## General Description

The XUH is an HCMOS Crystal Oscillator with 300fs typical phase jitter over 12kHz to 20 MHz bandwidth. Available in a wide frequency range from 0.016MHz to 167MHz, the IDT XUH 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 XUH is an excellent choice over the conventional technologies. The XUH has stabilities as tight as ±20ppm with extremely quick delivery for both standard and custom frequencies

Features

- Frequency range: 0.016 to 167MHz
- Output Type: HCMOS
- Frequency Stability: ± 20ppm, ± 25ppm, ± 50ppm, or ± 100 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 (JS4)
                    7.0mm x 5.0mm x 1.3mm (JU4)
- Operating Temperatures: -20°C to +70°C or -40°C to +85°C

Pin Assignment

6-pin CLCC
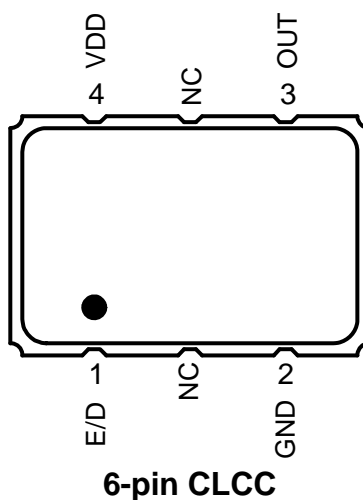
Pin Descriptions

Pin Number	Pin Name	Description
1	E/D	Enable/Disable[1] (0=Output Disabled)
2	GND	Connect to ground
3	OUT	Output
4	VDD	Supply voltage

1. Pulled high internally.

Absolute Maximum Ratings

Stresses above the ratings listed below can cause permanent damage to the XUH. 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 Temperature Burn-in	2000 Hours 125°C (under power)
Hermetic Seal	Gross leak (Air leak test) Fine leak (Helium leak test) He-pressure: 6kgf/cm² 2 hours.

Solder Reflow Profile
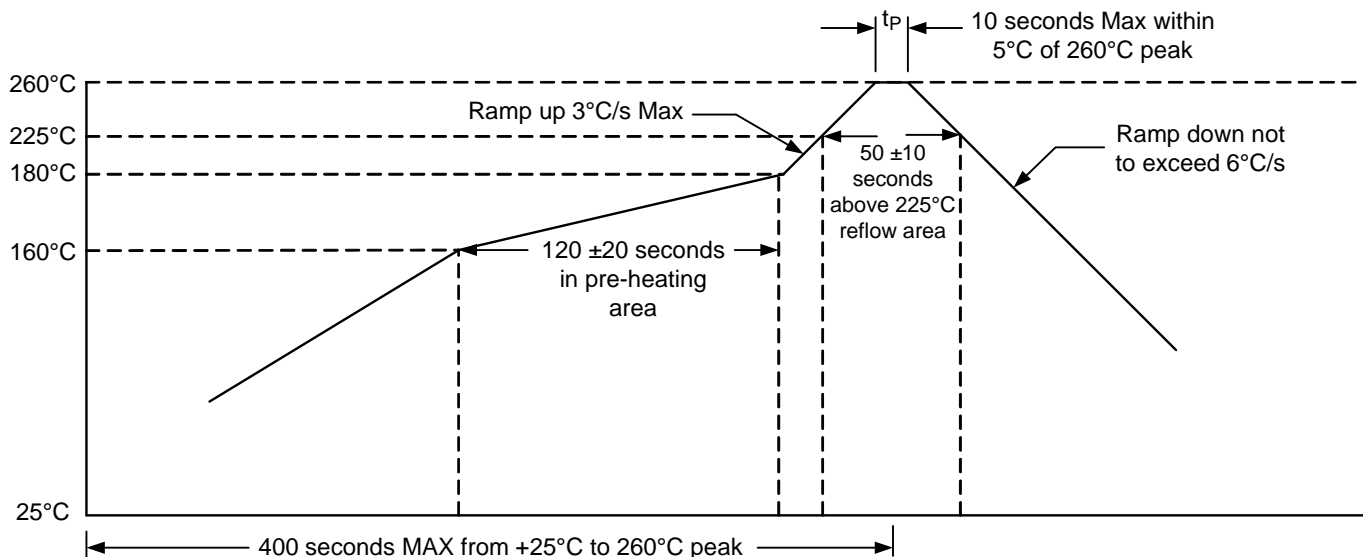
DC Characteristics
(V_{DD}= 3.3 V ± 5%, T_A= - 20°C to +70°C; -40° to +85°C) Below are guaranteed for listed standard frequencies.

