

74LVT16245B; 74LVTH16245B

3.3 V 16-bit transceiver; 3-state

Rev. 11 — 31 October 2018

Product data sheet

1. General description

The 74LVT16245B; 74LVTH16245B 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 ($n\overline{OE}$) for easy cascading and a direction input ($n\overline{DIR}$) for direction control.

2. Features and benefits

- 16-bit bidirectional 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
- Bus hold data inputs eliminate need for external pull-up resistors to hold unused inputs
- Live insertion and extraction permitted
- Power-up 3-state
- No bus current loading when output is tied to 5 V bus
- Latch-up protection:
 - JESD78B Class II exceeds 500 mA
- ESD protection:
 - HBM JESD22-A114F exceeds 2000 V
 - MM JESD22-A115-A exceeds 200 V

3. Ordering information

Table 1. Ordering information

Type number	Package			
	Temperature range	Name	Description	Version
74LVT16245BDL	-40 °C to +85 °C	SSOP48	plastic shrink small outline package; 48 leads; body width 7.5 mm	SOT370-1
74LVTH16245BDL				
74LVT16245BDGG	-40 °C to +85 °C	TSSOP48	plastic thin shrink small outline package; 48 leads; body width 6.1 mm	SOT362-1
74LVTH16245BDGG				

4. Functional diagram

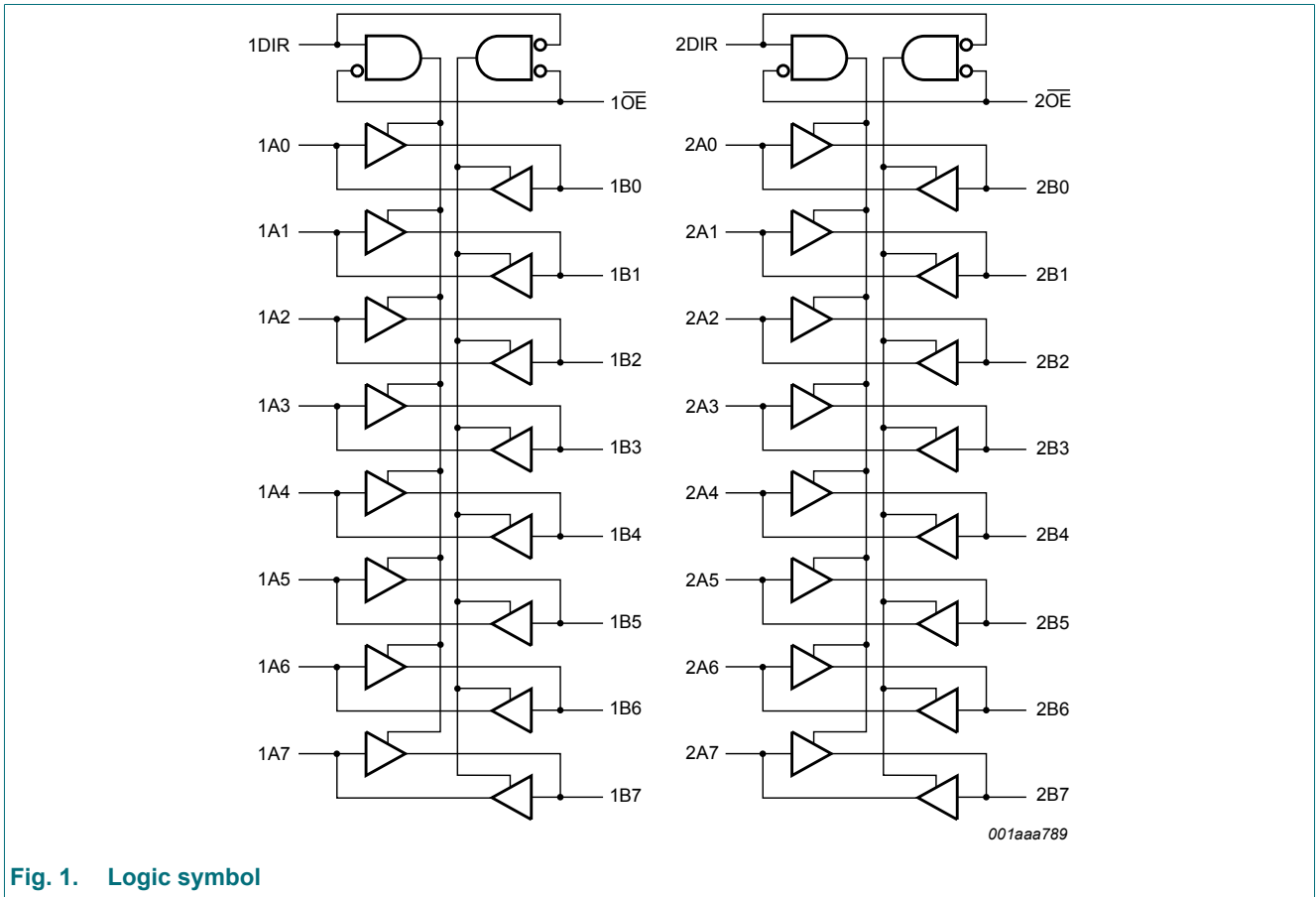


Fig. 1. Logic symbol

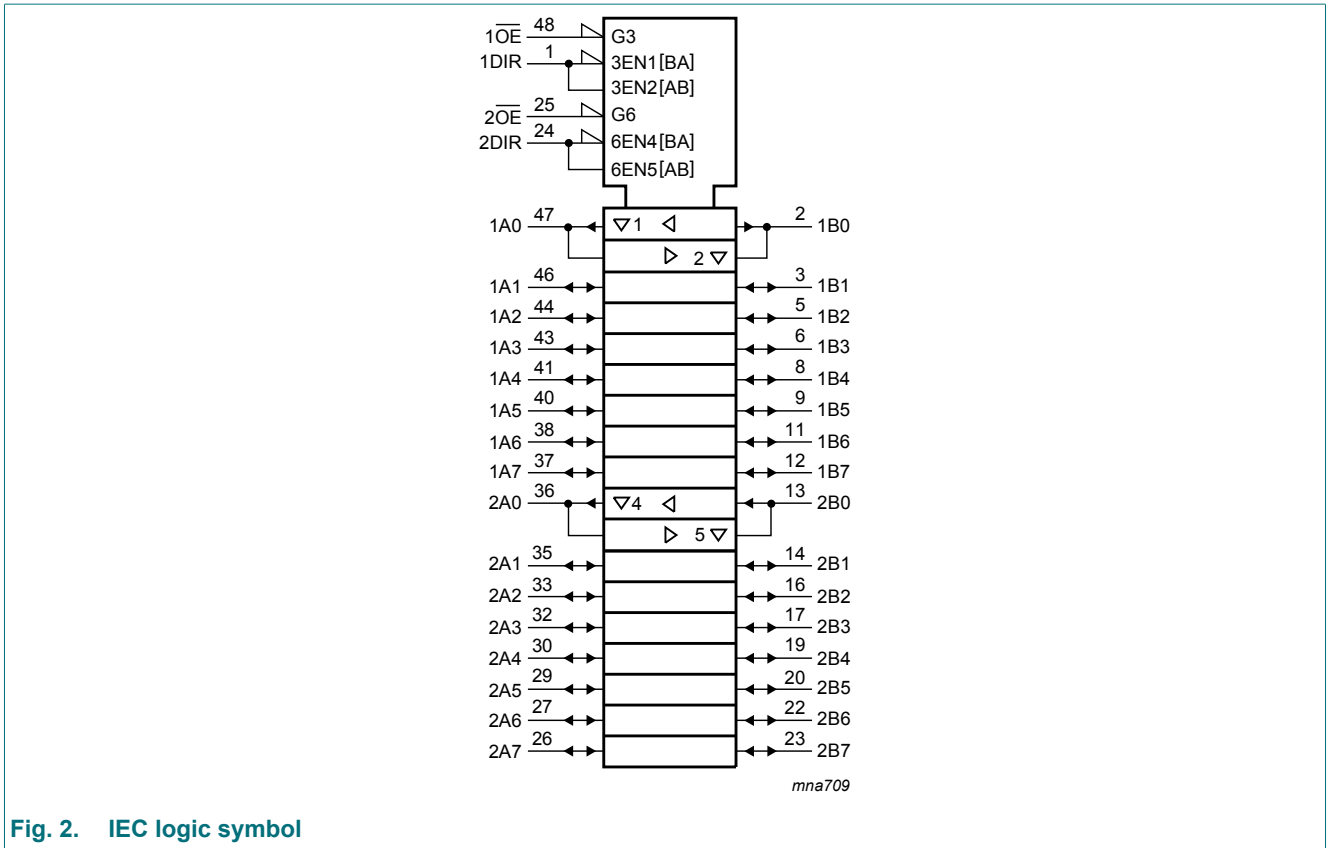


Fig. 2. IEC logic symbol

5. Pinning information

5.1. Pinning

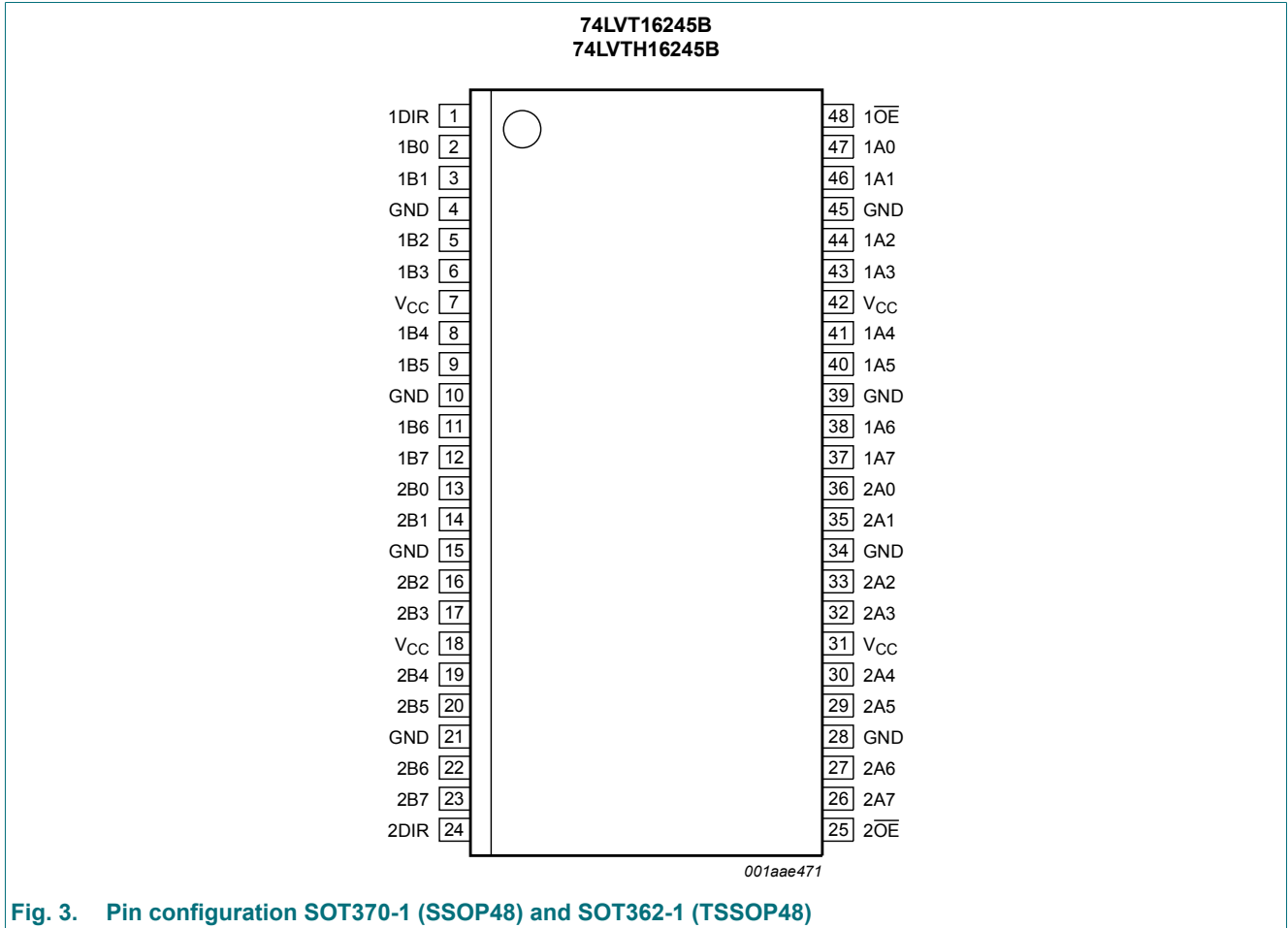


Fig. 3. Pin configuration SOT370-1 (SSOP48) and SOT362-1 (TSSOP48)

