DESCRIPTION

The AL1T45-Q is a single bit, dual-supply, non-inverting bus transceiver uses two separate configurable power supply rails. The A port and DIR are designed to track V_{CCA}, which supporting operating voltages from 1.65V to 5.5V, and the B port supporting operating voltages from 1.65V to 5.5V while it tracks the V_{CCB} supply. This allows for universal low-voltage bidirectional translation between any of the 1.8V, 2.5V, 3.3V and 5V voltage nodes.

The AL1T45-Q is designed for low power consumption, asynchronous communication between two data buses and fully specified for partial-power-down applications.. The logic levels of the direction- control (DIR) input activate either the B-port outputs or the A-port outputs. The AL1T45-Q 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 is always active on both A and B ports and must have a logic HIGH or LOW level applied to prevent excess I_{CC} and I_{CCZ}.

The AL1T45-Q is available in SOT-26 and SC70-6 Packages.

ORDERING INFORMATION

Package Type		Part Number
SOT-26 SPQ: 3,000pcs/Reel	E6	AL1T45E6R-Q
		AL1T45E6VR-Q
SC70-6 SPQ:3,000pcs/Reel	C6	AL1T45C6R-Q
		AL1T45C6VR-Q
Note	Q: AEC-Q V: Halogen free Package R: Tape & Reel	
AiT provides all RoHS products		

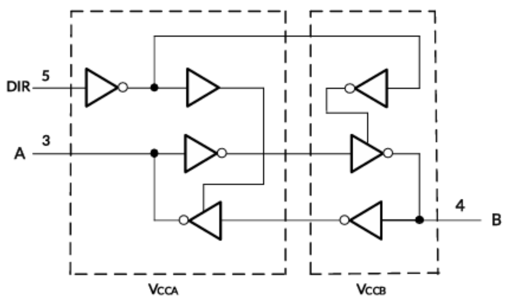
FEATURES

- Qualified for Automotive AEC-Q Applications
- Control Input Threshold 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
- Low Power Consumption, 4μA Max
- Output Drive Up to ±24mA@3.0V
- No Power-Supply Sequencing Required: Either VCCA or VCCB can be Ramped First
- I_{OFF}: Supports Partial-Power-Down Mode Operation
- Extended Temperature: -40°C to +125°C

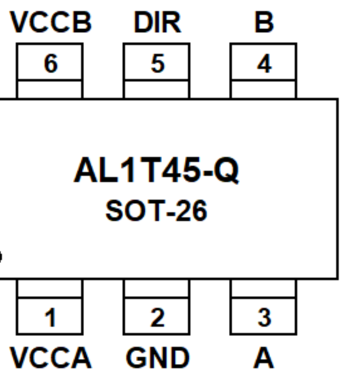
APPLICATION

- ADAS Fusion
- ADAS Front Camera
- HEV Battery Management System Eliminate slow or noisy input signals
- Driving indicator LEDs or Buzzers
- Debouncing a Mechanical Switch
- General Purpose I/P (GPIO) Level Shifting

SIMPLIFIELD SCHEMATIC

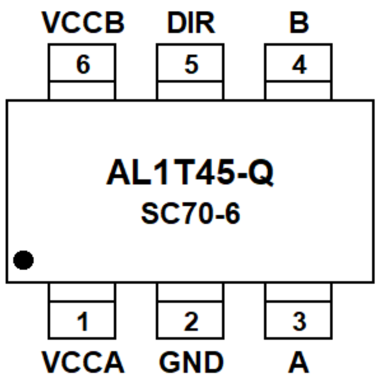


PIN DESCRIPTION



SOT-26, E6

Top View



SC70-6, C6

Top View

PIN#		Symbol	I/O	Function
SOT-26	SC70-6			
1	1	V_{CCA}	P	A Port Supply Voltage. 1.65V ≤ V_{CCA} ≤ 5.5V
2	2	GND	-	Ground
3	3	A	I/O	Input/output A. Reference to V_{CCA}.
4	4	B	I/O	Input/output B. Reference to V_{CCB}.
5	5	DIR	I	Direction control. Referenced to V_{CCA}.
6	6	V_{CCB}	I	B Port Supply Voltage. 1.65V ≤ V_{CCB} ≤ 5.5V.

I=input, O=output, I/O=input and output, P=power

FUNCTION TABLE

CONTROL INPUTS (1)	OUTPUT CIRCUITS		OPERATION
DIR	A PORT	B PORT	
L	Enabled	Hi-Z	B data to A bus
H	Hi-Z	Enabled	A data to B bus

(1) The input circuit of the data I/O is always active.

(2) When either V_{CCA} or V_{CCB} is at GND level, the device goes into suspend mode.

ABSOLUTE MAXIMUM RATINGS

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

V_{CCA} (2), Supply Voltage Range		-0.5V ~ + 6.5V
V_{CCB} (2), Supply Voltage Range		-0.5V ~ + 6.5V
V_I (3), Input Voltage Range (1)		-0.5V ~ + 6.5V
V_O (3), Voltage Range Applied to any Output in the High-Impedance or Power-Off State	A Port	-0.5V ~ + 6.5V
	B Port	-0.5V ~ + 6.5V
I_{IK}, Input Clamp Current	V_I<0	-50mA
I_{OK}, Output Clamp Current	V_O<0	-50mA
I_O, Continuous Output Current		±50mA
I_O, Continuous Current through V_{CC} or GND		±100mA
θ_{JA}, Package Thermal Impedance (3)	SOT-26	230°C/W
	SC70-6	265°C/W
T_J, Junction Temperature (4)		-40℃ ~ +150℃
T_{STG}, Storage Temperature		-65℃ ~ +150℃

Stresses above 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 in the Electrical Characteristics are not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

(1) The input and output negative-voltage ratings may be exceeded if the input and output current ratings are observed.
(2) The value of V_{CC} is provided in the Recommended Operating Conditions table.
(3) The package thermal impedance is calculated in accordance with JESD-51.
(4) The maximum power dissipation is a function of TJ(MAX), $R_{\theta JA}$, and T_A. The maximum allowable power dissipation at any ambient temperature is $P_D = (T_{J(MAX)} - T_A) / R_{\theta JA}$. All numbers apply for packages soldered directly onto a PCB.

