

## SINGLE 3-INPUT POSITIVE AND GATE

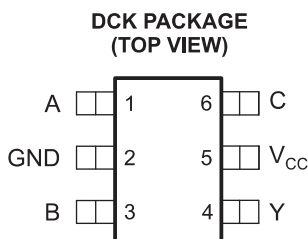
### FEATURES

- 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
- $I_{off}$  Supports Partial-Power-Down Mode Operation
- Latch-Up Performance Exceeds 100 mA Per JESD 78, Class II
- ESD Protection Exceeds JESD 22
  - 2000-V Human-Body Model (A114-A)
  - 200-V Machine Model (A115-A)
  - 1000-V Charged-Device Model (C101)

### SUPPORTS DEFENSE, AEROSPACE, AND MEDICAL APPLICATIONS

- Controlled Baseline
- One Assembly/Test Site
- One Fabrication Site
- Available in Military ( $-55^{\circ}\text{C}/125^{\circ}\text{C}$ ) Temperature Range<sup>(1)</sup>
- Extended Product Life Cycle
- Extended Product-Change Notification
- Product Traceability

(1) Additional temperature ranges are available - contact factory



See mechanical drawings for dimensions.

### DESCRIPTION/ORDERING INFORMATION

The SN74LVC1G11 performs the Boolean function  $Y = A \cdot B \cdot C$  or  $Y = \overline{\overline{A} + \overline{B} + \overline{C}}$  in positive logic.

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

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

#### ORDERING INFORMATION<sup>(1)</sup>

| $T_A$  | PACKAGE <sup>(2)</sup>            | ORDERABLE PART NUMBER | TOP-SIDE MARKING |
|--|-----------------------------------|-----------------------|------------------|
| $-55^{\circ}\text{C}$ to $125^{\circ}\text{C}$ | SOT (SC-70) – DCK<br>Reel of 3000 | SN74LVC1G11DCKREP     | OBF              |

(1) For the most current package and ordering information, see the Package Option Addendum at the end of this document, or see the TI website at [www.ti.com](http://www.ti.com).

(2) Package drawings, thermal data, and symbolization are available at [www.ti.com/packaging](http://www.ti.com/packaging).



Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

NanoFree is a trademark of Texas Instruments.

**FUNCTION TABLE**

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

**LOGIC DIAGRAM (POSITIVE LOGIC)****Absolute Maximum Ratings<sup>(1)</sup>**

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

|               |   | MIN       | MAX            | UNIT |      |
|---------------|---|-----------|----------------|------|------|
| $V_{CC}$      | Supply voltage range  | -0.5      | 6.5            | V    |      |
| $V_I$         | Input voltage range <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   |
| $\theta_{JA}$ | Package thermal impedance <sup>(4)</sup>  |           |                | 259  | °C/W |
| $T_{stg}$     | Storage temperature range   | -65       | 150            | °C   |      |

- (1) Stresses beyond those listed under "absolute maximum ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
- (2) The input negative-voltage and output voltage ratings may be exceeded if the input and output current ratings are observed.
- (3) The value of  $V_{CC}$  is provided in the recommended operating conditions table.
- (4) The package thermal impedance is calculated in accordance with JESD 51-7.

