

74HC273; 74HCT273

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

Rev. 03 — 24 January 2006

Product data sheet

1. General description

The 74HC273; 74HCT273 is a high-speed Si-gate CMOS device and is pin compatible with Low-power Schottky TTL (LSTTL).

The 74HC273; 74HCT273 has eight edge-triggered, D-type flip-flops with individual D inputs and Q outputs. The common clock (pin CP) and master reset (pin $\overline{\text{MR}}$) 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 independently of clock or data inputs by a LOW voltage level on the $\overline{\text{MR}}$ input.

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

2. Features

- Ideal buffer for MOS microprocessor or memory
- Common clock and master reset
- Eight positive edge-triggered D-type flip-flops
- Complies with JEDEC standard no. 7A
- ESD protection:
 - ◆ HBM EIA/JESD22-A114-C exceeds 2000 V
 - ◆ MM EIA/JESD22-A115-A exceeds 200 V
- Multiple package options
- Specified from $-40\text{ }^{\circ}\text{C}$ to $+85\text{ }^{\circ}\text{C}$ and from $-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$

3. Quick reference data

Table 1: Quick reference data
 $GND = 0\text{ V}$; $T_{amb} = 25\text{ }^{\circ}\text{C}$; $t_r = t_f = 6\text{ ns}$.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
74HC273						
t_{PHL} , t_{PLH}	propagation delay CP to Qn	$V_{\text{CC}} = 5\text{ V}$; $C_{\text{L}} = 15\text{ pF}$	-	15	-	ns
t_{PHL}	HIGH-to-LOW propagation delay $\overline{\text{MR}}$ to Qn	$V_{\text{CC}} = 5\text{ V}$; $C_{\text{L}} = 15\text{ pF}$	-	15	-	ns
f_{max}	maximum input clock frequency	$V_{\text{CC}} = 5\text{ V}$; $C_{\text{L}} = 15\text{ pF}$	-	66	-	MHz

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Table 1: Quick reference data ...continued $GND = 0\text{ V}$; $T_{amb} = 25\text{ °C}$; $t_r = t_f = 6\text{ ns}$.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
C_i	input capacitance		-	3.5	-	pF
C_{PD}	power dissipation capacitance	per flip-flop; $V_i = GND$ to V_{CC}	[1]	20	-	pF
74HCT273						
t_{PHL} , t_{PLH}	propagation delay CP to Qn	$V_{CC} = 5\text{ V}$; $C_L = 15\text{ pF}$	-	15	-	ns
t_{PHL}	HIGH-to-LOW propagation delay MR to Qn	$V_{CC} = 5\text{ V}$; $C_L = 15\text{ pF}$	-	20	-	ns
f_{max}	maximum input clock frequency	$V_{CC} = 5\text{ V}$; $C_L = 15\text{ pF}$	-	36	-	MHz
C_i	input capacitance		-	3.5	-	pF
C_{PD}	power dissipation capacitance	per flip-flop; $V_i = GND$ to $(V_{CC} - 1.5\text{ V})$	[1]	23	-	pF

[1] C_{PD} is used to determine the dynamic power dissipation (P_D in μW). $P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \sum(C_L \times V_{CC}^2 \times f_o)$ 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; $\sum(C_L \times V_{CC}^2 \times f_o)$ = sum of outputs.

4. Ordering information

Table 2: Ordering information

Type number	Package			
	Temperature range	Name	Description	Version
74HC273				
74HC273N	-40 °C to +125 °C	DIP20	plastic dual in-line package; 20 leads (300 mil)	SOT146-1
74HC273D	-40 °C to +125 °C	SO20	plastic small outline package; 20 leads; body width 7.5 mm	SOT163-1
74HC273DB	-40 °C to +125 °C	SSOP20	plastic shrink small outline package; 20 leads; body width 5.3 mm	SOT339-1
74HC273PW	-40 °C to +125 °C	TSSOP20	plastic thin shrink small outline package; 20 leads; body width 4.4 mm	SOT360-1
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
74HCT273				
74HCT273N	-40 °C to +125 °C	DIP20	plastic dual in-line package; 20 leads (300 mil)	SOT146-1
74HCT273D	-40 °C to +125 °C	SO20	plastic small outline package; 20 leads; body width 7.5 mm	SOT163-1

