

# 74LVT2245; 74LVTH2245

3.3 V octal transceiver with 30  $\Omega$  termination resistors; 3-state

Rev. 5 — 10 April 2017

Product data sheet

## 1 General description

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The 74LVT2245; 74LVTH2245 is a high-performance BiCMOS product designed for  $V_{CC}$  operation at 3.3 V.

This device is an octal 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 ( $\overline{OE}$ ) for easy cascading and a direction input (DIR) for direction control.

The 74LVT2245; 74LVTH2245 is designed with 30  $\Omega$  series resistance in both the HIGH-state and LOW-state of the output. This design reduces line noise in applications such as memory address drivers, clock drivers and bus transceivers and transmitters.

## 2 Features and benefits

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- 30  $\Omega$  output termination resistors
- Octal bidirectional bus interface
- 3-state buffers
- Output capability: +12 mA and -12 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:
  - JESD78: exceeds 500 mA
- ESD protection:
  - MIL STD 883 method 3015: exceeds 2000 V
  - MM JESD22-A115-A exceeds 200 V (C = 200 pF, R = 0  $\Omega$ )

### 3 Ordering information

Table 1. Ordering information

Type number	Package			Version
	Temperature range	Name	Description	
74LVT2245D	-40 °C to +85 °C	SO20	plastic small outline package; 20 leads; body width 7.5 mm	SOT163-1
74LVTH2245D				
74LVT2245DB	-40 °C to +85 °C	SSOP20	plastic shrink small outline package; 20 leads; body width 5.3 mm	SOT339-1
74LVTH2245DB				
74LVT2245PW	-40 °C to +85 °C	TSSOP20	plastic thin shrink small outline package; 20 leads; body width 4.4 mm	SOT360-1
74LVTH2245PW				

