Features

- Control Inputs VIH/VIL Levels Are Referenced to VCCA Voltage
- 1.1 V to 1.95 V on A Port and 1.65 V to 5.5 V on B Port (VCCA ≤ VCCB)
- Fully Configurable Dual-Rail Design
- Ioff Supports Partial Power-Down-Mode Operation
- Maximum Data Rates
  - 380 Mbps (1.8V to 3.3V Translation)
  - 200 Mbps (< 1.8V to 3.3V Translation)
  - 200 Mbps (Translate to 2.5 V or 1.8 V)
  - 150 Mbps (Translate to 1.5 V)
  - 100 Mbps (Translate to 1.2 V)
- Latch-Up Performance Exceeds 00 mA Per JESD 78, Class II
- ESD Protection Exceeds JESD 22
  - 3000V Human-Body Model (A114-A)
  - 1000V Charged-Device Model (C101)
- AEC-Q100 qualified, PPAP capable, and manufactured in IATF 16949 certified facilities.
- Grade 1 temperature range (- 40℃ ~ +125 ℃)

Applications

- Automotive
- Industrial
- Telecom

Description

This 4-bit noninverting bus transceiver uses two separate configurable power-supply rails. The A port is designed to track VCCA. VCCA accepts any supply voltage from 1.1 V to 1.95 V. The B port is designed to track VCCB. VCCB accepts any supply voltage from 1.65 V to 5.5V.

The RS7LS4T245Q device is designed for asynchronous communication between two data buses. The logic levels of the direction-control (DIR) input and the output-enable (/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 ICC and ICCZ.

The RS7LS4T245Q device is designed so that the control pins (1DIR, 2DIR, 1/OE, and 2/OE) are supplied by VCCA.

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

The VCC isolation feature ensures that if either VCC input is at GND, then both ports are in the high-impedance state.

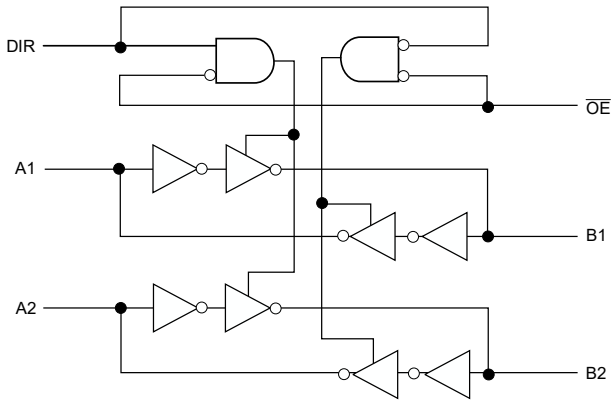
To ensure the high-impedance state during power up or power down, OE should be tied to VCC through a pullup resistor; the minimum value of the resistor is determined by the current-sinking capability of the driver.

Ordering Information

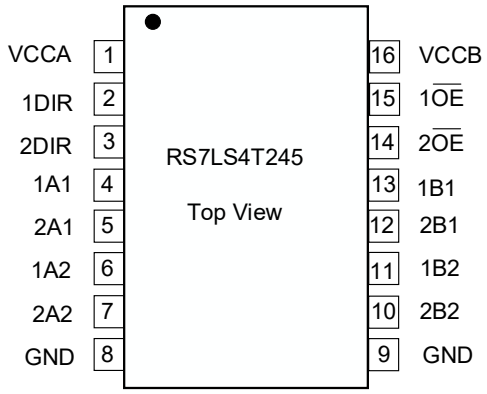
Part Number	Package	Description
RS7LS4T245QLE	TSSOP16	5.0 mm x 4.4mm
RS7LS4T245QZNE	QFN-16L	2.6 mm x 1.8 mm
RS7LS4T245QWE	SOP16	9.9mm x 3.9mm
RS7LS4T245QZPE	DFN16	2.5mmX3.5mm

