

DATA SHEET

74LVT16245B

3.3 V LVT 16-bit transceiver (3-State)

Product data
Supersedes data of 1998 Feb 19
File under Integrated Circuits, IC23

2001 Dec 03

3.3 V LVT 16-bit transceiver (3-State)

74LVT16245B

FEATURES

- 16-bit bidirectional bus interface
- 3-State buffers
- Output capability: +64 mA / -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/extraction permitted
- Power-up 3-State
- No bus current loading when output is tied to 5 V bus
- Latch-up protection exceeds 500 mA per JEDEC Std 17
- ESD protection exceeds 2000 V per MIL STD 883 Method 3015 and 200 V per Machine Model

DESCRIPTION

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

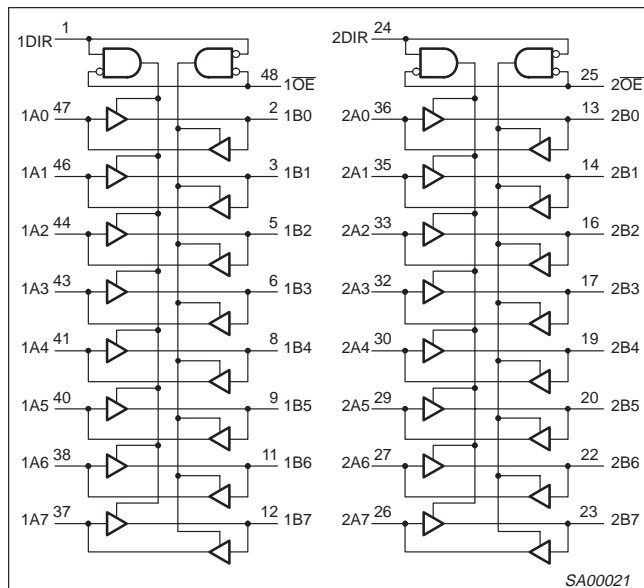
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS $T_{amb} = 25\text{ }^{\circ}\text{C}$	TYPICAL	UNIT
t_{PLH} t_{PHL}	Propagation delay nAx to nBx or nBx to nAx	$C_L = 50\text{ pF}$; $V_{CC} = 3.3\text{ V}$	1.9	ns
C_{IN}	Input capacitance DIR, \overline{OE}	$V_I = 0\text{ V or }3.0\text{ V}$	3	pF
$C_{I/O}$	I/O pin capacitance	$V_{I/O} = 0\text{ V or }3.0\text{ V}$	9	pF
I_{CCZ}	Total supply current	Outputs disabled; $V_{CC} = 3.6\text{ V}$	70	μA

ORDERING INFORMATION

TYPE NUMBER	PACKAGE	TEMPERATURE RANGE	DWG NUMBER
74LVT16245BDL	48-Pin Plastic SSOP Type III	-40 °C to +85 °C	SOT370-1
74LVT16245BDGG	48-Pin Plastic TSSOP Type II	-40 °C to +85 °C	SOT362-1
74LVT16245BEV	56VFBGA Ball Grid Array	-40 °C to +85 °C	SOT702-1

LOGIC SYMBOL



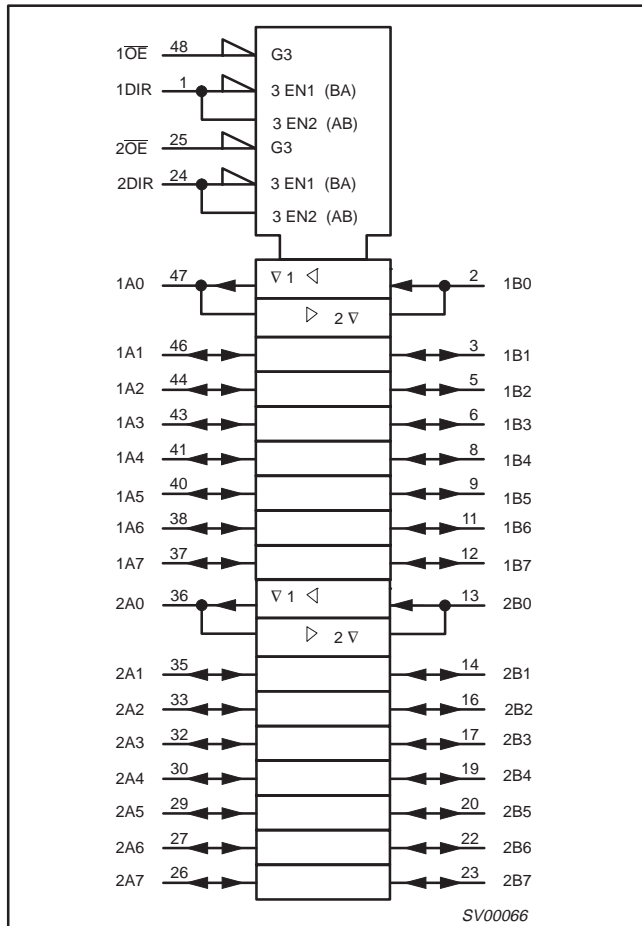
NOTE:

Pin numbers are shown for SSOP and TSSOP packages only.

3.3 V LVT 16-bit transceiver (3-State)

74LVT16245B

LOGIC SYMBOL (IEEE/IEC)



NOTE:
Pin numbers are shown for SSOP and TSSOP packages only.

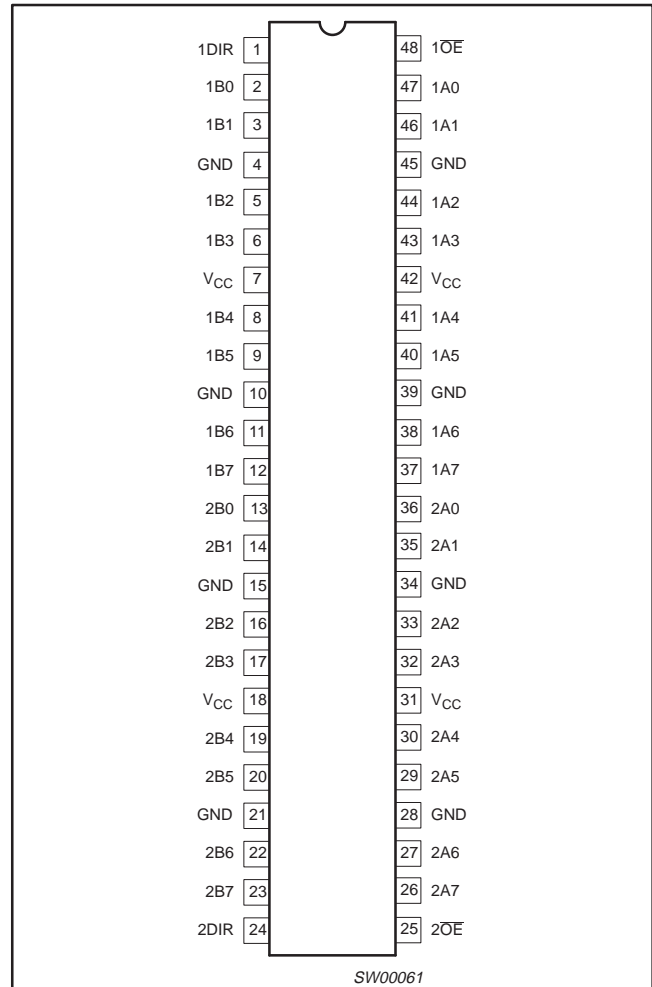
FUNCTION TABLE

INPUTS		INPUTS/OUTPUTS	
nOE	nDIR	nAx	nBx
L	L	nAx = nBx	Inputs
L	H	Inputs	nBx = nAx
H	X	Z	Z

H = High voltage level
L = Low voltage level
X = Don't care
Z = High Impedance "off" state

