



### Specification Control Drawing

#### Scope

- Scope
- Part Number

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- Standards - Military
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## REVISIONS

REVISION	DESCRIPTION	APPROVED	DATE
-	Initial release		11/1/06
A	Correct Table V Subgroup 4 method and conditions		12/4/06

**GENERAL RELEASE DOCUMENT.  
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<b>SPECIFICATION CONTROL DRAWING</b>				<b>Q-TECH CORPORATION</b>			
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES.  TOLERANCES: 3 PLACE DECIMAL = .005 2 PLACE DECIMAL = .02 1 PLACE DECIMAL = .1 FRACTIONS = ± 1/16 ANGLES = 2 DEGREES	PREPARED BY	DATE	10150 W. JEFFERSON BLVD. CULVER CITY, CA. 90232-3510				
	E.Jackson		<b>HYBRID CRYSTAL OSCILLATOR, TCXO, CLASS S, GENERAL SPECIFICATION</b>				
	CHECKED BY	DATE					
	B.Remtulla		DRAWING NO.:	<b>401-0298-017</b>			REVISION
	RELEASE BY	DATE				<b>A</b>	
	T.Mitchell		SCALE	SIZE	CAGE CODE	SHEET 1 of 12	
		<b>NONE</b>	<b>A</b>	<b>51774</b>			

**1 SCOPE**

- 1.1 Scope. This specification establishes the general quality and reliability requirements for a family of hybrid, hermetically sealed, temperature compensated crystal oscillators (TCXO's) for use in space flight missions. Oscillators shall be produced by a manufacturer presently listed on the MIL-PRF-55310 QPL (Qualified Products List).
- 1.2 Part number. The part number shall be as specified in the detail specification.

**2 APPLICABLE DOCUMENTS**

- 2.1 Specifications and Standards. Unless otherwise specified, the following documents shall be applicable to this specification to the extent specified herein.

**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-975 NASA Standard Electrical, Electronic, and Electromechanical (EEE) Parts List

- 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 REQUIREMENTS**

- 3.1 Item Requirements. The individual item requirements shall be as specified herein and the detail specification.
- 3.2 Case Outline. The case outline and terminal connections shall be as specified in the detail specification.
  - 3.2.1. Maximum Ratings. Unless otherwise specified, the maximum ratings shall as specified in the detail specification.

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- 3.3 Electrical Performance Requirements. The electrical performance requirements shall be as specified herein and the applicable detail specification.
- 3.4 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 3.4.3 herein.
- 3.4.1. Radiation Hardness. No elements shall be used in the unit that latch-up in a single event upset (SEU) environment. All devices used in the unit shall be capable of meeting all electrical performance requirements after being subjected to the total dose level specified in the detail specification.
- 3.4.2. Element derating. 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 derated values.
- 3.4.3. 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.
- 3.4.4. Quartz crystal material. Unless otherwise specified by the detail specification, the quartz crystal material shall be swept synthetic, grade 2.2 or better.
- 3.4.5. Crystal Mounting. The crystal element shall be three or four point minimum mounted in such a manner as to assure adequate crystal performance when the oscillator is subjected to the environmental conditions specified herein.
- 3.4.6. Thick Film Hybrid Technology. When possible, all piece part electronic elements (except the quartz crystal resonator) shall be mounted on the surface of thick film substrates. All lead attachment shall have appropriate strain relief. There shall be no solder allowed internally.
- 3.4.7. Package material and finish. The package material and finish shall be in accordance with MIL-PRF-38534 and as specified in the detail specification.
- 3.4.8. Lead material and finish. The lead material and finish shall be in accordance with MIL-PRF-38534 and as specified in the detail specification.
- 3.4.8.1 Maximum allowable leak rate. The maximum allowable leakage rate shall be as specified by MIL-STD-883, method 1014 based on the internal cavity volume. The hermetic seal (fine and gross leak) tests shall be in accordance with MIL-STD-883, Method 1014.

