4-Bit Dual-Supply Bus Transceiver with Configurable Voltage Translation, and 3-State Outputs

1 FEATURES

- **Control Inputs V_{IH}/V_{IL} Levels are Referenced to V_{CCA} Voltage**
- **Fully Configurable Dual-Rail Design Allows Each Port to Operate Over the Full 1.2V to 3.6V Power-Supply Range**
- **I/Os Are 4.6V Tolerant**
- **I_{off} Supports Partial Power-Down-Mode Operation**
- **Max Data Rates**
  - **380 Mbps (1.8 V to 3.3 V Translation)**
  - **200 Mbps (<1.8 V to 3.3 V Translation)**
  - **200 Mbps (Translate to 2.5 V or 1.8 V)**
- **Extended Temperature: -40°C to 125°C**

2 APPLICATIONS

- **Personal Electronics**
- **Industrial**
- **Enterprise**
- **Telecom**

3 DESCRIPTIONS

This 4-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 1.2 V to 3.6 V. The B port is designed to track V_{CCB}. V_{CCB} accepts any supply voltage from 1.2 V to 3.6 V. The RS74AVC4T245 is optimized to operate with V_{CCA}/V_{CCB} set at 1.4 V to 3.6 V. It is operational with V_{CCA}/V_{CCB} as low as 1.2 V. This allows for universal low voltage bidirectional translation between any of the 1.2V, 1.5V, 1.8V, 2.5V, and 3.3V voltage nodes.

The RS74AVC4T245 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}.

The RS74AVC4T245 device control pins (1DIR, 2DIR, $1\overline{OE}$, and $2\overline{OE}$) are supplied by V_{CCA}.

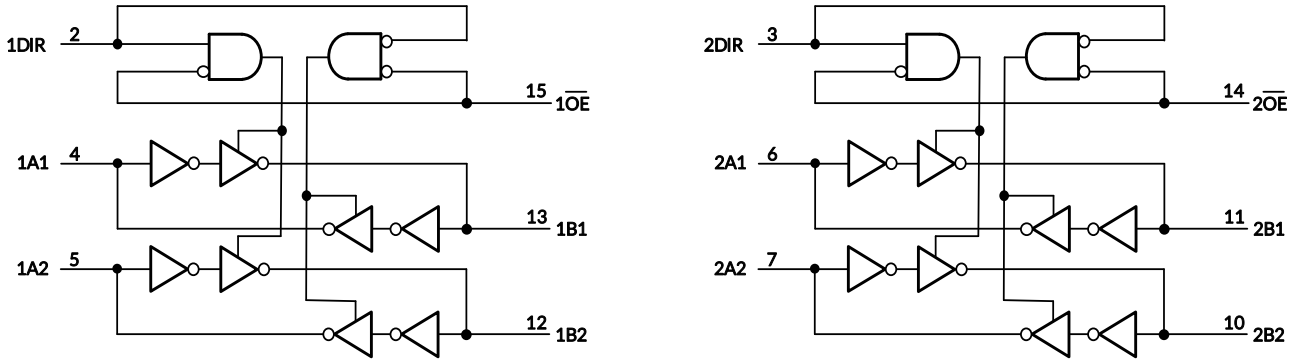
This device is fully specified for partial-power-down applications using I_{off}. The I_{off} circuitry disables the outputs, preventing damaging current backflow through the device when it is powered down.

Device Information (1)

PART NUMBER	PACKAGE	BODY SIZE (NOM)
RS74AVC4T245	TSSOP16	5.00mm×4.40mm
	QFN2.5X3.5-16	2.50mm×3.50mm
	UQFN2.6X1.8-16	2.60mm×1.80mm

(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 different from page numbers in the current version.

VERSION	Change Date	Change Item
A.1	2025/05/19	Initial version completed

6 PACKAGE/ORDERING INFORMATION (1)

PRODUCT	ORDERING NUMBER	TEMPERATURE RANGE	PACKAGE LEAD	PACKAGE MARKING (2)	MSL(3)	PACKAGE OPTION
RS74AVC4T245	RS74AVC4T245XTSS16	-40°C ~125°C	TSSOP16	V4T245	MSL3	Tape and Reel, 4000
	RS74AVC4T245XTQW16	-40°C ~125°C	QFN2.5X3.5-16	V4T245	MSL3	Tape and Reel, 5000
	RS74AVC4T245XTQQ16	-40°C ~125°C	UQFN2.6X1.8-16	V4T	MSL3	Tape and Reel, 3000

NOTE:

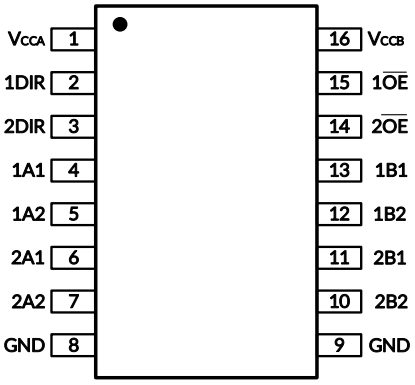
(1) This information is the most current data available for the designated devices. This data is subject to change without notice and revision of this document. For browser-based versions of this data sheet, refer to the right-hand navigation.

(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) RUNIC classify the MSL level with using the common preconditioning setting in our assembly factory conforming to the JEDEC industrial standard J-STD-20F. Please align with RUNIC if your end application is quite critical to the preconditioning setting or if you have special requirement.

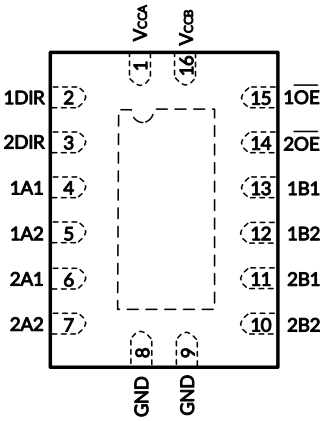
7 PIN CONFIGURATIONS

(TOP VIEW)



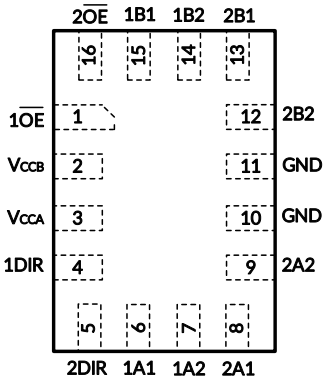
TSSOP16

(TOP VIEW)



QFN2.5X3.5-16

(TOP VIEW)



