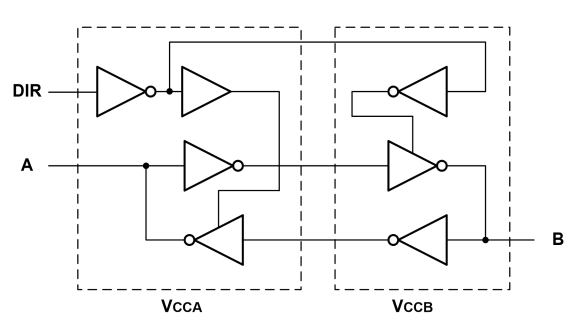


GT74LVC1T45

Single-bit Dual-Supply Bus Transceiver with Voltage Translation

1 Features	2 Application
- Control inputs V_{IH}/V_{IL} levels are referenced to V_{CCA} - V_{CC} isolation Feature – if either V_{CC} input is at GND, all are in the high-impedance state - Fully configurable dual-rail design allows each port to operate over the full 1.65V to 5.5V power supply range - Recommended temperature range: -40°C to $+125^{\circ}\text{C}$ - Max data rates 420 Mbps (3.3-V to 5-V Translation) 210 Mbps (Translate to 3.3V) 140 Mbps (Translate to 2.5V) 75 Mbps (Translate to 1.8V)	- Personal Electronic - Industrial - Enterprise - Telecom

3 Description	Circuit Diagram
This single-bit noninverting bus transceiver uses two separate power-supply rails. The GT74LVC1T45 is optimized to operate with V_{CCA} and V_{CCB} set at 1.65V to 5.5 V. The A port is designed to track V_{CCA}. V_{CCA} accepts any supply voltage from 1.65V to 5.5 V. 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 bidirectional translation between any of the 1.8 V, 2.5 V, 3.3 V, and 5.5V voltage nodes. The logic levels of the direction-control (DIR) input activate either the B-port outputs or the A-port outputs. 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 have a logic HIGH or LOW level applied to prevent excess I_{CC} and I_{CCZ}. The GT74LVC1T45 is designed so that the control pin (DIR) is supplied by V_{CCA}.	 The circuit diagram shows the internal structure of the GT74LVC1T45. It features two input/output ports, A and B, and a direction-control input DIR. Port A is connected to a supply rail V_{CCA}, and Port B is connected to a supply rail V_{CCB}. The DIR input is connected to a network of inverters and buffers that control the direction of data flow between the two ports. The diagram illustrates how the device can translate signals between different voltage levels (1.65V to 5.5V) and operate in both directions.

4 Revision History

Revision	Date	Note
Rev. A1. 0	2023. 10. 21	Original Version
Rev. A1. 1	2023. 11. 02	1.Updated Package Qty 2.Added Tape and Reel Information
Rev. A1. 2	2023. 12. 26	1. Added Marking 2.Added MSL
Rev. A1. 3	2024. 01. 26	Updated Part Name
Rev. A1. 4	2024. 12. 13	Updated Marking and Package Qty
Rev. A1. 5	2025. 06. 19	Updated Package

The latest datasheet version should be checked on the GTIC official website, as the company does not actively inform customers about updates to the datasheet.

5 Device Summary, Pin and Packages

Table.5-1. Device Summary⁽¹⁾

Serial Name	Part Name	Package	Body Size (Nom)	Marking ⁽²⁾	MSL ⁽³⁾	Package Qty
GT74LVC1T45	GT74LVC1T45S6	SOT23-6	3.00mmx2.80mmx1.15mm	1T45 XXXX	3	Tape and Reel,3000

(1)For all available packages, please contact product sales.

(2)There may be additional marking, which relates to the lot trace code information (data code and Vendor code), the logo or the environmental category on the device.

(3)MSL, The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications.

(4)"XXXXX" in Marking will be appeared as the batch code.

