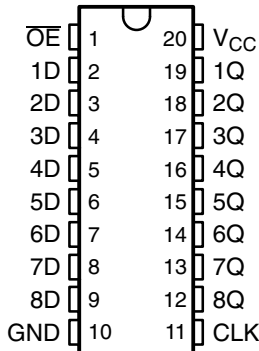


# SN54LVC574A, SN74LVC574A OCTAL EDGE-TRIGGERED D-TYPE FLIP-FLOPS WITH 3-STATE OUTPUTS

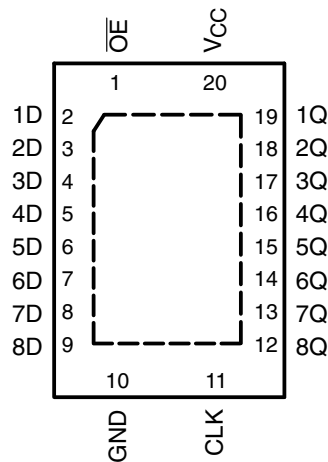
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- Operate From 1.65 V to 3.6 V
- Inputs Accept Voltages to 5.5 V
- Specified From  $-40^{\circ}\text{C}$  to  $85^{\circ}\text{C}$ ,  $-40^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ , and  $-55^{\circ}\text{C}$  to  $125^{\circ}\text{C}$
- Max  $t_{pd}$  of 7 ns 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,  $T_A = 25^{\circ}\text{C}$
- Support Mixed-Mode Signal Operation on All Ports (5-V Input/Output Voltage With 3.3-V  $V_{CC}$ )
- $I_{off}$  Supports Partial-Power-Down Mode Operation
- Latch-Up Performance Exceeds 250 mA Per JESD 17
- ESD Protection Exceeds JESD 22
  - 2000-V Human-Body Model (A114-A)
  - 200-V Machine Model (A115-A)
  - 1000-V Charged-Device Model (C101)

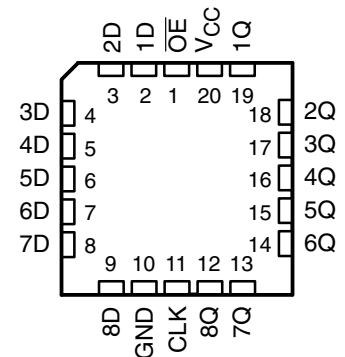
SN54LVC574A . . . J OR W PACKAGE  
SN74LVC574A . . . DB, DGV, DW, N, NS,  
OR PW PACKAGE  
(TOP VIEW)



SN74LVC574A . . . RGY PACKAGE  
(TOP VIEW)



SN54LVC574A . . . FK PACKAGE  
(TOP VIEW)



## description/ordering information

The SN54LVC574A octal edge-triggered D-type flip-flop is designed for 2.7-V to 3.6-V  $V_{CC}$  operation, and the SN74LVC574A octal edge-triggered D-type flip-flop is designed for 1.65-V to 3.6-V  $V_{CC}$  operation.

These devices feature 3-state outputs designed specifically for driving highly capacitive or relatively low-impedance loads. They are particularly suitable for implementing buffer registers, I/O ports, bidirectional bus drivers, and working registers.

On the positive transition of the clock (CLK) input, the Q outputs are set to the logic levels at the data (D) inputs.

A buffered output-enable ( $\overline{OE}$ ) input can be used to place the eight outputs in either a normal logic state (high or low logic levels) or the high-impedance state. In the high-impedance state, the outputs neither load nor drive the bus lines significantly. The high-impedance state and increased drive provide the capability to drive bus lines without interface or pullup components.

$\overline{OE}$  does not affect the internal operations of the flip-flops. Old data can be retained or new data can be entered while the outputs are in the high-impedance state.

These devices are 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.



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.

PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

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On products compliant to MIL-PRF-38535, all parameters are tested unless otherwise noted. On all other products, production processing does not necessarily include testing of all parameters.

# SN54LVC574A, SN74LVC574A

## OCTAL EDGE-TRIGGERED D-TYPE FLIP-FLOPS

### WITH 3-STATE OUTPUTS

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#### description/ordering information (continued)

To ensure the high-impedance state during power up or power down,  $\overline{OE}$  should be tied to  $V_{CC}$  through a pullup resistor; the minimum value of the resistor is determined by the current-sinking capability of the driver.

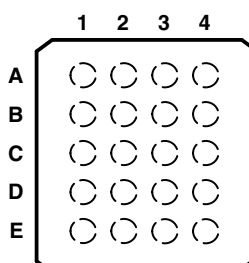
Inputs can be driven from either 3.3-V or 5-V devices. This feature allows the use of these devices as translators in a mixed 3.3-V/5-V system environment.

#### ORDERING INFORMATION

| $T_A$          | PACKAGE†              |              | ORDERABLE PART NUMBER | TOP-SIDE MARKING |
|----------------|-----------------------|--------------|-----------------------|------------------|
| –40°C to 85°C  | QFN – RGY             | Reel of 1000 | SN74LVC574ARGYR       | LC574A           |
|                | VFBGA – GQN           | Reel of 1000 | SN74LVC574AGQNR       | LC574A           |
|                | VFBGA – ZQN (Pb-free) |              | SN74LVC574AZQNR       |                  |
| –40°C to 125°C | PDIP – N              | Tube of 20   | SN74LVC574AN          | SN74LVC574AN     |
|                | SOIC – DW             | Tube of 25   | SN74LVC574ADW         | LVC574A          |
|                |                       | Reel of 2000 | SN74LVC574ADWR        |                  |
|                | SOP – NS              | Reel of 2000 | SN74LVC574ANSR        | LVC574A          |
|                | SSOP – DB             | Reel of 2000 | SN74LVC574ADBR        | LC574A           |
|                | TSSOP – PW            | Tube of 70   | SN74LVC574APW         | LC574A           |
|                |                       | Reel of 2000 | SN74LVC574APWR        |                  |
|                |                       | Reel of 250  | SN74LVC574APWT        |                  |
| –55°C to 125°C | TVSOP – DGV           | Reel of 2000 | SN74LVC574ADGVR       | LC574A           |
|                | CDIP – J              | Tube of 20   | SNJ54LVC574AJ         | SNJ54LVC574AJ    |
|                | CFP – W               | Tube of 85   | SNJ54LVC574AW         | SNJ54LVC574AW    |
|                | LCCC – FK             | Tube of 55   | SNJ54LVC574AFK        | SNJ54LVC574AFK   |

† Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at [www.ti.com/sc/package](http://www.ti.com/sc/package).

#### GQN OR ZQN PACKAGE (TOP VIEW)



#### terminal assignments

|   | 1   | 2               | 3        | 4  |
|---|-----|-----------------|----------|----|
| A | 1D  | $\overline{OE}$ | $V_{CC}$ | 1Q |
| B | 3D  | 3Q              | 2D       | 2Q |
| C | 5D  | 4D              | 5Q       | 4Q |
| D | 7D  | 7Q              | 6D       | 6Q |
| E | GND | 8D              | CLK      | 8Q |

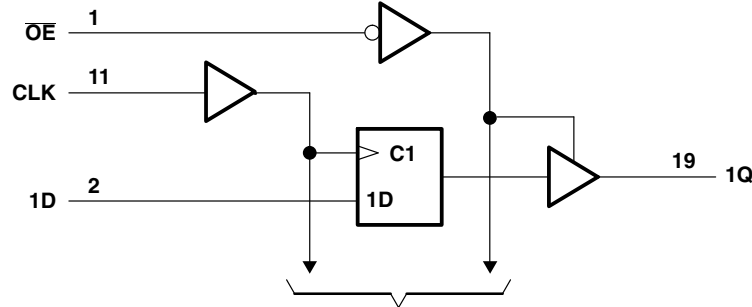
#### FUNCTION TABLE (each flip-flop)

| INPUTS          |     |   | OUTPUT<br>Q |
|-----------------|-----|---|-------------|
| $\overline{OE}$ | CLK | D |             |
| L               | ↑   | H | H           |
| L               | ↑   | L | L           |
| L               | L   | X | $Q_0$       |
| H               | X   | X | Z           |

# SN54LVC574A, SN74LVC574A OCTAL EDGE-TRIGGERED D-TYPE FLIP-FLOPS WITH 3-STATE OUTPUTS

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## logic diagram (positive logic)



To Seven Other Channels

Pin numbers shown are for the DB, DGV, DW, FK, J, N, NS, PW, RGY, and W packages.

## absolute maximum ratings over operating free-air temperature range (unless otherwise noted)<sup>†</sup>

|                                                                                                       |                            |
|-------------------------------------------------------------------------------------------------------|----------------------------|
| Supply voltage range, $V_{CC}$                                                                        | –0.5 V to 6.5 V            |
| Input voltage range, $V_I$ (see Note 1)                                                               | –0.5 V to 6.5 V            |
| Voltage range applied to any output in the high-impedance or power-off state, $V_O$<br>(see Note 1)   | –0.5 V to 6.5 V            |
| Voltage range applied to any output in the high or low state, $V_O$<br>(see Notes 1 and 2)            | –0.5 V to $V_{CC} + 0.5$ V |
| Input clamp current, $I_{IK}$ ( $V_I < 0$ )                                                           | –50 mA                     |
| Output clamp current, $I_{OK}$ ( $V_O < 0$ )                                                          | –50 mA                     |
| Continuous output current, $I_O$                                                                      | ±50 mA                     |
| Continuous current through $V_{CC}$ or GND                                                            | ±100 mA                    |
| Package thermal impedance, $\theta_{JA}$ (see Note 3): DB package                                     | 70°C/W                     |
| (see Note 3): DGV package                                                                             | 92°C/W                     |
| (see Note 3): DW package                                                                              | 58°C/W                     |
| (see Note 3): GQN/ZQN package                                                                         | 78°C/W                     |
| (see Note 3): N package                                                                               | 69°C/W                     |
| (see Note 3): NS package                                                                              | 60°C/W                     |
| (see Note 3): PW package                                                                              | 83°C/W                     |
| (see Note 4): RGY package                                                                             | 37°C/W                     |
| Storage temperature range, $T_{stg}$                                                                  | –65°C to 150°C             |
| Power dissipation, $P_{tot}$ ( $T_A = -40^\circ\text{C}$ to $125^\circ\text{C}$ ) (see Notes 5 and 6) | 500 mW                     |

<sup>†</sup> 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.

- NOTES:
1. The input negative-voltage and output voltage ratings may be exceeded if the input and output current ratings are observed.
  2. The value of  $V_{CC}$  is provided in the recommended operating conditions table.
  3. The package thermal impedance is calculated in accordance with JESD 51-7.
  4. The package thermal impedance is calculated in accordance with JESD 51-5.
  5. For the DW package: above 70°C the value of  $P_{tot}$  derates linearly with 8 mW/K.
  6. For the DB, DGV, N, NS, and PW packages: above 60°C the value of  $P_{tot}$  derates linearly with 5.5 mW/K.

# SN54LVC574A, SN74LVC574A

## OCTAL EDGE-TRIGGERED D-TYPE FLIP-FLOPS

### WITH 3-STATE OUTPUTS

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#### recommended operating conditions (see Note 7)

|                 |                                    |                                  | SN54LVC574A  |                 | UNIT |
|-----------------|------------------------------------|----------------------------------|--------------|-----------------|------|
|                 |                                    |                                  | –55 TO 125°C |                 |      |
|                 |                                    |                                  | MIN          | MAX             |      |
| V <sub>CC</sub> | Supply voltage                     | Operating                        | 2            | 3.6             | V    |
|                 |                                    | Data retention only              | 1.5          |                 |      |
| V <sub>IH</sub> | High-level input voltage           | V <sub>CC</sub> = 2.7 V to 3.6 V | 2            |                 | V    |
| V <sub>IL</sub> | Low-level input voltage            | V <sub>CC</sub> = 2.7 V to 3.6 V |              | 0.8             | V    |
| V <sub>I</sub>  | Input voltage                      |                                  | 0            | 5.5             | V    |
| V <sub>O</sub>  | Output voltage                     | High or low state                | 0            | V <sub>CC</sub> | V    |
|                 |                                    | 3–state                          | 0            | 5.5             |      |
| I <sub>OH</sub> | High-level output current          | V <sub>CC</sub> = 2.7 V          |              | –12             | mA   |
|                 |                                    | V <sub>CC</sub> = 3 V            |              | –24             |      |
| I <sub>OL</sub> | Low-level output current           | V <sub>CC</sub> = 2.7 V          |              | 12              | mA   |
|                 |                                    | V <sub>CC</sub> = 3 V            |              | 24              |      |
| Δt/Δv           | Input transition rise or fall rate |                                  |              | 6               | ns/V |

NOTE 7: All unused inputs of the device must be held at  $V_{CC}$  or GND to ensure proper device operation. Refer to the TI application report, *Implications of Slow or Floating CMOS Inputs*, literature number SCBA004.

