

# 74ALVT162823

18-bit bus-interface D-type flip-flop with reset and enable with 30  $\Omega$  termination resistors; 3-state

Rev. 02 — 11 August 2005

Product data sheet

## 1. General description

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The 74ALVT162823 18-bit bus interface register is designed to eliminate the extra packages required to buffer existing registers and provide extra data width for wider data or address paths of buses carrying parity.

The 74ALVT162823 has two 9-bit wide buffered registers with clock enable ( $\overline{nCE}$ ) and master reset ( $\overline{nMR}$ ) which are ideal for parity bus interfacing in high microprogrammed systems.

The registers are fully edge-triggered. The state of each D input, one set-up time before the LOW-to-HIGH clock transition is transferred to the corresponding Q output of the flip-flop.

The 74ALVT162823 is designed with 30  $\Omega$  series resistance in both the pull-up and pull-down output structures. This design reduces line noise in applications such as memory address drivers, clock drivers, and bus receivers or transmitters.

## 2. Features

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- Two sets of high speed parallel registers with positive edge-triggered D-type flip-flops
- 5 V I/O compatible
- Ideal where high speed, light loading or increased fan-in are required with MOS microprocessors
- Bus hold data inputs eliminate the need for external pull-up resistors to hold unused inputs
- Live insertion and extraction permitted
- Power-up 3-state
- Power-up reset
- Output capability: +12 mA to -12 mA
- Outputs include series resistance of 30  $\Omega$  making external termination resistors unnecessary
- Latch-up protection:
  - ◆ JESD78: exceeds 500 mA
- ESD protection:
  - ◆ MIL STD 883, method 3015: exceeds 2000 V
  - ◆ Machine Model: exceeds 200 V

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### 3. Quick reference data

**Table 1: Quick reference data**

$T_{amb} = 25^{\circ}\text{C}$ .

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
t <sub>PLH</sub>	propagation delay nCP to nQx	C <sub>L</sub> = 50 pF; V <sub>CC</sub> = 2.5 V	-	3.7	-	ns
		C <sub>L</sub> = 50 pF; V <sub>CC</sub> = 3.3 V	-	2.9	-	ns
t <sub>PHL</sub>	propagation delay nCP to nQx	C <sub>L</sub> = 50 pF; V <sub>CC</sub> = 2.5 V	-	2.8	-	ns
		C <sub>L</sub> = 50 pF; V <sub>CC</sub> = 3.3 V	-	2.3	-	ns
C <sub>i</sub>	input capacitance	V <sub>I</sub> = 0 V or V <sub>CC</sub>	-	3	-	pF
C <sub>o</sub>	output capacitance	V <sub>IO</sub> = 0 V or 3.0 V	-	9	-	pF
I <sub>CC</sub>	quiescent supply current	outputs disabled; V <sub>CC</sub> = 2.5 V	-	40	-	μA
		outputs disabled; V <sub>CC</sub> = 3.3 V	-	70	-	μA

### 4. Ordering information

**Table 2: Ordering information**

Type number	Package			
	Temperature range	Name	Description	Version
74ALVT162823DL	-40 °C to +85 °C	SSOP56	plastic shrink small outline package; 56 leads; body width 7.5 mm	SOT371-1
74ALVT162823DGG	-40 °C to +85 °C	TSSOP56	plastic thin shrink small outline package; 56 leads; body width 6.1 mm	SOT364-1

