

# 74LV245A

Octal bus transceiver; 3-state

Rev. 2 — 3 November 2016

Product data sheet

## 1. General description

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The 74LV245A 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.

Inputs are overvoltage tolerant. This feature allows the use of these devices as translators in mixed voltage environments.

Schmitt-trigger action at all inputs makes the circuit tolerant of slower input rise and fall times.

This device is fully specified for partial power down applications using  $I_{OFF}$ . The  $I_{OFF}$  circuitry disables the output, preventing the potentially damaging backflow current through the device when it is powered down.

## 2. Features and benefits

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- Wide supply voltage range from 2.0 V to 5.5 V
- Maximum  $t_{pd}$  of 6.5 ns at 5 V
- Typical  $V_{OL(p)} < 0.8$  V at  $V_{CC} = 3.3$  V,  $T_{amb} = 25$  °C
- Typical  $V_{OH(v)} > 2.3$  V at  $V_{CC} = 3.3$  V,  $T_{amb} = 25$  °C
- Supports mixed-mode voltage operation on all ports
- $I_{OFF}$  circuitry provides partial Power-down mode operation
- Latch-up performance exceeds 250 mA per JESD 78 Class II
- ESD protection:
  - ◆ HBM ANSI/ESDA/JEDEC JS-001 Class 2 exceeds 3 kV
  - ◆ MM JESD22-A115-A exceeds 200 V
  - ◆ CDM JESD22-C101E exceeds 2 kV
- Specified from  $-40$  °C to  $+85$  °C and from  $-40$  °C to  $+125$  °C

### 3. Ordering information

Table 1. Ordering information

Type number	Package			Version
	Temperature range	Name	Description	
74LV245APW	-40 °C to +125 °C	TSSOP20	plastic thin shrink small outline package; 20 leads; body width 4.4 mm	SOT360-1

