

74AVC16T245

16-bit dual supply translating transceiver with configurable voltage translation; 3-state

Rev. 02 — 30 March 2010

Product data sheet

1. General description

The 74AVC16T245 is a 16-bit transceiver with bidirectional level voltage translation and 3-state outputs. The device can be used as two 8-bit transceivers or as a 16-bit transceiver. It has dual supplies ($V_{CC(A)}$ and $V_{CC(B)}$) for voltage translation and two 8-bit input-output ports (nAn and nBn) each with its own output enable (\overline{nOE}) and send/receive ($nDIR$) input for direction control. $V_{CC(A)}$ and $V_{CC(B)}$ can be independently supplied at any voltage between 0.8 V and 3.6 V making the device suitable for low voltage translation between any of the following voltages: 0.8 V, 1.2 V, 1.5 V, 1.8 V, 2.5 V and 3.3 V. A HIGH on $nDIR$ selects transmission from nAn to nBn while a LOW on $nDIR$ selects transmission from nBn to nAn . A HIGH on \overline{nOE} causes the outputs to assume a high-impedance OFF-state

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 nAn and nBn are in the high-impedance OFF-state.

2. Features and benefits

- Wide supply voltage range:
 - ◆ $V_{CC(A)}$: 0.8 V to 3.6 V
 - ◆ $V_{CC(B)}$: 0.8 V to 3.6 V
- 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:
 - ◆ HBM JESD22-A114F Class 3B exceeds 8000 V
 - ◆ MM JESD22-A115-A exceeds 200 V
 - ◆ CDM JESD22-C101D exceeds 1000 V
- Maximum data rates:
 - ◆ 380 Mbit/s (≥ 1.8 V to 3.3 V translation)
 - ◆ 200 Mbit/s (≥ 1.1 V to 3.3 V translation)
 - ◆ 200 Mbit/s (≥ 1.1 V to 2.5 V translation)
 - ◆ 200 Mbit/s (≥ 1.1 V to 1.8 V translation)
 - ◆ 150 Mbit/s (≥ 1.1 V to 1.5 V translation)



- ◆ 100 Mbit/s ($\geq 1.1\text{ V}$ to 1.2 V translation)
- Suspend mode
- Latch-up performance exceeds 100 mA per JESD 78 Class II
- Inputs accept voltages up to 3.6 V
- I_{OFF} circuitry provides partial Power-down mode operation
- Multiple package options
- Specified from $-40\text{ }^{\circ}\text{C}$ to $+85\text{ }^{\circ}\text{C}$ and $-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$

3. Ordering information

Table 1. Ordering information

Type number	Package			
	Temperature range	Name	Description	Version
74AVC16T245DGG	$-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$	TSSOP48	plastic thin shrink small outline package; 48 leads; body width 6.1 mm	SOT362-1
74AVC16T245DGV	$-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$	TSSOP48 ^[1]	plastic thin shrink small outline package; 48 leads; body width 4.4 mm; lead pitch 0.4 mm	SOT480-1
74AVC16T245EV	$-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$	VFBGA56	plastic very thin fine-pitch ball grid array package; 56 balls; body $4.5 \times 7 \times 0.65\text{ mm}$	SOT702-1
74AVC16T245BQ	$-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$	HXQFN60U	plastic thermal enhanced extremely thin quad flat package; no leads; 60 terminals; UTLP based; body $4 \times 6 \times 0.5\text{ mm}$	SOT1134-1

[1] Also known as TVSOP48.

