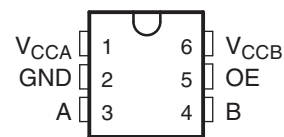


1-BIT BIDIRECTIONAL VOLTAGE-LEVEL TRANSLATOR FOR OPEN-DRAIN AND PUSH-PULL APPLICATIONS

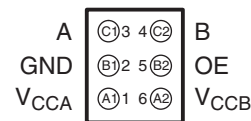
FEATURES

- No Direction-Control Signal Needed
- Maximum Data Rates
 - 24 Mbps (Push Pull)
 - 2 Mbps (Open Drain)
- Available in the Texas Instruments NanoFree™ Package
- 1.65 V to 3.6 V on A port and 2.3 V to 5.5 V on B port ($V_{CCA} \leq V_{CCB}$)
- V_{CC} Isolation Feature – If Either V_{CC} Input Is at GND, Both Ports Are in the High-Impedance State
- No Power-Supply Sequencing Required – Either V_{CCA} or V_{CCB} Can be Ramped First
- I_{off} Supports Partial-Power-Down Mode Operation
- Latch-Up Performance Exceeds 100 mA Per JESD 78, Class II
- ESD Protection Exceeds JESD 22
 - A Port
 - 2500-V Human-Body Model (A114-B)
 - 200-V Machine Model (A115-A)
 - 1500-V Charged-Device Model (C101)
 - B Port
 - 8-kV Human-Body Model (A114-B)
 - 200-V Machine Model (A115-A)
 - 1500-V Charged-Device Model (C101)

DBV, DCK, OR DRL PACKAGE
(TOP VIEW)



YZP PACKAGE
(BOTTOM VIEW)



DESCRIPTION/ORDERING INFORMATION

This one-bit noninverting translator uses two separate configurable power-supply rails. The A port is designed to track V_{CCA} . V_{CCA} accepts any supply voltage from 1.65 V to 3.6 V. The B port is designed to track V_{CCB} . V_{CCA} must be less than or equal to V_{CCB} . V_{CCB} accepts any supply voltage from 2.3 V to 5.5 V. This allows for low-voltage bidirectional translation between any of the 1.8-V, 2.5-V, 3.3-V, and 5-V voltage nodes.

When the output-enable (OE) input is low, all outputs are placed in the high-impedance state.

To ensure the high-impedance state during power up or power down, OE should be tied to GND through a pulldown resistor; the minimum value of the resistor is determined by the current-sourcing capability of the driver.



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

NanoFree is a trademark of Texas Instruments.

ORDERING INFORMATION

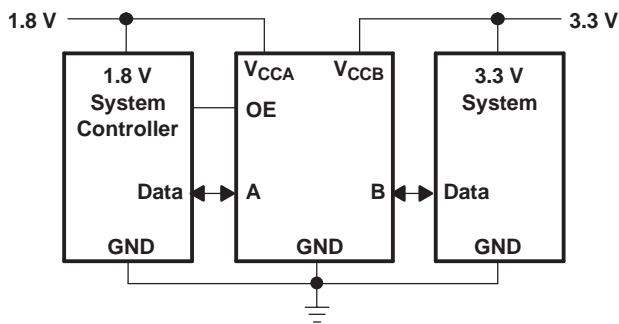
| T _A | PACKAGE ⁽¹⁾⁽²⁾ | | ORDERABLE PART NUMBER | TOP-SIDE MARKING ⁽³⁾ |
|----------------|--|-------------------|-----------------------|---------------------------------|
| –40°C to 85°C | NanoFree™ – WCSP (DSBGA) 0.23-mm Large Bump – YZP (Pb-free) | Reel of 3000 | TXS0101YZPR | _ _ _2G_ |
| | | Reel of 3000 | TXS0101DBVR | NFF_ |
| | SOT (SOT-23) – DBV | Reel of 250 | TXS0101DBVT | |
| | | SOT (SC-70) – DCK | Reel of 3000 | TXS0101DCKR |
| | Reel of 250 | | TXS0101DCKT | |
| | SOT (SOT-563) – DRL | Reel of 3000 | TXS0101DRLR | 2G_ |
| | | Reel of 250 | TXS0101DRLT | |

- (1) For the most current package and ordering information, see the Package Option Addendum at the end of this document, or see the TI web site at www.ti.com.
- (2) Package drawings, thermal data, and symbolization are available at www.ti.com/packaging.
- (3) DBV/DCK/DRL: The actual top-side marking has one additional character that designates the wafer fab/assembly site.
YZP: The actual top-side marking has three preceding characters to denote year, month, and sequence code, and one following character to designate the wafer fab/assembly site. Pin 1 identifier indicates solder-bump composition (1 = SnPb, • = Pb-free).

PIN DESCRIPTION

| NO. | NAME | FUNCTION |
|-----|------------------|---|
| 1 | V _{CCA} | A-port supply voltage. $1.65\text{ V} \leq V_{CCA} \leq 3.6\text{ V}$ and $V_{CCA} \leq V_{CCB}$ |
| 2 | GND | Ground |
| 3 | A | Input/output A. Referenced to V _{CCA} . |
| 4 | B | Input/output B. Referenced to V _{CCB} . |
| 5 | OE | Output enable. Pull OE low to place all outputs in 3-state mode. Referenced to V _{CCA} . |
| 6 | V _{CCB} | B-port supply voltage. $2.3\text{ V} \leq V_{CCB} \leq 5.5\text{ V}$ |

TYPICAL OPERATING CIRCUIT



ABSOLUTE MAXIMUM RATINGS⁽¹⁾

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

| | | | MIN | MAX | UNIT |
|------------------|---|--------------------|------|------------------------|------|
| V _{CCA} | Supply voltage range | | -0.5 | 4.6 | V |
| V _{CCB} | Supply voltage range | | -0.5 | 6.5 | V |
| V _I | Input voltage range ⁽²⁾ | A port | -0.5 | 4.6 | V |
| | | B port, OE | -0.5 | 6.5 | |
| V _O | Voltage range applied to any output in the high-impedance or power-off state ⁽²⁾ | A port | -0.5 | 4.6 | V |
| | | B port | -0.5 | 6.5 | |
| V _O | Voltage range applied to any output in the high or low state ⁽²⁾⁽³⁾ | A port | -0.5 | V _{CCA} + 0.5 | V |
| | | B port | -0.5 | V _{CCB} + 0.5 | |
| I _{IK} | Input clamp current | V _I < 0 | | -50 | mA |
| I _{OK} | Output clamp current | V _O < 0 | | -50 | mA |
| I _O | Continuous output current | | | ±50 | mA |
| | Continuous current through V _{CCA} , V _{CCB} , or GND | | | ±100 | mA |
| 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 and output negative-voltage ratings may be exceeded if the input and output current ratings are observed.
- (3) The value of V_{CCA} and V_{CCB} are provided in the recommended operating conditions table.

