

# 74HC273; 74HCT273

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

Rev. 5 — 26 February 2016

Product data sheet

## 1. General description

The 74HC273; 74HCT273 is an octal positive-edge triggered D-type flip-flop. The device features clock (CP) and master reset (MR) inputs. The outputs Q<sub>n</sub> will assume the state of their corresponding D<sub>n</sub> 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. This enables the use of current limiting resistors to interface inputs to voltages in excess of V<sub>CC</sub>.

## 2. Features and benefits

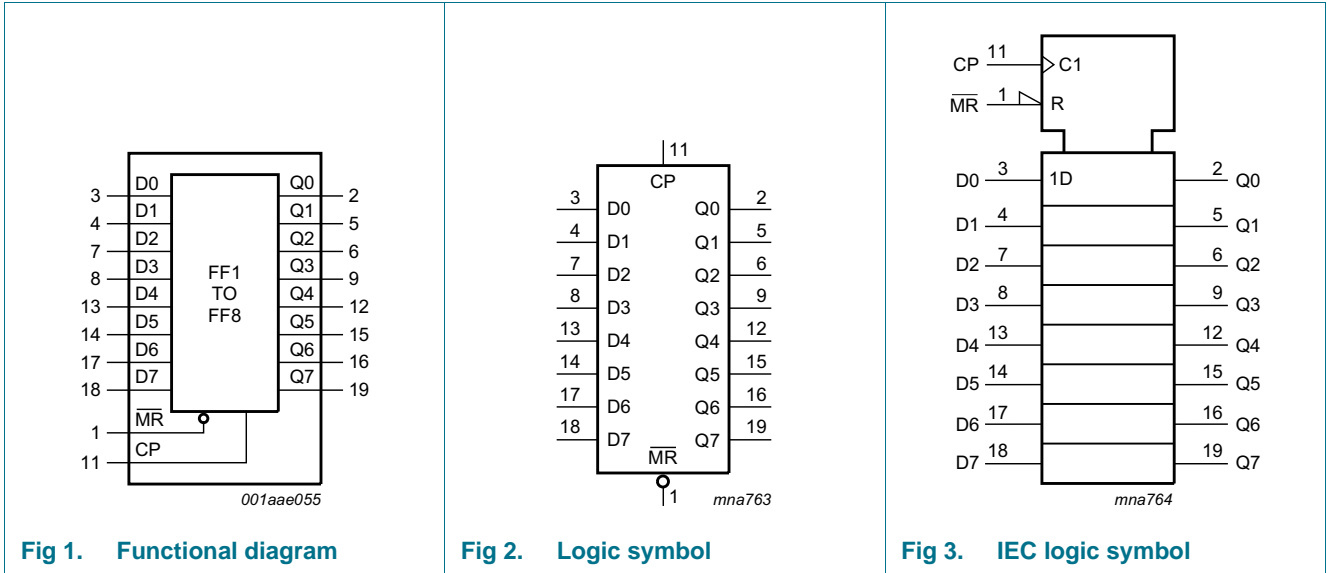
- Input levels:
  - ◆ For 74HC273: CMOS level
  - ◆ For 74HCT273: TTL level
- Common clock and master reset
- Eight positive edge-triggered D-type flip-flops
- Complies with JEDEC standard no. 7A
- ESD protection:
  - ◆ HBM JESD22-A114F exceeds 2000 V
  - ◆ MM JESD22-A115-A exceeds 200 V
- Multiple package options
- Specified from –40 °C to +85 °C and from –40 °C to +125 °C

## 3. Ordering information

Table 1. Ordering information

Type number	Package			
	Temperature range	Name	Description	Version
74HC273D	–40 °C to +125 °C	SO20	plastic small outline package; 20 leads; body width 7.5 mm	SOT163-1
74HCT273D				
74HC273DB	–40 °C to +125 °C	SSOP20	plastic shrink small outline package; 20 leads; body width 5.3 mm	SOT339-1
74HCT273DB				
74HC273PW	–40 °C to +125 °C	TSSOP20	plastic thin shrink small outline package; 20 leads; body width 4.4 mm	SOT360-1
74HCT273PW				
74HC273BQ	–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
74HCT273BQ				

