

| REV LTR | DESCRIPTION                    | DATE     | APPVD. |
|---------|--------------------------------|----------|--------|
| -       | Orig. Release                  | 9/25/13  | MLG    |
| A       | Corrected P/N on Pages 1 and 2 | 7/01/14  | MLG    |
| B       | Revised per ECN 2014-2         | 9/01/14  | MLG    |
| C       | Revised per ECN 2016-1         | 8/15/16  | MLG    |
| D       | Revised per ECN 2016-2         | 12/15/16 | MLG    |

**XSIS XE7S – L0**  
**HC/ACMOS OSCILLATORS**  
**FOR SPACE APPLICATIONS**  
**500 KHz to 125 MHz**  
**( 5 x 7 mm, SMD, 3.3 V )**

For Other Supply Voltages and Package Configurations Contact Factory or visit our website [www.xsis.com](http://www.xsis.com)

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

| REV STATUS OF SHEETS | REV SHEET NO. | 1   | 2 | 3 | 4 | 5 | 6 | 7 | 8              | 9 | 10    | 11 | 12     | 13 | 14 | 15 | 16 |  |
|----------------------|---------------|---|---|---|---|---|---|---|----------------|---|-------|----|--------|----|----|----|----|--|
| APPROVALS            | DATE          | <b>XSIS ELECTRONICS, INC.</b>                           |   |   |   |   |   |   |                |   |       |    |        |    |    |    |    |  |
| PREP.<br>S. Gupta    | 9/25/13       | 12620 W. 63 <sup>rd</sup> Street, Shawnee, KS 66216 USA |   |   |   |   |   |   |                |   |       |    |        |    |    |    |    |  |
| ENG.<br>M. Gupta     | 9/25/13       | <b>XE7S-L0 HC/ACMOS</b>                                 |   |   |   |   |   |   |                |   |       |    |        |    |    |    |    |  |
| Q. A.<br>M. Gupta    | 9/25/13       | FSC NO.   |   |   |   |   |   |   | DWG. NO.       |   |       |    |        |    |    |    |    |  |
| CUST. ENG.           |               | 57051   |   |   |   |   |   |   | <b>XE7S-L0</b> |   |       |    |        |    |    |    |    |  |
| CUST Q A.            |               | SCALE   |   |   |   |   |   |   | N/A            |   | SHEET |    | 1 OF 3 |    |    |    |    |  |

1. SCOPE: XE7S-L0, HC/ACMOS series, 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 advanced military, avionics and space applications. These devices are of hybrid microcircuit technology conforming to MIL-PRF-55310, Type 1, Class 2 oscillators.

2. APPLICABLE DOCUMENTS:

MIL-PRF-55310E Oscillator, Crystal Controlled, General Specifications for  
MIL-PRF-38534G Hybrid Microcircuits, General Specifications for  
MIL-STD-883E 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<sub>2</sub>O<sub>3</sub>. Thermal Resistance,  $\theta_{JC}$ : 40 °C / Watt.

3.2.1 Termination Finish: 1.3  $\mu$ m minimum gold plate over 2.0  $\mu$ m minimum nickel plate. Hot Solder tinning with Sn60/Pb40 solder per MIL-PRF-55310 is optional at an additional cost.

3.2.2 Weight: 0.30 Gms Max.

3.2.3 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(10)<sup>-8</sup> atm-cc/s Max.

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

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

|                                      |                 |
|--------------------------------------|-----------------|
| Supply Voltage                       | -0.5 to +5 VDC  |
| 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: 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: Crystal element shall be mounted at 4 points in such a manner as to provide adequate ruggedness and performance under extreme environments specified herein.

**XSIS ELECTRONICS, INC.**  
12620 W. 63<sup>rd</sup> St., Shawnee, KS 66216 USA

FSC NO.

57051

DWG. NO.

