



**THE DATASHEET OF  
SN74LVC2G02DCURG4**



## SN74LVC2G02 Dual 2-Input Positive-NOR Gate

### 1 Features

- Available in the Texas Instruments NanoFree™ package
- Supports 5-V  $V_{CC}$  operation
- Inputs accept voltages to 5.5 V
- Max  $t_{pd}$  of 4.9 ns at 3.3 V
- Low power consumption, 10- $\mu$ A Max  $I_{CC}$
- $\pm 24$ -mA Output drive at 3.3 V
- Typical  $V_{OLP}$  (output ground bounce) <0.8 V at  $V_{CC} = 3.3$  V,  $T_A = 25^\circ\text{C}$
- Typical  $V_{OHV}$  (output  $V_{OH}$  undershoot) >2 V at  $V_{CC} = 3.3$  V,  $T_A = 25^\circ\text{C}$
- $I_{off}$  supports partial-power-down mode operation
- Latch-up performance exceeds 100 mA er JESD 78, class II
- ESD protection exceeds JESD 22
  - 2000-V Human-body model (A114-A)
  - 1000-V Charged-device model (C101)

### 2 Applications

- AV receiver
- Audio dock: portable
- Blu-ray player and home theater
- Embedded PC
- MP3 Player/recorder (portable audio)
- Personal digital assistant (PDA)
- Power: Telecom/server AC/DC supply: single controller: analog and digital
- Solid state drive (SSD): client and enterprise
- TV: LCD/digital and high-definition (HDTV)
- Tablet: enterprise
- Video analytics: server
- Wireless headset, keyboard, and mouse

### 3 Description

This dual 2-input positive-NOR gate is designed for 1.65-V to 5.5-V  $V_{CC}$  operation.

The SN74LVC2G02 device performs the Boolean function  $Y = \overline{A + B}$  or  $Y = \overline{A} \times \overline{B}$  in positive logic.

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

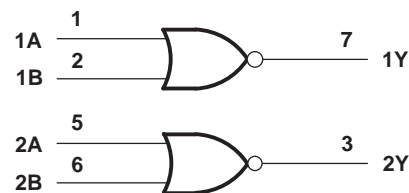
This device is fully specified for partial-power-down applications using  $I_{off}$ . The  $I_{off}$  circuitry disables the outputs, preventing damaging current backflow through the device when it is powered down.

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

| PART NUMBER    | PACKAGE   | BODY SIZE (NOM)   |
|----------------|-----------|-------------------|
| SN74LVC2G02DCT | SSOP (8)  | 2.95 mm × 2.8 mm  |
| SN74LVC2G02DCU | VSSOP (8) | 2.3 mm × 2.0 mm   |
| SN74LVC2G02YZP | DSBGA (8) | 1.91 mm × 0.91 mm |

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

#### Simplified Schematic



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## 4 Revision History

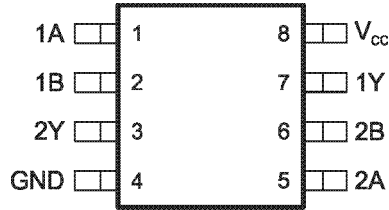
NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

| <b>Changes from Revision M (November 2013) to Revision N</b>  | <b>Page</b> |
|---|-------------|
| • Updated document to new TI data sheet format .....          | <b>1</b>    |
| • Added Device Information table. ....                        | <b>1</b>    |
| • Added $T_J(\text{Max})$ spec to Abs Max Ratings table ..... | <b>4</b>    |
| • Moved $T_{\text{stg}}$ spec to Abs Max Ratings table. ....  | <b>4</b>    |

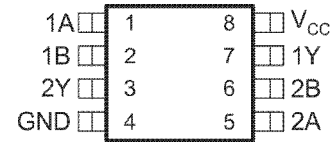
| <b>Changes from Revision L (April 1999) to Revision M</b> | <b>Page</b> |
|---|-------------|
| • Removed Ordering Information table. ....                | <b>1</b>    |
| • Updated operating temperature range. ....               | <b>5</b>    |

## 5 Pin Configuration and Functions

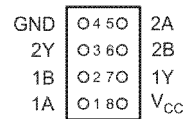
**DCT Package  
8-Pin SSOP  
Top View**



**DCU Package  
8-Pin VSSOP  
Top View**



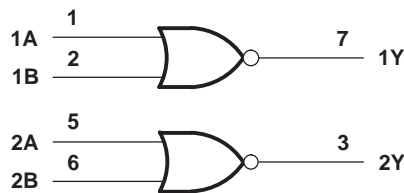
**YZP Package  
8-Pin DSBGA  
Bottom View**



### Pin Functions

| PIN  |     | I/O    | DESCRIPTION        |
|------|-----|--------|--------------------|
| NAME | NO. |        |                    |
| 1A   | 1   | Input  | Channel 1 input A  |
| 1B   | 2   | Input  | Channel 1 input B  |
| 2Y   | 3   | Output | Channel 2 output Y |
| GND  | 4   | –      | Ground             |
| 2A   | 5   | Input  | Channel 2 input A  |
| 2B   | 6   | Input  | Channel 2 input B  |
| 1Y   | 7   | Output | Channel 1 output Y |
| VCC  | 8   | –      | Positive supply    |

### Logic Diagram (Positive Logic)



## 6 Specifications

### 6.1 Absolute Maximum Ratings<sup>(1)</sup>

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

|                  |   | MIN                | MAX                   | UNIT |    |
|------------------|---|--------------------|-----------------------|------|----|
| V <sub>CC</sub>  | Supply voltage range  | -0.5               | 6.5                   | V    |    |
| V <sub>I</sub>   | Input voltage range <sup>(2)</sup>  | -0.5               | 6.5                   | V    |    |
| V <sub>O</sub>   | Voltage range applied to any output in the high-impedance or power-off state <sup>(2)</sup> | -0.5               | 6.5                   | V    |    |
| V <sub>O</sub>   | Voltage range applied to any output in the high or low state <sup>(2)(3)</sup>              | -0.5               | V <sub>CC</sub> + 0.5 | V    |    |
| I <sub>IK</sub>  | Input clamp current   | V <sub>I</sub> < 0 | -50                   | mA   |    |
| I <sub>OK</sub>  | Output clamp current  | V <sub>O</sub> < 0 | -50                   | mA   |    |
| I <sub>O</sub>   | Continuous output current   |                    | ±50                   | mA   |    |
|                  | Continuous current through V <sub>CC</sub> or GND   |                    | ±100                  | mA   |    |
| T <sub>J</sub>   | Junction temperature  |                    | 150                   | °C   |    |
| T <sub>stg</sub> | Storage temperature   |                    | -65                   | 150  | °C |

- (1) Stresses beyond those listed under *Absolute Maximum Ratings* may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under *Recommended Operating Conditions* is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
- (2) The input negative-voltage and output voltage ratings may be exceeded if the input and output clamp-current ratings are observed.
- (3) The value of V<sub>CC</sub> is provided in the *Recommended Operating Conditions* table.