### 4. Functional diagram

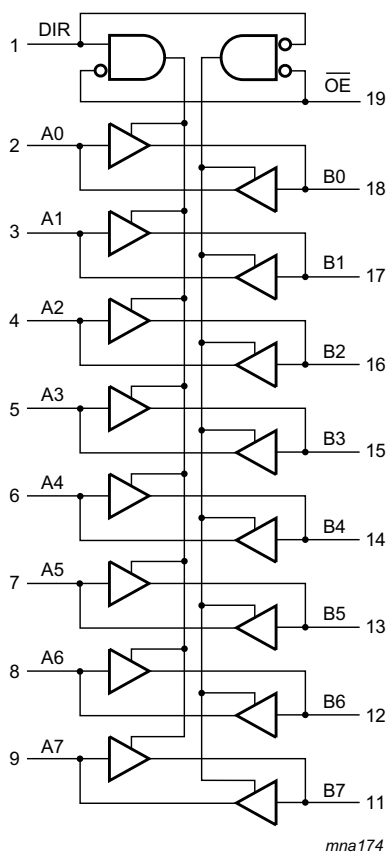


Fig 1. Logic symbol

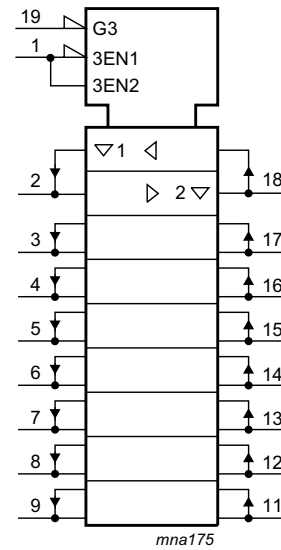
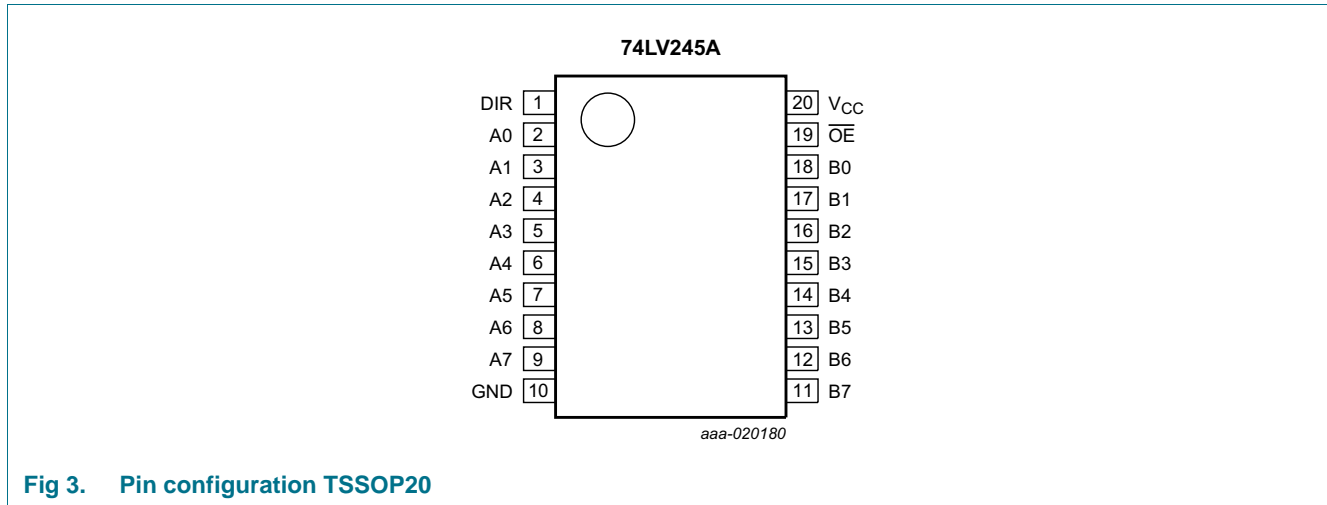


Fig 2. IEC logic symbol

## 5. Pinning information

### 5.1 Pinning



### 5.2 Pin description

**Table 2. Pin description**

Symbol	Pin	Description
DIR	1	direction control
A0 to A7	2, 3, 4, 5, 6, 7, 8, 9	data input/output
GND	10	ground (0 V)
B0 to B7	18, 17, 16, 15, 14, 13, 12, 11	data input/output
$\overline{OE}$	19	output enable input (active LOW)
V <sub>CC</sub>	20	supply voltage

## 6. Functional description

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

Input		Input/output		
$\overline{\text{OE}}$	DIR	An	Bn	
L	L	A = B	input	
L	H	input	B = A	
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	+7.0	V
$V_I$	input voltage		-0.5	+7.0	V
$V_O$	output voltage	active mode	-0.5	$V_{CC} + 0.5$	V
		power-down or 3-state mode	-0.5	+7.0	V
$I_{IK}$	input clamping current	$V_I < 0\text{ V}$	-20	-	mA
$I_{OK}$	output clamping current	$V_O < 0\text{ V}$	-50	-	mA
$I_O$	output current	$V_O = 0\text{ V}$ to $V_{CC}$	-	$\pm 35$	mA
$I_{CC}$	supply current		-	70	mA
$I_{GND}$	ground current		-70	-	mA
$T_{stg}$	storage temperature		-65	+150	°C
$P_{tot}$	total power dissipation	$T_{amb} = -40\text{ °C}$ to $+125\text{ °C}$	-	500	mW

[1] If the input current ratings are observed, the minimum input voltage ratings may be exceeded.

[2] If the output current ratings are observed, the output voltage ratings may be exceeded.

[3] This value is limited to 7.0 V maximum.

[4] For TSSOP20 package: above 100 °C, the value of  $P_{tot}$  derates linearly with 10 mW/K.