## 4. Functional diagram



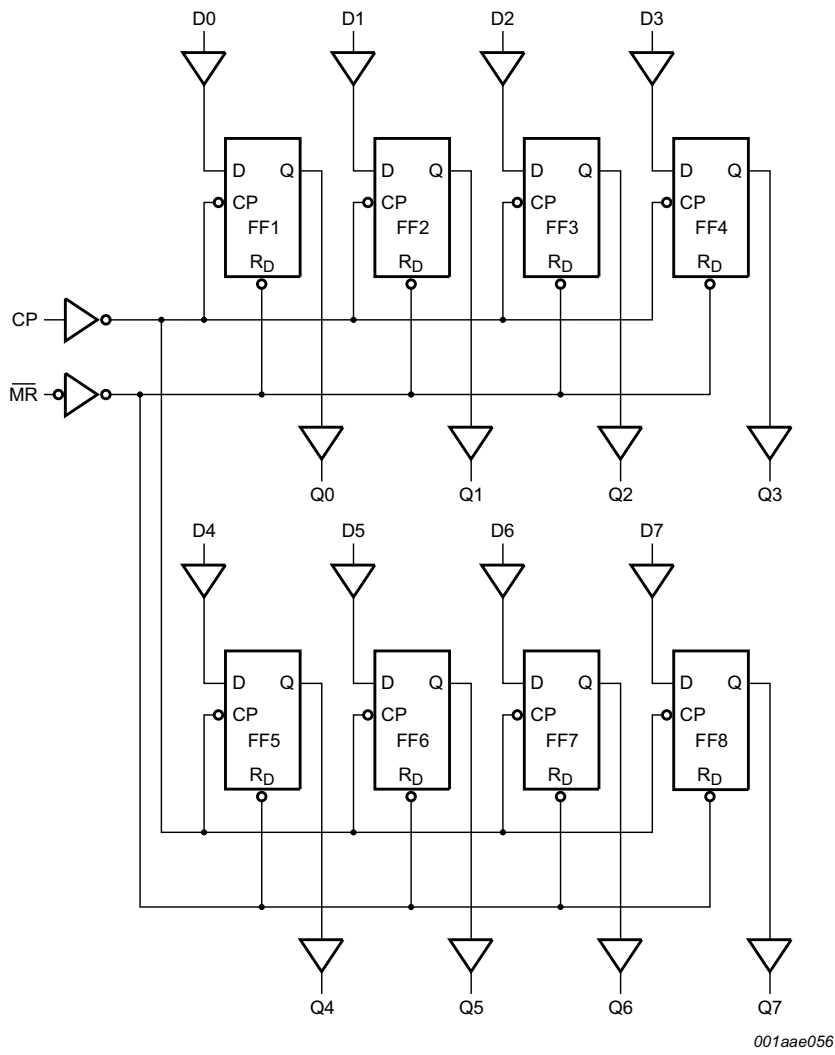
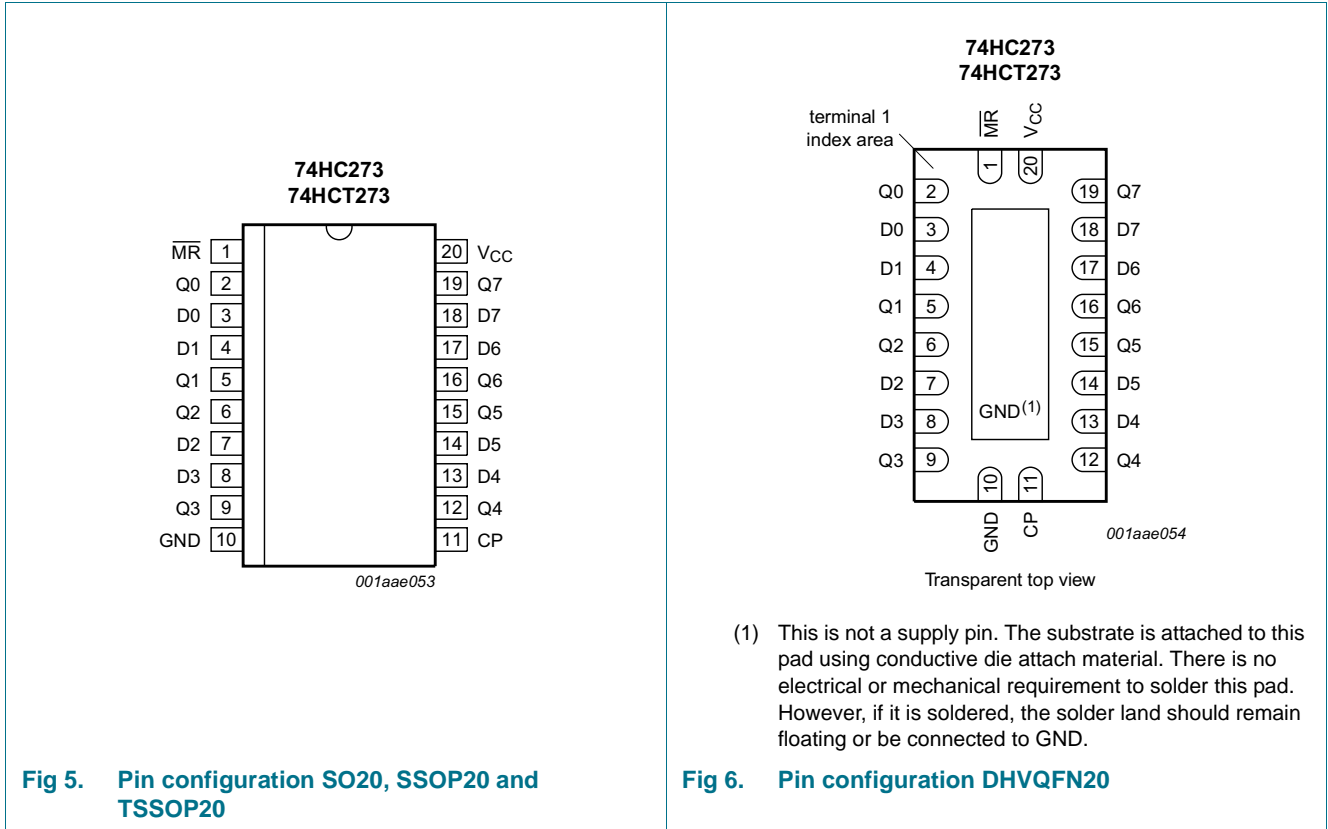


