# 74AHC273-Q100; 74AHCT273-Q100

Octal D-type flip-flop with reset; positive-edge trigger

Rev. 2 — 23 September 2020 Product data sheet

### 1. General description

The 74AHC273-Q100; 74AHCT273-Q100 is a high-speed Si-gate CMOS device and is pin compatible with Low-power Schottky TTL (LSTTL). It is specified in compliance with JEDEC standard No. 7-A.

The 74AHC273-Q100; 74AHCT273-Q100 has eight edge-triggered, D-type flip-flops with individual D inputs and Q outputs. The common clock (CP) and master reset ( $\overline{\text{MR}}$ ) inputs, load and reset (clear) all flip-flops simultaneously. The state of each D input, one set-up time before the LOW-to-HIGH clock transition, is transferred to the corresponding output (Qn) of the flip-flop. All outputs will be forced LOW, independent of clock or data inputs, by a LOW on the  $\overline{\text{MR}}$  input.

The device is useful for applications where only the true output is required and the clock and master reset are common to all storage elements.

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

- 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
- Inputs accept voltages higher than V<sub>CC</sub>
- · Ideal buffer for MOS microcontroller or memory
- Common clock and master reset
- Input levels:
  - For 74AHC273-Q100: CMOS level
  - For 74AHCT273-Q100: TTL level
- 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)
- DHVQFN package with Side-Wettable Flanks enabling Automatic Optical Inspection (AOI) of solder joints

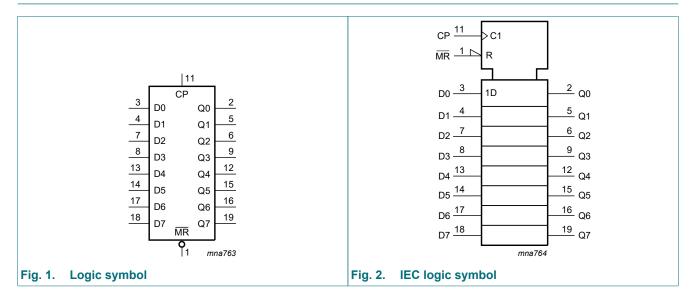


### 3. Ordering information

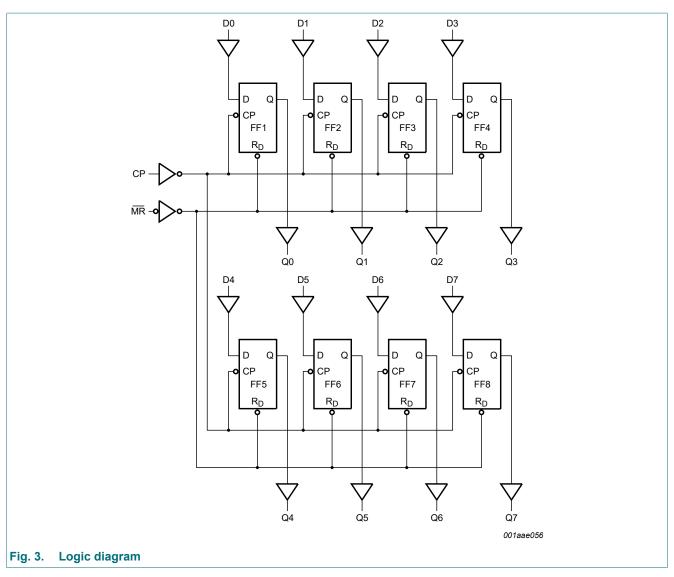
**Table 1. Ordering information** 

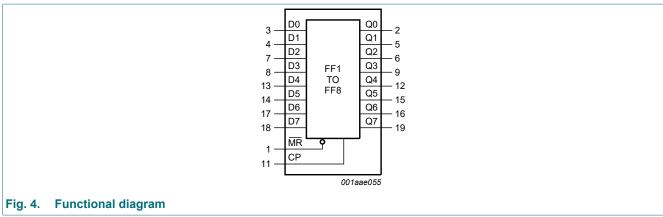
Type number	Package									
	Temperature range	Name	Description	Version						
74AHC273D-Q100	-40 °C to +125 °C	SO20								
74AHCT273D-Q100	-		body width 7.5 mm							
74AHC273PW-Q100	-40 °C to +125 °C	TSSOP20	plastic thin shrink small outline package; 20 leads;	SOT360-1						
74AHCT273PW-Q100			body width 4.4 mm							
74AHC273BQ-Q100	-40 °C to +125 °C	DHVQFN20	plastic dual in-line compatible thermal	SOT764-1						
74AHCT273BQ-Q100			enhanced very thin quad flat package; no leads; 20 terminals; body 2.5 × 4.5 × 0.85 mm							

