HIGH STABILITY DIGITAL TCXO

SURFACE MOUNT CRYSTAL OSCILLATORS

3.3 to 5Vdc - 1MHz to 125MHz

Description

Q-Tech's High Stability Digital TCXO is a high reliability signal generator that provides an HCMOS output. The TCXO is available in a Surface Mount (SMD) package.

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 guarantees 1PPB/G or better. The reliable construction of this design qualifies it for stringent environmental applications.

Standard Frequencies (MHz)

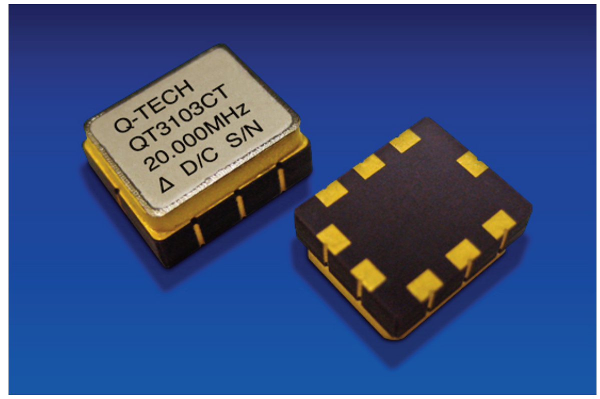
- 10, 10.001355, 15.05, 16, 16.384, 20, 25, 27.48, 30, 32, 40, 80, 100 (See table on pg 2 for details)

Features

- Made in the USA
- ECCN: EAR99
- DFARS 252-225-7014 Compliant: Electronic Component Exemption
- USML Registration # M17677
- Supply voltages 3.3Vdc and 5Vdc
- Wide temperature range (-55ºC to +125ºC)
- AT-Cut crystal
- Low phase noise and jitter
- Choice of output power and load
- 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

Applications

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



Ordering Information

(Sample part number)

QT3103CRM-25.000MHz

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

Package Type:
0 SMD

Supply Voltage:
3 +3.3V
5 +5.0V

Logic:
C HCMOS

Output Frequency

Screening Option:
Blank No Screening
M Per MIL-PRF-55310, Level B

Frequency vs. Temperature Code (*):

N	±	0.075ppm	at	0ºC	to	+70ºC
O	±	0.09ppm	at	-20ºC	to	+70ºC
R	±	1ppm	at	-20ºC	to	+70ºC
S	±	0.3ppm	at	-20ºC	to	+70ºC
T	±	1ppm	at	-40ºC	to	+85ºC
U	±	0.3ppm	at	-40ºC	to	+85ºC
V	±	1ppm	at	-55ºC	to	+125ºC

(*) Option "V" and custom frequencies higher than 50MHz may require NRE

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

- 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.

Electrical Characteristics

Parameters	QT3103 or QT3105	
Output Freq. Range (Fo)	**1MHz 125MHz**	
Supply Voltage (Vdd)	+3.3Vdc ± 5% or +5Vdc ± 5%	
Maximum Applied Voltage (Vdd max.)	+5.5Vdc	
Nominal Tolerance	±0.3ppm	
Frequency Stability (ΔF/ΔT)	See Option codes	
Frequency Stability vs. Load Variation	±0.2ppm	
Frequency Stability vs. Voltage Supply Variation	±0.2ppm	
Operating Temp. (Topr)	See Option codes	
Storage Temp. (Tsto)	-62ºC to + 125ºC	
Operating Supply Current (Idd)	8mA (No Load) at 3.3Vdc (10MHz) 14mA (No Load) at 5.0Vdc (10MHz)	
Output Amplitude or Power	**+3.3Vdc** High (min.): Vcc -10% Low (max.): Gnd +10%	**+5Vdc** High (min.): 3.3V-10% Low (max.): Gnd+10%
Output Load	10k//15pF	
Start-up Time	10ms max.	
Phase Noise at 25ºC (typ.) at 10MHz (See Note 4)	10Hz	-90dBc/Hz
	100Hz	-120dBc/Hz
	1kHz	-135dBc/Hz
	10kHz	-150dBc/Hz
	100kHz	-155dBc/Hz
Integrated Phase Jitter RMS (12kHz to 20MHz) typ. (See Note 4)	1ps	
Aging (at 70ºC)	± 5ppm max. 10 years	