4. Functional diagram

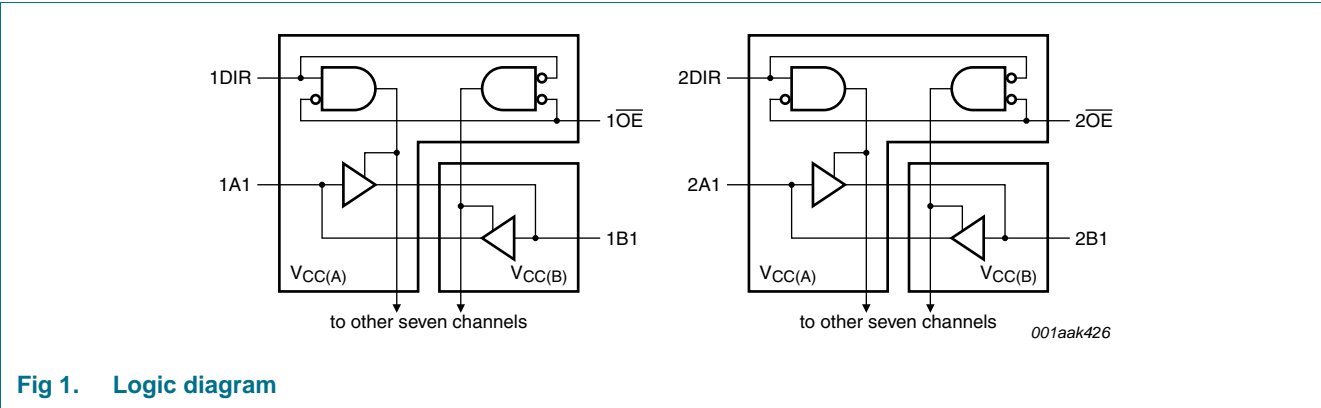


Fig 1. Logic diagram

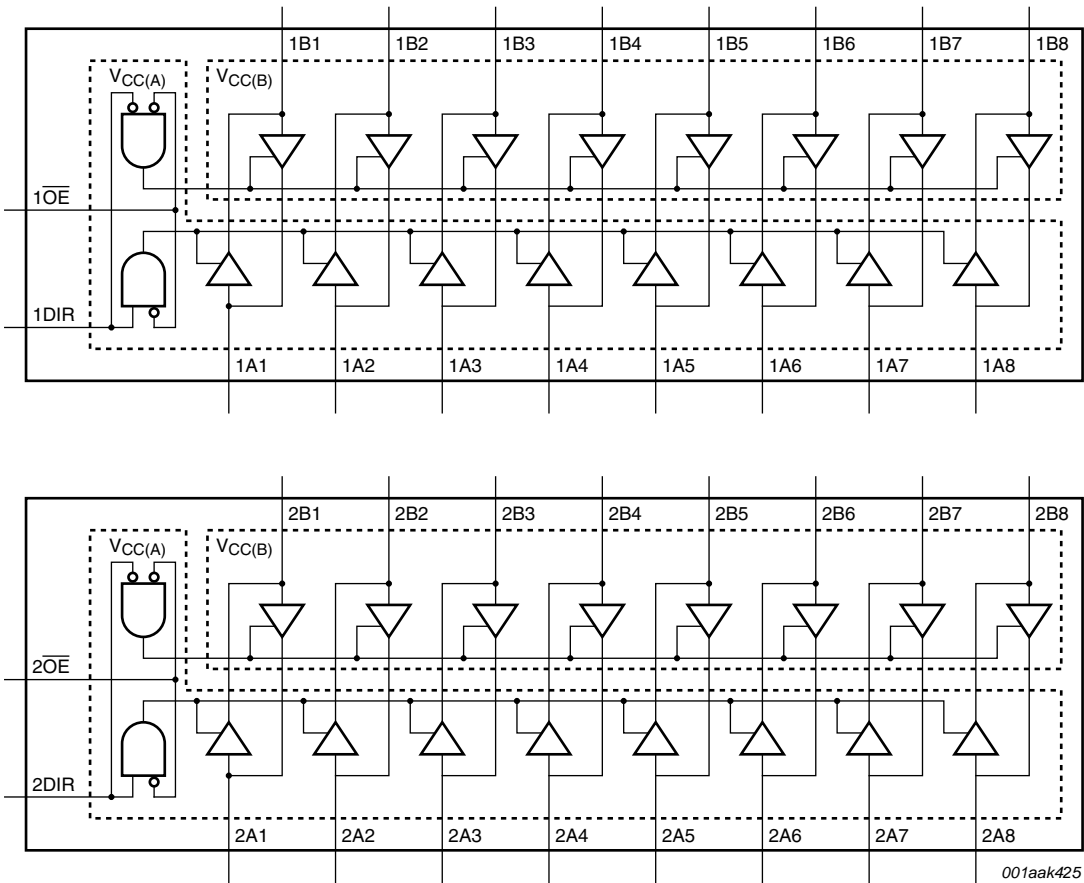
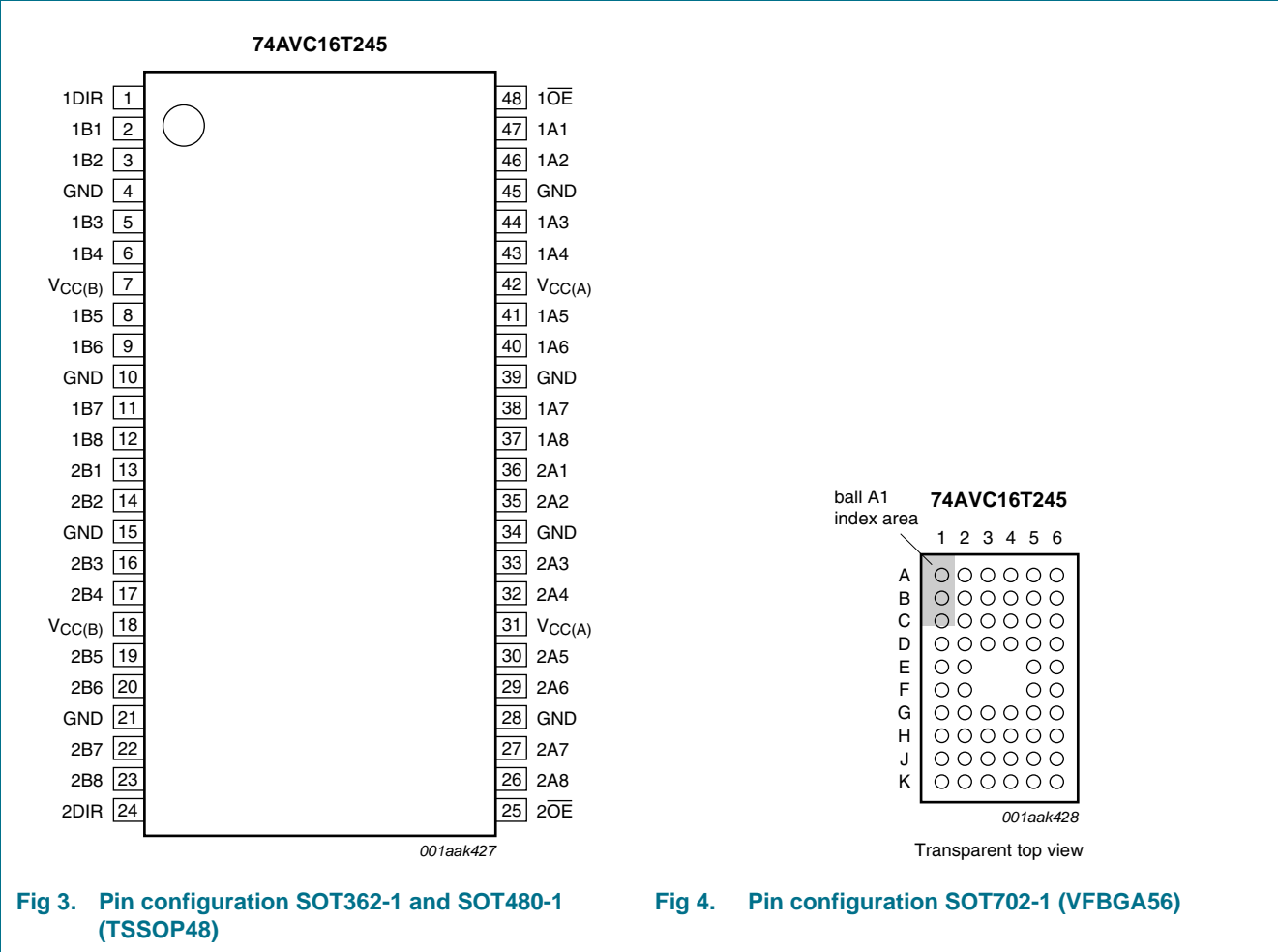
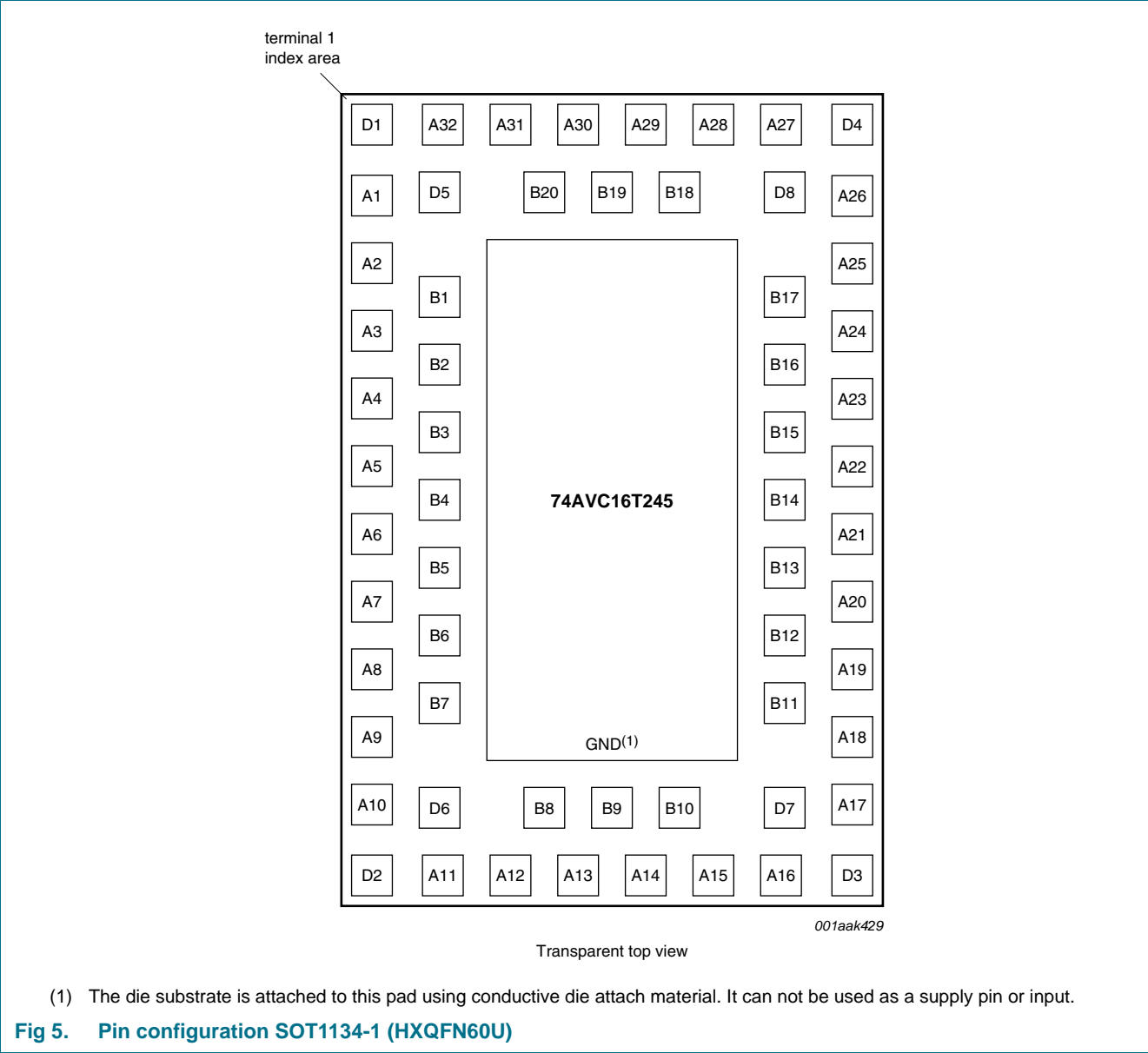


Fig 2. Logic symbol

5. Pinning information

5.1 Pinning





5.2 Pin description

Table 2. Pin description

Symbol	Pin			Description
	SOT362-1 and SOT480-1	SOT702-1	SOT1134-1	
1DIR, 2DIR	1, 24	A1, K1	A30, A13	direction control
1B1 to 1B8	2, 3, 5, 6, 8, 9, 11, 12	B2, B1, C2, C1, D2, D1, E2, E1	B20, A31, D5, D1, A2, B2, B3, A5	data input or output
2B1 to 2B8	13, 14, 16, 17, 19, 20, 22, 23	F1, F2, G1, G2, H1, H2, J1, J2	A6, B5, B6, A9, D2, D6, A12, B8	data input or output
GND ^[1]	4, 10, 15, 21, 28, 34, 39, 45	B3, D3, G3, J3, J4, G4, D4, B4	A32, A3, A8, A11, A16, A19, A24, A27	ground (0 V)
V _{CC(B)}	7, 18	C3, H3	A1, A10	supply voltage B (nBn inputs are referenced to V _{CC(B)})
$\overline{1OE}$, $\overline{2OE}$	48, 25	A6, K6	A29, A14	output enable input (active LOW)
1A1 to 1A8	47, 46, 44, 43, 41, 40, 38, 37	B5, B6, C5, C6, D5, D6, E5, E6	B18, A28, D8, D4, A25, B16, B15, A22	data input or output
2A1 to 2A8	36, 35, 33, 32, 30, 29, 27, 26	F6, F5, G6, G5, H6, H5, J6, J5	A21, B13, B12, A18, D3, D7, A15, B10	data input or output
V _{CC(A)}	31, 42	C4, H4	A17, A26	supply voltage A (nAn, \overline{nOE} and nDIR inputs are referenced to V _{CC(A)})
n.c.	-	A2, A3, A4, A5, K2, K3, K4, K5	A4, A7, A20, A23, B1, B4, B7, B9, B11, B14, B17, B19	not connected

[1] All GND pins must be connected to ground (0 V).

6. Functional description

Table 3. Function table^[1]

Supply voltage	Input		Input/output ^[3]	
	\overline{nOE} ^[2]	nDIR ^[2]	nAn ^[2]	nBn ^[2]
0.8 V to 3.6 V	L	L	nAn = nBn	input
0.8 V to 3.6 V	L	H	input	nBn = nAn
0.8 V to 3.6 V	H	X	Z	Z
GND ^[3]	X	X	Z	Z

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

[2] The nAn, nDIR and \overline{nOE} input circuit is referenced to V_{CC(A)}; The nBn input circuit is referenced to V_{CC(B)}.

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

7. Limiting values

Table 4. 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}	[2] -	± 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;			
		TSSOP48 package	[4] -	500	mW
		VFBGA56 package	[5] -	1000	mW
		HXQFN60U package	[5] -	1000	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] Above 60 °C the value of P_{tot} derates linearly with 5.5 mW/K.

[5] Above 70 °C the value of P_{tot} derates linearly with 1.8 mW/K.

8. Recommended operating conditions

Table 5. 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	$V_{CCI} = 0.8$ V to 3.6 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.