### 6.2 ESD Ratings

|                    |                         |  | VALUE | UNIT |
|--------------------|-------------------------|--|-------|------|
| V <sub>(ESD)</sub> | Electrostatic discharge | Human-body model (HBM), per ANSI/ESDA/JEDEC JS-001 <sup>(1)</sup>              | ±2500 | V    |
|                    |                         | Charged-device model (CDM), per JEDEC specification JESD22-C101 <sup>(2)</sup> | ±1500 |      |

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

|                 |                                    | MIN   | MAX                    | UNIT                   |      |
|-----------------|------------------------------------|---|------------------------|------------------------|------|
| V <sub>CC</sub> | Supply voltage                     | Operating                                       | 1.65                   | 5.5                    | V    |
|                 |                                    | Data retention only                             | 1.5                    |                        |      |
| V <sub>IH</sub> | High-level input voltage           | V <sub>CC</sub> = 1.65 V to 1.95 V              | 0.65 × V <sub>CC</sub> |                        | V    |
|                 |                                    | V <sub>CC</sub> = 2.3 V to 2.7 V                | 1.7                    |                        |      |
|                 |                                    | V <sub>CC</sub> = 3 V to 3.6 V                  | 2                      |                        |      |
|                 |                                    | V <sub>CC</sub> = 4.5 V to 5.5 V                | 0.7 × V <sub>CC</sub>  |                        |      |
| V <sub>IL</sub> | Low-level input voltage            | V <sub>CC</sub> = 1.65 V to 1.95 V              |                        | 0.35 × V <sub>CC</sub> | V    |
|                 |                                    | V <sub>CC</sub> = 2.3 V to 2.7 V                |                        | 0.7                    |      |
|                 |                                    | V <sub>CC</sub> = 3 V to 3.6 V                  |                        | 0.8                    |      |
|                 |                                    | V <sub>CC</sub> = 4.5 V to 5.5 V                |                        | 0.3 × V <sub>CC</sub>  |      |
| V <sub>I</sub>  | Input voltage                      | 0   | 5.5                    | V                      |      |
| V <sub>O</sub>  | Output voltage                     | 0   | V <sub>CC</sub>        | V                      |      |
| I <sub>OH</sub> | High-level output current          | V <sub>CC</sub> = 1.65 V                        |                        | –4                     | mA   |
|                 |                                    | V <sub>CC</sub> = 2.3 V                         |                        | –8                     |      |
|                 |                                    | V <sub>CC</sub> = 3 V                           |                        | –16                    |      |
|                 |                                    | V <sub>CC</sub> = 4.5 V                         |                        | –24                    |      |
| I <sub>OL</sub> | Low-level output current           | V <sub>CC</sub> = 1.65 V                        |                        | 4                      | mA   |
|                 |                                    | V <sub>CC</sub> = 2.3 V                         |                        | 8                      |      |
|                 |                                    | V <sub>CC</sub> = 3 V                           |                        | 16                     |      |
|                 |                                    | V <sub>CC</sub> = 4.5 V                         |                        | 24                     |      |
| Δt/Δv           | Input transition rise or fall rate | V <sub>CC</sub> = 1.8 V ± 0.15 V, 2.5 V ± 0.2 V |                        | 20                     | ns/V |
|                 |                                    | V <sub>CC</sub> = 3.3 V ± 0.3 V                 |                        | 10                     |      |
|                 |                                    | V <sub>CC</sub> = 5 V ± 0.5 V                   |                        | 5                      |      |
| T <sub>A</sub>  | Operating free-air temperature     | –40   | 125                    | °C                     |      |

(1) All unused inputs of the device must be held at V<sub>CC</sub> or GND to ensure proper device operation. Refer to the TI application report, *Implications of Slow or Floating CMOS Inputs*, literature number [SCBA004](#).

### 6.4 Thermal Information

| THERMAL METRIC <sup>(1)</sup> |  | SN74LVC2G02 |             |             | UNIT |
|-------------------------------|--|-------------|-------------|-------------|------|
|                               |  | DCT (SSOP)  | DCU (VSSOP) | YZP (DSBGA) |      |
|                               |  | 8 PINS      | 8 PINS      | 8 PINS      |      |
| R <sub>θJA</sub>              | Junction-to-ambient thermal resistance       | 182.8       | 201.8       | 99.9        | °C/W |
| R <sub>θJC(top)</sub>         | Junction-to-case (top) thermal resistance    | 87.8        | 93.3        | 1.0         | °C/W |
| R <sub>θJB</sub>              | Junction-to-board thermal resistance         | 97.9        | 124.0       | 27.8        | °C/W |
| Ψ <sub>JT</sub>               | Junction-to-top characterization parameter   | 20.7        | 32.3        | 0.4         | °C/W |
| Ψ <sub>JB</sub>               | Junction-to-board characterization parameter | 96.6        | 123.6       | 27.8        | °C/W |
| R <sub>θJC(bot)</sub>         | Junction-to-case (bottom) thermal resistance | N/A         | N/A         | N/A         | °C/W |

