

# 74LVT245

## 3.3 V octal transceiver with direction pin; 3-state

Rev. 5 — 4 August 2021

Product data sheet

### 1. General description

The 74LVT245 is an 8-bit transceiver with 3-state outputs. The device features an output enable ( $\overline{OE}$ ) and send/receive (DIR) for direction control. A HIGH on  $\overline{OE}$  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

- Wide supply voltage range from 2.7 to 3.6 V
- 3-state buffers
- Octal bidirectional bus interface
- Overvoltage tolerant inputs to 5.5 V
- Direct interface with TTL levels
- BiCMOS high speed and output drive
- Output capability: +64 mA/-32 mA
- Latch-up protection exceeds 500 mA per JESD78 class II level A
- Bus-hold data inputs eliminate the need for external pull-up resistors for unused inputs
- No bus current loading when output is tied to 5 V bus
- Live insertion/extraction permitted
- Power-up 3-state
- $I_{OFF}$  circuitry provides partial Power-down mode operation
- Complies with JEDEC standards JESD8C (2.7 V to 3.6 V)
- ESD protection:
  - HBM JESD22-A114E exceeds 2000 V
  - MM JESD22-A115-A exceeds 200 V
- Specified from -40 °C to 85 °C

### 3. Ordering information

Table 1. Ordering information

Type number	Package			Version
	Temperature range	Name	Description	
74LVT245D	-40 °C to +85 °C	SO20	plastic small outline package; 20 leads; body width 7.5 mm	SOT163-1
74LVT245PW	-40 °C to +85 °C	TSSOP20	plastic thin shrink small outline package; 20 leads; body width 4.4 mm	SOT360-1
74LVT245BQ	-40 °C to +85 °C	DHVQFN20	plastic dual in-line compatible thermal enhanced very thin quad flat package; no leads; 20 terminals; body 2.5 × 4.5 × 0.85 mm	SOT764-1

