

## 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 $\mu$ 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.

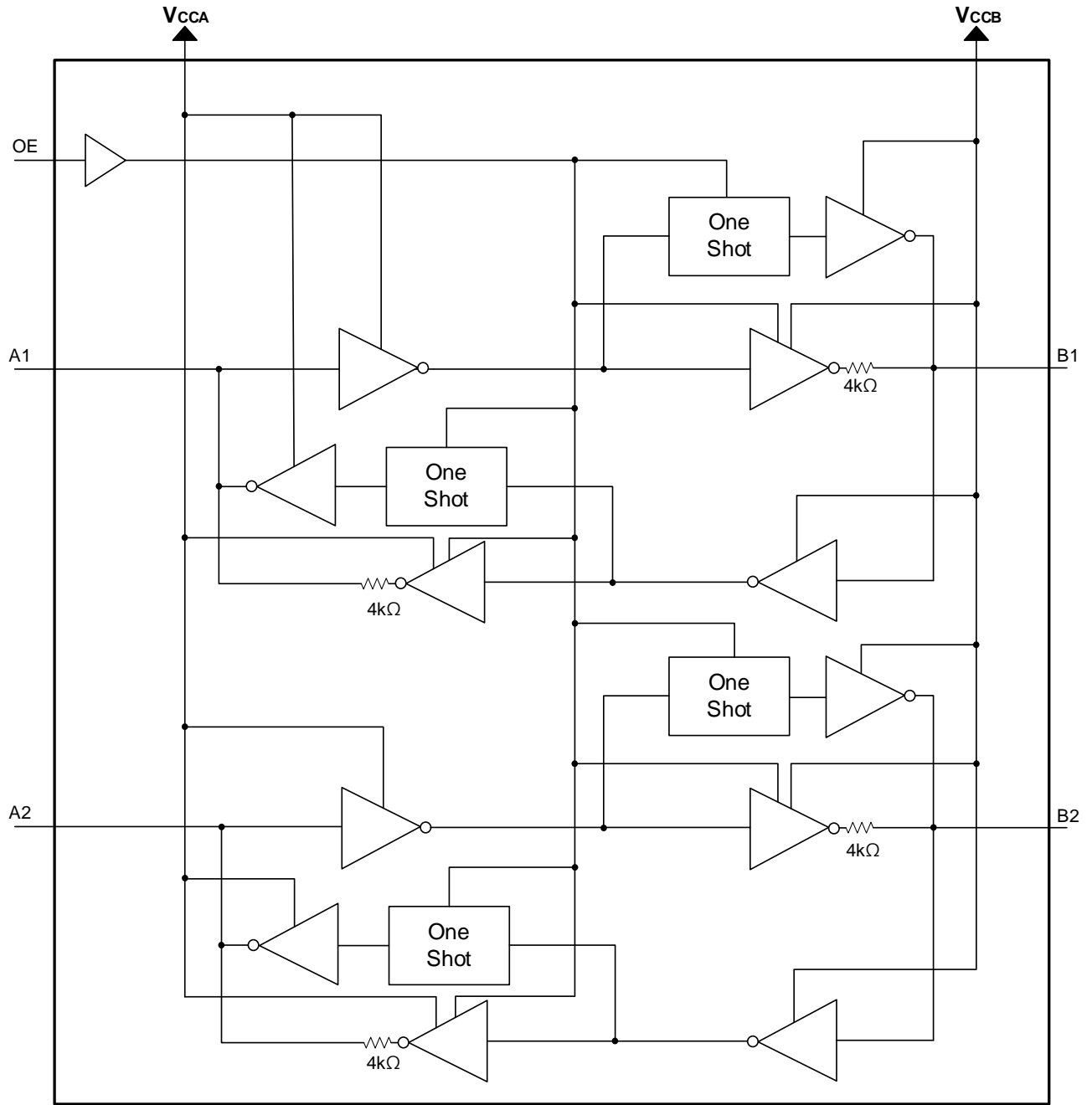
The RS0202 is available in Green SOT23-8, DFN2\*3-8 and MSOP-8 packages. It operates over an ambient temperature range of -40°C to +85°C.