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

## 6.5 Electrical Characteristics

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

| PARAMETER        | TEST CONDITIONS   | V <sub>CC</sub> | –40°C to 85°C         |                    |     | –40°C to 125°C        |                    |     | UNIT |
|------------------|---|-----------------|-----------------------|--------------------|-----|-----------------------|--------------------|-----|------|
|                  |   |                 | MIN                   | TYP <sup>(1)</sup> | MAX | MIN                   | TYP <sup>(1)</sup> | MAX |      |
| V <sub>OH</sub>  | I <sub>OH</sub> = –100 μA   | 1.65 V to 5.5 V | V <sub>CC</sub> – 0.1 |                    |     | V <sub>CC</sub> – 0.1 |                    |     | V    |
|                  | I <sub>OH</sub> = –4 mA   | 1.65 V          | 1.2                   |                    |     | 1.2                   |                    |     |      |
|                  | I <sub>OH</sub> = –8 mA   | 2.3 V           | 1.9                   |                    |     | 1.9                   |                    |     |      |
|                  | I <sub>OH</sub> = –16 mA  | 3 V             | 2.4                   |                    |     | 2.4                   |                    |     |      |
|                  | I <sub>OH</sub> = –24 mA  |                 | 2.3                   |                    |     | 2.3                   |                    |     |      |
|                  | I <sub>OH</sub> = –32 mA  | 4.5 V           | 3.8                   |                    |     | 3.8                   |                    |     |      |
| V <sub>OL</sub>  | I <sub>OL</sub> = 100 μA  | 1.65 V to 5.5 V | 0.1                   |                    |     | 0.1                   |                    |     | V    |
|                  | I <sub>OL</sub> = 4 mA  | 1.65 V          | 0.45                  |                    |     | 0.45                  |                    |     |      |
|                  | I <sub>OL</sub> = 8 mA  | 2.3 V           | 0.3                   |                    |     | 0.3                   |                    |     |      |
|                  | I <sub>OL</sub> = 16 mA   | 3 V             | 0.4                   |                    |     | 0.4                   |                    |     |      |
|                  | I <sub>OL</sub> = 24 mA   |                 | 0.55                  |                    |     | 0.75                  |                    |     |      |
|                  | I <sub>OL</sub> = 32 mA   | 4.5 V           | 0.55                  |                    |     | 0.75                  |                    |     |      |
| I <sub>I</sub>   | A or B inputs<br>V <sub>I</sub> = 5.5 V or GND                                  | 0 to 5.5 V      | ±5                    |                    |     | ±5                    |                    |     | μA   |
| I <sub>off</sub> | V <sub>I</sub> or V <sub>O</sub> = 5.5 V  | 0               | ±10                   |                    |     | ±10                   |                    |     | μA   |
| I <sub>CC</sub>  | V <sub>I</sub> = 5.5 V or GND, I <sub>O</sub> = 0                               | 1.65 V to 5.5 V | 10                    |                    |     | 10                    |                    |     | μA   |
| ΔI <sub>CC</sub> | One input at V <sub>CC</sub> – 0.6 V,<br>Other inputs at V <sub>CC</sub> or GND | 3 V to 5.5 V    | 500                   |                    |     | 500                   |                    |     | μA   |
| C <sub>i</sub>   | V <sub>I</sub> = V <sub>CC</sub> or GND   | 3.3 V           | 5                     |                    |     | 5                     |                    |     | pF   |

 (1) All typical values are at V<sub>CC</sub> = 3.3 V, T<sub>A</sub> = 25°C.

## 6.6 Switching Characteristics

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

| PARAMETER       | FROM (INPUT) | TO (OUTPUT) | –40°C to 85°C                    |     |                                 |     |                                 |     |                               |     | UNIT |
|-----------------|--------------|-------------|----------------------------------|-----|---------------------------------|-----|---------------------------------|-----|-------------------------------|-----|------|
|                 |              |             | V <sub>CC</sub> = 1.8 V ± 0.15 V |     | V <sub>CC</sub> = 2.5 V ± 0.2 V |     | V <sub>CC</sub> = 3.3 V ± 0.3 V |     | V <sub>CC</sub> = 5 V ± 0.5 V |     |      |
|                 |              |             | MIN                              | MAX | MIN                             | MAX | MIN                             | MAX | MIN                           | MAX |      |
| t <sub>pd</sub> | A or B       | Y           | 3.2                              | 8.9 | 1                               | 5.4 | 1                               | 4.9 | 1                             | 4.4 | ns   |

## 6.7 Switching Characteristics

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

| PARAMETER       | FROM (INPUT) | TO (OUTPUT) | –40°C to 125°C                   |      |                                 |     |                                 |     |                               |     | UNIT |
|-----------------|--------------|-------------|----------------------------------|------|---------------------------------|-----|---------------------------------|-----|-------------------------------|-----|------|
|                 |              |             | V <sub>CC</sub> = 1.8 V ± 0.15 V |      | V <sub>CC</sub> = 2.5 V ± 0.2 V |     | V <sub>CC</sub> = 3.3 V ± 0.3 V |     | V <sub>CC</sub> = 5 V ± 0.5 V |     |      |
|                 |              |             | MIN                              | MAX  | MIN                             | MAX | MIN                             | MAX | MIN                           | MAX |      |
| t <sub>pd</sub> | A or B       | Y           | 3.2                              | 10.9 | 1                               | 6.4 | 1                               | 5.9 | 1                             | 5.4 | ns   |

## 6.8 Operating Characteristics

 T<sub>A</sub> = 25°C

| PARAMETER       | TEST CONDITIONS                             | V <sub>CC</sub> = 1.8 V | V <sub>CC</sub> = 2.5 V | V <sub>CC</sub> = 3.3 V | V <sub>CC</sub> = 5 V | UNIT |
|-----------------|---|-------------------------|-------------------------|-------------------------|-----------------------|------|
|                 |   | TYP                     | TYP                     | TYP                     | TYP                   |      |
| C <sub>pd</sub> | Power dissipation capacitance<br>f = 10 MHz | 18                      | 18                      | 19                      | 22                    | pF   |

## 6.9 Typical Characteristics

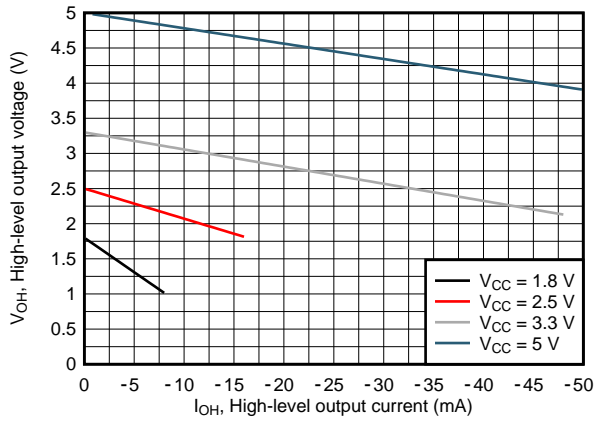


Figure 1. Simulated typical high-level output voltage ( $V_{OH}$ ) across high-level output current ( $I_{OH}$ ) at common supply values

