Transko Cal Crystal Comclok

TMM

RoHS Compliant

MEMS OSCILLATOR

■ FEATURES

- Output frequency from 1M~110MHz
- Low power consumption of 3.5 mA typical at 1.8V
- Available LVCMOS/HCMOS outputs
- Industry-standard packages: 2.0x1.6, 2.5x2.0, 3.2x2.5, 5.0x3.2, 7.0x5.0
- RoHS and REACH compliant, Pb-free, Halogen-free and Antimony-free

■ APPLICATIONS

- DSC, DVC, DVR, IP CAM, SSD, GPON, EPON, USB
- SATA, SAS, Firewire, 100M / 1G / 10G Ethernet
- Tablets, e-Books

■ ELECTRICAL CHARACTERISTICS

Parameters	Symbol	Min.	Typ.	Max.	Unit	Condition
Frequency Range						
Output Frequency Range	f	1	–	110	MHz	
Frequency Stability and Aging						
Frequency Stability	F_stab	-20	–	+20	ppm	Inclusive of initial tolerance at 25°C, 1st year aging at 25°C, and variations over operating temperature, rated power supply voltage and load.
		-25	–	+25	ppm	
		-50	–	+50	ppm	
Operating Temperature Range						
Operating Temperature Range	T_use	-20	–	+70	°C	Extended Commercial
		-40	–	+85	°C	Industrial
Supply Voltage and Current Consumption						
Supply Voltage	Vdd	1.62	1.8	1.98	V	
		2.25	2.5	2.75	V	
		2.52	2.8	3.08	V	
		2.7	3.0	3.3	V	
		2.97	3.3	3.63	V	
		2.25	–	3.63	V	
Current Consumption	Idd	–	3.8	4.5	mA	No load condition, f = 20 MHz, Vdd = 2.8V to 3.3V
		–	3.7	4.2	mA	No load condition, f = 20 MHz, Vdd = 2.5V
		–	3.5	4.1	mA	No load condition, f = 20 MHz, Vdd = 1.8V
OE Disable Current	I_OD	–	–	4.2	mA	Vdd = 2.5V to 3.3V, OE = GND, Output in high-Z state
		–	–	4.0	mA	Vdd = 1.8V, OE = GND, Output in high-Z state
Standby Current	I_std	–	2.1	4.3	µA	$\overline{ST}$ = GND, Vdd = 2.8V to 3.3V, Output is weakly pulled down
		–	1.1	2.5	µA	$\overline{ST}$ = GND, Vdd = 2.5V, Output is weakly pulled down
		–	0.2	1.3	µA	$\overline{ST}$ = GND, Vdd = 1.8V, Output is weakly pulled down
LVCMOS Output Characteristics						
Duty Cycle	DC	45	–	55	%	All Vdds. See Waveform figure
Rise/Fall Time	Tr, Tf	–	1	2	ns	Vdd = 2.5V, 2.8V, 3.0V or 3.3V, 20% - 80%
		–	1.3	2.5	ns	Vdd =1.8V, 20% - 80%
		–	–	2	ns	Vdd = 2.25V - 3.63V, 20% - 80%
Output High Voltage	VOH	90%	–	–	Vdd	IOH = -4 mA (Vdd = 3.0V or 3.3V) IOH = -3 mA (Vdd = 2.8V and Vdd = 2.5V) IOH = -2 mA (Vdd = 1.8V)
Output Low Voltage	VOL	–	–	10%	Vdd	IOL = 4 mA (Vdd = 3.0V or 3.3V) IOL = 3 mA (Vdd = 2.8V and Vdd = 2.5V) IOL = 2 mA (Vdd = 1.8V)
Input Characteristics						
Input High Voltage	VIH	70%	–	–	Vdd	Pin 1, OE or $\overline{ST}$
Input Low Voltage	VIL	–	–	30%	Vdd	Pin 1, OE or $\overline{ST}$
Input Pull-up Impedance	Z_in	50	87	150	kΩ	Pin 1, OE logic high or logic low, or $\overline{ST}$ logic high
		2	–	–	MΩ	Pin 1, $\overline{ST}$ logic low
Startup and Resume Timing						
Startup Time	T_start	–	–	5	ms	Measured from the time Vdd reaches its rated minimum value
Enable/Disable Time	T_oe	–	–	130	ns	f = 110 MHz. For other frequencies, T_oe = 100 ns + 3 * cycles
Resume Time	T_resume	–	–	5	ms	Measured from the time $\overline{ST}$ pin crosses 50% threshold
Jitter						
RMS Period Jitter	T_jitt	–	1.8	3	ps	f = 75 MHz, Vdd = 2.5V, 2.8V, 3.0V or 3.3V
		–	1.8	3	ps	f = 75 MHz, Vdd = 1.8V
Peak-to-peak Period Jitter	T_pk	–	12	25	ps	f = 75 MHz, Vdd = 2.5V, 2.8V, 3.0V or 3.3V
		–	14	30	ps	f = 75 MHz, Vdd = 1.8V
RMS Phase Jitter (random)	T_phj	–	0.5	0.9	ps	f = 75 MHz, Integration bandwidth = 900 kHz to 7.5 MHz
		–	1.3	2	ps	f = 75 MHz, Integration bandwidth = 12 kHz to 20 MHz

