



**THE DATASHEET OF  
SN74LVC2G74DCUTG4**



# 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
- Max  $t_{pd}$  of 5.9 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 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.

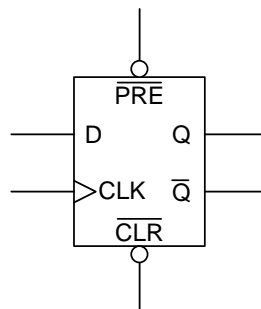
This device is fully specified for partial-power-down applications using  $I_{off}$ . The  $I_{off}$  circuitry disables the outputs, preventing damaging current backflow through the device when it is powered down.

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

| PART NUMBER | PACKAGE   | BODY SIZE         |
|-------------|-----------|-------------------|
| SN74LVC2G74 | SM8 (8)   | 2.95 mm x 2.80 mm |
|             | VSSOP (8) | 2.30 mm x 2.00 mm |
|             | DSBGA (8) | 1.91 mm x 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

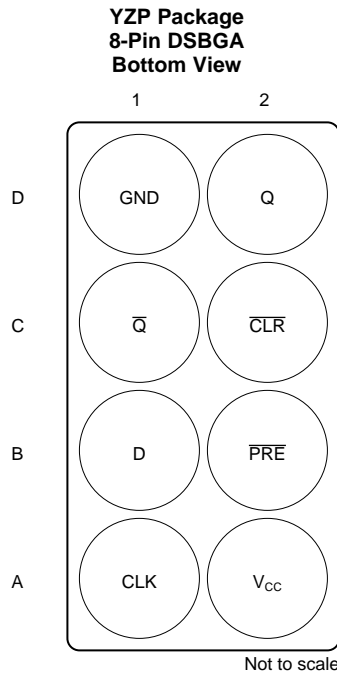
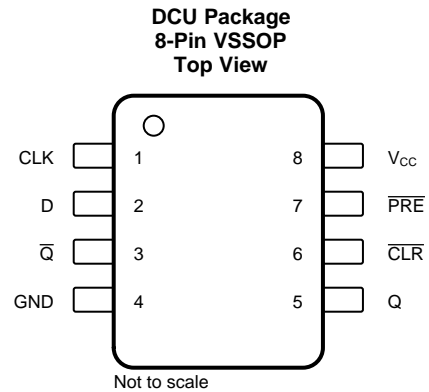
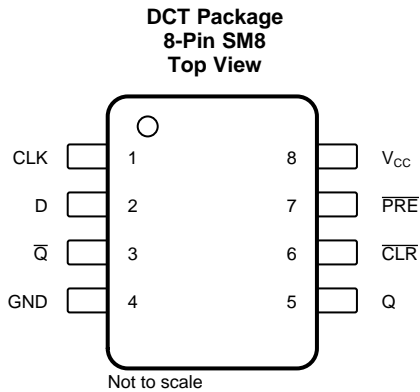
NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

| Changes from Revision O (January 2015) to Revision P   | Page |
|--|------|
| • 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    |
| • Added <i>Receiving Notification of Documentation Updates</i> section and <i>Community Resources</i> section..... | 13   |

| Changes from Revision N (July 2013) to Revision O   | Page |
|---|------|
| • 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    |

| Changes from Revision M (February 2007) to Revision N  | Page |
|--|------|
| • 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    |
| • Changed <i>Timing Requirements, –40°C to +85°C</i> table.....  | 6    |
| • Added <i>Timing Requirements, –40°C to +125°C</i> table.....   | 6    |
| • Changed <i>Switching Characteristics, –40°C to +85°C</i> table.....  | 7    |
| • Added <i>Switching Characteristics, –40°C to +125°C</i> table.....   | 7    |

## 5 Pin Configuration and Functions



See mechanical drawings for dimensions.

### Pin Functions

| NAME                    | PIN        |       | TYPE | DESCRIPTION                                  |
|-------------------------|------------|-------|------|--|
|                         | VSSOP, SM8 | DSBGA |      |  |
| CLK                     | 1          | A1    | I    | Clock input                                  |
| $\overline{\text{CLR}}$ | 6          | C2    | I    | Clear input - Pull low to set Q output low   |
| D                       | 2          | B1    | I    | Input  |
| GND                     | 4          | D1    | —    | Ground                                       |
| Q                       | 5          | D2    | O    | Output                                       |
| $\overline{\text{Q}}$   | 3          | C1    | O    | Inverted output                              |
| $\overline{\text{PRE}}$ | 7          | B2    | I    | Preset input - Pull low to set Q output high |
| 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 |
|-----------|---|-----------|----------------|------|
| $V_{CC}$  | Supply voltage  | -0.5      | 6.5            | V    |
| $V_I$     | Input voltage <sup>(2)</sup>  | -0.5      | 6.5            | V    |
| $V_O$     | Voltage range applied to any output in the high-impedance or power-off state <sup>(2)</sup> | -0.5      | 6.5            | V    |
| $V_O$     | Voltage range applied to any output in the high or low state <sup>(2)(3)</sup>              | -0.5      | $V_{CC} + 0.5$ | V    |
| $I_{IK}$  | Input clamp current   | $V_I < 0$ | -50            | mA   |
| $I_{OK}$  | Output clamp current  | $V_O < 0$ | -50            | mA   |
| $I_O$     | Continuous output current   |           | ±50            | mA   |
|           | Continuous current through $V_{CC}$ or GND  |           | ±100           | mA   |
| $T_{stg}$ | Storage temperature   | -65       | 150            | °C   |

