

# TXB0106 6-Bit Bidirectional Level-Shifting and Voltage Translator With Auto-Direction Sensing and $\pm 15\text{kV}$ ESD Protection

## 1 Features

- 1.2V to 3.6V on A port and 1.65 to 5.5V on B Port ( $V_{CCA} \leq V_{CCB}$ )
- $V_{CC}$  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,  $4\mu\text{A}$  max  $I_{CC}$
- $I_{off}$  supports partial-power-down mode operation
- Latch-up performance exceeds 100mA per JESD 78, class II
- ESD protection exceeds JESD 22
  - A port
    - 2500V human body model (A114-B)
    - 150V machine model (A115-A)
    - 1500V charged-device model (C101)
  - B port
    - $\pm 15\text{kV}$  human body model (A114-B)
    - 150V machine model (A115-A)
    - 1500V charged-device model (C101)

to track  $V_{CCB}$ .  $V_{CCB}$  accepts any supply voltage from 1.65V to 5.5V. This allows for universal low-voltage bidirectional translation between any of the 1.2V, 1.5V, 1.8V, 2.5V, 3.3V, and 5V voltage nodes.  $V_{CCA}$  must not exceed  $V_{CCB}$ .

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

The TXB0106 is designed so that the OE input circuit is supplied by  $V_{CCA}$ .

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 during power down.

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

## 2 Applications

- Headset
- Smartphone
- Tablet
- Desktop PC

## 3 Description

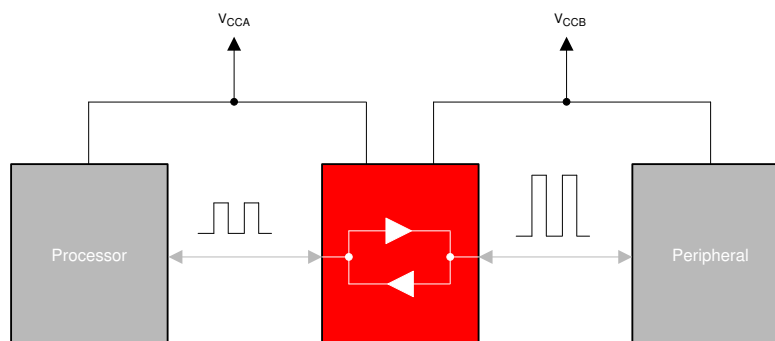
This 6-bit noninverting translator uses two separate configurable power-supply rails. The A port is designed to track  $V_{CCA}$ .  $V_{CCA}$  accepts any supply voltage from 1.2V to 3.6V. The B port is designed

### Package Information

PART NUMBER	PACKAGE <sup>(1)</sup>	PACKAGE SIZE <sup>(2)</sup>
TXB0106	PW (TSSOP, 16)	5.00mm × 4.40mm
	RGY (VQFN, 16)	4.00mm × 3.50mm
	RSV (UQFN, 16)	2.60mm × 1.80mm
	BQB (WQFN, 16)	3.50mm × 2.50mm
	DYY (SOT, 16)	4.20mm × 2.00mm

(1) For more information, see [Section 11](#).

(2) The package size (length × width) is a nominal value and includes pins, where applicable.



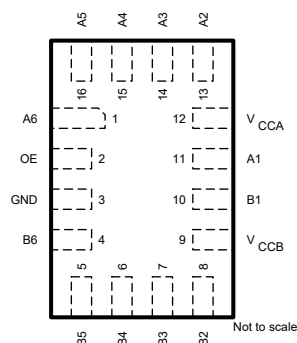
Typical Application Block Diagram for TXB010X



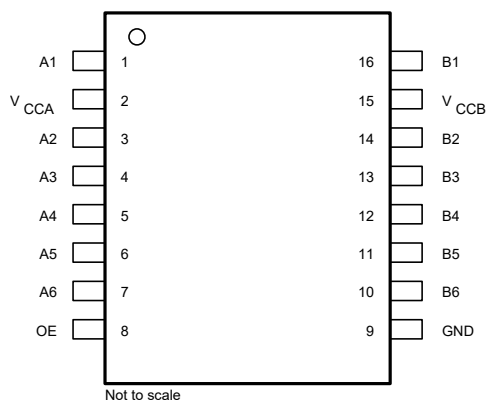
## Table of Contents

<b>1 Features</b> .....	<b>1</b>	5.19 Switching Characteristics: $V_{CCA} = 2.5V \pm 0.2V$ (Other Packages).....	<b>11</b>
<b>2 Applications</b> .....	<b>1</b>	5.20 Switching Characteristics: $V_{CCA} = 3.3V \pm 0.3V$ (BQB/RSV/DYY).....	<b>11</b>
<b>3 Description</b> .....	<b>1</b>	5.21 Switching Characteristics: $V_{CCA} = 3.3V \pm 0.3V$ (Other Packages).....	<b>12</b>
<b>4 Pin Configuration and Functions</b> .....	<b>3</b>	5.22 Operating Characteristics.....	<b>12</b>
<b>5 Specifications</b> .....	<b>5</b>	5.23 Typical Characteristics.....	<b>13</b>
5.1 Absolute Maximum Ratings.....	<b>5</b>	<b>6 Parameter Measurement Information</b> .....	<b>14</b>
5.2 ESD Ratings.....	<b>5</b>	<b>7 Detailed Description</b> .....	<b>14</b>
5.3 Recommended Operating Conditions.....	<b>5</b>	7.1 Overview.....	<b>14</b>
5.4 Thermal Information.....	<b>6</b>	7.2 Functional Block Diagram.....	<b>15</b>
5.5 Electrical Characteristics (BQB/RSV/DYY).....	<b>6</b>	7.3 Feature Description.....	<b>16</b>
5.6 Electrical Characteristics (Other Packages).....	<b>7</b>	7.4 Device Functional Modes.....	<b>18</b>
5.7 Timing Requirements: $V_{CCA} = 1.2V$ .....	<b>7</b>	<b>8 Application and Implementation</b> .....	<b>19</b>
5.8 Timing Requirements: $V_{CCA} = 1.5V \pm 0.1V$ .....	<b>8</b>	8.1 Application Information.....	<b>19</b>
5.9 Timing Requirements: $V_{CCA} = 1.8V \pm 0.15V$ .....	<b>8</b>	8.2 Typical Application.....	<b>19</b>
5.10 Timing Requirements: $V_{CCA} = 2.5V \pm 0.2V$ .....	<b>8</b>	8.3 Power Supply Recommendations.....	<b>21</b>
5.11 Timing Requirements: $V_{CCA} = 3.3V \pm 0.3V$ .....	<b>8</b>	8.4 Layout.....	<b>21</b>
5.12 Switching Characteristics: $V_{CCA} = 1.2V$ (BQB/RSV/DYY).....	<b>8</b>	<b>9 Device and Documentation Support</b> .....	<b>23</b>
5.13 Switching Characteristics: $V_{CCA} = 1.2V$ (Other Packages).....	<b>9</b>	9.1 Documentation Support.....	<b>23</b>
5.14 Switching Characteristics: $V_{CCA} = 1.5V \pm 0.1V$ (BQB/RSV/DYY).....	<b>9</b>	9.2 Receiving Notification of Documentation Updates.....	<b>23</b>
5.15 Switching Characteristics: $V_{CCA} = 1.5V \pm 0.1V$ (Other Packages).....	<b>9</b>	9.3 Support Resources.....	<b>23</b>
5.16 Switching Characteristics: $V_{CCA} = 1.8V \pm 0.15V$ (BQB/RSV/DYY).....	<b>10</b>	9.4 Trademarks.....	<b>23</b>
5.17 Switching Characteristics: $V_{CCA} = 1.8V \pm 0.15V$ (Other Packages).....	<b>10</b>	9.5 Electrostatic Discharge Caution.....	<b>23</b>
5.18 Switching Characteristics: $V_{CCA} = 2.5V \pm 0.2V$ (BQB/RSV/DYY).....	<b>10</b>	9.6 Glossary.....	<b>23</b>
		<b>10 Revision History</b> .....	<b>23</b>
		<b>11 Mechanical, Packaging, and Orderable Information</b> .....	<b>24</b>

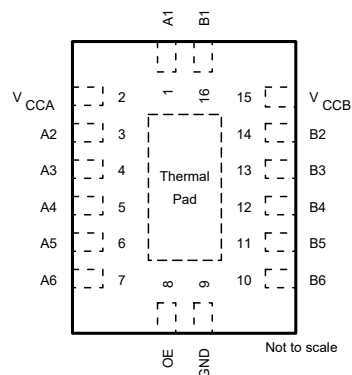
## 4 Pin Configuration and Functions



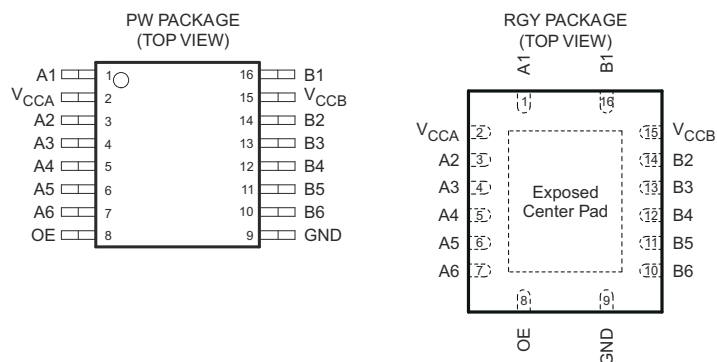
**Figure 4-1. RSV Package, 16-Pin UQFN (Top View)**



**Figure 4-3. DYY Package, 16-Pin SOT (Top View)**



**Figure 4-2. BQB Package, 16-Pin WQFN With Exposed Thermal Pad (Top View)**



**Figure 4-4. PW, RGY Package (Top View)**

- A. The exposed center pad, if used, must be connected as a secondary ground or left electrically open.
- B. Pull up resistors are not required on both sides for Logic I/O.
- C. If pull up or pull down resistors are needed, the resistor value must be over 50kΩ.
- D. 50kΩ is a safe recommended value, if the user can accept higher Vol or lower Voh, smaller pull up or pull down resistor is allowed, the draft estimation is  $V_{OL} = V_{CCOUT} \times 4.5k \div (4.5k + R_{PU})$  and  $V_{OH} = V_{CCOUT} \times R_{DW} \div (4.5k + R_{DW})$ .
- E. If pull up resistors are needed, please refer to the TXS0108 (different package with TXB0106), or contact TI.
- F. For detailed information, please refer to the [A Guide to Voltage Translation With TXB-Type Translators](#) application note.

