

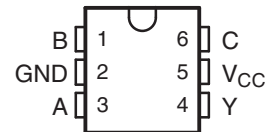
SINGLE-SUPPLY VOLTAGE-LEVEL TRANSLATOR WITH NINE CONFIGURABLE GATE LOGIC FUNCTIONS

Check for Samples: [SN74AUP1T98](#)

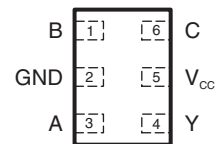
FEATURES

- 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 μ 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.

NanoStar is a trademark of Texas Instruments.

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 |

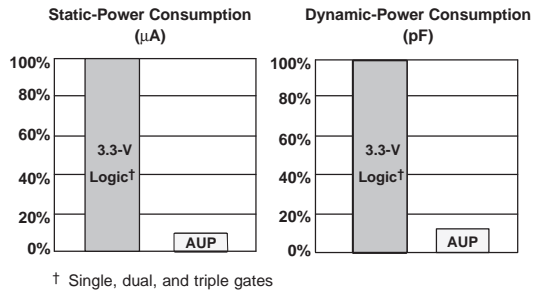


Figure 1. AUP – The Lowest-Power Family

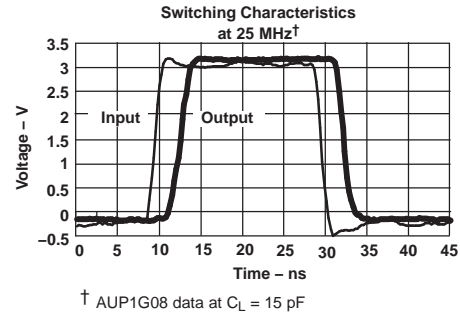


Figure 2. Excellent Signal Integrity

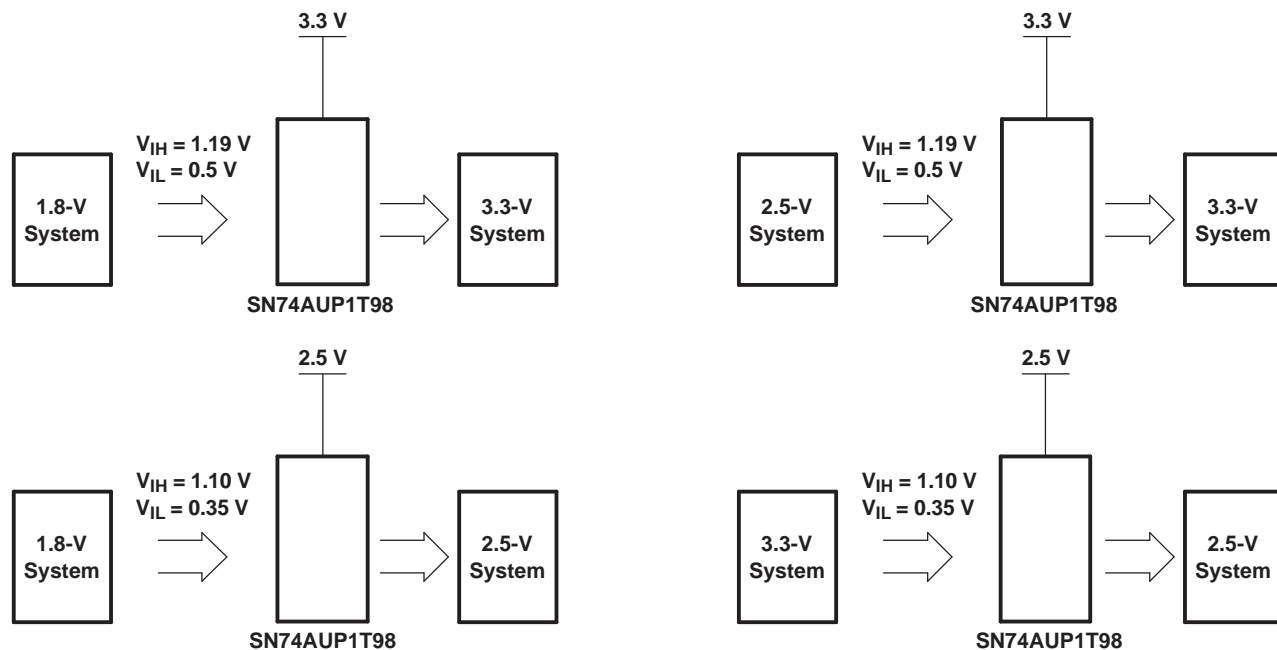


