

# 8-Bit Dual-Supply Bus Transceiver with Configurable Voltage Translation and 3-State Output

## 1 FEATURES

- **Control Input  $V_{IH}/V_{IL}$  Levels are Referenced to  $V_{CCA}$  Voltage**
- **Power-Supply Range:**  
 $V_{CCA}$  and  $V_{CCB}$ : **1.65V to 5.5V**
- **Latch-up performance exceeds 100mA per JESD 78, Class II**
- **$V_{CC}$  Isolation: If Either  $V_{CC}$  is at GND, Both Ports are in the High-Impedance State**
- **$I_{OFF}$ : Supports Partial-Power-Down Mode Operation**
- **Extended Temperature: -40°C to +125°C**

## 2 APPLICATIONS

- Handset
- Smartphone
- Tablet
- Desktop PC

## 3 DESCRIPTIONS

This 8-bit non-inverting bus transceiver is a bidirectional voltage-level translator and can be used to establish digital switching compatibility between mixed-voltage systems. It uses two separate configurable power-supply rails, Both  $V_{CC(A)}$  and  $V_{CC(B)}$  supporting operating voltages from 1.65V to 5.5V, A ports, DIR and  $\overline{OE}$  tracks the  $V_{CCA}$  supply and B ports tracks the  $V_{CCB}$  supply. This allows the support of both lower and higher logic signal levels while providing bidirectional translation capabilities between any of the 1.8V, 2.5V, 3.3V and 5.5V voltage nodes.

The RS8T245 is designed for asynchronous communication between two data buses. The logic levels of the direction-control (DIR) input and the output-enable ( $\overline{OE}$ ) input activate either the B-port outputs or the A-port outputs or place both output ports into the high-impedance mode. The device transmits data from the A bus to the B bus when the B-port outputs are activated, and from the B bus to the A bus when the A-port outputs are activated. The input circuitry on both A and B ports is always active and must have a logic HIGH or LOW level applied to prevent excess  $I_{CC}$  and  $I_{CCZ}$ .

This device is fully specified for partial-power-down applications using  $I_{OFF}$ . The  $I_{OFF}$  circuitry disables the outputs, preventing damaging current backflow through the device when it is powered down.

The  $V_{CC}$  isolation feature ensures that if either  $V_{CC}$  input is at GND, all outputs are in the high-impedance state. To ensure the high-impedance state during power up or power down,  $\overline{OE}$  should be tied to  $V_{CC}$  through a pullup resistor, the minimum value of the resistor is determined by the current-sinking capability of the driver.

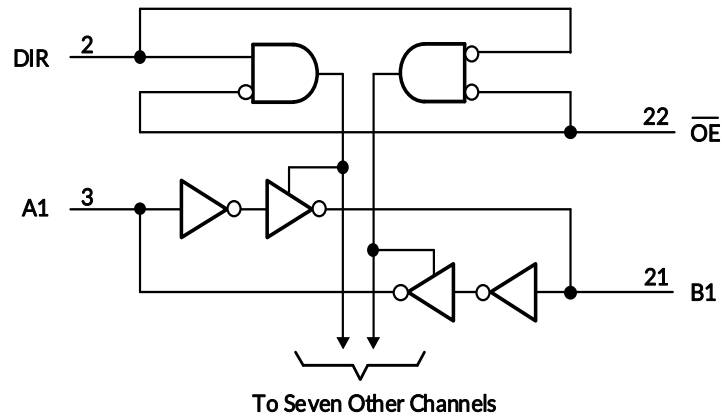
The RS8T245 is designed so that the control pins (DIR and  $\overline{OE}$ ) are supplied by  $V_{CCA}$ . It operates over an ambient temperature range of -40°C to +125°C.

**Device Information <sup>(1)</sup>**

| PART NUMBER | PACKAGE | BODY SIZE (NOM) |
|-------------|---------|-----------------|
| RS8T245     | TSSOP24 | 7.80mm×4.40mm   |
|             | SOP24   | 15.40mm×7.50mm  |

(1) For all available packages, see the orderable addendum at the end of the data sheet.

### 4 Functional Block Diagram



**Function Table**

| CONTROL INPUTS  |     | OUTPUT CIRCUITS |         | OPERATION       |
|-----------------|-----|-----------------|---------|-----------------|
| $\overline{OE}$ | DIR | A PORT          | B PORT  |                 |
| L               | L   | Enabled         | Hi-Z    | B data to A bus |
| L               | H   | Hi-Z            | Enabled | A data to B bus |
| H               | X   | Hi-Z            | Hi-Z    | Isolation       |

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## 5 Revision History

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

| <b>VERSION</b> | <b>Change Date</b> | <b>Change Item</b>   |
|----------------|--------------------|--|
| A.0            | 2020/08/01         | Initial version completed  |
| A.1            | 2021/03/25         | Add SOP24 package  |
| A.2            | 2021/07/14         | Changed TSSOP24 Package quantities in Page 7@ A.1 Version  |
| A.3            | 2022/08/31         | 1. Added the TAPE AND REEL INFORMATION<br>2. Modify Application Information                          |
| A.4            | 2022/12/14         | Changed Recommended Operating Conditions and Switching Characteristics and Operating Characteristics |
| A.4.1          | 2024/02/23         | Modify packaging naming  |
| A.5            | 2024/04/01         | Update PACKAGE note  |

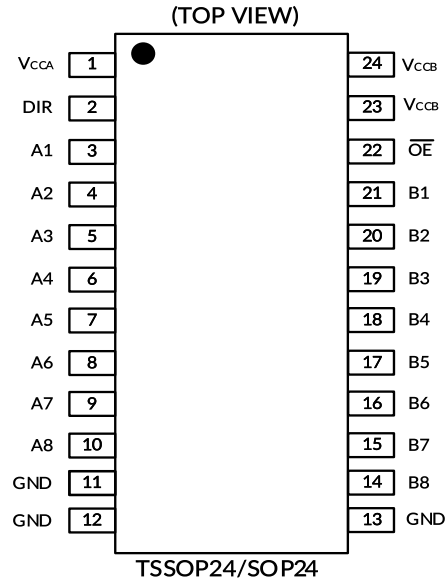
**6 PACKAGE/ORDERING INFORMATION <sup>(1)</sup>**

| PRODUCT | ORDERING NUMBER | TEMPERATURE RANGE | PACKAGE LEAD | PACKAGE MARKING <sup>(2)</sup> | MSL <sup>(3)</sup> | PACKAGE OPTION      |
|---------|-----------------|-------------------|--------------|--------------------------------|--------------------|---------------------|
| RS8T245 | RS8T245YTSS24   | -40°C ~+125°C     | TSSOP24      | RS8T245                        | MSL3               | Tape and Reel, 4000 |
|         | RS8T245YS24     | -40°C ~+125°C     | SOP24        | RS8T245                        | MSL3               | Tape and Reel, 1200 |

## NOTE:

- (1) 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 right-hand navigation.
- (2) There may be additional marking, which relates to the lot trace code information (data code and vendor code), the logo or the environmental category on the device.
- (3) MSL, The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications.

