

# 74ALVC164245

16-bit dual supply translating transceiver; 3-state

Rev. 02 — 1 June 2004

Product data sheet

## 1. General description

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The 74ALVC164245 is a high-performance, low-power, low-voltage, Si-gate CMOS device, superior to most advanced CMOS compatible TTL families.

The 74ALVC164245 is a 16-bit (dual octal) dual supply translating transceiver featuring non-inverting 3-state bus compatible outputs in both send and receive directions. It is designed to interface between a 3 V and 5 V bus in a mixed 3 V and 5 V supply environment.

This device can be used as two 8-bit transceivers or one 16-bit transceiver.

The direction control inputs (1DIR and 2DIR) determine the direction of the data flow. nDIR (active HIGH) enables data from nA ports to nB ports. nDIR (active LOW) enables data from nB ports to nA ports. The output enable inputs ( $1\overline{OE}$  and  $2\overline{OE}$ ), when HIGH, disable both nA and nB ports by placing them in a high-impedance OFF-state. The nB ports interface with the 5 V bus. The nA ports interface with the 3 V bus.

In suspend mode, when one of the supply voltages is zero, there will be no current flow from the non-zero supply towards the zero supply. The A-outputs must be set 3-state and the voltage on the A-bus must be smaller than  $V_{\text{diode}}$  (typical 0.7 V).  $V_{\text{CCB}} \geq V_{\text{CCA}}$  (except in suspend mode).

## 2. Features

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- 5 V tolerant inputs/outputs for interfacing with 5 V logic
- Wide supply voltage range:
  - ◆ 3 V port ( $V_{\text{CCA}}$ ): 1.5 V to 3.6 V
  - ◆ 5 V port ( $V_{\text{CCB}}$ ): 1.5 V to 5.5 V.
- CMOS low power consumption
- Direct interface with TTL levels
- Control inputs voltage range from 2.7 V to 5.5 V
- Inputs accept voltages up to 5.5 V
- High-impedance outputs when  $V_{\text{CCA}}$  or  $V_{\text{CCB}} = 0$  V
- Complies with JEDEC standard JESD8-B/JESD36
- ESD protection:
  - ◆ HBM EIA/JESD22-A114-B exceeds 2000 V
  - ◆ MM EIA/JESD22-A115-A exceeds 200 V.
- Specified from  $-40$  °C to  $+85$  °C and  $-40$  °C to  $+125$  °C.

### 3. Quick reference data

**Table 1: Quick reference data**
 $GND = 0\text{ V}; T_{amb} = 25\text{ }^{\circ}\text{C}; t_r = t_f \leq 2.5\text{ ns}$ 

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$t_{PHL}, t_{PLH}$	propagation delay nAn to nBn	$C_L = 50\text{ pF};$ $V_{CCB} = 4.5\text{ V to }5.5\text{ V};$ $V_{CCA} = 3.0\text{ V to }3.6\text{ V}$	-	2.9	-	ns
	propagation delay nBn to nAn	$C_L = 50\text{ pF};$ $V_{CCB} = 4.5\text{ V to }5.5\text{ V};$ $V_{CCA} = 3.0\text{ V to }3.6\text{ V}$	-	2.5	-	ns
	propagation delay nAn to nBn	$C_L = 50\text{ pF};$ $V_{CCB} = 3.0\text{ V to }3.6\text{ V};$ $V_{CCA} = 2.3\text{ V to }2.7\text{ V}$	-	3.3	-	ns
	propagation delay nBn to nAn	$C_L = 50\text{ pF};$ $V_{CCB} = 3.0\text{ V to }3.6\text{ V};$ $V_{CCA} = 2.3\text{ V to }2.7\text{ V}$	-	3.0	-	ns
$C_I$	input capacitance		-	4.0	-	pF
$C_{I/O}$	input/output capacitance A and B port		-	5.0	-	pF
$C_{PD}$	power dissipation capacitance 5 V port: nAn to nBn	$V_{CCB} = 5\text{ V}; V_{CCA} = 3.3\text{ V}$ [1] [2]				
		outputs enabled	-	30	-	pF
		outputs disabled	-	15	-	pF
	power dissipation capacitance 3 V port: nBn to nA	$V_{CCB} = 5\text{ V}; V_{CCA} = 3.3\text{ V}$ [1] [2]				
outputs enabled		-	40	-	pF	
	outputs disabled	-	5	-	pF	

[1]  $C_{PD}$  is used to determine the dynamic power dissipation ( $P_D$  in  $\mu\text{W}$ ).

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

$f_i$  = input frequency in MHz;

$f_o$  = output frequency in MHz;

$C_L$  = output load capacitance in pF;

$V_{CC}$  = supply voltage in Volts;

$N$  = total load switching outputs;

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

[2] The condition is  $V_I = GND$  to  $V_{CC}$ .

### 4. Ordering information

**Table 2: Ordering information**

Type number	Temperature range	Package		
		Name	Description	Version
74ALVC164245DGG	-40 °C to +125 °C	TSSOP48	plastic thin shrink small outline package; 48 leads; body width 6.1 mm	SOT362-1
74ALVC164245DL	-40 °C to +125 °C	SSOP48	plastic shrink small outline package; 48 leads; body width 7.5 mm	SOT370-1