### 4 Functional diagram

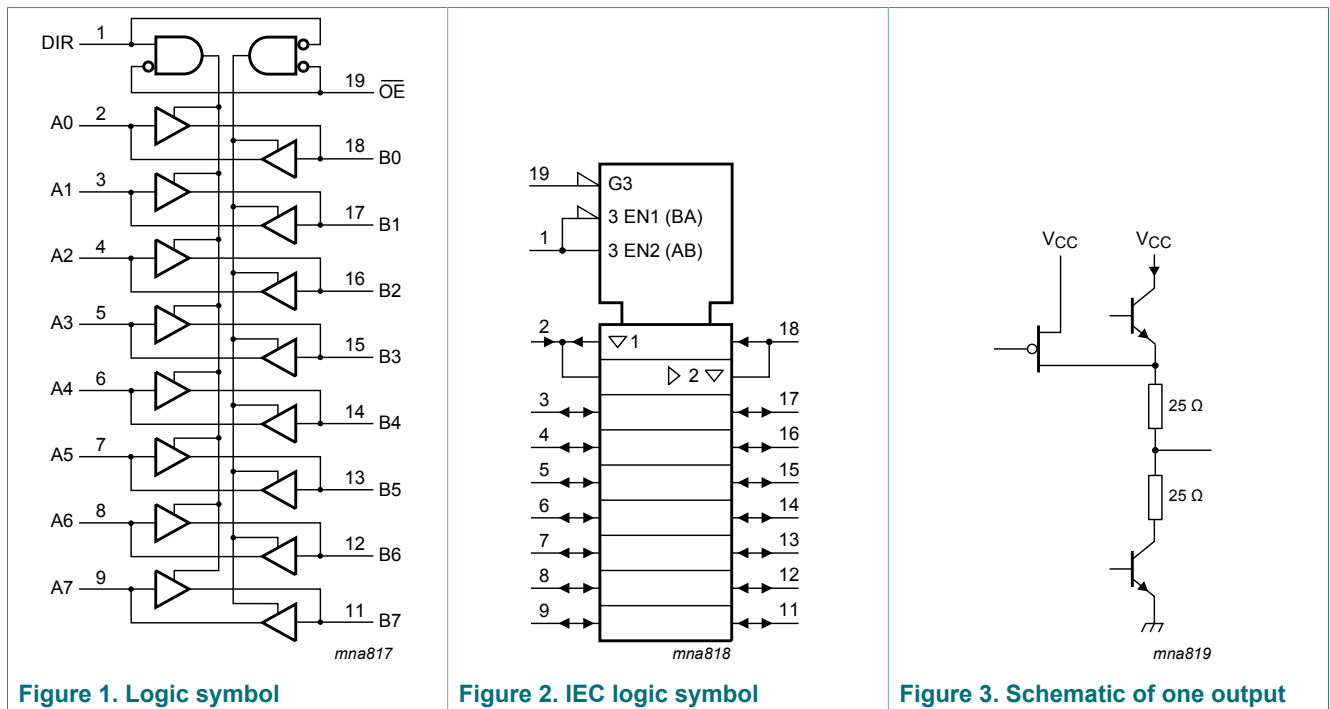


Figure 1. Logic symbol

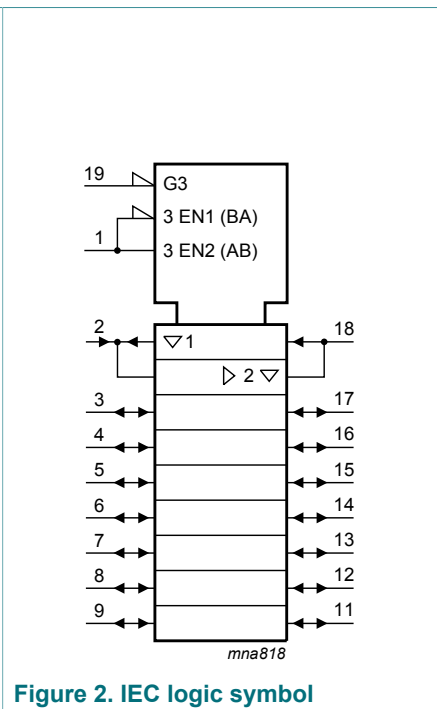


Figure 2. IEC logic symbol

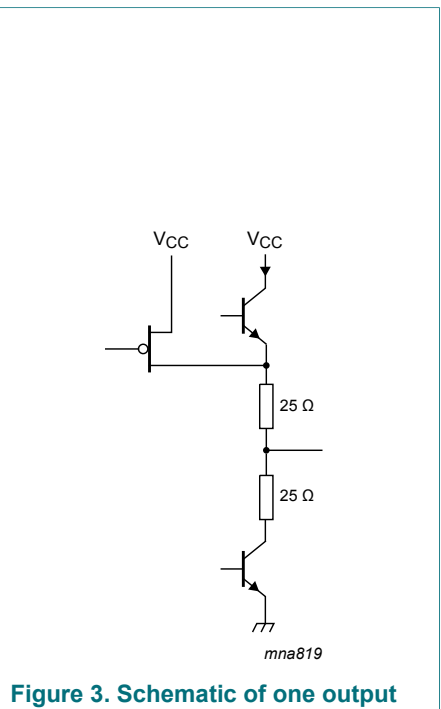


Figure 3. Schematic of one output

## 5 Pinning information

### 5.1 Pinning

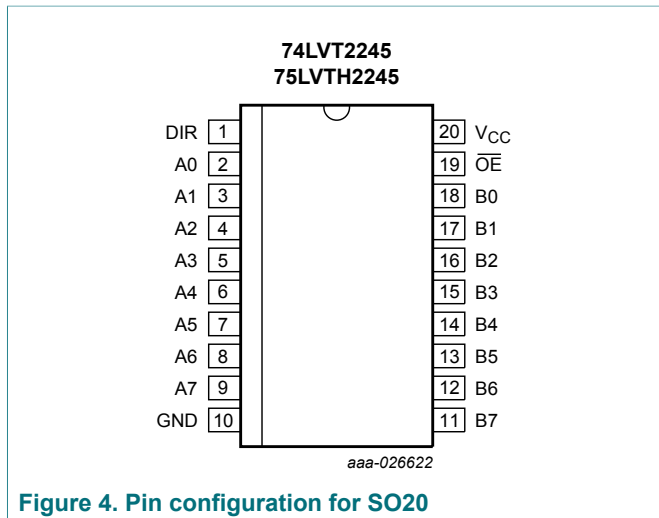


Figure 4. Pin configuration for SO20

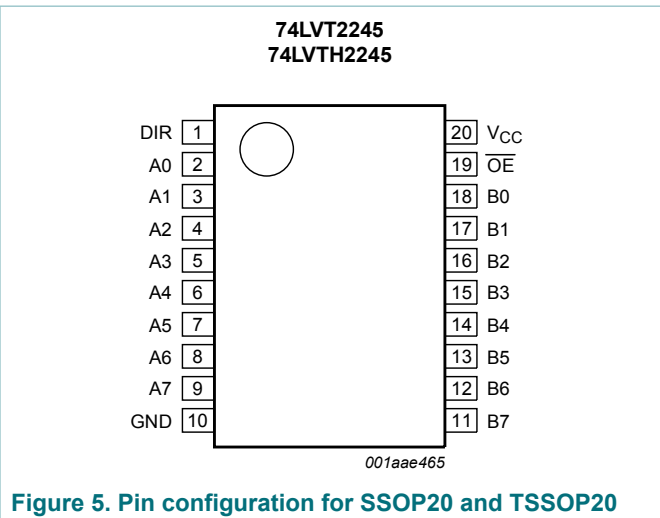


Figure 5. Pin configuration for SSOP20 and TSSOP20

### 5.2 Pin description

Table 2. Pin description

Symbol	Pin	Description
DIR	1	direction control input
A0, A1, A2, A3, A4, A5, A6, A7	2, 3, 4, 5, 6, 7, 8, 9	data input/output
GND	10	ground (0 V)
B7, B6, B5, B4, B3, B2, B1, B0	11, 12, 13, 14, 15, 16, 17, 18	data input/output
OE	19	output enable input
V <sub>CC</sub>	20	supply voltage

## 6 Functional description

Table 3. Function table <sup>[1]</sup>

Control		Input/output	
OE	DIR	An	Bn
L	L	output An = Bn	input
L	H	input	output Bn = An
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
