

# 74AVC32T245

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

Rev. 1 — 16 January 2013

Product data sheet

### 1. General description

The 74AVC32T245 is a 32-bit transceiver with bidirectional level voltage translation and 3-state outputs. The device can be used as eight 8-bit input-output ports (nAn and nBn), two 16-bit transceiver or as a 32-bit transceiver. It has dual supplies ( $V_{CC(A)}$  and  $V_{CC(B)}$ ) for voltage translation and four 8-bit input-output ports (nAn and nBn) each with its own output enable ( $n\overline{OE}$ ) 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  $n\overline{OE}$  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 ( $\geq$  1.8 V to 3.3 V translation)
  - ◆ 200 Mbit/s ( $\geq$  1.1 V to 3.3 V translation)
  - ◆ 200 Mbit/s ( $\geq$  1.1 V to 2.5 V translation)
  - ◆ 200 Mbit/s ( $\geq$  1.1 V to 1.8 V translation)
  - ◆ 150 Mbit/s ( $\geq$  1.1 V to 1.5 V translation)

- ◆ 100 Mbit/s ( $\geq 1.1$  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  $-40$  °C to  $+85$  °C and  $-40$  °C to  $+125$  °C

### 3. Ordering information

Table 1. Ordering information

Type number	Package			Version
	Temperature range	Name	Description	
74AVC32T245EC	$-40$ °C to $+125$ °C	LFBGA96	plastic low profile fine-pitch ball grid array package; 96 balls; body $13.5 \times 5.5 \times 1.05$ mm	SOT536-1

