turn-on.			
Output	Output Logic High (V_{OH})	+2.4 V (min.)		+2.4 V (min.)	
	Output Logic Low (V_{OL})	+ 0.5 V (max.)		+ 0.5 V (max.)	
	Duty Cycle (V_{DD})	50 % ± 5% @ + 2.0V			
	Output Load	15pF			
	Rise and Fall Time	7 nS (max.) (20% → 80% of waveform)			
	Phase Noise Offset [10.0 MHz] (typical)	1 Hz	10 Hz	1 KHz	10 KHz
		-70 dBc	-108 dBc	-140 dBc	-150 dBc

Outline Dimensions (Unit : ±0.2 mm)



OCXOs

" OCXO " [Oven Controlled Crystal Oscillators]

OC18T	OC19T	Best stability	Standard	DIP	3.3V	5.0V	Min.	Max.
Square Wave	Square Wave	± 10 ppb	OCXO Series				5 MHz	40 MHz

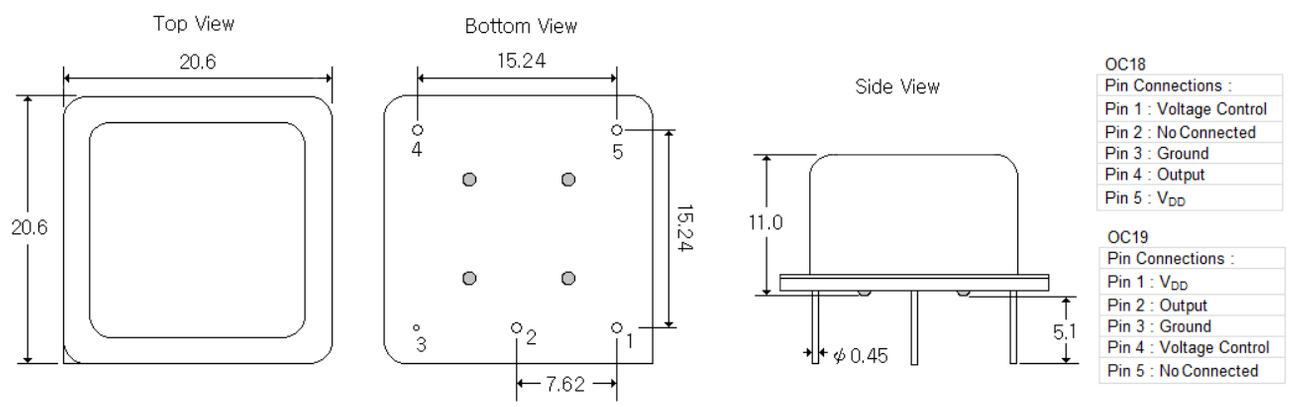
Applications

- OC18 / OC19 _ (20.6 * 20.6 * 11.0 mm) typical
- Full Size 5 pin dip full metal package
- +3.3V , +5.0V Supply Voltages
- Voltage control (Electronic Frequency Tuning) is standard

General Specifications (at+25°C and specified input voltage)

Output Waveform		Square wave . Waveform code is " T "			
Supply Voltage		+3.3 V		+5.0 V	
Supply Voltage range , " Voltage code "		+3.3V ± 5% , " 3 "		+5.0V ± 5% , " 5 "	
Frequency Range		5 ~ 40.0 MHz Standard Frequency : 10.0 MHz		5 ~ 40.0 MHz Standard Frequency : 10.0 MHz	
Initial Calibration Tolerance		± 500 ppb (max.) Vcon = +1.65 V		± 500 ppb (max.) Vcon = +2.5 V	
Type of Crystal Cut Used		" SC - cut " crystal or " IT - cut " crystal			
Frequency Stability	vs Temperature (refer to +25°C)	± 5 ppb (max.) over 0°C to +70°C			
		± 10 ppb (max.) over -30°C to +70°C			
		± 10 ppb (max.) over -40°C to +85°C			
	vs Voltage Change	± 0.5ppb (max.) , for a ± 5% input voltage change .			
	vs Warm-up time (+25°C)	3 minute max. Within ± 50 ppb of its reference frequency.			
	vs Aging	± 0.5 ppb max./after 30 days ; ± 50 ppb max./first year ; ± 300 ppb max. over 10 years.			
Voltage Control On pin 1 (EFC) (Electronic Freq. Tuning)	Freq. Deviation Range	± 0.5 ppm min, ± 2 ppm max. Reference to fo at +25°C and over operating temperature range.			
	Control Voltage Range	+1.65V ± 1.65V		+2.5V ± 2.5V	
	Transfer Function	Positive : Increasing control voltage increases output frequency .			
	Input Impedance	100 K ohms min.			
	EFC Linearity	± 10 % (max.)			
Power	Power Dissipation (at +25°C)	1.3 Watts max. at steady-state; 800 mA max. at turn-on.			
Output	Output Logic High (V_{OH})	+2.4 V (min.)		+3.5 V (min.)	
	Output Logic Low (V_{OL})	+ 0.5 V (max.)		+ 0.5 V (max.)	
	Duty Cycle (V_{DD})	50 % ± 5% @ 2.0V			
	Load	15pF			
	Rise and Fall Time	7 nS (max.) (20% → 80% of waveform)			
	Phase Noise Offset [20.0 MHz] (typical)	10 Hz	100 Hz	1 KHz	10 KHz
		-115 dBc	-135 dBc	-145 dBc	-150 dBc

Outline Dimensions (Unit : ±0.2 mm)



" OCXO " [Oven Controlled Crystal Oscillators]

OC32T	OC32E	Best stability	Standard OCXO Series	DIP	3.3V	5.0V	Min.	Max.
Square Wave	True Sine Wave	± 5.0 ppb					5 MHz	40 MHz

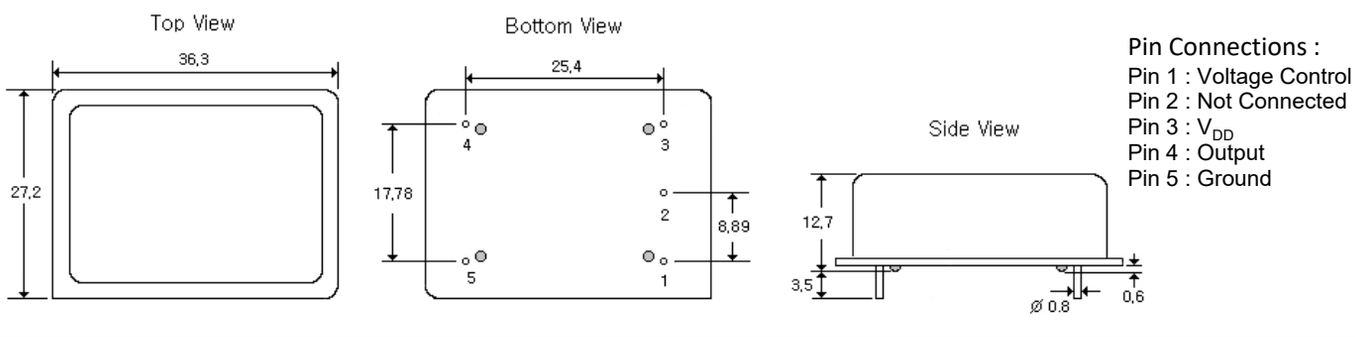
Applications

- OC32_ (36.3 * 27.2 * 12.7 mm)
- Full Size 5 pin dip full metal package
- +3.3V , +5.0V Supply Voltages
- Voltage control (Electronic Frequency Tuning) is standard .

General Specifications (at+25°C and specified input voltage)

Output Waveform		Square wave. Waveform code is " T "		True Sine Wave. Waveform code is " E "	
Supply Voltage		+3.3 V	+5.0 V	+3.3 V	+5.0 V
Supply Voltage range , " Voltage code "		+3.3V ± 5% , " 3 "	+5.0V ± 5% , " 5 "	+3.3V ± 5% , " 3 "	+5.0V ± 5% , " 5 "
Frequency Range		5 ~ 40.0 MHz Standard Frequency : 10.0 MHz		5 ~ 40.0 MHz Standard Frequency : 10.0 MHz	
Initial Calibration Tolerance		± 100 ppb (max.) Vcon = +1.65 V	± 100 ppb (max.) Vcon = +2.5 V	± 100 ppb (max.) Vcon = +1.65 V	± 100 ppb (max.) Vcon = +2.5 V
Type of Crystal Cut Used		" SC - cut " crystal or " IT - cut " crystal			
Frequency Stability	vs Temperature (refer to +25°C)	± 3 ppb (max.) over 0°C to +70°C			
		± 5.0 ppb (max.) over -30°C to +70°C			
		± 10 ppb (max.) over -40°C to +85°C			
	vs Voltage Change	± 0.5ppb (max.) , for a ± 5% input voltage change .			
	vs Warm-up time (+25°C)	10 minute max. Within ± 10 ppb of its reference frequency.			
	vs Aging	± 0.5 ppb max./after 30 days ; ± 50 ppb max./first year ; ± 300 ppb max.over 10 years.			
Voltage Control On pin 1 (EFC) (Electronic Freq. Tuning)	Freq. Deviation Range	± 0.5 ppm min, ± 2 ppm max. Reference to fo at +25°C and over operating temperature range.			
	Control Voltage Range	+1.65V ± 1.65V		+2.5V ± 2.5V	
	Transfer Function	Positive : Increasing control voltage increases output frequency .			
	Input Impedance	50 K ohms min.			
	EFC Linearity	± 10 % (max.)			
Power	Power Dissipation (at +25°C)	1.3 Watts max. at steady-state; 850 mA max. at turn-on.			
Output	Output Level (for True Sine)	---	---	+8 dBm (typ.) , +10 dBm (max.)	
	Harmonic (for True Sine)	---	---	-30 dBc (min.)	
	Spurious (for True Sine)	---	---	-60 dBc (min.)	
	Load	15pF		50 Ω	
	Output Logic High (V_{OH})	+2.4 V (min.)	+2.4 V (min.)	---	---
	Output Logic Low (V_{OL})	+ 0.4 V (max.)	+ 0.4 V (max.)	---	---
	Duty Cycle (V_{DD})	50 % ± 5% @ +1.4V			
	Rise and Fall Time	7 nsec. (max.) (20% → 80% of waveform)			
	Phase Noise Offset [10.0 MHz] (typical)	10 Hz	100 Hz	1 KHz	10 KHz
		-120 dBc	-135 dBc	-145 dBc	-150 dBc

Outline Dimensions (Unit : ±0.2 mm)



Pin Connections :
Pin 1 : Voltage Control
Pin 2 : Not Connected
Pin 3 : V_{DD}
Pin 4 : Output
Pin 5 : Ground

" OCXO " [Oven Controlled Crystal Oscillators]

OC41T	Best stability	Standard OCXO Series	SMD	3.3V	Min.	Max.
Square Wave	± 30 ppb				5 MHz	40 MHz

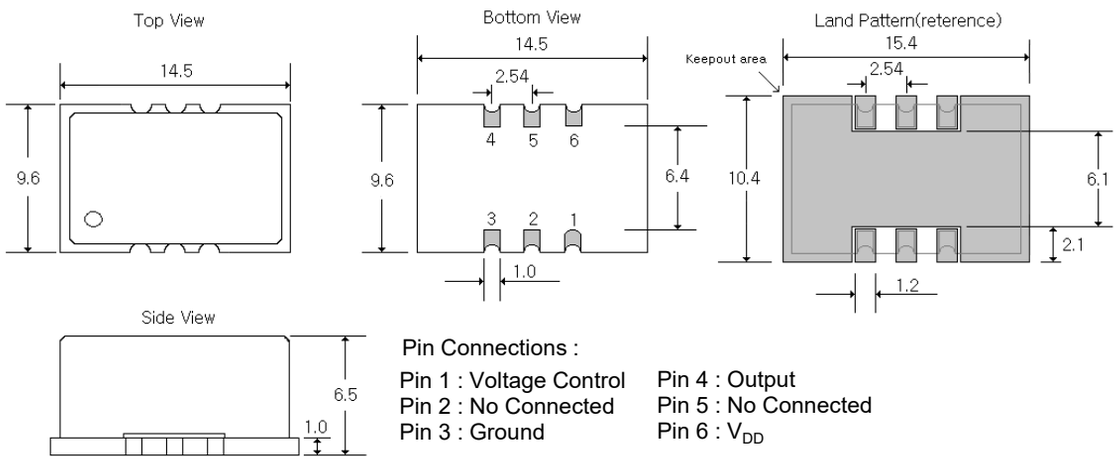
Applications

- OC41_ (14.5 * 9.6 * 6.5 mm)
- 6 pin SMD package
- +3.3V Supply Voltages
- Voltage control (Electronic Frequency Tuning) is standard .

