

74AHC374-Q100; 74AHCT374-Q100

Octal D-type flip-flop; positive edge-trigger; 3-state

Rev. 2 — 4 September 2023

Product data sheet

1. General description

The 74AHC374-Q100; 74AHCT374-Q100 is an octal positive-edge triggered D-type flip-flop with 3-state outputs. The device features a clock (CP) and output enable ($\overline{OE}$) inputs. The flip-flops will store the state of their individual D-inputs that meet the set-up and hold time requirements on the LOW-to-HIGH clock (CP) transition. A HIGH on $\overline{OE}$ causes the outputs to assume a high-impedance OFF-state. Operation of the $\overline{OE}$ input does not affect the state of the flip-flops. Inputs are overvoltage tolerant. The 74AHCT374-Q100 device features TTL compatible inputs that 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
- Balanced propagation delays
- All inputs have Schmitt-trigger actions
- Wide supply voltage range from 2.0 V to 5.5 V
- Overvoltage tolerant inputs to 5.5 V
- High noise immunity
- CMOS low power dissipation
- Common 3-state output enable input
- Input levels:
 - For 74AHC374-Q100: CMOS level
 - For 74AHCT374-Q100: TTL 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

3. Ordering information

Table 1. Ordering information

Type number	Package			
	Temperature range	Name	Description	Version
74AHC374D-Q100 74AHCT374D-Q100	-40 °C to +125 °C	SO20	plastic small outline package; 20 leads; body width 7.5 mm	SOT163-1
74AHC374PW-Q100 74AHCT374PW-Q100	-40 °C to +125 °C	TSSOP20	plastic thin shrink small outline package; 20 leads; body width 4.4 mm	SOT360-1