## 8. Recommended operating conditions

**Table 5. Recommended operating conditions**

Voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions	Min	Max	Unit
$V_{CC}$	supply voltage		2.0	5.5	V
$V_I$	input voltage		0	5.5	V
$V_O$	output voltage	active mode	0	$V_{CC}$	V
		power-down or 3-state mode	0	5.5	V
$T_{amb}$	ambient temperature		-40	+125	°C
$\Delta t/\Delta V$	input transition rise and fall rate	$V_{CC} = 2.3\text{ V to }2.7\text{ V}$	-	200	ns/V
		$V_{CC} = 3.0\text{ V to }3.6\text{ V}$	-	100	ns/V
		$V_{CC} = 4.5\text{ V to }5.5\text{ V}$	-	20	ns/V

## 9. Static characteristics

**Table 6. Static characteristics**

Voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions	25 °C			-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
$V_{IH}$	HIGH-level input voltage	$V_{CC} = 2\text{ V}$	1.5	-	-	1.5	-	1.5	-	V
		$V_{CC} = 2.3\text{ V to }2.7\text{ V}$	$0.7V_{CC}$	-	-	$0.7V_{CC}$	-	$0.7V_{CC}$	-	V
		$V_{CC} = 3.0\text{ V to }3.6\text{ V}$	$0.7V_{CC}$	-	-	$0.7V_{CC}$	-	$0.7V_{CC}$	-	V
		$V_{CC} = 4.5\text{ V to }5.5\text{ V}$	$0.7V_{CC}$	-	-	$0.7V_{CC}$	-	$0.7V_{CC}$	-	V
$V_{IL}$	LOW-level input voltage	$V_{CC} = 2\text{ V}$	-	-	0.5	-	0.5	-	0.5	V
		$V_{CC} = 2.3\text{ V to }2.7\text{ V}$	-	-	$0.3V_{CC}$	-	$0.3V_{CC}$	-	$0.3V_{CC}$	V
		$V_{CC} = 3.0\text{ V to }3.6\text{ V}$	-	-	$0.3V_{CC}$	-	$0.3V_{CC}$	-	$0.3V_{CC}$	V
		$V_{CC} = 4.5\text{ V to }5.5\text{ V}$	-	-	$0.3V_{CC}$	-	$0.3V_{CC}$	-	$0.3V_{CC}$	V
$V_{OH}$	HIGH-level output voltage	$V_I = V_{IH}$ or $V_{IL}$								V
		$V_{CC} = 2.0\text{ V to }5.5\text{ V};$ $I_O = -50\text{ }\mu\text{A}$	$V_{CC}-0.1$	-	-	$V_{CC}-0.1$	-	$V_{CC}-0.1$	-	V
		$V_{CC} = 2.3\text{ V}; I_O = -2\text{ mA}$	2	-	-	2	-	2	-	V
		$V_{CC} = 3.0\text{ V}; I_O = -8\text{ mA}$	2.58	-	-	2.48	-	2.48	-	V
		$V_{CC} = 4.5\text{ V}; I_O = -16\text{ mA}$	3.94	-	-	3.8	-	3.8	-	V
$V_{OL}$	LOW-level output voltage	$V_I = V_{IH}$ or $V_{IL}$								V
		$V_{CC} = 2.0\text{ V to }5.5\text{ V};$ $I_O = 50\text{ }\mu\text{A}$	-	-	0.1	-	0.1	-	0.1	V
		$V_{CC} = 2.3\text{ V}; I_O = 2\text{ mA}$	-	-	0.4	-	0.4	-	0.4	V
		$V_{CC} = 3.0\text{ V}; I_O = 8\text{ mA}$	-	-	0.36	-	0.44	-	0.44	V
		$V_{CC} = 4.5\text{ V}; I_O = 16\text{ mA}$	-	-	0.44	-	0.55	-	0.55	V
$I_{OZ}$	OFF-state output current	$V_{CC} = 5.5\text{ V};$ $V_I = V_{IH}$ or $V_{IL};$ $V_O = \text{GND to }5.5\text{ V}$	-	-	$\pm 0.25$	-	$\pm 2.5$	-	$\pm 2.5$	$\mu\text{A}$

