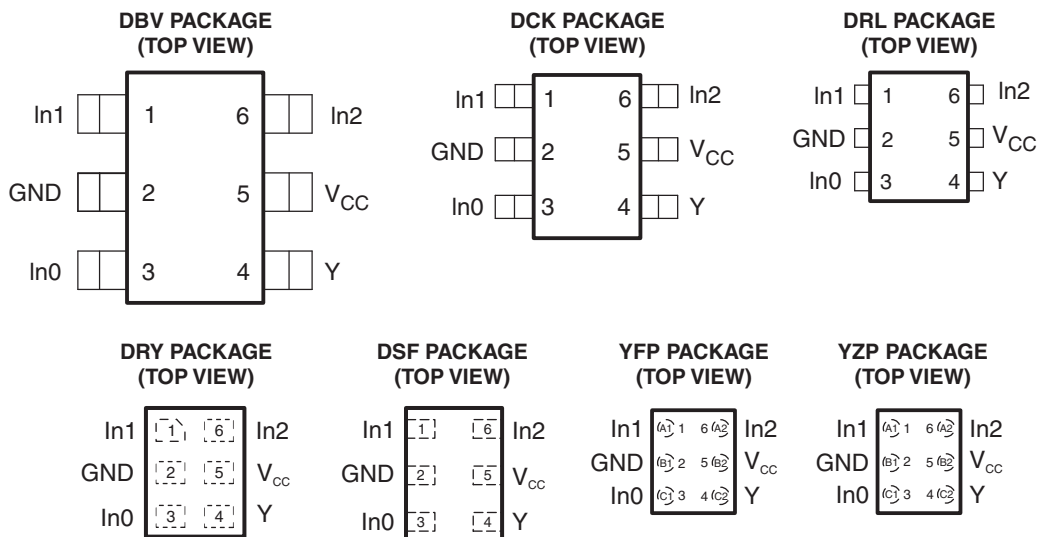


## LOW-POWER CONFIGURABLE MULTIPLE-FUNCTION GATE

Check for Samples: [SN74AUP1G58](#)

### FEATURES

- Available in the Texas Instruments NanoStar™ Packages
- Low Static-Power Consumption ( $I_{CC} = 0.9 \mu A$  Max)
- Low Dynamic-Power Consumption ( $C_{pd} = 4.6$  pF Typ at 3.3 V)
- Low Input Capacitance ( $C_i = 1.5$  pF Typ)
- Low Noise – Overshoot and Undershoot <10% of  $V_{CC}$
- $I_{off}$  Supports Partial-Power-Down Mode Operation
- Includes Schmitt-Trigger Inputs
- 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
- $t_{pd} = 5.5$  ns Max 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 an increased battery life. This product also maintains excellent signal integrity, which produces very low undershoot and overshoot characteristics.

The SN74AUP1G58 features configurable multiple functions. The output state is determined by eight patterns of 3-bit input. The user can choose the logic functions AND, OR, NAND, NOR, XNOR, inverter, and noninverter. All inputs can be connected to  $V_{CC}$  or GND.

The device functions as an independent gate with Schmitt-trigger inputs, which allow for slow input transition and better switching noise immunity at the input.



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™ 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>

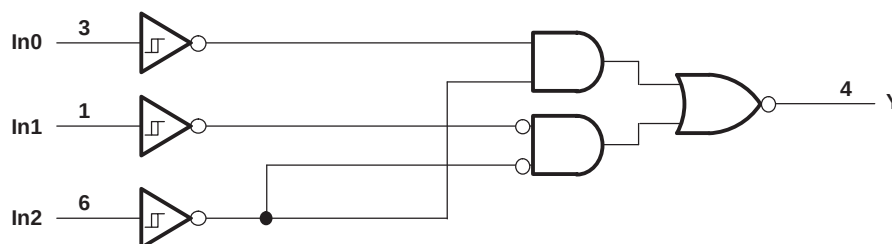
| $T_A$         | PACKAGE <sup>(2)</sup>                                         |              | ORDERABLE PART NUMBER | TOP-SIDE MARKING <sup>(3)</sup> |
|---------------|----------------------------------------------------------------|--------------|-----------------------|---------------------------------|
| –40°C to 85°C | NanoStar™ – WCSP (DSBGA)<br>0.23-mm Large Bump – YFP (Pb-free) | Reel of 3000 | SN74AUP1G58YFPR       | _ _ _HJ_                        |
|               | NanoStar™ – WCSP (DSBGA)<br>0.23-mm Large Bump – YZP (Pb-free) | Reel of 3000 | SN74AUP1G58YZPR       | _ _ _HJ_                        |
|               | QFN – DRY                                                      | Reel of 5000 | SN74AUP1G58DRYR       | HJ                              |
|               | uQFN – DSF                                                     | Reel of 5000 | SN74AUP1G58DSFR       | HJ                              |
|               | SOT (SOT-23) – DBV                                             | Reel of 3000 | SN74AUP1G58DBVR       | H58_                            |
|               | SOT (SC-70) – DCK                                              | Reel of 3000 | SN74AUP1G58DCKR       | HJ_                             |
|               | SOT (SOT-553) – DRL                                            | Reel of 4000 | SN74AUP1G58DRLR       | HJ_                             |

- (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) DBV/DCK/DRL: The actual top-side marking has one additional character that designates the wafer fab/assembly site.  
YFP/YZP: 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

| INPUTS |     |     | OUTPUT<br>Y |
|--------|-----|-----|-------------|
| In2    | In1 | In0 |             |
| L      | L   | L   | L           |
| L      | L   | H   | H           |
| L      | H   | L   | L           |
| L      | H   | H   | H           |
| H      | L   | L   | H           |
| H      | L   | H   | H           |
| H      | H   | L   | L           |
| H      | H   | H   | L           |

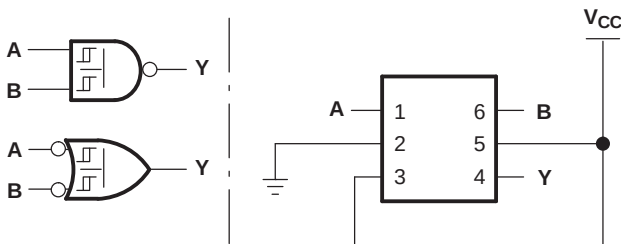
### LOGIC DIAGRAM (POSITIVE LOGIC)



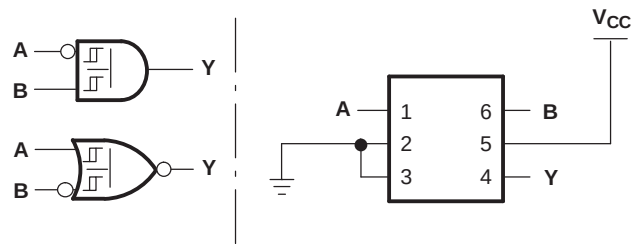
### FUNCTION SELECTION TABLE

| LOGIC FUNCTION                         | FIGURE NO. |
|----------------------------------------|------------|
| 2-input AND with inverted input        | 2, 3       |
| 2-input NAND                           | 1          |
| 2-input NAND with both inputs inverted | 4          |
| 2-input OR                             | 4          |
| 2-input OR with both inputs inverted   | 1          |
| 2-input NOR with inverted input        | 2, 3       |
| 2-input XOR                            | 5          |

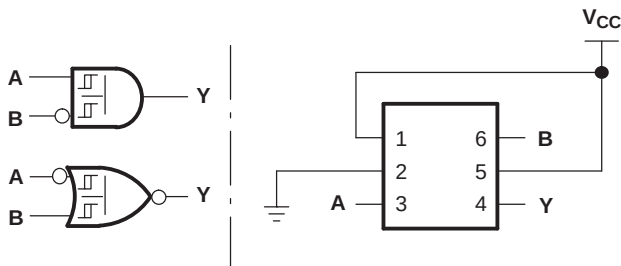
### LOGIC CONFIGURATIONS



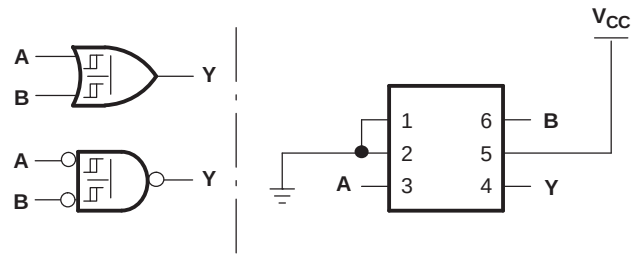
**Figure 1. 2-Input NAND Gate**



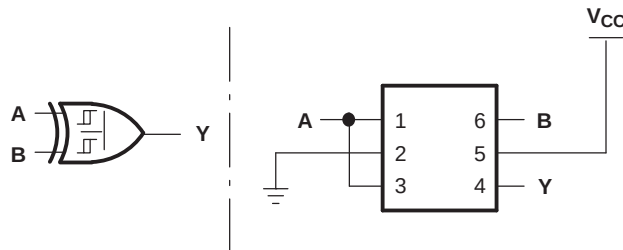
**Figure 2. 2-Input AND Gate With Inverted A Input**