4. Functional diagram

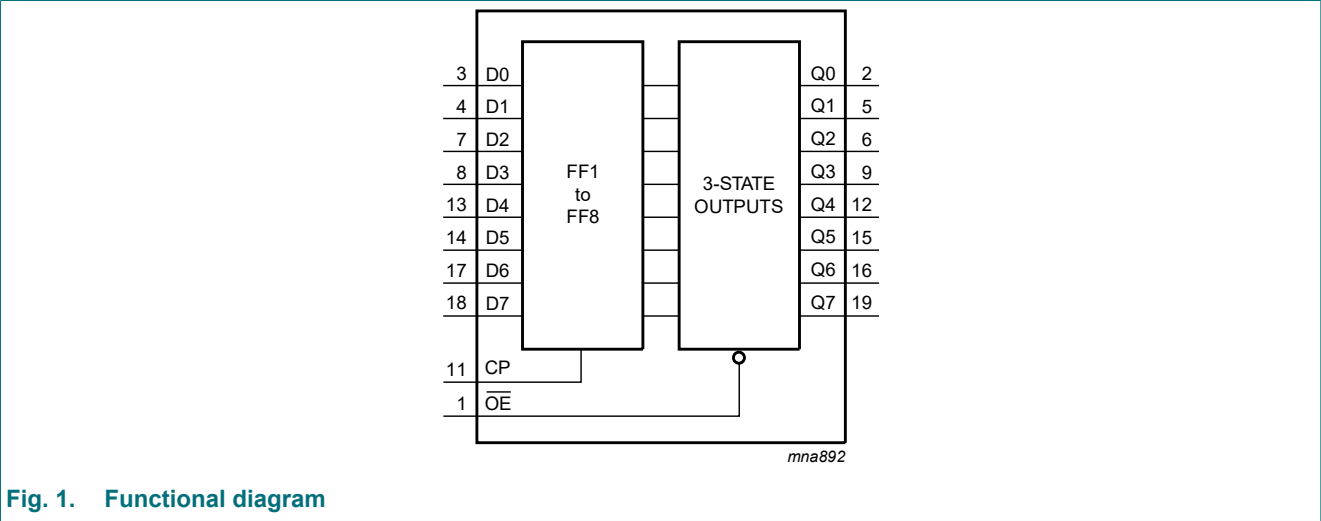


Fig. 1. Functional diagram

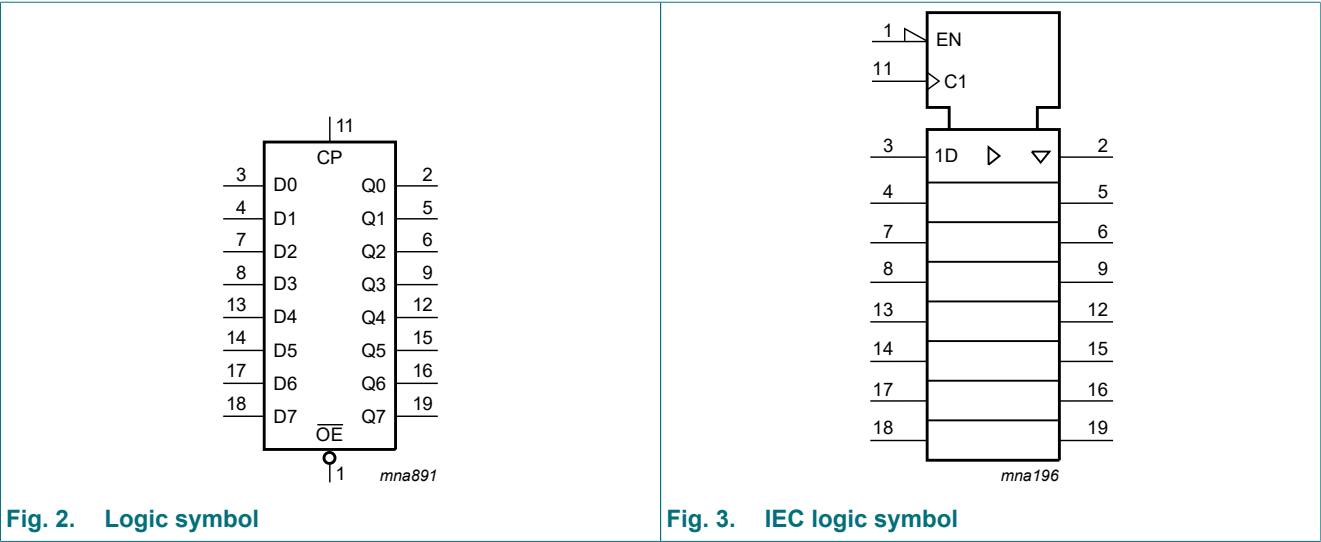


