

### General Description

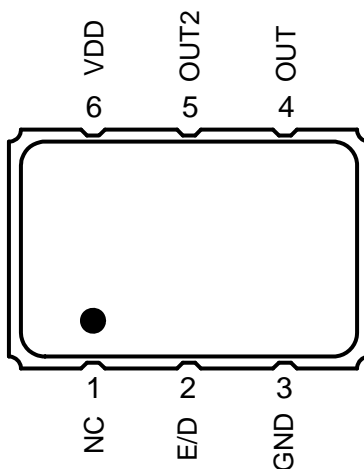
The XUQ is an Ultra Precision LVPECL Crystal Oscillator with 300fs typical phase jitter over 12kHz to 20 MHz bandwidth. Available in a wide frequency range from 16kHz to 670 MHz, the IDT XUQ Series Crystal Oscillator utilizes a family of proprietary ASICs, with a key focus on noise reduction technologies.

The 4th 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 XUQ is an excellent choice over the conventional technologies. The XUQ has stabilities as tight as  $\pm 20\text{ppm}$  with extremely quick delivery for both standard and custom frequencies.

### Features

- Frequency range: 0.016 to 670 MHz
- Output Type: LVPECL
- Frequency Stability:  $\pm 20\text{ppm}$ ,  $\pm 25\text{ppm}$ ,  $\pm 50\text{ppm}$ , or  $\pm 100\text{ppm}$
- Supply Voltage: 1.8V, 2.5V, or 3.3V
- Phase Jitter (1.875MHz to 20MHz): 100fs typical
- Phase Jitter (12kHz to 20MHz): 300fs typical
- Package options: 5.0mm x 3.2mm x 1.2mm (JS6)  
7.0mm x 5.0mm x 1.3mm (JU6)
- Operating Temperatures:  $-20^{\circ}\text{C}$  to  $+70^{\circ}\text{C}$  or  $-40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$

### Pin Assignment



**6-pin CLCC**

### Pin Descriptions

Pin Number	Pin Name	Description
1	NC	No connect
2	E/D	Enable/Disable <sup>1</sup> (0=Output Disabled)
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 XUQ. 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