General Specifications (at+25°C and specified input voltage)

Output Waveform		Square wave . Waveform code is " T "			
Supply Voltage		+3.3 V			
Supply Voltage range , " Voltage code "		+3.3V ± 5% , " 3 "			
Frequency Range		5 ~ 40.0 MHz			
Initial Calibration Tolerance		Vcon = +1.65 V ; ± 500 ppb (max.) typ. , ± 200 ppb (max.) available			
Type of Crystal Cut Used		" IT - cut " crystal			
Frequency Stability	vs Temperature (refer to +25°C)	± 20 ppb (max.) over -20°C to +70°C			
		± 30 ppb (max.) over -40°C to +85°C			
	vs Voltage Change	± 10 ppb (max.) , for a ± 5% input voltage change .			
	vs Warm-up time (+25°C)	5 minute max. Within ± 100 ppb of its reference frequency.			
	vs Aging	± 3.0 ppb max./after 30 days ; ± 400 ppb max./first year ; ± 2 ppm max. over 10 years.			
	vs Load Change	≦ ± 10 ppb , for ±10 % load condition change .			
	vs Reflow	± 1.0 ppm max . , 1 reflow and measured 24 hours afterwards.			
Voltage Control On pin 1 (EFC) (Electronic Freq. Tuning)	Freq. Deviation Range	> ± 5 ppm Reference to fo at +25°C and over operating temperature range.			
	Control Voltage Range	+1.65V ± 1.65V			
	Transfer Function	Positive : Increasing control voltage increases output frequency .			
	Input Impedance	50 K ohms min.			
	EFC Linearity	± 10 % (max.)			
Power	Power Dissipation (at +25°C)	0.6 Watts max. at steady-state; 600 mA max. at turn-on.			
Output	Output Logic High (V_{OH})	+ 2.4 V (min.)			
	Output Logic Low (V_{OL})	+0.4 V (max.)			
	Duty Cycle (V_{DD})	50 % ± 5% @ 1.65V			
	Load	15pF			
	Rise and Fall Time	7 nS (max.) (20% → 80% of waveform)			
	Phase Noise Offset [20.0 MHz] (typical)	10 Hz	100 Hz	1 KHz	10 KHz
		-98 dBc	-126 dBc	-145 dBc	-152 dBc

Outline Dimensions (Unit : ±0.2 mm)



Pin Connections :

Pin 1 : Voltage Control
Pin 2 : No Connected
Pin 3 : Ground
Pin 4 : Output
Pin 5 : No Connected
Pin 6 : V_{DD}

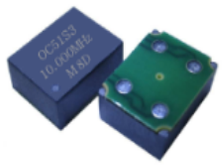
OCXOs

" OCXO " [Oven Controlled Crystal Oscillators]

OC51T	OC51S	Best stability	Standard OCXO Series	SMD	3.3V	5.0V	Min.	Max.
Square Wave	Clipped Sine Wave	± 20 ppb					10 MHz	40 MHz

Applications

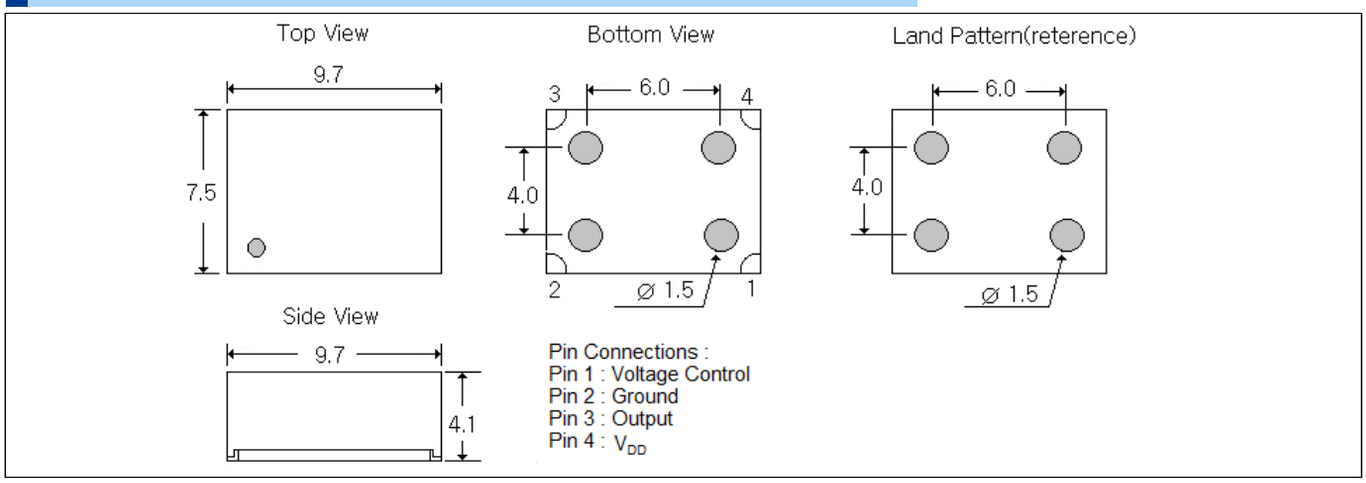
- OC51_ (9.7 x 7.5 x 4.1 mm) Miniaturized 4-Pad SMD package
- +3.3V , +5.0V Supply Voltages
- Voltage control (Electronic Frequency Tuning) is standard .



General Specifications (at+25°C and specified input voltage)

Output Waveform		Square wave. Waveform code is " T "		Clipped Sine Wave. Waveform code is " S "	
Supply Voltage		+3.3 V	+5.0 V	+3.3 V	+5.0 V
Supply Voltage range , " Voltage code "		+3.3V ± 5% , " 3 "	+5.0V ± 5% , " 5 "	+3.3V ± 5% , " 3 "	+5.0V ± 5% , " 5 "
Frequency Range		10 ~ 40.0 MHz		10 ~ 40.0 MHz	
Initial Calibration Tolerance		± 500 ppb (max.)		± 500 ppb (max.)	
		Vcon = +1.65 V	Vcon = +2.5 V	Vcon = +1.65 V	Vcon = +2.5 V
Type of Crystal Cut Used		" IT - cut " crystal			
Frequency Stability	vs Temperature (refer to +25°C)	± 10 ppb (max.) over -30°C to +70°C			
		± 20 ppb (max.) over -40°C to +85°C			
	vs Voltage Change	± 10ppb (max.), for a ± 5% input voltage change .			
	vs Warm-up time (+25°C)	5 minute max. Within ± 0.1 ppm of its reference frequency.			
	vs Aging	± 3.0 ppb max./after 30 days ; ± 600 ppb max./first year ; ± 3 ppm max. over 10 years.			
	vs Reflow	± 1.0 ppm max . , 1 reflow and measured 24 hours afterwards.			
Voltage Control On pin 1 (EFC) (Electronic Freq. Tuning)	Freq. Deviation Range	> ± 5 ppm Reference to fo at +25°C and over operating temperature range.			
	Control Voltage Range	+1.65V ± 1.65V		+2.5V ± 2.5V	
	Transfer Function	Positive : Increasing control voltage increases output frequency .			
	Input Impedance	100 K ohms min.			
	EFC Linearity	± 10 % (max.)			
Power	Power Dissipation (at +25°C)	0.4 Watts max. at steady-state; 350 mA max. at turn-on.			
Output	Output Logic High (V_{OH})	+2.4 V (min.)	+4.5 V (min.)	_	_
	Output Logic Low (V_{OL})	+ 0.4 V (max.)	+ 0.4 V (max.)	_	_
	Duty Cycle (V_{DD})	50 % ± 5% @ 1.65V		_	
	Load	15pF		10 KΩ // 10 pF ± 10%	
	Output Voltage Level (peak to peak)	_	_	0.8 V p-p (min.)	
	Rise and Fall Time	7 nS (max.) (20% → 80% of waveform)			
	Phase Noise Offset [20.0 MHz] (typical)	10 Hz	100 Hz	1 KHz	10 KHz
		-98 dBc	-126 dBc	-145 dBc	-152 dBc

Outline Dimensions (Unit : ±0.2 mm)



OCXOs

" OCXO " [Oven Controlled Crystal Oscillators]

Square Wave " OC _ T "	Clipped Sine Wave " OC _ S "	True Sine Wave " OC _ E "

Part Number Format and Example

	[1] Holder Type	[2] Output Wave	[3] Supply Voltage	-	[4] Center Frequency	-	[5] Frequency Stability	/	[6] Operating Temp. Range
Examples	(1) OC14	T	5	-	5.000	-	10	/	-40+85
	(2) OC18	E	5	-	100.000	-	100	/	-30+70
	(3) OC51	S	3	-	10.000	-	30	/	-20+70
	(4) OC12	E	3	-	10.000	-	200	/	0+70

Ex (1) : OC14T5 - 5.000 - 10 / -40+85 [OC14 type , Square Wave , 5.0V , 5.000MHz , ± 10ppb from -40°C to 85°C]

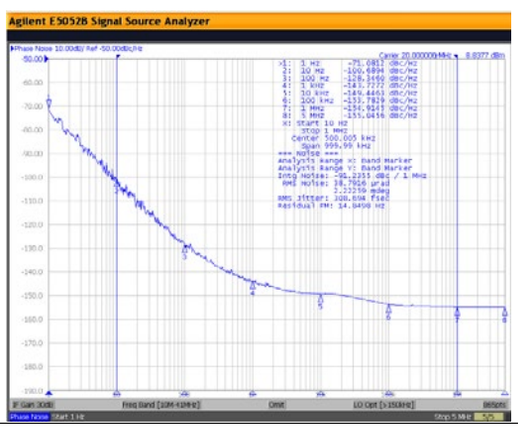
Ex (2) : OC18E5 - 100.000 - 100 / -30+70 [OC18 type , True Sine Wave , 5.0V , 100.000MHz , ± 100ppb from -30°C to 70°C]

Ex (3) : OC51S3 - 10.000 - 30 / -20+70 [OC51 type , Clipped Sine Wave , 3.3V , 10.000MHz , ± 30ppb from -20°C to 70°C]

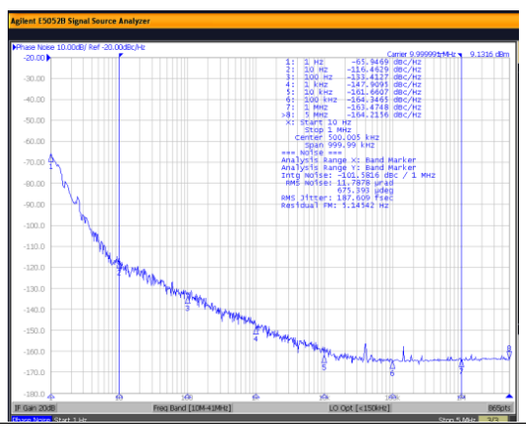
Ex (4) : OC12E3 - 10.000 - 200 / 0+70 [OC12 type , True Sine Wave , 3.3V , 10.000MHz , ± 200ppb from 0°C to 70°C]

[1]	Holder Type
	" OC_ _ " stands for OCXO ,
[2]	" T " stands for Square Wave , " E " stands for True Sine Wave , " S " stands for Clipped Sine Wave
	ex 1 : OC14T , OC14 package , Square Wave ; ex 2 : OC18E , OC18 package , True Sine Wave ;
	ex 3 : OC51S , OC51 package , Clipped Sine Wave ; ex 4 : OC12E , OC12 package , True Sine Wave
[3]	Supply voltage , " 5 " for 5.0V D.C , " 3 " for 3.3V D.C
[4]	Center Frequency in MHz
[5]	Frequency stability in ± _ ppb ; ex 1 : ± 10ppb ---10 , ex 2 : ± 100ppb ---100 , ex 3 : ± 30ppb ---30 , ex 4 : ± 200ppb ---200
[6]	Operating temperature range in °C
	ex 1 : -40 °C to 85°C ----- -40+85 ; ex 2 : -30 °C to 70°C ----- -30+70 ; ex 3 : -20 °C to 70°C ----- -20+70 ; ex 4 : 0 °C to 70°C ----- 0+70

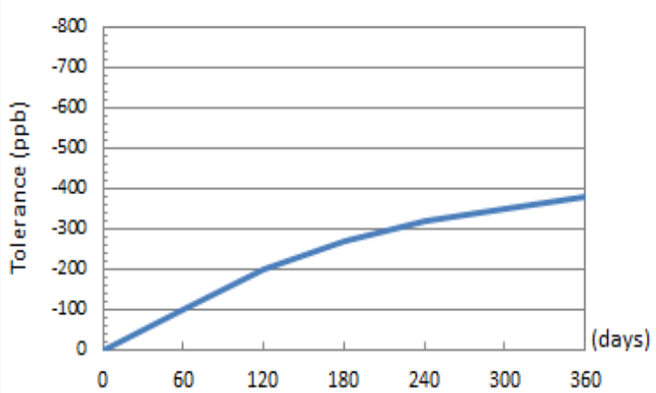
SSB Phase Noise : Clipped Sine Wave(OC51S-20.000)



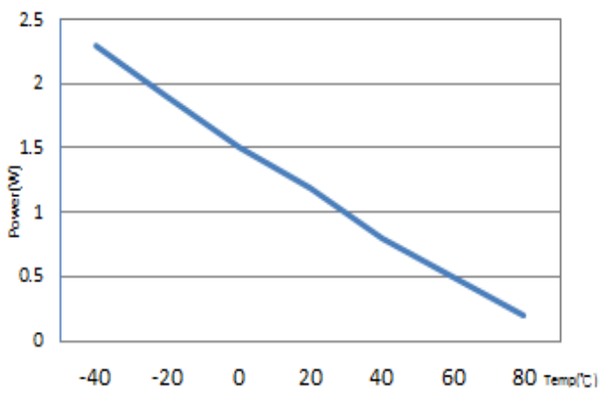
SSB Phase Noise : Square Wave(OC13T-10.000)



Aging : OC51S-20.000



Power Consumption vs Temperature (OC13T5-10.000)

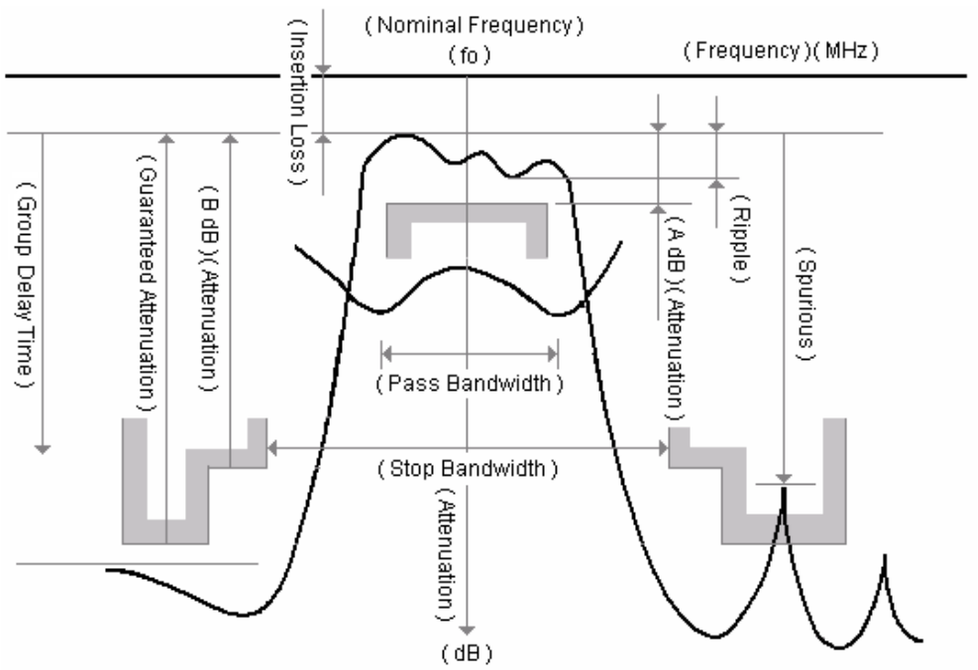


OCXOs

M. C. F. [Monolithic Crystal Filters]

M.C.F. (Monolithic Crystal Filters) features high quality quartz resonators with sharp cutoff characteristics, low loss , good inter-modulation and a high stability over a wide temperature range .
Consider applying band pass filters to communication systems .

