



**THE DATASHEET OF  
XLL735125.000000I**



**Description**

The Renesas XL devices (XO and VCXO options) are ultra-precision crystal oscillators with 750 to 890fs typical phase jitter over 12kHz to 20MHz bandwidth. Available in a wide frequency range from 0.750MHz to 1350MHz, the XL series crystal oscillators utilize 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 XL devices are an excellent choice over the conventional technologies. The XL (XO option) devices have stabilities as tight as  $\pm 20$ ppm and the XL (VCXO option) devices have  $\pm 50$ ppm APR. Either option provides extremely quick delivery for both standard and custom frequencies.

**Pin Assignments**

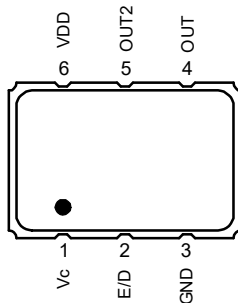
**(XO Option)**

**NOTE:** To minimize power supply line noise, a 0.01 $\mu$ F bypass capacitor should be placed between V<sub>DD</sub> (Pin 6) and GND (Pin 3).



**(VCXO Option)**

**NOTE:** To minimize power supply line noise, a 0.01 $\mu$ F bypass capacitor should be placed between V<sub>DD</sub> (Pin 6) and GND (Pin 3).



**Features**

- Output types: LVDS, LVPECL, LVCMOS
- Phase jitter (12kHz to 20MHz): 750fs to 890fs typical
- Supply voltage: 2.5V or 3.3V
- Package options:
  - 3.2 × 2.5 × 1.0 mm (not available for VCXO)
  - 5.0 × 3.2 × 1.2 mm
  - 7.0 × 5.0 × 1.3 mm
- Operating temperature: -20°C to +70°C
  - Frequency stability options:  $\pm 20$ ,  $\pm 25$ ,  $\pm 50$ , or  $\pm 100$  ppm (XO only)
  - $\pm 50$ ppm APR (VCXO only)
- Operating temperature: -40°C to +85°C
  - Frequency stability options:  $\pm 25$ ,  $\pm 50$ , or  $\pm 100$  ppm (XO only)
  - $\pm 50$ ppm APR (VCXO only)
- Operating temperature: -40°C to +105°C (XO only)
  - Frequency stability options:  $\pm 50$  or  $\pm 100$  ppm
- kV of 85ppm/volt typical from 0.5VDC to VDD (VCXO only)
  - Better than  $\pm 10\%$  linearity for Vc range

## Pin Descriptions

**Table 1. XO Pin Description**

| Number | Name            | Description                         |
|--------|-----------------|-------------------------------------|
| 1      | E/D             | Enable/Disable <sup>[a][b]</sup>    |
|        | NC              | No connect                          |
| 2      | NC              | No connect                          |
|        | E/D             | Enable/Disable <sup>[a][b]</sup>    |
| 3      | GND             | Connect to ground                   |
| 4      | OUT             | Output                              |
| 5      | OUT2            | Complementary output <sup>[c]</sup> |
| 6      | V <sub>DD</sub> | Supply voltage                      |

[a] Pulled high internally.

[b] Low = output disabled.

[c] Do not connect for LVCMOS. For XLVCMOS, both OUT and OUT2 are ON and in opposite phase.

See [Ordering Information \(XO\)](#) for more details.

