

## 具有可配置电平转换的 SN74LXCH8T245 8 位转换收发器

### 1 特性

- 完全可配置的双电源轨设计可允许各个端口在 1.1V 至 5.5V 范围内运行
- 稳健、无干扰电源定序
- 在 3.3V 至 5.0V 范围内，支持高达 420Mbps 的速率
- 总线保持数据输入消除了对外部上拉或下拉电阻器的需求
- 施密特触发控制输入可实现慢速或高噪声输入
- 带集成静态下拉电阻器的控制输入允许浮动控制输入
- 高驱动强度 (在 5V 时最高达 32mA)
- 低功耗
  - 最大值 4 $\mu$ A (25°C)
  - 最大值 12 $\mu$ A ( - 40°C 至 125°C )
- VCC 隔离和 VCC 断开特性
  - 如果任何一个 VCC 电源低于 100mV，则所有 I/O 均变为高阻抗状态
  - loff-float 支持 VCC 断开操作
- I<sub>off</sub> 支持局部断电模式运行
- 兼容 LVC 系列电平转换器
- 控制逻辑 ( DIR 和 OE ) 以 VCCA 为基准
- 工作温度范围为 - 40°C 至 +125°C
- 闩锁性能超出 100mA，符合 JESD 78 II 类规范的要求
- ESD 保护性能超过 JESD 22 规范要求
  - 4000V 人体放电模型
  - 1000V 充电器件模型

### 2 应用

- 消除慢速或高噪声输入信号
- 驱动指示 LED 或蜂鸣器
- 机械开关去抖
- 通用 I/O 电平转换
- 推挽电平转换 ( UART、SPI、JTAG 等等。 )

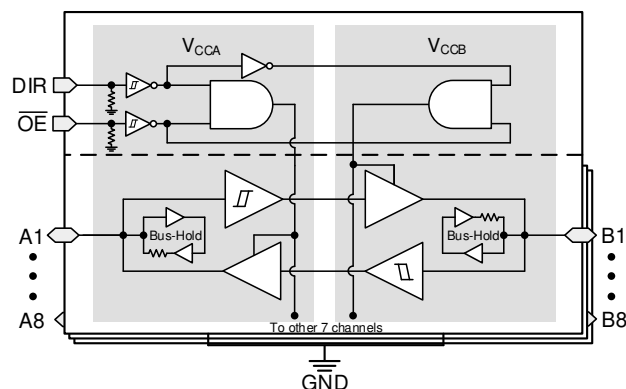
### 3 说明

SN74LXCH8T245 是一款 8 位双电源同相双向电压电平转换器件，具有总线保持电路。Ax 引脚和控制引脚 ( DIR 和 OE ) 以 VCCA 逻辑电平为基准，Bx 引脚以 VCCB 逻辑电平为基准。A 端口能够接受 1.1V 至 5.5V 的 I/O 电压，而 B 端口可接受 1.1V 至 5.5V 的 I/O 电压。如果 OE 设为低电平，DIR 上为高电平时允许数据从 A 传输到 B，DIR 上为低电平时允许数据从 B 传输到 A。OE 设为高电平时，Ax 和 Bx 引脚均处于高阻抗状态。请参阅 [器件功能模式](#)，了解控制逻辑的运行摘要。

#### 器件信息(1)

| 器件型号              | 封装         | 封装尺寸 (标称值)      |
|-------------------|------------|-----------------|
| SN74LXCH8T245PWR  | TSSOP (24) | 7.80mm × 6.40mm |
| SN74LXCH8T245RHLR | VQFN (24)  | 5.50mm × 3.50mm |

(1) 如需了解所有可用封装，请参阅数据表末尾的可订购产品附录。



功能模块图



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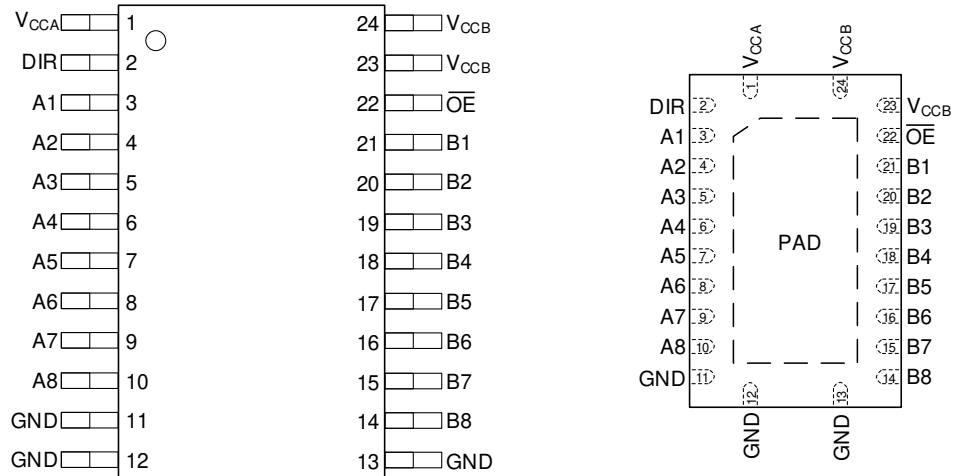
## 4 Revision History

注：以前版本的页码可能与当前版本的页码不同

| Changes from Revision A (January 2021) to Revision B (March 2021)                                                                                                                                            | Page |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|
| • Updated $t_{pd}$ values in <i>Switching Characteristics</i> , $V_{CCA} = 1.2 \pm 0.1 \text{ V}$ section.....                                                                                               | 9    |
| • Updated $t_{pd}$ values in <i>Switching Characteristics</i> , $V_{CCA} = 1.5 \pm 0.1 \text{ V}$ section.....                                                                                               | 10   |
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| • Updated $t_{pd}$ values in <i>Switching Characteristics</i> , $V_{CCA} = 5.0 \pm 0.5 \text{ V}$ section.....                                                                                               | 14   |
| • Changed the $t_{sk}$ – output skew's maximum operating free-air temperature ( $T_A$ ) range for $V_{CCI}$ and $V_{CCO}$ in the <i>Switching Characteristics: <math>T_{sk}, T_{MAX}</math></i> section..... | 15   |

| Changes from Revision * (January 2021) to Revision A (January 2021) | Page |
|---------------------------------------------------------------------|------|
| • Changed $I_{OZ}$ spec at 25C.....                                 | 6    |

## 5 Pin Configuration and Functions



All packages are on the same relative scale.

图 5-1. PW, and RHL Package 24-Pin TSSOP, and VQFN Transparent Top View

表 5-1. Pin Functions

| PIN             |         | I/O | DESCRIPTION                                                                                                                                |
|-----------------|---------|-----|--------------------------------------------------------------------------------------------------------------------------------------------|
| NAME            | PW, RHL |     |                                                                                                                                            |
| A1              | 3       | I/O | Input or output A1. Referenced to $V_{CCA}$ .                                                                                              |
| A2              | 4       | I/O | Input or output A2. Referenced to $V_{CCA}$ .                                                                                              |
| A3              | 5       | I/O | Input or output A3. Referenced to $V_{CCA}$ .                                                                                              |
| A4              | 6       | I/O | Input or output A4. Referenced to $V_{CCA}$ .                                                                                              |
| A5              | 7       | I/O | Input or output A5. Referenced to $V_{CCA}$ .                                                                                              |
| A6              | 8       | I/O | Input or output A6. Referenced to $V_{CCA}$ .                                                                                              |
| A7              | 9       | I/O | Input or output A7. Referenced to $V_{CCA}$ .                                                                                              |
| A8              | 10      | I/O | Input or output A8. Referenced to $V_{CCA}$ .                                                                                              |
| B1              | 21      | I/O | Input or output B1. Referenced to $V_{CCB}$ .                                                                                              |
| B2              | 20      | I/O | Input or output B2. Referenced to $V_{CCB}$ .                                                                                              |
| B3              | 19      | I/O | Input or output B3. Referenced to $V_{CCB}$ .                                                                                              |
| B4              | 18      | I/O | Input or output B4. Referenced to $V_{CCB}$ .                                                                                              |
| B5              | 17      | I/O | Input or output B5. Referenced to $V_{CCB}$ .                                                                                              |
| B6              | 16      | I/O | Input or output B6. Referenced to $V_{CCB}$ .                                                                                              |
| B7              | 15      | I/O | Input or output B7. Referenced to $V_{CCB}$ .                                                                                              |
| B8              | 14      | I/O | Input or output B8. Referenced to $V_{CCB}$ .                                                                                              |
| DIR             | 2       | I   | Direction-control signal for all ports. Referenced to $V_{CCA}$ .                                                                          |
| GND             | 11      | —   | Ground.                                                                                                                                    |
|                 | 12      | —   | Ground.                                                                                                                                    |
|                 | 13      | —   | Ground.                                                                                                                                    |
| $\overline{OE}$ | 22      | I   | Output Enable. Pull to GND to enable all outputs. Pull to $V_{CCA}$ to place all outputs in high-impedance mode. Referenced to $V_{CCA}$ . |
| $V_{CCA}$       | 1       | —   | A-port supply voltage. $1.1\text{ V} \leq V_{CCA} \leq 5.5\text{ V}$ .                                                                     |
| $V_{CCB}$       | 23      | —   | B-port supply voltage. $1.1\text{ V} \leq V_{CCB} \leq 5.5\text{ V}$ .                                                                     |
|                 | 24      | —   | B-port supply voltage. $1.1\text{ V} \leq V_{CCB} \leq 5.5\text{ V}$ .                                                                     |
| PAD             | —       | —   | Thermal pad. May be grounded (recommended) or left floating.                                                                               |

## 6 Specifications

### 6.1 Absolute Maximum Ratings

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

|           |                                                                                       |                    | 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 <sup>(2)</sup>                                                          | I/O Ports (A Port) | - 0.5                 | 6.5 | V    |
|           |                                                                                       | I/O Ports (B Port) | - 0.5                 | 6.5 |      |
|           |                                                                                       | Control Inputs     | - 0.5                 | 6.5 |      |
| $V_O$     | Voltage applied to any output in the high-impedance or power-off state <sup>(2)</sup> | 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 <sup>(2) (3)</sup>             | A Port             | - 0.5 $V_{CCA} + 0.5$ |     | V    |
|           |                                                                                       | B Port             | - 0.5 $V_{CCB} + 0.5$ |     |      |
| $I_{IK}$  | Input clamp current                                                                   | $V_I < 0$          | - 50                  |     | mA   |
| $I_{OK}$  | Output clamp current                                                                  | $V_O < 0$          | - 50                  |     | mA   |
| $I_O$     | Continuous output current                                                             |                    | - 50                  | 50  | mA   |
|           | Continuous current through $V_{CC}$ or GND                                            |                    | - 200                 | 200 | mA   |
| $T_J$     | Junction Temperature                                                                  |                    |                       | 150 | °C   |
| $T_{stg}$ | Storage temperature                                                                   |                    | - 65                  | 150 | °C   |

- (1) Stresses beyond those listed under [Absolute Maximum Ratings](#) may cause permanent damage to the device. These are stress ratings only, which do not imply functional operation of the device at these or any other conditions beyond those indicated under [Recommended Operating Conditions](#). Exposure beyond the limits listed in [Recommended Operating Conditions](#) may affect device reliability.
- (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 ANSI/ESDA/JEDEC JS-001 <sup>(1)</sup>              | ±4000 | V    |
|             |                         | Charged device model (CDM), per JEDEC specification JESD22-C101 <sup>(2)</sup> | ±1000 |      |

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

## 6.3 Recommended Operating Conditions

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

|                  |                                     |                                                              |                                   | MIN                     | MAX | UNIT |
|------------------|-------------------------------------|--------------------------------------------------------------|-----------------------------------|-------------------------|-----|------|
| V <sub>CCA</sub> | Supply voltage A                    |                                                              |                                   | 1.1                     | 5.5 | V    |
| V <sub>CCB</sub> | Supply voltage B                    |                                                              |                                   | 1.1                     | 5.5 | V    |
| V <sub>IH</sub>  | High-level input voltage            | Data Inputs<br>(Ax, Bx)<br>(Referenced to V <sub>CCI</sub> ) | V <sub>CCI</sub> = 1.1 V - 1.3 V  | V <sub>CCI</sub> × 0.8  | V   |      |
|                  |                                     |                                                              | V <sub>CCI</sub> = 1.4 V - 1.95 V | V <sub>CCI</sub> × 0.65 |     |      |
|                  |                                     |                                                              | V <sub>CCI</sub> = 2.3 V - 2.7 V  | 1.7                     |     |      |
|                  |                                     |                                                              | V <sub>CCI</sub> = 3.0 V - 3.6 V  | 2                       |     |      |
|                  |                                     |                                                              | V <sub>CCI</sub> = 4.5 V - 5.5 V  | V <sub>CCI</sub> × 0.7  |     |      |
| V <sub>IL</sub>  | Low-level input voltage             | Data Inputs<br>(Ax, Bx)<br>(Referenced to V <sub>CCI</sub> ) | V <sub>CCI</sub> = 1.1 V - 1.3 V  | V <sub>CCI</sub> × 0.2  | V   |      |
|                  |                                     |                                                              | V <sub>CCI</sub> = 1.4 V - 1.95 V | V <sub>CCI</sub> × 0.35 |     |      |
|                  |                                     |                                                              | V <sub>CCI</sub> = 2.3 V - 2.7 V  | 0.7                     |     |      |
|                  |                                     |                                                              | V <sub>CCI</sub> = 3.0 V - 3.6 V  | 0.8                     |     |      |
|                  |                                     |                                                              | V <sub>CCI</sub> = 4.5 V - 5.5 V  | V <sub>CCI</sub> × 0.3  |     |      |
| I <sub>OH</sub>  | High-level output current           |                                                              | V <sub>CCO</sub> = 1.1 V          | - 0.1                   | mA  |      |
|                  |                                     |                                                              | V <sub>CCO</sub> = 1.4 V          | - 2                     |     |      |
|                  |                                     |                                                              | V <sub>CCO</sub> = 1.65 V         | - 4                     |     |      |
|                  |                                     |                                                              | V <sub>CCO</sub> = 2.3 V          | - 12                    |     |      |
|                  |                                     |                                                              | V <sub>CCO</sub> = 3 V            | - 24                    |     |      |
|                  |                                     |                                                              | V <sub>CCO</sub> = 4.5 V          | - 32                    |     |      |
| I <sub>OL</sub>  | Low-level output current            |                                                              | V <sub>CCO</sub> = 1.1 V          | 0.1                     | mA  |      |
|                  |                                     |                                                              | V <sub>CCO</sub> = 1.4 V          | 2                       |     |      |
|                  |                                     |                                                              | V <sub>CCO</sub> = 1.65 V         | 4                       |     |      |
|                  |                                     |                                                              | V <sub>CCO</sub> = 2.3 V          | 12                      |     |      |
|                  |                                     |                                                              | V <sub>CCO</sub> = 3 V            | 24                      |     |      |
|                  |                                     |                                                              | V <sub>CCO</sub> = 4.5 V          | 32                      |     |      |
| V <sub>I</sub>   | Input voltage                       |                                                              |                                   | 0                       | 5.5 | V    |
| V <sub>O</sub>   | Output voltage                      | Active State                                                 | 0                                 | V <sub>CCO</sub>        | V   |      |
|                  |                                     | Tri-State                                                    | 0                                 | 5.5                     |     |      |
| Δ t / Δ v        | Input transition rise and fall time |                                                              |                                   |                         | 20  | ns/V |
| T <sub>A</sub>   | Operating free-air temperature      |                                                              |                                   | - 40                    | 125 | °C   |

(1) V<sub>CCI</sub> is the V<sub>CC</sub> associated with the input port. V<sub>CCO</sub> is the V<sub>CC</sub> associated with the output port.

