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

FEATURES

- **No Direction-Control**
- **Data Rates**
  100Mbps
- **1.2V to 3.6V on A ports 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**
- **OE Input Circuit Referenced to V_{CCA}**
- **Low Power Consumption,10uA 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 8-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 ports supporting operating voltages from 1.2V to 3.6V while it tracks the V_{CCA} supply, and the B ports 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}.

When the output-enable (OE) input is low, all outputs are placed in the high-impedance state, which significantly reduces the power-supply quiescent current consumption.
OE has an internal pull-down current source, as long as V_{CCA} is powered.

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.

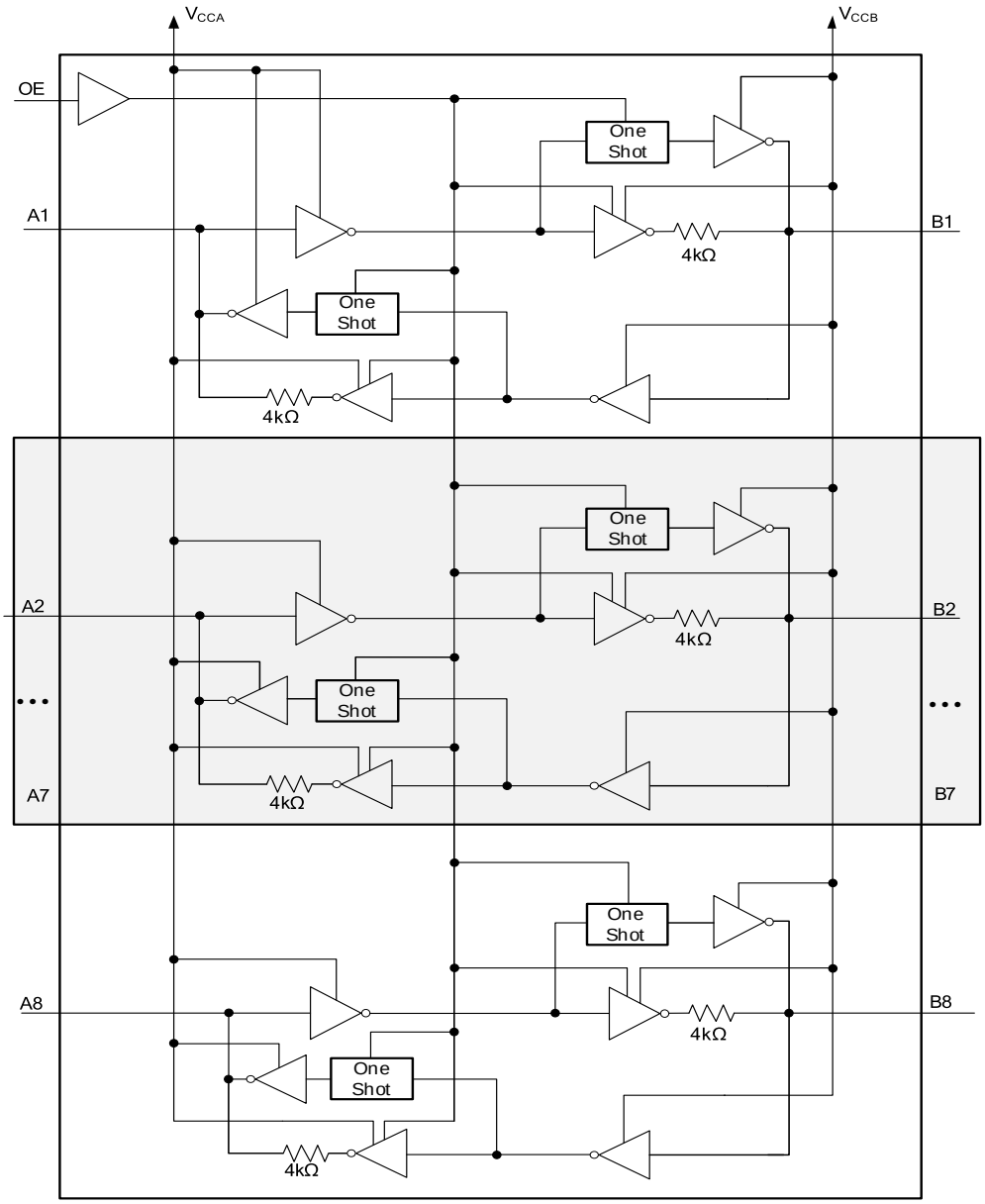
The RS0208 is available in Green QFN3*3-20L and TSSOP20 packages. It operates over an ambient temperature range of -40°C to +85°C.

