



Features

- Each channel has an independent DIR control input
- Control inputs V_{IH}/V_{IL} levels are referenced to V_{CCA} voltage
- 1.1 V to 1.95 V on A Port and 1.65 V to 5.5 V on B Port
- I/Os are 2.5V tolerant (IOA) and 6.5V tolerant (IOB).
- I_{off} Supports partial power-down-mode operation
- Typical data rates
 - 380Mbps (1.8V to 3.3V translation)
 - 200Mbps (<1.8V to 3.3V translation)
 - 200Mbps (translate to 2.5V or 1.8V)
 - 150Mbps (translate to 1.5V)
 - 100Mbps (translate to 1.2V)
- Latch-up performance exceeds 100mA Per JESD 78, class II
- ESD Protection exceeds the following levels
 - $\pm 4000V$ Human-body model
 - $\pm 1000V$ Charged-device model

Applications

- Telematics
- Personal electronic
- Industrial
- Enterprise
- Telecom

Description

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 1.1V to 1.95V. The B port is designed to track V_{CCB} . V_{CCB} accepts any supply voltage from 1.65V to 5.5V. This allows for universal low-voltage bi-directional translation between any of the 1.2V, 1.5V, 1.8V, 2.5V, and 3.3V voltage nodes.

The RS7LS4T774 is designed for asynchronous communication between 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 in the high-impedance mode. The device transmits data from the A bus to the B bus when the B outputs are activated, and from the B bus to the A bus when the A 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 RS7LS4T774 is designed so that the control pins (DIR1, DIR2, DIR3, DIR4, and \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. The V_{CC} isolation feature ensures that if either V_{CC} input is at GND, then both ports are in the high-impedance state.

For a high-impedance state during power-up or power-down, \overline{OE} should be tied to V_{CCA} through a pullup resistor; the minimum value of the resistor is determined by the current-sinking capability of the driver. Since this device has CMOS inputs, it is very important to not allow them to float. If the inputs are not driven to either a high V_{CC} state, or a low-GND state, an undesirable larger than expected I_{CC} current may result. Since the input voltage settlement is governed by many factors (for example, capacitance, board-layout, package inductance, surrounding conditions, and so forth), ensuring that these inputs are kept out of erroneous switching states and tying them to either a high or a low level minimizes the leakage current.

Ordering Information

Part Number	Package	Description
RS7LS4T774LE	TSSOP16	5mm x 6.4mm
RS7LS4T774ZPE	DFN2.5X3.5X0.75	2.5mm x 3.5mm

