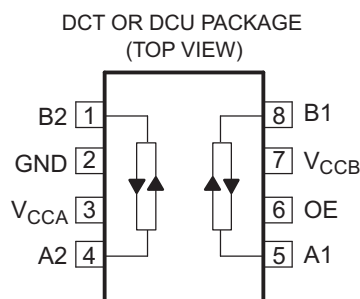# 2-BIT BIDIRECTIONAL VOLTAGE-LEVEL TRANSLATOR
WITH AUTO DIRECTION SENSING AND ±15-kV ESD PROTECTION
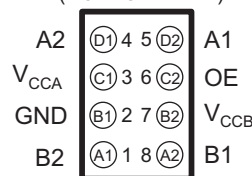
Check for Samples: TXB0102

FEATURES

- **Available in the Texas Instruments NanoFree™ Packages**
- **1.2 V to 3.6 V on A Port and 1.65 V to 5.5 V on B Port ($V_{CCA} ≤ V_{CCB}$)**
- **V_{CC} Isolation Feature – If Either V_{CC} Input Is at GND, All Outputs Are in the High-Impedance State**
- **OE Input Circuit Referenced to V_{CCA}**
- **Low Power Consumption, 4-μA Max I_{CC}**
- **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**
    - **15-kV Human-Body Model (A114-B)**
    - **200-V Machine Model (A115-A)**
    - **1500-V Charged-Device Model (C101)**

DCT OR DCU PACKAGE
(TOP VIEW)

B2	1	8 B1
GND	2	7 V_{CCB}
V_{CCA}	3	6 OE
A2	4	5 A1

YZP PACKAGE
(BOTTOM VIEW)

A2	(D1) 4 5 (D2)	A1
V_{CCA}	(C1) 3 6 (C2)	OE
GND	(B1) 2 7 (B2)	V_{CCB}
B2	(A1) 1 8 (A2)	B1

DESCRIPTION/ORDERING INFORMATION

This 2-bit non-inverting translator uses two separate configurable power-supply rails. The A port is designed to track V_{CCA}. V_{CCA} accepts any supply voltage from 1.2 V to 3.6 V. The B port is designed to track V_{CCB}. V_{CCB} accepts any supply voltage from 1.65 V to 5.5 V. This allows for universal low-voltage bidirectional translation between any of the 1.2-V, 1.5-V, 1.8-V, 2.5-V, 3.3-V, and 5-V voltage nodes. V_{CCA} should not exceed V_{CCB}.

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

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

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.

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

⚠ 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.

TXB0102

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	TXB0102YZPR	2E_
	SOT (SOT-23) – DCT	Reel of 3000	TXB0102DCTR	NFD_
		Reel of 250	TXB0102DCTT	
	SOT (SOT-70) – DCU	Reel of 3000	TXB0102DCUR	NFD_
		Reel of 250	TXB0102DCUT	

(1) Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at www.ti.com/sc/package.
(2) For the most current package and ordering information, see the Package Option Addendum at the end of this document, or see the TI website at www.ti.com.
(3) YZP: The actual top-side marking has three preceding characters to denote year, month, and sequence code, and one following character to designate the assembly/test site. Pin 1 identifier indicates solder-bump composition (1 = SnPb, • = Pb-free).

Table 1. PIN DESCRIPTION

PIN	NAME	FUNCTION
1	B2	Input/output B. Referenced to V_{CCB}.
2	GND	Ground
3	V_{CCA}	A port supply voltage. 1.2 V ≤ V_{CCA} ≤ 3.6 V and V_{CCA} ≤ V_{CCB}
4	A2	Input/output A. Referenced to V_{CCA}.
5	A1	Input/output A. Referenced to V_{CCA}.
6	OE	3-State output. Pull OE low to place all outputs in 3-state mode. Referenced to V_{CCA}.
7	V_{CCB}	B port supply voltage. 1.65 V ≤ V_{CCB} ≤ 5.5 V
8	B1	Input/output B. Referenced to V_{CCB}.