## 6.4 Thermal Information

| THERMAL METRIC <sup>(1)</sup> |                                              | SN74LXCH8T245 |            | UNIT |
|-------------------------------|----------------------------------------------|---------------|------------|------|
|                               |                                              | PW (TSSOP)    | RHL (VQFN) |      |
|                               |                                              | 24 PINS       | 24 PINS    |      |
| R <sub>θJA</sub>              | Junction-to-ambient thermal resistance       | 98.2          | 45.6       | °C/W |
| R <sub>θJC(top)</sub>         | Junction-to-case (top) thermal resistance    | 42.3          | 41.0       | °C/W |
| R <sub>θJB</sub>              | Junction-to-board thermal resistance         | 53.3          | 23.3       | °C/W |
| Y <sub>JT</sub>               | Junction-to-top characterization parameter   | 5.8           | 2.2        | °C/W |
| Y <sub>JB</sub>               | Junction-to-board characterization parameter | 52.9          | 23.3       | °C/W |
| R <sub>θJC(bottom)</sub>      | Junction-to-case (bottom) thermal resistance | N/A           | 13.2       | °C/W |

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

## 6.5 Electrical Characteristics

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

| PARAMETER        |                                                                 | TEST CONDITIONS                                            | V <sub>CCA</sub> | V <sub>CCB</sub> | Operating free-air temperature (T <sub>A</sub> ) |     |                        |                |                        |      |                 |     |     | UNIT |
|------------------|-----------------------------------------------------------------|------------------------------------------------------------|------------------|------------------|--------------------------------------------------|-----|------------------------|----------------|------------------------|------|-----------------|-----|-----|------|
|                  |                                                                 |                                                            |                  |                  | 25°C                                             |     |                        | – 40°C to 85°C |                        |      | – 40°C to 125°C |     |     |      |
|                  |                                                                 |                                                            |                  |                  | MIN                                              | TYP | MAX                    | MIN            | TYP                    | MAX  | MIN             | TYP | MAX |      |
| V <sub>T+</sub>  | Positive-going input-threshold voltage                          | Control Inputs (OE, DIR) (Referenced to V <sub>CCA</sub> ) | 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 <sub>T-</sub>  | Negative-going input-threshold voltage                          | Control Inputs (OE, DIR) (Referenced to V <sub>CCA</sub> ) | 1.1 V            | 1.1 V            |                                                  |     |                        | 0.17           | 0.48                   | 0.17 | 0.48            | V   |     |      |
|                  |                                                                 |                                                            | 1.4 V            | 1.4 V            |                                                  |     |                        | 0.28           | 0.6                    | 0.28 | 0.6             |     |     |      |
|                  |                                                                 |                                                            | 1.65 V           | 1.65 V           |                                                  |     |                        | 0.35           | 0.71                   | 0.35 | 0.71            |     |     |      |
|                  |                                                                 |                                                            | 2.3 V            | 2.3 V            |                                                  |     |                        | 0.56           | 1                      | 0.56 | 1               |     |     |      |
|                  |                                                                 |                                                            | 3 V              | 3 V              |                                                  |     |                        | 0.89           | 1.5                    | 0.89 | 1.5             |     |     |      |
|                  |                                                                 |                                                            | 4.5 V            | 4.5 V            |                                                  |     |                        | 1.51           | 2                      | 1.51 | 2               |     |     |      |
|                  |                                                                 |                                                            | 5.5 V            | 5.5 V            |                                                  |     |                        | 1.88           | 2.46                   | 1.88 | 2.46            |     |     |      |
| Δ V <sub>T</sub> | Input-threshold hysteresis (V <sub>T+</sub> – V <sub>T-</sub> ) | Control Inputs (OE, DIR) (Referenced to V <sub>CCA</sub> ) | 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            |     |     |      |
| V <sub>OH</sub>  | High-level output voltage <sup>(3)</sup>                        | I <sub>OH</sub> = – 100 μA                                 | 1.1V – 5.5V      | 1.1V – 5.5V      |                                                  |     | V <sub>CCO</sub> – 0.1 |                | V <sub>CCO</sub> – 0.1 |      | V               |     |     |      |
|                  |                                                                 | I <sub>OH</sub> = – 4 mA                                   | 1.4 V            | 1.4 V            |                                                  |     | 1                      |                | 1                      |      |                 |     |     |      |
|                  |                                                                 | I <sub>OH</sub> = – 8 mA                                   | 1.65 V           | 1.65 V           |                                                  |     | 1.2                    |                | 1.2                    |      |                 |     |     |      |
|                  |                                                                 | I <sub>OH</sub> = – 12 mA                                  | 2.3 V            | 2.3 V            |                                                  |     | 1.9                    |                | 1.9                    |      |                 |     |     |      |
|                  |                                                                 | I <sub>OH</sub> = – 24 mA                                  | 3 V              | 3 V              |                                                  |     | 2.4                    |                | 2.4                    |      |                 |     |     |      |
|                  |                                                                 | I <sub>OH</sub> = – 32 mA                                  | 4.5 V            | 4.5 V            |                                                  |     | 3.8                    |                | 3.8                    |      |                 |     |     |      |
| V <sub>OL</sub>  | Low-level output voltage <sup>(4)</sup>                         | I <sub>OL</sub> = 100 μA                                   | 1.1V – 5.5V      | 1.1V – 5.5V      |                                                  |     |                        | 0.1            |                        | 0.1  | V               |     |     |      |
|                  |                                                                 | I <sub>OL</sub> = 4 mA                                     | 1.4 V            | 1.4 V            |                                                  |     |                        | 0.3            |                        | 0.3  |                 |     |     |      |
|                  |                                                                 | I <sub>OL</sub> = 8 mA                                     | 1.65 V           | 1.65 V           |                                                  |     |                        | 0.45           |                        | 0.45 |                 |     |     |      |
|                  |                                                                 | I <sub>OL</sub> = 12 mA                                    | 2.3 V            | 2.3 V            |                                                  |     |                        | 0.3            |                        | 0.3  |                 |     |     |      |
|                  |                                                                 | I <sub>OL</sub> = 24 mA                                    | 3 V              | 3 V              |                                                  |     |                        | 0.55           |                        | 0.55 |                 |     |     |      |
|                  |                                                                 | I <sub>OL</sub> = 32 mA                                    | 4.5 V            | 4.5 V            |                                                  |     |                        | 0.55           |                        | 0.55 |                 |     |     |      |
| I <sub>BHL</sub> | Bus-hold low sustaining current Port A or Port B <sup>(6)</sup> | V <sub>I</sub> = 0.39                                      | 1.1 V            | 1.1 V            |                                                  |     | 4                      |                | 4                      |      | μA              |     |     |      |
|                  |                                                                 | V <sub>I</sub> = 0.49                                      | 1.4 V            | 1.4 V            |                                                  |     | 15                     |                | 10                     |      |                 |     |     |      |
|                  |                                                                 | V <sub>I</sub> = 0.58                                      | 1.65 V           | 1.65 V           |                                                  |     | 25                     |                | 20                     |      |                 |     |     |      |
|                  |                                                                 | V <sub>I</sub> = 0.70                                      | 2.3 V            | 2.3 V            |                                                  |     | 45                     |                | 45                     |      |                 |     |     |      |
|                  |                                                                 | V <sub>I</sub> = 0.80                                      | 3 V              | 3 V              |                                                  |     | 75                     |                | 75                     |      |                 |     |     |      |
|                  |                                                                 | V <sub>I</sub> = 1.35                                      | 4.5 V            | 4.5 V            |                                                  |     | 100                    |                | 100                    |      |                 |     |     |      |

## 6.5 Electrical Characteristics (continued)

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

| PARAMETER              |                                                                  | TEST CONDITIONS                                                                                                                         | V <sub>CCA</sub> | V <sub>CCB</sub> | Operating free-air temperature (T <sub>A</sub> ) |     |       |                |       |     |                 |     |     | UNIT |
|------------------------|------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|------------------|------------------|--------------------------------------------------|-----|-------|----------------|-------|-----|-----------------|-----|-----|------|
|                        |                                                                  |                                                                                                                                         |                  |                  | 25°C                                             |     |       | – 40°C to 85°C |       |     | – 40°C to 125°C |     |     |      |
|                        |                                                                  |                                                                                                                                         |                  |                  | MIN                                              | TYP | MAX   | MIN            | TYP   | MAX | MIN             | TYP | MAX |      |
| I <sub>BHH</sub>       | Bus-hold high sustaining current Port A or Port B <sup>(7)</sup> | V <sub>I</sub> = 0.71 V                                                                                                                 | 1.1 V            | 1.1 V            |                                                  |     |       | – 4            |       |     | – 4             |     |     | μA   |
|                        |                                                                  | V <sub>I</sub> = 0.91 V                                                                                                                 | 1.4 V            | 1.4 V            |                                                  |     |       | – 15           |       |     | – 10            |     |     |      |
|                        |                                                                  | V <sub>I</sub> = 1.07 V                                                                                                                 | 1.65 V           | 1.65 V           |                                                  |     |       | – 25           |       |     | – 20            |     |     |      |
|                        |                                                                  | V <sub>I</sub> = 1.70 V                                                                                                                 | 2.3 V            | 2.3 V            |                                                  |     |       | – 45           |       |     | – 45            |     |     |      |
|                        |                                                                  | V <sub>I</sub> = 2.00 V                                                                                                                 | 3 V              | 3 V              |                                                  |     |       | – 75           |       |     | – 75            |     |     |      |
|                        |                                                                  | V <sub>I</sub> = 3.15 V                                                                                                                 | 4.5 V            | 4.5 V            |                                                  |     |       | –<br>100       |       |     | –<br>100        |     |     |      |
| I <sub>BHLO</sub>      | Bus-hold low overdrive current <sup>(8)</sup>                    | Ramp input up<br>V <sub>I</sub> = 0 to V <sub>CCI</sub>                                                                                 | 1.3 V            | 1.3 V            |                                                  |     |       | 75             |       |     | 75              |     |     | μA   |
|                        |                                                                  |                                                                                                                                         | 1.6 V            | 1.6 V            |                                                  |     |       | 125            |       |     | 125             |     |     |      |
|                        |                                                                  |                                                                                                                                         | 1.95 V           | 1.95 V           |                                                  |     |       | 200            |       |     | 200             |     |     |      |
|                        |                                                                  |                                                                                                                                         | 2.7 V            | 2.7 V            |                                                  |     |       | 300            |       |     | 300             |     |     |      |
|                        |                                                                  |                                                                                                                                         | 3.6 V            | 3.6 V            |                                                  |     |       | 500            |       |     | 500             |     |     |      |
|                        |                                                                  |                                                                                                                                         | 5.5 V            | 5.5 V            |                                                  |     |       | 900            |       |     | 900             |     |     |      |
| I <sub>BHHO</sub>      | Bus-hold high overdrive current <sup>(9)</sup>                   | Ramp input down<br>V <sub>I</sub> = V <sub>CCI</sub> to 0                                                                               | 1.3 V            | 1.3 V            |                                                  |     |       | – 75           |       |     | – 75            |     |     | μA   |
|                        |                                                                  |                                                                                                                                         | 1.6 V            | 1.6 V            |                                                  |     |       | –<br>125       |       |     | –<br>125        |     |     |      |
|                        |                                                                  |                                                                                                                                         | 1.95 V           | 1.95 V           |                                                  |     |       | –<br>200       |       |     | –<br>200        |     |     |      |
|                        |                                                                  |                                                                                                                                         | 2.7 V            | 2.7 V            |                                                  |     |       | –<br>300       |       |     | –<br>300        |     |     |      |
|                        |                                                                  |                                                                                                                                         | 3.6 V            | 3.6 V            |                                                  |     |       | –<br>500       |       |     | –<br>500        |     |     |      |
|                        |                                                                  |                                                                                                                                         | 5.5 V            | 5.5 V            |                                                  |     |       | –<br>900       |       |     | –<br>900        |     |     |      |
| I <sub>I</sub>         | Input leakage current                                            | Control inputs (DIR, $\overline{\text{OE}}$ )<br>V <sub>I</sub> = V <sub>CCA</sub> or GND                                               | 1.1V – 5.5V      | 1.1V – 5.5V      | – 0.1                                            | 1.5 | – 0.1 | 2              | – 0.1 | 2   | μA              |     |     |      |
|                        |                                                                  | Data Inputs (Ax, Bx)<br>V <sub>I</sub> = V <sub>CCI</sub> or GND                                                                        | 1.1V – 5.5V      | 1.1V – 5.5V      | – 0.3                                            | 0.3 | – 1   | 1              | – 2   | 2   | μA              |     |     |      |
| I <sub>off</sub>       | Partial power down current                                       | A Port<br>V <sub>I</sub> or V <sub>O</sub> = 0 V - 5.5 V                                                                                | 0 V              | 0 V – 5.5 V      | – 1.5                                            | 1.5 | – 2   | 2              | – 2.5 | 2.5 | μA              |     |     |      |
|                        |                                                                  | B Port<br>V <sub>I</sub> or V <sub>O</sub> = 0 V - 5.5 V                                                                                | 0 V – 5.5 V      | 0 V              | – 1.5                                            | 1.5 | – 2   | 2              | – 2.5 | 2.5 |                 |     |     |      |
| I <sub>off-float</sub> | Floating supply Partial power down current                       | A Port<br>V <sub>I</sub> or V <sub>O</sub> = GND                                                                                        | Floating         | 0 V – 5.5 V      | – 1.5                                            | 1.5 | – 2   | 2              | – 2.5 | 2.5 | μA              |     |     |      |
|                        |                                                                  | B Port<br>V <sub>I</sub> or V <sub>O</sub> = GND                                                                                        | 0 V - 5.5 V      | Floating         | – 1.5                                            | 1.5 | – 2   | 2              | – 2.5 | 2.5 |                 |     |     |      |
| I <sub>OZ</sub>        | Tri-state output current <sup>(5)</sup>                          | A or B Port: (Rev)<br>V <sub>I</sub> = V <sub>CCI</sub> or GND<br>V <sub>O</sub> = V <sub>CCO</sub> or GND<br>OE = V <sub>T+(MAX)</sub> | 1.1V – 5.5V      | 1.1V – 5.5V      | – 1                                              | 1   | – 1   | 1              | – 2   | 2   | μA              |     |     |      |