#### recommended operating conditions (see Note 7)

|                 |                                    |                                    | SN74LVC574A            |                 |                        |                 |                        |                 | UNIT |
|-----------------|------------------------------------|------------------------------------|------------------------|-----------------|------------------------|-----------------|------------------------|-----------------|------|
|                 |                                    |                                    | T <sub>A</sub> = 25°C  |                 | –40 TO 85°C            |                 | –40 TO 125°C           |                 |      |
|                 |                                    |                                    | MIN                    | MAX             | MIN                    | MAX             | MIN                    | MAX             |      |
| V <sub>CC</sub> | Supply voltage                     | Operating                          | 1.65                   | 3.6             | 1.65                   | 3.6             | 1.65                   | 3.6             | V    |
|                 |                                    | Data retention only                | 1.5                    |                 | 1.5                    |                 | 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> |                 | 0.65 × V <sub>CC</sub> |                 | 0.65 × V <sub>CC</sub> |                 | V    |
|                 |                                    | V <sub>CC</sub> = 2.3 V to 2.7 V   | 1.7                    |                 | 1.7                    |                 | 1.7                    |                 |      |
|                 |                                    | V <sub>CC</sub> = 2.7 V to 3.6 V   | 2                      |                 | 2                      |                 | 2                      |                 |      |
| 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> |                 | 0.35 × V <sub>CC</sub> |                 | 0.35 × V <sub>CC</sub> |                 | V    |
|                 |                                    | V <sub>CC</sub> = 2.3 V to 2.7 V   | 0.7                    |                 | 0.7                    |                 | 0.7                    |                 |      |
|                 |                                    | V <sub>CC</sub> = 2.7 V to 3.6 V   | 0.8                    |                 | 0.8                    |                 | 0.8                    |                 |      |
| V <sub>I</sub>  | Input voltage                      |                                    | 0                      | 5.5             | 0                      | 5.5             | 0                      | 5.5             | V    |
| V <sub>O</sub>  | Output voltage                     | High or low state                  | 0                      | V <sub>CC</sub> | 0                      | V <sub>CC</sub> | 0                      | V <sub>CC</sub> | V    |
|                 |                                    | 3–state                            | 0                      | 5.5             | 0                      | 5.5             | 0                      | 5.5             |      |
| I <sub>OH</sub> | High-level output current          | V <sub>CC</sub> = 1.65 V           | –4                     |                 | –4                     |                 | –4                     |                 | mA   |
|                 |                                    | V <sub>CC</sub> = 2.3 V            | –8                     |                 | –8                     |                 | –8                     |                 |      |
|                 |                                    | V <sub>CC</sub> = 2.7 V            | –12                    |                 | –12                    |                 | –12                    |                 |      |
|                 |                                    | V <sub>CC</sub> = 3 V              | –24                    |                 | –24                    |                 | –24                    |                 |      |
| I <sub>OL</sub> | Low-level output current           | V <sub>CC</sub> = 1.65 V           | 4                      |                 | 4                      |                 | 4                      |                 | mA   |
|                 |                                    | V <sub>CC</sub> = 2.3 V            | 8                      |                 | 8                      |                 | 8                      |                 |      |
|                 |                                    | V <sub>CC</sub> = 2.7 V            | 12                     |                 | 12                     |                 | 12                     |                 |      |
|                 |                                    | V <sub>CC</sub> = 3 V              | 24                     |                 | 24                     |                 | 24                     |                 |      |
| Δt/Δv           | Input transition rise or fall rate |                                    | 6                      |                 | 6                      |                 | 6                      |                 | ns/V |

NOTE 7: All unused inputs of the device must be held at  $V_{CC}$  or GND to ensure proper device operation. Refer to the TI application report, *Implications of Slow or Floating CMOS Inputs*, literature number SCBA004.



# SN54LVC574A, SN74LVC574A OCTAL EDGE-TRIGGERED D-TYPE FLIP-FLOPS WITH 3-STATE OUTPUTS

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

| PARAMETER       | TEST CONDITIONS                                                         | $V_{CC}$       | SN54LVC574A                 | UNIT    |
|-----------------|-------------------------------------------------------------------------|----------------|-----------------------------|---------|
|                 |                                                                         |                | –55 TO 125°C                |         |
|                 |                                                                         |                | MIN    TYP <sup>†</sup> MAX |         |
| $V_{OH}$        | $I_{OH} = -100 \mu A$                                                   | 2.7 V to 3.6 V | $V_{CC} - 0.2$              | V       |
|                 | $I_{OH} = -12 \text{ mA}$                                               | 2.7 V          | 2.2                         |         |
|                 |                                                                         | 3 V            | 2.4                         |         |
|                 | $I_{OH} = -24 \text{ mA}$                                               | 3 V            | 2.2                         |         |
| $V_{OL}$        | $I_{OL} = 100 \mu A$                                                    | 2.7 V to 3.6 V | 0.2                         | V       |
|                 | $I_{OL} = 12 \text{ mA}$                                                | 2.7 V          | 0.4                         |         |
|                 | $I_{OL} = 24 \text{ mA}$                                                | 3 V            | 0.55                        |         |
| $I_I$           | $V_I = 5.5 \text{ V or GND}$                                            | 3.6 V          | $\pm 5$                     | $\mu A$ |
| $I_{OZ}$        | $V_O = 0 \text{ to } 5.5 \text{ V}$                                     | 3.6 V          | $\pm 15$                    | $\mu A$ |
| $I_{CC}$        | $V_I = V_{CC} \text{ or GND}$                                           | 3.6 V          | 10                          | $\mu A$ |
|                 | $3.6 \text{ V} \leq V_I \leq 5.5 \text{ V}^\ddagger$                    |                | 10                          |         |
| $\Delta I_{CC}$ | One input at $V_{CC} - 0.6 \text{ V}$ , Other inputs at $V_{CC}$ or GND | 2.7 V to 3.6 V | 500                         | $\mu A$ |
| $C_i$           | $V_I = V_{CC} \text{ or GND}$                                           | 3.3 V          | 4                           | pF      |
| $C_o$           | $V_O = V_{CC} \text{ or GND}$                                           | 3.3 V          | 5.5                         | pF      |

<sup>†</sup>  $T_A = 25^\circ C$

<sup>‡</sup> This applies in the disabled state only.

# SN54LVC574A, SN74LVC574A

## OCTAL EDGE-TRIGGERED D-TYPE FLIP-FLOPS

### WITH 3-STATE OUTPUTS

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

| PARAMETER        | TEST CONDITIONS                                                                 | V <sub>CC</sub> | SN74LVC574A           |     |     |                       |     |                       | UNIT |     |
|------------------|---------------------------------------------------------------------------------|-----------------|-----------------------|-----|-----|-----------------------|-----|-----------------------|------|-----|
|                  |                                                                                 |                 | T <sub>A</sub> = 25°C |     |     | –40 TO 85°C           |     | –40 TO 125°C          |      |     |
|                  |                                                                                 |                 | MIN                   | TYP | MAX | MIN                   | MAX | MIN                   |      | MAX |
| V <sub>OH</sub>  | I <sub>OH</sub> = –100 μA                                                       | 1.65 V to 3.6 V | V <sub>CC</sub> – 0.2 |     |     | V <sub>CC</sub> – 0.2 |     | V <sub>CC</sub> – 0.2 |      | V   |
|                  | I <sub>OH</sub> = –4 mA                                                         | 1.65 V          | 1.29                  |     |     | 1.2                   |     | 1.2                   |      |     |
|                  | I <sub>OH</sub> = –8 mA                                                         | 2.3 V           | 1.9                   |     |     | 1.7                   |     | 1.7                   |      |     |
|                  | I <sub>OH</sub> = –12 mA                                                        | 2.7 V           | 2.2                   |     |     | 2.2                   |     | 2.2                   |      |     |
|                  |                                                                                 | 3 V             | 2.4                   |     |     | 2.4                   |     | 2.4                   |      |     |
|                  | I <sub>OH</sub> = –24 mA                                                        | 3 V             | 2.3                   |     |     | 2.2                   |     | 2.2                   |      |     |
| V <sub>OL</sub>  | I <sub>OL</sub> = 100 μA                                                        | 1.65 V to 3.6 V | 0.1                   |     |     | 0.2                   |     | 0.2                   |      | V   |
|                  | I <sub>OL</sub> = 4 mA                                                          | 1.65 V          | 0.24                  |     |     | 0.45                  |     | 0.45                  |      |     |
|                  | I <sub>OL</sub> = 8 mA                                                          | 2.3 V           | 0.3                   |     |     | 0.7                   |     | 0.7                   |      |     |
|                  | I <sub>OL</sub> = 12 mA                                                         | 2.7 V           | 0.4                   |     |     | 0.4                   |     | 0.4                   |      |     |
|                  | I <sub>OL</sub> = 24 mA                                                         | 3 V             | 0.55                  |     |     | 0.55                  |     | 0.55                  |      |     |
| I <sub>I</sub>   | V <sub>I</sub> = 5.5 V or GND                                                   | 3.6 V           | ±1                    |     |     | ±5                    |     | ±5                    |      | μA  |
| I <sub>off</sub> | V <sub>I</sub> or V <sub>O</sub> = 5.5 V                                        | 0               | ±4                    |     |     | ±10                   |     | ±10                   |      | μA  |
| I <sub>OZ</sub>  | V <sub>I</sub> = 0 to 5.5 V                                                     | 3.6 V           | ±1                    |     |     | ±10                   |     | ±10                   |      | μA  |
| I <sub>CC</sub>  | V <sub>I</sub> = V <sub>CC</sub> or GND                                         | 3.6 V           | 1.5                   |     |     | 10                    |     | 10                    |      | μA  |
|                  | 3.6 V ≤ V <sub>I</sub> ≤ 5.5 V†                                                 |                 | 1.5                   |     |     | 10                    |     | 10                    |      |     |
| ΔI <sub>CC</sub> | One input at V <sub>CC</sub> – 0.6 V,<br>Other inputs at V <sub>CC</sub> or GND | 2.7 V to 3.6 V  | 500                   |     |     | 500                   |     | 500                   |      | μA  |
| C <sub>i</sub>   | V <sub>I</sub> = V <sub>CC</sub> or GND                                         | 3.3 V           | 4                     |     |     |                       |     |                       |      | pF  |
| C <sub>o</sub>   | V <sub>O</sub> = V <sub>CC</sub> or GND                                         | 3.3 V           | 5.5                   |     |     |                       |     |                       |      | pF  |

† This applies in the disabled state only.

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

|                    |                                 | V <sub>CC</sub> | SN54LVC574A  |     | UNIT |
|--------------------|---------------------------------|-----------------|--------------|-----|------|
|                    |                                 |                 | –55 TO 125°C |     |      |
|                    |                                 |                 | MIN          | MAX |      |
| f <sub>clock</sub> | Clock frequency                 | 2.7 V           | 150          |     | MHz  |
|                    |                                 | 3.3 V ± 0.3 V   | 150          |     |      |
| t <sub>w</sub>     | Pulse duration, CLK high or low | 2.7 V           | 3.3          |     | ns   |
|                    |                                 | 3.3 V ± 0.3 V   | 3.3          |     |      |
| t <sub>su</sub>    | Setup time, data before CLK↑    | 2.7 V           | 2            |     | ns   |
|                    |                                 | 3.3 V ± 0.3 V   | 2            |     |      |
| t <sub>h</sub>     | Hold time, data after CLK↑      | 2.7 V           | 2            |     | ns   |
|                    |                                 | 3.3 V ± 0.3 V   | 2            |     |      |

# SN54LVC574A, SN74LVC574A OCTAL EDGE-TRIGGERED D-TYPE FLIP-FLOPS WITH 3-STATE OUTPUTS

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

| PARAMETER        | FROM<br>(INPUT) | TO<br>(OUTPUT) | V <sub>CC</sub> | SN54LVC574A  |     | UNIT |
|------------------|-----------------|----------------|-----------------|--------------|-----|------|
|                  |                 |                |                 | –55 TO 125°C |     |      |
|                  |                 |                |                 | MIN          | MAX |      |
| f <sub>max</sub> |                 |                | 2.7 V           | 150          |     | MHz  |
|                  |                 |                | 3.3 V ± 0.3 V   | 150          |     |      |
| t <sub>pd</sub>  | CLK             | Q              | 2.7 V           | 8            |     | ns   |
|                  |                 |                | 3.3 V ± 0.3 V   | 1            | 7   |      |
| t <sub>en</sub>  | OE              | Q              | 2.7 V           | 9            |     | ns   |
|                  |                 |                | 3.3 V ± 0.3 V   | 1            | 7.5 |      |
| t <sub>dis</sub> | OE              | Q              | 2.7 V           | 7            |     | ns   |
|                  |                 |                | 3.3 V ± 0.3 V   | 0.5          | 6.4 |      |

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

|                                                | V <sub>CC</sub> | SN74LVC574A           |     |     |             |     |              | UNIT |
|------------------------------------------------|-----------------|-----------------------|-----|-----|-------------|-----|--------------|------|
|                                                |                 | T <sub>A</sub> = 25°C |     |     | –40 TO 85°C |     | –40 TO 125°C |      |
|                                                |                 | MIN                   | TYP | MAX | MIN         | MAX | MIN          | MAX  |
| f <sub>clock</sub> Clock frequency             | 1.8 V ± 0.15 V  | 55                    |     |     | 55          |     | 40           |      |
|                                                | 2.5 V ± 0.2 V   | 95                    |     |     | 95          |     | 80           |      |
|                                                | 2.7 V           | 150                   |     |     | 150         |     | 150          |      |
|                                                | 3.3 V ± 0.3 V   | 150                   |     |     | 150         |     | 150          |      |
| t <sub>w</sub> Pulse duration, CLK high or low | 1.8 V ± 0.15 V  | 9                     |     |     | 9           |     | 9            |      |
|                                                | 2.5 V ± 0.2 V   | 4                     |     |     | 4           |     | 4            |      |
|                                                | 2.7 V           | 3.3                   |     |     | 3.3         |     | 3.3          |      |
|                                                | 3.3 V ± 0.3 V   | 3.3                   |     |     | 3.3         |     | 3.3          |      |
| t <sub>su</sub> Setup time, data before CLK↑   | 1.8 V ± 0.15 V  | 6                     |     |     | 6           |     | 6            |      |
|                                                | 2.5 V ± 0.2 V   | 4                     |     |     | 4           |     | 4            |      |
|                                                | 2.7 V           | 2                     |     |     | 2           |     | 2            |      |
|                                                | 3.3 V ± 0.3 V   | 2                     |     |     | 2           |     | 2            |      |
| t <sub>h</sub> Hold time, data after CLK↑      | 1.8 V ± 0.15 V  | 4                     |     |     | 4           |     | 4            |      |
|                                                | 2.5 V ± 0.2 V   | 2                     |     |     | 2           |     | 2            |      |
|                                                | 2.7 V           | 1.5                   |     |     | 1.5         |     | 1.5          |      |
|                                                | 3.3 V ± 0.3 V   | 1.5                   |     |     | 1.5         |     | 1.5          |      |

