

# SN74LVC2G74 Single Positive-Edge-Triggered D-Type Flip-Flop With Clear and Preset

## 1 Features

- Available in the Texas Instruments NanoFree™ package
- Supports 5 V  $V_{CC}$  operation
- Inputs accept voltages to 5.5 V
- Maximum  $t_{pd}$  of 5.9 ns at 3.3 V
- Low power consumption, 10  $\mu$ A maximum  $I_{CC}$
- $\pm 24$  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 live insertion, partial-power-down mode, and back-drive protection
- Latch-up performance exceeds 100 mA Per JESD 78, class II
- ESD protection exceeds JESD 22
  - 2000 V human-body model
  - 200 V machine model
  - 1000 V charged-device model

## 2 Applications

- Servers
- LED displays
- Network switch
- Telecom infrastructure
- Motor drivers
- I/O expanders

## 3 Description

This single positive-edge-triggered D-type flip-flop is designed for 1.65 V to 5.5 V  $V_{CC}$  operation.

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

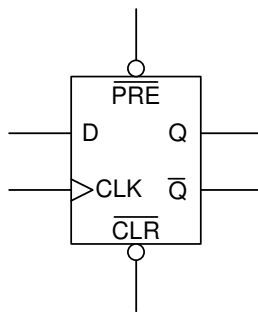
A low level at the preset ( $\overline{\text{PRE}}$ ) or clear ( $\overline{\text{CLR}}$ ) input sets or resets the outputs, regardless of the levels of the other inputs. When  $\overline{\text{PRE}}$  and  $\overline{\text{CLR}}$  are inactive (high), data at the data (D) input meeting the setup time requirements is transferred to the outputs on the positive-going edge of the clock pulse. Clock triggering occurs at a voltage level and is not related directly to the rise time of the clock pulse. Following the hold-time interval, data at the D input can be changed without affecting the levels at the outputs.

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         |
|-------------|-----------|-------------------|
| SN74LVC2G74 | SM8 (8)   | 2.95 mm × 2.80 mm |
|             | VSSOP (8) | 2.30 mm × 2.00 mm |
|             | 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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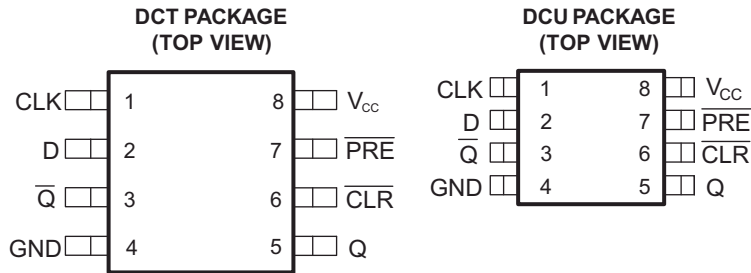
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## 4 Revision History

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

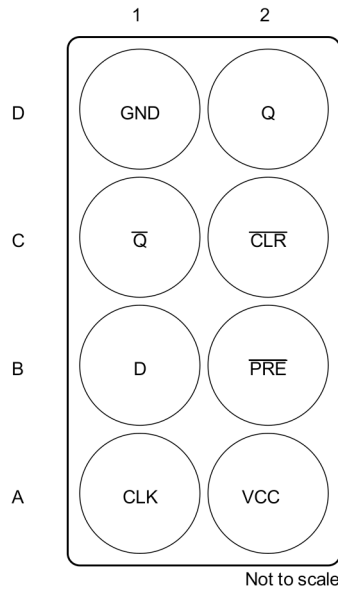
| <b>Changes from Revision P (July 2016) to Revision Q (September 2021)</b>   | <b>Page</b> |
|---|-------------|
| • Updated the numbering format for tables, figures, and cross-references throughout the document.....   | 1           |
| • Updated the <i>Application and Information</i> section.....   | 10          |
| • Updated the <i>Device Power Button Circuit</i> figure in the <i>Typical Power Button Circuit</i> section.....   | 10          |
| <b>Changes from Revision O (January 2015) to Revision P (July 2016)</b>   | <b>Page</b> |
| • Changed SSOP to SM8 in <i>Device Information</i> table.....   | 1           |
| • Updated pinout images to new format.....  | 3           |
| • Added pin number for DSBGA package in <i>Pin Functions</i> table.....   | 3           |
| • Changed 6 PINS to 8 PINS in <i>Thermal Information</i> table.....   | 5           |
| • Changed 23 to 2.3 for $t_{SU}$ data in <i>Timing Requirements, –40°C to +125°C</i> .....  | 6           |
| <b>Changes from Revision N (July 2013) to Revision O (January 2015)</b>   | <b>Page</b> |
| • Added <i>Applications</i> , <i>Device Information</i> table, <i>Pin Functions</i> table, <i>ESD Ratings</i> table, <i>Thermal Information</i> table, <i>Typical Characteristics</i> , <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..... | 1           |
| <b>Changes from Revision M (February 2007) to Revision N (July 2013)</b>  | <b>Page</b> |
| • Changed $I_{off}$ description in <i>Features</i> .....  | 1           |
| • Added parameter values for –40 to +125°C temperature ratings in <i>Electrical Characteristics</i> table.....  | 6           |
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### 5 Pin Configuration and Functions



See mechanical drawings for dimensions.

**Figure 5-1. DCT 8-Pin SM8 and DCU 8-Pin VSSOP Package Top View**



See mechanical drawings for dimensions.

**Figure 5-2. YZP Package 8-Pin DSBGA Bottom View**

**Table 5-1. Pin Functions**

| NAME            | PIN        |       | TYPE | DESCRIPTION                                  |
|-----------------|------------|-------|------|--|
|                 | VSSOP, SM8 | DSBGA |      |  |
| CLK             | 1          | A1    | I    | Clock input                                  |
| CLR             | 6          | C2    | I    | Clear input – Pull low to set Q output low   |
| D               | 2          | B1    | I    | Input  |
| GND             | 4          | D1    | —    | Ground                                       |
| PRE             | 7          | B2    | I    | Preset input – Pull low to set Q output high |
| Q               | 5          | D2    | O    | Output                                       |
| Q̄              | 3          | C1    | O    | Inverted output                              |
| V <sub>CC</sub> | 8          | A2    | —    | Supply                                       |

## 6 Specifications

### 6.1 Absolute Maximum Ratings

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

|                  |   | MIN                | MAX                   | UNIT |
|------------------|---|--------------------|-----------------------|------|
| V <sub>CC</sub>  | Supply voltage  | -0.5               | 6.5                   | V    |
| V <sub>I</sub>   | Input voltage <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)</sup> <sup>(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>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 [Section 6.3](#) 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 [Section 6.3](#) table.

### 6.2 ESD Ratings

| PARAMETER          | DEFINITION              | VALUE  | UNIT |
|--------------------|-------------------------|--|------|
| V <sub>(ESD)</sub> | Electrostatic discharge | Human body model (HBM), per ANSI/ESDA/JEDEC JS-001, all pins <sup>(1)</sup>              | 2000 |
|                    |                         | Charged device model (CDM), per JEDEC specification JESD22-C101, all pins <sup>(2)</sup> | 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 <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. See *Implications of Slow or Floating CMOS Inputs*, SCBA004.

### 6.4 Thermal Information

| THERMAL METRIC <sup>(1)</sup> | SN74LVC2G74   |     |     | UNIT |      |
|-------------------------------|---|-----|-----|------|------|
|                               | DCT   | DCU | YZP |      |      |
|                               | 8 PINS  |     |     |      |      |
| R <sub>θJA</sub>              | Junction-to-ambient thermal resistance <sup>(2)</sup> | 220 | 227 | 102  | °C/W |

- (1) For more information about traditional and new thermal metrics, see the [Semiconductor and IC Package Thermal Metrics](#) application report.
- (2) The package thermal impedance is calculated in accordance with JESD 51-7.

