

# Dual-Bit Dual-Supply Bus Transceiver with Configurable Voltage-Level Shifting and 3-State Outputs with Independent Direction Control Inputs

## 1 FEATURES

- **Each Channel Has an Independent DIR Control Input**
- **Control Inputs  $V_{IH}/V_{IL}$  Levels are Referenced to  $V_{CCA}$  Voltage**
- **Power-Supply Range:  $V_{CCA}$  and  $V_{CCB}$ : 0.9V to 3.6V**
- **$V_{CC}$  Isolation Feature: If Either  $V_{CC}$  Input is Below 100 mV, all I/Os Outputs are Disabled and Become High Impedance**
- **$I_{OFF}$ : Supports Partial-Power-Down Mode Operation**
- **Extended Temperature: -40°C to +125°C**

## 2 APPLICATIONS

- **Desktop PC**
- **Personal electronics**
- **Industrial**
- **Enterprise**

## 3 DESCRIPTIONS

This dual-bit noninverting bus transceiver uses two separate configurable power-supply rails. The A port is designed to track  $V_{CCA}$ .  $V_{CCA}$  accepts any supply voltage from 0.9 V to 3.6 V. The B port is designed to track  $V_{CCB}$ .  $V_{CCB}$  accepts any supply voltage from 0.9 to 3.6 V. This allows for universal low-voltage bi-directional translation between any of the 0.9V, 1.2V, 1.5V, 1.8V, 2.5V, and 3.3V voltage nodes.

The RS2T245 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  $I_{CCZ}$ .

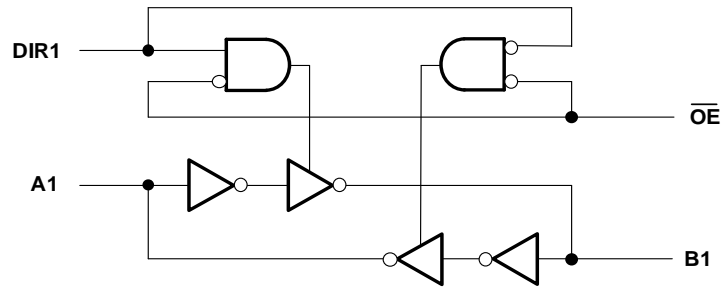
This device is fully specified for partial-power-down applications using  $I_{OFF}$ . The  $I_{OFF}$  circuitry disables the outputs, preventing damaging current backflow through the device when it is powered down.

**Device Information (1)**

PART NUMBER	PACKAGE	BODY SIZE (NOM)
RS2T245	QFN1.4×1.8-10L	1.80mm×1.40mm

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

## 4 Functional Block Diagram



Logic Diagram (Positive Logic)

Function Table

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

VERSION	Change Date	Change Item
A.1	2023/03/10	Initial version completed

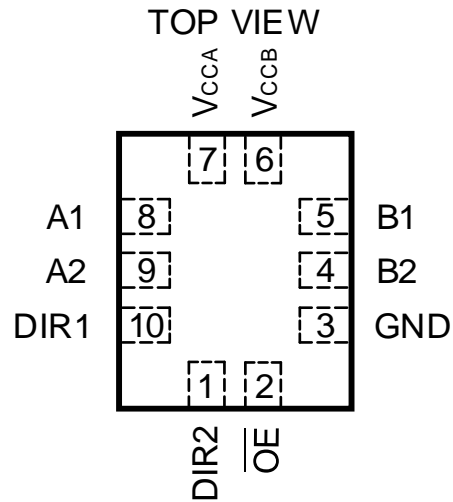
**6 PACKAGE/ORDERING INFORMATION <sup>(1)</sup>**

PRODUCT	ORDERING NUMBER	TEMPERATURE RANGE	PACKAGE LEAD	PACKAGE MARKING <sup>(2)</sup>	MSL <sup>(3)</sup>	PACKAGE OPTION
RS2T245	RS2T245XUTQK10	-40°C ~+125°C	QFN1.4x1.8-10L	2T245	MSL3	Tape and Reel,4000

## 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



QFN1.4x1.8-10L

### PIN DESCRIPTION

PIN	NAME	TYPE <sup>(1)</sup>	FUNCTION
QFN1.4x1.8-10L			
1	DIR2	I	Direction-control input referenced to $V_{CCA}$ , controls signal flow for the second (A2/B2) I/O channels.
2	$\overline{OE}$	I	3-state output-mode enables. Pull $\overline{OE}$ high to place all outputs in 3-state mode. Referenced to $V_{CCA}$ .
3	GND	G	Ground.
4	B2	I/O	Input/output B2. Reference to $V_{CCB}$ .
5	B1	I/O	Input/output B1. Reference to $V_{CCB}$ .
6	$V_{CCB}$	P	B-port supply voltage. $0.9V \leq V_{CCB} \leq 3.6V$
7	$V_{CCA}$	P	A-port supply voltage. $0.9V \leq V_{CCA} \leq 3.6V$
8	A1	I/O	Input/output A1. Reference to $V_{CCA}$ .
9	A2	I/O	Input/output A2. Reference to $V_{CCA}$ .
10	DIR1	I	Direction-control input referenced to $V_{CCA}$ , controls signal flow for the first(A1/B1) I/O channels.