Fig 4. Logic diagram

## 5. Pinning information

### 5.1 Pinning



### 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)
VCC	20	supply voltage

## 6. Functional description

Table 3. Function table<sup>[1]</sup>

Operating modes	Inputs			Outputs
	$\overline{\text{MR}}$	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 $V_I > V_{CC} + 0.5 \text{ V}$ <sup>[1]</sup>	-	±20	mA
$I_{OK}$	output clamping current	$V_O < -0.5 \text{ V}$ or $V_O > V_{CC} + 0.5 \text{ V}$ <sup>[1]</sup>	-	±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 $+125 \text{ °C}$			
		SO20, SSOP20, TSSOP20 and DHVQFN20 package <sup>[2]</sup>	-	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 SSOP20 and TSSOP20 packages: above 60 °C the value of  $P_{tot}$  derates linearly with 5.5 mW/K.  
 For DHVQFN20 packages:  $P_{tot}$  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			74HCT273			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</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>O</sub> = 5.2 mA; V <sub>CC</sub> = 6.0 V	-	0.16	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
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> = 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</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</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	
$t_{PHL}$	HIGH to LOW propagation delay	$\overline{MR}$ to Qn; see <a href="#">Figure 8</a>								
		$V_{CC} = 2.0$ V	-	44	150	-	185	-	225	ns
		$V_{CC} = 4.5$ V	-	16	30	-	37	-	45	ns
		$V_{CC} = 5.0$ V; $C_L = 15$ pF	-	15	-	-	-	-	-	ns
		$V_{CC} = 6.0$ V	-	14	26	-	31	-	38	ns
$t_t$	transition time	Qn output; see <a href="#">Figure 7</a> <sup>[2]</sup>								
		$V_{CC} = 2.0$ V	-	19	75	-	95	-	110	ns
		$V_{CC} = 4.5$ V	-	7	15	-	19	-	22	ns
		$V_{CC} = 6.0$ V	-	6	13	-	15	-	19	ns
$t_{w}$	pulse width	CP input HIGH or LOW; see <a href="#">Figure 7</a>								
		$V_{CC} = 2.0$ V	80	14	-	100	-	120	-	ns
		$V_{CC} = 4.5$ V	16	5	-	20	-	24	-	ns
		$V_{CC} = 6.0$ V	14	4	-	17	-	20	-	ns
		$\overline{MR}$ input LOW; see <a href="#">Figure 8</a>								
		$V_{CC} = 2.0$ V	60	17	-	75	-	90	-	ns
		$V_{CC} = 4.5$ V	12	6	-	15	-	18	-	ns
		$V_{CC} = 6.0$ V	10	5	-	13	-	15	ns	
$t_{rec}$	recovery time	$\overline{MR}$ to CP; see <a href="#">Figure 8</a>								
		$V_{CC} = 2.0$ V	50	-6	-	65	-	75	-	ns
		$V_{CC} = 4.5$ V	10	-2	-	13	-	15	-	ns
		$V_{CC} = 6.0$ V	9	-2	-	11	-	13	-	ns
$t_{su}$	set-up time	Dn to CP; see <a href="#">Figure 9</a>								
		$V_{CC} = 2.0$ V	60	11	-	75	-	90	-	ns
		$V_{CC} = 4.5$ V	12	4	-	15	-	18	-	ns
		$V_{CC} = 6.0$ V	10	3	-	13	-	15	-	ns
$t_h$	hold time	Dn to CP; see <a href="#">Figure 9</a>								
		$V_{CC} = 2.0$ V	3	-6	-	3	-	3	-	ns
		$V_{CC} = 4.5$ V	3	-2	-	3	-	3	-	ns
		$V_{CC} = 6.0$ V	3	-2	-	3	-	3	-	ns
$f_{max}$	maximum frequency	CP input; see <a href="#">Figure 7</a>								
		$V_{CC} = 2.0$ V	6	20.6	-	4.8	-	4	-	MHz
		$V_{CC} = 4.5$ V	30	103	-	24	-	20	-	MHz
		$V_{CC} = 5.0$ V; $C_L = 15$ pF	-	66	-	-	-	-	-	MHz
		$V_{CC} = 6.0$ V	35	122	-	28	-	24	-	MHz
$C_{PD}$	power dissipation capacitance	per package; $V_I = \text{GND to } V_{CC}$ <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](#)

