

74AHC541-Q100; 74AHCT541-Q100

Octal buffer/line driver; 3-state

Rev. 2 — 14 April 2020

Product data sheet

1. General description

The 74AHC541-Q100; 74AHCT541-Q100 is a high-speed Si-gate CMOS device.

The 74AHC541-Q100; 74AHCT541-Q100 are octal non-inverting buffer/line drivers with 3-state bus compatible outputs.

The output enable inputs $\overline{OE}0$ and $\overline{OE}1$, control the 3-state outputs.

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

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
- Balanced propagation delays
- All inputs have a Schmitt-trigger action
- Inputs accept voltages higher than V_{CC}
- For 74AHC541-Q100 only: operates with CMOS input levels
- For 74AHCT541-Q100 only: operates with TTL input levels
- ESD protection:
 - MIL-STD-883, method 3015 exceeds 2000 V
 - HBM JESD22-A114F exceeds 2000 V
 - MM JESD22-A115-A exceeds 200 V (C = 200 pF, R = 0 Ω)
- 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			Version
	Temperature range	Name	Description	
74AHC541D-Q100	-40 °C to +125 °C	SO20	plastic small outline package; 20 leads; body width 7.5 mm	SOT163-1
74AHCT541D-Q100				
74AHC541PW-Q100	-40 °C to +125 °C	TSSOP20	plastic thin shrink small outline package; 20 leads; body width 4.4 mm	SOT360-1
74AHCT541PW-Q100				
74AHC541BQ-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	SOT764-1
74AHCT541BQ-Q100				

4. Functional diagram

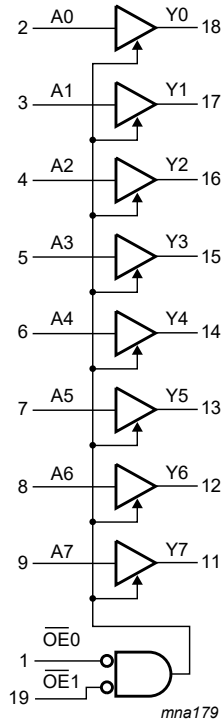


Fig. 1. Logic symbol

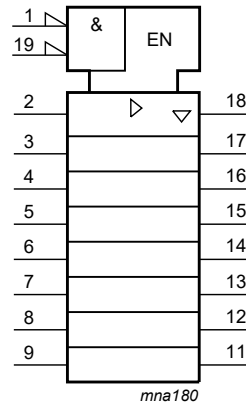


Fig. 2. IEC logic symbol

5. Pinning information

5.1. Pinning

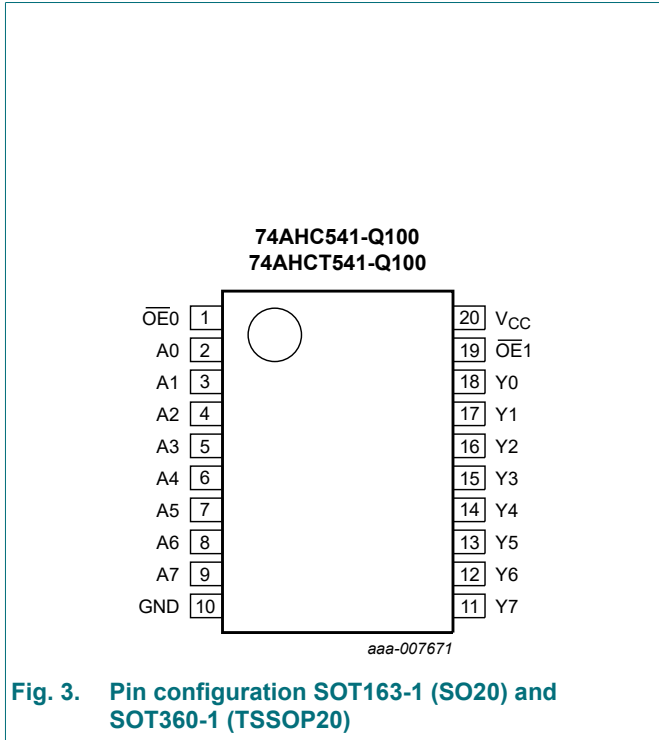


Fig. 3. Pin configuration SOT163-1 (SO20) and SOT360-1 (TSSOP20)

