DETAIL PRODUCT

SPECIFICATION CONTROL DRAWING

Revision Record

Revision	DCO	Description	Eng. Approval Initials and Date	QA Approval Initials and Date	Release Date
–		Initial release			5/28/08
A		Updated part numbers	LV RS	CA	1/9/09
B		Edited part numbers	LV RS	CA	6/21/09
C		Edited Environmental Conditions, added temperature range options.	LV RS	CA	12/2/10
D		Changed par. 3.1.1 split supply and load variation from frequency stability vs. temperature characteristics; changed phase noise note; split current for lower supply voltage. (ECO 10551)	LV BR	CA	7/24/12
E	2223	Section 3.1.1 Electrical Characteristics: Parameter: Freq. stability vs. ±5 % Input Voltage Variation, Max; Value: WAS: ±1.2 for Vss= 5 and 3.3V ±0.3 for Vss= 5 and 3.3V IS: ±1.2 for Vss= 5 and 3.3V ±0.3 for Vss= 12	LV JL 10/2/13	CP 10/2/13	10/2/13

UNLESS OTHERWISE SPECIFIED
Dimensions are in Inches
Tolerances

Decimal	Fraction	Angular
.xxx ± .005		
.xx ± .02	$x/x \pm 1/16$	x° ± 2°
.x ± .1		

Initial Release

Prepared	Date
Luis Vargas	5/28/08
Checked	**Date**
Craig Albright	2/10/09
Engineering Approval	**Date**
Ron Stephens	2/10/09
Quality Assurance Approval	**Date**
Craig Albright	2/10/09
Released	**Date**
Alfred Min	2/10/09

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LOW PROFILE 24 PIN DDIP HYBRID CRYSTAL OSCILLATOR, TCXO, CLASS S, STANDARD DESIGN FOR SINE WAVE UP TO 150MHz

DRAWING NO.	REVISION
QT804, QT805 and QT806 Sine-Wave 24 DDIP	**E**

SCALE	SIZE	CAGE CODE	PAGE
NONE	A	51774	**1 of 10**

1.0 SCOPE

This specification establishes the detail requirements for low profile hybrid, hermetically sealed, HCMOS output temperature compensated crystal oscillators (TCXO) Type 3, Class 2 (Reference MIL-PRF-55310).

2.0 APPLICABLE DOCUMENTS

The following documents of the latest issue form a part of this drawing to the extent specified herein.

2.1 Specifications and Standards

SPECIFICATIONS	
MILITARY	
MIL-S-19500	Semiconductor Devices, General Specification For
MIL-PRF-55310	Crystal Oscillators, General Specification For
MIL-PRF-38535	Integrated Circuits, (Microcircuits) Manufacturing, General Specification For
MIL-PRF-38534	Hybrid Microcircuits, General Specification For
STANDARDS	
MILITARY	
MIL-STD-202	Test Methods for Electronic and Electrical Component Parts
MIL-STD-883	Test Methods and Procedures for Microelectronics
MIL-STD-1686	Electrostatic Discharge Control Program for Protection of Electrical and Electronics Parts, Assemblies and Equipment.

2.2 Conflicting Requirements

In the event of conflict between requirements of this specification and other requirements of the applicable detail drawing, the precedence in which requirements shall govern, in descending order, is as follows:

a) Applicable Customer purchase order.

b) Applicable detail drawing.

c) This specification.

d) Other specifications or standards referenced in 2.1 herein.

2.3 Customer Purchase Order Special Requirements

Additional special requirements shall be specified in the applicable Customer purchase order when additional requirements or modifications specified herein are needed for compliance to special program or product line requirements.

3.0 PERFORMANCE REQUIREMENTS

3.1 General Definition

The TCXO is a high reliability signal generator that provides a sine-wave output. The TCXO has been designed to operate in a spaceflight environment with an expected lifetime in excess of 15 years. Lifetime is defined as the sum of operational and storage environments.