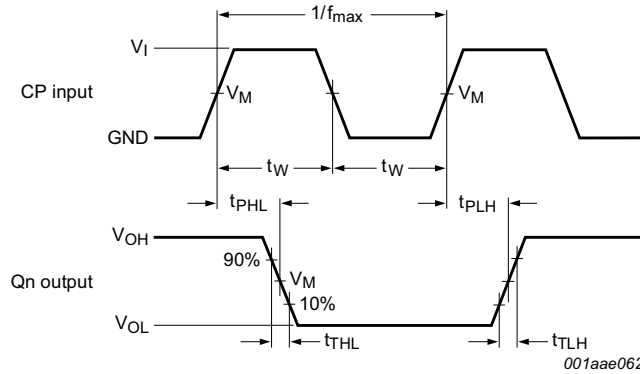
Symbol	Parameter	Conditions	25 °C			−40 °C to +85 °C		−40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
<b>74HCT273</b>										
$t_{pd}$	propagation delay	CP to Qn; see <a href="#">Figure 7</a> [1]								
		$V_{CC} = 4.5$ V	-	16	30	-	38	-	45	ns
		$V_{CC} = 5.0$ V; $C_L = 15$ pF	-	15	-	-	-	-	-	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> [2]								
		$V_{CC} = 4.5$ 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 [3]	-	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.

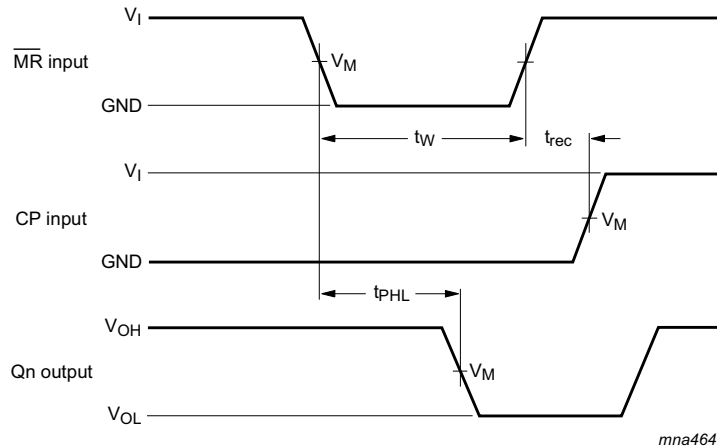
11. Waveforms



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

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

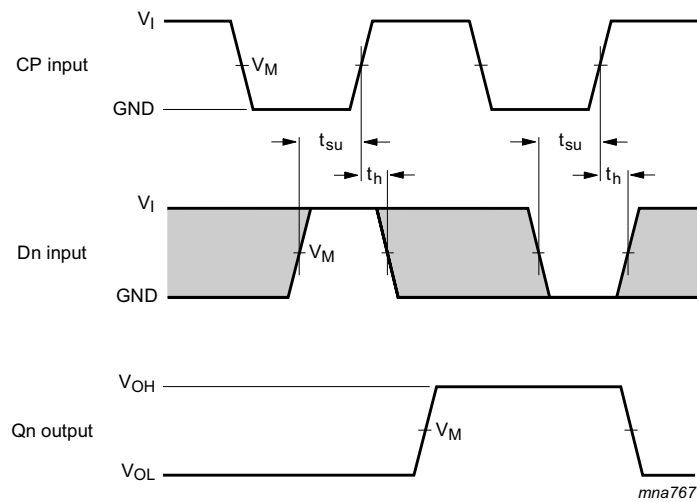
**Fig 7. Propagation delay clock input (CP) to output (Qn), clock (CP) pulse width, output transition time and the maximum clock pulse frequency**



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 (MR) to output (Qn), pulse width master reset (MR) and recovery time master reset (MR) to clock (CP)**



