

74HC273; 74HCT273

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

Rev. 4 — 10 June 2013

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_n will assume the state of their corresponding D_n inputs that meet the set-up and hold time requirements on the LOW-to-HIGH clock (CP) transition. A LOW on $\overline{\text{MR}}$ 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_{CC}.

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

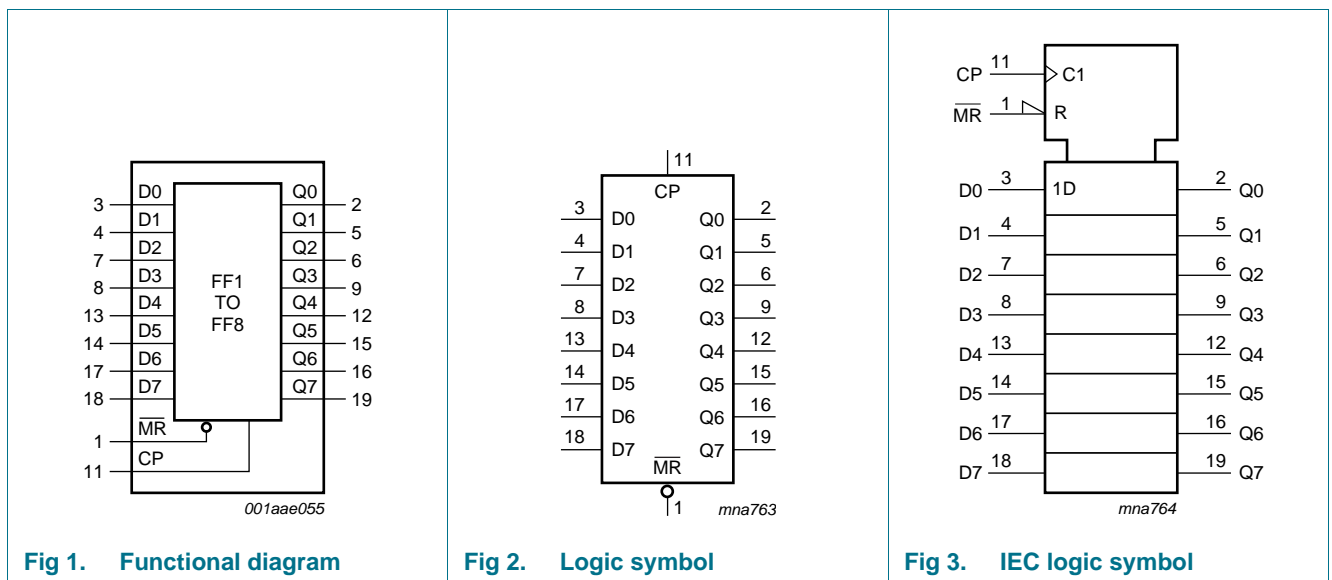
Type number	Package			
	Temperature range	Name	Description	Version
74HC273N	–40 °C to +125 °C	DIP20	plastic dual in-line package; 20 leads (300 mil)	SOT146-1
74HCT273N				
74HC273D	–40 °C to +125 °C	SO20	plastic small outline package; 20 leads; body width 7.5 mm	SOT163-1
74HCT273D				
74HC273DB	–40 °C to +125 °C	SSOP20	plastic shrink small outline package; 20 leads; body width 5.3 mm	SOT339-1
74HCT273DB				



