TXU0202-Q1 シングル・ビット、固定方向電圧レベル・トランスレータ、シュミット・トリガ入力、3 ステート出力

1 特長

- 完全に構成可能なデュアル・レール設計により、各ポートは 1.1V～5.5V で動作可能
- 3.3V～5.0V で最高 200Mbps をサポート
- シュミット・トリガ入力により低速またはノイズの多い入力に対応
- 入力に静的プルダウン抵抗を内蔵することで、チャネルがフローティングになることを防止
- 高い駆動強度 (5V で最大 12mA)
- 低消費電力
  - 最大 2.5µA (25℃)
  - 最大 6µA (-40℃～125℃)
- V_{CC} 絶縁および V_{CC} 切断 ($I_{off-float}$) 機能
  - どちらかの V_{CC} 入力が 100mV 未満になる、または切り離されると、すべての出力がディセーブルされ高インピーダンス化
- I_{off} により部分的パワーダウン・モードでの動作をサポート
- 制御ロジック (OE) に $V_{CC(MIN)}$ 回路を備えているため、A ポートと B ポートのどちら側からも制御可能
- TXB ファミリのレベル・シフタとピン互換
- 一般的なアプリケーションをサポートする他のバリアントで使用可能：TXU0102
- 動作温度範囲：-40℃～+125℃
- JESD 78、Class II 準拠で 100mA 超のラッチアップ性能
- JESD 22 を上回る ESD 保護
  - 人体モデルで 2500V
  - 荷電デバイス・モデルで 1500V

2 アプリケーション

- 低速またはノイズの多い入力信号の除去
- インジケータ LED またはブザーの駆動
- メカニカル・スイッチのデバウンス
- 汎用 I/O レベル・シフト
- プッシュプル・レベル・シフト (UART、SPI、JTAG など)

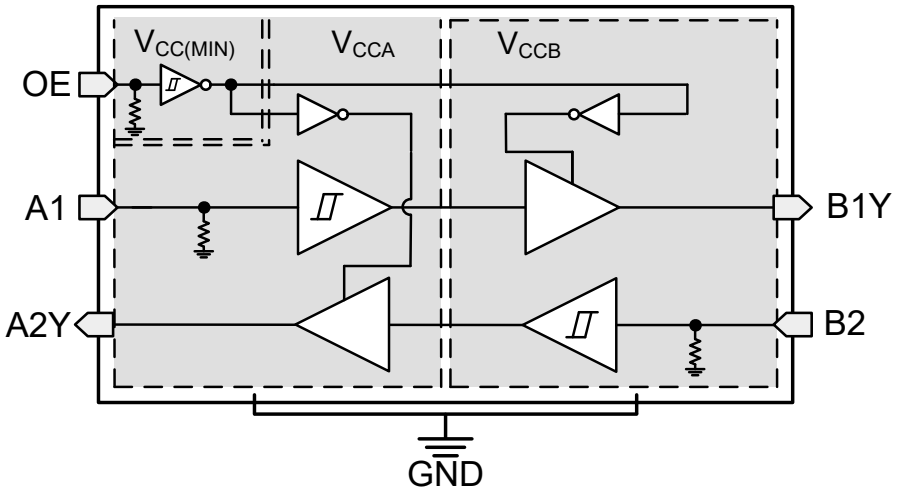
3 概要

TXU0202-Q1 は、2 ビット、2 電源の非反転固定方向電圧レベル変換デバイスです。Ax ピンは V_{CCA} ロジック・レベルを基準にし、OE ピンは V_{CCA} または V_{CCB} ロジック・レベルのいずれかを基準にでき、Bx ピンは V_{CCB} ロジック・レベルを基準にします。A ポート、B ポートとも 1.1V～5.5V の範囲の入力電圧を受け付けることができます。OE がどちらかの電源を基準として High に設定されているとき、固定方向のデータ伝送が A から B、または B から A に発生することがあります。OE を Low に設定すると、すべての出力ピンは高インピーダンス状態になります。制御ロジックの動作の概要については、「デバイスの機能モード」を参照してください。

パッケージ情報(1)

部品番号	パッケージ	本体サイズ (公称)
TXU0202	VSSOP (DCU) (8)	2.30mm × 2.00mm
	SON (DTT) (8)	1.95mm × 1.00mm

(1) 利用可能なパッケージについては、この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。



TXU0202-Q1 機能ブロック図

英語版の TI 製品についての情報を翻訳したこの資料は、製品の概要を確認する目的で便宜的に提供しているものです。該当する正式な英語版の最新情報は、www.ti.com で閲覧でき、その内容が常に優先されます。TI では翻訳の正確性および妥当性につきましては一切保証いたしません。実際の設計などの前には、必ず最新版の英語版をご参照くださいますようお願いいたします。

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4 Revision History

DATE	REVISION	NOTES
August 2022	*	Initial Release

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5 Pin Configuration and Functions—TXU0202-Q1

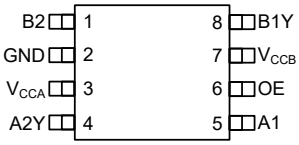


図 5-1. DCU Package, 8-Pin VSSOP (Top View)

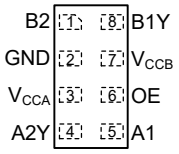


図 5-2. DTT Package, 8-Pin SON Transparent (Top View)

表 5-1. TXU0202 Pin Functions

PIN		TYPE(1)	DESCRIPTION
NAME	NO.		
B2	1	I	Input B2. Referenced to V_{CCB}.
GND	2	—	Ground.
V_{CCA}	3	—	A-port supply voltage. 1.1 V ≤ V_{CCA} ≤ 5.5 V
A2Y	4	O	Output A2. Referenced to V_{CCA}.
A1	5	I	Input A1. Referenced to V_{CCA}.
OE	6	I	Output Enable. Pull to GND to place all outputs in high-impedance mode. Pull to V_{CCA} or V_{CCB} to enable all outputs.
V_{CCB}	7	—	B-port supply voltage. 1.1 V ≤ V_{CCB} ≤ 5.5 V
B1Y	8	O	Output B1. Referenced to V_{CCB}.

(1) I = input, O = output

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6 Specifications

6.1 Absolute Maximum Ratings

over operating free-air temperature range (unless otherwise noted)(1)

			MIN	MAX	UNIT
V_{CCA}	Supply voltage A		–0.5	6.5	V
V_{CCB}	Supply voltage B		–0.5	6.5	V
V_I	Input Voltage(2)	I/O Ports (A Port)	–0.5	6.5	V
		I/O Ports (B Port)	–0.5	6.5	
		OE	–0.5	6.5	
V_O	Voltage applied to any output in the high-impedance or power-off state(2)	A Port	–0.5	6.5	V
		B Port	–0.5	6.5	
V_O	Voltage 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	–20		mA
I_{OK}	Output clamp current	V_O < 0	–20		mA
I_O	Continuous output current		–25	25	mA
	Continuous current through V_{CC} or GND		–100	100	mA
T_j	Junction Temperature			150	°C
T_{stg}	Storage temperature		–65	150	°C

(1) Operation outside the *Absolute Maximum Ratings* may cause permanent device damage. *Absolute Maximum Ratings* do not imply functional operation of the device at these or any other conditions beyond those listed under *Recommended Operating Conditions*.. If used outside the *Recommended Operating Conditions* but within the *Absolute Maximum Ratings*, the device may not be fully functional, and this may affect device reliability, functionality, performance, and shorten the device lifetime.
(2) The input voltage and output negative-voltage ratings may be exceeded if the input and output current ratings are observed.
(3) The output positive-voltage rating may be exceeded up to 6.5 V maximum if the output current rating is observed.

6.2 ESD Ratings

			VALUE	UNIT
$V_{(ESD)}$	Electrostatic discharge	Human body model (HBM), per AEC Q100-002 (1)	±2500	V
		Charged device model (CDM), per AEC Q100-011	±1500	

(1) AEC Q100-002 indicates that HBM stressing shall be in accordance with the ANSI/ESDA/JEDEC JS-001 specification.

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6.3 Recommended Operating Conditions

over operating free-air temperature range (unless otherwise noted) (1) (2) (3)

				MIN	MAX	UNIT
V_{CCA}	Supply voltage A			1.08	5.5	V
V_{CCB}	Supply voltage B			1.08	5.5	V
I_{OH}	High-level output current		V_{CCO} = 1.1 V		–1.5	mA
			V_{CCO} = 1.4 V		–3	
			V_{CCO} = 1.65 V		–4.5	
			V_{CCO} = 2.3 V		–8	
			V_{CCO} = 3 V		–10	
			V_{CCO} = 4.5 V		–12	
I_{OL}	Low-level output current		V_{CCO} = 1.1 V		1.5	mA
			V_{CCO} = 1.4 V		3	
			V_{CCO} = 1.65 V		4.5	
			V_{CCO} = 2.3 V		8	
			V_{CCO} = 3 V		10	
			V_{CCO} = 4.5 V		12	
V_I	Input voltage (3)			0	5.5	V
V_O	Output voltage	Active State		0	V_{CCO}	V
		Tri-State		0	5.5	
T_A	Operating free-air temperature			–40	125	°C

(1) V_{CCI} is the V_{CC} associated with the input port.
(2) V_{CCO} is the V_{CC} associated with the output port.
(3) All control inputs and data I/Os of this device have weak pulldowns to ensure the line is not floating when undefined external to the device. The input leakage from these weak pulldowns is defined by the I_I specification indicated under *Electrical Characteristics*.