$V_{CC}$	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	$^{\circ}$ C
$T_j$	junction temperature	[2]	-	150	$^{\circ}$ C
$P_{tot}$	total power dissipation	$T_{amb} = -40$ to $+85$ $^{\circ}$ 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] For SO20 package: above 70  $^{\circ}$ C derate linearly with 8 mW/K.  
For (T)SSOP20 package: above 60  $^{\circ}$ C derate 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
$I_{OH}$	HIGH-level output current		-12	-	-	mA
$I_{OL}$	LOW-level output current		-	-	12	mA
$\Delta t/\Delta V$	input transition rise and fall rate	outputs enabled	-	-	10	ns/V
$T_{amb}$	ambient temperature	in free-air	-40	+25	+85	$^{\circ}$ C

## 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
$T_{amb} = -40$ $^{\circ}$ C to $+85$ $^{\circ}$ C						
$V_{IK}$	input clamping voltage	$V_{CC} = 2.7$ V; $I_{IK} = -18$ mA	-1.2	-0.9	-	V
$V_{IH}$	HIGH-level input voltage		2.0	-	-	V
$V_{IL}$	LOW-level input voltage		-	-	0.8	V
$V_{OH}$	HIGH-level output voltage	$V_{CC} = 3.0$ V; $I_{OH} = -12$ mA	2.0	2.2	-	V

