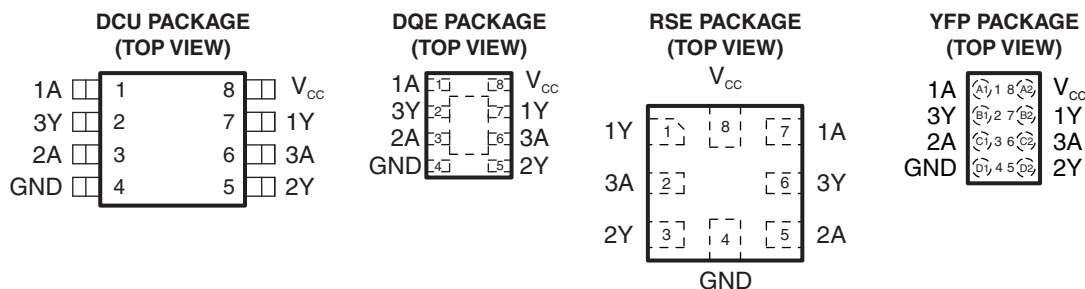


# LOW-POWER TRIPLE SCHMITT-TRIGGER INVERTER

Check for Samples: [SN74AUP3G14](#)

## FEATURES

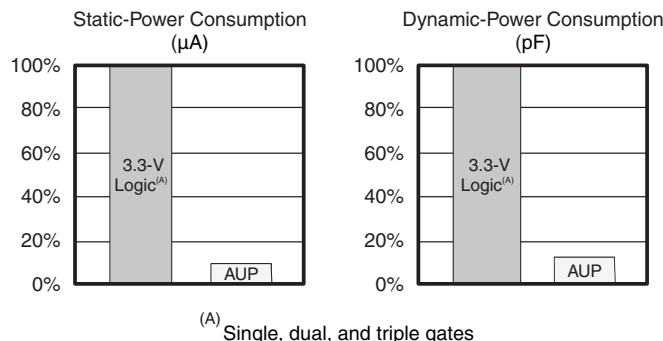
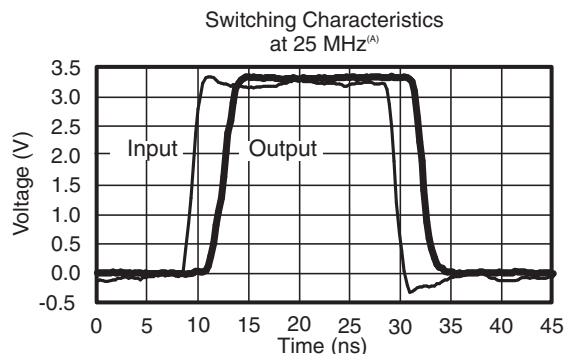
- Available in the Texas Instruments NanoStar™ Package
- Low Static-Power Consumption ( $I_{CC} = 0.9 \mu A$  Maximum)
- Low Dynamic-Power Consumption ( $C_{pd} = 4.3 pF$  Typ at 3.3 V)
- Low Input Capacitance ( $C_i = 1.5 pF$  Typical)
- Low Noise – Overshoot and Undershoot <10% of  $V_{CC}$
- $I_{off}$  Supports Partial-Power-Down Mode Operation
- Wide Operating  $V_{CC}$  Range of 0.8 V to 3.6 V
- Optimized for 3.3-V Operation
- 3.6-V I/O Tolerant to Support Mixed-Mode Signal Operation
- $t_{pd} = 4.3 ns$  Maximum at 3.3 V
- Suitable for Point-to-Point Applications
- Latch-Up Performance Exceeds 100 mA Per JESD 78, Class II
- ESD Performance Tested Per JESD 22
  - 2000-V Human-Body Model (A114-B, Class II)
  - 1000-V Charged-Device Model (C101)



See mechanical drawings for dimensions.

## DESCRIPTION/ORDERING INFORMATION

The AUP family is TI's premier solution to the industry's low-power needs in battery-powered portable applications. This family ensures a very low static- and dynamic-power consumption across the entire  $V_{CC}$  range of 0.8 V to 3.6 V, resulting in increased battery life (see [Figure 1](#)). This product also maintains excellent signal integrity (see the very low undershoot and overshoot characteristics shown in [Figure 2](#)).


**Figure 1. AUP – The Lowest-Power Family**

(A) SN74AUP3Gxx data at  $C_L = 15 pF$ .

**Figure 2. Excellent Signal Integrity**


Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

NanoStar is a trademark of Texas Instruments.

PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of the Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

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The SN74AUP3G14 contains three inverters and performs the Boolean function  $Y = \overline{A}$ . The device functions as three independent inverters but, because of Schmitt action, it may have different input threshold levels for positive-going ( $V_{T+}$ ) and negative-going ( $V_{T-}$ ) signals.

NanoStar™ package technology is a major breakthrough in IC packaging concepts, using the die as the package.

This device is fully specified for partial-power-down applications using  $I_{off}$ . The  $I_{off}$  circuitry disables the outputs, preventing damaging current backflow through the device when it is powered down.

### ORDERING INFORMATION<sup>(1)</sup>

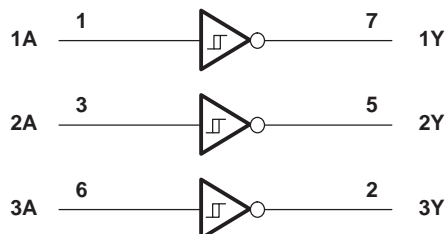
$T_A$	PACKAGE <sup>(2)</sup>		ORDERABLE PART NUMBER	TOP-SIDE MARKING <sup>(3)</sup>
–40°C to 85°C	NanoStar™ – WCSP (DSBGA) 0.23-mm Large Bump – YFP (Pb-free)	Reel of 3000	SN74AUP3G14YFPR	__ _ H F _
	uQFN – DQE	Reel of 5000	SN74AUP3G14DQER	TX
	QFN – RSE	Reel of 5000	SN74AUP3G14RSE	TX
	SSOP – DCU	Reel of 3000	SN74AUP3G14DCUR	H14_

- (1) For the most current package and ordering information, see the Package Option Addendum at the end of this document, or see the TI web site at [www.ti.com](http://www.ti.com).
- (2) Package drawings, thermal data, and symbolization are available at [www.ti.com/packaging](http://www.ti.com/packaging).
- (3) DCU: The actual top-side marking has one additional character that designates the wafer fab/assembly site.  
YFP: The actual top-side marking has three preceding characters to denote year, month, and sequence code, and one following character to designate the wafer fab/assembly site. Pin 1 identifier indicates solder-bump composition (1 = SnPb, • = Pb-free).

### FUNCTION TABLE

INPUT A	OUTPUT Y
H	L
L	H

### LOGIC DIAGRAM (POSITIVE LOGIC)



Pin numbers shown are for the DCU and DQE package.

### ABSOLUTE MAXIMUM RATINGS<sup>(1)</sup>

over operating free-air temperature range (unless otherwise noted)

		MIN	MAX	UNIT
$V_{CC}$	Supply voltage range	–0.5	4.6	V
$V_I$	Input voltage range <sup>(2)</sup>	–0.5	4.6	V
$V_O$	Voltage range applied to any output in the high-impedance or power-off state <sup>(2)</sup>	–0.5	4.6	V
$V_O$	Output voltage range in the high or low state <sup>(2)</sup>	–0.5	$V_{CC} + 0.5$	V
$I_{IK}$	Input clamp current		–50	mA
$I_{OK}$	Output clamp current		–50	mA
$I_O$	Continuous output current		±20	mA
	Continuous current through $V_{CC}$ or GND		±50	mA
$\theta_{JA}$	Package thermal impedance <sup>(3)</sup>	DCU package	220	°C/W
		DQE package	261	
		RSE package	253	
		YFP package	132	
$T_{stg}$	Storage temperature range	–65	150	°C

- (1) Stresses beyond those listed under "absolute maximum ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
- (2) The input negative-voltage and output voltage ratings may be exceeded if the input and output current ratings are observed.
- (3) The package thermal impedance is calculated in accordance with JESD 51-7.