Other Design and Test Options

- Supply voltage +3.3Vdc to +5Vdc
- 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 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.
4. Guaranteed by design, can be tested by customer request.
5. TCXO with frequencies higher than 50MHz, have amplitude more sensitive to load and it may be lower than standard.

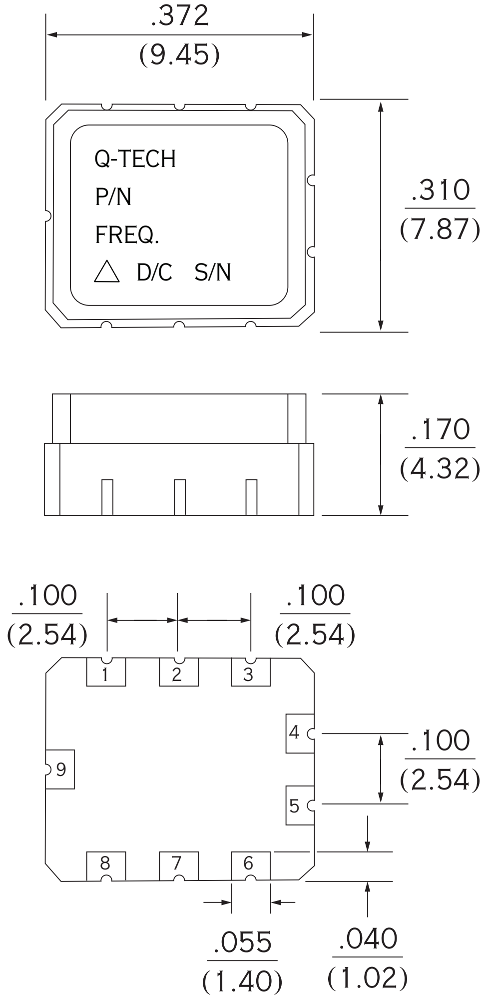
Standard Frequencies Below Available With Faster Delivery

Part Number	Frequency	Voltage	Temperature	Stability
MCM5273 27.480MHz	27.480MHz	3.3V	40ºC to +85ºC	±0.3ppm
MCM5281 1 10.000MHz	10.000MHz	3.3V	40ºC to +85ºC	±0.3ppm
QT3103CT 10.001355MHz	10.001355MHz	3.3V	40ºC to +85ºC	±1ppm
QT3103CT 15.050MHz	15.050MH	3.3V	40ºC to +85ºC	±1ppm
QT3103CT 40.000MHz	40.000MHz	3.3V	40ºC to +85ºC	±1ppm
QT3103CT 80.000MHz	80.000MHz	3.3V	40ºC to +85ºC	±1ppm
QT3103CT 100.000MHz	10.000MHz	3.3V	40ºC to +85ºC	±1ppm
QT3103CU 25.000MHz	25.000MHz	3.3V	40ºC to +85ºC	±0.3ppm
QT3103CU 30.000MHz	30.000MHz	3.3V	40ºC to +85ºC	±0.3ppm
QT3103CV 16.384MHz	16.384MHz	3.3V	55ºC to +125ºC	±1ppm
QT3105CV 16.000MHz	16.000MHz	5.0V	55ºC to +125ºC	±1ppm
QT3105CV 20.000MHz	20.000MHz	5.0V	55ºC to +125ºC	±1ppm
QT3105CV 32.000MHz	32.000MHz	5.0V	55ºC to +125ºC	±1ppm

Note: Custom frequencies are available but require an NRE and a longer lead time.