PIN CONFIGURATION

48-pin SSOP and TSSOP



PIN DESCRIPTION

48-pin SSOP and TSSOP

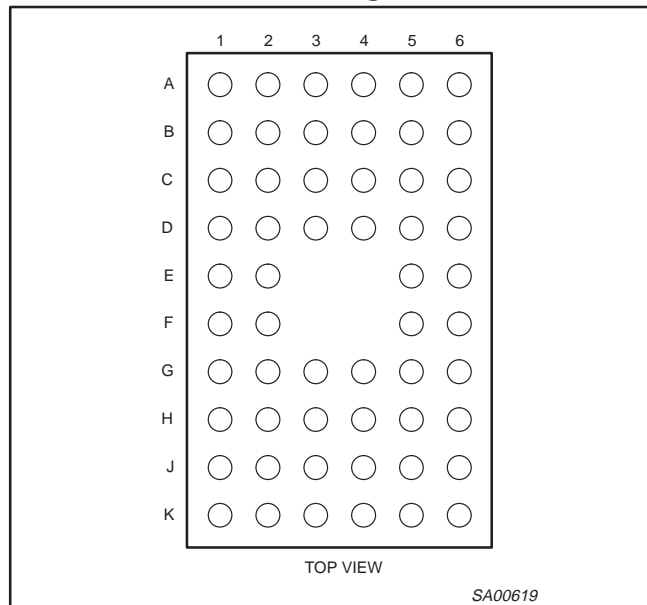
PIN NUMBER	SYMBOL	NAME AND FUNCTION
1, 24	nDIR	Direction control input
47, 46, 44, 43, 41, 40, 38, 37, 36, 35, 33, 32, 30, 29, 27, 26	nA0 – nA7	Data inputs/outputs (A side)
2, 3, 5, 6, 8, 9, 11, 12, 13, 14, 16, 17, 19, 20, 22, 23	nB0 – nB7	Data inputs/outputs (B side)
25, 48	nOE	Output enable input (active-Low)
4, 10, 15, 21, 28, 34, 39, 45	GND	Ground (0V)
7, 18, 31, 42	VCC	Positive supply voltage

3.3 V LVT 16-bit transceiver (3-State)

74LVT16245B

PIN CONFIGURATION

56-ball VFBGA terminal assignments



PIN DESCRIPTION

56-ball VFBGA terminal assignments

	1	2	3	4	5	6
A	1DIR	NC	NC	NC	NC	1OE
B	1B1	1B0	GND	GND	1A0	1A1
C	1B3	1B2	V _{CC}	V _{CC}	1A2	1A3
D	1B5	1B4	GND	GND	1A4	1A5
E	1B7	1B6			1A6	1A7
F	2B0	2B1			2A1	2A0
G	2B2	2B3	GND	GND	2A3	2A2
H	2B4	2B5	V _{CC}	V _{CC}	2A5	2A4
J	2B6	2B7	GND	GND	2A7	2A6
K	2DIR	NC	NC	NC	NC	2OE

3.3 V LVT 16-bit transceiver (3-State)

74LVT16245B

ABSOLUTE MAXIMUM RATINGS^{1,2}

SYMBOL	PARAMETER	CONDITIONS	RATING	UNIT
V _{CC}	DC supply voltage		-0.5 to +4.6	V
I _{IK}	DC input diode current	V _I < 0	-50	mA
V _I	DC input voltage ³		-0.5 to +7.0	V
I _{OK}	DC output diode current	V _O < 0	-50	mA
V _{OUT}	DC output voltage ³	Output in OFF or HIGH state	-0.5 to +7.0	V
I _{OUT}	DC output current	Output in LOW state	128	mA
		Output in HIGH state	-64	
T _{stg}	Storage temperature range		-65 to +150	°C

NOTES:

- Stresses beyond those listed may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
- The performance capability of a high-performance integrated circuit in conjunction with its thermal environment can create junction temperatures which are detrimental to reliability. The maximum junction temperature of this integrated circuit should not exceed 150 °C.
- The input and output negative voltage ratings may be exceeded if the input and output clamp current ratings are observed.

RECOMMENDED OPERATING CONDITIONS

SYMBOL	PARAMETER	LIMITS		UNIT
		MIN	MAX	
V _{CC}	DC 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}	Input voltage		0.8	V
I _{OH}	HIGH-level output current		-32	mA
I _{OL}	LOW-level output current		32	mA
	LOW-level output current; current duty cycle ≤ 50%; f ≥ 1 kHz		64	
Δt/Δv	Input transition rise or fall rate; Outputs enabled		10	ns/V
T _{amb}	Operating free-air temperature range	-40	+85	°C

