

74AVC1T45-Q100

Dual-supply voltage level translator/transceiver; 3-state

Rev. 4 — 28 January 2019

Product data sheet

1. General description

The 74AVC1T45-Q100 is a single bit, dual supply transceiver with 3-state output that enables bidirectional level translation. It features two 1-bit input-output ports (A and B), a direction control input (DIR) and dual supply pins ($V_{CC(A)}$ and $V_{CC(B)}$). Both $V_{CC(A)}$ and $V_{CC(B)}$ can be supplied at any voltage between 0.8 V and 3.6 V making the device suitable for translating between any of the low voltage nodes (0.8 V, 1.2 V, 1.5 V, 1.8 V, 2.5 V and 3.3 V). Pins A and DIR are referenced to $V_{CC(A)}$ and pin B is referenced to $V_{CC(B)}$. A HIGH on DIR allows transmission from A to B and a LOW on DIR allows transmission from B to A.

The device is fully specified for partial power-down applications using I_{OFF} . The I_{OFF} circuitry disables the output, preventing any damaging backflow current through the device when it is powered down. In suspend mode when either $V_{CC(A)}$ or $V_{CC(B)}$ are at GND level, both A and B are in the high-impedance OFF-state.

This product has been qualified to the Automotive Electronics Council (AEC) standard Q100 (Grade 1) and is suitable for use in automotive applications.

2. Features and benefits

- Automotive product qualification in accordance with AEC-Q100 (Grade 1)
 - Specified from -40 °C to +85 °C and from -40 °C to +125 °C
- Wide supply voltage range:
 - $V_{CC(A)}$: 0.8 V to 3.6 V
 - $V_{CC(B)}$: 0.8 V to 3.6 V
- High noise immunity
- Complies with JEDEC standards:
 - JESD8-12 (0.8 V to 1.3 V)
 - JESD8-11 (0.9 V to 1.65 V)
 - JESD8-7 (1.2 V to 1.95 V)
 - JESD8-5 (1.8 V to 2.7 V)
 - JESD8-B (2.7 V to 3.6 V)
- ESD protection:
 - MIL-STD-883, method 3015 Class 3B exceeds 8000 V
 - HBM JESD22-A114E Class 3B exceeds 8000 V
 - MM JESD22-A115-A exceeds 200 V ($C = 200$ pF; $R = 0$ Ω)
- Maximum data rates:
 - 500 Mbit/s (1.8 V to 3.3 V translation)
 - 320 Mbit/s (< 1.8 V to 3.3 V translation)
 - 320 Mbit/s (translate to 2.5 V or 1.8 V)
 - 280 Mbit/s (translate to 1.5 V)
 - 240 Mbit/s (translate to 1.2 V)
- Suspend mode
- Latch-up performance exceeds 100 mA per JESD 78 Class II
- Inputs accept voltages up to 3.6 V
- Low noise overshoot and undershoot < 10 % of V_{CC}
- I_{OFF} circuitry provides partial Power-down mode operation

3. Ordering information

Table 1. Ordering information

Type number	Package			
	Temperature range	Name	Description	Version
74AVC1T45GW-Q100	-40 °C to +125 °C	SC-88	plastic surface-mounted package; 6 leads	SOT363
74AVC1T45GS-Q100	-40 °C to +125 °C	XSON6	extremely thin small outline package; no leads; 6 terminals; body 1.0 x 1.0 x 0.35 mm	SOT1202

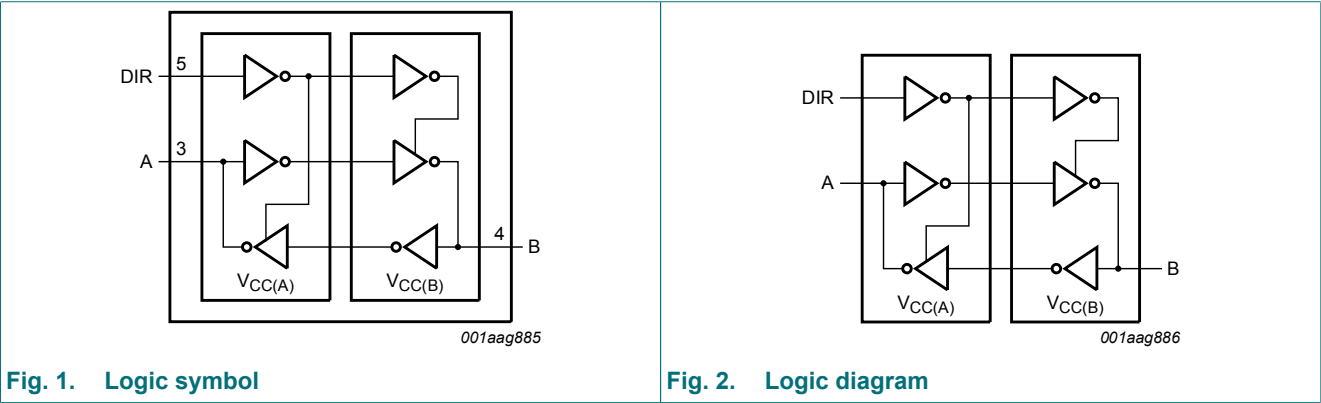
4. Marking

Table 2. Marking

Type number	Marking code[1]
74AVC1T45GW-Q100	B5
74AVC1T45GS-Q100	B5

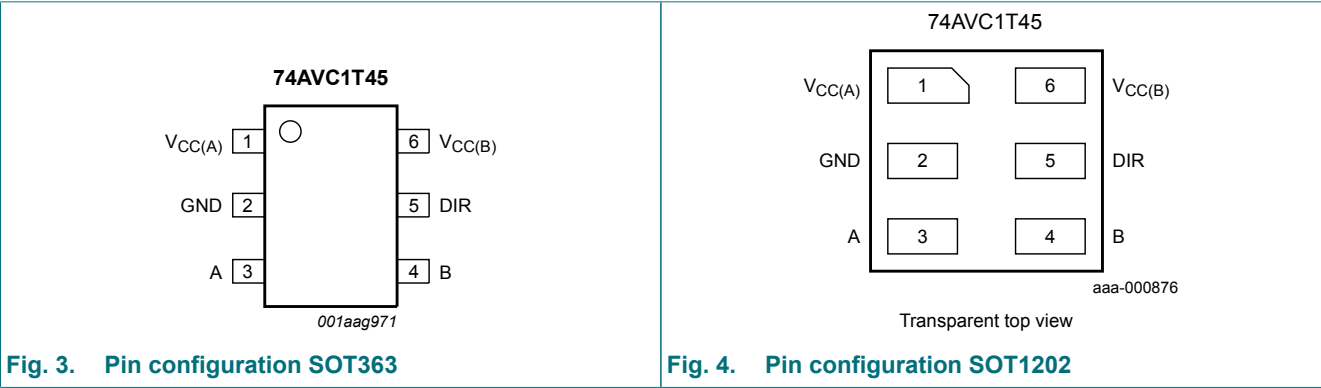
[1] The pin 1 indicator is located on the lower left corner of the device, below the marking code.

5. Functional diagram



6. Pinning information

6.1. Pinning



6.2. Pin description

Table 3. Pin description

Symbol	Pin	Description
V _{CC(A)}	1	supply voltage port A and DIR
GND	2	ground (0 V)
A	3	data input or output
B	4	data input or output
DIR	5	direction control
V _{CC(B)}	6	supply voltage port B

7. Functional description

Table 4. Function table

H = HIGH voltage level; L = LOW voltage level; X = don't care; Z = high-impedance OFF-state.