THERMAL IMPEDANCE RATINGS

| | | | UNIT |
|-----------------|--|-------------|------|
| θ _{JA} | Package thermal impedance ⁽¹⁾ | DBV package | 165 |
| | | DCK package | 259 |
| | | DRL package | 142 |
| | | YZP package | 123 |

- (1) The package thermal impedance is calculated in accordance with JESD 51-7.

RECOMMENDED OPERATING CONDITIONS⁽¹⁾⁽²⁾

| | | V_{CCA} | V_{CCB} | MIN | MAX | UNIT | |
|---------------------|------------------------------------|--------------------------------|------------------------------------|----------------|-----------------|-----------------------|------|
| V_{CCA} | Supply voltage ⁽³⁾ | | | 1.65 | 3.6 | V | |
| V_{CCB} | | | | 2.3 | 5.5 | | |
| V_{IH} | High-level input voltage | A-port I/Os | 1.65 V to 1.95 V 2.3 V to 3.6 V | 2.3 V to 5.5 V | $V_{CCI} - 0.2$ | V_{CCI} | V |
| | | | | | $V_{CCI} - 0.4$ | V_{CCI} | |
| | | B-port I/Os | 1.65 V to 3.6 V | 2.3 V to 5.5 V | $V_{CCI} - 0.4$ | V_{CCI} | |
| OE input | $V_{CCA} \times 0.65$ | 5.5 | | | | | |
| V_{IL} | Low-level input voltage | A-port I/Os | 1.65 V to 3.6 V | 2.3 V to 5.5 V | 0 | 0.15 | V |
| | | B-port I/Os | | | 0 | 0.15 | |
| | | OE input | | | 0 | $V_{CCA} \times 0.35$ | |
| $\Delta t/\Delta v$ | Input transition rise or fall rate | A-port I/Os, push-pull driving | 1.65 V to 3.6 V | 2.3 V to 5.5 V | | 10 | ns/V |
| | | B-port I/Os, push-pull driving | | | | 10 | |
| | | Control Input | | | | 10 | |
| T_A | Operating free-air temperature | | | -40 | 85 | °C | |

- (1) V_{CCI} is the supply associated with the input port.
- (2) V_{CCO} is the supply associated with the output port.
- (3) V_{CCA} must be less than or equal to V_{CCB} , and V_{CCA} must not exceed 3.6 V.

ELECTRICAL CHARACTERISTICS⁽¹⁾⁽²⁾⁽³⁾

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

| PARAMETER | TEST CONDITIONS | V_{CCA} | V_{CCB} | $T_A = 25^\circ\text{C}$ | | | $-40^\circ\text{C to } 85^\circ\text{C}$ | | UNIT |
|---------------------|---|---------------------|-----------------|--------------------------|-----|---------|--|---------|---------------|
| | | | | MIN | TYP | MAX | MIN | MAX | |
| V_{OHA} | $I_{OH} = -20 \mu\text{A}$, $V_{IB} \geq V_{CCB} - 0.4 \text{ V}$ | 1.65 V to 3.6 V | 2.3 V to 5.5 V | | | | $V_{CCA} \times 0.67$ | | V |
| V_{OLA} | $I_{OL} = 1 \text{ mA}$, $V_{IB} \leq 0.15 \text{ V}$ | 1.65 V to 3.6 V | 2.3 V to 5.5 V | | | | 0.4 | | V |
| V_{OHB} | $I_{OH} = -20 \mu\text{A}$, $V_{IA} \geq V_{CCA} - 0.2 \text{ V}$ | 1.65 V to 3.6 V | 2.3 V to 5.5 V | | | | $V_{CCB} \times 0.67$ | | V |
| V_{OLB} | $I_{OL} = 1 \text{ mA}$, $V_{IA} \leq 0.15 \text{ V}$ | 1.65 V to 3.6 V | 2.3 V to 5.5 V | | | | 0.4 | | V |
| I_I | OE | 1.65 V to 3.6 V | 1.65 V to 5.5 V | | | ± 1 | | ± 2 | μA |
| I_{off} | A port | 0 V | 0 to 5.5 V | | | ± 1 | | ± 2 | μA |
| | B port | 0 to 3.6 V | 0 V | | | ± 1 | | ± 2 | μA |
| I_{OZ} | A or B port | 1.65 V to 3.6 V | 2.3 V to 5.5 V | | | ± 1 | | ± 2 | μA |
| I_{CCA} | $V_I = V_O = \text{open}$, $I_O = 0$ | 1.65 V to V_{CCB} | 2.3 V to 5.5 V | | | | 2.4 | | μA |
| | | 3.6 V | 0 V | | | | 2.2 | | |
| | | 0 V | 5.5 V | | | | -1 | | |
| I_{CCB} | $V_I = V_O = \text{open}$, $I_O = 0$ | 1.65 V to V_{CCB} | 2.3 V to 5.5 V | | | | 12 | | μA |
| | | 3.6 V | 0 V | | | | -1 | | |
| | | 0 V | 5.5 V | | | | 1 | | |
| $I_{CCA} + I_{CCB}$ | $V_I = V_{CCI}$, $I_O = 0$ | 1.65 V to V_{CCB} | 2.3 V to 5.5 V | | | | 14.4 | | μA |
| C_I | OE | 3.3 V | 3.3 V | | | 2.5 | | 3.5 | pF |
| C_{io} | A port | 3.3 V | 3.3 V | | | 5 | | 6 | pF |
| | B port | | | | | 6 | | 7.5 | |

- (1) V_{CCI} is the V_{CC} associated with the input port.
- (2) V_{CCO} is the V_{CC} associated with the output port.
- (3) V_{CCA} must be less than or equal to V_{CCB} , and V_{CCA} must not exceed 3.6 V.

TIMING REQUIREMENTS

 over recommended operating free-air temperature range, $V_{CCA} = 1.8 \text{ V} \pm 0.15 \text{ V}$ (unless otherwise noted)

| | | | $V_{CCB} = 2.5 \text{ V} \pm 0.2 \text{ V}$ | | $V_{CCB} = 3.3 \text{ V} \pm 0.3 \text{ V}$ | | $V_{CCB} = 5 \text{ V} \pm 0.5 \text{ V}$ | | UNIT |
|-----------|--------------------|--------------------|---|-----|---|-----|---|-----|------|
| | | | MIN | MAX | MIN | MAX | MIN | MAX | |
| Data rate | Push-pull driving | | 21 | | 22 | | 24 | | Mbps |
| | Open-drain driving | | 2 | | 2 | | 2 | | |
| t_w | Pulse duration | Push-pull driving | 47 | | 45 | | 41 | | ns |
| | | Open-drain driving | 500 | | 500 | | 500 | | |