- All Min and Max limits are specified over temperature and rated operating voltage with 15 pF output load unless otherwise stated.
- Typical values are at 25°C and nominal supply voltage.

■ ABSOLUTE MAXIMUM LIMITS

Attempted operation outside the absolute maximum ratings may cause permanent damage to the part. Actual performance of the IC is only guaranteed within the operational specifications, not at absolute maximum ratings.

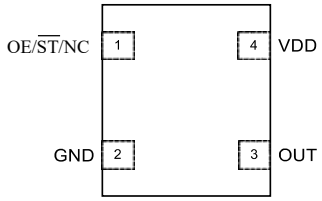
Parameter	Min.	Max.	Unit
Storage Temperature	-65	150	°C
Vdd	-0.5	4	V
Electrostatic Discharge	–	2000	V
Soldering Temperature (follow standard Pb free soldering guidelines)	–	260	°C
Junction Temperature	–	150	°C

■ PIN DESCRIPTION

Pin	Symbol		Function
1	OE/$\overline{ST}$/NC	Output Enable	H[1]: specified frequency output L: output is high impedance. Only output driver is disabled.
		Standby	H[1]: specified frequency output L: output is low (weak pull down). Device goes to sleep mode. Supply current reduces to I_std.
		No Connect	Any voltage between 0 and Vdd or Open[1]: Specified frequency output. Pin 1 has no function.
2	GND	Power	Electrical ground
3	OUT	Output	Oscillator output
4	VDD	Power	Power supply voltage[2]

■ PIN ASSIGNMENTS

TOP VIEW



1. In OE or $\overline{ST}$ mode, a pull-up resistor of 10 kΩ or less is recommended if pin 1 is not externally driven. If pin 1 needs to be left floating, use the NC option.
2. A capacitor of value 0.1 µF or higher between Vdd and GND is required

Pin 1 Configuration Options (OE, $\overline{ST}$, or NC)

Pin 1 can be factory-programmed to support three modes: Output Enable (OE), Standby ($\overline{ST}$) or No Connect (NC).

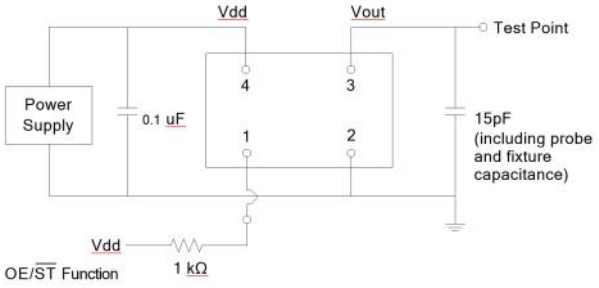
Output Enable (OE) Mode
In the OE mode, applying logic Low to the OE pin only disables the output driver and puts it in Hi-Z mode. The core of the device continues to operate normally. Power consumption is reduced due to the inactivity of the output. When the OE pin is pulled High, the output is typically enabled in <1 µs.

Standby ($\overline{ST}$) Mode
In the ST mode, a device enters into the standby mode when Pin 1 pulled Low. All internal circuits of the device are turned off. The current is reduced to a standby current, typically in the range of a few µA. When $\overline{ST}$ is pulled High, the device goes through the "resume" process, which can take up to 5 ms.