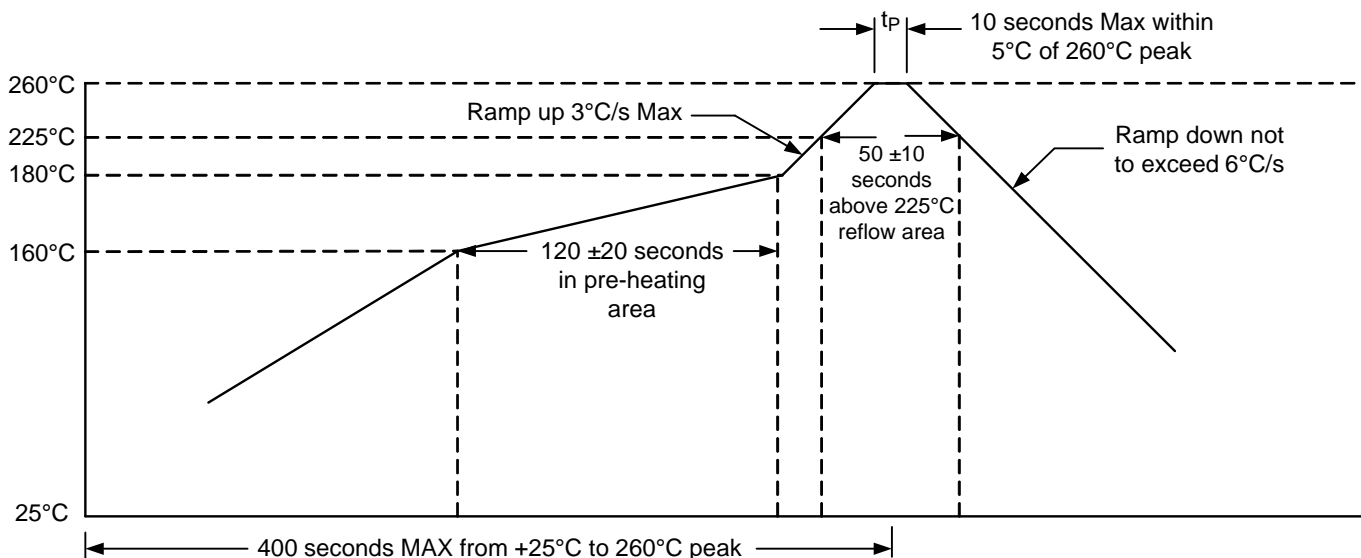
## ESD Compliance

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

## Mechanical Testing

Parameter	Test Method
Mechanical Shock	Half-Sine wave with 0.3ms 3000G X, Y, Z each direction 1 time
Mechanical Vibration	Frequency: 10 to 55 MHz Amplitude: 1.5mm Frequency: 55~2000Hz Peak value: 20G Duration time: 4H for each X,Y,Z axis Total 12hours
High Temp Operating Life (HTOL)	2000 Hours 125°C (under power)
Hermetic Seal	Gross leak (Air leak test) Fine leak (Helium leak test) He-pressure: 6kgf/cm <sup>2</sup> 2 hours

## Solder Reflow Profile



## DC Characteristics

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

Parameter	Symbol	Condition	Min	Typ	Max	Units
Power Supply Current	$I_{DD}$	$\leq 212.5\text{MHz}$ $> 212.5\text{MHz}$			115 128	mA
Output HIGH Voltage	$V_{OH}$	Std LVPECL load	1.85		2.3	V
Output LOW Voltage	$V_{OL}$	Std LVPECL load	1.1		1.65	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  $+70^\circ\text{C}$ ;  $-40^\circ$  to  $+85^\circ\text{C}$ ). Below are guaranteed for listed standard frequencies.

Parameter	Symbol	Condition	Min	Typ	Max	Units
Output Frequency Range	$F_{OUTR}$		0.016		670	MHz
Frequency Stability		Temperature = $-20^\circ\text{C}$ to $+70^\circ\text{C}$	$\pm 20$		$\pm 100$	ppm
		Temperature = $-40^\circ\text{C}$ to $+85^\circ\text{C}$	$\pm 25$		$\pm 100$	ppm
Aging (1 <sup>st</sup> year)		$T_a = 25^\circ\text{C}$			3	
Aging (10 years)		$T_a = 25^\circ\text{C}$			10	
Output Load		To $V_{DD} - 2.0\text{V}$		50		Ohms
Start-up Time	$T_{ST}$	Output valid time after VDD meets minimum specified level			10	ms
Output Rise Time		20% to 80% $V_{PP}$ , Std frequencies			400	ps
Output Fall Time		80% to 20% $V_{PP}$ , Std frequencies			400	ps
Output Clock Duty Cycle	$T_{DTCY}$	$50\% V_{PP}$ $\leq 312.5\text{MHz}$ $> 312.5\text{MHz}$	45 40		55 60	%
Output Enable/ Disable Time	$T_{OE}$				100	ns
Period Jitter, RMS	$J_{PER}$	Frequency = 156.25MHz		1.8	7	psec
Random Jitter	$R_J$	Frequency = 156.25MHz		0.7	1.8	psec
Deterministic Jitter	$D_J$	Per MJSQ spec (Methodologies for Jitter and Signal Quality specifications)		8	24	psec
Total Jitter	$T_J$			18	42	psec
Phase Jitter (12kHz – 20MHz)	$\phi_{JITTER}$	Standard frequencies @ $25^\circ\text{C}$ , 3.3V		300	400	fsec
Phase Noise Performance Frequency = 156.25MHz	$\phi_{NOISE}$	100Hz of Carrier		-95		dBc/Hz
		1kHz of Carrier		-115		dBc/Hz
		10kHz of Carrier		-120		dBc/Hz
		100kHz of Carrier		-129		dBc/Hz
		1MHz of Carrier		-149		dBc/Hz
		10MHz of Carrier		-156		dBc/Hz
Output Frequency (Standards)	$F_{OUT}$	100MHz, 106.25MHz, 125MHz, 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  $25^\circ\text{C}$ . 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  $+70^\circ\text{C}$ ;  $-40^\circ$  to  $+85^\circ\text{C}$ ). Below are guaranteed for listed standard frequencies.