Table 1. Ordering information ...continued

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



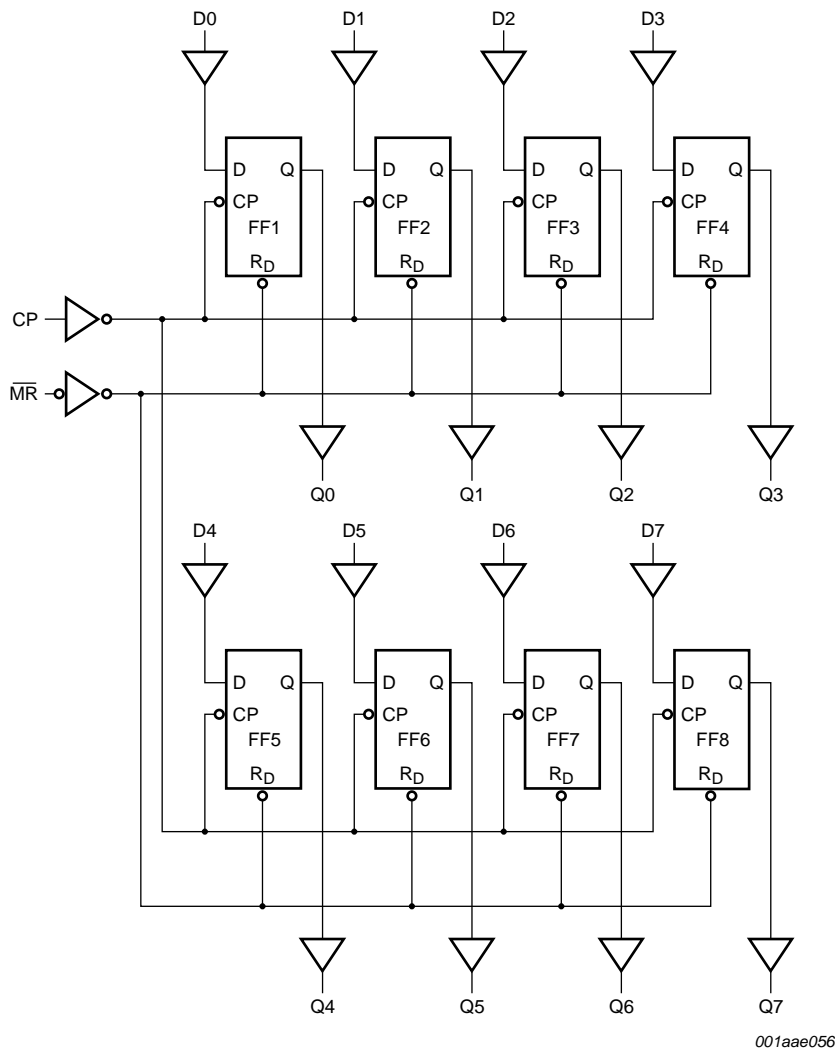
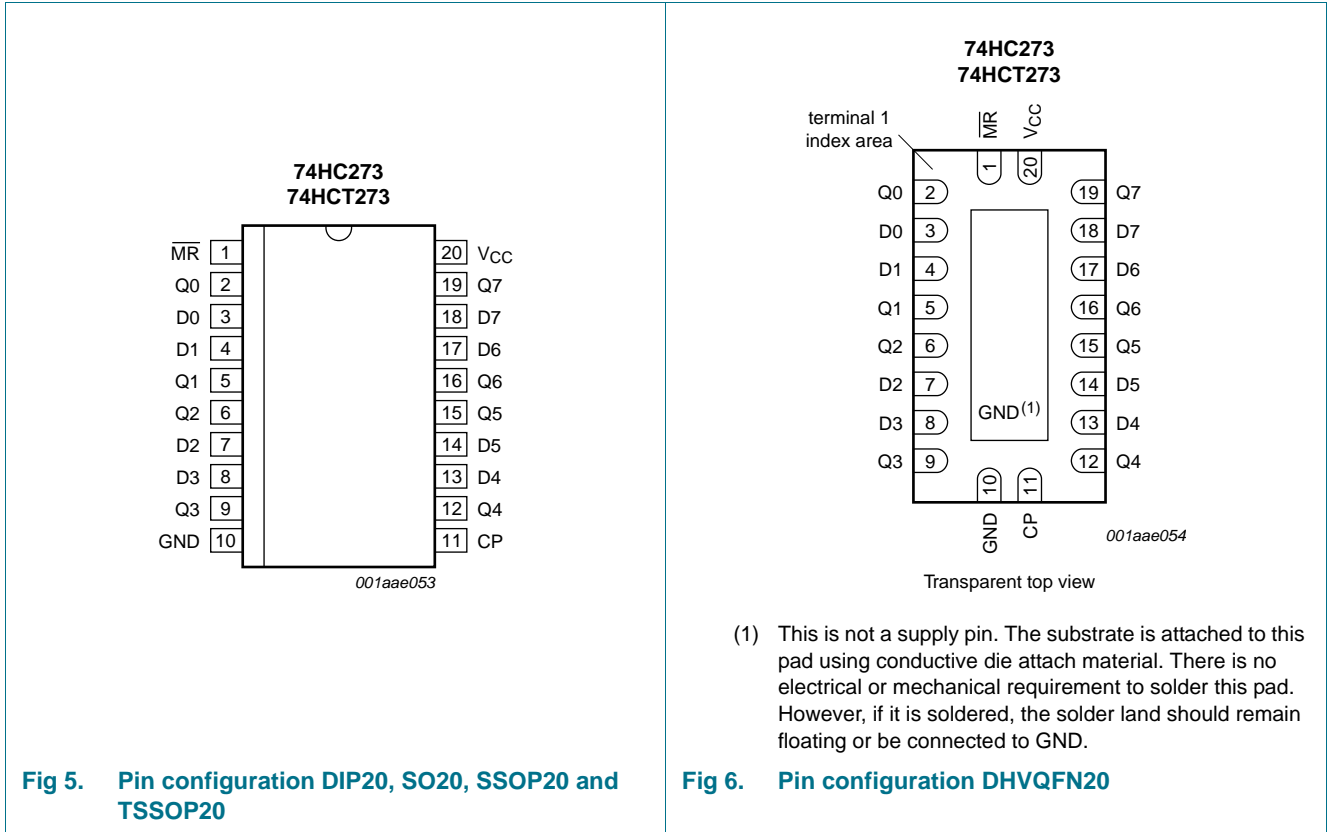


Fig 4. Logic diagram

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)
V _{CC}	20	supply voltage

6. Functional description

Table 3. Function table^[1]

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 V or V _I > V _{CC} + 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	-0.5 V < V _O < V _{CC} + 0.5 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 °C to +125 °C			
		DIP20 package	[2] -	750	mW
		SO20, SSOP20, TSSOP20 and DHVQFN20 package	[3] -	500	mW

