# **74AHCV245A**

# Octal bus transceiver; 3-state Rev. 2 — 8 November 2016

**Product data sheet** 

#### **General description** 1.

The 74AHCV245A is an 8-bit transceiver with 3-state outputs and Schmitt trigger inputs. The device features an output enable (OE) and send/receive (DIR) for direction control. A HIGH on 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.

The data (An, Bn) and control (OE and DIR) inputs include Schmitt trigger inputs. These inputs can of transform slowly changing input signals into sharply defined, jitter-free output signals.

This device is ideal for driving bus lines or buffer memory address registers. It features inputs and outputs on opposite sides of the package to facilitate printed circuit board layout.

This device is fully specified for partial Power-down applications using I<sub>OFF</sub>. The I<sub>OFF</sub> circuitry disables the output, preventing the damaging backflow current through the device when it is powered down.

#### Features and benefits 2.

- Wide supply voltage range from 1.8 V to 5.5 V
- Typical t<sub>pd</sub> of 3.2 ns at 5 V
- Typical  $V_{OL(p)}$  < 0.8 V at  $V_{CC}$  = 3.3 V,  $T_{amb}$  = 25 °C
- Typical  $V_{OH(v)} > 2.3 \text{ V}$  at  $V_{CC} = 3.3 \text{ V}$ ,  $T_{amb} = 25 ^{\circ}\text{C}$
- Supports mixed-mode voltage operation on all ports
- I<sub>OFF</sub> 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

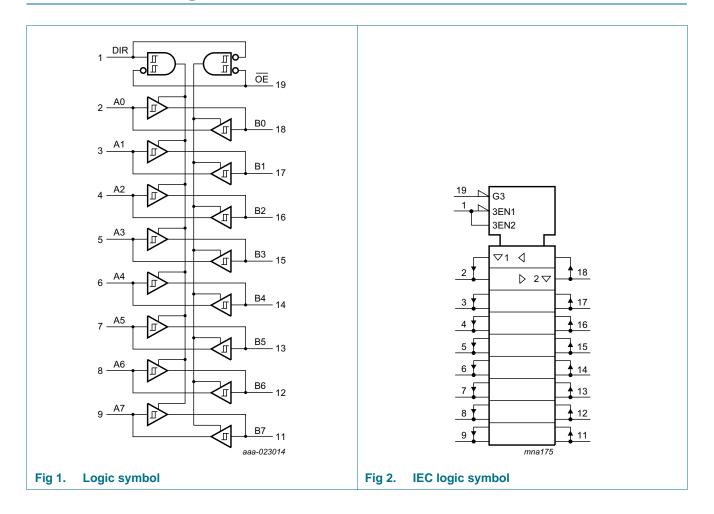


# 3. Ordering information

Table 1. Ordering information

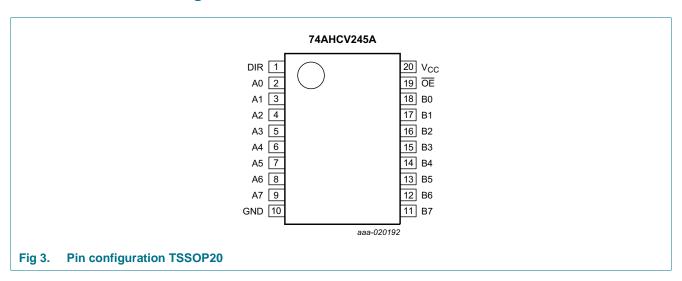
Type number	Package							
	Temperature range	Name	Description	Version				
74AHCV245APW	–40 °C to +125 °C	TSSOP20	plastic thin shrink small outline package; 20 leads; body width 4.4 mm	SOT360-1				

# 4. Functional diagram



# 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
ŌĒ	19	output enable input (active LOW)
V <sub>CC</sub>	20	supply voltage

# 6. Functional description

Table 3. Function table[1]

