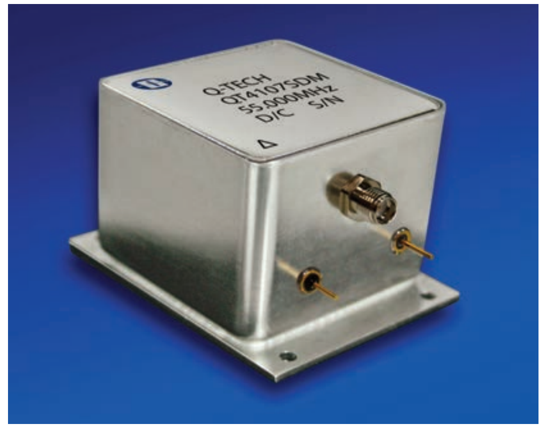
Description

Q-Tech's High Stability Oven Controlled Crystal Oscillator (OCXO) is a high reliability signal generator that provides Sine wave or HCMOS output. The OCXO is designed to be used in Aerospace applications.

It is designed to withstand radiation level up to 100kRad (*) (total dose), high shock and vibration. The OCXO has very low phase noise. Low G-Sensitivity SC-Cut Crystal utilized in the design guarantees 1PPB/G or better. The reliable construction of this design qualifies it for stringent environmental applications.

(*) Please contact factory for higher level of radiation hardness.



Features

- Made in the USA
- DFARS 252-225-7014 Compliant: Electronic Component Exemption
- Supply voltages 3.3Vdc to 15Vdc
- Wide temperature range (-40ºC to +85ºC)
- SC-Cut crystal
- Low phase noise and jitter
- Choice of output power and load
- Radiation Hardened
- Custom design available tailored to meet customer's needs
- Q-Tech does not use pure lead or pure tin in its products

Applications

- Designed to meet today's requirements for Space Grade applications
- Control and measurement
- Signal processing

EAR Destination Control Statement

This product and related technical data are subject to the EAR as promulgated and implemented by the U.S. Department of Commerce Bureau of Industry and Security. This product and related technical data are controlled under Export Control Classification Number (ECCN) 9A515.e.1 of the Commerce Control List (CCL), and may not be exported, re-exported, or re-transferred outside of the U.S. or released or disclosed to Foreign Persons, as defined by the EAR, without first complying with all applicable U.S. Export Regulations.

Ordering Information

(Sample part number)
QT4107SDM-55.000MHz

Q	T	4	1	0	7	S	D	M	-	55.000MHz

Supply Voltage:	
3 =	+3.3V
5 =	+5.0V
6 =	+12.0V
7 =	+15.0V

Logic:
C = HCMOS
S = Sine Wave

Frequency vs. Temperature Code:					
G =	± 100PPB	at	-20ºC	to	+70ºC
H =	± 10PPB	at	-20ºC	to	+70ºC
J =	± 200PPB	at	-40ºC	to	+85ºC
D =	± 20PPB	at	-40ºC	to	+85ºC

Screening Option:
B = Breadboard Model
E = Engineering Model
M = Flight Model with Screening Per MIL-PRF-55310, Level S