## 7 PIN CONFIGURATIONS



### PIN DESCRIPTION

| PIN           | NAME             | TYPE <sup>(1)</sup> | FUNCTION   |
|---------------|------------------|---------------------|--|
| TSSOP24/SOP24 |                  |                     |  |
| 3             | A1               | I/O                 | Input/output A1. Reference to V <sub>CCA</sub> .   |
| 4             | A2               | I/O                 | Input/output A2. Reference to V <sub>CCA</sub> .   |
| 5             | A3               | I/O                 | Input/output A3. Reference to V <sub>CCA</sub> .   |
| 6             | A4               | I/O                 | Input/output A4. Reference to V <sub>CCA</sub> .   |
| 7             | A5               | I/O                 | Input/output A5. Reference to V <sub>CCA</sub> .   |
| 8             | A6               | I/O                 | Input/output A6. Reference to V <sub>CCA</sub> .   |
| 9             | A7               | I/O                 | Input/output A7. Reference to V <sub>CCA</sub> .   |
| 10            | A8               | I/O                 | Input/output A8. Reference to V <sub>CCA</sub> .   |
| 14            | B8               | I/O                 | Input/output B8. Reference to V <sub>CCB</sub> .   |
| 15            | B7               | I/O                 | Input/output B7. Reference to V <sub>CCB</sub> .   |
| 16            | B6               | I/O                 | Input/output B6. Reference to V <sub>CCB</sub> .   |
| 17            | B5               | I/O                 | Input/output B5. Reference to V <sub>CCB</sub> .   |
| 18            | B4               | I/O                 | Input/output B4. Reference to V <sub>CCB</sub> .   |
| 19            | B3               | I/O                 | Input/output B3. Reference to V <sub>CCB</sub> .   |
| 20            | B2               | I/O                 | Input/output B2. Reference to V <sub>CCB</sub> .   |
| 21            | B1               | I/O                 | Input/output B1. Reference to V <sub>CCB</sub> .   |
| 2             | DIR              | I                   | Direction-control signal.  |
| 11,12,13      | GND              | G                   | Ground.  |
| 22            | $\overline{OE}$  | I                   | Output Enable (Active Low). Pull $\overline{OE}$ high to place all outputs in 3-state mode. Referenced to V <sub>CCA</sub> . |
| 1             | V <sub>CCA</sub> | P                   | A-port supply voltage. $1.65V \leq V_{CCA} \leq 5.5V$  |
| 23,24         | V <sub>CCB</sub> | P                   | B-port supply voltage. $1.65V \leq V_{CCB} \leq 5.5V$  |

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

## 8 SPECIFICATIONS

### 8.1 Absolute Maximum Ratings

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

| SYMBOL                           | PARAMETER  | MIN               | MAX  | UNIT                  |      |
|----------------------------------|--|-------------------|------|-----------------------|------|
| V <sub>CCA</sub>                 | Supply Voltage Range   | -0.5              | 6.5  | V                     |      |
| V <sub>CCB</sub>                 | Supply Voltage Range   | -0.5              | 6.5  | V                     |      |
| V <sub>I</sub> <sup>(2)</sup>    | Input Voltage Range  | A port            | -0.5 | 6.5                   | V    |
|                                  |  | B port            | -0.5 | 6.5                   |      |
|                                  |  | Control inputs    | -0.5 | 6.5                   |      |
| V <sub>O</sub> <sup>(2)</sup>    | Voltage range applied to any output in the high-impedance or power-off state | A port            | -0.5 | 6.5                   | V    |
|                                  |  | B port            | -0.5 | 6.5                   |      |
| V <sub>O</sub> <sup>(2)(3)</sup> | Voltage range applied to any output in the high or low state                 | A port            | -0.5 | V <sub>CCA</sub> +0.5 | V    |
|                                  |  | B port            | -0.5 | V <sub>CCB</sub> +0.5 |      |
| I <sub>IK</sub>                  | Input clamp current  | V <sub>I</sub> <0 |      | -50                   | mA   |
| I <sub>OK</sub>                  | Output clamp current   | V <sub>O</sub> <0 |      | -50                   | mA   |
| I <sub>O</sub>                   | Continuous output current  |                   |      | ±50                   | mA   |
|                                  | Continuous current through V <sub>CCA</sub> , V <sub>CCB</sub> or GND        |                   |      | ±100                  | mA   |
| θ <sub>JA</sub>                  | Package thermal impedance <sup>(4)</sup>                                     | TSSOP24           |      | 35                    | °C/W |
|                                  |  | SOP24             |      | 85                    |      |
| T <sub>J</sub>                   | Junction Temperature <sup>(5)</sup>  | -40               | 150  |                       | °C   |
| T <sub>stg</sub>                 | Storage temperature  | -65               | +150 |                       |      |

(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 to absolute-maximum-rated conditions for extended periods may affect device reliability.

(2) The input and output negative-voltage ratings may be exceeded if the input and output current ratings are observed.

(3) The value of V<sub>CCA</sub> and V<sub>CCB</sub> are provided in the recommended operating conditions table.

(4) The package thermal impedance is calculated in accordance with JESD-51.

(5) The maximum power dissipation is a function of T<sub>J(MAX)</sub>, R<sub>θJA</sub>, and T<sub>A</sub>. The maximum allowable power dissipation at any ambient temperature is P<sub>D</sub> = (T<sub>J(MAX)</sub> - T<sub>A</sub>) / R<sub>θJA</sub>. All numbers apply for packages soldered directly onto a PCB.

### 8.2 ESD Ratings

The following ESD information is provided for handling of ESD-sensitive devices in an ESD protected area only.

|                    |                         | VALUE   | UNIT  |   |
|--------------------|-------------------------|---|-------|---|
| V <sub>(ESD)</sub> | Electrostatic discharge | Human-body model (HBM), per ANSI/ESDA/JEDEC JS-001 <sup>(1)</sup> | ±3000 | V |
|                    |                         | Machine Model (MM)  | ±400  | V |

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



#### ESD SENSITIVITY CAUTION

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

### 8.3 Recommended Operating Conditions

$V_{CCI}$  is the supply voltage associated with the input port.  $V_{CCO}$  is the supply voltage associated with the output port.