3.1.1 Electrical Characteristics

PARAMETER	SYMBOL	CONDITIONS	VALUE		UNIT
Frequency Nom.	fo	-	***See part number generation table***		MHz
Supply voltage, Nom.	Vs	Vs±5%	***See part number generation table***		V
Input Current, max.	Is	Vs, nom. / Ta=+25°C	30 for Vs= 12 and 15V	55 for Vs= 5 and 3.3V	mA
Freq. stability vs. Operating Temperature	Δf/fc (Ta)	***Contact factory for other options available***	***See part number generation table***		ppm
Electrical Frequency Adjustment Min. (when specified)	Δf/fo (ΔVcc)	±5 PPM Two options: 1) via an external select-at-test resistor connected from Pin 1 to Ground 2) Via External tuning voltage	±5.0 ***See part number generation table***		ppm
Freq. stability vs. ±5 % Input Voltage Variation, Max	Δf/fc (Vs)	±5 % Vs,, Ta=+25°C	±1.2 for Vss= 5 and 3.3V	±0.3 for Vss= 12	ppm
Freq. stability vs. ±5 % Load Variation, Max	Δf/fc (Load)	Vs, nom. / Ta=+25°C	±0.3		
Aging Max	Δf/fo	over 10 year (first year ≤ 1 ppm)	±5.0		ppm
Freq. stability vs. Vacuum	Δf/fo	Met by design, not tested	±0.2		ppm
Short term stability	Δf/fc(Δt)	Δt=1sec. (Allan Deviation)	0.001		ppm
RF Output		***Contact factory for other options available***	30 to 75 3rd	75.1 to 350 3rd X	MHz
Output level Min.		Sine Class S, 100 krads (Si) total dose Min	***See part number generation table***		dBm
Harmonics Max.			-20	-20	dBc
Sub-harmonics Max.			N/A	-20	dBc
Phase noise @ freq. offset **(Output Frequency up to 75 MHz)** ***See note A below***	£ (Δf) £ (Δf) £ (Δf) £ (Δf) £ (Δf)	Δf=10Hz Δf=100Hz Δf=1kHz Δf=10kHz Δf=100kHz	-80 -110 -135 -155 -155		dBc/Hz dBc/Hz dBc/Hz dBc/Hz dBc/Hz
Spurious		Under static conditions. Met by design, not tested.	-70	-70	dBc

Note A: ***For Frequencies between 75.1 MHz and 150 MHz phase noise degrades between 6 dbc/Hz to 9 dbc/Hz***

3.2 Absolute Maximum Rating

Supply Voltage	0 to +16.5 VDC	Note 1
DC Input Current	55 mA maximum	Note 1
Storage Temperature range	-62°C to +125°C	Note 1
Lead Temperature (Soldering, 10 seconds)	300°C	Note 1

Notes: 1 – without irreversible damages

3.2.1 Physical Characteristics

3.2.1.1 Dimensions - The TCXO outline dimensions and terminal connections shall be as shown in Figure 1 herein.

3.2.1.2 Weight - The TCXO shall weigh less than or equal to 25 grams.

3.2.1.3 Materials - The TCXO package body and lead finish shall be gold in accordance with MIL-PRF-38534.

3.3 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 3.3.1.

SCREENING FLOW CHART (Screening is performed on a 100% basis)	
Operation	
Non-Destruct Wire Bond Pull	100%, MIL-STD-883, Method 2023 (2.4 grams)
Internal Visual	MIL-STD-883, methods 2017 & 2032 condition K (class S). During the time interval between final internal visual inspection and preparation for sealing, hybrid crystal oscillators shall be stored in a dry, controlled environment as defined in MIL-STD-883, method 2017 or in a vacuum bake oven.
Stabilization Bake	48 hrs minimum @ +150°C MIL-STD-883, Method 1008 TC B
Thermal Shock	MI-STD 883, Method 1011, TC A
Temperature Cycling	MI-STD 883, Method 1010, TC B
Constant Acceleration	MIL-STD-883, Method 2001, TC A (5000 gs, Y1 Axis only)
PIND	MIL-STD-883, Method 2020, TC B
Electrical Test	Frequency, Output levels, Input Current@ +25°C
Burn-In (Powered with load)	+125°C for 240 hours
Seal Test (fine & gross)	100% Method 1014, (TC A1 for fine leak and TC C for gross leak)
Electrical Test	Frequency, Output levels, Input Current @ +25°C & Temp Extremes listed on the Electrical Specification
Radiographic	MIL-STD-883, Method 2012 class S
External visual	MIL-STD-883 Method 2009