### 4. Functional diagram



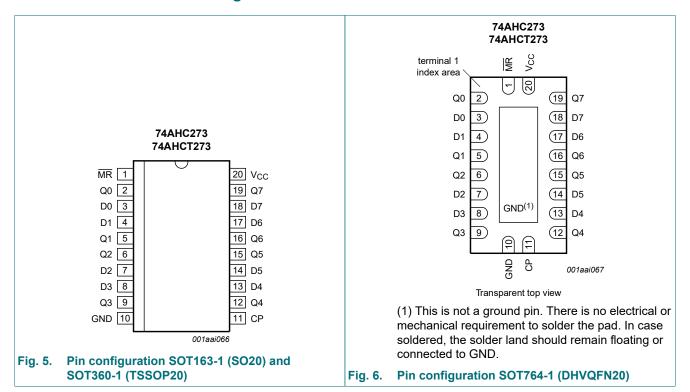
**Product data sheet** 





### 5. Pinning information

#### 5.1. Pinning



### 5.2. Pin description

Table 2. Pin description

Table 2. I ill description		
Symbol	Pin	Description
MR	1	master reset input (active LOW)
Q0, Q1, Q2, Q3, Q4, Q5, Q6, Q7	2, 5, 6, 9, 12, 15, 16, 19	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 <sub>CC</sub>	20	supply voltage

### 6. Functional description

#### Table 3. Function table

H = HIGH voltage level; h = HIGH voltage level one set-up time prior to the LOW-to-HIGH CP transition;

L = LOW voltage level; I = LOW voltage level one set-up time prior to the LOW-to-HIGH CP transition;

 $\uparrow$  = LOW-to-HIGH; X = don't care.

Operating mode	Control		Input	Output
	MR	СР	Dn	Qn
Reset (clear)	L	Х	Х	L
Load '1'	Н	<b>↑</b>	h	Н
Load '0'	Н	<b>↑</b>	I	L

### 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 <sub>CC</sub>	supply voltage			-0.5	+7.0	V
VI	input voltage			-0.5	+7.0	V
I <sub>IK</sub>	input clamping current	V <sub>I</sub> < -0.5 V	[1]	-20	-	mA
I <sub>OK</sub>	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
Icc	supply current			-	+75	mA
I <sub>GND</sub>	ground current			-75	-	mA
T <sub>stg</sub>	storage temperature			-65	+150	°C
P <sub>tot</sub>	total power dissipation	T <sub>amb</sub> = -40 °C to +125 °C	[2]	-	500	mW

<sup>[1]</sup> 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	Parameter Conditions		74AHC273-Q100			74AHCT273-Q100		
			Min	Тур	Max	Min	Тур	Max	
V <sub>CC</sub>	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 <sub>CC</sub>	0	-	V <sub>CC</sub>	V
T <sub>amb</sub>	ambient temperature		-40	+25	+125	-40	+25	+125	°C
Δt/ΔV	input transition rise and	$V_{CC} = 3.3 \text{ V} \pm 0.3 \text{ V}$	-	-	100	-	-	-	ns/V
	fall rate	V <sub>CC</sub> = 5.0 V ± 0.5 V	-	-	20	-	-	20	ns/V

<sup>[2]</sup> For SOT163-1 (SO20) package: P<sub>tot</sub> derates linearly with 12.3 mW/K above 109 °C. For SOT360-1 (TSSOP20) package: P<sub>tot</sub> derates linearly with 10.0 mW/K above 100 °C. For SOT764-1 (DHVQFN20) package: P<sub>tot</sub> derates linearly with 12.9 mW/K above 111 °C.