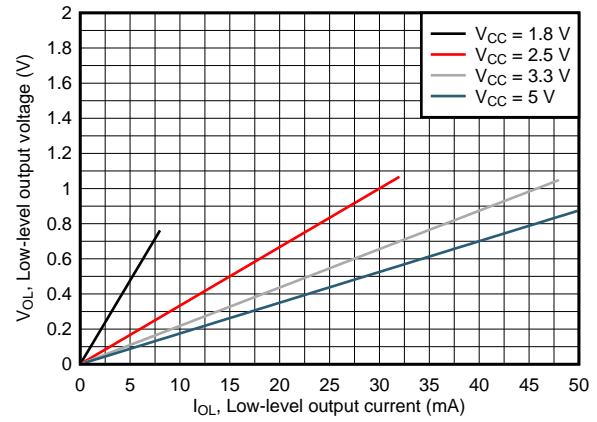
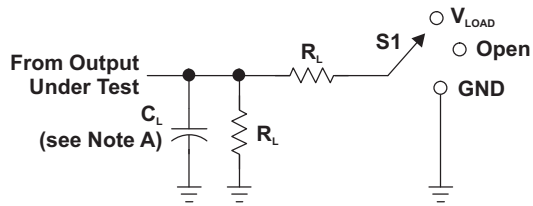


Figure 2. Simulated typical low-level output voltage ( $V_{OL}$ ) across low-level output current ( $I_{OL}$ ) at common supply values

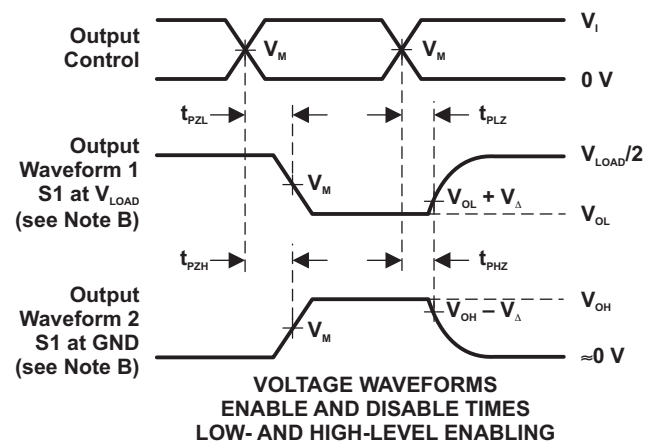
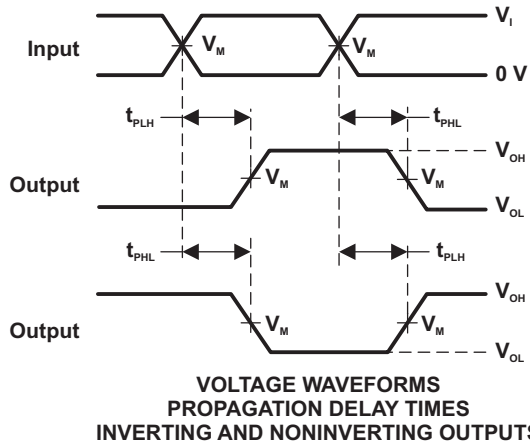
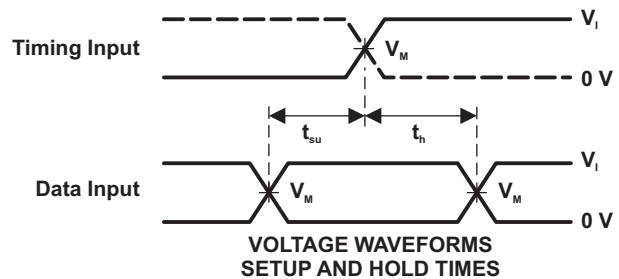
## 7 Parameter Measurement Information



LOAD CIRCUIT

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

| $V_{CC}$                         | INPUTS   |                      | $V_M$      | $V_{LOAD}$        | $C_L$ | $R_L$        | $V_{\Delta}$ |
|----------------------------------|----------|----------------------|------------|-------------------|-------|--------------|--------------|
|                                  | $V_i$    | $t_i/t_r$            |            |                   |       |              |              |
| $1.8\text{ V} \pm 0.15\text{ V}$ | $V_{CC}$ | $\leq 2\text{ ns}$   | $V_{CC}/2$ | $2 \times V_{CC}$ | 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        |



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

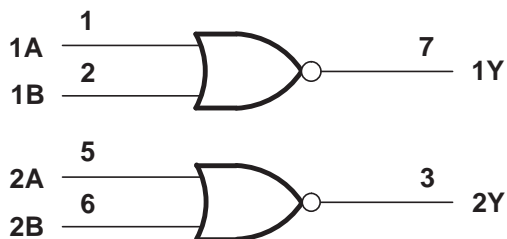
Figure 3. Load Circuit and Voltage Waveforms

## 8 Detailed Description

### 8.1 Overview

The SN74LVC2G02 device contains two 2-input positive-NOR gates and each gate performs the Boolean function  $Y = A + B$  or  $Y = \overline{A} \cdot \overline{B}$ . 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.

### 8.2 Functional Block Diagram



### 8.3 Feature Description

- Wide operating voltage range.
  - Operates from 1.65 V to 5.5 V.
- Allows down voltage translation.
- Inputs accept voltages to 5.5 V.
- $I_{off}$  feature allows voltages on the inputs and outputs, when  $V_{CC}$  is 0 V.