## 6.5 Electrical Characteristics (continued)

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

| PARAMETER                           |                                                      | TEST CONDITIONS                                                                                                                           | V <sub>CCA</sub> | V <sub>CCB</sub> | Operating free-air temperature (T <sub>A</sub> ) |     |       |                |     |     |                 |     |     | UNIT |
|-------------------------------------|------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|------------------|------------------|--------------------------------------------------|-----|-------|----------------|-----|-----|-----------------|-----|-----|------|
|                                     |                                                      |                                                                                                                                           |                  |                  | 25°C                                             |     |       | – 40°C to 85°C |     |     | – 40°C to 125°C |     |     |      |
|                                     |                                                      |                                                                                                                                           |                  |                  | MIN                                              | TYP | MAX   | MIN            | TYP | MAX | MIN             | TYP | MAX |      |
| I <sub>CCA</sub>                    | V <sub>CCA</sub> supply current                      | V <sub>I</sub> = V <sub>CCI</sub> or GND<br>I <sub>O</sub> = 0                                                                            | 1.1V – 5.5V      | 1.1V – 5.5V      |                                                  | 2   |       | 4              |     | 8   |                 | μA  |     |      |
|                                     |                                                      |                                                                                                                                           | 0 V              | 5.5 V            | – 0.2                                            |     | – 0.5 |                | – 1 |     |                 |     |     |      |
|                                     |                                                      |                                                                                                                                           | 5.5 V            | 0 V              |                                                  | 2   |       | 4              |     | 8   |                 |     |     |      |
|                                     |                                                      |                                                                                                                                           | 5.5 V            | Floating         |                                                  | 2   |       | 4              |     | 8   |                 |     |     |      |
| I <sub>CCB</sub>                    | V <sub>CCB</sub> supply current                      | V <sub>I</sub> = V <sub>CCI</sub> or GND<br>I <sub>O</sub> = 0                                                                            | 1.1V – 5.5V      | 1.1V – 5.5V      |                                                  | 2   |       | 4              |     | 8   |                 | μA  |     |      |
|                                     |                                                      |                                                                                                                                           | 0 V              | 5.5 V            |                                                  | 2   |       | 4              |     | 8   |                 |     |     |      |
|                                     |                                                      |                                                                                                                                           | 5.5 V            | 0 V              | – 0.2                                            |     | – 0.5 |                | – 1 |     |                 |     |     |      |
|                                     |                                                      |                                                                                                                                           | Floating         | 5.5 V            |                                                  | 2   |       | 4              |     | 8   |                 |     |     |      |
| I <sub>CCA</sub> + I <sub>CCB</sub> | Combined supply current                              | V <sub>I</sub> = V <sub>CCI</sub> or GND<br>I <sub>O</sub> = 0                                                                            | 1.1V – 5.5V      | 1.1V – 5.5V      |                                                  | 4   |       | 8              |     | 12  |                 | μA  |     |      |
| Δ I <sub>CCA</sub>                  | V <sub>CCA</sub> additional supply current per input | Control inputs (DIR, $\overline{OE}$ ):<br>V <sub>I</sub> = V <sub>CCA</sub> – 0.6 V<br>A port = V <sub>CCA</sub> or GND<br>B Port = open | 3.0 V – 5.5V     | 3.0 V – 5.5V     |                                                  |     |       | 50             |     | 75  |                 | μA  |     |      |
| C <sub>i</sub>                      | Control Input Capacitance                            | V <sub>I</sub> = 3.3 V or GND                                                                                                             | 3.3 V            | 3.3 V            |                                                  | 2.9 |       | 5              |     | 5   |                 | pF  |     |      |
| C <sub>io</sub>                     | Data I/O Capacitance                                 | OE = V <sub>CCA</sub> , V <sub>O</sub> = 1.65V DC +1 MHz<br>-16 dBm sine wave                                                             | 3.3 V            | 3.3 V            |                                                  | 5.9 |       | 10             |     | 10  |                 | 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) For I/O ports, the parameter  $I_{OZ}$  includes the input leakage current.
- (6)  $I_{BHL}$  should be measured after lowering  $V_I$  to GND and then raising it to the defined input voltage.
- (7)  $I_{BHH}$  should be measured after raising  $V_I$  to  $V_{CCI}$  and then lowering it to the defined input voltage.
- (8) An external driver must source at least  $I_{BHL0}$  to switch this node from low-to-high.
- (9) An external driver must sink at least  $I_{BHH0}$  to switch this node from high to low.



## 6.6 Switching Characteristics, $V_{CCA} = 1.2 \pm 0.1 \text{ V}$

See 图 7-1 and 表 7-1 for test circuit and loading. See [Propagation Delay](#), [Input Transition Rise and Fall Rate](#), and [Enable Time And Disable Time](#) for measurement waveforms.

| PARAMETER        |                   | FROM | TO | Test Conditions | B-Port Supply Voltage (V <sub>CCB</sub> ) |     |     |             |     |     |              |     |     |             |     |     |             |     |     | 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 <sub>pd</sub>  | Propagation delay | A    | B  | -40°C to 85°C   | 10                                        |     | 65  | 10          |     | 31  | 7            |     | 25  | 7           |     | 24  | 5           |     | 22  | 5    |             | 21  | ns  |
|                  |                   |      |    | -40°C to 125°C  | 10                                        |     | 70  | 10          |     | 33  | 7            |     | 27  | 7           |     | 26  | 5           |     | 24  | 5    |             | 23  |     |
|                  |                   | B    | A  | -40°C to 85°C   | 10                                        |     | 62  | 10          |     | 55  | 10           |     | 49  | 8           |     | 42  | 8           |     | 40  | 8    |             | 39  |     |
|                  |                   |      |    | -40°C to 125°C  | 10                                        |     | 68  | 10          |     | 60  | 10           |     | 54  | 8           |     | 47  | 8           |     | 45  | 8    |             | 44  |     |
| t <sub>dis</sub> | Disable time      | OE   | A  | -40°C to 85°C   | 20                                        |     | 64  | 20          |     | 64  | 20           |     | 64  | 20          |     | 64  | 20          |     | 64  | 20   |             | 64  | ns  |
|                  |                   |      |    | -40°C to 125°C  | 20                                        |     | 69  | 20          |     | 69  | 20           |     | 69  | 20          |     | 69  | 20          |     | 69  | 20   |             | 69  |     |
|                  |                   | OE   | B  | -40°C to 85°C   | 20                                        |     | 80  | 20          |     | 62  | 20           |     | 54  | 20          |     | 48  | 20          |     | 47  | 20   |             | 45  |     |
|                  |                   |      |    | -40°C to 125°C  | 20                                        |     | 85  | 20          |     | 67  | 20           |     | 59  | 20          |     | 52  | 20          |     | 50  | 20   |             | 48  |     |
| t <sub>en</sub>  | Enable time       | OE   | A  | -40°C to 85°C   | 20                                        |     | 90  | 20          |     | 91  | 20           |     | 91  | 20          |     | 91  | 20          |     | 90  | 20   |             | 90  | ns  |
|                  |                   |      |    | -40°C to 125°C  | 20                                        |     | 97  | 20          |     | 98  | 20           |     | 97  | 20          |     | 96  | 20          |     | 96  | 20   |             | 96  |     |
|                  |                   | OE   | B  | -40°C to 85°C   | 20                                        |     | 95  | 20          |     | 57  | 15           |     | 48  | 10          |     | 38  | 10          |     | 36  | 10   |             | 36  |     |
|                  |                   |      |    | -40°C to 125°C  | 20                                        |     | 100 | 20          |     | 61  | 15           |     | 53  | 10          |     | 42  | 10          |     | 39  | 10   |             | 39  |     |

## 6.7 Switching Characteristics, $V_{CCA} = 1.5 \pm 0.1 \text{ V}$

See 图 7-1 and 表 7-1 for test circuit and loading. See [Propagation Delay](#), [Input Transition Rise and Fall Rate](#), and [Enable Time And Disable Time](#) for measurement waveforms.

| PARAMETER        |                   | FROM | TO | Test Conditions | B-Port Supply Voltage (V <sub>CCB</sub> ) |     |     |             |     |     |              |     |     |             |     |     |             |     |     | 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 <sub>pd</sub>  | Propagation delay | A    | B  | -40°C to 85°C   | 10                                        |     | 52  | 5           |     | 25  | 5            |     | 23  | 5           |     | 17  | 5           |     | 14  | 3    |             | 13  | ns  |
|                  |                   |      |    | -40°C to 125°C  | 10                                        |     | 57  | 5           |     | 26  | 5            |     | 23  | 5           |     | 18  | 5           |     | 16  | 3    |             | 14  |     |
|                  |                   | B    | A  | -40°C to 85°C   | 8                                         |     | 36  | 7           |     | 28  | 7            |     | 26  | 5           |     | 20  | 5           |     | 18  | 5    |             | 17  |     |
|                  |                   |      |    | -40°C to 125°C  | 8                                         |     | 40  | 7           |     | 29  | 7            |     | 26  | 5           |     | 22  | 5           |     | 20  | 5    |             | 18  |     |
| t <sub>dis</sub> | Disable time      | OE   | A  | -40°C to 85°C   | 15                                        |     | 40  | 15          |     | 40  | 15           |     | 40  | 15          |     | 40  | 15          |     | 40  | 15   |             | 40  | ns  |
|                  |                   |      |    | -40°C to 125°C  | 15                                        |     | 44  | 15          |     | 44  | 15           |     | 44  | 15          |     | 44  | 15          |     | 44  | 15   |             | 44  |     |
|                  |                   | OE   | B  | -40°C to 85°C   | 20                                        |     | 69  | 20          |     | 50  | 15           |     | 45  | 15          |     | 35  | 15          |     | 34  | 14   |             | 31  |     |
|                  |                   |      |    | -40°C to 125°C  | 20                                        |     | 74  | 20          |     | 54  | 15           |     | 48  | 15          |     | 39  | 15          |     | 37  | 14   |             | 33  |     |
| t <sub>en</sub>  | Enable time       | OE   | A  | -40°C to 85°C   | 15                                        |     | 48  | 15          |     | 48  | 15           |     | 48  | 15          |     | 48  | 15          |     | 48  | 15   |             | 48  | ns  |
|                  |                   |      |    | -40°C to 125°C  | 15                                        |     | 52  | 15          |     | 52  | 15           |     | 52  | 15          |     | 52  | 15          |     | 52  | 15   |             | 52  |     |
|                  |                   | OE   | B  | -40°C to 85°C   | 20                                        |     | 85  | 15          |     | 50  | 15           |     | 40  | 10          |     | 31  | 10          |     | 26  | 10   |             | 24  |     |
|                  |                   |      |    | -40°C to 125°C  | 20                                        |     | 91  | 15          |     | 54  | 15           |     | 44  | 10          |     | 33  | 10          |     | 29  | 10   |             | 26  |     |

## 6.8 Switching Characteristics, $V_{CCA} = 1.8 \pm 0.15 \text{ V}$

See 图 7-1 and 表 7-1 for test circuit and loading. See [Propagation Delay](#), [Input Transition Rise and Fall Rate](#), and [Enable Time And Disable Time](#) for measurement waveforms.