Parameter	Symbol	Condition	Min	Typ	Max	Units
Power Supply Current	I_{DD}	Standard Frequencies		90		mA
Output HIGH Voltage	V_{OH}	C_L = 15pF	90%V_{DD}			V
Output LOW Voltage	V_{OL}	C_L = 15pF			10%V_{DD}	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 4 (VDD) to pin 1 (E/D) enables output when pin 1 is left open.

AC Characteristics
(V_{DD}= 3.3 V ± 5%, T_A= - 20°C to +70°C; -40° to +85°C) Below are guaranteed for listed standard frequencies.

Parameter	Symbol	Condition	Min	Typ	Max	Units
Output Frequency Range	F_{OUTR}		0.016		167	MHz
Frequency Stability		Temperature = -20°C to +70°C	±20		±100	ppm
		Temperature = -40°C to +85°C	±25		±100	ppm
Aging (1st year)		Ta = 25°C			±3	
Aging (10 years)		Ta = 25°C			±10	
Output Load					15	pF
Start-up Time	T_{ST}	Output valid time after VDD meets minimum specified level			10	ms
Output Rise Time		10% to 90% V_{DD}, Standard Frequencies			3	ns
Output Fall Time		90% to 10% V_{DD}, Standard Frequencies			3	ns
Output Clock Duty Cycle	T_{DTCY}	@ 50% V_{DD} Std. Frequencies to 125MHz Std. Frequencies >125MHz	45 40		55 60	%
Output Enable/ Disable Time	T_{OE}				100	ns
Period Jitter, RMS	J_{PER}	Frequency = 156.25MHz		5		psec
Random Jitter	R_J	Frequency = 156.25MHz Per MJSQ spec (Methodologies for Jitter and Signal Quality specifications)		0.6		psec
Deterministic Jitter	D_J			10		psec
Total Jitter	T_J			19		psec
Phase Jitter (12kHz – 20MHz)	ϕ_{JITTER}	Standard Frequencies		300	400	fsec
Phase Noise Performance Frequency = 156.25MHz	ϕ_{NOISE}	100Hz of Carrier		-97		dBc/Hz
		1kHz of Carrier		-116		dBc/Hz
		10kHz of Carrier		-126		dBc/Hz
		100kHz of Carrier		-133		dBc/Hz
		1MHz of Carrier		-147		dBc/Hz
		10MHz of Carrier		-156		dBc/Hz
Output Frequency (Standards)	F_{OUT}	10MHz, 12MHz, 12.288MHz, 16MHz, 20MHz, 24MHz, 24.576MHz, 25MHz, 33.333MHz, 40MHz, 48MHZ, 50MHz, 100MHz, 125MHz, 156.25MHz (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 V ± 5%, T_A= - 20°C to +70°C; -40° to +85°C) Below are guaranteed for listed standard frequencies.

