74AHC541-Q100; 74AHCT541-Q100

Octal buffer/line driver; 3-state Rev. 3 — 6 September 2023

Product data sheet

1. General description

The 74AHC541-Q100; 74AHCT541-Q100 is an 8-bit buffer/line driver with 3-state outputs. The device features two output enables ($\overline{OE1}$ and $\overline{OE2}$). A HIGH on \overline{OEn} causes the associated 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.

This product has been qualified to the Automotive Electronics Council (AEC) standard Q100 (Grade 1) and is suitable for use in automotive applications.

2. Features and benefits

- Automotive product qualification in accordance with AEC-Q100 (Grade 1)
 Specified from -40 °C to +85 °C and from -40 °C to +125 °C
- Wide supply voltage range from 2.0 to 5.5 V
- Balanced propagation delays
- High noise immunity
- All inputs have a Schmitt-trigger action
- Overvoltage tolerant inputs to 5.5 V
- CMOS low power dissipation
- Input levels:
 - For 74AHC541: CMOS level
 - For 74AHCT541: TTL level
- Latch-up performance exceeds 100 mA per JESD 78 Class II Level A
- 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
- DHVQFN package with Side-Wettable Flanks enabling Automatic Optical Inspection (AOI) of solder joints

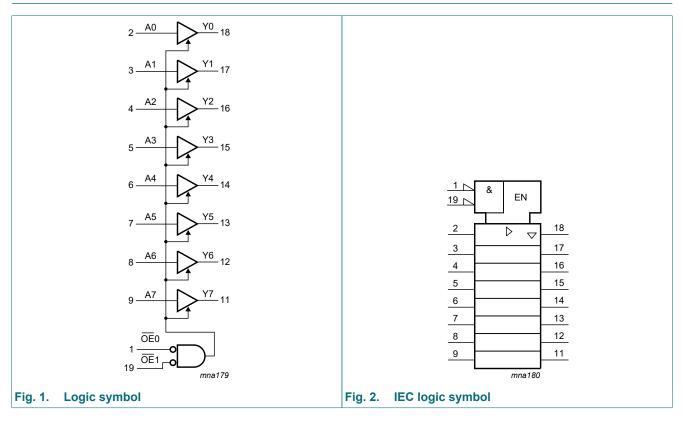
3. Ordering information

Table 1. Ordering information

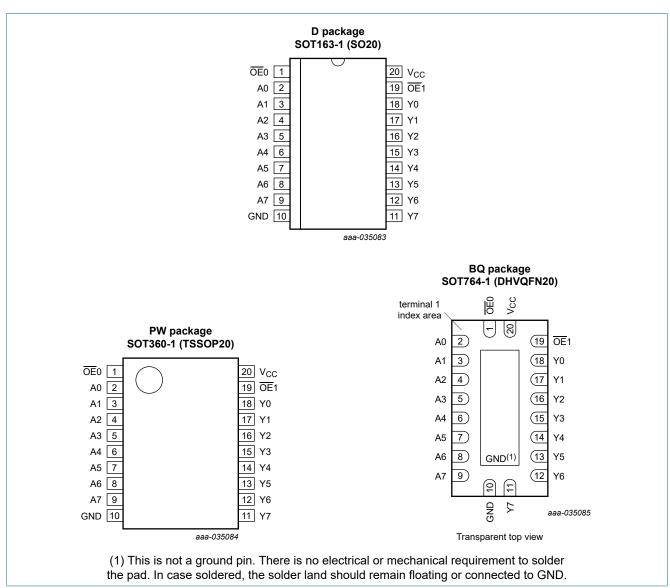
Type number	Package							
	Temperature range	Name	Description	Version				
74AHC541D-Q100 74AHCT541D-Q100	-40 °C to +125 °C	SO20	plastic small outline package; 20 leads; body width 7.5 mm	<u>SOT163-1</u>				
74AHC541PW-Q100 74AHCT541PW-Q100	-40 °C to +125 °C	TSSOP20	plastic thin shrink small outline package; 20 leads; body width 4.4 mm	<u>SOT360-1</u>				
74AHC541BQ-Q100 74AHCT541BQ-Q100	-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	<u>SOT764-1</u>				

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4. Functional diagram



5. Pinning information



5.1. Pinning

5.2. Pin description

Table 2. Pin 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 voltage level; L = LOW voltage level; X = don't care; Z = high-impedance OFF-state.