Table 2: Ordering information ...continued

Type number	Package			Version
	Temperature range	Name	Description	
74HCT273DB	-40 °C to +125 °C	SSOP20	plastic shrink small outline package; 20 leads; body width 5.3 mm	SOT339-1
74HCT273PW	-40 °C to +125 °C	TSSOP20	plastic thin shrink small outline package; 20 leads; body width 4.4 mm	SOT360-1
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

5. Functional diagram

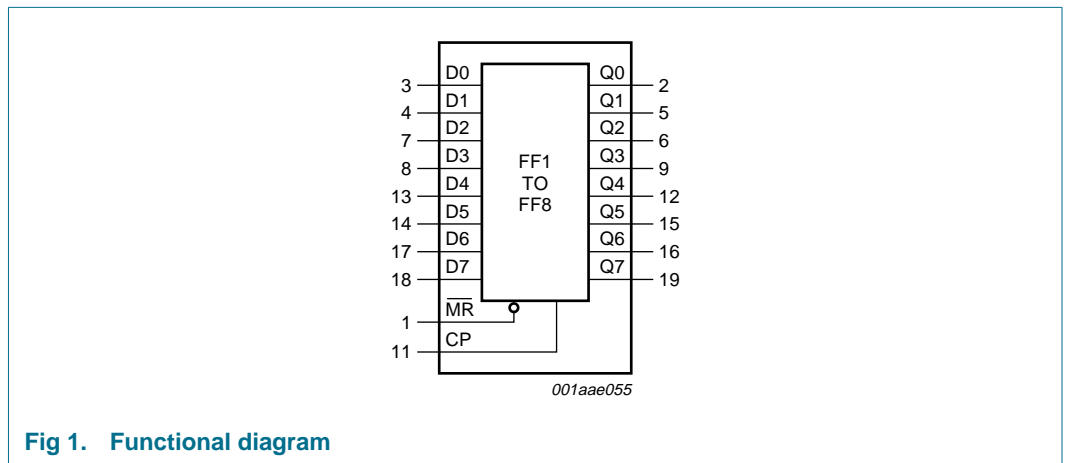


Fig 1. Functional diagram

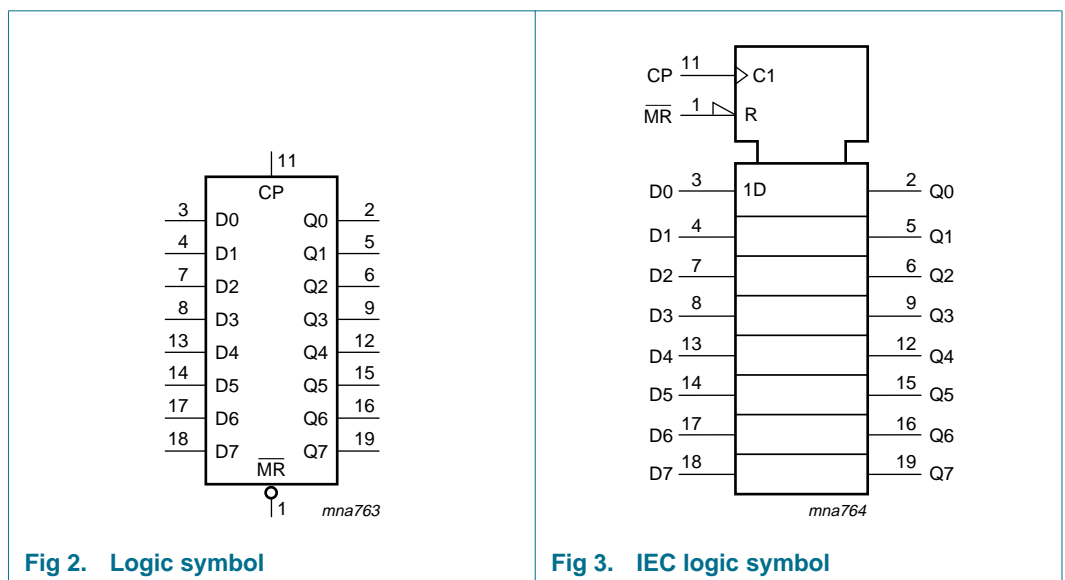


Fig 2. Logic symbol

Fig 3. IEC logic symbol

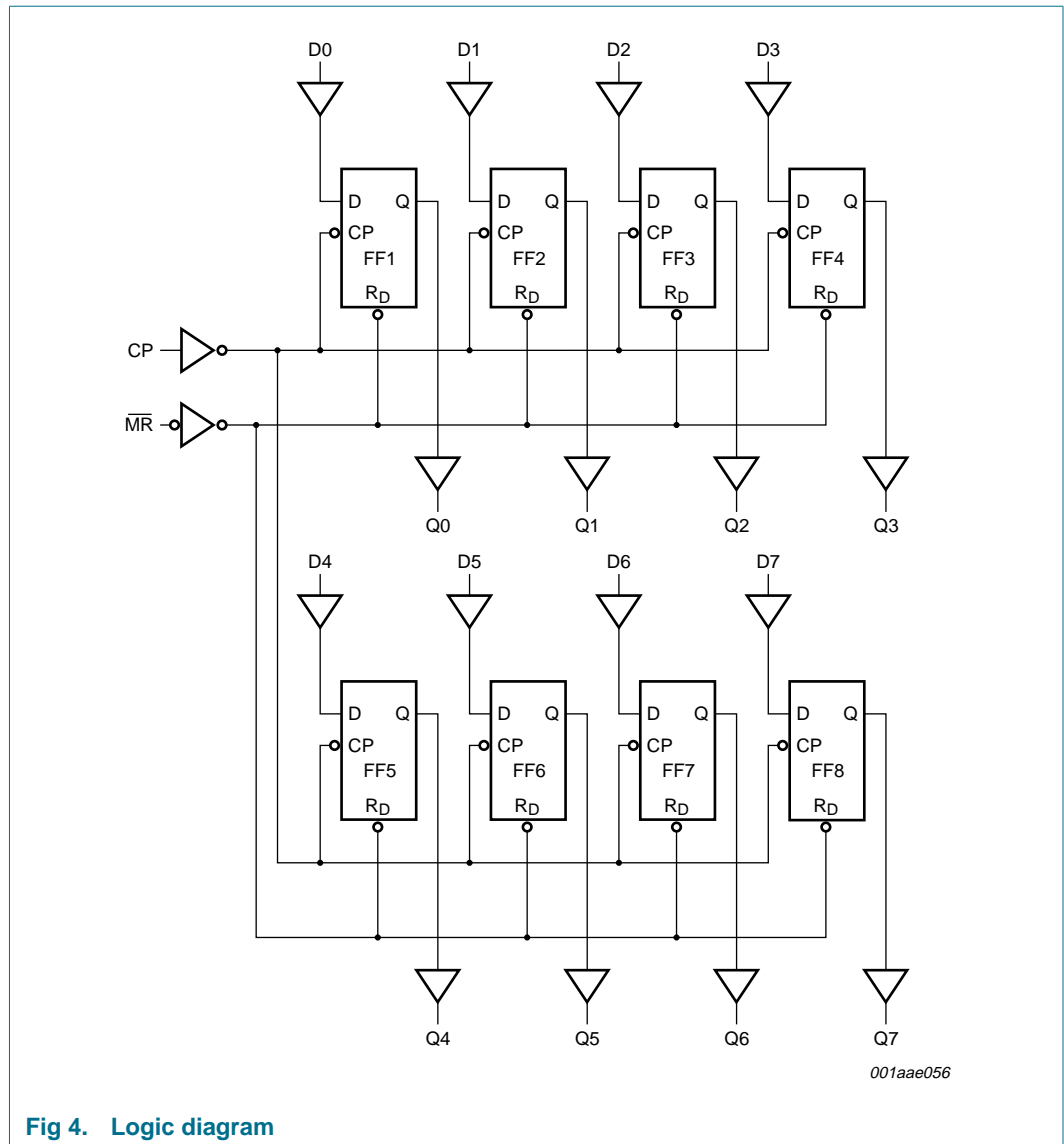
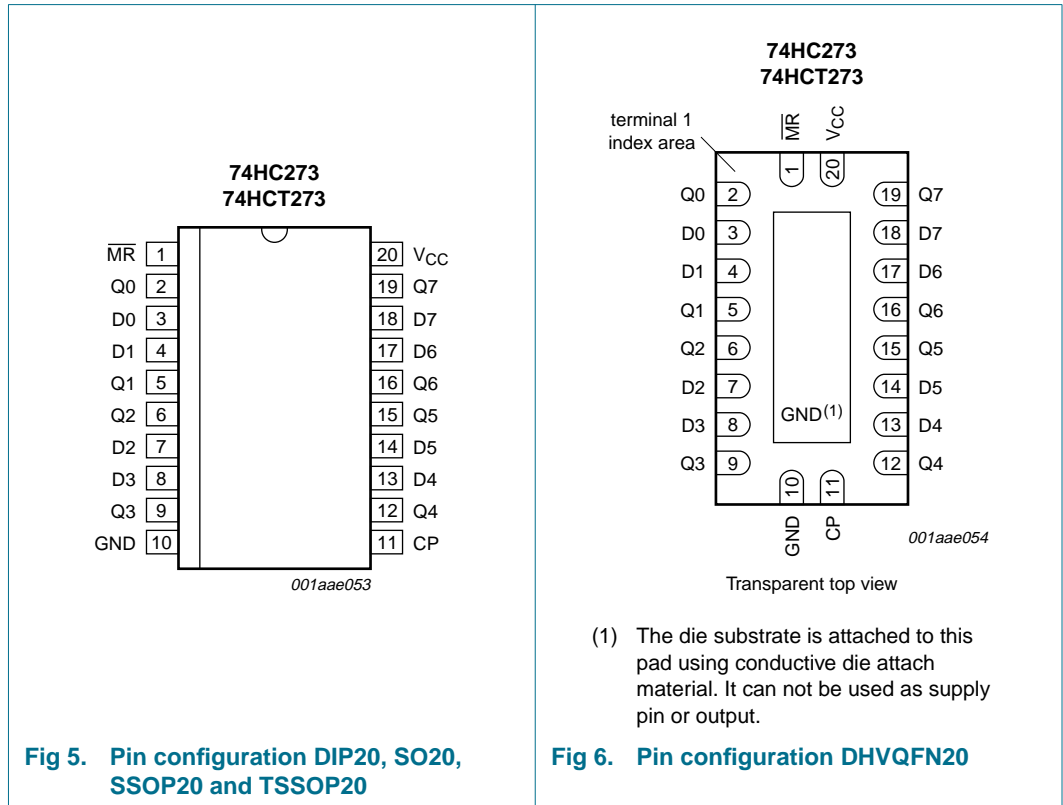


