

# 74HC273-Q100; 74HCT273-Q100

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

Rev. 1 — 19 June 2013

Product data sheet

## 1. General description

The 74HC273-Q100; 74HCT273-Q100 is an octal positive-edge triggered D-type flip-flop. The device features clock (CP) and master reset ( $\overline{MR}$ ) inputs. The outputs Qn assume the state of their corresponding Dn inputs that meet the set-up and hold time requirements on the LOW-to-HIGH clock (CP) transition. A LOW on  $\overline{MR}$  forces the outputs LOW independently of clock and data inputs. Inputs include clamp diodes which enable the use of current limiting resistors to interface inputs to voltages in excess of V<sub>CC</sub>.

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
- Input levels:
  - ◆ For 74HC273-Q100: CMOS level
  - ◆ For 74HCT273-Q100: TTL level
- Common clock and master reset
- Eight positive edge-triggered D-type flip-flops
- Complies with JEDEC standard no. 7A
- ESD protection:
  - ◆ HBM JESD22-A114F exceeds 2000 V
  - ◆ MM JESD22-A115-A exceeds 200 V.
- Multiple package options

## 3. Ordering information

Table 1. Ordering information

Type number	Package			
	Temperature range	Name	Description	Version
74HC273D-Q100 74HCT273D-Q100	-40 °C to +125 °C	SO20	plastic small outline package; 20 leads; body width 7.5 mm	SOT163-1
74HC273PW-Q100 74HCT273PW-Q100	-40 °C to +125 °C	TSSOP20	plastic thin shrink small outline package; 20 leads; body width 4.4 mm	SOT360-1
74HC273BQ-Q100 74HCT273BQ-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



