MEMS Oscillator, High Temperature, LVCMOS / HCMOS Compatible, 1.000 MHz to 100.000MHz **IM820 Series**

Features:

- MEMS Technology
- Direct pin to pin drop-in replacement for industry-standard packages
- LVCMOS/HCMOS Compatible Output
- Industry-standard package 2.0 x1.6, 2.5 x 2.0, 3.2 x 2.5, and 5.0 x 3.2 mm x mm
- Pb-free, RoHS and REACH compliant
- Fast delivery times

Typical Applications:

- Fibre Channel
- Server and Storage
- GPON, EPON
- 100M / 1G /10G Ethernet

Electronic Specifications:

Frequency Range	1.000 MHz to 110.000MHz	
Frequency Stability	See Part Number Guide	Inclusive of Initial Tolerance, Operating Temperature Range, Load, Voltage, and Aging
Operating Temperature	See Part Number Guide	
Supply Voltage (Vdd) ±10%	See Part Number Guide	
Current Consumption	3.8 mA typ./ 4.7 mA max 3.6 mA typ./ 4.5 mA max 3.5 mA typ./ 4.5 mA max	No load condition, F = 20 MHz, Vdd = +2.8 V, +3.0 V or +3.3 V No load condition, F = 20 MHz, Vdd = +2.5 V No load condition, F = 20 MHz, Vdd = +1.8 V
OE Disable Current	4.5 mA max 4.3 mA max	Vdd = +2.5 V, to +3.3 V, OE = Low, output is high Z state Vdd = +1.8 V, OE = Low, output is high Z state
Standby Current	2.6 µA typ./ 8.5 µA max 1.4 µA typ. 5.5 µA max 0.6 µA typ./ 4.0 µA max	Vdd = +2.8 V to 3.3 V, $\overline{ST}$ = low Vdd = +2.5 V, $\overline{ST}$ = Low Vdd = +1.8 V, $\overline{ST}$ = Low
Waveform Output	LVCMOS/HCMOS	
Symmetry	45%/55%	50% of waveform
Rise / Fall Time	1.0 nSec typ./ 2.0 nSec max 1.3 nSec typ./ 2.5 nSec max	Vdd = +2.5 V, +2.8 V, 3.0 V or 3.3 V from 20% to 80% of waveform Vdd = +1.8 V, from 20% or 80% of waveform
Logic "1"	90% of Vdd min	
Logic "0"	10% of Vdd max	
Input Voltage High	70% of Vdd min	Pin 1, OE or $\overline{ST}$
Input Voltage Low	30% of Vdd max	Pin 1, OE or $\overline{ST}$
Input Pull-up Impedance	50 kΩ min, 87 kΩ typ./ 150 kΩ max 2.0 MΩ min	Pin 1, OE logic high or logic low, or $\overline{ST}$ logic high Pin 1, $\overline{ST}$ logic low
Startup Time	5 mSec max	Measured from the time Vdd reaches its rated minimum values
Enable/Disable Time	130 nSec max	F = 110 MHz, For other frequencies, T_oe = 100 nSec + 3 * clock periods
Resume Time	5 mSec max	Measured from the time $\overline{ST}$ pin crosses 50% threshold.
RMS Period Jitter	1.6 pSec typ./ 2.5 pSec max 1.9 pSec typ./ 3.0 pSec max	F = 75 MHz, Vdd = +2.5 V, +2.8 V, +3.0 V or +3.3 V F = 75 MHz, Vdd = +1.8 V
Peak-to-Peak Period Jitter	12 pSec typ./ 20 pSec max 14 pSec typ./ 25 pSec max	F = 75 MHz, Vdd = +2.5 V, +2.8 V, +3.0 V or +3.3 V F = 75 MHz, Vdd = +1.8 V
RMS Period Jitter (random)	0.5 pSec typ./ 0.8 pSec max 1.3 pSec typ./ 2.0 pSec max	F = 75 MHz, Integration bandwidth = 900 kHz to 7.5 MHz F = 75 MHz, Integration bandwidth = 12.0 kHz to 20.0 MHz

Notes:

- All min and max limits are specified over temperature and rated operating voltage with 15pF output unless otherwise stated.
- Typical values are at +25ºC and nominal supply voltage.