**Table 6. Static characteristics ...continued**  
 Voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions	25 °C			−40 °C to +85 °C		−40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
$I_{OFF}$	power-off leakage current	$V_I$ or $V_O = \text{GND to } 5.5 \text{ V};$ $V_{CC} = 0 \text{ V}$	-	-	0.5	-	5	-	5	$\mu\text{A}$
$I_I$	input leakage current	$V_I = V_{CC}$ or GND; $V_{CC} = 0 \text{ V to } 5.5 \text{ V}$	-	-	$\pm 0.1$	-	$\pm 1$	-	$\pm 1$	$\mu\text{A}$
$I_{CC}$	supply current	$V_I = V_{CC}$ or GND; $I_O = 0 \text{ A};$ $V_{CC} = 5.5 \text{ V}$	-	-	2	-	20	-	20	$\mu\text{A}$

## 10. Dynamic characteristics

**Table 7. Dynamic characteristics**  
 GND = 0 V. For test circuit, see [Figure 6](#).

Symbol	Parameter	Conditions	25 °C			−40 °C to +85 °C		−40 °C to +125 °C		Unit
			Min	Typ <sup>[1]</sup>	Max	Min	Max	Min	Max	
$t_{pd}$	propagation delay	An to Bn or Bn to An; see <a href="#">Figure 4</a>								
		$V_{CC} = 2.3 \text{ V to } 2.7 \text{ V}$								
		$C_L = 15 \text{ pF}$	-	5.2	13	1	15	1	17	ns
		$C_L = 50 \text{ pF}$	-	7.2	15.9	1	18	1	21	ns
		$V_{CC} = 3.0 \text{ V to } 3.6 \text{ V}$								
		$C_L = 15 \text{ pF}$	-	4.0	8.4	1	10	1	11	ns
		$C_L = 50 \text{ pF}$	-	5.6	11.9	1	13.5	1	14.5	ns
		$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}$								
$t_{en}$	enable time	$\overline{\text{OE}}$ to An or $\overline{\text{OE}}$ to Bn; see <a href="#">Figure 5</a>								
		$V_{CC} = 2.3 \text{ V to } 2.7 \text{ V}$								
		$C_L = 15 \text{ pF}$	-	6.5	19.9	1	22	1	24	ns
		$C_L = 50 \text{ pF}$	-	8.6	22.7	1	26	1	28	ns
		$V_{CC} = 3.0 \text{ V to } 3.6 \text{ V}$								
		$C_L = 15 \text{ pF}$	-	4.9	13.2	1	15.5	1	16.5	ns
		$C_L = 50 \text{ pF}$	-	6.6	16.7	1	19	1	20	ns
		$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}$								
$C_L = 15 \text{ pF}$	-	3.7	8.5	1	10	1	10.5	ns		
$C_L = 50 \text{ pF}$	-	5.1	10.6	1	12	1	12.5	ns		

**Table 7. Dynamic characteristics ...continued**  
 GND = 0 V. For test circuit, see [Figure 6](#).

Symbol	Parameter	Conditions	25 °C			-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Typ <sup>[1]</sup>	Max	Min	Max	Min	Max	
t <sub>dis</sub>	disable time	OE to An or OE to Bn; see <a href="#">[2]</a> <a href="#">Figure 5</a>								
		V <sub>CC</sub> = 2.3 V to 2.7 V								
		C <sub>L</sub> = 15 pF	-	6.8	18.1	1	20	1	22	ns
		C <sub>L</sub> = 50 pF	-	11.4	23.1	1	25	1	27	ns
		V <sub>CC</sub> = 3.0 V to 3.6 V								
		C <sub>L</sub> = 15 pF	-	5.4	16.5	1	19.5	1	20.5	ns
		C <sub>L</sub> = 50 pF	-	8.8	19.8	1	22	1	23	ns
		V <sub>CC</sub> = 4.5 V to 5.5 V								
		C <sub>L</sub> = 15 pF	-	4.2	12.8	1	14.2	1	14.7	ns
		C <sub>L</sub> = 50 pF	-	6.5	14.7	1	16	1	16.5	ns
t <sub>sk(o)</sub>	output skew time	C <sub>L</sub> = 50 pF								
		V <sub>CC</sub> = 2.3 V to 2.7 V	-	-	2	-	2	-	2	ns
		V <sub>CC</sub> = 3.0 V to 3.6 V	-	-	1.5	-	1.5	-	1.5	ns
		V <sub>CC</sub> = 4.5 V to 5.5 V	-	-	1	-	1	-	1	ns
C <sub>I</sub>	input capacitance	V <sub>I</sub> = V <sub>CC</sub> or GND; V <sub>CC</sub> = 3.3 V	-	2	6	-	6	-	6	pF
C <sub>I/O</sub>	input/output capacitance	V <sub>O</sub> = V <sub>CC</sub> or GND; V <sub>CC</sub> = 3.3 V	-	5.5	-	-	-	-	-	pF
C <sub>PD</sub>	power dissipation capacitance	per buffer; <a href="#">[3]</a> C <sub>L</sub> = 50 pF; f = 10 MHz; V <sub>I</sub> = GND to V <sub>CC</sub>								
		V <sub>CC</sub> = 3.3 V	-	9.5	-	-	-	-	-	pF
		V <sub>CC</sub> = 5.0 V	-	10.4	-	-	-	-	-	pF