3.3 V LVT 16-bit transceiver (3-State)

74LVT16245B

DC ELECTRICAL CHARACTERISTICS

SYMBOL	PARAMETER	TEST CONDITIONS	LIMITS			UNIT
			Temp = -40 °C to +85 °C			
			MIN	TYP ¹	MAX	
V_{IK}	Input clamp voltage	$V_{CC} = 2.7 \text{ V}; I_{IK} = -18 \text{ mA}$		-0.85	-1.2	V
V_{OH}	High-level output voltage	$V_{CC} = 2.7 \text{ V to } 3.6 \text{ V}; I_{OH} = -100 \mu\text{A}$	$V_{CC}-0.2$	V_{CC}		V
		$V_{CC} = 2.7 \text{ V}; I_{OH} = -8 \text{ mA}$	2.4	2.5		
		$V_{CC} = 3.0 \text{ V}; I_{OH} = -32 \text{ mA}$	2.0	2.3		
V_{OL}	Low-level output voltage	$V_{CC} = 2.7 \text{ V}; I_{OL} = 100 \mu\text{A}$		0.07	0.2	V
		$V_{CC} = 2.7 \text{ V}; I_{OL} = 24 \text{ mA}$		0.3	0.5	
		$V_{CC} = 3.0 \text{ V}; I_{OL} = 16 \text{ mA}$		0.25	0.4	
		$V_{CC} = 3.0 \text{ V}; I_{OL} = 32 \text{ mA}$		0.3	0.5	
		$V_{CC} = 3.0 \text{ V}; I_{OL} = 64 \text{ mA}$		0.4	0.55	
I_I	Input leakage current	$V_{CC} = 3.6 \text{ V}; V_I = V_{CC} \text{ or GND}$	Control pins	0.1	± 1	μA
		$V_{CC} = 0 \text{ V or } 3.6 \text{ V}; V_I = 5.5 \text{ V}$		0.1	10	
		$V_{CC} = 3.6 \text{ V}; V_I = 5.5 \text{ V}$	I/O Data pins ⁴	0.1	20	
		$V_{CC} = 3.6 \text{ V}; V_I = V_{CC}$		0.5	10	
		$V_{CC} = 3.6 \text{ V}; V_I = 0$		0.1	-5	
I_{OFF}	Output off current	$V_{CC} = 0 \text{ V}; V_I \text{ or } V_O = 0 \text{ V to } 4.5 \text{ V}$		0.1	± 100	μA
I_{HOLD}	Bus Hold current A or B outputs ⁶	$V_{CC} = 3 \text{ V}; V_I = 0.8 \text{ V}$	75	135		μA
		$V_{CC} = 3 \text{ V}; V_I = 2.0 \text{ V}$	-75	-135		
		$V_{CC} = 0 \text{ V to } 3.6 \text{ V}; V_{CC} = 3.6 \text{ V}$	± 500			
I_{EX}	Current into an output in the High state when $V_O > V_{CC}$	$V_O = 5.5 \text{ V}; V_{CC} = 3.0 \text{ V}$		75	125	μA
$I_{PU/PD}$	Power up/down 3-State output current ³	$V_{CC} \leq 1.2 \text{ V}; V_O = 0.5 \text{ V to } V_{CC}; V_I = \text{GND or } V_{CC}; \text{OE/OE} = \text{Don't care}$		40	± 100	μA
I_{CCH}	Quiescent supply current	$V_{CC} = 3.6 \text{ V}; \text{Outputs HIGH, } V_I = \text{GND or } V_{CC}, I_O = 0$		0.07	0.12	mA
I_{CCL}		$V_{CC} = 3.6 \text{ V}; \text{Outputs LOW, } V_I = \text{GND or } V_{CC}, I_O = 0$		4.7	6	
I_{CCZ}		$V_{CC} = 3.6 \text{ V}; \text{Outputs Disabled; } V_I = \text{GND or } V_{CC}, I_O = 0^5$		0.07	0.12	
ΔI_{CC}	Additional supply current per input pin ²	$V_{CC} = 3 \text{ V to } 3.6 \text{ V}; \text{One input at } V_{CC}-0.6 \text{ V}, \text{Other inputs at } V_{CC} \text{ or GND}$		0.1	0.2	mA

NOTES:

- All typical values are at $V_{CC} = 3.3 \text{ V}$ and $T_{amb} = 25 \text{ }^\circ\text{C}$.
- This is the increase in supply current for each input at the specified voltage level other than V_{CC} or GND
- This parameter is valid for any V_{CC} between 0 V and 1.2 V with a transition time of up to 10 msec.
From $V_{CC} = 1.2 \text{ V to } V_{CC} = 3.3 \text{ V} \pm 0.3 \text{ V}$ a transition time of 100 μsec is permitted. This parameter is valid for $T_{amb} = 25 \text{ }^\circ\text{C}$ only.
- Unused pins at V_{CC} or GND.
- I_{CCZ} is measured with outputs pulled to V_{CC} or GND.
- This is the bus-hold overdrive current required to force the input to the opposite logic state.

3.3 V LVT 16-bit transceiver (3-State)

74LVT16245B

AC CHARACTERISTICS

GND = 0 V; $t_R = t_F = 2.5$ ns; $C_L = 50$ pF; $R_L = 500$ Ω ; $T_{amb} = -40$ °C to $+85$ °C.