### 4. Functional diagram

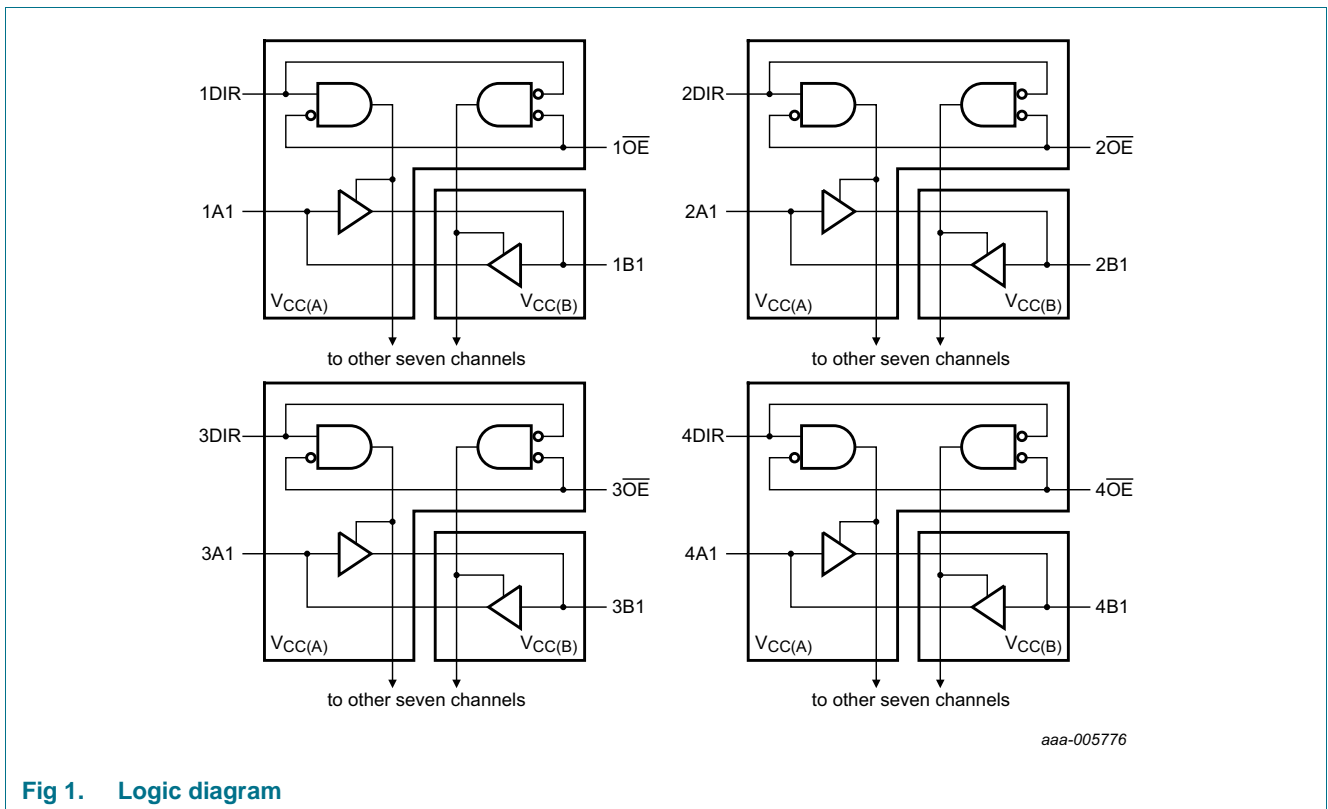


Fig 1. Logic diagram

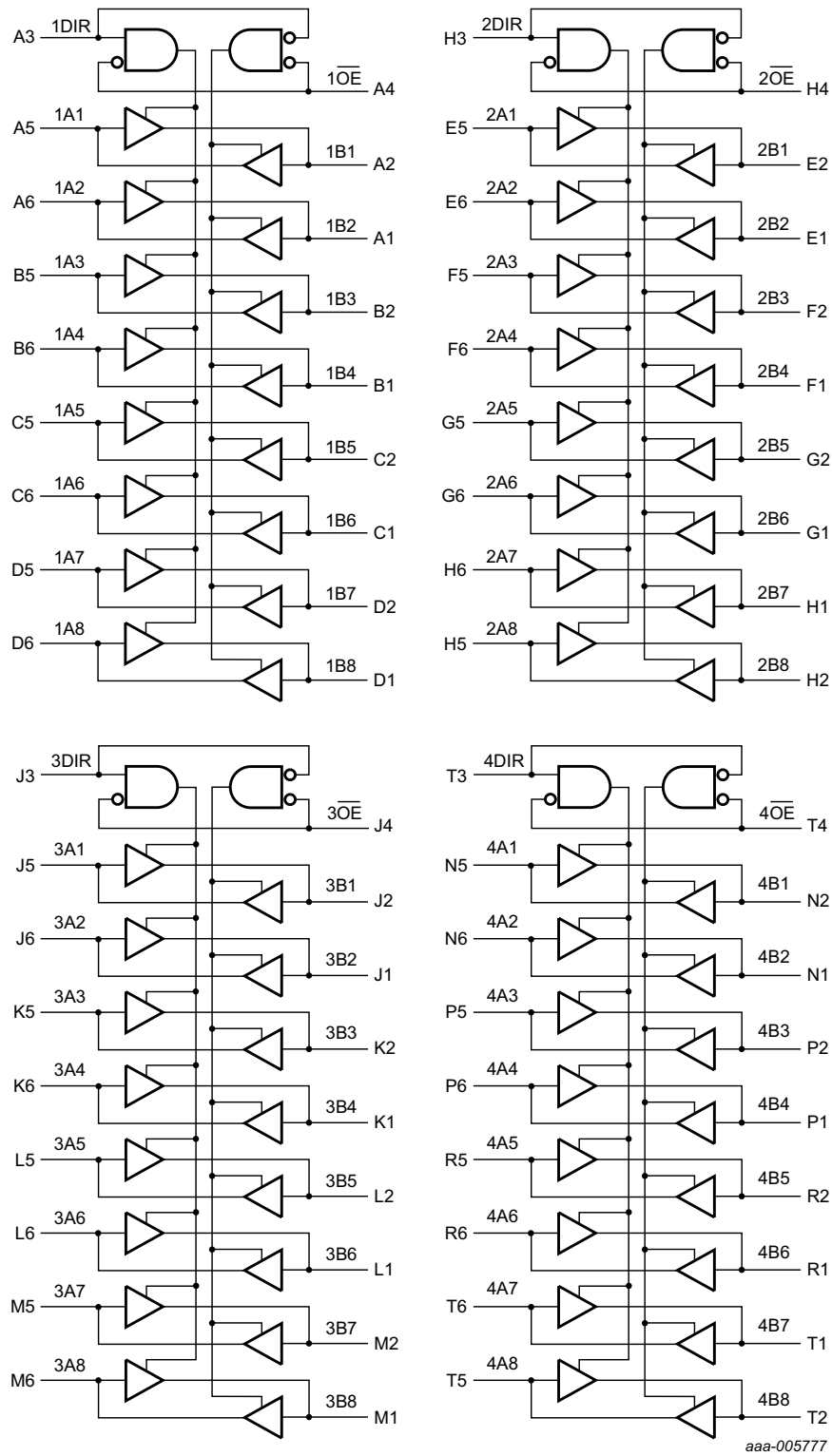
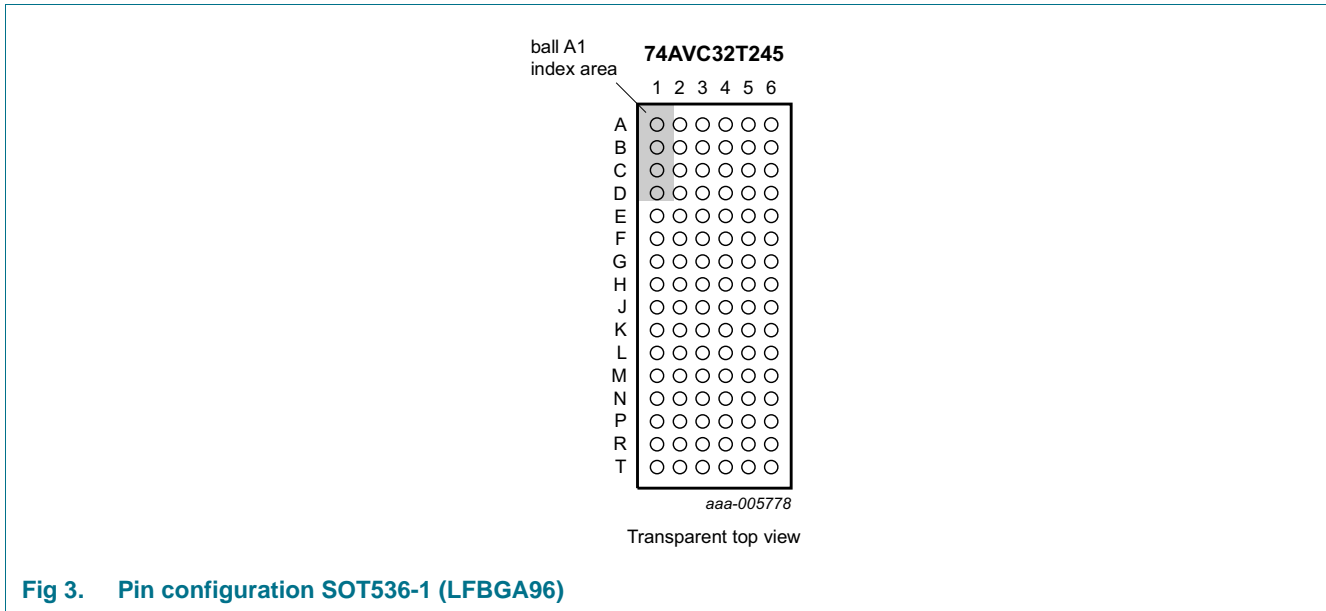


Fig 2. Logic symbol

## 5. Pinning information

### 5.1 Pinning



### 5.2 Pin description

**Table 2. Pin description**

Symbol	Ball	Description
1DIR, 2DIR, 3DIR, 4DIR	A3, H3, J3, T3	direction control
1OE, 2OE, 3OE, 4OE	A4, H4, J4, T4	output enable input (active LOW)
1A1 to 1A8	A5, A6, B5, B6, C5, C6, D5, D6	input or output
1B1 to 1B8	A2, A1, B2, B1, C2, C1, D2, D1	input or output
2A1 to 2A8	E5, E6, F5, F6, G5, G6, H6, H5	input or output
2B1 to 2B8	E2, E1, F2, F1, G2, G1, H1, H2	input or output
3A1 to 3A8	J5, J6, K5, K6, L5, L6, M5, M6	input or output
3B1 to 3B8	J2, J1, K2, K1, L2, L1, M2, M1	input or output
4A1 to 4A8	N5, N6, P5, P6, R5, R6, T6, T5	input or output
4B1 to 4B8	N2, N1, P2, P1, R2, R1, T1, T2	input or output
GND <sup>[1]</sup>	B3, B4, D3, D4, E3, E4, G3, G4, K3, K4, M3, M4, N3, N4, R3, R4	ground (0 V)
V <sub>CC(A)</sub>	C4, F4, L4, P4	supply voltage A (nAn, nOE and nDIR inputs are referenced to V <sub>CC(A)</sub> )
V <sub>CC(B)</sub>	C3, F3, L3, P3	supply voltage B (nBn inputs are referenced to V <sub>CC(B)</sub> )

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

## 6. Functional description

Table 3. Function table<sup>[1]</sup>

Supply voltage	Input		Input/output <sup>[3]</sup>	
	$\overline{\text{nOE}}$ <sup>[2]</sup>	nDIR <sup>[2]</sup>	nAn <sup>[2]</sup>	nBn <sup>[2]</sup>
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 <sup>[3]</sup>	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  $\overline{\text{nOE}}$  input circuit is referenced to  $V_{\text{CC(A)}}$ ; The nBn input circuit is referenced to  $V_{\text{CC(B)}}$ .