Parameter	Symbol	Condition	Min	Typ	Max	Units
Power Supply Current	I_{DD}	Standard Frequencies		80		mA
Output HIGH Voltage	V_{OH}	C_L = 10pF	90%V_{DD}			V
Output LOW Voltage	V_{OL}	C_L = 10pF			10%V_{DD}	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

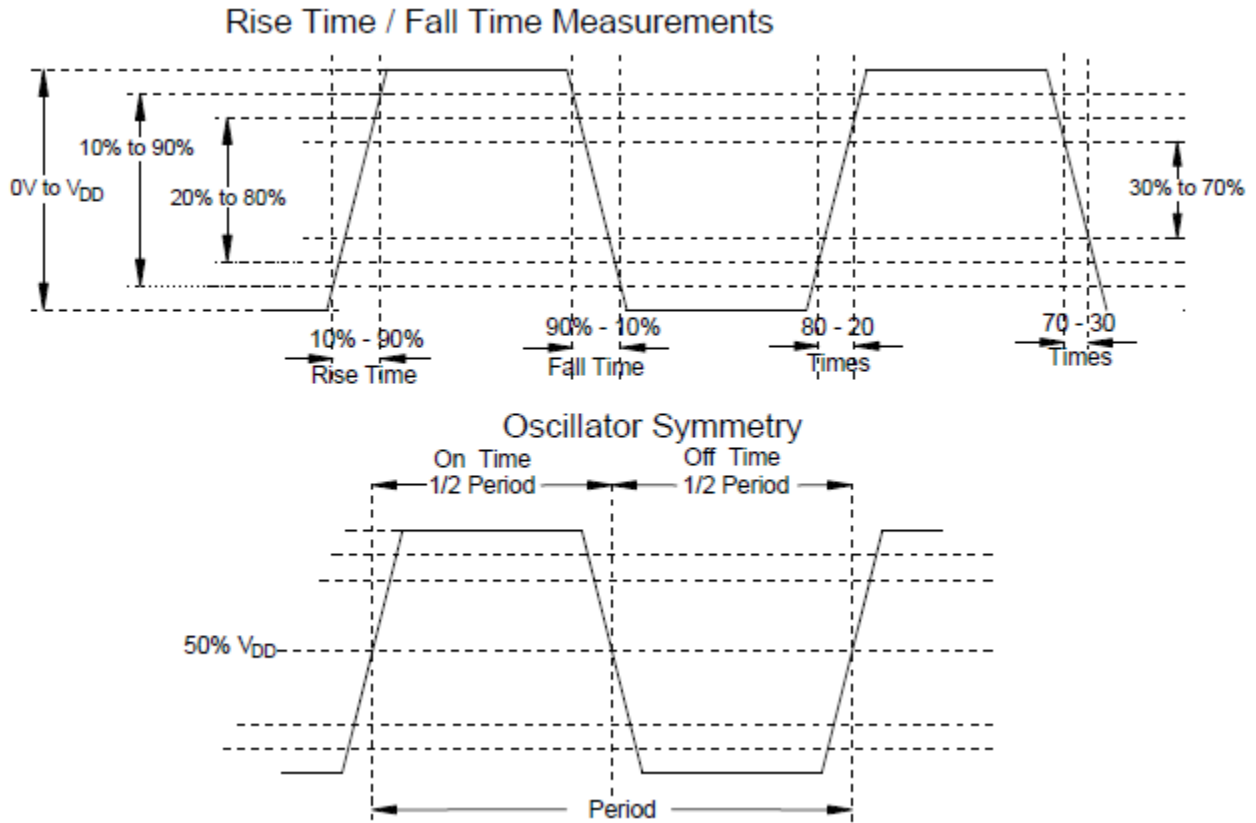* A pullup resistor from pin 4 (VDD) to pin 1 (E/D) enables output when pin 1 is left open.

AC Characteristics

(V_{DD}= 2.5 V ± 5%, T_A= - 20°C to +70°C; -40° to +85°C) Below are guaranteed for listed standard frequencies.

