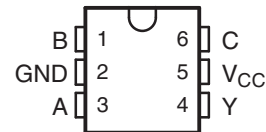
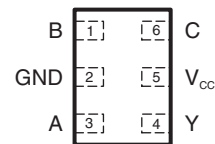


# SINGLE-SUPPLY VOLTAGE-LEVEL TRANSLATOR WITH NINE CONFIGURABLE GATE LOGIC FUNCTIONS

Check for Samples: [SN74AUP1T98](#)

## FEATURES

- Available in the Texas Instruments NanoStar™ Packages
- Single-Supply Voltage Translator
- 1.8 V to 3.3 V (at  $V_{CC} = 3.3$  V)
- 2.5 V to 3.3 V (at  $V_{CC} = 3.3$  V)
- 1.8 V to 2.5 V (at  $V_{CC} = 2.5$  V)
- 3.3 V to 2.5 V (at  $V_{CC} = 2.5$  V)
- Nine Configurable Gate Logic Functions
- Schmitt-Trigger Inputs Reject Input Noise and Provide Better Output Signal Integrity
- $I_{off}$  Supports Partial-Power-Down Mode With Low Leakage Current (0.5  $\mu$ A)
- Very Low Static and Dynamic Power Consumption
- Pb-Free Packages Available: SOT-23 (DBV), SC-70 (DCK), and WCSP (NanoStar)
- Latch-Up Performance Exceeds 100 mA Per JESD 78, Class II
- ESD Performance Tested Per JESD 22
  - 2000-V Human-Body Model (A114-B, Class II)
  - 1000-V Charged-Device Model (C101)
- Related Devices: SN74AUP1T97, SN74AUP1T57, and SN74AUP1T58

DBV OR DCK PACKAGE  
(TOP VIEW)

DRY OR DSF PACKAGE  
(TOP VIEW)

YFP OR YZP PACKAGE  
(TOP VIEW)


## DESCRIPTION

AUP technology is the industry's lowest-power logic technology designed for use in battery-operated or battery backed-up equipment. The SN74AUP1T98 is designed for logic-level translation applications with input switching levels that accept 1.8-V LVCMOS signals, while operating from either a single 3.3-V or 2.5-V  $V_{CC}$  supply.

The wide  $V_{CC}$  range of 2.3 V to 3.6 V allows the possibility of battery voltage drop during system operation and ensures normal operation between this range.

Schmitt-trigger inputs ( $\Delta V_T = 210$  mV between positive and negative input transitions) offer improved noise immunity during switching transitions, which is especially useful on analog mixed-mode designs. Schmitt-trigger inputs reject input noise, ensure integrity of output signals, and allow for slow input signal transition.

The SN74AUP1T98 can be easily configured to perform a required gate function by connecting A, B, and C inputs to  $V_{CC}$  or ground (see Function Selection table). Up to nine commonly used logic gate functions can be performed.

$I_{off}$  is a feature that allows for powered-down conditions ( $V_{CC} = 0$  V) and is important in portable and mobile applications. When  $V_{CC} = 0$  V, signals in the range from 0 V to 3.6 V can be applied to the inputs and outputs of the device. No damage occurs to the device under these conditions.



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.

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

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The SN74AUP1T98 is designed with optimized current-drive capability of 4 mA to reduce line reflections, overshoot, and undershoot caused by high-drive outputs.

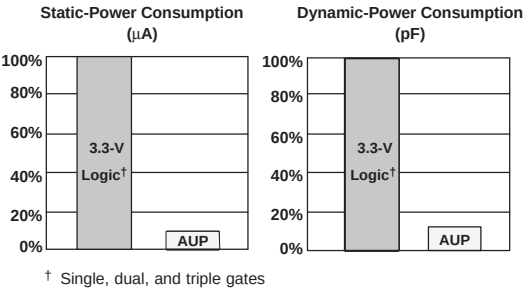
NanoStar package technology is a major breakthrough in IC packaging concepts, using the die as the package.

**ORDERING INFORMATION**

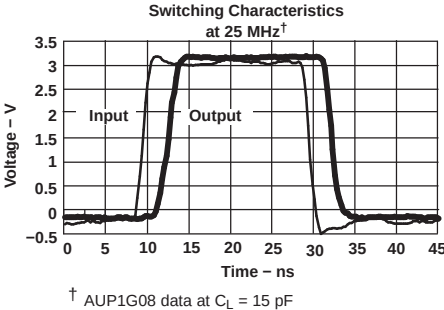
For package and ordering information, see the Package Option Addendum at the end of this document.

**FUNCTION SELECTION TABLE**

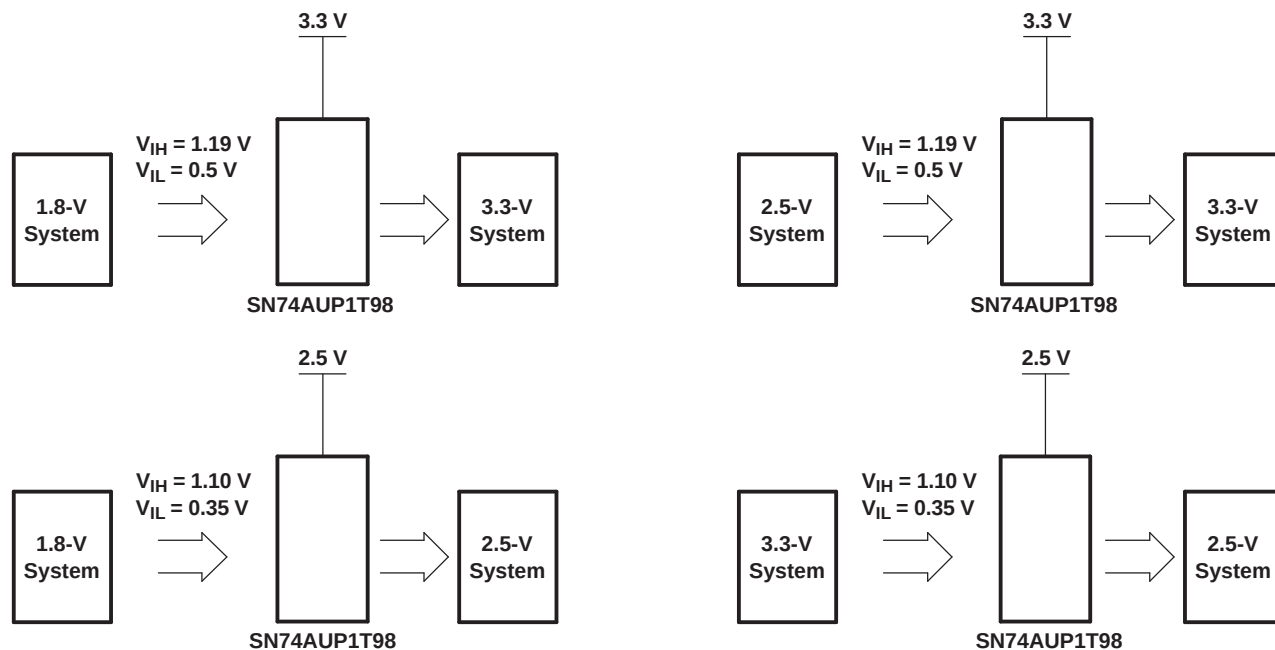
| LOGIC FUNCTION                            | FIGURE NO. |
|-------------------------------------------|------------|
| 2-to-1 data selector                      | 5          |
| 2-input NAND gate                         | 6          |
| 2-input NOR gate with one inverted input  | 7          |
| 2-input NAND gate with one inverted input | 7          |
| 2-input NAND gate with one inverted input | 8          |
| 2-input NOR gate with one inverted input  | 8          |
| 2-input NOR gate                          | 9          |
| Inverter                                  | 10         |
| Noninverted buffer                        | 11         |



