74LVT16245B; 74LVTH16245B

3.3 V 16-bit transceiver; 3-state

Rev. 14 — 8 July 2024 Product data sheet

1. General description

The 74LVT16245B; 74LVTH16245B is a 16-bit transceiver with 3-state outputs. The device can be used as two 8-bit transceivers or one 16-bit transceiver. The device features two output enables (1$\overline{OE}$ and 2$\overline{OE}$) each controlling eight outputs, and two send/receive (1DIR and 2DIR) inputs for direction control. A HIGH on n$\overline{OE}$ causes the outputs to assume a high-impedance OFF-state. Bus hold data inputs eliminate the need for external pull-up resistors to define unused inputs

2. Features and benefits

- 16-bit bidirectional bus interface
- 3-state buffers
- Wide supply voltage range from 2.7 to 3.6 V
- Overvoltage tolerant inputs to 5.5 V
- BiCMOS high speed and output drive
- Output capability: +64 mA and -32 mA
- Direct interface with TTL 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
- I_{OFF} circuitry provides partial Power-down mode operation
- Latch-up performance exceeds 500 mA per JESD 78 Class II Level B
- Complies with JEDEC standard JESD8C (2.7 V to 3.6 V)
- ESD protection:
  - HBM: ANSI/ESDA/JEDEC JS-001 class 2 exceeds 2000 V
  - CDM: ANSI/ESDA/JEDEC JS-002 class C3 exceeds 1000 V
- Specified from -40 °C to 85 °C