TYPICAL OPERATING CIRCUIT

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Product Folder Link(s): TXB0102
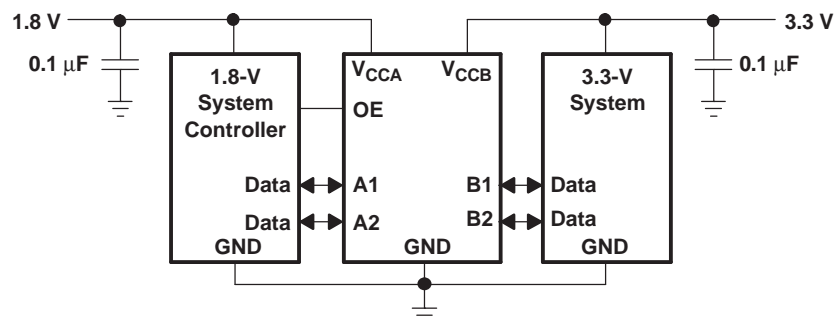
Absolute Maximum Ratings[1]

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_I	Input voltage range[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-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
θ_{JA}	Package thermal impedance[4]	DCT package		220	°C/W
		DCU package		227	
		YZP package		102	
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.
(4) 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				1.2	3.6	V
V_{CCB}					1.65	5.5	
V_{IH}	High-level input voltage	Data inputs	1.2 V to 3.6 V	1.65 V to 5.5 V	$V_{CCI} \times 0.65$[3]	V_{CCI}	V
		OE input	1.2 V to 3.6 V	1.65 V to 5.5 V	$V_{CCA} \times 0.65$	5.5	
V_{IL}	Low-level input voltage	Data inputs	1.2 V to 5.5 V	1.65 V to 5.5 V	0	$V_{CCI} \times 0.35$[3]	V
		OE input	1.2 V to 3.6 V	1.65 V to 5.5 V	0	$V_{CCA} \times 0.35$	
V_O	Voltage range applied to any output in the high-impedance or power-off state	A port	1.2 V to 3.6 V	1.65 V to 5.5 V	0	3.6	V
		B port			0	5.5	
$\Delta t/\Delta v$	Input transition rise or fall rate	A port inputs	1.2 V to 3.6 V	1.65 V to 5.5 V		40	ns/V
		B port inputs	1.2 V to 3.6 V	1.65 V to 1.95 V		40	
				4.5 V to 5.5 V		30	
T_A	Operating free-air temperature				−40	85	°C

(1) The A and B sides of an unused data I/O pair must be held in the same state, i.e., both at V_{CCI} or both at GND.
(2) V_{CCA} must be less than or equal to V_{CCB} and must not exceed 3.6 V.
(3) V_{CCI} is the supply voltage associated with the input port.

TEXAS INSTRUMENTS

Electrical Characteristics[1] [2]

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

PARAMETER		TEST CONDITIONS	V_{CCA}	V_{CCB}	T_A = 25°C			−40°C to 85°C		UNIT
					MIN	TYP	MAX	MIN	MAX	
V_{OHA}		I_{OH} = −20 µA	1.2 V			1.1				V
			1.4 V to 3.6 V					V_{CCA} − 0.4		
V_{OLA}		I_{OL} = 20 µA	1.2 V			0.9				V
			1.4 V to 3.6 V						0.4	
V_{OHB}		I_{OH} = −20 µA		1.65 V to 5.5 V				V_{CCB} − 0.4		V
V_{OLB}		I_{OL} = 20 µA		1.65 V to 5.5 V					0.4	V
I_I	OE	V_I = V_{CCI} or GND	1.2 V to 3.6 V	1.65 V to 5.5 V			±1		±2	µA
I_{off}	A port	V_I or V_O = 0 to 3.6 V	0 V	0 V to 5.5 V			±1		±2	µA
	B port	V_I or V_O = 0 to 5.5 V	0 V to 3.6 V	0 V			±1		±2	
I_{OZ}	A or B port	OE = GND	1.2 V to 3.6 V	1.65 V to 5.5 V			±1		±2	µA
I_{CCA}		V_I = V_{CCI} or GND, I_O = 0	1.2 V	1.65 V to 5.5 V		0.06				µA
			1.4 V to 3.6 V	1.65 V to 5.5 V					3	
			3.6 V	0 V					2	
			0 V	5.5 V					−2	
I_{CCB}		V_I = V_{CCI} or GND, I_O = 0	1.2 V	1.65 V to 5.5 V		3.4				µA
			1.4 V to 3.6 V	1.65 V to 5.5 V					5	
			3.6 V	0 V					−2	
			0 V	5.5 V					2	
I_{CCA} + I_{CCB}		V_I = V_{CCI} or GND, I_O = 0	1.2 V	1.65 V to 5.5 V		3.5				µA
			1.4 V to 3.6 V	1.65 V to 5.5 V					8	
I_{CCZA}		V_I = V_{CCI} or GND, I_O = 0, OE = GND	1.2 V	1.65 V to 5.5 V		0.05				µA
			1.4 V to 3.6 V	1.65 V to 5.5 V					3	
I_{CCZB}		V_I = V_{CCI} or GND, I_O = 0, OE = GND	1.2 V	1.65 V to 5.5 V		3.3				µA
			1.4 V to 3.6 V	1.65 V to 5.5 V					5	
C_i	OE		1.2 V to 3.6 V	1.65 V to 5.5 V		2.5	3			pF
C_{io}	A port		1.2 V to 3.6 V	1.65 V to 5.5 V		5	6			pF
	B port					11	14			

(1) V_{CCI} is the supply voltage associated with the input port.
(2) V_{CCO} is the supply voltage associated with the output port.