| PARAMETER        |                   | FROM | TO | Test Conditions | B-Port Supply Voltage (V <sub>CCB</sub> ) |     |     |             |     |     |              |     |     |             |     |     |             |     |     | 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 <sub>pd</sub>  | Propagation delay | A    | B  | -40°C to 85°C   | 8                                         |     | 50  | 6           |     | 21  | 6            |     | 18  | 4           |     | 14  | 4           |     | 11  | 2    |             | 10  | ns  |
|                  |                   |      |    | -40°C to 125°C  | 8                                         |     | 53  | 6           |     | 23  | 6            |     | 20  | 4           |     | 15  | 4           |     | 12  | 2    |             | 11  |     |
|                  |                   | B    | A  | -40°C to 85°C   | 5                                         |     | 32  | 5           |     | 21  | 5            |     | 19  | 4           |     | 17  | 4           |     | 15  | 4    |             | 15  |     |
|                  |                   |      |    | -40°C to 125°C  | 5                                         |     | 33  | 5           |     | 23  | 5            |     | 21  | 4           |     | 18  | 4           |     | 16  | 4    |             | 16  |     |
| t <sub>dis</sub> | Disable time      | OE   | A  | -40°C to 85°C   | 10                                        |     | 34  | 10          |     | 33  | 10           |     | 33  | 10          |     | 33  | 10          |     | 33  | 10   |             | 33  | ns  |
|                  |                   |      |    | -40°C to 125°C  | 10                                        |     | 36  | 10          |     | 35  | 10           |     | 35  | 10          |     | 35  | 10          |     | 35  | 10   |             | 35  |     |
|                  |                   | OE   | B  | -40°C to 85°C   | 20                                        |     | 64  | 15          |     | 45  | 15           |     | 40  | 12          |     | 31  | 12          |     | 31  | 10   |             | 26  |     |
|                  |                   |      |    | -40°C to 125°C  | 20                                        |     | 69  | 15          |     | 49  | 15           |     | 44  | 12          |     | 33  | 12          |     | 38  | 10   |             | 28  |     |
| t <sub>en</sub>  | Enable time       | OE   | A  | -40°C to 85°C   | 10                                        |     | 38  | 10          |     | 38  | 10           |     | 38  | 10          |     | 38  | 10          |     | 38  | 10   |             | 38  | ns  |
|                  |                   |      |    | -40°C to 125°C  | 10                                        |     | 40  | 10          |     | 40  | 10           |     | 40  | 10          |     | 40  | 10          |     | 40  | 10   |             | 40  |     |
|                  |                   | OE   | B  | -40°C to 85°C   | 20                                        |     | 84  | 15          |     | 47  | 10           |     | 38  | 10          |     | 29  | 10          |     | 25  | 8    |             | 23  |     |
|                  |                   |      |    | -40°C to 125°C  | 20                                        |     | 89  | 15          |     | 51  | 10           |     | 42  | 10          |     | 30  | 10          |     | 26  | 8    |             | 25  |     |

## 6.9 Switching Characteristics, $V_{CCA} = 2.5 \pm 0.2 \text{ V}$

See 图 7-1 and 表 7-1 for test circuit and loading. See [Propagation Delay](#), [Input Transition Rise and Fall Rate](#), and [Enable Time And Disable Time](#) for measurement waveforms.

| PARAMETER        |                   | FROM | TO | Test Conditions | B-Port Supply Voltage (V <sub>CCB</sub> ) |     |     |             |     |     |              |     |     |             |     |     |             |     |     | 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 <sub>pd</sub>  | Propagation delay | A    | B  | -40°C to 85°C   | 7                                         |     | 40  | 5           |     | 21  | 4            |     | 16  | 3           |     | 12  | 3           |     | 10  | 3    |             | 8   | ns  |
|                  |                   |      |    | -40°C to 125°C  | 7                                         |     | 45  | 5           |     | 22  | 4            |     | 17  | 3           |     | 13  | 3           |     | 11  | 3    |             | 9   |     |
|                  |                   | B    | A  | -40°C to 85°C   | 5                                         |     | 26  | 5           |     | 16  | 5            |     | 15  | 4           |     | 12  | 3           |     | 11  | 3    |             | 10  |     |
|                  |                   |      |    | -40°C to 125°C  | 5                                         |     | 28  | 5           |     | 17  | 5            |     | 15  | 4           |     | 13  | 3           |     | 12  | 3    |             | 11  |     |
| t <sub>dis</sub> | Disable time      | OE   | A  | -40°C to 85°C   | 10                                        |     | 24  | 10          |     | 24  | 10           |     | 24  | 10          |     | 24  | 10          |     | 22  | 10   |             | 24  | ns  |
|                  |                   |      |    | -40°C to 125°C  | 10                                        |     | 26  | 10          |     | 26  | 10           |     | 24  | 10          |     | 24  | 10          |     | 24  | 10   |             | 24  |     |
|                  |                   | OE   | B  | -40°C to 85°C   | 15                                        |     | 56  | 15          |     | 41  | 12           |     | 34  | 12          |     | 25  | 10          |     | 24  | 10   |             | 21  |     |
|                  |                   |      |    | -40°C to 125°C  | 15                                        |     | 62  | 15          |     | 44  | 12           |     | 37  | 12          |     | 29  | 10          |     | 26  | 10   |             | 22  |     |
| t <sub>en</sub>  | Enable time       | OE   | A  | -40°C to 85°C   | 8                                         |     | 25  | 8           |     | 25  | 8            |     | 25  | 8           |     | 25  | 8           |     | 25  | 8    |             | 25  | ns  |
|                  |                   |      |    | -40°C to 125°C  | 8                                         |     | 27  | 8           |     | 27  | 8            |     | 27  | 8           |     | 27  | 8           |     | 27  | 8    |             | 27  |     |
|                  |                   | OE   | B  | -40°C to 85°C   | 20                                        |     | 80  | 15          |     | 46  | 10           |     | 34  | 10          |     | 25  | 5           |     | 23  | 5    |             | 18  |     |
|                  |                   |      |    | -40°C to 125°C  | 20                                        |     | 86  | 15          |     | 48  | 10           |     | 37  | 10          |     | 27  | 5           |     | 25  | 5    |             | 20  |     |

## 6.10 Switching Characteristics, $V_{CCA} = 3.3 \pm 0.3 \text{ V}$

See 图 7-1 and 表 7-1 for test circuit and loading. See [Propagation Delay](#), [Input Transition Rise and Fall Rate](#), and [Enable Time And Disable Time](#) for measurement waveforms.

| PARAMETER        |                   | FROM | TO | Test Conditions | B-Port Supply Voltage (V <sub>CCB</sub> ) |     |     |             |     |     |              |     |     |             |     |     |             |     | 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 <sub>pd</sub>  | Propagation delay | A    | B  | -40°C to 85°C   | 8                                         |     | 41  | 6           |     | 19  | 4            |     | 15  | 3           |     | 10  | 3           |     | 9    | 2           |     | 6.5 | ns  |
|                  |                   |      |    | -40°C to 125°C  | 8                                         |     | 43  | 6           |     | 21  | 4            |     | 16  | 3           |     | 11  | 3           |     | 10   | 2           |     | 7.5 |     |
|                  |                   | B    | A  | -40°C to 85°C   | 5                                         |     | 22  | 5           |     | 15  | 4            |     | 12  | 3           |     | 10  | 3           |     | 9    | 3           |     | 8.5 |     |
|                  |                   |      |    | -40°C to 125°C  | 5                                         |     | 24  | 5           |     | 16  | 4            |     | 13  | 3           |     | 11  | 3           |     | 10   | 3           |     | 9   |     |
| t <sub>dis</sub> | Disable time      | OE   | A  | -40°C to 85°C   | 9                                         |     | 19  | 9           |     | 19  | 9            |     | 19  | 8           |     | 19  | 8           |     | 19   | 8           |     | 19  | ns  |
|                  |                   |      |    | -40°C to 125°C  | 9                                         |     | 20  | 9           |     | 20  | 9            |     | 20  | 8           |     | 20  | 8           |     | 20   | 8           |     | 20  |     |
|                  |                   | OE   | B  | -40°C to 85°C   | 15                                        |     | 52  | 15          |     | 38  | 12           |     | 32  | 10          |     | 23  | 10          |     | 22   | 9           |     | 18  |     |
|                  |                   |      |    | -40°C to 125°C  | 15                                        |     | 59  | 15          |     | 41  | 12           |     | 35  | 10          |     | 26  | 10          |     | 23   | 9           |     | 20  |     |
| t <sub>en</sub>  | Enable time       | OE   | A  | -40°C to 85°C   | 5                                         |     | 20  | 5           |     | 20  | 5            |     | 20  | 5           |     | 20  | 5           |     | 20   | 5           |     | 20  | ns  |
|                  |                   |      |    | -40°C to 125°C  | 5                                         |     | 22  | 5           |     | 22  | 5            |     | 22  | 5           |     | 22  | 5           |     | 22   | 5           |     | 22  |     |
|                  |                   | OE   | B  | -40°C to 85°C   | 20                                        |     | 80  | 15          |     | 43  | 10           |     | 34  | 5           |     | 24  | 5           |     | 19   | 5           |     | 16  |     |
|                  |                   |      |    | -40°C to 125°C  | 20                                        |     | 85  | 15          |     | 46  | 10           |     | 36  | 5           |     | 27  | 5           |     | 21   | 5           |     | 18  |     |

## 6.11 Switching Characteristics, $V_{CCA} = 5.0 \pm 0.5 \text{ V}$

See 图 7-1 and 表 7-1 for test circuit and loading. See [Propagation Delay](#), [Input Transition Rise and Fall Rate](#), and [Enable Time And Disable Time](#) for measurement waveforms.

| PARAMETER        |                   | FROM | TO | Test Conditions | B-Port Supply Voltage (V <sub>CCB</sub> ) |     |     |             |     |     |              |     |      |             |     |      |             |     |     | 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 <sub>pd</sub>  | Propagation delay | A    | B  | -40°C to 85°C   | 8                                         |     | 38  | 6           |     | 15  | 3            |     | 14   | 3           |     | 9.5  | 2           |     | 8   | 2    |             | 6   | ns  |
|                  |                   |      |    | -40°C to 125°C  | 8                                         |     | 42  | 6           |     | 17  | 3            |     | 15   | 3           |     | 10.5 | 2           |     | 8.5 | 2    |             | 7   |     |
|                  |                   | B    | A  | -40°C to 85°C   | 5                                         |     | 22  | 4           |     | 13  | 3            |     | 10.5 | 3           |     | 8    | 2           |     | 7.5 | 2    |             | 7   |     |
|                  |                   |      |    | -40°C to 125°C  | 5                                         |     | 24  | 4           |     | 15  | 3            |     | 11.5 | 3           |     | 8.5  | 2           |     | 8   | 2    |             | 7.5 |     |
| t <sub>dis</sub> | Disable time      | OE   | A  | -40°C to 85°C   | 7                                         |     | 15  | 5           |     | 15  | 5            |     | 15   | 5           |     | 15   | 5           |     | 14  | 5    |             | 14  | ns  |
|                  |                   |      |    | -40°C to 125°C  | 7                                         |     | 16  | 5           |     | 16  | 5            |     | 16   | 5           |     | 16   | 5           |     | 15  | 5    |             | 15  |     |
|                  |                   | OE   | B  | -40°C to 85°C   | 15                                        |     | 52  | 12          |     | 33  | 10           |     | 31   | 10          |     | 22   | 10          |     | 21  | 5    |             | 16  |     |
|                  |                   |      |    | -40°C to 125°C  | 15                                        |     | 56  | 12          |     | 37  | 10           |     | 35   | 10          |     | 24   | 10          |     | 23  | 5    |             | 18  |     |
| t <sub>en</sub>  | Enable time       | OE   | A  | -40°C to 85°C   | 5                                         |     | 15  | 5           |     | 15  | 5            |     | 15   | 5           |     | 15   | 5           |     | 15  | 5    |             | 15  | ns  |
|                  |                   |      |    | -40°C to 125°C  | 5                                         |     | 16  | 5           |     | 16  | 5            |     | 16   | 5           |     | 16   | 5           |     | 16  | 5    |             | 16  |     |
|                  |                   | OE   | B  | -40°C to 85°C   | 20                                        |     | 80  | 15          |     | 44  | 10           |     | 33   | 5           |     | 24   | 5           |     | 18  | 5    |             | 15  |     |
|                  |                   |      |    | -40°C to 125°C  | 20                                        |     | 85  | 15          |     | 48  | 10           |     | 35   | 5           |     | 26   | 5           |     | 20  | 5    |             | 17  |     |

## 6.12 Switching Characteristics: $T_{sk}$ , $T_{MAX}$

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

| PARAMETER                            | TEST CONDITIONS                                                                                                             |                  | V <sub>CCI</sub> | V <sub>CCO</sub> | Operating free-air temperature (T <sub>A</sub> ) |     |      | UNIT |
|--------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|------------------|------------------|------------------|--------------------------------------------------|-----|------|------|
|                                      |                                                                                                                             |                  |                  |                  | -40°C to 125°C                                   |     |      |      |
|                                      |                                                                                                                             |                  |                  |                  | MIN                                              | TYP | MAX  |      |
| T <sub>MAX</sub> - Maximum Data Rate | 50% Duty Cycle Input<br>One channel switching<br>20% of pulse > 0.7*V <sub>CCO</sub><br>20% of pulse < 0.3*V <sub>CCO</sub> | Up Translation   | 3.0 V - 3.6 V    | 4.5 V - 5.5 V    | 200                                              | 420 | Mbps |      |
|                                      |                                                                                                                             |                  | 1.65 V - 1.95 V  | 4.5 V - 5.5 V    | 100                                              | 200 | Mbps |      |
|                                      |                                                                                                                             |                  | 1.1 V - 1.3 V    | 4.5 V - 5.5 V    | 20                                               | 40  | Mbps |      |
|                                      |                                                                                                                             |                  | 1.65 V - 1.95 V  | 3.0 V - 3.6 V    | 100                                              | 210 | Mbps |      |
|                                      |                                                                                                                             |                  | 1.1 V - 1.3 V    | 3.0 V - 3.6 V    | 10                                               | 20  | Mbps |      |
|                                      |                                                                                                                             |                  | 1.1 V - 1.3 V    | 1.65 V - 1.95 V  | 5                                                | 10  | Mbps |      |
|                                      |                                                                                                                             | Down Translation | 4.5 V - 5.5 V    | 3.0 V - 3.6 V    | 100                                              | 210 | Mbps |      |
|                                      |                                                                                                                             |                  | 4.5 V - 5.5 V    | 1.65 V - 1.95 V  | 50                                               | 75  | Mbps |      |
|                                      |                                                                                                                             |                  | 4.5 V - 5.5 V    | 1.1 V - 1.3 V    | 15                                               | 30  | Mbps |      |
|                                      |                                                                                                                             |                  | 3.0 V - 3.6 V    | 1.65 V - 1.95 V  | 40                                               | 75  | Mbps |      |
|                                      |                                                                                                                             |                  | 3.0 V - 3.6 V    | 1.1 V - 1.3 V    | 10                                               | 20  | Mbps |      |
|                                      |                                                                                                                             |                  | 1.65 V - 1.95 V  | 1.1 V - 1.3 V    | 5                                                | 10  | Mbps |      |
| t <sub>sk</sub> - Output skew        | Timing skew between any two switching outputs within the same device                                                        | Up Translation   | 3.0 V - 3.6 V    | 4.5 V - 5.5 V    | 0.5                                              |     | ns   |      |
|                                      |                                                                                                                             |                  | 1.65 V - 1.95 V  | 4.5 V - 5.5 V    | 1                                                |     |      |      |
|                                      |                                                                                                                             |                  | 1.1 V - 1.3 V    | 4.5 V - 5.5 V    | 1.5                                              |     |      |      |
|                                      |                                                                                                                             |                  | 1.65 V - 1.95 V  | 3.0 V - 3.6 V    | 1                                                |     |      |      |
|                                      |                                                                                                                             |                  | 1.1 V - 1.3 V    | 3.0 V - 3.6 V    | 1.5                                              |     |      |      |
|                                      |                                                                                                                             |                  | 1.1 V - 1.3 V    | 1.65 V - 1.95 V  | 2                                                |     |      |      |
|                                      |                                                                                                                             | Down Translation | 4.5 V - 5.5 V    | 3.0 V - 3.6 V    | 0.5                                              |     |      |      |
|                                      |                                                                                                                             |                  | 4.5 V - 5.5 V    | 1.65 V - 1.95 V  | 1                                                |     |      |      |
|                                      |                                                                                                                             |                  | 4.5 V - 5.5 V    | 1.1 V - 1.3 V    | 1.5                                              |     |      |      |
|                                      |                                                                                                                             |                  | 3.0 V - 3.6 V    | 1.65 V - 1.95 V  | 1                                                |     |      |      |
|                                      |                                                                                                                             |                  | 3.0 V - 3.6 V    | 1.1 V - 1.3 V    | 1.5                                              |     |      |      |
|                                      |                                                                                                                             |                  | 1.65 V - 1.95 V  | 1.1 V - 1.3 V    | 2                                                |     |      |      |