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

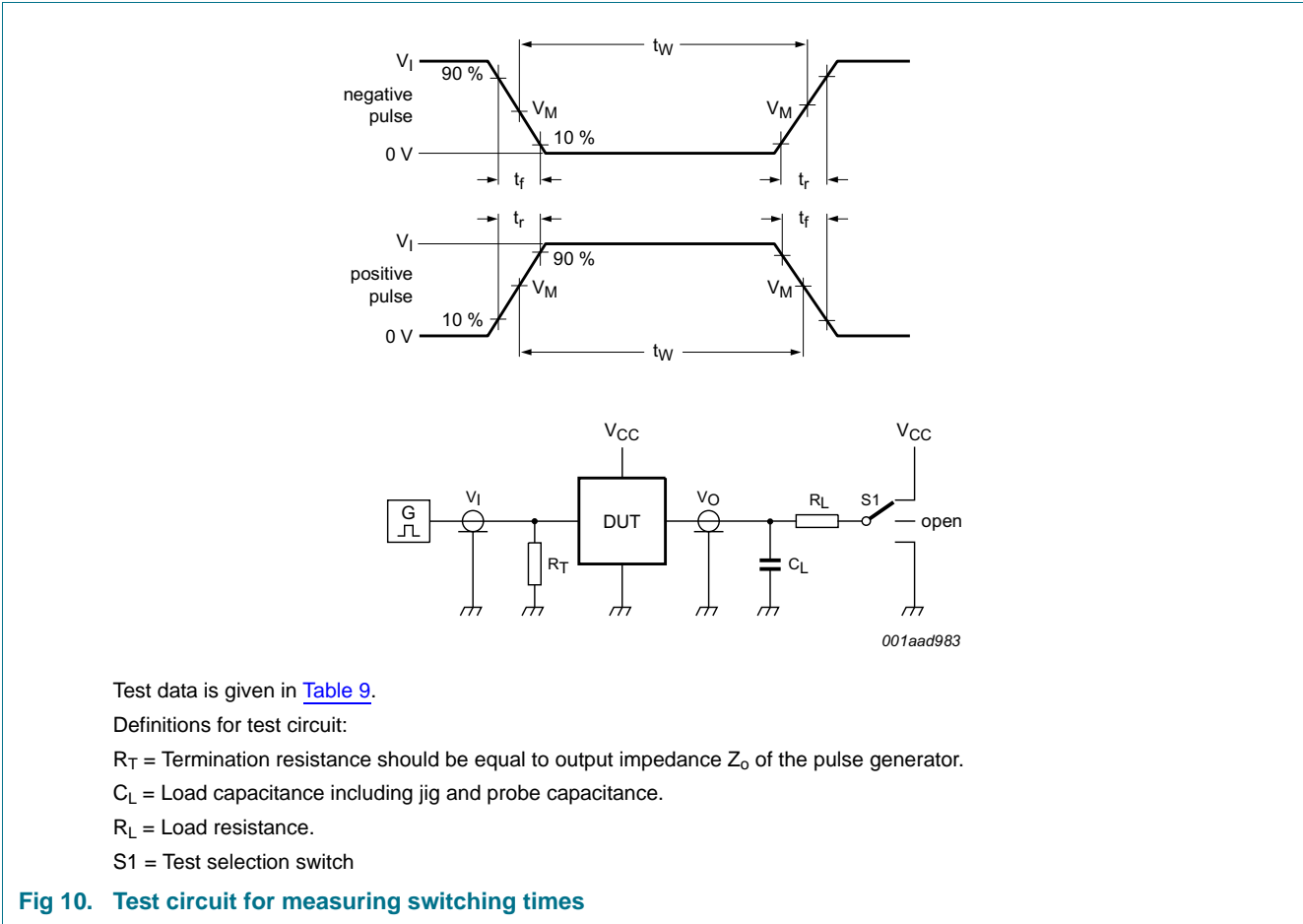
The shaded areas indicate when the input is permitted to change for predictable output performance.

$V_{OL}$  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	$V_{CC}$	$0.5V_{CC}$	$0.5V_{CC}$
74HCT273	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	$V_{CC}$	6 ns	15 pF, 50 pF	1 k $\Omega$	open
74HCT273	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