## 4. Functional diagram

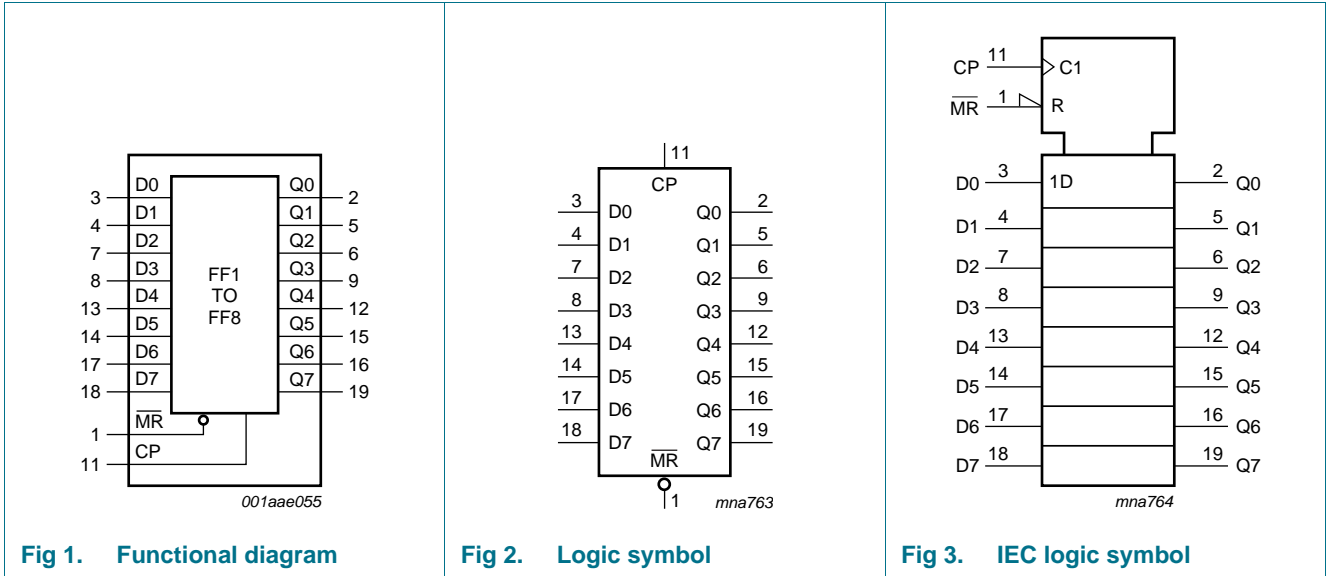


Fig 1. Functional diagram

Fig 2. Logic symbol

Fig 3. IEC logic symbol

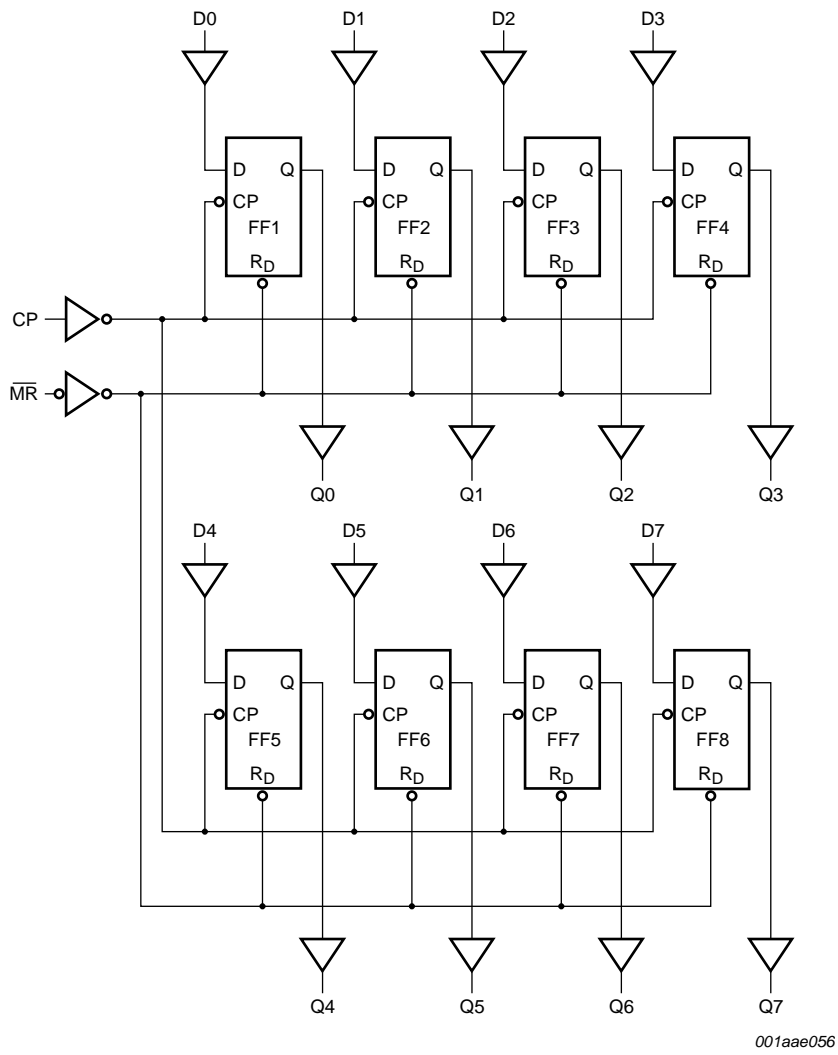


Fig 4. Logic diagram

## 5. Pinning information

### 5.1 Pinning

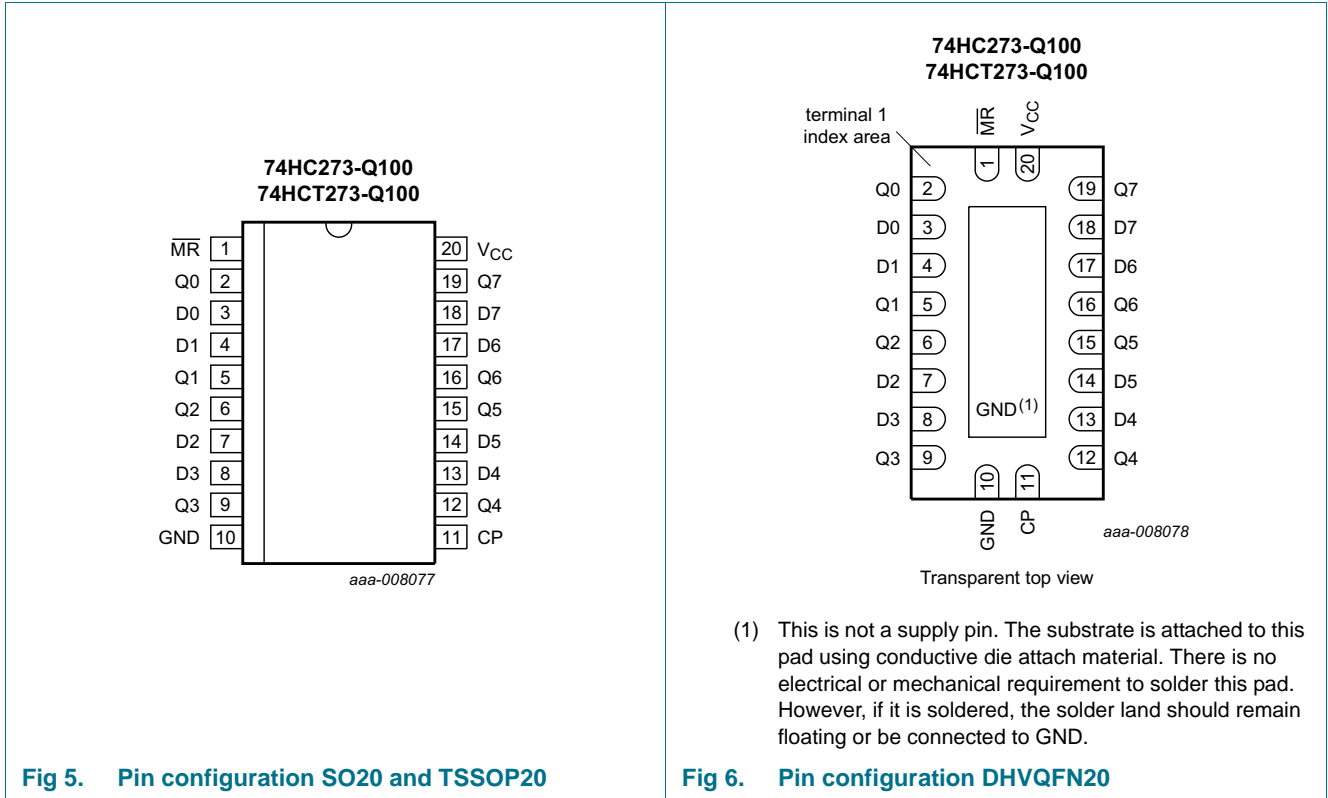


Fig 5. Pin configuration SO20 and TSSOP20

Fig 6. Pin configuration DHVQFN20

### 5.2 Pin description

Table 2. Pin description

Symbol	Pin	Description
$\overline{\text{MR}}$	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<sup>[1]</sup>

Operating modes	Inputs			Outputs
	MR	CP	Dn	Qn
reset (clear)	L	X	X	L
load "1"	H	↑	h	H
load "0"	H	↑	l	L

- [1] H = HIGH voltage level;  
 h = HIGH voltage level one set-up time prior to the LOW-to-HIGH clock transition;  
 L = LOW voltage level;  
 l = LOW voltage level one set-up time prior to the LOW-to-HIGH clock transition;  
 X = don't care;  
 ↑ = LOW-to-HIGH clock transition.

