

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

## 1 FEATURES

- **Qualified for Automotive Applications**
- **AEC-Q100 Qualified with the Grade 1**
- **Control Inputs  $V_{IH}/V_{IL}$  Levels are Referenced to  $V_{CCA}$  Voltage**
- **Power-Supply Range:**  
 **$V_{CCA}$  and  $V_{CCB}$ : 1.65V to 5.5V**
- **$V_{CC}$  Isolation: If Either  $V_{CC}$  is at GND, Both Ports are in the High-Impedance State**
- **$I_{OFF}$ : Supports Partial-Power-Down Mode Operation**
- **Extended Temperature: -40°C to +125°C**

## 2 APPLICATIONS

- **Automotive Infotainment**
- **Advance Driver Assistance Systems (ADAS)**
- **Telematics**
- **Navigation Systems**
- **Cluster**

## 3 DESCRIPTIONS

This 4-bit non-inverting bus transceiver is a bidirectional voltage-level translator and can be used to establish digital switching compatibility between mixed-voltage systems. It uses two separate configurable power-supply rails, Both  $V_{CCA}$  and  $V_{CCB}$  supporting operating voltages from 1.65 V to 5.5 V, A ports, DIR and  $\overline{OE}$  tracks the  $V_{CCA}$  supply and B ports tracks the  $V_{CCB}$  supply. This allows the support of both lower and higher logic signal levels while providing bidirectional translation capabilities between any of the 1.8V, 2.5V, 3.3V and 5.5V voltage nodes.

The RS4T245-Q1 is designed for asynchronous communication between two data buses. The logic levels of the direction-control (DIR) input and the output-enable ( $\overline{OE}$ ) input activate either the B-port outputs or the A-port outputs or place both output ports into the high-impedance mode. The device transmits data from the A bus to the B bus when the B-port outputs are activated, and from the B bus to the A bus when the A-port outputs are activated. The input circuitry on both A and B ports is always active and must have a logic HIGH or LOW level applied to prevent excess  $I_{CC}$  and  $I_{CCZ}$ .

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

The  $V_{CC}$  isolation feature ensures that if either  $V_{CC}$  input is at GND, all outputs are in the high-impedance state.

To ensure the high-impedance state during power up or power down,  $\overline{OE}$  should be tied to  $V_{CC}$  through a pullup resistor, the minimum value of the resistor is determined by the current-sinking capability of the driver.

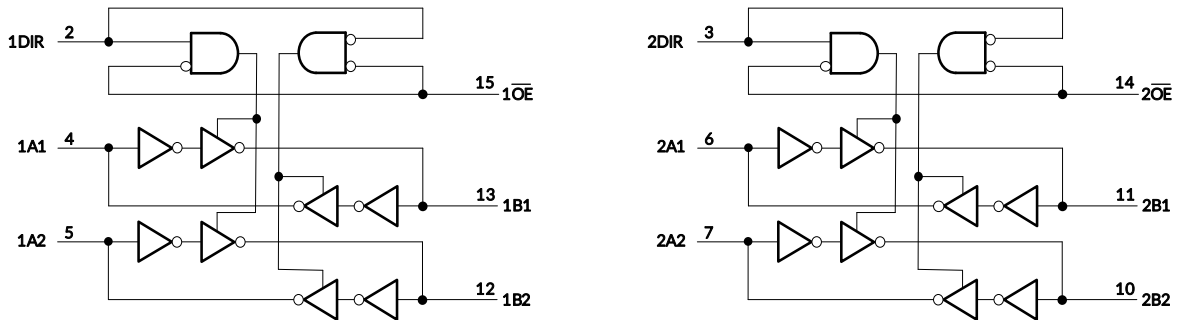
The RS4T245-Q1 is designed so that the control pins (DIR and  $\overline{OE}$ ) are supplied by  $V_{CCA}$ . It operates over an ambient temperature range of -40°C to +125°C.

**Device Information (1)**

PART NUMBER	PACKAGE	BODY SIZE (NOM)
RS4T245-Q1	QFN2.5x3.5-16L	2.50mm×3.50mm

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

## 4 Functional Block Diagram



**Function Table**

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

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## 5 Revision History

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

<b>VERSION</b>	<b>Change Date</b>	<b>Change Item</b>
A.1	2023/06/06	Initial version completed
A.2	2023/09/18	Update PIN CONFIGURATIONS

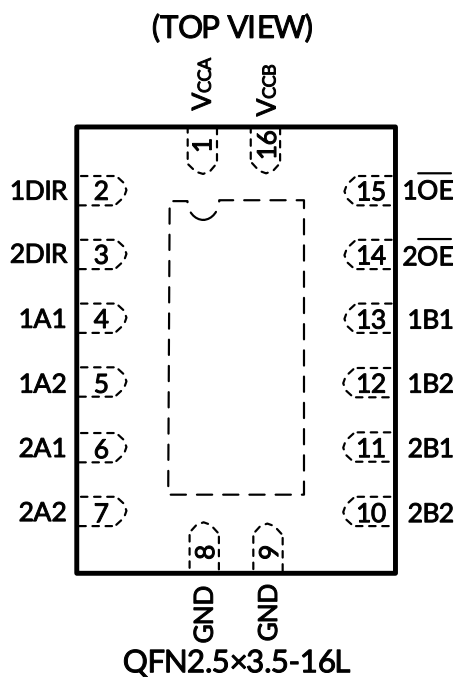
**6 PACKAGE/ORDERING INFORMATION <sup>(1)</sup>**