3. Ordering information

Table 1. Ordering information

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

4. Functional diagram

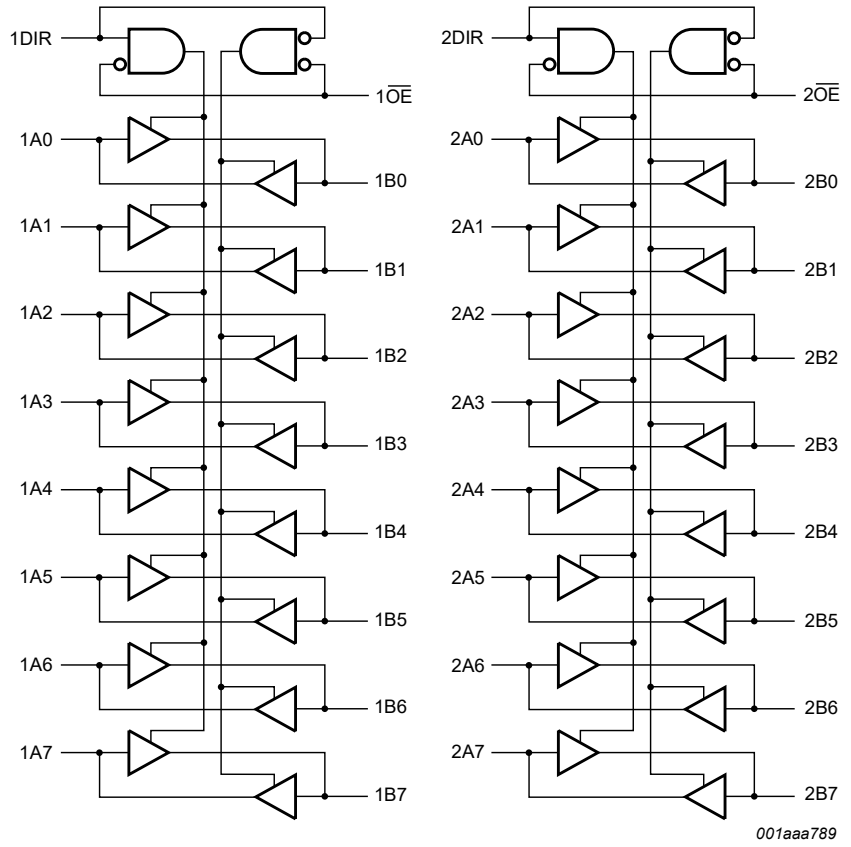


Fig. 1. Logic symbol

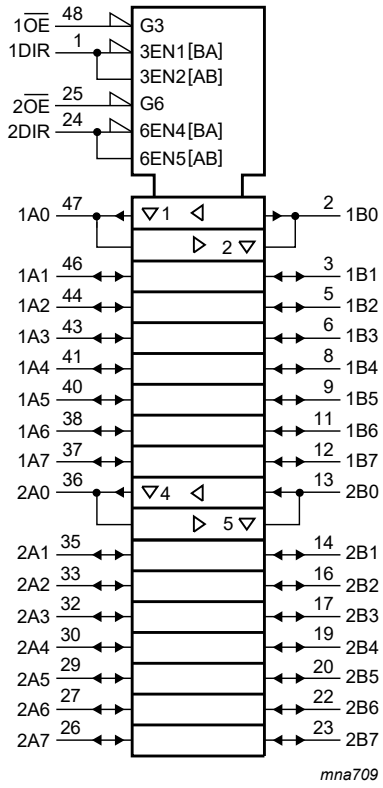
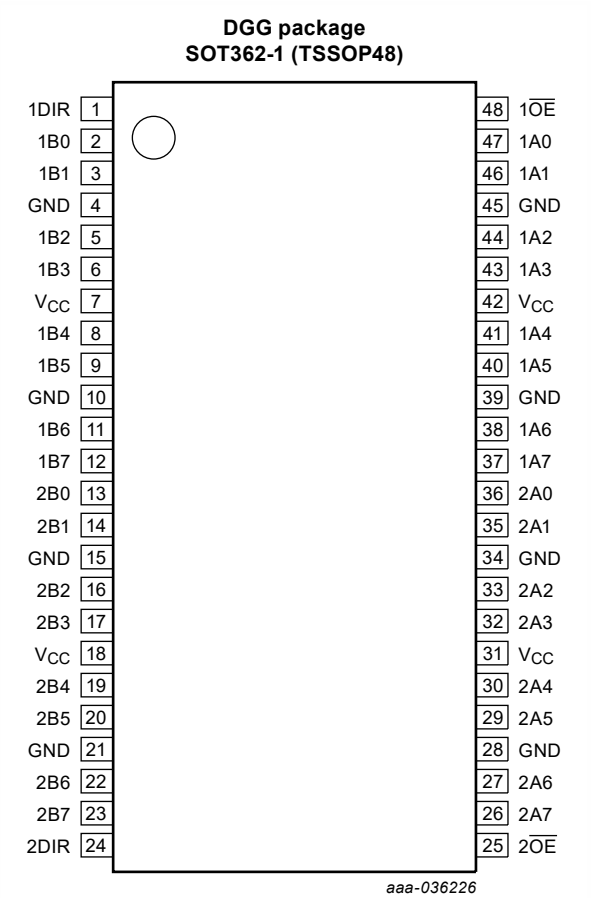


Fig. 2. IEC logic symbol

5. Pinning information

5.1. Pinning



5.2. Pin description

Table 2. Pin description

Symbol	Pin	Description
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
$1\overline{OE}$, $2\overline{OE}$	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	
n$\overline{OE}$	**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]	-0.5	+7.0	V
V_O	output voltage	output in OFF-state or HIGH-state	[1]	-0.5	+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;		-	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.