UQFN2.6X1.8-16

PIN DESCRIPTION

PIN		NAME	TYPE (1)	FUNCTION
TSSOP16 /QFN2.5X3.5-16	UQFN2.6X1.8-16			
1	3	V_{CCA}	P	A-port power supply voltage. 1.2 V ≤ V_{CCA} ≤ 3.6 V
2	4	1DIR	I	Direction-control input for ”1” ports.
3	5	2DIR	I	Direction-control input for ”2” ports.
4	6	1A1	I/O	Input/output 1A1. Referenced to V_{CCA}.
5	7	1A2	I/O	Input/output 1A2. Referenced to V_{CCA}.
6	8	2A1	I/O	Input/output 2A1. Referenced to V_{CCA}.
7	9	2A2	I/O	Input/output 2A2. Referenced to V_{CCA}.
8	10	GND	G	Ground.
9	11	GND	G	Ground.
10	12	2B2	I/O	Input/output 2B2. Referenced to V_{CCB}.
11	13	2B1	I/O	Input/output 2B1. Referenced to V_{CCB}.
12	14	1B2	I/O	Input/output 1B2. Referenced to V_{CCB}.
13	15	1B1	I/O	Input/output 1B1. Referenced to V_{CCB}.
14	16	$2\overline{OE}$	I	3-state output-mode enables. Pull $\overline{OE}$ high to place “2” outputs in 3-state mode. Referenced to V_{CCA}.
15	1	$1\overline{OE}$	I	3-state output-mode enables. Pull $\overline{OE}$ high to place “1” outputs in 3-state mode. Referenced to V_{CCA}.
16	2	V_{CCB}	P	B-port power supply voltage. 1.2 V ≤ V_{CCB} ≤ 3.6 V

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

8 SPECIFICATIONS

8.1 Absolute Maximum Ratings

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

SYMBOL	PARAMETER		MIN	MAX	UNIT
V_{CCA}	Supply Voltage Range		-0.5	4.6	V
V_{CCB}	Supply Voltage Range		-0.5	4.6	V
V_I	Input Voltage Range (2)	I/O ports (A port)	-0.5	4.6	V
		I/O ports (B port)	-0.5	4.6	
		Control inputs	-0.5	4.6	
V_O	Voltage range applied to any output in the high-impedance or power-off state (2)	A port	-0.5	4.6	V
		B port	-0.5	4.6	
V_O	Voltage range applied to any output in the high or low state (2) (3)	A port	-0.5	V_{CCA}+0.5	V
		B port	-0.5	V_{CCB}+0.5	
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
θ_{JA}	Package thermal impedance (4)	TSSOP16		45	°C/W
		UQFN2.6X1.8-16		145	°C/W
		QFN2.5X3.5-16		65	°C/W
T_{stg}	Storage temperature		-65	150	°C

(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 output positive voltage rating may be exceeded up to 4.6V maximum if the output current rating is observed.
(4) The package thermal impedance is calculated in accordance with JESD-51.

8.2 ESD Ratings

The following ESD information is provided for handling of ESD-sensitive devices in an ESD protected area only.

			VALUE	UNIT
$V_{(ESD)}$	Electrostatic discharge	Human-Body Model (HBM), JESD22-A114F:2008	±2000	V
		Charged-Device Model (CDM), ANSI/ESDA/JEDEC JS-002:2022	±1000	V
		Machine Model (MM), JESD22-A115C:2010	±200	V

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_{CCI} (1)	V_{CCO} (2)	MIN	MAX	UNIT
V_{CCA}	Supply voltage				1.2	3.6	V
V_{CCB}	Supply voltage				1.2	3.6	V
V_{IH}	HIGH-level input voltage	Data inputs (4)	1.2 V to 1.95 V		V_{CCI} × 0.65		V
			1.95 V to 2.7 V		1.6		
			2.7 V to 3.6 V		2		
V_{IL}	LOW-level input voltage	Data inputs (4)	1.2 V to 1.95 V			V_{CCI} × 0.35	V
			1.95 V to 2.7 V			0.7	
			2.7 V to 3.6 V			0.8	
V_{IH}	HIGH-level input voltage	DIR (referenced to V_{CCA}) (5)	1.2 V to 1.95 V		V_{CCA} × 0.65		V
			1.95 V to 2.7 V		1.6		
			2.7 V to 3.6 V		2		
V_{IL}	LOW-level input voltage	DIR (referenced to V_{CCA}) (5)	1.2 V to 1.95 V			V_{CCA} × 0.35	V
			1.95 V to 2.7 V			0.7	
			2.7 V to 3.6 V			0.8	
V_I	Input voltage				0	3.6	V
V_O	Output voltage	Active state			0	V_{CCO}	V
		3-state			0	3.6	
I_{OH}	High-level output current			1.2 V		-3	mA
				1.4 V to 1.6 V		-6	
				1.65 V to 1.95 V		-8	
				2.3 V to 2.7 V		-9	
				3 V to 3.6 V		-12	
I_{OL}	Low-level output current			1.2 V		3	mA
				1.4 V to 1.6 V		6	
				1.65 V to 1.95 V		8	
				2.3 V to 2.7 V		9	
				3 V to 3.6 V		12	
Δt/Δv	Input transition rise or fall rate					5	ns/V
T_A	Operating free-air temperature				-40	125	°C

(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) All unused data inputs of the device must be held at V_{CCI} or GND to ensure proper device operation
(4) For V_{CCI} values not specified in the data sheet, V_{IH} min = V_{CCI} × 0.65 V, V_{IL} max = V_{CCI} × 0.35 V.
(5) For V_{CCA} values not specified in the data sheet, V_{IH} min = V_{CCA} × 0.65 V, V_{IL} max = V_{CCA} × 0.35 V.