Fig. 2. Logic symbol

Fig. 3. IEC logic symbol

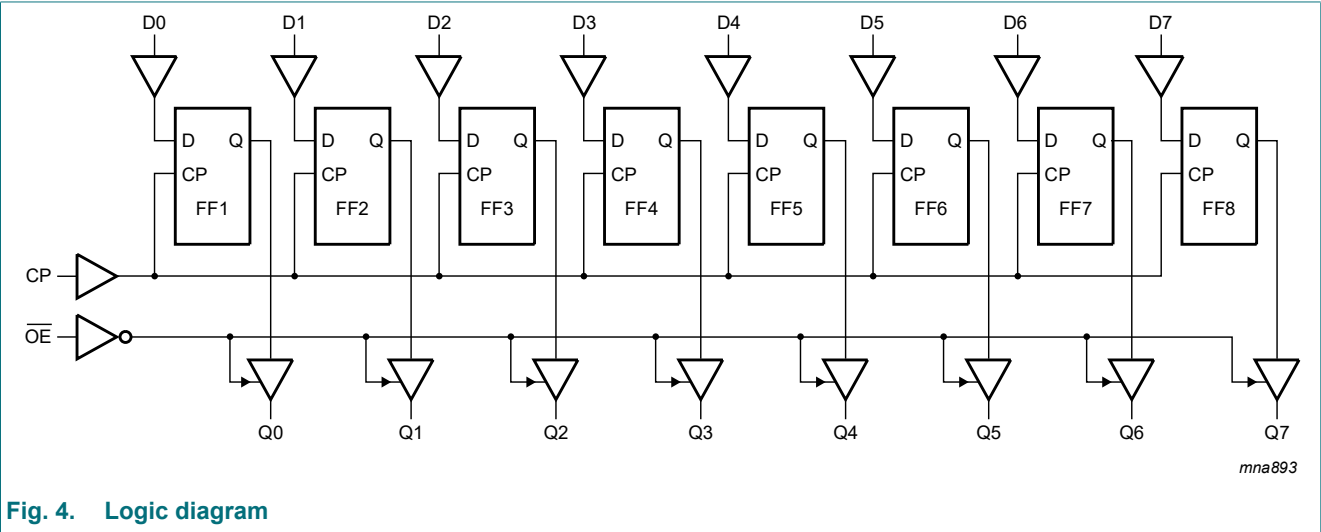
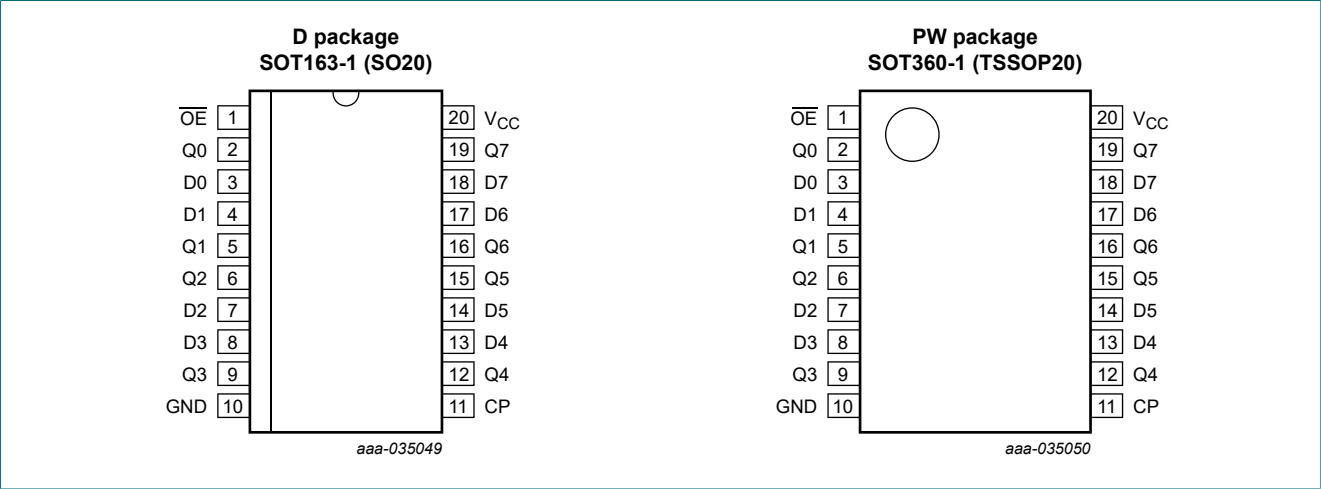