5. Functional diagram

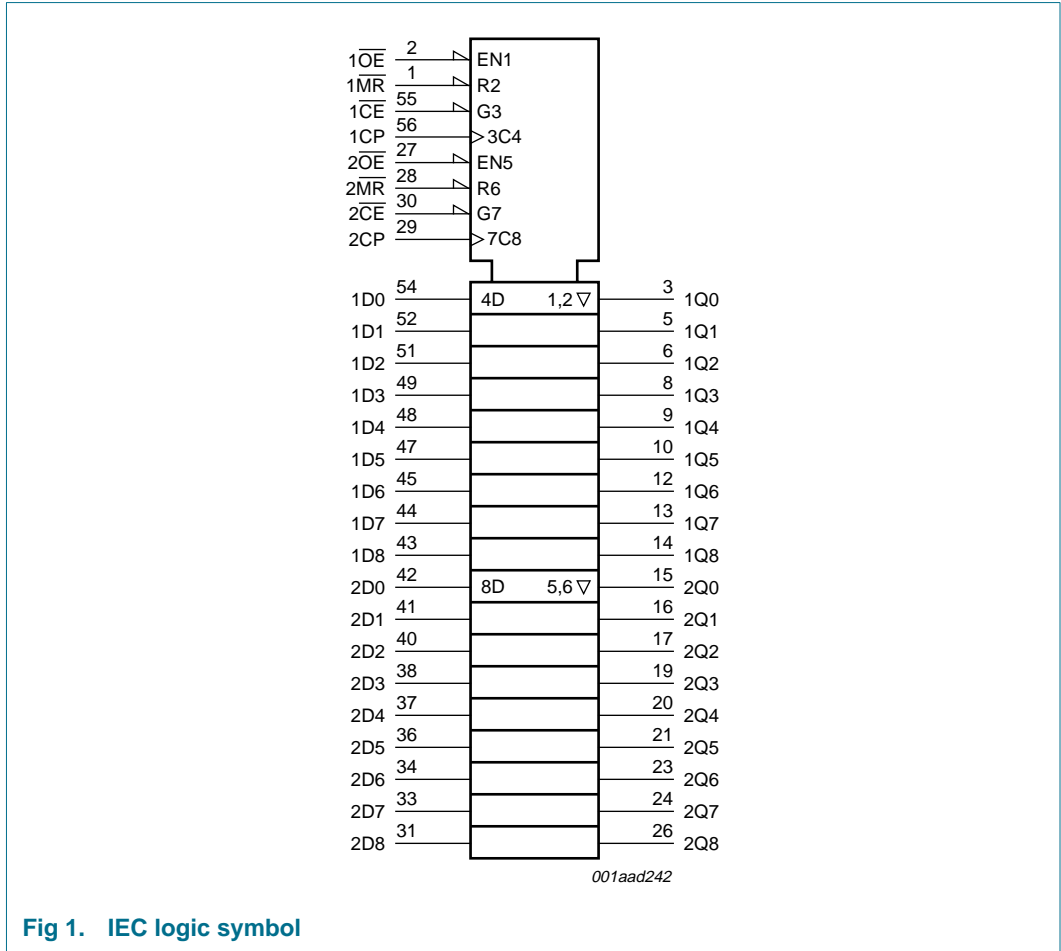


Fig 1. IEC logic symbol

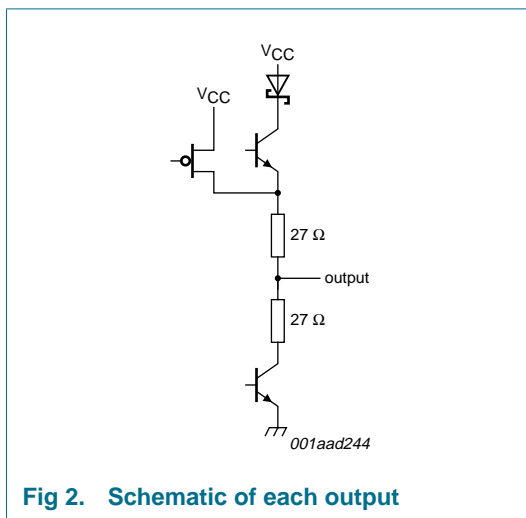


Fig 2. Schematic of each output

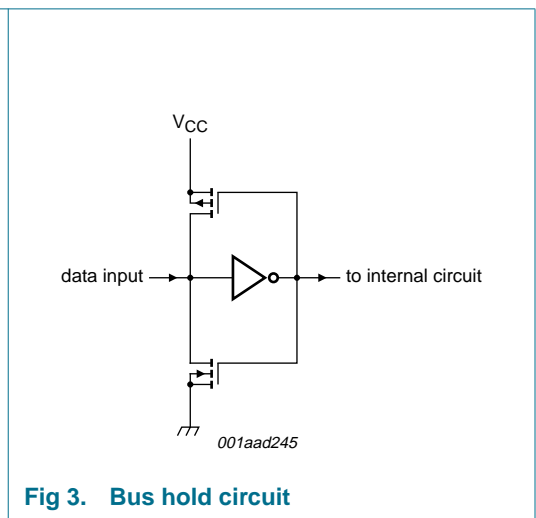


Fig 3. Bus hold circuit

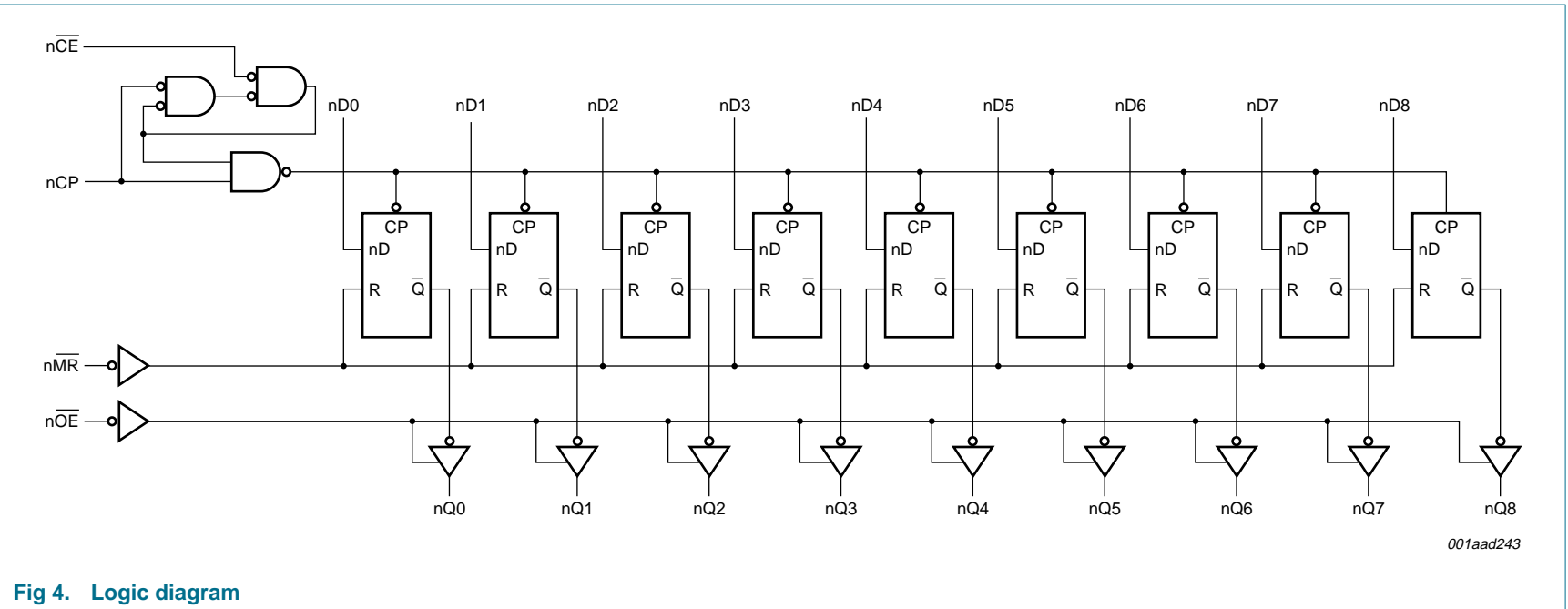
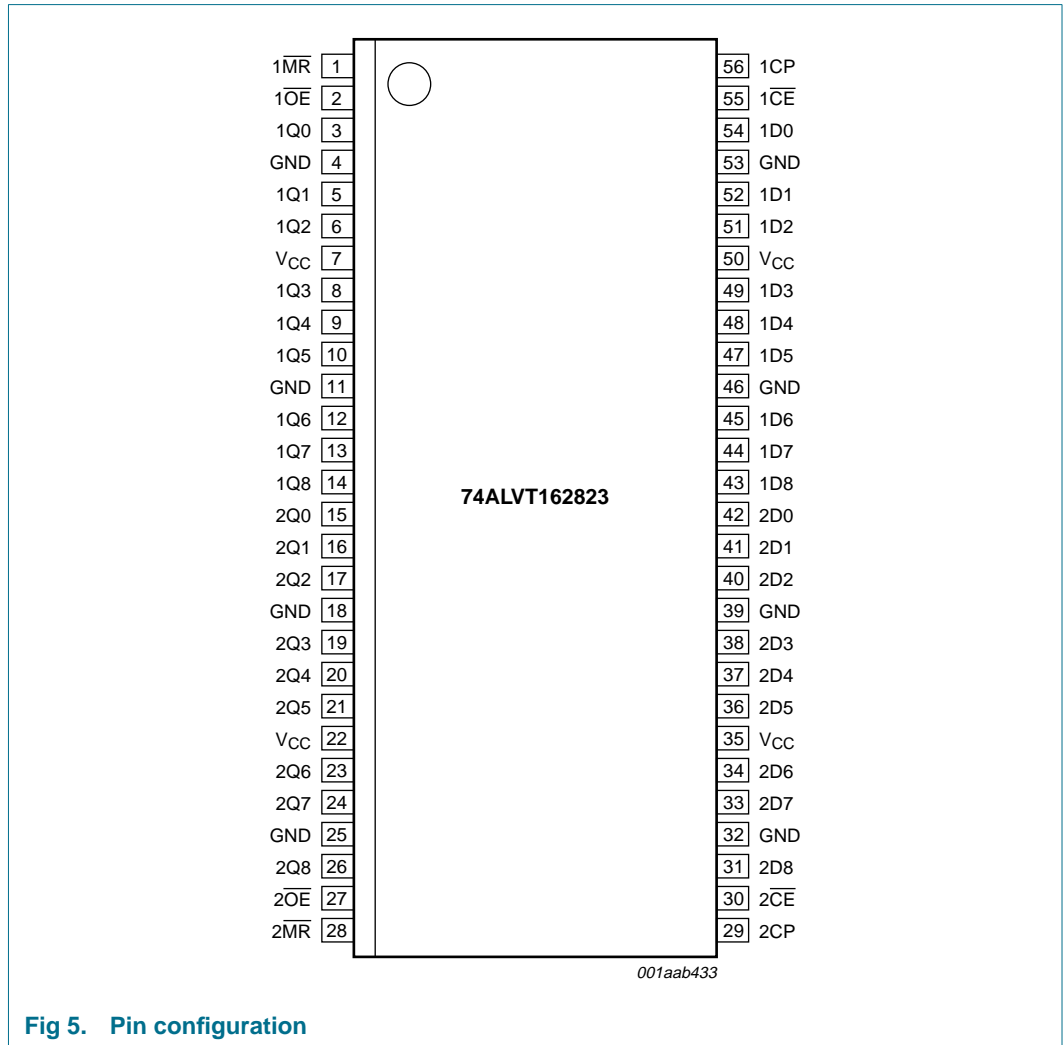