8.4 Electrical Characteristics

All typical limits apply over T_A = 25°C, and all maximum and minimum limits apply over T_A = −40°C to 125°C (unless otherwisenoted). (1) (2)

PARAMETER		TEST CONDITIONS		MIN(3)	TYP(4)	MAX(3)	UNIT
V_{OH}		I_{OH}=−100 µA; V_{CCA}=1.2 V to 3.6 V; V_{CCB}=1.2 V to 3.6 V; V_I=V_{IH}		V_{CCO}-0.2			V
		I_{OH}=−3 mA; V_{CCA}=1.2 V; V_{CCB}=1.2 V; V_I=V_{IH}			0.95		
		I_{OH}=−6 mA; V_{CCA}=1.4 V; V_{CCB}=1.4 V; V_I=V_{IH}		0.9			
		I_{OH}=−8 mA; V_{CCA}=1.65 V; V_{CCB}=1.65 V; V_I=V_{IH}		1.2			
		I_{OH}=−9 mA; V_{CCA}=2.3 V; V_{CCB}=2.3 V; V_I=V_{IH}		1.75			
		I_{OH}=−12 mA; V_{CCA}=3.0 V; V_{CCB}=3.0 V; V_I=V_{IH}		2.3			
V_{OL}		I_{OL}=100 µA; V_{CCA}=1.2 V to 3.6 V; V_{CCB}=1.2 V to 3.6 V; V_I=V_{IL}				0.2	V
		I_{OL}=3 mA; V_{CCA}=1.2 V; V_{CCB}=1.2 V; V_I=V_{IL}			0.25		
		I_{OL}=6 mA; V_{CCA}=1.4 V; V_{CCB}=1.4 V; V_I=V_{IL}				0.35	
		I_{OL}=8 mA; V_{CCA}=1.65 V; V_{CCB}=1.65 V; V_I=V_{IL}				0.45	
		I_{OL}=9 mA; V_{CCA}=2.3 V; V_{CCB}=2.3 V; V_I=V_{IL}				0.55	
		I_{OL}=12 mA; V_{CCA}=3.0 V; V_{CCB}=3.0 V; V_I=V_{IL}				0.7	
I_I (DIR input)		V_I=V_{CCA} or GND; V_{CCA} =1.2 V to 3.6 V; V_{CCB}=1.2 V to 3.6 V	T_A = 25°C		±0.002	±1	µA
			T_A = −40°C to 125°C			±2	
I_{off}	A port	V_I or V_O=0 V to 3.6 V; V_{CCA} = 0 V; V_{CCB} = 0 V to 3.6 V	T_A = 25°C		±0.001	±1	µA
			T_A = −40°C to 125°C			±5	
	B port	V_I or V_O=0 V to 3.6 V; V_{CCA} =0 V to 3.6 V; V_{CCB} = 0 V	T_A = 25°C		±0.002	±1	
			T_A = −40°C to 125°C			±5	
I_{OZ} (5)	A port & B port	V_O=V_{CCO} or GND; V_I=V_{CCI} or GND; $\overline{OE}$=V_{IH}; V_{CCA}=3.6 V; V_{CCB}=3.6 V	T_A = 25°C		±0.05	±1	µA
			T_A = −40°C to 125°C			±5	
I_{CCA}		V_I=V_{CCI} or GND, I_O=0	V_{CCA}=1.2V to 3.6V; V_{CCB}=1.2V to 3.6V			8	µA
			V_{CCA}=0V; V_{CCB}=3.6V			-2	
			V_{CCA}=3.6V; V_{CCB}=0V			8	
I_{CCB}		V_I=V_{CCI} or GND, I_O=0	V_{CCA}=1.2V to 3.6V; V_{CCB}=1.2V to 3.6V			8	µA
			V_{CCA}=0V; V_{CCB}=3.6V			8	
			V_{CCA}=3.6V; V_{CCB}=0V			-2	
I_{CCA}+I_{CCB}		V_I=V_{CCI} or GND, I_O=0; V_{CCA}=1.2 V to 3.6 V; V_{CCB}=1.2 V to 3.6 V				16	µA
C_i	Control inputs	V_I = 3.3 V or GND; V_{CCA} = 3.3 V; V_{CCB} = 3.3 V			1.5	4.5	pF
C_{io}	A or B port	V_O = 3.3 V or GND; V_{CCA} = 3.3 V; V_{CCB} = 3.3 V			2.5	7	pF

(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) 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_{OZ} includes the input leakage current.

8.5 Switching Characteristics, V_{CCA}=1.2 V

over recommended operating free-air temperature range.

PARAMETER	FROM (INPUT)	TO (OUTPUT)	V_{CCB}=1.2V	V_{CCB}=1.5V ±0.1V	V_{CCB}=1.8V ±0.15V	V_{CCB}=2.5V ±0.2V	V_{CCB}=3.3V ±0.3V	UNIT
			TYP	TYP	TYP	TYP	TYP	
t_{PLH}	A	B	20.6	15.8	14.1	12.5	12.2	ns
t_{PHL}			16.3	13.0	12.1	11.1	11.1	
t_{PLH}	B	A	20.3	17.3	15.7	14.4	14.1	ns
t_{PHL}			16.3	13.3	12.0	10.4	9.5	
t_{PZH}	$\overline{OE}$	A	24.0	23.0	23.3	23.8	22.8	ns
t_{PZL}			20.0	19.8	19.5	19.3	19.3	
t_{PZH}	$\overline{OE}$	B	25.3	21.0	19.8	16.8	15.3	ns
t_{PZL}			22.3	18.3	16.5	15.3	14.3	
t_{PHZ}	$\overline{OE}$	A	19.3	18.5	17.8	18.5	19.5	ns
t_{PLZ}			17.8	17.0	16.3	16.3	16.8	
t_{PHZ}	$\overline{OE}$	B	17.8	16.3	15.3	14.5	14.0	ns
t_{PLZ}			18.0	17.3	16.0	16.0	15.8	

8.6 Switching Characteristics, V_{CCA}=1.5 V ± 0.1 V

over recommended operating free-air temperature range.

PARA METER	FROM (INPUT)	TO (OUTPUT)	V_{CCB}=1.2V	V_{CCB}=1.5V ±0.1V		V_{CCB}=1.8V ±0.15V		V_{CCB}=2.5V ±0.2V		V_{CCB}=3.3V ±0.3V		UNIT
			TYP	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
t_{PLH}	A	B	17.1	6.2	14.6	5.2	12.5	4.4	10.2	4.0	9.5	ns
t_{PHL}			12.2	4.7	11.4	4.0	9.3	3.5	8.9	3.3	7.7	
t_{PLH}	B	A	15.5	6.2	15.2	5.5	13.1	4.7	11.5	4.5	11.2	ns
t_{PHL}			13.1	5.0	12.2	4.2	10.4	3.5	8.4	3.1	7.6	
t_{PZH}	$\overline{OE}$	A	20.5	10.4	24.7	8.3	25.0	6.8	25.0	6.3	24.7	ns
t_{PZL}			15.0	6.6	18.1	6.3	18.4	5.5	18.4	5.3	18.1	
t_{PZH}	$\overline{OE}$	B	23.5	9.9	25.9	10.0	20.6	10.0	16.9	9.9	15.6	ns
t_{PZL}			17.3	7.3	16.6	7.4	15.6	7.4	13.8	7.3	13.1	
t_{PHZ}	$\overline{OE}$	A	12.0	6.8	13.8	5.8	14.1	5.6	13.8	5.3	14.1	ns
t_{PLZ}			14.0	6.4	17.2	6.0	16.6	5.9	16.3	5.6	15.9	
t_{PHZ}	$\overline{OE}$	B	14.8	5.5	16.9	5.6	14.4	5.5	14.1	5.6	13.1	ns
t_{PLZ}			13.5	6.9	15.9	6.6	15.0	6.5	14.7	6.4	14.1	

8.7 Switching Characteristics, V_{CCA}=1.8 V ± 0.15 V

over recommended operating free-air temperature range.

