

TXB0108-Q1 8 ビット双方向電圧レベルトランスレータ、自動方向検出機能および $\pm 15\text{kV}$ ESD 保護機能搭載

1 特長

- 1.2V~3.6V (A ポート)、1.65V~5.5V (B ポート) ($V_{CCA} \leq V_{CCB}$)
- V_{CC} 絶縁機能: どちらかの V_{CC} 入力が高インピーダンス状態になると、すべての出力が高インピーダンス状態
- V_{CCA} を基準とする出力イネーブル (OE) 入力回路
- 低消費電力、最大 $I_{CC}: 4\mu\text{A}$
- I_{off} により部分的パワーダウン モード動作をサポート
- JESD 78、Class II 準拠で 100mA 超のラッチアップ性能
- JESD 22 を超える ESD 保護
 - A ポート
 - 2000V、人体モデル (A114-B)
 - 1000V、デバイス帯電モデル (C101)
 - B ポート
 - $\pm 15\text{kV}$ 、人体モデル (A114-B)
 - 1000V、デバイス帯電モデル (C101)

2 アプリケーション

- ハンドセット
- スマートフォン
- タブレット
- デスクトップ PC

3 概要

この 8 ビット非反転トランスレータは、設定可能な 2 本の独立した電源レールを使用します。A ポートは V_{CCA} に追従するように設計されています。 V_{CCA} ピンには、1.2V~3.6V の電源電圧を入力できます。B ポートは、 V_{CCB} に追従する設計になっています。 V_{CCB} ピンには、1.65V~5.5V の電源電圧を入力できます。これにより、1.2V、1.5V、1.8V、2.5V、3.3V、5V の任意の電圧ノード間での自在な低電圧双方向変換が可能です。 V_{CCA} が V_{CCB} を上回ることはいけません。

出力イネーブル (OE) 入力が高レベル (High) のとき、全出力が高インピーダンス状態になります。

TXB0108-Q1 は、OE 入力回路が V_{CCA} によって給電されるように設計されています。

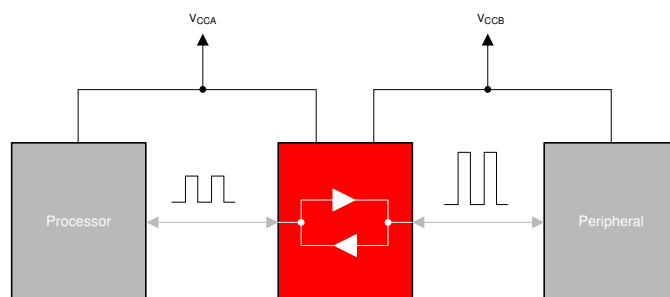
このデバイスは、 I_{off} を使用する部分的パワーダウン アプリケーション用の動作が完全に規定されています。 I_{off} 回路で出力をディセーブルすることにより、電源切断時にデバイスに電流が逆流して損傷するのを回避できます。

電源オンまたは電源オフ時に高インピーダンス状態を確保するため、OE をプルダウン抵抗経路で GND に接続する必要があります。この抵抗の最小値は、ドライバの電流ソース能力によって決まります。

製品情報

部品番号	パッケージ (1)	本体サイズ (公称)
TXB0108QPW-Q1	TSSOP (20)	6.50 mm × 4.40mm
TXB0108QRKS-Q1	VQFN (20)	4.50 mm × 2.50mm

(1) 利用可能なすべてのパッケージについては、データシートの末尾にある注文情報を参照してください。



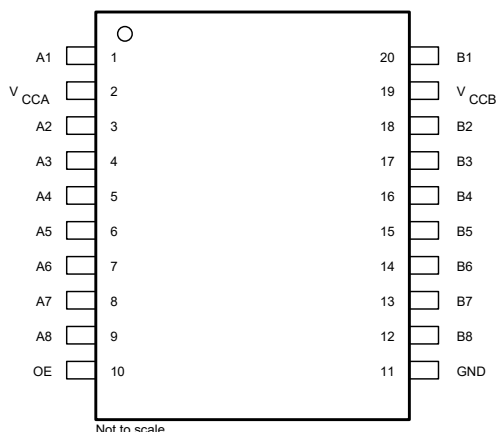
TXB0108-Q1 の代表的なアプリケーション ブロック図



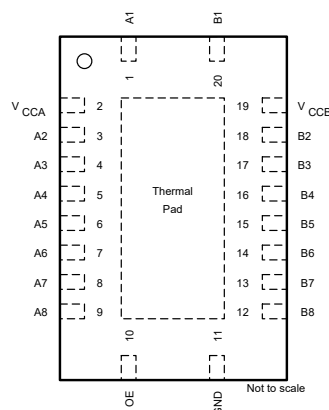
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4 Pin Configuration and Functions



4-1. PW Package (Top View)



4-2. RKS Package (Top View)

- For the RKS package, the exposed center thermal pad must be connected to ground.
- Pullup resistors are not required on both sides for Logic I/O.
- If pullup or pulldown resistors are needed, the resistor value must be over 50kΩ.
- 50 kΩ is a safe recommended value, if the customer can accept higher V_{OL} or lower V_{OH} , smaller pullup or pulldown resistor is allowed, the draft estimation is $V_{OL} = V_{CCOUT} \times 4.5 \text{ k} / (4.5 \text{ k} + R_{PU})$ and $V_{OH} = V_{CCOUT} \times R_{DW} / (4.5 \text{ k} + R_{DW})$.
- If pullup resistors are needed, please refer to the TXS0108 or contact TI.
- For detailed information, please refer [A Guide to Voltage Translation With TXB-Type Translators](#).

