Q-TECH CORPORATION

ANALOG TCXO

DUAL-IN-LINE CRYSTAL OSCILLATORS

3.3 to 5Vdc - 10MHz to 80MHz

Description

The Q-Tech Analog TCXO encompasses state-of-the-art oscillators with low phase noise, jitter, and tight temperature stability. The TCXO is available in a DIP (QT3003), SMD (QT3013) or Gull Wing (QT3023) package and as a square or sine wave oscillator.

A flexible design allows Q-Tech Corporation to offer a variety of choices of output standard, power and load. Based on this flexibility, Q-Tech welcomes specifications with parameters other than standard.

Low G-Sensitivity AT-Cut Crystal utilized in the design allows to get 1PPB/G.

The reliable construction of this design qualifies it for stringent environmental applications.

Features

- Made in the USA
- ECCN: EAR99
- DFARS 252-225-7014 Compliant:
  Electronic Component Exemption
- USML Registration # M17677
- Available in both DIP and SMD packages
- Supply voltages 3.3Vdc and 5Vdc
- AT-Cut crystal
- Low Total Harmonic Distortion
- Low phase noise and Jitter
- Choice of output power and load
- All metal and hermetically sealed packages
- Custom design available tailored to meet customer's needs
- Q-Tech does not use pure lead or pure tin in its products
- RoHS compliant

Applications

- Designed to meet today's requirements for communication systems.
- Wide military clock applications
- Control and measurement
- Signal processing

Ordering Information

Sample part number

QT3013CXM-25.000MHz

Q T 3 0 1 3 C X M - 25.000MHz

Lead Finish:
T = Standard
S = Solder Dip (**)

Package Type:
0 = DIP-14
1 = SMD
2 = Gull Wing

Supply Voltage:
3 = +3.3V
5 = +5.0V

Logic:
C = HCMOS
S = Sine Wave

Frequency vs. Temperature Code (*):
P = ± 1ppm at 0ºC to +70ºC
R = ± 1ppm at -20ºC to +70ºC
W = ± 3ppm at -25ºC to +71ºC
X = ± 3ppm at -40ºC to +85ºC

Screening Option:
Blank = No Screening
M = Screening similar to MIL-PRF-55310, Level B (***)

Output Frequency (*)

(*) Custom frequencies higher than 50MHz may require NRE
(**) Hot Solder Dip Sn60/Pb40 per MIL-PRF-55310 (additional cost)
(***) See Table II for Screening and Testing flow

For custom load, supply voltage, output power, harmonic distortion, frequency stability vs. temperature, and others not listed herein, please request a custom part number.

For Non-Standard requirements, contact Q-Tech Corporation at Sales@Q-Tech.com

Packaging Options

- Standard packaging in black foam
- Optional anti-static plastic tube

Other Options Available For An Additional Charge

- Hot Solder Dip Sn60/Pb40 per MIL-PRF 55310
- Lead forming available on all packages. Please contact for details.
- P. I. N. D. test (MIL-STD 883, Method 2020)
- Lead trimming
- Phase Noise test (Static and under vibration)
- Jitter test

All packages are available in surface mount form.

Specifications subject to change without prior notice.

Table I - Electrical Characteristics

Parameters	QT3003C (DIP)	QT3013C (SMD)	QT3023C (Gull Wing)	QT3003S (DIP)	QT3013S (SMD)	QT3023S (Gull Wing)
	HCMOS			SINE WAVE		
Output freq. range (Fo)	**10MHz — 80MHz**					
Supply voltage (Vdd)	+3.3Vdc ± 5% or +5Vdc ± 5%					
Maximum Applied Voltage (Vdd max.)	+6.5Vdc					
Frequency stability (ΔF/ΔT)	See Option codes					
Operating temp. (Topr)	See Option codes					
Storage temp. (Tsto)	-62ºC to + 125ºC					
Operating supply current (Idd)	20mA (No Load) at 3.3Vdc 40mA (No Load) at 5.0Vdc					
Output amplitude or power	High (min.): Vcc -10% Low (max.): Gnd +10%			3dBm ± 3dBm		
Output Load	10k//15pF			50Ω		
Total Harmonic Distortion (THD) or harmonics	N/A			-20dBc max.		
Sub-harmonics	-40dBc max.					
Start-up time	10ms max.					
Phase Noise at 25ºC (typ.) at 80MHz	10Hz			-70dBc/Hz		
	100Hz			-100dBc/Hz		
	1kHz			-130dBc/Hz		
	10kHz			-150dBc/Hz		
	100kHz			-155dBc/Hz		
Integrated Phase Jitter RMS (12kHz to 20MHz) typ.	1ps					
Aging (at 70ºC)	± 5ppm max. 10 years					