Fig 4. Logic diagram

## 6. Pinning information

### 6.1 Pinning



### 6.2 Pin description

Table 3: Pin description

Symbol	Pin	Description
1MR	1	1 master reset input (active LOW)
1OE	2	1 output enable input (active LOW)
1Q0	3	1 data output 0
GND	4	ground (0 V)
1Q1	5	1 data output 1
1Q2	6	1 data output 2
V <sub>CC</sub>	7	supply voltage
1Q3	8	1 data output 3

Table 3: Pin description ...continued

Symbol	Pin	Description
1Q4	9	1 data output 4
1Q5	10	1 data output 5
GND	11	ground (0 V)
1Q6	12	1 data output 6
1Q7	13	1 data output 7
1Q8	14	1 data output 8
2Q0	15	2 data output 0
2Q1	16	2 data output 1
2Q2	17	2 data output 2
GND	18	ground (0 V)
2Q3	19	2 data output 3
2Q4	20	2 data output 4
2Q5	21	2 data output 5
V <sub>CC</sub>	22	supply voltage
2Q6	23	2 data output 6
2Q7	24	2 data output 7
GND	25	ground (0 V)
2Q8	26	2 data output 8
2 $\overline{OE}$	27	2 output enable input (active LOW)
2 $\overline{MR}$	28	2 master reset input (active LOW)
2CP	29	2 clock pulse input (active rising edge)
2 $\overline{CE}$	30	2 clock enable input (active LOW)
2D8	31	2 data input 8
GND	32	ground (0 V)
2D7	33	2 data input 7
2D6	34	2 data input 6
V <sub>CC</sub>	35	supply voltage
2D5	36	2 data input 5
2D4	37	2 data input 4
2D3	38	2 data input 3
GND	39	ground (0 V)
2D2	40	2 data input 2
2D1	41	2 data input 1
2D0	42	2 data input 0
1D8	43	1 data input 8
1D7	44	1 data input 7
1D6	45	1 data input 6
GND	46	ground (0 V)
1D5	47	1 data input 5
1D4	48	1 data input 4
1D3	49	1 data input 3

Table 3: Pin description ...continued

Symbol	Pin	Description
V <sub>CC</sub>	50	supply voltage
1D2	51	1 data input 2
1D1	52	1 data input 1
GND	53	ground (0 V)
1D0	54	1 data input 0
1 $\overline{\text{CE}}$	55	1 clock enable input (active LOW)
1CP	56	1 clock pulse input (active rising edge)

## 7. Functional description

### 7.1 Function table

Table 4: Function table [1]

Operating mode	Input					Output
	n $\overline{\text{OE}}$	n $\overline{\text{MR}}$	n $\overline{\text{CE}}$	nCP	nDx	nQx
Clear	L	L	X	X	X	L
Load and read data	L	H	L	$\uparrow$	h	H
					l	L
Hold	L	H	H	NC	X	NC
High-impedance	H	X	X	X	X	Z

- [1] H = HIGH voltage level;  
h = HIGH voltage level one set-up time prior to the LOW-to-HIGH clock transition;  
L = LOW voltage level;  
l = LOW voltage level one set-up time prior to the LOW-to-HIGH clock transition;  
NC = no change;  
X = don't care;  
Z = high-impedance OFF-state;  
 $\uparrow$  = LOW-to-HIGH clock transition;

## 8. Limiting values

Table 5: Limiting values

In accordance with the Absolute Maximum Rating System (IEC 60134).

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
I <sub>IK</sub>	input diode current	V <sub>I</sub> < 0 V	-	-50	mA
I <sub>OK</sub>	output diode current	V <sub>O</sub> < 0 V	-	-50	mA

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

In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions	Min	Max	Unit
I <sub>O</sub>	output current	output in LOW-state	-	128	mA
		output in HIGH-state	-	-64	mA
T <sub>stg</sub>	storage temperature		-65	+150	°C
T <sub>j</sub>	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>V<sub>CC</sub> = 2.5 V</b>						
V <sub>CC</sub>	supply voltage		2.3	-	2.7	V
V <sub>I</sub>	input voltage		0	-	5.5	V
V <sub>IH</sub>	HIGH-level input voltage		1.7	-	-	V
V <sub>IL</sub>	LOW-level input voltage		-	-	0.7	V
I <sub>OH</sub>	HIGH-level output current		-	-	-8	mA
I <sub>OL</sub>	LOW-level output current		-	-	12	mA
Δt/ΔV	input transition rise or fall rate	outputs enabled	-	-	10	ns/V
T <sub>amb</sub>	ambient temperature	in free air	-40	-	+85	°C
<b>V<sub>CC</sub> = 3.3 V</b>						
V <sub>CC</sub>	supply voltage		3.0	-	3.6	V
V <sub>I</sub>	input voltage		0	-	5.5	V
V <sub>IH</sub>	HIGH-level input voltage		2.0	-	-	V
V <sub>IL</sub>	LOW-level input voltage		-	-	0.8	V
I <sub>OH</sub>	HIGH-level output current		-	-	-12	mA
I <sub>OL</sub>	LOW-level output current		-	-	12	mA
Δt/ΔV	input transition rise or fall rate	outputs enabled	-	-	10	ns/V
T <sub>amb</sub>	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);  $T_{amb} = -40\text{ }^{\circ}\text{C}$  to  $+85\text{ }^{\circ}\text{C}$ .