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 °C to +85 °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 V; I_{IK} = -18 mA	-1.2	-0.85	-	V
V_{OH}	HIGH-level output voltage	I_{OH} = -100 µA; V_{CC} = 2.7 V to 3.6 V	V_{CC} - 0.2	V_{CC}	-	V
		I_{OH} = -8 mA; V_{CC} = 2.7 V	2.4	2.5	-	V
		I_{OH} = -32 mA; V_{CC} = 3.0 V	2.0	2.3	-	V
V_{OL}	LOW-level output voltage	V_{CC} = 2.7 V				
		I_{OL} = 100 µA	-	0.07	0.2	V
		I_{OL} = 24 mA	-	0.3	0.5	V
		V_{CC} = 3.0 V				
		I_{OL} = 16 mA	-	0.25	0.4	V
		I_{OL} = 32 mA	-	0.3	0.5	V
		I_{OL} = 64 mA	-	0.4	0.55	V
I_I	input leakage current	control pins				
		V_{CC} = 3.6 V; V_I = V_{CC} or GND	-	0.1	±1	µA
		V_{CC} = 0 V or 3.6 V; V_I = 5.5 V	-	0.1	10	µA
		input/output data pins; V_{CC} = 3.6 V [2]				
		V_I = 5.5 V	-	0.1	20	µA
		V_I = V_{CC}	-	0.5	10	µA
		V_I = 0 V	-5	-0.1	-	µA
I_{OFF}	power-off leakage current	V_{CC} = 0 V; V_I or V_O = 0 V to 4.5 V	-	0.1	±100	µA
I_{BHL}	bus hold LOW current	V_{CC} = 3 V; V_I = 0.8 V	75	135	-	µA
I_{BHH}	bus hold HIGH current	V_{CC} = 3 V; V_I = 2.0 V	-	-135	-75	µA
I_{BHLO}	bus hold LOW overdrive current	nAn input; V_I = 0 V to 3.6 V; V_{CC} = 3.6 V [3]	500	-	-	µA
I_{BHHO}	bus hold HIGH overdrive current	nAn input; V_I = 0 V to 3.6 V; V_{CC} = 3.6 V [3]	-	-	-500	µA
I_{LO}	output leakage current	output in HIGH-state when V_O > V_{CC}; V_O = 5.5 V; V_{CC} = 3.0 V	-	75	125	µA
$I_{O(pu/pd)}$	power-up/power-down output current	V_{CC} ≤ 1.2 V; V_O = 0.5 V to V_{CC}; V_I = GND or V_{CC}; $n\overline{OE}$ = don't care [4]	-	40	±100	µA

Symbol	Parameter	Conditions	Min	Typ [1]	Max	Unit
I_{CC}	supply current	V_{CC} = 3.6 V; V_I = GND or V_{CC}; I_O = 0 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 V to 3.6 V; one input at V_{CC} - 0.6 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 V or 3.0 V	-	3	-	pF
$C_{io(off)}$	off-state input/output capacitance	pins nAn and nBn, outputs disabled; V_O = GND or V_{CC}	-	9	-	pF

[1] Typical values are measured at V_{CC} = 3.3 V and at T_{amb} = 25 °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 V to V_{CC} = 3.3 V ± 0.3 V a transition time of 100 µs is permitted. This parameter is valid for T_{amb} = 25 °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

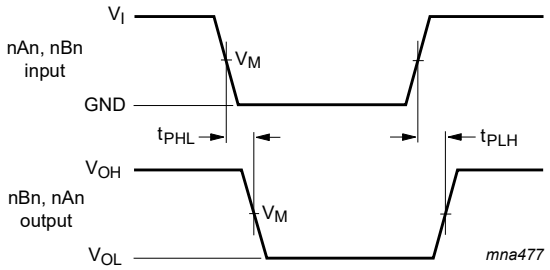
Table 7. Dynamic characteristics

Voltages are referenced to GND (ground = 0 V); T_{amb} = -40 °C to +85 °C; For test circuit see Fig. 5.

Symbol	Parameter	Conditions	Min	Typ [1]	Max	Unit
t_{PLH}	LOW to HIGH propagation delay	nAn to nBn or nBn to nAn; see Fig. 3				
		V_{CC} = 2.7 V	-	-	3.5	ns
		V_{CC} = 3.0 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. 3				
		V_{CC} = 2.7 V	-	-	3.5	ns
		V_{CC} = 3.0 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. 4				
		V_{CC} = 2.7 V	-	-	5.3	ns
		V_{CC} = 3.0 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. 4				
		V_{CC} = 2.7 V	-	-	5.1	ns
		V_{CC} = 3.0 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. 4				
		V_{CC} = 2.7 V	-	-	5.7	ns
		V_{CC} = 3.0 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. 4				
		V_{CC} = 2.7 V	-	-	4.6	ns
		V_{CC} = 3.0 V to 3.6 V	1.5	3.0	4.6	ns

[1] All typical values are at V_{CC} = 3.3 V and T_{amb} = 25 °C.