TIMING REQUIREMENTS

 over recommended operating free-air temperature range, $V_{CCA} = 2.5 \text{ V} \pm 0.2 \text{ V}$ (unless otherwise noted)

| | | | $V_{CCB} = 2.5 \text{ V} \pm 0.2 \text{ V}$ | | $V_{CCB} = 3.3 \text{ V} \pm 0.3 \text{ V}$ | | $V_{CCB} = 5 \text{ V} \pm 0.5 \text{ V}$ | | UNIT |
|-----------|--------------------|--------------------|---|-----|---|-----|---|-----|------|
| | | | MIN | MAX | MIN | MAX | MIN | MAX | |
| Data rate | Push-pull driving | | 20 | | 22 | | 24 | | Mbps |
| | Open-drain driving | | 2 | | 2 | | 1 | | |
| t_w | Pulse duration | Push-pull driving | 50 | | 45 | | 41 | | ns |
| | | Open-drain driving | 500 | | 500 | | 500 | | |

TIMING REQUIREMENTS

 over recommended operating free-air temperature range, $V_{CCA} = 3.3 \text{ V} \pm 0.3 \text{ V}$ (unless otherwise noted)

| | | | $V_{CCB} = 3.3 \text{ V} \pm 0.3 \text{ V}$ | | $V_{CCB} = 5 \text{ V} \pm 0.5 \text{ V}$ | | UNIT |
|-----------|--------------------|--------------------|---|-----|---|-----|------|
| | | | MIN | MAX | MIN | MAX | |
| Data rate | Push-pull driving | | 23 | | 24 | | Mbps |
| | Open-drain driving | | 2 | | 2 | | |
| t_w | Pulse duration | Push-pull driving | 43 | | 41 | | ns |
| | | Open-drain driving | 500 | | 500 | | |

SWITCHING CHARACTERISTICS

over recommended operating free-air temperature range, $V_{CCA} = 1.8 \text{ V} \pm 0.15 \text{ V}$ (unless otherwise noted)

| PARAMETER | FROM (INPUT) | TO (OUTPUT) | TEST CONDITIONS | $V_{CCB} = 2.5 \text{ V} \pm 0.2 \text{ V}$ | | $V_{CCB} = 3.3 \text{ V} \pm 0.3 \text{ V}$ | | $V_{CCB} = 5 \text{ V} \pm 0.5 \text{ V}$ | | UNIT |
|---------------|------------------|----------------|--------------------|---|------|---|------|---|------|------|
| | | | | MIN | MAX | MIN | MAX | MIN | MAX | |
| t_{PHL} | A | B | Push-pull driving | 5.3 | | 5.4 | | 6.8 | | ns |
| | | | Open-drain driving | 2.3 | 8.8 | 2.4 | 9.6 | 2.6 | 10 | |
| t_{PLH} | | | Push-pull driving | 6.8 | | 7.1 | | 7.5 | | |
| | | | Open-drain driving | 45 | 260 | 36 | 208 | 27 | 198 | |
| t_{PHL} | B | A | Push-pull driving | 4.4 | | 4.5 | | 4.7 | | ns |
| | | | Open-drain driving | 1.9 | 5.3 | 1.1 | 4.4 | 1.2 | 4 | |
| t_{PLH} | | | Push-pull driving | 5.3 | | 4.5 | | 0.5 | | |
| | | | Open-drain driving | 45 | 175 | 36 | 140 | 27 | 102 | |
| t_{en} | OE | A or B | | 200 | | 200 | | 200 | | ns |
| t_{dis} | OE | A or B | | 50 | | 40 | | 35 | | ns |
| t_{rA} | A-port rise time | | Push-pull driving | 3.2 | 9.5 | 2.3 | 9.3 | 2 | 7.6 | ns |
| | | | Open-drain driving | 38 | 165 | 30 | 132 | 22 | 95 | |
| t_{rB} | B-port rise time | | Push-pull driving | 1.1 | 10.8 | 1 | 9.1 | 1 | 7.6 | ns |
| | | | Open-drain driving | 34 | 145 | 23 | 106 | 10 | 76 | |
| t_{fA} | A-port fall time | | Push-pull driving | 1.9 | 5.9 | 1.9 | 6 | 1.4 | 13.3 | ns |
| | | | Open-drain driving | 4.4 | 6.9 | 4.3 | 6.4 | 4.2 | 6.1 | |
| t_{fB} | B-port fall time | | Push-pull driving | 2.2 | 13.8 | 2.2 | 16.2 | 2.6 | 16.2 | ns |
| | | | Open-drain driving | 6.9 | 13.8 | 7.5 | 16.2 | 7 | 16.2 | |
| Max data rate | | | Push-pull driving | 21 | | 22 | | 24 | | Mbps |
| | | | Open-drain driving | 2 | | 2 | | 2 | | |

SWITCHING CHARACTERISTICS

 over recommended operating free-air temperature range, $V_{CCA} = 2.5 \text{ V} \pm 0.2 \text{ V}$ (unless otherwise noted)

| PARAMETER | FROM (INPUT) | TO (OUTPUT) | TEST CONDITIONS | $V_{CCB} = 2.5 \text{ V} \pm 0.2 \text{ V}$ | | $V_{CCB} = 3.3 \text{ V} \pm 0.3 \text{ V}$ | | $V_{CCB} = 5 \text{ V} \pm 0.5 \text{ V}$ | | UNIT |
|---------------|------------------|----------------|--------------------|---|-----|---|-----|---|------|------|
| | | | | MIN | MAX | MIN | MAX | MIN | MAX | |
| t_{PHL} | A | B | Push-pull driving | 3.2 | | 3.7 | | 3.8 | | ns |
| | | | Open-drain driving | 1.7 | 6.3 | 2 | 6 | 2.1 | 5.8 | |
| t_{PLH} | | | Push-pull driving | 3.5 | | 4.1 | | 4.4 | | |
| | | | Open-drain driving | 43 | 250 | 36 | 206 | 27 | 190 | |
| t_{PHL} | B | A | Push-pull driving | 3 | | 3.6 | | 4.3 | | ns |
| | | | Open-drain driving | 1.8 | 4.7 | 1.6 | 4.2 | 1.2 | 4 | |
| t_{PLH} | | | Push-pull driving | 2.5 | | 1.6 | | 1 | | |
| | | | Open-drain driving | 44 | 170 | 37 | 140 | 27 | 103 | |
| t_{en} | OE | A or B | | 200 | | 200 | | 200 | | ns |
| t_{dis} | OE | A or B | | 50 | | 40 | | 35 | | ns |
| t_{rA} | A-port rise time | | Push-pull driving | 2.8 | 7.4 | 2.1 | 6.6 | 0.9 | 5.6 | ns |
| | | | Open-drain driving | 34 | 149 | 28 | 121 | 24 | 89 | |
| t_{rB} | B-port rise time | | Push-pull driving | 1.3 | 8.3 | 0.9 | 7.2 | 0.4 | 6.1 | ns |
| | | | Open-drain driving | 35 | 151 | 24 | 112 | 12 | 81 | |
| t_{fA} | A-port fall time | | Push-pull driving | 1.9 | 5.7 | 1.4 | 5.5 | 0.8 | 5.3 | ns |
| | | | Open-drain driving | 4.4 | 6.9 | 4.3 | 6.2 | 4.2 | 5.8 | |
| t_{fB} | B-port fall time | | Push-pull driving | 2.2 | 7.8 | 2.4 | 6.7 | 2.6 | 6.6 | ns |
| | | | Open-drain driving | 5.1 | 8.8 | 5.4 | 9.4 | 5.4 | 10.4 | |
| Max data rate | | | Push-pull driving | 20 | | 22 | | 24 | | Mbps |
| | | | Open-drain driving | 2 | | 2 | | 2 | | |