[3] If at least one of  $V_{\text{CC(A)}}$  or  $V_{\text{CC(B)}}$  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
$V_{\text{CC(A)}}$	supply voltage A		-0.5	+4.6	V
$V_{\text{CC(B)}}$	supply voltage B		-0.5	+4.6	V
$I_{\text{IK}}$	input clamping current	$V_{\text{I}} < 0 \text{ V}$	-50	-	mA
$V_{\text{I}}$	input voltage		<sup>[1]</sup> -0.5	+4.6	V
$I_{\text{OK}}$	output clamping current	$V_{\text{O}} < 0 \text{ V}$	-50	-	mA
$V_{\text{O}}$	output voltage	Active mode	<sup>[1][2][3]</sup> -0.5	$V_{\text{CCO}} + 0.5$	V
		Suspend or 3-state mode	<sup>[1]</sup> -0.5	+4.6	V
$I_{\text{O}}$	output current	$V_{\text{O}} = 0 \text{ V to } V_{\text{CCO}}$	<sup>[2]</sup> -	$\pm 50$	mA
$I_{\text{CC}}$	supply current	per $V_{\text{CC(A)}}$ or $V_{\text{CC(B)}}$ pin	-	100	mA
$I_{\text{GND}}$	ground current	per GND pin	-100	-	mA
$T_{\text{stg}}$	storage temperature		-65	+150	°C
$P_{\text{tot}}$	total power dissipation	$T_{\text{amb}} = -40 \text{ °C to } +125 \text{ °C}$			
		LFBGA96 package	<sup>[4]</sup> -	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]  $V_{\text{CCO}}$  is the supply voltage associated with the output port.

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

[4] Above 70 °C the value of  $P_{\text{tot}}$  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	$V_{CCI} = 0.8\text{ V to }3.6\text{ V}$	[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.

## 9. Static characteristics

**Table 6. Typical static characteristics at  $T_{amb} = 25\text{ °C}$  [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, $\overline{\text{nOE}}$ input; $V_I = 0\text{ V or }3.6\text{ V}$ ; $V_{CC(A)} = V_{CC(B)} = 0.8\text{ V to }3.6\text{ V}$	-	$\pm 0.025$	$\pm 0.25$	$\mu\text{A}$
$I_{OZ}$	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] -	$\pm 0.5$	$\pm 2.5$	$\mu\text{A}$
		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] -	$\pm 0.5$	$\pm 2.5$	$\mu\text{A}$
		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] -	$\pm 0.5$	$\pm 2.5$	$\mu\text{A}$
$I_{OFF}$	power-off leakage current	A port; $V_I$ or $V_O = 0\text{ V to }3.6\text{ V}$ ; $V_{CC(A)} = 0\text{ V}$ ; $V_{CC(B)} = 0.8\text{ V to }3.6\text{ V}$	-	$\pm 0.1$	$\pm 1$	$\mu\text{A}$
		B port; $V_I$ or $V_O = 0\text{ V to }3.6\text{ V}$ ; $V_{CC(B)} = 0\text{ V}$ ; $V_{CC(A)} = 0.8\text{ V to }3.6\text{ V}$	-	$\pm 0.1$	$\pm 1$	$\mu\text{A}$
$C_I$	input capacitance	nDIR, $\overline{\text{nOE}}$ input; $V_I = 0\text{ V or }3.3\text{ V}$ ; $V_{CC(A)} = V_{CC(B)} = 3.3\text{ V}$	-	2.0	-	pF
$C_{I/O}$	input/output capacitance	A and B port; $V_O = 3.3\text{ V or }0\text{ V}$ ; $V_{CC(A)} = V_{CC(B)} = 3.3\text{ V}$	-	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					
		$V_{CCI} = 0.8 \text{ V}$	0.70 $V_{CCI}$	-	0.70 $V_{CCI}$	-	V
		$V_{CCI} = 1.1 \text{ V to } 1.95 \text{ V}$	0.65 $V_{CCI}$	-	0.65 $V_{CCI}$	-	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
		nDIR, $\overline{nOE}$ input					
		$V_{CC(A)} = 0.8 \text{ V}$	0.70 $V_{CC(A)}$	-	0.70 $V_{CC(A)}$	-	V
		$V_{CC(A)} = 1.1 \text{ V to } 1.95 \text{ V}$	0.65 $V_{CC(A)}$	-	0.65 $V_{CC(A)}$	-	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					
		$V_{CCI} = 0.8 \text{ V}$	-	0.30 $V_{CCI}$	-	0.30 $V_{CCI}$	V
		$V_{CCI} = 1.1 \text{ V to } 1.95 \text{ V}$	-	0.35 $V_{CCI}$	-	0.35 $V_{CCI}$	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					
		$V_{CC(A)} = 0.8 \text{ V}$	-	0.30 $V_{CC(A)}$	-	0.30 $V_{CC(A)}$	V
		$V_{CC(A)} = 1.1 \text{ V to } 1.95 \text{ V}$	-	0.35 $V_{CC(A)}$	-	0.35 $V_{CC(A)}$	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	$V_I = V_{IH}$ 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