- [1] The input and output voltage ratings may be exceeded if the input and output current ratings are observed.
 [2] For DIP20 package: above 70 °C the value of P_{tot} derates linearly with 12 mW/K.
 [3] 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 _{CC}	supply voltage		2.0	5.0	6.0	4.5	5.0	5.5	V
V _I	input voltage		0	-	V _{CC}	0	-	V _{CC}	V
V _O	output voltage		0	-	V _{CC}	0	-	V _{CC}	V
T _{amb}	ambient temperature		-40	-	+125	-40	-	+125	°C
Δt/ΔV	input transition rise and fall rate	V _{CC} = 2.0 V	-	-	625	-	-	-	ns/V
		V _{CC} = 4.5 V	-	1.67	139	-	1.67	139	ns/V
		V _{CC} = 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	
74HC273										
V _{IH}	HIGH-level input voltage	V _{CC} = 2.0 V	1.5	1.2	-	1.5	-	1.5	-	V
		V _{CC} = 4.5 V	3.15	2.4	-	3.15	-	3.15	-	V
		V _{CC} = 6.0 V	4.2	3.2	-	4.2	-	4.2	-	V
V _{IL}	LOW-level input voltage	V _{CC} = 2.0 V	-	0.8	0.5	-	0.5	-	0.5	V
		V _{CC} = 4.5 V	-	2.1	1.35	-	1.35	-	1.35	V
		V _{CC} = 6.0 V	-	2.8	1.8	-	1.8	-	1.8	V
V _{OH}	HIGH-level output voltage	V _I = V _{IH} or V _{IL}								
		I _O = -20 μA; V _{CC} = 2.0 V	1.9	2.0	-	1.9	-	1.9	-	V
		I _O = -20 μA; V _{CC} = 4.5 V	4.4	4.5	-	4.4	-	4.4	-	V
		I _O = -20 μA; V _{CC} = 6.0 V	5.9	6.0	-	5.9	-	5.9	-	V
		I _O = -4.0 mA; V _{CC} = 4.5 V	3.98	4.32	-	3.84	-	3.7	-	V
		I _O = -5.2 mA; V _{CC} = 6.0 V	5.48	5.81	-	5.34	-	5.2	-	V
V _{OL}	LOW-level output voltage	V _I = V _{IH} or V _{IL}								
		I _O = 20 μA; V _{CC} = 2.0 V	-	0	0.1	-	0.1	-	0.1	V
		I _O = 20 μA; V _{CC} = 4.5 V	-	0	0.1	-	0.1	-	0.1	V
		I _O = 20 μA; V _{CC} = 6.0 V	-	0	0.1	-	0.1	-	0.1	V
		I _O = 4.0 mA; V _{CC} = 4.5 V	-	0.15	0.26	-	0.33	-	0.4	V
		I _O = 5.2 mA; V _{CC} = 6.0 V	-	0.16	0.26	-	0.33	-	0.4	V
I _I	input leakage current	V _I = V _{CC} or GND; V _{CC} = 6.0 V	-	-	±0.1	-	±1	-	±1	μA
I _{CC}	supply current	V _I = V _{CC} or GND; I _O = 0 A; V _{CC} = 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 _I	input capacitance		-	3.5	-	-	-	-	-	pF
74HCT273										
V _{IH}	HIGH-level input voltage	V _{CC} = 4.5 V to 5.5 V	2.0	1.6	-	2.0	-	2.0	-	V
V _{IL}	LOW-level input voltage	V _{CC} = 4.5 V to 5.5 V	-	1.2	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 = -20 μA	4.4	4.5	-	4.4	-	4.4	-	V
		I _O = -4.0 mA	3.98	4.32	-	3.84	-	3.7	-	V
V _{OL}	LOW-level output voltage	V _I = V _{IH} or V _{IL} ; V _{CC} = 4.5 V								
		I _O = 20 μA; V _{CC} = 4.5 V	-	0	0.1	-	0.1	-	0.1	V
		I _O = 5.2 mA; V _{CC} = 5.5 V	-	0.15	0.26	-	0.33	-	0.4	V
I _I	input leakage current	V _I = V _{CC} or GND; V _{CC} = 5.5 V	-	-	±0.1	-	±1	-	±1	μA
I _{CC}	supply current	V _I = V _{CC} or GND; I _O = 0 A; V _{CC} = 5.5 V	-	-	8.0	-	80	-	160	μA
ΔI _{CC}	additional supply current	per input pin; V _I = V _{CC} - 2.1 V; other inputs at V _{CC} or GND; V _{CC} = 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 _I	input capacitance		-	3.5	-	-	-	-	-	pF

10. Dynamic characteristics

Table 7. Dynamic characteristics

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	
74HC273										
t _{pd}	propagation delay	CP to Qn; see Figure 7 ^[1]								
		V _{CC} = 2.0 V	-	41	150	-	185	-	225	ns
		V _{CC} = 4.5 V	-	15	30	-	37	-	45	ns
		V _{CC} = 5.0 V; C _L = 15 pF	-	15	-	-	-	-	-	ns
		V _{CC} = 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 Figure 8									
		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 Figure 7 ^[2]									
		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 Figure 7									
		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 Figure 8									
		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 Figure 8									
		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 Figure 9									
		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 Figure 9									
		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 Figure 7									
		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 = GND to V _{CC} ^[3]	-	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	
74HCT273										
t_{pd}	propagation delay	CP to Qn; see Figure 7 [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 Figure 8								
		$V_{CC} = 4.5$ V	-	23	34	-	43	-	51	ns
		$V_{CC} = 5.0$ V; $C_L = 15$ pF	-	20	-	-	-	-	-	ns
t_t	transition time	Qn output; see Figure 7 [2]								
		$V_{CC} = 4.5$ V	-	7	15	-	19	-	22	ns
t_W	pulse width	CP input; see Figure 7								
		$V_{CC} = 4.5$ V	16	9	-	20	-	24	-	ns
		\overline{MR} input LOW; see Figure 8								
t_{rec}	recovery time	\overline{MR} to CP; see Figure 8								
		$V_{CC} = 4.5$ V	10	-2	-	13	-	15	-	ns
t_{su}	set-up time	Dn to CP; see Figure 9								
		$V_{CC} = 4.5$ V	12	5	-	15	-	18	-	ns
t_h	hold time	Dn to CP; see Figure 9								
		$V_{CC} = 4.5$ V	3	-4	-	3	-	3	-	ns
f_{max}	maximum frequency	CP input; see Figure 7								
		$V_{CC} = 4.5$ 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 μ 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;