SWITCHING CHARACTERISTICS

over recommended operating free-air temperature range, $V_{CCA} = 3.3 \text{ V} \pm 0.3 \text{ V}$ (unless otherwise noted)

| PARAMETER | FROM (INPUT) | TO (OUTPUT) | TEST CONDITIONS | $V_{CCB} = 3.3 \text{ V} \pm 0.3 \text{ V}$ | | $V_{CCB} = 5 \text{ V} \pm 0.5 \text{ V}$ | | UNIT |
|---------------|--------------------|----------------|--------------------|---|--------------------|---|-----|------|
| | | | | MIN | MAX | MIN | MAX | |
| t_{PHL} | A | B | Push-pull driving | 2.4 | | 3.1 | | ns |
| t_{PLH} | | | Open-drain driving | 1.3 | 4.2 | 1.4 | 4.6 | |
| | | | Push-pull driving | 4.2 | | 4.4 | | |
| t_{PHL} | | | B | A | Open-drain driving | 36 | 204 | |
| | Push-pull driving | 2.5 | | | 3.3 | | | |
| t_{PLH} | Open-drain driving | 1 | | | 124 | 1 | 97 | |
| | Push-pull driving | 2.5 | | | 2.6 | | | |
| t_{en} | OE | A or B | | 200 | | 200 | | ns |
| t_{dis} | OE | A or B | | 40 | | 35 | | ns |
| t_{rA} | A-port rise time | | Push-pull driving | 2.3 | 5.6 | 1.9 | 4.8 | ns |
| | | | Open-drain driving | 25 | 116 | 19 | 85 | |
| t_{rB} | B-port rise time | | Push-pull driving | 1.6 | 6.4 | 0.6 | 7.4 | ns |
| | | | Open-drain driving | 26 | 116 | 14 | 72 | |
| t_{fA} | A-port fall time | | Push-pull driving | 1.4 | 5.4 | 1 | 5 | ns |
| | | | Open-drain driving | 4.3 | 6.1 | 4.2 | 5.7 | |
| t_{fB} | B-port fall time | | Push-pull driving | 2.3 | 7.4 | 2.4 | 7.6 | ns |
| | | | Open-drain driving | 5 | 7.6 | 4.8 | 8.3 | |
| Max data rate | | | Push-pull driving | 23 | | 24 | | Mbps |
| | | | Open-drain driving | 2 | | 2 | | |

PRINCIPLES OF OPERATION

Applications

The TXS0101 can be used in level-translation applications for interfacing devices or systems operating at different interface voltages with one another. The TXS0101 is ideal for use in applications where an open-drain driver is connected to the data I/Os. The TXB0101 can also be used in applications where a push-pull driver is connected to the data I/Os, but the TXB0102 might be a better option for such push-pull applications.

Architecture

The TXS0101 architecture (see [Figure 1](#)) does not require a direction-control signal to control the direction of data flow from A to B or from B to A.

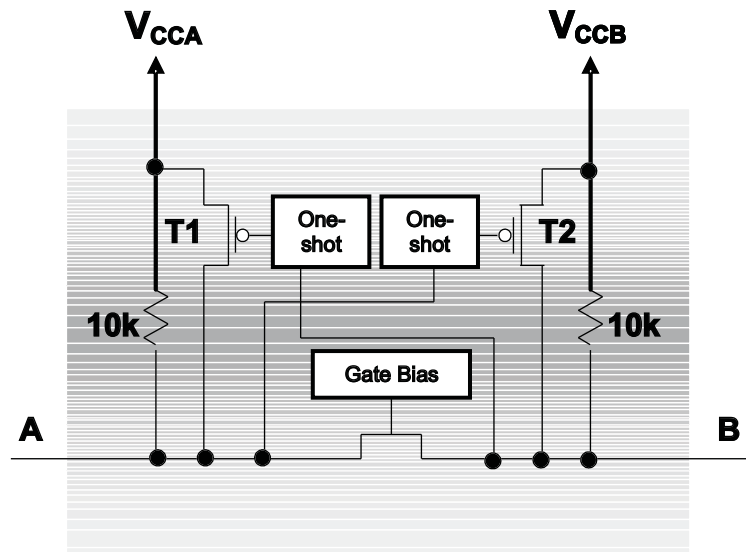


Figure 1. Architecture of a TXS01xx Cell

Each A-port I/O has an internal 10-k Ω pullup resistor to V_{CCA} , and each B-port I/O has an internal 10-k Ω pullup resistor to V_{CCB} . The output one-shots detect rising edges on the A or B ports. During a rising edge, the one-shot turns on the PMOS transistors (T1,T2) for a short duration, which speeds up the low-to-high transition.

Input Driver Requirements

The fall time (t_{fA} , t_{fB}) of a signal depends on the output impedance of the external device driving the data I/Os of the TXS0101. Similarly, the t_{PHL} and max data rates also depend on the output impedance of the external driver. The values for t_{fA} , t_{fB} , t_{PHL} , and maximum data rates in the data sheet assume that the output impedance of the external driver is less than 50 Ω .

Power Up

During operation, ensure that $V_{CCA} \leq V_{CCB}$ at all times. During power-up sequencing, $V_{CCA} \geq V_{CCB}$ does not damage the device, so any power supply can be ramped up first.