Ordering Information:

Part Number Guide						
Packages	Input Voltage	Operating Temperature	Output Drive Strength	Stability (ppm)	Select Function	Frequency
IM820B – 5.0 X 3.2 IM820C – 3.2 x 2.5 IM820D – 2.5 x 2.0 IM820E – 2.0 x 1.6	1 = +1.8 V 6 = +2.5 V 2 = +2.8 V 7 = +3.0 V 3 = +3.3 V	E = -40ºC to +105ºC F = -40ºC to +125ºC	- = Default (see tables 2 through 5)	F = ±20 A = ±25 Z = ±30 B = ±50	H = Tri-state S = Standby O = N/C	- Frequency

Sample Part Number: **IM820E-1E-FS-50.0000 MHz**

This 50.0000 MHz oscillator in a 1.6 x 2.0 package with stability ±20 ppm from -40ºC to +105ºC using a supply voltage of +1.8 V. The Output Drive Strength (Rise and Fall Time) is 2.40 nSec per Table 1 with 30 pF load. With Pin 1 function as Standby

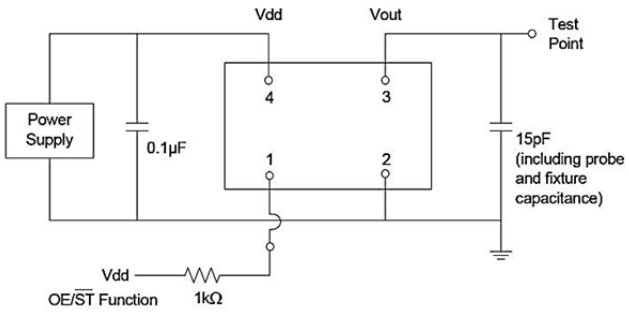
Sample Part Number: **IM820C-1F-AH-66.0000 MHz**

This 66.0000 MHz oscillator in a 2.5 x 3.2 package with stability ±25 ppm from -40ºC to +125ºC using a supply voltage of +1.8 V. The Output Drive Strength (Rise and Fall Time) is 2.40 nSec per Table 1 with 30 pF load. With Pin 1 function as Tri-state

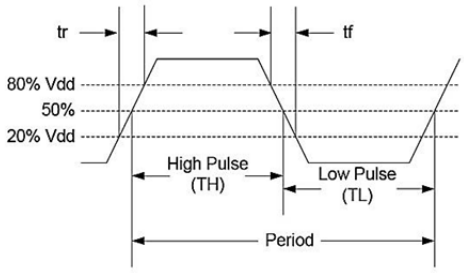
Notes:
- Not all options are available at all frequencies and temperatures ranges.
- Please consult with sales department for any other parameters or options.
- Oscillator specification subject to change without notice.

Absolute Maximum Limits	
Storage Temperature	-65ºC to +150ºC
Supply Voltage (Vdd)	-0.5 VDC to 4.0 VDC
Electrostatic Discharge	2000 V max
Solder Temperature (follow standard Pb free soldering guidelines)	260ºC max
Junction Temperature	150ºC max

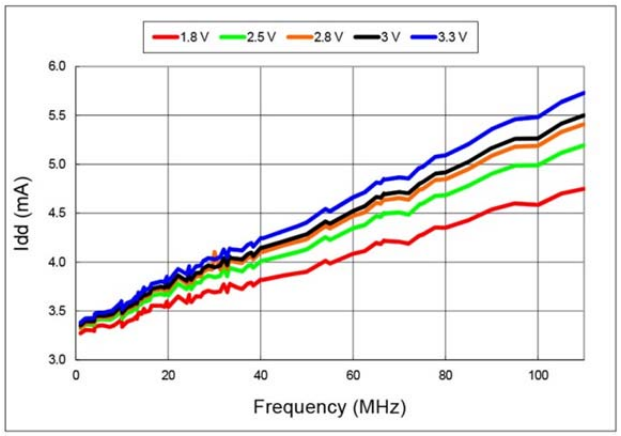
Test Circuit



Waveform



Performance Plots:



