REV LTR	DESCRIPTION	DATE	APPVD.
-	Orig. Release	4/12/22	MLG
A	Updated Phase Jitter characteristics in Table I. Slight changes to Para. 1. and 4.1.	1/20/24	MLG

XE63K SERIES

HC/ACMOS OSCILLATORS

FOR SPACE & HI-REL APPLICATIONS

400 KHz to 125 MHz

(9 x 14 mm, J-Leads, SMD, 2.5V, 3.3V & 5.0V)

(Refer to Page 5 for Reduced QCI Models XE63E, XE63B & XE63P)

REV STATUS	REV																
OF SHEETS	SHEET NO.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

APPROVALS	DATE	XSIS ELECTRONICS, INC. 12620 W. 63rd Street, Shawnee, KS 66216 USA	
PREP. S. Gupta	4/12/22		
ENG. M. Gupta	4/12/22	XE63K SERIES HC/ACMOS OSCILLATORS	
Q. A. M. Gupta	4/12/22		
CUST. ENG.		FSC NO. 57051	DWG. NO. XE63K
CUST Q A.		SCALE N/A	SHEET 1 OF 11

1. SCOPE:

XE63K Series, HC/ACMOS, high reliability hybrid microcircuit crystal oscillators are designed, produced and tested by Xsis Electronics, Inc. as MIL-PRF-38534 (modified), Class K equivalent devices, as described herein, for use in high reliability industrial, military, avionics and space applications. These devices are of hybrid microcircuit technology conforming to MIL-PRF-55310, Type 1, Class 2 oscillators.

1.1 ALTERNATE MODELS: Models XE63E, XE63B and XE63P with reduced QCI and/or reduced screening and shorter lead times are also offered as explained on page 5.

2. APPLICABLE DOCUMENTS:

MIL-PRF-55310F	Oscillator, Crystal Controlled, General Specifications for
MIL-PRF-38534K	Hybrid Microcircuits, General Specifications for
MIL-STD-883L	Test Methods and Procedures for Microelectronics

3. REQUIREMENTS:

3.1 General: The individual item requirements shall be as specified herein.

3.2 Package: Ceramic, 90% Min. AL_2O_3., Weight: 1.0 Gms Max., Thermal Resistance, θ_{JC}: 30 °C / Watt.

3.2.1 Lead Material & finish: Kovar, 50 to 70 micro-inches gold over 100 to 250 micro-inches nickel. Hot Solder tinning with Sn63/Pb37 solder per MIL-PRF-55310 is optional at an additional cost.

3.2.2 Reflow Soldering: Reflow soldering at 260 °C for 10 seconds shall not degrade the performance.

3.3 Hermeticity: Resistance welded, hermetically sealed, leak rate of 1 x $(10)^{-8}$ atm-cc/s Max.

3.4 Marking: As a minimum, the parts shall be marked with Xsis P/N, ESD symbol, date code and serial number.

3.5 Absolute Maximum Ratings: Unless otherwise specified, absolute maximum ratings shall be as follows:

Supply Voltage	See Table I
Operating Free-Air Temperature Range	-55°C to +125°C
Storage Temperature	-55°C to +125°C

3.6 Electrical Characteristics: See Table I

3.6.1 Total Dose Radiation: Hybrid Microcircuit Crystal Oscillators shall be capable of meeting the electrical characteristics of Para. 3.6 after being exposed to total ionizing dose radiation of 100 krads as per MIL-STD-883, method 1019.

3.7 Hybrid Elements:

3.7.1 Quartz Crystals: A high grade cultured quartz crystal shall be used. As an option, Xsis will use a premium Q swept quartz crystal at an additional charge, refer to part numbering example in paragraph 6 to specify swept quartz crystal. Crystal element evaluation shall be in accordance with MIL-PRF-55310.

3.7.2 Crystal Mounting: The crystal element shall be mounted at 4 points in such a manner as to provide adequate ruggedness and performance under extreme environments specified herein.

3.7.3 Passive Elements: Established Reliability (ER) QPL components, failure level R minimum shall be used or element evaluation shall be as per MIL-PRF-38534, Level K.

3.7.4 The Microcircuit die shall be from lots that have passed the element evaluation per MIL-PRF-38534, Level K. In addition, ionizing radiation testing shall be performed at the oscillator level as explained in paragraph 3.7.5 herein.