## 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 |
|---------------------------------------|--|-----------------|-----------------------|--------------------|-----|-----------------------|-----|-----|------|
|                                       |  |                 |                       |                    |     | Recommended           |     |     |      |
|                                       |  |                 | MIN                   | TYP <sup>(1)</sup> | MAX | MIN                   | TYP | 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                   |                    |     | 1.85                  |     |     |      |
|                                       | 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                   |     |     | V    |
|                                       | I <sub>OL</sub> = 4 mA   | 1.65 V          |                       |                    |     | 0.45                  |     |     |      |
|                                       | I <sub>OL</sub> = 8 mA   | 2.3 V           |                       |                    |     | 0.3                   |     |     |      |
|                                       | I <sub>OL</sub> = 16 mA  | 3 V             |                       |                    |     | 0.4                   |     |     |      |
|                                       | I <sub>OL</sub> = 24 mA  |                 |                       |                    |     | 0.55                  |     |     |      |
|                                       | I <sub>OL</sub> = 32 mA  | 4.5 V           |                       |                    |     | 0.55                  |     |     |      |
| I <sub>I</sub> Data or control inputs | V <sub>I</sub> = 5.5 V or GND  | 0 to 5.5 V      |                       |                    |     | ±5                    |     |     | μA   |
| I <sub>off</sub>                      | V <sub>I</sub> or V <sub>O</sub> = 5.5 V                                     | 0               |                       |                    |     | ±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                    |     |     | μA   |
| ΔI <sub>CC</sub>                      | One input at V <sub>CC</sub> – 0.6 V, Other inputs at V <sub>CC</sub> or GND | 3 V to 5.5 V    |                       |                    |     | 500                   |     |     | μA   |
| C <sub>i</sub>                        | V <sub>I</sub> = V <sub>CC</sub> or GND                                      | 3.3 V           |                       |                    |     | 5                     |     |     | pF   |

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

## 6.6 Timing Requirements, –40°C to +85°C

over recommended operating free-air temperature range (unless otherwise noted) (see Figure 7-1)

| PARAMETER          | FROM                | TO | –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 |      |
| f <sub>clock</sub> |                     |    | 80                               |     | 175                             |     | 175                             |     | 200                           |     | MHz  |
| t <sub>w</sub>     | CLK                 |    | 6.2                              |     | 2.7                             |     | 2.7                             |     | 2                             |     | ns   |
|                    | PRE or CLR low      |    | 6.2                              |     | 2.7                             |     | 2.7                             |     | 2                             |     |      |
| t <sub>su</sub>    | Data                |    | 2.9                              |     | 1.7                             |     | 1.3                             |     | 1.1                           |     | ns   |
|                    | PRE or CLR inactive |    | 1.9                              |     | 1.4                             |     | 1.2                             |     | 1                             |     |      |
| t <sub>h</sub>     |                     |    | 0                                |     | 0.3                             |     | 1.2                             |     | 0.5                           |     | ns   |

## 6.7 Timing Requirements, –40°C to +125°C

over recommended operating free-air temperature range (unless otherwise noted) (see Figure 7-1)

| PARAMETER          | FROM                | TO | –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 |      |
| f <sub>clock</sub> |                     |    | 80                               |     | 120                             |     | 120                             |     | 140                           |     | MHz  |
| t <sub>w</sub>     | CLK                 |    | 6.2                              |     | 3.5                             |     | 3.5                             |     | 3.3                           |     | ns   |
|                    | PRE or CLR low      |    | 6.2                              |     | 3.5                             |     | 3.5                             |     | 3.3                           |     |      |
| t <sub>su</sub>    | Data                |    | 2.9                              |     | 2.3                             |     | 1.9                             |     | 1.7                           |     | ns   |
|                    | PRE or CLR inactive |    | 1.9                              |     | 2                               |     | 1.8                             |     | 1.6                           |     |      |
| t <sub>h</sub>     |                     |    | 0                                |     | 0.3                             |     | 0.5                             |     | 0.5                           |     | ns   |

### 6.8 Switching Characteristics, –40°C to +85°C

over recommended operating free-air temperature range (unless otherwise noted) (see Figure 7-1)

| PARAMETER | FROM           | TO             | –40°C to +85°C                            |      |  |     |  |     |  |     | UNIT |
|-----------|----------------|----------------|---|------|--|-----|--|-----|--|-----|------|
|           |                |                | $V_{CC} = 1.8\text{ V} \pm 0.15\text{ V}$ |      | $V_{CC} = 2.5\text{ V} \pm 0.2\text{ V}$ |     | $V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$ |     | $V_{CC} = 5\text{ V} \pm 0.5\text{ V}$ |     |      |
|           |                |                | MIN                                       | MAX  | MIN                                      | MAX | MIN                                      | MAX | MIN                                    | MAX |      |
| $f_{max}$ |                |                | 80  |      | 175                                      |     | 175                                      |     | 200                                    |     | MHz  |
| $t_{pd}$  | CLK            | Q              | 4.8                                       | 13.4 | 2.2                                      | 7.1 | 2.2                                      | 5.9 | 1.4                                    | 4.1 | ns   |
|           |                | $\bar{Q}$      | 6   | 14.4 | 3  | 7.7 | 2.6                                      | 6.2 | 1.6                                    | 4.4 |      |
|           | PRE or CLR low | Q or $\bar{Q}$ | 4.4                                       | 12.9 | 2.3                                      | 7   | 1.7                                      | 5.9 | 1.6                                    | 4.1 |      |

### 6.9 Switching Characteristics, –40°C to +125°C

over recommended operating free-air temperature range (unless otherwise noted) (see Figure 7-1)

