

TXU0101 デュアル・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 から 5.0V への変換時に最高 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
- 入りに静的プルダウン抵抗を内蔵することで、チャンネルがフローティングになることを防止
- 高い駆動能力 (5V で最大 12mA)
- 低消費電力:
 - 最大 2.5 μ A (25 $^{\circ}$ C)
 - 最大 6 μ A (-40 $^{\circ}$ C~125 $^{\circ}$ C)
- V_{CC} 絶縁および V_{CC} 切断 (I_{off-float}) 機能
 - どちらかの V_{CC} 入力を 100mV 未満に下げる、または切り離すと、すべての出力が無効化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 シフトとピン互換
- 動作温度範囲: -40 $^{\circ}$ C~+125 $^{\circ}$ C
- 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)

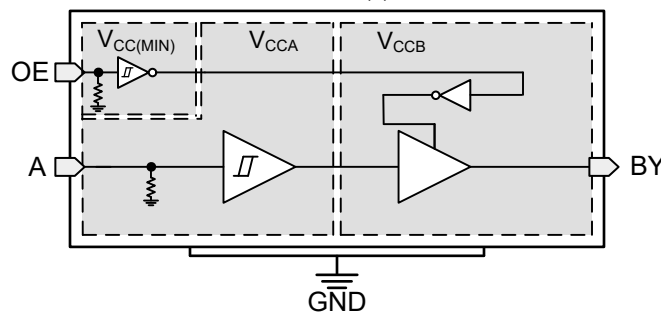
3 概要

TXU0101 は、1 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。A ピンは V_{CCA} ロジック レベルを基準にし、OE ピンは V_{CCA} ロジック レベルと V_{CCB} ロジック レベルのいずれかを基準にでき、B ピンは V_{CCB} ロジック レベルを基準にします。A ポートは 1.1V~5.5V の範囲の入力電圧に対応し、B ポートも 1.1V~5.5V の範囲の入力電圧に対応しています。OE をいずれかの電源を基準として High に設定すると、A から B に固定方向のデータ伝送を発生させることができます。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

| 部品番号 | パッケージ (1) | パッケージ サイズ(2) |
|---------|---------------------------------|---------------|
| TXU0101 | DBV (SOT-23, 6) | 2.9mm × 2.8mm |
| | DCK (SC70, 6) | 2mm × 2.1mm |
| | DRL (SOT-5X3, 6) ⁽³⁾ | 1.6mm × 1.6mm |
| | DRY (SON, 6) | 1.45mm × 1mm |
| | DTQ (X2SON, 6) | 1mm × 0.8mm |

- 詳細については、[セクション 11](#) を参照してください。
- パッケージ サイズ (長さ × 幅) は公称値であり、該当する場合はピンも含まれます。
- 開発中パッケージです。



TXU0101 の機能ブロック図



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4 Pin Configuration and Functions—TXU0101

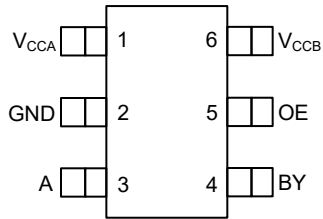


図 4-1. DBV Package, 6-Pin SOT-23 Transparent (Top View)

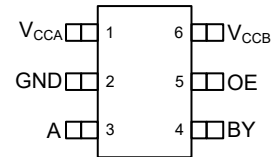


図 4-2. DCK Package, 6-Pin SC70 Transparent (Top View)

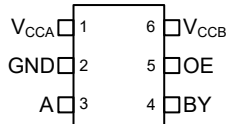


図 4-3. DRL Package, 6-Pin SOT-5X3 Transparent (Top View)

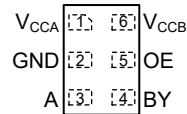


図 4-4. DRY Package, 6-Pin SON Transparent (Top View)

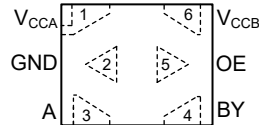


図 4-5. DTQ Package, 6-Pin X2SON Transparent (Top View)

表 4-1. TXU0101 Pin Functions

| PIN | | TYPE ⁽¹⁾ | DESCRIPTION |
|------------------|-----|---------------------|---|
| NAME | NO. | | |
| V _{CCA} | 1 | — | A-port supply voltage. $1.1V \leq V_{CCA} \leq 5.5V$ |
| GND | 2 | — | Ground |
| A | 3 | I | Input A. Referenced to V _{CCA} . |
| BY | 4 | O | Output B. Referenced to V _{CCB} . |
| OE | 5 | 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} | 6 | — | B-port supply voltage. $1.1V \leq V_{CCB} \leq 5.5V$ |

(1) I = input, O = output.

5 Specifications

5.1 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 | |
| T _j | Junction Temperature | | | 150 | °C |
| T _{stg} | Storage temperature | | -65 | 150 | °C |

- (1) Operation outside the *Absolute Maximum Rating* may cause permanent device damage. *Absolute Maximum Rating* do not imply functional operation of the device at these or any other conditions beyond those listed under *Recommended Operating Condition*. If used outside the *Recommended Operating Condition* but within the *Absolute Maximum Rating*, 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 6.5V maximum if the output current rating is observed.

5.2 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.

5.3 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} = 1.1V | -1.5 | mA | |
| | | V _{CCO} = 1.4V | -3 | | |
| | | V _{CCO} = 1.65V | -4.5 | | |
| | | V _{CCO} = 2.3V | -8 | | |
| | | V _{CCO} = 3V | -10 | | |
| | | V _{CCO} = 4.5V | -12 | | |
| I _{OL} | Low-level output current | V _{CCO} = 1.1V | 1.5 | mA | |
| | | V _{CCO} = 1.4V | 3 | | |
| | | V _{CCO} = 1.65V | 4.5 | | |
| | | V _{CCO} = 2.3V | 8 | | |
| | | V _{CCO} = 3V | 10 | | |
| | | V _{CCO} = 4.5V | 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 so that 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](#).

5.4 Thermal Information

| THERMAL METRIC ⁽¹⁾ | | TXU0101-Q1 | | | UNIT |
|-------------------------------|--|------------|---------------|-----------|------|
| | | DCK (SC70) | DRL (SOT-5X3) | DRY (SON) | |
| | | 8 PINS | 8 PINS | 8 PINS | |
| R _{θJA} | Junction-to-ambient thermal resistance | 215.9 | TBD | 279.2 | °C/W |
| R _{θJC(top)} | Junction-to-case (top) thermal resistance | 143.2 | TBD | 172.6 | °C/W |
| R _{θJB} | Junction-to-board thermal resistance | 76.6 | TBD | 154.6 | °C/W |
| Y _{JT} | Junction-to-top characterization parameter | 58.6 | TBD | 22.1 | °C/W |
| Y _{JB} | Junction-to-board characterization parameter | 76.2 | TBD | 153.8 | °C/W |
| R _{θJC(bottom)} | Junction-to-case (bottom) thermal resistance | N/A | TBD | N/A | °C/W |

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

5.5 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}) | 1.1V | 1.1V | | 0.44 | 0.88 | 0.44 | 0.88 | V | | | |
| | | | 1.4V | 1.4V | | 0.60 | 0.98 | 0.60 | 0.98 | | | | |
| | | | 1.65V | 1.65V | | 0.76 | 1.13 | 0.76 | 1.13 | | | | |
| | | | 2.3V | 2.3V | | 1.08 | 1.56 | 1.08 | 1.56 | | | | |
| | | | 3V | 3V | | 1.48 | 1.92 | 1.48 | 1.92 | | | | |
| | | | 4.5V | 4.5V | | 2.19 | 2.74 | 2.19 | 2.74 | | | | |
| | | | 5.5V | 5.5V | | 2.65 | 3.33 | 2.65 | 3.33 | | | | |
| | OE (Referenced to V _{CCA} or V _{CCB}) | 1.1V | 1.1V | | 0.44 | 0.88 | 0.44 | 0.88 | V | | | | |
| | | 1.4V | 1.4V | | 0.60 | 0.98 | 0.60 | 0.98 | | | | | |
| | | 1.65V | 1.65V | | 0.76 | 1.13 | 0.76 | 1.13 | | | | | |
| | | 2.3V | 2.3V | | 1.08 | 1.56 | 1.08 | 1.56 | | | | | |
| | | 3V | 3V | | 1.48 | 1.92 | 1.48 | 1.92 | | | | | |
| | | 4.5V | 4.5V | | 2.19 | 2.74 | 2.19 | 2.74 | | | | | |
| | | 5.5V | 5.5V | | 2.65 | 3.33 | 2.65 | 3.33 | | | | | |
| V _{T-} | Negative-going input-threshold voltage | Data Inputs (Ax, Bx) (Referenced to V _{CCI}) | 1.1V | 1.1V | | 0.17 | 0.48 | 0.17 | 0.48 | V | | | |
| | | | 1.4V | 1.4V | | 0.28 | 0.59 | 0.28 | 0.59 | | | | |
| | | | 1.65V | 1.65V | | 0.35 | 0.69 | 0.35 | 0.69 | | | | |
| | | | 2.3V | 2.3V | | 0.56 | 0.97 | 0.56 | 0.97 | | | | |
| | | | 3V | 3V | | 0.89 | 1.5 | 0.89 | 1.5 | | | | |
| | | | 4.5V | 4.5V | | 1.51 | 1.97 | 1.51 | 1.97 | | | | |
| | | | 5.5V | 5.5V | | 1.88 | 2.4 | 1.88 | 2.4 | | | | |
| | OE (Referenced to V _{CCA} or V _{CCB}) | 1.1V | 1.1V | | 0.17 | 0.48 | 0.17 | 0.48 | V | | | | |
| | | 1.4V | 1.4V | | 0.28 | 0.59 | 0.28 | 0.59 | | | | | |
| | | 1.65V | 1.65V | | 0.35 | 0.69 | 0.35 | 0.69 | | | | | |
| | | 2.3V | 2.3V | | 0.56 | 0.97 | 0.56 | 0.97 | | | | | |
| | | 3V | 3V | | 0.89 | 1.5 | 0.89 | 1.5 | | | | | |
| | | 4.5V | 4.5V | | 1.51 | 1.97 | 1.51 | 1.97 | | | | | |
| | | 5.5V | 5.5V | | 1.88 | 2.46 | 1.88 | 2.46 | | | | | |