E = Pb-free and Green

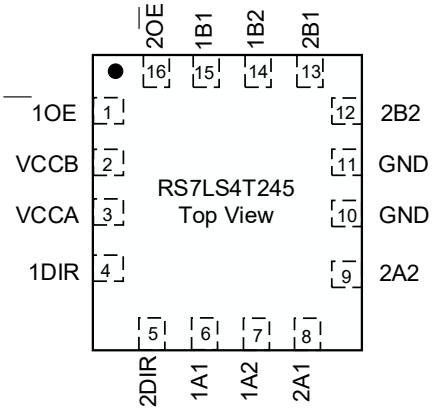
Block Diagram



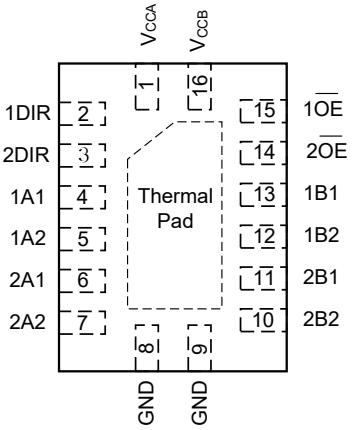
Pin Configuration



TSSOP16、SOP16



QFN-16



DFN-16

PIN	NO.		TYPE	DESCRIPTION
NAME	TSSOP16、SOP16、DFN16	QFN-16		
VCCA	1	3	—	A-port power supply voltage. 1.1 V ≤ VCCA ≤ 1.95 V
1DIR	2	4	I	Direction-control input for ‘1’ ports
2DIR	3	5	I	Direction-control input for ‘2’ ports
1A1	4	6	I/O	Input/output 1A1. Referenced to VCCA.
1A2	5	7	I/O	Input/output 1A2. Referenced to VCCA.
2A1	6	8	I/O	Input/output 2A1. Referenced to VCCA.
2A2	7	9	I/O	Input/output 2A2. Referenced to VCCA.
GND	8, 9	10, 11	—	Ground
2B2	10	12	I/O	Input/output 2B2. Referenced to VCCB.
2B1	11	13	I/O	Input/output 2B1. Referenced to VCCB.
1B2	12	14	I/O	Input/output 1B2. Referenced to VCCB.
1B1	13	15	I/O	Input/output 1B1. Referenced to VCCB.
2/OE	14	16	I	3-state output-mode enables. Pull OE high to place ‘2’ outputs in 3-state mode. Referenced to VCCA.
1/OE	15	1	I	3-state output-mode enables. Pull OE high to place ‘1’ outputs in 3-state mode. Referenced to VCCA.
VCCB	16	2	—	B-port power supply voltage. 1.65 V ≤ VCCB ≤ 5.5 V

Absolute Maximum Ratings

over operating free-air temperature range (unless otherwise noted)

		MIN	TYP	MAX	UNIT
VCCA	Supply voltage range	–0.5		2.5	V
VCCB		–0.5		6.5	
VI Input voltage range(2)	I/O ports (A port)	–0.5		2.5	V
	I/O ports (B port)	–0.5		6.5	
	Control inputs	–0.5		2.5	
VO Voltage range applied to any output in the high-impedance or power-off state(2)	A port	–0.5		2.5	V
	B port	–0.5		6.5	
VO Voltage range applied to any output in the high or low state(2)(3)	A port	–0.5		VCCA + 0.5	V
	B port	–0.5		VCCB + 0.5	
IIK Input clamp current	VI < 0			–50	mA
IOK Output clamp current	VO < 0			–50	mA
IO Continuous output current				±50	mA
Continuous current through VCCA, VCCB, or GND				±100	mA

Stresses beyond those listed under *Absolute Maximum Ratings* may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under *Recommended Operating Conditions* is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

The input voltage and output negative-voltage ratings may be exceeded if the input and output current ratings are observed.

Handling Ratings

		MIN	TYP	MAX	UNIT
Tstg Storage temperature range		–65		150	°C
V(ESD) Electrostatic discharge	Human body model (HBM), per ANSI/ESDA/JEDEC JS-001, all pins(1)			8	kV
	Charged device model (CDM), per JEDEC specification JESD22-C101, all pins(2)			1	

(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.

Recommended operation conditions

over operating free-air temperature range (unless otherwise noted)(1)(2)(3)

PARAMETER		VCCI	VCCO	MIN	TYP	MAX	UNIT
VCCA Supply voltage				1.1		1.95	V
VCCB Supply voltage				1.65		5.5	V
VIH High-level input voltage	Data inputs(4)	1.1 V to 1.95 V		VCCI × 0.8			
		1.95 V to 2.7 V		VCCI × 0.8			V
		2.7 V to 5.5 V		VCCI × 0.8			
VIL Low-level input voltage	Data inputs(4)	1.2 V to 1.95 V				VCCI × 0.2	
		1.95 V to 2.7 V				VCCI × 0.2	V
		2.7 V to 5.5 V				VCCI × 0.2	
VIH High-level input voltage	DIR (referenced to VCCA)(5)	1.1 V to 1.95 V		VCCA × 0.8			
VIH High-level input voltage	DIR (referenced to VCCA)(5)	1.1 V to 1.95 V				VCCA × 0.2	
VI Input voltage				0		VCCI	V
VO Output voltage	Active state			0		VCCO	
	3-state			0		VCCO	V
IOH High-level output current			1.1~1.95 V			–4	
			2.3 V to 2.7 V			–8	
			3 V to 3.6 V			–12	
			4~5V			-18	
			5~5.5V			-24	
IOL Low-level output current			1.1~1.95 V			4	
			2.3 V to 2.7 V			8	
			3 V to 3.6 V			12	mA
			4~5V			18	
			5~5.5V			24	
Δt/Δv Input transition rise or fall rate						5	ns/V
TA Operating free-air temperature				–40		125	°C