**XE7S-L0**

REV

D

SCALE

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SHEET

2 OF 9

- 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 Microcircuit die shall be from lots that have passed the 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 herein.
- 3.7.5 For Output Frequency up to 90 MHz, microcircuit die used in the oscillator shall be from NSC/FC 54ACT family and must be from wafer lot that has been successfully tested in the oscillator for ionizing radiation of up to 100 krad. Xsis Electronics has also performed SET & SEL testing on the microcircuit die. Test reports are available on request. For output frequencies above 90 MHz, the microcircuit die shall be from 0,8  $\mu\text{m}$  BiCMOS Si family and must be from wafer lots that have been successfully tested in the oscillator for ionizing radiation of up to 100Krad and is known to be Single Event Latch-up immune for LET of up to 95 Mev-cm<sup>2</sup>/mg.
- 3.7.6 Workmanship, Rework and Process controls shall be in accordance with the requirements of MIL-PRF-55310.
- 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.
4. Quality Assurance Provisions: The quality assurance provisions shall be per MIL-PRF-55310, except as specified herein.
- 4.1 100% Screening: The 100% screening shall be performed as per Table II. 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 1 wire whichever is greater.
- 4.3 PDA for Burn-in: Unless otherwise specified, PDA for burn-in shall be 2% or 1 oscillator whichever is greater and shall be applicable to +23 °C and/or +25 °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 3.3 VDC 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.

|   |                         |                                   |                 |
|---|-------------------------|-----------------------------------|-----------------|
| <b>XSIS ELECTRONICS, INC.</b><br>12620 W. 63 <sup>rd</sup> St., Shawnee, KS 66216 USA | <b>FSC NO.</b><br>57051 | <b>DWG. NO.</b><br><b>XE7S-L0</b> | <b>REV</b><br>D |
|   | <b>SCALE</b> N/A        | <b>SHEET</b> 3 OF 9               |                 |

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 XE7S )

**Model XE7S:**

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 XE7H:**

Same as for **Model XE7S** except Group B (30 day Aging) Data

**Model XE7E:**

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

**Model XE7B:**

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

**Model XE7P:**

Certificate of Conformance

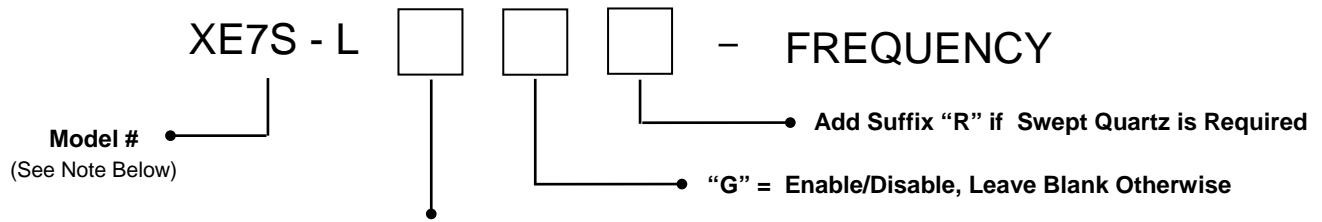
4.8 The following test and inspection options are available at customer request.

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

5.0 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.

|   |                         |                                   |                 |
|---|-------------------------|-----------------------------------|-----------------|
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|   | <b>SCALE</b><br>N/A     | <b>SHEET</b><br>4 OF 9            |                 |

6.0 Part Numbering Example:



**\* Overall Frequency Accuracy Options**

- 1 =  $\pm 50$  PPM -10°C to +70°C
- 2 =  $\pm 25$  PPM -10°C to +70°C
- 3 =  $\pm 100$  PPM -40°C to +85°C
- 4 =  $\pm 50$  PPM -40°C to +85°C
- 5 =  $\pm 25$  PPM -40°C to +85°C
- 6 =  $\pm 100$  PPM -55°C to +125°C
- 7 =  $\pm 75$  PPM -55°C to +125°C
- 8 =  $\pm 60$  PPM -55°C to +125°C

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

P/N Example: XE7S - L7 - 24.000 MHz = 24.000 MHz, Class "S" Oscillator,  $\pm 75$  PPM Overall Frequency Accuracy over an operating temperature range of -55°C to +125°C,