Other Design and Test Options

- Supply voltage +3.3Vdc to +5Vdc
- Output power -10dBm to +13dBm into 50Ω (see note 1)
- Harmonics better than -20dBc (see note 2)
- Sub-harmonics better than -30dBc (see note 3)
- Amplitude stability versus temperature to within ±1% (see note 4)
- Phase Noise and Jitter built to specification including static and vibration.
- Low supply current
- QCI tests
- Tight frequency stability versus temperature, supply voltage, and load variations
- Low g-sensitivity and low phase noise
- Low spurious (see note 5)
- Low Harmonic Distortion (THD < 5%)
- Low frequency aging, Allan Variance
- High-shock resistant

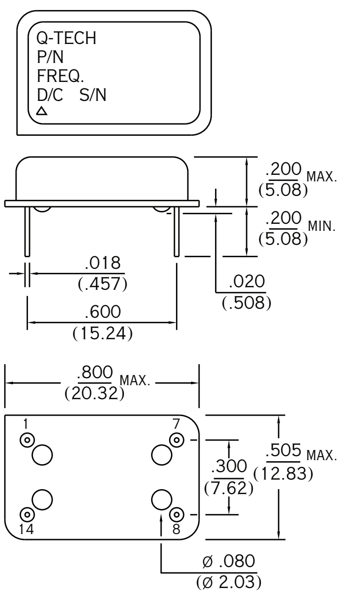
Notes:

1. The output level is determined by the supply voltage, load, and package size.
2. A specified harmonic level of -20dBc is easily achievable. The typical harmonics of Q-Tech Sine Wave source are better than -25dBc.
3. Sub-harmonic level is determined by frequency multiplication method, supply voltage, output power, and input current.
4. Typical amplitude stability over temperature is ±10% or less.
5. Typical spurious level is better than -90dBc over the spectrum of 100kHz to 1GHz.

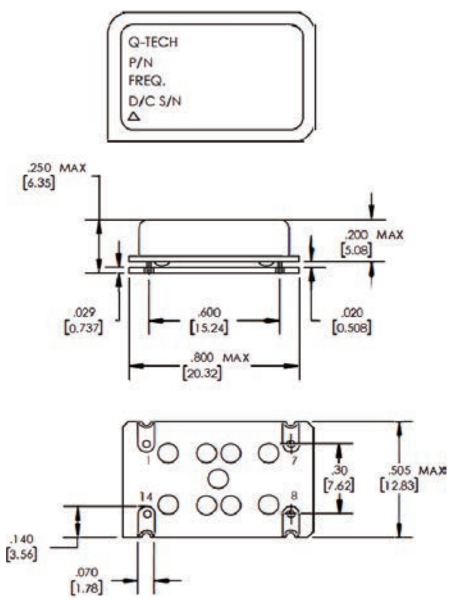
Package Outline and Pin Connections

Dimensions are in inches (mm)