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

### 6.2 ESD Ratings

| PARAMETER                           | DEFINITION   | VALUE | UNIT |
|-------------------------------------|--|-------|------|
| $V_{(ESD)}$ Electrostatic discharge | Human body model (HBM), per ANSI/ESDA/JEDEC JS-001, all pins <sup>(1)</sup>              | 2000  | V    |
|                                     | 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                    |      |
|                         |                                    |   |                        | –24                    |      |
| V <sub>CC</sub> = 4.5 V |                                    | –32   |                        |                        |      |
| 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                     |      |
|                         |                                    |   |                        | 24                     |      |
| V <sub>CC</sub> = 4.5 V |                                    | 32  |                        |                        |      |
| 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>              | 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 3)

| 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   |
|                    | $\overline{\text{PRE}}$ or $\overline{\text{CLR}}$ low      |    | 6.2                              |     | 2.7                             |     | 2.7                             |     | 2                             |     |      |
| t <sub>su</sub>    | Data  |    | 2.9                              |     | 1.7                             |     | 1.3                             |     | 1.1                           |     | ns   |
|                    | $\overline{\text{PRE}}$ or $\overline{\text{CLR}}$ 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 3)

| 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   |
|                    | $\overline{\text{PRE}}$ or $\overline{\text{CLR}}$ low      |    | 6.2                              |     | 3.5                             |     | 3.5                             |     | 3.3                           |     |      |
| t <sub>su</sub>    | Data  |    | 2.9                              |     | 2.3                             |     | 1.9                             |     | 1.7                           |     | ns   |
|                    | $\overline{\text{PRE}}$ or $\overline{\text{CLR}}$ 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 3)

| 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 |      |
|           | $\overline{PRE}$ or $\overline{CLR}$ 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 3)

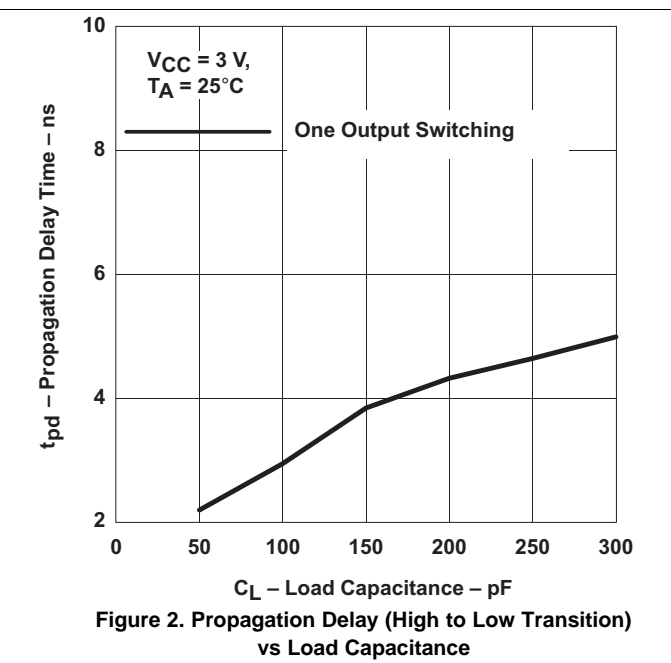
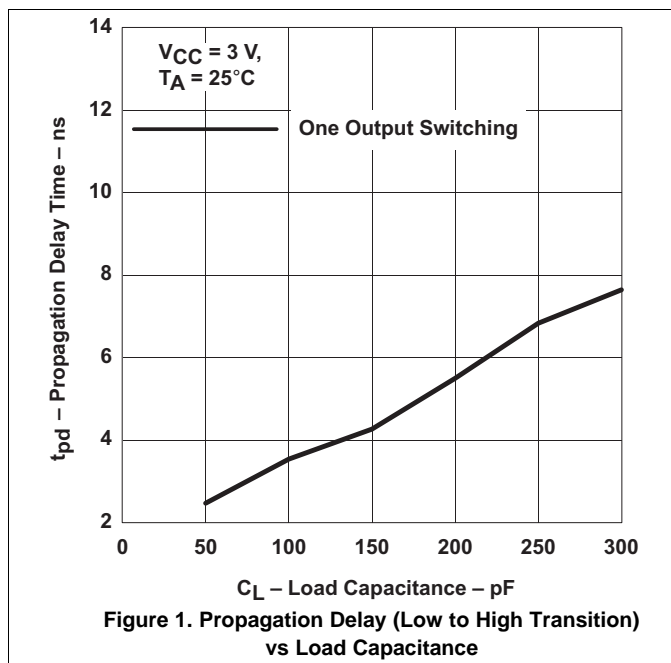
| PARAMETER | FROM                                     | TO             | –40°C to +125°C                           |      |  |     |  |     |  |     | UNIT |
|-----------|--|----------------|---|------|--|-----|--|-----|--|-----|------|
|           |  |                | $V_{CC} = 1.8\text{ V} \pm 0.15\text{ V}$ |      | $V_{CC} = 2.5\text{ V} \pm 0.2\text{ V}$ |     | $V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$ |     | $V_{CC} = 5\text{ V} \pm 0.5\text{ V}$ |     |      |
|           |  |                | 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 |      |
|           | $\overline{PRE}$ or $\overline{CLR}$ 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

