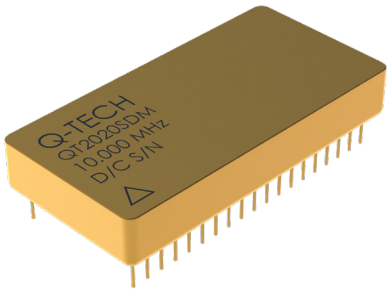
QT2021 MCXO

Enhanced Radiation Tolerant Microcomputer-Compensated Crystal Oscillator
3.3Vdc, 5MHz to 100MHz

Description

Q-Tech's microcomputer compensated crystal oscillator (MCXO) uses a high stability, overtone SC-cut crystal with microprocessor-controlled compensation. The self-temperature sensing resonator, using a dual-mode oscillator, virtually eliminates thermometry-related errors. As a result, all basic TCXO and OCXO limitations are overcome or significantly reduced in the MCXO. Even though the MCXO is built from COTS components, it can provide performance equivalent to a RAD-tolerant OCXO, but with 90 mW maximum power consumption!

The QT2021 is additionally designed to be single event latch-up immune and can be used for full space missions!



Features

RAD tolerant OCXO performance with 90 mW maximum power consumption

- Tested for Single Event Latch-up to 75 MeV-cm^2/mg
- Radiation tolerant to 50 kRad (Si)
- 1 PPS input and output can be configured for holdover applications (consult factory)
- Made in the USA
- MIL-PRF-55310, Class 3 device (Discrete and Hybrid technology)
- Start-up time: 1.5 sec. to ±50 ppm and as low as 10 sec to ±10 ppb
- Temperature stability as low as ±10 ppb to ±30 ppb (see ordering information on Page 2)
- Maximum aging rate: ±1.5ppm over 20 years
- DC Power Input: 3.3 Vdc, 90 milliwatts max.
- High reliability signal generator that can produce CMOS & Sine Wave Outputs
- Designed to withstand high shock and vibration levels
- Outputs: 5 - 100 MHz (Sine Wave or CMOS) and 1 PPS, with other frequency options available
- Capability to sync to GPS at 1PPS or 10MHz
- Environmental: Inherently rugged design capable of full military screening
- Low phase noise and jitter
- Small form factor
- G-Sensitivity: 1 ppb/G maximum
- DFARS 252-225-7014 compliant: Electronic Component Exemption
- Hermetically sealed

Applications

- Low Earth Orbit
- Full Space

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

For non-standard requirements, email Q-Tech Corporation at Sales@Q-Tech.com
Specifications subject to change without prior notice.

Sample Part Number: QT2021CBN - 10.000 MHz

QT202	1	C	B	N	-	10.000MHz

Part Series Designation

Model Number

1 = 50 kRad (Si) TID **and** SEL to 75 MeV-cm²/mg

Output Logic & Supply Voltage

C = CMOS, 3.3V
S = Sine Wave, 3.3V

Frequency vs. Temperature Code

A = ± 50.0 ppb at 0°C to +70°C
B = ± 10.0 ppb at 0°C to +70°C
C = ± 30.0 ppb at -40°C to +85°C
D = ± 20.0 ppb at -40°C to +85°C
E = ± 50.0 ppb at -40°C to +85°C
F = ± 100.0 ppb at -40°C to +85°C

-Frequency Stability is referenced to the midpoint between minimum and maximum frequency value over the temperature range.
-Frequency Stability vs. temperature codes may have different lead times associated. Please contact Q-Tech for more info.

Screening Options

B = Breadboard Model (No Screening)
E = Engineering Model (No Screening)
N = MIL-PRF-55310, Level B (modified, see Screening Table)

Output Frequency

Standard Frequencies:
10, 20, 30, 40, 50, 60, 80, and 100MHz

For frequencies over 100MHz, consult with the factory.

Package Outline and Pin Connections

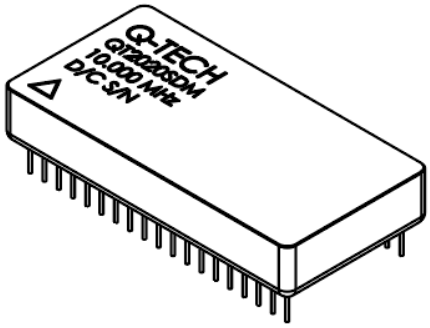
Dimensions are in inches (mm)