### 4. Functional diagram

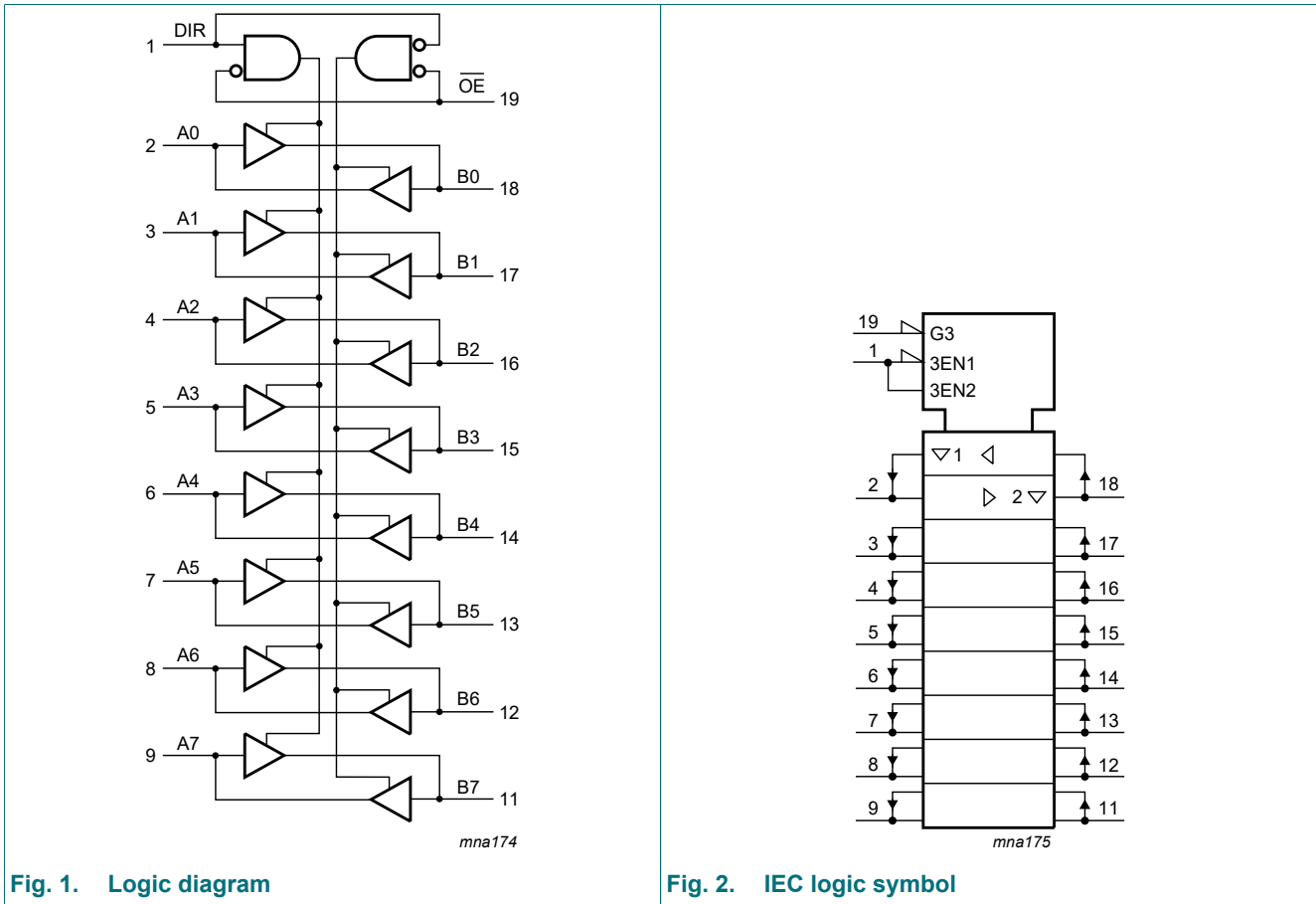
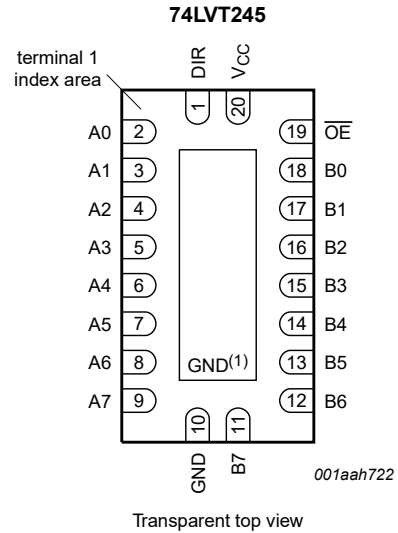
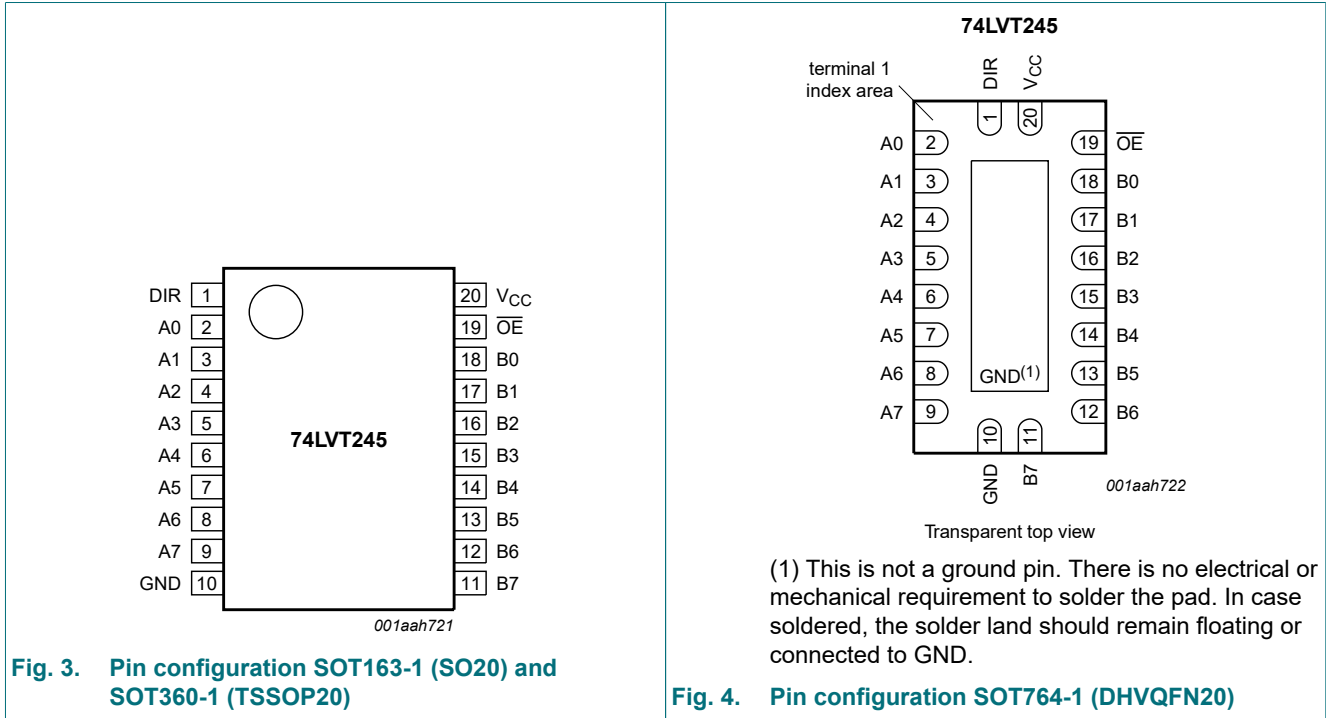