Figure 3. Possible Voltage-Translation Combinations

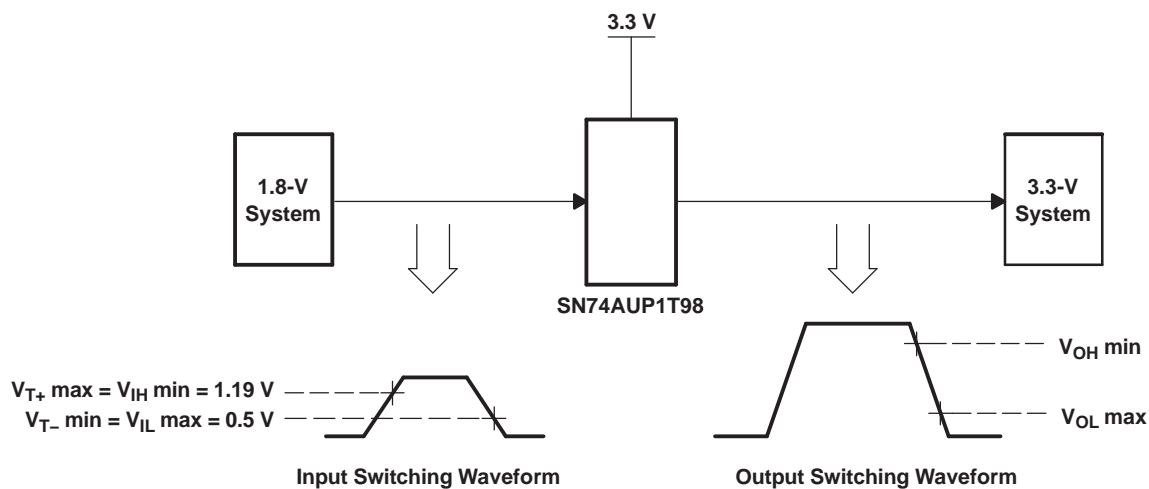
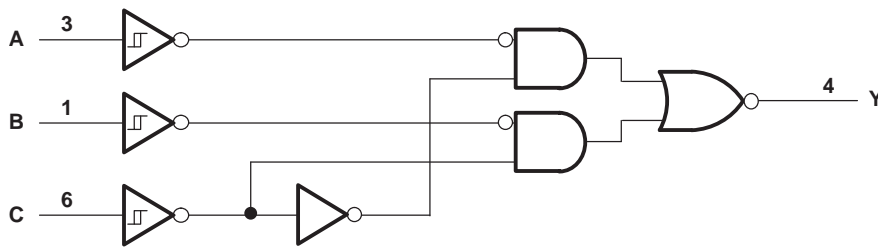


Figure 4. Switching Thresholds for 1.8-V to 3.3-V Translation

FUNCTION TABLE

| INPUTS | | | OUTPUT 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

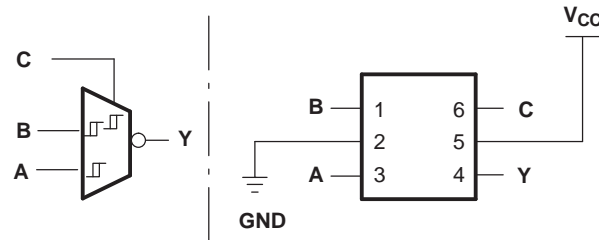


Figure 5. 157+04: 2-to-1 Data Selector With Inverted Output
 When C is L, Y = \overline{B}
 When C is H, Y = A

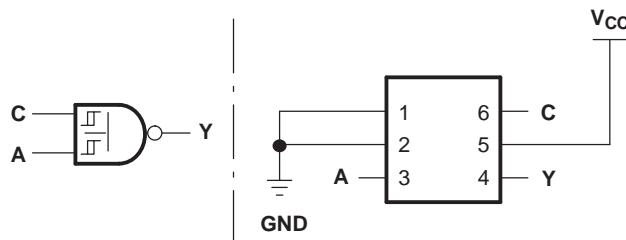


Figure 6. 00: 2-Input NAND Gate

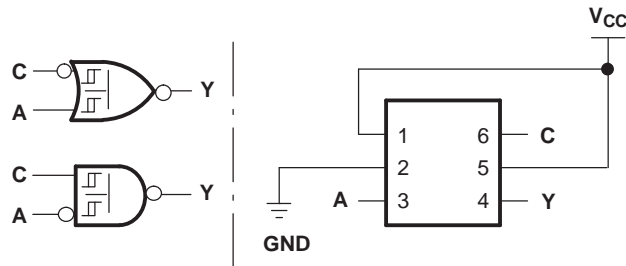


Figure 7. 14+02/14+08: 2-Input NOR Gate With One Inverted Input
2-Input NAND Gate With One Inverted Input