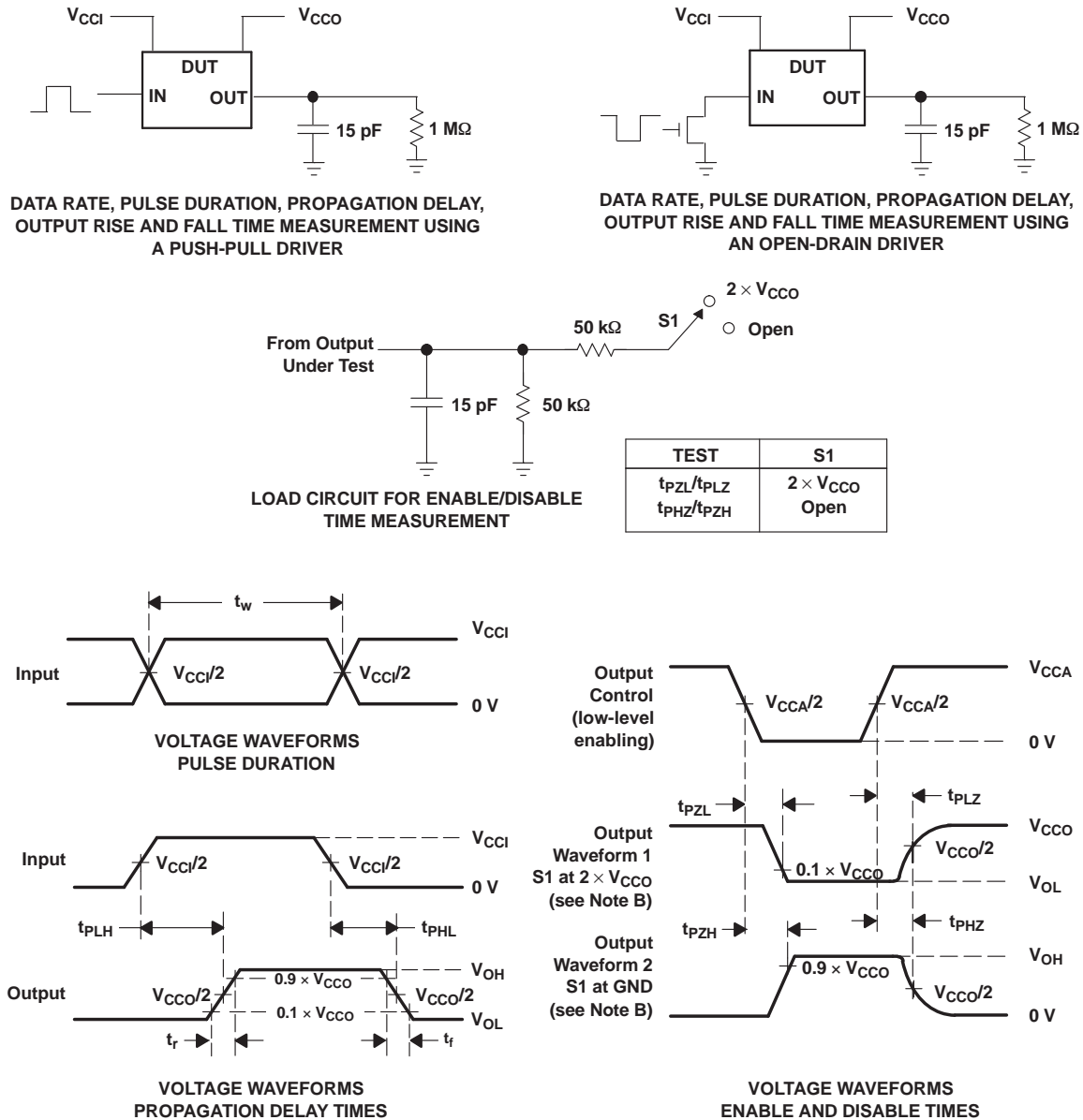
Enable and Disable

The TXS0101 has an OE input that is used to disable the device by setting OE low, which places all I/Os in the Hi-Z state. The disable time (t_{dis}) indicates the delay between the time when OE goes low and when the outputs actually get disabled (Hi-Z). The enable time (t_{en}) indicates the amount of time the user must allow for the one-shot circuitry to become operational after OE is taken high.

Pullup or Pulldown Resistors on I/O Lines

Each A-port I/O has an internal 10-k Ω pullup resistor to V_{CCA} , and each B-port I/O has an internal 10-k Ω pullup resistor to V_{CCB} . If a smaller value of pullup resistor is required, an external resistor must be added from the I/O to V_{CCA} or V_{CCB} (in parallel with the internal 10-k Ω resistors).

PARAMETER MEASUREMENT INFORMATION



- 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: $PRR \leq 10$ MHz, $Z_O = 50 \Omega$, $dv/dt \geq 1$ V/ns.
- 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. V_{CCI} is the V_{CC} associated with the input port.
- I. V_{CCO} is the V_{CC} associated with the output port.
- J. All parameters and waveforms are not applicable to all devices.

Figure 2. Load Circuit and Voltage Waveforms

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 |
|------------------|---------------|--------------|-----------------|------|-------------|-------------------------|------------------|----------------------|--------------|-------------------------|-------------------------|
| TXS0101DBVR | ACTIVE | SOT-23 | DBV | 6 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | (NFFF ~ NFFR) | Samples |
| TXS0101DBVRG4 | ACTIVE | SOT-23 | DBV | 6 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | (NFFF ~ NFFR) | Samples |
| TXS0101DBVT | ACTIVE | SOT-23 | DBV | 6 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -55 to 125 | NFFR | Samples |
| TXS0101DBVTG4 | ACTIVE | SOT-23 | DBV | 6 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | NFFR | Samples |
| TXS0101DCKR | ACTIVE | SC70 | DCK | 6 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | 2GO | Samples |
| TXS0101DCKRG4 | ACTIVE | SC70 | DCK | 6 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | 2GO | Samples |
| TXS0101DCKT | ACTIVE | SC70 | DCK | 6 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | 2GO | Samples |
| TXS0101DCKTG4 | ACTIVE | SC70 | DCK | 6 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | 2GO | Samples |
| TXS0101DRLR | ACTIVE | SOT | DRL | 6 | 4000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | 2GR | Samples |
| TXS0101DRLRG4 | ACTIVE | SOT | DRL | 6 | 4000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | 2GR | Samples |
| TXS0101YZPR | ACTIVE | DSBGA | YZP | 6 | 3000 | Green (RoHS & no Sb/Br) | SNAGCU | Level-1-260C-UNLIM | -40 to 85 | 2G7 | 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.

OBSOLETE: 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.

Important Information and Disclaimer: The information provided on this page represents TI's knowledge and belief as of the date that it is provided. TI bases its knowledge and belief on information provided by third parties, and makes no representation or warranty as to the accuracy of such information. Efforts are underway to better integrate information from third parties. TI has taken and continues to take reasonable steps to provide representative and accurate information but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals. TI and TI suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.

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
REEL DIMENSIONS

TAPE DIMENSIONS


| | |
|----|---|
| A0 | Dimension designed to accommodate the component width |
| B0 | Dimension designed to accommodate the component length |
| K0 | Dimension designed to accommodate the component thickness |
| W | Overall width of the carrier tape |
| P1 | Pitch between successive cavity centers |

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 |
|-------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| TXS0101DBVR | SOT-23 | DBV | 6 | 3000 | 180.0 | 8.4 | 3.23 | 3.17 | 1.37 | 4.0 | 8.0 | Q3 |
| TXS0101DBVT | SOT-23 | DBV | 6 | 250 | 180.0 | 8.4 | 3.23 | 3.17 | 1.37 | 4.0 | 8.0 | Q3 |
| TXS0101DCKR | SC70 | DCK | 6 | 3000 | 179.0 | 8.4 | 2.2 | 2.5 | 1.2 | 4.0 | 8.0 | Q3 |
| TXS0101DCKT | SC70 | DCK | 6 | 250 | 179.0 | 8.4 | 2.2 | 2.5 | 1.2 | 4.0 | 8.0 | Q3 |
| TXS0101DRLR | SOT | DRL | 6 | 4000 | 180.0 | 8.4 | 1.98 | 1.78 | 0.69 | 4.0 | 8.0 | Q3 |
| TXS0101YZPR | DSBGA | YZP | 6 | 3000 | 180.0 | 8.4 | 1.02 | 1.52 | 0.63 | 4.0 | 8.0 | Q1 |