5.2. Pin description

Table 2. Pin description

Symbol	Pin	Description
1DIR, 2DIR	1, 24	direction control input
1B0, 1B1, 1B2, 1B3, 1B4, 1B5, 1B6, 1B7	2, 3, 5, 6, 8, 9, 11, 12	data input/output
2B0, 2B1, 2B2, 2B3, 2B4, 2B5, 2B6, 2B7	13, 14, 16, 17, 19, 20, 22, 23	data input/output
GND	4, 10, 15, 21, 28, 34, 39, 45	ground (0 V)
V _{CC}	7, 18, 31, 42	supply voltage
1OE, 2OE	48, 25	output enable input (active LOW)
2A0, 2A1, 2A2, 2A3, 2A4, 2A5, 2A6, 2A7	36, 35, 33, 32, 30, 29, 27, 26	data input/output
1A0, 1A1, 1A2, 1A3, 1A4, 1A5, 1A6, 1A7	47, 46, 44, 43, 41, 40, 38, 37	data input/output

6. Functional description

Table 3. Function table

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

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

7. Limiting values

Table 4. Limiting values

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

Symbol	Parameter	Conditions	Min	Max	Unit
V _{CC}	supply voltage		-0.5	+4.6	V
V _I	input voltage		[1]	+7.0	V
V _O	output voltage	output in OFF-state or HIGH-state	[1]	+7.0	V
I _{IK}	input clamping current	V _I < 0 V	-50	-	mA
I _{OK}	output clamping 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
P _{tot}	total power dissipation	T _{amb} = -40 °C to +85 °C;	[3]	500	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_{tot} derates linearly with 5.5 mW/K.

8. Recommended operating conditions

Table 5. Recommended operating conditions

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V _{CC}	supply voltage		2.7	-	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 ≤ 50 %; f _i ≥ 1 kHz	-	-	64	mA
T _{amb}	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; $T_{amb} = -40\text{ }^{\circ}\text{C}$ to $+85\text{ }^{\circ}\text{C}$; Voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions	Min	Typ [1]	Max	Unit
V_{IK}	input clamping voltage	$V_{CC} = 2.7\text{ V}$; $I_{IK} = -18\text{ mA}$	-1.2	-0.85	-	V
V_{OH}	HIGH-level output voltage	$I_{OH} = -100\text{ }\mu\text{A}$; $V_{CC} = 2.7\text{ V}$ to 3.6 V	$V_{CC} - 0.2$	V_{CC}	-	V
		$I_{OH} = -8\text{ mA}$; $V_{CC} = 2.7\text{ V}$	2.4	2.5	-	V
		$I_{OH} = -32\text{ mA}$; $V_{CC} = 3.0\text{ V}$	2.0	2.3	-	V
V_{OL}	LOW-level output voltage	$V_{CC} = 2.7\text{ V}$				
		$I_{OL} = 100\text{ }\mu\text{A}$	-	0.07	0.2	V
		$I_{OL} = 24\text{ mA}$	-	0.3	0.5	V
		$V_{CC} = 3.0\text{ V}$				
		$I_{OL} = 16\text{ mA}$	-	0.25	0.4	V
		$I_{OL} = 32\text{ mA}$	-	0.3	0.5	V
I_I	input leakage current	control pins				
		$V_{CC} = 3.6\text{ V}$; $V_I = V_{CC}$ or GND	-	0.1	± 1	μA
		$V_{CC} = 0\text{ V}$ or 3.6 V ; $V_I = 5.5\text{ V}$	-	0.1	10	μA
		input/output data pins; $V_{CC} = 3.6\text{ V}$ [2]				
		$V_I = 5.5\text{ V}$	-	0.1	20	μA
		$V_I = V_{CC}$	-	0.5	10	μA
I_{OFF}	power-off leakage current	$V_{CC} = 0\text{ V}$; V_I or $V_O = 0\text{ V}$ to 4.5 V	-	0.1	± 100	μA
		$V_{CC} = 3\text{ V}$; $V_I = 0.8\text{ V}$	75	135	-	μA
I_{BHL}	bus hold LOW current	$V_{CC} = 3\text{ V}$; $V_I = 0.8\text{ V}$	75	135	-	μA
I_{BHH}	bus hold HIGH current	$V_{CC} = 3\text{ V}$; $V_I = 2.0\text{ V}$	-	-135	-75	μA
I_{BHLO}	bus hold LOW overdrive current	nAn input; $V_I = 0\text{ V}$ to 3.6 V ; $V_{CC} = 3.6\text{ V}$ [3]	500	-	-	μA
I_{BHHO}	bus hold HIGH overdrive current	nAn input; $V_I = 0\text{ V}$ to 3.6 V ; $V_{CC} = 3.6\text{ V}$ [3]	-	-	-500	μA
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	μA
$I_{O(pu/pd)}$	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} ; nOE = don't care [4]	-	40	± 100	μA

