

# 74ALVT16601

18-bit universal bus transceiver; 3-state

Rev. 03 — 5 July 2005

Product data sheet

## 1. General description

The 74ALVT16601 is a high-performance Bipolar Complementary Metal Oxide Semiconductor (BiCMOS) product designed for  $V_{CC}$  operation at 2.5 V and 3.3 V with I/O compatibility up to 5 V. This device is an 18-bit universal transceiver featuring non-inverting 3-state bus compatible outputs in both send and receive directions. Data flow in each direction is controlled by output enable ( $\overline{OEAB}$  and  $\overline{OEBA}$ ), latch enable (LEAB and LEBA), and clock (CPAB and CPBA) inputs. For A-to-B data flow, the device operates in the transparent mode when LEAB is HIGH. When LEAB is LOW, the A-bus data is latched if CPAB is held at a HIGH or LOW level. If LEAB is LOW, the A-bus data is stored in the latch/flip-flop on the LOW-to-HIGH transition of CPAB. When  $\overline{OEAB}$  is LOW, the outputs are active. When  $\overline{OEAB}$  is HIGH, the outputs are in the high-impedance state. The clocks can be controlled with the clock enable inputs ( $\overline{CEAB}$  and  $\overline{CEBA}$ ).

Data flow for B-to-A is similar to that of A-to-B but uses  $\overline{OEBA}$ , LEBA and CPBA.

Active bus hold circuitry is provided to hold unused or floating data inputs at a valid logic level.

## 2. Features

- 18-bit bidirectional bus interface
- 5 V I/O compatible
- 3-state buffers
- Output capability: +64 mA and -32 mA
- TTL input and output switching levels
- Input and output interface capability to systems at 5 V supply
- Bus hold data inputs eliminate the need for external pull-up resistors to hold unused inputs
- Live insertion and extraction permitted
- Power-up reset
- Power-up 3-state
- No bus current loading when output is tied to 5 V bus
- Positive-edge triggered clock inputs
- Latch-up protection:
  - ◆ JESD78: exceeds 500 mA
- ESD protection:
  - ◆ MIL STD 883, method 3015: exceeds 2000 V
  - ◆ Machine model: exceeds 200 V

**PHILIPS**

### 3. Quick reference data

**Table 1: Quick reference data**

$GND = 0\text{ V}$ ;  $T_{amb} = 25\text{ }^{\circ}\text{C}$ .

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b><math>V_{CC} = 2.5\text{ V}</math></b>						
$t_{PLH}$	propagation delay An to Bn or Bn to An	$C_L = 30\text{ pF}$	-	1.8	-	ns
$t_{PHL}$	propagation delay An to Bn or Bn to An	$C_L = 30\text{ pF}$	-	2.2	-	ns
$C_i$	input capacitance of control pins	$V_I = 0\text{ V}$ or $V_{CC}$		4	-	pF
$C_{io}$	input/output capacitance of I/O pins	$V_{I/O} = 0\text{ V}$ or $V_{CC}$ ; outputs disabled		8	-	pF
$I_{CC}$	supply current	outputs disabled	-	40	-	$\mu\text{A}$
<b><math>V_{CC} = 3.3\text{ V}</math></b>						
$t_{PLH}$	propagation delay An to Bn or Bn to An	$C_L = 50\text{ pF}$	-	1.9	-	ns
$t_{PHL}$	propagation delay An to Bn or Bn to An	$C_L = 50\text{ pF}$	-	2	-	ns
$C_i$	input capacitance of control pins	$V_I = 0\text{ V}$ or $V_{CC}$		4	-	pF
$C_{io}$	input/output capacitance of I/O pins	$V_{I/O} = 0\text{ V}$ or $V_{CC}$ ; outputs disabled		8	-	pF
$I_{CC}$	supply current	outputs disabled	-	60	-	$\mu\text{A}$

### 4. Ordering information

**Table 2: Ordering information**

Type number	Package			
	Temperature range	Name	Description	Version
74ALVT16601DL	$-40\text{ }^{\circ}\text{C}$ to $+85\text{ }^{\circ}\text{C}$	SSOP56	plastic shrink small outline package; 56 leads; body width 7.5 mm	SOT371-1
74ALVT16601DGG	$-40\text{ }^{\circ}\text{C}$ to $+85\text{ }^{\circ}\text{C}$	TSSOP56	plastic thin shrink small outline package; 56 leads; body width 6.1 mm	SOT364-1

