



# THE DATASHEET OF SN74LVC1G57DRLR



## SN74LVC1G57 Configurable Multiple-Function Gate

### 1 Features

- Supports 5-V  $V_{CC}$  Operation
- Inputs Accept Voltages to 5.5 V
  - Supports Down Translation to  $V_{CC}$
- Max  $t_{pd}$  of 6.3 ns at 3.3 V
- Schmitt-Triggered Inputs
- Low Power Consumption, 10- $\mu$ A Maximum  $I_{CC}$
- $\pm$ 24-mA Output Drive at 3.3 V
- $I_{off}$  Supports Live Insertion, Partial-Power-Down Mode, and Back-Drive Protection
- Latch-Up Performance Exceeds 100 mA Per JESD 78, Class II
- Available in the Texas Instruments NanoFree™ Package

### 2 Applications

- Active Noise Cancellation (ANC)
- Barcode Scanners
- Blood Pressure Monitors
- CPAP Machines
- Cable Solutions
- Embedded PCs
- Field Transmitter: Temperature or Pressure Sensors
- HVAC: Heating, Ventilating, and Air Conditioning
- TVs: High-Definition (HDTV), LCD, and Digital
- Video Communications Systems

### 3 Description

The SN74LVC1G57 device 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 buffer. All inputs can be connected to  $V_{CC}$  or GND.

This device functions as an independent gate, but because of Schmitt action, it may have different input threshold levels for positive-going ( $V_{T+}$ ) and negative-going ( $V_{T-}$ ) signals.

This configurable multiple-function gate is designed for 1.65-V to 5.5-V  $V_{CC}$  operation.

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.

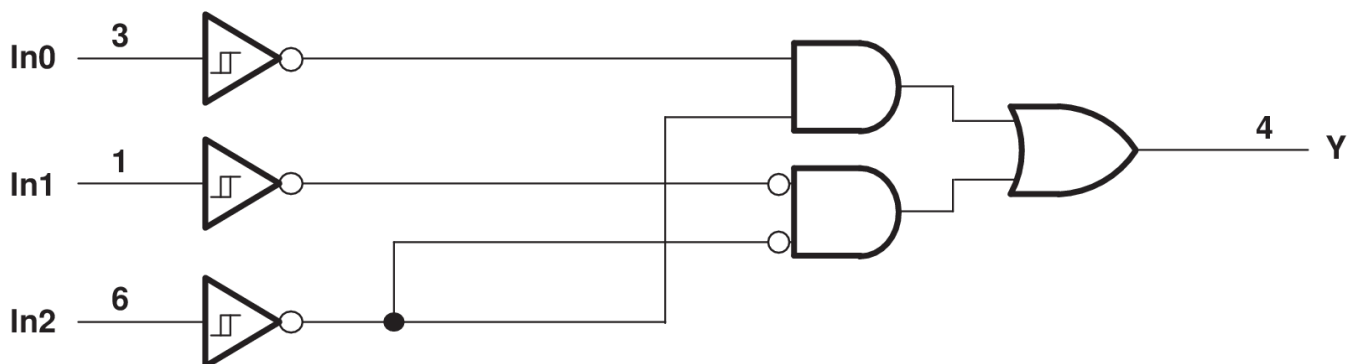
NanoFree™ package technology is a major breakthrough in IC packaging concepts, using the die as the package.

#### Device Information<sup>(1)</sup>

| DEVICE NAME    | PACKAGE    | BODY SIZE (NOM)   |
|----------------|------------|-------------------|
| SN74LVC1G57DBV | SOT-23 (6) | 2.90 mm × 1.60 mm |
| SN74LVC1G57DCK | SC70 (6)   | 2.00 mm × 1.25 mm |
| SN74LVC1G57DRL | SOT (6)    | 1.60 mm × 1.20 mm |
| SN74LVC1G57DRY | SON (6)    | 1.45 mm × 1.00 mm |
| SN74LVC1G57DSF | SON (6)    | 1.00 mm × 1.00 mm |
| SN74LVC1G57YZP | DSBGA (6)  | 1.41 mm × 0.91 mm |

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

#### Logic Diagram (Positive Logic)



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## Table of Contents

|  |          |  |           |
|--|----------|--|-----------|
| <b>1 Features</b> .....                          | <b>1</b> | 8.3 Feature Description.....                                     | <b>8</b>  |
| <b>2 Applications</b> .....                      | <b>1</b> | 8.4 Device Functional Modes.....                                 | <b>8</b>  |
| <b>3 Description</b> .....                       | <b>1</b> | <b>9 Application and Implementation</b> .....                    | <b>10</b> |
| <b>4 Revision History</b> .....                  | <b>2</b> | 9.1 Application Information.....                                 | <b>10</b> |
| <b>5 Pin Configuration and Functions</b> .....   | <b>3</b> | 9.2 Typical Application .....                                    | <b>10</b> |
| <b>6 Specifications</b> .....                    | <b>4</b> | <b>10 Power Supply Recommendations</b> .....                     | <b>12</b> |
| 6.1 Absolute Maximum Ratings .....               | <b>4</b> | <b>11 Layout</b> .....   | <b>12</b> |
| 6.2 ESD Ratings.....                             | <b>4</b> | 11.1 Layout Guidelines .....                                     | <b>12</b> |
| 6.3 Recommended Operating Conditions.....        | <b>4</b> | 11.2 Layout Example .....  | <b>12</b> |
| 6.4 Thermal Information .....                    | <b>5</b> | <b>12 Device and Documentation Support</b> .....                 | <b>13</b> |
| 6.5 Electrical Characteristics.....              | <b>5</b> | 12.1 Documentation Support .....                                 | <b>13</b> |
| 6.6 Switching Characteristics .....              | <b>6</b> | 12.2 Receiving Notification of Documentation Updates             | <b>13</b> |
| 6.7 Typical Characteristics .....                | <b>6</b> | 12.3 Community Resources.....                                    | <b>13</b> |
| <b>7 Parameter Measurement Information</b> ..... | <b>7</b> | 12.4 Trademarks .....  | <b>13</b> |
| <b>8 Detailed Description</b> .....              | <b>8</b> | 12.5 Electrostatic Discharge Caution.....                        | <b>13</b> |
| 8.1 Overview .....                               | <b>8</b> | 12.6 Glossary .....  | <b>13</b> |
| 8.2 Functional Block Diagram .....               | <b>8</b> | <b>13 Mechanical, Packaging, and Orderable Information</b> ..... | <b>13</b> |

## 4 Revision History

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

| <b>Changes from Revision O (December 2013) to Revision P</b>  | <b>Page</b> |
|---|-------------|
| <ul style="list-style-type: none"> <li>Added <i>Applications</i> section, <i>Device Information</i> table, <i>ESD Ratings</i> table, <i>Thermal Information</i> table, <i>Feature Description</i> section, <i>Device Functional Modes</i>, <i>Application and Implementation</i> section, <i>Power Supply Recommendations</i> section, <i>Layout</i> section, <i>Device and Documentation Support</i> section, and <i>Mechanical, Packaging, and Orderable Information</i> section .....</li> </ul> | <b>1</b>    |
| <ul style="list-style-type: none"> <li>Changed Package thermal impedance, <math>R_{\theta JA}</math>, values From: 165°C/W To: 223°C/W (DBV), From: 259°C/W To: 271.7°C/W (DCK), From: 142°C/W To: 252.5°C/W (DRL), and From: 123°C/W To: 124°C/W (YZP).....</li> </ul>   | <b>5</b>    |

| <b>Changes from Revision N (April 2013) to Revision O</b>   | <b>Page</b> |
|---|-------------|
| <ul style="list-style-type: none"> <li>Changed <math>I_{off}</math> in <i>Features</i> .....</li> </ul> | <b>1</b>    |
| <ul style="list-style-type: none"> <li>Changed Operating temperature range.....</li> </ul>              | <b>4</b>    |

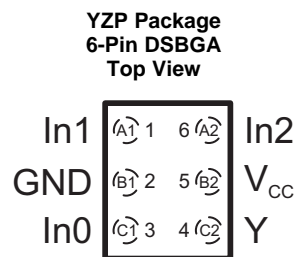
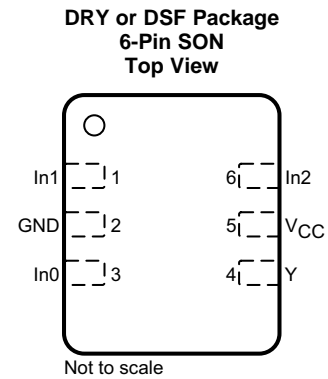
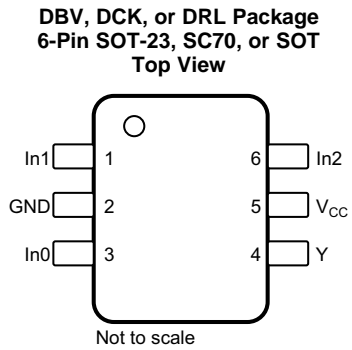
  

| <b>Changes from Revision M (October 2011) to Revision N</b>   | <b>Page</b> |
|---|-------------|
| <ul style="list-style-type: none"> <li>Removed Ordering Information table; package updates now included in Package Ordering Addendum .....</li> </ul> | <b>1</b>    |

| <b>Changes from Revision L (January 2007) to Revision M</b>  | <b>Page</b> |
|--|-------------|
| <ul style="list-style-type: none"> <li>Added additional package options to the Ordering Information table .....</li> </ul> | <b>1</b>    |
| <ul style="list-style-type: none"> <li>Added DRY and DSF packages to data sheet.....</li> </ul>                            | <b>1</b>    |

## 5 Pin Configuration and Functions



### Pin Functions

| PIN |                 | I/O | DESCRIPTION   |
|-----|-----------------|-----|---------------|
| NO. | NAME            |     |               |
| 1   | In1             | I   | Logic input 1 |
| 2   | GND             | —   | Ground        |
| 3   | In0             | I   | Logic input 0 |
| 4   | Y               | O   | Logic output  |
| 5   | V <sub>CC</sub> | —   | Power         |
| 6   | In2             | I   | Logic input 2 |