#### 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

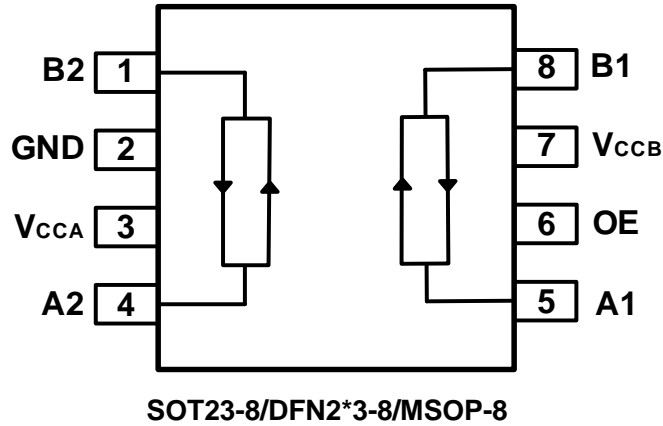


## Revision History

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

SYMBOL	PARAMETER	MIN	MAX	UNIT	
V <sub>CCA</sub>	Supply Voltage Range	-0.3	4.6	V	
V <sub>CCB</sub>	Supply Voltage Range	-0.3	6.5	V	
V <sub>I</sub> <sup>(2)</sup>	Input Voltage Range	A port	-0.3	4.6	V
		B port	-0.3	6.5	
		OE	-0.3	4.6	
V <sub>O</sub> <sup>(2)</sup>	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 <sub>O</sub> <sup>(2)(3)</sup>	Voltage range applied to any output in the high or low state	A port	-0.3	V <sub>CCA</sub> +0.3	V
		B port	-0.3	V <sub>CCB</sub> +0.3	
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
T <sub>J</sub>	Junction Temperature			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.

### ESD Ratings

			VALUE	UNIT
V <sub>(ESD)</sub>	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. <sup>(1)(2)</sup>

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 <sub>A</sub> 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 <sup>(1)</sup>	MSL <sup>(2)</sup>	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) <sup>(1)</sup> <sup>(2)</sup> <sup>(3)</sup>

PARAMETER	CONDITIONS	V <sub>CCA</sub>	V <sub>CCB</sub>	TEMP	MIN	TYP	MAX	UNIT	
V <sub>OHA</sub> Port A output high voltage	I <sub>OH</sub> = -20 μA	1.2V		+25°C		1.1		V	
		1.4V to 3.6V		Full	V <sub>CCA</sub> -0.4				
V <sub>OLA</sub> Port A output low voltage	I <sub>OL</sub> = 20 μA	1.2V		+25°C		0.3			
		1.4V to 3.6V		Full			0.4		
V <sub>OHB</sub> Port B output high voltage	I <sub>OH</sub> = -20 μA		1.65V to 5.5V	Full	V <sub>CCB</sub> -0.4				
V <sub>OLB</sub> Port B output low voltage	I <sub>OL</sub> = 20 μA		1.65V to 5.5V	Full			0.4		
I <sub>I</sub> Input leakage current	OE V <sub>I</sub> =V <sub>CCI</sub> or GND	1.2V to 3.6V	1.65V to 5.5V	+25°C			±1		μA
				Full			±2		
I <sub>off</sub> Partial power down current	A Port V <sub>I</sub> or V <sub>O</sub> =0 to 3.6V	0V	0V to 5.5V	+25°C			±1	μA	
				Full			±2		
	B Port V <sub>I</sub> or V <sub>O</sub> =0 to 5.5V	0V to 3.6V	0V	+25°C			±1	μA	
				Full			±2		
I <sub>oz</sub> 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 <sub>CCA</sub> V <sub>CCA</sub> supply current	V <sub>I</sub> =V <sub>CCI</sub> or GND I <sub>O</sub> = 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 <sub>CCB</sub> V <sub>CCB</sub> supply current	V <sub>I</sub> =V <sub>CCI</sub> or GND I <sub>O</sub> = 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 <sub>CCA</sub> + I <sub>CCB</sub> Combined supply current	V <sub>I</sub> = V <sub>CCI</sub> or GND I <sub>O</sub> = 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 <sub>CCZA</sub> V <sub>CCA</sub> supply current	V <sub>I</sub> = V <sub>CCI</sub> or GND I <sub>O</sub> = 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 <sub>CCZB</sub> V <sub>CCB</sub> supply current	V <sub>I</sub> = V <sub>CCI</sub> or GND I <sub>O</sub> = 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 <sub>i</sub> Input capacitance	OE	1.2V to 3.6V	1.65V to 5.5V	+25°C		4		pF	
C <sub>io</sub> 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<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) V<sub>CCA</sub> must be less than or equal to V<sub>CCB</sub>.