Parameter	Symbol	Condition	Min	Typ	Max	Units
Power Supply Current	$I_{DD}$	$\leq 156.25\text{MHz}$ $> 156.25\text{MHz}$			102 112	mA
Output HIGH Voltage	$V_{OH}$	Std LVPECL load	1.1		1.45	V
Output LOW Voltage	$V_{OL}$	Std LVPECL load	0.035		0.085	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  $+70^\circ\text{C}$ ;  $-40^\circ$  to  $+85^\circ\text{C}$ ). Below are guaranteed for listed standard frequencies.

Parameter	Symbol	Condition	Min	Typ	Max	Units
Output Frequency Range	$F_{OUTR}$		0.750		670	MHz
Frequency Stability		Temperature = $-20^\circ\text{C}$ to $+70^\circ\text{C}$	$\pm 20$		$\pm 100$	ppm
		Temperature = $-40^\circ\text{C}$ to $+85^\circ\text{C}$	$\pm 25$		$\pm 100$	ppm
Output Load		To $V_{DD} - 2.0\text{V}$		50		Ohms
Start-up Time	$T_{ST}$	Output valid time after VDD meets minimum specified level			10	ms
Output Rise Time		20% to 80% $V_{PP}$		250	630	ps
Output Fall Time		80% to 20% $V_{PP}$		360	630	ps
Output Clock Duty Cycle	$T_{DTCY}$	50% $V_{PP}$ $\leq 156.25\text{MHz}$ $> 156.25\text{MHz}$	45 40		55 60	%
Output Enable/ Disable Time	$T_{OE}$				100	ns
Period Jitter, RMS	$J_{PER}$	Frequency = 156.25MHz		2	5	psec
Random Jitter	$R_J$	Frequency = 156.25MHz		0.7	1.6	psec
Deterministic Jitter	$D_J$	Per MJSQ spec (Methodologies for Jitter and Signal Quality specifications)		8	22	psec
Total Jitter	$T_J$			18	38	psec
Phase Jitter (12kHz – 20MHz)	$\phi_{JITTER}$	Frequency = 156.25MHz @ $25^\circ\text{C}$ , 2.5V		350	500	fsec
Phase Noise Performance Frequency = 156.25MHz	$\phi_{NOISE}$	100Hz of Carrier		-94		dBc/Hz
		1kHz of Carrier		-113		dBc/Hz
		10kHz of Carrier		-120		dBc/Hz
		100kHz of Carrier		-128		dBc/Hz
		1MHz of Carrier		-147		dBc/Hz
		10MHz of Carrier		-155		dBc/Hz
Output Frequency (Standards)	$F_{OUT}$	100MHz, 106.25MHz, 125MHz, 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  $25^\circ\text{C}$ . We do not recommend hand soldering the devices

## DC Characteristics

( $V_{DD} = 1.8\text{ V} \pm 5\%$ ,  $T_A = -20^\circ\text{C}$  to  $+70^\circ\text{C}$ ;  $-40^\circ$  to  $+85^\circ\text{C}$ ). Below are guaranteed for listed standard frequencies.

Parameter	Symbol	Condition	Min	Typ	Max	Units
Power Supply Current	$I_{DD}$	$\leq 250\text{MHz}$ $> 250\text{MHz}$			75 90	mA
Output HIGH Voltage	$V_{OH}$	Std LVPECL load	0.5		0.8	V
Output LOW Voltage	$V_{OL}$	Std LVPECL load	0		0.25	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

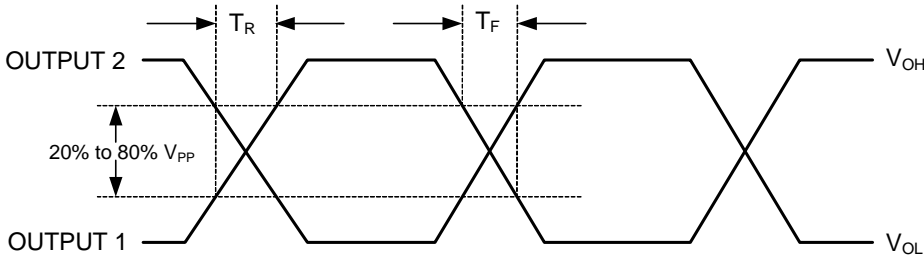
( $V_{DD} = 1.8\text{ V} \pm 5\%$ ,  $T_A = -20^\circ\text{C}$  to  $+70^\circ\text{C}$ ;  $-40^\circ$  to  $+85^\circ\text{C}$ ). Below are guaranteed for listed standard frequencies.