# SN54LVC574A, SN74LVC574A

## OCTAL EDGE-TRIGGERED D-TYPE FLIP-FLOPS

### WITH 3-STATE OUTPUTS

SCAS301R – JANUARY 1993 – REVISED MARCH 2005

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

| PARAMETER          | FROM<br>(INPUT)        | TO<br>(OUTPUT) | V <sub>CC</sub> | SN74LVC574A           |     |      |             |      |              | UNIT |     |
|--------------------|------------------------|----------------|-----------------|-----------------------|-----|------|-------------|------|--------------|------|-----|
|                    |                        |                |                 | T <sub>A</sub> = 25°C |     |      | –40 TO 85°C |      | –40 TO 125°C |      |     |
|                    |                        |                |                 | MIN                   | TYP | MAX  | MIN         | MAX  | MIN          |      | MAX |
| f <sub>max</sub>   |                        |                | 1.8 V ± 0.15 V  | 55                    |     |      | 55          |      | 40           |      | MHz |
|                    |                        |                | 2.5 V ± 0.2 V   | 95                    |     |      | 95          |      | 80           |      |     |
|                    |                        |                | 2.7 V           | 150                   |     |      | 150         |      | 150          |      |     |
|                    |                        |                | 3.3 V ± 0.3 V   | 150                   |     |      | 150         |      | 150          |      |     |
| t <sub>pd</sub>    | CLK                    | Q              | 1.8 V ± 0.15 V  | 1.0                   | 7.1 | 21.5 | 1           | 21.6 | 1.0          | 21.6 | ns  |
|                    |                        |                | 2.5 V ± 0.2 V   | 1.0                   | 4.9 | 10.0 | 1           | 10.5 | 1.0          | 10.5 |     |
|                    |                        |                | 2.7 V           | 1.0                   | 5.0 | 7.8  | 1           | 8    | 1.0          | 8.0  |     |
|                    |                        |                | 3.3 V ± 0.3 V   | 2.2                   | 4.6 | 6.8  | 2.2         | 7    | 2.2          | 7.0  |     |
| t <sub>en</sub>    | $\overline{\text{OE}}$ | Q              | 1.8 V ± 0.15 V  | 1.0                   | 6.6 | 19.0 | 1           | 19.5 | 1.0          | 19.5 | ns  |
|                    |                        |                | 2.5 V ± 0.2 V   | 1.0                   | 4.8 | 10.0 | 1           | 10.5 | 1.0          | 10.5 |     |
|                    |                        |                | 2.7 V           | 1.0                   | 5.5 | 8.3  | 1           | 8.5  | 1.0          | 8.5  |     |
|                    |                        |                | 3.3 V ± 0.3 V   | 1.5                   | 4.4 | 7.3  | 1.5         | 7.5  | 1.5          | 7.5  |     |
| t <sub>dis</sub>   | $\overline{\text{OE}}$ | Q              | 1.8 V ± 0.15 V  | 1.0                   | 5.4 | 18.3 | 1           | 18.8 | 1.0          | 18.8 | ns  |
|                    |                        |                | 2.5 V ± 0.2 V   | 1.0                   | 3.0 | 7.3  | 1           | 7.8  | 1.0          | 7.8  |     |
|                    |                        |                | 2.7 V           | 1.0                   | 4.0 | 6.8  | 1           | 7    | 1.0          | 7.3  |     |
|                    |                        |                | 3.3 V ± 0.3 V   | 1.7                   | 3.9 | 6.2  | 1.7         | 6.4  | 1.7          | 6.6  |     |
| t <sub>sk(o)</sub> |                        |                | 3.3 V ± 0.3 V   |                       |     |      | 1           |      | 1            |      | ns  |

operating characteristics, T<sub>A</sub> = 25°C

| PARAMETER       |                                             | TEST CONDITIONS | V <sub>CC</sub> | TYP | UNIT |
|-----------------|---------------------------------------------|-----------------|-----------------|-----|------|
| C <sub>pd</sub> | Power dissipation capacitance per flip–flop | Outputs enabled | 1.8 V           | 25  | pF   |
|                 |                                             |                 | 2.5 V           | 29  |      |
|                 |                                             |                 | 3.3 V           | 30  |      |
|                 | Outputs disabled                            | 1.8 V           | 9               |     |      |
|                 |                                             | 2.5 V           | 9               |     |      |
|                 |                                             | 3.3 V           | 11              |     |      |



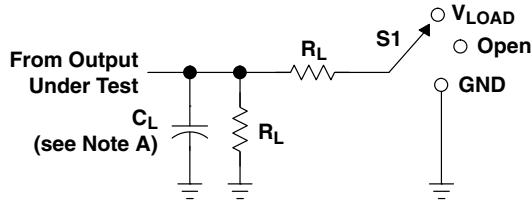
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# SN54LVC574A, SN74LVC574A OCTAL EDGE-TRIGGERED D-TYPE FLIP-FLOPS WITH 3-STATE OUTPUTS

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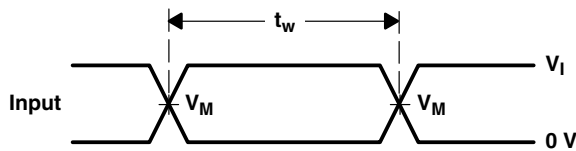
## PARAMETER MEASUREMENT INFORMATION



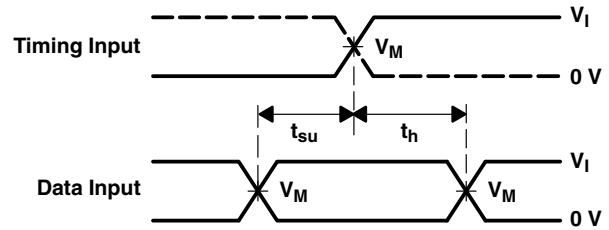
LOAD CIRCUIT

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

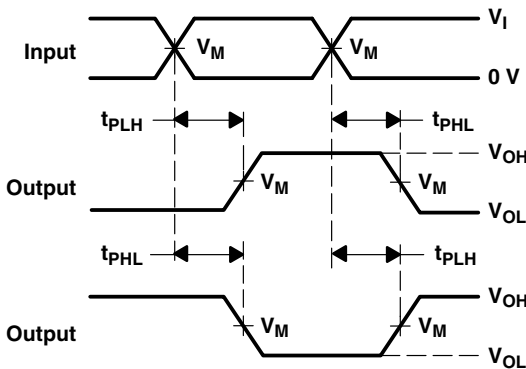
| $V_{CC}$                         | INPUTS   |                      | $V_M$      | $V_{LOAD}$        | $C_L$ | $R_L$        | $V_{\Delta}$ |
|----------------------------------|----------|----------------------|------------|-------------------|-------|--------------|--------------|
|                                  | $V_I$    | $t_r/t_f$            |            |                   |       |              |              |
| $1.8\text{ V} \pm 0.15\text{ V}$ | $V_{CC}$ | $\leq 2\text{ ns}$   | $V_{CC}/2$ | $2 \times V_{CC}$ | 30 pF | 1 k $\Omega$ | 0.15 V       |
| $2.5\text{ V} \pm 0.2\text{ V}$  | $V_{CC}$ | $\leq 2\text{ ns}$   | $V_{CC}/2$ | $2 \times V_{CC}$ | 30 pF | 500 $\Omega$ | 0.15 V       |
| 2.7 V                            | 2.7 V    | $\leq 2.5\text{ ns}$ | 1.5 V      | 6 V               | 50 pF | 500 $\Omega$ | 0.3 V        |
| $3.3\text{ V} \pm 0.3\text{ V}$  | 2.7 V    | $\leq 2.5\text{ ns}$ | 1.5 V      | 6 V               | 50 pF | 500 $\Omega$ | 0.3 V        |



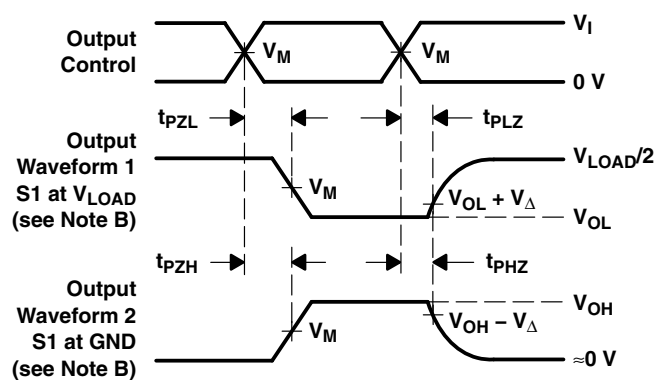
VOLTAGE WAVEFORMS  
PULSE DURATION



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.

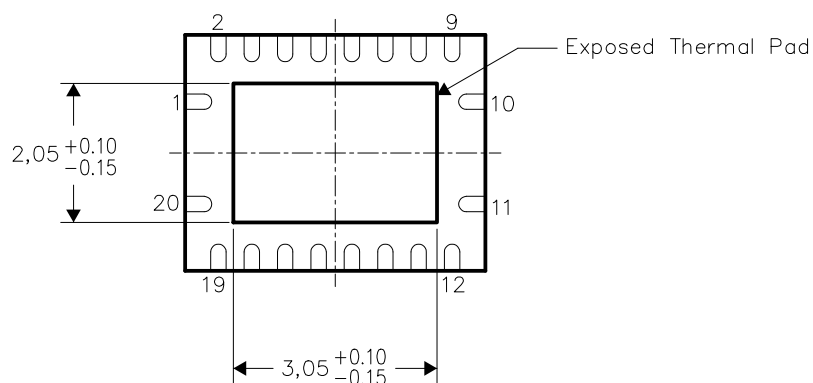
Figure 1. Load Circuit and Voltage Waveforms

## THERMAL INFORMATION

This package incorporates an exposed thermal pad that is designed to be attached directly to an external heatsink. The thermal pad must be soldered directly to the printed circuit board (PCB), the PCB can be used as a heatsink. In addition, through the use of thermal vias, the thermal pad can be attached directly to a ground plane or special heatsink structure designed into the PCB. This design optimizes the heat transfer from the integrated circuit (IC).

For information on the Quad Flatpack No-Lead (QFN) package and its advantages, refer to Application Report, Quad Flatpack No-Lead Logic Packages, Texas Instruments Literature No. SCBA017. This document is available at [www.ti.com](http://www.ti.com).

The exposed thermal pad dimensions for this package are shown in the following illustration.



Bottom View

NOTE: All linear dimensions are in millimeters

## Exposed Thermal Pad Dimensions

**PACKAGING INFORMATION**

| Orderable Device  | Status<br>(1) | Package Type | Package<br>Drawing | Pins | Package<br>Qty | Eco Plan<br>(2)     | Lead finish/<br>Ball material<br>(6) | MSL Peak Temp<br>(3) | Op Temp (°C) | Device Marking<br>(4/5)              | Samples                 |
|-------------------|---------------|--------------|--------------------|------|----------------|---------------------|--------------------------------------|----------------------|--------------|--------------------------------------|-------------------------|
| 5962-9757601QRA   | ACTIVE        | CDIP         | J                  | 20   | 1              | Non-RoHS<br>& Green | SNPB                                 | N / A for Pkg Type   | -55 to 125   | 5962-9757601QR<br>A<br>SNJ54LVC574AJ | <a href="#">Samples</a> |
| 5962-9757601QSA   | ACTIVE        | CFP          | W                  | 20   | 1              | Non-RoHS<br>& Green | SNPB                                 | N / A for Pkg Type   | -55 to 125   | 5962-9757601QS<br>A<br>SNJ54LVC574AW | <a href="#">Samples</a> |
| SN74LVC574ADBR    | ACTIVE        | SSOP         | DB                 | 20   | 2000           | RoHS & Green        | NIPDAU                               | Level-1-260C-UNLIM   | -40 to 125   | LC574A                               | <a href="#">Samples</a> |
| SN74LVC574ADGVR   | ACTIVE        | TVSOP        | DGV                | 20   | 2000           | RoHS & Green        | NIPDAU                               | Level-1-260C-UNLIM   | -40 to 125   | LC574A                               | <a href="#">Samples</a> |
| SN74LVC574ADGVRE4 | ACTIVE        | TVSOP        | DGV                | 20   | 2000           | RoHS & Green        | NIPDAU                               | Level-1-260C-UNLIM   | -40 to 125   | LC574A                               | <a href="#">Samples</a> |
| SN74LVC574ADW     | ACTIVE        | SOIC         | DW                 | 20   | 25             | RoHS & Green        | NIPDAU                               | Level-1-260C-UNLIM   | -40 to 125   | LVC574A                              | <a href="#">Samples</a> |
| SN74LVC574ADWE4   | ACTIVE        | SOIC         | DW                 | 20   | 25             | RoHS & Green        | NIPDAU                               | Level-1-260C-UNLIM   | -40 to 125   | LVC574A                              | <a href="#">Samples</a> |
| SN74LVC574ADWR    | ACTIVE        | SOIC         | DW                 | 20   | 2000           | RoHS & Green        | NIPDAU                               | Level-1-260C-UNLIM   | -40 to 125   | LVC574A                              | <a href="#">Samples</a> |
| SN74LVC574ADWRE4  | ACTIVE        | SOIC         | DW                 | 20   | 2000           | RoHS & Green        | NIPDAU                               | Level-1-260C-UNLIM   | -40 to 125   | LVC574A                              | <a href="#">Samples</a> |
| SN74LVC574AN      | ACTIVE        | PDIP         | N                  | 20   | 20             | RoHS &<br>Non-Green | NIPDAU                               | N / A for Pkg Type   | -40 to 125   | SN74LVC574AN                         | <a href="#">Samples</a> |
| SN74LVC574ANSR    | ACTIVE        | SO           | NS                 | 20   | 2000           | RoHS & Green        | NIPDAU                               | Level-1-260C-UNLIM   | -40 to 125   | LVC574A                              | <a href="#">Samples</a> |
| SN74LVC574APW     | ACTIVE        | TSSOP        | PW                 | 20   | 70             | RoHS & Green        | NIPDAU                               | Level-1-260C-UNLIM   | -55 to 125   | LC574A                               | <a href="#">Samples</a> |
| SN74LVC574APWG4   | ACTIVE        | TSSOP        | PW                 | 20   | 70             | RoHS & Green        | NIPDAU                               | Level-1-260C-UNLIM   | -40 to 125   | LC574A                               | <a href="#">Samples</a> |
| SN74LVC574APWR    | ACTIVE        | TSSOP        | PW                 | 20   | 2000           | RoHS & Green        | NIPDAU   SN                          | Level-1-260C-UNLIM   | -40 to 125   | LC574A                               | <a href="#">Samples</a> |
| SN74LVC574APWRG4  | ACTIVE        | TSSOP        | PW                 | 20   | 2000           | RoHS & Green        | NIPDAU                               | Level-1-260C-UNLIM   | -40 to 125   | LC574A                               | <a href="#">Samples</a> |
| SN74LVC574APWT    | ACTIVE        | TSSOP        | PW                 | 20   | 250            | RoHS & Green        | NIPDAU                               | Level-1-260C-UNLIM   | -40 to 125   | LC574A                               | <a href="#">Samples</a> |
| SN74LVC574ARGYR   | ACTIVE        | VQFN         | RGY                | 20   | 3000           | RoHS & Green        | NIPDAU                               | Level-2-260C-1 YEAR  | -40 to 125   | LC574A                               | <a href="#">Samples</a> |
| SNJ54LVC574AJ     | ACTIVE        | CDIP         | J                  | 20   | 1              | Non-RoHS<br>& Green | SNPB                                 | N / A for Pkg Type   | -55 to 125   | 5962-9757601QR<br>A<br>SNJ54LVC574AJ | <a href="#">Samples</a> |

| Orderable Device | Status<br>(1) | Package Type | Package<br>Drawing | Pins | Package<br>Qty | Eco Plan<br>(2)     | Lead finish/<br>Ball material<br>(6) | MSL Peak Temp<br>(3) | Op Temp (°C) | Device Marking<br>(4/5)              | Samples                 |
|------------------|---------------|--------------|--------------------|------|----------------|---------------------|--------------------------------------|----------------------|--------------|--------------------------------------|-------------------------|
| SNJ54LVC574AW    | ACTIVE        | CFP          | W                  | 20   | 1              | Non-RoHS<br>& Green | SNPB                                 | N / A for Pkg Type   | -55 to 125   | 5962-9757601QS<br>A<br>SNJ54LVC574AW | <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 finish/Ball material - Orderable Devices 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.