5. Functional diagram

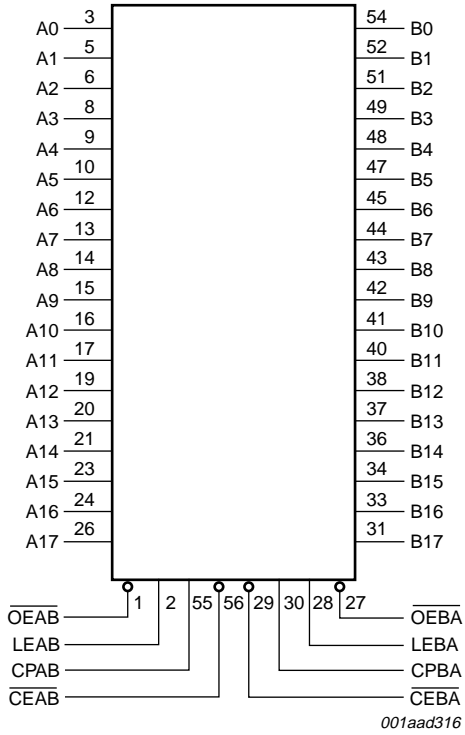


Fig 1. Logic symbol

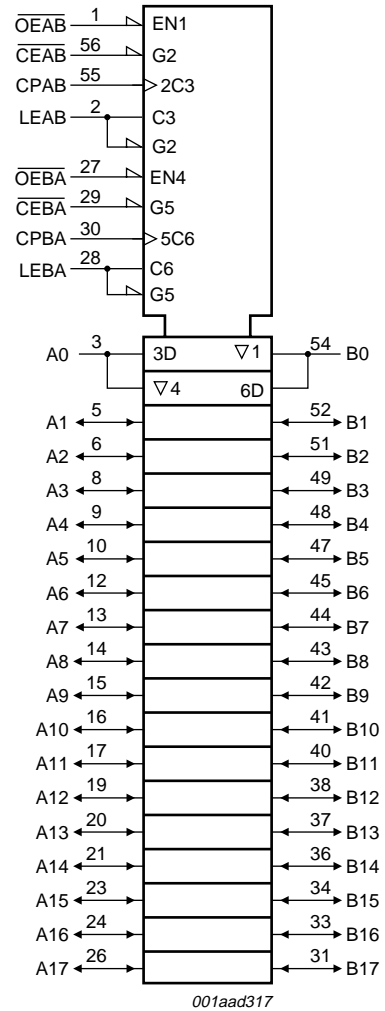


Fig 2. IEC logic symbol

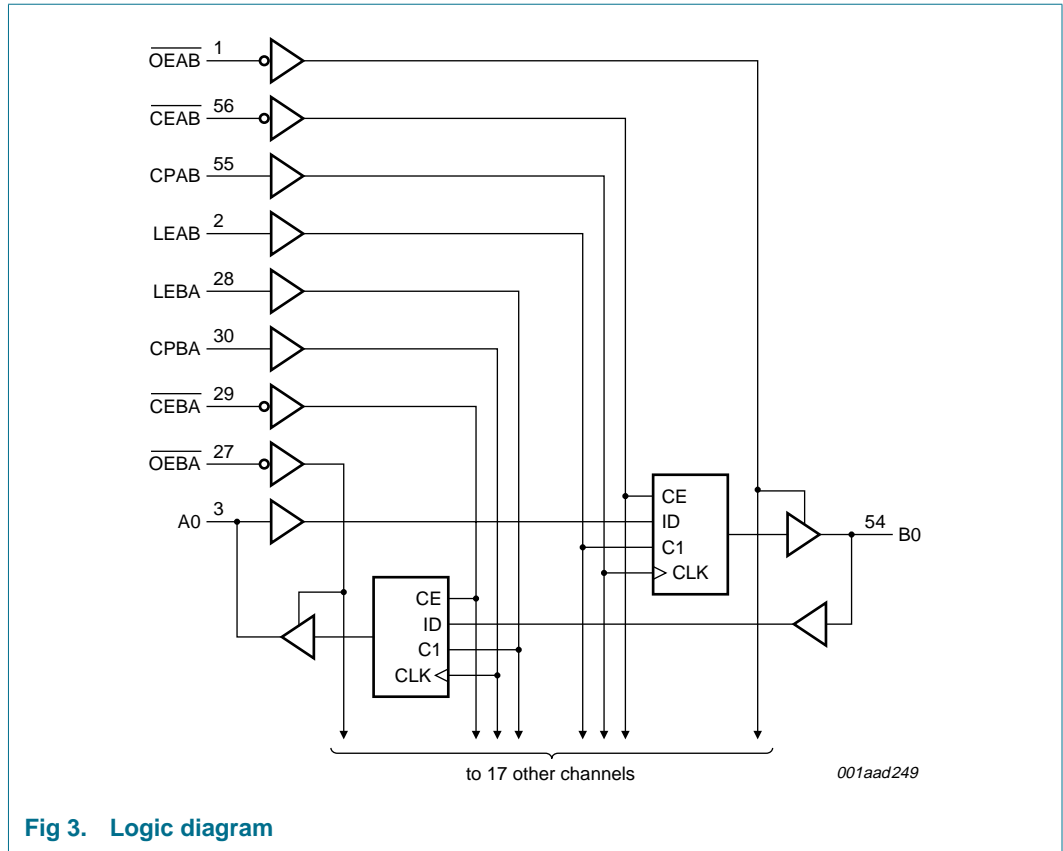
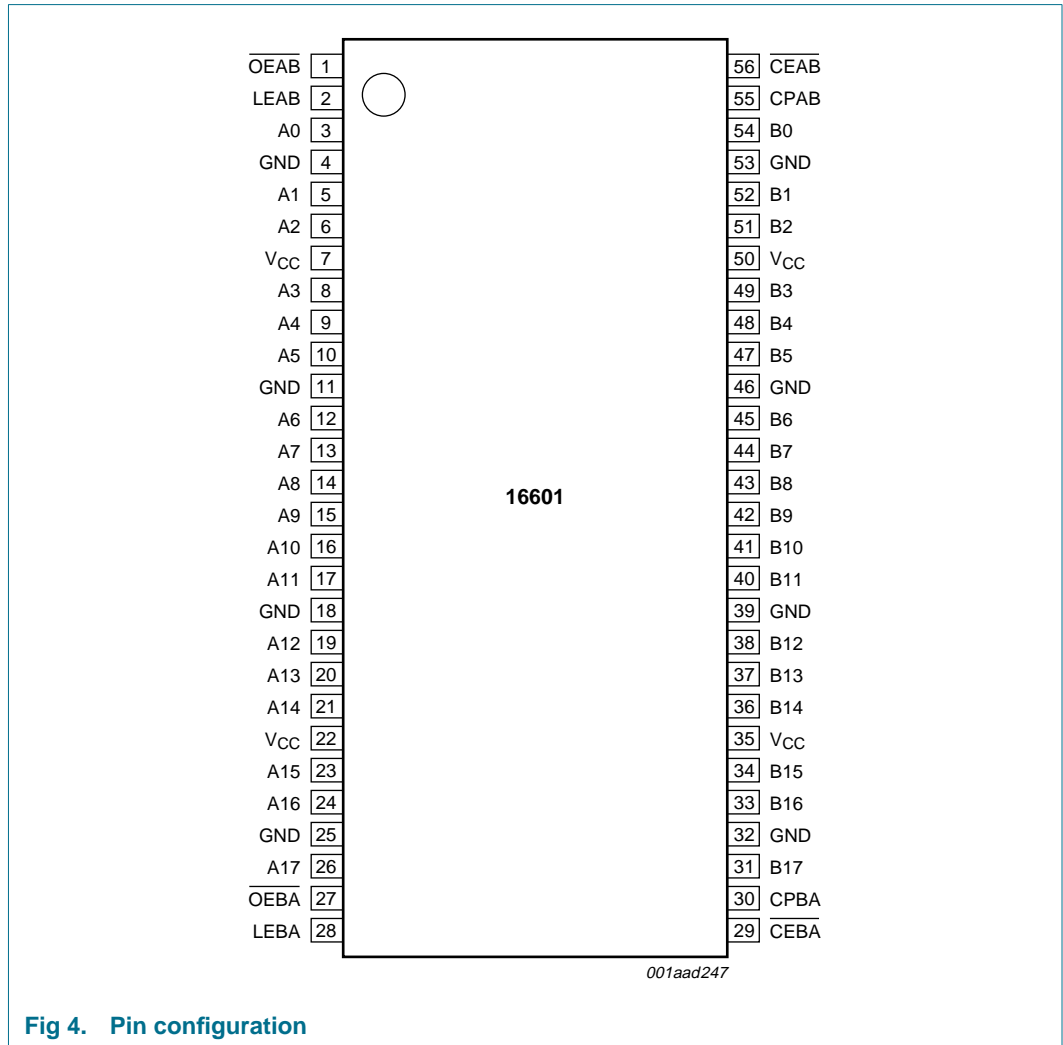


Fig 3. Logic diagram

## 6. Pinning information

### 6.1 Pinning



### 6.2 Pin description

Table 3: Pin description

Symbol	Pin	Description
OEAB	1	A-to-B output enable input (active LOW)
LEAB	2	A-to-B latch enable input
A0	3	data input or output (A side)
GND	4	ground (0 V)
A1	5	data input or output (A side)
A2	6	data input or output (A side)
V <sub>CC</sub>	7	voltage supply
A3	8	data input or output (A side)

Table 3: Pin description ...continued

Symbol	Pin	Description
A4	9	data input or output (A side)
A5	10	data input or output (A side)
GND	11	ground (0 V)
A6	12	data input or output (A side)
A7	13	data input or output (A side)
A8	14	data input or output (A side)
A9	15	data input or output (A side)
A10	16	data input or output (A side)
A11	17	data input or output (A side)
GND	18	ground (0 V)
A12	19	data input or output (A side)
A13	20	data input or output (A side)
A14	21	data input or output (A side)
V <sub>CC</sub>	22	voltage supply
A15	23	data input or output (A side)
A16	24	data input or output (A side)
GND	25	ground (0 V)
A17	26	data input or output (A side)
$\overline{\text{OEBA}}$	27	B-to-A output enable input (active LOW)
LEBA	28	B-to-A latch enable input
$\overline{\text{CEBA}}$	29	B-to-A clock enable (active LOW)
CPBA	30	B-to-A clock input (active rising edge)
B17	31	data input or output (B side)
GND	32	ground (0 V)
B16	33	data input or output (B side)
B15	34	data input or output (B side)
V <sub>CC</sub>	35	voltage supply
B14	36	data input or output (B side)
B13	37	data input or output (B side)
B12	38	data input or output (B side)
GND	39	ground (0 V)
B11	40	data input or output (B side)
B10	41	data input or output (B side)
B9	42	data input or output (B side)
B8	43	data input or output (B side)
B7	44	data input or output (B side)
B6	45	data input or output (B side)
GND	46	ground (0 V)
B5	47	data input or output (B side)
B4	48	data input or output (B side)
B3	49	data input or output (B side)