[1] Typical values are measured at T<sub>amb</sub> = 25 °C and V<sub>CC</sub> = 2.5 V, 3.3 V, and 5 V respectively, unless otherwise specified.

[2] t<sub>pd</sub> is the same as t<sub>PLH</sub> and t<sub>PHL</sub>.  
 t<sub>en</sub> is the same as t<sub>PZL</sub> and t<sub>PZH</sub>.  
 t<sub>dis</sub> is the same as t<sub>PLZ</sub> and t<sub>PHZ</sub>.

[3] C<sub>PD</sub> is used to determine the dynamic power dissipation P<sub>D</sub> (μW).

$$P_D = C_{PD} \times V_{CC}^2 \times f_i + \sum (C_L \times V_{CC}^2 \times f_o) \text{ where:}$$

f<sub>i</sub> = input frequency in MHz;

f<sub>o</sub> = output frequency in MHz;

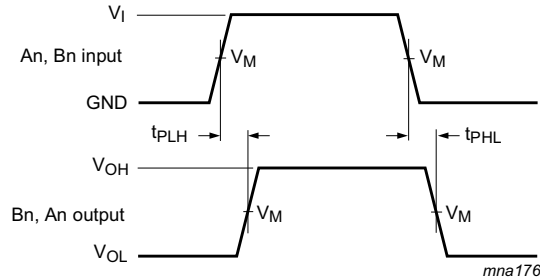
C<sub>L</sub> = output load capacitance in pF;

V<sub>CC</sub> = supply voltage in Volts.

**Table 8. Noise characteristics**  
 GND = 0 V. For test circuit, see [Figure 6](#).

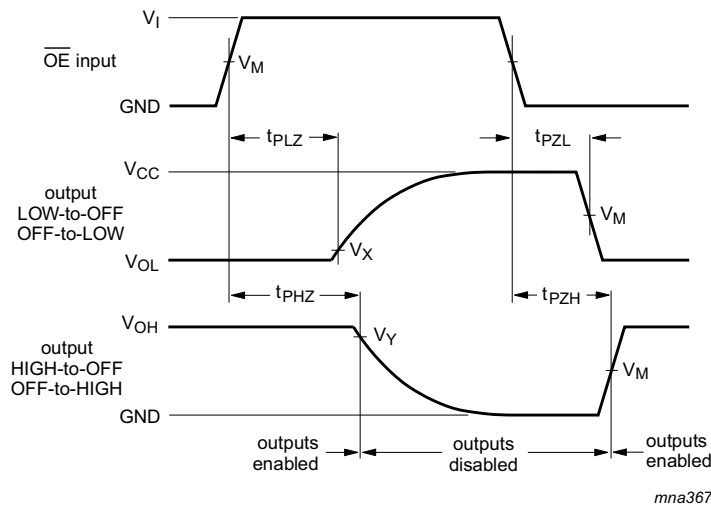
Symbol	Parameter	Conditions	T <sub>amb</sub> = 25 °C			Unit
			Min	Typ	Max	
<b>V<sub>CC</sub> = 3.3 V; C<sub>L</sub> = 50 pF</b>						
V <sub>OL(p)</sub>	LOW-level output voltage (peak)		-	0.3	0.8	V
V <sub>OL(v)</sub>	LOW-level output voltage (valley)		-0.8	-0.2	-	V
V <sub>OH(v)</sub>	HIGH-level output voltage (valley)		-	2.9	-	V
V <sub>IH(AC)</sub>	AC HIGH-level input voltage	dynamic	2.31	-	-	V
V <sub>IL(AC)</sub>	AC LOW-level input voltage	dynamic	-	-	0.99	V

