

# 74LVTN16245B

3.3 V 16-bit transceiver; 3-state

Rev. 01 — 29 July 2009

Product data sheet

## 1. General description

The 74LVTN16245B is a high-performance BiCMOS product designed for  $V_{CC}$  operation at 3.3 V.

This device is a 16-bit transceiver featuring non-inverting 3-state bus compatible outputs in both send and receive directions. The control function implementation minimizes external timing requirements. The device features an output enable input ( $\overline{nOE}$ ) for easy cascading and a direction input ( $nDIR$ ) for direction control.

## 2. Features

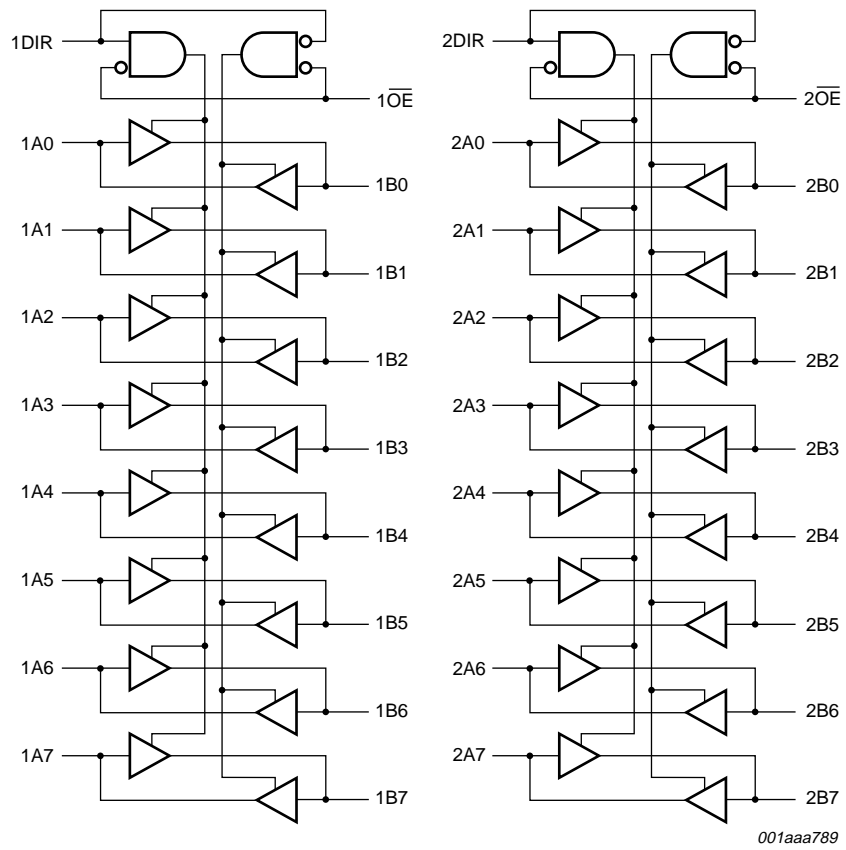
- 16-bit bus interface
- 3-state buffers
- Output capability: +64 mA and -32 mA
- TTL input and output switching levels
- Input and output interface capability to systems at 5 V supply
- Power-up 3-state
- Live insertion and extraction permitted
- No bus current loading when output is tied to 5 V bus
- Latch-up protection
  - ◆ JESD78 Class II exceeds 500 mA
- ESD protection:
  - ◆ HBM JESD22-A114E exceeds 2000 V
  - ◆ MM JESD22-A115-A exceeds 200 V

## 3. Ordering information

Table 1. Ordering information

Type number	Package			Version
	Temperature range	Name	Description	
74LVTN16245BDGG	-40 °C to +85 °C	TSSOP48	plastic thin shrink small outline package; 48 leads; body width 6.1 mm	SOT362-1
74LVTN16245BBQ	-40 °C to +85 °C	HUQFN60U	plastic thermal enhanced ultra thin quad flat package; no leads; 60 terminals; UTLP based; body 4 x 6 x 0.55 mm	SOT1025-1

