

SN74AUP1G08 Low-Power Single 2-Input Positive-AND Gate

1 Features

- Available in the Ultra Small 0.64 mm² Package (DPW) With 0.5-mm Pitch
- Low Static-Power Consumption:
 $I_{CC} = 0.9 \mu\text{A}$ Maximum
- Low Dynamic-Power Consumption:
 $C_{pd} = 4.3 \text{ pF}$ Typical at 3.3 V
- Low Input Capacitance: $C_i = 1.5 \text{ pF}$ Typical
- Low Noise: Overshoot and Undershoot <10% of V_{CC}
- I_{off} Supports Live Insertion, Partial-Power-Down Mode, and Back Drive Protection
- Schmitt-Trigger Action Allows Slow Input Transition and Better Switching Noise Immunity at the Input ($V_{hys} = 250 \text{ mV}$ Typical at 3.3 V)
- 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
- $t_{pd} = 4.3 \text{ ns}$ 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)

Simplified Schematic



2 Applications

- ATCA Solutions
- Active Noise Cancellation (ANC)
- Barcode Scanner
- Blood Pressure Monitor
- CPAP Machine
- Cable Solutions
- DLP 3D Machine Vision, Hyperspectral Imaging, Optical Networking, and Spectroscopy
- E-Book
- Embedded PC
- Field Transmitter: Temperature or Pressure Sensor
- Fingerprint Biometrics
- HVAC: Heating, Ventilating, and Air Conditioning
- Network-Attached Storage (NAS)
- Server Motherboard and PSU
- Software Defined Radio (SDR)
- TV: High-Definition (HDTV), LCD, and Digital
- Video Communications System
- Wireless Data Access Card, Headset, Keyboard, Mouse, and LAN Card
- X-ray: Baggage Scanner, Medical, and Dental

3 Description

This single 2-input positive-AND gate is designed for 0.8-V to 3.6-V V_{CC} operation and performs the Boolean function $Y = A \bullet B$ or $Y = \overline{A + B}$ in positive logic.

Device Information⁽¹⁾

PART NUMBER	PACKAGE	BODY SIZE (NOM)
SN74AUP1G08DBV	SOT-23 (5)	2.90 mm x 1.60 mm
SN74AUP1G08DRL	SOT (5)	1.60 mm x 1.20 mm
SN74AUP1G08DRY	SON (6)	1.45 mm x 1.00 mm
SN74AUP1G08DPW	X2SON (5)	0.80 mm x 0.80 mm
SN74AUP1G08YZP	DSBGA (5)	1.37 mm x 0.88 mm
SN74AUP1G08DCK	SC70 (5)	1.25 mm x 2.00 mm
SN74AUP1G08DSF	SON (6)	1.00 mm x 1.00 mm
SN74AUP1G08YFP	DSBGA (6)	1.16 mm x 0.76 mm

(1) For all available packages, see the orderable addendum at the end of the data sheet.



Table of Contents

1 Features	1	8 Detailed Description	12
2 Applications	1	8.1 Overview	12
3 Description	1	8.2 Functional Block Diagram	12
4 Revision History	2	8.3 Feature Description	12
5 Pin Configuration and Functions	4	8.4 Device Functional Modes	12
6 Specifications	5	9 Application and Implementation	13
6.1 Absolute Maximum Ratings	5	9.1 Application Information	13
6.2 ESD Ratings	5	9.2 Typical Application	13
6.3 Recommended Operating Conditions	5	10 Power Supply Recommendations	14
6.4 Thermal Information	6	11 Layout	14
6.5 Electrical Characteristics	7	11.1 Layout Guidelines	14
6.6 Switching Characteristics, $C_L = 5$ pF	7	11.2 Layout Example	14
6.7 Switching Characteristics, $C_L = 10$ pF	8	12 Device and Documentation Support	15
6.8 Switching Characteristics, $C_L = 15$ pF	8	12.1 Receiving Notification of Documentation Updates	15
6.9 Switching Characteristics, $C_L = 30$ pF	8	12.2 Community Resources	15
6.10 Operating Characteristics	8	12.3 Trademarks	15
6.11 Typical Characteristics	9	12.4 Electrostatic Discharge Caution	15
7 Parameter Measurement Information	10	12.5 Glossary	15
7.1 Propagation Delays, Setup and Hold Times, and Pulse Duration	10	13 Mechanical, Packaging, and Orderable Information	15
7.2 Enable and Disable Times	11		

4 Revision History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

Changes from Revision O (June 2014) to Revision P	Page
• Updated <i>Applications</i> and <i>Device Information</i> table	1
• Updated pinout images and <i>Pin Functions</i> table	4
• Added temperature ranges for Storage temperature, T_{stg} and Junction temperature, T_J in <i>Absolute Maximum Ratings</i>	5
• Changed <i>Handling Ratings</i> to <i>ESD Ratings</i> and changed MIN, MAX column to a VALUE column	5
• Added <i>Receiving Notification of Documentation Updates</i> section	15

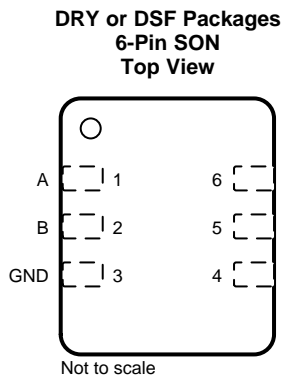
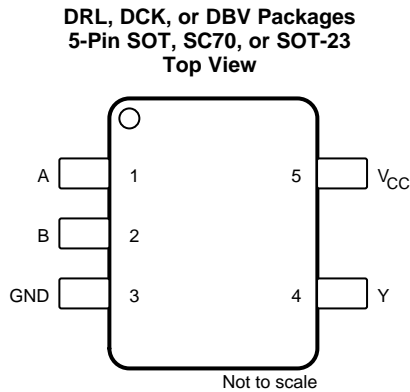
Changes from Revision N (November 2012) to Revision O	Page
• Updated document to new TI data sheet format	1
• Removed ordering information.	1
• Added Applications.	1
• Fixed typo in YFP package drawing.	4
• Added <i>Handling Ratings</i> table	5
• Added Thermal Information table.	6
• Added Typical Characteristics.	9

Changes from Revision M (September 2012) to Revision N	Page
• Changed DPW package pinout	4

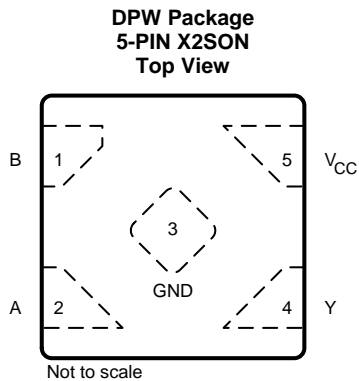
Changes from Revision K (October 2011) to Revision L**Page**

-
- Revised document to fix package addendum issue. **1**
-

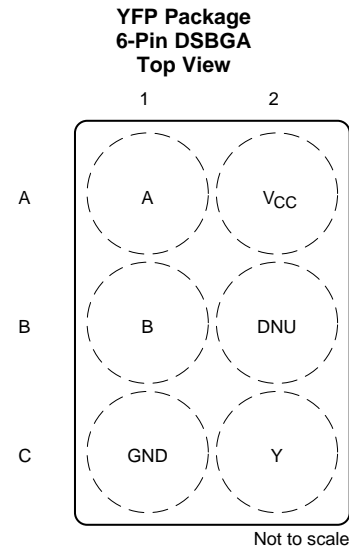
5 Pin Configuration and Functions



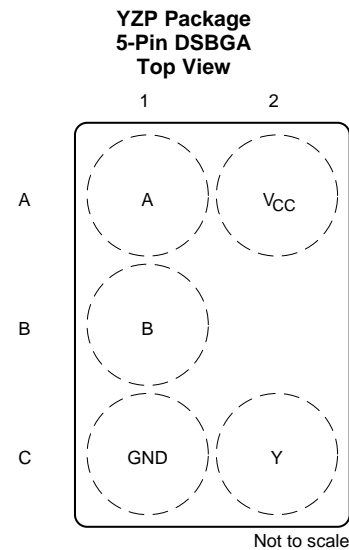
N.C. – No internal connection



See mechanical drawings for dimensions.



DNU – Do not use



Pin Functions

NAME	PIN					I/O	DESCRIPTION
	DRL, DCK, DBV	DPW	DRY, DSF	YZP	YFP		
A	1	2	1	A1	A1	I	Input A
B	2	1	2	B1	B1	I	Input B
DNU	–	–	–	–	B2	–	Do not use
GND	3	3	3	C1	C1	–	Ground
N.C.	–	–	5	–	–	–	No internal connection
V _{CC}	5	5	6	A2	A2	–	Power Pin
Y	4	4	4	C2	C2	O	Output Y

6 Specifications

6.1 Absolute Maximum Ratings

over operating free-air temperature range (unless otherwise noted) ⁽¹⁾

		MIN	MAX	UNIT	
V _{CC}	Supply voltage	–0.5	4.6	V	
V _I	Input voltage ⁽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
T _J	Maximum junction temperature			150	°C
T _{stg}	Storage temperature	–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.

6.2 ESD Ratings

		VALUE	UNIT
V _(ESD)	Electrostatic discharge	Human body model (HBM), per ANSI/ESDA/JEDEC JS-001 ⁽¹⁾	2000
		Charged device model (CDM), per JEDEC specification JESD22-C101 ⁽²⁾	1000

- (1) JEDEC document JEP155 states that 500-V HBM allows safe manufacturing with a standard ESD control process.
- (2) JEDEC document JEP157 states that 250-V CDM allows safe manufacturing with a standard ESD control process.

6.3 Recommended Operating Conditions

over operating free-air temperature range (unless otherwise noted) ⁽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}	V
		V _{CC} = 1.1 V to 1.95 V	0.65 × V _{CC}	
		V _{CC} = 2.3 V to 2.7 V	1.6	
		V _{CC} = 3 V to 3.6 V	2	

- (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](#).

Recommended Operating Conditions (continued)

 over operating free-air temperature range (unless otherwise noted) ⁽¹⁾

		MIN	MAX	UNIT
V _{IL}	Low-level input voltage	V _{CC} = 0.8 V	0	V
		V _{CC} = 1.1 V to 1.95 V	0.35 × V _{CC}	
		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	μA
		V _{CC} = 1.1 V	–1.1	
		V _{CC} = 1.4 V	–1.7	
		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	μA
		V _{CC} = 1.1 V	1.1	
		V _{CC} = 1.4 V	1.7	
		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

6.4 Thermal Information

THERMAL METRIC ⁽¹⁾	SN74AUP1G08						UNIT	
	DBV (SOT-23)	DCK (SC70)	DRL (SOT)	DSF (SON)	DRY (SON)	DPW (X2SON)		
	5 PINS	5 PINS	5 PINS	6 PINS	6 PINS	5 PINS		
R _{θJA}	Junction-to-ambient thermal resistance	298.6	314.4	349.7	407.1	554.9	291.8	°C/W
R _{θJC(top)}	Junction-to-case (top) thermal resistance	240.2	128.7	120.5	232	385.4	224.2	°C/W
R _{θJB}	Junction-to-board thermal resistance	134.6	100.6	171.4	306.9	388.2	245.8	°C/W
Ψ _{JT}	Junction-to-top characterization parameter	114.5	7.1	10.8	40.3	159	245.6	°C/W
Ψ _{JB}	Junction-to-board characterization parameter	133.9	99.8	169.4	306	384.1	195.4	°C/W

(1) For more information about traditional and new thermal metrics, see the [Semiconductor and IC Package Thermal Metrics](#) application report.

6.5 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 V, other input at V_{CC} or GND.