**Table 2. VCXO Pin Description**

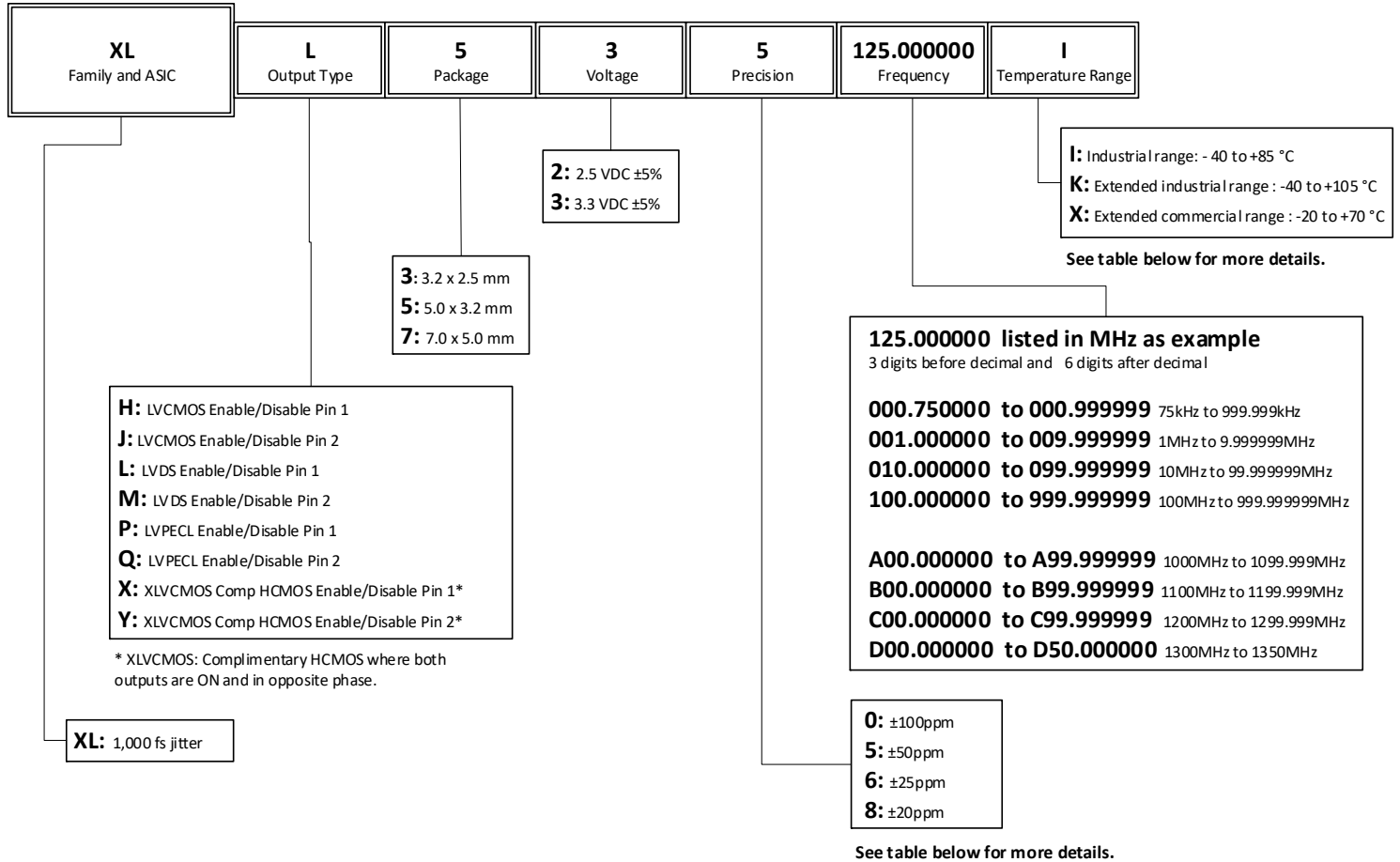
| Number | Name            | Description                      |
|--------|-----------------|----------------------------------|
| 1      | Vc              | Voltage control                  |
| 2      | E/D             | Enable/Disable <sup>[a][b]</sup> |
| 3      | GND             | Connect to ground                |
| 4      | OUT             | Output                           |
| 5      | OUT2            | Complementary output (NC LVCMOS) |
| 6      | V <sub>DD</sub> | Supply voltage                   |

[a] Pulled high internally.

[b] Low = output disabled.

See [Ordering Information \(VCXO\)](#) for more details.

## Ordering Information (XO)



**Table 3. Frequency Stability and Operating Temperature Decoder**

| "Precision" and "Temperature Range" Codes | Operating Temperature | Frequency Stability |         |       |
|---|-----------------------|---------------------|---------|-------|
|   |                       | Minimum             | Maximum | Units |
| "8" and "X"                               | -20°C to +70°C        | -20                 | +20     | ppm   |
| "6" and "X"                               | -20°C to +70°C        | -25                 | +25     | ppm   |
| "5" and "X"                               | -20°C to +70°C        | -50                 | +50     | ppm   |
| "0" and "X"                               | -20°C to +70°C        | -100                | +100    | ppm   |
| "6" and "I"                               | -40°C to +85°C        | -25                 | +25     | ppm   |
| "5" and "I"                               | -40°C to +85°C        | -50                 | +50     | ppm   |
| "0" and "I"                               | -40°C to +85°C        | -100                | +100    | ppm   |
| "5" and "K"                               | -40° to +105°C        | -50                 | +50     | ppm   |
| "0" and "K"                               | -40° to +105°C        | -100                | +100    | ppm   |

# Ordering Information (VCXO)



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## Absolute Maximum Ratings

Stresses above the ratings listed below can cause permanent damage to the device. These ratings, which are standard values for Renesas 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.

**Table 4. Absolute Maximum Ratings**

| Item                         | Rating                          |           |                    |           |                    |           |
|------------------------------|---------------------------------|-----------|--------------------|-----------|--------------------|-----------|
| V <sub>DD</sub>              | -0.5 to +5.0V                   |           |                    |           |                    |           |
| E/D                          | -0.5V to V <sub>DD</sub> + 0.5V |           |                    |           |                    |           |
| OUT                          | -0.5V to V <sub>DD</sub> + 0.5V |           |                    |           |                    |           |
| Storage Temperature          | -55°C to 125°C                  |           |                    |           |                    |           |
| Maximum Junction Temperature | 125°C                           |           |                    |           |                    |           |
| Core Current                 | 65mA maximum                    |           |                    |           |                    |           |
| Theta J <sub>A</sub>         | JU6                             | 75.9 °C/W | JS6                | 89.6 °C/W | JX6                | 94.7 °C/W |
| Theta J <sub>B</sub>         | 7.0 × 5.0 × 1.3 mm              | 48.6°C/W  | 5.0 × 3.2 × 1.2 mm | 54.3 °C/W | 3.2 × 2.5 × 1.0 mm | 66.8 °C/W |