**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 <sub>OL</sub>	LOW-level output voltage	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>						
		I <sub>O</sub> = 100 μA; V <sub>CC(A)</sub> = V <sub>CC(B)</sub> = 0.8 V to 3.6 V	-	0.1	-	0.1	V	
		I <sub>O</sub> = 3 mA; V <sub>CC(A)</sub> = V <sub>CC(B)</sub> = 1.1 V	-	0.25	-	0.25	V	
		I <sub>O</sub> = 6 mA; V <sub>CC(A)</sub> = V <sub>CC(B)</sub> = 1.4 V	-	0.35	-	0.35	V	
		I <sub>O</sub> = 8 mA; V <sub>CC(A)</sub> = V <sub>CC(B)</sub> = 1.65 V	-	0.45	-	0.45	V	
		I <sub>O</sub> = 9 mA; V <sub>CC(A)</sub> = V <sub>CC(B)</sub> = 2.3 V	-	0.55	-	0.55	V	
		I <sub>O</sub> = 12 mA; V <sub>CC(A)</sub> = V <sub>CC(B)</sub> = 3.0 V	-	0.7	-	0.7	V	
I <sub>I</sub>	input leakage current	nDIR, nOE input; V <sub>I</sub> = 0 V or 3.6 V; V <sub>CC(A)</sub> = V <sub>CC(B)</sub> = 0.8 V to 3.6 V	-	±1	-	±5	μA	
I <sub>OZ</sub>	OFF-state output current	A or B port; V <sub>O</sub> = 0 V or V <sub>CCO</sub> ; V <sub>CC(A)</sub> = V <sub>CC(B)</sub> = 3.6 V	<a href="#">[3]</a>	-	±5	-	±30	μA
		suspend mode A port; V <sub>O</sub> = 0 V or V <sub>CCO</sub> ; V <sub>CC(A)</sub> = 3.6 V; V <sub>CC(B)</sub> = 0 V	<a href="#">[3]</a>	-	±5	-	±30	μA
		suspend mode B port; V <sub>O</sub> = 0 V or V <sub>CCO</sub> ; V <sub>CC(A)</sub> = 0 V; V <sub>CC(B)</sub> = 3.6 V	<a href="#">[3]</a>	-	±5	-	±30	μA
I <sub>OFF</sub>	power-off leakage current	A port; V <sub>I</sub> or V <sub>O</sub> = 0 V to 3.6 V; V <sub>CC(A)</sub> = 0 V; V <sub>CC(B)</sub> = 0.8 V to 3.6 V	-	±5	-	±30	μA	
		B port; V <sub>I</sub> or V <sub>O</sub> = 0 V to 3.6 V; V <sub>CC(B)</sub> = 0 V; V <sub>CC(A)</sub> = 0.8 V to 3.6 V	-	±5	-	±30	μA	



**Table 7.** Static characteristics ...continued<sup>[1][2]</sup>

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 <sub>CC</sub>	supply current	A port; V <sub>I</sub> = 0 V or V <sub>CCI</sub> ; I <sub>O</sub> = 0 A					
		V <sub>CC(A)</sub> = 0.8 V to 3.6 V; V <sub>CC(B)</sub> = 0.8 V to 3.6 V	-	60	-	250	μA
		V <sub>CC(A)</sub> = 1.1 V to 3.6 V; V <sub>CC(B)</sub> = 1.1 V to 3.6 V	-	50	-	200	μA
		V <sub>CC(A)</sub> = 3.6 V; V <sub>CC(B)</sub> = 0 V	-	50	-	200	μA
		V <sub>CC(A)</sub> = 0 V; V <sub>CC(B)</sub> = 3.6 V	-10	-	-40	-	μA
		B port; V <sub>I</sub> = 0 V or V <sub>CCI</sub> ; I <sub>O</sub> = 0 A					
		V <sub>CC(A)</sub> = 0.8 V to 3.6 V; V <sub>CC(B)</sub> = 0.8 V to 3.6 V	-	60	-	250	μA
		V <sub>CC(A)</sub> = 1.1 V to 3.6 V; V <sub>CC(B)</sub> = 1.1 V to 3.6 V	-	50	-	200	μA
		V <sub>CC(A)</sub> = 3.6 V; V <sub>CC(B)</sub> = 0 V	-10	-	-40	-	μA
		V <sub>CC(A)</sub> = 0 V; V <sub>CC(B)</sub> = 3.6 V	-	50	-	200	μA
		A plus B port (I <sub>CC(A)</sub> + I <sub>CC(B)</sub> ); I <sub>O</sub> = 0 A; V <sub>I</sub> = 0 V or V <sub>CCI</sub> ; V <sub>CC(A)</sub> = 0.8 V to 3.6 V; V <sub>CC(B)</sub> = 0.8 V to 3.6 V	-	110	-	370	μA
		A plus B port (I <sub>CC(A)</sub> + I <sub>CC(B)</sub> ); I <sub>O</sub> = 0 A; V <sub>I</sub> = 0 V or V <sub>CCI</sub> ; V <sub>CC(A)</sub> = 1.1 V to 3.6 V; V <sub>CC(B)</sub> = 1.1 V to 3.6 V	-	90	-	300	μA

[1] V<sub>CCO</sub> is the supply voltage associated with the output port.[2] V<sub>CCI</sub> is the supply voltage associated with the data input port.[3] For I/O ports, the parameter I<sub>OZ</sub> includes the input leakage current.**Table 8.** Typical total supply current (I<sub>CC(A)</sub> + I<sub>CC(B)</sub>)

V <sub>CC(A)</sub>	V <sub>CC(B)</sub>							Unit
	0 V	0.8 V	1.2 V	1.5 V	1.8 V	2.5 V	3.3 V	
0 V	0	0.2	0.2	0.2	0.2	0.2	0.2	μA
0.8 V	0.2	0.2	0.2	0.2	0.2	0.6	3.2	μA
1.2 V	0.2	0.2	0.2	0.2	0.2	0.2	1.6	μA
1.5 V	0.2	0.2	0.2	0.2	0.2	0.2	0.8	μA
1.8 V	0.2	0.2	0.2	0.2	0.2	0.2	0.4	μA
2.5 V	0.2	0.6	0.2	0.2	0.2	0.2	0.2	μA
3.3 V	0.2	3.2	1.6	0.8	0.4	0.2	0.2	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  $\mu\text{W}$ ).

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

$f_i$  = 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 6](#); for wave forms see [Figure 4](#) and [Figure 5](#)

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 6](#); for wave forms see [Figure 4](#) and [Figure 5](#)

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 °C [1]**Voltages are referenced to GND (ground = 0 V); for test circuit see [Figure 6](#); for wave forms see [Figure 4](#) and [Figure 5](#).