6.6 Switching Characteristics, C_L = 5 pF

over recommended operating free-air temperature range (unless otherwise noted) (see [Figure 3](#) and [Figure 4](#))

PARAMETER	FROM (INPUT)	TO (OUTPUT)	V _{CC}	T _A = 25°C			T _A = –40°C to +85°C		UNIT
				MIN	TYP	MAX	MIN	MAX	
t _{pd}	A or B	Y	0.8 V	18					ns
			1.2 V ± 0.1 V	2.6	7.3	12.8	2.1	15.6	
			1.5 V ± 0.1 V	1.4	5.2	8.7	0.9	10.3	
			1.8 V ± 0.15 V	1	4.2	6.6	0.5	8.2	
			2.5 V ± 0.2 V	1	3	4.4	0.5	5.5	
			3.3 V ± 0.3 V	1	2.4	3.5	0.5	4.3	

6.7 Switching Characteristics, $C_L = 10$ pF

 over recommended operating free-air temperature range (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	21					ns
			1.2 V \pm 0.1 V	1.5	8.5	14.7	1	17.2	
			1.5 V \pm 0.1 V	1	6.2	10	0.5	11.3	
			1.8 V \pm 0.15 V	1	5	7.7	0.5	9	
			2.5 V \pm 0.2 V	1	3.6	5.2	0.5	6.1	
			3.3 V \pm 0.3 V	1	2.9	4.2	0.5	4.7	

6.8 Switching Characteristics, $C_L = 15$ pF

 over recommended operating free-air temperature range (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	

6.9 Switching Characteristics, $C_L = 30$ pF

 over recommended operating free-air temperature range (unless otherwise noted) (see [Figure 3](#) and [Figure 4](#))

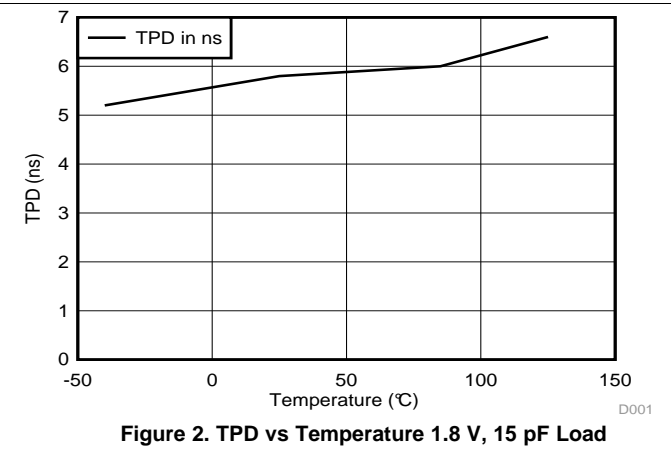
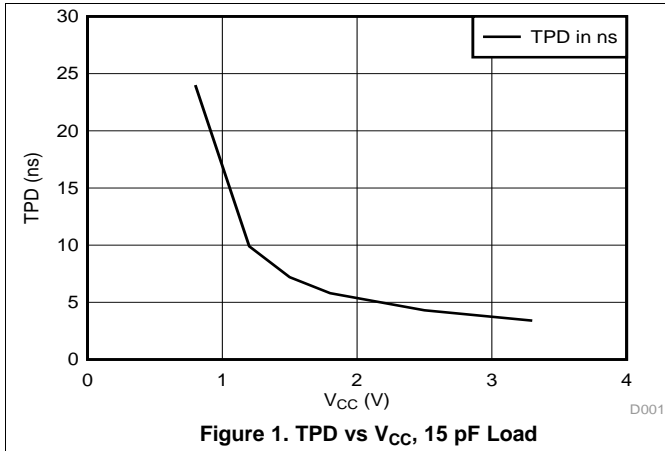
PARAMETER	FROM (INPUT)	TO (OUTPUT)	V_{CC}	$T_A = 25^\circ\text{C}$			$T_A = -40^\circ\text{C to } +85^\circ\text{C}$		UNIT
				MIN	TYP	MAX	MIN	MAX	
t_{pd}	A or B	Y	0.8 V	32.8					ns
			1.2 V \pm 0.1 V	4.9	13.1	20.9	4.4	25.5	
			1.5 V \pm 0.1 V	3.4	9.5	14.2	2.9	16.9	
			1.8 V \pm 0.15 V	2.5	7.7	11	2	13.5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

6.10 Operating Characteristics

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

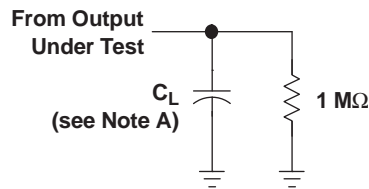
PARAMETER	TEST CONDITIONS	V_{CC}	TYP	UNIT
C_{pd} Power dissipation capacitance	$f = 10$ MHz	0.8 V	4	pF
		1.2 V \pm 0.1 V	4	
		1.5 V \pm 0.1 V	4	
		1.8 V \pm 0.15 V	4	
		2.5 V \pm 0.2 V	4.1	
		3.3 V \pm 0.3 V	4.3	

6.11 Typical Characteristics



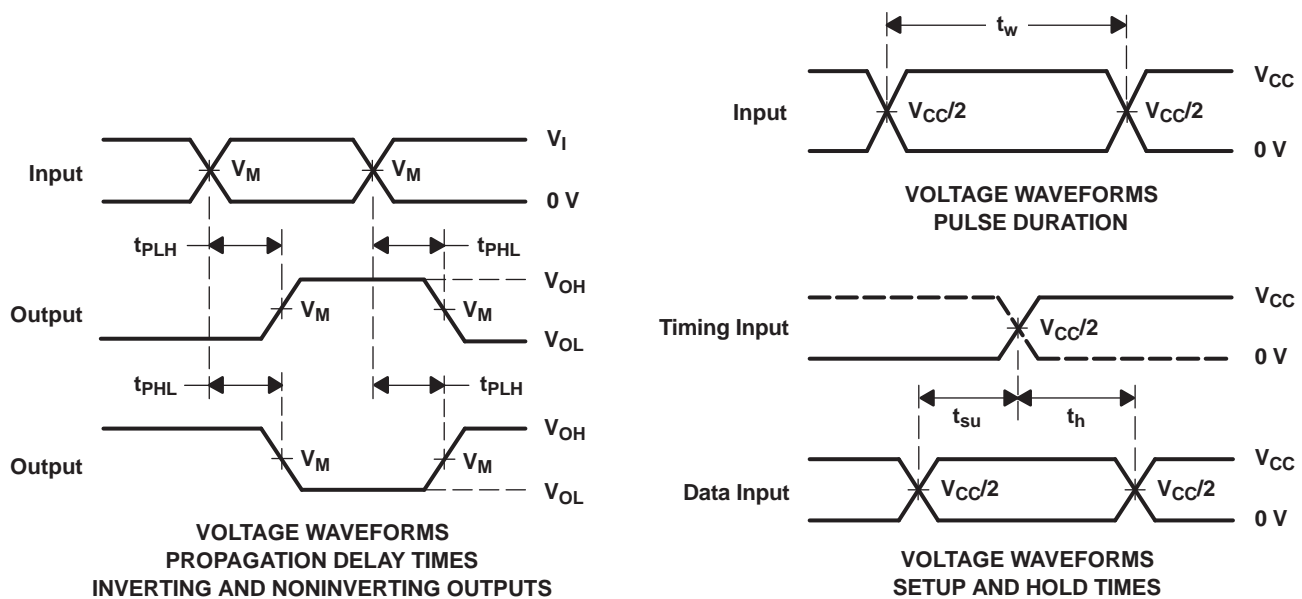
7 Parameter Measurement Information

7.1 Propagation Delays, Setup and Hold Times, and Pulse Duration



LOAD CIRCUIT

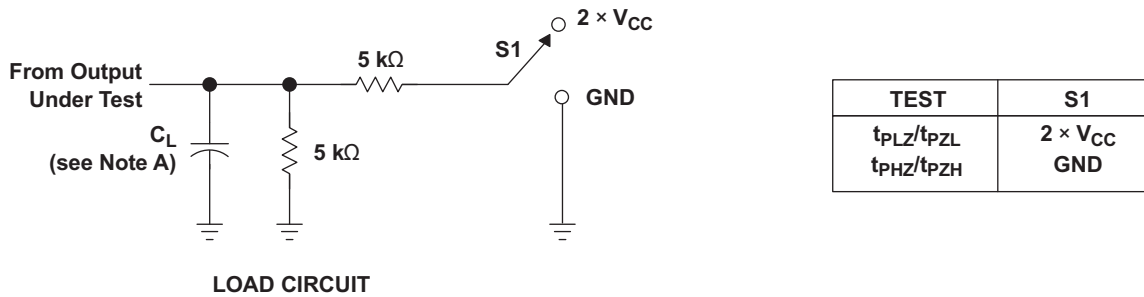
	$V_{CC} = 0.8\text{ V}$	$V_{CC} = 1.2\text{ V}$ $\pm 0.1\text{ V}$	$V_{CC} = 1.5\text{ V}$ $\pm 0.1\text{ V}$	$V_{CC} = 1.8\text{ V}$ $\pm 0.15\text{ V}$	$V_{CC} = 2.5\text{ V}$ $\pm 0.2\text{ V}$	$V_{CC} = 3.3\text{ V}$ $\pm 0.3\text{ V}$
C_L	5, 10, 15, 30 pF	5, 10, 15, 30 pF	5, 10, 15, 30 pF	5, 10,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



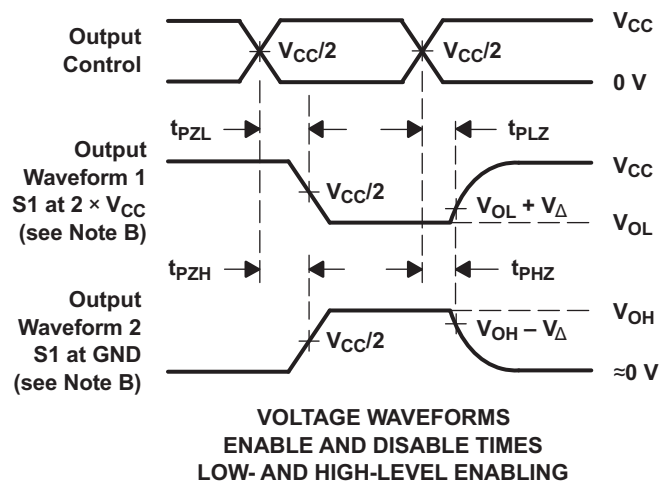
- NOTES:
- C_L includes probe and jig capacitance.
 - All input pulses are supplied by generators having the following characteristics: PRR ≤ 10 MHz, $Z_O = 50\ \Omega$, slew rate ≥ 1 V/ns.
 - The outputs are measured one at a time, with one transition per measurement.
 - t_{PLH} and t_{PHL} are the same as t_{pd} .
 - All parameters and waveforms are not applicable to all devices.

Figure 3. Load Circuit and Voltage Waveforms

7.2 Enable and Disable Times



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



- NOTES:
- 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: $PRR \leq 10 \text{ MHz}$, $Z_O = 50 \Omega$, slew rate $\geq 1 \text{ V/ns}$.
 - 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_{PZL} and t_{PZH} are the same as t_{en} .
 - G. All parameters and waveforms are not applicable to all devices.

Figure 4. Load Circuit and Voltage Waveforms

8 Detailed Description

8.1 Overview

This single 2-input positive-AND gate is designed for 0.8-V to 3.6-V V_{CC} operation and performs the Boolean function $Y = A \bullet B$ or $Y = \overline{\overline{A} + \overline{B}}$ in positive logic.

The AUP family of devices has quiescent power consumption less than 1 μA and comes in the ultra small DPW package. The DPW package technology is a major breakthrough in IC packaging. Its tiny 0.64 mm² square footprint saves significant board space over other package options while still retaining the traditional manufacturing friendly lead pitch of 0.5 mm.

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. The I_{off} feature also allows for live insertion.

8.2 Functional Block Diagram



8.3 Feature Description

- Wide operating V_{CC} range of 0.8 V to 3.6 V
- 3.6-V I/O tolerant to support down translation
- Input hysteresis allows slow input transition and better switching noise immunity at the input
- I_{off} feature allows voltages on the inputs and outputs when V_{CC} is 0 V
- Low noise due to slower edge rates

8.4 Device Functional Modes

Table 1. Function Table

INPUTS		OUTPUT Y
A	B	
L	L	L
L	H	L
H	L	L
H	H	H

9 Application and Implementation

9.1 Application 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 an increased battery life. This product also maintains excellent signal integrity. It has a small amount of hysteresis built in allowing for slower or noisy input signals. The lowered drive produces slower edges and prevents overshoot and undershoot on the outputs.

The AUP family of single gate logic makes excellent translators for the new lower voltage Micro- processors that typically are powered from 0.8 V to 1.2 V. They can drop the voltage of peripheral drivers and accessories that are still powered by 3.3 V to the new μC power levels.