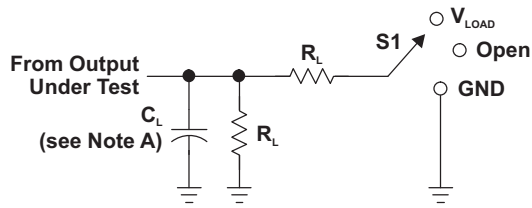
$T_A = 25^\circ\text{C}$

| 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

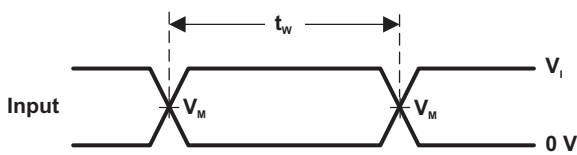
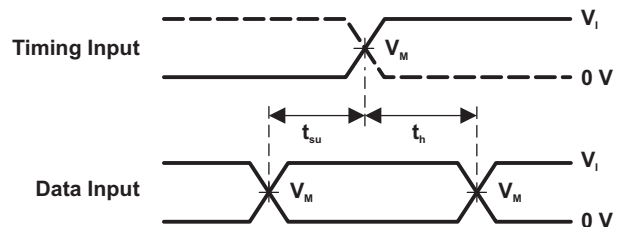
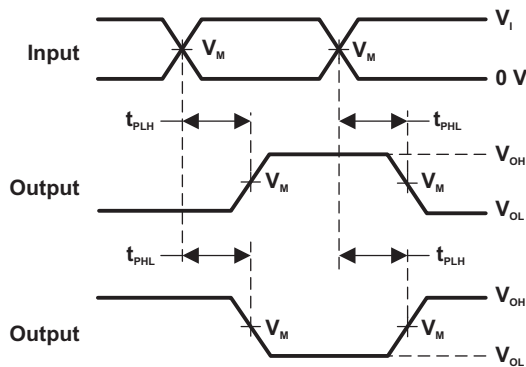
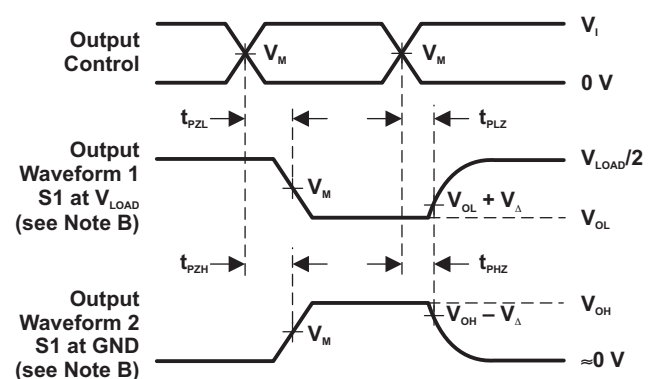


## 7 Parameter Measurement Information


**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        |


**VOLTAGE WAVEFORMS PULSE DURATION**

**VOLTAGE WAVEFORMS SETUP AND HOLD TIMES**

**VOLTAGE WAVEFORMS PROPAGATION DELAY TIMES INVERTING AND NONINVERTING OUTPUTS**

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

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

**Figure 3. Load Circuit and Voltage Waveforms**



## 9 Application and Implementation

### NOTE

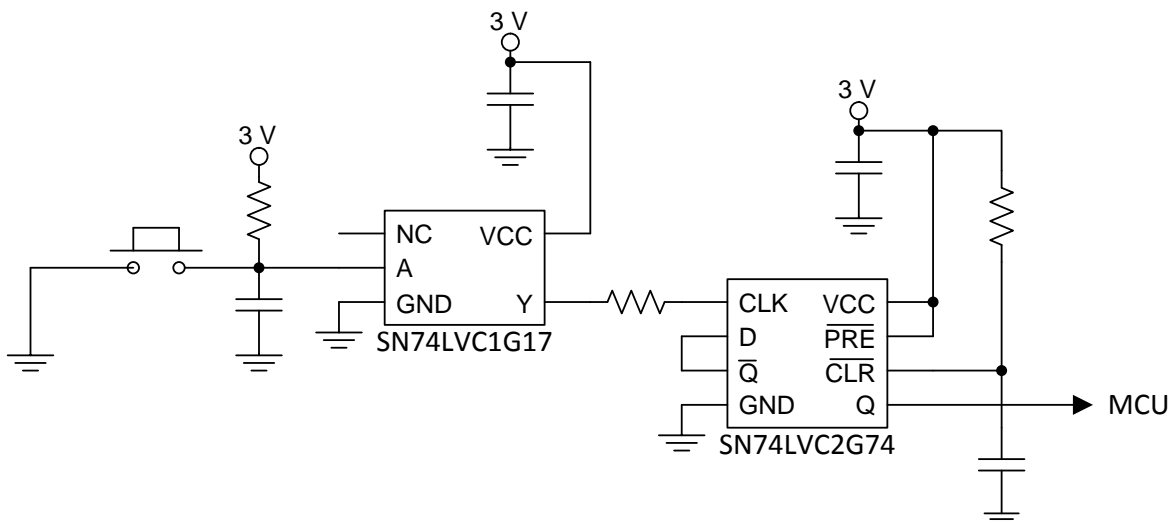
Information in the following applications sections is not part of the TI component specification, and TI does not warrant its accuracy or completeness. TI's customers are responsible for determining suitability of components for their purposes. Customers should validate and test their design implementation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

### 9.1 Application Information

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 resistor and capacitor at the  $\overline{\text{CLR}}$  pin are optional. If they are not used, the  $\overline{\text{CLR}}$  pin should be connected directly to  $V_{\text{CC}}$  to be inactive.

