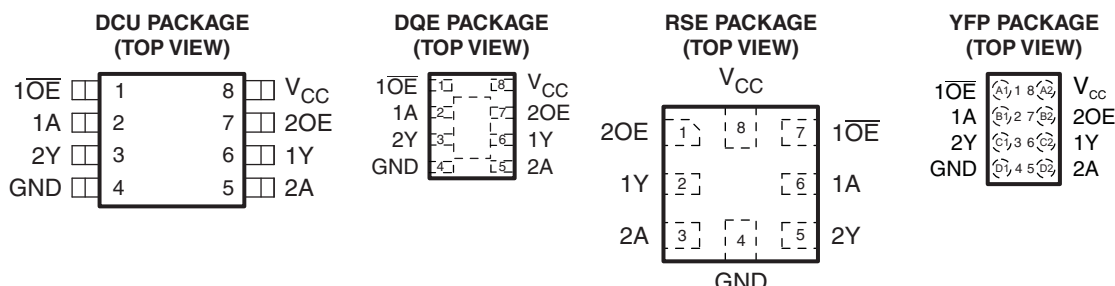


LOW-POWER DUAL BUFFER/DRIVER WITH 3-STATE OUTPUTS

Check for Samples: [SN74AUP2G241](#)

FEATURES

- Available in the Texas Instruments NanoStar™ Package
- Low Static-Power Consumption ($I_{CC} = 0.9 \mu A$ Maximum)
- Low Dynamic-Power Consumption ($C_{pd} = 4.2 pF$ 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
- $t_{pd} = 9.9 ns$ 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](#)).

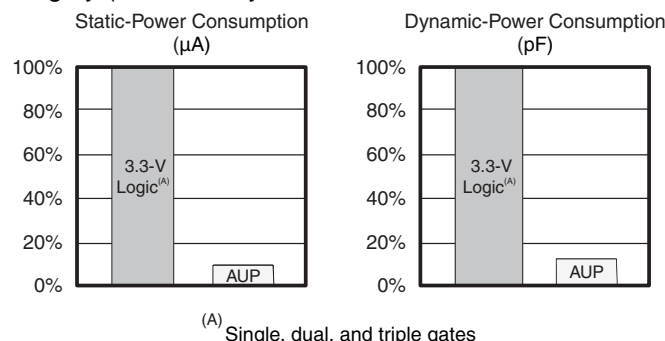
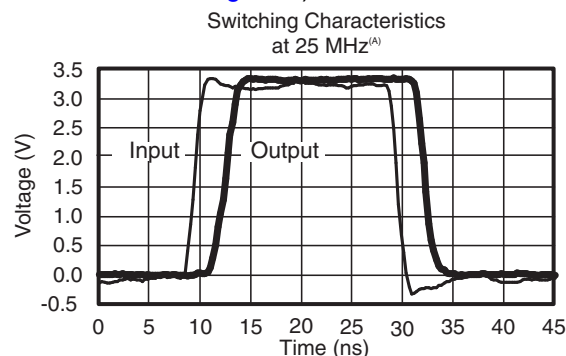

Figure 1. AUP – The Lowest-Power Family

^(A) SN74AUP2Gxx 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.

The SN74AUP2G241 is designed specifically to improve both the performance and density of 3-state memory-address drivers, clock drivers, and bus-oriented receivers and transmitters.

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⁽¹⁾

T _A	PACKAGE ⁽²⁾		ORDERABLE PART NUMBER	TOP-SIDE MARKING ⁽³⁾
–40°C to 85°C	NanoStar™ – WCSP (DSBGA) 0.23-mm Large Bump – YFP (Pb-free)	Reel of 3000	SN74AUP2G241YFPR	_ _ H Q _
	uQFN – DQE	Reel of 5000	SN74AUP2G241DQER	HQ
	QFN – RSE	Reel of 5000	SN74AUP2G241RSE	HQ
	SSOP – DCU	Reel of 3000	SN74AUP2G241DCUR	H41_

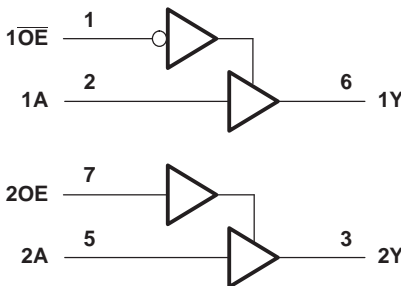
- (1) For the most current package and ordering information, see the Package Option Addendum at the end of this document, or see the TI web site at www.ti.com.
- (2) Package drawings, thermal data, and symbolization are available at www.ti.com/packaging.
- (3) DCU: The actual top-side marking has one 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 TABLES

INPUTS		OUTPUT 1Y
$\overline{1OE}$	1A	
L	H	H
L	L	L
H	X	Z

INPUTS		OUTPUT 2Y
2OE	2A	
H	H	H
H	L	L
L	X	Z

LOGIC DIAGRAM (POSITIVE LOGIC)



Pin numbers shown are for DCU and DQE packages.

ABSOLUTE MAXIMUM RATINGS⁽¹⁾

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 ⁽²⁾		–0.5	4.6	V
V_O	Voltage range applied to any output in the high-impedance or power-off state ⁽²⁾		–0.5	4.6	V
V_O	Output voltage range in the high or low state ⁽²⁾		–0.5	$V_{CC} + 0.5$	V
I_{IK}	Input clamp current	$V_I < 0$		–50	mA
I_{OK}	Output clamp current	$V_O < 0$		–50	mA
I_O	Continuous output current			±20	mA
	Continuous current through V_{CC} or GND			±50	mA
θ_{JA}	Package thermal impedance ⁽³⁾	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⁽¹⁾

			MIN	MAX	UNIT
V _{CC}	Supply voltage		0.8	3.6	V
V _{IH}	High-level input voltage	V _{CC} = 0.8 V	V _{CC}	0.65 × V _{CC}	V
		V _{CC} = 1.1 V to 1.95 V			
		V _{CC} = 2.3 V to 2.7 V	1.6		
		V _{CC} = 3 V to 3.6 V	2		
V _{IL}	Low-level input voltage	V _{CC} = 0.8 V	0	0.35 × V _{CC}	V
		V _{CC} = 1.1 V to 1.95 V			
		V _{CC} = 2.3 V to 2.7 V	0.7		
		V _{CC} = 3 V to 3.6 V	0.9		
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 V	−20	−1.1	μA
		V _{CC} = 1.1 V			
		V _{CC} = 1.4 V	−1.7		mA
		V _{CC} = 1.65	−1.9		
		V _{CC} = 2.3 V	−3.1		
		V _{CC} = 3 V	−4		
I _{OL}	Low-level output current	V _{CC} = 0.8 V	20	1.1	μA
		V _{CC} = 1.1 V			
		V _{CC} = 1.4 V	1.7		mA
		V _{CC} = 1.65 V	1.9		
		V _{CC} = 2.3 V	3.1		
		V _{CC} = 3 V	4		
Δt/Δv	Input transition rise or fall rate	V _{CC} = 0.8 V to 3.6 V	200	ns/V	
T _A	Operating free-air temperature		−40	85	°C