9.2 Typical Application

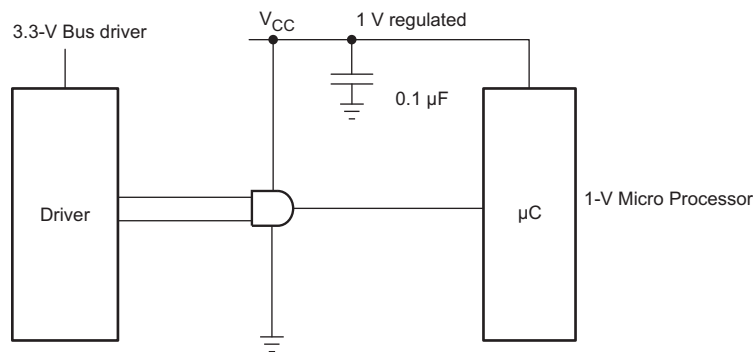


Figure 5. Typical Application Schematic

9.2.1 Design Requirements

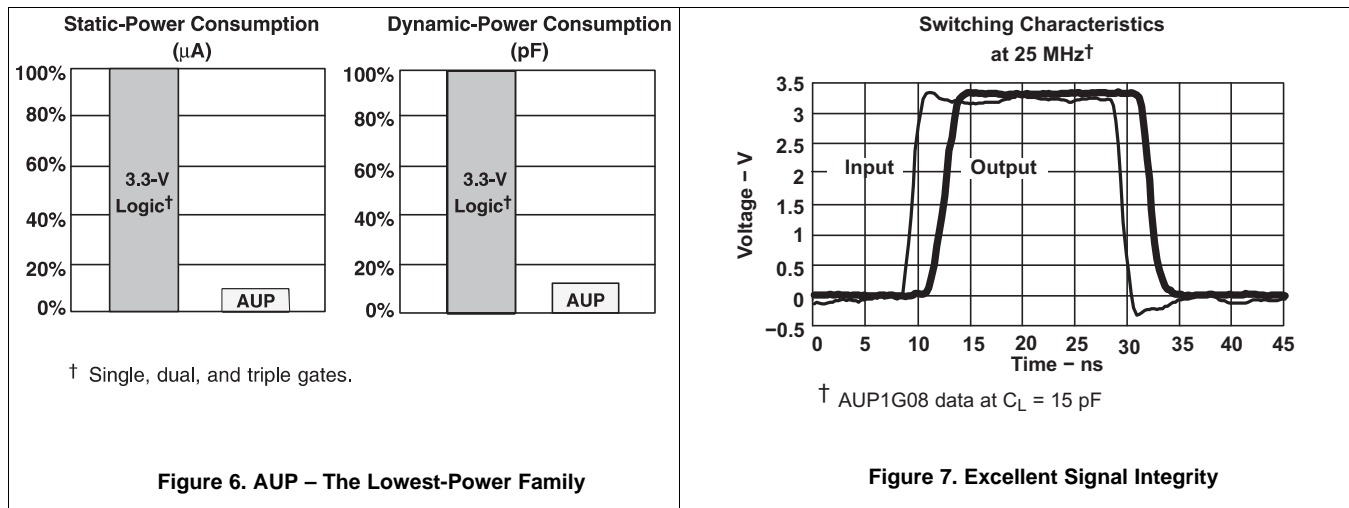
SN74AUP1G08 device uses CMOS technology and has balanced output drive. Take care to avoid bus contention because it can drive currents that would exceed maximum limits.

9.2.2 Detailed Design Procedure

1. Recommended Input conditions
 - Rise time and fall time specifications. See $(\Delta t/\Delta V)$ in [Recommended Operating Conditions](#) table.
 - Specified high and low levels. See $(V_{IH}$ and $V_{IL})$ in [Recommended Operating Conditions](#) table.
 - Inputs are overvoltage tolerant allowing them to go as high as 3.6 V at any valid V_{CC}
2. Recommended output conditions
 - Load currents should not exceed 20 mA on the output and 50 mA total for the part
 - Outputs should not be pulled above V_{CC}

Typical Application (continued)

9.2.3 Application Curves



10 Power Supply Recommendations

The power supply can be any voltage between the Min and Max supply voltage rating located in the [Recommended Operating Conditions](#) table.

Each V_{CC} terminal should have a good bypass capacitor to prevent power disturbance. For devices with a single supply, 0.1 μ F is recommended and if there are multiple V_{CC} terminals then 0.01 μ F or 0.022 μ F is recommended for each power terminal. It is ok to parallel multiple bypass caps to reject different frequencies of noise. A 0.1 μ F and 1 μ F are commonly used in parallel. The bypass capacitor should be installed as close to the power terminal as possible for best results.

11 Layout

11.1 Layout Guidelines

When using multiple bit logic devices inputs should not ever float.

In many cases, functions or parts of functions of digital logic devices are unused, for example, when only two inputs of a triple-input AND gate are used or only 3 of the 4 buffer gates are used. Such input pins should not be left unconnected because the undefined voltages at the outside connections result in undefined operational states. Specified in [Figure 8](#) are the rules that must be observed under all circumstances. All unused inputs of digital logic devices must be connected to a high or low bias to prevent them from floating. The logic level that should be applied to any particular unused input depends on the function of the device. Generally they will be tied to GND or V_{CC} whichever make more sense or is more convenient. It is generally OK to float outputs unless the part is a transceiver. If the transceiver has an output enable pin it will disable the outputs section of the part when asserted. This will not disable the input section of the I/Os so they also cannot float when disabled.

11.2 Layout Example

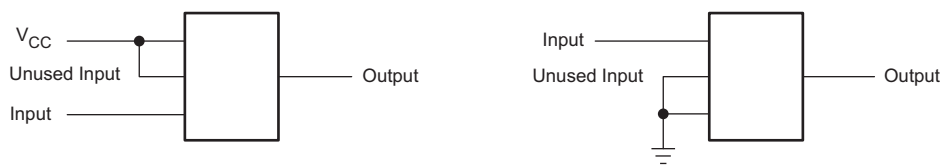


Figure 8. Layout Diagram

12 Device and Documentation Support

12.1 Receiving Notification of Documentation Updates

To receive notification of documentation updates — go to the product folder for your device on ti.com. In the upper right-hand corner, click the *Alert me* button to register and receive a weekly digest of product information that has changed (if any). For change details, check the revision history of any revised document.

12.2 Community Resources

The following links connect to TI community resources. Linked contents are provided "AS IS" by the respective contributors. They do not constitute TI specifications and do not necessarily reflect TI's views; see TI's [Terms of Use](#).

TI E2E™ Online Community *TI's Engineer-to-Engineer (E2E) Community*. Created to foster collaboration among engineers. At e2e.ti.com, you can ask questions, share knowledge, explore ideas and help solve problems with fellow engineers.

Design Support *TI's Design Support* Quickly find helpful E2E forums along with design support tools and contact information for technical support.

12.3 Trademarks

E2E is a trademark of Texas Instruments.
All other trademarks are the property of their respective owners.

12.4 Electrostatic Discharge Caution



These devices have limited built-in ESD protection. The leads should be shorted together or the device placed in conductive foam during storage or handling to prevent electrostatic damage to the MOS gates.

12.5 Glossary

[SLYZ022](#) — *TI Glossary*.

This glossary lists and explains terms, acronyms, and definitions.

13 Mechanical, Packaging, and Orderable Information

The following pages include mechanical, packaging, and orderable information. This information is the most current data available for the designated devices. This data is subject to change without notice and revision of this document. For browser-based versions of this data sheet, refer to the left-hand navigation.

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
SN74AUP1G08DBVR	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU CU SN	Level-1-260C-UNLIM	-40 to 85	(H08F ~ H08R)	Samples
SN74AUP1G08DBVT	ACTIVE	SOT-23	DBV	5	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	H08R	Samples
SN74AUP1G08DBVTG4	ACTIVE	SOT-23	DBV	5	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	H08R	Samples
SN74AUP1G08DCKR	ACTIVE	SC70	DCK	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	(HE5 ~ HEF ~ HEK ~ HER) (HEH ~ HEP ~ HES)	Samples
SN74AUP1G08DCKRE4	ACTIVE	SC70	DCK	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	(HE5 ~ HEF ~ HEK ~ HER) (HEH ~ HEP ~ HES)	Samples
SN74AUP1G08DCKRG4	ACTIVE	SC70	DCK	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	(HE5 ~ HEF ~ HEK ~ HER) (HEH ~ HEP ~ HES)	Samples
SN74AUP1G08DCKT	ACTIVE	SC70	DCK	5	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	(HE5 ~ HER)	Samples
SN74AUP1G08DCKTE4	ACTIVE	SC70	DCK	5	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	(HE5 ~ HER)	Samples
SN74AUP1G08DPWR	ACTIVE	X2SON	DPW	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	E4	Samples
SN74AUP1G08DRLR	ACTIVE	SOT-5X3	DRL	5	4000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	(HE7 ~ HER)	Samples
SN74AUP1G08DRY2	ACTIVE	SON	DRY	6	5000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	HE	Samples
SN74AUP1G08DRYR	ACTIVE	SON	DRY	6	5000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	HE	Samples
SN74AUP1G08DSF2	ACTIVE	SON	DSF	6	5000	Green (RoHS & no Sb/Br)	CU NIPDAU CU NIPDAUAG	Level-1-260C-UNLIM	-40 to 85	(HE ~ HER) HEH	Samples
SN74AUP1G08DSFR	ACTIVE	SON	DSF	6	5000	Green (RoHS & no Sb/Br)	CU NIPDAU CU NIPDAUAG	Level-1-260C-UNLIM	-40 to 85	(HE ~ HER) HEH	Samples
SN74AUP1G08YFPR	ACTIVE	DSBGA	YFP	6	3000	Green (RoHS & no Sb/Br)	SNAGCU	Level-1-260C-UNLIM		HEN	Samples
SN74AUP1G08YZPR	ACTIVE	DSBGA	YZP	5	3000	Green (RoHS & no Sb/Br)	SNAGCU	Level-1-260C-UNLIM	-40 to 85	(HE7 ~ HEN)	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 ≤ 1000 ppm threshold. Antimony trioxide based flame retardants must also meet the ≤ 1000 ppm 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/Ball Finish - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead/Ball Finish values may wrap to two lines if the finish value exceeds the maximum column width.

Important Information and Disclaimer: The information provided on this page represents TI's knowledge and belief as of the date that it is provided. TI bases its knowledge and belief on information provided by third parties, and makes no representation or warranty as to the accuracy of such information. Efforts are underway to better integrate information from third parties. TI has taken and continues to take reasonable steps to provide representative and accurate information but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals. TI and TI suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.