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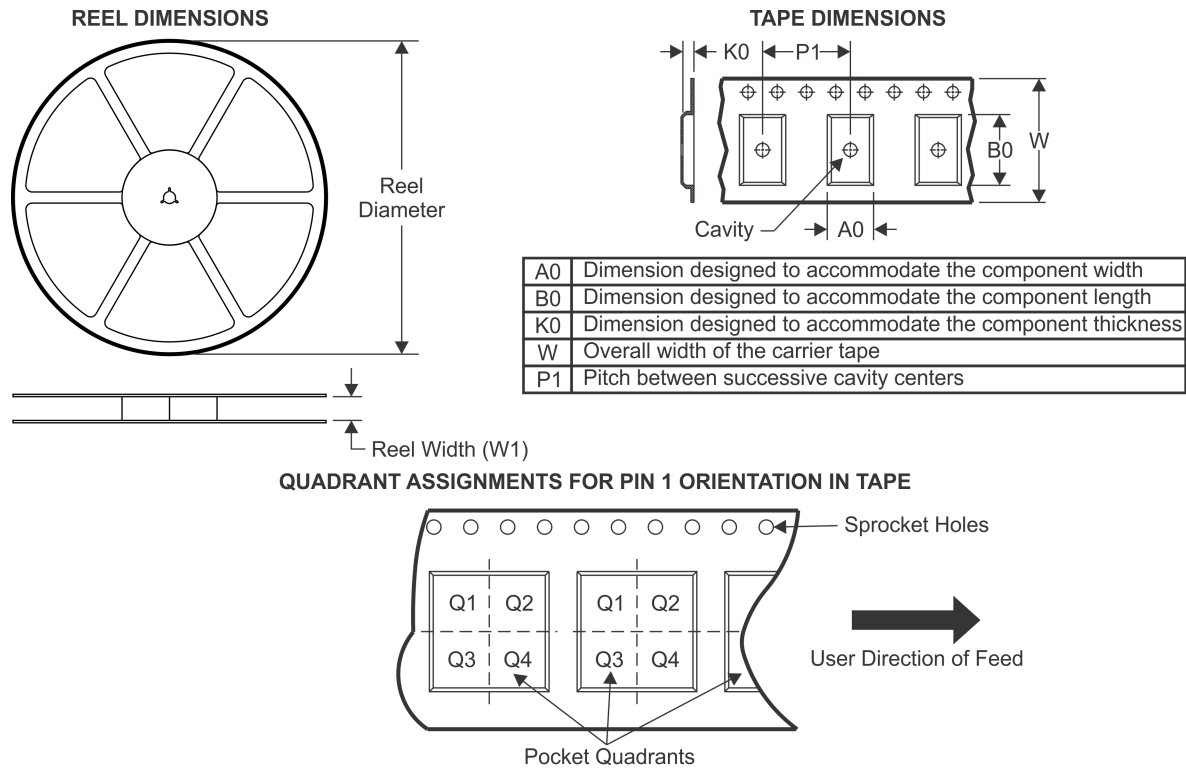
In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

**OTHER QUALIFIED VERSIONS OF SN54LVC574A, SN74LVC574A :**

- Catalog: [SN74LVC574A](#)
- Automotive: [SN74LVC574A-Q1](#), [SN74LVC574A-Q1](#)
- Enhanced Product: [SN74LVC574A-EP](#), [SN74LVC574A-EP](#)
- Military: [SN54LVC574A](#)

NOTE: Qualified Version Definitions:

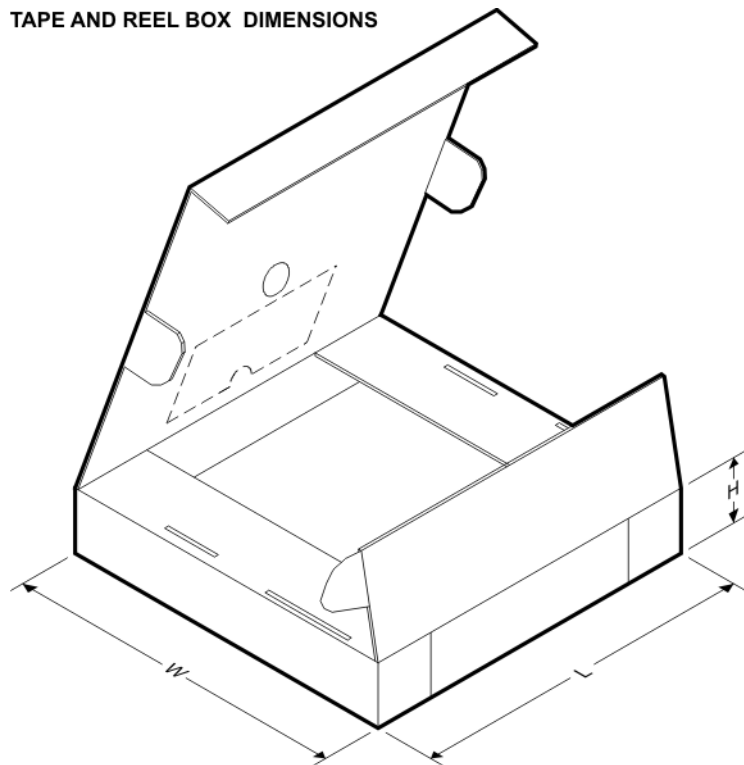
- Catalog - TI's standard catalog product
- Automotive - Q100 devices qualified for high-reliability automotive applications targeting zero defects
- Enhanced Product - Supports Defense, Aerospace and Medical Applications
- Military - QML certified for Military and Defense Applications

**TAPE AND REEL INFORMATION**


\*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 |
|------------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| SN74LVC574ADBR   | SSOP         | DB              | 20   | 2000 | 330.0              | 16.4               | 8.2     | 7.5     | 2.5     | 12.0    | 16.0   | Q1            |
| SN74LVC574ADGVR  | TVSOP        | DGV             | 20   | 2000 | 330.0              | 12.4               | 6.9     | 5.6     | 1.6     | 8.0     | 12.0   | Q1            |
| SN74LVC574ADWR   | SOIC         | DW              | 20   | 2000 | 330.0              | 24.4               | 10.8    | 13.3    | 2.7     | 12.0    | 24.0   | Q1            |
| SN74LVC574ANSR   | SO           | NS              | 20   | 2000 | 330.0              | 24.4               | 8.4     | 13.0    | 2.5     | 12.0    | 24.0   | Q1            |
| SN74LVC574APWR   | TSSOP        | PW              | 20   | 2000 | 330.0              | 16.4               | 6.95    | 7.1     | 1.6     | 8.0     | 16.0   | Q1            |
| SN74LVC574APWR   | TSSOP        | PW              | 20   | 2000 | 330.0              | 16.4               | 6.95    | 7.0     | 1.4     | 8.0     | 16.0   | Q1            |
| SN74LVC574APWRG4 | TSSOP        | PW              | 20   | 2000 | 330.0              | 16.4               | 6.95    | 7.1     | 1.6     | 8.0     | 16.0   | Q1            |
| SN74LVC574APWT   | TSSOP        | PW              | 20   | 250  | 330.0              | 16.4               | 6.95    | 7.0     | 1.4     | 8.0     | 16.0   | Q1            |
| SN74LVC574ARGYR  | VQFN         | RGY             | 20   | 3000 | 330.0              | 12.4               | 3.8     | 4.8     | 1.6     | 8.0     | 12.0   | Q1            |

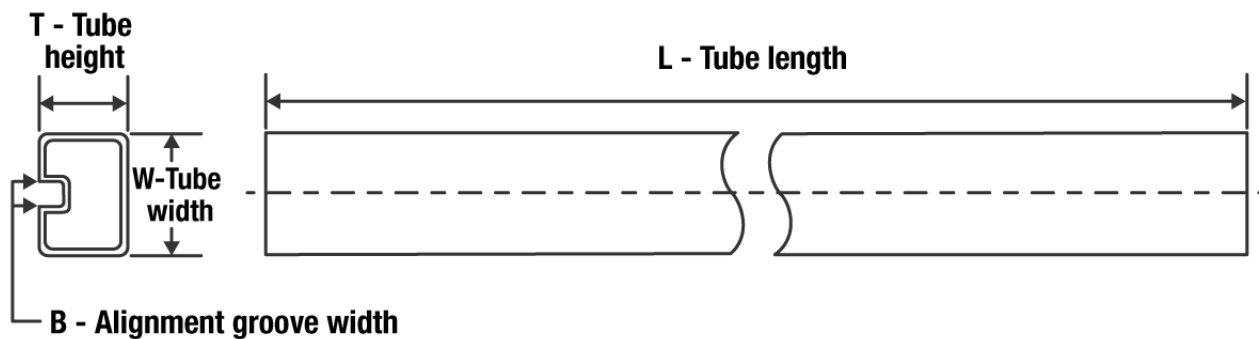
## TAPE AND REEL BOX DIMENSIONS



\*All dimensions are nominal

| Device           | Package Type | Package Drawing | Pins | SPQ  | Length (mm) | Width (mm) | Height (mm) |
|------------------|--------------|-----------------|------|------|-------------|------------|-------------|
| SN74LVC574ADBR   | SSOP         | DB              | 20   | 2000 | 853.0       | 449.0      | 35.0        |
| SN74LVC574ADGVR  | TVSOP        | DGV             | 20   | 2000 | 853.0       | 449.0      | 35.0        |
| SN74LVC574ADWR   | SOIC         | DW              | 20   | 2000 | 367.0       | 367.0      | 45.0        |
| SN74LVC574ANSR   | SO           | NS              | 20   | 2000 | 367.0       | 367.0      | 45.0        |
| SN74LVC574APWR   | TSSOP        | PW              | 20   | 2000 | 364.0       | 364.0      | 27.0        |
| SN74LVC574APWR   | TSSOP        | PW              | 20   | 2000 | 853.0       | 449.0      | 35.0        |
| SN74LVC574APWRG4 | TSSOP        | PW              | 20   | 2000 | 853.0       | 449.0      | 35.0        |
| SN74LVC574APWT   | TSSOP        | PW              | 20   | 250  | 853.0       | 449.0      | 35.0        |
| SN74LVC574ARGYR  | VQFN         | RGY             | 20   | 3000 | 853.0       | 449.0      | 35.0        |

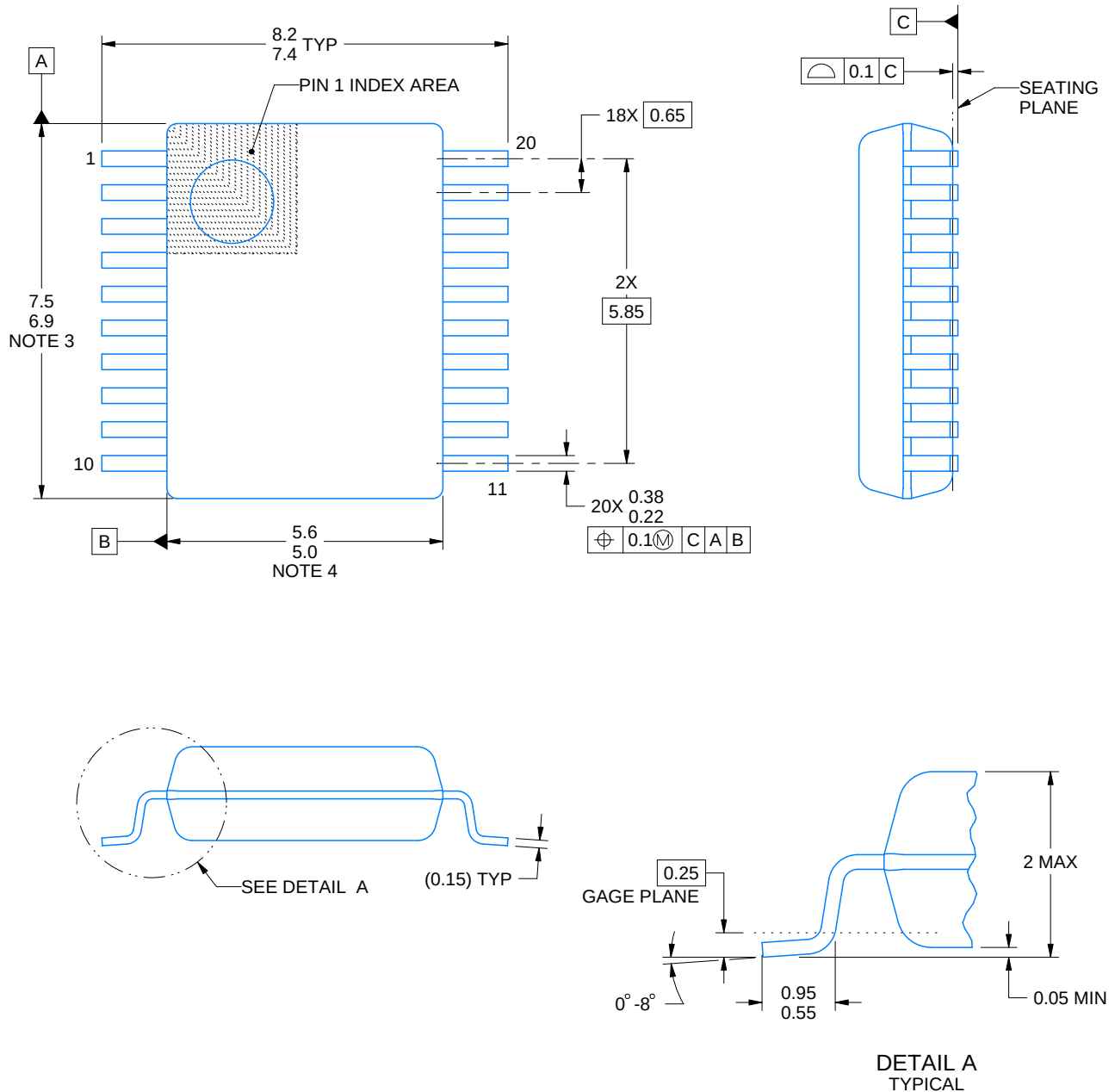
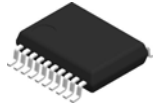
## TUBE



\*All dimensions are nominal

| Device          | Package Name | Package Type | Pins | SPQ | L (mm) | W (mm) | T (μm) | B (mm) |
|-----------------|--------------|--------------|------|-----|--------|--------|--------|--------|
| SN74LVC574ADW   | DW           | SOIC         | 20   | 25  | 507    | 12.83  | 5080   | 6.6    |
| SN74LVC574ADWE4 | DW           | SOIC         | 20   | 25  | 507    | 12.83  | 5080   | 6.6    |
| SN74LVC574AN    | N            | PDIP         | 20   | 20  | 506    | 13.97  | 11230  | 4.32   |
| SN74LVC574APW   | PW           | TSSOP        | 20   | 70  | 530    | 10.2   | 3600   | 3.5    |
| SN74LVC574APWG4 | PW           | TSSOP        | 20   | 70  | 530    | 10.2   | 3600   | 3.5    |





4214851/B 08/2019

## 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. This dimension does not include interlead flash. Interlead flash shall not exceed 0.25 mm per side.
5. Reference JEDEC registration MO-150.