| PARAMETER  |  | $V_{CCI}^{(1)}$ | $V_{CCO}^{(2)}$ | MIN                   | TYP | MAX                   | UNIT |
|--|--|-----------------|-----------------|-----------------------|-----|-----------------------|------|
| Supply voltage <sup>(1)</sup>                              | $V_{CCA}$  |                 |                 | 1.65                  |     | 5.5                   | V    |
|  | $V_{CCB}$  |                 |                 | 1.65                  |     | 5.5                   |      |
| High-level input Voltage ( $V_{IH}$ )                      | Data inputs <sup>(5)</sup>                               | 1.65V to 1.95V  |                 | $V_{CCI} \times 0.75$ |     |                       | V    |
|  |  | 2.3V to 2.7V    |                 | $V_{CCI} \times 0.7$  |     |                       |      |
|  |  | 3V to 3.6V      |                 | $V_{CCI} \times 0.7$  |     |                       |      |
|  |  | 4.5V to 5.5V    |                 | $V_{CCI} \times 0.7$  |     |                       |      |
| Low-level input Voltage ( $V_{IL}$ )                       | Data inputs <sup>(5)</sup>                               | 1.65V to 1.95V  |                 |                       |     | $V_{CCI} \times 0.35$ | V    |
|  |  | 2.3V to 2.7V    |                 |                       |     | $V_{CCI} \times 0.3$  |      |
|  |  | 3V to 3.6V      |                 |                       |     | $V_{CCI} \times 0.3$  |      |
|  |  | 4.5V to 5.5V    |                 |                       |     | $V_{CCI} \times 0.3$  |      |
| High-level input Voltage ( $V_{IH}$ )                      | Control inputs (referenced to $V_{CCA}$ ) <sup>(6)</sup> | 1.65V to 1.95V  |                 | $V_{CCA} \times 0.75$ |     |                       | V    |
|  |  | 2.3V to 2.7V    |                 | $V_{CCA} \times 0.7$  |     |                       |      |
|  |  | 3V to 3.6V      |                 | $V_{CCA} \times 0.7$  |     |                       |      |
|  |  | 4.5V to 5.5V    |                 | $V_{CCA} \times 0.7$  |     |                       |      |
| Low-level input Voltage ( $V_{IL}$ )                       | Control inputs (referenced to $V_{CCA}$ ) <sup>(6)</sup> | 1.65V to 1.95V  |                 |                       |     | $V_{CCA} \times 0.35$ | V    |
|  |  | 2.3V to 2.7V    |                 |                       |     | $V_{CCA} \times 0.3$  |      |
|  |  | 3V to 3.6V      |                 |                       |     | $V_{CCA} \times 0.3$  |      |
|  |  | 4.5V to 5.5V    |                 |                       |     | $V_{CCA} \times 0.3$  |      |
| Input voltage ( $V_i$ )                                    | Control inputs <sup>(4)</sup>                            |                 |                 | 0                     |     | 5.5                   | V    |
| Input/output voltage ( $V_{I/O}$ )                         | Active state   |                 |                 | 0                     |     | $V_{CCO}$             | V    |
|  | 3-state  |                 |                 | 0                     |     | 5.5                   | V    |
| High-level output current ( $I_{OH}$ )                     |  |                 | 1.65V to 1.95V  |                       |     | -4                    | mA   |
|  |  |                 | 2.3V to 2.7V    |                       |     | -8                    |      |
|  |  |                 | 3V to 3.6V      |                       |     | -24                   |      |
|  |  |                 | 4.5V to 5.5V    |                       |     | -32                   |      |
| Low-level output current ( $I_{OL}$ )                      |  |                 | 1.65V to 1.95V  |                       |     | 4                     | mA   |
|  |  |                 | 2.3V to 2.7V    |                       |     | 8                     |      |
|  |  |                 | 3V to 3.6V      |                       |     | 24                    |      |
|  |  |                 | 4.5V to 5.5V    |                       |     | 32                    |      |
| Input transition rise or fall rate ( $\Delta t/\Delta v$ ) | Data inputs <sup>(3)</sup>                               | 1.65V to 1.95V  |                 |                       |     | 20                    | ns/V |
|  |  | 2.3V to 2.7V    |                 |                       |     | 20                    |      |
|  |  | 3V to 3.6V      |                 |                       |     | 10                    |      |
|  |  | 4.5V to 5.5V    |                 |                       |     | 5                     |      |
| T <sub>A</sub> Operating free-air temperature              |  |                 |                 | -40                   |     | 125                   | °C   |

(1)  $V_{CCI}$  is the  $V_{CC}$  associated with the data input port.

(2)  $V_{CCO}$  is the  $V_{CC}$  associated with the output port.

(3) All unused or driven (floating) data inputs (I/Os) of the device must be held at logic HIGH or LOW (preferably  $V_{CCI}$  or GND) to ensure proper device operation and minimize power.

(4) All unused control inputs must be held at  $V_{CCA}$  or GND to ensure proper device operation and minimize power consumption.

(5) For  $V_{CCI}$  values not specified in the data sheet,  $V_{IH} \text{ min} = V_{CCI} \times 0.7 \text{ V}$ ,  $V_{IL} \text{ max} = V_{CCI} \times 0.3 \text{ V}$ .

(6) For  $V_{CCA}$  values not specified in the data sheet,  $V_{IH} \text{ min} = V_{CCA} \times 0.7 \text{ V}$ ,  $V_{IL} \text{ max} = V_{CCA} \times 0.3 \text{ V}$ .



