

2-Bit Bidirectional Voltage-Level Translator with Automatic Direction Sensing

FEATURES

- **No Direction-Control**
- **Data Rates 100Mbps**
- **1.2V to 3.6V on A Port and 1.65V to 5.5V on B Ports ($V_{CCA} \leq V_{CCB}$)**
- **V_{CC} Isolation Feature: If Either V_{CC} Input is at GND, Both Ports are in the High-Impedance State**
- **Output Enable (OE) Input Circuit Referenced to V_{CCA}**
- **Low Power Consumption, 10 μ A Maximum I_{CC}**
- **No Power-Supply Sequencing Required: Either V_{CCA} or V_{CCB} can be Ramped First**
- **I_{OFF} : Supports Partial-Power-Down Mode Operation**
- **Extended Temperature: -40°C to +85°C**

APPLICATIONS

- Handset
- Smartphone
- Tablet
- Desktop PC

DESCRIPTION

This 2-bit non-inverting translator 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, with the A port supporting operating voltages from 1.2V to 3.6V while it tracks the V_{CCA} supply, and the B port supporting operating voltages from 1.65V to 5.5V while it 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 1.2V, 1.5V, 1.8V, 2.5V, 3.3V and 5V voltage nodes. V_{CCA} must not exceed V_{CCB} .

To ensure the high-impedance state during power up or power down, OE should be tied to GND through a pull-down resistor, the minimum value of the resistor is determined by the current-sourcing capability of the driver.

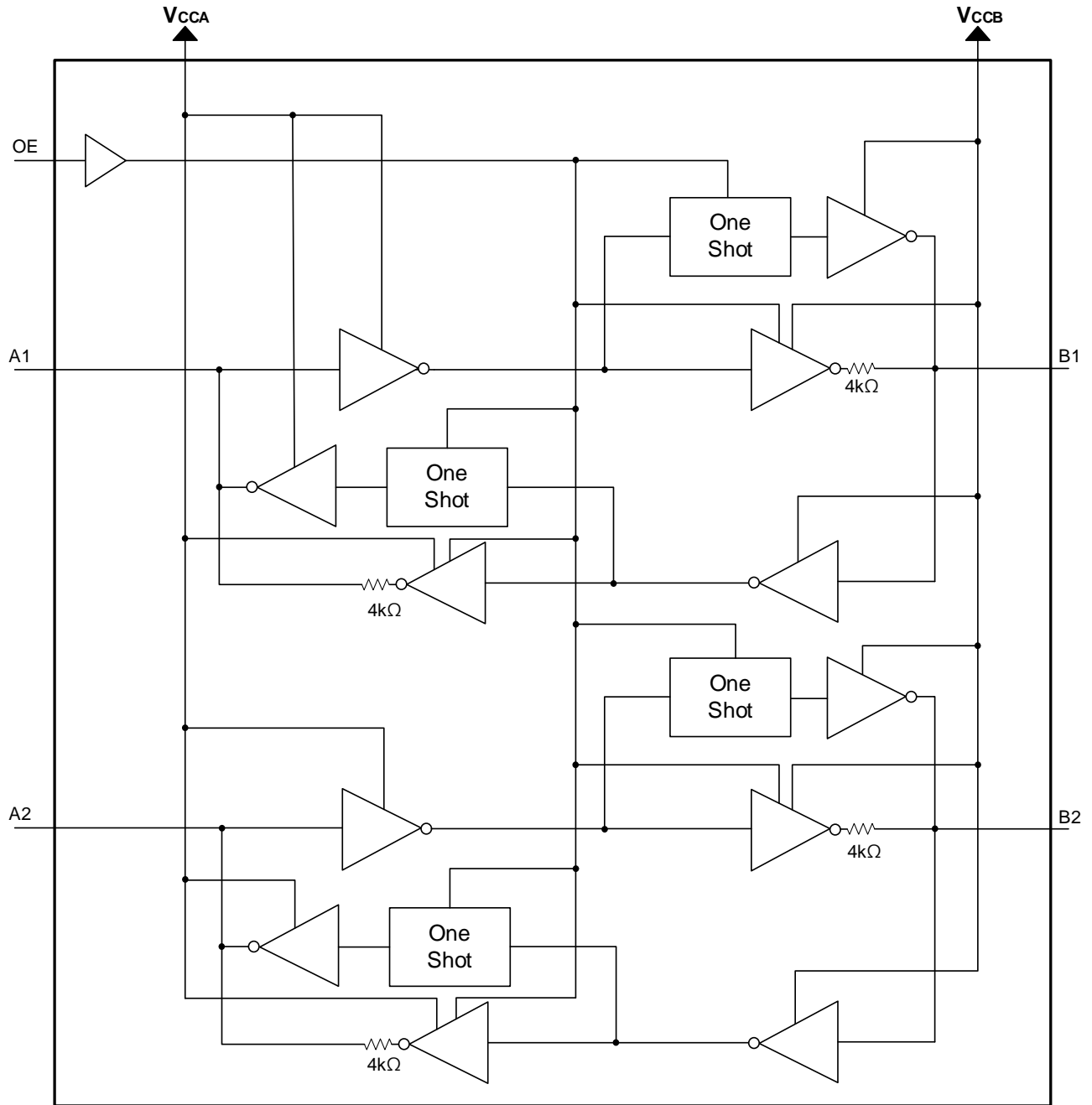
The RS0202 is available in Green SOT23-8, DFN2*3-8 and MSOP-8 packages. It operates over an ambient temperature range of -40°C to +85°C.

Device Information (1)

| PART NUMBER | PACKAGE | BODY SIZE (NOM) |
|-------------|-------------|-----------------|
| RS0202 | SOT23-8(8) | 2.92mm×1.60mm |
| | DFN2*3-8(8) | 2.00mm×3.00mm |
| | MSOP-8 | 3.00mm×3.00mm |