Fig 4. Logic diagram

6. Pinning information

6.1 Pinning



6.2 Pin description

Table 3: Pin description

Symbol	Pin	Description
MR	1	master reset input (active LOW)
Q0	2	flip-flop output 0
D0	3	data input 0
D1	4	data input 1
Q1	5	flip-flop output 1
Q2	6	flip-flop output 2
D2	7	data input 2
D3	8	data input 3
Q3	9	flip-flop output 3
GND	10	ground (0 V)
CP	11	clock input (LOW-to-HIGH, edge-triggered)
Q4	12	flip-flop output 4
D4	13	data input 4
D5	14	data input 5

Table 3: Pin description ...continued

Symbol	Pin	Description
Q5	15	flip-flop output 5
Q6	16	flip-flop output 6
D6	17	data input 6
D7	18	data input 7
Q7	19	flip-flop output 7
V _{CC}	20	supply voltage

7. Functional description

7.1 Function table

Table 4: Function table [1]

Operating modes	Control		Input	Output
	$\overline{\text{MR}}$	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 CP transition;
 L = LOW voltage level;
 l = LOW voltage level one set-up time prior to the LOW-to-HIGH CP transition;
 ↑ = LOW-to-HIGH transition;
 X = don't care.

8. Limiting values

Table 5: 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 $V_I > V_{CC} + 0.5 \text{ V}$	-	±20	mA
I _{OK}	output clamping current	$V_O < -0.5 \text{ V}$ or $V_O > V_{CC} + 0.5 \text{ V}$	-	±20	mA
I _O	output current	$V_O = -0.5 \text{ V}$ to $(V_{CC} + 0.5 \text{ V})$	-	±25	mA
I _{CC}	quiescent supply current		-	50	mA
I _{GND}	ground current		-	-50	mA
T _{stg}	storage temperature		-65	+150	°C

Table 5: Limiting values ...continued

In accordance with the Absolute Maximum Rating System (IEC 60134). Voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions	Min	Max	Unit
P _{tot}	total power dissipation				
	DIP20 package		[1] -	750	mW
	SO20 package		[2] -	500	mW
	SSOP20 package		[3] -	500	mW
	TSSOP20 package		[3] -	500	mW
	DHVQFN20 package		[4] -	500	mW

[1] For DIP20 package: P_{tot} derates linearly with 12 mW/K above 70 °C.