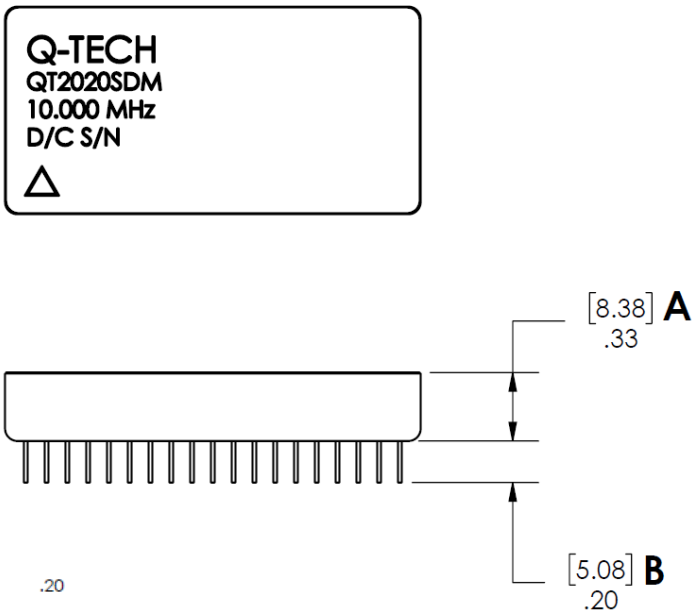
Package Material: Kovar

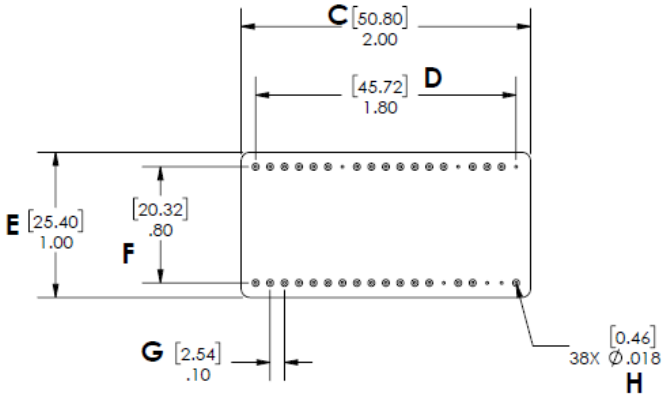
Finish: 50 uin. gold over nickel plating

Weight: 50g typ.

Installation Note: Care should be taken during installation of the MCXO. Hand soldering is recommended to avoid reflow of internal components and damage to the unit.







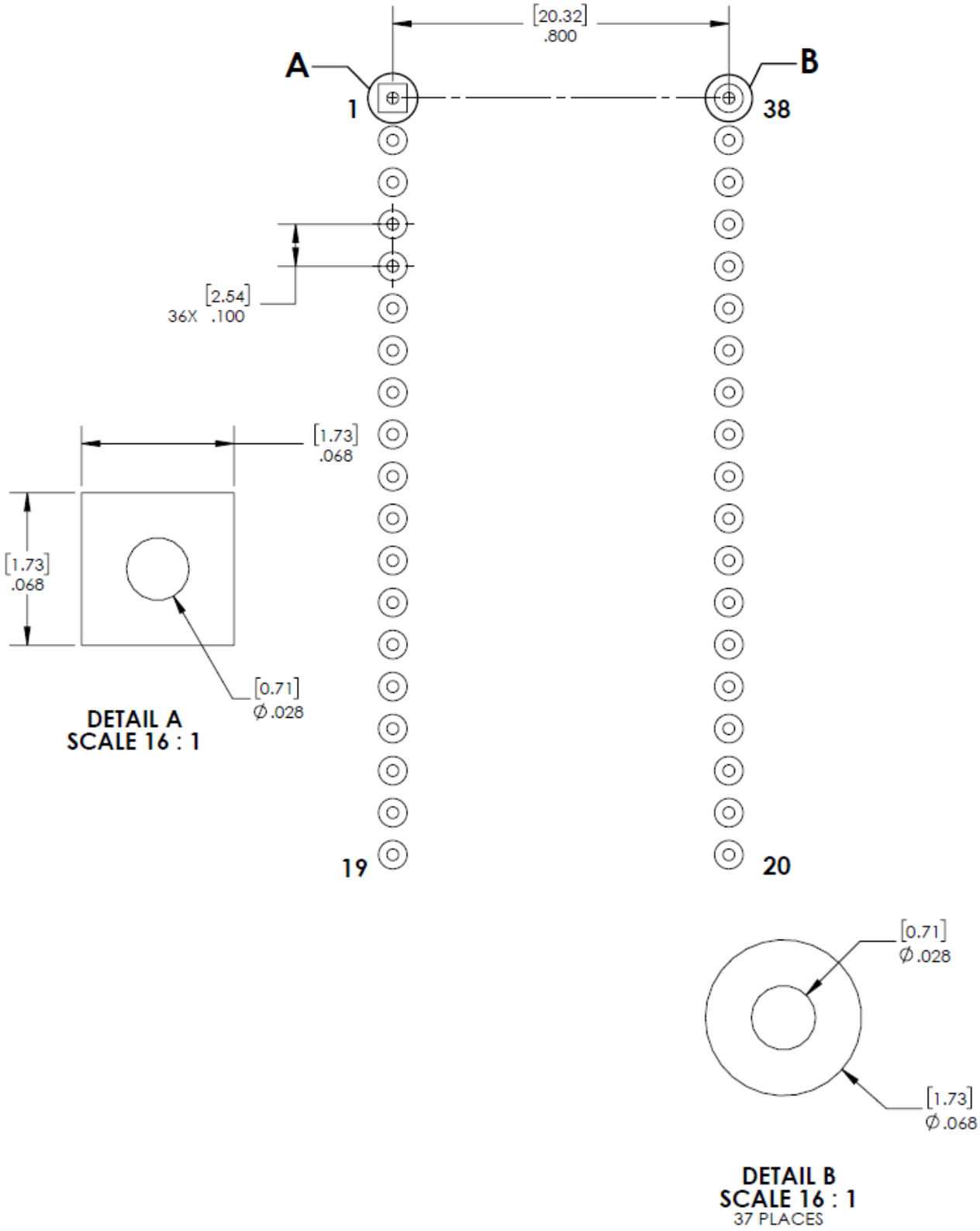
QT2021 Pin-Out Table

Pin No.	Function
1 (2)	Reference Frequency/10MHz Synchronization
16, 17, 23	NC (Note 1)
3, 6, 7, 14, 15, 18, 19, 21, 22, 24, 25, 33	GND/CASE
4 (5)	Mode Select
13 (12)	1 PPS Input
9 (8), 11 (10), (34), (35), (36)	Factory Use (Note 1)
20	Frequency Output
26 (27)	Sync 1
30 (31)	Sync 2
29 (28)	1 PPS Output
32	Status
38 (37)	Voltage Supply