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

Functional Block Diagram

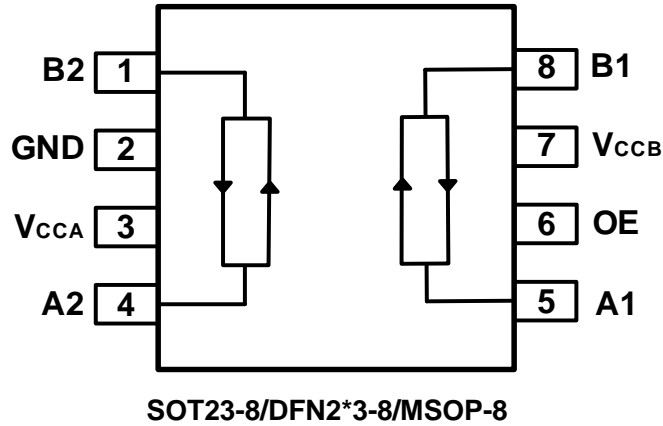


Revision History

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

| VERSION | Change Date | Change Item |
|---------|-------------|---|
| A.0 | 2021/03/03 | Preview version completed |
| A.1 | 2021/09/09 | Fix Device Information、PIN CONFIGURATIONS、PACKAGE/ORDERING INFORMATION and PACKAGE OUTLINE DIMENSIONS in Page 1,4,7,18@A.0 Version. |
| A.2 | 2021/10/27 | Add MSOP-8 package |

PIN CONFIGURATIONS (TOP VIEW)



PIN DESCRIPTION

| PIN | NAME | TYPE ⁽¹⁾ | FUNCTION |
|--------------------------------|------------------|---------------------|---|
| SOT23-8/DFN2*3-8/MSOP-8 | | | |
| 7 | V _{CCB} | P | B Ports Supply Voltage. $1.65V \leq V_{CCB} \leq 5.5V$. |
| 8 | B1 | I/O | Input/output B1. Reference to V _{CCB} . |
| 1 | B2 | I/O | Input/output B2. Reference to V _{CCB} . |
| 6 | OE | I | Output Enable (Active High). Pull OE low to place all outputs in 3-state mode. Referenced to V _{CCA} . |
| 2 | GND | – | Ground. |
| 4 | A2 | I/O | Input/output A2. Reference to V _{CCA} . |
| 5 | A1 | I/O | Input/output A1. Reference to V _{CCA} . |
| 3 | V _{CCA} | P | A Port Supply Voltage. $1.2V \leq V_{CCA} \leq 3.6V$ and $V_{CCA} \leq V_{CCB}$. |

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

SPECIFICATIONS

Absolute Maximum Ratings

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

| SYMBOL | PARAMETER | MIN | MAX | UNIT | |
|----------------------------------|--|-------------------|------|-----------------------|----|
| V _{CCA} | Supply Voltage Range | -0.3 | 4.6 | V | |
| V _{CCB} | Supply Voltage Range | -0.3 | 6.5 | V | |
| V _I ⁽²⁾ | Input Voltage Range | A port | -0.3 | 4.6 | V |
| | | B port | -0.3 | 6.5 | |
| | | OE | -0.3 | 4.6 | |
| V _O ⁽²⁾ | Voltage range applied to any output in the high-impedance or power-off state | A port | -0.3 | 4.6 | V |
| | | B port | -0.3 | 6.5 | |
| V _O ⁽²⁾⁽³⁾ | Voltage range applied to any output in the high or low state | A port | -0.3 | V _{CCA} +0.3 | V |
| | | B port | -0.3 | V _{CCB} +0.3 | |
| I _{IK} | Input clamp current | V _I <0 | | -50 | mA |
| I _{OK} | Output clamp current | V _O <0 | | -50 | mA |
| I _O | Continuous output current | | | ±50 | mA |
| | Continuous current through V _{CCA} , V _{CCB} or GND | | | ±100 | mA |
| T _J | Junction Temperature | | | 150 | °C |
| T _{stg} | 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_{CCA} and V_{CCB} are provided in the recommended operating conditions table.

ESD Ratings

| | | | VALUE | UNIT |
|--------------------|-------------------------|------------------------|-------|------|
| V _(ESD) | Electrostatic discharge | Human-body model (HBM) | ±5000 | V |
| | | machine model (MM) | ±300 | V |

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. ⁽¹⁾⁽²⁾

| PARAMETER | CONDITIONS | | MIN | TYP | MAX | UNIT |
|--|--------------|---|---|-----|-----------------------------|------|
| Supply voltage | V_{CCA} | | 1.2 | | 3.6 | V |
| | V_{CCB} | | 1.65 | | 5.5 | |
| High-level input voltage (V_{IH}) | A-port input | $V_{CCA} = 1.2\text{ V to }3.6\text{ V}$ $V_{CCB} = 1.65\text{ V to }5.5\text{ V}$ | $V_{CCI} \times 0.65^{(3)}$ | | V_{CCI} | V |
| | B-port input | $V_{CCA} = 1.2\text{ V to }3.6\text{ V}$ $V_{CCB} = 1.65\text{ V to }5.5\text{ V}$ | $V_{CCI} \times 0.65$ | | V_{CCI} | |
| | OE input | $V_{CCA} = 1.2\text{ V to }3.6\text{ V}$ $V_{CCB} = 1.65\text{ V to }5.5\text{ V}$ | $V_{CCA} \times 0.65$ | | 5.5 | |
| Low-level input voltage (V_{IL}) | A-port input | $V_{CCA} = 1.2\text{ V to }3.6\text{ V}$ $V_{CCB} = 1.65\text{ V to }5.5\text{ V}$ | 0 | | $V_{CCI} \times 0.35^{(3)}$ | V |
| | B-port input | $V_{CCA} = 1.2\text{ V to }3.6\text{ V}$ $V_{CCB} = 1.65\text{ V to }5.5\text{ V}$ | 0 | | $V_{CCI} \times 0.35$ | |
| | OE input | $V_{CCA} = 1.2\text{ V to }3.6\text{ V}$ $V_{CCB} = 1.65\text{ V to }5.5\text{ V}$ | 0 | | $V_{CCA} \times 0.35$ | |
| Voltage applied to any output in the high-impedance or power-off state (V_o) | A-port | $V_{CCA} = 1.2\text{ V to }3.6\text{ V}$ $V_{CCB} = 1.65\text{ V to }5.5\text{ V}$ | 0 | | 3.6 | V |
| | B-port | $V_{CCA} = 1.2\text{ V to }3.6\text{ V}$ $V_{CCB} = 1.65\text{ V to }5.5\text{ V}$ | 0 | | 5.5 | |
| Input transition rise or fall rate($\Delta t/\Delta v$) | A-port input | $V_{CCA} = 1.2\text{ V to }3.6\text{ V}$ $V_{CCB} = 1.65\text{ V to }5.5\text{ V}$ | | | 40 | ns/V |
| | B-port input | $V_{CCA} = 1.2\text{ V to }3.6\text{ V}$ | $V_{CCB} = 1.65\text{ V to }3.6\text{ V}$ | | 40 | |
| $V_{CCB} = 4.5\text{ V to }5.5\text{ V}$ | | | | 30 | | |
| T _A Operating free-air temperature | | | -40 | | 85 | °C |

(1) The A and B sides of an unused data I/O pair must be held in the same state that is, both at V_{CCI} or both at GND.