5. Functional diagram

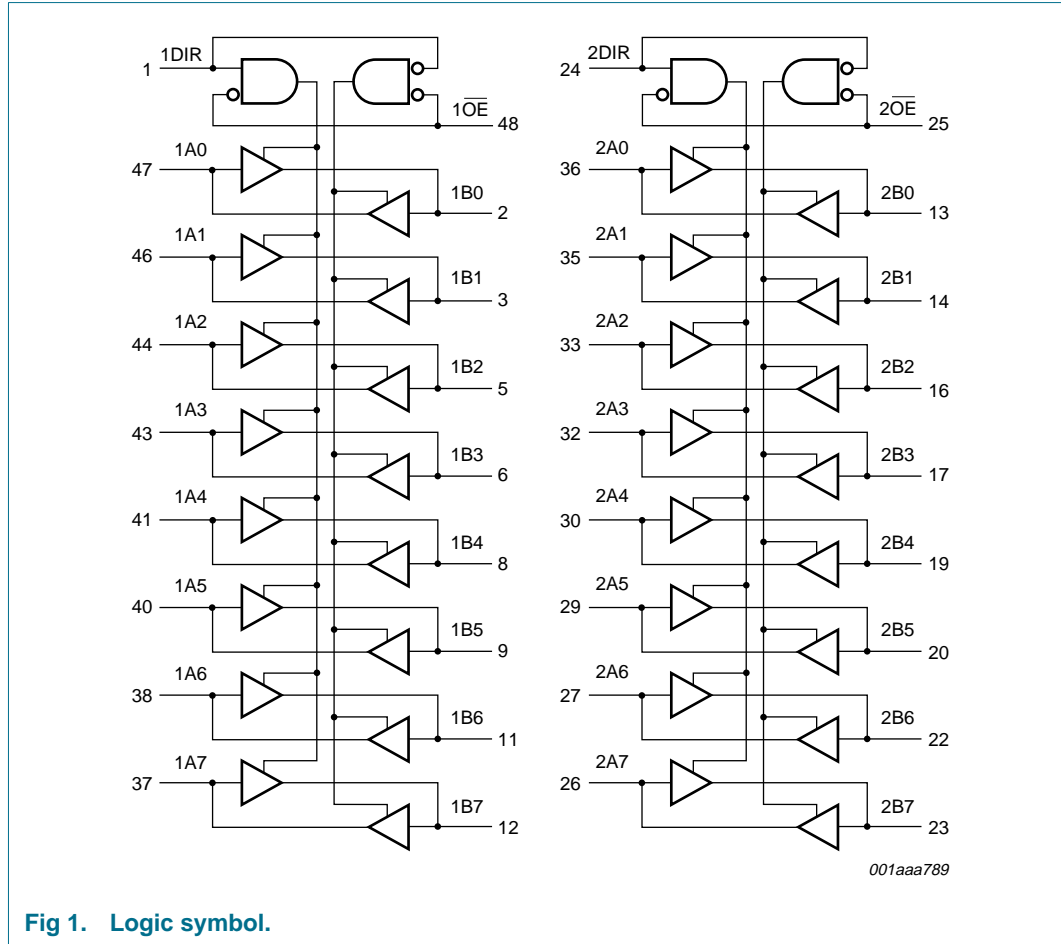


Fig 1. Logic symbol.

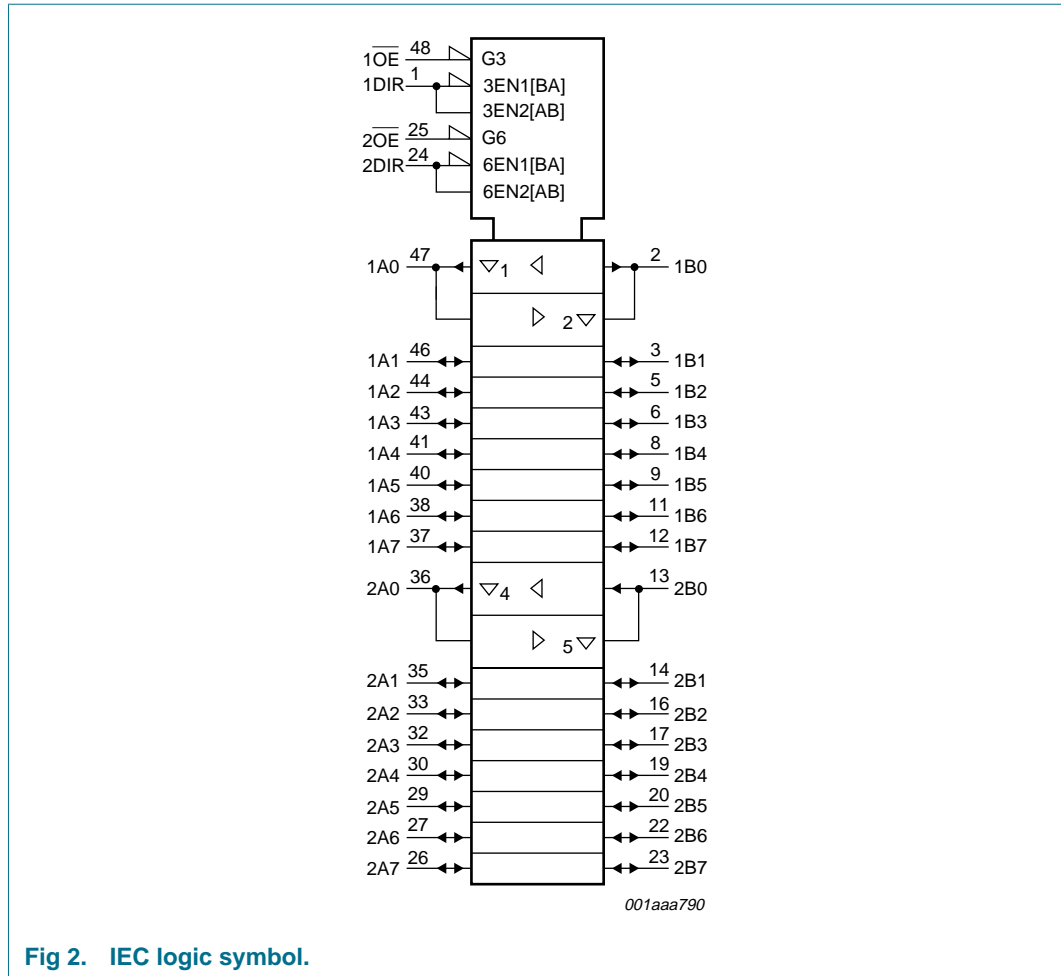


Fig 2. IEC logic symbol.

## 6. Pinning information

### 6.1 Pinning

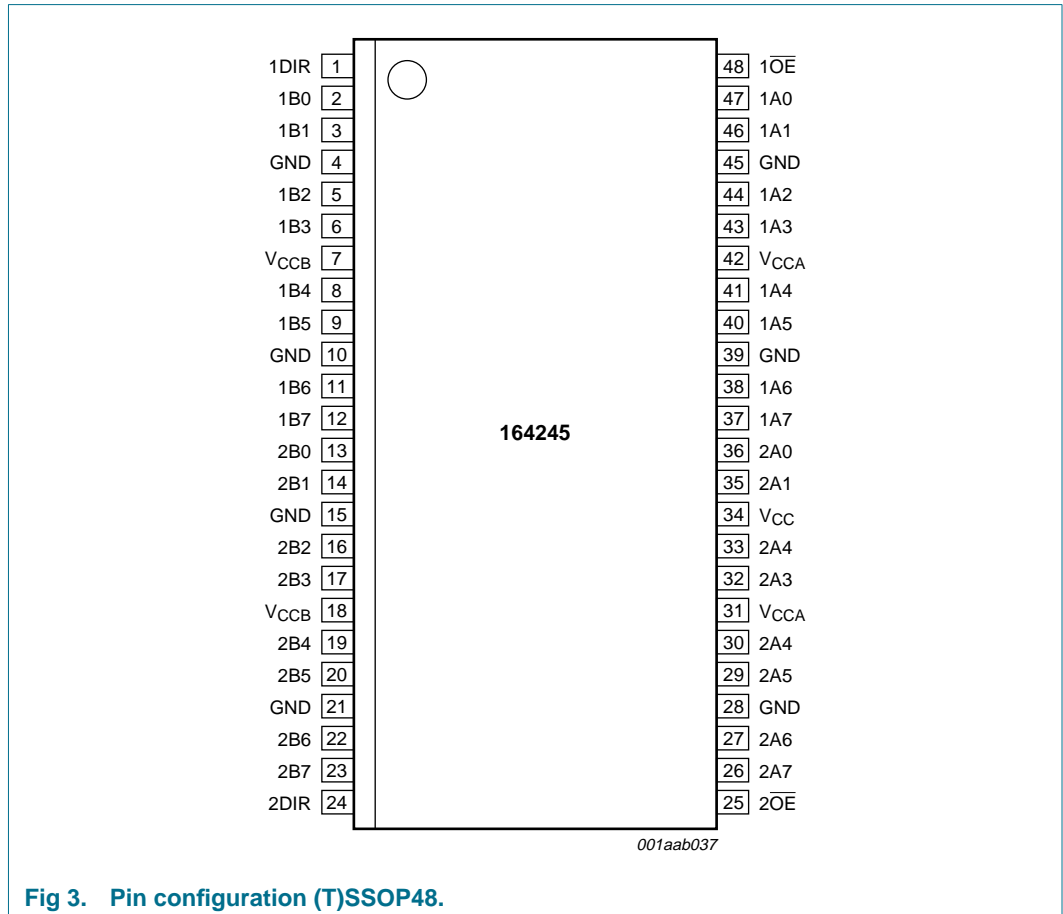


Fig 3. Pin configuration (T)SSOP48.