## 6 Specifications

### 6.1 Absolute Maximum Ratings

 over operating free-air temperature range (unless otherwise noted)<sup>(1)</sup>

|  |  | MIN  | MAX            | UNIT |
|--|--|------|----------------|------|
| Supply voltage, $V_{CC}$                     |  | -0.5 | 6.5            | V    |
| Input voltage, $V_I$ <sup>(2)</sup>          |  | -0.5 | 6.5            | V    |
| Voltage range (applied to any output), $V_O$ | High-impedance or power-off state <sup>(2)</sup> | -0.5 | 6.5            | V    |
|  | High or low state <sup>(2)(3)</sup>              | -0.5 | $V_{CC} + 0.5$ |      |
| Input clamp current, $I_{IK}$ ( $V_I < 0$ )  |  |      | -50            | mA   |
| Output clamp current, $I_{OK}$ ( $V_O < 0$ ) |  |      | -50            | mA   |
| Continuous output current, $I_O$             |  |      | $\pm 50$       | mA   |
| Continuous current through $V_{CC}$ or GND   |  |      | $\pm 100$      | mA   |
| Junction temperature, $T_J$                  |  |      | 150            | °C   |
| Storage temperature, $T_{stg}$               |  | -65  | 150            | °C   |

(1) Stresses beyond those listed under *Absolute Maximum Ratings* may cause permanent damage to the device. These are stress ratings only, which do not imply functional operation of the device at these or any other conditions beyond those indicated under *Recommended Operating Conditions*. 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 value of  $V_{CC}$  is provided in the *Recommended Operating Conditions* table.

### 6.2 ESD Ratings

|                                     |  | VALUE      | UNIT |
|-------------------------------------|--|------------|------|
| $V_{(ESD)}$ Electrostatic discharge | Human-body model (HBM), per ANSI/ESDA/JEDEC JS-001 <sup>(1)</sup>              | $\pm 2000$ | V    |
|                                     | Charged-device model (CDM), per JEDEC specification JESD22-C101 <sup>(2)</sup> | $\pm 1000$ |      |

(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)<sup>(1)</sup>

|                                      |                     |  | MIN  | MAX      | UNIT |
|--------------------------------------|---------------------|--|------|----------|------|
| $V_{CC}$ Supply voltage              | Operating           |  | 1.65 | 5.5      | V    |
|                                      | Data retention only |  | 1.5  |          |      |
| $V_I$ Input voltage                  |                     |  | 0    | 5.5      | V    |
| $V_O$ Output voltage                 |                     |  | 0    | $V_{CC}$ | V    |
| $I_{OH}$ High-level output current   | $V_{CC} = 1.65$ V   |  |      | -4       | mA   |
|                                      | $V_{CC} = 2.3$ V    |  |      | -8       |      |
|                                      | $V_{CC} = 3$ V      |  |      | -16      |      |
|                                      |                     |  |      | -24      |      |
|                                      | $V_{CC} = 4.5$ V    |  |      | -32      |      |
| $I_{OL}$ Low-level output current    | $V_{CC} = 1.65$ V   |  |      | 4        | mA   |
|                                      | $V_{CC} = 2.3$ V    |  |      | 8        |      |
|                                      | $V_{CC} = 3$ V      |  |      | 16       |      |
|                                      |                     |  |      | 24       |      |
|                                      | $V_{CC} = 4.5$ V    |  |      | 32       |      |
| $T_A$ Operating free-air temperature | BGA package         |  | -40  | 85       | °C   |
|                                      | All other packages  |  | -40  | 125      |      |

(1) All unused inputs of the device must be held at  $V_{CC}$  or GND to ensure proper device operation, see [Implications of Slow or Floating CMOS Inputs](#) (SCBA004).

## 6.4 Thermal Information

| THERMAL METRIC <sup>(1)</sup>                                  | SN74LVC1G57 |           |           |             |           |           | UNIT |
|--|-------------|-----------|-----------|-------------|-----------|-----------|------|
|  | DBV (SOT)   | DCK (SOT) | DRL (SOT) | YZP (DSGBA) | DSF (SON) | DRY (SON) |      |
|  | 6 PINS      | 6 PINS    | 6 PINS    | 6 PINS      | 6 PINS    | 6 PINS    |      |
| $R_{\theta JA}$ Junction-to-ambient thermal resistance         | 223         | 271.7     | 252.5     | 124         | 360.1     | 332.5     | °C/W |
| $R_{\theta JC(top)}$ Junction-to-case (top) thermal resistance | 174.4       | 129.8     | 111.6     | 1.4         | 158.8     | 198.5     | °C/W |
| $R_{\theta JB}$ Junction-to-board thermal resistance           | 71          | 73.1      | 118.5     | 29.7        | 213.5     | 189       | °C/W |
| $\Psi_{JT}$ Junction-to-top characterization parameter         | 57.1        | 8.3       | 11.8      | 0.5         | 20.4      | 44.3      | °C/W |
| $\Psi_{JB}$ Junction-to-board characterization parameter       | 70.3        | 72.4      | 118.8     | 30.1        | 213.2     | 189.7     | °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   | MIN   | TYP <sup>(1)</sup> | MAX      | UNIT          |
|---|---|---|--------------------|----------|---------------|
| $V_{T+}$ Positive-going input threshold voltage | $V_{CC} = 1.65\text{ V}$  | 0.79  |                    | 1.16     | V             |
|   | $V_{CC} = 2.3\text{ V}$   | 1.11  |                    | 1.56     |               |
|   | $V_{CC} = 3\text{ V}$   | 1.5   |                    | 1.87     |               |
|   | $V_{CC} = 4.5\text{ V}$   | 2.16  |                    | 2.74     |               |
|   | $V_{CC} = 5.5\text{ V}$   | 2.61  |                    | 3.33     |               |
| $V_{T-}$ Negative-going input threshold voltage | $V_{CC} = 1.65\text{ V}$  | 0.35  |                    | 0.62     | V             |
|   | $V_{CC} = 2.3\text{ V}$   | 0.58  |                    | 0.87     |               |
|   | $V_{CC} = 3\text{ V}$   | 0.84  |                    | 1.19     |               |
|   | $V_{CC} = 4.5\text{ V}$   | 1.41  |                    | 1.9      |               |
|   | $V_{CC} = 5.5\text{ V}$   | 1.87  |                    | 2.29     |               |
| $\Delta V_T$ Hysteresis ( $V_{T+} - V_{T-}$ )   | $V_{CC} = 1.65\text{ V}$  | 0.3   |                    | 0.62     | V             |
|   | $V_{CC} = 2.3\text{ V}$   | 0.4   |                    | 0.8      |               |
|   | $V_{CC} = 3\text{ V}$   | 0.53  |                    | 0.87     |               |
|   | $V_{CC} = 4.5\text{ V}$   | 0.71  |                    | 1.04     |               |
|   | $V_{CC} = 5.5\text{ V}$   | 0.71  |                    | 1.11     |               |
| $V_{OH}$  | $V_{CC} = 1.65\text{ V to } 5.5\text{ V}, I_{OH} = -100\text{ }\mu\text{A}$   | $V_{CC} - 0.1$                                  |                    |          | V             |
|   | $V_{CC} = 1.65\text{ V}, I_{OH} = -4\text{ mA}$   | 1.2   |                    |          |               |
|   | $V_{CC} = 2.3\text{ V}, I_{OH} = -8\text{ mA}$  | 1.9   |                    |          |               |
|   | $V_{CC} = 3\text{ V}, I_{OH} = -16\text{ mA}$   | 2.4   |                    |          |               |
|   | $V_{CC} = 3\text{ V}, I_{OH} = -24\text{ mA}$   | 2.3   |                    |          |               |
|   | $V_{CC} = 4.5\text{ V}, I_{OH} = -32\text{ mA}$   | 3.8   |                    |          |               |
| $V_{OL}$  | $V_{CC} = 1.65\text{ V to } 5.5\text{ V}, I_{OL} = 100\text{ }\mu\text{A}$  |   |                    | 0.1      | V             |
|   | $V_{CC} = 1.65\text{ V}, I_{OL} = 4\text{ mA}$  |   |                    | 0.45     |               |
|   | $V_{CC} = 2.3\text{ V}, I_{OL} = 8\text{ mA}$   |   |                    | 0.3      |               |
|   | $V_{CC} = 3\text{ V}, I_{OL} = 16\text{ mA}$  | $T_A = -40^\circ\text{C to } 85^\circ\text{C}$  |                    | 0.4      |               |
|   |   | $T_A = -40^\circ\text{C to } 125^\circ\text{C}$ |                    | 0.45     |               |
|   | $V_{CC} = 3\text{ V}, I_{OL} = 24\text{ mA}$  |   |                    | 0.55     |               |
|   | $V_{CC} = 4.5\text{ V}, I_{OL} = 32\text{ mA}$  | $T_A = -40^\circ\text{C to } 85^\circ\text{C}$  |                    | 0.55     |               |
|   |   | $T_A = -40^\circ\text{C to } 125^\circ\text{C}$ |                    | 0.58     |               |
| $I_I$   | $V_{CC} = 0\text{ V to } 5.5\text{ V}, V_I = 5.5\text{ V or GND}$   |   |                    | $\pm 1$  | $\mu\text{A}$ |
| $I_{off}$                                       | $V_{CC} = 0\text{ V}, V_I \text{ or } V_O = 5.5\text{ V}$   |   |                    | $\pm 10$ | $\mu\text{A}$ |
| $I_{CC}$  | $V_{CC} = 1.65\text{ V to } 5.5\text{ V}, V_I = 5.5\text{ V or GND}, I_O = 0$   |   |                    | 10       | $\mu\text{A}$ |
| $\Delta I_{CC}$                                 | $V_{CC} = 3\text{ V to } 5.5\text{ V}, \text{ one input at } V_{CC} - 0.6\text{ V}, \text{ other inputs at } V_{CC} \text{ or GND}$ |   |                    | 500      | $\mu\text{A}$ |
| $C_i$   | $V_{CC} = 3.3\text{ V}, V_I = V_{CC} \text{ or GND}$  |   | 3.5                |          | pF            |

