74AHC541; 74AHCT541

Octal buffer/line driver; 3-state

Rev. 4 — 14 April 2020

Product data sheet

1. General description

The 74AHC541; 74AHCT541 is a high-speed Si-gate CMOS device.

The 74AHC541; 74AHCT541 are octal non-inverting buffer/line drivers with 3-state bus compatible outputs.

The 3-state outputs are controlled by the output enable inputs $\overline{\text{OE}}0$ and $\overline{\text{OE}}1$.

A HIGH on $\overline{\text{OE}}$ n causes the outputs to assume a high-impedance OFF-state.

2. Features

- · Balanced propagation delays
- All inputs have a Schmitt-trigger action
- Inputs accepts voltages higher than V_{CC}
- For 74AHC541 only: operates with CMOS input levels
- For 74AHCT541 only: operates with TTL input levels
- ESD protection:
 - HBM JESD22-A114E exceeds 2000 V
 - MM JESD22-A115-A exceeds 200 V
 - CDM JESD22-C101C exceeds 1000 V
- Multiple package options
- Specified from -40 °C to +85 °C and from -40 °C to +125 °C

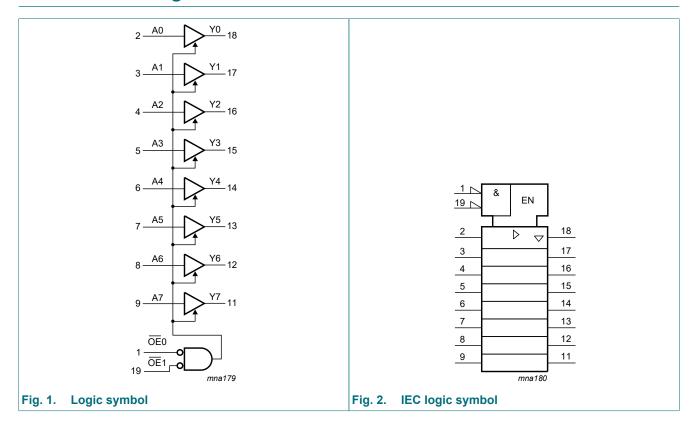
3. Ordering information

Table 1. Ordering information

Type number	Package	Package									
	Temperature range	Name	Description	Version							
74AHC541D	-40 °C to +125 °C	SO20	plastic small outline package; 20 leads;	SOT163-1							
74AHCT541D			body width 7.5 mm								
74AHC541PW	-40 °C to +125 °C	TSSOP20	plastic thin shrink small outline package; 20 leads;	SOT360-1							
74AHCT541PW	_		body width 4.4 mm								
74AHC541BQ	-40 °C to +125 °C	DHVQFN20	plastic dual in-line compatible thermal enhanced	SOT764-1							
74AHCT541BQ			very thin quad flat package; no leads; 20 terminals; body 2.5 × 4.5 × 0.85 mm								



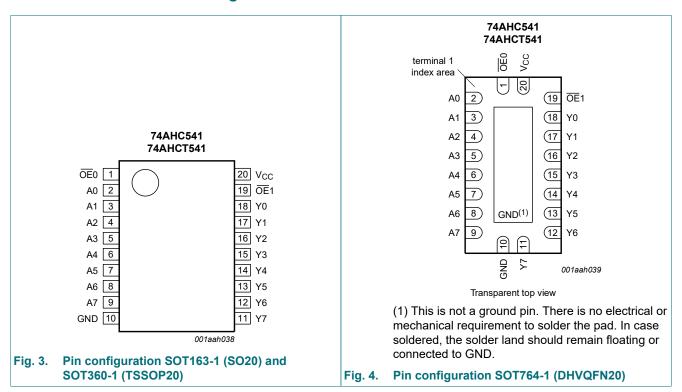
4. Functional diagram



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5. Pinning information

5.1. Pinning



5.2. Pin description

Table 2. Pin description

Table 2. Fill description		
Symbol	Pin	Description
OE0	1	output enable input (active LOW)
A0, A1, A2, A3, A4, A5, A6, A7	2, 3, 4, 5, 6, 7, 8, 9	data input
GND	10	ground (0 V)
Y0, Y1, Y2, Y3, Y4, Y5, Y6, Y7	18, 17, 16, 15, 14, 13, 12, 11	data output
OE1	19	output enable input (active LOW)
V _{CC}	20	supply voltage