### 6.2 Pin description

Table 3: Pin description

Symbol	Pin	Description
1DIR	1	direction control input
1B0	2	data input/output
1B1	3	data input/output
GND	4, 10, 15, 21, 28, 34, 39, 45	ground (0 V)
1B2	5	data input/output
1B3	6	data input/output
V <sub>CCB</sub>	7, 18	supply voltage (5 V bus)
1B4	8	data input/output
1B5	9	data input/output
1B6	11	data input/output
1B7	12	data input/output

Table 3: Pin description ...continued

Symbol	Pin	Description
2B0	13	data input/output
2B1	14	data input/output
2B2	16	data input/output
2B3	17	data input/output
2B4	19	data input/output
2B5	20	data input/output
2B6	22	data input/output
2B7	23	data input/output
2DIR	24	direction control input
$2\overline{OE}$	25	output enable input (active LOW)
2A7	26	data input/output
2A6	27	data input/output
2A5	29	data input/output
2A4	30	data input/output
$V_{CCA}$	31, 42	supply voltage (3 V bus)
2A3	32	data input/output
2A2	33	data input/output
2A1	35	data input/output
2A0	36	data input/output
1A7	37	data input/output
1A6	38	data input/output
1A5	40	data input/output
1A4	41	data input/output
1A3	43	data input/output
1A2	44	data input/output
1A1	46	data input/output
1A0	47	data input/output
$1\overline{OE}$	48	output enable input (active LOW)
n.c.	-	not connected

## 7. Functional description

### 7.1 Function table

Table 4: Function table <sup>[1]</sup>

Inputs		Outputs	
nOE	nDIR	nAn	nBn
L	L	A = B	inputs
L	H	inputs	B = A
H	X	Z	Z

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

## 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). See [Table note 1](#).

Symbol	Parameter	Conditions	Min	Max	Unit
$V_{CCB}$	supply voltage B port	$V_{CCB} \geq V_{CCA}$	-0.5	+6.0	V
$V_{CCA}$	supply voltage A port	$V_{CCB} \geq V_{CCA}$	-0.5	+4.6	V
$I_{IK}$	input diode current	$V_I < 0$ V	-	-50	mA
$V_I$	input voltage		<sup>[2]</sup> -0.5	+6.0	V
$V_{I/O}$	input voltage range for I/Os		-0.5	$V_{CC} + 0.5$	V
$I_{OK}$	output diode current	$V_O > V_{CC}$ or $V_O < 0$ V	-	$\pm 50$	mA
$V_O$	output voltage	output HIGH or LOW state	<sup>[2]</sup> -0.5	$V_{CC} + 0.5$	V
		output 3-state	<sup>[2]</sup> -0.5	+6.0	V
$I_O$	output source or sink current	$V_O = 0$ V to $V_{CC}$	-	$\pm 50$	mA
$I_{CC}, I_{GND}$	$V_{CC}$ or GND current		-	$\pm 100$	mA
$T_{stg}$	storage temperature		-65	+150	°C
$P_{tot}$	power dissipation				
	SSOP and TSSOP package	$T_{amb} = -40$ °C to +125 °C	<sup>[3]</sup> -	500	mW

- [1] The performance capability of a high-performance integrated circuit in conjunction with its thermal environment can create junction temperatures which are detrimental to reliability. The maximum junction temperature of this integrated circuit should not exceed 150 °C.
- [2] The input and output voltage ratings may be exceeded if the input and output current ratings are observed.
- [3] For (T)SSOP48 packages: above 60 °C the value of  $P_{tot}$  derates linearly with 5.5 mW/K.

## 9. Recommended operating conditions

**Table 6: Recommended operating conditions**

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{CCB}$	supply voltage B port	$V_{CCB} \geq V_{CCA}$				
		maximum speed performance	2.7	-	5.5	V
		low-voltage applications	1.5	-	5.5	V
$V_{CCA}$	supply voltage A port	$V_{CCB} \geq V_{CCA}$				
		maximum speed performance	2.7	-	3.6	V
		low-voltage applications	1.5	-	3.6	V
$V_I$	input voltage control inputs		0	-	5.5	V
$V_{I/O}$	input voltage					
	A port		0	-	$V_{CCA}$	V
	B port		0	-	$V_{CCB}$	V
$V_O$	output voltage					
	A port		0	-	$V_{CCA}$	V
	B port		0	-	$V_{CCB}$	V
$T_{amb}$	operating ambient temperature		-40	-	+125	°C
$t_r, t_f$	input rise and fall times	$V_{CCA} = 2.7\text{ V to }3.0\text{ V}$	0	-	20	ns/V
		$V_{CCA} = 3.0\text{ V to }3.6\text{ V}$	0	-	10	ns/V
		$V_{CCB} = 3.0\text{ V to }4.5\text{ V}$	0	-	20	ns/V
		$V_{CCB} = 4.5\text{ V to }5.5\text{ V}$	0	-	10	ns/V

## 10. Static characteristics

**Table 7: Static characteristics**

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$T_{amb} = -40\text{ °C to }+85\text{ °C}$ [1]						
$V_{IH}$	HIGH-level input voltage					
	B port	$V_{CCB} = 3.0\text{ V to }5.5\text{ V}$	[2] 2.0	-	-	V
	A port	$V_{CCA} = 3.0\text{ V to }3.6\text{ V}$	2.0	-	-	V
		$V_{CCA} = 2.3\text{ V to }2.7\text{ V}$	[2] 1.7	-	-	V
$V_{IL}$	LOW-level input voltage					
	B port	$V_{CCB} = 4.5\text{ V to }5.5\text{ V}$	[2] -	-	0.8	V
		$V_{CCB} = 3.0\text{ V to }3.6\text{ V}$	[2] -	-	0.7	V
	A port	$V_{CCA} = 3.0\text{ V to }3.6\text{ V}$	-	-	0.8	V
$V_{CCA} = 2.3\text{ V to }2.7\text{ V}$		[2] -	-	0.7	V	