Characteristic diagram and terms of crystal filters



● Nominal Frequency :	This is the nominal value of the center frequency (fo) and is used as the reference frequency of related standards.
● Pass Bandwidth :	This is the frequency interval in which the relative attenuation (the attenuation from the minimum insertion loss) is equal to the specified value "A dB" (Usually 3dB).
● Insertion Loss :	This is the difference of attenuation when a filter is and isn't inserted. The minimum insertion loss is the minimum value of insertion loss and becomes as the reference level of attenuation characteristics specification. The constant loss is the insertion loss at the nominal frequency.
● Ripple :	This is the maximum value of the difference between the peak value of attenuation in the pass band and the minimum insertion loss.
● Stop Bandwidth :	This is the frequency interval in which the relative attenuation is equal to the specified value "B dB".
● Guaranteed Attenuation :	This is the relative attenuation guaranteed in the specified range within attenuation band scope.
● Spurious Response :	This is the value of relative attenuation generated by the secondary vibration in the specified range within attenuation band scope.
● Group Delay Time :	This is the difference between the maximum and the minimum value of the group delay in the specified range of the pass band.
● Terminating Impedance :	This is the impedance value terminated to the input and the output side of filter and is indicated by the resistance portion and the parallel capacity portion including the floating capacity.

M. C. F. [Monolithic Crystal Filters]

MQ	Surface Mount	Fund.	21.4 MHz	21.7 MHz	45.0 MHz	50.85 MHz	2 poles
7.0 * 5.0 * 1.3 mm	4 poles in one package						4 poles

Features

● Specifically designed for mobile, wireless communications pagers, cellular and cordless phones.

Surface Mount Type [MQ series (21.400 , 21.700 , 45.000 , 50.850 MHz)]

Frequency (MHz)	Model	No. of poles	Pass Bandwidth		Stop Bandwidth		Ripple	Insertion Loss	Guaranteed Attenuation		Terminating Impedance	
			dB	KHz (min.)	dB	KHz (max.)	dB (max.)	dB (max.)	dB	KHz	ohms // pF	Cc (pF)
21.400	**21MQ7.5A**	2	3	± 3.75	20	± 18	1.0	2.0	70	-910	850 // 6.0	
	21MQ15A	2	3	± 7.5	18	± 25	0.5	1.5	70	-910	1500 // 2.5	
	21MQ15B	4	3	± 7.5	40	± 25	1.0	3.0	70	-910	1800 // 0.35	5.0
	21MQ30A	2	3	± 15	15	± 50	1.5	2.0	60	-910	2500 // 0	
21.700	**21.7MQ15A**	2	3	± 7.5	18	± 28	1.0	2.0	70	-910	1500 // 2.5	
45.000	**45MQ7.5A**	2	3	± 3.75	15	± 18	1.0	2.0	70	-910	350 // 6.0	
	45MQ7.5B	4	3	± 3.75	40	± 15	1.0	4.0	80	-910	300 // 5.0	16.0
	45MQ15A	2	3	± 7.5	15	± 25	1.0	2.0	70	-910	560 // 6.0	
	45MQ15B	4	3	± 7.5	30	± 25	1.0	3.0	80	-910	800 // 1.7	8.0
50.850	**50.85MQ15B**	4	3	± 7.5	35	± 25	1.0	3.0	80	-910	620 // 0.5	5.0

(Operating Temperature Range : -20°C to +70°C ; Storage Temperature Range : -40°C to +85°C)

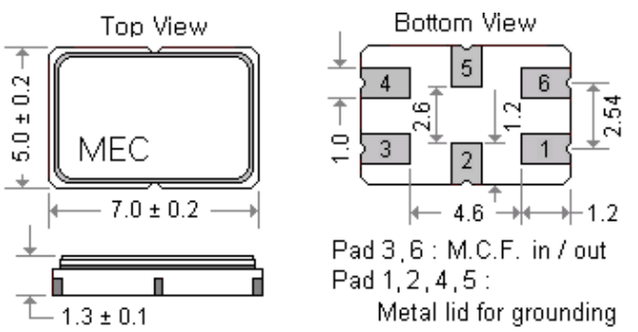
Part Number Format and Example

[1]	[2]	[3]	[4]
Center Freq. Code	Package	Pass band width	Poles code

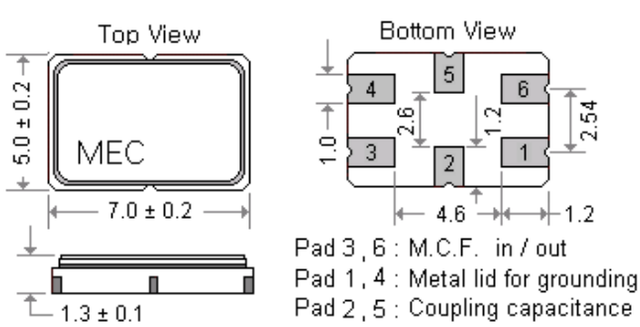
Ex (1) : 45MQ15B [45.000 MHz , SMD Type package , Pass band width ± 7.5KHz , 4 poles]

[1]	Center freq. code : " 21 " for 21.400MHz , " 21.7 " for 21.700MHz , " 45 " for 45.000MHz , " 50.85 " for 50.850MHz
[2]	" MQ " series for (7.0 * 5.0 * 1.3mm) SMD Type package
[3]	Pass band width (3dB) (min.) [" 7.5 " for ± 3.75 KHz , " 15 " for ± 7.5 KHz , " 30 " for ± 15 KHz]
[4]	Poles code [" A " for 2 poles] [" B " for 4 poles]

2 poles Outline Dimensions (Unit : mm)



4 poles Outline Dimensions (Unit : mm)



M.C.F.

M. C. F. [Monolithic Crystal Filters]

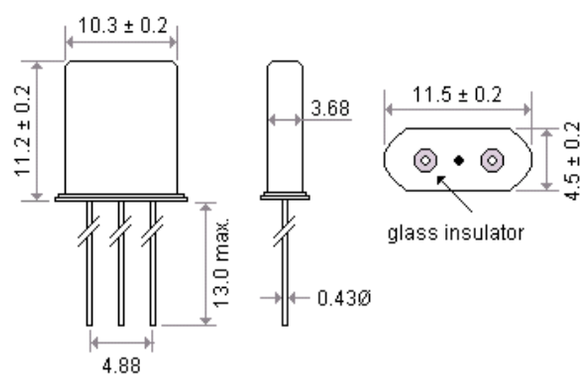
49T	Dip Type	Fundumental	10.7 MHz	2 poles	4 poles	6 poles	8 poles
[11.5 * 4.5 * 11.2 mm]							

Thru - Hole Type (standard frequency 10.700 MHz)

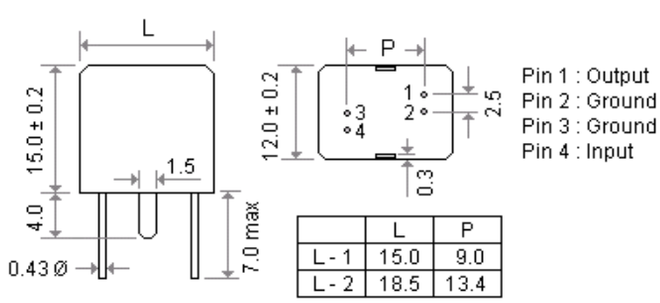
Channel Spacing (KHz)	Model	No. of poles	Pass Bandwidth		Stop Bandwidth		Ripple	Insertion Loss	Guaranteed Attenuation		Terminating Impedance	Package	
			dB	KHz (min.)	dB	KHz (max.)	dB (max.)	dB (max.)	dB	KHz	ohms // pF	Tandem set	One package
12.5	**10M7.5A**	2	3	± 3.75	20	± 18	0.5	1.5	35	±300 ~ ±1000	1.8K // 5.0	49T	
	10M7.5B	4	3	± 3.75	40	± 14	1.0	2.5	65	±300 ~ ±1000	1.8K // 4.5	49T a pair	
	10M7.5C	6	3	± 3.75	45	± 8.75	2.0	3.5	65	±12.5 ~ ±300	1.8K // 3.5	49T 3 pcs	L1
	10M7.5D	8	3	± 3.75	65	± 8.75	2.0	4.0	90	±12.5 ~ ±300	1.8K // 3.5	49T 4 pcs	L2
20.0	**10M12A**	2	3	± 6.0	18	± 25	0.5	2.0	35	±300 ~ ±1000	2.5K // 2.5	49T	
	10M12B	4	3	± 6.0	40	± 20	1.0	2.5	65	±300 ~ ±1000	2.5K // 1.5	49T a pair	
	10M12C	6	3	± 6.0	45	± 15	2.0	4.0	65	±20 ~ ±300	2.5K // 1.5	49T 3 pcs	L1
	10M12D	8	3	± 6.0	65	± 15	2.0	2.0	90	±20 ~ ±300	2.5K // 1.5	49T 4 pcs	L2
25.0	**10M15A**	2	3	± 7.5	18	± 25	0.5	1.5	35	±300 ~ ±1000	3.0K // 2.0	49T	
	10M15B	4	3	± 7.5	40	± 25	1.0	2.5	55	±300 ~ ±1000	3.0K // 1.5	49T a pair	
	10M15C	6	3	± 7.5	45	± 18	2.0	3.0	65	±25 ~ ±300	3.3K // 1.5	49T 3 pcs	L1
	10M15D	8	3	± 7.5	65	± 18	2.0	4.0	90	±25 ~ ±300	3.3K // 1.5	49T 4 pcs	L2
50.0	**10M30A**	2	3	± 15	15	± 50	0.5	1.5	30	±300 ~ ±1000	5.0K // 0	49T	
	10M30B	4	3	± 15	30	± 40	1.0	2.5	30	±300 ~ ±1000	5.5K // -1.0	49T a pair	
	10M30C	6	3	± 15	60	± 45	2.0	3.0	65	±45 ~ ±300	5.5K // -1.0	49T 3 pcs	L1
	10M30D	8	3	± 15	60	± 30	2.0	3.5	90	±50 ~ ±300	5.5K // -1.0	49T 4 pcs	L2

Part Number Format and Example

49T

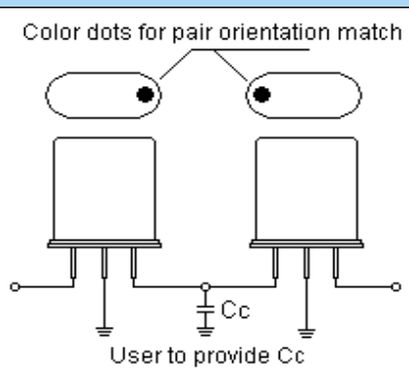


(L - 1) , (L - 2) - - - One Package Type



	L	P
L - 1	15.0	9.0
L - 2	18.5	13.4

4 pole M.C.F. (Paired packages , Tandem set)



M.C.F.

