

General Description

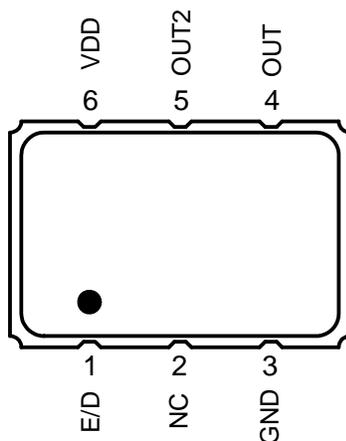
The XLL is an LVDS Crystal Oscillator with 0.89ps typical phase jitter over 12kHz to 20 MHz bandwidth. Available in a wide frequency range from 0.750MHz to 1350MHz, the IDT XLL Series Crystal Oscillator utilizes a family of proprietary ASICs, with a key focus on noise reduction technologies.

The 3rd order Delta Sigma Modulator reduces noise to the levels that are comparable to traditional Bulk Quartz and SAW oscillators. With short lead-time, low cost, low noise, wide frequency range, excellent ambient performance, the XLL is an excellent choice over the conventional technologies. The XLL has stabilities as tight as $\pm 20\text{ppm}$ with extremely quick delivery for both standard and custom frequencies

Features

- Frequency range: 0.750MHz to 1350MHz
- Output Type: LVDS
- Frequency Stability: $\pm 20\text{ppm}$, $\pm 25\text{ppm}$, $\pm 50\text{ppm}$, or $\pm 100\text{ppm}$
- Supply Voltage: 2.5V or 3.3V
- Phase Jitter (1.875MHz to 20MHz): 225fs typical
- Phase Jitter (12kHz to 20MHz): 0.89ps typical
- Package options: 3.2mm x 2.5mm x 1.0mm (JX6)
5.0mm x 3.2mm x 1.2mm (JS6)
7.0mm x 5.0mm x 1.3mm (JU6)
- Operating Temperatures: -20°C to $+70^{\circ}\text{C}$ or -40°C to $+85^{\circ}\text{C}$

Pin Assignment



6-pin CLCC

Pin Descriptions

| Pin Number | Pin Name | Description |
|------------|----------|---|
| 1 | E/D | Enable/Disable ¹ (0=Output Disabled) |
| 2 | NC | No connect |
| 3 | GND | Connect to ground |
| 4 | OUT | Output |
| 5 | OUT2 | Complementary Output |
| 6 | VDD | Supply voltage |

1. Pulled high internally.

Absolute Maximum Ratings

Stresses above the ratings listed below can cause permanent damage to the XLL. These ratings, which are standard values for IDT commercially rated parts, are stress ratings only. Functional operation of the device at these or any other conditions above those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods can affect product reliability. Electrical parameters are guaranteed only over the recommended operating temperature range.

| Item | Rating |
|--------------------------------|-----------------------|
| VDD | -0.5 to +5.0 V |
| E/D | -0.5 V to VDD + 0.5 V |
| OUT | -0.5 V to VDD + 0.5 V |
| Storage Temperature | -55°C to 125°C |
| Theta Ja (Junction to Ambient) | 102°C/W – Still Air |

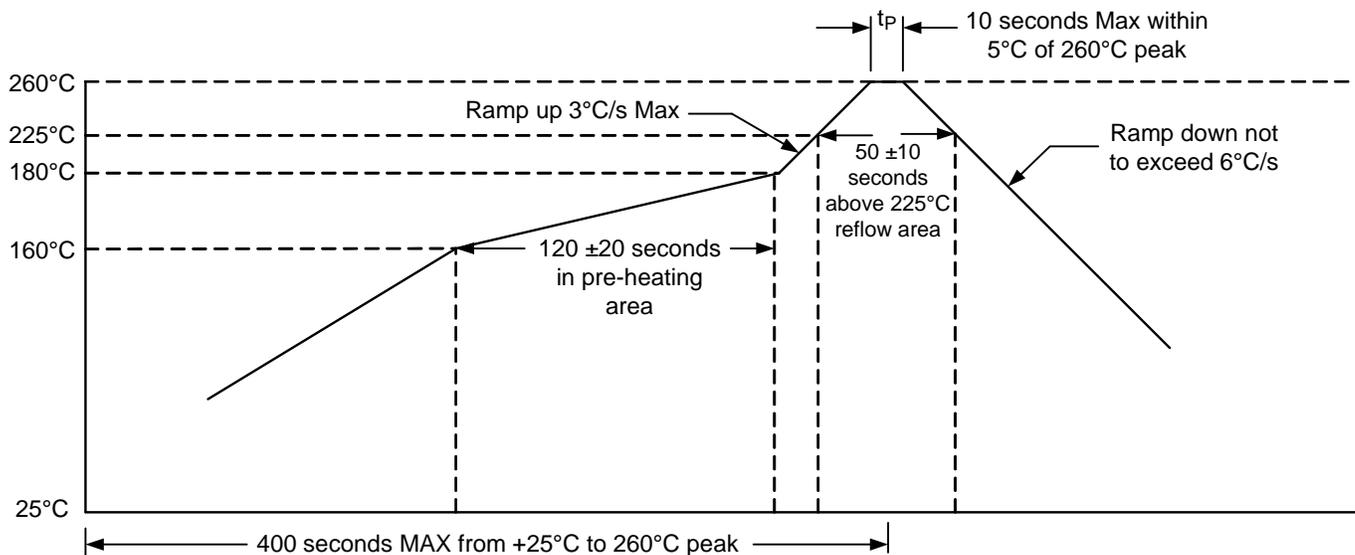
ESD Compliance

| | |
|------------------------|-------|
| Human Body Model (HBM) | 1000V |
| Machine Model (MM) | 150V |

