REV LTR	DESCRIPTION	DATE	APPVD.
-	Orig., this release incorporates XE73S-Ax Rev C, XE73S-Lx Rev F & XE73S-Nx Rev C	5/15/23	MLG

XE73S SERIES

(XE73S-Ax, XE73S-Lx, XE73S-Nx)

HC/ACMOS OSCILLATORS

FOR SPACE & HI-REL APPLICATIONS

500 KHz to 125 MHz

(5 x 7 mm, Through-Hole, 2.5V, 3.3V & 5.0V)

(Refer to Page 5 for Alternate Models with Reduced Screening & QCI)

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. N. Gupta	5/15/23	XE73S SERIES HC/ACMOS "S" LEVEL OSCILLATORS	
ENG. M. Gupta	5/15/23		
Q. A. S. Gupta	5/15/23		
CUST. ENG.		FSC NO. 57051	DWG. NO. XE73S
CUST Q A.		SCALE N/A	SHEET 1 OF 9

1. SCOPE:

XE73S Series, HC/ACMOS, high reliability hybrid microcircuit crystal oscillators are designed, produced and tested by Xsis Electronics, Inc. as MIL-PRF-55310, Class "S" equivalent devices 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 **XE73E, XE73B and XE73P**, 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 0.30 g Max., Thermal Resistance, θ_{JC}: 40°C / Watt.

3.2.1 Lead Material & finish: Kovar, 50 to 85 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 $1 \times (10)^{-8}$ 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: The 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 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 lot evaluation shall be as per MIL-PRF-55310, class S, or MIL-PRF-38534, Appendix C, Class K as applicable.

3.7.4 The Microcircuit die shall be from lots that have passed element evaluation per MIL-PRF-55310, Appendix B, Level S, except testing per Subgroup 5 is omitted. Subgroup 5 testing is circuit configuration dependent, therefore, it is more effectively performed at the oscillator level as explained in Paragraph 3.7.5.

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: Assembly, Rework and Process controls shall be in accordance with the requirements of MIL-PRF-55310 & 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, and 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. In addition, MIL-PRF-38534 Group B Option 1 in-line inspection for bond strength and die shear shall be performed at pre-seal inspection. PDA requirements for nondestructive bond pull and burn-in 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 shall be 2% or one oscillator, whichever is greater, and shall be applicable to +23°C and/or +25°C static tests only. In addition, Delta Calculations 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 Calculations 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 Group A inspection shall be in accordance with MIL-PRF-55310 for product level S.

4.5 Group B inspection (30 day aging) shall be in accordance with MIL-PRF-55310 for product level S. In order to expedite delivery, by customer request, the aging test can be ended after 15 days if the amount of frequency aging is less than 50% of the 30 day specification limit.

4.6 Oscillators shall be capable of meeting group C inspection per MIL-PRF-55310. Generic group C inspection data on similar parts may be used to satisfy this requirement. When specified by the Customer, Xsis Electronics will perform Group C testing at an additional charge.

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4.7 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 other than XE73S)

Model XE73S:

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 (30 day Aging) Data
Radiographic Inspection Certificate

Model XE73E:

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

Model XE73B:

Certificate of Conformance
Summary of Screening Test Results per Table III
Group A Inspection Summary
Radiographic Inspection is not applicable, unless required by the Purchase Order, at additional cost.

Model XE73P:

Certificate of Conformance

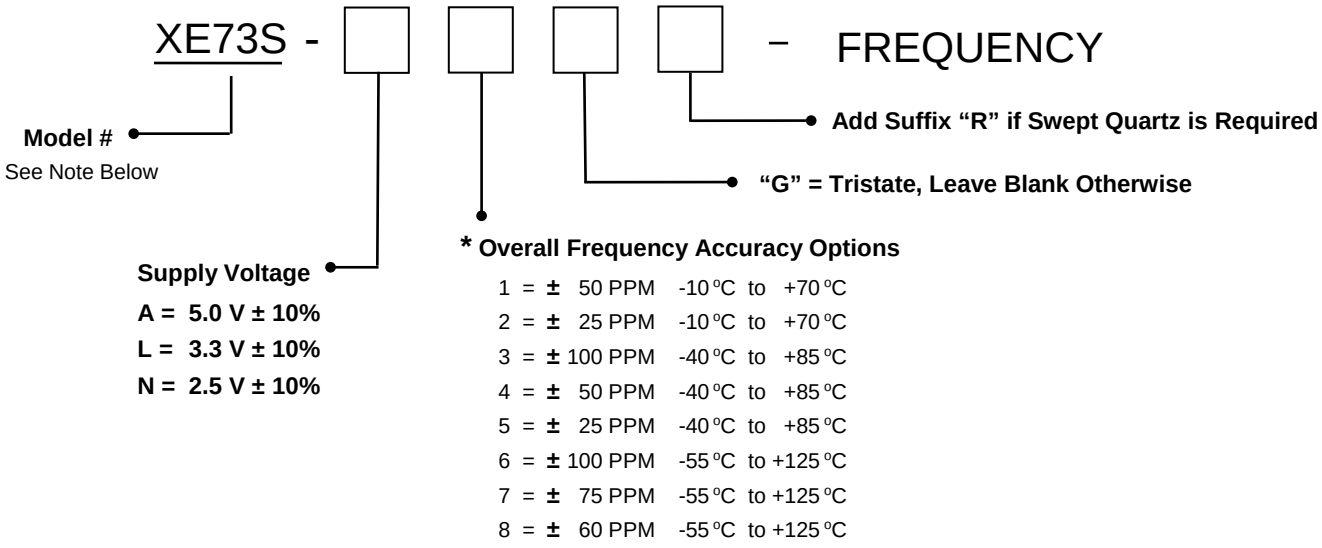
4.8 The following test and inspection options are available upon customer request, at additional cost.

Customer Source Inspection for Pre-Cap and Final
Group C Inspection per MIL-PRF-55310 on 4 or 8 units
DPA (Destructive Physical Analysis)
Life Test per MIL-STD-883, Method 1005, 1000 Hrs. at +125°C
MIL-PRF-38534, Group B Inspection
MIL-PRF-38534, Group C Inspection

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:



* Overall Frequency Accuracy includes effects of Operating Temperature, Supply Voltage, Load variations and 5 year aging.

P/N Example: XE73S - L8 - 100.000 MHz = 100.000 MHz, 3.3V Oscillator, ± 60 PPM Overall Frequency Accuracy over an operating temperature range of -55ºC to +125ºC.

NOTE: Besides model XE73S, the following additional models are available for applications that can accommodate reduced level of screening and quality conformance inspection:

XE73E: **Model XE73E** uses the same design and elements as **Model XE73S** 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

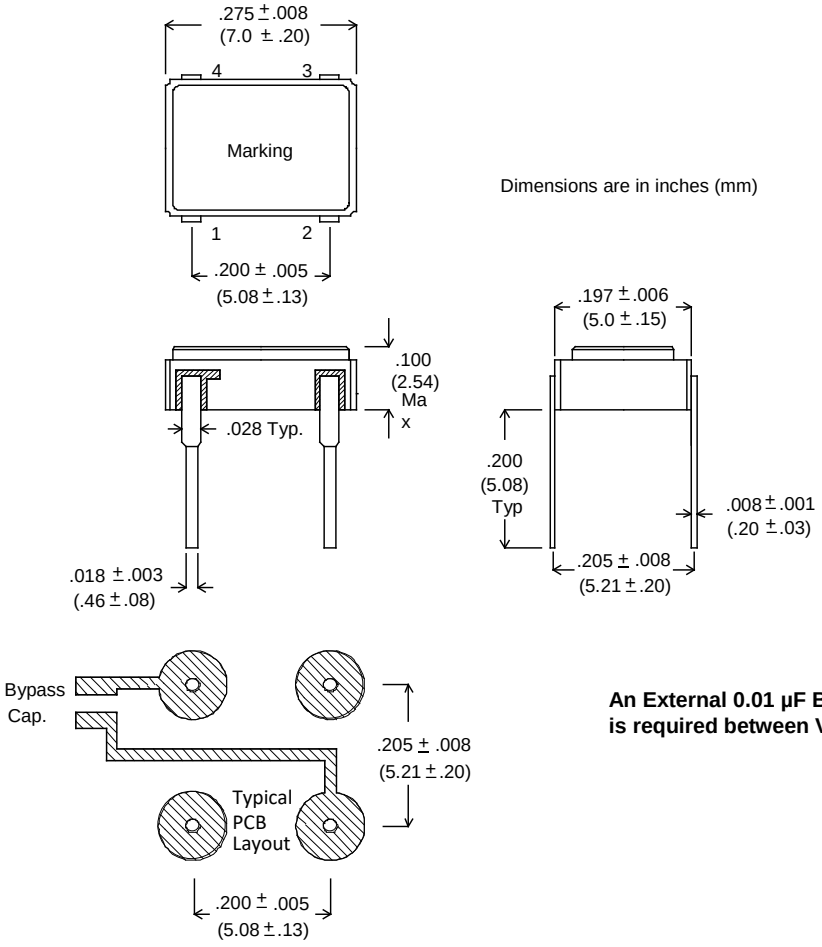
XE73B: **Model XE73B** is same as **Model XE73E** except as follows:

- Active and Passive Elements are as per MIL-PRF-55310, Class B. The Microcircuit die is the same as in Model XE73S but is not from a radiation tested wafer lot.
- Radiographic Inspection is not applicable, unless required by the Purchase Order at additional cost.

XE73P: **Model XE73P** is a form, fit and function equivalent prototype of **Model XE73S.**

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

7. PACKAGE OUTLINE:



Dimensions are in inches (mm)

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

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.

An External 0.01 µF Bypass Capacitor is required between VDD and GND.

Figure 1 - Package Configuration & Pin Connections

Table I - Electrical Characteristics

Parameter	Spec. Limits		
	"N"	"L"	"A"
Frequency Range	500 KHz to 120 MHz	500 KHz to 125 MHz	500 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
Overall Frequency Accuracy **1/**	See Options in Paragraph 6.0		
Operating Temperature Range	See Options in Paragraph 6.0		
Input Current (no load)	2.5 mA Max. 500KHz - 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. 500KHz - 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. 500KHz - 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)	6 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		5 nS Max. Frequency ≤ 40 MHz 3 nS Max. Frequency ≥ 40 MHz
Start-up Time	10 mS Max.		
Phase Jitter	0.5 pS rms typ, (10 KHz to 20 MHz Integrated)		0.3 pS rms typ. (10 KHz to 20 MHz Integrated)
Frequency Aging @ 70°C	± 1.5 PPM Max. / 30 days, ± 5 PPM Max. First Year, ± 2.5 PPM Max. / Year thereafter		

1/ Overall Frequency Accuracy includes calibration tolerance, frequency change due to Operating temperature, Supply Voltage and Load variations of ± 10% and 5 year aging.

Contact Xsis Engineering for any other special requirements.

Table II - Model XE73S 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
Random Vibration	MIL-STD-883, Method 2026, Condition I - B
Thermal Shock	MIL-STD-883, Method 1011, Condition A
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. 4.8.2.2.3
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	+125 °C, Nominal Supply Voltage and Burn-in load 320 Hours Minimum
Post Burn-in Electrical Tests: Record as applicable	Refer to Table II-a below
External Visual	MIL-STD-883, Method 2009

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

Table II-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	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	✓	✓	✓	✓
Tristate, if applicable	4.8.28	✓	✓	✓	✓

Table III - Models XE73E & XE73B, 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 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 **(Model XE73E Only) 2/**	MIL-STD-883, Method 2012, Class S
Pre Burn-in Electrical Tests: Record as applicable	Refer to Table III-a below
Burn-in	+125 °C, Nominal Supply Voltage and Burn-in load 160 Hours Minimum
Post Burn-in Electrical Tests: Record as applicable	Refer to Table III-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 XE73E only

Table III-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	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	✓	✓	✓	✓
Tristate, if applicable	4.8.28	✓	✓	✓	✓