**RECOMMENDED OPERATING CONDITIONS** <sup>(1)</sup>

		MIN	MAX	UNIT
$V_{CC}$	Supply voltage	0.8	3.6	V
$V_I$	Input voltage	0	3.6	V
$V_O$	Output voltage	0	$V_{CC}$	V
$I_{OH}$	High-level output current	$V_{CC} = 0.8\text{ V}$	–20	$\mu\text{A}$
		$V_{CC} = 1.1\text{ V}$	–1.1	mA
		$V_{CC} = 1.4\text{ V}$	–1.7	
		$V_{CC} = 1.65\text{ V}$	–1.9	
		$V_{CC} = 2.3\text{ V}$	–3.1	
		$V_{CC} = 3\text{ V}$	–4	
$I_{OL}$	Low-level output current	$V_{CC} = 0.8\text{ V}$	20	$\mu\text{A}$
		$V_{CC} = 1.1\text{ V}$	1.1	mA
		$V_{CC} = 1.4\text{ V}$	1.7	
		$V_{CC} = 1.65\text{ V}$	1.9	
		$V_{CC} = 2.3\text{ V}$	3.1	
		$V_{CC} = 3\text{ V}$	4	
$T_A$	Operating free-air temperature	–40	85	$^{\circ}\text{C}$

(1) All unused inputs of the device must be held at  $V_{CC}$  or GND to ensure proper device operation. Refer to the TI application report, *Implications of Slow or Floating CMOS Inputs*, literature number SCBA004.

## ELECTRICAL CHARACTERISTICS

over recommended operating free-air temperature range (unless otherwise noted)

PARAMETER		TEST CONDITIONS	V <sub>CC</sub>	T <sub>A</sub> = 25°C			T <sub>A</sub> = –40°C to 85°C		UNIT
				MIN	TYP	MAX	MIN	MAX	
V <sub>T+</sub> Positive-going input threshold voltage			0.8 V	0.3		0.6	0.3	0.6	V
			1.1 V	0.53		0.9	0.53	0.9	
			1.4 V	0.74		1.11	0.74	1.11	
			1.65 V	0.91		1.29	0.91	1.29	
			2.3 V	1.37		1.77	1.37	1.77	
			3 V	1.88		2.29	1.88	2.29	
V <sub>T–</sub> Negative-going input threshold voltage			0.8 V	0.1		0.6	0.1	0.6	V
			1.1 V	0.26		0.65	0.26	0.65	
			1.4 V	0.39		0.75	0.39	0.75	
			1.65 V	0.47		0.84	0.47	0.84	
			2.3 V	0.69		1.04	0.69	1.04	
			3 V	0.88		1.24	0.88	1.24	
ΔV <sub>T</sub> Hysteresis (V <sub>T+</sub> – V <sub>T–</sub> )			0.8 V	0.07		0.5	0.07	0.5	V
			1.1 V	0.08		0.46	0.08	0.46	
			1.4 V	0.18		0.56	0.18	0.56	
			1.65 V	0.27		0.66	0.27	0.66	
			2.3 V	0.53		0.92	0.53	0.92	
			3 V	0.79		1.31	0.79	1.31	
V <sub>OH</sub>	I <sub>OH</sub> = –20 μA I <sub>OH</sub> = –1.1 mA I <sub>OH</sub> = –1.7 mA I <sub>OH</sub> = –1.9 mA I <sub>OH</sub> = –2.3 mA I <sub>OH</sub> = –3.1 mA I <sub>OH</sub> = –2.7 mA I <sub>OH</sub> = –4 mA	0.8 V to 3.6 V	V <sub>CC</sub> – 0.1			V <sub>CC</sub> – 0.1		V	
		1.1 V	0.75 × V <sub>CC</sub>			0.7 × V <sub>CC</sub>			
		1.4 V	1.11			1.03			
		1.65 V	1.32			1.3			
		2.3 V	2.05			1.97			
			1.9			1.85			
		3 V	2.72			2.67			
			2.6			2.55			
V <sub>OL</sub>	I <sub>OL</sub> = 20 μA I <sub>OL</sub> = 1.1 mA I <sub>OL</sub> = 1.7 mA I <sub>OL</sub> = 1.9 mA I <sub>OL</sub> = 2.3 mA I <sub>OL</sub> = 3.1 mA I <sub>OL</sub> = 2.7 mA I <sub>OL</sub> = 4 mA	0.8 V to 3.6 V	0.1			0.1		V	
		1.1 V	0.3 × V <sub>CC</sub>			0.3 × V <sub>CC</sub>			
		1.4 V	0.31			0.37			
		1.65 V	0.31			0.35			
		2.3 V	0.31			0.33			
			0.44			0.45			
		3 V	0.31			0.33			
			0.44			0.45			
I <sub>I</sub>	A or B input	V <sub>I</sub> = GND to 3.6 V	0 V to 3.6 V			0.1		0.5	μA
I <sub>off</sub>		V <sub>I</sub> or V <sub>O</sub> = 0 V to 3.6 V	0 V			0.2		0.6	μA
ΔI <sub>off</sub>		V <sub>I</sub> or V <sub>O</sub> = 0 V to 3.6 V	0 V to 0.2 V			0.2		0.6	μA
I <sub>CC</sub>		V <sub>I</sub> = GND or (V <sub>CC</sub> to 3.6 V), I <sub>O</sub> = 0	0.8 V to 3.6 V			0.5		0.9	μA
ΔI <sub>CC</sub>		V <sub>I</sub> = V <sub>CC</sub> – 0.6 V <sup>(1)</sup> , I <sub>O</sub> = 0	3.3 V			40		50	μA
C <sub>i</sub>		V <sub>I</sub> = V <sub>CC</sub> or GND	0 V	1.5					pF
			3.6 V	1.5					
C <sub>o</sub>		V <sub>O</sub> = GND	0 V			3			pF

(1) One input at V<sub>CC</sub> – 0.6 V, other input at V<sub>CC</sub> or GND

## SWITCHING CHARACTERISTICS

over recommended operating free-air temperature range,  $C_L = 5$  pF (unless otherwise noted) (see [Figure 3](#) and [Figure 4](#))

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CC}$	$T_A = 25^\circ\text{C}$			$T_A = -40^\circ\text{C to } 85^\circ\text{C}$		UNIT
				MIN	TYP	MAX	MIN	MAX	
$t_{pd}$	A or B	Y	0.8 V		18				ns
			1.2 V $\pm$ 0.1 V	2.6	7.3	12.8	2.1	15.6	
			1.5 V $\pm$ 0.1 V	1.4	5.2	8.7	0.9	10.3	
			1.8 V $\pm$ 0.15 V	1	4.2	6.6	0.5	8.2	
			2.5 V $\pm$ 0.2 V	1	3	4.4	0.5	5.5	
			3.3 V $\pm$ 0.3 V	1	2.4	3.5	0.5	4.3	

## SWITCHING CHARACTERISTICS

over recommended operating free-air temperature range,  $C_L = 10$  pF (unless otherwise noted) (see [Figure 3](#) and [Figure 4](#))

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CC}$	$T_A = 25^\circ\text{C}$			$T_A = -40^\circ\text{C to } 85^\circ\text{C}$		UNIT
				MIN	TYP	MAX	MIN	MAX	
$t_{pd}$	A	Y	0.8 V		18.4				ns
			1.2 V $\pm$ 0.1 V	4.6	7.9	13.4	1.3	16.7	
			1.5 V $\pm$ 0.1 V	4	6	9.6	2.2	11.8	
			1.8 V $\pm$ 0.15 V	3.6	5	7.9	2.4	9.5	
			2.5 V $\pm$ 0.2 V	3.2	4	5.5	2.3	6.8	
			3.3 V $\pm$ 0.3 V	2.9	3.5	4.6	2.1	5.6	