Firgure 1: Idd vs Frequency

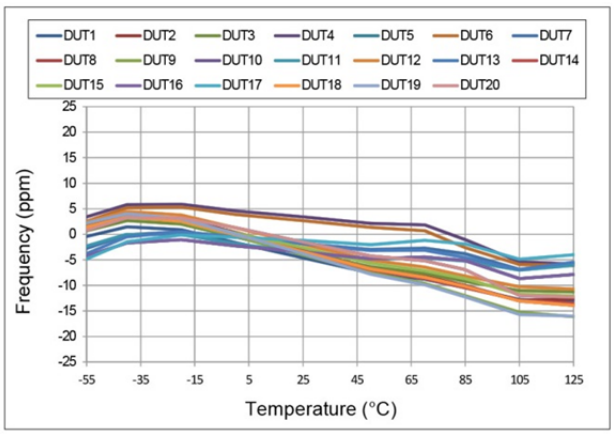


Figure 2: Frequency vs Temperature

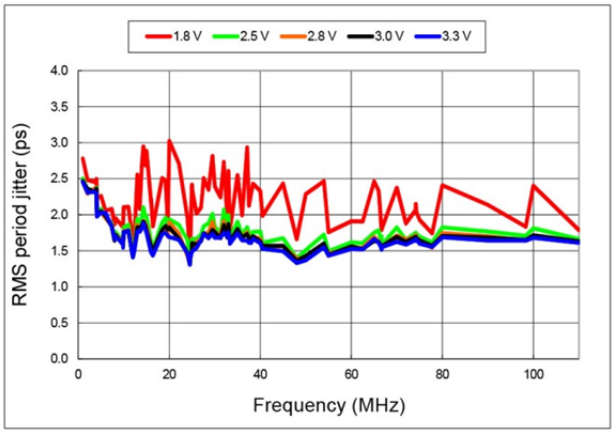


Figure 3: RMS Period Jitter vs Frequency

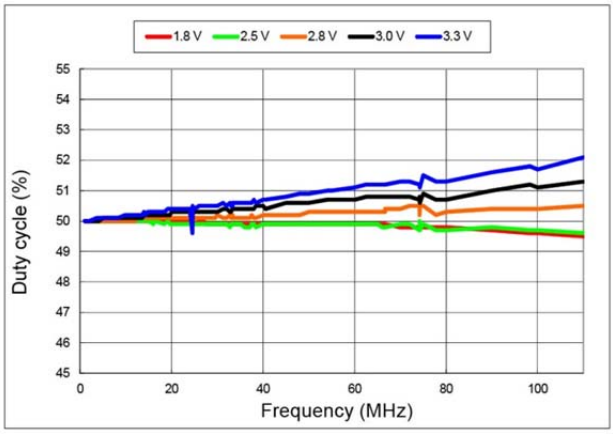


Figure 4Duty Cycle vs Frequency

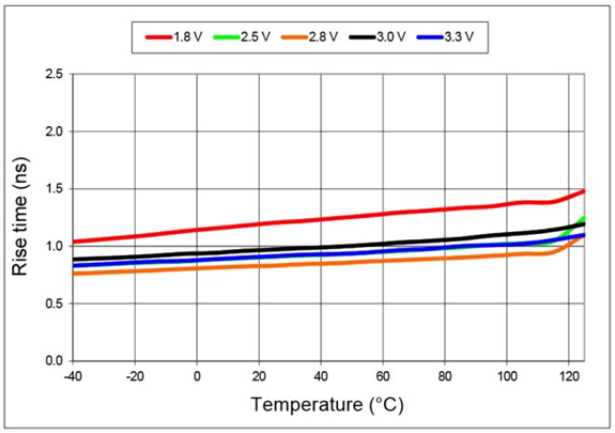


Figure 5: 20% to 80% Rise Time vs Temperature

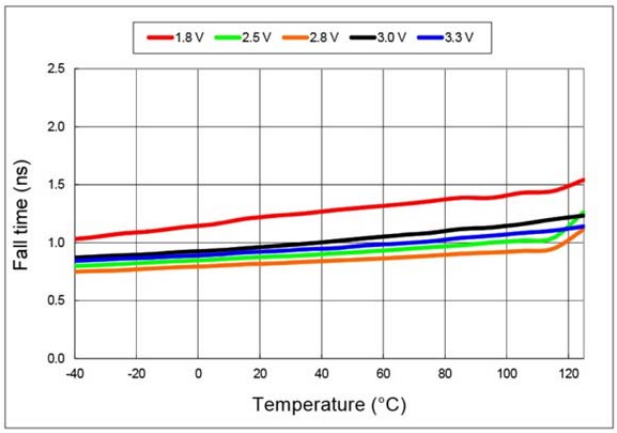


Figure 6: 20% to 80% Fall Time vs Temperature

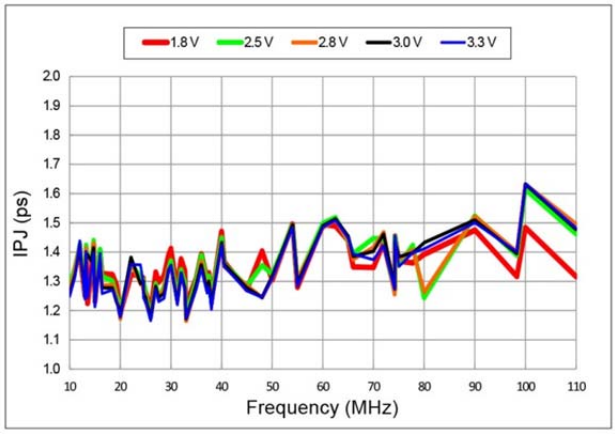