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	
<b><math>V_{CC(A)} = 1.1 \text{ V to } 1.3 \text{ V}</math></b>													
$t_{pd}$	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	$\overline{nOE}$ to nAn	1.5	11.6	1.5	11.6	1.5	11.6	1.5	11.6	1.5	11.6	ns
		$\overline{nOE}$ 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	$\overline{nOE}$ to nAn	1.0	14.5	1.0	14.5	1.0	14.5	1.0	14.5	1.0	14.5	ns
		$\overline{nOE}$ to nBn	1.1	14.9	1.1	11.0	1.1	9.6	1.0	8.1	1.0	7.7	ns
<b><math>V_{CC(A)} = 1.4 \text{ V to } 1.6 \text{ V}</math></b>													
$t_{pd}$	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	$\overline{nOE}$ to nAn	1.5	9.1	1.5	9.1	1.5	9.1	1.5	9.1	1.5	9.1	ns
		$\overline{nOE}$ 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	$\overline{nOE}$ to nAn	1.0	10.1	1.0	10.1	1.0	10.1	1.0	10.1	1.0	10.1	ns
		$\overline{nOE}$ to nBn	1.0	13.5	1.0	10.1	0.5	8.1	0.5	5.9	0.5	5.2	ns
<b><math>V_{CC(A)} = 1.65 \text{ V to } 1.95 \text{ V}</math></b>													
$t_{pd}$	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	$\overline{nOE}$ to nAn	1.5	7.7	1.5	7.7	1.5	7.7	1.5	7.7	1.5	7.7	ns
		$\overline{nOE}$ 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	$\overline{nOE}$ to nAn	1.0	7.8	1.0	7.8	1.0	7.8	1.0	7.8	1.0	7.8	ns
		$\overline{nOE}$ to nBn	1.0	13.0	1.0	9.2	0.5	7.4	0.5	5.3	0.5	4.5	ns
<b><math>V_{CC(A)} = 2.3 \text{ V to } 2.7 \text{ V}</math></b>													
$t_{pd}$	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	$\overline{nOE}$ to nAn	1.0	6.1	1.0	6.1	1.0	6.1	1.0	6.1	1.0	6.1	ns
		$\overline{nOE}$ 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	$\overline{nOE}$ to nAn	0.5	5.3	0.5	5.3	0.5	5.3	0.5	5.3	0.5	5.3	ns
		$\overline{nOE}$ to nBn	0.5	12.5	0.5	9.4	0.5	7.3	0.5	5.1	0.5	4.5	ns
<b><math>V_{CC(A)} = 3.0 \text{ V to } 3.6 \text{ V}</math></b>													
$t_{pd}$	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	$\overline{nOE}$ to nAn	0.5	5.0	0.5	5.0	0.5	5.0	0.5	5.0	0.5	5.0	ns
		$\overline{nOE}$ 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	$\overline{nOE}$ to nAn	0.5	4.3	0.5	4.3	0.5	4.2	0.5	4.1	0.5	4.0	ns
		$\overline{nOE}$ to nBn	0.5	12.4	0.5	9.3	0.5	7.2	0.5	4.9	0.5	4.0	ns

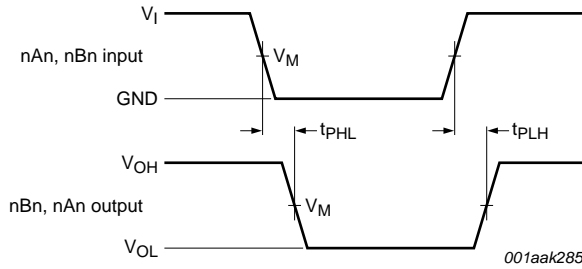
[1]  $t_{pd}$  is the same as  $t_{PLH}$  and  $t_{PHL}$ ;  $t_{dis}$  is the same as  $t_{PLZ}$  and  $t_{PHZ}$ ;  $t_{en}$  is the same as  $t_{PZL}$  and  $t_{PZH}$ .

**Table 13. Dynamic characteristics for temperature range  $-40\text{ }^{\circ}\text{C}$  to  $+125\text{ }^{\circ}\text{C}$  [1]**Voltages are referenced to GND (ground = 0 V); for test circuit see [Figure 6](#); for wave forms see [Figure 4](#) and [Figure 5](#)

Symbol	Parameter	Conditions	$V_{CC(B)}$										Unit
			1.2 V $\pm$ 0.1 V		1.5 V $\pm$ 0.1 V		1.8 V $\pm$ 0.15 V		2.5 V $\pm$ 0.2 V		3.3 V $\pm$ 0.3 V		
			Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	
<b><math>V_{CC(A)} = 1.1\text{ V to }1.3\text{ V}</math></b>													
$t_{pd}$	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
<b><math>V_{CC(A)} = 1.4\text{ V to }1.6\text{ V}</math></b>													
$t_{pd}$	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
<b><math>V_{CC(A)} = 1.65\text{ V to }1.95\text{ V}</math></b>													
$t_{pd}$	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
<b><math>V_{CC(A)} = 2.3\text{ V to }2.7\text{ V}</math></b>													
$t_{pd}$	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
<b><math>V_{CC(A)} = 3.0\text{ V to }3.6\text{ V}</math></b>													
$t_{pd}$	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

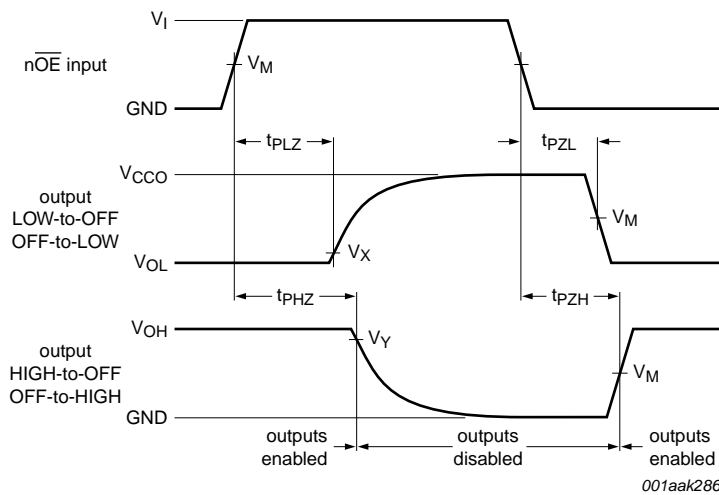
[1]  $t_{pd}$  is the same as  $t_{PLH}$  and  $t_{PHL}$ ;  $t_{dis}$  is the same as  $t_{PLZ}$  and  $t_{PHZ}$ ;  $t_{en}$  is the same as  $t_{PZL}$  and  $t_{PZH}$ .

11. Waveforms



Measurement points are given in [Table 14](#).  
 $V_{OL}$  and  $V_{OH}$  are typical output voltage levels that occur with the output load.

**Fig 4. The data input (nAn, nBn) to output (nBn, nAn) propagation delay times**



Measurement points are given in [Table 14](#).  
 $V_{OL}$  and  $V_{OH}$  are typical output voltage levels that occur with the output load.