## SWITCHING CHARACTERISTICS

over recommended operating free-air temperature range,  $C_L = 15$  pF (unless otherwise noted) (see [Figure 3](#) and [Figure 4](#))

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CC}$	$T_A = 25^\circ\text{C}$			$T_A = -40^\circ\text{C to } 85^\circ\text{C}$		UNIT
				MIN	TYP	MAX	MIN	MAX	
$t_{pd}$	A or B	Y	0.8 V		24				ns
			1.2 V $\pm$ 0.1 V	3.6	9.9	16.3	3.1	19.9	
			1.5 V $\pm$ 0.1 V	2.3	7.2	11.1	1.8	13.2	
			1.8 V $\pm$ 0.15 V	1.6	5.8	8.7	1.1	10.6	
			2.5 V $\pm$ 0.2 V	1	4.3	5.9	0.5	7.3	
			3.3 V $\pm$ 0.3 V	1	3.4	4.8	0.5	5.9	

## SWITCHING CHARACTERISTICS

over recommended operating free-air temperature range,  $C_L = 30$  pF (unless otherwise noted) (see [Figure 3](#) and [Figure 4](#))

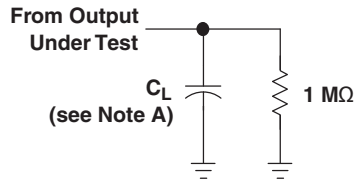
PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CC}$	$T_A = 25^\circ\text{C}$			$T_A = -40^\circ\text{C to } 85^\circ\text{C}$		UNIT
				MIN	TYP	MAX	MIN	MAX	
$t_{pd}$	A or B	Y	0.8 V		32.8				ns
			1.2 V $\pm$ 0.1 V	4.9	13.1	20.9	4.4	25.5	
			1.5 V $\pm$ 0.1 V	3.4	9.5	14.2	2.9	16.9	
			1.8 V $\pm$ 0.15 V	2.5	7.7	11	2	13.5	
			2.5 V $\pm$ 0.2 V	1.8	5.7	7.6	1.3	9.4	
			3.3 V $\pm$ 0.3 V	1.5	4.7	6.2	1	7.5	

## OPERATING CHARACTERISTICS

 $T_A = 25^\circ\text{C}$ 

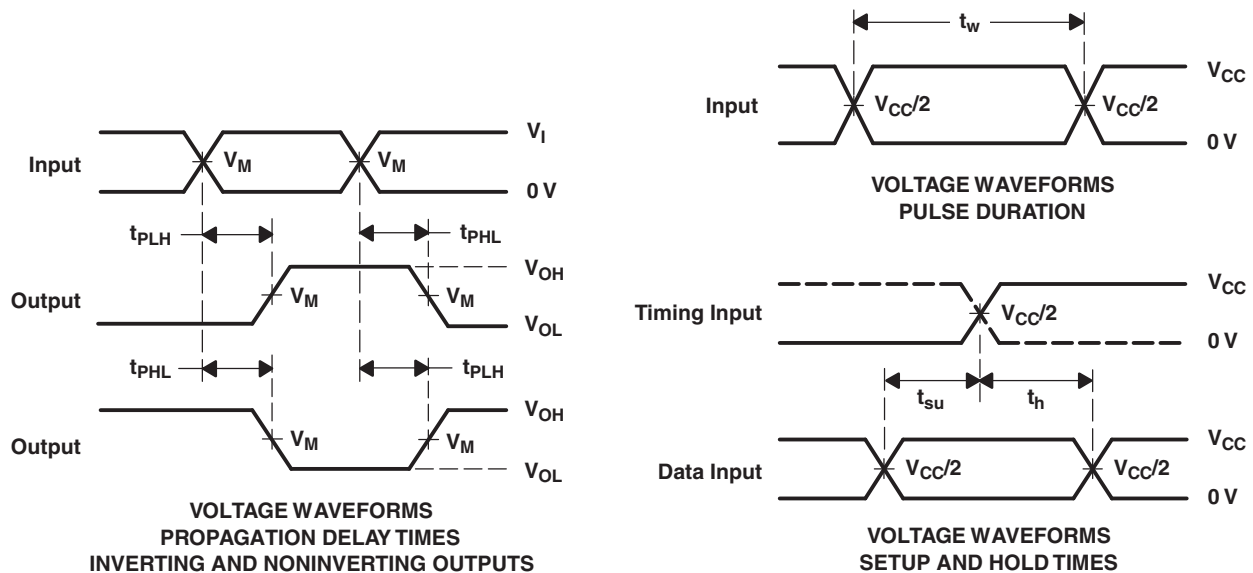
PARAMETER		TEST CONDITIONS	$V_{CC}$	TYP	UNIT
$C_{pd}$	Power dissipation capacitance	$f = 10\text{ MHz}$	0.8 V	4	pF
			1.2 V $\pm$ 0.1 V	4	
			1.5 V $\pm$ 0.1 V	4	
			1.8 V $\pm$ 0.15 V	4	
			2.5 V $\pm$ 0.2 V	4.1	
			3.3 V $\pm$ 0.3 V	4.3	

## PARAMETER MEASUREMENT INFORMATION (Propagation Delays, Setup and Hold Times, and Pulse Width)



LOAD CIRCUIT

	$V_{CC} = 0.8 \text{ V}$	$V_{CC} = 1.2 \text{ V}$ $\pm 0.1 \text{ V}$	$V_{CC} = 1.5 \text{ V}$ $\pm 0.1 \text{ V}$	$V_{CC} = 1.8 \text{ V}$ $\pm 0.15 \text{ V}$	$V_{CC} = 2.5 \text{ V}$ $\pm 0.2 \text{ V}$	$V_{CC} = 3.3 \text{ V}$ $\pm 0.3 \text{ V}$
$C_L$	5, 10, 15, 30 pF	5, 10, 15, 30 pF	5, 10, 15, 30 pF	5, 10, 15, 30 pF	5, 10, 15, 30 pF	5, 10, 15, 30 pF
$V_M$	$V_{CC}/2$	$V_{CC}/2$	$V_{CC}/2$	$V_{CC}/2$	$V_{CC}/2$	$V_{CC}/2$
$V_I$	$V_{CC}$	$V_{CC}$	$V_{CC}$	$V_{CC}$	$V_{CC}$	$V_{CC}$

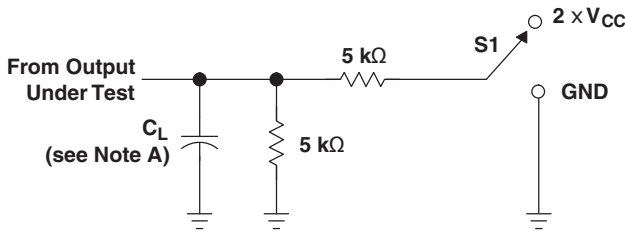


- $C_L$  includes probe and jig capacitance.
- Waveform 1 is for an output with internal conditions such that the output is low, except when disabled by the output control. Waveform 2 is for an output with internal conditions such that the output is high, except when disabled by the output control.
- All input pulses are supplied by generators having the following characteristics:  $PRR \leq 10 \text{ MHz}$ ,  $Z_O = 50 \Omega$ , for propagation delays  $t_r/t_f = 3 \text{ ns}$ , for setup and hold times and pulse width  $t_r/t_f = 1.2 \text{ ns}$ .
- The outputs are measured one at a time, with one transition per measurement.
- $t_{PLH}$  and  $t_{PHL}$  are the same as  $t_{pd}$ .
- All parameters and waveforms are not applicable to all devices.