6. Functional description

Table 3. Functional table

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

Control		Input	Output
OE0	OE1	An	Yn
L	L	L	L
L	L	Н	Н
X	Н	X	Z
Н	X	X	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	$V_{I} < -0.5 \text{ V}$ [1]	-20	-	mA
I _{OK}	output clamping current	$V_O < -0.5 \text{ V or } V_O > V_{CC} + 0.5 \text{ V}$ [1]	-	±20	mA
Io	output current	$V_O = -0.5 \text{ V to } (V_{CC} + 0.5 \text{ V})$	-	±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	$T_{amb} = -40 ^{\circ}\text{C} \text{ to } +125 ^{\circ}\text{C}$ [2]	-	500	mW

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

8. Recommended operating conditions

Table 5. Recommended operating conditions

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

Symbol	Parameter	Conditions	7	4AHC54	11	74	AHCT5	41	Unit
			Min	Тур	Max	Min	Тур	Max	
V_{CC}	supply voltage		2.0	5.0	5.5	4.5	5.0	5.5	V
VI	input voltage		0	-	5.5	0	-	5.5	V
Vo	output voltage		0	-	V _{CC}	0	-	V _{CC}	V
T _{amb}	ambient temperature		-40	+25	+125	-40	+25	+125	°C
Δt/ΔV	input transition rise and fall rate	$V_{CC} = 3.3 \text{ V} \pm 0.3 \text{ V}$	-	-	100	-	-	-	ns/V
		V _{CC} = 5.0 V ± 0.5 V	-	-	20	-	-	20	ns/V

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^[2] For SOT163-1 (SO20) package: P_{tot} derates linearly with 12.3 mW/K above 109 °C. For SOT360-1 (TSSOP20) package: P_{tot} derates linearly with 10.0 mW/K above 100 °C. For SOT764-1 (DHVQFN20) package: P_{tot} derates linearly with 12.9 mW/K above 111 °C.

9. Static characteristics

Table 6. Static characteristics

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

Symbol	Parameter	Conditions		25 °C			°C to 5 °C		°C to 5 °C	Unit
			Min	Тур	Max	Min	Max	Min	Max	
For type	74AHC541									
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	-	V
V _{IL}	LOW-level	V _{CC} = 2.0 V	-	-	0.5	-	0.5	-	0.5	V
	input voltage	V _{CC} = 3.0 V	-	-	0.9	-	0.9	-	0.9	V
		V _{CC} = 5.5 V	-	-	1.65	-	1.65	-	1.65	V
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	-	V
		I _O = -50 μA; V _{CC} = 3.0 V	2.9	3.0	-	2.9	-	2.9	-	V
		I _O = -50 μA; V _{CC} = 4.5 V	4.4	4.5	-	4.4	-	4.4	-	V
		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	-	-	3.8	-	3.70	-	V
V_{OL}	LOW-level	V _I = V _{IH} or V _{IL}								
	output voltage	I _O = 50 μA; V _{CC} = 2.0 V	-	0	0.1	-	0.1	-	0.1	V
		I _O = 50 μA; V _{CC} = 3.0 V	-	0	0.1	-	0.1	-	0.1	V
		I _O = 50 μA; V _{CC} = 4.5 V	-	0	0.1	-	0.1	-	0.1	V
		I _O = 4.0 mA; V _{CC} = 3.0 V	-	-	0.36	-	0.44	-	0.55	V
		I _O = 8.0 mA; V _{CC} = 4.5 V	-	-	0.36	-	0.44	-	0.55	V
l _{OZ}	OFF-state output current	$V_I = V_{IH}$ or V_{IL} ; $V_O = V_{CC}$ or GND; $V_{CC} = 5.5$ V	-	-	±0.25	-	±2.5	-	±10.0	μΑ
I _I	input leakage current	$V_I = V_{CC}$ or GND; $V_{CC} = 0$ V to 5.5 V	-	-	0.1	-	1.0	-	2.0	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	μΑ
C _I	input capacitance		-	3.0	10	-	10	-	10	pF
Co	output capacitance		-	4.0	-	-	-	-	-	pF