(1) All unused inputs of the device must be held at V_{CC} or GND to ensure proper device operation. See 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 _{CC}	T _A = 25°C			T _A = −40°C to 85°C		UNIT
				MIN	TYP	MAX	MIN	MAX	
V _{OH}		I _{OH} = −20 μA	0.8 V to 3.6 V	V _{CC} − 0.1			V _{CC} − 0.1		V
		I _{OH} = −1.1 mA	1.1 V	0.75 × V _{CC}			0.7 × V _{CC}		
		I _{OH} = −1.7 mA	1.4 V	1.11			1.03		
		I _{OH} = −1.9 mA	1.65 V	1.32			1.3		
		I _{OH} = −2.3 mA	2.3 V	2.05			1.97		
		I _{OH} = −3.1 mA		1.9			1.85		
		I _{OH} = −2.7 mA	3 V	2.72			2.67		
		I _{OH} = −4 mA		2.6			2.55		
V _{OL}		I _{OL} = 20 μA	0.8 V to 3.6 V	0.1			0.1		V
		I _{OL} = 1.1 mA	1.1 V	0.3 × V _{CC}			0.3 × V _{CC}		
		I _{OL} = 1.7 mA	1.4 V	0.31			0.37		
		I _{OL} = 1.9 mA	1.65 V	0.31			0.35		
		I _{OL} = 2.3 mA	2.3 V	0.31			0.33		
		I _{OL} = 3.1 mA		0.44			0.45		
		I _{OL} = 2.7 mA	3 V	0.31			0.33		
		I _{OL} = 4 mA		0.44			0.45		
I _I	A or B input	V _I = GND to 3.6 V	0 V to 3.6 V		0.1		0.5		μA
I _{off}		V _I or V _O = 0 V to 3.6 V	0 V		0.2		0.6		μA
ΔI _{off}		V _I or V _O = 0 V to 3.6 V	0 V to 0.2 V		0.2		0.6		μA
I _{CC}		V _I = GND or (V _{CC} to 3.6 V), I _O = 0	0.8 V to 3.6 V		0.5		0.9		μA
ΔI _{CC}		V _I = V _{CC} − 0.6 V ⁽¹⁾ , I _O = 0	3.3 V		40		50		μA
C _i		V _I = V _{CC} or GND	0 V		1.5				pF
			3.6 V		1.5				
C _o		V _O = GND	0 V		3				pF

(1) One input at $V_{CC} - 0.6\ \text{V}$, other input at V_{CC} or GND

SWITCHING CHARACTERISTICS

over recommended operating free-air temperature range, $C_L = 5 \text{ pF}$ (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		19.2				ns
			1.2 V $\pm 0.1 \text{ V}$	0.5	7.5	17.9	0.5	18.7	
			1.5 V $\pm 0.1 \text{ V}$	0.6	5.2	10.8	0.5	12.4	
			1.8 V $\pm 0.15 \text{ V}$	0.8	4.1	8.1	0.5	9.7	
			2.5 V $\pm 0.2 \text{ V}$	1.1	2.9	5	0.5	6.5	
			3.3 V $\pm 0.3 \text{ V}$	0.5	3	9.5	0.5	9.9	
t_{en}	\overline{OE}	Y	0.8 V		32.5				ns
			1.2 V $\pm 0.1 \text{ V}$	0.5	8.5	21.7	0.5	23.1	
			1.5 V $\pm 0.1 \text{ V}$	0.7	5.5	11.6	0.5	14.2	
			1.8 V $\pm 0.15 \text{ V}$	1.0	4.3	8.6	0.5	11.1	
			2.5 V $\pm 0.2 \text{ V}$	1.3	3.0	5.4	0.5	7.6	
			3.3 V $\pm 0.3 \text{ V}$	1.3	2.4	4.0	0.5	5.8	
t_{dis}	\overline{OE}	Y	0.8 V		13.0				ns
			1.2 V $\pm 0.1 \text{ V}$	1.8	5.0	9.8	1.5	10.2	
			1.5 V $\pm 0.1 \text{ V}$	0.5	3.6	7.3	0.5	7.6	
			1.8 V $\pm 0.15 \text{ V}$	0.5	3.3	5.9	0.5	6.3	
			2.5 V $\pm 0.2 \text{ V}$	0.5	2.2	3.7	0.5	4.1	
			3.3 V $\pm 0.3 \text{ V}$	1.5	2.6	4.3	1.1	4.6	
t_{en}	OE	Y	0.8 V		19.6				ns
			1.2 V $\pm 0.1 \text{ V}$	0.5	8.4	20.8	0.5	21.8	
			1.5 V $\pm 0.1 \text{ V}$	0.5	5.6	11.8	0.5	13.7	
			1.8 V $\pm 0.15 \text{ V}$	0.7	4.3	8.8	0.5	10.6	
			2.5 V $\pm 0.2 \text{ V}$	0.9	2.9	5.4	0.5	7	
			3.3 V $\pm 0.3 \text{ V}$	0.5	2.8	8.8	0.5	9.3	
t_{dis}	OE	Y	0.8 V		12.1				ns
			1.2 V $\pm 0.1 \text{ V}$	0.6	5.2	10.9	0.5	11.1	
			1.5 V $\pm 0.1 \text{ V}$	1.1	3.8	7	0.9	7.1	
			1.8 V $\pm 0.15 \text{ V}$	1.9	3.5	5.6	1.6	5.8	
			2.5 V $\pm 0.2 \text{ V}$	0.9	2.5	3.9	0.8	4.2	
			3.3 V $\pm 0.3 \text{ V}$	0.5	3.5	9.3	0.5	9.3	