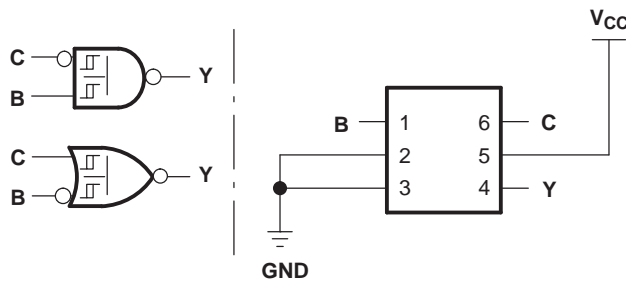


Figure 8. 14+00/14+32: 2-Input NAND Gate With One Inverted Input
2-Input NOR Gate With One Inverted Input

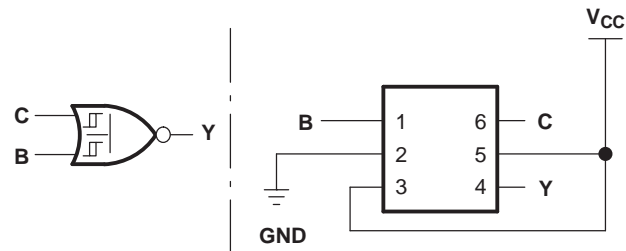


Figure 9. 32: 2-Input NOR Gate

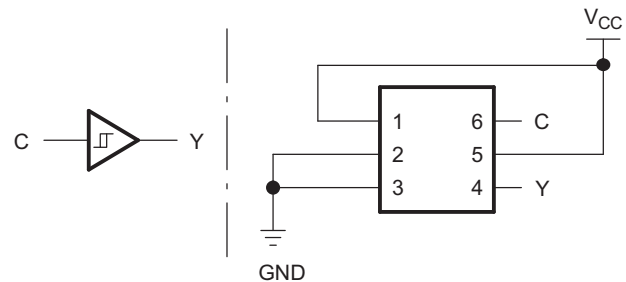
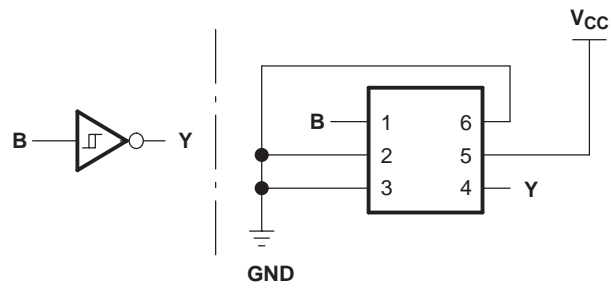


Figure 10. 17/34: Noninverted Buffer

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

ABSOLUTE MAXIMUM RATINGS⁽¹⁾

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

| | | MIN | MAX | UNIT |
|------------------|---|--------------------|-----------------------|------|
| V _{CC} | Supply voltage range | -0.5 | 4.6 | V |
| V _I | Input voltage range ⁽²⁾ | -0.5 | 4.6 | V |
| V _O | Voltage range applied to any output in the high-impedance or power-off state ⁽²⁾ | -0.5 | 4.6 | V |
| V _O | Output voltage range in the high or low state ⁽²⁾ | -0.5 | V _{CC} + 0.5 | V |
| I _{IK} | Input clamp current | V _I < 0 | -50 | mA |
| I _{OK} | Output clamp current | V _O < 0 | -50 | mA |
| I _O | Continuous output current | | ±20 | mA |
| | Continuous current through V _{CC} or GND | | ±50 | mA |
| θ _{JA} | Package thermal impedance ⁽³⁾ | DBV package | 165 | °C/W |
| | | DCK package | 259 | |
| | | DRY package | 340 | |
| | | DSF package | 300 | |
| | | YFP package | 123 | |
| | | YZP package | 123 | |
| T _{stg} | Storage temperature range | -65 | 150 | °C |

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

RECOMMENDED OPERATING CONDITIONS⁽¹⁾

| | | MIN | MAX | UNIT |
|-----------------|--------------------------------|-------------------------|-----------------|------|
| V _{CC} | Supply voltage | 2.3 | 3.6 | V |
| V _I | Input voltage | 0 | 3.6 | V |
| V _O | Output voltage | 0 | V _{CC} | V |
| I _{OH} | High-level output current | V _{CC} = 2.3 V | -3.1 | mA |
| | | V _{CC} = 3 V | -4 | |
| I _{OL} | Low-level output current | V _{CC} = 2.3 V | 3.1 | mA |
| | | V _{CC} = 3 V | 4 | |
| T _A | Operating free-air temperature | -40 | 85 | °C |