Symbol	Parameter	Conditions		25 °C			°C to 5 °C		°C to 5 °C	Unit
			Min	Тур	Max	Min	Max	Min	Max	
For type	74AHCT541		'					'		
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} ; $V_{CC} = 4.5 \text{ V}$								
	output voltage	Ι _Ο = -50 μΑ	4.4	4.5	-	4.4	-	4.4	-	V
		I _O = -8.0 mA	3.94	-	-	3.8	-	3.70	-	V
V _{OL}	LOW-level	$V_I = V_{IH}$ or V_{IL} ; $V_{CC} = 4.5 \text{ V}$								
	output voltage	Ι _Ο = 50 μΑ	-	0	0.1	-	0.1	-	0.1	V
		I _O = 8.0 mA	-	-	0.36	-	0.44	-	0.55	V
I _{OZ}	OFF-state output current	per input pin; $V_I = V_{IH}$ or V_{IL} ; $V_{CC} = 5.5 \text{ V}$; $I_O = 0 \text{ A}$; $V_O = V_{CC}$ or GND; other pins at V_{CC} or GND	-	-	±0.25	-	±2.5	-	±10.0	μА
I _I	input leakage current	$V_I = V_{CC}$ or GND; $V_{CC} = 0$ V to 5.5 V	-	-	0.1	-	1.0	-	2.0	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
ΔI _{CC}	additional supply current	per input pin; $V_I = V_{CC}$ - 2.1 V; $I_O = 0$ A; other pins at V_{CC} or GND; $V_{CC} = 4.5$ V to 5.5 V	-	-	1.35	-	1.5	-	1.5	mA
Cı	input capacitance		-	3	10	-	10	-	10	pF
C _O	output capacitance		-	4.0	-	-	-	-	-	pF

10. Dynamic characteristics

Table 7. Dynamic characteristics

GND = 0 V. For test circuit see Fig. 7.