## 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	V
$I_{IK}$	input clamping current	$V_I < -0.5\text{ V}$ or $V_I > V_{CC} + 0.5\text{ V}$	[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
$I_O$	output current	$-0.5\text{ V} < V_O < V_{CC} + 0.5\text{ V}$	-	±25	mA
$I_{CC}$	supply current		-	50	mA
$I_{GND}$	ground current		-50	-	mA
$T_{stg}$	storage temperature		-65	+150	°C
$P_{tot}$	total power dissipation	$T_{amb} = -40\text{ °C}$ to $+125\text{ °C}$	[2] -	500	mW

- [1] The input and output voltage ratings may be exceeded if the input and output current ratings are observed.  
 [2] For SO20 package: above 70 °C the value of  $P_{tot}$  derates linearly with 8 mW/K.  
 For TSSOP20 package: above 60 °C the value of  $P_{tot}$  derates linearly with 5.5 mW/K.  
 For DHVQFN20 package:  $P_{tot}$  derates linearly with 4.5 mW/K above 60 °C.

## 8. Recommended operating conditions

**Table 5. Recommended operating conditions**

Voltages are referenced to GND (ground = 0 V)

Symbol	Parameter	Conditions	74HC273-Q100			74HCT273-Q100			Unit
			Min	Typ	Max	Min	Typ	Max	
V <sub>CC</sub>	supply voltage		2.0	5.0	6.0	4.5	5.0	5.5	V
V <sub>I</sub>	input voltage		0	-	V <sub>CC</sub>	0	-	V <sub>CC</sub>	V
V <sub>O</sub>	output voltage		0	-	V <sub>CC</sub>	0	-	V <sub>CC</sub>	V
T <sub>amb</sub>	ambient temperature		-40	-	+125	-40	-	+125	°C
Δt/ΔV	input transition rise and fall rate	V <sub>CC</sub> = 2.0 V	-	-	625	-	-	-	ns/V
		V <sub>CC</sub> = 4.5 V	-	1.67	139	-	1.67	139	ns/V
		V <sub>CC</sub> = 6.0 V	-	-	83	-	-	-	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	
<b>74HC273-Q100</b>										
V <sub>IH</sub>	HIGH-level input voltage	V <sub>CC</sub> = 2.0 V	1.5	1.2	-	1.5	-	1.5	-	V
		V <sub>CC</sub> = 4.5 V	3.15	2.4	-	3.15	-	3.15	-	V
		V <sub>CC</sub> = 6.0 V	4.2	3.2	-	4.2	-	4.2	-	V
V <sub>IL</sub>	LOW-level input voltage	V <sub>CC</sub> = 2.0 V	-	0.8	0.5	-	0.5	-	0.5	V
		V <sub>CC</sub> = 4.5 V	-	2.1	1.35	-	1.35	-	1.35	V
		V <sub>CC</sub> = 6.0 V	-	2.8	1.8	-	1.8	-	1.8	V
V <sub>OH</sub>	HIGH-level output voltage	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>								
		I <sub>O</sub> = -20 μA; V <sub>CC</sub> = 2.0 V	1.9	2.0	-	1.9	-	1.9	-	V
		I <sub>O</sub> = -20 μA; V <sub>CC</sub> = 4.5 V	4.4	4.5	-	4.4	-	4.4	-	V
		I <sub>O</sub> = -20 μA; V <sub>CC</sub> = 6.0 V	5.9	6.0	-	5.9	-	5.9	-	V
		I <sub>O</sub> = -4.0 mA; V <sub>CC</sub> = 4.5 V	3.98	4.32	-	3.84	-	3.7	-	V
V <sub>OL</sub>	LOW-level output voltage	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>								
		I <sub>O</sub> = 20 μA; V <sub>CC</sub> = 2.0 V	-	0	0.1	-	0.1	-	0.1	V
		I <sub>O</sub> = 20 μA; V <sub>CC</sub> = 4.5 V	-	0	0.1	-	0.1	-	0.1	V
		I <sub>O</sub> = 20 μA; V <sub>CC</sub> = 6.0 V	-	0	0.1	-	0.1	-	0.1	V
		I <sub>O</sub> = 4.0 mA; V <sub>CC</sub> = 4.5 V	-	0.15	0.26	-	0.33	-	0.4	V
I <sub>I</sub>	input leakage current	V <sub>I</sub> = V <sub>CC</sub> or GND; V <sub>CC</sub> = 6.0 V	-	-	±0.1	-	±1	-	±1	μA
		V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0 A; V <sub>CC</sub> = 6.0 V	-	-	8.0	-	80	-	160	μA

**Table 6. Static characteristics ...continued**

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	
C <sub>I</sub>	input capacitance		-	3.5	-	-	-	-	-	pF
<b>74HCT273-Q100</b>										
V <sub>IH</sub>	HIGH-level input voltage	V <sub>CC</sub> = 4.5 V to 5.5 V	2.0	1.6	-	2.0	-	2.0	-	V
V <sub>IL</sub>	LOW-level input voltage	V <sub>CC</sub> = 4.5 V to 5.5 V	-	1.2	0.8	-	0.8	-	0.8	V
V <sub>OH</sub>	HIGH-level output voltage	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; V <sub>CC</sub> = 4.5 V								
		I <sub>O</sub> = -20 μA	4.4	4.5	-	4.4	-	4.4	-	V
		I <sub>O</sub> = -4.0 mA	3.98	4.32	-	3.84	-	3.7	-	V
V <sub>OL</sub>	LOW-level output voltage	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; V <sub>CC</sub> = 4.5 V								
		I <sub>O</sub> = 20 μA; V <sub>CC</sub> = 4.5 V	-	0	0.1	-	0.1	-	0.1	V
		I <sub>O</sub> = 5.2 mA; V <sub>CC</sub> = 5.5 V	-	0.15	0.26	-	0.33	-	0.4	V
I <sub>I</sub>	input leakage current	V <sub>I</sub> = V <sub>CC</sub> or GND; V <sub>CC</sub> = 5.5 V	-	-	±0.1	-	±1	-	±1	μA
I <sub>CC</sub>	supply current	V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0 A; V <sub>CC</sub> = 5.5 V	-	-	8.0	-	80	-	160	μA
ΔI <sub>CC</sub>	additional supply current	per input pin; V <sub>I</sub> = V <sub>CC</sub> - 2.1 V; other inputs at V <sub>CC</sub> or GND; V <sub>CC</sub> = 4.5 V to 5.5 V								
		MR input	-	100	360	-	450	-	490	μA
		CP input	-	175	630	-	787.5	-	857.5	μA
		Dn input	-	15	54	-	67.5	-	73.5	μA
C <sub>I</sub>	input capacitance		-	3.5	-	-	-	-	-	pF