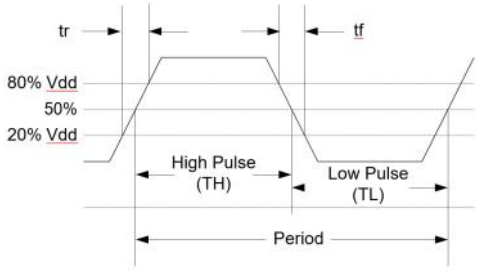
No Connect (NC) Mode
In the NC mode, the device always operates in its normal mode and outputs the specified frequency regardless of the logic level on pin 1.

	OE	$\overline{ST}$	NC
Active current 20 MHz (max, 1.8V)	4.1 mA	4.1 mA	4.1 mA
OE disable current (max. 1.8V)	4 mA	N/A	N/A
Standby current (typical 1.8V)	N/A	0.6 µA	N/A
OE enable time at 77.76 MHz (max)	138 ns	N/A	N/A
Resume time from standby (max, all frequency)	N/A	5 ms	N/A
Output driver in OE disable/standby mode	High Z	weak pull-down	N/A

■ TEST CIRCUIT



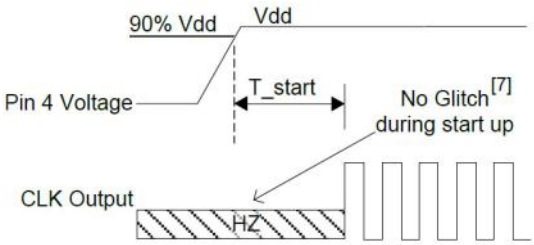
■ WAVEFORM



Duty Cycle is computed as Duty Cycle =TH/Period.

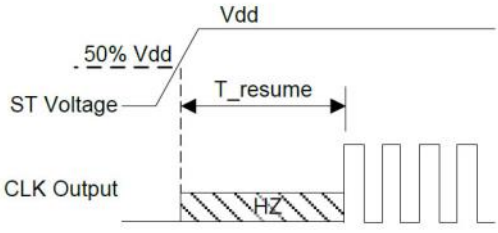
■ TIMING DIAGRAMS

Startup Timing (OE / ST Mode)



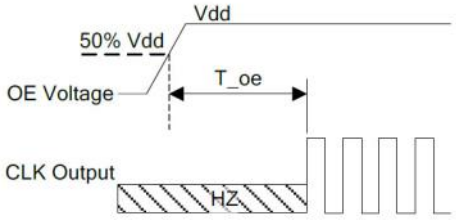
T_start: Time to start from power-off

Standby Resume Timing (ST Mode Only)



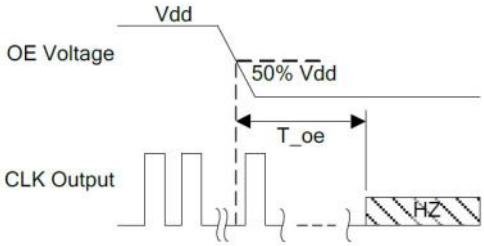
T_resume: Time to resume from ST

OE Enable Timing (OE Mode Only)



T_oe: Time to re-enable the clock output

OE Disable Timing (OE Mode Only)