Fig. 4. Logic diagram

5. Pinning information

5.1. Pinning



5.2. Pin description

Table 2. Pin description

Symbol	Pin	Description
$\overline{OE}$	1	3-state output enable input (active LOW)
Q0, Q1, Q2, Q3, Q4, Q5, Q6, Q7	2, 5, 6, 9, 12, 15, 16, 19	3-state flip-flop output
D0, D1, D2, D3, D4, D5, D6, D7	3, 4, 7, 8, 13, 14, 17, 18	data input
GND	10	ground (0 V)
CP	11	clock input (LOW-to-HIGH, edge triggered)
V _{CC}	20	supply voltage

6. Functional description

Table 3. Function table

*H = HIGH voltage level; h = HIGH voltage level one setup time prior to the LOW-to-HIGH CP transition;
L = LOW voltage level; l = LOW voltage level one setup time prior to the LOW-to-HIGH CP transition;
↑ = LOW-to-HIGH CP transition; Z = high-impedance OFF-state.*

Operating mode	Control		Input	Internal flip-flop	Output
	$\overline{OE}$	CP	Dn		Q0 to Q7
Load and read register	L	↑	l	L	L
	L	↑	h	H	H
Load register and disable outputs	H	↑	l	L	Z
	H	↑	h	H	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	+20	mA
I _O	output current	V _O = -0.5 V to (V _{CC} + 0.5 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.

[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.

8. Recommended operating conditions

Table 5. Operating conditions

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
74AHC374-Q100						
V _{CC}	supply voltage		2.0	5.0	5.5	V
V _I	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
74AHCT374-Q100						
V _{CC}	supply voltage		4.5	5.0	5.5	V
V _I	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} = 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	Typ	Max	Min	Max	Min	Max	
74AHC374-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	-	-	3.80	-	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	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 _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
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 _{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	V _I = V _{CC} or GND	-	3	10	-	10	-	10	pF
C _O	output capacitance		-	4	-	-	-	-	-	pF

Symbol	Parameter	Conditions	25 °C			-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
74AHCT374-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	-	-	3.80	-	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 _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
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 _{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; other pins at V _{CC} or GND; I _O = 0 A; V _{CC} = 4.5 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
C _O	output capacitance		-	4	-	-	-	-	-	pF

10. Dynamic characteristics

Table 7. Dynamic characteristics

Voltages are referenced to GND (ground = 0 V); for test circuit see Fig. 8.

Symbol	Parameter	Conditions	25 °C			-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Typ[1]	Max	Min	Max	Min	Max	
74AHC374-Q100										
t _{pd}	propagation delay	CP to Qn; see Fig. 5 and Fig. 7 [2]								
		V _{CC} = 3.0 V to 3.6 V								
		C _L = 15 pF	-	6.4	12.7	1.0	15.0	1.0	16.0	ns
		C _L = 50 pF	-	8.4	16.2	1.0	18.5	1.0	20.5	ns
		V _{CC} = 4.5 V to 5.5 V								
		C _L = 15 pF	-	4.4	8.1	1.0	9.5	1.0	10.0	ns
		C _L = 50 pF	-	5.7	10.1	1.0	11.5	1.0	12.5	ns

