

| REV LTR | DESCRIPTION | DATE | APPVD. |
|---------|---|----------|--------|
| - | Orig. | 9/10/12 | MLG |
| A | Revised Scope, Added Random Vibration in Table II | 11/20/20 | SPG |
| B | Updated per ECN 2022-1 | 3/15/22 | SPG |

XE66S – L00, SERIES
HC/ACMOS OSCILLATORS
FOR SPACE & HI-REL APPLICATIONS
450 KHz to 100 MHz
(TO-5 Package, 3.3V)

For Other Supply Voltages and Package Configurations Contact Factory or visit our website www.xsis.com

(Refer to Page 5 for Reduced QCI Models XE66E, XE66B & XE66P)

| 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 | XSIS ELECTRONICS, INC. 12620 W. 63rd Street, Shawnee, KS 66216 USA XE66S – L00 SERIES HC/ACMOS "S" LEVEL OSCILLATORS | | | | | | | | | | | | | | | |
| PREP. S. Gupta | 9/10/12 | | | | | | | | | | | | | | | | |
| ENG. M. Gupta | 9/10/12 | | | | | | | | | | | | | | | | |
| Q. A. M. Gupta | 9/10/12 | | | | | | | | | | | | | | | | |
| CUST. ENG. | | FSC NO. 57051 | | | | | | DWG. NO. XE66S-L00 | | | | | | | | | |
| CUST Q A. | | SCALE N/A | | | | | | SHEET 1 OF 9 | | | | | | | | | |

1. SCOPE: XE66S-L00, 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 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: Alternate models, XE66E, XE66B and XE66P 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: Kovar, 100 to 250 microinches nickel plated. Physical configuration as shown in Figure 1. Weight: 1.2 Gms Max., Thermal Resistance, θ_{JC} : 30°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.

3.3 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 +5 VDC |
| Operating Free-Air Temperature Range | -55°C to +125°C |
| Storage Temperature | -55°C to +125°C |
| Lead Soldering Temperature/Time | +250°C, 10 Seconds |

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.

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.

XSIS ELECTRONICS, INC.

12620 W. 63rd St., Shawnee, KS 66216 USA

Tel: 913-631-0448 e-mail: xsis@xis.com website: www.xsis.com

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- 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.
- 3.7.5 Microcircuit die used in the oscillator shall be from NSC/FC 54ACT family and shall be from wafer lot that has been successfully tested in the oscillator for ionizing radiation of up to 100 krads and is known to be Single Event Latch-up immune for LET of up to 95 Mev-cm²/mg. Xsis Electronics has also performed SET & SEL testing on the microcircuit die. 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 excess 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. 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 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.

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| XSIS ELECTRONICS, INC. 12620 W. 63 rd St., Shawnee, KS 66216 USA Tel: 913-631-0448 e-mail: xsis@xis.com website: www.xsis.com | FSC NO. | DWG. NO. | REV |
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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 XE66S)

Model XE66S:

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 XE66E:

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

Model XE66B:

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 XE66P:

Certificate of Conformance

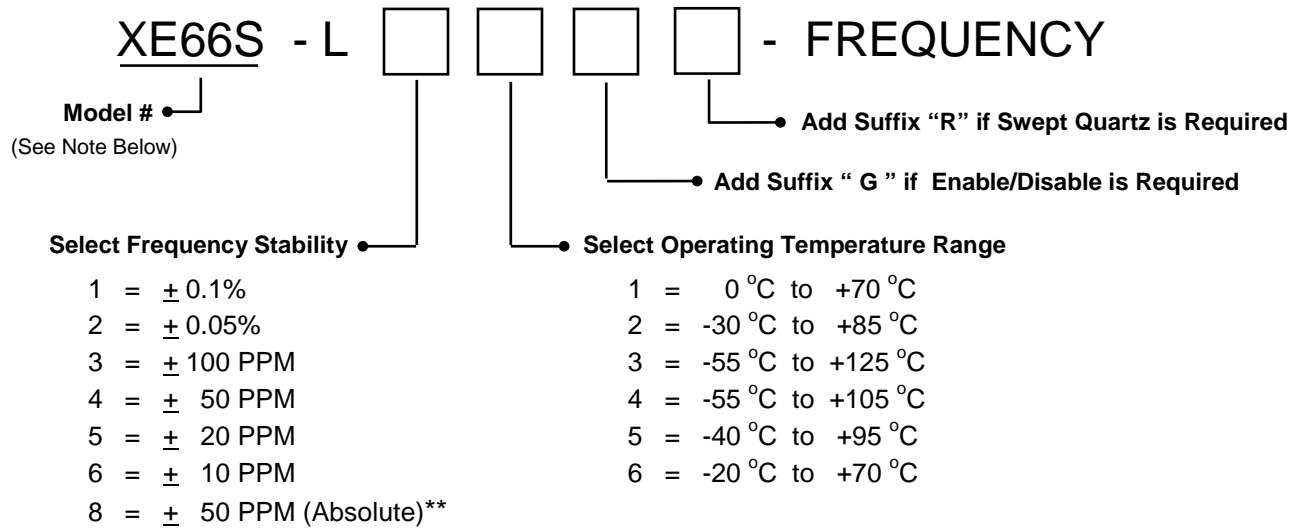
4.8 The following test and inspection options are available at customer request, at additional cost.

