74VHC245; 74VHCT245

Octal bus transceiver; 3-state Rev. 3 — 29 November 2024

Product data sheet

1. General description

The 74VHC245; 74VHCT245 are high-speed Si-gate CMOS devices.

The 74VHC245; 74VHCT245 are octal transceivers featuring non-inverting 3-state bus compatible outputs in both send and receive directions.

The 74VHC245; 74VHCT245 feature an output enable input (\overline{OE}), for easy cascading, and a send and receive direction control input (DIR).

OE controls the outputs so that the buses are effectively isolated.

2. Features and benefits

- · Balanced propagation delays
- All inputs have Schmitt-trigger action
- Inputs accept voltages higher than V_{CC}
- Input levels:
 - The 74VHC245 operates with CMOS input level
 - The 74VHCT245 operates with TTL input level
- ESD protection:
 - HBM: ANSI/ESDA/JEDEC JS-001 class 2 exceeds 2000 V
 - CDM: ANSI/ESDA/JEDEC JS-002 class C3 exceeds 1000 V
- Multiple package options
- Specified from -40 °C to +85 °C and from -40 °C to +125 °C

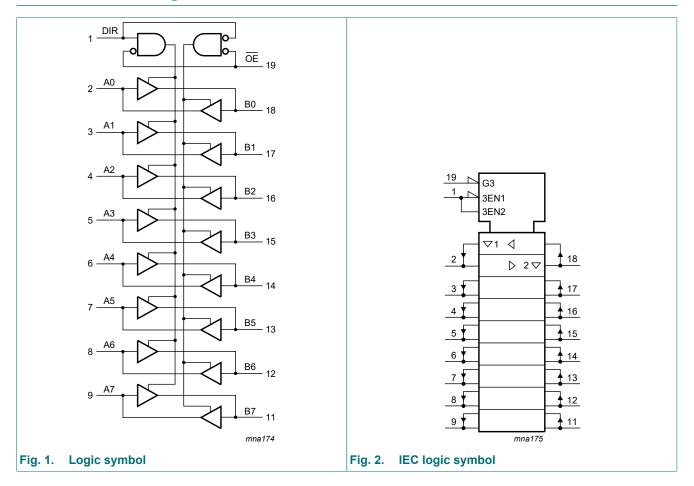
3. Ordering information

Table 1. Ordering information

Type number	Package									
	Temperature range	Name	Description	Version						
74VHC245D 74VHCT245D	-40 °C to +125 °C	SO20	plastic small outline package; 20 leads; body width 7.5 mm	SOT163-1						
74VHC245PW 74VHCT245PW	-40 °C to +125 °C	TSSOP20	plastic thin shrink small outline package; 20 leads; body width 4.4 mm	SOT360-1						
74VHC245BQ 74VHCT245BQ	-40 °C to +125 °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						

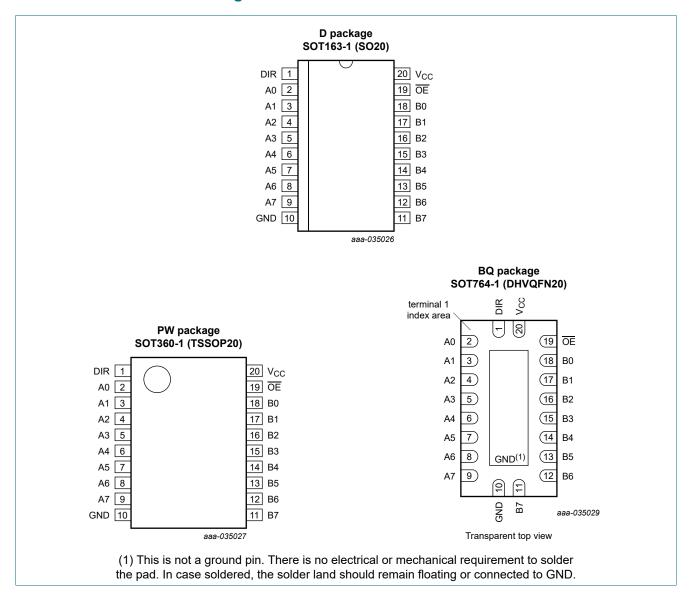


4. Functional diagram



5. Pinning information

5.1. Pinning



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
ŌĒ	19	output enable input (active LOW)
V _{CC}	20	supply voltage