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

## 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	4.6	V
V <sub>CCB</sub>	Supply Voltage Range		-0.5	4.6	V
V <sub>I</sub> <sup>(2)</sup>	Input Voltage Range	A port	-0.5	4.6	V
		B port	-0.5	4.6	V
		Control inputs	-0.5	4.6	V
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	4.6	V
		B port	-0.5	4.6	V
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	V
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 <sup>(4)</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 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>	±4000	V
		Charged-device model (CDM), per ANSI/ESDA/JEDEC JS-002 <sup>(2)</sup>	±1500	V
		Machine Model (MM)	±300	V

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

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



#### 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<sub>CCI</sub> is the supply voltage associated with the input port. V<sub>CCO</sub> is the supply voltage associated with the output port. <sup>(1)(2)(3)</sup>

PARAMETER		V <sub>CCI</sub> <sup>(1)</sup>	V <sub>CCO</sub> <sup>(2)</sup>	MIN	TYP	MAX	UNIT
Supply voltage <sup>(1)</sup>	V <sub>CCA</sub>			0.9		3.6	V
	V <sub>CCB</sub>			0.9		3.6	
High-level input Voltage (V <sub>IH</sub> )	Data inputs <sup>(4)</sup>	0.9V to 1.95V		V <sub>CCI</sub> ×0.75			V
		1.95V to 2.7V		V <sub>CCI</sub> ×0.75			
		2.7V to 3.6V		V <sub>CCI</sub> ×0.75			
Low-level input Voltage (V <sub>IL</sub> )	Data inputs <sup>(4)</sup>	0.9V to 1.95V				V <sub>CCI</sub> ×0.35	V
		1.95V to 2.7V				V <sub>CCI</sub> ×0.35	
		2.7V to 3.6V				V <sub>CCI</sub> ×0.35	
High-level input Voltage (V <sub>IH</sub> )	Control inputs (referenced to V <sub>CCA</sub> ) <sup>(5)</sup>	0.9V to 1.95V		V <sub>CCI</sub> ×0.75			V
		1.95V to 2.7V		V <sub>CCI</sub> ×0.75			
		2.7V to 3.6V		V <sub>CCI</sub> ×0.75			
Low-level input Voltage (V <sub>IL</sub> )	Control inputs (referenced to V <sub>CCA</sub> ) <sup>(5)</sup>	0.9V to 1.95V				V <sub>CCI</sub> ×0.35	V
		1.95V to 2.7V				V <sub>CCI</sub> ×0.35	
		2.7V to 3.6V				V <sub>CCI</sub> ×0.35	
Input voltage (V <sub>I</sub> )				0		3.6	V
output voltage (V <sub>O</sub> )	Active state			0		V <sub>CCO</sub>	V
	3-state			0		3.6	V
High-level output current (I <sub>OH</sub> )			0.9V to 1.3V			-3	mA
			1.4V to 1.6V			-6	
			1.65V to 1.95V			-8	
			2.3V to 2.7V			-9	
			3V to 3.6V			-12	
Low-level output current (I <sub>OL</sub> )			0.9V to 1.3V			3	mA
			1.4V to 1.6V			6	
			1.65V to 1.95V			8	
			2.3V to 2.7V			9	
			3V to 3.6V			12	
Input transition rise or fall rate(Δt/Δv)						5	ns/V
T <sub>A</sub> Operating free-air temperature				-40		125	°C

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

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

(3) All unused data inputs of the device must be held at V<sub>CCI</sub> or GND to ensure proper device operation.

(4) For V<sub>CCI</sub> values not specified in the data sheet, V<sub>IH</sub> min = V<sub>CCI</sub> × 0.75 V, V<sub>IL</sub> max = V<sub>CCI</sub> × 0.35 V.