3.7.5 For Output Frequencies up to 70 MHz for 2.5V parts, and up to 90 MHz for 3.3V & 5.0V parts, the microcircuit die shall be from NSC/FC 54ACT family. For higher output frequencies, the microcircuit die shall be from 0.8 µm BiCMOS Si family. The Microcircuit die shall be from wafer lots that have been successfully tested in the oscillator for ionizing radiation up to 100 krads. Xsis Electronics has also performed SET & SEL testing on both types of microcircuit die stated above. Both die are SEL immune for LET of up to 95 Mev-cm^2/mg. Test reports are available on request.

3.7.6 Workmanship, Rework and Process controls shall be in accordance with the requirements of MIL-PRF-55310 and MIL-PRF-38534 as applicable.

3.7.7 Lot Traceability: Production lot for these oscillators shall be homogenous. Each element used in the production lot shall be traceable to a single lot. Swept quartz shall be traceable to the quartz bar, and its applicable processing details.

3.7.8 Prohibited Materials: The following items shall not be used in these oscillators: Pure Tin (Sn >97%), Cadmium, Zinc, Mercury, Selenium, Silver as under plate. Gold Plating without a nickel barrier.

3.7.9 Element Derating: All active and passive elements shall be derated in accordance with the applicable Hybrid microcircuit requirements of MIL-STD-975. Elements shall not operate in access of derated values.

3.7.10 Material Outgassing: All materials shall meet a TML of 1% Max. and a CVCM of 0.1% Max., when tested in accordance with ASTM E595.

4. QUALITY ASSURANCE PROVISIONS: The quality assurance provisions shall be as specified herein.

4.1 100% Screening: The 100% screening shall be performed as per Table II. PDA requirements for nondestructive bond pull, burn-in and frequency aging shall be as specified below.

4.2 PDA for Nondestruct Bond Pull: Unless otherwise specified, PDA shall be 2% of total number of wires or one wire whichever is greater.

4.3 PDA for Burn-in: Unless otherwise specified, PDA for burn-in #2 shall be 2% or 1 oscillator whichever is greater and shall be applicable to +23 ^{o}C and/or +25 ^{o}C static tests only. In addition Delta Calculation shall be performed after Burn-in and shall count for PDA. All measured values for Delta Calculation shall be recorded. Parts that exceed the specified delta limits shall be rejected and be counted for PDA. Delta Calculation shall be performed at 2.5 VDC, 3.3 VDC or 5.0 VDC as applicable for the following parameters:

Input Current	10% change Maximum
Output High Level	10% change Maximum
Output Low Level	0.1V change Maximum

4.4 PDA for Frequency Aging: 5% or 1 oscillator whichever is greater. Delta limit for frequency aging shall be as specified in Table I.

4.5 Group A inspection shall be performed as per Table III.

4.6 Group B inspection shall be performed as per Table IV.

4.7 If required by the purchase order, Group C inspection shall be performed as per Table V.

NOTE: Frequency accuracy limit after life test shall be increased by 10 PPM to allow for Accelerated frequency aging at +125^{o}C.

4.8 Group D inspection per Table VI is omitted because it is performed as a part of receiving inspection of packages.

4.9 Inspection and Test Data: Unless otherwise specified in the purchase order, the following Inspection and test data documentation shall be supplied with the parts.

(See Page 5 for the description of the Model Numbers XE63E, XE63B & XE63P)

Model XE63K:

Certificate of Conformance
Summary of Screening Test Results per Table II
PDA Calculations for Non-Destruct Bond Pull and Burn-in
Summary of Elements Lot Traceability
Electrical Tests before and after Burn-in
Group A Inspection Summary
Group B Inspection Data
Group C Inspection Data, if required by the purchase order
Group D Inspection Data
Radiographic Inspection Certificate

Model XE63E:

Certificate of Conformance
Summary of Screening Test Results per Table VII
Summary of Elements Lot Traceability
Group A Inspection Summary
Radiographic Inspection Certificate

Model XE63B:

Certificate of Conformance
Summary of Screening Test Results per Table VII
Group A Inspection Summary
Radiographic Inspection Certificate, if required by the Purchase Order

Model XE63P:

Certificate of Conformance

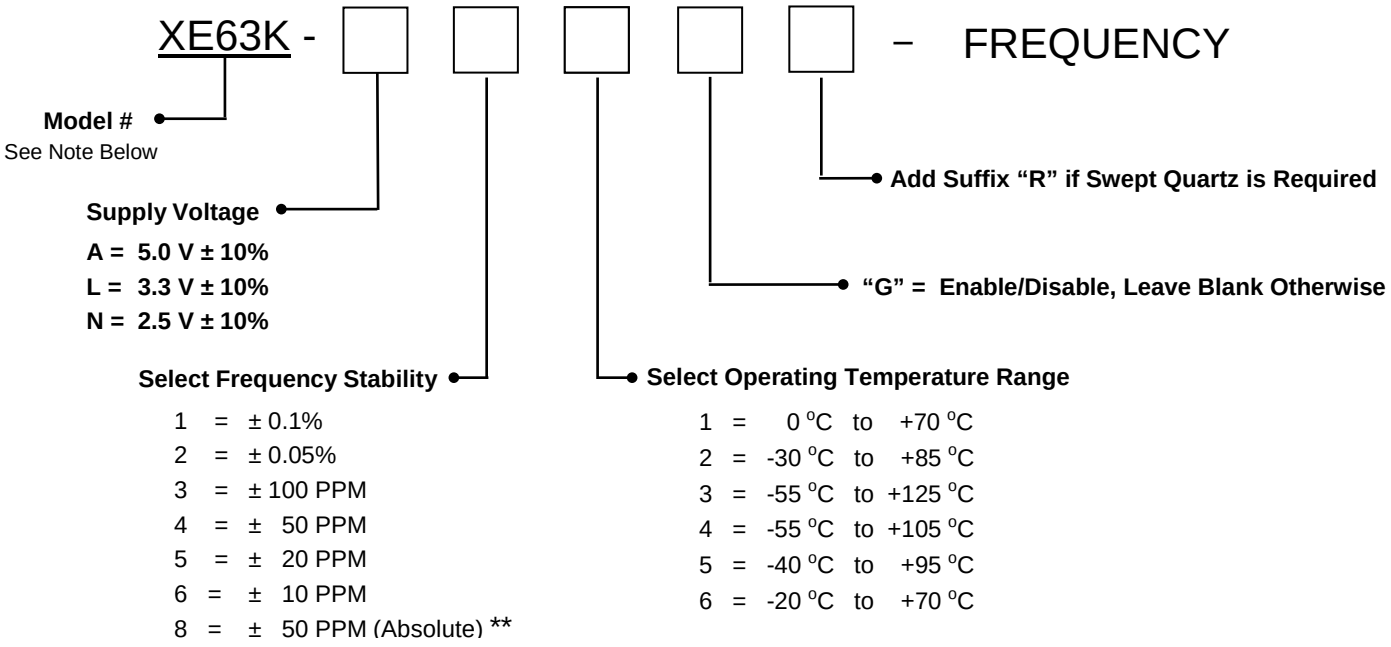
4.10 The following test and inspection options are available at customer request.

Customer Source Inspection for Pre-Cap and Final
DPA (Destructive Physical Analysis)
Group C testing per Table V

5. PRESERVATION, PACKAGING AND PACKING:

The oscillators shall be clean, dry and packaged in a manner to provide adequate protection against electrostatic discharge, corrosion, deterioration and physical damage during shipment.

6. PART NUMBERING EXAMPLE:



** Option 8 provides ± 50 PPM frequency-temperature stability referenced to the specified nominal frequency including load & supply voltage variations of ± 10%.

(Frequency Stability Options 5 & 6 are not available for all Temperature Range Options)

P/N Example: XE63K - L43 - 24.000 MHz = 24.000 MHz, 3.3V Oscillator, ± 50 PPM Frequency Stability over an operating temperature range of -55 °C to +125 °C.

NOTE: Besides model **XE63K**, the following additional models are available for applications that can accommodate reduced level of screening and quality conformance inspection:

XE63E: **Model XE63E** uses the same design and elements as **Model XE63K** except as follows:

- 100% screening is as per Table III herein
- PDA for Burn-in is 10% or 1 unit whichever is greater
- Delta measurements of paragraph 4.3 are not applicable
- Group A inspection is as per MIL-PRF-55310, Class B
- Group B inspection (30 day aging) per MIL-PRF-55310 is not applicable