Timing Requirements

T_A = 25°C, V_{CCA} = 1.2 V

			V_{CCB} = 1.8 V	V_{CCB} = 2.5 V	V_{CCB} = 3.3 V	V_{CCB} = 5 V	UNIT
			TYP	TYP	TYP	TYP	
	Data rate		20	20	20	20	Mbps
t_w	Pulse duration	Data inputs	50	50	50	50	ns

Timing Requirements

over recommended operating free-air temperature range, V_{CCA} = 1.5 V ± 0.1 V (unless otherwise noted)

			V_{CCB} = 1.8 V ± 0.15 V		V_{CCB} = 2.5 V ± 0.2 V		V_{CCB} = 3.3 V ± 0.3 V		V_{CCB} = 5 V ± 0.5 V		UNIT
			MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
	Data rate			40		40		40		40	Mbps
t_w	Pulse duration	Data inputs	25		25		25		25		ns

Product Folder Link(s): *TXB0102*

Timing Requirements

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

			V_{CCB} = 1.8 V ± 0.15 V		V_{CCB} = 2.5 V ± 0.2 V		V_{CCB} = 3.3 V ± 0.3 V		V_{CCB} = 5 V ± 0.5 V		UNIT
			MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
	Data rate			60		60		60		60	Mbps
t_w	Pulse duration	Data inputs	17		17		17		17		ns

Timing Requirements

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

			V_{CCB} = 2.5 V ± 0.2 V		V_{CCB} = 3.3 V ± 0.3 V		V_{CCB} = 5 V ± 0.5 V		UNIT
			MIN	MAX	MIN	MAX	MIN	MAX	
	Data rate			100		100		100	Mbps
t_w	Pulse duration	Data inputs	10		10		10		ns

Timing Requirements

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

			V_{CCB} = 3.3 V ± 0.3 V		V_{CCB} = 5 V ± 0.5 V		UNIT
			MIN	MAX	MIN	MAX	
	Data rate			100		100	Mbps
t_w	Pulse duration	Data inputs	10		10		ns

Switching Characteristics

T_A = 25°C, V_{CCA} = 1.2 V

PARAMETER	FROM (INPUT)	TO (OUTPUT)	V_{CCB} = 1.8 V TYP	V_{CCB} = 2.5 V TYP	V_{CCB} = 3.3 V TYP	V_{CCB} = 5 V TYP	UNIT
t_{pd}	A	B	6.9	5.7	5.3	5.5	ns
	B	A	7.4	6.4	6	5.8	
t_{en}	OE	A	1	1	1	1	µs
		B	1	1	1	1	
t_{dis}	OE	A	18	15	14	14	ns
		B	20	17	16	16	
t_{rA}	A port rise time		4.2	4.2	4.2	4.2	ns
t_{fA}	A port fall times		4.2	4.2	4.2	4.2	ns
t_{rB}	B port rise times		2.1	1.5	1.2	1.1	ns
t_{fB}	B port fall times		2.1	1.5	1.2	1.1	ns
$t_{sk(o)}$	Channel-to-channel		0.5	0.5	0.5	1.4	ns
Max data rate			20	20	20	20	Mbps

Switching Characteristics

over recommended operating free-air temperature range, V_{CCA} = 1.5 V ± 0.1 V (unless otherwise noted)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	V_{CCB} = 1.8 V ± 0.15 V		V_{CCB} = 2.5 V ± 0.2 V		V_{CCB} = 3.3 V ± 0.3 V		V_{CCB} = 5 V ± 0.5 V		UNIT
			MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
t_{pd}	A	B	1.4	12.9	1.2	10.1	1.1	10	0.8	9.9	ns
	B	A	0.9	14.2	0.7	12	0.4	11.7	0.3	13.7	
t_{en}	OE	A		1		1		1		1	µs
		B		1		1		1		1	
t_{dis}	OE	A	5.9	31	5.7	25.9	5.6	23	5.7	22.4	ns
		B	5.4	30.3	4.9	22.8	4.8	20	4.9	19.5	
t_{rA}	A port rise times		1.4	5.1	1.4	5.1	1.4	5.1	1.4	5.1	ns
t_{fA}	A port fall times		1.4	5.1	1.4	5.1	1.4	5.1	1.4	5.1	ns
t_{rB}	B port rise times		0.9	4.5	0.6	3.2	0.5	2.8	0.4	2.7	ns
t_{fB}	B port fall times		0.9	4.5	0.6	3.2	0.5	2.8	0.4	2.7	ns
$t_{sk(o)}$	Channel-to-channel			0.5		0.5		0.5		0.5	ns
Max data rate			40		40		40		40		Mbps