**Table 4-1. Pin Functions**

PIN			I/O	DESCRIPTION
NO.	NO. (RSV)	NAME		
1	11	A1		Input/output 1. Referenced to $V_{CCA}$ .
2	12	$V_{CCA}$	-	A-port supply voltage. $1.2V \leq V_{CCA} \leq 3.6V$ , $V_{CCA} \leq V_{CCB}$ .
3	13	A2	I/O	Input/output 2. Referenced to $V_{CCA}$ .
4	14	A3	I/O	Input/output 3. Referenced to $V_{CCA}$ .
5	15	A4	I/O	Input/output 4. Referenced to $V_{CCA}$ .
6	16	A5	I/O	Input/output 5. Referenced to $V_{CCA}$ .
7	1	A6	I/O	Input/output 6. Referenced to $V_{CCA}$ .
8	2	OE	-	Output enable. Pull OE low to place all outputs in tri-state mode. Referenced to $V_{CCA}$ .
9	3	GND	-	Ground
10	4	B6	I/O	Input/output 6. Referenced to $V_{CCB}$ .
11	5	B5	I/O	Input/output 5. Referenced to $V_{CCB}$ .
12	6	B4	I/O	Input/output 4. Referenced to $V_{CCB}$ .
13	7	B3	I/O	Input/output 3. Referenced to $V_{CCB}$ .
14	8	B2	I/O	Input/output 2. Referenced to $V_{CCB}$ .
15	9	$V_{CCB}$	-	B-port supply voltage. $1.65V \leq V_{CCB} \leq 5.5V$ .
16	10	B1	I/O	Input/output 1. Referenced to $V_{CCB}$ .

## 5 Specifications

### 5.1 Absolute Maximum Ratings

over operating free-air temperature range (unless otherwise noted)<sup>(1)</sup>

		MIN	MAX	UNIT
V <sub>CCA</sub>	Supply voltage	−0.5	4.6	V
V <sub>CCB</sub>	Supply voltage	−0.5	6.5	V
V <sub>I</sub>	Input voltage <sup>(2)</sup>	−0.5	6.5	V
V <sub>O</sub>	Voltage applied to any output in the high-impedance or power-off state <sup>(2)</sup>	−0.5	6.5	V
V <sub>O</sub>	Voltage applied to any output in the high or low state <sup>(2) (3)</sup>	A inputs	−0.5 V <sub>CCA</sub> + 0.5	V
		B inputs	−0.5 V <sub>CCB</sub> + 0.5	
I <sub>IK</sub>	Input clamp current	V <sub>I</sub> < 0	−50	mA
I <sub>OK</sub>	Output clamp current	V <sub>O</sub> < 0	−50	mA
I <sub>O</sub>	Continuous output current		±50	mA
	Continuous current through V <sub>CCA</sub> , V <sub>CCB</sub> , or GND		±100	mA
T <sub>J</sub>	Junction Temperature	−40	150	°C
T <sub>stg</sub>	Storage temperature	−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<sub>CCA</sub> and V<sub>CCB</sub> are provided in the recommended operating conditions table.

### 5.2 ESD Ratings

			VALUE	UNIT
V <sub>(ESD)</sub>	Electrostatic discharge	Human body model (HBM), per ANSI/ESDA/JEDEC JS-001 <sup>(1)</sup>	A Port	2500
			B Port	±15000
		Charged-device model (CDM), per JEDEC specification JESD22-C101 <sup>(2)</sup>	A Port	1500
			B Port	
		Machine model (A115-A)	A Port	150
			B Port	

- (1) JEDEC document JEP155 states that 500V HBM allows safe manufacturing with a standard ESD control process.
- (2) JEDEC document JEP157 states that 250V CDM allows safe manufacturing with a standard ESD control process.

### 5.3 Recommended Operating Conditions

			V <sub>CCA</sub>	V <sub>CCB</sub>	MIN	MAX	UNIT
V <sub>CCA</sub>	Supply voltage				1.2	3.6	V
V <sub>CCB</sub>					1.65	5.5	
V <sub>IH</sub>	High-level input voltage	Data inputs	1.2V to 3.6V	1.65V to 5.5V	V <sub>CCI</sub> × 0.65 <sup>(1)</sup>	V <sub>CCI</sub>	V
		OE			V <sub>CCA</sub> × 0.65	5.5	
V <sub>IL</sub>	Low-level input voltage	Data inputs	1.2V to 5.5V	1.65V to 5.5V	0	V <sub>CCI</sub> × 0.35 <sup>(1)</sup>	V
		OE	1.2V to 3.6V		0	V <sub>CCA</sub> × 0.35	
Δt/Δv	Input transition rise or fall rate	A-port inputs	1.2V to 3.6V	1.65V to 5.5V		40	ns/V
		B-port inputs	1.2V to 3.6V	1.65V to 3.6V		40	
				4.5V to 5.5V		30	
T <sub>A</sub>	Operating free-air temperature				−40	85	°C

- (1) V<sub>CCI</sub> is the supply voltage associated with the input port.

## 5.4 Thermal Information

THERMAL METRIC <sup>(1)</sup>		TXB0106					UNIT
		PW (TSSOP)	RGY (VQFN)	RSV (UQFN)	BQB(WQFN)	DYY (SOT)	
		16 PINS	16 PINS	16 PINS	16 PINS	16 PINS	
$R_{\theta JA}$	Junction-to-ambient thermal resistance	107.2	40.7	134.5	63.4	132.0	°C/W
$R_{\theta JC(top)}$	Junction-to-case (top) thermal resistance	34.9	54.1	58.0	64.3	65.4	°C/W
$R_{\theta JB}$	Junction-to-board thermal resistance	13.3	20.9	62.5	33.6	63.5	°C/W
$\Psi_{JT}$	Junction-to-top characterization parameter	0.5	1.1	1.8	2.8	4.0	°C/W
$\Psi_{JB}$	Junction-to-board characterization parameter	13.3	20.9	62.3	33.6	63.3	°C/W
$R_{\theta JC(bot)}$	Junction-to-case (bottom) thermal resistance	2.7	6.7	N/A	16.2	N/A	°C/W

(1) For more information about traditional and new thermal metrics, see the [Semiconductor and IC Package Thermal Metrics](#) application note.

## 5.5 Electrical Characteristics (BQB/RSV/DYY)

over recommended operating free-air temperature range (unless otherwise noted)<sup>(1) (2)</sup>

PARAMETER		TEST CONDITIONS	V <sub>CCA</sub>	V <sub>CCB</sub>	T <sub>A</sub> = 25°C			−40°C to 85°C		UNIT
					MIN	TYP	MAX	MIN	MAX	
V <sub>OHA</sub>		I <sub>OH</sub> = −20μA	1.2V		1.1			V <sub>CCA</sub> − 0.4		V
			1.4V to 3.6V							
V <sub>OLA</sub>		I <sub>OL</sub> = 20μA	1.2V		0.9					V
			1.4V to 3.6V		0.4					
V <sub>OHB</sub>		I <sub>OH</sub> = −20μA		1.65V to 5.5V				V <sub>CCB</sub> − 0.4		V
V <sub>OLB</sub>		I <sub>OL</sub> = 20μA		1.65V to 5.5V				0.4		V
I <sub>I</sub>	OE		1.2V to 3.6V	1.65V to 5.5V	±1			±2		μA
I <sub>off</sub>	A port		0V	0V to 5.5V	±1			±2		μA
	B port		0V to 3.6V	0V	±1			±2		
I <sub>OZ</sub>	A or B port	OE = GND	1.2V to 3.6V	1.65V to 5.5V	±1			±2		μA
I <sub>CCA</sub>		V <sub>I</sub> = V <sub>CCI</sub> or GND, I <sub>O</sub> = 0	1.2V	1.65V to 5.5V	0.4			5		μA
			1.4V to 3.6V							
			3.6V	0V	2.75					
			0V	5.5V	-2					
I <sub>CCB</sub>		V <sub>I</sub> = V <sub>CCI</sub> or GND, I <sub>O</sub> = 0	1.2V	1.65V to 5.5V	3.4			7.75		μA
			1.4V to 3.6V							
			3.6V	0V	−2					
			0V	5.5V	7.1					
I <sub>CCA</sub> + I <sub>CCB</sub>		V <sub>I</sub> = V <sub>CCI</sub> or GND, I <sub>O</sub> = 0	1.2V	1.65V to 5.5V	3.5			10.4		μA
			1.4V to 3.6V							
I <sub>CCZA</sub>		V <sub>I</sub> = V <sub>CCI</sub> or GND, I <sub>O</sub> = 0, OE = GND	1.2V	1.65V to 5.5V	0.4			5		μA
			1.4V to 3.6V							
I <sub>CCZB</sub>		V <sub>I</sub> = V <sub>CCI</sub> or GND, I <sub>O</sub> = 0, OE = GND	1.2V	1.65V to 5.5V	3.3			7.6		μA
			1.4V to 3.6V							
C <sub>I</sub>	OE		1.2V to 3.6V	1.65V to 5.5V	5			6.5		pF
C <sub>io</sub>	A port		1.2V to 3.6V	1.65V to 5.5V	5			6.5		pF
	B port				8			13.1		

## 5.6 Electrical Characteristics (Other Packages)

over recommended operating free-air temperature range (unless otherwise noted)<sup>(1) (2)</sup>

PARAMETER		TEST CONDITIONS	V <sub>CCA</sub>	V <sub>CCB</sub>	T <sub>A</sub> = 25°C			–40°C to 85°C		UNIT
					MIN	TYP	MAX	MIN	MAX	
V <sub>OHA</sub>		I <sub>OH</sub> = –20μA	1.2V		1.1			V <sub>CCA</sub> – 0.4		V
			1.4V to 3.6V							
V <sub>OLA</sub>		I <sub>OL</sub> = 20μA	1.2V		0.9			0.4		V
			1.4V to 3.6V							
V <sub>OHB</sub>		I <sub>OH</sub> = –20μA		1.65V to 5.5V				V <sub>CCB</sub> – 0.4	V	
V <sub>OLB</sub>		I <sub>OL</sub> = 20μA		1.65V to 5.5V				0.4	V	
I <sub>I</sub>	OE		1.2V to 3.6V	1.65V to 5.5V	±1			±2	μA	
I <sub>off</sub>	A port		0V	0V to 5.5V	±1			±2	μA	
	B port		0V to 3.6V	0V	±1			±2		
I <sub>OZ</sub>	A or B port	OE = GND	1.2V to 3.6V	1.65V to 5.5V	±1			±2	μA	
I <sub>CCA</sub>		V <sub>I</sub> = V <sub>CCI</sub> or GND, I <sub>O</sub> = 0	1.2V	1.65V to 5.5V	0.06				μA	
			1.4V to 3.6V					5		
			3.6V	0V				2		
			0V	5.5V				2		
I <sub>CCB</sub>		V <sub>I</sub> = V <sub>CCB</sub> or GND, I <sub>O</sub> = 0	1.2V	1.65V to 5.5V	3.4				μA	
			1.4V to 3.6V					5		
			3.6V	0V				–2		
			0V	5.5V				2		
I <sub>CCA</sub> + I <sub>CCB</sub>		V <sub>I</sub> = V <sub>CCI</sub> or GND, I <sub>O</sub> = 0	1.2V	1.65V to 5.5V	3.5				μA	
			1.4V to 3.6V					10		
I <sub>CCZA</sub>		V <sub>I</sub> = V <sub>CCI</sub> or GND, I <sub>O</sub> = 0, OE = GND	1.2V	1.65V to 5.5V	0.05				μA	
			1.4V to 3.6V					5		
I <sub>CCZB</sub>		V <sub>I</sub> = V <sub>CCB</sub> or GND, I <sub>O</sub> = 0, OE = GND	1.2V	1.65V to 5.5V	3.3				μA	
			1.4V to 3.6V					5		
C <sub>I</sub>	OE		1.2V to 3.6V	1.65V to 5.5V	5			5.5	pF	
C <sub>io</sub>	A port		1.2V to 3.6V	1.65V to 5.5V	5			6.5	pF	
	B port				8			10		

- (1) V<sub>CCI</sub> is the supply voltage associated with the input port.  
(2) V<sub>CCO</sub> is the supply voltage associated with the output port.