M. C. F. [Monolithic Crystal Filters]

U1 [7.8 * 3.1 * 8.0 mm] | **U5** [7.8 * 3.1 * 6.0 mm] | **Dip Type** | **Fund.** | **21.4 MHz** | **45.0 MHz** | **2 poles** | **4 poles** | **6 poles** | **8 poles**

Thru - Hole Type (standard frequency 21.400 MHz)

Channel Spacing (KHz)	Model	No. of poles	Pass Bandwidth		Stop Bandwidth		Ripple	Insertion Loss	Guaranteed Attenuation		Terminating Impedance	Package	
			dB	KHz (min.)	dB	KHz (max.)	dB (max.)	dB (max.)	dB	KHz	ohms // pF	Tandem set	One package
12.5	**21M7.5A**	2	3	± 3.75	20	± 18	0.5	1.5	35	±300 ~ ±1000	850 // 6.0	U-1 , U-5	
	21M7.5B	4	3	± 3.75	40	± 15	1.0	2.5	65	±300 ~ ±1000	850 // 5.0	a pair (U -1,U-5)	
	21M7.5C	6	3	± 3.75	45	± 8.75	2.0	3.0	65	±12.5 ~ ±300	850 // 5.0	3 pcs	S1
	21M7.5D	8	3	± 3.75	65	± 8.75	2.0	4.0	90	±12.5 ~ ±300	850 // 5.0	4 pcs	S2
20.0	**21M12A**	2	3	± 6.0	20	± 25	0.5	1.5	35	±300 ~ ±1000	1.2K // 3.0	U-1 , U-5	
	21M12B	4	3	± 6.0	40	± 20	1.0	2.5	65	±300 ~ ±1000	1.2K // 2.5	a pair (U -1,U-5)	
	21M12C	6	3	± 6.0	45	± 15	2.0	3.0	65	±20 ~ ±300	1.2K // 2.5	3 pcs	S1
	21M12D	8	3	± 6.0	65	± 15	2.0	4.0	90	±20 ~ ±300	1.2K // 2.5	4 pcs	S2
25.0	**21M15A**	2	3	± 7.5	18	± 25	0.5	1.5	35	±300 ~ ±1000	1.5K // 2.0	U-1 , U-5	
	21M15B	4	3	± 7.5	40	± 25	1.0	2.5	65	±300 ~ ±1000	1.5K // 2.0	a pair (U -1,U-5)	
	21M15C	6	3	± 7.5	45	± 18	2.0	3.0	65	±25 ~ ±300	1.5K // 2.0	3 pcs	S1
	21M15D	8	3	± 7.5	65	± 18	2.0	4.0	90	±25 ~ ±300	1.5K // 2.0	4 pcs	S2
50.0	**21M30A**	2	3	± 15	15	± 45	0.5	1.5	35	±300 ~ ±1000	1.5K // 1.0	U-1 , U-5	
	21M30B	4	3	± 15	40	± 50	1.0	2.5	65	±300 ~ ±1000	2.2K // 0.5	a pair (U -1,U-5)	
	21M30C	6	3	± 15	45	± 35	2.0	3.0	65	±45 ~ ±300	2.2K // 0.5	3 pcs	S1
	21M30D	8	3	± 15	65	± 35	2.0	4.0	90	±50 ~ ±300	2.2K // 0.5	4 pcs	S2

Thru - Hole Type [standard frequency 45.000 MHz(Fundamental mode)] ; available frequency range (45.000 ~ 45.100 MHz)

Channel Spacing (KHz)	Model	No. of poles	Pass Bandwidth		Stop Bandwidth		Ripple	Insertion Loss	Guaranteed Attenuation		Terminating Impedance	Package Type	
			dB	KHz (min.)	dB	KHz (max.)	dB (max.)	dB (max.)	dB	KHz	ohms // pF		
12.5	**45M7.5A**	2	3	± 3.75	10	± 12.5	1.0	2.0	65	±300 ~ ±1000	200 // 4.0	U5	U1
	45M7.5B	4	3	± 3.75	30	± 12.5	1.0	4.0	80	±300 ~ ±1000	350 // 6.5	U5 a pair	U1 a pair
25.0	**45M15A**	2	3	± 7.5	15	± 25	1.0	2.0	35	±300 ~ ±1000	650 // 3.0	U5	U1
	45M15B	4	3	± 7.5	30	± 25	1.0	3.0	80	±300 ~ ±1000	650 // 3.0	U5 a pair	U1 a pair
50.0	**45M30A**	2	3	± 15	15	± 60	1.5	2.5	35	±300 ~ ±1000	1.2K // 0	U5	U1
	45M30B	4	3	± 15	30	± 50	1.0	3.0	80	±300 ~ ±1000	1.2K // 0.7	U5 a pair	U1 a pair

M. C. F. [Monolithic Crystal Filters]

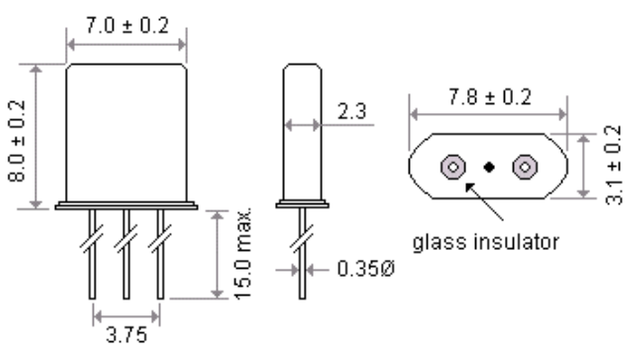
Part Number Format and Example

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

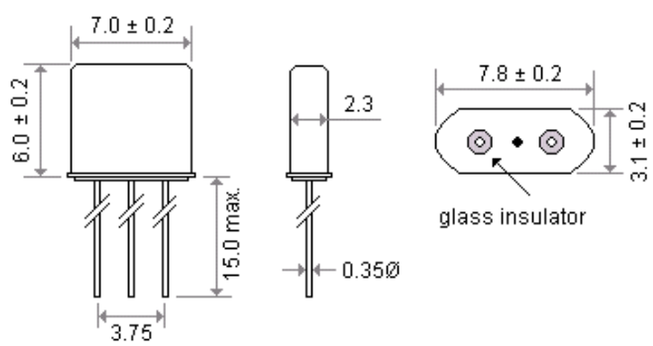
[1]	Freq. code : " 10 " for 10.700MHz , " 21 " for 21.400MHz , " 45 " for 45.000MHz , " 50.85 " for 50.850MHz
	Freq. code : If none standard freq. please show freqency with one decimal point .
[2]	" M " Dip Type series ,
[3]	Pass band width (3dB) (min.)
	" 7.5 " for ± 3.75KHz , " 12 " for ± 6.0KHz , " 15 " for ± 7.5KHz , " 30 " for ± 15KHz ,
[4]	No. of poles
	" 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 ,
	If non-standard please enter the desired temp. range after " / " , for example " / -30+70 " : -30°C to 70°C

Package Dimensions (unit : mm)

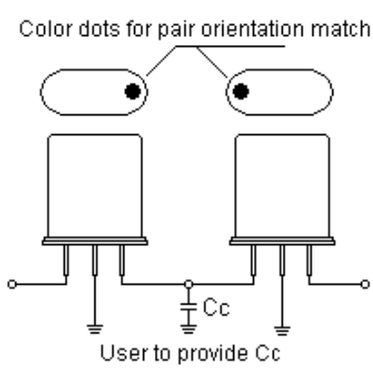
[U 1]



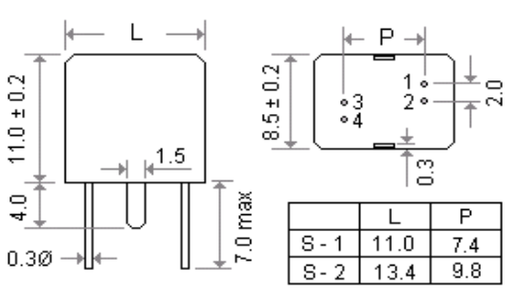
[U 5]



4 pole M.C.F. (Paired packages , Tandem set)



[S - 1] , [S - 2]



	L	P
S - 1	11.0	7.4
S - 2	13.4	9.8

Part Number Formats and Product Marking Rules

Quartz Crystals

Holder Type

SMD type : X11 | X21 | X22 | X32 | MJ | MQ | M49 | ML49 | MP5 | MP4 | MP25 | MP24 | X2012 | X3215

Dip type : H49 | HUS | HUSL | U1 | U5 | T38 | T26

Part Number Format

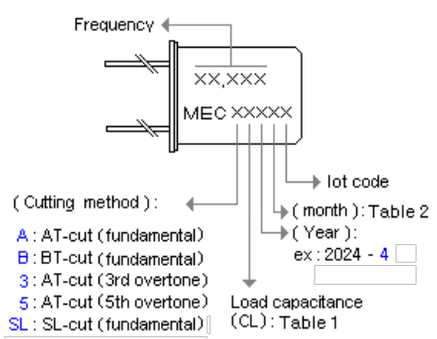
	[1] Holder Type	-	[2] Center Freq.	-	[3] CL	-	[4] Freq . Tolerance	/	[5] Freq. Stability	[6] Operating Temp. Range Code	/	[7] Special ESR
Example (1)	H49	-	40.000A3	-	12	-	30	/	30	X		
Example (2)	X32	-	26.000	-	16	-	30	/	30	X	/	20R
Example (3)	MJ	-	12.000	-	20	-	10	/	10	W		
Example (4)	M49	-	24.000	-	18	-	20	/	30	H	/	15R

Ex (1) : H49 - 40.000A3 - 12 - 30 / 30 X [49/U type , 40.000MHz , AT-cut 3rd overtone , 12pF , ±30ppm (25°C) , ±30ppm (-10°C to 60°C)]
Ex (2) : X32 - 26.000 - 16 - 30 / 30 X / 20R [X32 type , 26.000MHz , 16pF , ±30ppm (25°C) , ±30ppm (-10°C to 60°C) , 20 Ω]
Ex (3) : MJ - 12.000 - 20 - 10 / 10 W [MJ type , 12.000MHz , 20pF , ±10ppm (25°C) , ±10ppm (0°C to 50°C)]
Ex (4) : M49 - 24.000 - 18 - 20 / 30 H / 15R [M49 type , 24.000MHz , 18pF , ±20ppm (25°C) , ±30ppm (-30°C to 85°C) , 15 Ω]

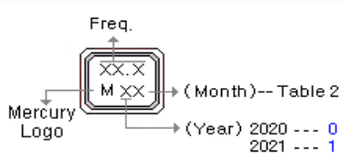
[1]	Holder Type												
[2]	Center frequency . Please add " A3 , A5 or B " after the " Freq. in MHz " for the quartz cut other options .												
	Blank : AT-cut fund. mode ; A3 : AT-cut 3rd overtone ; A5 : AT-cut 5th overtone ; B : BT-cut fund. mode ; SL : SL-cut fund. mode												
[3]	Load Capacitance (CL) : series (spec. code is " S ") or												
	Parallel (If parallel , please specify CL value , typical CL ranges from 8 to 32 pF)												
	Available Options " V " = Vinyl sleeve around holder , " K " = 3rd lead at bottom center , " R " = On reel												
	" G " = 3rd lead at top center , " I " = Teflon insulator at bottom												
[4]	Calibration tolerance value : freq. tolerance value (at 25°C) , industrial temp. range												
[5]	Frequency Stability , industrial temp. range												
[6]	Temp. Range Options	W	0°C ~ +50°C	X	-10°C ~ +60°C	Y	-20°C ~ +70°C	F	-30°C ~ +70°C	G	-10°C ~ +80°C		
		H	-30°C ~ +85°C	I	-40°C ~ +85°C	J	-40°C ~ +90°C	K	-40°C ~ +105°C	M	-55°C ~ +105°C		
		N	-55°C ~ +125°C										
	Temp. Range is -10°C to 60°C , for example " X "												
[7]	If non-standard please enter the desired Temp. Range after " / " , for example " -20 + 60 " : -20°C to 60°C												
	If non-standard please enter the desired ESR (Equivalent Series Resistance) after " / " , for example " 20R " : 20Ω												

Production Marking Rules

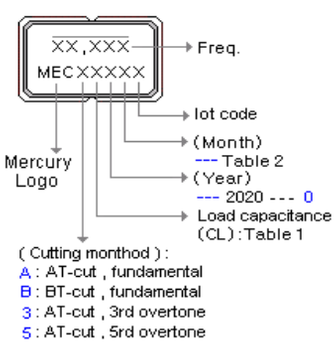
General X'tal package type marking rules



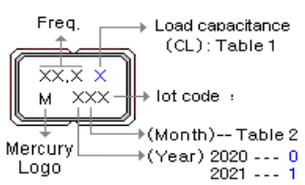
X11 marking rules



MQ , MJ marking rules



X22 , X32 marking rules



X21 marking rules

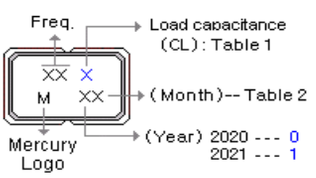


Table 1	CL	< 10	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	>34	Series
	Code	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	a	b

Table 2	Month	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
	Code	A	B	C	D	E	F	G	H	I	J	K	L

Part Number Formats and Product Marking Rules

Crystal Oscillators

Holder Type

Output Wave / Output Logic	Supply Voltage	Product Series	SMD types
Square Wave LVPECL	2.5 / 3.3	HPK x x x	x x x = 576 , 536 , 326 , 226
	3.3	HPEK x x x	x x x = 576 , 536 , 326 , 226
	2.5 / 3.3	HPJK x x x	x x x = 576 , 536 , 326 , 226
	2.5 / 3.3	HPQN x x x	x x x = 576 , 536 , 326
	2.5 / 3.3	HPQF x x x	x x x = 576 , 536 , 326
	2.5 / 3.3	HPRK x x x	x x x = 576 , 536 , 326 , 226
	2.5 / 3.3	HPJFN x x x	x x x = 578 , 538 , 328
	2.5 / 3.3	HCPQF x x x	x x x = 576 , 536 , 326
	2.5 / 3.3	HCPJFN x x x	x x x = 578
Square Wave LVDS	1.8 / 2.5 / 3.3	HDK x x x	x x x = 576 , 536 , 326 , 226
	2.5 / 3.3	HDEK x x x	x x x = 576 , 536 , 326 , 226
	1.8 / 2.5 / 3.3	HDJK x x x	x x x = 576 , 536 , 326 , 226
	2.5 / 3.3	HDQN x x x	x x x = 576 , 536 , 326
	2.5 / 3.3	HDQF x x x	x x x = 576 , 536 , 326
	1.8 / 2.5 / 3.3	HDRK x x x	x x x = 576 , 536 , 326 , 226
	1.8 / 2.5 / 3.3	HDJFN x x x	x x x = 578 , 538 , 328
	2.5 / 3.3	HCDQF x x x	x x x = 576 , 536 , 326
	1.8 / 2.5 / 3.3	HCDJFN x x x	x x x = 578
Square Wave HCSL	1.8 / 2.5 / 3.3	HCK x x x	x x x = 576 , 536 , 326 , 226
	2.5 / 3.3	HCEK x x x	x x x = 576 , 536 , 326 , 226
	1.8 / 2.5 / 3.3	HCJK x x x	x x x = 576 , 536 , 326 , 226
	2.5 / 3.3	HCRK x x x	x x x = 576 , 536 , 326 , 226
	1.8 / 2.5 / 3.3	HCJFN x x x	x x x = 578 , 538 , 328
	1.8 / 2.5 / 3.3	HCCJFN x x x	x x x = 578
Square Wave CML	1.8 / 2.5 / 3.3	HQJFN x x x	x x x = 578 , 538 , 328
	1.8 / 2.5 / 3.3	HCQJFN x x x	x x x = 578
Square Wave LPHCSL	1.8 / 2.5 / 3.3	HCLK x x x	x x x = 576 , 536 , 326 , 226