[2] For SO20 package: P_{tot} derates linearly with 8 mW/K above 70 °C.

[3] For SSOP20 and TSSOP20 packages: P_{tot} derates linearly with 5.5 mW/K above 60 °C.

[4] For DHVQFN20 packages: P_{tot} derates linearly with 4.5 mW/K above 60 °C.

9. Recommended operating conditions

Table 6: Recommended operating conditions

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
74HC273						
V _{CC}	supply voltage		2.0	5.0	6.0	V
V _I	input voltage		0	-	V _{CC}	V
V _O	output voltage		0	-	V _{CC}	V
T _{amb}	ambient temperature		-40	+25	+125	°C
t _r , t _f	input rise and fall time	V _{CC} = 2.0 V	-	-	1000	ns
		V _{CC} = 4.5 V	-	6.0	500	ns
		V _{CC} = 6.0 V	-	-	400	ns
74HCT273						
V _{CC}	supply voltage		4.5	5.0	5.5	V
V _I	input voltage		0	-	V _{CC}	V
V _O	output voltage		0	-	V _{CC}	V
T _{amb}	ambient temperature		-40	+25	+125	°C
t _r , t _f	input rise and fall time	V _{CC} = 4.5 V	-	6.0	500	ns

10. Static characteristics

Table 7: Static characteristics 74HC273

At recommended operating conditions; voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
T_{amb} = 25 °C						
V _{IH}	HIGH-state input voltage	V _{CC} = 2.0 V	1.5	1.2	-	V
		V _{CC} = 4.5 V	3.15	2.4	-	V
		V _{CC} = 6.0 V	4.2	3.2	-	V

Table 7: Static characteristics 74HC273 ...continued

At recommended operating conditions; voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V _{IL}	LOW-state input voltage	V _{CC} = 2.0 V	-	0.8	0.5	V
		V _{CC} = 4.5 V	-	2.1	1.35	V
		V _{CC} = 6.0 V	-	2.8	1.8	V
V _{OH}	HIGH-state output voltage	V _I = V _{IH} or V _{IL}				
		I _O = -20 μA; V _{CC} = 2.0 V	1.9	2.0	-	V
		I _O = -20 μA; V _{CC} = 4.5 V	4.4	4.5	-	V
		I _O = -20 μA; V _{CC} = 6.0 V	5.9	6.0	-	V
		I _O = -4.0 mA; V _{CC} = 4.5 V	3.98	4.32	-	V
		I _O = -5.2 mA; V _{CC} = 6.0 V	5.48	5.81	-	V
V _{OL}	LOW-state output voltage	V _I = V _{IH} or V _{IL}				
		I _O = 20 μA; V _{CC} = 2.0 V	-	0	0.1	V
		I _O = 20 μA; V _{CC} = 4.5 V	-	0	0.1	V
		I _O = 20 μA; V _{CC} = 6.0 V	-	0	0.1	V
		I _O = 4.0 mA; V _{CC} = 4.5 V	-	0.15	0.26	V
		I _O = 5.2 mA; V _{CC} = 6.0 V	-	0.16	0.26	V
I _{LI}	input leakage current	V _I = V _{CC} or GND; V _{CC} = 6.0 V	-	-	±0.1	μA
I _{OZ}	OFF-state output current	V _I = V _{IH} or V _{IL} ; V _O = V _{CC} or GND; V _{CC} = 6.0 V	-	-	±0.5	μA
I _{CC}	quiescent supply current	V _I = V _{CC} or GND; I _O = 0 A; V _{CC} = 6.0 V	-	-	8.0	μA
C _i	input capacitance		-	3.5	-	pF
T_{amb} = -40 °C to +85 °C						
V _{IH}	HIGH-state input voltage	V _{CC} = 2.0 V	1.5	-	-	V
		V _{CC} = 4.5 V	3.15	-	-	V
		V _{CC} = 6.0 V	4.2	-	-	V
V _{IL}	LOW-state input voltage	V _{CC} = 2.0 V	-	-	0.5	V
		V _{CC} = 4.5 V	-	-	1.35	V
		V _{CC} = 6.0 V	-	-	1.8	V
V _{OH}	HIGH-state output voltage	V _I = V _{IH} or V _{IL}				
		I _O = -20 μA; V _{CC} = 2.0 V	1.9	-	-	V
		I _O = -20 μA; V _{CC} = 4.5 V	4.4	-	-	V
		I _O = -20 μA; V _{CC} = 6.0 V	5.9	-	-	V
		I _O = -4.0 mA; V _{CC} = 4.5 V	3.84	-	-	V
		I _O = -5.2 mA; V _{CC} = 6.0 V	5.34	-	-	V
V _{OL}	LOW-state output voltage	V _I = V _{IH} or V _{IL}				
		I _O = 20 μA; V _{CC} = 2.0 V	-	-	0.1	V
		I _O = 20 μA; V _{CC} = 4.5 V	-	-	0.1	V
		I _O = 20 μA; V _{CC} = 6.0 V	-	-	0.1	V
		I _O = 4.0 mA; V _{CC} = 4.5 V	-	-	0.33	V
		I _O = 5.2 mA; V _{CC} = 6.0 V	-	-	0.33	V
I _{LI}	input leakage current	V _I = V _{CC} or GND; V _{CC} = 6.0 V	-	-	±1.0	μA