### 8.4 Device Functional Modes

**Table 1. Function Table  
(Each Gate)**

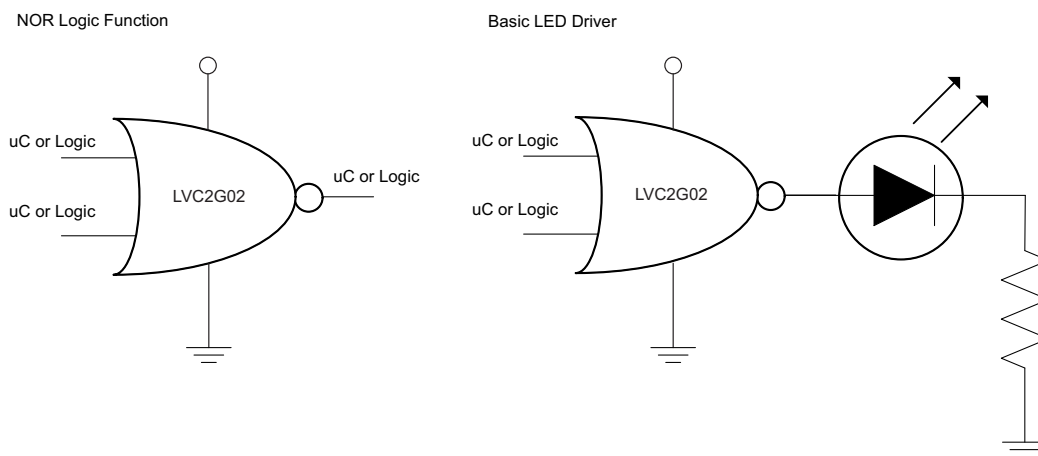
| INPUTS |   | OUTPUT<br>Y |
|--------|---|-------------|
| A      | B |             |
| H      | X | L           |
| X      | H | L           |
| L      | L | H           |

## 9 Application and Implementation

### 9.1 Application Information

The SN74LVC2G02 is a high-drive CMOS device that can be used for implement NOR logic with a high output drive, such as an LED application. It can produce 24-mA of drive current at 3.3 V making it Ideal for driving multiple outputs and good for high speed applications up to 100 Mhz. The inputs are 5.5-V tolerant allowing translation down to  $V_{CC}$ .

### 9.2 Typical Application



#### 9.2.1 Design Requirements

This device uses CMOS technology and has balanced output drive. Care should be taken to avoid bus contention because it can drive currents that would exceed maximum limits. The high drive will also create fast edges into light loads, so routing and load conditions should be considered to prevent ringing.

#### 9.2.2 Detailed Design Procedure

##### 1. Recommended Input Conditions:

- Rise time and fall time specs. See ( $\Delta t/\Delta V$ ) in the [Recommended Operating Conditions](#) table.
- Specified high and low levels. See ( $V_{IH}$  and  $V_{IL}$ ) in the [Recommended Operating Conditions](#) table.
- Inputs are overvoltage tolerant allowing them to go as high as ( $V_I$  max) in the [Recommended Operating Conditions](#) table at any valid  $V_{CC}$ .

##### 2. Recommend Output Conditions:

- Load currents should not exceed ( $I_O$  max) per output and should not exceed total current (continuous current through  $V_{CC}$  or GND) for the part. These limits are located in the [Absolute Maximum Ratings](#) table.
- Outputs should not be pulled above  $V_{CC}$ .

## Typical Application (continued)

### 9.2.3 Application Curves

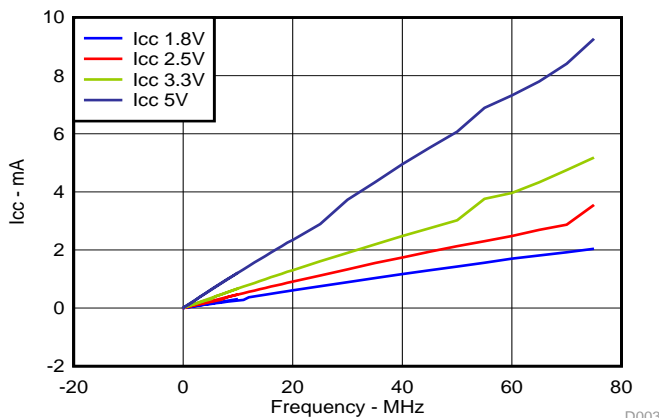


Figure 4. I<sub>CC</sub> vs Frequency

## 10 Power Supply Recommendations

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

Each VCC pin should have a good bypass capacitor to prevent power disturbance. For devices with a single supply, a 0.1- $\mu$ F capacitor is recommended. If there are multiple VCC pins, then a 0.01- $\mu$ F or 0.022- $\mu$ F capacitor is recommended for each power pin. It is ok to parallel multiple bypass capacitors to reject different frequencies of noise. A 0.1- $\mu$ F and 1- $\mu$ F capacitors are commonly used in parallel. The bypass capacitor should be installed as close to the power pin as possible for best results.

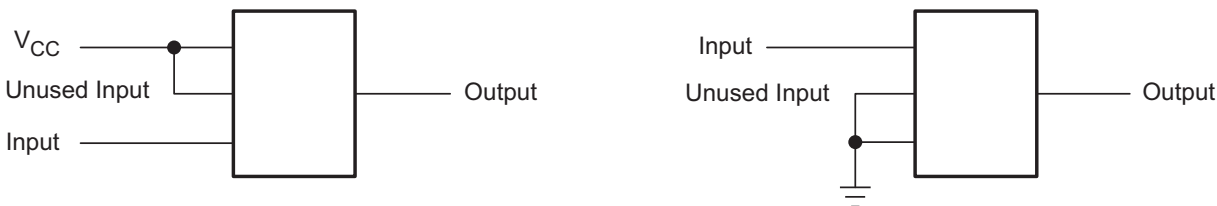
## 11 Layout

### 11.1 Layout Guidelines

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

In many cases, functions or parts of functions of digital logic devices are unused; for example, when only two inputs of a triple-input AND gate are used or only 3 of the 4 buffer gates are used. Such input pins should not be left unconnected because the undefined voltages at the outside connections result in undefined operational states. Specified below are the rules that must be observed under all circumstances. All unused inputs of digital logic devices must be connected to a high or low bias to prevent them from floating. The logic level that should be applied to any particular unused input depends on the function of the device. Generally they will be tied to GND or VCC, whichever makes more sense or is more convenient.

### 11.2 Layout Example



## 12 Device and Documentation Support

### 12.1 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](http://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.

### 12.2 Trademarks

NanoFree, E2E are trademarks of Texas Instruments.