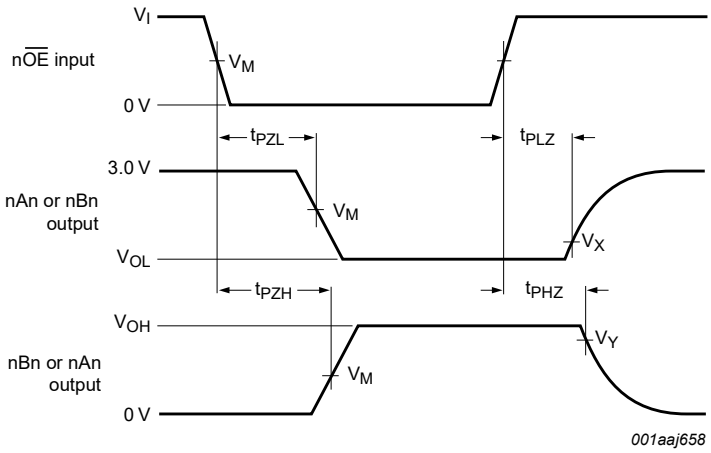
10.1. Waveforms and test circuit



Measurements points are given in Table 8.

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

Fig. 3. Propagation delay input (nAn, nBn) to output (nBn, nAn)



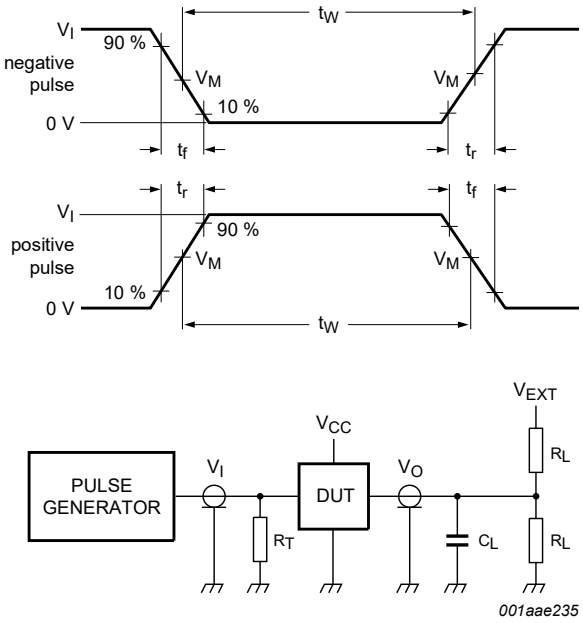
Measurements points are given in Table 8.

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

Fig. 4. 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 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.