Symbol	Parameter	Conditions		25 °C			°C to 5 °C		°C to 5 °C	Unit
			Min	Typ[1]	Max	Min	Max	Min	Max	
For type	74AHC541									
t _{pd}	propagation	An to Yn; see Fig. 5								
	delay	V _{CC} = 3.0 V to 3.6 V; C _L = 15 pF	-	5.0	7.0	1.0	8.5	1.0	9.0	ns
		V _{CC} = 3.0 V to 3.6 V; C _L = 50 pF	-	7.0	10.5	1.0	12.0	1.0	13.5	ns
		V _{CC} = 4.5 V to 5.5 V; C _L = 15 pF	-	3.5	5.0	1.0	6.0	1.0	6.5	ns
		V _{CC} = 4.5 V to 5.5 V; C _L = 50 pF		5.0	7.0	1.0	8.0	1.0	9.0	ns
t _{en}	enable time	OEn to Yn; see Fig. 6 [2]								
		V _{CC} = 3.0 V to 3.6 V; C _L = 15 pF	-	5.5	10.5	1.0	11.0	1.0	13.5	ns
		V _{CC} = 3.0 V to 3.6 V; C _L = 50 pF	-	7.5	14.0	1.0	16.0	1.0	17.5	ns
		V _{CC} = 4.5 V to 5.5 V; C _L = 15 pF	-	3.5	7.2	1.0	8.5	1.0	9.0	ns
		V _{CC} = 4.5 V to 5.5 V; C _L = 50 pF	-	5.0	9.2	1.0	10.5	1.0	11.5	ns
t _{dis}	disable time	OEn to Yn; see Fig. 6								
		V _{CC} = 3.0 V to 3.6 V; C _L = 15 pF	-	6.0	11.0	1.0	12.0	1.0	14.0	ns
		V _{CC} = 3.0 V to 3.6 V; C _L = 50 pF	-	9.5	15.4	1.0	17.5	1.0	19.5	ns
		V _{CC} = 4.5 V to 5.5 V; C _L = 15 pF	-	4.5	7.5	1.0	8.0	1.0	9.5	ns
		V _{CC} = 4.5 V to 5.5 V; C _L = 50 pF	-	6.5	8.8	1.0	10.0	1.0	11.0	ns
C _{PD}	power dissipation capacitance	$C_L = 50 \text{ pF}; f_i = 1 \text{ MHz};$ [3] $V_I = \text{GND to } V_{CC}$	-	10	-	-	-	-	-	pF
For type	74AHCT541									
t _{pd}	propagation	An to Yn; see Fig. 5								
	delay	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
		V _{CC} = 4.5 V to 5.5 V; C _L = 50 pF	-	5.0	8.5	1.0	9.5	1.0	11.0	ns
t _{en}	enable time	OEn to Yn; see Fig. 6								
		V _{CC} = 4.5 V to 5.5 V; C _L = 15 pF	-	4.0	7.0	1.0	8.0	1.0	9.0	ns
		V _{CC} = 4.5 V to 5.5 V; C _L = 50 pF	-	5.5	10.0	1.0	12.0	1.0	12.5	ns
t _{dis}	disable time	OEn to Yn; see Fig. 6								
		V _{CC} = 4.5 V to 5.5 V; C _L = 15 pF	-	5.0	7.0	1.0	8.0	1.0	9.0	ns
		V _{CC} = 4.5 V to 5.5 V; C _L = 50 pF	-	7.0	10.0	1.0	12.0	1.0	12.5	ns
C _{PD}	power dissipation capacitance	per buffer; $C_L = 50 \text{ pF}$; $f = 1 \text{ MHz}$; [3] $V_I = GND \text{ to } V_{CC}$	-	12	-	-	-	-	-	pF

Typical values are measured at nominal supply voltage (V_{CC} = 3.3 V and V_{CC} = 5.0 V).

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

f_i = input frequency in MHz;

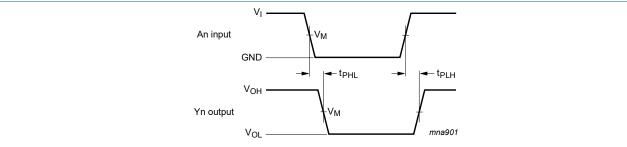
f_o = output frequency in MHz;

C_L = output load capacitance in pF;

V_{CC} = supply voltage in Volts.

 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} . t_{CPD} is used to determine the dynamic power dissipation t_{PD} (t_{PM}).

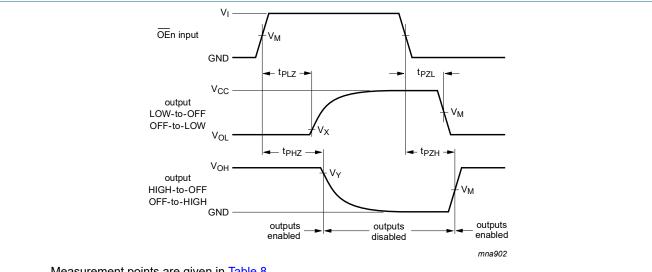
10.1. Waveforms



Measurement points are given in Table 8.