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	$V_{CC} = 2.3\text{ V}$ ; $I_{OH} = -8\text{ mA}$	1.7	2.5	-	V	
$V_{OL}$	LOW-level output voltage	$V_{CC} = 2.3\text{ V}$ ; $I_{OL} = 12\text{ mA}$	-	0.3	0.5	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]	-	0.2	0.55	V
$I_{LI}$	input leakage current	control pins	$V_{CC} = 2.7\text{ V}$ ; $V_I = \text{GND}$	-	0.1	$\pm 1$	$\mu\text{A}$
			$V_{CC} = 2.7\text{ V}$ ; $V_I = 5.5\text{ V}$	-	0.1	10	$\mu\text{A}$
	data pins	$V_{CC} = 2.7\text{ V}$ ; $V_I = 5.5\text{ V}$	[3]	-	0.1	10	$\mu\text{A}$
		$V_{CC} = 2.7\text{ V}$ ; $V_I = V_{CC}$	[3]	-	0.5	1	$\mu\text{A}$
		$V_{CC} = 2.7\text{ V}$ ; $V_I = 0\text{ V}$	[3]	-	+0.1	-5	$\mu\text{A}$
$I_{OFF}$	power-down output 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	$V_{CC} = 2.5\text{ V}$ ; $V_I = 0.7\text{ V}$	[4]	-	100	-	$\mu\text{A}$
		$V_{CC} = 2.5\text{ V}$ ; $V_I = 1.7\text{ V}$	[4]	-	-70	-	$\mu\text{A}$
$I_{EX}$	external current into output	output HIGH-state when $V_O > V_{CC}$ ; $V_O = 5.5\text{ V}$ ; $V_{CC} = 2.5\text{ V}$	-	10	125	$\mu\text{A}$	
$I_{PU}$	power-up 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 $V_{CC}$	[5]	-	1	$\pm 100$	$\mu\text{A}$
$I_{PD}$	power-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 $V_{CC}$	[5]	-	1	$\pm 100$	$\mu\text{A}$
$I_{OZ}$	3-state output current	$V_{CC} = 2.7\text{ V}$ ; $V_I = V_{IL}$ or $V_{IH}$					
		output HIGH-state; $V_O = 2.3\text{ V}$	-	0.5	5	$\mu\text{A}$	
		output LOW-state; $V_O = 0.5\text{ V}$	-	+0.5	-5	$\mu\text{A}$	
$I_{CC}$	quiescent 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	-	2.7	4.5	mA	
		outputs disabled	[6]	-	0.04	0.1	mA
$\Delta I_{CC}$	additional quiescent 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	[7]	-	0.04	0.4	mA
$C_i$	input capacitance	$V_I = 0\text{ V}$ or $V_{CC}$	-	3	-	pF	
$C_o$	output capacitance	$V_{IO} = 0\text{ V}$ or $3.0\text{ V}$	-	9	-	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	$V_{CC} = 3.0\text{ V}$ ; $I_{OH} = -12\text{ mA}$	2.0	2.3	-	V	
$V_{OL}$	LOW-level output voltage	$V_{CC} = 3.0\text{ V}$ ; $I_{OL} = 12\text{ mA}$	-	0.5	0.8	V	
$V_{RST}$	power-up LOW-state output voltage	$V_{CC} = 3.6\text{ V}$ ; $I_O = 1\text{ mA}$ ; $V_I = V_{CC}$ or GND	[2]	-	-	0.55	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	
$I_{LI}$	input leakage current	control pins					
		$V_{CC} = 3.6\text{ V}$ ; $V_I = V_{CC}$ or GND	-	0.1	$\pm 1$	$\mu\text{A}$	
		$V_{CC} = 0\text{ V}$ or $3.6\text{ V}$ ; $V_I = 5.5\text{ V}$	-	0.1	10	$\mu\text{A}$	
	data pins	$V_{CC} = 3.6\text{ V}$ ; $V_I = 5.5\text{ V}$	[3]	-	0.1	10	$\mu\text{A}$
		$V_{CC} = 3.6\text{ V}$ ; $V_I = V_{CC}$	[3]	-	0.5	1	$\mu\text{A}$
$V_{CC} = 3.6\text{ V}$ ; $V_I = 0\text{ V}$		[3]	-	+0.1	-5	$\mu\text{A}$	
$I_{OFF}$	power-down output 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	$V_{CC} = 3\text{ V}$ ; $V_I = 0.8\text{ V}$	[9]	75	130	-	$\mu\text{A}$
		$V_{CC} = 3\text{ V}$ ; $V_I = 2.0\text{ V}$	[9]	-75	-140	-	$\mu\text{A}$
		$V_{CC} = 3.6\text{ V}$ ; $V_I = 0\text{V}$ to $3.6\text{ V}$	[9]	$\pm 500$	-	-	$\mu\text{A}$
$I_{EX}$	external current into output	output HIGH-state when $V_O > V_{CC}$ ; $V_O = 5.5\text{ V}$ ; $V_{CC} = 3.0\text{ V}$	-	10	125	$\mu\text{A}$	
$I_{PU}$	power-up 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 $V_{CC}$	[10]	-	1	$\pm 100$	$\mu\text{A}$
$I_{PD}$	power-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 $V_{CC}$	[10]	-	1	$\pm 100$	$\mu\text{A}$
$I_{OZ}$	3-state output current	$V_{CC} = 3.6\text{ V}$ ; $V_I = V_{IL}$ or $V_{IH}$					
		output HIGH-state; $V_O = 3.0\text{ V}$	-	0.5	5	$\mu\text{A}$	
		output LOW-state; $V_O = 0.5\text{ V}$	-	+0.5	-5	$\mu\text{A}$	
$I_{CC}$	quiescent supply current	$V_{CC} = 3.6\text{ V}$ ; $V_I = \text{GND}$ or $V_{CC}$ ; $I_O = 0\text{ A}$					
		outputs HIGH-state	-	0.05	0.1	$\text{mA}$	
		outputs LOW-state	-	3.9	5.5	$\text{mA}$	
		outputs disabled	[6]	-	0.06	0.1	$\text{mA}$
$\Delta I_{CC}$	additional quiescent supply current per input pin	$V_{CC} = 3\text{ V}$ to $3.6\text{ V}$ ; one input at $V_{CC} - 0.6\text{ V}$ , other inputs at $V_{CC}$ or GND	[7]	-	0.04	0.4	$\text{mA}$
$C_i$	input capacitance	$V_I = 0\text{ V}$ or $V_{CC}$	-	3	-	$\text{pF}$	
$C_o$	output capacitance	$V_{IO} = 0\text{ V}$ or $3.0\text{ V}$	-	9	-	$\text{pF}$	

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

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

[3] Unused pins at  $V_{CC}$  or GND.

[4] Not guaranteed.

[5] This parameter is valid for any  $V_{CC}$  between  $0\text{ V}$  and  $1.2\text{ V}$  with a transition time of up to  $10\text{ ms}$ . From  $V_{CC} = 1.2\text{ V}$  to  $V_{CC} = 2.5\text{ V} \pm 0.2\text{ V}$  a transition time of  $100\text{ }\mu\text{s}$  is permitted. This parameter is valid for  $T_{amb} = 25\text{ }^{\circ}\text{C}$  only.[6]  $I_{CC}$  is measured with outputs pulled up to  $V_{CC}$  or pulled down to ground.[7] This is the increase in supply current for each input at the specified voltage level other than  $V_{CC}$  or GND.[8] All typical values are at  $V_{CC} = 3.3\text{ V}$  and  $T_{amb} = 25\text{ }^{\circ}\text{C}$ .