Symbol	Parameter	Conditions	Min	Typ <sup>[1]</sup>	Max	Unit
V <sub>OL</sub>	LOW-level output voltage	V <sub>CC</sub> = 3.0 V; I <sub>OL</sub> = 12 mA	-	-	0.8	V
I <sub>I</sub>	input leakage current	control pins				
		V <sub>CC</sub> = 0 V or 3.6 V; V <sub>I</sub> = 5.5 V	-	1	10	$\mu$ A
		V <sub>CC</sub> = 3.6 V; V <sub>I</sub> = V <sub>CC</sub> or GND	-	$\pm 0.1$	$\pm 1$	$\mu$ A
		I/O data pins; V <sub>CC</sub> = 3.6 V <sup>[2]</sup>				
		V <sub>I</sub> = 5.5 V	-	1	20	$\mu$ A
		V <sub>I</sub> = V <sub>CC</sub>	-	0.1	1	$\mu$ A
		V <sub>I</sub> = 0 V	-	-1	-5	$\mu$ A
I <sub>OFF</sub>	power-off leakage current	V <sub>CC</sub> = 0 V; V <sub>I</sub> or V <sub>O</sub> = 0 V to 4.5 V	-	1	$\pm 100$	$\mu$ A
I <sub>BHL</sub>	bus hold LOW current	V <sub>CC</sub> = 3 V; V <sub>I</sub> = 0.8 V	75	150	-	$\mu$ A
I <sub>BHH</sub>	bus hold HIGH current	V <sub>CC</sub> = 3 V; V <sub>I</sub> = 2.0 V	-	-150	-75	$\mu$ A
I <sub>BHLO</sub>	bus hold LOW overdrive current	V <sub>CC</sub> = 0 V to 3.6 V; V <sub>I</sub> = 3.6 V <sup>[3]</sup>	-	-	500	$\mu$ A
I <sub>BHHO</sub>	bus hold HIGH overdrive current	V <sub>CC</sub> = 0 V to 3.6 V; V <sub>I</sub> = 3.6 V <sup>[3]</sup>	-500	-	-	$\mu$ A
I <sub>CEX</sub>	output high leakage current	output in HIGH-state when V <sub>O</sub> > V <sub>CC</sub> ; V <sub>O</sub> = 5.5 V; V <sub>CC</sub> = 3.0 V	-	60	125	$\mu$ A
I <sub>O(pu/pd)</sub>	power-up/power-down output current	V <sub>CC</sub> $\leq$ 1.2 V; V <sub>O</sub> = 0.5 V to V <sub>CC</sub> ; V <sub>I</sub> = GND or V <sub>CC</sub> ; $\overline{OE}$ = don't care <sup>[4]</sup>	-	15	$\pm 100$	$\mu$ A
I <sub>CC</sub>	supply current	V <sub>CC</sub> = 3.6 V; V <sub>I</sub> = GND or V <sub>CC</sub> ; I <sub>O</sub> = 0 A				
		outputs HIGH	-	0.13	0.19	mA
		outputs LOW	-	3	12	mA
		outputs disabled <sup>[5]</sup>	-	0.13	0.19	mA
$\Delta$ I <sub>CC</sub>	additional supply current	per input pin; V <sub>CC</sub> = 3 V to 3.6 V; one input at V <sub>CC</sub> - 0.6 V; other inputs at V <sub>CC</sub> or GND <sup>[6]</sup>	-	0.1	0.2	mA
C <sub>I</sub>	input capacitance	DIR and $\overline{OE}$ ; V <sub>I</sub> = 0 V or 3.0 V	-	4	-	pF
C <sub>I/O</sub>	input/output capacitance	An and Bn; outputs disabled; V <sub>I/O</sub> = 0 V or 3.0 V	-	10	-	pF

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

[2] Unused pins at V<sub>CC</sub> 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<sub>CC</sub> between 0 V and 1.2 V with a transition time of up to 10 ms. From V<sub>CC</sub> = 1.2 V to V<sub>CC</sub> = 3.0 V to 3.6 V a transition time of 100  $\mu$ s is permitted.

[5] I<sub>CC</sub> is measured with outputs pulled to V<sub>CC</sub> or GND.

[6] This is the increase in supply current for each input at the specified voltage level other than V<sub>CC</sub> or GND.

## 10 Dynamic characteristics

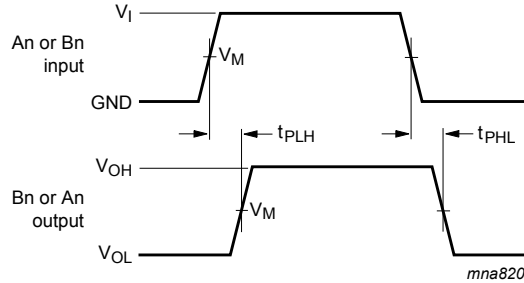
**Table 7. Dynamic characteristics**

Voltages are referenced to GND (ground = 0 V); for test circuit see [Figure 8](#).