**Table 7: Static characteristics ...continued**

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit					
V <sub>OH</sub>	HIGH-level output voltage	B port	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>								
							I <sub>O</sub> = -24 mA; V <sub>CCB</sub> = 4.5 V	V <sub>CCB</sub> - 0.8	-	-	V
			I <sub>O</sub> = -12 mA; V <sub>CCB</sub> = 4.5 V	V <sub>CCB</sub> - 0.5	-	-	V				
			I <sub>O</sub> = -18 mA; V <sub>CCB</sub> = 3.0 V	V <sub>CCB</sub> - 0.8	-	-	V				
			I <sub>O</sub> = -100 μA; V <sub>CCB</sub> = 3.0 V	V <sub>CCB</sub> - 0.2	V <sub>CCB</sub>	-	V				
		A port	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>								
	I <sub>O</sub> = -24 mA; V <sub>CCA</sub> = 3.0 V							V <sub>CCA</sub> - 0.7	-	-	V
	I <sub>O</sub> = -100 μA; V <sub>CCA</sub> = 3.0 V							V <sub>CCA</sub> - 0.2	-	-	V
	I <sub>O</sub> = -12 mA; V <sub>CCA</sub> = 2.7 V							V <sub>CCA</sub> - 0.5	-	-	V
	I <sub>O</sub> = -8 mA; V <sub>CCA</sub> = 2.3 V							V <sub>CCA</sub> - 0.6	-	-	V
	I <sub>O</sub> = -100 μA; V <sub>CCA</sub> = 2.3 V							V <sub>CCA</sub> - 0.2	V <sub>CCA</sub>	-	V
	V <sub>OL</sub>	LOW-level output voltage	B port	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>							
I <sub>O</sub> = 24 mA; V <sub>CCB</sub> = 4.5 V								-	-	0.55	V
			I <sub>O</sub> = 12 mA; V <sub>CCB</sub> = 4.5 V	-	-	0.40	V				
			I <sub>O</sub> = 100 μA; V <sub>CCB</sub> = 4.5 V	-	-	0.20	V				
			I <sub>O</sub> = 18 mA; V <sub>CCB</sub> = 3.0 V	-	-	0.55	V				
			I <sub>O</sub> = 100 μA; V <sub>CCB</sub> = 3.0 V	-	-	0.20	V				
		A port	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>								
I <sub>O</sub> = 24 mA; V <sub>CCA</sub> = 3.0 V								-	-	0.55	V
I <sub>O</sub> = 100 μA; V <sub>CCA</sub> = 3.0 V								-	-	0.20	V
I <sub>O</sub> = 12 mA; V <sub>CCA</sub> = 2.7 V								-	-	0.40	V
I <sub>O</sub> = 12 mA; V <sub>CCA</sub> = 2.3 V								-	-	0.60	V
I <sub>O</sub> = 100 μA; V <sub>CCA</sub> = 2.3 V								-	-	0.20	V
I <sub>LI</sub>		input leakage current	V <sub>I</sub> = 5.5 V or GND	-	±0.1	±5	μA				
I <sub>OZ</sub>		3-state output OFF-state current	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; V <sub>O</sub> = V <sub>CC</sub> or GND	[3]	±0.1	±10	μA				
I <sub>CC</sub>	quiescent supply current	V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0 A	-	0.1	40	μA					
ΔI <sub>CC</sub>	additional quiescent supply current per control pin	V <sub>I</sub> = V <sub>CC</sub> - 0.6 V; I <sub>O</sub> = 0 A	[4]	5	500	μA					
C <sub>I</sub>	input capacitance		-	4.0	-	pF					
C <sub>I/O</sub>	input/output capacitance A and B port		-	5.0	-	pF					
<b>T<sub>amb</sub> = -40 °C to +125 °C</b>											
V <sub>IH</sub>	HIGH-level input voltage	B port	V <sub>CCB</sub> = 3.0 V to 5.5 V	[2]	2.0	-	V				
		A port	V <sub>CCA</sub> = 3.0 V to 3.6 V		2.0	-	V				
			V <sub>CCA</sub> = 2.3 V to 2.7 V	[2]	1.7	-	V				

**Table 7: Static characteristics ...continued**

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit	
V <sub>IL</sub>	LOW-level input voltage	B port	V <sub>CCB</sub> = 4.5 V to 5.5 V	[2] -	-	0.8	V
			V <sub>CCB</sub> = 3.0 V to 3.6 V	[2] -	-	0.7	V
	A port		V <sub>CCA</sub> = 3.0 V to 3.6 V	-	-	0.8	V
			V <sub>CCA</sub> = 2.3 V to 2.7 V	[2] -	-	0.7	V
V <sub>OH</sub>	HIGH-level output voltage	B port	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>				
			I <sub>O</sub> = -24 mA; V <sub>CCB</sub> = 4.5 V	V <sub>CCB</sub> - 1.2	-	-	V
	I <sub>O</sub> = -12 mA; V <sub>CCB</sub> = 4.5 V		V <sub>CCB</sub> - 0.8	-	-	V	
	I <sub>O</sub> = -18 mA; V <sub>CCB</sub> = 3.0 V		V <sub>CCB</sub> - 1.0	-	-	V	
	I <sub>O</sub> = -100 μA; V <sub>CCB</sub> = 3.0 V		V <sub>CCB</sub> - 0.3 V <sub>CCB</sub>	-	-	V	
	A port	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>					
		I <sub>O</sub> = -24 mA; V <sub>CCA</sub> = 3.0 V	V <sub>CCA</sub> - 1.0	-	-	V	
		I <sub>O</sub> = -100 μA; V <sub>CCA</sub> = 3.0 V	V <sub>CCA</sub> - 0.3	-	-	V	
		I <sub>O</sub> = -12 mA; V <sub>CCA</sub> = 2.7 V	V <sub>CCA</sub> - 0.8	-	-	V	
		I <sub>O</sub> = -8 mA; V <sub>CCA</sub> = 2.3 V	V <sub>CCA</sub> - 0.6	-	-	V	
		I <sub>O</sub> = -100 μA; V <sub>CCA</sub> = 2.3 V	V <sub>CCA</sub> - 0.3 V <sub>CCA</sub>	-	-	V	
V <sub>OL</sub>	LOW-level output voltage	B port	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>				
			I <sub>O</sub> = 24 mA; V <sub>CCB</sub> = 4.5 V	-	-	0.60	V
	I <sub>O</sub> = 12 mA; V <sub>CCB</sub> = 4.5 V		-	-	0.80	V	
	I <sub>O</sub> = 100 μA; V <sub>CCB</sub> = 4.5 V		-	-	0.30	V	
	I <sub>O</sub> = 18 mA; V <sub>CCB</sub> = 3.0 V		-	-	0.80	V	
	I <sub>O</sub> = 100 μA; V <sub>CCB</sub> = 3.0 V	-	-	0.30	V		
	A port	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>					
		I <sub>O</sub> = 24 mA; V <sub>CCA</sub> = 3.0 V	-	-	0.80	V	
		I <sub>O</sub> = 100 μA; V <sub>CCA</sub> = 3.0 V	-	-	0.30	V	
		I <sub>O</sub> = 12 mA; V <sub>CCA</sub> = 2.7 V	-	-	0.60	V	
		I <sub>O</sub> = 12 mA; V <sub>CCA</sub> = 2.3 V	-	-	0.60	V	
		I <sub>O</sub> = 100 μA; V <sub>CCA</sub> = 2.3 V	-	-	0.20	V	
I <sub>LI</sub>	input leakage current	V <sub>I</sub> = 5.5 V or GND	-	±0.1	±10	μA	
I <sub>OZ</sub>	3-state output OFF-state current	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; V <sub>O</sub> = V <sub>CC</sub> or GND	[3] -	±0.1	±20	μA	
I <sub>CC</sub>	quiescent supply current	V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0 A	-	0.1	80	μA	
ΔI <sub>CC</sub>	additional quiescent supply current per control pin	V <sub>I</sub> = V <sub>CC</sub> - 0.6 V; I <sub>O</sub> = 0 A	[4] -	5	5000	μA	

[1] All typical values are measured at V<sub>CCB</sub> = 5.0 V, V<sub>CCA</sub> = 3.3 V and T<sub>amb</sub> = 25 °C.