Device Information (1)

PART NUMBER	PACKAGE	BODY SIZE (NOM)
RS0208	TSSOP20(20)	6.50mm×4.40mm
	QFN3*3-20L(20)	3.00mm×3.00mm

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

Functional Block Diagram



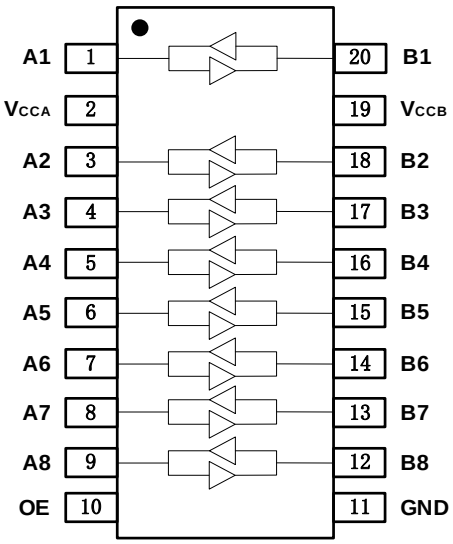
Revision History

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

VERSION	Change Date	Change Item
A.0	2021/1/20	Preview version completed
A.1	2021/4/25	Initial version completed
A.2	2021/11/01	1. Added Detailed Description and Application Information 2. Correct the maximum of OE Input leakage current 3. Add TAPE AND REEL INFORMATION
A.3	2022/1/13	Added Switching Characteristics Min and Max value

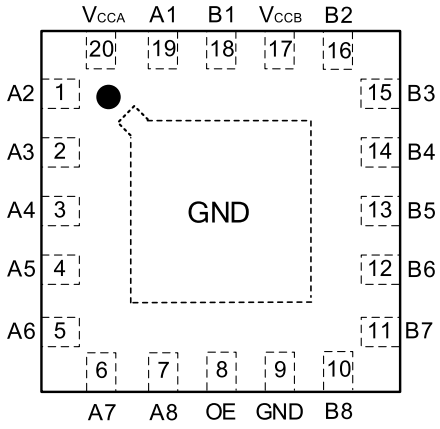
PIN CONFIGURATIONS

(TOP VIEW)



TSSOP20

(TOP VIEW)



QFN3*3-20L

PIN DESCRIPTION

PIN		NAME	TYPE (1)	FUNCTION
TSSOP20	QFN3*3-20L			
1	19	A1	I/O	Input/output A1. Reference to V_{CCA}.
2	20	V_{CCA}	P	A Port Supply Voltage.1.2V ≤ V_{CCA} ≤ 3.6V and V_{CCA} ≤ V_{CCB}.
3	1	A2	I/O	Input/output A2. Reference to V_{CCA}.
4	2	A3	I/O	Input/output A3. Reference to V_{CCA}.
5	3	A4	I/O	Input/output A4. Reference to V_{CCA}.
6	4	A5	I/O	Input/output A5. Reference to V_{CCA}.
7	5	A6	I/O	Input/output A6. Reference to V_{CCA}.
8	6	A7	I/O	Input/output A7. Reference to V_{CCA}.
9	7	A8	I/O	Input/output A8. Reference to V_{CCA}.
10	8	OE	I	Output Enable (Active High). Pull OE low to place all outputs in 3-state mode. Referenced to V_{CCA}.
11	9	GND	–	Ground.
12	10	B8	I/O	Input/output B8. Reference to V_{CCB}.
13	11	B7	I/O	Input/output B7. Reference to V_{CCB}.
14	12	B6	I/O	Input/output B6. Reference to V_{CCB}.
15	13	B5	I/O	Input/output B5. Reference to V_{CCB}.
16	14	B4	I/O	Input/output B4. Reference to V_{CCB}.
17	15	B3	I/O	Input/output B3. Reference to V_{CCB}.
18	16	B2	I/O	Input/output B2. Reference to V_{CCB}.
19	17	V_{CCB}	P	B Ports Supply Voltage.1.65V ≤ V_{CCB} ≤ 5.5V.
20	18	B1	I/O	Input/output B1. Reference to V_{CCB}.
-	Exposed Pad	GND	-	Exposed pad should be soldered to PCB board and connected to GND or left floating.

(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	
		B port	-0.3	6.5	V
		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	Vo<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 inputs	V_{CCA} = 1.2 V to 3.6 V V_{CCB} = 1.65 V to 5.5 V		V_{CCI} x 0.65(3)		V_{CCI}	V
	B-port inputs	V_{CCA} = 1.2 V to 3.6 V V_{CCB} = 1.65 V to 5.5 V		V_{CCI} x 0.65		V_{CCI}	
	OE input	V_{CCA} = 1.2 V to 3.6 V V_{CCB} = 1.65 V to 5.5 V		V_{CCA} x 0.65		5.5	
Low-level input voltage (V_{IL})	A-port inputs	V_{CCA} = 1.2 V to 3.6 V V_{CCB} = 1.65 V to 5.5 V		0		V_{CCI} x 0.35(3)	V
	B-port inputs	V_{CCA} = 1.2 V to 3.6 V V_{CCB} = 1.65 V to 5.5 V		0		V_{CCI} x 0.35	
	OE input	V_{CCA} = 1.2 V to 3.6 V V_{CCB} = 1.65 V to 5.5 V		0		V_{CCA} x0.35	
Voltage applied to any output in the high-impedance or power-off state (Vo)	A-port	V_{CCA} = 1.2 V to 3.6 V V_{CCB} = 1.65 V to 5.5 V		0		3.6	V
	B-port	V_{CCA} = 1.2 V to 3.6 V V_{CCB} = 1.65 V to 5.5 V		0		5.5	
Input transition rise or fall rate(Δt/Δv)	A-port inputs	V_{CCA} = 1.2 V to 3.6 V V_{CCB} = 1.65 V to 5.5 V				40	ns/V
	B-port inputs	V_{CCA} = 1.2 V to 3.6 V	V_{CCB} = 1.65 V to 3.6 V			40	
			V_{CCB} = 4.5 V to 5.5 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
RS0208	RS0208YTQC20	-40°C ~+85°C	QFN3*3-20L	RS0208	MSL3	Tape and Reel,5000
	RS0208YTSS20	-40°C ~+85°C	TSSOP20	RS0208	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			±2	μA
					Full			±3	
I_{off}	Partial power down current	A Ports V_I or Vo=0 to 3.6V	0V	0V to 5.5V	+25°C			±1	μA
					Full			±2	
		B Ports V_I or Vo=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}.