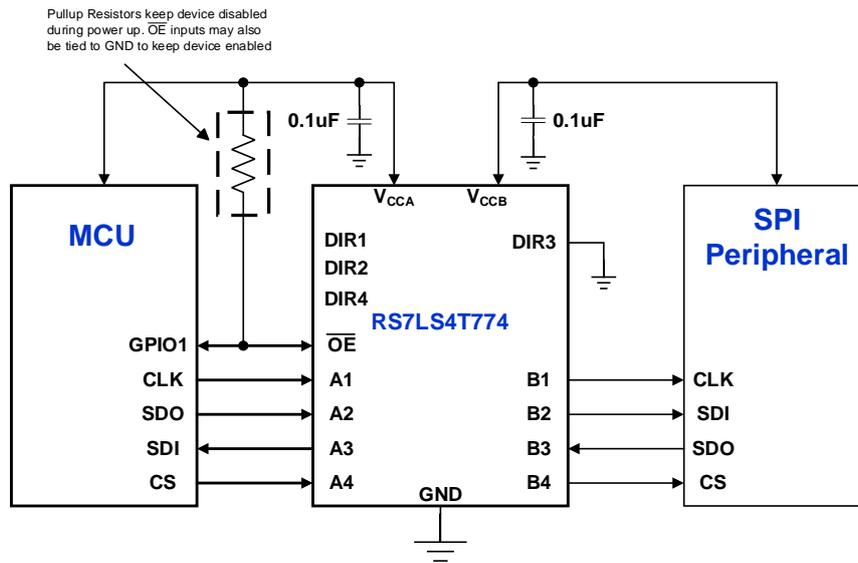


Figure 1. Typical Application Schematic



Pin Configuration

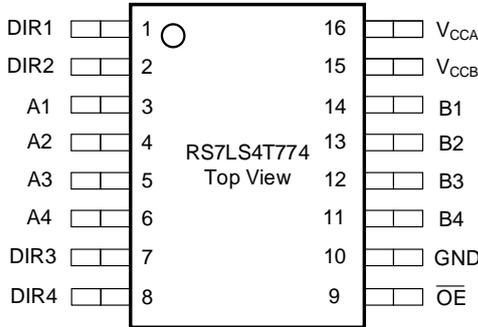


Figure 2. TSSOP16, Top View

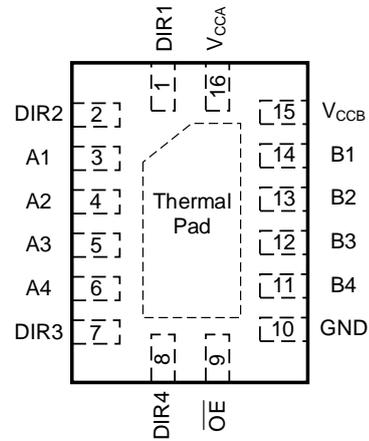


Figure 3. QFN16L, Top View

Table 1. Pin Functions

PINS		TYPE ⁽¹⁾	Description
NAME	No.		
DIR1	1	I	Direction-control input referenced to V _{CCA} , controls signal flow for the first (A1/B1) I/O channels.
DIR2	2	I	Direction-control input referenced to V _{CCA} , controls signal flow for the second (A2/B2) I/O channels.
A1	3	I/O	Input/output A1. Referenced to V _{CCA} .
A2	4	I/O	Input/output A2. Referenced to V _{CCA} .
A3	5	I/O	Input/output A3. Referenced to V _{CCA} .
A4	6	I/O	Input/output A4. Referenced to V _{CCA} .
DIR3	7	I	Direction-control input referenced to V _{CCA} , controls signal flow for the third (A3/B3) I/O channels.
DIR4	8	I	Direction-control input referenced to V _{CCA} , controls signal flow for the fourth (A4/B4) I/O channels.
$\overline{\text{OE}}$	9	I	3-state output-mode enables. Pull $\overline{\text{OE}}$ high to place all outputs in 3-state mode. Referenced to V _{CCA} .
GND	10	—	Ground.
B4	11	I/O	Input/output B4. Referenced to V _{CCB} .
B3	12	I/O	Input/output B3. Referenced to V _{CCB} .
B2	13	I/O	Input/output B2. Referenced to V _{CCB} .
B1	14	I/O	Input/output B1. Referenced to V _{CCB} .
V _{CCB}	15	—	B-port supply voltage. 1.65V ≤ V _{CCB} ≤ 5.5V.
V _{CCA}	16	—	A-port supply voltage. 1.1V ≤ V _{CCA} ≤ 1.95V.



Absolute Maximum Ratings

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

Symbol	Parameter		MIN	MAX	Unit
V _{CCA}	Supply voltage		-0.5	2.5	V
V _{CCB}	Supply voltage		-0.5	6.5	
V _I	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	
V _O	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	
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	VI < 0	-0.5	-50	mA
I _{OK}	Output clamp current	VO < 0		-50	mA
I _O	Continuous output current			±50	mA
	Continuous current through V _{CCA} , V _{CCB} , or GND			±100	mA
T _J	Junction temperature			+150	°C
T _{stg}	Storage temperature		-65	+150	°C

(1) 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.

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

ESD Ratings

Symbol	Parameter		Value	Unit
V _(ESD)	Electrostatic discharge	Human body model (HBM), per ANSI/ESDA/JEDEC JS-001	±3000	V
		Charged device model (CDM), per JEDEC specification JESD22-C101	±1000	