Output Wave / Output Logic	Supply Voltage	Product Series	SMD types	Thru-Hole types
Square Wave CMOS	1.8 / 2.5 / 3.3 / 5.0	SWO	SWO	- - - - -
	1.8 / 2.5 / 3.3 / 5.0	H x x	x x = 53 , 32 , 22 , 21	x x = 8,14
	1.8 / 2.5 / 3.3 / 5.0	HG x x	- - - - -	
	1.8 / 2.5 / 3.3 / 5.0	HA x x	x x = 57 , 53 , 32 , 22	
	1.8 / 2.5 / 3.3	HEA x x	x x = 57 , 53 , 32 , 22	
	1.8 / 2.5 / 3.3	HJN x x	x x = 57 , 53 , 32 , 22	
	1.8 / 2.5 / 3.3	HY x x	x x = 57 , 53 , 32 , 22	
	1.0 / 1.2	HU x x	x x = 57 , 53 , 32 , 22	
	1.8 / 2.5 / 3.3	HTF x x	x x = 57 , 53 , 32 , 22 , 21	- - - - -
	2.5 / 3.3	HTQN x x x	x x x = 576 , 536 , 326	
	2.5 / 3.3	HTQF x x x	x x x = 576 , 536 , 326	
	1.8 / 2.5 / 3.3	HTJFN x x x	x x x = 578 , 538	
	2.5 / 3.3	HCTQF x x x	x x x = 576 , 536 , 326	
	1.8 / 2.5 / 3.3	HCTJFN x x x	x x x = 578	
Square Wave True Sine	3.3 / 5.0	HS x x	- - - - -	x x = 14
	3.3 / 5.0	HS x x	- - - - -	x x = 24

" x x x " = package code

Part Number Format

[1]	[2]	-	[3]	[4]	-	[5]
Supply Voltage	Holder Type		Frequency Stability	OE Function		Center Frequency

EX.	(1)	25	H32	-	C20	T	- 100.000
	(2)	3	HDQN5761	-	E	T	- 156.250

Ex (1) : 25H32 - C20T - 100.000 [2.5V , H32 type , OE on pin 1 , ±20ppm from -20°C to 70°C , 100.000MHz]

Ex (2) : 3HDQN5761 - ET - 156.250 [3.3V , HDQN5761 type , OE on pin 1 , ±50ppm from -40°C to 85°C , 156.250MHz]

[1]	Supply voltage , " 10 " for +1.0V ; " 12 " for +1.2V ; " 18 " for +1.8V ; " 25 " for +2.5V ; " 28 " for +2.8V ; " 3 " for +3.3V ; " 5 " for +5.0V	
[2]	Holder Type	
[3]	-20°C ~ 70°C	" A " ± 25ppm ; " B " ± 50ppm ; " C " ± 100ppm ;
		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 ;
		If non-standard please enter the desired stability after " F " , for example " F20 " : represents ±20ppm over -40 to +85°C
[4]	" T " for OE Function , Leave this space blank if no connection on pad 1.	
[5]	Frequency in MHz	

Part Number Formats and Product Marking Rules

Crystal Oscillators

Production Marking Rules

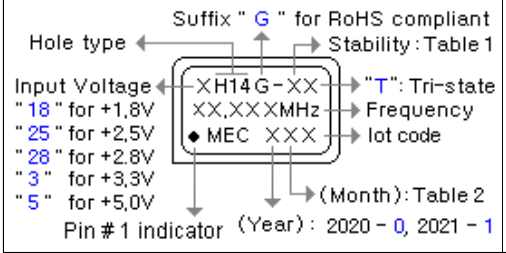
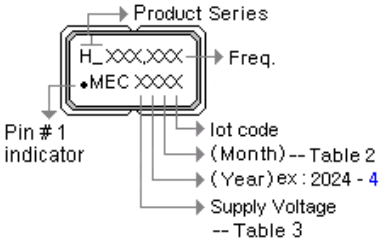
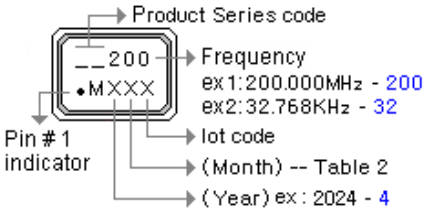
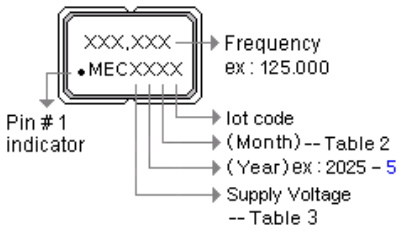
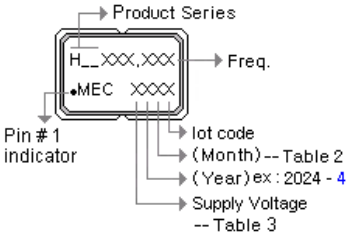
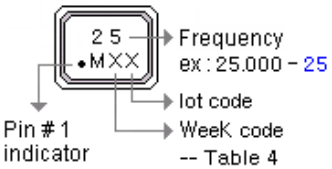
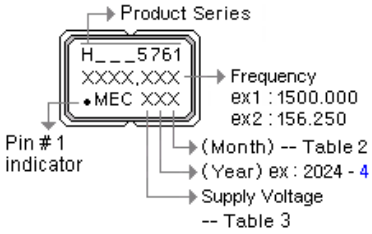
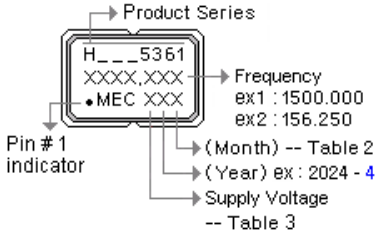
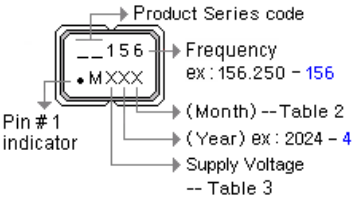
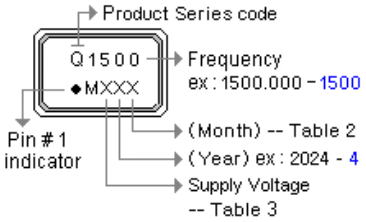
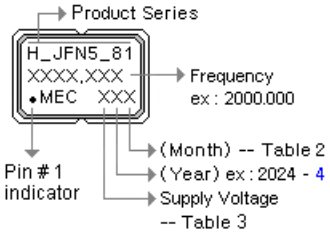
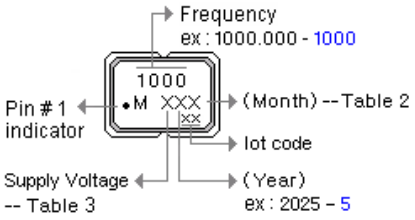
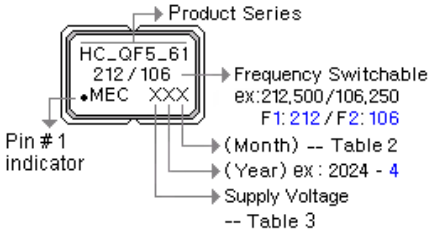
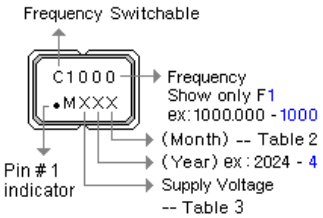
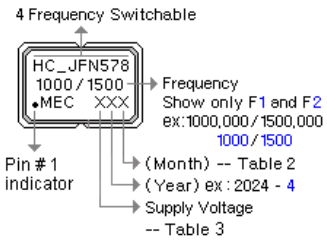
H14 , H8	H (A , Y , U) 57 H (A , Y , U) 53	H (A , Y , U , EA , JN , TF) 32 H (A , Y , U , EA , JN , TF) 22
		
SWO , H53	H (EA , JN , TF) 57 , 53	H21 , HTF21
		
(H_K , H_JK , H_EK , H_RK) 5761 (H_QN , H_QF) 5761	(H_K , H_JK , H_EK , H_RK) 5361 (H_QN , H_QF) 5361	(H_K , H_JK , H_EK , H_RK) 3261 (H_K , H_JK , H_EK , H_RK) 2261
		
H_QN3261 , H_QF3261	H_JFN5781 , H_JFN5381	H_JFN3281
		
HC__QF5761 , HC__QF5361	HC__QF3261	HC__JFN578
		

Table 1	-20°C ~ 70°C	" A " ± 25ppm ; " B " ± 50ppm ; " C " ± 100ppm ; If non-standard please enter the desired stability after " C " , for example " C20 " : ± 20ppm
	-40°C ~ 85°C	" D " ± 25ppm ; " E " ± 50ppm ; " F " ± 100ppm ; If non-standard please enter the desired stability after " F " , for example " F30 " : ± 30ppm
	-40°C ~ 105°C	" H " ± 50ppm ; " J " ± 100ppm

Table 2	Month	1	2	3	4	5	6	7	8	9	10	11	12
	Code	A	B	C	D	E	F	G	H	I	J	K	L

Table 3	Input Voltage	Tri - State	5.0 V	3.3 V	3.0 V	2.8 V	2.5 V	1.8 V	1.5 V	1.2 V	1.0 V
			B	D	E	F	H	J	L	N	P

Part Number Formats and Product Marking Rules

Spread Spectrum Low EMI Clock Oscillators

Holder Type

Type	SMD types	Waveform
HM x x	x x = 22 , 32 , 53 , 572	square wave

x x = package code

Part Number Format

[1]	[2]	-	[3]	[4]	-	[5]	[6]	-	[7]
Supply Voltage	Holder Type		Frequency Stability	OE Function		Center Frequency	Group Type		Spread type Percentage
Examples (1)	3	HM572	-	B	T	-	10.000	B	-	C1.5
(2)	25	HM53	-	F	T	-	75.000	B	-	C2.0
(3)	18	HM32	-	E	T	-	25.000	C	-	D1.0

Ex (1) : 3HM572 - BT - 10.000B - C1.5 [3.3V , HM572 type , ±50ppm from -20°C to 70°C , OE Function , 10.000MHz , B group , Center Spread 1.5%]

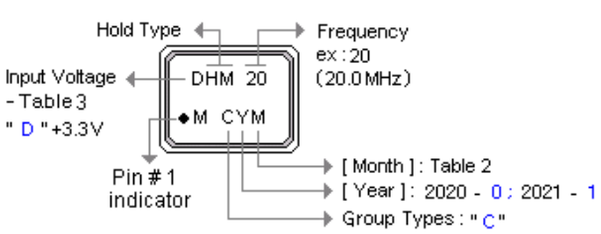
Ex (2) : 25HM53 - FT - 75.000B - C2.0 [2.5V , HM53 type , ±100ppm from -40°C to 85°C , OE Function , 75.000MHz , B group , Center Spread 2.0%]

Ex (3) : 18HM32 - ET - 25.000C - D1.0 [1.8V , HM32 type , ±50ppm from -40°C to 85°C , OE Function , 25.000MHz , C group , Down Spread 1.0%]

[1]	Supply voltage , " 18 " for +1.8V ; " 25 " for +2.5V ; " 3 " for +3.3V	
[2]	Holder Type (HM572 , HM53 , HM32)	
[3]	-20°C ~ 70°C	" A " ± 25ppm ; " B " ± 50ppm ; " C " ± 100ppm ;
	-40°C ~ 85°C	" D " ± 25ppm ; " E " ± 50ppm ; " F " ± 100ppm ;
[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	

Production Marking Rules

HM22 , HM32



HM572 , HM53

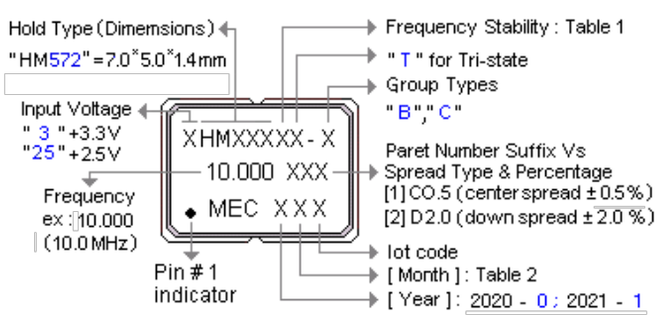


Table 1	-20°C ~ 70°C	" A " ± 25ppm ; " B " ± 50ppm ; " C " ± 100ppm ;
	-40°C ~ 85°C	" D " ± 25ppm ; " E " ± 50ppm ; " F " ± 100ppm ;

Table 2	Month	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
	Code	A	B	C	D	E	F	G	H	I	J	K	L