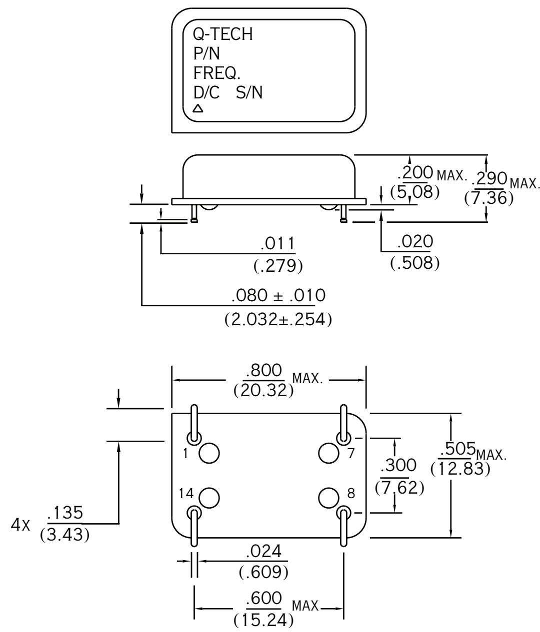
A
QT3003



B
QT3013



C
QT3023

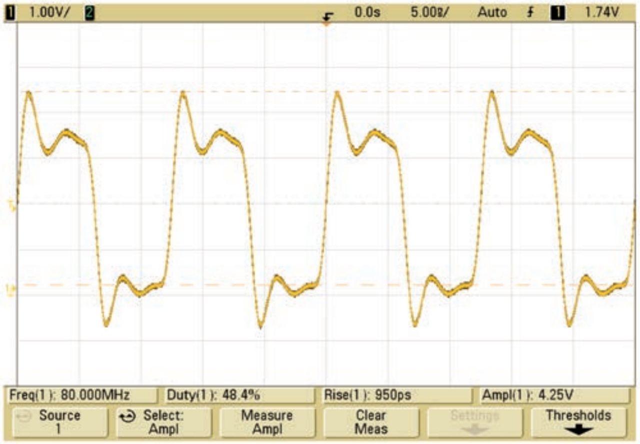


QT #	Conf	Vcc	GND	Case	Output	Equivalent MIL-PRF-55310 Configuration
QT3003	A	14	7	7	8	N/A
QT3013	B					
QT3023	C					

Package Information

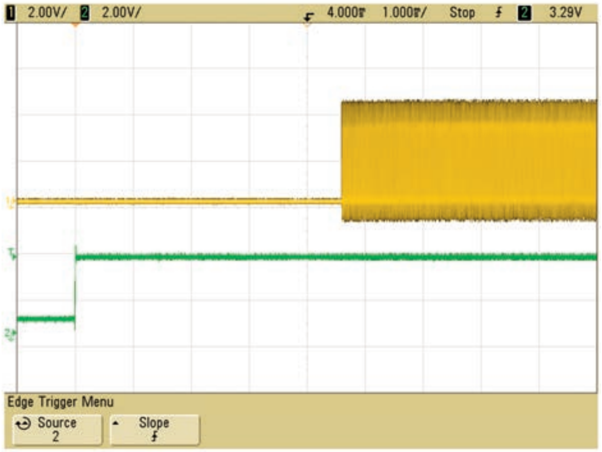
- Package Material: Kovar, Nickel Plated
- PCB: FR4 (QT3013)
- Package to PCB Attachment: Solder Sn60
- Package to Lid Attachment: Resistance Weld
- Weight: 4.0g typ., 14.2g max.