5 Device Summary, Pin and Packages(Continued)

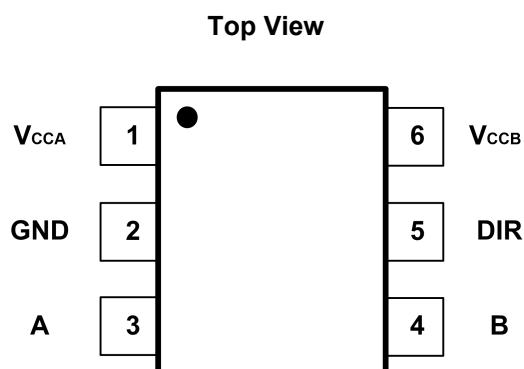


Fig.5-1. GT74LVC1T45: S6 (SOT23-6) Package

Table.5-2. Pin Definition

PIN		I/O	Description
Name	S6		
V _{CCA}	1	-	System-1 supply voltage (1.65V to 5.5 V)
GND	2	-	Device GND
A	3	I/O	Output level depends on V _{CC1} voltage.
B	4	I/O	Input threshold value depends on V _{CC2} voltage.
DIR	5	I	GND (low level) determines B-port to A-port direction.
V _{CCB}	6	-	SYSTEM-2 supply voltage (1.65V to 5.5 V)

* All unused input pins cannot be suspended and suggested to connect to GND.

6 Voltage, Temperature, ESD and Thermal Ratings

6.1 Absolute Maximum Ratings⁽¹⁾

Parameters			Min	Max	Unit
Supply voltage range, V_{CCA} , V_{CCB}			-0.5	6.5	V
V_I	Input voltage range ⁽²⁾	I/O ports (A port)	-0.5	6.5	V
		I/O ports (B port)	-0.5	6.5	
		Control inputs	-0.5	6.5	
V_O	Voltage range applied to any output in the high-impedance or power-off state ⁽²⁾	A port	-0.5	6.5	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	$V_I < 0$		-50	mA
I_{OK}	Output clamp current	$V_O < 0$		-50	mA
I_O	Continuous output current			± 50	mA
Continuous current through each V_{CCA} , V_{CCB} , and GND				± 100	mA

(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 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 6.5V maximum if the output current rating is observed.

6.2 ESD Ratings^{(1) (2)}

ESD			Value	Unit
V(ESD)	Electrostatic discharge	Human-Body Model (HBM)	8 K	V
		Charged-Device Model (CDM)	2 K	V

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

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

6 Voltage, Temperature, ESD and Thermal Ratings(Continued)

6.3 Recommended Operating Conditions^{(1) (2) (3) (4)}

			V _{CCI}	V _{CCO}	Min	Max	Unit
V _{CCA}	Supply Voltage				1.65	5.5	V
V _{CCB}					1.65	5.5	
V _{IH}	High-level Input Voltage	Data Inputs	1.65V to 1.95V		V _{CCI} × 0.65		V
			2.3V to 2.7V		1.7		
			3V to 3.6V		2		
			4.5V to 5.5V		V _{CCI} × 0.7		
V _{IL}	Low-level Input Voltage	Data Inputs	1.65V to 1.95V			V _{CCI} × 0.35	V
			2.3V to 2.7V			0.7	
			3V to 3.6V			0.8	
			4.5V to 5.5V			V _{CCI} × 0.3	
V _{IH}	High-level Input Voltage	Control Inputs (referenced to V _{CCA})	1.65V to 1.95V		V _{CCA} × 0.65		V
			2.3V to 2.7V		1.7		
			3V to 3.6V		2		
			4.5V to 5.5V		V _{CCA} × 0.7		
V _{IL}	Low-level Input Voltage	Control Inputs (referenced to V _{CCA})	1.65V to 1.95V			V _{CCI} × 0.35	V
			2.3V to 2.7V			0.7	
			3V to 3.6V			0.8	
			4.5V to 5.5V			V _{CCI} × 0.3	
V _I	Input Voltage	Control Inputs			0	5.5	V
V _{I/O}	Input/Output voltage	Active State			0	V _{CCO}	V
		3-State			0	5.5	V
I _{OH} High-Level Output Current				1.65V to 1.95V		−4	mA
				2.3V to 2.7V		−8	
				3V to 3.6V		−24	
				4.5V to 5.5V		−32	
I _{OL} Low-Level Output Current				1.65V to 1.95V		4	mA
				2.3V to 2.7V		8	
				3V to 3.6V		24	
				4.5V to 5.5V		32	
Δt/Δv Input Transition rise or fall		Data Inputs	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 _A	Operating Free-Air Temperature				−40	+125	°C

(1)V_{CCI} is the V_{CC} associated with the data input port.

(2)V_{CCO} is the V_{CC} associated with the output port .