Table 3	Input Voltage	3.3 V	2.5 V	1.8 V
		D	H	J

Part Number Formats and Product Marking Rules

[VCXO] Voltage Controlled Crystal Oscillators

Holder Type

Output Wave / Output Logic	Supply Voltage	Product Series	SMD types
Square Wave LVPECL	2.5 / 3.3	GPQN x x x	x x x = 576 , 536 , 326
	2.5 / 3.3	GPQF x x x	x x x = 576 , 536 , 326
	2.5 / 3.3	GCPQF x x x	x x x = 576 , 536 , 326
	2.5 / 3.3	GPJFN x x x	x x x = 578 , 538
Square Wave LVDS	2.5 / 3.3	GDQN x x x	x x x = 576 , 536 , 326
	2.5 / 3.3	GDQF x x x	x x x = 576 , 536 , 326
	2.5 / 3.3	GCDQF x x x	x x x = 576 , 536 , 326
	1.8 / 2.5 / 3.3	GDJFN x x x	x x x = 578 , 538
Square Wave HCSL	1.8 / 2.5 / 3.3	GCJFN x x x	x x x = 578 , 538
Square Wave CML	1.8 / 2.5 / 3.3	GQJFN x x x	x x x = 578 , 538

Output Wave / Output Logic	Supply Voltage	Product Series	SMD types	Thru-Hole types
Square Wave CMOS	1.8 / 3.3	G x x	- - - - -	x x = 8,14
	1.8 / 3.3	G x x x	x x x = 576 , 536 , 326 , 226	
	2.5 / 3.3	GTQN x x x	x x x = 576 , 536 , 326	
	2.5 / 3.3	GTQF x x x	x x x = 576 , 536 , 326	- - - - -
	1.8 / 2.5 / 3.3	GTJFN x x x	x x x = 578 , 538	
	2.5 / 3.3	GCTQF x x x	x x x = 576 , 536 , 326	

" x x x " = package code

Part Number Format

[1] Supply Voltage	[2] Holder Type	-	[3] Frequency Stability	-	[4] Pulling Range	[5] Range Code	-	[6] Center Frequency
Ex. (1) 18	G14	-	B	-	80	N	-	35.328
(2) 3	GTQF576	-	C20	-	150	M	-	200.000

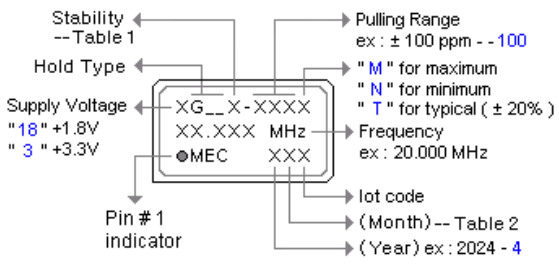
Ex (1) : 18G14 - B - 80N - 35.328 [1.8V , G14 type , ±50ppm from -20°C to 70°C , Pulling : ±80ppm (min.) , 35.328MHz]

Ex (2) : 3GTQF576 - C20 - 150M - 200.000 [3.3V , GTQF576 type , ±20ppm from -20°C to 70°C , Pulling : ±150ppm (max.) , 200.000MHz]

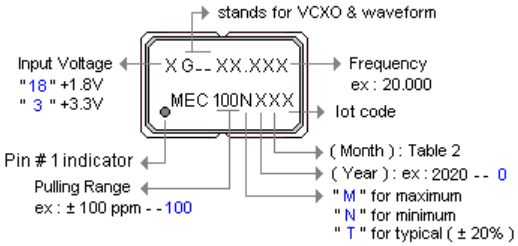
[1]	Supply voltage , " 18 " for +1.8V ; " 25 " for +2.5V ; " 3 " for +3.3V	
[2]	Holder Type	
[3]	-20°C ~ 70°C	" A " ± 25ppm ; " B " ± 50ppm ; " C " ± 100ppm ;
		If non-standard please enter the desired stability after " C " , for example " C15 " : represents ±15ppm over -20 to +70°C
	-40°C ~ 85°C	" D " ± 25ppm ; " E " ± 50ppm ; " F " ± 100ppm ;
		If non-standard please enter the desired stability after " F " , for example " F20 " : represents ±20ppm over -40 to +85°C
[4]	Freqency Pulling Range	
[5]	Pulling Range Code	" M " stands for maximum ; " N " stands for minimum ; " T " stands for typical (tolerance is ± 20%)
[6]	Center Frequency in MHz	

Production Marking Rules

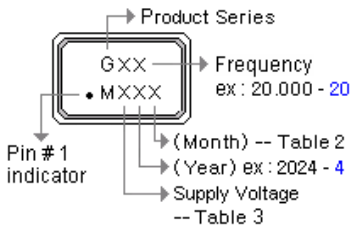
G_8 , G_14



G536 , G576



G_226 , G_326

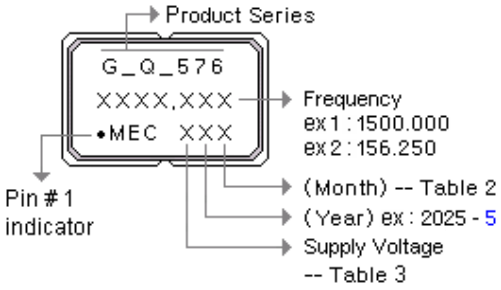


Part Number Formats and Product Marking Rules

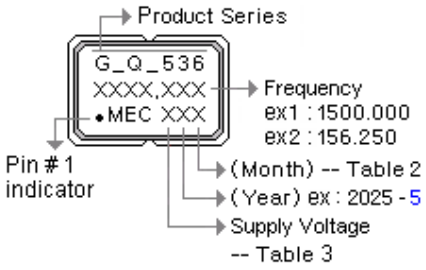
[VCXO] Voltage Controlled Crystal Oscillators

Production Marking Rules

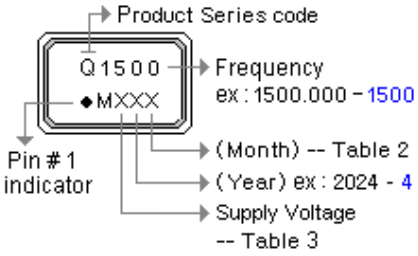
G_QF576 , G_QN576



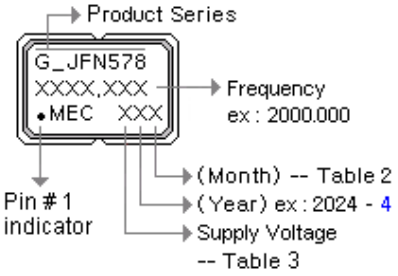
G_QF536 , G_QN536



G_QF326 , G_QN326



G_JFN578



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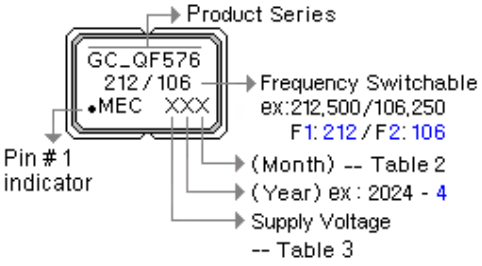

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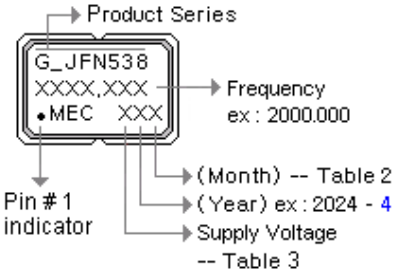

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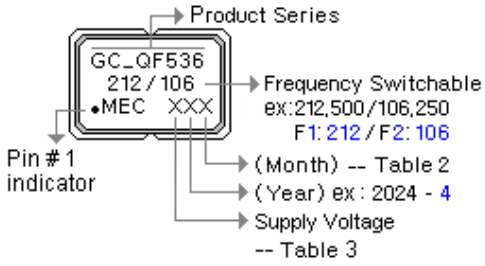


GC_QF326

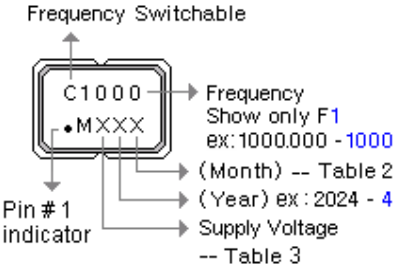


Table 1	-20°C ~ 70°C [Commercial]	" A " ± 25ppm ; " B " ± 50ppm ; " C " ± 100ppm ; If non-standard please enter the desired stability after " C " , Ex : " C15 " : represents ±15ppm over -20 to +70°C
	-40°C ~ 85°C [Industrial]	" D " ± 25ppm ; " E " ± 50ppm ; " F " ± 100ppm ; If non-standard please enter the desired stability after " F " , Ex : " F20 " : represents ±20ppm over -40 to +85°C
	-40°C ~ 105°C	" H " ± 50ppm ; " J " ± 100ppm

Table 2	Month	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
	Code	A	B	C	D	E	F	G	H	I	J	K	L

Table 3	Input Voltage	Tri - State	5.0 V	3.3 V	3.0 V	2.8 V	2.5 V	1.8 V	1.5 V	1.2 V	1.0 V
			B	D	E	F	H	J	L	N	P

Part Number Formats and Product Marking Rules

[TCXO vs VCTCXO] Temperature Compensated Crystal Oscillators

Holder Type

Waveform	TCXO	VCTCXO	SMD types	Thru-Hole types
Clipped Sine Wave	M x x S	VM x x S	x x = 21 , 22 , 32 , 53 , 57 , 572	x x = 8 , 9 , 14 , 15 , 39
CMOS output	M x x T	VM x x T	x x = 32 , 53 , 572	
	M x x 1 T	-----	x x = 21 , 22 , 32	-----
	ME x x T	-----	x x = 21 , 32	
	MTF x x x T	VMTF x x x T	x x x = 326 , 538	
	MQN x x x T	VMQN x x x T	x x x = 326 , 574	
	MQF x x x T	VMQF x x x T	x x x = 326 , 574	
LVPECL output	MJF x x x P	VMJF x x x P	x x x = 326 , 538	
	MQN x x x P	VMQN x x x P	x x x = 326 , 576	
	MQF x x x P	VMQF x x x P	x x x = 326 , 576	-----
LVDS output	MJF x x x D	VMJF x x x D	x x x = 326 , 538	
	MQN x x x D	VMQN x x x D	x x x = 326 , 576	
	MQF x x x D	VMQF x x x D	x x x = 326 , 576	
HCSL output	MJF x x x C	VMJF x x x C	x x x = 326 , 538	
CML output	MJF x x x Q	VMJF x x x Q	x x x = 326 , 538	

" x x x " = package code

Part Number Format

	[1] Holder Type	[2] Output Wave	[3] Supply Voltage	–	[4] Center Frequency	–	[5] Frequency Stability	/	[6] Operating Temp. Range
Examples	(1) VM32	T	33	-	10.000	-	1.5	/	-20+70
	(2) M53	S	3	-	20.000	-	2.5	/	-30+75
	(3) MQN576	P	33	-	155.520	-	1.0	/	0+50

Ex (1) : VM32T33 - 10.000 - 1.5 / -20+70 [VCTCXO , VM32 type , CMOS output , 3.3V , 10.000MHz , ±1.5ppm from -20°C to 70°C]

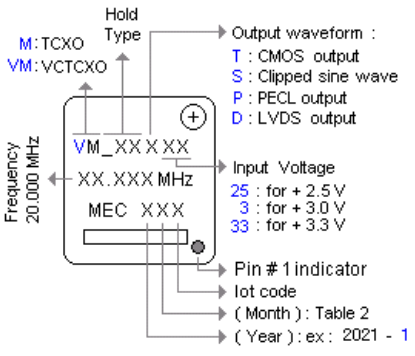
Ex (2) : M53S3 - 20.000 - 2.5 / -30+75 [TCXO , M53 type , Clipped Sine Wave , 3.0V , 20.000MHz , ±2.5ppm from -30°C to 75°C]

Ex (3) : MQN576P33 - 155.520 -1.0 / 0+50 [TCXO , MQN576 type , PECL differential , 3.3V , 155.520MHz , ±1.0ppm from 0°C to 50°C]

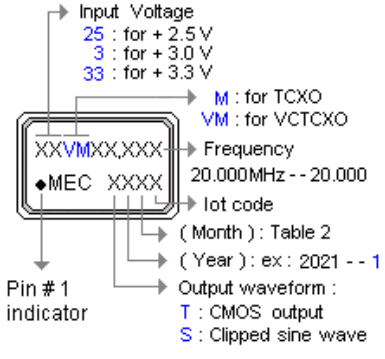
[1]	Holder Type
	" M " stands for TCXO , " VM " stands for VCTCXO
[2]	" S " stands for Clipped Sine Wave ; " T " stands for CMOS output ; " D " stands for LVDS differential ; " P " stands for PECL differential ; " C " stands for HCSL output ; " Q " stands for CML output
	ex 1 : VM32T --- TCXO , VM32 pcakage , CMOS output
[3]	Supply voltage , " 18 " stands for +1.8V ; " 25 " stands for +2.5V ; " 3 " stands for +3.0V ; " 33 " stands for +3.3V
[4]	Center Frequency in MHz
[5]	Frequency stability in ± _ ppm ; ex 1 : ± 1.5ppm --- 1.5 , ex 2 : ± 2.5ppm --- 2.5 , ex 3 : ± 1.0ppm --- 1.0
[6]	Operating temperature range in °C
	ex 1 : -20 °C to 70 °C ----- -20+70 ; ex 2 : -30 °C to 75 °C ----- -30+75 ; ex 3 : 0 °C to 50 °C ----- 0+50