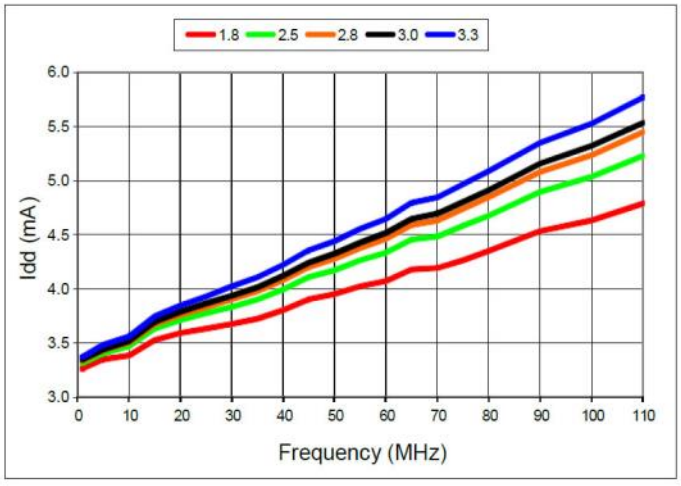


T_oe: Time to put the output in High Z mode

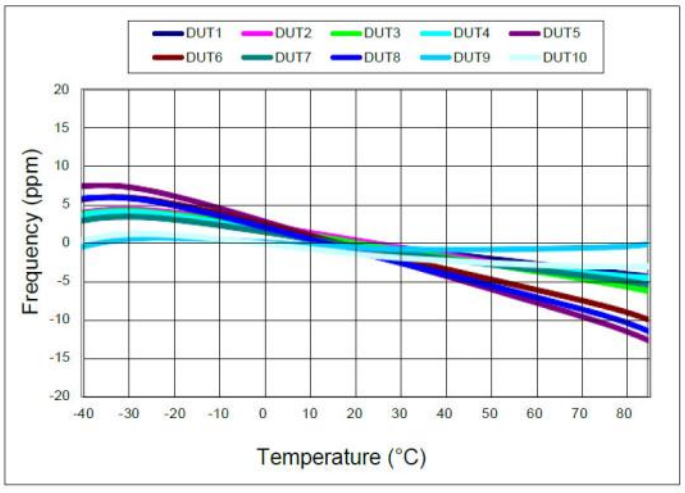
■ PERFORMANCE PLOTS

All plots are measured with 15 pF load at room temperature, unless otherwise stated.

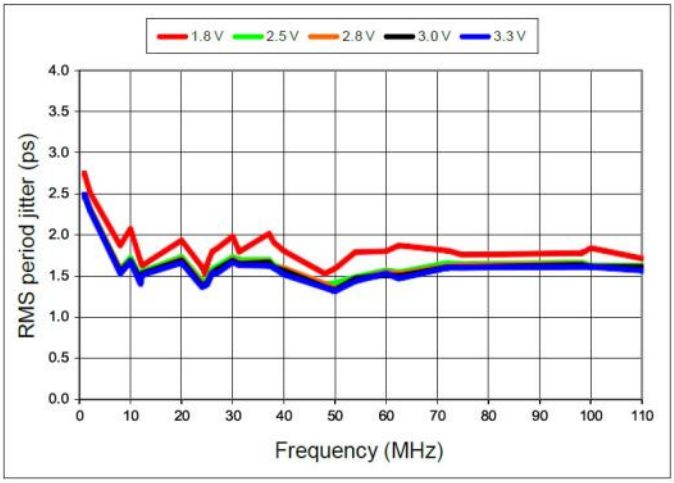
Phase noise plots are measured with Agilent E5052B signal source analyzer. Integration range is up to 5 MHz for carrier frequencies below 40 MHz.