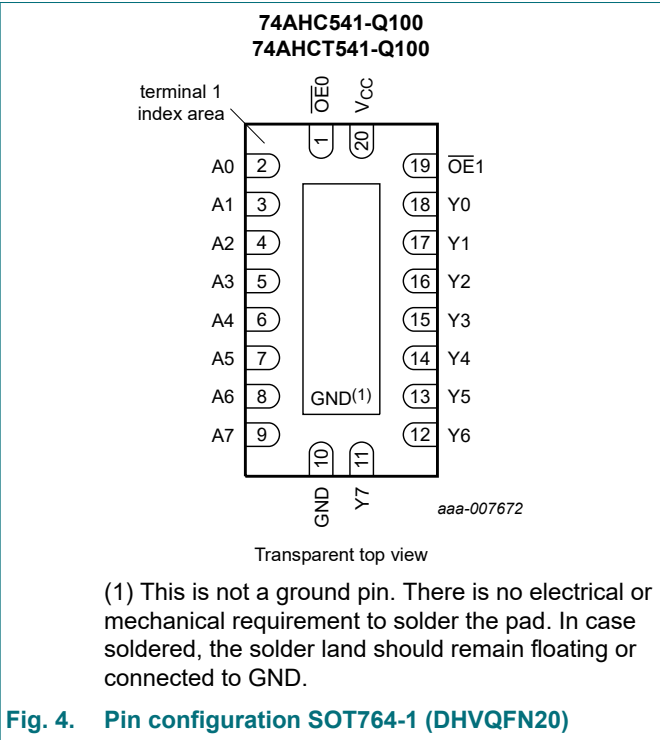


Fig. 4. Pin configuration SOT764-1 (DHVQFN20)

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)
VCC	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.

Control		Input	Output
OE0	OE1	An	Yn
L	L	L	L
L	L	H	H
X	H	X	Z
H	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
V_I	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	mA
I_O	output current	$V_O = -0.5$ V to $(V_{CC} + 0.5$ 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: 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.

8. Recommended operating conditions

Table 5. Recommended operating conditions

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

Symbol	Parameter	Conditions	74AHC541-Q100			74AHCT541-Q100			Unit
			Min	Typ	Max	Min	Typ	Max	
V_{CC}	supply voltage		2.0	5.0	5.5	4.5	5.0	5.5	V
V_I	input voltage		0	-	5.5	0	-	5.5	V
V_O	output voltage		0	-	V_{CC}	0	-	V_{CC}	V
T_{amb}	ambient temperature		-40	+25	+125	-40	+25	+125	°C
$\Delta t/\Delta V$	input transition rise and fall rate	$V_{CC} = 3.3$ V \pm 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			-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
For type 74AHC541-Q100										
V _{IH}	HIGH-level input voltage	V _{CC} = 2.0 V	1.5	-	-	1.5	-	1.5	-	V
		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 input voltage	V _{CC} = 2.0 V	-	-	0.5	-	0.5	-	0.5	V
		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} 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 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	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} or V _{IL} ; V _O = V _{CC} or GND; V _{CC} = 5.5 V	-	-	±0.25	-	±2.5	-	±10.0	μA
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	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
C _I	input capacitance		-	3.0	10	-	10	-	10	pF
C _O	output capacitance		-	4.0	-	-	-	-	-	pF