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		23				ns
			1.2 V \pm 0.1 V	0.5	8.7	20.6	0.5	21.3	
			1.5 V \pm 0.1 V	1.2	6	12.2	0.5	13.7	
			1.8 V \pm 0.15 V	1.4	4.8	9.2	0.5	10.8	
			2.5 V \pm 0.2 V	1.5	3.4	5.8	0.5	7.2	
			3.3 V \pm 0.3 V	0.5	3.4	8.9	0.5	9.4	
t_{en}	\overline{OE}	Y	0.8 V		35.7				ns
			1.2 V \pm 0.1 V	0.5	9.6	23.8	0.5	25.1	
			1.5 V \pm 0.1 V	1.5	6.4	12.9	0.5	15.5	
			1.8 V \pm 0.15 V	1.5	5.0	9.8	0.5	12.2	
			2.5 V \pm 0.2 V	1.6	3.5	9.6	0.5	12.3	
			3.3 V \pm 0.3 V	1.6	2.9	4.7	0.5	6.4	
t_{dis}	\overline{OE}	Y	0.8 V		14.5				ns
			1.2 V \pm 0.1 V	0.9	5.8	11.2	0.8	11.5	
			1.5 V \pm 0.1 V	0.5	4.1	9.0	0.5	9.2	
			1.8 V \pm 0.15 V	1.3	4.4	7.5	1.1	7.8	
			2.5 V \pm 0.2 V	1.2	2.9	4.7	1.0	5.0	
			3.3 V \pm 0.3 V	1.9	3.8	6.1	1.7	6.3	
t_{en}	OE	Y	0.8 V		21.9				ns
			1.2 V \pm 0.1 V	0.5	9.7	23.1	0.5	24	
			1.5 V \pm 0.1 V	1	6.4	13.2	0.5	15	
			1.8 V \pm 0.15 V	1	5	9.9	0.5	11.7	
			2.5 V \pm 0.2 V	1.2	3.4	10.4	0.5	12	
			3.3 V \pm 0.3 V	0.5	3.2	8.1	0.5	8.7	
t_{dis}	OE	Y	0.8 V		13.4				ns
			1.2 V \pm 0.1 V	0.8	6.2	12.6	0.6	12.7	
			1.5 V \pm 0.1 V	2.1	4.6	7.9	1.9	8.1	
			1.8 V \pm 0.15 V	1.7	4.7	8.2	1.5	8.3	
			2.5 V \pm 0.2 V	1	3.3	5.1	0.9	5.3	
			3.3 V \pm 0.3 V	1.2	4.5	7.8	1.1	7.9	

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	Y	0.8 V		26.2				ns
			1.2 V \pm 0.1 V	0.5	9.7	22.7	0.5	23.4	
			1.5 V \pm 0.1 V	1.7	4.6	13.6	0.5	15	
			1.8 V \pm 0.15 V	1.7	5.4	10.2	0.5	11.7	
			2.5 V \pm 0.2 V	1.7	3.9	6.5	0.5	7.9	
			3.3 V \pm 0.3 V	0.5	3.7	8.4	0.5	8.9	
t_{en}	\overline{OE}	Y	0.8 V		38.9				ns
			1.2 V \pm 0.1 V	0.5	10.7	24.7	0.5	26.0	
			1.5 V \pm 0.1 V	1.7	7.2	14.1	0.5	16.5	
			1.8 V \pm 0.15 V	2.0	5.6	10.3	0.5	12.7	
			2.5 V \pm 0.2 V	2.0	4.0	6.8	0.5	8.9	
			3.3 V \pm 0.3 V	1.9	3.3	5.2	0.5	6.8	
t_{dis}	\overline{OE}	Y	0.8 V		14.8				ns
			1.2 V \pm 0.1 V	0.5	6.3	13.7	0.5	14.0	
			1.5 V \pm 0.1 V	0.5	4.6	8.8	0.5	9.1	
			1.8 V \pm 0.15 V	0.7	4.9	8.1	0.6	8.4	
			2.5 V \pm 0.2 V	1.1	3.7	6.5	1.0	6.7	
			3.3 V \pm 0.3 V	1.3	4.8	7.6	1.2	7.7	
t_{en}	OE	Y	0.8 V		23				ns
			1.2 V \pm 0.1 V	0.5	10.5	24.8	0.5	25.6	
			1.5 V \pm 0.1 V	1.5	7.1	14.3	0.5	16	
			1.8 V \pm 0.15 V	1.4	5.6	10.8	0.5	12.4	
			2.5 V \pm 0.2 V	1.6	3.9	6.8	0.5	8.3	
			3.3 V \pm 0.3 V	0.5	3.6	7.6	0.5	8.3	
t_{dis}	OE	Y	0.8 V		13.6				ns
			1.2 V \pm 0.1 V	1.1	6.5	12.7	1	12.8	
			1.5 V \pm 0.1 V	0.5	4.8	9.1	0.5	9.2	
			1.8 V \pm 0.15 V	1.8	5.4	9.2	1.7	9.3	
			2.5 V \pm 0.2 V	1.6	3.7	5.5	1.5	5.7	
			3.3 V \pm 0.3 V	2.8	5.3	7.9	2.7	7.9	

SWITCHING CHARACTERISTICS

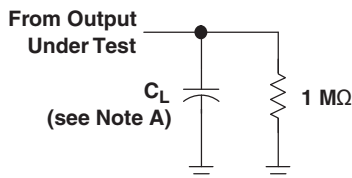
over recommended operating free-air temperature range, $C_L = 30$ pF (unless otherwise noted) (see [Figure 3](#) and [Figure 4](#))

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	Y	0.8 V		36.4				ns
			1.2 V \pm 0.1 V	0.5	13	30.8	0.5	31.2	
			1.5 V \pm 0.1 V	2.7	9.1	18	1.1	19.1	
			1.8 V \pm 0.15 V	2.6	7.2	13.6	1	14.8	
			2.5 V \pm 0.2 V	2.6	5.3	8.6	1.3	9.9	
			3.3 V \pm 0.3 V	1.4	4.8	7.9	0.7	8.6	
t_{en}	\overline{OE}	Y	0.8 V		49.9				ns
			1.2 V \pm 0.1 V	0.5	14.1	31.7	0.5	32.8	
			1.5 V \pm 0.1 V	2.7	9.6	17.8	0.6	20.0	
			1.8 V \pm 0.15 V	2.5	7.5	13.2	0.5	15.4	
			2.5 V \pm 0.2 V	2.9	5.5	8.6	1.2	10.6	
			3.3 V \pm 0.3 V	2.7	4.6	6.7	1.4	8.3	
t_{dis}	\overline{OE}	Y	0.8 V		17.9				ns
			1.2 V \pm 0.1 V	0.5	8.7	17.4	0.5	17.6	
			1.5 V \pm 0.1 V	0.5	6.5	14.0	0.5	14.0	
			1.8 V \pm 0.15 V	2.4	8.1	12.9	2.3	13.0	
			2.5 V \pm 0.2 V	1.8	5.7	10.4	1.7	10.6	
			3.3 V \pm 0.3 V	3.9	8.6	13.5	3.8	13.6	
t_{en}	OE	Y	0.8 V		32.8				ns
			1.2 V \pm 0.1 V	0.5	14.4	32.4	0.5	33.1	
			1.5 V \pm 0.1 V	2.5	9.7	18.5	1.1	19.9	
			1.8 V \pm 0.15 V	2.3	7.6	14.3	0.8	15.7	
			2.5 V \pm 0.2 V	2.4	5.3	9	1.2	10.3	
			3.3 V \pm 0.3 V	2.8	4.6	7.2	1.7	8.2	
t_{dis}	OE	Y	0.8 V		20.1				ns
			1.2 V \pm 0.1 V	0.5	10.3	19.3	0.5	19.3	
			1.5 V \pm 0.1 V	1.9	7.6	14.5	1.8	14.5	
			1.8 V \pm 0.15 V	3	8.8	14.9	2.8	14.9	
			2.5 V \pm 0.2 V	2.9	6.5	10	2.9	10.1	
			3.3 V \pm 0.3 V	0.5	8.2	17.9	0.5	17.9	