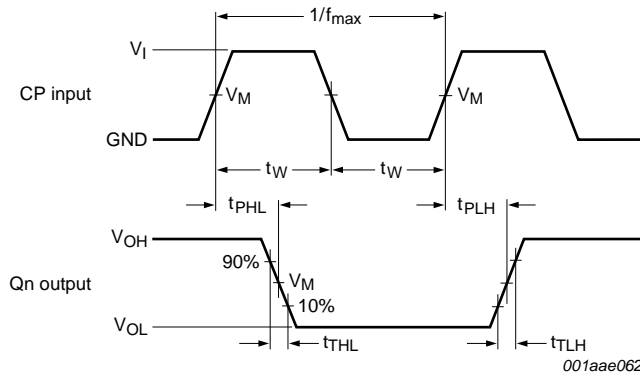
f_o = output frequency in MHz;

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

C_L = output load capacitance in pF;

V_{CC} = supply voltage in V.

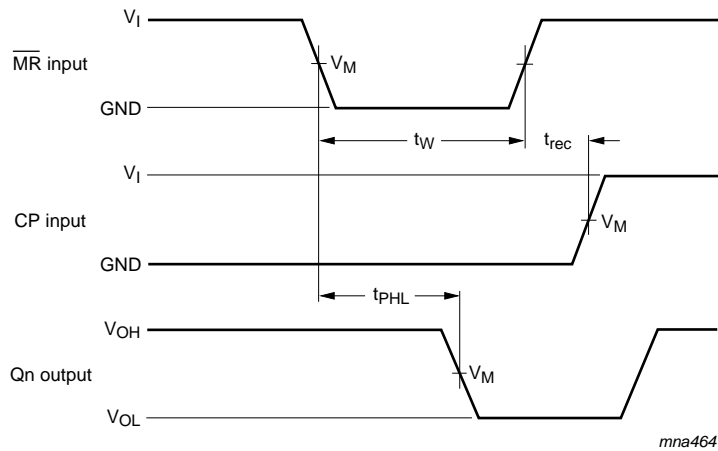
11. Waveforms



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

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

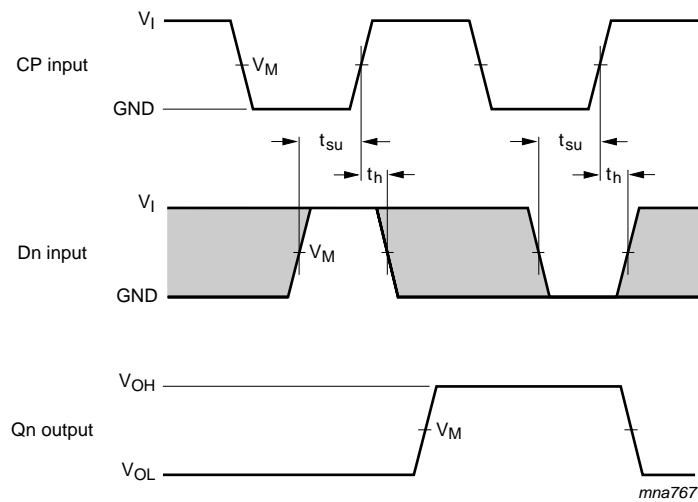
Fig 7. Propagation delay clock input (CP) to output (Qn), clock (CP) pulse width, output transition time and the maximum clock pulse frequency



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	V_{CC}	$0.5V_{CC}$	$0.5V_{CC}$
74HCT273	3 V	1.3 V	1.3 V