(5) For V<sub>CCA</sub> values not specified in the data sheet, V<sub>IH</sub> min = V<sub>CCA</sub> × 0.75 V, V<sub>IL</sub> max = V<sub>CCA</sub> × 0.35 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> = -100μA V <sub>I</sub> =V <sub>IH</sub>	0.9V to 3.6V	0.9V to 3.6V	Full	V <sub>CCO</sub> - 0.2			V	
	I <sub>OH</sub> = -3mA V <sub>I</sub> =V <sub>IH</sub>	1.2V	1.2V		0.95				
	I <sub>OH</sub> = -6mA V <sub>I</sub> =V <sub>IH</sub>	1.4V	1.4V		1.05				
	I <sub>OH</sub> = -8mA V <sub>I</sub> =V <sub>IH</sub>	1.65V	1.65V		1.2				
	I <sub>OH</sub> = -9mA V <sub>I</sub> =V <sub>IH</sub>	2.3V	2.3V		1.75				
	I <sub>OH</sub> = -12mA V <sub>I</sub> =V <sub>IH</sub>	3V	3V		2.3				
V <sub>OL</sub>	I <sub>OL</sub> = 100μA V <sub>I</sub> =V <sub>IL</sub>	0.9V to 3.6V	0.9V to 3.6V					0.2	V
	I <sub>OL</sub> = 3mA V <sub>I</sub> =V <sub>IL</sub>	1.2V	1.2V					0.25	
	I <sub>OL</sub> = 6mA V <sub>I</sub> =V <sub>IL</sub>	1.4V	1.4V					0.35	
	I <sub>OL</sub> = 8mA V <sub>I</sub> =V <sub>IL</sub>	1.65V	1.65V					0.45	
	I <sub>OL</sub> = 9mA V <sub>I</sub> =V <sub>IL</sub>	2.3V	2.3V					0.55	
	I <sub>OL</sub> = 12mA V <sub>I</sub> =V <sub>IL</sub>	3V	3V					0.7	
I <sub>I</sub> DIR	V <sub>I</sub> = V <sub>CCA</sub> or GND	0.9V to 3.6V	0.9V to 3.6V	+25°C			±1	μA	
				Full			±5		
I <sub>off</sub> A or B Port	V <sub>I</sub> or V <sub>O</sub> = 0 to 3.6V	0V	0V to 3.6V	+25°C			±1	μA	
		0V to 3.6V	0V	Full			±5		
I <sub>OZ</sub> <sup>(5)</sup> A or B Port	V <sub>O</sub> =V <sub>CCO</sub> or GND V <sub>IH</sub> =V <sub>CC1</sub> or GND OE=V <sub>IH</sub>	3.6V	3.6V	+25°C			±1	μA	
				Full			±2		
I <sub>CCA</sub> V <sub>CCA</sub> supply current	V <sub>I</sub> = V <sub>CC1</sub> or GND <sup>(6)</sup> I <sub>O</sub> = 0	0.9V to 3.6V	0.9V to 3.6V	Full			15	μA	
		0V	0V to 3.6V	Full	-2				
		0V to 3.6V	0V	Full			15		
I <sub>CCB</sub> V <sub>CCB</sub> supply current	V <sub>I</sub> = V <sub>CC1</sub> or GND <sup>(6)</sup> I <sub>O</sub> = 0	0.9V to 3.6V	0.9V to 3.6V	Full			15	μA	
		0V	0V to 3.6V	Full			15		
		0V to 3.6V	0V	Full	-2				
I <sub>CCA</sub> + I <sub>CCB</sub> Combined supply current	V <sub>I</sub> = V <sub>CC1</sub> or GND I <sub>O</sub> = 0	0.9V to 3.6V	0.9V to 3.6V	Full			30	μA	
C <sub>I</sub> Control inputs	V <sub>I</sub> = V <sub>CCA</sub> or GND	3.3V	3.3V	+25°C		2.5		pF	
C <sub>IO</sub> A or B Port	V <sub>O</sub> = V <sub>CCA</sub> or GND	3.3V	3.3V	+25°C		5		pF	

(1) V<sub>CC1</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>CC1</sub> or GND to assure proper device operation.

## 8.5 Switching Characteristics

### 8.5.1 $V_{CCA}=0.9V\pm 0.1V$

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

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CCB}=0.9V \pm 0.1V^{(1)}$		$V_{CCB}=1.2V \pm 0.1V^{(1)}$		$V_{CCB}=1.5V \pm 0.1V^{(1)}$		$V_{CCB}=1.8V \pm 0.15V^{(1)}$		$V_{CCB}=2.5V \pm 0.2V^{(1)}$		$V_{CCB}=3.3V \pm 0.3V^{(1)}$		UNIT
			MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
$t_{PLH}$	An	Bn	6.6	23.9	5.9	18.6	5.5	17.0	5.2	16.5	5.0	15.9	5.0	15.9	ns
$t_{PHL}$			5.9	18.9	4.9	16.1	4.8	15.5	4.6	15.3	4.8	15.2	4.8	15.0	
$t_{PLH}$	Bn	An	7.7	24.5	6.8	21.3	6.2	21.2	6.3	19.5	6.1	19.1	6.4	20.1	ns
$t_{PHL}$			5.9	19.2	5.2	16.5	4.9	16.1	4.7	16.1	4.5	14.9	4.4	14.3	
$t_{PZH}$	$\overline{OE}$	An	10.2	60.0	7.6	39.3	6.4	42.8	6.0	32.6	5.6	28.1	7.4	27.8	ns
$t_{PZL}$			9.1	30.2	8.2	27.8	7.8	26.3	7.8	25.4	7.7	25.2	7.5	24.0	
$t_{PZH}$	$\overline{OE}$	Bn	10.1	44.3	10.7	44.7	10.7	48.9	10.1	56.3	10.7	47.4	12.6	52.4	ns
$t_{PZL}$			7.3	30.2	6.6	30.9	6.5	30.2	5.8	29.3	6.4	27.5	6.9	30.8	
$t_{PHZ}$	$\overline{OE}$	An	6.4	31.2	5.8	25.2	5.2	24.5	5.6	22.1	5.4	19.2	7.1	24.3	ns
$t_{PLZ}$			7.2	29.1	5.7	24.6	4.9	22.2	4.9	23.3	4.8	20.4	6.4	23.6	
$t_{PHZ}$	$\overline{OE}$	Bn	6.0	28.5	5.5	26.1	5.6	30.2	5.7	28.8	5.6	28.4	5.5	27.9	ns
$t_{PLZ}$			9.2	31.5	9.4	31.8	9.4	31.4	9.2	31.4	9.6	32.4	9.8	32.4	