(1) All typical values are at  $V_{CC} = 3.3\text{ V}, T_A = 25^\circ\text{C}$

### Electrical Characteristics (continued)

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

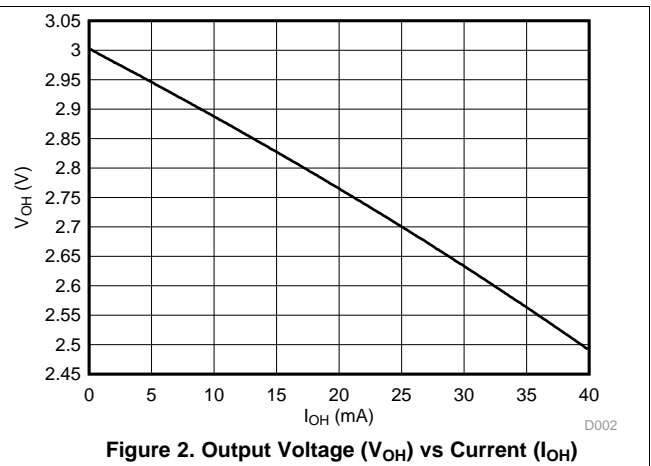
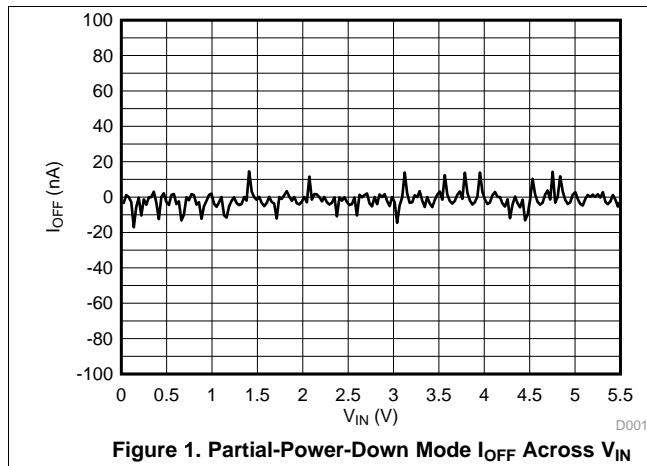
| PARAMETER       |                               | TEST CONDITIONS                   | MIN                     | TYP <sup>(1)</sup> | MAX | UNIT |
|-----------------|-------------------------------|-----------------------------------|-------------------------|--------------------|-----|------|
| C <sub>pd</sub> | Power dissipation capacitance | f = 10 MHz, T <sub>A</sub> = 25°C | V <sub>CC</sub> = 1.8 V |                    | 20  | pF   |
|                 |                               |                                   | V <sub>CC</sub> = 2.5 V |                    | 20  |      |
|                 |                               |                                   | V <sub>CC</sub> = 3.3 V |                    | 21  |      |
|                 |                               |                                   | V <sub>CC</sub> = 5 V   |                    | 22  |      |

### 6.6 Switching Characteristics

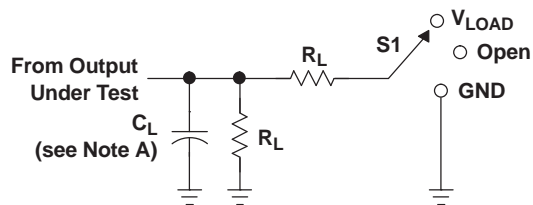
over recommended operating free-air temperature range (unless otherwise noted; see Figure 3)

| PARAMETER       | TEST CONDITIONS         |                                 | MIN                              | TYP | MAX  | UNIT |
|-----------------|-------------------------|---------------------------------|----------------------------------|-----|------|------|
| t <sub>pd</sub> | Any input to Y (output) | T <sub>A</sub> = -40°C to 85°C  | V <sub>CC</sub> = 1.8 V ± 0.15 V | 3.2 | 14.4 | ns   |
|                 |                         |                                 | V <sub>CC</sub> = 2.5 V ± 0.2 V  | 2   | 8.3  |      |
|                 |                         |                                 | V <sub>CC</sub> = 3.3 V ± 0.3 V  | 1.5 | 6.3  |      |
|                 |                         |                                 | V <sub>CC</sub> = 5 V ± 0.5 V    | 1.1 | 5.1  |      |
|                 |                         | T <sub>A</sub> = -40°C to 125°C | V <sub>CC</sub> = 1.8 V ± 0.15 V | 3.2 | 16.4 |      |
|                 |                         |                                 | V <sub>CC</sub> = 2.5 V ± 0.2 V  | 2   | 9.3  |      |
|                 |                         |                                 | V <sub>CC</sub> = 3.3 V ± 0.3 V  | 1.5 | 7.3  |      |
|                 |                         |                                 | V <sub>CC</sub> = 5 V ± 0.5 V    | 1.1 | 6.1  |      |

### 6.7 Typical Characteristics



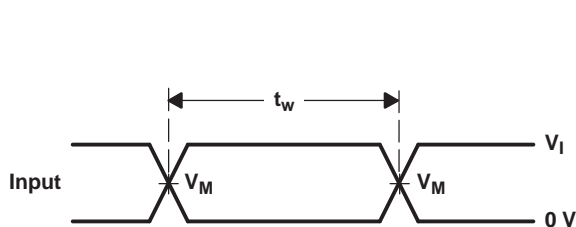
## 7 Parameter Measurement Information



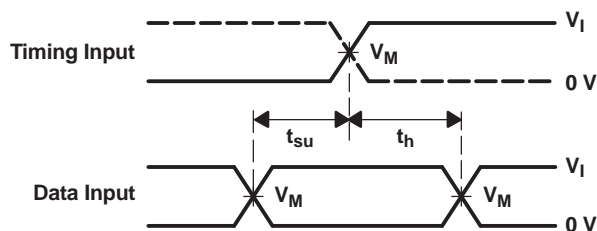
LOAD CIRCUIT

| TEST              | S1         |
|-------------------|------------|
| $t_{PLH}/t_{PHL}$ | Open       |
| $t_{PLZ}/t_{PZL}$ | $V_{LOAD}$ |
| $t_{PHZ}/t_{PZH}$ | GND        |

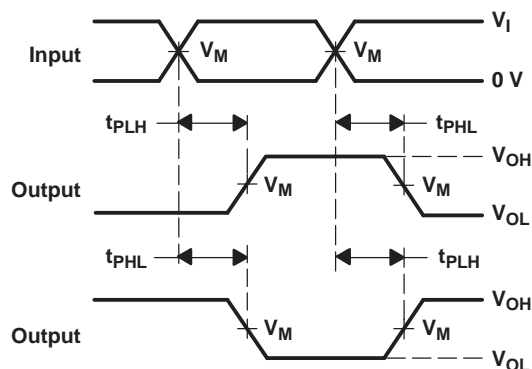
| $V_{CC}$                         | INPUTS   |                      | $V_M$      | $V_{LOAD}$        | $C_L$ | $R_L$        | $V_{\Delta}$ |
|----------------------------------|----------|----------------------|------------|-------------------|-------|--------------|--------------|
|                                  | $V_I$    | $t_r/t_f$            |            |                   |       |              |              |
| $1.8\text{ V} \pm 0.15\text{ V}$ | $V_{CC}$ | $\leq 2\text{ ns}$   | $V_{CC}/2$ | $2 \times V_{CC}$ | 30 pF | 1 k $\Omega$ | 0.15 V       |
| $2.5\text{ V} \pm 0.2\text{ V}$  | $V_{CC}$ | $\leq 2\text{ ns}$   | $V_{CC}/2$ | $2 \times V_{CC}$ | 30 pF | 500 $\Omega$ | 0.15 V       |
| $3.3\text{ V} \pm 0.3\text{ V}$  | 3 V      | $\leq 2.5\text{ ns}$ | 1.5 V      | 6 V               | 50 pF | 500 $\Omega$ | 0.3 V        |
| $5\text{ V} \pm 0.5\text{ V}$    | $V_{CC}$ | $\leq 2.5\text{ ns}$ | $V_{CC}/2$ | $2 \times V_{CC}$ | 50 pF | 500 $\Omega$ | 0.3 V        |



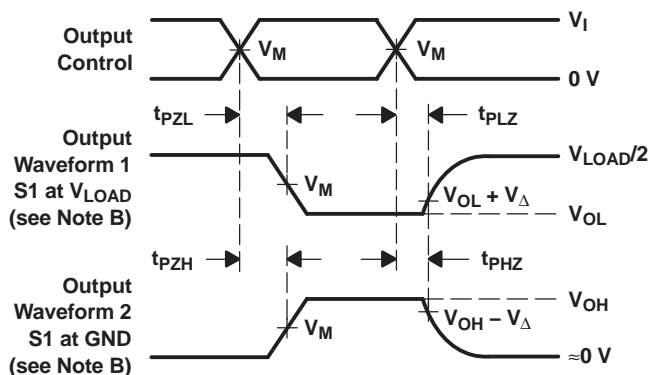
VOLTAGE WAVEFORMS PULSE DURATION



VOLTAGE WAVEFORMS SETUP AND HOLD TIMES



VOLTAGE WAVEFORMS PROPAGATION DELAY TIMES INVERTING AND NONINVERTING OUTPUTS



VOLTAGE WAVEFORMS ENABLE AND DISABLE TIMES LOW- AND HIGH-LEVEL ENABLING

- 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:  $PRR \leq 10\text{ MHz}$ ,  $Z_O = 50\ \Omega$ .
  - 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  $t_{en}$ .
  - $t_{PLH}$  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

## 8 Detailed Description

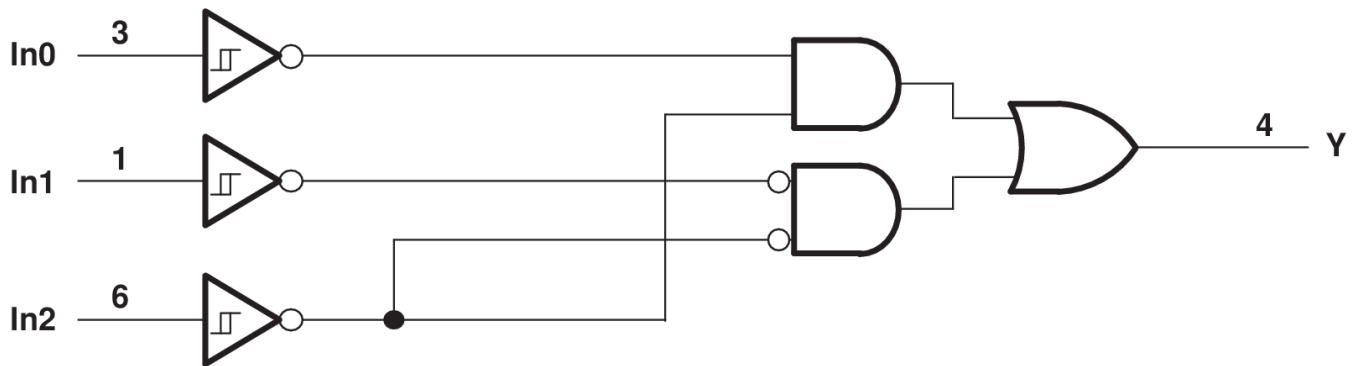
### 8.1 Overview

The SN74LVC1G57 device 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 buffer. All inputs can be connected to  $V_{CC}$  or GND.