Group A Inspection (Testing is performed on a 100% basis)					
PARAMETER	**SYMBOL**	**CONDITIONS**	**VALUE**		**UNIT**
Input Current, max.	Is	Vs, nom. / Ta=+25°C	30 for Vss= 12 and 15V	55 for Vss= 5 and 3.3V	mA
Freq. stability vs. Operating Temperature	Δf/fc (Ta)	Vs, nominal and over the operating temperature range indicated under part number definition	indicated under part number definition		ppm
Electrical Frequency Adjustment Min. (when specified)	Δf/fo (ΔVcc)	± Vs, nom. / Ta=+25°C as indicated under part number definition	indicated under part number definition		ppm
Output level Min.		Sine Class S, 100 krads (Si) total dose Min	indicated under part number definition		dBm
Harmonics/Harmonicas, Max.		± Vs, nom. / Ta=+25°C	-30		dBc
Phase noise @ freq. offset **(Output Frequency up to 75 MHz)** ***See note A below***	£ (Δf) £ (Δf) £ (Δf) £ (Δf) £ (Δf)	± Vs, nom. / Ta=+25°C Δf=10Hz Δf=100Hz Δf=1kHz Δf=10kHz Δf=100kHz	 -80 -110 -135 -155 -155		 dBc/Hz dBc/Hz dBc/Hz dBc/Hz dBc/Hz
External Visual		MIL-STD-883, Method 2009			

Note A: ***For Frequencies between 75.1 MHz and 150 MHz phase noise degrades between 6 dbc/Hz to 9 dbc/Hz***

Group B Inspection Testing shall be performed after completion of Frequency Aging and before parts are shipped			
SUB-GROUP	**TEST DESCRIPTION**	**CONDITION**	**QTY**
1	Frequency Aging	MIL-PRF-55310 Para 3.6.34.2	100%
2	Hermetic Seal 1/	Fine Leak – MIL-STD-883 Method 1014 Condition A1 Gross Leak – MIL-STD-883, Method 1014 Condition C	100%
3	Electrical 1/ (Go/NoGo)		100%

Group C Inspection1 Group C Electrical Inspections are performed on a 100% basis NOTE: Samples from Subgroup 1 may be divided and used for Subgroups 3 and 4 Inspections.			
SUB-GROUP	**TEST DESCRIPTION**	**CONDITION**	**QTY**
1	Vibration (random)	MI-STD 202 Method 214/ T.C. I-K (46Grms) for 3 minutes in each plane.	4 parts (0 failures)
	Shock	MI-STD 202 Method 213 T.C. F (1500g, 0.5ms half-sine pulse) 3 blows each direction of three axes (18 shocks total)	
	Electrical Test	Frequency, Output levels, Input Current @ +25°C & Temp Extremes listed on the Electrical Specification.	
	Hermetic Seal	Fine Leak – MIL-STD-883 Method 1014 Condition A1 Gross Leak – MIL-STD-883, Method 1014 Condition C	
	Electrical Test	Frequency, Output levels, Input Current @ +25°C & Temp Extremes listed on the Electrical Specification.	
	Temperature Cycling	MI-STD 883, Method 1010, TC B 100 cycles.	
	Electrical Test	Frequency, Output levels, Input Current @ +25°C & Temp Extremes listed on the Electrical Specification	
	Ambient Pressure (Non-Operating	2 MI-STD 202 Method 105 T.C. C	
	Electrical Test	Frequency, Output levels, Input Current @ +25°C & Temp Extremes listed on the Electrical Specification	
	Storage Temperature	Low Temp.of - 55 (+0, -5) °C HighTemp.of +150 (+5,-0) °C	
	Hermetic Seal	Fine Leak – MIL-STD-883 Method 1014 Condition A1 Gross Leak – MIL-STD-883, Method 1014 Condition C	
	Electrical Test	Frequency, Output levels, Input Current @ +25°C & Temp Extremes listed on the Electrical Specification	
3	Resistance to Soldering Heat	MI-STD 202 Method 210 T.C. B	1 parts (0 failures)
	Hermetic Seal	Fine Leak – MIL-STD-883,Method 1014 Condition A1 Gross Leak – MIL-STD-883, Method 1014 Condition C	
	Moisture Resistance	MI-STD 202 Method 106	
4	Terminal Strength (Lead Integrity)	MI-STD 202 Method 211 T.C. B	1 parts (0 failures)
	Visual Inspection		
	Hermetic Seal	Fine Leak – MIL-STD-883,Method 1014 Condition A1 Gross Leak – MIL-STD-883, Method 1014 Condition C	
	Resistance To Solvents	MI-STD 202 Method 215	

3.3.1 All piece parts shall be derived from lots that meet the element evaluation requirements of MIL-PRF-38534, Class K, with 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, to 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 purchase order.