## 11. Waveforms



Measurement points are given in [Table 9](#).  
 V<sub>OL</sub> and V<sub>OH</sub> are typical voltage output levels that occur with the output load.

**Fig 4. Propagation delay input (An, Bn) to output (Bn, An)**



Measurement points are given in [Table 9](#).  
 V<sub>OL</sub> and V<sub>OH</sub> are typical voltage output levels that occur with the output load.

**Fig 5. Enable and disable times**



Table 9. Measurement points

Input	Output		
$V_M$	$V_M$	$V_X$	$V_Y$
$0.5V_{CC}$	$0.5V_{CC}$	$V_{OL} + 0.3 V$	$V_{OH} - 0.3 V$

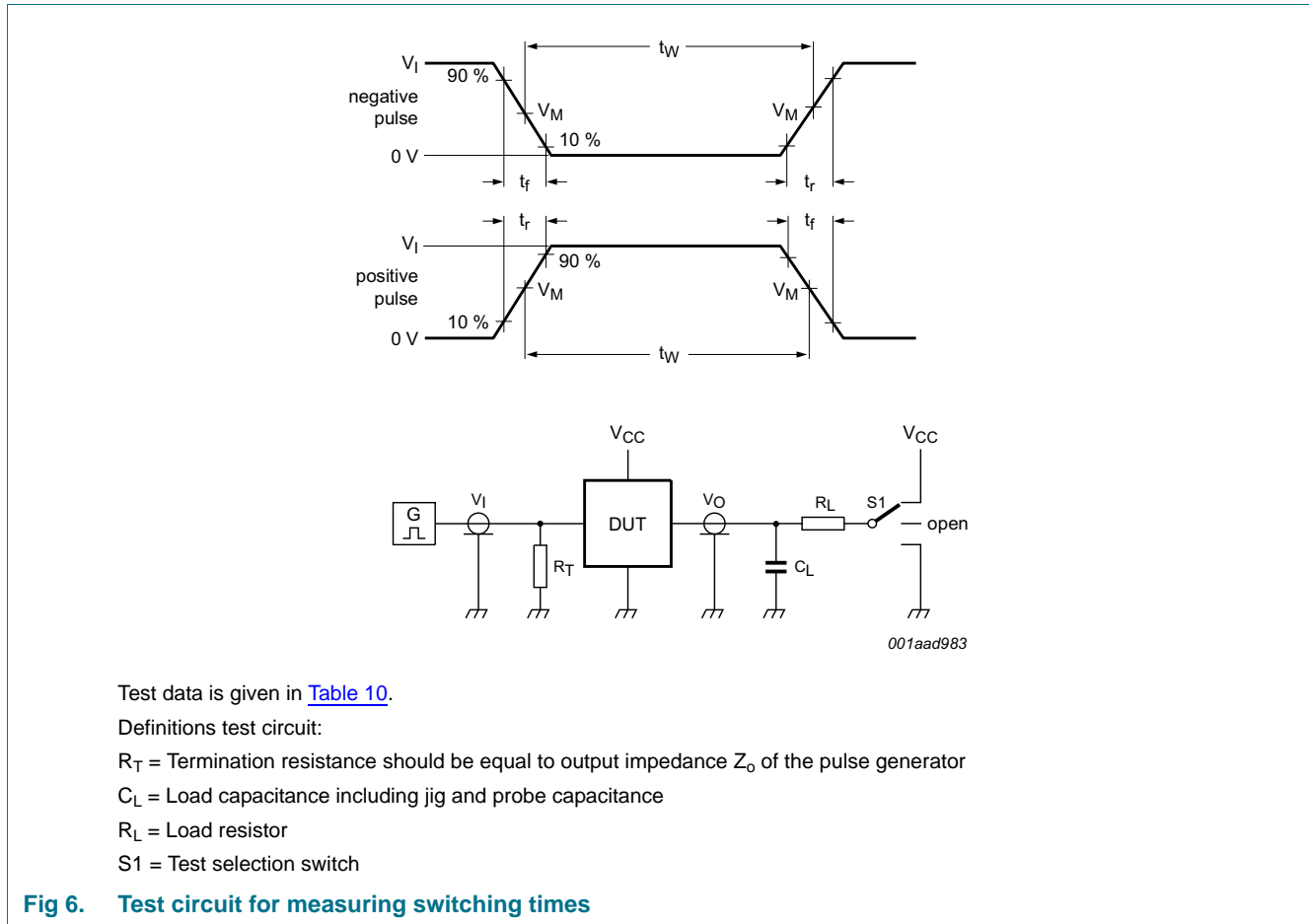


Fig 6. Test circuit for measuring switching times

Table 10. Test data

Input		Load		S1 position		
$V_I$	$t_r, t_f$	$C_L$	$R_L$	$t_{PHL}, t_{PLH}$	$t_{PZH}, t_{PHZ}$	$t_{PZL}, t_{PLZ}$
GND to $V_{CC}$	3.0 ns	15 pF, 50 pF	1 k $\Omega$	open	GND	$V_{CC}$