ESD RATINGS

Parameter	Symbol	Min	Unit
Human-Body Model (HBM), per AEC Q100-002 *	$V_{(ESD)}$ Electrostatic Discharge	±2000	V
Charged-Device Model (CDM), per AEC Q100-011		±1000	
Latch-Up (LU), per AEC Q100-004		±200	

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

RECOMMENDED OPERATING CONFITIONS

V_{CCI} is the supply voltage associated with the input port. V_{CCO} is the supply voltage associated with the output port.

Parameter	Symbol	Conditions	Min	Typ.	Max	Unit
Supply Voltage	V_{CCA}	-	1.65	-	5.50	V
	V_{CCB}	-	1.65	-	5.50	
High-Level Input Voltage, Data Inputs (2)	V_{IH}	V_{CC} = 1.65 V ~1.95 V	V_{CCI} x 0.75	-	-	
		V_{CC} = 2.3V ~2.7 V	V_{CCI} x 0.7	-	-	
		V_{CC} = 3 V ~3.6 V	V_{CCI} x 0.7	-	-	
		V_{CC} = 4.5 V ~5.5 V	V_{CCI} x 0.7	-	-	
Low-Level Input Voltage, Data Inputs (2)	V_{IL}	V_{CC} = 1.65 V ~1.95 V	-	-	V_{CC} x0.35	V
		V_{CC} = 2.3V ~2.7 V	-	-	V_{CC} x 0.3	
		V_{CC} = 3 V ~3.6 V	-	-	V_{CC} x 0.3	
		V_{CC} = 4.5 V ~5.5 V	-	-	V_{CC} x 0.3	
High-Level Input Voltage, DIR (Referenced to V_{CCA}) (3)	V_{IH}	V_{CC} = 1.65 V ~1.95 V	V_{CCI} x 0.75	-	-	V
		V_{CC} = 2.3V ~2.7 V	V_{CCI} x 0.7	-	-	
		V_{CC} = 3 V ~3.6 V	V_{CCI} x 0.7	-	-	
		V_{CC} = 4.5 V ~5.5 V	V_{CCI} x 0.7	-	-	
Low-Level Input Voltage, DIR (Referenced to V_{CCA}) (3)	V_{IL}	V_{CC} = 1.65 V ~1.95 V	-	-	V_{CC} x0.35	V
		V_{CC} = 2.3V ~2.7 V	-	-	V_{CC} x 0.3	
		V_{CC} = 3 V ~3.6 V	-	-	V_{CC} x 0.3	
		V_{CC} = 4.5 V ~5.5 V	-	-	V_{CC} x 0.3	
Input Voltage	V_I	-	0	-	5.50	V
Output Voltage	V_O	-	0	-	V_{CC}	V
High-Level Output Current	I_{OH}	V_{CC} = 1.65 V ~1.95 V	-	-	-4	mA
		V_{CC} = 2.3V ~2.7 V	-	-	-8	
		V_{CC} = 3 V ~3.6 V	-	-	-24	
		V_{CC} = 4.5 V ~5.5 V	-	-	-32	
Low-Level Output Current	I_{OL}	V_{CC} = 1.65 V ~1.95 V	-	-	4	mA
		V_{CC} = 2.3V ~2.7 V	-	-	8	
		V_{CC} = 3 V ~3.6 V	-	-	24	
		V_{CC} = 4.5 V ~5.5 V	-	-	32	
Input Transition Rise or Fall, Data Inputs (1)	$\Delta t/\Delta v$	V_{CC} = 1.65 V ~1.95 V	-	-	20	ns/V
		V_{CC} = 2.3V ~2.7 V	-	-	20	
		V_{CC} = 3 V ~3.6 V	-	-	10	
		V_{CC} = 4.5 V ~5.5 V	-	-	5	
Control Inputs		V_{CC} = 1.65 V ~5.5 V	-	-	5	
Operating Temperature	T_A	-	-40	-	+125	°C

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

(2) For VCCI values not specified in the data sheet, VIH min = VCCI × 0.7 V, VIL max = VCCI × 0.3 V.

(3) For VCCA values not specified in the data sheet, VIH min = VCCA × 0.7 V, VIL max = VCCA × 0.3 V.