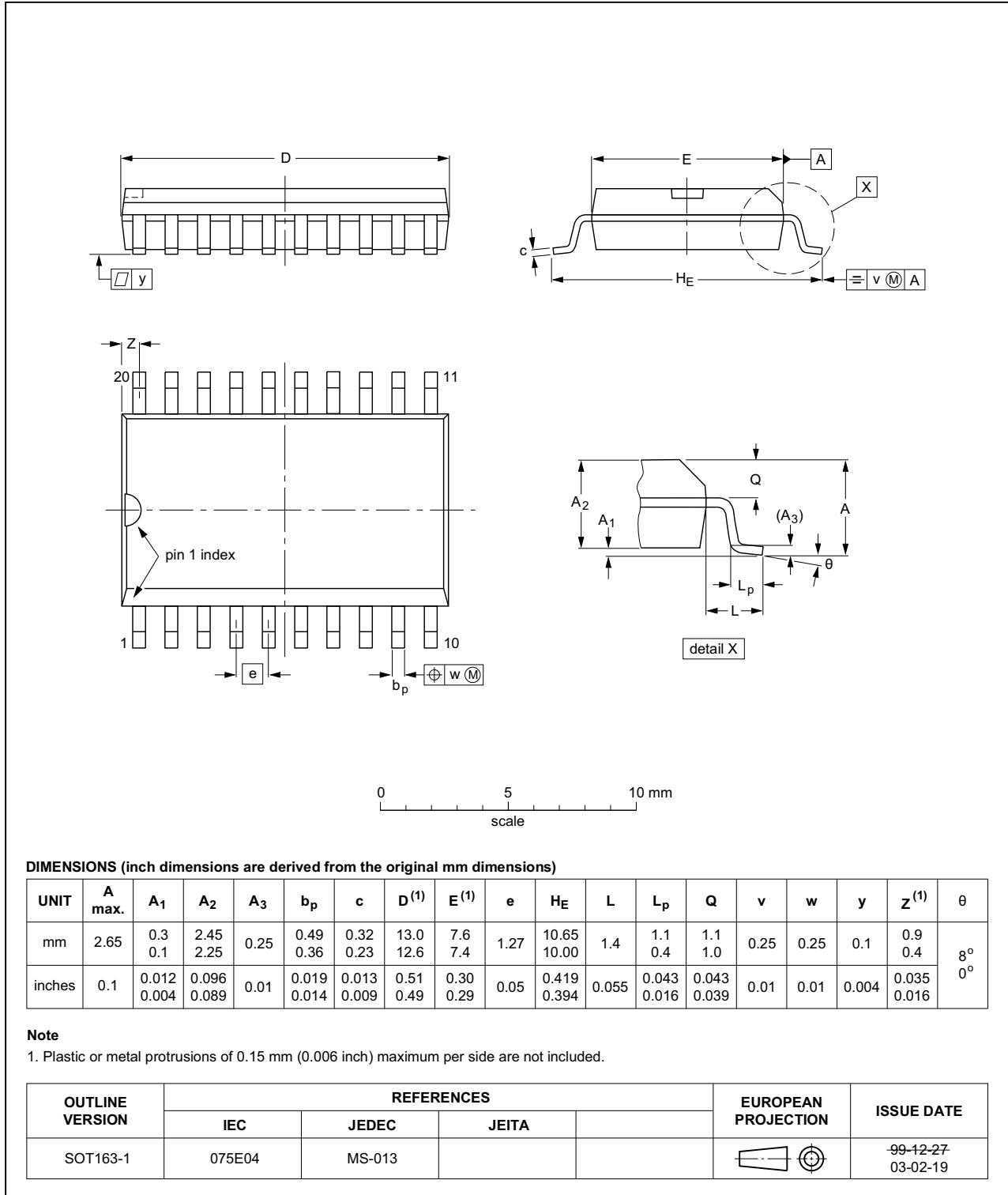


Fig 11. Package outline SOT163-1 (SO20)