Switching Characteristics

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

PARAMETER	FROM (INPUT)	TO (OUTPUT)	V_{CCB} = 1.8 V ± 0.15 V		V_{CCB} = 2.5 V ± 0.2 V		V_{CCB} = 3.3 V ± 0.3 V		V_{CCB} = 5 V ± 0.5 V		UNIT
			MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
t_{pd}	A	B	1.6	11	1.4	7.7	1.3	6.8	1.2	6.5	ns
	B	A	1.5	12	1.3	8.4	1	7.6	0.9	7.1	
t_{en}	OE	A		1		1		1		1	µs
		B		1		1		1		1	
t_{dis}	OE	A	5.9	31	5.1	21.3	5	19.3	5	17.4	ns
		B	5.4	30.3	4.4	20.8	4.2	17.9	4.3	16.3	
t_{rA}	A port rise times		1	4.2	1.1	4.1	1.1	4.1	1.1	4.1	ns
t_{fA}	A port fall times		1	4.2	1.1	4.1	1.1	4.1	1.1	4.1	ns
t_{rB}	B port rise times		0.9	4.5	0.6	3.2	0.5	2.8	0.4	2.7	ns
t_{fB}	B port fall times		0.9	4.5	0.6	3.2	0.5	2.8	0.4	2.7	ns
$t_{sk(o)}$	Channel-to-channel			0.5		0.5		0.5		0.5	ns
Max data rate			60		60		60		60		Mbps

Product Folder Link(s): *TXB0102*

Switching Characteristics

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

PARAMETER	FROM (INPUT)	TO (OUTPUT)	V_{CCB} = 2.5 V ± 0.2 V		V_{CCB} = 3.3 V ± 0.3 V		V_{CCB} = 5 V ± 0.5 V		UNIT
			MIN	MAX	MIN	MAX	MIN	MAX	
t_{pd}	A	B	1.1	6.3	1	5.2	0.9	4.7	ns
	B	A	1.2	6.6	1.1	5.1	0.9	4.4	
t_{en}	OE	A		1		1		1	µs
		B		1		1		1	
t_{dis}	OE	A	5.1	21.3	4.6	15.2	4.6	13.2	ns
		B	4.4	20.8	3.8	16	3.9	13.9	
t_{rA}	A port rise times		0.8	3	0.8	3	0.8	3	ns
t_{fA}	A port fall times		0.8	3	0.8	3	0.8	3	ns
t_{rB}	B port rise times		0.7	3	0.5	2.8	0.4	2.7	ns
t_{fB}	B port fall times		0.7	3	0.5	2.8	0.4	2.7	ns
$t_{sk(o)}$	Channel-to-channel			0.5		0.5		0.5	ns
Max data rate			100		100		100		Mbps

Switching Characteristics

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

PARAMETER	FROM (INPUT)	TO (OUTPUT)	V_{CCB} = 3.3 V ± 0.3 V		V_{CCB} = 5 V ± 0.5 V		UNIT
			MIN	MAX	MIN	MAX	
t_{pd}	A	B	0.9	4.7	0.8	4	ns
	B	A	1	4.9	0.9	4.5	
t_{en}	OE	A		1		1	µs
		B		1		1	
t_{dis}	OE	A	4.6	15.2	4.3	12.1	ns
		B	3.8	16	3.4	13.2	
t_{rA}	A port rise times		0.7	2.5	0.7	2.5	ns
t_{fA}	A port fall times		0.7	2.5	0.7	2.5	ns
t_{rB}	B port rise times		0.5	2.3	0.4	2.7	ns
t_{fB}	B port fall times		0.5	2.3	0.4	2.7	ns
$t_{sk(o)}$	Channel-to-channel			0.5		0.5	ns
Max data rate			100		100		Mbps