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

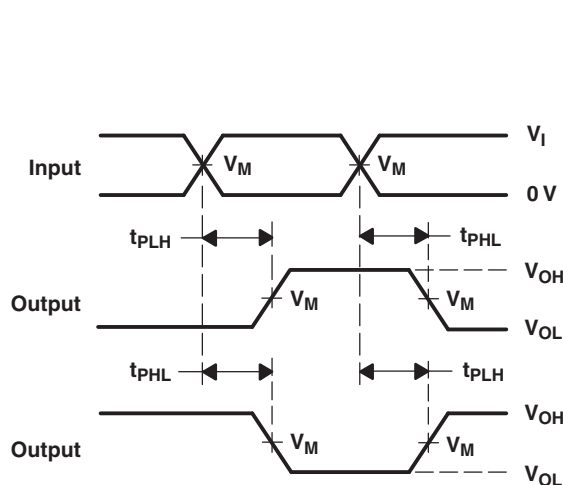
PARAMETER		TEST CONDITIONS	V _{CC}	TYP	UNIT
C _{pd}	Power dissipation capacitance	f = 10 MHz	0.8 V	4	pF
			1.2 V ± 0.1 V	3.9	
			1.5 V ± 0.1 V	3.9	
			1.8 V ± 0.15 V	3.9	
			2.5 V ± 0.2 V	4	
			3.3 V ± 0.3 V	4.2	
	Outputs disabled		0.8 V	0	
			1.2 V ± 0.1 V	0	
			1.5 V ± 0.1 V	0	
			1.8 V ± 0.15 V	0	
			2.5 V ± 0.2 V	0	
			3.3 V ± 0.3 V	0	

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

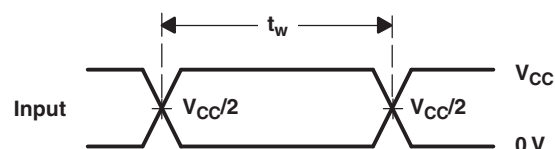


LOAD CIRCUIT

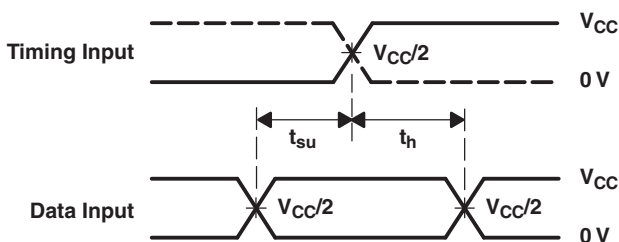
	$V_{CC} = 0.8 \text{ V}$	$V_{CC} = 1.2 \text{ V}$ $\pm 0.1 \text{ V}$	$V_{CC} = 1.5 \text{ V}$ $\pm 0.1 \text{ V}$	$V_{CC} = 1.8 \text{ V}$ $\pm 0.15 \text{ V}$	$V_{CC} = 2.5 \text{ V}$ $\pm 0.2 \text{ V}$	$V_{CC} = 3.3 \text{ V}$ $\pm 0.3 \text{ V}$
C_L	5, 10, 15, 30 pF	5, 10, 15, 30 pF	5, 10, 15, 30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



VOLTAGE WAVEFORMS
PROPAGATION DELAY TIMES
INVERTING AND NONINVERTING OUTPUTS



VOLTAGE WAVEFORMS
PULSE DURATION

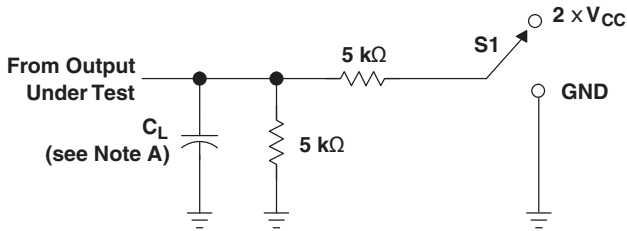


VOLTAGE WAVEFORMS
SETUP AND HOLD TIMES

- 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

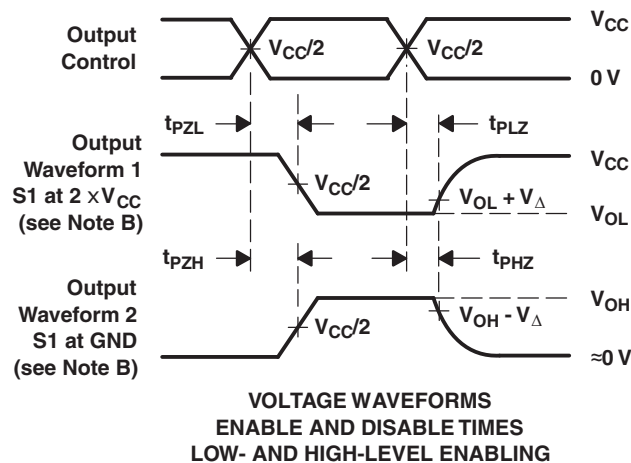
PARAMETER MEASUREMENT INFORMATION (Enable and Disable Times)



LOAD CIRCUIT

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

	$V_{CC} = 0.8 \text{ V}$	$V_{CC} = 1.2 \text{ V}$ $\pm 0.1 \text{ V}$	$V_{CC} = 1.5 \text{ V}$ $\pm 0.1 \text{ V}$	$V_{CC} = 1.8 \text{ V}$ $\pm 0.15 \text{ V}$	$V_{CC} = 2.5 \text{ V}$ $\pm 0.2 \text{ V}$	$V_{CC} = 3.3 \text{ V}$ $\pm 0.3 \text{ V}$
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_{Δ}	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

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead finish/ Ball material (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
SN74AUP2G241DCUR	ACTIVE	VSSOP	DCU	8	3000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	H41R	Samples
SN74AUP2G241DQER	ACTIVE	X2SON	DQE	8	5000	RoHS & Green	NIPDAUAG	Level-1-260C-UNLIM	-40 to 85	HQ	Samples
SN74AUP2G241RSER	ACTIVE	UQFN	RSE	8	5000	RoHS & Green	NIPDAUAG	Level-1-260C-UNLIM	-40 to 85	HQ	Samples
SN74AUP2G241YFPR	ACTIVE	DSBGA	YFP	8	3000	RoHS & Green	SNAGCU	Level-1-260C-UNLIM	-40 to 85	HQN	Samples

(1) The marketing status values are defined as follows:

ACTIVE: Product device recommended for new designs.

LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

PREVIEW: Device has been announced but is not in production. Samples may or may not be available.

OBsolete: TI has discontinued the production of the device.

(2) **RoHS:** TI defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".

RoHS Exempt: TI defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.

Green: TI defines "Green" to mean the content of Chlorine (Cl) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of <=1000ppm threshold. Antimony trioxide based flame retardants must also meet the <=1000ppm threshold requirement.

(3) MSL, Peak Temp. - The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

(6) Lead finish/Ball material - Orderable Devices 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.

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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
SN74AUP2G241DCUR	VSSOP	DCU	8	3000	180.0	8.4	2.25	3.35	1.05	4.0	8.0	Q3
SN74AUP2G241DQER	X2SON	DQE	8	5000	180.0	8.4	1.2	1.6	0.55	4.0	8.0	Q1
SN74AUP2G241RSER	UQFN	RSE	8	5000	180.0	8.4	1.7	1.7	0.7	4.0	8.0	Q2
SN74AUP2G241YFPR	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)
SN74AUP2G241DCUR	VSSOP	DCU	8	3000	202.0	201.0	28.0
SN74AUP2G241DQER	X2SON	DQE	8	5000	202.0	201.0	28.0
SN74AUP2G241RSER	UQFN	RSE	8	5000	202.0	201.0	28.0
SN74AUP2G241YFPR	DSBGA	YFP	8	3000	220.0	220.0	35.0

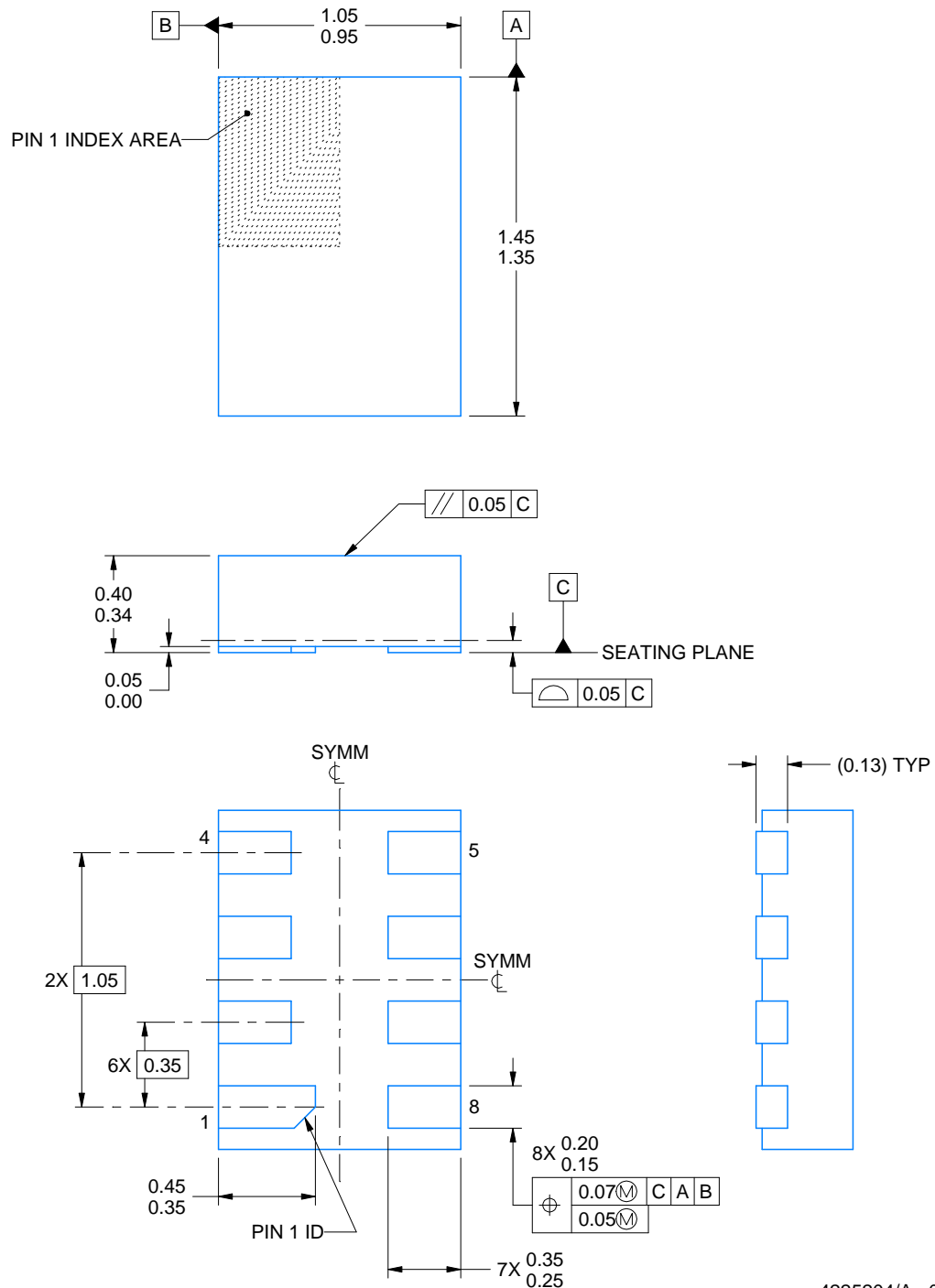
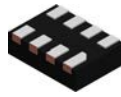
DCU (R-PDSO-G8)

PLASTIC SMALL-OUTLINE PACKAGE (DIE DOWN)



NOTES:

- All linear dimensions are in millimeters.
- This drawing is subject to change without notice.
- Body dimensions do not include mold flash or protrusion. Mold flash and protrusion shall not exceed 0.15 per side.
- Falls within JEDEC MO-187 variation CA.