**Figure 3. Load Circuit and Voltage Waveforms**



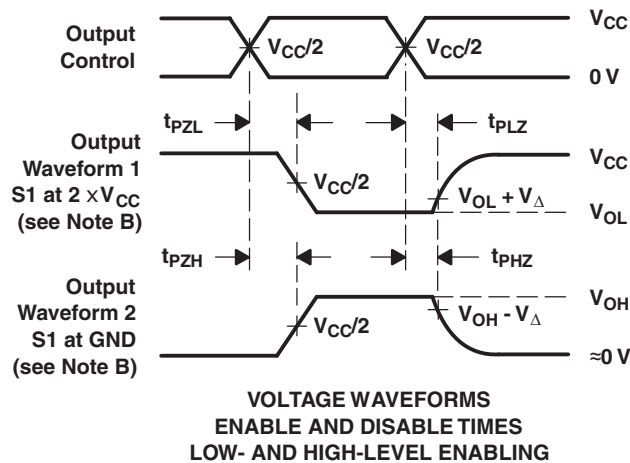
## PARAMETER MEASUREMENT INFORMATION (Enable and Disable Times)



TEST	S1
$t_{PLZ}/t_{PZL}$ $t_{PHZ}/t_{PZH}$	$2 \times V_{CC}$ GND

LOAD CIRCUIT

	$V_{CC} = 0.8 \text{ V}$	$V_{CC} = 1.2 \text{ V}$ $\pm 0.1 \text{ V}$	$V_{CC} = 1.5 \text{ V}$ $\pm 0.1 \text{ V}$	$V_{CC} = 1.8 \text{ V}$ $\pm 0.15 \text{ V}$	$V_{CC} = 2.5 \text{ V}$ $\pm 0.2 \text{ V}$	$V_{CC} = 3.3 \text{ V}$ $\pm 0.3 \text{ V}$
$C_L$	5, 10, 15, 30 pF	5, 10, 15, 30 pF	5, 10, 15, 30 pF	5, 10, 15, 30 pF	5, 10, 15, 30 pF	5, 10, 15, 30 pF
$V_M$	$V_{CC}/2$	$V_{CC}/2$	$V_{CC}/2$	$V_{CC}/2$	$V_{CC}/2$	$V_{CC}/2$
$V_I$	$V_{CC}$	$V_{CC}$	$V_{CC}$	$V_{CC}$	$V_{CC}$	$V_{CC}$
$V_{\Delta}$	0.1 V	0.1 V	0.1 V	0.15 V	0.15 V	0.3 V



- A.  $C_L$  includes probe and jig capacitance.
- B. Waveform 1 is for an output with internal conditions such that the output is low, except when disabled by the output control. Waveform 2 is for an output with internal conditions such that the output is high, except when disabled by the output control.
- C. All input pulses are supplied by generators having the following characteristics:  $PRR \leq 10 \text{ MHz}$ ,  $Z_O = 50 \Omega$ ,  $t_r/t_f = 3 \text{ ns}$ .
- D. The outputs are measured one at a time, with one transition per measurement.
- E.  $t_{PLZ}$  and  $t_{PHZ}$  are the same as  $t_{dis}$ .
- F.  $t_{PLH}$  and  $t_{PHL}$  are the same as  $t_{pd}$ .
- G. All parameters and waveforms are not applicable to all devices.

Figure 4. Load Circuit and Voltage Waveforms

## REVISION HISTORY

### Changes from Revision C (July 2010) to Revision D

### Page

- Deleted input transition rise or fall rate ( $\Delta t/\Delta v$ ) parameter from Recommended Operation Conditions table ..... [4](#)

## PACKAGING INFORMATION

Orderable part number	Status (1)	Material type (2)	Package   Pins	Package qty   Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
<a href="#">SN74AUP3G14DCUR</a>	Active	Production	VSSOP (DCU)   8	3000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	H14R
<a href="#">SN74AUP3G14DQER</a>	Active	Production	X2SON (DQE)   8	5000   LARGE T&R	Yes	NIPDAUAG	Level-1-260C-UNLIM	-40 to 85	TX
<a href="#">SN74AUP3G14RSE</a>	Active	Production	UQFN (RSE)   8	5000   LARGE T&R	Yes	NIPDAUAG	Level-1-260C-UNLIM	-40 to 85	TX
<a href="#">SN74AUP3G14YFPR</a>	Active	Production	DSBGA (YFP)   8	3000   LARGE T&R	Yes	SNAGCU	Level-1-260C-UNLIM	-40 to 85	HFN

<sup>(1)</sup> **Status:** For more details on status, see our [product life cycle](#).

<sup>(2)</sup> **Material type:** When designated, preproduction parts are prototypes/experimental devices, and are not yet approved or released for full production. Testing and final process, including without limitation quality assurance, reliability performance testing, and/or process qualification, may not yet be complete, and this item is subject to further changes or possible discontinuation. If available for ordering, purchases will be subject to an additional waiver at checkout, and are intended for early internal evaluation purposes only. These items are sold without warranties of any kind.

<sup>(3)</sup> **RoHS values:** Yes, No, RoHS Exempt. See the [TI RoHS Statement](#) for additional information and value definition.

<sup>(4)</sup> **Lead finish/Ball material:** Parts may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

<sup>(5)</sup> **MSL rating/Peak reflow:** The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will be used to mount the part to the printed circuit board.

<sup>(6)</sup> **Part marking:** There may be an additional marking, which relates to the logo, the lot trace code information, or the environmental category of the part.

Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "~" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

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## TAPE AND REEL INFORMATION