Output Frequency

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

Packaging Options

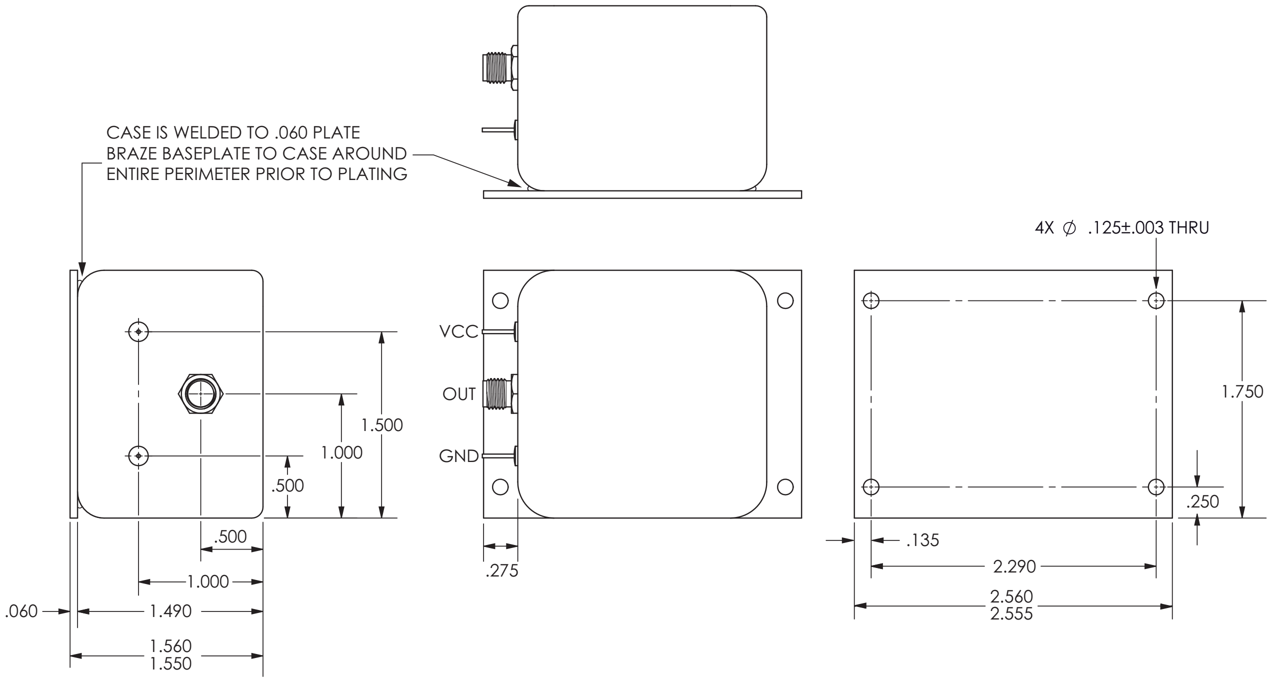
- Standard packaging in black foam

Other Options Available For An Additional Charge

- P. I. N. D. test (MIL-STD 883, Method 2020)
- Phase Noise test (Static and under vibration)
- Jitter test

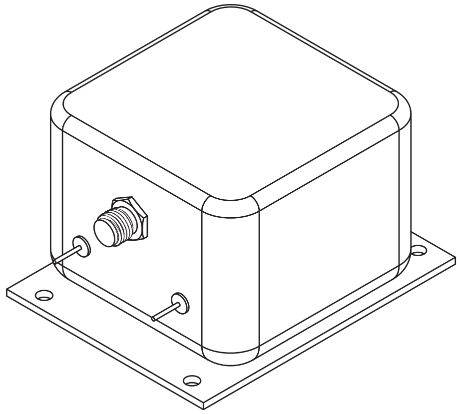
Specifications subject to change without prior notice.

Package Outline - Dimensions are in inches



Package Information

- Package Material: CRS
- Weight: 165g typ., 175g max.
- Package Finish: Nickel Plating 500 micro Inches
- SMA Connector: Body = Brass (QQ-B-626), Nickel Plated
  Contact Pin = BeCu, Gold Plated
  Insulators = Teflon, MIL-P-19468
- Power Connectors: Gold Plated per MIL-G-45204C, Class 00