PARA METER	FROM (INPUT)	TO (OUTPUT)	V_{CCB}=1.2V	V_{CCB}=1.5V ±0.1V		V_{CCB}=1.8V ±0.15V		V_{CCB}=2.5V ±0.2V		V_{CCB}=3.3V ±0.3V		UNIT
			TYP	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
t_{PLH}	A	B	15.3	5.4	13.0	4.3	10.5	3.4	7.9	3.1	7.4	ns
t_{PHL}			10.7	4.0	9.8	3.3	8.2	2.8	6.8	2.5	6.3	
t_{PLH}	B	A	13.7	5.3	13.1	4.6	11.0	3.9	9.5	3.5	8.9	ns
t_{PHL}			11.8	4.3	10.6	3.7	8.7	2.9	6.9	2.6	6.2	
t_{PZH}	$\overline{OE}$	A	14.0	9.6	17.5	7.5	17.5	6.3	17.2	5.4	17.2	ns
t_{PZL}			11.3	5.8	13.8	5.0	14.1	4.3	13.8	4.0	13.4	
t_{PZH}	$\overline{OE}$	B	22.8	7.0	24.1	7.0	18.8	6.9	15.6	6.9	13.4	ns
t_{PZL}			15.3	5.5	14.4	5.6	12.5	5.5	10.6	5.4	10.0	
t_{PHZ}	$\overline{OE}$	A	13.0	6.3	15.6	5.0	15.9	4.6	15.0	4.3	15.0	ns
t_{PLZ}			11.3	5.3	13.1	4.6	13.4	4.6	13.1	4.5	12.2	
t_{PHZ}	$\overline{OE}$	B	13.3	6.3	15.6	6.4	12.5	6.0	11.6	6.0	10.6	ns
t_{PLZ}			11.8	5.3	13.1	5.4	11.6	5.3	11.6	4.9	11.3	

8.8 Switching Characteristics, V_{CCA}=2.5 V ± 0.2 V

over recommended operating free-air temperature range.

PARA METER	FROM (INPUT)	TO (OUTPUT)	V_{CCB}=1.2V	V_{CCB}=1.5V ±0.1V		V_{CCB}=1.8V ±0.15V		V_{CCB}=2.5V ±0.2V		V_{CCB}=3.3V ±0.3V		UNIT
			TYP	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
t_{PLH}	A	B	14.4	4.8	11.6	3.8	9.5	3.1	7.5	2.5	6.3	ns
t_{PHL}			9.0	3.1	7.9	2.6	6.3	2.0	5.1	2.0	4.8	
t_{PLH}	B	A	12.6	4.5	11.0	3.8	9.2	3.0	7.2	2.7	6.8	ns
t_{PHL}			10.8	3.8	9.7	3.2	7.8	2.6	6.0	2.2	5.2	
t_{PZH}	$\overline{OE}$	A	9.8	9.4	12.2	7.0	12.5	5.5	11.9	4.9	11.9	ns
t_{PZL}			8.8	4.9	10.6	4.3	10.9	3.8	10.9	3.4	10.6	
t_{PZH}	$\overline{OE}$	B	20.8	4.9	23.4	5.0	17.5	4.8	13.8	4.8	12.2	ns
t_{PZL}			13.3	4.3	12.2	4.4	10.6	4.4	9.4	4.3	8.4	
t_{PHZ}	$\overline{OE}$	A	8.8	5.6	9.7	5.0	10.6	4.6	10.0	4.0	10.0	ns
t_{PLZ}			9.8	4.9	11.9	4.3	11.6	4.6	11.9	4.3	10.9	
t_{PHZ}	$\overline{OE}$	B	12.5	3.9	14.1	4.3	12.5	4.0	11.6	4.0	10.0	ns
t_{PLZ}			11.3	4.8	12.2	4.6	10.6	4.8	11.6	4.4	10.6	

8.9 Switching Characteristics, V_{CCA}=3.3 V ± 0.3 V

over recommended operating free-air temperature range.

PARA METER	FROM (INPUT)	TO (OUTPUT)	V_{CCB}=1.2V	V_{CCB}=1.5V ±0.1V		V_{CCB}=1.8V ±0.15V		V_{CCB}=2.5V ±0.2V		V_{CCB}=3.3V ±0.3V		UNIT
			TYP	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
t_{PLH}	A	B	14.3	4.7	11.4	3.7	8.7	2.8	6.7	2.4	5.9	ns
t_{PHL}			8.6	2.8	7.2	2.5	5.9	1.8	4.4	1.6	4.3	
t_{PLH}	B	A	12.3	4.2	10.4	3.3	8.3	2.7	6.3	2.5	6.3	ns
t_{PHL}			11.1	3.7	9.2	2.9	7.4	2.3	5.5	1.8	4.4	
t_{PZH}	$\overline{OE}$	A	7.8	9.1	9.7	7.0	9.7	5.4	9.7	5.0	9.7	ns
t_{PZL}			7.8	4.4	9.7	3.6	10.0	3.6	10.0	3.0	9.7	
t_{PZH}	$\overline{OE}$	B	22.0	3.9	22.8	3.9	17.5	3.9	13.4	3.9	12.5	ns
t_{PZL}			13.5	3.9	10.9	4.0	9.1	4.0	9.1	3.9	7.5	
t_{PHZ}	$\overline{OE}$	A	8.0	5.8	10.0	4.5	10.3	4.1	10.0	4.0	10.6	ns
t_{PLZ}			8.0	4.1	10.3	3.3	10.9	2.6	10.3	2.4	10.3	
t_{PHZ}	$\overline{OE}$	B	12.0	4	14.7	4.1	11.3	4.0	10.3	4.3	10.0	ns
t_{PLZ}			9.8	4.1	10.3	4.4	8.1	4.1	6.6	4.1	5.9	