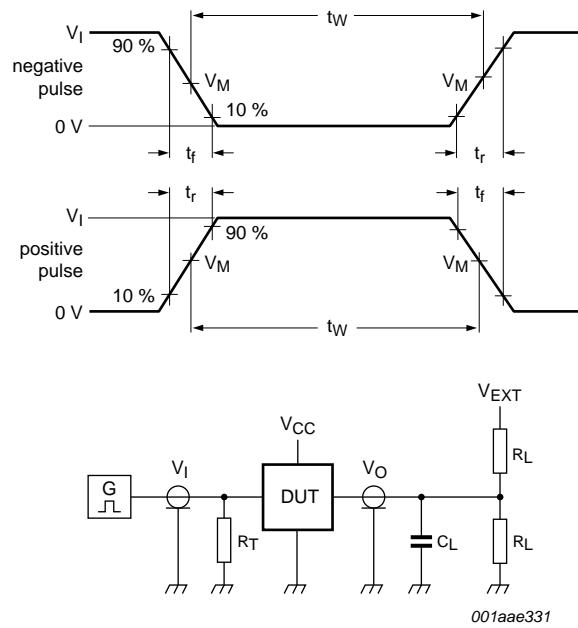
**Fig 5. Enable and disable times**

**Table 14. Measurement points**

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

[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.

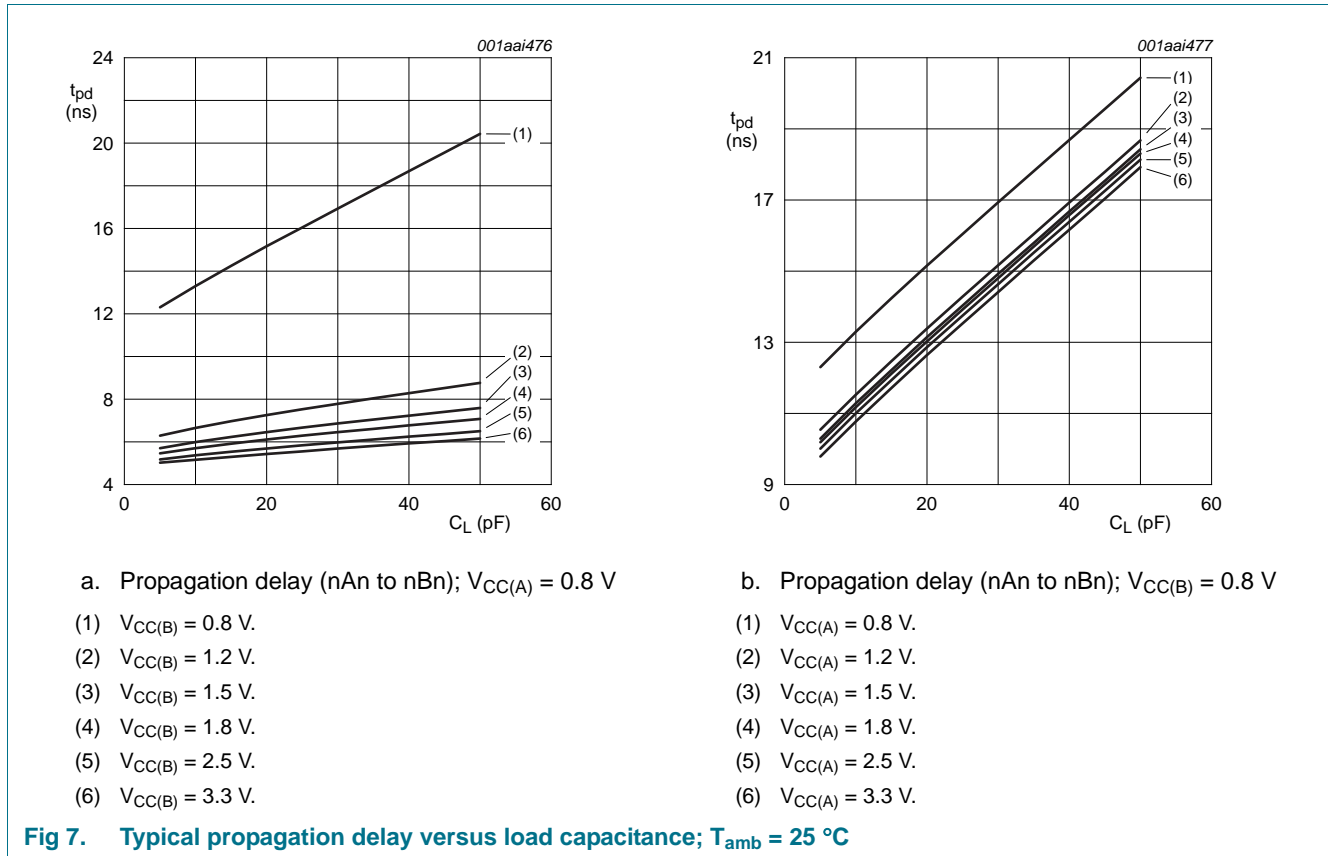
**Fig 6. Test circuit for measuring switching times**

**Table 15. Test data**

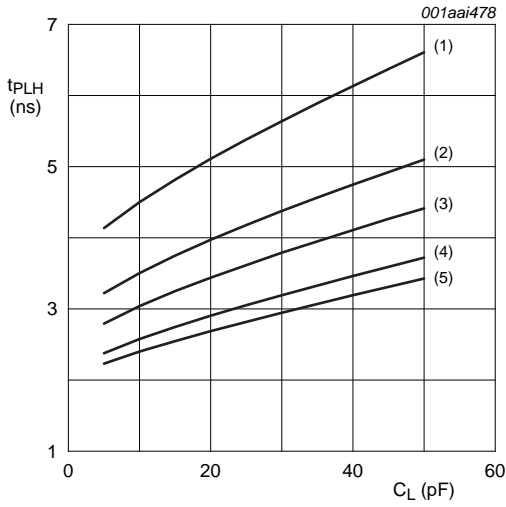
Supply voltage	Input		Load		$V_{EXT}$		
	$V_{CC(A)}$ , $V_{CC(B)}$	$V_I$ <sup>[1]</sup>	$\Delta t/\Delta V$ <sup>[2]</sup>	$C_L$	$R_L$	$t_{PLH}$ , $t_{PHL}$	$t_{PZH}$ , $t_{PHZ}$
0.8 V to 1.6 V	$V_{CCI}$	$\leq 1.0$ ns/V	15 pF	2 k $\Omega$	open	GND	$2V_{CCO}$
1.65 V to 2.7 V	$V_{CCI}$	$\leq 1.0$ ns/V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