5.5 Electrical Characteristics (続き)

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 |
| ΔV_T | Input-threshold hysteresis (V _{T+} - V _{T-}) | Data Inputs (Ax, Bx) (Referenced to V _{CCI}) | 1.1V | 1.1V | | | 0.2 | 0.4 | 0.2 | 0.4 | V | | |
| | | | 1.4V | 1.4V | | | 0.25 | 0.5 | 0.25 | 0.5 | | | |
| | | | 1.65V | 1.65V | | | 0.3 | 0.55 | 0.3 | 0.55 | | | |
| | | | 2.3V | 2.3V | | | 0.38 | 0.65 | 0.38 | 0.65 | | | |
| | | | 3V | 3V | | | 0.46 | 0.72 | 0.46 | 0.72 | | | |
| | | | 4.5V | 4.5V | | | 0.58 | 0.93 | 0.58 | 0.93 | | | |
| | | | 5.5V | 5.5V | | | 0.69 | 1.06 | 0.69 | 1.06 | | | |
| | | OE (Referenced to V _{CCA} or V _{CCB}) | 1.1V | 1.1V | | | 0.15 | 0.41 | 0.15 | 0.41 | V | | |
| | | | 1.4V | 1.4V | | | 0.2 | 0.5 | 0.2 | 0.5 | | | |
| | | | 1.65V | 1.65V | | | 0.23 | 0.55 | 0.23 | 0.55 | | | |
| | | | 2.3V | 2.3V | | | 0.32 | 0.65 | 0.32 | 0.65 | | | |
| | | | 3V | 3V | | | 0.39 | 0.72 | 0.39 | 0.72 | | | |
| | | | 4.5V | 4.5V | | | 0.57 | 0.97 | 0.57 | 0.97 | | | |
| | | | 5.5V | 5.5V | | | 0.69 | 1.18 | 0.69 | 1.18 | | | |
| V _{OH} | High-level output voltage ⁽³⁾ | I _{OH} = -0.1mA | 1.1V – 5.5V | 1.1V – 5.5V | | | V _{CCO} - 0.1 | V _{CCO} - 0.1 | | V | | | |
| | | I _{OH} = -0.5mA | 1.1V | 1.1V | | | 0.82 | 0.82 | | | | | |
| | | I _{OH} = -3mA | 1.4V | 1.4V | | | 1 | 1 | | | | | |
| | | I _{OH} = -4.5mA | 1.65V | 1.65V | | | 1.2 | 1.2 | | | | | |
| | | I _{OH} = -8mA | 2.3V | 2.3V | | | 1.7 | 1.7 | | | | | |
| | | I _{OH} = -10mA | 3V | 3V | | | 2.2 | 2.2 | | | | | |
| | | I _{OH} = -12mA | 4.5V | 4.5V | | | 3.7 | 3.7 | | | | | |
| V _{OL} | Low-level output voltage ⁽⁴⁾ | I _{OL} = 0.1mA | 1.1V – 5.5V | 1.1V – 5.5V | | | | 0.1 | 0.1 | V | | | |
| | | I _{OL} = 0.5mA | 1.1V | 1.1V | | | | 0.27 | 0.27 | | | | |
| | | I _{OL} = 3mA | 1.4V | 1.4V | | | | 0.35 | 0.35 | | | | |
| | | I _{OL} = 4.5mA | 1.65V | 1.65V | | | | 0.45 | 0.45 | | | | |
| | | I _{OL} = 8mA | 2.3V | 2.3V | | | | 0.7 | 0.7 | | | | |
| | | I _{OL} = 10mA | 3V | 3V | | | | 0.8 | 0.8 | | | | |
| | | I _{OL} = 8mA | 4.5V | 4.5V | | | | 0.55 | 0.55 | | | | |
| | | I _{OL} = 12mA | 4.5V | 4.5V | | | | 0.8 | 0.8 | | | | |
| I _I | Input leakage current | OE V _I = V _{CC} or GND | 1.1V – 5.5V | 1.1V – 5.5V | -0.1 | 1.5 | -0.1 | 1.5 | -0.1 | 2 | μA | | |
| | | Data Inputs (Ax, Bx) V _I = V _{CCI} or GND | 1.1V – 5.5V | 1.1V – 5.5V | -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 = 0V – 5.5V | 0V | 1.1V – 5.5V | -1.5 | 1.5 | -2 | 2 | -2.5 | 2.5 | μA | | |
| | | 1.1V – 5.5V | 0V | -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⁾ | 1.1V – 5.5V | -1.5 | 1.5 | -2 | 2 | -2.5 | 2.5 | μA | | |
| | | 0V – 5.5V | 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 | 1.1V – 5.5V | 1.1V – 5.5V | -0.3 | 0.3 | -1 | 1 | -2 | 2 | μA | | |

5.5 Electrical Characteristics (続き)

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 | | |
| I _{CCA} | V _{CCA} supply current | V _I = V _{CCI} or GND I _O = 0 | 1.1V – 5.5V | 1.1V – 5.5V | 1.5 | | | 2.5 | | | 6 | | | μA |
| | | | 0V | 5.5V | –0.3 | | | –1 | | | –1 | | | |
| | | | 5.5V | 0V | 1 | | | 1.5 | | | 3 | | | |
| | | V _I = GND I _O = 0 | 5.5V | Floating ⁽⁵⁾ | 1.5 | | | 7 | | | 15 | | | |
| I _{CCB} | V _{CCB} supply current | V _I = V _{CCI} or GND I _O = 0 | 1.1V – 5.5V | 1.1V – 5.5V | 1.5 | | | 2.5 | | | 6 | | | μA |
| | | | 0V | 5.5V | 1 | | | 1.5 | | | 3 | | | |
| | | | 5.5V | 0V | –0.3 | | | –1 | | | –1 | | | |
| | | V _I = GND I _O = 0 | Floating ⁽⁵⁾ | 5.5V | 1.5 | | | 7 | | | 15 | | | |
| I _{CCA} + I _{CCB} | Combined supply current | V _I = V _{CCI} or GND I _O = 0 | 1.1V – 5.5V | 1.1V – 5.5V | 2.5 | | | 3 | | | 6 | | | μA |
| C _i | Control Input Capacitance | V _I = 3.3V or GND | 3.3V | 3.3V | 2.75 | | | 3 | | | 3.5 | | | pF |
| C _{io} | Data I/O Capacitance | OE = GND, V _O = 1.65V DC + 1MHz –16 dBm sine wave | 3.3V | 3.3V | 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 exceeding 10 nA.

5.6 Switching Characteristics, $V_{CCA} = 1.2 \pm 0.1V$

See [図 6-1](#) and [表 6-1](#) for test circuit and loading. See [図 6-2](#), [図 6-3](#), and [図 6-4](#) for measurement waveforms.

| PARAMETER | FROM | TO | Test Conditions | B-Port Supply Voltage (V_{CCB}) | | | | | | | | | | | | UNIT | | | | | | |
|-----------|-------------------|----|-----------------|-------------------------------------|------|-----|----------------|-----|------|-----------------|------|-----|----------------|-----|------|------|----------------|-----|-----|----------------|-----|-----|
| | | | | $1.2 \pm 0.1V$ | | | $1.5 \pm 0.1V$ | | | $1.8 \pm 0.15V$ | | | $2.5 \pm 0.2V$ | | | | $3.3 \pm 0.3V$ | | | $5.0 \pm 0.5V$ | | |
| | | | | 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 | 5.7 | 60 | 3.0 | 39 | 1.4 | 33 | 0.5 | 28 | 0.5 | 27 | 0.5 | 26 | | | | | | |
| | | 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 | 5.7 | 60 | 4.1 | 51 | 2.9 | 48 | 1.8 | 45 | 1.5 | 44 | 1.3 | 44 | | | | | | |
| 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 | 43.3 | 133 | 43.3 | 130 | 43.7 | 130 | 44.7 | 131 | 45.4 | 134 | 31.8 | 140 | | | | | | |
| | | 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 | 48.3 | 149 | 43.2 | 120 | 40.8 | 113 | 36.8 | 104 | 36.5 | 107 | 33.8 | 111 | | | | | | |
| 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 | 34.9 | 156 | 33.3 | 167 | 32.0 | 169 | 31.7 | 173 | 32.0 | 177 | 34.2 | 187 | | | | | | |
| | | 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 | 29.8 | 143 | 23.0 | 116 | 18.6 | 107 | 15.4 | 97 | 14.5 | 97 | 14.8 | 103 | | | | | | |