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

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

7 Electrical Specifications

7.1 Electrical Characteristics^{(1) (2)}

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

Parameter		Test Conditions	V _{CCA}	V _{CCB}	Min	Typ	Max	Unit
V _{OH}		I _{OH} =−100 μA,(V _I =V _{IH})	1.65V to 4.5V	1.65V to 4.5V	V _{CCO} −0.1			V
		I _{OH} =−4 mA,(V _I =V _{IH})	1.65V	1.65V	1.2			
		I _{OH} =−8 mA,(V _I =V _{IH})	2.3V	2.3V	1.9			
		I _{OH} =−24 mA,(V _I =V _{IH})	3V	3V	2.4			
		I _{OH} =−32 mA,(V _I =V _{IH})	4.5V	4.5V	3.8			
V _{OL}		I _{OL} =100 μA,(V _I =V _{IH})	1.65V to 4.5V	1.65V to 4.5V			0.1	V
		I _{OL} =4 mA,(V _I =V _{IH})	1.65V	1.65V			0.45	
		I _{OL} =8 mA,(V _I =V _{IH})	2.3V	2.3V			0.3	
		I _{OL} =24 mA,(V _I =V _{IH})	3V	3V			0.55	
		I _{OL} =32 mA,(V _I =V _{IH})	4.5V	4.5V			0.55	
I _I	DIR	V _I =V _{CCA} or GND	1.65V to 5.5V	1.65V to 5.5V			±2	μA
I _{off}	A or B Port	V _I or V _O =0 to 5.5V	0V	0 to 5.5V			±2	μA
			0 to 5.5V	0V			±2	
I _{OZ}	A or B Port	V _O =V _{CCO} or GND, OEB=V _{IH}	1.65V to 5.5V	1.65V to 5.5V			±2	μA
I _{CCA}		V _I =V _{CCI} or GND,I _O =0	1.65V to 5.5V	1.65V to 5.5V			15	μA
			5V	0V			15	
			0V	5V			−2	
I _{CCB}		V _I =V _{CCI} or GND,I _O =0	1.65V to 5.5V	1.65V to 5.5V			15	μA
			5V	0V			−2	
			0V	5V			15	
I _{CCA} + I _{CCB}		V _I =V _{CCI} or GND,I _O =0	1.65V to 5.5V	1.65V to 5.5V			25	μA
ΔI _{CCA}	A Port	One A Port at V _{CCA} −0.6V, DIR at V _{CCA} , B Port=Open	3V to 5.5V	3V to 5.5V			50	μA
	DIR	DIR at V _{CCA} −0.6V, B Port=Open, A Port at V _{CCA} or GND					50	
ΔI _{CCB}	B Port	One B Port at V _{CCB} −0.6V, DIR at GND, A Port=Open	3V to 5.5V	3V to 5.5V			50	μA
C _i	Control Inputs	V _I =V _{CCA} or GND	3.3V	3.3V		4	5	pF
C _{io}	A or B Port	V _O =V _{CCA/B} or GND	3.3V	3.3V		8.5	10	pF

(1)V_{CCO} is the V_{CC} associated with the output port.

(2)V_{CCI} is the V_{CC} associated with the input port.

7 Electrical Specifications(Continued)

7.2 Switching Characteristics, $V_{CCA}=1.8V\pm0.15V$

over recommended operating free-air temperature range, $V_{CCA}=1.8V\pm0.15V$ (unless otherwise noted)

Parameter	From (Input)	To (Output)	$V_{CCB}=1.8V\pm0.15V$		$V_{CCB}=2.5V\pm0.2V$		$V_{CCB}=3.3V\pm0.3V$		$V_{CCB}=5V\pm0.5V$		Unit
			Min	Max	Min	Max	Min	Max	Min	Max	
TPLH	A	B	7.4	10.3	5.3	5.8	5.0	5.4	4.9	5.1	ns
TPHL											
TPLH	B	A	7.4	10.4	5.6	7.7	5.2	7.2	4.8	6.9	ns
TPHL											
TPHZ	OEB	A	11.0	11.8	8.3	12.0	7.6	12.3	6.6	12.7	ns
TPLZ											
TPHZ	OEB	B	10.5	12.3	9.9	10.5	9.9	10.6	10.6	11.3	ns
TPLZ											
TPZH	OEB	A	11.5	14.6	11.4	14.0	11.3	14.0	11.8	15.8	ns
TPZL											
TPZH	OEB	B	14.4	17.9	9.8	11.5	9.0	10.9	9.3	11.3	ns
TPZL											