**Figure 3. 2-Input AND Gate With Inverted B Input**



**Figure 4. 2-Input OR Gate**



**Figure 5. 2-Input XOR Gate**

**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                                                                         | $V_I < 0$       |      | –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   |
| $\theta_{JA}$ | Package thermal impedance <sup>(3)</sup>                                                    | DBV package     |      | 165            | °C/W |
|               |                                                                                             | DCK package     |      | 259            |      |
|               |                                                                                             | DRL package     |      | 142            |      |
|               |                                                                                             | DSF package     |      | 300            |      |
|               |                                                                                             | DRY package     |      | 234            |      |
|               |                                                                                             | YFP/YZP package |      | 123            |      |
| $T_{stg}$     | 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      | μA   |
|          |                                | $V_{CC} = 1.1\text{ V}$  |     | –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       | μA   |
|          |                                | $V_{CC} = 1.1\text{ V}$  |     | 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       | °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)

| PARMETER                                                               |                                         | 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  |      |
| V <sub>T+</sub><br><br>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><br><br>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><br><br>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                | 0.8 V to 3.6 V                                                                  | V <sub>CC</sub> – 0.1  |                       | V <sub>CC</sub> – 0.1 |                                | V    |      |
|                                                                        | I <sub>OH</sub> = –1.1 mA               | 1.1 V                                                                           | 0.75 × V <sub>CC</sub> |                       | 0.7 × V <sub>CC</sub> |                                |      |      |
|                                                                        | I <sub>OH</sub> = –1.7 mA               | 1.4 V                                                                           | 1.11                   |                       | 1.03                  |                                |      |      |
|                                                                        | I <sub>OH</sub> = –1.9 mA               | 1.65 V                                                                          | 1.32                   |                       | 1.3                   |                                |      |      |
|                                                                        | I <sub>OH</sub> = –2.3 mA               | 2.3 V                                                                           | 2.05                   |                       | 1.97                  |                                |      |      |
|                                                                        | I <sub>OH</sub> = –3.1 mA               |                                                                                 | 1.9                    |                       | 1.85                  |                                |      |      |
|                                                                        | I <sub>OH</sub> = –2.7 mA               | 3 V                                                                             | 2.72                   |                       | 2.67                  |                                |      |      |
|                                                                        | I <sub>OH</sub> = –4 mA                 |                                                                                 | 2.6                    |                       | 2.55                  |                                |      |      |
| V <sub>OL</sub>                                                        | I <sub>OL</sub> = 20 μA                 | 0.8 V to 3.6 V                                                                  | 0.1                    |                       | 0.1                   |                                | V    |      |
|                                                                        | I <sub>OL</sub> = 1.1 mA                | 1.1 V                                                                           | 0.3 × V <sub>CC</sub>  |                       | 0.3 × V <sub>CC</sub> |                                |      |      |
|                                                                        | I <sub>OL</sub> = 1.7 mA                | 1.4 V                                                                           | 0.31                   |                       | 0.37                  |                                |      |      |
|                                                                        | I <sub>OL</sub> = 1.9 mA                | 1.65 V                                                                          | 0.31                   |                       | 0.35                  |                                |      |      |
|                                                                        | I <sub>OL</sub> = 2.3 mA                | 2.3 V                                                                           | 0.31                   |                       | 0.33                  |                                |      |      |
|                                                                        | I <sub>OL</sub> = 3.1 mA                |                                                                                 | 0.44                   |                       | 0.45                  |                                |      |      |
|                                                                        | I <sub>OL</sub> = 2.7 mA                | 3 V                                                                             | 0.31                   |                       | 0.33                  |                                |      |      |
|                                                                        | I <sub>OL</sub> = 4 mA                  |                                                                                 | 0.44                   |                       | 0.45                  |                                |      |      |
| I <sub>I</sub>                                                         | All inputs                              | 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),<br>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> ,<br>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 inputs 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 6](#) and [Figure 7](#))

| PARAMETER | FROM<br>(INPUT)  | TO<br>(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  |      |
| $t_{pd}$  | In0, In1, or In2 | Y              | 0.8 V                            |                          | 23.6 |      |                                                |      | ns   |
|           |                  |                | $1.2\text{ V} \pm 0.1\text{ V}$  | 2.8                      | 9.4  | 13.8 | 2.3                                            | 17.4 |      |
|           |                  |                | $1.5\text{ V} \pm 0.1\text{ V}$  | 2.1                      | 6.5  | 9.2  | 1.6                                            | 11.3 |      |
|           |                  |                | $1.8\text{ V} \pm 0.15\text{ V}$ | 1.5                      | 5.4  | 7.4  | 1                                              | 9    |      |
|           |                  |                | $2.5\text{ V} \pm 0.2\text{ V}$  | 1.1                      | 4    | 5.6  | 0.6                                            | 6.6  |      |
|           |                  |                | $3.3\text{ V} \pm 0.3\text{ V}$  | 1                        | 3.2  | 4.6  | 0.5                                            | 5.5  |      |

## SWITCHING CHARACTERISTICS

over recommended operating free-air temperature range,  $C_L = 10$  pF (unless otherwise noted) (see [Figure 6](#) and [Figure 7](#))

| PARAMETER | FROM<br>(INPUT)  | TO<br>(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  |      |
| $t_{pd}$  | In0, In1, or In2 | Y              | 0.8 V                            |                          | 26.4 |      |                                                |      | ns   |
|           |                  |                | $1.2\text{ V} \pm 0.1\text{ V}$  | 3.2                      | 10.7 | 15.2 | 2.7                                            | 19   |      |
|           |                  |                | $1.5\text{ V} \pm 0.1\text{ V}$  | 2                        | 7.5  | 10.5 | 1.5                                            | 12.5 |      |
|           |                  |                | $1.8\text{ V} \pm 0.15\text{ V}$ | 1.1                      | 6.2  | 8.4  | 0.6                                            | 10.2 |      |
|           |                  |                | $2.5\text{ V} \pm 0.2\text{ V}$  | 1                        | 4.6  | 6.4  | 0.5                                            | 7.6  |      |
|           |                  |                | $3.3\text{ V} \pm 0.3\text{ V}$  | 1                        | 3.7  | 5.3  | 0.5                                            | 6.3  |      |

## SWITCHING CHARACTERISTICS

over recommended operating free-air temperature range,  $C_L = 15$  pF (unless otherwise noted) (see [Figure 6](#) and [Figure 7](#))

| PARAMETER | FROM<br>(INPUT)  | TO<br>(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  |      |
| $t_{pd}$  | In0, In1, or In2 | Y              | 0.8 V                            |                          | 29.6 |      |                                                |      | ns   |
|           |                  |                | $1.2\text{ V} \pm 0.1\text{ V}$  | 3.8                      | 11.8 | 16.8 | 3.3                                            | 21.1 |      |
|           |                  |                | $1.5\text{ V} \pm 0.1\text{ V}$  | 2.9                      | 8.3  | 11.6 | 2.4                                            | 13.8 |      |
|           |                  |                | $1.8\text{ V} \pm 0.15\text{ V}$ | 2.2                      | 6.8  | 9.3  | 1.7                                            | 11.3 |      |
|           |                  |                | $2.5\text{ V} \pm 0.2\text{ V}$  | 1.7                      | 5.1  | 7    | 1.2                                            | 8.4  |      |
|           |                  |                | $3.3\text{ V} \pm 0.3\text{ V}$  | 1.4                      | 4.2  | 5.9  | 0.9                                            | 7    |      |

## SWITCHING CHARACTERISTICS

over recommended operating free-air temperature range,  $C_L = 30$  pF (unless otherwise noted) (see [Figure 6](#) and [Figure 7](#))

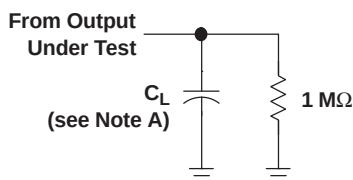
| PARAMETER | FROM<br>(INPUT)  | TO<br>(OUTPUT) | $V_{CC}$                         | $T_A = 25^\circ\text{C}$ |      |      | $T_A = -40^\circ\text{C to } 85^\circ\text{C}$ |      | UNIT |
|-----------|------------------|----------------|----------------------------------|--------------------------|------|------|------------------------------------------------|------|------|
|           |                  |                |                                  | MIN                      | TYP  | MAX  | MIN                                            | MAX  |      |
| $t_{pd}$  | In0, In1, or In2 | Y              | 0.8 V                            |                          | 38.1 |      |                                                |      | ns   |
|           |                  |                | $1.2\text{ V} \pm 0.1\text{ V}$  | 5.1                      | 15   | 21.4 | 4.6                                            | 26.6 |      |
|           |                  |                | $1.5\text{ V} \pm 0.1\text{ V}$  | 4                        | 10.6 | 14.6 | 3.5                                            | 17.4 |      |
|           |                  |                | $1.8\text{ V} \pm 0.15\text{ V}$ | 3.2                      | 8.7  | 11.7 | 2.7                                            | 14.2 |      |
|           |                  |                | $2.5\text{ V} \pm 0.2\text{ V}$  | 2.5                      | 6.5  | 8.7  | 2                                              | 10.5 |      |
|           |                  |                | $3.3\text{ V} \pm 0.3\text{ V}$  | 2.1                      | 5.4  | 7.3  | 1.6                                            | 8.7  |      |