5.7 Switching Characteristics, $V_{CCA} = 1.5 \pm 0.1V$

See [Figure 6-1](#) and [Table 6-1](#) for test circuit and loading. See [Figure 6-2](#), [Figure 6-3](#), and [Figure 6-4](#) for measurement waveforms.

| PARAMETER | FROM | TO | Test Conditions | B-Port Supply Voltage (V_{CCB}) | | | | | | | | | | | | UNIT | | | | | | |
|-----------|-------------------|----|-----------------|-------------------------------------|------|-----|----------------|-----|------|-----------------|------|-----|----------------|-----|------|------|----------------|-----|-----|----------------|-----|-----|
| | | | | $1.2 \pm 0.1V$ | | | $1.5 \pm 0.1V$ | | | $1.8 \pm 0.15V$ | | | $2.5 \pm 0.2V$ | | | | $3.3 \pm 0.3V$ | | | $5.0 \pm 0.5V$ | | |
| | | | | 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 | 4.1 | 51 | 1.6 | 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 | 3.0 | 39 | 1.6 | 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 | 87 | ns | | | | | |
| | | | | -40°C to 125°C | 34.9 | 95 | 32.6 | 86 | 32.8 | 85 | 33.4 | 87 | 34.2 | 88 | 24.6 | 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 | 44.4 | 130 | 36.7 | 95 | 34.7 | 86 | 30.2 | 75 | 29.8 | 75 | 26.6 | 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 | 25.5 | 102 | 25.2 | 89 | 24.1 | 91 | 22.8 | 93 | 22.8 | 96 | 23.5 | 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 | 26.6 | 135 | 21.0 | 81 | 16.8 | 71 | 12.5 | 60 | 10.8 | 56 | 10.4 | 57 | | | | | | |

5.8 Switching Characteristics, $V_{CCA} = 1.8 \pm 0.15V$

See [図 6-1](#) and [表 6-1](#) for test circuit and loading. See [図 6-2](#), [図 6-3](#), and [図 6-4](#) for measurement waveforms.

| PARAMETER | FROM | TO | Test Conditions | B-Port Supply Voltage (V_{CCB}) | | | | | | | | | | | | UNIT | | | | | | |
|-----------|-------------------|----|-----------------|-------------------------------------|------|-----|------------|-----|------|-------------|------|-----|------------|-----|------|------|------------|-----|-----|------------|-----|-----|
| | | | | 1.2 ± 0.1V | | | 1.5 ± 0.1V | | | 1.8 ± 0.15V | | | 2.5 ± 0.2V | | | | 3.3 ± 0.3V | | | 5.0 ± 0.5V | | |
| | | | | 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 | 2.9 | 48 | 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 | 1.4 | 33 | 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 | 68 | ns | | | | | |
| | | | | -40°C to 125°C | 30.9 | 83 | 28.0 | 71 | 26.6 | 69 | 27.5 | 70 | 27.2 | 71 | 20.0 | 73 | | | | | | |
| | | 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 | 41.7 | 123 | 34.0 | 86 | 30.3 | 76 | 26.2 | 64 | 25.3 | 62 | 21.8 | 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 | 20.3 | 87 | 19.0 | 69 | 18.9 | 67 | 17.6 | 68 | 17.1 | 70 | 17.1 | 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 | 25.1 | 135 | 18.7 | 77 | 15.5 | 60 | 11.0 | 49 | 8.7 | 44 | 7.3 | 42 | | | | | | |

5.9 Switching Characteristics, $V_{CCA} = 2.5 \pm 0.2V$

See [Figure 6-1](#) and [Table 6-1](#) for test circuit and loading. See [Figure 6-2](#), [Figure 6-3](#), and [Figure 6-4](#) for measurement waveforms.

| PARAMETER | | FROM | TO | Test Conditions | B-Port Supply Voltage (V_{CCB}) | | | | | | | | | | | | UNIT | | | | | | |
|-----------|-------------------|------|----|-----------------|-------------------------------------|-----|------|----------------|------|-----|-----------------|-----|------|----------------|------|-----|------|----------------|-----|-----|----------------|-----|-----|
| | | | | | $1.2 \pm 0.1V$ | | | $1.5 \pm 0.1V$ | | | $1.8 \pm 0.15V$ | | | $2.5 \pm 0.2V$ | | | | $3.3 \pm 0.3V$ | | | $5.0 \pm 0.5V$ | | |
| | | | | | 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 | 1.8 | 45 | 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 | 28 | 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 | 24.9 | 68 | 21.8 | 55 | 19.7 | 50 | 18.2 | 47 | 18.6 | 48 | 15.0 | 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 | 38.7 | 115 | 30.9 | 79 | 27.1 | 66 | 21.6 | 51 | 20.5 | 48 | 16.8 | 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 | 15.6 | 74 | 13.5 | 53 | 12.4 | 47 | 12.0 | 42 | 11.5 | 43 | 10.8 | 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 | 24.4 | 139 | 17.2 | 76 | 13.0 | 57 | 9.8 | 38 | 7.1 | 33 | 4.7 | 29 | | | | | | | |

5.10 Switching Characteristics, $V_{CCA} = 3.3 \pm 0.3V$

See 図 6-1 and 表 6-1 for test circuit and loading. See 図 6-2, 図 6-3, and 図 6-4 for measurement waveforms.

| PARAMETER | | FROM | TO | Test Conditions | B-Port Supply Voltage (V_{CCB}) | | | | | | | | | | | | UNIT | | | | | | |
|-----------|-------------------|------|----|-----------------|-------------------------------------|-----|------|------------|------|-----|-------------|-----|------|------------|------|-----|------|------------|-----|-----|------------|-----|-----|
| | | | | | 1.2 ± 0.1V | | | 1.5 ± 0.1V | | | 1.8 ± 0.15V | | | 2.5 ± 0.2V | | | | 3.3 ± 0.3V | | | 5.0 ± 0.5V | | |
| | | | | | 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 | 1.5 | 44 | 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 | 27 | 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 | 24.0 | 65 | 20.6 | 51 | 18.4 | 46 | 15.7 | 40 | 15.3 | 39 | 15.9 | 40 | | | | | | | |
| | | OE | B | -40°C to 85°C | 22.7 | 109 | 15.7 | 71 | 13.2 | 59 | 8.5 | 42 | 7.6 | 38 | 4.7 | 34 | | | | | | | |
| | | | | -40°C to 125°C | 37.6 | 111 | 29.5 | 75 | 25.4 | 63 | 19.2 | 46 | 18.5 | 42 | 14.2 | 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 | 13.6 | 72 | 10.9 | 47 | 9.3 | 40 | 8.2 | 33 | 8.1 | 32 | 7.5 | 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 | 24.3 | 144 | 16.7 | 78 | 12.2 | 57 | 8.0 | 36 | 6.6 | 29 | 3.7 | 24 | | | | | | | |

5.11 Switching Characteristics, $V_{CCA} = 5.0 \pm 0.5V$

See [Figure 6-1](#) and [Table 6-1](#) for test circuit and loading. See [Figure 6-2](#), [Figure 6-3](#), and [Figure 6-4](#) for measurement waveforms.

| PARAMETER | | FROM | TO | Test Conditions | B-Port Supply Voltage (V_{CCB}) | | | | | | | | | | | | UNIT | | | | | | |
|-----------|-------------------|------|----|-----------------|-------------------------------------|-----|------|------------|------|-----|-------------|-----|------|------------|------|-----|------|------------|-----|-----|------------|-----|-----|
| | | | | | 1.2 ± 0.1V | | | 1.5 ± 0.1V | | | 1.8 ± 0.15V | | | 2.5 ± 0.2V | | | | 3.3 ± 0.3V | | | 5.0 ± 0.5V | | |
| | | | | | 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 | 1.3 | 44 | 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 | 26 | 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 | 36 | 4.2 | 31 | 3.4 | 30 | 2.8 | 26 | ns | | | | | | |
| | | | | -40°C to 125°C | 20.8 | 62 | 17.0 | 46 | 14.5 | 40 | 11.8 | 33 | 10.4 | 31 | 9.6 | 29 | | | | | | | |
| | | OE | B | -40°C to 85°C | 9.7 | 109 | 5.9 | 69 | 13.2 | 56 | 8.4 | 40 | 6.9 | 36 | 3.7 | 30 | | | | | | | |
| | | | | -40°C to 125°C | 37.4 | 111 | 29.2 | 73 | 24.6 | 60 | 18.1 | 43 | 16.4 | 39 | 12.2 | 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 | 12.4 | 81 | 8.8 | 46 | 6.5 | 36 | 4.7 | 27 | 4.2 | 24 | 4.4 | 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 | 24.8 | 158 | 16.7 | 83 | 11.7 | 60 | 6.9 | 37 | 4.7 | 28 | 3.5 | 21 | | | | | | | |