Symbol	Parameter	Conditions	Min	Typ <sup>[1]</sup>	Max	Unit
$T_{amb} = -40\text{ }^{\circ}\text{C to }+85\text{ }^{\circ}\text{C}$						
$t_{PLH}$	LOW to HIGH propagation delay	An to Bn or Bn to An; see <a href="#">Figure 6</a>				
		$V_{CC} = 2.7\text{ V}$	-	-	5.3	ns
		$V_{CC} = 3.0\text{ V to }3.6\text{ V}$	1.0	3.2	4.6	ns
$t_{PHL}$	HIGH to LOW propagation delay	An to Bn or Bn to An; see <a href="#">Figure 6</a>				
		$V_{CC} = 2.7\text{ V}$	-	-	4.9	ns
		$V_{CC} = 3.0\text{ V to }3.6\text{ V}$	1.0	3.1	4.5	ns
$t_{PZH}$	OFF-state to HIGH propagation delay	see <a href="#">Figure 7</a>				
		$V_{CC} = 2.7\text{ V}$	-	-	9.1	ns
		$V_{CC} = 3.0\text{ V to }3.6\text{ V}$	1.1	4.5	7.0	ns
$t_{PZL}$	OFF-state to LOW propagation delay	see <a href="#">Figure 7</a>				
		$V_{CC} = 2.7\text{ V}$	-	-	7.6	ns
		$V_{CC} = 3.0\text{ V to }3.6\text{ V}$	1.5	4.3	6.5	ns
$t_{PHZ}$	HIGH to OFF-state propagation delay	see <a href="#">Figure 7</a>				
		$V_{CC} = 2.7\text{ V}$	-	-	5.6	ns
		$V_{CC} = 3.0\text{ V to }3.6\text{ V}$	2.2	3.7	5.2	ns
$t_{PLZ}$	LOW to OFF-state propagation delay	see <a href="#">Figure 7</a>				
		$V_{CC} = 2.7\text{ V}$	-	-	5.0	ns
		$V_{CC} = 3.0\text{ V to }3.6\text{ V}$	2.0	3.6	5.0	ns

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

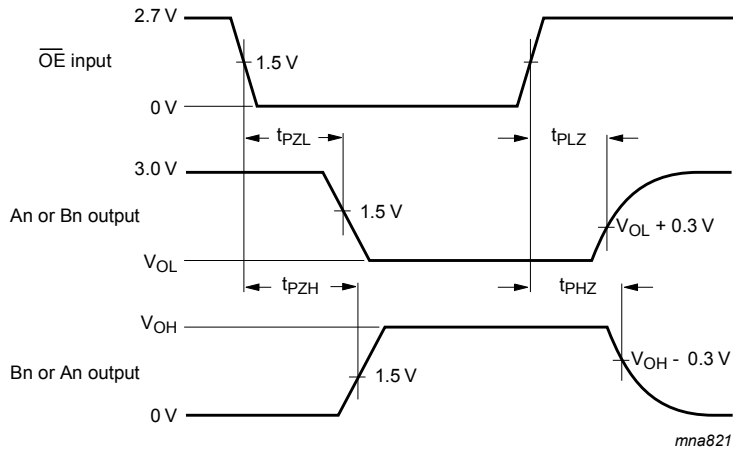
10.1 Waveforms and test circuit



$V_M = 1.5\text{ V}$

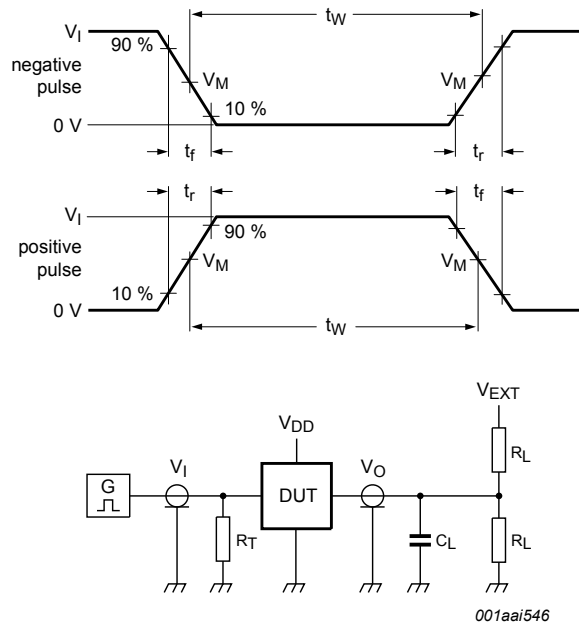
$V_{OL}$  and  $V_{OH}$  are typical voltage output levels that occur with the output load.

Figure 6. Input (An or Bn) to output (Bn or An) propagation delays



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

Figure 7. 3-state output enable and disable times



Test data is given in [Table 8](#).

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.

$V_{EXT}$  = Test voltage for switching times.