(2) V_{CCA} must be less than or equal to V_{CCB} and must not exceed 3.6 V.

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

PACKAGE/ORDERING INFORMATION

| PRODUCT | ORDERING NUMBER | TEMPERATURE RANGE | PACKAGE LEAD | PACKAGE MARKING ⁽¹⁾ | MSL ⁽²⁾ | PACKAGE OPTION |
|---------|-----------------|-------------------|--------------|--------------------------------|--------------------|--------------------|
| RS0202 | RS0202YH8 | -40°C ~+85°C | SOT23-8 | 0202 | MSL3 | Tape and Reel,3000 |
| | RS0202YTDB8 | -40°C ~+85°C | DFN2*3-8 | 0202 | MSL3 | Tape and Reel,3000 |
| | RS0202XM | -40°C ~+85°C | MSOP-8 | RS0202 | MSL3 | Tape and Reel,4000 |

NOTE:

- (1) 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.
- (2) MSL, the Moisture Sensitivity Level rating according to the JEDEC industry standard classifications.

ELECTRICAL CHARACTERISTICS

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

| PARAMETER | CONDITIONS | V _{CCA} | V _{CCB} | TEMP | MIN | TYP | MAX | UNIT | |
|---|--|------------------|------------------|-------|-----------------------|------|-----|------|----|
| V _{OHA} Port A output high voltage | I _{OH} = -20 μA | 1.2V | | +25°C | | 1.1 | | V | |
| | | 1.4V to 3.6V | | Full | V _{CCA} -0.4 | | | | |
| V _{OLA} Port A output low voltage | I _{OL} = 20 μA | 1.2V | | +25°C | | 0.3 | | | |
| | | 1.4V to 3.6V | | Full | | | 0.4 | | |
| V _{OHB} Port B output high voltage | I _{OH} = -20 μA | | 1.65V to 5.5V | Full | V _{CCB} -0.4 | | | | |
| V _{OLB} Port B output low voltage | I _{OL} = 20 μA | | 1.65V to 5.5V | Full | | | 0.4 | | |
| I _I Input leakage current | OE V _I =V _{CCI} or GND | 1.2V to 3.6V | 1.65V to 5.5V | +25°C | | | ±1 | | μA |
| | | | | Full | | | ±2 | | |
| I _{off} Partial power down current | A Port V _I or V _O =0 to 3.6V | 0V | 0V to 5.5V | +25°C | | | ±1 | μA | |
| | | | | Full | | | ±2 | | |
| | B Port V _I or V _O =0 to 5.5V | 0V to 3.6V | 0V | +25°C | | | ±1 | μA | |
| | | | | Full | | | ±2 | | |
| I _{oz} High-impedance State output current | A or B port OE=GND | 1.2V to 3.6V | 1.65V to 5.5V | +25°C | | | ±1 | μA | |
| | | | | Full | | | ±2 | | |
| I _{CCA} V _{CCA} supply current | V _I =V _{CCI} or GND I _O = 0 | 1.2V | 1.65V to 5.5V | +25°C | | 0.06 | | μA | |
| | | 1.4V to 3.6V | 1.65V to 5.5V | Full | | | 5 | | |
| | | 3.6V | 0V | Full | | | 2 | | |
| | | 0V | 5.5V | Full | | | -2 | | |
| I _{CCB} V _{CCB} supply current | V _I =V _{CCI} or GND I _O = 0 | 1.2V | 1.65V to 5.5V | +25°C | | 3.4 | | μA | |
| | | 1.4V to 3.6V | 1.65V to 5.5V | Full | | | 5 | | |
| | | 3.6V | 0V | Full | | | -2 | | |
| | | 0V | 5.5V | Full | | | 2 | | |
| I _{CCA} + I _{CCB} Combined supply current | V _I = V _{CCI} or GND I _O = 0 | 1.2V | 1.65V to 5.5V | +25°C | | 3.5 | | μA | |
| | | 1.4V to 3.6V | 1.65V to 5.5V | Full | | | 10 | | |
| I _{CCZA} V _{CCA} supply current | V _I = V _{CCI} or GND I _O = 0, OE=GND | 1.2V | 1.65V to 5.5V | +25°C | | 0.05 | | μA | |
| | | 1.4V to 3.6V | 1.65V to 5.5V | Full | | | 5 | | |
| I _{CCZB} V _{CCB} supply current | V _I = V _{CCI} or GND I _O = 0, OE=GND | 1.2V | 1.65V to 5.5V | +25°C | | 3.3 | | μA | |
| | | 1.4V to 3.6V | 1.65V to 5.5V | Full | | | 5 | | |
| C _i Input capacitance | OE | 1.2V to 3.6V | 1.65V to 5.5V | +25°C | | 4 | | pF | |
| C _{io} Input-to-output internal capacitance | A port | 1.2V to 3.6V | 1.65V to 5.5V | +25°C | | 5 | | pF | |
| | B port | 1.2V to 3.6V | 1.65V to 5.5V | +25°C | | 9 | | | |

 (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) V_{CCA} must be less than or equal to V_{CCB}.