8.10 Operating Characteristics

T_A=25°C

PARAMETER			TEST CONDITIONS	V_{CCA}= V_{CCB}=1.2V	V_{CCA}= V_{CCB}=1.5V	V_{CCA}= V_{CCB}=1.8V	V_{CCA}= V_{CCB}=2.5V	V_{CCA}= V_{CCB}=3.3V	UNIT
				TYP	TYP	TYP	TYP	TYP	
C_{pdA}(1)	A to B	Outputs enabled	C_L=0, f=10MHz, t_r = t_f = 1ns	2	2	2	1.5	2.5	pF
		Outputs disable		1	1	1	0.5	1	
	B to A	Outputs enabled		12	13	13	14	15	
		Outputs disable		1	1	1	1	1.5	
C_{pdB}(1)	A to B	Outputs enabled	C_L=0, f=10MHz, t_r = t_f = 1ns	12	13	13	14	15	pF
		Outputs disable		1	1	1	1	1.5	
	B to A	Outputs enabled		2	2	2	2	2.5	
		Outputs disable		1	1	1	0.5	1	

(1) Power dissipation capacitance per transceiver.

8.11 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.

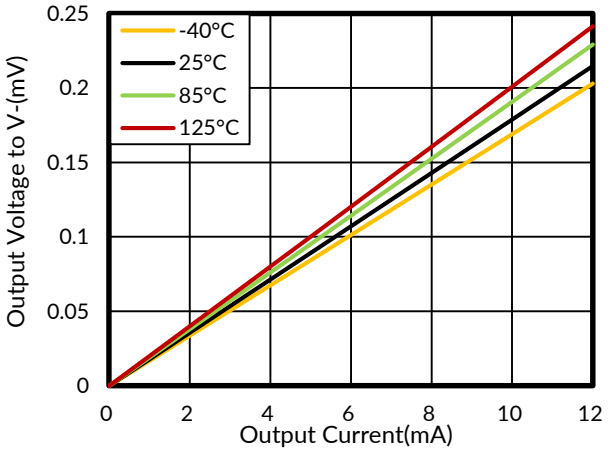


Figure 1. Output Voltage Low vs Output Current, 3V

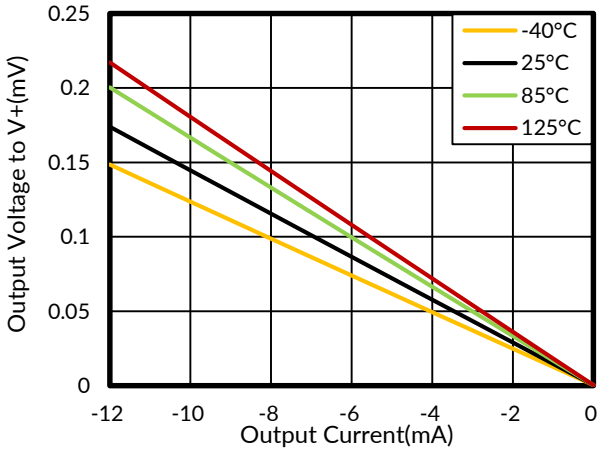
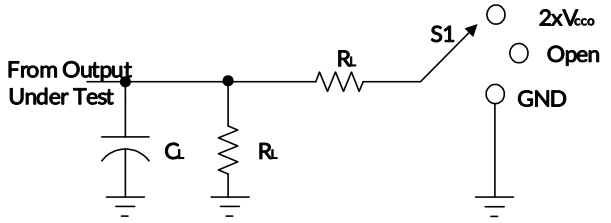


Figure 2. Output Voltage High vs Output Current, 3V

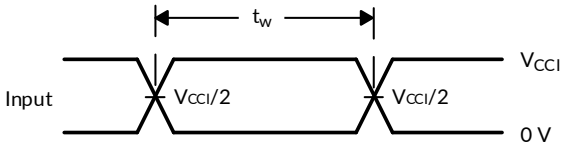
9 PARAMETER MEASUREMENT INFORMATION



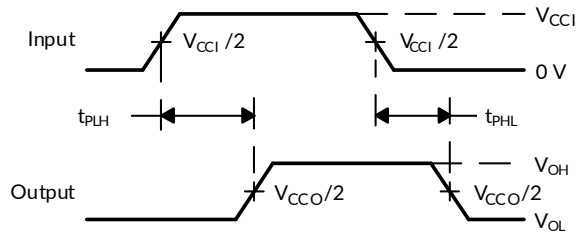
LOAD CIRCUIT

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

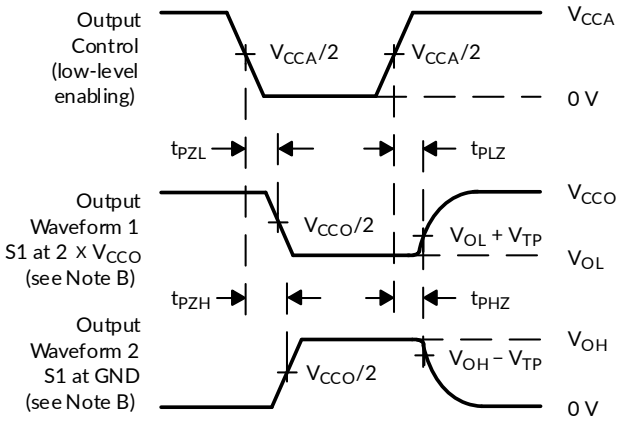
V_{CC}	C_L	R_L	V_{TP}
1.2V	15pF	2kΩ	0.1V
1.5V±0.1V	15pF	2kΩ	0.1V
1.8V±0.15V	15pF	2kΩ	0.15V
2.5V±0.2V	15pF	2kΩ	0.15V
3.3V±0.3V	15pF	2kΩ	0.3V



VOLTAGE WAVEFORMS
PULSE DURA TION



VOLTAGE WAVEFORMS
PROPAGA TION DELAY TIMES



VOLTAGE WAVEFORMS
ENABLE AND DISABLE TIMES

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≤10 MHz, Z_O = 50Ω, dv/dt≥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. V_{CCI} is the V_{CC} associated with the input port.
I. V_{CCO} is the V_{CC} associated with the output port.