## ESD Compliance

**Table 5. ESD Compliance**

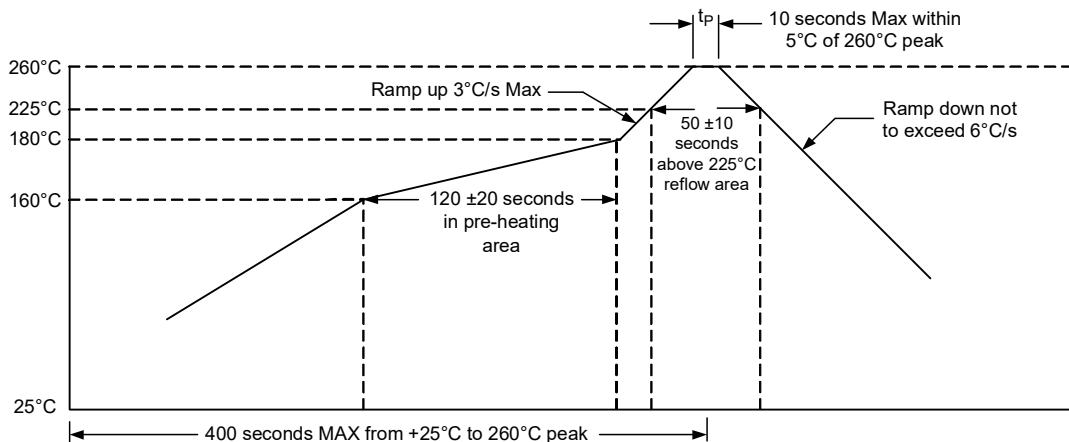
|                        |       |
|------------------------|-------|
| Human Body Model (HBM) | 1000V |
| Machine Model (MM)     | 150V  |

## Mechanical Testing

**Table 6. 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 at 125°C for 2000 hours.  |
| Hermetic Seal            | He pressure: 4 ±1kgf/cm <sup>2</sup> 2 hour soak.                                 |

## Solder Reflow Profile



## DC Electrical Characteristics

**Table 7. 3.3V IDD DC Electrical Characteristics**

$V_{DD} = 3.3V \pm 5\%$ ,  $T_A = -20^{\circ}C$  to  $+70^{\circ}C$ ;  $-40^{\circ}C$  to  $+85^{\circ}C$ ,  $-40^{\circ}C$  to  $+105^{\circ}C$ .

| Symbol             | Parameter            | Output Type           | Conditions          | Minimum | Typical | Maximum | Units |
|--------------------|----------------------|-----------------------|---------------------|---------|---------|---------|-------|
| $I_{DD}$           | Power Supply Current | LVDS                  | 0.75MHz to 40MHz.   | -       | 32      | 37      | mA    |
|                    |                      |                       | 40+MHz to 220MHz.   | -       | 40      | 47      |       |
|                    |                      |                       | 220+MHz to 630MHz.  | -       | 49      | 57      |       |
|                    |                      |                       | 630+MHz to 1350MHz. | -       | 72      | 100     |       |
|                    |                      | LVPECL <sup>[a]</sup> | 0.75MHz to 40MHz.   | -       | 26      | 31      |       |
|                    |                      |                       | 40+MHz to 220MHz.   | -       | 38      | 45      |       |
|                    |                      |                       | 220+MHz to 630MHz.  | -       | 56      | 64      |       |
|                    |                      |                       | 630+MHz to 1350MHz. | -       | 96      | 120     |       |
|                    |                      | LVCMOS                | 0.75MHz to 20MHz.   | -       | 27      | 32      |       |
|                    |                      |                       | 20+MHz to 50MHz.    | -       | 32      | 35      |       |
|                    |                      |                       | 50+MHz to 130MHz.   | -       | 43      | 47      |       |
|                    |                      |                       | 130+MHz to 200MHz.  | -       | 48      | 55      |       |
| 200+MHz to 250MHz. | -                    |                       | 48                  | 60      |         |         |       |

[a] Without termination resistors.

**Table 8. 2.5V IDD DC Electrical Characteristics**

$V_{DD} = 2.5V \pm 5\%$ ,  $T_A = -20^{\circ}C$  to  $+70^{\circ}C$ ;  $-40^{\circ}C$  to  $+85^{\circ}C$ ,  $-40^{\circ}C$  to  $+105^{\circ}C$ .

| Symbol             | Parameter            | Output Type           | Conditions          | Minimum | Typical | Maximum | Units |
|--------------------|----------------------|-----------------------|---------------------|---------|---------|---------|-------|
| $I_{DD}$           | Power Supply Current | LVDS                  | 0.75MHz to 20MHz.   | -       | 24      | 26      | mA    |
|                    |                      |                       | 20+MHz to 220MHz.   | -       | 29      | 34      |       |
|                    |                      |                       | 220+MHz to 630MHz.  | -       | 36      | 44      |       |
|                    |                      |                       | 630+MHz to 1000MHz. | -       | 46      | 65      |       |
|                    |                      | LVPECL <sup>[a]</sup> | 0.75MHz to 20MHz.   | -       | 20      | 33      |       |
|                    |                      |                       | 20+MHz to 220MHz.   | -       | 28      | 41      |       |
|                    |                      |                       | 220+MHz to 630MHz.  | -       | 41      | 63      |       |
|                    |                      |                       | 630+MHz to 1000MHz. | -       | 56      | 72      |       |
|                    |                      | LVCMOS                | 0.75MHz to 20MHz.   | -       | 17      | 22      |       |
|                    |                      |                       | 20+MHz to 50MHz.    | -       | 23      | 25      |       |
|                    |                      |                       | 50+MHz to 100MHz.   | -       | 28      | 29      |       |
|                    |                      |                       | 100+MHz to 130MHz.  | -       | 30      | 32      |       |
| 130+MHz to 160MHz. | -                    |                       | 32                  | 35      |         |         |       |
| 160+MHz to 180MHz. | -                    |                       | 33                  | 37      |         |         |       |

[a] Without termination resistors.