Symbol	Parameter	Conditions	25 °C			-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Typ[1]	Max	Min	Max	Min	Max	
t_{en}	enable time	$\overline{OE}$ to Qn; see Fig. 6 [3]								
		$V_{CC} = 3.0 \text{ V to } 3.6 \text{ V}$								
		$C_L = 15 \text{ pF}$	-	5.5	11.0	1.0	13.0	1.0	14.0	ns
		$C_L = 50 \text{ pF}$	-	7.3	14.5	1.0	16.5	1.0	18.0	ns
		$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}$								
		$C_L = 15 \text{ pF}$	-	3.9	7.6	1.0	9.0	1.0	9.5	ns
t_{dis}	disable time	$\overline{OE}$ to Qn; see Fig. 6 [4]								
		$V_{CC} = 3.0 \text{ V to } 3.6 \text{ V}$								
		$C_L = 15 \text{ pF}$	-	5.6	10.5	1.0	12.5	1.0	13.0	ns
		$C_L = 50 \text{ pF}$	-	9.4	14.0	1.0	16.0	1.0	17.5	ns
		$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}$								
		$C_L = 15 \text{ pF}$	-	4.2	6.8	1.0	8.0	1.0	8.5	ns
f_{max}	maximum frequency	see Fig. 5								
		$V_{CC} = 3.0 \text{ V to } 3.6 \text{ V}$								
		$C_L = 15 \text{ pF}$	80	130	-	70	-	70	-	MHz
		$C_L = 50 \text{ pF}$	55	85	-	50	-	50	-	MHz
		$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}$								
		$C_L = 15 \text{ pF}$	130	185	-	110	-	110	-	MHz
t_W	pulse width	CP HIGH or LOW; see Fig. 5								
		$V_{CC} = 3.0 \text{ V to } 3.6 \text{ V}$	5.0	-	-	5.5	-	5.5	-	ns
		$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}$	5.0	-	-	5.0	-	5.0	-	ns
t_{su}	set-up time	Dn to CP; see Fig. 7								
		$V_{CC} = 3.0 \text{ V to } 3.6 \text{ V}$	4.5	-	-	4.0	-	4.0	-	ns
		$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}$	3.0	-	-	3.0	-	3.0	-	ns
t_h	hold time	Dn to CP; see Fig. 7								
		$V_{CC} = 3.0 \text{ V to } 3.6 \text{ V}$	2.0	-	-	2.0	-	2.0	-	ns
		$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}$	2.0	-	-	2.0	-	2.0	-	ns
C_{PD}	power dissipation capacitance	$f_i = 1 \text{ MHz}$; $V_i = \text{GND to } V_{CC}$ [5]	-	10	-	-	-	-	-	pF
74AHCT374-Q100; $V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}$										
t_{pd}	propagation delay	CP to Qn; see Fig. 5 and Fig. 7 [2]								
		$C_L = 15 \text{ pF}$	-	4.3	9.4	1.0	10.5	1.0	12.0	ns
		$C_L = 50 \text{ pF}$	-	5.6	10.4	1.0	11.5	1.0	13.0	ns
t_{en}	enable time	$\overline{OE}$ to Qn; see Fig. 6 [3]								
		$C_L = 15 \text{ pF}$	-	3.5	10.2	1.0	11.5	1.0	13.0	ns
		$C_L = 50 \text{ pF}$	-	4.8	11.2	1.0	12.5	1.0	14.0	ns
t_{dis}	disable time	$\overline{OE}$ to Qn; see Fig. 6 [4]								
		$C_L = 15 \text{ pF}$	-	3.6	10.2	1.0	11.0	1.0	13.0	ns
		$C_L = 50 \text{ pF}$	-	5.7	11.2	1.0	12.0	1.0	14.0	ns

Symbol	Parameter	Conditions	25 °C			-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Typ[1]	Max	Min	Max	Min	Max	
$f_{\max}$	maximum frequency	see Fig. 5								
		$C_L = 15 \text{ pF}$	90	140	-	80	-	80	-	MHz
		$C_L = 50 \text{ pF}$	85	130	-	75	-	75	-	MHz
t_W	pulse width	CP HIGH or LOW; see Fig. 5	6.5	-	-	6.5	-	6.5	-	ns
t_{su}	set-up time	Dn to CP; see Fig. 7	2.5	-	-	2.5	-	2.5	-	ns
t_h	hold time	Dn to CP; see Fig. 7	2.5	-	-	2.5	-	2.5	-	ns
C_{PD}	power dissipation capacitance	$f_i = 1 \text{ MHz}$; $V_I = \text{GND to } V_{\text{CC}}$ [5]	-	12	-	-	-	-	-	pF

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

[2] t_{pd} is the same as t_{PLH} and t_{PHL} .

[3] t_{en} is the same as t_{PZH} and t_{PZL} .

[4] t_{dis} is the same as t_{PHZ} and t_{PLZ} .

[5] C_{PD} is used to determine the dynamic power dissipation (P_D in μW).