4225204/A 08/2019

NOTES:

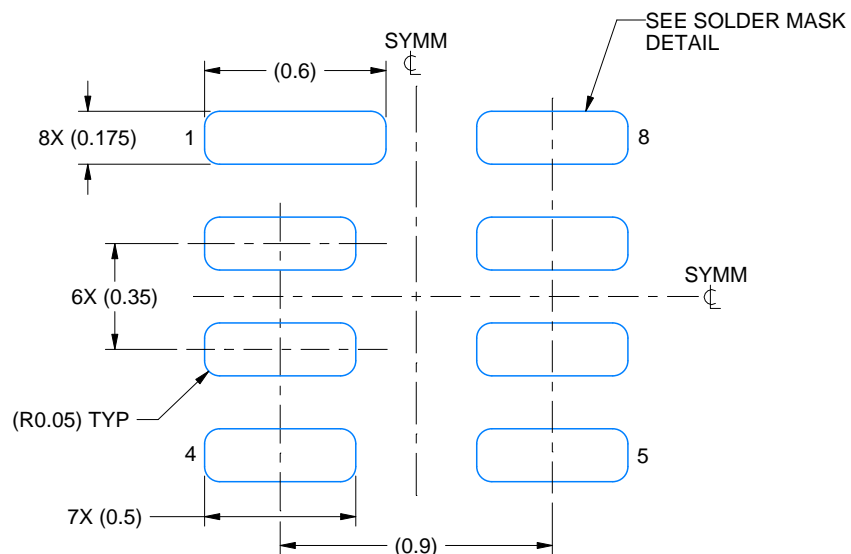
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This package complies to JEDEC MO-287 variation X2EAF.

EXAMPLE BOARD LAYOUT

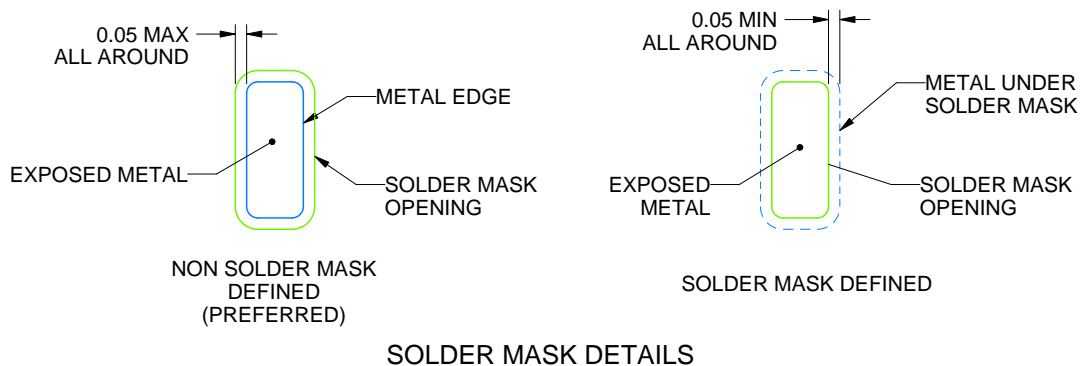
DQE0008A

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)

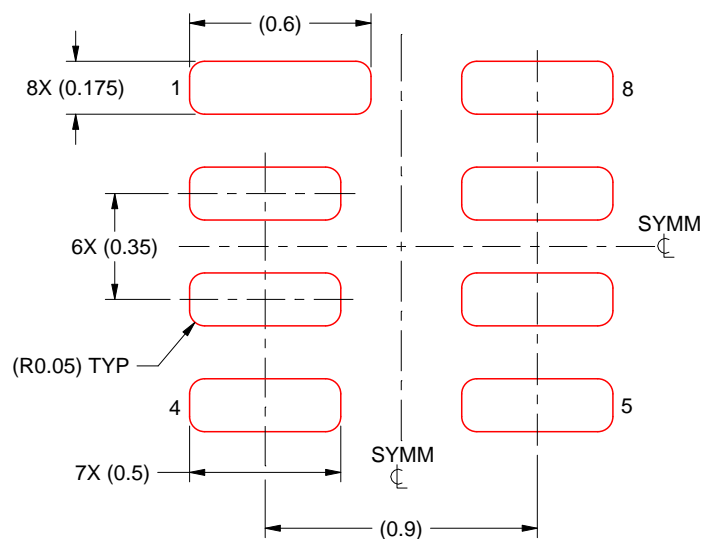
- This package is designed to be soldered to a thermal pad on the board. For more information, see Texas Instruments literature number SLUA271 (www.ti.com/lit/sluea271).

EXAMPLE STENCIL DESIGN

DQE0008A

X2SON - 0.4 mm max height

PLASTIC SMALL OUTLINE - NO LEAD



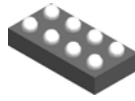
SOLDER PASTE EXAMPLE
BASED ON 0.075 MM THICK STENCIL
SCALE: 40X

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.