### 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 t	o +85 °C	-40 °C to	+125 °C	Unit
			Min	Тур	Max	Min	Max	Min	Max	
74AHC2	73-Q100		'					<u> </u>		
$V_{IH}$	HIGH-level	V <sub>CC</sub> = 2.0 V	1.5	-	-	1.5	-	1.5	-	V
	input voltage	V <sub>CC</sub> = 3.0 V	2.1	-	-	2.1	-	2.1	-	V
		V <sub>CC</sub> = 5.5 V	3.85	-	-	3.85	-	3.85	-	V
$V_{IL}$	LOW-level	V <sub>CC</sub> = 2.0 V	-	-	0.5	-	0.5	-	0.5	V
	input voltage	V <sub>CC</sub> = 3.0 V	-	-	0.9	-	0.9	-	0.9	V
		V <sub>CC</sub> = 5.5 V	-	-	1.65	-	1.65	-	1.65	V
V <sub>OH</sub>	HIGH-level	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>								
	output voltage	I <sub>O</sub> = -50 μA; V <sub>CC</sub> = 2.0 V	1.9	2.0	-	1.9	-	1.9	-	V
		I <sub>O</sub> = -50 μA; V <sub>CC</sub> = 3.0 V	2.9	3.0	-	2.9	-	2.9	-	V
		I <sub>O</sub> = -50 μA; V <sub>CC</sub> = 4.5 V	4.4	4.5	-	4.4	-	4.4	-	V
		$I_O = -4.0 \text{ mA}; V_{CC} = 3.0 \text{ V}$	2.58	-	-	2.48	-	2.40	-	V
		$I_O = -8.0 \text{ mA}; V_{CC} = 4.5 \text{ V}$	3.94	-	-	3.80	-	3.70	-	V
$V_{OL}$	LOW-level	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>								
	output voltage	I <sub>O</sub> = 50 μA; V <sub>CC</sub> = 2.0 V	-	0	0.1	-	0.1	-	0.1	V
		I <sub>O</sub> = 50 μA; V <sub>CC</sub> = 3.0 V	-	0	0.1	-	0.1	-	0.1	V
		I <sub>O</sub> = 50 μA; V <sub>CC</sub> = 4.5 V	-	0	0.1	-	0.1	-	0.1	V
		$I_O = 4.0 \text{ mA}; V_{CC} = 3.0 \text{ V}$	-	-	0.36	-	0.44	-	0.55	V
		$I_O = 8.0 \text{ mA}; V_{CC} = 4.5 \text{ V}$	-	-	0.36	-	0.44	-	0.55	V
l <sub>l</sub>	input leakage current	V <sub>I</sub> = 5.5 V or GND; V <sub>CC</sub> = 0 V to 5.5 V	-	-	0.1	-	1.0	-	2.0	μΑ
I <sub>CC</sub>	supply current	$V_I = V_{CC}$ or GND; $I_O = 0$ A; $V_{CC} = 5.5$ V	-	-	4.0	-	40	-	80	μΑ
C <sub>I</sub>	input capacitance		-	3	10	-	10	-	10	pF
Co	output capacitance		-	4	-	-	-	-	-	pF

Symbol	Parameter	Conditions		25 °C		-40 °C t	o +85 °C	-40 °C to +125 °C		Unit
			Min	Тур	Max	Min	Max	Min	Max	
74AHCT	273-Q100			•				'		
V <sub>IH</sub>	HIGH-level input voltage	V <sub>CC</sub> = 4.5 V to 5.5 V	2.0	-	-	2.0	-	2.0	-	V
V <sub>IL</sub>	LOW-level input voltage	V <sub>CC</sub> = 4.5 V to 5.5 V	-	-	0.8	-	0.8	-	0.8	V
V <sub>OH</sub>	HIGH-level	$V_I = V_{IH}$ or $V_{IL}$ ; $V_{CC} = 4.5 \text{ V}$								
	output voltage	I <sub>O</sub> = -50 μA	4.4	-	-	4.4	-	4.4	-	V
		I <sub>O</sub> = -8.0 mA	3.94	-	-	3.80	-	3.70	-	V
V <sub>OL</sub>	LOW-level	$V_I = V_{IH}$ or $V_{IL}$ ; $V_{CC} = 4.5 \text{ V}$								
	output voltage	I <sub>O</sub> = 50 μA	-	0	0.1	-	0.1	-	0.1	V
		I <sub>O</sub> = 8.0 mA	-	-	0.36	-	0.44	-	0.55	V
l <sub>l</sub>	input leakage current	V <sub>I</sub> = 5.5 V or GND; V <sub>CC</sub> = 0 V to 5.5 V	-	-	0.1	-	1.0	-	2.0	μA
I <sub>CC</sub>	supply current	$V_I = V_{CC}$ or GND; $I_O = 0$ A; $V_{CC} = 5.5 \text{ V}$	-	-	4.0	-	40	-	80	μA
ΔI <sub>CC</sub>	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
Cı	input capacitance		-	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. 10.