表 4-1. Pin Functions

PIN				I/O ⁽¹⁾	FUNCTION
SIGNAL NAME	PW, RGY NO.	DQS NO.	YZP GRID LOCATOR		
A1	1	1	A3	I/O	Input/output 1. Referenced to V_{CCA} .
V_{CCA}	2	5	C4	S	A-port supply voltage. $1.1\text{ V} \leq V_{CCA} \leq 3.6\text{ V}$, $V_{CCA} \leq V_{CCB}$.
A2	3	2	A4	I/O	Input/output 2. Referenced to V_{CCA} .
A3	4	3	B3	I/O	Input/output 3. Referenced to V_{CCA} .
A4	5	4	B4	I/O	Input/output 4. Referenced to V_{CCA} .
A5	6	7	C3	I/O	Input/output 5. Referenced to V_{CCA} .
A6	7	8	E4	I/O	Input/output 6. Referenced to V_{CCA} .
A7	8	9	D3	I/O	Input/output 7. Referenced to V_{CCA} .
A8	9	10	E3	I/O	Input/output 8. Referenced to V_{CCA} .
OE	10	6	D4	I	Output enable. Pull OE low to place all outputs in 3-state mode. Referenced to V_{CCA} .
GND	11	15	D1	S	Ground
B8	12	11	E2	I/O	Input/output 8. Referenced to V_{CCB} .
B7	13	12	D2	I/O	Input/output 7. Referenced to V_{CCB} .
B6	14	13	E1	I/O	Input/output 6. Referenced to V_{CCB} .
B5	15	14	C2	I/O	Input/output 5. Referenced to V_{CCB} .
B4	16	17	B1	I/O	Input/output 4. Referenced to V_{CCB} .
B3	17	18	B2	I/O	Input/output 3. Referenced to V_{CCB} .
B2	18	19	A1	I/O	Input/output 2. Referenced to V_{CCB} .
V_{CCB}	19	16	C1	S	B-port supply voltage. $1.65\text{ V} \leq V_{CCB} \leq 5.5\text{ V}$.
B1	20	20	A2	I/O	Input/output 1. Referenced to V_{CCB} .
Thermal Pad	—			—	For the RKS package, the exposed center thermal pad must be connected to ground.

(1) I = input, O = output, I/O = input and output, S = power supply

5 Specifications

5.1 Absolute Maximum Ratings

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

(1)			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⁾		−0.5	6.5	V
V _O	Voltage range applied to any output in the high-impedance or power-off state ⁽²⁾		−0.5	6.5	V
V _O	Voltage range applied to any output in the high or low state ^{(2) (3)}	A inputs	−0.5	V _{CCA} + 0.5	V
		B inputs	−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
T _J	Junction temperature		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.

5.2 Handling Ratings

			MIN	MAX	UNIT
V _(ESD)	Electrostatic discharge	Human body model (HBM), per ANSI/ESDA/JEDEC JS-001, all pins ⁽¹⁾ , A Port		2	kV
		Human body model (HBM), per ANSI/ESDA/JEDEC JS-001, all pins ⁽¹⁾ , B Port	−15	15	
		Charged device model (CDM), per JEDEC specification JESD22-C101, all pins ⁽²⁾ , A Port		1	
		Charged device model (CDM), per JEDEC specification JESD22-C101, all pins ⁽²⁾ , B Port		1	

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

5.3 Recommended Operating Conditions

over operating free-air temperature range (unless otherwise noted)^{(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} × 0.65 ⁽³⁾	V _{CCI}	V
		OE			V _{CCA} × 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} × 0.35 ⁽³⁾	V
		OE	1.2 V to 3.6 V		0	V _{CCA} × 0.35	
Δt/Δv	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 3.6 V		40	
				4.5 V to 5.5 V		30	

5.3 Recommended Operating Conditions (続き)

over operating free-air temperature range (unless otherwise noted)^{(1) (2)}

	V _{CCA}	V _{CCB}	MIN	MAX	UNIT
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.

5.4 Thermal Information

THERMAL METRIC ⁽¹⁾		TXB0108-Q1		UNIT
		PW	RKS	
		20 PINS		
R _{θJA}	Junction-to-ambient thermal resistance	101.8	58.8	°C/W
R _{θJC(top)}	Junction-to-case (top) thermal resistance	35.5	63.9	°C/W
R _{θJB}	Junction-to-board thermal resistance	52.8	31.6	°C/W
ψ _{JT}	Junction-to-top characterization parameter	2.2	5.9	°C/W
ψ _{JB}	Junction-to-board characterization parameter	52.2	31.6	°C/W
R _{θJC(bot)}	Junction-to-case (bottom) thermal resistance	-	15.3	°C/W

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

5.5 Electrical Characteristics

over recommended operating free-air temperature range (unless otherwise noted)^{(1) (2)}

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 _{CCA} – 0.4		V
			1.4 V to 3.6 V							
V _{OLA}		I _{OL} = 20 μA	1.2 V		0.3			0.4		V
			1.4 V to 3.6 V							
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		1.2 V to 3.6 V	1.65 V to 5.5 V	±1			±2		μA
I _{off}	A port		0 V	0 V to 5.5 V	±1			±2		μA
	B port		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	0.45			5		μA
			1.4 V to 3.6 V							
			3.6 V	0 V				2.75		
			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			7.75		μA
			1.4 V to 3.6 V							
			3.6 V	0 V				–2		
			0 V	5.5 V				7.1		
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			10.5		μA
			1.4 V to 3.6 V							