## OPERATING CHARACTERISTICS

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

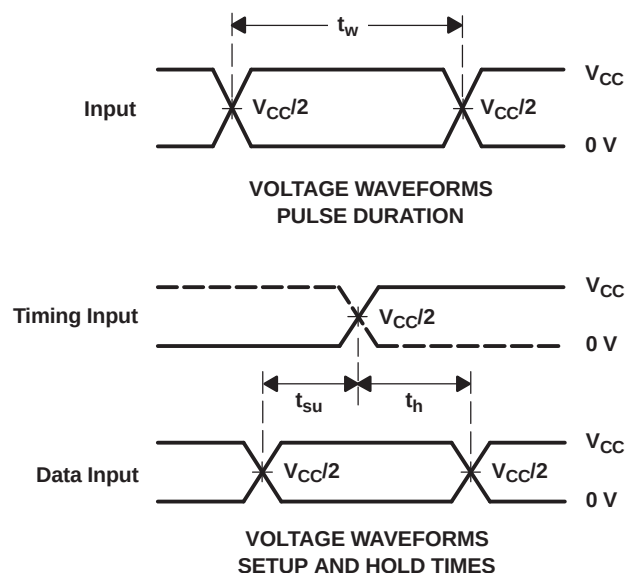
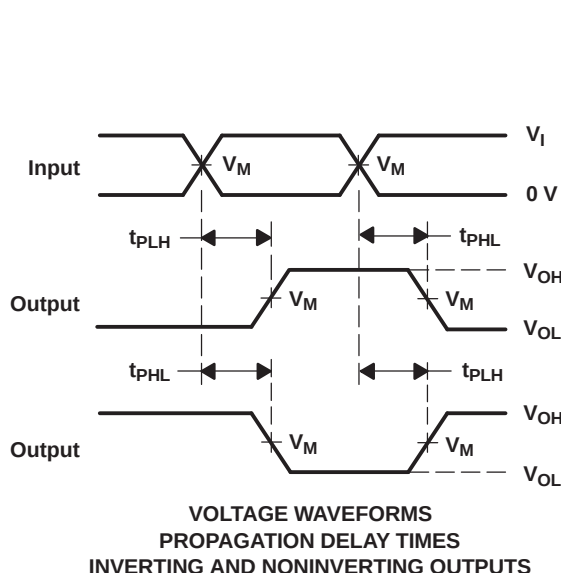
| PARAMETER |                               | TEST CONDITIONS     | $V_{CC}$                         | TYP | UNIT |
|-----------|-------------------------------|---------------------|----------------------------------|-----|------|
| $C_{pd}$  | Power dissipation capacitance | $f = 10\text{ MHz}$ | 0.8 V                            | 4   | pF   |
|           |                               |                     | $1.2\text{ V} \pm 0.1\text{ V}$  | 4   |      |
|           |                               |                     | $1.5\text{ V} \pm 0.1\text{ V}$  | 4   |      |
|           |                               |                     | $1.8\text{ V} \pm 0.15\text{ V}$ | 4   |      |
|           |                               |                     | $2.5\text{ V} \pm 0.2\text{ V}$  | 4.3 |      |
|           |                               |                     | $3.3\text{ V} \pm 0.3\text{ V}$  | 4.6 |      |

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



LOAD CIRCUIT

|       | $V_{CC} = 0.8 \text{ V}$ | $V_{CC} = 1.2 \text{ V}$<br>$\pm 0.1 \text{ V}$ | $V_{CC} = 1.5 \text{ V}$<br>$\pm 0.1 \text{ V}$ | $V_{CC} = 1.8 \text{ V}$<br>$\pm 0.15 \text{ V}$ | $V_{CC} = 2.5 \text{ V}$<br>$\pm 0.2 \text{ V}$ | $V_{CC} = 3.3 \text{ V}$<br>$\pm 0.3 \text{ V}$ |
|-------|--------------------------|-------------------------------------------------|-------------------------------------------------|--------------------------------------------------|-------------------------------------------------|-------------------------------------------------|
| $C_L$ | 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                                |
| $V_M$ | $V_{CC}/2$               | $V_{CC}/2$                                      | $V_{CC}/2$                                      | $V_{CC}/2$                                       | $V_{CC}/2$                                      | $V_{CC}/2$                                      |
| $V_I$ | $V_{CC}$                 | $V_{CC}$                                        | $V_{CC}$                                        | $V_{CC}$                                         | $V_{CC}$                                        | $V_{CC}$                                        |

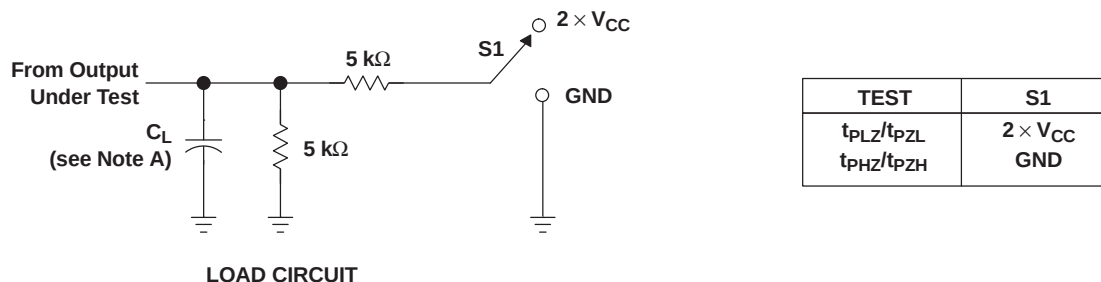


- NOTES: A.  $C_L$  includes probe and jig capacitance.  
 B. All input pulses are supplied by generators having the following characteristics: PRR  $\leq 10$  MHz,  $Z_O = 50 \Omega$ , slew rate  $\geq 1$  V/ns.  
 C. The outputs are measured one at a time, with one transition per measurement.  
 D.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

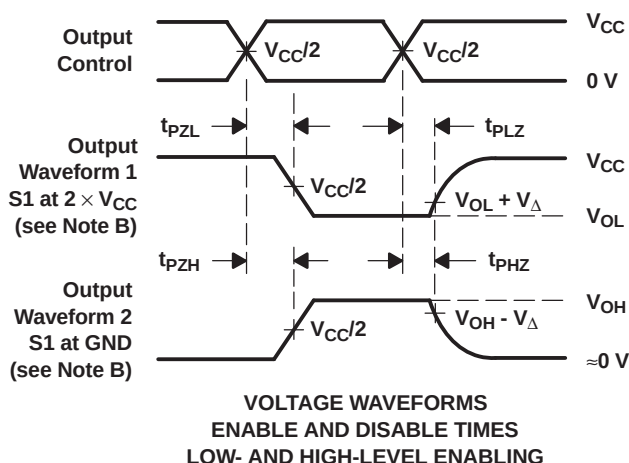
Figure 6. Load Circuit and Voltage Waveforms



## PARAMETER MEASUREMENT INFORMATION (Enable and Disable Times)



|              | $V_{CC} = 0.8 \text{ V}$ | $V_{CC} = 1.2 \text{ V}$<br>$\pm 0.1 \text{ V}$ | $V_{CC} = 1.5 \text{ V}$<br>$\pm 0.1 \text{ V}$ | $V_{CC} = 1.8 \text{ V}$<br>$\pm 0.15 \text{ V}$ | $V_{CC} = 2.5 \text{ V}$<br>$\pm 0.2 \text{ V}$ | $V_{CC} = 3.3 \text{ V}$<br>$\pm 0.3 \text{ V}$ |
|--------------|--------------------------|-------------------------------------------------|-------------------------------------------------|--------------------------------------------------|-------------------------------------------------|-------------------------------------------------|
| $C_L$        | 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                                           |



- NOTES:
- $C_L$  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  $\leq 10 \text{ MHz}$ ,  $Z_O = 50 \Omega$ , slew rate  $\geq 1 \text{ V/ns}$ .
  - The outputs are measured one at a time, with one transition per measurement.
  - $t_{PLZ}$  and  $t_{PHZ}$  are the same as  $t_{dis}$ .
  - $t_{PZL}$  and  $t_{PZH}$  are the same as  $t_{en}$ .
  - All parameters and waveforms are not applicable to all devices.

Figure 7. Load Circuit and Voltage Waveforms

## PACKAGING INFORMATION

| Orderable Device | Status<br>(1) | Package Type | Package<br>Drawing | Pins | Package<br>Qty | Eco Plan<br>(2)            | Lead/Ball Finish<br>(6) | MSL Peak Temp<br>(3) | Op Temp (°C) | Device Marking<br>(4/5) | Samples                 |
|------------------|---------------|--------------|--------------------|------|----------------|----------------------------|-------------------------|----------------------|--------------|-------------------------|-------------------------|
| SN74AUP1G58DBVR  | ACTIVE        | SOT-23       | DBV                | 6    | 3000           | Green (RoHS<br>& no Sb/Br) | NIPDAU                  | Level-1-260C-UNLIM   | -40 to 85    | H58R                    | <a href="#">Samples</a> |
| SN74AUP1G58DBVT  | ACTIVE        | SOT-23       | DBV                | 6    | 250            | Green (RoHS<br>& no Sb/Br) | NIPDAU                  | Level-1-260C-UNLIM   | -40 to 85    | H58R                    | <a href="#">Samples</a> |
| SN74AUP1G58DCKR  | ACTIVE        | SC70         | DCK                | 6    | 3000           | Green (RoHS<br>& no Sb/Br) | NIPDAU                  | Level-1-260C-UNLIM   | -40 to 85    | HJR                     | <a href="#">Samples</a> |
| SN74AUP1G58DCKT  | ACTIVE        | SC70         | DCK                | 6    | 250            | Green (RoHS<br>& no Sb/Br) | NIPDAU                  | Level-1-260C-UNLIM   | -40 to 85    | HJR                     | <a href="#">Samples</a> |
| SN74AUP1G58DRLR  | ACTIVE        | SOT-5X3      | DRL                | 6    | 4000           | Green (RoHS<br>& no Sb/Br) | NIPDAU   NIPDAUAG       | Level-1-260C-UNLIM   | -40 to 85    | (HJ7, HJR)              | <a href="#">Samples</a> |
| SN74AUP1G58DRYR  | ACTIVE        | SON          | DRY                | 6    | 5000           | Green (RoHS<br>& no Sb/Br) | NIPDAU                  | Level-1-260C-UNLIM   | -40 to 85    | HJ                      | <a href="#">Samples</a> |
| SN74AUP1G58DSFR  | ACTIVE        | SON          | DSF                | 6    | 5000           | Green (RoHS<br>& no Sb/Br) | NIPDAU   NIPDAUAG       | Level-1-260C-UNLIM   | -40 to 85    | HJ                      | <a href="#">Samples</a> |
| SN74AUP1G58YFPR  | ACTIVE        | DSBGA        | YFP                | 6    | 3000           | Green (RoHS<br>& no Sb/Br) | SNAGCU                  | Level-1-260C-UNLIM   |              | HJN                     | <a href="#">Samples</a> |
| SN74AUP1G58YZPR  | ACTIVE        | DSBGA        | YZP                | 6    | 3000           | Green (RoHS<br>& no Sb/Br) | SNAGCU                  | Level-1-260C-UNLIM   | -40 to 85    | HJN                     | <a href="#">Samples</a> |

(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.