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

Fig. 5. Propagation delay input (An) to output (Yn)



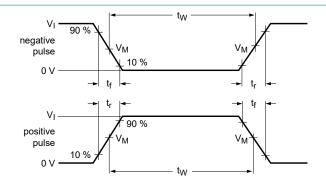
Measurement points are given in Table 8.

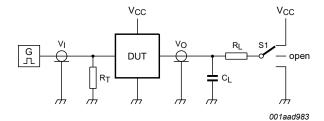
V_{OL} and V_{OH} are typical voltage output levels that occur with the output load.

Enable and disable times

Table 8. Measurement points

Туре	Input	Output		
	V _M	V _M	V _X	V _Y
74AHC541	0.5V _{CC}	0.5V _{CC}	V _{OL} + 0.3 V	V _{OH} - 0.3 V
74AHCT541	1.5 V	0.5V _{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_o of the pulse generator

 C_L = Load capacitance including jig and probe capacitance

R_L = Load resistor

S1 = Test selection switch

Fig. 7. Test circuit for measuring switching times

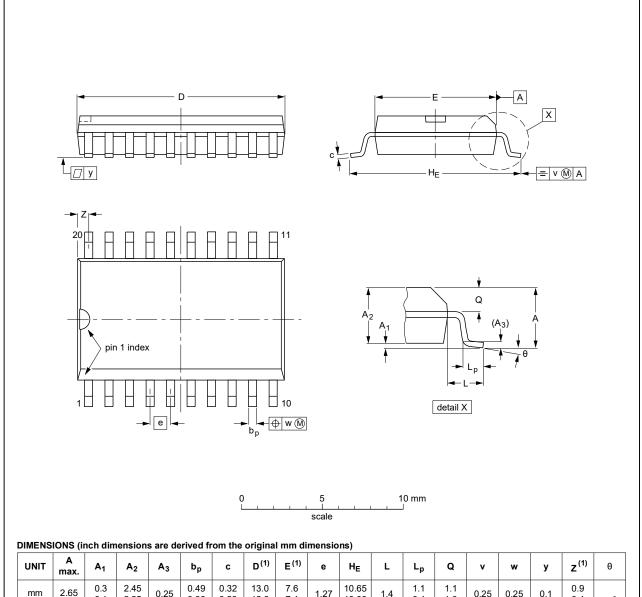
Table 9. Test data

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}	
74AHC541	V _{CC}	3.0 ns	15 pF, 50 pF	1 kΩ	open	GND	V _{CC}	
74AHCT541	3.0 V	3.0 ns	15 pF, 50 pF	1 kΩ	open	GND	V _{CC}	

11. Package outline

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

SOT163-1



UNIT	A max.	A ₁	A ₂	A ₃	bp	С	D ⁽¹⁾	E ⁽¹⁾	е	HE	L	Lp	Q	v	w	у	z ⁽¹⁾	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°
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	0°

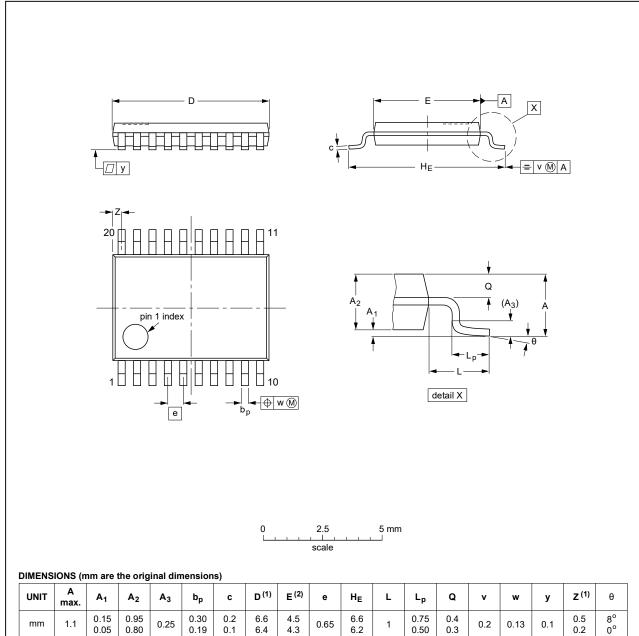
1. Plastic or metal protrusions of 0.15 mm (0.006 inch) maximum per side are not included.