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

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



Recommended Operating Conditions

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

Symbol	Parameter		V _{CCI}	V _{CCO}	MIN	MAX	Unit
V _{CCA}	Supply voltage				1.1	1.95	V
V _{CCB}	Supply voltage				1.65	5.5	V
V _{IH}	High-level input voltage	Data inputs ⁽⁴⁾	1.1V to 1.95V		V _{CCI} × 0.85		V
			1.95V to 2.7V		V _{CCI} × 0.85		
			2.7V to 5.5V		V _{CCI} × 0.85		
V _{IL}	Low-level input voltage	Data inputs ⁽⁴⁾	1.1V to 1.95V			V _{CCI} × 0.35	V
			1.95V to 2.7V			V _{CCI} × 0.35	
			2.7V to 5.5V			V _{CCI} × 0.35	
V _{IH}	High-level input voltage	Control Inputs (referenced to V _{CCA}) ⁽⁵⁾ (DIRx, \overline{OE})	1.1V to 1.95V		V _{CCA} × 0.65		V
V _{IL}	Low-level input voltage	Control Inputs (referenced to V _{CCA}) ⁽⁵⁾ (DIRx, \overline{OE})	1.1V to 1.95V			V _{CCA} × 0.35	V
V _I	Input voltage				0	V _{CCI}	V
V _O	Output voltage	Active state			0	V _{CCO}	V
		3-state			0	V _{CCO}	
I _{OH}	High-level output current			1.1V to 1.3V		-4	mA
				1.4V to 1.6V		-8	
				1.65V to 1.95V		-12	
				2.3V to 2.7V		-18	
				3V to 5.5V		-24	
I _{OL}	Low-level output current			1.1V to 1.3V		4	mA
				1.4V to 1.6V		8	
				1.65V to 1.95V		12	
				2.3V to 2.7V		18	
				3V to 5.5V		24	
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} × 0.7V, V_{IL} max = V_{CCI} × 0.3V.

(5) For V_{CCI} values not specified in the data sheet, V_{IH} min = V_{CCA} × 0.7V, V_{IL} max = V_{CCA} × 0.3V.



Electrical Characteristics

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

Parameter	Conditions	V _{CCA}	V _{CCB}	TA=25°C		TA=-45°C to 125°C		UNIT	
				TYP	MAX	MIN	MAX		
V _{OHA}	I _{OH} = -4mA	V _I =V _{IH}	1.1V	1.65V to 5.5V			V _{CCA} *0.7	V	
	I _{OH} = -4mA		1.4V	1.65V to 5.5V			V _{CCA} *0.75		
	I _{OH} = -4mA		1.65V	1.65V to 5.5V			V _{CCA} *0.75		
V _{OLA}	I _{OH} = -4mA	V _I =V _{IL}	1.1V	1.65V to 5.5V			V _{CCA} *0.3	V	
	I _{OH} = -4mA		1.4V	1.65V to 5.5V			V _{CCA} *0.25		
	I _{OH} = -4mA		1.65V	1.65V to 5.5V			V _{CCA} *0.25		
V _{OHB}	I _{OH} = -4mA	V _I =V _{IH}	1.1V to 1.95V	1.65V			V _{CCB} *0.75	V	
	I _{OH} = -8mA		1.1V to 1.95V	2.3V			V _{CCB} *0.75		
	I _{OH} = -12mA		1.1V to 1.95V	3V			V _{CCB} *0.75		
	I _{OH} = -18mA		1.1V to 1.95V	4.5V			V _{CCB} *0.75		
	I _{OH} = -24mA		1.1V to 1.95V	5.5V			V _{CCB} *0.75		
V _{OLB}	I _{OH} = -4mA	V _I =V _{IL}	1.1V to 1.95V	1.65V			V _{CCB} *0.25	V	
	I _{OH} = -8mA		1.1V to 1.95V	2.3V			V _{CCB} *0.25		
	I _{OH} = -12mA		1.1V to 1.95V	3V			V _{CCB} *0.25		
	I _{OH} = -18mA		1.1V to 1.95V	4.5V			V _{CCB} *0.25		
	I _{OH} = -24mA		1.1V to 1.95V	5.5V			V _{CCB} *0.25		
I _I	Control inputs	V _I =V _{CCA} or GND	1.1V to 1.95V	1.65V to 5.5V	±0.1	±0.25		±1	uA
I _{off}	A port	V _I or V _O = 0 to 1.95V	0V	0V to 5.5V	±0.1	±1		±5	uA
	B port	V _I or V _O = 0 to 5.5V	0V to 1.95V	0V	±0.1	±1		±8	
I _{OZ}	A or B port	V _O = V _{CCO} or GND, V _I = V _{CCI} or GND, \overline{OE} = V _{IH}	1.95	5.5V	±0.5	±2.5		±5	uA
I _{CCA}	V _I = V _{CCI} or GND, I _O = 0	1.1V to 1.95V	1.65V to 5.5V				8	uA	
		0V	0V to 5.5V				-2		
		0V to 1.95V	0V				8		
I _{CCB}	V _I = V _{CCI} or GND, I _O = 0	1.1V to 1.95V	1.65V to 5.5V				8	uA	
		0V	0V to 5.5V				8		
		0V to 1.95V	0V				-2		
I _{CCA} + I _{CCB}	V _I = V _{CCI} or GND, I _O = 0	1.1V to 1.95V	1.65V to 5.5V				16	uA	