Figure 3. Load Circuit and Voltage Waveforms

10 DETAILED DESCRIPTION

10.1 Overview

The RS74AVC4T245 is a 4-bit, dual-supply noninverting bidirectional voltage level translation device. Ax pins and control pins (1DIR, 2DIR,1$\overline{OE}$, and 2$\overline{OE}$) are supported by V_{CCA}, and Bx pins are supported by V_{CCB}. 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 1.2 V to 3.6 V. A high on DIR allows data transmission from Ax to Bx and a low on DIR allows data transmission from Bx to Ax when $\overline{OE}$ is set to low. When $\overline{OE}$ is set to high, both Ax and Bx pins are in the high-impedance state.

10.2 Feature Description

10.2.1 Fully Configurable Dual-Rail Design Allows Each Port to Operate Over the Full 1.2V to 3.6V Power-Supply Range

Both V_{CCA} and V_{CCB} can be supplied at any voltage between 1.2 V and 3.6 V; thus, making the device suitable for translating between any of the low voltage nodes (1.2 V, 1.8 V, 2.5 V, and 3.3 V).

10.2.2 Supports High Speed Translation

The RS74AVC4T245 device can support high data rate applications. The translated signal data rate can be up to 380 Mbps when the signal is translated from 1.8 V to 3.3 V.

10.2.3 I_{off} Supports Partial-Power-Down Mode Operation

I_{off} will prevent backflow current by disabling I/O output circuits when device is in partial-power-down mode.

11 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.

11.1 Application Information

RS74AVC4T245 device can be used in level-shifting applications for interfacing devices or systems operating at different interface voltages with one another. The RS74AVC4T245 device is ideal for use in applications where a push-pull driver is connected to the data I/Os. The max data rate can be up to 380 Mbps when device translates a signal from 1.8 V to 3.3 V.

11.2 Typical Application

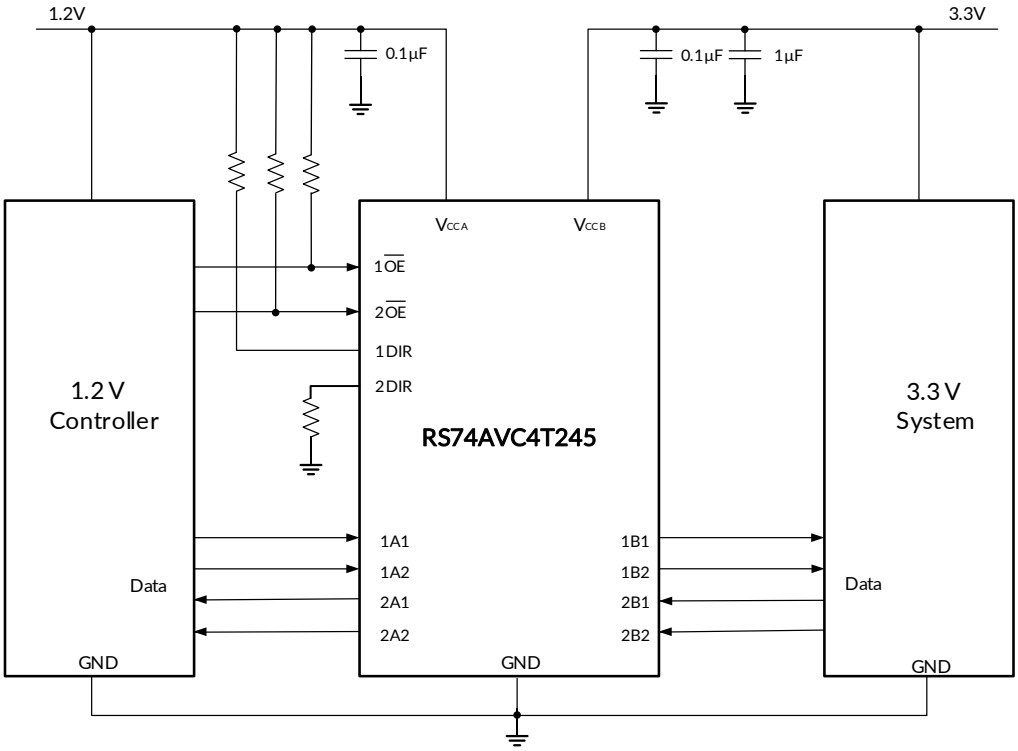


Figure 4. Typical Application Diagram

12 POWER SUPPLY RECOMMENDATIONS

The RS74AVC4T245 device uses two separate configurable power-supply rails, V_{CCA} and V_{CCB}. V_{CCA} accepts any supply voltage from 1.2 V to 3.6 V and V_{CCB} accepts any supply voltage from 1.2 V to 3.6 V. The A port and B port are designed to track V_{CCA} and V_{CCB} respectively allowing for low voltage bidirectional translation between any of the 1.2 V, 1.5 V, 1.8 V, 2.5 V, and 3.3 V voltage nodes.

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 pull-up resistor and must not be enabled until V_{CCA} and V_{CCB} are fully ramped and stable. The minimum value of the pull-up resistor to V_{CCA} is determined by the current-sinking capability of the driver.