Supply voltage	Input	Input/output[1]	
V _{CC(A)} , V _{CC(B)}	DIR[2]	A	B
0.8 V to 3.6 V	L	A = B	input
0.8 V to 3.6 V	H	input	B = A
GND[3]	X	Z	Z

[1] The input circuit of the data I/O is always active.

[2] The DIR input circuit is referenced to V_{CC(A)}.

[3] When either V_{CC(A)} or V_{CC(B)} is at GND level, the device goes into suspend mode.

8. Limiting values

Table 5. Limiting values

In accordance with the Absolute Maximum Rating System (IEC 60134). Voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions	Min	Max	Unit
V _{CC(A)}	supply voltage A		-0.5	+4.6	V
V _{CC(B)}	supply voltage B		-0.5	+4.6	V
I _{IK}	input clamping current	V _I < 0 V	-50	-	mA
V _I	input voltage	[1]	-0.5	+4.6	V
I _{OK}	output clamping current	V _O < 0 V	-50	-	mA
V _O	output voltage	Active mode [1][2][3]	-0.5	V _{CCO} + 0.5	V
		Suspend or 3-state mode [1]	-0.5	+4.6	V
I _O	output current	V _O = 0 V to V _{CCO}	-	±50	mA
I _{CC}	supply current	I _{CC(A)} or I _{CC(B)}	-	100	mA
I _{GND}	ground current		-100	-	mA
T _{stg}	storage temperature		-65	+150	°C
P _{tot}	total power dissipation	T _{amb} = -40 °C to +125 °C [4][5]	-	250	mW

[1] The minimum input voltage ratings and output voltage ratings may be exceeded if the input and output current ratings are observed.

[2] V_{CCO} is the supply voltage associated with the output port.

[3] V_{CCO} + 0.5 V should not exceed 4.6 V.

[4] For SC-88 package: above 87.5 °C the value of P_{tot} derates linearly with 4.0 mW/K.

[5] For XSON6 package: above 118 °C the value of P_{tot} derates linearly with 7.8 mW/K.

9. Recommended operating conditions

Table 6. Recommended operating conditions

Symbol	Parameter	Conditions	Min	Max	Unit
$V_{CC(A)}$	supply voltage A		0.8	3.6	V
$V_{CC(B)}$	supply voltage B		0.8	3.6	V
V_I	input voltage		0	3.6	V
V_O	output voltage	Active mode [1]	0	V_{CCO}	V
		Suspend or 3-state mode	0	3.6	V
T_{amb}	ambient temperature		-40	+125	°C
$\Delta t/\Delta V$	input transition rise and fall rate	$V_{CCI} = 0.8 \text{ V to } 3.6 \text{ V}$ [2]	-	5	ns/V

[1] V_{CCO} is the supply voltage associated with the output port.

[2] V_{CCI} is the supply voltage associated with the input port.

10. Static characteristics

Table 7. Typical static characteristics

At recommended operating conditions; voltages are referenced to GND (ground = 0 V). [1]

Symbol	Parameter	Conditions	$T_{amb} = 25 \text{ °C}$			Unit
			Min	Typ	Max	
V_{OH}	HIGH-level output voltage	$V_I = V_{IH} \text{ or } V_{IL}$				
		$I_O = -1.5 \text{ mA}; V_{CC(A)} = V_{CC(B)} = 0.8 \text{ V}$	-	0.69	-	V
V_{OL}	LOW-level output voltage	$V_I = V_{IH} \text{ or } V_{IL}$				
		$I_O = 1.5 \text{ mA}; V_{CC(A)} = V_{CC(B)} = 0.8 \text{ V}$	-	0.07	-	V
I_I	input leakage current	DIR input; $V_I = 0 \text{ V or } 3.6 \text{ V};$ $V_{CC(A)} = V_{CC(B)} = 0.8 \text{ V to } 3.6 \text{ V}$	-	± 0.025	± 0.25	μA
I_{OZ}	OFF-state output current	A or B port; $V_O = 0 \text{ V or } V_{CCO};$ $V_{CC(A)} = V_{CC(B)} = 0.8 \text{ V to } 3.6 \text{ V}$ [2]	-	± 0.5	± 2.5	μA
I_{OFF}	power-off leakage current	A port; $V_I \text{ or } V_O = 0 \text{ V to } 3.6 \text{ V}; V_{CC(A)} = 0 \text{ V};$ $V_{CC(B)} = 0.8 \text{ V to } 3.6 \text{ V}$	-	± 0.1	± 1	μA
		B port; $V_I \text{ or } V_O = 0 \text{ V to } 3.6 \text{ V}; V_{CC(B)} = 0 \text{ V};$ $V_{CC(A)} = 0.8 \text{ V to } 3.6 \text{ V}$	-	± 0.1	± 1	μA
C_I	input capacitance	DIR input; $V_I = 0 \text{ V or } 3.3 \text{ V};$ $V_{CC(A)} = V_{CC(B)} = 3.3 \text{ V}$	-	1.0	-	pF
$C_{I/O}$	input/output capacitance	A and B port; Suspend mode; $V_O = V_{CCO} \text{ or } \text{GND}; V_{CC(A)} = V_{CC(B)} = 3.3 \text{ V}$	-	4.0	-	pF

[1] V_{CCO} is the supply voltage associated with the output port.

[2] For I/O ports, the parameter I_{OZ} includes the input leakage current.

Table 8. Static characteristics

At recommended operating conditions; voltages are referenced to GND (ground = 0 V). [1][2]

