

### Description

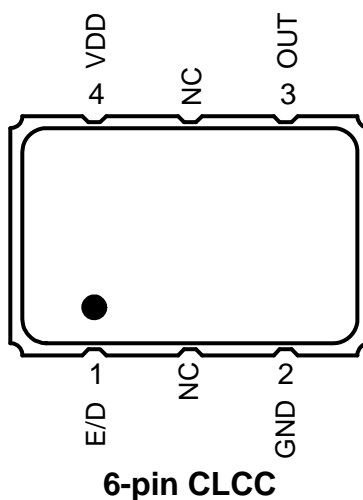
The XUH is an HCMOS crystal oscillator with 300fs typical phase jitter over 12kHz to 20MHz bandwidth. Available in a wide frequency range from 0.016MHz to 167MHz, the IDT XUH series crystal oscillator utilizes a family of proprietary ASICs, with a key focus on noise reduction technologies.

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  $\pm 20\text{ppm}$  with extremely quick delivery for both standard and custom frequencies

### Features

- Frequency range: 0.016 to 167MHz
- Output type: HCMOS
- 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 (JS4)  
7.0mm x 5.0mm x 1.3mm (JU4)
- Operating temperatures:  $-20^{\circ}\text{C}$  to  $+70^{\circ}\text{C}$  or  $-40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$

### Pin Assignment



### Pin Descriptions

Pin Number	Pin Name	Description
1	E/D	Enable/Disable <sup>1</sup> (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 +5.0V
E/D	-0.5V to VDD + 0.5V
OUT	-0.5V to VDD + 0.5V
Storage Temperature	-55°C to 125°C
Theta Ja (Junction to Ambient)	102°C/W – Still Air

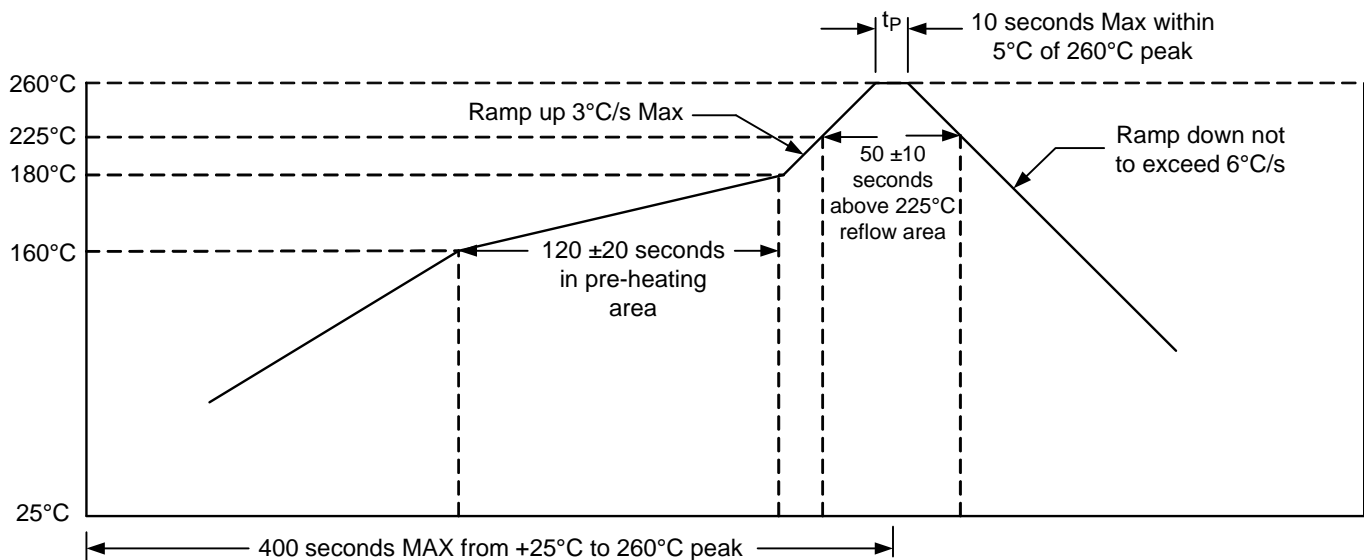
## ESD Compliance

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/cm <sup>2</sup> 2 hours.

