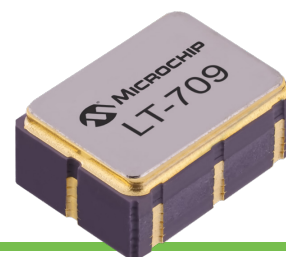


LT-709

New Space/Low-Earth Orbit (LEO)

Temperature-Compensated Crystal Oscillator (TCXO)



Summary

The LT-709 Temperature-Compensated Crystal Oscillator (TCXO) combines innovative manufacturing and the latest technology to provide low phase noise and excellent g-sensitivity. The fully hermetic assembly includes a dual-crystal circuit to cancel opposing g-sensitivity vectors, enclosed in a 5 × 7 mm ceramic package. The high shock and vibration and radiation tolerance make the LT-709 a viable solution for LEO space applications.

Features

- Temperature range of -40°C to +85°C
- Low phase noise and low g-sensitivity of 0.1 ppb/g
- Frequency range: 8 MHz to 52 MHz and 96 MHz to 160 MHz
- Fully hermetic seal
- High shock survival up to 20 kg
- Surface mount, low profile
- Fully RoHS compliant

Applications

- Low-Earth Orbit (LEO)
- Nuclear-hardened environments

Performance Specifications

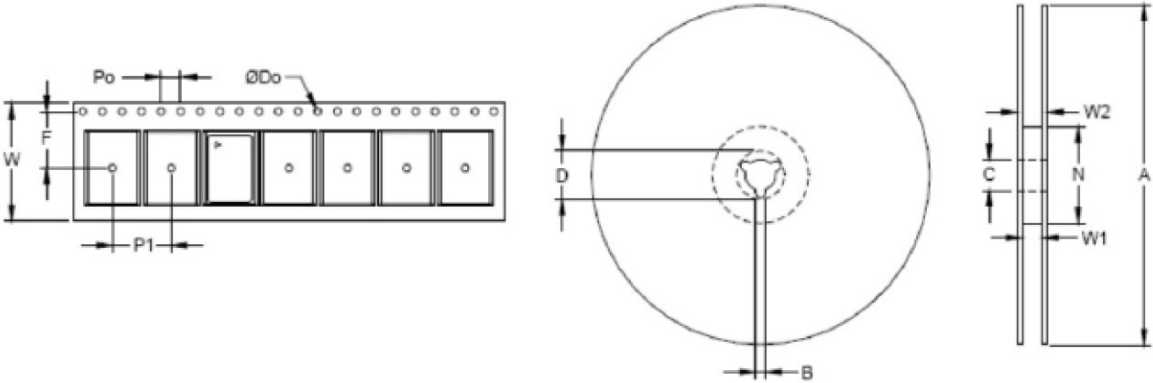
Frequency Stabilities ^{1,2}					
Parameter	Min	Typ	Max	Units	Condition
vs. Operating Temperature Range (Referenced to +25°C)	−1.0		+1.0	ppm	−40°C to +85°C
Initial Tolerance	−1	±1.5	+1	ppm	At time of shipment, nominal EFC
vs. Supply Voltage Change	−0.25		+0.25	ppm	VS ± 5%
vs. Load Change	−0.25		+0.25	ppm	Load ± 10%
vs. Aging/Year (Year 1)				ppm	@ +40°C
vs. Total Stability Budget			±7.0	ppm	For 5 years
Supply Voltage (VS)					
Supply Voltage	2.660	2.8	2.940	VDC	
	3.135	3.3	3.465	VDC	
Current Consumption		5	10	mA	8 MHz to 52 MHz output frequencies
		15	25	mA	96 MHz to 160 MHz output frequencies