Symbol	Parameter	Conditions	25 °C			-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
For type 74AHCT541-Q100										
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 output voltage	V _I = V _{IH} or V _{IL} ; V _{CC} = 4.5 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 output voltage	V _I = V _{IH} or V _{IL} ; V _{CC} = 4.5 V								
		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	per input pin; V _I = V _{IH} or V _{IL} ; V _{CC} = 5.5 V; I _O = 0 A; V _O = V _{CC} or GND; other pins at V _{CC} or GND	-	-	±0.25	-	±2.5	-	±10.0	µA
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	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 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
C _I	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			-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Typ[1]	Max	Min	Max	Min	Max	
For type 74AHC541-Q100										
t _{pd}	propagation delay	An to Yn; see Fig. 5 [2]								
		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	$\overline{\text{OEn}}$ 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	$\overline{\text{OEn}}$ to Yn; see Fig. 6 [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; V _I = GND to V _{CC} [3]	-	10	-	-	-	-	-	pF
For type 74AHCT541-Q100										
t _{pd}	propagation delay	An to Yn; see Fig. 5 [2]								
		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	$\overline{\text{OEn}}$ 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	$\overline{\text{OEn}}$ to Yn; see Fig. 6 [2]								
		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; V _I = GND to V _{CC} [3]	-	12	-	-	-	-	-	pF

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

[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 (μW).

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

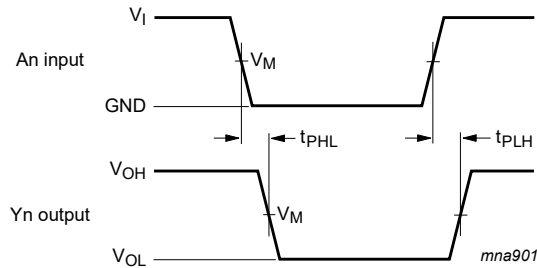
f_i = input frequency in MHz;

f_o = output frequency in MHz;

C_L = output load capacitance in pF;

V_{CC} = supply voltage in Volts.

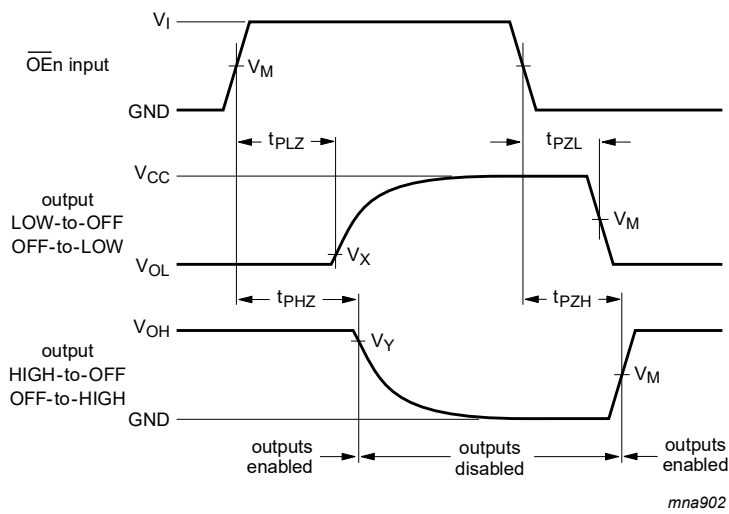
10.1. Waveforms



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.

Fig. 6. Enable and disable times

Table 8. Measurement points

Type	Input	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	$0.5V_{CC}$	$V_{OL} + 0.3 V$	$V_{OH} - 0.3 V$