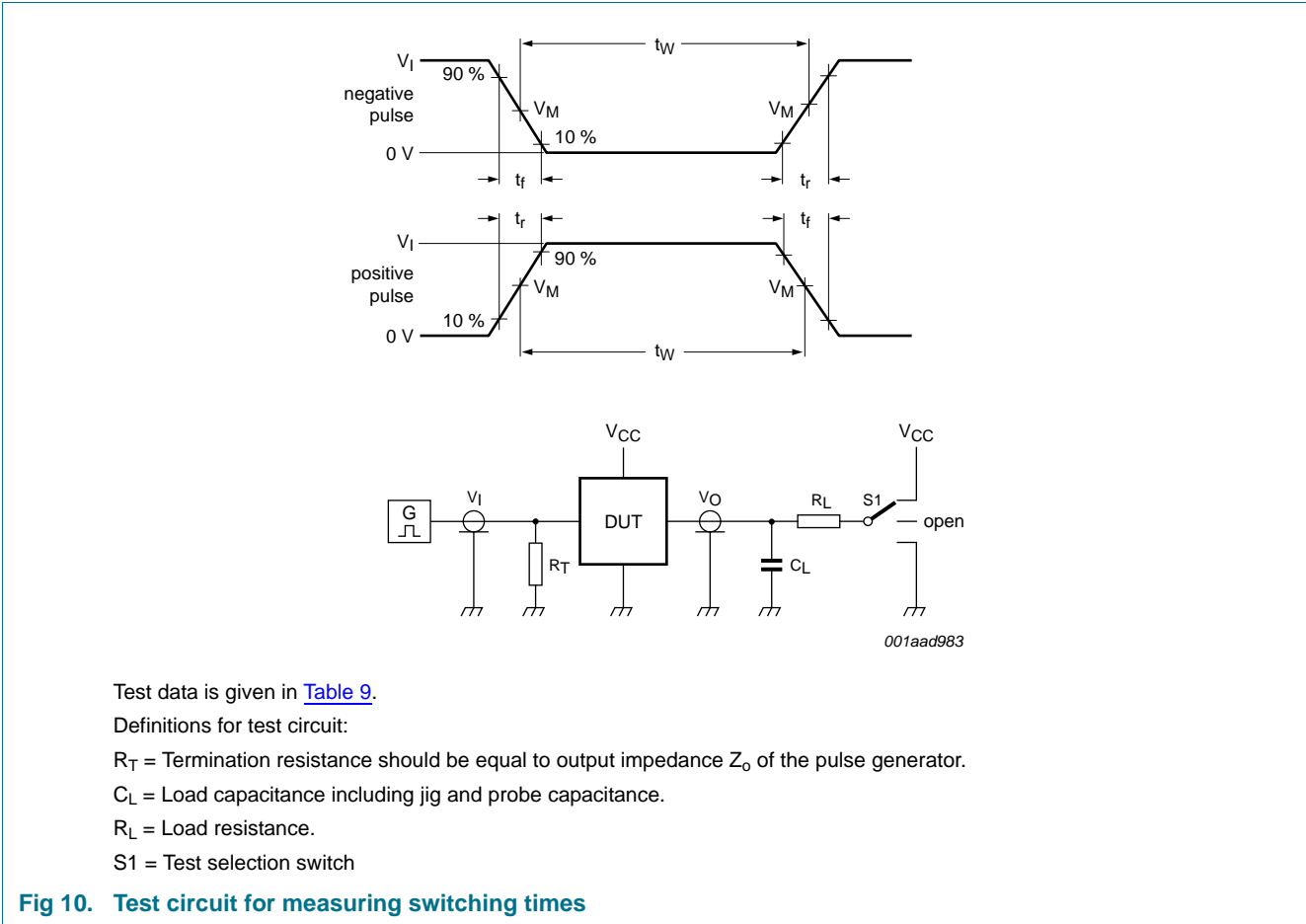


Table 9. Test data

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 Ω	open	
74HCT273	3 V	6 ns	15 pF, 50 pF	1 k Ω	open	

12. Package outline

DIP20: plastic dual in-line package; 20 leads (300 mil)

SOT146-1

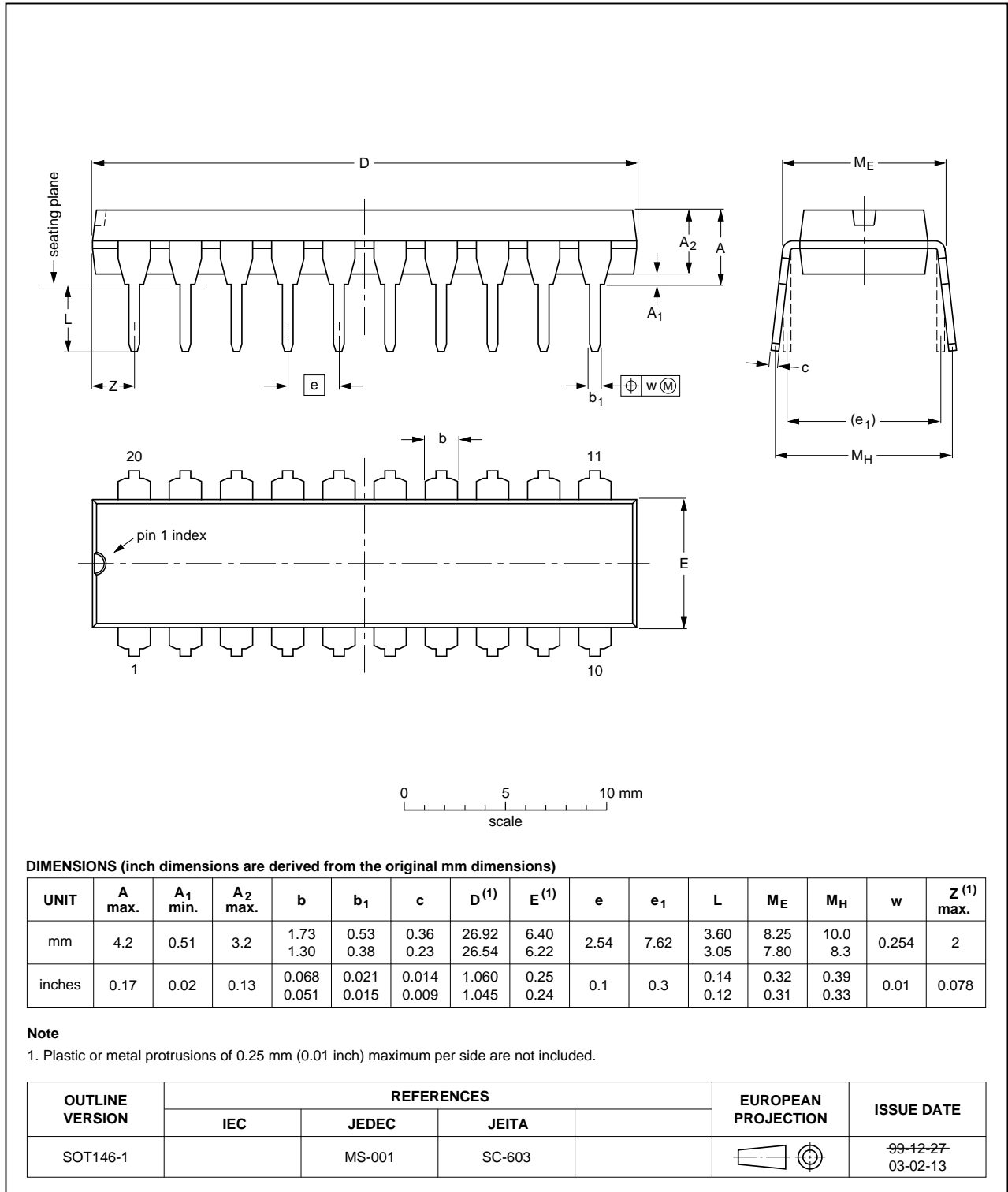


Fig 11. Package outline SOT146-1 (DIP20)