ELECTRICAL CHARACTERISTICS

Parameter	Conditions		Min	Typ.	Max	Unit
V_{OH}	I_{OH} = -100 μA, V_I =V_{IH} V_{CCA}=1.65~5.5V V_{CCB}=1.65~5.5V	-40℃ ~ +125℃	V_{CC}-0.1	-	-	V
	I_{OH} = -4mA, V_I =V_{IH} V_{CCA}=1.65V, V_{CCB}=1.65V		1.20	-	-	
	I_{OH} = -8mA, V_I =V_{IH} V_{CCA}=2.3V, V_{CCB}=2.3V		1.90	-	-	
	I_{OH} = -24mA, V_I =V_{IH} V_{CCA}=3V, V_{CCB}=3V		2.30	-	-	
	I_{OH}= -32mA, V_I =V_{IH} V_{CCA}=4.5V, V_{CCB}=4.5V		3.80	-	-	
V_{OL}	I_{OH} = -100 μA, V_I =V_{IL} V_{CCA}=1.65~5.5V V_{CCB}=1.65~5.5V	-40℃ ~ +125℃	-	-	0.10	V
	I_{OH} = -4mA, V_I =V_{IL} V_{CCA}=1.65V, V_{CCB}=1.65V		-	-	0.45	
	I_{OH} = -8mA, V_I =V_{IL} V_{CCA}=2.3V, V_{CCB}=2.3V		-	-	0.30	
	I_{OH} = -24mA, V_I =V_{IL} V_{CCA}=3V, V_{CCB}=3V		-	-	0.55	
	I_{OH}= -32mA, V_I =V_{IL} V_{CCA}=4.5V, V_{CCB}=4.5V		-	-	0.55	
I_I DIR Input Leakage Current	V_I = V_{CCA} or GND, V_{CCA}=1.65V~5.5V, V_{CCB}=1.65V~5.5V	+25℃	-	-	±1	μA
		-40℃ ~ +125℃	-	-	±2	
I_{off} A Port	VI or VO= 0 to 5.5V V_{CCA}=0V, V_{CCB}=0V~5.5V	+25℃	-	-	±1	μA
I_{off} B Port	VI or VO= 0 to 5.5V V_{CCB}=0V, V_{CCA}=0V~5.5V	-40℃ ~ +125℃	-	-	±2	
I_{OZ} A Port or B Port	V_O =V_{CCO} or GND, V_{CCA}=1.65V~5.5V, V_{CCB}=1.65V~5.5V	+25℃	-	-	±1	μA
		-40℃ ~ +125℃	-	-	±2	

Parameter		Conditions		Min	Typ.	Max	Unit
I_{CCA}	V_{CCA} Supply Current	V_I or V_{CCI} or GND, I_O=0 V_{CCA}=1.65V~5.5V, V_{CCB}=2.3V~5.5V	-40℃ ~ +125℃	-	-	3	µA
		V_I or V_{CCI} or GND, I_O=0 V_{CCA}=5V, V_{CCB}=0V		-	-	2	
		V_I or V_{CCI} or GND, I_O=0 V_{CCB}=5V, V_{CCA}=0V		-	-	-2	
I_{CCB}	V_{CCB} Supply Current	V_I or V_{CCI} or GND, I_O=0 V_{CCA}=1.65V~5.5V, V_{CCB}=2.3V~5.5V	-40℃ ~ +125℃	-	-	3	µA
				-	-	-2	
		V_I or V_{CCI} or GND, I_O=0 V_{CCA}=5V, V_{CCB}=0V		-	-	2	
		V_I or V_{CCI} or GND, I_O=0 V_{CCB}=5V, V_{CCA}=0V		-	-	3	
I_{CCA} + I_{CCB}	Combined Supply Current	V_I or V_{CCI} or GND, I_O=0 V_{CCA}=1.65V~5.5V, V_{CCB}=1.65V~5.5V	-40℃ ~ +125℃	-	-	4	µA
ΔI_{CCA}	A Port	One A port at VCCA – 0.6 V, DIR at VCCA, B port = open V_{CCA}=3V~5.5V, V_{CCB}=3V~5.5V	-40℃ ~ +125℃	-	-	50	µA
	DIR	DIR at VCCA – 0.6V, B port = open A port at VCCA or GND V_{CCA}=3V~5.5V, V_{CCB}=3V~5.5V	-40℃ ~ +125℃	-	-	50	
ΔI_{CCB}	B Port	One B port at VCCB – 0.6 V, DIR at GND, A port = open V_{CCA}=3V~5.5V, V_{CCB}=3V~5.5V	-40℃ ~ +125℃	-	-	50	µA
C_i (Input Capacitance)		V_I = V_{CC} or GND, V_{CC}=3.3V	+25℃	-	4	-	pF
C_O (Output Capacitance)		V_O = V_{CC} or GND, V_{CC}=3.3V	+25℃	-	6	-	pF

All unused inputs of the device must be held at VCC or GND to ensure proper device operation

TIMING REQUIREMENTS

VCCA=1.8V± 0.15 V

over recommended operating free-air temperature range Full=-40°C ~ +125°C.

Parameter	From (Input)	To (Output)	Temp.	V_{CC}=1.80V± 0.15V (1)		V_{CC}=2.50V± 0.2V(1)		V_{CCB}=3.30V± 0.3V (1)		V_{CCB}=5V± 0.5V(1)		Unit
				MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	
t_{PLH}	A	B	-40°C ~ +125°C	3.5	24.6	2.6	17.2	2.0	18.6	1.6	18.5	ns
t_{PHL}				3.3	18.4	2.6	15.5	2.1	16.4	2.0	16.8	
t_{PLH}	B	A	-40°C ~ +125°C	3.5	24.6	2.7	24.5	2.5	23.2	2.2	23.2	
t_{PHL}				3.3	18.4	2.5	18.4	2.4	15.3	2.1	14.1	
t_{PHZ}	DIR	A	-40°C ~ +125°C	6.2	33.9	5.7	37.1	5.6	32.3	6.1	31.9	ns
t_{PLZ}				2.7	35.9	2.5	37.3	2.8	17.8	3.7	41.7	ns
t_{PHZ}	DIR	B	-40°C ~ +125°C	8.8	33.9	5.8	30.0	4.3	33.2	2.7	34.6	ns
t_{PLZ}				5.0	35.9	2.6	23.6	2.7	22.4	2.4	22.2	ns
t_{PZH} (2)	DIR	A	-40°C ~ +125°C	-	60.5	-	48.1	-	45.6	-	45.4	ns
t_{PZL} (2)				-	52.3	-	48.4	-	48.5	-	48.7	ns
t_{PZH} (2)	DIR	B	-40°C ~ +125°C	-	60.5	-	54.5	-	36.4	-	60.2	ns
t_{PZL} (2)				-	52.3	-	52.6	-	48.7	-	48.7	ns