Timing Requirements:

V_{CCA}=1.2V

T_A=25ºC, 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±0.1 V

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

		V_{CCB}=1.8V ±0.15V		V_{CCB}=2.5V ±0.2V		V_{CCB}=3.3V ±0.3V		V_{CCB}=5V ±0.5V		UNIT
		MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
Data rate			40		40		40		40	Mbps
Pulse duration(t_w)	data inputs	25		25		25		25		ns

V_{CCA}=1.8V±0.15 V

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

		V_{CCB}=1.8V ±0.15V		V_{CCB}=2.5V ±0.2V		V_{CCB}=3.3V ±0.3V		V_{CCB}=5V ±0.5V		UNIT
		MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
Data rate			50		50		50		50	Mbps
Pulse duration(t_w)	data inputs	20		20		20		20		ns

V_{CCA}=2.5V±0.2 V

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

		V_{CCB}=2.5V ±0.2V		V_{CCB}=3.3V ±0.3V		V_{CCB}=5V ±0.5V		UNIT
		MIN	MAX	MIN	MAX	MIN	MAX	
Data rate			70		80		80	Mbps
Pulse duration(t_w)	data inputs	14		12		12		ns

V_{CCA}=3.3V±0.3 V

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

		V_{CCB}=3.3V ±0.3V		V_{CCB}=5V ±0.5V		UNIT
		MIN	MAX	MIN	MAX	
Data rate			80		100	Mbps
Pulse duration(t_w)	data inputs	12		10		ns

Switching Characteristics: V_{CCA}=1.2V

T_A=25ºC, 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_{pd}	A-to-B	27.8	21.9	20.3	26.5	ns
t_{pd}	B-to-A	36.9	37.1	37.5	36.6	ns
t_{en}	OE-to-A or B	378	387	365	348	ns
t_{dis}	OE-to-A or B	19	16	15	16	ns
t_{rA}, t_{fA}	A port rise and fall time	12.3	17.1	16.5	13.1	ns
t_{rB}, t_{fB}	B port rise and fall time	6.6	6.5	7.6	5.1	ns
tsk(O)	Channel-to-Channel Skew	2.4	1.6	1.9	7.1	ns
Max data rate		20	20	20	20	Mbps

Switching Characteristics: V_{CCA}=1.5V ± 0.1V

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

PARAMETER	CONDITIONS	V_{CCB}=1.8V ±0.15V			V_{CCB}=2.5V ±0.2V			V_{CCB}=3.3V ±0.3V			V_{CCB}=5V ±0.5V			UNIT
		MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
t_{pd}	A-to-B	5.0	15.1	37.7	5.2	15.7	39.2	4.2	12.8	32.0	3.8	11.6	29.0	ns
t_{pd}	B-to-A	5.8	17.4	43.5	5.1	15.3	38.2	5.0	15.1	37.7	6.5	19.6	49.0	ns
t_{en}	OE-to-A or B			1000			1000			1000			1000	ns
t_{dis}	OE-to-A or B	6.1	18.4	46	5.2	15.7	39.2	4.7	14.2	35.5	4.5	13.7	34.2	ns
t_{rA}, t_{fA}	A port rise and fall time	2	6.2	15.5	2	6.1	15.2	2	6.1	15.2	2	6.2	15.5	ns
t_{rB}, t_{fB}	B port rise and fall time	2.2	6.6	16.5	1.4	4.4	11	1.2	3.7	9.2	1	3.1	7.7	ns
tsk(O)	Channel-to-Channel Skew		0.7	1.7		0.7	1.7		0.6	1.5		0.7	1.7	ns
Max data rate		40			40			40			40			Mbps

Switching Characteristics: V_{CCA}=1.8V ± 0.15V

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

PARAMETER	CONDITIONS	V_{CCB}=1.8V ±0.15V			V_{CCB}=2.5V ±0.2V			V_{CCB}=3.3V ±0.3V			V_{CCB}=5V ±0.5V			UNIT
		MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
t_{pd}	A-to-B	4.6	13.8	34.5	3.0	9.1	22.7	2.3	6.9	17.2	2.3	7.0	17.5	ns
t_{pd}	B-to-A	4.4	13.3	33.2	3.1	9.3	23.2	2.8	8.6	21.5	2.7	8.1	20.2	ns
t_{en}	OE-to-A or B			1000			1000			1000			1000	ns
t_{dis}	OE-to-A or B	6.1	18.3	45.7	4.3	13	32.5	4	12.1	30.2	3.7	11.2	28	ns
t_{rA}, t_{fA}	A port rise and fall time	1.9	5.8	14.5	2.1	6.3	15.7	2.2	6.6	16.5	2.5	7.7	19.2	ns
t_{rB}, t_{fB}	B port rise and fall time	2	6.2	15.5	1.5	4.5	11.2	1.1	3.5	8.7	1.1	3.4	8.5	ns
tsk(O)	Channel-to-Channel Skew		0.8	2		0.7	1.7		0.7	1.7		0.6	1.5	ns
Max data rate		50			50			50			50			Mbps