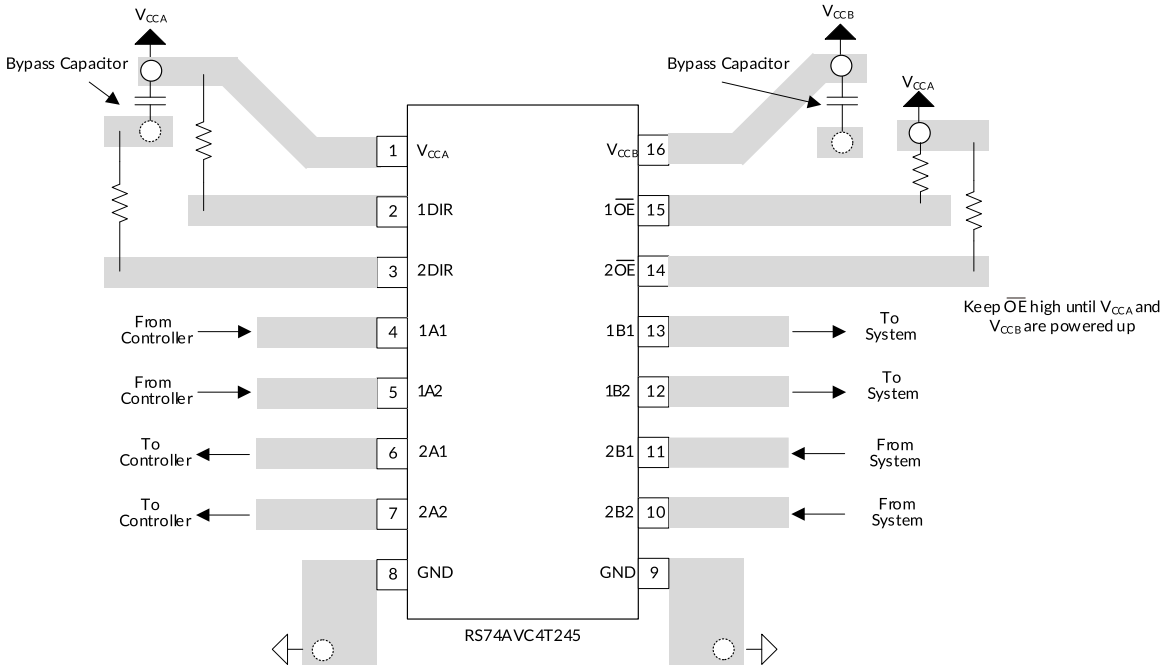
13 LAYOUT

13.1 Layout Guidelines

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

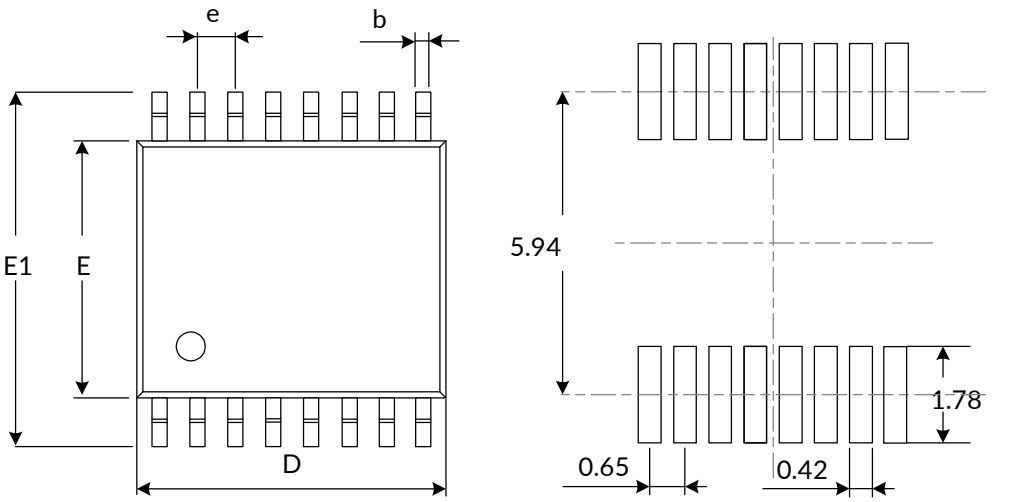
- Bypass capacitors should be used on power supplies.
- Short trace lengths should be used to avoid excessive loading.
- Place pads on the signal paths for loading capacitors or pull-up resistors to help adjust rise and fall times of signals, depending on the system requirements.

13.2 Layout Example

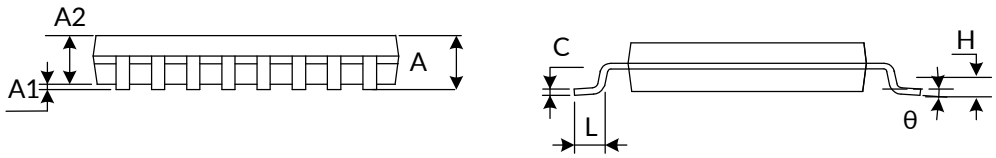


14 PACKAGE OUTLINE DIMENSIONS

TSSOP16 (3)



RECOMMENDED LAND PATTERN (Unit: mm)

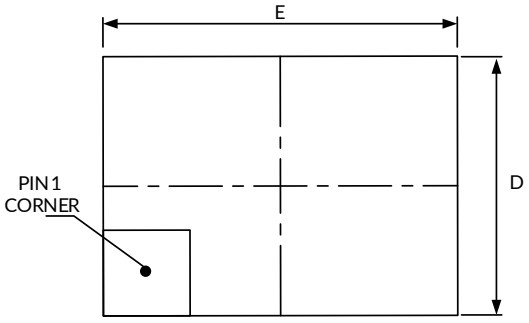


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A (1)		1.200		0.047
A1	0.050	0.150	0.002	0.006
A2	0.800	1.050	0.031	0.041
b	0.190	0.300	0.007	0.012
c	0.090	0.200	0.004	0.008
D (1)	4.860	5.100	0.191	0.201
E (1)	4.300	4.500	0.169	0.177
E1	6.200	6.600	0.244	0.260
e	0.650(BSC) (2)		0.026(BSC) (2)	
L	0.500	0.700	0.02	0.028
H	0.250 TYP		0.010 TYP	
θ	1°	7°	1°	7°

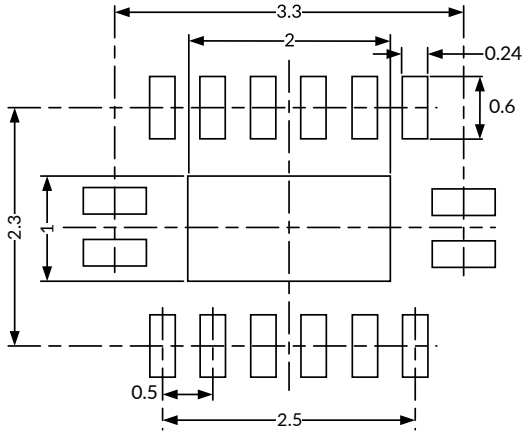
NOTE:

1. Plastic or metal protrusions of 0.15mm maximum per side are not included.
2. BSC (Basic Spacing between Centers), "Basic" spacing is nominal.
3. This drawing is subject to change without notice.