Operating Characteristics

 $T_A=25^{\circ}\text{C}$

| PARAMETER | | CONDITIONS | TYP | UNIT | |
|------------------|-----------------------------|---|--|------|----|
| C _{pdA} | A port input, B port output | C _L =0, f=10MHz t _r =t _f =1ns OE=V _{CCA} (outputs enabled) | V _{CCA} =1.2V, V _{CCB} =5V | 9 | pF |
| | | | V _{CCA} =1.2V, V _{CCB} =1.8V | 8 | |
| | | | V _{CCA} =1.5V, V _{CCB} =1.8V | 7 | |
| | | | V _{CCA} =1.8V, V _{CCB} =1.8V | 8 | |
| | | | V _{CCA} =2.5V, V _{CCB} =2.5V | 7 | |
| | | | V _{CCA} =2.5V, V _{CCB} =5V | 8 | |
| | | | V _{CCA} =3.3V, V _{CCB} =3.3V to 5V | 7 | |
| | B port input, A port output | | V _{CCA} =1.2V, V _{CCB} =5V | 12 | |
| | | | V _{CCA} =1.2V, V _{CCB} =1.8V | 11 | |
| | | | V _{CCA} =1.5V, V _{CCB} =1.8V | 12 | |
| | | | V _{CCA} =1.8V, V _{CCB} =1.8V | 11 | |
| | | | V _{CCA} =2.5V, V _{CCB} =2.5V | 11 | |
| | | | V _{CCA} =2.5V, V _{CCB} =5V | 11 | |
| | | | V _{CCA} =3.3V, V _{CCB} =3.3V to 5V | 11 | |
| C _{pdB} | A port input, B port output | V _{CCA} =1.2V, V _{CCB} =5V | 35 | | |
| | | V _{CCA} =1.2V, V _{CCB} =1.8V | 26 | | |
| | | V _{CCA} =1.5V, V _{CCB} =1.8V | 27 | | |
| | | V _{CCA} =1.8V, V _{CCB} =1.8V | 27 | | |
| | | V _{CCA} =2.5V, V _{CCB} =2.5V | 27 | | |
| | | V _{CCA} =2.5V, V _{CCB} =5V | 27 | | |
| | | V _{CCA} =3.3V, V _{CCB} =3.3V to 5V | 27 | | |
| | B port input, A port output | V _{CCA} =1.2V, V _{CCB} =5V | 25 | | |
| | | V _{CCA} =1.2V, V _{CCB} =1.8V | 28 | | |
| | | V _{CCA} =1.5V, V _{CCB} =1.8V | 19 | | |
| | | V _{CCA} =1.8V, V _{CCB} =1.8V | 19 | | |
| | | V _{CCA} =2.5V, V _{CCB} =2.5V | 18 | | |
| | | V _{CCA} =2.5V, V _{CCB} =5V | 19 | | |
| | | V _{CCA} =3.3V, V _{CCB} =3.3V to 5V | 20 | | |

Operating Characteristics (continued)
 $T_A=25^{\circ}\text{C}$

| PARAMETER | | CONDITIONS | TYP | UNIT |
|------------------|-----------------------------|--|------|------|
| C _{pdA} | A port input, B port output | V _{CCA} =1.2V, V _{CCB} =5V | 0.01 | pF |
| | | V _{CCA} =1.2V, V _{CCB} =1.8V | 0.01 | |
| | | V _{CCA} =1.5V, V _{CCB} =1.8V | 0.01 | |
| | | V _{CCA} =1.8V, V _{CCB} =1.8V | 0.01 | |
| | | V _{CCA} =2.5V, V _{CCB} =2.5V | 0.01 | |
| | | V _{CCA} =2.5V, V _{CCB} =5V | 0.01 | |
| | | V _{CCA} =3.3V, V _{CCB} =3.3V to 5V | 0.01 | |
| | B port input, A port output | V _{CCA} =1.2V, V _{CCB} =5V | 0.01 | |
| | | V _{CCA} =1.2V, V _{CCB} =1.8V | 0.01 | |
| | | V _{CCA} =1.5V, V _{CCB} =1.8V | 0.01 | |
| | | V _{CCA} =1.8V, V _{CCB} =1.8V | 0.01 | |
| | | V _{CCA} =2.5V, V _{CCB} =2.5V | 0.01 | |
| | | V _{CCA} =2.5V, V _{CCB} =5V | 0.01 | |
| | | V _{CCA} =3.3V, V _{CCB} =3.3V to 5V | 0.01 | |
| C _{pdB} | A port input, B port output | V _{CCA} =1.2V, V _{CCB} =5V | 0.01 | |
| | | V _{CCA} =1.2V, V _{CCB} =1.8V | 0.01 | |
| | | V _{CCA} =1.5V, V _{CCB} =1.8V | 0.01 | |
| | | V _{CCA} =1.8V, V _{CCB} =1.8V | 0.01 | |
| | | V _{CCA} =2.5V, V _{CCB} =2.5V | 0.01 | |
| | | V _{CCA} =2.5V, V _{CCB} =5V | 0.01 | |
| | | V _{CCA} =3.3V, V _{CCB} =3.3V to 5V | 0.01 | |
| | B port input, A port output | V _{CCA} =1.2V, V _{CCB} =5V | 0.01 | |
| | | V _{CCA} =1.2V, V _{CCB} =1.8V | 0.01 | |
| | | V _{CCA} =1.5V, V _{CCB} =1.8V | 0.01 | |
| | | V _{CCA} =1.8V, V _{CCB} =1.8V | 0.01 | |
| | | V _{CCA} =2.5V, V _{CCB} =2.5V | 0.01 | |
| | | V _{CCA} =2.5V, V _{CCB} =5V | 0.01 | |
| | | V _{CCA} =3.3V, V _{CCB} =3.3V to 5V | 0.01 | |

 $C_L=0$, $f=10\text{MHz}$
 $t_r=t_f=1\text{ns}$
 $\text{OE}=\text{GND}$
 (outputs enabled)

Timing Requirements

$V_{CCA}=1.2V$

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

| | | $V_{CCB}=1.8V$ | $V_{CCB}=2.5V$ | $V_{CCB}=3.3V$ | $V_{CCB}=5V$ | UNIT |
|-------------------------|-------------|----------------|----------------|----------------|--------------|------|
| | | TYP | TYP | TYP | TYP | |
| Data rate | | 20 | 20 | 20 | 20 | Mbps |
| Pulse duration(t_w) | data inputs | 50 | 50 | 50 | 50 | ns |

$V_{CCA}=1.5V\pm 0.1V$

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

| | | $V_{CCB}=1.8V\pm 0.15V$ | $V_{CCB}=2.5V\pm 0.2V$ | $V_{CCB}=3.3V\pm 0.3V$ | $V_{CCB}=5V\pm 0.5V$ | UNIT |
|-------------------------|-------------|-------------------------|------------------------|------------------------|----------------------|------|
| | | TYP | TYP | TYP | TYP | |
| Data rate | | 40 | 40 | 40 | 40 | Mbps |
| Pulse duration(t_w) | data inputs | 25 | 25 | 25 | 25 | ns |

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

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

| | | $V_{CCB}=1.8V\pm 0.15V$ | $V_{CCB}=2.5V\pm 0.2V$ | $V_{CCB}=3.3V\pm 0.3V$ | $V_{CCB}=5V\pm 0.5V$ | UNIT |
|-------------------------|-------------|-------------------------|------------------------|------------------------|----------------------|------|
| | | TYP | TYP | TYP | TYP | |
| Data rate | | 50 | 50 | 50 | 50 | Mbps |
| Pulse duration(t_w) | data inputs | 20 | 20 | 20 | 20 | ns |