(1) VCCI is the VCC associated with the input port.
(2) VCCO is the VCC associated with the output port.
(3) All unused data inputs of the device must be held at VCCI or GND to ensure proper device operation.
(4) For VCCI values not specified in the data sheet, VIH min = VCCI × 0.8 V, VIL max = VCCI × 0.2 V
(5) For VCCI values not specified in the data sheet, VIH min = VCCA × 0.8 V, VIL max = VCCA × 0.2 V

Electrical Characteristics (1)(2)

over recommended operating free-air temperature range (unless otherwise noted)

(1) VCCO is the VCC associated with the output port.
(2) VCCI is the VCC associated with the input port.

PARAMETER		TEST CONDITIONS		VCCA	VCCB	TA = 25°C		–40°C to 125°C		UNIT
						TYP	MAX	MIN	MAX	
VOHA		IOH = –4mA	VI = VIH	1.1	1.65 V to 5.5			VCCA*0.7		V
		IOH = –4mA		1.4	1.65 V to 5.5			VCCA*0.75		
		IOH = –4mA		1.65	1.65 V to 5.5			VCCA*0.75		
VOLA		IOH = 4mA	VI = VIL	1.1	1.65 V to 5.5				VCCA*0.3	
		IOH = 4mA		1.4	1.65 V to 5.5				VCCA*0.25	
		IOH = 4mA		1.65	1.65 V to 5.5				VCCA*0.25	
VOHB		IOH = –4mA	VI = VIH	1.1 V to 1.95	1.65			VCCB*0.75		V
		IOH = –8 mA		1.1 V to 1.95	2.3			VCCB*0.75		
		IOH = –12 mA		1.1 V to 1.95	3			VCCB*0.75		
		IOH = –18 mA		1.1 V to 1.95	4.5			VCCB*0.75		
		IOH = –24 mA		1.1 V to 1.95	5.5			VCCB*0.75		
VOLB		IOH = 4mA	VI = VIL	1.1 V to 1.95	1.65				VCCB*0.25	
		IOH = 8 mA		1.1 V to 1.95	2.3				VCCB*0.25	
		IOH = 12 mA		1.1 V to 1.95	3				VCCB*0.25	
		IOH = 18 mA		1.1 V to 1.95	4.5				VCCB*0.25	
		IOH = –24 mA		1.1 V to 1.95	5.5				VCCB*0.25	
II	Control inputs	VI = VCCA or GND		1.1 V to 1.95	1.65 V to 5.5				±1	µA
Ioff	A port	VI or VO = 0 to1.95 V		0 V	0 to 5.5 V	±0.1	±1		±5	
	B port	VI or VO = 0 to 5.5 V		0 to 1.95V	0	±0.1	±1		±8	µA
IOZ	A or B port	VO = VCCO or GND, VI = VCCI or GND, OE = VIH		1.95	5.5	±0.5	±2.5		±5	µA
ICCA		VI = VCCI or GND, IO = 0		1.1 V to 1.95	1.65 V to 5.5				8	
				0 V	0 V to 5.5 V				–2	µA
				0 V to 1.95	0				8	
ICCB		VI = VCCI or GND, IO = 0		1.1 V to 1.95	1.65 V to 5.5				8	
				0 V	0 V to 5.5 V				8	µA
				0 V to 1.95	0				–2	
ICCA + ICCB		VI = VCCI or GND, IO = 0		1.1 V to 1.95	1.65 V to 5.5				16	µA

AC Electrical characteristics

VCCA = 1.2 V

over recommended operating free-air temperature range, VCCA = 1.2 V (unless otherwise noted)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	VCCB = 1.2 V	VCCB = 1.5 V	VCCB = 1.8 V	VCCB = 2.5 V	VCCB = 3.3 V	UNIT
			TYP	TYP	TYP	TYP	TYP	
tPLH	A	B	3.4	2.9	2.7	2.6	2.8	ns
tPHL			3.4	2.9	2.7	2.6	2.8	
tPLH	B	A	3.6	3.1	2.8	2.6	2.6	ns
tPHL			3.6	3.1	2.8	2.6	2.6	
tPZH	/OE	A	5.6	4.7	4.3	3.9	3.7	ns
tPZL			5.6	4.7	4.3	3.9	3.7	
tPZH	/OE	B	5	4.3	3.9	3.6	3.6	ns
tPZL			5	4.3	3.9	3.6	3.6	
tPHZ	/OE	A	6.2	5.2	5.2	4.3	4.8	ns
tPLZ			6.2	5.2	5.2	4.3	4.8	
tPHZ	/OE	B	5.9	5.1	5	4.7	5.5	ns
tPLZ			5.9	5.1	5	4.7	5.5	