\*All dimensions are nominal

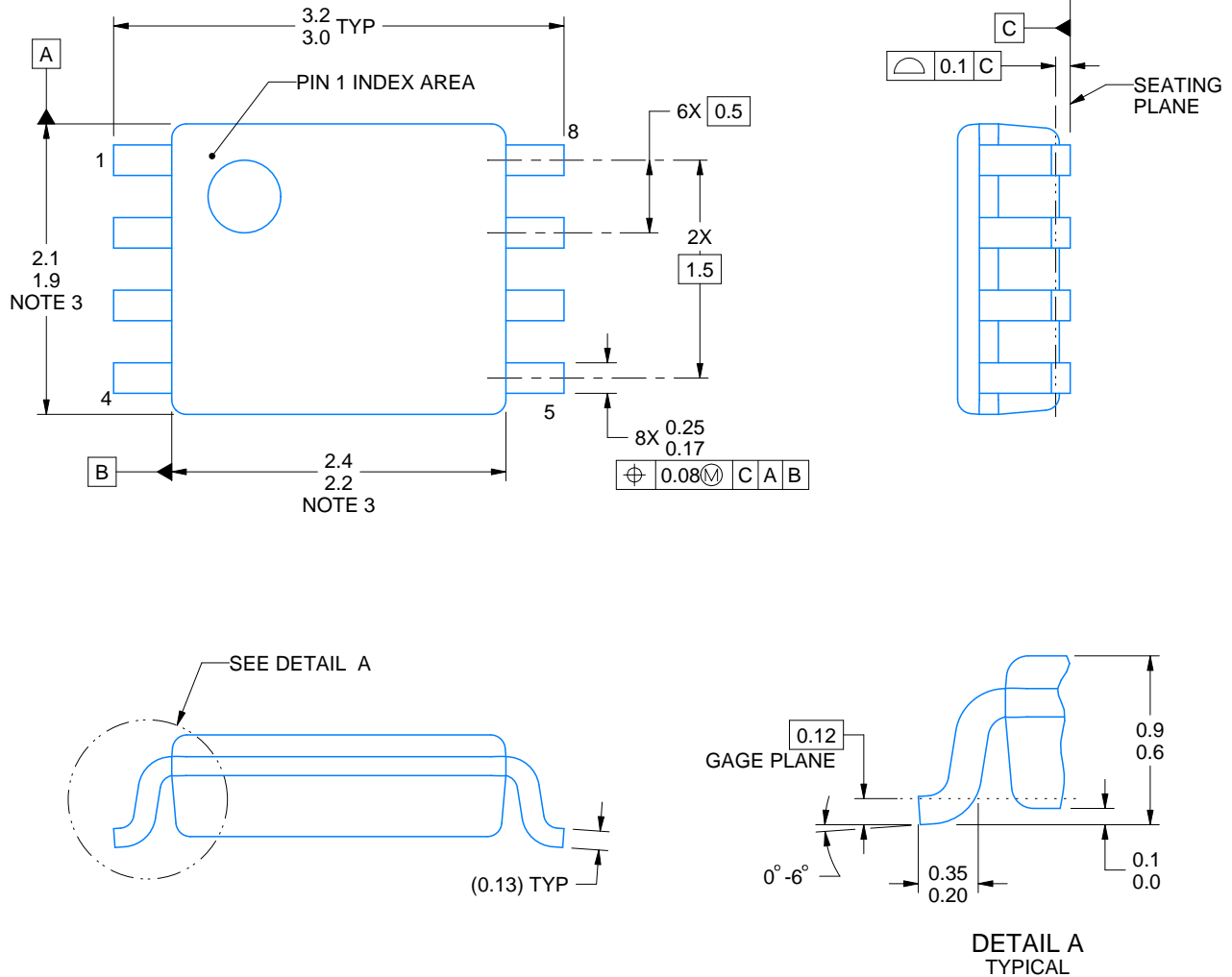
Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
SN74AUP3G14DCUR	VSSOP	DCU	8	3000	180.0	8.4	2.25	3.35	1.05	4.0	8.0	Q3
SN74AUP3G14DQER	X2SON	DQE	8	5000	180.0	8.4	1.2	1.6	0.55	4.0	8.0	Q1
SN74AUP3G14RSER	UQFN	RSE	8	5000	180.0	8.4	1.7	1.7	0.7	4.0	8.0	Q2
SN74AUP3G14YFPR	DSBGA	YFP	8	3000	178.0	9.2	0.9	1.75	0.6	4.0	8.0	Q1

## TAPE AND REEL BOX DIMENSIONS



\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN74AUP3G14DCUR	VSSOP	DCU	8	3000	202.0	201.0	28.0
SN74AUP3G14DQER	X2SON	DQE	8	5000	202.0	201.0	28.0
SN74AUP3G14RSER	UQFN	RSE	8	5000	202.0	201.0	28.0
SN74AUP3G14YFPR	DSBGA	YFP	8	3000	220.0	220.0	35.0



4225266/A 09/2014

## NOTES:

1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm per side.
4. Reference JEDEC registration MO-187 variation CA.

# EXAMPLE BOARD LAYOUT

DCU0008A

VSSOP - 0.9 mm max height

SMALL OUTLINE PACKAGE



LAND PATTERN EXAMPLE  
EXPOSED METAL SHOWN  
SCALE: 25X



4225266/A 09/2014

NOTES: (continued)

5. Publication IPC-7351 may have alternate designs.

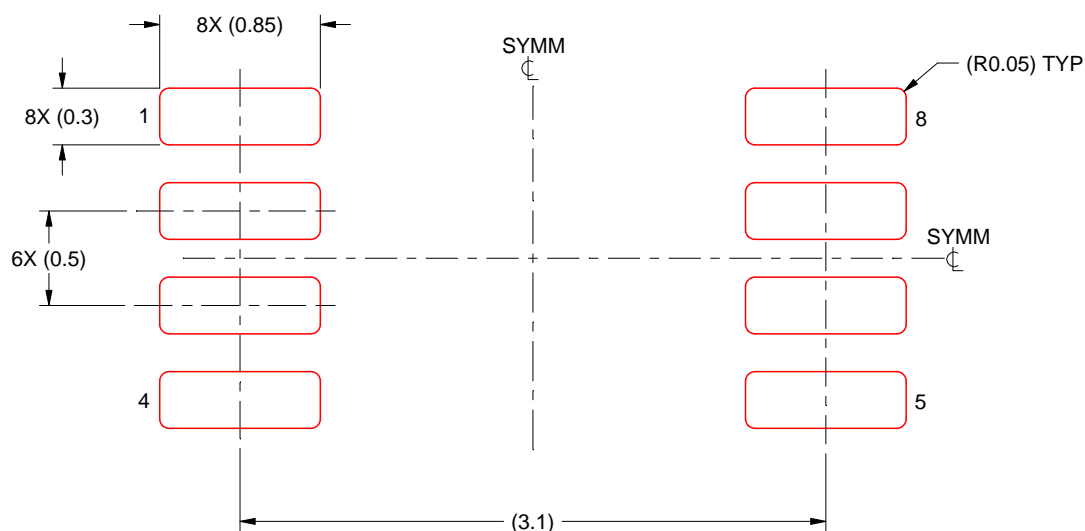
6. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

## EXAMPLE STENCIL DESIGN

DCU0008A

VSSOP - 0.9 mm max height

SMALL OUTLINE PACKAGE



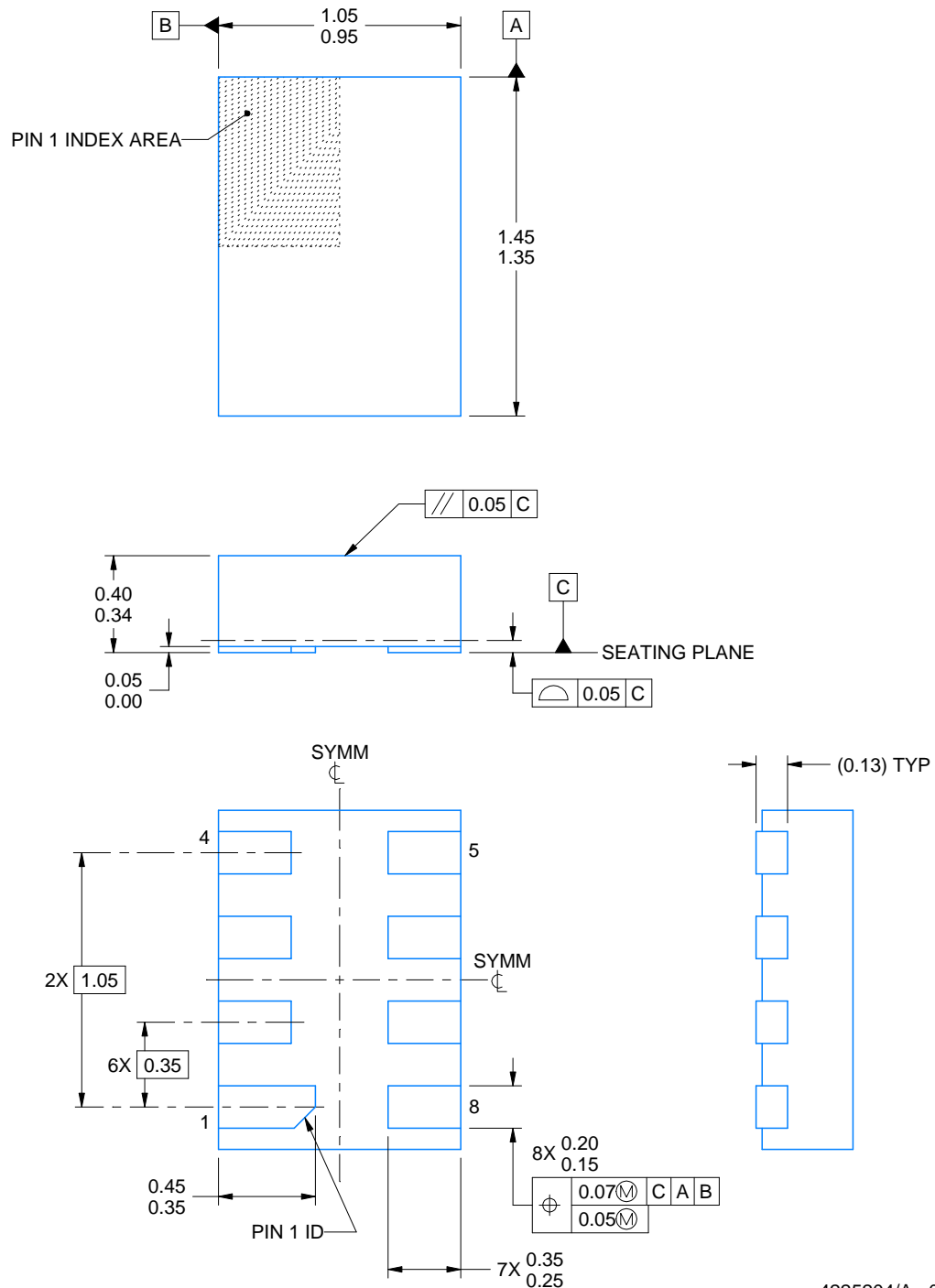
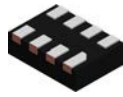
SOLDER PASTE EXAMPLE  
BASED ON 0.125 mm THICK STENCIL  
SCALE: 25X