Output Waveform into HCMOS load



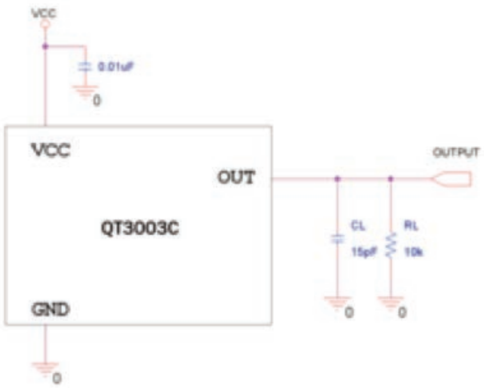
Typical output of QT3013C-80.000MHz

Startup Time

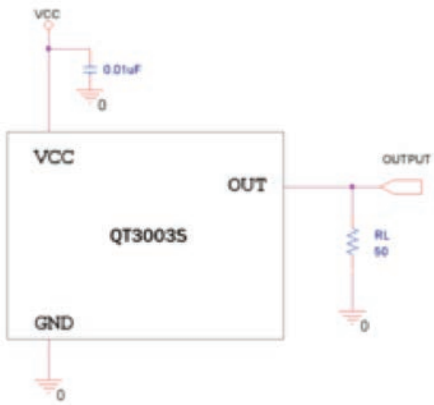


Typical start-up time of QT3013C-80.000MHz

Test Circuit

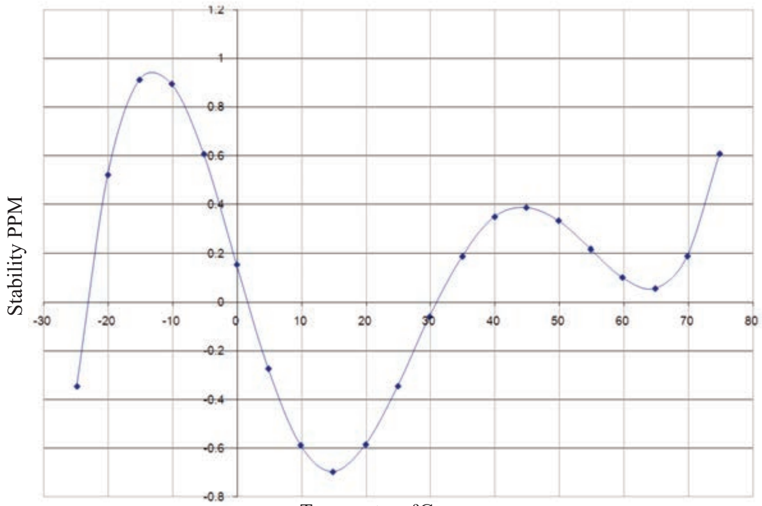


HCMOS Load



Sine Wave Load

Frequency vs. Temperature Curve



Typical Stability of QT3013C-80.000MHz

Table II - Screening and Testing

STEP	TEST (100% Unless Otherwise Specified)	CONDITION
1	Internal Visual	IPC-A-610/J-001 CLASS 1
2	Pre Burn-In Electrical Test	See Table I (optional)
3	Burn-In	MIL-PRF-55310 160 Hours @ 125ºC
4	Post Burn-In Electrical Test	See Table Parameters I
5	Aging	30 Days @70ºC (Note: Can be reduced to 15 Days for units that are two times (2X) better than the specified aging tolerance and the aging curve is monolithic)
6	Thermal Shock	MIL-STD-202, Method 107, Condition A1
7	Post Thermal Shock Electrical Test	See Table I
8	Seal; Fine Leak	MIL-STD-883, Method 1014, Condition A1
9	Seal; Gross Leak	MIL-STD-883, Method 1014, Condition C
10	Final Electrical Test (Includes Phase Noise)	See Table I
11	Group A Inspection (Subgroup 1 Only)	MIL-PRF-55310
12	External Visual Inspection	MIL-STD-883, Method 2009

Table III - Environmental Specifications

Q-Tech Standard Screening similar to (MIL-PRF55310) is available. Q-Tech can also customize screening and test procedures to meet your specific requirements. The packages are designed and processed to exceed the following test conditions:

Environmental Test	Test Conditions
Temperature cycling	MIL-STD-883, Method 1010, Cond. B
Constant acceleration	MIL-STD-883, Method 2001, Cond. A, Y1
Seal Fine Leak	MIL-STD-883, Method 1014, Cond. A1
Burn-in	160 hours, 125°C with load
Aging	30 days, 70°C
Vibration sinusoidal	MIL-STD-202, Method 204, Cond. D
Shock, non operating	MIL-STD-202, Method 213, Cond. I
Thermal shock, non operating	MIL-STD-202, Method 107, Cond. B
Ambient pressure, non operating	MIL-STD-202, 105, Cond. C, 5 minutes dwell time minimum
Resistance to solder heat	MIL-STD-202, Method 210, Cond. C
Moisture resistance	MIL-STD-202, Method 106
Terminal strength	MIL-STD-202, Method 211, Cond. C
Resistance to solvents	MIL-STD-202, Method 215
Solderability	MIL-STD-202, Method 208
ESD Classification	MIL-STD-883, Method 3015, Class 1HBM 0 to 1,999V
Moisture Sensitivity Level	J-STD-020, MSL=1