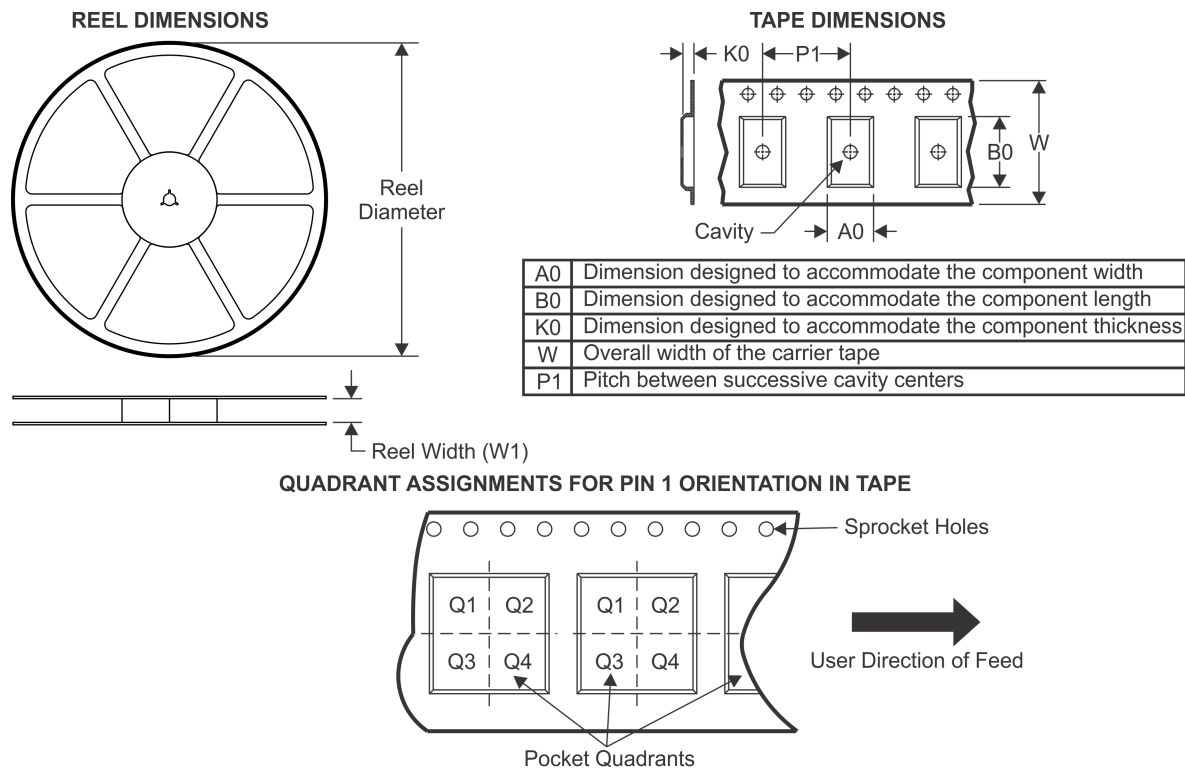
<sup>(4)</sup> There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

<sup>(5)</sup> 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.

<sup>(6)</sup> 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.

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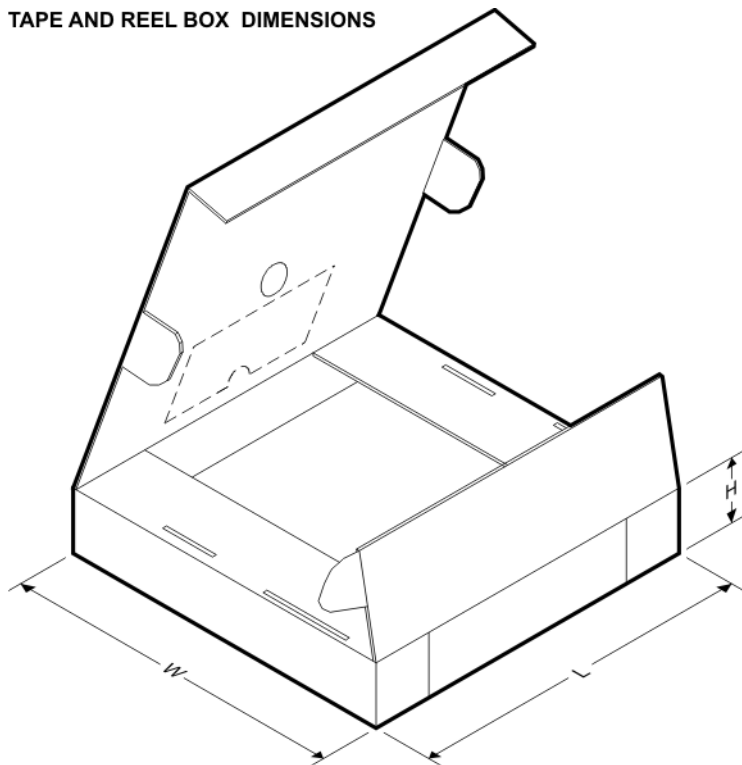
In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

**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 |
|-----------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| SN74AUP1G58DBVR | SOT-23       | DBV             | 6    | 3000 | 180.0              | 8.4                | 3.23    | 3.17    | 1.37    | 4.0     | 8.0    | Q3            |
| SN74AUP1G58DBVT | SOT-23       | DBV             | 6    | 250  | 180.0              | 8.4                | 3.23    | 3.17    | 1.37    | 4.0     | 8.0    | Q3            |
| SN74AUP1G58DCKR | SC70         | DCK             | 6    | 3000 | 180.0              | 8.4                | 2.41    | 2.41    | 1.2     | 4.0     | 8.0    | Q3            |
| SN74AUP1G58DCKT | SC70         | DCK             | 6    | 250  | 180.0              | 8.4                | 2.41    | 2.41    | 1.2     | 4.0     | 8.0    | Q3            |
| SN74AUP1G58DRLR | SOT-5X3      | DRL             | 6    | 4000 | 180.0              | 9.5                | 1.78    | 1.78    | 0.69    | 4.0     | 8.0    | Q3            |
| SN74AUP1G58DRLR | SOT-5X3      | DRL             | 6    | 4000 | 180.0              | 8.4                | 1.98    | 1.78    | 0.69    | 4.0     | 8.0    | Q3            |
| SN74AUP1G58DRYR | SON          | DRY             | 6    | 5000 | 180.0              | 9.5                | 1.15    | 1.6     | 0.75    | 4.0     | 8.0    | Q1            |
| SN74AUP1G58DSFR | SON          | DSF             | 6    | 5000 | 180.0              | 9.5                | 1.16    | 1.16    | 0.5     | 4.0     | 8.0    | Q2            |
| SN74AUP1G58YFPR | DSBGA        | YFP             | 6    | 3000 | 178.0              | 9.2                | 0.89    | 1.29    | 0.62    | 4.0     | 8.0    | Q1            |
| SN74AUP1G58YZPR | DSBGA        | YZP             | 6    | 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) |
|-----------------|--------------|-----------------|------|------|-------------|------------|-------------|
| SN74AUP1G58DBVR | SOT-23       | DBV             | 6    | 3000 | 202.0       | 201.0      | 28.0        |
| SN74AUP1G58DBVT | SOT-23       | DBV             | 6    | 250  | 202.0       | 201.0      | 28.0        |
| SN74AUP1G58DCKR | SC70         | DCK             | 6    | 3000 | 202.0       | 201.0      | 28.0        |
| SN74AUP1G58DCKT | SC70         | DCK             | 6    | 250  | 202.0       | 201.0      | 28.0        |
| SN74AUP1G58DRLR | SOT-5X3      | DRL             | 6    | 4000 | 184.0       | 184.0      | 19.0        |
| SN74AUP1G58DRLR | SOT-5X3      | DRL             | 6    | 4000 | 202.0       | 201.0      | 28.0        |
| SN74AUP1G58DRYR | SON          | DRY             | 6    | 5000 | 184.0       | 184.0      | 19.0        |
| SN74AUP1G58DSFR | SON          | DSF             | 6    | 5000 | 184.0       | 184.0      | 19.0        |
| SN74AUP1G58YFPR | DSBGA        | YFP             | 6    | 3000 | 220.0       | 220.0      | 35.0        |
| SN74AUP1G58YZPR | DSBGA        | YZP             | 6    | 3000 | 220.0       | 220.0      | 35.0        |

## 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

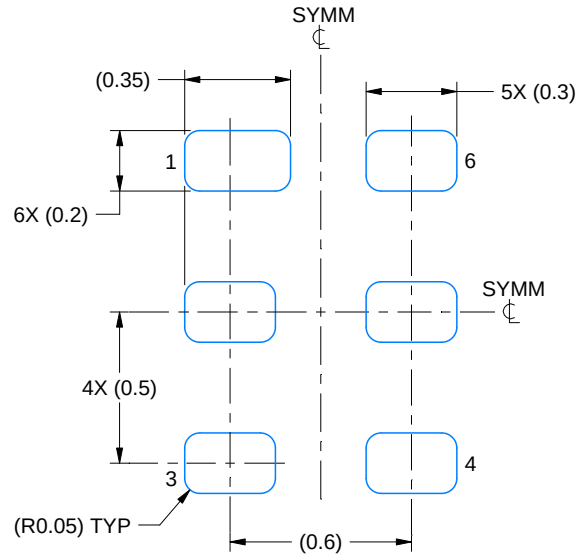


# EXAMPLE BOARD LAYOUT

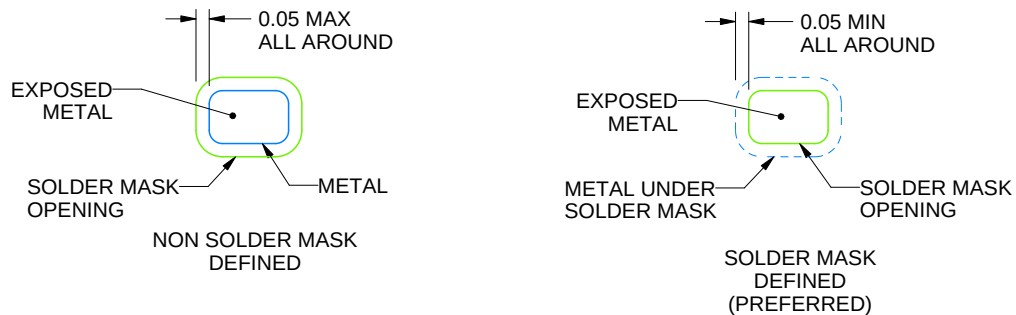
DRY0006A

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](http://www.ti.com/lit/slue271)).