4225266/A 09/2014

NOTES: (continued)

7. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
8. Board assembly site may have different recommendations for stencil design.





4225204/A 08/2019

## NOTES:

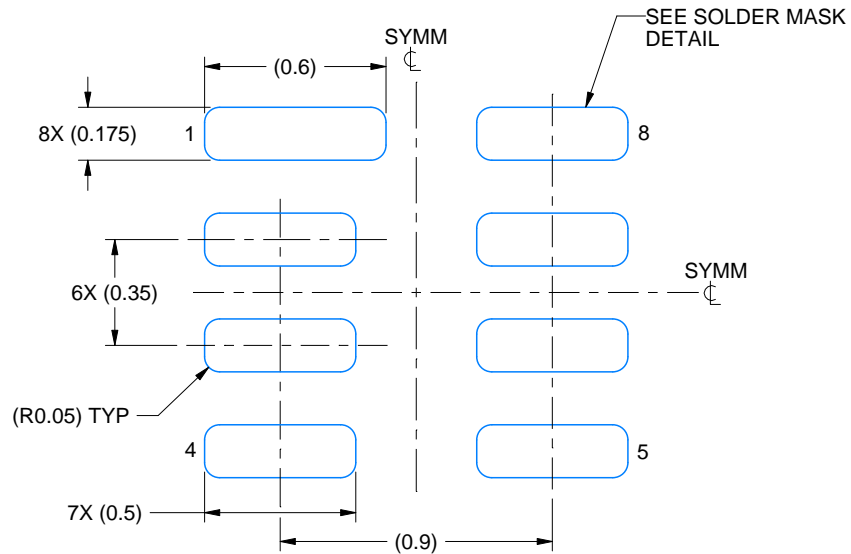
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This package complies to JEDEC MO-287 variation X2EAF.

# EXAMPLE BOARD LAYOUT

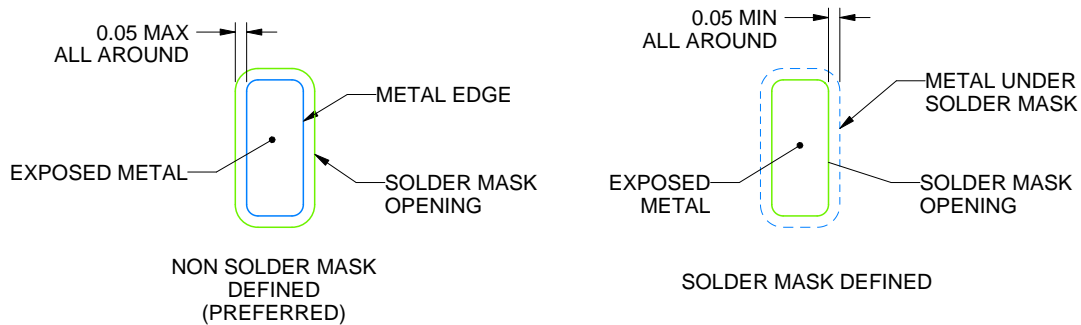
DQE0008A

X2SON - 0.4 mm max height

PLASTIC SMALL OUTLINE - NO LEAD



LAND PATTERN EXAMPLE  
EXPOSED METAL SHOWN  
SCALE: 40X



SOLDER MASK DETAILS

4225204/A 08/2019

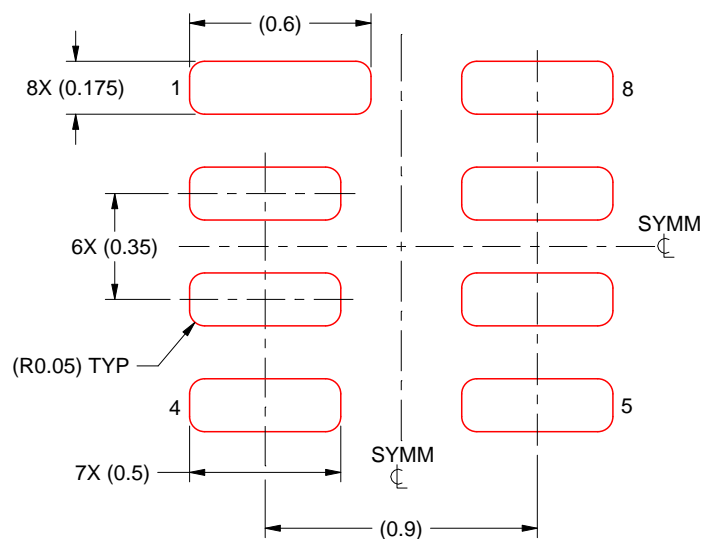
NOTES: (continued)

- This package is designed to be soldered to a thermal pad on the board. For more information, see Texas Instruments literature number SLUA271 ([www.ti.com/lit/sluea271](http://www.ti.com/lit/sluea271)).

**DQE0008A**

## X2SON - 0.4 mm max height

PLASTIC SMALL OUTLINE - NO LEAD



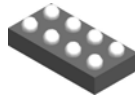
SOLDER PASTE EXAMPLE  
BASED ON 0.075 MM THICK STENCIL  
SCALE: 40X

4225204/A 08/2019

NOTES: (continued)

5. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.