**Table 9. LVDS DC Electrical Characteristics**

$V_{DD} = 3.3V, 2.5V \pm 5\%$ ,  $T_A = -20^\circ C$  to  $+70^\circ C$ ;  $-40^\circ C$  to  $+85^\circ C$ ,  $-40^\circ C$  to  $+105^\circ C$ . Below are guaranteed for listed standard frequencies.

| Symbol   | Parameter  | Conditions                | Minimum      | Typical | Maximum      | Units |
|----------|--|---------------------------|--------------|---------|--------------|-------|
| $V_{OD}$ | Differential Output Voltage                        | $V_{DD} = 3.3V \pm 5\%$ . | -            | -       | 0.6          | V     |
|          |  | $V_{DD} = 2.5V \pm 5\%$ . | -            | -       | 0.4          |       |
| $V_{OS}$ | Output Offset Voltage                              | $V_{DD} = 3.3V \pm 5\%$ . | -            | -       | 1.3          |       |
|          |  | $V_{DD} = 2.5V \pm 5\%$ . | -            | -       | 1.25         |       |
| $V_{IH}$ | Enable/Disable Input High Voltage (Output enabled) | -                         | 70% $V_{DD}$ | -       | -            |       |
| $V_{IL}$ | Enable/Disable Input Low Voltage (Output disabled) | -                         | -            | -       | 30% $V_{DD}$ |       |

**Table 10. LVPECL DC Electrical Characteristics**

$V_{DD} = 3.3V, 2.5V \pm 5\%$ ,  $T_A = -20^\circ C$  to  $+70^\circ C$ ;  $-40^\circ C$  to  $+85^\circ C$ ,  $-40^\circ C$  to  $+105^\circ C$ . Below are guaranteed for listed standard frequencies.

| Symbol   | Parameter  | Conditions                | Minimum      | Typical | Maximum      | Units |
|----------|--|---------------------------|--------------|---------|--------------|-------|
| $V_{OD}$ | Differential Output Voltage                        | $V_{DD} = 3.3V \pm 5\%$ . | 2.055        |         | 2.405        | V     |
|          |  | $V_{DD} = 2.5V \pm 5\%$ . | -            | 1.4     | -            |       |
| $V_{OS}$ | Output Offset Voltage                              | $V_{DD} = 3.3V \pm 5\%$ . | 1.305        |         | 1.65         |       |
|          |  | $V_{DD} = 2.5V \pm 5\%$ . | -            | 0.68    | -            |       |
| $V_{IH}$ | Enable/Disable Input High Voltage (Output enabled) | -                         | 70% $V_{DD}$ | -       | -            |       |
| $V_{IL}$ | Enable/Disable Input Low Voltage (Output disabled) | -                         | -            | -       | 30% $V_{DD}$ |       |

**Table 11. LVC MOS DC Electrical Characteristics**

$V_{DD} = 3.3V, 2.5V \pm 5\%$ ,  $T_A = -20^\circ C$  to  $+70^\circ C$ ;  $-40^\circ C$  to  $+85^\circ C$ ,  $-40^\circ C$  to  $+105^\circ C$ . Below are guaranteed for listed standard frequencies.

| Symbol   | Parameter  | Conditions                |                    | Minimum      | Typical | Maximum      | Units |
|----------|--|---------------------------|--------------------|--------------|---------|--------------|-------|
| $V_{OH}$ | Output High Voltage                                | $V_{DD} = 3.3V \pm 5\%$ . | 0.75MHz to 150MHz. | 90% $V_{DD}$ | -       | -            | V     |
|          |  |                           | 150+MHz to 250MHz. | 80% $V_{DD}$ | -       | -            |       |
|          |  | $V_{DD} = 2.5V \pm 5\%$ . | 0.75MHz to 160MHz. | 90% $V_{DD}$ | -       | -            |       |
|          |  |                           | 160+MHz to 180MHz. | 80% $V_{DD}$ | -       | -            |       |
| $V_{OL}$ | Output Low Voltage                                 | $V_{DD} = 3.3V \pm 5\%$ . | 0.75MHz to 150MHz. | -            | -       | 10% $V_{DD}$ |       |
|          |  |                           | 150+MHz to 250MHz. | -            | -       | 20% $V_{DD}$ |       |
|          |  | $V_{DD} = 2.5V \pm 5\%$ . | 0.75MHz to 160MHz. | -            | -       | 10% $V_{DD}$ |       |
|          |  |                           | 160+MHz to 180MHz. | -            | -       | 20% $V_{DD}$ |       |
| $V_{IH}$ | Enable/Disable Input High Voltage (Output enabled) | -                         | -                  | 70% $V_{DD}$ | -       | -            |       |
| $V_{IL}$ | Enable/Disable Input Low Voltage (Output disabled) | -                         | -                  | -            | -       | 30% $V_{DD}$ |       |

## AC Electrical Characteristics

**Table 12. 3.3V AC Electrical Characteristics**

$V_{DD} = 3.3V \pm 5\%$ ,  $T_A = -20^{\circ}C$  to  $+70^{\circ}C$ ;  $-40^{\circ}C$  to  $+85^{\circ}C$ ,  $-40^{\circ}C$  to  $+105^{\circ}C$ .