74VHC_VHCT245

6. Functional description

Table 3. Function table

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

Control		Input/output				
OE	DIR DIR		Bn			
L	L	A = B	inputs			
L	Н	inputs	B = A			
Н	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 _{CC}	supply voltage			-0.5	+7.0	V
VI	input voltage			-0.5	+7.0	V
I _{IK}	input clamping current	V _I < -0.5 V	[1]	-20	-	mA
I _{OK}	output clamping current	V_{O} < -0.5 V or V_{O} > V_{CC} + 0.5 V	[1]	-20	+20	mA
Io	output current	$V_{O} = -0.5 \text{ V to } (V_{CC} + 0.5 \text{ V})$		-25	+25	mA
I _{CC}	supply current			-	+75	mA
I _{GND}	ground current			-75	-	mA
T _{stg}	storage temperature			-65	+150	°C
P _{tot}	total power dissipation	T _{amb} = -40 °C to +125 °C	[2]	-	500	mW

^[1] The input and output voltage ratings may be exceeded if the input and output current ratings are observed.

For SOT360-1 (TSSOP20) package: Ptot derates linearly with 10.0 mW/K above 100 °C.

For SOT764-1 (DHVQFN20) package: Ptot derates linearly with 12.9 mW/K above 111 °C.

8. Recommended operating conditions

Table 5. Operating conditions

Symbol	Parameter	Conditions	Min	Тур	Max	Unit
74VHC2	45					
V_{CC}	supply voltage		2.0	5.0	5.5	V
VI	input voltage		0	-	5.5	V
V _O	output voltage		0	-	V _{CC}	V
T _{amb}	ambient temperature		-40	+25	+125	°C
Δt/ΔV	input transition rise and fall rate	V _{CC} = 3.0 V to 3.6 V	-	-	100	ns/V
		V _{CC} = 4.5 V to 5.5 V	-	-	20	ns/V

^[2] For SOT163-1 (SO20) package: Ptot derates linearly with 12.3 mW/K above 109 °C.

Symbol	Parameter	Conditions	Min	Тур	Max	Unit
74VHCT	245					
V _{CC}	supply voltage		4.5	5.0	5.5	V
VI	input voltage		0	-	5.5	V
Vo	output voltage		0	-	V _{CC}	V
T _{amb}	ambient temperature		-40	+25	+125	°C
Δt/ΔV	input transition rise and fall rate	V _{CC} = 4.5 V to 5.5 V	-	-	20	ns/V

9. Static characteristics

Table 6. Static characteristics

At recommended operating conditions; 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	Тур	Max	Min	Max	Min	Max	
74VHC2	45									
V _{IH}	HIGH-level	V _{CC} = 2.0 V	1.5	-	-	1.5	-	1.5	-	V
	input voltage	V _{CC} = 3.0 V	2.1	-	-	2.1	-	2.1	-	V
		V _{CC} = 5.5 V	3.85	-	-	3.85	-	3.85	-	٧
V _{IL}	LOW-level	V _{CC} = 2.0 V	-	-	0.5	-	0.5	-	0.5	٧
input voltage	V _{CC} = 3.0 V	-	-	0.9	-	0.9	-	0.9	٧	
		V _{CC} = 5.5 V	-	-	1.65	-	1.65	-	1.65	٧
V _{OH}	HIGH-level	$V_I = V_{IH}$ or V_{IL}								
output voltage	I _O = -50 μA; V _{CC} = 2.0 V	1.9	2.0	-	1.9	-	1.9	-	٧	
		I _O = -50 μA; V _{CC} = 3.0 V	2.9	3.0	-	2.9	-	2.9	-	٧
		I _O = -50 μA; V _{CC} = 4.5 V	4.4	4.5	-	4.4	-	4.4	-	٧
		I _O = -4.0 mA; V _{CC} = 3.0 V	2.58	-	-	2.48	-	2.40	-	V
		I _O = -8.0 mA; V _{CC} = 4.5 V	3.94	-	-	3.80	-	3.70	-	V
V _{OL}	LOW-level output voltage	$V_I = V_{IH}$ or V_{IL}								
		I _O = 50 μA; V _{CC} = 2.0 V	-	0	0.1	-	0.1	-	0.1	٧
		I _O = 50 μA; V _{CC} = 3.0 V	-	0	0.1	-	0.1	-	0.1	٧
		I _O = 50 μA; V _{CC} = 4.5 V	-	0	0.1	-	0.1	-	0.1	٧
		I _O = 4.0 mA; V _{CC} = 3.0 V	-	-	0.36	-	0.44	-	0.55	٧
		I _O = 8.0 mA; V _{CC} = 4.5 V	-	-	0.36	-	0.44	-	0.55	٧
I _I	input leakage current	V _I = 5.5 V or GND; V _{CC} = 0 V to 5.5 V	-	-	0.1	-	1.0	-	2.0	μΑ
l _{OZ}	OFF-state output current	$V_I = V_{IH}$ or V_{IL} ; $V_O = V_{CC}$ or GND; $V_{CC} = 5.5 \text{ V}$	-	-	±0.25	-	±2.5	-	±10.0	μΑ
I _{CC}	supply current	$V_I = V_{CC}$ or GND; $I_O = 0$ A; $V_{CC} = 5.5 \text{ V}$	-	-	4.0	-	40	-	80	μA
Cı	input capacitance	V _I = V _{CC} or GND	-	3	10	-	10	-	10	pF
Co	output capacitance		-	4	-	-	-	-	-	pF