Package Outline and Pin Connections

Dimensions are in inches (mm)



Pin No.	Function	Pin No.	Function
1	NC or VC (*)	6	OUTPUT
2	NC or ED (*)	7	NC
3	GND	8	SUPPLY VOLTAGE
4	NC	9	NC
5	NOISE CAP OR NC (**)		

NC (No Connection), **VC** (Voltage Control), **ED** (Enable/Disable)

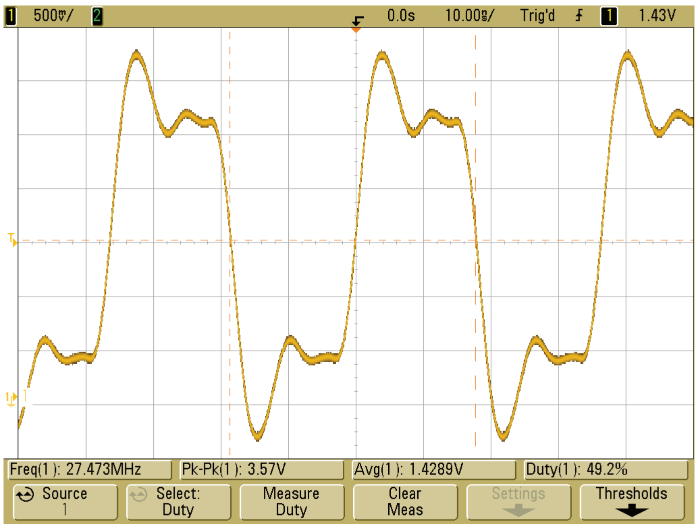
(*) For VC or ED options, consult factory otherwise they will be NC

(**) By connecting 100-200uF capacitor to pin #5, close-in phase noise may be improved up to -10dBc/Hz. Warm up time will increase from 0.5sec to 10sec.

Package Information

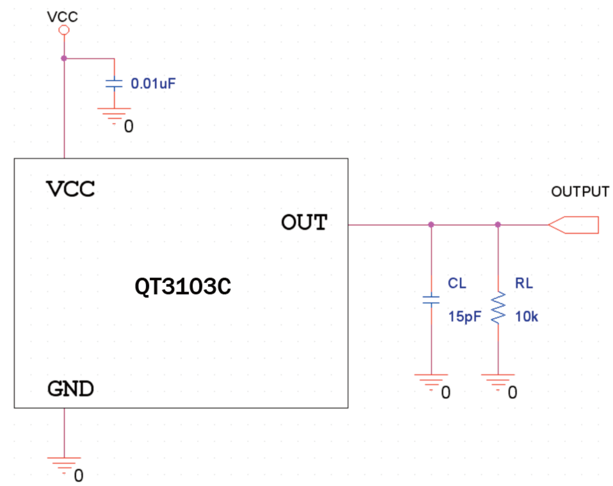
- Package Material: 91% AL_2O_3
- Cover: Kovar, Nickel Plated 100 ~ 200µ
- Weight: 1g typ., 2g max.
- Termination Pads (4x): Tungsten
- Termination Finish: Nickel Underplate: 100µ ~ 250µ inches
  Gold Plated: 50µ ~ 80µ inches