| Symbol    | Parameter                   | Test Condition  |                       | Minimum                   | Typical | Maximum                   | Units    |
|-----------|-----------------------------|---|-----------------------|---------------------------|---------|---------------------------|----------|
| F         | Output Frequency Range      | LVDS.   |                       | 0.75                      | -       | 1350                      | MHz      |
|           |                             | LVPECL.   |                       | 0.75                      | -       | 1350                      |          |
|           |                             | LVCMOS.   |                       | 0.75                      | -       | 250                       |          |
|           | Frequency Stability         | Temperature = $-20^{\circ}C$ to $+70^{\circ}C$ .                |                       | -20<br>-25<br>-50<br>-100 | -       | +20<br>+25<br>+50<br>+100 | ppm      |
|           |                             | Temperature = $-40^{\circ}C$ to $+85^{\circ}C$ .                |                       | -25<br>-50<br>-100        | -       | +25<br>+50<br>+100        | ppm      |
|           |                             | Temperature = $-40^{\circ}C$ to $+105^{\circ}C$ .               |                       | -50<br>-100               | -       | +50<br>+100               | ppm      |
|           | Output Load                 | LVDS.   | Differential.         | -                         | 100     | -                         | $\Omega$ |
|           |                             | LVPECL.   | $V_{DD} - 2.0V$ .     | -                         | 50      | -                         |          |
|           |                             | LVCMOS.   | To GND.               | -                         | 15      | -                         | pF       |
| $T_{ST}$  | Start-up Time               | Output valid time after $V_{DD}$ meets minimum specified level. |                       | -                         | -       | 10                        | ms       |
| $t_R$     | Output Rise Time            | LVDS.   | 20% to 80% $V_{pp}$ . | -                         | -       | 400                       | ps       |
|           |                             | LVPECL.   |                       | -                         | -       | 400                       |          |
|           |                             | LVCMOS.   | 10% to 90% $V_{DD}$ . | -                         | -       | 3                         | ns       |
| $t_F$     | Output Fall Time            | LVDS.   | 80% to 20% $V_{pp}$ . | -                         | -       | 400                       | ps       |
|           |                             | LVPECL.   |                       | -                         | -       | 400                       |          |
|           |                             | LVCMOS.   | 90% to 10% $V_{DD}$ . | -                         | -       | 3                         | ns       |
| $O_{DC}$  | Output Clock Duty Cycle     | LVDS.   |                       | 47                        | -       | 53                        | %        |
|           |                             | LVPECL.   |                       | 47                        | -       | 53                        |          |
|           |                             | LVCMOS.   |                       | 47                        | -       | 53                        |          |
| $T_{OE}$  | Output Enable/ Disable Time | -   |                       | -                         | -       | 100                       | ns       |
| $J_{PER}$ | Period Jitter, RMS          | LVDS.   |                       | -                         | 3       | -                         | ps       |
|           |                             | LVPECL.   |                       | -                         | 5.8     | -                         |          |
|           |                             | LVCMOS.   | $F_{OUT} = 125MHz$ .  | -                         | 5       | -                         |          |
| $R_J$     | Random Jitter               | LVDS.   |                       | -                         | 1.3     | -                         | ps       |
|           |                             | LVPECL.   |                       | -                         | 1.29    | -                         |          |
|           |                             | LVCMOS.   | $F_{OUT} = 125MHz$ .  | -                         | 0.6     | -                         |          |

**Table 12. 3.3V AC Electrical Characteristics (Cont.)**

$V_{DD} = 3.3V \pm 5\%$ ,  $T_A = -20^\circ C$  to  $+70^\circ C$ ;  $-40^\circ C$  to  $+85^\circ C$ ,  $-40^\circ C$  to  $+105^\circ C$ .

| Symbol              | Parameter                  | Test Condition | Minimum                    | Typical | Maximum | Units |
|---------------------|----------------------------|----------------|----------------------------|---------|---------|-------|
| D <sub>J</sub>      | Deterministic Jitter       | LVDS.          | -                          | 5.8     | -       | ps    |
|                     |                            | LVPECL.        | -                          | 9.3     | -       |       |
|                     |                            | LVC MOS.       | F <sub>OUT</sub> = 125MHz. | -       | 10      |       |
| T <sub>J</sub>      | Total Jitter               | LVDS.          | -                          | 23.6    | -       | ps    |
|                     |                            | LVPECL.        | -                          | 27.7    | -       |       |
|                     |                            | LVC MOS.       | F <sub>OUT</sub> = 125MHz. | -       | 19      |       |
| f <sub>JITTER</sub> | Phase Jitter (12kHz–20MHz) | LVDS.          | -                          | 890     | -       | fs    |
|                     |                            | LVPECL.        | -                          | 860     | -       |       |
|                     |                            | LVC MOS.       | F <sub>OUT</sub> = 125MHz. | -       | 750     |       |

**Table 13. 2.5V AC Electrical Characteristics**

$V_{DD} = 2.5V \pm 5\%$ ,  $T_A = -20^\circ C$  to  $+70^\circ C$ ;  $-40^\circ C$  to  $+85^\circ C$ ,  $-40^\circ C$  to  $+105^\circ C$ .