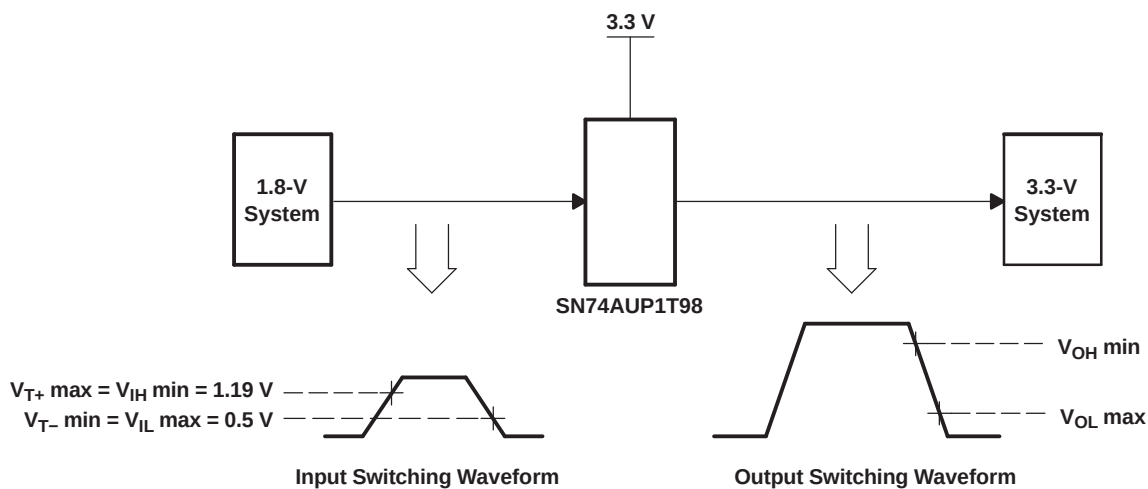
**Figure 1. AUP – The Lowest-Power Family**



**Figure 2. Excellent Signal Integrity**



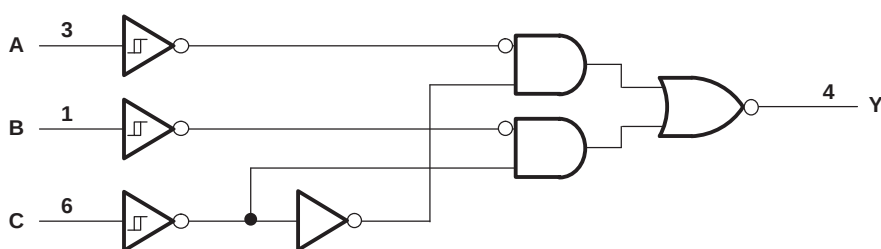
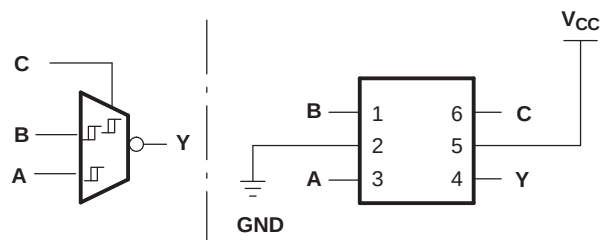
**Figure 3. Possible Voltage-Translation Combinations**



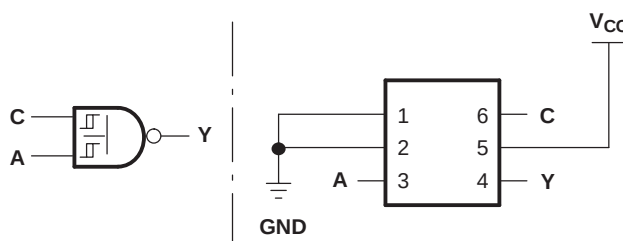
**Figure 4. Switching Thresholds for 1.8-V to 3.3-V Translation**

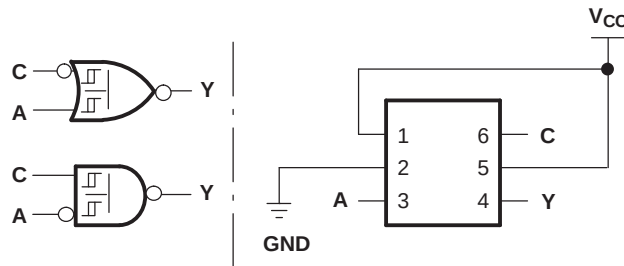
**FUNCTION TABLE**

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

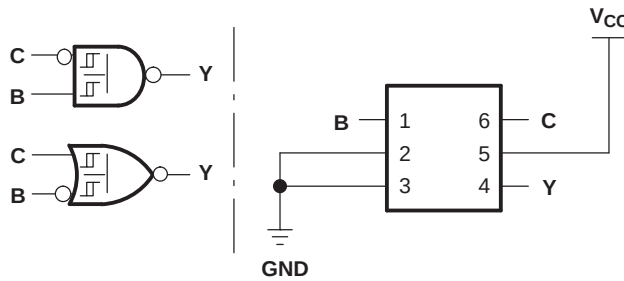
**LOGIC DIAGRAM (POSITIVE LOGIC)****LOGIC CONFIGURATIONS**

**Figure 5. 157+04: 2-to-1 Data Selector With Inverted Output**  
 When C is L, Y =  $\overline{B}$   
 When C is H, Y =  $\overline{A}$

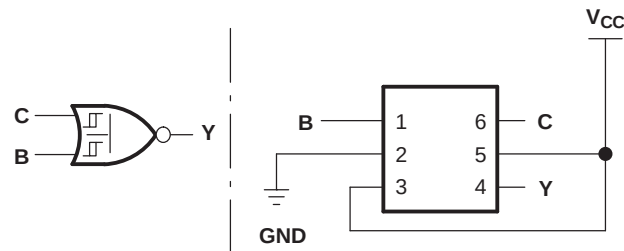
**Figure 6. 00: 2-Input NAND Gate**



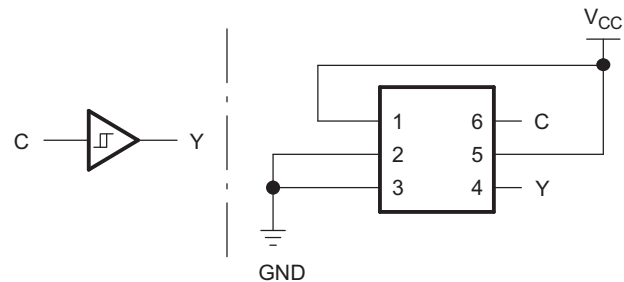
**Figure 7. 14+02/14+08: 2-Input NOR Gate With One Inverted Input  
2-Input NAND Gate With One Inverted Input**



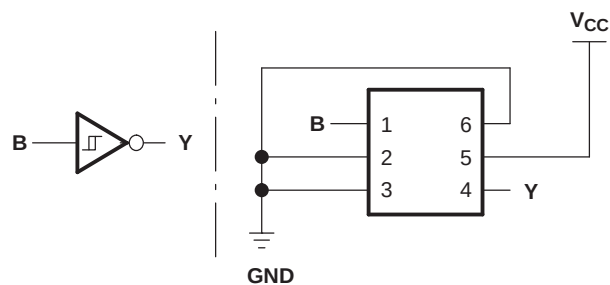
**Figure 8. 14+00/14+32: 2-Input NAND Gate With One Inverted Input  
2-Input NOR Gate With One Inverted Input**