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.

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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: XE66S - L43 - 24.000 MHz = 24.000 MHz, Class "S" Oscillator, ± 50 PPM Frequency Stability over an operating temperature range of -55 °C to +125 °C,

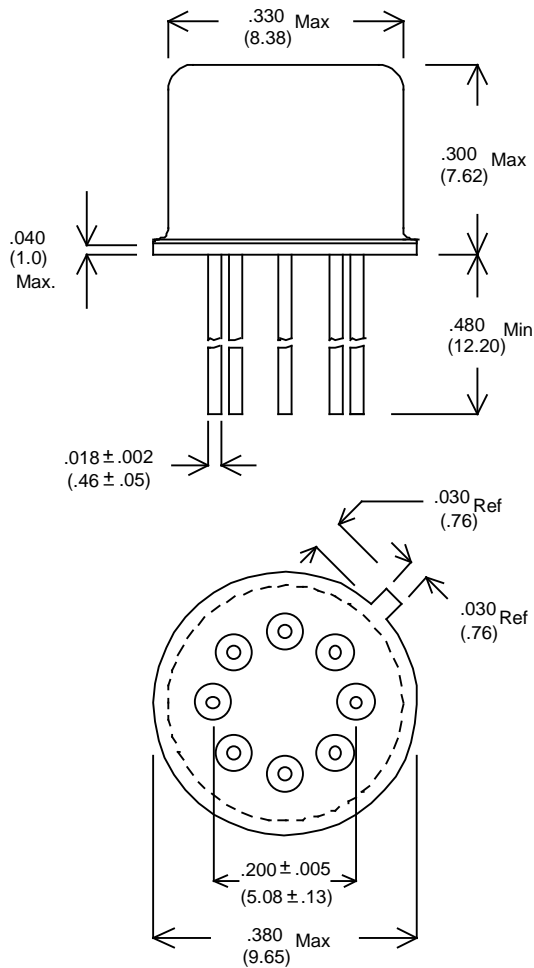
NOTE: Besides model XE66S above, the following additional models are available for applications that can accommodate reduced level of Elements, Screening and Quality Conformance inspection:

XE66E: Model XE66E uses the same design and elements as Model X66S 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

XE66B: Model XE66B is same as Model XE66E 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 XE66S but is not from radiation tested wafer lot.
 Radiographic Inspection is not applicable, unless required by the Purchase Order at additional cost.

XE66P: Model XE66P is a form, fit and function equivalent prototype of Model XE66S. Prototypes may use commercial grade elements and are not screened. Quality Conformance inspection is not applicable.

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| Pin# | Function |
|------------|----------------|
| 3 | E/D (Optional) |
| 4 | GND/CASE |
| 5 | OUTPUT |
| 8 | B+ |
| All Others | N/C |

Enable/Disable Input: A "Low" level at the input disables the Output into a high impedance state. Enable/Disable Input has internal pull-up.

Dimensions Inches (mm)

Figure 1 - Package Configuration & Pin Connections

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TABLE I – Electrical Characteristics

| Parameter | Spec. Limits |
|---|---|
| Frequency Range | 450 KHz to 100 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 | + 3.3 VDC ± 10% |
| Input Current at 3.3V (no load) 450.00 KHz to 5.00 MHz 5.01 MHz to 10.00 MHz 10.01 MHz to 20.00 MHz 20.01 MHz to 30.00 MHz 30.01 MHz to 40.00 MHz 40.01 MHz to 50.00 MHz 50.01 MHz to 100.00 MHz | 4 mA Max. 5 mA Max. 8 mA Max. 10 mA Max. 15 mA Max. 20 mA Max. 35 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. |
| Enable/Disable (Option G) | ≥ 2.2V or Open: Normal Output < 0.8V High Impedance |
| Rise & Fall Times 450.00 KHz to 25.00 MHz 25.01 MHz to 45.00 MHz 45.01 MHz to 100.00 MHz | 5 nS Max 4 nS Max. 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, 5 PPM Max. first year, ± 2.5 PPM Max./year thereafter |

Contact Xsis Engineering for any other special Requirements.

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Table II - Model XE66S 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 |
| 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 | ✓ | ✓ | ✓ | ✓ |
| Enable/Disable, if applicable | 4.8.28 | ✓ | ✓ | ✓ | ✓ |

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Table III - Models XE66E & XE66B, 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 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 XE66E Only) <u>2/</u> | 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 XE66E 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 | ✓ | ✓ | ✓ | ✓ |
| Enable/Disable, if applicable | 4.8.28 | ✓ | ✓ | ✓ | ✓ |

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