5.5 Electrical Characteristics (続き)

over recommended operating free-air temperature range (unless otherwise noted)^{(1) (2)}

PARAMETER		TEST CONDITIONS	V _{CCA}	V _{CCB}	T _A = 25°C			–40°C to 85°C		UNIT
					MIN	TYP	MAX	MIN	MAX	
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					5		
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					7.6		
C _I	OE		1.2 V to 3.6 V	1.65 V to 5.5 V	5			6.5		pF
C _{io}	A port		1.2 V to 3.6 V	1.65 V to 5.5 V	5			6.5		pF
	B port				8			13.3		

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

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

5.6 Timing Requirements: V_{CCA} = 1.2V

T_A = 25°C, V_{CCA} = 1.2V

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

5.7 Timing Requirements: V_{CCA} = 1.5V ± 0.1V

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

			V _{CCB} = 1.8V ± 0.15V		V _{CCB} = 2.5V ± 0.2V		V _{CCB} = 3.3V ± 0.3V		V _{CCB} = 5V ± 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

5.8 Timing Requirements: V_{CCA} = 1.8V ± 0.15V

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

			V _{CCB} = 1.8V ± 0.15V		V _{CCB} = 2.5V ± 0.2V		V _{CCB} = 3.3V ± 0.3V		V _{CCB} = 5V ± 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

5.9 Timing Requirements: V_{CCA} = 2.5V ± 0.2V

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

			V _{CCB} = 2.5V ± 0.2V		V _{CCB} = 3.3V ± 0.3V		V _{CCB} = 5V ± 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

5.10 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

5.11 Switching Characteristics: $V_{CCA} = 1.2V$

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

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	μs
		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

5.12 Switching Characteristics: $V_{CCA} = 1.5V \pm 0.1V$

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	μs
		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

5.13 Switching Characteristics: $V_{CCA} = 1.8V \pm 0.15V$

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	μs
		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

5.14 Switching Characteristics: $V_{CCA} = 2.5V \pm 0.2V$

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	μs
		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
Max data rate			70		100		100		Mbps

5.15 Switching Characteristics: $V_{CCA} = 3.3V \pm 0.3V$

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

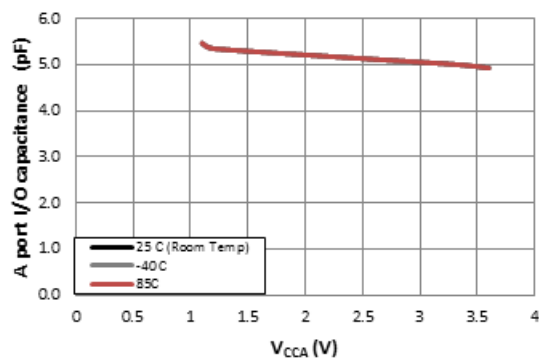
PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CCB} = 3.3V \pm 0.3V$		$V_{CCB} = 5V \pm 0.5V$		UNIT
			MIN	MAX	MIN	MAX	
t_{pd}	A	B	0.9	4.9	0.8	4	ns
	B	A	0.5	5.4	0.2	4	
t_{en}	OE	A		1		1	μs
		B		1		1	
t_{dis}	OE	A	137	183	97.6	127	ns
		B	137	183	97.6	127	
t_{rA}, t_{fA}	A-port rise and fall times		0.5	3	0.5	3	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

5.16 Operating Characteristics

$T_A = 25^\circ C$

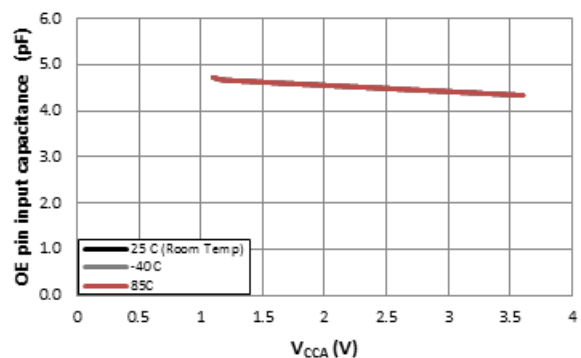
PARAMETER		TEST CONDITIONS	V _{CCA}							UNIT
			1.2V	1.2V	1.5V	1.8V	2.5V	2.5V	3.3V	
			V _{CCB}							
			5V	1.8V	1.8V	1.8V	2.5V	5V	3.3V to 5V	
			TYP	TYP	TYP	TYP	TYP	TYP	TYP	
C _{pdA}	A-port input, B-port output	C _L = 0, f = 10MHz, t _r = t _f = 1ns, OE = V _{CCA} (outputs enabled)	9	8	7	7	7	7	8	pF
	B-port input, A-port output		12	11	11	11	11	11	11	
C _{pdB}	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 _{pdA}	A-port input, B-port output	C _L = 0, f = 10MHz, t _r = t _f = 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 _{pdB}	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	