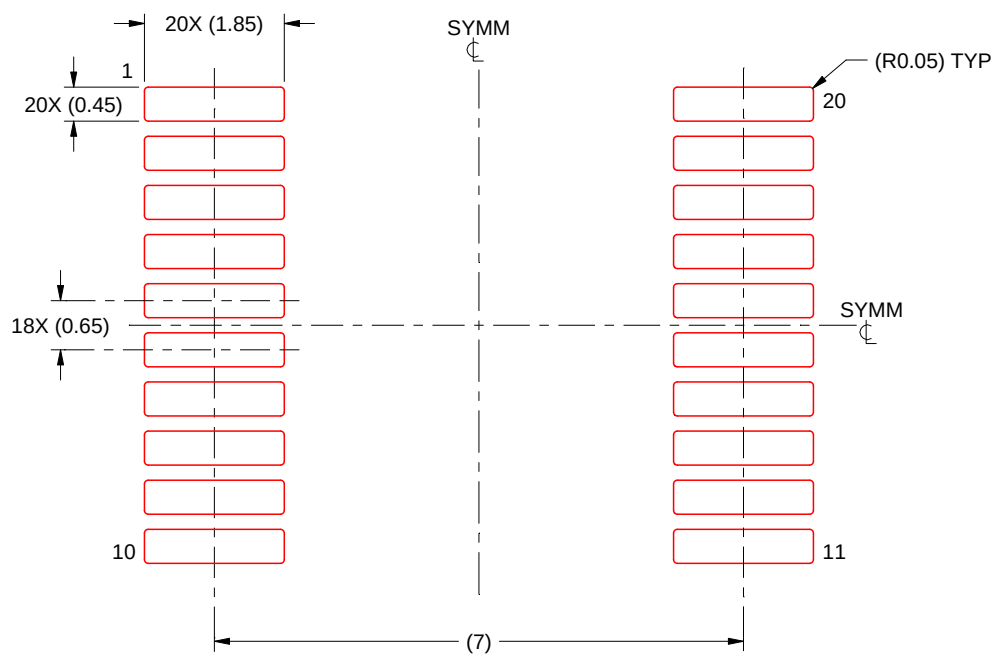


## EXAMPLE STENCIL DESIGN

DB0020A

SSOP - 2 mm max height

SMALL OUTLINE PACKAGE



SOLDER PASTE EXAMPLE  
BASED ON 0.125 mm THICK STENCIL  
SCALE: 10X

4214851/B 08/2019

NOTES: (continued)

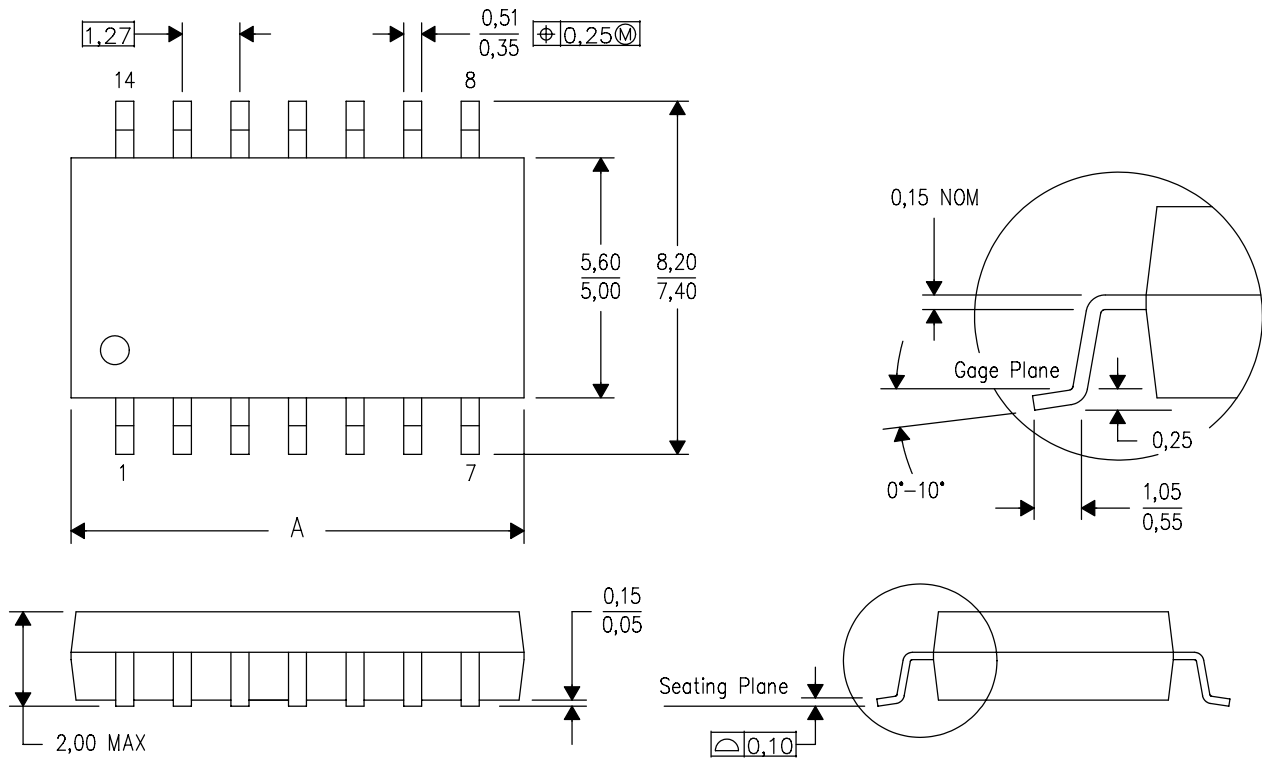
8. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
9. Board assembly site may have different recommendations for stencil design.

# MECHANICAL DATA

NS (R-PDSO-G\*\*)

PLASTIC SMALL-OUTLINE PACKAGE

14-PINS SHOWN



| DIM \ PINS ** | 14    | 16    | 20    | 24    |
|---------------|-------|-------|-------|-------|
| A MAX         | 10,50 | 10,50 | 12,90 | 15,30 |
| A MIN         | 9,90  | 9,90  | 12,30 | 14,70 |

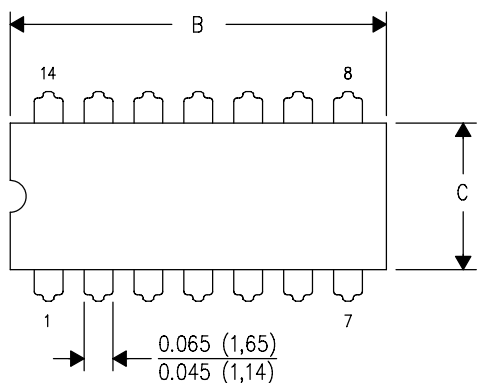
4040062/C 03/03

- 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, not to exceed 0,15.

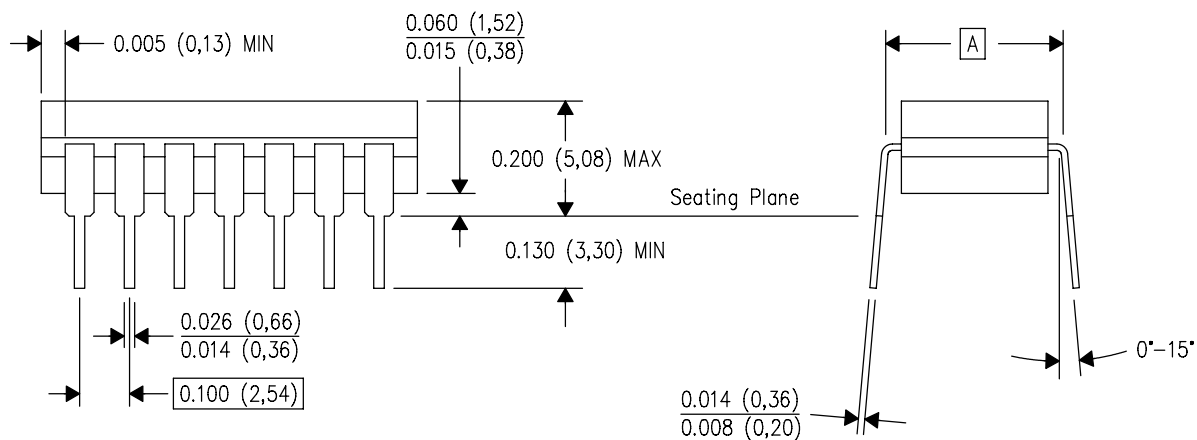
J (R-GDIP-T\*\*)

14 LEADS SHOWN

# CERAMIC DUAL IN-LINE PACKAGE



| DIM \ PINS ** | 14                     | 16                     | 18                     | 20                     |
|---------------|------------------------|------------------------|------------------------|------------------------|
| A             | 0.300<br>(7,62)<br>BSC | 0.300<br>(7,62)<br>BSC | 0.300<br>(7,62)<br>BSC | 0.300<br>(7,62)<br>BSC |
| B MAX         | 0.785<br>(19,94)       | .840<br>(21,34)        | 0.960<br>(24,38)       | 1.060<br>(26,92)       |
| B MIN         | —                      | —                      | —                      | —                      |
| C MAX         | 0.300<br>(7,62)        | 0.300<br>(7,62)        | 0.310<br>(7,87)        | 0.300<br>(7,62)        |
| C MIN         | 0.245<br>(6,22)        | 0.245<br>(6,22)        | 0.220<br>(5,59)        | 0.245<br>(6,22)        |



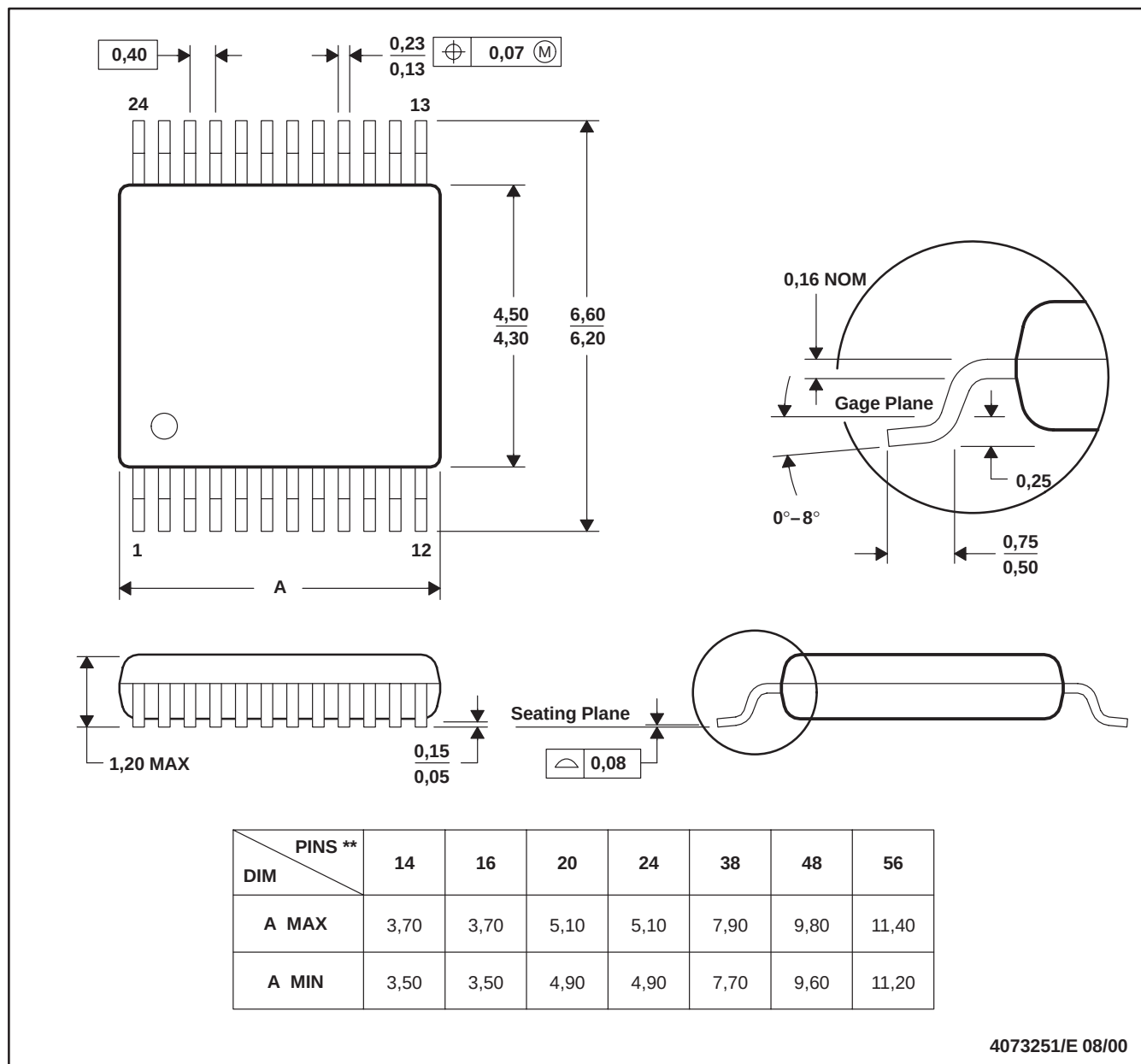
4040083/F 03/03

- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - C. This package is hermetically sealed with a ceramic lid using glass frit.
  - D. Index point is provided on cap for terminal identification only on press ceramic glass frit seal only.
  - E. Falls within MIL STD 1835 GDIP1-T14, GDIP1-T16, GDIP1-T18 and GDIP1-T20.