Figure 7: RMS Integrated Phase Jitter Random (12 kHz to 20.0 MHz) vs. Frequency

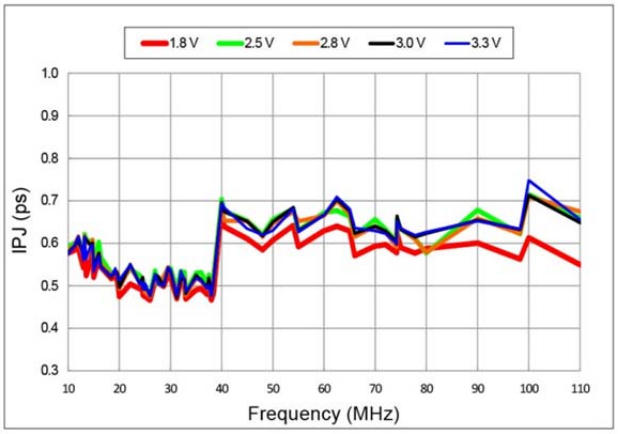
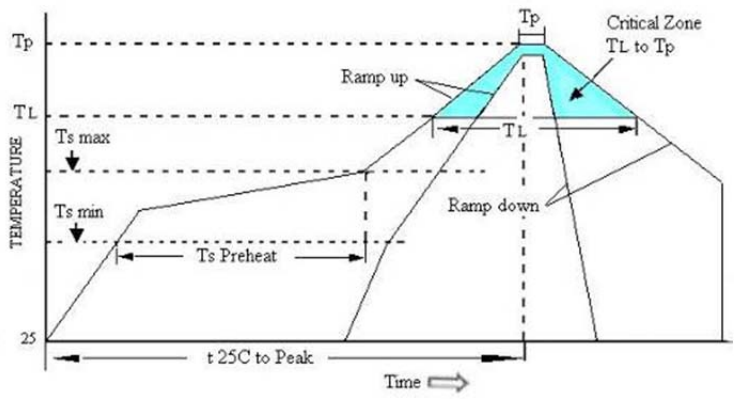


Figure 8: RMS Integrated Phase Jitter Random (900 kHz to 20.0 MHz) vs. Frequency

Environmental Specifications:

Environmental Compliance	
Parameter	Condition/Test Method
Mechanical Shock	MIL-STD-883F, Method 2002
Mechanical Vibration	MIL-STD-883F, Method 2007
Temperature Cycle	JESD22, Method A104
Solderability	MIL-STD-883F, Method 2003
Moisture Sensitivity Level	MSL Level 1 at +260ºC