Electrical Characteristics

Parameters	Conditions	Requirements	
Output Frequency Range (Fo)		**1MHz — 125MHz**	
Supply Voltage (Vdd)	±5.0%	+3.3Vdc, +5Vdc, +12Vdc and +15Vdc	
Initial Tolerance	@+25ºC	±0.2ppm	
Temperature Range		See Option Codes	
Frequency Stability vs. Temperature		See Option Codes	
Frequency Stability vs. Voltage Variation	Over Temperature Range	±10PPB	
Frequency Stability vs. Load Variation	±5.0% Load Variation	±20PPB	
Warm-up Power max.	@-40ºC	4.8W	
Steady State Power max.	@+25ºC	2.7W	
Warm-up Time	@+25ºC to ±100PPB (2 hours ref.)	10 min.	
Output Waveform		**Sine Wave**	**HCMOS**
Output Power (See note 1)		+3.0±1.0dBm	
Output Power Stability (See note 2)	Over Temperature Range	±1.0dBm	
Duty Cycle	Over Temperature Range		50%±5.0%
Output Load		50Ω	10kΩ//15pF
Harmonics	Over Temperature Range	-35dBc	
Spurious (See note 3)	Over Temperature Range	-90dBc	
Aging	Per Day	1PPB	
	15 years	1.5PPM	
G-Sensitivity max.		1PPB/G	
Phase Noise for 50MHz OCXO (typ.)	1Hz	-70dBc/Hz	
	10Hz	-102dBc/Hz	
	100Hz	-132dBc/Hz	
	1kHz	-148dBc/Hz	
	10kHz	-155dBc/Hz	
	100kHz	-155dBc/Hz	

Other Design and Test Options

- 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 spurious (see note 3)
- Low frequency aging, Allan Variance
- High-shock resistant

Notes:

1. The output level is determined by the supply voltage, load, and package size.
2. Typical amplitude stability over temperature is ±10% or less.
3. Typical spurious level is better than -100dBc over the spectrum of 100kHz to 1GHz.

Environmental Specifications

Q-Tech Standard Screening similar to (MIL-PRF-55310) 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
Initial Accuracy at Reference Temperature	MIL-PRF-55310, Type 4, Class 3
Frequency Warm-up	MIL-PRF-55310, Type 4, Class 3
Initial Frequency-Temperature Accuracy	MIL-PRF-55310 (4.8.10.1)
Frequency-Voltage Tolerance	MIL-PRF-55310
Frequency-Load Tolerance	MIL-PRF-55310
Phase Noise Steady-State	MIL-PRF-55310
Phase Noise Random Vibration	MIL-PRF-55310
Output Power (Sinusoidal Waveform)	MIL-PRF-55310
Output Logic Voltage Levels (Square wave)	MIL-PRF-55310
Rise Time and Fall Time (Square wave)	MIL-PRF-55310
Duty Cycle (Square wave)	MIL-PRF-55310
Harmonic and Sub-harmonic Distortion	MIL-PRF-55310
Spurious Response	MIL-PRF-55310
Oven Input Current-Power	MIL-PRF-55310, Type 4, Class 3
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. A & C
Burn-in	240 hours, At highest operating temperature with load
Aging	30 days, MIL-PRF-55310, Type 4, Class 3
Random Vibration	MIL-STD-883, Method 2026
Shock, Non Operating	MIL-STD-883, Method 2002
Thermal Shock, Non Operating	MIL-STD-202, Method 107, Cond. B
Ambient Pressure	MIL-STD-202, 105, Cond. G, 5 minutes dwell time minimum
Resistance to Solder Heat	MIL-STD-202, Method 210, Cond. C
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
Non-destructive Bond Pull	MIL-STD-883, Method 2023

Please contact Q-Tech for higher shock requirements

Design and Construction

The design and construction of the crystal oscillator shall be as specified herein. As a minimum, the oscillators shall meet the design and construction requirements of MIL-PRF-55310.

Element De-rating

All active and passive elements shall be derated in accordance with the applicable hybrid microcircuit element requirements of MIL-STD-975. Elements shall not operate in excess of de-rated values.

Worst Case Circuit Analysis

Worst case analysis shall be based on:

a. Maximum rated value

b. The worst case design value

c. Derating factor for each element

d. Temperature variation

e. Radiation

MTBF

Mean Time between Failure analysis shall be done based on MIL-HDBK-217

Element Evaluation

All piece parts shall be derived from lots that meet the element evaluation requirements of MIL-PRF-38534, Class K except for the following exceptions:

Active Elements

a) Visual inspection of silicon on sapphire microcircuits. Semicircular crack(s) or multiple adjacent cracks, not in the active area, starting and terminating at the edge of the die are acceptable. Attached (chip in place) sapphire is nonconductive material and shall not be considered as foreign material and will be considered as nonconductive material for all inspection criteria.

b) Subgroup 4, Scanning Electron Microscope (SEM) inspection. The manufacturer may allow the die distributor, at his option, select two (2) dice from a waffle pack (containing a maximum quantity of 100 die), visually inspect for the worst case metallization of the 2 dice, and take SEM photographs of the worst case.

c) Subgroup 5 radiation tests. Subgroup 5 radiation tests are not required unless otherwise specified in the detail specification.