VCCA=2.5V±0.2 V

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

Parameter	From (Input)	To (Output)	Temp.	V_{CC}=1.80V± 0.15V (1)		V_{CC}=2.50V± 0.2V(1)		V_{CCB}=3.30V± 0.3V (1)		V_{CCB}=5V± 0.5V(1)		Unit
				MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	
t_{PLH}	A	B	-40°C ~ +125°C	2.7	24.5	1.8	16.5	1.5	15.4	1.3	16.6	ns
t_{PHL}				2.5	18.4	1.6	12.7	1.5	11.3	1.0	10.4	
t_{PLH}	B	A	-40°C ~ +125°C	2.6	17.2	1.8	16.5	1.6	16.2	1.2	16.2	
t_{PHL}				2.6	15.5	1.6	12.7	1.5	12.5	1.0	11.4	
t_{PHZ}	DIR	A	-40°C ~ +125°C	3.6	30.0	2.5	32.8	2.7	33.2	3.8	32.4	ns
t_{PLZ}				1.5	23.6	1.5	25.7	1.5	14.8	1.2	18.1	ns
t_{PHZ}	DIR	B	-40°C ~ +125°C	7.8	37.1	4.9	32.8	3.6	33.2	2.2	34.3	ns
t_{PLZ}				4.2	37.3	2.6	25.7	3.0	26.4	1.9	26.4	ns
t_{PZH} (2)	DIR	A	-40°C ~ +125°C	-	54.5	-	42.2	-	42.6	-	42.6	ns
t_{PZL} (2)				-	52.6	-	45.5	-	45.7	-	45.7	ns
t_{PZH} (2)	DIR	B	-40°C ~ +125°C	-	48.1	-	42.2	-	30.2	-	34.7	ns
t_{PZL} (2)				-	48.4	-	45.5	-	44.5	-	42.8	ns

VCCA=3.3V±0.3 V

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

Parameter	From (Input)	To (Output)	Temp.	V_{CC}=1.80V± 0.15V (1)		V_{CC}=2.50V± 0.2V(1)		V_{CCB}=3.30V± 0.3V (1)		V_{CCB}=5V± 0.5V(1)		Unit
				MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	
t_{PLH}	A	B	-40°C ~ +125°C	2.5	23.2	1.6	16.2	0.8	15.2	0.8	15.1	ns
t_{PHL}				2.4	15.3	1.5	12.5	0.9	10.2	0.8	10.0	
t_{PLH}	B	A	-40°C ~ +125°C	2.0	18.6	1.5	15.4	0.8	15.2	0.7	15.8	
t_{PHL}				2.1	16.4	1.5	11.3	0.9	10.2	0.8	10.4	
t_{PHZ}	DIR	A	-40°C ~ +125°C	2.7	33.2	2.8	33.2	1.8	34.3	2.8	32.8	ns
t_{PLZ}				2.1	22.4	1.9	26.4	2.2	15.1	2.4	19.5	ns
t_{PHZ}	DIR	B	-40°C ~ +125°C	6.4	32.3	4.6	33.2	3.4	34.3	2.0	34.1	ns
t_{PLZ}				2.7	17.8	2.5	14.8	2.8	15.1	1.8	14.8	ns
t_{PZH} (2)	DIR	A	-40°C ~ +125°C	-	36.4	-	30.2	-	30.3	-	30.6	ns
t_{PZL} (2)				-	48.7	-	44.5	-	44.5	-	44.5	ns
t_{PZH} (2)	DIR	B	-40°C ~ +125°C	-	45.6	-	42.6	-	30.3	-	34.6	ns
t_{PZL} (2)				-	48.5	-	45.7	-	44.5	-	42.8	ns