Symbol	Parameter	Conditions	-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Max	Min	Max	
V_{IH}	HIGH-level input voltage	data input					
		$V_{CCI} = 0.8 \text{ V}$	$0.70V_{CCI}$	-	$0.70V_{CCI}$	-	V
		$V_{CCI} = 1.1 \text{ V to } 1.95 \text{ V}$	$0.65V_{CCI}$	-	$0.65V_{CCI}$	-	V
		$V_{CCI} = 2.3 \text{ V to } 2.7 \text{ V}$	1.6	-	1.6	-	V
		$V_{CCI} = 3.0 \text{ V to } 3.6 \text{ V}$	2	-	2	-	V
		DIR input					
		$V_{CC(A)} = 0.8 \text{ V}$	$0.70V_{CC(A)}$	-	$0.70V_{CC(A)}$	-	V
		$V_{CC(A)} = 1.1 \text{ V to } 1.95 \text{ V}$	$0.65V_{CC(A)}$	-	$0.65V_{CC(A)}$	-	V
		$V_{CC(A)} = 2.3 \text{ V to } 2.7 \text{ V}$	1.6	-	1.6	-	V
		$V_{CC(A)} = 3.0 \text{ V to } 3.6 \text{ V}$	2	-	2	-	V
V_{IL}	LOW-level input voltage	data input					
		$V_{CCI} = 0.8 \text{ V}$	-	$0.30V_{CCI}$	-	$0.30V_{CCI}$	V
		$V_{CCI} = 1.1 \text{ V to } 1.95 \text{ V}$	-	$0.35V_{CCI}$	-	$0.35V_{CCI}$	V
		$V_{CCI} = 2.3 \text{ V to } 2.7 \text{ V}$	-	0.7	-	0.7	V
		$V_{CCI} = 3.0 \text{ V to } 3.6 \text{ V}$	-	0.9	-	0.9	V
		DIR input					
		$V_{CC(A)} = 0.8 \text{ V}$	-	$0.30V_{CC(A)}$	-	$0.30V_{CC(A)}$	V
		$V_{CC(A)} = 1.1 \text{ V to } 1.95 \text{ V}$	-	$0.35V_{CC(A)}$	-	$0.35V_{CC(A)}$	V
		$V_{CC(A)} = 2.3 \text{ V to } 2.7 \text{ V}$	-	0.7	-	0.7	V
		$V_{CC(A)} = 3.0 \text{ V to } 3.6 \text{ V}$	-	0.9	-	0.9	V
V_{OH}	HIGH-level output voltage	$V_I = V_{IH} \text{ or } V_{IL}$					
		$I_O = -100 \mu\text{A};$ $V_{CC(A)} = V_{CC(B)} = 0.8 \text{ V to } 3.6 \text{ V}$	$V_{CCO} - 0.1$	-	$V_{CCO} - 0.1$	-	V
		$I_O = -3 \text{ mA};$ $V_{CC(A)} = V_{CC(B)} = 1.1 \text{ V}$	0.85	-	0.85	-	V
		$I_O = -6 \text{ mA};$ $V_{CC(A)} = V_{CC(B)} = 1.4 \text{ V}$	1.05	-	1.05	-	V
		$I_O = -8 \text{ mA};$ $V_{CC(A)} = V_{CC(B)} = 1.65 \text{ V}$	1.2	-	1.2	-	V
		$I_O = -9 \text{ mA};$ $V_{CC(A)} = V_{CC(B)} = 2.3 \text{ V}$	1.75	-	1.75	-	V
		$I_O = -12 \text{ mA};$ $V_{CC(A)} = V_{CC(B)} = 3.0 \text{ V}$	2.3	-	2.3	-	V
V_{OL}	LOW-level output voltage	$V_I = V_{IH} \text{ or } V_{IL}$					
		$I_O = 100 \mu\text{A};$ $V_{CC(A)} = V_{CC(B)} = 0.8 \text{ V to } 3.6 \text{ V}$	-	0.1	-	0.1	V
		$I_O = 3 \text{ mA}; V_{CC(A)} = V_{CC(B)} = 1.1 \text{ V}$	-	0.25	-	0.25	V
		$I_O = 6 \text{ mA}; V_{CC(A)} = V_{CC(B)} = 1.4 \text{ V}$	-	0.35	-	0.35	V
		$I_O = 8 \text{ mA};$ $V_{CC(A)} = V_{CC(B)} = 1.65 \text{ V}$	-	0.45	-	0.45	V
		$I_O = 9 \text{ mA}; V_{CC(A)} = V_{CC(B)} = 2.3 \text{ V}$	-	0.55	-	0.55	V
		$I_O = 12 \text{ mA};$ $V_{CC(A)} = V_{CC(B)} = 3.0 \text{ V}$	-	0.7	-	0.7	V

Dual-supply voltage level translator/transceiver; 3-state

Symbol	Parameter	Conditions	-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Max	Min	Max	
I_I	input leakage current	DIR input; $V_I = 0 \text{ V}$ or 3.6 V ; $V_{CC(A)} = V_{CC(B)} = 0.8 \text{ V}$ to 3.6 V	-	± 1	-	± 1.5	μA
I_{OZ}	OFF-state output current	A or B port; $V_O = 0 \text{ V}$ or V_{CCO} ; $V_{CC(A)} = V_{CC(B)} = 3.6 \text{ V}$ [3]	-	± 5	-	± 7.5	μA
I_{OFF}	power-off leakage current	A port; V_I or $V_O = 0 \text{ V}$ to 3.6 V ; $V_{CC(A)} = 0 \text{ V}$; $V_{CC(B)} = 0.8 \text{ V}$ to 3.6 V	-	± 5	-	± 35	μA
		B port; V_I or $V_O = 0 \text{ V}$ to 3.6 V ; $V_{CC(B)} = 0 \text{ V}$; $V_{CC(A)} = 0.8 \text{ V}$ to 3.6 V	-	± 5	-	± 35	μA
I_{CC}	supply current	A port; $V_I = 0 \text{ V}$ or V_{CCI} ; $I_O = 0 \text{ A}$					
		$V_{CC(A)} = 0.8 \text{ V}$ to 3.6 V ; $V_{CC(B)} = 0.8 \text{ V}$ to 3.6 V	-	8	-	12	μA
		$V_{CC(A)} = 3.6 \text{ V}$; $V_{CC(B)} = 0 \text{ V}$	-	8	-	12	μA
		$V_{CC(A)} = 0 \text{ V}$; $V_{CC(B)} = 3.6 \text{ V}$	-2	-	-8	-	μA
		B port; $V_I = 0 \text{ V}$ or V_{CCI} ; $I_O = 0 \text{ A}$					
		$V_{CC(A)} = 0.8 \text{ V}$ to 3.6 V ; $V_{CC(B)} = 0.8 \text{ V}$ to 3.6 V	-	8	-	12	μA
		$V_{CC(A)} = 3.6 \text{ V}$; $V_{CC(B)} = 0 \text{ V}$	-2	-	-8	-	μA
		$V_{CC(A)} = 0 \text{ V}$; $V_{CC(B)} = 3.6 \text{ V}$	-	8	-	12	μA
		A plus B port ($I_{CC(A)} + I_{CC(B)}$); $I_O = 0 \text{ A}$; $V_I = 0 \text{ V}$ or V_{CCI} ; $V_{CC(A)} = 0.8 \text{ V}$ to 3.6 V ; $V_{CC(B)} = 0.8 \text{ V}$ to 3.6 V	-	16	-	24	μA

[1] V_{CCO} is the supply voltage associated with the output port.

[2] V_{CCI} is the supply voltage associated with the data input port.

[3] For I/O ports, the parameter I_{OZ} includes the input leakage current.

11. Dynamic characteristics

Table 9. Typical dynamic characteristics

Voltages are referenced to GND (ground = 0 V); for test circuit see Fig. 7; for wave forms see Fig. 5 and Fig. 6[1]

Symbol	Parameter	Conditions	V _{CC(B)}						Unit
			0.8 V	1.2 V	1.5 V	1.8 V	2.5 V	3.3 V	
V _{CC(A)} = 0.8 V and T _{amb} = 25 °C									
t _{pd}	propagation delay	A to B	15.5	8.1	7.6	7.7	8.4	9.2	ns
		B to A	15.5	12.7	12.3	12.2	12.0	11.8	ns
t _{dis}	disable time	DIR to A	12.2	12.2	12.2	12.2	12.2	12.2	ns
		DIR to B	11.7	7.9	7.6	8.2	8.7	10.2	ns
t _{en}	enable time	DIR to A	27.2	20.6	19.9	20.4	20.7	22.0	ns
		DIR to B	27.7	20.3	19.8	19.9	20.6	21.4	ns

- [1] t_{pd} is the same as t_{PLH} and t_{PHL}; t_{dis} is the same as t_{PLZ} and t_{PHZ}; t_{en} is the same as t_{PZL} and t_{PZH}.
t_{en} is a calculated value using the formula shown in Section 12.4