Parameter	Symbol	Condition	Min	Typ	Max	Units
Output Frequency Range	$F_{OUTR}$		0.016		670	MHz
Frequency Stability STD Frequencies		Temperature = $-20^\circ\text{C}$ to $+70^\circ\text{C}$	$\pm 20$		$\pm 100$	ppm
		Temperature = $-40^\circ\text{C}$ to $+85^\circ\text{C}$	$\pm 25$		$\pm 100$	ppm
Output Load		To GND		50		Ohms
Start-up Time	$T_{ST}$	Output valid time after VDD meets minimum specified level			10	ms
Output Rise Time		20% to 80% $V_{PP}$		250	350	ps
Output Fall Time		80% to 20% $V_{PP}$		250	350	ps
Output Clock Duty Cycle	$T_{DTCY}$	@ 50% $V_{PP}$ $\leq 312.5\text{MHz}$ $> 312.5\text{MHz}$	45 40		55 60	%
Output Enable/ Disable Time	$T_{OE}$				100	ns
Period Jitter, RMS	$J_{PER}$	Frequency = 156.25MHz		1.8	4.2	psec
Random Jitter	$R_J$	Frequency = 156.25MHz		0.75	1.6	psec
Deterministic Jitter	$D_J$	Per MJSQ spec (Methodologies for Jitter and Signal Quality specifications)		8	25	psec
Total Jitter	$T_J$			20	45	psec
Phase Jitter (12kHz – 20MHz)	$\phi_{JITTER}$	Frequency = 156.25MHz @ $25^\circ\text{C}$ , 1.8V		750	1200	fsec
Phase Noise Performance Frequency = 156.25MHz	$\phi_{NOISE}$	100Hz of Carrier		-90		dBc/Hz
		1kHz of Carrier		-101		dBc/Hz
		10kHz of Carrier		-109		dBc/Hz
		100kHz of Carrier		-122		dBc/Hz
		1MHz of Carrier		-144		dBc/Hz
		10MHz of Carrier		-149		dBc/Hz
Output Frequency (Standards)	$F_{OUT}$	100MHz, 106.25MHz, 125MHz, 150MHz, 155.52MHz, 156.25MHz, 200MHz, 212.5MHz, 250MHz, 300MHz, 312.5MHz, 400MHz (Contact IDT for additional frequencies)				

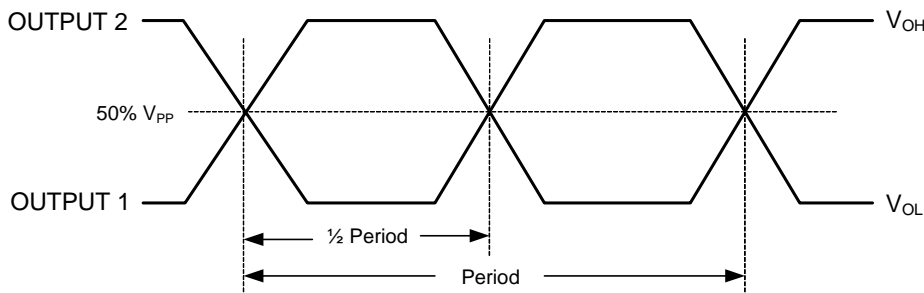
Note: Inclusive of initial frequency accuracy, operating temperature range, supply variation, load variation, 3 times solder reflow, shock, vibration and 1 year aging at  $25^\circ\text{C}$ . We do not recommend hand soldering the devices