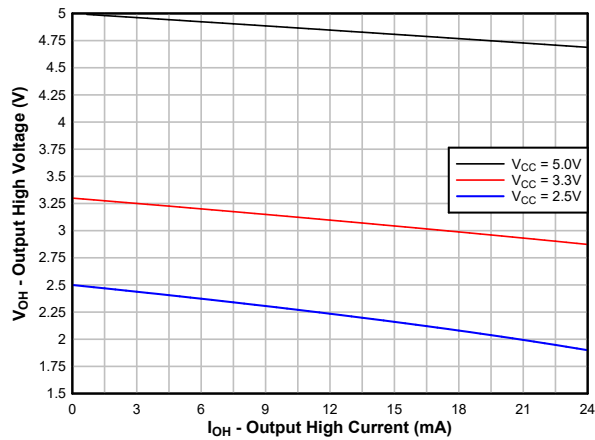
5.12 Operating Characteristics

$T_A = 25^\circ\text{C}$ (1)

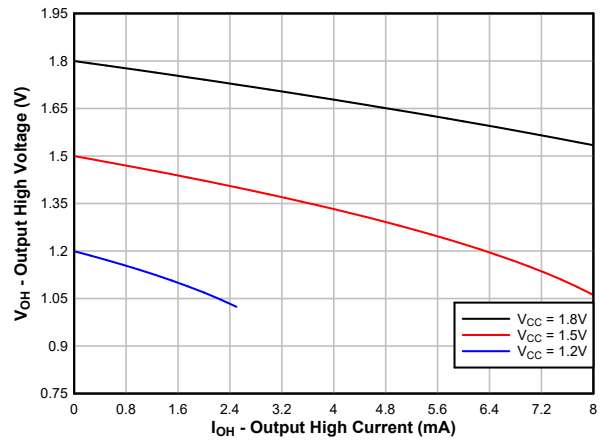
| PARAMETER | | Test Conditions | Supply Voltage ($V_{CCB} = V_{CCA}$) | | | | | | UNIT |
|---------------|--------------------------|---|--|------------|-------------|------------|------------|------------|------|
| | | | 1.2 ± 0.1V | 1.5 ± 0.1V | 1.8 ± 0.15V | 2.5 ± 0.2V | 3.3 ± 0.3V | 5.0 ± 0.5V | |
| | | | TYP | TYP | TYP | TYP | TYP | TYP | |
| C_{pdA} (2) | A to B: outputs enabled | A Port CL = 0, RL = Open f = 10MHz $t_{rise} = t_{fall} = 1\text{ ns}$ | 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 = 10MHz $t_{rise} = t_{fall} = 1\text{ ns}$ | 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.

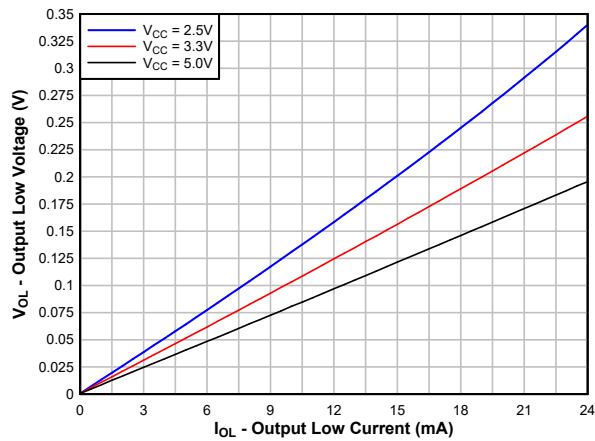
5.13 Typical Characteristics



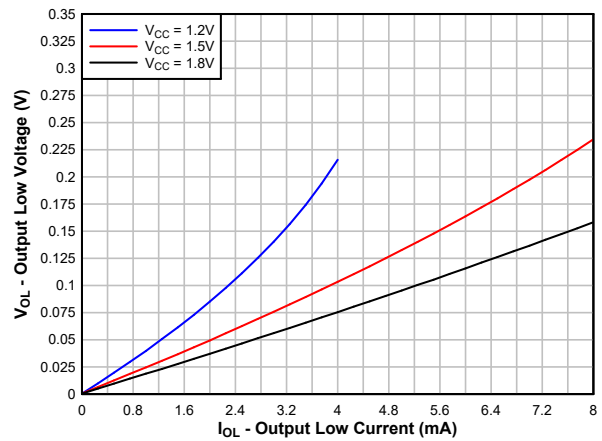
5-1. Typical ($T_A=25^\circ\text{C}$) Output High Voltage (V_{OH}) vs Source Current (I_{OH})



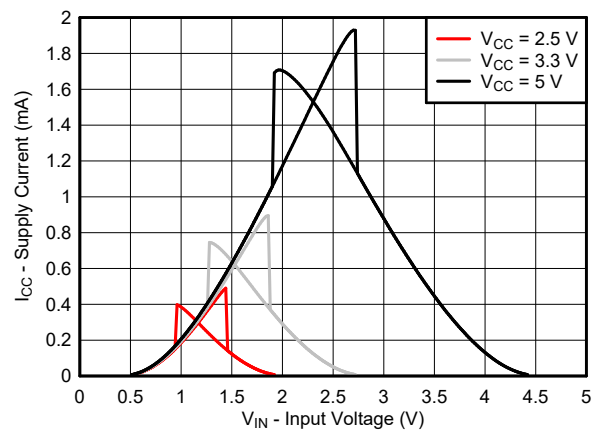
5-2. Typical ($T_A=25^\circ\text{C}$) Output High Voltage (V_{OH}) vs Source Current (I_{OH})



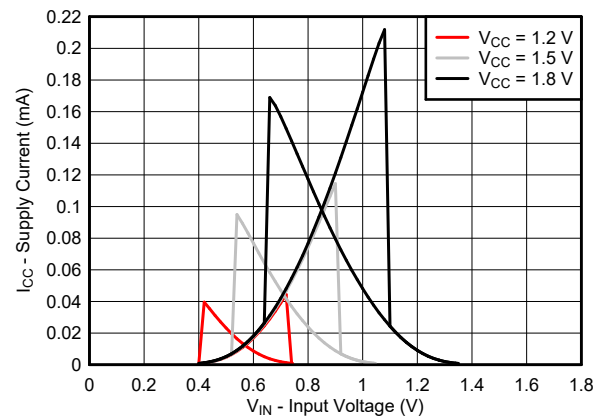
5-3. Typical ($T_A=25^\circ\text{C}$) Output Low Voltage (V_{OL}) vs Sink Current (I_{OL})



5-4. Typical ($T_A=25^\circ\text{C}$) Output Low Voltage (V_{OL}) vs Sink Current (I_{OL})



5-5. Typical ($T_A=25^\circ\text{C}$) Supply Current (I_{CC}) vs Input Voltage (V_{IN})



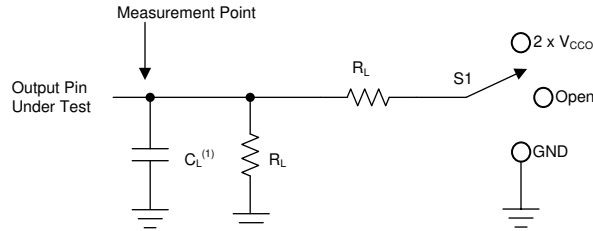
5-6. Typical ($T_A=25^\circ\text{C}$) Supply Current (I_{CC}) vs Input Voltage (V_{IN})

6 Parameter Measurement Information

6.1 Load Circuit and Voltage Waveforms

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

- $f = 1\text{MHz}$
- $Z_O = 50\Omega$
- $\Delta t/\Delta V \leq 1\text{ns/V}$

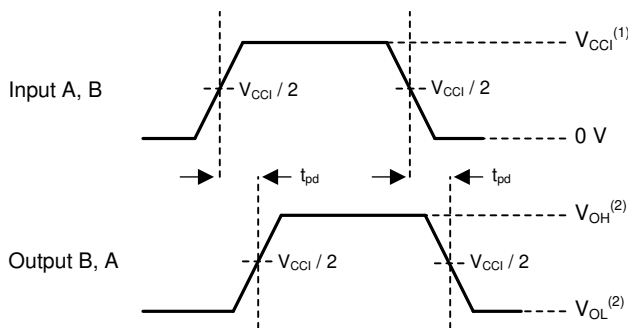


A. C_L includes probe and jig capacitance.

図 6-1. Load Circuit

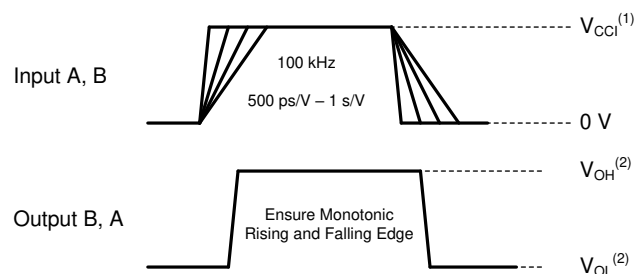
表 6-1. Load Circuit Conditions

| Parameter | V_{CC0} | R_L | C_L | S_1 | V_{TP} |
|---|--------------|--------------|-------|--------------------|----------|
| t_{pd} Propagation (delay) time | 1.1V – 5.5V | 10k Ω | 5pF | Open | N/A |
| t_{en}, t_{dis} Enable time, disable time | 1.1V – 1.6V | 10k Ω | 5pF | $2 \times V_{CC0}$ | 0.1V |
| | 1.65V – 2.7V | 10k Ω | 5pF | $2 \times V_{CC0}$ | 0.15V |
| | 3.0V – 5.5V | 10k Ω | 5pF | $2 \times V_{CC0}$ | 0.3V |
| t_{en}, t_{dis} Enable time, disable time | 1.1V – 1.6V | 10k Ω | 5pF | GND | 0.1V |
| | 1.65V – 2.7V | 10k Ω | 5pF | GND | 0.15V |
| | 3.0V – 5.5V | 10k Ω | 5pF | GND | 0.3V |