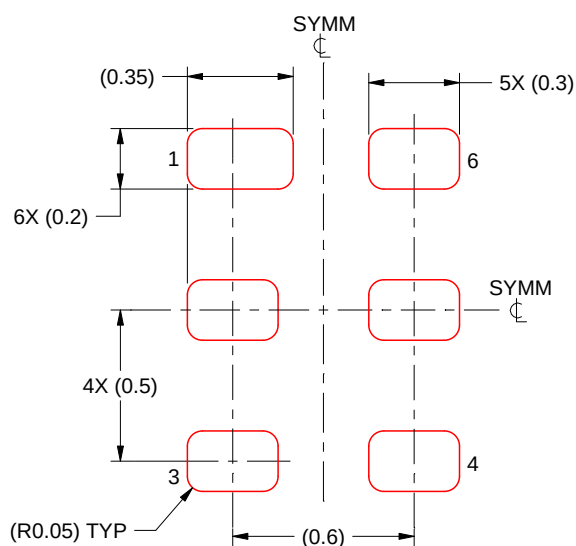


## EXAMPLE STENCIL DESIGN

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.

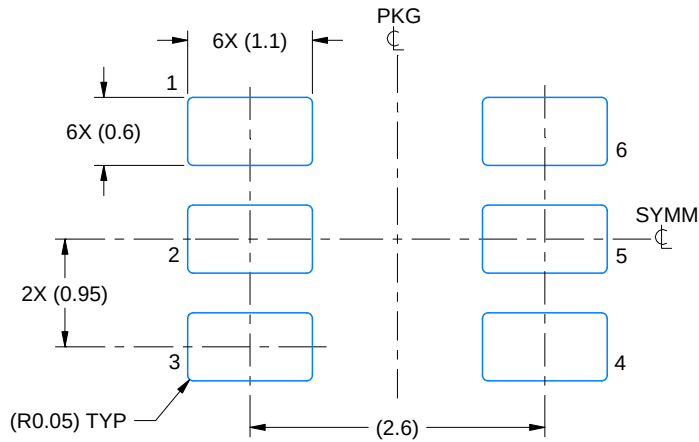


# EXAMPLE BOARD LAYOUT

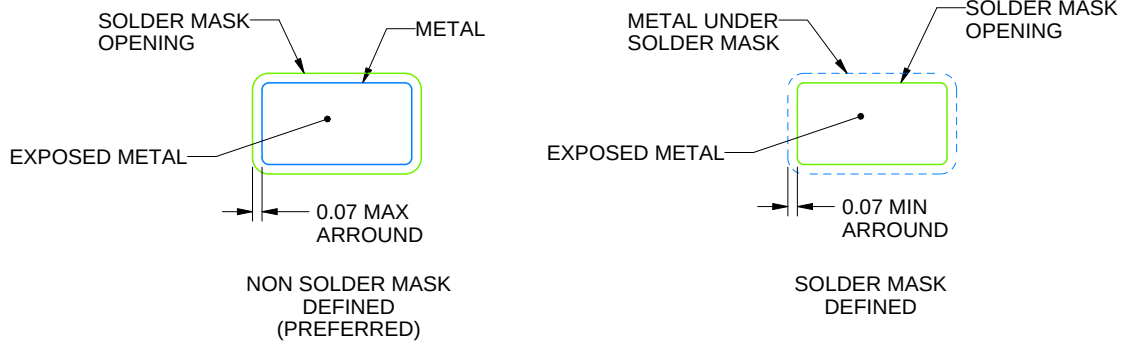
DBV0006A

SOT-23 - 1.45 mm max height

SMALL OUTLINE TRANSISTOR



LAND PATTERN EXAMPLE  
EXPOSED METAL SHOWN  
SCALE:15X



SOLDER MASK DETAILS

4214840/B 03/2018

NOTES: (continued)

6. Publication IPC-7351 may have alternate designs.

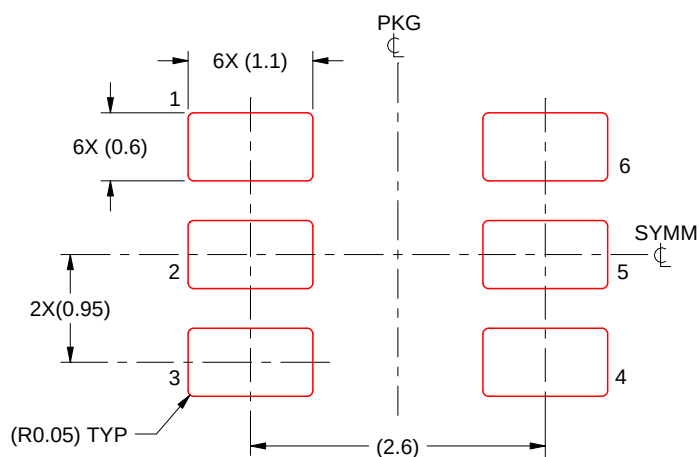
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

## EXAMPLE STENCIL DESIGN

DBV0006A

SOT-23 - 1.45 mm max height

SMALL OUTLINE TRANSISTOR



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

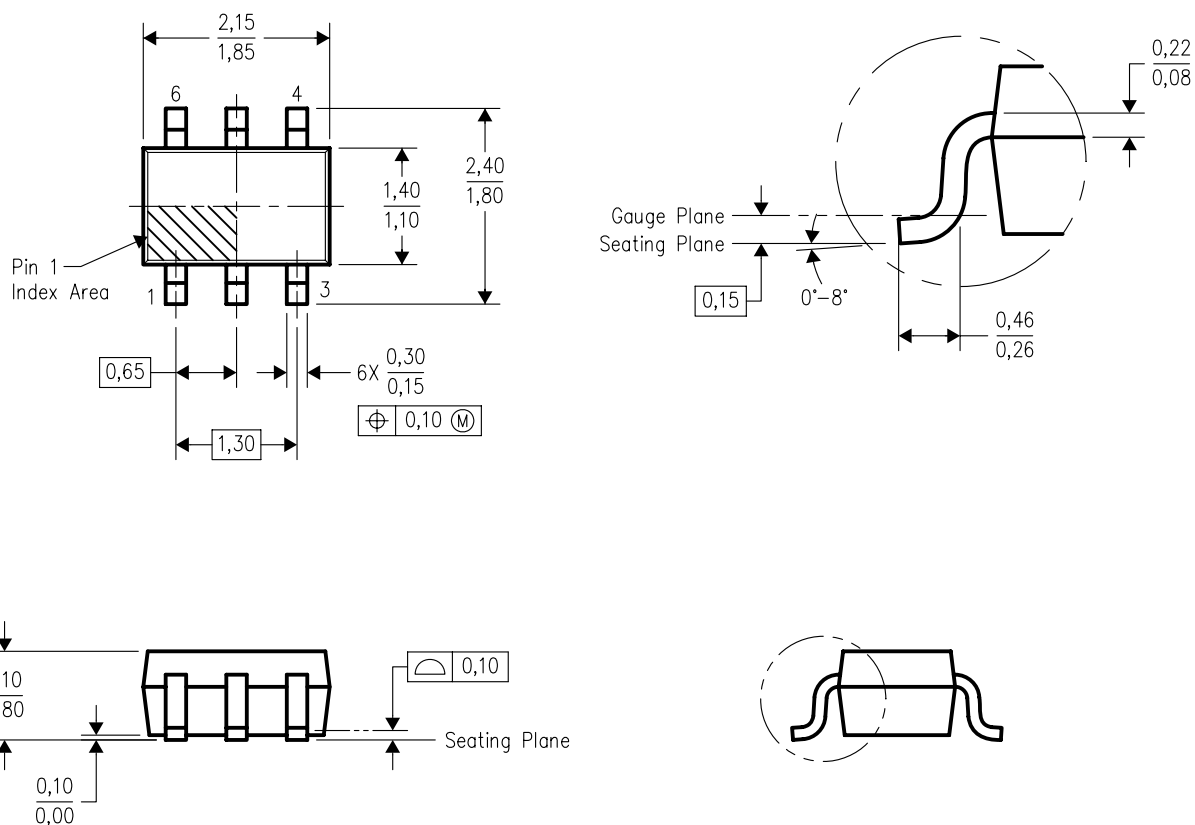
4214840/B 03/2018

NOTES: (continued)