5.17 Typical Characteristics



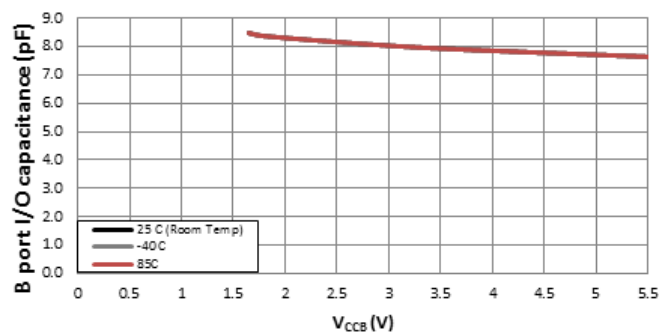
$V_{CCB} = 3.3V$

✎ 5-1. Input Capacitance for OE Pin (C_i) vs Power Supply (V_{CCA})



$V_{CCB} = 3.3V$

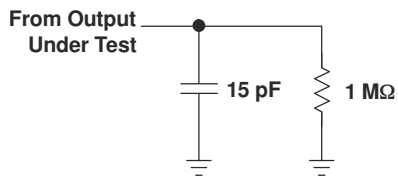
✎ 5-2. Capacitance for A Port I/O Pins (C_{IO}) vs Power Supply (V_{CCA})



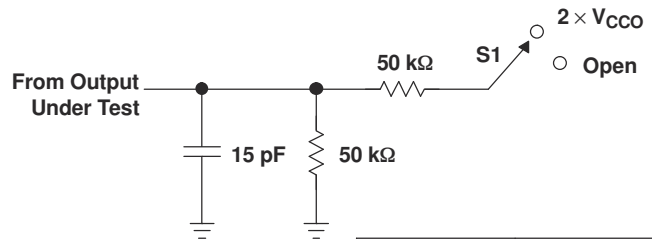
$V_{CCA} = 1.8V$

✎ 5-3. Capacitance for B Port I/O Pins (C_{IO}) vs Power Supply (V_{CCB})

6 Parameter Measurement Information

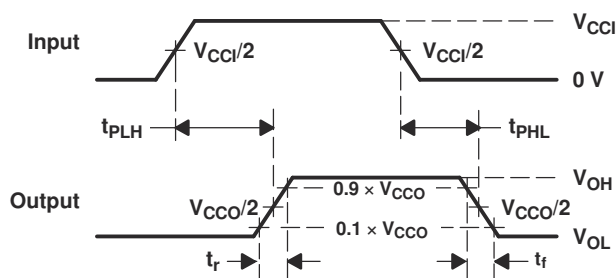


**LOAD CIRCUIT FOR MAX DATA RATE,
PULSE DURATION PROPAGATION
DELAY OUTPUT RISE AND FALL TIME
MEASUREMENT**

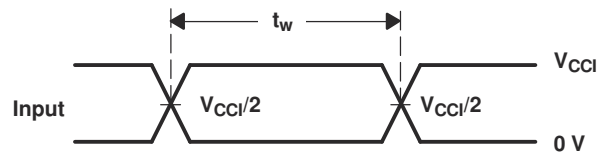


**LOAD CIRCUIT FOR
ENABLE/DISABLE
TIME MEASUREMENT**

TEST	S1
t_{PZL}/t_{PLZ} t_{PHZ}/t_{PZH}	$2 \times V_{CCO}$ 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: $PRR \leq 10$ 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.

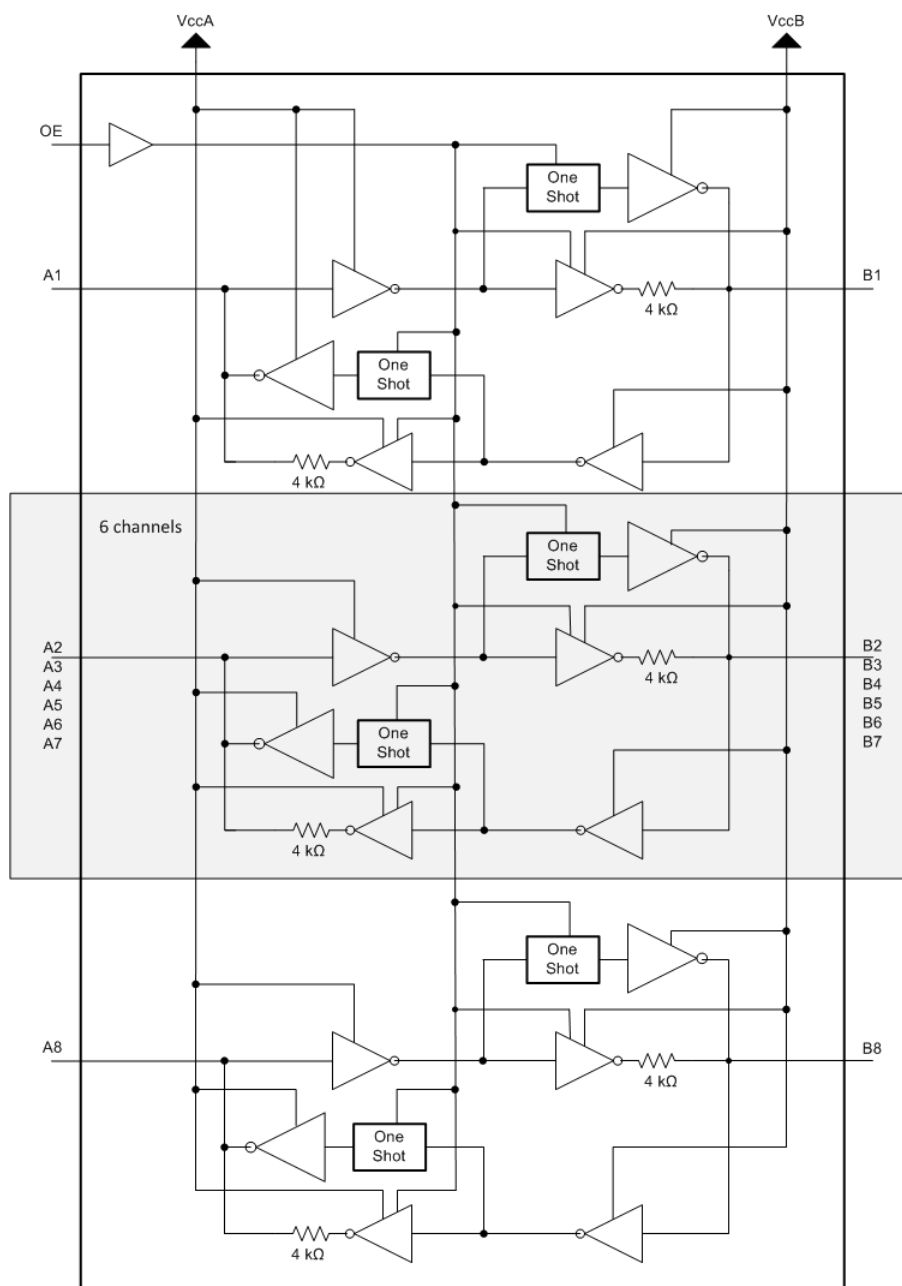
6-1. Load Circuits and Voltage Waveforms