### 9.2 Typical Power Button Circuit



**Figure 4. 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:

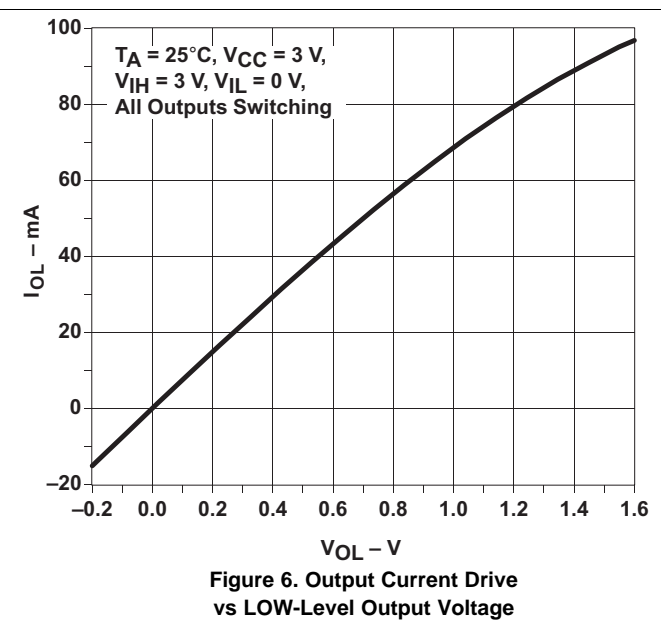
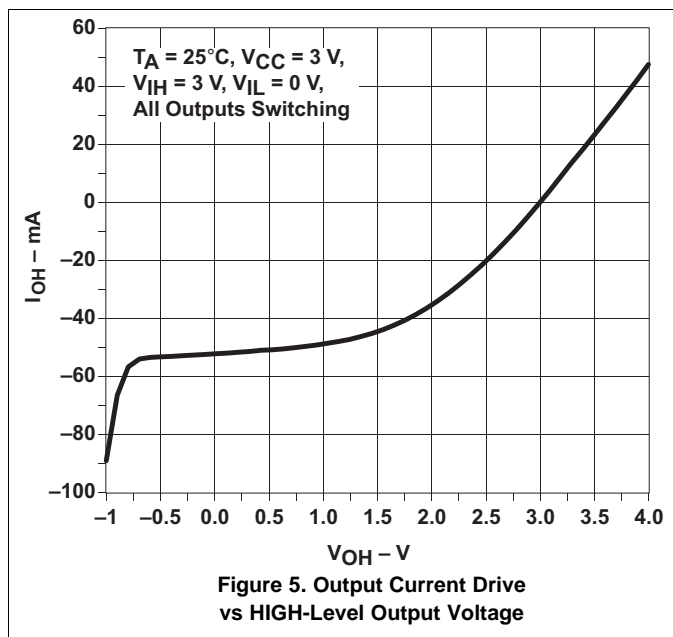
- For rise time and fall time specifications, see  $(\Delta t/\Delta V)$  in [Recommended Operating Conditions](#) table.
- For specified high and low levels, see  $(V_{\text{IH}}$  and  $V_{\text{IL}})$  in [Recommended Operating Conditions](#) table.
- Inputs are overvoltage tolerant allowing them to go as high as 5.5 V at any valid  $V_{\text{CC}}$

##### 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.

Typical Power Button Circuit (continued)

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- $\mu$ F capacitor is recommended and if there are multiple  $V_{CC}$  terminals then .01- $\mu$ F or .022- $\mu$ 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- $\mu$ F and 1- $\mu$ 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 7](#) 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

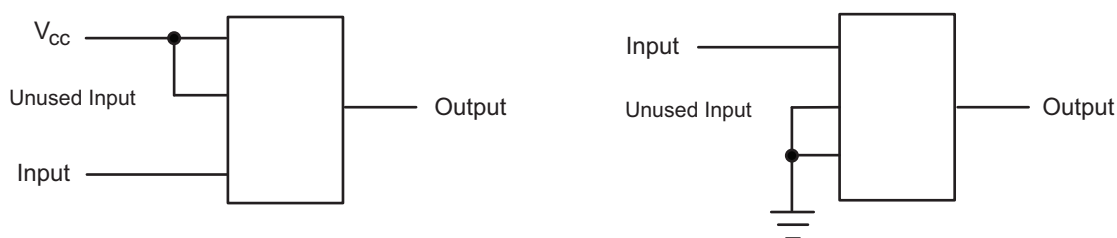


Figure 7. Layout Diagram

## 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. In the upper right corner, click on Alert me to register and receive a weekly digest of any product information that has changed. For change details, review the revision history included in any revised document.

### 12.2 Community Resources

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

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

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

### 12.3 Trademarks

NanoFree, E2E are trademarks of Texas Instruments.  
All other 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

[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                 |
|-------------------|---------------|--------------|-----------------|------|-------------|-------------------------|-------------------------|----------------------|--------------|-------------------------|-------------------------|
| SN74LVC2G74DCT3   | ACTIVE        | SM8          | DCT             | 8    | 3000        | Pb-Free (RoHS)          | CU SNBI                 | Level-1-260C-UNLIM   | -40 to 125   | C74<br>Z                | <a href="#">Samples</a> |
| SN74LVC2G74DCTR   | ACTIVE        | SM8          | DCT             | 8    | 3000        | Green (RoHS & no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | -40 to 125   | C74<br>Z                | <a href="#">Samples</a> |
| SN74LVC2G74DCTRE4 | ACTIVE        | SM8          | DCT             | 8    | 3000        | Green (RoHS & no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | -40 to 125   | C74<br>Z                | <a href="#">Samples</a> |
| SN74LVC2G74DCTRE6 | ACTIVE        | SM8          | DCT             | 8    | 3000        | Pb-Free (RoHS)          | CU SNBI                 | Level-1-260C-UNLIM   | -40 to 125   | C74<br>Z                | <a href="#">Samples</a> |
| SN74LVC2G74DCTRG4 | ACTIVE        | SM8          | DCT             | 8    | 3000        | Green (RoHS & no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | -40 to 125   | C74<br>Z                | <a href="#">Samples</a> |
| SN74LVC2G74DCUR   | ACTIVE        | VSSOP        | DCU             | 8    | 3000        | Green (RoHS & no Sb/Br) | CU NIPDAU   CU SN       | Level-1-260C-UNLIM   | -40 to 125   | (74, C74Q, C74R)<br>CZ  | <a href="#">Samples</a> |
| SN74LVC2G74DCURE4 | ACTIVE        | VSSOP        | DCU             | 8    | 3000        | Green (RoHS & no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | -40 to 125   | C74R                    | <a href="#">Samples</a> |
| SN74LVC2G74DCURG4 | ACTIVE        | VSSOP        | DCU             | 8    | 3000        | Green (RoHS & no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | -40 to 125   | C74R                    | <a href="#">Samples</a> |
| SN74LVC2G74DCUT   | ACTIVE        | VSSOP        | DCU             | 8    | 250         | Green (RoHS & no Sb/Br) | CU NIPDAU   CU SN       | Level-1-260C-UNLIM   | -40 to 125   | (C74Q, C74R)            | <a href="#">Samples</a> |
| SN74LVC2G74DCUTE4 | ACTIVE        | VSSOP        | DCU             | 8    | 250         | Green (RoHS & no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | -40 to 125   | C74R                    | <a href="#">Samples</a> |
| SN74LVC2G74DCUTG4 | ACTIVE        | VSSOP        | DCU             | 8    | 250         | Green (RoHS & no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | -40 to 125   | C74R                    | <a href="#">Samples</a> |
| SN74LVC2G74YZPR   | ACTIVE        | DSBGA        | YZP             | 8    | 3000        | Green (RoHS & no Sb/Br) | SNAGCU                  | Level-1-260C-UNLIM   | -40 to 85    | CPN                     | <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.