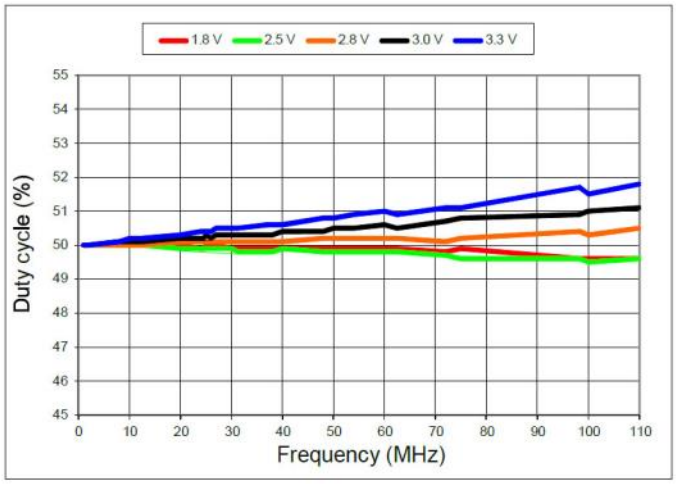
Idd vs Frequency



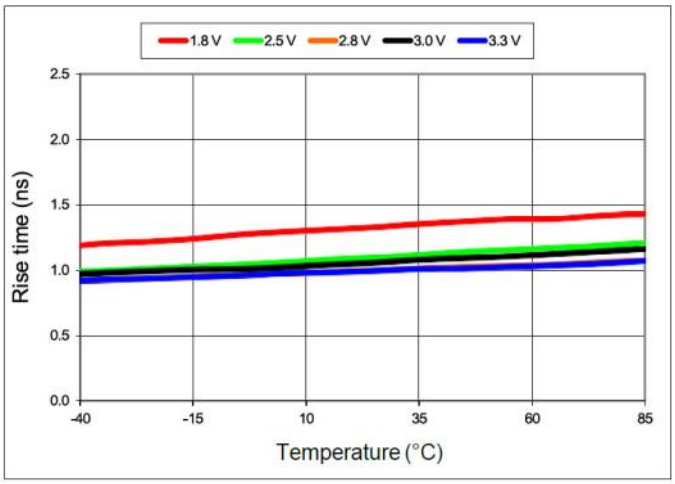
Frequency vs Temperature



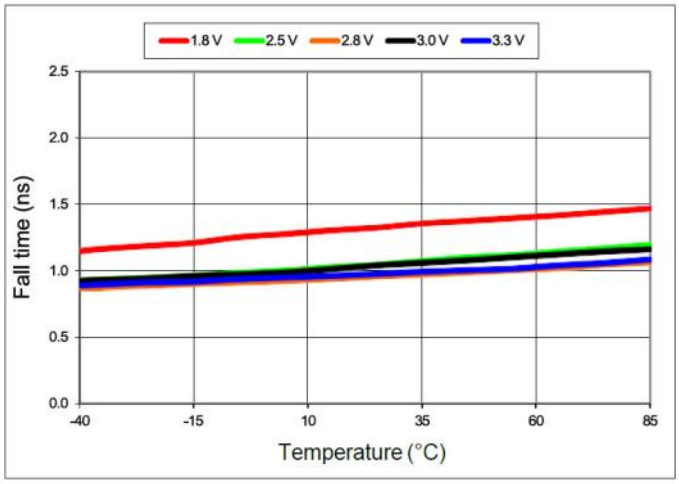
RMS Period Jitter vs Frequency



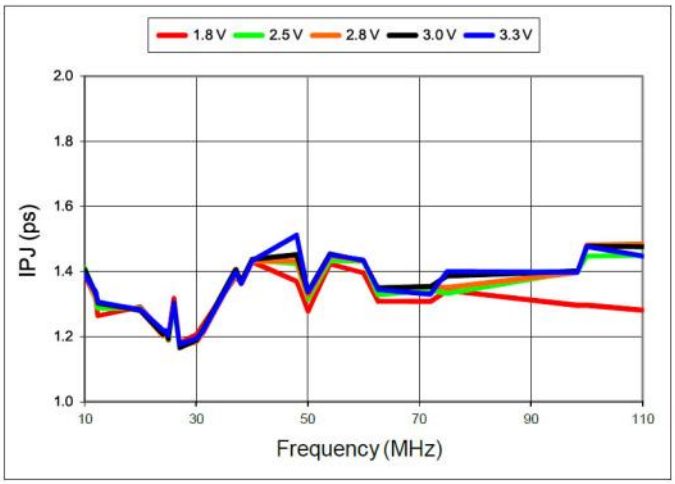
Duty Cycle vs Frequency



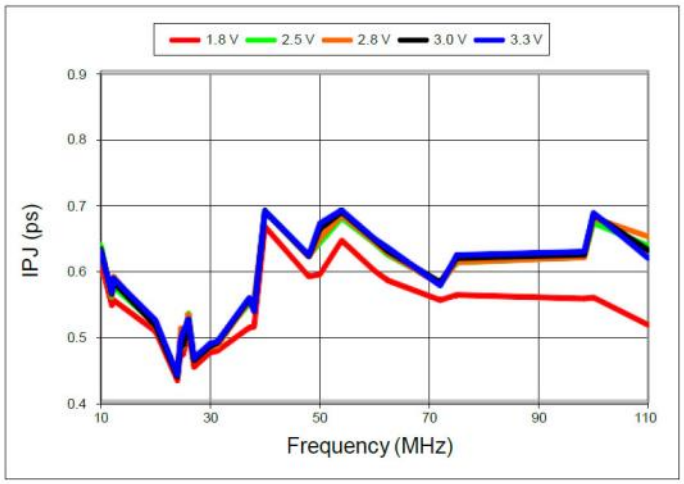
RMS Period Jitter vs Frequency



Duty Cycle vs Frequency



RMS Integrated Phase Jitter Random (12 kHz to 20M Hz) vs Frequency



RMS Integrated Phase Jitter Random (900 kHz to 20 MHz) vs Frequency

■ OUTPUT DRIVE STRENGTH—RISE / FALL TIME OPTIONS

Rise/Fall Time Typ (ns) Vdd = 1.8V					
Drive Strength \ CLOAD	5 pF	15 pF	30 pF	45 pF	60 pF
L	6.16	11.61	22.00	31.27	39.91
A	3.19	6.35	11.00	16.01	21.52
R	2.11	4.31	7.65	10.77	14.47
B	1.65	3.23	5.79	8.18	11.08
T	0.93	1.91	3.32	4.66	6.48
E	0.78	1.66	2.94	4.09	5.74
U	0.70	1.48	2.64	3.68	5.09
F or BLANK: default	0.65	1.30	2.40	3.35	4.56

Rise/Fall Time Typ (ns) Vdd = 2.5V					
Drive Strength \CLOAD	5 pF	15 pF	30 pF	45 pF	60 pF
L	4.13	8.25	12.82	21.45	27.79
A	2.11	4.27	7.64	11.20	14.49
R	1.45	2.81	5.16	7.65	9.88
B	1.09	2.20	3.88	5.86	7.57
T	0.62	1.28	2.27	3.51	4.45