VCCA = 1.5 V

over recommended operating free-air temperature range, VCCA = 1.5 V ± 0.1 V

PARAMETER	FROM (INPUT)	TO (OUTPUT)	VCCB = 1.2 V	VCCB = 1.5 V		VCCB = 1.8 V		VCCB = 2.5 V		VCCB = 3.3 V		UNIT
			Typ	Min	Max	Min	Max	Min	Max	Min	Max	
tPLH	A	B	3.2	0.3	6.3	0.3	5.2	0.4	4.2	0.4	4.2	ns
tPHL			3.2	0.3	6.3	0.3	5.2	0.4	4.2	0.4	4.2	
tPLH	B	A	3.3	0.7	6.3	0.5	6	0.4	5.7	0.3	5.6	ns
tPHL			3.3	0.7	6.3	0.5	6	0.4	5.7	0.3	5.6	
tPZH	/OE	A	4.9	1.4	9.6	1.1	9.5	0.7	9.4	0.4	9.4	ns
tPZL			4.9	1.4	9.6	1.1	9.5	0.7	9.4	0.4	9.4	
tPZH	/OE	B	4.5	1.4	9.6	1.1	7.7	0.9	5.8	0.9	5.6	ns
tPZL			4.5	1.4	9.6	1.1	7.7	0.9	5.8	0.9	5.6	
tPHZ	/OE	A	5.6	1.8	10.2	1.5	10.2	1.3	10.2	1.6	10.2	ns
tPLZ			5.6	1.8	10.2	1.5	10.2	1.3	10.2	1.6	10.2	
tPHZ	/OE	B	5.2	1.9	10.3	1.9	9.1	1.4	7.4	1.2	7.6	ns
tPLZ			5.2	1.9	10.3	1.9	9.1	1.4	7.4	1.2	7.6	

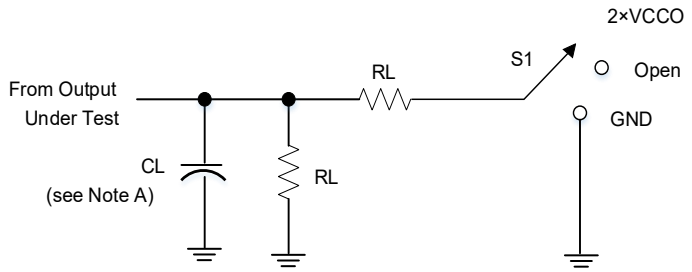
VCCA = 1.8 V

over recommended operating free-air temperature range, VCCA = 1.8 V ± 0.15 V

PARAMETER	FROM (INPUT)	TO (OUTPUT)	VCCB = 1.2 V	VCCB = 1.5 V		VCCB = 1.8 V		VCCB = 2.5 V		VCCB = 3.3 V		UNIT
			TYP	Min	Max	Min	Max	Min	Max	Min	Max	
tPLH	A	B	2.9	0.1	6	0.1	4.9	0.1	3.9	0.3	3.9	ns
tPHL			2.9	0.1	6	0.1	4.9	0.1	3.9	0.3	3.9	
tPLH	B	A	3	0.6	5.3	0.5	4.9	0.3	4.6	0.3	4.5	ns
tPHL			3	0.6	5.3	0.5	4.9	0.3	4.6	0.3	4.5	
tPZH	/OE	A	4.4	1	7.4	1	7.3	0.6	7.3	0.4	7.2	ns
tPZL			4.4	1	7.4	1	7.3	0.6	7.3	0.4	7.2	
tPZH	/OE	B	4.1	1.2	9.2	1	7.4	0.8	5.3	0.8	4.6	ns
tPZL			4.1	1.2	9.2	1	7.4	0.8	5.3	0.8	4.6	
tPHZ	/OE	A	5.4	1.6	8.6	1.8	8.7	1.3	8.7	1.6	8.7	ns
tPLZ			5.4	1.6	8.6	1.8	8.7	1.3	8.7	1.6	8.7	
tPHZ	/OE	B	5	1.7	9.9	1.6	8.7	1.2	6.9	1	6.9	ns
tPLZ			5	1.7	9.9	1.6	8.7	1.2	6.9	1	6.9	