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

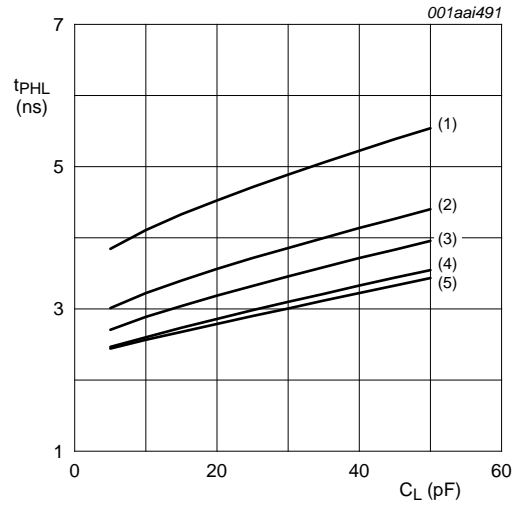
## 12. Typical propagation delay characteristics



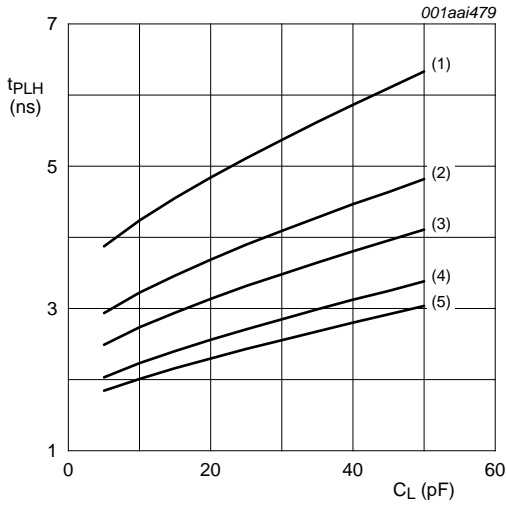




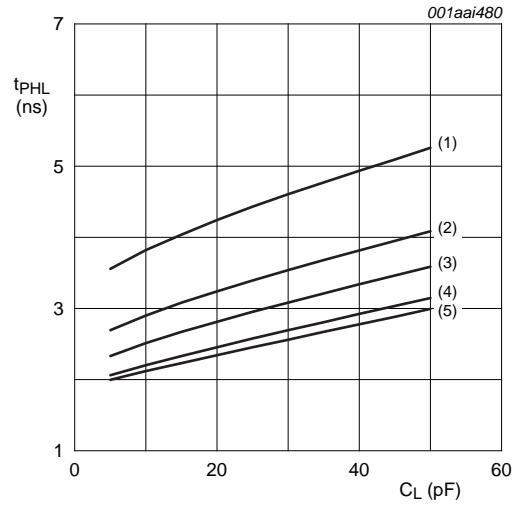
a. LOW to HIGH propagation delay (nAn to nBn);  
 $V_{CC(A)} = 1.2\text{ V}$



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



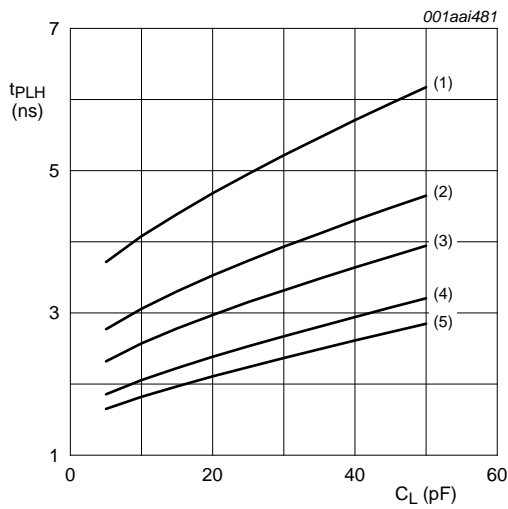
c. LOW to HIGH propagation delay (nAn to nBn);  
 $V_{CC(A)} = 1.5\text{ V}$



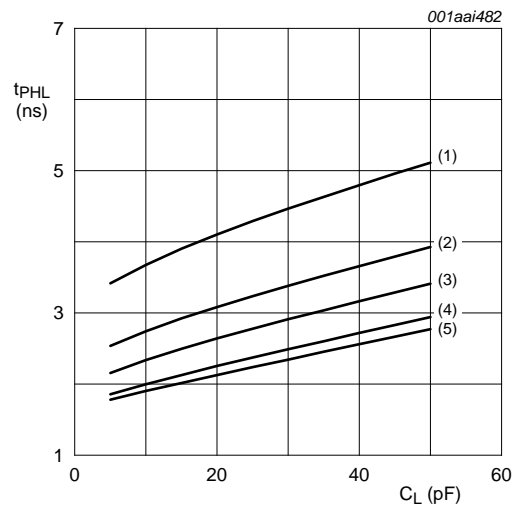
d. HIGH to LOW propagation delay (nAn to nBn);  
 $V_{CC(A)} = 1.5\text{ V}$

- (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)  $V_{CC(B)} = 3.3\text{ V}$ .

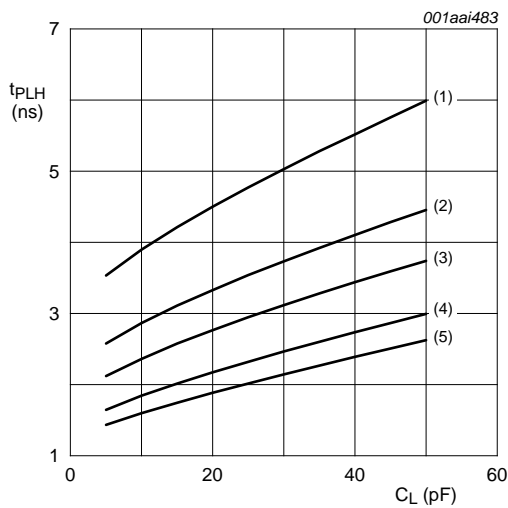
**Fig 8. Typical propagation delay versus load capacitance;  $T_{amb} = 25\text{ °C}$**



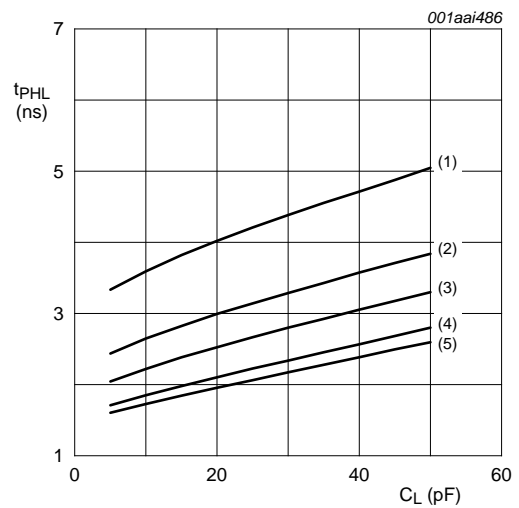
a. LOW to HIGH propagation delay (nAn to nBn);  
 $V_{CC(A)} = 1.8\text{ V}$