**OBSELETE:** 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  $\leq 1000$ ppm threshold. Antimony trioxide based flame retardants must also meet the  $\leq 1000$ ppm threshold requirement.

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

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

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

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

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**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

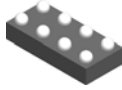
| Device            | Package Type | Package Drawing | Pins | SPQ  | Reel Diameter (mm) | Reel Width W1 (mm) | A0 (mm) | B0 (mm) | K0 (mm) | P1 (mm) | W (mm) | Pin1 Quadrant |
|-------------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| SN74LVC2G74DCT3   | SM8          | DCT             | 8    | 3000 | 180.0              | 13.0               | 3.35    | 4.5     | 1.55    | 4.0     | 12.0   | Q3            |
| SN74LVC2G74DCTR   | SM8          | DCT             | 8    | 3000 | 180.0              | 13.0               | 3.35    | 4.5     | 1.55    | 4.0     | 12.0   | Q3            |
| SN74LVC2G74DCTRE6 | SM8          | DCT             | 8    | 3000 | 180.0              | 13.0               | 3.35    | 4.5     | 1.55    | 4.0     | 12.0   | Q3            |
| SN74LVC2G74DCUR   | VSSOP        | DCU             | 8    | 3000 | 180.0              | 8.4                | 2.25    | 3.35    | 1.05    | 4.0     | 8.0    | Q3            |
| SN74LVC2G74DCUR   | VSSOP        | DCU             | 8    | 3000 | 180.0              | 9.0                | 2.05    | 3.3     | 1.0     | 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            |
| 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) |
|-------------------|--------------|-----------------|------|------|-------------|------------|-------------|
| SN74LVC2G74DCT3   | SM8          | DCT             | 8    | 3000 | 182.0       | 182.0      | 20.0        |
| SN74LVC2G74DCTR   | SM8          | DCT             | 8    | 3000 | 182.0       | 182.0      | 20.0        |
| SN74LVC2G74DCTRE6 | SM8          | DCT             | 8    | 3000 | 182.0       | 182.0      | 20.0        |
| SN74LVC2G74DCUR   | VSSOP        | DCU             | 8    | 3000 | 202.0       | 201.0      | 28.0        |
| SN74LVC2G74DCUR   | VSSOP        | DCU             | 8    | 3000 | 182.0       | 182.0      | 20.0        |
| SN74LVC2G74DCURG4 | VSSOP        | DCU             | 8    | 3000 | 202.0       | 201.0      | 28.0        |
| SN74LVC2G74DCUTG4 | VSSOP        | DCU             | 8    | 250  | 202.0       | 201.0      | 28.0        |
| SN74LVC2G74YZPR   | DSBGA        | YZP             | 8    | 3000 | 220.0       | 220.0      | 35.0        |