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

### 8.5.2 $V_{CCA}=1.2V\pm 0.1V$

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

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CCB}=0.9V \pm 0.1V^{(1)}$		$V_{CCB}=1.2V \pm 0.1V^{(1)}$		$V_{CCB}=1.5V \pm 0.1V^{(1)}$		$V_{CCB}=1.8V \pm 0.15V^{(1)}$		$V_{CCB}=2.5V \pm 0.2V^{(1)}$		$V_{CCB}=3.3V \pm 0.3V^{(1)}$		UNIT
			MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
$t_{PLH}$	An	Bn	6.8	21.5	5.1	16.7	4.5	14.1	4.1	13.7	4.1	12.6	4.0	12.6	ns
$t_{PHL}$			5.0	17.0	4.1	14.3	3.9	12.9	3.8	12.5	3.8	11.7	3.6	12	
$t_{PLH}$	Bn	An	6.1	18.9	5.0	17.0	4.7	16.2	4.5	15.5	4.0	15.2	4.0	15	ns
$t_{PHL}$			5.1	16.2	4.2	14.4	4.0	14.3	3.7	13.1	3.6	12.3	3.6	11.6	
$t_{PZH}$	$\overline{OE}$	An	10.2	42.0	7.4	29.1	6.2	31.2	5.6	23.9	5.4	21.5	5.1	20.0	ns
$t_{PZL}$			7.1	25.5	6.0	22.4	5.7	21.0	5.3	19.7	5.2	18.6	5.1	17.9	
$t_{PZH}$	$\overline{OE}$	Bn	7.3	29.3	7.2	29.0	7.3	29.7	7.1	29.3	7.1	27.8	7.5	27.5	ns
$t_{PZL}$			5.1	23.3	5.0	22.1	4.9	21.2	4.5	23.1	5.0	20.6	5.0	20.6	
$t_{PHZ}$	$\overline{OE}$	An	5.4	27.6	5.4	24.5	4.2	22.7	5.3	21.2	4.7	17.4	5.7	22.8	ns
$t_{PLZ}$			5.9	25.8	4.8	22.5	4.2	17.7	4.9	20.1	4.3	17.1	5.4	20.4	
$t_{PHZ}$	$\overline{OE}$	Bn	4.8	23.3	4.6	20.0	5.1	21.0	5.1	21.3	4.6	22.5	4.8	22.8	ns
$t_{PLZ}$			6.1	21.9	5.9	21.8	6.0	22.8	6.0	21.9	5.9	22.8	5.8	22.5	

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

### 8.5.3 $V_{CCA}=1.5V\pm 0.1V$

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

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CCB}=0.9V \pm 0.1V^{(1)}$		$V_{CCB}=1.2V \pm 0.1V^{(1)}$		$V_{CCB}=1.5V \pm 0.1V^{(1)}$		$V_{CCB}=1.8V \pm 0.15V^{(1)}$		$V_{CCB}=2.5V \pm 0.2V^{(1)}$		$V_{CCB}=3.3V \pm 0.3V^{(1)}$		UNIT
			MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
t <sub>PLH</sub>	An	Bn	6.5	21.0	4.6	16.1	4.0	13.7	3.9	12.8	3.6	11.9	3.5	11.1	ns
t <sub>PHL</sub>			4.9	15.9	4.0	13.1	3.5	11.9	3.5	11.7	3.2	11.1	3.3	11.1	
t <sub>PLH</sub>	Bn	An	5.1	17.0	4.4	14.4	4.0	13.7	3.7	13.5	3.5	12.5	3.5	12.5	ns
t <sub>PHL</sub>			4.9	15.8	4.1	13.2	3.8	12.6	3.4	12.2	3.4	11.3	3.3	11.0	
t <sub>PZH</sub>	$\overline{OE}$	An	8.7	49.4	6.2	26.3	5.6	22.7	5.0	18.5	4.8	17.7	4.4	16.5	ns
t <sub>PZL</sub>			6.4	24.3	5.0	18.9	4.8	18.3	4.4	17.4	4.5	16.8	4.1	15.5	
t <sub>PZH</sub>	$\overline{OE}$	Bn	5.6	22.4	5.6	21.8	5.7	21.5	5.7	21.9	5.5	22.5	5.6	21.8	ns
t <sub>PZL</sub>			4.0	19.1	4.3	19.8	4.6	19.2	4.0	17.1	3.9	20.1	4.2	21.2	
t <sub>PHZ</sub>	$\overline{OE}$	An	6.2	25.8	5.1	24.2	4.1	24.0	5.2	20.1	4.0	16.7	5.1	20.7	ns
t <sub>PLZ</sub>			5.2	26.7	4.8	19.8	4.1	18.9	4.3	20.1	3.9	16.7	5.3	19.7	
t <sub>PHZ</sub>	$\overline{OE}$	Bn	3.3	18.0	3.5	17.4	3.4	18.6	3.7	20.1	4.0	17.9	3.9	19.5	ns
t <sub>PLZ</sub>			5.1	18.9	4.8	18.5	4.9	19.2	4.7	18.2	4.9	18.3	4.8	18.6	