Symbol	Parameter	Conditions		25 °C		-40 °C	to +85 °C	-40 °C to +125 °C		Unit
			Min	Тур	Max	Min	Max	Min	Max	
74VHCT	245		ı							
V _{IH}	HIGH-level input voltage	V _{CC} = 4.5 V to 5.5 V	2.0	-	-	2.0	-	2.0	-	V
V _{IL}	LOW-level input voltage	V _{CC} = 4.5 V to 5.5 V	-	-	0.8	-	0.8	-	0.8	V
V _{OH}	HIGH-level	$V_I = V_{IH}$ or V_{IL} ; $V_{CC} = 4.5 V$								
output voltage	I _O = -50 μA	4.4	4.5	-	4.4	-	4.4	-	V	
		I _O = -8.0 mA	3.94	-	-	3.80	-	3.70	-	V
V _{OL}	LOW-level	$V_I = V_{IH}$ or V_{IL} ; $V_{CC} = 4.5 V$								
	output voltage	I _O = 50 μA	-	0	0.1	-	0.1	-	0.1	V
		I _O = 8.0 mA	-	-	0.36	-	0.44	-	0.55	V
I _I	input leakage current	V _I = 5.5 V or GND; V _{CC} = 0 V to 5.5 V	-	-	0.1	-	1.0	-	2.0	μA
l _{oz}	OFF-state output current	per input pin; $V_I = V_{IH}$ or V_{IL} ; other inputs at V_{CC} or GND; $V_O = V_{CC}$ or GND; $I_O = 0$ A; $V_{CC} = 5.5$ V	-	-	±0.25	-	±2.5	-	±10.0	μA
I _{CC}	supply current	$V_I = V_{CC}$ or GND; $I_O = 0$ A; $V_{CC} = 5.5$ V	-	-	4.0	-	40	-	80	μΑ
ΔI _{CC}	additional supply current	per input pin; $V_I = V_{CC} - 2.1 \text{ V}$; other pins at V_{CC} or GND; $I_O = 0 \text{ A}$; $V_{CC} = 4.5 \text{ V}$ to 5.5 V	-	-	1.35	-	1.5	-	1.5	mA
C _I	input capacitance	V _I = V _{CC} or GND	-	3	10	-	10	-	10	pF
Co	output capacitance		-	4	-	-	-	-	-	pF

10. Dynamic characteristics

Table 7. Dynamic characteristics

Voltages are referenced to GND (ground = 0 V); for test circuit see Fig. 5.