[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  $V_{CC}$  between  $0\text{ V}$  and  $1.2\text{ V}$  with a transition time of up to  $10\text{ ms}$ . From  $V_{CC} = 1.2\text{ V}$  to  $V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$  a transition time of  $100\text{ }\mu\text{s}$  is permitted. This parameter is valid for  $T_{amb} = 25\text{ }^{\circ}\text{C}$  only.

## 11. Dynamic characteristics

**Table 8: Dynamic characteristics**

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

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b><math>V_{CC} = 2.5\text{ V} \pm 0.2\text{ V}</math> [1]</b>						
t <sub>PLH</sub>	propagation delay nCP to nQx	see <a href="#">Figure 6</a>	2.1	3.7	5.8	ns
t <sub>PHL</sub>	propagation delay					
	nCP to nQx	see <a href="#">Figure 6</a>	2.0	2.8	4.6	ns
	nMR to nQx	see <a href="#">Figure 8</a>	2.0	3.0	4.6	ns
t <sub>PZH</sub>	output enable time to HIGH-level	see <a href="#">Figure 9</a>	2.8	4.4	6.6	ns
t <sub>PZL</sub>	output enable time to LOW-level	see <a href="#">Figure 10</a>	2.0	3.4	5.2	ns
t <sub>PHZ</sub>	output disable time from HIGH-level	see <a href="#">Figure 9</a>	2.3	3.2	4.6	ns
t <sub>PLZ</sub>	output disable time from LOW-level	see <a href="#">Figure 10</a>	2.0	2.5	3.5	ns
t <sub>su(H)</sub>	set-up time HIGH					
	nDx to nCP	see <a href="#">Figure 7</a>	1.0	0.5	-	ns
	n $\overline{\text{CE}}$ to nCP	see <a href="#">Figure 7</a>	1.0	0.2	-	ns
t <sub>su(L)</sub>	set-up time LOW					
	nDx to nCP	see <a href="#">Figure 7</a>	2.0	1.3	-	ns
	n $\overline{\text{CE}}$ to nCP	see <a href="#">Figure 7</a>	+0.5	-0.1	-	ns
t <sub>h(H)</sub>	hold time HIGH					
	nDx to nCP	see <a href="#">Figure 7</a>	+0.1	-1.4	-	ns
	n $\overline{\text{CE}}$ to nCP	see <a href="#">Figure 7</a>	1.0	0.2	-	ns
t <sub>h(L)</sub>	hold time LOW					
	nDx to nCP	see <a href="#">Figure 7</a>	+0.1	-0.5	-	ns
	n $\overline{\text{CE}}$ to nCP	see <a href="#">Figure 7</a>	+1.0	-0.1	-	ns
t <sub>WH</sub>	pulse width HIGH nCP	see <a href="#">Figure 6</a>	2.0	0.8	-	ns
t <sub>WL</sub>	pulse width LOW					
	nCP	see <a href="#">Figure 6</a>	3.0	2.1	-	ns
	nMR	see <a href="#">Figure 8</a>	2.0	0.8	-	ns
t <sub>rec</sub>	recovery time nMR to nCP	see <a href="#">Figure 8</a>	2.3	1.3	-	ns
<b><math>V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}</math> [2]</b>						
t <sub>PLH</sub>	propagation delay nCP to nQx	see <a href="#">Figure 6</a>	1.8	2.9	4.4	ns
t <sub>PHL</sub>	propagation delay					
	nCP to nQx	see <a href="#">Figure 6</a>	1.6	2.3	3.6	ns
	nMR to nQx	see <a href="#">Figure 8</a>	1.8	2.5	3.7	ns
t <sub>PZH</sub>	output enable time to HIGH-level	see <a href="#">Figure 9</a>	2.0	3.5	5.2	ns
t <sub>PZL</sub>	output enable time to LOW-level	see <a href="#">Figure 10</a>	1.7	2.8	3.8	ns
t <sub>PHZ</sub>	output disable time from HIGH-level	see <a href="#">Figure 9</a>	2.4	3.5	4.7	ns
t <sub>PLZ</sub>	output disable time from LOW-level	see <a href="#">Figure 10</a>	1.9	2.8	3.8	ns

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

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

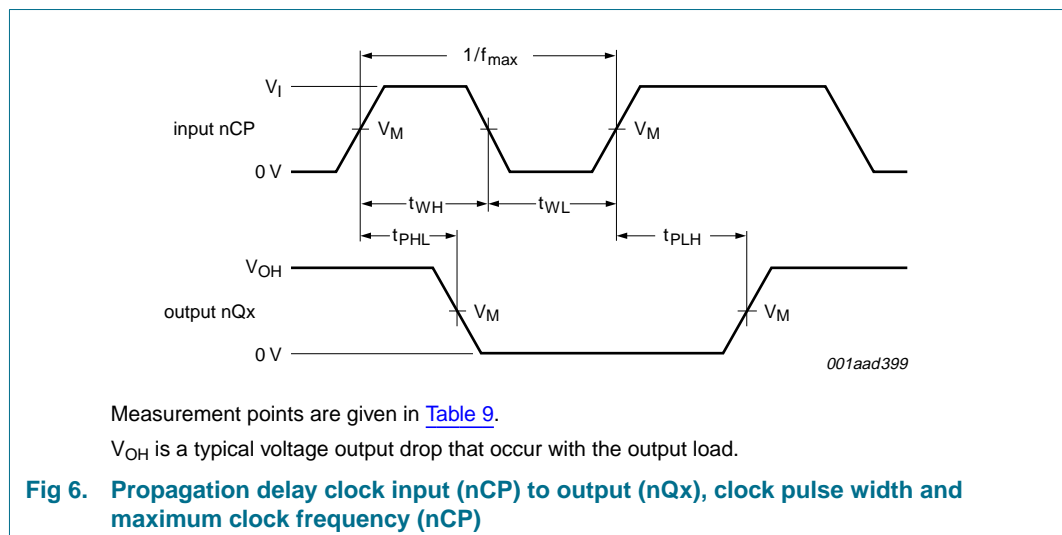
$T_{amb} = -40\text{ }^{\circ}\text{C}$  to  $+85\text{ }^{\circ}\text{C}$ .