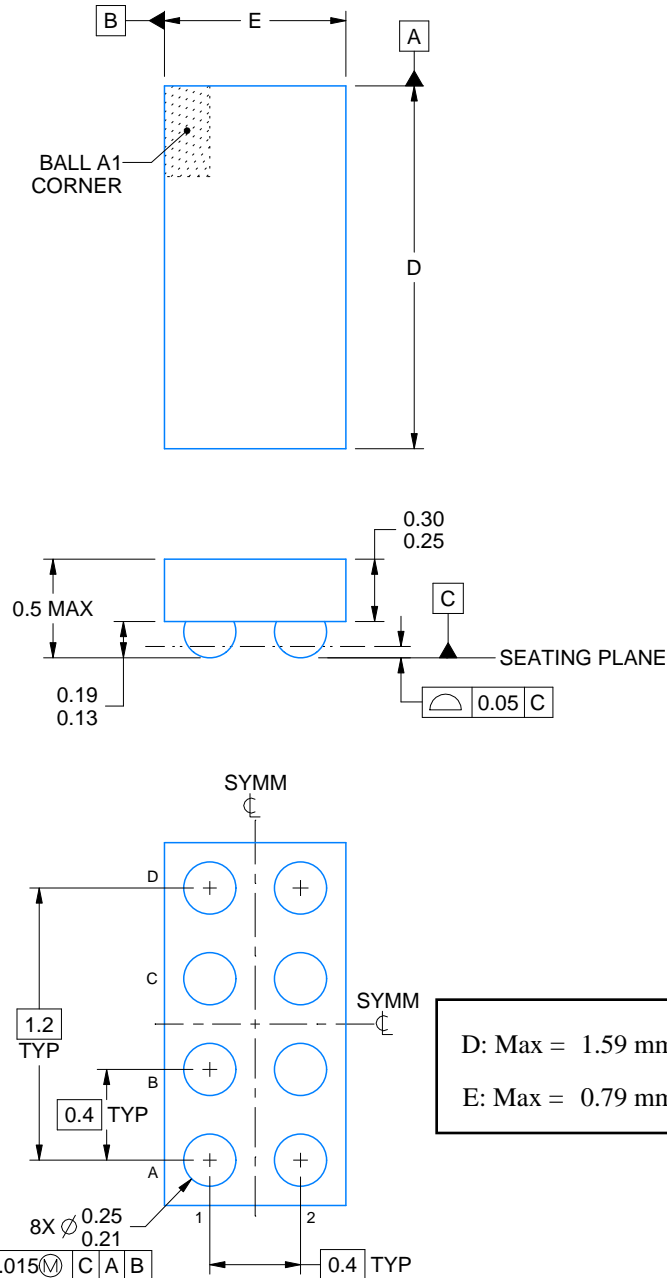
YFP0008



PACKAGE OUTLINE

DSBGA - 0.5 mm max height

DIE SIZE BALL GRID ARRAY



4225242/A 08/2019

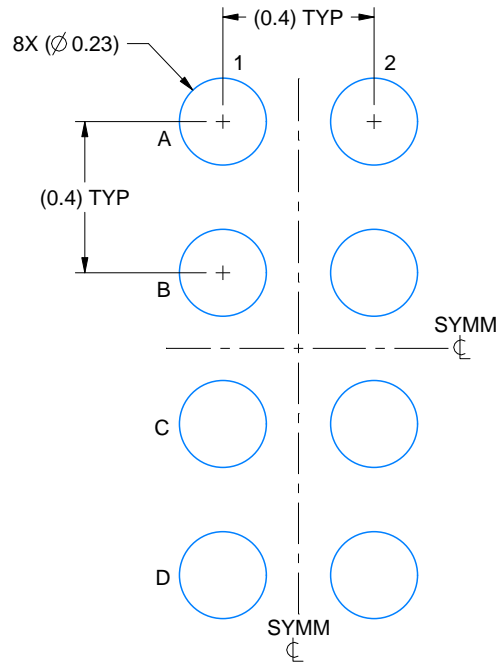
NOTES:

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.

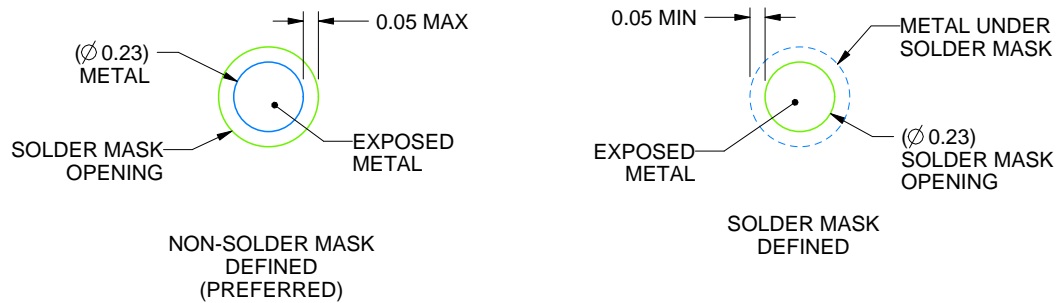
YFP0008

DSBGA - 0.5 mm max height

DIE SIZE BALL GRID ARRAY



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE: 50X

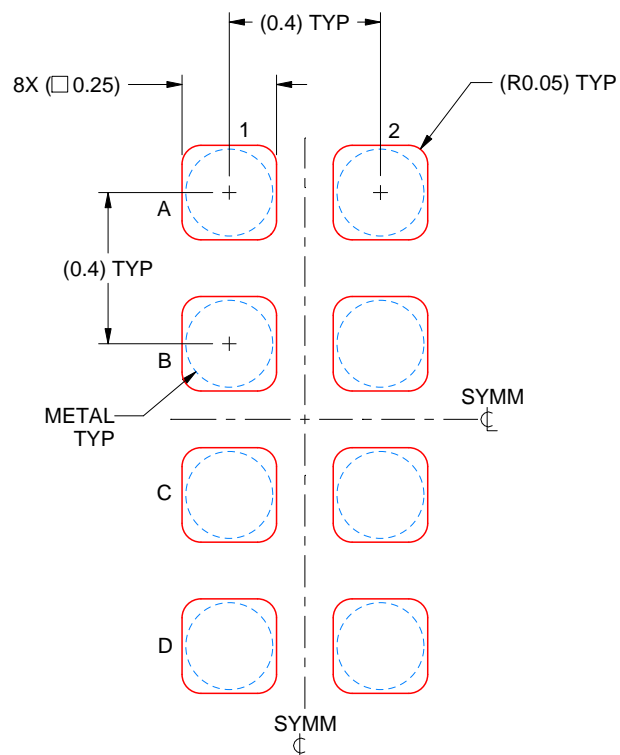


SOLDER MASK DETAILS
NOT TO SCALE

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).

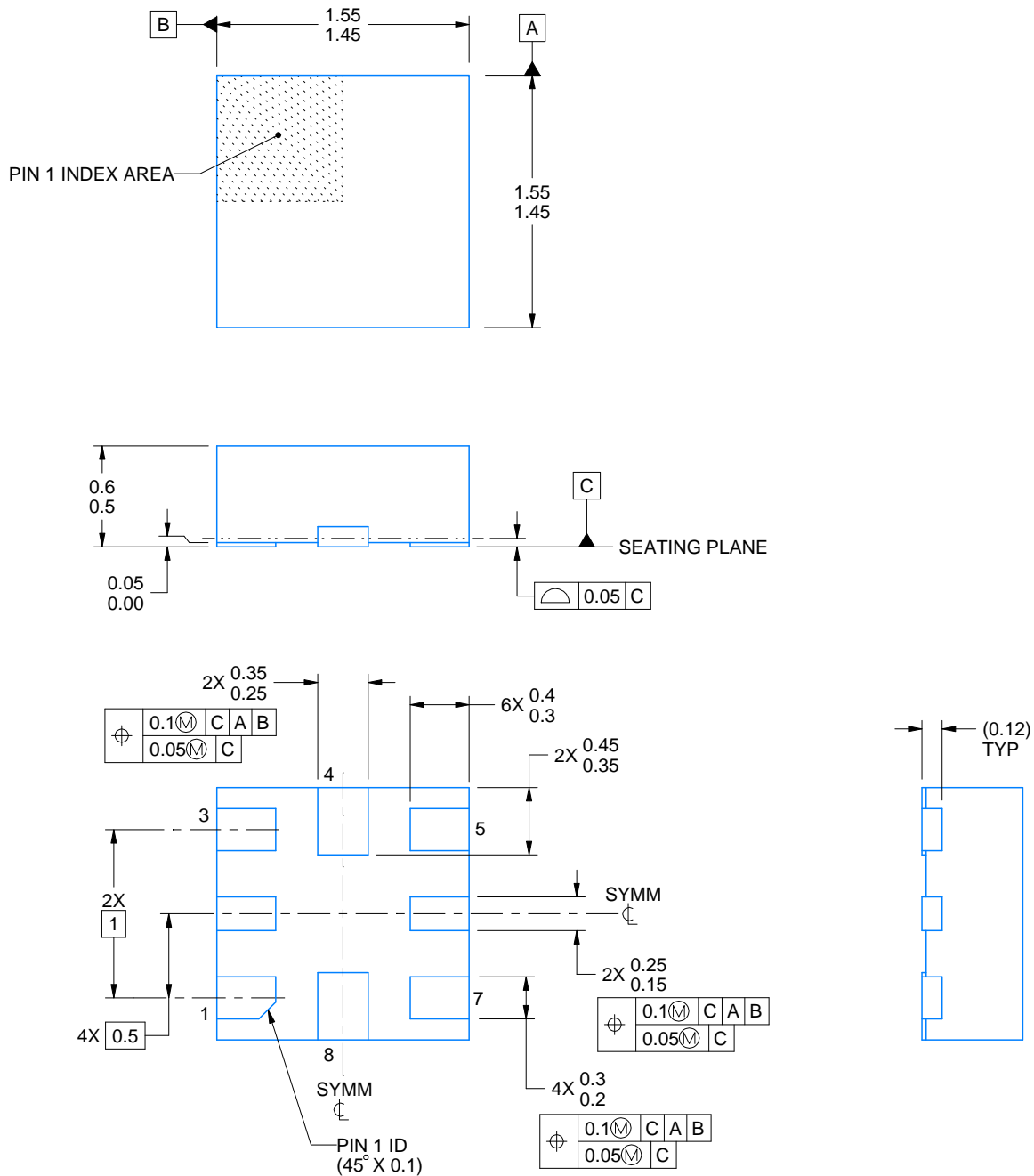
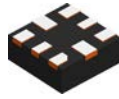