- (1) All unused inputs of the device must be held at V_{CC} 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 _{CC} | T _A = 25°C | | | T _A = -40°C to 85°C | | UNIT |
|---|---------------------------|--|-----------------------|-----|-----------------------|--------------------------------|------|------|
| | | | MIN | TYP | MAX | MIN | MAX | |
| V _{T+} 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 _{T-} 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 _T Hysteresis (V _{T+} - V _{T-}) | | 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 _{OH} | I _{OH} = -20 μA | 2.3 V to 3.6 V | V _{CC} - 0.1 | | V _{CC} - 0.1 | | V | |
| | I _{OH} = -2.3 mA | 2.3 V | 2.05 | | 1.97 | | | |
| | I _{OH} = -3.1 mA | | 1.9 | | 1.85 | | | |
| | I _{OH} = -2.7 mA | 3 V | 2.72 | | 2.67 | | | |
| | I _{OH} = -4 mA | | 2.6 | | 2.55 | | | |
| V _{OL} | I _{OL} = 20 μA | 2.3 V to 3.6 V | | | 0.1 | 0.1 | V | |
| | I _{OL} = 2.3 mA | 2.3 V | | | 0.31 | 0.33 | | |
| | I _{OL} = 3.1 mA | | | | 0.44 | 0.45 | | |
| | I _{OL} = 2.7 mA | 3 V | | | 0.31 | 0.33 | | |
| | I _{OL} = 4 mA | | | | 0.44 | 0.45 | | |
| I _I | All inputs | V _I = 3.6 V or GND | 0 V to 3.6 V | | 0.1 | 0.5 | μA | |
| I _{off} | | V _I or V _O = 0 V to 3.6 V | 0 V | | 0.1 | 0.5 | μA | |
| ΔI _{off} | | V _I or V _O = 3.6 V | 0 V to 0.2 V | | 0.2 | 0.5 | μA | |
| I _{CC} | | V _I = 3.6 V or GND, I _O = 0 | 2.3 V to 3.6 V | | 0.5 | 0.9 | μA | |
| ΔI _{CC} | | One input at 0.3 V or 1.1 V, Other inputs at 0 or V _{CC} , I _O = 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 _{CC} , I _O = 0 | 3 V to 3.6 V | | | 12 | | |
| C _i | | V _I = V _{CC} or GND | 3.3 V | | 1.5 | | pF | |
| C _o | | V _O = V _{CC} or GND | 3.3 V | | 3 | | pF | |

SWITCHING CHARACTERISTICS

over recommended operating free-air temperature range, V_{CC} = 2.5 V ± 0.2 V, V_I = 1.8 V ± 0.15 V (unless otherwise noted) (see Figure 12)

| PARAMETER | FROM (INPUT) | TO (OUTPUT) | C _L | T _A = 25°C | | | T _A = -40°C to 85°C | | UNIT |
|-----------------|-----------------|----------------|----------------|-----------------------|-----|-----|--------------------------------|------|------|
| | | | | MIN | TYP | MAX | MIN | MAX | |
| t _{pd} | 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 (INPUT) | TO (OUTPUT) | C_L | $T_A = 25^\circ\text{C}$ | | | $T_A = -40^\circ\text{C}$ to 85°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 (INPUT) | TO (OUTPUT) | C_L | $T_A = 25^\circ\text{C}$ | | | $T_A = -40^\circ\text{C}$ to 85°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 (INPUT) | TO (OUTPUT) | C_L | $T_A = 25^\circ\text{C}$ | | | $T_A = -40^\circ\text{C}$ to 85°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 (INPUT) | TO (OUTPUT) | C_L | $T_A = 25^\circ\text{C}$ | | | $T_A = -40^\circ\text{C}$ to 85°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](#))

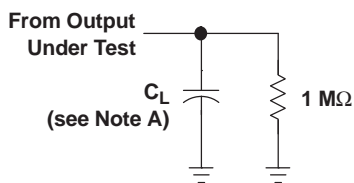
| PARAMETER | FROM (INPUT) | TO (OUTPUT) | C_L | $T_A = 25^\circ\text{C}$ | | | $T_A = -40^\circ\text{C}$ to 85°C | | UNIT |
|-----------|-----------------|----------------|-------|--------------------------|-----|-----|--|-----|------|
| | | | | MIN | TYP | MAX | MIN | MAX | |
| t_{pd} | A, B, or C | 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

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

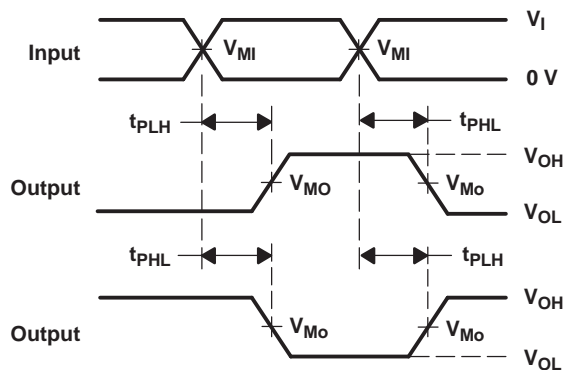
| PARAMETER | TEST CONDITIONS | $V_{CC} = 2.5 \text{ V}$ | $V_{CC} = 3.3 \text{ V}$ | UNIT |
|--|----------------------|--------------------------|--------------------------|------|
| | | TYP | TYP | |
| C_{pd} Power dissipation capacitance | $f = 10 \text{ MHz}$ | 4 | 5 | pF |