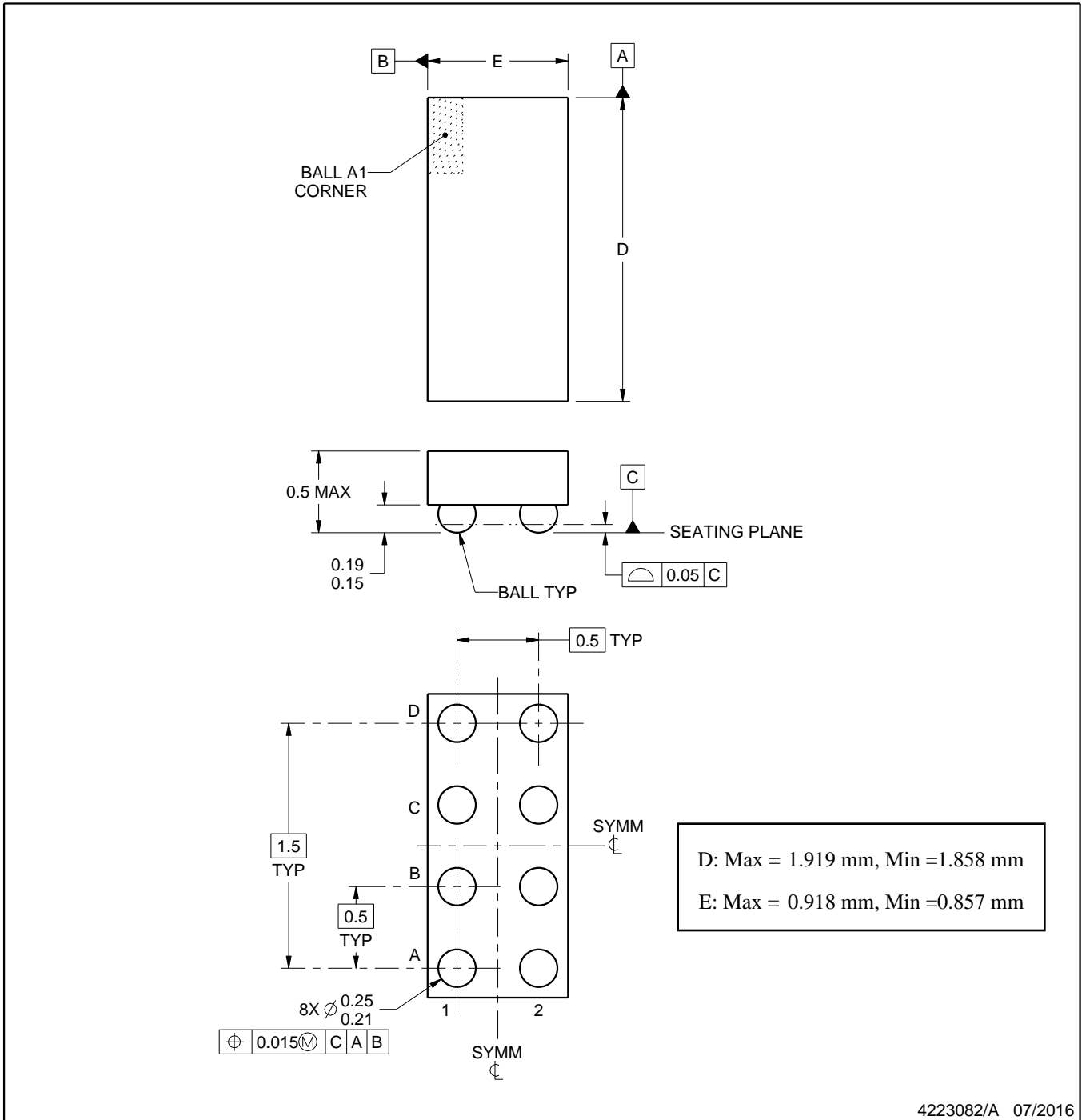
YZP0008



PACKAGE OUTLINE

DSBGA - 0.5 mm max height

DIE SIZE BALL GRID ARRAY



NOTES:

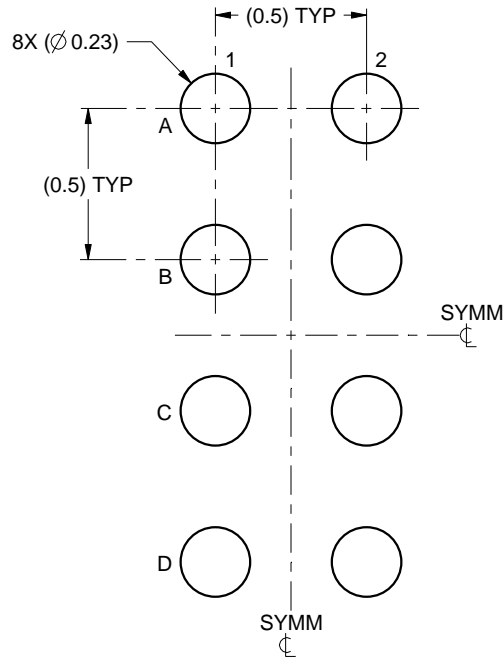
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.

# EXAMPLE BOARD LAYOUT

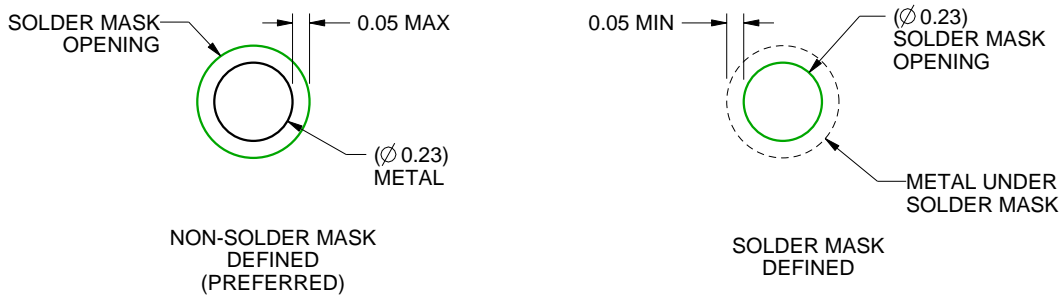
YZP0008

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)

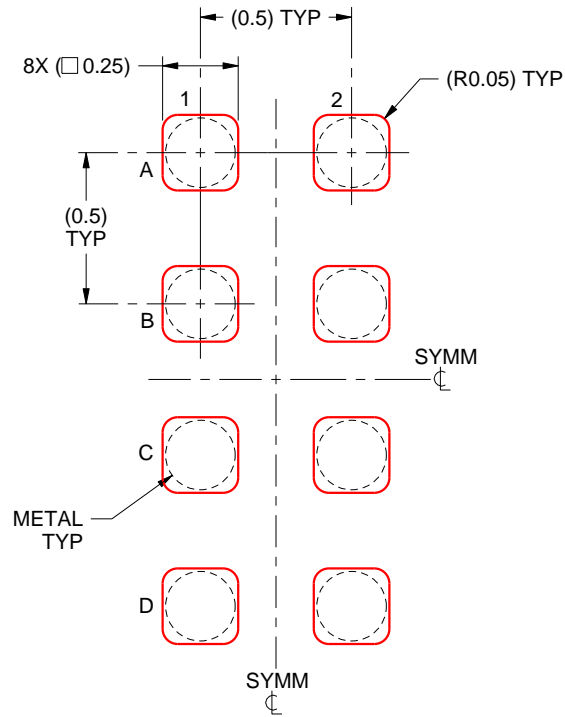
3. Final dimensions may vary due to manufacturing tolerance considerations and also routing constraints. For more information, see Texas Instruments literature number SNVA009 ([www.ti.com/lit/snva009](http://www.ti.com/lit/snva009)).