Note 1: Pins may have internal connection. Do not ground.
Note 2: Pins in parantheses () are redundant pins and must also be connected to provide function redundancy. See "Secondary Pins" in pinout description for more details.

Recommended Land Pattern

Dimensions are in inches (mm)



Pinout Description

Pin 20 **Frequency Output**

Depending on the specified part number, frequency output can be HCMOS or Sine Wave. HCMOS has 10 kΩ in parallel with 15 pF load. Sine Wave output has 50 Ω load.

Frequency Output range is 5MHz to 100MHz

Pins: 3, 6, 7, 14 Case Ground

15, 18, 19, 21, 22 This pin(s) provides negative voltage (0V) to the MCXO. It is connected to the oscillator case to reduce EMI.

24, 25, 33

Pins: 1 (2), **Reference Inputs**

13 (12) These inputs can be configured as Frequency Correction or Synchronization 10MHz or 1 PPS. In the case of the Synchronization option, the MCXO output will be frequency locked (FLL) to an external signal as soon as it is applied to the input. With no signal applied, the MCXO maintains its specified stability over temperature and time. In the case of the Frequency Correction option (Logic (0,0)), the MCXO performs a one time routine to adjust its frequency to the reference signal. When signal is provided to the pin, the MCXO starts an aging correction routine and synchronizes both frequency and timing mode outputs to the reference signal. This routine takes about 10-15 seconds, and after the frequency is synchronized, the MCXO continues to operate normally. In order to perform synchronization again, the reference should be disconnected and connected one more time. Precision of synchronization is ±5 ppb.

For the Synchronization option (Logic (1, 0) - Output Frequency locked to 1 PPS signal on Pin 13), the MCXO output will be frequency locked (FLL) to the external 1 PPS signal as soon as it is applied to the input. With no signal applied, the MCXO maintains the specified stability over temperature and time.

Pin 29 (28) **1 PPS Output**

This output provides 1 PPS (Hz) HCMOS signal.

Pin 5 (4) **Mode Select**

This pin is responsible for selecting the MCXO operating modes. If a low level (<0.5V) signal is applied to the pin, the MCXO will start to operate in Frequency Mode. The output signal at pin 20 will be the specified frequency, and pin 29 will provide the 1 PPS output. Power consumption will be in accordance with the Frequency Mode specification. If a high level (>2.8V) signal is applied to the pin, the MCXO will start to operate in Timing Mode, and will output a 1 PPS signal at pin 29. Power consumption will be in accordance with the Timing Mode specification, and pin 20 will be disabled.

***Contact the factory for deviations from the standard functions and operations.**

Pins: 26 (27), 30 (31) **Synchronization Options**

See Table II for detailed synchronization options. All operations are performed while in "Frequency Mode"(See "Pin 5 - Mode Select").

Pin 32 **Status**

Status output has a low level signal during normal operation. It provides a low frequency signal (2-4 Hz) for 5-10 seconds after power is applied to pin 38. The status output goes to a high level signal during the aging correction routine. It also goes high in case of a malfunction in the MCXO, and can be connected to an LED as an indicator of the MCXO's status.

Pins: 38 (37) **Voltage Supply**

This pin provides positive voltage (3.3V) to the MCXO. Minimum bypass capacitor value is 2.2uF. It must be installed close to pin 38.

Other Pins: **Not Connected**

Leave these pins as not connected, as they have internal functions and grounding them may lead to MCXO malfunctions.

Secondary Pins **Redundancy**

For pins marked in parentheses, they are made to be redundant pins for the pin that precedes them. For example, the Voltage Supply pin is 38, with pin 37 being its redundant pin. On the next level assembly, the primary and redundant pins should both be connected to its intended function. For example, for Voltage Supply, both pins 37 and 38 should be connected to the voltage supply on the board the MCXO is installed on.

***Contact the factory for deviations from the standard functions and operations.**

1. PURPOSE

1.1 The purpose of this Data Sheet (QPDS) is to describe the specific quality and reliability requirements for a radiation tolerant microcomputer-compensated crystal oscillator (MCXO).

2. SCOPE

2.1 This specification establishes the minimum detail requirements for a low profile, hermetically sealed, MCXO.

3. PART PROTECTION AND SAFETY

3.1 These items are susceptible to breakdown damage resulting from electrostatic discharge. Every precaution shall be taken while handling, installing, and testing the parts to prevent static charge. Care should be exercised to not apply more than rated voltage or current to any terminal/pad during testing.