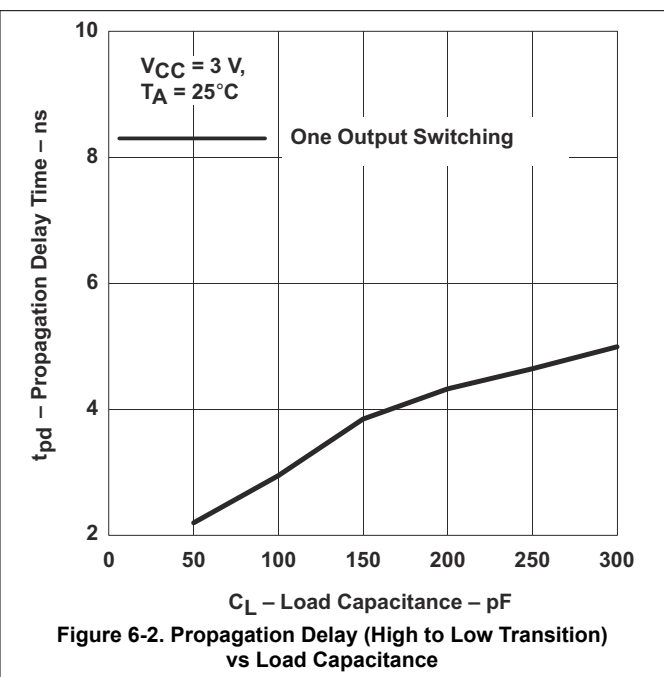
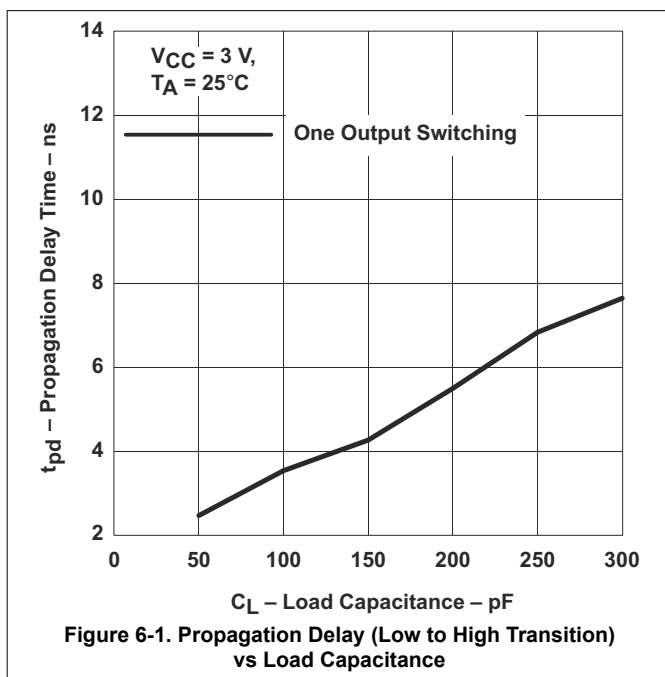
| PARAMETER | FROM           | TO             | –40°C to +125°C                           |      |  |     |  |     |  |     | UNIT |
|-----------|----------------|----------------|---|------|--|-----|--|-----|--|-----|------|
|           |                |                | $V_{CC} = 1.8\text{ V} \pm 0.15\text{ V}$ |      | $V_{CC} = 2.5\text{ V} \pm 0.2\text{ V}$ |     | $V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$ |     | $V_{CC} = 5\text{ V} \pm 0.5\text{ V}$ |     |      |
|           |                |                | MIN                                       | MAX  | MIN                                      | MAX | MIN                                      | MAX | MIN                                    | MAX |      |
| $f_{max}$ |                |                | 80  |      | 120                                      |     | 120                                      |     | 140                                    |     | MHz  |
| $t_{pd}$  | CLK            | Q              | 4.8                                       | 14.4 | 2.2                                      | 8.1 | 2.2                                      | 6.9 | 1.4                                    | 5.1 | ns   |
|           |                | $\bar{Q}$      | 6   | 16   | 3  | 9.7 | 2.6                                      | 7.2 | 1.6                                    | 5.4 |      |
|           | PRE or CLR low | Q or $\bar{Q}$ | 4.4                                       | 14.9 | 2.3                                      | 9.5 | 1.7                                      | 7.9 | 1.6                                    | 6.1 |      |

### 6.10 Operating Characteristics

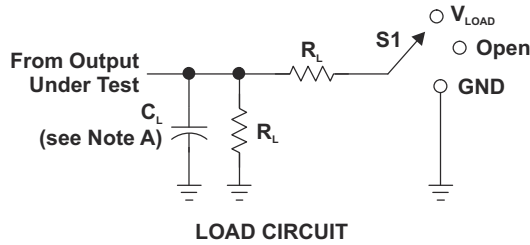
$T_A = 25^\circ\text{C}$

| PARAMETER                              | TEST CONDITIONS     | $V_{CC} = 1.8\text{ V}$ | $V_{CC} = 2.5\text{ V}$ | $V_{CC} = 3.3\text{ V}$ | $V_{CC} = 5\text{ V}$ | UNIT |
|--|---------------------|-------------------------|-------------------------|-------------------------|-----------------------|------|
|  |                     | TYP                     | TYP                     | TYP                     | TYP                   |      |
| $C_{pd}$ Power dissipation capacitance | $f = 10\text{ MHz}$ | 35                      | 35                      | 37                      | 40                    | pF   |

### 6.11 Typical Characteristics

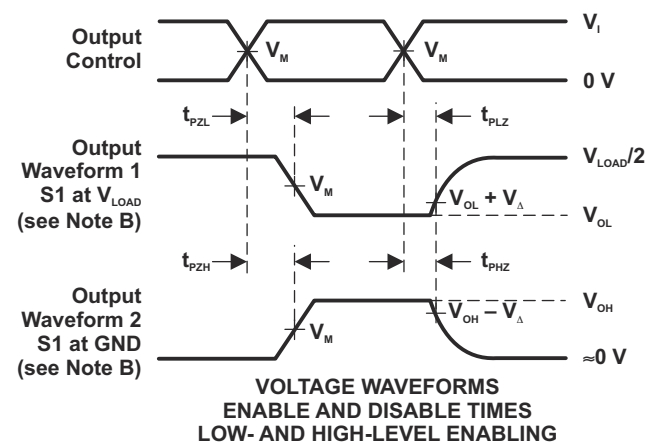
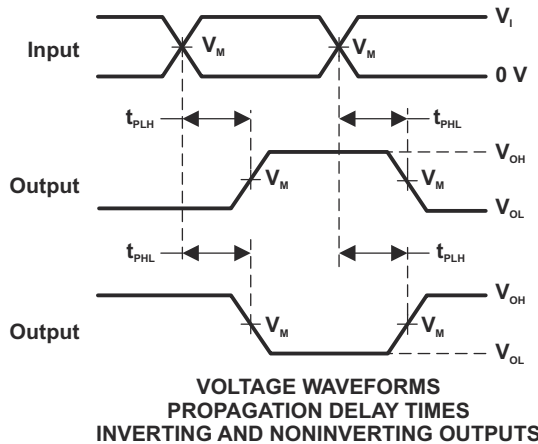
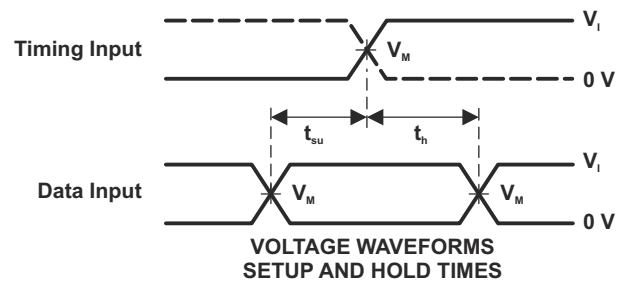
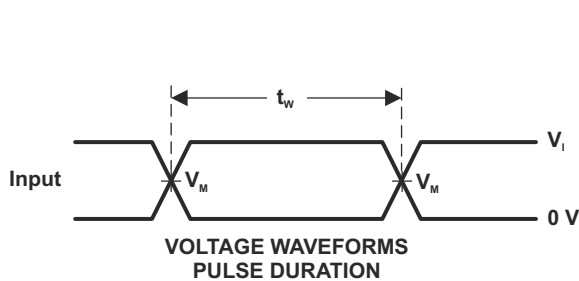


## 7 Parameter Measurement Information



| 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        |



- 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 7-1. Load Circuit and Voltage Waveforms**