## 6.13 Operating Characteristics

$T_A = 25^\circ\text{C}$  <sup>(1)</sup>

| 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        |      |
| $C_{pdA}$ <sup>(2)</sup> | A to B: outputs enabled  | A Port<br>CL = 0, RL = Open<br>f = 10 MHz<br>$t_{rise} = t_{fall} = 1$ ns | 1                                      | 4          | 4           | 4          | 5          | 5          | pF   |
|                          | A to B: outputs disabled |                                                                           | 3                                      | 3          | 3           | 4          | 4          | 4          |      |
|                          | B to A: outputs enabled  |                                                                           | 22                                     | 22         | 22          | 23         | 24         | 25         |      |
|                          | B to A: outputs disabled |                                                                           | 1                                      | 1          | 1           | 1          | 1          | 2          |      |
| $C_{pdB}$ <sup>(2)</sup> | A to B: outputs enabled  | B Port<br>CL = 0, RL = Open<br>f = 10 MHz<br>$t_{rise} = t_{fall} = 1$ ns | 22                                     | 22         | 22          | 23         | 24         | 25         | pF   |
|                          | A to B: outputs disabled |                                                                           | 1                                      | 1          | 1           | 1          | 1          | 2          |      |
|                          | B to A: outputs enabled  |                                                                           | 1                                      | 1          | 1           | 1          | 1          | 5          |      |
|                          | B to A: outputs disabled |                                                                           | 3                                      | 3          | 3           | 1          | 1          | 1          |      |

(1) See the [CMOS Power Consumption and  \$C\_{pd}\$  Calculation](#) application report for more information about power dissipation capacitance.

(2)  $C_{pdA}$  and  $C_{pdB}$  are respectively A-Port and B-Port power dissipation capacitances per transceiver.

## 6.14 Typical Characteristics

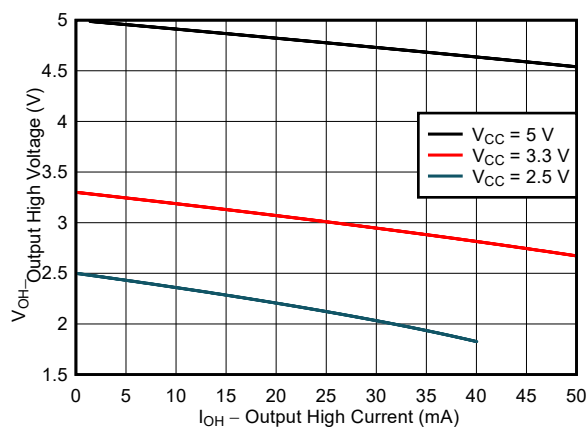


图 6-1. Typical ( $T_A=25^\circ\text{C}$ ) Output High Voltage ( $V_{OH}$ ) vs Source Current ( $I_{OH}$ )

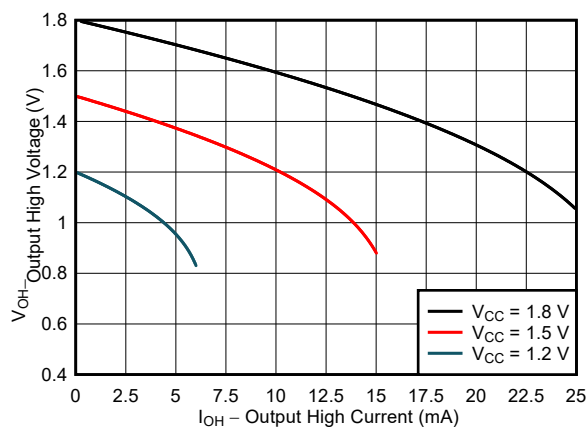


图 6-2. Typical ( $T_A=25^\circ\text{C}$ ) Output High Voltage ( $V_{OH}$ ) vs Source Current ( $I_{OH}$ )

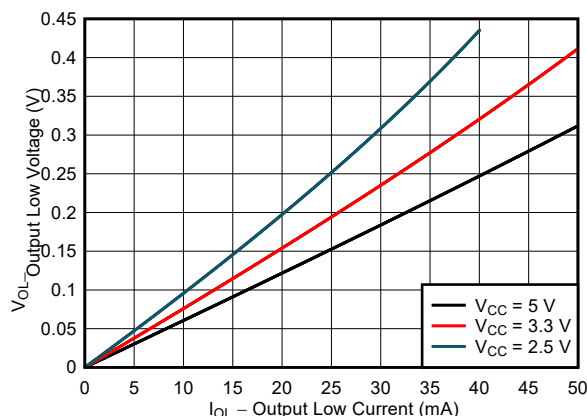


图 6-3. Typical ( $T_A=25^\circ\text{C}$ ) Output Low Voltage ( $V_{OL}$ ) vs Sink Current ( $I_{OL}$ )

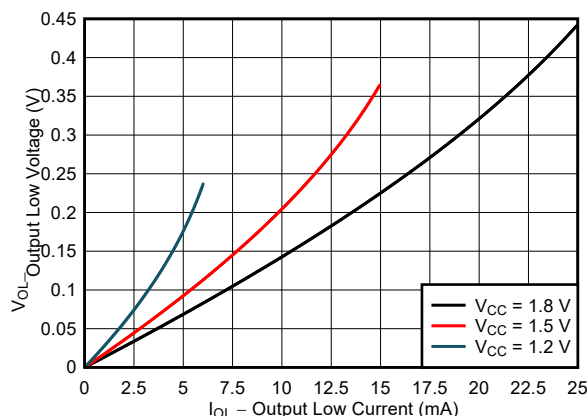


图 6-4. Typical ( $T_A=25^\circ\text{C}$ ) Output Low Voltage ( $V_{OL}$ ) vs Sink Current ( $I_{OL}$ )

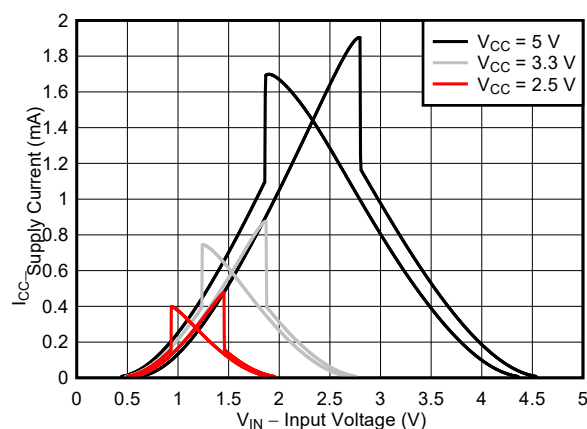


图 6-5. Typical ( $T_A=25^\circ\text{C}$ ) Supply Current ( $I_{CC}$ ) vs Input Voltage ( $V_{IN}$ )

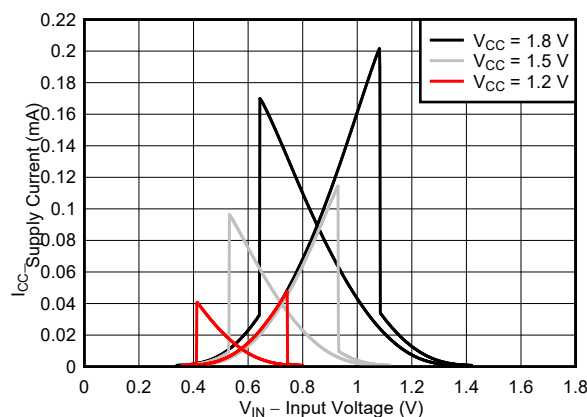


图 6-6. Typical ( $T_A=25^\circ\text{C}$ ) Supply Current ( $I_{CC}$ ) vs Input Voltage ( $V_{IN}$ )

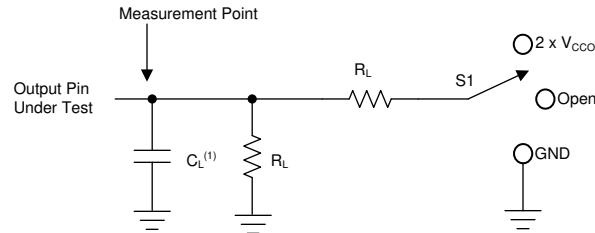


## 7 Parameter Measurement Information

### 7.1 Load Circuit and Voltage Waveforms

Unless otherwise noted, all input pulses are supplied by generators having the following characteristics:

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

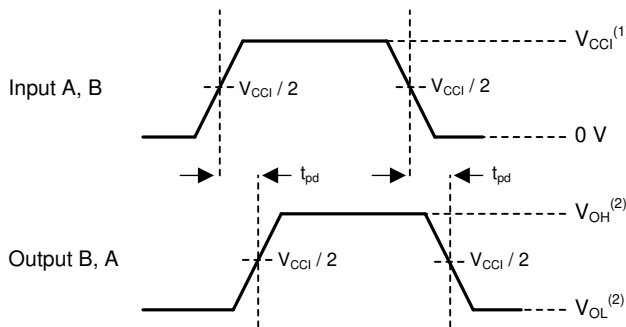


A.  $C_L$  includes probe and jig capacitance.

图 7-1. Load Circuit

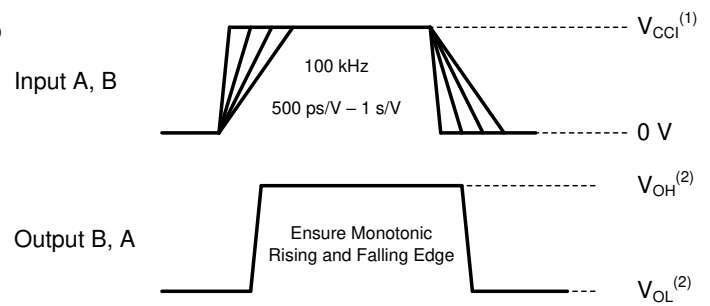
表 7-1. Load Circuit Conditions

| Parameter                                     | $V_{CCO}$      | $R_L$        | $C_L$ | $S_1$              | $V_{TP}$ |
|-----------------------------------------------|----------------|--------------|-------|--------------------|----------|
| $t_{pd}$ Propagation (delay) time             | 1.1 V – 5.5 V  | 2 k $\Omega$ | 15 pF | Open               | N/A      |
| $t_{en}, t_{dis}$ Enable time or disable time | 1.1 V – 1.6 V  | 2 k $\Omega$ | 15 pF | $2 \times V_{CCO}$ | 0.1 V    |
|                                               | 1.65 V – 2.7 V | 2 k $\Omega$ | 15 pF | $2 \times V_{CCO}$ | 0.15 V   |
|                                               | 3.0 V – 5.5 V  | 2 k $\Omega$ | 15 pF | $2 \times V_{CCO}$ | 0.3 V    |
| $t_{en}, t_{dis}$ Enable time or disable time | 1.1 V – 1.6 V  | 2 k $\Omega$ | 15 pF | GND                | 0.1 V    |
|                                               | 1.65 V – 2.7 V | 2 k $\Omega$ | 15 pF | GND                | 0.15 V   |
|                                               | 3.0 V – 5.5 V  | 2 k $\Omega$ | 15 pF | GND                | 0.3 V    |



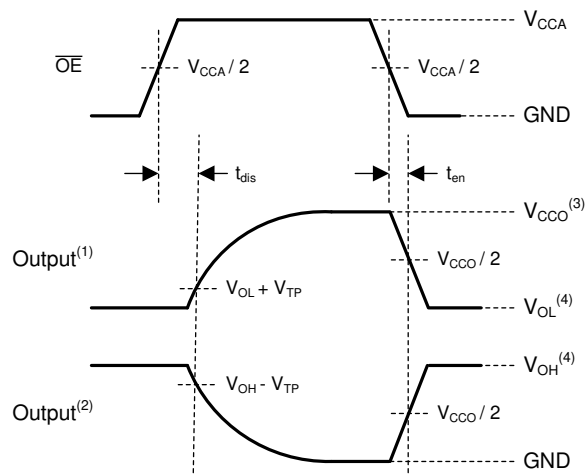
1.  $V_{CCI}$  is the supply pin associated with the input port.
2.  $V_{OH}$  and  $V_{OL}$  are typical output voltage levels that occur with specified  $R_L$ ,  $C_L$ , and  $S_1$ .