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

### 8.5.4 $V_{CCA}=1.8V\pm 0.15V$

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

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CCB}=0.9V \pm 0.1V^{(1)}$		$V_{CCB}=1.2V \pm 0.1V^{(1)}$		$V_{CCB}=1.5V \pm 0.1V^{(1)}$		$V_{CCB}=1.8V \pm 0.15V^{(1)}$		$V_{CCB}=2.5V \pm 0.2V^{(1)}$		$V_{CCB}=3.3V \pm 0.3V^{(1)}$		UNIT
			MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
t <sub>PLH</sub>	An	Bn	6.6	20.6	4.6	15.5	4.0	14.0	3.7	12.9	3.5	11.7	3.5	11.3	ns
t <sub>PHL</sub>			4.5	15.3	3.5	12.5	3.2	11.1	3.1	10.5	3.0	10.2	3.0	9.9	
t <sub>PLH</sub>	Bn	An	5.3	16.4	4.0	13.2	3.8	12.6	3.7	12.3	3.4	11.7	3.3	11.6	ns
t <sub>PHL</sub>			4.7	15.3	3.9	12.8	3.7	12.0	3.3	11.3	3.2	10.7	3.2	10.4	
t <sub>PZH</sub>	$\overline{OE}$	An	9.5	40.4	6.0	26.6	5.2	29.0	4.5	22.8	4.4	15.8	4.0	15.0	ns
t <sub>PZL</sub>			5.7	21.5	4.5	17.7	4.1	15.9	4.0	15	3.9	14.1	3.5	13.4	
t <sub>PZH</sub>	$\overline{OE}$	Bn	5.1	17.6	4.8	17.4	5.0	17.3	4.9	18.2	5.0	17.1	4.8	17.1	ns
t <sub>PZL</sub>			4.6	20.0	4.6	19.1	5.2	20.9	4.9	20.1	5.1	19.7	4.5	19.1	
t <sub>PHZ</sub>	$\overline{OE}$	An	5.8	27.2	5.6	24.8	4.2	21.5	4.9	23.3	4.4	16.7	5.3	21.6	ns
t <sub>PLZ</sub>			6.3	27.0	4.5	20.9	4.1	19.1	4.8	20.7	4.0	16.7	5.1	18.9	
t <sub>PHZ</sub>	$\overline{OE}$	Bn	4.7	21.3	4.7	20.7	5.0	19.8	4.7	21.6	4.4	20.4	4.8	21.6	ns
t <sub>PLZ</sub>			4.0	15.2	4.1	15.0	3.8	15.2	4.0	14.7	3.7	15.2	3.7	15.0	

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

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

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

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CCB}=0.9V \pm 0.1V^{(1)}$		$V_{CCB}=1.2V \pm 0.1V^{(1)}$		$V_{CCB}=1.5V \pm 0.1V^{(1)}$		$V_{CCB}=1.8V \pm 0.15V^{(1)}$		$V_{CCB}=2.5V \pm 0.2V^{(1)}$		$V_{CCB}=3.3V \pm 0.3V^{(1)}$		UNIT
			MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
t <sub>PLH</sub>	An	Bn	6.3	19.8	4.3	15.5	3.8	13.1	3.4	12.2	3.3	11.1	3.2	11.0	ns
t <sub>PHL</sub>			4.6	14.9	3.5	11.6	3.3	10.8	3.1	10.2	3.0	9.8	2.8	9.5	
t <sub>PLH</sub>	Bn	An	4.6	15.0	3.8	12.6	3.5	11.6	3.3	11.3	3.2	10.5	2.9	10.8	ns
t <sub>PHL</sub>			4.8	15.0	3.8	12.6	3.6	11.7	3.2	10.8	3.1	10.5	3.1	10.1	
t <sub>PZH</sub>	$\overline{OE}$	An	8.0	37.7	5.1	23.9	4.4	21.0	4.0	15.0	3.8	13.5	3.4	12.3	ns
t <sub>PZL</sub>			5.4	19.8	3.8	15.5	3.5	14.6	3.2	12.6	3.1	12.2	2.8	10.8	
t <sub>PZH</sub>	$\overline{OE}$	Bn	4.0	14.3	3.9	14.1	3.9	14.3	3.8	14.3	3.9	14.4	3.9	14.0	ns
t <sub>PZL</sub>			4.1	15.3	4.1	15.2	4.1	16.5	4.0	16.7	4.3	16.1	4.1	17.9	
t <sub>PHZ</sub>	$\overline{OE}$	An	6.6	27.5	5.3	25.7	5.0	20.9	5.4	21.5	4.8	18.2	5.8	22.5	ns
t <sub>PLZ</sub>			5.3	25.5	4.4	22.7	4.0	19.1	4.7	19.7	4.2	16.8	4.8	20.4	
t <sub>PHZ</sub>	$\overline{OE}$	Bn	3.7	17.3	3.4	17.3	3.6	17.3	4.0	17.0	4.3	17.6	3.6	16.1	ns
t <sub>PLZ</sub>			3.3	12.5	3.3	12.5	3.1	12.3	3.1	12.5	3.2	12.3	2.5	11.7	