9. Static characteristics

Table 6. Typical static characteristics at $T_{amb} = 25\text{ }^{\circ}\text{C}$ [1][2]

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{OH}	HIGH-level output voltage	$V_I = V_{IH}$ 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	$V_I = V_{IH}$ 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	nDIR, \overline{nOE} input; $V_I = 0\text{ V}$ or 3.6 V ; $V_{CC(A)} = V_{CC(B)} = 0.8\text{ V}$ to 3.6 V	-	± 0.025	± 0.25	μA
I_{OZ}	OFF-state output current	A or B port; $V_O = 0\text{ V}$ or V_{CCO} ; $V_{CC(A)} = V_{CC(B)} = 3.6\text{ V}$	[3]	± 0.5	± 2.5	μA
		suspend mode A port; $V_O = 0\text{ V}$ or V_{CCO} ; $V_{CC(A)} = 3.6\text{ V}$; $V_{CC(B)} = 0\text{ V}$	[3]	± 0.5	± 2.5	μA
		suspend mode B port; $V_O = 0\text{ V}$ or V_{CCO} ; $V_{CC(A)} = 0\text{ V}$; $V_{CC(B)} = 3.6\text{ V}$	[3]	± 0.5	± 2.5	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	-	± 0.1	± 1	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	-	± 0.1	± 1	μA
C_I	input capacitance	nDIR, \overline{nOE} input; $V_I = 0\text{ V}$ or 3.3 V ; $V_{CC(A)} = V_{CC(B)} = 3.3\text{ V}$	-	2.0	-	pF
$C_{I/O}$	input/output capacitance	A and B port; $V_O = 3.3\text{ V}$ or 0 V ; $V_{CC(A)} = V_{CC(B)} = 3.3\text{ V}$	-	4.5	-	pF

[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.

Table 7. Static characteristics [1][2]

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

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 V	$0.65V_{CCI}$	-	$0.65V_{CCI}$	-	V
		$V_{CCI} = 2.3\text{ V}$ to 2.7 V	1.6	-	1.6	-	V
		$V_{CCI} = 3.0\text{ V}$ to 3.6 V	2	-	2	-	V
	nDIR, \overline{nOE} 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 V	$0.65V_{CC(A)}$	-	$0.65V_{CC(A)}$	-	V
		$V_{CC(A)} = 2.3\text{ V}$ to 2.7 V	1.6	-	1.6	-	V
		$V_{CC(A)} = 3.0\text{ V}$ to 3.6 V	2	-	2	-	V

Table 7. Static characteristics ...continued [1][2]

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

Symbol	Parameter	Conditions	–40 °C to +85 °C		–40 °C to +125 °C		Unit
			Min	Max	Min	Max	
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
		$V_{CCI} = 3.0 \text{ V to } 3.6 \text{ V}$	-	0.8	-	0.8	V
		nDIR, \overline{nOE} 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
		$V_{CC(A)} = 3.0 \text{ V to } 3.6 \text{ V}$	-	0.8	-	0.8	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
I_I	input leakage current	nDIR, \overline{nOE} input; $V_I = 0 \text{ V or } 3.6 \text{ V};$ $V_{CC(A)} = V_{CC(B)} = 0.8 \text{ V to } 3.6 \text{ V}$	-	± 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	-	± 30	μA
		suspend mode A port; $V_O = 0 \text{ V or } V_{CCO}; V_{CC(A)} = 3.6 \text{ V};$ $V_{CC(B)} = 0 \text{ V}$ [3]	-	± 5	-	± 30	μA
		suspend mode B port; $V_O = 0 \text{ V or } V_{CCO}; V_{CC(A)} = 0 \text{ V};$ $V_{CC(B)} = 3.6 \text{ V}$ [3]	-	± 5	-	± 30	μA

Table 7. Static characteristics ...continued^{[1][2]}

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

Symbol	Parameter	Conditions	-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Max	Min	Max	
I _{OFF}	power-off leakage current	A port; V _I or V _O = 0 V to 3.6 V; V _{CC(A)} = 0 V; V _{CC(B)} = 0.8 V to 3.6 V	-	±5	-	±30	μA
		B port; V _I or V _O = 0 V to 3.6 V; V _{CC(B)} = 0 V; V _{CC(A)} = 0.8 V to 3.6 V	-	±5	-	±30	μA
I _{CC}	supply current	A port; V _I = 0 V or V _{CCI} ; I _O = 0 A					
		V _{CC(A)} = 0.8 V to 3.6 V; V _{CC(B)} = 0.8 V to 3.6 V	-	30	-	125	μA
		V _{CC(A)} = 1.1 V to 3.6 V; V _{CC(B)} = 1.1 V to 3.6 V	-	25	-	100	μA
		V _{CC(A)} = 3.6 V; V _{CC(B)} = 0 V	-	25	-	100	μA
		V _{CC(A)} = 0 V; V _{CC(B)} = 3.6 V	-5	-	-20	-	μA
		B port; V _I = 0 V or V _{CCI} ; I _O = 0 A					
		V _{CC(A)} = 0.8 V to 3.6 V; V _{CC(B)} = 0.8 V to 3.6 V	-	30	-	125	μA
		V _{CC(A)} = 1.1 V to 3.6 V; V _{CC(B)} = 1.1 V to 3.6 V	-	25	-	100	μA
		V _{CC(A)} = 3.6 V; V _{CC(B)} = 0 V	-5	-	-20	-	μA
		V _{CC(A)} = 0 V; V _{CC(B)} = 3.6 V	-	25	-	100	μA
		A plus B port (I _{CC(A)} + I _{CC(B)}); I _O = 0 A; V _I = 0 V or V _{CCI} ; V _{CC(A)} = 0.8 V to 3.6 V; V _{CC(B)} = 0.8 V to 3.6 V	-	55	-	185	μA
		A plus B port (I _{CC(A)} + I _{CC(B)}); I _O = 0 A; V _I = 0 V or V _{CCI} ; V _{CC(A)} = 1.1 V to 3.6 V; V _{CC(B)} = 1.1 V to 3.6 V	-	45	-	150	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.**Table 8.** 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	0.3	1.6	μA
1.2 V	0.1	0.1	0.1	0.1	0.1	0.1	0.8	μA
1.5 V	0.1	0.1	0.1	0.1	0.1	0.1	0.4	μA
1.8 V	0.1	0.1	0.1	0.1	0.1	0.1	0.2	μA
2.5 V	0.1	0.3	0.1	0.1	0.1	0.1	0.1	μA
3.3 V	0.1	1.6	0.8	0.4	0.2	0.1	0.1	μA

10. Dynamic characteristics

Table 9. Typical power dissipation capacitance at $V_{CC(A)} = V_{CC(B)}$ and $T_{amb} = 25\text{ °C}$ [1][2]

Voltages are referenced to GND (ground = 0 V).

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	
C_{PD}	power dissipation capacitance	A port: (direction nAn to nBn); output enabled	0.2	0.2	0.2	0.2	0.3	0.4	pF
		A port: (direction nAn to nBn); output disabled	0.2	0.2	0.2	0.2	0.3	0.4	pF
		A port: (direction nBn to nAn); output enabled	9	9.7	9.8	10.3	11.7	13.7	pF
		A port: (direction nBn to nAn); output disabled	0.6	0.6	0.6	0.7	0.7	0.7	pF
		B port: (direction nAn to nBn); output enabled	9	9.7	9.8	10.3	11.7	13.7	pF
		B port: (direction nAn to nBn); output disabled	0.6	0.6	0.6	0.7	0.7	0.7	pF
		B port: (direction nBn to nAn); output enabled	0.2	0.2	0.2	0.2	0.3	0.4	pF
		B port: (direction nBn to nAn); output disabled	0.2	0.2	0.2	0.2	0.3	0.4	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] $f_i = 10\text{ MHz}$; $V_i = \text{GND to } V_{CC}$; $t_r = t_f = 1\text{ ns}$; $C_L = 0\text{ pF}$; $R_L = \infty\ \Omega$.

Table 10. Typical dynamic characteristics at $V_{CC(A)} = 0.8\text{ V}$ and $T_{amb} = 25\text{ °C}$ [1]

Voltages are referenced to GND (ground = 0 V); for test circuit see [Figure 8](#); for wave forms see [Figure 6](#) and [Figure 7](#)

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	
t_{pd}	propagation delay	nAn to nBn	14.4	7.0	6.2	6.0	5.9	6.0	ns
		nBn to nAn	14.4	12.4	12.1	11.9	11.8	11.8	ns
t_{dis}	disable time	\overline{nOE} to nAn	16.2	16.2	16.2	16.2	16.2	16.2	ns
		\overline{nOE} to nBn	17.6	10.0	9.0	9.1	8.7	9.3	ns
t_{en}	enable time	\overline{nOE} to nAn	21.9	21.9	21.9	21.9	21.9	21.9	ns
		\overline{nOE} to nBn	22.2	11.1	9.8	9.4	9.4	9.6	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} .

Table 11. Typical dynamic characteristics at $V_{CC(B)} = 0.8\text{ V}$ and $T_{amb} = 25\text{ °C}$ [1]

Voltages are referenced to GND (ground = 0 V); for test circuit see [Figure 8](#); for wave forms see [Figure 6](#) and [Figure 7](#)

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	
t_{pd}	propagation delay	nAn to nBn	14.4	12.4	12.1	11.9	11.8	11.8	ns
		nBn to nAn	14.4	7.0	6.2	6.0	5.9	6.0	ns
t_{dis}	disable time	\overline{nOE} to nAn	16.2	5.9	4.4	4.2	3.1	3.5	ns
		\overline{nOE} to nBn	17.6	14.2	13.7	13.6	13.3	13.1	ns
t_{en}	enable time	\overline{nOE} to nAn	21.9	6.4	4.4	3.5	2.6	2.3	ns
		\overline{nOE} to nBn	22.2	17.7	17.2	17.0	16.8	16.7	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} .

Table 12. Dynamic characteristics for temperature range -40°C to $+85^{\circ}\text{C}$ [1]

Voltages are referenced to GND (ground = 0 V); for test circuit see [Figure 8](#); for wave forms see [Figure 6](#) and [Figure 7](#).