		Input	Output
OE0	OE1	An	Yn
L	L	L	L
L	L	Н	Н
X	Н	Х	Z
Н	Х	Х	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 _{ОК}	output clamping current	$V_{\rm O} < -0.5 \text{ V or } V_{\rm O} > V_{\rm CC} + 0.5 \text{ V}$ [1]	-	±20	mA
I _O	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 °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.

[2] For SOT163-1 (SO20) package: Ptot 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: Ptot derates linearly with 12.9 mW/K above 111 °C.

8. Recommended operating conditions

Table 5. Recommended operating conditions

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

Symbol	Parameter	Conditions	74A	HC541-0	2100	74Ał	Unit		
			Min	Тур	Мах	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 V ± 0.3 V	-	-	100	-	-	-	ns/V
		$V_{CC} = 5.0 V \pm 0.5 V$	-	-	20	-	-	20	ns/V

9. Static characteristics

Table 6. Static characteristics

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

Symbol	Parameter	Conditions		25 °C			°C to 5 °C	-40 °C to +125 °C		Unit
			Min	Тур	Max	Min	Мах	Min	Max	
For type	74AHC541-Q10	00								
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 output voltage	$V_{I} = V_{IH} \text{ or } V_{IL}$									
	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
I _{OZ}	OFF-state output current	$V_{I} = V_{IH} \text{ or } V_{IL};$ $V_{O} = V_{CC} \text{ or GND}; V_{CC} = 5.5 \text{ V}$	-	-	±0.25	-	±2.5	-	±10.0	μA
l _l	input leakage current	$V_I = V_{CC}$ or GND; $V_{CC} = 0$ V to 5.5 V	-	-	0.1	-	1.0	-	2.0	μA
I _{CC}	supply current	$V_I = V_{CC}$ or GND; $I_O = 0$ A; $V_{CC} = 5.5$ V	-	-	4.0	-	40	-	80	μA
CI	input capacitance		-	3.0	10	-	10	-	10	pF
Co	output capacitance		-	4.0	-	-	-	-	-	pF

5/15

Symbol	Parameter	Conditions		25 °C		-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Тур	Max	Min	Max	Min	Max	-
For type	74AHCT541-Q	100								
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}	/ _{OH} HIGH-level output voltage	$V_{I} = V_{IH} \text{ or } V_{IL}; V_{CC} = 4.5 \text{ V}$								
		I _O = -50 μA	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	$V_{I} = V_{IH} \text{ or } V_{IL}; V_{CC} = 4.5 \text{ V}$									
	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 _{OZ}	OFF-state output current	$V_{I} = V_{IH} \text{ or } V_{IL};$ $V_{O} = V_{CC} \text{ or GND}; V_{CC} = 5.5 \text{ V}$	-	-	±0.25	-	±2.5	-	±10.0	μA
l _l	input leakage current	$V_I = V_{CC}$ or GND; $V_{CC} = 0 V$ to 5.5 V	-	-	0.1	-	1.0	-	2.0	μA
I _{CC}	supply current	$V_I = V_{CC}$ or GND; $I_O = 0$ A; $V_{CC} = 5.5$ V	-	-	4.0	-	40	-	80	μA
ΔI _{CC}	additional supply current	per input pin; $V_I = V_{CC} - 2.1 \text{ V}; I_O = 0 \text{ A};$ other pins at V_{CC} or GND; $V_{CC} = 4.5 \text{ V}$ to 5.5 V	-	-	1.35	-	1.5	-	1.5	mA
CI	input capacitance		-	3	10	-	10	-	10	pF
Co	output capacitance		-	4.0	-	-	-	-	-	pF

10. Dynamic characteristics

Table 7. Dynamic characteristics

GND = 0 V. For test circuit see Fig. 5.