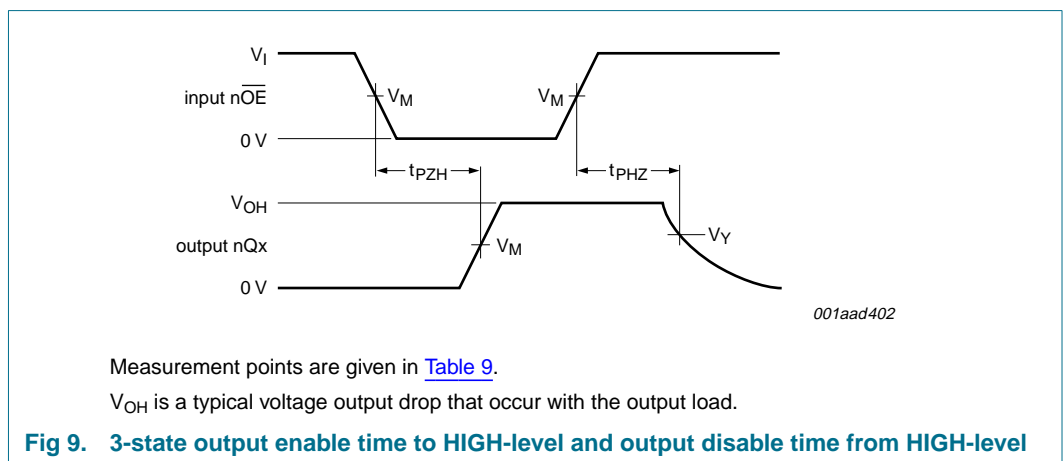
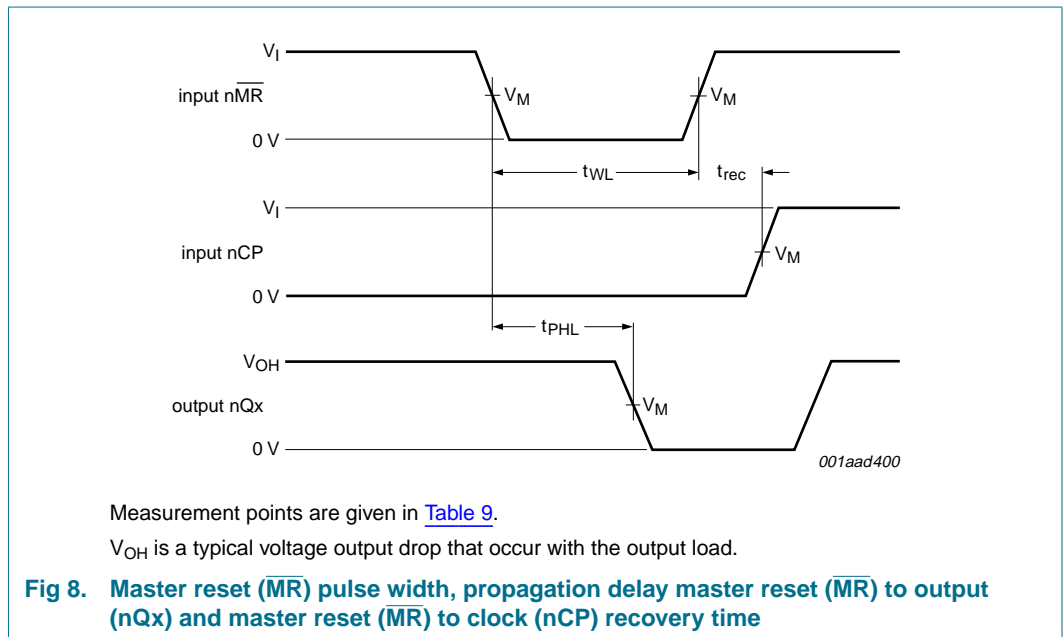
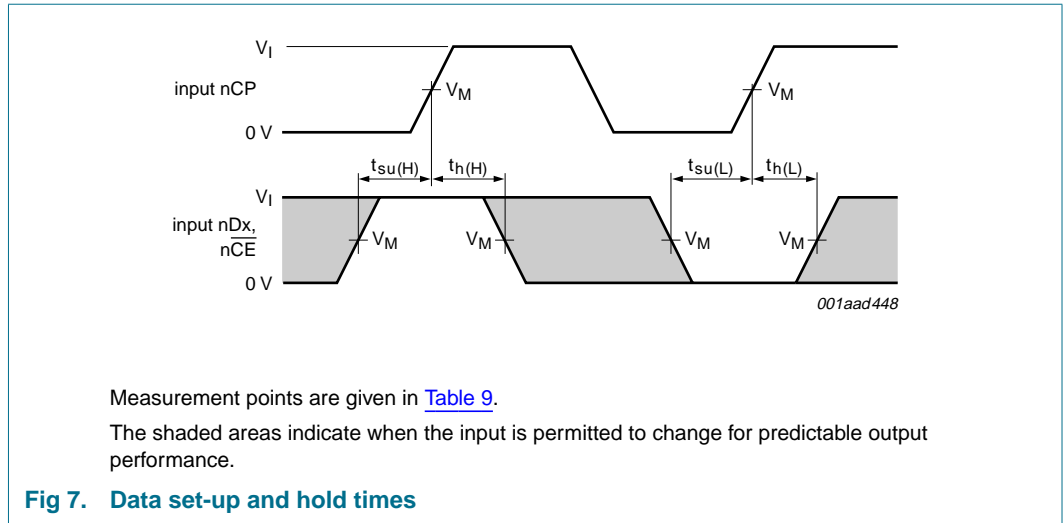
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$t_{su(H)}$	set-up time HIGH					
	nDx to nCP	see <a href="#">Figure 7</a>	1.0	0.5	-	ns
	n $\overline{\text{CE}}$ to nCP	see <a href="#">Figure 7</a>	1.0	0.1	-	ns
$t_{su(L)}$	set-up time LOW					
	nDx to nCP	see <a href="#">Figure 7</a>	1.6	1.1	-	ns
	n $\overline{\text{CE}}$ to nCP	see <a href="#">Figure 7</a>	+0.5	-0.5	-	ns
$t_{h(H)}$	hold time HIGH					
	nDx to nCP	see <a href="#">Figure 7</a>	+0.1	-0.5	-	ns
	n $\overline{\text{CE}}$ to nCP	see <a href="#">Figure 7</a>	1.0	-0.1	-	ns
$t_{h(L)}$	hold time LOW					
	nDx to nCP	see <a href="#">Figure 7</a>	+0.1	-0.7	-	ns
	n $\overline{\text{CE}}$ to nCP	see <a href="#">Figure 7</a>	1.0	0.5	-	ns
$t_{WH}$	pulse width HIGH nCP	see <a href="#">Figure 6</a>	1.5	0.7	-	ns
$t_{WL}$	pulse width LOW					
	nCP	see <a href="#">Figure 6</a>	2.5	1.4	-	ns
	n $\overline{\text{MR}}$	see <a href="#">Figure 8</a>	2.0	1.5	-	ns
$t_{rec}$	recovery time n $\overline{\text{MR}}$ to nCP	see <a href="#">Figure 8</a>	2.0	1.1	-	ns

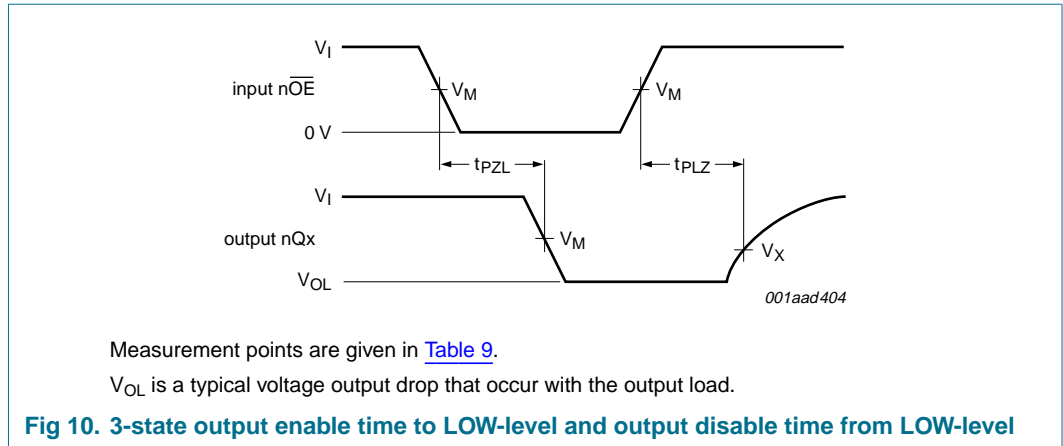
[1] All typical values are measured at  $V_{CC} = 2.5\text{ V}$  and  $T_{amb} = 25\text{ }^{\circ}\text{C}$ .