7.3 Switching Characteristics, $V_{CCA}=2.5V\pm0.2V$

over recommended operating free-air temperature range, $V_{CCA}=2.5V\pm0.2V$ (unless otherwise noted)

Parameter	From (Input)	To (Output)	$V_{CCB}=1.8V\pm0.15V$		$V_{CCB}=2.5V\pm0.2V$		$V_{CCB}=3.3V\pm0.3V$		$V_{CCB}=5V\pm0.5V$		Unit
			Min	Max	Min	Max	Min	Max	Min	Max	
TPLH	A	B	5.7	7.5	2.9	3.9	2.5	3.3	2.3	2.9	ns
TPHL											
TPLH	B	A	5.3	6.1	2.9	3.9	2.4	3.5	1.9	3.2	ns
TPHL											
TPHZ	OEB	A	5.5	6.9	5.4	6.8	3.2	6.7	2.8	6.6	ns
TPLZ											
TPHZ	OEB	B	7.6	9.1	5.0	7.5	4.1	7.2	5.2	7.2	ns
TPLZ											
TPZH	OEB	A	4.6	10.8	4.7	6.4	4.7	6.5	5.0	7.0	ns
TPZL											
TPZH	OEB	B	11.6	13.4	5.6	7.3	4.6	6.1	4.0	5.2	ns
TPZL											

7 Electrical Specifications(Continued)

7.4 Switching Characteristics, $V_{CCA}=3.3V\pm0.3V$

over recommended operating free-air temperature range, $V_{CCA}=3.3V\pm0.3V$ (unless otherwise noted)

Parameter	From (Input)	To (Output)	$V_{CCB}=1.8V\pm0.15V$		$V_{CCB}=2.5V\pm0.2V$		$V_{CCB}=3.3V\pm0.3V$		$V_{CCB}=5V\pm0.5V$		Unit
			Min	Max	Min	Max	Min	Max	Min	Max	
TPLH	A	B	5.2	7.0	2.4	3.5	2.0	2.9	1.8	2.5	ns
TPHL											
TPLH	B	A	5.3	6.1	2.9	3.9	2.4	3.5	1.9	3.2	ns
TPHL											
TPHZ	OEB	A	4.3	5.8	4.4	5.9	4.3	5.5	2.1	4.8	ns
TPLZ											
TPHZ	OEB	B	6.0	8.8	4.7	6.8	3.2	6.3	3.3	5.9	ns
TPLZ											
TPZH	OEB	A	3.3	10.0	3.4	6.0	3.4	4.8	3.4	5.4	ns
TPZL											
TPZH	OEB	B	11.2	13.0	5.0	6.8	3.9	5.5	3.3	4.6	ns
TPZL											

7.5 Switching Characteristics, $V_{CCA}=5V\pm0.5V$

over recommended operating free-air temperature range, $V_{CCA}=5V\pm0.5V$ (unless otherwise noted)

Parameter	From (Input)	To (Output)	$V_{CCB}=1.8V\pm0.15V$		$V_{CCB}=2.5V\pm0.2V$		$V_{CCB}=3.3V\pm0.3V$		$V_{CCB}=5V\pm0.5V$		Unit
			Min	Max	Min	Max	Min	Max	Min	Max	
TPLH	A	B	4.9	6.7	1.9	3.3	1.6	2.7	1.4	2.3	ns
TPHL											
TPLH	B	A	5.2	5.7	2.3	3.0	1.8	2.6	1.3	2.3	ns
TPHL											
TPHZ	OEB	A	3.3	4.3	3.1	3.8	3.3	4.5	2.6	3.7	ns
TPLZ											
TPHZ	OEB	B	3.3	9.5	3.8	4.9	3.3	4.3	1.7	3.8	ns
TPLZ											
TPZH	OEB	A	2.6	9.6	2.6	7.2	2.6	4.8	2.6	3.9	ns
TPZL											
TPZH	OEB	B	10.6	12.3	5.3	6.7	3.7	5.4	3.5	4.2	ns
TPZL											