## 5.7 Timing Requirements: V<sub>CCA</sub> = 1.2V

T<sub>A</sub> = 25°C, V<sub>CCA</sub> = 1.2V

			V <sub>CCB</sub> = 1.8V	V <sub>CCB</sub> = 2.5V	V <sub>CCB</sub> = 3.3V	V <sub>CCB</sub> = 5V	UNIT
			NOM	NOM	NOM	NOM	
Data rate			20	20	20	20	Mbps
t <sub>w</sub>	Pulse duration	Data inputs	50	50	50	50	ns

### 5.8 Timing Requirements: $V_{CCA} = 1.5V \pm 0.1V$

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

			$V_{CCB} = 1.8V \pm 0.15V$		$V_{CCB} = 2.5V \pm 0.2V$		$V_{CCB} = 3.3V \pm 0.3V$		$V_{CCB} = 5V \pm 0.5V$		UNIT
			MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
Data rate			50		50		50		50		Mbps
$t_w$	Pulse duration	Data inputs	20		20		20		20		ns

### 5.9 Timing Requirements: $V_{CCA} = 1.8V \pm 0.15V$

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

			$V_{CCB} = 1.8V \pm 0.15V$		$V_{CCB} = 2.5V \pm 0.2V$		$V_{CCB} = 3.3V \pm 0.3V$		$V_{CCB} = 5V \pm 0.5V$		UNIT
			MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
Data rate			52		60		60		60		Mbps
$t_w$	Pulse duration	Data inputs	19		17		17		17		ns

### 5.10 Timing Requirements: $V_{CCA} = 2.5V \pm 0.2V$

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

			$V_{CCB} = 2.5V \pm 0.2V$		$V_{CCB} = 3.3V \pm 0.3V$		$V_{CCB} = 5V \pm 0.5V$		UNIT
			MIN	MAX	MIN	MAX	MIN	MAX	
Data rate			70		100		100		Mbps
$t_w$	Pulse duration	Data inputs	14		10		10		ns

### 5.11 Timing Requirements: $V_{CCA} = 3.3V \pm 0.3V$

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

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

### 5.12 Switching Characteristics: $V_{CCA} = 1.2V$ (BQB/RSV/DYY)

$T_A = 25^\circ C$ ,  $V_{CCA} = 1.2V$

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CCB} = 1.8V$	$V_{CCB} = 2.5V$	$V_{CCB} = 3.3V$	$V_{CCB} = 5V$	UNIT
			TYP	TYP	TYP	TYP	
$t_{pd}$	A	B	9.5	7.9	7.6	8.5	ns
	B	A	9.2	8.8	8.4	8	
$t_{en}$	OE	A	1	1	1	1	$\mu s$
		B	1	1	1	1	
$t_{dis}$	OE	A	392	392	392	392	ns
		B	392	392	392	392	
$t_{rA}$ , $t_{fA}$	A-port rise and fall times		4.1	4.4	4.1	3.9	ns
$t_{rB}$ , $t_{fB}$	B-port rise and fall times		5	5	5.1	5.1	ns
$t_{SK(O)}$	Channel-to-channel skew		2.4	1.7	1.9	7	ns
Max data rate			20	20	20	20	Mbps



### 5.13 Switching Characteristics: $V_{CCA} = 1.2V$ (Other Packages)

$T_A = 25^\circ C$ ,  $V_{CCA} = 1.2V$

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CCB} = 1.8V$	$V_{CCB} = 2.5V$	$V_{CCB} = 3.3V$	$V_{CCB} = 5V$	UNIT
			TYP	TYP	TYP	TYP	
$t_{pd}$	A	B	9.5	7.9	7.6	8.5	ns
	B	A	9.2	8.8	8.4	8	
$t_{en}$	OE	A	1	1	1	1	$\mu s$
		B	1	1	1	1	
$t_{dis}$	OE	A	20	17	17	18	ns
		B	20	16	15	15	
$t_{rA}, t_{fA}$	A-port rise and fall times		4.1	4.4	4.1	3.9	ns
$t_{rB}, t_{fB}$	B-port rise and fall times		5	5	5.1	5.1	ns
$t_{SK(O)}$	Channel-to-channel skew		2.4	1.7	1.9	7	ns
Max data rate			20	20	20	20	Mbps

### 5.14 Switching Characteristics: $V_{CCA} = 1.5V \pm 0.1V$ (BQB/RSV/DYY)

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

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CCB} = 1.8V \pm 0.15V$		$V_{CCB} = 2.5V \pm 0.2V$		$V_{CCB} = 3.3V \pm 0.3V$		$V_{CCB} = 5V \pm 0.5V$		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	$\mu s$
		B		1		1		1		1	
$t_{dis}$	OE	A	278	390	236	305	236	305	236	305	ns
		B	278	390	236	305	236	305	236	305	
$t_{rA}, t_{fA}$	A-port rise and fall times		0.8	6.5	0.8	6.3	0.8	6.3	0.8	6.3	ns
$t_{rB}, t_{fB}$	B-port rise and fall times		1	7.3	0.7	4.9	0.7	4.6	0.6	4.6	ns
$t_{SK(O)}$	Channel-to-channel skew			2.6		1.9		1.6		1.3	ns
Max data rate			50		50		50		50		Mbps

### 5.15 Switching Characteristics: $V_{CCA} = 1.5V \pm 0.1V$ (Other Packages)

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

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CCB} = 1.8V \pm 0.15V$		$V_{CCB} = 2.5V \pm 0.2V$		$V_{CCB} = 3.3V \pm 0.3V$		$V_{CCB} = 5V \pm 0.5V$		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	$\mu s$
		B		1		1		1		1	
$t_{dis}$	OE	A	6.6	33	6.4	25.3	6.1	23.1	5.9	24.6	ns
		B	6.6	35.6	5.8	25.6	5.5	22.1	5.6	20.6	
$t_{rA}, t_{fA}$	A-port rise and fall times		0.8	6.5	0.8	6.3	0.8	6.3	0.8	6.3	ns
$t_{rB}, t_{fB}$	B-port rise and fall times		1	7.3	0.7	4.9	0.7	4.6	0.6	4.6	ns
$t_{SK(O)}$	Channel-to-channel skew			2.6		1.9		1.6		1.3	ns
Max data rate			50		50		50		50		Mbps

### 5.16 Switching Characteristics: $V_{CCA} = 1.8V \pm 0.15V$ (BQB/RSV/DYY)

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

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CCB} = 1.8V \pm 0.15V$		$V_{CCB} = 2.5V \pm 0.2V$		$V_{CCB} = 3.3V \pm 0.3V$		$V_{CCB} = 5V \pm 0.5V$		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	1.2	8.4	0.8	7.6	0.5	7.1	
$t_{en}$	OE	A		1		1		1		1	$\mu s$
		B		1		1		1		1	
$t_{dis}$	OE	A	278	389	191	253	190	248	189	248	ns
		B	278	389	191	253	190	248	189	248	
$t_{rA}, t_{fA}$	A-port rise and fall times		0.7	5.1	0.7	5	1	5	0.7	5	ns
$t_{rB}, t_{fB}$	B-port rise and fall times		1	7.3	0.7	5	0.7	3.9	0.6	3.8	ns
$t_{SK(O)}$	Channel-to-channel skew			0.8		0.7		0.6		0.6	ns
Max data rate			52		60		60		60		Mbps

### 5.17 Switching Characteristics: $V_{CCA} = 1.8V \pm 0.15V$ (Other Packages)

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

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CCB} = 1.8V \pm 0.15V$		$V_{CCB} = 2.5V \pm 0.2V$		$V_{CCB} = 3.3V \pm 0.3V$		$V_{CCB} = 5V \pm 0.5V$		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	1.2	8.4	0.8	7.6	0.5	7.1	
$t_{en}$	OE	A		1		1		1		1	$\mu s$
		B		1		1		1		1	
$t_{dis}$	OE	A	5.9	26.7	5.6	21.6	5.4	18.9	4.8	18.7	ns
		B	6.1	33.9	5.2	23.7	5	19.9	5	17.6	
$t_{rA}, t_{fA}$	A-port rise and fall times		0.7	5.1	0.7	5	1	5	0.7	5	ns
$t_{rB}, t_{fB}$	B-port rise and fall times		1	7.3	0.7	5	0.7	3.9	0.6	3.8	ns
$t_{SK(O)}$	Channel-to-channel skew			0.8		0.7		0.6		0.6	ns
Max data rate			52		60		60		60		Mbps

### 5.18 Switching Characteristics: $V_{CCA} = 2.5V \pm 0.2V$ (BQB/RSV/DYY)

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

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CCB} = 2.5V \pm 0.2V$		$V_{CCB} = 3.3V \pm 0.3V$		$V_{CCB} = 5V \pm 0.5V$		UNIT
			MIN	MAX	MIN	MAX	MIN	MAX	
$t_{pd}$	A	B	1.1	6.4	1	5.3	0.9	4.7	ns
	B	A	1	7	0.6	5.6	0.3	4.4	
$t_{en}$	OE	A		1		1		1	$\mu s$
		B		1		1		1	
$t_{dis}$	OE	A	190	252	137	184	133	169	ns
		B	190	252	137	184	133	169	
$t_{rA}, t_{fA}$	A-port rise and fall times		0.8	3.6	0.6	3.6	0.5	3.5	ns
$t_{rB}, t_{fB}$	B-port rise and fall times		0.6	4.9	0.7	3.9	0.6	3.2	ns
$t_{SK(O)}$	Channel-to-channel skew			0.4		0.3		0.3	ns

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

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CCB} = 2.5V \pm 0.2V$		$V_{CCB} = 3.3V \pm 0.3V$		$V_{CCB} = 5V \pm 0.5V$		UNIT
			MIN	MAX	MIN	MAX	MIN	MAX	
Max data rate			70		100		100		Mbps