[2] If V<sub>CCA</sub> < 2.7 V, the switching levels at all inputs are not TTL compatible.

[3] For transceivers, the parameter I<sub>OZ</sub> includes the input leakage current.

[4] V<sub>CCA</sub> = 2.7 V to 3.6 V: other inputs at V<sub>CCA</sub> or GND; V<sub>CCB</sub> = 4.5 V to 5.5 V: other inputs at V<sub>CCB</sub> or GND.

## 11. Dynamic characteristics

**Table 8: Dynamic characteristics**
*GND = 0 V;  $t_r = t_f \leq 2.5$  ns;  $C_L = 50$  pF; see [Figure 6](#).*

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b><math>T_{amb} = -40</math> °C to <math>+85</math> °C [1]</b>						
$t_{PHL}$ , $t_{PLH}$	propagation delay nAn to nBn	see <a href="#">Figure 4</a>				
		$V_{CCA} = 2.3$ V to $2.7$ V; $V_{CCB} = 3.0$ V tot $3.6$ V	1.5	3.3	7.6	ns
		$V_{CCA} = 2.7$ V; $V_{CCB} = 4.5$ V to $5.5$ V	1.0	3.0	5.9	ns
		$V_{CCA} = 3.0$ V to $3.6$ V; $V_{CCB} = 4.5$ V to $5.5$ V	1.0	2.9	5.8	ns
	propagation delay nBn to nAn	see <a href="#">Figure 4</a>				
		$V_{CCA} = 2.3$ V to $2.7$ V; $V_{CCB} = 3.0$ V tot $3.6$ V	1.0	3.0	7.6	ns
$V_{CCA} = 2.7$ V; $V_{CCB} = 4.5$ V to $5.5$ V		1.0	4.3	6.7	ns	
	$V_{CCA} = 3.0$ V to $3.6$ V; $V_{CCB} = 4.5$ V to $5.5$ V	1.2	2.5	5.8	ns	
$t_{PZH}$ , $t_{PZL}$	3-state output enable time nOE to nBn	see <a href="#">Figure 5</a>				
		$V_{CCA} = 2.3$ V to $2.7$ V; $V_{CCB} = 3.0$ V tot $3.6$ V	1.5	4.1	11.5	ns
		$V_{CCA} = 2.7$ V; $V_{CCB} = 4.5$ V to $5.5$ V	1.5	3.6	9.2	ns
		$V_{CCA} = 3.0$ V to $3.6$ V; $V_{CCB} = 4.5$ V to $5.5$ V	1.0	3.2	8.9	ns
	3-state output enable time nOE to nAn	see <a href="#">Figure 5</a>				
		$V_{CCA} = 2.3$ V to $2.7$ V; $V_{CCB} = 3.0$ V tot $3.6$ V	1.5	4.6	12.3	ns
$V_{CCA} = 2.7$ V; $V_{CCB} = 4.5$ V to $5.5$ V		1.5	4.3	9.3	ns	
	$V_{CCA} = 3.0$ V to $3.6$ V; $V_{CCB} = 4.5$ V to $5.5$ V	1.0	3.2	8.9	ns	
$t_{PHZ}$ , $t_{PLZ}$	3-state output disable time nOE to nBn	see <a href="#">Figure 5</a>				
		$V_{CCA} = 2.3$ V to $2.7$ V; $V_{CCB} = 3.0$ V tot $3.6$ V	2.0	2.7	10.5	ns
		$V_{CCA} = 2.7$ V; $V_{CCB} = 4.5$ V to $5.5$ V	2.5	4.6	9.0	ns
		$V_{CCA} = 3.0$ V to $3.6$ V; $V_{CCB} = 4.5$ V to $5.5$ V	2.1	4.9	8.6	ns
	3-state output disable time nOE to nAn	see <a href="#">Figure 5</a>				
		$V_{CCA} = 2.3$ V to $2.7$ V; $V_{CCB} = 3.0$ V tot $3.6$ V	1.0	2.7	9.3	ns
$V_{CCA} = 2.7$ V; $V_{CCB} = 4.5$ V to $5.5$ V		1.5	3.5	9.0	ns	
	$V_{CCA} = 3.0$ V to $3.6$ V; $V_{CCB} = 4.5$ V to $5.5$ V	2.0	3.2	8.6	ns	
$C_{PD}$	power dissipation capacitance 5 V port: nAn to nBn	$V_{CCB} = 5$ V; $V_{CCA} = 3.3$ V	[2] [3]			
		outputs enabled	-	30	-	pF
		outputs disabled	-	15	-	pF
	power dissipation capacitance 3 V port: nBn to nA	$V_{CCB} = 5$ V; $V_{CCA} = 3.3$ V	[2] [3]			
outputs enabled		-	40	-	pF	
	outputs disabled	-	5	-	pF	

**Table 8: Dynamic characteristics ...continued**  
 $GND = 0\text{ V}$ ;  $t_r = t_f \leq 2.5\text{ ns}$ ;  $C_L = 50\text{ pF}$ ; see [Figure 6](#).

