

| REV LTR | DESCRIPTION             | DATE     | APPVD. |
|---------|-------------------------|----------|--------|
| -       | Orig.                   | 8/15/12  | MLG    |
| A       | Updated                 | 10/25/13 | MLG    |
| B       | Updated per ECN 2016-10 | 12/15/16 | MLG    |

**XSIS XE642S - A00, SERIES**  
**HC/ACMOS OSCILLATORS**  
**FOR SPACE APPLICATIONS**  
**450 KHz to 90 MHz**  
**( 7 x 9 mm, Formed-Leads, SMD, 5.0V)**

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

| REV STATUS<br>OF SHEETS | REV         |   |   |   |   |   |   |   |            |   |    |    |    |    |    |    |    |
|-------------------------|-------------|---|---|---|---|---|---|---|------------|---|----|----|----|----|----|----|----|
|                         | SHEET NO.   | 1   | 2 | 3 | 4 | 5 | 6 | 7 | 8          | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| <b>APPROVALS</b>        | <b>DATE</b> | <b>XSIS ELECTRONICS, INC.</b>                                 |   |   |   |   |   |   |            |   |    |    |    |    |    |    |    |
| PREP.<br>S. Gupta       | 8/15/12     | 12620 W. 63 <sup>rd</sup> Street, Shawnee, KS 66216 USA       |   |   |   |   |   |   |            |   |    |    |    |    |    |    |    |
| ENG.<br>M. Gupta        | 8/15/12     | <b>XE642S - A00 SERIES HC/ACMOS<br/>"S" LEVEL OSCILLATORS</b> |   |   |   |   |   |   |            |   |    |    |    |    |    |    |    |
| Q. A.<br>M. Gupta       | 8/15/12     | FSC NO.   |   |   |   |   |   |   | DWG. NO.   |   |    |    |    |    |    |    |    |
| CUST.<br>ENG.           |             | 57051   |   |   |   |   |   |   | XE642S-A00 |   |    |    |    |    |    |    |    |
| CUST<br>Q A.            |             | SCALE   |   |   |   |   |   |   | SHEET      |   |    |    |    |    |    |    |    |
|                         |             | N/A   |   |   |   |   |   |   | 1 OF 3     |   |    |    |    |    |    |    |    |

1. SCOPE: XE642S-A00, 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-38534H | Hybrid Microcircuits, General Specifications for           |
| MIL-STD-883H   | 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,  $\theta_{JC}$ : 28 °C / Watt.

3.2.1 Lead finish: 50 to 70 micro-inches gold over 100 to 250 micro-inches nickel. Hot Solder tinning with Sn60/Pb40 solder per MIL-PRF-55310 is optional at an additional cost.

3.2.2 Weight: 0.5 Gms typical, 0.6 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  $1(10)^{-8}$  atm-cc/s Max.

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

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

|                                      |                   |
|--------------------------------------|-------------------|
| Supply Voltage                       | -0.5 to +7 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 krad 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.

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- 3.7.2 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.
- 3.7.3 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.
- 3.7.4 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.
- 3.7.5 Workmanship, Rework and Process controls shall be in accordance with the requirements of MIL-PRF-55310.
- 3.7.6 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 5.0 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.

|   |                         |                               |                 |
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|   | <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 XE642S )

**Model XE642S:**

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 XE642H:**

Same as for **Model XE64S** except Group B (30 day Aging) Data

**Model XE642E:**

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 XE642B:**

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 XE642P:**

Certificate of Conformance

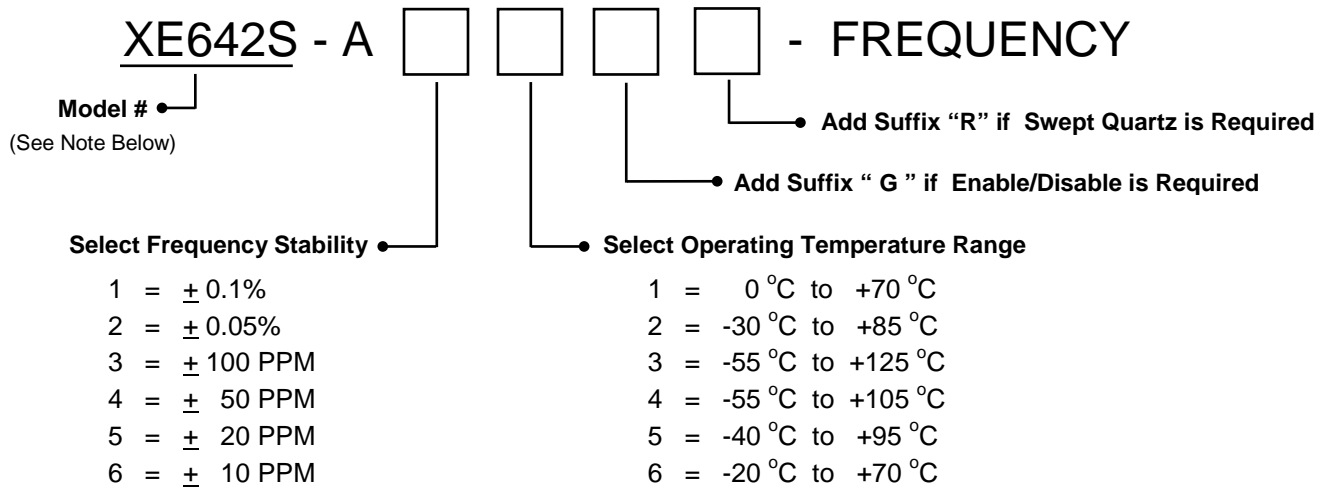
4.8 The following test and inspection options are available at customer request.