### 5.19 Switching Characteristics: $V_{CCA} = 2.5V \pm 0.2V$ (Other Packages)

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

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CCB} = 2.5V \pm 0.2V$		$V_{CCB} = 3.3V \pm 0.3V$		$V_{CCB} = 5V \pm 0.5V$		UNIT
			MIN	MAX	MIN	MAX	MIN	MAX	
$t_{pd}$	A	B	1.1	6.4	1	5.3	0.9	4.7	ns
	B	A	1	7	0.6	5.6	0.3	4.4	
$t_{en}$	OE	A		1		1		1	$\mu s$
		B		1		1		1	
$t_{dis}$	OE	A	5	16.9	4.9	15	4.5	13.8	ns
		B	4.8	21.8	4.5	17.9	4.4	15.2	
$t_{rA}, t_{fA}$	A-port rise and fall times		0.8	3.6	0.6	3.6	0.5	3.5	ns
$t_{rB}, t_{fB}$	B-port rise and fall times		0.6	4.9	0.7	3.9	0.6	3.2	ns
$t_{SK(O)}$	Channel-to-channel skew			0.4		0.3		0.3	ns
Max data rate			70		100		100		Mbps

### 5.20 Switching Characteristics: $V_{CCA} = 3.3V \pm 0.3V$ (BQB/RSV/DYY)

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

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CCB} = 3.3V \pm 0.3V$		$V_{CCB} = 5V \pm 0.5V$		UNIT
			MIN	MAX	MIN	MAX	
$t_{pd}$	A	B	0.9	4.9	0.8	4	ns
	B	A	0.5	5.4	0.2	4	
$t_{en}$	OE	A		1		1	$\mu s$
		B		1		1	
$t_{dis}$	OE	A	137	183	97.6	127	ns
		B	137	183	97.6	127	
$t_{rA}, t_{fA}$	A-port rise and fall times		0.5	3	0.5	3	ns
$t_{rB}, t_{fB}$	B-port rise and fall times		0.7	3.9	0.6	3.2	ns
$t_{SK(O)}$	Channel-to-channel skew			0.4		0.3	ns
Max data rate			100		100		Mbps

## 5.21 Switching Characteristics: $V_{CCA} = 3.3V \pm 0.3V$ (Other Packages)

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

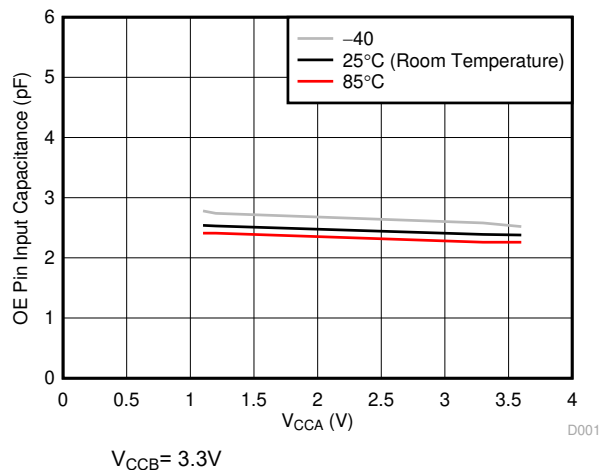
PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CCB} = 3.3V \pm 0.3V$		$V_{CCB} = 5V \pm 0.5V$		UNIT
			MIN	MAX	MIN	MAX	
$t_{pd}$	A	B	0.9	4.9	0.8	4	ns
	B	A	0.5	5.4	0.2	4	
$t_{en}$	OE	A		1		1	$\mu s$
		B		1		1	
$t_{dis}$	OE	A	4.5	13.9	4.1	12.4	ns
		B	4.1	17.3	4	14.4	
$t_{rA}, t_{fA}$	A-port rise and fall times		0.5	3	0.5	3	ns
$t_{rB}, t_{fB}$	B-port rise and fall times		0.7	3.9	0.6	3.2	ns
$t_{SK(O)}$	Channel-to-channel skew			0.4		0.3	ns
Max data rate			100		100		Mbps

## 5.22 Operating Characteristics

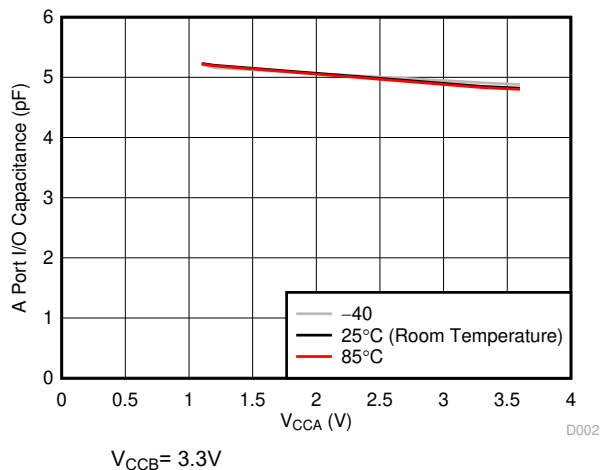
$T_A = 25^\circ C$

PARAMETER		TEST CONDITIONS	V <sub>CCA</sub>							UNIT
			1.2V	1.2V	1.5V	1.8V	2.5V	2.5V	3.3V	
			V <sub>CCB</sub>							
			5V	1.8V	1.8V	1.8V	2.5V	5V	3.3V to 5V	
			TYP	TYP	TYP	TYP	TYP	TYP	TYP	
C <sub>pdA</sub>	A-port input, B-port output	C <sub>L</sub> = 0, f = 10MHz, t <sub>r</sub> = t <sub>f</sub> = 1ns, OE = V <sub>CCA</sub> (outputs enabled)	9	8	7	7	7	7	8	pF
	B-port input, A-port output		12	11	11	11	11	11	11	
C <sub>pdB</sub>	A-port input, B-port output		35	26	27	27	27	27	28	
	B-port input, A-port output		26	19	18	18	18	20	21	
C <sub>pdA</sub>	A-port input, B-port output	C <sub>L</sub> = 0, f = 10MHz, t <sub>r</sub> = t <sub>f</sub> = 1ns, 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 <sub>pdB</sub>	A-port input, B-port output		0.01	0.01	0.01	0.01	0.01	0.01	0.03	
	B-port input, A-port output		0.01	0.01	0.01	0.01	0.01	0.01	0.03	

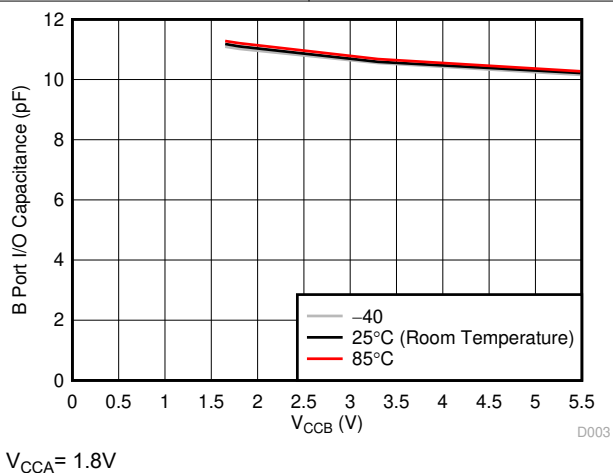
## 5.23 Typical Characteristics



**Figure 5-1. Input capacitance for OE pin ( $C_I$ ) vs Power Supply ( $V_{CCA}$ )**

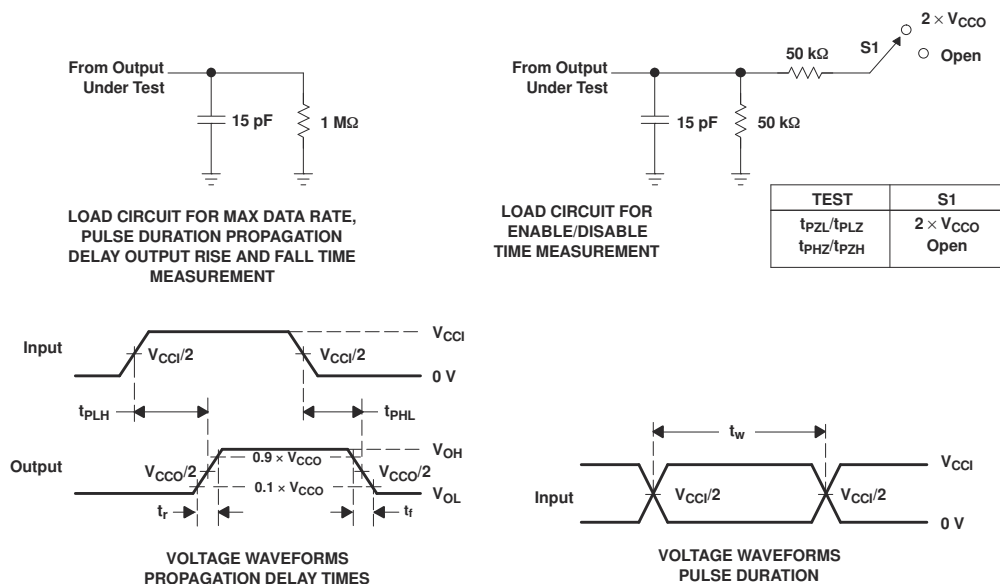


**Figure 5-2. Capacitance for A port I/O pins ( $C_{IO}$ ) vs Power Supply ( $V_{CCA}$ )**



**Figure 5-3. Capacitance for B port I/O pins ( $C_{IO}$ ) vs Power Supply ( $V_{CCB}$ )**

## 6 Parameter Measurement Information



- A.  $C_L$  includes probe and jig capacitance.
- B. All input pulses are supplied by generators having the following characteristics:  $PRR \leq 10$  MHz,  $Z_O = 50 \Omega$ ,  $dv/dt \geq 1$  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  $t_{pd}$ .
- 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.