- (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.



AC Electrical Characteristics

Switching Characteristics: $V_{CCA} = 1.2V \pm 0.1V$

See Figure 4 and Table 2 for test circuit and loading. See Figure 5 and Figure 6 for measurement waveforms.

Parameter	From	To	Test Conditions	$V_{CCB}=1.8V\pm0.1V$		$V_{CCB}=2.5V\pm0.15V$		$V_{CCB}=3.3V\pm0.2V$		$V_{CCB}=5.5V\pm0.3V$		Unit
				MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
t_{PLH}	A	B	$T_A=25^\circ C$	1	5.5	1	4	0.5	4	0.5	4	ns
t_{PHL}				1	5.5	0.5	4.5	0.5	6	0.5	6	
t_{PLH}	B	A		1	6	1	6	1	6	1	6	
t_{PHL}				1	4.5	0.5	4	0.5	4	0.5	4	
t_{PZH}	\overline{OE}	A		1	10	1	8	1	8.5	1	8.5	
t_{PZL}				1.5	9	1	9	1	9	1	9	
t_{PZH}	\overline{OE}	B		1	13	1	9.5	0.5	30	0.5	30	
t_{PZL}				1	11	1	8.5	0.5	24	0.5	24	
t_{PHZ}	\overline{OE}	A		2	6.5	1.5	6.5	2	6.5	2	6.5	
t_{PLZ}				2.5	6.5	2	6.5	2	6.5	2	6.5	
t_{PHZ}	\overline{OE}	B		2	8.5	1.5	7.5	2	6.5	2	6.5	
t_{PLZ}				2.5	5.5	1.5	7.5	2	6	2	6	

Switching Characteristics: $V_{CCA} = 1.5V \pm 0.1V$

See Figure 4 and Table 2 for test circuit and loading. See Figure 5 and Figure 6 for measurement waveforms.

Parameter	From	To	Test Conditions	$V_{CCB}=1.8V\pm0.1V$		$V_{CCB}=2.5V\pm0.15V$		$V_{CCB}=3.3V\pm0.2V$		$V_{CCB}=5.5V\pm0.3V$		Unit
				MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
t_{PLH}	A	B	$T_A=25^\circ C$	0.3	5.2	0.4	4.2	0.4	4.2	0.4	4.2	ns
t_{PHL}				0.3	5.2	0.4	4.2	0.4	4.2	0.4	4.2	
t_{PLH}	B	A		0.5	6	0.4	5.7	0.3	5.6	0.3	5.6	
t_{PHL}				0.5	6	0.4	5.7	0.3	5.6	0.3	5.6	
t_{PZH}	\overline{OE}	A		1.1	9.5	0.7	9.4	0.4	9.4	0.4	9.4	
t_{PZL}				1.1	9.5	0.7	9.4	0.4	9.4	0.4	9.4	
t_{PZH}	\overline{OE}	B		1.1	7.7	0.9	5.8	0.9	5.6	0.9	5.6	
t_{PZL}				1.1	7.7	0.9	5.8	0.9	5.6	0.9	5.6	
t_{PHZ}	\overline{OE}	A		1.5	10.2	1.3	10.2	1.6	10.2	1.6	10.2	
t_{PLZ}				1.5	10.2	1.3	10.2	1.6	10.2	1.6	10.2	
t_{PHZ}	\overline{OE}	B		1.9	9.1	1.4	7.4	1.2	7.6	1.2	7.6	
t_{PLZ}				1.9	9.1	1.4	7.4	1.2	7.6	1.2	7.6	



Switching Characteristics: VCCA = 1.8 V ± 0.15V

See Figure 4 and Table 2 for test circuit and loading. See Figure 5 and Figure 6 for measurement waveforms.