### 12.3 Electrostatic Discharge Caution



This integrated circuit can be damaged by ESD. Texas Instruments recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage.

ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

### 12.4 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                 |
|-------------------|---------------|--------------|-----------------|------|-------------|-------------------------|-------------------------|----------------------|--------------|-------------------------|-------------------------|
| SN74LVC2G02DCTR   | ACTIVE        | SM8          | DCT             | 8    | 3000        | Green (RoHS & no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | -40 to 125   | C02<br>(R, Z)           | <a href="#">Samples</a> |
| SN74LVC2G02DCTRE4 | ACTIVE        | SM8          | DCT             | 8    | 3000        | Green (RoHS & no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | -40 to 125   | C02<br>(R, Z)           | <a href="#">Samples</a> |
| SN74LVC2G02DCUR   | ACTIVE        | VSSOP        | DCU             | 8    | 3000        | Green (RoHS & no Sb/Br) | CU NIPDAU   CU SN       | Level-1-260C-UNLIM   | -40 to 125   | (C02Q, C02R)            | <a href="#">Samples</a> |
| SN74LVC2G02DCUT   | ACTIVE        | VSSOP        | DCU             | 8    | 250         | Green (RoHS & no Sb/Br) | CU NIPDAU   CU SN       | Level-1-260C-UNLIM   | -40 to 125   | (C02Q, C02R)            | <a href="#">Samples</a> |
| SN74LVC2G02YZPR   | ACTIVE        | DSBGA        | YZP             | 8    | 3000        | Green (RoHS & no Sb/Br) | SNAGCU                  | Level-1-260C-UNLIM   | -40 to 125   | CBN                     | <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.

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

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

(6) Lead/Ball Finish - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead/Ball Finish values may wrap to two lines if the finish value exceeds the maximum column width.

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**OTHER QUALIFIED VERSIONS OF SN74LVC2G02 :**

- Enhanced Product: [SN74LVC2G02-EP](#)

NOTE: Qualified Version Definitions:

- Enhanced Product - Supports Defense, Aerospace and Medical Applications

## 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 |
|-----------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| SN74LVC2G02DCTR | SM8          | DCT             | 8    | 3000 | 180.0              | 13.0               | 3.35    | 4.5     | 1.55    | 4.0     | 12.0   | Q3            |
| SN74LVC2G02DCUR | VSSOP        | DCU             | 8    | 3000 | 180.0              | 8.4                | 2.25    | 3.35    | 1.05    | 4.0     | 8.0    | Q3            |
| SN74LVC2G02DCUR | VSSOP        | DCU             | 8    | 3000 | 178.0              | 9.5                | 2.25    | 3.35    | 1.05    | 4.0     | 8.0    | Q3            |
| SN74LVC2G02DCUT | VSSOP        | DCU             | 8    | 250  | 178.0              | 9.5                | 2.25    | 3.35    | 1.05    | 4.0     | 8.0    | Q3            |
| SN74LVC2G02YZPR | DSBGA        | YZP             | 8    | 3000 | 178.0              | 9.2                | 1.02    | 2.02    | 0.63    | 4.0     | 8.0    | Q1            |