## 10. Dynamic characteristics

**Table 7. Dynamic characteristics**

GND (ground = 0 V); C<sub>L</sub> = 50 pF unless otherwise specified; for test circuit, see [Figure 10](#)

Symbol	Parameter	Conditions	25 °C			-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
<b>74HC273-Q100</b>										
t <sub>pd</sub>	propagation delay	CP to Qn; see <a href="#">Figure 7</a> <sup>[1]</sup>								
		V <sub>CC</sub> = 2.0 V	-	41	150	-	185	-	225	ns
		V <sub>CC</sub> = 4.5 V	-	15	30	-	37	-	45	ns
		V <sub>CC</sub> = 5.0 V; C <sub>L</sub> = 15 pF	-	15	-	-	-	-	-	ns
		V <sub>CC</sub> = 6.0 V	-	13	26	-	31	-	38	ns

**Table 7. Dynamic characteristics ...continued**GND (ground = 0 V);  $C_L = 50$  pF unless otherwise specified; for test circuit, see [Figure 10](#)

Symbol	Parameter	Conditions	25 °C			−40 °C to +85 °C		−40 °C to +125 °C		Unit	
			Min	Typ	Max	Min	Max	Min	Max		
t <sub>PHL</sub>	HIGH to LOW propagation delay	$\overline{MR}$ to Qn; see <a href="#">Figure 8</a>									
		V <sub>CC</sub> = 2.0 V	-	44	150	-	185	-	225	ns	
		V <sub>CC</sub> = 4.5 V	-	16	30	-	37	-	45	ns	
		V <sub>CC</sub> = 5.0 V; C <sub>L</sub> = 15 pF	-	15	-	-	-	-	-	ns	
		V <sub>CC</sub> = 6.0 V	-	14	26	-	31	-	38	ns	
t <sub>t</sub>	transition time	Qn output; see <a href="#">Figure 7</a> <sup>[2]</sup>									
		V <sub>CC</sub> = 2.0 V	-	19	75	-	95	-	110	ns	
		V <sub>CC</sub> = 4.5 V	-	7	15	-	19	-	22	ns	
		V <sub>CC</sub> = 6.0 V	-	6	13	-	15	-	19	ns	
t <sub>w</sub>	pulse width	CP input HIGH or LOW; see <a href="#">Figure 7</a>									
		V <sub>CC</sub> = 2.0 V	80	14	-	100	-	120	-	ns	
		V <sub>CC</sub> = 4.5 V	16	5	-	20	-	24	-	ns	
		V <sub>CC</sub> = 6.0 V	14	4	-	17	-	20	-	ns	
		$\overline{MR}$ input LOW; see <a href="#">Figure 8</a>									
		V <sub>CC</sub> = 2.0 V	60	17	-	75	-	90	-	ns	
		V <sub>CC</sub> = 4.5 V	12	6	-	15	-	18	-	ns	
		V <sub>CC</sub> = 6.0 V	10	5	-	13	-	15	-	ns	
t <sub>rec</sub>	recovery time	$\overline{MR}$ to CP; see <a href="#">Figure 8</a>									
		V <sub>CC</sub> = 2.0 V	50	-6	-	65	-	75	-	ns	
		V <sub>CC</sub> = 4.5 V	10	-2	-	13	-	15	-	ns	
		V <sub>CC</sub> = 6.0 V	9	-2	-	11	-	13	-	ns	
t <sub>su</sub>	set-up time	Dn to CP; see <a href="#">Figure 9</a>									
		V <sub>CC</sub> = 2.0 V	60	11	-	75	-	90	-	ns	
		V <sub>CC</sub> = 4.5 V	12	4	-	15	-	18	-	ns	
		V <sub>CC</sub> = 6.0 V	10	3	-	13	-	15	-	ns	
t <sub>h</sub>	hold time	Dn to CP; see <a href="#">Figure 9</a>									
		V <sub>CC</sub> = 2.0 V	3	-6	-	3	-	3	-	ns	
		V <sub>CC</sub> = 4.5 V	3	-2	-	3	-	3	-	ns	
		V <sub>CC</sub> = 6.0 V	3	-2	-	3	-	3	-	ns	
f <sub>max</sub>	maximum frequency	CP input; see <a href="#">Figure 7</a>									
		V <sub>CC</sub> = 2.0 V	6	20.6	-	4.8	-	4	-	MHz	
		V <sub>CC</sub> = 4.5 V	30	103	-	24	-	20	-	MHz	
		V <sub>CC</sub> = 5.0 V; C <sub>L</sub> = 15 pF	-	66	-	-	-	-	-	MHz	
		V <sub>CC</sub> = 6.0 V	35	122	-	28	-	24	-	MHz	
C <sub>PD</sub>	power dissipation capacitance	per package; V <sub>I</sub> = GND to V <sub>CC</sub> <sup>[3]</sup>	-	20	-	-	-	-	-	pF	

**Table 7. Dynamic characteristics ...continued**

GND (ground = 0 V);  $C_L = 50$  pF unless otherwise specified; for test circuit, see [Figure 10](#)