## Operating Characteristics

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

PARAMETER		CONDITIONS	TYP	UNIT	
C <sub>pdA</sub>	A port input, B port output	C <sub>L</sub> =0, f=10MHz t <sub>r</sub> =t <sub>f</sub> =1ns OE=V <sub>CCA</sub> (outputs enabled)	V <sub>CCA</sub> =1.2V, V <sub>CCB</sub> =5V	9	pF
			V <sub>CCA</sub> =1.2V, V <sub>CCB</sub> =1.8V	8	
			V <sub>CCA</sub> =1.5V, V <sub>CCB</sub> =1.8V	7	
			V <sub>CCA</sub> =1.8V, V <sub>CCB</sub> =1.8V	8	
			V <sub>CCA</sub> =2.5V, V <sub>CCB</sub> =2.5V	7	
			V <sub>CCA</sub> =2.5V, V <sub>CCB</sub> =5V	8	
			V <sub>CCA</sub> =3.3V, V <sub>CCB</sub> =3.3V to 5V	7	
	B port input, A port output		V <sub>CCA</sub> =1.2V, V <sub>CCB</sub> =5V	12	
			V <sub>CCA</sub> =1.2V, V <sub>CCB</sub> =1.8V	11	
			V <sub>CCA</sub> =1.5V, V <sub>CCB</sub> =1.8V	12	
			V <sub>CCA</sub> =1.8V, V <sub>CCB</sub> =1.8V	11	
			V <sub>CCA</sub> =2.5V, V <sub>CCB</sub> =2.5V	11	
			V <sub>CCA</sub> =2.5V, V <sub>CCB</sub> =5V	11	
			V <sub>CCA</sub> =3.3V, V <sub>CCB</sub> =3.3V to 5V	11	
C <sub>pdB</sub>	A port input, B port output	V <sub>CCA</sub> =1.2V, V <sub>CCB</sub> =5V	35		
		V <sub>CCA</sub> =1.2V, V <sub>CCB</sub> =1.8V	26		
		V <sub>CCA</sub> =1.5V, V <sub>CCB</sub> =1.8V	27		
		V <sub>CCA</sub> =1.8V, V <sub>CCB</sub> =1.8V	27		
		V <sub>CCA</sub> =2.5V, V <sub>CCB</sub> =2.5V	27		
		V <sub>CCA</sub> =2.5V, V <sub>CCB</sub> =5V	27		
		V <sub>CCA</sub> =3.3V, V <sub>CCB</sub> =3.3V to 5V	27		
	B port input, A port output	V <sub>CCA</sub> =1.2V, V <sub>CCB</sub> =5V	25		
		V <sub>CCA</sub> =1.2V, V <sub>CCB</sub> =1.8V	28		
		V <sub>CCA</sub> =1.5V, V <sub>CCB</sub> =1.8V	19		
		V <sub>CCA</sub> =1.8V, V <sub>CCB</sub> =1.8V	19		
		V <sub>CCA</sub> =2.5V, V <sub>CCB</sub> =2.5V	18		
		V <sub>CCA</sub> =2.5V, V <sub>CCB</sub> =5V	19		
		V <sub>CCA</sub> =3.3V, V <sub>CCB</sub> =3.3V to 5V	20		