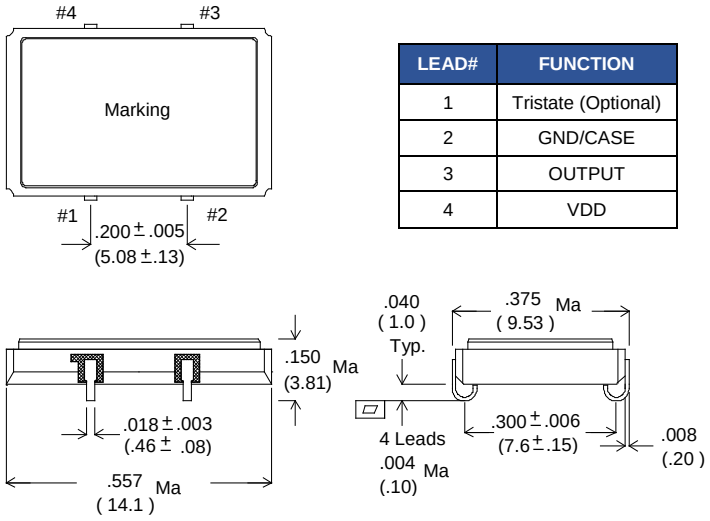
XE63B: **Model XE63B** is same as **Model XE63E** except as follows:

- Active and Passive Elements are as per MIL-PRF-55310, Class B. The Microcircuit die is the same as in Model XE63K but is not from a radiation tested wafer lot.
- Radiographic Inspection is not applicable, unless required by the Purchase Order at additional cost.

XE63P: **Model XE63P** is a form, fit and function equivalent prototype of **Model XE63K.**

- Prototypes may use commercial grade elements and are not screened.
- Quality Conformance inspection is not applicable

7. PACKAGE OUTLINE:



LEAD#	FUNCTION
1	Tristate (Optional)
2	GND/CASE
3	OUTPUT
4	VDD

Dimensions: Inches (mm)

Tristate Input: A “Low” level at the input disables the Output into a high impedance state.

Tristate Input has internal pull-up, it can be left floating or connected to Vdd.

Figure 1 - Package Configuration & Pin Connections

Table I - Electrical Characteristics

Parameter	Spec. Limits		
	"N"	"L"	"A"
Frequency Range	400 KHz to 120 MHz	400 KHz to 125 MHz	400 KHz to 90 MHz
Input Voltage	+ 2.5 VDC ± 10%	+ 3.3 VDC ± 10%	+ 5 VDC ± 10%
Absolute Max. Applied Voltage	+ 5.0 VDC	+ 5.0 VDC	+ 7.0 VDC
Frequency Accuracy at 23 °C	± 15 PPM Max.		
Frequency Stability vs. Temperature	See Options in Paragraph 6.0		
Operating Temperature Range	See Options in Paragraph 6.0		
Input Current (no load)	2.5 mA Max. 400KHz - 5MHz 4 mA Max. 5MHz - 10MHz 6 mA Max. 10MHz - 20MHz 8 mA Max. 20MHz - 30MHz 12 mA Max. 30MHz - 40MHz 16 mA Max. 40MHz - 50MHz 25 mA Max. 50MHz - 70MHz 35 mA Max. 70MHz - 120MHz	3 mA Max. 400KHz - 5MHz 5 mA Max. 5MHz - 10MHz 8 mA Max. 10MHz - 20MHz 10 mA Max. 20MHz - 30MHz 15 mA Max. 30MHz - 40MHz 20 mA Max. 40MHz - 50MHz 35 mA Max. 50MHz - 100MHz 40 mA Max. 100MHz - 125MHz	5 mA Max. 400KHz - 5MHz 10 mA Max. 5MHz - 10MHz 20 mA Max. 10MHz - 20MHz 25 mA Max. 20MHz - 30MHz 30 mA Max. 30MHz - 40MHz 35 mA Max. 40MHz - 50MHz 50 mA Max. 50MHz - 90MHz
Output Waveform	Square Wave, HC/ACMOS		
Output Duty Cycle (at 50% Output Levels)	55/45% Max		
Output Load	10K || 15 pF		
High Output Level	0.9 VDD Min.		
Low Output Level	0.1 VDD Max.		
Tristate (Option G)	≥ 0.7 Vdd or Open:Normal Output, ≤ 0.3 Vdd:High Impedance	≥ 2.2 Vdd or Open:Normal Output, ≤ 0.8 Vdd High Impedance	
Rise & Fall Times (at 10 to 90% Output Levels)	5 nS Max for Frequency ≤ 25.00 MHz 4 nS Max for Frequency 25.01 MHz to 45.00 MHz 3 nS Max. for Frequency > 45MHz		
Start-up Time	10 mS Max.		
Phase Jitter	0.3 pS rms typ, (10 KHz to 20 MHz Integrated)		
Frequency Stability Vs. Voltage	± 4 PPM Max for ± 10% change in Supply Voltage		
Frequency Aging @ 70°C	± 1.5 PPM Max. / 30 days, ± 5 PPM Max. First Year, ± 2.5 PPM Max. / Year thereafter		