**Figure 8. Test circuit for measuring switching times**

**Table 8. Test data**

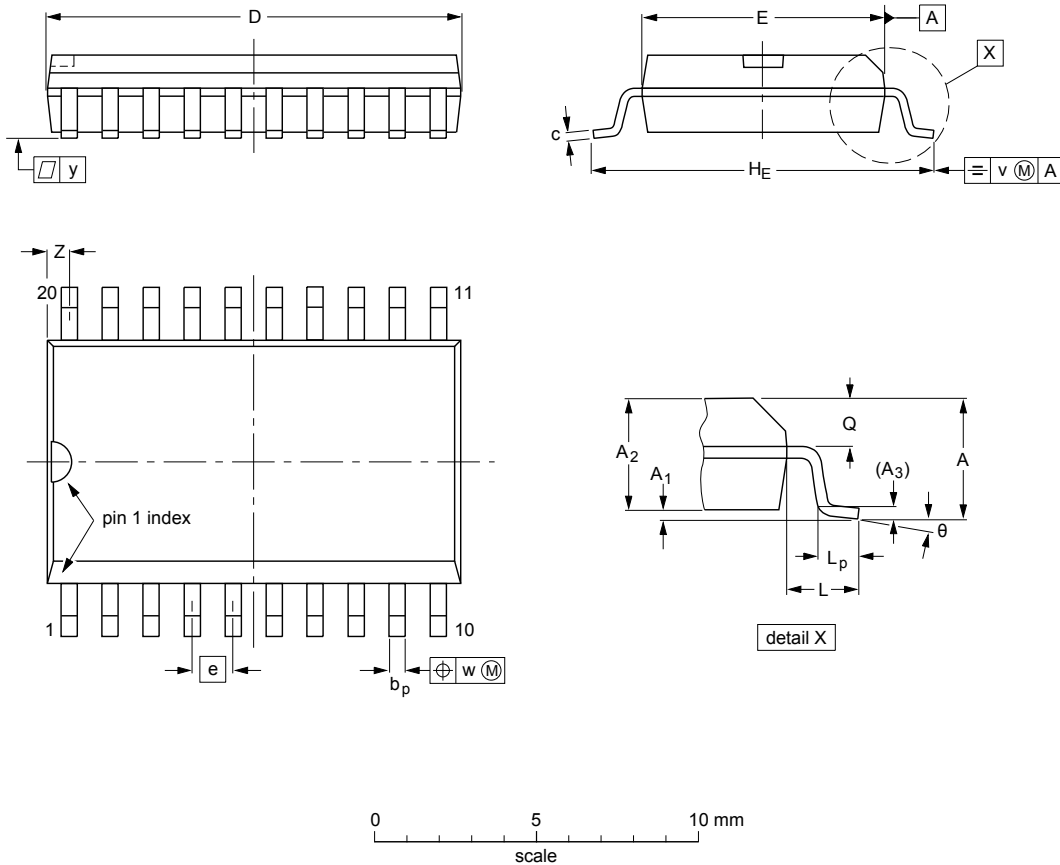
Input				Load		$V_{EXT}$		
$V_I$	$f_i$	$t_W$	$t_r, t_f$	$C_L$	$R_L$	$t_{PHZ}, t_{PZH}$	$t_{PLZ}, t_{PZL}$	$t_{PLH}, t_{PHL}$
2.7 V	≤ 10 MHz	500 ns	≤ 2.5 ns	50 pF	500 Ω	GND	6 V	open



11 Package outline

SO20: plastic small outline package; 20 leads; body width 7.5 mm

SOT163-1



DIMENSIONS (inch dimensions are derived from the original mm dimensions)

UNIT	A max.	A <sub>1</sub>	A <sub>2</sub>	A <sub>3</sub>	b <sub>p</sub>	c	D <sup>(1)</sup>	E <sup>(1)</sup>	e	H <sub>E</sub>	L	L <sub>p</sub>	Q	v	w	y	Z <sup>(1)</sup>	θ
mm	2.65	0.3 0.1	2.45 2.25	0.25	0.49 0.36	0.32 0.23	13.0 12.6	7.6 7.4	1.27	10.65 10.00	1.4	1.1 0.4	1.1 1.0	0.25	0.25	0.1	0.9 0.4	8° 0°
inches	0.1	0.012 0.004	0.096 0.089	0.01	0.019 0.014	0.013 0.009	0.51 0.49	0.30 0.29	0.05	0.419 0.394	0.055	0.043 0.016	0.043 0.039	0.01	0.01	0.004	0.035 0.016	