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

PARAMETER		CONDITIONS	TYP	UNIT
C <sub>pdA</sub>	A port input, B port output	V <sub>CCA</sub> =1.2V, V <sub>CCB</sub> =5V	0.01	pF
		V <sub>CCA</sub> =1.2V, V <sub>CCB</sub> =1.8V	0.01	
		V <sub>CCA</sub> =1.5V, V <sub>CCB</sub> =1.8V	0.01	
		V <sub>CCA</sub> =1.8V, V <sub>CCB</sub> =1.8V	0.01	
		V <sub>CCA</sub> =2.5V, V <sub>CCB</sub> =2.5V	0.01	
		V <sub>CCA</sub> =2.5V, V <sub>CCB</sub> =5V	0.01	
		V <sub>CCA</sub> =3.3V, V <sub>CCB</sub> =3.3V to 5V	0.01	
	B port input, A port output	V <sub>CCA</sub> =1.2V, V <sub>CCB</sub> =5V	0.01	
		V <sub>CCA</sub> =1.2V, V <sub>CCB</sub> =1.8V	0.01	
		V <sub>CCA</sub> =1.5V, V <sub>CCB</sub> =1.8V	0.01	
		V <sub>CCA</sub> =1.8V, V <sub>CCB</sub> =1.8V	0.01	
		V <sub>CCA</sub> =2.5V, V <sub>CCB</sub> =2.5V	0.01	
		V <sub>CCA</sub> =2.5V, V <sub>CCB</sub> =5V	0.01	
		V <sub>CCA</sub> =3.3V, V <sub>CCB</sub> =3.3V to 5V	0.01	
C <sub>pdB</sub>	A port input, B port output	V <sub>CCA</sub> =1.2V, V <sub>CCB</sub> =5V	0.01	
		V <sub>CCA</sub> =1.2V, V <sub>CCB</sub> =1.8V	0.01	
		V <sub>CCA</sub> =1.5V, V <sub>CCB</sub> =1.8V	0.01	
		V <sub>CCA</sub> =1.8V, V <sub>CCB</sub> =1.8V	0.01	
		V <sub>CCA</sub> =2.5V, V <sub>CCB</sub> =2.5V	0.01	
		V <sub>CCA</sub> =2.5V, V <sub>CCB</sub> =5V	0.01	
		V <sub>CCA</sub> =3.3V, V <sub>CCB</sub> =3.3V to 5V	0.01	
	B port input, A port output	V <sub>CCA</sub> =1.2V, V <sub>CCB</sub> =5V	0.01	
		V <sub>CCA</sub> =1.2V, V <sub>CCB</sub> =1.8V	0.01	
		V <sub>CCA</sub> =1.5V, V <sub>CCB</sub> =1.8V	0.01	
		V <sub>CCA</sub> =1.8V, V <sub>CCB</sub> =1.8V	0.01	
		V <sub>CCA</sub> =2.5V, V <sub>CCB</sub> =2.5V	0.01	
		V <sub>CCA</sub> =2.5V, V <sub>CCB</sub> =5V	0.01	
		V <sub>CCA</sub> =3.3V, V <sub>CCB</sub> =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	$\mu s$
$t_{dis}$	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	$\mu s$
$t_{dis}$	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	$\mu s$
$t_{dis}$	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	$\mu s$
$t_{dis}$	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)

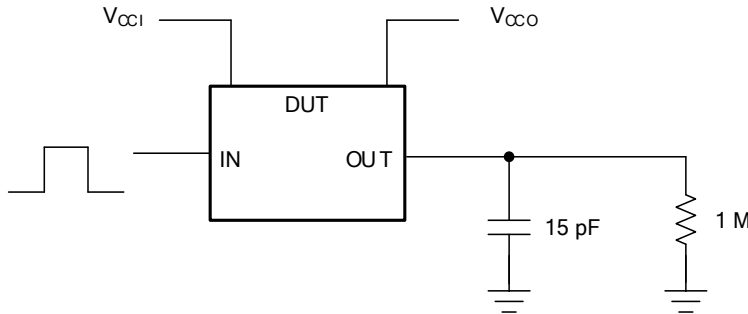
PARAMETER	CONDITIONS	$V_{CCB}=3.3V \pm 0.3V$	$V_{CCB}=5V \pm 0.5V$	UNIT
		TYP	TYP	
$t_{PHL}$ Propagation delay time high-to-low output	A-to-B	4.8	3.6	ns
$t_{PLH}$ Propagation delay time low-to-high output	A-to-B	4.9	3.5	ns
$t_{PHL}$ Propagation delay time high-to-low output	B-to-A	3.5	3.2	ns
$t_{PLH}$ 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	$\mu s$
$t_{dis}$ 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