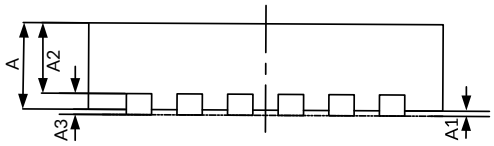
QFN2.5X3.5-16 (4)



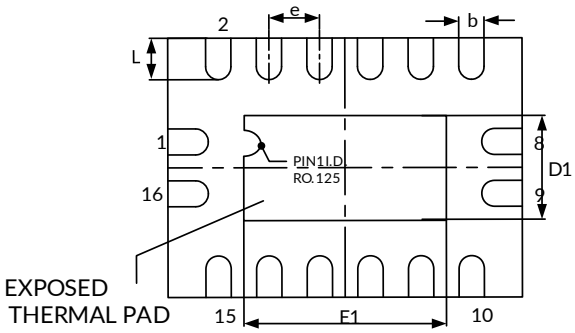
TOP VIEW



RECOMMENDED LAND PATTERN (Unit: mm)



SIDE VIEW



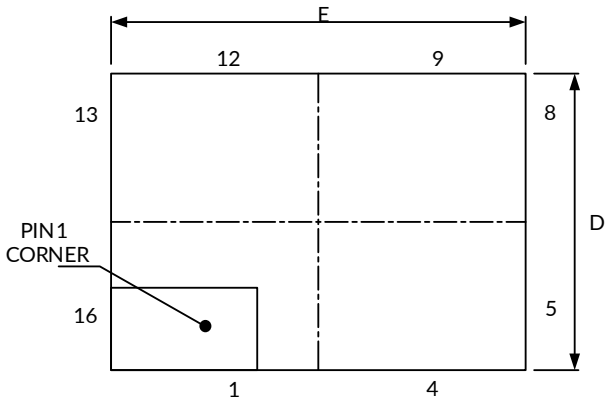
BOTTOM VIEW

Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A (1)	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) (2)		0.008(REF) (2)	
D (1)	2.400	2.600	0.094	0.102
E (1)	3.400	3.600	0.134	0.142
e	0.500(BSC) (3)		0.020(BSC) (3)	
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

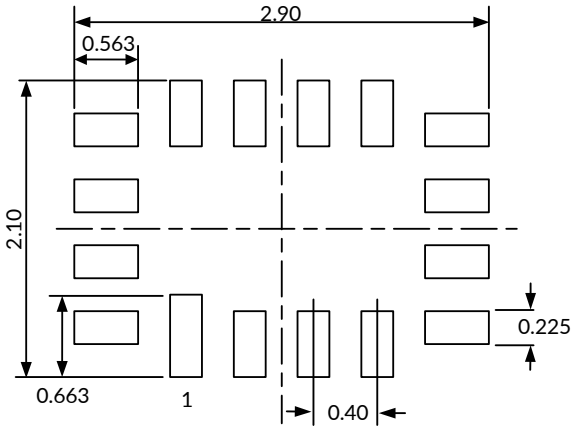
NOTE:

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.

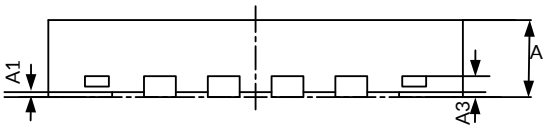
UQFN2.6X1.8-16 (3)



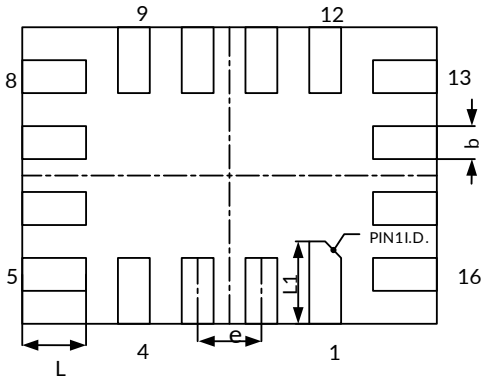
TOP VIEW



RECOMMENDED LAND PATTERN (Unit: mm)



SIDE VIEW



BOTTOM VIEW

Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A (1)	0.450	0.550	0.018	0.022
A1	0.000	0.046	0.000	0.002
A3	0.110 (REF) (2)		0.004 (REF) (2)	
b	0.150	0.250	0.006	0.010
E (1)	2.550	2.650	0.100	0.104
D (1)	1.750	1.850	0.069	0.073
e	0.400 (TYP)		0.016 (TYP)	
L	0.350	0.450	0.014	0.018
L1	0.450	0.550	0.018	0.022

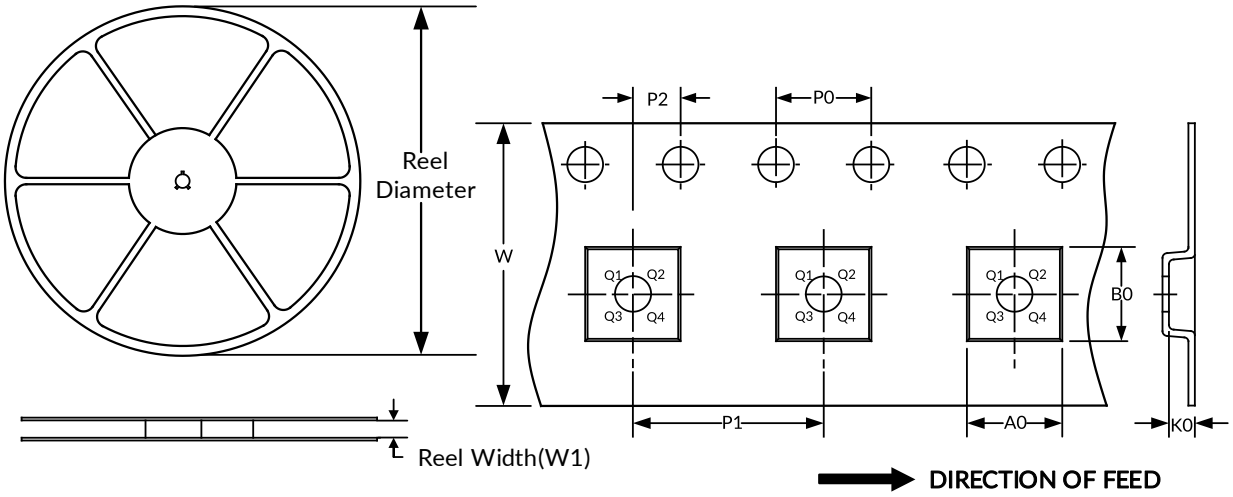
NOTE:

1. Plastic or metal protrusions of 0.075mm maximum per side are not included.
2. REF is the abbreviation for Reference.
3. This drawing is subject to change without notice.

15 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
TSSOP16	13”	12.4	6.90	5.60	1.20	4.0	8.0	2.0	12.0	Q1
QFN2.5X3.5-16	7”	15.0	2.80	3.80	1.20	4.0	4.0	2.0	12.0	Q1
UQFN2.6X1.8-16	7”	8.3	2.10	2.90	0.75	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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