Parameter	Symbol	Condition	Min	Typ	Max	Units
Output Frequency Range	F_{OUTR}		0.016		167	MHz
Frequency Stability		Temperature = -20°C to +70°C	±20		±100	ppm
		Temperature = -40°C to +85°C	±25		±100	ppm
Output Load					10	pF
Start-up Time	T_{ST}	Output valid time after VDD meets minimum specified level			10	ms
Output Rise Time		10% to 90% V_{DD}, Standard Frequencies			3	ns
Output Fall Time		90% to 10% V_{DD}, Standard Frequencies			3	ns
Output Clock Duty Cycle	T_{DTCY}	@ 50% V_{DD} Std. Frequencies to 62.5MHz Std. Frequencies >62.5MHz	45 40		55 60	%
Output Enable/ Disable Time	T_{OE}				100	ns
Period Jitter, RMS	J_{PER}	Frequency = 125MHz		7		psec
Random Jitter	R_J	Frequency = 125MHz Per MJSQ spec (Methodologies for Jitter and Signal Quality specifications)		0.7		psec
Deterministic Jitter	D_J			10		psec
Total Jitter	T_J			20		psec
Phase Jitter (12kHz – 20MHz)	ϕ_{JITTER}	Frequency = 125MHz		350	500	fsec
Phase Noise Performance Frequency = 125 MHz	ϕ_{NOISE}	100Hz of Carrier		-94		dBc/Hz
		1kHz of Carrier		-116		dBc/Hz
		10kHz of Carrier		-123		dBc/Hz
		100kHz of Carrier		-129		dBc/Hz
		1MHz of Carrier		-150		dBc/Hz
		10MHz of Carrier		-156		dBc/Hz
Output Frequency (Standards)	F_{OUT}	10MHz, 12MHz, 12.288MHz, 16MHz, 20MHz, 24MHz, 24.576MHz, 25MHz, 33.333MHz, 40MHz, 48MHZ, 50MHz, 100MHz, 125MHz, 156.25MHz (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
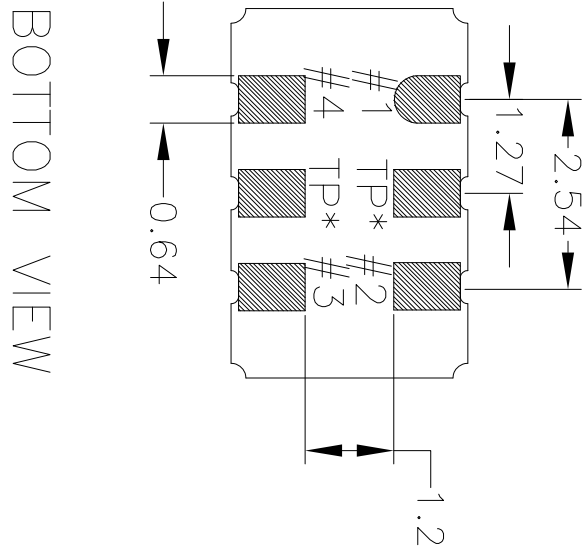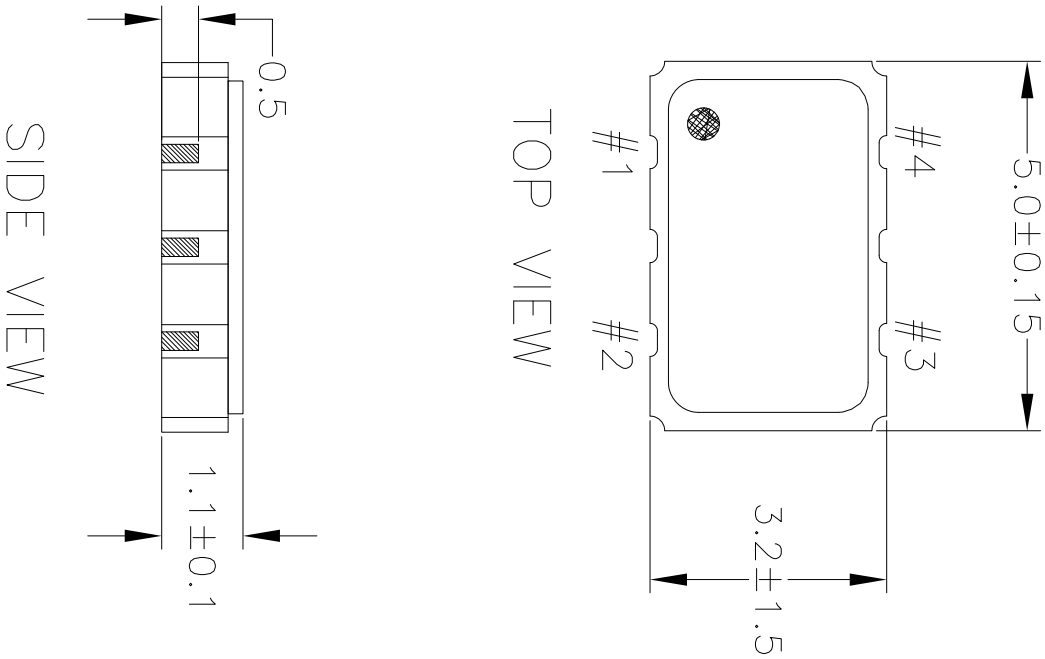(V_{DD}= 1.8 V ± 5%, T_A= - 20°C to +70°C; -40° to +85°C) Below are guaranteed for listed standard frequencies.