Production Marking Rules

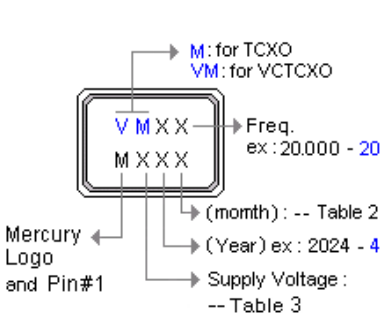
General (VC)TCXO pcakage types marking rules



(V)M572_



(V)M32_ , (V)M22_ , (V)M21_

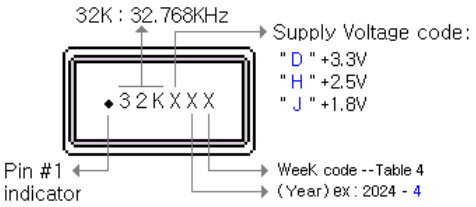


Part Number Formats and Product Marking Rules

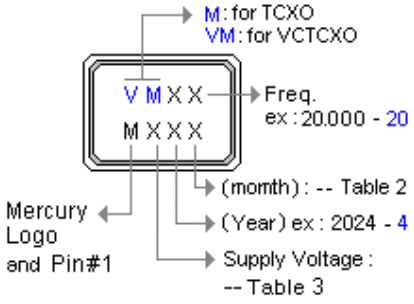
[TCXO vs VCTCXO] Temperature Compensated Crystal Oscillators

Production Marking Rules

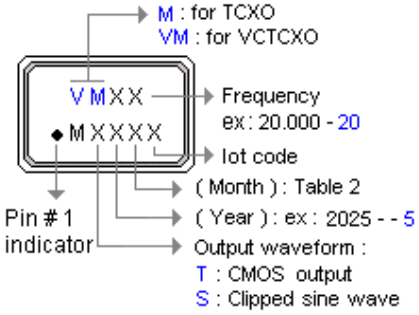
ME32 , ME21



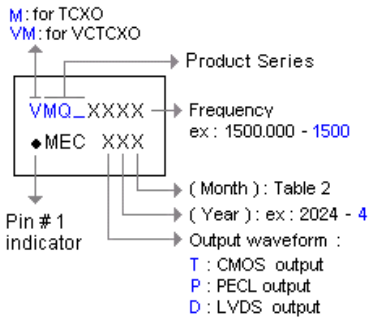
M321T , M211T , M221T



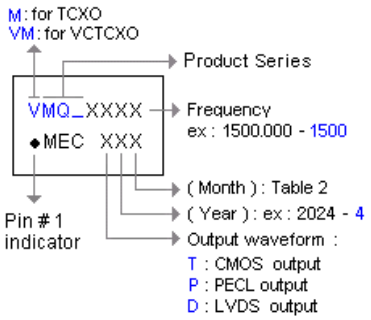
(V)M57_ , (V)M53_



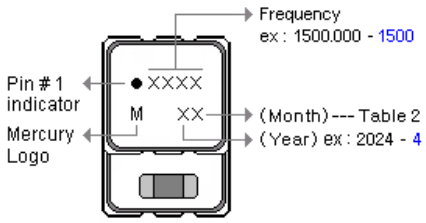
(V)MQN574_ , (V)MQF574_



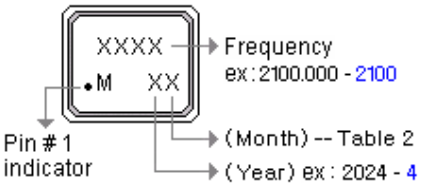
(V)MQN576_ , (V)MQF576_



(V)MQF326_ , (V)MQN326_ , (V)MTF326_



(V)MJF538_ , (V)MTF538_



(V)MJF326_

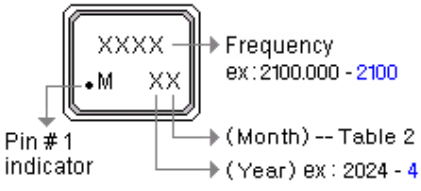


Table 2	Month	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
	Code	A	B	C	D	E	F	G	H	I	J	K	L

Table 3	Input Voltage	5.0 V	3.3 V	3.0 V	2.8 V	2.5 V	1.8 V	1.5 V	1.2 V	1.0 V
		B	D	E	F	H	J	L	N	P

Table 4 Week Code	Week	1	2	3	4	5	6	7	8	9	10	11	12	13
	Code	A	B	C	D	E	F	G	H	I	J	K	L	M
	Week	14	15	16	17	18	19	20	21	22	23	24	25	26
	Code	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
	Week	27	28	29	30	31	32	33	34	35	36	37	38	39
	Code	a	b	c	d	e	f	g	h	i	j	k	l	m
	Week	40	41	42	43	44	45	46	47	48	49	50	51	52
	Code	n	o	p	q	r	s	t	u	v	w	x	y	z

Part Number Formats and Product Marking Rules

[OCXO] Oven Controlled Crystal Oscillators

Holder Type

Type	Thru-Hole types	SMD types	Waveform
OC x x	x x = 13 , 14 , 18 , 19 , 32	x x = 12 , 41 , 51	Square Wave ; True Sine Wave ; Clipped Sine Wave

Part Number Format

[1]	[2]	[3]		[4]		[5]		[6]
Holder Type	Output Wave	Supply Voltage	-	Center Frequency	-	Frequency Stability	/	Operating Temp. Range

Examples									
(1)	OC14	T	5	-	5.000	-	10	/	-40+85
(2)	OC18	E	5	-	100.000	-	100	/	-30+70
(3)	OC51	S	3	-	10.000	-	30	/	-20+70
(4)	OC12	E	3	-	10.000	-	200	/	0+70

Ex (1) : OC14T5 - 5.000 - 10 / -40+85 [OC14 type , Square Wave , 5.0V , 5.000MHz , ± 10ppb from -40°C to 85°C]

Ex (2) : OC18E5 - 100.000 - 100 / -30+70 [OC18 type , True Sine Wave , 5.0V , 100.000MHz , ± 100ppb from -30°C to 70°C]

Ex (3) : OC51S3 - 10.000 - 30 / -20+70 [OC51 type , Clipped Sine Wave , 3.3V , 10.000MHz , ± 30ppb from -20°C to 70°C]

Ex (4) : OC12E3 - 10.000 - 200 / 0+70 [OC12 type , True Sine Wave , 3.3V , 10.000MHz , ± 200ppb from 0°C to 70°C]

[1]	Holder Type
	" OC_ _ " stands for OCXO ,
[2]	" T " stands for Square Wave , " E " stands for True Sine Wave , " S " stands for Clipped Sine Wave
	ex 1 : OC14T , OC14 package , Square Wave ; ex 2 : OC18E , OC18 package , True Sine Wave ;
	ex 3 : OC51S , OC51 package , Clipped Sine Wave ; ex 4 : OC12E , OC12 package , True Sine Wave
[3]	Supply voltage , " 5 " for 5.0V D.C , " 3 " for 3.3V D.C
[4]	Center Frequency in MHz
[5]	Frequency stability in ± _ ppb ; ex 1 : ±10ppb --- 10 , ex 2 : ± 100ppb --- 100 , ex 3 : ± 30ppb --- 30 , ex 4 : ± 200ppb --- 200
[6]	Operating temperature range in °C
	ex 1 : -40 °C to 85°C ----- -40+85 ; ex 2 : -30 °C to 70°C ----- -30+70 ; ex 3 : -20 °C to 70°C ----- -20+70 ; ex 4 : 0 °C to 70°C ----- 0+70

Production Marking Rules

General OCXO package types marking rules

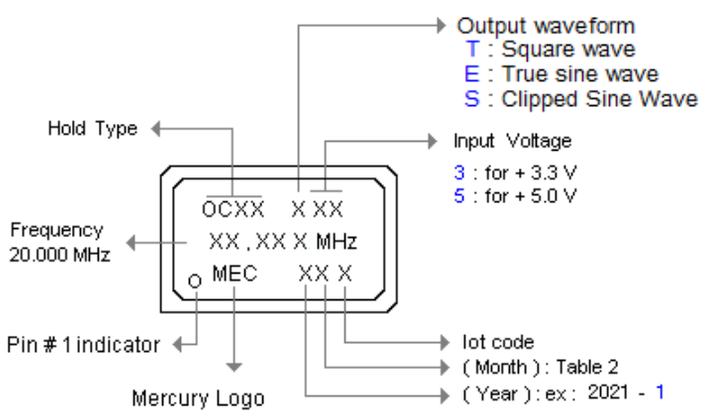


Table 2	Month	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
	Code	A	B	C	D	E	F	G	H	I	J	K	L

Part Number Formats and Product Marking Rules

[M. C. F.] Monolithic Crystal Filters

Holder Type

SMD Types : MQ

Dip Types : 49T | U1 | U5 | S1 | S2 | L1 | L2

SMD Type (7.0 * 5.0 * 1.3 mm) Part Number Format

[1]	[2]	[3]	[4]
Frequency Code	MQ	Width Code	Poles Code
Examples: 45		15	B

Ex : 45MQ15B [45.000MHz , SMD type MQ , Passband : ±7.5KHz , 4poles]

Dip Type Part Number Format

[1]	[2]	[3]	[4]	[5]	[6]
Frequency Code	M	Width Code	Poles Code	Holder Type	Temperature range
Examples: 21	M	15	B	U5	

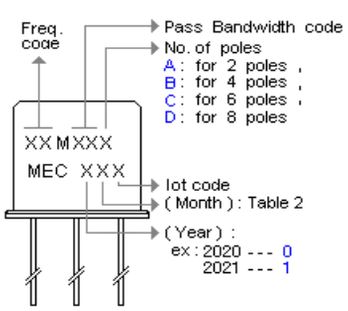
Ex : 21M15BU5 [21.400MHz , Dip Type , Passband : ±7.5KHz , 4poles , RoHS compliant , U5 Dip type]

[1]	Freq. code : " 10 " for 10.700MHz , " 21 " for 21.400MHz , " 21.7 " for 21.700MHz , " 45 " for 45.000MHz , " 50.85 " for 50.850MHz
	Freq. code : If none standard freq. please show freqency with one decimal point .
[2]	" M " Dip Type , " MQ " SMD Type
[3]	Pass band width (3dB) (min.)
	" 7.5 " for ± 3.75KHz , " 15 " for ± 7.5KHz , " 20 " for ± 10KHz , " 30 " for ± 15KHz ,
[4]	No. of poles
	" 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 ,
	If non-standard please enter the desired temp. range after " / " , for example " / -30+70 " : -30°C to 70°C

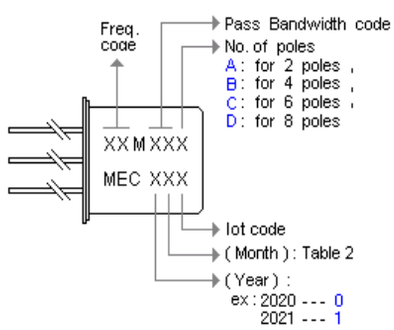
Production Marking Rules

General MCF package types marking rules

U5 series



U1 , 49T series



MQ series

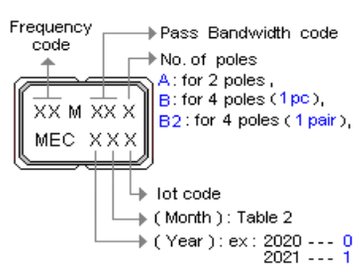
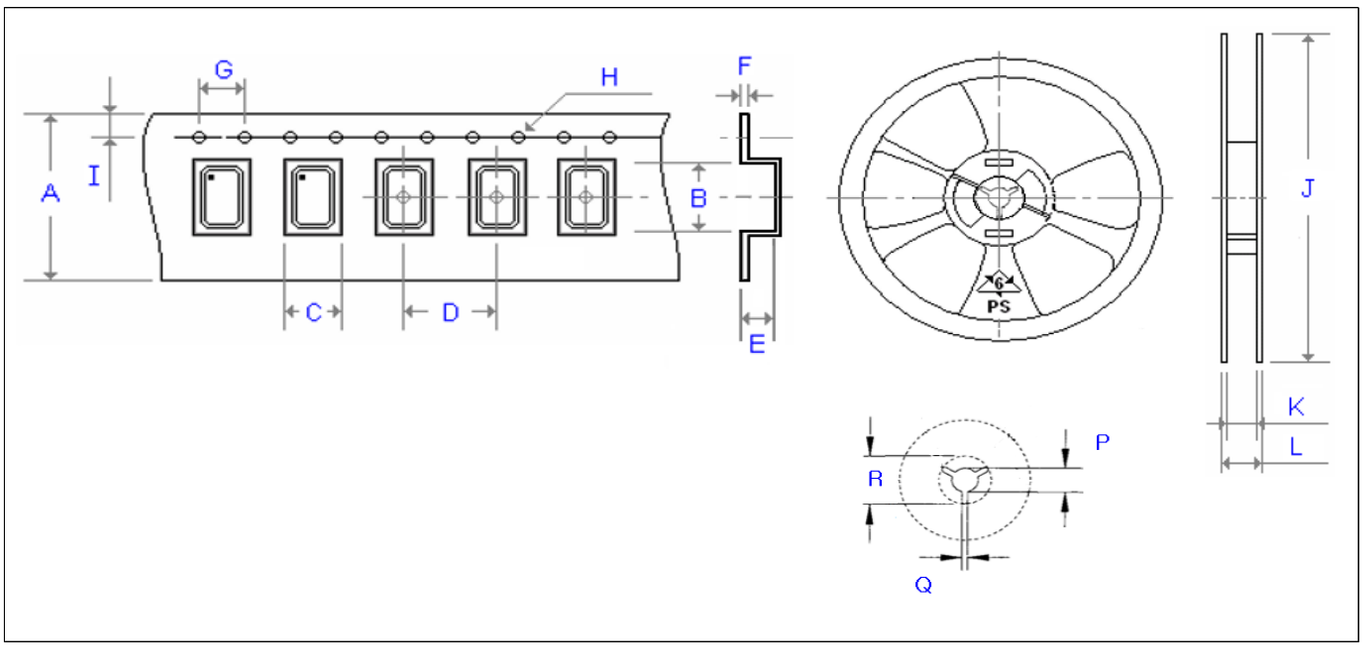