**NOTE:** Besides model XE7S above, the following additional models are available for applications that can accommodate reduced level of screening and quality conformance inspection:

**XE7H:** Model XE7H is same as Model XE7S except as follows:

Group B inspection (30 day aging ) per MIL-PRF-55310 is not applicable

**XE7E:** Model XE7E uses the same design and elements as Model X7S 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

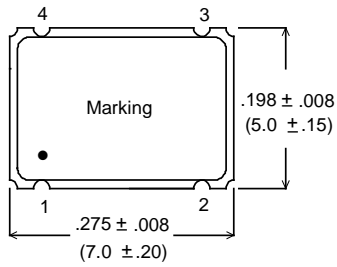
**XE7B:** Model XE7B is same as Model XE7E except as follows:

Active and Passive Elements are as per MIL-PRF-55310, Class B. Microcircuit die is similar to the one used in Model XE7S but is not from radiation tested wafer lot.

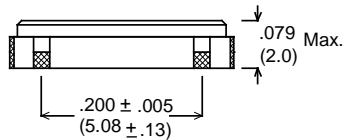
**XE7P:** Model XE7P is a form, fit and function equivalent prototype of Model XE7S.

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

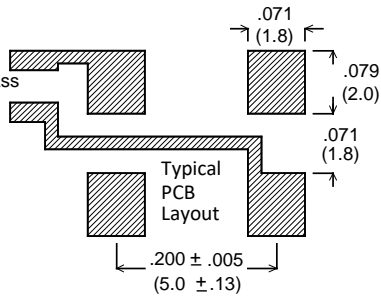
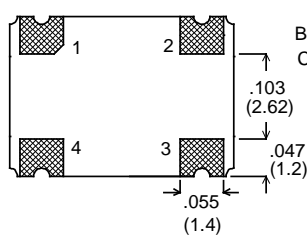
|  |                  |                     |          |
|--|------------------|---------------------|----------|
| XSIS ELECTRONICS, INC.<br>12620 W. 63 <sup>rd</sup> St., Shawnee, KS 66216 USA | FSC NO.<br>57051 | DWG. NO.<br>XE7S-L0 | REV<br>D |
|  | SCALE<br>N/A     | SHEET<br>5 OF 9     |          |



| PAD# | FUNCTION       |
|------|----------------|
| 1    | E/D (Optional) |
| 2    | GND/CASE       |
| 3    | OUTPUT         |
| 4    | VDD            |



Dimensions: Inches (mm).



**E/D (Enable/Disable) Input:** A “Low” level at the input disables the Output into a high impedance state.

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

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

Figure 1 - Package Configuration & Pin Connections

**TABLE I – Electrical Characteristics**

| Parameter                                | Spec. Limits                                   |
|--|--|
| Frequency Range                          | 500 KHz to 125 MHz                             |
| Overall Frequency Accuracy <sup>1/</sup> | See Options in Paragraph 6.0                   |
| Operating Temperature Range              | See Options in Paragraph 6.0                   |
| Input Voltage                            | + 3.3 VDC $\pm$ 10%                            |
| Input Current at 3.3V ( no load )        |  |
| 500.00 KHz to 5.00 MHz                   | 3 mA Max.                                      |
| 5.01 MHz to 10.00 MHz                    | 5 mA Max.                                      |
| 10.01 MHz to 20.00 MHz                   | 8 mA Max.                                      |
| 20.01 MHz to 30.00 MHz                   | 10 mA Max.                                     |
| 30.01 MHz to 40.00 MHz                   | 15 mA Max.                                     |
| 40.01 MHz to 50.00 MHz                   | 20 mA Max.                                     |
| 50.01 MHz to 100.00 MHz                  | 35 mA Max.                                     |
| 100.01 MHz to 125.00 MHz                 | 40 mA Max.                                     |
| Output Waveform                          | Square Wave, HC/ACMOS                          |
| Output Duty Cycle                        | 55/45% Max                                     |
| Output Load                              | 10K    15 pF                                   |
| High Output Level                        | 0.9 VDD Min                                    |
| Low Output Level                         | 0.1 VDD Max.                                   |
| Rise & Fall Times                        |  |
| $\leq$ 25.00 MHz                         | 6 nS Max.                                      |
| 25.01 to 45.00 MHz                       | 4 nS Max.                                      |
| 45.01 to 125.00 MHz                      | 3 nS Max.                                      |
| Start-up Time                            | 10 mS Max.                                     |
| Phase Jitter                             | 0.5 pS rms typ, (10 KHz to 20 MHz Integrated ) |
| Frequency Aging @ 70 °C                  | 1.5 PPM Max./30 days, 3 PPM / Year Max.        |

Contact Xsis Engineering for any other special requirements.