6.4 Thermal Information

THERMAL METRIC (1)		TXU0202-Q1		UNIT
		DCU (VSSOP)	DTT (SON)	
		8 PINS	8 PINS	
$R_{\theta JA}$	Junction-to-ambient thermal resistance	257.0	249.8	°C/W
$R_{\theta JC(top)}$	Junction-to-case (top) thermal resistance	106.9	175.2	°C/W
$R_{\theta JB}$	Junction-to-board thermal resistance	168.3	145.4	°C/W
Y_{JT}	Junction-to-top characterization parameter	47.2	32.1	°C/W
Y_{JB}	Junction-to-board characterization parameter	167.3	145.0	°C/W

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

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6.5 Electrical Characteristics

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

PARAMETER		TEST CONDITIONS	V_{CCA}	V_{CCB}	Operating free-air temperature (T_A)									UNIT
					25°C			–40°C to 85°C			–40°C to 125°C			
					MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
V_{T+}	Positive-going input-threshold voltage	Data Inputs (Ax, Bx) (Referenced to V_{CCI})	1.1 V	1.1 V				0.44		0.88	0.44		0.88	V
			1.4 V	1.4 V				0.60		0.98	0.60		0.98	
			1.65 V	1.65 V				0.76		1.13	0.76		1.13	
			2.3 V	2.3 V				1.08		1.56	1.08		1.56	
			3 V	3 V				1.48		1.92	1.48		1.92	
			4.5 V	4.5 V				2.19		2.74	2.19		2.74	
			5.5 V	5.5 V				2.65		3.33	2.65		3.33	
		OE (Referenced to V_{CCA} or V_{CCB})	1.1 V	1.1 V				0.44		0.88	0.44		0.88	V
			1.4 V	1.4 V				0.60		0.98	0.60		0.98	
			1.65 V	1.65 V				0.76		1.13	0.76		1.13	
			2.3 V	2.3 V				1.08		1.56	1.08		1.56	
			3 V	3 V				1.48		1.92	1.48		1.92	
			4.5 V	4.5 V				2.19		2.74	2.19		2.74	
			5.5 V	5.5 V				2.65		3.33	2.65		3.33	
V_{T-}	Negative-going input-threshold voltage	Data Inputs (Ax, Bx) (Referenced to V_{CCI})	1.1 V	1.1 V				0.17		0.48	0.17		0.48	V
			1.4 V	1.4 V				0.28		0.59	0.28		0.59	
			1.65 V	1.65 V				0.35		0.69	0.35		0.69	
			2.3 V	2.3 V				0.56		0.97	0.56		0.97	
			3 V	3 V				0.89		1.5	0.89		1.5	
			4.5 V	4.5 V				1.51		1.97	1.51		1.97	
			5.5 V	5.5 V				1.88		2.4	1.88		2.4	
		OE (Referenced to V_{CCA} or V_{CCB})	1.1 V	1.1 V				0.17		0.48	0.17		0.48	V
			1.4 V	1.4 V				0.28		0.59	0.28		0.59	
			1.65 V	1.65 V				0.35		0.69	0.35		0.69	
			2.3 V	2.3 V				0.56		0.97	0.56		0.97	
			3 V	3 V				0.89		1.5	0.89		1.5	
			4.5 V	4.5 V				1.51		1.97	1.51		1.97	
			5.5 V	5.5 V				1.88		2.46	1.88		2.46	
ΔV_T	Input-threshold hysteresis ($V_{T+} - V_{T-}$)	Data Inputs (Ax, Bx) (Referenced to V_{CCI})	1.1 V	1.1 V				0.2		0.4	0.2		0.4	V
			1.4 V	1.4 V				0.25		0.5	0.25		0.5	
			1.65 V	1.65 V				0.3		0.55	0.3		0.55	
			2.3 V	2.3 V				0.38		0.65	0.38		0.65	
			3 V	3 V				0.46		0.72	0.46		0.72	
			4.5 V	4.5 V				0.58		0.93	0.58		0.93	
			5.5 V	5.5 V				0.69		1.06	0.69		1.06	
		OE (Referenced to V_{CCA} or V_{CCB})	1.1 V	1.1 V				0.15		0.41	0.15		0.41	V
			1.4 V	1.4 V				0.2		0.5	0.2		0.5	
			1.65 V	1.65 V				0.23		0.55	0.23		0.55	
			2.3 V	2.3 V				0.32		0.65	0.32		0.65	
			3 V	3 V				0.39		0.72	0.39		0.72	
			4.5 V	4.5 V				0.57		0.97	0.57		0.97	
			5.5 V	5.5 V				0.69		1.18	0.69		1.18	

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6.5 Electrical Characteristics (continued)

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

PARAMETER		TEST CONDITIONS	V_{CCA}	V_{CCB}	Operating free-air temperature (T_A)									UNIT
					25°C			–40°C to 85°C			–40°C to 125°C			
					MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
V_{OH}	High-level output voltage (3)	I_{OH} = –0.1 mA	1.1 V – 5.5 V	1.1 V – 5.5 V				V_{CCO} – 0.1			V_{CCO} – 0.1			V
		I_{OH} = –0.5 mA	1.1 V	1.1 V				0.82			0.82			
		I_{OH} = –3 mA	1.4 V	1.4 V				1			1			
		I_{OH} = –4.5 mA	1.65 V	1.65 V				1.2			1.2			
		I_{OH} = –8 mA	2.3 V	2.3 V				1.7			1.7			
		I_{OH} = –10 mA	3 V	3 V				2.2			2.2			
		I_{OH} = –12 mA	4.5 V	4.5 V				3.7			3.7			
V_{OL}	Low-level output voltage (4)	I_{OL} = 0.1 mA	1.1 V – 5.5 V	1.1 V – 5.5 V						0.1			0.1	V
		I_{OL} = 0.5 mA	1.1 V	1.1 V						0.27			0.27	
		I_{OL} = 3 mA	1.4 V	1.4 V						0.35			0.35	
		I_{OL} = 4.5 mA	1.65 V	1.65 V						0.45			0.45	
		I_{OL} = 8 mA	2.3 V	2.3 V						0.7			0.7	
		I_{OL} = 10 mA	3 V	3 V						0.8			0.8	
		I_{OL} = 8 mA	4.5 V	4.5 V						0.55			0.55	
		I_{OL} = 12 mA	4.5 V	4.5 V						0.8			0.8	
I_I	Input leakage current	OE V_I = V_{CC} or GND	1.1 V – 5.5 V	1.1 V – 5.5 V	–0.1		1.5	–0.1		1.5	–0.1		2	µA
		Data Inputs (Ax, Bx) V_I = V_{CCI} or GND	1.1 V – 5.5 V	1.1 V – 5.5 V	–0.1		1.5	–0.1		1.5	–2		2	µA
I_{off}	Partial power down current	A Port or B Port V_I or V_O = 0 V – 5.5 V	0 V	1.1 V – 5.5 V	–1.5		1.5	–2		2	–2.5		2.5	µA
			1.1 V – 5.5 V	0 V	–1.5		1.5	–2		2	–2.5		2.5	
$I_{off-float}$	Floating supply Partial power down current	A Port or B Port V_I or V_O = GND	Floating(5)	1.1 V – 5.5 V	–1.5		1.5	–2		2	–2.5		2.5	µA
			0 V – 5.5 V	Floating(5)	–1.5		1.5	–2		2	–2.5		2.5	
I_{OZ}	Tri-state output current	A or B Port: V_I = V_{CCI} or GND V_O = V_{CCO} or GND OE = GND	1.1 V – 5.5 V	1.1 V – 5.5 V	–0.3		0.3	–1		1	–2		2	µA
I_{CCA}	V_{CCA} supply current	V_I = V_{CCI} or GND I_O = 0	1.1 V – 5.5 V	1.1 V – 5.5 V			1.5			2.5			6	µA
			0 V	5.5 V	–0.3			–1			–1			
			5.5 V	0 V			1			1.5			3	
		V_I = GND I_O = 0	5.5 V	Floating(5)			1.5			7			15	
I_{CCB}	V_{CCB} supply current	V_I = V_{CCI} or GND I_O = 0	1.1 V – 5.5 V	1.1 V – 5.5 V			1.5			2.5			6	µA
			0 V	5.5 V			1			1.5			3	
			5.5 V	0 V	–0.3			–1			–1			
		V_I = GND I_O = 0	Floating(5)	5.5 V			1.5			7			15	
I_{CCA} + I_{CCB}	Combined supply current	V_I = V_{CCI} or GND I_O = 0	1.1 V – 5.5 V	1.1 V – 5.5 V			2.5			3			6	µA
C_i	Control Input Capacitance	V_I = 3.3 V or GND	3.3 V	3.3 V		2.75			3			3.5		pF

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6.5 Electrical Characteristics (continued)

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

PARAMETER		TEST CONDITIONS	V_{CCA}	V_{CCB}	Operating free-air temperature (T_A)									UNIT
					25°C			–40°C to 85°C			–40°C to 125°C			
					MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
C_{io}	Data I/O Capacitance	OE = GND, V_O = 1.65 V DC +1 MHz −16 dBm sine wave	3.3 V	3.3 V		3			4			4		pF

(1) V_{CCI} is the V_{CC} associated with the input port.
(2) V_{CCO} is the V_{CC} associated with the output port.
(3) Tested at $V_I = V_{T+(MAX)}$.
(4) Tested at $V_I = V_{T-(MIN)}$.
(5) Floating is defined as a node that is both not actively driven by an external device and has leakage not exeeding 10 nA.

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6.6 Switching Characteristics, V_{CCA} = 1.2 ± 0.1 V

See 図 7-1 and 表 7-1 for test circuit and loading. See 図 7-2, 図 7-3, and 図 7-4 for measurement waveforms.