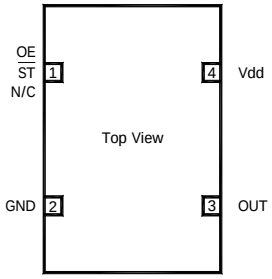
Pb Free Solder Reflow Profile



Units are backward compatible with +240ºC reflow processes

Ts max to T_L (Ramp-up Rate)	3ºC / second max
Preheat Temperature min (Ts min) Temperature typ (Ts typ) Temperature max (Ts max) Time (Ts)	 150ºC 175ºC 200ºC 60 to180 seconds
Ramp-up Tate (T_L to Tp	3ºC / second max
Time Maintained Above Temperature (T_L) Time (T_L)	 217ºC 60 to 150 seconds
Peak Temperature (Tp)	260ºC max for seconds
Time within 5ºC to Peak Temperature (Tp)	20 to 40 seconds
Ramp-down Rate	6ºC / second max
Tune 25ºC to Peak Temperature	8 minute max
Moisture Sensitivity Level (MSL)	Level 1

Pin Functionally

Pin Description				
Pin	Symbol	Functionality		Pin Assignments
1	OE	Tri-state	High or Open = specified frequency output Low = Output is high impedance, only output is disabled.	
	$\overline{ST}$	Standby	High or Open = specified frequency output. Low = Output is low. Device goes to sleep mode. Supply current reduces to standby current.	
	N/C	No Connect	Any voltage between 0.0 V to Vdd or Open = specified frequency output Pin 1 has no functiion	
2	GND	Power	Electrical ground	
3	Out	Output	Oscillator output	
4	Vdd	Power	Power supply voltage	
Notes: 1. In OE or $\overline{ST}$ mode, a pull-up resistor of 10.0 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 Pin 4 (Vdd) and Pin 1 (GND) is required.				

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

Pin 1 of the IM820 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 µSec.

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 mSec.

No Connect (NC) Mode

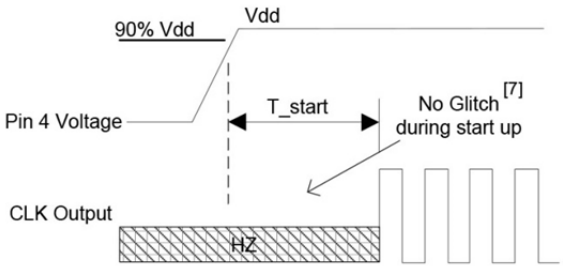
In the NC mode, the device always operates in its normal mode and outputs the specified frequency regardless of the logic level on Pin 1.

Table 1 below summarizes the key relevant parameters in the operation of the device in OE, ST, or NC mode.

Parameters	OE	ST	NC
Active current 20.0 MHz (max +1.80 VDC)	6.0 mA	6.0 mA	6.0 mA
OE disable current (max +1.80 VDC)	4.5 mA	N/A	N/A
Standby current (typical +1.80 VDC)	N/A	0.6 µA	N/A
OE enable time at 20.0 MHz (max)	130 nSec	N/A	N/A
Resume time from standby (max, all frequency)	N/A	5 mSec	N/A
Output driver in OE disable/standby mode	High Z		N/A

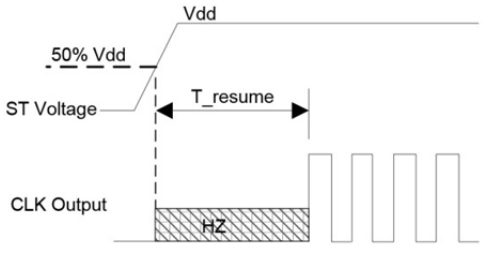
Table 1 OE vs. $\overline{ST}$ vs. NC

Timing Diagram:



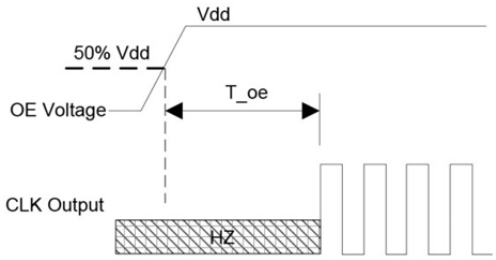
T_start: Time to start from power-off

Figure 11: Startup Timing (OE/$\overline{ST}$ Mode)