Symbol	Parameter	Conditions			25 °C		-40 °C	to +85 °C	-40 °C to +125 °C		Unit
				Min	Typ[1]	Max	Min	Max	Min	Max	
74VHC2	45				'		'				
t _{pd}	propagation delay	An to Bn; Bn to An; see Fig. 3	[2]								
		V _{CC} = 3.0 V to 3.6 V									
		C _L = 15 pF		-	5.0	8.4	1.0	10.0	1.0	10.5	ns
		C _L = 50 pF		-	6.5	11.9	1.0	13.5	1.0	15.0	ns
		V _{CC} = 4.5 V to 5.5 V									
		C _L = 15 pF		-	3.5	5.5	1.0	6.5	1.0	7.0	ns
		C _L = 50 pF			5.0	7.5	1.0	8.5	1.0	9.5	ns
t _{en}	enable time	OE to An; OE to Bn; signal name DIR; see Fig. 4	[3]								
		V _{CC} = 3.0 V to 3.6 V									
		C _L = 15 pF		-	6.5	13.2	1.0	15.5	1.0	16.5	ns
		C _L = 50 pF		-	9.0	16.7	1.0	19.0	1.0	21.0	ns
		V _{CC} = 4.5 V to 5.5 V									
		C _L = 15 pF		-	4.0	8.5	1.0	10.0	1.0	11.0	ns
		C _L = 50 pF		-	5.0	10.6	1.0	12.0	1.0	13.5	ns
t _{dis}	disable time	OE to An; OE to Bn; signal name DIR; see Fig. 4	[4]								
		V _{CC} = 3.0 V to 3.6 V									
		C _L = 15 pF		-	7.5	12.5	1.0	15.5	1.0	16.0	ns
		C _L = 50 pF		-	10.0	15.8	1.0	18.0	1.0	20.0	ns
		V _{CC} = 4.5 V to 5.5 V									
		C _L = 15 pF		-	4.5	7.8	1.0	9.2	1.0	10.0	ns
		C _L = 50 pF		-	6.0	9.7	1.0	11.0	1.0	12.5	ns
C _{PD}	power dissipation capacitance	$f_i = 1 \text{ MHz};$ $V_I = \text{GND to } V_{CC}$	[5]	-	12	-	-	-	-	-	pF

Symbol	Parameter	Conditions			25 °C		-40 °C	to +85 °C	-40 °C to +125 °C		Unit
				Min	Typ[1]	Max	Min	Max	Min	Max	
74VHCT	245; V _{CC} = 4.5	5 V to 5.5 V						,	'		
t _{pd}	propagation delay	An to Bn; Bn to An; see Fig. 3	[2]								
		C _L = 15 pF		-	3.5	7.7	1.0	8.5	1.0	10.0	ns
		C _L = 50 pF		-	4.5	8.7	1.0	9.5	1.0	11.0	ns
t _{en}	enable time	OE to An; OE to Bn; signal name DIR; see Fig. 4	[3]								
		C _L = 15 pF		-	5.0	13.8	1.0	15.0	1.0	17.5	ns
		C _L = 50 pF		-	6.0	14.8	1.0	16.0	1.0	18.5	ns
t _{dis}	disable time	OE to An; OE to Bn; signal name DIR; see Fig. 4	[4]								
		C _L = 15 pF		-	5.0	14.4	1.0	15.5	1.0	18.0	ns
		C _L = 50 pF		-	6.0	15.4	1.0	16.5	1.0	19.5	ns
C _{PD}	power dissipation capacitance	$f_i = 1 \text{ MHz};$ $V_I = \text{GND to } V_{CC}$	[5]	-	15	-	-	-	-	-	pF

- Typical values are measured at nominal supply voltage (V_{CC} = 3.3 V and V_{CC} = 5.0 V).
- 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}.
 C_{PD} is used to determine the dynamic power dissipation (P_D in μW).
 P_D = C_{PD} × V_{CC}² × f_i × N + Σ(C_L × V_{CC}² × f_o) where:

f_i = input frequency in MHz;

f_o = output frequency in MHz;

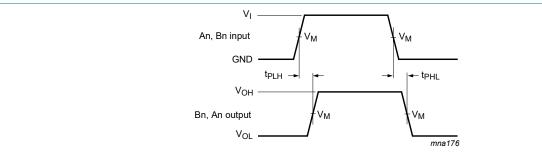
 C_L = output load capacitance in pF;

V_{CC} = supply voltage in V;

N = number of inputs switching;

 $\Sigma(C_L \times V_{CC}^2 \times f_0)$ = sum of the outputs.

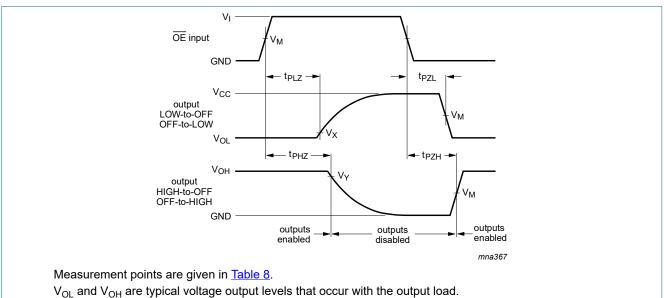
10.1. Waveforms and test circuit



Measurement points are given in Table 8.