Please contact Q-Tech for higher shock requirements

Phase Noise and Phase Jitter Integration

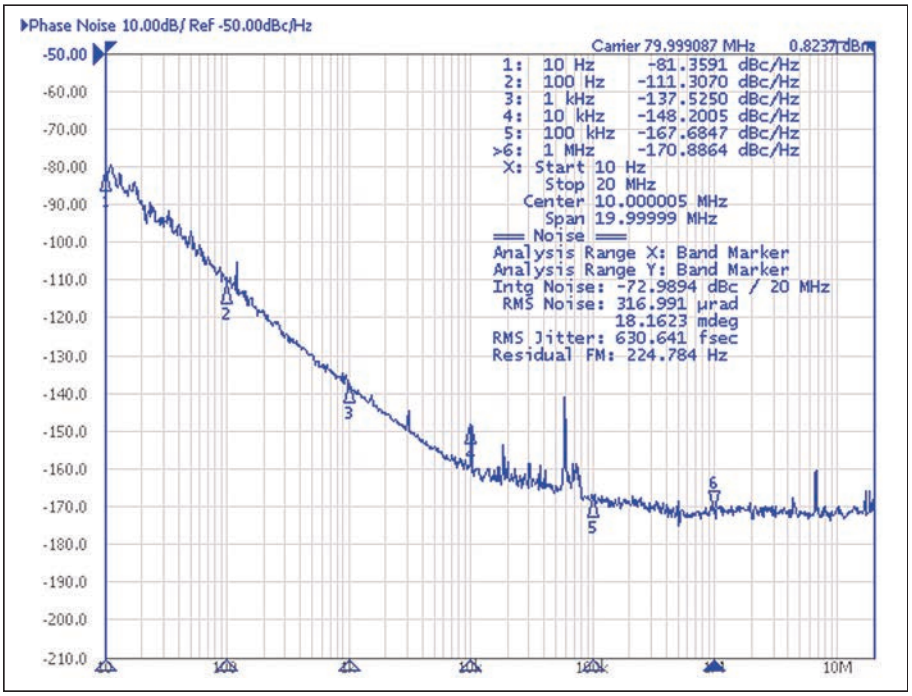
Phase noise is measured in the frequency domain, and is expressed as a ratio of signal power to noise power measured in a 1Hz bandwidth at an offset frequency from the carrier, e.g. 10Hz, 100Hz, 1kHz, 10kHz, 100kHz, etc. Phase noise measurement is made with an Agilent E5052A Signal Source Analyzer (SSA) with built-in outstanding low-noise DC power supply source. The DC source is floated from the ground and isolated from external noise to ensure accuracy and repeatability.

In order to determine the total noise power over a certain frequency range (bandwidth), the time domain must be analyzed in the frequency domain, and then reconstructed in the time domain into an RMS value with the unwanted frequencies excluded. This may be done by converting L(f) back to Sφ(f) over the bandwidth of interest, integrating and performing some calculations.

Symbol	Definition
$\int \mathcal{L}(f)$	Integrated single side band phase noise (dBc)
$S\varphi(f)=(180/\Pi) x \sqrt{2 \int \mathcal{L}(f) df}$	Spectral density of phase modulation, also known as RMS phase error (in degrees)
RMS jitter = Sφ (f)/(fosc.360°)	Jitter(in seconds) due to phase noise. Note Sφ (f) in degrees.

The value of RMS jitter over the bandwidth of interest, e.g. 10kHz to 20MHz, 10Hz to 20MHz, represents 1 standard deviation of phase jitter contributed by the noise in that defined bandwidth.

Figure below shows a typical Phase Noise/Phase Jitter of a QT3013C, 3.3Vdc, 80.000MHz TCXO at offset frequencies 10Hz to 1MHz, and phase jitter integrated over the bandwidth of 10Hz to 20MHz.



DCO	REV	REVISION SUMMARY	PAGE	DATE
6802	-	Initial Release renamed from Analog TCXO (Revision D, December 2011) (ECO# 10367)	All	5/16/2017
		Add Solder Dip (S) option in Ordering Information	1	
		Update QT3013 Outline	3	
6997	A	Add lead length to QT3023 Outline	3	7/14/2017
7984	B	Clarify ‘M’ screening option: Re-word option ‘M’ in ordering information; Add note (***) Add Screening and Testing flow (Table II)	 1 5	3/22/2018
		Move Frequency vs Temperature curve from Page 5 to Page 4	4, 5	
		Assign numbers to tables (Electrical Characteristics and Environmental Specifications	2, 5	