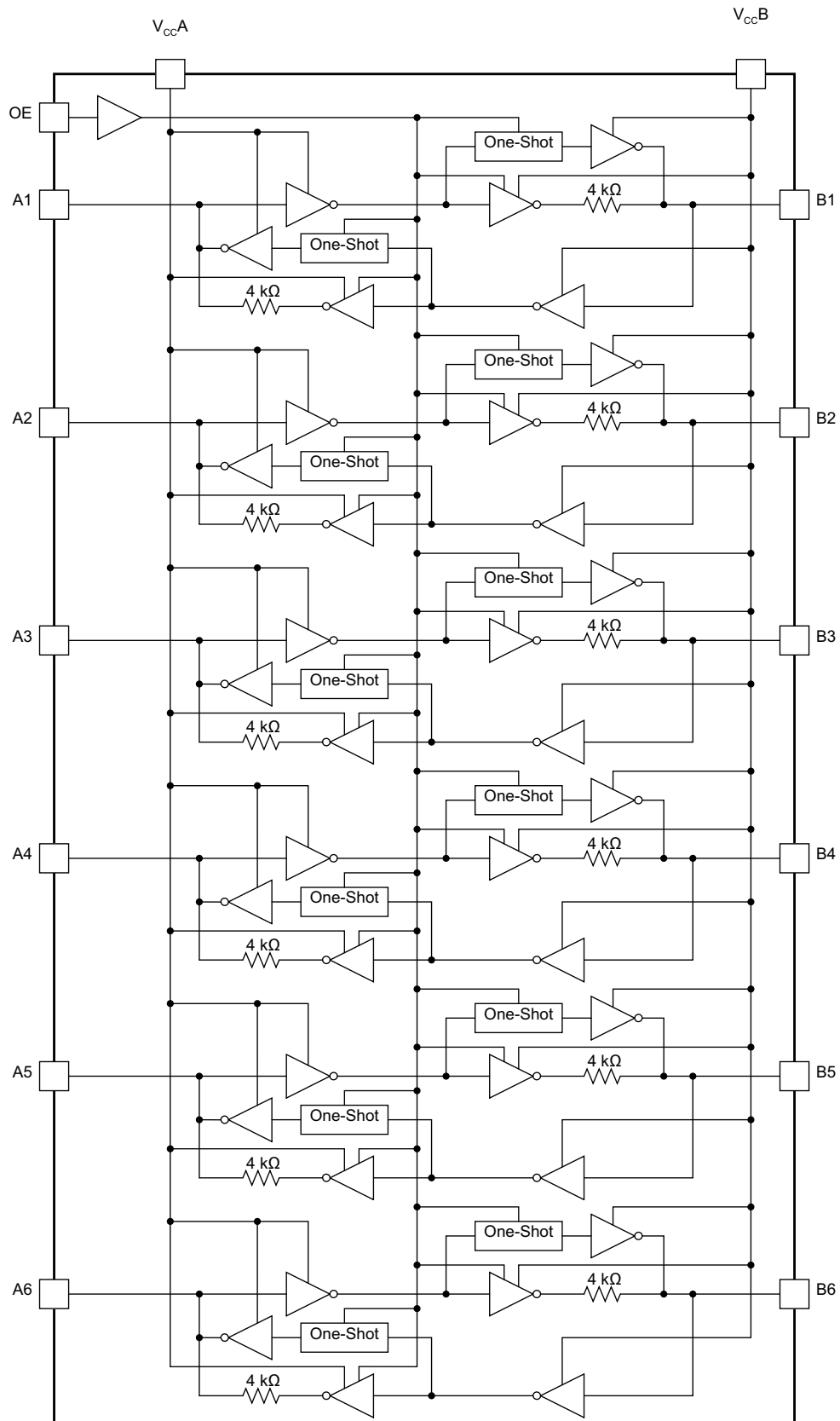
**Figure 6-1. Load Circuits and Voltage Waveforms**

## 7 Detailed Description

### 7.1 Overview

The TXB0106 device is a 6-bit, directionless voltage-level translator specifically designed for translating logic voltage levels. The A port is able to accept I/O voltages ranging from 1.2V to 3.6V, while the B port can accept I/O voltages from 1.65V to 5.5V. The device is a buffered architecture with edge-rate accelerators (one-shots) to improve the overall data rate. This device can only translate push-pull CMOS logic outputs. If for open-drain signal translation, please refer to TI's TXS010X products.

## 7.2 Functional Block Diagram



## 7.3 Feature Description

### 7.3.1 Architecture

The TXB0106 architecture (see [Figure 7-1](#)) 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 TXB0106 maintain a high or low and are designed to be weak, so that an external driver can overdrive the output drivers 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 70Ω at  $V_{CCO} = 1.2V$  to 1.8V, 50Ω at  $V_{CCO} = 1.8V$  to 3.3V, and 40Ω at  $V_{CCO} = 3.3V$  to 5V.

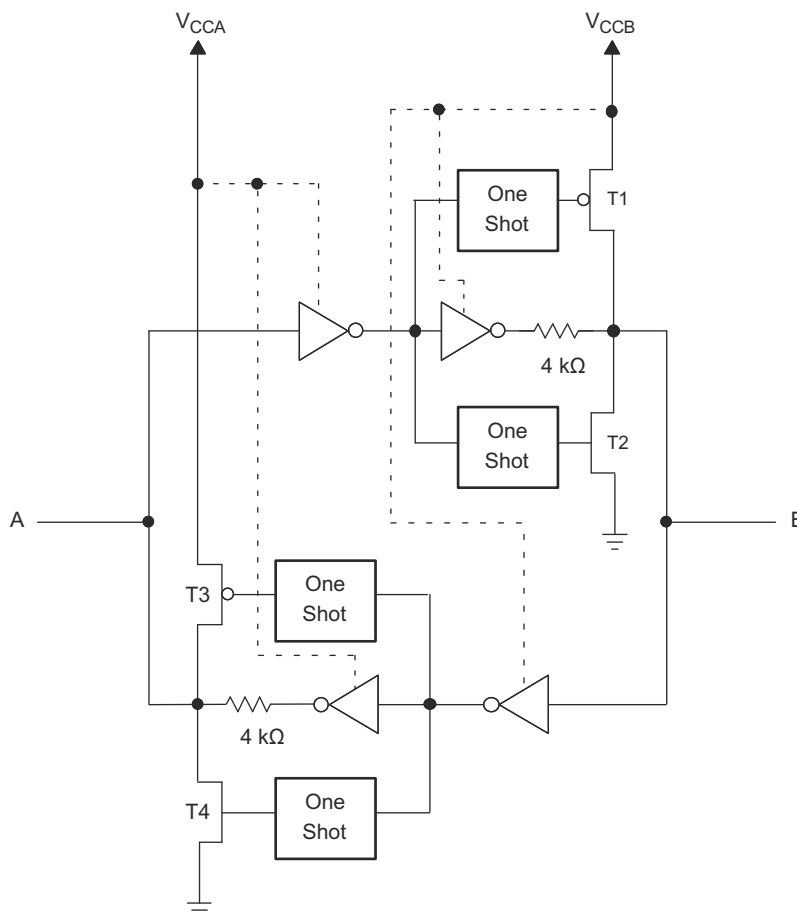
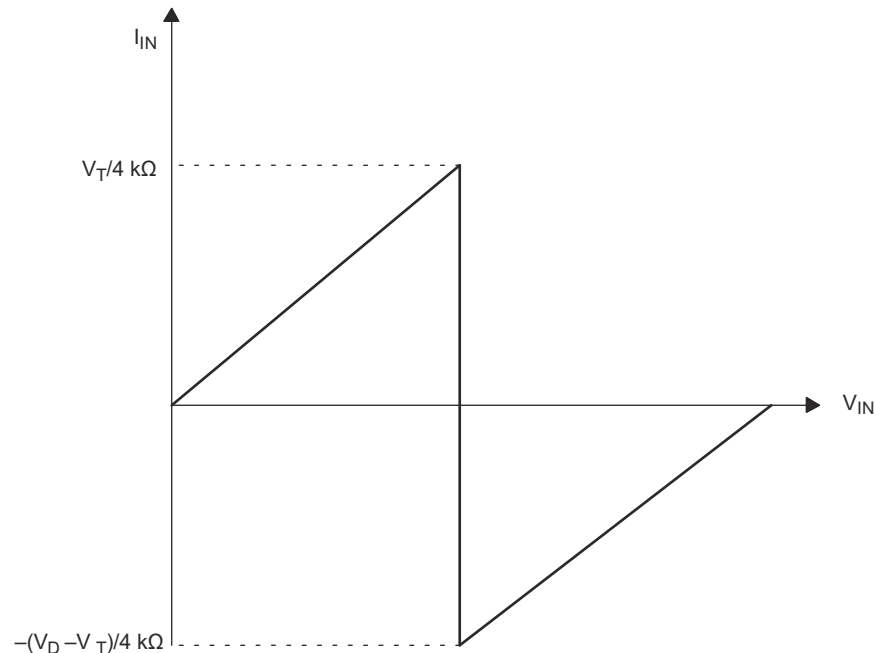


Figure 7-1. Architecture of TXB0106 I/O Cell

### 7.3.2 Input Driver Requirements

Typical  $I_{IN}$  vs  $V_{IN}$  characteristics of the TXB0106 are shown in [Figure 7-2](#). For proper operation, the device driving the data I/Os of the TXB0106 must have drive strength of at least  $\pm 2mA$ .





- A.  $V_T$  is the input threshold voltage of the TXB0106 (typically  $V_{CCI}/2$ ).
- B.  $V_D$  is the supply voltage of the external driver.

**Figure 7-2. Typical  $I_{IN}$  vs  $V_{IN}$  Curve**

### 7.3.3 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 TXB0106 has circuitry that disables all output ports when either  $V_{CC}$  is switched off ( $V_{CCA/B} = 0V$ ).

### 7.3.4 Output Load Considerations

TI recommends careful PCB layout practices with short PCB trace lengths to avoid excessive capacitive loading and to establish that proper O.S. triggering takes place. Keep PCB signal trace-lengths short enough so that the round trip delay of any reflection is less than the one-shot duration. This improves signal integrity by ensuring that any reflection sees a low impedance at the driver. The O.S. circuits are designed to stay on for approximately 10ns. The maximum capacitance of the lumped load that can be driven also depends directly on the one-shot duration. With very heavy capacitive loads, the one-shot can time-out before the signal is driven fully to the positive rail. The O.S. duration has been set to best optimize trade-offs between dynamic ICC, load driving capability, and maximum bit-rate considerations. Both PCB trace length and connectors add to the capacitance that the TXB0106 output undergoes, so it is recommended that this lumped-load capacitance be considered to avoid O.S. retriggering, bus contention, output signal oscillations, or other adverse system-level affects.

### 7.3.5 Enable and Disable

The TXB0106 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 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.

### 7.3.6 Pullup or Pulldown Resistors on I/O Lines

The TXB0106 is designed to drive capacitive loads of up to 70pF. The output drivers of the TXB0106 have low dc drive strength. If pullup or pulldown resistors are connected externally to the data I/Os, keep values higher than 50kΩ to establish that they do not contend with the output drivers of the TXB0106.

For the same reason, do not use the TXB0106 in applications such as I<sup>2</sup>C 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.

## 7.4 Device Functional Modes

The TXB0106 device has two functional modes, enabled and disabled. To disable the device, set the OE input to low, which places all I/Os in a high impedance state. Setting the OE input to high will enable the device.