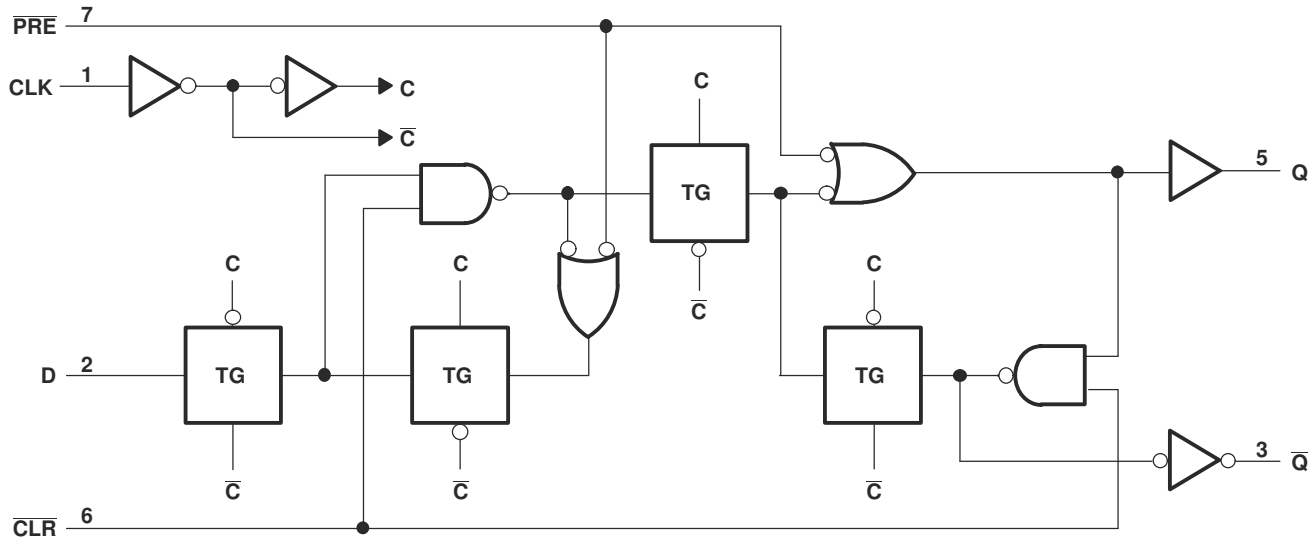


## 8 Detailed Description

### 8.1 Overview

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

- Allows down voltage translation
  - 5 V to 3.3 V
  - 5 V or 3.3 V to 1.8 V
- Inputs accept voltage levels up to 5.5 V
- $I_{off}$  Feature
  - Can prevent backflow current that can damage device when powered down.

### 8.4 Device Functional Modes

Table 8-1 shows the functional modes of SN74LVC2G74.

Table 8-1. Function Table

| INPUTS           |                  |     |   | OUTPUTS          |                  |
|------------------|------------------|-----|---|------------------|------------------|
| $\overline{PRE}$ | $\overline{CLR}$ | CLK | D | Q                | $\overline{Q}$   |
| L                | H                | X   | X | H                | L                |
| H                | L                | X   | X | L                | H                |
| L                | L                | X   | X | H <sup>(1)</sup> | H <sup>(1)</sup> |
| H                | H                | ↑   | H | H                | L                |
| H                | H                | ↑   | L | L                | H                |
| H                | H                | L   | X | $Q_0$            | $\overline{Q}_0$ |

(1) This configuration is non-stable; that is, it does not persist when  $\overline{PRE}$  or  $\overline{CLR}$  returns to its inactive (high) level.

## 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, as well as validating and testing their design implementation to confirm system functionality.

### 9.1 Application Information

A low level at the preset ( $\overline{\text{PRE}}$ ) or clear ( $\overline{\text{CLR}}$ ) input sets or resets the outputs, regardless of the levels of the other inputs. When  $\overline{\text{PRE}}$  and  $\overline{\text{CLR}}$  are inactive (high), data at the data (D) input meeting the setup time requirements is transferred to the outputs on the positive-going edge of the clock pulse. Clock triggering occurs at a voltage level and is not related directly to the rise time of the clock pulse. Following the hold-time interval, data at the D input can be changed without affecting the levels at the outputs.

The 330  $\Omega$  resistor and 22 pF capacitor shown in Figure 9-1 produce enough delay to meet the hold time requirement of the D input. To calculate the delay for a particular RC combination, use Equation 1. The delay with this RC combination is 5.03 ns

$$t_{\text{delay}} = -RC \ln(0.5) \approx 0.693 RC \quad (1)$$

To ensure proper operation, check that the transition time of the RC circuit meets the transition time requirements of the device inputs listed in the Recommended Operating Conditions table. Transition time for an RC can be approximated with Equation 2.

$$t_r \approx 2.2 RC \quad (2)$$

In this case, transition time is 18.15 ns, which equates to a 4.54 ns / V input transition rate at  $V_{CC} = 5$  V, and is below the 5 ns / V maximum requirement for recommended operation.