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- 3.4.8.2 Weight. The weight of the crystal oscillator shall be 15 grams maximum.
- 3.4.9. Electrical performance limits and conditions. Unless otherwise specified, the electrical performance limits and conditions shall be as specified in the detail specification.
- 3.4.9.1 Spurious Output Frequencies. The oscillator shall not break into unwanted modes of oscillations.
- 3.4.10. Delta Criteria. The crystal oscillator shall meet the parameter delta criteria of Table II herein. The change in the parameter (delta) shall be calculated between the initial measurement and the present (interim or final) measurement.
- 3.4.11. 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.
- 3.4.12. Traceability. Material, element and process traceability requirements shall be as specified by MIL-PRF-38534 for class K hybrids.
- 3.4.13. Rework provisions. Rework shall be in accordance with the provisions of MIL-PRF-38534 except rebonding to microcircuit elements shall be as specified by MIL-PRF-38534 and transistor elements shall be as specified by MIL-S-19500.
- 3.4.14. Prototype oscillators. The requirements for the prototype oscillators shall be as follows:  
a) Prototype oscillators need only meet the form, fit and function of the flight units.
- 3.4.15. Engineering Model (EM) Oscillators. The requirements for engineering model oscillators shall be as follows:  
a) Design and manufacturing processes shall be identical to flight units.  
b) Finished units shall be functional over the operating temperature range.  
c) Screening test and/or Quality Conformance Inspection is not required.  
d) Engineering model oscillators shall be suitably identified (see detail specification).

#### 4 QUALITY ASSURANCE PROVISIONS

- 4.1 Responsibility for Inspection. Unless otherwise specified in the contract or purchase order, the supplier shall be responsible for the performance of all inspection requirements as specified. Except as otherwise specified in the contract or purchase order, the supplier may use their own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by Customer. Customer reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements, and to return any product failing to meet the specified requirements.
- 4.2 Screening. Hybrid crystal oscillators shall have been subjected to and successfully passed all the screening tests as specified in table I herein in order to be acceptable for delivery. All variables data shall be read and record. Devices which fail any test criteria in the screening sequence shall be removed from the lot at the time of observation or immediately at the conclusion of the test in which the failure was observed. Once rejected and verified as a device failure, rework and subsequent rescreening in accordance with the rework provisions of may be performed. Devices which fail during screening may be used for Group B inspection provided that they have completed screening through completion of the burn-in testing.

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- 4.2.1. Nondestructive bondpull. Except for the wires connecting the crystal to the circuit (if applicable), 100 percent nondestructive bond pull, shall be performed on each hybrid crystal oscillator in accordance with MIL-STD-883, method 2023. The total number of failed wires and the total number of devices failed shall be recorded. The lot shall have a percent defective allowable (PDA) of 2 percent or less based on the total number of wires pulled in the production lot.
- 4.2.2. Internal visual inspection. Internal visual inspection shall be in accordance with the condition K (class S) requirements of MIL-STD-883, methods 2017 and 2032. 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. The following details shall apply:
- a) The final internal visual inspection shall occur after crystal resonator installation and prior to cover seal. Hybrid crystal oscillator inspection and preparation for sealing shall be in a class 100 environment as defined in Federal Standard 209. Hybrid crystal oscillators shall be in a covered container when transferred from one controlled environment to another.
- 4.2.3. Stabilization bake. Stabilization bake shall be performed prior to package seal. Stabilization bake shall be performed in a vacuum environment.
- 4.2.4. Temperature cycling. Unless otherwise specified, temperature cycling shall be in accordance with Table I herein.
- 4.2.5. Constant acceleration. Constant acceleration shall be performed in the Y1 orientation.
- 4.2.6. Particle impact noise detection (PIND) test. PIND testing shall be performed in accordance with MIL-STD-883, method 2020, condition B. The PIND test shall be performed using five independent passes and all failures found at the end of each pass are rejected. The survivors of the last pass are acceptable.
- 4.2.7. Pre burn-in electrical characteristics test. Unless otherwise specified, pre burn-in electrical testing shall consist of the tests listed in Table VII. Electrical performance limits shall be in accordance with the detail specification.
- 4.2.8. Burn-in. The burn-in period shall be 320 hours minimum. The 320 hour burn-in period shall be divided into two successive 160 hour minimum burn-in periods. Electrical testing shall be performed after the first burn-in to select acceptable devices for the second burn-in.
- 4.2.9. Interim electrical testing. Unless otherwise specified, interim electrical testing shall consist of the tests listed in Table VII. Electrical performance limits shall be in accordance with the detail specification.
- 4.2.10. Final electrical testing. Unless otherwise specified, final electrical testing shall consist of the tests listed in Table VII. Electrical performance limits shall be in accordance with the detail specification.
- 4.2.10.1 Delta limits review. Unless otherwise specified, delta limits shall be in accordance with Table II herein.
- 4.2.10.2 Percent defective allowable (PDA). The percent defective allowable shall be 2 percent or one device, whichever is greater. PDA accountability shall be based on failures occurring during the second half of burn-in only. PDA shall be applicable to the +25 °C static tests only.
- 4.2.11. Seal test. The seal test may be performed in any sequence between the final electrical test and the external visual but it shall be performed after all shearing and forming operations on the terminals. All hybrid crystal oscillators having any physical processing steps (e.g. solder dipping to the glass seal, etc.) performed following seal or external visual shall be retested for hermeticity and visual defects.
- 4.2.12. Radiographic Inspection. Radiographic inspection shall be performed in accordance with MIL-STD-883, method 2012. Views X, Y and Z axis.
- 4.2.13. Frequency aging. The energized oscillator(s) shall be maintained at a temperature of 70 ± 2°C for a continuous period of 30 days. Unless otherwise specified, the frequency of the oscillator shall be