TXB0102

Operating Characteristics

$T_A = 25°C$

PARAMETER		TEST CONDITIONS	V_{CCA}							UNIT
			1.2 V	1.2 V	1.5 V	1.8 V	2.5 V	2.5 V	3.3 V	
			V_{CCB}							
			5 V	1.8 V	1.8 V	1.8 V	2.5 V	5 V	3.3 V to 5 V	
			TYP	TYP	TYP	TYP	TYP	TYP	TYP	
C_{pdA}	A port input, B port output	$C_L = 0$, f = 10 MHz, $t_r = t_f = 1$ ns, OE = V_{CCA} (outputs enabled)	7.8	8	8	7	7	8	8	pF
	B port input, A port output		12	11	11	11	11	11	11	
C_{pdB}	A port input, B port output		38.1	29	29	29	29	30	30	
	B port input, A port output		25.4	19	18	18	18	21	21	
C_{pdA}	A port input, B port output	$C_L = 0$, f = 10 MHz, $t_r = t_f = 1$ ns, OE = GND (outputs disabled)	0.01	0.01	0.01	0.01	0.01	0.01	0.01	pF
	B port input, A port output		0.01	0.01	0.01	0.01	0.01	0.01	0.01	
C_{pdB}	A port input, B port output		0.01	0.01	0.01	0.01	0.01	0.01	0.02	
	B port input, A port output		0.01	0.01	0.01	0.01	0.01	0.02	0.03	

Product Folder Link(s): *TXB0102*

PRINCIPLES OF OPERATION

Applications

The TXB0102 can be used in level-translation applications for interfacing devices or systems operating at different interface voltages with one another.

Architecture

The TXB0102 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. In a dc state, the output drivers of the TXB0101 can maintain a high or low, but are designed to be weak, so that they can be overdriven by an external driver when data on the bus starts flowing the opposite direction.

The output one shots detect rising or falling edges on the A or B ports. During a rising edge, the one shot turns on the PMOS transistors (T1, T3) for a short duration, which speeds up the low-to-high transition. Similarly, during a falling edge, the one shot turns on the NMOS transistors (T2, T4) for a short duration, which speeds up the high-to-low transition. The typical output impedance during output transition is 70 Ω at V_{CCO} = 1.2 V to 1.8 V, 50 Ω at V_{CCO} = 1.8 V to 3.3 V, and 40 Ω at V_{CCO} = 3.3 V to 5 V.
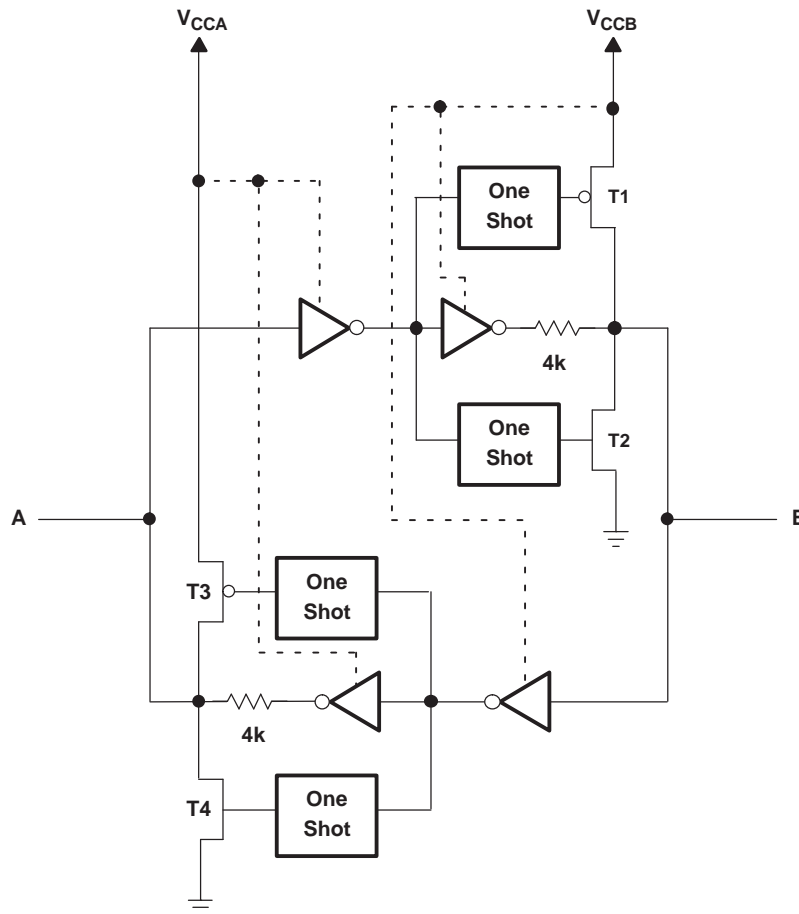
Figure 1. Architecture of TXB0102 I/O Cell

Input Driver Requirements

Typical I_{IN} vs V_{IN} characteristics of the TXB0102 are shown in Figure 2. For proper operation, the device driving the data I/Os of the TXB0102 must have drive strength of at least ±2 mA.