Symbol	Parameter	Conditions		25 °C		-40 °C to	o +85 °C	-40 °C to +125 °C		Unit
			Min	Typ[1]	Max	Min	Max	Min	Max	
74AHC27	73-Q100									•
t <sub>pd</sub>	propagation	CP to Qn; see Fig. 7 [2]								
	delay	V <sub>CC</sub> = 3.0 V to 3.6 V								
		C <sub>L</sub> = 15 pF	-	6.0	13.6	1.0	16.0	1.0	17.0	ns
		C <sub>L</sub> = 50 pF	-	8.6	17.1	1.0	19.5	1.0	21.5	ns
		V <sub>CC</sub> = 4.5 V to 5.5 V								
		C <sub>L</sub> = 15 pF	-	4.2	9	1.0	10.5	1.0	11.5	ns
		C <sub>L</sub> = 50 pF	-	6.0	11.0	1.0	12.5	1.0	14.0	ns
		MR to Qn; see Fig. 8 [3]								
		V <sub>CC</sub> = 3.0 V to 3.6 V								
		C <sub>L</sub> = 15 pF	-	5.1	13.6	1.0	16.0	1.0	17.0	ns
		C <sub>L</sub> = 50 pF	-	7.3	17.1	1.0	19.5	1.0	21.5	ns
		V <sub>CC</sub> = 4.5 V to 5.5 V								
		C <sub>L</sub> = 15 pF	-	3.7	8.5	1.0	10.0	1.0	11.0	ns
		C <sub>L</sub> = 50 pF	-	5.3	10.5	1.0	12.0	1.0	13.5	ns

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Symbol	Parameter	Conditions		25 °C		-40 °C t	o +85 °C	-40 °C to +125 °C		Unit
			Min	Typ[1]	Max	Min	Max	Min	Max	
f <sub>max</sub>	maximum	see Fig. 7								
	frequency	V <sub>CC</sub> = 3.0 V to 3.6 V								
		C <sub>L</sub> = 15 pF	75	120	-	65	-	65	-	MHz
		C <sub>L</sub> = 50 pF	50	75	-	45	-	45	-	MHz
		V <sub>CC</sub> = 4.5 V to 5.5 V								
		C <sub>L</sub> = 15 pF	120	165	-	100	-	100	-	MHz
		C <sub>L</sub> = 50 pF	80	110	-	70	-	70	-	MHz
t <sub>W</sub> pulse widt	pulse width	CP HIGH or LOW; see Fig. 7								
		V <sub>CC</sub> = 3.0 V to 3.6 V	5.0	-	-	6.5	-	6.5	-	ns
		V <sub>CC</sub> = 4.5 V to 5.5 V	5.0	-	-	5.0	-	5.0	-	ns
		MR LOW; see Fig. 8								
		V <sub>CC</sub> = 3.0 V to 3.6 V	5.0	-	-	6.0	-	6.0	-	ns
		V <sub>CC</sub> = 4.5 V to 5.5 V	5.0	-	-	5.0	-	5.0	-	ns
t <sub>su</sub>	set-up time	Dn to CP; see Fig. 9								
		V <sub>CC</sub> = 3.0 V to 3.6 V	3.0	-	-	3.0	-	3.0	-	ns
		V <sub>CC</sub> = 4.5 V to 5.5 V	3.0	-	-	3.0	-	3.0	-	ns
t <sub>h</sub>	hold time	Dn to CP; see Fig. 9								
		V <sub>CC</sub> = 3.0 V to 3.6 V	1.0	-	-	1.0	-	1.0	-	ns
		V <sub>CC</sub> = 4.5 V to 5.5 V	1.0	-	-	1.0	-	1.0	-	ns
t <sub>rec</sub>	recovery	MR to CP; see Fig. 8								
	time	V <sub>CC</sub> = 3.0 V to 3.6 V	2.5	-	-	2.5	-	2.5	-	ns
		V <sub>CC</sub> = 4.5 V to 5.5 V	2.0	-	-	2.0	-	2.0	-	ns
C <sub>PD</sub>	power dissipation capacitance	$f_i = 1 \text{ MHz}$ ; $V_I = \text{GND to } V_{CC}$ [4]	-	14	-	-	-	-	-	pF