[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	$V_{OL} + 0.3\text{ V}$	$V_{OH} - 0.3\text{ V}$
$\leq 2.7\text{ V}$	$0.5 \times V_{CC}$	$0.5 \times V_{CC}$	$V_{OL} + 0.3\text{ V}$	$V_{OH} - 0.3\text{ V}$

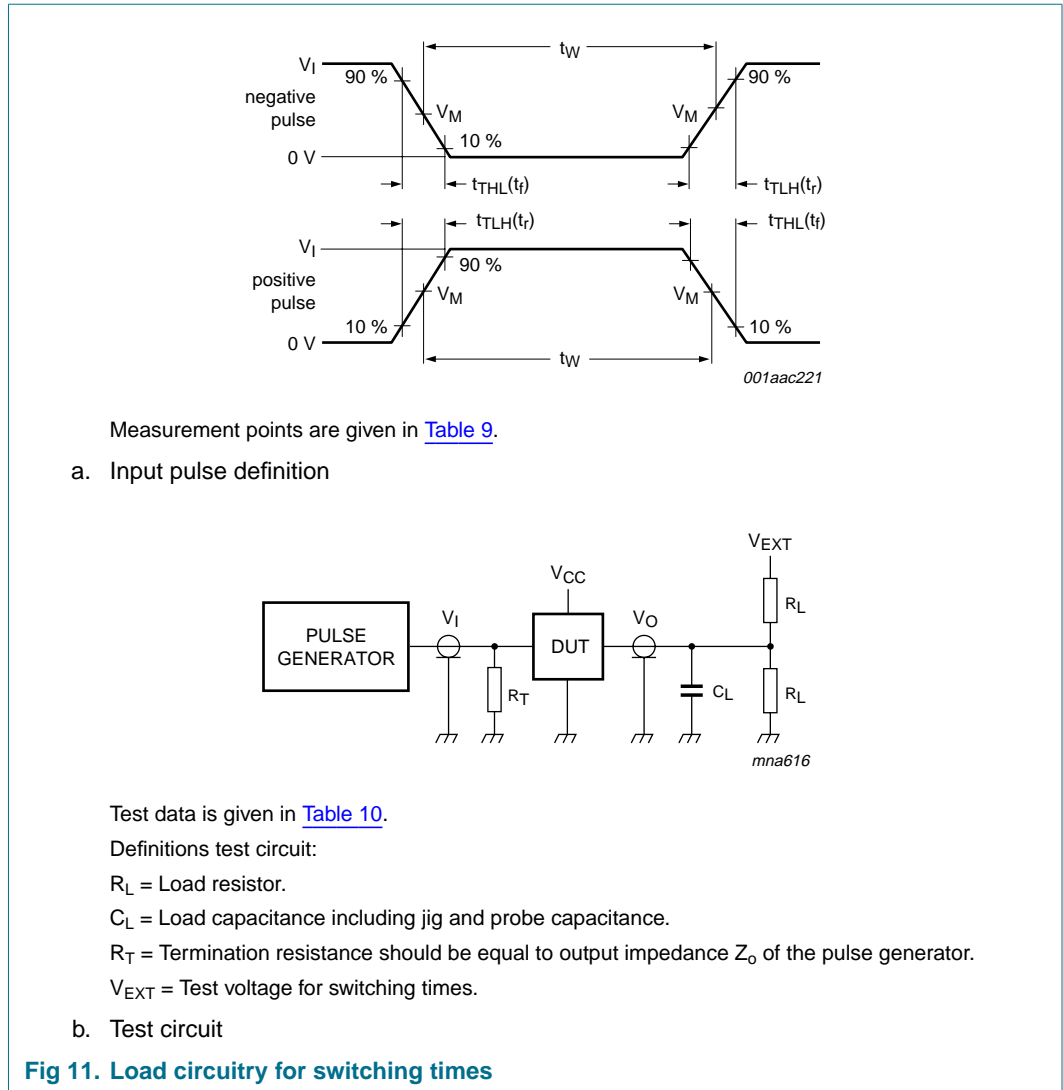


Table 10: Test data

Input				Load		V <sub>EXT</sub>		
V <sub>I</sub>	f <sub>i</sub>	t <sub>w</sub>	t <sub>r</sub> , t <sub>f</sub>	C <sub>L</sub>	R <sub>L</sub>	t <sub>PLZ</sub> , t <sub>PZL</sub>	t <sub>PLH</sub> , t <sub>PHL</sub>	t <sub>PHZ</sub> , t <sub>PZH</sub>
3.0 V or V <sub>CC</sub> whichever is less	≤ 10 MHz	500 ns	≤ 2.5 ns	50 pF	500 Ω	6 V or 2 × V <sub>CC</sub>	open	GND