### 9.2 Typical Power Button Circuit

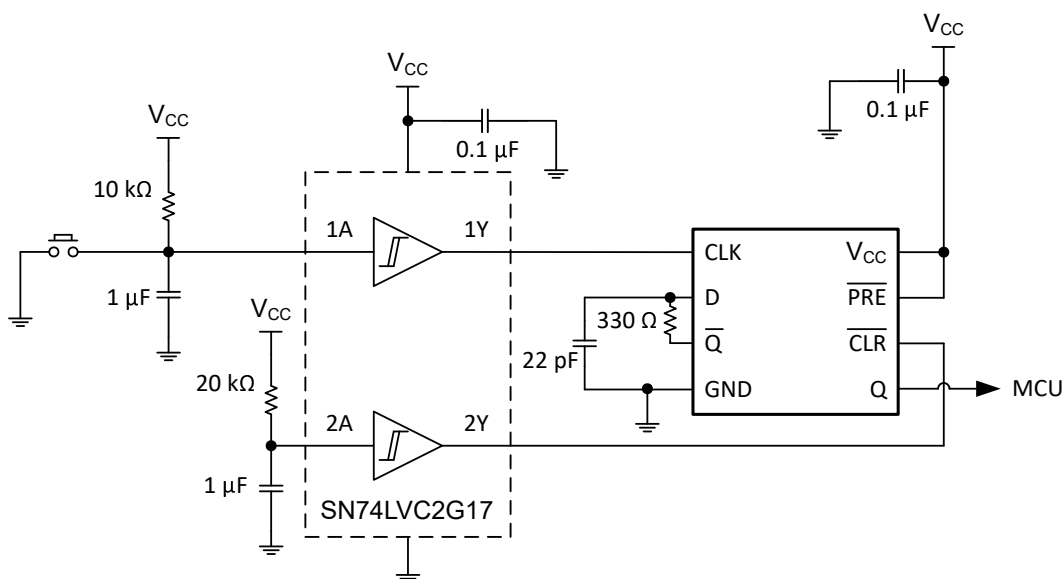


Figure 9-1. Device Power Button Circuit

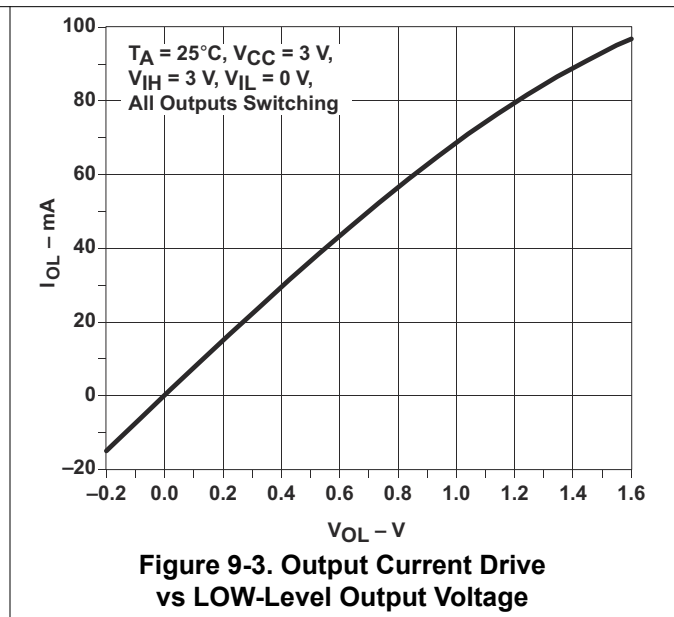
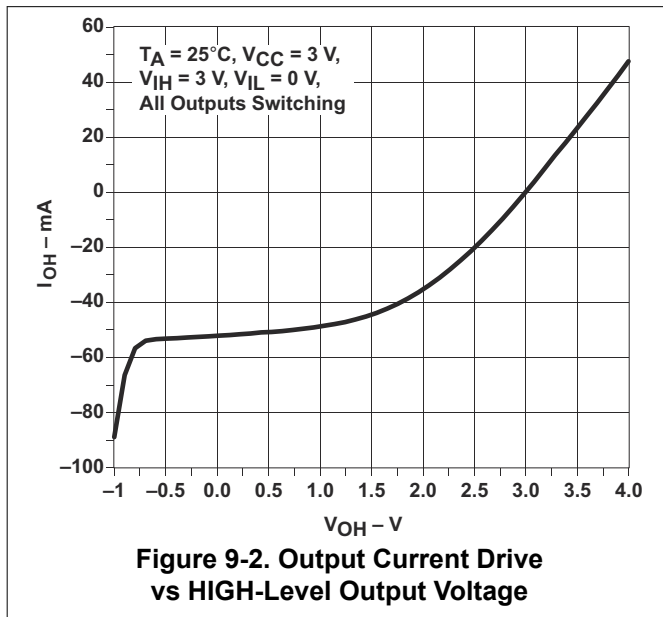
### 9.2.1 Design Requirements

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. Outputs can be combined to produce higher drive but the high drive will also create faster 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:
  - For rise time and fall time specifications, see  $(\Delta t/\Delta V)$  in the *Recommended Operating Conditions* table.
  - For 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 5.5 V at any valid  $V_{CC}$
2. Recommend Output Conditions:
  - Load currents should not exceed 50 mA per output and 100 mA total for the part.
  - Series resistors on the output may be used if the user desires to slow the output edge signal or limit the output current.

### 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* table. Each  $V_{CC}$  terminal should have a good bypass capacitor to prevent power disturbance. For devices with a single supply, a 0.1- $\mu\text{F}$  capacitor is recommended and if there are multiple  $V_{CC}$  terminals then .01- $\mu\text{F}$  or .022- $\mu\text{F}$  capacitors are recommended for each power terminal. It is acceptable to parallel multiple bypass caps to reject different frequencies of noise. The 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

When using multiple bit logic devices, inputs should not float. In many cases, functions or parts of functions of digital logic devices are unused. Some examples are when only two inputs of a triple-input AND gate are used, or when only 3 of the 4-buffer gates are used. Such input pins should not be left unconnected because the undefined voltages at the outside connections result in undefined operational states.

Specified in [Figure 11-1](#) are rules that must be observed under all circumstances. All unused inputs of digital logic devices must be connected to a high or low bias to prevent them from floating. The logic level that should be applied to any particular unused input depends on the function of the device. Generally they will be tied to GND or  $V_{CC}$ , whichever makes more sense or is more convenient. It is acceptable to float outputs unless the part is a transceiver. If the transceiver has an output enable pin, it will disable the outputs section of the part when asserted. This will not disable the input section of the I/Os so they also cannot float when disabled.

### 11.2 Layout Example

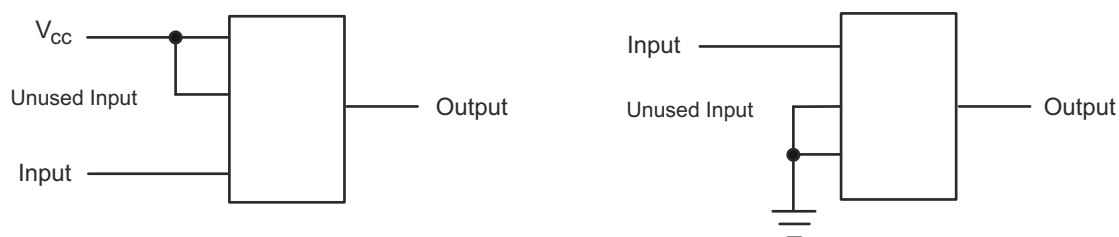


Figure 11-1. Layout Diagram

## 12 Device and Documentation Support

### 12.1 Receiving Notification of Documentation Updates

To receive notification of documentation updates, navigate to the device product folder on [ti.com](http://ti.com). Click on *Subscribe to updates* 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.

### 12.2 Support Resources

TI E2E™ [support forums](#) are an engineer's go-to source for fast, verified answers and design help — straight from the experts. Search existing answers or ask your own question to get the quick design help you need.

Linked content is 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](#).

### 12.3 Trademarks

NanoFree™ is a trademark of Texas Instruments.

TI E2E™ is a trademark of Texas Instruments.

All trademarks are the property of their respective owners.

### 12.4 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.

### 12.5 Glossary

[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 part number             | Status<br>(1) | Material type<br>(2) | Package   Pins  | Package qty   Carrier | RoHS<br>(3) | Lead finish/<br>Ball material<br>(4) | MSL rating/<br>Peak reflow<br>(5) | Op temp (°C) | Part marking<br>(6)              |
|-----------------------------------|---------------|----------------------|-----------------|-----------------------|-------------|--------------------------------------|-----------------------------------|--------------|----------------------------------|
| <a href="#">SN74LVC2G74DCT3</a>   | Obsolete      | Production           | SSOP (DCT)   8  | -                     | -           | Call TI                              | Call TI                           | -40 to 125   | C74<br>Z                         |
| <a href="#">SN74LVC2G74DCTR</a>   | Active        | Production           | SSOP (DCT)   8  | 3000   LARGE T&R      | Yes         | SN                                   | Level-1-260C-UNLIM                | -40 to 125   | (2WS5, C74)<br>Z                 |
| SN74LVC2G74DCTR.B                 | Active        | Production           | SSOP (DCT)   8  | 3000   LARGE T&R      | Yes         | SN                                   | Level-1-260C-UNLIM                | -40 to 125   | (2WS5, C74)<br>Z                 |
| SN74LVC2G74DCTRE4                 | Active        | Production           | SSOP (DCT)   8  | 3000   null           | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | C74<br>Z                         |
| SN74LVC2G74DCTRE4.B               | Active        | Production           | SSOP (DCT)   8  | 3000   null           | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | C74<br>Z                         |
| <a href="#">SN74LVC2G74DCTRE6</a> | Obsolete      | Production           | SSOP (DCT)   8  | -                     | -           | Call TI                              | Call TI                           | -40 to 125   | C74<br>Z                         |
| <a href="#">SN74LVC2G74DCTRG4</a> | Active        | Production           | SSOP (DCT)   8  | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | C74<br>Z                         |
| SN74LVC2G74DCTRG4.B               | Active        | Production           | SSOP (DCT)   8  | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | C74<br>Z                         |
| <a href="#">SN74LVC2G74DCUR</a>   | Active        | Production           | VSSOP (DCU)   8 | 3000   LARGE T&R      | Yes         | NIPDAU   SN                          | Level-1-260C-UNLIM                | -40 to 125   | (74, C74J, C74Q, C<br>74R)<br>CZ |
| SN74LVC2G74DCUR.B                 | Active        | Production           | VSSOP (DCU)   8 | 3000   LARGE T&R      | Yes         | SN                                   | Level-1-260C-UNLIM                | -40 to 125   | (74, C74J, C74Q, C<br>74R)<br>CZ |
| SN74LVC2G74DCURE4                 | Active        | Production           | VSSOP (DCU)   8 | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | C74R                             |
| <a href="#">SN74LVC2G74DCURG4</a> | Active        | Production           | VSSOP (DCU)   8 | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | C74R                             |
| SN74LVC2G74DCURG4.B               | Active        | Production           | VSSOP (DCU)   8 | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | C74R                             |
| <a href="#">SN74LVC2G74DCUT</a>   | Active        | Production           | VSSOP (DCU)   8 | 250   SMALL T&R       | Yes         | NIPDAU   SN                          | Level-1-260C-UNLIM                | -40 to 125   | (C74J, C74Q, C74R)               |
| SN74LVC2G74DCUT.B                 | Active        | Production           | VSSOP (DCU)   8 | 250   SMALL T&R       | Yes         | SN                                   | Level-1-260C-UNLIM                | -40 to 125   | (C74J, C74Q, C74R)               |
| SN74LVC2G74DCUTE4                 | Active        | Production           | VSSOP (DCU)   8 | 250   SMALL T&R       | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | C74R                             |
| <a href="#">SN74LVC2G74DCUTG4</a> | Active        | Production           | VSSOP (DCU)   8 | 250   SMALL T&R       | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | C74R                             |
| SN74LVC2G74DCUTG4.B               | Active        | Production           | VSSOP (DCU)   8 | 250   SMALL T&R       | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | C74R                             |
| <a href="#">SN74LVC2G74YZPR</a>   | Active        | Production           | DSBGA (YZP)   8 | 3000   LARGE T&R      | Yes         | SNAGCU                               | Level-1-260C-UNLIM                | -40 to 85    | CPN                              |