Frequency Tuning (EFC)					
Parameter	Min	Typical	Max	Units	Condition
Tuning Range	Fixed; no adjust				Ordering option A
Tuning Range	±7.0		±25	ppm	Ordering option B
Tuning Slope	Positive				
Input Impedance	10			kOhm	
Control Voltage Range	0.0		VS	VDC	
RF Output					
Signal	HCMOS				
Load		15		pF	
Signal Level (Vol)			0.1*VS	VDC	
Signal Level (Voh)	0.9*VS			VDC	
Rise/Fall Time			5	ns	@ nominal load and 10% to 90% of waveform
Duty Cycle	40	50	60	%	@ nominal load and at 50% level
Sub-Harmonics			-20	dBc	96 MHz to 160 MHz output frequencies
Signal	Clipped Sine Wave				Frequencies of 15 MHz to 52 MHz only
Level		1		Vpp	
Load R		10		kohm	
Load C		10		pF	
Additional Parameters					
Parameter	Min	Typical	Max	Units	Condition
Phase noise ³ (@ 50 MHz – No Vibration)		-82	-81	dBc/Hz	10 Hz
		-113	-110	dBc/Hz	100 Hz
		-135	-134	dBc/Hz	1 kHz
		-152	-148	dBc/Hz	10 kHz
		-156	-154	dBc/Hz	100 kHz
Phase noise ³ (@ 100 MHz – No Vibration)		-82	-76	dBc/Hz	10 Hz
		-113	-108	dBc/Hz	100 Hz
		-134	-131	dBc/Hz	1 kHz
		-145	-140	dBc/Hz	10 kHz
		-147	-142	dBc/Hz	100 kHz
g-Sensitivity			0.1	ppb/g	Per axis; parts 100% tested with 100 Hz sine vibration

Absolute Maximum Ratings					
Supply Voltage (VS)	−0.3		4.6	VDC	Damage may occur beyond this level
Control Voltage	0		Vs	VDC	
Operable Temperature Range	−40		+105	°C	Operable temperature range implies the device will continue to operate with no long- term damage to unit; however, it will not be specification compliant outside the operating temperature range.
Storage Temperature Range	−55		+125	°C	
Environmental and Product Classification					
Shock	MIL-STD-883G, Method 2002.4, Test Condition F				
Sine Vibration	MIL-STD-202G, Method 204D, Test Condition D				
Thermal Cycling	MIL-STD-202, Method 107, Test Condition A				
Radiation at 2.8V Supply (TID)	50 krad				
Radiation at 2.8V Supply (SEL)	45 MeV/mg/cm^2				
Radiation at 3.3V Supply (TID)	50 krad				
Radiation at 3.3V Supply (SEL)	20 MeV/mg/cm^2				
Moisture Sensitive Level	1				
RoHS	6 (fully compliant)				