Symbol	Parameter	Conditions		25 °C		-40 °C to	o +85 °C	-40 °C to	+125 °C	Unit
			Min	Typ[1]	Max	Min	Max	Min	Max	1
74AHCT	273-Q100; V <sub>C</sub>	<sub>C</sub> = 4.5 V to 5.5 V		<u>'</u>			'			•
t <sub>pd</sub>		CP to Qn; see Fig. 7 [2]								
	delay	C <sub>L</sub> = 15 pF	-	4.0	7.5	1.0	8.8	1.0	9.5	ns
		C <sub>L</sub> = 50 pF	-	5.8	9.2	1.0	10.5	1.0	11.5	ns
		MR to Qn; see Fig. 8 [3]								
		C <sub>L</sub> = 15 pF	-	3.9	10.0	1.0	11.6	1.0	12.5	ns
		C <sub>L</sub> = 50 pF	-	5.6	11.0	1.0	12.6	1.0	14.0	ns
f <sub>max</sub>	maximum	see Fig. 7								
	frequency	C <sub>L</sub> = 15 pF	75	120	-	65	-	65	-	MHz
		C <sub>L</sub> = 50 pF	50	75	-	45	-	45	-	MHz
t <sub>W</sub>	pulse width	CP HIGH or LOW; see Fig. 7	5.0	-	-	6.5	-	6.5	-	ns
		MR LOW; see Fig. 8	5.0	-	-	6.0	-	6.0	-	ns
t <sub>su</sub>	set-up time	Dn to CP; see Fig. 9	3.0	-	-	3.0	-	3.0	-	ns
t <sub>h</sub>	hold time	Dn to CP; see Fig. 9	1.0	-	-	1.0	-	1.0	-	ns
t <sub>rec</sub>	recovery time	MR to CP; see Fig. 8	2.5	-	-	2.5	-	2.5	-	ns
C <sub>PD</sub>	power dissipation capacitance	$f_i = 1 \text{ MHz}$ ; $V_i = \text{GND to } V_{CC}$ [4]	-	18	-	-	-	-	-	pF

- Typical values are measured at nominal supply voltage ( $V_{CC} = 3.3 \text{ V}$  and  $V_{CC} = 5.0 \text{ V}$ ).
- $t_{pd}$  is the same as  $t_{PLH}$  and  $t_{PHL}$ .
- [3]
- $t_{pd}$  is the same as  $t_{PHL}$  only.  $C_{PD}$  is used to determine the dynamic power dissipation ( $P_D$  in  $\mu W$ ).

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

f<sub>i</sub> = input frequency in MHz;

fo = output frequency in MHz;

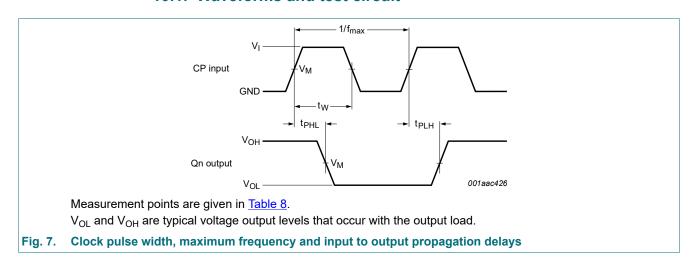
C<sub>L</sub> = output load capacitance in pF;