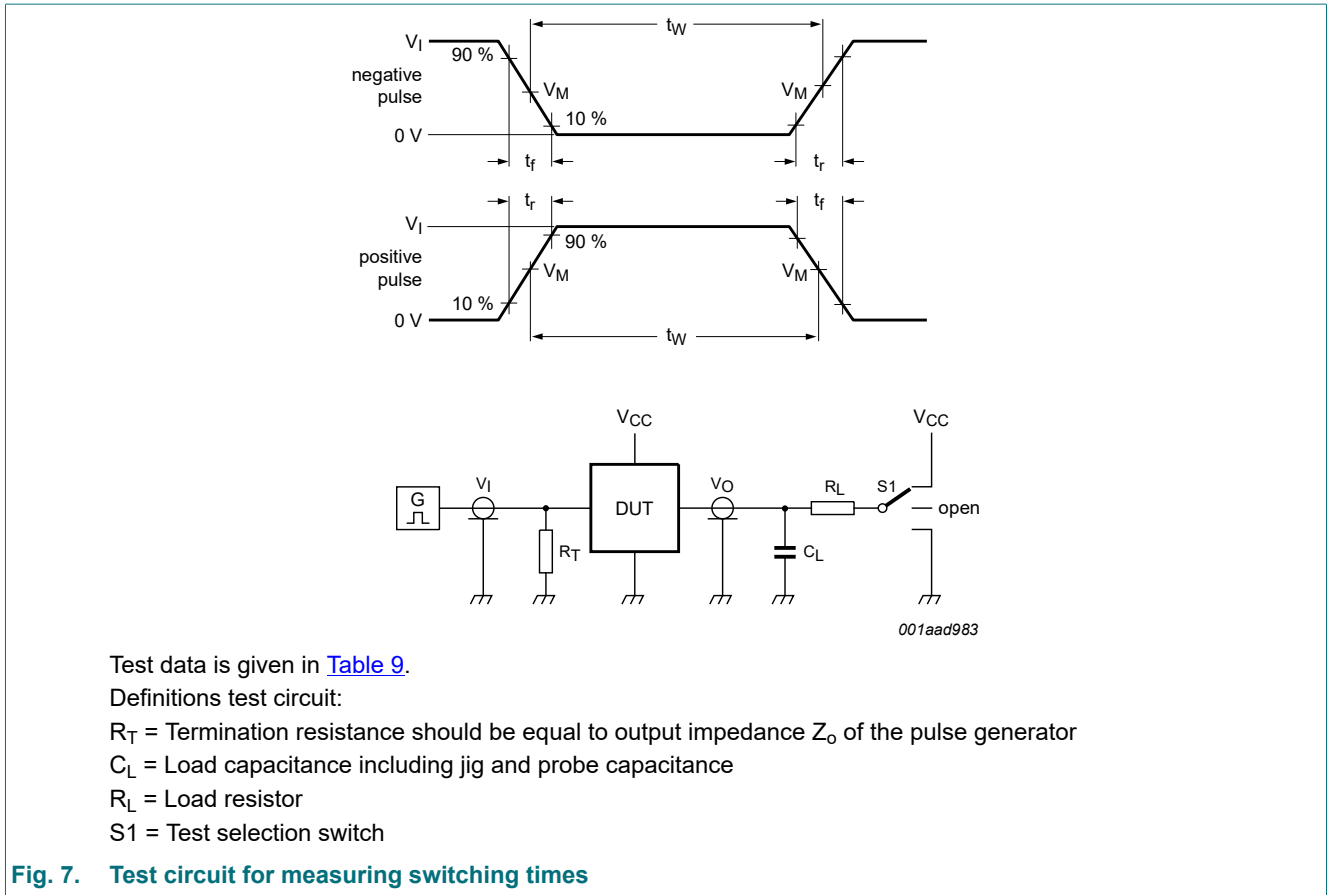


Fig. 7. Test circuit for measuring switching times

Table 9. Test data

Type	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}
74AHC541-Q100	V_{CC}	3.0 ns	15 pF, 50 pF	1 k Ω	open	GND	V_{CC}
74AHCT541-Q100	3.0 V	3.0 ns	15 pF, 50 pF	1 k Ω	open	GND	V_{CC}