PRODUCT	ORDERING NUMBER	PACKAGE LEAD	TEMPERATURE RANGE	Lead finish/Ball material <sup>(2)</sup>	MSL Peak Temp <sup>(3)</sup>	PACKAGE MARKING <sup>(4)</sup>	PACKAGE OPTION
RS4T245-Q1	RS4T245XT QW16-Q1	QFN2.5x3. 5-16L	-40°C ~+125°C	NIPDAUAG	MSL1-260°- Unlimited	RS4T245	Tape and Reel,5000

**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) Lead finish/Ball material. Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.
- (3) MSL Peak Temp. The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.
- (4) 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.

## 7 PIN CONFIGURATIONS



## PIN DESCRIPTION

PIN	NAME	TYPE <sup>(1)</sup>	FUNCTION
QFN2.5×3.5-16L			
1	V <sub>CCA</sub>	P	A-port supply voltage. $1.65V \leq V_{CCA} \leq 5.5V$
2	1DIR	I	Direction-control input for "1" ports.
3	2DIR	I	Direction-control input for "2" ports.
4	1A1	I/O	Input/output 1A1. Reference to V <sub>CCA</sub> .
5	1A2	I/O	Input/output 1A2. Reference to V <sub>CCA</sub> .
6	2A1	I/O	Input/output 2A1. Reference to V <sub>CCA</sub> .
7	2A2	I/O	Input/output 2A2. Reference to V <sub>CCA</sub> .
8	GND	G	Ground.
9	GND	G	Ground.
10	2B2	I/O	Input/output 2B2. Reference to V <sub>CCB</sub> .
11	2B1	I/O	Input/output 2B1. Reference to V <sub>CCB</sub> .
12	1B2	I/O	Input/output 1B2. Reference to V <sub>CCB</sub> .
13	1B1	I/O	Input/output 1B1. Reference to V <sub>CCB</sub> .
14	2OE	I	Output Enable (Active Low). Pull 2OE high to place all "2" outputs in 3-state mode. Referenced to V <sub>CCA</sub> .
15	1OE	I	Output Enable (Active Low). Pull 1OE high to place all "1" outputs in 3-state mode. Referenced to V <sub>CCA</sub> .
16	V <sub>CCB</sub>	P	B-port supply voltage. $1.65V \leq V_{CCB} \leq 5.5V$

(1) I=input, O=output, I/O=input and output, P=power, 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	6.5	V
V <sub>CCB</sub>	Supply Voltage Range		-0.5	6.5	V
V <sub>I</sub> <sup>(2)</sup>	Input Voltage Range	A port	-0.5	6.5	V
		B port	-0.5	6.5	
		Control inputs	-0.5	6.5	V
V <sub>O</sub> <sup>(2)</sup>	Voltage range applied to any output in the high-impedance or power-off state	A port	-0.5	6.5	V
		B port	-0.5	6.5	
V <sub>O</sub> <sup>(2)(3)</sup>	Voltage range applied to any output in the high or low state	A port	-0.5	V <sub>CCA</sub> +0.5	V
		B port	-0.5	V <sub>CCB</sub> +0.5	
I <sub>IK</sub>	Input clamp current	V <sub>I</sub> <0		-50	mA
I <sub>OK</sub>	Output clamp current	V <sub>O</sub> <0		-50	mA
I <sub>O</sub>	Continuous output current			±50	mA
	Continuous current through V <sub>CCA</sub> , V <sub>CCB</sub> or GND			±100	mA
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 AEC Q100-002 <sup>(1)</sup>	±2000	V
		Charged-Device Model (CDM), per AEC Q100-011	±500	V
		Latch-Up (LU), per AEC Q100-004	±100	mA

(1) AEC Q100-002 indicates that HBM stressing shall be in accordance with the ANSI/ESDA/JEDEC JS-001 specification.