## 8.4 Electrical Characteristics

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

| PARAMETER   | CONDITIONS  | V <sub>CCA</sub>                         | V <sub>CCB</sub> | TEMP  | MIN <sup>(3)</sup>     | TYP <sup>(4)</sup> | MAX <sup>(3)</sup> | UNIT |
|---|---|--|------------------|-------|------------------------|--------------------|--------------------|------|
| V <sub>OH</sub>   | I <sub>OH</sub> = -100 μA V <sub>I</sub> =V <sub>IH</sub>                     | 1.65V to 4.5V                            | 1.65V to 4.5V    | Full  | V <sub>CCO</sub> - 0.1 |                    |                    | V    |
|   | I <sub>OH</sub> = -4mA V <sub>I</sub> =V <sub>IH</sub>                        | 1.65V                                    | 1.65V            |       | 1.2                    |                    |                    |      |
|   | I <sub>OH</sub> = -8mA V <sub>I</sub> =V <sub>IH</sub>                        | 2.3V                                     | 2.3V             |       | 1.9                    |                    |                    |      |
|   | I <sub>OH</sub> = -24mA V <sub>I</sub> =V <sub>IH</sub>                       | 3V                                       | 3V               |       | 2.4                    |                    |                    |      |
|   | I <sub>OH</sub> = -32mA V <sub>I</sub> =V <sub>IH</sub>                       | 4.5V                                     | 4.5V             |       | 3.8                    |                    |                    |      |
| V <sub>OL</sub>   | I <sub>OL</sub> = 100 μA V <sub>I</sub> =V <sub>IL</sub>                      | 1.65V to 4.5V                            | 1.65V to 4.5V    | Full  |                        |                    | 0.1                | V    |
|   | I <sub>OL</sub> = 4mA V <sub>I</sub> =V <sub>IL</sub>                         | 1.65V                                    | 1.65V            |       |                        |                    | 0.45               |      |
|   | I <sub>OL</sub> = 8mA V <sub>I</sub> =V <sub>IL</sub>                         | 2.3V                                     | 2.3V             |       |                        |                    | 0.3                |      |
|   | I <sub>OL</sub> = 24mA V <sub>I</sub> =V <sub>IL</sub>                        | 3V                                       | 3V               |       |                        |                    | 0.55               |      |
|   | I <sub>OL</sub> = 32mA V <sub>I</sub> =V <sub>IL</sub>                        | 4.5V                                     | 4.5V             |       |                        |                    | 0.55               |      |
| I <sub>I</sub> DIR  | V <sub>I</sub> = V <sub>CCA</sub> or GND                                      | 1.65V to 5.5V                            | 1.65V to 5.5V    | +25°C |                        |                    | ±1                 | μA   |
|   |   |  |                  | Full  |                        |                    | ±2                 |      |
| I <sub>off</sub> A or B Port                                | V <sub>I</sub> or V <sub>O</sub> = 0 to 5.5V                                  | 0V                                       | 0V to 5.5V       | +25°C |                        |                    | ±1                 | μA   |
|   |   | 0V to 5.5V                               | 0V               | Full  |                        |                    | ±2                 |      |
| I <sub>OZ</sub> <sup>(5)</sup> A or B Port                  | V <sub>O</sub> = V <sub>CCO</sub> or GND,<br>OE=V <sub>IH</sub>               | 1.65V to 5.5V                            | 1.65V to 5.5V    | +25°C |                        |                    | ±1                 | μA   |
|   |   |  |                  | Full  |                        |                    | ±2                 |      |
| I <sub>CCA</sub> V <sub>CCA</sub> supply current            | V <sub>I</sub> = V <sub>CCi</sub> or GND <sup>(6)</sup><br>I <sub>O</sub> = 0 | 1.65V to 5.5V                            | 1.65V to 5.5V    | Full  |                        |                    | 15                 | μA   |
|   |   | 5V                                       | 0V               | Full  |                        |                    | 15                 |      |
|   |   | 0V                                       | 5V               | Full  |                        |                    | -2                 |      |
| I <sub>CCB</sub> V <sub>CCB</sub> supply current            | V <sub>I</sub> = V <sub>CCi</sub> or GND <sup>(6)</sup><br>I <sub>O</sub> = 0 | 1.65V to 5.5V                            | 1.65V to 5.5V    | Full  |                        |                    | 15                 | μA   |
|   |   | 5V                                       | 0V               | Full  |                        |                    | -2                 |      |
|   |   | 0V                                       | 5V               | Full  |                        |                    | 15                 |      |
| 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                | 1.65V to 5.5V                            | 1.65V to 5.5V    | Full  |                        |                    | 25                 | μA   |
| ΔI <sub>CCA</sub>   | A port  | 3V to 5.5V                               | 3V to 5.5V       | Full  |                        |                    | 50                 | μA   |
|   | DIR   |  |                  |       |                        |                    |                    |      |
| ΔI <sub>CCB</sub>   | B port  | 3V to 5.5V                               | 3V to 5.5V       | Full  |                        |                    | 50                 | μA   |
| C <sub>I</sub>  | Control inputs  | V <sub>I</sub> = V <sub>CCA</sub> or GND | 3.3V             | 3.3V  | +25°C                  |                    | 4                  | pF   |
| C <sub>IO</sub>   | A port  |  | 3.3V             | 3.3V  | +25°C                  |                    | 8.5                | pF   |
|   | B port  |  | 3.3V             | 3.3V  | +25°C                  |                    | 8.5                |      |

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

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

(3) Limits are 100% production tested at 25°C. Limits over the operating temperature range are ensured through correlations using statistical quality control (SQC) method.

(4) Typical values represent the most likely parametric norm as determined at the time of characterization. Actual typical values may vary over time and will also depend on the application and configuration.

(5) For I/O ports, the parameter I<sub>OZ</sub> includes the input leakage current.

(6) Hold all unused data inputs of the device at V<sub>CCi</sub> or GND to assure proper device operation.

## 8.5 Switching Characteristics

### 8.5.1 $V_{CCA}=1.8V\pm 0.15V$

over recommended operating free-air temperature range, Full=-40°C to 125°C.

| PARAMETER | FROM (INPUT)    | TO (OUTPUT) | TEMP | $V_{CCB}=1.8V \pm 0.15V^{(1)}$ |      | $V_{CCB}=2.5V \pm 0.2V^{(1)}$ |      | $V_{CCB}=3.3V \pm 0.3V^{(1)}$ |      | $V_{CCB}=5V \pm 0.5V^{(1)}$ |      | UNIT |
|-----------|-----------------|-------------|------|--------------------------------|------|-------------------------------|------|-------------------------------|------|-----------------------------|------|------|
|           |                 |             |      | MIN                            | MAX  | MIN                           | MAX  | MIN                           | MAX  | MIN                         | MAX  |      |
| $t_{PLH}$ | An              | Bn          | Full | 2.0                            | 24.6 | 1.5                           | 17.2 | 1.2                           | 18.6 | 0.9                         | 18.5 | ns   |
| $t_{PHL}$ |                 |             |      |                                |      |                               |      |                               |      |                             |      |      |
| $t_{PLH}$ | Bn              | An          | Full | 1.0                            | 24.6 | 0.9                           | 24.5 | 0.8                           | 23.2 | 0.8                         | 23.2 | ns   |
| $t_{PHL}$ |                 |             |      |                                |      |                               |      |                               |      |                             |      |      |
| $t_{PHZ}$ | $\overline{OE}$ | An          | Full | 1.8                            | 31.5 | 1.8                           | 21.9 | 1.8                           | 25.2 | 1.6                         | 20.3 | ns   |
| $t_{PLZ}$ |                 |             |      |                                |      |                               |      |                               |      |                             |      |      |
| $t_{PHZ}$ | $\overline{OE}$ | Bn          | Full | 2.8                            | 27.9 | 2.2                           | 29.0 | 2.0                           | 30.2 | 1.5                         | 28.4 | ns   |
| $t_{PLZ}$ |                 |             |      |                                |      |                               |      |                               |      |                             |      |      |
| $t_{PZH}$ | $\overline{OE}$ | An          | Full | 0.5                            | 29.7 | 0.5                           | 21.2 | 0.5                           | 23.0 | 0.5                         | 18.2 | ns   |
| $t_{PZL}$ |                 |             |      |                                |      |                               |      |                               |      |                             |      |      |
| $t_{PZH}$ | $\overline{OE}$ | Bn          | Full | 2.1                            | 23.9 | 1.8                           | 24.0 | 1.4                           | 38.7 | 1.0                         | 41.6 | ns   |
| $t_{PZL}$ |                 |             |      |                                |      |                               |      |                               |      |                             |      |      |

(1) This parameter is ensured by design and/or characterization and is not tested in production.