In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

OTHER QUALIFIED VERSIONS OF SN74AUP1G08 :

- Automotive: [SN74AUP1G08-Q1](#)

NOTE: Qualified Version Definitions:

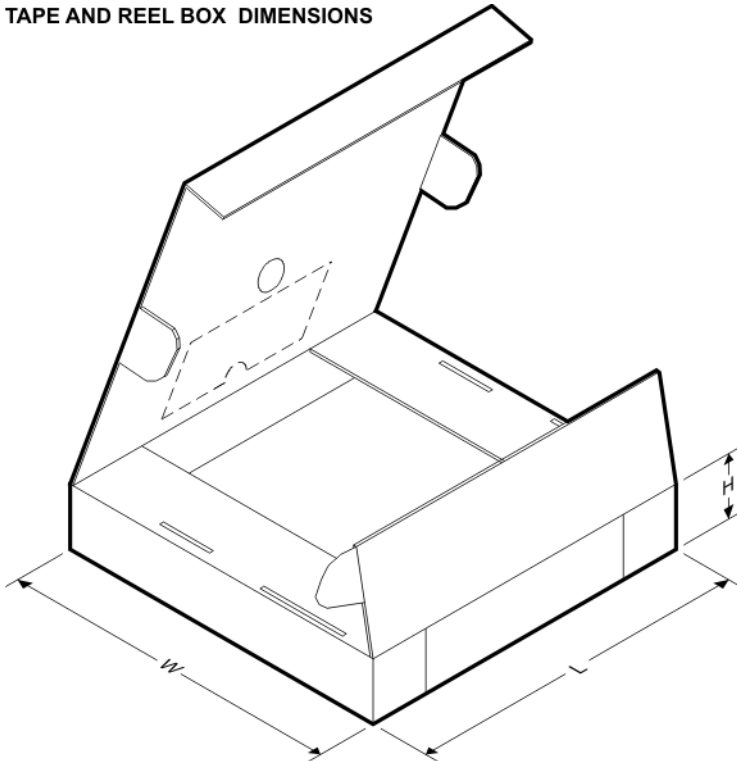
- Automotive - Q100 devices qualified for high-reliability automotive applications targeting zero defects

TAPE AND REEL INFORMATION

QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE


*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
SN74AUP1G08DBVR	SOT-23	DBV	5	3000	178.0	9.0	3.23	3.17	1.37	4.0	8.0	Q3
SN74AUP1G08DBVR	SOT-23	DBV	5	3000	180.0	8.4	3.23	3.17	1.37	4.0	8.0	Q3
SN74AUP1G08DBVT	SOT-23	DBV	5	250	180.0	8.4	3.23	3.17	1.37	4.0	8.0	Q3
SN74AUP1G08DCKR	SC70	DCK	5	3000	180.0	8.4	2.47	2.3	1.25	4.0	8.0	Q3
SN74AUP1G08DCKR	SC70	DCK	5	3000	178.0	9.2	2.4	2.4	1.22	4.0	8.0	Q3
SN74AUP1G08DCKT	SC70	DCK	5	250	178.0	9.2	2.4	2.4	1.22	4.0	8.0	Q3
SN74AUP1G08DCKT	SC70	DCK	5	250	180.0	8.4	2.47	2.3	1.25	4.0	8.0	Q3
SN74AUP1G08DPWR	X2SON	DPW	5	3000	178.0	8.4	0.91	0.91	0.5	2.0	8.0	Q3
SN74AUP1G08DRLR	SOT-5X3	DRL	5	4000	180.0	9.5	1.78	1.78	0.69	4.0	8.0	Q3
SN74AUP1G08DRLR	SOT-5X3	DRL	5	4000	180.0	8.4	1.98	1.78	0.69	4.0	8.0	Q3
SN74AUP1G08DRY2	SON	DRY	6	5000	180.0	9.5	1.15	1.6	0.75	4.0	8.0	Q3
SN74AUP1G08DRYR	SON	DRY	6	5000	180.0	8.4	1.25	1.6	0.7	4.0	8.0	Q1
SN74AUP1G08DRYR	SON	DRY	6	5000	180.0	9.5	1.15	1.6	0.75	4.0	8.0	Q1
SN74AUP1G08DSF2	SON	DSF	6	5000	180.0	9.5	1.16	1.16	0.5	4.0	8.0	Q3
SN74AUP1G08DSFR	SON	DSF	6	5000	180.0	9.5	1.16	1.16	0.5	4.0	8.0	Q2
SN74AUP1G08YFPR	DSBGA	YFP	6	3000	178.0	9.2	0.89	1.29	0.62	4.0	8.0	Q1
SN74AUP1G08YZPR	DSBGA	YZP	5	3000	178.0	9.2	1.02	1.52	0.63	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)
SN74AUP1G08DBVR	SOT-23	DBV	5	3000	180.0	180.0	18.0
SN74AUP1G08DBVR	SOT-23	DBV	5	3000	202.0	201.0	28.0
SN74AUP1G08DBVT	SOT-23	DBV	5	250	202.0	201.0	28.0
SN74AUP1G08DCKR	SC70	DCK	5	3000	202.0	201.0	28.0
SN74AUP1G08DCKR	SC70	DCK	5	3000	180.0	180.0	18.0
SN74AUP1G08DCKT	SC70	DCK	5	250	180.0	180.0	18.0
SN74AUP1G08DCKT	SC70	DCK	5	250	202.0	201.0	28.0
SN74AUP1G08DPWR	X2SON	DPW	5	3000	205.0	200.0	33.0
SN74AUP1G08DRLR	SOT-5X3	DRL	5	4000	184.0	184.0	19.0
SN74AUP1G08DRLR	SOT-5X3	DRL	5	4000	202.0	201.0	28.0
SN74AUP1G08DRY2	SON	DRY	6	5000	184.0	184.0	19.0
SN74AUP1G08DRYR	SON	DRY	6	5000	202.0	201.0	28.0
SN74AUP1G08DRYR	SON	DRY	6	5000	184.0	184.0	19.0
SN74AUP1G08DSF2	SON	DSF	6	5000	184.0	184.0	19.0
SN74AUP1G08DSFR	SON	DSF	6	5000	184.0	184.0	19.0
SN74AUP1G08YFPR	DSBGA	YFP	6	3000	220.0	220.0	35.0
SN74AUP1G08YZPR	DSBGA	YZP	5	3000	220.0	220.0	35.0

DCK (R-PDSO-G5)

PLASTIC SMALL-OUTLINE PACKAGE



- NOTES:
- A. All linear dimensions are in millimeters.
 - B. This drawing is subject to change without notice.
 - C. Body dimensions do not include mold flash or protrusion. Mold flash and protrusion shall not exceed 0.15 per side.
 - D. Falls within JEDEC MO-203 variation AA.

DCK (R-PDSO-G5)

PLASTIC SMALL OUTLINE



- NOTES:
- All linear dimensions are in millimeters.
 - This drawing is subject to change without notice.
 - Customers should place a note on the circuit board fabrication drawing not to alter the center solder mask defined pad.
 - Publication IPC-7351 is recommended for alternate designs.
 - Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Example stencil design based on a 50% volumetric metal load solder paste. Refer to IPC-7525 for other stencil recommendations.

GENERIC PACKAGE VIEW

DRY 6

USON - 0.6 mm max height

PLASTIC SMALL OUTLINE - NO LEAD



Images above are just a representation of the package family, actual package may vary.
Refer to the product data sheet for package details.

4207181/G

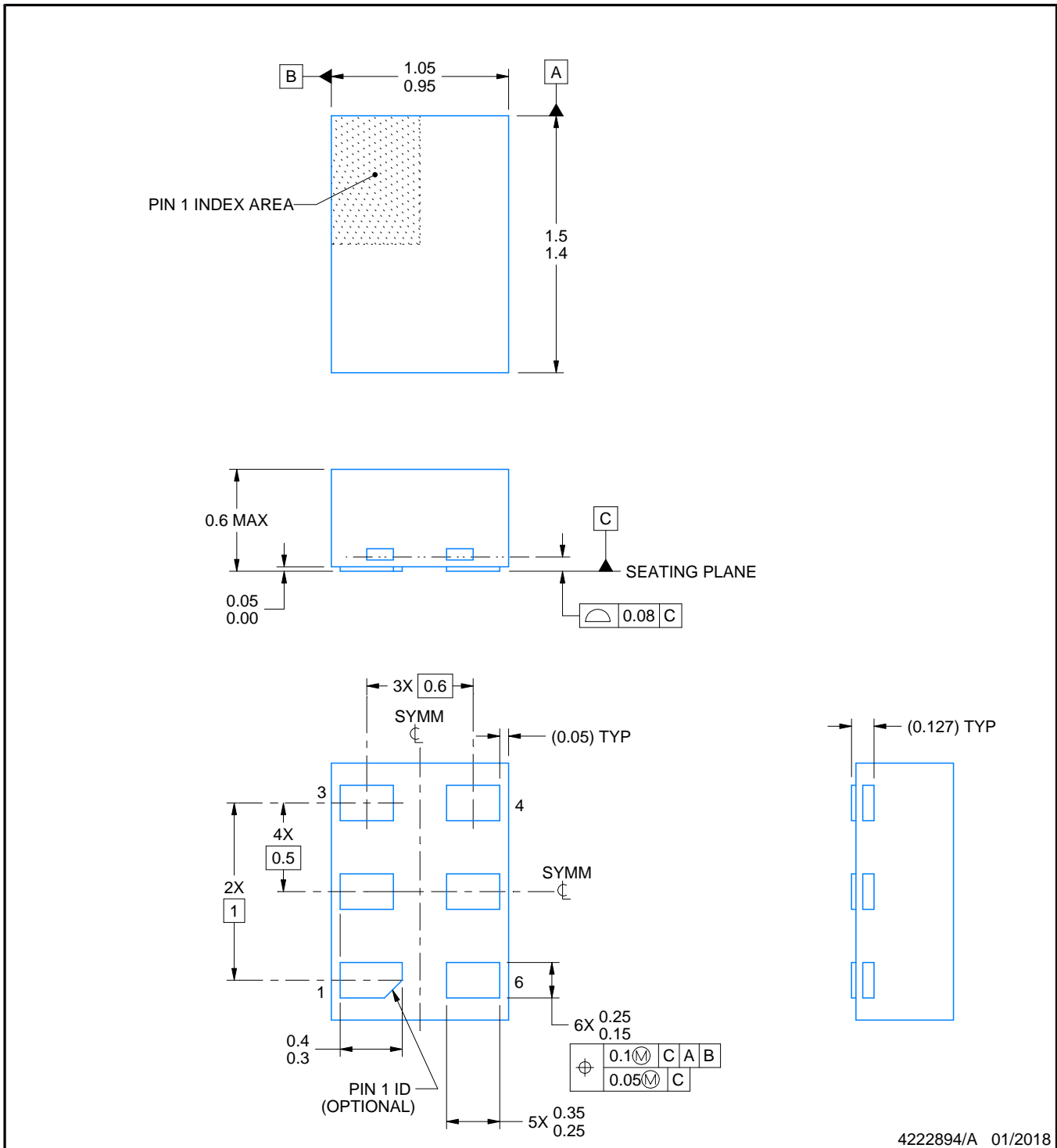
DRY0006A



PACKAGE OUTLINE

USON - 0.6 mm max height

PLASTIC SMALL OUTLINE - NO LEAD



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

DRY0006A

USON - 0.6 mm max height

PLASTIC SMALL OUTLINE - NO LEAD



LAND PATTERN EXAMPLE
1:1 RATIO WITH PKG SOLDER PADS
EXPOSED METAL SHOWN
SCALE:40X



SOLDER MASK DETAILS

4222894/A 01/2018

NOTES: (continued)

3. For more information, see QFN/SON PCB application report in literature No. SLUA271 (www.ti.com/lit/slue271).

EXAMPLE STENCIL DESIGN

DRY0006A

USON - 0.6 mm max height

PLASTIC SMALL OUTLINE - NO LEAD



SOLDER PASTE EXAMPLE
BASED ON 0.075 - 0.1 mm THICK STENCIL
SCALE:40X

4222894/A 01/2018

NOTES: (continued)

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

GENERIC PACKAGE VIEW

DBV 5

SOT-23 - 1.45 mm max height

SMALL OUTLINE TRANSISTOR



Images above are just a representation of the package family, actual package may vary.
Refer to the product data sheet for package details.

4073253/P

DBV0005A



PACKAGE OUTLINE

SOT-23 - 1.45 mm max height

SMALL OUTLINE TRANSISTOR



4214839/C 04/2017

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. Reference JEDEC MO-178.