Table 2

Month	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Code	A	B	C	D	E	F	G	H	I	J	K	L

Emboss Taping and Reel Specifications

[Crystal Units]	[M . C . F . Units]



Carrier Type Dimensions (unit : mm) ±0.3mm

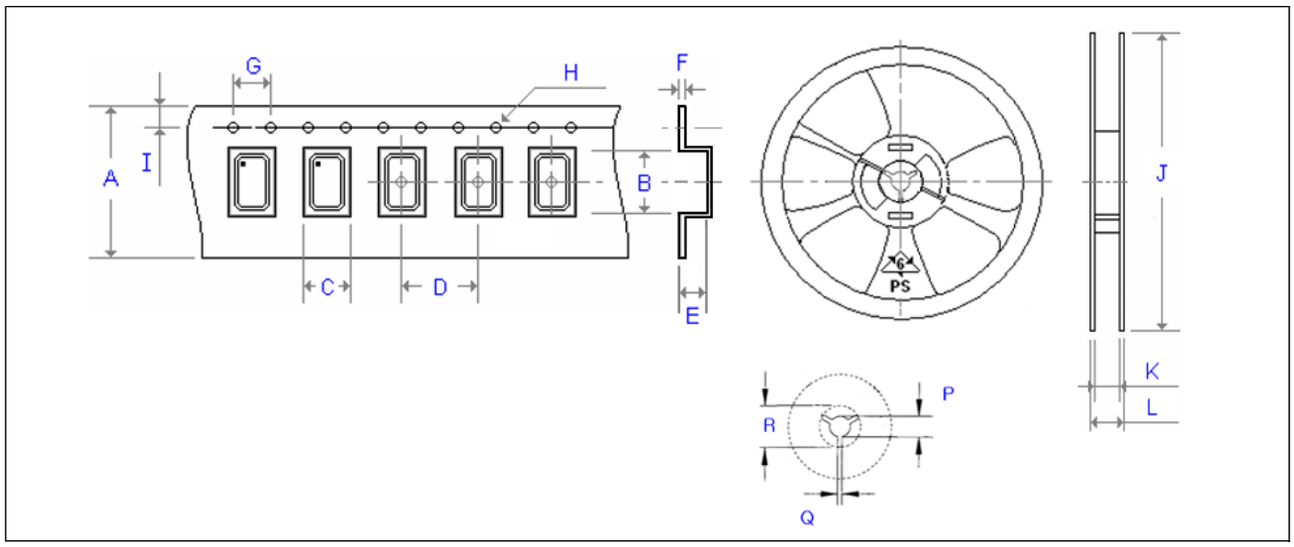
	A	B	C	D	E	F	G	H	I	pcs / reel
X11	8.00	1.79	1.39	4.00	0.45	0.25	4.00	Ø 1.50	1.75	3000
X21	8.00	2.30	1.90	4.00	0.60	0.20	4.00	Ø 1.50	1.75	3000
X22	8.00	2.80	2.25	4.00	1.10	0.30	4.00	Ø 1.50	1.75	3000
X32	8.00	3.40	2.70	4.00	1.40	0.25	4.00	Ø 1.50	1.75	3000
X2012	8.00	2.25	1.45	4.00	0.75	0.25	4.00	Ø 1.50	1.75	3000
X3215	12.00	3.40	1.70	4.00	1.00	0.30	4.00	Ø 1.50	1.75	3000
MJ	12.00	5.30	3.60	8.00	1.40	0.30	4.00	Ø 1.50	1.75	1000
MQ	16.00	7.20	5.40	8.00	1.80	0.30	4.00	Ø 1.50	1.75	1000
M49	24.00	15.00	5.00	12.00	4.25	0.40	4.00	Ø 1.50	1.75	1000
ML49	24.00	14.80	5.00	12.00	3.50	0.40	4.00	Ø 1.50	1.75	1000
MP4 (24)	24.00	13.30	5.10	12.00	4.20	0.40	4.00	Ø 1.50	1.75	1000
MP5 (25)	24.00	13.40	5.10	12.00	5.20	0.40	4.00	Ø 1.50	1.75	1000

Reel Dimensions (unit : mm) +2.0 / -0.0mm

	J	K	L	P	Q	R	pcs / reel
X11	180.00	9.00	12.00	13.20	2.10	-	3000
X21	180.00	9.00	12.00	13.20	2.10	-	3000
X22	180.00	9.00	12.00	13.20	2.10	-	3000
X32	180.00	9.00	12.00	13.20	2.10	-	3000
X2012	180.00	9.00	12.00	13.20	2.10	-	3000
X3215	180.00	13.00	16.00	13.20	2.50	-	3000
MJ	180.00	13.00	16.00	13.20	2.50	-	1000
MQ	180.00	17.20	19.30	13.30	2.20	22.00	1000
M49	330.00	24.50	29.10	13.00	2.20	17.30	1000
ML49	330.00	24.50	29.10	13.00	2.20	17.30	1000
MP4 (24)	330.00	24.50	29.10	13.00	2.20	17.30	1000
MP5 (25)	330.00	24.50	29.10	13.00	2.20	17.30	1000

Emboss Taping and Reel Specifications

[Crystal Oscillator Units]



Carrier Type Dimensions (unit : mm) ±0.3mm

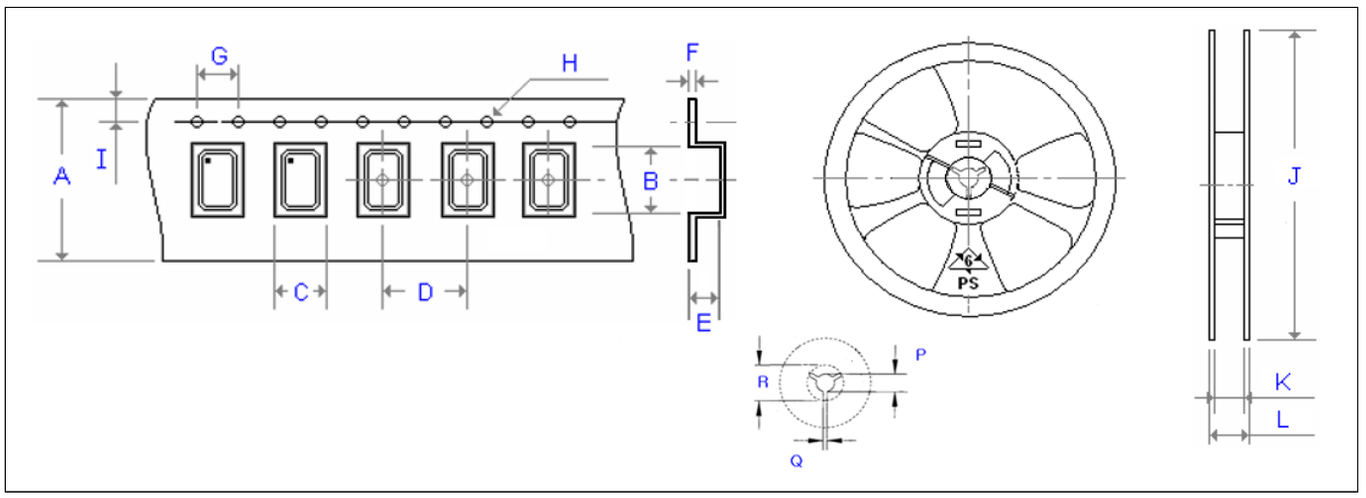
	A	B	C	D	E	F	G	H	I	pcs / reel
H21	8.00	2.30	1.90	4.00	0.90	0.25	4.00	Ø 1.50	1.75	3000
H_22	8.00	2.80	2.25	4.00	1.10	0.30	4.00	Ø 1.50	1.75	3000
H_32	8.00	3.40	2.70	4.00	1.40	0.25	4.00	Ø 1.50	1.75	3000
H_53	12.00	5.30	3.60	8.00	1.40	0.30	4.00	Ø 1.50	1.75	1000
H_57	16.00	7.30	5.30	8.00	1.90	0.30	4.00	Ø 1.50	1.75	1000
SWO	16.00	7.20	5.40	8.00	1.80	0.30	4.00	Ø 1.50	1.75	1000
H _ 216	8.00	2.30	1.90	4.00	0.90	0.25	4.00	Ø 1.50	1.75	3000
H _ 226	8.00	2.80	2.25	4.00	1.10	0.30	4.00	Ø 1.50	1.75	3000
H _ 326	8.00	3.40	2.70	4.00	1.40	0.25	4.00	Ø 1.50	1.75	3000
H _ 536	12.00	5.30	3.60	8.00	1.40	0.30	4.00	Ø 1.50	1.75	1000
H _ 576	16.00	7.30	5.30	8.00	1.90	0.30	4.00	Ø 1.50	1.75	1000
H _ 328	8.00	3.40	2.70	4.00	1.40	0.25	4.00	Ø 1.50	1.75	3000
H _ 538	12.00	5.40	3.60	8.00	1.70	0.30	4.00	Ø 1.50	1.75	1000
H _ 578	16.00	7.30	5.30	8.00	1.90	0.30	4.00	Ø 1.50	1.75	1000
H_43	24.00	11.80	10.00	16.00	5.00	0.30	4.00	Ø 1.50	1.75	500

Reel Dimensions (unit : mm) +2.0 / -0.0mm

	J	K	L	P	Q	R	pcs / reel
H21	180.00	9.00	12.00	13.20	2.10	-	3000
H_22	180.00	9.00	12.00	13.20	2.10	-	3000
H_32	180.00	9.00	12.00	13.20	2.10	-	3000
H_53	180.00	13.00	16.00	13.20	2.50	-	1000
H_57	180.00	17.20	19.30	13.30	2.20	22.00	1000
SWO	180.00	17.20	19.30	13.30	2.20	22.00	1000
H _ 216	178.00	8.40	11.40	13.30	2.50	20.50	3000
H _ 226	180.00	8.40	11.40	13.20	2.10	-	3000
H _ 326	180.00	9.00	12.00	13.20	2.10	-	3000
H _ 536	180.00	13.00	16.00	13.20	2.50	-	1000
H _ 576	180.00	17.20	19.30	13.30	2.20	22.00	1000
H _ 328	180.00	8.00	12.00	13.20	2.10	-	3000
H _ 538	180.00	13.00	16.00	13.20	2.50	-	1000
H _ 578	180.00	17.20	19.30	13.30	2.20	22.00	1000
H_43	330.00	24.50	29.10	13.00	2.20	17.30	500

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	Ø 1.50	1.75	3000
G_326	8.00	3.40	2.70	4.00	1.40	0.25	4.00	Ø 1.50	1.75	3000
G_536	12.00	5.30	3.60	8.00	1.40	0.30	4.00	Ø 1.50	1.75	1000
G_576	16.00	7.30	5.30	8.00	1.90	0.30	4.00	Ø 1.50	1.75	1000
G_538	12.00	5.40	3.60	8.00	1.70	0.30	4.00	Ø 1.50	1.75	1000
G_578	16.00	7.30	5.30	8.00	1.90	0.30	4.00	Ø 1.50	1.75	1000
(V)M21	8.00	2.30	1.90	4.00	0.90	0.25	4.00	Ø 1.50	1.75	3000
ME21	8.00	2.30	1.50	4.00	1.35	0.25	4.00	Ø 1.50	1.75	3000
(V)M22	8.00	2.80	2.25	4.00	1.10	0.30	4.00	Ø 1.50	1.75	3000
(V)M_32	8.00	3.71	2.80	4.00	1.75	0.25	4.00	Ø 1.50	1.75	3000
(V)M_326	12.00	3.60	2.90	4.00	1.70	0.30	4.00	Ø 1.50	1.75	1000
(V)M_53	12.00	5.30	3.60	8.00	1.40	0.30	4.00	Ø 1.50	1.75	1000
(V)M_538	12.00	5.40	3.60	8.00	1.70	0.30	4.00	Ø 1.50	1.75	1000
(V)M_57(2)	16.00	7.40	5.50	8.00	2.80	0.35	4.00	Ø 1.50	1.75	500
(V)M_43 (63)	24.00	11.80	10.00	16.00	5.00	0.30	4.00	Ø 1.50	1.75	500

Reel Dimensions (unit : mm) +2.0 / -0.0mm

	J	K	L	P	Q	R	pcs / reel
G_226	180.00	9.00	12.00	13.20	2.10	-	3000
G_326	180.00	9.00	12.00	13.20	2.10	-	3000
G_536	180.00	13.00	16.00	13.20	2.50	-	1000
G_576	180.00	17.20	19.30	13.30	2.20	22.00	1000
G_538	180.00	13.00	16.00	13.20	2.50	-	1000
G_578	180.00	17.20	19.30	13.30	2.20	22.00	1000
(V)M21	180.00	9.00	12.00	13.20	2.10	-	3000
ME21	180.00	9.00	12.00	13.20	2.10	-	3000
(V)M22	180.00	9.00	12.00	13.20	2.10	-	3000
(V)M_32	180.00	9.00	12.00	13.20	2.10	-	3000
(V)M_326	180.00	13.00	16.00	13.20	2.50	-	1000
(V)M_53	180.00	13.00	16.00	13.20	2.50	-	1000
(V)M_538	180.00	13.00	16.00	13.20	2.50	-	1000
(V)M_57(2)	180.00	17.20	19.30	13.30	2.20	22.00	500
(V)M_43 (63)	330.00	24.50	29.10	13.00	2.20	17.30	500

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