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



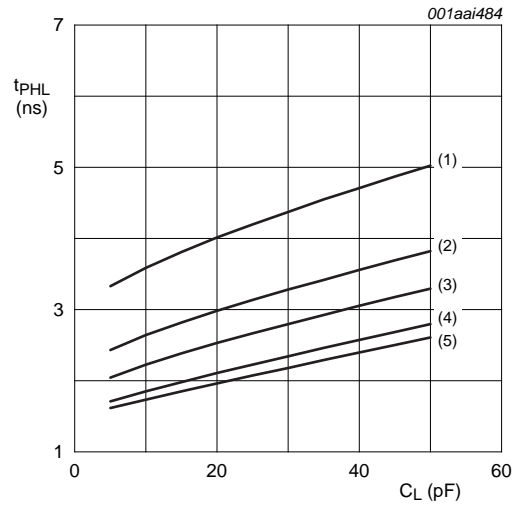
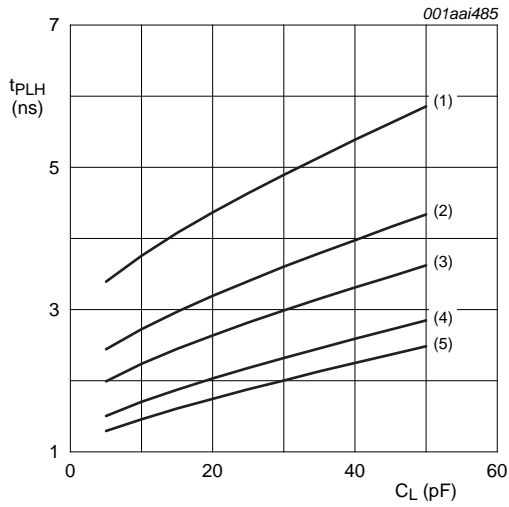
c. LOW to HIGH propagation delay (nAn to nBn);  
 $V_{CC(A)} = 2.5\text{ V}$



d. HIGH to LOW 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)  $V_{CC(B)} = 3.3\text{ V}$ .

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



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

- (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 10. Typical propagation delay versus load capacitance;  $T_{amb} = 25\text{ °C}$

13. Package outline

LFBGA96: plastic low profile fine-pitch ball grid array package; 96 balls; body 13.5 x 5.5 x 1.05 mm SOT536-1

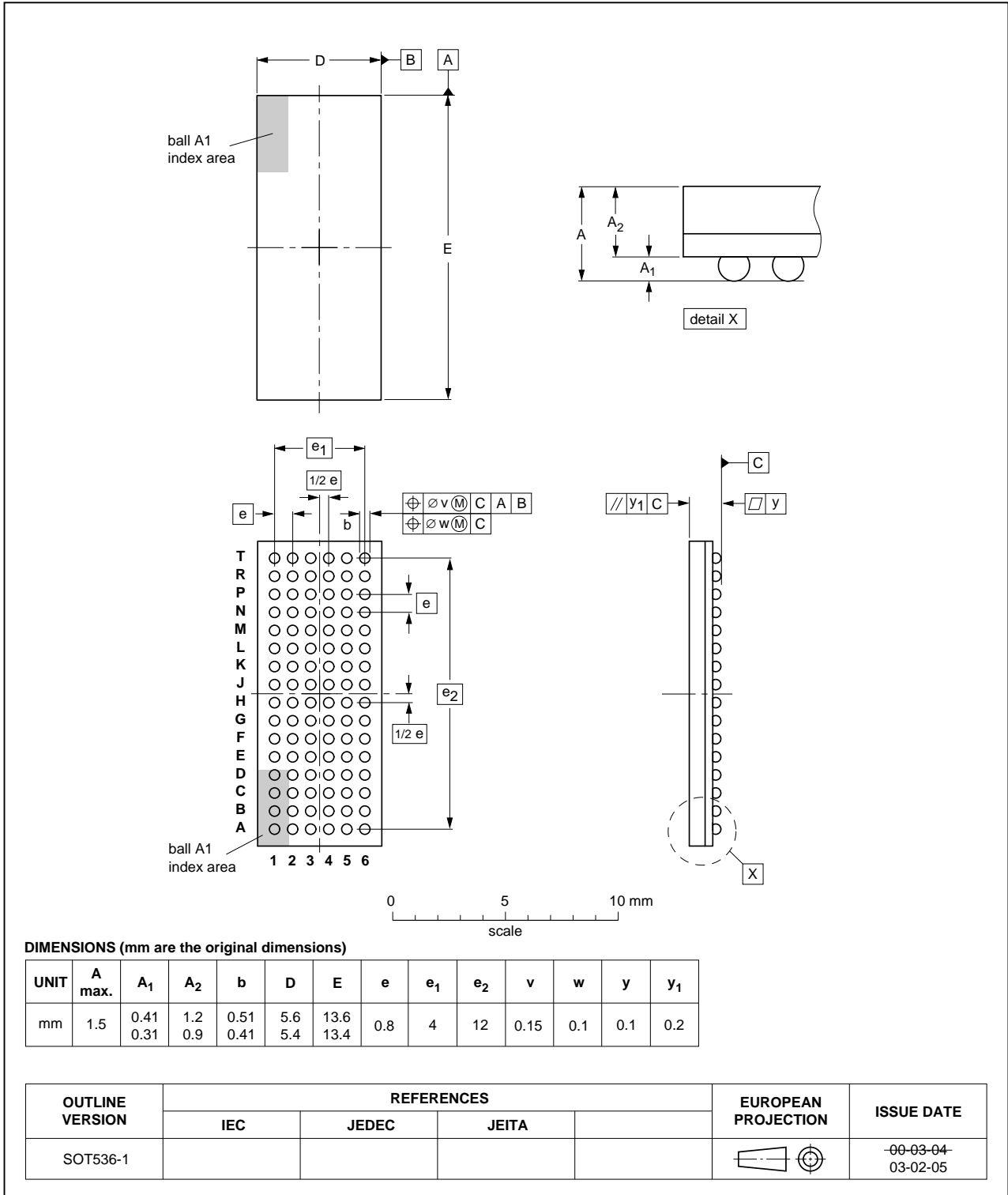


Fig 11. Package outline SOT536-1 (LFBGA96)

## 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
74AVC32T245 v.1	20130116	Product data sheet	-	-

## 16. Legal information

### 16.1 Data sheet status

Document status <sup>[1][2]</sup>	Product status <sup>[3]</sup>	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.nexperia.com>.

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