The CMOS device has high output drive while maintaining low static power dissipation over a broad  $V_{CC}$  operating range.

This configurable multiple-function gate is designed for 1.65-V to 5.5-V  $V_{CC}$  operation.

### 8.2 Functional Block Diagram



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### 8.3 Feature Description

#### 8.3.1 Schmitt-Trigger Inputs

Schmitt-trigger inputs are designed to provide a minimum separation between positive and negative switching thresholds. This allows for noisy or slow inputs that would cause problems such as oscillation or excessive current draw with normal CMOS inputs

#### 8.3.2 Inputs Accept Voltages to 5.5 V

The SN74LVC1G57 is a configurable multiple-function gate is designed for 1.65-V to 5.5-V  $V_{CC}$  operation. Inputs are over-voltage tolerant up to 5.5 V. This feature allows the use of this device as a translator in a mixed 1.8-V, 3.3-V, and 5-V system environment.

### 8.4 Device Functional Modes

[Table 1](#) lists the functional modes of the SN74LVC1G57 and [Table 2](#) lists the logic configuration images.

**Table 1. Function Table**

| INPUTS |     |     | OUTPUT |
|--------|-----|-----|--------|
| In2    | In1 | In0 | Y      |
| L      | L   | L   | H      |
| L      | L   | H   | L      |
| L      | H   | L   | H      |
| L      | H   | H   | L      |
| H      | L   | L   | L      |
| H      | L   | H   | L      |
| H      | H   | L   | H      |
| H      | H   | H   | H      |

Table 2. Logic Configurations

| LOGIC FUNCTION                        | FIGURE NO.            |
|---------------------------------------|-----------------------|
| 2-Input AND                           | Figure 4              |
| 2-Input AND with both inputs inverted | Figure 7              |
| 2-Input NAND with inverted input      | Figure 5 and Figure 6 |
| 2-Input OR with inverted input        | Figure 5 and Figure 6 |
| 2-Input NOR                           | Figure 7              |
| 2-Input NOR with both inputs inverted | Figure 4              |
| 2-Input XNOR                          | Figure 8              |

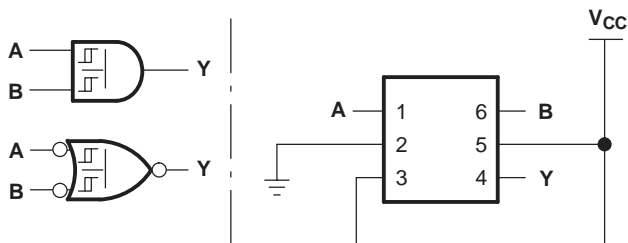


Figure 4. 2-Input AND Gate

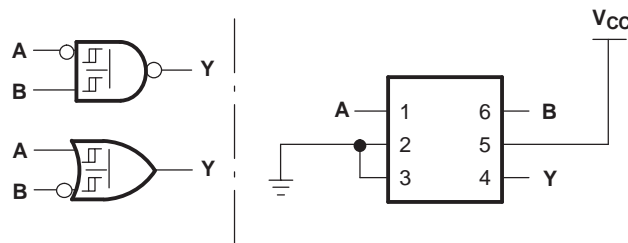


Figure 5. 2-Input NAND Gate With Inverted A Input

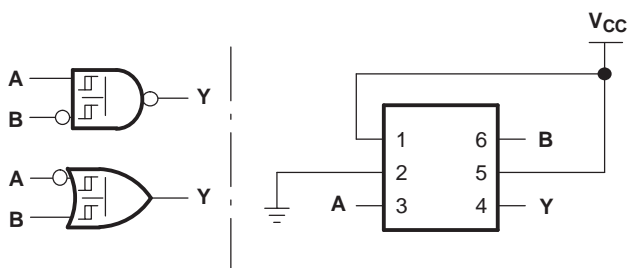


Figure 6. 2-Input NAND Gate With Inverted B Input

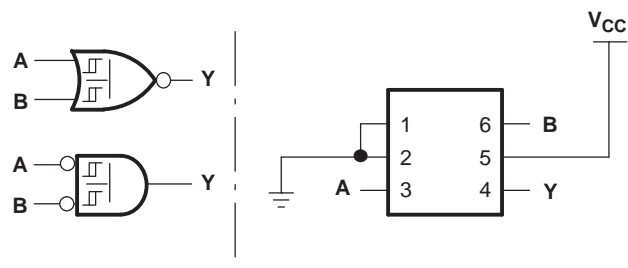


Figure 7. 2-Input NOR Gate

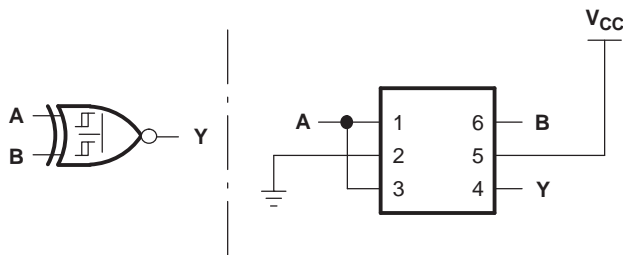


Figure 8. 2-Input XNOR Gate

## 9 Application and Implementation

### NOTE

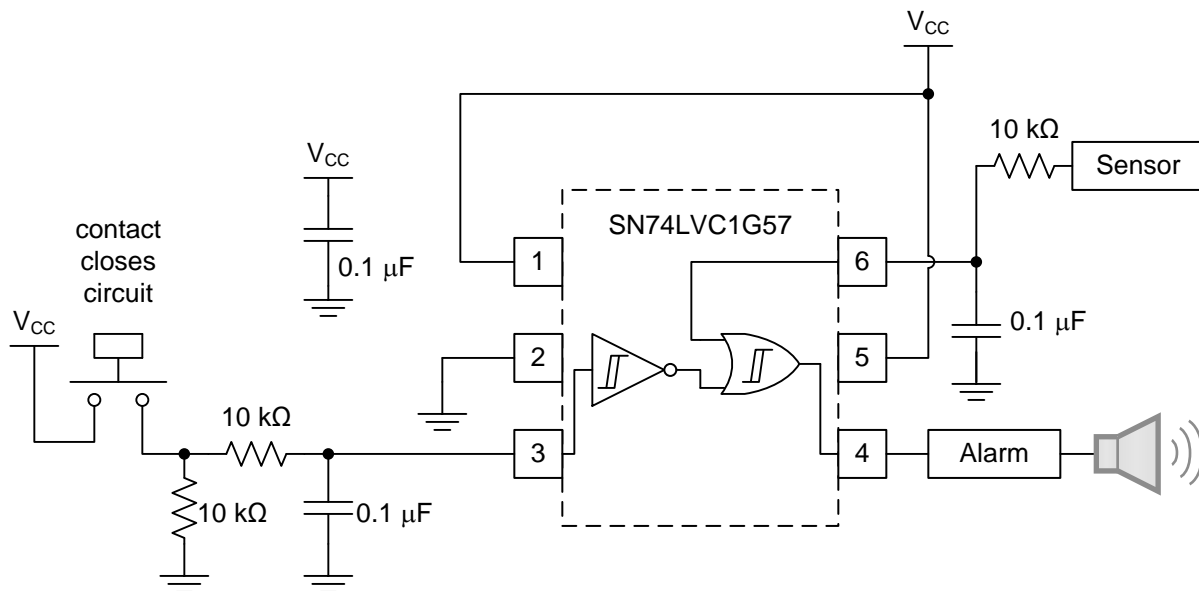
Information in the following applications sections is not part of the TI component specification, and TI does not warrant its accuracy or completeness. TI's customers are responsible for determining suitability of components for their purposes. Customers should validate and test their design implementation to confirm system functionality.

### 9.1 Application Information

The SN74LVC1G57 features configurable multiple functions. The output state is determined by eight patterns of 3-bit input. The user can choose the logic functions AND, NAND, NOR, XNOR, inverter, and buffer. All inputs can be connected to  $V_{CC}$  or GND.

### 9.2 Typical Application

This application shows the SN74LVC1G57 configured as an OR gate with an inverted input. This particular configuration is helpful for dual sensor or switch applications where one of the inputs is normally closed or a logic high 1. Normally this application would require two external gates, but because the SN74LVC1G57 can be configured to meet this function the application can be implemented with a single chip solution.



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**Figure 9. Dual-Sensor Alarm Trigger**

## Typical Application (continued)

### 9.2.1 Design Requirements

#### 9.2.1.1 Application Truth Table

Because we are working with two independent alarm triggers, we need to ensure that the alarm signal is only sent whenever either condition is met. Therefore our resulting truth table will look very much like a logic OR function. However, since we are also assuming one of the conditions to always be true, i.e. a door that should remain closed, we make use of the inverted input in [Table 3](#).