**Figure 9. 32: 2-Input NOR Gate**



**Figure 10. 17/34: Noninverted Buffer**

**Figure 11. 04/14: Inverter**

## ABSOLUTE MAXIMUM RATINGS<sup>(1)</sup>

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

|                  |                                                                                             |                    | MIN  | MAX                   | UNIT |
|------------------|---------------------------------------------------------------------------------------------|--------------------|------|-----------------------|------|
| V <sub>CC</sub>  | Supply voltage range                                                                        |                    | –0.5 | 4.6                   | V    |
| V <sub>I</sub>   | Input voltage range <sup>(2)</sup>                                                          |                    | –0.5 | 4.6                   | V    |
| V <sub>O</sub>   | Voltage range applied to any output in the high-impedance or power-off state <sup>(2)</sup> |                    | –0.5 | 4.6                   | V    |
| V <sub>O</sub>   | Output voltage range in the high or low state <sup>(2)</sup>                                |                    | –0.5 | V <sub>CC</sub> + 0.5 | V    |
| I <sub>IK</sub>  | Input clamp current                                                                         | V <sub>I</sub> < 0 |      | –50                   | mA   |
| I <sub>OK</sub>  | Output clamp current                                                                        | V <sub>O</sub> < 0 |      | –50                   | mA   |
| I <sub>O</sub>   | Continuous output current                                                                   |                    |      | ±20                   | mA   |
|                  | Continuous current through V <sub>CC</sub> or GND                                           |                    |      | ±50                   | mA   |
| θ <sub>JA</sub>  | Package thermal impedance <sup>(3)</sup>                                                    | DBV package        |      | 165                   | °C/W |
|                  |                                                                                             | DCK package        |      | 259                   |      |
|                  |                                                                                             | DRY package        |      | 340                   |      |
|                  |                                                                                             | DSF package        |      | 300                   |      |
|                  |                                                                                             | YFP package        |      | 123                   |      |
|                  |                                                                                             | YZP package        |      | 123                   |      |
| T <sub>stg</sub> | 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 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                 |                         | 2.3 | 3.6             | V    |
| V <sub>I</sub>  | Input voltage                  |                         | 0   | 3.6             | 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> = 2.3 V |     | –3.1            | mA   |
|                 |                                | V <sub>CC</sub> = 3 V   |     | –4              |      |
| I <sub>OL</sub> | Low-level output current       | V <sub>CC</sub> = 2.3 V |     | 3.1             | mA   |
|                 |                                | V <sub>CC</sub> = 3 V   |     | 4               |      |
| T <sub>A</sub>  | Operating free-air temperature |                         | –40 | 85              | °C   |

- (1) All unused inputs of the device must be held at V<sub>CC</sub> or GND to ensure proper device operation. See 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> | T <sub>A</sub> = 25°C |     |      | T <sub>A</sub> = –40°C to 85°C |      | UNIT |
|--------------------------------------------------------------------|------------|-----------------------------------------------------------------------------------------|-----------------|-----------------------|-----|------|--------------------------------|------|------|
|                                                                    |            |                                                                                         |                 | MIN                   | TYP | MAX  | MIN                            | MAX  |      |
| V <sub>T+</sub><br>Positive-going input threshold voltage          |            |                                                                                         | 2.3 V to 2.7 V  | 0.6                   |     | 1.1  | 0.6                            | 1.1  | V    |
|                                                                    |            |                                                                                         | 3 V to 3.6 V    | 0.75                  |     | 1.16 | 0.75                           | 1.19 |      |
| V <sub>T–</sub><br>Negative-going input threshold voltage          |            |                                                                                         | 2.3 V to 2.7 V  | 0.35                  |     | 0.6  | 0.35                           | 0.6  | V    |
|                                                                    |            |                                                                                         | 3 V to 3.6 V    | 0.5                   |     | 0.85 | 0.5                            | 0.85 |      |
| ΔV <sub>T</sub><br>Hysteresis (V <sub>T+</sub> – V <sub>T–</sub> ) |            |                                                                                         | 2.3 V to 2.7 V  | 0.23                  |     | 0.6  | 0.1                            | 0.6  | V    |
|                                                                    |            |                                                                                         | 3 V to 3.6 V    | 0.25                  |     | 0.56 | 0.15                           | 0.56 |      |
| V <sub>OH</sub>                                                    |            | I <sub>OH</sub> = –20 μA                                                                | 2.3 V to 3.6 V  | V <sub>CC</sub> – 0.1 |     |      | V <sub>CC</sub> – 0.1          |      | V    |
|                                                                    |            | I <sub>OH</sub> = –2.3 mA                                                               | 2.3 V           | 2.05                  |     |      | 1.97                           |      |      |
|                                                                    |            | I <sub>OH</sub> = –3.1 mA                                                               |                 | 1.9                   |     |      | 1.85                           |      |      |
|                                                                    |            | I <sub>OH</sub> = –2.7 mA                                                               | 3 V             | 2.72                  |     |      | 2.67                           |      |      |
|                                                                    |            | I <sub>OH</sub> = –4 mA                                                                 |                 | 2.6                   |     |      | 2.55                           |      |      |
| V <sub>OL</sub>                                                    |            | I <sub>OL</sub> = 20 μA                                                                 | 2.3 V to 3.6 V  | 0.1                   |     |      | 0.1                            |      | V    |
|                                                                    |            | I <sub>OL</sub> = 2.3 mA                                                                | 2.3 V           | 0.31                  |     |      | 0.33                           |      |      |
|                                                                    |            | I <sub>OL</sub> = 3.1 mA                                                                |                 | 0.44                  |     |      | 0.45                           |      |      |
|                                                                    |            | I <sub>OL</sub> = 2.7 mA                                                                | 3 V             | 0.31                  |     |      | 0.33                           |      |      |
|                                                                    |            | I <sub>OL</sub> = 4 mA                                                                  |                 | 0.44                  |     |      | 0.45                           |      |      |
| I <sub>I</sub>                                                     | All inputs | V <sub>I</sub> = 3.6 V or GND                                                           | 0 V to 3.6 V    | 0.1                   |     |      | 0.5                            | μA   |      |
| I <sub>off</sub>                                                   |            | V <sub>I</sub> or V <sub>O</sub> = 0 V to 3.6 V                                         | 0 V             | 0.1                   |     |      | 0.5                            | μA   |      |
| ΔI <sub>off</sub>                                                  |            | V <sub>I</sub> or V <sub>O</sub> = 3.6 V                                                | 0 V to 0.2 V    | 0.2                   |     |      | 0.5                            | μA   |      |
| I <sub>CC</sub>                                                    |            | V <sub>I</sub> = 3.6 V or GND, I <sub>O</sub> = 0                                       | 2.3 V to 3.6 V  | 0.5                   |     |      | 0.9                            | μA   |      |
| ΔI <sub>CC</sub>                                                   |            | One input at 0.3 V or 1.1 V, Other inputs at 0 or V <sub>CC</sub> , I <sub>O</sub> = 0  | 2.3 V to 2.7 V  |                       |     |      | 4                              | μA   |      |
|                                                                    |            | One input at 0.45 V or 1.2 V, Other inputs at 0 or V <sub>CC</sub> , I <sub>O</sub> = 0 | 3 V to 3.6 V    |                       |     |      | 12                             |      |      |
| C <sub>i</sub>                                                     |            | V <sub>I</sub> = V <sub>CC</sub> or GND                                                 | 3.3 V           | 1.5                   |     |      |                                | pF   |      |
| C <sub>o</sub>                                                     |            | V <sub>O</sub> = V <sub>CC</sub> or GND                                                 | 3.3 V           | 3                     |     |      |                                | pF   |      |