图 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  $S_1$ .

图 7-3. 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.  $V_{CCO}$  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  $S_1$ .

**图 7-4. Enable Time And Disable Time**

## 8 Detailed Description

### 8.1 Overview

The SN74LXCH8T245 is an 8-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 operates with  $V_{CCA} = V_{CCB}$ . The A port is designed to track  $V_{CCA}$ , and the B port is designed to track  $V_{CCB}$ .

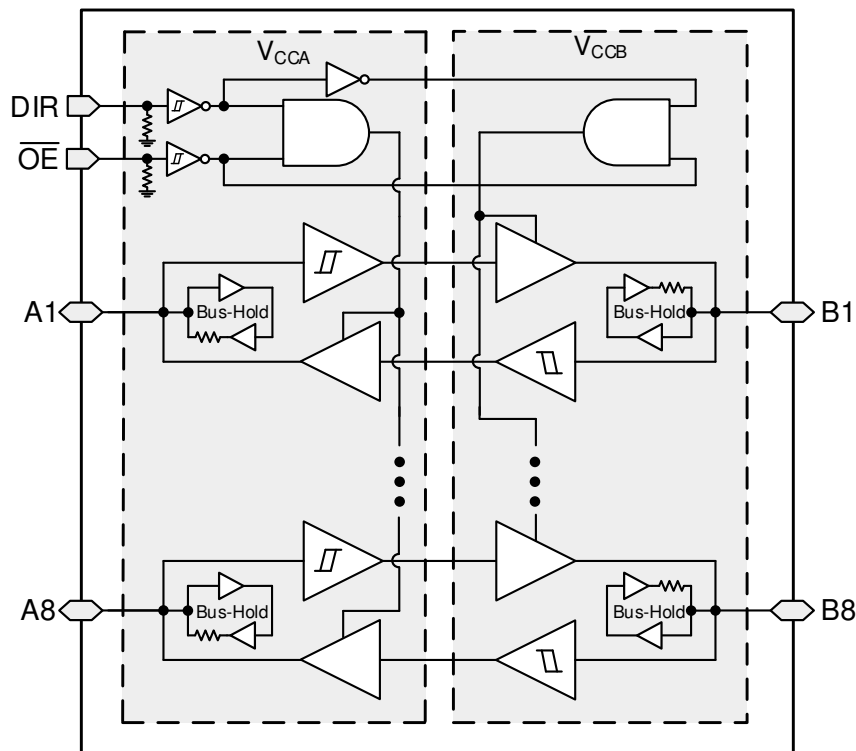
The SN74LXCH8T245 device is designed for asynchronous communication between data buses and transmits data from the A bus to the B bus or from the B bus to the A bus based on the logic level of the direction-control input (DIR). The output-enable input ( $\overline{OE}$ ) is used to disable the outputs so the buses are effectively isolated. The control pins of the SN74LXCH8T245 (DIR and  $\overline{OE}$ ) are referenced to  $V_{CCA}$ . The  $\overline{OE}$  pin should be tied to  $V_{CCA}$  through a pullup resistor to ensure the high-impedance state of the level shifter I/Os 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, output, or I/O while the device is powered down.

The  $V_{CC}$  isolation and  $V_{CC}$  disconnect feature ensures that if either  $V_{CC}$  is less than 100 mV or floating with the complementary supply within the recommended operating conditions, both I/O ports are set to the high-impedance state by disabling their outputs and the supply current is maintained.

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

### 8.2 Functional Block Diagram



Note: Bus-hold circuits are only present for data inputs, not control inputs

图 8-1. SN74LXCH8T245 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 ( $R = V \div I$ ).

The Schmitt-trigger input architecture provides hysteresis as defined by  $\Delta V_T$  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 Control Inputs with Integrated Static Pull-Down Resistors

Similar to the data I/O's, floating control inputs can cause high current consumption. This device has integrated weak static pull-downs of 5-M $\Omega$  typical on the control inputs (DIR and  $\overline{OE}$ ) to help avoid this concern. These pull-downs are always present. For example, if the DIR pin is left floating, then the B port will be configured as an input and the A port will be configured as an output.

### 8.3.2 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 defined in the [Absolute Maximum Ratings](#) must be followed at all times.

### 8.3.3 Partial Power Down ( $I_{off}$ )

The inputs and outputs for this device enter a high-impedance state when the device is powered down, inhibiting current backflow into the device.  $I_{off}$  in the [Electrical Characteristics](#) specifies the maximum leakage into or out of any input or output pin on the device.

### 8.3.4 $V_{CC}$ Isolation and $V_{CC}$ Disconnect

The inputs and outputs for this device enter a high-impedance state when either supply is <100 mV, requiring one supply to connect to the device. Note: the bus-hold circuitry always remains active even when the device is disabled and all outputs are in the high-impedance state.

Either supply can be disconnected (floated), while the other supply is still connected and the device will maintain the maximum supply current specified by  $I_{CCX(floating)}$  in the [Electrical Characteristics](#). The I/O's will not enter a high-impedance state unless the supply is disconnected after it is driven to <100 mV.  $I_{off(float)}$  in the [Electrical Characteristics](#) specifies the maximum leakage into or out of any input or output pin on the device.

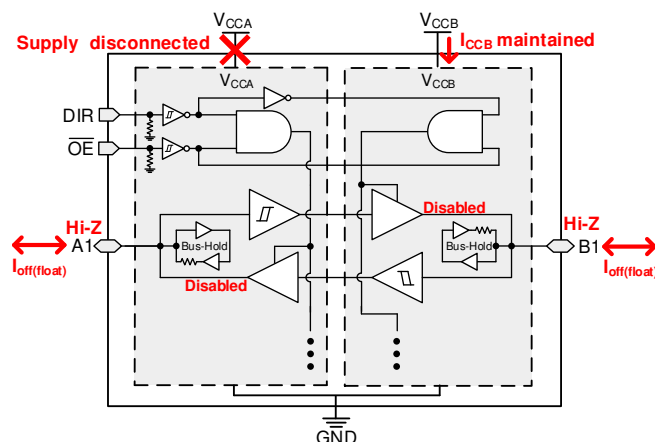


图 8-2.  $V_{CC}$  Disconnect Feature

### 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

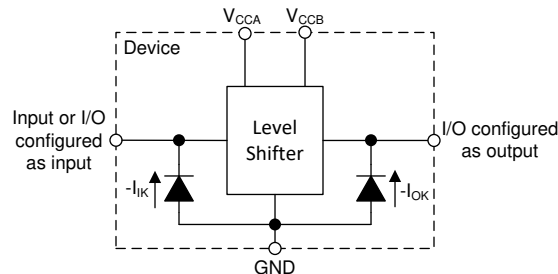
Either supply rail may be powered on or off in any order without producing a glitch on the I/Os (that is, where the output erroneously transitions to VCC when it should be held low or vice versa). Glitches of this nature can be misinterpreted by a peripheral as a valid data bit, which could trigger a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

### 8.3.7 Negative Clamping Diodes

The inputs and outputs to this device have negative clamping diodes as depicted in [图 8-3](#).

**CAUTION**

Voltages beyond the values specified in [节 6.1](#) 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.



**图 8-3. 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 SN74LXCH8T245 device can support high data-rate applications. The translated signal data rate can be up to 420 Mbps when the signal is translated from 3.3 V to 5.0 V.

### 8.3.10 Bus-Hold Data Inputs

Each data input on this device includes a weak latch that maintains a valid logic level on the input. The state of these latches is unknown at startup and remains unknown until the input has been forced to a valid high or low state. After data is sent through a channel, the latch maintains the previous state on the input (if the line is left floating). It is not recommended to use pull-up or pull-down resistors together with a bus-hold input, as it may cause undefined inputs to occur which leads to excessive current consumption.

Bus-hold data inputs prevent floating inputs on this device. The [Implications of Slow or Floating CMOS Inputs](#) application report explains the problems associated with leaving the CMOS inputs floating. These latches remain active at all times, independent of all control signals such as direction control or output enable. The latches also remain active when the device is in the partial power down state, corresponding supply is still present, or when the I/O's are floated. The [Bus-Hold Circuit](#) application report has additional details regarding bus-hold inputs.

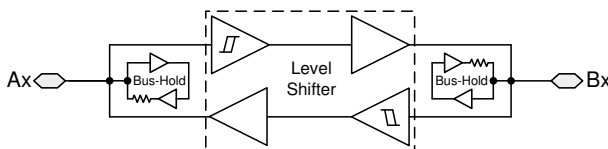


图 8-4. Schematic Description of Location of Bus-Hold Circuits

## 8.4 Device Functional Modes

表 8-1. Function Table<sup>(1)</sup>

| CONTROL INPUTS |     | Port Status      |                  | OPERATION       |
|----------------|-----|------------------|------------------|-----------------|
| OE             | DIR | A PORT           | B PORT           |                 |
| L              | L   | Output (Enabled) | Input (Hi-Z)     | B data to A bus |
| L              | H   | Input (Hi-Z)     | Output (Enabled) | A data to B bus |
| H              | X   | Input (Hi-Z)     | Input (Hi-Z)     | Isolation       |

(1) Input circuits of the data I/Os are always active.

## 9 Application and Implementation

### Note

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

### 9.1 Application Information

The SN74LXCH8T245 device can be used in level-translation applications for interfacing devices or systems operating at different interface voltages with one another. The SN74LXCH8T245 device is ideal for use in applications where a push-pull driver is connected to the data I/Os. The maximum data rate can be up to 420 Mbps when the device translates a signal from 3.3 V to 5.0 V.

### 9.2 Typical Application

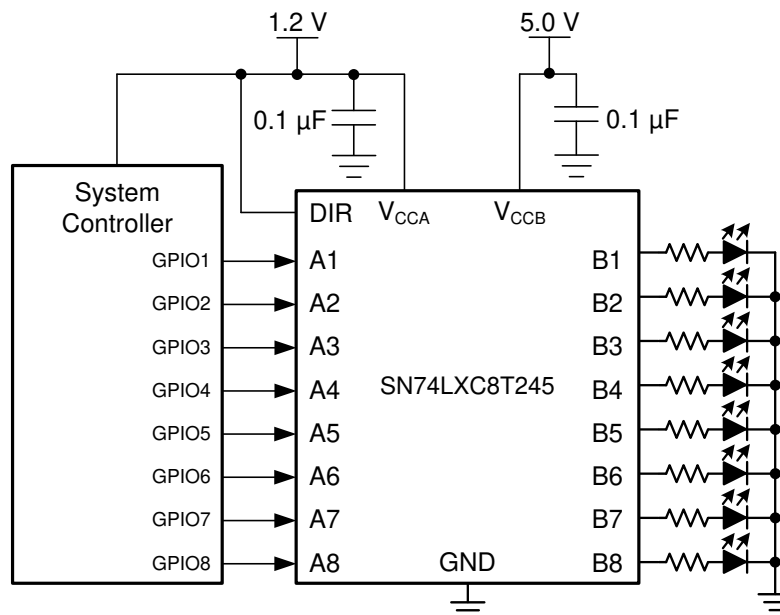


图 9-1. LED Driver Application

#### 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 SN74LXCH8T245 device to determine the input voltage range. The value must exceed the high-level input voltage ( $V_{IH}$ ) of the input port for a valid logic-high. The value must be less than the low-level input voltage ( $V_{IL}$ ) of the input port for a valid logic low.
- Output voltage range:
  - Use the device's supply voltage that the SN74LXCH8T245 device is driving to determine the output voltage range.

### 9.2.3 Application Curve

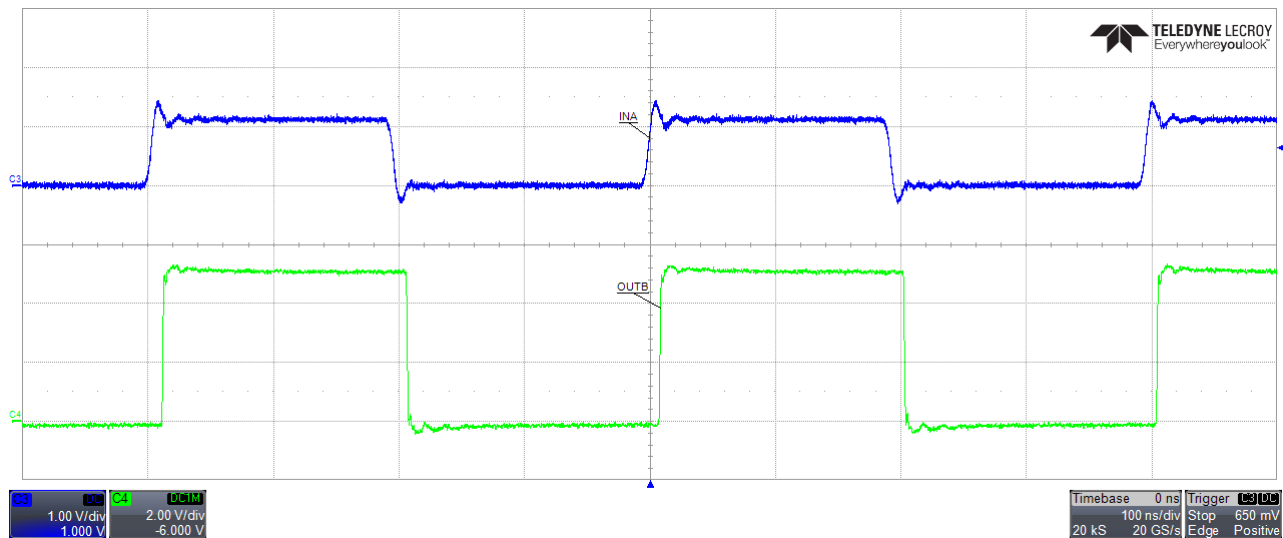


图 9-2. Up Translation at 2.5 MHz (1.2 V to 5 V)



## 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.

节 8.3.6 describes how this device was designed with various power supply sequencing methods in mind to help prevent unintended triggering of downstream devices.