| Orderable part number | Status<br>(1) | Material type<br>(2) | Package   Pins  | Package qty   Carrier | RoHS<br>(3) | Lead finish/<br>Ball material<br>(4) | MSL rating/<br>Peak reflow<br>(5) | Op temp (°C) | Part marking<br>(6) |
|-----------------------|---------------|----------------------|-----------------|-----------------------|-------------|--------------------------------------|-----------------------------------|--------------|---------------------|
| SN74LVC2G74YZPR.B     | Active        | Production           | DSBGA (YZP)   8 | 3000   LARGE T&R      | Yes         | SNAGCU                               | Level-1-260C-UNLIM                | -40 to 85    | CPN                 |

(1) **Status:** For more details on status, see our [product life cycle](#).

(2) **Material type:** When designated, preproduction parts are prototypes/experimental devices, and are not yet approved or released for full production. Testing and final process, including without limitation quality assurance, reliability performance testing, and/or process qualification, may not yet be complete, and this item is subject to further changes or possible discontinuation. If available for ordering, purchases will be subject to an additional waiver at checkout, and are intended for early internal evaluation purposes only. These items are sold without warranties of any kind.

(3) **RoHS values:** Yes, No, RoHS Exempt. See the [TI RoHS Statement](#) for additional information and value definition.

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

(5) **MSL rating/Peak reflow:** The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will be used to mount the part to the printed circuit board.

(6) **Part marking:** There may be an additional marking, which relates to the logo, the lot trace code information, or the environmental category of the part.

Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "~" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

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

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

**OTHER QUALIFIED VERSIONS OF SN74LVC2G74 :**

- Automotive : [SN74LVC2G74-Q1](#)
- Enhanced Product : [SN74LVC2G74-EP](#)

NOTE: Qualified Version Definitions:

- Automotive - Q100 devices qualified for high-reliability automotive applications targeting zero defects
- Enhanced Product - Supports Defense, Aerospace and Medical Applications



**TAPE AND REEL INFORMATION**

**QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE**

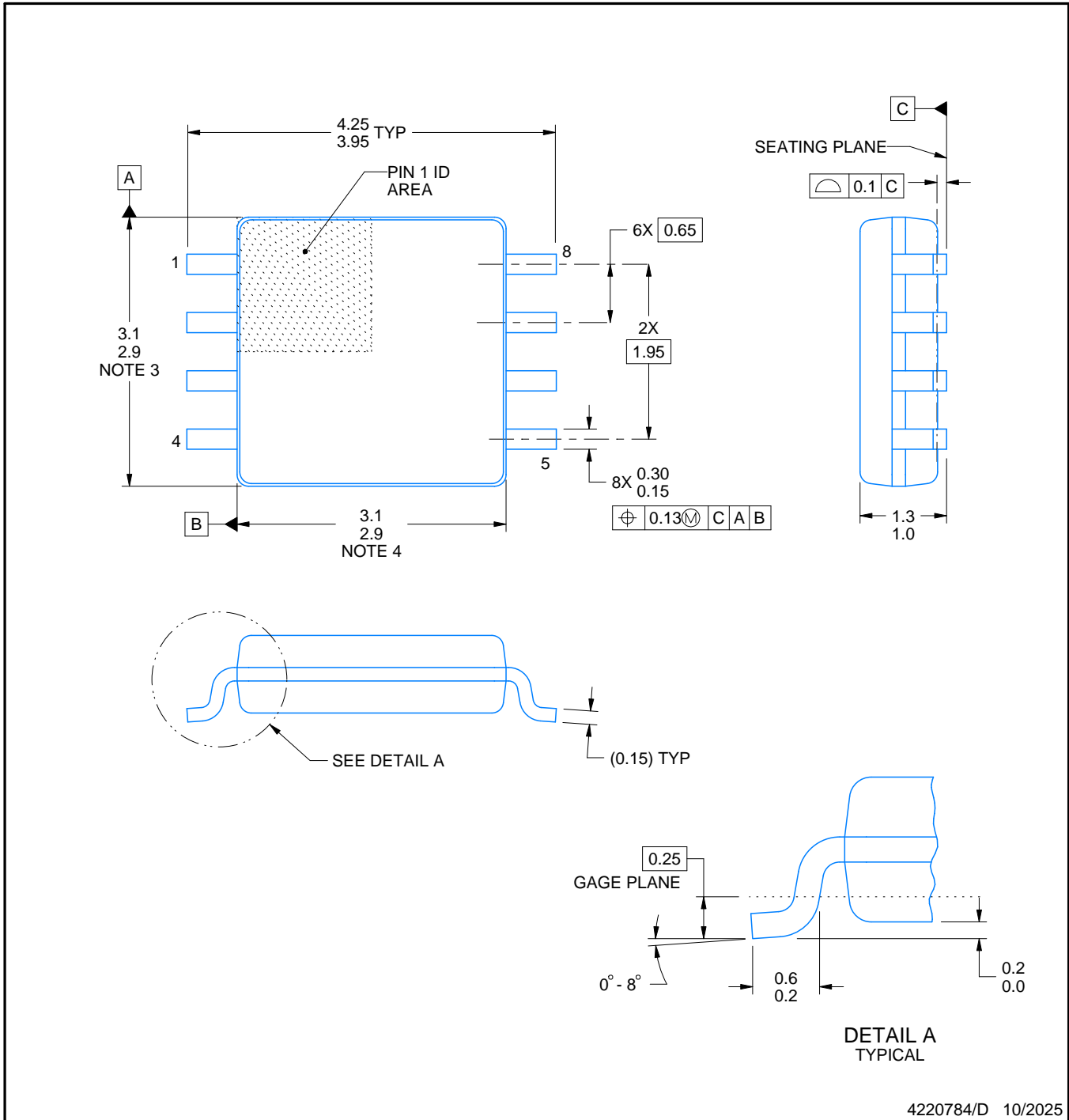
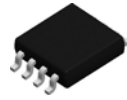