Mechanical Testing

| Parameter | Test Method |
|--------------------------|--|
| Mechanical Shock | Drop from 75cm to hardwood surface–3 times |
| Mechanical Vibration | 10–55Hz, 1.5mm amplitude, 1 minute sweep 2 hours each in 3 directions (X, Y, Z) |
| High Temperature Burn-in | Under power @ 125°C for 2000 hours |
| Hermetic Seal | He pressure: 4 ±1kgf/cm ² 2 hour soak |

Solder Reflow Profile



DC Characteristics

($V_{DD} = 3.3\text{ V} \pm 5\%$, $T_A = -20^\circ\text{C}$ to $+70^\circ\text{C}$; -40° to $+85^\circ\text{C}$)

| Parameter | Symbol | Condition | Min | Typ | Max | Units |
|---|----------|--------------------|--------------|-----|--------------|-------|
| Power Supply Current | I_{DD} | Common Frequencies | | | 100 | mA |
| Differential Output Voltage | V_{OD} | Standard LVDS load | | 0.6 | | V |
| Output Offset Voltage | V_{OS} | Standard LVDS load | | 1.3 | | V |
| Enable/Disable Input HIGH Voltage (Output enabled)* | V_{IH} | | $70\%V_{DD}$ | | | V |
| Enable/Disable Input LOW Voltage (Output disabled) | V_{IL} | | | | $30\%V_{DD}$ | V |

* A pullup resistor from pin 6 (VDD) to pin 1 (E/D) enables output when pin 1 is left open.

AC Characteristics

($V_{DD} = 3.3\text{ V} \pm 5\%$, $T_A = -20^\circ\text{C}$ to $+70^\circ\text{C}$; -40° to $+85^\circ\text{C}$)

| Parameter | Symbol | Condition | Min | Typ | Max | Units |
|--|-----------------|--|----------|------|-----------|--------|
| Output Frequency Range | F_{OUTR} | | 0.750 | | 1350 | MHz |
| Frequency Stability | | Temperature = -20°C to $+70^\circ\text{C}$ | ± 20 | | ± 100 | ppm |
| | | Temperature = -40°C to $+85^\circ\text{C}$ | ± 25 | | ± 100 | ppm |
| Aging (1 st year) | | $T_a = 25^\circ\text{C}$ | | | 3 | |
| Aging (10 years) | | $T_a = 25^\circ\text{C}$ | | | 10 | |
| Output Load | | Differential | | 100 | | Ohms |
| Start-up Time | T_{ST} | Output valid time after VDD meets minimum specified level | | | 10 | ms |
| Output Rise Time | | 20% to 80% V_{PP} | | | 400 | ps |
| Output Fall Time | | 80% to 20% V_{PP} | | | 400 | ps |
| Output Clock Duty Cycle | T_{DTCY} | 50% V_{P-P} | 45 | | 55 | % |
| Output Enable/ Disable Time | T_{OE} | | | | 100 | ns |
| Period Jitter, RMS | J_{PER} | Frequency = 156.25MHz | | 3.0 | | ps |
| Random Jitter | R_J | Frequency = 156.25MHz | | 1.3 | | ps |
| Deterministic Jitter | D_J | Per MJSQ spec (Methodologies for Jitter and Signal Quality specifications) | | 5.8 | | ps |
| Total Jitter | T_J | | | 23.6 | | ps |
| Phase Jitter (12kHz – 20MHz) | ϕ_{JITTER} | Common Frequencies | | 0.89 | | ps |
| Phase Noise Performance Frequency = 156.25MHz | ϕ_{NOISE} | 100Hz of Carrier | | -80 | | dBc/Hz |
| | | 1kHz of Carrier | | -115 | | dBc/Hz |
| | | 10kHz of Carrier | | -118 | | dBc/Hz |
| | | 100kHz of Carrier | | -124 | | dBc/Hz |
| | | 1MHz of Carrier | | -142 | | dBc/Hz |
| | | 10MHz of Carrier | | -151 | | dBc/Hz |
| Output Frequency (Common) | F_{OUT} | 100MHz, 106.25MHz, 1258MHz, 150MHz, 155.52MHz, 156.25MHz, 200MHz, 212.5MHz, 250MHz, 300MHz, 312.5MHz, 400MHz (Contact IDT for additional frequencies) | | | | |

Note: Inclusive of initial frequency accuracy, operating temperature range, supply variation, load variation, 3 times solder reflow, shock, vibration and 1 year aging at 25°C . We do not recommend hand soldering the devices