**Table 3. Dual-Sensor Truth Table**

| INPUTS            |        | OUTPUT |
|-------------------|--------|--------|
| TRIGGER OR SWITCH | SENSOR | ALARM  |
| L                 | X      | H      |
| H                 | L      | L      |
| X                 | H      | H      |

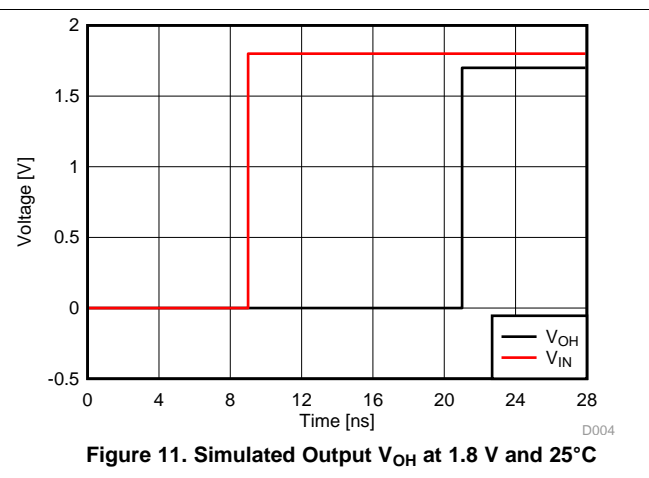
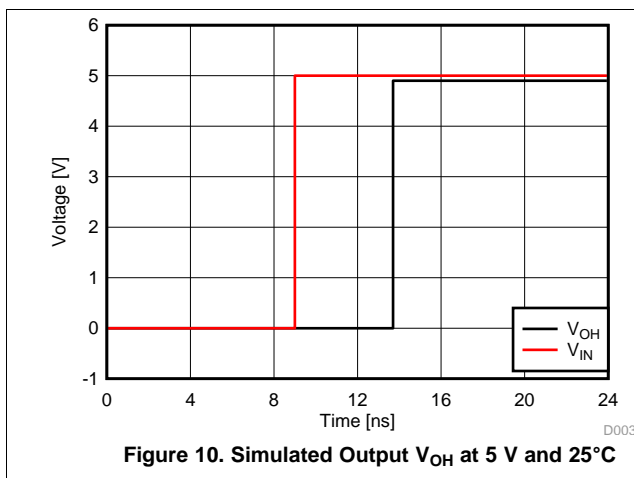
#### 9.2.1.2 Schmitt-Trigger Inputs

On a normal (non-Schmitt-Trigger) input the part will switch at the same point on the rising edge and falling edge. With a slow rising edge the part will switch at the threshold. When the switch occurs it will require current from  $V_{CC}$ . When current is forced from  $V_{CC}$ , the  $V_{CC}$  level can drop causing the threshold to shift. When the threshold shifts it will cross the input again causing the part to switch again. This can go on and on causing oscillation which can cause excessive current. The same thing can happen if there is noise on the input. The noise can cross the threshold multiple times and cause oscillation or multiple clocking. The solution to these problems is to use a Schmitt-Trigger type device to translate the slow or noisy edges into something faster that will meet the input rise and fall specs of the following device. A true Schmitt-Trigger input will not have rise and fall time limitations.

### 9.2.2 Detailed Design Procedure

- Recommended Input conditions:
  - Specified high and low levels. See ( $V_{IH}$  and  $V_{IL}$ ) in [Recommended Operating Conditions](#).
  - Inputs are overvoltage tolerant allowing them to go as high as 5.5 V at any valid  $V_{CC}$ .
- 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  $V_{CC}$ .

### 9.2.3 Application Curves



## 10 Power Supply Recommendations

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

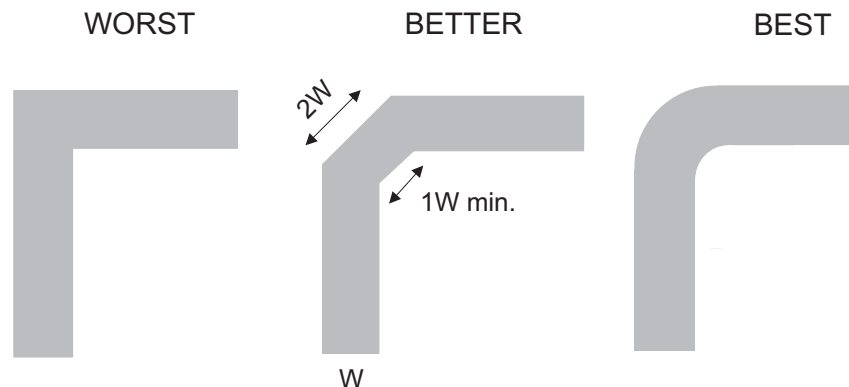
Each  $V_{CC}$  terminal should have a good bypass capacitor to prevent power disturbance. For devices with a single supply, a 0.1- $\mu\text{F}$  bypass capacitor is recommended. If there are multiple pins labeled  $V_{CC}$ , then a 0.01- $\mu\text{F}$  or 0.022- $\mu\text{F}$  capacitor is recommended for each  $V_{CC}$  because the  $V_{CC}$  pins will be tied together internally. For devices with dual supply pins operating at different voltages, for example  $V_{CC}$  and  $V_{DD}$ , a 0.1- $\mu\text{F}$  bypass capacitor is recommended for each supply pin. It is acceptable to parallel multiple bypass capacitors to reject different frequencies of noise. 0.1- $\mu\text{F}$  and 1- $\mu\text{F}$  capacitors 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

Reflections and matching are closely related to the loop antenna theory but are different enough to be discussed separately from the theory. When a PCB trace turns a corner at a 90° angle, a reflection can occur. A reflection occurs primarily because of the change of width of the trace. At the apex of the turn, the trace width increases to 1.414 times the width. This increase upsets the transmission-line characteristics, especially the distributed capacitance and self-inductance of the trace which results in the reflection. Not all PCB traces can be straight and therefore some traces must turn corners. [Figure 12](#) shows progressively better techniques of rounding corners. Only the last example (BEST) maintains constant trace width and minimizes reflections.

### 11.2 Layout Example



**Figure 12. Trace Example**

## 12 Device and Documentation Support

### 12.1 Documentation Support

#### 12.1.1 Related Documentation

For related documentation see the following:

[Implications of Slow or Floating CMOS Inputs](#) (SCBA004)

### 12.2 Receiving Notification of Documentation Updates

To receive notification of documentation updates, navigate to the device product folder on ti.com. In the upper right corner, click on *Alert me* to register and receive a weekly digest of any product information that has changed. For change details, review the revision history included in any revised document.

### 12.3 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.

### 12.4 Trademarks

NanoFree, E2E are trademarks of Texas Instruments.  
All other trademarks are the property of their respective owners.

### 12.5 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.

### 12.6 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<br>(1) | Package Type | Package Drawing | Pins | Package Qty | Eco Plan<br>(2)         | Lead/Ball Finish<br>(6) | MSL Peak Temp<br>(3) | Op Temp (°C) | Device Marking<br>(4/5)   | Samples                 |
|-------------------|---------------|--------------|-----------------|------|-------------|-------------------------|-------------------------|----------------------|--------------|---------------------------|-------------------------|
| SN74LVC1G57DBVR   | ACTIVE        | SOT-23       | DBV             | 6    | 3000        | Green (RoHS & no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | -40 to 125   | (CA7O, CA7R)              | <a href="#">Samples</a> |
| SN74LVC1G57DCKR   | ACTIVE        | SC70         | DCK             | 6    | 3000        | Green (RoHS & no Sb/Br) | CU NIPDAU   CU SN       | Level-1-260C-UNLIM   | -40 to 125   | (CL5, CLF, CLJ, CLK, CLR) | <a href="#">Samples</a> |
| SN74LVC1G57DCKRG4 | ACTIVE        | SC70         | DCK             | 6    | 3000        | Green (RoHS & no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | -40 to 125   | CLF                       | <a href="#">Samples</a> |
| SN74LVC1G57DRLR   | ACTIVE        | SOT-5X3      | DRL             | 6    | 4000        | Green (RoHS & no Sb/Br) | CU NIPDAU   CU NIPDAUAG | Level-1-260C-UNLIM   | -40 to 125   | (CL7, CLR)                | <a href="#">Samples</a> |
| SN74LVC1G57DRY2   | ACTIVE        | SON          | DRY             | 6    | 5000        | Green (RoHS & no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | -40 to 125   | CL                        | <a href="#">Samples</a> |
| SN74LVC1G57DRYR   | ACTIVE        | SON          | DRY             | 6    | 5000        | Green (RoHS & no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | -40 to 125   | CL                        | <a href="#">Samples</a> |
| SN74LVC1G57DSFR   | ACTIVE        | SON          | DSF             | 6    | 5000        | Green (RoHS & no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | -40 to 125   | CL                        | <a href="#">Samples</a> |
| SN74LVC1G57YZPR   | ACTIVE        | DSBGA        | YZP             | 6    | 3000        | Green (RoHS & no Sb/Br) | SNAGCU                  | Level-1-260C-UNLIM   | -40 to 85    | CLN                       | <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 <=100ppm threshold. Antimony trioxide based flame retardants must also meet the <=1000ppm threshold requirement.