Symbol	Parameter	Conditions	Min	Typ	Max	Unit	
<b><math>T_{\text{amb}} = -40\text{ °C to }+125\text{ °C}</math></b>							
$t_{\text{PHL}}, t_{\text{PLH}}$	propagation delay nAn to nBn	see <a href="#">Figure 4</a>					
		$V_{\text{CCA}} = 2.3\text{ V to }2.7\text{ V}$ ; $V_{\text{CCB}} = 3.0\text{ V tot }3.6\text{ V}$	1.5	-	9.5	ns	
		$V_{\text{CCA}} = 2.7\text{ V}$ ; $V_{\text{CCB}} = 4.5\text{ V to }5.5\text{ V}$	1.0	-	7.5	ns	
		$V_{\text{CCA}} = 3.0\text{ V to }3.6\text{ V}$ ; $V_{\text{CCB}} = 4.5\text{ V to }5.5\text{ V}$	1.0	-	7.5	ns	
	propagation delay nBn to nAn	see <a href="#">Figure 4</a>					
		$V_{\text{CCA}} = 2.3\text{ V to }2.7\text{ V}$ ; $V_{\text{CCB}} = 3.0\text{ V tot }3.6\text{ V}$	1.0	-	9.5	ns	
$V_{\text{CCA}} = 2.7\text{ V}$ ; $V_{\text{CCB}} = 4.5\text{ V to }5.5\text{ V}$		1.0	-	8.5	ns		
	$V_{\text{CCA}} = 3.0\text{ V to }3.6\text{ V}$ ; $V_{\text{CCB}} = 4.5\text{ V to }5.5\text{ V}$	1.2	-	7.5	ns		
$t_{\text{PZH}}, t_{\text{PZL}}$	3-state output enable time $n\overline{\text{OE}}$ to nBn	see <a href="#">Figure 5</a>					
		$V_{\text{CCA}} = 2.3\text{ V to }2.7\text{ V}$ ; $V_{\text{CCB}} = 3.0\text{ V tot }3.6\text{ V}$	1.5	-	14.5	ns	
		$V_{\text{CCA}} = 2.7\text{ V}$ ; $V_{\text{CCB}} = 4.5\text{ V to }5.5\text{ V}$	1.5	-	11.5	ns	
		$V_{\text{CCA}} = 3.0\text{ V to }3.6\text{ V}$ ; $V_{\text{CCB}} = 4.5\text{ V to }5.5\text{ V}$	1.0	-	12.0	ns	
	3-state output enable time $n\overline{\text{OE}}$ to nAn	see <a href="#">Figure 5</a>					
		$V_{\text{CCA}} = 2.3\text{ V to }2.7\text{ V}$ ; $V_{\text{CCB}} = 3.0\text{ V tot }3.6\text{ V}$	1.5	-	15.5	ns	
$V_{\text{CCA}} = 2.7\text{ V}$ ; $V_{\text{CCB}} = 4.5\text{ V to }5.5\text{ V}$		1.5	-	12.0	ns		
	$V_{\text{CCA}} = 3.0\text{ V to }3.6\text{ V}$ ; $V_{\text{CCB}} = 4.5\text{ V to }5.5\text{ V}$	1.0	-	11.5	ns		
$t_{\text{PHZ}}, t_{\text{PLZ}}$	3-state output disable time $n\overline{\text{OE}}$ to nBn	see <a href="#">Figure 5</a>					
		$V_{\text{CCA}} = 2.3\text{ V to }2.7\text{ V}$ ; $V_{\text{CCB}} = 3.0\text{ V tot }3.6\text{ V}$	2.0	-	13.5	ns	
		$V_{\text{CCA}} = 2.7\text{ V}$ ; $V_{\text{CCB}} = 4.5\text{ V to }5.5\text{ V}$	2.5	-	11.5	ns	
		$V_{\text{CCA}} = 3.0\text{ V to }3.6\text{ V}$ ; $V_{\text{CCB}} = 4.5\text{ V to }5.5\text{ V}$	2.1	-	11.0	ns	
	3-state output disable time $n\overline{\text{OE}}$ to nAn	see <a href="#">Figure 5</a>					
		$V_{\text{CCA}} = 2.3\text{ V to }2.7\text{ V}$ ; $V_{\text{CCB}} = 3.0\text{ V tot }3.6\text{ V}$	1.0	-	12.0	ns	
$V_{\text{CCA}} = 2.7\text{ V}$ ; $V_{\text{CCB}} = 4.5\text{ V to }5.5\text{ V}$		1.5	-	11.5	ns		
	$V_{\text{CCA}} = 3.0\text{ V to }3.6\text{ V}$ ; $V_{\text{CCB}} = 4.5\text{ V to }5.5\text{ V}$	2.0	-	11.0	ns		

[1] All typical values are measured at nominal voltage for  $V_{\text{CCB}}$  and  $V_{\text{CCA}}$  and at  $T_{\text{amb}} = 25\text{ °C}$ .

[2]  $C_{\text{PD}}$  is used to determine the dynamic power dissipation ( $P_{\text{D}}$  in  $\mu\text{W}$ ).

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

$f_i$  = input frequency in MHz;

$f_o$  = output frequency in MHz;

$C_L$  = output load capacitance in pF;

$V_{\text{CC}}$  = supply voltage in Volts;

$N$  = total load switching outputs;

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

[3] The condition is  $V_i = GND$  to  $V_{\text{CC}}$ .

12. AC waveforms

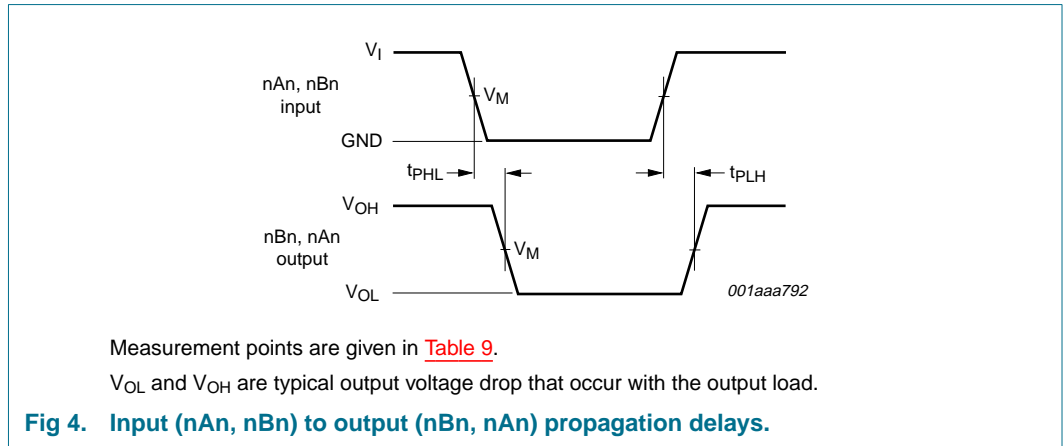


Table 9: Measurement points

Direction	Supply voltage		Input		Output
	$V_{CCA}$	$V_{CCB}$	$V_I$	$V_M$	$V_M$
A port to B port	2.3 V to 2.7 V	2.7 V to 3.6 V	$V_{CCA}$	$0.5 \times V_{CCA}$	1.5 V
B port to A port	2.3 V to 2.7 V	2.7 V to 3.6 V	2.7 V	1.5 V	$0.5 \times V_{CCA}$
A port to B port	2.7 V to 3.6 V	4.5 V to 5.5 V	2.7 V	1.5 V	$0.5 \times V_{CCB}$
B port to A port	2.7 V to 3.6 V	4.5 V to 5.5 V	3.0 V	1.5 V	1.5 V