TAPE AND REEL BOX DIMENSIONS

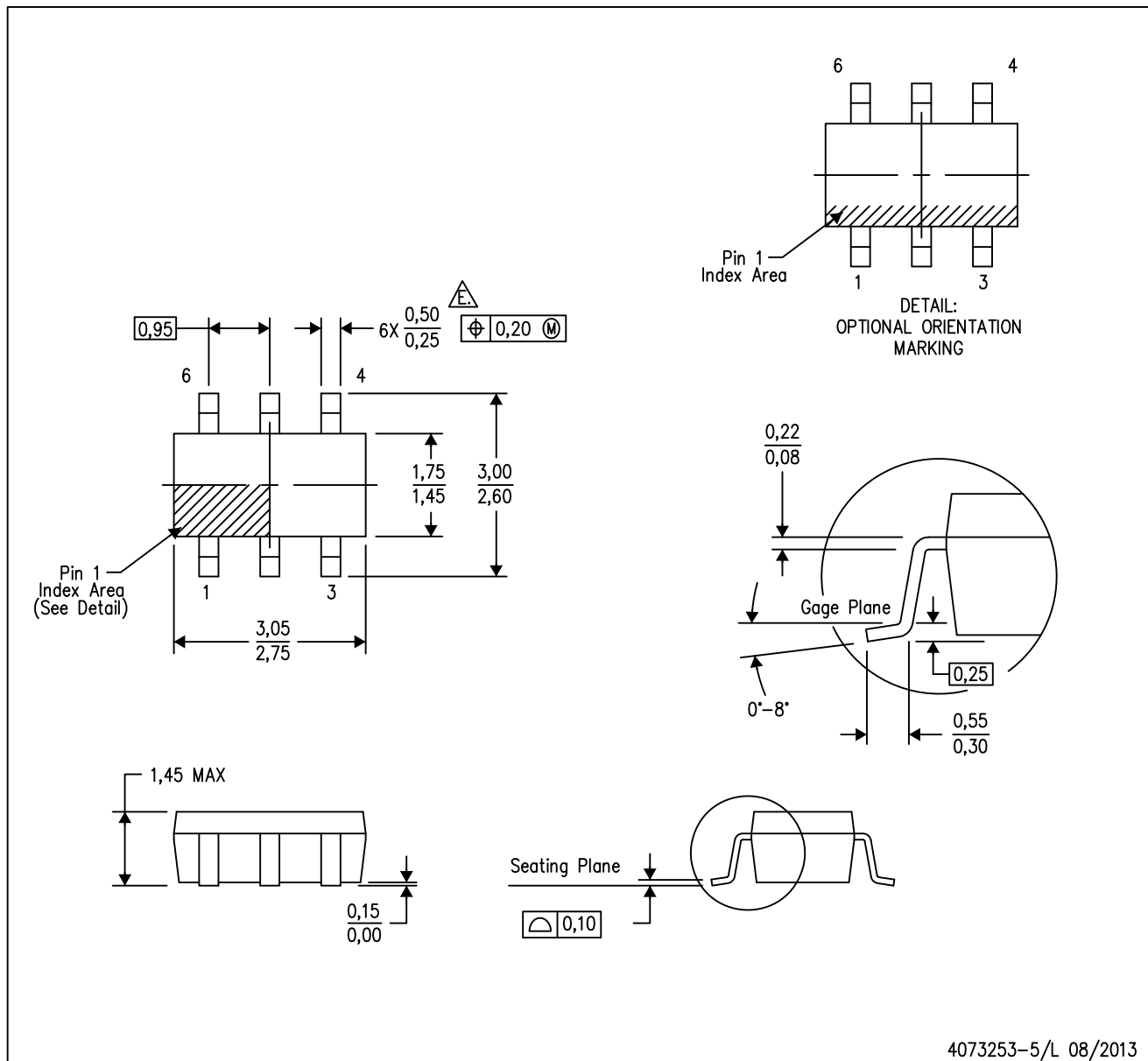

*All dimensions are nominal

| Device | Package Type | Package Drawing | Pins | SPQ | Length (mm) | Width (mm) | Height (mm) |
|-------------|--------------|-----------------|------|------|-------------|------------|-------------|
| TXS0101DBVR | SOT-23 | DBV | 6 | 3000 | 202.0 | 201.0 | 28.0 |
| TXS0101DBVT | SOT-23 | DBV | 6 | 250 | 202.0 | 201.0 | 28.0 |
| TXS0101DCKR | SC70 | DCK | 6 | 3000 | 203.0 | 203.0 | 35.0 |
| TXS0101DCKT | SC70 | DCK | 6 | 250 | 203.0 | 203.0 | 35.0 |
| TXS0101DRLR | SOT | DRL | 6 | 4000 | 202.0 | 201.0 | 28.0 |
| TXS0101YZPR | DSBGA | YZP | 6 | 3000 | 220.0 | 220.0 | 34.0 |

MECHANICAL DATA

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.
- ⚠ 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.

DCK (R-PDSO-G6)