## 12. Package outline

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

SOT360-1

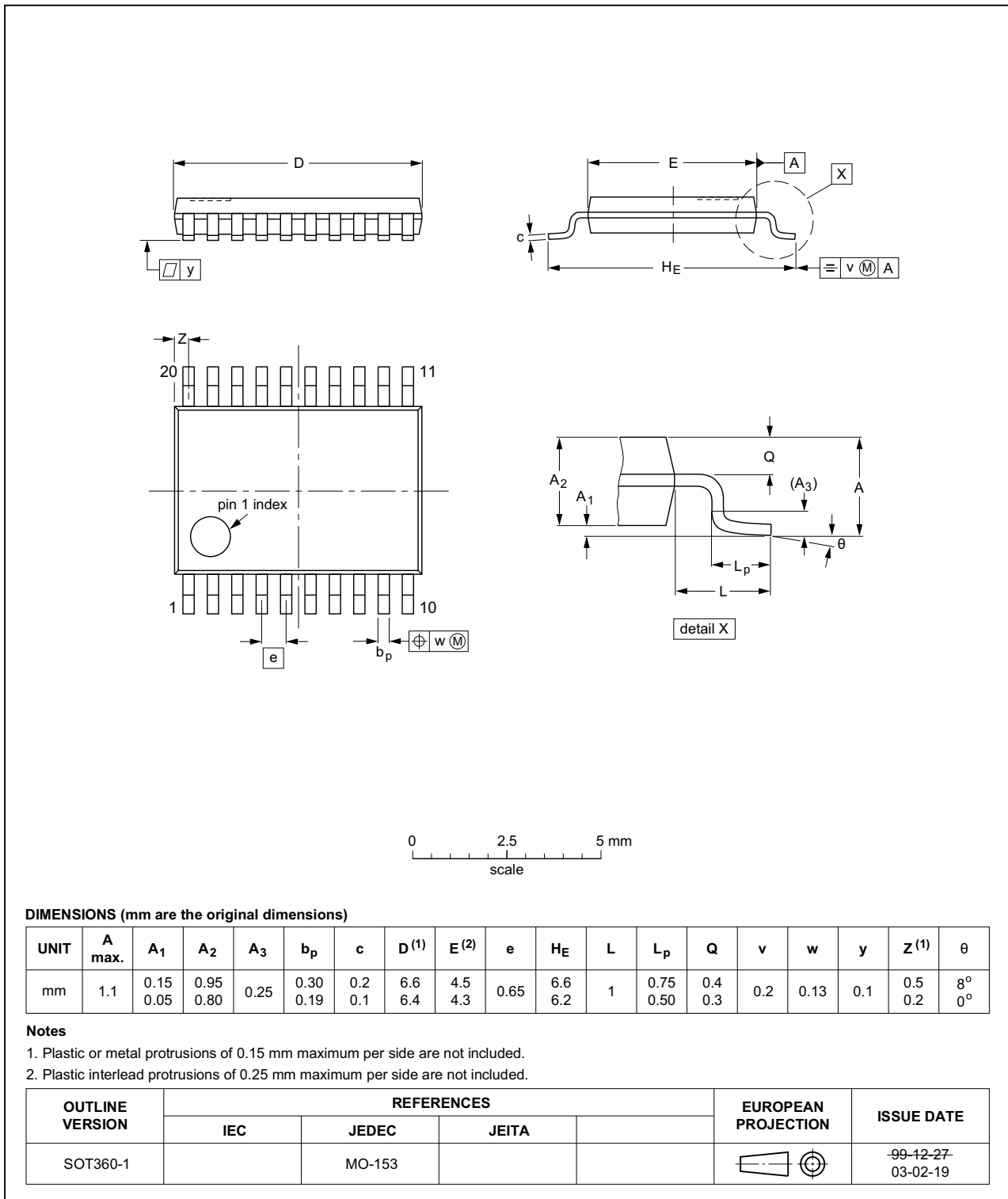


Fig 7. Package outline SOT360-1 (TSSOP20)

## 13. Abbreviations

Table 11. Abbreviations

Acronym	Description
CDM	Charge Device Model
DUT	Device Under Test
ESD	ElectroStatic Discharge
HBM	Human Body Model
MM	Machine Model

## 14. Revision history

Table 12. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74LV245A v.2	20161103	Product data sheet	-	74LV245A v.1
Modifications:	• Type number 74LV245ABQ removed.			
74LV245A v.1	20160610	Product data sheet	-	-

## 15. Legal information

### 15.1 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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Компания «Океан Электроники» предлагает заключение долгосрочных отношений при поставках импортных электронных компонентов на взаимовыгодных условиях!

Наши преимущества:

- Поставка оригинальных импортных электронных компонентов напрямую с производств Америки, Европы и Азии, а так же с крупнейших складов мира;
- Широкая линейка поставок активных и пассивных импортных электронных компонентов (более 30 млн. наименований);
- Поставка сложных, дефицитных, либо снятых с производства позиций;
- Оперативные сроки поставки под заказ (от 5 рабочих дней);
- Экспресс доставка в любую точку России;
- Помощь Конструкторского Отдела и консультации квалифицированных инженеров;
- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
- Поставка электронных компонентов под контролем ВП;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- При необходимости вся продукция военного и аэрокосмического назначения проходит испытания и сертификацию в лаборатории (по согласованию с заказчиком);
- Поставка специализированных компонентов военного и аэрокосмического уровня качества (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Actel, Aeroflex, Peregrine, VPT, Syfer, Eurofarad, Texas Instruments, MS Kennedy, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits, General Dynamics и др.);

Компания «Океан Электроники» является официальным дистрибьютором и эксклюзивным представителем в России одного из крупнейших производителей разъемов военного и аэрокосмического назначения «JONHON», а так же официальным дистрибьютором и эксклюзивным представителем в России производителя высокотехнологичных и надежных решений для передачи СВЧ сигналов «FORSTAR».



## JONHON

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(Применяются в военной, авиационной, аэрокосмической, морской, железнодорожной, горно- и нефтедобывающей отраслях промышленности)

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ВЧ соединители, коаксиальные кабели, кабельные сборки и микроволновые компоненты:

(Применяются в телекоммуникациях гражданского и специального назначения, в средствах связи, РЛС, а так же военной, авиационной и аэрокосмической отраслях промышленности).



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