#### 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.

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>			1.65		5.5	V
	V <sub>CCB</sub>			1.65		5.5	
High-level input Voltage (V <sub>IH</sub> )	Data inputs <sup>(5)</sup>	1.65V to 1.95V		V <sub>CCI</sub> x0.75			V
		2.3V to 2.7V		V <sub>CCI</sub> x0.7			
		3V to 3.6V		V <sub>CCI</sub> x0.7			
		4.5V to 5.5V		V <sub>CCI</sub> x0.7			
Low-level input Voltage (V <sub>IL</sub> )	Data inputs <sup>(5)</sup>	1.65V to 1.95V				V <sub>CCI</sub> x0.35	V
		2.3V to 2.7V				V <sub>CCI</sub> x0.3	
		3V to 3.6V				V <sub>CCI</sub> x0.3	
		4.5V to 5.5V				V <sub>CCI</sub> x0.3	
High-level input Voltage (V <sub>IH</sub> )	Control inputs (referenced to V <sub>CCA</sub> ) <sup>(6)</sup>	1.65V to 1.95V		V <sub>CCA</sub> x0.75			V
		2.3V to 2.7V		V <sub>CCA</sub> x0.7			
		3V to 3.6V		V <sub>CCA</sub> x0.7			
		4.5V to 5.5V		V <sub>CCA</sub> x0.7			
Low-level input Voltage (V <sub>IL</sub> )	Control inputs (referenced to V <sub>CCA</sub> ) <sup>(6)</sup>	1.65V to 1.95V				V <sub>CCA</sub> x0.35	V
		2.3V to 2.7V				V <sub>CCA</sub> x0.3	
		3V to 3.6V				V <sub>CCA</sub> x0.3	
		4.5V to 5.5V				V <sub>CCA</sub> x0.3	
Input voltage (V <sub>I</sub> )	Control inputs <sup>(4)</sup>			0		5.5	V
Input/output voltage (V <sub>I/O</sub> )	Active state			0		V <sub>CCO</sub>	V
	3-state			0		5.5	V
High-level output current (I <sub>OH</sub> )			1.65V to 1.95V			-4	mA
			2.3V to 2.7V			-8	
			3V to 3.6V			-24	
			4.5V to 5.5V			-32	
Low-level output current (I <sub>OL</sub> )			1.65V to 1.95V			4	mA
			2.3V to 2.7V			8	
			3V to 3.6V			24	
			4.5V to 5.5V			32	
Input transition rise or fall rate (Δt/Δv)	Data inputs <sup>(3)</sup>	1.65V to 1.95V				20	ns/V
		2.3V to 2.7V				20	
		3V to 3.6V				10	
		4.5V to 5.5V				5	
T <sub>A</sub> Operating free-air temperature				-40		125	°C

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

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

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

(4) All unused control inputs must be held at V<sub>CCA</sub> or GND to ensure proper device operation and minimize power consumption.

(5) For V<sub>CCI</sub> values not specified in the data sheet, V<sub>IH</sub> min = V<sub>CCI</sub> × 0.7 V, V<sub>IL</sub> max = V<sub>CCI</sub> × 0.3 V.

(6) For V<sub>CCA</sub> values not specified in the data sheet, V<sub>IH</sub> min = V<sub>CCA</sub> × 0.7 V, V<sub>IL</sub> max = V<sub>CCA</sub> × 0.3 V.



## 8.4 Electrical Characteristics

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

PARAMETER		CONDITIONS	V <sub>CCA</sub>	V <sub>CCB</sub>	TEMP	MIN <sup>(3)</sup>	TYP <sup>(4)</sup>	MAX <sup>(3)</sup>	UNIT	
V <sub>OH</sub>		I <sub>OH</sub> = -100 μA V <sub>I</sub> = V <sub>IH</sub>	1.65V to 4.5V	1.65V to 4.5V	Full	V <sub>CCO</sub> - 0.1			V	
		I <sub>OH</sub> = -4mA V <sub>I</sub> = V <sub>IH</sub>	1.65V	1.65V		1.2				
		I <sub>OH</sub> = -8mA V <sub>I</sub> = V <sub>IH</sub>	2.3V	2.3V		1.9				
		I <sub>OH</sub> = -24mA V <sub>I</sub> = V <sub>IH</sub>	3V	3V		2.4				
		I <sub>OH</sub> = -32mA V <sub>I</sub> = V <sub>IH</sub>	4.5V	4.5V		3.8				
V <sub>OL</sub>		I <sub>OL</sub> = 100 μA V <sub>I</sub> = V <sub>IL</sub>	1.65V to 4.5V	1.65V to 4.5V					0.1	V
		I <sub>OL</sub> = 4mA V <sub>I</sub> = V <sub>IL</sub>	1.65V	1.65V					0.45	
		I <sub>OL</sub> = 8mA V <sub>I</sub> = V <sub>IL</sub>	2.3V	2.3V					0.3	
		I <sub>OL</sub> = 24mA V <sub>I</sub> = V <sub>IL</sub>	3V	3V					0.55	
		I <sub>OL</sub> = 32mA V <sub>I</sub> = V <sub>IL</sub>	4.5V	4.5V					0.55	
I <sub>I</sub>	DIR	V <sub>I</sub> = V <sub>CCA</sub> or GND	1.65V to 5.5V	1.65V to 5.5V	+25°C			±1	μA	
					Full			±2		
I <sub>off</sub>	A or B Port	V <sub>I</sub> or V <sub>O</sub> = 0 to 5.5V	0V	0V to 5.5V	+25°C			±1	μA	
			0V to 5.5V	0V	Full			±2		
I <sub>OZ</sub> <sup>(5)</sup>	A or B Port	V <sub>O</sub> = V <sub>CCO</sub> or GND 0E = V <sub>IH</sub>	1.65V to 5.5V	1.65V to 5.5V	+25°C			±1	μA	
					Full			±2		
I <sub>CCA</sub>	V <sub>CCA</sub> supply current	V <sub>I</sub> = V <sub>CCI</sub> or GND <sup>(6)</sup> I <sub>O</sub> = 0	1.65V to 5.5V	1.65V to 5.5V	Full			8	μA	
			5V	0V	Full			8		
			0V	5V	Full			-2		
I <sub>CCB</sub>	V <sub>CCB</sub> supply current	V <sub>I</sub> = V <sub>CCI</sub> or GND <sup>(6)</sup> I <sub>O</sub> = 0	1.65V to 5.5V	1.65V to 5.5V	Full			8	μA	
			5V	0V	Full			-2		
			0V	5V	Full			8		
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	1.65V to 5.5V	1.65V to 5.5V	Full			20	μA	
ΔI <sub>CCA</sub>	A port	One A port at V <sub>CCA</sub> - 0.6 V, DIR at V <sub>CCA</sub> , B port = open	3V to 5.5V	3V to 5.5V	Full			50	μA	
	DIR	DIR at V <sub>CCA</sub> - 0.6 V, B port = open A port at V <sub>CCA</sub> or GND			Full			50	μA	
ΔI <sub>CCB</sub>	B port	One B port at V <sub>CCB</sub> - 0.6 V, DIR at GND, A port = open	3V to 5.5V	3V to 5.5V	Full			50	μA	
C <sub>I</sub>	Control inputs	V <sub>I</sub> = V <sub>CCA</sub> or GND	3.3V	3.3V	+25°C		4		pF	
C <sub>IO</sub>	A port		3.3V	3.3V	+25°C		8.5		pF	
	B port		3.3V	3.3V	+25°C		8.5			