Table 10. Typical dynamic characteristics

Voltages are referenced to GND (ground = 0 V); for test circuit see Fig. 7; for wave forms see Fig. 5 and Fig. 6[1]

Symbol	Parameter	Conditions	V _{CC(A)}						Unit
			0.8 V	1.2 V	1.5 V	1.8 V	2.5 V	3.3 V	
V _{CC(B)} = 0.8 V and T _{amb} = 25 °C									
t _{pd}	propagation delay	A to B	15.5	12.7	12.3	12.2	12.0	11.8	ns
		B to A	15.5	8.1	7.6	7.7	8.4	9.2	ns
t _{dis}	disable time	DIR to A	12.2	4.9	3.8	3.7	2.8	3.4	ns
		DIR to B	11.7	9.2	9.0	8.8	8.7	8.6	ns
t _{en}	enable time	DIR to A	27.2	17.3	16.6	16.5	17.1	17.8	ns
		DIR to B	27.7	17.6	16.1	15.9	14.8	15.2	ns

- [1] t_{pd} is the same as t_{PLH} and t_{PHL}; t_{dis} is the same as t_{PLZ} and t_{PHZ}; t_{en} is the same as t_{PZL} and t_{PZH}.
t_{en} is a calculated value using the formula shown in Section 12.4

Table 11. Typical power dissipation capacitance

Voltages are referenced to GND (ground = 0 V). [1][2]

Symbol	Parameter	Conditions	V _{CC(A)} = V _{CC(B)}						Unit
			0.8 V	1.2 V	1.5 V	1.8 V	2.5 V	3.3 V	
T _{amb} = 25 °C									
C _{PD}	power dissipation capacitance	A port: (direction A to B); B port: (direction B to A)	1	2	2	2	2	2	pF
		A port: (direction B to A); B port: (direction A to B)	9	11	11	12	14	17	pF

- [1] C_{PD} is used to determine the dynamic power dissipation (P_D in μW).

$P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \Sigma(C_L \times V_{CC}^2 \times f_o)$ where:

f_i = input frequency in MHz;

f_o = output frequency in MHz;

C_L = load capacitance in pF;

V_{CC} = supply voltage in V;

N = number of inputs switching;

$\Sigma(C_L \times V_{CC}^2 \times f_o)$ = sum of the outputs.

- [2] f_i = 10 MHz; V_i = GND to V_{CC}; t_r = t_f = 1 ns; C_L = 0 pF; R_L = ∞ Ω.

Table 12. Dynamic characteristics

Voltages are referenced to GND (ground = 0 V); for test circuit see Fig. 7; for wave forms see Fig. 5 and Fig. 6[1]

Symbol	Parameter	Conditions	V _{CC(B)}										Unit
			1.2 V±0.1 V		1.5 V±0.1 V		1.8 V±0.15 V		2.5 V±0.2 V		3.3 V±0.3 V		
			Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	
V _{CC(A)} = 1.1 V to 1.3 V; T _{amb} = -40 °C to +85 °C													
t _{pd}	propagation delay	A to B	1.0	9.0	0.7	6.8	0.6	6.1	0.5	5.7	0.5	6.1	ns
		B to A	1.0	9.0	0.8	8.0	0.7	7.7	0.6	7.2	0.5	7.1	ns
t _{dis}	disable time	DIR to A	2.2	8.8	2.2	8.8	2.2	8.8	2.2	8.8	2.2	8.8	ns
		DIR to B	2.2	8.4	1.8	6.7	2.0	6.9	1.7	6.2	2.4	7.2	ns
t _{en}	enable time	DIR to A	-	17.4	-	14.7	-	14.6	-	13.4	-	14.3	ns
		DIR to B	-	17.8	-	15.6	-	14.9	-	14.5	-	14.9	ns
V _{CC(A)} = 1.4 V to 1.6 V; T _{amb} = -40 °C to +85 °C													
t _{pd}	propagation delay	A to B	1.0	8.0	0.7	5.4	0.6	4.6	0.5	3.7	0.5	3.5	ns
		B to A	1.0	6.8	0.8	5.4	0.7	5.1	0.6	4.7	0.5	4.5	ns
t _{dis}	disable time	DIR to A	1.6	6.3	1.6	6.3	1.6	6.3	1.6	6.3	1.6	6.3	ns
		DIR to B	2.0	7.6	1.8	5.9	1.6	6.0	1.2	4.8	1.7	5.5	ns
t _{en}	enable time	DIR to A	-	14.4	-	11.3	-	11.1	-	9.5	-	10.0	ns
		DIR to B	-	14.3	-	11.7	-	10.9	-	10.0	-	9.8	ns
V _{CC(A)} = 1.65 V to 1.95 V; T _{amb} = -40 °C to +85 °C													
t _{pd}	propagation delay	A to B	1.0	7.7	0.6	5.1	0.5	4.3	0.5	3.4	0.5	3.1	ns
		B to A	1.0	6.1	0.7	4.6	0.5	4.4	0.5	3.9	0.5	3.7	ns
t _{dis}	disable time	DIR to A	1.6	5.5	1.6	5.5	1.6	5.5	1.6	5.5	1.6	5.5	ns
		DIR to B	1.8	7.7	1.8	5.7	1.4	5.8	1.0	4.5	1.5	5.2	ns
t _{en}	enable time	DIR to A	-	13.8	-	10.3	-	10.2	-	8.4	-	8.9	ns
		DIR to B	-	13.2	-	10.6	-	9.8	-	8.9	-	8.6	ns
V _{CC(A)} = 2.3 V to 2.7 V; T _{amb} = -40 °C to +85 °C													
t _{pd}	propagation delay	A to B	1.0	7.2	0.5	4.7	0.5	3.9	0.5	3.0	0.5	2.6	ns
		B to A	1.0	5.7	0.6	3.8	0.5	3.4	0.5	3.0	0.5	2.8	ns
t _{dis}	disable time	DIR to A	1.5	4.2	1.5	4.2	1.5	4.2	1.5	4.2	1.5	4.2	ns
		DIR to B	1.7	7.3	2.0	5.2	1.5	5.1	0.6	4.2	1.1	4.8	ns
t _{en}	enable time	DIR to A	-	13.0	-	9.0	-	8.5	-	7.2	-	7.6	ns
		DIR to B	-	11.4	-	8.9	-	8.1	-	7.2	-	6.8	ns
V _{CC(A)} = 3.0 V to 3.6 V; T _{amb} = -40 °C to +85 °C													
t _{pd}	propagation delay	A to B	1.0	7.1	0.5	4.5	0.5	3.7	0.5	2.8	0.5	2.4	ns
		B to A	1.0	6.1	0.6	3.6	0.5	3.1	0.5	2.6	0.5	2.4	ns
t _{dis}	disable time	DIR to A	1.5	4.7	1.5	4.7	1.5	4.7	1.5	4.7	1.5	4.7	ns
		DIR to B	1.7	7.2	0.7	5.5	0.6	5.5	0.7	4.1	1.7	4.7	ns
t _{en}	enable time	DIR to A	-	13.3	-	9.1	-	8.6	-	6.7	-	7.1	ns
		DIR to B	-	11.8	-	9.2	-	8.4	-	7.5	-	7.1	ns

[1] t_{pd} is the same as t_{PLH} and t_{PHL}; t_{dis} is the same as t_{PLZ} and t_{PHZ}; t_{en} is the same as t_{PZL} and t_{PZH}. t_{en} is a calculated value using the formula shown in Section 12.4