**4. Functional diagram**



**Fig 1. Logic symbol**

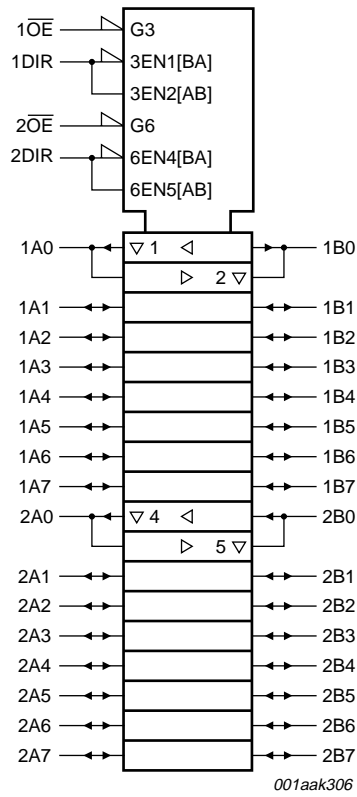
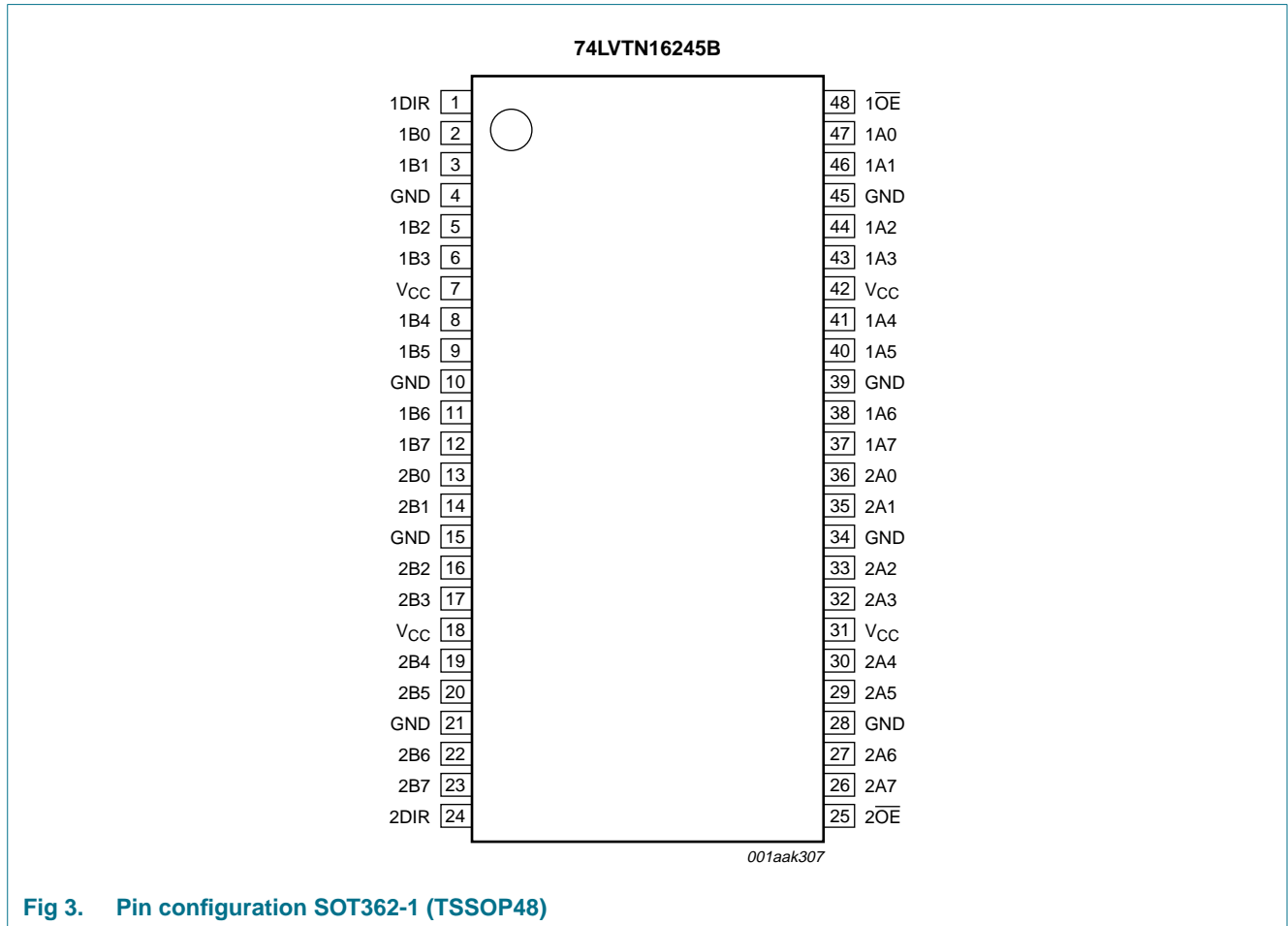
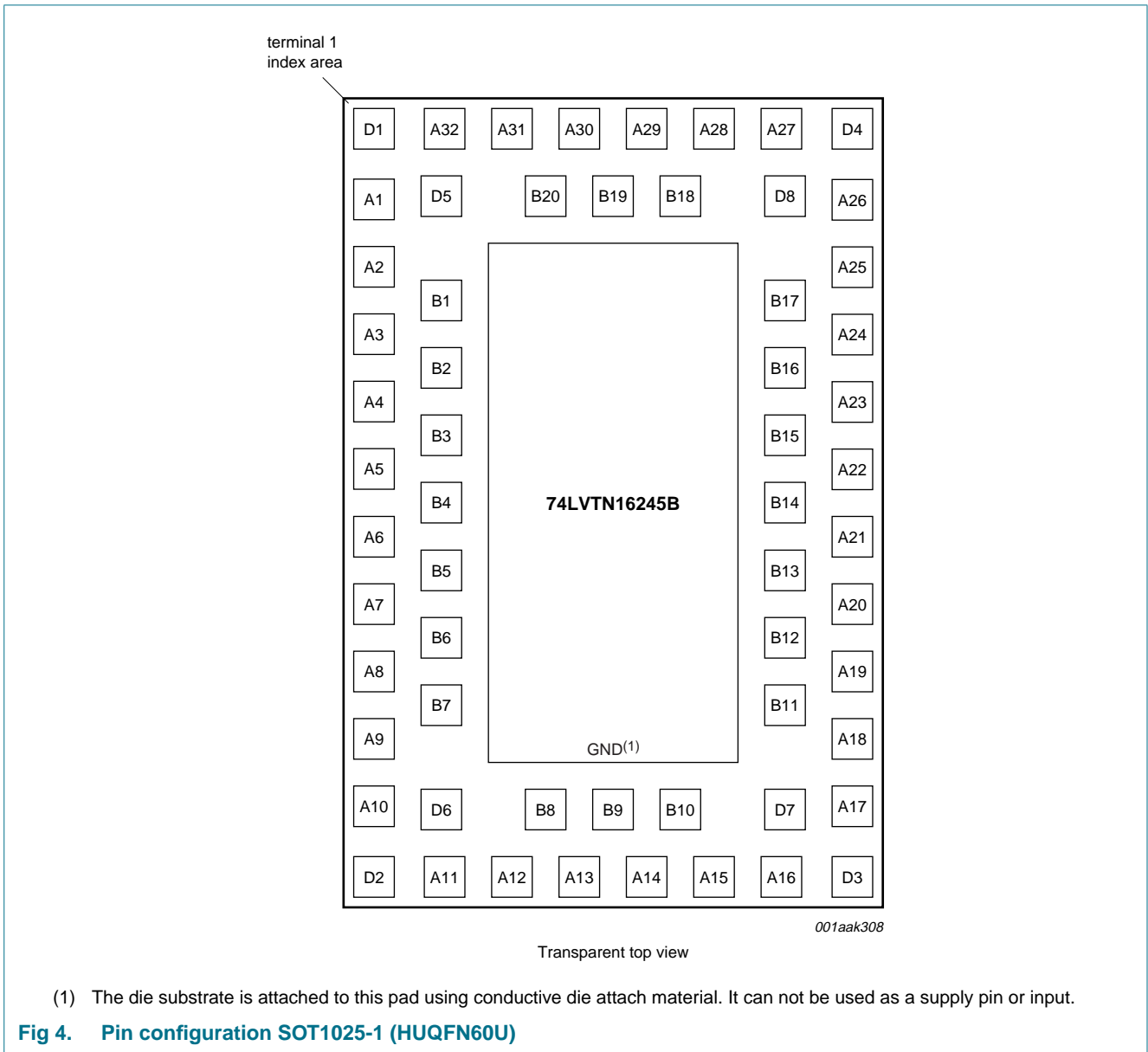