**Table 3: Pin description ...continued**

Symbol	Pin	Description
V <sub>CC</sub>	50	voltage supply
B2	51	data input or output (B side)
B1	52	data input or output (B side)
GND	53	ground (0 V)
B0	54	data input or output (B side)
CPAB	55	A-to-B clock input (active rising edge)
CEAB	56	A-to-B clock enable (active LOW)

## 7. Functional description

### 7.1 Function table

**Table 4: Function table [1]**

Control				Input	Output
CEAB	OEAB	LEAB	CPAB	A <sub>n</sub>	B <sub>n</sub>
CEBA	OEBA	LEBA	CPBA	B <sub>n</sub>	A <sub>n</sub>
X	H	X	X	X	Z
X	L	H	X	L	L
				H	H
L	L	L	↑	L	L
				H	H
L	L	L	H	X	Y [2]
			L	X	Y [3]
H	L	L	X	X	Y [2]

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

[2] Output level before the indicated steady-state input conditions were established.

[3] Output level before the indicated steady-state input conditions were established, provided that CPAB or CPBA was LOW before LEAB or LEBA went LOW.

## 8. Limiting values

**Table 5: Limiting values**

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

Symbol	Parameter	Conditions	Min	Max	Unit
V <sub>CC</sub>	supply voltage		-0.5	+4.6	V
V <sub>I</sub>	input voltage		[1] -0.5	+7.0	V
V <sub>O</sub>	output voltage	output in OFF-state or HIGH-state	[1] -0.5	+7.0	V

**Table 5: Limiting values ...continued**

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

Symbol	Parameter	Conditions	Min	Max	Unit
$I_{IK}$	input diode current	$V_I < 0$ V	-	-50	mA
$I_{OK}$	output diode current	$V_O < 0$ V	-	-50	mA
$I_O$	output current	output in LOW-state	-	128	mA
		output in HIGH-state	-	-64	mA
$T_{stg}$	storage temperature		-65	+150	°C
$T_j$	junction temperature		[2] -	150	°C

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

[2] The performance capability of a high-performance integrated circuit in conjunction with its thermal environment can create junction temperatures which are detrimental to reliability.

## 9. Recommended operating conditions

**Table 6: Recommended operating conditions**

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b><math>V_{CC} = 2.5</math> V <math>\pm</math> 0.2 V</b>						
$V_{CC}$	supply voltage		2.3	-	2.7	V
$V_I$	input voltage		0	-	5.5	V
$V_{IH}$	HIGH-level input voltage		1.7	-	-	V
$V_{IL}$	LOW-level input voltage		-	-	0.7	V
$I_{OH}$	HIGH-level output current		-	-	-8	mA
$I_{OL}$	LOW-level output current	none	-	-	8	mA
		current duty cycle $\leq$ 50 %; $f \geq$ 1 kHz	-	-	24	mA
$\Delta t/\Delta V$	input transition rise or fall rate	outputs enabled	-	-	10	ns/V
$T_{amb}$	ambient temperature		-40	-	+85	°C
<b><math>V_{CC} = 3.3</math> V <math>\pm</math> 0.3 V</b>						
$V_{CC}$	supply voltage		3.0	-	3.6	V
$V_I$	input voltage		0	-	5.5	V
$V_{IH}$	HIGH-level input voltage		2.0	-	-	V
$V_{IL}$	LOW-level input voltage		-	-	0.8	V
$I_{OH}$	HIGH-level output current		-	-	-32	mA
$I_{OL}$	LOW-level output current	none	-	-	32	mA
		current duty cycle $\leq$ 50 %; $f \geq$ 1 kHz	-	-	64	mA
$\Delta t/\Delta V$	input transition rise or fall rate	outputs enabled	-	-	10	ns/V
$T_{amb}$	ambient temperature	in free air	-40	-	+85	°C



## 10. Static characteristics

**Table 7: Static characteristics**

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

$T_{amb} = -40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$ .

Symbol	Parameter	Conditions	Min	Typ	Max	Unit	
<b><math>V_{CC} = 2.5\text{ V} \pm 0.2\text{ V}</math> [1]</b>							
$V_{IK}$	input diode voltage	$V_{CC} = 2.3\text{ V}$ ; $I_{IK} = -18\text{ mA}$	-	-0.85	-1.2	V	
$V_{OH}$	HIGH-level output voltage	$V_{CC} = 2.3\text{ V}$ to $3.6\text{ V}$ ; $I_{OH} = -100\text{ }\mu\text{A}$	$V_{CC} - 0.2$	-	-	V	
		$V_{CC} = 2.3\text{ V}$ ; $I_{OH} = -8\text{ mA}$	1.8	-	-	V	
$V_{OL}$	LOW-level output voltage	$V_{CC} = 2.3\text{ V}$ ; $I_{OL} = 100\text{ }\mu\text{A}$	-	0.07	0.2	V	
		$V_{CC} = 2.3\text{ V}$ ; $I_{OL} = 24\text{ mA}$	-	0.3	0.5	V	
		$V_{CC} = 2.3\text{ V}$ ; $I_{OL} = 8\text{ mA}$	-	-	0.4	V	
$V_{RST}$	power-up LOW-state output voltage	$V_{CC} = 2.7\text{ V}$ ; $I_O = 1\text{ mA}$ ; $V_I = V_{CC}$ or GND	[2] -	-	0.55	V	
$I_{LI}$	input leakage current control pins	$V_{CC} = 2.7\text{ V}$ ; $V_I = V_{CC}$ or GND	-	0.1	$\pm 1$	$\mu\text{A}$	
		$V_{CC} = 0\text{ V}$ or $2.7\text{ V}$ ; $V_I = 5.5\text{ V}$	-	0.1	10	$\mu\text{A}$	
	I/O data pins	$V_{CC} = 0\text{ V}$ or $2.7\text{ V}$ ; $V_I = 5.5\text{ V}$	[3] -	0.1	20	$\mu\text{A}$	
		$V_{CC} = 2.7\text{ V}$ ; $V_I = V_{CC}$	[3] -	0.1	10	$\mu\text{A}$	
		$V_{CC} = 2.7\text{ V}$ ; $V_I = 0\text{ V}$	[3] -	+0.1	-5	$\mu\text{A}$	
$I_{OFF}$	power-down leakage current	$V_{CC} = 0\text{ V}$ ; $V_I$ or $V_O = 0\text{ V}$ to $4.5\text{ V}$	-	0.1	$\pm 100$	$\mu\text{A}$	
$I_{HOLD}$	bus hold current data inputs	$V_{CC} = 2.3\text{ V}$ ; $V_I = 0.7\text{ V}$	[4] -	90	-	$\mu\text{A}$	
		$V_{CC} = 2.3\text{ V}$ ; $V_I = 1.7\text{ V}$	[4] -	-75	-	$\mu\text{A}$	
$I_{EX}$	external current into output	output in HIGH-state when $V_O > V_{CC}$ ; $V_O = 5.5\text{ V}$ ; $V_{CC} = 2.3\text{ V}$	-	10	125	$\mu\text{A}$	
$I_{PU}, I_{PD}$	power-up/down 3-state output current	$V_{CC} \leq 1.2\text{ V}$ ; $V_O = 0.5\text{ V}$ to $V_{CC}$ ; $V_I = \text{GND}$ or $V_{CC}$ ; $\overline{\text{OEAB}}$ or $\overline{\text{OEAB}}$ don't care	[5] -	1	100	$\mu\text{A}$	
$I_{CC}$	supply current	$V_{CC} = 2.7\text{ V}$ ; $V_I = \text{GND}$ or $V_{CC}$ ; $I_O = 0\text{ A}$	-	-	-	-	
		outputs HIGH-state	-	0.04	0.1	mA	
		outputs LOW-state	-	2.5	4.5	mA	
$\Delta I_{CC}$	additional supply current per input pin	$V_{CC} = 2.3\text{ V}$ to $2.7\text{ V}$ ; one input at $V_{CC} - 0.6\text{ V}$ , other inputs at $V_{CC}$ or GND	[6] -	0.04	0.1	mA	
			outputs disabled	[6] -	0.04	0.1	mA
				[7] -	0.01	0.4	mA
$C_i$	input capacitance of control pins	$V_I = 0\text{ V}$ or $V_{CC}$		4	-	pF	
$C_{io}$	input/output capacitance of I/O pins	$V_{I/O} = 0\text{ V}$ or $V_{CC}$ ; outputs disabled		8	-	pF	
<b><math>V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}</math> [8]</b>							
$V_{IK}$	input diode voltage	$V_{CC} = 3.0\text{ V}$ ; $I_{IK} = -18\text{ mA}$	-	-0.85	-1.2	V	
$V_{OH}$	HIGH-level output voltage	$V_{CC} = 3.0\text{ V}$ to $3.6\text{ V}$ ; $I_{OH} = -100\text{ }\mu\text{A}$	$V_{CC} - 0.2$	$V_{CC}$	-	V	
		$V_{CC} = 3.0\text{ V}$ ; $I_{OH} = -32\text{ mA}$	2.0	2.3	-	V	