Table 13. Dynamic characteristics

Voltages are referenced to GND (ground = 0 V); for test circuit see Fig. 7; for wave forms see Fig. 5 and Fig. 6[1]

Symbol	Parameter	Conditions	V _{CC(B)}										Unit
			1.2 V±0.1 V		1.5 V±0.1 V		1.8 V±0.15 V		2.5 V±0.2 V		3.3 V±0.3 V		
			Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	
V _{CC(A)} = 1.1 V to 1.3 V; T _{amb} = -40 °C to +125 °C													
t _{pd}	propagation delay	A to B	1.0	9.9	0.7	7.5	0.6	6.8	0.5	6.3	0.5	6.8	ns
		B to A	1.0	9.9	0.8	8.8	0.7	8.5	0.6	8.0	0.5	7.9	ns
t _{dis}	disable time	DIR to A	2.2	9.7	2.2	9.7	2.2	9.7	2.2	9.7	2.2	9.7	ns
		DIR to B	2.2	9.2	1.8	7.4	2.0	7.6	1.7	6.9	2.4	8.0	ns
t _{en}	enable time	DIR to A	-	19.1	-	16.2	-	16.1	-	14.9	-	15.9	ns
		DIR to B	-	19.6	-	17.2	-	16.5	-	16.0	-	16.5	ns
V _{CC(A)} = 1.4 V to 1.6 V; T _{amb} = -40 °C to +125 °C													
t _{pd}	propagation delay	A to B	1.0	8.8	0.7	6.0	0.6	5.1	0.5	4.1	0.5	3.9	ns
		B to A	1.0	7.5	0.8	6.0	0.7	5.7	0.6	5.2	0.5	5.0	ns
t _{dis}	disable time	DIR to A	1.6	7.0	1.6	7.0	1.6	7.0	1.6	7.0	1.6	7.0	ns
		DIR to B	2.0	8.3	1.8	6.5	1.6	6.6	1.2	5.3	1.7	6.1	ns
t _{en}	enable time	DIR to A	-	15.8	-	12.5	-	12.3	-	10.5	-	11.1	ns
		DIR to B	-	15.8	-	13.0	-	12.1	-	11.1	-	10.9	ns
V _{CC(A)} = 1.65 V to 1.95 V; T _{amb} = -40 °C to +125 °C													
t _{pd}	propagation delay	A to B	1.0	8.5	0.6	5.7	0.5	4.8	0.5	3.8	0.5	3.5	ns
		B to A	1.0	6.8	0.7	5.1	0.5	4.9	0.5	4.3	0.5	4.1	ns
t _{dis}	disable time	DIR to A	1.6	6.1	1.6	6.1	1.6	6.1	1.6	6.1	1.6	6.1	ns
		DIR to B	1.8	8.5	1.8	6.3	1.4	6.4	1.0	5.0	1.5	5.8	ns
t _{en}	enable time	DIR to A	-	15.3	-	11.4	-	11.3	-	9.3	-	9.9	ns
		DIR to B	-	14.6	-	11.8	-	10.9	-	9.9	-	9.6	ns
V _{CC(A)} = 2.3 V to 2.7 V; T _{amb} = -40 °C to +125 °C													
t _{pd}	propagation delay	A to B	1.0	8.0	0.5	5.2	0.5	4.3	0.5	3.3	0.5	2.9	ns
		B to A	1.0	6.3	0.6	4.2	0.5	3.8	0.5	3.3	0.5	3.1	ns
t _{dis}	disable time	DIR to A	1.5	4.7	1.5	4.7	1.5	4.7	1.5	4.7	1.5	4.7	ns
		DIR to B	1.7	8.0	2.0	5.8	1.5	5.7	0.6	4.7	1.1	5.3	ns
t _{en}	enable time	DIR to A	-	14.3	-	10.0	-	9.5	-	8.0	-	8.4	ns
		DIR to B	-	12.7	-	9.9	-	9.0	-	8.0	-	7.6	ns
V _{CC(A)} = 3.0 V to 3.6 V; T _{amb} = -40 °C to +125 °C													
t _{pd}	propagation delay	A to B	1.0	7.9	0.5	5.0	0.5	4.1	0.5	3.1	0.5	2.7	ns
		B to A	1.0	6.8	0.6	4.0	0.5	3.5	0.5	2.9	0.5	2.7	ns
t _{dis}	disable time	DIR to A	1.5	5.2	1.5	5.2	1.5	5.2	1.5	5.2	1.5	5.2	ns
		DIR to B	1.7	7.9	0.7	6.1	0.6	6.1	0.7	4.6	1.7	5.2	ns
t _{en}	enable time	DIR to A	-	14.7	-	10.1	-	9.6	-	7.5	-	7.9	ns
		DIR to B	-	13.1	-	10.2	-	9.3	-	8.3	-	7.9	ns

[1] t_{pd} is the same as t_{PLH} and t_{PHL}; t_{dis} is the same as t_{PLZ} and t_{PHZ}; t_{en} is the same as t_{PZL} and t_{PZH}. t_{en} is a calculated value using the formula shown in Section 12.4