7.6 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	
CpdA	A-port Input, B-port Output	CL=0, f=10 MHz, tr=tf=1 ns	2.4	2.6	2.9	3.7	pF
	B-port Input, A-port Output		16.7	17.3	17.9	22.6	
CpdB	A-port Input, B-port Output		16.4	17.1	17.8	22.5	
	B-port Input, A-port Output		2.4	2.6	2.9	3.9	

8 Typical Characteristics

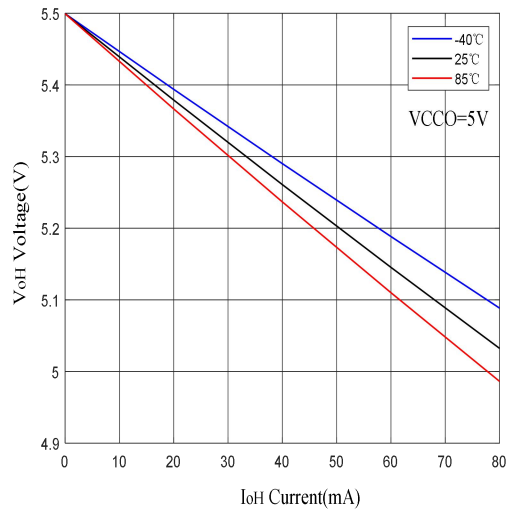


Fig.8-1. Voltage Vs Current

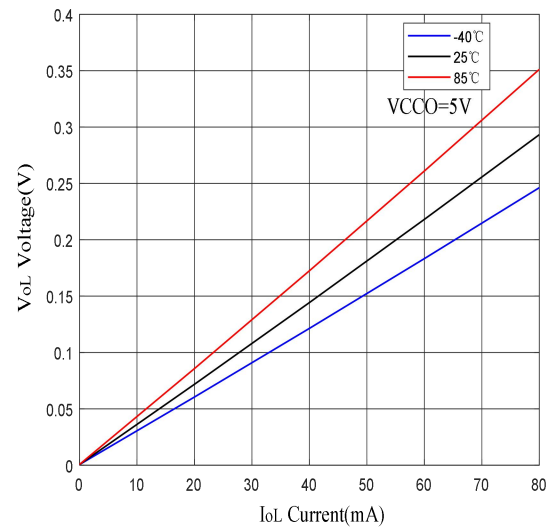
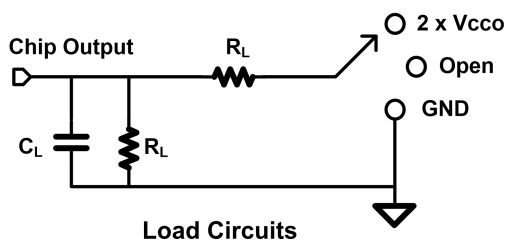


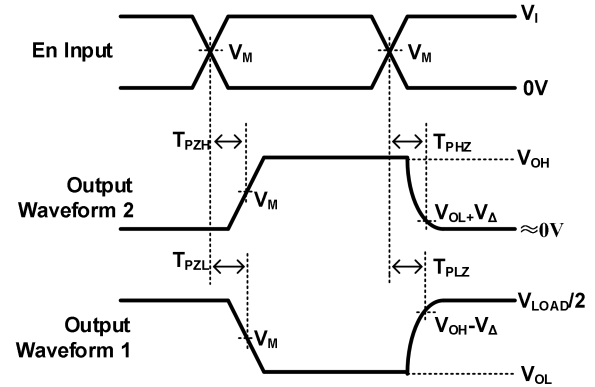
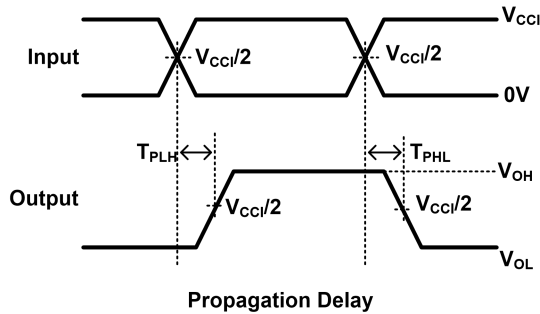
Fig.8-2. Voltage Vs Current