DC Characteristics

($V_{DD} = 2.5\text{ V} \pm 5\%$, $T_A = -20^\circ\text{C}$ to $+70^\circ\text{C}$; -40° to $+85^\circ\text{C}$)

| Parameter | Symbol | Condition | Min | Typ | Max | Units |
|---|----------|--------------------|--------------|------|--------------|-------|
| Power Supply Current | I_{DD} | Common Frequencies | 26 | | 65 | mA |
| Differential Output Voltage | V_{OD} | Standard LVDS load | | 0.4 | | V |
| Output Offset Voltage | V_{OS} | Standard LVDS load | | 1.25 | | V |
| Enable/Disable Input HIGH Voltage (Output enabled)* | V_{IH} | | $70\%V_{DD}$ | | | V |
| Enable/Disable Input LOW Voltage (Output disabled) | V_{IL} | | | | $30\%V_{DD}$ | V |

* A pullup resistor from pin 6 (VDD) to pin 1 (E/D) enables output when pin 1 is left open.

AC Characteristics

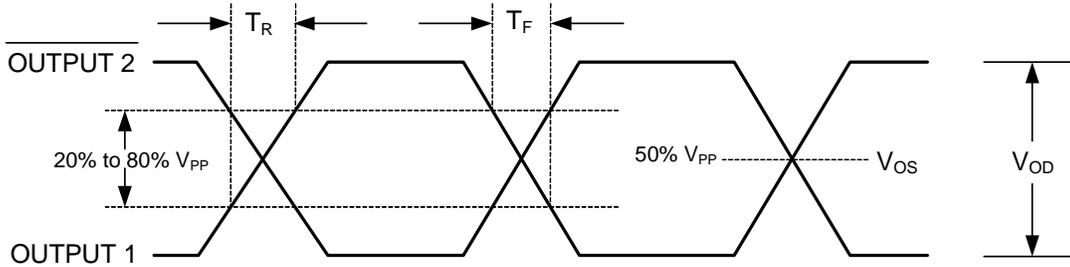
($V_{DD} = 2.5\text{ V} \pm 5\%$, $T_A = -20^\circ\text{C}$ to $+70^\circ\text{C}$; -40° to $+85^\circ\text{C}$)

| Parameter | Symbol | Condition | Min | Typ | Max | Units |
|--|-----------------|--|----------|------|-----------|--------|
| Output Frequency Range | F_{OUTR} | | 0.750 | | 1000 | MHz |
| Frequency Stability | | Temperature = -20°C to $+70^\circ\text{C}$ | ± 20 | | ± 100 | ppm |
| | | Temperature = -40°C to $+85^\circ\text{C}$ | ± 25 | | ± 100 | ppm |
| Output Load | | Differential | | 100 | | Ohms |
| Start-up Time | T_{ST} | Output valid time after VDD meets minimum specified level | | | 10 | ms |
| Output Rise Time | | 20% to 80% V_{PP} | | | 400 | ps |
| Output Fall Time | | 80% to 20% V_{PP} | | | 400 | ps |
| Output Clock Duty Cycle | T_{DTCY} | 50% V_{P-P} | 45 | | 55 | % |
| Output Enable/ Disable Time | T_{OE} | | | | 100 | ns |
| Period Jitter, RMS | J_{PER} | Frequency = 156.25MHz | | 4.0 | | ps |
| Random Jitter | R_J | Frequency = 156.25MHz Per MJSQ spec (Methodologies for Jitter and Signal Quality specifications) | | 1.4 | | ps |
| Deterministic Jitter | D_J | | | 9.2 | | ps |
| Total Jitter | T_J | | | 29.2 | | ps |
| Phase Jitter (12kHz – 20MHz) | ϕ_{JITTER} | Frequency = 156.25MHz | | 1.04 | | ps |
| Phase Noise Performance Frequency = 156.25MHz | ϕ_{NOISE} | 100Hz of Carrier | | -83 | | dBc/Hz |
| | | 1kHz of Carrier | | -105 | | dBc/Hz |
| | | 10kHz of Carrier | | -113 | | dBc/Hz |
| | | 100kHz of Carrier | | -119 | | dBc/Hz |
| | | 1MHz of Carrier | | -137 | | dBc/Hz |
| | | 10MHz of Carrier | | -146 | | dBc/Hz |
| Output Frequency (Standards) | F_{OUT} | 100MHz, 106.25MHz, 1258MHz, 150MHz, 155.52MHz, 156.25MHz, 200MHz, 212.5MHz, 250MHz, 300MHz, 312.5MHz, 400MHz (Contact IDT for additional frequencies) | | | | |

Note: Inclusive of initial frequency accuracy, operating temperature range, supply variation, load variation, 3 times solder reflow, shock, vibration and 1 year aging at 25°C . We do not recommend hand soldering the devices