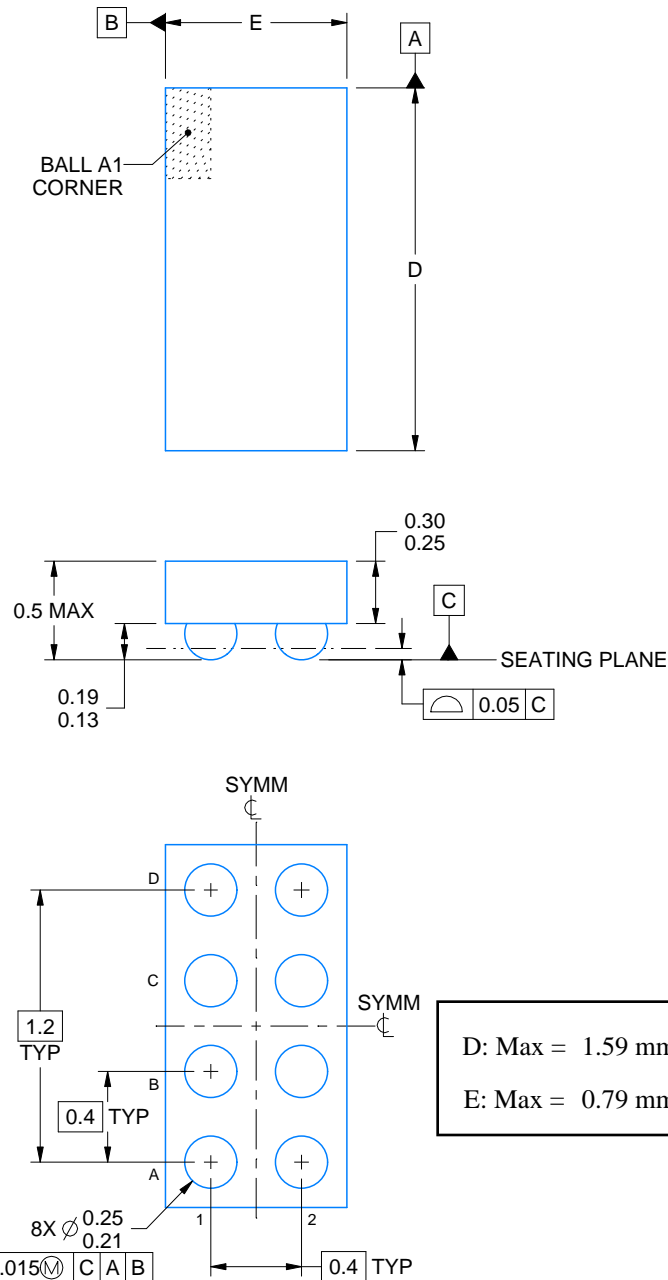
YFP0008



## PACKAGE OUTLINE

DSBGA - 0.5 mm max height

DIE SIZE BALL GRID ARRAY



4225242/A 08/2019

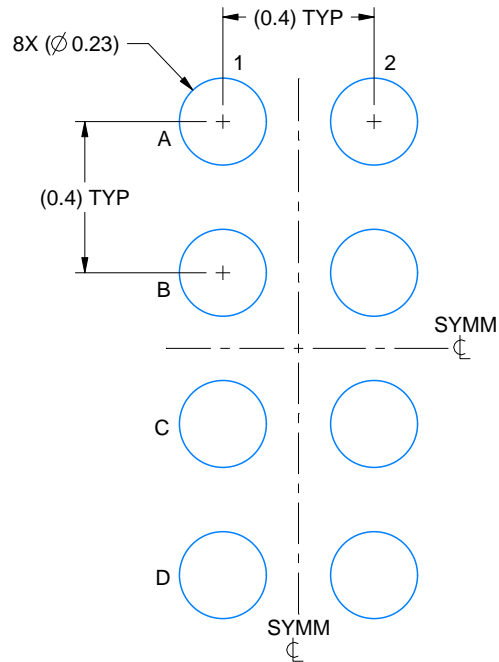
### NOTES:

1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.

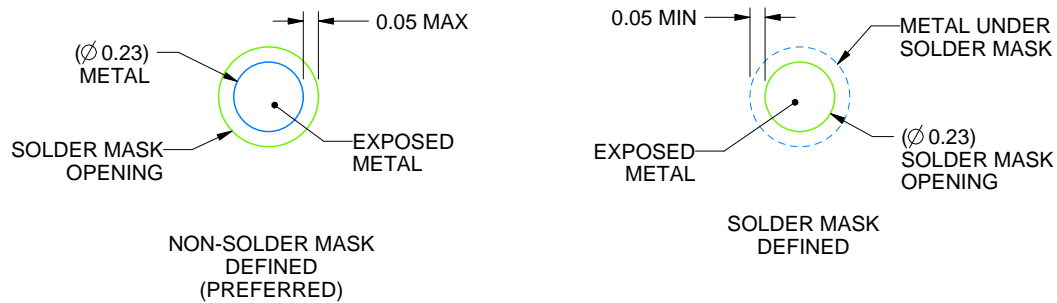
**YFP0008**

**DSBGA - 0.5 mm max height**

## DIE SIZE BALL GRID ARRAY



LAND PATTERN EXAMPLE  
EXPOSED METAL SHOWN  
SCALE: 50X

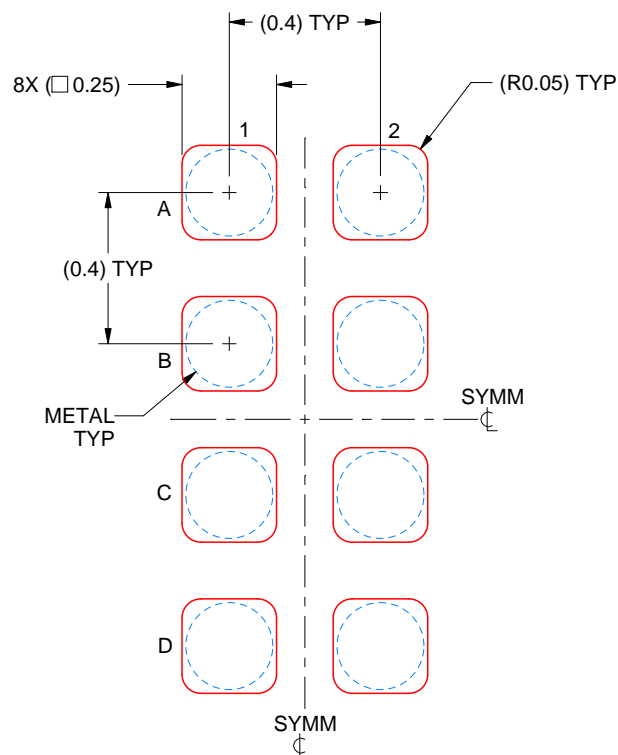


SOLDER MASK DETAILS  
NOT TO SCALE

4225242/A 08/2019

NOTES: (continued)

3. Final dimensions may vary due to manufacturing tolerance considerations and also routing constraints. See Texas Instruments Literature No. SNVA009 ([www.ti.com/lit/snva009](http://www.ti.com/lit/snva009)).