E or BLANK: default	0.54	1.00	2.01	3.10	4.01
U	0.43	0.96	1.81	2.79	3.65
F	0.34	0.88	1.64	2.54	3.32

Rise/Fall Time Typ (ns) Vdd = 2.8V					
Drive Strength \ CLOAD	5 pF	15 pF	30 pF	45 pF	60 pF
L	3.77	7.54	12.28	19.57	25.27
A	1.94	3.90	7.03	10.24	13.34
R	1.29	2.57	4.72	7.01	9.06
B	0.97	2.00	3.54	5.43	6.93
T	0.55	1.12	2.08	3.22	4.08
E or BLANK: default	0.44	1.00	1.83	2.82	3.67
U	0.34	0.88	1.64	2.52	3.30
F	0.29	0.81	1.48	2.29	2.99

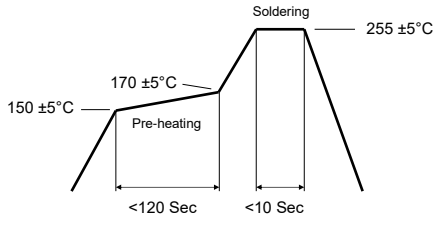
Rise/Fall Time Typ (ns) Vdd = 3.0V					
Drive Strength \ CLOAD	5 pF	15 pF	30 pF	45 pF	60 pF
L	3.60	7.21	11.97	18.74	24.30
A	1.84	3.71	6.72	9.86	12.68
R	1.22	2.46	4.54	6.76	8.62
B	0.89	1.92	3.39	5.20	6.64
T or BLANK: default	0.51	1.00	1.97	3.07	3.90
E	0.38	0.92	1.72	2.71	3.51
U	0.30	0.83	1.55	2.40	3.13
F	0.27	0.76	1.39	2.16	2.85

Rise/Fall Time Typ (ns) Vdd = 3.3V					
Drive Strength \ CLOAD	5 pF	15 pF	30 pF	45 pF	60 pF
L	3.39	6.88	11.63	17.56	23.59
A	1.74	3.50	6.38	8.98	12.19
R	1.16	2.33	4.29	6.04	8.34
B	0.81	1.82	3.22	4.52	6.33
T or BLANK: default	0.46	1.00	1.86	2.60	3.84
E	0.33	0.87	1.64	2.30	3.35
U	0.28	0.79	1.46	2.05	2.93
F	0.25	0.72	1.31	1.83	2.61