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measured in accordance with MIL-PRF-55310. The measuring instrument's accuracy shall be commensurable with the required accuracy of the oscillator. The same measuring instruments shall be used throughout the aging test. If any condition develops that will change the temperature of the oscillator from the aging temperature for a time interval of more than one hour, no measurement shall be made until 24 hours after the temperature restoration and the specified test period shall be lengthened by the length of time that the temperature failed.

- 4.2.14. External visual. The final external visual screen shall be conducted in accordance with MIL-STD-883, method 2009 after all other 100 percent screens have been performed to determine that no damage to, or contamination of the package exterior has occurred.
- 4.3 Quality Conformance Inspection (QCI). Quality conformance inspection shall be as specified herein. All records shall be traceable to the lot number and unit serial number. Samples used for Group A that pass all tests may be delivered on contract.
  - 4.3.1. Oscillator Group A Inspection. Group A testing shall be in accordance with Table III. Group A inspection shall be performed on units that have passed the screening tests. All electrical performance tests of this specification shall be performed during Group A with the exception of any tests performed as part of final electrical testing during 100 percent screening.
  - 4.3.2. Oscillator Group B Inspection. Group B inspection shall be in accordance with Table IV. The screening test rejects may be used for this test.
  - 4.3.3. Oscillator Group C Inspection. Group C inspection shall be in accordance with Table V.
  - 4.3.4. Oscillator Group D Inspection. Group D inspection shall be performed per Table VI. The generic package evaluation data may be submitted to Customer for review in lieu of performing this test.
    - 4.3.4.1 Group D samples. Sealed empty packages that have been subjected to the handling and stress conditions may be used for Group D testing.
- 4.4 Destructive Physical Analysis (DPA). A DPA may be performed on each lot of devices in accordance with MIL-STD-883, Method 5009. The DPA shall be performed by the Customer.
- 4.5 Workmanship. Devices shall be manufactured, processed, and tested in a careful and workmanlike manner in accordance with good engineering practice, with the requirements of this specification, and with the production practices, workmanship instructions and inspections and test procedures prepared by the manufacturer in fulfillment of the product assurance program.
- 4.6 DATA.
  - 4.6.1. Design and Part Configuration Documentation. The manufacturer shall establish baseline documentation sufficient to completely define and control the configuration of devices supplied to this specification. The documentation shall form the basis for defining the device qualified to this specification and all devices supplied on subsequent procurement shall be the same as that qualified. No changes in construction, technology, or manufacturing processing shall occur without Customer approval.
  - 4.6.2. 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.
    - 4.6.2.1 Technical Data Package. When required by the detail specification or 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:

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- 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.

4.6.3. Design Documentation Approval. After the design documentation referenced in 4.6 is approved by Customer, any changes or revisions to these documents must be submitted for review and approval to Customer prior to processing subsequent lots, or at the time of placement of subsequent purchase order.

4.7 Test Report. A test report shall be supplied with each shipment of oscillators and shall include 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.