11. Package outline

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

SOT163-1

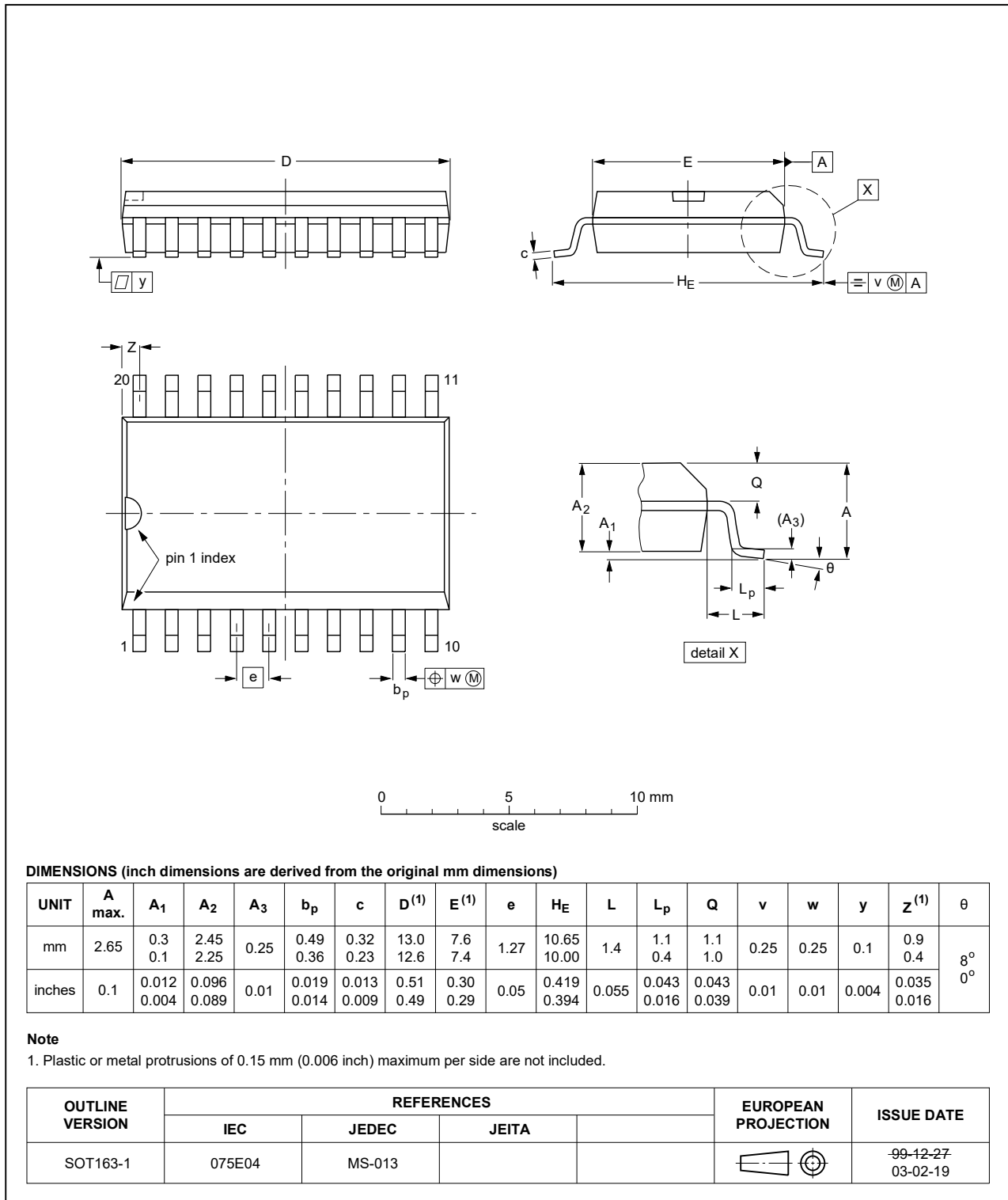


Fig. 8. Package outline SOT163-1 (SO20)

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

SOT360-1



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

DHVQFN20: plastic dual in-line compatible thermal enhanced very thin quad flat package; no leads; 20 terminals; body 2.5 x 4.5 x 0.85 mm

SOT764-1



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

12. Abbreviations

Table 10. Abbreviations

Acronym	Description
CMOS	Complementary Metal Oxide Semiconductor
DUT	Device Under Test
ESD	ElectroStatic Discharge
HBM	Human Body Model
MIL	Military
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_Q100 v.2	20200414	Product data sheet	-	74AHC_AHCT541_Q100 v.1
Modifications:	<ul style="list-style-type: none"> 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. Section 2 updated. Table 4: Derating values for P_{tot} total power dissipation updated. Fig. 10: Package outline drawing SOT764-1 (DHVQFN20) updated. 			
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.

- [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".
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