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

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

<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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**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 |
|-------------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| SN74LVC1G57DBVR   | SOT-23       | DBV             | 6    | 3000 | 180.0              | 8.4                | 3.23    | 3.17    | 1.37    | 4.0     | 8.0    | Q3            |
| SN74LVC1G57DCKR   | SC70         | DCK             | 6    | 3000 | 180.0              | 8.4                | 2.41    | 2.41    | 1.2     | 4.0     | 8.0    | Q3            |
| SN74LVC1G57DCKR   | SC70         | DCK             | 6    | 3000 | 178.0              | 9.0                | 2.4     | 2.5     | 1.2     | 4.0     | 8.0    | Q3            |
| SN74LVC1G57DCKR   | SC70         | DCK             | 6    | 3000 | 178.0              | 9.0                | 2.4     | 2.5     | 1.2     | 4.0     | 8.0    | Q3            |
| SN74LVC1G57DCKRG4 | SC70         | DCK             | 6    | 3000 | 178.0              | 9.0                | 2.4     | 2.5     | 1.2     | 4.0     | 8.0    | Q3            |
| SN74LVC1G57DRLR   | SOT-5X3      | DRL             | 6    | 4000 | 180.0              | 9.5                | 1.78    | 1.78    | 0.69    | 4.0     | 8.0    | Q3            |
| SN74LVC1G57DRLR   | SOT-5X3      | DRL             | 6    | 4000 | 180.0              | 8.4                | 1.98    | 1.78    | 0.69    | 4.0     | 8.0    | Q3            |
| SN74LVC1G57DRY2   | SON          | DRY             | 6    | 5000 | 180.0              | 9.5                | 1.6     | 1.15    | 0.75    | 4.0     | 8.0    | Q3            |
| SN74LVC1G57DRYR   | SON          | DRY             | 6    | 5000 | 180.0              | 9.5                | 1.15    | 1.6     | 0.75    | 4.0     | 8.0    | Q1            |
| SN74LVC1G57DSFR   | SON          | DSF             | 6    | 5000 | 180.0              | 9.5                | 1.16    | 1.16    | 0.5     | 4.0     | 8.0    | Q2            |
| SN74LVC1G57YZPR   | DSBGA        | YZP             | 6    | 3000 | 178.0              | 9.2                | 1.02    | 1.52    | 0.63    | 4.0     | 8.0    | Q1            |

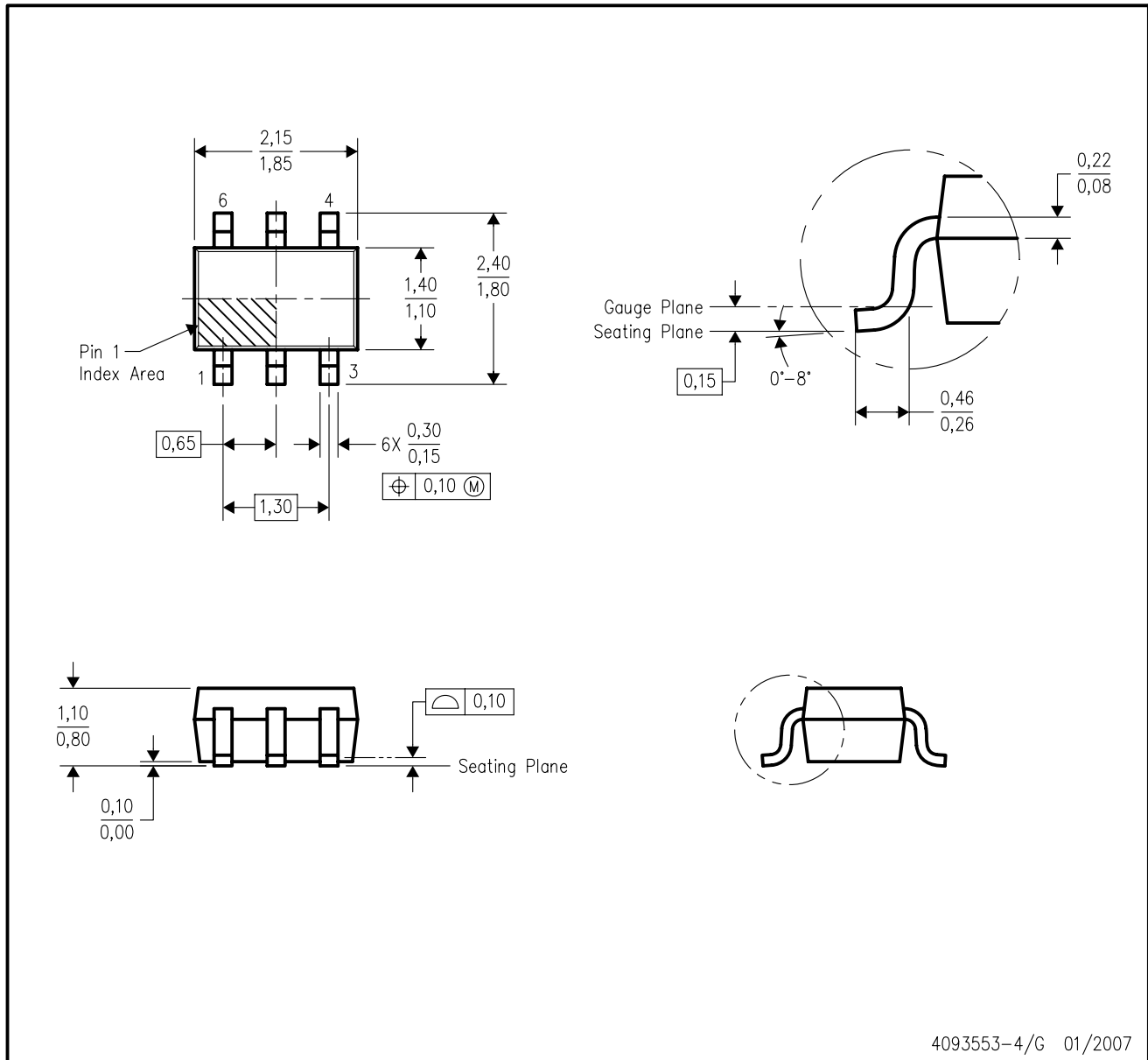
**TAPE AND REEL BOX DIMENSIONS**


\*All dimensions are nominal

| Device            | Package Type | Package Drawing | Pins | SPQ  | Length (mm) | Width (mm) | Height (mm) |
|-------------------|--------------|-----------------|------|------|-------------|------------|-------------|
| SN74LVC1G57DBVR   | SOT-23       | DBV             | 6    | 3000 | 202.0       | 201.0      | 28.0        |
| SN74LVC1G57DCKR   | SC70         | DCK             | 6    | 3000 | 202.0       | 201.0      | 28.0        |
| SN74LVC1G57DCKR   | SC70         | DCK             | 6    | 3000 | 180.0       | 180.0      | 18.0        |
| SN74LVC1G57DCKR   | SC70         | DCK             | 6    | 3000 | 180.0       | 180.0      | 18.0        |
| SN74LVC1G57DCKRG4 | SC70         | DCK             | 6    | 3000 | 180.0       | 180.0      | 18.0        |
| SN74LVC1G57DRLR   | SOT-5X3      | DRL             | 6    | 4000 | 184.0       | 184.0      | 19.0        |
| SN74LVC1G57DRLR   | SOT-5X3      | DRL             | 6    | 4000 | 202.0       | 201.0      | 28.0        |
| SN74LVC1G57DRY2   | SON          | DRY             | 6    | 5000 | 184.0       | 184.0      | 19.0        |
| SN74LVC1G57DRYR   | SON          | DRY             | 6    | 5000 | 184.0       | 184.0      | 19.0        |
| SN74LVC1G57DSFR   | SON          | DSF             | 6    | 5000 | 184.0       | 184.0      | 19.0        |
| SN74LVC1G57YZPR   | DSBGA        | YZP             | 6    | 3000 | 220.0       | 220.0      | 35.0        |

DCK (R-PDSO-G6)

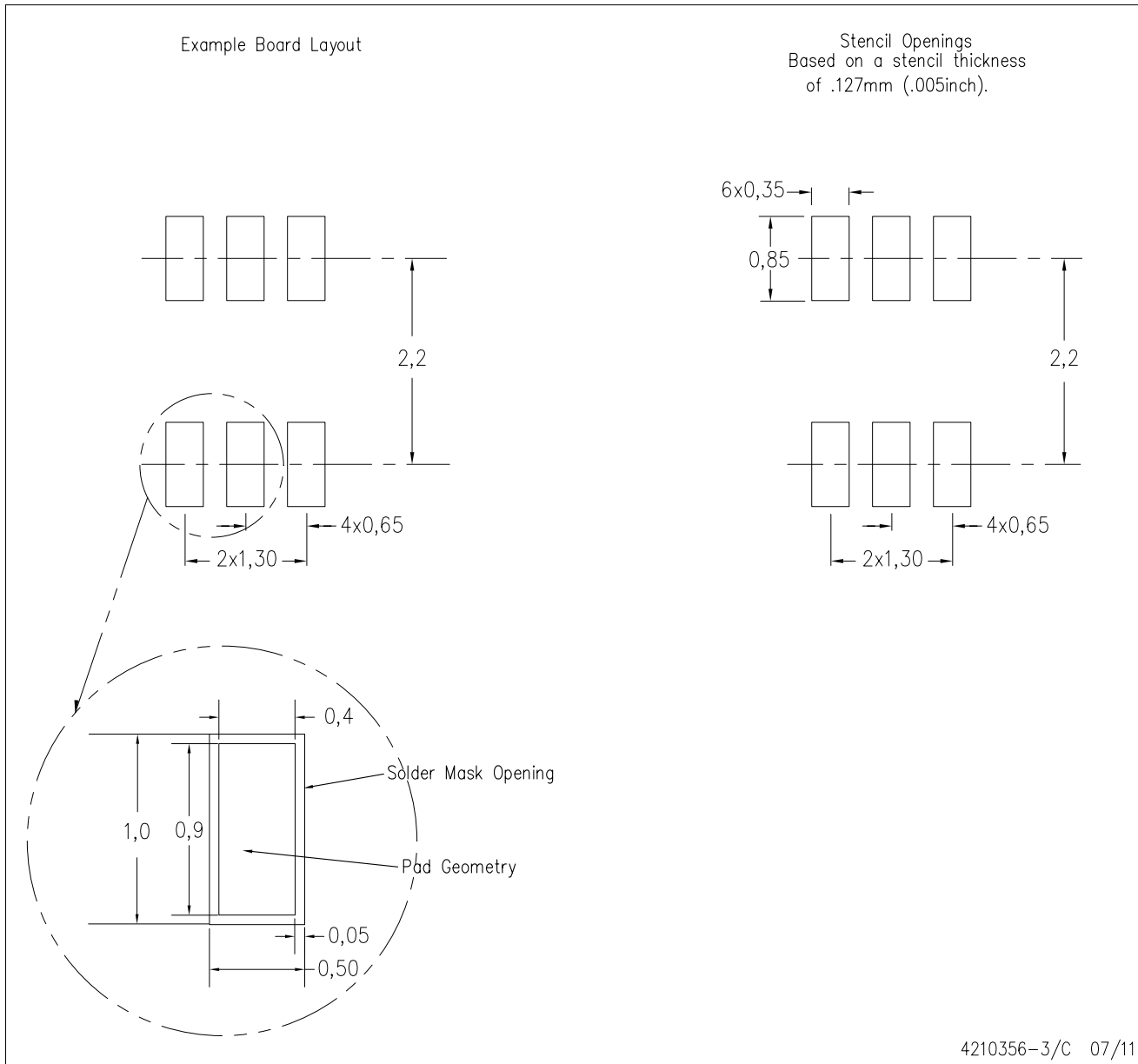
PLASTIC SMALL-OUTLINE PACKAGE



- 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 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.