## DGV (R-PDSO-G\*\*)

## PLASTIC SMALL-OUTLINE

24 PINS SHOWN



- 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, not to exceed 0,15 per side.  
 D. Falls within JEDEC: 24/48 Pins – MO-153  
 14/16/20/56 Pins – MO-194

## GENERIC PACKAGE VIEW

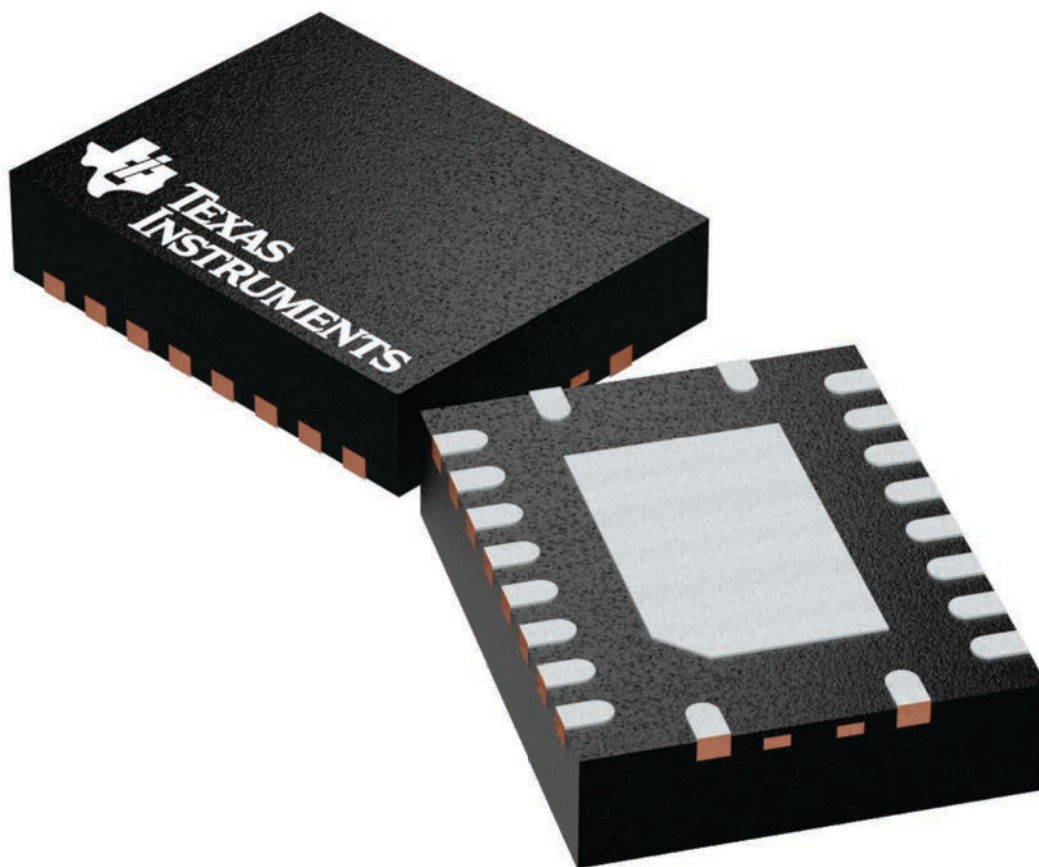
**RGY 20**

**VQFN - 1 mm max height**

3.5 x 4.5, 0.5 mm pitch

PLASTIC QUAD FGLATPACK - NO LEAD

This image is a representation of the package family, actual package may vary.  
Refer to the product data sheet for package details.





## VQFN - 1 mm max height

PLASTIC QUAD FLATPACK - NO LEAD



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. The package thermal pad must be soldered to the printed circuit board for thermal and mechanical performance.

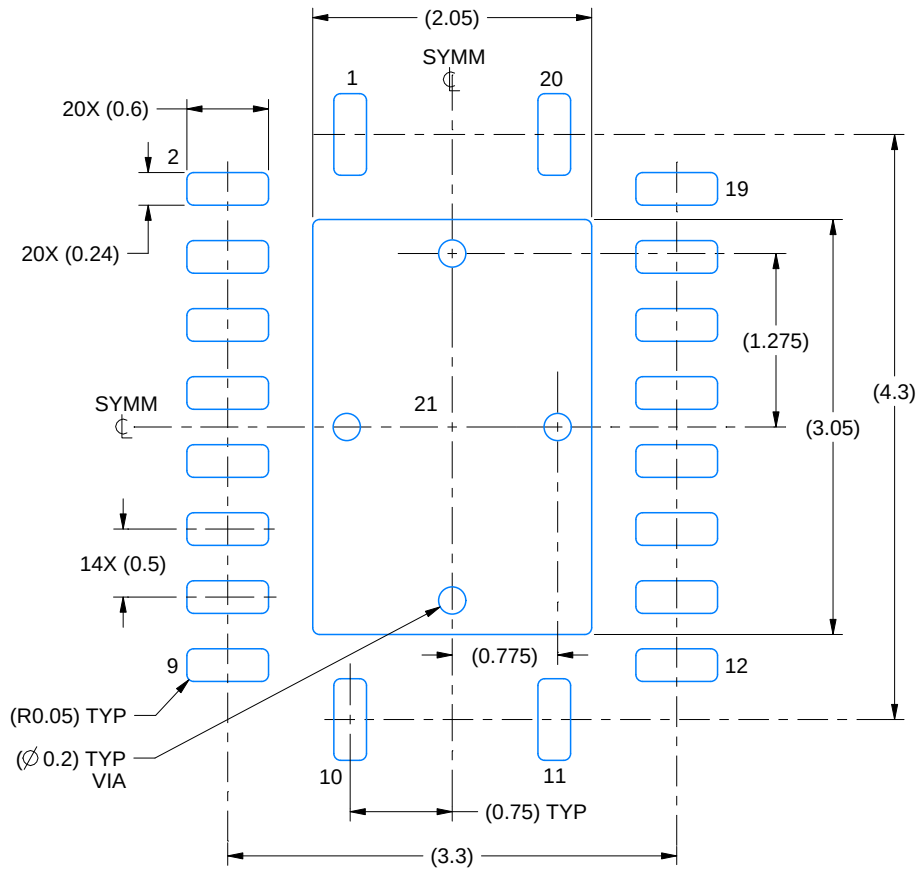


# EXAMPLE BOARD LAYOUT

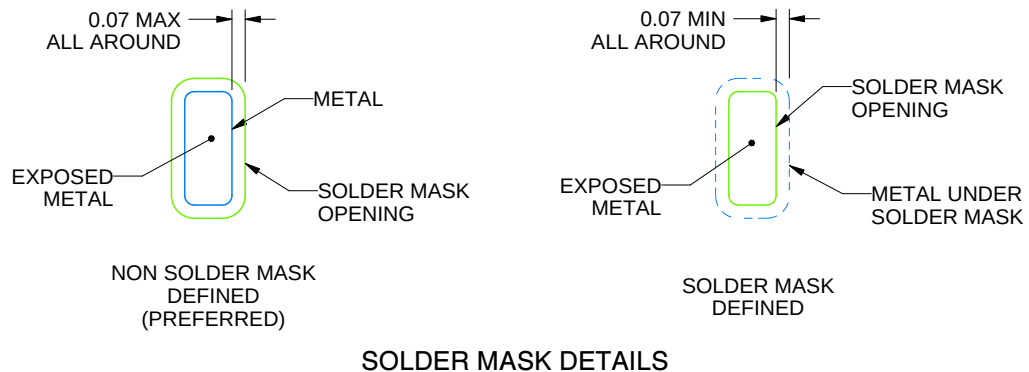
RGY0020A

VQFN - 1 mm max height

PLASTIC QUAD FLATPACK - NO LEAD



LAND PATTERN EXAMPLE  
EXPOSED METAL SHOWN  
SCALE:18X



SOLDER MASK DETAILS

4225320/A 09/2019

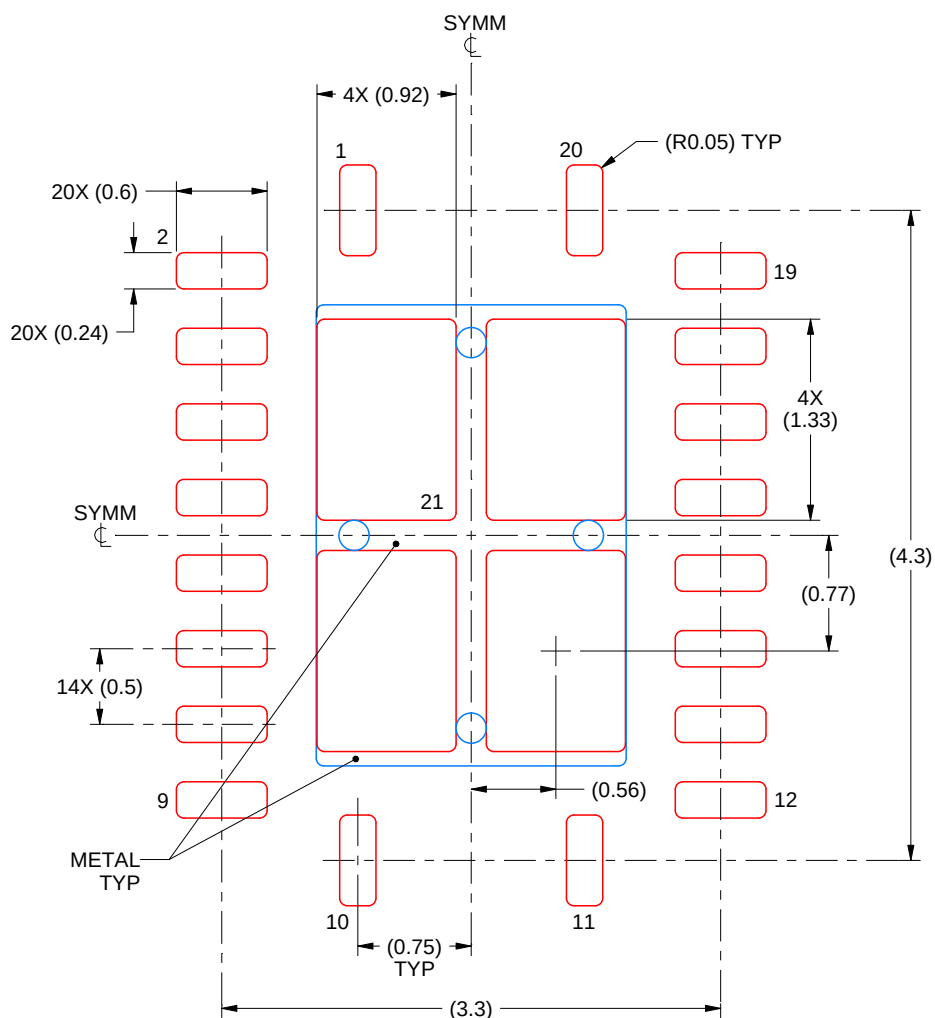
NOTES: (continued)

4. This package is designed to be soldered to a thermal pad on the board. For more information, see Texas Instruments literature number SLUA271 ([www.ti.com/lit/sluea271](http://www.ti.com/lit/sluea271)).
5. Vias are optional depending on application, refer to device data sheet. If any vias are implemented, refer to their locations shown on this view. It is recommended that vias under paste be filled, plugged or tented.