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 _{pd}	propagation delay	nAn to nBn	0.5	9.2	0.5	6.9	0.5	6.0	0.5	5.1	0.5	4.9	ns
		nBn to nAn	0.5	9.2	0.5	8.7	0.5	8.5	0.5	8.2	0.5	8.0	ns
t _{dis}	disable time	$\overline{\text{noE}}$ to nAn	1.5	11.6	1.5	11.6	1.5	11.6	1.5	11.6	1.5	11.6	ns
		$\overline{\text{noE}}$ to nBn	1.5	12.5	1.5	9.7	1.5	9.5	1.0	8.1	1.0	8.9	ns
t _{en}	enable time	$\overline{\text{noE}}$ to nAn	1.0	14.5	1.0	14.5	1.0	14.5	1.0	14.5	1.0	14.5	ns
		$\overline{\text{noE}}$ to nBn	1.1	14.9	1.1	11.0	1.1	9.6	1.0	8.1	1.0	7.7	ns
V _{CC(A)} = 1.4 V to 1.6 V													
t _{pd}	propagation delay	nAn to nBn	0.5	8.7	0.5	6.2	0.5	5.2	0.5	4.1	0.5	3.7	ns
		nBn to nAn	0.5	6.9	0.5	6.2	0.5	5.9	0.5	5.6	0.5	5.5	ns
t _{dis}	disable time	$\overline{\text{noE}}$ to nAn	1.5	9.1	1.5	9.1	1.5	9.1	1.5	9.1	1.5	9.1	ns
		$\overline{\text{noE}}$ to nBn	1.5	11.4	1.5	8.7	1.5	7.5	1.0	6.5	1.0	6.3	ns
t _{en}	enable time	$\overline{\text{noE}}$ to nAn	1.0	10.1	1.0	10.1	1.0	10.1	1.0	10.1	1.0	10.1	ns
		$\overline{\text{noE}}$ to nBn	1.0	13.5	1.0	10.1	0.5	8.1	0.5	5.9	0.5	5.2	ns
V _{CC(A)} = 1.65 V to 1.95 V													
t _{pd}	propagation delay	nAn to nBn	0.5	8.5	0.5	5.9	0.5	4.8	0.5	3.7	0.5	3.3	ns
		nBn to nAn	0.5	6.0	0.5	5.2	0.5	4.8	0.5	4.5	0.5	4.4	ns
t _{dis}	disable time	$\overline{\text{noE}}$ to nAn	1.5	7.7	1.5	7.7	1.5	7.7	1.5	7.7	1.5	7.7	ns
		$\overline{\text{noE}}$ to nBn	1.5	11.1	1.5	8.4	1.5	7.1	1.0	5.9	1.0	5.7	ns
t _{en}	enable time	$\overline{\text{noE}}$ to nAn	1.0	7.8	1.0	7.8	1.0	7.8	1.0	7.8	1.0	7.8	ns
		$\overline{\text{noE}}$ to nBn	1.0	13.0	1.0	9.2	0.5	7.4	0.5	5.3	0.5	4.5	ns
V _{CC(A)} = 2.3 V to 2.7 V													
t _{pd}	propagation delay	nAn to nBn	0.5	8.2	0.5	5.6	0.5	4.6	0.5	3.3	0.5	2.8	ns
		nBn to nAn	0.5	5.1	0.5	4.1	0.5	3.7	0.5	3.4	0.5	3.2	ns
t _{dis}	disable time	$\overline{\text{noE}}$ to nAn	1.0	6.1	1.0	6.1	1.0	6.1	1.0	6.1	1.0	6.1	ns
		$\overline{\text{noE}}$ to nBn	1.0	10.6	1.0	7.9	1.0	6.6	1.0	6.1	1.0	5.2	ns
t _{en}	enable time	$\overline{\text{noE}}$ to nAn	0.5	5.3	0.5	5.3	0.5	5.3	0.5	5.3	0.5	5.3	ns
		$\overline{\text{noE}}$ to nBn	0.5	12.5	0.5	9.4	0.5	7.3	0.5	5.1	0.5	4.5	ns
V _{CC(A)} = 3.0 V to 3.6 V													
t _{pd}	propagation delay	nAn to nBn	0.5	8.0	0.5	5.5	0.5	4.4	0.5	3.2	0.5	2.7	ns
		nBn to nAn	0.5	4.9	0.5	3.7	0.5	3.3	0.5	2.9	0.5	2.7	ns
t _{dis}	disable time	$\overline{\text{noE}}$ to nAn	0.5	5.0	0.5	5.0	0.5	5.0	0.5	5.0	0.5	5.0	ns
		$\overline{\text{noE}}$ to nBn	1.0	10.3	1.0	7.7	1.0	6.5	1.0	5.2	0.5	5.0	ns
t _{en}	enable time	$\overline{\text{noE}}$ to nAn	0.5	4.3	0.5	4.3	0.5	4.2	0.5	4.1	0.5	4.0	ns
		$\overline{\text{noE}}$ to nBn	0.5	12.4	0.5	9.3	0.5	7.2	0.5	4.9	0.5	4.0	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} .

Table 13. Dynamic characteristics for temperature range -40°C to $+125^{\circ}\text{C}$ [1]Voltages are referenced to GND (ground = 0 V); for test circuit see [Figure 8](#); for wave forms see [Figure 6](#) and [Figure 7](#)

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 _{pd}	propagation delay	nAn to nBn	0.5	10.2	0.5	7.6	0.5	6.6	0.5	5.7	0.5	5.4	ns
		nBn to nAn	0.5	10.2	0.5	9.6	0.5	9.4	0.5	9.1	0.5	8.8	ns
t _{dis}	disable time	$\overline{\text{noE}}$ to nAn	1.5	12.8	1.5	12.8	1.5	12.8	1.5	12.8	1.5	12.8	ns
		$\overline{\text{noE}}$ to nBn	1.5	13.8	1.5	10.7	1.5	10.5	1.0	9.0	1.5	9.8	ns
t _{en}	enable time	$\overline{\text{noE}}$ to nAn	1.0	16.0	1.0	16.0	1.0	16.0	1.0	16.0	1.0	16.0	ns
		$\overline{\text{noE}}$ to nBn	1.1	16.4	1.1	12.1	1.1	10.6	1.0	9.0	1.0	8.5	ns
V _{CC(A)} = 1.4 V to 1.6 V													
t _{pd}	propagation delay	nAn to nBn	0.5	9.6	0.5	6.9	0.5	5.8	0.5	4.6	0.5	4.1	ns
		nBn to nAn	0.5	7.6	0.5	6.9	0.5	6.5	0.5	6.2	0.5	6.1	ns
t _{dis}	disable time	$\overline{\text{noE}}$ to nAn	1.5	10.1	1.5	10.1	1.5	10.1	1.5	10.1	1.5	10.1	ns
		$\overline{\text{noE}}$ to nBn	1.5	12.6	1.5	9.6	1.5	8.3	1.0	7.2	1.0	7.0	ns
t _{en}	enable time	$\overline{\text{noE}}$ to nAn	1.0	11.2	1.0	11.2	1.0	11.2	1.0	11.2	1.0	11.2	ns
		$\overline{\text{noE}}$ to nBn	1.0	14.9	1.0	11.2	0.5	9.0	0.5	6.5	0.5	5.8	ns
V _{CC(A)} = 1.65 V to 1.95 V													
t _{pd}	propagation delay	nAn to nBn	0.5	9.4	0.5	6.5	0.5	5.3	0.5	4.1	0.5	3.7	ns
		nBn to nAn	0.5	6.6	0.5	5.8	0.5	5.3	0.5	5.0	0.5	4.9	ns
t _{dis}	disable time	$\overline{\text{noE}}$ to nAn	1.5	8.5	1.5	8.5	1.5	8.5	1.5	8.5	1.5	8.5	ns
		$\overline{\text{noE}}$ to nBn	1.5	12.3	1.5	9.3	1.5	7.9	1.0	6.5	1.0	6.3	ns
t _{en}	enable time	$\overline{\text{noE}}$ to nAn	1.0	8.6	1.0	8.6	1.0	8.6	1.0	8.6	1.0	8.6	ns
		$\overline{\text{noE}}$ to nBn	1.0	14.3	1.0	10.2	0.5	8.2	0.5	5.9	0.5	5.0	ns
V _{CC(A)} = 2.3 V to 2.7 V													
t _{pd}	propagation delay	nAn to nBn	0.5	9.1	0.5	6.2	0.5	5.1	0.5	3.7	0.5	3.1	ns
		nBn to nAn	0.5	5.7	0.5	4.6	0.5	4.1	0.5	3.8	0.5	3.6	ns
t _{dis}	disable time	$\overline{\text{noE}}$ to nAn	1.0	6.8	1.0	6.8	1.0	6.8	1.0	6.8	1.0	6.8	ns
		$\overline{\text{noE}}$ to nBn	1.0	11.7	1.0	8.7	1.0	7.3	1.0	6.8	1.0	5.8	ns
t _{en}	enable time	$\overline{\text{noE}}$ to nAn	0.5	5.9	0.5	5.9	0.5	5.9	0.5	5.9	0.5	5.9	ns
		$\overline{\text{noE}}$ to nBn	0.5	13.8	0.5	10.4	0.5	8.1	0.5	5.7	0.5	5.0	ns
V _{CC(A)} = 3.0 V to 3.6 V													
t _{pd}	propagation delay	nAn to nBn	0.5	8.8	0.5	6.1	0.5	4.9	0.5	3.6	0.5	3.0	ns
		nBn to nAn	0.5	5.4	0.5	4.1	0.5	3.7	0.5	3.2	0.5	3.0	ns
t _{dis}	disable time	$\overline{\text{noE}}$ to nAn	0.5	5.5	0.5	5.5	0.5	5.5	0.5	5.5	0.5	5.5	ns
		$\overline{\text{noE}}$ to nBn	1.0	11.4	1.0	8.5	1.0	7.2	1.0	5.8	0.5	5.5	ns
t _{en}	enable time	$\overline{\text{noE}}$ to nAn	0.5	4.8	0.5	4.8	0.5	4.7	0.5	4.6	0.5	4.4	ns
		$\overline{\text{noE}}$ to nBn	0.5	13.7	0.5	10.3	0.5	8.0	0.5	5.4	0.5	4.4	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} .