7 Detailed Description

7.1 Overview

The TXB0108-Q1 device is an 8-bit, directionless voltage-level translator specifically designed for translating logic voltage levels. The A port is able to accept I/O voltages ranging from 1.2 V to 3.6 V, while the B port can accept I/O voltages from 1.65 V to 5.5 V. 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 [TXS](#) products.

7.2 Functional Block Diagram



7.3 Feature Description

7.3.1 Architecture

The TXB0108-Q1 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 TXB0108 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 $V_{CCO} = 1.2\text{ V}$ to 1.8 V , 50 Ω at $V_{CCO} = 1.8\text{ V}$ to 3.3 V and 40 Ω at $V_{CCO} = 3.3\text{ V}$ to 5 V .

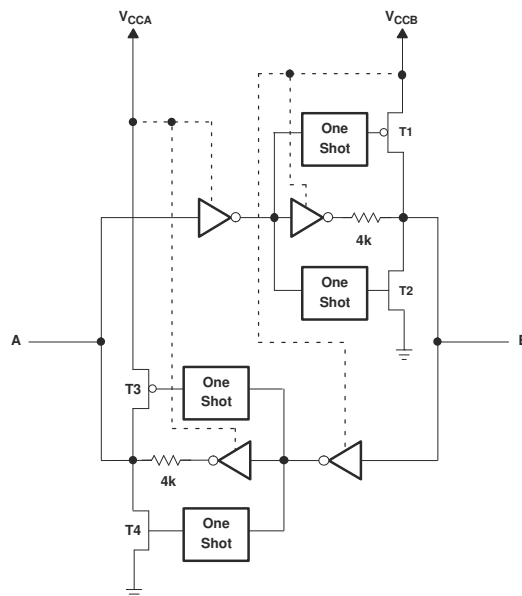
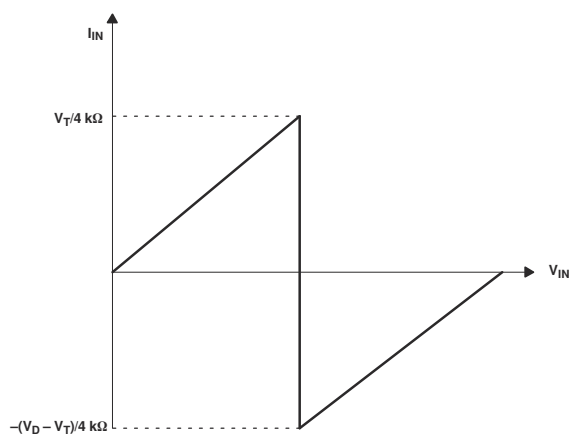


Figure 7-1. Architecture of TXB0108-Q1 I/O Cell

7.3.2 Input Driver Requirements

Typical I_{IN} vs V_{IN} characteristics of the TXB0108-Q1 are shown in [Figure 7-2](#). For proper operation, the device driving the data I/Os of the TXB0108 must have drive strength of at least $\pm 2\text{ mA}$.



A. V_T is the input threshold voltage of the TXB0108 (typically $V_{CC}/2$).
 B. V_D is the supply voltage of the external driver.

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

7.3.3 Output Load Considerations

TI recommends careful PCB layout practices with short PCB trace lengths to avoid excessive capacitive loading and to ensure that proper O.S. triggering takes place. PCB signal trace-lengths should be kept short enough such 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 have been designed to stay on for approximately 10 ns. 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 TXB0108 output sees, so it is recommended that this lumped-load capacitance be considered to avoid O.S. re-triggering, bus contention, output signal oscillations, or other adverse system-level affects.

7.3.4 Enable and Disable

The TXB0108-Q1 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 (tdis) indicates the delay between when OE goes low and when the outputs actually get disabled (Hi-Z). The enable time (ten) indicates the amount of time the user must allow for the one-shot circuitry to become operational after the OE is high.

7.3.5 Pullup or Pulldown Resistors on I/O Lines

The TXB0108-Q1 is designed to drive capacitive loads of up to 70 pF. The output drivers of the TXB0108-Q1 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 TXB0108. For the same reason, the TXB0108-Q1 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.