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

f_i = input frequency in MHz;

f_o = output frequency in MHz;

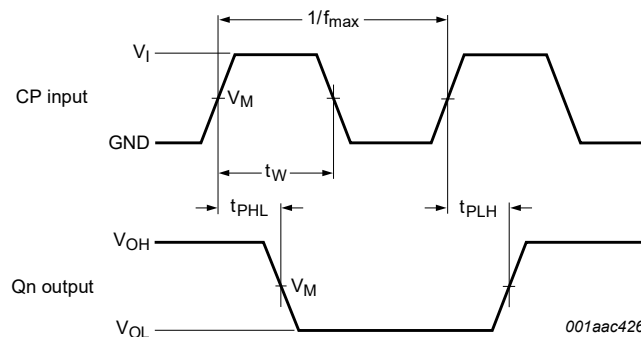
C_L = output load capacitance in pF;

V_{CC} = supply voltage in V;

N = number of inputs switching;

$\Sigma(C_L \times V_{\text{CC}}^2 \times f_o)$ = 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.

Fig. 5. Clock pulse width, maximum frequency and input to output propagation delays

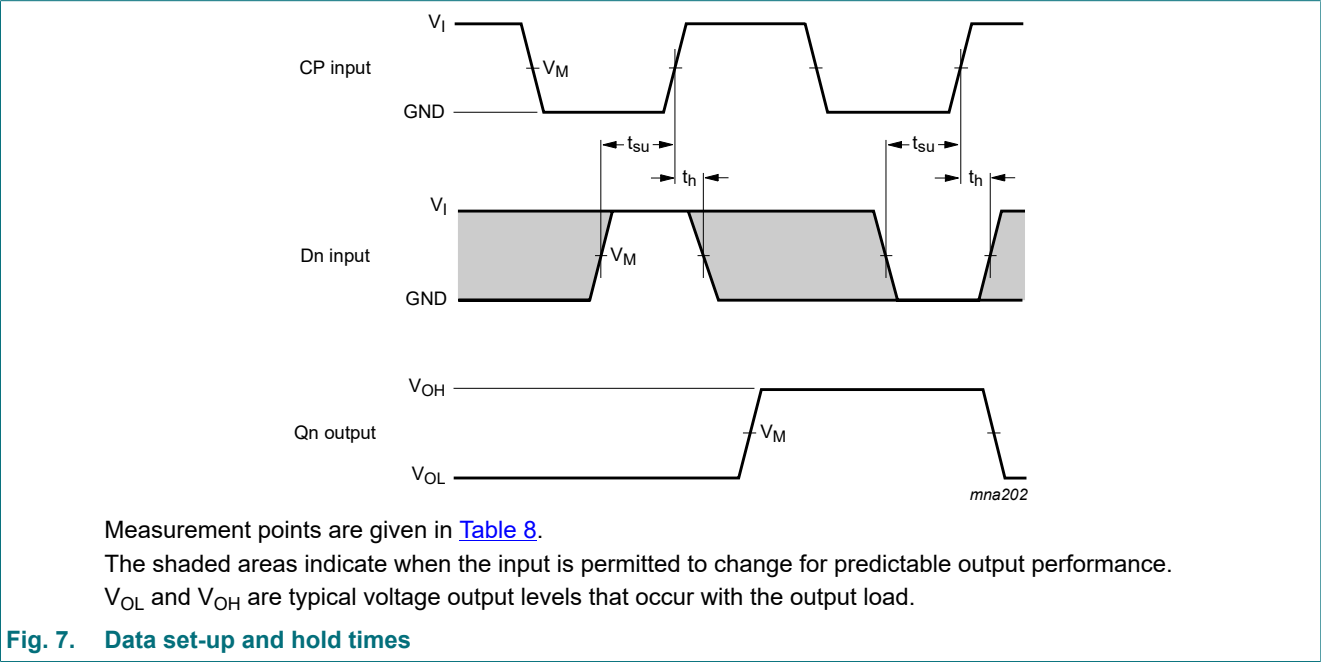
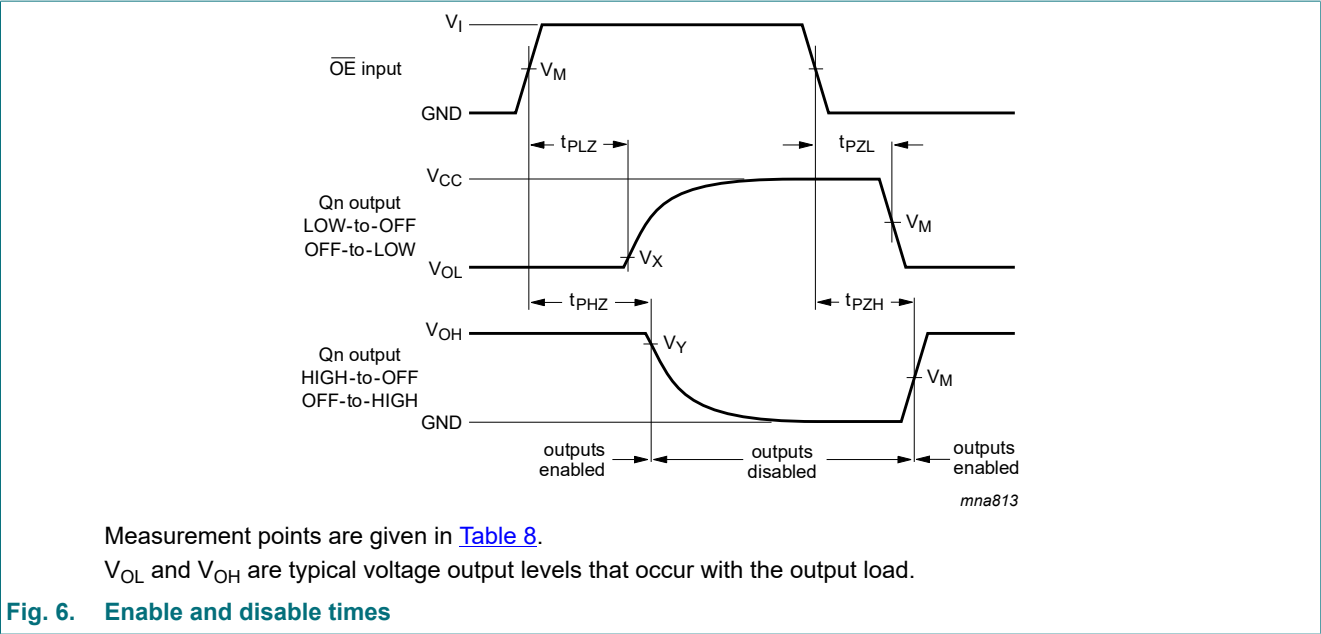