\*All dimensions are nominal

| 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 |
|-------------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| SN74LVC2G74DCTR   | SSOP         | DCT             | 8    | 3000 | 180.0              | 12.4               | 3.15    | 4.35    | 1.55    | 4.0     | 12.0   | Q3            |
| SN74LVC2G74DCTRG4 | SSOP         | DCT             | 8    | 3000 | 180.0              | 13.0               | 3.35    | 4.5     | 1.55    | 4.0     | 12.0   | Q3            |
| SN74LVC2G74DCUR   | VSSOP        | DCU             | 8    | 3000 | 178.0              | 9.0                | 2.25    | 3.35    | 1.05    | 4.0     | 8.0    | Q3            |
| SN74LVC2G74DCURG4 | VSSOP        | DCU             | 8    | 3000 | 180.0              | 8.4                | 2.25    | 3.35    | 1.05    | 4.0     | 8.0    | Q3            |
| SN74LVC2G74DCUT   | VSSOP        | DCU             | 8    | 250  | 178.0              | 9.0                | 2.25    | 3.35    | 1.05    | 4.0     | 8.0    | Q3            |
| SN74LVC2G74DCUTG4 | VSSOP        | DCU             | 8    | 250  | 180.0              | 8.4                | 2.25    | 3.35    | 1.05    | 4.0     | 8.0    | Q3            |
| SN74LVC2G74YZPR   | 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) |
|-------------------|--------------|-----------------|------|------|-------------|------------|-------------|
| SN74LVC2G74DCTR   | SSOP         | DCT             | 8    | 3000 | 190.0       | 190.0      | 30.0        |
| SN74LVC2G74DCTRG4 | SSOP         | DCT             | 8    | 3000 | 182.0       | 182.0      | 20.0        |
| SN74LVC2G74DCUR   | VSSOP        | DCU             | 8    | 3000 | 180.0       | 180.0      | 18.0        |
| SN74LVC2G74DCURG4 | VSSOP        | DCU             | 8    | 3000 | 202.0       | 201.0      | 28.0        |
| SN74LVC2G74DCUT   | VSSOP        | DCU             | 8    | 250  | 180.0       | 180.0      | 18.0        |
| SN74LVC2G74DCUTG4 | VSSOP        | DCU             | 8    | 250  | 202.0       | 201.0      | 28.0        |
| SN74LVC2G74YZPR   | DSBGA        | YZP             | 8    | 3000 | 220.0       | 220.0      | 35.0        |



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**NOTES:**

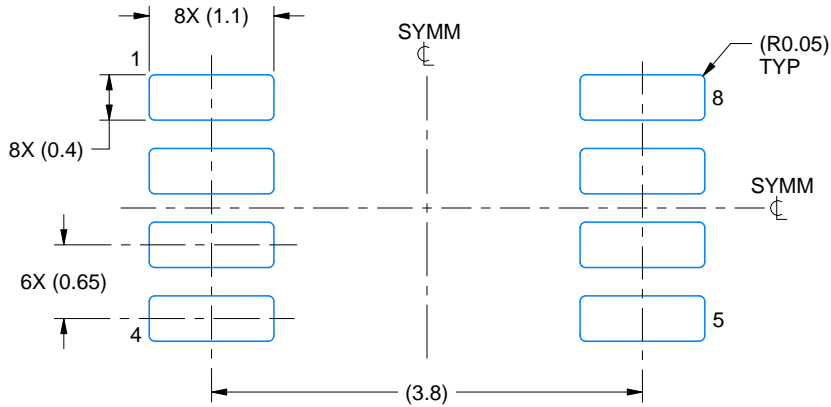
1. All linear dimensions are in millimeters. Dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm per side.
4. This dimension does not include interlead flash. Interlead flash shall not exceed 0.25 mm per side.

# EXAMPLE BOARD LAYOUT

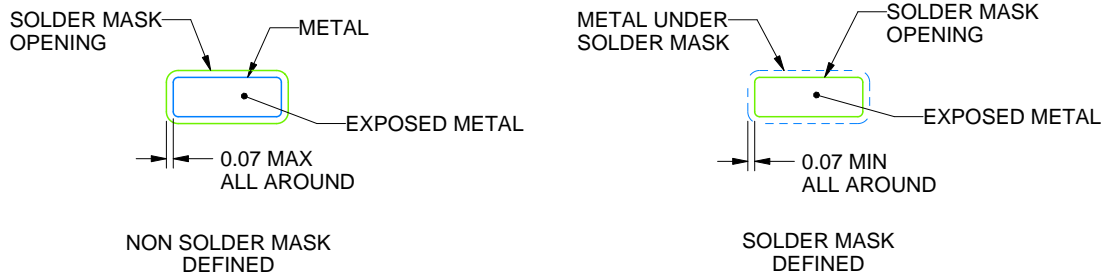
DCT0008A

SSOP - 1.3 mm max height

SMALL OUTLINE PACKAGE



LAND PATTERN EXAMPLE  
EXPOSED METAL SHOWN  
SCALE:15X



SOLDER MASK DETAILS

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NOTES: (continued)

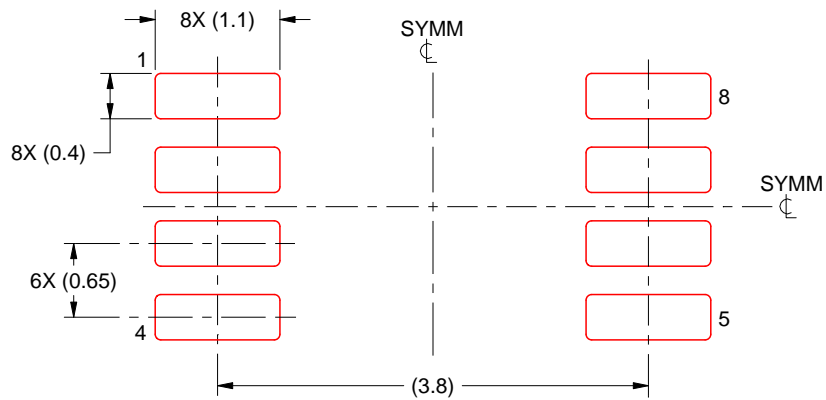
- 5. Publication IPC-7351 may have alternate designs.
- 6. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