<sup>1/</sup> Overall Frequency Accuracy includes calibration tolerance, frequency change due to Operating Temperature, Supply Voltage and Load variations and 5 year aging.

|   |                         |                            |                 |
|---|-------------------------|----------------------------|-----------------|
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|   | SCALE<br>N/A            | SHEET<br>7 OF 9            |                 |

**Table II - Models XE7S & XE7H, 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 ) <u>1/</u>  | MIL-STD-883, Method 1008, Condition C ( +150 °C ), 48 hours minimum  |
| Thermal Shock   | MIL-STD-883, Method 1011, Condition A  |
| Temperature Cycling   | MIL-STD-883, Method 1010, Condition B  |
| Constant Acceleration   | MIL-STD-883, Method 2001, Condition A<br>Y <sub>1</sub> 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  |
| Electrical Tests: Record all measurements.<br><br>Input Current<br>Output Frequency<br>Output Voltage Levels<br>Output Rise & Fall Times<br>Output Duty Cycle | Nominal Supply Voltage, Specified load, +23 °C<br><br>MIL-PRF-55310, Para. 4.8.5<br>MIL-PRF-55310, Para. 4.8.6<br>MIL-PRF-55310, Para. 4.8.21.3<br>MIL-PRF-55310, Para. 4.8.22<br>MIL-PRF-55310, Para. 4.8.23  |
| Burn-in ( load )  | +125 °C, Nominal Supply Voltage and Burn-in load, 320 Hours Minimum  |
| Electrical Tests: Record all measurements.<br><br>Input Current<br>Output Frequency<br>Output Voltage Levels<br>Output Rise & Fall Times<br>Output Duty Cycle | Nominal and Extreme Supply Voltages, Specified load, +23 °C and operating temperature extremes,<br><br>MIL-PRF-55310, Para. 4.8.5<br>MIL-PRF-55310, Para. 4.8.6<br>MIL-PRF-55310, Para. 4.8.21.3<br>MIL-PRF-55310, Para. 4.8.22<br>MIL-PRF-55310, Para. 4.8.23 |

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



**Table III - Models XE7E & XE7B, 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 ) <u>1/</u>   | 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<br>Y <sub>1</sub> 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  |
| Electrical Tests:<br><br>Input Current<br>Output Frequency<br>Output Voltage Levels<br>Output Rise & Fall Times<br>Output Duty Cycle | Nominal Supply Voltage, Specified load, +23 °C<br>Verify all parameters<br><br>MIL-PRF-55310, Para. 4.8.5<br>MIL-PRF-55310, Para. 4.8.6<br>MIL-PRF-55310, Para. 4.8.21.3<br>MIL-PRF-55310, Para. 4.8.22<br>MIL-PRF-55310, Para. 4.8.23                         |
| Burn-in ( load )   | +125 °C, Nominal Supply Voltage and Burn-in load, 160 Hours Minimum  |
| Electrical Tests:<br><br>Input Current<br>Output Frequency<br>Output Voltage Levels<br>Output Rise & Fall Times<br>Output Duty Cycle | Nominal Supply Voltage, Specified load, +23 °C<br>and verify frequency at temperature extremes.<br><br>MIL-PRF-55310, Para. 4.8.5<br>MIL-PRF-55310, Para. 4.8.6<br>MIL-PRF-55310, Para. 4.8.21.3<br>MIL-PRF-55310, Para. 4.8.22<br>MIL-PRF-55310, Para. 4.8.23 |

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