Symbol	Parameter	Conditions	25 °C			-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
<b>74HCT273-Q100</b>										
$t_{pd}$	propagation delay	CP to Qn; see <a href="#">Figure 7</a> <sup>[1]</sup>								
		$V_{CC} = 4.5$ V	-	16	30	-	38	-	45	ns
		$V_{CC} = 5.0$ V; $C_L = 15$ pF	-	15	-	-	-	-	-	ns
$t_{PHL}$	HIGH to LOW propagation delay	$\overline{MR}$ to Qn; see <a href="#">Figure 8</a>								
		$V_{CC} = 4.5$ V	-	23	34	-	43	-	51	ns
		$V_{CC} = 5.0$ V; $C_L = 15$ pF	-	20	-	-	-	-	-	ns
$t_t$	transition time	Qn output; see <a href="#">Figure 7</a> <sup>[2]</sup>								
		$V_{CC} = 4.5$ V	-	7	15	-	19	-	22	ns
$t_W$	pulse width	CP input; see <a href="#">Figure 7</a>								
		$V_{CC} = 4.5$ V	16	9	-	20	-	24	-	ns
		$\overline{MR}$ input LOW; see <a href="#">Figure 8</a>								
$t_{rec}$	recovery time	$\overline{MR}$ to CP; see <a href="#">Figure 8</a>								
		$V_{CC} = 4.5$ V	10	-2	-	13	-	15	-	ns
$t_{su}$	set-up time	Dn to CP; see <a href="#">Figure 9</a>								
		$V_{CC} = 4.5$ V	12	5	-	15	-	18	-	ns
$t_h$	hold time	Dn to CP; see <a href="#">Figure 9</a>								
		$V_{CC} = 4.5$ V	3	-4	-	3	-	3	-	ns
$f_{max}$	maximum frequency	CP input; see <a href="#">Figure 7</a>								
		$V_{CC} = 4.5$ V	30	56	-	24	-	20	-	MHz
		$V_{CC} = 5.0$ V; $C_L = 15$ pF	-	36	-	-	-	-	-	MHz
$C_{PD}$	power dissipation capacitance	per package; $V_I = GND$ to $V_{CC} - 1.5$ V <sup>[3]</sup>	-	23	-	-	-	-	-	pF

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

[2]  $t_t$  is the same as  $t_{THL}$  and  $t_{TLH}$ .

[3]  $C_{PD}$  is used to determine the dynamic power dissipation ( $P_D$  in  $\mu$ W).

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

$f_i$  = input frequency in MHz;

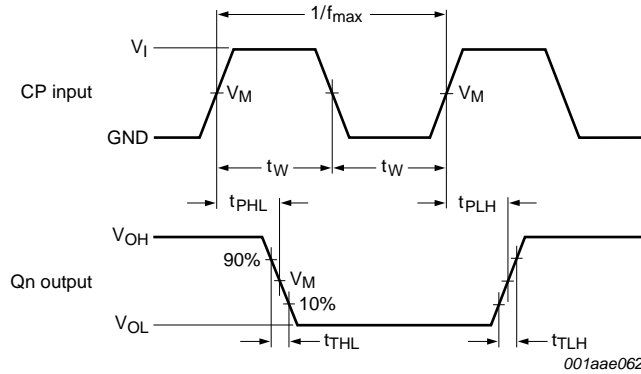
$f_o$  = output frequency in MHz;

$\Sigma (C_L \times V_{CC}^2 \times f_o)$  = sum of outputs;

$C_L$  = output load capacitance in pF;

$V_{CC}$  = supply voltage in V.

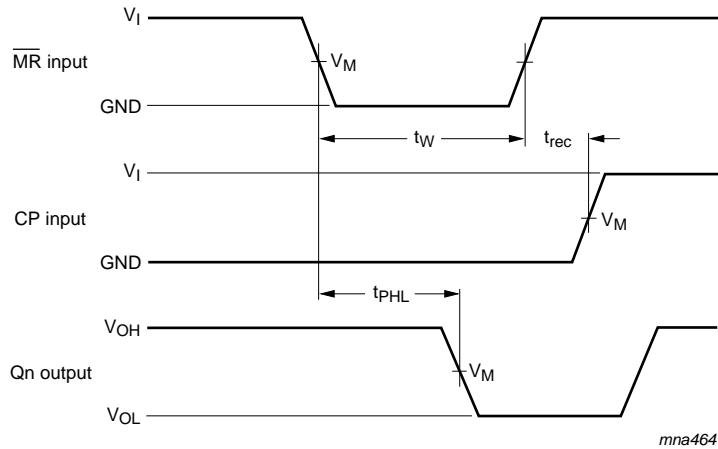
11. Waveforms



Measurement points are given in [Table 8](#).

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

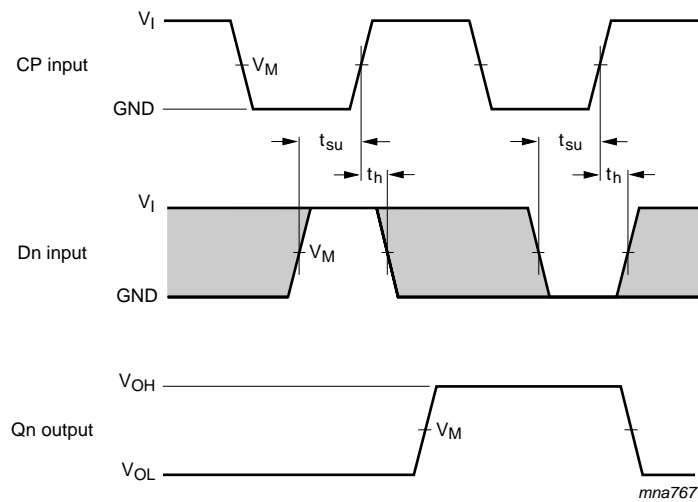
**Fig 7. Propagation delay clock input (CP) to output (Qn), clock (CP) pulse width, output transition time and the maximum clock pulse frequency**



Measurement points are given in [Table 8](#).

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

**Fig 8. Propagation delay master reset ( $\overline{MR}$ ) to output (Qn), pulse width master reset ( $\overline{MR}$ ) and recovery time master reset (MR) to clock (CP)**



Measurement points are given in [Table 8](#).