Switching Characteristics: V_{CCA}=2.5V ± 0.2V

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

PARAMETER	CONDITIONS	V_{CCB}=2.5V ±0.2V			V_{CCB}=3.3V ±0.3V			V_{CCB}=5V ±0.5V			UNIT
		MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
t_{pd}	A-to-B	2.7	8.1	20.2	2.0	6.2	15.5	1.6	4.8	12.0	ns
t_{pd}	B-to-A	1.8	5.5	13.7	1.5	4.6	11.5	1.4	4.2	10.5	ns
t_{en}	OE-to-A or B			1000			1000			1000	ns
t_{dis}	OE-to-A or B	4.3	13.1	32.7	3.2	9.7	24.2	2.9	8.7	21.7	ns
t_{rA}, t_{fA}	A port rise and fall time	1.1	3.5	8.7	0.9	2.9	7.2	1	3	7.5	ns
t_{rB}, t_{fB}	B port rise and fall time	1.3	4	10	0.9	2.8	7	0.8	2.5	6.2	ns
tsk(O)	Channel-to-Channel Skew		0.4	1		0.4	1		0.3	0.7	ns
Max data rate		70			80			80			Mbps

Switching Characteristics: V_{CCA}=3.3V ± 0.3V

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

PARAMETER	CONDITIONS	V_{CCB}=3.3V ±0.3V			V_{CCB}=5V ±0.5V			UNIT
		MIN	TYP	MAX	MIN	TYP	MAX	
t_{pd}	A-to-B	1.6	4.9	12.2	1.2	3.8	9.5	ns
t_{pd}	B-to-A	1.1	3.5	8.7	1.0	3.2	8.0	ns
t_{en}	OE-to-A or B			1000			1000	ns
t_{dis}	OE-to-A or B	3.2	9.8	24.5	2.5	7.7	19.2	ns
t_{rA}, t_{fA}	A port rise and fall time	0.6	1.8	4.5	0.7	2.3	5.7	ns
t_{rB}, t_{fB}	B port rise and fall time	0.9	2.9	7.2	0.8	2.6	6.5	ns
tsk(O)	Channel-to-Channel Skew		0.4	1		0.3	0.7	ns
Max data rate		80			100			Mbps

Operating Characteristics

T_A=25ºC

PARAMETER		CONDITIONS		V_{CCA}							UNIT
				1.2V	1.2V	1.5V	1.8V	2.5V	2.5V	3.3V	
				V_{CCB}							
				5V	1.8V	1.8V	1.8V	2.5V	5V	3.3V to 5V	
				TYP	TYP	TYP	TYP	TYP	TYP	TYP	
C_{pdA}	Power dissipation capacitance	C_L=0 f=10MHz t_r=t_f=1ns OE=V_{CCA} (outputs enabled)	A-port input B-port output	9	8	7	8	7	8	7	pF
			B-port input A-port output	12	11	12	11	11	11	11	
C_{pdB}	Power dissipation capacitance		A-port input B-port output	35	26	27	27	27	27	27	
			B-port input A-port output	25	18	19	19	18	19	20	
C_{pdA}	Power dissipation capacitance	C_L=0 f=10MHz t_r=t_f=1ns OE=GND (outputs enabled)	A-port input B-port output	0.01	0.01	0.01	0.01	0.01	0.01	0.01	pF
			B-port input A-port output	0.01	0.01	0.01	0.01	0.01	0.01	0.01	
C_{pdB}	Power dissipation capacitance		A-port input B-port output	0.01	0.01	0.01	0.01	0.01	0.01	0.01	
			B-port input A-port output	0.01	0.01	0.01	0.01	0.01	0.01	0.01	

Parameter Measurement Information

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

- PRR 10 MHz
- Z_O = 50 Ω
- dv/dt ≥ 1 V/ns

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

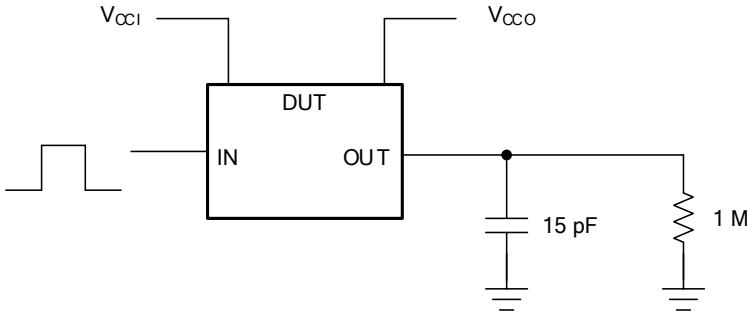


Figure 1. Data Rate, Pulse Duration, Propagation Delay, Output Rise And Fall Time Measurement Using A Push-Pull Driver