9 Parameter Measurement Information



Parameter	V _{CCO}	R _L	C _L	S1	VTP
T _{pd} Propagation delay time	1.8V-5.5V	2 kΩ	15 pF	Open	N/A
T _{PLZ} , T _{PZL} Enable time, disable time	1.8V ± 0.15V	2 kΩ	15 pF	2 X V _{CCO}	0.15V
	2.5V ± 0.2V	2 kΩ	15 pF	2 X V _{CCO}	0.15V
	3.3V ± 0.3V	2 kΩ	15 pF	2 X V _{CCO}	0.3V
	5V ± 0.5V	2 kΩ	15 pF	2 X V _{CCO}	0.3V
T _{PHZ} , T _{PZH} Enable time, disable time	1.8V ± 0.15V	2 kΩ	15 pF	GND	0.15V
	2.5V ± 0.2V	2 kΩ	15 pF	GND	0.15V
	3.3V ± 0.3V	2 kΩ	15 pF	GND	0.3V
	5V ± 0.5V	2 kΩ	15 pF	GND	0.3V

9 Parameter Measurement Information(Continued)



Notes:

A.CL 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: $PRR \leq 10 \text{ MHz}$, $Z_O = 50 \Omega$, $dv/dt \geq 1 \text{ V/ns}$.

D.The outputs are measured one at a time, with one transition per measurement.

E.TPLZ and TPHZ are the same as t_{dis} .

F.TPZL and TPZH are the same as t_{en} .

G.TPLH and TPHL 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.

J.All parameters and waveforms are not applicable to all devices.

10 Detailed Description

The GT74LVC1T45 is a single-bit, dual supply non-inverting voltage level translation. Pin A and direction control pin are support by V_{CCA} and pin B is support by V_{CCB} . The A port is able to accept I/O voltages ranging from 1.65V to 5.5 V, while the B port can accept I/O voltages from 1.65V to 5.5 V. The high on DIR allows data transmission from A to B and a low on DIR allows data transmission from B to A. 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.

The GT74LVC1T45 is a voltage level translator that can operate from 1.65V to 5.5V (V_{CCA}) and 1.65V to 5.5V (V_{CCB}). The signal translation between 1.65V and 5.5V requires direction control. When DIR is high, data transmission is from A to B. When DIR is low, data transmission is from B to A.

Table.10-1. Function Table

Control input	Operation
DIR	
L	B TO A
H	A TO B

11 Application Note

The GT74LVC1T45 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.

11.1 Typical Application

Fig.11-1 shows the GT74LVC1T45 being used in a bidirectional logic level-shifting application. Because the GT74LVC1T45 does not have an output-enable (OE) pin, the system designer should take precautions to avoid bus contention between SYSTEM-1 and SYSTEM-2 when changing directions.