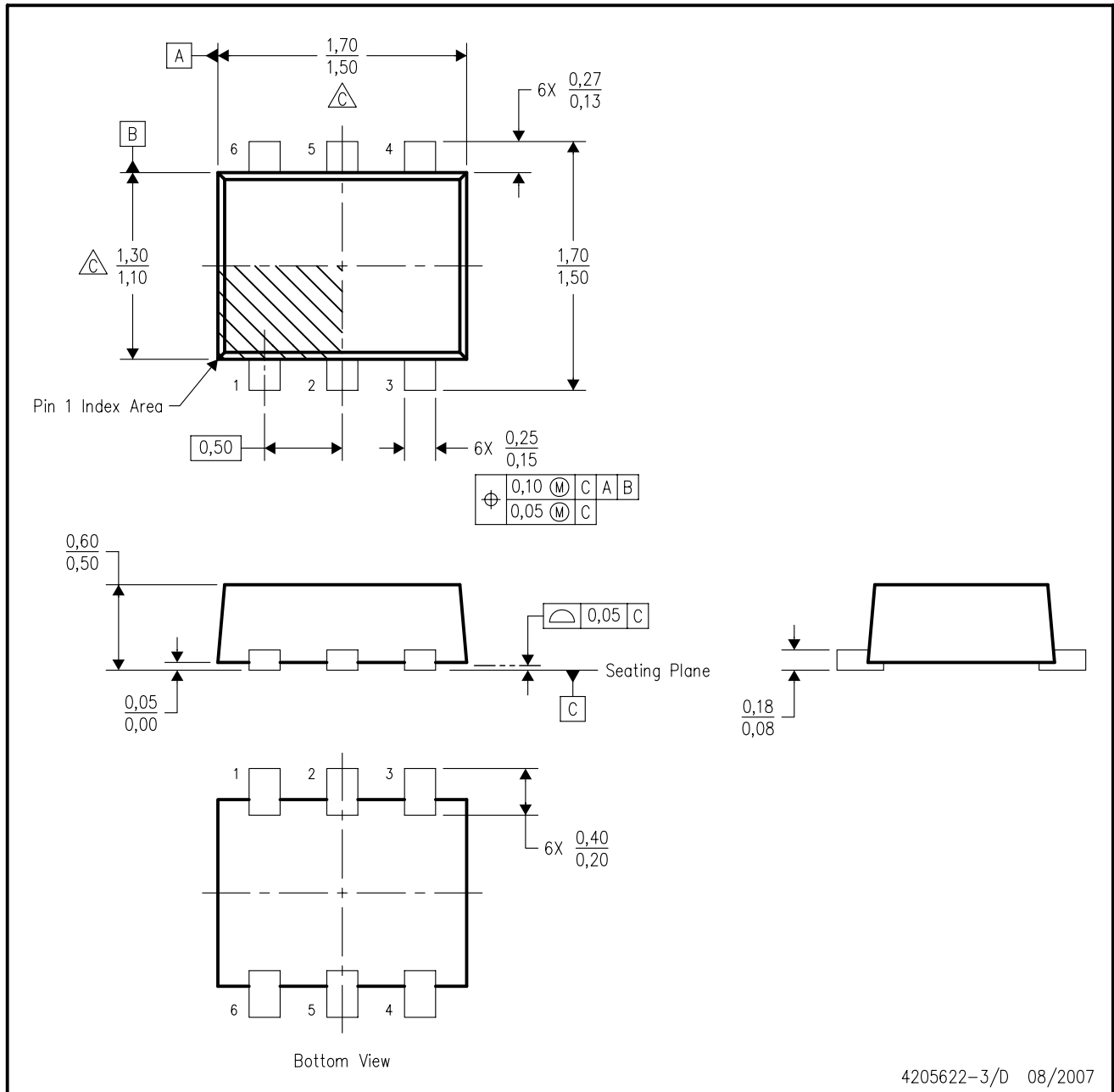
PLASTIC SMALL OUTLINE



- 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.

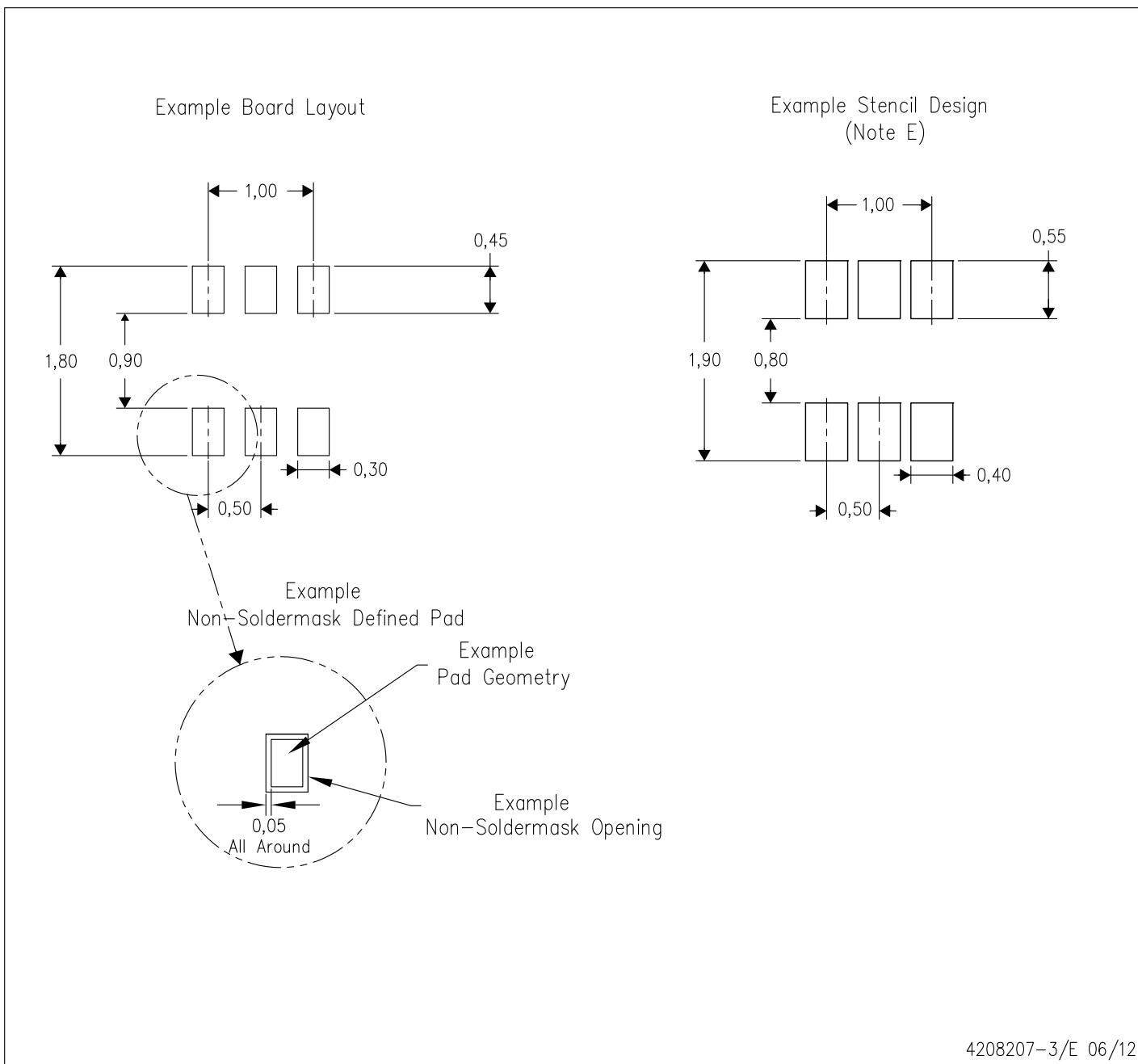
DRL (R-PDSO-N6)