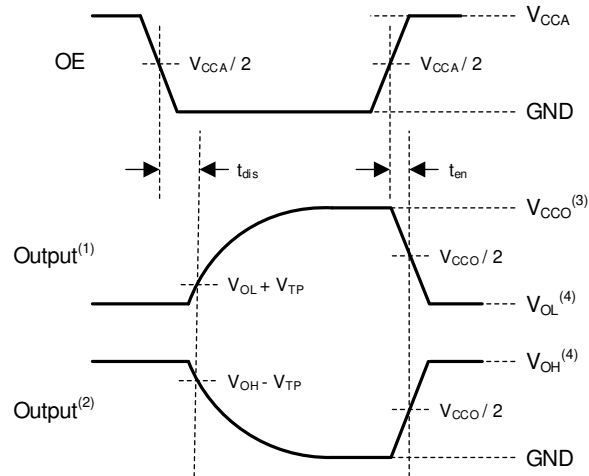
1. V_{CCI} is the supply pin associated with the input port.
2. V_{OH} and V_{OL} are typical output voltage levels that occur with specified R_L , C_L , and S_1

図 6-2. 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 6-3. Input Transition Rise and Fall Rate



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_{CC0} 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 .

6-4. Enable Time And Disable Time

7 Detailed Description

7.1 Overview

The TXU0101 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 1.1V and as high as 5.5V. 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} .

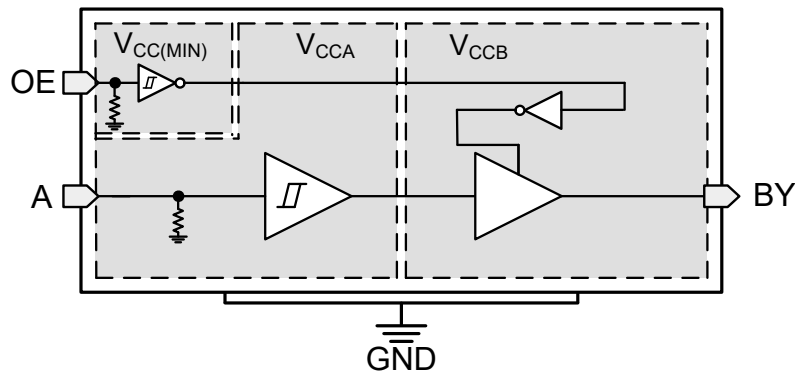
The TXU0101 device is designed for asynchronous communication between data buses, and transmits data with fixed direction from the A bus to the B bus. The output-enable input (OE) is used to disable the outputs so the buses are effectively isolated. The output-enable pin of the TXU0101 (OE) can be referenced to either V_{CCA} or V_{CCB} . The OE pin can be left floating or externally pulled down to ground so that 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 is designed so that no excessive current is drawn from or sourced into an input or output while the device is powered down.

The V_{CC} isolation or V_{CC} disconnect feature is designed so that if either V_{CC} is less than 100mV or disconnected with the complementary supply within the recommended operating conditions, then the outputs are disabled and set to the high-impedance state while the supply current is maintained. The $I_{off-float}$ circuitry is designed so 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.

7.2 Functional Block Diagram



7.3 Feature Description

7.3.1 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 ($R = V \div I$).

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.

7.3.1.1 Inputs with Integrated Static Pull-Down Resistors

This device has 5 M Ω 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 M Ω to avoid contention with the 5 M Ω internal pull-down.

7.3.2 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.

7.3.3 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. [Absolute Maximum Ratings](#) defines the electrical and thermal limits that must be followed at all times.

7.3.4 VCC Isolation and V_{CC} Disconnect

The outputs for this device are disabled and enter a high-impedance state when either supply is <100mV or left floating (disconnected), with the complementary supply within recommended operating conditions. It is recommended that the inputs are kept 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.

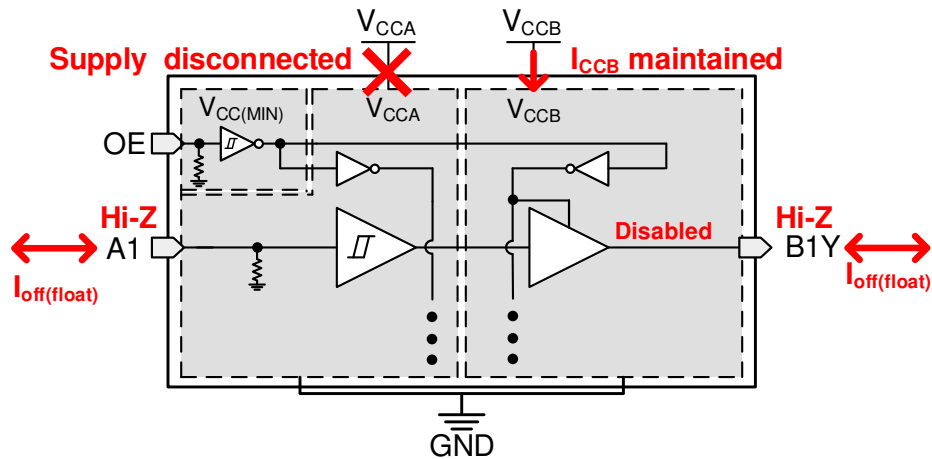


図 7-1. V_{CC} Disconnect Feature

7.3.5 Over-Voltage Tolerant Inputs

Input signals to this device can be driven above the supply voltage so long as they remain below the maximum input voltage value specified in the [Recommended Operating Conditions](#).

7.3.6 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.

7.3.7 Negative Clamping Diodes

図 7-2 shows the inputs and outputs to this device that have negative clamping diodes.

注意

Voltages beyond the values specified in the [Absolute 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.

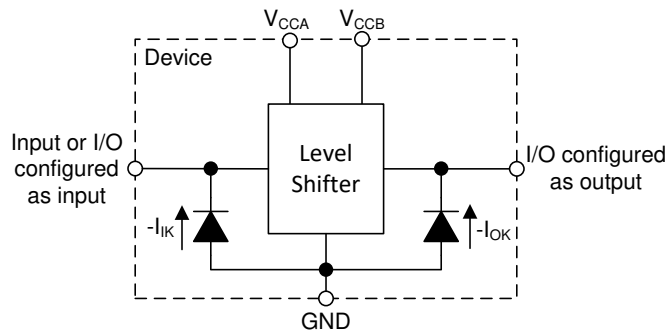


図 7-2. Electrical Placement of Clamping Diodes for Each Input and Output

7.3.8 Fully Configurable Dual-Rail Design

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

7.3.9 Supports High-Speed Translation

The TXU0101 device can support high data-rate applications. The translated signal data rate can be up to 200Mbps when the signal is translated from 3.3V to 5.0V.

7.4 Device Functional Modes

表 7-1. Function Table

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

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 TXU0101 device can be used in level-translation applications for interfacing devices or systems operating at different interface voltages with one another. The TXU0101 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 200Mbps when device translates a signal from 3.3V to 5.0V.

8.2 Typical Application

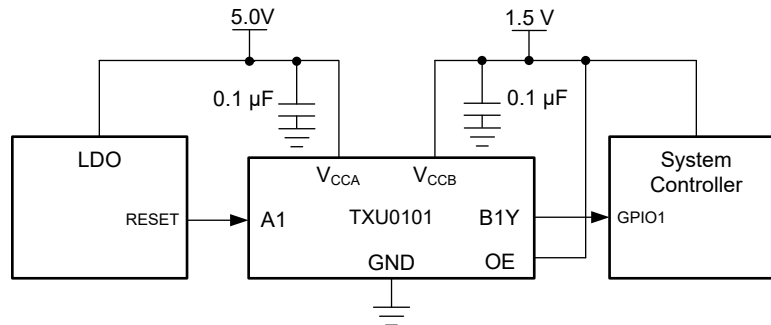


図 8-1. TXU0101 LDO Reset Application

8.2.1 Design Requirements

Use the parameters listed in 表 8-1 for this design example.