PARAMETER		FROM	TO	Test Conditions	B-Port Supply Voltage (V_{CCB})														UNIT
					1.2 ± 0.1 V			1.5 ± 0.1 V			1.8 ± 0.15 V			2.5 ± 0.2 V			3.3 ± 0.3 V			5.0 ± 0.5 V			
					MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
t_{pd}	Propagation delay	A	B	−40°C to 85°C	3.3		96	0.5		43	0.5		37	0.5		32	0.5		30	0.5		31	ns
				−40°C to 125°C	3.3		96	0.5		43	0.5		37	0.5		32	0.5		30	0.5		31	
		B	A	−40°C to 85°C	3.3		95	1.9		80	0.5		75	0.5		70	0.5		69	0.5		69	
				−40°C to 125°C	3.3		95	1.9		80	0.5		75	0.5		70	0.5		69	0.5		69	
t_{dis}	Disable time	OE	A	−40°C to 85°C	28.8		133	28.5		130	28.4		133	28.8		137	28.4		143	18.7		211	ns
				−40°C to 125°C	28.8		133	28.5		130	28.4		133	28.8		137	28.4		143	18.7		211	
		OE	B	−40°C to 85°C	32.5		150	27.6		117	25.8		110	22.5		104	22.1		112	20.1		181	
				−40°C to 125°C	32.5		150	27.6		117	25.8		110	22.5		104	22.1		112	20.1		181	
t_{en}	Enable time	OE	A	−40°C to 85°C	24.1		237	22.1		229	21.4		230	21.3		232	21.7		235	22.7		244	ns
				−40°C to 125°C	24.1		237	22.1		229	21.4		230	21.3		232	21.7		235	22.7		244	
		OE	B	−40°C to 85°C	21.3		237	14.3		152	11.2		140	8.8		130	8.2		130	8.4		132	
				−40°C to 125°C	21.3		237	14.3		152	11.2		140	8.8		130	8.2		130	8.4		132	

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6.7 Switching Characteristics, V_{CCA} = 1.5 ± 0.1 V

See 図 7-1 and 表 7-1 for test circuit and loading. See 図 7-2, 図 7-3, and 図 7-4 for measurement waveforms.

PARAMETER		FROM	TO	Test Conditions	B-Port Supply Voltage (V_{CCB})																		UNIT
					1.2 ± 0.1 V			1.5 ± 0.1 V			1.8 ± 0.15 V			2.5 ± 0.2 V			3.3 ± 0.3 V			5.0 ± 0.5 V			
					MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
t_{pd}	Propagation delay	A	B	−40°C to 85°C	1.9		80	0.5		31	0.5		25	0.5		19	0.5		17	0.5		15	ns
				−40°C to 125°C	1.9		80	0.5		31	0.5		25	0.5		20	0.5		18	0.5		16	
		B	A	−40°C to 85°C	0.5		43	0.5		31	0.5		28	0.5		26	0.5		25	0.5		24	
				−40°C to 125°C	0.5		43	0.5		31	0.5		28	0.5		26	0.5		25	0.5		24	
t_{dis}	Disable time	OE	A	−40°C to 85°C	20.0		91	19.0		82	18.8		81	19.2		82	19.6		83	12.2		90	ns
				−40°C to 125°C	20.0		95	19.0		86	18.8		85	19.2		87	19.6		88	12.2		92	
		OE	B	−40°C to 85°C	27.4		127	21.7		91	19.9		82	16.3		71	15.9		71	13.7		70	
				−40°C to 125°C	27.4		127	21.7		95	19.9		86	16.3		75	15.9		75	13.7		74	
t_{en}	Enable time	OE	A	−40°C to 85°C	14.9		102	14.4		86	13.5		88	12.7		90	12.6		92	13.2		97	ns
				−40°C to 125°C	14.9		102	14.4		89	13.5		91	12.7		93	12.6		96	13.2		100	
		OE	B	−40°C to 85°C	17.9		175	12.7		80	9.1		69	6.1		57	4.9		53	4.5		54	
				−40°C to 125°C	17.9		175	12.7		81	9.1		71	6.1		60	4.9		56	4.5		57	

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6.8 Switching Characteristics, V_{CCA} = 1.8 ± 0.15 V

See 図 7-1 and 表 7-1 for test circuit and loading. See 図 7-2, 図 7-3, and 図 7-4 for measurement waveforms.

PARAMETER		FROM	TO	Test Conditions	B-Port Supply Voltage (V_{CCB})														UNIT
					1.2 ± 0.1 V			1.5 ± 0.1 V			1.8 ± 0.15 V			2.5 ± 0.2 V			3.3 ± 0.3 V			5.0 ± 0.5 V			
					MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
t_{pd}	Propagation delay	A	B	−40°C to 85°C	0.5		75	0.5		28	0.5		22	0.5		17	0.5		14	0.5		12	ns
				−40°C to 125°C	0.5		75	0.5		28	0.5		23	0.5		17	0.5		15	0.5		13	
		B	A	−40°C to 85°C	0.5		37	0.5		25	0.5		22	0.5		19	0.5		19	0.5		18	
				−40°C to 125°C	0.5		37	0.5		25	0.5		23	0.5		20	0.5		19	0.5		19	
t_{dis}	Disable time	OE	A	−40°C to 85°C	17.2		79	14.7		67	14.5		65	14.3		65	14.4		66	8.5		71	ns
				−40°C to 125°C	17.2		83	14.7		71	14.5		69	14.3		70	14.4		71	8.5		75	
		OE	B	−40°C to 85°C	25.4		121	18.7		81	16.5		71	12.8		60	12.5		58	9.8		55	
				−40°C to 125°C	25.4		123	18.7		86	16.5		76	12.8		64	12.5		62	9.8		59	
t_{en}	Enable time	OE	A	−40°C to 85°C	10.9		88	9.5		66	9.4		63	8.6		65	8.2		66	8.1		69	ns
				−40°C to 125°C	10.9		88	9.5		69	9.4		67	8.6		68	8.2		70	8.1		73	
		OE	B	−40°C to 85°C	16.7		177	10.4		75	8.1		58	4.9		46	3.3		42	2.2		39	
				−40°C to 125°C	16.7		177	10.4		77	8.1		60	4.9		49	3.3		44	2.2		42	

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6.9 Switching Characteristics, V_{CCA} = 2.5 ± 0.2 V

See 図 7-1 and 表 7-1 for test circuit and loading. See 図 7-2, 図 7-3, and 図 7-4 for measurement waveforms.

PARAMETER		FROM	TO	Test Conditions	B-Port Supply Voltage (V_{CCB})														UNIT
					1.2 ± 0.1 V			1.5 ± 0.1 V			1.8 ± 0.15 V			2.5 ± 0.2 V			3.3 ± 0.3 V			5.0 ± 0.5 V			
					MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
t_{pd}	Propagation delay	A	B	−40°C to 85°C	0.5		70	0.5		26	0.5		20	0.5		14	0.5		12	0.5		9	ns
				−40°C to 125°C	0.5		70	0.5		26	0.5		20	0.5		14	0.5		12	0.5		10	
		B	A	−40°C to 85°C	0.5		32	0.5		19	0.5		17	0.5		14	0.5		13	0.5		13	
				−40°C to 125°C	0.5		32	0.5		20	0.5		17	0.5		14	0.5		13	0.5		13	
t_{dis}	Disable time	OE	A	−40°C to 85°C	12.9		65	10.5		51	9.0		51	8.1		43	8.4		44	5.0		45	ns
				−40°C to 125°C	12.9		68	10.5		55	9.0		50	8.1		47	8.4		48	5.0		49	
		OE	B	−40°C to 85°C	23.2		112	16.5		74	14.0		61	9.0		46	9.1		44	6.4		39	
				−40°C to 125°C	23.2		115	16.5		79	14.0		66	9.0		51	9.1		48	6.4		43	
t_{en}	Enable time	OE	A	−40°C to 85°C	7.9		80	5.9		50	5.1		44	4.7		39	4.4		40	3.7		41	ns
				−40°C to 125°C	7.9		80	5.9		53	5.1		47	4.7		42	4.4		43	3.7		44	
		OE	B	−40°C to 85°C	16.3		183	9.2		74	6.0		54	4.0		36	2.1		31	0.5		27	
				−40°C to 125°C	16.3		183	9.2		76	6.0		57	4.0		38	2.1		33	0.5		29	

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6.10 Switching Characteristics, V_{CCA} = 3.3 ± 0.3 V

See 図 7-1 and 表 7-1 for test circuit and loading. See 図 7-2, 図 7-3, and 図 7-4 for measurement waveforms.

PARAMETER		FROM	TO	Test Conditions	B-Port Supply Voltage (V_{CCB})																		UNIT
					1.2 ± 0.1 V			1.5 ± 0.1 V			1.8 ± 0.15 V			2.5 ± 0.2 V			3.3 ± 0.3 V			5.0 ± 0.5 V			
					MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
t_{pd}	Propagation delay	A	B	−40°C to 85°C	0.5		69	0.5		25	0.5		19	0.5		13	0.5		11	0.5		8	ns
				−40°C to 125°C	0.5		69	0.5		25	0.5		19	0.5		13	0.5		11	0.5		9	
		B	A	−40°C to 85°C	0.5		30	0.5		17	0.5		14	0.5		12	0.5		11	0.5		10	
				−40°C to 125°C	0.5		30	0.5		18	0.5		15	0.5		12	0.5		11	0.5		10	
t_{dis}	Disable time	OE	A	−40°C to 85°C	12.9		62	10.1		47	8.7		42	6.9		39	6.6		39	6.9		40	ns
				−40°C to 125°C	12.9		65	10.1		51	8.7		46	6.9		40	6.6		40	6.9		40	
		OE	B	−40°C to 85°C	22.7		109	15.7		71	13.2		59	8.5		42	7.6		40	4.7		36	
				−40°C to 125°C	22.7		111	15.7		75	13.2		63	8.5		46	7.6		43	4.7		36	
t_{en}	Enable time	OE	A	−40°C to 85°C	6.6		85	4.2		45	3.0		37	2.4		31	2.2		30	1.7		30	ns
				−40°C to 125°C	6.6		85	4.2		47	3.0		40	2.4		33	2.2		32	1.7		33	
		OE	B	−40°C to 85°C	16.3		192	8.9		76	5.4		55	2.6		34	1.8		27	0.5		22	
				−40°C to 125°C	16.3		192	8.9		78	5.4		57	2.6		36	1.8		29	0.5		24	

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6.11 Switching Characteristics, V_{CCA} = 5.0 ± 0.5 V

See 図 7-1 and 表 7-1 for test circuit and loading. See 図 7-2, 図 7-3, and 図 7-4 for measurement waveforms.