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

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

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

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CCB}=0.9V \pm 0.1V^{(1)}$		$V_{CCB}=1.2V \pm 0.1V^{(1)}$		$V_{CCB}=1.5V \pm 0.1V^{(1)}$		$V_{CCB}=1.8V \pm 0.15V^{(1)}$		$V_{CCB}=2.5V \pm 0.2V^{(1)}$		$V_{CCB}=3.3V \pm 0.3V^{(1)}$		UNIT
			MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
t <sub>PLH</sub>	An	Bn	6.3	19.8	4.1	15.2	3.7	13.1	3.4	11.9	3.1	11.0	3.1	10.2	ns
t <sub>PHL</sub>			4.3	14.0	3.5	11.3	3.2	10.5	3.1	9.8	2.9	9.3	2.9	9.2	
t <sub>PLH</sub>	Bn	An	4.9	15.6	3.8	12.2	3.5	11.1	3.3	10.7	3.1	10.1	2.9	9.9	ns
t <sub>PHL</sub>			4.8	15.8	3.8	12.5	3.5	11.7	3.3	10.8	3.0	10.2	3.0	9.6	
t <sub>PZH</sub>	$\overline{OE}$	An	7.1	31.8	4.7	20.6	3.6	17.9	3.2	13.2	2.9	11.9	2.7	10.7	ns
t <sub>PZL</sub>			4.4	18.6	3.0	13.5	2.6	11.1	2.5	10.1	2.3	9.15	1.9	8.4	
t <sub>PZH</sub>	$\overline{OE}$	Bn	2.6	10.2	2.6	10.1	2.7	10.4	2.8	11.0	2.8	10.8	2.8	10.8	ns
t <sub>PZL</sub>			5.1	20.9	5.8	20.6	5.3	20.3	5.7	20.3	5.8	20.4	5.8	20.4	
t <sub>PHZ</sub>	$\overline{OE}$	An	6.9	29.9	5.9	27.2	5.2	22.8	5.4	23.1	4.7	18.5	5.9	21.5	ns
t <sub>PLZ</sub>			5.1	28.8	4.5	20.6	4.3	18.2	4.8	21	4.2	17.9	5.0	20.1	
t <sub>PHZ</sub>	$\overline{OE}$	Bn	5.6	21.5	5.5	19.7	5.7	20.4	5.1	20.1	5.0	19.7	5.3	20.6	ns
t <sub>PLZ</sub>			2.1	8.55	2.0	8.6	2.0	8.6	1.8	8.7	2.0	8.4	2.0	8.6	

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

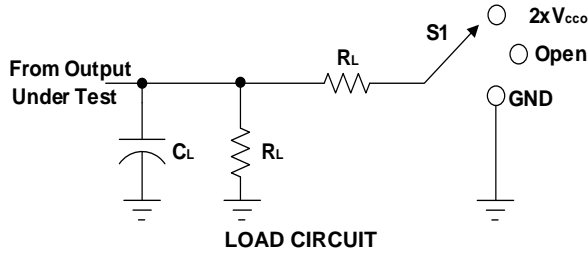
## 8.6 Operating Characteristics

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

PARAMETER		TEST CONDITIONS	$V_{CCA}=$ $V_{CCB}=0.9\text{V}$	$V_{CCA}=$ $V_{CCB}=1.2\text{V}$	$V_{CCA}=$ $V_{CCB}=1.5\text{V}$	$V_{CCA}=$ $V_{CCB}=1.8\text{V}$	$V_{CCA}=$ $V_{CCB}=2.5\text{V}$	$V_{CCA}=$ $V_{CCB}=3.3\text{V}$	UNIT
			TYP	TYP	TYP	TYP	TYP	TYP	
$C_{pdA}^{(1)}$	A-port input, B-port output	$C_L=0,$ $f=10\text{MHz},$ $t_r=t_f=1\text{ns}$	2	2	2	3	3	5	pF
	B-port input, A-port output		15	18	22	25	28	32	
$C_{pdB}^{(1)}$	A-port input, B-port output		15	18	22	25	28	32	
	B-port input, A-port output		2	2	2	3	3	5	