Output Waveform into HCMOS load



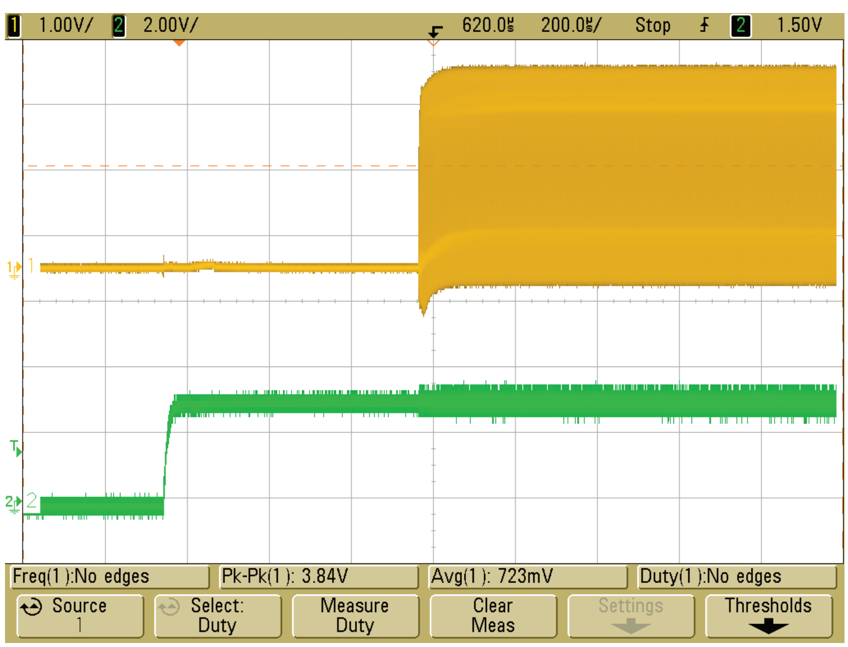
Typical output of QT3103C-27.48MHz

Test Circuit



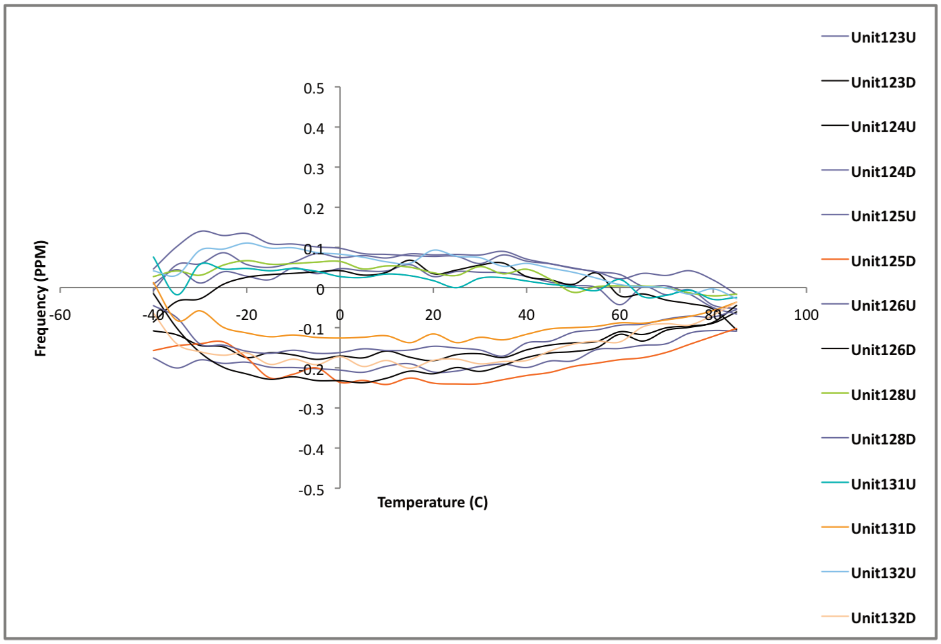
HCMOS Load

Startup Time



Typical start-up time of QT3103C-27.48MHz

Frequency vs. Temperature Curve



Typical Stability of QT3103C-10.000MHz

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
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
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