PARAMETER		FROM	TO	Test Conditions	B-Port Supply Voltage (V_{CCB})																		UNIT
					1.2 ± 0.1 V			1.5 ± 0.1 V			1.8 ± 0.15 V			2.5 ± 0.2 V			3.3 ± 0.3 V			5.0 ± 0.5 V			
					MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
t_{pd}	Propagation delay	A	B	−40°C to 85°C	0.5		69	0.5		24	0.5		18	0.5		13	0.5		10	0.5		8	ns
				−40°C to 125°C	0.5		69	0.5		24	0.5		19	0.5		13	0.5		11	0.5		8	
		B	A	−40°C to 85°C	0.5		31	0.5		15	0.5		12	0.5		9	0.5		8	0.5		8	
				−40°C to 125°C	0.5		31	0.5		16	0.5		13	0.5		10	0.5		9	0.5		8	
t_{dis}	Disable time	OE	A	−40°C to 85°C	10.8		60	7.7		42	5.9		38	4.2		31	3.4		31	2.8		30	ns
				−40°C to 125°C	10.8		62	7.7		46	5.9		40	4.2		33	3.4		33	2.8		32	
		OE	B	−40°C to 85°C	9.7		109	5.9		69	13.2		56	8.4		40	6.9		37	3.7		30	
				−40°C to 125°C	9.7		111	5.9		73	13.2		60	8.4		43	6.9		39	3.7		33	
t_{en}	Enable time	OE	A	−40°C to 85°C	6.0		102	2.8		44	1.2		33	0.5		25	0.5		22	0.5		21	ns
				−40°C to 125°C	6.0		102	2.8		46	1.2		36	0.5		27	0.5		24	0.5		23	
		OE	B	−40°C to 85°C	16.7		212	8.8		82	4.8		58	1.6		35	0.5		26	0.5		19	
				−40°C to 125°C	16.7		212	8.8		83	4.8		60	1.6		37	0.5		28	0.5		21	

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6.12 Operating Characteristics

T_A = 25°C (1)

PARAMETER		Test Conditions	Supply Voltage (V_{CCB} = V_{CCA})						UNIT
			1.2 ± 0.1 V	1.5 ± 0.1 V	1.8 ± 0.15 V	2.5 ± 0.2 V	3.3 ± 0.3 V	5.0 ± 0.5 V	
			TYP	TYP	TYP	TYP	TYP	TYP	
C_{pdA} (2)	A to B: outputs enabled	A Port CL = 0, RL = Open f = 10 MHz t_{rise} = t_{fall} = 1 ns	2	2	2	2	2	3	pF
	A to B: outputs disabled		2	2	2	2	2	3	
	B to A: outputs enabled		12	12	12	13	13	16	
	B to A: outputs disabled		2	2	2	2	2	3	
C_{pdB} (3)	A to B: outputs enabled	B Port CL = 0, RL = Open f = 10 MHz t_{rise} = t_{fall} = 1 ns	12	12	12	13	13	16	pF
	A to B: outputs disabled		2	2	2	2	2	3	
	B to A: outputs enabled		2	2	2	2	2	3	
	B to A: outputs disabled		2	2	2	2	2	3	

(1) See the *CMOS Power Consumption and C_{pd} Calculation* application report for additional information about how power dissipation capacitance affects power consumption.
(2) A-Port power dissipation capacitance per transceiver.
(3) B-Port power dissipation capacitance per transceiver.

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6.13 Typical Characteristics

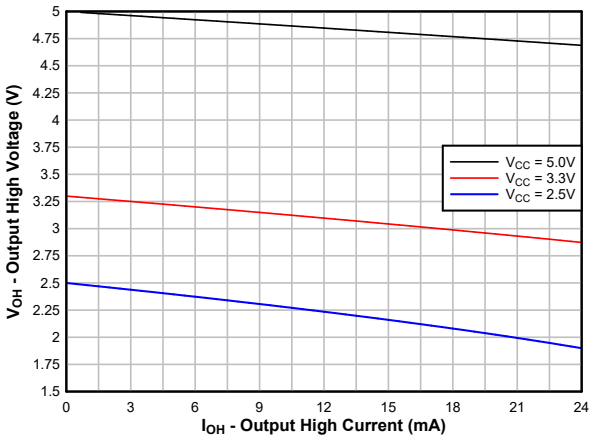


図 6-1. Typical (T_A=25°C) Output High Voltage (V_{OH}) vs Source Current (I_{OH})

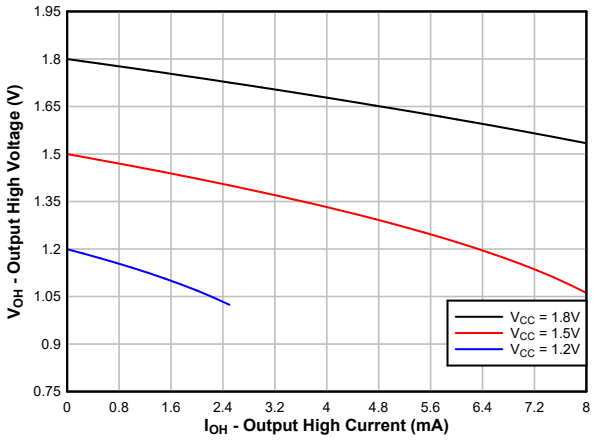


図 6-2. Typical (T_A=25°C) Output High Voltage (V_{OH}) vs Source Current (I_{OH})

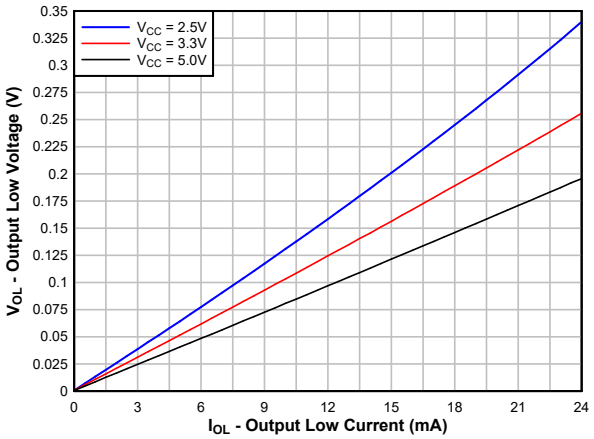


図 6-3. Typical (T_A=25°C) Output Low Voltage (V_{OL}) vs Sink Current (I_{OL})

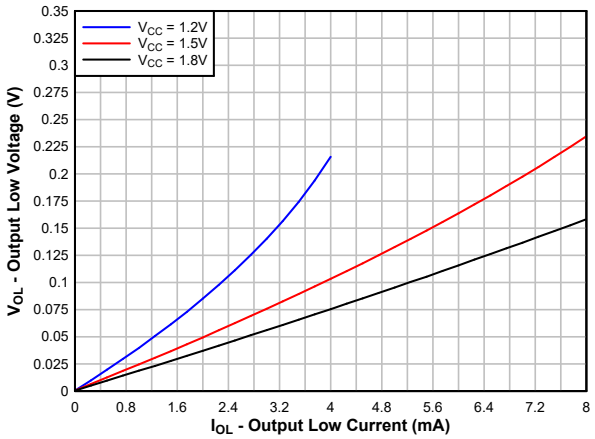


図 6-4. Typical (T_A=25°C) Output Low Voltage (V_{OL}) vs Sink Current (I_{OL})

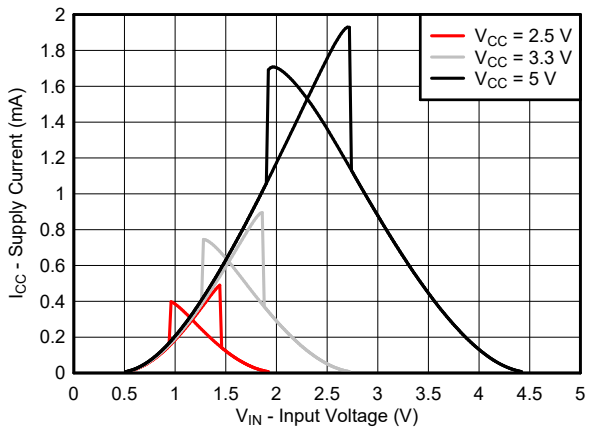


図 6-5. Typical (T_A=25°C) Supply Current (I_{CC}) vs Input Voltage (V_{IN})

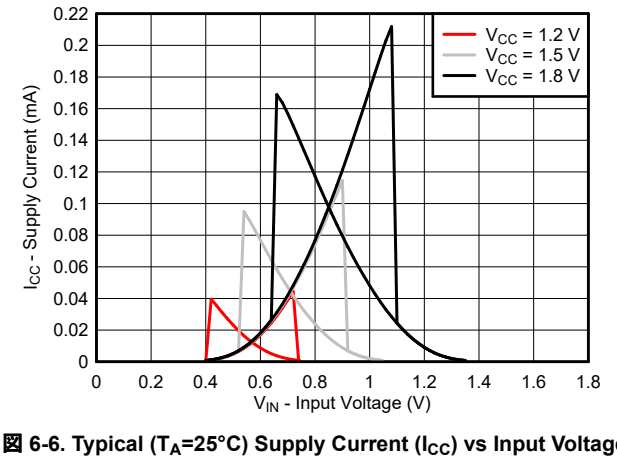


図 6-6. Typical (T_A=25°C) Supply Current (I_{CC}) vs Input Voltage (V_{IN})

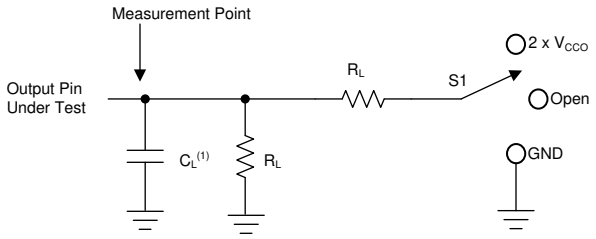
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7 Parameter Measurement Information