Symbol	Parameter	Conditions	Min	Typ [1]	Max	Unit
I_{CC}	supply current	$V_{CC} = 3.6\text{ V}$; $V_I = \text{GND}$ or V_{CC} ; $I_O = 0\text{ A}$				
		outputs HIGH	-	0.07	0.12	mA
		outputs LOW	-	4.7	6.0	mA
		outputs disabled [5]	-	0.07	0.12	mA
ΔI_{CC}	additional supply current	per input pin; $V_{CC} = 3.0\text{ V}$ to 3.6 V ; one input at $V_{CC} - 0.6\text{ V}$, other inputs at V_{CC} or GND [6]	-	0.1	0.2	mA
C_I	input capacitance	pins nDIR and n \overline{OE} , $V_O = 0\text{ V}$ or 3.0 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 is the bus hold overdrive current required to force the input to the opposite logic state.

[4] 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 $100\text{ }\mu\text{s}$ is permitted. This parameter is valid for $T_{amb} = 25\text{ }^\circ\text{C}$ only.

[5] I_{CC} is measured with outputs pulled to V_{CC} or GND.

[6] This is the increase in supply current for each input at the specified voltage level other than V_{CC} or GND.

10. Dynamic characteristics

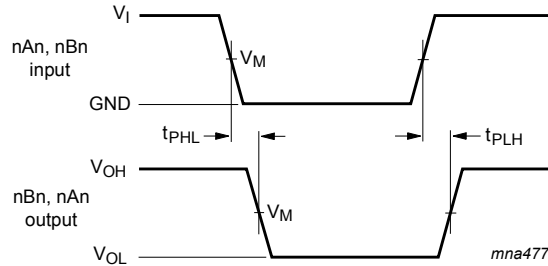
Table 7. Dynamic characteristics

Voltages are referenced to GND (ground = 0 V); $T_{amb} = -40\text{ }^\circ\text{C}$ to $+85\text{ }^\circ\text{C}$; For test circuit see Fig. 6.

Symbol	Parameter	Conditions	Min	Typ [1]	Max	Unit
t_{PLH}	LOW to HIGH propagation delay	nAn to nBn or nBn to nAn; see Fig. 4				
		$V_{CC} = 2.7\text{ V}$	-	-	3.5	ns
		$V_{CC} = 3.0\text{ V}$ to 3.6 V	1.0	1.9	3.3	ns
t_{PHL}	HIGH to LOW propagation delay	nAn to nBn or nBn to nAn; see Fig. 4				
		$V_{CC} = 2.7\text{ V}$	-	-	3.5	ns
		$V_{CC} = 3.0\text{ V}$ to 3.6 V	1.0	1.7	3.3	ns
t_{PZH}	OFF-state to HIGH propagation delay	n \overline{OE} to nAn or nBn; see Fig. 5				
		$V_{CC} = 2.7\text{ V}$	-	-	5.3	ns
		$V_{CC} = 3.0\text{ V}$ to 3.6 V	1.0	2.8	4.5	ns
t_{PZL}	OFF-state to LOW propagation delay	n \overline{OE} to nAn or nBn; see Fig. 5				
		$V_{CC} = 2.7\text{ V}$	-	-	5.1	ns
		$V_{CC} = 3.0\text{ V}$ to 3.6 V	1.0	2.8	4.1	ns
t_{PHZ}	HIGH to OFF-state propagation delay	n \overline{OE} to nAn or nBn; see Fig. 5				
		$V_{CC} = 2.7\text{ V}$	-	-	5.7	ns
		$V_{CC} = 3.0\text{ V}$ to 3.6 V	1.5	3.2	5.1	ns
t_{PLZ}	LOW to OFF-state propagation delay	n \overline{OE} to nAn or nBn; see Fig. 5				
		$V_{CC} = 2.7\text{ V}$	-	-	4.6	ns
		$V_{CC} = 3.0\text{ V}$ to 3.6 V	1.5	3.0	4.6	ns