## 11 Layout

### 11.1 Layout Guidelines

Following common printed-circuit board layout guidelines are recommended to ensure reliability of the device, which follows:

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

### 11.2 Layout Example

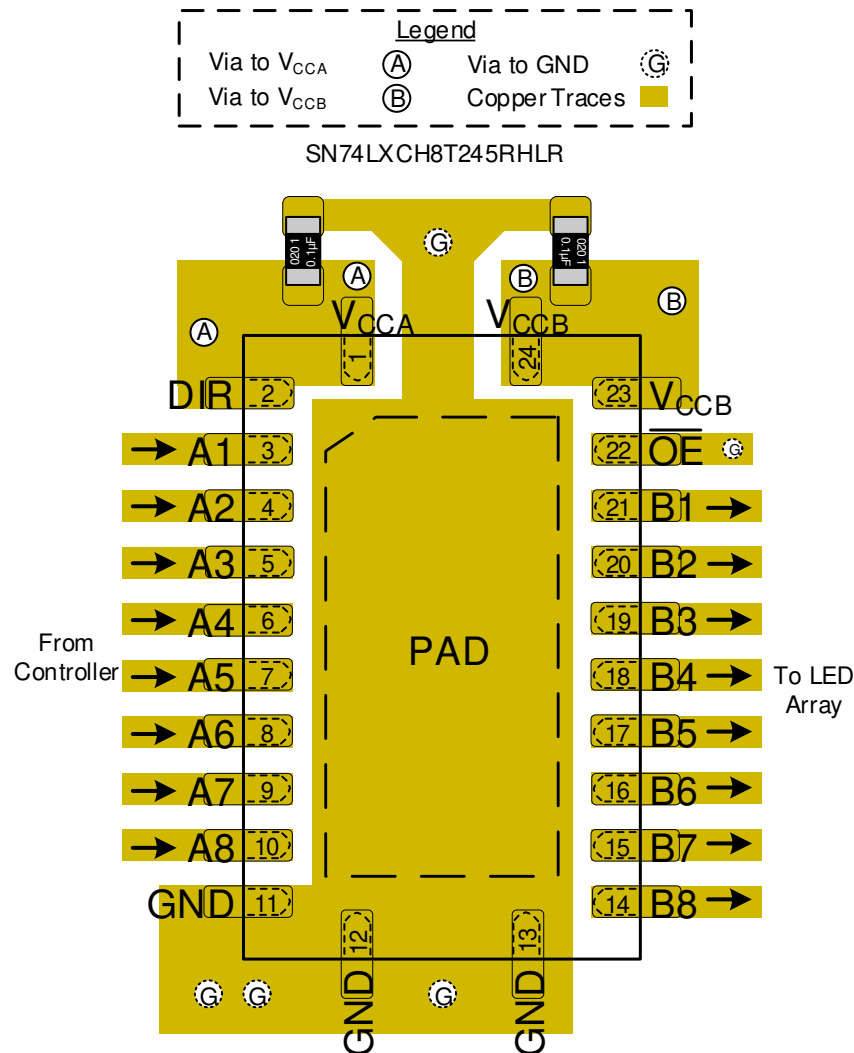


图 11-1. Layout Example

## 12 Device and Documentation Support

### 12.1 Documentation Support

#### 12.1.1 Related Documentation

For related documentation, see the following:

- Texas Instruments, [CMOS Power Consumption and  \$C\_{pd}\$  Calculation application report](#)
- Texas Instruments, [Implications of Slow or Floating CMOS Inputs application report](#)
- Texas Instruments, [Semiconductor and IC Package Thermal Metrics application report](#)
- Texas Instruments, [System Considerations for Using Bus-Hold Circuits to Avoid Floating Inputs application report](#)

#### 12.2 接收文档更新通知

要接收文档更新通知，请导航至 [ti.com](https://www.ti.com) 上的器件产品文件夹。点击 [订阅更新](#) 进行注册，即可每周接收产品信息更改摘要。有关更改的详细信息，请查看任何已修订文档中包含的修订历史记录。

#### 12.3 支持资源

[TI E2E™ 支持论坛](#) 是工程师的重要参考资料，可直接从专家获得快速、经过验证的解答和设计帮助。搜索现有解答或提出自己的问题可获得所需的快速设计帮助。

链接的内容由各个贡献者“按原样”提供。这些内容并不构成 TI 技术规范，并且不一定反映 TI 的观点；请参阅 TI 的 [《使用条款》](#)。

#### 12.4 Trademarks

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#### 12.5 静电放电警告



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ESD 的损坏小至导致微小的性能降级，大至整个器件故障。精密的集成电路可能更容易受到损坏，这是因为非常细微的参数更改都可能会导致器件与其发布的规格不相符。

#### 12.6 术语表

[TI 术语表](#) 本术语表列出并解释了术语、首字母缩略词和定义。

## 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.

## PACKAGING INFORMATION

| Orderable part number             | Status<br>(1) | Material type<br>(2) | Package   Pins  | Package qty   Carrier | RoHS<br>(3) | Lead finish/<br>Ball material<br>(4) | MSL rating/<br>Peak reflow<br>(5) | Op temp (°C) | Part marking<br>(6) |
|-----------------------------------|---------------|----------------------|-----------------|-----------------------|-------------|--------------------------------------|-----------------------------------|--------------|---------------------|
| 74LXCH8T245RHRLRG4                | Active        | Production           | VQFN (RHL)   24 | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | LX8T245H            |
| 74LXCH8T245RHRLRG4.A              | Active        | Production           | VQFN (RHL)   24 | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | LX8T245H            |
| <a href="#">SN74LXCH8T245PWR</a>  | Active        | Production           | TSSOP (PW)   24 | 2000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | LXH8T245            |
| SN74LXCH8T245PWR.A                | Active        | Production           | TSSOP (PW)   24 | 2000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | LXH8T245            |
| SN74LXCH8T245PWRG4                | Active        | Production           | TSSOP (PW)   24 | 2000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | LXH8T245            |
| SN74LXCH8T245PWRG4.A              | Active        | Production           | TSSOP (PW)   24 | 2000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | LXH8T245            |
| <a href="#">SN74LXCH8T245RHRL</a> | Active        | Production           | VQFN (RHL)   24 | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | LX8T245H            |
| SN74LXCH8T245RHRL.A               | Active        | Production           | VQFN (RHL)   24 | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | LX8T245H            |

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

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

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

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

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

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

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

**Important Information and Disclaimer:** The information provided on this page represents TI's knowledge and belief as of the date that it is provided. TI bases its knowledge and belief on information provided by third parties, and makes no representation or warranty as to the accuracy of such information. Efforts are underway to better integrate information from third parties. TI has taken and continues to take reasonable steps to provide representative and accurate information but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals. TI and TI suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.

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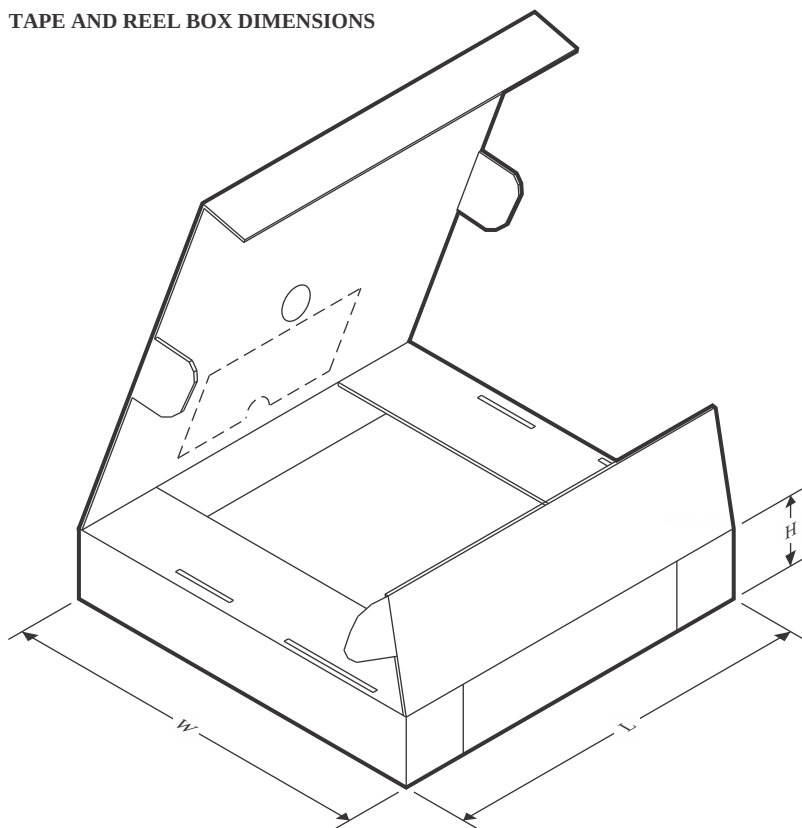
## TAPE AND REEL INFORMATION



\*All dimensions are nominal

| Device             | Package Type | Package Drawing | Pins | SPQ  | Reel Diameter (mm) | Reel Width W1 (mm) | A0 (mm) | B0 (mm) | K0 (mm) | P1 (mm) | W (mm) | Pin1 Quadrant |
|--------------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| 74LXCH8T245RHRLRG4 | VQFN         | RHL             | 24   | 3000 | 330.0              | 12.4               | 3.8     | 5.8     | 1.2     | 8.0     | 12.0   | Q1            |
| SN74LXCH8T245PWR   | TSSOP        | PW              | 24   | 2000 | 330.0              | 16.4               | 6.95    | 8.3     | 1.6     | 8.0     | 16.0   | Q1            |
| SN74LXCH8T245PWRG4 | TSSOP        | PW              | 24   | 2000 | 330.0              | 16.4               | 6.95    | 8.3     | 1.6     | 8.0     | 16.0   | Q1            |
| SN74LXCH8T245RHRLR | VQFN         | RHL             | 24   | 3000 | 330.0              | 12.4               | 3.8     | 5.8     | 1.2     | 8.0     | 12.0   | Q1            |

## TAPE AND REEL BOX DIMENSIONS



\*All dimensions are nominal

| Device             | Package Type | Package Drawing | Pins | SPQ  | Length (mm) | Width (mm) | Height (mm) |
|--------------------|--------------|-----------------|------|------|-------------|------------|-------------|
| 74LXCH8T245RHLRG4  | VQFN         | RHL             | 24   | 3000 | 367.0       | 367.0      | 35.0        |
| SN74LXCH8T245PWR   | TSSOP        | PW              | 24   | 2000 | 356.0       | 356.0      | 35.0        |
| SN74LXCH8T245PWRG4 | TSSOP        | PW              | 24   | 2000 | 356.0       | 356.0      | 35.0        |
| SN74LXCH8T245RHRLR | VQFN         | RHL             | 24   | 3000 | 367.0       | 367.0      | 35.0        |

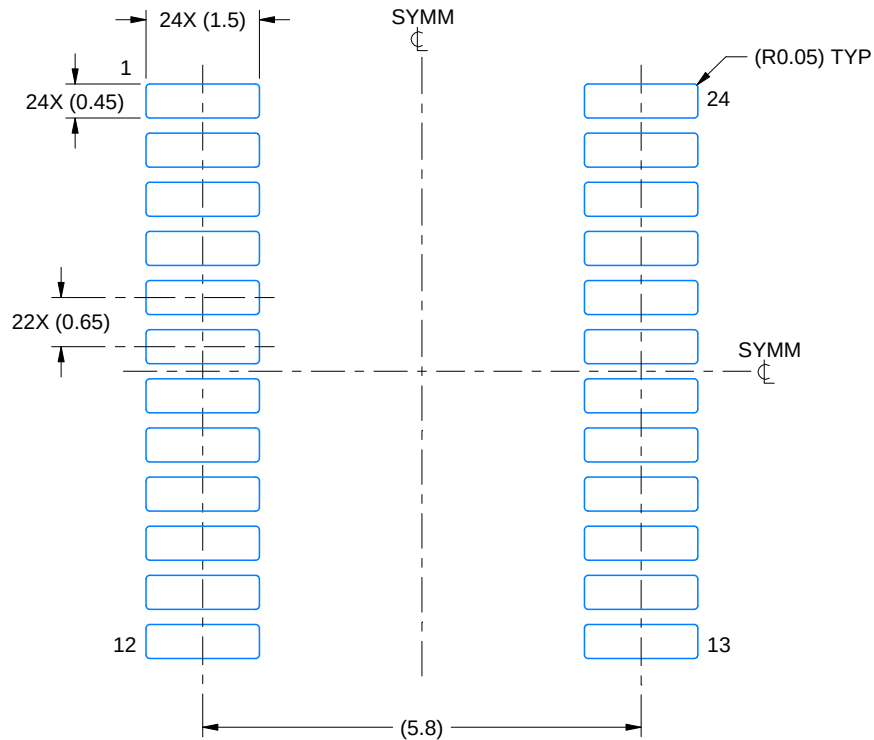


# EXAMPLE BOARD LAYOUT

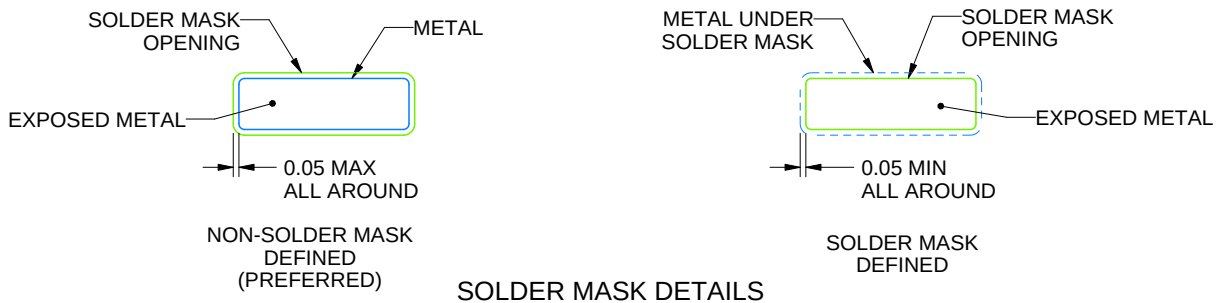
PW0024A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



LAND PATTERN EXAMPLE  
EXPOSED METAL SHOWN  
SCALE: 10X



SOLDER MASK DETAILS

4220208/A 02/2017

NOTES: (continued)