Package Elements

a) Salt spray. Salt spray testing is not required.

Quartz Crystal Material

Unless otherwise specified by the detail specification, the quartz Crystal material shall be swept synthetic, grade 2.2 or better.

Crystal Mounting

The crystal element shall be four-point mounted in such a manner as to assure adequate crystal performance when the oscillator is subjected to the environmental conditions specified herein.

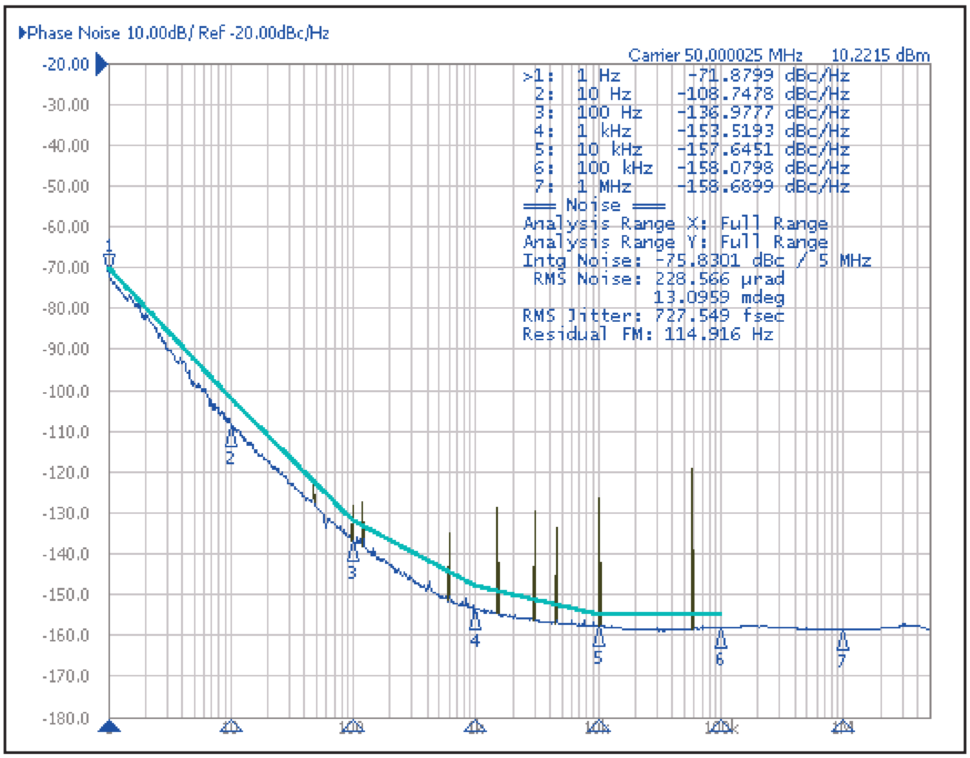
Phase Noise and Phase Jitter Integration

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)
$S\varphi\,(f)=(180/\Pi)\text{x}\sqrt{2\int \mathcal{L}(f)df}$	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.



Typical Phase Noise of 50MHz OCXO

DCO	REV	REVISION SUMMARY	Page	Date
10572	A	Change from ECCN:EAR99 to ITAR	1	
10835	B	Fixed typo under “Other Design and Test Options” (from see note 5 to 3)	3	
		Add document # on footer (QPDS-0008)	All	
12619	C	Add EAR Destination Control Statement	1	11/05/2020
		Ordering Information Table: Revise ‘Engineering Model’ option code from ‘Blank’ to ‘E’ Add ‘Breadboard Model’ option code ‘B’	1	