3.3.2 Processes - Processes used for manufacturing the TCXO are selected on the basis of their ability to meet the quality requirements for space High Reliability manufacturing. Travelers or Process Cards are used in the manufacturing and testing of all of the TCXO Series, and might be available for customer review. Copies of these Travelers can be provided with the TCXOs at time of shipment if so specified on the purchase order.

3.3.3 Interchangeability - Each TCXO shall be interchangeable without using a special selection process.

3.3.4 Product Marking - Each unit shall be permanently marked with the manufacturer's name or symbol, part number, lot date code number, and serial number. The unit shall be marked with the outline of an equilateral triangle near pin 1 to show that it contains devices which are sensitive to electrostatic discharge.

3.4 Parts Program

Devices delivered to this specification represent the standardized Parts, Materials and Processes (PMP) Program developed, implemented and certified for advanced applications and extended environments.

3.4.1 Quartz Crystal Resonator - The crystal resonator used shall be constructed using a 4-point mount premium synthetic swept Quartz and procured to Q-TECH SCD. (For the Engineering models, non-swept quartz may be used).

3.4.2 Active devices – Radiation testing is not performed at the oscillator level, but these TCXOs have been acceptable for use in environments up to 100K rads by analysis of the components used. ONLY Bipolar semiconductors are employed in the design. This device is specified to be radiation tolerant to:
100 kRad(Si) total ionizing dose(TID)

3.4.3 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.

3.5 Traceability Requirements

Material, element and process traceability requirements shall be as specified by MIL-PRF-38534 for Class K hybrids.

3.6 Data

3.6.1. Design Documentation - When required by the purchase order, design, topography, process and flow charts for all assembly/inspection and test operation for devices to be supplied under this specification on the initial procurement shall be established and shall be available in-plant for review by the procuring activity upon request. This design documentation shall be sufficient to depict the physical and electrical construction of the devices supplied under the specification and shall be traceable to the specific parts, drawings or part type numbers to which it applies, and to the production lot(s) and inspection lot codes under which devices are manufactured and tested so that revisions can be identified.

3.6.2. Technical Data Package - When required by the purchase order, the following design documentation and information is deliverable 30 days prior to the start of production. The Technical Data Package shall consist of the following:

a) Assembly drawing(s).

b) All electrical schematics and drawings *not considered proprietary*.

c) The assembly and screening travelers to be used on-line to manufacture the devices supplied to this specification.

d) Parts and materials list.

e) Element evaluation data confirming compliance with MIL-PRF-38534, Class K, and Prohibited Materials paragraph 3.4.3

3.7 Test Report

A test report is supplied with each shipment of oscillators and includes the following information, as a minimum:

a) A Certificate of Conformance to all specifications and purchase order requirements. As a minimum, the Certificate of Conformance shall include the following information:

Purchase order number.

Applicable part number.

Manufacturers lot number.

Lot date code.

b) Parts and materials traceability information.

c) Certificate of crystal sweeping.

d) Manufacturing lot traveler.

e) Screening attributes and variables data as applicable.

f) Quality conformance inspection attributes and variables data as applicable.

g) Radiographic inspection negatives.

3.8 Engineering Models

Engineering Models are fit, form, and function representative of Flight Models and of commercial construction using commercial parts of same generic type as Flight Models. Completed oscillators are not screened.

NOTES:

This oscillator is offered to meet the specifications above and is not guaranteed to meet any other requirements.