Symbol	Parameter	Conditions	25 °C				°C to 5 °C	-40 °C to +125 °C		Unit
			Min	Typ[1]	Мах	Min	Мах	Min	Max	
For type	74AHC541-C	100								
t _{pd}	propagation	An to Yn; see Fig. 3 [2]								
	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. 4 [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. 4 [2]								
		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 pF; f _i = 1 MHz; [3] V _I = GND to V _{CC}	-	10	-	-	-	-	-	pF
For type	74AHCT541-	Q100		1						1
t _{pd}	propagation	An to Yn; see Fig. 3 [2]								
	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 <u>Fig. 4</u>								
		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. 4 [2]								1
		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 pF; f = 1 MHz; [3] V _I = GND to V _{CC}	-	12	-	-	-	-	-	pF

Typical values are measured at nominal supply voltage (V_{CC} = 3.3 V and V_{CC} = 5.0 V). [1]

t_{pd} is the same as t_{PLH} and t_{PHL}; t_{en} is the same as t_{PZL} and t_{PZL}; t_{dis} is the same as t_{PLZ} and t_{PHZ}. C_{PD} is used to determine the dynamic power dissipation P_D (μ W). P_D = C_{PD} × V_{CC}² × f_i + Σ (C_L × V_{CC}² × f_o) where: [2]

[3]

 f_i = input frequency in MHz;

fo = output frequency in MHz;

C_L = output load capacitance in pF; V_{CC} = supply voltage in Volts.

74AHC_AHCT541_Q100



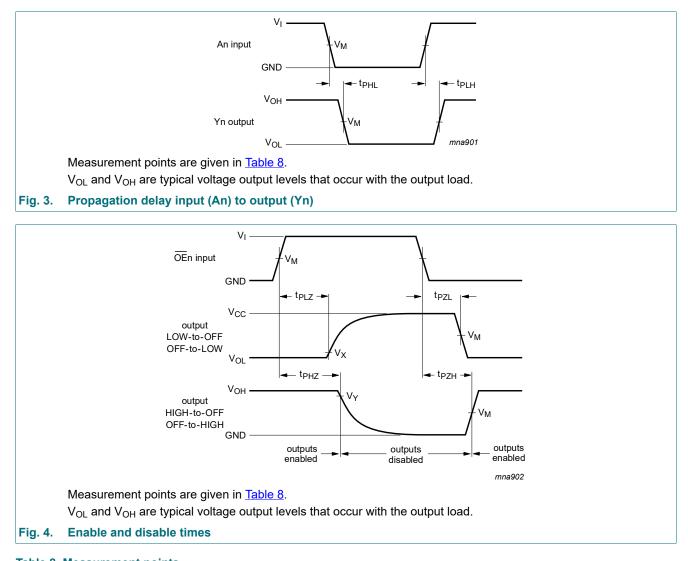


Table 8. Measurement po	Input	Output	Output					
	V _M	V _M	V _X	V _Y				
74AHC541-Q100	0.5V _{CC}	0.5V _{CC}	V _{OL} + 0.3 V	V _{OH} - 0.3 V				
74AHCT541-Q100	1.5 V	0.5V _{CC}	V _{OL} + 0.3 V	V _{OH} - 0.3 V				