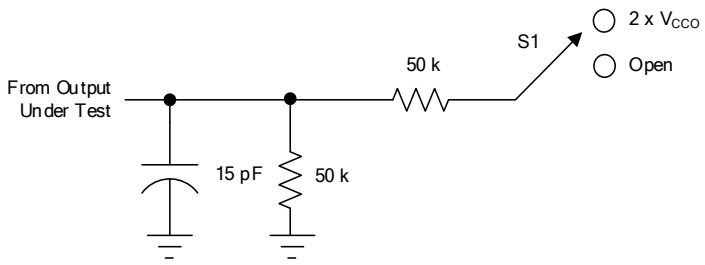
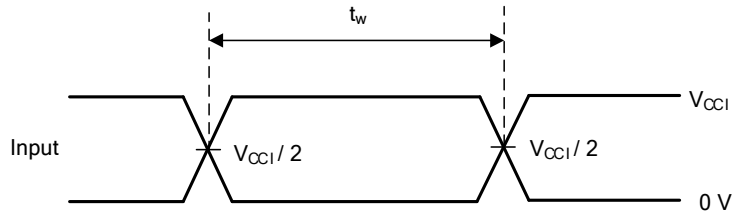


Figure 2. Load Circuit For Enable/Disable Time Measurement

Table 1. Switch Configuration For Enable/Disable Timing

TEST	S1
t_{PZL}(1), t_{PLZ}(2)	2 × V_{CCO}
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}.



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

Figure 3. Voltage Waveforms Pulse Duration

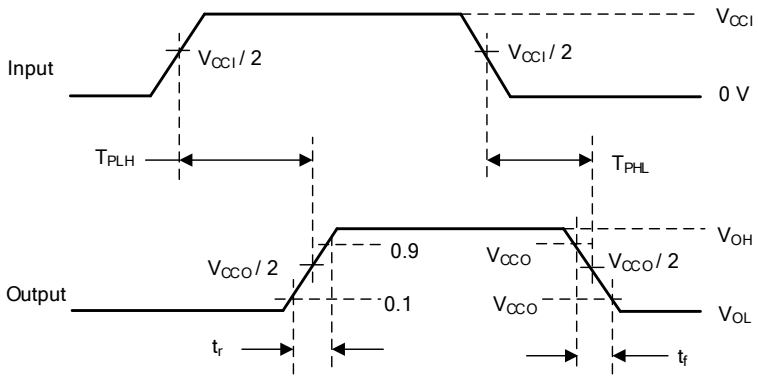


Figure 4. Voltage Waveforms Propagation Delay Times

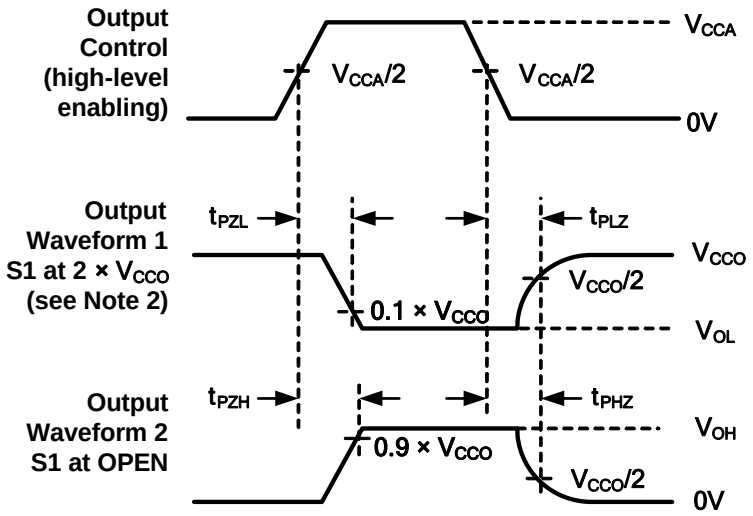


Figure 5. Voltage Waveforms Enable And Disable

Detailed Description

Overview

The RS0208 device is a 8-bit, directionless voltage-level translator specifically designed for translating logic voltage levels. The A port is able to accept I/O voltages ranging from 1.2 V to 3.6 V, while the B port can accept I/O voltages from 1.65 V to 5.5 V. The device is a buffered architecture with edge-rate accelerators (one-shots) to improve the overall data rate. This device can only translate push-pull CMOS logic outputs. If for open-drain signal translation, please refer to RS010X products.

Feature Description

Architecture

The RS0208 device architecture (see Figure 6) does not require a direction-control signal to control the direction of data flow from A to B or from B to A. In a DC state, the output drivers of the device maintain a high or low, but are designed to be weak, so the output drivers can be overdriven by an external driver when data on the bus flows the opposite direction.

The output one-shots detect rising or falling edges on the A or B ports. During a rising edge, the one-shot turns on the PMOS transistors (T1, T3) for a short duration, which speeds up the low-to-high transition. Similarly, during a falling edge, the one-shot turns on the NMOS transistors (T2, T4) for a short duration, which speeds up the high-to-low transition. The typical output impedance during output transition is 70 Ω at V_{CCO} = 1.2 V to 1.8 V, 50 Ω at V_{CCO} = 1.8 V to 3.3 V, and 40 Ω at V_{CCO} = 3.3 V to 5 V.