Input		Input/output			
OE	DIR	An	Bn		
L	L	A = B	input		
L	Н	input	B = A		
Н	X	Z	Z		

<sup>[1]</sup> 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
VI	input voltage		[1]	-0.5	+7.0	V
Vo	output voltage	active mode	[2][3]	-0.5	V <sub>CC</sub> + 0.5	V
		power-down or 3-state mode	[2]	-0.5	+7.0	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
Io	output current	$V_O = 0 \text{ V to } V_{CC}$		-	±50	mA
I <sub>CC</sub>	supply current			-	100	mA
I <sub>GND</sub>	ground current			-100	-	mA
T <sub>stg</sub>	storage temperature			-65	+150	°C
P <sub>tot</sub>	total power dissipation	$T_{amb} = -40  ^{\circ}\text{C} \text{ to } +125  ^{\circ}\text{C}$	<u>[4]</u>	-	500	mW

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

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

<sup>[3]</sup> This value is limited to 7.0 V maximum.

<sup>[4]</sup> For TSSOP20 package: above 100 °C, the value of Ptot 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 <sub>CC</sub>	supply voltage		1.8	5.5	V
VI	input voltage		0	5.5	V
Vo	output voltage	active mode	0	V <sub>CC</sub>	V
		power-down or 3-state mode	0	5.5	V
T <sub>amb</sub>	ambient temperature		-40	+125	°C
Δt/ΔV	input transition rise and fall rate	V <sub>CC</sub> = 2.3 V to 2.7 V	-	50	ms/V
		V <sub>CC</sub> = 3.0 V to 3.6 V	-	20	ms/V
		V <sub>CC</sub> = 4.5 V to 5.5 V	-	1	ms/V

### 9. Static characteristics

#### Table 6. Static characteristics

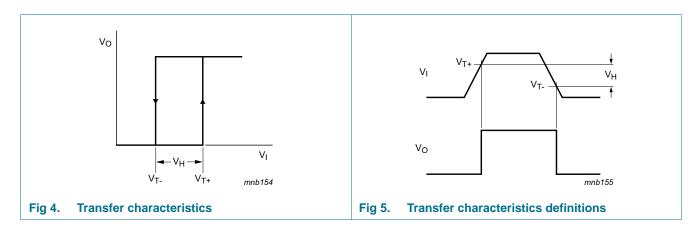
Voltages are referenced to GND (ground = 0 V).

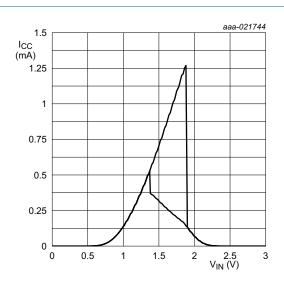
Symbol	Parameter	Conditions		25 °C		-40 °C to	o +85 °C	–40 °C to +125 °C		Unit
			Min	Тур	Max	Min	Max	Min	Max	
$V_{T+}$	positive-going	V <sub>CC</sub> = 1.8 V	-	-	1.65	-	1.65	-	1.65	V
	threshold	V <sub>CC</sub> = 2.3 V	-	-	1.85	-	1.85	-	1.85	V
	voltage	V <sub>CC</sub> = 3.0 V	-	-	2.2	-	2.2	-	2.2	V
		V <sub>CC</sub> = 4.5 V	-	-	3.15	-	3.15	-	3.15	٧
		V <sub>CC</sub> = 5.5 V	-	-	3.85	-	3.85	-	3.85	V
$V_{T-}$	negative-going	V <sub>CC</sub> = 1.8 V	0.15	-	-	0.15	-	0.15	-	V
	threshold	V <sub>CC</sub> = 2.3 V	0.45	-	-	0.45	-	0.45	-	V
	voltage	V <sub>CC</sub> = 3.0 V	0.9	-	-	0.9	-	0.9	-	V
		V <sub>CC</sub> = 4.5 V	1.35	-	-	1.35	-	1.35	-	V
		V <sub>CC</sub> = 5.5 V	1.65	-	-	1.65	-	1.65	-	V
$V_{H}$	hysteresis	V <sub>CC</sub> = 1.8 V	0.15	-	1.05	0.15	1.05	0.15	1.05	V
	voltage	V <sub>CC</sub> = 2.3 V	0.2	-	1.1	0.2	1.1	0.2	1.1	V
		V <sub>CC</sub> = 3.0 V	0.3	-	1.2	0.3	1.2	0.3	1.2	V
		V <sub>CC</sub> = 4.5 V	0.4	-	1.4	0.4	1.4	0.4	1.4	V
		V <sub>CC</sub> = 5.5 V	0.5	-	1.6	0.5	1.6	0.5	1.6	V
V <sub>OH</sub>	HIGH-level	$V_I = V_{T+}$ or $V_{T-}$								V
	output voltage	$I_O = -50 \mu A; V_{CC} = 1.8 \text{ V}$	1.7	1.8	-	1.7	-	1.7	-	V
		$I_O = -50 \mu A; V_{CC} = 3.0 \text{ V}$	2.9	3.0	-	2.9	-	2.9	-	V
		$I_O = -50 \mu A; V_{CC} = 4.5 V$	4.4	4.5	-	4.4	-	4.4	-	V
	_	$I_{O} = -8 \text{ mA}; V_{CC} = 3.0 \text{ V}$	2.58	-	-	2.48	-	2.48	-	V
		$I_{O} = -16 \text{ mA}; V_{CC} = 4.5 \text{ V}$	3.94	-	-	3.80	-	3.80	-	