Note

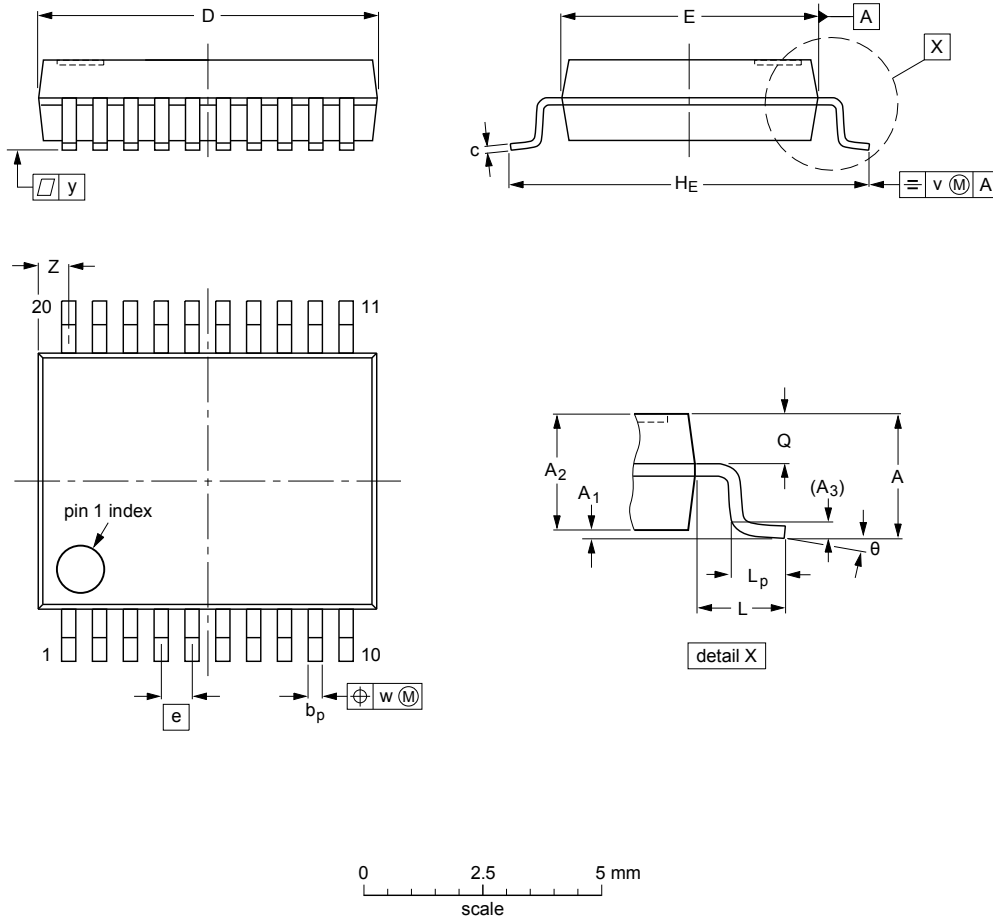
1. Plastic or metal protrusions of 0.15 mm (0.006 inch) maximum per side are not included.

OUTLINE VERSION	REFERENCES			EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA		
SOT163-1	075E04	MS-013			99-12-27 03-02-19

Figure 9. Package outline SOT163-1 (SO20)

SSOP20: plastic shrink small outline package; 20 leads; body width 5.3 mm

SOT339-1



**DIMENSIONS (mm are the original dimensions)**

UNIT	A <sub>max.</sub>	A <sub>1</sub>	A <sub>2</sub>	A <sub>3</sub>	b <sub>p</sub>	c	D <sup>(1)</sup>	E <sup>(1)</sup>	e	H <sub>E</sub>	L	L <sub>p</sub>	Q	v	w	y	Z <sup>(1)</sup>	θ
mm	2	0.21 0.05	1.80 1.65	0.25	0.38 0.25	0.20 0.09	7.4 7.0	5.4 5.2	0.65	7.9 7.6	1.25	1.03 0.63	0.9 0.7	0.2	0.13	0.1	0.9 0.5	8° 0°