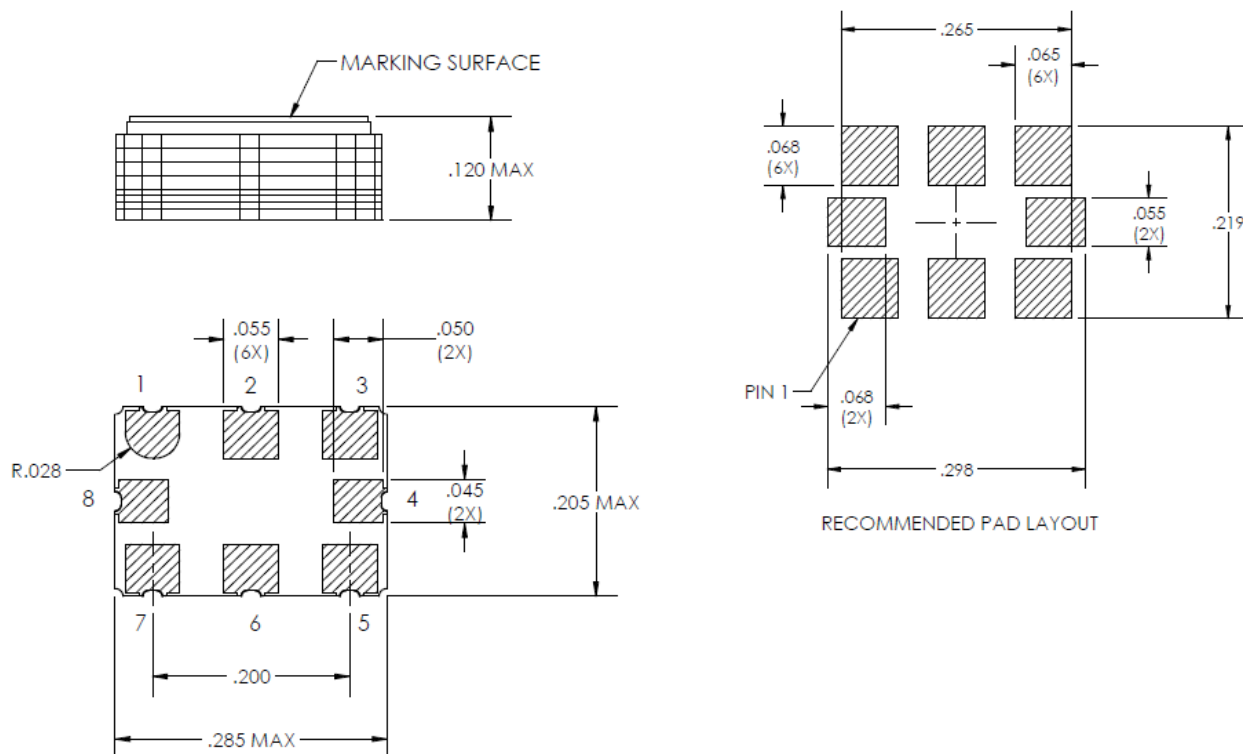
Standard Shipping Method

Tape and Reel Information											
Tape Dimensions (mm)					Reel Dimensions (mm)						
W	F	Do	Po	P1	A	B	C	D	N	W1	W2
16	7.5	1.5	4	8	180	1.5	13	20.2	60	16.4	20.4



Outline Drawing/Enclosure

Dimensions in inches



Pin Connections

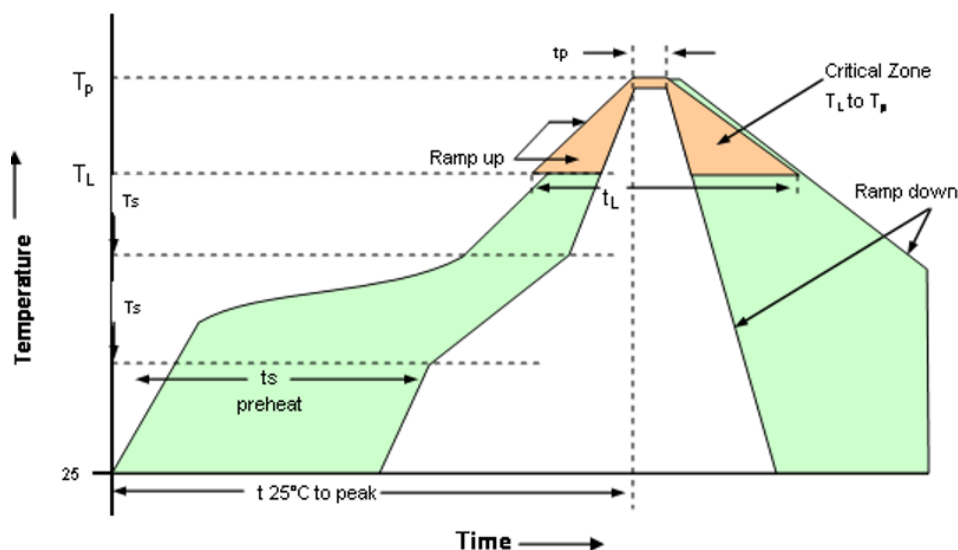
1	Electronic Frequency Control (EFC) Option or No Connect*
2	No Connect*
3	Ground
4	No Connect*
5	RF Output
6	No Connect*
7	Supply Voltage Input (VS)
8	No Connect*

Plating Composition of TX-709 Pads:

30–90 microinches electroless gold over 50–350 microinches electroless nickel

Contact factory for tin-dipped parts; tinning increases overall height of units to 0.130 max.

Recommended Reflow Profiles for Pb-Free and Sn-Pb



230°C Reflow Profile

Profile Feature	Sn-Pb Assembly	Profile Feature	Sn-Pb Assembly
Average ramp-up rate (TL to TP)	3°C/second max.	Time 25°C to peak temperature	4 minutes max.
Preheat - Temperature min Tsmin	135°C	Time maintained above	
	155°C	- Temperature (TL)	183°C
- Temperature min Tsmax - Time (min to max) (ts)	60-90 seconds	- Time (tL)	45-60 seconds
Tsmax to TL-ramp-up rate	3°C/second max.		
Time maintained above - Temperature (TL)	183°C	Time within 5°C of actual	10-20 seconds max.
	40-60 seconds	Peak temperature (Tp)	
Time (tL)			
Peak temperature (Tp)	max 230°C	Ramp-down rate	6°C/second max.