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

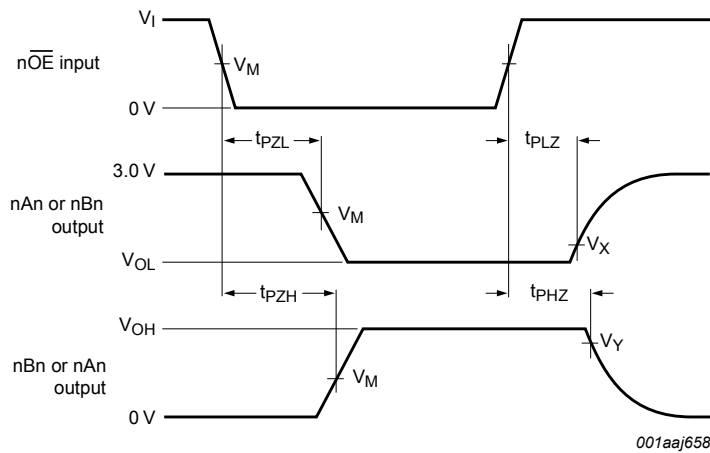
10.1. Waveforms and test circuit



Measurements points are given in [Table 8](#).

V_{OL} and V_{OH} are typical voltage output levels that occur with the output load.

Fig. 4. Propagation delay input (nAn, nBn) to output (nBn, nAn)



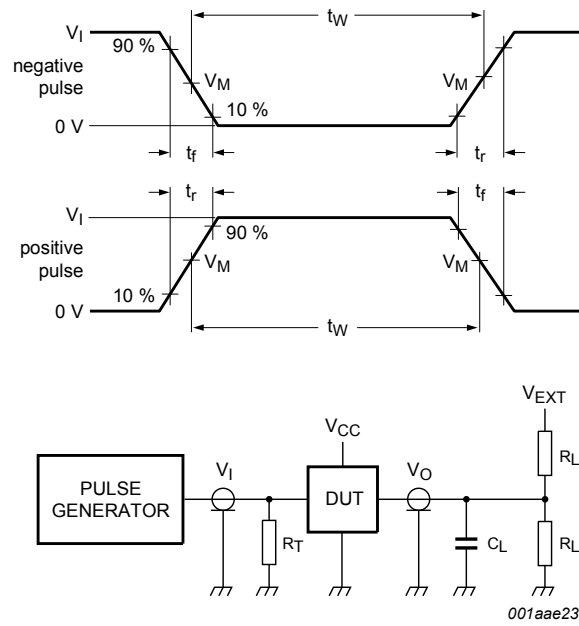
Measurements points are given in [Table 8](#).

V_{OL} and V_{OH} are typical voltage output levels that occur with the output load.

Fig. 5. 3-state output enable and disable times

Table 8. Measurement points

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



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. 6. Test 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	≤ 10 MHz	500 ns	≤ 2.5 ns	50 pF	500 Ω	GND	6 V	open