EXAMPLE BOARD LAYOUT

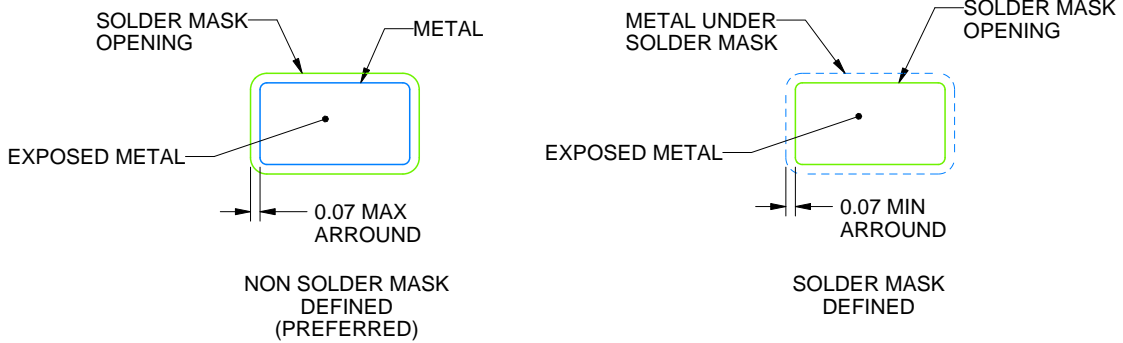
DBV0005A

SOT-23 - 1.45 mm max height

SMALL OUTLINE TRANSISTOR



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE:15X



SOLDER MASK DETAILS

4214839/C 04/2017

NOTES: (continued)

- 4. Publication IPC-7351 may have alternate designs.
- 5. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

EXAMPLE STENCIL DESIGN

DBV0005A

SOT-23 - 1.45 mm max height

SMALL OUTLINE TRANSISTOR



SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL
SCALE:15X

4214839/C 04/2017

NOTES: (continued)

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

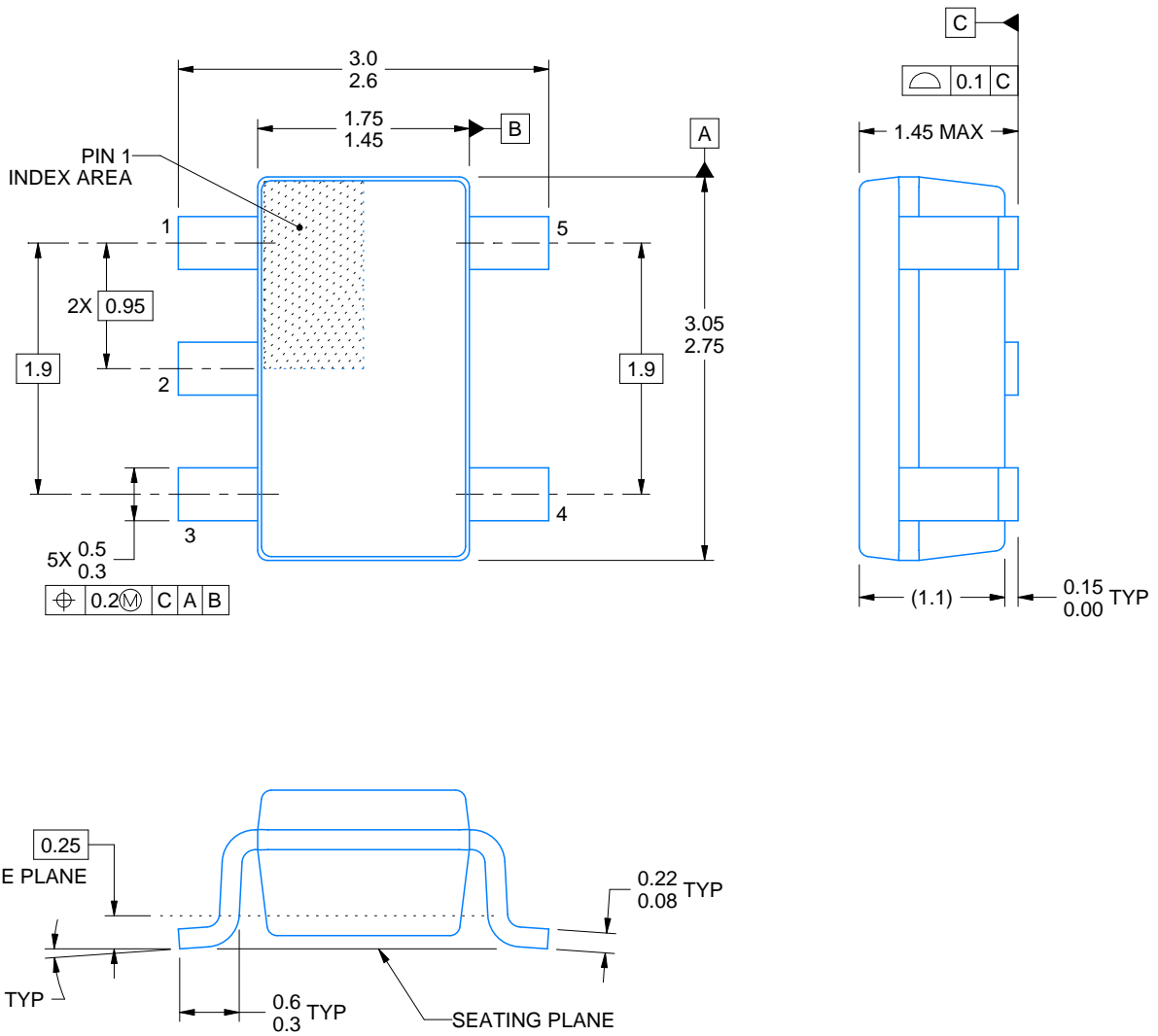
DBV0005A



PACKAGE OUTLINE

SOT-23 - 1.45 mm max height

SMALL OUTLINE TRANSISTOR



4214839/C 04/2017

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. Reference JEDEC MO-178.

EXAMPLE BOARD LAYOUT

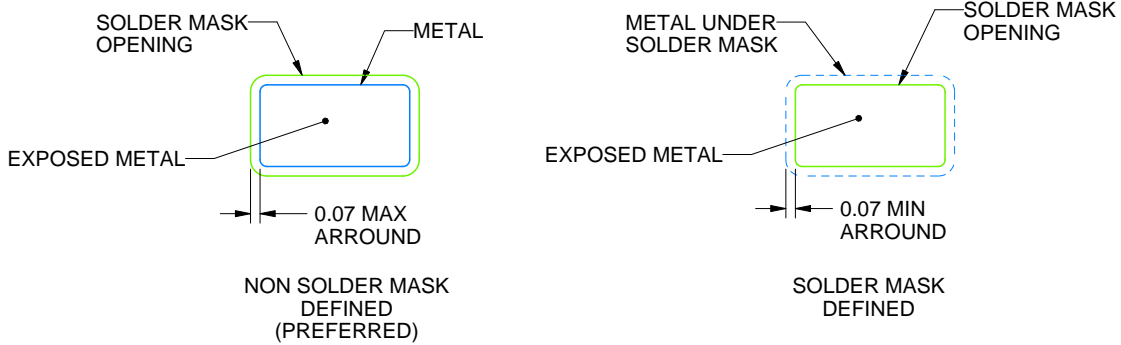
DBV0005A

SOT-23 - 1.45 mm max height

SMALL OUTLINE TRANSISTOR



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE:15X



SOLDER MASK DETAILS

4214839/C 04/2017

NOTES: (continued)

4. Publication IPC-7351 may have alternate designs.
5. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

EXAMPLE STENCIL DESIGN

DBV0005A

SOT-23 - 1.45 mm max height

SMALL OUTLINE TRANSISTOR

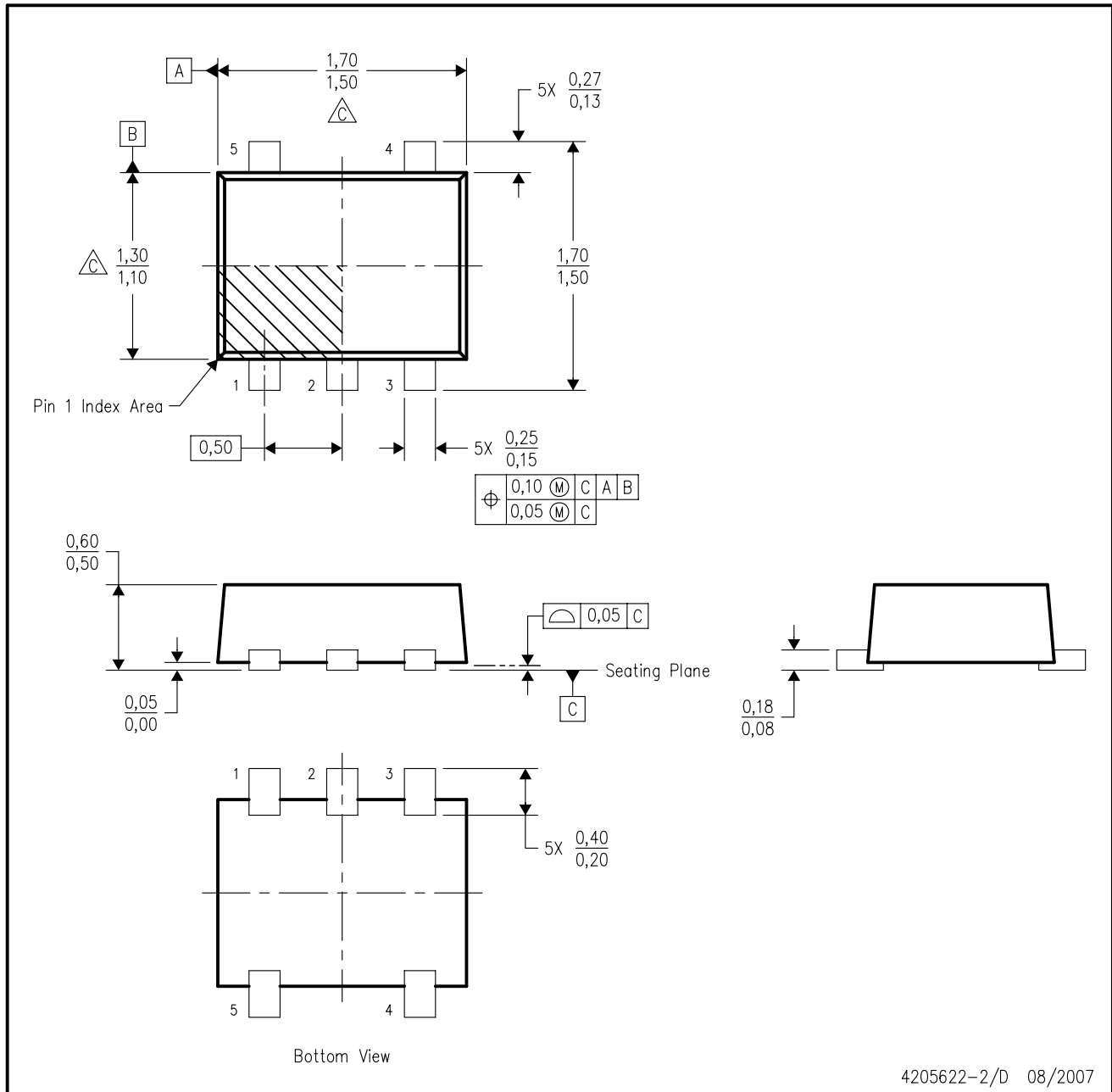


SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL
SCALE:15X

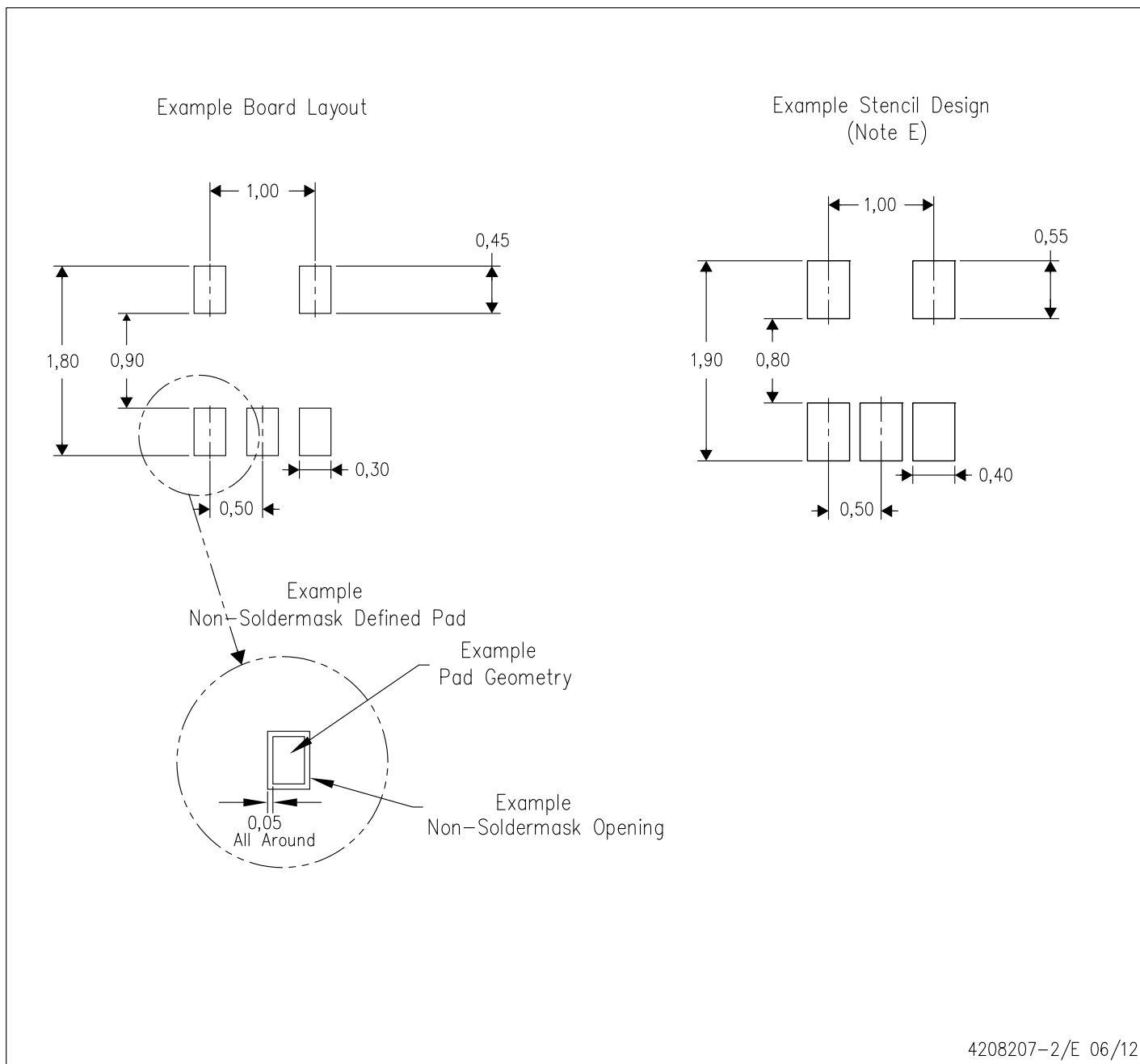
4214839/C 04/2017

NOTES: (continued)