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

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

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

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

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

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

## 8.5 Switching Characteristics

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

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

PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEMP	$V_{CCB}=1.8V \pm 0.15V^{(1)}$		$V_{CCB}=2.5V \pm 0.2V^{(1)}$		$V_{CCB}=3.3V \pm 0.3V^{(1)}$		$V_{CCB}=5V \pm 0.5V^{(1)}$		UNIT
				MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
$t_{PLH}$	An	Bn	Full	2.0	24.5	1.5	17.3	1.1	18.8	0.8	18.5	ns
$t_{PHL}$												
$t_{PLH}$	Bn	An	Full	1.0	24.5	0.8	24.4	0.8	23.3	0.7	23.4	ns
$t_{PHL}$												
$t_{PHZ}$	$\overline{OE}$	An	Full	1.8	31.0	1.7	21.8	1.7	25.2	1.5	20.8	ns
$t_{PLZ}$												
$t_{PHZ}$	$\overline{OE}$	Bn	Full	2.6	28.0	2.1	29.0	2.0	30.4	1.5	28.5	ns
$t_{PLZ}$												
$t_{PZH}$	$\overline{OE}$	An	Full	0.6	29.5	0.5	21.3	0.5	23.3	0.5	18.6	ns
$t_{PZL}$												
$t_{PZH}$	$\overline{OE}$	Bn	Full	2.0	24.0	1.8	24.0	1.3	38.9	1.0	41.8	ns
$t_{PZL}$												

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

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

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

PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEMP	$V_{CCB}=1.8V \pm 0.15V^{(1)}$		$V_{CCB}=2.5V \pm 0.2V^{(1)}$		$V_{CCB}=3.3V \pm 0.3V^{(1)}$		$V_{CCB}=5V \pm 0.5V^{(1)}$		UNIT
				MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
$t_{PLH}$	An	Bn	Full	1.6	24.6	1.3	16.5	0.9	15.7	0.6	16.9	ns
$t_{PHL}$												
$t_{PLH}$	Bn	An	Full	1.4	17.4	1.2	16.5	1.1	16.5	1.0	16.6	ns
$t_{PHL}$												
$t_{PHZ}$	$\overline{OE}$	An	Full	1.4	29.6	1.7	18.0	1.4	21.6	1.5	15.9	ns
$t_{PLZ}$												
$t_{PHZ}$	$\overline{OE}$	Bn	Full	2.3	17.4	2.1	16.7	2.0	17.5	1.0	18.5	ns
$t_{PLZ}$												
$t_{PZH}$	$\overline{OE}$	An	Full	1.3	25.3	1.1	16.7	1.1	18.5	1.3	13.5	ns
$t_{PZL}$												
$t_{PZH}$	$\overline{OE}$	Bn	Full	2.0	16.7	1.5	15.6	1.3	24.7	1.2	22.3	ns
$t_{PZL}$												