| Symbol          | Parameter              | Test Condition   | Minimum                      | Typical | Maximum                   | Units |    |
|-----------------|------------------------|--|------------------------------|---------|---------------------------|-------|----|
| F               | Output Frequency Range | LVDS.  | 0.75                         | -       | 1000                      | MHz   |    |
|                 |                        | LVPECL.  | 0.75                         | -       | 1000                      |       |    |
|                 |                        | LVC MOS.   | 0.75                         | -       | 180                       |       |    |
|                 | Frequency Stability    | Temperature = $-20^\circ C$ to $+70^\circ C$ .                         | -20<br>-25<br>-50<br>-100    | -       | +20<br>+25<br>+50<br>+100 | ppm   |    |
|                 |                        | Temperature = $-40^\circ C$ to $+85^\circ C$ .                         | -25<br>-50<br>-100           | -       | +25<br>+50<br>+100        | ppm   |    |
|                 |                        | Temperature = $-40^\circ C$ to $+105^\circ C$ .                        | -50<br>-100                  | -       | +50<br>+100               | ppm   |    |
|                 | Output Load            | LVDS.  | Differential.                | -       | 100                       | -     | Ω  |
|                 |                        | LVPECL.  | V <sub>DD</sub> - 2.0V.      | -       | 50                        | -     |    |
|                 |                        | LVC MOS.   | To GND.                      | -       | 15                        | -     |    |
| T <sub>ST</sub> | Start-up Time          | Output valid time after V <sub>DD</sub> meets minimum specified level. | -                            | -       | 10                        | ms    |    |
| t <sub>R</sub>  | Output Rise Time       | LVDS.  | 20% to 80% V <sub>pp</sub> . | -       | -                         | 400   | ps |
|                 |                        | LVPECL.  |                              | -       | -                         | 400   |    |
|                 |                        | LVC MOS.   | 10% to 90% V <sub>DD</sub> . | -       | -                         | 3.5   | ns |
| t <sub>F</sub>  | Output Fall Time       | LVDS.  | 80% to 20% V <sub>pp</sub> . | -       | -                         | 400   | ps |
|                 |                        | LVPECL.  |                              | -       | -                         | 400   |    |
|                 |                        | LVC MOS.   | 90% to 10% V <sub>DD</sub> . | -       | -                         | 3     | ns |

**Table 13. 2.5V AC Electrical Characteristics (Cont.)**

$V_{DD} = 2.5V \pm 5\%$ ,  $T_A = -20^\circ C$  to  $+70^\circ C$ ;  $-40^\circ C$  to  $+85^\circ C$ ,  $-40^\circ C$  to  $+105^\circ C$ .

| Symbol       | Parameter                   | Test Condition | Minimum             | Typical | Maximum | Units |
|--------------|-----------------------------|----------------|---------------------|---------|---------|-------|
| $O_{DC}$     | Output Clock Duty Cycle     | LVDS.          | 47                  | -       | 53      | %     |
|              |                             | LVPECL.        | 47                  | -       | 53      |       |
|              |                             | LVC MOS.       | 47                  | -       | 53      |       |
| $T_{OE}$     | Output Enable/ Disable Time | —              | -                   | -       | 100     | ns    |
| $J_{PER}$    | Period Jitter, RMS          | LVDS.          | -                   | 4       | -       | ps    |
|              |                             | LVPECL.        | -                   | 5.12    | -       |       |
|              |                             | LVC MOS.       | $F_{OUT} = 125MHz.$ | -       | 3.3     |       |
| $R_J$        | Random Jitter               | LVDS.          | -                   | 1.4     | -       | ps    |
|              |                             | LVPECL.        | -                   | 1.36    | -       |       |
|              |                             | LVC MOS.       | $F_{OUT} = 125MHz.$ | -       | 1.3     |       |
| $D_J$        | Deterministic Jitter        | LVDS.          | -                   | 9.2     | -       | ps    |
|              |                             | LVPECL.        | -                   | 10      | -       |       |
|              |                             | LVC MOS.       | $F_{OUT} = 125MHz.$ | -       | 6.7     |       |
| $T_J$        | Total Jitter                | LVDS.          | -                   | 29.2    | -       | ps    |
|              |                             | LVPECL.        | -                   | 29.3    | -       |       |
|              |                             | LVC MOS.       | $F_{OUT} = 125MHz.$ | -       | 25.6    |       |
| $f_{JITTER}$ | Phase Jitter (12kHz–20MHz)  | LVDS.          | -                   | 1040    | -       | fs    |
|              |                             | LVPECL.        | -                   | 1200    | -       |       |
|              |                             | LVC MOS.       | $F_{OUT} = 125MHz.$ | -       | 850     |       |

Notes for all AC Electrical Characteristics tables:

<sup>1</sup> All jitter values provided at 156.25MHz, unless noted otherwise.

<sup>2</sup> Stability is inclusive of 25°C tolerance, operating temperature range, input voltage change, load change, aging, shock and vibration.

## Output Waveforms – LVDS

Output Levels/Rise Time/Fall Time Measurements



Oscillator Symmetry

Ideally, Symmetry should be 50/50 for  $\frac{1}{2}$  period –Other expressions are 45/55 or 55/45



## Output Waveforms – LVPECL

Rise Time/Fall Time Measurements



Oscillator Symmetry



## Output Waveforms – LVCMOS

Rise Time / Fall Time Measurements



Oscillator Symmetry

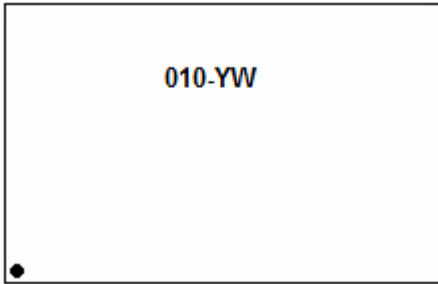


## Package Outline Drawings

The package outline drawings (JS6, JX6, JU6) are appended at the end of this document. The package information is the most current data available.