Table 7: Static characteristics 74HC273 ...continued

At recommended operating conditions; voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
I _{OZ}	OFF-state output current	V _I = V _{IH} or V _{IL} ; V _O = V _{CC} or GND; V _{CC} = 6.0 V	-	-	±5.0	µA
I _{CC}	quiescent supply current	V _I = V _{CC} or GND; I _O = 0 A; V _{CC} = 6.0 V	-	-	80	µA
T_{amb} = -40 °C to +125 °C						
V _{IH}	HIGH-state input voltage	V _{CC} = 2.0 V	1.5	-	-	V
		V _{CC} = 4.5 V	3.15	-	-	V
		V _{CC} = 6.0 V	4.2	-	-	V
V _{IL}	LOW-state input voltage	V _{CC} = 2.0 V	-	-	0.5	V
		V _{CC} = 4.5 V	-	-	1.35	V
		V _{CC} = 6.0 V	-	-	1.8	V
V _{OH}	HIGH-state output voltage	V _I = V _{IH} or V _{IL}	-	-	-	
		I _O = -20 µA; V _{CC} = 2.0 V	1.9	-	-	V
		I _O = -20 µA; V _{CC} = 4.5 V	4.4	-	-	V
		I _O = -20 µA; V _{CC} = 6.0 V	5.9	-	-	V
		I _O = -4.0 mA; V _{CC} = 4.5 V	3.7	-	-	V
V _{OL}	LOW-state output voltage	V _I = V _{IH} or V _{IL}	-	-	-	
		I _O = 20 µA; V _{CC} = 2.0 V	-	-	0.1	V
		I _O = 20 µA; V _{CC} = 4.5 V	-	-	0.1	V
		I _O = 20 µA; V _{CC} = 6.0 V	-	-	0.1	V
		I _O = 4.0 mA; V _{CC} = 4.5 V	-	-	0.4	V
I _{LI}	input leakage current	V _I = V _{CC} or GND; V _{CC} = 6.0 V	-	-	±1.0	µA
		V _I = V _{CC} or GND; V _{CC} = 6.0 V	-	-	±10.0	µA
I _{CC}	quiescent supply current	V _I = V _{CC} or GND; I _O = 0 A; V _{CC} = 6.0 V	-	-	160	µA

Table 8: Static characteristics 74HCT273

At recommended operating conditions; voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
T_{amb} = 25 °C						
V _{IH}	HIGH-state input voltage	V _{CC} = 4.5 V to 5.5 V	2.0	1.6	-	V
V _{IL}	LOW-state input voltage	V _{CC} = 4.5 V to 5.5 V	-	1.2	0.8	V
V _{OH}	HIGH-state output voltage	V _I = V _{IH} or V _{IL} ; V _{CC} = 4.5 V	-	-	-	
		I _O = -20 µA	4.4	4.5	-	V
		I _O = -4.0 mA	3.98	4.32	-	V
V _{OL}	LOW-state output voltage	V _I = V _{IH} or V _{IL} ; V _{CC} = 4.5 V	-	-	-	
		I _O = 20 µA	-	0	0.1	V
		I _O = 4.0 mA	-	0.15	0.26	V
I _{LI}	input leakage current	V _I = V _{CC} or GND; V _{CC} = 5.5 V	-	-	±0.1	µA