Parameter	From	To	Test Conditions	V _{CCB} = 1.8V±0.1V		V _{CCB} = 2.5V±0.15V		V _{CCB} = 3.3V±0.2V		V _{CCB} = 5.5V±0.3V		Unit
				MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
t _{PLH}	A	B	T _A =25°C	0.3	5.2	0.4	4.2	0.4	4.2	0.4	4.2	ns
t _{PHL}				0.3	5.2	0.4	4.2	0.4	4.2	0.4	4.2	
t _{PLH}	B	A		0.5	6	0.4	5.7	0.3	5.6	0.3	5.6	
t _{PHL}				0.5	6	0.4	5.7	0.3	5.6	0.3	5.6	
t _{PZH}	OE	A		1.1	9.5	0.7	9.4	0.4	9.4	0.4	9.4	
t _{PZL}				1.1	9.5	0.7	9.4	0.4	9.4	0.4	9.4	
t _{PZH}	OE	B		1.1	7.7	0.9	5.8	0.9	5.6	0.9	5.6	
t _{PZL}				1.1	7.7	0.9	5.8	0.9	5.6	0.9	5.6	
t _{PHZ}	OE	A		1.5	10.2	1.3	10.2	1.6	10.2	1.6	10.2	
t _{PLZ}				1.5	10.2	1.3	10.2	1.6	10.2	1.6	10.2	
t _{PHZ}	OE	B		1.9	9.1	1.4	7.4	1.2	7.6	1.2	7.6	
t _{PLZ}				1.9	9.1	1.4	7.4	1.2	7.6	1.2	7.6	