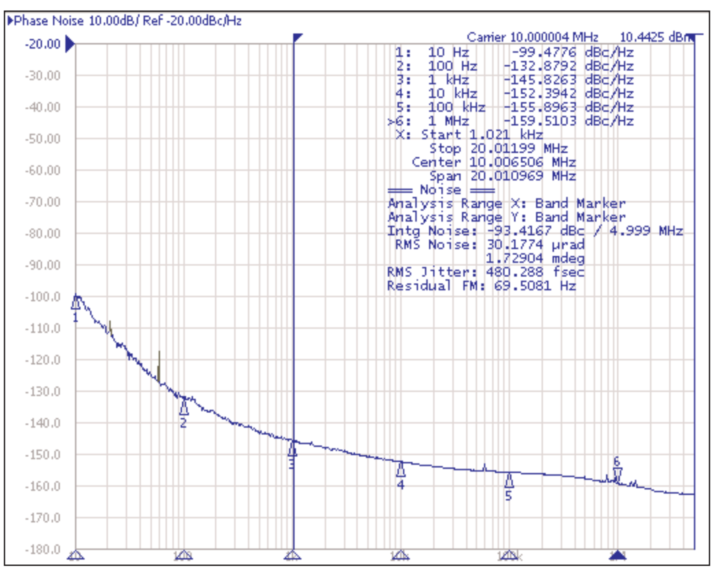
Phase noise is measured in the frequency domain, and is expressed as a ratio of signal power to noise power measured in a 1Hz bandwidth at an offset frequency from the carrier, e.g. 10Hz, 100Hz, 1kHz, 10kHz, 100kHz, etc. Phase noise measurement is made with an Agilent E5052A Signal Source Analyzer (SSA) 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.

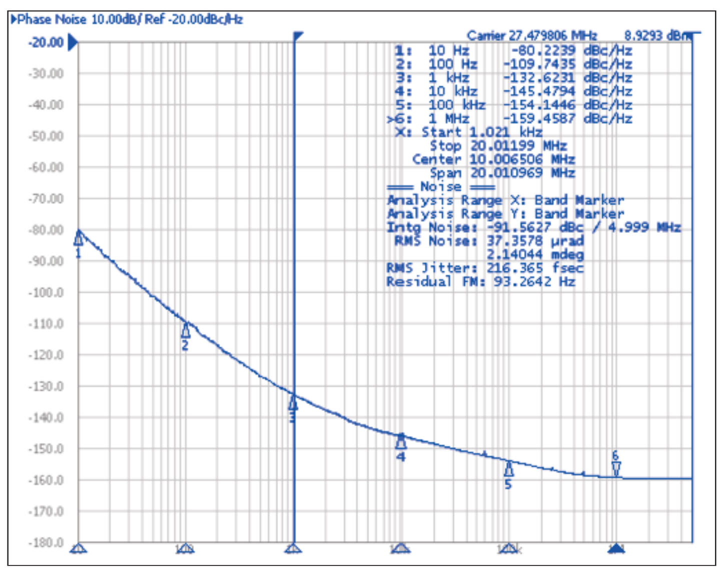
Symbol	Definition
$\int\mathcal{L}(f)$	Integrated single side band phase noise (dBc)
Sφ (f) $(180/\Pi)\text{x}\sqrt{2\int\mathcal{L}(f)df}$	Spectral density of phase modulation, also known as RMS phase error (in degrees)
RMS jitter Sφ (f)/(fosc.360°)	Jitter(in seconds) due to phase noise. Note Sφ (f)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

Figure below shows a typical phase noise/phase jitter of a QT3103C, 3.3Vdc, 10.000MHz and a QT3103C, 3.3Vdc, 27.48MHz TCXO at offset frequencies 10Hz to 5MHz, and phase jitter integrated over the bandwidth of 1kHz to 5MHz. Typical phase noise jitter (1kHz to 20MHz) smaller than 1psec