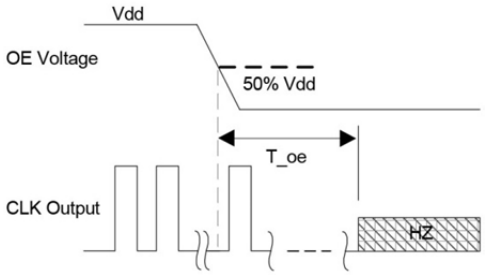
T_resume: Time to resume from ST

Figure 12: Standby Resume Timing ($\overline{ST}$ Mode Only)



T_oe: Time to re-enable the clock output

Figure 13: OE Enable Timing (OE Mode Only)



T_oe: Time to put the output in High Z mode

Figure 14: OE Disable Timing (OE Mode Only)

Selectable Drive Strength Option
Rise / Fall Time (20 % to 80 %) vs C_{LOAD} Tables

Rise/Fall Time Typ (nS)					
Drive Strength (C_{LOAD})	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
- = Default	0.65	1.30	2.40	3.35	4.56

Table 2: Vdd = +1.8 V Rise/Fall time for Specific C_{LOAD}

Rise/Fall Time Typ (nS)					
Drive Strength (C_{LOAD})	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
- = 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

Table 3: Vdd = +2.5 V Rise/Fall time for Specific C_{LOAD}

Rise/Fall Time Typ (nS)					
Drive Strength (C_{LOAD})	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	12.04	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
- = 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

Table 4: Vdd = +2.8 V Rise/Fall time for Specific C_{LOAD}

Rise/Fall Time Typ (nS)					
Drive Strength (C_{LOAD})	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
- = 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

Table 5: Vdd= +3.0 V Rise/Fall time for Specific C_{LOAD}

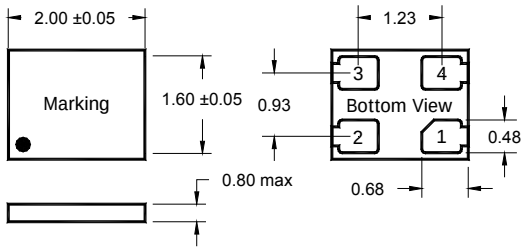
Rise/Fall Time Typ (nS)					
Drive Strength (C_{LOAD})	5 pF	15 pF	30 pF	45 pF	60 pF
L	3.39	6.88	11.63	17.56	23.59
A	1.74	3.50	6.38	8.98	12.19
R	1.16	2.33	4.29	6.04	8.34
B	0.81	1.82	3.22	4.52	6.33
- = Default	0.46	1.00	1.86	2.60	3.84
E	0.33	0.87	1.64	2.30	3.35
U	0.28	0.79	1.46	2.05	2.93
F	0.25	0.72	1.31	1.83	2.61

Table 6: Vdd = +3.3 V Rise/Fall time for Specific C_{LOAD}

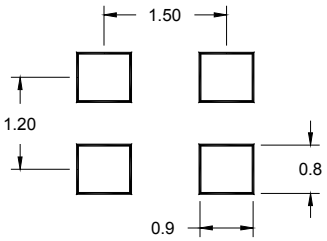
Mechanical Details:

Package Dimensions and Suggest Land Pattern

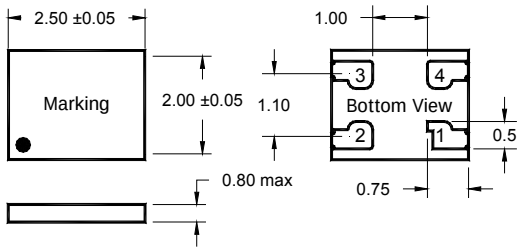
Option E: 2.00 x 1.60 x 0.80 Package



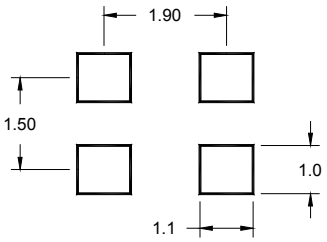
Suggested Land Pattern



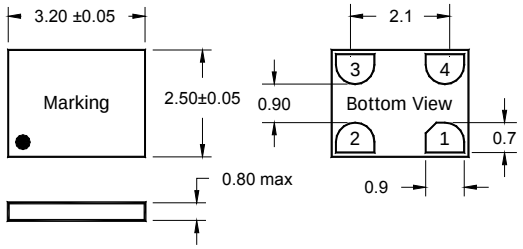
Option D: 2.50 x 2.00 x 0.80 Package



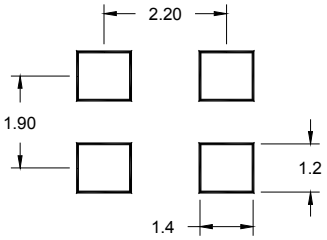
Suggested Land Pattern



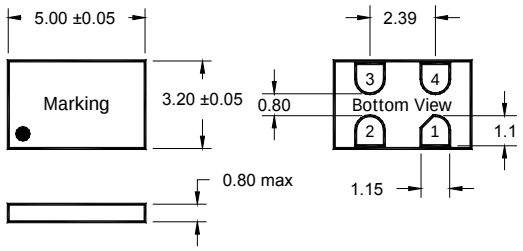
Option C: 3.20 x 2.50 x 0.80 Package



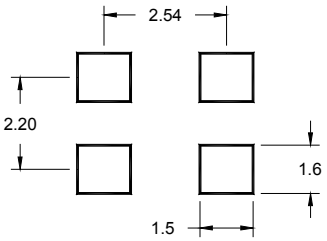
Suggested Land Pattern



Option B: 5.00 x 3.20 X 0.80 Package



Suggested Land Pattern



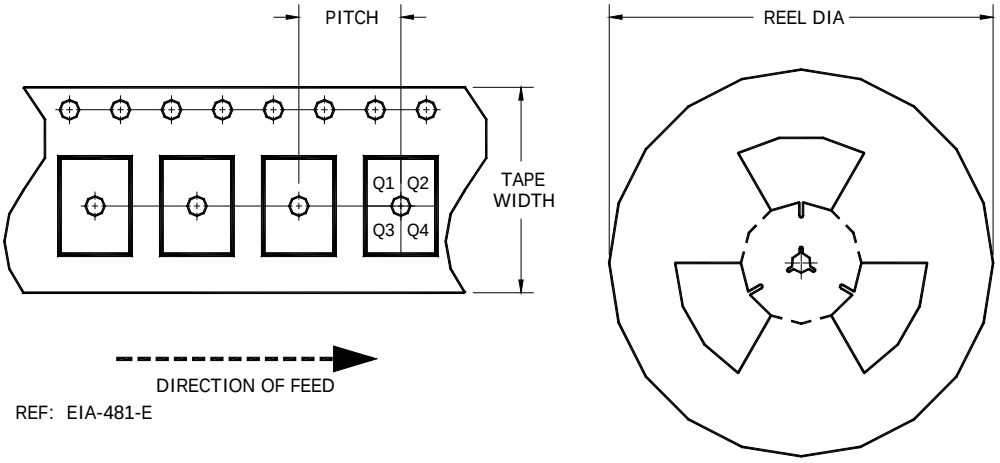
Marking

Line 1 = XXXXX (Lot code)
Dot to denote Pin 1 location

Package Information

Leadframe: C194
Plating: NiPdAu

Tape and Reel Dimensions



REF: EIA-481-E

Part Number	Size	Pitch	Tape Width	Pin Orient.	Reel Dia.	Count
IM821B	5.0 x 3.2	8.0 ± 0.1	12.3 max	Q1	180 Dia	1000
					330 Dia	3000
IM821C	3.2 x 2.5	4.0 ± 0.1	8.3 max	Q1	180 Dia	3000
IM821D	2.5 x 2.0	4.0 ± 0.1	8.3 max	Q1	180 Dia	3000
IM821E	2.0 x 1.6	4.0 ± 0.1	8.3 max	Q1	180 Dia	3000

Notes:`
- All dimensions are in mm.
- Do not scale drawings.