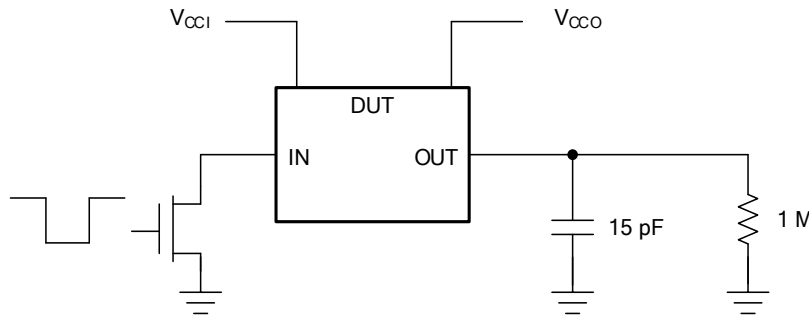
Unless otherwise noted, all input pulses are supplied by generators having the following characteristics:

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

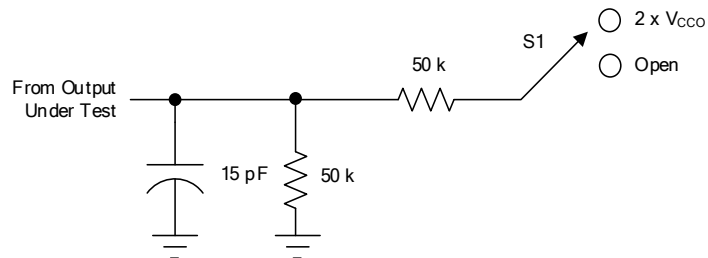
Note: All input pulses are measured one at a time, with one transition per measurement.



**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**

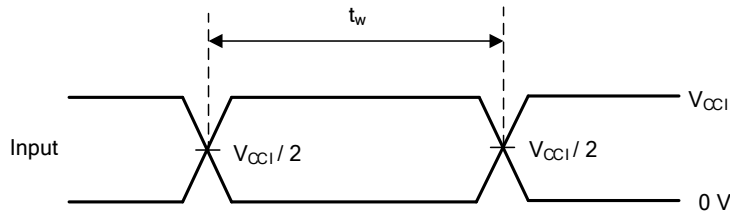
**Table 1. Switch Configuration for Enable/Disable Timing**

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  $t_{en}$ .

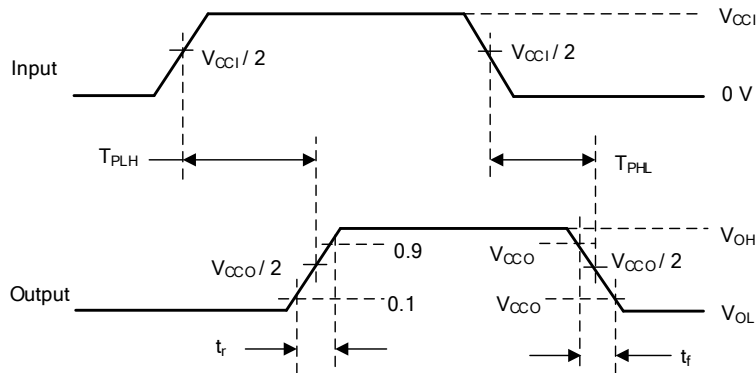
(2)  $t_{PLZ}$  and  $t_{PHZ}$  are the same as  $t_{dis}$ .