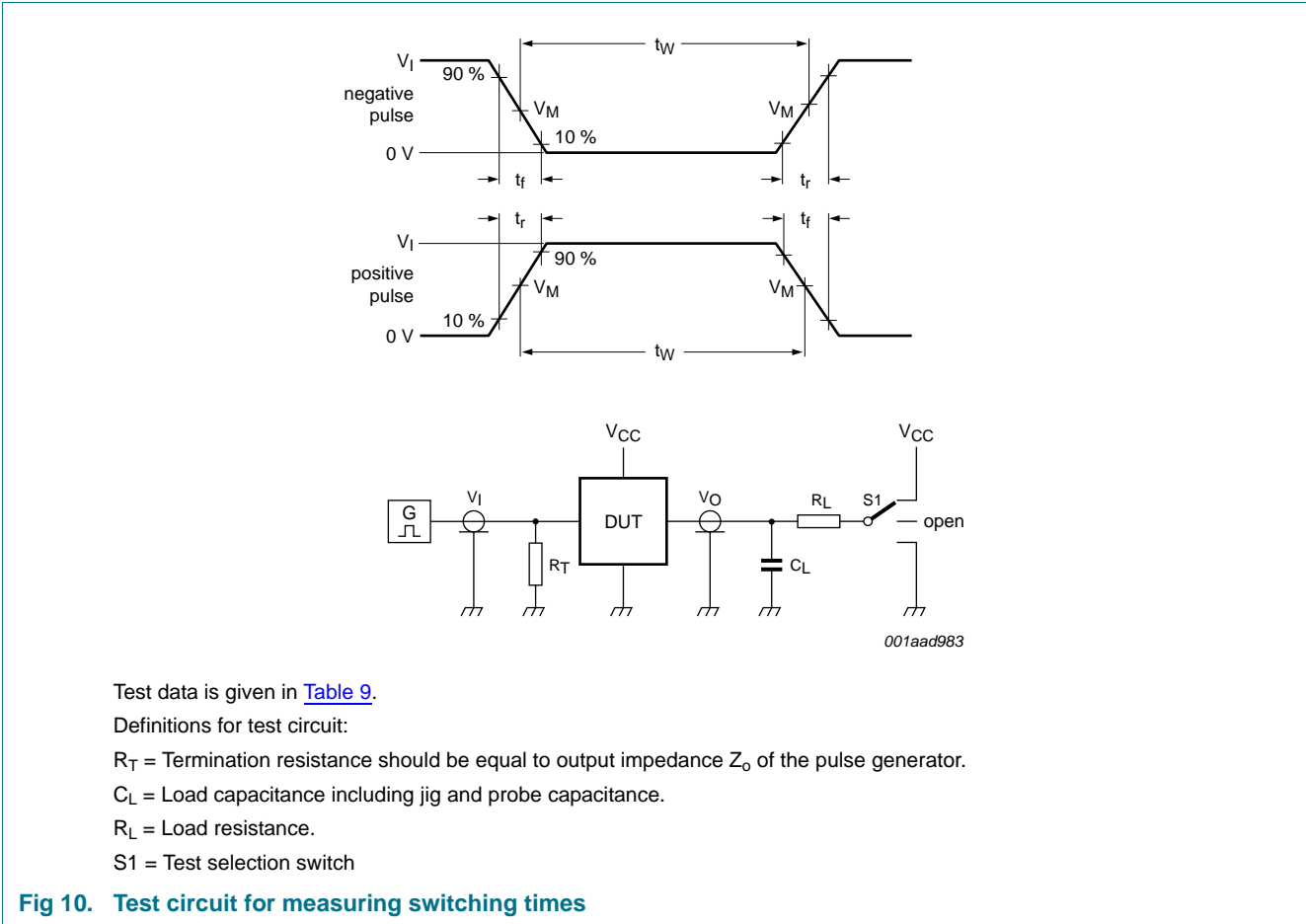
The shaded areas indicate when the input is permitted to change for predictable output performance.

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

**Fig 9. Data set-up and hold times data input (Dn)**

**Table 8. Measurement points**

Type	Input		Output
	$V_I$	$V_M$	$V_M$
74HC273-Q100	$V_{CC}$	$0.5V_{CC}$	$0.5V_{CC}$
74HCT273-Q100	3 V	1.3 V	1.3 V



**Table 9. Test data**

Type	Input		Load			S1 position
	$V_I$	$t_r, t_f$	$C_L$	$R_L$	$t_{PHL}, t_{PLH}$	
74HC273-Q100	$V_{CC}$	6 ns	15 pF, 50 pF	1 k $\Omega$	open	
74HCT273-Q100	3 V	6 ns	15 pF, 50 pF	1 k $\Omega$	open	