Table 8. Measurement points

Type	Input	Output		
	V_M	V_M	V_X	V_Y
74AHC374-Q100	$0.5 \times V_{CC}$	$0.5 \times V_{CC}$	$V_{OL} + 0.3 \text{ V}$	$V_{OH} - 0.3 \text{ V}$
74AHCT374-Q100	1.5 V	$0.5 \times V_{CC}$	$V_{OL} + 0.3 \text{ V}$	$V_{OH} - 0.3 \text{ V}$

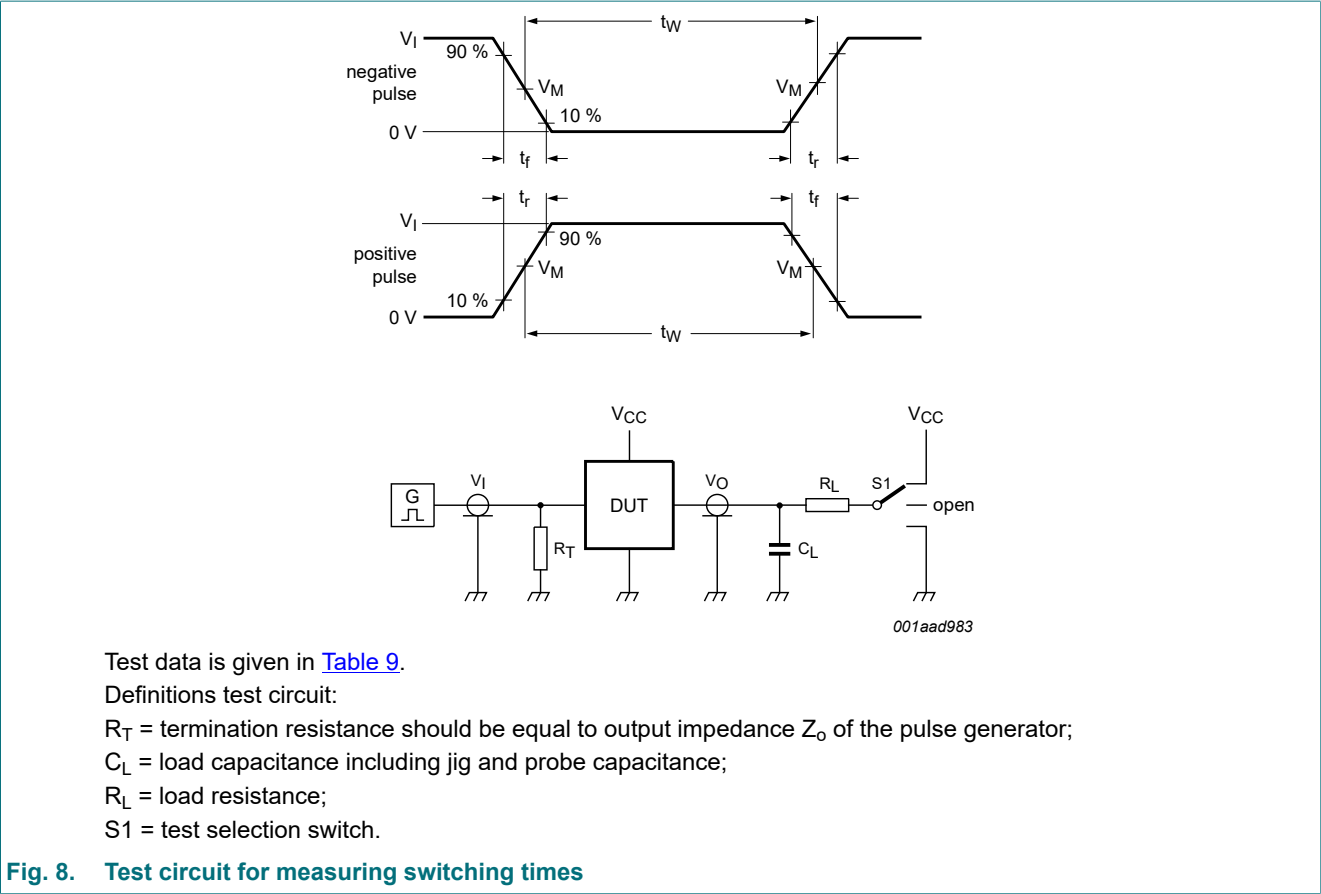


Fig. 8. Test circuit for measuring switching times

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}
74AHC374-Q100	V_{CC}	$\leq 3.0 \text{ ns}$	15 pF, 50 pF	1 k Ω	open	GND	V_{CC}
74AHCT374-Q100	3.0 V	$\leq 3.0 \text{ ns}$	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

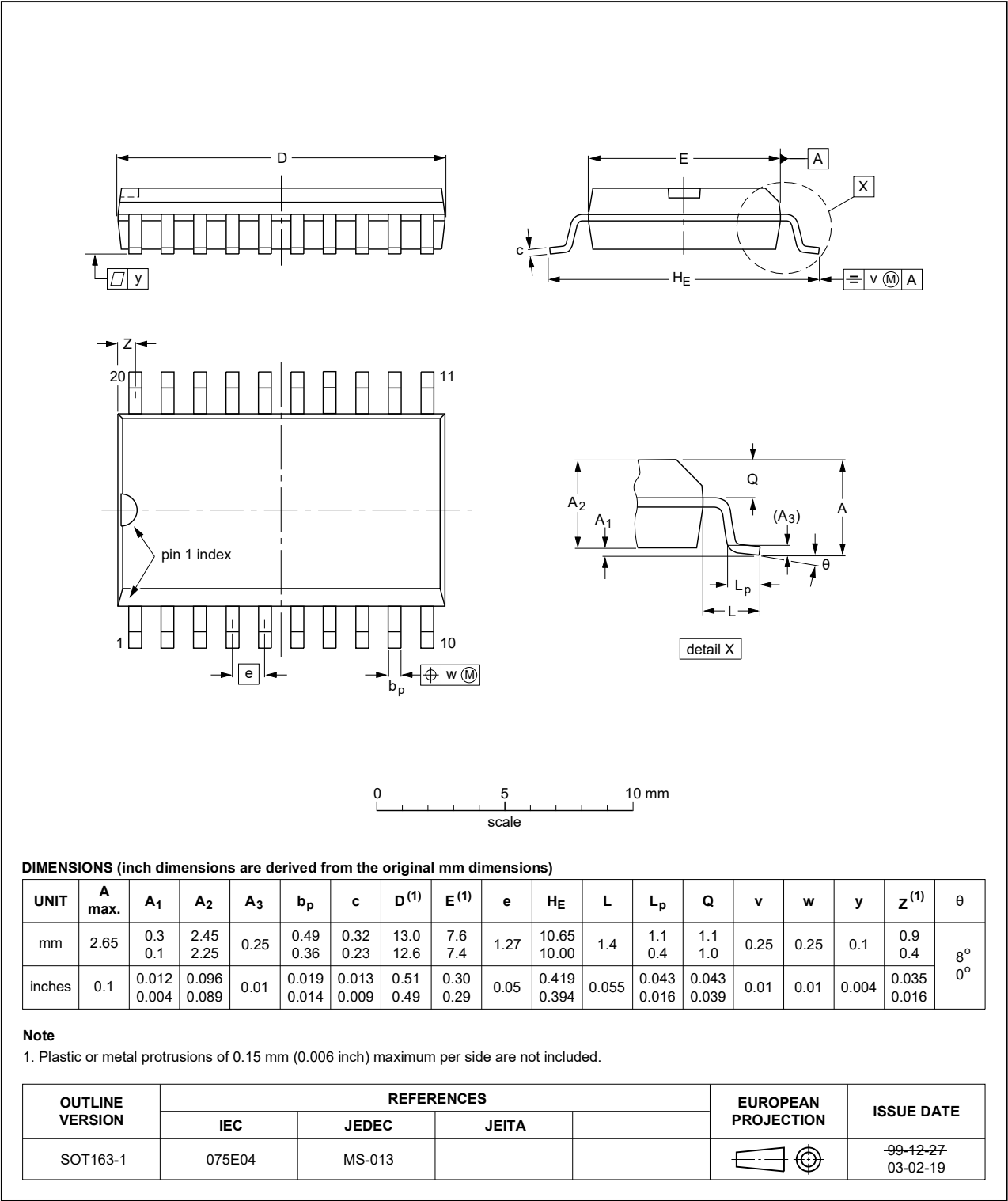


Fig. 9. Package outline SOT163-1 (SO20)