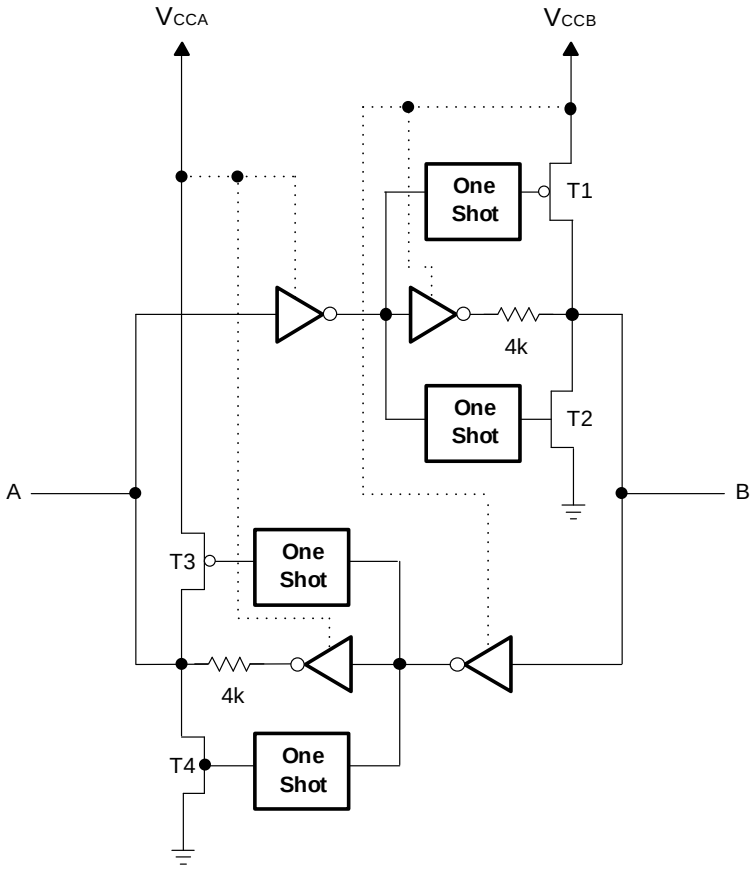
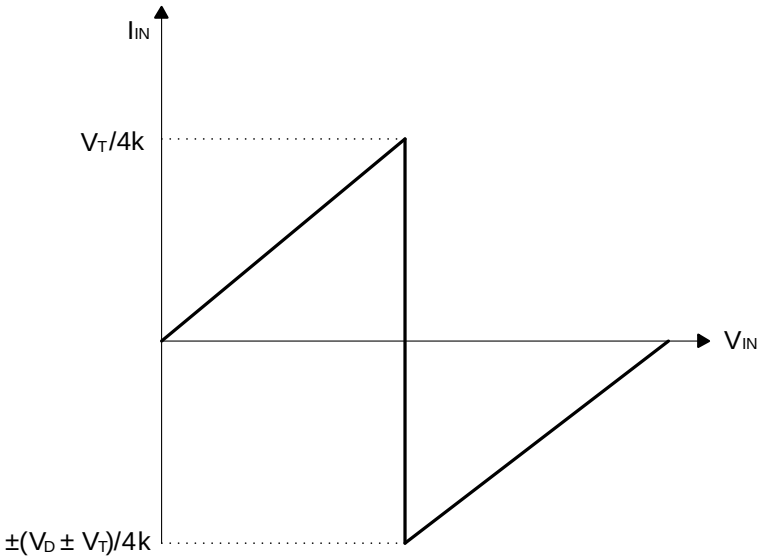


Figure 6. Architecture of RS0208 Device I/O Cell

Input Driver Requirements

Typical I_{IN} vs V_{IN} characteristics of the device are shown in Figure 7. For proper operation, the device driving the data I/Os of the RS0208 device must have drive strength of at least ±2 mA.



(1) V_T is the input threshold of the RS0208 device, (typically V_{CC} / 2).

(2) V_D is the supply voltage of the external driver.

Figure 7. Typical I_{IN} vs V_{IN} Curve

Output Load Considerations

We recommend careful PCB layout practices with short PCB trace lengths to avoid excessive capacitive loading and to ensure that proper O.S. triggering takes place. PCB signal trace-lengths must be kept short enough such that the round trip delay of any reflection is less than the one-shot duration. This improves signal integrity by ensuring that any reflection sees a low impedance at the driver. The O.S. circuits have been designed to stay on for approximately 10 ns. The maximum capacitance of the lumped load that can be driven also depends directly on the one-shot duration. With very heavy capacitive loads, the one-shot can time-out before the signal is driven fully to the positive rail. The O.S. duration has been set to best optimize trade-offs between dynamic ICC, load driving capability, and maximum bit-rate considerations. Both PCB trace length and connectors add to the capacitance that the device output sees, so it is recommended that this lumped-load capacitance be considered to avoid O.S. retriggering, bus contention, output signal oscillations, or other adverse system-level affects.

Enable and Disable

The RS0208 device has an OE input that is used to disable the device by setting OE = low, which places all I/Os in the high-impedance (Hi-Z) state. The disable time (t_{dis}) indicates the delay between when OE goes low and when the outputs acutally get disabled (Hi-Z). The enable time (t_{en}) indicates the amount of time the user must allow for the one-shot circuitry to become operational after OE is taken high.

Pullup or Pulldown Resistors on I/O Lines

The device is designed to drive capacitive loads of up to 70 pF. The output drivers of the RS0208 device have low dc drive strength. If pullup or pulldown resistors are connected externally to the data I/Os, their values must be kept higher than 50 kΩ to ensure that they do not contend with the output drivers of the RS0208 device.