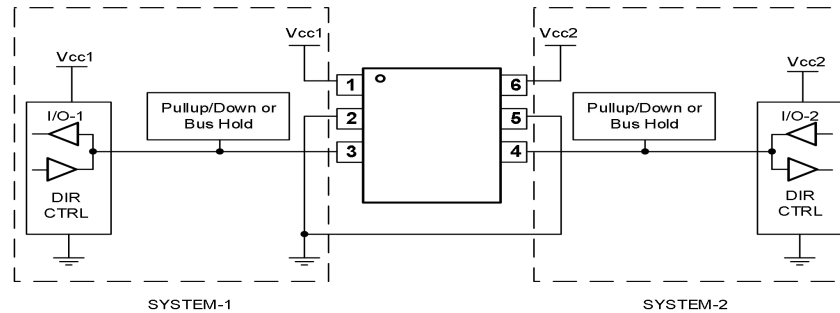


Fig.11-1. Typical application circuit

11.2 Enable Times

$TPZH \text{ (DIR to A)} = TPLZ \text{ (DIR to B)} + TPLH \text{ (B to A)}$

$TPZL \text{ (DIR to A)} = TPHZ \text{ (DIR to B)} + TPHL \text{ (B to A)}$

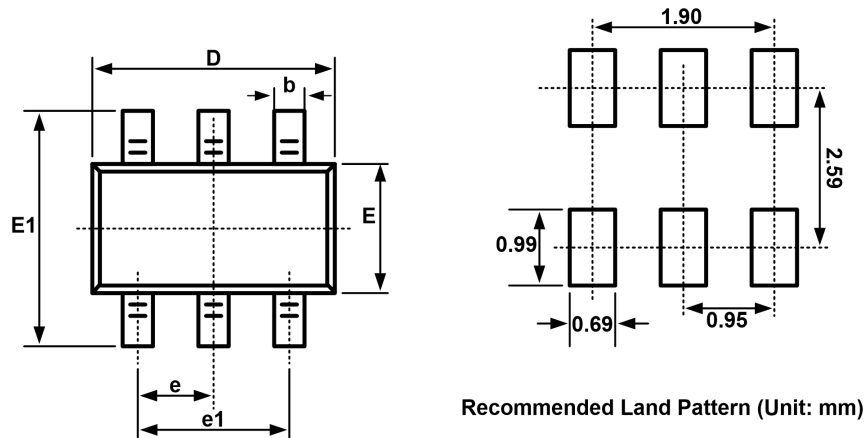
$TPZH \text{ (DIR to B)} = TPLZ \text{ (DIR to A)} + TPLH \text{ (A to B)}$

$TPZL \text{ (DIR to B)} = TPHZ \text{ (DIR to A)} + TPHL \text{ (A to B)}$

In a bidirectional application, these enable times provide the maximum delay from the time the DIR bit is switched until an output is expected. For example, if the GT74LVC1T45 initially is transmitting from A to B, then the DIR bit is switched; the B port of the device must be disabled before presenting it with an input. After the B port has been disabled, an input signal applied to it appears on the corresponding A port after the specified propagation delay.

12 Package Outline Dimension

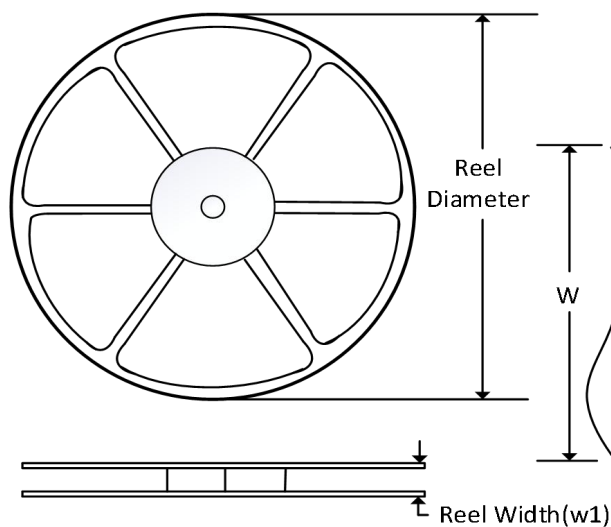
SOT23-6



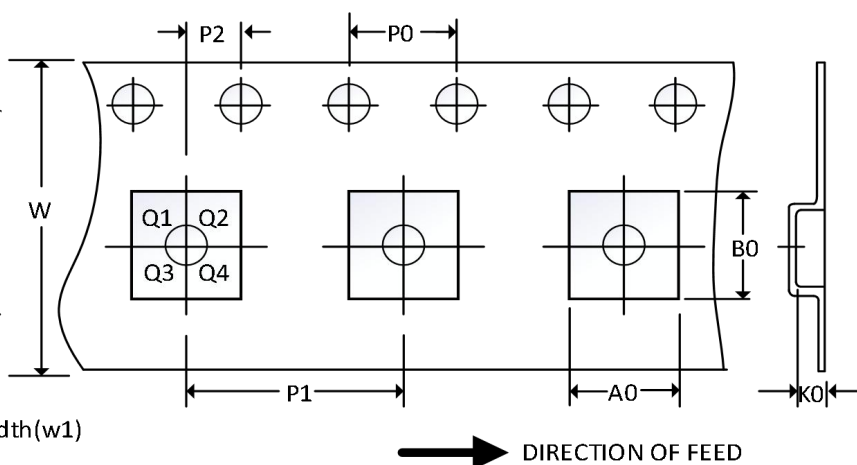
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950(BSC)		0.037(BSC)	
e1	1.800	2.000	0.071	0.079
L	0.300	0.600	0.012	0.024
θ	0°	8°	0°	8°

13 Tape and Reel Information

Reel Dimensions



Reel Dimensions



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
SOT23-6	7"	9.5	3.17	3.23	1.37	4	4	2	8	Q3

Note:

(1)All dimensions are nominal.

(2)Plastic or metal protrusions of 0.15mm maximum per side are not included.