7.4 Device Functional Modes

The TXB0108-Q1 device has two functional modes, enabled and disabled. To disable the device, set the OE input low, which places all I/Os in a high impedance state. Setting the OE input high will enable the device.

8 Application and Implementation

注

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, as well as validating and testing their design implementation to confirm system functionality.

8.1 Application Information

The TXB0108-Q1 can be used in level-translation applications for interfacing devices or systems operating at different interface voltages with one another. It can only translate push-pull CMOS logic outputs. If for open-drain signal translation, please refer to TI TXS010X products. Any external pulldown or pullup resistors are recommended to be larger than 50kΩ.

8.2 Typical Application

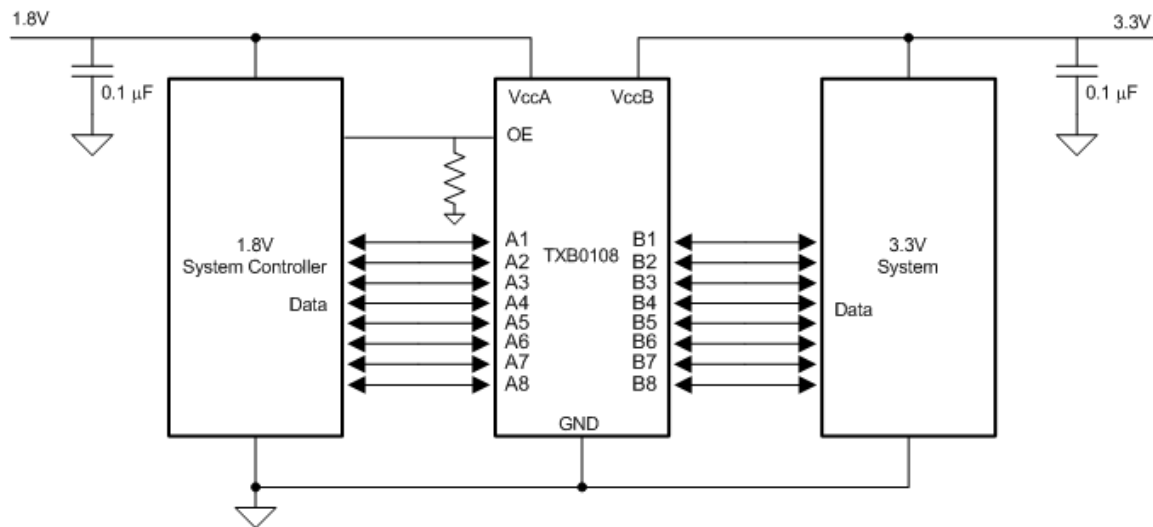


図 8-1. Typical Operating Circuit

8.2.1 Design Requirements

For this design example, use the parameters listed in 表 8-1. Make sure the $V_{CCA} \leq V_{CCB}$.

表 8-1. Design Parameters

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

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 TXB0108-Q1 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 TXB0108-Q1 device is driving to determine the output voltage range.
- Do not recommend having the external pullup or pulldown resistors. If mandatory, it is recommended the value should be larger than 50 kΩ.
- 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.

$$V_{OH} = V_{CCx} \times R_{PD} / (R_{PD} + 4.5 \text{ k}\Omega)$$

$$V_{OL} = V_{CCx} \times 4.5 \text{ k}\Omega / (R_{PU} + 4.5 \text{ k}\Omega)$$

Where:

- V_{CCx} is the output port supply voltage on either VCCA or VCCB
- R_{PD} is the value of the external pull down resistor
- R_{PU} is the value of the external pull up resistor
- 4.5 kΩ is the counting the variation of the serial resistor 4 kΩ in the I/O line. Refer to the [Effects of external pullup and pulldown resistors on TXB](#) application note