PARAMETER MEASUREMENT INFORMATION



LOAD CIRCUIT

| | $V_{CC} = 2.5\text{ V}$ $\pm 0.2\text{ V}$ | $V_{CC} = 3.3\text{ V}$ $\pm 0.3\text{ V}$ |
|----------|---|---|
| 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 MHz, $Z_O = 50\ \Omega$, slew rate \geq 1 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. | 2 |
| • Updated figure caption. | 5 |
| • Updated figure caption. | 5 |

PACKAGING INFORMATION

| Orderable Device | Status (1) | Package Type | Package Drawing | Pins | Package Qty | Eco Plan (2) | Lead/Ball Finish | MSL Peak Temp (3) | Op Temp (°C) | Device Marking (4/5) | Samples |
|-------------------|---------------|--------------|--------------------|------|----------------|----------------------------|------------------|----------------------|--------------|-------------------------|-------------------------|
| SN74AUP1T98DBVR | ACTIVE | SOT-23 | DBV | 6 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | HT6R | Samples |
| SN74AUP1T98DBVRE4 | ACTIVE | SOT-23 | DBV | 6 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | HT6R | Samples |
| SN74AUP1T98DBVRG4 | ACTIVE | SOT-23 | DBV | 6 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | HT6R | Samples |
| SN74AUP1T98DBVT | ACTIVE | SOT-23 | DBV | 6 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | HT6R | Samples |
| SN74AUP1T98DBVTE4 | ACTIVE | SOT-23 | DBV | 6 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | HT6R | Samples |
| SN74AUP1T98DBVTG4 | ACTIVE | SOT-23 | DBV | 6 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | HT6R | Samples |
| SN74AUP1T98DCKR | ACTIVE | SC70 | DCK | 6 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | TKR | Samples |
| SN74AUP1T98DCKRE4 | ACTIVE | SC70 | DCK | 6 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | TKR | Samples |
| SN74AUP1T98DCKRG4 | ACTIVE | SC70 | DCK | 6 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | TKR | Samples |
| SN74AUP1T98DCKT | ACTIVE | SC70 | DCK | 6 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | TKR | Samples |
| SN74AUP1T98DCKTE4 | ACTIVE | SC70 | DCK | 6 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | TKR | Samples |
| SN74AUP1T98DCKTG4 | ACTIVE | SC70 | DCK | 6 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | TKR | Samples |
| SN74AUP1T98DRYR | ACTIVE | SON | DRY | 6 | 5000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | TK | Samples |
| SN74AUP1T98DSFR | ACTIVE | SON | DSF | 6 | 5000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | TK | Samples |
| SN74AUP1T98YFPR | ACTIVE | DSBGA | YFP | 6 | 3000 | Green (RoHS & no Sb/Br) | SNAGCU | Level-1-260C-UNLIM | -40 to 85 | (TK2 ~ TKN) | Samples |
| SN74AUP1T98YZPR | ACTIVE | DSBGA | YZP | 6 | 3000 | Green (RoHS & no Sb/Br) | SNAGCU | Level-1-260C-UNLIM | -40 to 85 | TK7 | Samples |

(1) The marketing status values are defined as follows:
ACTIVE: Product device recommended for new designs.

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

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

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

OBSELETE: TI has discontinued the production of the device.

⁽²⁾ Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

TBD: The Pb-Free/Green conversion plan has not been defined.

Pb-Free (RoHS): TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

Pb-Free (RoHS Exempt): This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

Green (RoHS & no Sb/Br): TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

⁽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.

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TAPE AND REEL INFORMATION

QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE


*All dimensions are nominal

| Device | Package Type | Package Drawing | Pins | SPQ | Reel Diameter (mm) | Reel Width W1 (mm) | A0 (mm) | B0 (mm) | K0 (mm) | P1 (mm) | W (mm) | Pin1 Quadrant |
|-----------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| 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 | 180.0 | 8.4 | 2.25 | 2.4 | 1.22 | 4.0 | 8.0 | Q3 |
| SN74AUP1T98DCKT | SC70 | DCK | 6 | 250 | 180.0 | 8.4 | 2.25 | 2.4 | 1.22 | 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 |
| SN74AUP1T98YFPR | DSBGA | YFP | 6 | 3000 | 178.0 | 9.2 | 0.89 | 1.29 | 0.62 | 4.0 | 8.0 | Q1 |
| SN74AUP1T98YZPR | DSBGA | YZP | 6 | 3000 | 180.0 | 8.4 | 1.02 | 1.52 | 0.63 | 4.0 | 8.0 | Q1 |