## Output Waveform

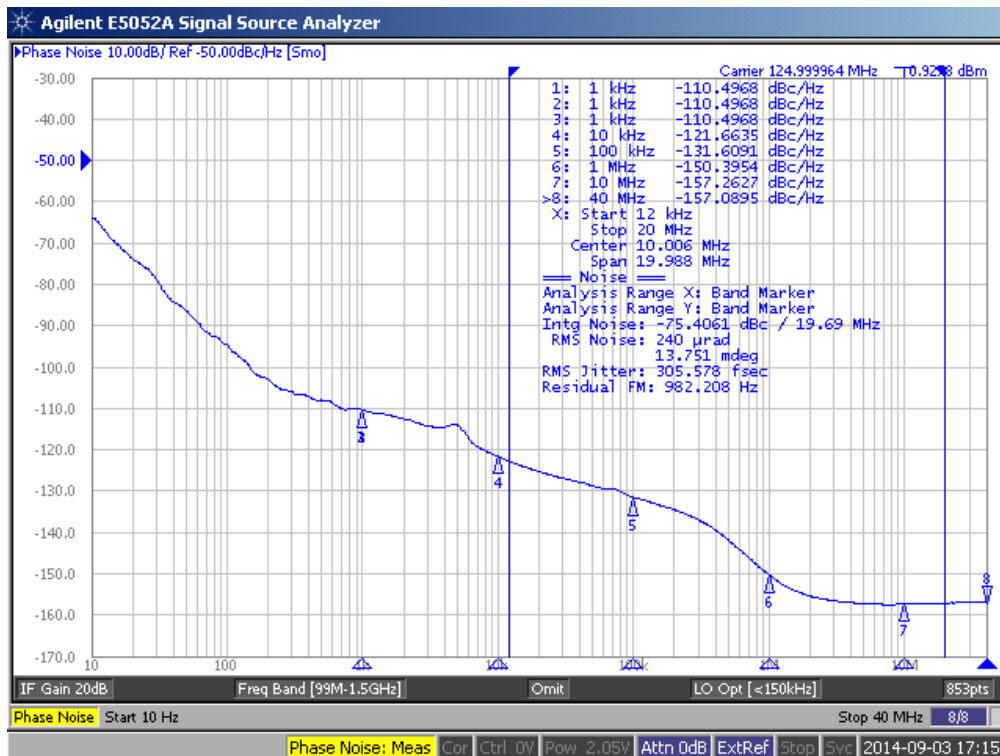
Rise Time/Fall Time Measurements



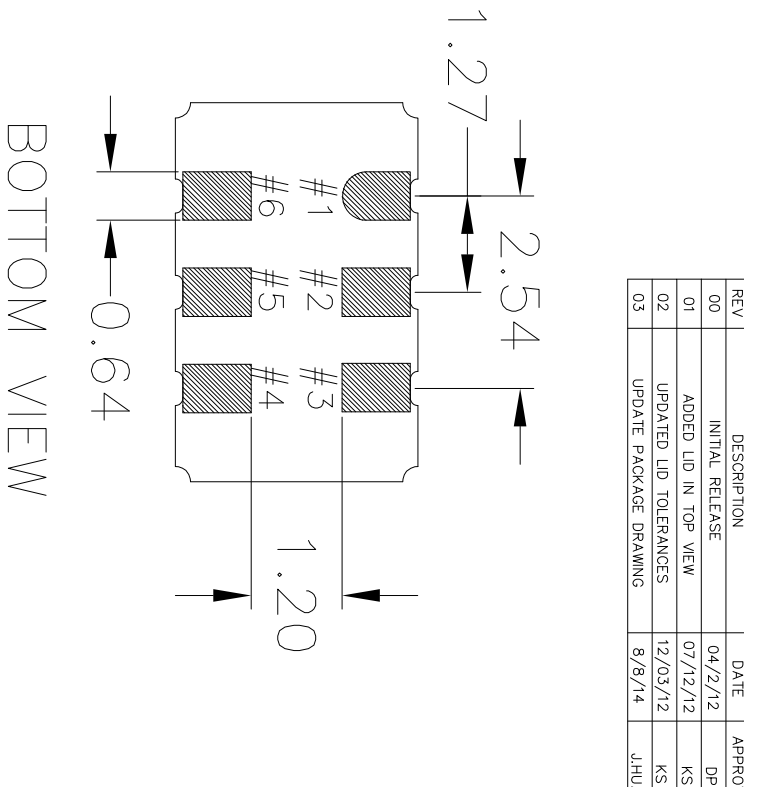
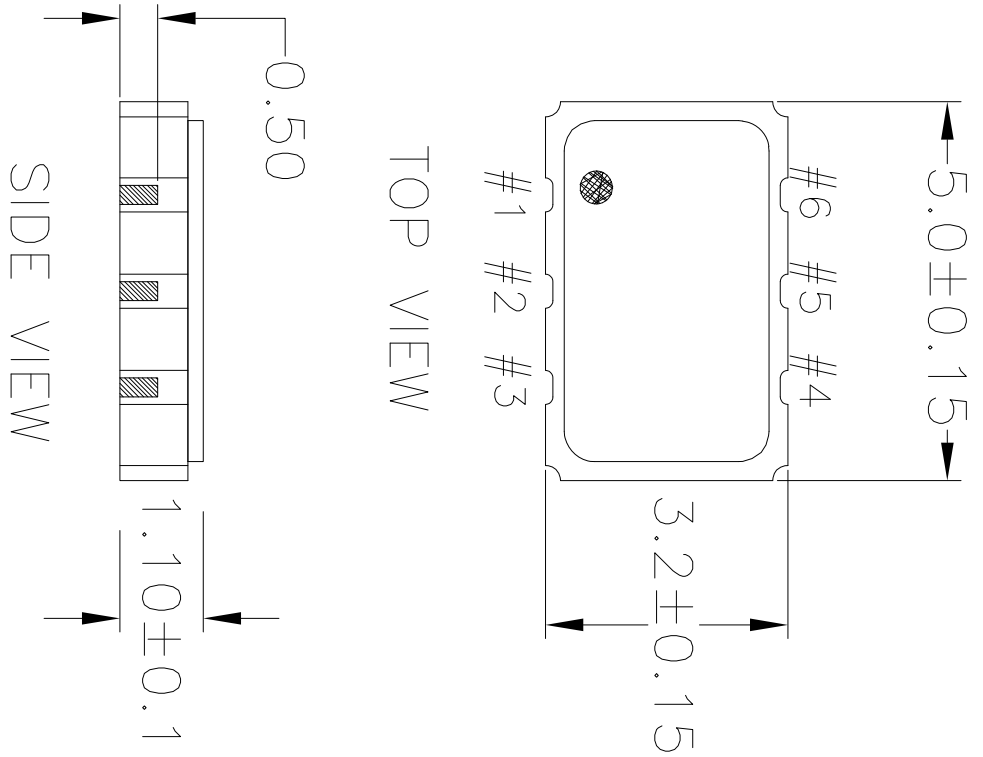
Oscillator Symmetry