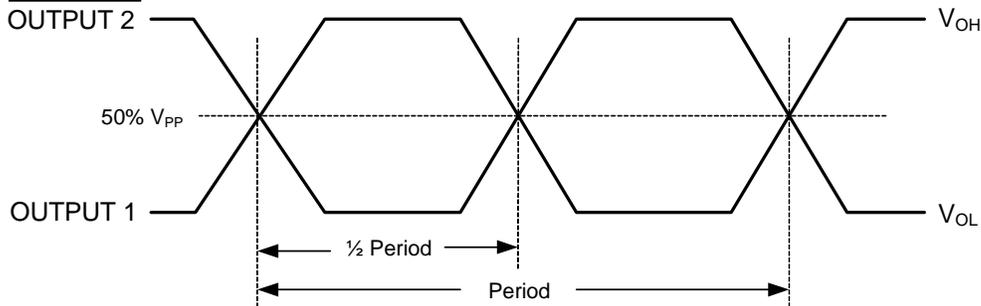
Output Waveform

Output Levels/Rise Time/Fall Time Measurements

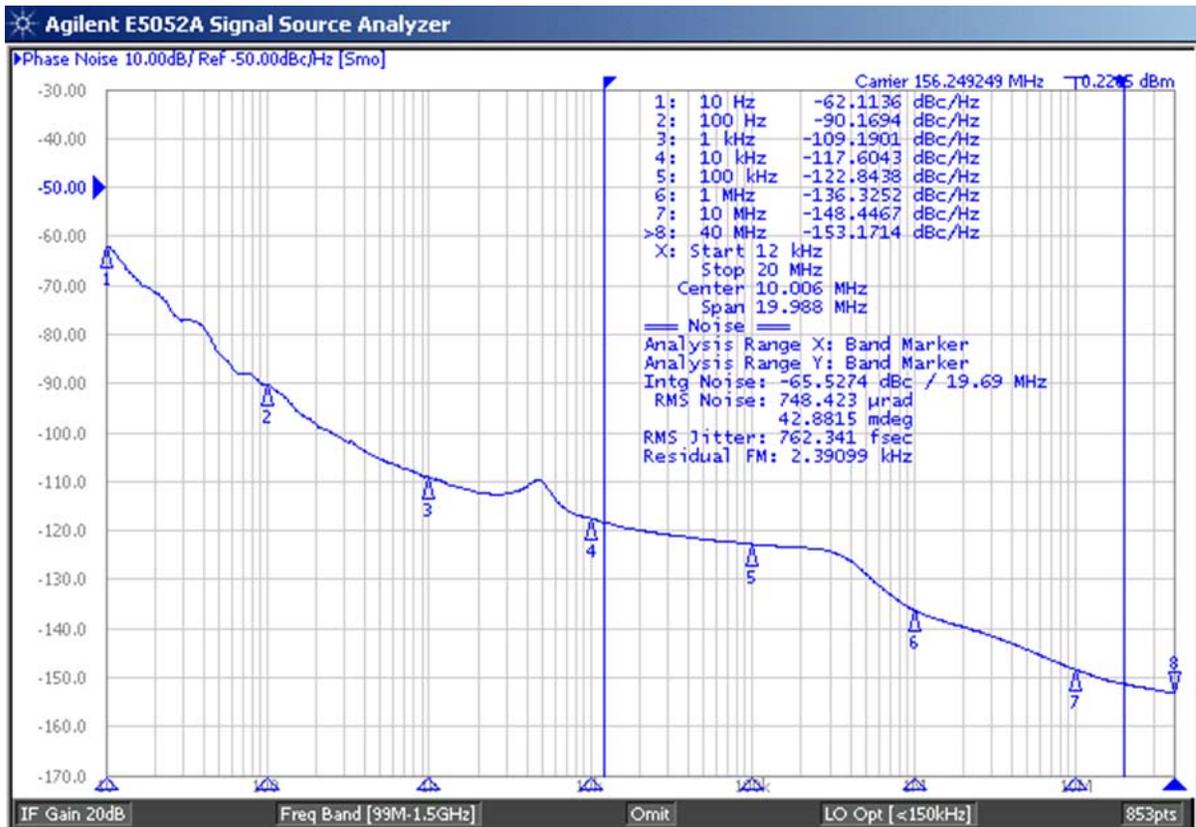


Oscillator Symmetry

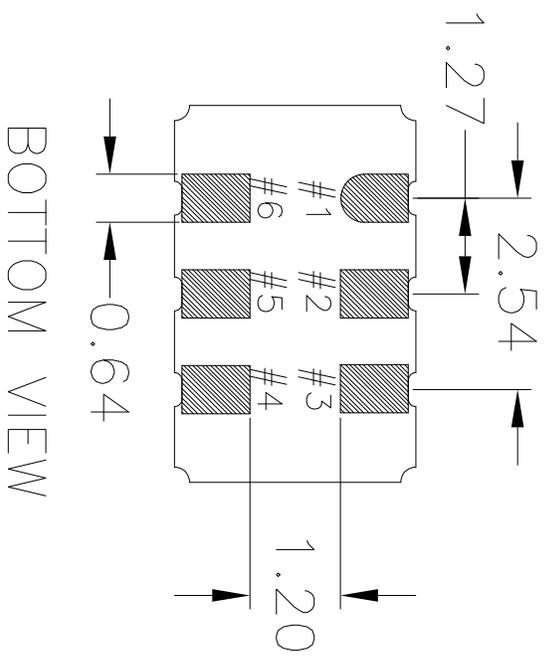
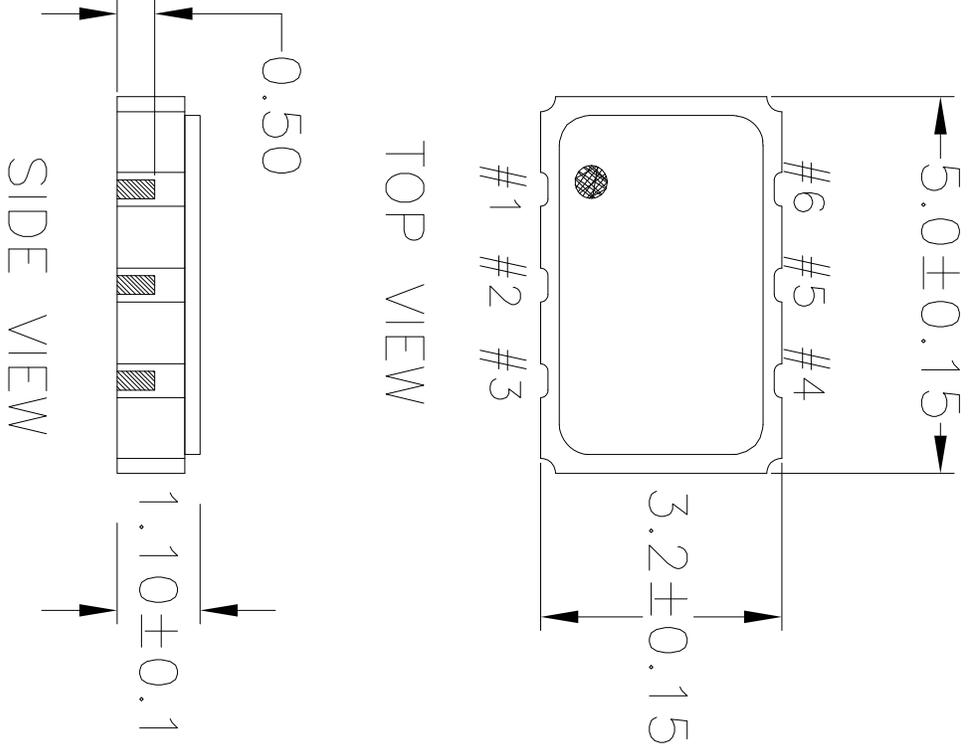
Ideally, Symmetry should be 50/50 for 1/2 period –Other expressions are 45/55 or 55/45



Typical Phase Noise (3.3V)



JS6 Package Outline and Dimensions



| REV | DESCRIPTION | DATE | APPRO |
|-----|------------------------|----------|-------|
| 00 | INITIAL RELEASE | 04/2/12 | DP |
| 01 | ADDED LID IN TOP VIEW | 07/12/12 | KS |