74AHC541-Q100; 74AHCT541-Q100

Octal buffer/line driver; 3-state

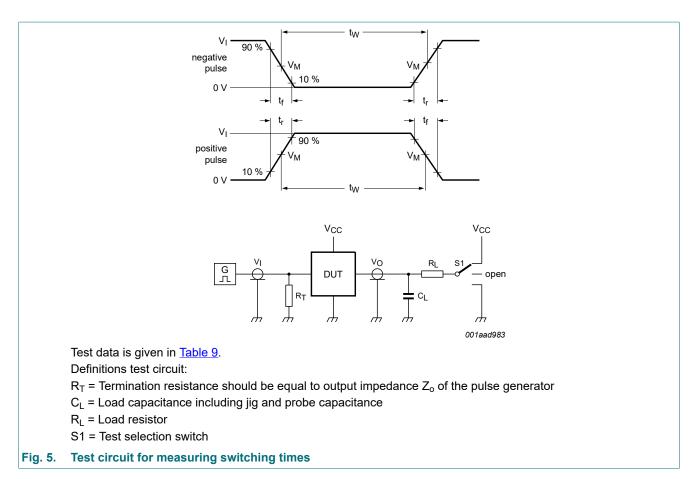


Table 9. Test data

Туре	Input		Load		S1 position		
	VI	t _r , t _f	CL	RL	t _{PHL} , t _{PLH}	t _{PZH} , t _{PHZ}	t _{PZL} , t _{PLZ}
74AHC541-Q100	V _{CC}	3.0 ns	15 pF, 50 pF	1 kΩ	open	GND	V _{CC}
74AHCT541-Q100	3.0 V	3.0 ns	15 pF, 50 pF	1 kΩ	open	GND	V _{CC}

11. Package outline

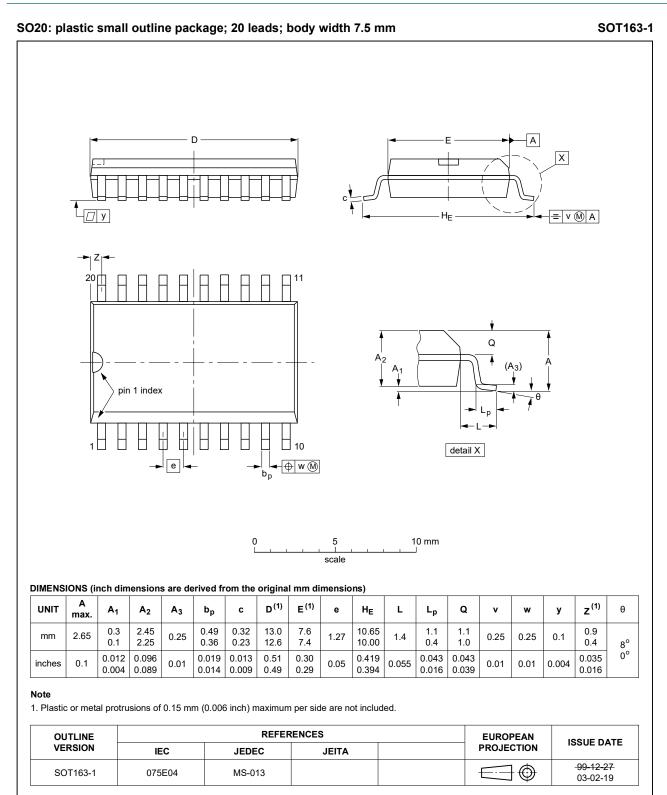


Fig. 6. Package outline SOT163-1 (SO20)