## 8 Application and Implementation

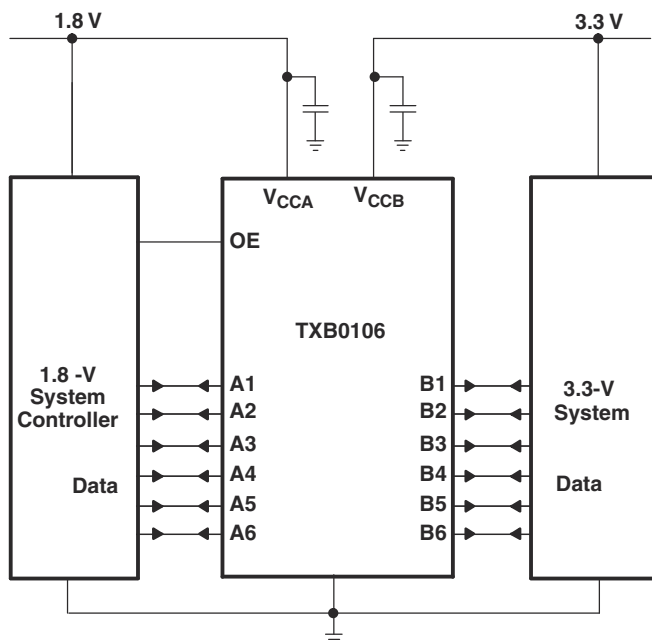
### Note

Information in the following applications sections is not part of the TI component specification, and TI does not warrant its accuracy or completeness. TI's customers are responsible for determining suitability of components for their purposes. Customers should validate and test their design implementation to confirm system functionality.

### 8.1 Application Information

The TXB0106 can be used in level-translation applications for interfacing devices or systems operating at different interface voltages with one another. The TXB0106 can only translate push-pull CMOS logic outputs. If for open-drain signal translation, refer to TI TXS010X products. Any external pulldown or pullup resistors are recommended larger than 50k $\Omega$ .

### 8.2 Typical Application



**Figure 8-1. Typical Operating Circuit**

### 8.2.1 Design Requirements

For this design example, use the parameters listed in [Table 8-1](#). Check that  $V_{CCA} \leq V_{CCB}$ .

**Table 8-1. Design Parameters**

DESIGN PARAMETERS	EXAMPLE VALUE
Input voltage range	1.2V to 3.6V
Output voltage range	1.65V to 5.5V

### 8.2.2 Detailed Design Procedure

To begin the design process, determine the following:

- Input voltage range
  - Use the supply voltage of the device that is driving the TXB0106 device to determine the input voltage range. For a valid logic high the value must exceed the  $V_{IH}$  of the input port. For a valid logic low the value must be less than the  $V_{IL}$  of the input port.
- Output voltage range
  - Use the supply voltage of the device that the TXB0106 device is driving to determine the output voltage range.
  - External pullop and pulldown resistors are not recommended. If the pullup and pulldown resistors are mandatory, the value must not be larger than 50k $\Omega$ .
- An external pulldown or pullup resistor decreases the output  $V_{OH}$  and  $V_{OL}$ . Use the below equations to draft estimate the  $V_{OH}$  and  $V_{OL}$  as a result of an external pulldown and pullup resistor.

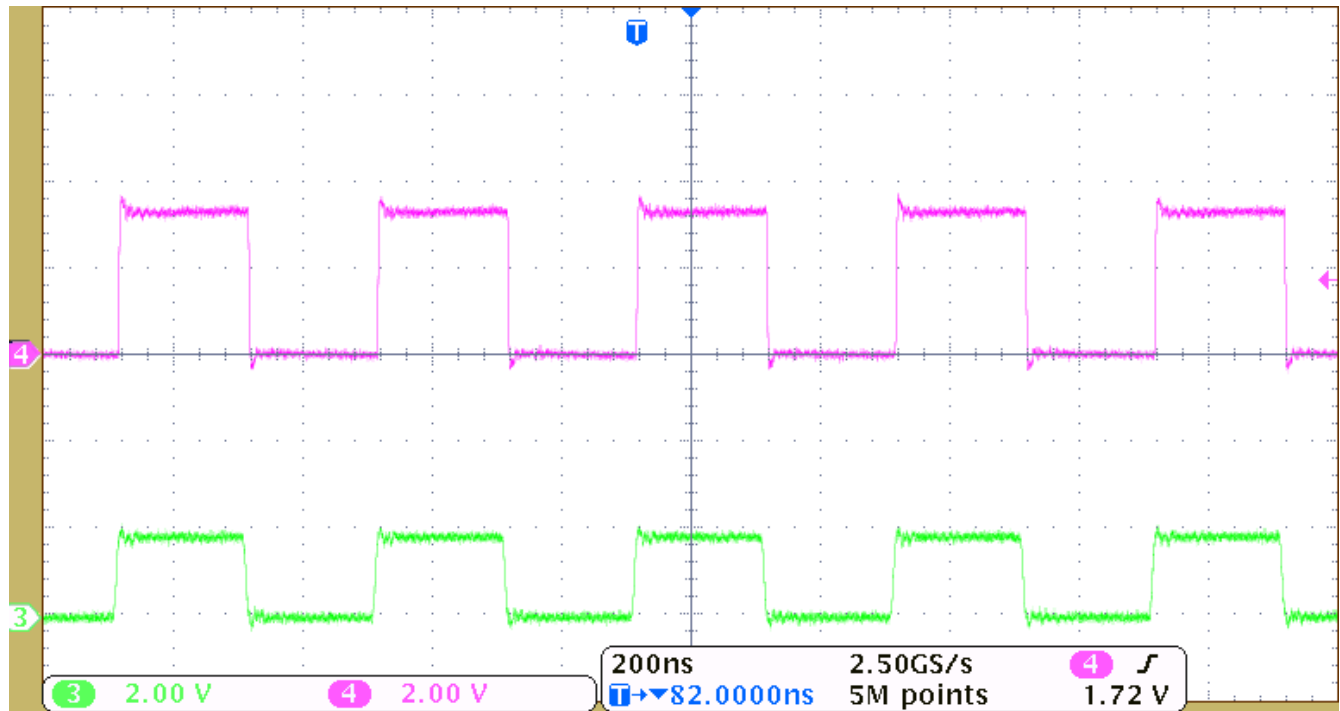
$$V_{OH} = V_{CCx} \times R_{PD} \div (R_{PD} + 4.5k\Omega) \quad (1)$$

$$V_{OH} = V_{CCx} \times 4.5k\Omega \div (R_{PU} + 4.5k\Omega) \quad (2)$$

where

- $V_{CCx}$  is the output port supply voltage on either  $V_{CCA}$  or  $V_{CCB}$
- $R_{PD}$  is the value of the external pull down resistor
- $R_{PU}$  is the value of the external pull up resistor
- 4.5k $\Omega$  is the counting the variation of the serial resistor 4k $\Omega$  in the I/O line

### 8.2.3 Application Curves



**Figure 8-2. 2.5MHz Signal Level Translation**

## 8.3 Power Supply Recommendations

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 TXB0106 has circuitry that disables all output ports when either  $V_{CC}$  is switched off ( $V_{CCA/B} = 0V$ ). The output-enable (OE) input circuit is designed so that it is supplied by  $V_{CCA}$  and when the (OE) input is low, all outputs are placed in the high-impedance state. To verify that the high-impedance state of the outputs during power up or power down, the OE input pin must be tied to GND through a pulldown resistor and must not be enabled until  $V_{CCA}$  and  $V_{CCB}$  are fully ramped and stable. The minimum value of the pulldown resistor to ground is determined by the current-sourcing capability of the driver.

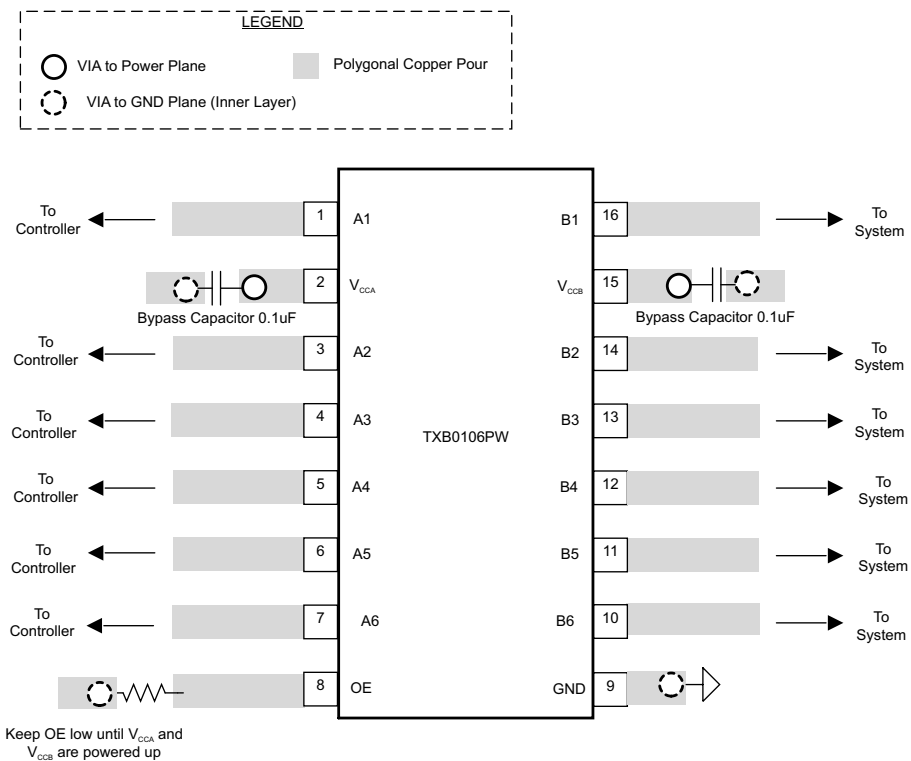
## 8.4 Layout

### 8.4.1 Layout Guidelines

To confirm reliability of the device, following common printed-circuit board layout guidelines is recommended.

- Use bypass capacitors on power supplies. Place bypass capacitors as close as possible to the  $V_{CCA}$ ,  $V_{CCB}$  pin, and GND pin.
- Use short trace-lengths to avoid excessive loading.
- Keep PCB signal trace-lengths short enough so that the round-trip delay of any reflection is less than the one-shot duration, approximately 10ns, establishing that any reflection encounters low impedance at the source driver.

### 8.4.2 Layout Example



## 9 Device and Documentation Support

### 9.1 Documentation Support

#### 9.1.1 Related Documentation

Texas Instruments, [A Guide to Voltage Translation With TXB-Type Translators](#) application report

Texas Instruments, [Semiconductor and IC Package Thermal Metrics](#) application note

### 9.2 Receiving Notification of Documentation Updates

To receive notification of documentation updates, navigate to the device product folder on [ti.com](http://ti.com). Click on *Notifications* to register and receive a weekly digest of any product information that has changed. For change details, review the revision history included in any revised document.

### 9.3 Support Resources

[TI E2E™ support forums](#) are an engineer's go-to source for fast, verified answers and design help — straight from the experts. Search existing answers or ask your own question to get the quick design help you need.

Linked content is provided "AS IS" by the respective contributors. They do not constitute TI specifications and do not necessarily reflect TI's views; see TI's [Terms of Use](#).