**RGY0020A**

**VQFN - 1 mm max height**

PLASTIC QUAD FLATPACK - NO LEAD



## SOLDER PASTE EXAMPLE

BASED ON 0.125 mm THICK STENCIL

EXPOSED PAD 21

78% PRINTED SOLDER COVERAGE BY AREA UNDER PACKAGE  
SCALE:20X

4225320/A 09/2019

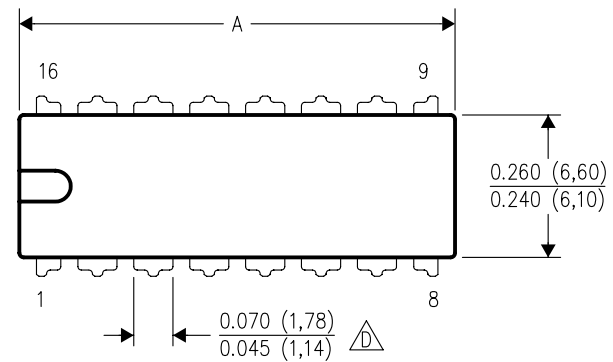
NOTES: (continued)

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

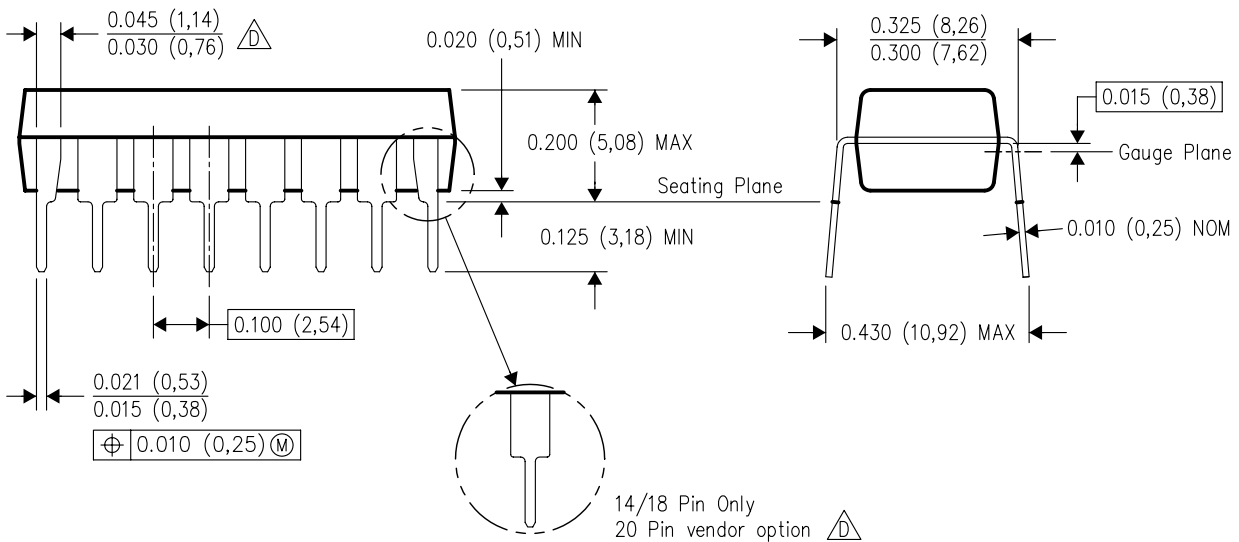
## N (R-PDIP-T\*\*)

16 PINS SHOWN

## PLASTIC DUAL-IN-LINE PACKAGE



| PINS **             | 14               | 16               | 18               | 20               |
|---------------------|------------------|------------------|------------------|------------------|
| DIM                 |                  |                  |                  |                  |
| A MAX               | 0.775<br>(19,69) | 0.775<br>(19,69) | 0.920<br>(23,37) | 1.060<br>(26,92) |
| A MIN               | 0.745<br>(18,92) | 0.745<br>(18,92) | 0.850<br>(21,59) | 0.940<br>(23,88) |
| MS-001<br>VARIATION | AA               | BB               | AC               | AD               |



14/18 Pin Only  
20 Pin vendor option

4040049/E 12/2002

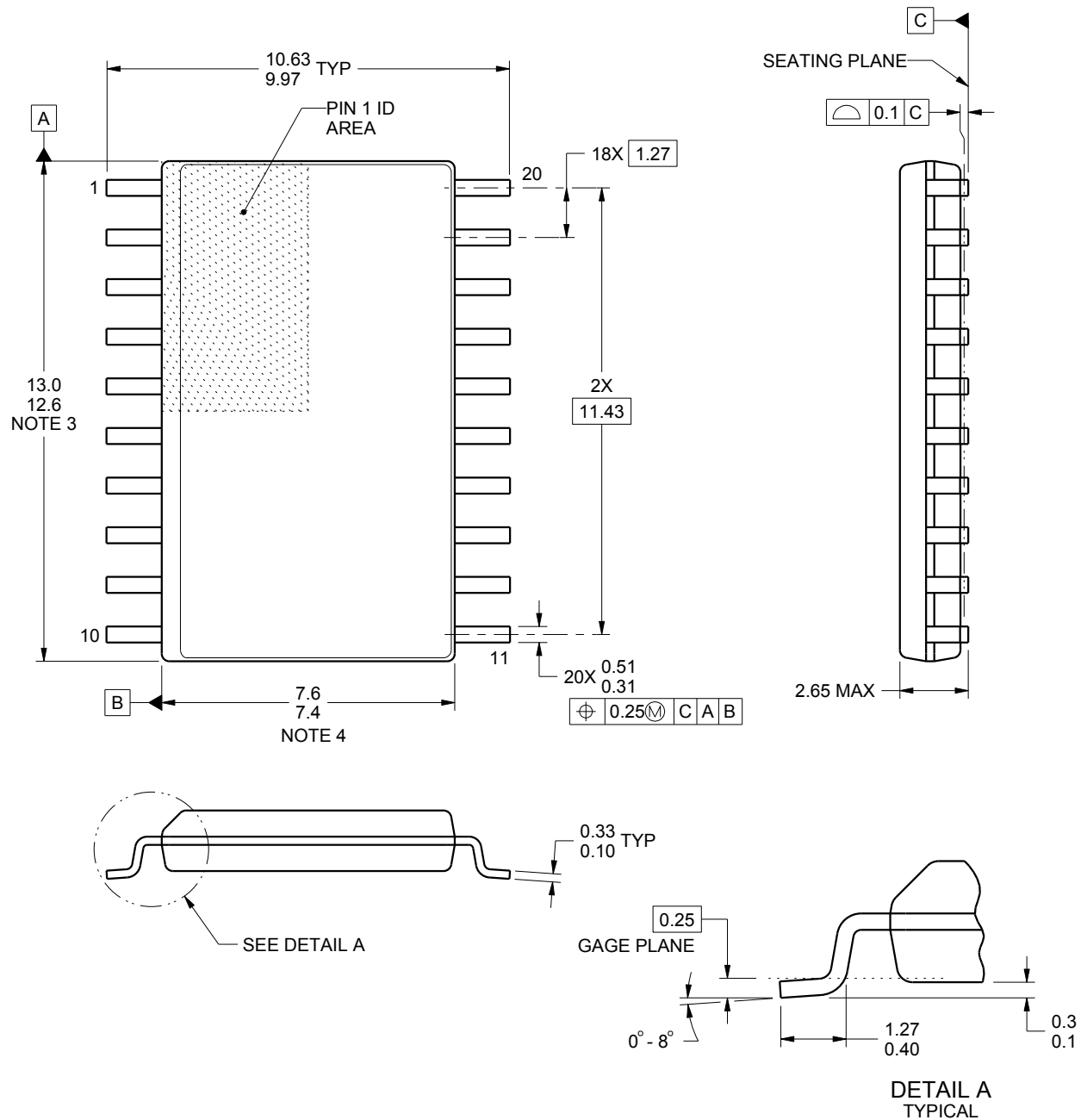
- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - Falls within JEDEC MS-001, except 18 and 20 pin minimum body length (Dim A).
  - The 20 pin end lead shoulder width is a vendor option, either half or full width.

**DW0020A**

## PACKAGE OUTLINE

**SOIC - 2.65 mm max height**

SOIC



4220724/A 05/2016

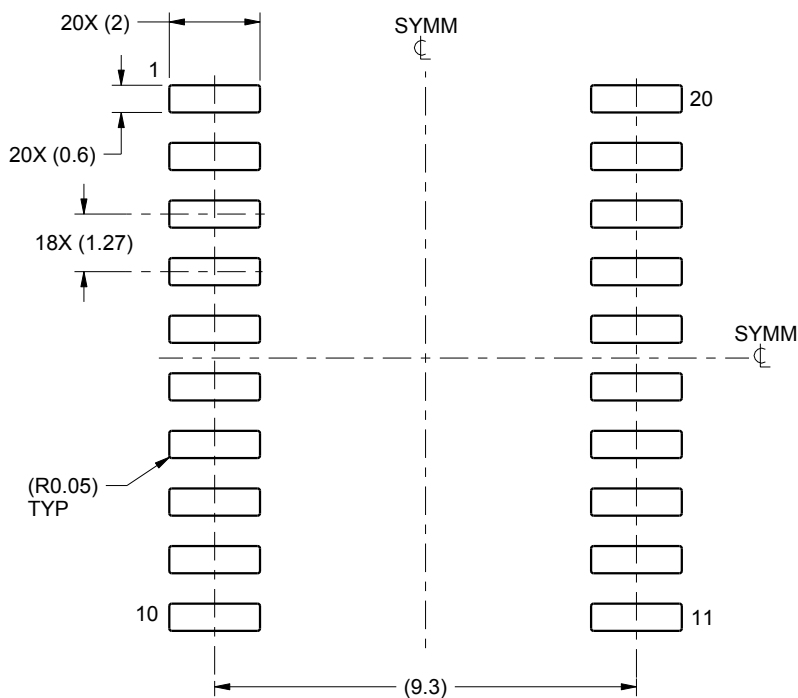
NOTES:

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 0.43 mm per side.
5. Reference JEDEC registration MS-013.

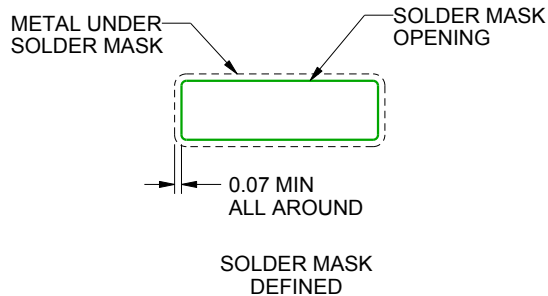
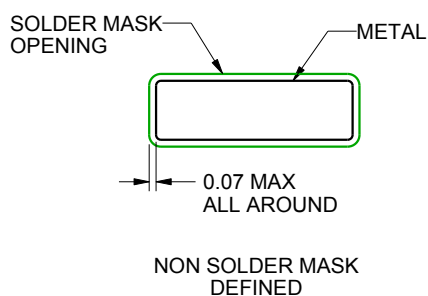
**DW0020A**

### SOIC - 2.65 mm max height

SOIC



LAND PATTERN EXAMPLE  
SCALE:6X



## SOLDER MASK DETAILS

4220724/A 05/2016

NOTES: (continued)

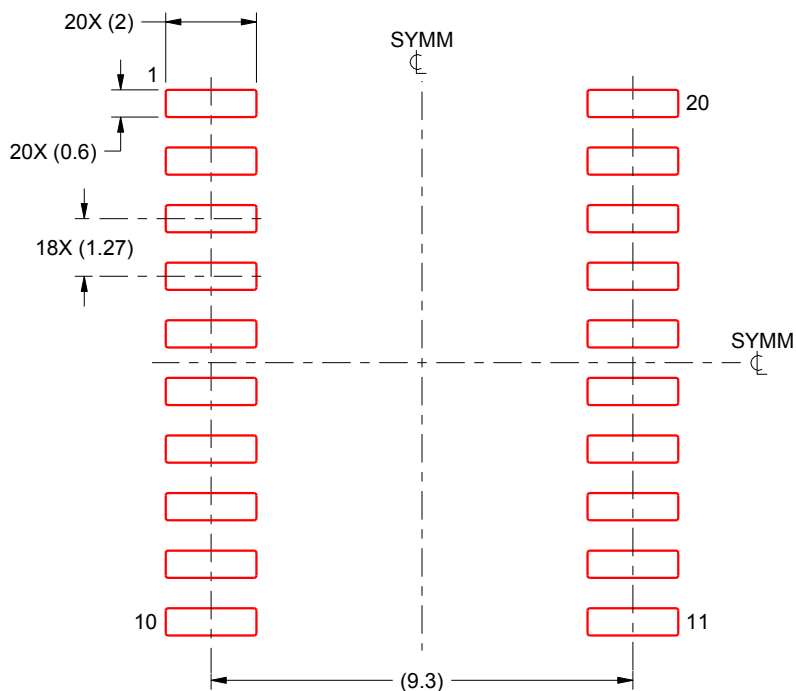
6. Publication IPC-7351 may have alternate designs.  
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

## EXAMPLE STENCIL DESIGN

DW0020A

SOIC - 2.65 mm max height

SOIC



SOLDER PASTE EXAMPLE  
BASED ON 0.125 mm THICK STENCIL  
SCALE:6X

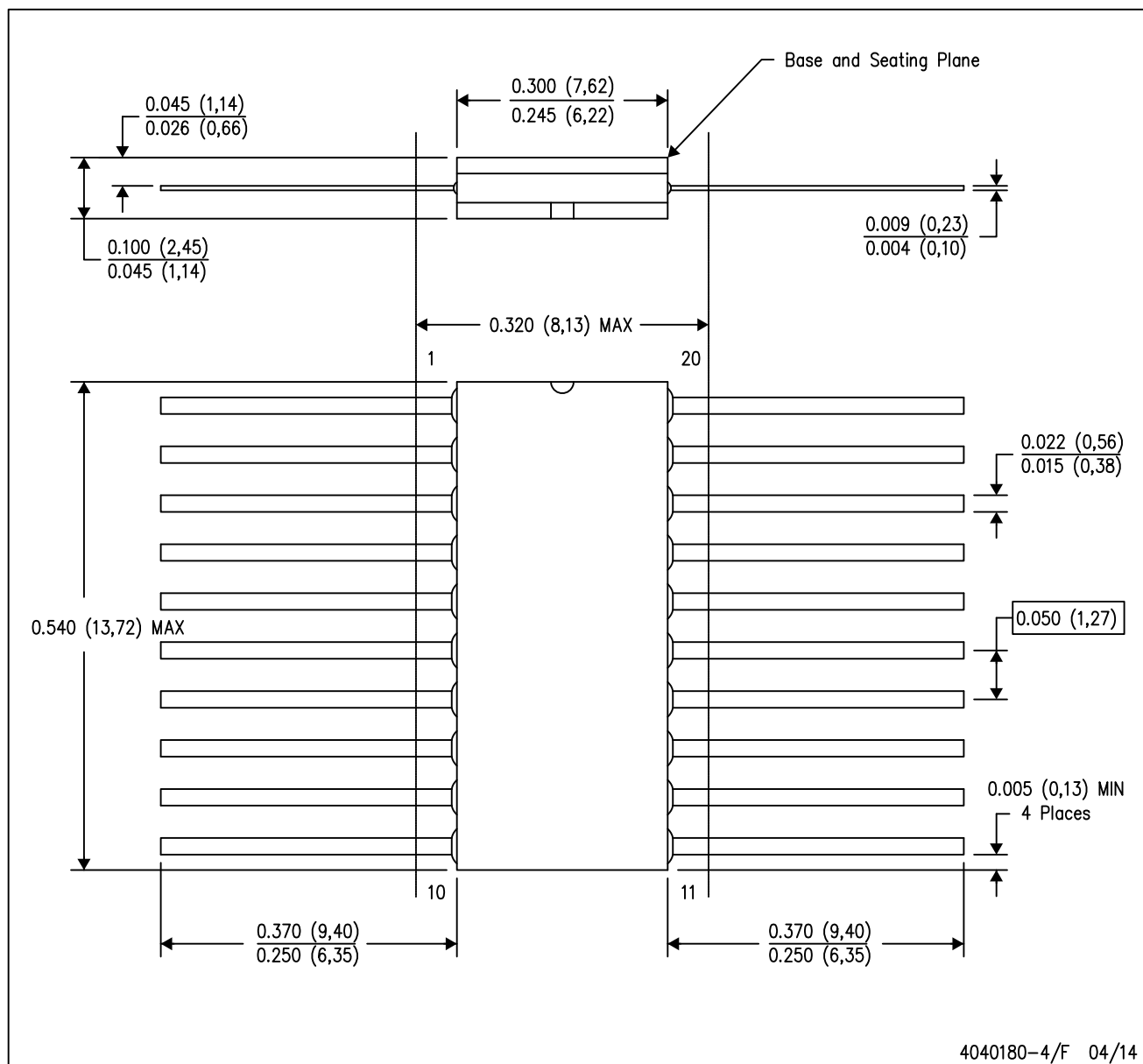
4220724/A 05/2016

NOTES: (continued)