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

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

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

PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEMP	$V_{CCB}=1.8V \pm 0.15V^{(1)}$		$V_{CCB}=2.5V \pm 0.2V^{(1)}$		$V_{CCB}=3.3V \pm 0.3V^{(1)}$		$V_{CCB}=5V \pm 0.5V^{(1)}$		UNIT
				MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
$t_{PLH}$	An	Bn	Full	1.6	23.7	1.5	16.7	0.8	15.6	0.6	15.6	ns
$t_{PHL}$												
$t_{PLH}$	Bn	An	Full	0.8	18.9	0.7	15.7	0.7	15.6	0.7	15.8	ns
$t_{PHL}$												
$t_{PHZ}$	$\overline{OE}$	An	Full	1.7	27.3	1.6	17.6	1.5	20.5	1.5	15.7	ns
$t_{PLZ}$												
$t_{PHZ}$	$\overline{OE}$	Bn	Full	2.4	21.9	2.0	19.7	1.7	20.4	0.9	19.7	ns
$t_{PLZ}$												
$t_{PZH}$	$\overline{OE}$	An	Full	0.9	23.7	0.9	16.5	0.7	17.9	0.9	13.7	ns
$t_{PZL}$												
$t_{PZH}$	$\overline{OE}$	Bn	Full	2.3	13.8	1.4	14.4	1.6	17.3	1.1	17.5	ns
$t_{PZL}$												

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

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

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

PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEMP	$V_{CCB}=1.8V \pm 0.15V^{(1)}$		$V_{CCB}=2.5V \pm 0.2V^{(1)}$		$V_{CCB}=3.3V \pm 0.3V^{(1)}$		$V_{CCB}=5V \pm 0.5V^{(1)}$		UNIT
				MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
$t_{PLH}$	An	Bn	Full	1.6	23.5	1.4	16.2	0.8	15.8	0.5	15.5	ns
$t_{PHL}$												
$t_{PLH}$	Bn	An	Full	0.6	18.8	0.5	16.9	0.5	15.3	0.5	15.4	ns
$t_{PHL}$												
$t_{PHZ}$	$\overline{OE}$	An	Full	0.4	27.9	0.4	17.4	0.5	19.7	0.5	15.6	ns
$t_{PLZ}$												
$t_{PHZ}$	$\overline{OE}$	Bn	Full	2.5	14.9	1.9	14.6	1.6	14.6	0.8	14.8	ns
$t_{PLZ}$												
$t_{PZH}$	$\overline{OE}$	An	Full	0.8	24.8	0.8	16.6	0.7	18.5	0.7	13.5	ns
$t_{PZL}$												
$t_{PZH}$	$\overline{OE}$	Bn	Full	1.7	12.8	1.4	12.8	1.2	12.8	1.0	12.8	ns
$t_{PZL}$												

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

## 8.6 Operating Characteristics

$T_A=25^\circ C$

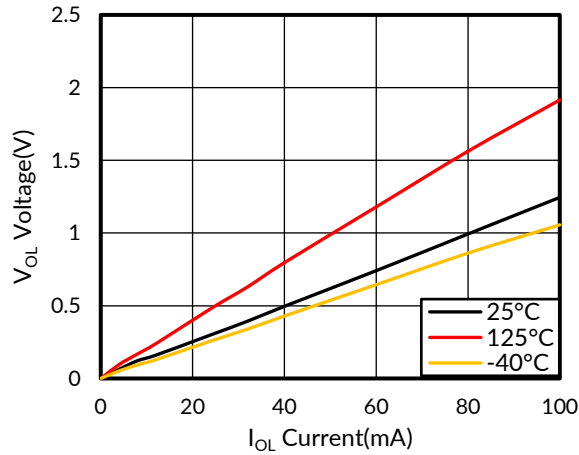
PARAMETER	TEST CONDITIONS	$V_{CCA}=V_{CCB}=1.8V$	$V_{CCA}=V_{CCB}=2.5V$	$V_{CCA}=V_{CCB}=3.3V$	$V_{CCA}=V_{CCB}=5V$	UNIT
		TYP	TYP	TYP	TYP	
$C_{pdA}^{(1)}$	A-port input, B-port output	3	4	6	9	pF
	B-port input, A-port output	14	17	22	32	
$C_{pdB}^{(1)}$	A-port input, B-port output	14	16	21	32	
	B-port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

(1) Power dissipation capacitance per transceiver.