4.8 Problem Reporting. The manufacturer shall notify the Customer technical representative, within 24 hours, of the occurrence of the following:

- a) Any failures detected during quality conformance inspection.
- b) Delays resulting from test equipment breakdown, test error, or testing related problems that adversely affect the schedule.

4.9 Customer Source Inspection. Provisions for periodic in-process source inspection by Customer shall be included in the supplier's manufacturing plan if required by purchase order. The supplier shall provide Customer 72 hours minimum notice when the deliverable devices are ready for an in-process source inspection. The inspection points shall, as a minimum, be:

- a) Pre cap visual inspection.
- b) Prior to shipment inspection.

4.10 Retention of Records. All records pertaining to the design, processes, incoming receiving, in-process inspections, screening and quality conformance inspection, product lot identification, product traceability, failure reports and analyses etc., shall be retained by the vendor for a period of 10 years from the date of product shipment.

**5 PREPARATION FOR DELIVERY**

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- 5.1 Packaging. The requirements for packaging shall be in accordance with MIL-PRF-55310.
- 5.2 Electrostatic Discharge Sensitivity. The devices supplied to this drawing 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.

**6 NOTES**

- 6.1 Ordering Data. The contract or purchase order should specify the following:
- a) Customer part number.
  - b) Quality Conformance Inspection requirements.
  - c) Requirements for special technical documentation (see 4.6.2.1).
  - d) Test data requirements.
  - e) Special packaging.
  - f) Requirement for source inspection and notification.
- 6.2 Handling. The devices used must be handled with certain precautions to avoid damage due to electrostatic discharge.
- 6.3 Certificate of Conformance. Certificate of conformance to this specification, signed by an authorized representative of the manufacturer, shall accompany each shipment.

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**TABLE I. SCREENING TESTS**

TEST DESCRIPTION	STANDARD	METHOD	CONDITION	Comments
Non destructive bond pull	883	2023		2.4 grams
Internal visual	883	2017	K	Class S
Stabilization bake	883	1008	B	24 hours at 150 °C
Temperature cycling	883	1010	B	-55 °C to +125 °C
Constant acceleration	883	2001	A	Y1 direction only
Radiographic inspection	883	2012	Class S	
Particle impact noise detection (PIND)	883	2020	B	5 passes minimum (Note 1)
Pre burn-in electrical	Refer to Table VII and detail specification			
Burn-in	883	1015	+125 °C for 160 hours	Note 2
Interim electrical	Refer to Tables II, VII and detail specification			
Burn-in	883	1015	+125 °C for 160 hours	Note 2
Final electrical	Refer to Tables II, VII and detail specification			
Seal; Fine leak	883	1014	A1	
Seal; Gross leak	883	1014	C	
Frequency aging	MIL-PRF-55310	-	70 °C	Note 3
External visual	883	2009		

**NOTES:**

- 1) PIND testing shall be performed using five (5) independent passes and all failures found at the end of each pass are rejected. The survivors of the last pass are acceptable.
- 2) Burn-in shall be under the specified load and nominal voltage conditions.
- 3) Normally, frequency aging tests are for 30 days.
- 4) Percent defective allowable (PDA) of selected critical parameters is accountable from interim to final electrical testing.

**TABLE II. DELTA LIMITS**

Test	Parameter	Symbol	Delta Limits
Burn-in (Second 160 hour burn-in period)	Supply Current	I <sub>CC</sub>	±10% of initial reading
Frequency aging after 30 days at 70 °C	Output Frequency	F <sub>0</sub>	Refer to detail specification
Life test after 1000 hours at 125 °C	Supply Current	I <sub>CC</sub> (Life)	±10% of initial reading

**TABLE III. GROUP A INSPECTION**

TEST DESCRIPTION	CONDITION
Supply current	25 °C and temperature extremes
Initial accuracy	25 °C
Frequency / load stability	
Phase noise	
Acceleration Sensitivity	
Frequency - temperature stability	
Frequency - voltage tolerance	25 °C and temperature extremes
Output voltage	
Duty cycle (output waveform symmetry)	
Output rise and fall times	
Start-up time	