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

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

 $T_{amb} = -40\text{ }^{\circ}\text{C}$  to  $+85\text{ }^{\circ}\text{C}$ .

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V <sub>OL</sub>	LOW-level output voltage	V <sub>CC</sub> = 3.0 V; I <sub>OL</sub> = 100 μA	-	0.07	0.2	V
		V <sub>CC</sub> = 3.0 V; I <sub>OL</sub> = 16 mA	-	0.25	0.4	V
		V <sub>CC</sub> = 3.0 V; I <sub>OL</sub> = 32 mA	-	0.3	0.5	V
		V <sub>CC</sub> = 3.0 V; I <sub>OL</sub> = 64 mA	-	0.4	0.55	V
V <sub>RST</sub>	power-up LOW-state output voltage	V <sub>CC</sub> = 2.7 V; I <sub>O</sub> = 1 mA; V <sub>I</sub> = V <sub>CC</sub> or GND	[2] -	-	0.55	V
I <sub>LI</sub>	input leakage current control pins	V <sub>CC</sub> = 3.6 V; V <sub>I</sub> = V <sub>CC</sub> or GND	-	0.1	±1	μA
		V <sub>CC</sub> = 0 V or 3.6 V; V <sub>I</sub> = 5.5 V	-	0.1	10	μA
	I/O data pins	V <sub>CC</sub> = 3.6 V; V <sub>I</sub> = 5.5 V	[3] -	0.1	20	μA
		V <sub>CC</sub> = 3.6 V; V <sub>I</sub> = V <sub>CC</sub>	[3] -	0.5	10	μA
		V <sub>CC</sub> = 3.6 V; V <sub>I</sub> = 0 V	[3] -	+0.1	-5	μA
I <sub>OFF</sub>	power-down leakage current	V <sub>CC</sub> = 0 V; V <sub>I</sub> or V <sub>O</sub> = 0 V to 4.5 V	-	0.1	±100	μA
I <sub>HOLD</sub>	bus hold current data inputs	V <sub>CC</sub> = 3 V; V <sub>I</sub> = 0.8 V	[9] 75	130	-	μA
		V <sub>CC</sub> = 3 V; V <sub>I</sub> = 2.0 V	[9] -75	-140	-	μA
		V <sub>CC</sub> = 0 V to 3.6 V; V <sub>CC</sub> = 3.6 V	[9] ±500	-	-	μA
I <sub>EX</sub>	external current into output	output in HIGH-state when V <sub>O</sub> > V <sub>CC</sub> ; V <sub>O</sub> = 5.5 V; V <sub>CC</sub> = 2.3 V	-	10	125	μA
I <sub>PU</sub> , I <sub>PD</sub>	power-up/down 3-state output current	V <sub>CC</sub> ≤ 1.2 V; V <sub>O</sub> = 0.5 V to V <sub>CC</sub> ; V <sub>I</sub> = GND or V <sub>CC</sub> ; $\overline{\text{OEAB}}$ or $\overline{\text{OEAB}}$ don't care	[10] -	1	±100	μA
I <sub>CC</sub>	supply current	V <sub>CC</sub> = 3.6 V; V <sub>I</sub> = GND or V <sub>CC</sub> ; I <sub>O</sub> = 0 A				
		outputs HIGH-state	-	0.06	0.1	mA
		outputs LOW-state	-	3.5	5	mA
		outputs disabled	[6] -	0.06	0.1	mA
ΔI <sub>CC</sub>	additional supply current per input pin	V <sub>CC</sub> = 3 V to 3.6 V; one input at V <sub>CC</sub> - 0.6 V, other inputs at V <sub>CC</sub> or GND	[7] -	0.04	0.4	mA
C <sub>i</sub>	input capacitance of control pins	V <sub>I</sub> = 0 V or V <sub>CC</sub>		4	-	pF
C <sub>IO</sub>	input/output capacitance of I/O pins	V <sub>I/O</sub> = 0 V or V <sub>CC</sub> ; outputs disabled		8	-	pF

[1] All typical values are at V<sub>CC</sub> = 2.5 V and T<sub>amb</sub> = 25 °C.

[2] For valid test results, data must not be loaded into the flip-flops (or latches) after applying power.

[3] Unused pins at V<sub>CC</sub> or GND.

[4] Not guaranteed.

[5] This parameter is valid for any V<sub>CC</sub> between 0 V and 1.2 V with a transition time of up to 10 ms. From V<sub>CC</sub> = 1.2 V to V<sub>CC</sub> = 2.5 V ± 0.2 V a transition time of 100 μs is permitted. This parameter is valid for T<sub>amb</sub> = 25 °C only.[6] I<sub>CC</sub> is measured with outputs pulled up to V<sub>CC</sub> or pulled down to ground.[7] This is the increase in supply current for each input at the specified voltage level other than V<sub>CC</sub> or GND.[8] All typical values are at V<sub>CC</sub> = 3.3 V and T<sub>amb</sub> = 25 °C.

[9] This is the bus hold overdrive current required to force the input to the opposite logic state.