**Note**

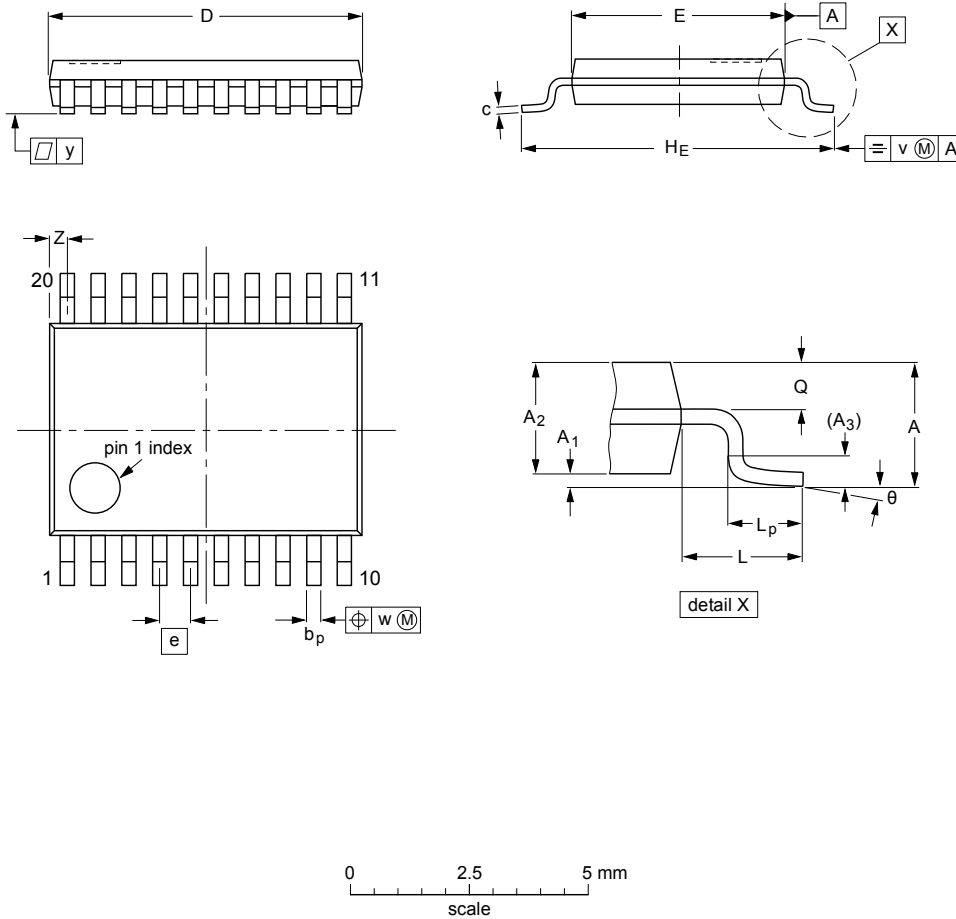
1. Plastic or metal protrusions of 0.2 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT339-1		MO-150				99-12-27 03-02-19

Figure 10. Package outline SOT339-1 (SSOP20)

TSSOP20: plastic thin shrink small outline package; 20 leads; body width 4.4 mm

SOT360-1



**DIMENSIONS (mm are the original dimensions)**

UNIT	A max.	A <sub>1</sub>	A <sub>2</sub>	A <sub>3</sub>	b <sub>p</sub>	c	D <sup>(1)</sup>	E <sup>(2)</sup>	e	H <sub>E</sub>	L	L <sub>p</sub>	Q	v	w	y	Z <sup>(1)</sup>	θ
mm	1.1	0.15 0.05	0.95 0.80	0.25	0.30 0.19	0.2 0.1	6.6 6.4	4.5 4.3	0.65	6.6 6.2	1	0.75 0.50	0.4 0.3	0.2	0.13	0.1	0.5 0.2	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	JEITA			
SOT360-1		MO-153				-99-12-27 03-02-19

Figure 11. Package outline SOT360-1 (TSSOP20)

## 12 Abbreviations

Table 9. Abbreviations

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

## 13 Revision history

Table 10. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74LVT_LVTH2245 v.5	20170410	Product data sheet	-	74LVT_LVTH2245 v.4
Modifications:	<ul style="list-style-type: none"> <li>The format of this data sheet has been redesigned to comply with the identity guidelines of Nexperia.</li> <li>Legal texts have been adapted to the new company name where appropriate.</li> </ul>			
74LVT_LVTH2245 v.4	20060424	Product data sheet	-	74LVT_LVTH2245 v.3
Modifications:	<ul style="list-style-type: none"> <li>Text changes have been made to the parameter descriptions of <math>t_{PLH}</math> and <math>t_{PHL}</math> in the Quick reference and Dynamic characteristics tables.</li> </ul>			
74LVT_LVTH2245 v.3	20060323	Product data sheet	-	74LVT2245 v.2
74LVT2245 v.2	19980219	Product specification	-	74LVT2245 v.1
74LVT2245 v.1	19960311	Product specification	-	-

## 14 Legal information

### 14.1 Data sheet status

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

[3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the Internet at URL <http://www.nexperia.com>.

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