Fig. 1. Logic diagram

Fig. 2. IEC logic symbol

## 5. Pinning information

### 5.1. Pinning



### 5.2. Pin description

Table 2. Pin description

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

## 6. Functional description

Table 3. Function selection

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

Inputs		Inputs/outputs	
OE	DIR	An	Bn
L	L	An = Bn	inputs
L	H	inputs	Bn = An
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 <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 or HIGH state [1]	-0.5	+7	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
P <sub>tot</sub>	total power dissipation	T <sub>amb</sub> = -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. The maximum junction temperature of this integrated circuit should not exceed 150 °C.

## 8. Recommended operating conditions

**Table 5. Recommended operating conditions**

Symbol	Parameter	Conditions	Min	Max	Unit
V <sub>CC</sub>	supply voltage		2.7	3.6	V
V <sub>I</sub>	input voltage		0	5.5	V
I <sub>OH</sub>	HIGH-level output current		-	-32	mA
I <sub>OL</sub>	LOW-level output current		-	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	output 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	-40 °C to +85 °C			Unit
			Min	Typ [1]	Max	
V <sub>IK</sub>	input clamping voltage	V <sub>CC</sub> = 2.7 V; I <sub>IK</sub> = -18 mA	-1.2	-0.9	-	V
V <sub>IH</sub>	HIGH-level input voltage		2.0	-	-	V
V <sub>IL</sub>	LOW-level input voltage		-	-	0.8	V
V <sub>OH</sub>	HIGH-level output voltage	V <sub>CC</sub> = 2.7 V to 3.6 V; I <sub>OH</sub> = -100 μA	V <sub>CC</sub> - 0.2	V <sub>CC</sub> - 0.1	-	V
		V <sub>CC</sub> = 2.7 V; I <sub>OH</sub> = -8 mA	2.4	2.5	-	
		V <sub>CC</sub> = 3.0 V; I <sub>OH</sub> = -32 mA	2.0	2.2	-	V