Fig 2. IEC logic symbol

**5. Pinning information**

**5.1 Pinning**





## 5.2 Pin description

Table 2. Pin description

Symbol	Pin		Description
	SOT362-1	SOT1025-1	
1DIR, 2DIR	1, 24	A30, A13	direction control input
1B0 to 1B7	2, 3, 5, 6, 8, 9, 11, 12	B20, A31, D5, D1, A2, B2, B3, A5	data input/output
2B0 to 2B7	13, 14, 16, 17, 19, 20, 22, 23	A6, B5, B6, A9, D2, D6, A12, B8	data input/output
GND	4, 10, 15, 21, 28, 34, 39, 45	A32, A3, A8, A11, A16, A19, A24, A27	ground (0 V)
V <sub>CC</sub>	7, 18, 31, 42	A1, A10, A17, A26	supply voltage
1OE, 2OE	48, 25	A29, A14	output enable input (active LOW)
2A0 to 2A7	36, 35, 33, 32, 30, 29, 27, 26	A21, B13, B12, A18, D3, D7, A15, B10	data input/output
1A0, to 1A7	47, 46, 44, 43, 41, 40, 38, 37	B18, A28, D8, D4, A25, B16, B15, A22	data input/output
n.c.	-	A4, A7, A20, A23, B1, B4, B7, B9, B11, B14, B17, B19	not connected

## 6. Functional description

Table 3. Function table [1]

Control		Input/output	
nOE	nDIR	nAn	nBn
L	L	output nAn = nBn	input
L	H	input	output nBx = nAx
H	X	Z	Z

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

## 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 <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 clamping current	V <sub>I</sub> < 0 V	-50	-	mA
I <sub>OK</sub>	output clamping current	V <sub>O</sub> < 0 V	-50	-	mA
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

**Table 4. 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
P <sub>tot</sub>	total power dissipation	T <sub>amb</sub> = -40 °C to +85 °C			
		TSSOP48 package	[3] -	500	mW
		HUQFN60U package	[4] -	1000	mW

- [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.
- [3] Above 60 °C the value of P<sub>tot</sub> derates linearly with 5.5 mW/K.
- [4] Above 70 °C the value of P<sub>tot</sub> derates linearly with 1.8 mW/K.

## 8. Recommended operating conditions

**Table 5. Recommended operating conditions**

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V <sub>CC</sub>	supply voltage		2.7	-	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		-32	-	-	mA
I <sub>OL</sub>	LOW-level output current	none	-	-	32	mA
		current duty cycle ≤ 50 %; f <sub>i</sub> ≥ 1 kHz	-	-	64	mA
T <sub>amb</sub>	ambient temperature	in free-air	-40	-	+85	°C
Δt/ΔV	input transition rise and fall rate	outputs enabled	-	-	10	ns/V

## 9. Static characteristics

**Table 6. Static characteristics**

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

Symbol	Parameter	Conditions	Min	Typ <sup>[1]</sup>	Max	Unit
<b>T<sub>amb</sub> = -40 °C to +85 °C</b>						
V <sub>IK</sub>	input clamping voltage	V <sub>CC</sub> = 2.7 V; I <sub>IK</sub> = -18 mA	-1.2	-0.85	-	V
V <sub>OH</sub>	HIGH-level output voltage	I <sub>OH</sub> = -100 μA; V <sub>CC</sub> = 2.7 V to 3.6 V	V <sub>CC</sub> - 0.2	V <sub>CC</sub>	-	V
		I <sub>OH</sub> = -8 mA; V <sub>CC</sub> = 2.7 V	2.4	2.5	-	V
		I <sub>OH</sub> = -32 mA; V <sub>CC</sub> = 3.0 V	2.0	2.3	-	V
V <sub>OL</sub>	LOW-level output voltage	V <sub>CC</sub> = 2.7 V				
		I <sub>OL</sub> = 100 μA	-	0.07	0.2	V
		I <sub>OL</sub> = 24 mA	-	0.3	0.5	V
		V <sub>CC</sub> = 3.0 V				
		I <sub>OL</sub> = 16 mA	-	0.25	0.4	V
		I <sub>OL</sub> = 32 mA	-	0.3	0.5	V
		I <sub>OL</sub> = 64 mA	-	0.4	0.55	V