## Solder Reflow Profile



## DC Characteristics

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

( $V_{DD} = 3.3V \pm 5\%$ ,  $T_A = -20^\circ C$  to  $+70^\circ C$ ;  $-40^\circ$  to  $+85^\circ C$ ) 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 = $-20^\circ C$ to $+70^\circ C$	$\pm 20$		$\pm 100$	ppm
		Temperature = $-40^\circ C$ to $+85^\circ C$	$\pm 25$		$\pm 100$	ppm
Aging (1 <sup>st</sup> year)		$T_a = 25^\circ C$			$\pm 3$	ppm
Aging (10 years)		$T_a = 25^\circ C$			$\pm 10$	ppm
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	$T_{DTCY}$	At 50% $V_{DD}$ Std. Frequencies to 125MHz	45		55	%
		Std. Frequencies >125MHz	40		60	
Output Enable/ Disable Time	$T_{OE}$				100	ns
Period Jitter, RMS	$J_{PER}$	Frequency = 156.25MHz		5		ps
Random Jitter	$R_J$	Frequency = 156.25MHz		0.6		ps
Deterministic Jitter	$D_J$	Per MJSQ spec (Methodologies for Jitter and Signal Quality specifications)		10		ps
Total Jitter	$T_J$			19		ps
Phase Jitter (12kHz – 20MHz)	$\phi_{JITTER}$	Standard Frequencies		300	400	fs
Phase Noise Performance Frequency = 156.25MHz	$\phi_{NOISE}$	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

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

( $V_{DD} = 2.5V \pm 5\%$ ,  $T_A = -20^\circ C$  to  $+70^\circ C$ ;  $-40^\circ$  to  $+85^\circ C$ ) 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 = $-20^\circ C$ to $+70^\circ C$	$\pm 20$		$\pm 100$	ppm
		Temperature = $-40^\circ C$ to $+85^\circ C$	$\pm 25$		$\pm 100$	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	$T_{DTCY}$	At 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		ps
Random Jitter	$R_J$	Frequency = 125MHz		0.7		ps
Deterministic Jitter	$D_J$	Per MJSQ spec (Methodologies for Jitter and Signal Quality specifications)		10		ps
Total Jitter	$T_J$			20		ps
Phase Jitter (12kHz – 20MHz)	$\phi_{JITTER}$	Frequency = 125MHz		350	500	fs
Phase Noise Performance Frequency = 125MHz	$\phi_{NOISE}$	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

( $V_{DD} = 1.8V \pm 5\%$ ,  $T_A = -20^\circ C$  to  $+70^\circ C$ ;  $-40^\circ$  to  $+85^\circ C$ ) 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.