表 8-1. Design Parameters

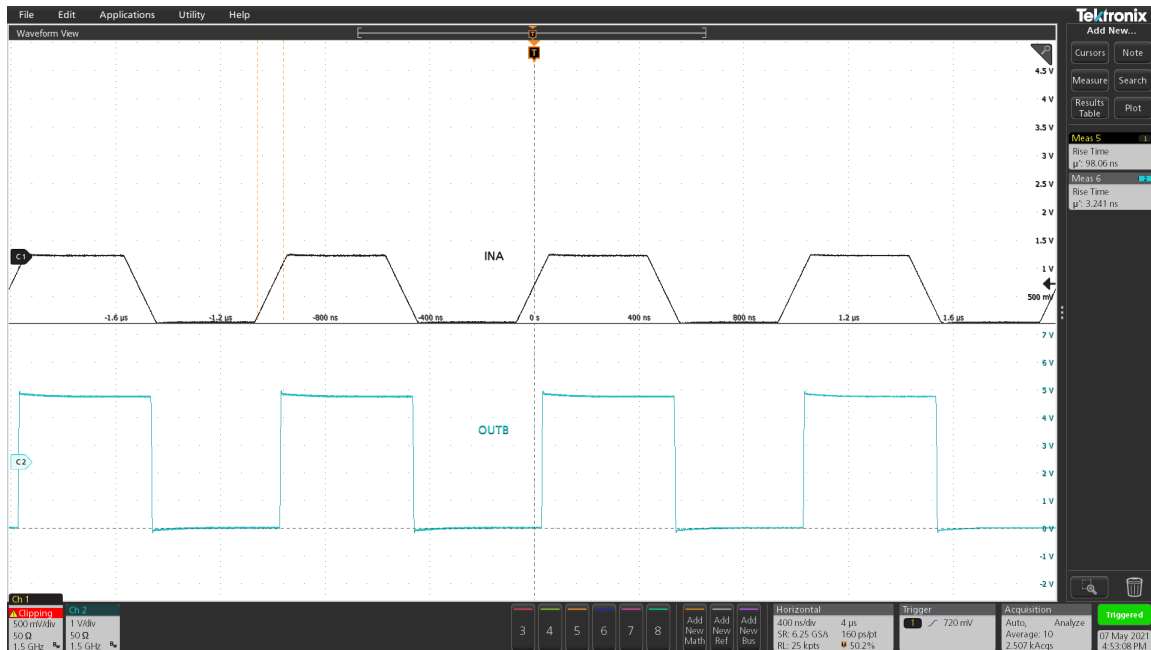
| DESIGN PARAMETERS | EXAMPLE VALUES |
|----------------------|----------------|
| Input voltage range | 1.1V to 5.5V |
| Output voltage range | 1.1V to 5.5V |

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 TXU0101 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 TXU0101 device is driving to determine the output voltage range.

8.2.3 Application Curve



8-2. Up Translation at 1MHz (1.2V to 5V)

8.3 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.

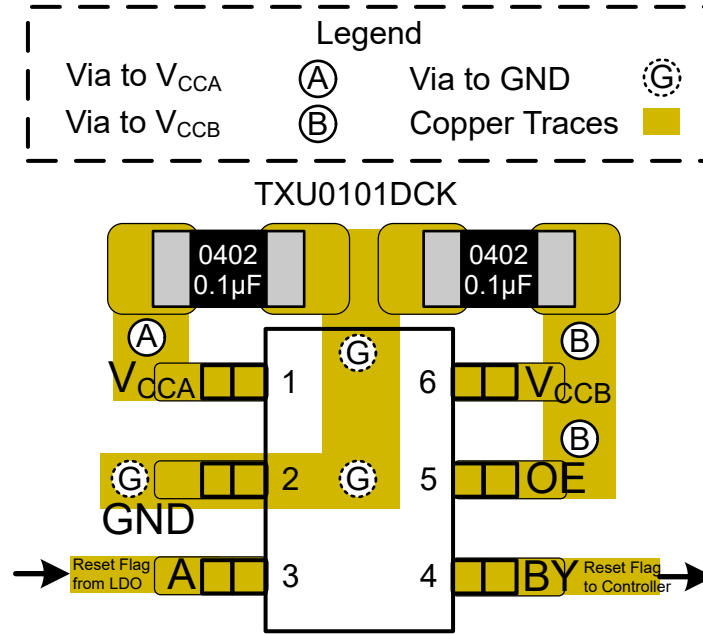
8.4 Layout

8.4.1 Layout Guidelines

For device reliability, it is recommended to follow common printed-circuit board layout guidelines such as follows:

- Use bypass capacitors on the power supply pins and place them as close to the device as possible. A 0.1 μ F capacitor is recommended, but transient performance can be improved by having 1 μ F and 0.1 μ F 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.

8.4.2 Layout Example



8-3. Layout Example – TXU0101

9 Device and Documentation Support

9.1 Device Support

9.1.1 Regulatory Requirements

No statutory or regulatory requirements apply to this device.

There are no special characteristics for this product.

9.2 Documentation Support

9.2.1 Related Documentation

- Texas Instruments, [Understanding Schmitt Triggers application report](#)
- Texas Instruments, [CMOS Power Consumption and \$C_{pd}\$ Calculation application report](#)

9.3 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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9.7 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。

10 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 * (February 2022) to Revision A (May 2024) | Page |
|---|------|
| • 「特長」セクションの低消費電力の仕様を更新 | 1 |
| • Updated the device design features in the <i>Overview</i> section..... | 19 |
| • Updated the layout example figure in the <i>Layout Example</i> section..... | 25 |

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.

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PACKAGING INFORMATION

| Orderable Device | Status (1) | Package Type | Package Drawing | Pins | Package Qty | Eco Plan (2) | Lead finish/ Ball material (6) | MSL Peak Temp (3) | Op Temp (°C) | Device Marking (4/5) | Samples |
|------------------|---------------|--------------|-----------------|------|-------------|-----------------|--------------------------------------|----------------------|--------------|-------------------------|-------------------------|
| TXU0101DBVR | ACTIVE | SOT-23 | DBV | 6 | 3000 | RoHS & Green | SN | Level-1-260C-UNLIM | -40 to 125 | 2T9H | Samples |
| TXU0101DCKR | ACTIVE | SC70 | DCK | 6 | 3000 | RoHS & Green | SN | Level-1-260C-UNLIM | -40 to 125 | 1LQ | Samples |
| TXU0101DRYR | ACTIVE | SON | DRY | 6 | 5000 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | MO | Samples |
| TXU0101DTQR | ACTIVE | X2SON | DTQ | 6 | 3000 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | MN | Samples |

(1) The marketing status values are defined as follows:

ACTIVE: Product device recommended for new designs.

LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

PREVIEW: Device has been announced but is not in production. Samples may or may not be available.

OBSELETE: TI has discontinued the production of the device.

(2) **RoHS:** TI defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".

RoHS Exempt: TI defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.

Green: TI defines "Green" to mean the content of Chlorine (Cl) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of <=1000ppm threshold. Antimony trioxide based flame retardants must also meet the <=1000ppm threshold requirement.

(3) MSL, Peak Temp. - The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "-" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

(6) Lead finish/Ball material - Orderable Devices 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.

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OTHER QUALIFIED VERSIONS OF TXU0101 :

- Automotive : [TXU0101-Q1](#)

NOTE: Qualified Version Definitions:

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

TAPE AND REEL INFORMATION

QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE


*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 |
|-------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| TXU0101DBVR | SOT-23 | DBV | 6 | 3000 | 180.0 | 8.4 | 3.2 | 3.2 | 1.4 | 4.0 | 8.0 | Q3 |
| TXU0101DCKR | SC70 | DCK | 6 | 3000 | 178.0 | 9.0 | 2.4 | 2.5 | 1.2 | 4.0 | 8.0 | Q3 |
| TXU0101DRYR | SON | DRY | 6 | 5000 | 180.0 | 9.5 | 1.2 | 1.65 | 0.7 | 4.0 | 8.0 | Q1 |
| TXU0101DTQR | X2SON | DTQ | 6 | 3000 | 180.0 | 9.5 | 0.94 | 1.13 | 0.5 | 2.0 | 8.0 | Q2 |

TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

| Device | Package Type | Package Drawing | Pins | SPQ | Length (mm) | Width (mm) | Height (mm) |
|-------------|--------------|-----------------|------|------|-------------|------------|-------------|
| TXU0101DBVR | SOT-23 | DBV | 6 | 3000 | 210.0 | 185.0 | 35.0 |
| TXU0101DCKR | SC70 | DCK | 6 | 3000 | 180.0 | 180.0 | 18.0 |
| TXU0101DRYR | SON | DRY | 6 | 5000 | 189.0 | 185.0 | 36.0 |
| TXU0101DTQR | X2SON | DTQ | 6 | 3000 | 189.0 | 185.0 | 36.0 |

DRL0006A



PACKAGE OUTLINE

SOT - 0.6 mm max height

PLASTIC SMALL OUTLINE



4223266/F 11/2024

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-293 Variation UAAD

EXAMPLE BOARD LAYOUT

DRL0006A

SOT - 0.6 mm max height

PLASTIC SMALL OUTLINE



LAND PATTERN EXAMPLE
SCALE:30X



SOLDERMASK DETAILS

4223266/F 11/2024

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.
7. Land pattern design aligns to IPC-610, Bottom Termination Component (BTC) solder joint inspection criteria.

EXAMPLE STENCIL DESIGN

DRL0006A

SOT - 0.6 mm max height

PLASTIC SMALL OUTLINE



SOLDER PASTE EXAMPLE
BASED ON 0.1 mm THICK STENCIL
SCALE:30X

4223266/F 11/2024

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.