**Recommended Operating Conditions<sup>(1)</sup>**

|                 |                                    | MIN   | MAX                    | UNIT                   |      |
|-----------------|------------------------------------|---|------------------------|------------------------|------|
| V <sub>CC</sub> | Supply voltage                     | Operating                                       | 1.65                   | 5.5                    | V    |
|                 |                                    | Data retention only                             | 1.5                    |                        |      |
| V <sub>IH</sub> | High-level input voltage           | V <sub>CC</sub> = 1.65 V to 1.95 V              | 0.65 × V <sub>CC</sub> |                        | V    |
|                 |                                    | V <sub>CC</sub> = 2.3 V to 2.7 V                | 1.7                    |                        |      |
|                 |                                    | V <sub>CC</sub> = 3 V to 3.6 V                  | 2                      |                        |      |
|                 |                                    | V <sub>CC</sub> = 4.5 V to 5.5 V                | 0.7 × V <sub>CC</sub>  |                        |      |
| V <sub>IL</sub> | Low-level input voltage            | V <sub>CC</sub> = 1.65 V to 1.95 V              |                        | 0.35 × V <sub>CC</sub> | V    |
|                 |                                    | V <sub>CC</sub> = 2.3 V to 2.7 V                |                        | 0.7                    |      |
|                 |                                    | V <sub>CC</sub> = 3 V to 3.6 V                  |                        | 0.8                    |      |
|                 |                                    | V <sub>CC</sub> = 4.5 V to 5.5 V                |                        | 0.3 × V <sub>CC</sub>  |      |
| V <sub>I</sub>  | Input voltage                      | 0   | 5.5                    | V                      |      |
| V <sub>O</sub>  | Output voltage                     | 0   | V <sub>CC</sub>        | V                      |      |
| I <sub>OH</sub> | High-level output current          | V <sub>CC</sub> = 1.65 V                        |                        | −4                     | mA   |
|                 |                                    | V <sub>CC</sub> = 2.3 V                         |                        | −8                     |      |
|                 |                                    | V <sub>CC</sub> = 3 V                           |                        | −16                    |      |
|                 |                                    | V <sub>CC</sub> = 4.5 V                         |                        | −24                    |      |
| I <sub>OL</sub> | Low-level output current           | V <sub>CC</sub> = 1.65 V                        |                        | 4                      | mA   |
|                 |                                    | V <sub>CC</sub> = 2.3 V                         |                        | 8                      |      |
|                 |                                    | V <sub>CC</sub> = 3 V                           |                        | 16                     |      |
|                 |                                    | V <sub>CC</sub> = 4.5 V                         |                        | 24                     |      |
| Δt/Δv           | Input transition rise or fall rate | V <sub>CC</sub> = 1.8 V ± 0.15 V, 2.5 V ± 0.2 V |                        | 20                     | ns/V |
|                 |                                    | V <sub>CC</sub> = 3.3 V ± 0.3 V                 |                        | 10                     |      |
|                 |                                    | V <sub>CC</sub> = 5 V ± 0.5 V                   |                        | 10                     |      |
| T <sub>A</sub>  | Operating free-air temperature     | −55   | 125                    | °C                     |      |

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

## Electrical Characteristics

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

| PARAMETER        |            | TEST CONDITIONS  | V <sub>CC</sub> | MIN                   | TYP <sup>(1)</sup> | MAX  | UNIT |
|------------------|------------|--|-----------------|-----------------------|--------------------|------|------|
| V <sub>OH</sub>  |            | I <sub>OH</sub> = -100 μA  | 1.65 V to 5.5 V | V <sub>CC</sub> - 0.1 |                    |      | V    |
|                  |            | I <sub>OH</sub> = -4 mA  | 1.65 V          | 1.2                   |                    |      |      |
|                  |            | I <sub>OH</sub> = -8 mA  | 2.3 V           | 1.9                   |                    |      |      |
|                  |            | I <sub>OH</sub> = -16 mA   | 3 V             | 2.4                   |                    |      |      |
|                  |            | I <sub>OH</sub> = -24 mA   |                 | 2.3                   |                    |      |      |
|                  |            | I <sub>OH</sub> = -32 mA   | 4.5 V           | 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>   | All 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           |                       |                    | 3.5  | pF   |

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

## Switching Characteristics

over recommended operating free-air temperature range, C<sub>L</sub> = 30 pF or 50 pF (unless otherwise noted) (see Figure 2)