7.1 Load Circuit and Voltage Waveforms

Unless otherwise noted, generators supply all input pulses that have the following characteristics:

- f = 1 MHz
- Z_O = 50 Ω
- Δt/ΔV ≤ 1 ns/V

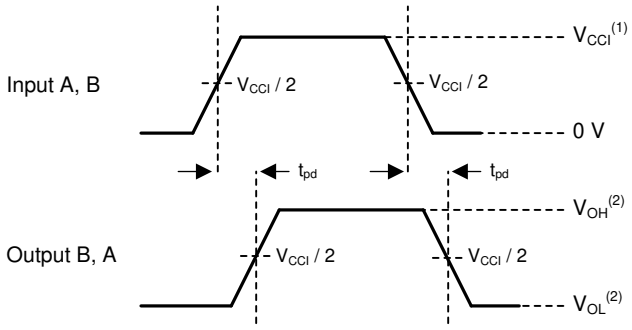


1. C_L includes probe and jig capacitance.

図 7-1. Load Circuit

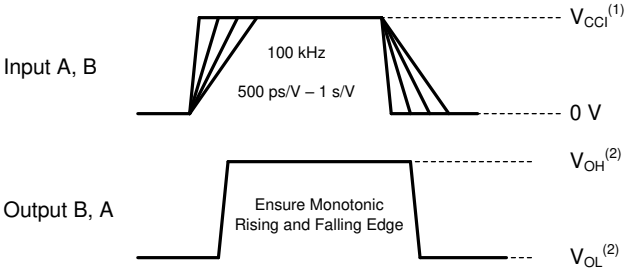
表 7-1. Load Circuit Conditions

Parameter		V_{CCO}	R_L	C_L	S_1	V_{TP}
t_{pd}	Propagation (delay) time	1.1 V – 5.5 V	10 kΩ	5 pF	Open	N/A
t_{en}, t_{dis}	Enable time, disable time	1.1 V – 1.6 V	10 kΩ	5 pF	2 × V_{CCO}	0.1 V
		1.65 V – 2.7 V	10 kΩ	5 pF	2 × V_{CCO}	0.15 V
		3.0 V – 5.5 V	10 kΩ	5 pF	2 × V_{CCO}	0.3 V
t_{en}, t_{dis}	Enable time, disable time	1.1 V – 1.6 V	10 kΩ	5 pF	GND	0.1 V
		1.65 V – 2.7 V	10 kΩ	5 pF	GND	0.15 V
		3.0 V – 5.5 V	10 kΩ	5 pF	GND	0.3 V



1. V_{CCI} is the supply pin associated with the input port.
2. V_{OH} and V_{OL} are typical output voltage levels that occur with specified R_L, C_L, and S_1

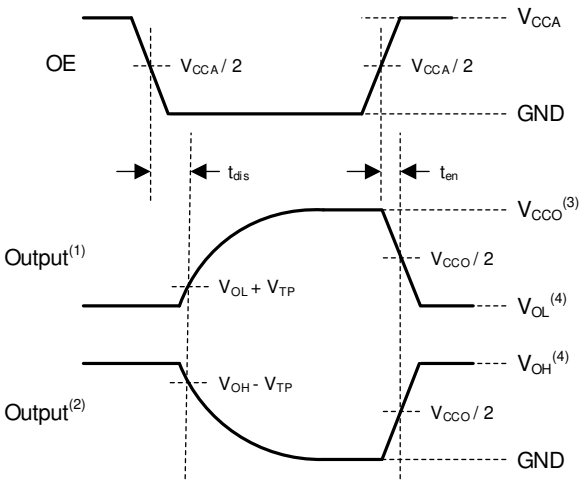
図 7-2. Propagation Delay



1. V_{CCI} is the supply pin associated with the input port.
2. V_{OH} and V_{OL} are typical output voltage levels that occur with specified R_L, C_L, and S_1

図 7-3. Input Transition Rise and Fall Rate

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1. Output waveform on the condition that input is driven to a valid Logic Low.
2. Output waveform on the condition that input is driven to a valid Logic High.
3. V_{CCO} is the supply pin associated with the output port.
4. V_{OH} and V_{OL} are typical output voltage levels with specified R_L, C_L, and S_1.

図 7-4. Enable Time And Disable Time

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8 Detailed Description

8.1 Overview

The TXU0202-Q1 is a 4-bit translating transceiver that uses two individually configurable power-supply rails. The device is operational with V_{CCA} and V_{CCB} supplies as low as 1.1 V and as high as 5.5 V. Additionally, the device can be operated with V_{CCA} = V_{CCB}. The A port is designed to track V_{CCA}, and the B port is designed to track V_{CCB}.

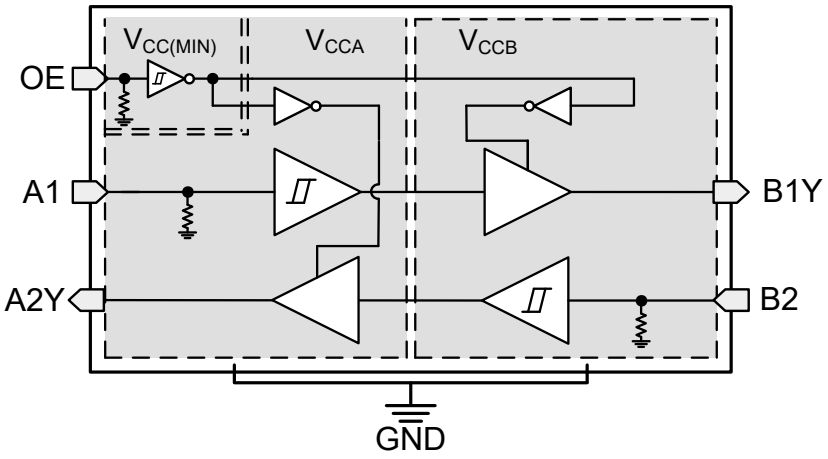
The TXU0202-Q1 device is designed for asynchronous communication between data buses, and transmits data with fixed direction from the A bus to the B bus on some channels and from the B bus to the A bus on the remaining channels. The output-enable input (OE) is used to disable the outputs so the buses are effectively isolated. The output-enable pin of the TXU0202-Q1 (OE) can be referenced to either V_{CCA} or V_{CCB}. The OE pin can be left floating or externally pulled down to ground to ensure the high-impedance state of the level shifter outputs during power up or power down.

This device is fully specified for partial-power-down applications using the I_{off} current. The I_{off} protection circuitry ensures that no excessive current is drawn from or sourced into an input or output while the device is powered down.

The VCC isolation or VCC disconnect feature ensures that if either VCC is less than 100 mV or disconnected with the complementary supply within recommended operating conditions, then the outputs disable and are set to the high-impedance state while the supply current is maintained. The $I_{off-float}$ circuitry ensures that no excessive current is drawn from or sourced into an input or output while the supply is floating.

Glitch-free power supply sequencing allows either supply rail to be powered on or off in any order while providing robust power sequencing performance.

8.2 Functional Block Diagram



8.3 Feature Description

8.3.1 CMOS Schmitt-Trigger Inputs with Integrated Pulldowns

Standard CMOS inputs are high impedance and are typically modeled as a resistor in parallel with the input capacitance given in the *Electrical Characteristics*. The worst case resistance is calculated with the maximum input voltage, given in the *Absolute Maximum Ratings*, and the maximum input leakage current, given in the *Electrical Characteristics*, using ohm's law (R = V ÷ I).

The Schmitt-trigger input architecture provides hysteresis as defined by ΔV_T in the *Electrical Characteristics*, which makes this device extremely tolerant to slow or noisy inputs. Driving the inputs slowly will increase dynamic current consumption of the device. See *Understanding Schmitt Triggers* for additional information regarding Schmitt-trigger inputs.

8.3.1.1 Inputs with Integrated Static Pull-Down Resistors

This device has 5 MΩ typical integrated weak pull-downs for each input. This feature allows all inputs to be left floating without the concern for unstable outputs or increased current consumption. This also helps to reduce external component count for applications where not all channels are used or need to be fixed low. If an external pull-up is required, it should be no larger than 1 MΩ to avoid contention with the 5 MΩ internal pull-down.

8.3.2 Control Logic (OE) with $V_{CC(MIN)}$ Circuitry

The output-enable input (OE) is used to disable the outputs so the buses are effectively isolated. The output-enable pin of the TXU0x04 has $V_{CC(MIN)}$ circuitry, which allows the OE pin to operate with the lower supply voltage. The *Over-Voltage Tolerant Inputs* feature allows the OE pin to operate with the higher supply voltage. This combination means that the enable pin can be referenced to either V_{CCA} or V_{CCB} supply. Multiple permutations of each device are possible since the controller can be placed on either the A or B port and can still control the enable pin.

8.3.3 Balanced High-Drive CMOS Push-Pull Outputs

A balanced output allows the device to sink and source similar currents. The high drive capability of this device creates fast edges into light loads, so routing and load conditions should be considered to prevent ringing. Additionally, the outputs of this device are capable of driving larger currents than the device can sustain without being damaged. The electrical and thermal limits that must be followed at all times are defined in *Absolute Maximum Ratings*.

8.3.4 VCC Isolation and V_{CC} Disconnect

The outputs for this device disable and enter a high-impedance state when either supply is <100 mV or left floating (disconnected), with the complementary supply within the recommended operating conditions. It is recommended to keep the inputs low before floating (disconnecting) either supply.

The $I_{CCx(floating)}$ in the *Electrical Characteristics* specifies the maximum supply current. The $I_{off(float)}$ in the *Electrical Characteristics* specifies the maximum leakage into or out of any input or output pin on the device.