8.2.3 Application Curves

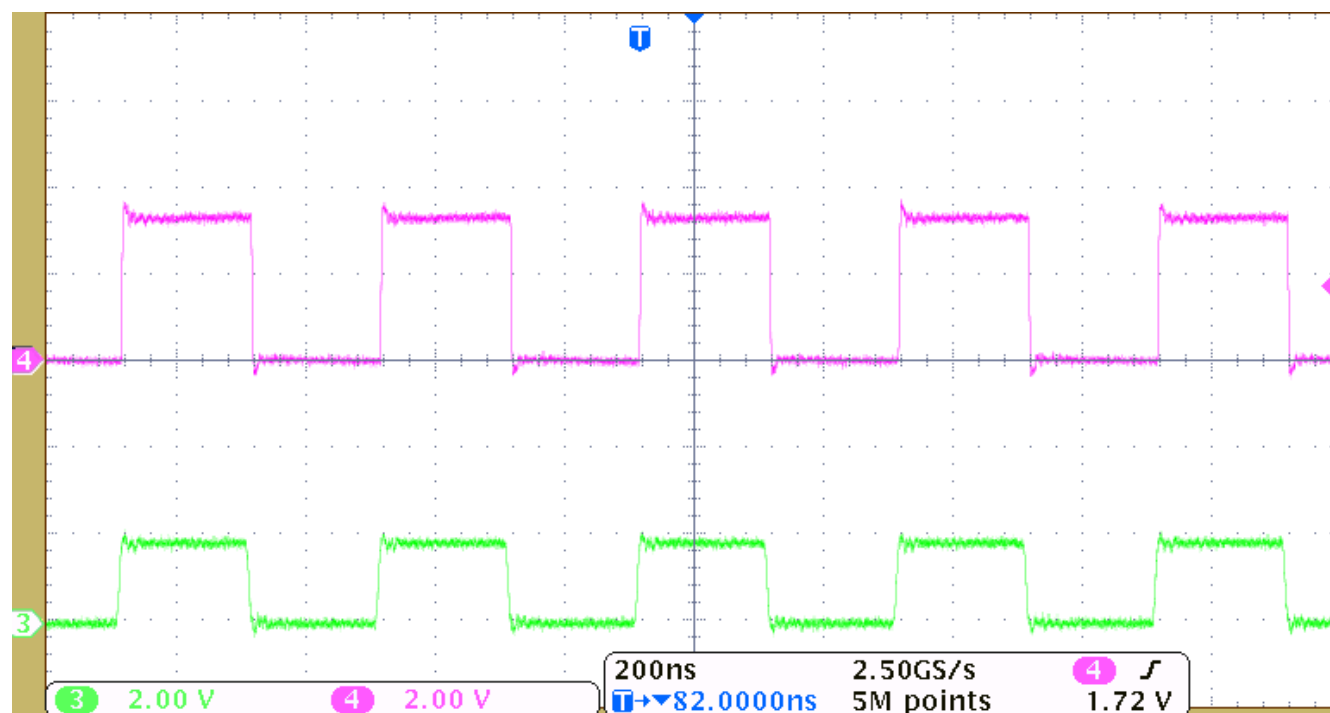


図 8-2. Level-Translation of a 2.5-MHz Signal

9 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 TXB0108 has circuitry that disables all output ports when either VCC is switched off ($V_{CCA/B} = 0\text{ V}$).

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 ensure 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.

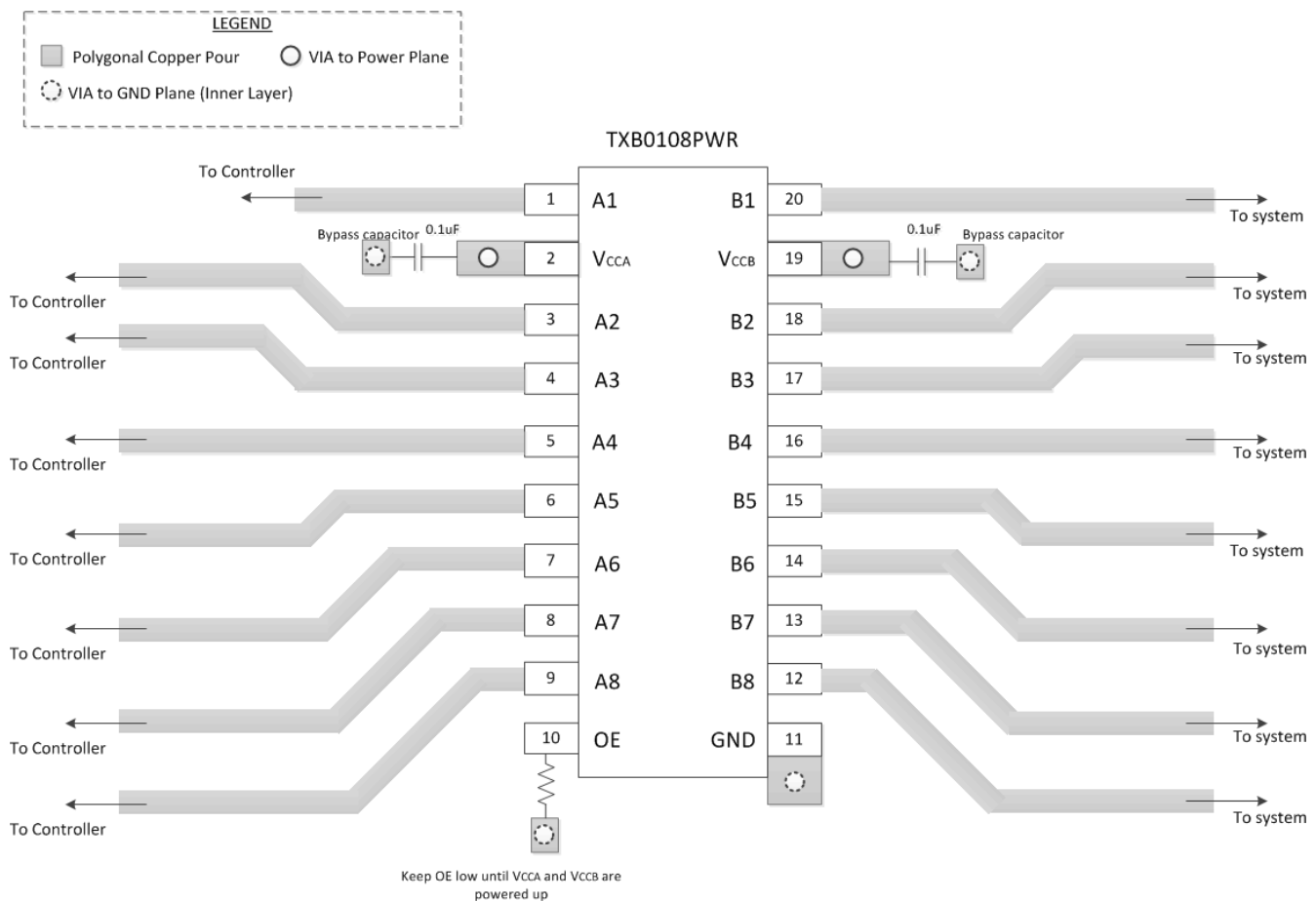
10 Layout

10.1 Layout Guidelines

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

- Bypass capacitors should be used on power supplies and should be placed as close as possible to the V_{CCA} , V_{CCB} pin and GND pin.
- Short trace lengths should be used to avoid excessive loading.
- PCB signal trace-lengths must be kept short enough so that the round-trip delay of any reflection is less than the one-shot duration, approximately 10 ns, ensuring that any reflection encounters low impedance at the source driver.