**Table 6. Static characteristics ...continued**

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

Symbol	Parameter	Conditions	Min	Typ <sup>[1]</sup>	Max	Unit
$I_I$	input leakage current	control pins				
		$V_{CC} = 3.6\text{ V}; V_I = V_{CC}\text{ or GND}$	-	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	$\mu\text{A}$
		input/output data pins; $V_{CC} = 3.6\text{ V}$	<sup>[2]</sup>			
		$V_I = 5.5\text{ V}$	-	0.1	20	$\mu\text{A}$
		$V_I = V_{CC}$	-	0.5	10	$\mu\text{A}$
		$V_I = 0\text{ V}$	-5	-0.1	-	$\mu\text{A}$
$I_{OFF}$	power-off leakage current	$V_{CC} = 0\text{ V}; V_I\text{ or }V_O = 0\text{ V to }4.5\text{ V}$	-	0.1	$\pm 100$	$\mu\text{A}$
$I_{LO}$	output leakage current	output in HIGH-state when $V_O > V_{CC}$ ; $V_O = 5.5\text{ V}; V_{CC} = 3.0\text{ V}$	-	75	125	$\mu\text{A}$
$I_{O(pu/pd)}$	power-up/power-down output current	$V_{CC} \leq 1.2\text{ V}; V_O = 0.5\text{ V to }V_{CC}$ ; $V_I = \text{GND or }V_{CC}; \text{n}\overline{\text{OE}} = \text{don't care}$	<sup>[3]</sup> -	40	$\pm 100$	$\mu\text{A}$
$I_{CC}$	supply current	$V_{CC} = 3.6\text{ V}; V_I = \text{GND or }V_{CC}; I_O = 0\text{ A}$				
		output HIGH	-	0.07	0.12	mA
		output LOW	-	4.0	6.0	mA
		outputs disabled	<sup>[4]</sup> -	0.07	0.12	mA
$\Delta I_{CC}$	additional supply current	per input pin; $V_{CC} = 3.0\text{ V to }3.6\text{ V}$ ; one input at $V_{CC} - 0.6\text{ V}$ other inputs at $V_{CC}$ or GND	<sup>[5]</sup> -	0.1	0.2	mA
$C_I$	input capacitance	pins nDIR and n $\overline{\text{OE}}$ , $V_O = 0\text{ V or }3.0\text{ V}$	-	3	-	pF
$C_{io(off)}$	off-state input/output capacitance	pins nAn and nBn, outputs disabled; $V_O = \text{GND or }V_{CC}$	-	9	-	pF

[1] Typical values are measured at  $V_{CC} = 3.3\text{ V}$  and at  $T_{amb} = 25\text{ }^\circ\text{C}$ .[2] Unused pins at  $V_{CC}$  or GND.[3] This parameter is valid for any  $V_{CC}$  between 0 V and 1.2 V with a transition time of up to 10 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  $\mu\text{s}$  is permitted. This parameter is valid for  $T_{amb} = 25\text{ }^\circ\text{C}$  only.[4]  $I_{CC}$  is measured with outputs pulled to  $V_{CC}$  or GND.[5] This is the increase in supply current for each input at the specified voltage level other than  $V_{CC}$  or GND.



## 10. Dynamic characteristics

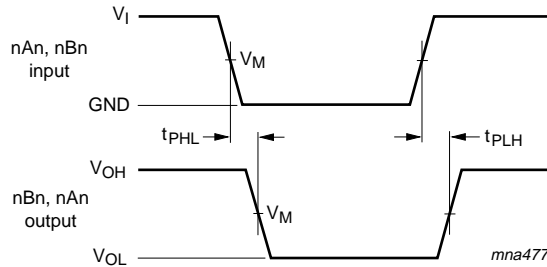
**Table 7. Dynamic characteristics**

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

Symbol	Parameter	Conditions	Min	Typ <sup>[1]</sup>	Max	Unit
<b>T<sub>amb</sub> = -40 °C to +85 °C</b>						
t <sub>PLH</sub>	LOW to HIGH propagation delay	nAn to nBn or nBn to nAn; see <a href="#">Figure 5</a>				
		V <sub>CC</sub> = 2.7 V	-	-	3.5	ns
		V <sub>CC</sub> = 3.0 V to 3.6 V	1.0	1.9	3.3	ns
t <sub>PHL</sub>	HIGH to LOW propagation delay	nAn to nBn or nBn to nAn; see <a href="#">Figure 5</a>				
		V <sub>CC</sub> = 2.7 V	-	-	3.5	ns
		V <sub>CC</sub> = 3.0 V to 3.6 V	1.0	1.7	3.3	ns
t <sub>PZH</sub>	OFF-state to HIGH propagation delay	n $\overline{\text{OE}}$ to nAn or nBn; see <a href="#">Figure 6</a>				
		V <sub>CC</sub> = 2.7 V	-	-	5.3	ns
		V <sub>CC</sub> = 3.0 V to 3.6 V	1.0	2.8	4.5	ns
t <sub>PZL</sub>	OFF-state to LOW propagation delay	n $\overline{\text{OE}}$ to nAn or nBn; see <a href="#">Figure 6</a>				
		V <sub>CC</sub> = 2.7 V	-	-	5.1	ns
		V <sub>CC</sub> = 3.0 V to 3.6 V	1.0	2.8	4.1	ns
t <sub>PHZ</sub>	HIGH to OFF-state propagation delay	n $\overline{\text{OE}}$ to nAn or nBn; see <a href="#">Figure 6</a>				
		V <sub>CC</sub> = 2.7 V	-	-	5.7	ns
		V <sub>CC</sub> = 3.0 V to 3.6 V	1.5	3.2	5.1	ns
t <sub>PLZ</sub>	LOW to OFF-state propagation delay	n $\overline{\text{OE}}$ to nAn or nBn; see <a href="#">Figure 6</a>				
		V <sub>CC</sub> = 2.7 V	-	-	4.6	ns
		V <sub>CC</sub> = 3.0 V to 3.6 V	1.5	3.0	4.6	ns