## SWITCHING CHARACTERISTICS

over recommended operating free-air temperature range, V<sub>CC</sub> = 2.5 V ± 0.2 V, V<sub>I</sub> = 1.8 V ± 0.15 V (unless otherwise noted) (see Figure 12)

| PARAMETER       | FROM (INPUT) | TO (OUTPUT) | C <sub>L</sub> | T <sub>A</sub> = 25°C |     |     | T <sub>A</sub> = –40°C to 85°C |      | UNIT |
|-----------------|--------------|-------------|----------------|-----------------------|-----|-----|--------------------------------|------|------|
|                 |              |             |                | MIN                   | TYP | MAX | MIN                            | MAX  |      |
| t <sub>pd</sub> | A, B, or C   | Y           | 5 pF           | 1.8                   | 2.3 | 2.9 | 0.5                            | 6.8  | ns   |
|                 |              |             | 10 pF          | 2.3                   | 2.8 | 3.4 | 1                              | 7.9  |      |
|                 |              |             | 15 pF          | 2.6                   | 3.1 | 3.8 | 1                              | 8.7  |      |
|                 |              |             | 30 pF          | 3.8                   | 4.4 | 5.1 | 1.5                            | 10.8 |      |

## SWITCHING CHARACTERISTICS

over recommended operating free-air temperature range,  $V_{CC} = 2.5\text{ V} \pm 0.2\text{ V}$ ,  $V_I = 2.5\text{ V} \pm 0.2\text{ V}$  (unless otherwise noted)  
(see [Figure 12](#))

| PARAMETER | FROM<br>(INPUT) | TO<br>(OUTPUT) | $C_L$ | $T_A = 25^\circ\text{C}$ |     |     | $T_A = -40^\circ\text{C}$<br>to $85^\circ\text{C}$ |     | UNIT |
|-----------|-----------------|----------------|-------|--------------------------|-----|-----|----------------------------------------------------|-----|------|
|           |                 |                |       | MIN                      | TYP | MAX | MIN                                                | MAX |      |
| $t_{pd}$  | A, B, or C      | Y              | 5 pF  | 1.8                      | 2.3 | 3.1 | 0.5                                                | 6   | ns   |
|           |                 |                | 10 pF | 2.2                      | 2.8 | 3.5 | 1                                                  | 7.1 |      |
|           |                 |                | 15 pF | 2.6                      | 3.2 | 5.2 | 1                                                  | 7.9 |      |
|           |                 |                | 30 pF | 3.7                      | 4.4 | 5.2 | 1.5                                                | 10  |      |

## SWITCHING CHARACTERISTICS

over recommended operating free-air temperature range,  $V_{CC} = 2.5\text{ V} \pm 0.2\text{ V}$ ,  $V_I = 3.3\text{ V} \pm 0.3\text{ V}$  (unless otherwise noted)  
(see [Figure 12](#))

| PARAMETER | FROM<br>(INPUT) | TO<br>(OUTPUT) | $C_L$ | $T_A = 25^\circ\text{C}$ |     |     | $T_A = -40^\circ\text{C}$<br>to $85^\circ\text{C}$ |     | UNIT |
|-----------|-----------------|----------------|-------|--------------------------|-----|-----|----------------------------------------------------|-----|------|
|           |                 |                |       | MIN                      | TYP | MAX | MIN                                                | MAX |      |
| $t_{pd}$  | A, B, or C      | Y              | 5 pF  | 2                        | 2.7 | 3.5 | 0.5                                                | 5.5 | ns   |
|           |                 |                | 10 pF | 2.4                      | 3.1 | 3.9 | 1                                                  | 6.5 |      |
|           |                 |                | 15 pF | 2.8                      | 3.5 | 4.3 | 1                                                  | 7.4 |      |
|           |                 |                | 30 pF | 4                        | 4.7 | 5.5 | 1.5                                                | 9.5 |      |

## SWITCHING CHARACTERISTICS

over recommended operating free-air temperature range,  $V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$ ,  $V_I = 1.8\text{ V} \pm 0.15\text{ V}$  (unless otherwise noted)  
(see [Figure 12](#))

| PARAMETER | FROM<br>(INPUT) | TO<br>(OUTPUT) | $C_L$ | $T_A = 25^\circ\text{C}$ |     |     | $T_A = -40^\circ\text{C}$<br>to $85^\circ\text{C}$ |     | UNIT |
|-----------|-----------------|----------------|-------|--------------------------|-----|-----|----------------------------------------------------|-----|------|
|           |                 |                |       | MIN                      | TYP | MAX | MIN                                                | MAX |      |
| $t_{pd}$  | A, B, or C      | Y              | 5 pF  | 1.6                      | 2   | 2.5 | 0.5                                                | 8   | ns   |
|           |                 |                | 10 pF | 2                        | 2.4 | 2.9 | 1                                                  | 8.5 |      |
|           |                 |                | 15 pF | 2.3                      | 2.8 | 3.3 | 1                                                  | 9.1 |      |
|           |                 |                | 30 pF | 3.4                      | 3.9 | 4.4 | 1.5                                                | 9.8 |      |

## SWITCHING CHARACTERISTICS

over recommended operating free-air temperature range,  $V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$ ,  $V_I = 2.5\text{ V} \pm 0.2\text{ V}$  (unless otherwise noted)  
(see [Figure 12](#))

| PARAMETER | FROM<br>(INPUT) | TO<br>(OUTPUT) | $C_L$ | $T_A = 25^\circ\text{C}$ |     |     | $T_A = -40^\circ\text{C}$<br>to $85^\circ\text{C}$ |     | UNIT |
|-----------|-----------------|----------------|-------|--------------------------|-----|-----|----------------------------------------------------|-----|------|
|           |                 |                |       | MIN                      | TYP | MAX | MIN                                                | MAX |      |
| $t_{pd}$  | A, B, or C      | Y              | 5 pF  | 1.6                      | 1.9 | 2.4 | 0.5                                                | 5.3 | ns   |
|           |                 |                | 10 pF | 2                        | 2.3 | 2.7 | 1                                                  | 6.1 |      |
|           |                 |                | 15 pF | 2.3                      | 2.7 | 3.1 | 1                                                  | 6.8 |      |
|           |                 |                | 30 pF | 3.4                      | 3.8 | 4.2 | 1.5                                                | 8.5 |      |

## SWITCHING CHARACTERISTICS

over recommended operating free-air temperature range,  $V_{CC} = 3.3 \text{ V} \pm 0.3 \text{ V}$ ,  $V_I = 3.3 \text{ V} \pm 0.3 \text{ V}$  (unless otherwise noted)  
(see [Figure 12](#))

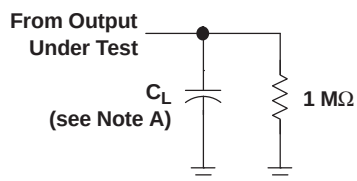
| PARAMETER | FROM<br>(INPUT) | TO<br>(OUTPUT) | $C_L$ | $T_A = 25^\circ\text{C}$ |     |     | $T_A = -40^\circ\text{C}$<br>to $85^\circ\text{C}$ |     | UNIT |
|-----------|-----------------|----------------|-------|--------------------------|-----|-----|----------------------------------------------------|-----|------|
|           |                 |                |       | MIN                      | TYP | MAX | MIN                                                | MAX |      |
| $t_{pd}$  | A, B, or C      | Y              | 5 pF  | 1.6                      | 2.1 | 2.7 | 0.5                                                | 4.7 | ns   |
|           |                 |                | 10 pF | 2                        | 2.4 | 3   | 1                                                  | 5.7 |      |
|           |                 |                | 15 pF | 2.3                      | 2.7 | 3.3 | 1                                                  | 6.2 |      |
|           |                 |                | 30 pF | 3.4                      | 3.8 | 4.4 | 1.5                                                | 7.8 |      |