■ ENVIRONMENTAL COMPLIANCE

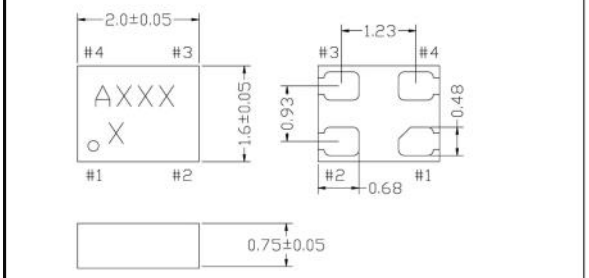
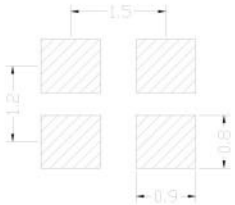
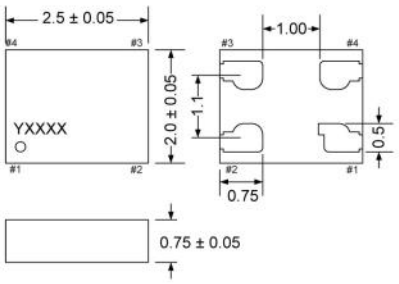
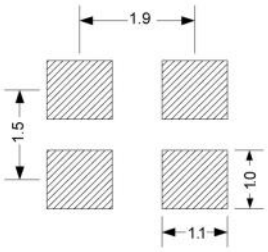
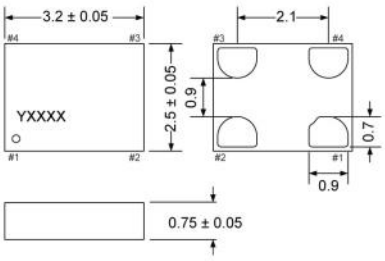
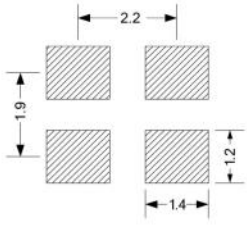
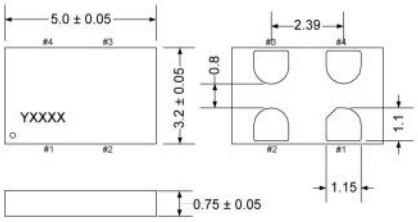
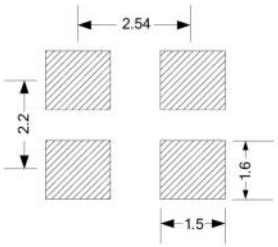
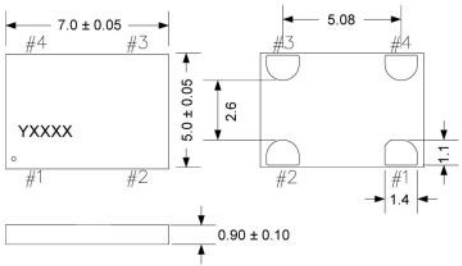
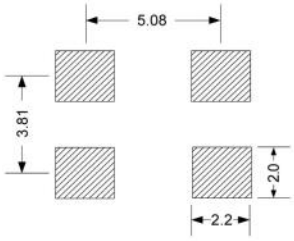
Parameter	Condition / Test Method
Mechanical Shock	MIL-STD-883F, Method2002
Mechanical Vibration	MIL-STD-883F, Method 2007
Temperature Cycle	JESD22, Method A104
Solderability	MIL-STD-883F, Method2003
Moisture Sensitivity Level	MSL1 @ 260°C

■ REFLOW PROFILE



Note: Consult factory for detail

■ PACKAGE OPTIONS / LAND PATTERN (Unit:mm)

PACKAGE 21	2.0 x 1.6 x 0.75 mm 	
PACKAGE 22	2.5 x 2.0 x 0.75 mm 	
PACKAGE 32	3.2 x 2.5 x 0.75 mm 	
PACKAGE 53	5.0 x 3.2 x 0.75 mm 	
PACKAGE 75	7.0 x 5.0 x 0.90 mm 	

MARKING

A = FACTORY CODE
Y = FACTORY CODE
XXXX = LOT CODE
O = PIN 1 LOCATION

A capacitor of value 0.1 µF or higher between Vdd and GND is required.

■ PART NUMBERING GUIDE