| 02 | UPDATED LID TOLERANCES | 12/03/12 | KS |
| 03 | UPDATE PACKAGE DRAWING | 8/8/14 | JHU |

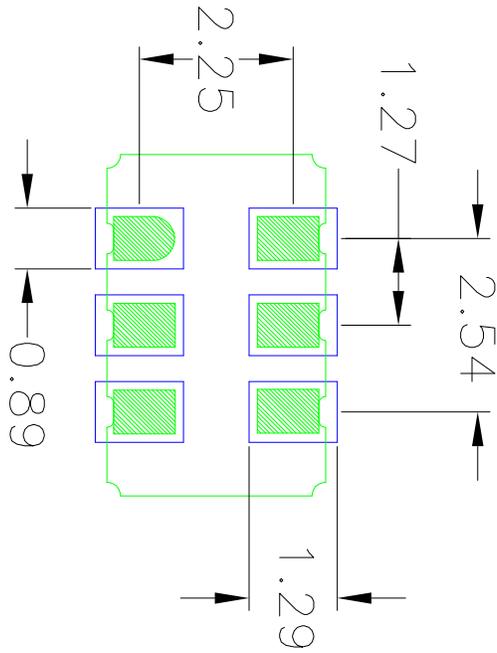
NOTES:
1. ALL DIMENSIONS IN MM.

| TOLERANCES UNLESS SPECIFIED | |
|-----------------------------|-----------------------------|
| DECIMAL | ANGULAR |
| XXX | ± |
| XXXX | |
| XXXXX | |
| APPROVALS | DATE |
| DRAWN: gac | 04/2/12 |
| CHECKED | |
| SIZE: C | DRAWING No: PSC-4411 |

IDT™ 6024 Silver Creek Valle
 San Jose, CA 95138
 PHONE: (408) 727-6116
 FAX: (408) 492-8674

www.IDT.com

JS6 Package Outline and Dimensions (cont.)