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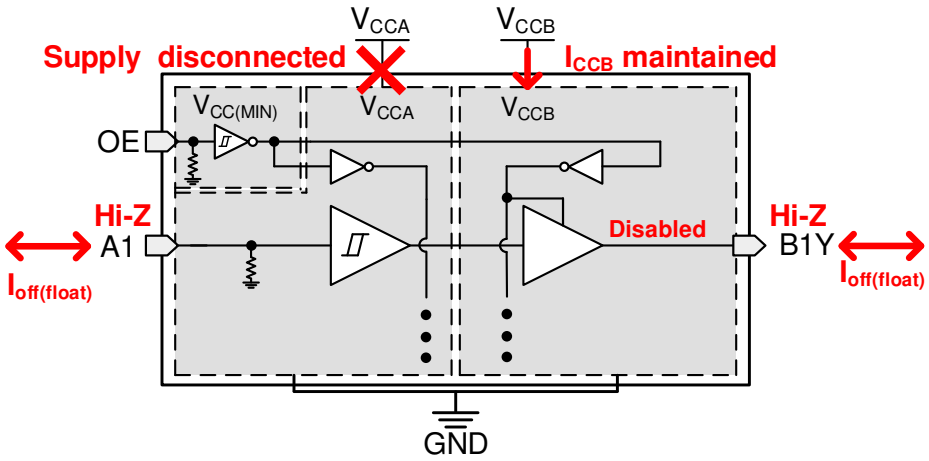


図 8-1. V_{CC} Disconnect Feature

8.3.5 Over-Voltage Tolerant Inputs

Input signals to this device can be driven above the supply voltage as long as they remain below the maximum input voltage value specified in the *Recommended Operating Conditions*.

8.3.6 Glitch-Free Power Supply Sequencing

Either supply rail may be powered on or off in any order without producing a glitch on the inputs or outputs (that is, where the output erroneously transitions to VCC when it should be held low or vice versa). Glitches of this nature can be misinterpreted by a peripheral as a valid data bit, which could trigger a false device reset of the peripheral, a false device configuration of the peripheral, or even a false data initialization by the peripheral.

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8.3.7 Negative Clamping Diodes

図 8-2 shows the inputs and outputs to this device that have negative clamping diodes.

> **注意**
> Voltages beyond the values specified in the *Absoulte Maximum Ratings* table can cause damage to the device. The input negative-voltage and output voltage ratings may be exceeded if the input and output clamp-current ratings are observed.

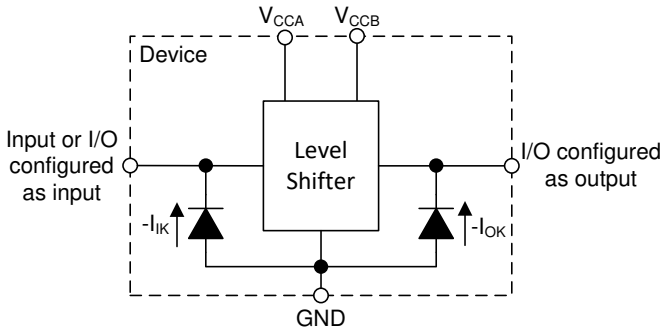


図 8-2. Electrical Placement of Clamping Diodes for Each Input and Output

8.3.8 Fully Configurable Dual-Rail Design

The V_{CCA} and V_{CCB} pins can be supplied at any voltage from 1.1 V to 5.5 V, making the device suitable for translating between any of the voltage nodes (1.2 V, 1.5 V, 1.8 V, 3.3 V, and 5.0 V).

8.3.9 Supports High-Speed Translation

The TXU0202-Q1 device can support high data-rate applications. The translated signal data rate can be up to 200 Mbps when the signal is translated from 3.3 V to 5.0 V.

8.4 Device Functional Modes

表 8-1. Function Table

CONTROL INPUTS	Port Status		OPERATION
OE	Input	Output	
H	L	L	Unidirectional non-inverting voltage translation
H	H	H	Unidirectional non-inverting voltage translation
L	X	Hi-Z	Isolation

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9 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.

9.1 Application Information

The TXU0202-Q1 device can be used in level-translation applications for interfacing devices or systems operating at different interface voltages with one another. The TXU0202-Q1 device is ideal for use in applications where a push-pull driver is connected to the data Inputs. The maximum data rate can be up to 200 Mbps when the device translates a signal from 3.3 V to 5.0 V.

9.2 Typical Application

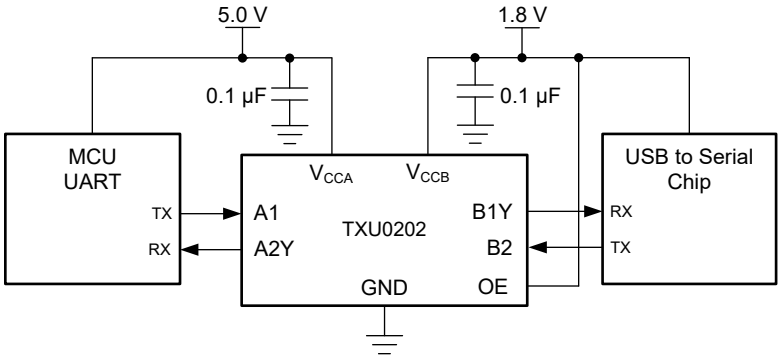


図 9-1. TXU0202-Q1 LED Driver Application

9.2.1 Design Requirements

Use the parameters listed in 表 9-1 for this design example.

表 9-1. Design Parameters

DESIGN PARAMETERS	EXAMPLE VALUES
Input voltage range	1.1 V to 5.5 V
Output voltage range	1.1 V to 5.5 V

9.2.2 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 TXU0202-Q1 device to determine the input voltage range. For a valid logic-high, the value must exceed the positive-going input-threshold voltage (V_{T+}) of the input port. For a valid logic low the value must be less than the negative-going input-threshold voltage (V_{T-}) of the input port.
- Output voltage range
  - Use the supply voltage of the device that the TXU0202-Q1 device is driving to determine the output voltage range.

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9.2.3 Application Curve

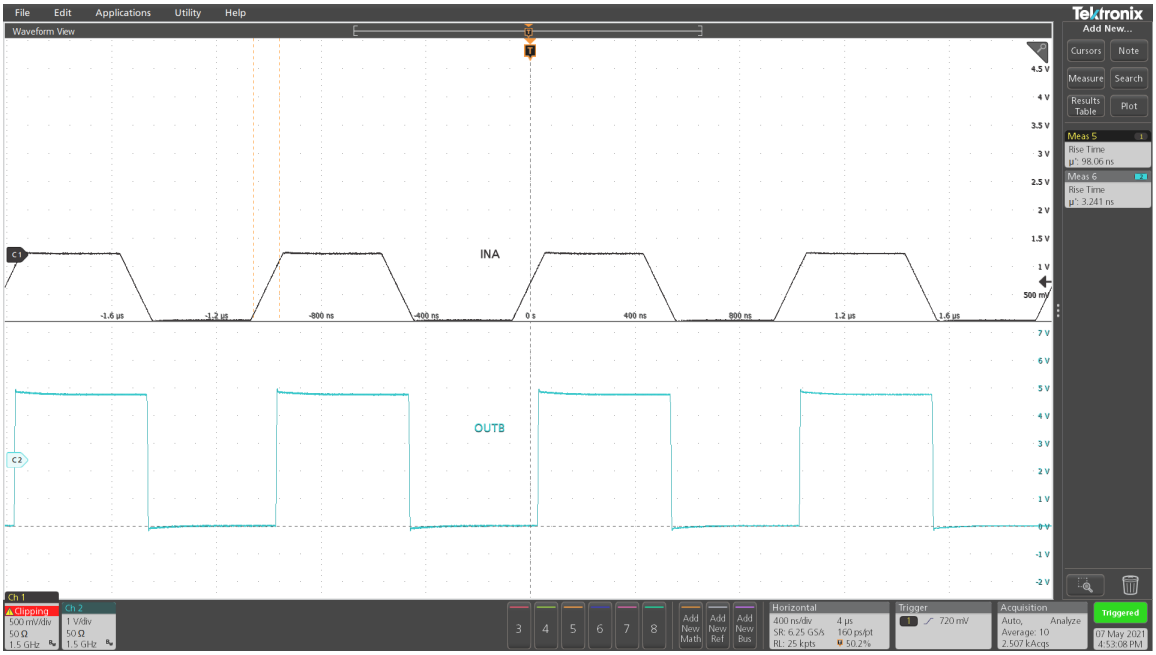


図 9-2. Up Translation at 1 MHz (1.2 V to 5 V)

10 Power Supply Recommendations

Always apply a ground reference to the GND pins first. This device is designed for glitch free power sequencing without any supply sequencing requirements such as ramp order or ramp rate.

Glitch-Free Power Supply Sequencing describes how this device was designed with various power supply sequencing methods in mind to help prevent unintended triggering of downstream devices.

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11 Layout

11.1 Layout Guidelines

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

- Use bypass capacitors on the power supply pins and place them as close to the device as possible. A 0.1 µF capacitor is recommended, but transient performance can be improved by having 1 µF and 0.1 µF capacitors in parallel as bypass capacitors.
- The high drive capability of this device creates fast edges into light loads so routing and load conditions should be considered to prevent ringing.

11.2 Layout Example

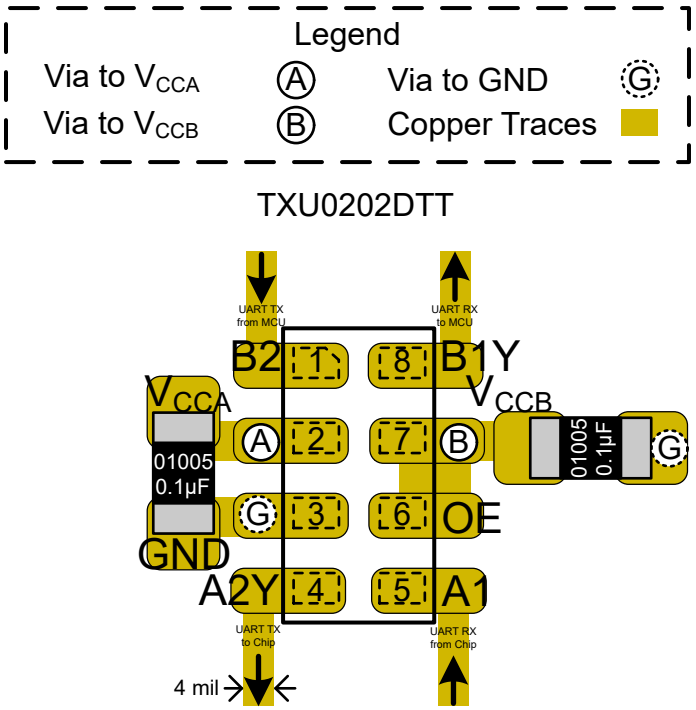


図 11-1. Layout Example – TXU0202-Q1

12 Device and Documentation Support

12.1 Device Support

12.1.1 Regulatory Requirements

No statutory or regulatory requirements apply to this device.