### 9.4 Trademarks

TI E2E™ is a trademark of Texas Instruments.

All trademarks are the property of their respective owners.

### 9.5 Electrostatic Discharge Caution



This integrated circuit can be damaged by ESD. Texas Instruments recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage.

ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

### 9.6 Glossary

[TI Glossary](#) This glossary lists and explains terms, acronyms, and definitions.

## 10 Revision History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

Changes from Revision B (February 2015) to Revision C (May 2025)	Page
• Updated the numbering format for tables, figures, and cross-references throughout the document.....	1
• Added thermal information for BQB, RSV and DYY packages.....	6
• Added <i>Related Documentation</i> section.....	23

Changes from Revision A (April 2012) to Revision B (February 2015)	Page
• Added <i>Pin Configuration and Functions</i> section, <i>ESD Ratings</i> table, <i>Feature Description</i> section, <i>Device Functional Modes</i> , <i>Application and Implementation</i> section, <i>Power Supply Recommendations</i> section, <i>Layout</i> section, <i>Device and Documentation Support</i> section, and <i>Mechanical, Packaging, and Orderable Information</i> section.....	1

Changes from Revision * (September 2008) to Revision A (April 2012)	Page
• Added notes to pin out graphics.....	3

## 11 Mechanical, Packaging, and Orderable Information

The following pages include mechanical, packaging, and orderable information. This information is the most current data available for the designated devices. This data is subject to change without notice and revision of this document. For browser-based versions of this data sheet, refer to the left-hand navigation.



## PACKAGING INFORMATION

Orderable part number	Status (1)	Material type (2)	Package   Pins	Package qty   Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
<a href="#">TXB0106PWR</a>	Active	Production	TSSOP (PW)   16	2000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	YE06
TXB0106PWR.A	Active	Production	TSSOP (PW)   16	2000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	YE06
TXB0106PWR.B	Active	Production	TSSOP (PW)   16	2000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	YE06
TXB0106PWRG4.A	Active	Production	TSSOP (PW)   16	2000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	YE06
TXB0106PWRG4.B	Active	Production	TSSOP (PW)   16	2000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	YE06
<a href="#">TXB0106RGYR</a>	Active	Production	VQFN (RGY)   16	3000   LARGE T&R	Yes	NIPDAU	Level-2-260C-1 YEAR	-40 to 85	YE06
TXB0106RGYR.A	Active	Production	VQFN (RGY)   16	3000   LARGE T&R	Yes	NIPDAU	Level-2-260C-1 YEAR	-40 to 85	YE06
TXB0106RGYR.B	Active	Production	VQFN (RGY)   16	3000   LARGE T&R	Yes	NIPDAU	Level-2-260C-1 YEAR	-40 to 85	YE06
TXB0106RGYRG4.A	Active	Production	VQFN (RGY)   16	3000   LARGE T&R	Yes	NIPDAU	Level-2-260C-1 YEAR	-40 to 85	YE06
TXB0106RGYRG4.B	Active	Production	VQFN (RGY)   16	3000   LARGE T&R	Yes	NIPDAU	Level-2-260C-1 YEAR	-40 to 85	YE06

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

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

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

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

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

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

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

**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.

**OTHER QUALIFIED VERSIONS OF TXB0106 :**

- Automotive : [TXB0106-Q1](#)

NOTE: Qualified Version Definitions:

- Automotive - Q100 devices qualified for high-reliability automotive applications targeting zero defects

## TAPE AND REEL INFORMATION



\*All dimensions are nominal

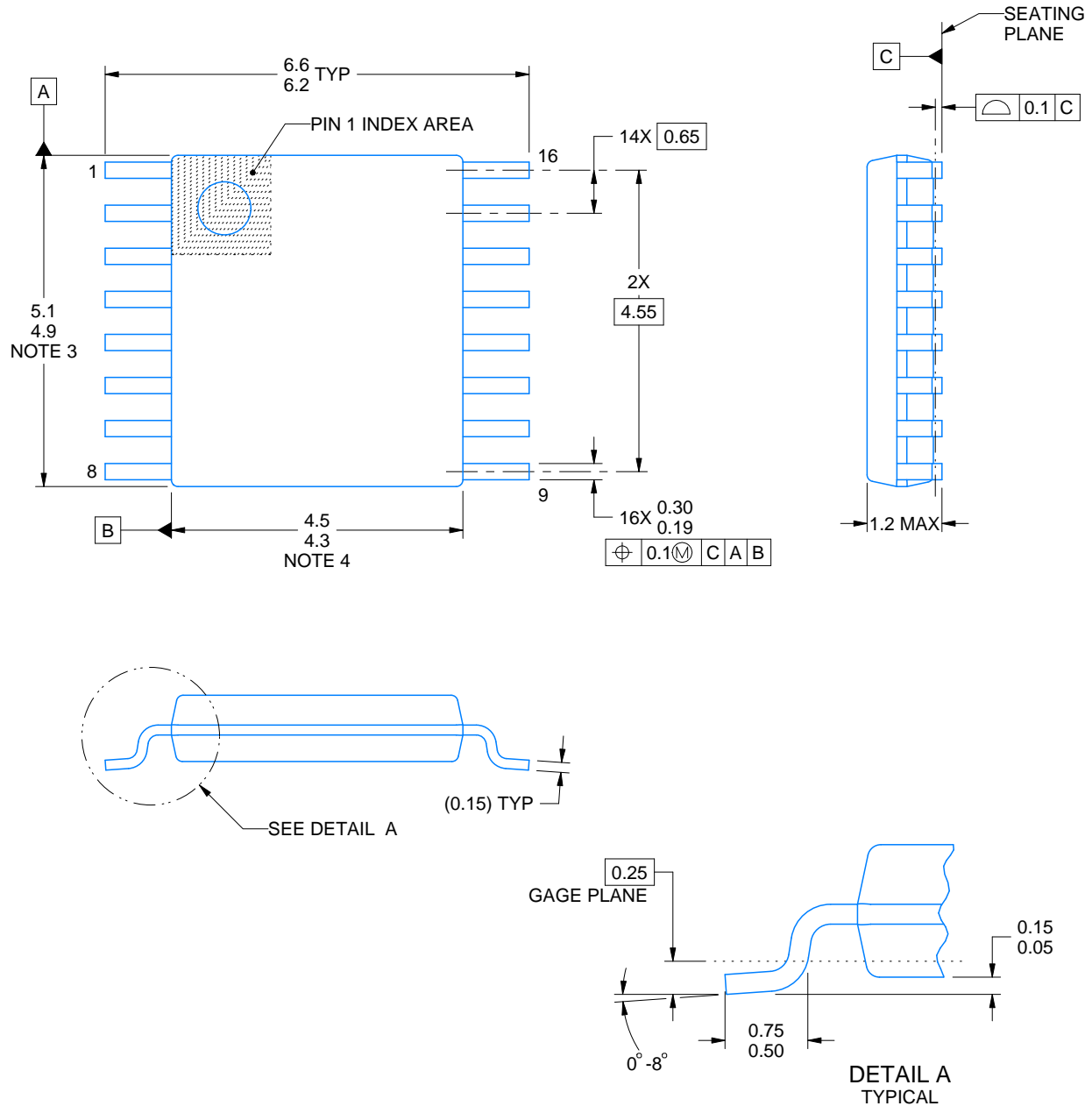
Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
TXB0106PWR	TSSOP	PW	16	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1
TXB0106RGYR	VQFN	RGY	16	3000	330.0	12.4	3.8	4.3	1.5	8.0	12.0	Q1

## TAPE AND REEL BOX DIMENSIONS



\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
TXB0106PWR	TSSOP	PW	16	2000	356.0	356.0	35.0
TXB0106RGYR	VQFN	RGY	16	3000	356.0	356.0	35.0



4220204/A 02/2017

## NOTES:

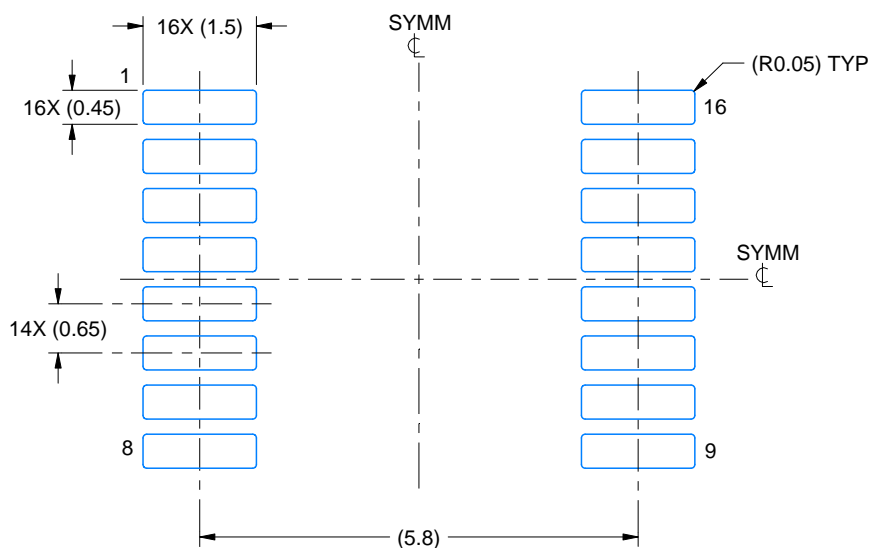
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm per side.
4. This dimension does not include interlead flash. Interlead flash shall not exceed 0.25 mm per side.
5. Reference JEDEC registration MO-153.