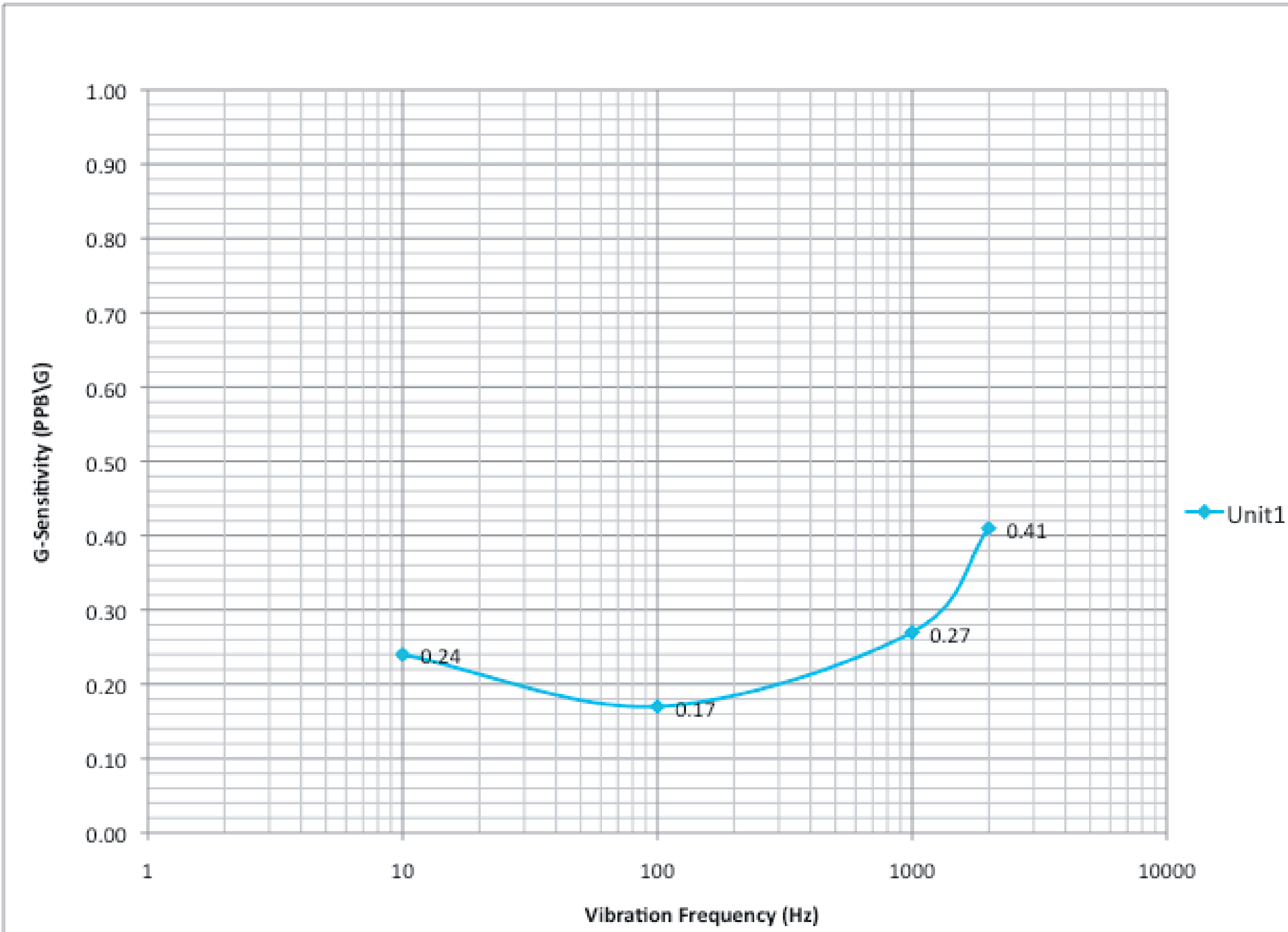


QT3103C-10.000MHz



QT3103C-27.48MHz

G-Sensitivity



Typical G-Sensitivity of QT3103CU-27.480MHz

ECO	REV	REVISION SUMMARY	Page
10540	D	Add Standard Frequencies	1, 2
10608	E	Change package photo	1
		Add Note #4	2
		Modified Package Information: • Add cover information • Modified Package Material From 90% to 91%	3
10834	F	Modified Ampliude or Power	2
		Fixed typo under "Other Design and Test Options" (from see note 5 to 3)	
		Add Note #5	
		Add document # on footer (QPDS 0009)	All