Parameter	Symbol	Condition	Min	Typ	Max	Units
Power Supply Current	I_{DD}	Standard Frequencies		54		mA
Output HIGH Voltage	V_{OH}	C_L = 10pF	90%V_{DD}			V
Output LOW Voltage	V_{OL}	C_L = 10pF			10%V_{DD}	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 4 (VDD) to pin 1 (E/D) enables output when pin 1 is left open.

AC Characteristics
(V_{DD}= 1.8 V ± 5%, T_A= - 20°C to +70°C; -40° to +85°C) Below are guaranteed for listed standard frequencies.

Parameter	Symbol	Condition	Min	Typ	Max	Units
Output Frequency Range	F_{OUTR}		0.016		62.5	MHz
Frequency Stability		Temperature = -20°C to +70°C	±20		±100	ppm
		Temperature = -40°C to +85°C	±25		±100	ppm
Output Load					10	pF
Start-up Time	T_{ST}	Output valid time after VDD meets minimum specified level			10	ms
Output Rise Time		10% to 90% $V_{DD,}$ Standard Frequencies		5		ns
Output Fall Time		90% to 10% $V_{DD,}$ Standard Frequencies		5		ns
Output Clock Duty Cycle	T_{DTCY}	@ 50% V_{DD}	40		60	%
Output Enable/ Disable Time	T_{OE}				100	ns
Period Jitter, RMS	J_{PER}	Frequency = 62.5MHz		7		psec
Random Jitter	R_J	Frequency = 62.5MHz Per MJSQ spec (Methodologies for Jitter and Signal Quality specifications)		0.9		psec
Deterministic Jitter	D_J			10		psec
Total Jitter	T_J			20		psec
Phase Jitter (12kHz – 20MHz)	ϕ_{JITTER}	Frequency = 62.5MHz		800	1200	fsec
Phase Noise Performance Frequency = 62.5MHz	ϕ_{NOISE}	100Hz of Carrier		-94		dBc/Hz
		1kHz of Carrier		-113		dBc/Hz
		10kHz of Carrier		-123		dBc/Hz
		100kHz of Carrier		-128		dBc/Hz
		1MHz of Carrier		-152		dBc/Hz
		10MHz of Carrier		-155		dBc/Hz
Output Frequency (Standards)	F_{OUT}	10MHz, 12MHz, 12.288MHz, 16MHz, 20MHz, 24MHz, 24.576MHz, 25MHz, 33.333MHz, 40MHz, 48MHZ, 50MHz, 62.5MHz (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