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

## DCK (R-PDSO-G6)

## PLASTIC SMALL-OUTLINE PACKAGE

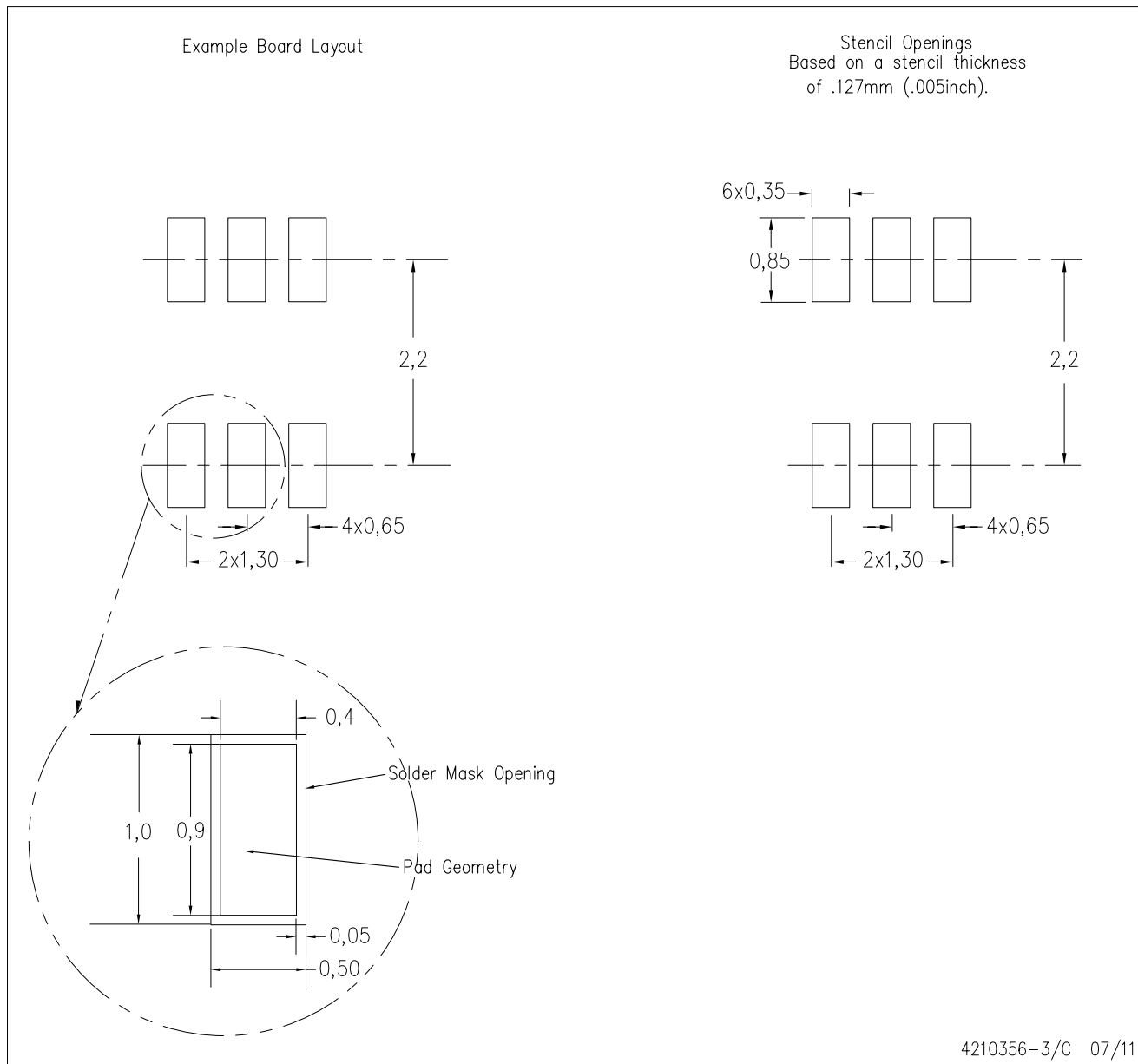


4093553-4/G 01/2007

- 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-203 variation AB.

DCK (R-PDSO-G6)

PLASTIC SMALL OUTLINE



- NOTES:
- A. All linear dimensions are in millimeters.
  - B. This drawing is subject to change without notice.
  - C. Customers should place a note on the circuit board fabrication drawing not to alter the center solder mask defined pad.
  - D. Publication IPC-7351 is recommended for alternate designs.
  - E. 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.

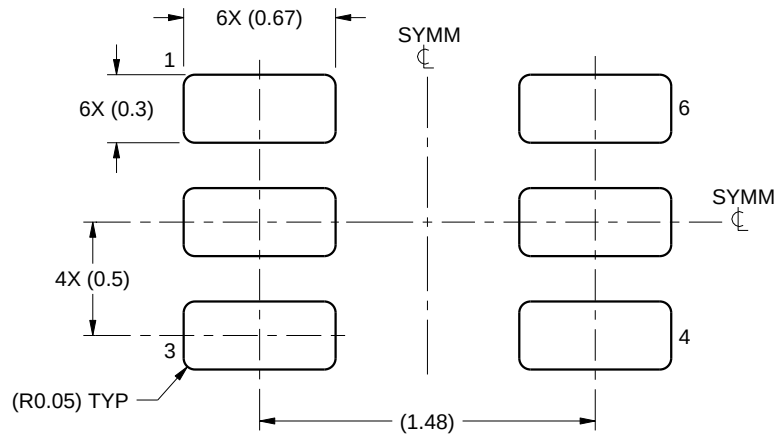


# EXAMPLE BOARD LAYOUT

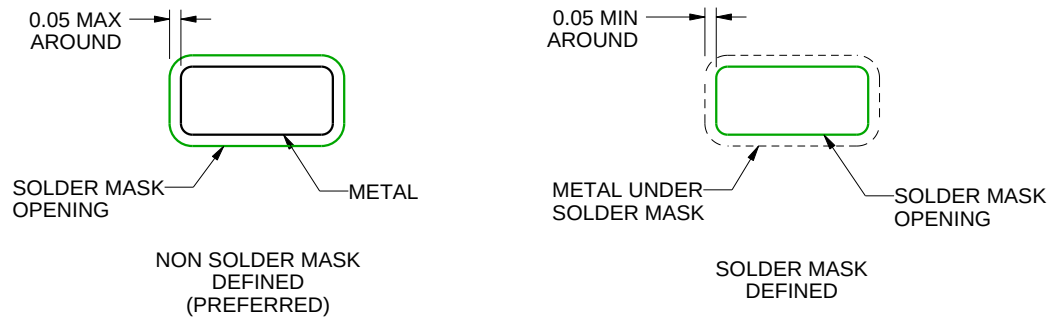
DRL0006A

SOT - 0.6 mm max height

PLASTIC SMALL OUTLINE



LAND PATTERN EXAMPLE  
SCALE:30X



SOLDERMASK DETAILS

4223266/A 09/2016

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.

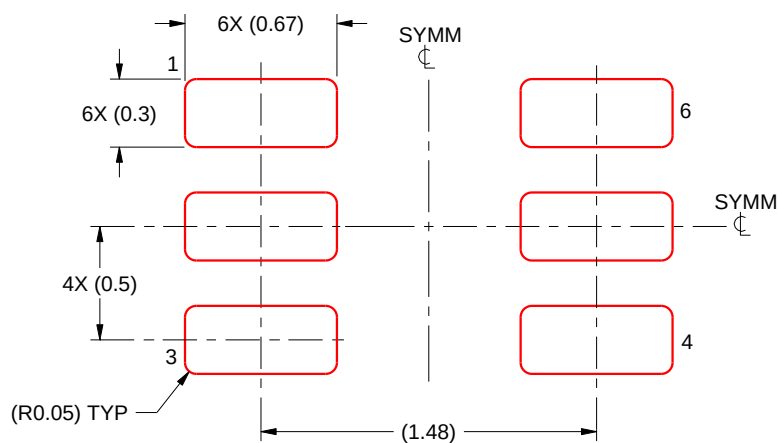


## EXAMPLE STENCIL DESIGN

DRL0006A

SOT - 0.6 mm max height

PLASTIC SMALL OUTLINE



SOLDER PASTE EXAMPLE  
BASED ON 0.1 mm THICK STENCIL  
SCALE:30X

4223266/A 09/2016

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.