TAPE AND REEL BOX DIMENSIONS


*All dimensions are nominal

| Device | Package Type | Package Drawing | Pins | SPQ | Length (mm) | Width (mm) | Height (mm) |
|-----------------|--------------|-----------------|------|------|-------------|------------|-------------|
| 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 | 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 |
| SN74AUP1T98YFPR | DSBGA | YFP | 6 | 3000 | 220.0 | 220.0 | 35.0 |
| SN74AUP1T98YZPR | DSBGA | YZP | 6 | 3000 | 220.0 | 220.0 | 34.0 |

DBV (R-PDSO-G6)

PLASTIC SMALL-OUTLINE PACKAGE



- NOTES:
- A. All linear dimensions are in millimeters.
 - B. This drawing is subject to change without notice.
 - C. Body dimensions do not include mold flash or protrusion. Mold flash and protrusion shall not exceed 0.15 per side.
 - D. Leads 1,2,3 may be wider than leads 4,5,6 for package orientation.
- $\triangle E$ Falls within JEDEC MO-178 Variation AB, except minimum lead width.

DBV (R-PDSO-G6)

PLASTIC SMALL OUTLINE



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

DCK (R-PDSO-G6)

PLASTIC SMALL-OUTLINE PACKAGE





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

DRY (R-PUSON-N6)

PLASTIC SMALL OUTLINE NO-LEAD

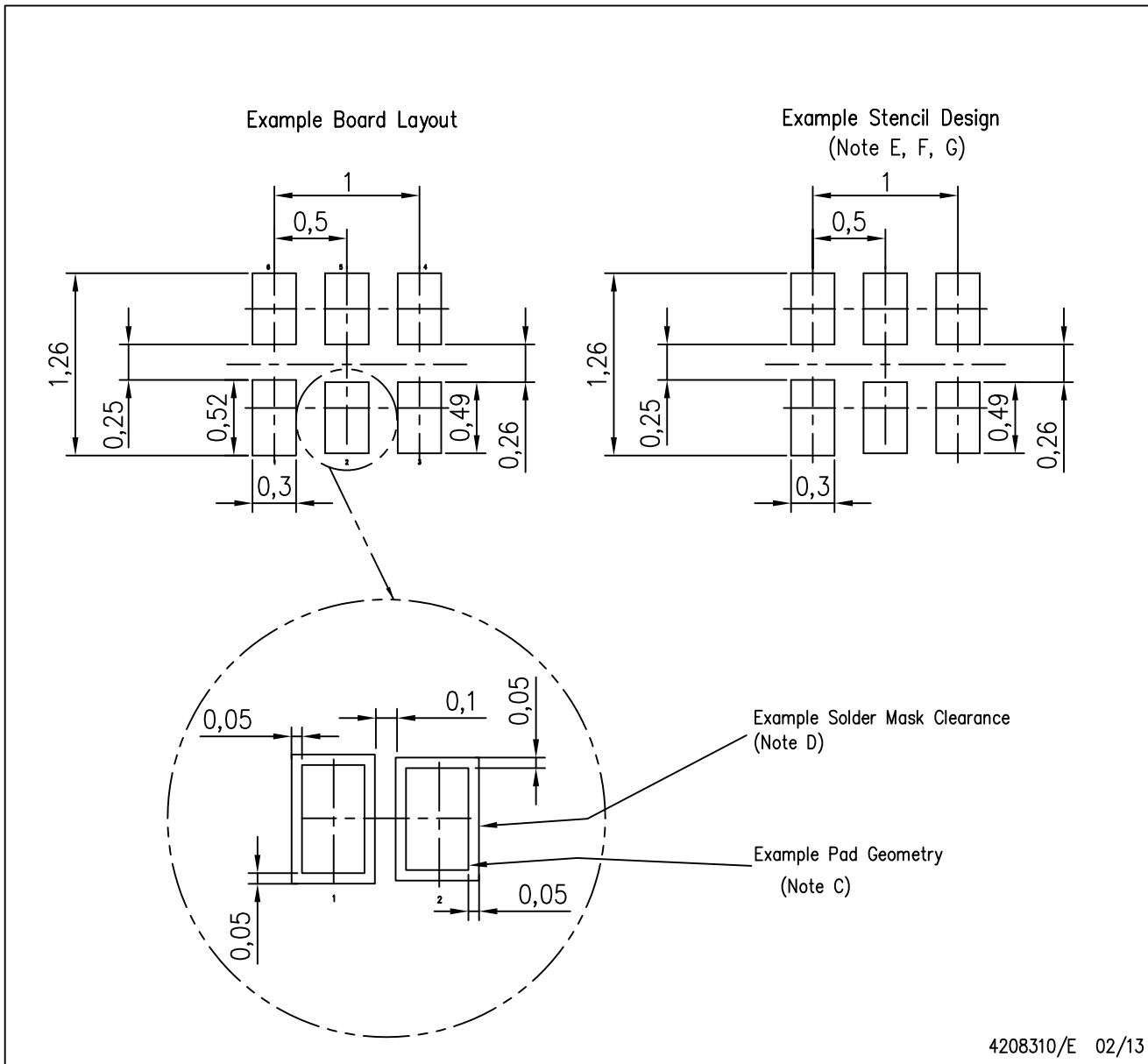


4207181/F 12/11

- NOTES:
- A. All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M-1994.
 - B. This drawing is subject to change without notice.
 - C. SON (Small Outline No-Lead) package configuration.
 -  The exposed lead frame feature on side of package may or may not be present due to alternative lead frame designs.
 - E. This package complies to JEDEC MO-287 variation UFAD.
 -  See the additional figure in the Product Data Sheet for details regarding the pin 1 identifier shape.