### 8.5.2 $V_{CCA}=2.5V\pm 0.2V$

over recommended operating free-air temperature range, Full=-40°C to 125°C.

| PARAMETER | FROM (INPUT)    | TO (OUTPUT) | TEMP | $V_{CCB}=1.8V \pm 0.15V^{(1)}$ |      | $V_{CCB}=2.5V \pm 0.2V^{(1)}$ |      | $V_{CCB}=3.3V \pm 0.3V^{(1)}$ |      | $V_{CCB}=5V \pm 0.5V^{(1)}$ |      | UNIT |
|-----------|-----------------|-------------|------|--------------------------------|------|-------------------------------|------|-------------------------------|------|-----------------------------|------|------|
|           |                 |             |      | MIN                            | MAX  | MIN                           | MAX  | MIN                           | MAX  | MIN                         | MAX  |      |
| $t_{PLH}$ | An              | Bn          | Full | 1.8                            | 24.5 | 1.4                           | 16.5 | 0.9                           | 15.4 | 0.7                         | 16.6 | ns   |
| $t_{PHL}$ |                 |             |      |                                |      |                               |      |                               |      |                             |      |      |
| $t_{PLH}$ | Bn              | An          | Full | 1.4                            | 17.2 | 1.2                           | 16.5 | 1.2                           | 16.2 | 1.0                         | 16.2 | ns   |
| $t_{PHL}$ |                 |             |      |                                |      |                               |      |                               |      |                             |      |      |
| $t_{PHZ}$ | $\overline{OE}$ | An          | Full | 1.6                            | 29.3 | 1.6                           | 18.0 | 1.6                           | 21.6 | 1.6                         | 15.9 | ns   |
| $t_{PLZ}$ |                 |             |      |                                |      |                               |      |                               |      |                             |      |      |
| $t_{PHZ}$ | $\overline{OE}$ | Bn          | Full | 2.7                            | 17.1 | 2.1                           | 16.7 | 2.0                           | 17.0 | 1.0                         | 18.6 | ns   |
| $t_{PLZ}$ |                 |             |      |                                |      |                               |      |                               |      |                             |      |      |
| $t_{PZH}$ | $\overline{OE}$ | An          | Full | 1.2                            | 25.1 | 1.2                           | 16.7 | 1.2                           | 18.2 | 1.2                         | 13.5 | ns   |
| $t_{PZL}$ |                 |             |      |                                |      |                               |      |                               |      |                             |      |      |
| $t_{PZH}$ | $\overline{OE}$ | Bn          | Full | 2.0                            | 16.7 | 1.8                           | 15.3 | 1.4                           | 24.2 | 1.2                         | 22.1 | ns   |
| $t_{PZL}$ |                 |             |      |                                |      |                               |      |                               |      |                             |      |      |

(1) This parameter is ensured by design and/or characterization and is not tested in production.

### 8.5.3 $V_{CCA}=3.3V\pm 0.3V$

over recommended operating free-air temperature range, Full=-40°C to 125°C.

| PARAMETER | FROM (INPUT)    | TO (OUTPUT) | TEMP | $V_{CCB}=1.8V \pm 0.15V^{(1)}$ |      | $V_{CCB}=2.5V \pm 0.2V^{(1)}$ |      | $V_{CCB}=3.3V \pm 0.3V^{(1)}$ |      | $V_{CCB}=5V \pm 0.5V^{(1)}$ |      | UNIT |
|-----------|-----------------|-------------|------|--------------------------------|------|-------------------------------|------|-------------------------------|------|-----------------------------|------|------|
|           |                 |             |      | MIN                            | MAX  | MIN                           | MAX  | MIN                           | MAX  | MIN                         | MAX  |      |
| $t_{PLH}$ | An              | Bn          | Full | 1.8                            | 23.2 | 1.3                           | 16.2 | 0.9                           | 15.2 | 0.6                         | 15.1 | ns   |
| $t_{PHL}$ |                 |             |      |                                |      |                               |      |                               |      |                             |      |      |
| $t_{PLH}$ | Bn              | An          | Full | 0.9                            | 18.6 | 0.9                           | 15.4 | 0.8                           | 15.2 | 0.7                         | 15.8 | ns   |
| $t_{PHL}$ |                 |             |      |                                |      |                               |      |                               |      |                             |      |      |
| $t_{PHZ}$ | $\overline{OE}$ | An          | Full | 1.9                            | 27.2 | 1.9                           | 17.4 | 1.9                           | 20.1 | 1.9                         | 15.2 | ns   |
| $t_{PLZ}$ |                 |             |      |                                |      |                               |      |                               |      |                             |      |      |
| $t_{PHZ}$ | $\overline{OE}$ | Bn          | Full | 2.5                            | 21.8 | 2.0                           | 19.7 | 1.8                           | 20.0 | 0.9                         | 19.2 | ns   |
| $t_{PLZ}$ |                 |             |      |                                |      |                               |      |                               |      |                             |      |      |
| $t_{PZH}$ | $\overline{OE}$ | An          | Full | 0.9                            | 23.4 | 0.9                           | 16.2 | 0.9                           | 17.9 | 0.9                         | 13.4 | ns   |
| $t_{PZL}$ |                 |             |      |                                |      |                               |      |                               |      |                             |      |      |
| $t_{PZH}$ | $\overline{OE}$ | Bn          | Full | 2.1                            | 13.5 | 1.6                           | 14.0 | 1.3                           | 17.0 | 1.0                         | 17.1 | ns   |
| $t_{PZL}$ |                 |             |      |                                |      |                               |      |                               |      |                             |      |      |

(1) This parameter is ensured by design and/or characterization and is not tested in production.

### 8.5.4 $V_{CCA}=5V\pm 0.5V$

over recommended operating free-air temperature range, Full=-40°C to 125°C.

| PARAMETER | FROM (INPUT)    | TO (OUTPUT) | TEMP | $V_{CCB}=1.8V \pm 0.15V^{(1)}$ |      | $V_{CCB}=2.5V \pm 0.2V^{(1)}$ |      | $V_{CCB}=3.3V \pm 0.3V^{(1)}$ |      | $V_{CCB}=5V \pm 0.5V^{(1)}$ |      | UNIT |
|-----------|-----------------|-------------|------|--------------------------------|------|-------------------------------|------|-------------------------------|------|-----------------------------|------|------|
|           |                 |             |      | MIN                            | MAX  | MIN                           | MAX  | MIN                           | MAX  | MIN                         | MAX  |      |
| $t_{PLH}$ | An              | Bn          | Full | 1.8                            | 23.2 | 1.2                           | 16.2 | 0.8                           | 15.8 | 0.5                         | 15.2 | ns   |
| $t_{PHL}$ |                 |             |      |                                |      |                               |      |                               |      |                             |      |      |
| $t_{PLH}$ | Bn              | An          | Full | 0.8                            | 18.5 | 0.5                           | 16.6 | 0.4                           | 15.1 | 0.4                         | 15.2 | ns   |
| $t_{PHL}$ |                 |             |      |                                |      |                               |      |                               |      |                             |      |      |
| $t_{PHZ}$ | $\overline{OE}$ | An          | Full | 0.4                            | 27.8 | 0.4                           | 17.4 | 0.4                           | 19.2 | 0.4                         | 15.5 | ns   |
| $t_{PLZ}$ |                 |             |      |                                |      |                               |      |                               |      |                             |      |      |
| $t_{PHZ}$ | $\overline{OE}$ | Bn          | Full | 2.4                            | 14.6 | 1.9                           | 14.4 | 1.6                           | 14.6 | 0.8                         | 14.7 | ns   |
| $t_{PLZ}$ |                 |             |      |                                |      |                               |      |                               |      |                             |      |      |
| $t_{PZH}$ | $\overline{OE}$ | An          | Full | 0.8                            | 24.5 | 0.8                           | 16.5 | 0.8                           | 18.3 | 0.8                         | 13.5 | ns   |
| $t_{PZL}$ |                 |             |      |                                |      |                               |      |                               |      |                             |      |      |
| $t_{PZH}$ | $\overline{OE}$ | Bn          | Full | 1.8                            | 12.8 | 1.5                           | 12.8 | 1.2                           | 12.8 | 1.0                         | 12.8 | ns   |
| $t_{PZL}$ |                 |             |      |                                |      |                               |      |                               |      |                             |      |      |

(1) This parameter is ensured by design and/or characterization and is not tested in production.