For the same reason, the RS0208 device must not be used in applications such as I^2C or 1-Wire where an open-drain driver is connected on the bidirectional data I/O. For these applications, use a device from the RS01xx series of level translators.

Device Functional Modes

The device has two functional modes, enabled and disabled. To disable the device, set the OE input to low, which places all I/Os in a high impedance state. Setting the OE input to high will enable the device.

Application Information

The RS0208 device can be used in level-translation applications for interfacing devices or systems operating at different interface voltages with one another. It can only translate push-pull CMOS logic outputs. Any external pulldown or pullup resistors are recommended larger than 50 kΩ.

Typical Application

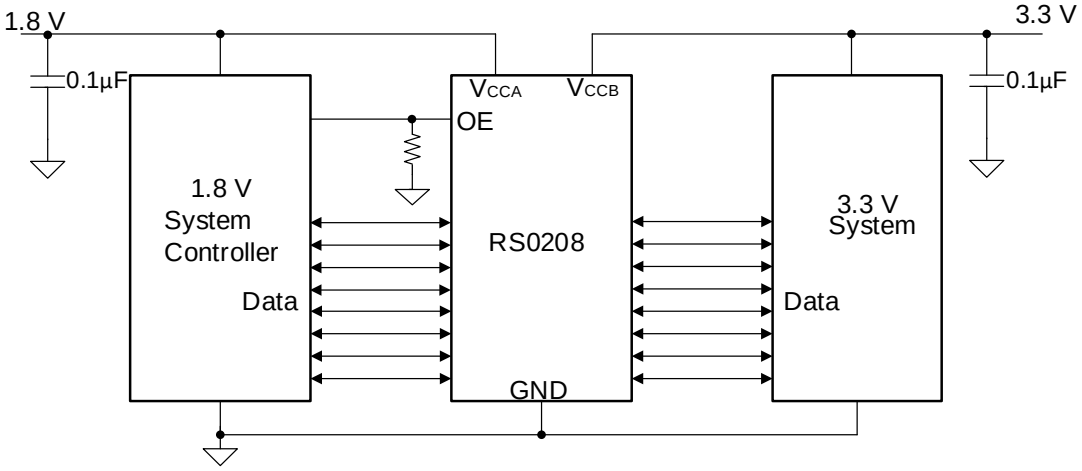
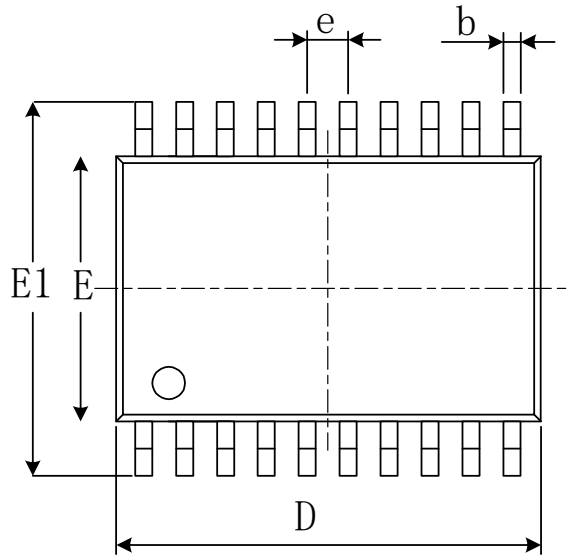
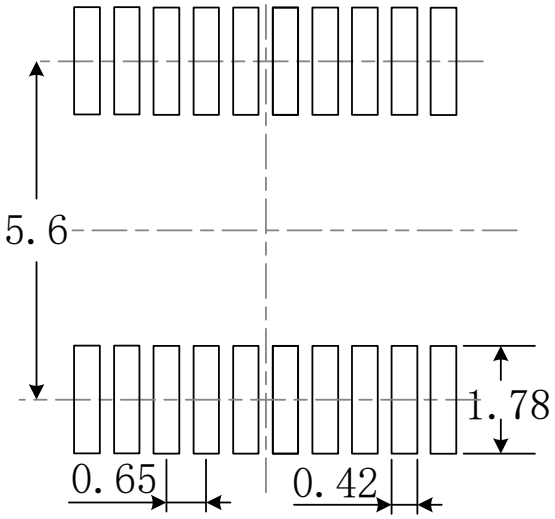