DRY (R-PUSON-N6)

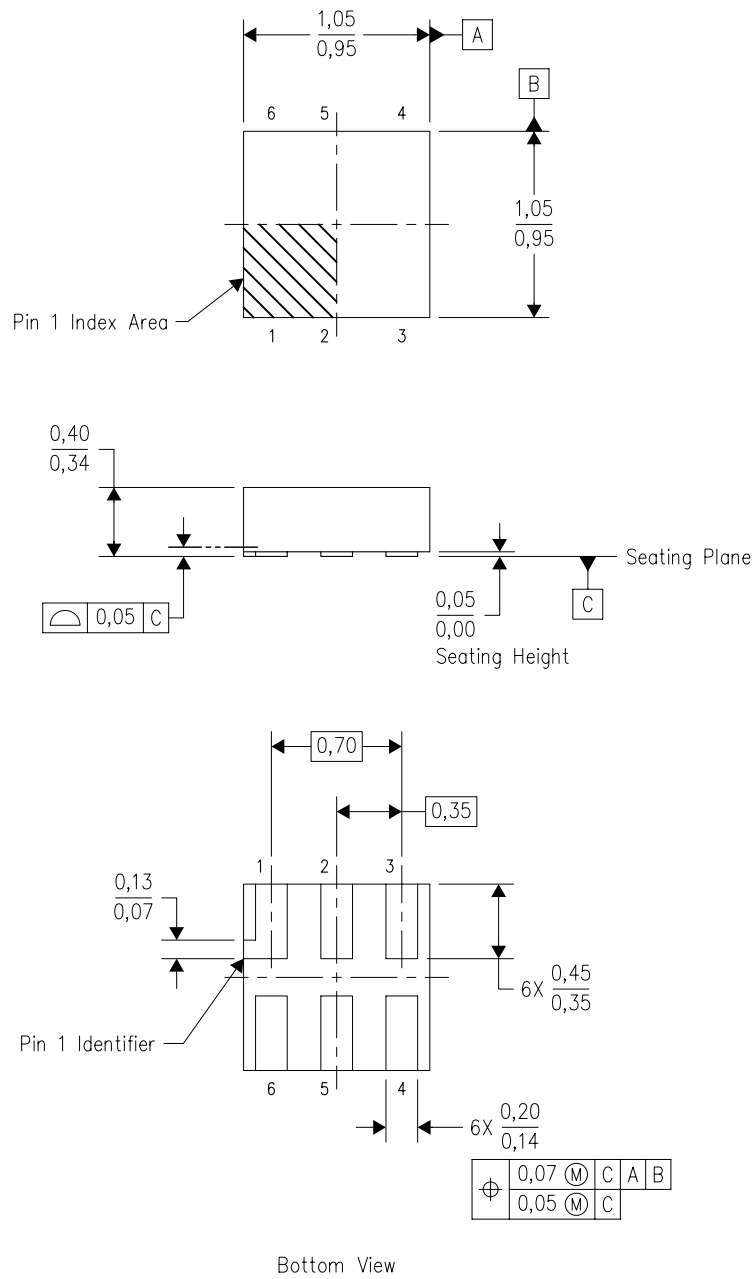
PLASTIC SMALL OUTLINE NO-LEAD



- NOTES:
- All linear dimensions are in millimeters.
 - This drawing is subject to change without notice.
 - Publication IPC-7351 is recommended for alternate designs.
 - Customers should contact their board fabrication site for minimum solder mask web tolerances between signal pads.
 - Maximum stencil thickness 0,127 mm (5 mils). All linear dimensions are in millimeters.
 - 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 stencil design considerations.
 - Side aperture dimensions over-print land for acceptable area ratio > 0.66 . Customer may reduce side aperture dimensions if stencil manufacturing process allows for sufficient release at smaller opening.

DSF (S-PX2SON-N6)

PLASTIC SMALL OUTLINE NO-LEAD



4208186/E 03/11

- NOTES:
- All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M-1994.
 - This drawing is subject to change without notice.
 - SON (Small Outline No-Lead) package configuration.
 - This package complies to JEDEC MO-287 variation X2AAF.