Contact Xsis Engineering for any other special requirements.

Table II - Model XE63K, Modified MIL-PRF-38534, Class K Screening (100%)

Test - Inspection	Test Method – Condition
Nondestructive Bond Pull	MIL-STD-883, Method 2023
Internal Visual	MIL-STD-883, Method 2017, Level S
Stabilization Bake (Prior to Seal) **1**/	MIL-STD-883, Method 1008, Condition C (+150 °C), 48 hours minimum
Temperature Cycling	MIL-STD-883, Method 1010, Condition C
Constant Acceleration	MIL-STD-883, Method 2001, Condition A Y_1 axis only (5000 G)
Seal (Fine and Gross Leak)	MIL-PRF-55310, Para. 4.8.2.2.2
Particle Impact Noise Detection (PIND)	MIL-STD-883, Method 2020, Condition A
Radiographic Inspection	MIL-STD-883, Method 2012, Class S
Pre Burn-in Electrical Tests: Record as applicable	Refer to Table II-a below
Burn-in #1	+125 °C, Nominal Supply Voltage and Burn-in load, 160 Hours Minimum
Interim Electrical Tests: Record as applicable	Refer to Table II-a below
Burn-in #2	+125 °C, Nominal Supply Voltage and Burn-in load, 160 Hours Minimum
Post Burn-in Electrical Tests: Record as applicable	Refer to Table II-a below
Frequency Aging 30 days	Per MIL-PRF-55310
Seal (Fine and Gross Leak)	MIL-PRF-55310, Para. 4.8.2.2.3
External Visual	MIL-STD-883, Method 2009

1/ Vacuum bake and maintain oscillators in dry nitrogen per MIL-PRF-55310.

Table II-a – Pre, Interim & Post Burn-in Electrical Tests

Test Parameter	MIL-PRF-55310 Method	Pre BI 24 ± 1 °C	Interim BI 24 ± 1 °C	Post BI 24 ± 1 °C	Post BI Low Temp	Post BI High Temp
Input Current	4.8.5	✓	✓	✓	✓	✓
Output Frequency	4.8.6	✓	✓	✓	✓	✓
Frequency Vs. Temperature Stability	4.8.10.1	✓	✓	✓	✓	✓
Frequency Vs. Supply Voltage	4.8.14	✓	✓	✓	✓	✓
Output Voltage Levels	4.8.21.3	✓	✓	✓	✓	✓
Output Rise & Fall Times	4.8.22	✓	✓	✓	✓	✓
Output Duty Cycle	4.8.23	✓	✓	✓	✓	✓
Start-up time	4.8.29	✓	✓	✓	✓	✓
Enable/Disable, if applicable	4.8.28	✓	✓	✓	✓	✓

Table III - Model XE63K, Group A Inspection 1/

Test - Inspection	Test Method – Condition
Input Current Frequency Accuracy Frequency Vs. Supply Voltage Tolerance Output Waveform Output Voltage Levels Output Rise & Fall Times Output Duty Cycle Start-up time Output Enable/Disable Function if Applicable	24 ± 1 °C, Applicable Method of MIL-PRF-55310
Frequency Vs. Temperature Stability	Measure output frequency at ten equispaced points of the operating temperature range.

1/ Any electrical tests performed as part of final electrical tests in 100% screening need not be repeated.