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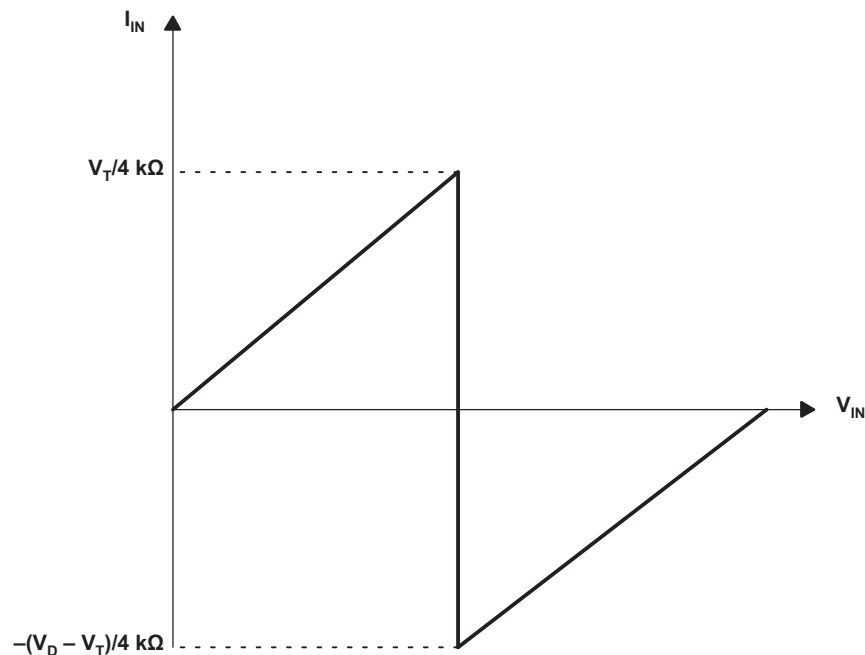
A. V_T is the input threshold voltage of the TXB0102 (typically $V_{CCI}/2$.

B. V_D is the supply voltage of the external driver.

Figure 2. Typical I_{IN} vs V_{IN} Curve

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. The TXB0102 has circuitry that disables all output ports when either V_{CC} is switched off ($V_{CCA/B} = 0$ V).

Enable and Disable

The TXB0102 has an OE input that is used to disable the device by setting OE = low, which places all I/Os in the high-impedance (Hi-Z) state. The disable time (t_{dis}) indicates the delay between when OE goes low and when the outputs are 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

The TXB0102 is designed to drive capacitive loads of up to 70 pF. The output drivers of the TXB0102 have low dc drive strength. If pullup or pulldown resistors are connected externally to the data I/Os, their values must be kept higher than 50 kΩ to ensure that they do not contend with the output drivers of the TXB0102.

For the same reason, the TXB0102 should not be used in applications such as I²C or 1-Wire where an open-drain driver is connected on the bidirectional data I/O. For these applications, use a device from the TI TXS01xx series of level translators.

PARAMETER MEASUREMENT INFORMATION
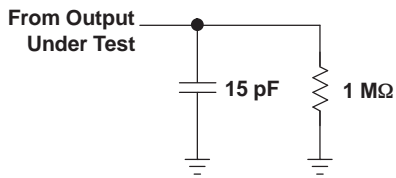
LOAD CIRCUIT FOR MAX DATA RATE, PULSE DURATION PROPAGATION DELAY OUTPUT RISE AND FALL TIME MEASUREMENT
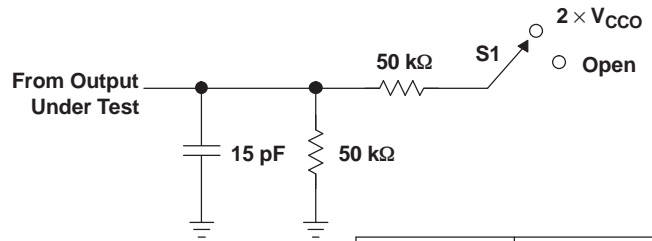
LOAD CIRCUIT FOR ENABLE/DISABLE TIME MEASUREMENT