11. Package outline

SSOP48: plastic shrink small outline package; 48 leads; body width 7.5 mm

SOT370-1

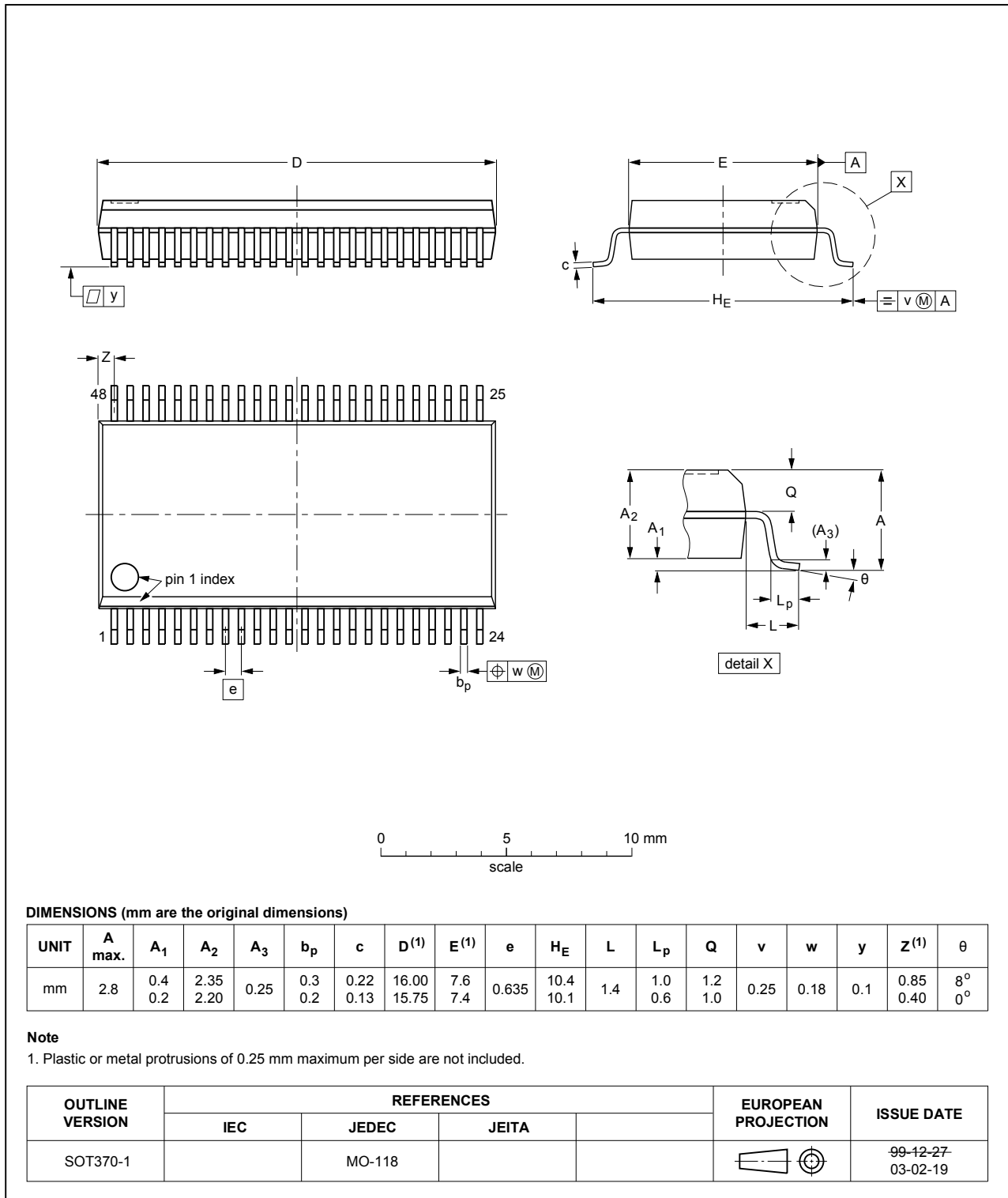


Fig. 7. Package outline SOT370-1 (SSOP48)