74AHC_AHCT541_Q100

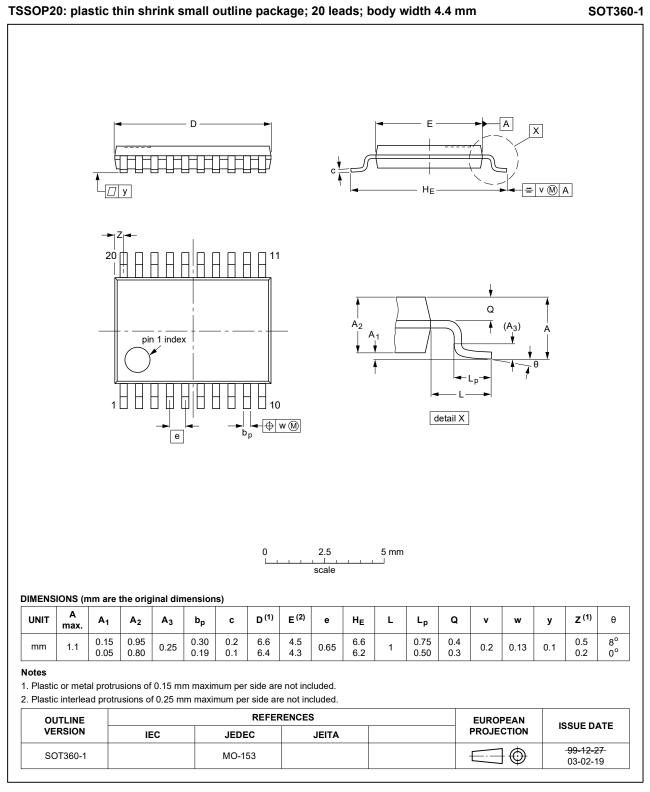


Fig. 7. Package outline SOT360-1 (TSSOP20)

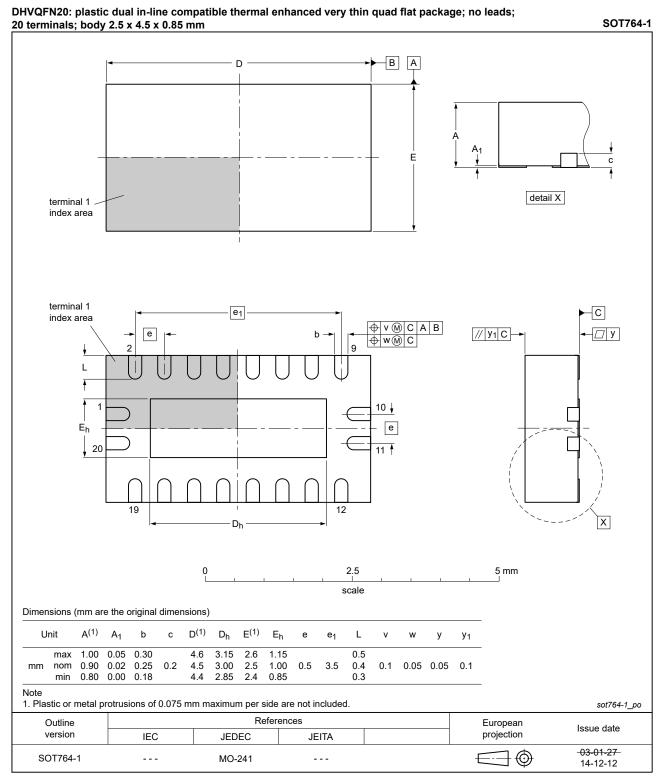


Fig. 8. Package outline SOT764-1 (DHVQFN20)

12. Abbreviations

Acronym	Description
CDM	Charged Device Model
CMOS	Complementary Metal Oxide Semiconductor
DUT	Device Under Test
ESD	ElectroStatic Discharge
HBM	Human Body Model
TTL	Transistor-Transistor Logic

13. Revision history

Table 11. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes			
74AHC_AHCT541_Q100 v.3	20230906	Product data sheet	-	74AHC_AHCT541_Q100 v.2			
Modifications:	 <u>Section 1</u> and <u>Section 2</u> updated. <u>Section 2</u>: ESD specification updated according to the latest JEDEC standard. <u>Section 9</u>: Conditions I_{OZ} of 74AHCT541-Q100 aligned with 74AHC541-Q100 (errata). 						
74AHC_AHCT541_Q100 v.2	20200414	Product data sheet	-	74AHC_AHCT541_Q100 v.1			
Modifications:	guidelines o Legal texts l <u>Section 2</u> up <u>Table 4</u> : Der	nat of this data sheet has been redesigned to comply with the identity es of Nexperia. xts have been adapted to the new company name where appropriate.					
74AHC_AHCT541_Q100 v.1	20130606	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.
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.

- [2] The term 'short data sheet' is explained in section "Definitions".
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