TEST	S1
t_{PZL}/t_{PLZ}	$2 \times V_{CCO}$
t_{PHZ}/t_{PZH}	Open
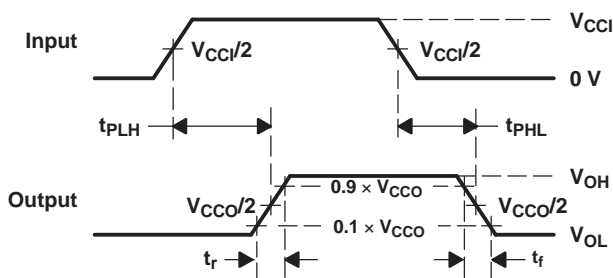
**VOLTAGE WAVEFORMS
PROPAGATION DELAY TIMES**
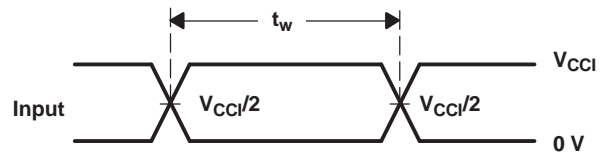
**VOLTAGE WAVEFORMS
PULSE DURATION**

A. C_L includes probe and jig capacitance.
B. All input pulses are supplied by generators having the following characteristics: PRR ≤ 10 MHz, Z_O = 50 Ω, dv/dt ≥ 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}.
E. V_{CCI} is the V_{CC} associated with the input port.
F. V_{CCO} is the V_{CC} associated with the output port.
G. All parameters and waveforms are not applicable to all devices.

Figure 3. Load Circuits and Voltage Waveforms

REVISION HISTORY

Changes from Original (May 2007) to Revision A   **Page**

• Added ball labels to the YZP Package. 1

PACKAGING INFORMATION

Orderable Device	Status [1]	Package Type	Package Drawing	Pins	Package Qty	Eco Plan [2]	Lead/ Ball Finish	MSL Peak Temp [3]	Samples (Requires Login)
TXB0102DCUR	ACTIVE	US8	DCU	8	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
TXB0102DCURG4	ACTIVE	US8	DCU	8	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
TXB0102DCUT	ACTIVE	US8	DCU	8	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
TXB0102DCUTG4	ACTIVE	US8	DCU	8	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
TXB0102YZPR	ACTIVE	DSBGA	YZP	8	3000	Green (RoHS & no Sb/Br)	SNAGCU	Level-1-260C-UNLIM	

[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.

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PACKAGE MATERIALS INFORMATION

TAPE AND REEL INFORMATION

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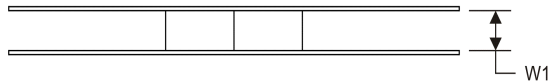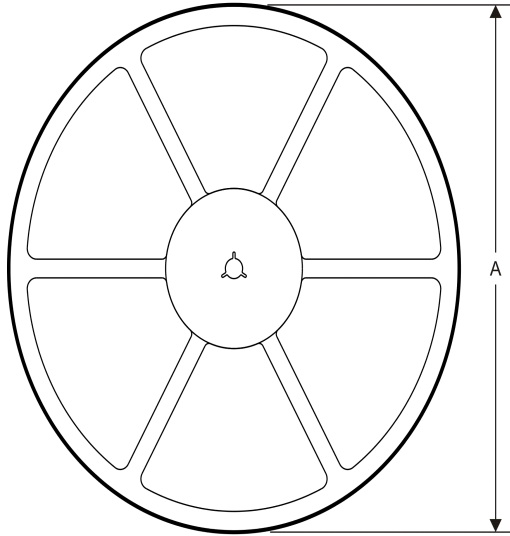
TAPE DIMENSIONS
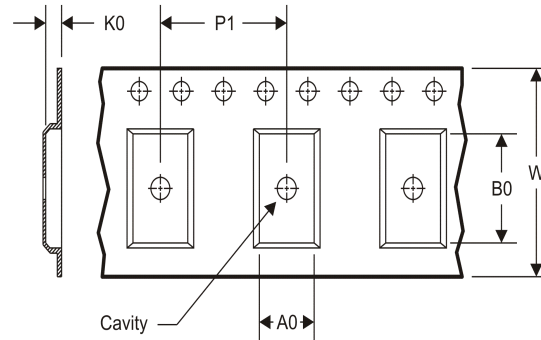
A0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

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
TXB0102YZPR	DSBGA	YZP	8	3000	178.0	9.2	1.02	2.02	0.63	4.0	8.0	Q1
TXB0102YZPR	DSBGA	YZP	8	3000	180.0	8.4	1.02	2.02	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)
TXB0102YZPR	DSBGA	YZP	8	3000	220.0	220.0	35.0
TXB0102YZPR	DSBGA	YZP	8	3000	210.0	185.0	35.0

DCU (R−PDSO−G8) PLASTIC SMALL−OUTLINE PACKAGE (DIE DOWN)

4200503/F 07/05

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−187 variation CA.