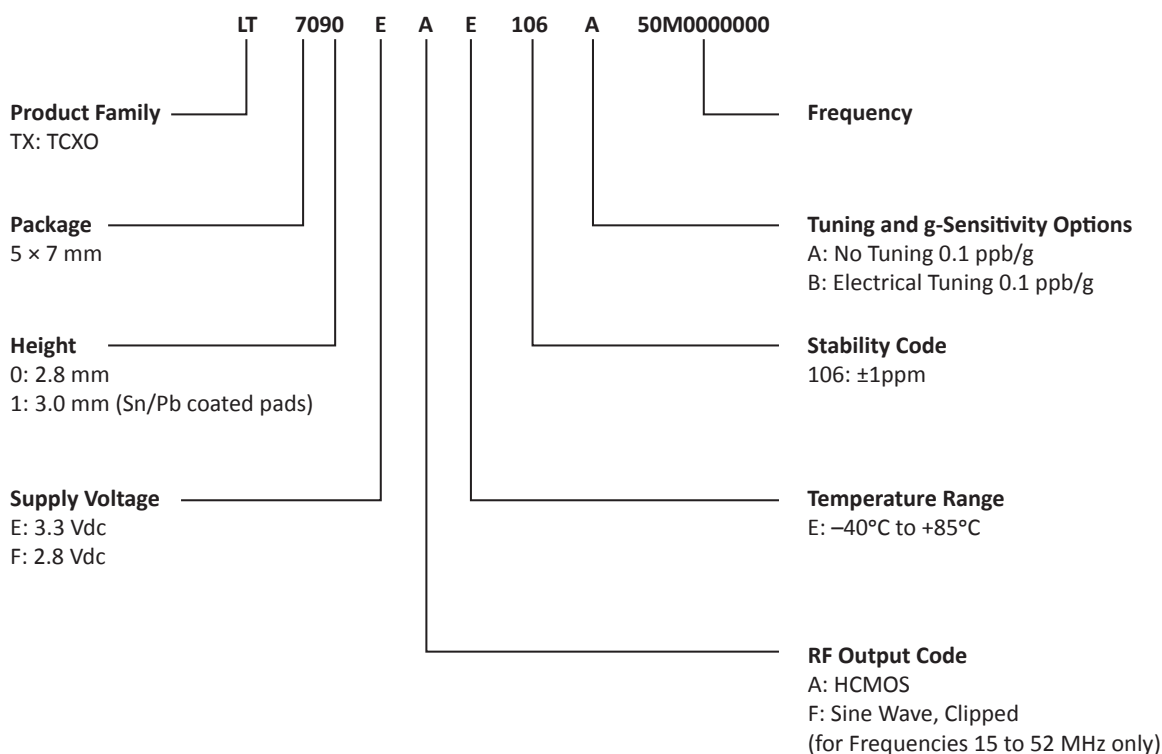
Note: All temperatures refer to topside of the package, measured on the package body surface.

260°C Reflow Profile

Profile Feature	Pb-Free Assembly	Profile Feature	Pb-Free Assembly
Average ramp-up rate (TL to TP)	3°C/second max.	Time 25°C to peak temperature	8 minutes max.
Preheat - Temperature min Tsmin	150°C	Time maintained above	
	200°C	- Temperature (TL)	217°C
- Temperature min Tsmax - Time (min to max) (ts)	60-180 seconds	- Time (tL)	60-150 seconds
Tsmax to TL-ramp-up rate	3°C/second max.		
Time maintained above - Temperature (TL)	217°C	Time within 5°C of actual	20-40 seconds max.
	60-150 seconds	Peak temperature (Tp)	
Time (tL)			
Peak temperature (Tp)	max 260°C	Ramp-down rate	6°C/second max.

Note: All temperatures refer to topside of the package, measured on the package body surface.

Ordering Information



Notes:

1. Contact factory for improved stabilities or additional product options
2. Not all options and codes are available at all frequencies
3. Unless otherwise stated, all values are valid after warm-up time and refer to typical conditions for supply voltage, frequency control voltage, load and temperature (25°C)
4. Phase noise degrades with increasing output frequency
5. Subject to technical modification
6. Frequencies not listed above will require NRE charges and additional lead times

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