11. Waveforms

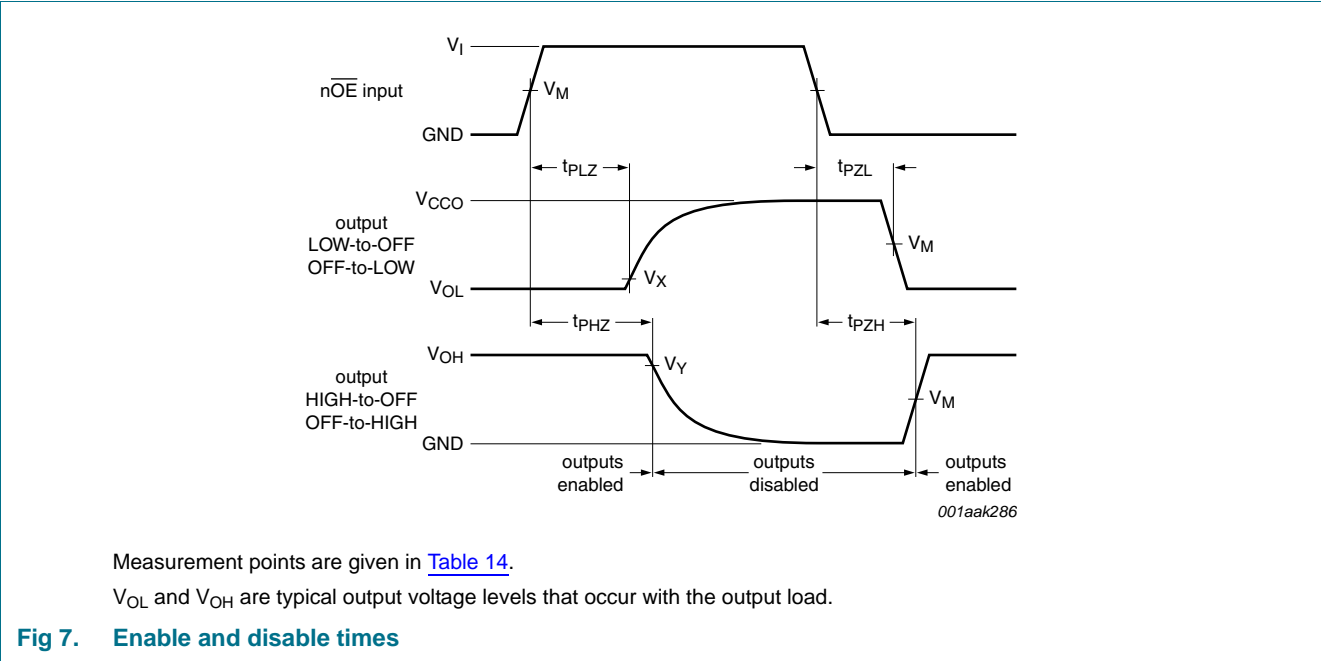
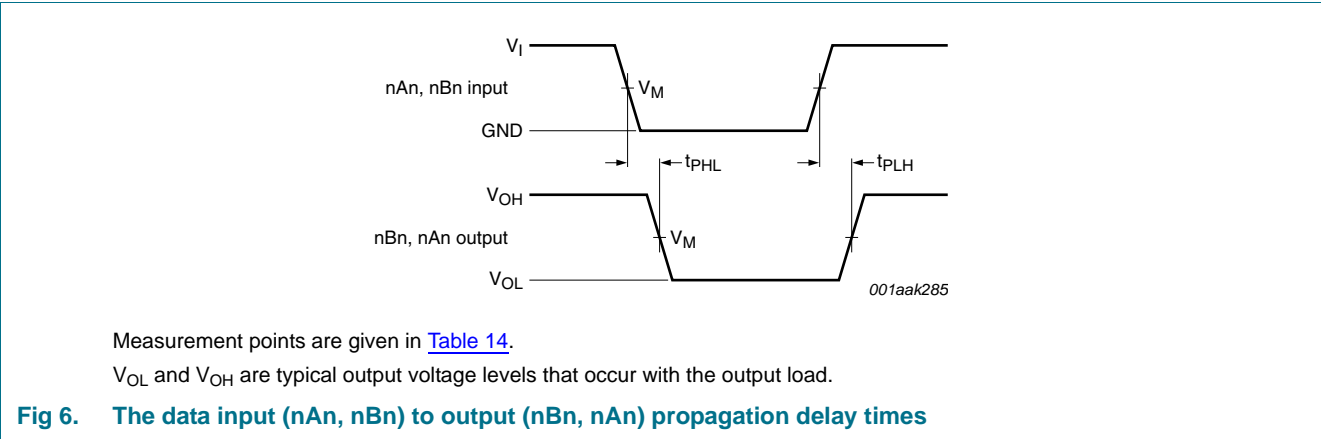
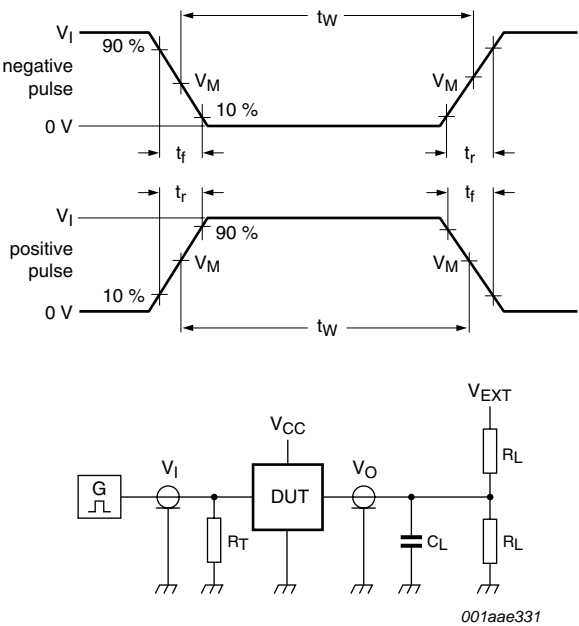


Table 14. Measurement points

Supply voltage	Input ^[1]	Output ^[2]		
$V_{CC(A)}, V_{CC(B)}$	V_M	V_M	V_X	V_Y
0.8 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.



Test data is given in [Table 15](#).
 R_L = Load resistance.
 C_L = Load capacitance including jig and probe capacitance.
 R_T = Termination resistance.
 V_{EXT} = External voltage for measuring switching times.

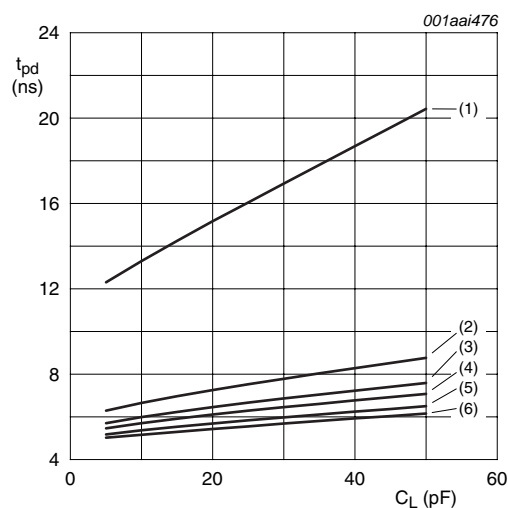
Fig 8. Load circuit for switching times

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]
0.8 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	$2V_{CCO}$

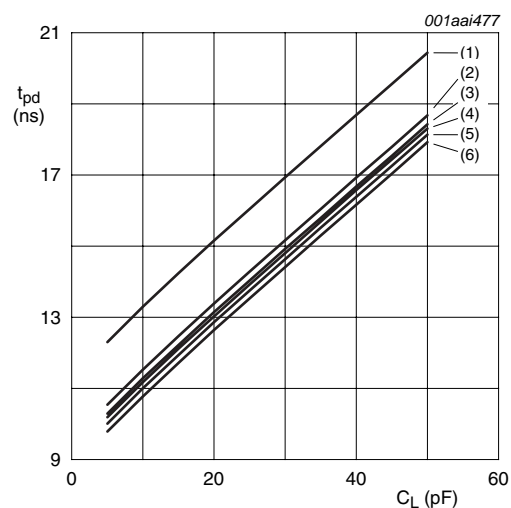
[1] V_{CCI} is the supply voltage associated with the data input port.
[2] $dV/dt \geq 1.0 \text{ V/ns}$
[3] V_{CCO} is the supply voltage associated with the output port.

12. Typical propagation delay characteristics



a. Propagation delay (nAn to nBn); $V_{CC(A)} = 0.8 \text{ V}$

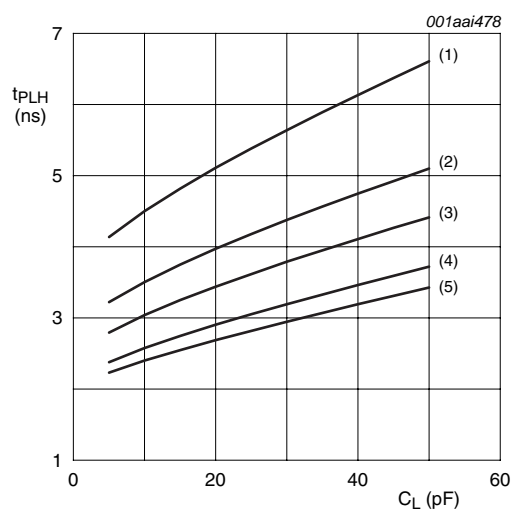
- (1) $V_{CC(B)} = 0.8 \text{ V}$.
- (2) $V_{CC(B)} = 1.2 \text{ V}$.
- (3) $V_{CC(B)} = 1.5 \text{ V}$.
- (4) $V_{CC(B)} = 1.8 \text{ V}$.
- (5) $V_{CC(B)} = 2.5 \text{ V}$.
- (6) $V_{CC(B)} = 3.3 \text{ V}$.