10.2 Layout Example



11 Device and Documentation Support

11.1 ドキュメントの更新通知を受け取る方法

ドキュメントの更新についての通知を受け取るには、www.tij.co.jp のデバイス製品フォルダを開いてください。[通知] をクリックして登録すると、変更されたすべての製品情報に関するダイジェストを毎週受け取ることができます。変更の詳細については、改訂されたドキュメントに含まれている改訂履歴をご覧ください。

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11.5 用語集

[テキサス・インスツルメンツ用語集](#) この用語集には、用語や略語の一覧および定義が記載されています。

12 Revision History

資料番号末尾の英字は改訂を表しています。その改訂履歴は英語版に準じています。

Changes from Revision * (December 2024) to Revision A (February 2025)	Page
• 「製品情報」表に PW および RKS パッケージ オプションを追加.....	1
• Added PW and RKS package to <i>Thermal Information</i> table.....	6

DATE	REVISION	NOTES
December 2024	*	Initial Release

13 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.

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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)
TXB0108QPWRQ1	Active	Production	TSSOP (PW) 20	2000 null	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	YE08Q
TXB0108QPWRQ1.A	Active	Production	TSSOP (PW) 20	2000 null	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	YE08Q

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

⁽²⁾ **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.

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

⁽⁴⁾ **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.

⁽⁵⁾ **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.

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

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

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In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

OTHER QUALIFIED VERSIONS OF TXB0108-Q1 :

- Catalog : [TXB0108](#)

NOTE: Qualified Version Definitions:

- Catalog - TI's standard catalog product



4220206/A 02/2017

NOTES:

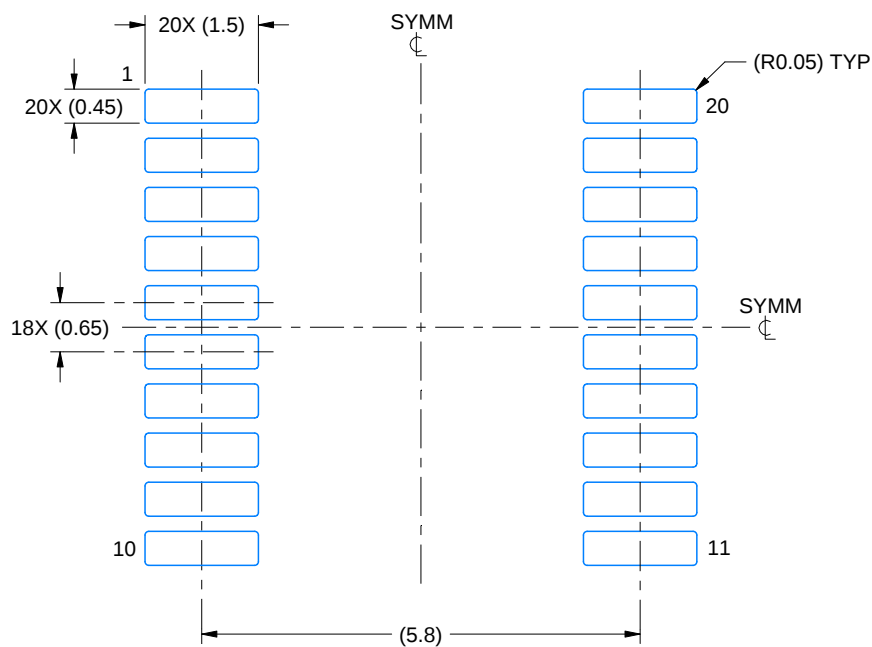
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or 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

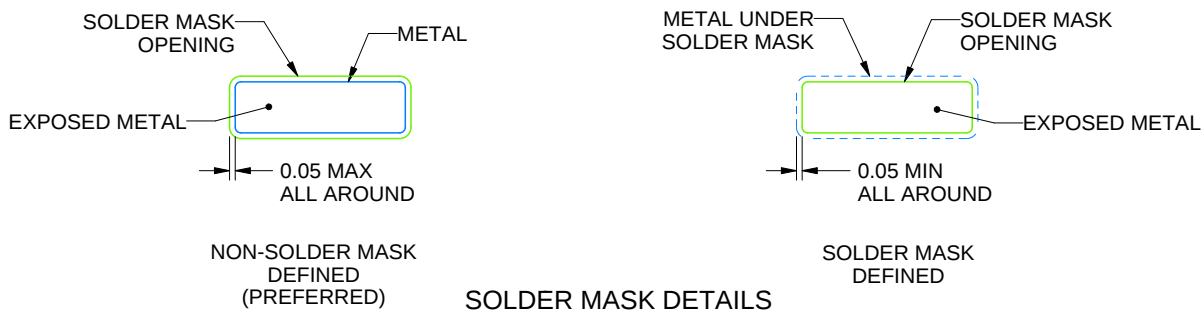
PW0020A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE: 10X



4220206/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

PW0020A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



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

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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.

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最終更新日：2025 年 10 月