## OPERATING CHARACTERISTICS

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

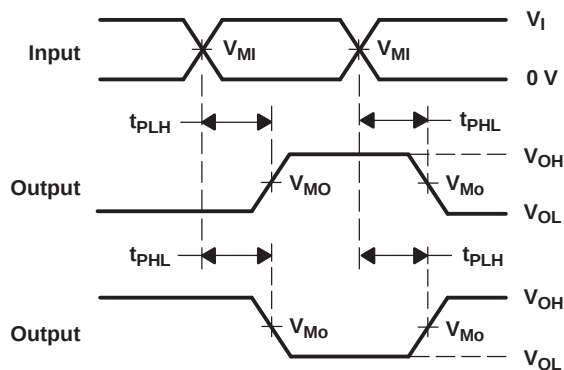
| PARAMETER |                               | TEST CONDITIONS      | $V_{CC} = 2.5 \text{ V}$ | $V_{CC} = 3.3 \text{ V}$ | UNIT |
|-----------|-------------------------------|----------------------|--------------------------|--------------------------|------|
|           |                               |                      | TYP                      | TYP                      |      |
| $C_{pd}$  | Power dissipation capacitance | $f = 10 \text{ MHz}$ | 4                        | 5                        | pF   |

## PARAMETER MEASUREMENT INFORMATION



LOAD CIRCUIT

|          | $V_{CC} = 2.5\text{ V}$<br>$\pm 0.2\text{ V}$ | $V_{CC} = 3.3\text{ V}$<br>$\pm 0.3\text{ V}$ |
|----------|-----------------------------------------------|-----------------------------------------------|
| $C_L$    | 5, 10, 15, 30 pF                              | 5, 10, 15, 30 pF                              |
| $V_{MI}$ | $V_I/2$                                       | $V_I/2$                                       |
| $V_{MO}$ | $V_{CC}/2$                                    | $V_{CC}/2$                                    |



VOLTAGE WAVEFORMS  
PROPAGATION DELAY TIMES  
INVERTING AND NONINVERTING OUTPUTS

- NOTES: A.  $C_L$  includes probe and jig capacitance.  
B. All input pulses are supplied by generators having the following characteristics: PRR  $\leq 10\text{ MHz}$ ,  $Z_O = 50\ \Omega$ , slew rate  $\geq 1\text{ V/ns}$ .  
C. The outputs are measured one at a time, with one transition per measurement.  
D.  $t_{PLH}$  and  $t_{PHL}$  are the same as  $t_{pd}$ .

**Figure 12. Load Circuit and Voltage Waveforms**

REVISION HISTORY

| Changes from Revision H (May 2010) to Revision I | Page              |
|--------------------------------------------------|-------------------|
| • Updated FUNCTION SELECTION Table. ....         | <a href="#">2</a> |
| • Updated figure caption. ....                   | <a href="#">5</a> |
| • Updated figure caption. ....                   | <a href="#">5</a> |

## PACKAGING INFORMATION

| Orderable part number           | Status<br>(1) | Material type<br>(2) | Package   Pins   | Package qty   Carrier | RoHS<br>(3) | Lead finish/<br>Ball material<br>(4) | MSL rating/<br>Peak reflow<br>(5) | Op temp (°C) | Part marking<br>(6) |
|---------------------------------|---------------|----------------------|------------------|-----------------------|-------------|--------------------------------------|-----------------------------------|--------------|---------------------|
| <a href="#">SN74AUP1T98DBVR</a> | Active        | Production           | SOT-23 (DBV)   6 | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 85    | HT6R                |
| SN74AUP1T98DBVR.B               | Active        | Production           | SOT-23 (DBV)   6 | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 85    | HT6R                |
| <a href="#">SN74AUP1T98DBVT</a> | Active        | Production           | SOT-23 (DBV)   6 | 250   SMALL T&R       | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 85    | HT6R                |
| SN74AUP1T98DBVT.B               | Active        | Production           | SOT-23 (DBV)   6 | 250   SMALL T&R       | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 85    | HT6R                |
| <a href="#">SN74AUP1T98DCKR</a> | Active        | Production           | SC70 (DCK)   6   | 3000   LARGE T&R      | Yes         | NIPDAU   SN                          | Level-1-260C-UNLIM                | -40 to 85    | TKR                 |
| SN74AUP1T98DCKR.B               | Active        | Production           | SC70 (DCK)   6   | 3000   LARGE T&R      | Yes         | SN                                   | Level-1-260C-UNLIM                | -40 to 85    | TKR                 |
| SN74AUP1T98DCKRG4               | Active        | Production           | SC70 (DCK)   6   | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 85    | TKR                 |
| SN74AUP1T98DCKRG4.B             | Active        | Production           | SC70 (DCK)   6   | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 85    | TKR                 |
| <a href="#">SN74AUP1T98DCKT</a> | Active        | Production           | SC70 (DCK)   6   | 250   SMALL T&R       | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 85    | TKR                 |
| SN74AUP1T98DCKT.B               | Active        | Production           | SC70 (DCK)   6   | 250   SMALL T&R       | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 85    | TKR                 |
| <a href="#">SN74AUP1T98DRYR</a> | Active        | Production           | SON (DRY)   6    | 5000   LARGE T&R      | Yes         | NIPDAUAG                             | Level-1-260C-UNLIM                | -40 to 85    | TK                  |
| SN74AUP1T98DRYR.B               | Active        | Production           | SON (DRY)   6    | 5000   LARGE T&R      | Yes         | NIPDAUAG                             | Level-1-260C-UNLIM                | -40 to 85    | TK                  |
| <a href="#">SN74AUP1T98DSFR</a> | Active        | Production           | SON (DSF)   6    | 5000   LARGE T&R      | Yes         | NIPDAU   NIPDAUAG                    | Level-1-260C-UNLIM                | -40 to 85    | TK                  |
| SN74AUP1T98DSFR.B               | Active        | Production           | SON (DSF)   6    | 5000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 85    | TK                  |

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

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

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

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

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

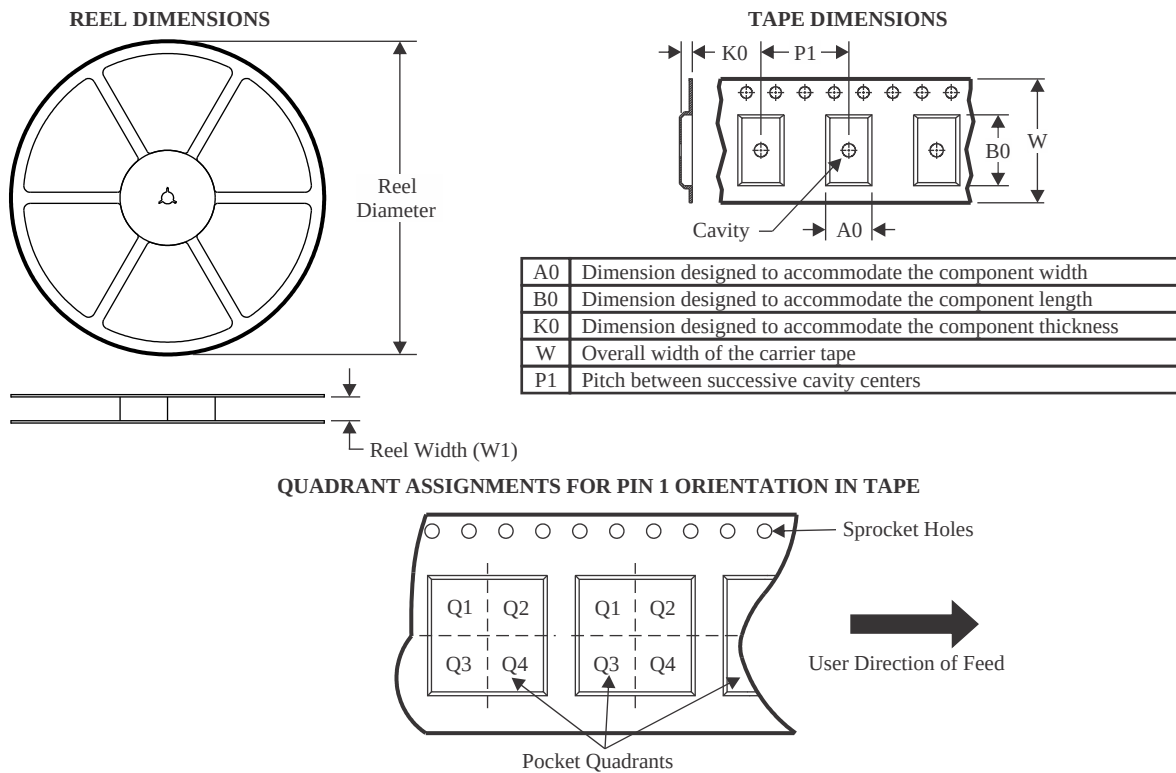
<sup>(6)</sup> **Part marking:** There may be an additional marking, which relates to the logo, the lot trace code information, or the environmental category of the part.