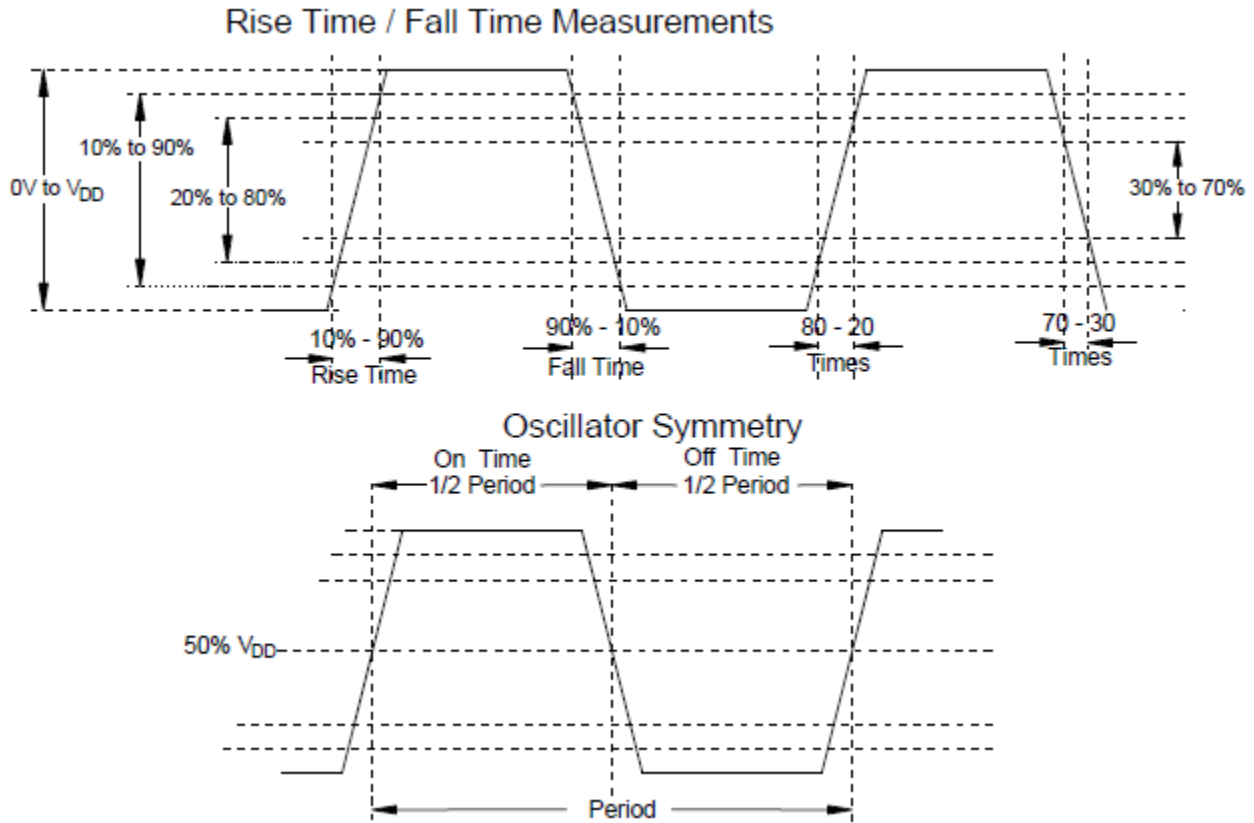
## AC Characteristics

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

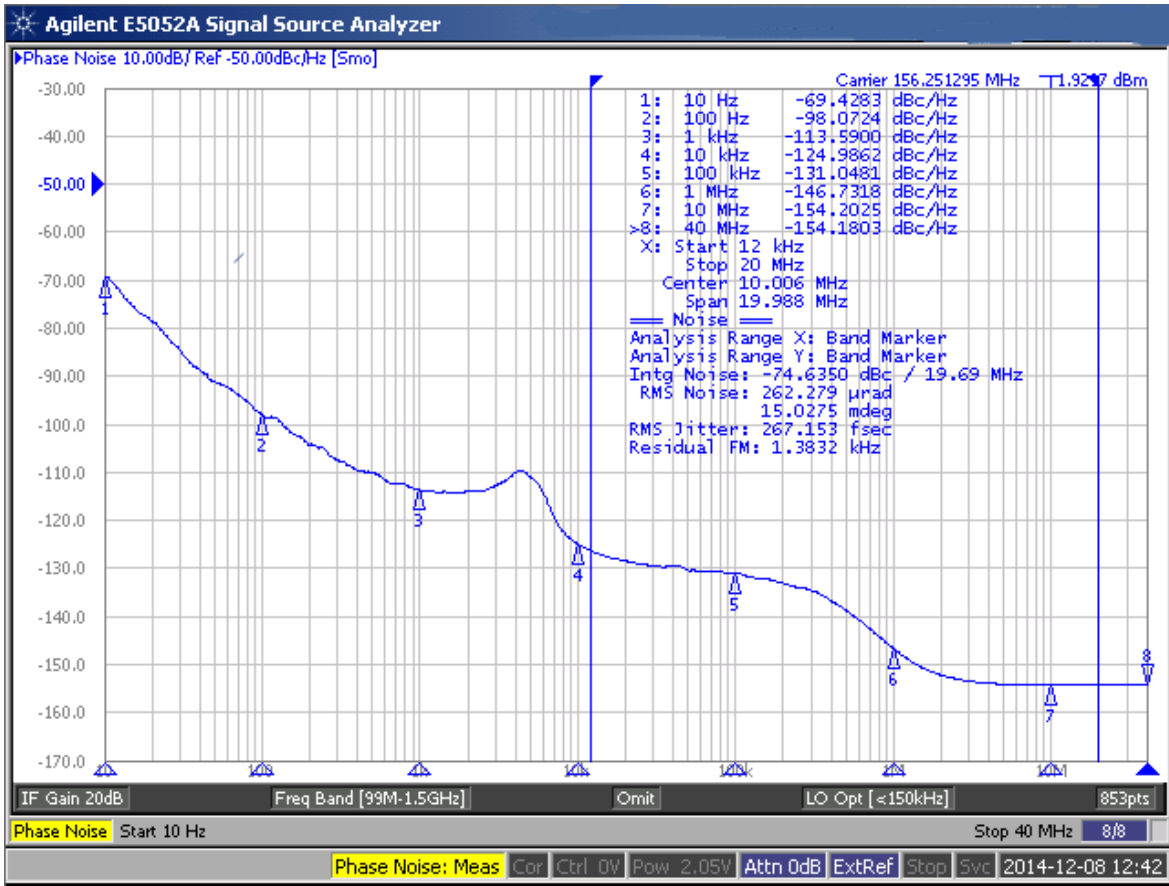
Parameter	Symbol	Condition	Min	Typ	Max	Units
Output Frequency Range	$F_{OUTR}$		0.016		62.5	MHz
Frequency Stability		Temperature = $-20^\circ C$ to $+70^\circ C$	$\pm 20$		$\pm 100$	ppm
		Temperature = $-40^\circ C$ to $+85^\circ C$	$\pm 25$		$\pm 100$	ppm
Output Load					10	pF
Start-up Time	$T_{ST}$	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	$T_{DTCY}$	At 50% $V_{DD}$	40		60	%
Output Enable/ Disable Time	$T_{OE}$				100	ns
Period Jitter, RMS	$J_{PER}$	Frequency = 62.5MHz		7		ps
Random Jitter	$R_J$	Frequency = 62.5MHz		0.9		ps
Deterministic Jitter	$D_J$	Per MJSQ spec (Methodologies for Jitter and Signal Quality specifications)		10		ps
Total Jitter	$T_J$			20		ps
Phase Jitter (12kHz – 20MHz)	$\phi_{JITTER}$	Frequency = 62.5MHz		800	1200	fs
Phase Noise Performance Frequency = 62.5MHz	$\phi_{NOISE}$	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.