There are no special characteristics for this product.

12.2 Documentation Support

12.2.1 Related Documentation

- Texas Instruments, *Understanding Schmitt Triggers* application report
- Texas Instruments, *CMOS Power Consumption and C_{pd} Calculation* application report

12.3 Receiving Notification of Documentation Updates

To receive notification of documentation updates, navigate to the device product folder on ti.com. Click on *Subscribe to updates* 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.

12.4 サポート・リソース

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12.5 Trademarks

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12.6 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.

12.7 Glossary

TI Glossary — This glossary lists and explains terms, acronyms, and definitions.

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)
TXU0202QDCURQ1	Active	Production	VSSOP (DCU) | 8	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	2PDT
TXU0202QDCURQ1.A	Active	Production	VSSOP (DCU) | 8	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	2PDT
TXU0202QDTTRQ1	Active	Production	X1SON (DTT) | 8	5000 | LARGE T&R	Yes	NIPDAUAG	Level-1-260C-UNLIM	-40 to 125	1LU
TXU0202QDTTRQ1.A	Active	Production	X1SON (DTT) | 8	5000 | LARGE T&R	Yes	NIPDAUAG	Level-1-260C-UNLIM	-40 to 125	1LU

(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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OTHER QUALIFIED VERSIONS OF TXU0202-Q1 :

- Catalog : TXU0202

NOTE: Qualified Version Definitions:

- Catalog - TI's standard catalog product

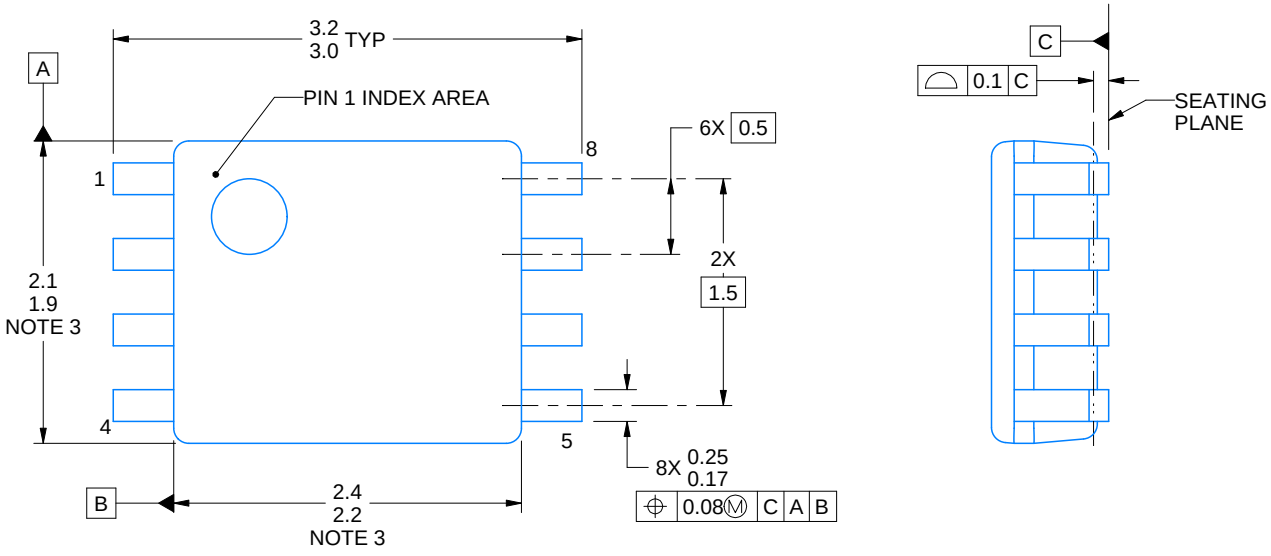
DCU0008A

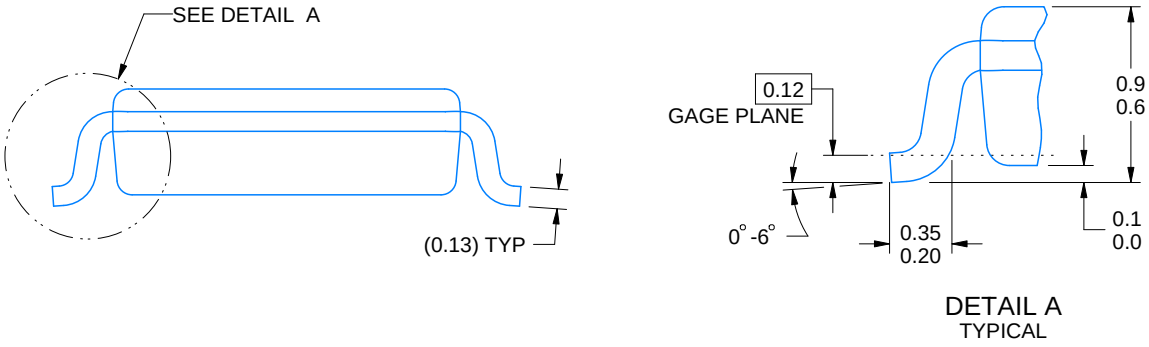


PACKAGE OUTLINE

VSSOP - 0.9 mm max height

SMALL OUTLINE PACKAGE

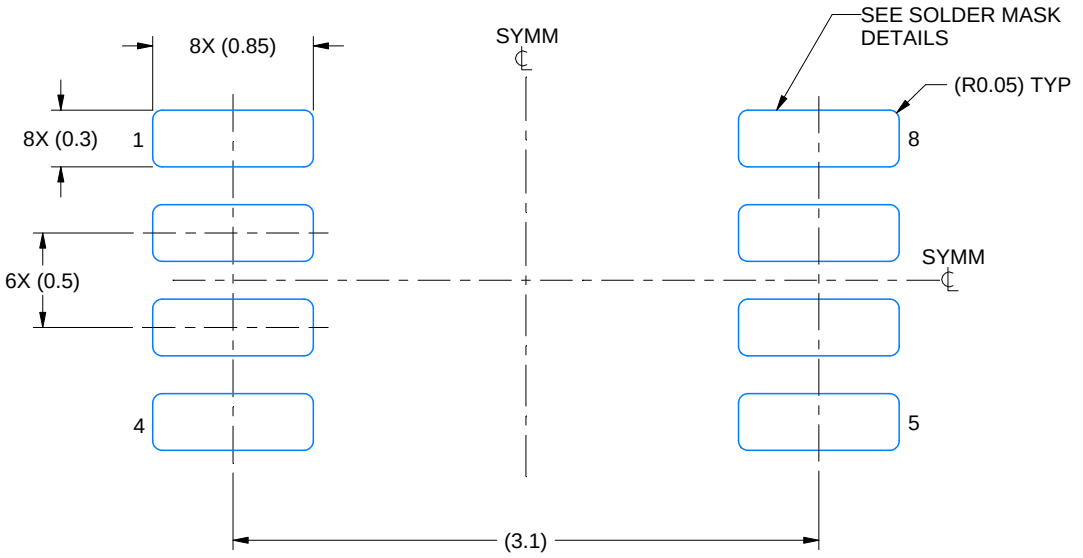




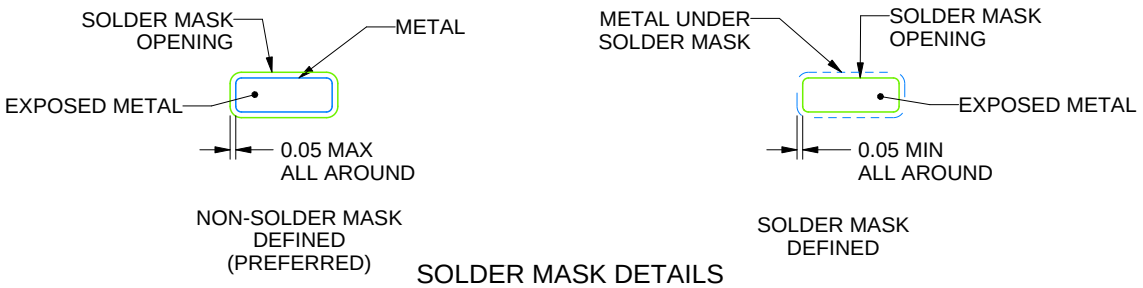
4225266/A 09/2014

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. Reference JEDEC registration MO-187 variation CA.