11.1. Waveforms and test circuit

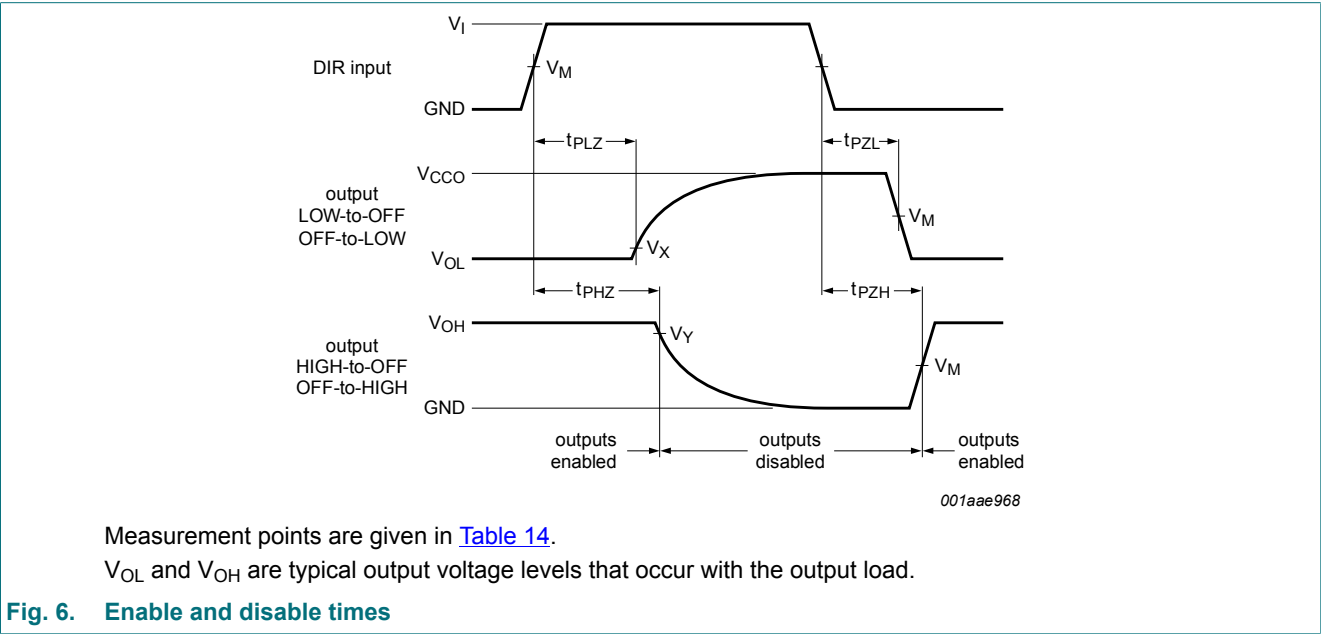
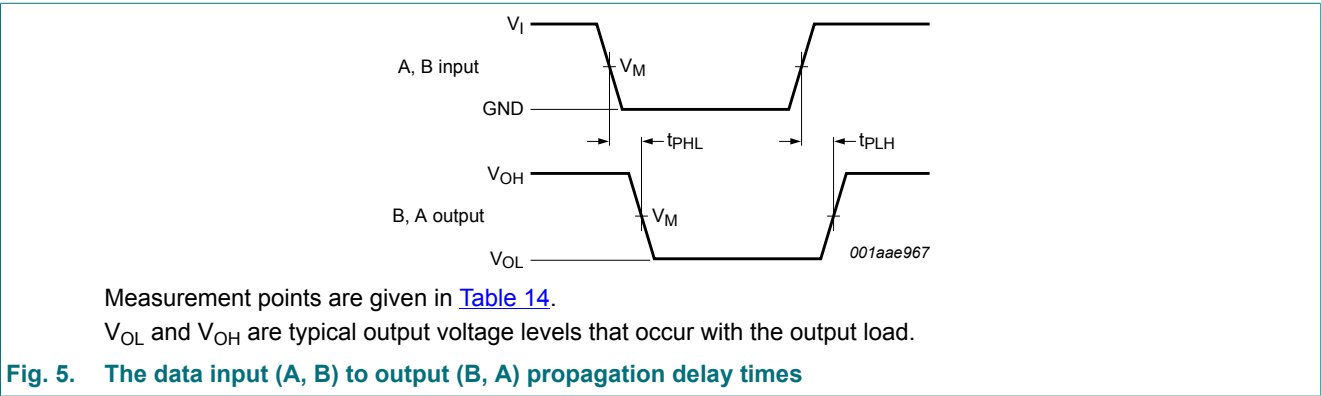


Table 14. Measurement points

Supply voltage	Input [1]	Output [2]		
$V_{CC(A)}, V_{CC(B)}$	V_M	V_M	V_X	V_Y
1.1 V to 1.6 V	$0.5V_{CCI}$	$0.5V_{CCO}$	$V_{OL} + 0.1\text{ V}$	$V_{OH} - 0.1\text{ V}$
1.65 V to 2.7 V	$0.5V_{CCI}$	$0.5V_{CCO}$	$V_{OL} + 0.15\text{ V}$	$V_{OH} - 0.15\text{ V}$
3.0 V to 3.6 V	$0.5V_{CCI}$	$0.5V_{CCO}$	$V_{OL} + 0.3\text{ V}$	$V_{OH} - 0.3\text{ V}$

[1] V_{CCI} is the supply voltage associated with the data input port.
[2] V_{CCO} is the supply voltage associated with the output port.

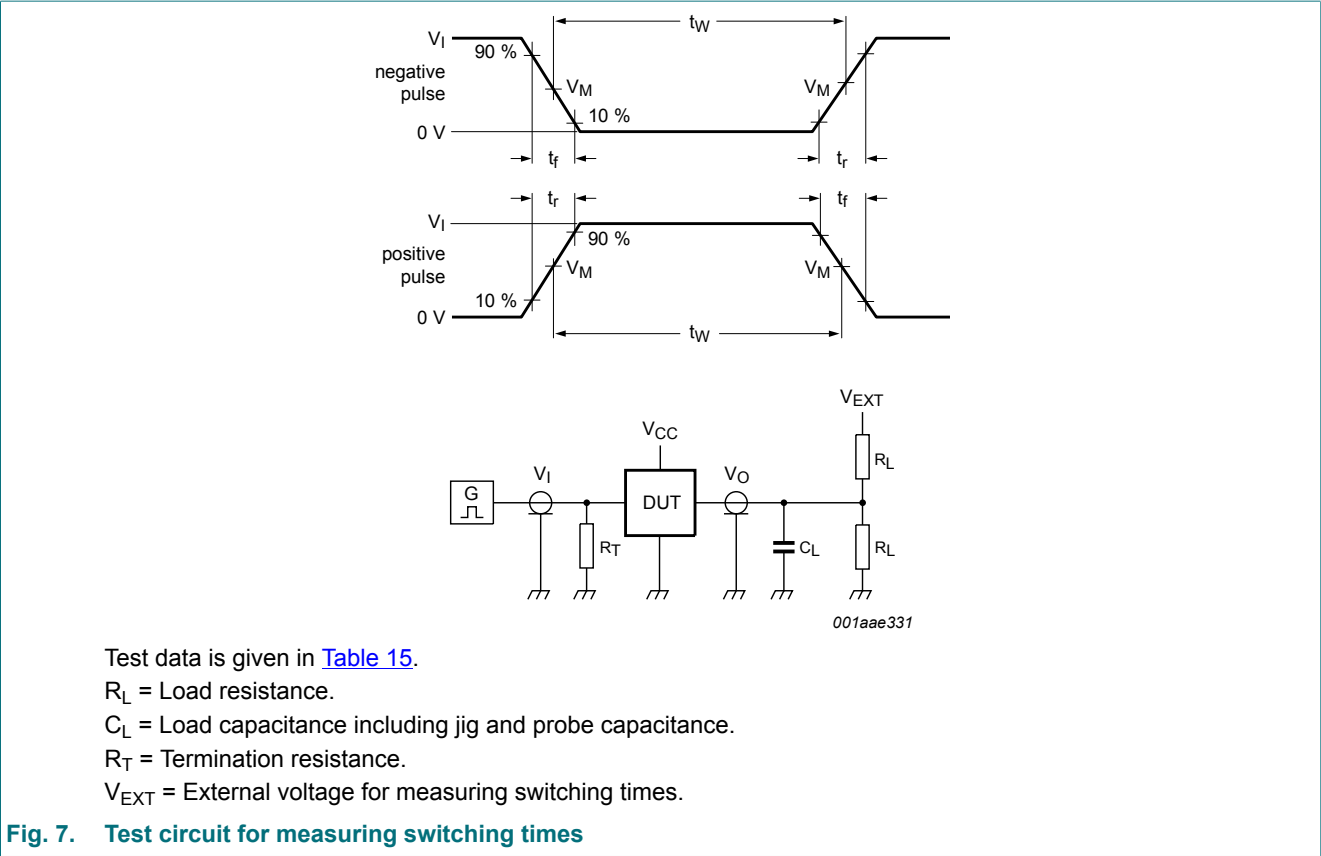


Table 15. Test data

Supply voltage	Input		Load		V_{EXT}		
$V_{CC(A)}, V_{CC(B)}$	V_I [1]	$\Delta t/\Delta V$ [2]	C_L	R_L	t_{PLH}, t_{PHL}	t_{PZH}, t_{PHZ}	t_{PZL}, t_{PLZ} [3]
1.1 V to 1.6 V	V_{CCI}	$\leq 1.0 \text{ ns/V}$	15 pF	2 k Ω	open	GND	$2V_{CCO}$
1.65 V to 2.7 V	V_{CCI}	$\leq 1.0 \text{ ns/V}$	15 pF	2 k Ω	open	GND	$2V_{CCO}$
3.0 V to 3.6 V	V_{CCI}	$\leq 1.0 \text{ ns/V}$	15 pF	2 k Ω	open	GND	$2V_{CCO}$

[1] V_{CCI} is the supply voltage associated with the data input port.