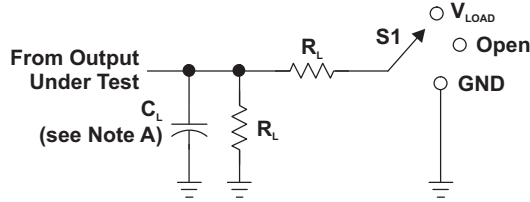
| PARAMETER       | FROM (INPUT) | TO (OUTPUT) | V <sub>CC</sub> = 1.8 V = 0.15 V |      | V <sub>CC</sub> = 2.5 V = 0.2 V |     | V <sub>CC</sub> = 3.3 V = 0.3 V |     | V <sub>CC</sub> = 5 V = 0.5 V |     | UNIT |
|-----------------|--------------|-------------|----------------------------------|------|---------------------------------|-----|---------------------------------|-----|-------------------------------|-----|------|
|                 |              |             | MIN                              | MAX  | MIN                             | MAX | MIN                             | MAX | MIN                           | MAX |      |
| t <sub>pd</sub> | A, B, or C   | Y           | 2.9                              | 17.2 | 1.4                             | 7.5 | 1.3                             | 5.9 | 1                             | 5.0 | ns   |

## Operating Characteristics

T<sub>A</sub> = 25°C

| PARAMETER       | TEST CONDITIONS               | V <sub>CC</sub> = 1.8 V | V <sub>CC</sub> = 2.5 V | V <sub>CC</sub> = 3.3 V | V <sub>CC</sub> = 5 V | UNIT |    |
|-----------------|-------------------------------|-------------------------|-------------------------|-------------------------|-----------------------|------|----|
|                 |                               | TYP                     | TYP                     | TYP                     | TYP                   |      |    |
| C <sub>pd</sub> | Power dissipation capacitance | f = 10 MHz              | 18                      | 19                      | 20                    | 23   | pF |

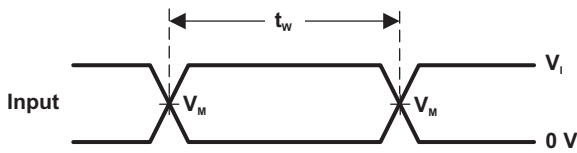
PARAMETER MEASUREMENT INFORMATION



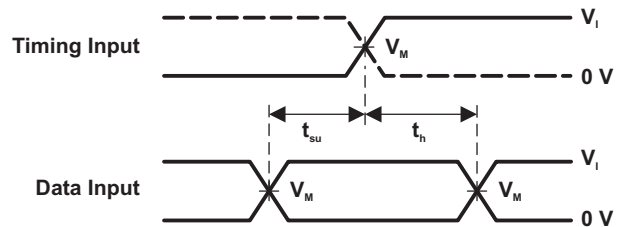
LOAD CIRCUIT

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

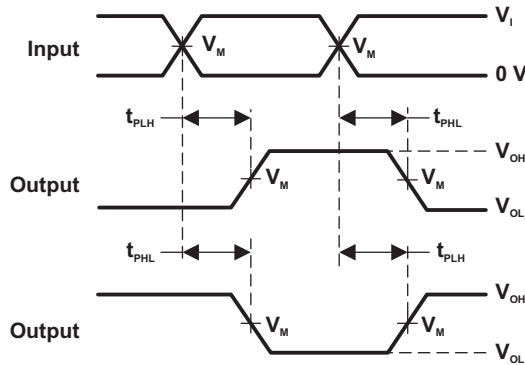
| $V_{CC}$                         | INPUTS   |                      | $V_M$      | $V_{LOAD}$        | $C_L$ | $R_L$        | $V_{\Delta}$ |
|----------------------------------|----------|----------------------|------------|-------------------|-------|--------------|--------------|
|               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