PLASTIC SMALL OUTLINE



4205622-3/D 08/2007

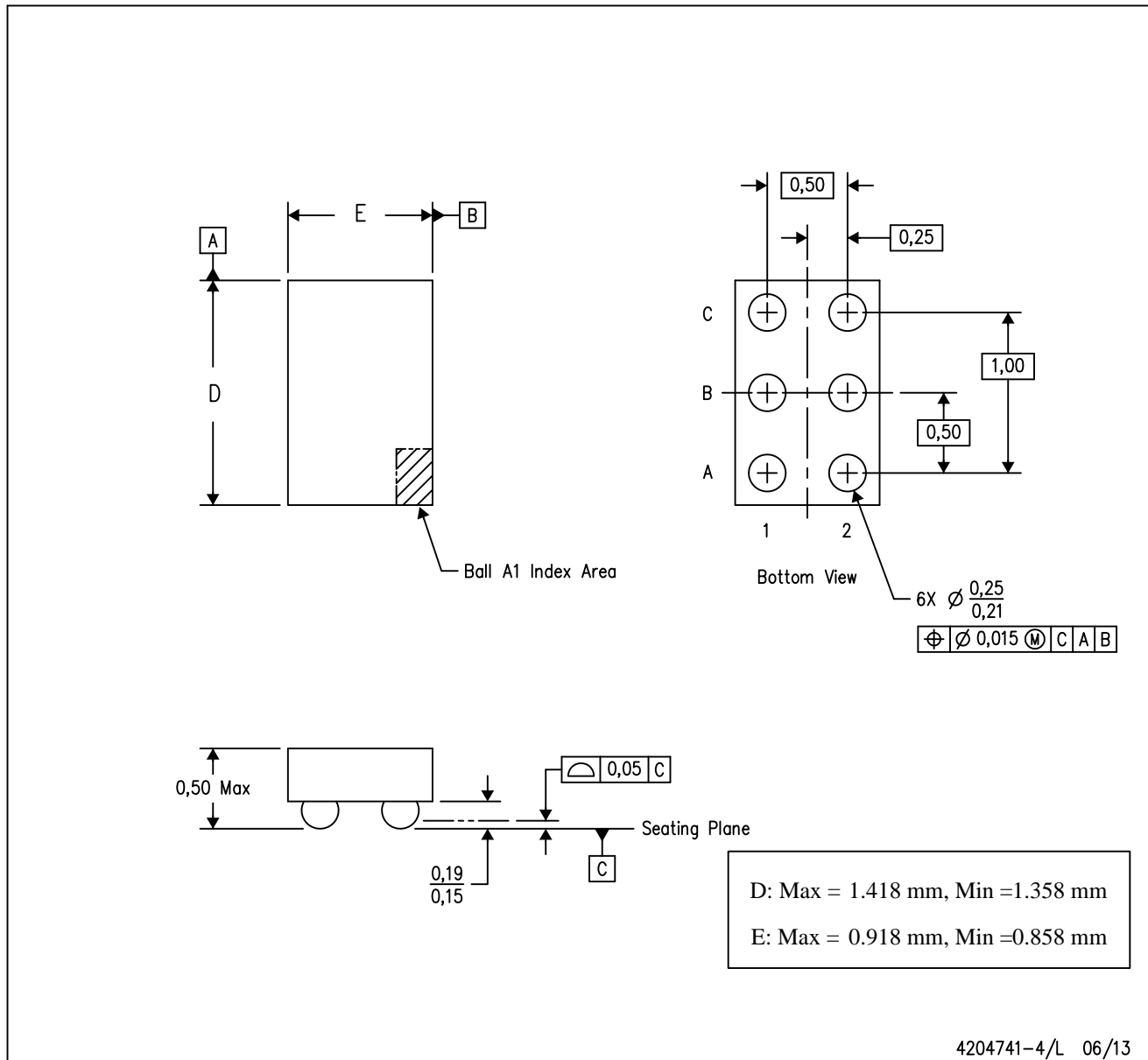
- NOTES:
- A. All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M-1994.
 - B. This drawing is subject to change without notice.
 - C. Body dimensions do not include mold flash, interlead flash, protrusions, or gate burrs. Mold flash, interlead flash, protrusions, or gate burrs shall not exceed 0,15 per end or side.
 - D. JEDEC package registration is pending.



- NOTES:
- A. All linear dimensions are in millimeters.
 - B. This drawing is subject to change without notice.
 - C. Publication IPC-7351 is recommended for alternate designs.
 - D. Customers should contact their board fabrication site for minimum solder mask web tolerances between signal pads.
 - E. Maximum stencil thickness 0,127 mm (5 mils). All linear dimensions are in millimeters.
 - F. 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.
 - G. 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.

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.

IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, enhancements, improvements and other changes to its semiconductor products and services per JESD46, latest issue, and to discontinue any product or service per JESD48, latest issue. Buyers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All semiconductor products (also referred to herein as "components") are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its components to the specifications applicable at the time of sale, in accordance with the warranty in TI's terms and conditions of sale of semiconductor products. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by applicable law, testing of all parameters of each component is not necessarily performed.

TI assumes no liability for applications assistance or the design of Buyers' products. Buyers are responsible for their products and applications using TI components. To minimize the risks associated with Buyers' products and applications, Buyers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any patent right, copyright, mask work right, or other intellectual property right relating to any combination, machine, or process in which TI components or services are used. Information published by TI regarding third-party products or services does not constitute a license to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of significant portions of TI information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

Resale of TI components or services with statements different from or beyond the parameters stated by TI for that component or service voids all express and any implied warranties for the associated TI component or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

Buyer acknowledges and agrees that it is solely responsible for compliance with all legal, regulatory and safety-related requirements concerning its products, and any use of TI components in its applications, notwithstanding any applications-related information or support that may be provided by TI. Buyer represents and agrees that it has all the necessary expertise to create and implement safeguards which anticipate dangerous consequences of failures, monitor failures and their consequences, lessen the likelihood of failures that might cause harm and take appropriate remedial actions. Buyer will fully indemnify TI and its representatives against any damages arising out of the use of any TI components in safety-critical applications.

In some cases, TI components may be promoted specifically to facilitate safety-related applications. With such components, TI's goal is to help enable customers to design and create their own end-product solutions that meet applicable functional safety standards and requirements. Nonetheless, such components are subject to these terms.

No TI components are authorized for use in FDA Class III (or similar life-critical medical equipment) unless authorized officers of the parties have executed a special agreement specifically governing such use.

Only those TI components which TI has specifically designated as military grade or "enhanced plastic" are designed and intended for use in military/aerospace applications or environments. Buyer acknowledges and agrees that any military or aerospace use of TI components which have **not** been so designated is solely at the Buyer's risk, and that Buyer is solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI has specifically designated certain components as meeting ISO/TS16949 requirements, mainly for automotive use. In any case of use of non-designated products, TI will not be responsible for any failure to meet ISO/TS16949.

Products

| | |
|------------------------------|--|
| Audio | www.ti.com/audio |
| Amplifiers | amplifier.ti.com |
| Data Converters | dataconverter.ti.com |
| DLP® Products | www.dlp.com |
| DSP | dsp.ti.com |
| Clocks and Timers | www.ti.com/clocks |
| Interface | interface.ti.com |
| Logic | logic.ti.com |
| Power Mgmt | power.ti.com |
| Microcontrollers | microcontroller.ti.com |
| RFID | www.ti-rfid.com |
| OMAP Applications Processors | www.ti.com/omap |
| Wireless Connectivity | www.ti.com/wirelessconnectivity |

Applications

| | |
|-------------------------------|--|
| Automotive and Transportation | www.ti.com/automotive |
| Communications and Telecom | www.ti.com/communications |
| Computers and Peripherals | www.ti.com/computers |
| Consumer Electronics | www.ti.com/consumer-apps |
| Energy and Lighting | www.ti.com/energy |
| Industrial | www.ti.com/industrial |
| Medical | www.ti.com/medical |
| Security | www.ti.com/security |
| Space, Avionics and Defense | www.ti.com/space-avionics-defense |
| Video and Imaging | www.ti.com/video |

TI E2E Community

e2e.ti.com