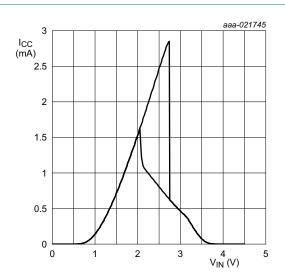
**Table 6. Static characteristics** ...continued Voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions		25 °C		-40 °C t	o +85 °C	-40 °C to +125 °C		Unit
			Min	Тур	Max	Min	Max	Min	Max	
$V_{OL}$	LOW-level	$V_I = V_{T+}$ or $V_{T-}$								
	output voltage	I <sub>O</sub> = 50 μA; V <sub>CC</sub> = 1.8 V	-	0	0.1	-	0.1	-	0.1	V
		$I_O = 50 \mu A; V_{CC} = 3.0 \text{ V}$	-	0	0.1	-	0.1	-	0.1	V
		$I_O = 50 \mu A; V_{CC} = 4.5 V$	-	0	0.1	-	0.1	-	0.1	V
		$I_O = 8 \text{ mA}; V_{CC} = 3.0 \text{ V}$	-	-	0.36	-	0.44	-	0.44	V
		$I_O = 16 \text{ mA}; V_{CC} = 4.5 \text{ V}$	-	-	0.44	-	0.55	-	0.55	V
I <sub>OZ</sub>	OFF-state output current	$V_{CC} = 5.5 \text{ V}; V_I = V_{IH} \text{ or } V_{IL};$ $V_O = \text{GND to } 5.5 \text{ V}$	-	-	±0.25	-	±2.5	-	±2.5	μΑ
I <sub>OFF</sub>	power-off leakage current	$V_I$ or $V_O$ = GND to 5.5 V; $V_{CC}$ = 0 V	-	-	0.5	-	5	-	5	μА
I <sub>I</sub>	input leakage current	$V_I = V_{CC}$ or GND; $V_{CC} = 0$ V to 5.5 V	-	-	±0.1	-	±1	-	±1	μΑ
I <sub>CC</sub>	supply current	$V_I = V_{CC}$ or GND; $I_O = 0$ A; $V_{CC} = 5.5 \text{ V}$	-	-	2	-	20	-	20	μΑ

### 9.1 Transfer characteristics waveforms

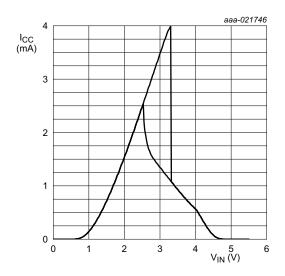






a.  $V_{CC} = 3.0 \text{ V}$ 





c.  $V_{CC} = 5.5 \text{ V}$ 

Fig 6. Typical transfer characteristics

# 10. Dynamic characteristics

Table 7. Dynamic characteristics

GND = 0 V. For test circuit, see Figure 9.