6. Publication IPC-7351 may have alternate designs.

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

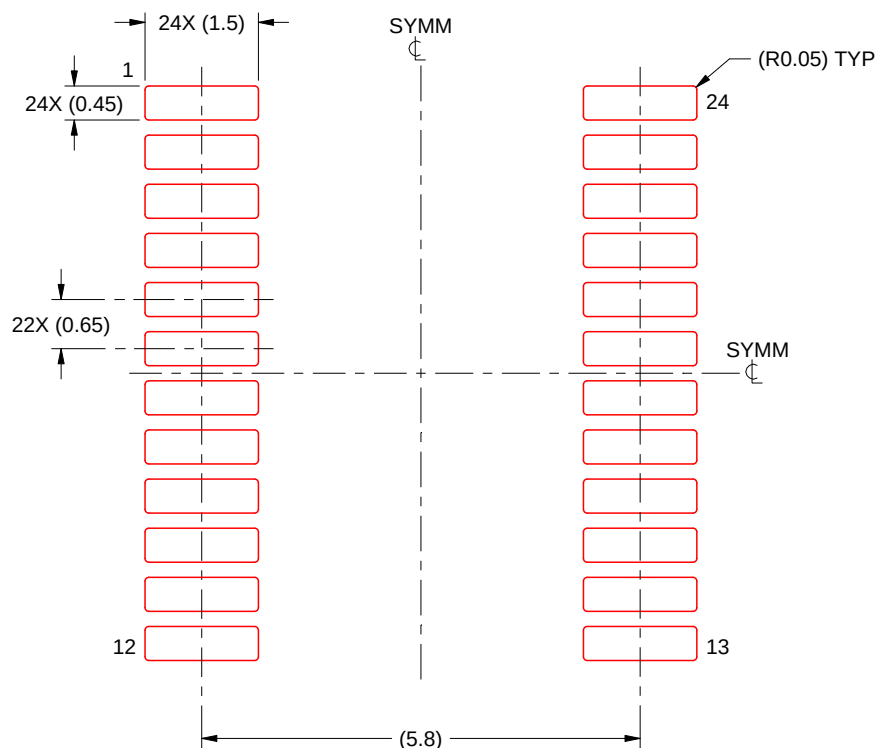


# EXAMPLE STENCIL DESIGN

PW0024A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE

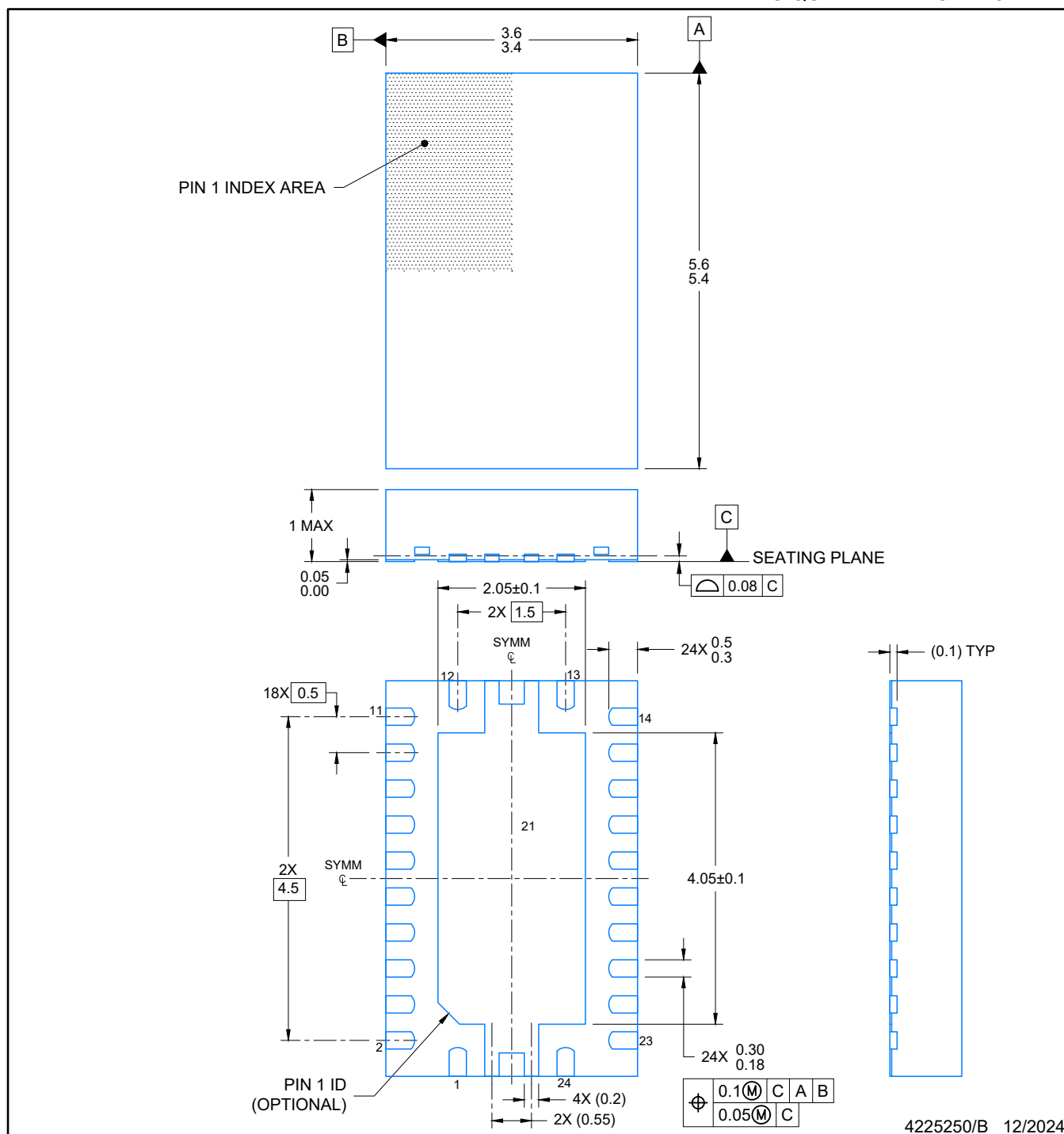


SOLDER PASTE EXAMPLE  
BASED ON 0.125 mm THICK STENCIL  
SCALE: 10X

4220208/A 02/2017

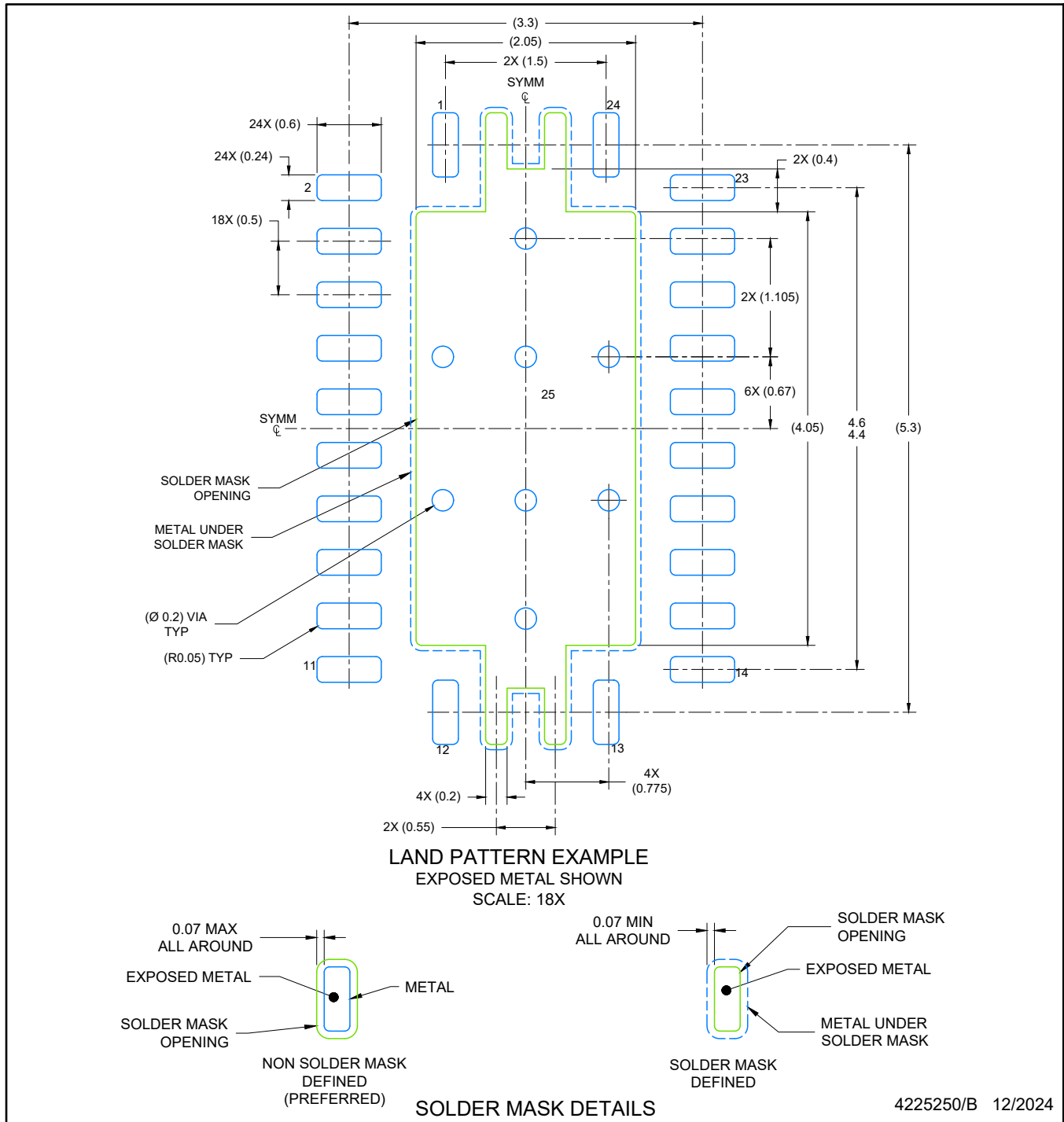
NOTES: (continued)

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



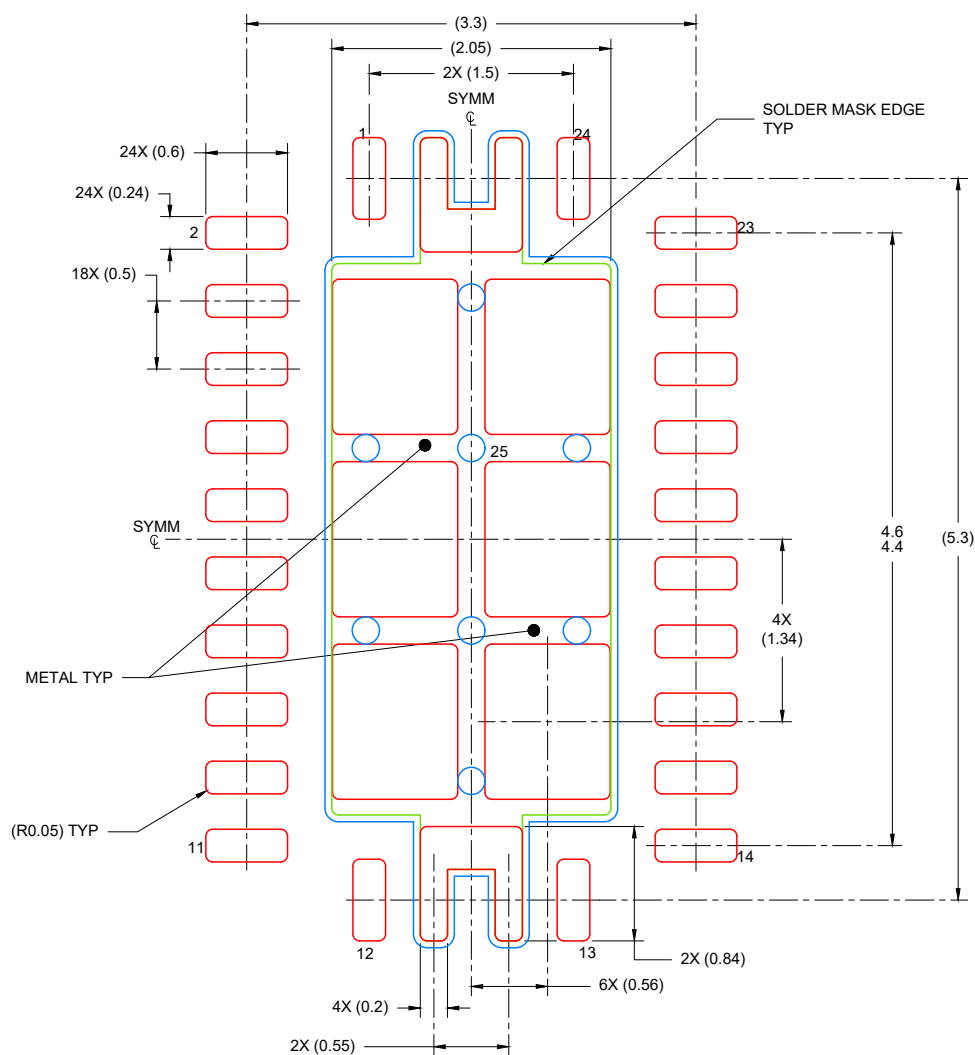
NOTES:

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 pad must be soldered to the printed circuit board for optimal thermal and mechanical performance.



NOTES: (continued)

- This package is designed to be soldered to a thermal pad on the board. For more information, see Texas Instruments literature number SLUA271 ([www.ti.com/lit/sluea271](http://www.ti.com/lit/sluea271)).
- Vias are optional depending on application, refer to device data sheet. If any vias are implemented, refer to their locations shown on this view. It is recommended that vias under paste be filled, plugged or tented.



SOLDER PASTE EXAMPLE  
BASED ON 0.125 mm THICK STENCIL

EXPOSED PAD  
80% PRINTED COVERAGE BY AREA  
SCALE: 18X

4225250/B 12/2024

NOTES: (continued)

6. 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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