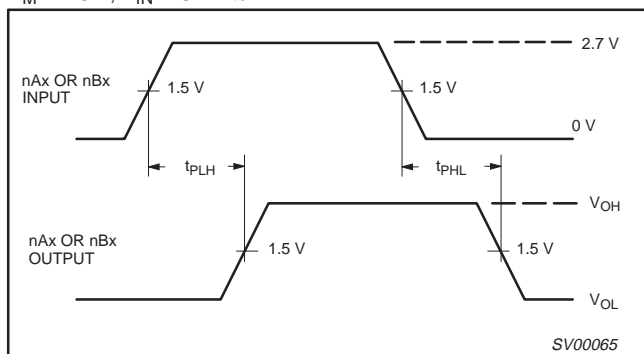
SYMBOL	PARAMETER	WAVEFORM	LIMITS				UNIT
			$V_{CC} = 3.3$ V ± 0.3 V		$V_{CC} = 2.7$ V		
			MIN	TYP ¹	MAX	MAX	
t_{PLH} t_{PHL}	Propagation delay nAx to nBx or nBx to nAx	1	1.0 1.0	1.9 1.7	3.3 3.3	3.5 3.5	ns
t_{PZH} t_{PZL}	Output enable time to HIGH and LOW level	2	1.0 1.0	2.8 2.8	4.5 4.1	5.3 5.1	ns
t_{PHZ} t_{PLZ}	Output disable time from HIGH and LOW Level	2	1.5 1.5	3.2 3.0	5.1 4.6	5.7 4.6	ns

NOTE:

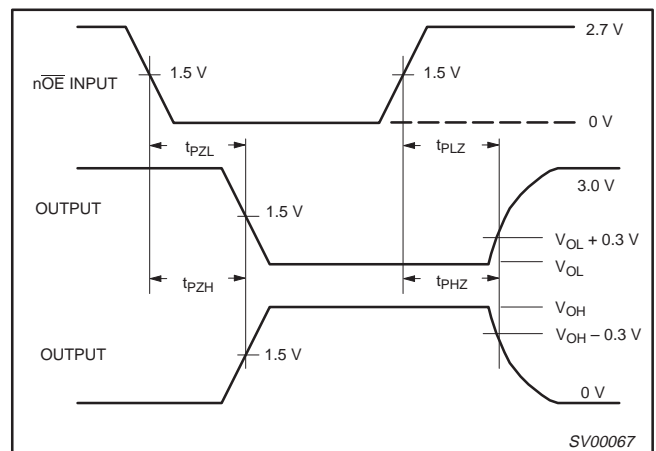
1. All typical values are at $V_{CC} = 3.3$ V and $T_{amb} = 25$ °C.

AC WAVEFORMS

$V_M = 1.5$ V; $V_{IN} =$ GND to 2.7 V.



Waveform 1. Input to Output Propagation Delays

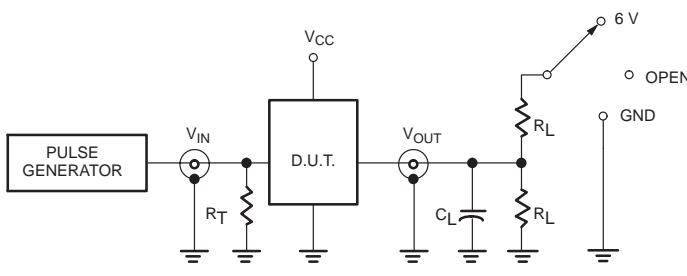


Waveform 2. 3-State Output Enable and Disable Times

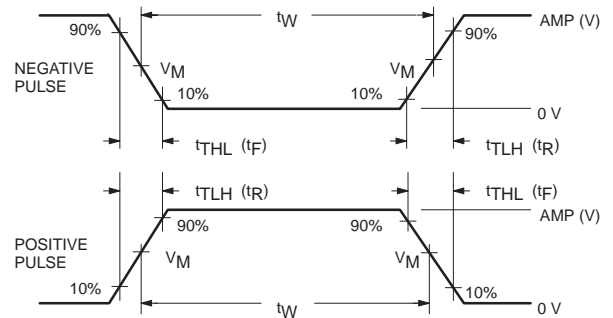
3.3 V LVT 16-bit transceiver (3-State)

74LVT16245B

TEST CIRCUIT AND WAVEFORMS



Test Circuit for 3-State Outputs



$V_M = 1.5 V$
Input Pulse Definition

SWITCH POSITION

TEST	SWITCH
t_{PHZ}/t_{PZH}	GND
t_{PLZ}/t_{PZL}	6 V
t_{PLH}/t_{PHL}	open

DEFINITIONS

- R_L = Load resistor; see AC CHARACTERISTICS for value.
- C_L = Load capacitance includes jig and probe capacitance; see AC CHARACTERISTICS for value.
- R_T = Termination resistance should be equal to Z_{OUT} of pulse generators.