## 8.6 Operating Characteristics

$T_A=25^\circ C$

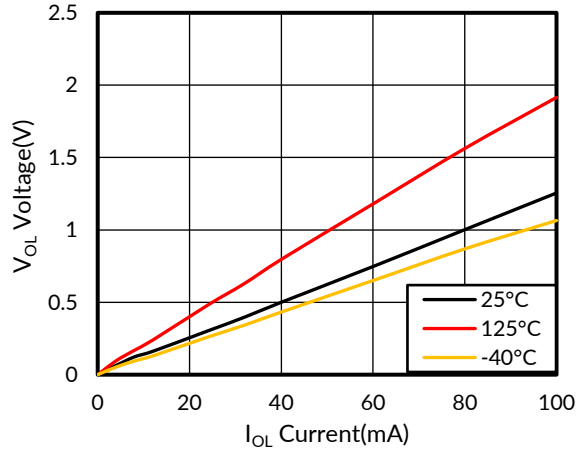
| PARAMETER       | TEST CONDITIONS             | $V_{CCA}=V_{CCB}=1.8V$ | $V_{CCA}=V_{CCB}=2.5V$ | $V_{CCA}=V_{CCB}=3.3V$ | $V_{CCA}=V_{CCB}=5V$ | UNIT |
|-----------------|-----------------------------|------------------------|------------------------|------------------------|----------------------|------|
|                 |                             | TYP                    | TYP                    | TYP                    | TYP                  |      |
| $C_{pdA}^{(1)}$ | A-port input, B-port output | 3                      | 4                      | 6                      | 9                    | pF   |
|                 | B-port input, A-port output | 14                     | 17                     | 22                     | 32                   |      |
| $C_{pdB}^{(1)}$ | A-port input, B-port output | 14                     | 16                     | 21                     | 32                   |      |
|                 | B-port input, A-port output | 3                      | 4                      | 6                      | 9                    |      |

(1) Power dissipation capacitance per transceiver

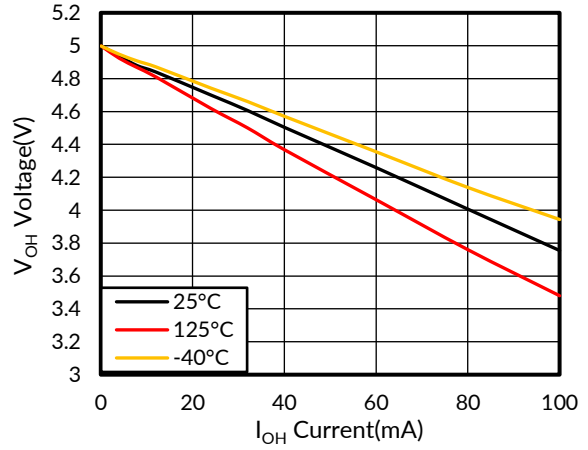
## 8.7 Typical Characteristics

NOTE: The graphs and tables provided following this note are a statistical summary based on a limited number of samples and are provided for informational purposes only.

At  $T_A = +25^\circ\text{C}$ ,  $V_{CCA}=5\text{V}$ ,  $V_{CCB}=5\text{V}$ , unless otherwise noted.

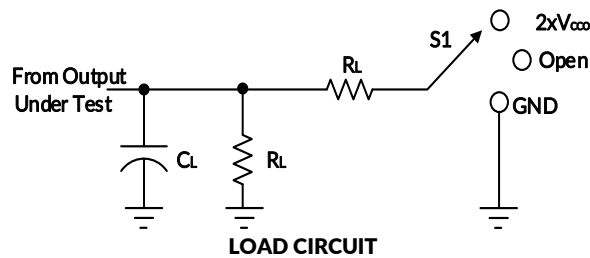


**Figure 1. Voltage vs Current**



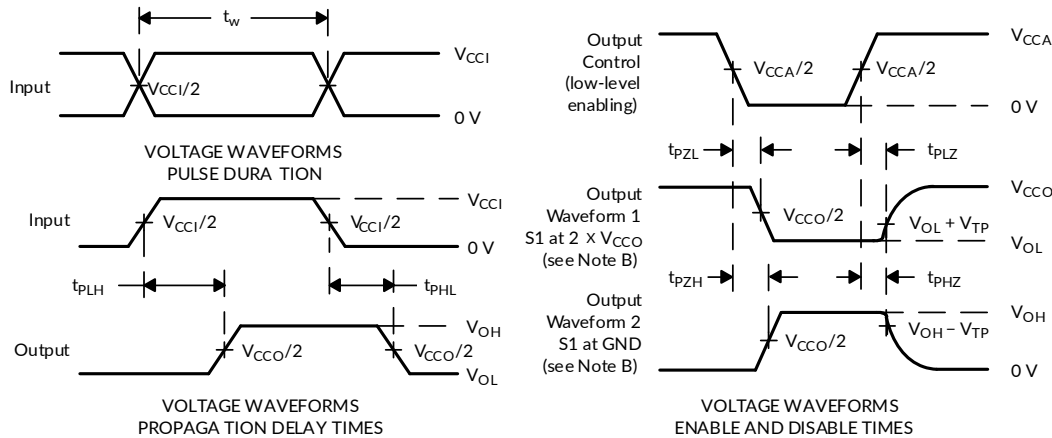
**Figure 2. Voltage vs Current**

## 9 Parameter Measurement Information



| TEST              | S1            |
|-------------------|---------------|
| $t_{pd}$          | Open          |
| $t_{PLZ}/t_{PZL}$ | 2 X $V_{CCO}$ |
| $t_{PHZ}/t_{PZH}$ | GND           |

| $V_{CC}$   | $C_L$ | $R_L$ | $V_{TP}$ |
|------------|-------|-------|----------|
| 1.8V±0.15V | 15pF  | 2kΩ   | 0.15V    |
| 2.5V±0.2V  | 15pF  | 2kΩ   | 0.15V    |
| 3.3V±0.3V  | 15pF  | 2kΩ   | 0.3V     |
| 5V±0.5V    | 15pF  | 2kΩ   | 0.3V     |



NOTES: A.  $C_L$  includes probe and jig capacitance.