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

SOT163-1

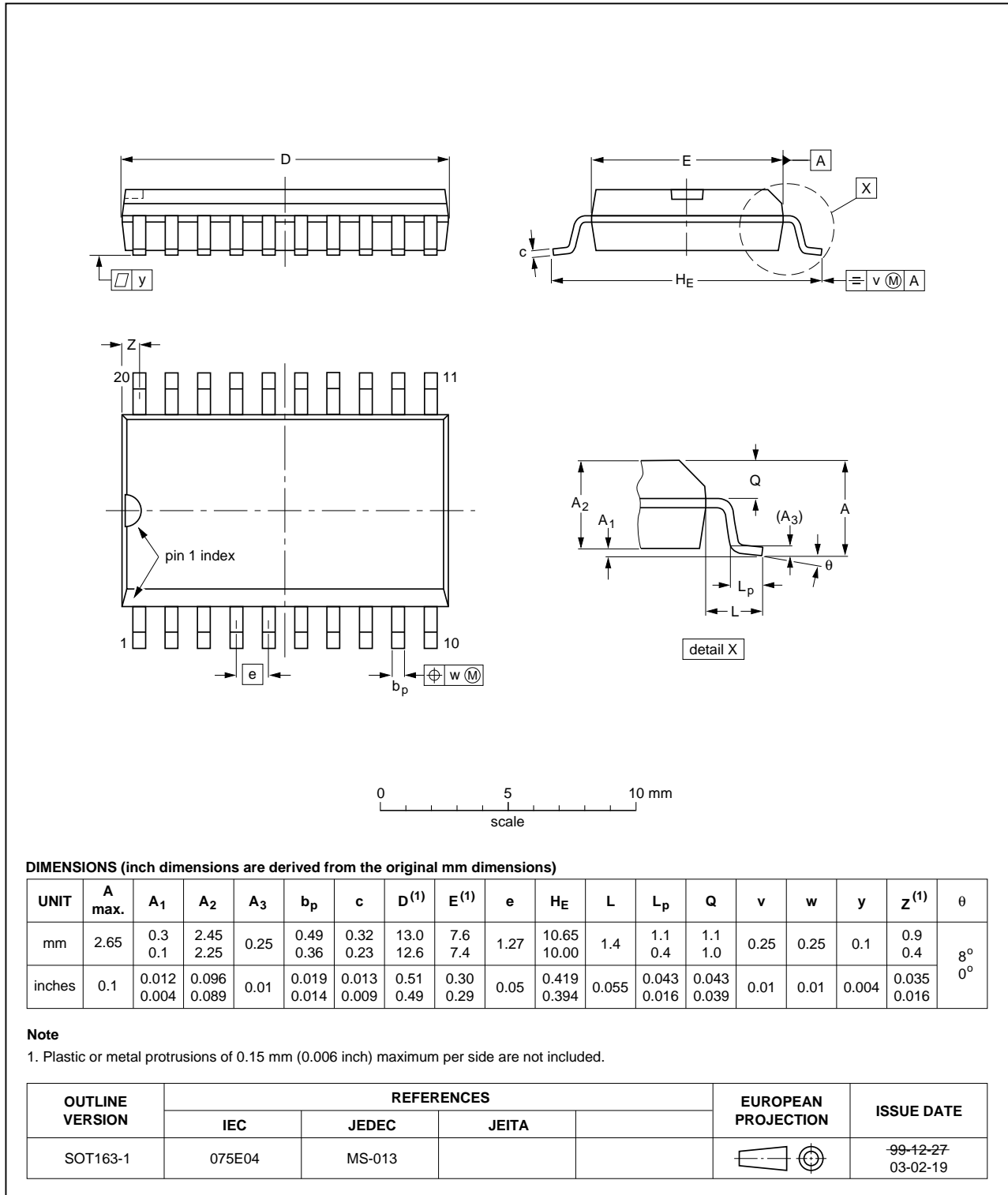


Fig 12. Package outline SOT163-1 (SO20)