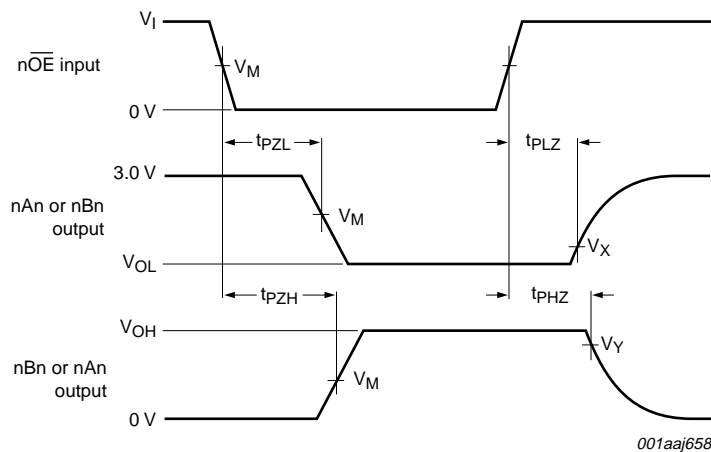
[1] Typical values are measured at V<sub>CC</sub> = 3.3 V and T<sub>amb</sub> = 25 °C.

11. Waveforms



Measurements points are given in [Table 8](#).  
 $V_{OL}$  and  $V_{OH}$  are typical voltage output levels that occur with the output load.

**Fig 5. Propagation delay input (nAn, nBn) to output (nBn, nAn)**

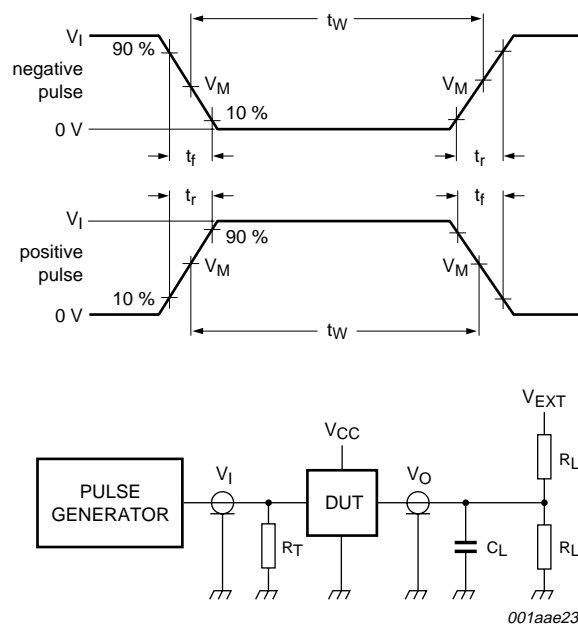


Measurements points are given in [Table 8](#).  
 $V_{OL}$  and  $V_{OH}$  are typical voltage output levels that occur with the output load.

**Fig 6. Enable and disable times**

**Table 8. Measurement points**

Input	Output		
$V_M$	$V_M$	$V_X$	$V_Y$
1.5 V	1.5 V	$V_{OL} + 0.3 V$	$V_{OH} - 0.3 V$



Test data is given in [Table 9](#).

Definitions test circuit:

$R_L$  = Load resistance.

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

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

$V_{EXT}$  = External voltage for measuring switching times.