RECOMMENDED LAND PATTERN

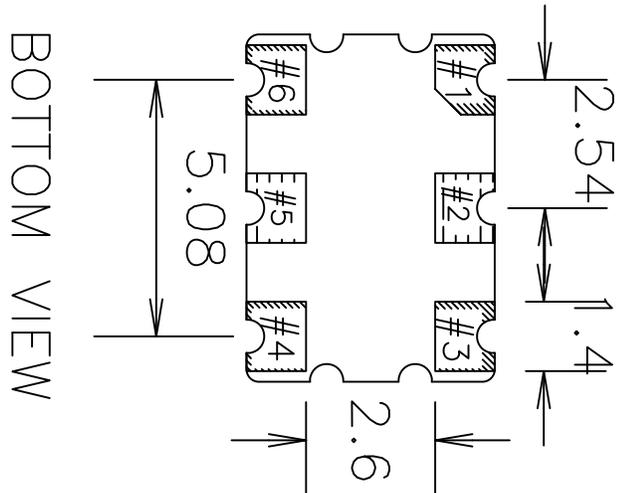
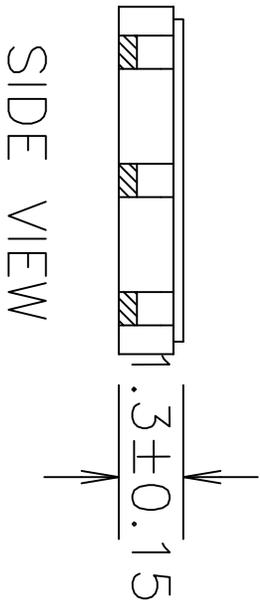
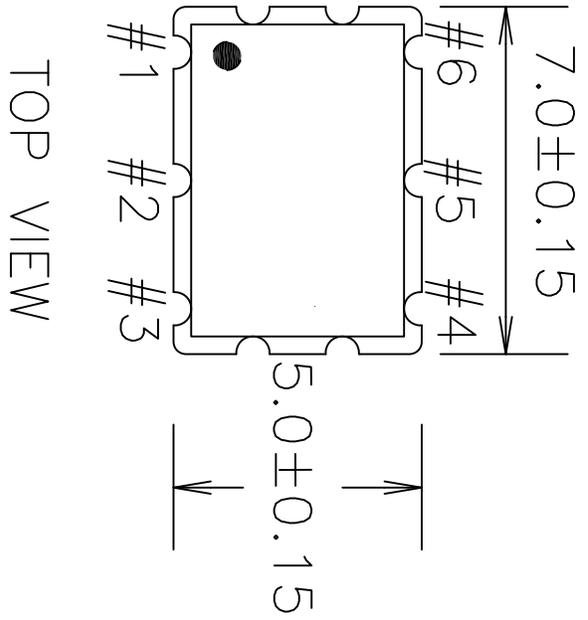
NOTES:

1. ALL DIMENSION ARE IN mm. ANGLES IN DEGREES.
2. TOP DOWN VIEW. AS VIEWED ON PCB.
3. COMPONENT OUTLINE SHOW FOR REFERENCE IN GREEN.
4. LAND PATTERN IN BLUE. NSMD PATTERN ASSUMED.
5. LAND PATTERN RECOMMENDATION PER IPC-7351B GENERIC REQUIREMENT FOR SURFACE MOUNT DESIGN AND LAND PATTERN.

| REVISIONS | | | |
|-----------|------------------------|----------|----------|
| REV | DESCRIPTION | DATE | APPROVED |
| 00 | INITIAL RELEASE | 04/2/12 | DP |
| 01 | ADDED LID IN TOP VIEW | 07/12/12 | KS |
| 02 | UPDATED LID TOLERANCES | 12/03/12 | KS |
| 03 | UPDATE PACKAGE DRAWING | 8/8/14 | JHUA |

| | | |
|-----------------------------|----------------------|---|
| TOLERANCES UNLESS SPECIFIED | | <p>6024 Silver Creek Valley Rd San Jose, CA 95138 PHONE: (408) 727-6116 FAX: (408) 492-8674</p> |
| DECIMAL | ANGULAR | |
| XXX± | ± | |
| XXXX± | | |
| DATE | TITLE | www.IDT.com 5.0 x 3.2 mm BODY 1.1 mm Thick |
| 04/2/12 | JS6 PACKAGE OUTLINE | |
| DRAWN | DATE | SIZE |
| GALG | 04/2/12 | C |
| CHECKED | | DRAWING No. |
| | | PSC-4411 |
| | | REV |
| | | 03 |
| | DO NOT SCALE DRAWING | SHEET |
| | | 2 OF 2 |

JU6 Package Outline and Dimensions

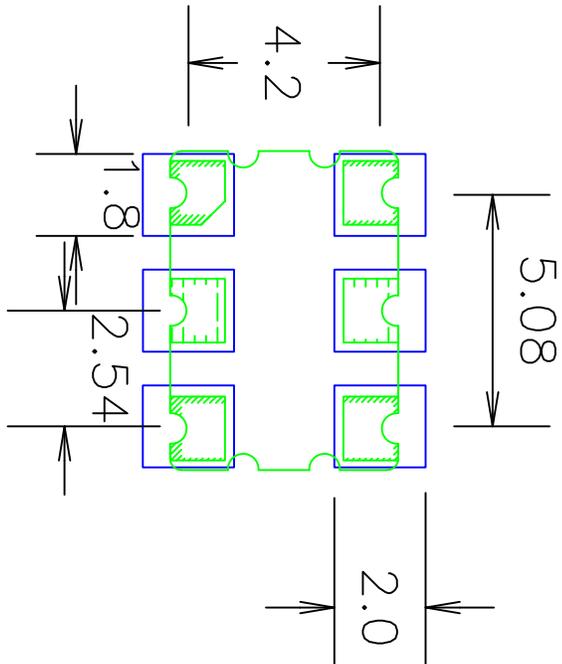


NOTES:
1. ALL DIMENSIONS IN MM.