Parameter Measurement Information

Load Circuit and Voltage Waveforms

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

- $F = 10\text{MHz}$
- $Z_o = 50\Omega$
- $\Delta t/\Delta V \leq 1\text{ns/V}$

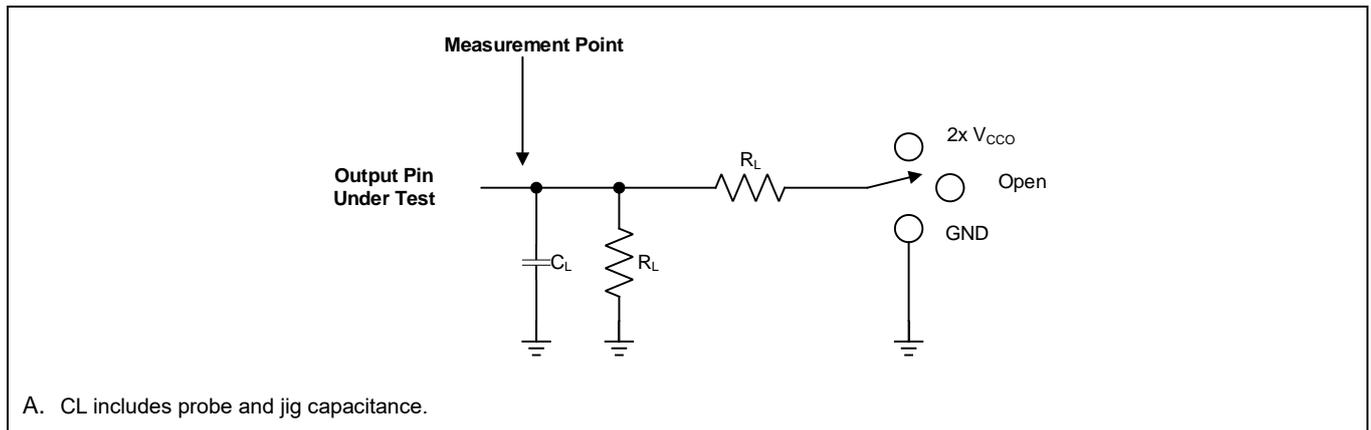


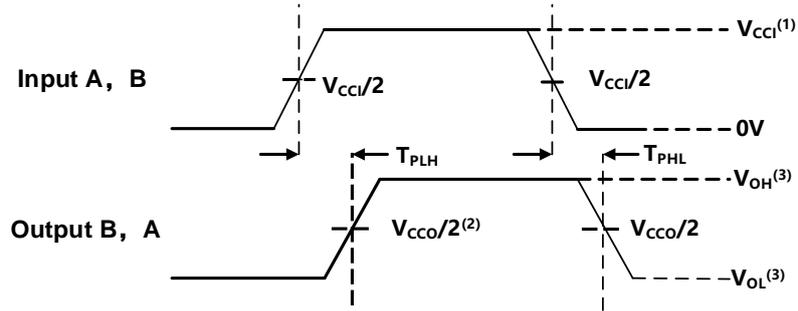
Figure 4. Load Circuit

Table 2. Load Circuit Parameters

Test Parameter		S1
t_{pd}	Propagation (delay) time	Open
t_{PZL}, t_{PLZ}	Enable time, disable time	$2 \times V_{CCO}$
t_{PZH}, t_{PHZ}	Enable time, disable time	GND

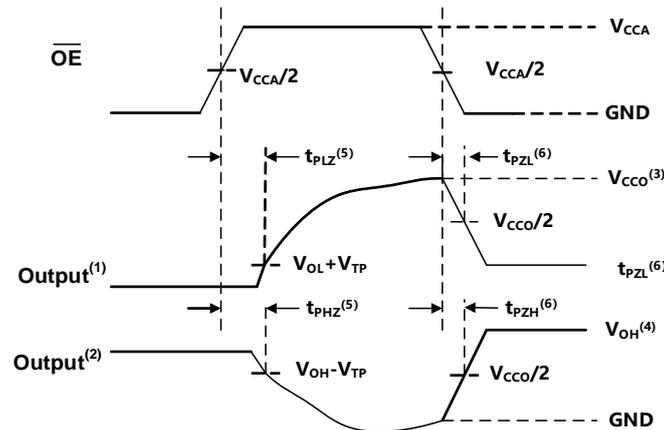
Table 3. Load Circuit Conditions

V_{CCO}	R_L	C_L	V_{TP}
$1.2V \pm 0.1V$	$2k\Omega$	$15pF$	$0.1V$
$1.5V \pm 0.1V$	$2k\Omega$	$15pF$	$0.1V$
$1.8V \pm 0.15V$	$2k\Omega$	$15pF$	$0.15V$
$2.5V \pm 0.2V$	$2k\Omega$	$15pF$	$0.15V$
$3.3V \pm 0.3V$	$2k\Omega$	$15pF$	$0.3V$
$5.5V \pm 0.3V$	$2k\Omega$	$15pF$	$0.3V$



- (1) V_{CCI} is the V_{CC} associated with the input port.
- (2) V_{CCO} is the V_{CC} associated with the output port.
- (3) V_{OH} and V_{OL} are typical output voltage levels that occur with specified R_L , C_L , and S_1 .
- (4) t_{PLH} and t_{PHL} are the same as t_{pd} .
- (5) The outputs are measured one at a time, with one transition per measurement.

Figure 5. Propagation Delay



- (1) Output waveform on the condition that input is driven to a valid Logic Low.
- (2) Output waveform on the condition that input is driven to a valid Logic High.
- (3) V_{CCO} is the supply pin associated with the output port.
- (4) V_{OH} and V_{OL} are typical output voltage levels with specified R_L , C_L , and S_1 .
- (5) t_{PLZ} and t_{PHZ} are the same as t_{dis} .
- (6) t_{PZL} and t_{PZH} are the same as t_{en} .

Figure 6. Enable Time And Disable Time



Detailed Description

● Overview

The RS7LS4T774 is a 4-bit, dual-supply, noninverting, bi-directional voltage level translation. Pins An and control pins (DIR1, DIR2, DIR3, DIR4 and \overline{OE}) are support by V_{CCA} and pins Bn are support by V_{CCB} . The A port is able to accept I/O voltages ranging from 1.1V to 1.95V, while the B port can accept I/O voltages from 1.65V to 5.5V. A high on DIR allows data transmission from An to Bn and a low on DIR allows data transmission from B to A when \overline{OE} is set to low. When \overline{OE} is set to high, both An and Bn are in the high-impedance state.