B. Waveform 1 is for an output with internal conditions such that the output is low, except when disabled by the output control.

Waveform 2 is for an output with internal conditions such that the output is high, except when disabled by the output control.

C. All input pulses are supplied by generators having the following characteristics:  $PRR \leq 10$  MHz,  $Z_o = 50\Omega$ ,  $dv/dt \geq 1V/ns$ .

D. The outputs are measured one at a time, with one transition per measurement.

E.  $t_{PLZ}$  and  $t_{PHZ}$  are the same as  $t_{dis}$ .

F.  $t_{PZL}$  and  $t_{PZH}$  are the same as  $t_{en}$ .

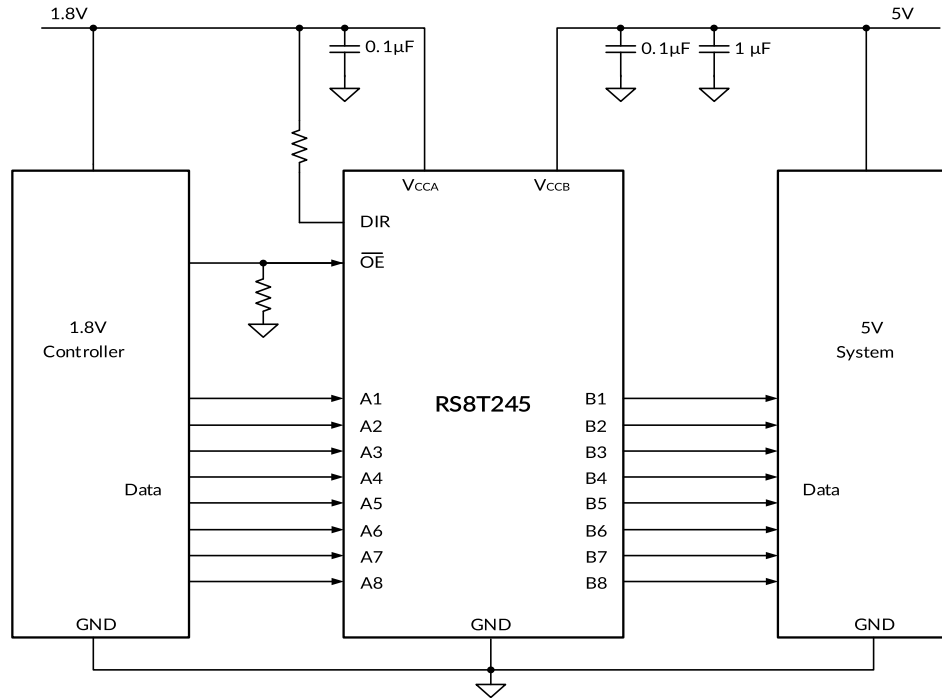
G.  $t_{PLH}$  and  $t_{PHL}$  are the same as  $t_{pd}$ .

H. All parameters and waveforms are not applicable to all devices.

**Figure 3. Load Circuit and Voltage Waveforms**

## 10 Application Information

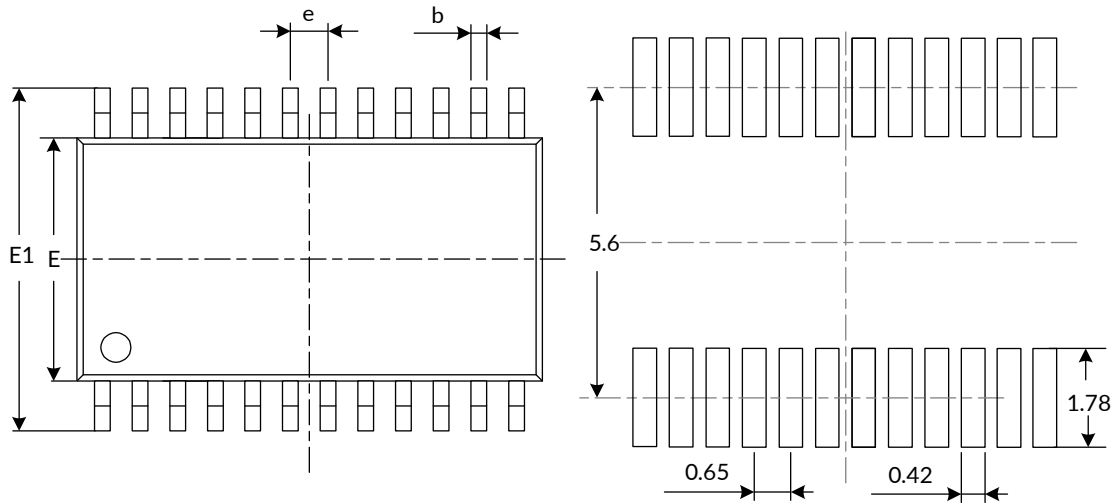
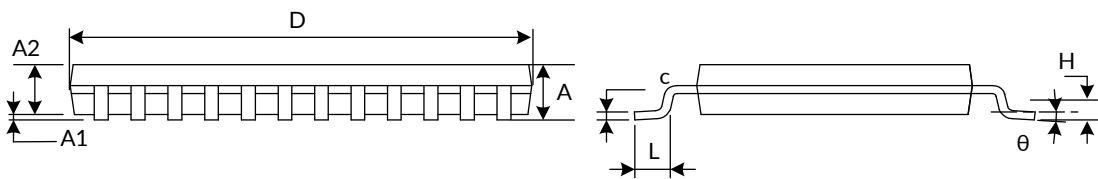
The RS8T245 device can be used in level-translation applications for interfacing devices or systems operating at different interface voltages with one another. The maximum output current can be up to 32 mA when device is powered by 5 V.