Table IV - Model XE63K, Group B Inspection 1/

Subgroup	Test - Inspection	MIL-STD-883		Quantity (Accept No.)
		Method	Condition	
1	Physical Dimensions	2016	-	2(0)
2	PIND 2/	2020	A	15(0)
3	Resistance to Solvents 3/	2015	-	3(0)
4	Internal Visual & Mechanical 4/	2014	-	1(0)
5	Bond Strength 5/	2011	C or D	2(0)
6	Die Shear Strength 6/	2019	-	2(0)
7	Solderability	2003	Solder Temp. 245 ± 5 °C	1(0)
8	Seal (Fine & Gross) 7/	1014	A1 or B1 & B3	15(0)

1/ Non-catastrophic screening rejects may be used for Group B testing.
2/ This test is performed during 100% screening
3/ This test is performed on each lot of marking ink
4/ Internal Visual inspection is performed at pre-seal on each unit.
5/ This test is performed prior to seal in accordance with Group B bond strength requirements of MIIL-PRF-38534.
6/ This test is performed prior to seal in accordance with Group B die shear strength requirements of MIIL-PRF-38534.
7/ Fine and Gross tests are being performed during 100% screening.

Table V - Model XE63K, Group C Inspection

Subgroup	Test - Inspection	MIL-STD-883		Quantity (Accept No.)
		Method	Condition	
1	External Visual	2009	-	5(0) **1**/
	PIND	2020	A	
	Temperature Cycling	1010	C, 20 cycles	
	Constant Acceleration	2001	5000G, Y_1 Axis	
	Seal (Fine Leak)	1014	A1 or B1	
	Seal (Gross Leak)	1014	B3	
	Visual Examination	1010	-	
	End Point Electricals	-	-	
2	End Point Electricals Steady State Life End Point Electricals **4**/	1005	1000 Hours at 125°C	5(0) **2**/
3	Internal Gas Analysis	1018	-	3(0) **3**/

1/ Five units are used for Group C inspection in accordance with limited usage requirements of MIL-PRF-38534

2/ Subgroup 1 test samples are not recommended to be used for Subgroup 2 testing

3/ Subgroup 1 test samples shall be used for Subgroup 3 testing.

4/ Frequency accuracy limit shall be increased by 10 PPM to allow for accelerated frequency aging during life test.

Table VI - Model XE63K, Group D Inspection

Subgroup	Test - Inspection	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 & Gross)	1014	A1 or B1 & C	5(0)

Group D inspection is not required when package evaluation has been performed as a part of receiving inspection.

Table VII - Models XE63E & XE63B, Screening (100%)

Test - Inspection	Test Method – Condition
Nondestructive Bond Pull	MIL-STD-883, Method 2023
Internal Visual	MIL-STD-883, Method 2017, Level B
Stabilization Bake (Prior to Seal) **1/**	MIL-STD-883, Method 1008, Condition C (+150 °C), 24 hours minimum
Temperature Cycling	MIL-STD-883, Method 1010, Condition B
Constant Acceleration	MIL-STD-883, Method 2001, Condition A Y_1 axis only (5000 G)
Seal (Fine & Gross)	MIL-PRF-55310, Para. 4.8.2.2.2
Particle Impact Noise Detection (PIND)	MIL-STD-883, Method 2020, Condition A
Radiographic Inspection **(Model XE63E only) 2/**	MIL-STD-883, Method 2012, Class S
Pre Burn-in Electrical Tests: Verify Measurements	Refer to Table VII-a below
Burn-in	+125 °C, Nominal Supply Voltage and Burn-in load, 160 Hours Minimum
Post Burn-in Electrical Tests: Verify Measurements	Refer to Table VII-a below
External Visual	MIL-STD-883, Method 2009

1/ Vacuum bake and maintain oscillators in dry nitrogen per MIL-PRF-55310.

2/ Radiographic Inspection is applicable to **Model XE63E** only**.**

Table VII-a - Pre & Post Burn-in Electrical Tests

Test Parameter	MIL-PRF-55310 Method	Pre BI 24 ± 1 °C	Post BI 24 ± 1 °C	Post BI Low Temp	Post BI High Temp
Input Current	4.8.5	✓	✓	✓	✓
Output Frequency at 23 to 25 °C	4.8.6	✓	✓	✓	✓
Frequency Vs. Temperature Stability	4.8.10.1	✓	✓	✓	✓
Frequency Vs. Supply Voltage	4.8.14	✓	✓	✓	✓
Output Voltage Levels	4.8.21.3	✓	✓	✓	✓
Output Rise & Fall Times	4.8.22	✓	✓	✓	✓
Output Duty Cycle	4.8.23	✓	✓	✓	✓
Start-up time	4.8.29	✓	✓	✓	✓
Enable/Disable, if applicable	4.8.28	✓	✓	✓	✓