## Typical Phase Noise



# 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.

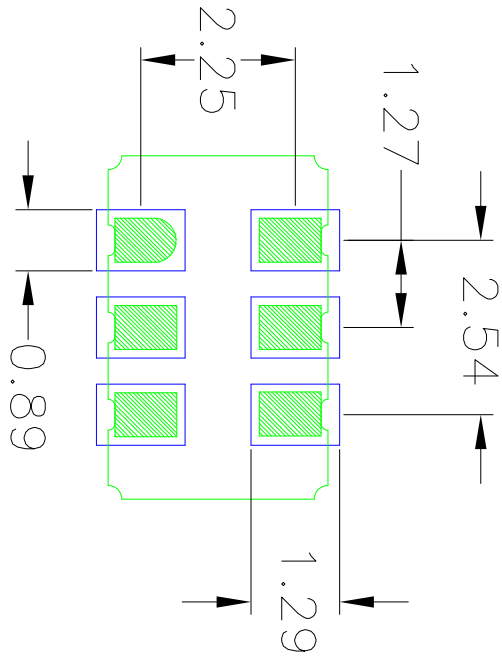
TOLERANCES UNLESS SPECIFIED	
DECIMAL	ANGULAR
XXX.X	±
XXXX.X	
XXXXXX.X	
APPROVALS	DATE
DRAWN: <b>gac</b>	04/2/12
CHECKED:	
SIZE: <b>C</b>	DRAWING No: PSC-4411