## 3.3 V octal transceiver with direction pin; 3-state

Symbol	Parameter	Conditions	-40 °C to +85 °C			Unit
			Min	Typ [1]	Max	
V <sub>OL</sub>	LOW-level output voltage	V <sub>CC</sub> = 2.7 V; I <sub>OL</sub> = 100 μA		0.1	0.2	V
		V <sub>CC</sub> = 2.7 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
		V <sub>CC</sub> = 3.0 V; I <sub>OL</sub> = 32 mA	-	0.3	0.5	V
		V <sub>CC</sub> = 3.0 V; I <sub>OL</sub> = 64 mA	-	0.4	0.55	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	μA
		V <sub>CC</sub> = 3.6 V; V <sub>I</sub> = V <sub>CC</sub> or GND	-	±0.1	±1	μA
		I/O data pins [2]				
		V <sub>CC</sub> = 3.6 V; V <sub>I</sub> = 5.5 V	-	1	20	μA
		V <sub>CC</sub> = 3.6 V; V <sub>I</sub> = V <sub>CC</sub>	-	0.1	1	μA
		V <sub>CC</sub> = 3.6 V; V <sub>I</sub> = 0 V	-5	-1	-	μA
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	±100	μA
I <sub>LO</sub>	output leakage current	V <sub>O</sub> = 5.5 V; V <sub>CC</sub> = 3.6 V; output HIGH	-	60	125	μA
I <sub>O(pu/pd)</sub>	power-up/power-down output current	V <sub>CC</sub> ≤ 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 [3]	-	15	±100	μA
I <sub>BHL</sub>	bus hold LOW current	V <sub>CC</sub> = 3.0 V; V <sub>I</sub> = 0.8 V	75	150	-	μA
I <sub>BHH</sub>	bus hold HIGH current	V <sub>CC</sub> = 3.0 V; V <sub>I</sub> = 2.0 V	-	-150	-75	μA
I <sub>BHLO</sub>	bus hold LOW overdrive current	V <sub>CC</sub> = 0 V to 3.0 V; V <sub>I</sub> = 3.6 V [4]	500	-	-	μA
I <sub>BHHO</sub>	bus hold HIGH overdrive current	V <sub>CC</sub> = 0 V to 3.0 V; V <sub>I</sub> = 3.6 V [4]	-	-	-500	μA
I <sub>CC</sub>	supply current	V <sub>CC</sub> = 3.6 V; V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0 A				
		outputs HIGH	-	0.13	0.19	mA
		outputs LOW	-	3	12	mA
		outputs disabled	-	0.13	0.19	mA
ΔI <sub>CC</sub>	additional supply current	per input pin; V <sub>CC</sub> = 3.0 V to 3.6 V; one input = V <sub>CC</sub> - 0.6 V; other inputs at V <sub>CC</sub> or GND [5]	-	0.1	0.2	mA
C <sub>I</sub>	input capacitance	DIR and $\overline{OE}$ inputs; outputs disabled; V <sub>I</sub> = 0 V or 3.0 V	-	4	-	pF
C <sub>I/O</sub>	input/output capacitance	at input/output data pins, outputs disabled; V <sub>I/O</sub> = 0 V or 3.0 V	-	10	-	pF

[1] All typical values are measured at V<sub>CC</sub> = 3.3 V (unless stated otherwise) and T<sub>amb</sub> = 25 °C.

[2] Unused pins at V<sub>CC</sub> or GND.

[3] 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> = 3.3 V ± 0.3 V a transition time of 100 ms is permitted. This parameter is valid for T<sub>amb</sub> = +25 °C only.

[4] This is the bus hold overdrive current required to force the input to the opposite logic state.

[5] 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

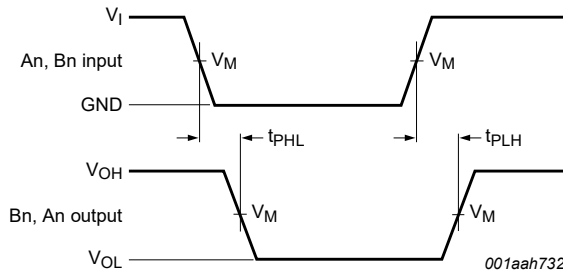
**Table 7. Dynamic characteristics**

Voltages are referenced to GND (ground = 0 V). For test circuit see [Fig. 7](#).

Symbol	Parameter	Conditions	-40 °C to +85 °C			Unit
			Min	Typ [1]	Max	
t <sub>PLH</sub>	LOW to HIGH propagation delay	An to Bn or Bn to An; see <a href="#">Fig. 5</a>				
		V <sub>CC</sub> = 2.7 V	-	-	4.7	ns
		V <sub>CC</sub> = 3.3 V ± 0.3 V	1.0	2.4	4.0	ns
t <sub>PHL</sub>	HIGH to LOW propagation delay	An to Bn or Bn to An; see <a href="#">Fig. 5</a>				
		V <sub>CC</sub> = 2.7 V	-	-	4.6	ns
		V <sub>CC</sub> = 3.3 V ± 0.3 V	1.0	2.4	4.0	ns
t <sub>PZH</sub>	OFF-state to HIGH propagation delay	see <a href="#">Fig. 6</a>				
		V <sub>CC</sub> = 2.7 V	-	-	7.1	ns
		V <sub>CC</sub> = 3.3 V ± 0.3 V	1.1	3.3	5.5	ns
t <sub>PZL</sub>	OFF-state to LOW propagation delay	see <a href="#">Fig. 6</a>				
		V <sub>CC</sub> = 2.7 V	-	-	6.5	ns
		V <sub>CC</sub> = 3.3 V ± 0.3 V	1.1	3.3	5.5	ns
t <sub>PHZ</sub>	HIGH to OFF-state propagation delay	see <a href="#">Fig. 6</a>				
		V <sub>CC</sub> = 2.7 V	-	-	6.5	ns
		V <sub>CC</sub> = 3.3 V ± 0.3 V	2.2	3.6	5.9	ns
t <sub>PLZ</sub>	LOW to OFF-state propagation delay	see <a href="#">Fig. 6</a>				
		V <sub>CC</sub> = 2.7 V	-	-	4.8	ns
		V <sub>CC</sub> = 3.3 V ± 0.3 V	2.0	3.4	4.8	ns