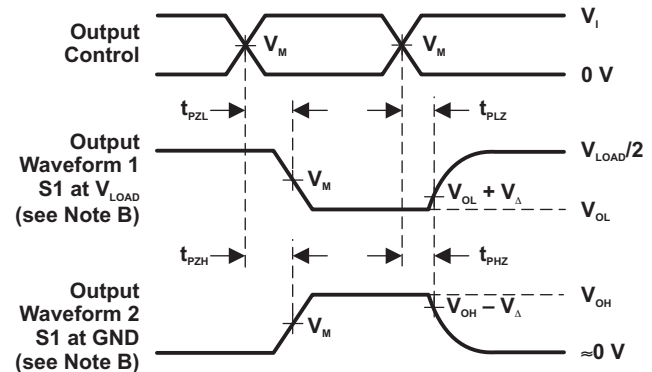
VOLTAGE WAVEFORMS PULSE DURATION



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: 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 1. Load Circuit and Voltage Waveforms

## 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                 |
|--------------------|---------------|--------------|-----------------|------|-------------|-------------------------|-------------------------|----------------------|--------------|-------------------------|-------------------------|
| SN74LVC1G11MDCKREP | ACTIVE        | SC70         | DCK             | 6    | 3000        | Green (RoHS & no Sb/Br) | NIPDAU                  | Level-1-260C-UNLIM   | -55 to 125   | OBF                     | <a href="#">Samples</a> |
| V62/09621-01XE     | ACTIVE        | SC70         | DCK             | 6    | 3000        | Green (RoHS & no Sb/Br) | NIPDAU                  | Level-1-260C-UNLIM   | -55 to 125   | OBF                     | <a href="#">Samples</a> |

(1) The marketing status values are defined as follows:

**ACTIVE:** Product device recommended for new designs.

**LIFEBUY:** TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

**NRND:** Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

**PREVIEW:** Device has been announced but is not in production. Samples may or may not be available.

**OBSOLETE:** TI has discontinued the production of the device.

(2) **RoHS:** TI defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".

**RoHS Exempt:** TI defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.

**Green:** TI defines "Green" to mean the content of Chlorine (Cl) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of <=1000ppm threshold. Antimony trioxide based flame retardants must also meet the <=1000ppm threshold requirement.

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

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

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

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

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**OTHER QUALIFIED VERSIONS OF SN74LVC1G11-EP :**

- Catalog: [SN74LVC1G11](#)
- Automotive: [SN74LVC1G11-Q1](#)

## NOTE: Qualified Version Definitions:

- Catalog - TI's standard catalog product
- Automotive - Q100 devices qualified for high-reliability automotive applications targeting zero defects

## 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 |
|--------------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| SN74LVC1G11MDCKREP | SC70         | DCK             | 6    | 3000 | 180.0              | 8.4                | 2.4     | 2.5     | 1.2     | 4.0     | 8.0    | Q3            |



**TAPE AND REEL BOX DIMENSIONS**


\*All dimensions are nominal

| Device             | Package Type | Package Drawing | Pins | SPQ  | Length (mm) | Width (mm) | Height (mm) |
|--------------------|--------------|-----------------|------|------|-------------|------------|-------------|
| SN74LVC1G11MDCKREP | SC70         | DCK             | 6    | 3000 | 202.0       | 201.0      | 28.0        |

DCK (R-PDSO-G6)