**IDT**<sup>TM</sup>

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

www.IDT.com

# JS6 Package Outline and Dimensions (cont.)



RECOMMENDED LAND PATTERN

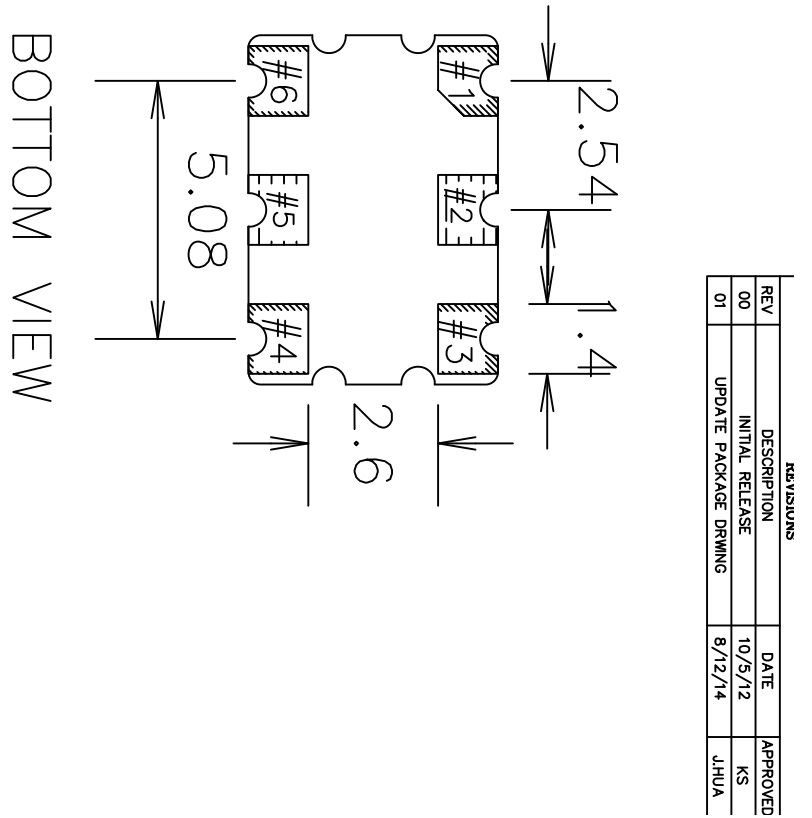
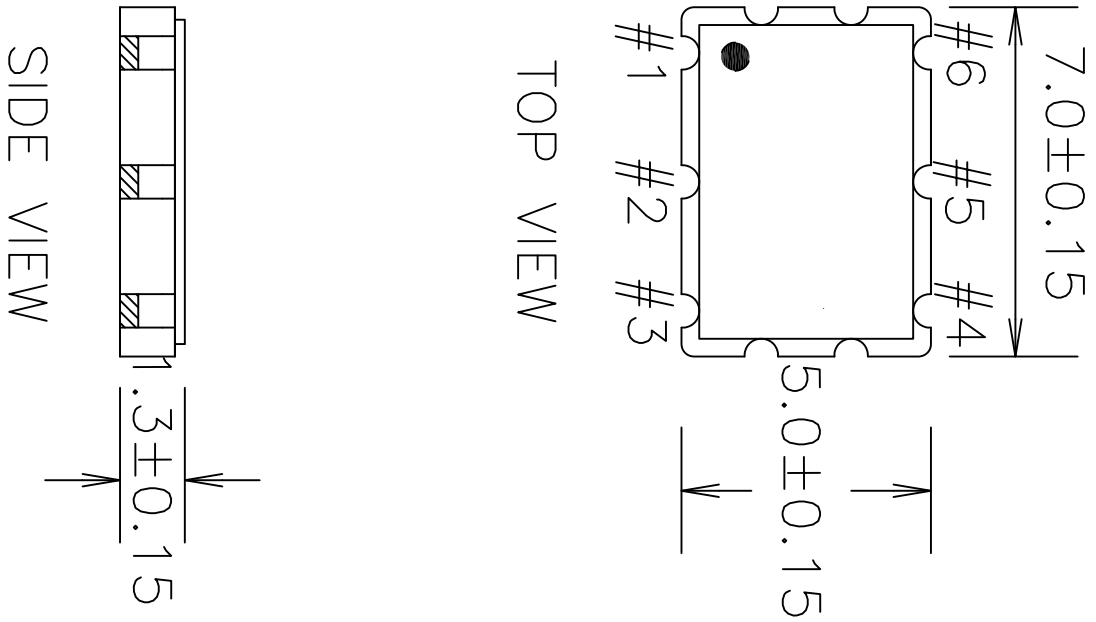
**NOTES:**

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
04/2/12	JS6 PACKAGE OUTLINE	
DRAWN: GJG	5.0 x 3.2 mm BODY	
CHECKED	1.1 mm Thick	
SIZE	DRAWING No.	REV
C	PSC-4411	03
DO NOT SCALE DRAWING		SHEET 2 OF 2