**Fig 7. Load circuit for measuring switching times**

**Table 9. Test data**

Input				Load		$V_{EXT}$		
$V_I$	$f_i$	$t_W$	$t_r, t_f$	$C_L$	$R_L$	$t_{PHZ}, t_{PZH}$	$t_{PLZ}, t_{PZL}$	$t_{PLH}, t_{PHL}$
2.7 V	$\leq 10$ MHz	500 ns	$\leq 2.5$ ns	50 pF	500 $\Omega$	GND	6 V	open

12. Package outline

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

SOT362-1

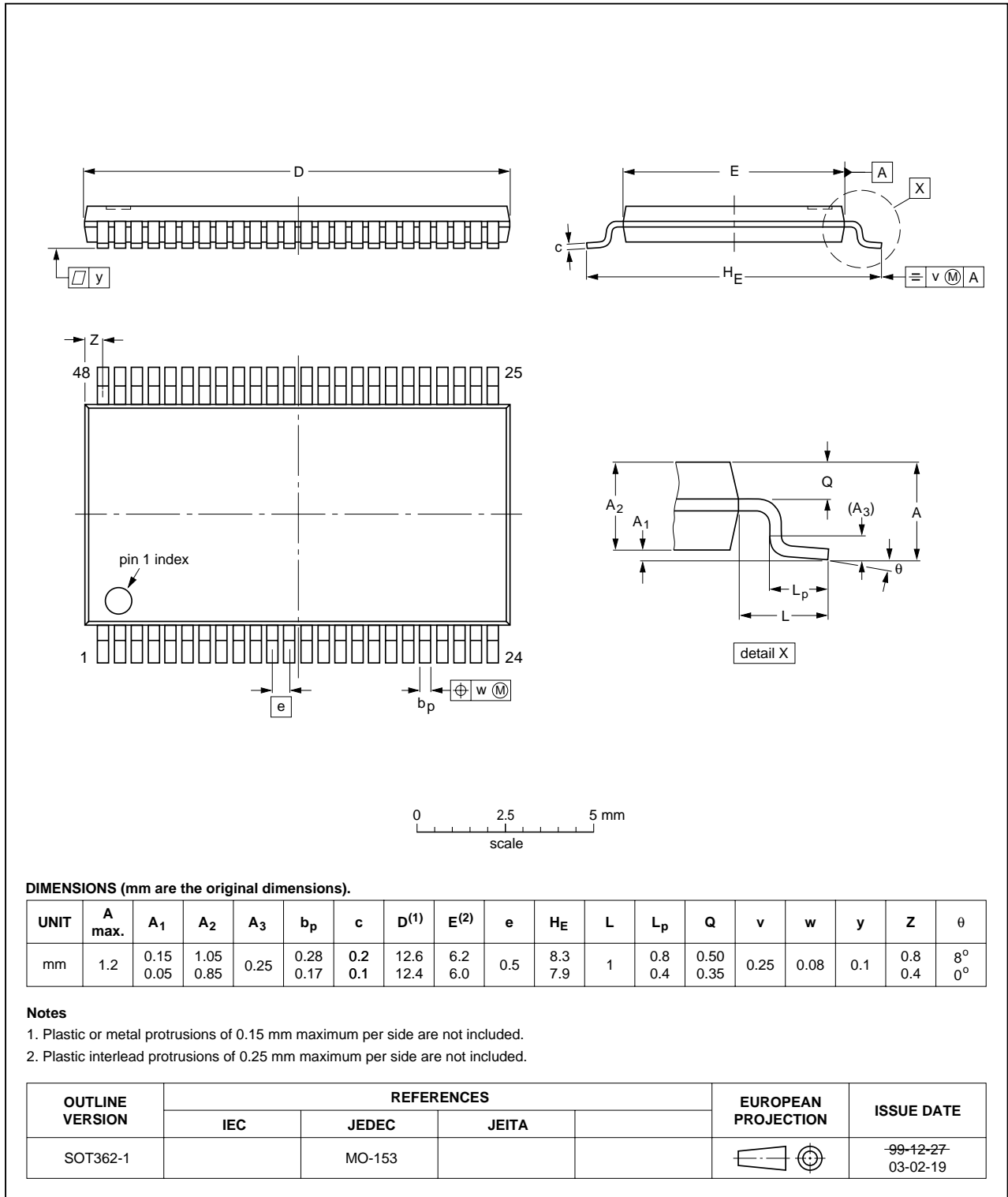


Fig 8. Package outline SOT362-1 (TSSOP48)

HUQFN60U: plastic thermal enhanced ultra thin quad flat package; no leads  
60 terminals; UTLP based; body 4 x 6 x 0.55 mm