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

SOT339-1

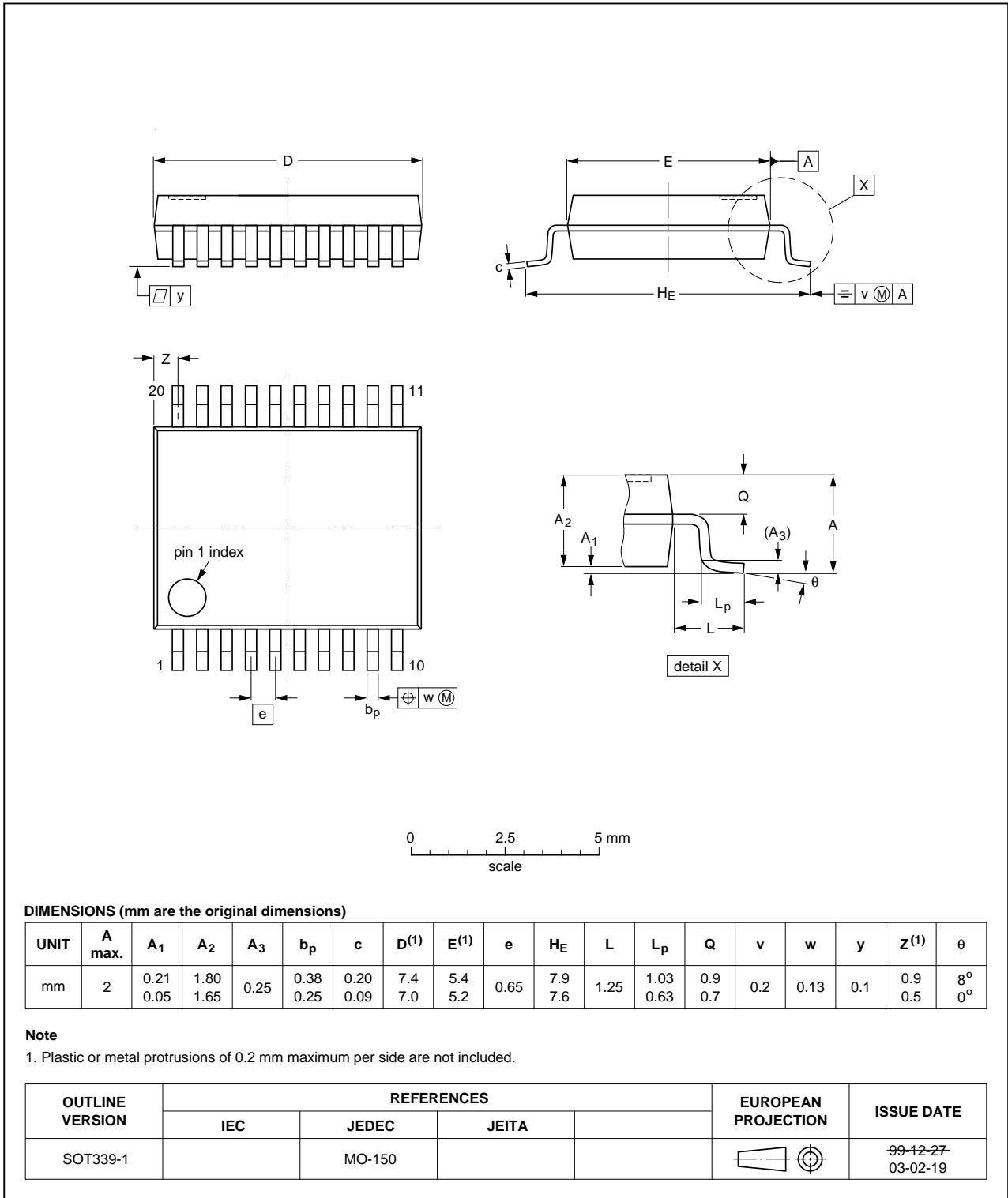


Fig 13. Package outline SOT339-1 (SSOP20)