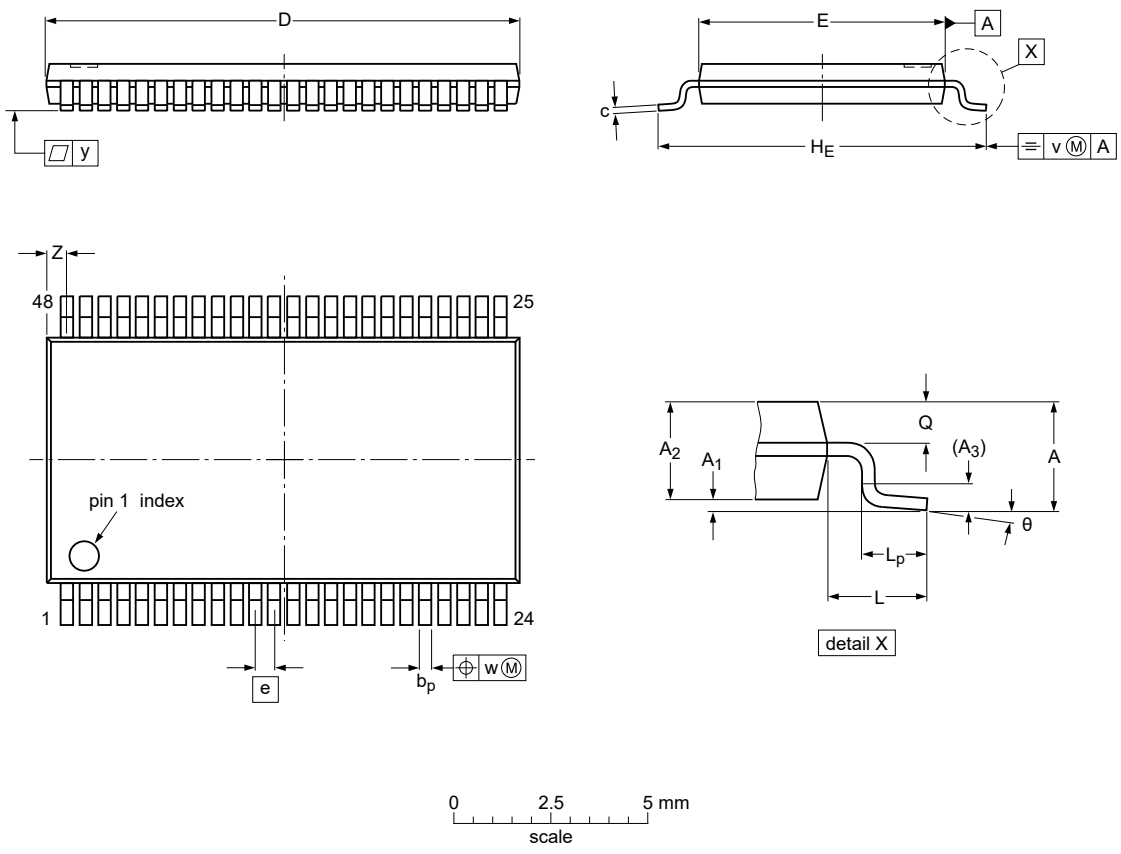
Fig. 5. Test circuit for measuring switching times

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

TSSOP48: plastic thin shrink small outline package; 48 leads; body width 6.1 mm **SOT362-1**



Dimensions (mm are the original dimensions)

Unit		A	A_1	A_2	A_3	b_p	c	$D^{(1)}$	$E^{(2)}$	e	H_E	L	L_p	Q	v	w	y	Z	θ
mm	max	1.2	0.15	1.05		0.28	0.2	12.6	6.2		8.3		0.8	0.50				0.8	8°
	nom				0.25					0.5		1			0.25	0.08	0.1		
	min		0.05	0.85		0.17	0.1	12.4	6.0		7.9		0.4	0.35				0.4	0°

Note
1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.
2. Plastic interlead protrusions of 0.25 mm maximum per side are not included.

sot362-1_po

Outline version	References				European projection	Issue date
	IEC	JEDEC	JEITA			
SOT362-1		MO-153				~~13-08-05~~ 24-01-05

Fig. 6. Package outline SOT362-1 (TSSOP48)

12. Abbreviations

Table 10. Abbreviations

Acronym	Description
ANSI	American National Standards Institute
BiCMOS	Bipolar Complementary Metal Oxide Semiconductor
CDM	Charge Device Model
DUT	Device Under Test
ESD	ElectroStatic Discharge
ESDA	ElectroStatic Discharge Association
HBM	Human Body Model
JEDEC	Joint Electron Device Engineering Council
TTL	Transistor-Transistor Logic

13. Revision history

Table 11. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74LVT_LVTH16245B v.14	20240708	Product data sheet	-	74LVT_LVTH16245B v.13
Modifications:	• Section 2: ESD specification updated according to the latest JEDEC standard.			
74LVT_LVTH16245B v.13	20240325	Product data sheet	-	74LVT_LVTH16245B v.12
Modifications:	• Fig. 6: Updated package outline drawing SOT362-1 (TSSOP48).			
74LVT_LVTH16245B v.12	20210812	Product data sheet	-	74LVT_LVTH16245B v.11
Modifications:	• Type numbers 74LVT16245BDL and 74LVTH16245BDL (SOT370-1/SSOP48) removed. • Section 1 and Section 2 updated. • Section 7: Derating values for P_{tot} total power dissipation removed.			
74LVT_LVTH16245B v.11	20181031	Product data sheet	-	74LVT_LVTH16245B v.10
Modifications:	• 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:	• 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:	• 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

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.
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".
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