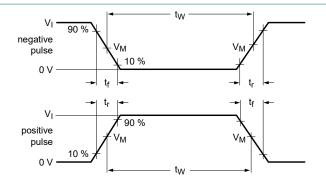
 V_{OL} and V_{OH} are typical voltage output levels that occur with the output load.

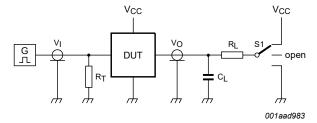
Input to output propagation delays Fig. 3.



Enable and disable times Fig. 4.

Table 8. Measurement points									
Туре	Input	Output							
	V _M	V _M	V _X	V _Y					
74VHC245	0.5 × V _{CC}	0.5 × V _{CC}	V _{OL} + 0.3 V	V _{OH} - 0.3 V					
74VHCT245	1.5 V	0.5 × V _{CC}	V _{OL} + 0.3 V	V _{OH} - 0.3 V					





Test data is given in Table 9.

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_L = Load resistance;

S1 = Test selection switch.

Fig. 5. Test circuit for measuring switching times

Table 9. Test data

Туре	Input		Load		S1 position		
	V _I	t _r , t _f	CL	R _L	t _{PHL} , t _{PLH}	t _{PZH} , t _{PHZ}	t _{PZL} , t _{PLZ}
74VHC245	V _{CC}	≤ 3.0 ns	15 pF, 50 pF	1 kΩ	open	GND	V _{CC}
74VHCT245	3.0 V	≤ 3.0 ns	15 pF, 50 pF	1 kΩ	open	GND	V _{CC}

11. Package outline

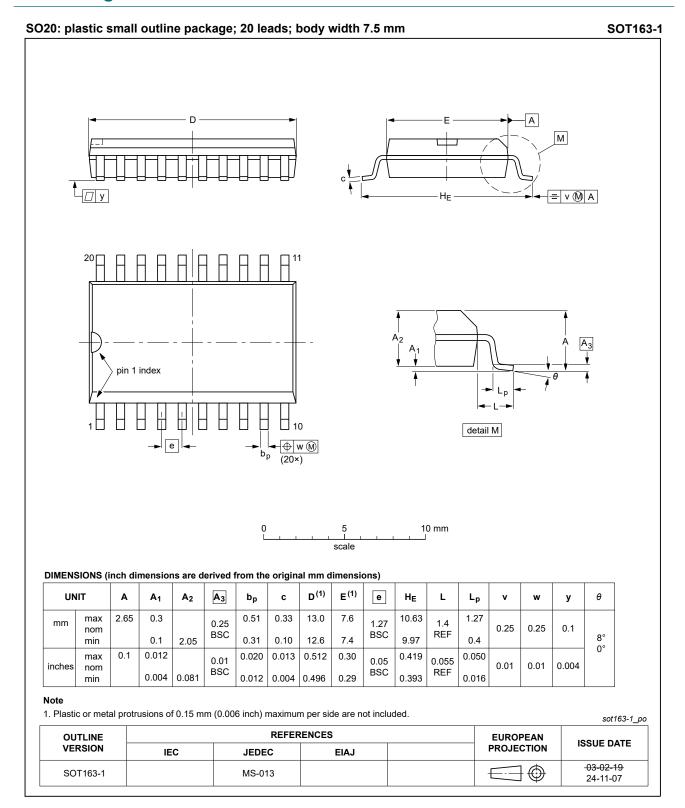


Fig. 6. Package outline SOT163-1 (SO20)