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

SOT360-1

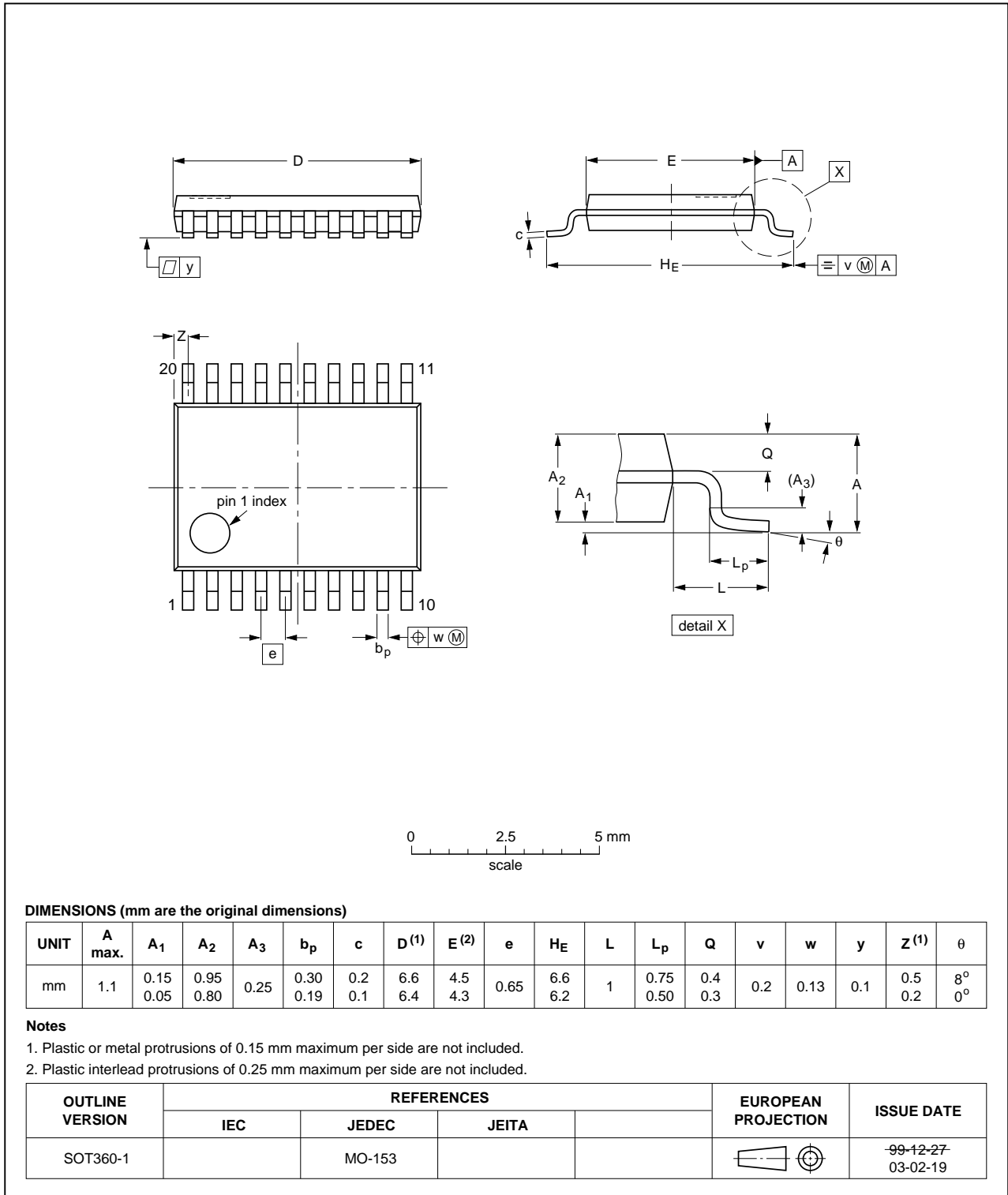


Fig 14. Package outline SOT360-1 (TSSOP20)

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

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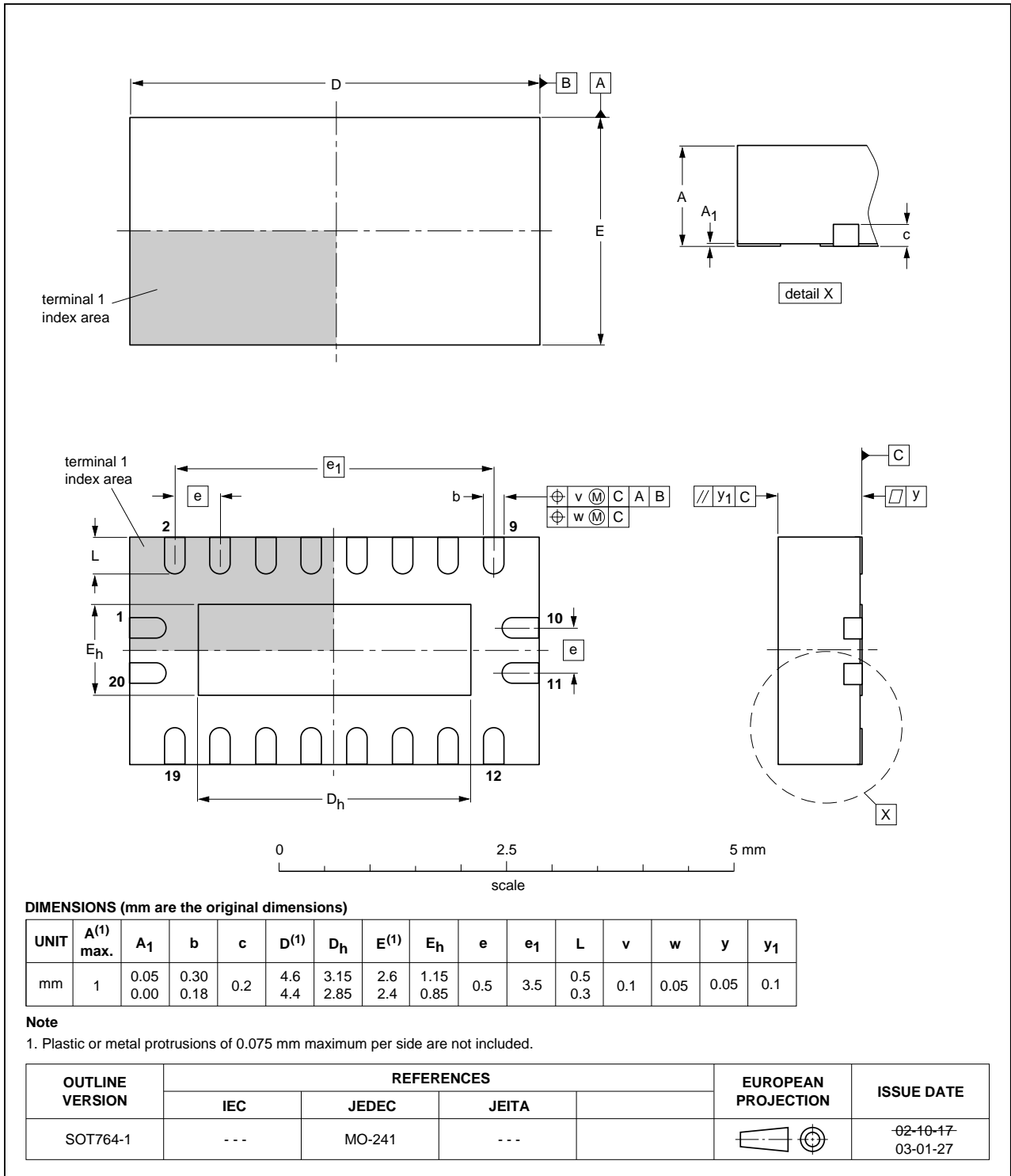


Fig 15. Package outline SOT764-1 (DHVQFN20)

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.4	20130610	Product data sheet	-	74HC_HCT273 v.3
Modifications:	<ul style="list-style-type: none"> The format of this data sheet has been redesigned to comply with the new identity guidelines of NXP Semiconductors. Legal texts have been adapted to the new company name where appropriate. 			
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 ^{[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 URL <http://www.nxp.com>.

15.2 Definitions

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