SOLDER PASTE EXAMPLE
 BASED ON 0.1 mm THICK STENCIL
 SCALE: 50X

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:

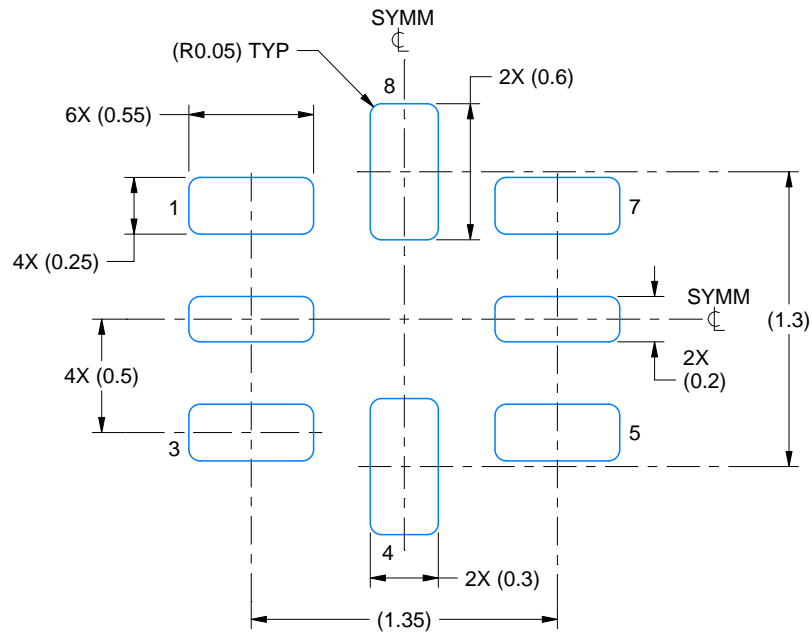
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.

EXAMPLE BOARD LAYOUT

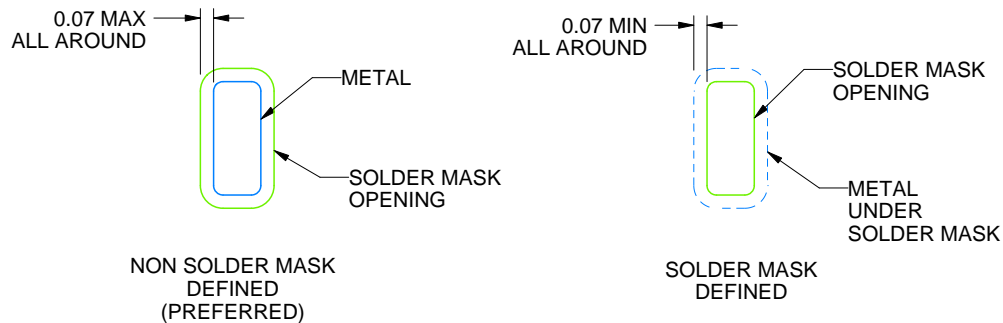
RSE0008A

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)

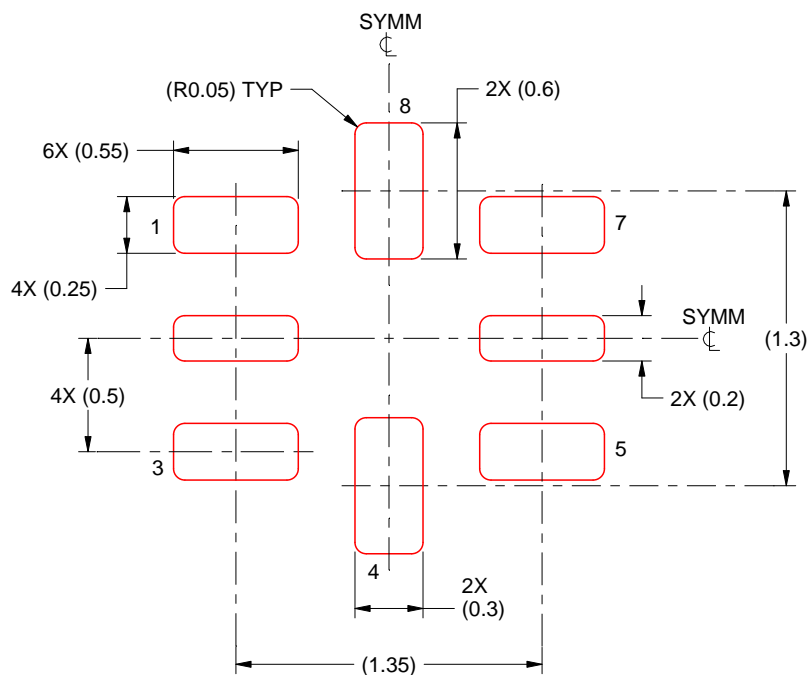
3. For more information, see Texas Instruments literature number SLUA271 (www.ti.com/lit/slua271).

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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