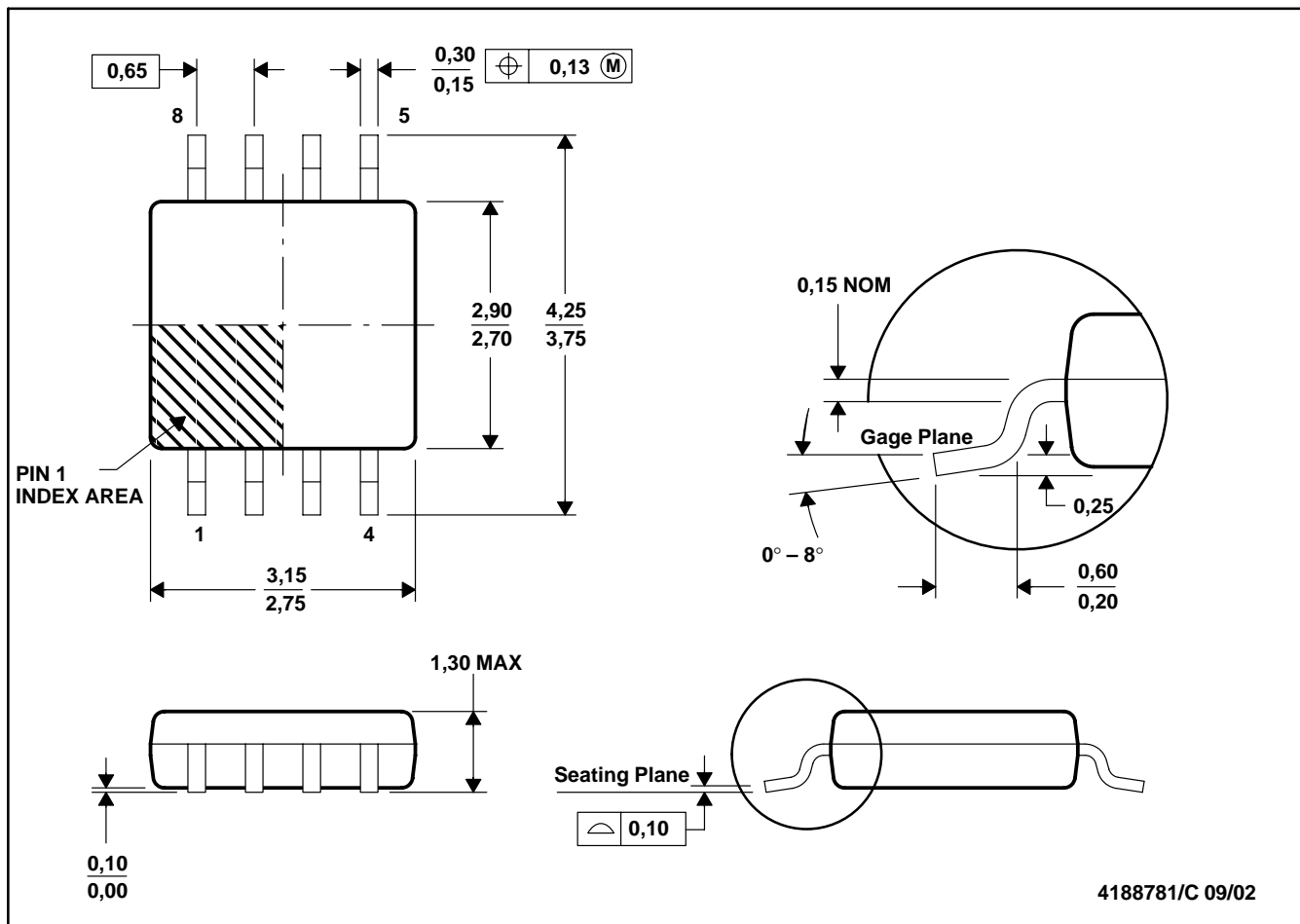
**TAPE AND REEL BOX DIMENSIONS**


\*All dimensions are nominal

| Device          | Package Type | Package Drawing | Pins | SPQ  | Length (mm) | Width (mm) | Height (mm) |
|-----------------|--------------|-----------------|------|------|-------------|------------|-------------|
| SN74LVC2G02DCTR | SM8          | DCT             | 8    | 3000 | 182.0       | 182.0      | 20.0        |
| SN74LVC2G02DCUR | VSSOP        | DCU             | 8    | 3000 | 202.0       | 201.0      | 28.0        |
| SN74LVC2G02DCUR | VSSOP        | DCU             | 8    | 3000 | 202.0       | 201.0      | 28.0        |
| SN74LVC2G02DCUT | VSSOP        | DCU             | 8    | 250  | 202.0       | 201.0      | 28.0        |
| SN74LVC2G02YZPR | DSBGA        | YZP             | 8    | 3000 | 220.0       | 220.0      | 35.0        |

DCT (R-PDSO-G8)

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.
  - D. Falls within JEDEC MO-187 variation DA.

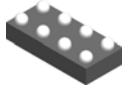
DCT (R-PDSO-G8)

PLASTIC SMALL OUTLINE



- NOTES:
- A. All linear dimensions are in millimeters.
  - B. This drawing is subject to change without notice.
  - C. Publication IPC-7351 is recommended for alternate designs.
  - D. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC-7525.
  - E. Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

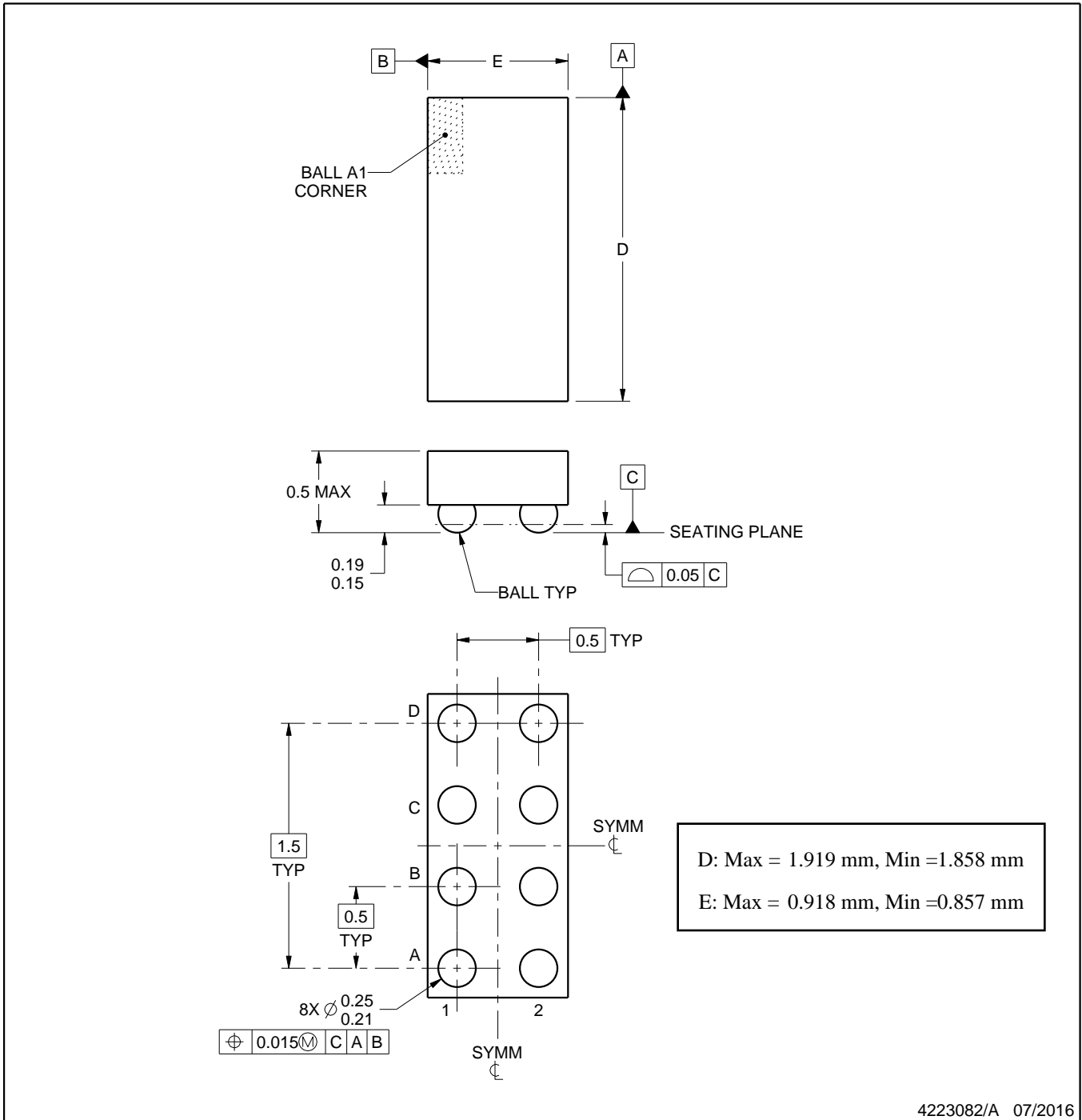
YZP0008



PACKAGE OUTLINE

DSBGA - 0.5 mm max height

DIE SIZE BALL GRID ARRAY



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

YZP0008

DSBGA - 0.5 mm max height

DIE SIZE BALL GRID ARRAY



LAND PATTERN EXAMPLE  
SCALE:40X



SOLDER MASK DETAILS  
NOT TO SCALE

4223082/A 07/2016

NOTES: (continued)