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

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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.

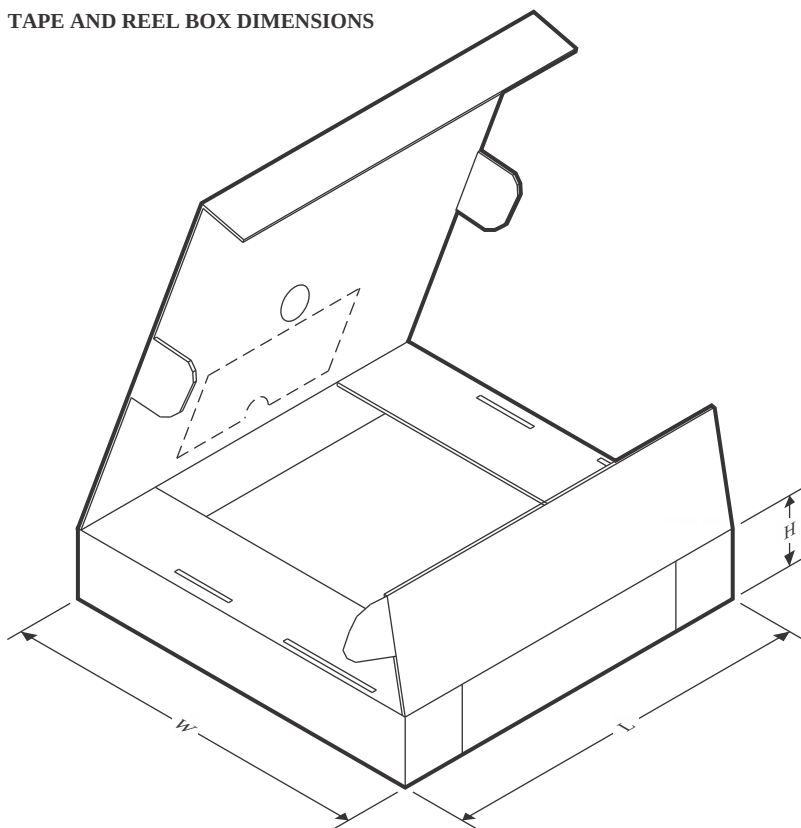
## TAPE AND REEL INFORMATION



\*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 |
|-------------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| SN74AUP1T98DBVR   | SOT-23       | DBV             | 6    | 3000 | 180.0              | 8.4                | 3.23    | 3.17    | 1.37    | 4.0     | 8.0    | Q3            |
| SN74AUP1T98DBVT   | SOT-23       | DBV             | 6    | 250  | 180.0              | 8.4                | 3.23    | 3.17    | 1.37    | 4.0     | 8.0    | Q3            |
| SN74AUP1T98DCKR   | SC70         | DCK             | 6    | 3000 | 178.0              | 8.4                | 2.25    | 2.45    | 1.2     | 4.0     | 8.0    | Q3            |
| SN74AUP1T98DCKR   | SC70         | DCK             | 6    | 3000 | 180.0              | 8.4                | 2.41    | 2.41    | 1.2     | 4.0     | 8.0    | Q3            |
| SN74AUP1T98DCKRG4 | SC70         | DCK             | 6    | 3000 | 180.0              | 8.4                | 2.41    | 2.41    | 1.2     | 4.0     | 8.0    | Q3            |
| SN74AUP1T98DCKT   | SC70         | DCK             | 6    | 250  | 180.0              | 8.4                | 2.41    | 2.41    | 1.2     | 4.0     | 8.0    | Q3            |
| SN74AUP1T98DRYR   | SON          | DRY             | 6    | 5000 | 180.0              | 8.4                | 1.25    | 1.6     | 0.7     | 4.0     | 8.0    | Q1            |
| SN74AUP1T98DSFR   | SON          | DSF             | 6    | 5000 | 180.0              | 8.4                | 1.16    | 1.16    | 0.63    | 4.0     | 8.0    | Q2            |
| SN74AUP1T98DSFR   | SON          | DSF             | 6    | 5000 | 180.0              | 8.4                | 1.16    | 1.16    | 0.5     | 4.0     | 8.0    | Q2            |

## TAPE AND REEL BOX DIMENSIONS



\*All dimensions are nominal

| Device            | Package Type | Package Drawing | Pins | SPQ  | Length (mm) | Width (mm) | Height (mm) |
|-------------------|--------------|-----------------|------|------|-------------|------------|-------------|
| SN74AUP1T98DBVR   | SOT-23       | DBV             | 6    | 3000 | 202.0       | 201.0      | 28.0        |
| SN74AUP1T98DBVT   | SOT-23       | DBV             | 6    | 250  | 202.0       | 201.0      | 28.0        |
| SN74AUP1T98DCKR   | SC70         | DCK             | 6    | 3000 | 208.0       | 191.0      | 35.0        |
| SN74AUP1T98DCKR   | SC70         | DCK             | 6    | 3000 | 202.0       | 201.0      | 28.0        |
| SN74AUP1T98DCKRG4 | SC70         | DCK             | 6    | 3000 | 202.0       | 201.0      | 28.0        |
| SN74AUP1T98DCKT   | SC70         | DCK             | 6    | 250  | 202.0       | 201.0      | 28.0        |
| SN74AUP1T98DRYR   | SON          | DRY             | 6    | 5000 | 202.0       | 201.0      | 28.0        |
| SN74AUP1T98DSFR   | SON          | DSF             | 6    | 5000 | 202.0       | 201.0      | 28.0        |
| SN74AUP1T98DSFR   | SON          | DSF             | 6    | 5000 | 210.0       | 185.0      | 35.0        |



## SOT-23 - 1.45 mm max height

## SMALL OUTLINE TRANSISTOR



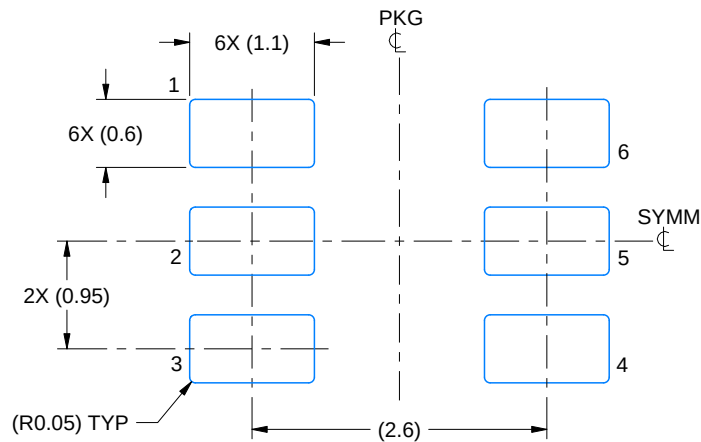
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. Body dimensions do not include mold flash or protrusion. Mold flash and protrusion shall not exceed 0.25 per side.
4. Leads 1,2,3 may be wider than leads 4,5,6 for package orientation.
5. Reference JEDEC MO-178.