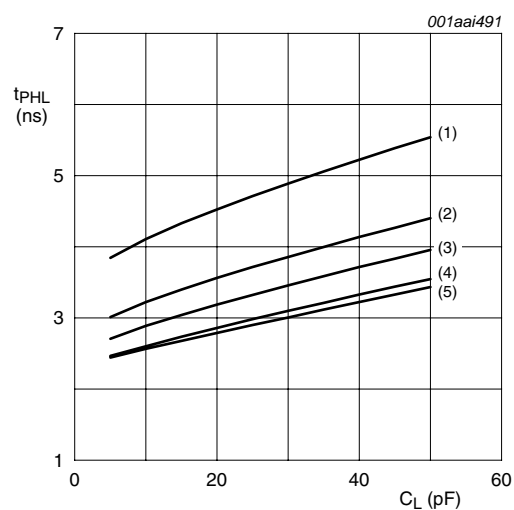
b. Propagation delay (nAn to nBn); $V_{CC(B)} = 0.8 \text{ V}$

- (1) $V_{CC(A)} = 0.8 \text{ V}$.
- (2) $V_{CC(A)} = 1.2 \text{ V}$.
- (3) $V_{CC(A)} = 1.5 \text{ V}$.
- (4) $V_{CC(A)} = 1.8 \text{ V}$.
- (5) $V_{CC(A)} = 2.5 \text{ V}$.
- (6) $V_{CC(A)} = 3.3 \text{ V}$.

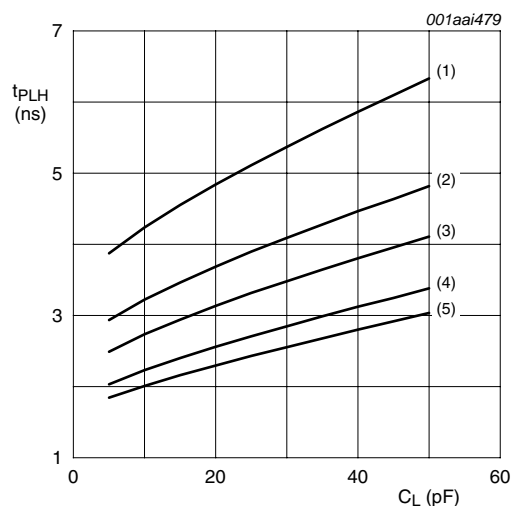
Fig 9. Typical propagation delay versus load capacitance; $T_{amb} = 25^\circ\text{C}$



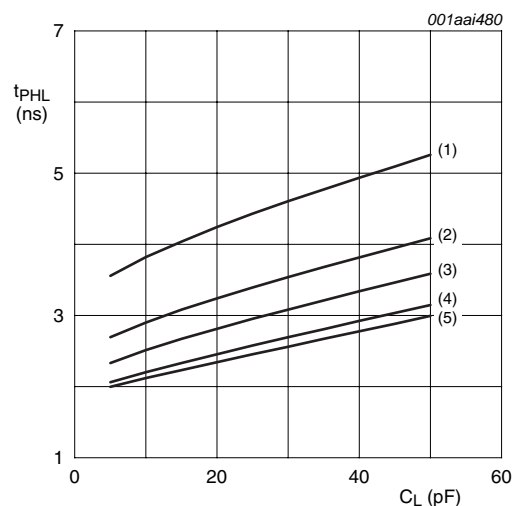
a. LOW to HIGH propagation delay (nAn to nBn);
 $V_{CC(A)} = 1.2\text{ V}$



b. HIGH to LOW propagation delay (nAn to nBn);
 $V_{CC(A)} = 1.2\text{ V}$



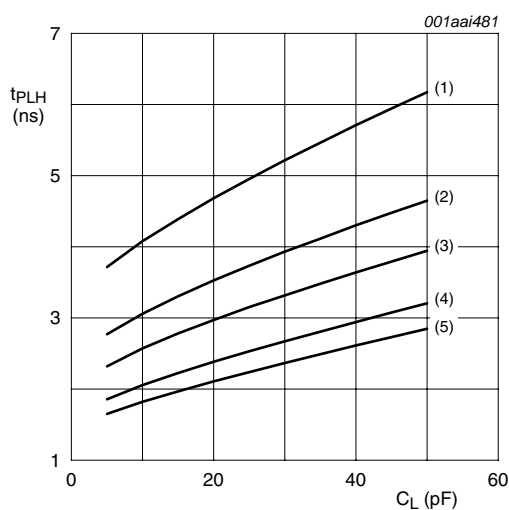
c. LOW to HIGH propagation delay (nAn to nBn);
 $V_{CC(A)} = 1.5\text{ V}$



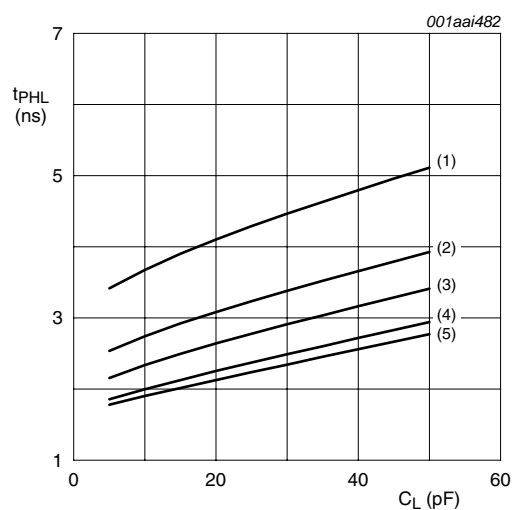
d. HIGH to LOW propagation delay (nAn to nBn);
 $V_{CC(A)} = 1.5\text{ V}$

- (1) $V_{CC(B)} = 1.2\text{ V}$.
- (2) $V_{CC(B)} = 1.5\text{ V}$.
- (3) $V_{CC(B)} = 1.8\text{ V}$.
- (4) $V_{CC(B)} = 2.5\text{ V}$.
- (5) $V_{CC(B)} = 3.3\text{ V}$.

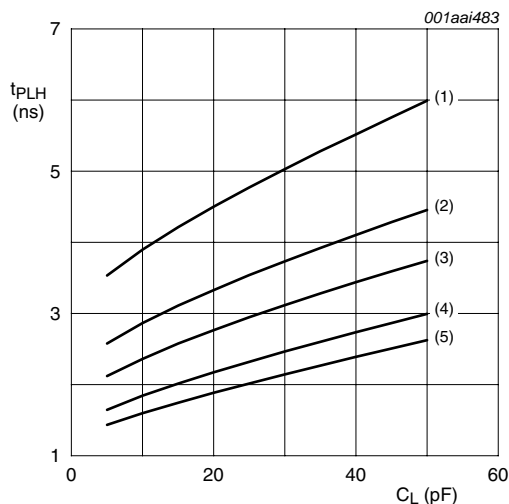
Fig 10. Typical propagation delay versus load capacitance; $T_{amb} = 25\text{ }^{\circ}\text{C}$



a. LOW to HIGH propagation delay (nAn to nBn);
 $V_{CC(A)} = 1.8 \text{ V}$

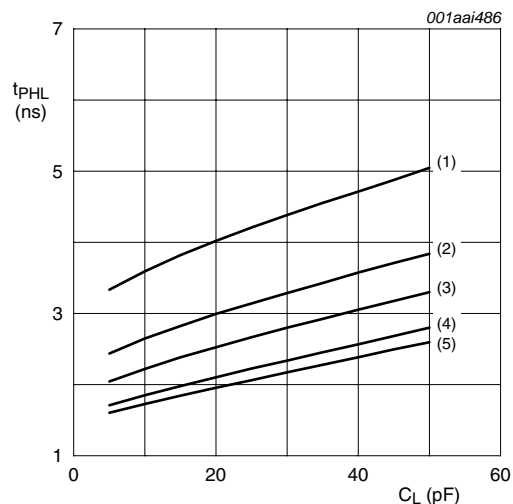


b. HIGH to LOW propagation delay (nAn to nBn);
 $V_{CC(A)} = 1.8 \text{ V}$



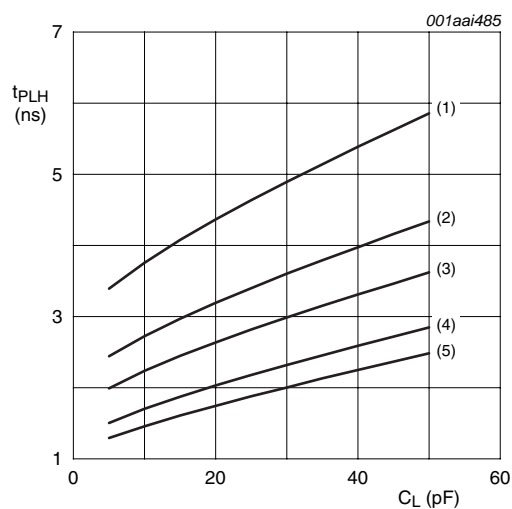
c. LOW to HIGH propagation delay (nAn to nBn);
 $V_{CC(A)} = 2.5 \text{ V}$

- (1) $V_{CC(B)} = 1.2 \text{ V}$.
- (2) $V_{CC(B)} = 1.5 \text{ V}$.
- (3) $V_{CC(B)} = 1.8 \text{ V}$.
- (4) $V_{CC(B)} = 2.5 \text{ V}$.
- (5) $V_{CC(B)} = 3.3 \text{ V}$.