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

SOT362-1

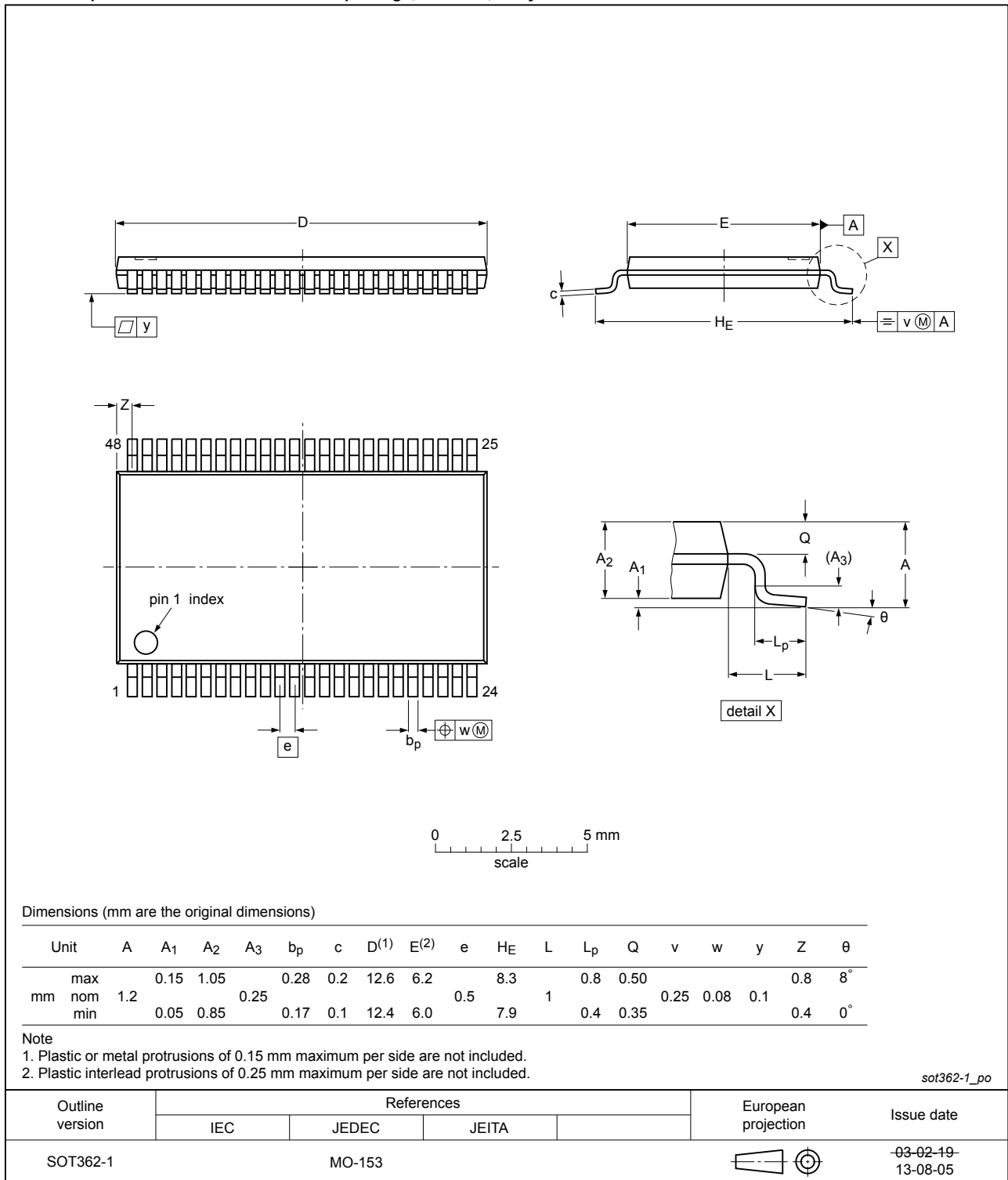


Fig. 8. Package outline SOT362-1 (TSSOP48)

12. 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

13. Revision history

Table 11. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74LVT_LVTH16245B v.11	20181031	Product data sheet	-	74LVT_LVTH16245B v.10
Modifications:	<ul style="list-style-type: none"> The format of this data sheet has been redesigned to comply with the identity guidelines of Nexperia. Legal texts have been adapted to the new company name where appropriate. Type numbers 74LVT16245BEV (SOT702-1), 74LVT16245BBX and 74LVTH16245BBX (SOT1134-2) removed. Package outline drawing SOT362-1 updated. 			
74LVT_LVTH16245B v.10	20120301	Product data sheet	-	74LVT_LVTH16245B v.9
Modifications:	<ul style="list-style-type: none"> For type number 74LVT16245BBX and 74LVTH16245BBX the sot code has changed to SOT1134-2. 			
74LVT_LVTH16245B v.9	20111122	Product data sheet	-	74LVT_LVTH16245B v.8
Modifications:	<ul style="list-style-type: none"> Legal pages updated. 			
74LVT_LVTH16245B v.8	20110617	Product data sheet	-	74LVT_LVTH16245B v.7
74LVT_LVTH16245B v.7	20100329	Product data sheet	-	74LVT_LVTH16245B v.6
74LVT_LVTH16245B v.6	20090409	Product data sheet	-	74LVT_LVTH16245B v.5
74LVT_LVTH16245B v.5	20090312	Product data sheet	-	74LVT_LVTH16245B v.4
74LVT_LVTH16245B v.4	20060323	Product data sheet	-	74LVT16245B v.3
74LVT16245B v.3	20021031	Product data sheet	-	74LVT16245B v.2
74LVT16245B v.2	19980219	Product specification	-	74LVT16245B v.1
74LVT16245B v.1	19940523	Product specification	-	-

14. Legal information

Data sheet status

Document status [1][2]	Product status [3]	Definition
Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
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