[10] This parameter is valid for any V<sub>CC</sub> between 0 V and 1.2 V with a transition time of up to 10 ms. From V<sub>CC</sub> = 1.2 V to V<sub>CC</sub> = 3.3 V ± 0.3 V a transition time of 100 μs is permitted. This parameter is valid for T<sub>amb</sub> = 25 °C only.

## 11. Dynamic characteristics

**Table 8: Dynamic characteristics**

Voltages are referenced to GND (ground = 0 V); for test circuit see [Figure 11](#).

$T_{amb} = -40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$ .

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b><math>V_{CC} = 2.5\text{ V} \pm 0.2\text{ V}</math> [1]; <math>C_L = 30\text{ pF}</math></b>						
$t_{PHL}$	propagation delay					
	An to Bn or Bn to An	see <a href="#">Figure 5</a>	1.4	2.2	3.5	ns
	LEAB to Bn or LEBA to An	see <a href="#">Figure 6</a>	1.5	2.5	4.0	ns
$t_{PLH}$	propagation delay					
	An to Bn or Bn to An	see <a href="#">Figure 5</a>	1.0	1.8	3.0	ns
	LEAB to Bn or LEBA to An	see <a href="#">Figure 6</a>	1.5	2.5	4.0	ns
$t_{PHZ}$	output disable time from HIGH-level	see <a href="#">Figure 9</a>	2.2	3.1	4.4	ns
	output disable time from LOW-level	see <a href="#">Figure 10</a>	1.6	2.3	3.4	ns
	output enable time to HIGH-level	see <a href="#">Figure 9</a>	2.3	3.6	4.8	ns
$t_{PZH}$	output enable time to HIGH-level	see <a href="#">Figure 9</a>	2.3	3.6	4.8	ns
	output enable time to LOW-level	see <a href="#">Figure 10</a>	1.9	2.9	4.4	ns
	output enable time to LOW-level	see <a href="#">Figure 10</a>	1.9	2.9	4.4	ns
$t_{h(H)}$	hold time HIGH					
	An to CPAB or Bn to CPBA	see <a href="#">Figure 8</a>	0.0	-1.1	-	ns
	An to LEAB or Bn to LEAB	see <a href="#">Figure 8</a>	1.5	0.4	-	ns
$t_{h(L)}$	hold time LOW					
	An to CPAB or Bn to CPBA	see <a href="#">Figure 8</a>	0.0	-0.3	-	ns
	An to LEAB or Bn to LEAB	see <a href="#">Figure 8</a>	1.9	1.0	-	ns
$t_{su(H)}$	set-up time HIGH					
	An to CPAB or Bn to CPBA	see <a href="#">Figure 8</a>	2.0	0.4	-	ns
	An to LEAB or Bn to LEBA	see <a href="#">Figure 8</a>	0.0	-1.0	-	ns
$t_{su(L)}$	set-up time LOW					
	An to CPAB or Bn to CPBA	see <a href="#">Figure 8</a>	2.0	1.2	-	ns
	An to LEAB or Bn to LEBA	see <a href="#">Figure 8</a>	1.5	0.4	-	ns
$t_{WH}$	pulse width HIGH					
	CPAB or CPBA	see <a href="#">Figure 7</a>	3.0	-	-	ns
	LEAB or LEBA	see <a href="#">Figure 6</a>	1.5	-	-	ns
$t_{WL}$	pulse width LOW					
	CPAB or CPBA	see <a href="#">Figure 7</a>	3.0	-	-	ns

**Table 8: Dynamic characteristics ...continued**

Voltages are referenced to GND (ground = 0 V); for test circuit see [Figure 11](#).

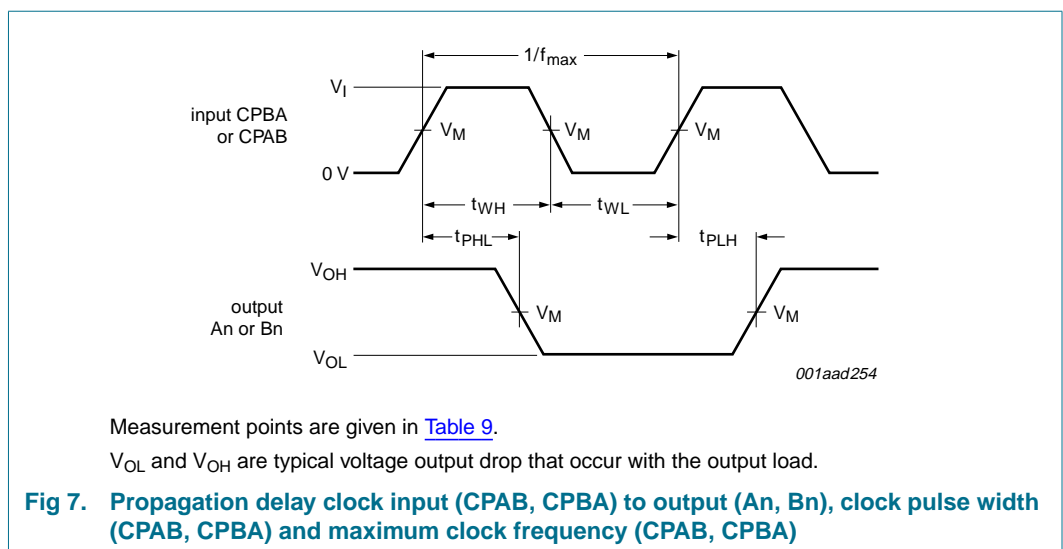
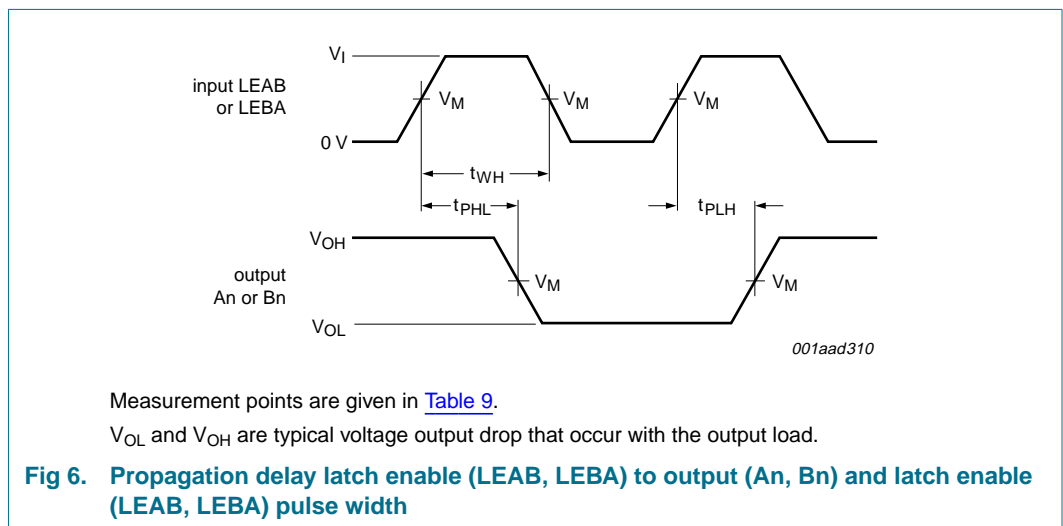
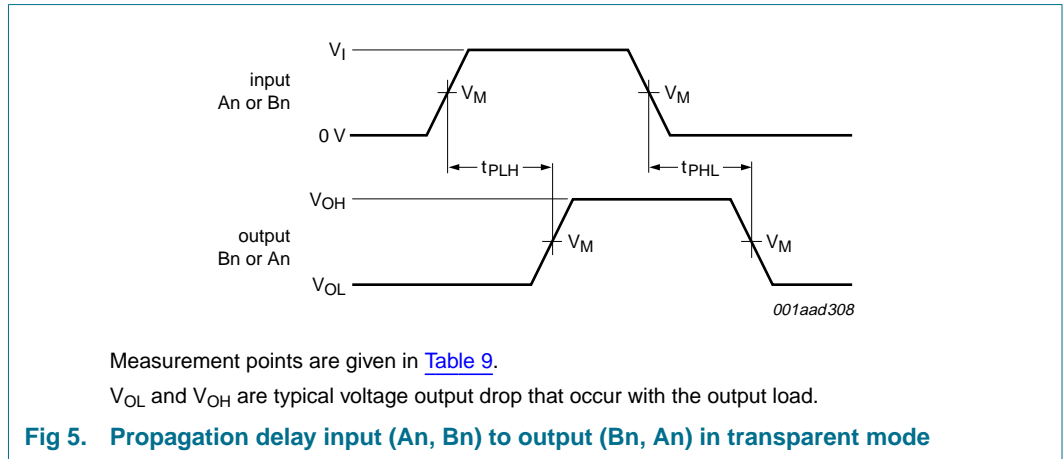
$T_{amb} = -40\text{ }^{\circ}\text{C}$  to  $+85\text{ }^{\circ}\text{C}$ .