Parameter Measurement Information

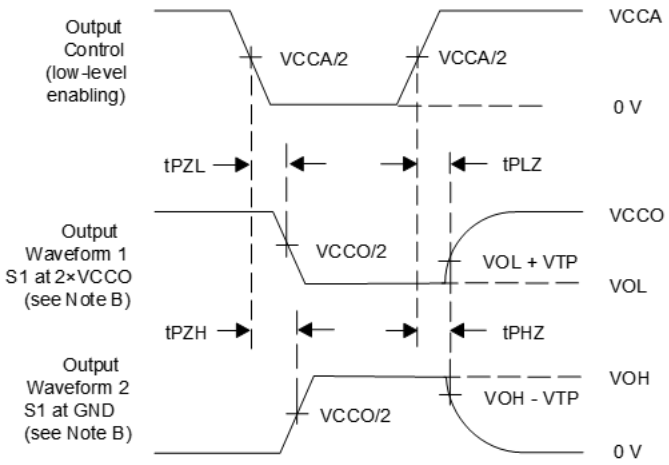
1. Circuit and voltage waveform of enable and disable times



LOAD CIRCUIT

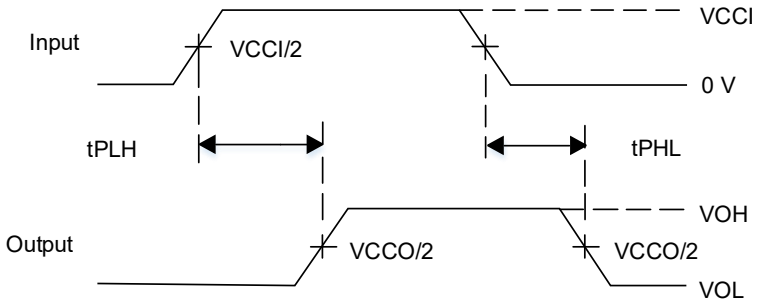
TEST	S1
tpd	Open
tPLZ/tPZL	2 × VCCO
tPHZ/tPZH	GND

VCCO	CL	RL	VTP
1.2	15 pF	2 kΩ	0.1V
1.5 V ± 0.15 V	15 pF	2 kΩ	0.1V
1.8 V ± 0.15 V	15 pF	2 kΩ	0.15 V
2.5 V ± 0.2 V	15 pF	2 kΩ	0.15 V
3.3 V ± 0.3 V	15 pF	2 kΩ	0.3 V
5 V ± 0.5 V	15 pF	2 kΩ	0.3 V



VOLTAGE WAVEFORMS
ENAVLLE AND DISABLE TIMES

2. Propagation Delay Times



VOLTAGE WAVEFORMS
PROPAGATION DELAY TIMES

NOTES:

1. CL includes probe and jig capacitance
2. Waveform 1 is for an output with internal conditions such that the output is low, except when disabled by the output control. Waveform2 is for an output with internal conditions such that the output is high, except when disabled by the output control
3. All input pulses are supplied by generators having the following characteristics: PRR ≤10 MHz, Z_O = 50 Ω, dv/dt ≥ 1 V/ns.
4. The outputs are measured one at a time, with one transition per measurement.
5. tPLZ and tPHZ are the same as tdis.
6. tPZL and tPZH are the same as ten.
7. tPLH and tPHL are the same as tpd
8. VCCI is the VCC associated with the input port.
9. VCCO is the VCC associated with the output port.
10. VCCO is the VCC associated with the output port.

Detailed Description

Overview

The RS7LS4T245Q is a 4-bit, dual-supply noninverting bidirectional voltage level translation device. Ax pins and control pins (1DIR, 2DIR,1OE, and 2OE) are supported by VCCA, and Bx pins are supported by VCCB. The A port is able to accept I/O voltages ranging from 1.1 V to 1.95 V, while the B port can accept I/O voltages from. 1.65 V to 5.5 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 OE is set to low. When OE is set to high, both Ax and Bx pins are in the high-impedance state.

Feature Description

1. **Fully Configurable Dual-Rail Design**
   VCCA accepts any supply voltage from 1.1 V to 1.95 V. The B port is designed to track VCCB. VCCB accepts any supply voltage from 1.65 V to 5.5V.