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



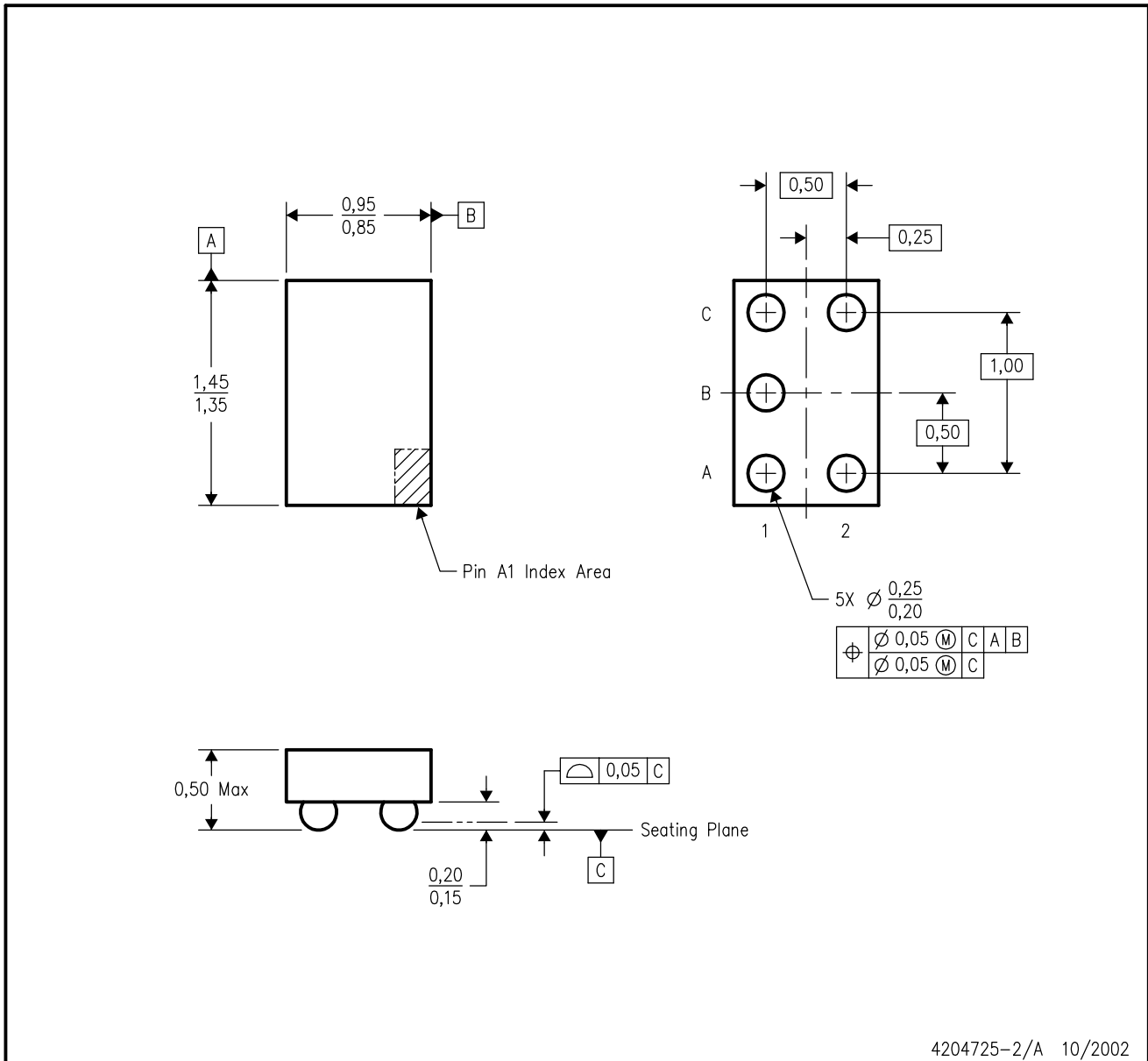
- NOTES:
- A. All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M-1994.
 - B. This drawing is subject to change without notice.
 - C. Body dimensions do not include mold flash, interlead flash, protrusions, or gate burrs. Mold flash, interlead flash, protrusions, or gate burrs shall not exceed 0,15 per end or side.
 - D. JEDEC package registration is pending.



- NOTES:
- A. All linear dimensions are in millimeters.
 - B. This drawing is subject to change without notice.
 - C. Publication IPC-7351 is recommended for alternate designs.
 - D. Customers should contact their board fabrication site for minimum solder mask web tolerances between signal pads.
 - E. Maximum stencil thickness 0,127 mm (5 mils). All linear dimensions are in millimeters.
 - F. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC 7525 for stencil design considerations.
 - G. Side aperture dimensions over-print land for acceptable area ratio > 0.66. Customer may reduce side aperture dimensions if stencil manufacturing process allows for sufficient release at smaller opening.

YEP (R-XBGA-N5)

DIE-SIZE BALL GRID ARRAY



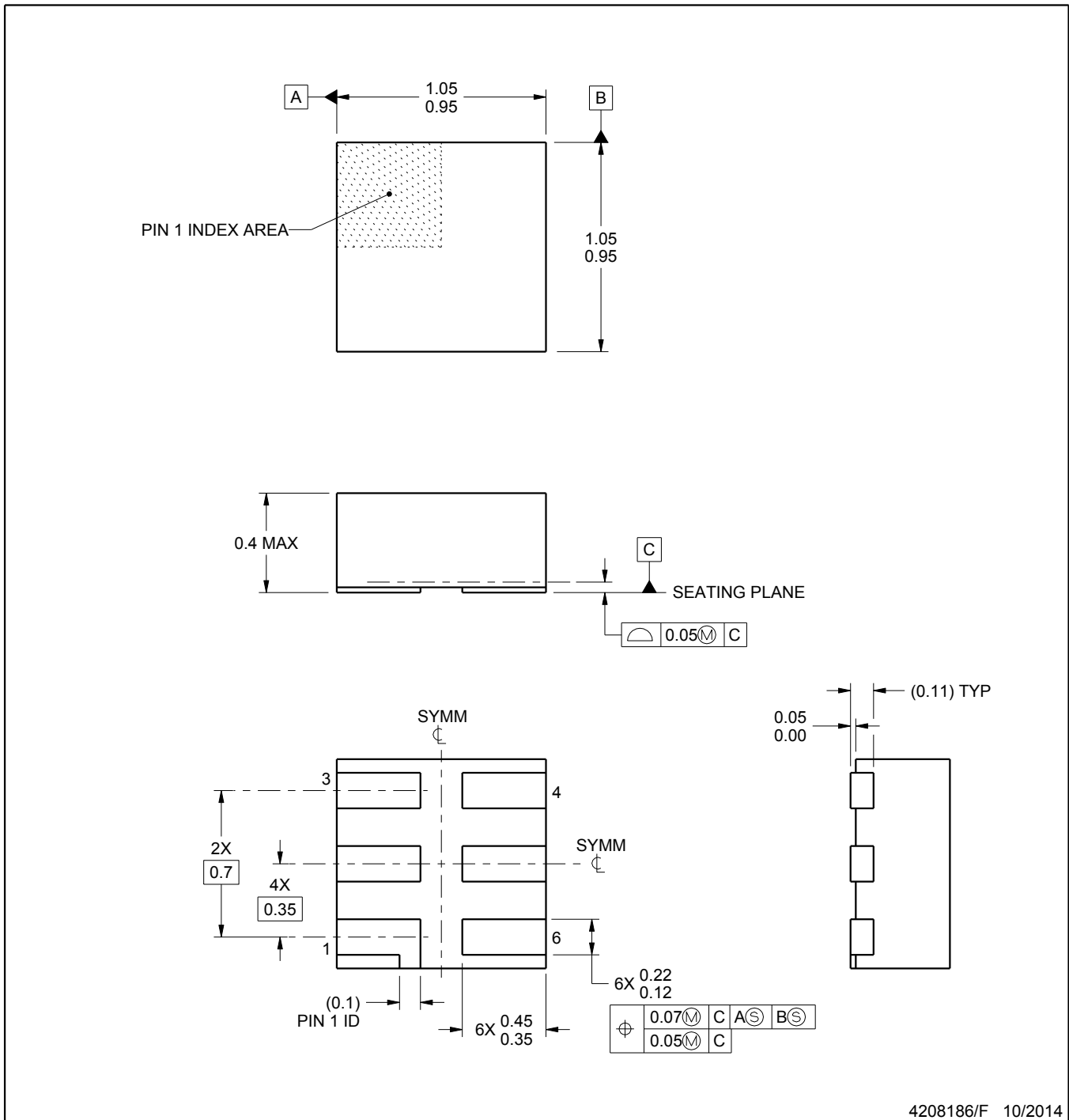
- NOTES:
- A. All linear dimensions are in millimeters.
 - B. This drawing is subject to change without notice.
 - C. NanoStar™ package configuration.
 - D. This package is tin-lead (SnPb). Refer to the 5 YZP package (drawing 4204741) for lead-free.

NanoStar is a trademark of Texas Instruments.