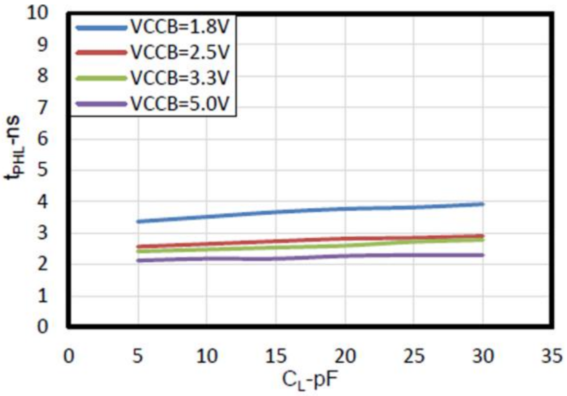
VCCA=5V±0.5 V

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

Parameter	From (Input)	To (Output)	Temp.	V_{CC}=1.80V± 0.15V (1)		V_{CC}=2.50V± 0.2V(1)		V_{CCB}=3.30V± 0.3V (1)		V_{CCB}=5V± 0.5V(1)		Unit
				MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	
t_{PLH}	A	B	-40°C ~ +125°C	2.2	23.2	1.2	16.2	0.7	15.8	0.6	15.2	ns
t_{PHL}				2.1	14.1	1.0	11.4	0.8	10.4	0.6	9.5	
t_{PLH}	B	A	-40°C ~ +125°C	1.6	18.5	1.3	16.6	0.8	15.1	0.6	15.2	
t_{PHL}				2.0	16.8	1.0	10.4	0.8	10.0	0.6	9.5	
t_{PHZ}	DIR	A	-40°C ~ +125°C	2.5	34.6	2.4	34.3	2.6	34.1	2.4	33.4	ns
t_{PLZ}				1.0	22.2	1.2	26.4	1.2	14.8	1.0	19.0	ns
t_{PHZ}	DIR	B	-40°C ~ +125°C	5.7	31.9	3.0	32.4	1.2	32.8	2.0	33.4	ns
t_{PLZ}				3.1	41.7	2.4	18.1	3.0	19.5	1.9	19.0	ns
t_{PZH} (2)	DIR	A	-40°C ~ +125°C	-	60.2	-	34.7	-	34.6	-	34.2	ns
t_{PZL} (2)				-	48.7	-	42.8	-	42.8	-	42.9	ns
t_{PZH} (2)	DIR	B	-40°C ~ +125°C	-	45.4	-	42.6	-	30.6	-	34.2	ns
t_{PZL} (2)				-	48.7	-	45.7	-	44.5	-	42.9	ns