**TABLE IV. GROUP B INSPECTION (NOTE 1)**

SUBGROUP	TEST DESCRIPTION	MIL-STD-883		QUANTITY/ (ACCEPT NO.)
		METHOD	CONDITION	
1	Physical dimensions	2016	-	2 (0)
2	Resistance to solvents	2015	-	4 (0)
3	Internal visual and mechanical	2014	-	1 (0)
4	Bond strength (note 2)	2011	C or D	2 (0)
5	Die shear strength (note 3)	2019	-	2 (0)
6	Solderability (note 4)	2003	Solder temperature: 245 ±5 °C	1 (0)

**NOTES:**

- 1) Non catastrophic screening test rejects may be used for Group B.
- 2) Subgroup 4 shall be performed in accordance with the Group B bond strength requirements of MIL-PRF-38534. This test is may be performed in-process anytime prior to cover seal.
- 3) Die shear test samples shall not be the same units as subjected to bond pull. Die shear specimens shall not be exposed to the 300 °C preconditioning used for the bond strength test.
- 4) Solder temperature shall be 245 +5 °C.

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**TABLE V. GROUP C INSPECTION**

SUBGROUP	TEST DESCRIPTION	MIL-STD-883		QUANTITY/ (ACCEPT NO.)
		METHOD	CONDITION	
1	External visual	2009		5 (0)
	Temperature cycling	1010	B, 20 cycles	
	Constant acceleration	2001	A, Y <sub>1</sub> axis	
	Seal (fine & gross leak)	1014	A & C	
	Radiographic inspection	2012		
	Visual examination			
2	End point electricals			5 (0)
	Steady state life	1005	1000 hs @125°C	
	End point electricals			
3	Internal water vapor content	1018		3 (0) or 5 (1)
4	End point electricals			5 (0)
	Random Vibration (non-operating)	2026	Table I - K	
	End point electricals			
	Shock (non-operating)	2002	B	
	End point electricals			

- 1) Five units shall be used for Group C inspection based on limited usage acquisition requirements of MIL-PRF-38534.
- 2) End point electricals shall be as specified in the detail specification.
- 3) Subgroup 1 specimens may be used for Subgroup 3 testing.

**TABLE VI. GROUP D INSPECTION**

SUBGROUP	TEST DESCRIPTION	MIL-STD-883		QUANTITY/ (ACCEPT NO.)
		METHOD	CONDITION	
1	Thermal shock	1011	C	5 (0)
	Stabilization bake	1008	1 hour at 150 °c	5 (0)
	Lead integrity	2004	B2 (lead fatigue)	1 (0)
	Seal (fine and gross leak)	2028	D (LCC) rigid leads A & C	5 (0)

**TABLE VII. ELECTRICAL TEST - MEASUREMENT REQUIREMENTS**

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ELECTRICAL PARAMETERS	TEST STEP AND ENVIRONMENTAL CONDITION 2/												
	PRE BURN-IN @ 25 °C	PRE BURN-IN @ LOW TEMP.	PRE BURN-IN @ HIGH TEMP.	INTERIM BURN-IN @ 25 °C	POST BURN-IN @ 25 °C	POST BURN-IN @ LOW TEMP.	POST BURN-IN @ HIGH TEMP.	GROUP A @ 25 °C	GROUP A @ LOW TEMP.	GROUP A @ HIGH TEMP.	GROUP C @ 25 °C	GROUP C @ LOW TEMP.	GROUP C @ HIGH TEMP.
Output frequency	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓
Frequency / temperature stability	See note 1/			1/	1/			1/			1/		
Frequency / voltage stability	✓				✓	✓	✓	✓	✓	✓	✓	✓	✓
Frequency / load stability	✓				✓			✓			✓	✓	✓
Input current	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Output voltage	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Waveform	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Duty cycle (symmetry)	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Rise and fall times	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Start up time	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Phase noise					✓	3/	3/	✓	3/	3/	✓	3/	3/

✓= Required measurement

Notes:

- 1/ Measure the output frequency at ten equispaced points minimum of the specified operating temperature range or as specified in the detail specification.
- 2/ Temperature extremes shall be as specified by the detail specification.
- 3/ Perform phase noise on one randomly selected unit at 25 °C, low and high temperature limits in accordance with the detail specification. All other flight units shall be tested at 25 C only.

<b>Q-Tech Corporation</b> 10150 W. Jefferson Blvd. Culver City, Ca. 90232	SIZE <b>A</b>	CAGE NO. <b>51774</b>	<b>401-0298-017</b>	REV.
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