2. **Supports High Speed Translation**

   The RS7LS4T245Q device can support high data rate applications. The translated signal data rate can be up to380 Mbps when the signal is translated from 1.8 V to 3.3 V

3. **Ioff Supports Partial-Power-Down Mode Operation**

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

Device Functional Modes

(Each 2-Bit Section)(1)

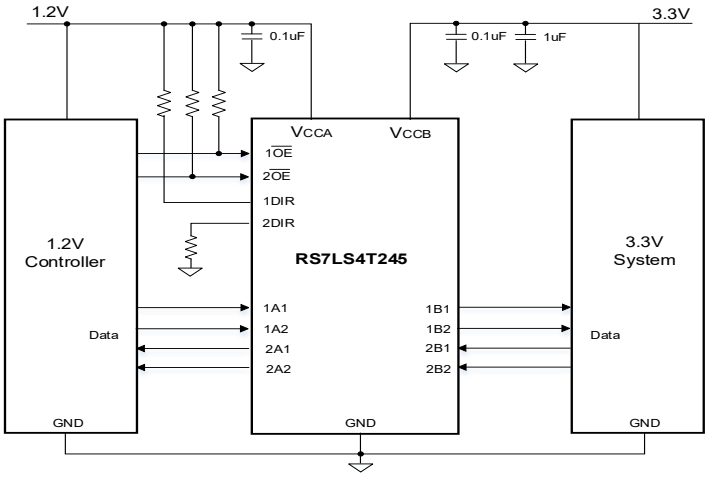
CONTROL INPUTS		OUTPUT CIRCUITS		OPERATION
/OE	DIR	A PORT	B PORT	
L	L	Enabled	Hi-Z	B data to A bus
L	H	Hi-Z	Enabled	A data to B bus
H	X	Hi-Z	Hi-Z	Isolation

(1) Input circuits of the data I/Os are always active.

Application and Implementation

The RS7LS4T245Q device can be used in level-translation applications for interfacing devices or systems operating at different interface voltages with one another. The RS7LS4T245Q 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

Typical Application



1. Detailed Design Procedure

To begin the design process, determine the following:

- Input voltage range
  - Use the supply voltage of the device that is driving the RS7LS4T245Q device to determine the input voltage range. For a valid logic high, the value must exceed the VIH of the input port. For a valid logic low, the value must be less than the VIL of the input port.
- Output voltage range
  - Use the supply voltage of the device that the RS7LS4T245Q device is driving to determine the output voltage range.

Power Supply Recommendations

The RS7LS4T245Q device uses two separate configurable power-supply rails, VCCA and VCCB. VCCA accepts any supply voltage from 1.1 V to 1.95 V. The B port is designed to track VCCB. VCCB accepts any supply voltage from 1.65 V to 5.5V.

The output-enable (OE) input circuit is designed so that it is supplied by VCCA and when the 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 OE input pin must be tied to VCCA through a pullup resistor and must not be enabled until VCCA and VCCB are fully ramped and stable. The minimum value of the pullup resistor to VCCA is determined by the current-sinking capability of the driver.

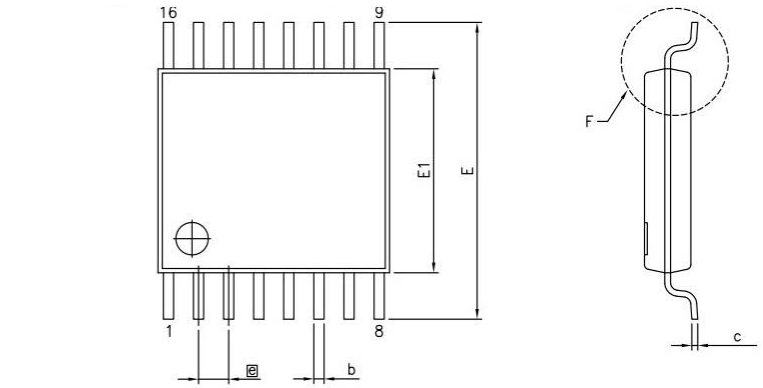
Layout Guidelines

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

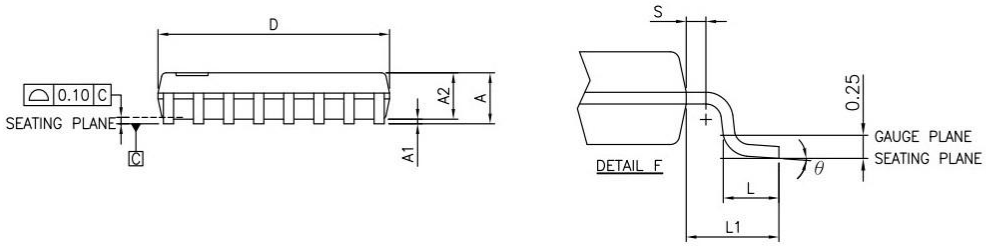
- Bypass capacitors should be used on power supplies.
- Short trace lengths should be used to avoid excessive loading.
- Place pads on the signal paths for loading capacitors or pullup resistors to help adjust rise and fall times of signals, depending on the system requirements.