4. PART NUMBER

4.1 The Q-Tech Part Number shall be as specified in Ordering Information (Page 2).

5. APPLICABLE DOCUMENTATION & REFERENCES

The following documents form a part of this data sheet to the extent specified or modified herein:

5.2 Military & Industry

MIL-PRF-55310, Oscillator, Crystal Controlled, General Specification for
MIL-PRF-38534, Microcircuit Manufacturing, General Specification for
MIL-PRF-38535, Integrated Circuits, (Microcircuits) Manufacturing, General Specification for
MIL-PRF-19500, Semiconductor Devices, General Specification for
MIL-STD-202, Test Methods for Electronic and Electrical Component Parts
MIL-STD-750, Test Methods for Semiconductor Devices
MIL-STD-883, Test Methods and Procedures for Microelectronics
MIL-STD-1686, Electrostatic Discharge Control Program for Protection of Electrical and Electronic Parts.
IPC-J-STD-001 Requirements for Soldering Electrical and Electronic Assemblies
ANSI/ASQ Q9001 (ISO 9001), Quality Management Systems - Requirements

5.3 Q-Tech

0401-00287-0000, General Specification for Assembling PC Boards
0401-00035-0001, General Specification for Metallic Hybrid Packages, Product Assurance Level S/K
F1297, Definitions for PCB-Based Product Development Levels

5.4 Application of Documents

5.4.1 Issue of Documents

Document revisions in effect on the date of the customer purchase order form a part of this data sheet except as modified herein.

5.4.2 Order of Precedence

In the event of conflict between this document and the references cited herein or other requirements, the precedence in which requirements shall govern, in descending order, is as follows:
a) Applicable Customer Purchase Order
b) Applicable Customer Detail SCD and/or Detail Drawing
c) Applicable Q-Tech Corporation Detail SCD/Drawing
d) Applicable Q-Tech Corporation General SCD
e) Other Specifications, Standards, and Documentation Referenced Above

5.4.3 Customer Purchase Order Special Requirements

Additional special requirements shall be specified in the applicable customer purchase order when additional requirements or modifications are needed for compliance to special programs or product line compliance. Unique identification of the items produced may be required.

6. General Requirements

6.1 General Definition

The microcomputer-compensated crystal oscillator (MCXO) is a high reliability signal generator that provides a sine-wave or CMOS output. The MCXO has been designed to operate in a spaceflight environment with an expecfted lifetime in excess of 15 years. "Lifetime" is defined as the sum of operational and storage environments.

6.2 Electrical Characteristics

The electrical characteristics shall be as specified in Table II and Table III.

6.3 Absolute Maximum Rating

The absolute maximum ratings shall be as specified in Table I.

6.4 Total Dose Radiation Limits

Crystal oscillators supplied in accordance with this specification shall be capable of meeting the performance requirements after being exposed to 50 kRad(Si) total dose radiation evels.

6.5 Physical Characteristics

6.5.1 Dimensions

The MCXO outline dimensions and terminal connections shall be as shown on Page 3.

6.5.2 Weight

The MCXO shall weigh less than or equal to 50 grams.

6.5.3 Materials (Package Body and Finish)

The MCXO chassis and covers shall be Kovar, gold plated.

6.6 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, except element evaluation shall be as specified in 6.5.1.

6.6.1 Component Selection

Devices are manufactured using COTS and automotive components.

6.6.2 Conformal Coating

Internal PCBAs are conformal coated using Arathane 5750 A/B.

6.6.3 Active Components - Single Event Latch-up

The QT2021 is manufactured using active components that have been tested for Single Event Latch-up (SEL). The QT2021 is SEL immune up to 75 MeV-cm^2/mg.

6.6.4 Element Derating

All active and passive components shall be derated in accordance with the applicable requirements of MIL-PRF-55310. Elements shall not operate in excess of derated values.

6.6.5 Quartz Crystal

The quartz crystal for the dual mode oscillator shall be swept synthetic, grade 2.2 or better. The crystal element shall be three-point mounted (at a minimum) in such a manner as to assure adequate crystal performance when the oscillator is subjected to the environmental conditions specified herein. The quartz crystal for the VCXO module can be a lower grade crystal with a 2-point mount construction.

6.6.6 Prohibited Materials

Materials containing more than 97% tin and materials containing measurable amounts (by common nondestructive test methods) of selenium, cadmium, or mercury shall not be used as plating, coating, or base materials in the construction of parts or components. Zinc is only acceptable as an alloying element and alloys containing zinc must be covered by suitable protective plating (e.g. nickel plating). Inert oxides of the above materials are allowed.

6.7 Engineering Model (EM) Oscillators

The requirements for the EM oscillators (designated in the part number with the letter E) shall be as follows:

a) Design and manufacturing processes shall be identical to flight units (part number letter N).
b) Finished units shall be functional over the specified operating temperature range.
c) Screening test and/or Qualification Conformance Inspection is not required.

7. Quality Assurance Provisions

7.1 Responsibility for Inspection/Test

The supplier shall be responsible for the performance of all inspections and tests specified herein and assure that the MCXO is in compliance with the requirements set forth in this specification.

7.2 Test Equipment and Inspection Facilities

During testing, supplier shall assure that test and measuring equipment is capable of sufficient accuracy for required testing. All such equipment shall be controlled by a calibration system in accordance with ISO-10012-1 and ANSI-Z-540-1-1994.