### Parameter Measurement Information (continued)

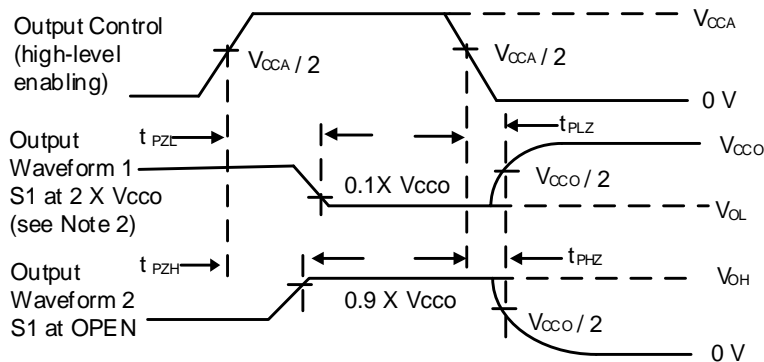


**Figure 4. Voltage Waveforms Pulse Duration**

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



**Figure 5. Voltage Waveforms Propagation Delay Times**

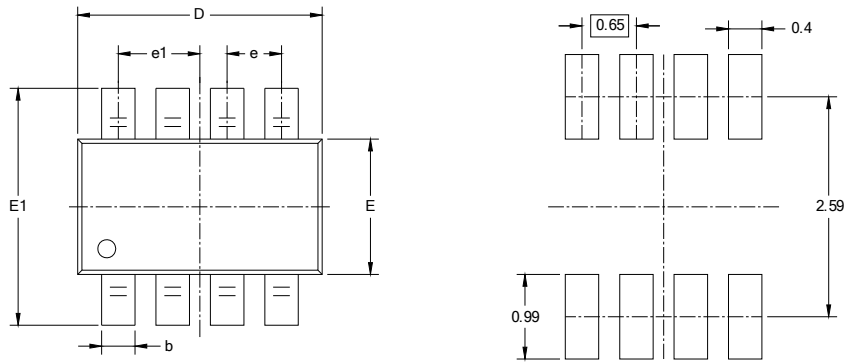


**Figure 6. Voltage Waveforms Enable and Disable**

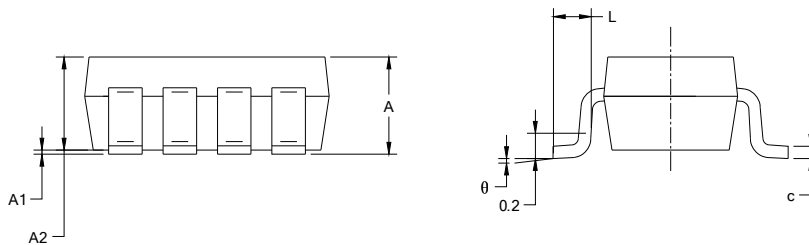


# PACKAGE OUTLINE DIMENSIONS

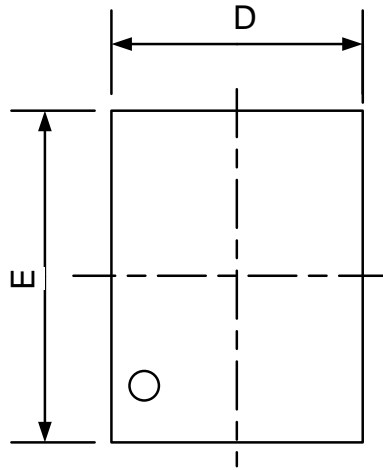
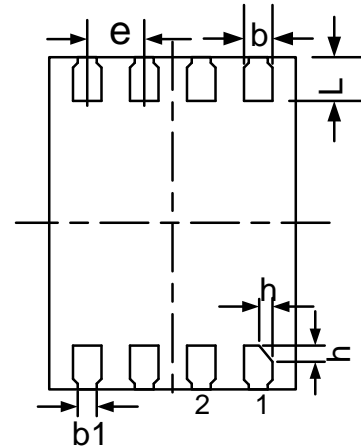
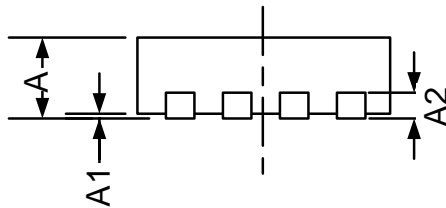
## SOT23-8