SSOP20: plastic shrink small outline package; 20 leads; body width 5.3 mm

SOT339-1

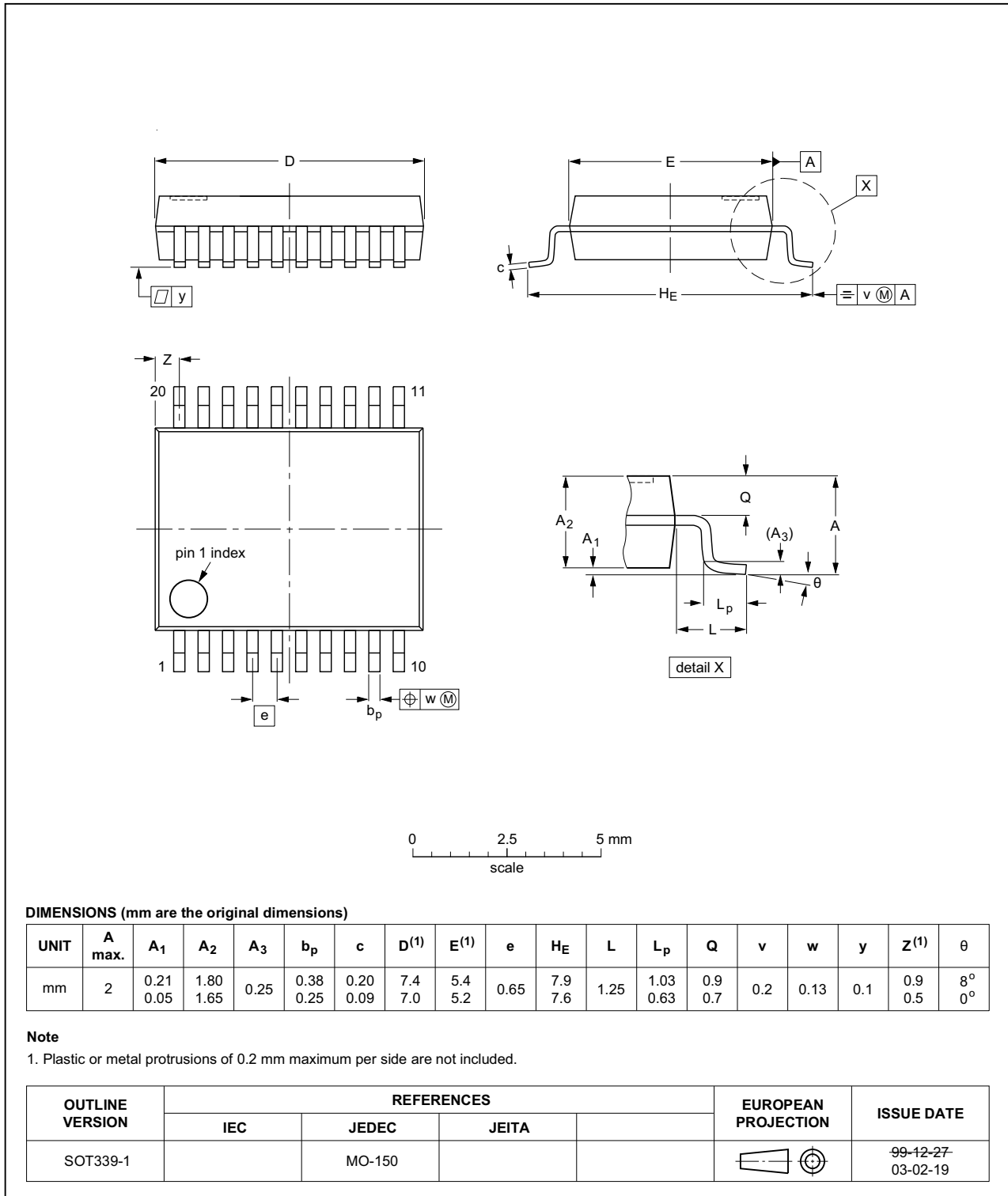


Fig 12. Package outline SOT339-1 (SSOP20)

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

SOT360-1

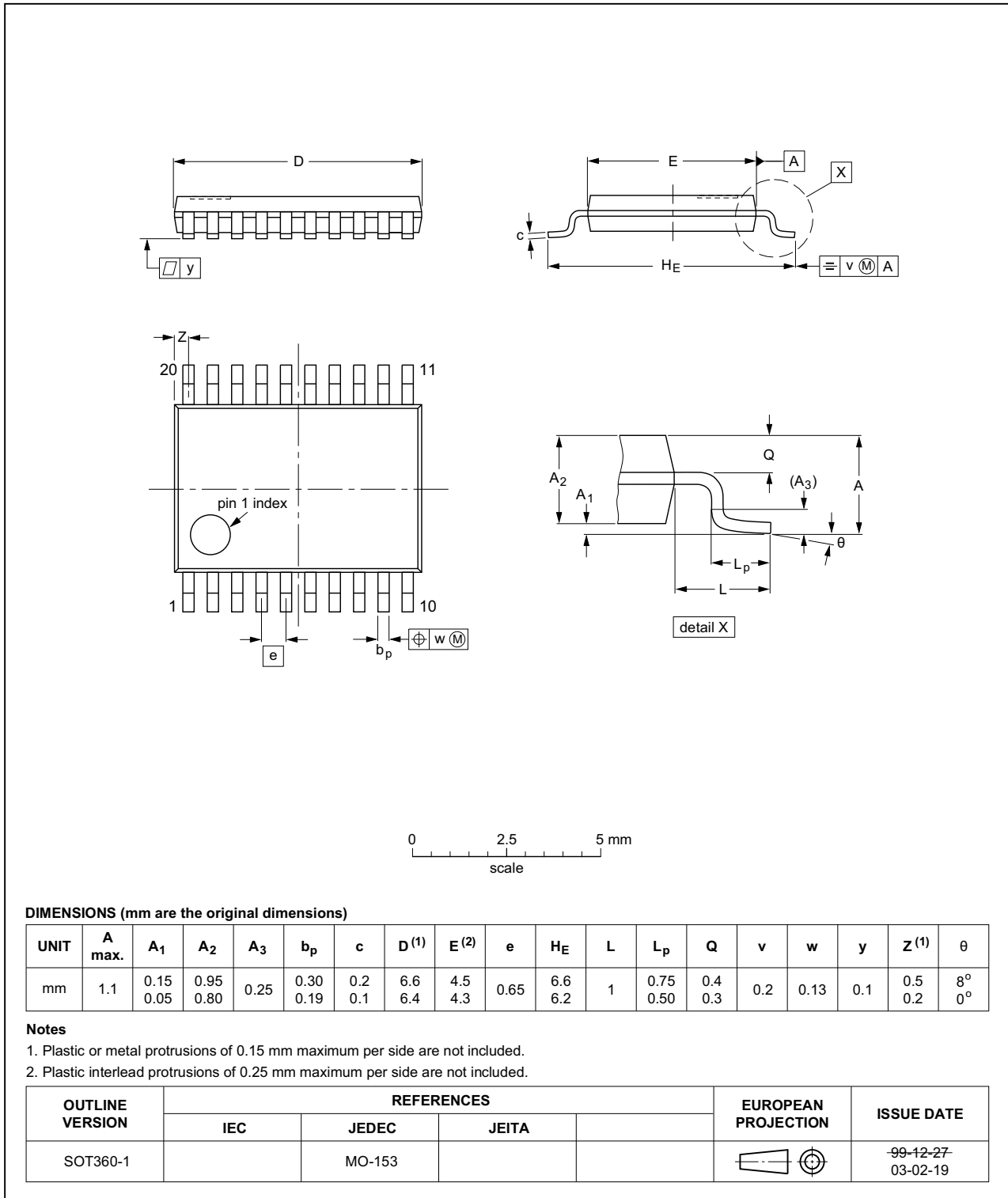


Fig 13. Package outline SOT360-1 (TSSOP20)