| REV | DESCRIPTION | DATE | APPROVED |
|-----|------------------------|---------|----------|
| 00 | INITIAL RELEASE | 10/5/12 | KS |
| 01 | UPDATE PACKAGE DRAWING | 8/12/14 | JHUA |

| | | | |
|-----------------------------|-------------|---------------------|---|
| TOLERANCES UNLESS SPECIFIED | | | 6024 Silver Creek Valley Rd San Jose, CA 95138 PHONE: (408) 727-6116 FAX: (408) 492-8674 |
| DECIMAL | ANGULAR | | |
| XXX± | ± | www.IDT.com | |
| XXXX± | | | |
| XXXX± | | | |
| APPROVALS | DATE | TITLE | |
| DRAWN: JCS | 10/03/12 | JU6 PACKAGE OUTLINE | |
| CHECKED | | 7.0 x 5.0 mm BODY | |
| | | 1.3 mm Thick | |
| SIZE | DRAWING No. | REV | |
| C | PSC-4430 | 01 | |

JU6 Package Outline and Dimensions (cont.)



RECOMMENDED LAND PATTERN

- NOTES:
1. ALL DIMENSION ARE IN mm. ANGLES IN DEGREES.
 2. TOP DOWN VIEW. AS VIEWED ON PCB.
 3. COMPONENT OUTLINE SHOW FOR REFERENCE IN GREEN.
 4. LAND PATTERN IN BLUE. NSMD PATTERN ASSUMED.
 5. LAND PATTERN RECOMMENDATION PER IPC-7351B GENERIC REQUIREMENT FOR SURFACE MOUNT DESIGN AND LAND PATTERN.

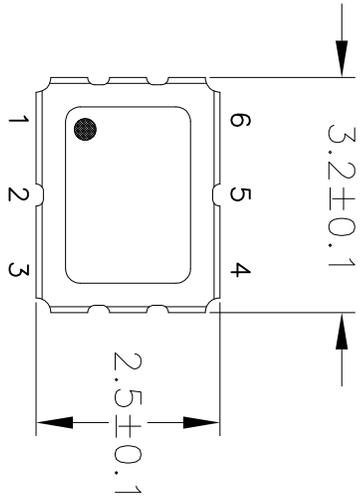
| REVISIONS | | | |
|-----------|-----------------------|---------|----------|
| REV | DESCRIPTION | DATE | APPROVED |
| 00 | INITIAL RELEASE | 10/5/12 | KS |
| 01 | UPDATE PACKAGE DRWING | 8/12/14 | JHUA |

| | | | |
|----------------------|-------------|---------------------|--------------|
| TOLERANCES | | UNLESS SPECIFIED | |
| DECIMAL | ANGULAR | ± | |
| XXX | ± | | |
| XXX | | | |
| XXX | | | |
| APPROVALS | DATE | TITLE | |
| DRAWN <i>gds</i> | 10/03/12 | JU6 PACKAGE OUTLINE | |
| CHECKED | | 7.0 x 5.0 mm BODY | |
| | | 1.3 mm Thick | |
| SIZE | DRAWING No. | REV | |
| C | PSC-4430 | 01 | |
| DO NOT SCALE DRAWING | | | SHEET 2 OF 2 |

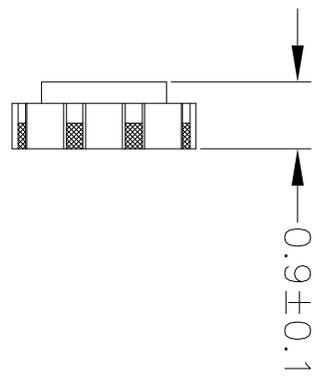
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 San Jose, CA 95138
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 FAX: (408) 482-8674
www.IDT.com

JX6 Package Outline and Dimensions

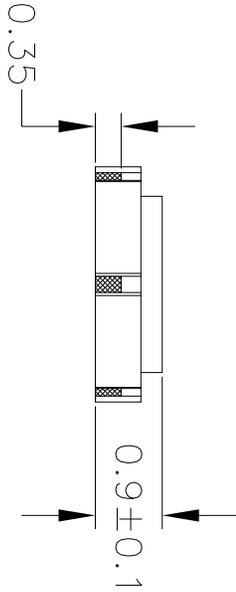
- NOTES:
 1. ALL DIMENSIONS IN MM.