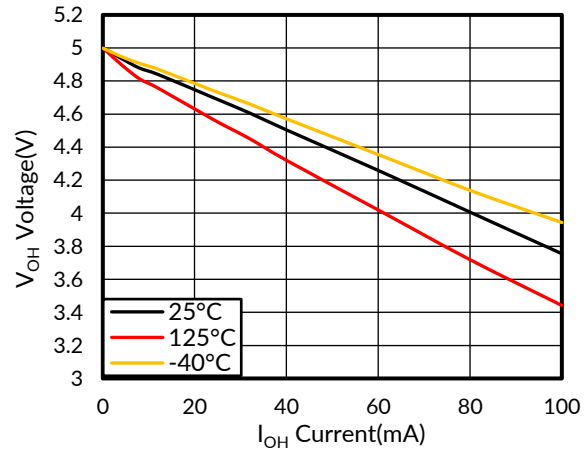
## 8.7 Typical Characteristics

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

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

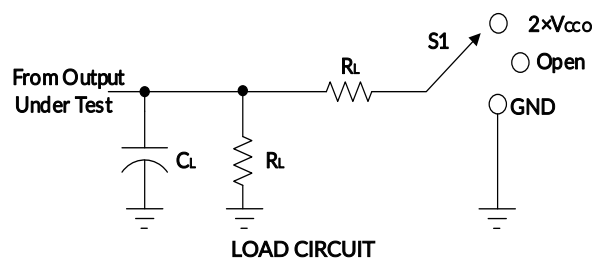


**Figure 1. Voltage vs Current**



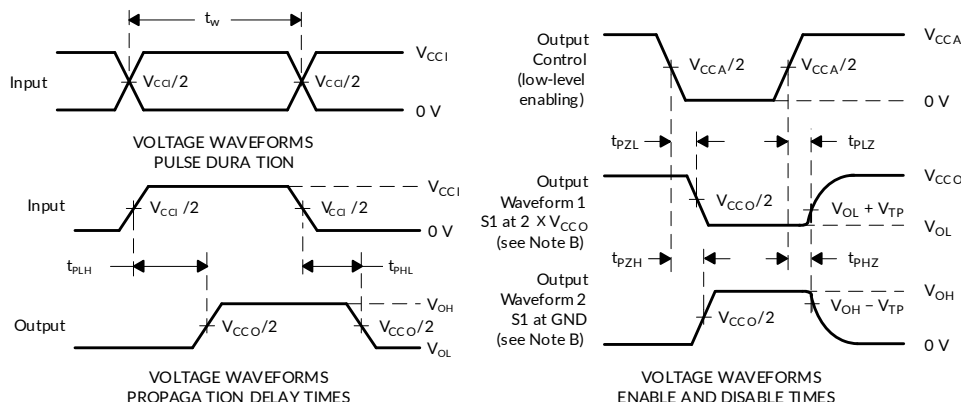
**Figure 2. Voltage vs Current**

## 9 Parameter Measurement Information



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

$V_{CC}$	$C_L$	$R_L$	$V_{TP}$
$1.8V \pm 0.15V$	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
$5V \pm 0.5V$	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 3. Load Circuit and Voltage Waveforms**

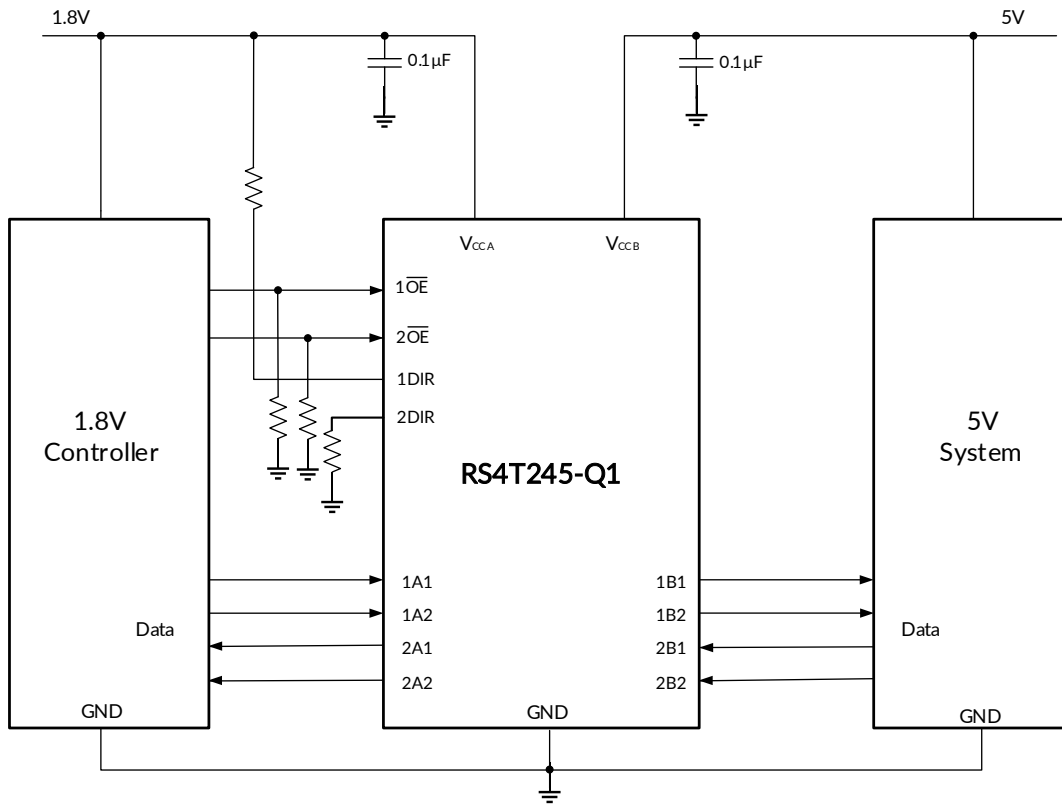
## 10 Application and Implementation

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 RS4T245-Q1 device can be used in level-translation applications for interfacing devices or systems operating at different interface voltages with one another. The maximum output current can be up to 32 mA when device is powered by 5 V.