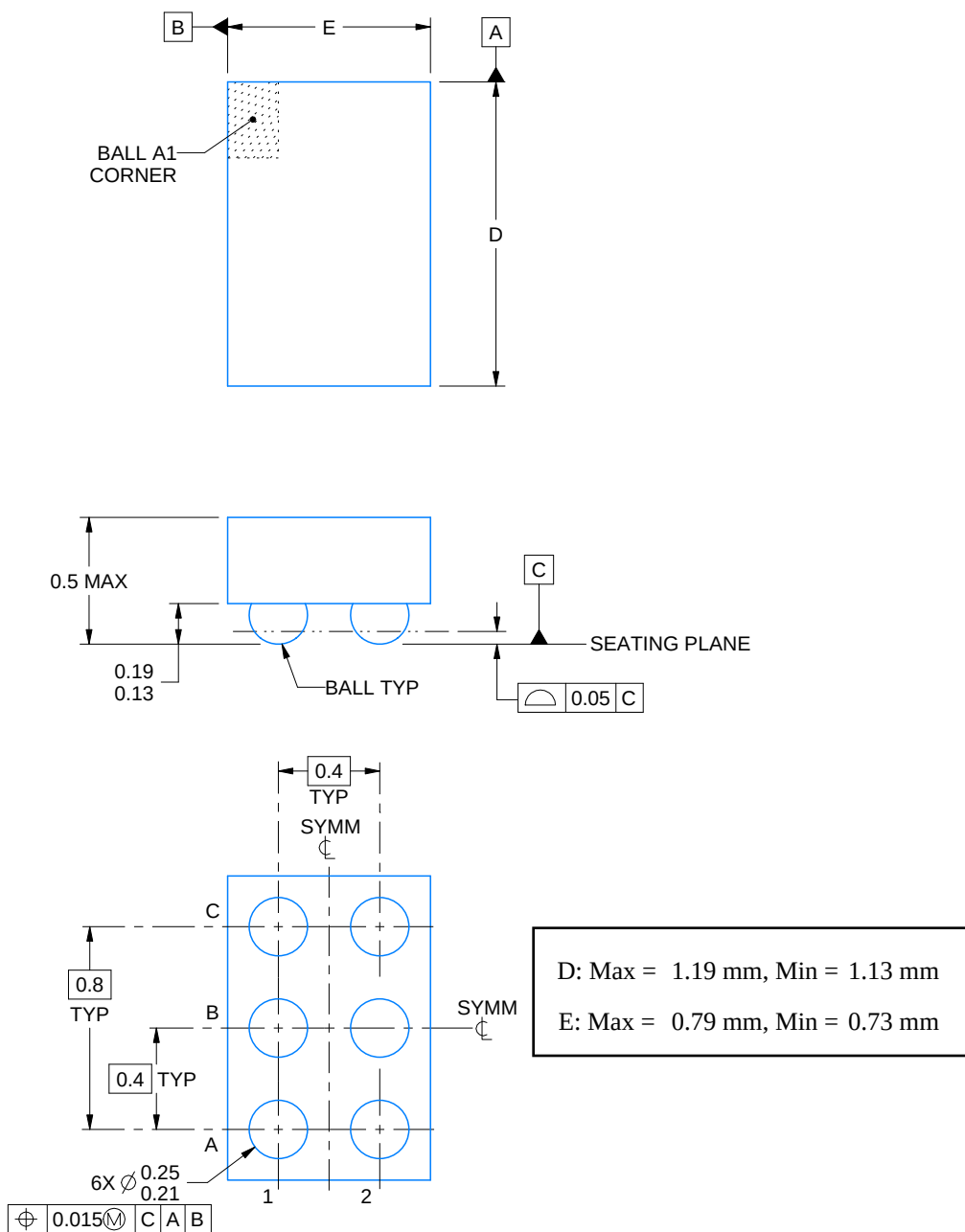
YFP0006



# PACKAGE OUTLINE

DSBGA - 0.5 mm max height

DIE SIZE BALL GRID ARRAY



4223410/A 11/2016

## NOTES:

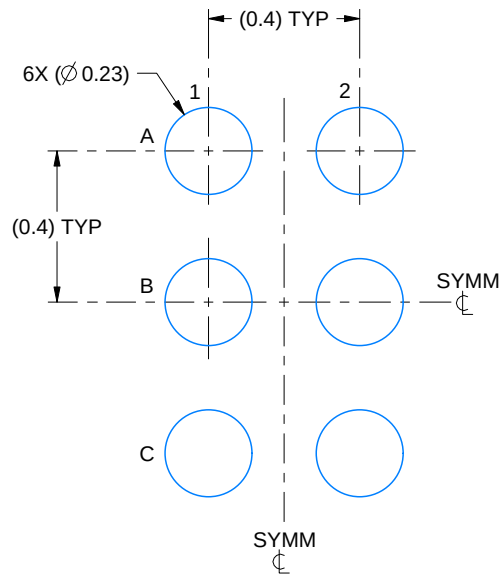
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.

# EXAMPLE BOARD LAYOUT

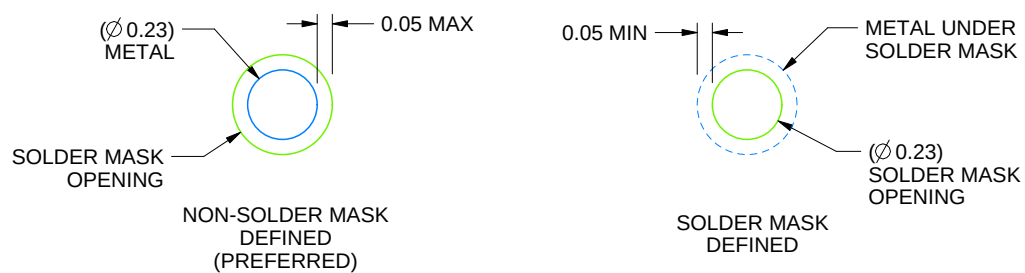
YFP0006

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)

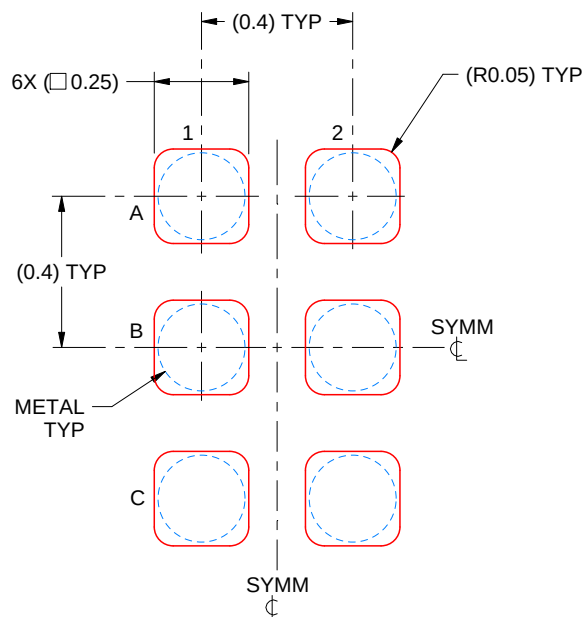
3. Final dimensions may vary due to manufacturing tolerance considerations and also routing constraints. For more information, see Texas Instruments literature number SNVA009 ([www.ti.com/lit/snva009](http://www.ti.com/lit/snva009)).

## EXAMPLE STENCIL DESIGN

YFP0006

DSBGA - 0.5 mm max height

DIE SIZE BALL GRID ARRAY

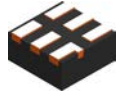


SOLDER PASTE EXAMPLE  
BASED ON 0.1 mm THICK STENCIL  
SCALE:50X

4223410/A 11/2016

NOTES: (continued)

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

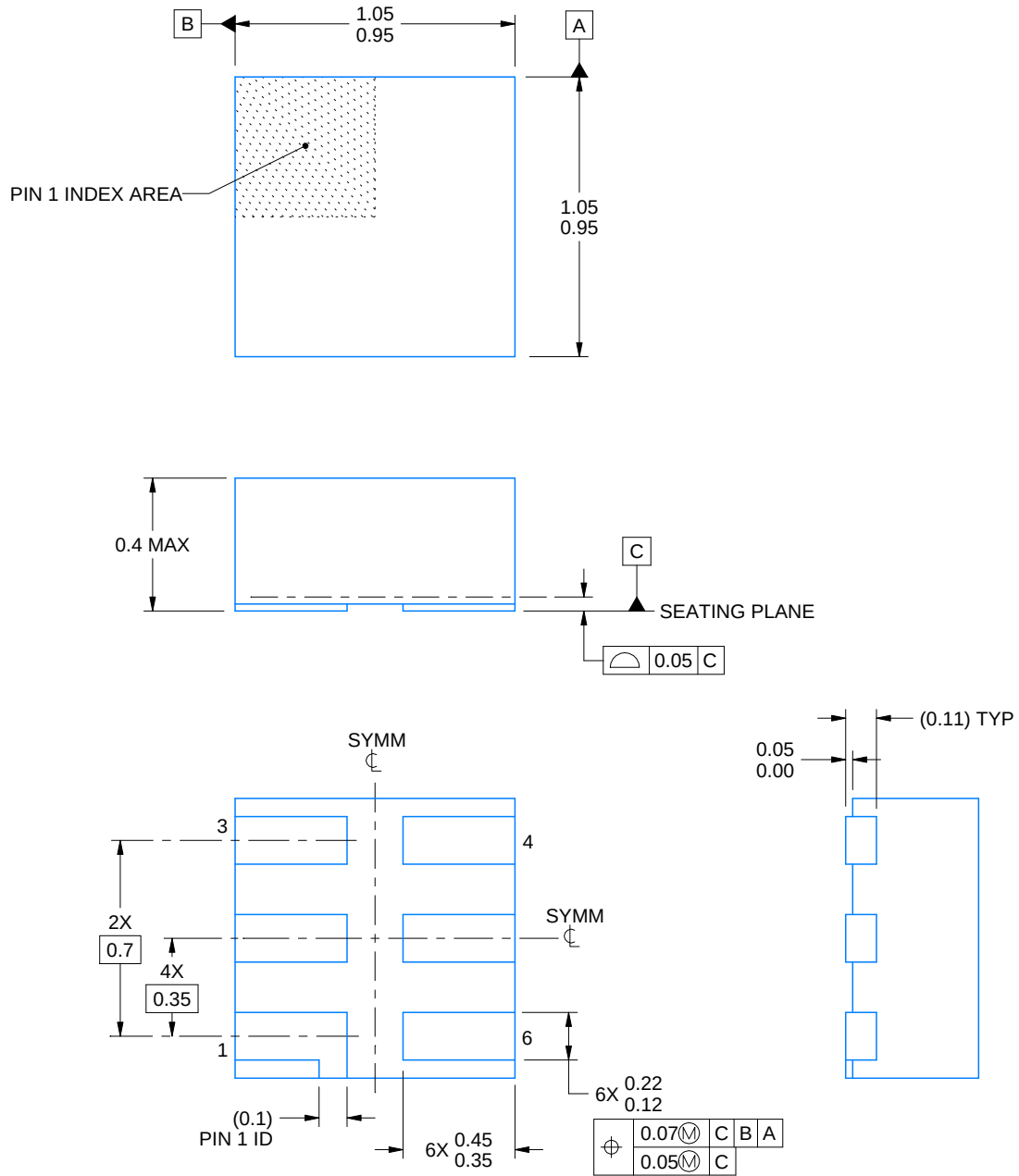


DSF0006A

# PACKAGE OUTLINE

X2SON - 0.4 mm max height

PLASTIC SMALL OUTLINE - NO LEAD



4220597/A 06/2017

## NOTES:

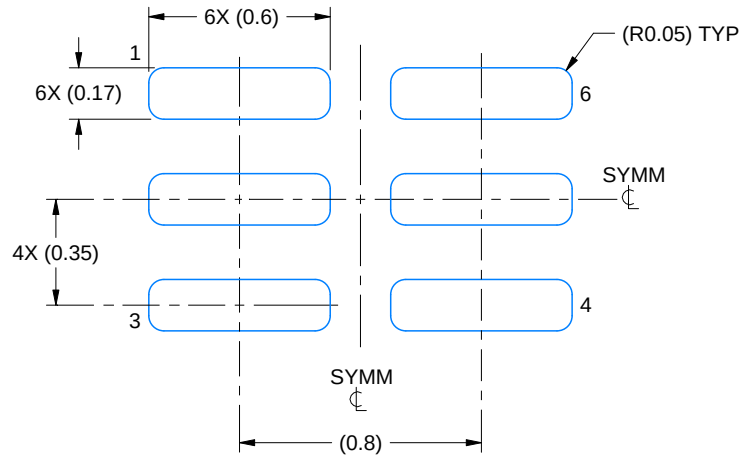
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. Reference JEDEC registration MO-287, variation X2AAF.