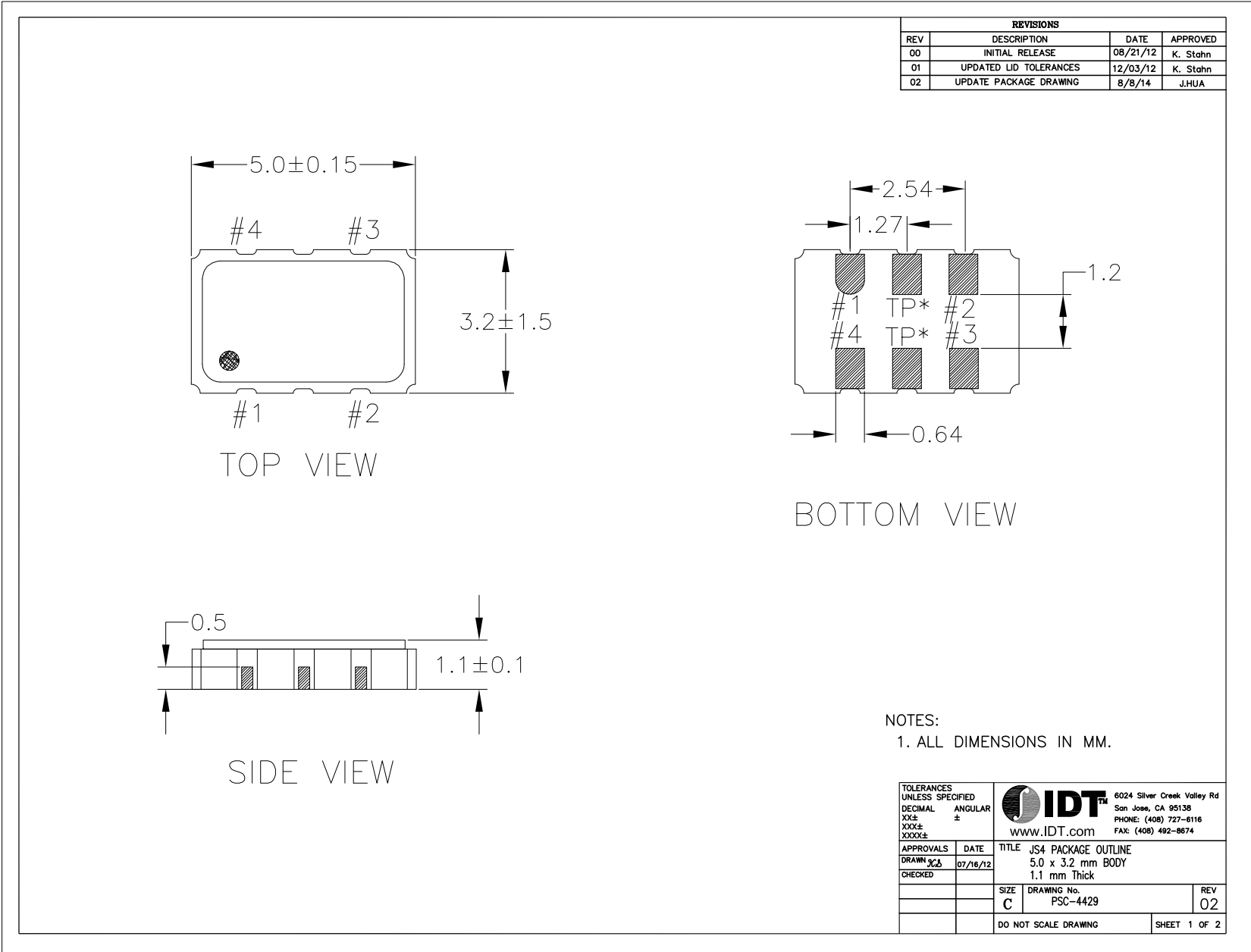
# Output Waveform



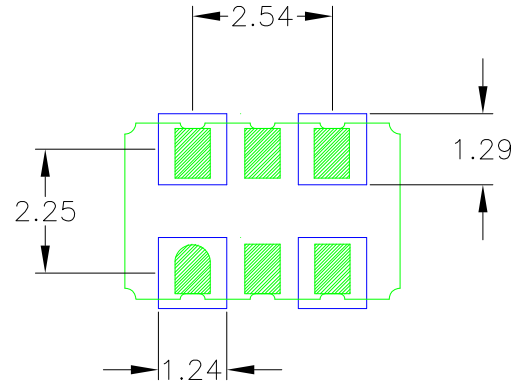
# Typical Phase Noise (3.3V)