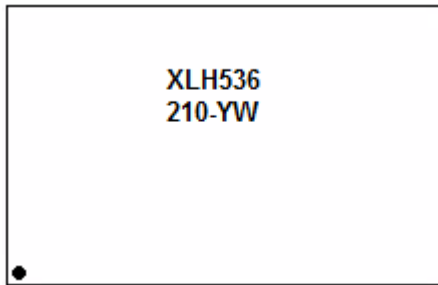
## Marking Diagrams

**JX6 3.2 × 2.5 mm Package Option** (example based on XLH320010.000000I)



- Line 1:
  - “010” denotes last three digits to the left of the decimal point as shown in the above example. This number will vary depending upon the frequency value selected in the orderable part number.
  - “YW” denotes the last digit of the year and work week the part was assembled.

**JS6 5.0 × 3.2 mm Package Option** (example based on XLH536210.380000I)



- Line 1:
  - “XL” = family; “H” = output type; “5” = package size; “3” = voltage; “6” = precision level. This number will vary depending upon the output type, voltage, and precision values selected in the orderable part number.
- Line 2:
  - “210” denotes last three digits to the left of the decimal point as shown in the above example. This number will vary depending upon the frequency value selected in the orderable part number.
  - “YW” denotes the last digit of the year and work week the part was assembled.

**JU6 7.0 × 5.0 mm Package Option** (example based on XLH735004.915200X)



- Line 1:
  - “XL” = family; “H” = output type; “7” = package size; “3” = voltage; “5” = precision level. This number will vary depending upon the output type, voltage, and precision values selected in the orderable part number.
- Line 2:
  - “004” denotes last three digits to the left of the decimal point as shown in the above example. This number will vary depending upon the frequency value selected in the orderable part number.
  - “YW” denotes the last digit of the year and work week the part was assembled.

## Revision History

| Revision Date      | Description of Change  |
|--------------------|--|
| March 2, 2022      | Changed Output Duty Cycle minimum and maximum values in <a href="#">Table 12</a> and <a href="#">Table 13</a> from 45% to 47% and 55% to 53% respectively.   |
| January 11, 2022   | <ul style="list-style-type: none"> <li>▪ Removed Aging parameters in <a href="#">Table 12</a> and <a href="#">Table 13</a>.</li> <li>▪ Added footnote 2 after <a href="#">Table 13</a>.</li> </ul>   |
| December 1, 2021   | Updated Frequency Stability values in <a href="#">Table 12</a> and <a href="#">Table 13</a> .  |
| November 23, 2021  | Added <a href="#">Frequency Stability and Operating Temperature Decoder</a> table after Ordering Information.  |
| August 18, 2021    | Moved XO and VCXO ordering information tables to be just after Pin Descriptions.   |
| January 19, 2021   | <ul style="list-style-type: none"> <li>▪ Removed 4-pin package description table, figure, and package drawing references.</li> <li>▪ Added footnote for pin 5 in <a href="#">Table 1</a>.</li> <li>▪ Added footnote under “Output Type” in XO Ordering Information.</li> </ul> |
| January 12, 2021   | Added Marking Diagrams section and updated Package Outline Drawings links.   |
| October 27, 2020   | Added pin counts to Output Type in XO ordering table.  |
| September 21, 2020 | Added typical IDD to tables. Added more frequency ranges to IDD tables. Updated H to be LVCMOS in order code.  |
| April 27, 2020     | Updated ODC parameter. 2nd LVCMOS row to be changed from $\leq$ to $>$ 62.5 MHz.   |
| September 7, 2018  | Updated frequency stability options value from $\pm 20$ ppm to $\pm 25$ ppm for $-40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$ XO only.  |
| June 25, 2018      | <ul style="list-style-type: none"> <li>▪ Updated Package Outline Drawings section.</li> </ul>  |
| May 4, 2018        | <ul style="list-style-type: none"> <li>▪ Added XO and VCXO options.</li> <li>▪ Updated description and Features sections.</li> <li>▪ Updated Package Outline Drawings section.</li> <li>▪ Added VCXO Ordering Information decoder diagram.</li> </ul>                          |
| January 12, 2018   | Initial release.   |

| 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     |



BOTTOM VIEW



TOP VIEW

SIDE VIEW

NOTES:  
1. ALL DIMENSIONS IN MM.

|                             |         |                             |              |
|-----------------------------|---------|-----------------------------|--------------|
| TOLERANCES UNLESS SPECIFIED |         | 6024 Silver Creek Valley Rd |              |
| DECIMAL                     | ANGULAR | Son Jose, CA 95138          |              |
| XXX±                        | ±       | PHONE: (408) 727-6116       |              |
| XXXX±                       |         | FAX: (408) 492-8874         |              |
| XXXX±                       |         |                             |              |
| APPROVALS                   | DATE    | TITLE                       | SIZE         |
| DRAWN <i>QAC</i>            | 04/2/12 | JS6 PACKAGE OUTLINE         | DRAWING No.  |
| CHECKED                     |         | 5.0 x 3.2 mm BODY           | PSC-4411     |
|                             |         | 1.1 mm Thick                |              |
|                             |         |                             | REV          |
|                             |         |                             | 03           |
| DO NOT SCALE DRAWING        |         |                             | SHEET 1 OF 2 |



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| 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     |



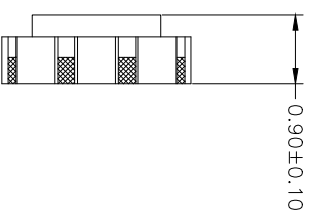
RECOMMENDED LAND PATTERN

- 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.