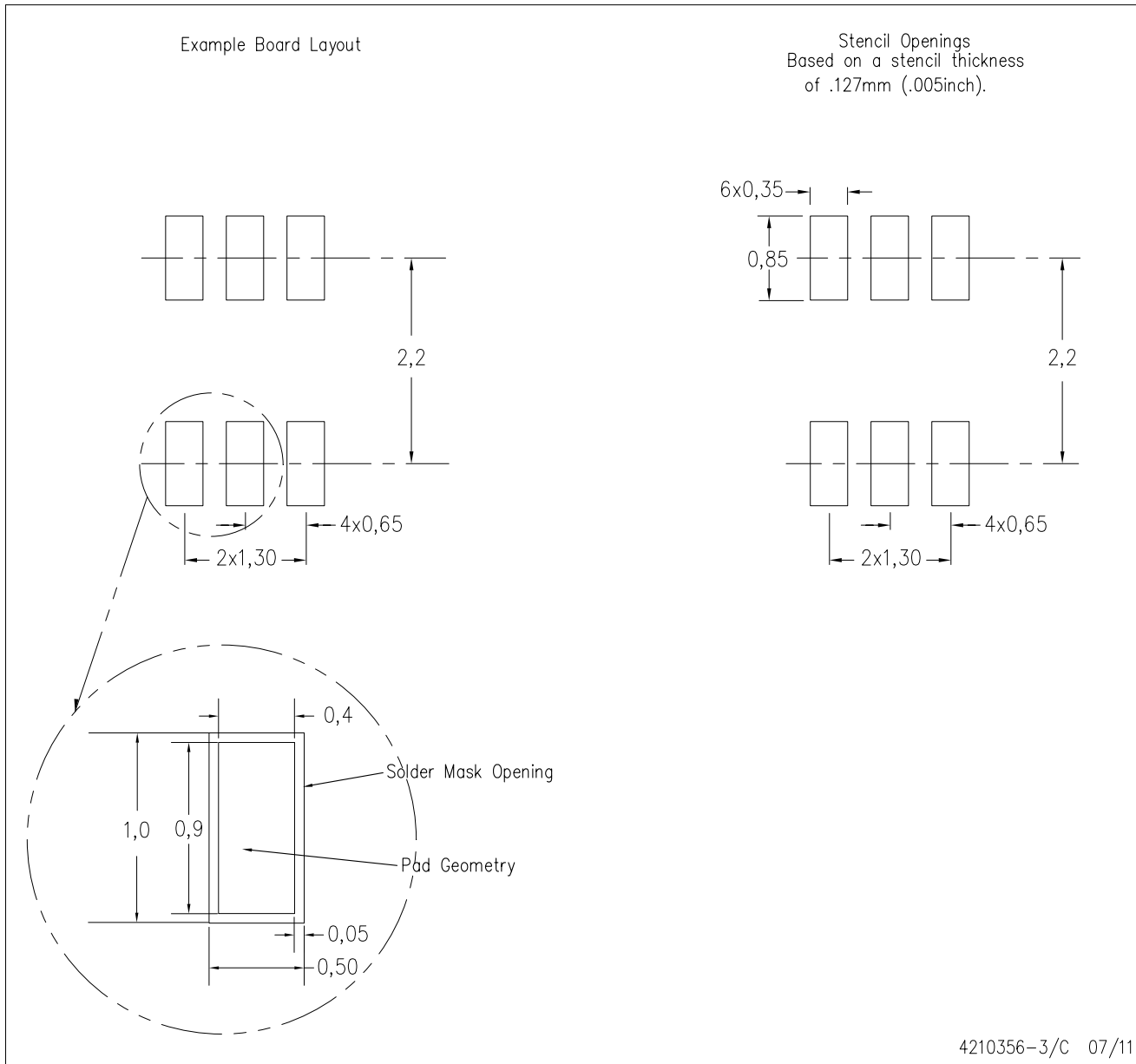
PLASTIC SMALL-OUTLINE PACKAGE



- NOTES:
- A. All linear dimensions are in millimeters.
  - B. This drawing is subject to change without notice.
  - C. Body dimensions do not include mold flash or protrusion. Mold flash and protrusion shall not exceed 0.15 per side.
  - D. Falls within JEDEC MO-203 variation AB.

DCK (R-PDSO-G6)

PLASTIC SMALL OUTLINE



- NOTES:
- All linear dimensions are in millimeters.
  - This drawing is subject to change without notice.
  - Customers should place a note on the circuit board fabrication drawing not to alter the center solder mask defined pad.
  - Publication IPC-7351 is recommended for alternate designs.
  - Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Example stencil design based on a 50% volumetric metal load solder paste. Refer to IPC-7525 for other stencil recommendations.

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