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

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

| | | $V_{CCB}=2.5V\pm 0.2V$ | $V_{CCB}=3.3V\pm 0.3V$ | $V_{CCB}=5V\pm 0.5V$ | UNIT |
|-------------------------|-------------|------------------------|------------------------|----------------------|------|
| | | TYP | TYP | TYP | |
| Data rate | | 70 | 80 | 80 | Mbps |
| Pulse duration(t_w) | data inputs | 14 | 12 | 12 | ns |

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

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

| | | $V_{CCB}=3.3V\pm 0.3V$ | $V_{CCB}=5V\pm 0.5V$ | UNIT |
|-------------------------|-------------|------------------------|----------------------|------|
| | | TYP | TYP | |
| Data rate | | 80 | 100 | Mbps |
| Pulse duration(t_w) | data inputs | 12 | 10 | ns |

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

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

| PARAMETER | CONDITIONS | $V_{CCB}=1.8V$ | $V_{CCB}=2.5V$ | $V_{CCB}=3.3V$ | $V_{CCB}=5V$ | UNIT | |
|---------------------|---|---------------------------|----------------|----------------|--------------|------|---------|
| | | TYP | TYP | TYP | TYP | | |
| t_{PHL} | Propagation delay time high-to-low output | A-to-B | 27.8 | 21.9 | 20.3 | 26.5 | ns |
| t_{PLH} | Propagation delay time low-to-high output | A-to-B | 26 | 19.1 | 18.6 | 22.1 | ns |
| t_{PHL} | Propagation delay time high-to-low output | B-to-A | 36.9 | 37.1 | 37.5 | 36.6 | ns |
| t_{PLH} | Propagation delay time low-to-high output | B-to-A | 34.5 | 34.4 | 32.8 | 33.2 | ns |
| t_{en} | Enable time | OE-to-A or B | 378 | 387 | 365 | 348 | μs |
| t_{dis} | Disable time | OE-to-A or B | 19 | 16 | 15 | 16 | ns |
| t_{rA} , t_{fA} | Input rise time | A port rise and fall time | 12.3 | 17.1 | 16.5 | 13.1 | ns |
| t_{rB} , t_{fB} | Input rise time | B port rise and fall time | 6.6 | 6.5 | 7.6 | 5.1 | ns |
| $t_{sk(O)}$ | Skew(time), output | Channel-to-Channel Skew | 2.4 | 1.6 | 1.9 | 7.1 | ns |
| Maximum data rate | | | 20 | 20 | 20 | 20 | Mbps |

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

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

| PARAMETER | CONDITIONS | $V_{CCB}=1.8V \pm 0.15V$ | $V_{CCB}=2.5V \pm 0.2V$ | $V_{CCB}=3.3V \pm 0.3V$ | $V_{CCB}=5V \pm 0.5V$ | UNIT | |
|---------------------|---|---------------------------|-------------------------|-------------------------|-----------------------|------|---------|
| | | TYP | TYP | TYP | TYP | | |
| t_{PHL} | Propagation delay time high-to-low output | A-to-B | 15.1 | 15.5 | 12.8 | 11.6 | ns |
| t_{PLH} | Propagation delay time low-to-high output | A-to-B | 17.9 | 15.2 | 11.5 | 9.8 | ns |
| t_{PHL} | Propagation delay time high-to-low output | B-to-A | 17.4 | 15.3 | 15.1 | 19.6 | ns |
| t_{PLH} | Propagation delay time low-to-high output | B-to-A | 14.5 | 15.3 | 15.7 | 21 | ns |
| t_{en} | Enable time | OE-to-A or B | 225 | 218 | 215 | 216 | μs |
| t_{dis} | Disable time | OE-to-A or B | 18.4 | 15.7 | 14.2 | 13.7 | ns |
| t_{rA} , t_{fA} | Input rise time | A port rise and fall time | 6.2 | 6.1 | 6.1 | 6.2 | ns |
| t_{rB} , t_{fB} | Input rise time | B port rise and fall time | 6.6 | 4.4 | 3.7 | 3.1 | ns |
| $t_{sk(O)}$ | Skew(time), output | Channel-to-Channel Skew | 0.6 | 0.7 | 0.6 | 0.6 | ns |
| Maximum data rate | | | 40 | 40 | 40 | 40 | Mbps |

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

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

| PARAMETER | CONDITIONS | $V_{CCB}=1.8V \pm 0.15V$ | $V_{CCB}=2.5V \pm 0.2V$ | $V_{CCB}=3.3V \pm 0.3V$ | $V_{CCB}=5V \pm 0.5V$ | UNIT | |
|------------------------|---|---------------------------|-------------------------|-------------------------|-----------------------|------|---------|
| | | TYP | TYP | TYP | TYP | | |
| t_{PHL} | Propagation delay time high-to-low output | A-to-B | 13.8 | 9.1 | 6.9 | 7 | ns |
| t_{PLH} | Propagation delay time low-to-high output | A-to-B | 16.4 | 9.5 | 7.7 | 7.5 | ns |
| t_{PHL} | Propagation delay time high-to-low output | B-to-A | 13.3 | 9.3 | 8.6 | 8.1 | ns |
| t_{PLH} | Propagation delay time low-to-high output | B-to-A | 10.2 | 9.3 | 8.6 | 8 | ns |
| t_{en} | Enable time | OE-to-A or B | 185 | 178 | 183 | 167 | μs |
| t_{dis} | Disable time | OE-to-A or B | 18.3 | 13 | 11.6 | 11.2 | ns |
| t_{rA} , t_{fA} | Input rise time | A port rise and fall time | 5.8 | 6.3 | 6.6 | 7.7 | ns |
| t_{rB} , t_{fB} | Input rise time | B port rise and fall time | 6.2 | 4.5 | 3.5 | 3.4 | ns |
| $t_{sk(O)}$ | Skew(time), output | Channel-to-Channel Skew | 0.8 | 0.7 | 0.7 | 0.6 | ns |
| Maximum data rate | | | 50 | 50 | 50 | 50 | Mbps |