# EXAMPLE STENCIL DESIGN

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

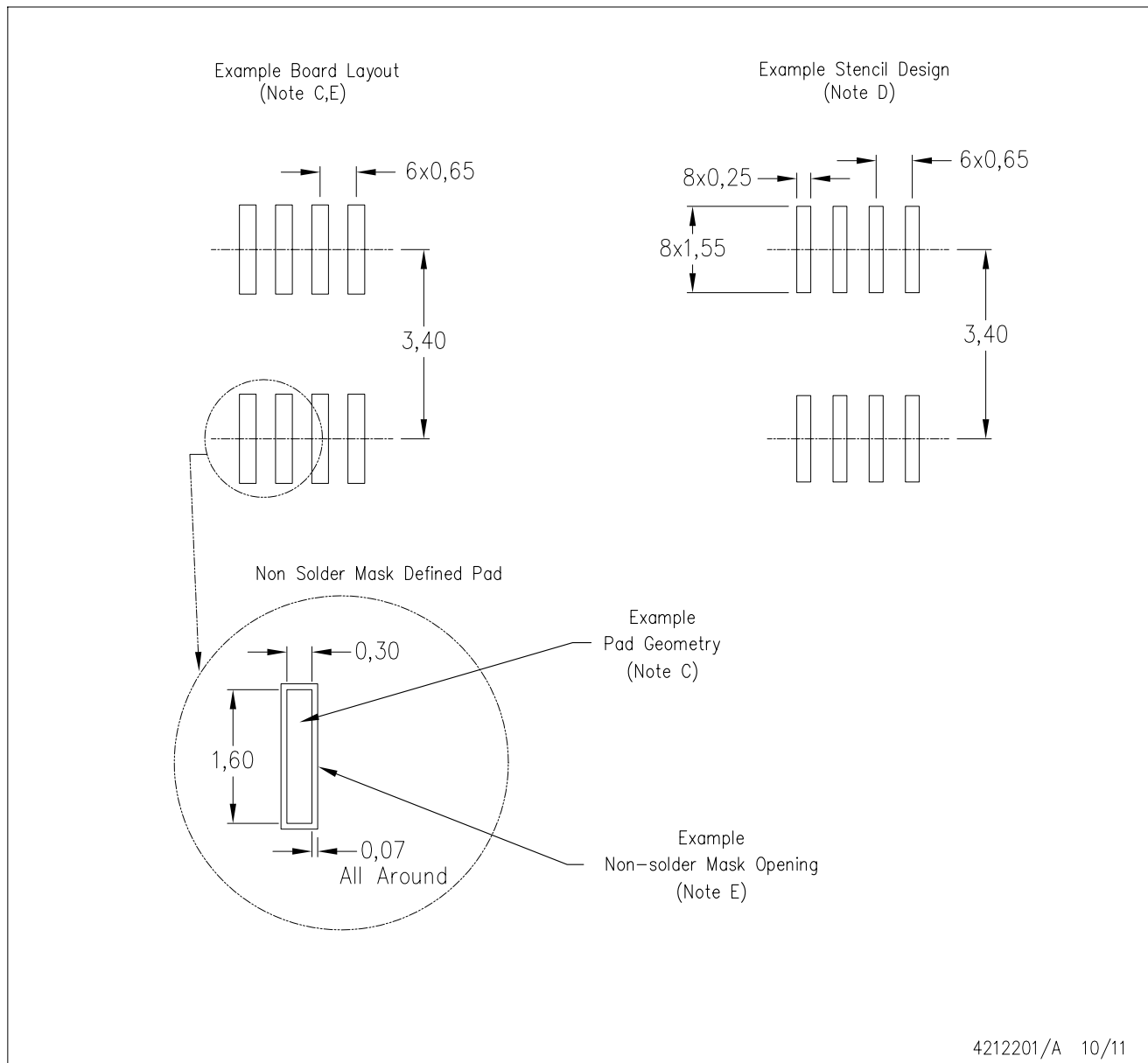
NOTES: (continued)

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



DCT (R-PDSO-G8)