7.3 Classification of Tests and Inspections

a) Screening: per MIL-PRF-55310, Level B (modified, see Table V)
b) Group A Inspection (See Table VI)
c) Group B Inspection (See Table VII)
d) Group C Inspection (See Table VIII)

7.4 Acceptance Testing

Each Flight Production Model MCXO delivered in accordance to this document shall have been subjected to and passed screening tests prior to delivery when specified by the purchase order. Screening and testing will be performed per an approved acceptance test procedure.

7.5 Group A Inspection

When specified on the purchase order, Group A Inspection shall be in accordance with MIL-PRF-55310 with the parameters defined in Table IV and Table VI.

7.5 Group B Inspection

Group B Inspection (Aging test) shall be in accordance with MIL-PRF-55310 and as specified in Table VII.

7.5 Group C Inspection

When specified on the purchase order, Group C Inspection shall be in accordance with MIL-PRF-55310 with the parameters defined in Table VII.

7.6 Deliverable Documentation

7.6.1 Data Package

One copy of the test data report shall be delivered with each MCXO. The report shall include:

a) The test data sheets recorded during the test program,
b) Failure reports and analysis (if applicable),
c) Deviations and waivers (if applicable),

The test data report shall be traceable to the oscillator it represents.

7.6.2 Certificate of Conformance

A Certificate of Conformance shall be provided as part of the delivered documentation.

7.6.3 Parts List

Upon request, an As-Designed Parts, Materials, and Processes List (ADPMPL) and an As-Built Parts, Materials, and Processes List (ABPMPL) shall be created and delivered in Microsoft Excel or other approved format. The ADPMPL shall be provided, at a minimum, 60 days prior to the start of assembly of the first lot of parts and the ABPMPL shall be delivered with the flight lot.

Note: The As-Designed Bill of Materials (BOM) shall be included as part of the final data package.

7.8 Manufacturing Changes

No changes shall be made to the design that affects the quality, reliability, or electrical interchangeability of the devices without written notification and approval of the procurement authority of the customer.

7.9 Source Inspection

The customer may choose to perform Source Inspection (Pre-cap and Final).

7.10 Counterfeit Parts Protection

Parts traceability to the original manufacturer or authorized distributor shall be provided.

8. Preparation for Delivery

8.1 Preservation, Packaging, and Packing

Crystal oscillators shall be prepared for delivery in accordance with MIL-PRF-55310.

8.2 Electrostatic Discharge Sensitivity

The devices supplied in this data sheet shall be considered to be electrostatic discharge-sensitive and require further protection and shall use one of the packaging requirements in accordance with MIL-PRF-38534, Category A, Section 5.

9. Marking

9.1 Marking material

Marking may be accomplished with permanent ink. Ink shall meet outgassing and marking permanency requirements for space applications.

9.2 Marking Content

Each MCXO shall be marked with the following information (reference page 3 for image):

a) Supplier Name and/or Cage Code
b) Part Number (per ordering information)
c) Lot Date Code
d) Unit Serial Number

Table I - Maximum Ratings

Parameter	Symbol	Minimum	Maximum	Units
Maximum Applied Voltage	V_s	0	5.5	Volts (V)
Operating Temperature Range	T_c	-40	+85	°C
Storage Temperature	T_{STO}	-55	+105	°C
Thermal Resistance		-	38.5	°C/W
Thermal Resistance		-	94.5	°C/W
Junction Temperature	-	-	+88.5	°C

Table II - Electrical Performance Characteristics (Frequency Mode)

Parameter	Symbol	Test Condition	Value	Unit
Frequency, nominal	f_0	-	5.000 - 100.000	MHz
Supply Voltage, nominal	V_s	-	3.3 ± 5%	V
Power Consumption (max.)	Ps	$f_0 \leq$ 50MHZ	50	mW
		50 $\leq f_0 \leq$ 100MHZ	90	mW
Initial Accuracy	Fnom	Nominal V_s, Ta = +25°C	± 10	ppb
Frequency Stability vs. Temperature	$\Delta f/f_c$(Ta)	See ordering codes on page 2		ppb
Frequency/Voltage Variation	$\Delta f/f_c$ (V_s)	± 5% V_s change	± 20	ppb
Frequency/Load Variation	$\Delta f/f_c$ (Load)	HCMOS 10kΩ/15pF ±5% load change / Sine Wave 50Ω ± 5%	± 20	ppb
Aging (max.) Note 1	$\Delta f/ f_0$	Per Day	± 1.0	ppb
		Over 10 Years	± 1.0	ppm
		Over 20 Years	± 1.5	ppm
Output Voltage, Low (VOL)	-	3.3V	10% V_s	V
Output Voltage, High (VOH)	-	3.3V	90% V_s	V
Output Power (Sine Wave)	-	3.3V	3dBm ± 3dB	-
Output Waveform Symmetry	-	Over Operating Temperature	50 ± 10 / N/A	%
Rise/Fall Time (max.)	-	Over Operating Temperature	3 / N/A	ns.
Start-Up Time (max.)	-	At cold temperature, Nominal V_s	1.5	sec.
Stabilization Time (max.)	-	To Frequency vs. Temperature Stability Over Operating Temperature	15	sec.
Phase Noise Jitter	-	1 kHz to 20 MHz	1	ps.
Spurious (max.)	-	+25°C, > 1 kHz offset	-100	dBc
Phase Noise @ 10 MHz	-	10Hz 100 Hz 1 kHz 10 kHz 100 kHz	-110 -135 -150 -163 -168	dBc/Hz

Note 1: Breadboards are only guaranteed to be within ±1.5ppm over 5 years. Specification shown applies to code E and N parts.