# EXAMPLE STENCIL DESIGN

DCT0008A

SSOP - 1.3 mm max height

SMALL OUTLINE PACKAGE

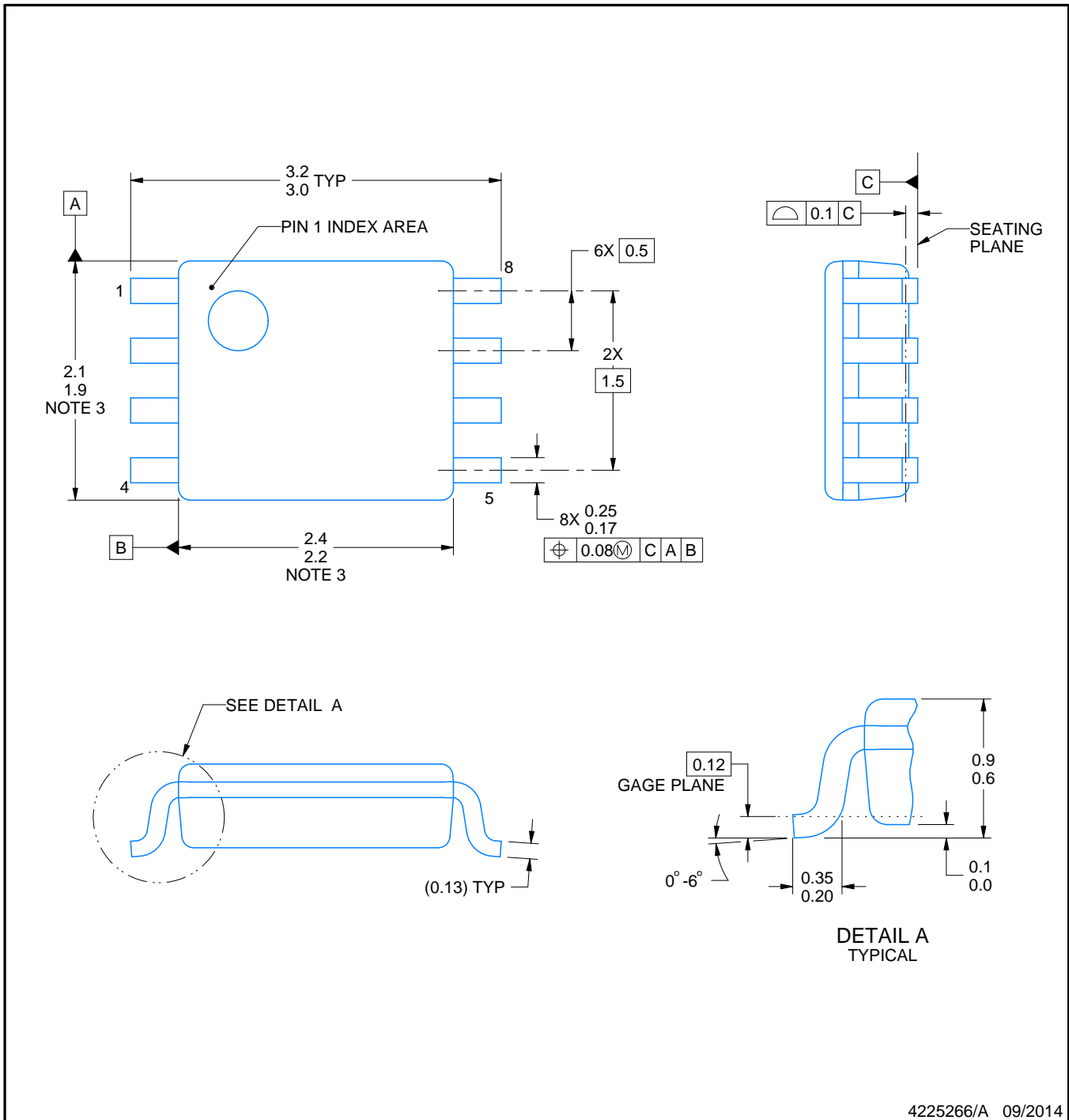


SOLDER PASTE EXAMPLE  
BASED ON 0.125 mm THICK STENCIL  
SCALE:15X

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NOTES: (continued)

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



4225266/A 09/2014

NOTES:

1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm per side.
4. Reference JEDEC registration MO-187 variation CA.

# EXAMPLE BOARD LAYOUT

DCU0008A

VSSOP - 0.9 mm max height

SMALL OUTLINE PACKAGE



LAND PATTERN EXAMPLE  
EXPOSED METAL SHOWN  
SCALE: 25X



4225266/A 09/2014

NOTES: (continued)

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

# EXAMPLE STENCIL DESIGN

DCU0008A

VSSOP - 0.9 mm max height

SMALL OUTLINE PACKAGE



SOLDER PASTE EXAMPLE  
BASED ON 0.125 mm THICK STENCIL  
SCALE: 25X

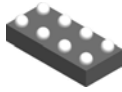
4225266/A 09/2014

NOTES: (continued)

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



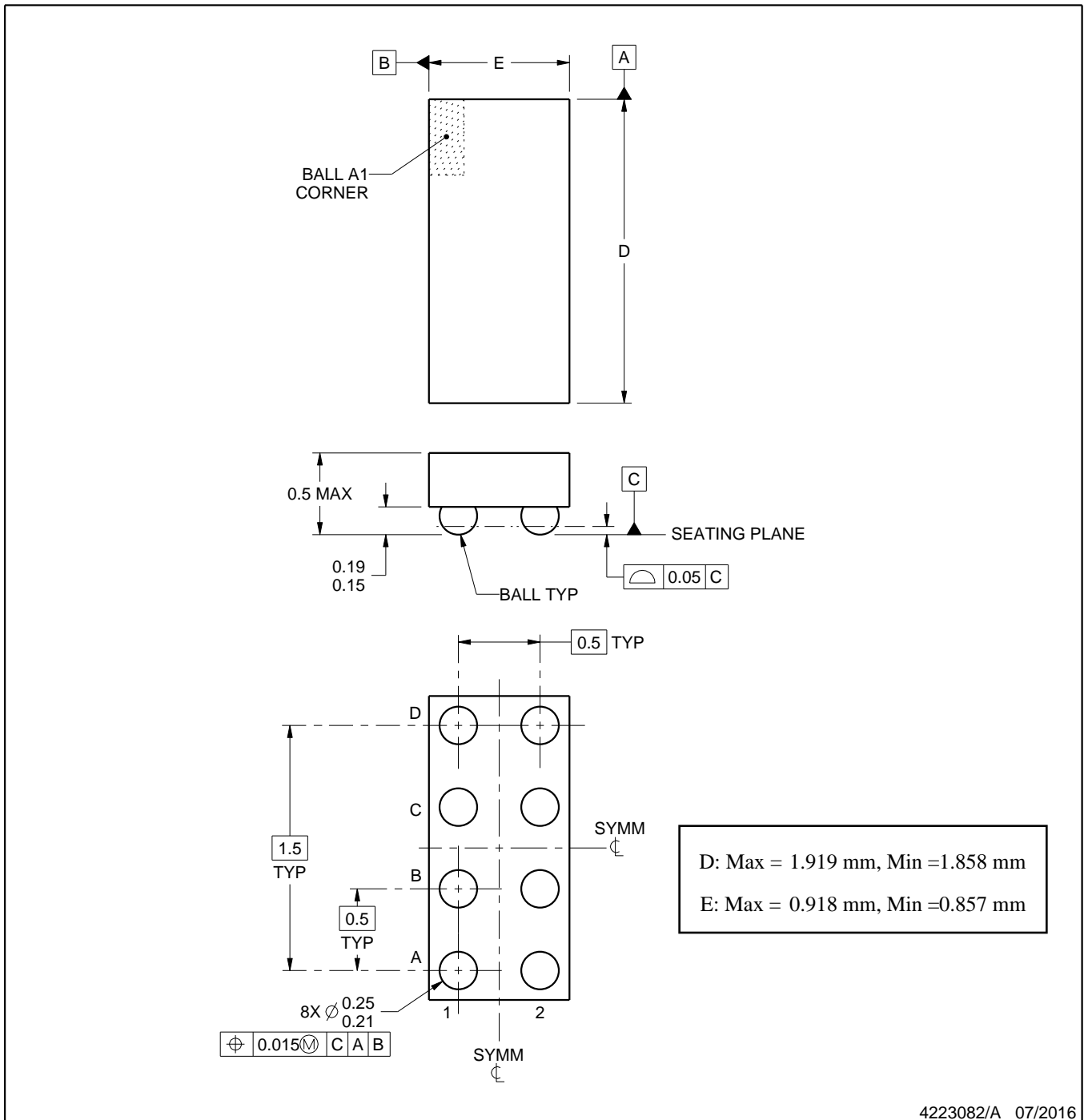
YZP0008



PACKAGE OUTLINE

DSBGA - 0.5 mm max height

DIE SIZE BALL GRID ARRAY



4223082/A 07/2016

NOTES:

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

# EXAMPLE BOARD LAYOUT

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.

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