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

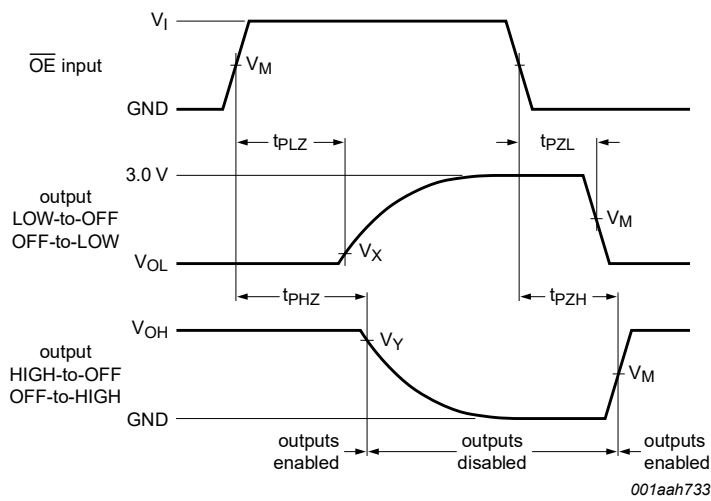
10.1. Waveforms and test circuit



See Table 8 for measurement points

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

Fig. 5. Input (An, Bn) to output (Bn, An) propagation delays and output transition times



See Table 8 for measurement points

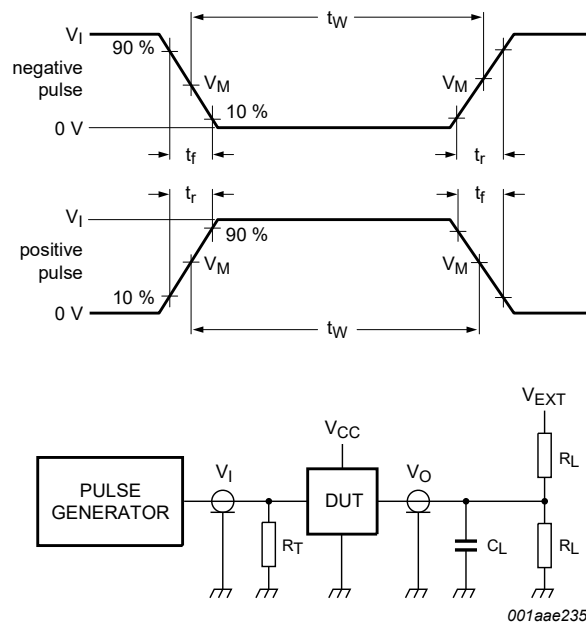
$V_{OL}$  and  $V_{OH}$  are typical output voltage levels that occur with the output load.

Fig. 6. 3-state output enable and disable times

Table 8. Measurement points

$V_{CC}$	Input		Output		
	$V_I$	$V_M$	$V_M$	$V_X$	$V_Y$
2.7 V to 3.6 V	GND to 2.7 V	1.5 V	1.5 V	$V_{OL} + 0.3 V$	$V_{OH} - 0.3 V$

3.3 V octal transceiver with direction pin; 3-state



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. Test circuit for switching times**