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b><math>V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}</math> [2]; <math>C_L = 50\text{ pF}</math></b>						
$t_{PHL}$	propagation delay					
	An to Bn or Bn to An	see <a href="#">Figure 5</a>	1.1	2.0	2.8	ns
	LEAB to Bn or LEBA to An	see <a href="#">Figure 6</a>	1.4	2.3	3.6	ns
	CPAB to Bn or CPBA to An	see <a href="#">Figure 7</a>	1.7	2.7	4.1	ns
$t_{PLH}$	propagation delay					
	An to Bn or Bn to An	see <a href="#">Figure 5</a>	1.2	1.9	2.9	ns
	LEAB to Bn or LEBA to An	see <a href="#">Figure 6</a>	1.5	2.5	3.8	ns
	CPAB to Bn or CPBA to An	see <a href="#">Figure 7</a>	2.1	3.1	4.5	ns
$t_{PHZ}$	output disable time from HIGH-level	see <a href="#">Figure 9</a>	2.7	3.6	4.9	ns
$t_{PLZ}$	output disable time from LOW-level	see <a href="#">Figure 10</a>	2.1	2.8	4	ns
$t_{PZH}$	output enable time to HIGH-level	see <a href="#">Figure 9</a>	2.2	3.2	4.2	ns
$t_{PZL}$	output enable time to LOW-level	see <a href="#">Figure 10</a>	1.6	2.5	3.8	ns
$t_{h(H)}$	hold time HIGH					
	An to CPAB or Bn to CPBA	see <a href="#">Figure 8</a>	+1.0	-0.5	-	ns
	An to LEAB or Bn to LEAB	see <a href="#">Figure 8</a>	1.5	0.1	-	ns
	$\overline{CEAB}$ to CPAB or $\overline{CEBA}$ to CPBA	see <a href="#">Figure 8</a>	1.5	0.7	-	ns
$t_{h(L)}$	hold time LOW					
	An to CPAB or Bn to CPBA	see <a href="#">Figure 8</a>	+1.0	-0.3	-	ns
	An to LEAB or Bn to LEAB	see <a href="#">Figure 8</a>	1.5	0.5	-	ns
	$\overline{CEAB}$ to CPAB or $\overline{CEBA}$ to CPBA	see <a href="#">Figure 8</a>	+1.0	-0.3	-	ns
$t_{su(H)}$	set-up time HIGH					
	An to CPAB or Bn to CPBA	see <a href="#">Figure 8</a>	1.5	0.4	-	ns
	An to LEAB or Bn to LEBA	see <a href="#">Figure 8</a>	+1.0	-0.5	-	ns
	$\overline{CEAB}$ to CPAB or $\overline{CEBA}$ to CPBA	see <a href="#">Figure 8</a>	1.5	0.3	-	ns
$t_{su(L)}$	set-up time LOW					
	An to CPAB or Bn to CPBA	see <a href="#">Figure 8</a>	1.5	0.6	-	ns
	An to LEAB or Bn to LEBA	see <a href="#">Figure 8</a>	+1.0	-0.1	-	ns
	$\overline{CEAB}$ to CPAB or $\overline{CEBA}$ to CPBA	see <a href="#">Figure 8</a>	1.0	-0.4	-	ns
$t_{WH}$	pulse width HIGH					
	CPAB or CPBA	see <a href="#">Figure 7</a>	2.0	-	-	ns
	LEAB or LEBA	see <a href="#">Figure 6</a>	1.5	-	-	ns
$t_{WL}$	pulse width LOW					
	CPAB or CPBA	see <a href="#">Figure 7</a>	2.0	-	-	ns

[1] All typical values are measured at  $V_{CC} = 2.5\text{ V}$  and  $T_{amb} = 25\text{ }^{\circ}\text{C}$ .

[2] All typical values are measured at  $V_{CC} = 3.3\text{ V}$  and  $T_{amb} = 25\text{ }^{\circ}\text{C}$ .