# EXAMPLE BOARD LAYOUT

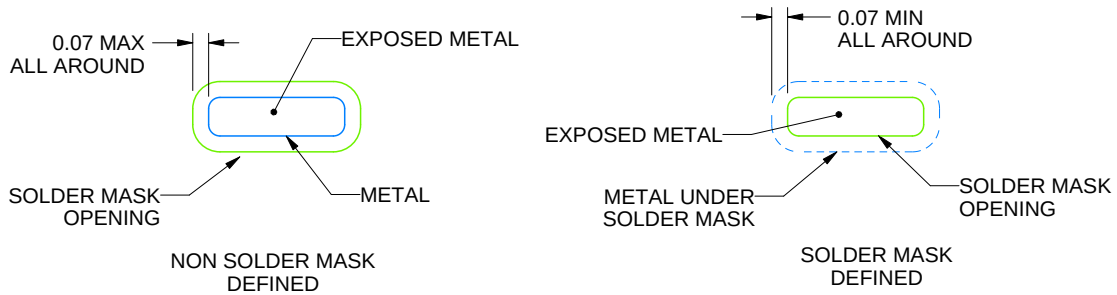
DSF0006A

X2SON - 0.4 mm max height

PLASTIC SMALL OUTLINE - NO LEAD



LAND PATTERN EXAMPLE  
EXPOSED METAL SHOWN  
SCALE:40X



SOLDER MASK DETAILS

4220597/A 06/2017

NOTES: (continued)

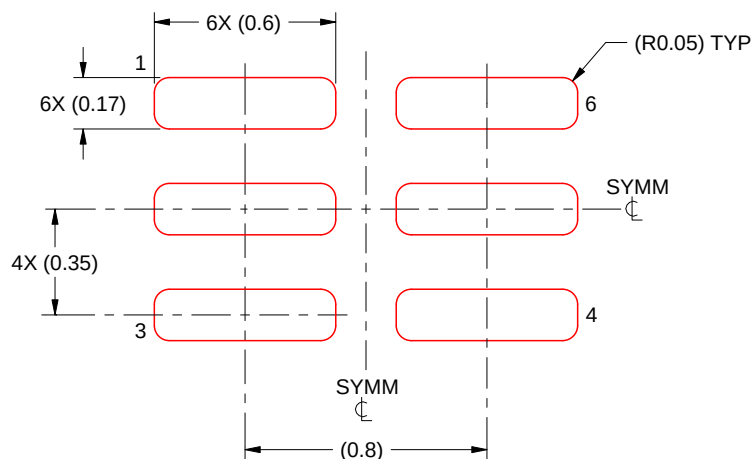
4. For more information, see Texas Instruments literature number SLUA271 ([www.ti.com/lit/sluea271](http://www.ti.com/lit/sluea271)).

## EXAMPLE STENCIL DESIGN

DSF0006A

X2SON - 0.4 mm max height

PLASTIC SMALL OUTLINE - NO LEAD

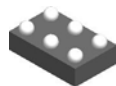


SOLDER PASTE EXAMPLE  
BASED ON 0.125 mm THICK STENCIL  
PRINTED SOLDER COVERAGE BY AREA UNDER PACKAGE  
SCALE:40X

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

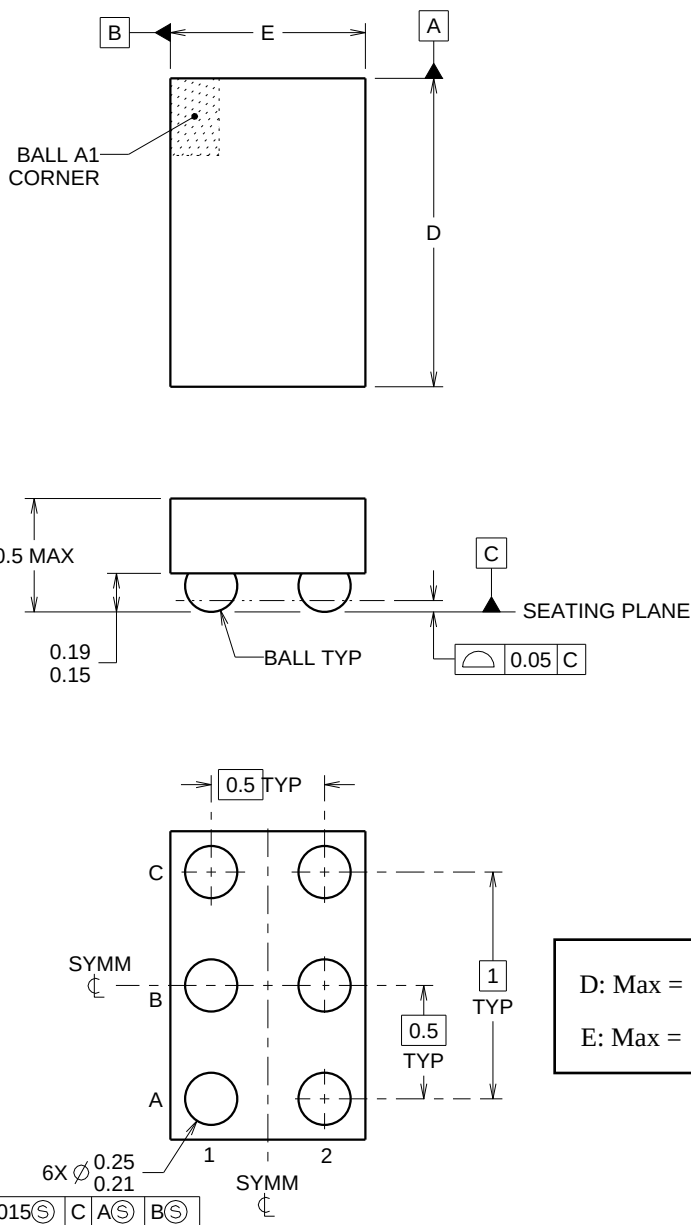
YZP0006



# PACKAGE OUTLINE

DSBGA - 0.5 mm max height

DIE SIZE BALL GRID ARRAY



4219524/A 06/2014

## NOTES:

NanoFree Is a trademark of Texas Instruments.

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. NanoFree™ package configuration.

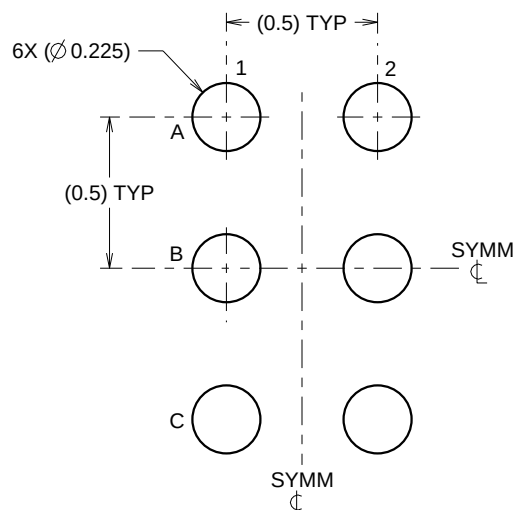


# EXAMPLE BOARD LAYOUT

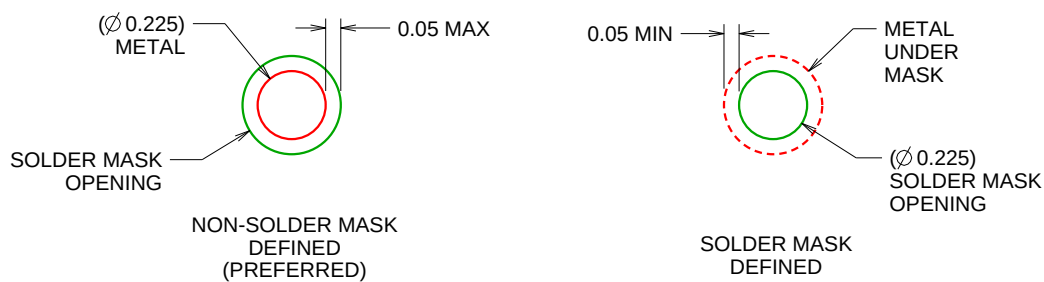
YZP0006

DSBGA - 0.5 mm max height

DIE SIZE BALL GRID ARRAY



LAND PATTERN EXAMPLE  
SCALE:40X

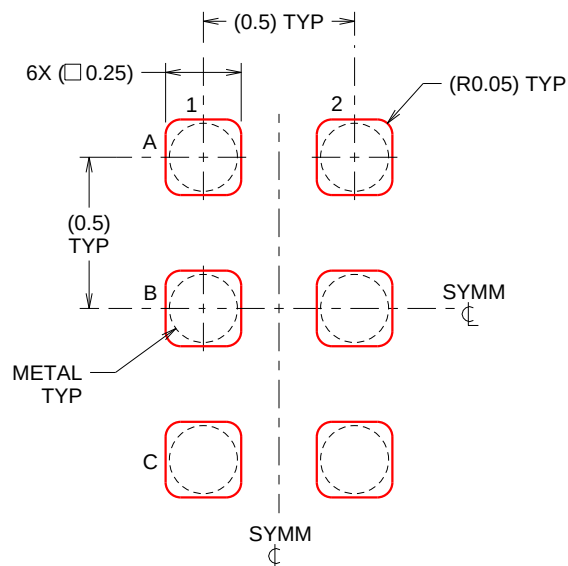


SOLDER MASK DETAILS  
NOT TO SCALE

4219524/A 06/2014

NOTES: (continued)

- Final dimensions may vary due to manufacturing tolerance considerations and also routing constraints. For more information, see Texas Instruments literature number SBVA017 ([www.ti.com/lit/sbva017](http://www.ti.com/lit/sbva017)).



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

4219524/A 06/2014

NOTES: (continued)

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

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