Package Information

TSSOP16



SYMBOLS	MIN.	NOM.	MAX.
A	–	–	1.20
A1	0.05	–	0.15
A2	0.80	1.00	1.05
b	0.19	–	0.30
c	0.09	–	0.20
D	4.90	5.00	5.10
E1	4.30	4.40	4.50
E	6.20	6.40	6.60
e	0.65 BSC		
L1	1.00 REF		
L	0.45	0.60	0.75
S	0.20	–	–
θ	0°	–	8°



Note:
1.All dimensions are in mm. Angels in degrees.
2.Dimensions exclude burrs, mold flash or protrusions.
3.Refer Jedec MS-012

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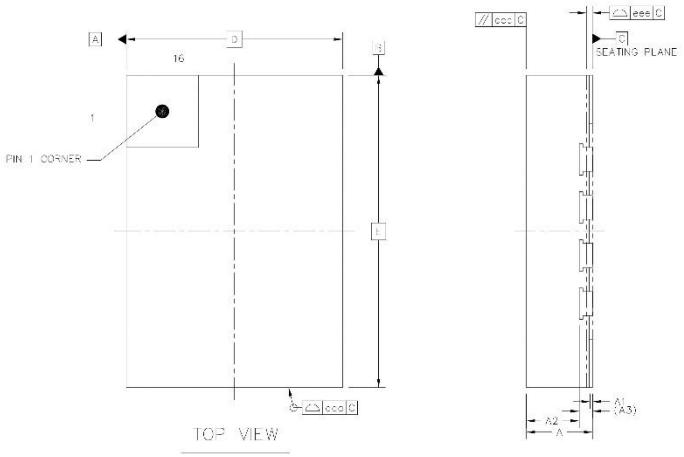

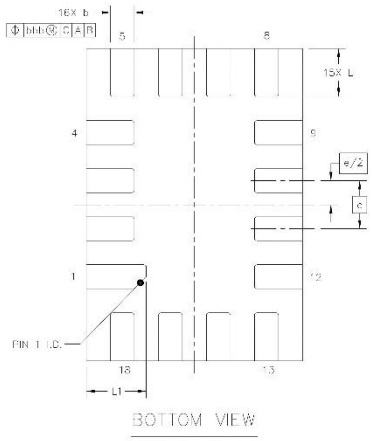

		SYMBOL	MIN	NOM	MAX
TOTAL THICKNESS		A	0.5	0.55	0.6
STAND OFF		A1	-0.004	---	0.046
MOLD THICKNESS		A2	---	0.41	---
L/F THICKNESS		A3		0.11 REF	
LEAD WIDTH		b	0.15	0.2	0.25
BODY SIZE	X	D		1.8 BSC	
	Y	E		2.6 BSC	
LEAD PITCH		e		0.4 BSC	
LEAD LENGTH		L	0.35	0.4	0.45
		L1	0.45	0.5	0.55
PACKAGE EDGE TOLERANCE		aaa		0.1	
MOLD FLATNESS		ccc		0.1	
COPLANARITY		eee		0.05	
LEAD OFFSET		bbb		0.07	

Notes:
1. All dimensions are in mm.
2. Dimensions exclude burrs, mold flash or protrusions.
3. Refer to JEDEC MO-220

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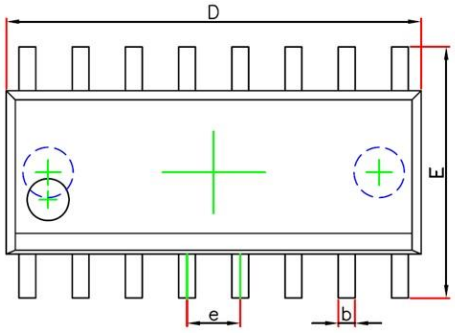

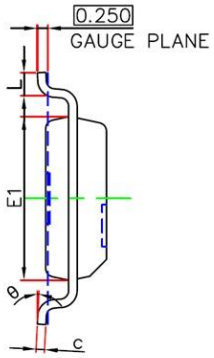

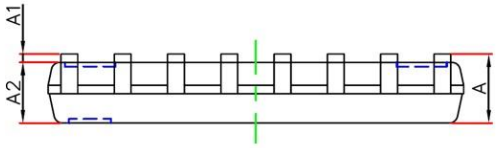

Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	——	1.750	——	0.069
A1	0.150	0.250	0.006	0.010
A2	1.400	1.500	0.055	0.059
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.007	0.010
D	9.800	10.000	0.386	0.394
e	1.270(BSC)		0.050(BSC)	
E	5.900	6.100	0.232	0.240
E1	3.800	4.000	0.150	0.157
L	0.400	1.270	0.016	0.050
θ	0°	8°	0°	8°

Note:
1.All dimensions are in mm. Angels in degrees.
2.Dimensions exclude burrs, mold flash or protrusions.
3.Refer Jedec MS-012
4. Recommended land pattern is for reference only.