12. Waveforms



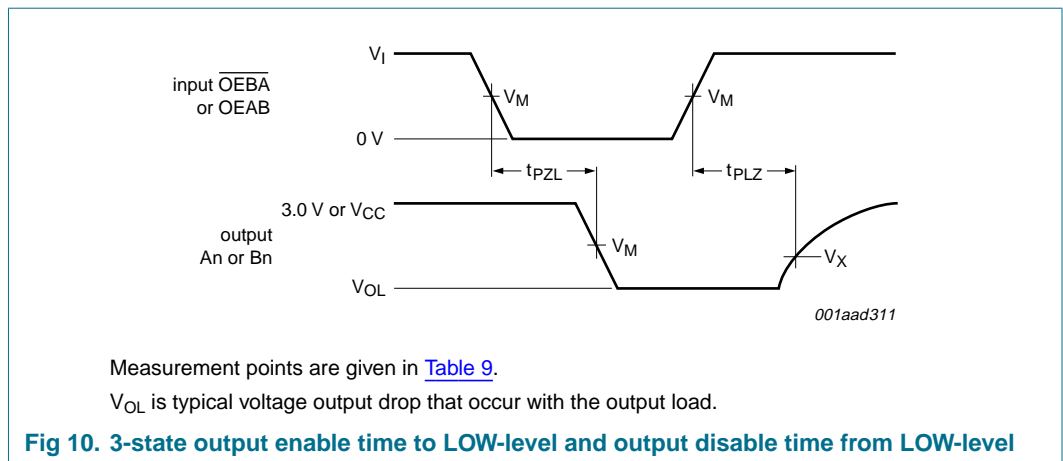
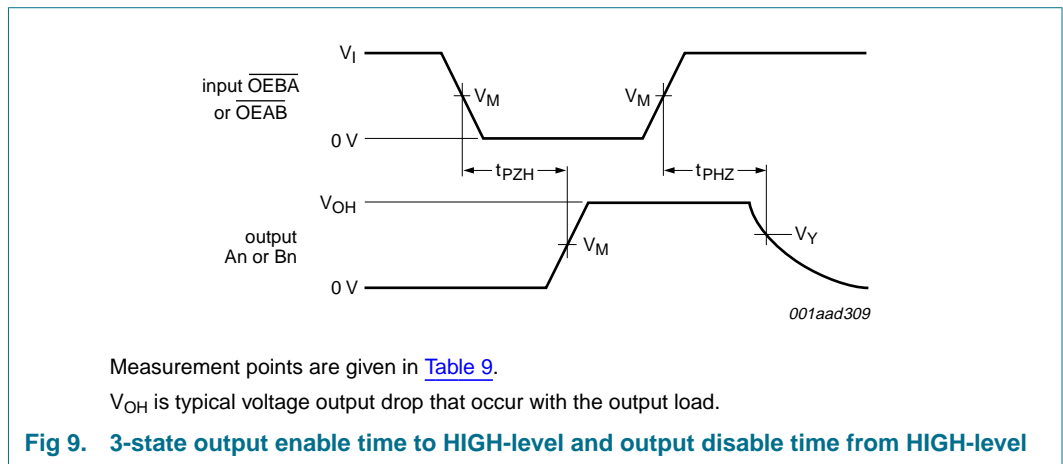
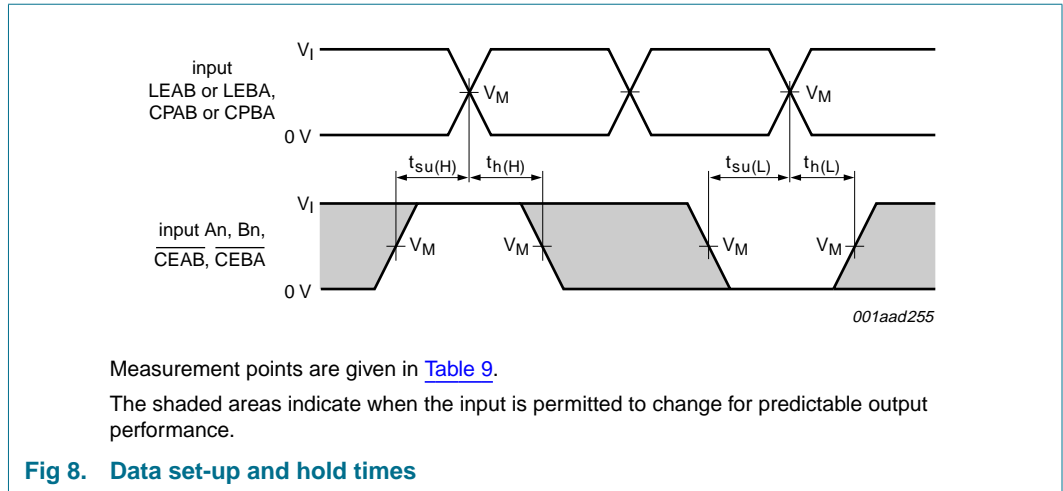
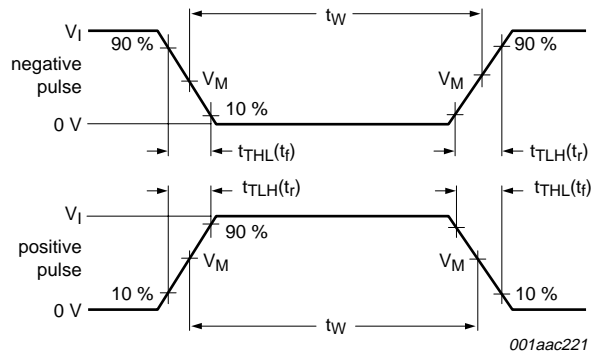


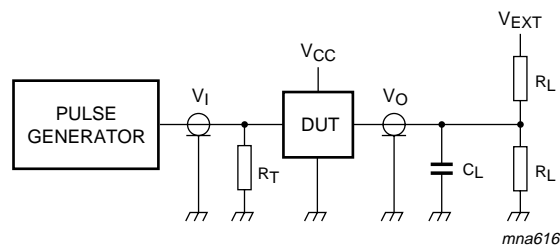
Table 9: Measurement points

Supply voltage	Input	Output		
	$V_M$	$V_M$	$V_X$	$V_Y$
$\geq 3\text{ V}$	1.5 V	1.5 V	$V_{OL} + 0.3\text{ V}$	$V_{OH} - 0.3\text{ V}$
$\leq 2.7\text{ V}$	$0.5 \times V_{CC}$	$0.5 \times V_{CC}$	$V_{OL} + 0.15\text{ V}$	$V_{OH} - 0.15\text{ V}$



Measurement points are given in Table 9.

a. Input pulse definition



Test data is given in Table 10.

Definitions test circuit:

$R_L$  = Load resistor.

$C_L$  = Load capacitance including jig and probe capacitance.

$R_T$  = Termination resistance should be equal to output impedance  $Z_o$  of the pulse generator.

$V_{EXT}$  = Test voltage for switching times.

b. Test circuit

Fig 11. Load circuitry for switching times

Table 10: Test data

Input				Load		$V_{EXT}$			
$V_I$	$f_i$	$t_w$	$t_r, t_f$	$C_L$	$R_L$	$t_{PLZ}, t_{PZL}$	$t_{PLH}, t_{PHL}$	$t_{PHZ}, t_{PZH}$	
3.0 V or $V_{CC}$ whichever is less	$\leq 10\text{ MHz}$	500 ns	$\leq 2.5\text{ ns}$	30 pF or 50 pF	500 $\Omega$	6 V or $2 \times V_{CC}$	open	GND	