Symbol	Parameter	Conditions		25 °C		-40 °C 1	to +85 °C	-40 °C to +125 °C		Unit
			Min	Typ[1]	Max	Min	Max	Min	Max	
t <sub>pd</sub>	propagation delay	An to Bn or Bn to An; see [2] Figure 7								
		V <sub>CC</sub> = 2.3 V to 2.7 V								
		C <sub>L</sub> = 15 pF	-	5.3	13	1	15	1	16.3	ns
		C <sub>L</sub> = 50 pF	-	7.3	15.9	1	18	1	19.4	ns
		V <sub>CC</sub> = 3.0 V to 3.6 V								
		C <sub>L</sub> = 15 pF	-	4.1	8.4	1	10	1	10.9	ns
		C <sub>L</sub> = 50 pF	-	5.7	11.9	1	13.5	1	14.6	ns
		V <sub>CC</sub> = 4.5 V to 5.5 V								
		C <sub>L</sub> = 15 pF	-	3.2	5.5	1	6.5	1	7	ns
		C <sub>L</sub> = 50 pF	-	4.5	7.5	1	8.5	1	9.3	ns
t <sub>en</sub>	enable time	OE to An or OE to Bn; see [2] Figure 8								
		V <sub>CC</sub> = 2.3 V to 2.7 V								
		C <sub>L</sub> = 15 pF	-	6.5	19.9	1	22	1	23	ns
		C <sub>L</sub> = 50 pF	-	8.6	22.7	1	26	1	27	ns
		V <sub>CC</sub> = 3.0 V to 3.6 V								
		C <sub>L</sub> = 15 pF	-	4.9	13.2	1	15.5	1	16	ns
		C <sub>L</sub> = 50 pF	-	6.6	16.7	1	19	1	20	ns
		V <sub>CC</sub> = 4.5 V to 5.5 V								
		C <sub>L</sub> = 15 pF	-	3.7	8.5	1	10	1	10.5	ns
		C <sub>L</sub> = 50 pF	-	5.1	10.6	1	12	1	12.5	ns
t <sub>dis</sub>	disable time	OE to An or OE to Bn; see Figure 8								
		V <sub>CC</sub> = 2.3 V to 2.7 V								
		C <sub>L</sub> = 15 pF	-	7	15.1	1	16.7	1	17.8	ns
		$C_L = 50 \text{ pF}$	-	11.6	23.1	1	25	1	26	ns
		$V_{CC} = 3.0 \text{ V to } 3.6 \text{ V}$								
		C <sub>L</sub> = 15 pF	-	5.7	10.5	1	12.3	1	13.2	ns
		C <sub>L</sub> = 50 pF	-	9.1	15.8	1	18	1	19	ns
		$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}$								
		C <sub>L</sub> = 15 pF	-	4.5	6.9	1	8	1	8.5	ns
		C <sub>L</sub> = 50 pF	-	6.7	9.7	1	11	1	11.5	ns
t <sub>sk(o)</sub>	output skew	C <sub>L</sub> = 50 pF								
	time	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

 Table 7.
 Dynamic characteristics ...continued

GND = 0 V. For test circuit, see Figure 9.