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

SOT360-1

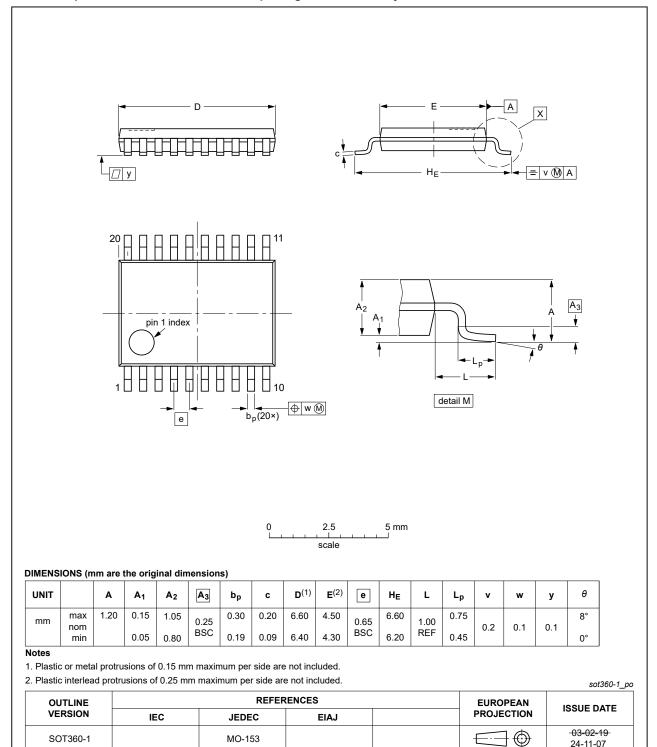


Fig. 7. Package outline SOT360-1 (TSSOP20)

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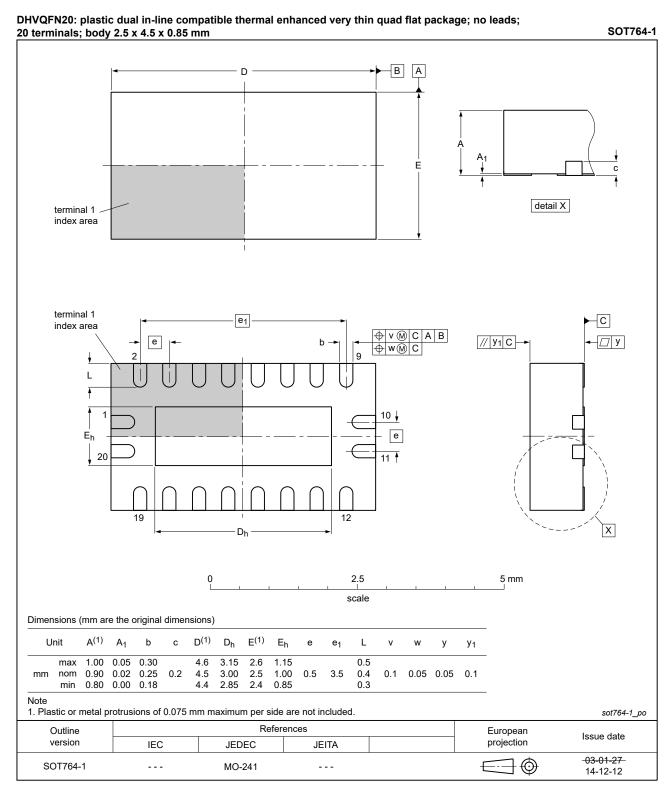


Fig. 8. Package outline SOT764-1 (DHVQFN20)

12. Abbreviations

Table 10. Abbreviations

Acronym	Description
ANSI	American National Standards Institute
CDM	Charged Device Model
CMOS	Complementary Metal-Oxide Semiconductor
DUT	Device Under Test
ESD	ElectroStatic Discharge
ESDA	ElectroStatic Discharge Association
НВМ	Human Body Model
JEDEC	Joint Electron Device Engineering Council
TTL	Transistor-Transistor Logic

13. Revision history

Table 11. Revision history

Table 11. Revision history						
Document ID	Release date	Data sheet status	Change notice	Supersedes		
74VHC_VHCT245 v.3	20241129	Product data sheet	-	74VHC_VHCT245 v.2		
Modifications:	 Fig. 6 and Fig. 7: : Aligned SO and TSSOP package outline drawings to JEDEC MS-013 and MO-153. 					
74VHC_VHCT245 v.2	20240708	Product data sheet	-	74VHC_VHCT245 v.1		
Modifications:	 Section 2: ESD specification updated according to the latest JEDEC standard. Section 7: Derating values for P_{tot} total power dissipation updated. Fig. 8: Updated package outline drawing SOT764-1 (DHVQFN20). The format of this data sheet has been redesigned to comply with the identity guidelines of Nexperia. Legal texts have been adapted to the new company name where appropriate. 					
74VHC_VHCT245 v.1	20090825	Product data sheet	-	-		

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.
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Product [short] data sheet	Production	This document contains the product specification.

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