12. Package outline

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

SOT163-1

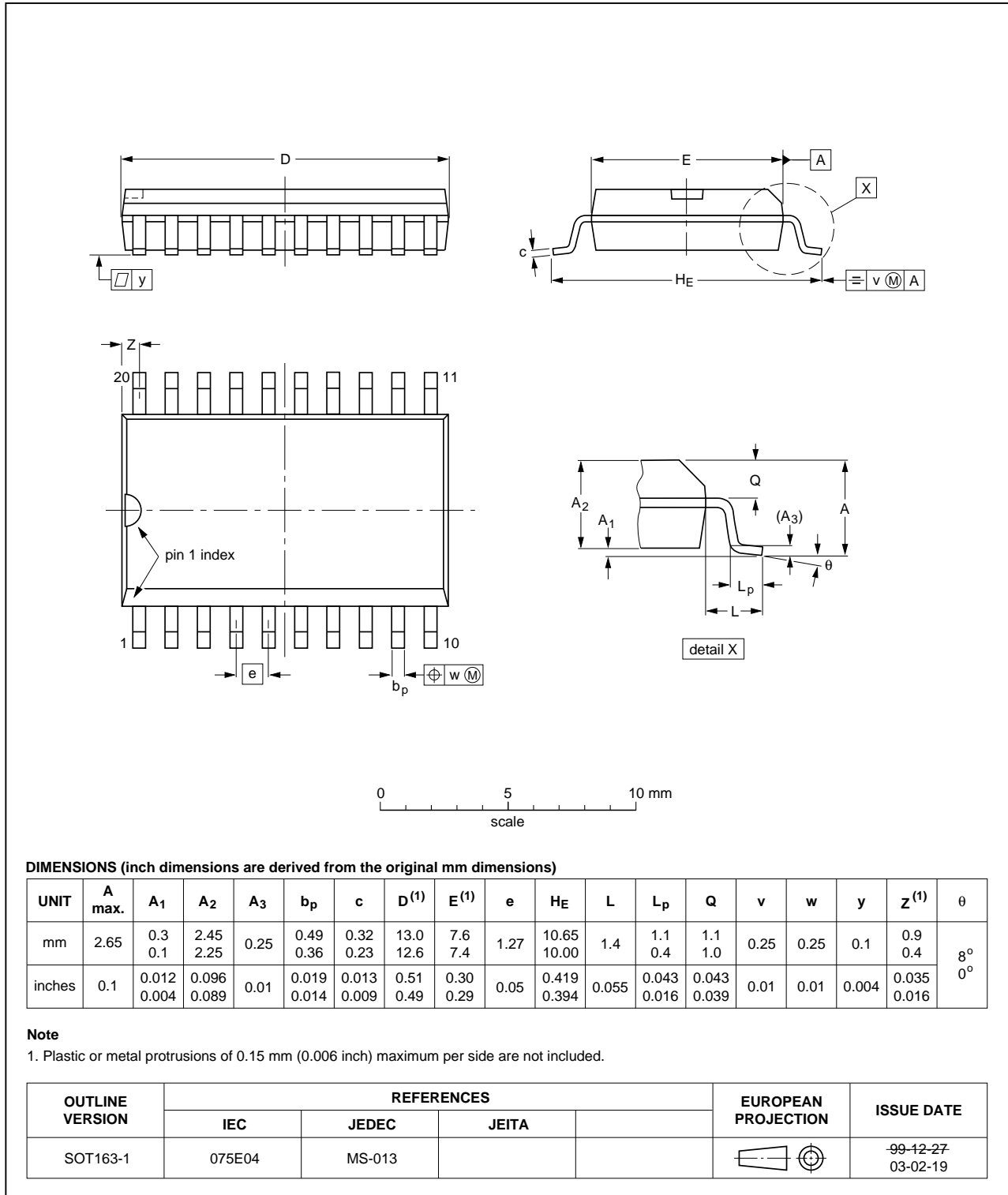


Fig 11. Package outline SOT163-1 (SO20)