13. Package outline

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

SOT371-1

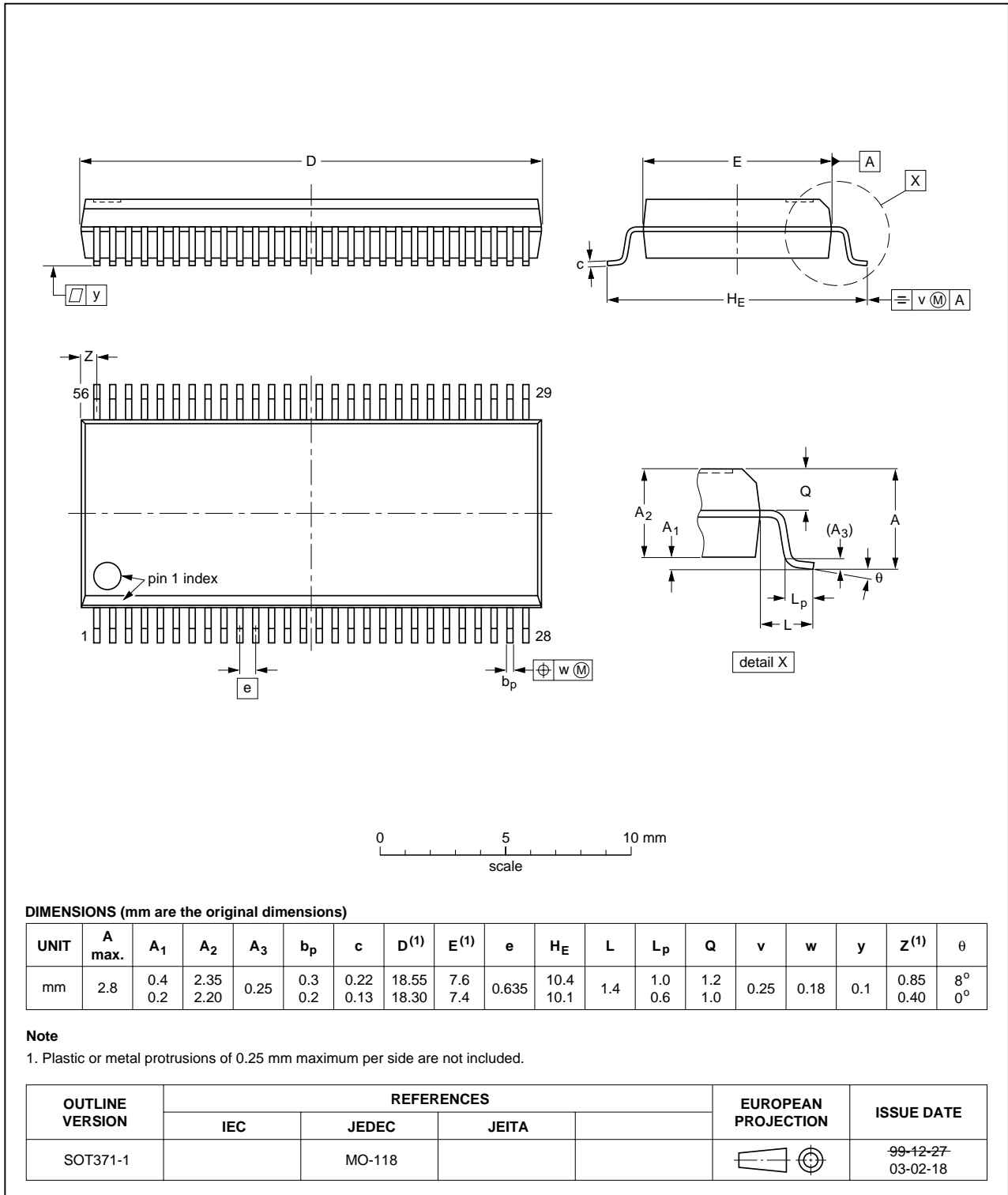


Fig 12. Package outline SOT371-1 (SSOP56)



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

SOT364-1

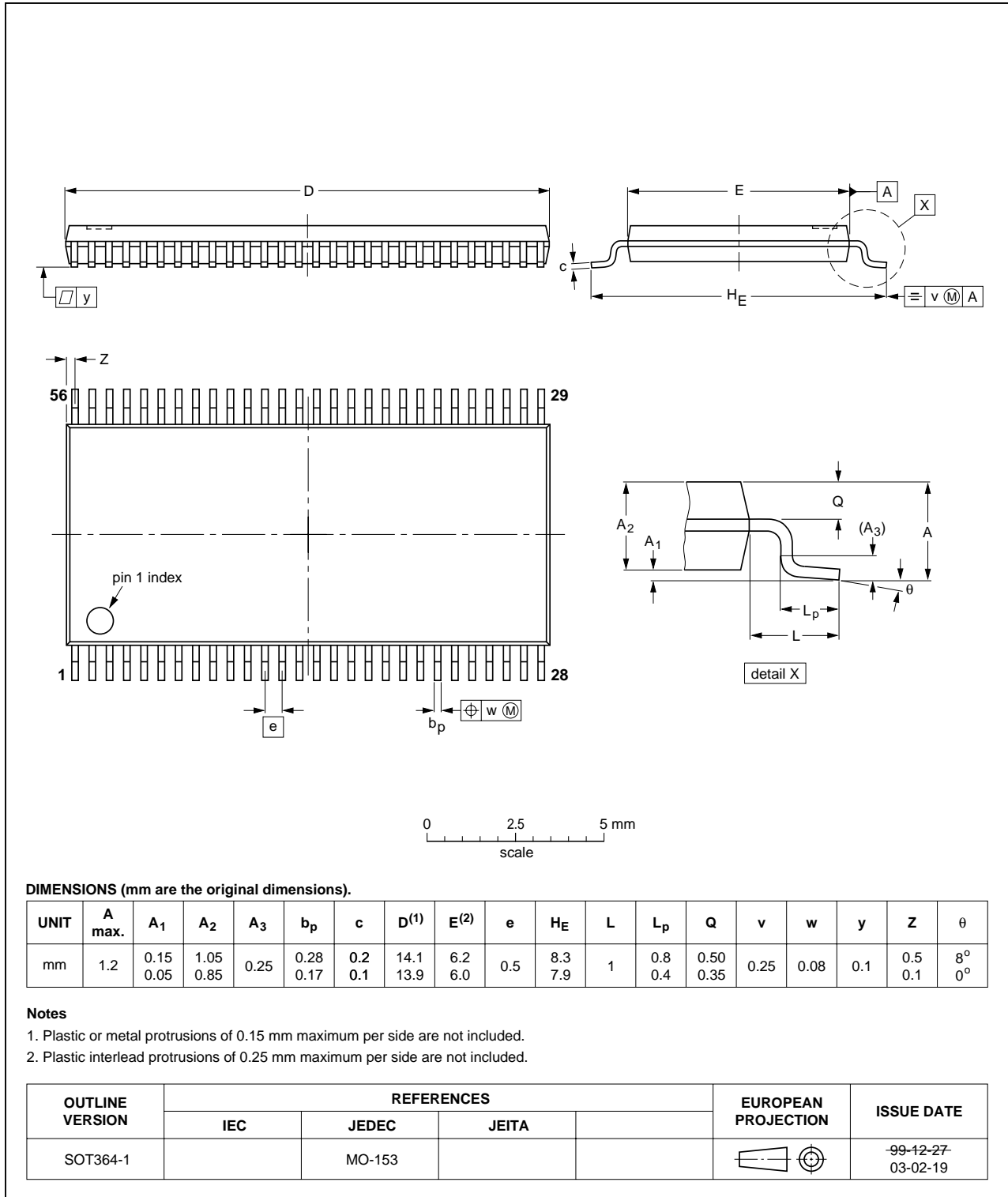


Fig 13. Package outline SOT364-1 (TSSOP56)

## 14. Revision history

Table 11: Revision history

Document ID	Release date	Data sheet status	Change notice	Doc. number	Supersedes
74ALVT162823_2	20050811	Product data sheet	-	-	74ALVT162823_1
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 1</a> and <a href="#">Table 8</a>: changed propagation delays.</li></ul>
74ALVT162823_1	19980827	Product specification	-	9397 750 03577	-

## 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.
II	Preliminary data	Qualification	This data sheet contains data from the preliminary specification. Supplementary data will be published at a later date. Philips Semiconductors reserves the right to change the specification without notice, in order to improve the design and supply the best possible product.
III	Product data	Production	This data sheet contains data from the product specification. Philips Semiconductors reserves the right to make changes at any time in order to improve the design, manufacturing and supply. Relevant changes will be communicated via a Customer Product/Process Change Notification (CPCN).

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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.

## 16. Definitions

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**Limiting values definition** — Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 60134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability.

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