### 10.2 Typical Application



**Figure 4. Typical Application Circuit**

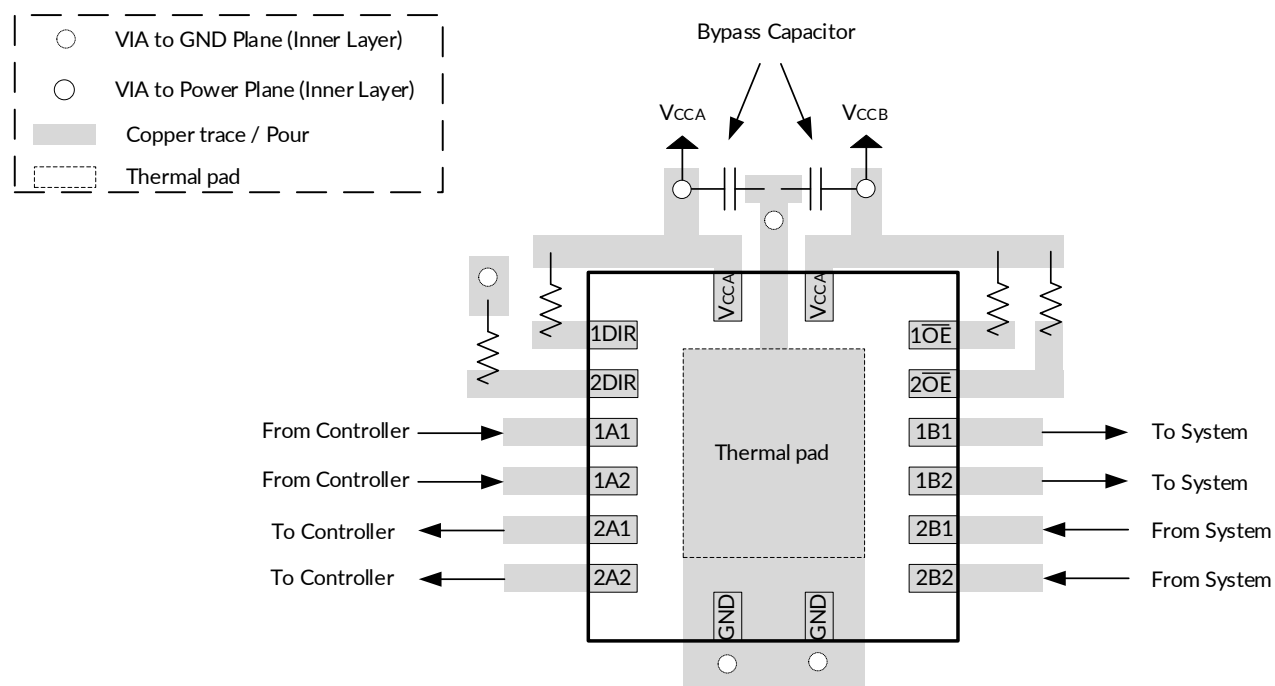
## 11 Layout

### 11.1 Layout Guidelines

To ensure reliability of the device, following common printed-circuit board layout guidelines are recommended:

- Use bypass capacitors on power supplies.
- Use short trace lengths to avoid excessive loading.
- Place pads on the signal paths for loading capacitors or pullup resistors to help adjust rise and fall times of signals depending on the system requirements.