Table II (cont.) - Electrical Performance Characteristics (Timekeeping Mode)

Parameter	Symbol	Test Condition	Value	Unit
Frequency, nominal	Ft	Over Operating Temperature	1	PPS
Power Consumption (max.)	Ps	Nominal V_s, Ta = +25°C (No load)	70	mW
Frequency Stability vs. Temperature	$\Delta f/f_c$(Ta)	See ordering codes on page 2		ppb
Output Waveform	-	-	HCMOS 3.3V	-
Symmetry	-	Over Operating Temperature	50 ± 5	%
Rise/Fall Time (max.)	-	Over Operating Temperature	100	ns.
Start-up Time (max.)	-	Over Operating Temperature	500	ms.
Period Jitter	-	-	5	ns.

Table III - Sychronization Options

Pin #	26	30	**Mode** *All operations performed in "Frequency Mode" (Pin #5)*
Function	Sync 1	Sync 2	
Logic Level	0	0	Aging adjustment when signal present on pin #1
	0	1	Output frequency locked to 10 MHz signal on pin #1
	1	0	Output frequency locked to 1 PPS signal on pin #13
	1	1	Reference signals ignored

Table IV - Testing for Engineering Model Units (Option E)

Example: QT2020CCE - 10.000MHz

Test Description	MIL-STD	Method	Condition	QTY	Comments
Internal Visual	883	2009	-	100%	Performed as function of Assembly
Stabilization Bake	883	1008	+85°C for 24 hours min.	100%	
Seal Test, Fine and Gross Leak					
Final Electrical Test (Frequency Mode)	55310	See Table V	See Table V	100%	
Final Electrical Test (Timekeeping Mode)	55310	See Table V	See Table V	100%	
External Visual	883	2009	-	100%	

Notes:

1. For breadboard-level units, please contact Q-Tech sales.

2. Unless otherwise specified on the PO, Engineering and Breadboard Model units do **not** undergo Screening.

Table V - Screening (Option N)

Test Description	MIL-STD	Method	Condition
Initial Electrical Test			
Frequency Mode			
Initial Accuracy	55310	4.8.6	+25°C
Frequency Stability vs. Voltage Variation		4.8.14	
Frequency Stability vs. Load Variation		4.8.15	
*Power Consumption		4.8.5.1	
*Rise/Fall Time (CMOS)		4.8.22	
Output Voltage (CMOS)/Output Power (Sine)		4.8.21	
Output Waveform Symmetry		4.8.5.1	
Harmonics (Sine)		4.8.24	
Spurious & Phase Noise		4.8.25, 4.8.17.1	
*Start-up Time		4.8.29	
Stabilization Time		4.8.8	
Timekeeping Mode			
1PPS Output Waveform			
1PPS Output Frequency			
Duty Cycle			
Period Jitter			
Random Vibration (non-operating)	202	214	I-B, 7.56 Grms, 5 min. each axis
****Pre-Thermal Shock Electrical Test**	55310	4.8.21	+25°C
Thermal Shock	202	107	A-1, 25 cycles from -55°C to +85°C
Pre-Burn-in Electrical Test			
Power Consumption	55310	4.8.6	+25°C, ambient pressure
Initial Accuracy	55310	4.8.5.1	
Output Voltage (CMOS)/Output Power (Sine)	55310	4.8.20	
Output Waveform Symmetry	55310	4.8.21	
Burn-In (Load)	55310	Table II	Max Operating Temperature, 160 Hours
****Post-Burn-in Electrical Test**	55310	4.8.21	+25°C
Seal Test (Fine and Gross Leak)	883	1014	A1 and C
External Visual	883	2009	-
*****Aging	55310	Type 7 Aging Prediction	+70°C ± 3°C, 30 days
*****Final Electrical Test**	55310	4.8.8	****+25°C, low and high temperature

* = Parameter is tested in both Frequency Mode and Timekeeping Mode.
** = Test sequence is the same as Pre-burn-in electrical testing.
*** = Test sequence is the same as Initial Electrical Test.
**** = Only Power Consumption, Output Voltage, Output Waveform Symmetry, Rise/Fall Time, and Start-up time are tested over temperature. All other parameters are tested at +25°C
***** = With the consent of customer, aging may be terminated at any time after 15 days (instead of 30 days).

Table VI - Group A Inspection (When specified on the Purchase Order)

Test Description	Standard	Condition	Notes
Power Consumption	MIL-PRF-55310	4.8.5.1	-
Initial Accuracy	MIL-PRF-55310	4.8.6	-
Start-up Time	MIL-PRF-55310	4.8.29	-
Stabilization Time	MIL-PRF-55310	4.8.8	-
Frequency Stability vs. Temperature	MIL-PRF-55310	4.8.10.1	-
Frequency Stability vs. Voltage Variation	MIL-PRF-55310	4.8.14	-
Frequency Stability vs. Load Variation	MIL-PRF-55310	4.8.15	-
Phase Noise	MIL-PRF-55310	4.8.17.1	-
Output Voltage (CMOS)	MIL-PRF-55310	4.8.21.3	-
Rise and Fall Time (CMOS)	MIL-PRF-55310	4.8.22	-
Duty Cycle (CMOS)	MIL-PRF-55310	4.8.23	-
Harmonics (Sine Wave)	MIL-PRF-55310	4.8.24	Note 1
Spurious (Sine Wave, CMOS)	MIL-PRF-55310	4.8.25	-

Notes:
1. No limits are specified, and the measurement is taken for information purposes only.
2. All electrical performance tests shall be performed during Group A with the exception of any tests performed as part of final electrical testing during 100 percent screening.