Figure 8. Typical Application Circuit

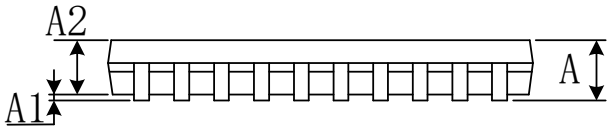
PACKAGE OUTLINE DIMENSIONS

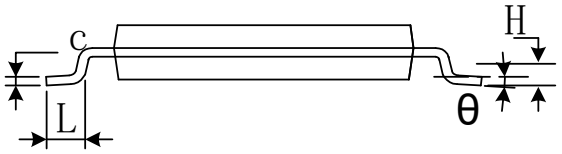
TSSOP20





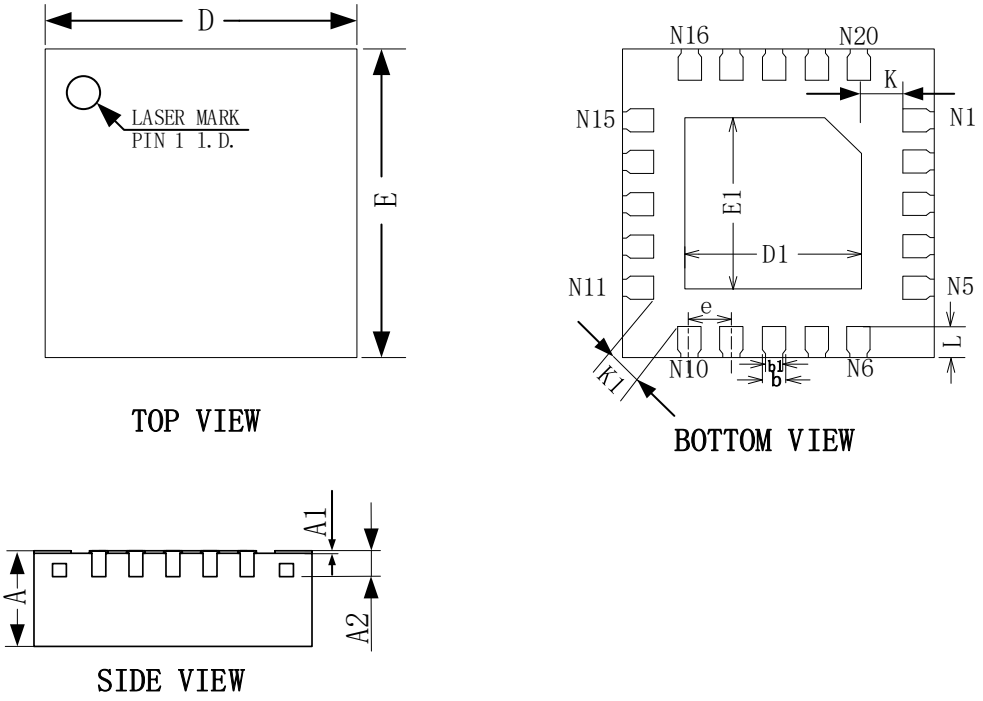
RECOMMENDED LAND PATTERN (Unit: mm)





Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A		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	0.280	0.008	0.011
c	0.130	0.170	0.005	0.007
D	6.400	6.600	0.252	0.260
E	4.300	4.500	0.169	0.177
E1	6.200	6.600	0.244	0.260
e	0.650(BSC)		0.026(BSC)	
L	0.450	0.750	0.018	0.030
H	0.250(TYP)		0.010(TYP)	
θ	0°	8°	0°	8°

QFN3*3-20L

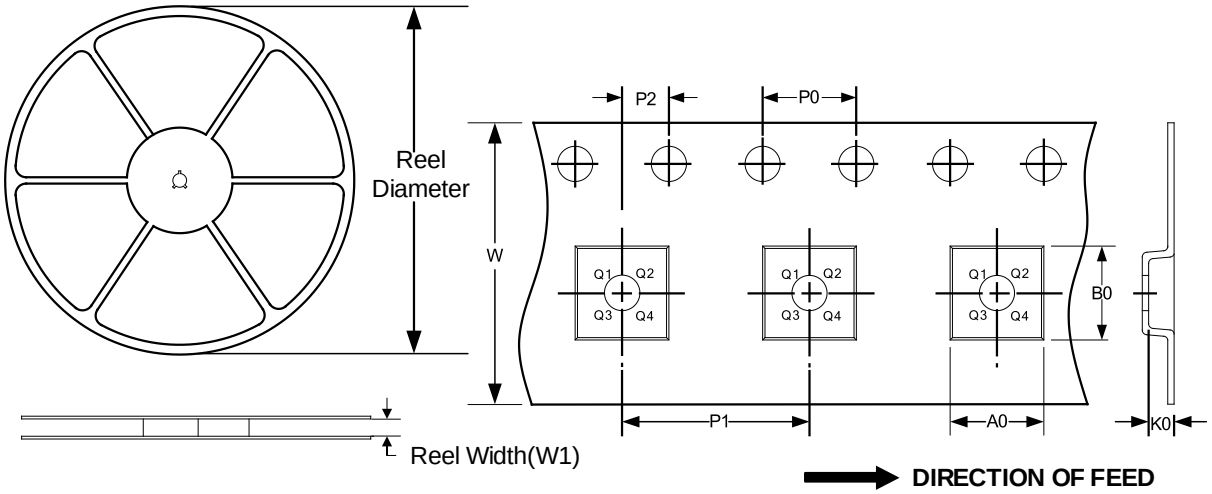


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	0.700	0.800	0.028	0.031
A1	0.000	0.050	0.000	0.002
A2	0.203REF		0.008 REF	
D	2.950	3.050	0.116	0.120
E	2.950	3.050	0.116	0.120
D1	1.550	1.650	0.061	0.065
E1	1.550	1.650	0.061	0.065
K	0.300REF		0.012REF	
K1	0.400REF		0.016REF	
b	0.150	0.250	0.006	0.010
b1	0.150REF		0.006REF	
e	0.400BSC		0.016BSC	
L	0.350	0.450	0.014	0.018

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
TSSOP20	13''	12.4	6.75	6.95	1.20	4.0	8.0	2.0	12.0	Q1
QFN3*3-20L	13''	12.4	3.35	3.35	1.13	4.0	8.0	2.0	12.0	Q1

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