● Functional Block Diagram

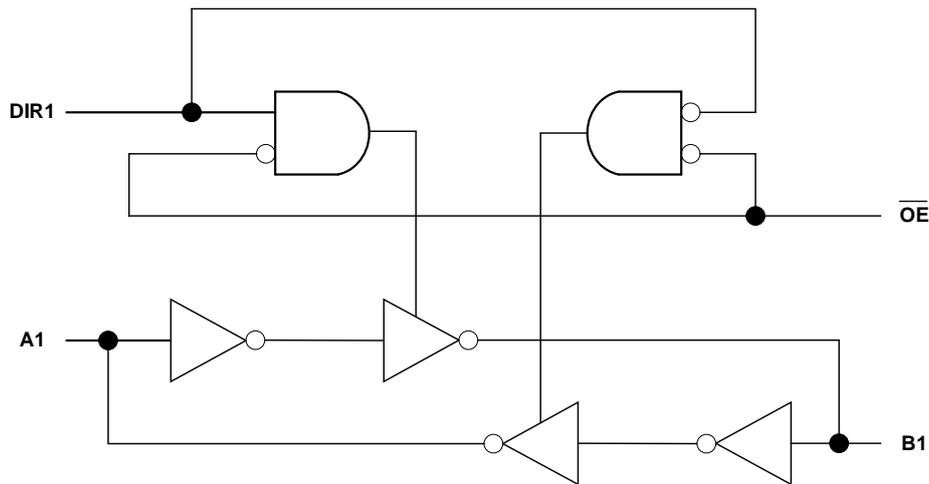


Figure 7. Logic Diagram (Positive Logic)

● Feature Description

1. Fully Configurable Dual-Rail Design Allows Each Port to Operate Over the Respective Power-Supply Range: V_{CCA} at 1.1V to 1.95V and V_{CCB} at 1.65V to 5.5V.

Both V_{CCA} (1.1V to 1.95V) and V_{CCB} (1.65V to 5.5V) can be supplied at any voltage within their respective ranges, making the device suitable for translating between various low-voltage and standard-voltage nodes (1.2V, 1.8V, 2.5V, 3.3V, and 5V).

2. Support High-Speed Translation

RS7LS4T774 can support high data rate application. The translated signal data rate can be up to 380Mbps when signal is translated from 1.8V to 3.3V.

3. I_{off} Supports Partial-Power-Down Mode Operation

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

● Device Functional Modes

Table 4. Function Table (Each Bit)

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



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°

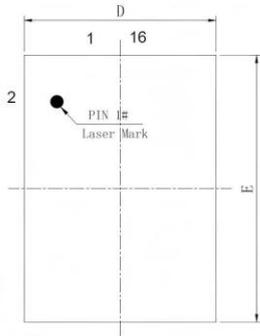
Note:
 1. All dimensions are in mm. Angles in degrees.
 2. Dimensions exclude burrs, mold flash or protrusions.
 3. Refer Jeduc MS-012

TSSOP16 POD Rev.0
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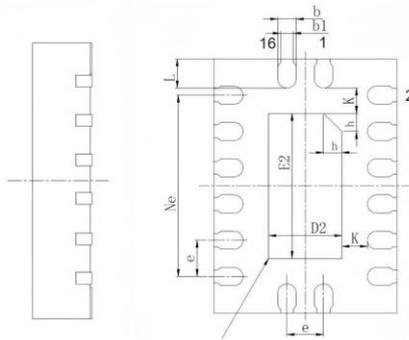




DFN2.5X3.5X0.75 16L (ZP16)

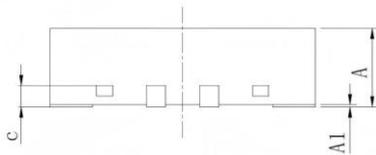


TOP VIEW



BOTTOM VIEW

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		



SIDE VIEW

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





Revision History

Revision	Description	Date
V0.9	Preliminary release	2025/04/10
V1.0	Update the minimum voltage of VIL	2026/01/27