Table VIII - Group C Inspection (When specified on the Purchase Order)

Subgroup	Test Description	MIL-STD Condition	Quantity
1	Shock (non-operating)	MIL-PRF-55310, Paragraph 4.8.41.1 MIL-STD-202, Method 213, Condition F	All units
	Random Vibration (non-operating)	MIL-PRF-55310, Paragraph 4.8.39.3 MIL-STD-202, Method 214, Cond. I-B, 5 min./axis	
2	Thermal Shock	MIL-PRF-55310, Paragraph 4.8.45 MIL-STD-202, Method 107, Cond. A-1, 10 cycles	1/2 Units - B Level
	Ambient Pressure (operating)	MIL-PRF-55310, Paragraph 4.8.46.2 MIL-STD-202, Method 105, 8.0E-5 mBar	
	Storage Temperature	MIL-PRF-55310, Paragraph 4.8.47	
3	Resistance to Soldering Heat	MIL-PRF-55310, Paragraph 4.8.49 MIL-STD-202, Method 210, Cond. C	1/4 units
	Moisture Resistance	MIL-PRF-55310, Paragraph 4.8.50 MIL-STD-202, Method 106	
	Salt Atmosphere	MIL-PRF-55310, Paragraph 4.8.51 MIL-STD-883, Method 1009, Cond. A	
4	Terminal Strength (Lead Integrity)	MIL-PRF-55310, Paragraph 4.8.52.2 MIL-STD-202, Method 211, Cond. C	1/4 units
	Resistance to Solvents	MIL-PRF-55310, Paragraph 4.8.54 MIL-STD-202, Method 215	

Figure 1 - Typical Phase Noise Plot (QT2020CCE-20.000MHz)