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

6.0 Part Numbering Example:



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

P/N Example: XE642S - A43 - 24.000 MHz = 24.000 MHz, Class "S" Oscillator, ± 50 PPM Frequency Stability over an operating temperature range of -55 °C to +125 °C,

**NOTE:** Besides model XE642S above, the following additional models are available for applications that can accommodate reduced level of Elements, Screening and Quality Conformance inspection:

**XE642H:** Model XE642H is same as Model XE642S except as follows:

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

**XE642E:** Model XE642E uses the same design & elements as Model XE642S 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

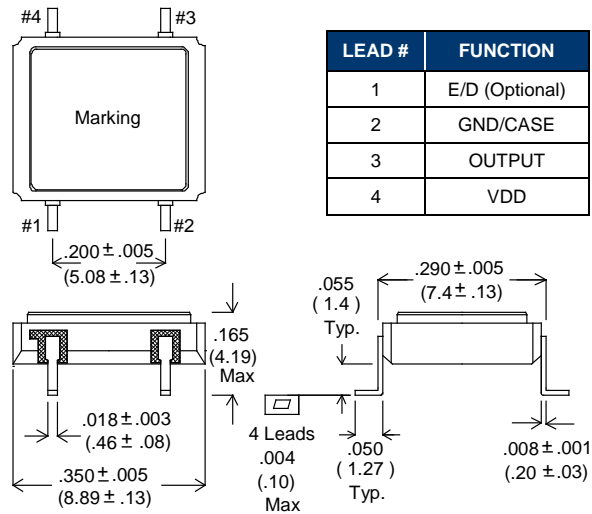
**XE642B:** Model XE642B is same as Model XE642E except as follows:

Active and Passive Elements are as per MIL-PRF-55310, Class B. Microcircuit die is similar to the one used in Model XE642S but is not from radiation tested wafer lot.

**XE642P:** Model XE642P is a form, fit and function equivalent prototype of Model XE642S.

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

|  |                         |                               |                 |
|--|-------------------------|-------------------------------|-----------------|
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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.

Figure 1 - Package Configuration & Pin Connections

**TABLE I – Electrical Characteristics**

| Parameter                             | Spec. Limits                                   |
|---------------------------------------|--|
| Frequency Range                       | 450 KHz to 90 MHz                              |
| 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 Voltage                         | + 5 VDC ± 10%                                  |
| Input Current at 5.0V ( no load )     |  |
| 450.00 KHz to 5.00 MHz                | 5 mA Max.                                      |
| 5.01 MHz to 10.00 MHz                 | 10 mA Max.                                     |
| 10.01 MHz to 20.00 MHz                | 20 mA Max.                                     |
| 20.01 MHz to 30.00 MHz                | 25 mA Max.                                     |
| 30.01 MHz to 40.00 MHz                | 30 mA Max.                                     |
| 40.01 MHz to 50.00 MHz                | 35 mA Max.                                     |
| 50.01 MHz to 90.00 MHz                | 50 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                     |  |
| 450.00 KHz to 25.00 MHz               | 5 nS Max                                       |
| 25.01 MHz to 45.00 MHz                | 4 nS Max.                                      |
| 45.01 MHz to 90.00 MHz                | 3 nS Max.                                      |
| Start-up Time                         | 10 mS Max.                                     |
| Phase Jitter                          | 0.3 pS rms typ, (10 KHz to 20 MHz Integrated ) |
| Frequency Stability Vs Supply Voltage | ± 4 PPM Max. for 10% change in Voltage         |
| Frequency Aging @ 70 °C               | 1.5 PPM Max. /30 days, 3 PPM Max. /year        |

Contact Xsis Engineering for any other special requirements.

|   |                         |                               |                 |
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Table II - Models XE642S & XE642H, 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.

|   |                         |                               |                 |
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|   | <b>SCALE</b><br>N/A     | <b>SHEET</b><br>8 OF 9        |                 |



Table III - Models XE642E & XE642B, 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 ) <sup>1/</sup>   | 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 |

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

|   |                         |                               |                 |
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