Symbol	Parameter	Conditions	25 °C			-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Typ[1]	Max	Min	Max	Min	Max	
Cı	input capacitance	$V_I = V_{CC}$ or GND; $V_{CC} = 3.3 \text{ V}$	-	2	6	-	6	-	6	pF
C <sub>I/O</sub>	input/output capacitance	$V_O = V_{CC}$ or GND; $V_{CC} = 3.3 \text{ V}$	-	5.5	-	-	-	-	-	pF
C <sub>PD</sub>	power dissipation capacitance	per buffer; [3] $C_L = 0$ pF; $f = 10$ MHz; $V_{CC} = 5$ V; $V_I = GND$ to $V_{CC}$	-	13.8	-	-	-	-	-	pF

- [1] Typical values are measured at  $T_{amb} = 25$  °C and  $V_{CC} = 2.5$  V, 3.3 V, and 5 V respectively, unless otherwise specified.
- [2]  $t_{pd}$  is the same as  $t_{PLH}$  and  $t_{PHL}$ .

 $t_{en}$  is the same as  $t_{PZL}$  and  $t_{PZH}$ .

 $t_{dis}$  is the same as  $t_{PLZ}$  and  $t_{PHZ}$ .

[3]  $C_{PD}$  is used to determine the dynamic power dissipation  $P_D$  ( $\mu W$ ).

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

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

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

 $C_L$  = 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 9.

Symbol	Parameter	Conditions	T	T <sub>amb</sub> = 25 °C			
			Min	Тур	Max		
$V_{CC} = 3.3$	V; C <sub>L</sub> = 50 pF			,	•		
$V_{OL(p)}$	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	
$V_{CC} = 5.0$	V; C <sub>L</sub> = 50 pF	<u>'</u>					
$V_{OL(p)}$	LOW-level output voltage (peak)		-	0.6	1.5	V	
V <sub>OL(v)</sub>	LOW-level output voltage (valley)		-1.5	-0.6	-	V	
V <sub>OH(v)</sub>	HIGH-level output voltage (valley)		-	4.0	-	V	
V <sub>IH(AC)</sub>	AC HIGH-level input voltage	dynamic	3.5	-	-	V	
V <sub>IL(AC)</sub>	AC LOW-level input voltage	dynamic	-	-	1.5	V	

### 11. Waveforms

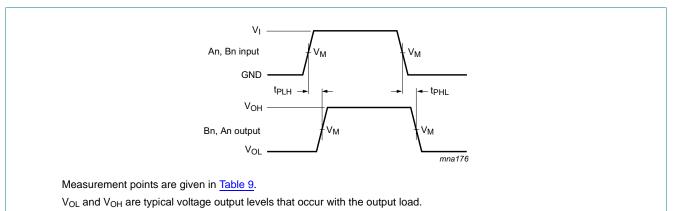


Fig 7. Propagation delay input (An, Bn) to output (Bn, An)

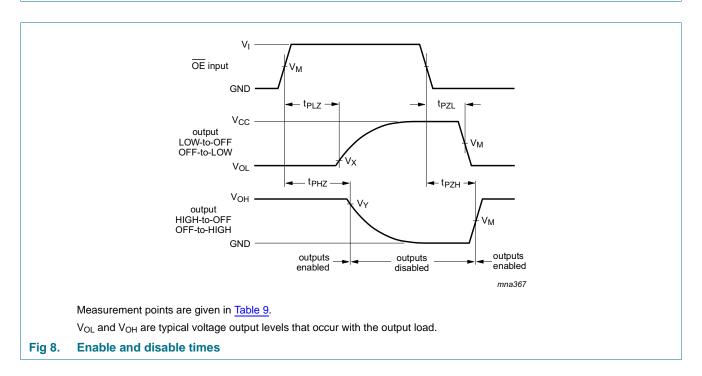
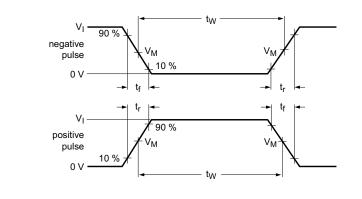
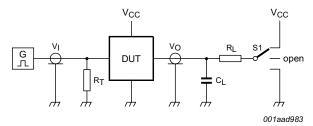


Table 9. Measurement points

Input	Output		
V <sub>M</sub>	V <sub>M</sub>	V <sub>X</sub>	V <sub>Y</sub>
0.5V <sub>CC</sub>	0.5V <sub>CC</sub>	V <sub>OL</sub> + 0.3 V	V <sub>OH</sub> – 0.3 V





Test data is given in Table 10.