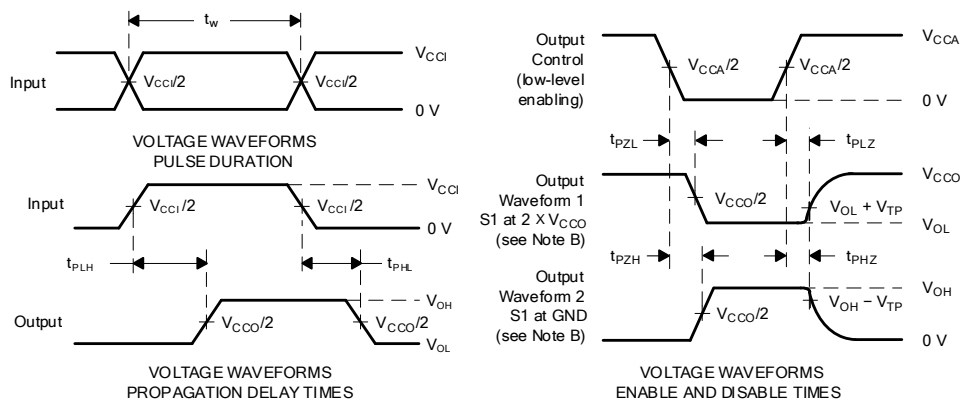
(1) Power dissipation capacitance per transceiver.

## 9 Parameter Measurement Information



TEST	S1
$t_{pd}$	Open
$t_{PLZ}/t_{PZL}$	$2 \times V_{CCO}$
$t_{PHZ}/t_{PZH}$	GND

$V_{CC}$	$C_L$	$R_L$	$V_{TP}$
$1.2V \pm 0.1V$	15pF	2k $\Omega$	0.1V
$1.5V \pm 0.1V$	15pF	2k $\Omega$	0.1V
$1.8V \pm 0.15V$	15pF	2k $\Omega$	0.15V
$2.5V \pm 0.2V$	15pF	2k $\Omega$	0.15V
$3.3V \pm 0.3V$	15pF	2k $\Omega$	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.

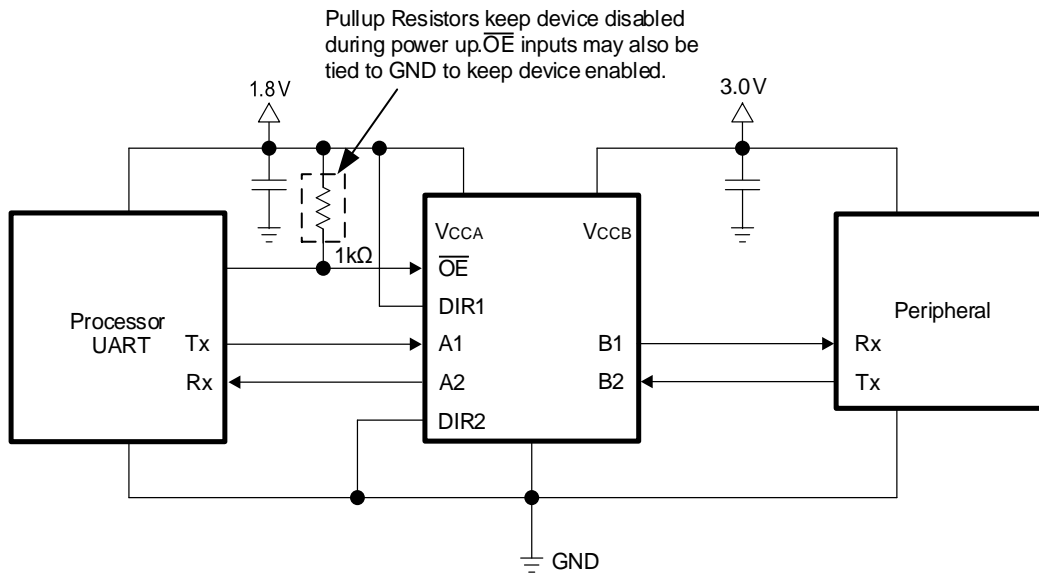
**Figure 1. Load Circuit and Voltage Waveforms**

## 10 Application and Implementation

Information in the following applications sections is not part of the Runic component specification, and Runic does not warrant its accuracy or completeness. Runic's customers are responsible for determining suitability of components for their purposes. Customers should validate and test their design implementation to confirm system functionality.

### 10.1 Application Information

The RS2T245 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 12 mA when device is powered by 3.3 V.