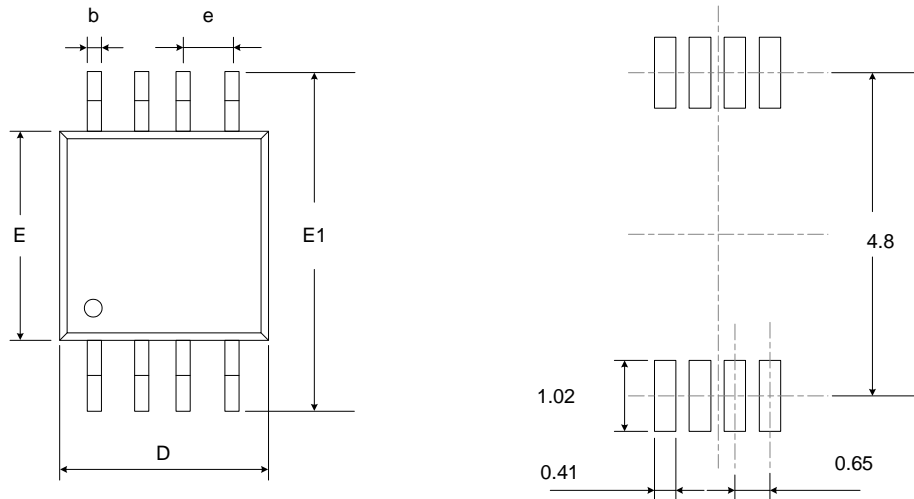
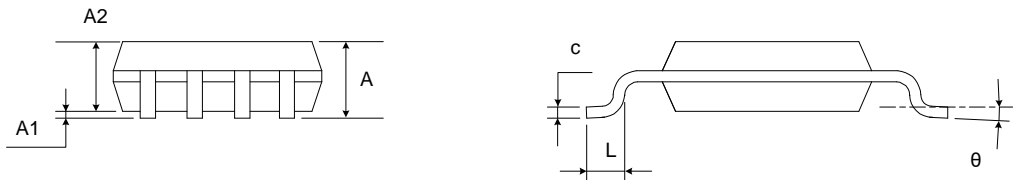
RECOMMENDED LAND PATTERN (Unit: mm)



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**

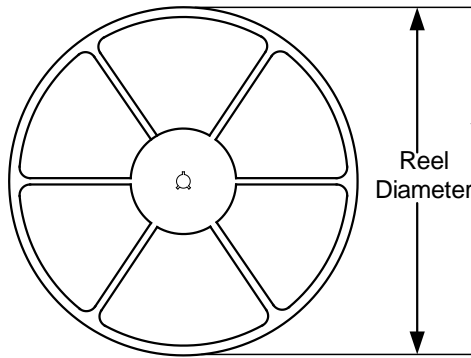
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	0.700	0.800	0.028	0.031
A1	0.000	0.050	0.000	0.002
A2	0.180	0.250	0.007	0.010
b	0.180	0.300	0.007	0.012
b1	0.16 REF		0.006 REF	
D	1.900	2.100	0.075	0.083
E	2.900	3.100	0.114	0.122
e	0.500 TYP		0.019 TYP	
L	0.350	0.450	0.014	0.018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

**MSOP-8**

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


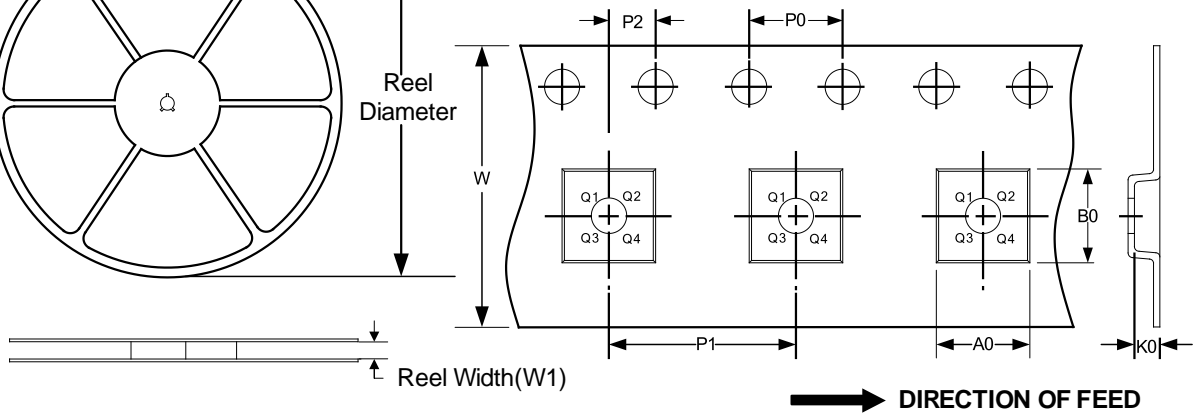
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	0.820	1.100	0.032	0.043
A1	0.020	0.150	0.001	0.006
A2	0.750	0.950	0.030	0.037
b	0.250	0.380	0.010	0.015
c	0.090	0.230	0.004	0.009
D	2.900	3.100	0.114	0.122
e	0.650 (BSC)		0.026 (BSC)	
E	2.900	3.100	0.114	0.122
E1	4.750	5.050	0.187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

## TAPE AND REEL INFORMATION

### 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
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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