MECHANICAL DATA

DSF (S-PX2SON-N6)

PLASTIC SMALL OUTLINE NO-LEAD

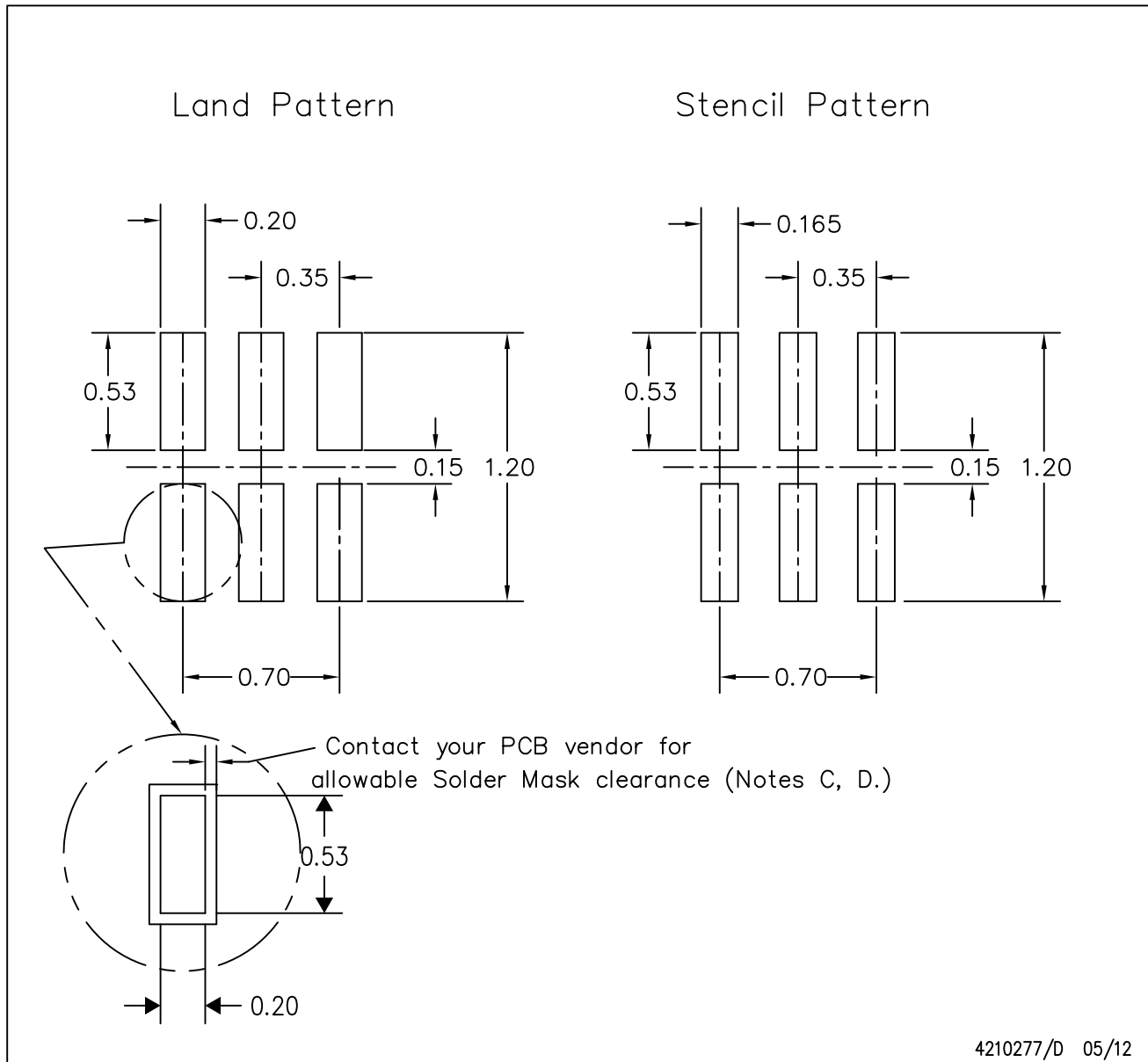


NOTES:

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. Reference JEDEC registration MO-287, variation X2AAF.

DSF (S-PX2SON-N6)

PLASTIC SMALL OUTLINE NO-LEAD



- NOTES:
- All linear dimensions are in millimeters.
 - This drawing is subject to change without notice.
 - Publication IPC-7351 is recommended for alternate designs.
 - Customers should contact their board fabrication site for minimum solder mask web tolerances between signal pads. If 2 mil solder mask is outside PCB vendor capability, it is advised to omit solder mask.
 - Maximum stencil thickness 0,1016 mm (4 mils). All linear dimensions are in millimeters.
 - Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC 7525 for stencil design considerations.
 - Suggest stencils cut with lasers such as Fiber Laser that produce the greatest positional accuracy.
 - Component placement force should be minimized to prevent excessive paste block deformation.

GENERIC PACKAGE VIEW

DPW 5

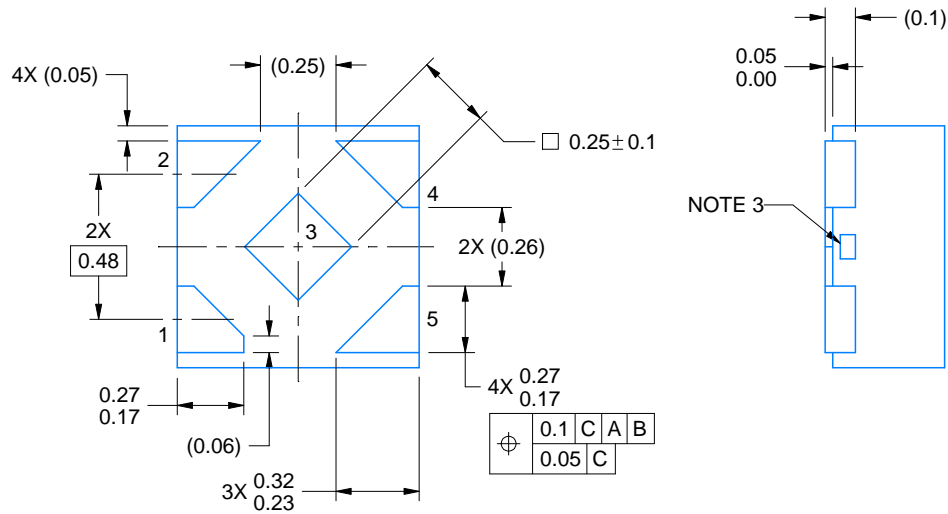
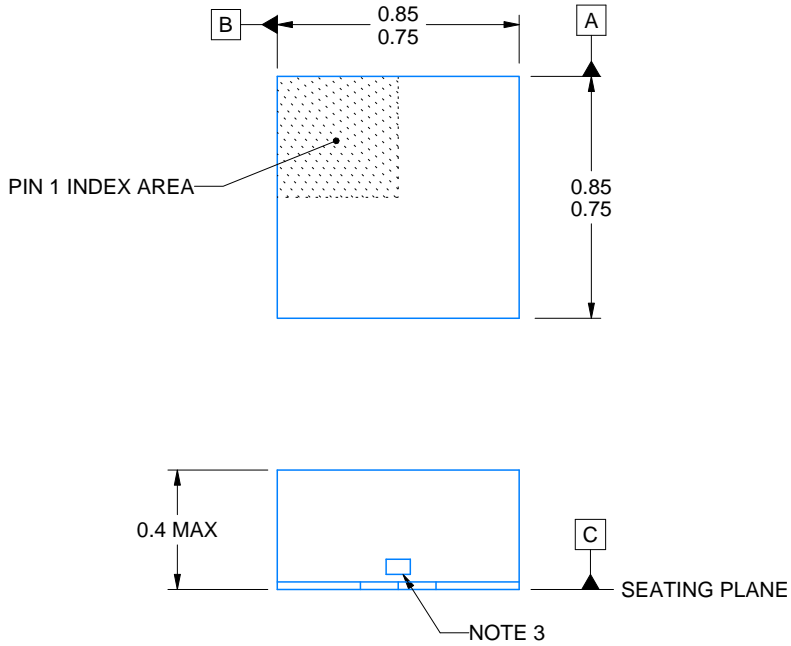
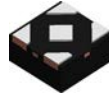
X2SON - 0.4 mm max height

PLASTIC SMALL OUTLINE - NO LEAD



Images above are just a representation of the package family, actual package may vary.
Refer to the product data sheet for package details.

4211218-3/D



4223102/B 09/2017

NOTES:

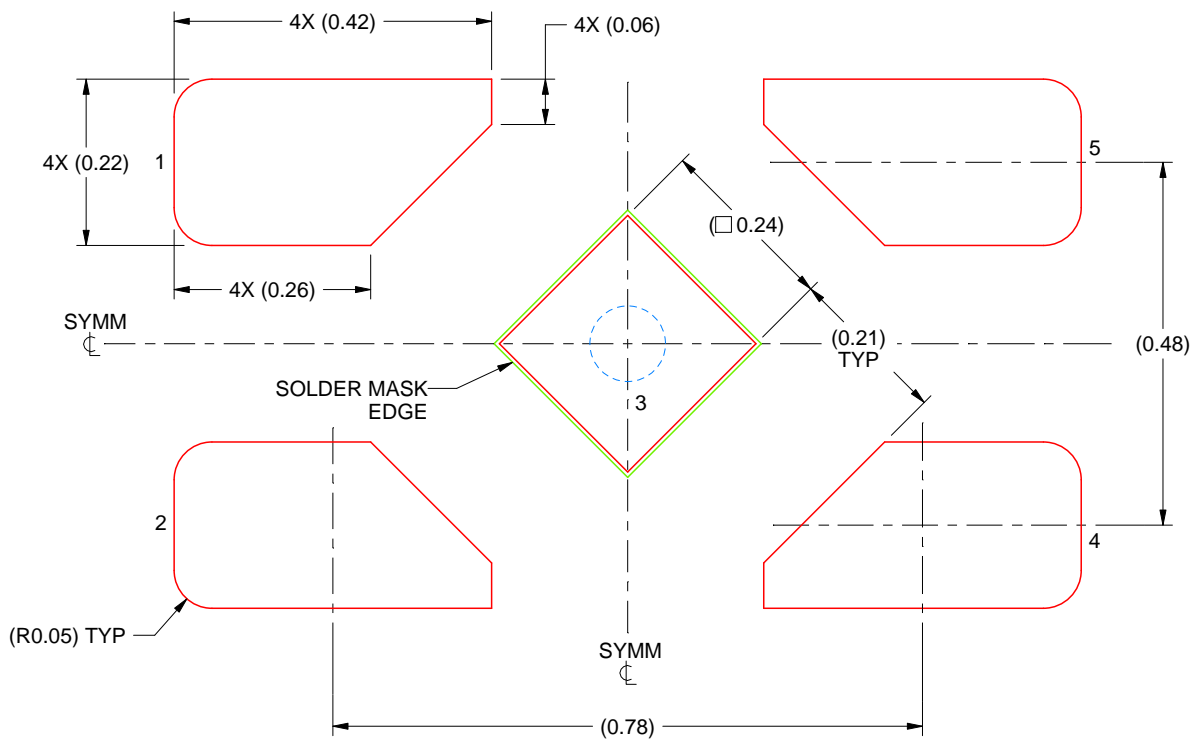
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. The size and shape of this feature may vary.

EXAMPLE STENCIL DESIGN

DPW0005A

X2SON - 0.4 mm max height

PLASTIC SMALL OUTLINE - NO LEAD



SOLDER PASTE EXAMPLE
BASED ON 0.1 mm THICK STENCIL

EXPOSED PAD
92% PRINTED SOLDER COVERAGE BY AREA
SCALE:100X

4223102/B 09/2017

NOTES: (continued)

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

EXAMPLE BOARD LAYOUT

YZP0005

DSBGA - 0.5 mm max height

DIE SIZE BALL GRID ARRAY



LAND PATTERN EXAMPLE
SCALE:40X



SOLDER MASK DETAILS
NOT TO SCALE

4219492/A 05/2017

NOTES: (continued)

3. Final dimensions may vary due to manufacturing tolerance considerations and also routing constraints. For more information, see Texas Instruments literature number SNVA009 (www.ti.com/lit/snva009).