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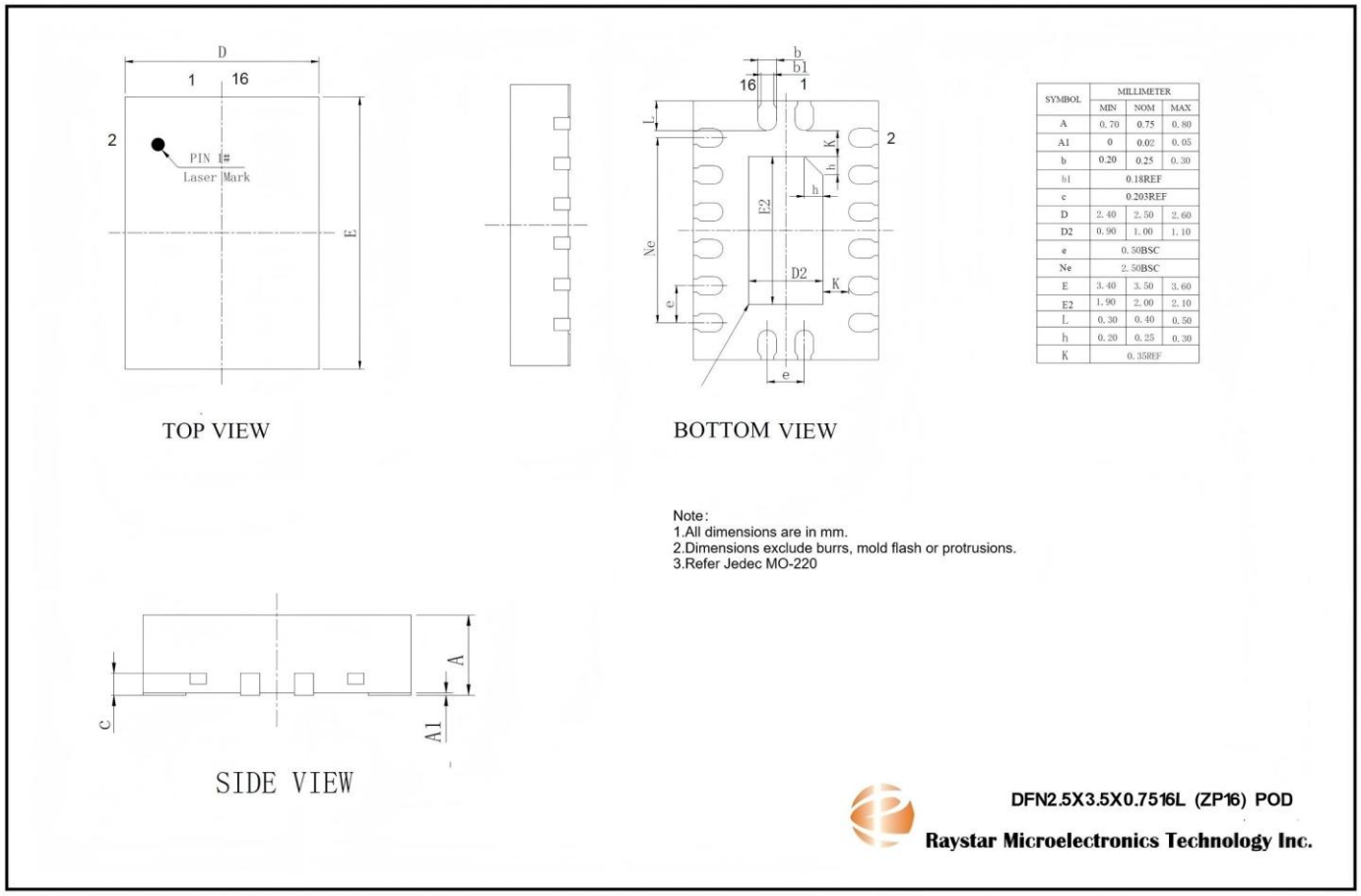
DFN16



SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	0.70	0.75	0.80
A1	0	0.02	0.05
b	0.20	0.25	0.30
b1	0.18REF		
c	0.203REF		
D	2.40	2.50	2.60
D2	0.90	1.00	1.10
e	0.50BSC		
Ne	2.50BSC		
E	3.40	3.50	3.60
E2	1.90	2.00	2.10
L	0.30	0.40	0.50
h	0.20	0.25	0.30
K	0.35REF		

Revision History

Revision	Description	DATE
1.0	Initial release	2026/6/30