

Q-Tech Corporation's Proposed Solution for Megaconstellations

APPLICATION NOTE QTAN-111 Rev B (April 2017)

I. INTRODUCTION

Q-Tech Corporation, a US based high-reliability manufacturer of state-of-the-art hybrid crystal oscillators, and the longtime leader in clock oscillators for space applications, is pleased to introduce a proposal for products used as primary clocks in electronics systems in small communication and broadcasting satellites for Megaconstellation, One Web, Cube-Sat projects in Low and Medium Earth Orbits. After observing industry trends and studying the requirements for high volume clocks for these projects, Q-Tech proposes a set of consistent and effective design and testing characteristics that will deliver optimal performance to the market. By allowing standardization around these, buyers of Megaconstellation, One Web clocks will all reap delivery and cost- saving benefits designed for procurements of 1,000 to 10,000pcs at a low price point.

Our QT778, QT781 to QT790, and QT792 to QT794 series clocks are cost effective but also use the proven designs that have flown on very many satellites. As such it uses very rad tolerant die that are good up to a minimum of 50kRad(Si) Total Dose Ionization with full configuration management control to guarantee products uniformity on all lots shipped.

Q-Tech proposes using our most cutting edge small design options for the LEO Megaconstellation market. Both Q-Tech's 5x7mm and 7x9mm packages are offered in SMD and leaded configurations allowing engineering the upmost flexibility, while Q-Tech's company-wide configuration and design control ensure each oscillator delivered is consistent with others in its family. This new series of high-reliability, low cost, radiation tolerant capable hybrid crystal oscillators will be offered in various hermetically sealed metallic and ceramic packages, small and SMT footprints, all voltages from 1.8Vdc to 5Vdc, CMOS and LVDS logic, and frequency range from 230kHz to 162.5MHz.

Produced and tested on the same line as our most stringent space qualified oscillators, these parts are made with the same Q-Tech quality and reliability that has flown for over 35 years. The design has been tested to 20,000g's shock with no problems, and is very mature as Q-Tech has shipped tens of thousands of class B and many hundreds of class S of this configuration over the last several years. Commercial-grade oscillator solutions may offer appealing prices, but the dependability of these solutions should make them unacceptable for flight use. Q-Tech

manufacturing is tried and tested, with the same methodology and accountability in place on all manufacturing efforts allowing our customers to receive extremely reliable, mature, rugged clock oscillator built and tested in the USA at Q-Tech, at a very low price.

II. GENERAL REQUIREMENTS

Products delivered to this specification possessed the following characteristics:

- 1) All passive meet or exceed Element Evaluation per military MIL-PRF-55310, Level B and Automotive Grade 0 (-40°C to +150°C) AEC-Q100.
- 2) Premium Q, cultured quartz resonators
- 3) Class H/B microcircuits, procured from wafer lots that have passed MIL-PRF-55310 element evaluation, with radiation tolerant capable both Total Ionizing Dose and Single Event Effects.
- 4) 100% screened per MIL-PRF-55310, Level B with additional PIND test.
- 5) Products passed and exceeded the environmental qualification levels of MIL-PRF-55310 which included:
 - a. Random Vibration (non-operating), per MIL-STD-202, Method 214, Cond. I-K, 46.320gRMS
 - b. Mechanical Shock (non-operating), per MIL-STD-202, Method 213, Cond. F, 1,500g, 0.5ms, half-sine.

III. PART NUMBERING

The part numbering consists of a prefix “7” following by the package styles, supply voltage, logic, frequency stability code, and frequency. The codes selection are standard on our Q-Tech data sheets. For example:

QT784LD11M-24.000MHz (SMT, 5x7mm, 3.3Vdc, tristate, ±50ppm, -40°C to +85°C)

Hot Solder Dip Sn60Pb40 per MIL-PRF-55310 is available and may be selected using a “QS” part number. For example:

QS778LD9M-48.000MHz (SMT, 4 J-lead, 9x14mm, 3.3Vdc, tristate, ±50ppm, -55°C to +125°C, solder dipped leads)

IV. SCREENING FLOW

Step No.	Description	MIL-STD/Test Method
1	Internal Visual Inspection	Pre-seal
2	Source Pre Cap Visual Inspection (optional)	
3	Stabilization bake (883/1008, Cond. C)	
4	Temperature Cycling	883/1010, Cond. B, 10 cycles
5	Constant Acceleration	883/2001, A (5,000g), Y1 axis,
6	Particle Impact Noise Detection (P.I.N.D)	883/2020, Cond. B
7	Pre Burn-In	+25°C
8	Burn-In	883/1015, +125°C, 160 hrs
9	Final Electrical tests	+25°C and extreme temperatures
10	PDA	10% supply current only
11	Seal Fine Leak	883/1014 A1 5x10E-8 atm-cc/s He
12	Seal Gross Leak	883/1014 C
13	External Visual	883/2009

V. QUALITY CONFORMING INSPECTION

Group A, B, and C inspections are optional per Purchase Order in a sampling basis or 100%. Group C generic data is available upon request