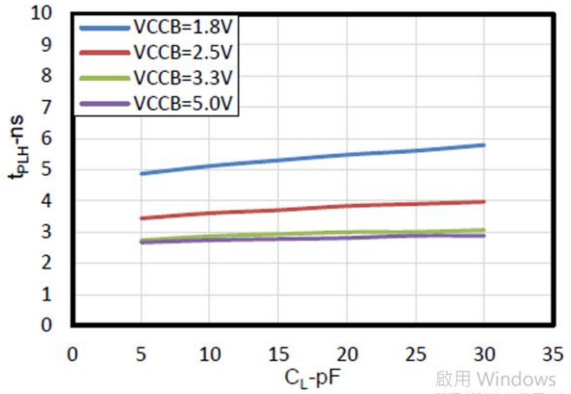
TYPICAL PERFORMANCE CHARACTERISTICS

Fig 1. Typical Propagation Delay High-to-Low (A to B) vs Load Capacitance



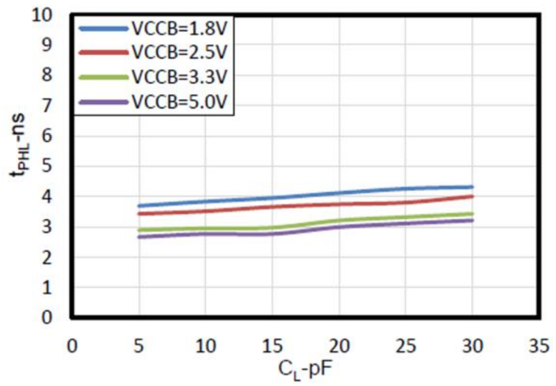
T_A = 25°C, V_{CCA} = 1.8 V

Fig 2. Typical Propagation Delay Low-to-High (B to A) vs Load Capacitance



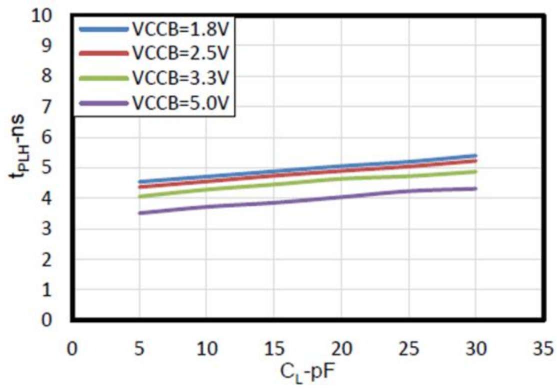
T_A = 25°C, V_{CCA} = 1.8 V

Fig 3. Typical Propagation Delay High-to-Low (A to B) vs Load Capacitance



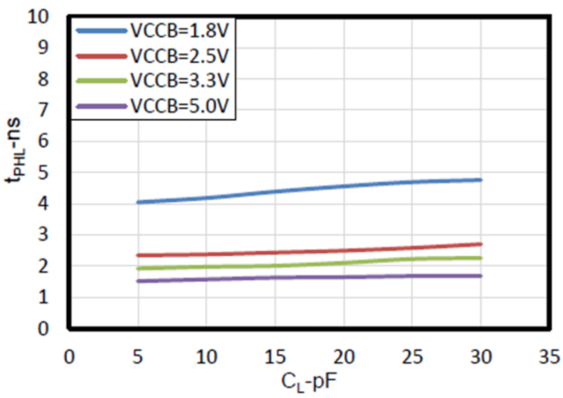
T_A = 25°C, V_{CCA} = 2.5 V

Fig 4. Typical Propagation Delay Low-to-High (B to A) vs Load Capacitance



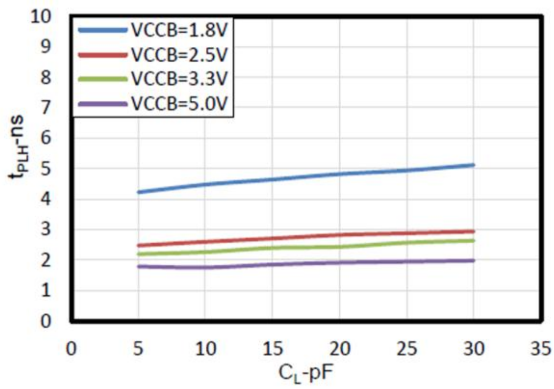
T_A = 25°C, V_{CCA} = 2.5 V

Fig 5. Typical Propagation Delay High-to-Low (A to B) vs Load Capacitance



T_A = 25°C, V_{CCA} = 3.3 V

Fig 6. Typical Propagation Delay Low-to-High (B to A) vs Load Capacitance



T_A = 25°C, V_{CCA} = 3.3 V

Fig 7. Typical Propagation Delay High-to-Low (A to B) vs Load Capacitance

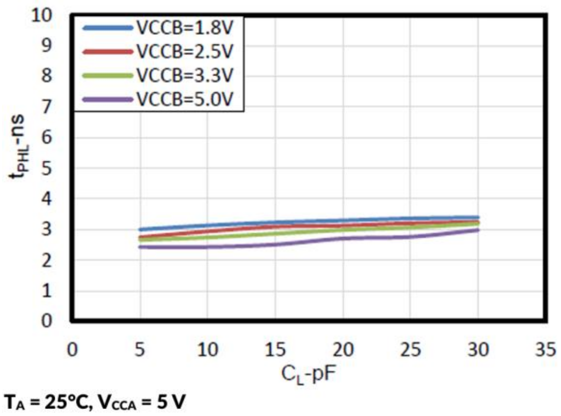
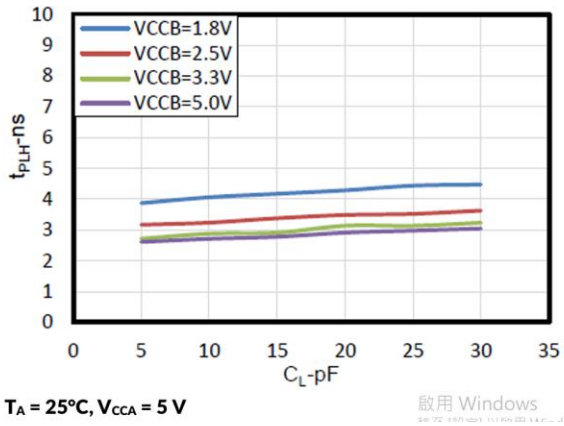


Fig 8. Typical Propagation Delay Low-to-High (B to A) vs Load Capacitance

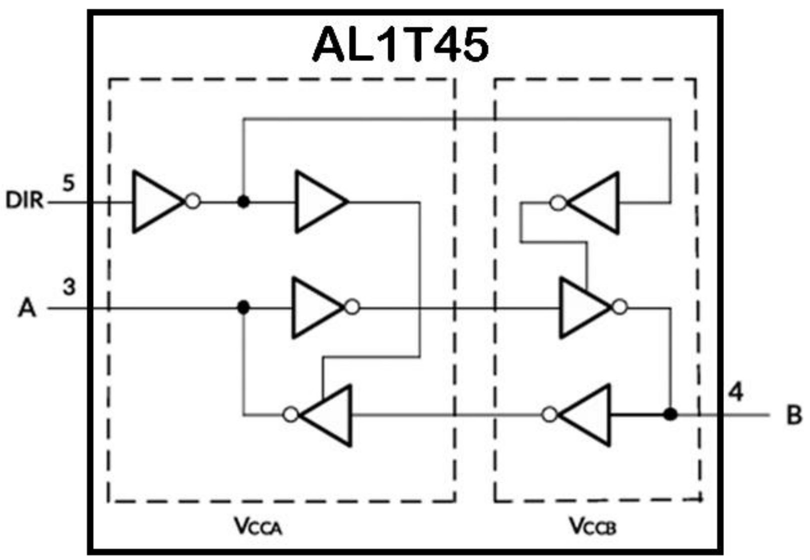


OPERATING CHARACTERISTICS

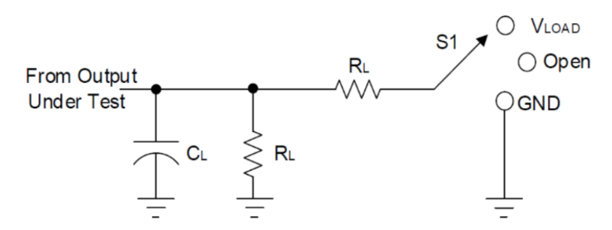
Parameter	Symbol	Test Condition	Vcc=1.8V Typ.	Vcc=2.5V Typ.	Vcc=3.3V Typ.	Vcc=5V Typ.	Unit
A-port input, B-port output	C_{pdA}	CL=0, f=10MHz, tr=tf=5ns	3	4	6	9	pF
B-port input, A-port output			14	17	22	32	
A-port input, B-port output	C_{pdB}		14	16	21	32	
B-port input, A-port output			3	4	6	9	

Power dissipation capacitance per transceiver.

BLOCK DIAGRAM



PARAMETER MEASUREMENT INFORMATION



TEST	S1
t_{PLH}/t_{PHL}	Open
t_{PIZ}/t_{PZL}	2 x V_{CCO}
t_{PHZ}/t_{PZH}	GND

VCC	C_L	R_L	VTP
1.8V±0.15V	15pF	2kΩ	0.15V
2.5V±0.2V	15pF	2kΩ	0.15V
3.3V±0.3V	15pF	2kΩ	0.3V
5V±0.5V	15pF	2kΩ	0.3V