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

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

| PARAMETER | CONDITIONS | $V_{CCB}=2.5V \pm 0.2V$ | $V_{CCB}=3.3V \pm 0.3V$ | $V_{CCB}=5V \pm 0.5V$ | UNIT | |
|------------------------|---|---------------------------|-------------------------|-----------------------|------|---------|
| | | TYP | TYP | TYP | | |
| t_{PHL} | Propagation delay time high-to-low output | A-to-B | 6.9 | 5.3 | 4 | ns |
| t_{PLH} | Propagation delay time low-to-high output | A-to-B | 8.1 | 6.2 | 4.8 | ns |
| t_{PHL} | Propagation delay time high-to-low output | B-to-A | 5.5 | 4.6 | 4.2 | ns |
| t_{PLH} | Propagation delay time low-to-high output | B-to-A | 2.9 | 4.3 | 4.1 | ns |
| t_{en} | Enable time | OE-to-A or B | 157 | 147 | 138 | μs |
| t_{dis} | Disable time | OE-to-A or B | 13.1 | 9.7 | 8.7 | ns |
| t_{rA} , t_{fA} | Input rise time | A port rise and fall time | 3.5 | 2.9 | 3 | ns |
| t_{rB} , t_{fB} | Input rise time | B port rise and fall time | 4 | 2.8 | 2.5 | ns |
| $t_{sk(O)}$ | Skew(time), output | Channel-to-Channel Skew | 0.4 | 0.4 | 0.3 | ns |
| Maximum data rate | | | 70 | 80 | 80 | Mbps |

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

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

| PARAMETER | CONDITIONS | $V_{CCB}=3.3V \pm 0.3V$ | $V_{CCB}=5V \pm 0.5V$ | UNIT |
|---|-------------------------|-------------------------|-----------------------|---------|
| | | TYP | TYP | |
| t_{PHL} Propagation delay time high-to-low output | A-to-B | 4.8 | 3.6 | ns |
| t_{PLH} Propagation delay time low-to-high output | A-to-B | 4.9 | 3.5 | ns |
| t_{PHL} Propagation delay time high-to-low output | B-to-A | 3.5 | 3.2 | ns |
| t_{PLH} Propagation delay time low-to-high output | B-to-A | 3.9 | 3.1 | ns |
| t_{en} Enable time | OE-to-A or B | 134 | 128 | μs |
| t_{dis} Disable time | OE-to-A or B | 9.8 | 7.7 | ns |
| t_{rA} Input rise time | A port rise time | 1.9 | 1.9 | ns |
| t_{rB} Input rise time | B port rise time | 1.8 | 2.2 | ns |
| t_{fA} Input fall time | A port fall time | 2.9 | 2.6 | ns |
| t_{fB} Input fall time | B port fall time | 1.8 | 1.6 | ns |
| $t_{sk(O)}$ Skew(time), output | Channel-to-Channel Skew | 0.4 | 0.3 | ns |
| Maximum data rate | | 80 | 100 | Mbps |

Parameter Measurement Information

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

- PRR 10 MHz
- $Z_O = 50 \Omega$
- $dv/dt \geq 1 \text{ V/ns}$

Note: All input pulses are measured one at a time, with one transition per measurement.

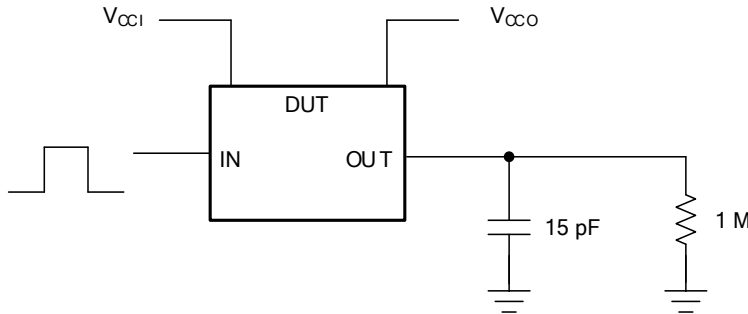


Figure 1. Data Rate, Pulse Duration, Propagation Delay, Output Rise And Fall Time Measurement Using A Push-Pull Driver

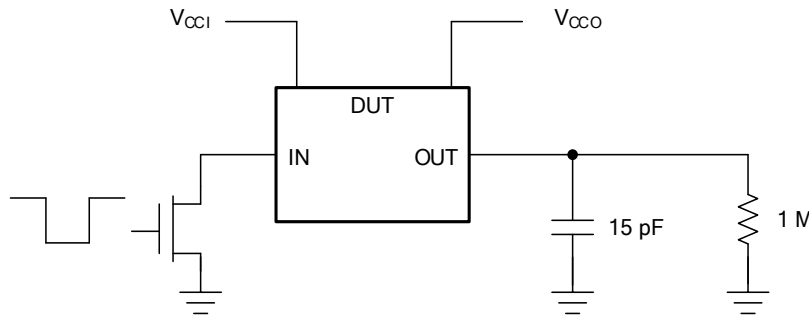


Figure 2. Data Rate, Pulse Duration, Propagation Delay, Output Rise And Fall Time Measurement Using an Open-Drain Driver

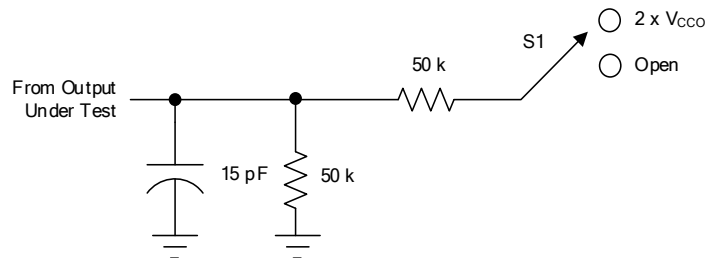


Figure 3. Load Circuit for Enable/ Disable Time Measurement

Table 1. Switch Configuration for Enable/Disable Timing

| TEST | S1 |
|------------------------------------|--------------------|
| $t_{PZL}^{(1)}$, $t_{PLZ}^{(2)}$ | $2 \times V_{CC0}$ |
| $t_{PHZL}^{(1)}$, $t_{PZH}^{(2)}$ | Open |

(1) t_{PZL} and t_{PZH} are the same as t_{en} .

(2) t_{PLZ} and t_{PHZ} are the same as t_{dis} .

Parameter Measurement Information (continued)

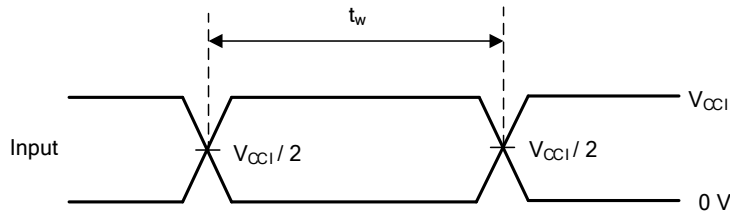


Figure 4. Voltage Waveforms Pulse Duration

(1) All input pulses are measured one at a time, with one transition per measurement.