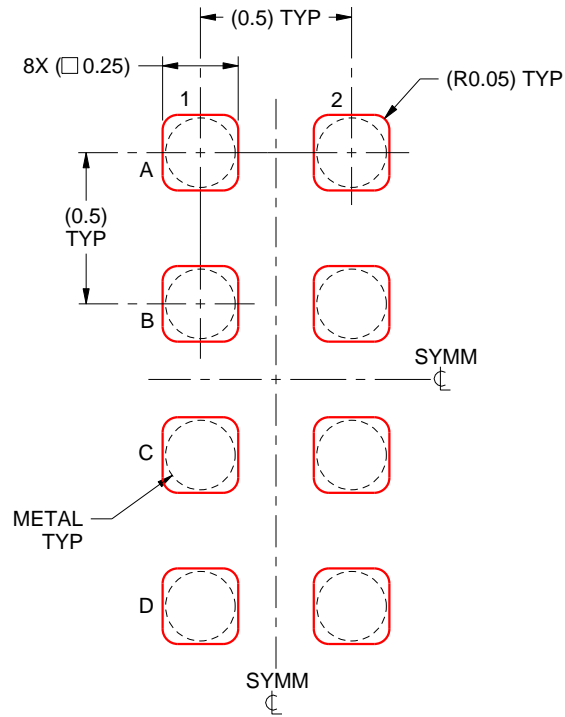
- Final dimensions may vary due to manufacturing tolerance considerations and also routing constraints. For more information, see Texas Instruments literature number SNVA009 ([www.ti.com/lit/snva009](http://www.ti.com/lit/snva009)).

# EXAMPLE STENCIL DESIGN

YZP0008

DSBGA - 0.5 mm max height

DIE SIZE BALL GRID ARRAY



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

4223082/A 07/2016

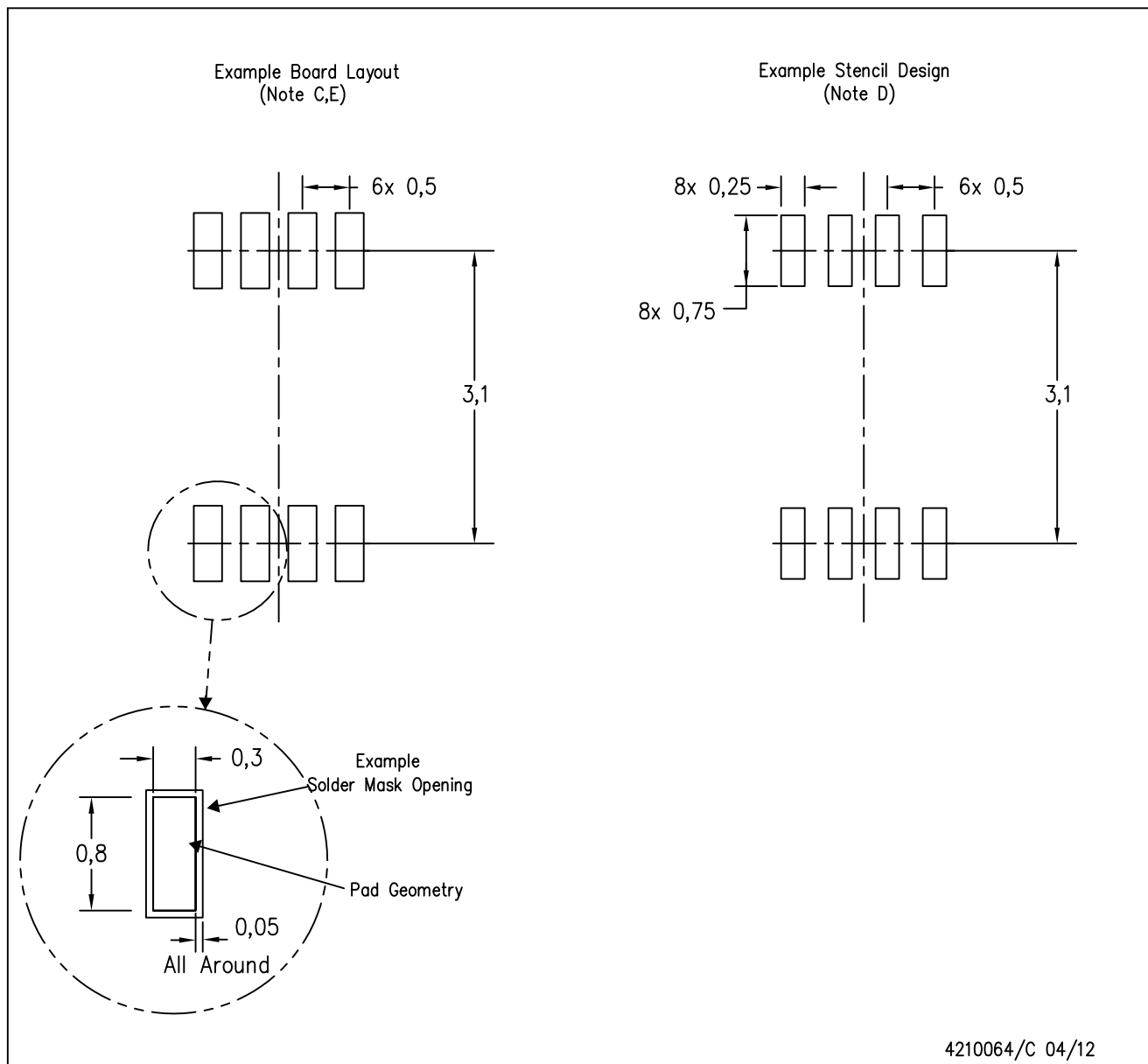
NOTES: (continued)

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



DCU (S-PDSO-G8)

PLASTIC SMALL OUTLINE PACKAGE (DIE DOWN)



4210064/C 04/12

- NOTES:
- A. All linear dimensions are in millimeters.
  - B. This drawing is subject to change without notice.
  - C. Publication IPC-7351 is recommended for alternate designs.
  - D. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC-7525 for other stencil recommendations.
  - E. Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

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