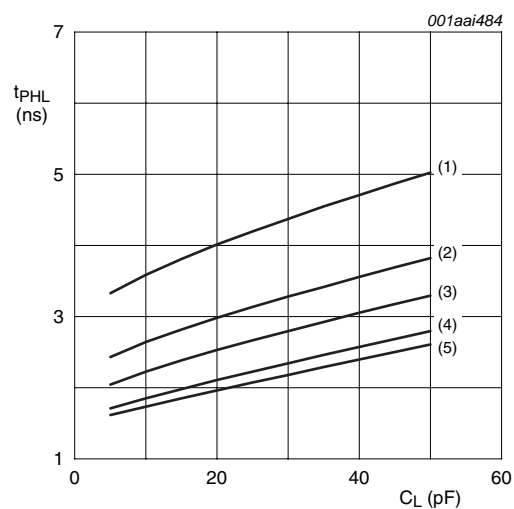
d. HIGH to LOW propagation delay (nAn to nBn);
 $V_{CC(A)} = 2.5 \text{ V}$

Fig 11. Typical propagation delay versus load capacitance; $T_{amb} = 25^\circ\text{C}$



a. LOW to HIGH propagation delay (nAn to nBn);
 $V_{CC(A)} = 3.3 \text{ V}$

- (1) $V_{CC(B)} = 1.2 \text{ V}$.
- (2) $V_{CC(B)} = 1.5 \text{ V}$.
- (3) $V_{CC(B)} = 1.8 \text{ V}$.
- (4) $V_{CC(B)} = 2.5 \text{ V}$.
- (5) $V_{CC(B)} = 3.3 \text{ V}$.



b. HIGH to LOW propagation delay (nAn to nBn);
 $V_{CC(A)} = 3.3 \text{ V}$

Fig 12. Typical propagation delay versus load capacitance; $T_{amb} = 25 \text{ }^{\circ}\text{C}$

13. Package outline

TSSOP48: plastic thin shrink small outline package; 48 leads; body width 6.1 mm SOT362-1

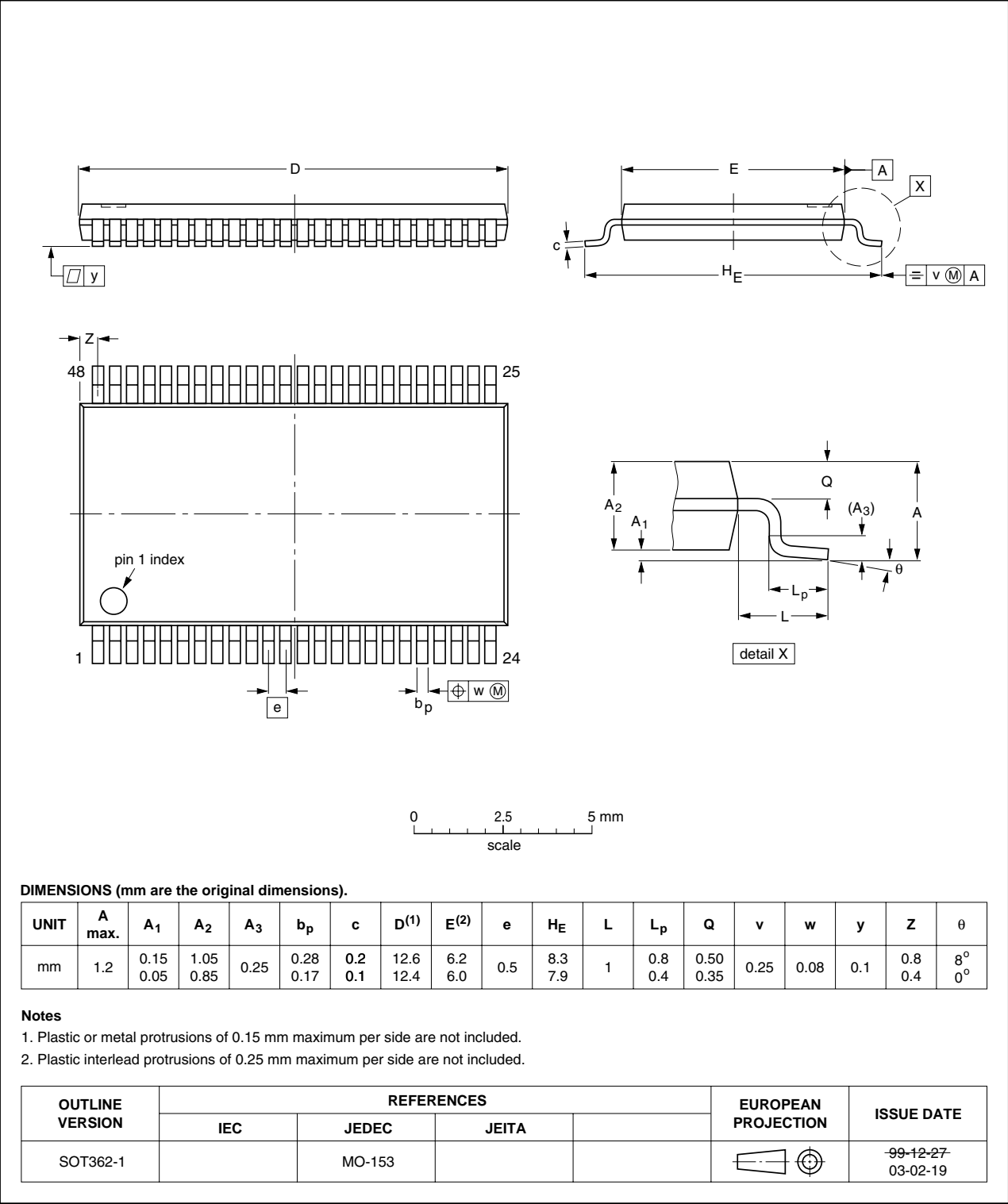


Fig 13. Package outline SOT362-1 (TSSOP48)

TSSOP48: plastic thin shrink small outline package; 48 leads;
body width 4.4 mm; lead pitch 0.4 mm

SOT480-1

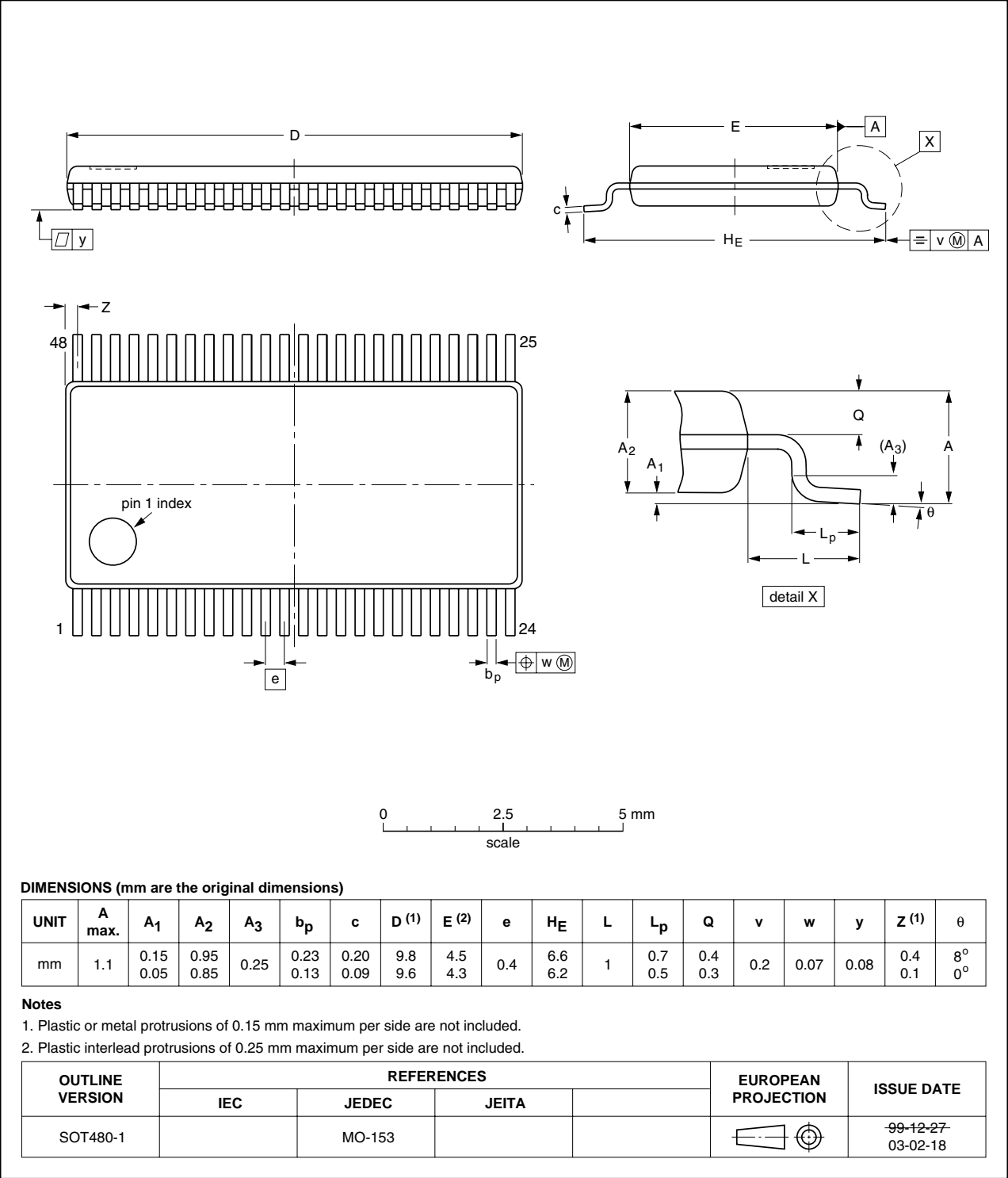


Fig 14. Package outline SOT480-1 (TSSOP48)