FAMILY	INPUT PULSE REQUIREMENTS				
	Amplitude	Rep. Rate	t_W	t_R	t_F
74LVT16	2.7 V	≤ 10 MHz	500 ns	≤ 2.5 ns	≤ 2.5 ns

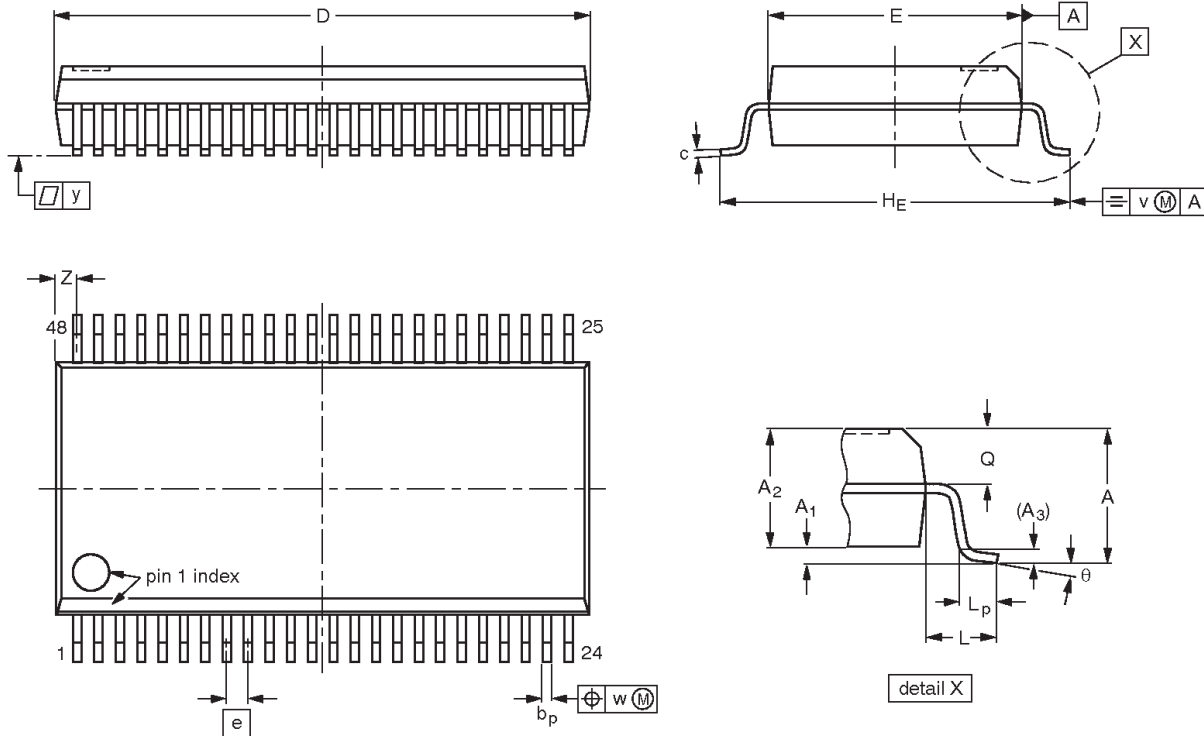
SW00003

3.3 V LVT 16-bit transceiver (3-State)

74LVT16245B

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

SOT370-1



DIMENSIONS (mm are the original dimensions)

UNIT	A max.	A ₁	A ₂	A ₃	b _p	c	D ⁽¹⁾	E ⁽¹⁾	e	H _E	L	L _p	Q	v	w	y	Z ⁽¹⁾	θ
mm	2.8	0.4 0.2	2.35 2.20	0.25	0.3 0.2	0.22 0.13	16.00 15.75	7.6 7.4	0.635	10.4 10.1	1.4	1.0 0.6	1.2 1.0	0.25	0.18	0.1	0.85 0.40	8° 0°