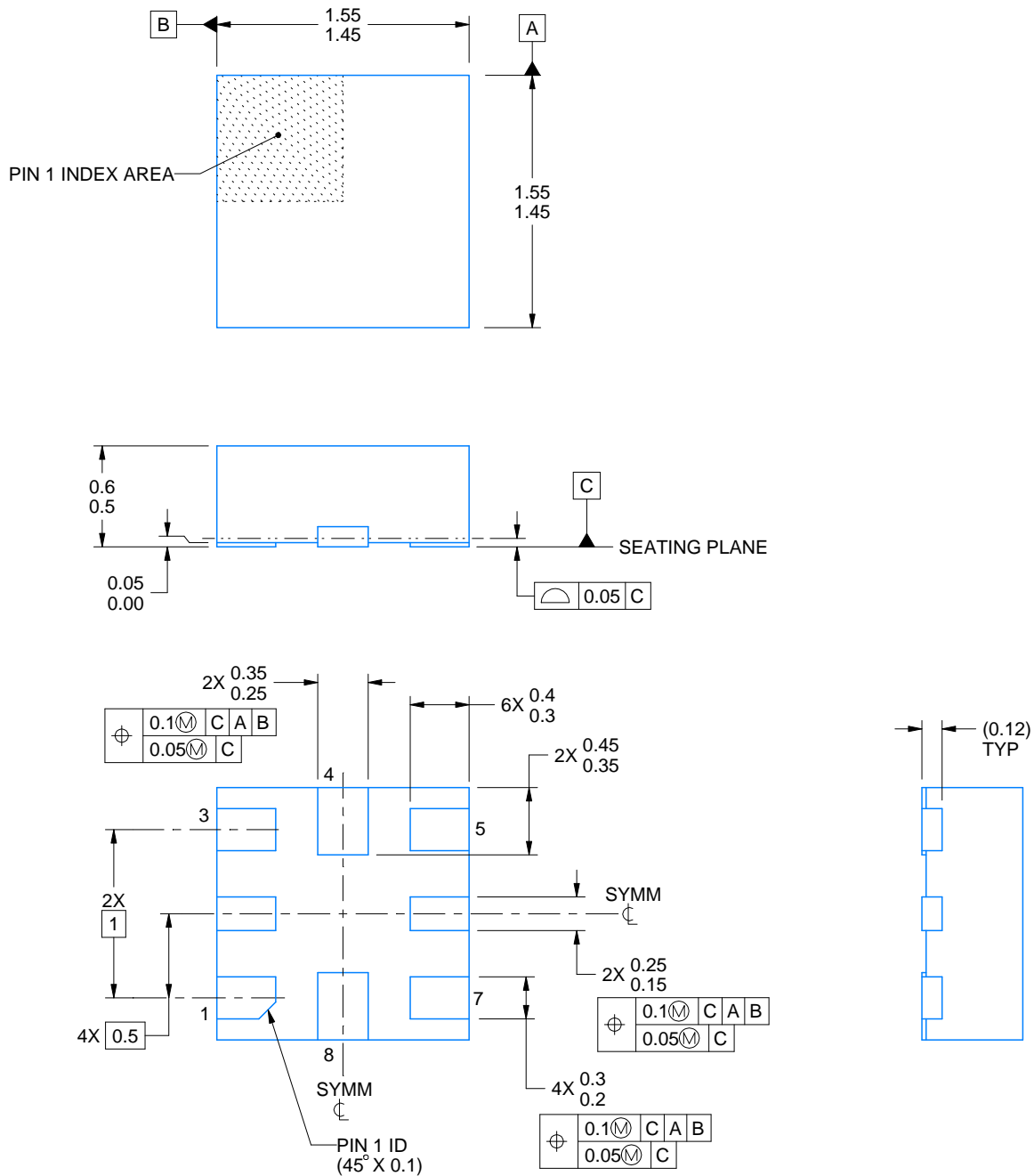
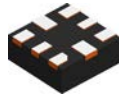


SOLDER PASTE EXAMPLE  
 BASED ON 0.1 mm THICK STENCIL  
 SCALE: 50X

4225242/A 08/2019

NOTES: (continued)

4. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release.



4220323/B 03/2018

## NOTES:

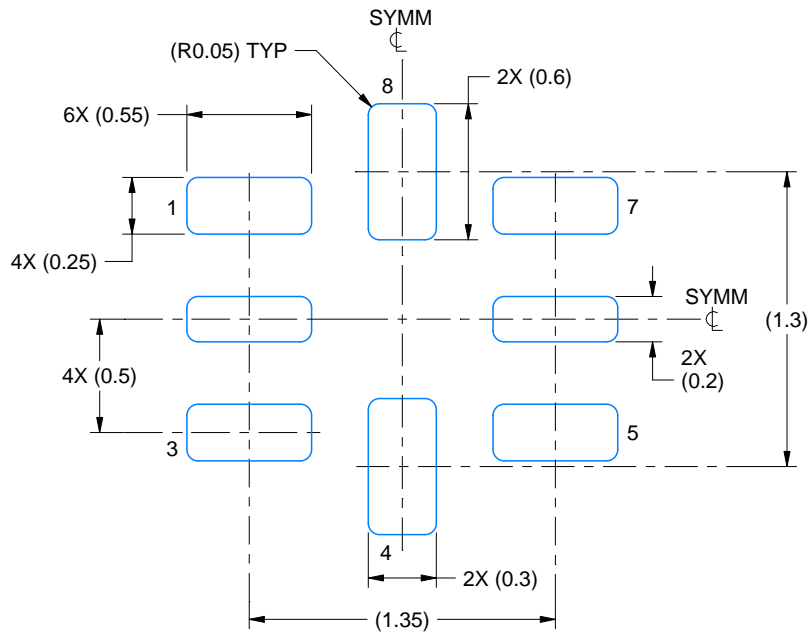
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.

# EXAMPLE BOARD LAYOUT

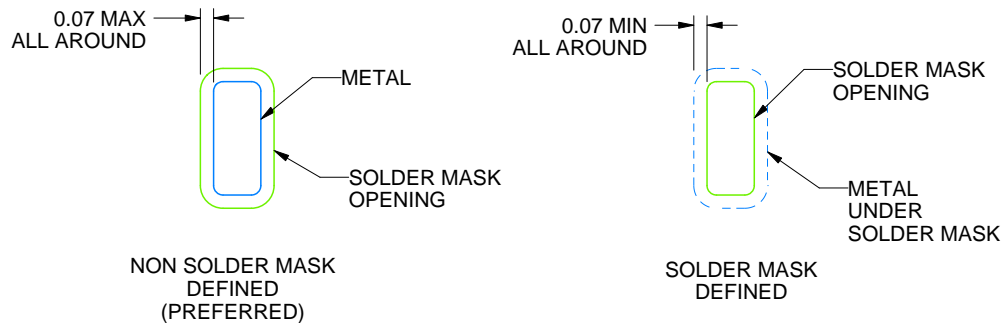
RSE0008A

UQFN - 0.6 mm max height

PLASTIC QUAD FLATPACK - NO LEAD



LAND PATTERN EXAMPLE  
SCALE:30X



SOLDER MASK DETAILS  
NOT TO SCALE

4220323/B 03/2018

NOTES: (continued)

3. For more information, see Texas Instruments literature number SLUA271 ([www.ti.com/lit/slua271](http://www.ti.com/lit/slua271)).

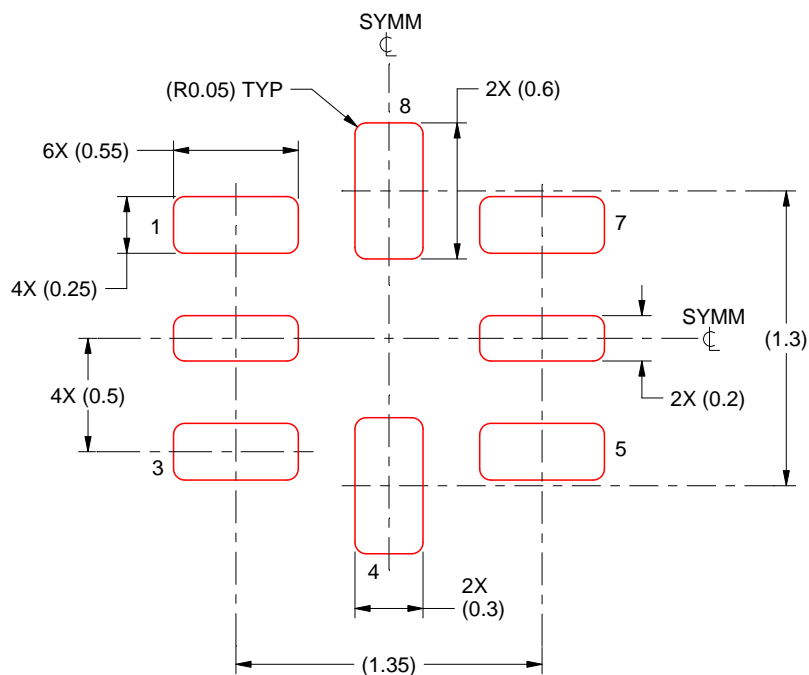


## EXAMPLE STENCIL DESIGN

RSE0008A

UQFN - 0.6 mm max height

PLASTIC QUAD FLATPACK - NO LEAD



SOLDER PASTE EXAMPLE  
BASED ON 0.1 mm THICKNESS  
SCALE: 30X

4220323/B 03/2018

NOTES: (continued)

5. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.

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