# EXAMPLE BOARD LAYOUT

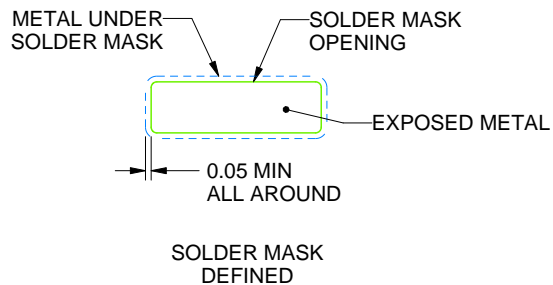
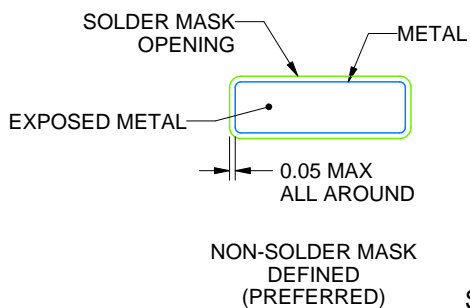
PW0016A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



LAND PATTERN EXAMPLE  
EXPOSED METAL SHOWN  
SCALE: 10X



SOLDER MASK DETAILS

4220204/A 02/2017

NOTES: (continued)

6. Publication IPC-7351 may have alternate designs.

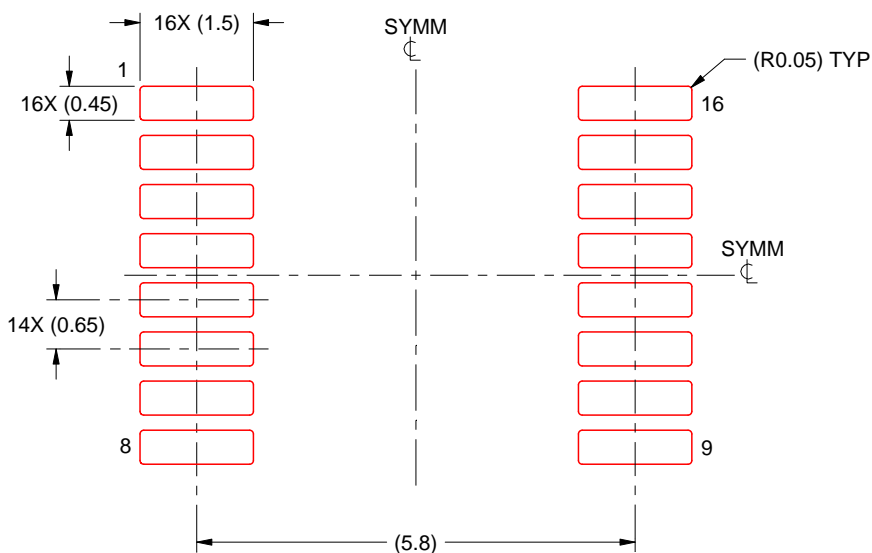
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

## EXAMPLE STENCIL DESIGN

PW0016A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



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

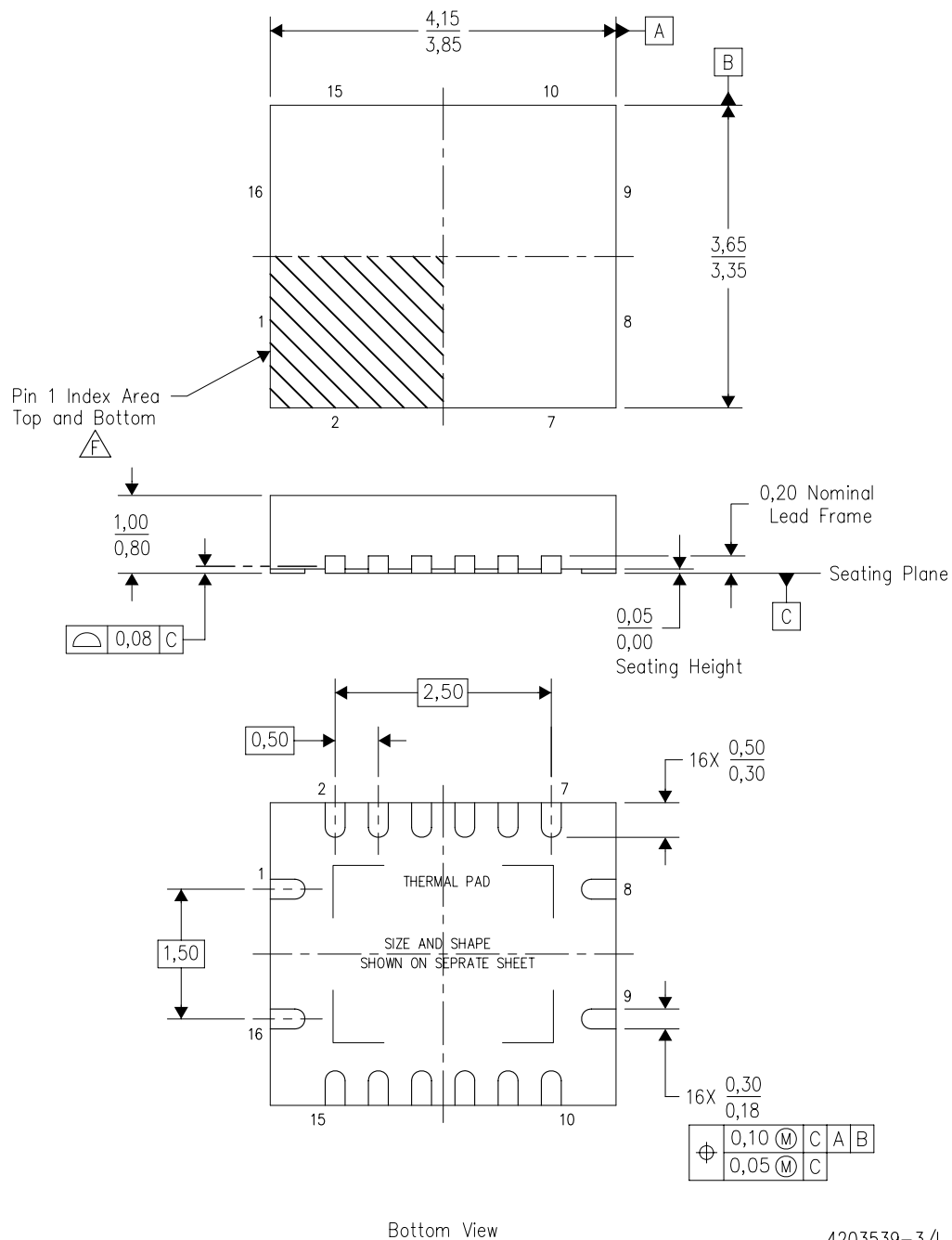
4220204/A 02/2017

NOTES: (continued)

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

RGY (R-PVQFN-N16)

PLASTIC QUAD FLATPACK NO-LEAD



4203539-3/I 06/2011

- NOTES:
- All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M-1994.
  - This drawing is subject to change without notice.
  - QFN (Quad Flatpack No-Lead) package configuration.
  - The package thermal pad must be soldered to the board for thermal and mechanical performance.
  - See the additional figure in the Product Data Sheet for details regarding the exposed thermal pad features and dimensions.
- F** Pin 1 identifiers are located on both top and bottom of the package and within the zone indicated. The Pin 1 identifiers are either a molded, marked, or metal feature.
- Package complies to JEDEC MO-241 variation BA.



RGY (R-PVQFN-N16)

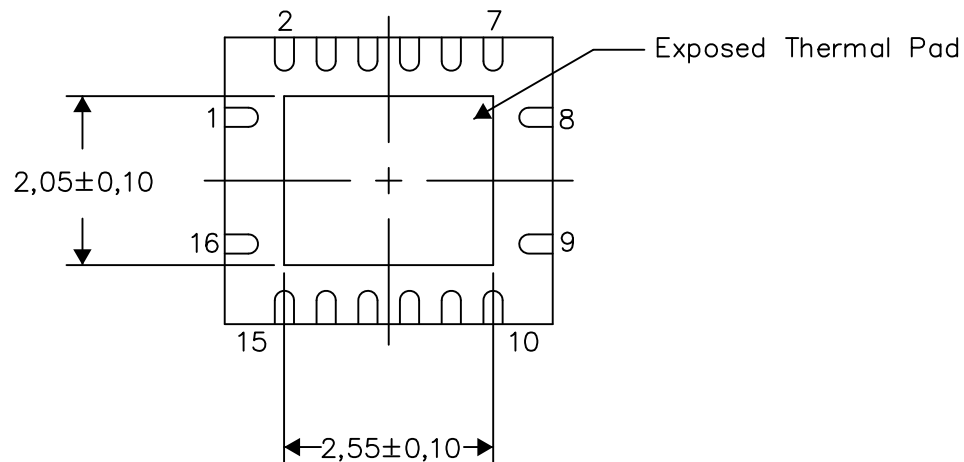
PLASTIC QUAD FLATPACK NO-LEAD

## THERMAL INFORMATION

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

For information on the Quad Flatpack No-Lead (QFN) package and its advantages, refer to Application Report, QFN/SON PCB Attachment, Texas Instruments Literature No. SLUA271. This document is available at [www.ti.com](http://www.ti.com).

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

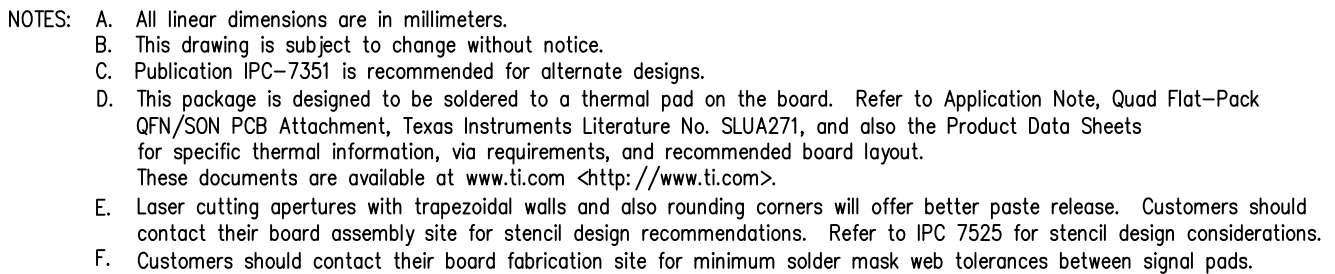


Bottom View

Exposed Thermal Pad Dimensions

4206353-3/P 03/14

NOTE: All linear dimensions are in millimeters



## IMPORTANT NOTICE AND DISCLAIMER

TI PROVIDES TECHNICAL AND RELIABILITY DATA (INCLUDING DATA SHEETS), DESIGN RESOURCES (INCLUDING REFERENCE DESIGNS), APPLICATION OR OTHER DESIGN ADVICE, WEB TOOLS, SAFETY INFORMATION, AND OTHER RESOURCES "AS IS" AND WITH ALL FAULTS, AND DISCLAIMS ALL WARRANTIES, EXPRESS AND IMPLIED, INCLUDING WITHOUT LIMITATION ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF THIRD PARTY INTELLECTUAL PROPERTY RIGHTS.

These resources are intended for skilled developers designing with TI products. You are solely responsible for (1) selecting the appropriate TI products for your application, (2) designing, validating and testing your application, and (3) ensuring your application meets applicable standards, and any other safety, security, regulatory or other requirements.

These resources are subject to change without notice. TI grants you permission to use these resources only for development of an application that uses the TI products described in the resource. Other reproduction and display of these resources is prohibited. No license is granted to any other TI intellectual property right or to any third party intellectual property right. TI disclaims responsibility for, and you will fully indemnify TI and its representatives against, any claims, damages, costs, losses, and liabilities arising out of your use of these resources.

TI's products are provided subject to [TI's Terms of Sale](#) or other applicable terms available either on [ti.com](https://www.ti.com) or provided in conjunction with such TI products. TI's provision of these resources does not expand or otherwise alter TI's applicable warranties or warranty disclaimers for TI products.

TI objects to and rejects any additional or different terms you may have proposed.

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265  
Copyright © 2025, Texas Instruments Incorporated