DBV0006A



PACKAGE OUTLINE

SOT-23 - 1.45 mm max height

SMALL OUTLINE TRANSISTOR



4214840/G 08/2024

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. Body dimensions do not include mold flash or protrusion. Mold flash and protrusion shall not exceed 0.25 per side.
4. Leads 1,2,3 may be wider than leads 4,5,6 for package orientation.
5. Reference JEDEC MO-178.

EXAMPLE BOARD LAYOUT

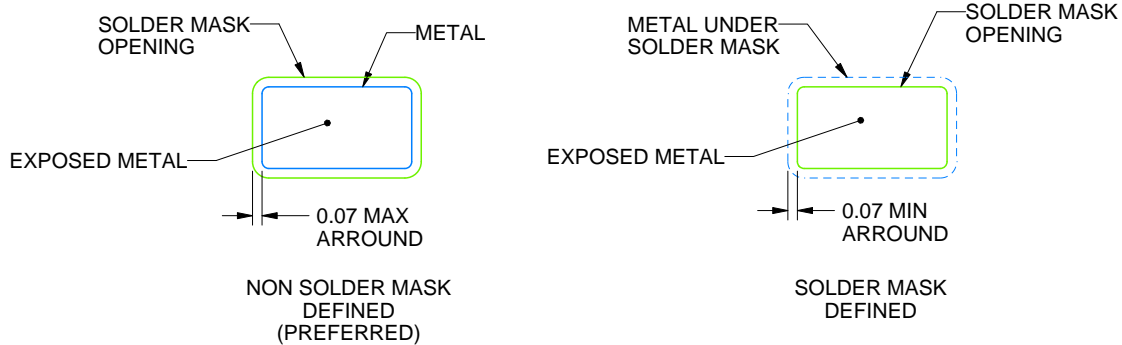
DBV0006A

SOT-23 - 1.45 mm max height

SMALL OUTLINE TRANSISTOR



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE:15X



SOLDER MASK DETAILS

4214840/G 08/2024

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

DBV0006A

SOT-23 - 1.45 mm max height

SMALL OUTLINE TRANSISTOR



SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL
SCALE:15X

4214840/G 08/2024

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.

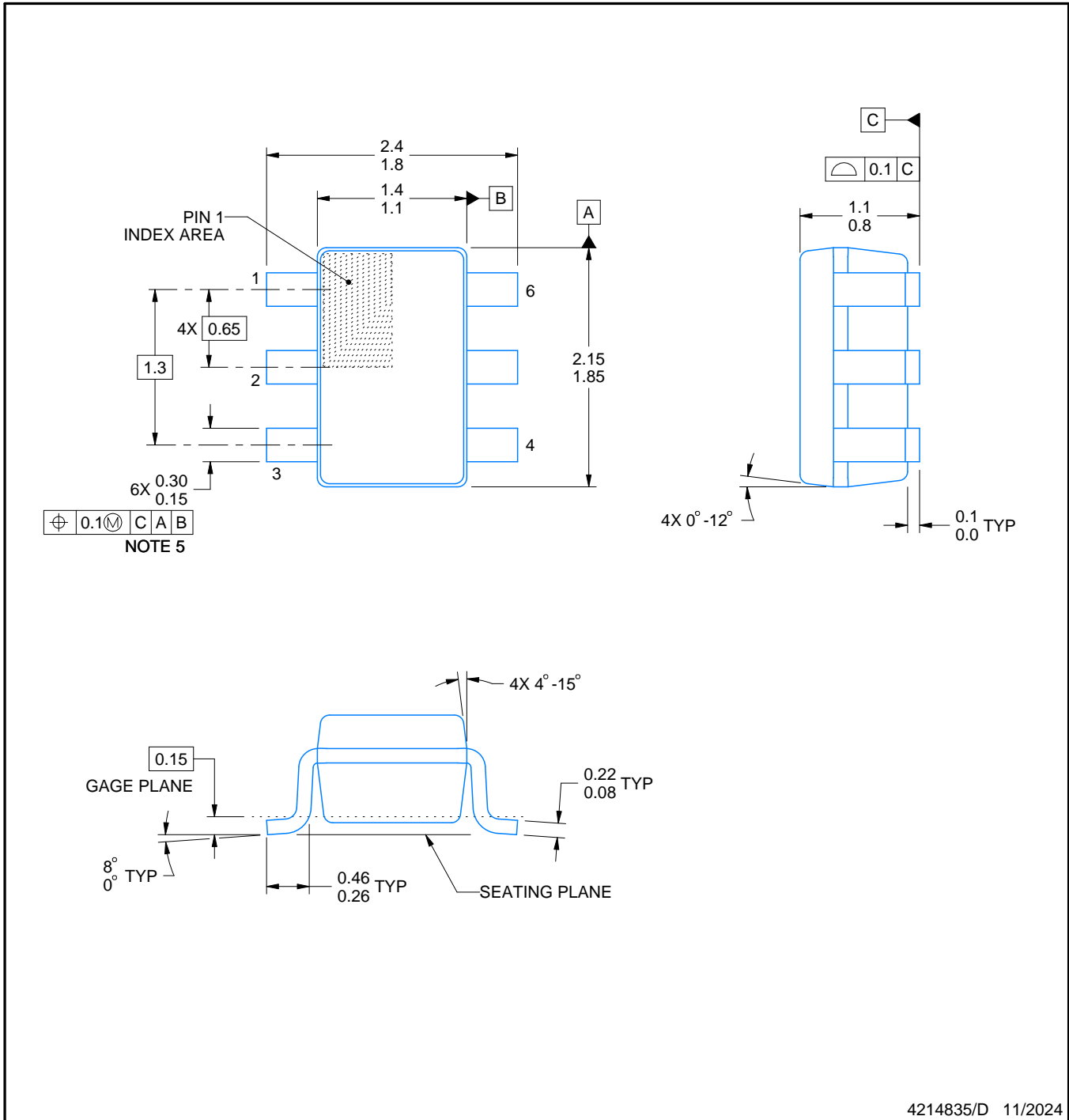
DCK0006A



PACKAGE OUTLINE

SOT - 1.1 max height

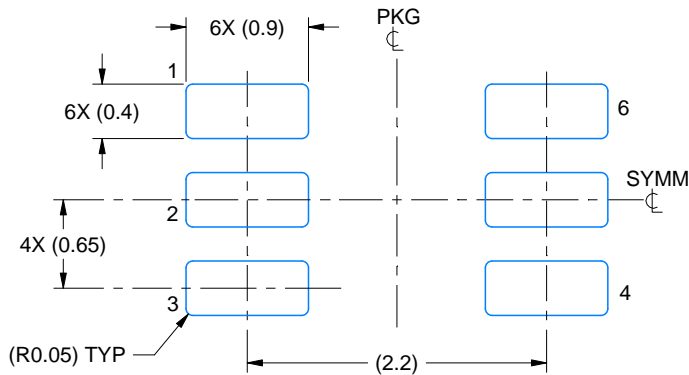
SMALL OUTLINE TRANSISTOR



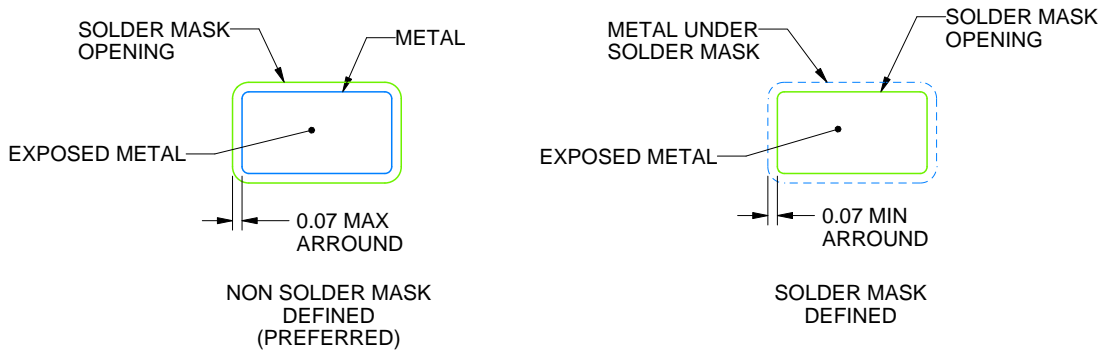
4214835/D 11/2024

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. Body dimensions do not include mold flash or protrusion. Mold flash and protrusion shall not exceed 0.15 per side.
4. Falls within JEDEC MO-203 variation AB.



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE:18X



SOLDER MASK DETAILS

4214835/D 11/2024

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 THICK STENCIL
SCALE:18X

4214835/D 11/2024

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.

GENERIC PACKAGE VIEW

DRY 6

USON - 0.6 mm max height

PLASTIC SMALL OUTLINE - NO LEAD



Images above are just a representation of the package family, actual package may vary.
Refer to the product data sheet for package details.

4207181/G

DRY0006A



PACKAGE OUTLINE

USON - 0.6 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.