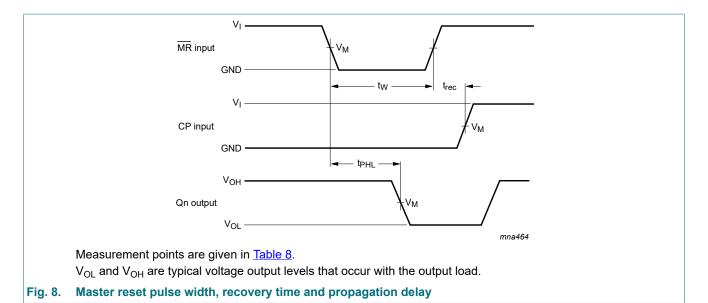
V<sub>CC</sub> = supply voltage in V;

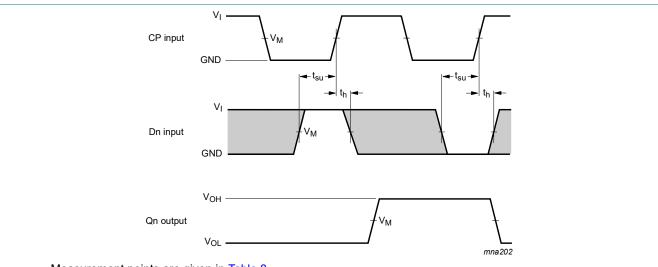
N = number of inputs switching;

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

#### 10.1. Waveforms and test circuit







Measurement points are given in Table 8.

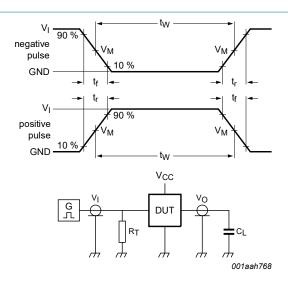
The shaded areas indicate when the input is permitted to change for predictable output performance.

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

Fig. 9. Data set-up and hold times

**Table 8. Measurement points** 

Туре	Input	Output		
	V <sub>M</sub>	V <sub>M</sub>		
74AHC273-Q100	0.5 x V <sub>CC</sub>	0.5 x V <sub>CC</sub>		
74AHCT273-Q100	1.5 V	0.5 x V <sub>CC</sub>		



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.

Fig. 10. Test circuit for measuring switching times

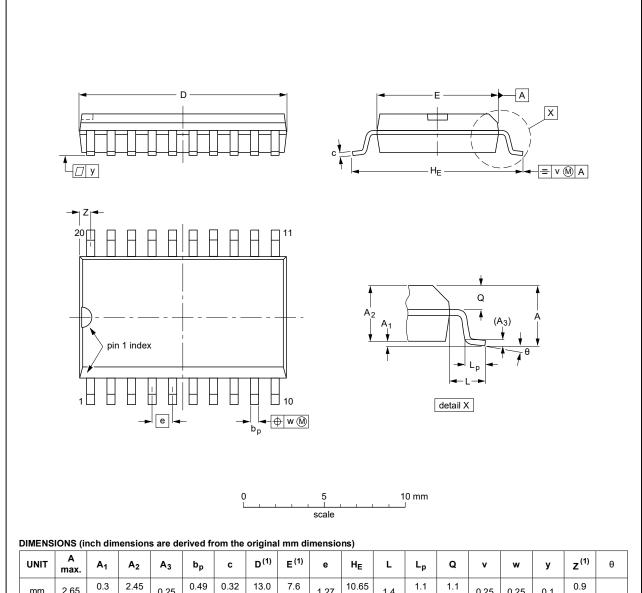
Table 9. Test data

Туре	Input L		Load	Test
	VI	t <sub>r</sub> , t <sub>f</sub>	CL	
74AHC273-Q100	V <sub>CC</sub>	≤ 3.0 ns	15 pF, 50 pF	t <sub>PLH</sub> , t <sub>PHL</sub>
74AHCT273-Q100	3.0 V	≤ 3.0 ns	15 pF, 50 pF	t <sub>PLH</sub> , t <sub>PHL</sub>

### 11. Package outline

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

SOT163-1



UNIT	A max.	A <sub>1</sub>	A <sub>2</sub>	<b>A</b> <sub>3</sub>	bp	С	D <sup>(1)</sup>	E <sup>(1)</sup>	е	HE	L	Lp	Q	v	w	у	z <sup>(1)</sup>	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°