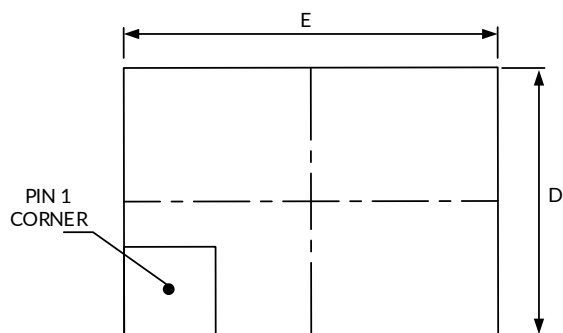
### 11.2 Layout Example



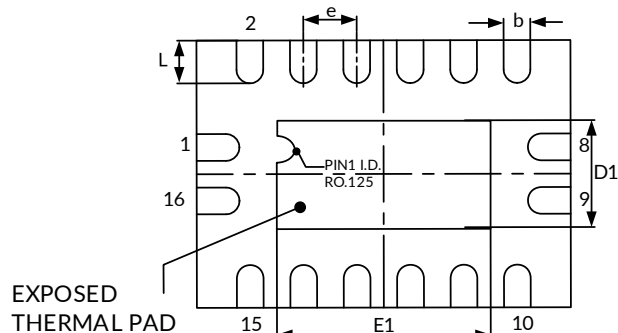
**Figure 5. Layout Diagram**

## 12 PACKAGE OUTLINE DIMENSIONS

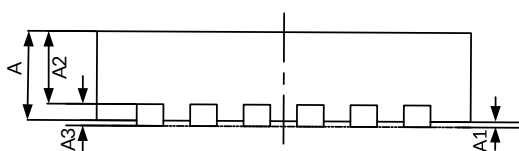
QFN2.5x3.5-16L<sup>(4)</sup>



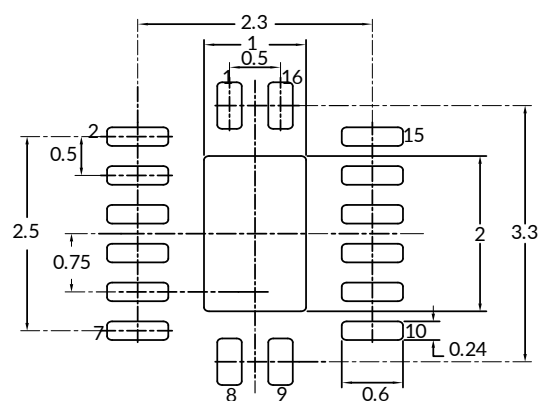
TOP VIEW



BOTTOM VIEW



SIDE VIEW



RECOMMENDED LAND PATTERN (Unit: mm)

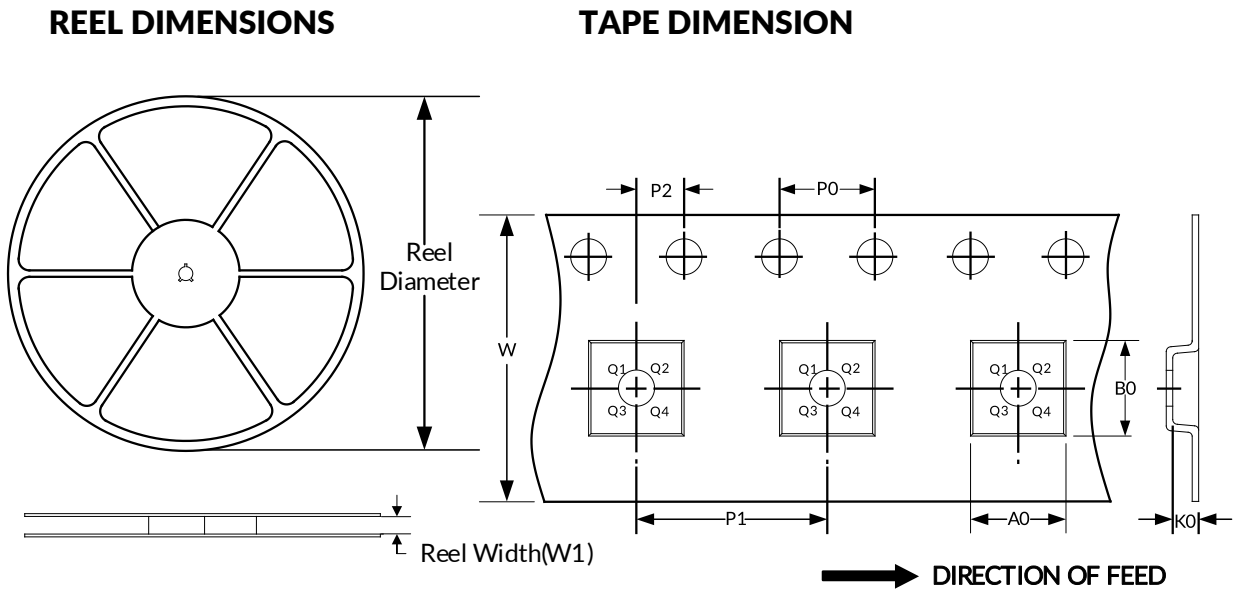
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A <sup>(1)</sup>	0.800	1.000	0.031	0.039
A1	0.000	0.050	0.000	0.002
A2	0.600	0.700	0.024	0.028
A3	0.203(REF) <sup>(2)</sup>		0.008(REF) <sup>(2)</sup>	
D <sup>(1)</sup>	2.400	2.600	0.094	0.102
E <sup>(1)</sup>	3.400	3.600	0.134	0.142
e	0.500(BSC) <sup>(3)</sup>		0.020(BSC) <sup>(3)</sup>	
b	0.180	0.300	0.007	0.012
L	0.300	0.500	0.012	0.020
D1	0.850	1.150	0.033	0.045
E1	1.850	2.150	0.073	0.085

NOTE:

1. Plastic or metal protrusions of 0.075mm maximum per side are not included.
2. REF is the abbreviation for Reference.
3. BSC (Basic Spacing between Centers), "Basic" spacing is nominal
4. This drawing is subject to change without notice.



### 13 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
QFN2.5x3.5-16L	7"	15.0	2.80	3.80	1.20	4.0	4.0	2.0	12.0	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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