# EXAMPLE BOARD LAYOUT

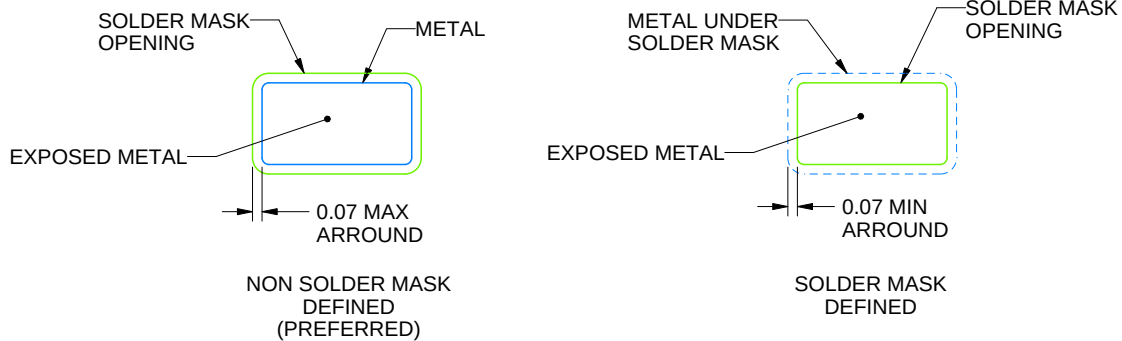
DBV0006A

SOT-23 - 1.45 mm max height

SMALL OUTLINE TRANSISTOR



LAND PATTERN EXAMPLE  
EXPOSED METAL SHOWN  
SCALE:15X



SOLDER MASK DETAILS

4214840/G 08/2024

NOTES: (continued)

6. Publication IPC-7351 may have alternate designs.

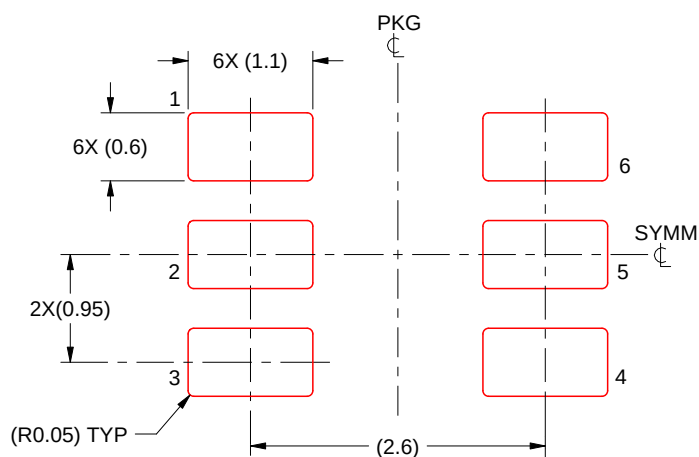
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

## EXAMPLE STENCIL DESIGN

DBV0006A

SOT-23 - 1.45 mm max height

SMALL OUTLINE TRANSISTOR



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

4214840/G 08/2024

NOTES: (continued)

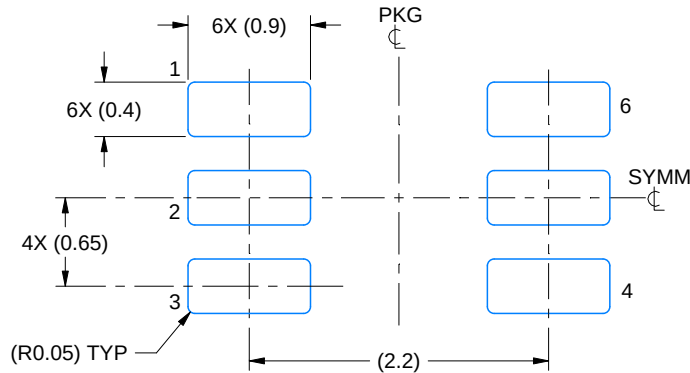
8. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
9. Board assembly site may have different recommendations for stencil design.



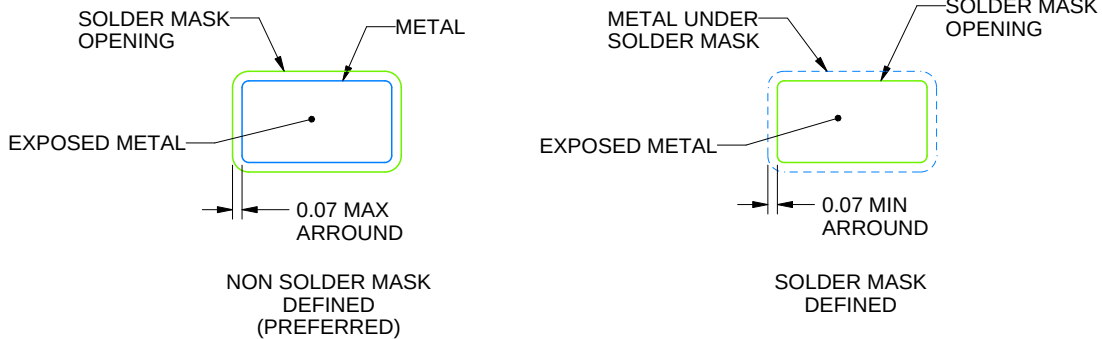
### SOT - 1.1 max height

[illegible]

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. Body dimensions do not include mold flash or protrusion. Mold flash and protrusion shall not exceed 0.15 per side.
4. Falls within JEDEC MO-203 variation AB.



LAND PATTERN EXAMPLE  
EXPOSED METAL SHOWN  
SCALE:18X

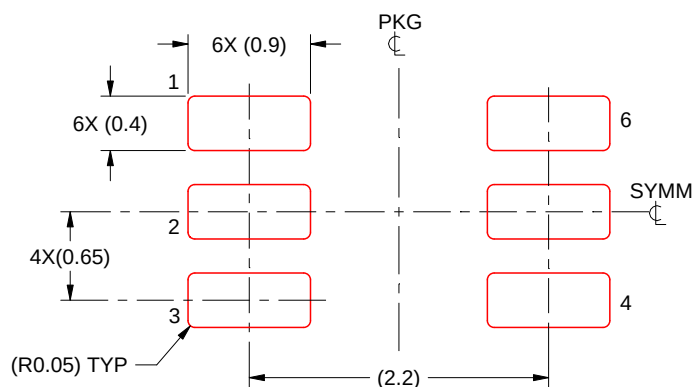


SOLDER MASK DETAILS

4214835/D 11/2024

NOTES: (continued)

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



SOLDER PASTE EXAMPLE  
 BASED ON 0.125 THICK STENCIL  
 SCALE:18X

4214835/D 11/2024

NOTES: (continued)

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

## GENERIC PACKAGE VIEW

**DRY 6**

**USON - 0.6 mm max height**

PLASTIC SMALL OUTLINE - NO LEAD



Images above are just a representation of the package family, actual package may vary.  
Refer to the product data sheet for package details.