■ PART NUMBER GENERATION

SERIES	Output type and supply voltage	TEMPERATURE RANGE (°C)	Stability Over Temperature	External Tuning	Level	FREQUENCY (MHz)
QT80: 24 Pin Double Dip	4: SINE WAVE 0 dBm …..5V	N: 0…+50……	±1 ppm	X: No tuning	E: Eng. Model	10……150
	5: SINE WAVE +7dBm ….12V	P: 0…+70……	±1 ppm	R: External resistor	M: Flight Model	
	6: SINE WAVE 7dBm …..15V	Q: 0…+70……	±2 ppm	V: External voltage		
		R: 0…+70……	±5 ppm			
		U: -20…+70……	±1 ppm			
		V: -20…+70……	±2 ppm			
		W:-20…+70……	±5 ppm			
		X: -40…+85……	±4 ppm			
		Y: -40…+85……	±5 ppm			
		Z: -40…+85……	±10 ppm			
		A: 0…..+50……	± 0.5ppm			
		G: 0….+70……	± 0.5ppm			
		H:-30…+70……	±2 ppm			
		K:-30…+70……	±4 ppm			
		(See note 1 below)				

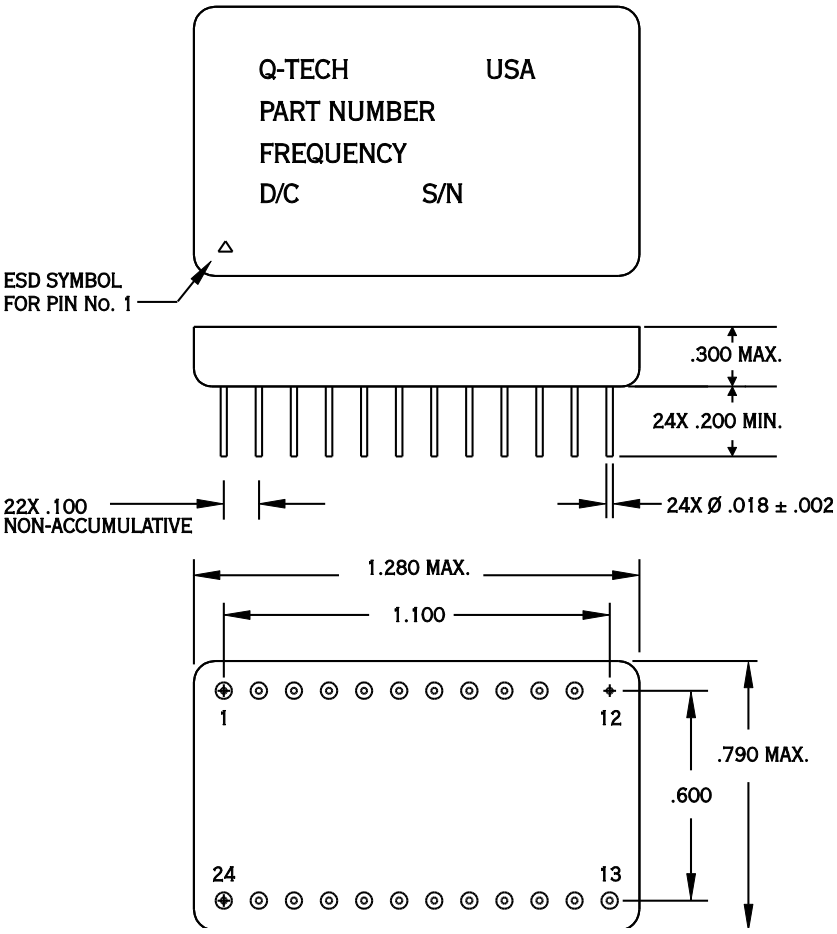
1. Variations from standard specification are available, please contact factory.

EXAMPLE:

QT805URM-100.000000 would be a Flight Model version HF TCXO, 24 pin Double Dip, sine-wave 12 volts, stability ±1 ppm over -20…+70°C, @ 100 MHz with external tuning via external resistor.

QT805URE-100.000000 would be a Engineering Model version HF TCXO, 24 pin Double Dip, sine-wave 12 volts, stability ±1 ppm over -20…+70°C, @ 100 MHz with external tuning via external resistor.

FIGURE 1 INTERFACE CONTROL DRAWING
24 pin DDIP



PIN NO.	DESIGNATION
1	External Frequency Adjustment (when specified)
2 - 11	NC
12	Ground/Case
13	RF Output
14 - 23	NC
24	Supply Voltage

NOTES:

- Dimensions are in inches.
- Lead numbers are for reference only and are not marked on the unit.
- A triangle symbol is marked on the corner of the package to indicate Pin 1
- All pins with NC function may not be connected as external tie or connections (Pins may be connected internally).