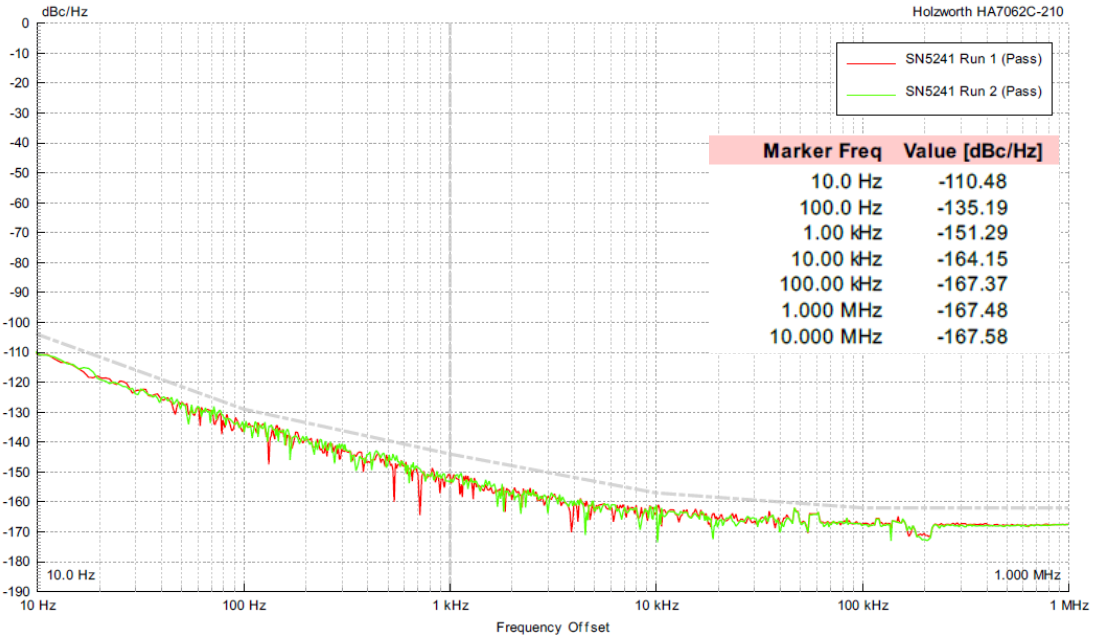


Figure 2 - Typical Temperature Stability

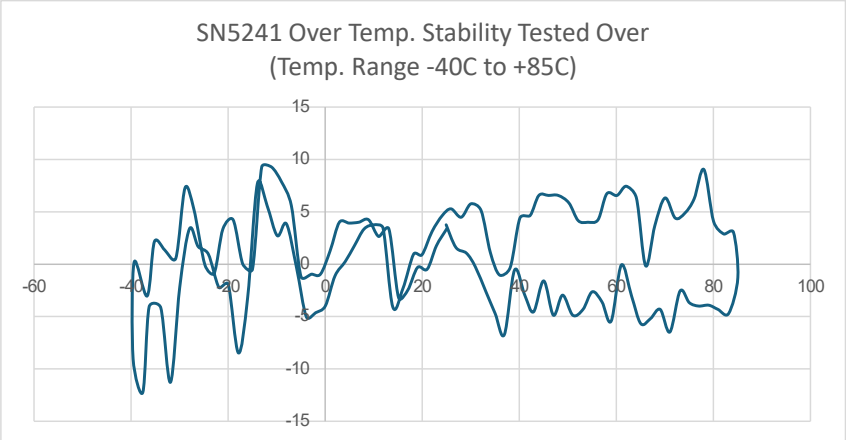
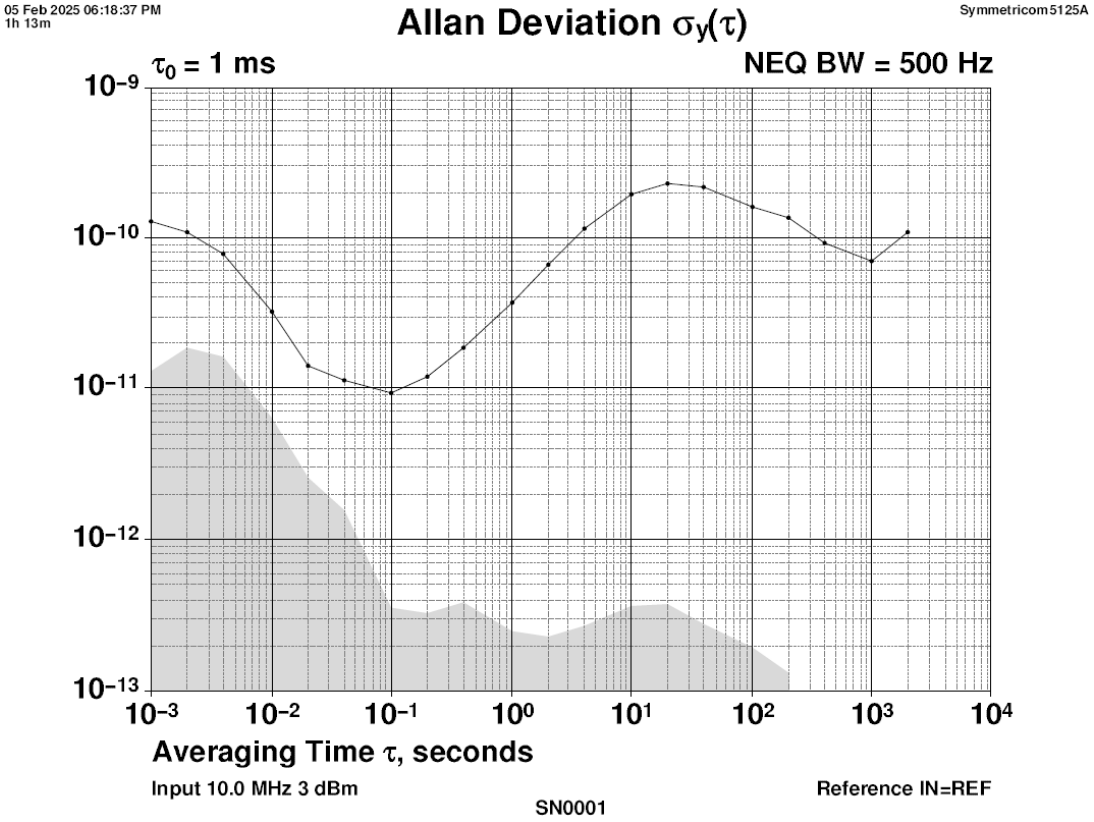


Figure 3 - Typical Allan Deviation Plot (10.000MHz)



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1h 13m

Symmetricom 5125A

Allan Deviation $\sigma_y(\tau)$

Avg. Time (s)	Allan Deviation $\sigma_y(\tau)$	Noise Floor
0.001	1.2580×10^{-10}	1.30649×10^{-11}
0.002	1.0907×10^{-10}	1.84645×10^{-11}
0.004	7.841×10^{-11}	1.61936×10^{-11}
0.01	3.1898×10^{-11}	6.28601×10^{-12}
0.02	1.3931×10^{-11}	2.55971×10^{-12}
0.04	1.1469×10^{-11}	1.56102×10^{-12}
0.1	9.268×10^{-12}	3.51953×10^{-13}
0.2	1.206×10^{-11}	3.25361×10^{-13}
0.4	1.870×10^{-11}	3.80796×10^{-13}
1	3.72×10^{-11}	2.50941×10^{-13}
2	6.64×10^{-11}	2.27444×10^{-13}
4	1.145×10^{-10}	2.68460×10^{-13}
10	1.93×10^{-10}	3.66571×10^{-13}
20	2.24×10^{-10}	3.73172×10^{-13}
40	2.16×10^{-10}	2.79439×10^{-13}
100	1.61×10^{-10}	1.92060×10^{-13}
200	1.35×10^{-10}	1.30132×10^{-13}
400	9.1×10^{-11}	
1000	6.9×10^{-11}	
2000	1.1×10^{-10}	

τ_0 = 1 ms NEQ BW = 500 Hz

Revision Log

DCO	Revision	Revision Summary	Page(s) Affected	Date
	-	Split off QT2021 from QPDS-0138 Rev. G	All	04/09/25
		Added Random Vibration to N-level screening		
		Added recommended land pattern		
		Initial Release		