**Table 9. Test data**

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



### 11. Package outline

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

SOT163-1

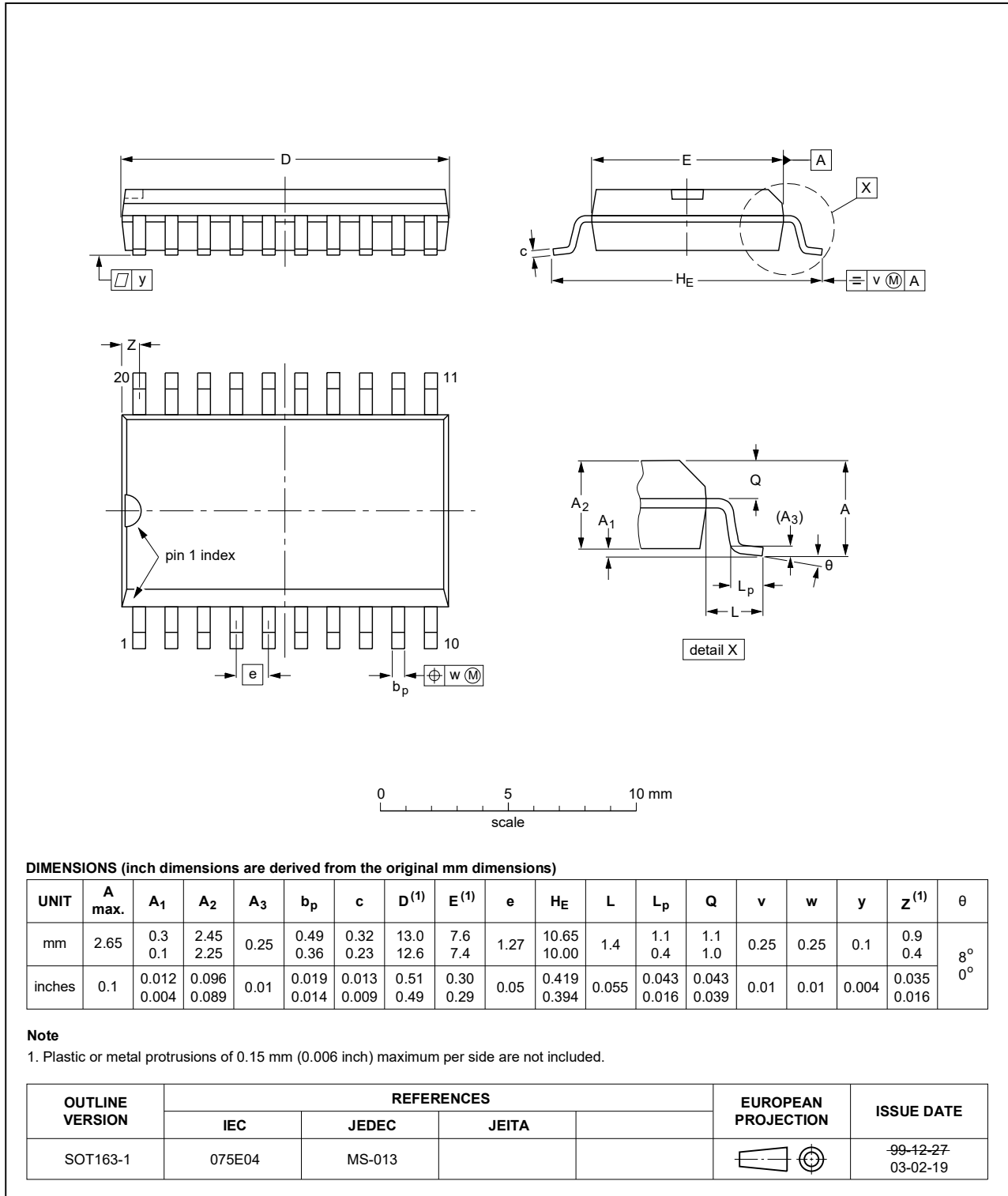


Fig. 8. Package outline SOT163-1 (SO20)