Typical Phase Noise (3.3V)
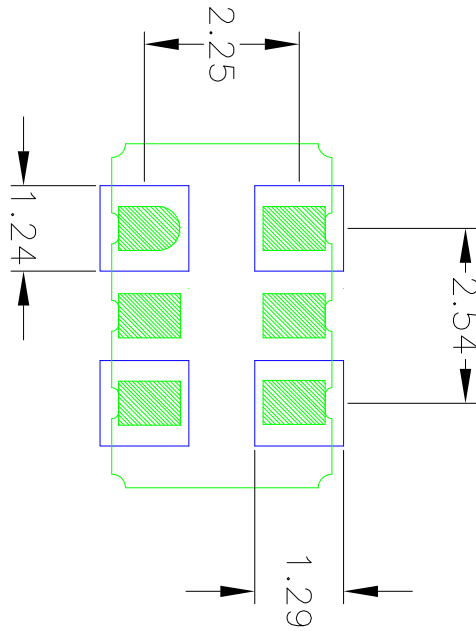
JS4 Package Outline and Dimensions

SIDE VIEW

0.5

1.1±0.1

TOP VIEW

#1

#2

#4

#3

5.0±0.15

3.2±1.5

BOTTOM VIEW

#1
#4

TP*
#4

#2
#3

TP*

2.54

1.27

0.64

1.2

NOTES:
1. ALL DIMENSIONS IN MM.

TOLERANCES
UNLESS SPECIFIED
DECIMAL   ANGULAR
XX±   ±
XXX±
XXXX±

APPROVALS   DATE
DRAWN JCB   07/16/12
CHECKED

www.IDT.com

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

TITLE   JS4 PACKAGE OUTLINE
5.0 x 3.2 mm BODY
1.1 mm Thick

SIZE   C

DRAWING No.
PSC-4429

REV
02

SHEET 1 OF 2

DO NOT SCALE DRAWING

REV	DESCRIPTION	DATE	APPROVED
00	INITIAL RELEASE	08/21/12	K. Stahn
01	UPDATED LID TOLERANCES	12/03/12	K. Stahn
02	UPDATE PACKAGE DRAWING	8/8/14	J.HUA

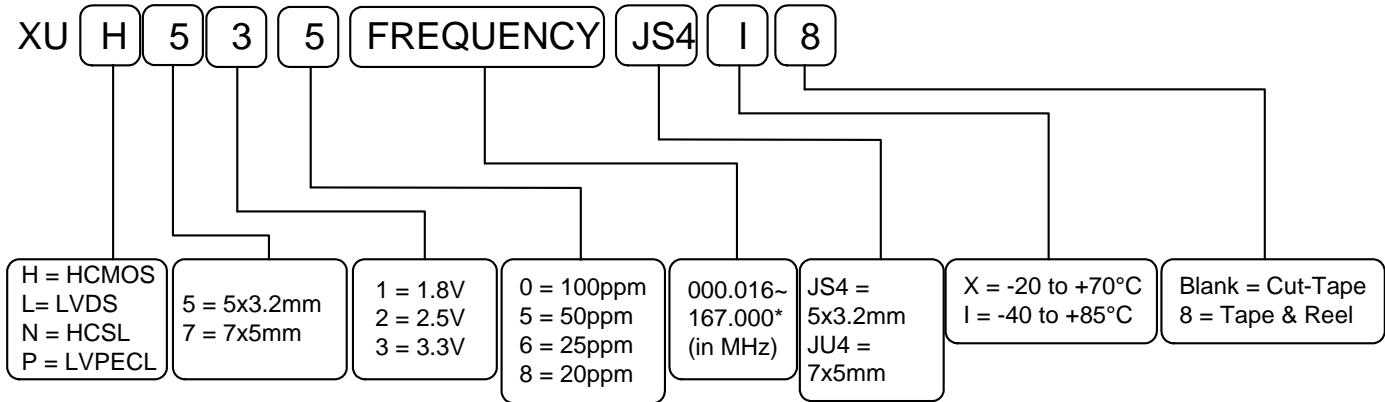REVISIONS

JS4 Package Outline and Dimensions (cont.)

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.