JS4 Package Outline and Dimensions



## JS4 Package Outline and Dimensions (cont.)




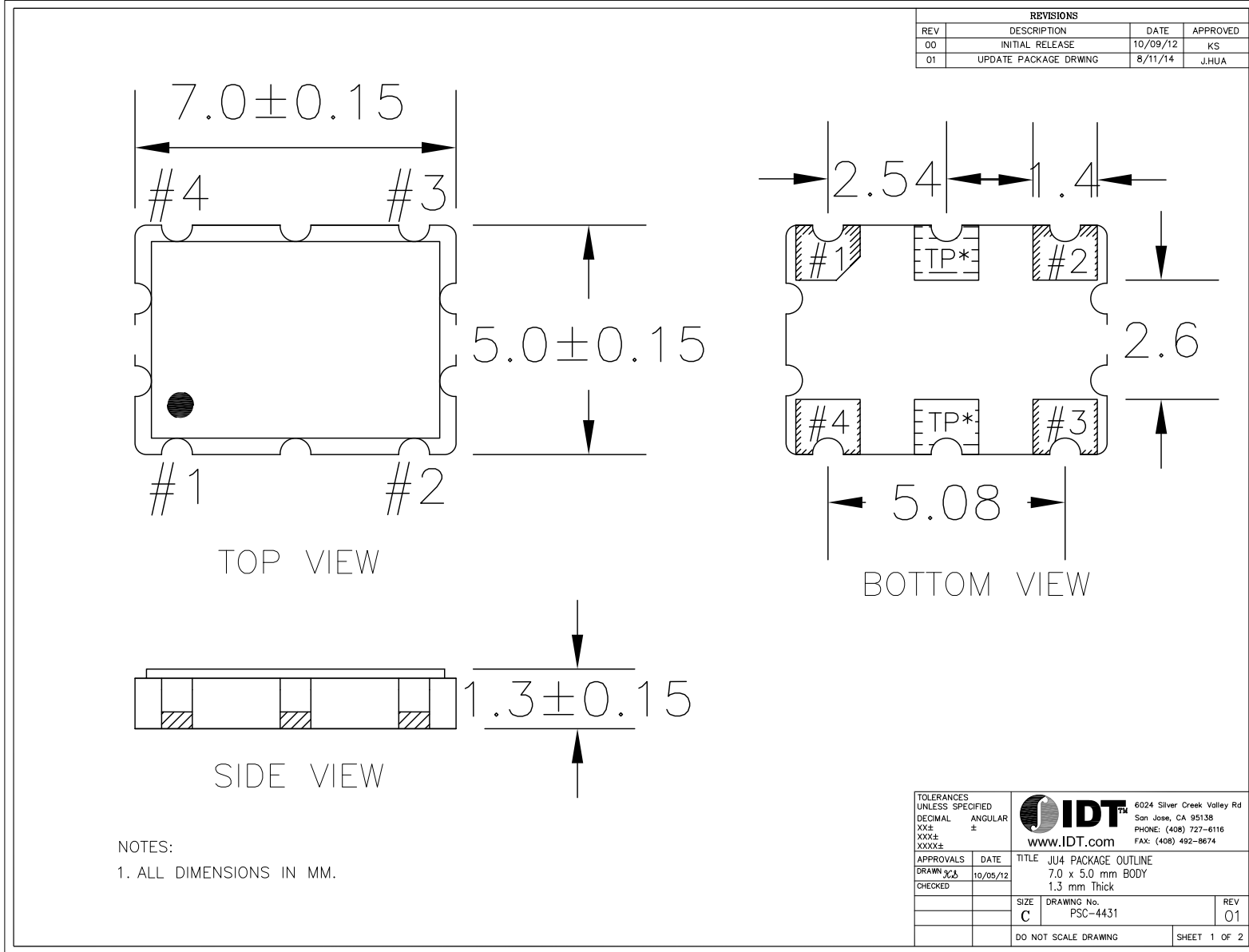
RECOMMENDED LAND PATTERN

NOTES:

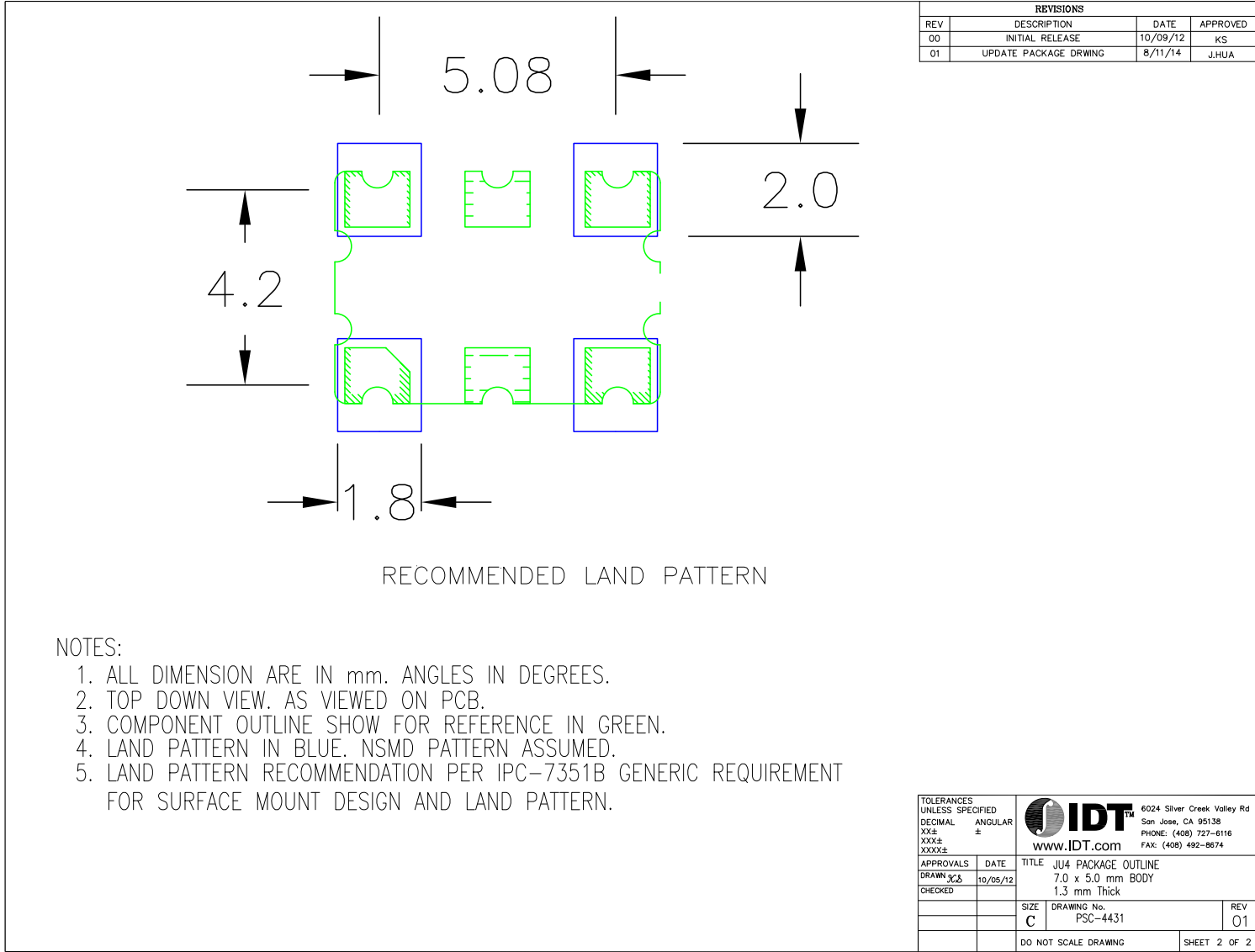
1. ALL DIMENSION ARE IN mm. ANGLES IN DEGREES.
2. TOP DOWN VIEW, AS VIEWED ON PCB.
3. COMPONENT OUTLINE SHOW FOR REFERENCE IN GREEN.
4. LAND PATTERN IN BLUE. NSMD PATTERN ASSUMED.
5. LAND PATTERN RECOMMENDATION PER IPC-7351B GENERIC REQUIREMENT FOR SURFACE MOUNT DESIGN AND LAND PATTERN.