DSF (S-PX2SON-N6)

PLASTIC SMALL OUTLINE NO-LEAD

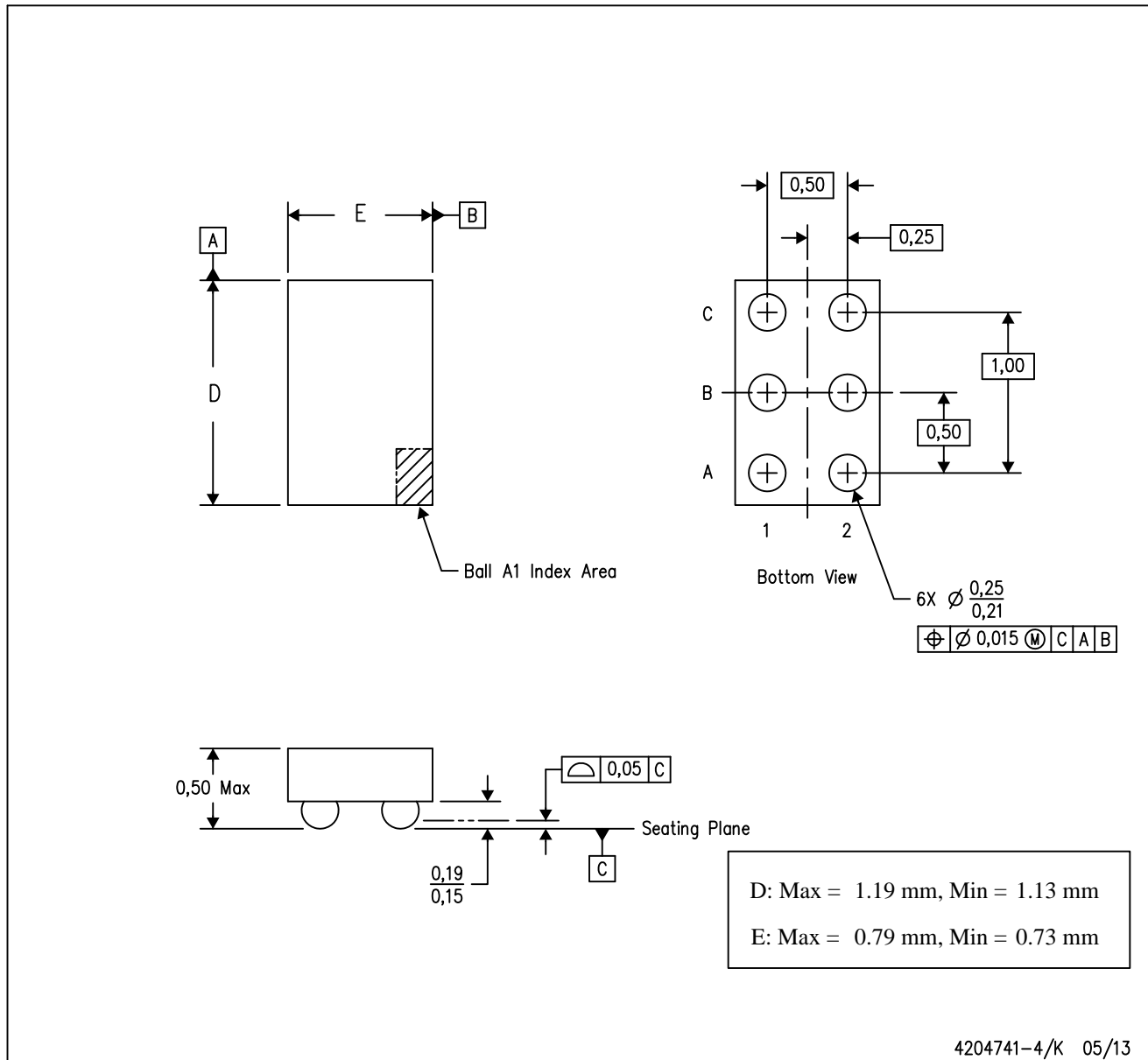


4210277/D 05/12

- NOTES:
- All linear dimensions are in millimeters.
 - This drawing is subject to change without notice.
 - Publication IPC-7351 is recommended for alternate designs.
 - Customers should contact their board fabrication site for minimum solder mask web tolerances between signal pads. If 2 mil solder mask is outside PCB vendor capability, it is advised to omit solder mask.
 - Maximum stencil thickness 0,1016 mm (4 mils). All linear dimensions are in millimeters.
 - 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 stencil design considerations.
 - Suggest stencils cut with lasers such as Fiber Laser that produce the greatest positional accuracy.
 - Component placement force should be minimized to prevent excessive paste block deformation.

YZP (R-XBGA-N6)

DIE-SIZE BALL GRID ARRAY



- NOTES:
- A. All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M-1994.
 - B. This drawing is subject to change without notice.
 - C. NanoFree™ package configuration.

NanoFree is a trademark of Texas Instruments.

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