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

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

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

SOT360-1



UNIT	A max.	A ₁	A ₂	A ₃	bp	С	D ⁽¹⁾	E (2)	е	HE	L	Lp	Q	v	w	у	Z ⁽¹⁾	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				99-12-27 03-02-19

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

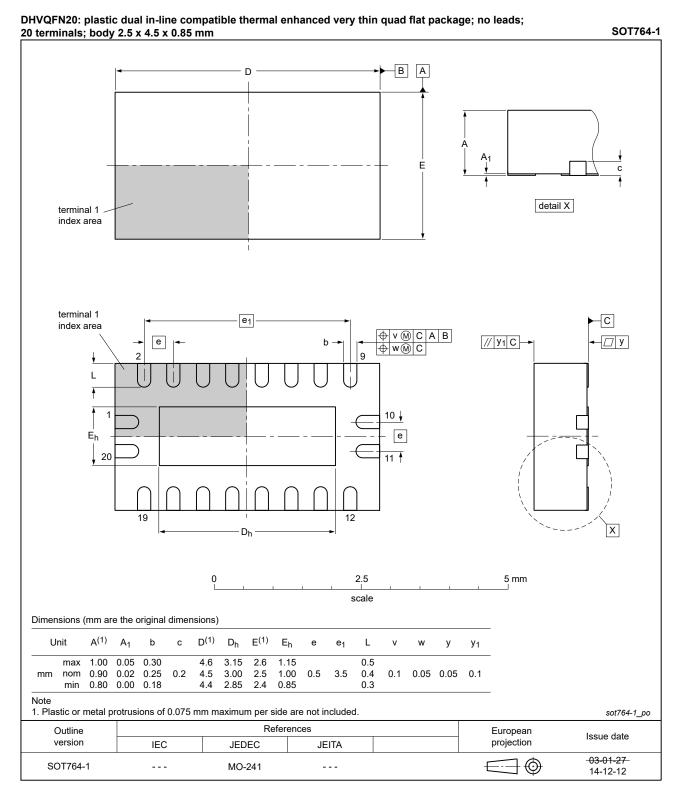


Fig. 10. Package outline SOT764-1 (DHVQFN20)

12. Abbreviations

Table 10. Abbreviations

Acronym	Description
CDM	Charged Device Model
CMOS	Complementary Metal Oxide Semiconductor
DUT	Device Under Test
ESD	ElectroStatic Discharge
НВМ	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
74AHC_AHCT541 v.4	20200414	Product data sheet	-	74AHC_AHCT541_3
Modifications:	guidelines o Legal texts I Table 4: Der	of this data sheet has been f Nexperia. have been adapted to the rating values for P _{tot} total p kage outline drawing SOT	new company nan ower dissipation u	ne where appropriate. updated.
74AHC_AHCT541_3	20071112	Product data sheet		74AHC_AHCT541_2
Modifications:	guidelines o Legal texts I Section 3: D Section 7: d	of this data sheet has been f NXP Semiconductors. have been adapted to the r DHVQFN20 package added erating values added for D outline drawing added for I	new company nan I. HVQFN20 packa	ne where appropriate.
74AHC_AHCT541_2 (939775006301)	19991124	Product specification		74AHC_AHCT541_1
74AHC_AHCT541_1 (939775004256)	19980921	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.
Product [short] data sheet	Production	This document contains the product specification.

- Please consult the most recently issued document before initiating or completing a design.
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