[2] $dV/dt \geq 1.0 \text{ V/ns}$

[3] V_{CCO} is the supply voltage associated with the output port.

12. Application information

12.1. Unidirectional logic level-shifting application

The circuit given in Fig. 8 is an example of the 74AVC1T45-Q100 being used in an unidirectional logic level-shifting application.

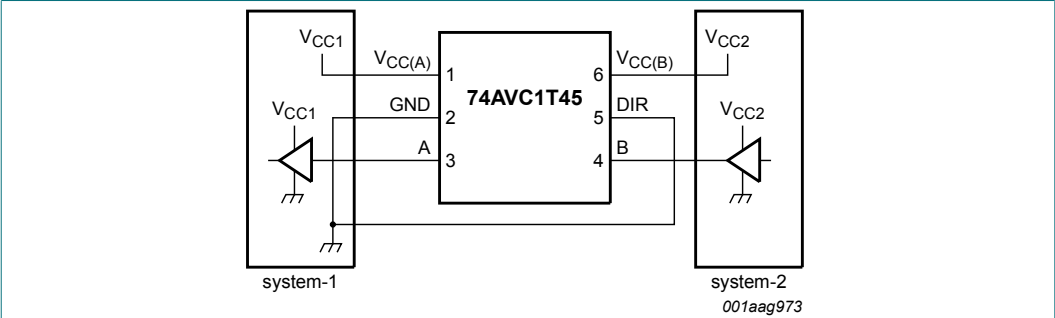


Fig. 8. Unidirectional logic level-shifting application

Table 16. Description unidirectional logic level-shifting application

Pin	Name	Function	Description
1	V _{CC(A)}	V _{CC1}	supply voltage of system-1 (0.8 V to 3.6 V)
2	GND	GND	device GND
3	A	OUT	output level depends on V _{CC1} voltage
4	B	IN	input threshold value depends on V _{CC2} voltage
5	DIR	DIR	the GND (LOW level) determines B port to A port direction
6	V _{CC(B)}	V _{CC2}	supply voltage of system-2 (0.8 V to 3.6 V)

12.2. Bidirectional logic level-shifting application

Fig. 9 shows the 74AVC1T45-Q100 being used in a bidirectional logic level-shifting application. Since the device does not have an output enable pin, the system designer should take precautions to avoid bus contention between system-1 and system-2 when changing directions.

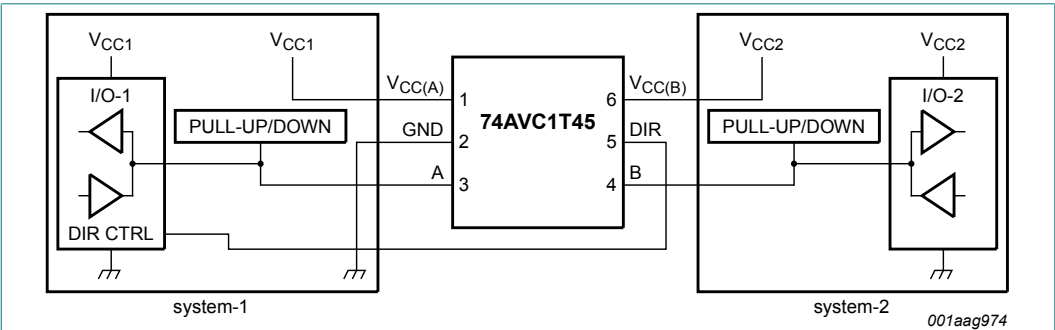


Fig. 9. Bidirectional logic level-shifting application

Table 17 gives a sequence that will illustrate data transmission from system-1 to system-2 and then from system-2 to system-1.

Table 17. Description bidirectional logic level-shifting application

H = HIGH voltage level; L = LOW voltage level; Z = high-impedance OFF-state.

State	DIR CTRL	I/O-1	I/O-2	Description
1	H	output	input	system-1 data to system-2
2	H	Z	Z	system-2 is getting ready to send data to system-1. I/O-1 and I/O-2 are disabled. The bus-line state depends on bus hold.
3	L	Z	Z	DIR bit is set LOW. I/O-1 and I/O-2 still are disabled. The bus-line state depends on bus hold.
4	L	input	output	system-2 data to system-1

12.3. Power-up considerations

The device is designed such that no special power-up sequence is required other than GND being applied first.

Table 18. Typical total supply current ($I_{CC(A)} + I_{CC(B)}$)

$V_{CC(A)}$	$V_{CC(B)}$							Unit
	0 V	0.8 V	1.2 V	1.5 V	1.8 V	2.5 V	3.3 V	
0 V	0	0.1	0.1	0.1	0.1	0.1	0.1	μA
0.8 V	0.1	0.1	0.1	0.1	0.1	0.7	2.3	μA
1.2 V	0.1	0.1	0.1	0.1	0.1	0.3	1.4	μA
1.5 V	0.1	0.1	0.1	0.1	0.1	0.1	0.9	μA
1.8 V	0.1	0.1	0.1	0.1	0.1	0.1	0.5	μA
2.5 V	0.1	0.7	0.3	0.1	0.1	0.1	0.1	μA
3.3 V	0.1	2.3	1.4	0.9	0.5	0.1	0.1	μA

12.4. Enable times

Calculate the enable times for the 74AVC1T45-Q100 using the following formulas:

- $t_{en} \text{ (DIR to A)} = t_{dis} \text{ (DIR to B)} + t_{pd} \text{ (B to A)}$
- $t_{en} \text{ (DIR to B)} = t_{dis} \text{ (DIR to A)} + t_{pd} \text{ (A to B)}$

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 74AVC1T45-Q100 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.