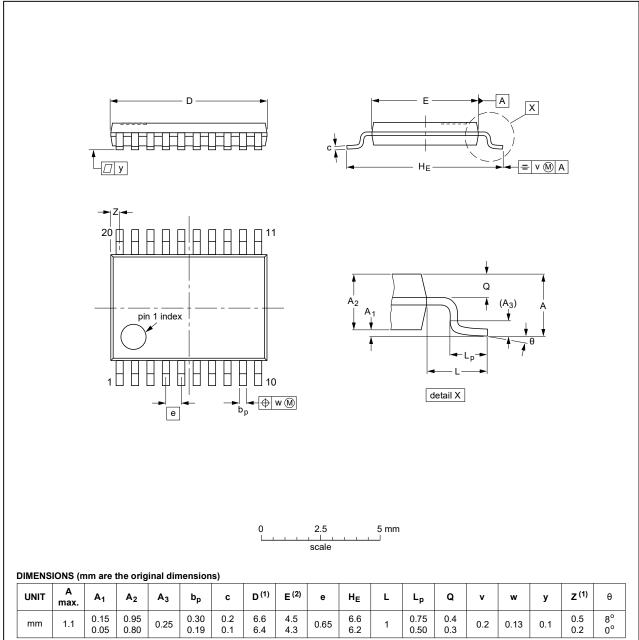
1. Plastic or metal protrusions of 0.15 mm (0.006 inch) maximum per side are not included.

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

Fig. 11. Package outline SOT163-1 (SO20)

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

SOT360-1



### 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				<del>99-12-27</del> 03-02-19

Fig. 12. Package outline SOT360-1 (TSSOP20)

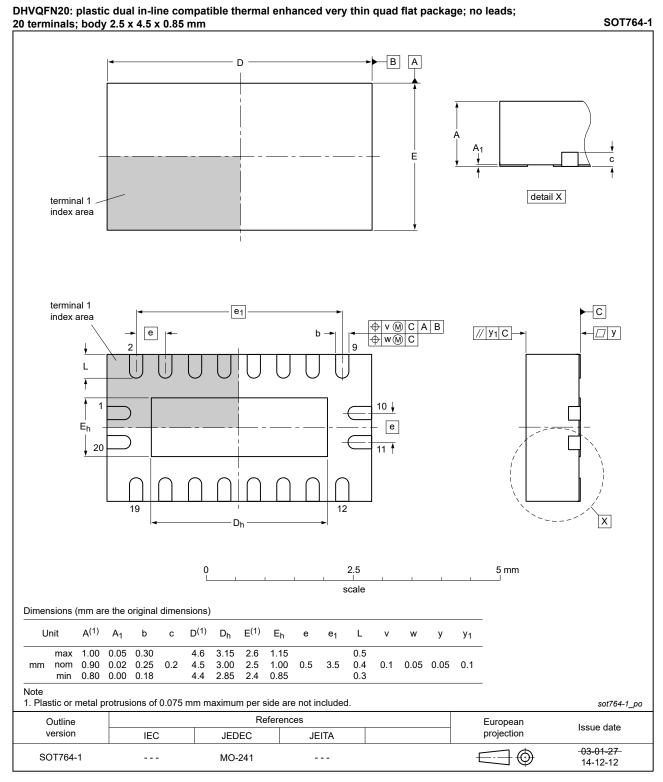


Fig. 13. Package outline SOT764-1 (DHVQFN20)

### 12. Abbreviations

#### **Table 10. Abbreviations**

Acronym	Description
CMOS	Complementary Metal-Oxide Semiconductor
DUT	Device Under Test
ESD	ElectroStatic Discharge
НВМ	Human Body Model
LSTTL	Low-power Schottky Transistor-Transistor Logic
MIL	Military
MM	Machine Model
MOS	Metal-Oxide Semiconductor

## 13. Revision history

#### Table 11. Revision history

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Document ID	Release date	Data sheet status	Change notice	Supersedes
74AHC_AHCT273_Q100 v.2	20200923	Product data sheet	-	74AHC_AHCT273_Q100 v.1
Modifications:	of Nexperia.  Legal texts have  Section 2 update  Table 4: Derating	been adapted to the n	ew company name w	
74AHC_AHCT273_Q100 v.1	20130327	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.

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