|                             |             |                             |              |
|-----------------------------|-------------|-----------------------------|--------------|
| TOLERANCES UNLESS SPECIFIED |             | 6024 Silver Creek Valley Rd |              |
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| XXX±                        | ±           | PHONE: (408) 727-6176       |              |
| XXXX±                       |             | FAX: (408) 492-8674         |              |
| APPROVALS                   |             | www.IDT.com                 |              |
| DRAWN                       | DATE        | TITLE                       |              |
| 04/2/12                     |             | J56 PACKAGE OUTLINE         |              |
| CHECKED                     |             | 5.0 x 3.2 mm BODY           |              |
|                             |             | 1.1 mm Thick                |              |
| SIZE                        | DRAWING No. | REV                         |              |
| C                           | PSC-4411    | 03                          |              |
| DO NOT SCALE DRAWING        |             |                             | SHEET 2 OF 2 |

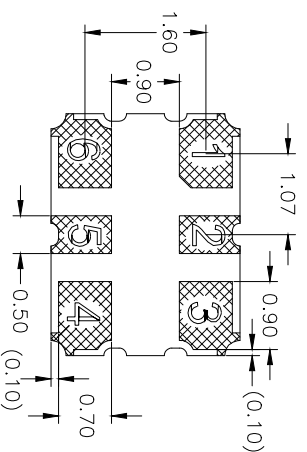
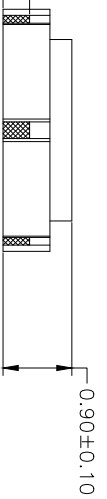
| REVISIONS |                 |              |            |
|-----------|-----------------|--------------|------------|
| REV       | DESCRIPTION     | DATE CREATED | AUTHOR     |
| 00        | INITIAL RELEASE | 8/11/14      | JHUA       |
| 01        | ADD PITCH       | 11/17/16     | JHUA       |
| 02        | ADD DIMENSION   | 7/04/24      | JHUA/JHTAN |

REFER TO DCP FOR OFFICIAL RELEASE DATE



TOP VIEW

END VIEW



SIDE VIEW

BOTTOM VIEW

UNLESS OTHERWISE SPECIFIED  
TOLERANCES:  $\pm 1.0\%$

**RENESAS**

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San Jose, CA 95138  
PHONE: (408) 284-8200  
FAX: (408) 284-3572

TITLE JX6 PACKAGE OUTLINE  
3.2 x 2.5 mm BODY  
0.9 mm Thick

SIZE C  
DRAWING No. PSC-4412

REV 02

DO NOT SCALE DRAWING

SHEET 1 OF 2

M.

| REVISIONS                              |                 |              |            |
|--|-----------------|--------------|------------|
| REV                                    | DESCRIPTION     | DATE CREATED | AUTHOR     |
| 00                                     | INITIAL RELEASE | 8/11/14      | JHUA       |
| 01                                     | ADD PITCH       | 11/17/16     | JHUA       |
| 02                                     | ADD DIMENSION   | 7/04/24      | JHUA/JHTAN |
| REFER TO DCP FOR OFFICIAL RELEASE DATE |                 |              |            |

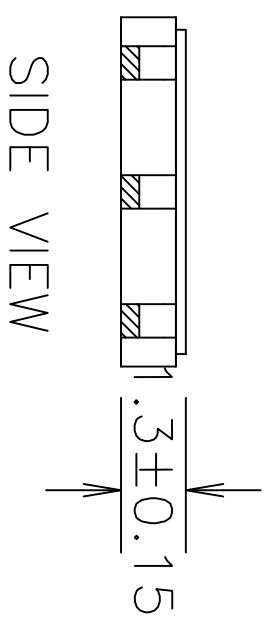


## RECOMMENDED LAND PATTERN DIMENSION

IN MM. ANGLES IN DEGREES.  
 VIEWED ON PCB.  
 SHOWS FOR REFERENCE IN GREEN.  
 JE. NSMD PATTERN ASSUMED.  
 DIMENSIONATION PER IPC-7351B GENERIC REQUIREMENT  
 DESIGN AND LAND PATTERN.

|   |                     |  |              |
|---|---------------------|--|--------------|
| UNLESS OTHERWISE SPECIFIED<br>TOLERANCES: ±1.0% |                     | <br>6024 Silver Creek Valley Rd<br>San Jose, CA 95138<br>PHONE: (408) 727-6116<br>FAX: (408) 492-8674 |              |
| TITLE   | JX6 PACKAGE OUTLINE |  |              |
|   | 3.2 x 2.5 mm BODY   |  |              |
|   | 0.9 mm Thick        |  |              |
| SIZE  | DRAWING No.         |  | REV          |
| C   | PSC-4412            |  | 02           |
| DO NOT SCALE DRAWING                            |                     |  | SHEET 2 OF 2 |

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



NOTES:  
1. ALL DIMENSIONS IN MM.

|                             |         |   |    |
|-----------------------------|---------|---|----|
| TOLERANCES UNLESS SPECIFIED |         | www.IDT.com   |    |
| DECIMAL                     | ANGULAR |  <b>IDT</b> <sup>TM</sup><br>6024 Silver Creek Valley Rd<br>San Jose, CA 95138<br>PHONE: (408) 727-6116<br>FAX: (408) 482-9874 |    |
| XXX±                        | ±       |   |    |
| XXXX±                       |         | TITLE J16 PACKAGE OUTLINE<br>DRAWN XJS 7.0 x 5.0 mm BODY<br>CHECKED 10/03/12 1.3 mm Thick<br>APPROVALS DATE<br>SIZE C DRAWING No. PSC-4430<br>DO NOT SCALE DRAWING  |    |
|                             |         | REV   | 01 |
|                             |         | SHEET 1 OF 2  |    |



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