13. Package outline

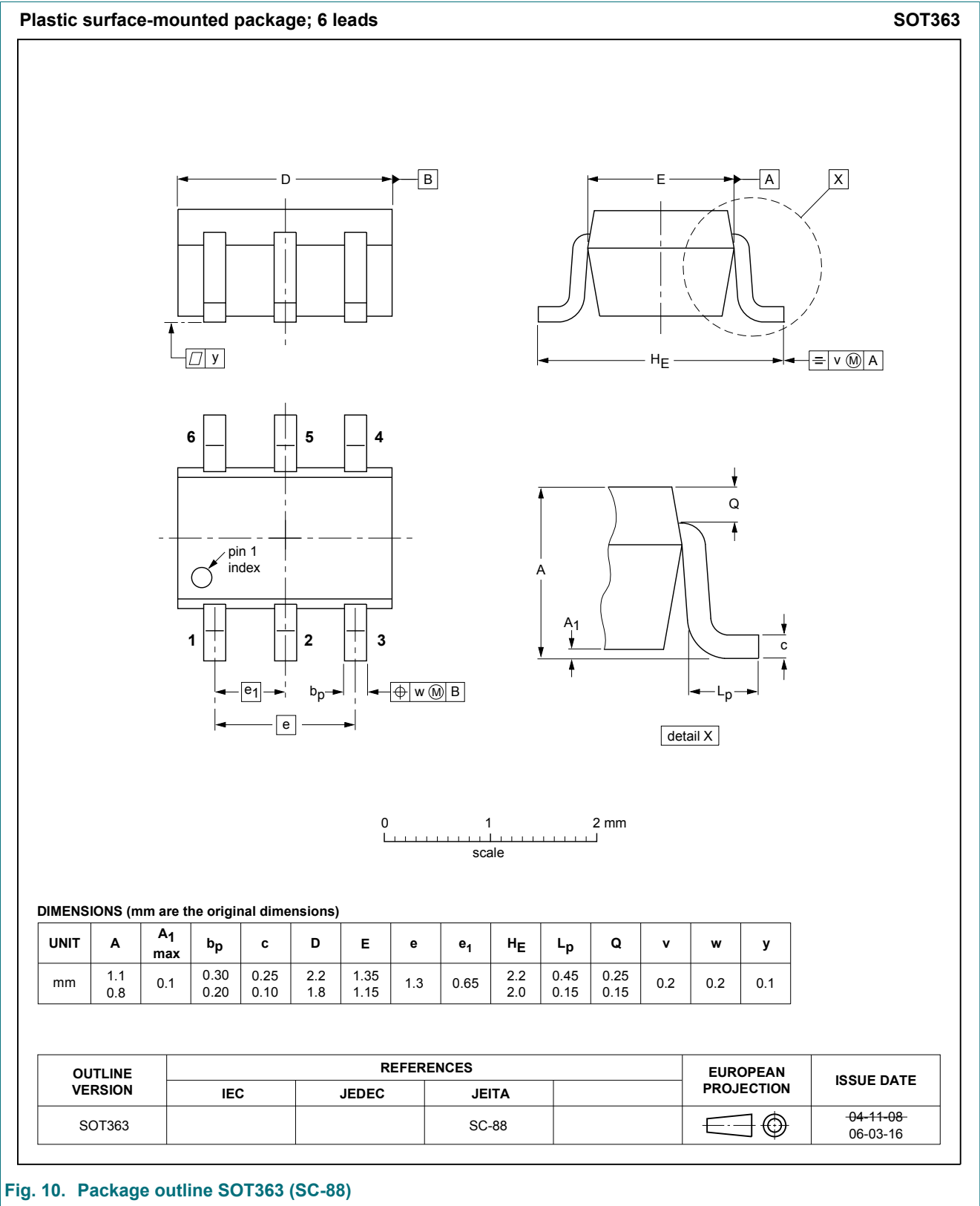
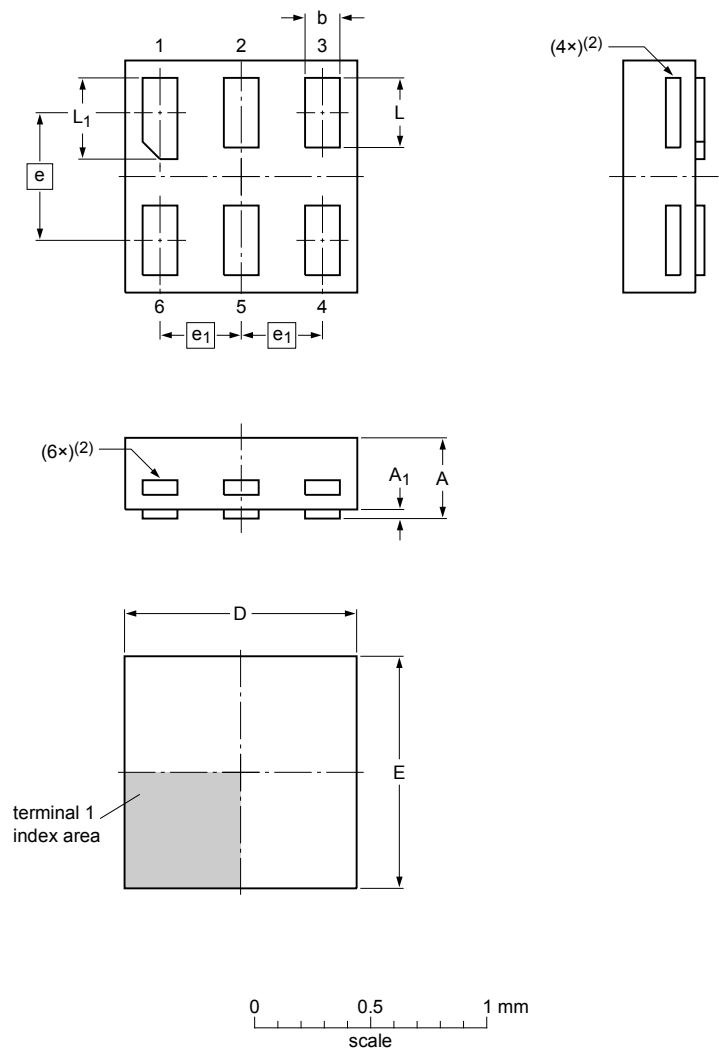


Fig. 10. Package outline SOT363 (SC-88)

XSON6: extremely thin small outline package; no leads;
6 terminals; body 1.0 x 1.0 x 0.35 mm

SOT1202



Dimensions

Unit	A ⁽¹⁾	A ₁	b	D	E	e	e ₁	L	L ₁
mm	max	0.35	0.04	0.20	1.05	1.05		0.35	0.40
	nom			0.15	1.00	1.00	0.55	0.30	0.35
	min			0.12	0.95	0.95		0.27	0.32

- Note
1. Including plating thickness.
 2. Visible depending upon used manufacturing technology.

sot1202_po

Outline version	References				European projection	Issue date
	IEC	JEDEC	JEITA			
SOT1202						10-04-02 10-04-06

Fig. 11. Package outline SOT1202 (XSON6)

14. Abbreviations

Table 19. Abbreviations

Acronym	Description
CDM	Charged Device Model
CMOS	Complementary Metal Oxide Semiconductor
DUT	Device Under Test
ESD	ElectroStatic Discharge
HBM	Human Body Model
MM	Machine Model
MIL	Military

15. Revision history

Table 20. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74AVC1T45_Q100 v.4	20190128	Product data sheet	-	74AVC1T45_Q100 v.3
Modifications:	- The format of this data sheet has been redesigned to comply with the identity guidelines of Nexperia. - Legal texts have been adapted to the new company name where appropriate. - Type number 74AVC1T45GS-Q100 (SOT1202/XSON6) added			
74AVC1T45_Q100 v.3	20160106	Product data sheet	-	74AVC1T45_Q100 v.2
Modifications:	Table 16: Labels for pins 4 and 5 corrected.			
74AVC1T45_Q100 v.2	20130408	Product data sheet	-	74AVC1T45_Q100 v.1
Modifications:	Type number 74AVC1T45GM-Q100 has been removed.			
74AVC1T45_Q100 v.1	20120820	Product data sheet	-	-

16. Legal information

Data sheet status

Document status [1][2]	Product status [3]	Definition
Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
Preliminary [short] data sheet	Qualification	This document contains data from the preliminary specification.
Product [short] data sheet	Production	This document contains the product specification.

- [1] Please consult the most recently issued document before initiating or completing a design.
- [2] The term 'short data sheet' is explained in section "Definitions".
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