Note

1. Plastic or metal protrusions of 0.25 mm maximum per side are not included.

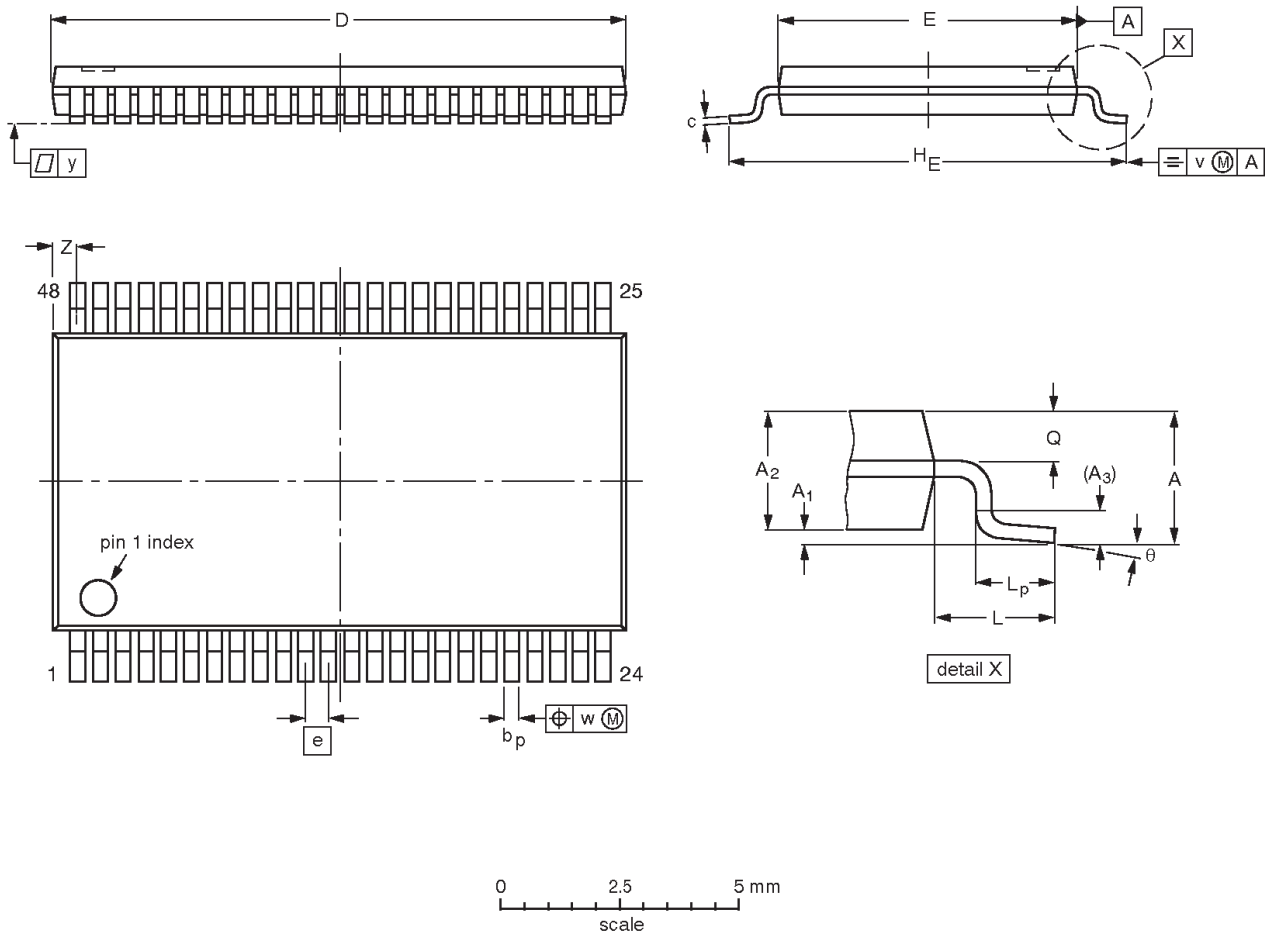
OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT370-1		MO-118				95-02-04 99-12-27

3.3 V LVT 16-bit transceiver (3-State)

74LVT16245B

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

SOT362-1



DIMENSIONS (mm are the original dimensions).

UNIT	A max.	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	1.2	0.15 0.05	1.05 0.85	0.25	0.28 0.17	0.2 0.1	12.6 12.4	6.2 6.0	0.5	8.3 7.9	1	0.8 0.4	0.50 0.35	0.25	0.08	0.1	0.8 0.4	8° 0°

Notes

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.