# JU6 Package Outline and Dimensions

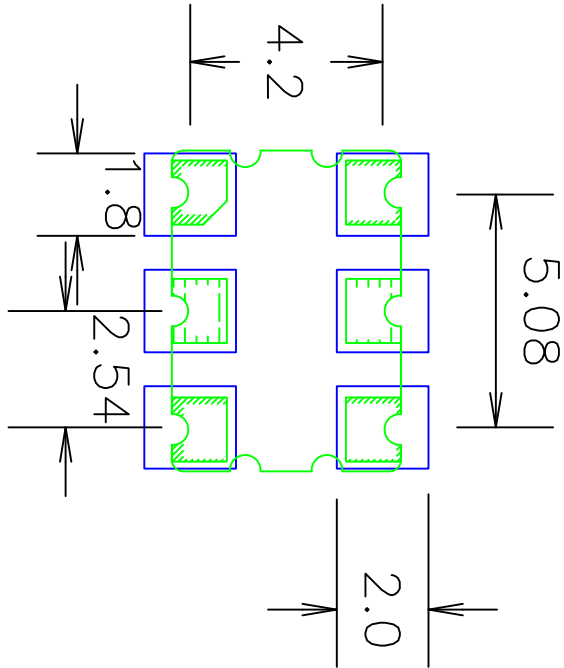


NOTES:  
1. ALL DIMENSIONS IN MM.

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

TOLERANCES UNLESS SPECIFIED		APPROVALS	
DECIMAL	ANGULAR	DATE	TITLE
XXX±	±	10/03/12	JU6 PACKAGE OUTLINE
XXXX±		DRAWN: JCS	7.0 x 5.0 mm BODY
XXXX±		CHECKED	1.3 mm Thick
XXXX±			
www.IDT.com 		SIZE	REV
6024 Silver Creek Valley Rd San Jose, CA 95138 PHONE: (408) 727-6116 FAX: (408) 492-8674		C	01
PSC-4430			

# JU6 Package Outline and Dimensions (cont.)



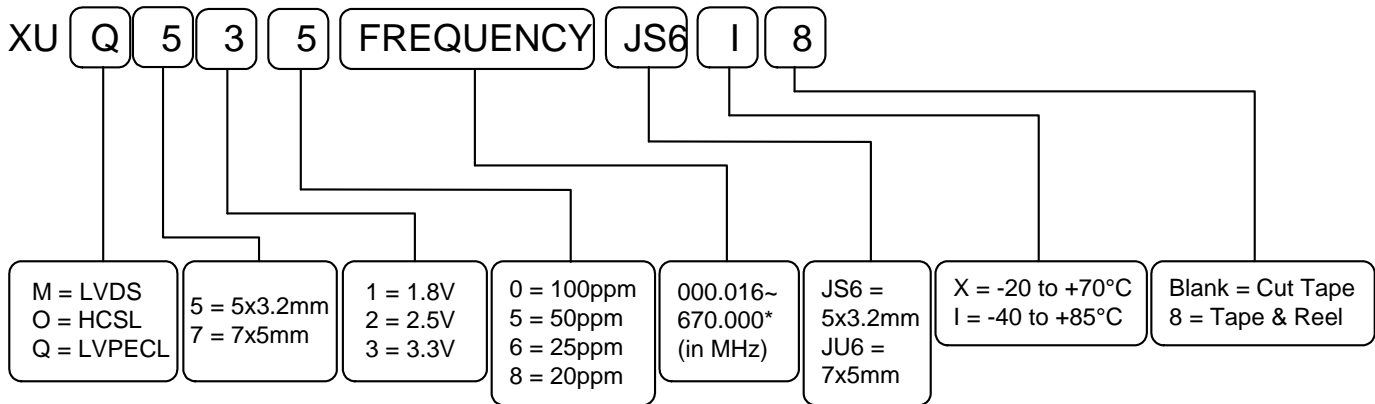
RECOMMENDED LAND PATTERN

- 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	J.HUA

TOLERANCES UNLESS SPECIFIED		IDT	
DECIMAL	ANGULAR	www.IDT.com	
XXX	±	San Jose, CA 95138	
XXX		PHONE: (408) 727-8116	
XXX		FAX: (408) 492-8674	
APPROVALS	DATE	TITLE	
DRAWN_GS	10/09/12	JU6 PACKAGE OUTLINE	
CHECKED		7.0 x 5.0 mm BODY	
		1.3 mm Thick	
		SIZE	REV
		C	01
		DRAWING No.	
		PSC-4430	
		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	01/09/15	B. Chandhoke	Initial release.



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