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

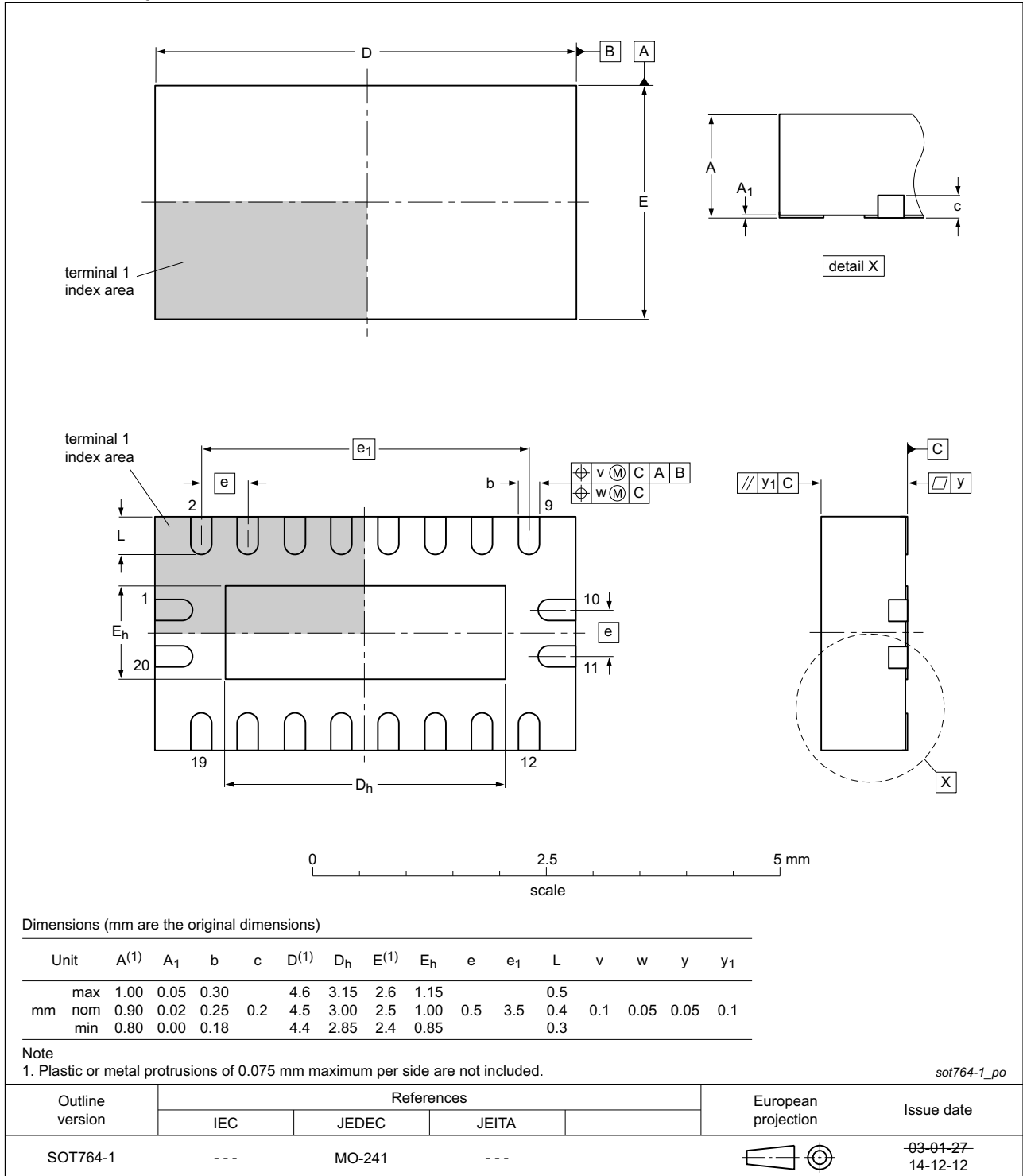


Fig 14. Package outline SOT764-1 (DHVQFN20)



## 13. Abbreviations

Table 10. Abbreviations

Acronym	Description
CMOS	Complementary Metal-Oxide Semiconductor
DUT	Device Under Test
ESD	ElectroStatic Discharge
HBM	Human Body Model
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 v.5	20160226	Product data sheet	-	74HC_HCT273 v.4
Modifications:	<ul style="list-style-type: none"> <li>Type numbers 74HC273N and 74HCT273N (SOT146-1) removed.</li> </ul>			
74HC_HCT273 v.4	20130610	Product data sheet	-	74HC_HCT273 v.3
Modifications:	<ul style="list-style-type: none"> <li>The format of this data sheet has been redesigned to comply with the new identity guidelines of NXP Semiconductors.</li> <li>Legal texts have been adapted to the new company name where appropriate.</li> </ul>			
74HC_HCT273 v.3	20060124	Product data sheet	-	74HC_HCT273_CNV v.2
74HC_HCT273_CNV v.2	19970827	Product specification	-	-

## 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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