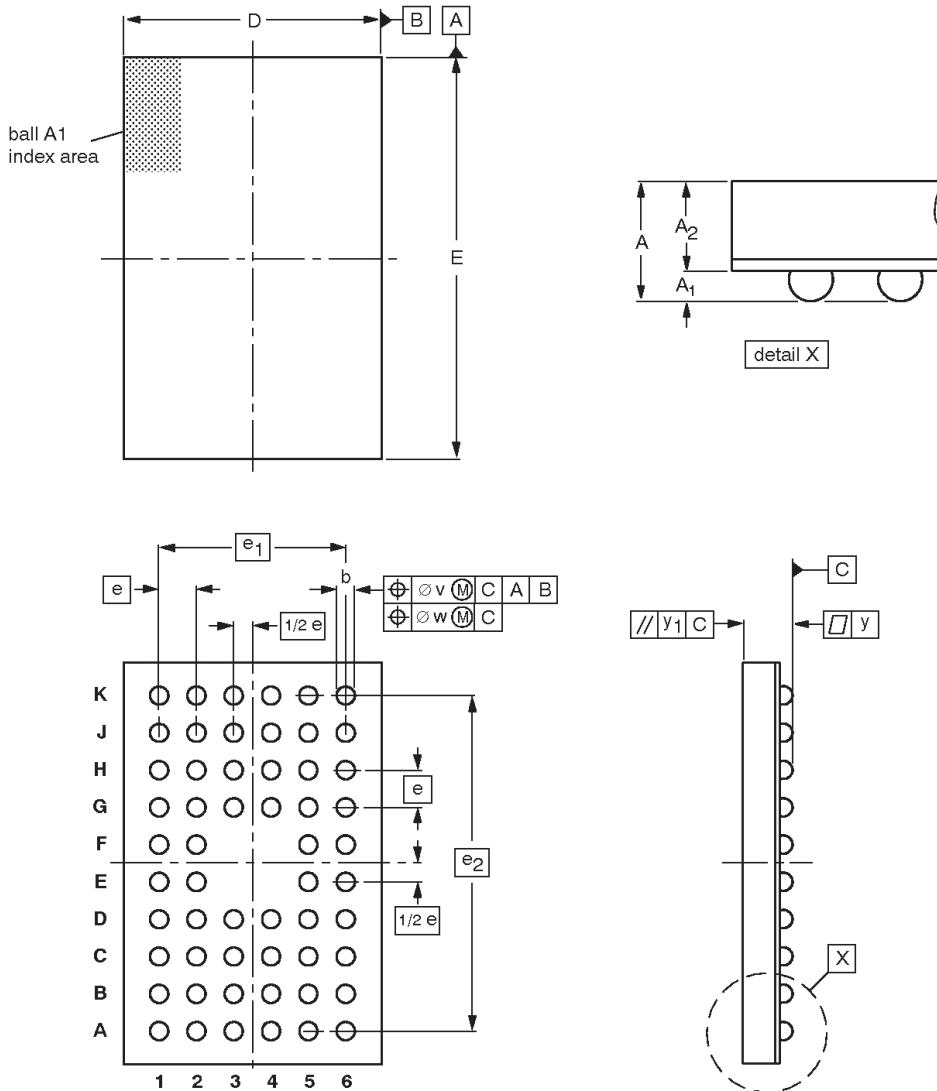
OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT362-1		MO-153				-95-02-10 99-12-27

3.3 V LVT 16-bit transceiver (3-State)

74LVT16245B

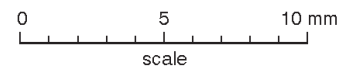
VFBA56: plastic very thin fine-pitch ball grid array package; 56 balls;
body 4.5 x 7 x 0.65 mm

SOT702-1



DIMENSIONS (mm are the original dimensions)

UNIT	A max.	A ₁	A ₂	b	D	E	e	e ₁	e ₂	v	w	y	y ₁
mm	0.97	0.28 0.16	0.69 0.61	0.37 0.27	4.6 4.4	7.1 6.9	0.65	3.25	5.85	0.15	0.08	0.08	0.1



OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT702-1		MO-225				-01-06-06 01-06-25

3.3 V LVT 16-bit transceiver (3-State)

74LVT16245B

Data sheet status

Data sheet status ^[1]	Product status ^[2]	Definitions
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.
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.
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[1] Please consult the most recently issued data sheet before initiating or completing a design.

[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>.

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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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