SOT1025-1

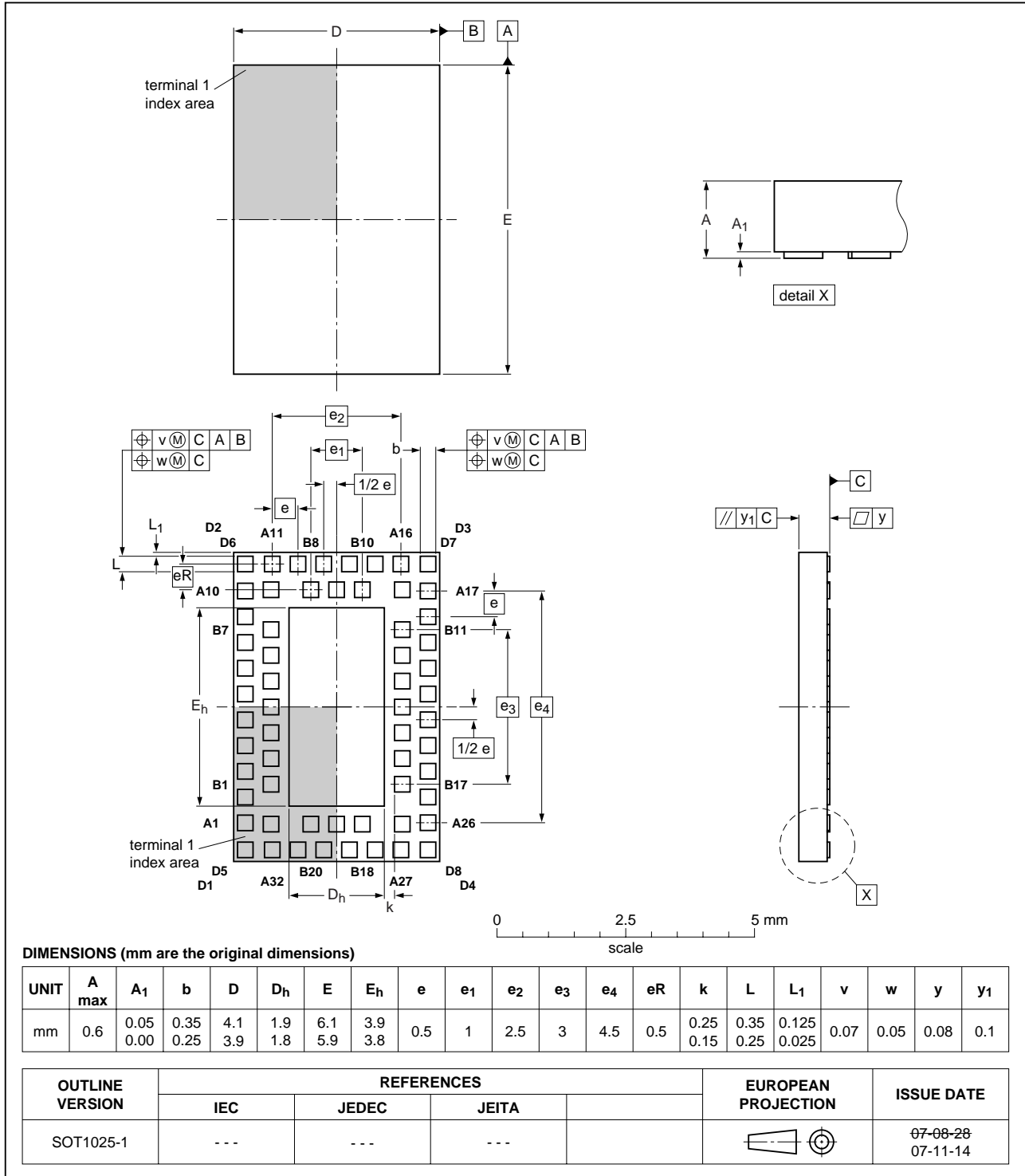


Fig 9. Package outline SOT1025-1 (HUQFN60U)

## 13. Abbreviations

Table 10. Abbreviations

Acronym	Description
BiCMOS	Bipolar Complementary Metal Oxide Semiconductor
DUT	Device Under Test
ESD	Electrostatic Discharge
HBM	Human Body Model
MM	Machine Model
TTL	Transistor-Transistor Logic

## 14. Revision history

Table 11. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74LVTN16245B_1	20090729	Product data sheet	-	-

## 15. Legal information

### 15.1 Data sheet status

Document status <sup>[1][2]</sup>	Product status <sup>[3]</sup>	Definition
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