EXAMPLE BOARD LAYOUT

DRY0006A

USON - 0.6 mm max height

PLASTIC SMALL OUTLINE - NO LEAD



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



SOLDER MASK DETAILS

4222894/A 01/2018

NOTES: (continued)

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

EXAMPLE STENCIL DESIGN

DRY0006A

USON - 0.6 mm max height

PLASTIC SMALL OUTLINE - NO LEAD

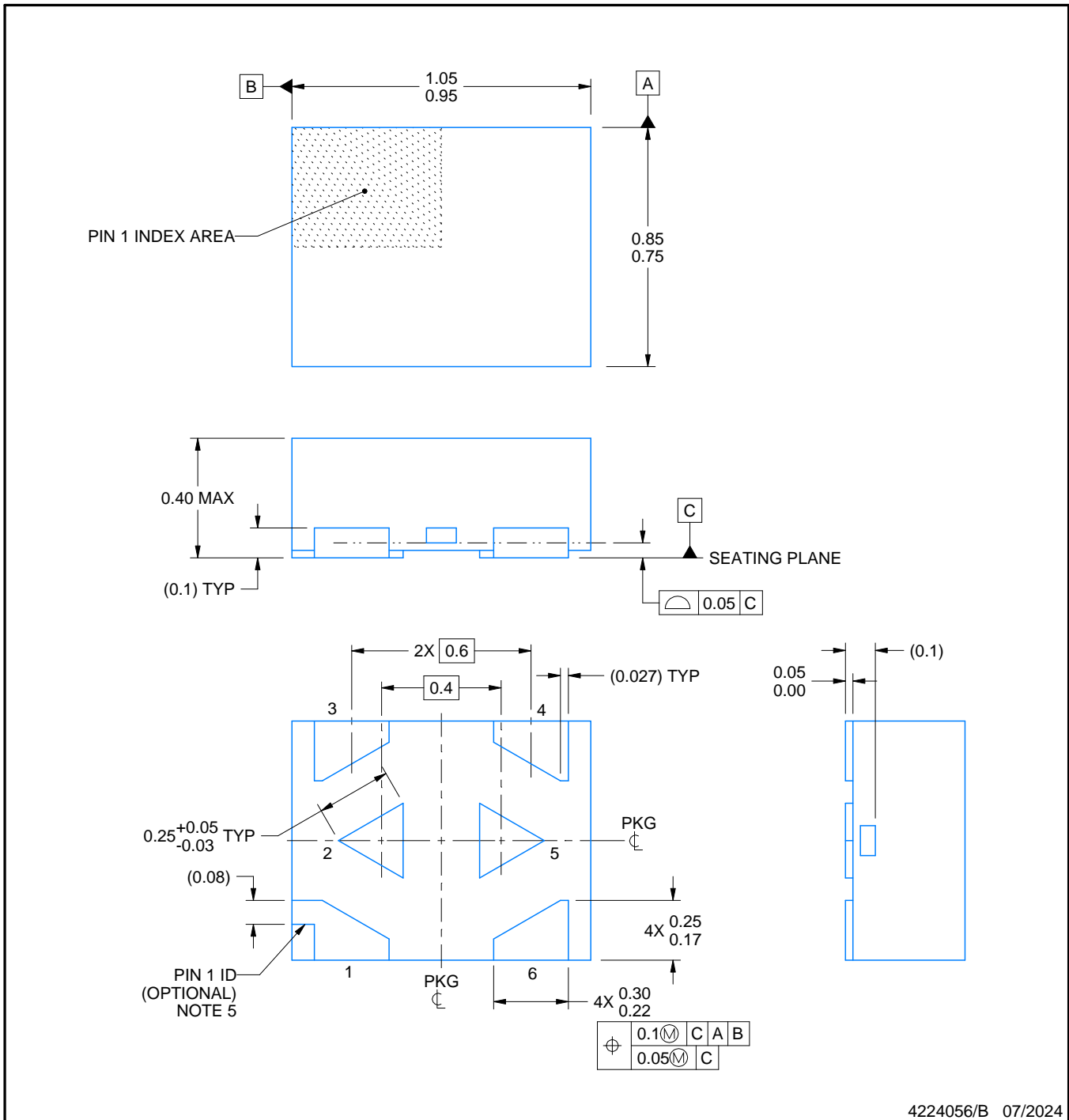


SOLDER PASTE EXAMPLE
BASED ON 0.075 - 0.1 mm THICK STENCIL
SCALE:40X

4222894/A 01/2018

NOTES: (continued)

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



NOTES:

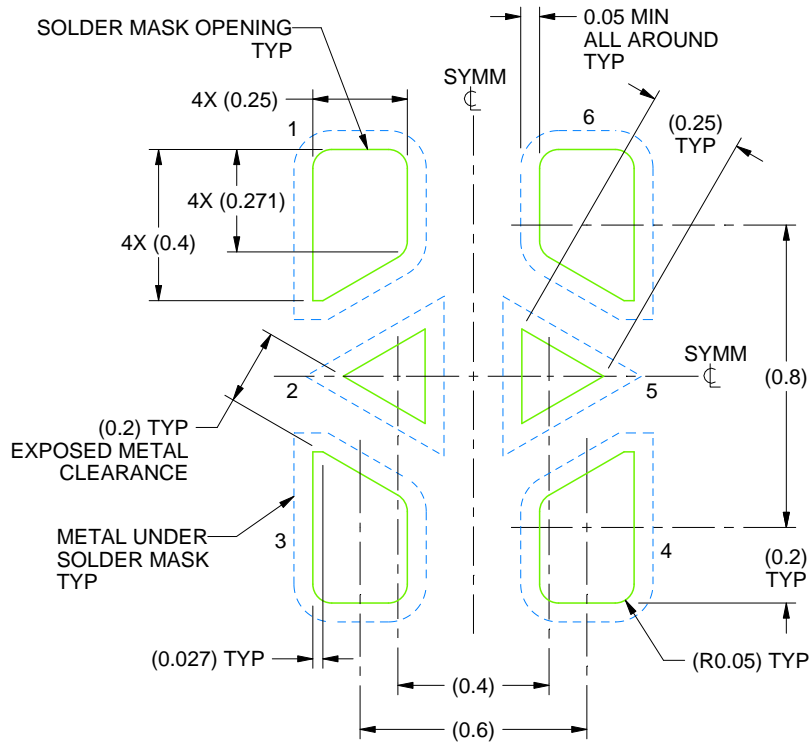
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. The package thermal pads must be soldered to the printed circuit board for optimal thermal and mechanical performance.
4. The size and shape of this feature may vary.
5. Features may not exist. Recommend use of pin 1 marking on top of package for orientation purposes.

EXAMPLE BOARD LAYOUT

DTQ0006A

X2SON - 0.4 mm max height

PLASTIC SMALL OUTLINE - NO LEAD



LAND PATTERN EXAMPLE
SOLDER MASK DEFINED
SCALE:50X

4224056/B 07/2024

NOTES: (continued)

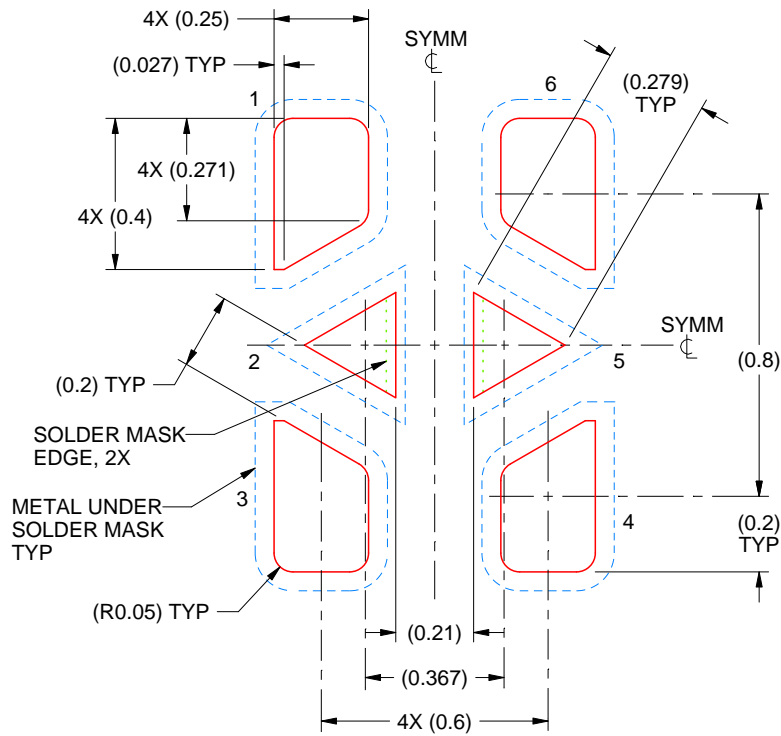
6. This package is designed to be soldered to a thermal pads on the board. For more information, see Texas Instruments literature number SLUA271 (www.ti.com/lit/slua271).
7. Vias are optional depending on application, refer to device data sheet. If some or all are implemented, recommended via locations are shown.

EXAMPLE STENCIL DESIGN

DTQ0006A

X2SON - 0.4 mm max height

PLASTIC SMALL OUTLINE - NO LEAD



SOLDER PASTE EXAMPLE
BASED ON 0.07 mm THICK STENCIL

PRINTED SOLDER COVERAGE BY AREA UNDER PACKAGE
SCALE:50X

4224056/B 07/2024

NOTES: (continued)

8. 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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