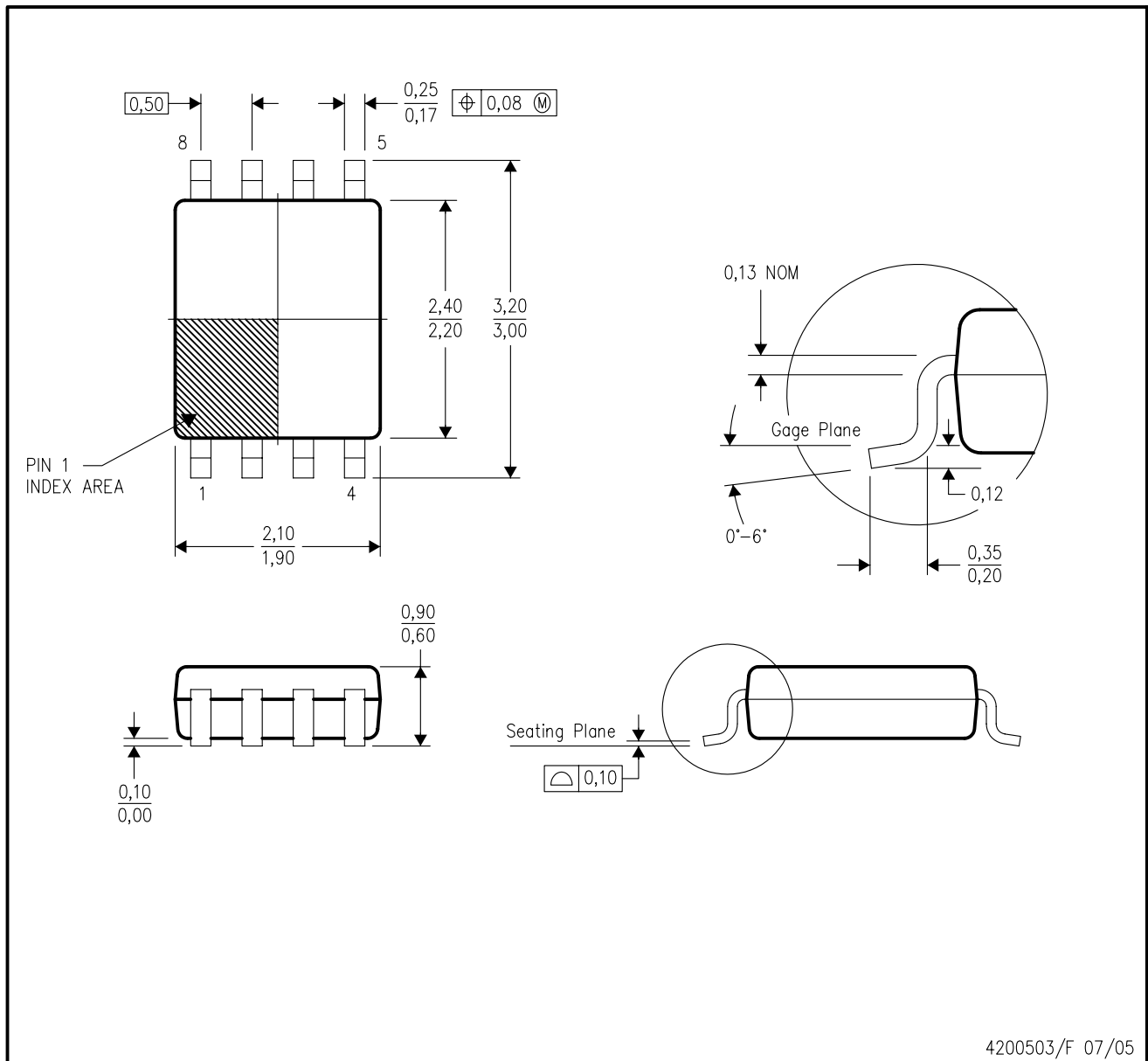
PLASTIC SMALL OUTLINE



- 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.

DCU (R-PDSO-G8)

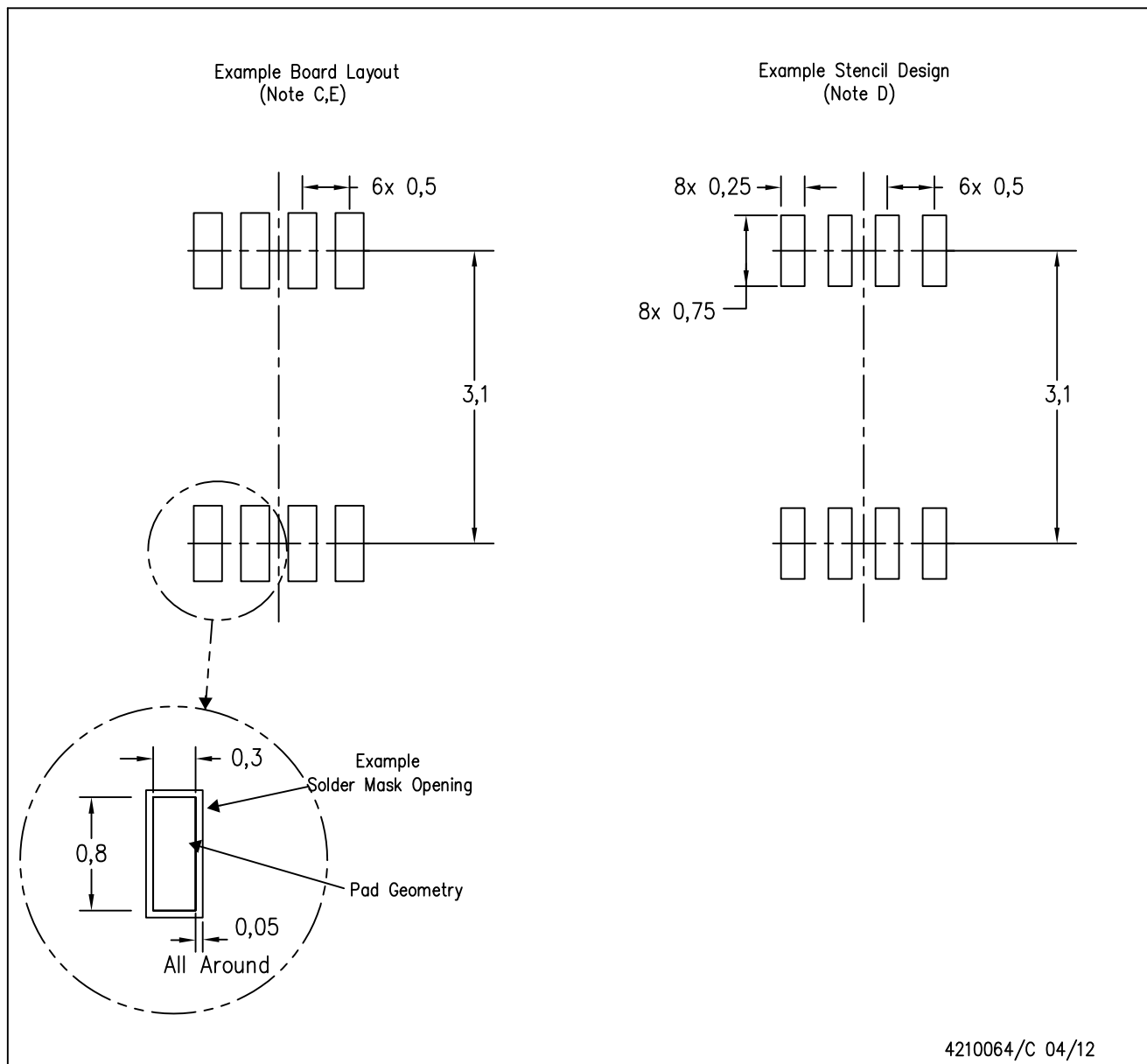
PLASTIC SMALL-OUTLINE PACKAGE (DIE DOWN)



- NOTES:
- A. All linear dimensions are in millimeters.
  - B. This drawing is subject to change without notice.
  - C. Body dimensions do not include mold flash or protrusion. Mold flash and protrusion shall not exceed 0.15 per side.
  - D. Falls within JEDEC MO-187 variation CA.

DCU (S-PDSO-G8)

PLASTIC SMALL OUTLINE PACKAGE (DIE DOWN)



- 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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