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

SOT360-1

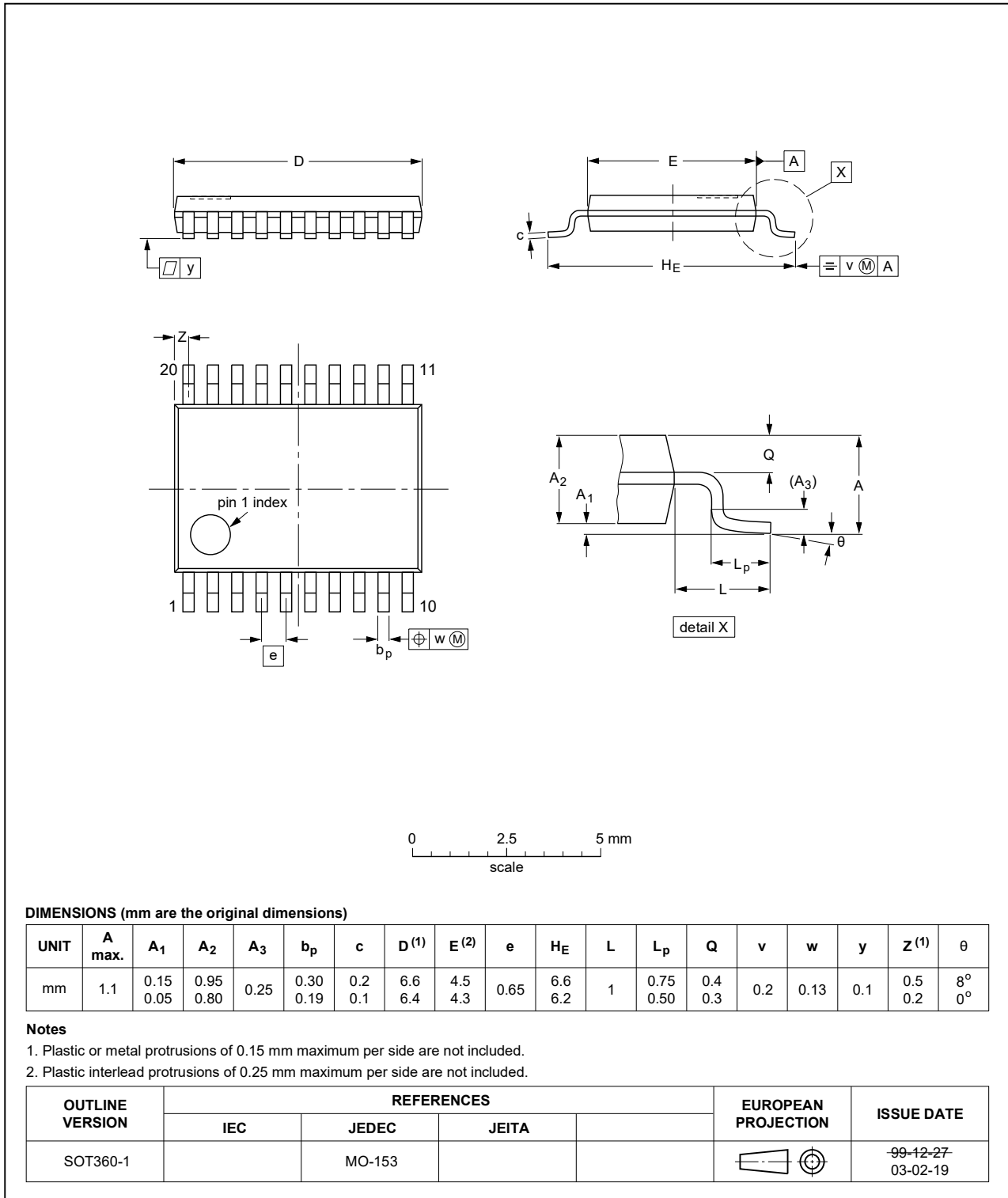


Fig. 9. Package outline SOT360-1 (TSSOP20)



## 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
74LVT245 v.5	20210804	Product data sheet	-	74LVT245 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> <li>Type number 74LVT245DB (SOT339-1/SSOP20) removed.</li> <li><a href="#">Section 1</a> and <a href="#">Section 2</a> updated.</li> <li><a href="#">Section 7</a>: Derating values for <math>P_{tot}</math> total power dissipation removed.</li> <li><a href="#">Fig. 10</a>: Package outline drawing SOT764-1 (DHVQFN20) updated.</li> </ul>			
74LVT245 v.4	20131224	Product data sheet	-	74LVT245 v.3
Modifications:	<ul style="list-style-type: none"> <li>Minimum, typical and maximum value of <math>I_{BHH}</math> corrected (errata).</li> </ul>			
74LVT245 v.3	20080508	Product data sheet	-	74LVT245 v.2
74LVT245 v.2	19980219	Product specification	-	74LVT245 v.1
74LVT245 v.1	19940520	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.
Preliminary [short] data sheet	Qualification	This document contains data from the preliminary specification.
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