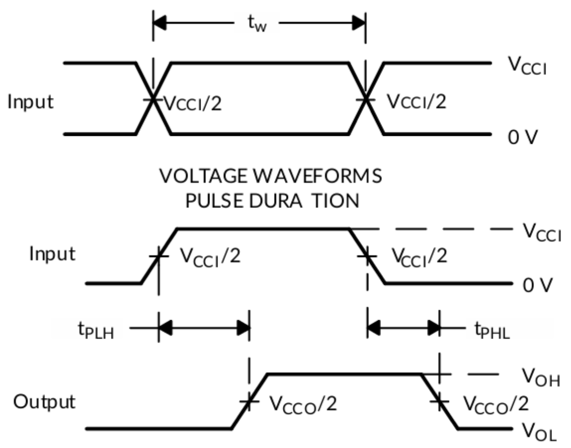


Fig 1. Voltage Waveforms Propagation Delay Times

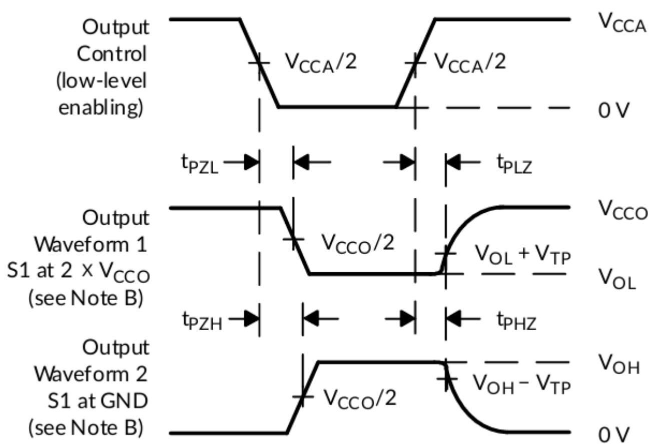


Fig 2. Voltage Waveforms Enable And Disable Times

(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 = 50 Ω.

(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_{LPZ} 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.

APPLICATION INFORMATION

The AL1T45-Q 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.

Typical Application

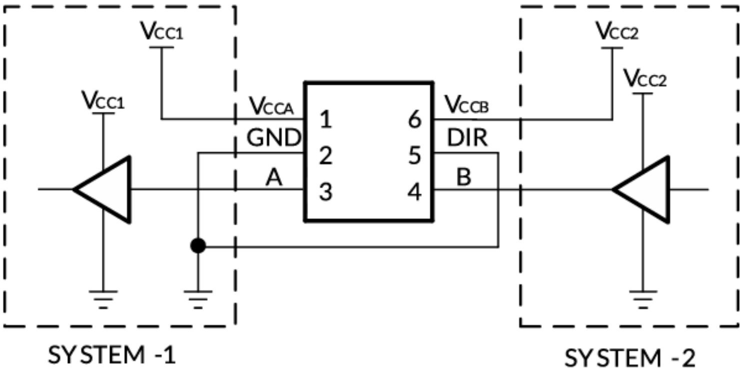


Fig 3. Unidirectional Logic Level-Shifting Application (B to A)

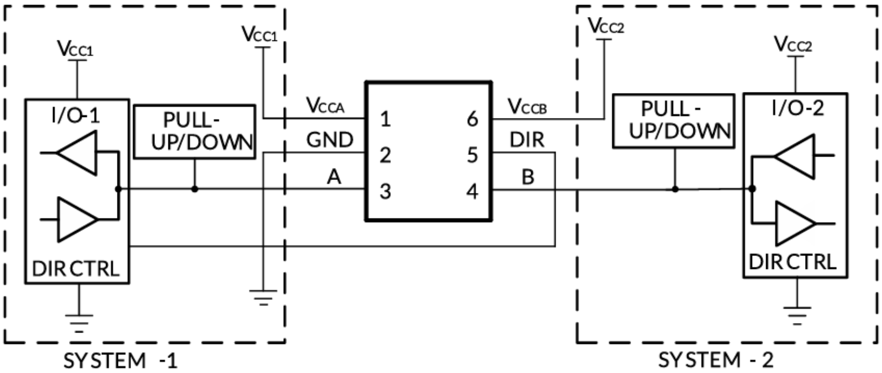


Fig 4. Bidirectional Logic Level-Shifting Application (B to A or A to B)

Enable Times

Calculate the enable times for the AL1T45-Q1 using the following formulas:

- tPZH (DIR to A) = tPLZ (DIR to B) + tPLH (B to A)
- tPZL (DIR to A) = tPHZ (DIR to B) + tPHL (B to A)
- tPZH (DIR to B) = tPLZ (DIR to A) + tPLH (A to B)
- tPZL (DIR to B) = tPHZ (DIR to A) + tPHL (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 AL1T45-Q1 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.

PCB LAYOUT GUIDELINES

PCB LAYOUT GUIDELINES

1. Decoupling Capacitors

- Place low-ESR/ESL ceramic capacitors as close as possible between VDD and GND pins of the IC.
- These capacitors supply the high peak currents required during the turn-on of external ICs, reducing voltage dips and improving switching performance.

2. Grounding Considerations

- Minimize Gate Current Loop Area:

Confine the high peak gate charge/discharge currents to the smallest possible physical area to reduce loop inductance and prevent gate ringing or noise issues.

- Use Star-Point Grounding:

Connect the gate driver's GND to other critical nodes (e.g., MOSFET source, PWM controller GND) at a single, common grounding point. This method minimizes ground bounce and noise coupling between loops. Keep all return paths short and direct to minimize parasitic inductance.

- Implement a Ground Plane:

A solid ground plane beneath the driver can serve as both noise shielding and thermal dissipation. However, the ground plane must not serve as a current return path. Instead, connect the ground plane to the star-point ground via a single, dedicated trace to maintain a clean ground reference.