**Figure 4. Typical Application Circuit**

# 11 PACKAGE OUTLINE DIMENSIONS

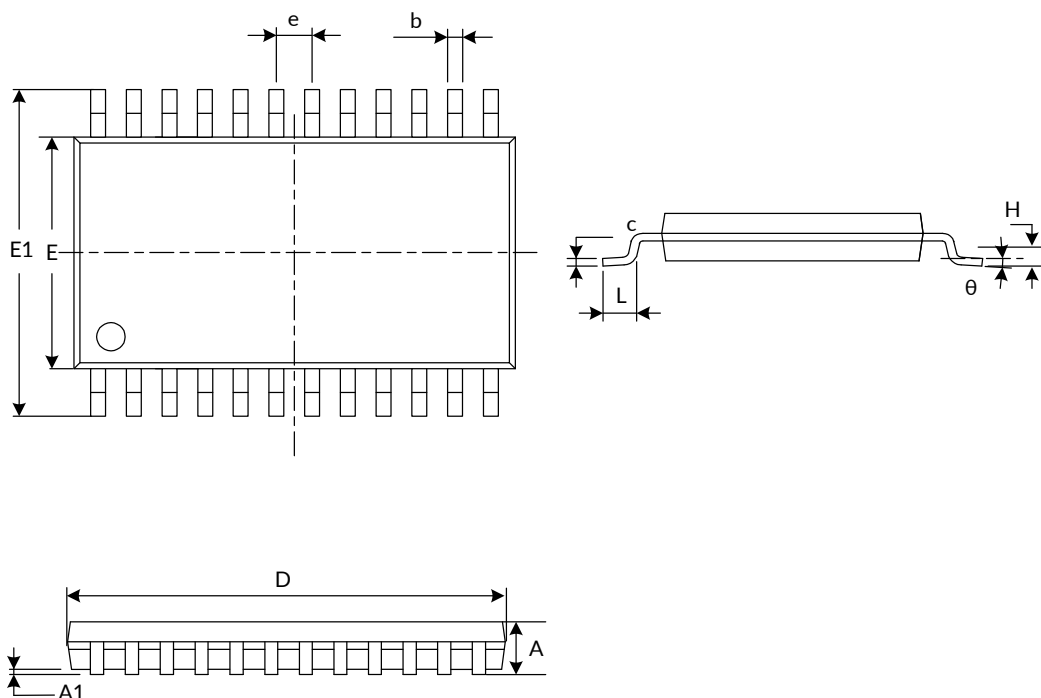
## TSSOP24<sup>(3)</sup>


**RECOMMENDED LAND PATTERN (Unit: mm)**


| Symbol           | Dimensions In Millimeters  |       | Dimensions In Inches       |       |
|------------------|----------------------------|-------|----------------------------|-------|
|                  | Min                        | Max   | Min                        | Max   |
| A <sup>(1)</sup> |                            | 1.200 |                            | 0.047 |
| A1               | 0.050                      | 0.150 | 0.002                      | 0.006 |
| A2               | 0.800                      | 1.050 | 0.031                      | 0.041 |
| b                | 0.200                      | 0.290 | 0.008                      | 0.011 |
| c                | 0.130                      | 0.170 | 0.005                      | 0.007 |
| D <sup>(1)</sup> | 7.700                      | 7.900 | 0.303                      | 0.311 |
| E <sup>(1)</sup> | 4.300                      | 4.500 | 0.169                      | 0.177 |
| E1               | 6.200                      | 6.600 | 0.244                      | 0.260 |
| e                | 0.650 (BSC) <sup>(2)</sup> |       | 0.026 (BSC) <sup>(2)</sup> |       |
| L                | 0.450                      | 0.750 | 0.018                      | 0.030 |
| H                | 0.250 (TYP)                |       | 0.010 (TYP)                |       |
| θ                | 0°                         | 8°    | 0°                         | 8°    |

**NOTE:**

1. Plastic or metal protrusions of 0.15mm maximum per side are not included.
2. BSC (Basic Spacing between Centers), "Basic" spacing is nominal.
3. This drawing is subject to change without notice.

**SOP24 (3)**


| Symbol           | Dimensions In Millimeters  |       | Dimensions In Inches       |       |
|------------------|----------------------------|-------|----------------------------|-------|
|                  | Min                        | Max   | Min                        | Max   |
| A <sup>(1)</sup> |                            | 2.650 |                            | 0.104 |
| A1               | 0.100                      | 0.300 | 0.004                      | 0.012 |
| b                | 0.310                      | 0.510 | 0.012                      | 0.020 |
| c                | 0.230                      | 0.270 | 0.009                      | 0.011 |
| D <sup>(1)</sup> | 15.20                      | 15.60 | 0.598                      | 0.614 |
| E <sup>(1)</sup> | 7.400                      | 7.600 | 0.291                      | 0.299 |
| E1               | 9.970                      | 10.63 | 0.393                      | 0.419 |
| e                | 1.270 (BSC) <sup>(2)</sup> |       | 0.050 (BSC) <sup>(2)</sup> |       |
| L                | 0.450                      | 0.750 | 0.018                      | 0.030 |
| H                | 0.250 (TYP)                |       | 0.010 (TYP)                |       |
| θ                | 0°                         | 8°    | 0°                         | 8°    |

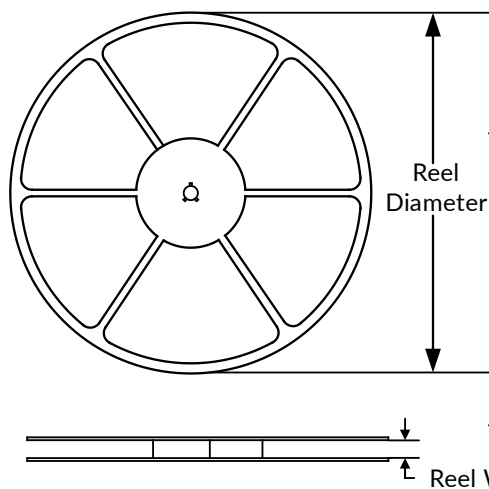
**NOTE:**

1. Plastic or metal protrusions of 0.15mm maximum per side are not included.
2. BSC (Basic Spacing between Centers), "Basic" spacing is nominal.
3. This drawing is subject to change without notice.

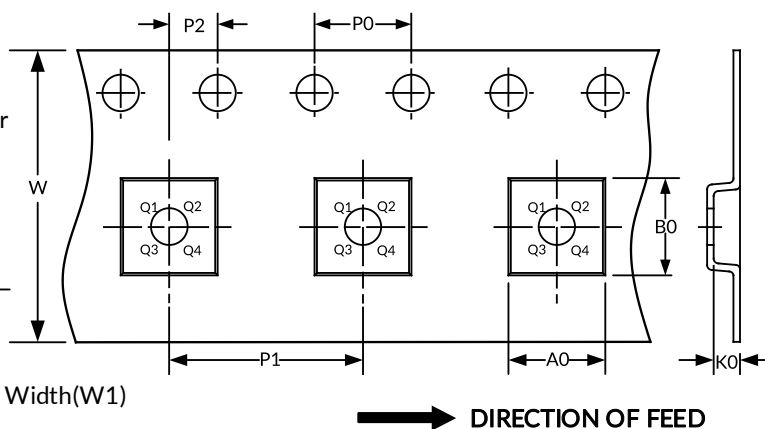


## 12 TAPE AND REEL INFORMATION

### REEL DIMENSIONS



### TAPE DIMENSION



NOTE: The picture is only for reference. Please make the object as the standard.

### KEY PARAMETER LIST OF TAPE AND REEL

| Package Type | Reel Diameter | Reel Width(mm) | A0 (mm) | B0 (mm) | K0 (mm) | P0 (mm) | P1 (mm) | P2 (mm) | W (mm) | Pin1 Quadrant |
|--------------|---------------|----------------|---------|---------|---------|---------|---------|---------|--------|---------------|
| TSSOP24      | 13"           | 16.4           | 6.95    | 8.30    | 1.60    | 4.0     | 8.0     | 2.0     | 16.0   | Q1            |
| SOP24        | 13"           | 24.4           | 10.85   | 16.15   | 2.85    | 4.0     | 16.0    | 2.0     | 24.0   | Q1            |

NOTE:

1. All dimensions are nominal.
2. Plastic or metal protrusions of 0.15mm maximum per side are not included.

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