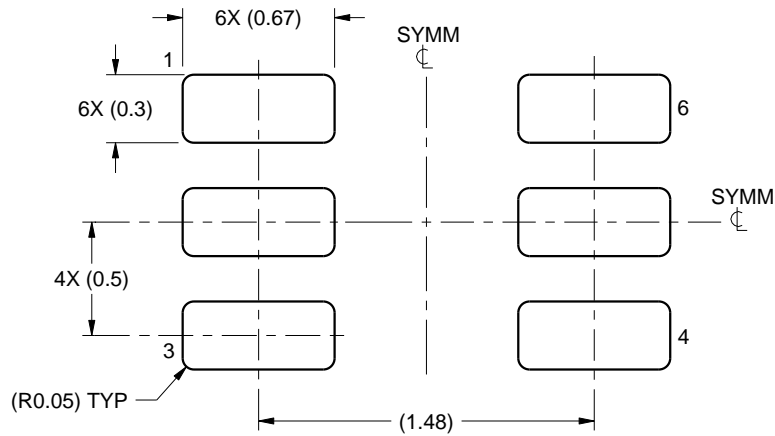


# EXAMPLE BOARD LAYOUT

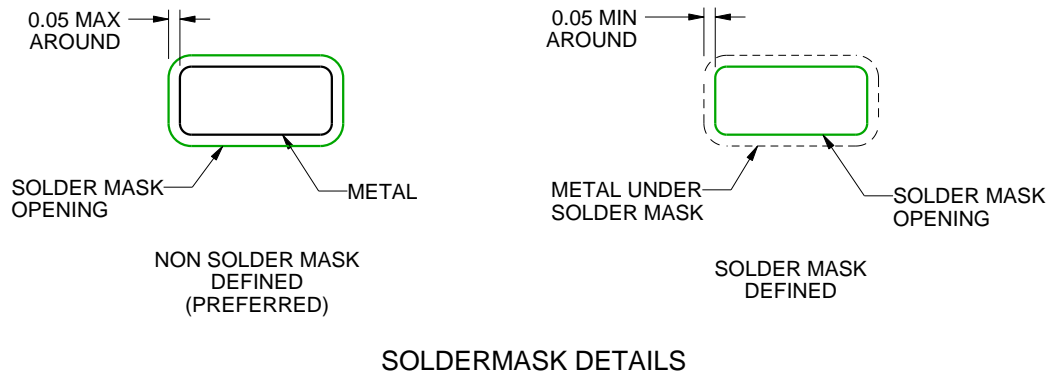
DRL0006A

SOT - 0.6 mm max height

PLASTIC SMALL OUTLINE



LAND PATTERN EXAMPLE  
SCALE:30X



SOLDERMASK DETAILS

4223266/A 09/2016

NOTES: (continued)

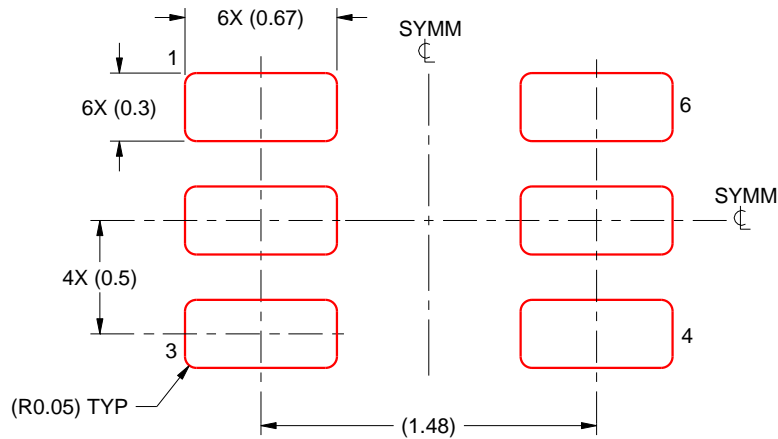
- 4. Publication IPC-7351 may have alternate designs.
- 5. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

# 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.

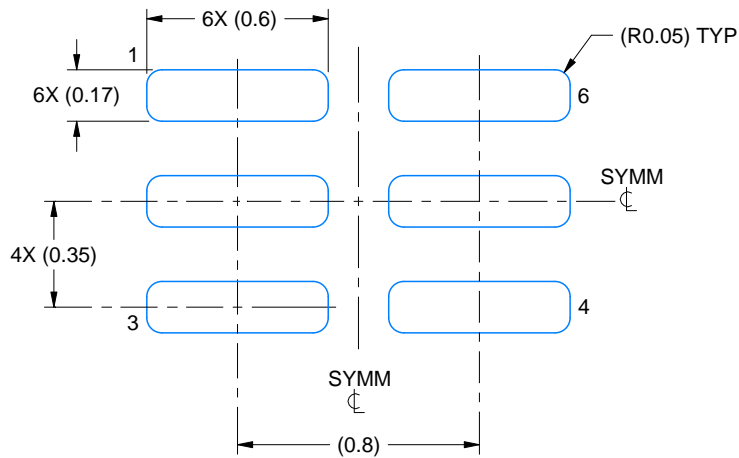


# EXAMPLE BOARD LAYOUT

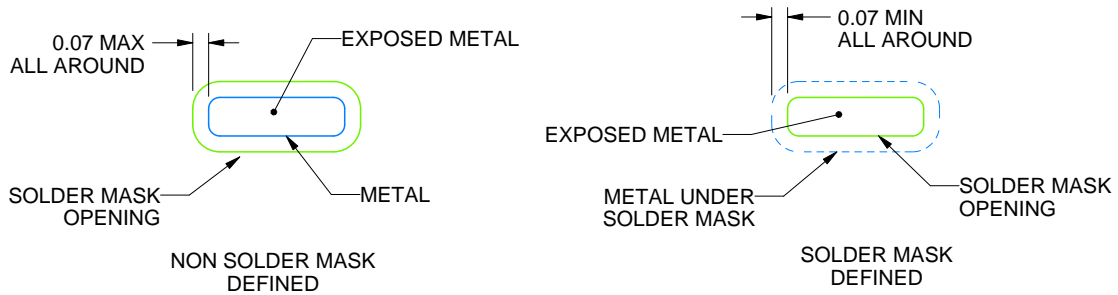
DSF0006A

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)

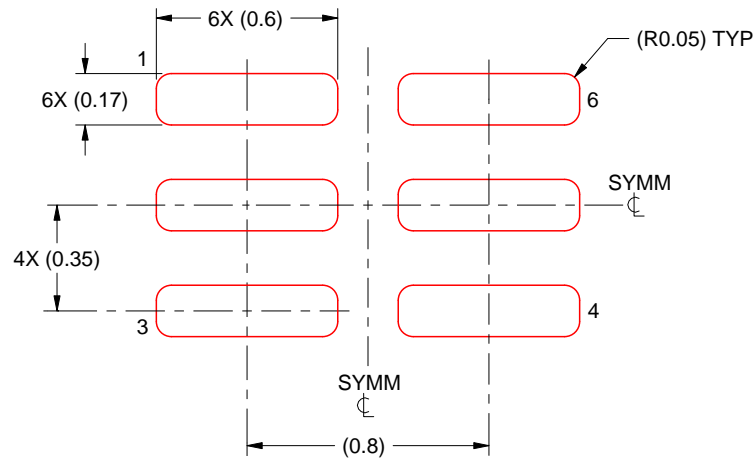
4. For more information, see Texas Instruments literature number SLUA271 ([www.ti.com/lit/sluea271](http://www.ti.com/lit/sluea271)).

# 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

4220597/A 06/2017

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

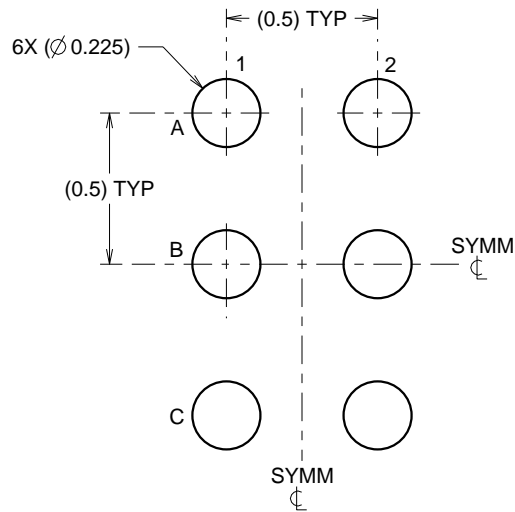


# EXAMPLE BOARD LAYOUT

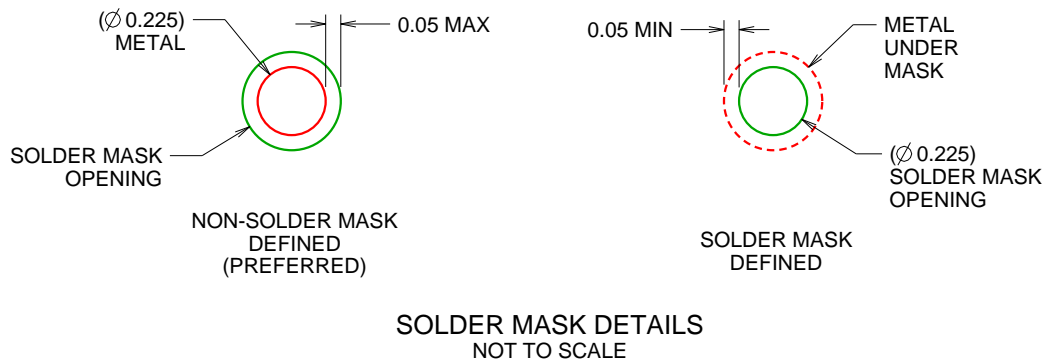
YZP0006

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)