13. Package outline

SSOP56: plastic shrink small outline package; 56 leads; body width 7.5 mm

SOT371-1

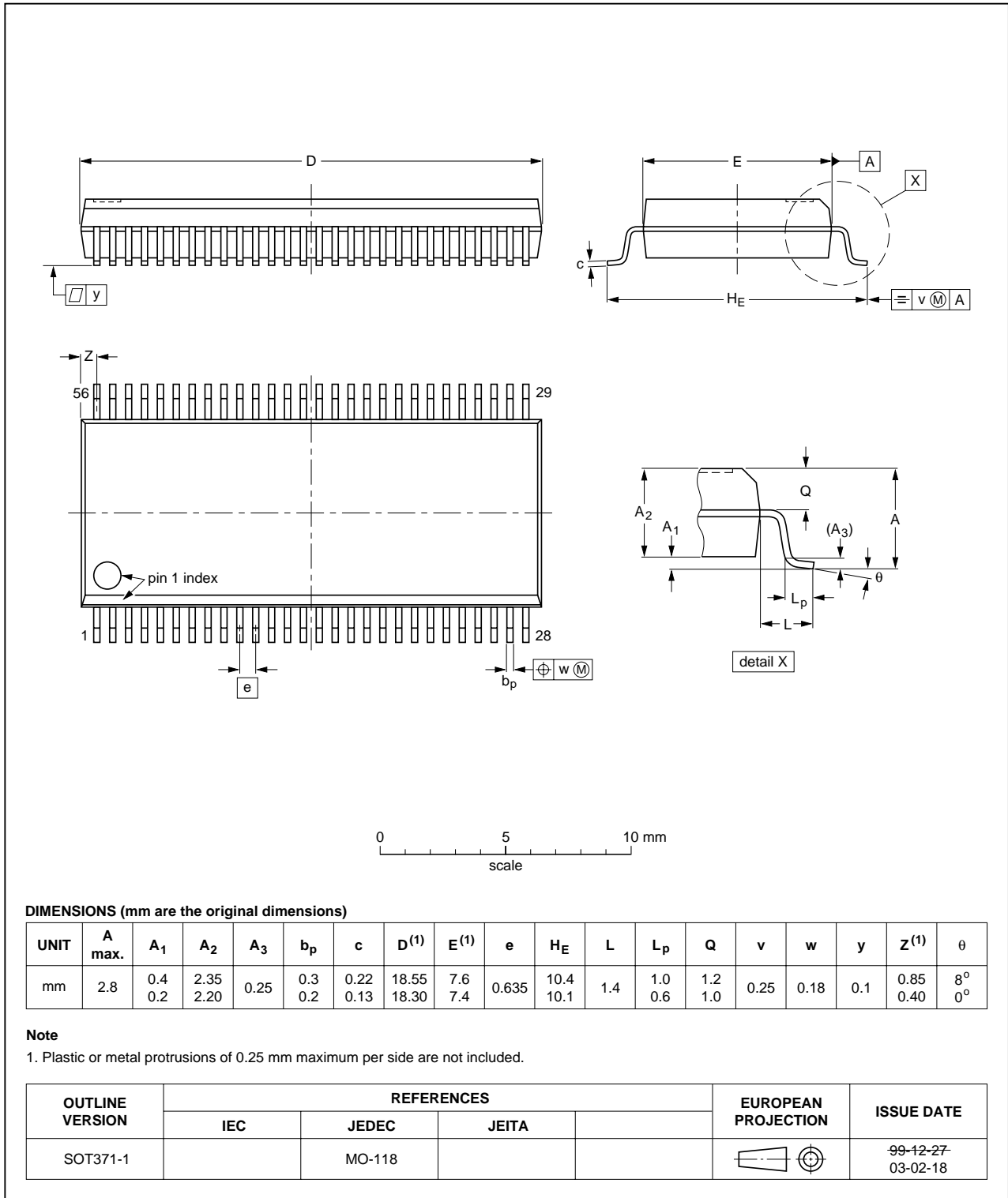


Fig 12. Package outline SOT371-1 (SSOP56)



TSSOP56: plastic thin shrink small outline package; 56 leads; body width 6.1 mm

SOT364-1

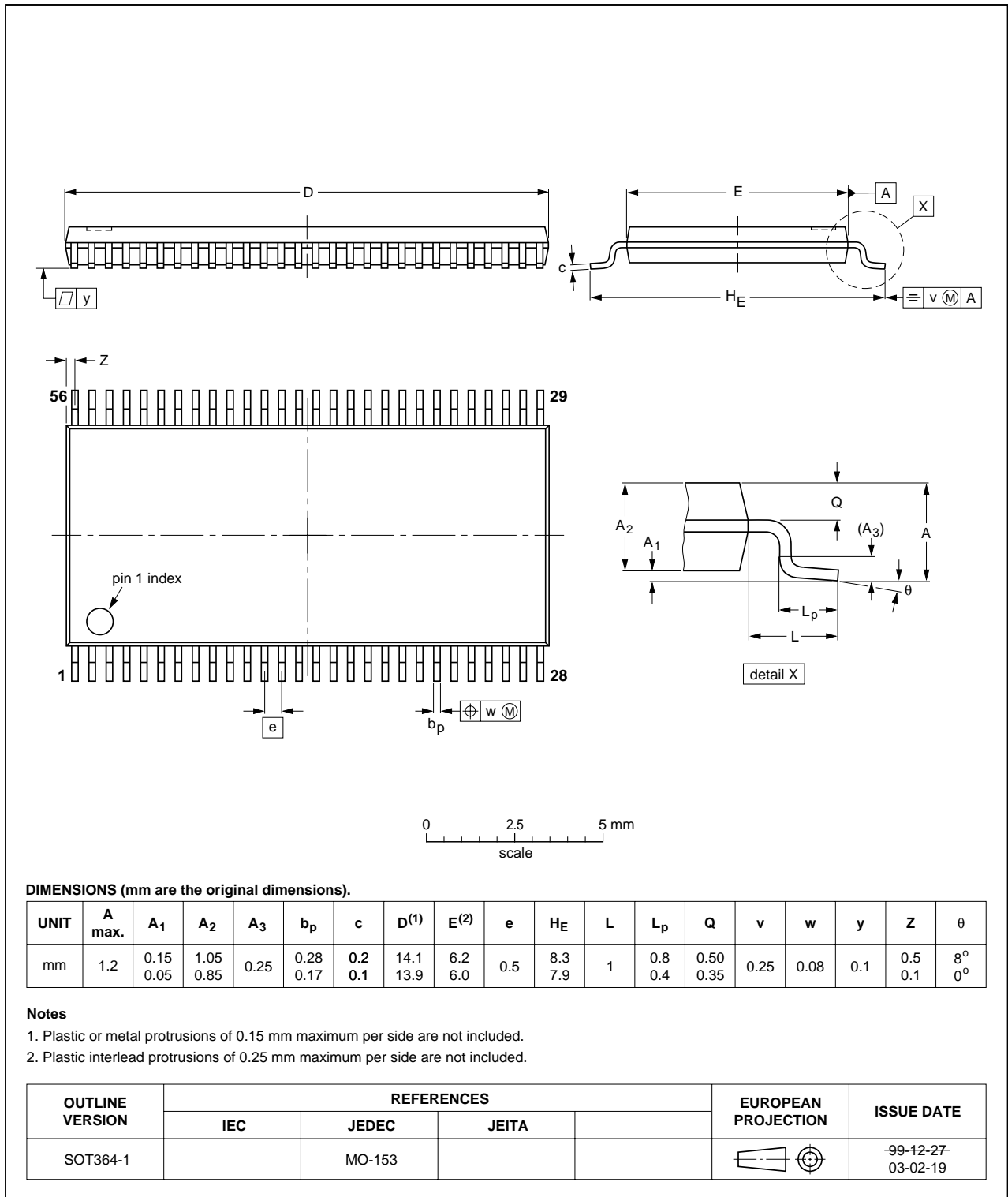


Fig 13. Package outline SOT364-1 (TSSOP56)

## 14. Revision history

**Table 11: Revision history**

Document ID	Release date	Data sheet status	Change notice	Doc. number	Supersedes
74ALVT16601_3	20050705	Product data sheet	-	-	74ALVT16601_2
Modifications:					
					<ul style="list-style-type: none"><li>• The format of this data sheet has been redesigned to comply with the new presentation and information standard of Philips Semiconductors.</li><li>• <a href="#">Section 2 “Features”</a>: modified ‘JEDEC Std 17’ into ‘JESD78’.</li><li>• <a href="#">Table 8 “Dynamic characteristics”</a>: changed values of propagation delay, output enable and output disable time.</li></ul>
74ALVT16601_2	19980213	Product specification	-	9397 750 03571	74ALVT16601_1
74ALVT16601_1	-	-	-	-	-

## 15. Data sheet status

Level	Data sheet status <sup>[1]</sup>	Product status <sup>[2] [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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[2] The product status of the device(s) described in this data sheet may have changed since this data sheet was published. The latest information is available on the Internet at URL <http://www.semiconductors.philips.com>.

[3] For data sheets describing multiple type numbers, the highest-level product status determines the data sheet status.

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