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

SOT360-1

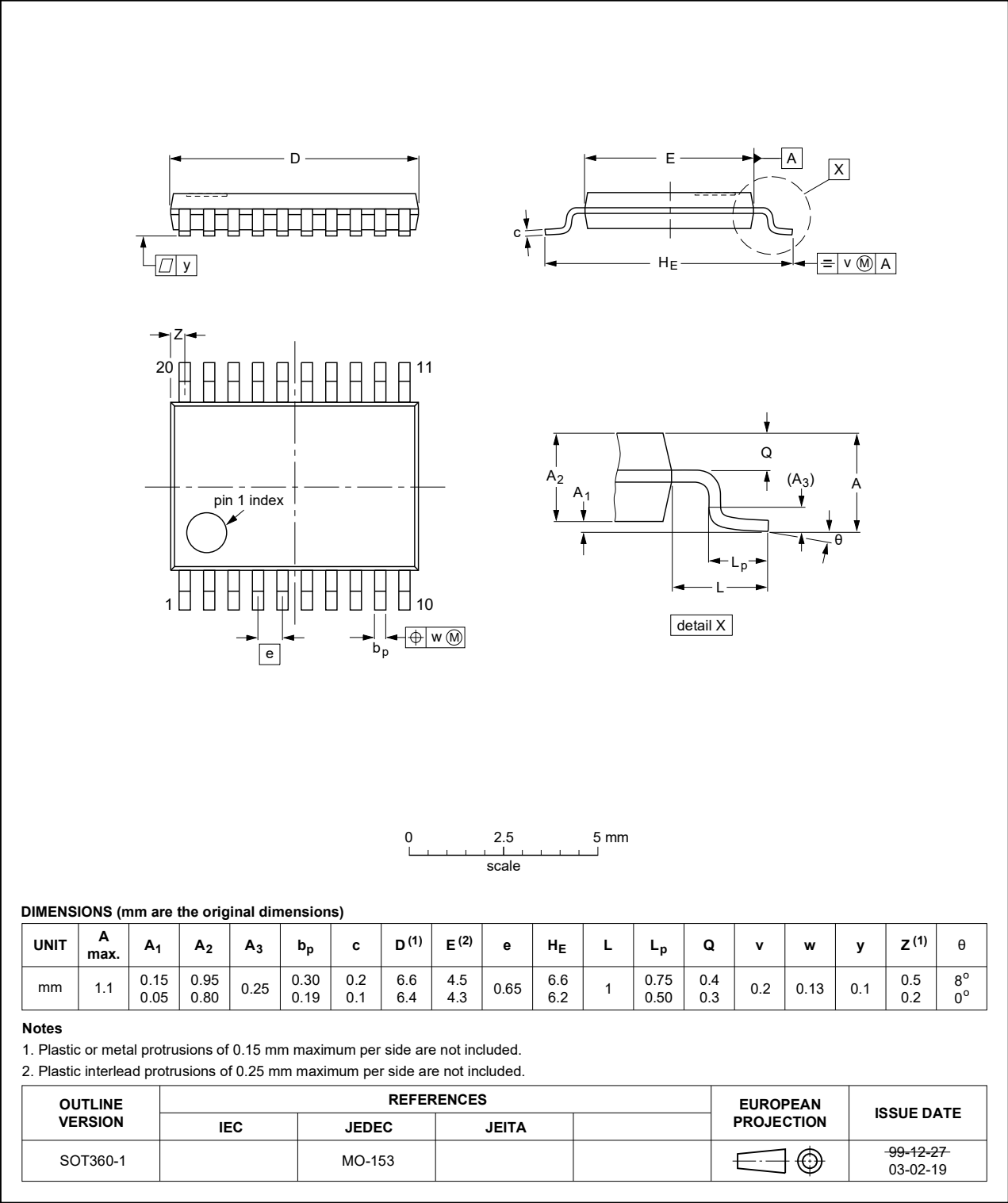


Fig. 10. Package outline SOT360-1 (TSSOP20)

12. Abbreviations

Table 10. 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_AHCT374_Q100 v.2	20230904	-	-	74AHC_AHCT374_Q100 v.1
Modifications	- 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 1 and Section 2 updated. Section 2: ESD specification updated according to the latest JEDEC standard. Table 4: Derating values for P_{tot} total power dissipation updated.			
74AHC_AHCT374_Q100 v.1	20140311	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".
- [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 <https://www.nexperia.com>.

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