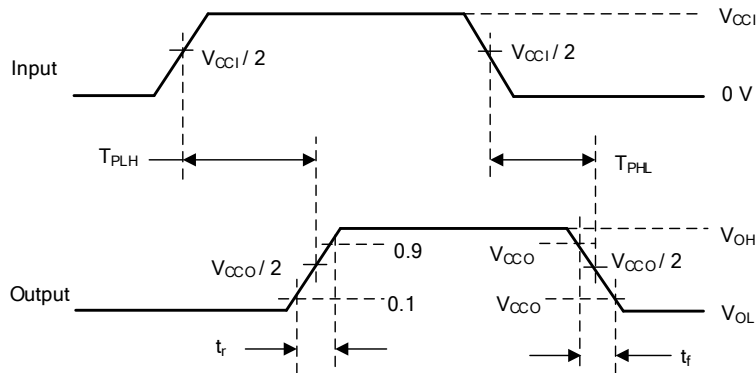


Figure 5. Voltage Waveforms Propagation Delay Times

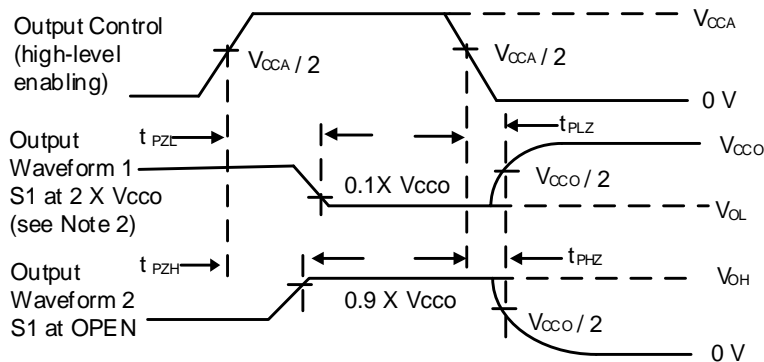
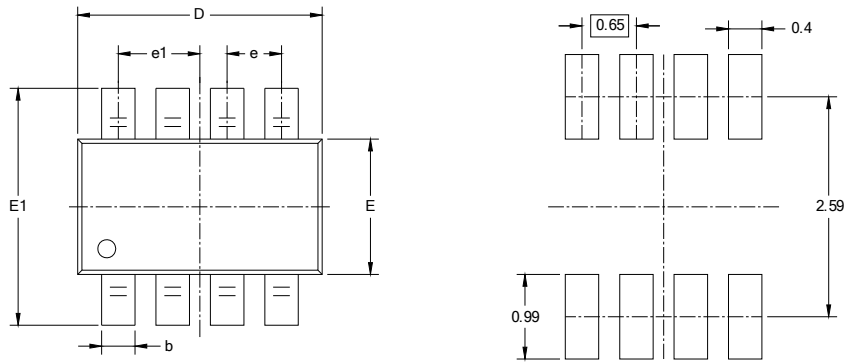


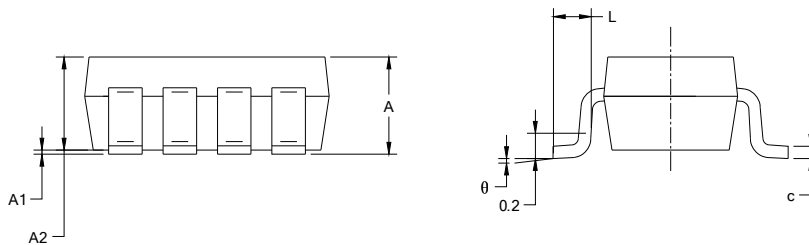
Figure 6. Voltage Waveforms Enable and Disable

PACKAGE OUTLINE DIMENSIONS

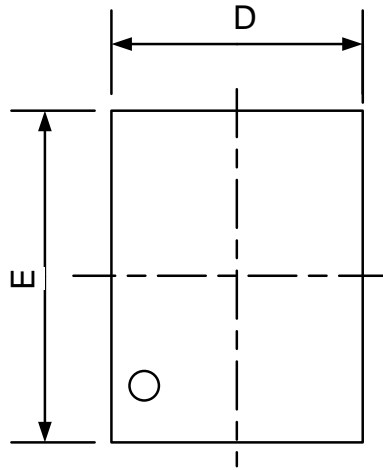
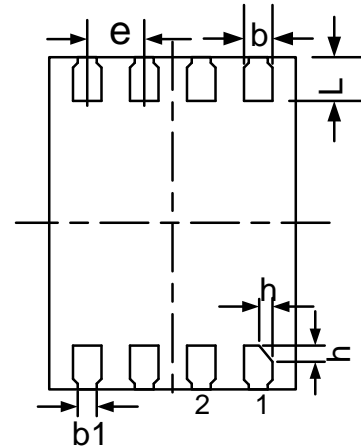
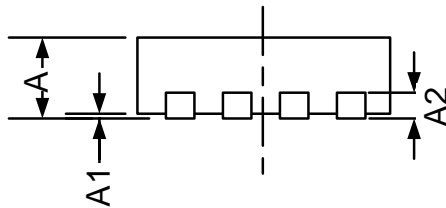
SOT23-8



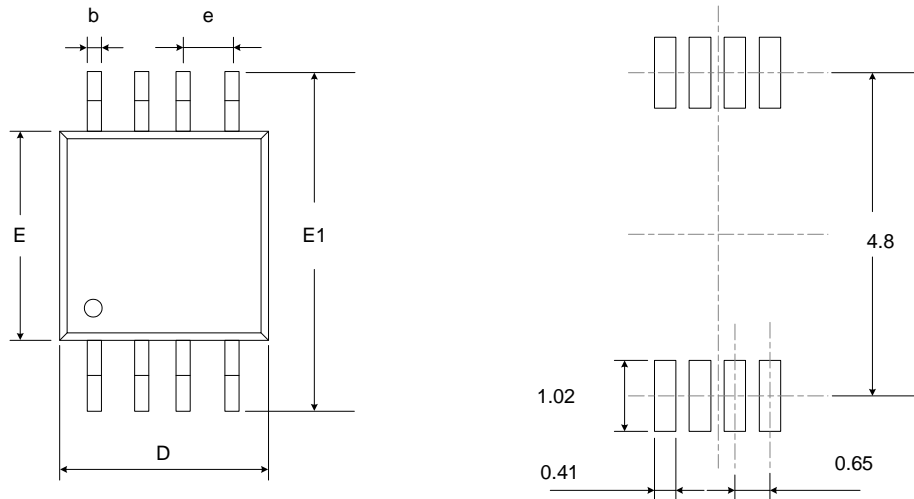
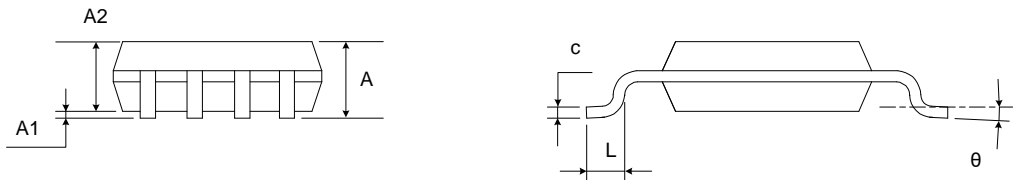
RECOMMENDED LAND PATTERN (Unit: mm)



| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|--------|---------------------------|-------|----------------------|-------|
| | Min | Max | Min | Max |
| A | 1.050 | 1.250 | 0.041 | 0.049 |
| A1 | 0.000 | 0.100 | 0.000 | 0.004 |
| A2 | 1.050 | 1.150 | 0.041 | 0.045 |
| b | 0.300 | 0.500 | 0.012 | 0.020 |
| c | 0.100 | 0.200 | 0.004 | 0.008 |
| D | 2.820 | 3.020 | 0.111 | 0.119 |
| E | 1.500 | 1.700 | 0.059 | 0.067 |
| E1 | 2.650 | 2.950 | 0.104 | 0.116 |
| e | 0.650 (BSC) | | 0.026 (BSC) | |
| e1 | 0.975 (BSC) | | 0.038 (BSC) | |
| L | 0.300 | 0.600 | 0.012 | 0.024 |
| θ | 0° | 8° | 0° | 8° |

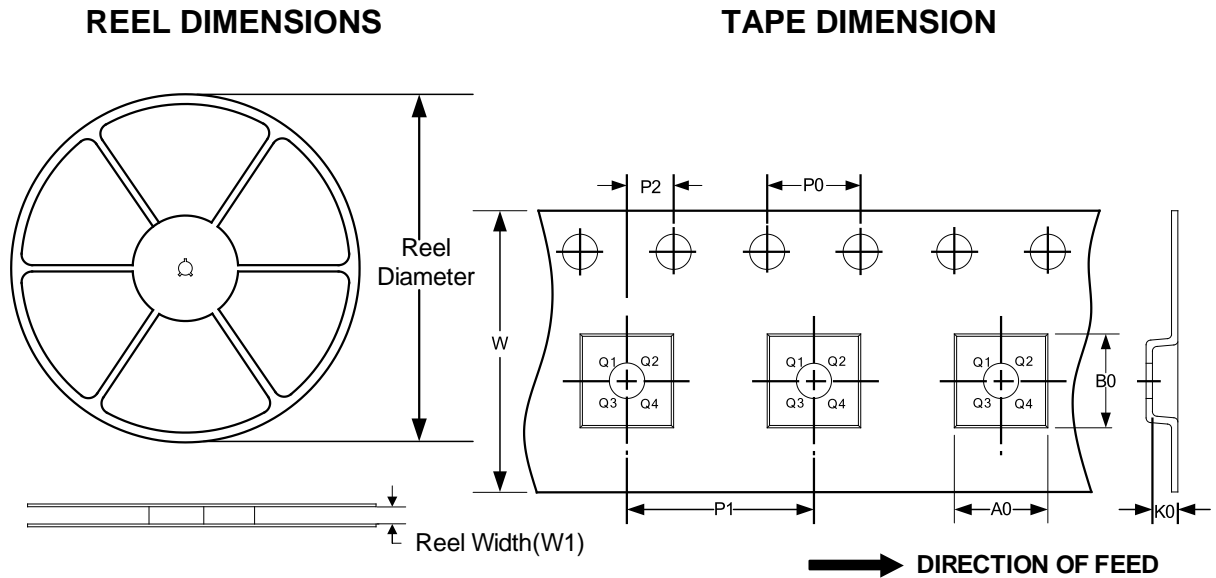
DFN2*3-8

TOP VIEW

BOTTOM VIEW

SIDE VIEW

| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|--------|---------------------------|-------|----------------------|-------|
| | Min | Max | Min | Max |
| A | 0.700 | 0.800 | 0.028 | 0.031 |
| A1 | 0.000 | 0.050 | 0.000 | 0.002 |
| A2 | 0.180 | 0.250 | 0.007 | 0.010 |
| b | 0.180 | 0.300 | 0.007 | 0.012 |
| b1 | 0.16 REF | | 0.006 REF | |
| D | 1.900 | 2.100 | 0.075 | 0.083 |
| E | 2.900 | 3.100 | 0.114 | 0.122 |
| e | 0.500 TYP | | 0.019 TYP | |
| L | 0.350 | 0.450 | 0.014 | 0.018 |
| h | 0.075 | 0.175 | 0.003 | 0.007 |

MSOP-8

RECOMMENDED LAND PATTERN (Unit: mm)


| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|--------|---------------------------|-------|----------------------|-------|
| | Min | Max | Min | Max |
| A | 0.820 | 1.100 | 0.032 | 0.043 |
| A1 | 0.020 | 0.150 | 0.001 | 0.006 |
| A2 | 0.750 | 0.950 | 0.030 | 0.037 |
| b | 0.250 | 0.380 | 0.010 | 0.015 |
| c | 0.090 | 0.230 | 0.004 | 0.009 |
| D | 2.900 | 3.100 | 0.114 | 0.122 |
| e | 0.650 (BSC) | | 0.026 (BSC) | |
| E | 2.900 | 3.100 | 0.114 | 0.122 |
| E1 | 4.750 | 5.050 | 0.187 | 0.199 |
| L | 0.400 | 0.800 | 0.016 | 0.031 |
| θ | 0° | 6° | 0° | 6° |

TAPE AND REEL INFORMATION



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 |
|--------------|---------------|-----------------|---------|---------|---------|---------|---------|---------|--------|---------------|
| SOT23-8 | 7" | 9.5 | 3.17 | 3.23 | 1.37 | 4.0 | 4.0 | 2.0 | 8.0 | Q3 |
| DFN2*3-8 | 7" | 9.5 | 2.30 | 3.30 | 0.95 | 4.0 | 4.0 | 2.0 | 8.0 | Q2 |
| MSOP-8 | 13" | 12.4 | 5.20 | 3.30 | 1.50 | 4.0 | 8.0 | 2.0 | 12.0 | Q1 |

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