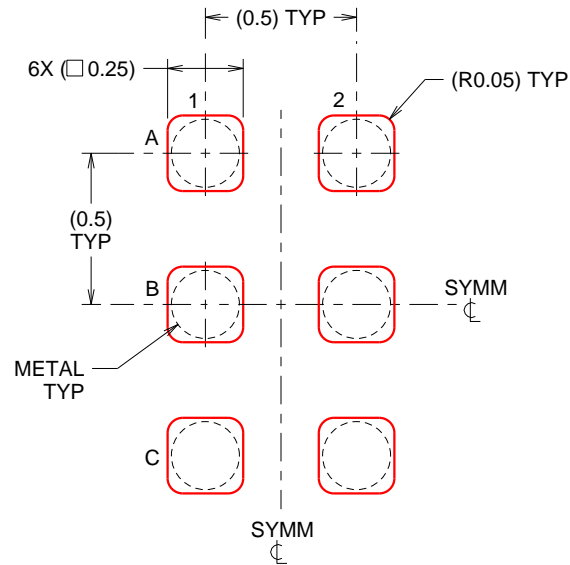
- Final dimensions may vary due to manufacturing tolerance considerations and also routing constraints. For more information, see Texas Instruments literature number SBVA017 ([www.ti.com/lit/sbva017](http://www.ti.com/lit/sbva017)).

# EXAMPLE STENCIL DESIGN

YZP0006

DSBGA - 0.5 mm max height

DIE SIZE BALL GRID ARRAY



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.

## 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

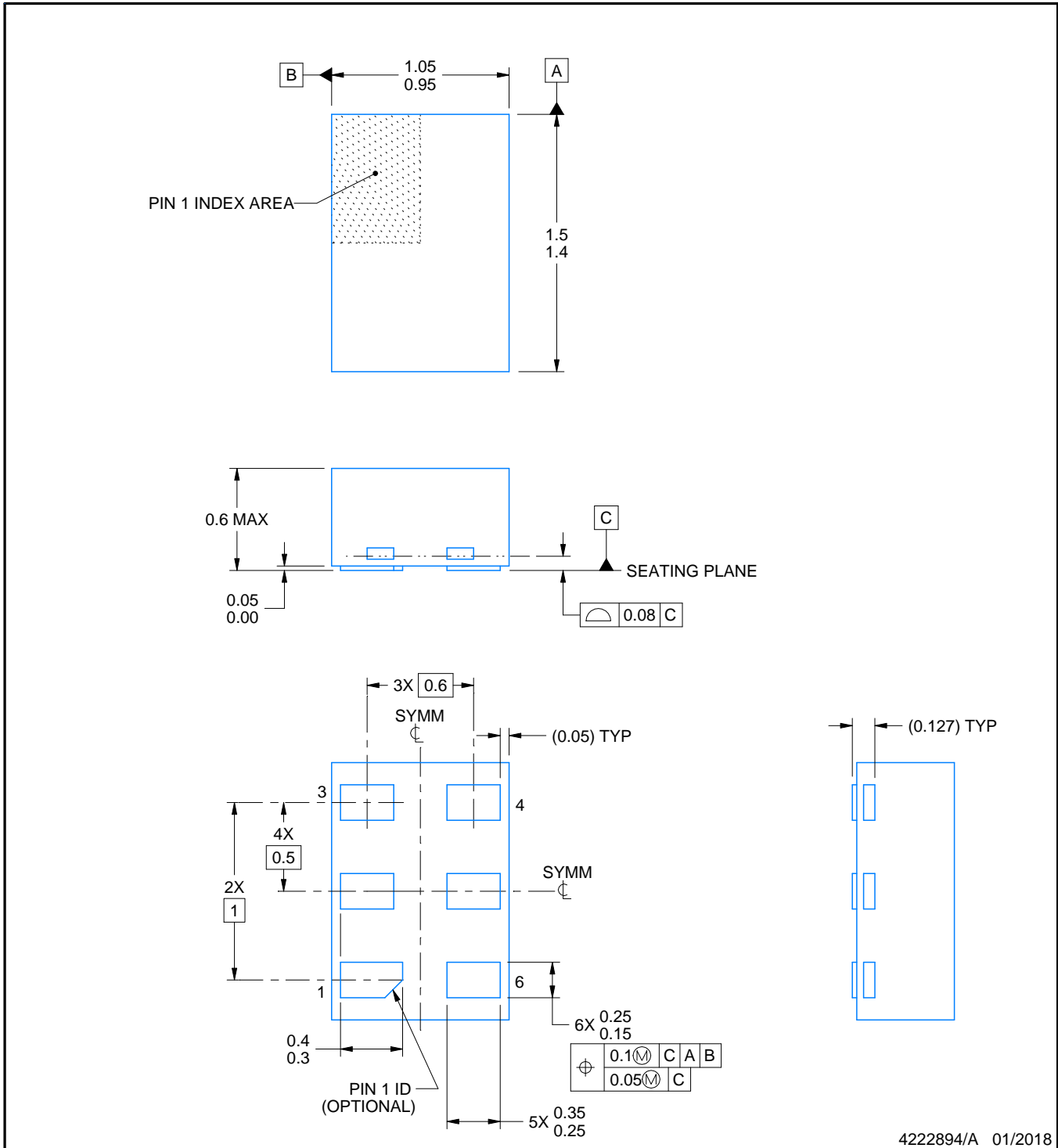
DRY0006A



# 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](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.

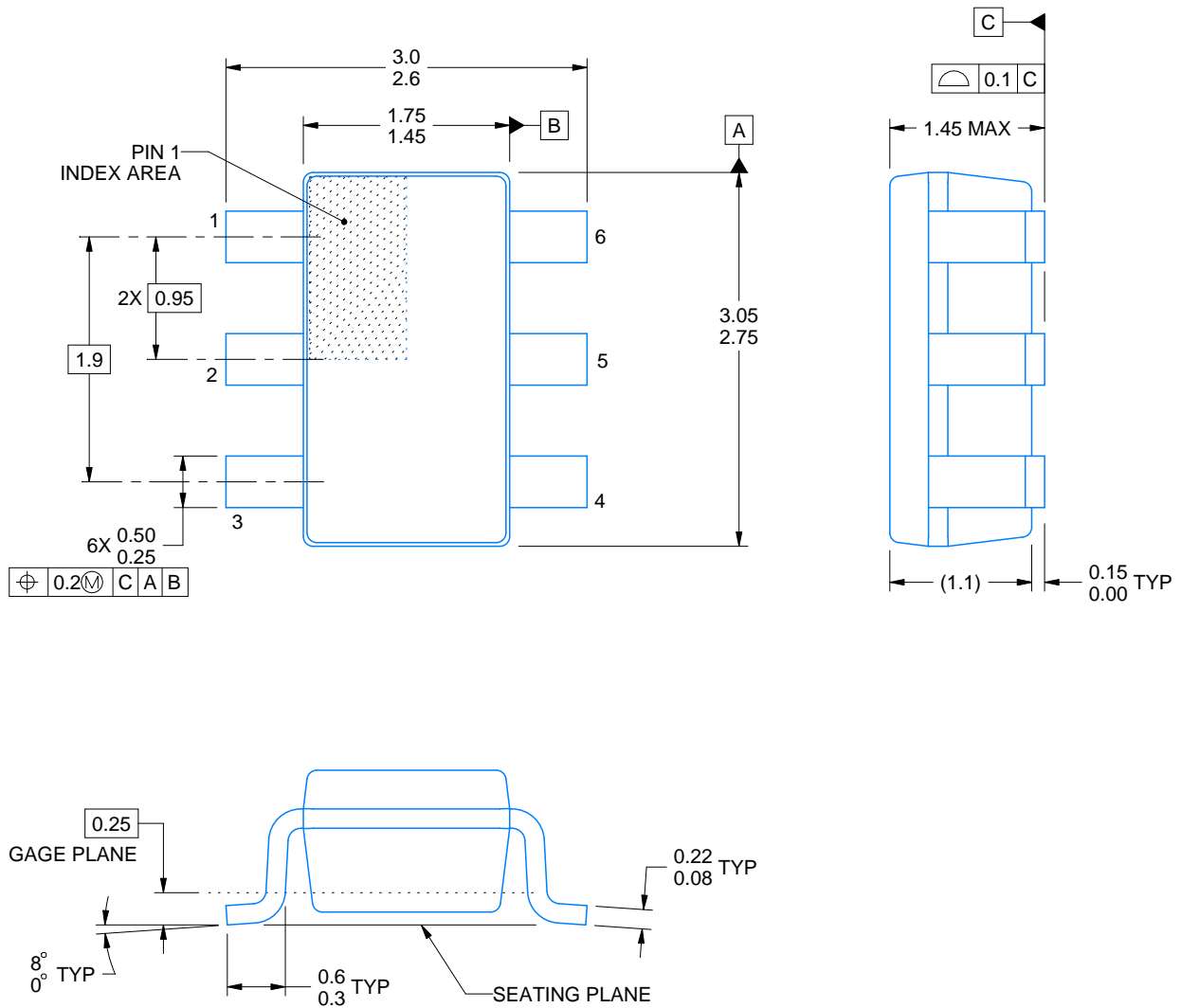
DBV0006A



PACKAGE OUTLINE

SOT-23 - 1.45 mm max height

SMALL OUTLINE TRANSISTOR



4214840/B 03/2018

NOTES:

1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. Body dimensions do not include mold flash or protrusion. Mold flash and protrusion shall not exceed 0.15 per side.
4. Leads 1,2,3 may be wider than leads 4,5,6 for package orientation.
5. Reference JEDEC MO-178.

# 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.

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