EXAMPLE STENCIL DESIGN

YZP0005

DSBGA - 0.5 mm max height

DIE SIZE BALL GRID ARRAY



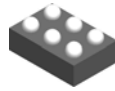
SOLDER PASTE EXAMPLE
BASED ON 0.1 mm THICK STENCIL
SCALE:40X

4219492/A 05/2017

NOTES: (continued)

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

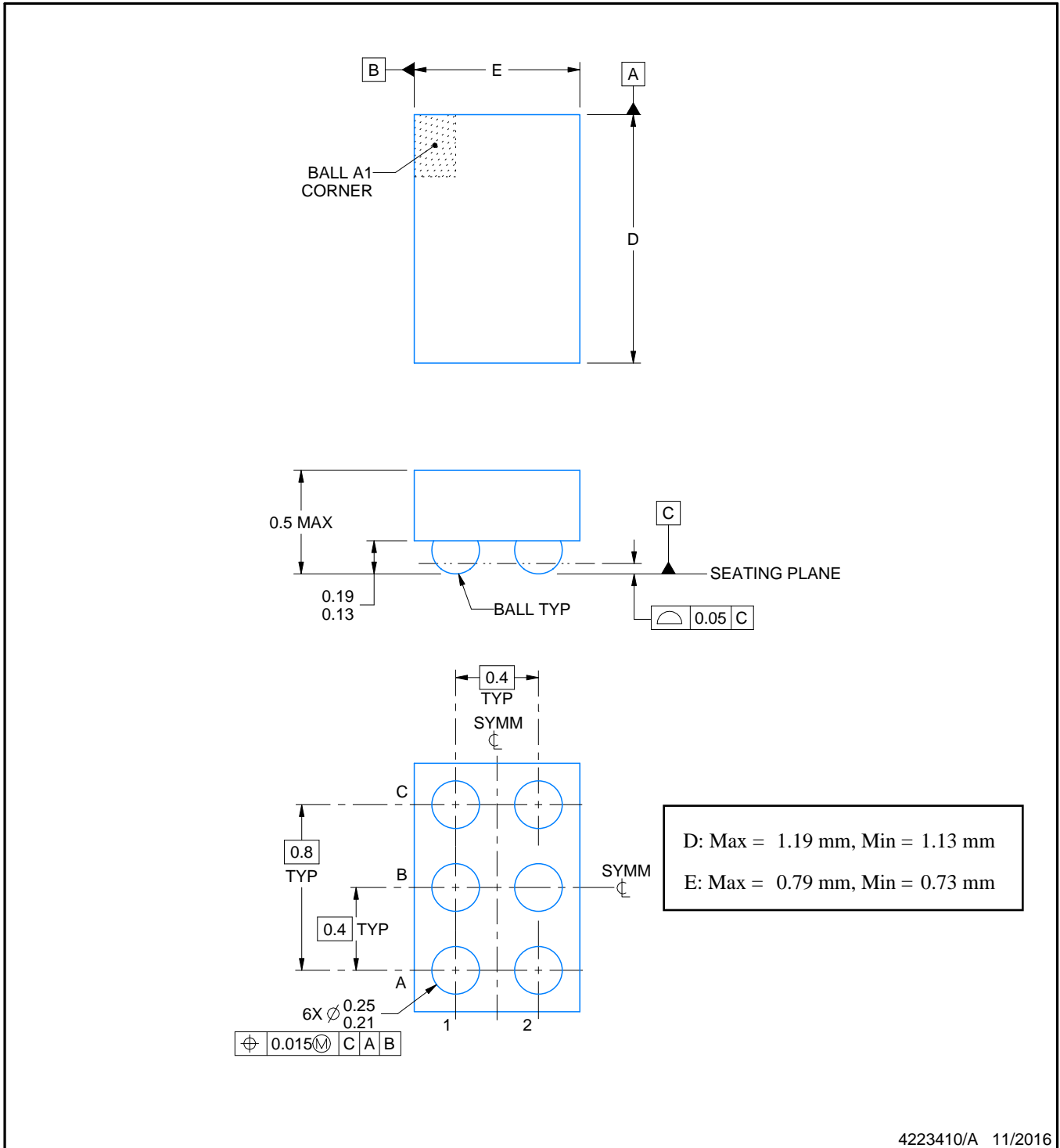
YFP0006



PACKAGE OUTLINE

DSBGA - 0.5 mm max height

DIE SIZE BALL GRID ARRAY



4223410/A 11/2016

NOTES:

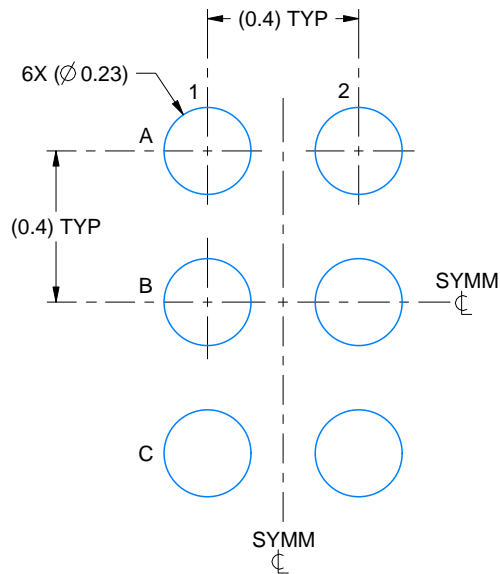
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.

EXAMPLE BOARD LAYOUT

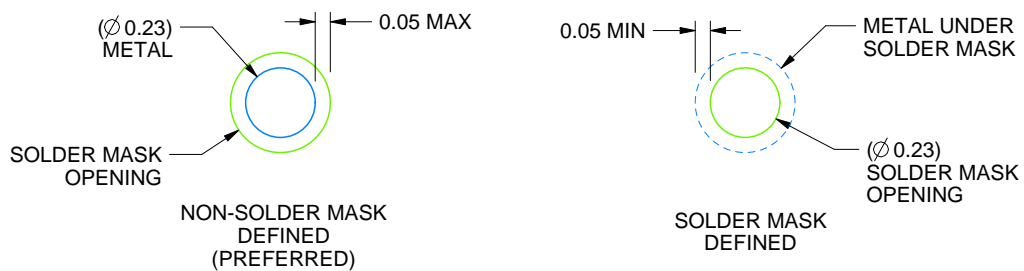
YFP0006

DSBGA - 0.5 mm max height

DIE SIZE BALL GRID ARRAY



LAND PATTERN EXAMPLE
SCALE:50X



SOLDER MASK DETAILS
NOT TO SCALE

4223410/A 11/2016

NOTES: (continued)

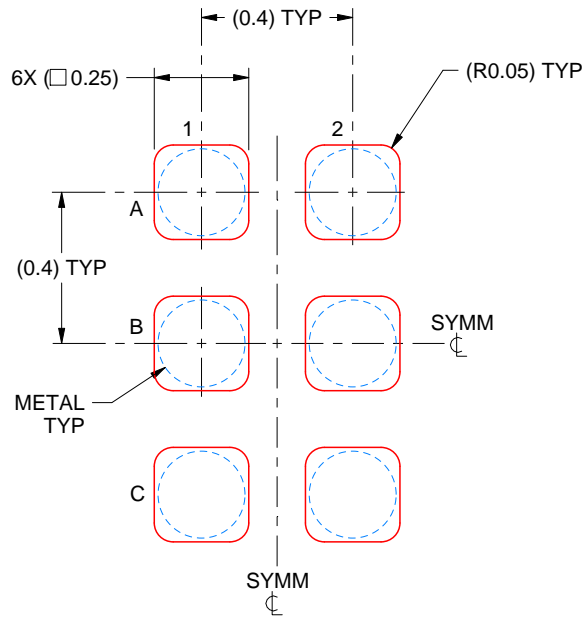
- Final dimensions may vary due to manufacturing tolerance considerations and also routing constraints. For more information, see Texas Instruments literature number SNVA009 (www.ti.com/lit/snva009).

EXAMPLE STENCIL DESIGN

YFP0006

DSBGA - 0.5 mm max height

DIE SIZE BALL GRID ARRAY



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

4223410/A 11/2016

NOTES: (continued)

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

IMPORTANT NOTICE

Texas Instruments Incorporated (TI) reserves the right to make corrections, enhancements, improvements and other changes to its semiconductor products and services per JESD46, latest issue, and to discontinue any product or service per JESD48, latest issue. Buyers should obtain the latest relevant information before placing orders and should verify that such information is current and complete.

TI's published terms of sale for semiconductor products (<http://www.ti.com/sc/docs/stdterms.htm>) apply to the sale of packaged integrated circuit products that TI has qualified and released to market. Additional terms may apply to the use or sale of other types of TI products and services.

Reproduction of significant portions of TI information in TI data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. TI is not responsible or liable for such reproduced documentation. Information of third parties may be subject to additional restrictions. Resale of TI products or services with statements different from or beyond the parameters stated by TI for that product or service voids all express and any implied warranties for the associated TI product or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

Buyers and others who are developing systems that incorporate TI products (collectively, "Designers") understand and agree that Designers remain responsible for using their independent analysis, evaluation and judgment in designing their applications and that Designers have full and exclusive responsibility to assure the safety of Designers' applications and compliance of their applications (and of all TI products used in or for Designers' applications) with all applicable regulations, laws and other applicable requirements. Designer represents that, with respect to their applications, Designer has all the necessary expertise to create and implement safeguards that (1) anticipate dangerous consequences of failures, (2) monitor failures and their consequences, and (3) lessen the likelihood of failures that might cause harm and take appropriate actions. Designer agrees that prior to using or distributing any applications that include TI products, Designer will thoroughly test such applications and the functionality of such TI products as used in such applications.

TI's provision of technical, application or other design advice, quality characterization, reliability data or other services or information, including, but not limited to, reference designs and materials relating to evaluation modules, (collectively, "TI Resources") are intended to assist designers who are developing applications that incorporate TI products; by downloading, accessing or using TI Resources in any way, Designer (individually or, if Designer is acting on behalf of a company, Designer's company) agrees to use any particular TI Resource solely for this purpose and subject to the terms of this Notice.

TI's provision of TI Resources does not expand or otherwise alter TI's applicable published warranties or warranty disclaimers for TI products, and no additional obligations or liabilities arise from TI providing such TI Resources. TI reserves the right to make corrections, enhancements, improvements and other changes to its TI Resources. TI has not conducted any testing other than that specifically described in the published documentation for a particular TI Resource.

Designer is authorized to use, copy and modify any individual TI Resource only in connection with the development of applications that include the TI product(s) identified in such TI Resource. NO OTHER LICENSE, EXPRESS OR IMPLIED, BY ESTOPPEL OR OTHERWISE TO ANY OTHER TI INTELLECTUAL PROPERTY RIGHT, AND NO LICENSE TO ANY TECHNOLOGY OR INTELLECTUAL PROPERTY RIGHT OF TI OR ANY THIRD PARTY IS GRANTED HEREIN, including but not limited to any patent right, copyright, mask work right, or other intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information regarding or referencing third-party products or services does not constitute a license to use such products or services, or a warranty or endorsement thereof. Use of TI Resources may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

TI RESOURCES ARE PROVIDED "AS IS" AND WITH ALL FAULTS. TI DISCLAIMS ALL OTHER WARRANTIES OR REPRESENTATIONS, EXPRESS OR IMPLIED, REGARDING RESOURCES OR USE THEREOF, INCLUDING BUT NOT LIMITED TO ACCURACY OR COMPLETENESS, TITLE, ANY EPIDEMIC FAILURE WARRANTY AND ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, AND NON-INFRINGEMENT OF ANY THIRD PARTY INTELLECTUAL PROPERTY RIGHTS. TI SHALL NOT BE LIABLE FOR AND SHALL NOT DEFEND OR INDEMNIFY DESIGNER AGAINST ANY CLAIM, INCLUDING BUT NOT LIMITED TO ANY INFRINGEMENT CLAIM THAT RELATES TO OR IS BASED ON ANY COMBINATION OF PRODUCTS EVEN IF DESCRIBED IN TI RESOURCES OR OTHERWISE. IN NO EVENT SHALL TI BE LIABLE FOR ANY ACTUAL, DIRECT, SPECIAL, COLLATERAL, INDIRECT, PUNITIVE, INCIDENTAL, CONSEQUENTIAL OR EXEMPLARY DAMAGES IN CONNECTION WITH OR ARISING OUT OF TI RESOURCES OR USE THEREOF, AND REGARDLESS OF WHETHER TI HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.

Unless TI has explicitly designated an individual product as meeting the requirements of a particular industry standard (e.g., ISO/TS 16949 and ISO 26262), TI is not responsible for any failure to meet such industry standard requirements.

Where TI specifically promotes products as facilitating functional safety or as compliant with industry functional safety standards, such products are intended to help enable customers to design and create their own applications that meet applicable functional safety standards and requirements. Using products in an application does not by itself establish any safety features in the application. Designers must ensure compliance with safety-related requirements and standards applicable to their applications. Designer may not use any TI products in life-critical medical equipment unless authorized officers of the parties have executed a special contract specifically governing such use. Life-critical medical equipment is medical equipment where failure of such equipment would cause serious bodily injury or death (e.g., life support, pacemakers, defibrillators, heart pumps, neurostimulators, and implantables). Such equipment includes, without limitation, all medical devices identified by the U.S. Food and Drug Administration as Class III devices and equivalent classifications outside the U.S.

TI may expressly designate certain products as completing a particular qualification (e.g., Q100, Military Grade, or Enhanced Product). Designers agree that it has the necessary expertise to select the product with the appropriate qualification designation for their applications and that proper product selection is at Designers' own risk. Designers are solely responsible for compliance with all legal and regulatory requirements in connection with such selection.

Designer will fully indemnify TI and its representatives against any damages, costs, losses, and/or liabilities arising out of Designer's non-compliance with the terms and provisions of this Notice.