VFBGA56: plastic very thin fine-pitch ball grid array package; 56 balls; body 4.5 x 7 x 0.65 mm SOT702-1

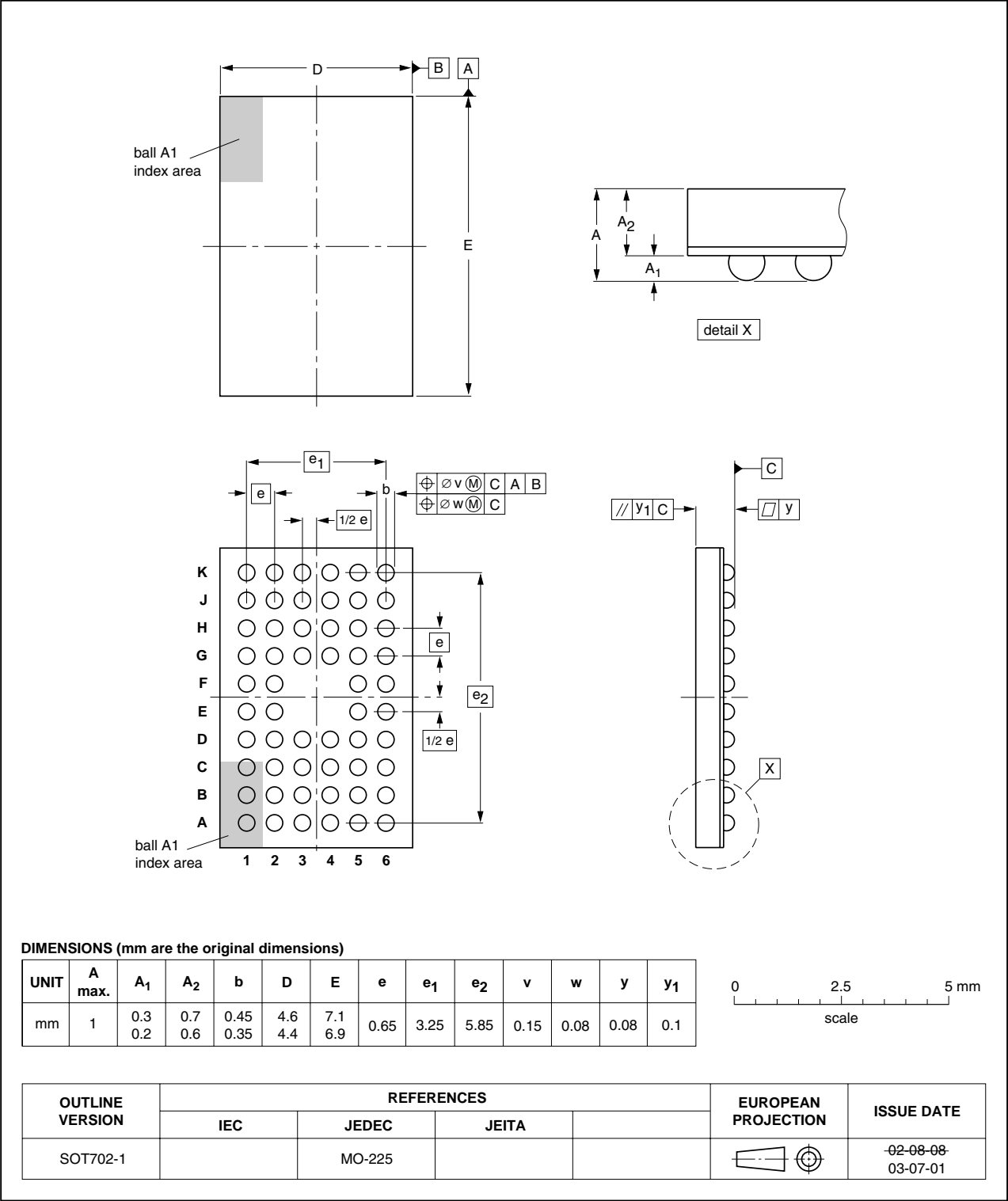


Fig 15. Package outline SOT702-1 (VFBGA56)

HXQFN60U: plastic thermal enhanced extremely thin quad flat package; no leads;
60 terminals; UTLP based; body 4 x 6 x 0.5 mm

SOT1134-1

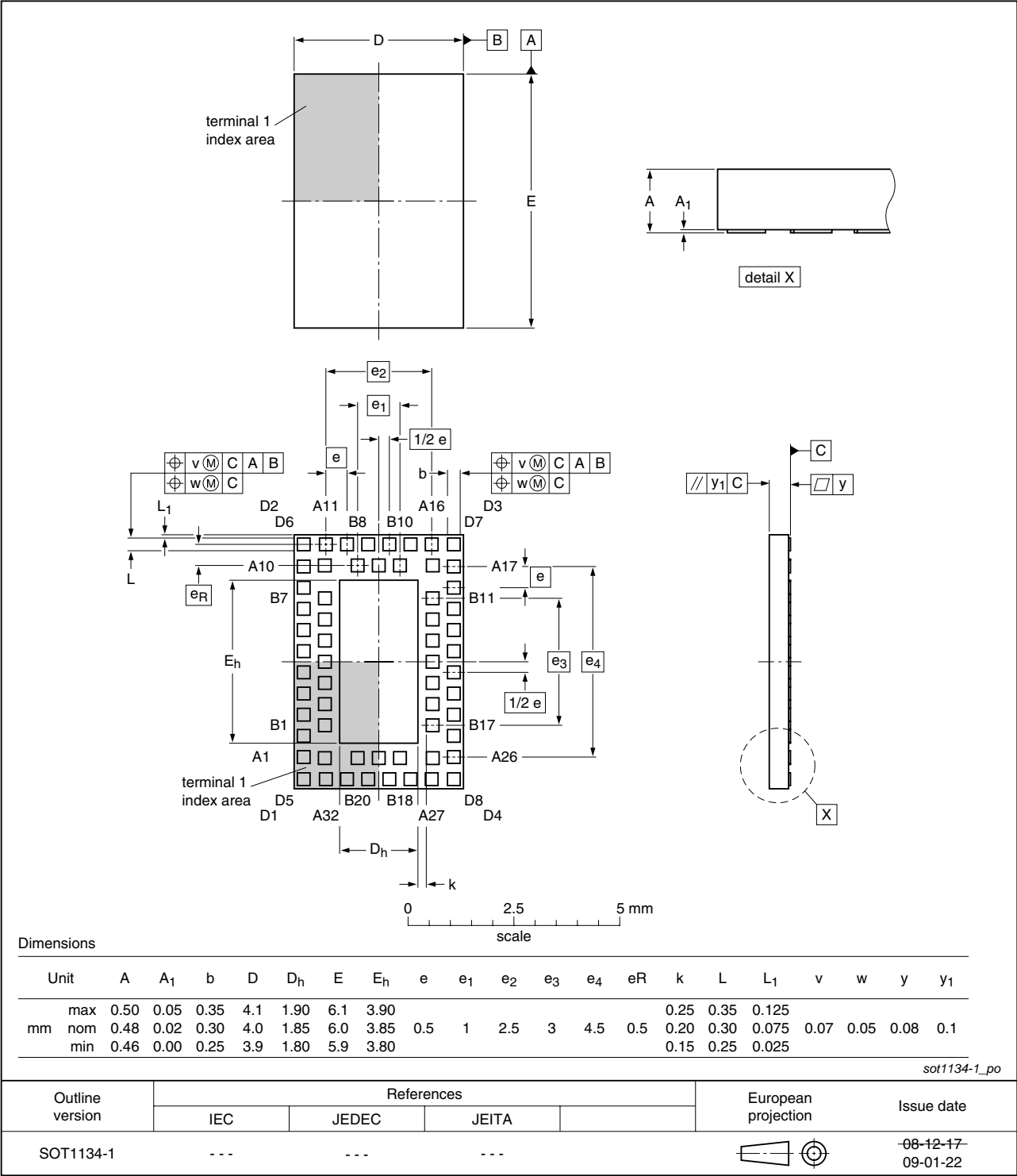


Fig 16. Package outline SOT1134-1 (HXQFN60U)

14. Abbreviations

Table 16. Abbreviations

Acronym	Description
CDM	Charged Device Model
DUT	Device Under Test
ESD	ElectroStatic Discharge
HBM	Human Body Model
MM	Machine Model

15. Revision history

Table 17. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74AVC16T245_2	20100330	Product data sheet	-	74AVC16T245_1
Modifications:	<ul style="list-style-type: none">74AVC16T245BQ changed from HUQFN60U (SOT1025-1) to HXQFN60U (SOT1134-1) package.			
74AVC16T245_1	20091001	Product data sheet	-	-

16. Legal information

16.1 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".

[3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the Internet at URL <http://www.nxp.com>.

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18. Contents

1	General description	1
2	Features and benefits	1
3	Ordering information	2
4	Functional diagram	2
5	Pinning information	4
5.1	Pinning	4
5.2	Pin description	6
6	Functional description	6
7	Limiting values	7
8	Recommended operating conditions	7
9	Static characteristics	8
10	Dynamic characteristics	11
11	Waveforms	15
12	Typical propagation delay characteristics ..	17
13	Package outline	21
14	Abbreviations	25
15	Revision history	25
16	Legal information	26
16.1	Data sheet status	26
16.2	Definitions	26
16.3	Disclaimers	26
16.4	Trademarks	26
17	Contact information	27
18	Contents	28

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