Definitions test circuit:

 $R_T$  = Termination resistance should be equal to output impedance  $Z_0$  of the pulse generator

 $C_L$  = Load capacitance including jig and probe capacitance

R<sub>L</sub> = Load resistor

S1 = Test selection switch

Fig 9. Test circuit for measuring switching times

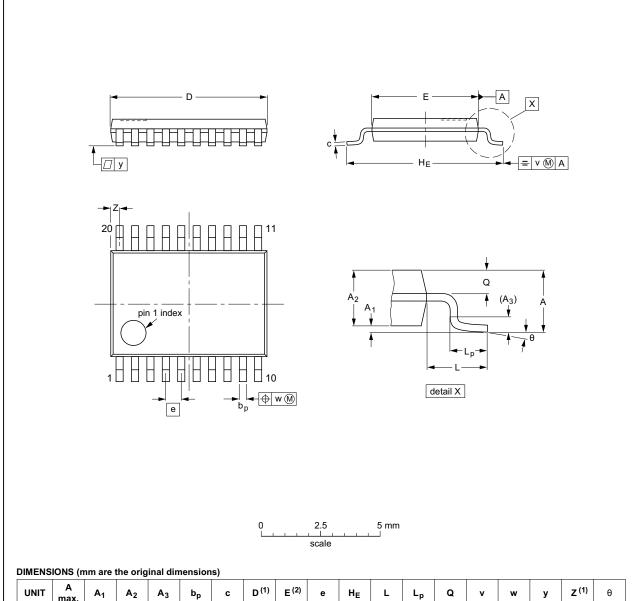
Table 10. Test data

Input Load			S1 position			
VI	t <sub>r</sub> , t <sub>f</sub>	C <sub>L</sub> R <sub>L</sub>		t <sub>PHL</sub> , t <sub>PLH</sub> t <sub>PZH</sub> , t <sub>PHZ</sub>		t <sub>PZL</sub> , t <sub>PLZ</sub>
GND to V <sub>CC</sub>	3.0 ns	15 pF, 50 pF	1 kΩ	open	GND	V <sub>CC</sub>

# 12. Package outline

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

SOT360-1



UNIT	A max.	A <sub>1</sub>	A <sub>2</sub>	<b>A</b> <sub>3</sub>	bp	С	D <sup>(1)</sup>	E (2)	е	HE	L	Lp	Q	٧	w	у	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		REFER	EUROPEAN	ISSUE DATE			
VERSION	IEC	JEDEC	JEITA		PROJECTION	ISSUE DATE	
SOT360-1		MO-153				<del>99-12-27</del> 03-02-19	
	VERSION	VERSION IEC	VERSION IEC JEDEC	VERSION IEC JEDEC JEITA	VERSION IEC JEDEC JEITA	VERSION IEC JEDEC JEITA PROJECTION	

Fig 10. Package outline SOT360-1 (TSSOP20)

74AHCV245A

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# 13. Abbreviations

#### Table 11. Abbreviations

Acronym	Description
CDM	Charge Device Model
DUT	Device Under Test
ESD	ElectroStatic Discharge
НВМ	Human Body Model
MM	Machine Model
TTL	Transistor-Transistor Logic

# 14. Revision history

#### Table 12. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes		
74AHCV245A v.2	20161108	Product data sheet	-	74AHCV245A v.1		
Modifications:	Type number 74AHCV245ABQ removed.					
74AHCV245A v.1	20160610	Product data sheet	-	-		

### 15. Legal information

#### 15.1 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"
- [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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# **74AHCV245A**

Octal bus transceiver; 3-state

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