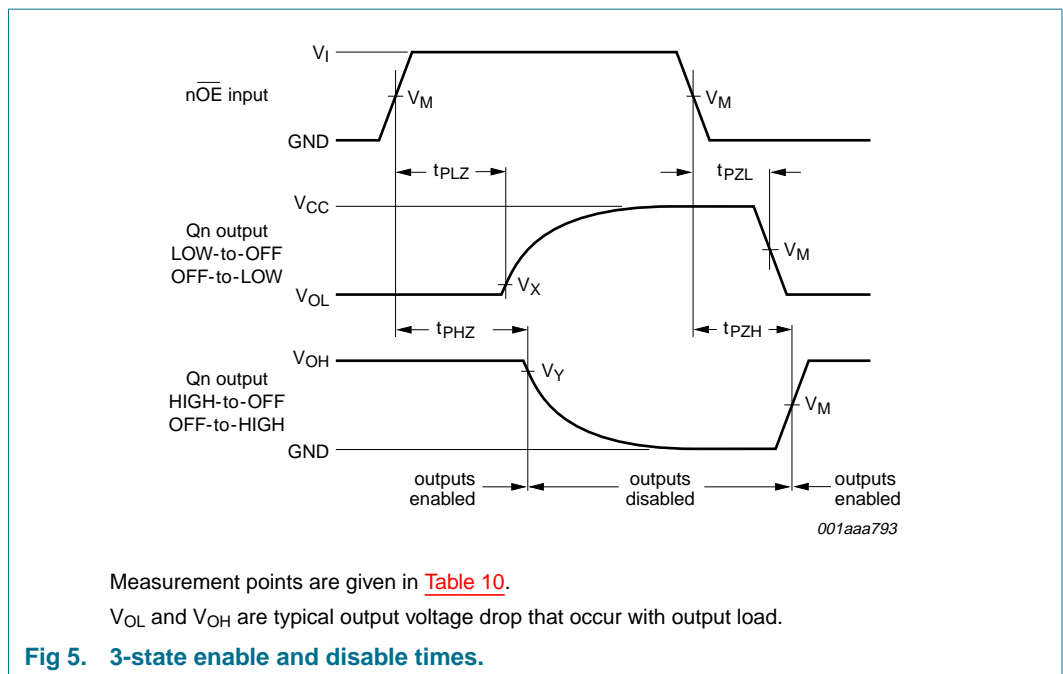


Table 10: Measurement points

Direction	Supply voltage		Input		Output		
	V <sub>CCA</sub>	V <sub>CCB</sub>	V <sub>I</sub>	V <sub>M</sub>	V <sub>M</sub>	V <sub>X</sub>	V <sub>Y</sub>
A port to B port	2.3 V to 2.7 V	2.7 V to 3.6 V	V <sub>CCA</sub>	0.5 × V <sub>CCA</sub>	1.5 V	V <sub>OL(B)</sub> + 0.3 V	V <sub>OH(B)</sub> - 0.3 V
B port to A port	2.3 V to 2.7 V	2.7 V to 3.6 V	2.7 V	1.5 V	0.5 × V <sub>CCA</sub>	V <sub>OL(A)</sub> + 0.15 V	V <sub>OH(A)</sub> - 0.15 V
A port to B port	2.7 V to 3.6 V	4.5 V to 5.5 V	2.7 V	1.5 V	0.5 × V <sub>CCB</sub>	0.2 × V <sub>CCB</sub>	0.8 × V <sub>CCB</sub>
B port to A port	2.7 V to 3.6 V	4.5 V to 5.5 V	3.0 V	1.5 V	1.5 V	V <sub>OL(A)</sub> + 0.3 V	V <sub>OH(A)</sub> - 0.3 V

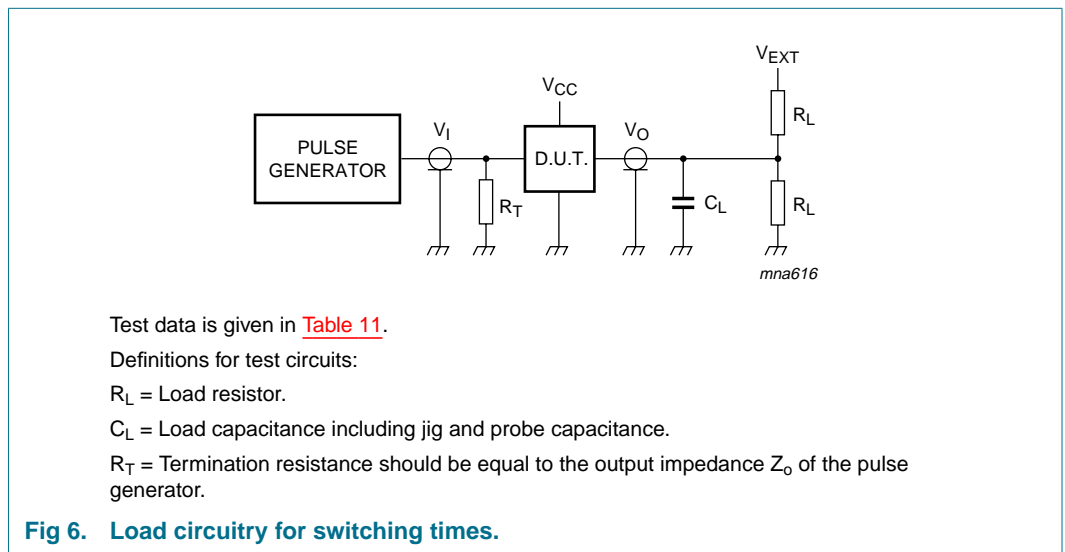


Fig 6. Load circuitry for switching times.

Table 11: Test data

Direction	Supply voltage		Load		V <sub>EXT</sub>		
	V <sub>CCA</sub>	V <sub>CCB</sub>	C <sub>L</sub>	R <sub>L</sub>	t <sub>PLH</sub> , t <sub>PHL</sub>	t <sub>PZH</sub> , t <sub>PHZ</sub>	t <sub>PZL</sub> , t <sub>PLZ</sub>
A port to B port	2.3 V to 2.7 V	2.7 V to 3.6 V	50 pF	500 Ω	open	GND	2 × V <sub>CC</sub>
B port to A port	2.3 V to 2.7 V	2.7 V to 3.6 V	50 pF	500 Ω	open	GND	6.0 V
A port to B port	2.7 V to 3.6 V	4.5 V to 5.5 V	50 pF	500 Ω	open	GND	2 × V <sub>CC</sub>
B port to A port	2.7 V to 3.6 V	4.5 V to 5.5 V	50 pF	500 Ω	open	GND	6.0 V