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

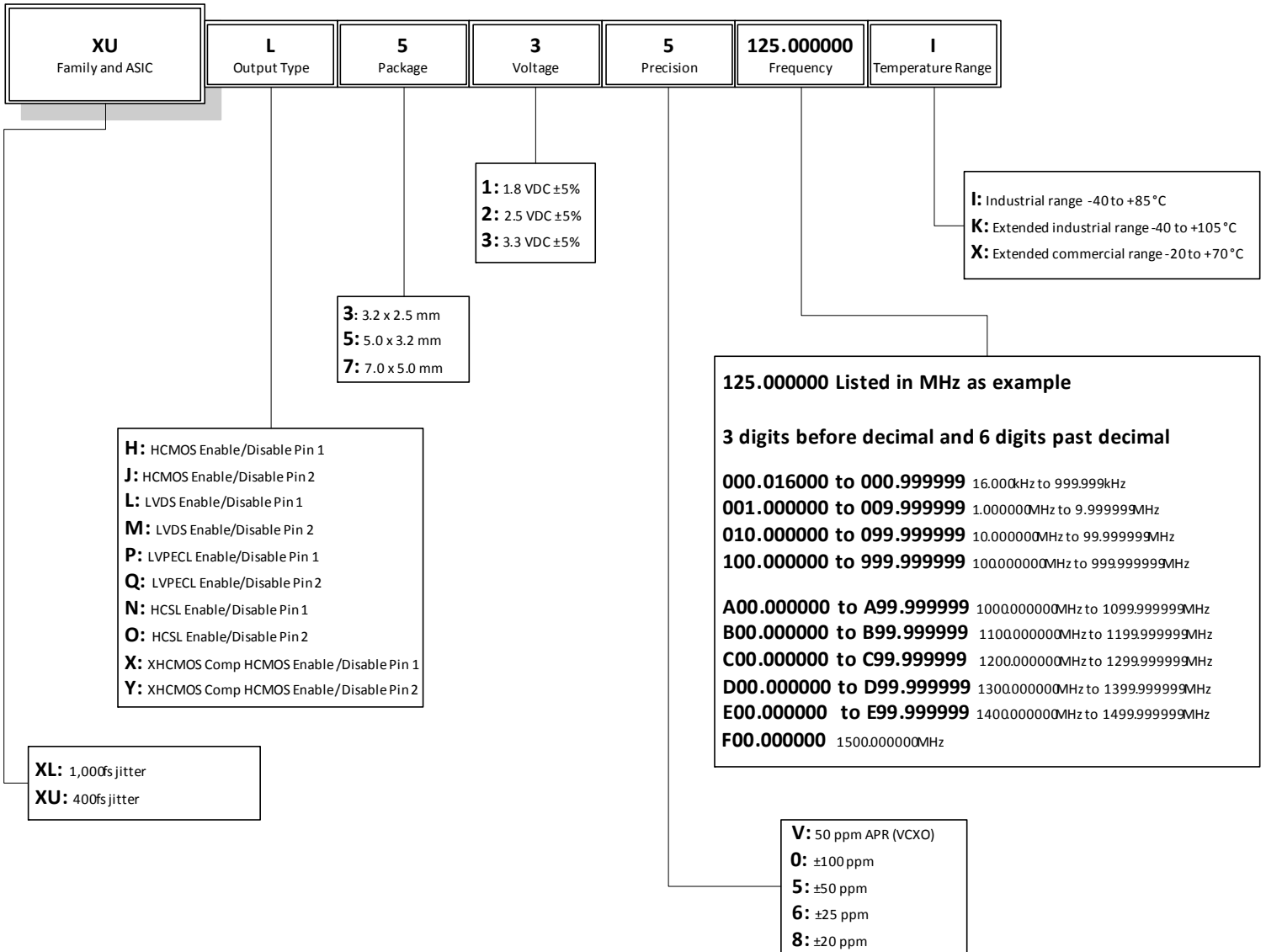
TOLERANCES UNLESS SPECIFIED		 6024 Silver Creek Valley Rd San Jose, CA 95138 PHONE: (408) 727-6116 FAX: (408) 492-8674 <a href="http://www.IDT.com">www.IDT.com</a>
DECIMAL	ANGULAR	
XX±	±	
XXX±		
APPROVALS	DATE	TITLE
DRAWN <i>gcs</i>	07/16/12	JS4 PACKAGE OUTLINE
CHECKED		5.0 x 3.2 mm BODY 1.1 mm Thick
	SIZE	DRAWING No.
	C	PSC-4429
		REV
		02
DO NOT SCALE DRAWING		SHEET 2 OF 2



# JU4 Package Outline and Dimensions (cont.)



# IDT Ordering Information



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## Revision History

Date	Originator	Description of Change
01/08/15	B. Chandhoke	Initial release.
10/28/16	P. Jenkins	Update ordering information decoder tables by separating them into Scheme 1 and Scheme 2; add note to distinguish the two tables.
06/13/17	L.S.	Removed "Ordering Information Scheme #1 (for reference only)". Replaced with a single ordering information table.
06/20/17	L.S.	Corrected frequency errors in Ordering Information table.



**Corporate Headquarters**  
6024 Silver Creek Valley Road  
San Jose, CA 95138 USA  
[www.IDT.com](http://www.IDT.com)

**Sales**  
1-800-345-7015 or 408-284-8200  
Fax: 408-284-2775  
[www.IDT.com/go/sales](http://www.IDT.com/go/sales)

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