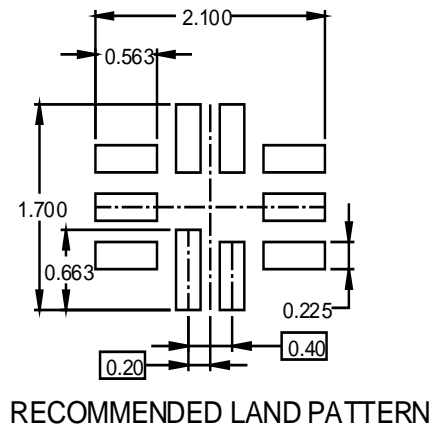
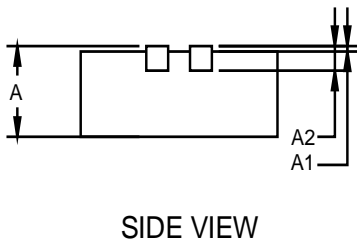
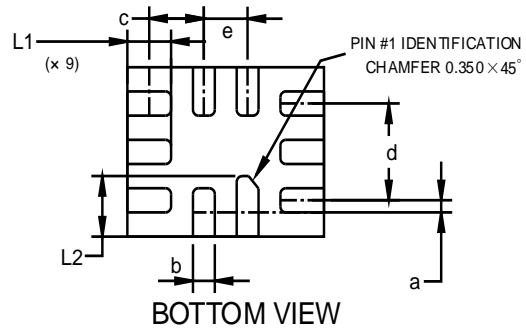
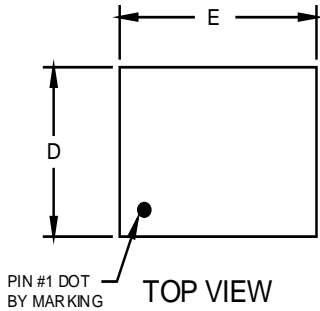
**Figure 2. Typical Application Circuit**

### 10.2 Power Supply Recommendations

The output-enable  $\overline{OE}$  input circuit is designed so that it is supplied by  $V_{CCA}$  and when the  $\overline{OE}$  input is high, all outputs are placed in the high-impedance state. To ensure the high-impedance state of the outputs during power-up or power-down, the  $\overline{OE}$  input pin must be tied to  $V_{CCA}$  through a pullup resistor and must not be enabled until  $V_{CCA}$  and  $V_{CCB}$  are fully ramped and stable. The minimum value of the pullup resistor to  $V_{CCA}$  is determined by the current-sinking capability of the driver.

# 11 PACKAGE OUTLINE DIMENSIONS

## QFN1.4x1.8-10L



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	0.500	0.600	0.020	0.024
A1	0.000	0.050	0.000	0.002
A2	0.203 REF		0.008 REF	
a	0.050	0.150	0.002	0.006
b	0.150	0.250	0.006	0.010
c	0.450	0.550	0.018	0.022
d	0.800 REF		0.031 REF	
D	1.350	1.450	0.053	0.057
E	1.750	1.850	0.069	0.073
e	0.400 TYP		0.016 TYP	
L1	0.350	0.450	0.014	0.018
L2	0.450	0.550	0.018	0.022

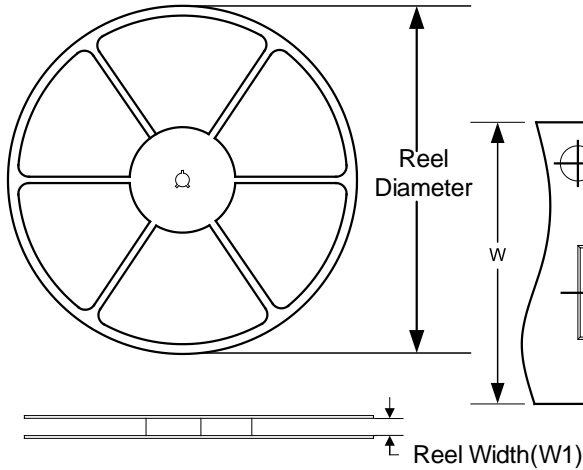
**NOTE:**

- A. All linear dimension is in millimeters.
- B. This drawing is subject to change without notice.
- C. Body dimensions do not include mold flash or protrusion. Mold flash and protrusion shall not exceed 0.15 per side.
- D. REF: Reference Dimension, usually without tolerance, for information purposes only.

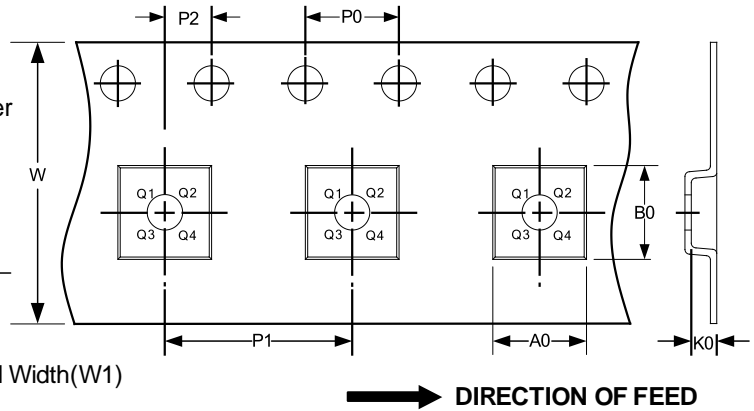


## 12 TAPE AND REEL INFORMATION

### 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
QFN1.4x1.8-10L	7"	9.0	1.6	2.00	0.85	4.0	4.0	2.0	8.0	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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