4207181/G

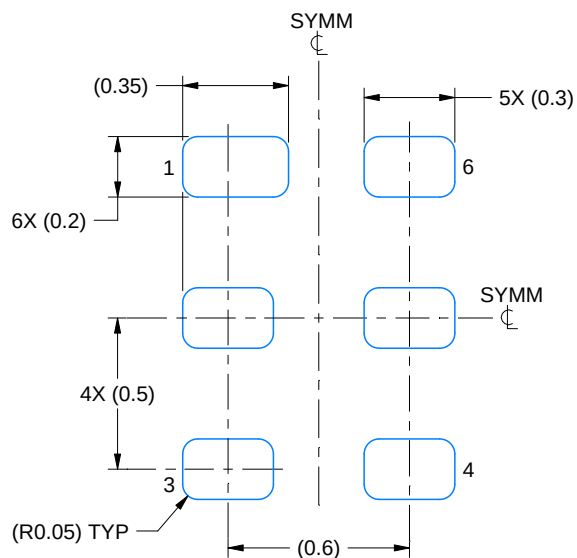


# EXAMPLE BOARD LAYOUT

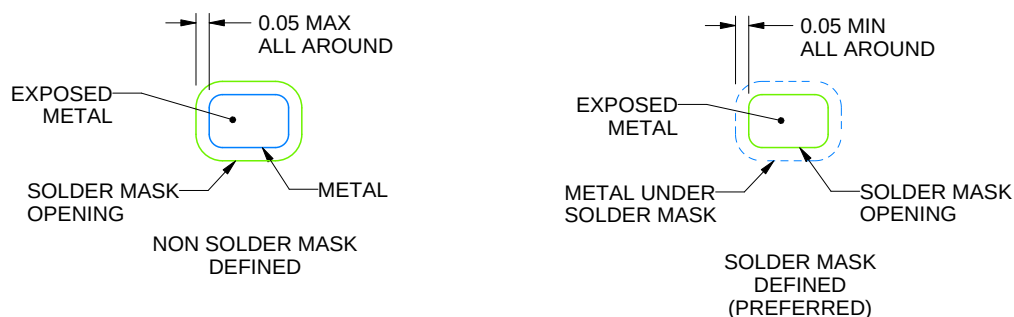
DRY0006A

USON - 0.6 mm max height

PLASTIC SMALL OUTLINE - NO LEAD



**LAND PATTERN EXAMPLE**  
1:1 RATIO WITH PKG SOLDER PADS  
EXPOSED METAL SHOWN  
SCALE:40X



**SOLDER MASK DETAILS**

4222894/A 01/2018

NOTES: (continued)

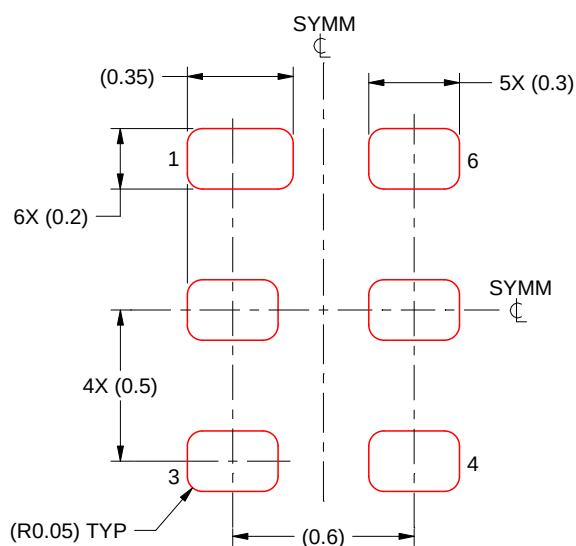
3. For more information, see QFN/SON PCB application report in literature No. SLUA271 ([www.ti.com/lit/sluea271](http://www.ti.com/lit/sluea271)).

## EXAMPLE STENCIL DESIGN

DRY0006A

USON - 0.6 mm max height

PLASTIC SMALL OUTLINE - NO LEAD



SOLDER PASTE EXAMPLE  
BASED ON 0.075 - 0.1 mm THICK STENCIL  
SCALE:40X

4222894/A 01/2018

NOTES: (continued)

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

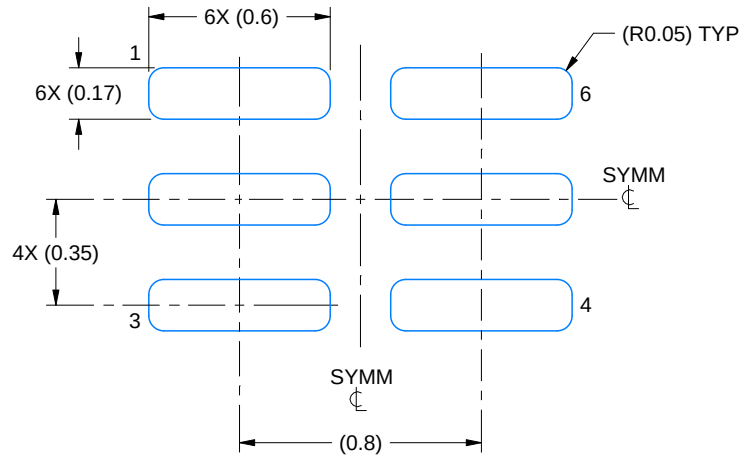


# EXAMPLE BOARD LAYOUT

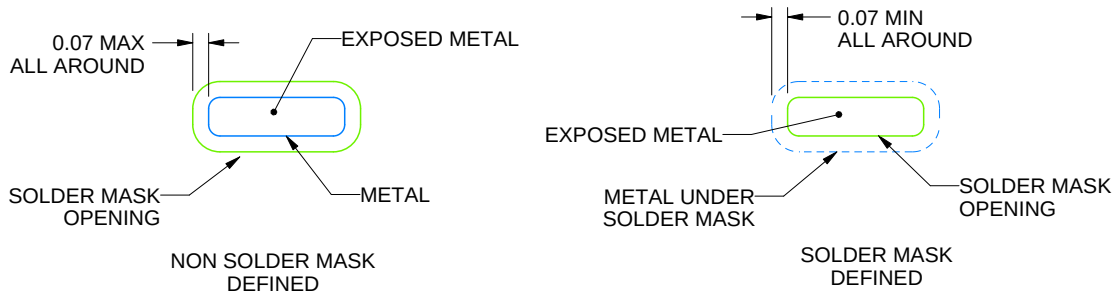
DSF0006A

X2SON - 0.4 mm max height

PLASTIC SMALL OUTLINE - NO LEAD



LAND PATTERN EXAMPLE  
EXPOSED METAL SHOWN  
SCALE:40X



SOLDER MASK DETAILS

4220597/B 06/2022

NOTES: (continued)

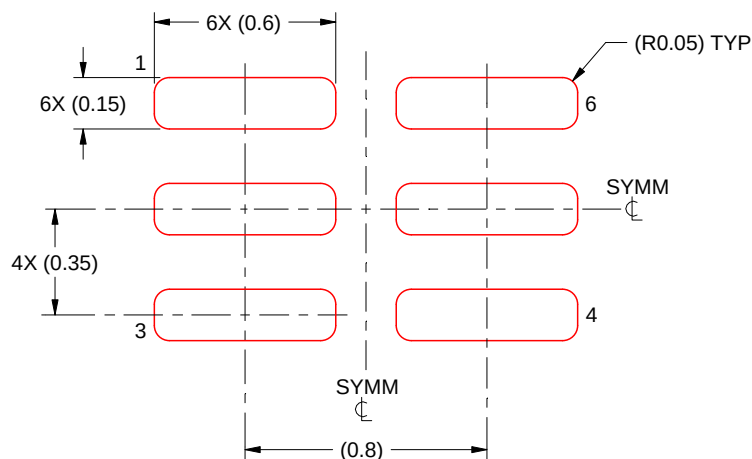
4. For more information, see Texas Instruments literature number SLUA271 ([www.ti.com/lit/sluea271](http://www.ti.com/lit/sluea271)).

## EXAMPLE STENCIL DESIGN

DSF0006A

X2SON - 0.4 mm max height

PLASTIC SMALL OUTLINE - NO LEAD



SOLDER PASTE EXAMPLE  
BASED ON 0.09 mm THICK STENCIL

PRINTED SOLDER COVERAGE BY AREA UNDER PACKAGE  
SCALE:40X

4220597/B 06/2022

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

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