13. Package outline

SSOP48: plastic shrink small outline package; 48 leads; body width 7.5 mm

SOT370-1

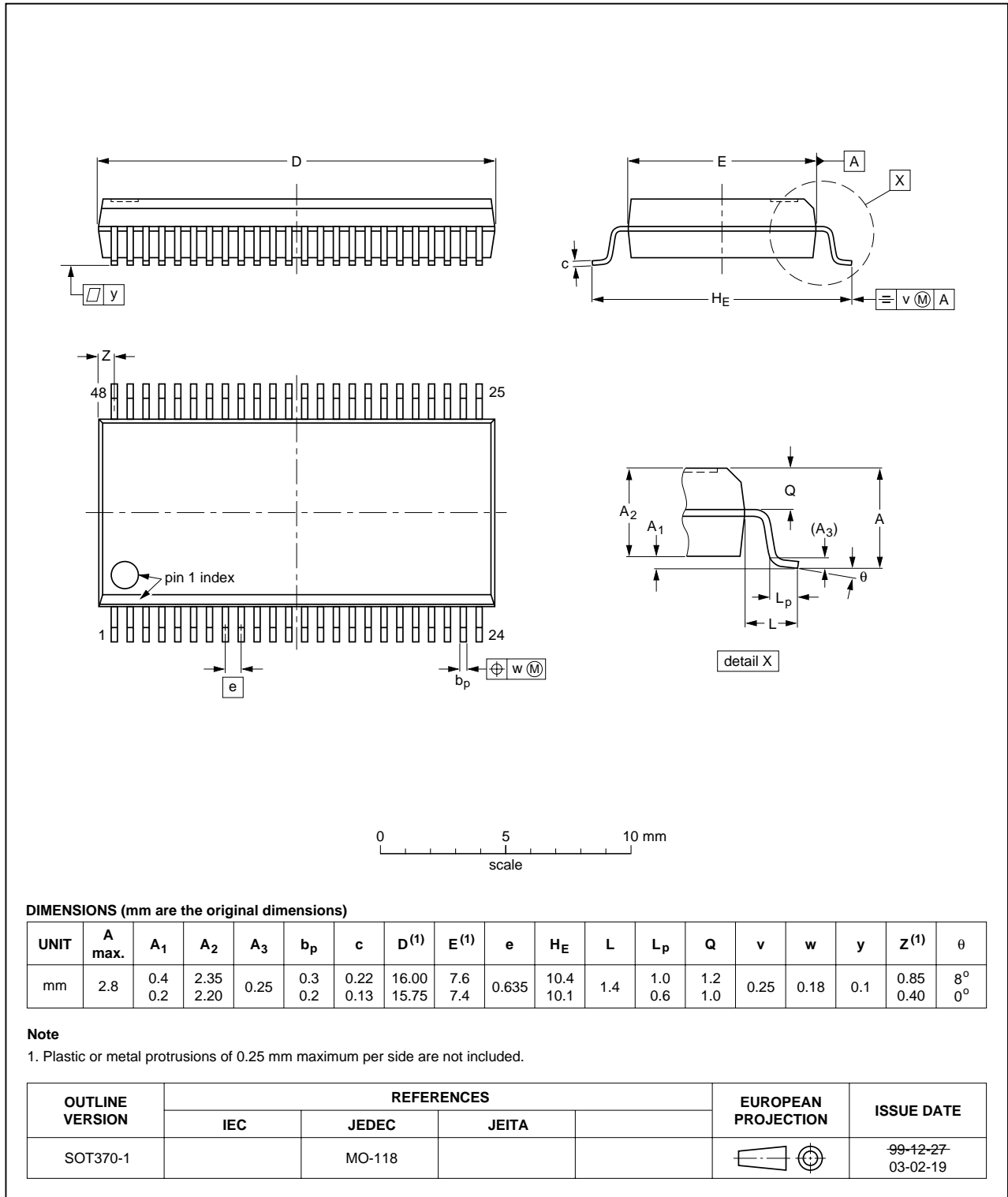


Fig 7. Package outline SSOP48.

TSSOP48: plastic thin shrink small outline package; 48 leads; body width 6.1 mm

SOT362-1

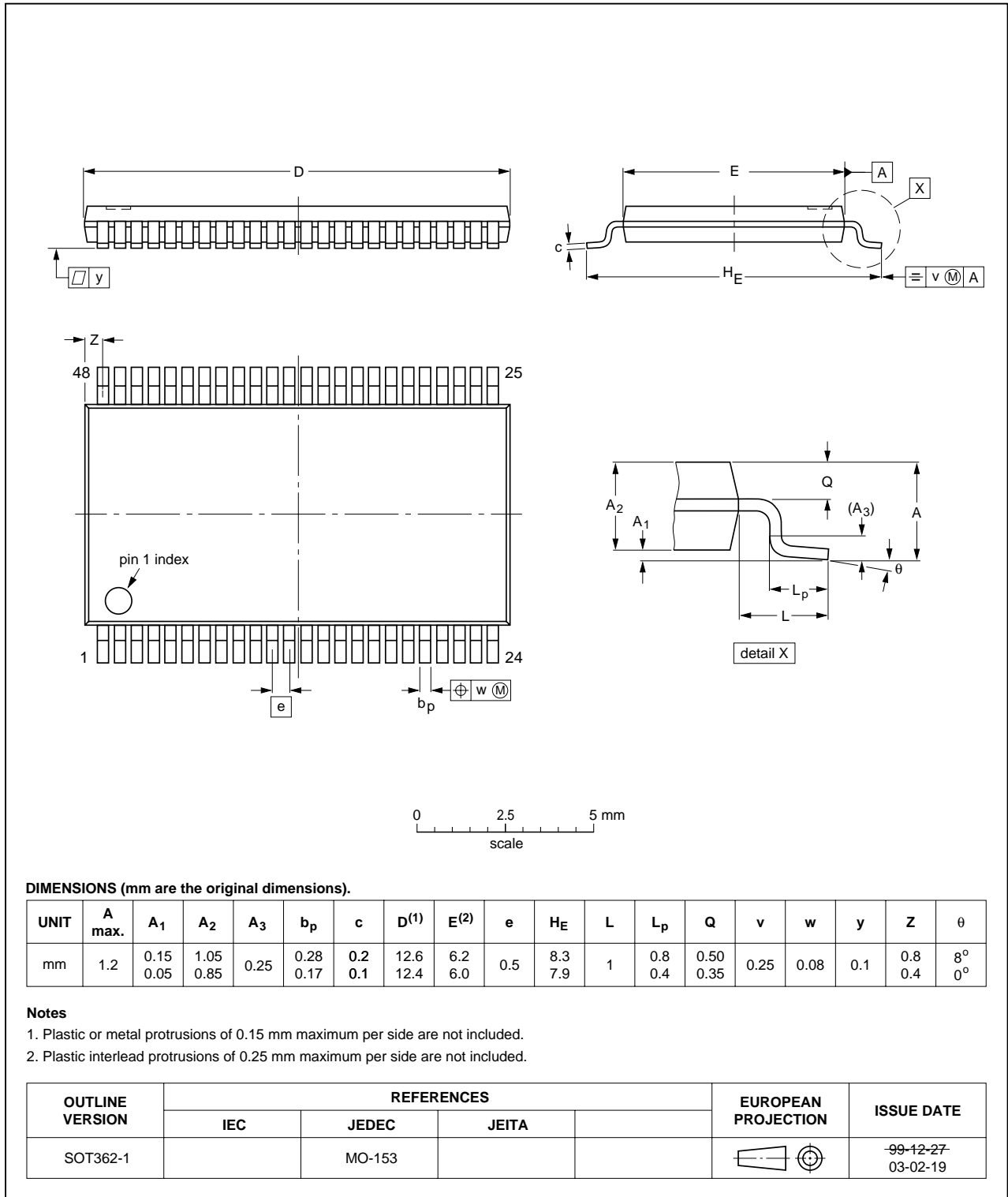


Fig 8. Package outline TSSOP48.



## 14. Revision history

**Table 12: Revision history**

Document ID	Release date	Data sheet status	Change notice	Order number	Supersedes
74ALVC164245_2	20040601	Product data	-	9397 750 13248	74ALVC164245_1
Modifications:					
					<ul style="list-style-type: none"><li>• The format of this data sheet has been redesigned to comply with the current presentation and information standard of Philips Semiconductors.</li><li>• <a href="#">Table 2</a>: VFPGA56 type added</li><li>• <a href="#">Table 7</a>: Values for <math>T_{amb} = -40\text{ °C}</math> to <math>+125\text{ °C}</math> added</li><li>• <a href="#">Table 8</a>: Values for <math>T_{amb} = -40\text{ °C}</math> to <math>+125\text{ °C}</math> added</li></ul>
74ALVC164245_1	19980826	Product specification	-	9397 750 04564	-

## 15. Data sheet status

Level	Data sheet status <sup>[1]</sup>	Product status <sup>[2]</sup> <sup>[3]</sup>	Definition
I	Objective data	Development	This data sheet contains data from the objective specification for product development. Philips Semiconductors reserves the right to change the specification in any manner without notice.
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[3] For data sheets describing multiple type numbers, the highest-level product status determines the data sheet status.

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