RECOMMENDED LAND PATTERN

2.25

1.24

2.54

1.29

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED
00	INITIAL RELEASE	08/21/12	K. Stahn
01	UPDATED LID TOLERANCES	12/03/12	K. Stahn
02	UPDATE PACKAGE DRAWING	8/8/14	J.HUA

TOLERANCES
UNLESS SPECIFIED
DECIMAL   ANGULAR
XX±   ±
XXX±
XXXX±

APPROVALS	DATE
DRAWN JCS	07/16/12
CHECKED	

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IDT

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

TITLE JS4 PACKAGE OUTLINE
5.0 x 3.2 mm BODY
1.1 mm Thick

SIZE C

DRAWING No.
PSC-4429

DO NOT SCALE DRAWING

SHEET 2 OF 2

REV 02

JU4 Package Outline and Dimensions

NOTES:
1. ALL DIMENSIONS IN MM.

SIDE VIEW

1.3±0.15

TOP VIEW

#1
#4
#2
#3

7.0±0.15

5.0±0.15

BOTTOM VIEW

#4
#1
TP*
TP*
#3
#2

5.08

2.54

1.4

2.6

JU4 Package Outline and Dimensions (cont.)

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.

RECOMMENDED LAND PATTERN

4.2

1.8

5.08

2.0
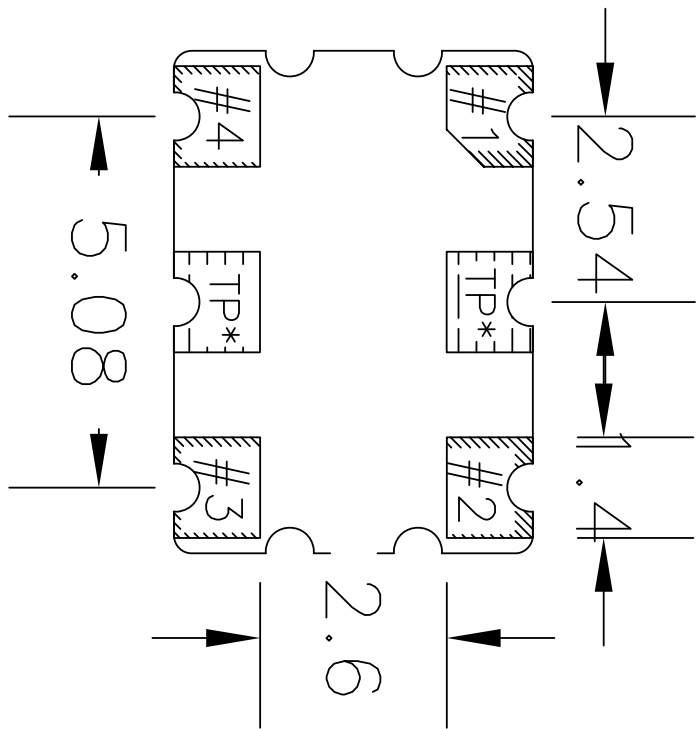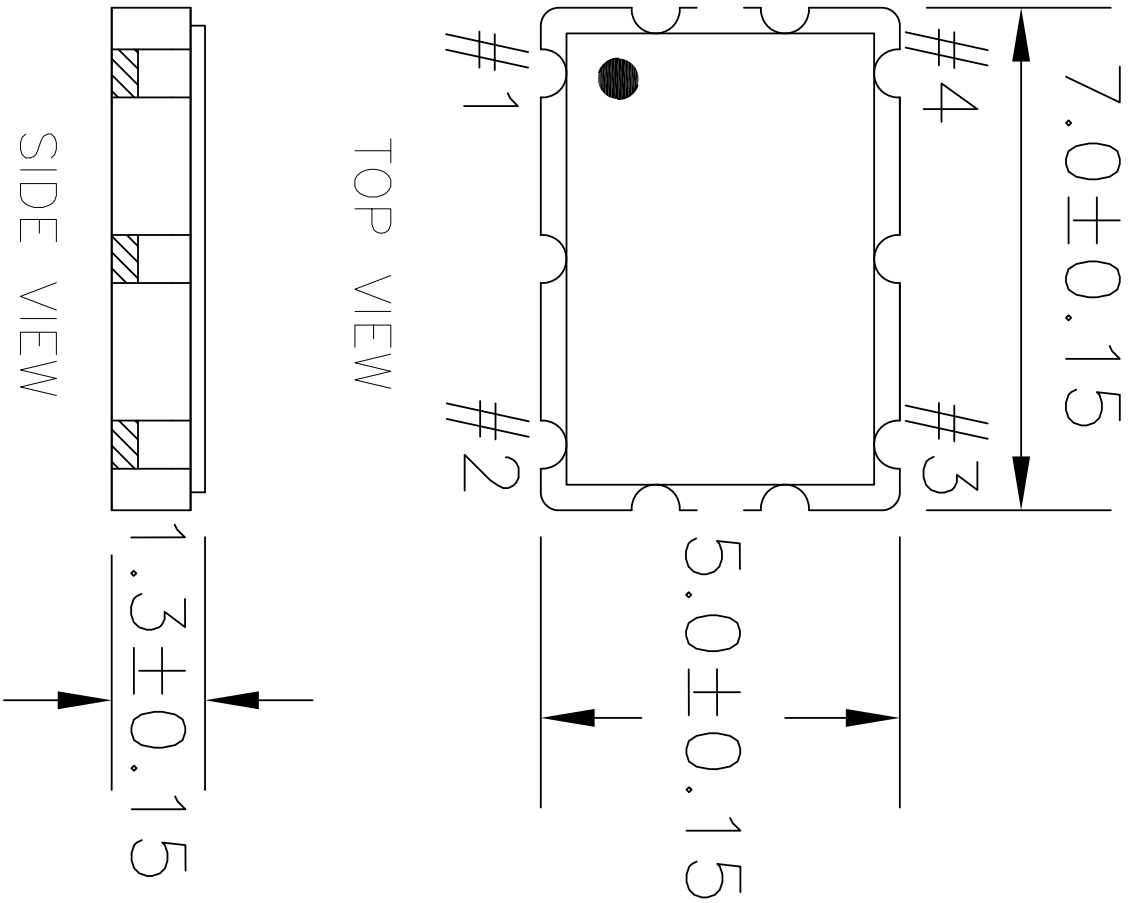
REVISIONS