3. Handling Unused Channels

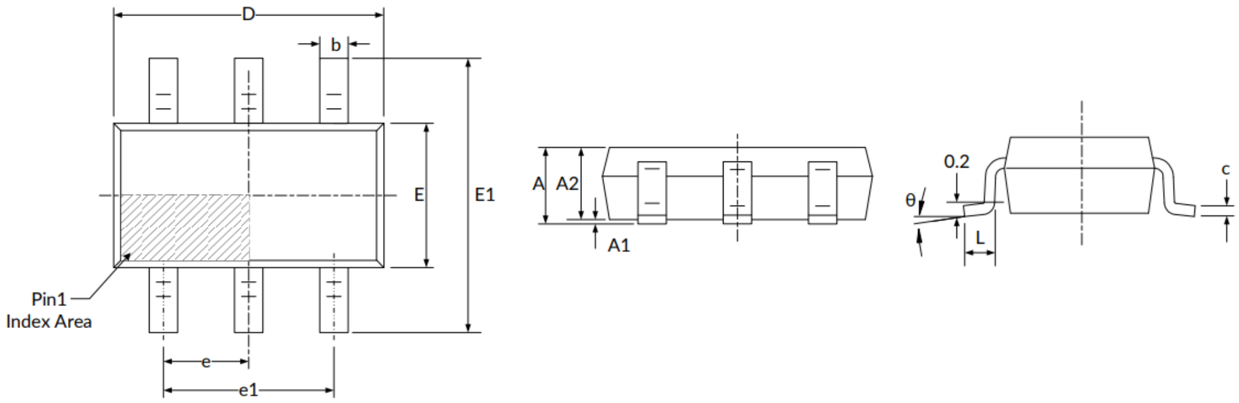
- In noisy environments, tie the inputs of unused channels to VDD or GND using short traces. This prevents unwanted switching due to noise coupling and ensures stable output behavior.

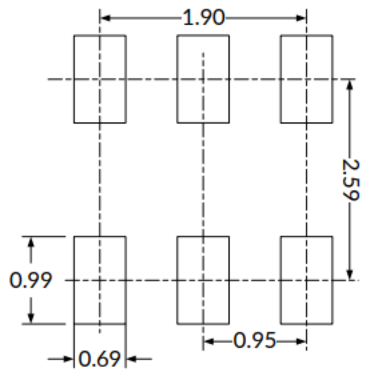
4. Trace Routing

- Keep power and signal traces separated. Route input and output signals away from high-current switching nodes to avoid coupling noise into sensitive control signals.

PACKAGE INFORMATION

Dimension in SOT-26 (Unit: mm)

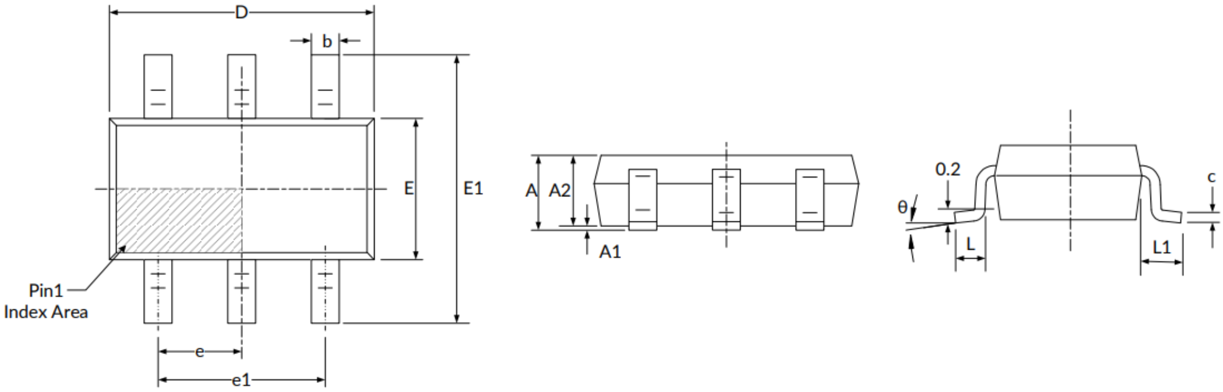


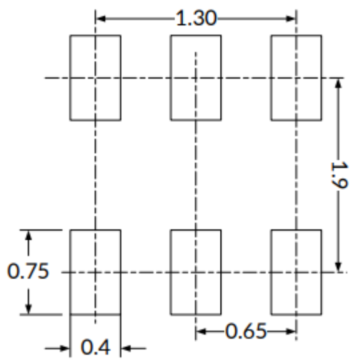


Recommended Land Pattern (Unit: mm)

Symbol	Millimeters	
	Min	Max
A	1.050	1.250
A1	0.000	0.100
A2	1.050	1.150
b	0.300	0.500
c	0.100	0.200
D	2.820	3.020
e	0.950 BSC	
e1	1.800	2.000
E	1.500	1.700
E1	2.650	2.950
L	0.300	0.600
θ	0°	8°

Dimension in SC70-6(Unit: mm)





Recommended Land Pattern (Unit: mm)

Symbol	Millimeters	
	Min	Max
A	0.900	1.100
A1	0.000	0.100
A2	0.900	1.000
b	0.150	0.350
c	0.080	0.150
D	2.000	2.200
E	1.150	1.350
E1	2.150	2.450
e	0.650 BSC	
e1	1.300 BSC	
L	0.260	0.460
H	0.525 TYP	
θ	0°	8°

IMPORTANT NOTICE

AiT Semiconductor Inc. (AiT) reserves the right to make changes to any its product, specifications, to discontinue any integrated circuit product or service without notice, and advises its customers to obtain the latest version of relevant information to verify, before placing orders, that the information being relied on is current.

AiT Semiconductor Inc.'s integrated circuit products are not designed, intended, authorized, or warranted to be suitable for use in life support applications, devices or systems or other critical applications. Use of AiT products in such applications is understood to be fully at the risk of the customer. As used herein may involve potential risks of death, personal injury, or servere property, or environmental damage. In order to minimize risks associated with the customer's applications, the customer should provide adequate design and operating safeguards.

AiT Semiconductor Inc. assumes to no liability to customer product design or application support. AiT warrants the performance of its products of the specifications applicable at the time of sale.