YZP (R−XBGA−N8)   DIE−SIZE BALL GRID ARRAY

A

0,95
0,85
B

1,95
1,85

Ball A1 Index Area

0,50

0,25

D

C

B

A

1   2

Bottom View

1,50

0,25

0,50

8X ∅ 0,25
0,21

⊕ ∅ 0,015 Ⓜ C A B

0,50 Max

0,05 C

Seating Plane

0,19
0,15

C

D: Max = 1.918 mm, Min =1.858 mm

E: Max = 0.918 mm, Min =0.858 mm

4204741−4/H 07/2011
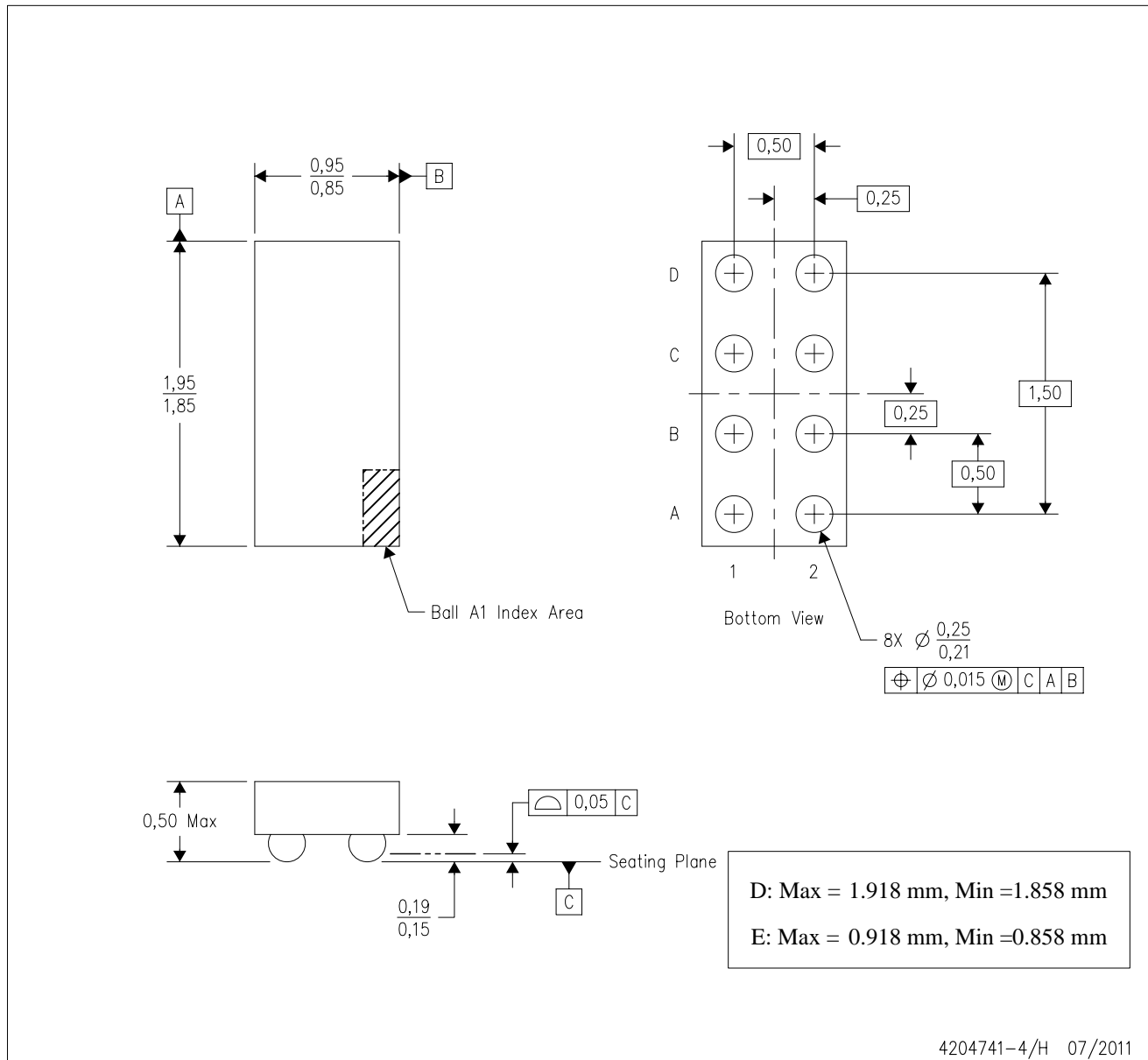
NOTES: A.   All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M−1994.
         B.   This drawing is subject to change without notice.
         C.   NanoFree™ package configuration.
         D.   This package is a Pb−free solder ball design. Refer to the 8 YEP package (drawing 4204725) for tin−lead (SnPb).

NanoFree is a trademark of Texas Instruments.

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