Table 8: Static characteristics 74HCT273 ...continued

At recommended operating conditions; voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
I_{OZ}	OFF-state output current	$V_I = V_{IH}$ or V_{IL} ; $V_{CC} = 5.5$ V; $V_O = V_{CC}$ or GND per input pin; other inputs at V_{CC} or GND; $I_O = 0$ A	-	-	± 0.5	μ A
I_{CC}	quiescent supply current	$V_I = V_{CC}$ or GND; $I_O = 0$ A; $V_{CC} = 5.5$ V	-	-	8.0	μ A
ΔI_{CC}	additional quiescent supply current	$V_I = V_{CC} - 2.1$ V; other inputs at V_{CC} or GND; $V_{CC} = 4.5$ V to 5.5 V; $I_O = 0$ A				
	pin \overline{MR}		-	100	360	μ A
	pin CP		-	175	630	μ A
	pin Dn		-	15	54	μ A
C_i	input capacitance		-	3.5	-	pF
$T_{amb} = -40$ °C to $+85$ °C						
V_{IH}	HIGH-state input voltage	$V_{CC} = 4.5$ V to 5.5 V	2.0	-	-	V
V_{IL}	LOW-state input voltage	$V_{CC} = 4.5$ V to 5.5 V	-	-	0.8	V
V_{OH}	HIGH-state output voltage	$V_I = V_{IH}$ or V_{IL} ; $V_{CC} = 4.5$ V				
		$I_O = -20$ μ A	4.4	-	-	V
		$I_O = -4.0$ mA	3.84	-	-	V
V_{OL}	LOW-state output voltage	$V_I = V_{IH}$ or V_{IL} ; $V_{CC} = 4.5$ V				
		$I_O = 20$ μ A	-	-	0.1	V
		$I_O = 4.0$ mA	-	-	0.33	V
I_{LI}	input leakage current	$V_I = V_{CC}$ or GND; $V_{CC} = 5.5$ V	-	-	± 1.0	μ A
I_{OZ}	OFF-state output current	$V_I = V_{IH}$ or V_{IL} ; $V_{CC} = 5.5$ V; $V_O = V_{CC}$ or GND per input pin; other inputs at V_{CC} or GND; $I_O = 0$ A	-	-	± 5.0	μ A
I_{CC}	quiescent supply current	$V_I = V_{CC}$ or GND; $I_O = 0$ A; $V_{CC} = 5.5$ V	-	-	80	μ A
ΔI_{CC}	additional quiescent supply current	$V_I = V_{CC} - 2.1$ V; other inputs at V_{CC} or GND; $V_{CC} = 4.5$ V to 5.5 V; $I_O = 0$ A				
	pin \overline{MR}		-	-	450	μ A
	pin CP		-	-	787.5	μ A
	pin Dn		-	-	67.5	μ A
$T_{amb} = -40$ °C to $+125$ °C						
V_{IH}	HIGH-state input voltage	$V_{CC} = 4.5$ V to 5.5 V	2.0	-	-	V
V_{IL}	LOW-state input voltage	$V_{CC} = 4.5$ V to 5.5 V	-	-	0.8	V
V_{OH}	HIGH-state output voltage	$V_I = V_{IH}$ or V_{IL} ; $V_{CC} = 4.5$ V				
		$I_O = -20$ μ A	4.4	-	-	V
		$I_O = -4.0$ mA	3.7	-	-	V
V_{OL}	LOW-state output voltage	$V_I = V_{IH}$ or V_{IL} ; $V_{CC} = 4.5$ V				
		$I_O = 20$ μ A	-	-	0.1	V
		$I_O = 4.0$ mA	-	-	0.4	V
I_{LI}	input leakage current	$V_I = V_{CC}$ or GND; $V_{CC} = 5.5$ V	-	-	± 1.0	μ A

Table 8: Static characteristics 74HCT273 ...continued

At recommended operating conditions; voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
I_{OZ}	OFF-state output current	$V_I = V_{IH}$ or V_{IL} ; $V_{CC} = 5.5$ V; $V_O = V_{CC}$ or GND per input pin; other inputs at V_{CC} or GND; $I_O = 0$ A	-	-	± 10	μ A
I_{CC}	quiescent supply current	$V_I = V_{CC}$ or GND; $I_O = 0$ A; $V_{CC} = 5.5$ V	-	-	160	μ A
ΔI_{CC}	additional quiescent supply current	$V_I = V_{CC} - 2.1$ V; other inputs at V_{CC} or GND; $V_{CC} = 4.5$ V to 5.5 V; $I_O = 0$ A				
	pin \overline{MR}		-	-	490	μ A
	pin CP		-	-	857.5	μ A
	pin Dn		-	-	73.5	μ A