REV	DESCRIPTION	DATE	APPROVED
00	INITIAL RELEASE	10/09/12	KS
01	UPDATE PACKAGE DRWING	8/11/14	J.HUA

TOLERANCES UNLESS SPECIFIED
DECIMAL   ANGULAR
XX±   ±
XXX±
XXXX±

APPROVALS | DATE
DRAWN JCS | 10/05/12
CHECKED

www.IDT.com

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

TITLE JU4 PACKAGE OUTLINE
7.0 x 5.0 mm BODY
1.3 mm Thick

SIZE C

DRAWING No.
PSC-4431

DO NOT SCALE DRAWING

SHEET 2 OF

Ordering Information

XU [H] [5] [3] [5] [FREQUENCY] [JS4] [I] [8]

| H = HCMOS
L= LVDS
N = HCSL
P = LVPECL | 5 = 5x3.2mm
7 = 7x5mm | 1 = 1.8V
2 = 2.5V
3 = 3.3V | 0 = 100ppm
5 = 50ppm
6 = 25ppm
8 = 20ppm | 000.016~
167.000*
(in MHz) | JS4 =
5x3.2mm
JU4 =
7x5mm | X = -20 to +70°C
I = -40 to +85°C | Blank = Cut-Tape
8 = Tape & Reel |

* See table or contact IDT for custom frequencies

Revision History

Rev.	Date	Originator	Description of Change
A	01/08/15	B. Chandhoke	Initial release.

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