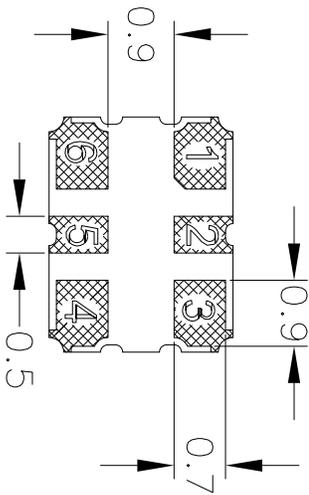
TOP VIEW



END VIEW



SIDE VIEW



BOTTOM VIEW

| REV | DESCRIPTION | DATE |
|-----|-----------------|---------|
| 00 | INITIAL RELEASE | 8/11/14 |

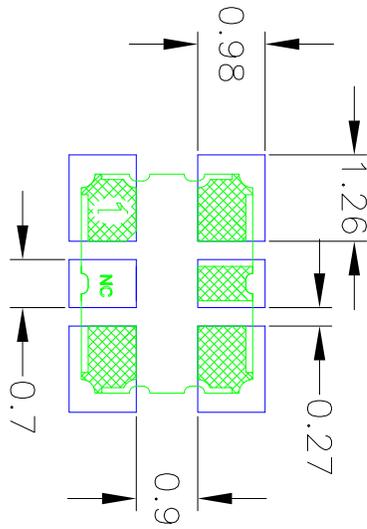
| TOLERANCES UNLESS SPECIFIED | |
|-----------------------------|-------------|
| DECIMAL | ANGULAR |
| ± | ± |
| XXXX± | |
| APPROVALS | DATE |
| DRAWN /BAG | 8/11/14 |
| CHECKED | |
| SIZE | DRAWING No. |
| C | PSC-4412 |

6024 Silver Creeb
 San Jose, CA 95
 PHONE: (408) 725-
 FAX: (408) 492-4

TITLE: JX6 PACKAGE OUTLINE
 3.2 x 2.5 mm BODY
 0.9 mm Thick
 PSC-4412

JX6 Package Outline and Dimensions (cont.)

| REVISIONS | | | |
|-----------|-----------------|---------|----------|
| REV | DESCRIPTION | DATE | APPROVED |
| 00 | INITIAL RELEASE | 8/11/14 | J.HUA |



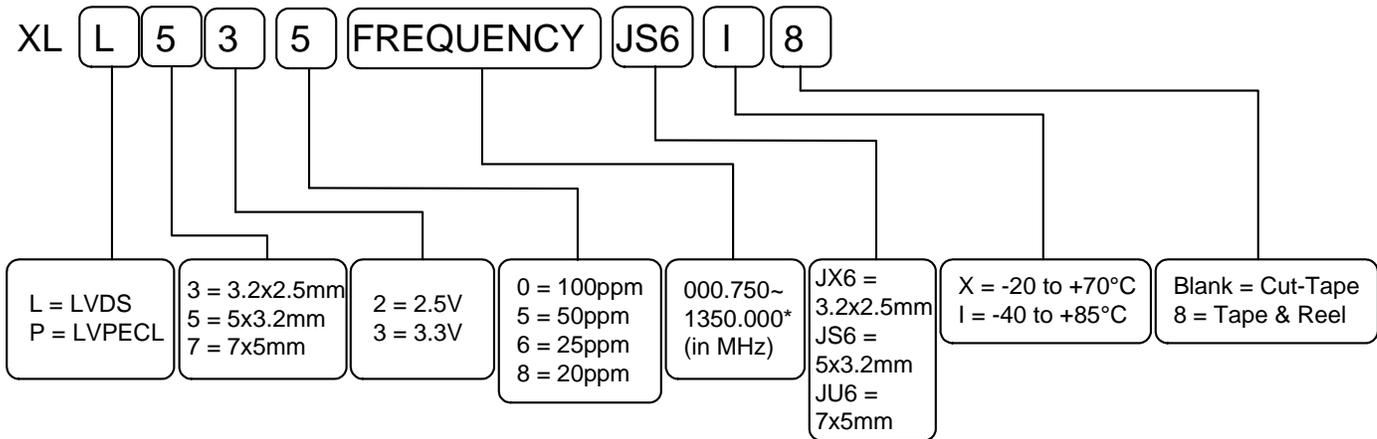
1. ALL DIMENSION ARE IN mm. ANGLES IN DEGREES.

NOTES:

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5. LAND PATTERN RECOMMENDATION PER IPC-7351B GENERIC REQUIREMENT FOR SURFACE MOUNT DESIGN AND LAND PATTERN.

| | | | |
|-----------------------------|----------------------|---|------|
| TOLERANCES UNLESS SPECIFIED | | 6024 Silver Creek Valley Rd San Jose, CA 95138 | |
| DECIMAL | ANGULAR | PHONE: (408) 727-6116 | |
| XX# | ± | FAX: (408) 492-8674 | |
| XXXX# | | | |
| APPROVALS | | TITLE JX6 PACKAGE OUTLINE | |
| DRAWN GAG | DATE 8/11/14 | 3.2 x 2.5 mm BODY | |
| CHECKED | | 0.9 mm Thick | |
| SIZE C | DRAWING No. PSC-4412 | REV 00 | |
| DO NOT SCALE DRAWING | | SHEET 2 | OF 2 |

Ordering Information



* See table or contact IDT for custom frequencies

Revision History

| Rev. | Date | Originator | Description of Change |
|------|----------|--------------|-----------------------|
| A | 12/10/14 | B. Chandhoke | Initial release. |
| | | | |



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