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE: 25X

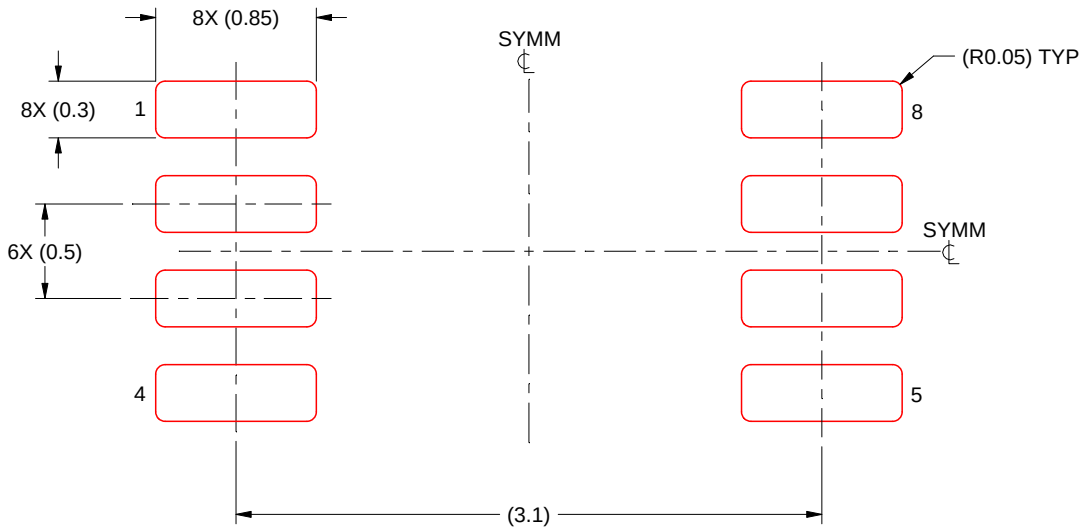


SOLDER MASK DETAILS

4225266/A 09/2014

NOTES: (continued)

5. Publication IPC-7351 may have alternate designs.
6. Solder mask tolerances between and around signal pads can vary based on board fabrication site.



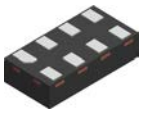
SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL
SCALE: 25X

4225266/A 09/2014

NOTES: (continued)

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

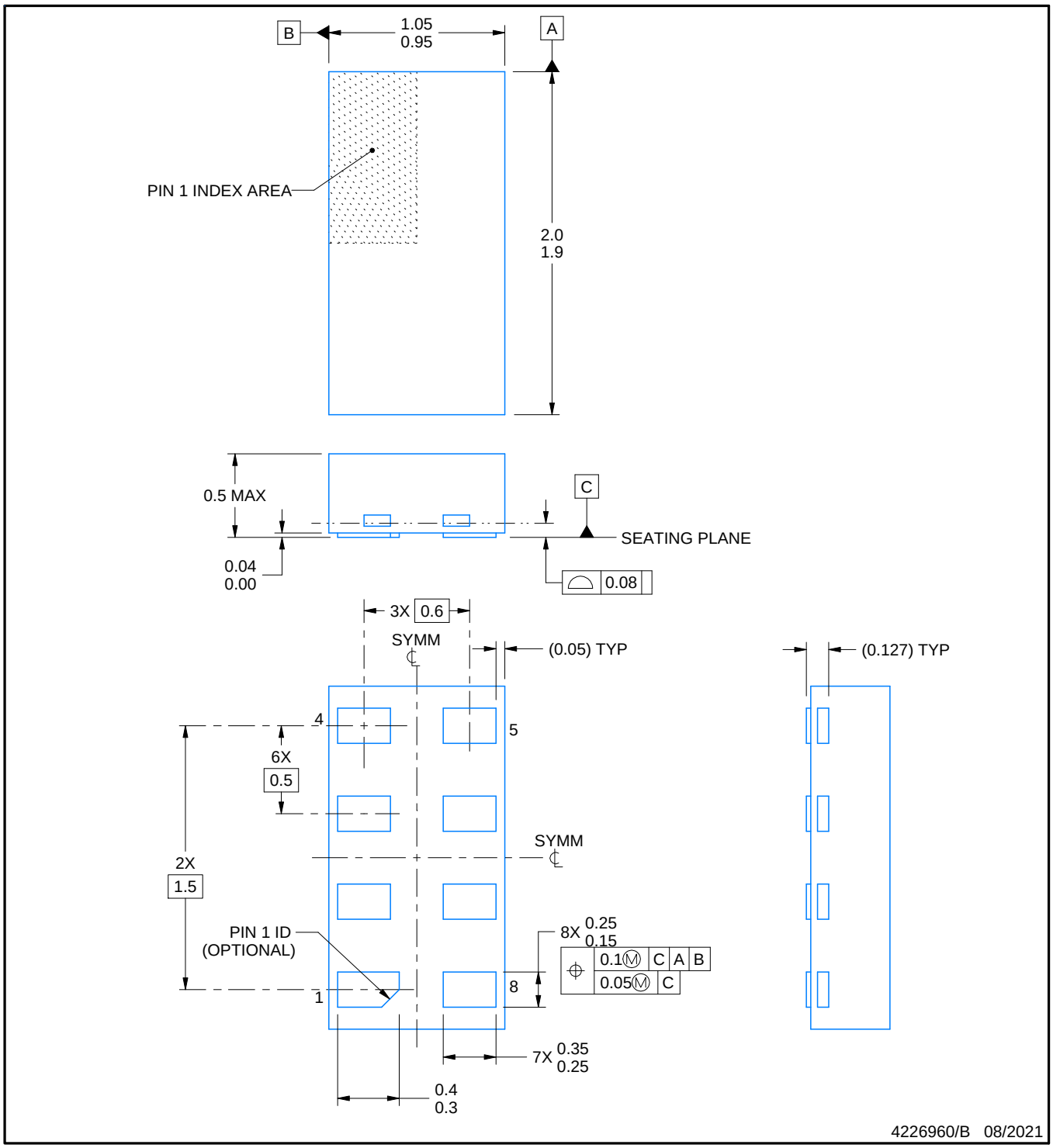
DTT0008A



PACKAGE OUTLINE

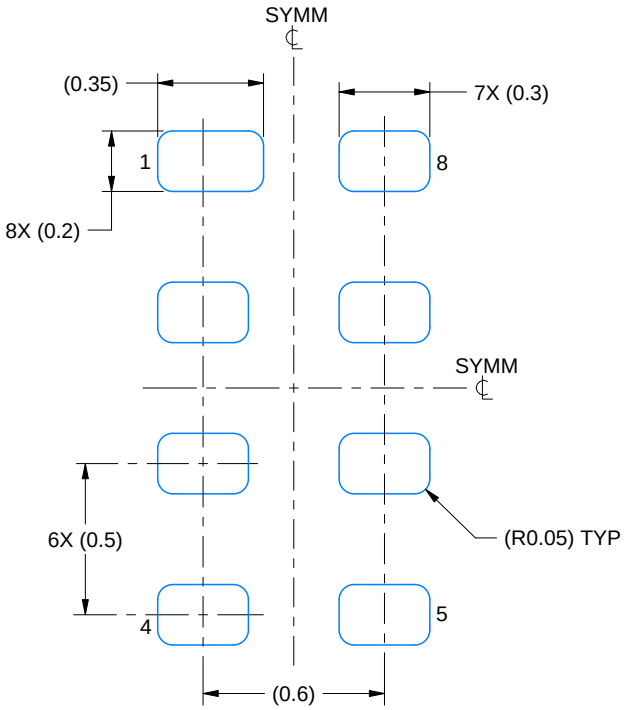
X1SON - 0.5 mm max height

PLASTIC SMALL OUTLINE - NO LEAD

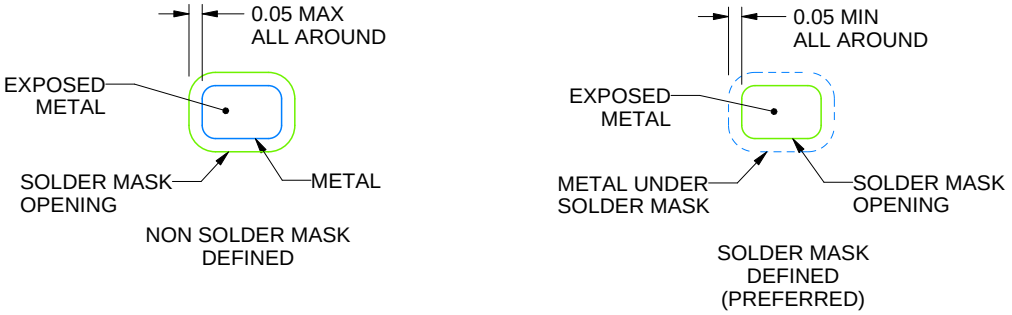


NOTES:

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.



LAND PATTERN EXAMPLE
1:1 RATIO WITH PKG SOLDER PADS
EXPOSED METAL SHOWN
SCALE:40X

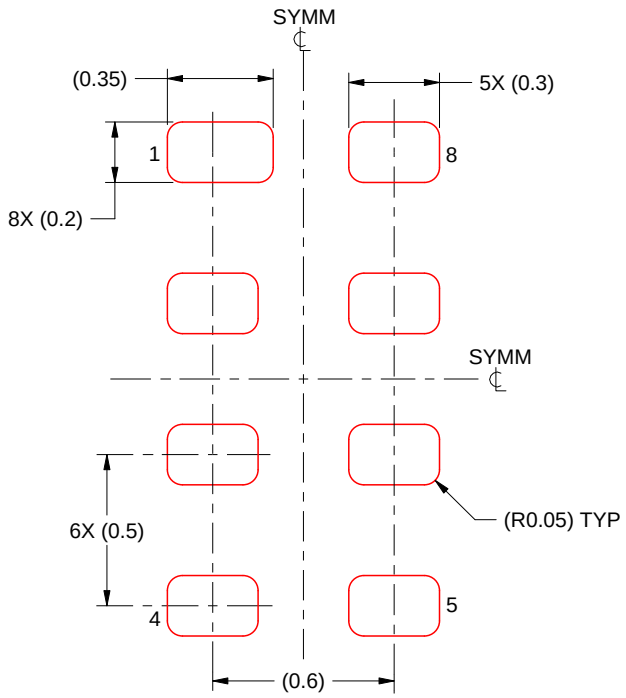


SOLDER MASK DETAILS

4226960/B 08/2021

NOTES: (continued)

3. For more information, see QFN/SON PCB application report in literature No. SLUA271 (www.ti.com/lit/slua271).



SOLDER PASTE EXAMPLE
BASED ON 0.075 - 0.1 mm THICK STENCIL
SCALE:40X

4226960/B 08/2021

NOTES: (continued)

4. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.

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