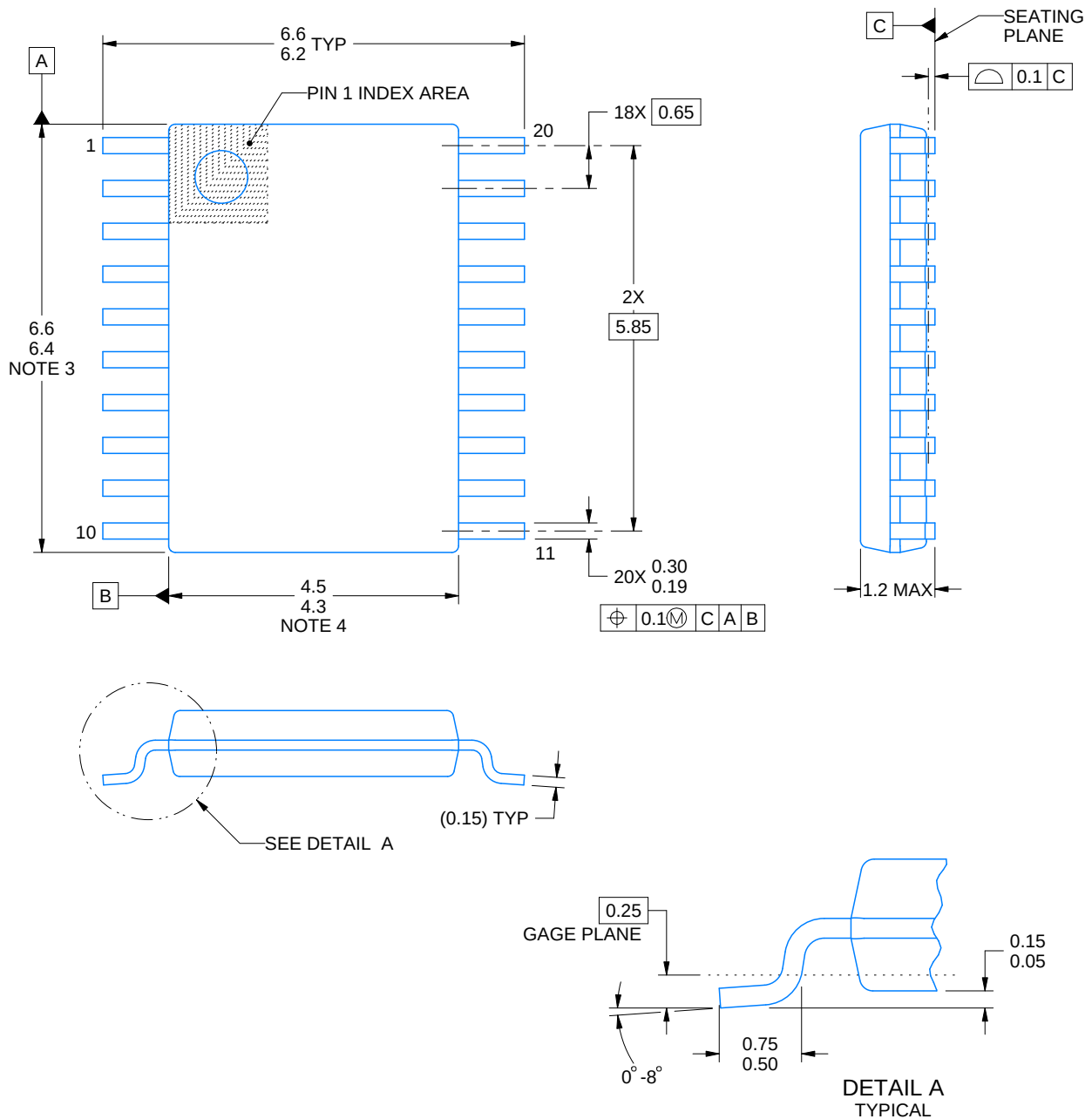
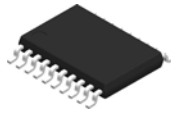
8. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
9. Board assembly site may have different recommendations for stencil design.

W (R-GDFP-F20)

CERAMIC DUAL FLATPACK



- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - C. This package can be hermetically sealed with a ceramic lid using glass frit.
  - D. Index point is provided on cap for terminal identification only.
  - E. Falls within Mil-Std 1835 GDFP2-F20



4220206/A 02/2017

## 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. This dimension does not include interlead flash. Interlead flash shall not exceed 0.25 mm per side.
5. Reference JEDEC registration MO-153.

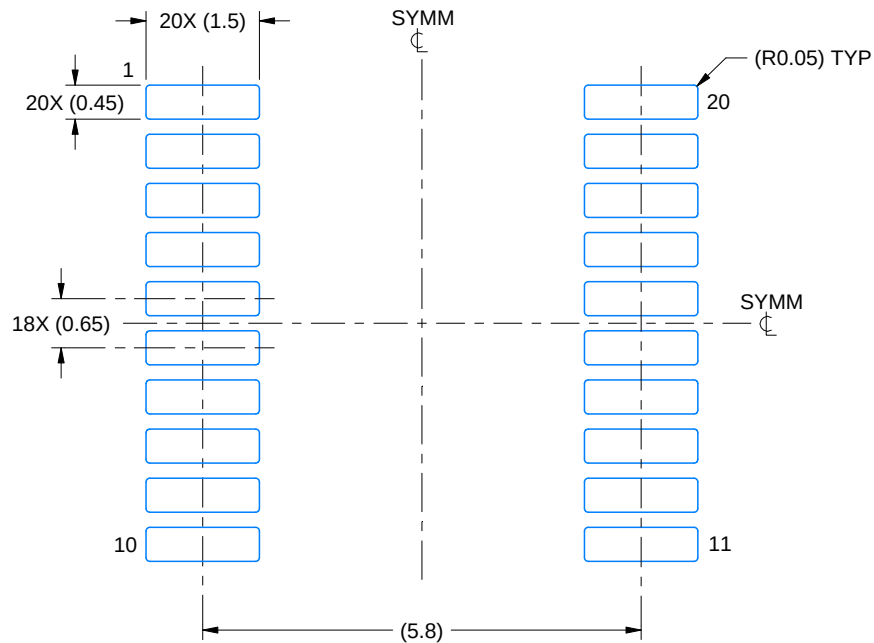


# EXAMPLE BOARD LAYOUT

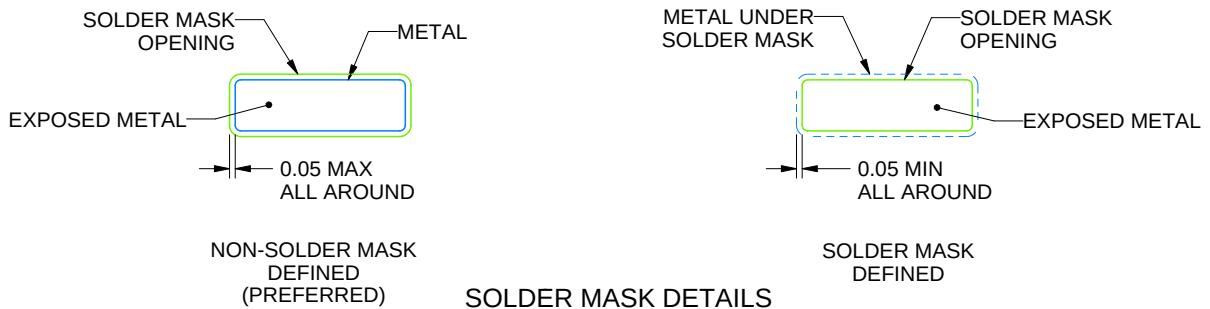
PW0020A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



LAND PATTERN EXAMPLE  
EXPOSED METAL SHOWN  
SCALE: 10X



4220206/A 02/2017

NOTES: (continued)

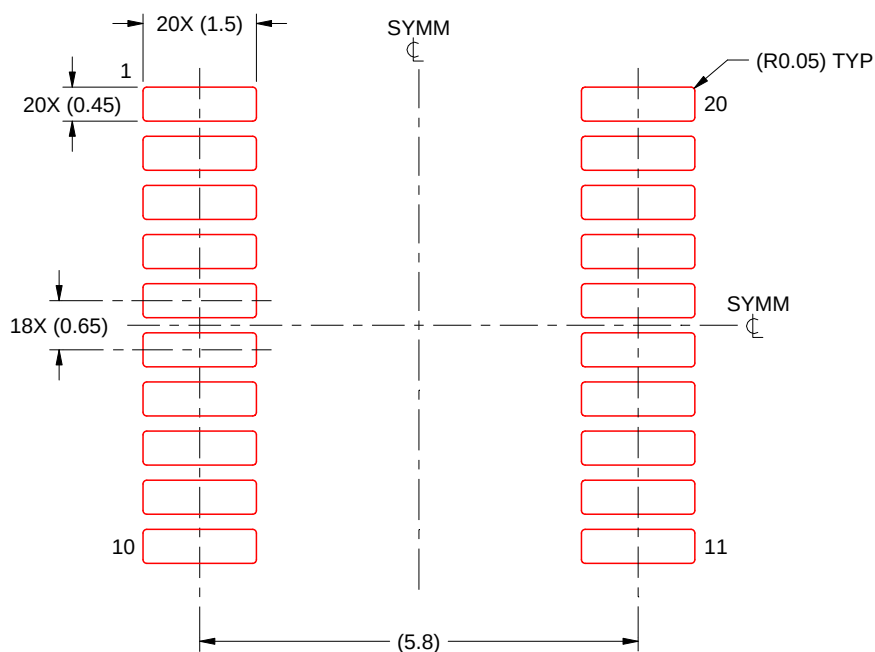
6. Publication IPC-7351 may have alternate designs.
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

## EXAMPLE STENCIL DESIGN

PW0020A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



SOLDER PASTE EXAMPLE  
BASED ON 0.125 mm THICK STENCIL  
SCALE: 10X

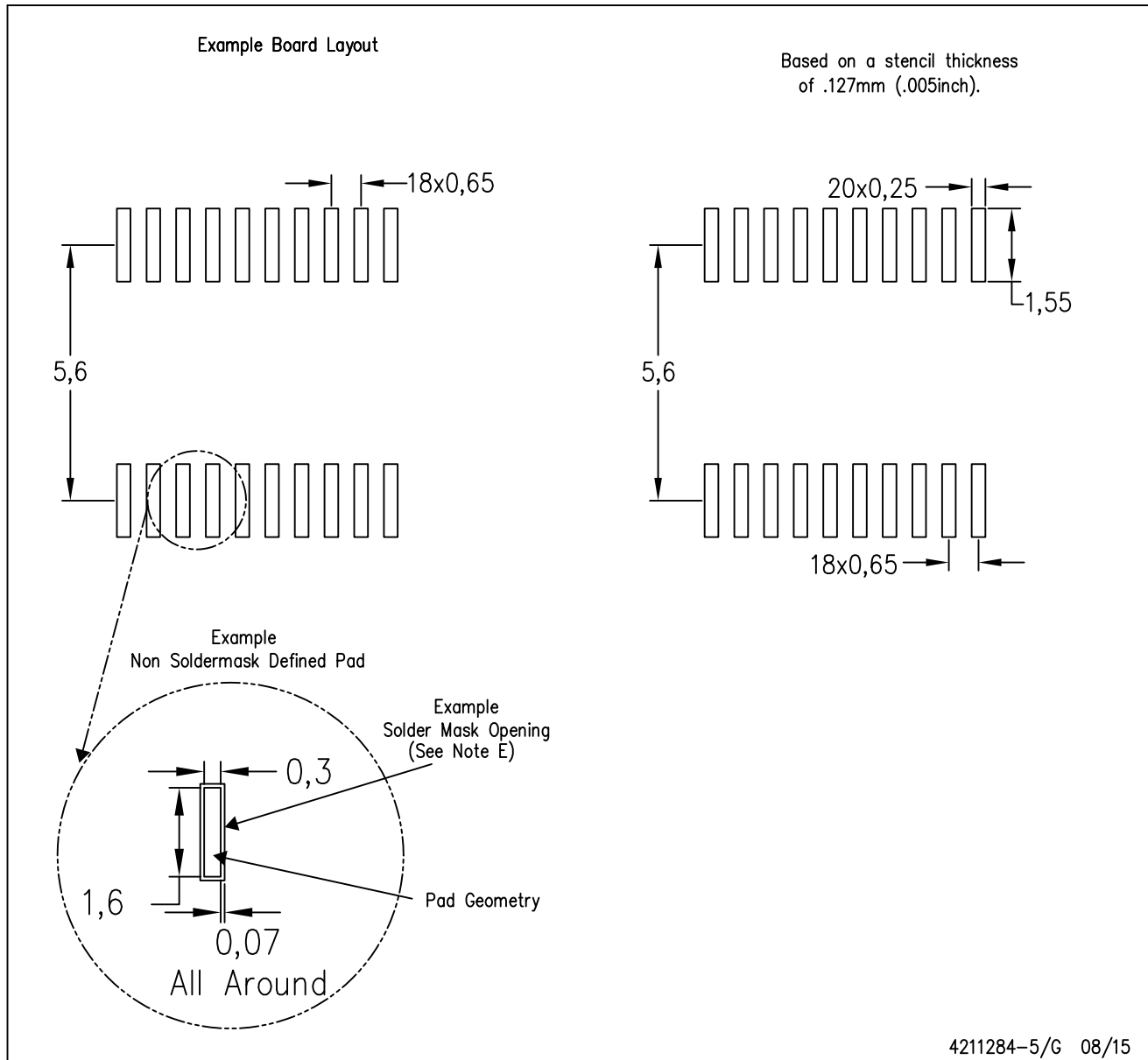
4220206/A 02/2017

NOTES: (continued)

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

PW (R-PDSO-G20)

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 design.
  - 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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