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

SOT360-1

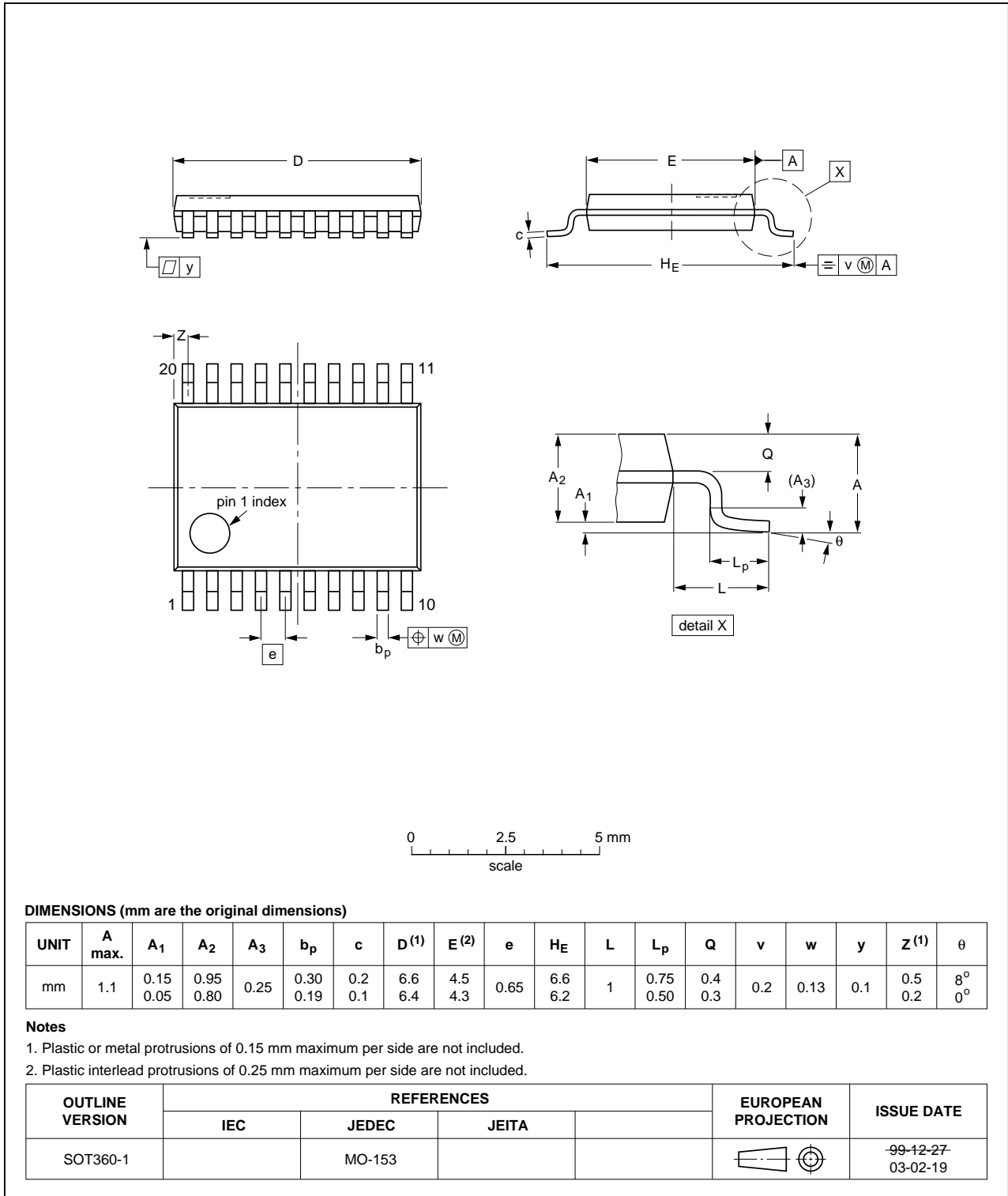
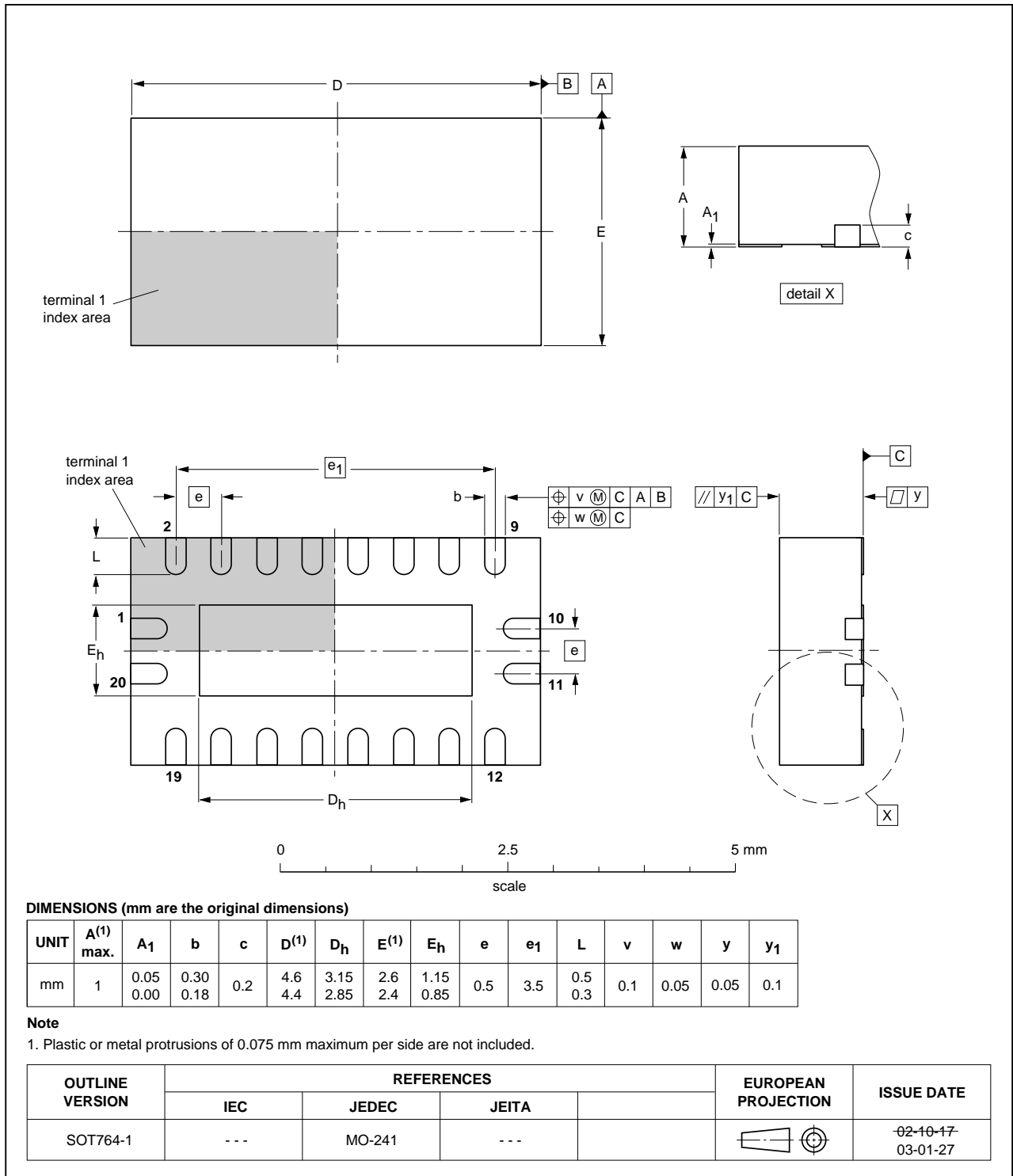


Fig 12. Package outline SOT360-1 (TSSOP20)

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

## 13. 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

## 14. Revision history

**Table 11. Revision history**

Document ID	Release date	Data sheet status	Change notice	Supersedes
74HC_HCT273_Q100 v.1	20130619	Product data sheet	-	-

## 15. Legal information

### 15.1 Data sheet status

Document status <sup>[1][2]</sup>	Product status <sup>[3]</sup>	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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## 17. Contents

<b>1</b>	<b>General description</b> .....	<b>1</b>
<b>2</b>	<b>Features and benefits</b> .....	<b>1</b>
<b>3</b>	<b>Ordering information</b> .....	<b>1</b>
<b>4</b>	<b>Functional diagram</b> .....	<b>2</b>
<b>5</b>	<b>Pinning information</b> .....	<b>4</b>
5.1	Pinning .....	4
5.2	Pin description .....	4
<b>6</b>	<b>Functional description</b> .....	<b>5</b>
<b>7</b>	<b>Limiting values</b> .....	<b>5</b>
<b>8</b>	<b>Recommended operating conditions</b> .....	<b>6</b>
<b>9</b>	<b>Static characteristics</b> .....	<b>6</b>
<b>10</b>	<b>Dynamic characteristics</b> .....	<b>7</b>
<b>11</b>	<b>Waveforms</b> .....	<b>10</b>
<b>12</b>	<b>Package outline</b> .....	<b>13</b>
<b>13</b>	<b>Abbreviations</b> .....	<b>16</b>
<b>14</b>	<b>Revision history</b> .....	<b>16</b>
<b>15</b>	<b>Legal information</b> .....	<b>17</b>
15.1	Data sheet status .....	17
15.2	Definitions .....	17
15.3	Disclaimers .....	17
15.4	Trademarks .....	18
<b>16</b>	<b>Contact information</b> .....	<b>18</b>
<b>17</b>	<b>Contents</b> .....	<b>19</b>

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