11. Dynamic characteristics

Table 9: Dynamic characteristics 74HC273Voltages are referenced to GND (ground = 0 V); $t_r = t_f = 6$ ns; $C_L = 50$ pF unless otherwise specified; for test circuit see Figure 10.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$T_{amb} = 25$ °C						
t_{PHL} , t_{PLH}	propagation delay CP to Qn	see Figure 7				
		$V_{CC} = 2.0$ V	-	41	150	ns
		$V_{CC} = 4.5$ V	-	15	30	ns
		$V_{CC} = 5$ V; $C_L = 15$ pF	-	15	-	ns
		$V_{CC} = 6.0$ V	-	13	26	ns
t_{PHL}	HIGH-to-LOW propagation delay MR to Qn	see Figure 8				
		$V_{CC} = 2.0$ V	-	44	150	ns
		$V_{CC} = 4.5$ V	-	16	30	ns
		$V_{CC} = 5$ V; $C_L = 15$ pF	-	15	-	ns
		$V_{CC} = 6.0$ V	-	14	26	ns
t_{THL} , t_{TLH}	output transition time	see Figure 7				
		$V_{CC} = 2.0$ V	-	19	75	ns
		$V_{CC} = 4.5$ V	-	7	15	ns
		$V_{CC} = 6.0$ V	-	6	13	ns
t_w	pulse width					
	clock HIGH or LOW	see Figure 7				
		$V_{CC} = 2.0$ V	80	14	-	ns
		$V_{CC} = 4.5$ V	16	5	-	ns
		$V_{CC} = 6.0$ V	14	4	-	ns
	master reset LOW	see Figure 8				
		$V_{CC} = 2.0$ V	60	17	-	ns
		$V_{CC} = 4.5$ V	12	6	-	ns
		$V_{CC} = 6.0$ V	10	5	-	ns

Table 9: Dynamic characteristics 74HC273 ...continued

Voltages are referenced to GND (ground = 0 V); $t_r = t_f = 6$ ns; $C_L = 50$ pF unless otherwise specified; for test circuit see Figure 10.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit	
t_{rec}	recovery time \overline{MR} to CP	see Figure 8					
		$V_{CC} = 2.0$ V	+50	-6	-	ns	
		$V_{CC} = 4.5$ V	+10	-2	-	ns	
		$V_{CC} = 6.0$ V	+9	-2	-	ns	
t_{su}	set-up time Dn to CP	see Figure 9					
		$V_{CC} = 2.0$ V	60	11	-	ns	
		$V_{CC} = 4.5$ V	12	4	-	ns	
		$V_{CC} = 6.0$ V	10	3	-	ns	
t_h	hold time Dn to CP	see Figure 9					
		$V_{CC} = 2.0$ V	+3	-6	-	ns	
		$V_{CC} = 4.5$ V	+3	-2	-	ns	
		$V_{CC} = 6.0$ V	+3	-2	-	ns	
f_{max}	maximum input clock frequency	see Figure 7					
		$V_{CC} = 2.0$ V	6.0	20.6	-	MHz	
		$V_{CC} = 4.5$ V	30	103	-	MHz	
		$V_{CC} = 5$ V; $C_L = 15$ pF	-	66	-	MHz	
		$V_{CC} = 6.0$ V	35	122	-	MHz	
C_{PD}	power dissipation capacitance	per flip-flop; $V_I = GND$ to V_{CC}	(1)	-	20	pF	
$T_{amb} = -40$ °C to $+85$ °C							
t_{PHL} , t_{PLH}	propagation delay CP to Qn	see Figure 7					
		$V_{CC} = 2.0$ V	-	-	185	ns	
		$V_{CC} = 4.5$ V	-	-	37	ns	
		$V_{CC} = 6.0$ V	-	-	31	ns	
t_{PHL}	HIGH-to-LOW propagation delay \overline{MR} to Qn	see Figure 8					
		$V_{CC} = 2.0$ V	-	-	185	ns	
		$V_{CC} = 4.5$ V	-	-	37	ns	
		$V_{CC} = 6.0$ V	-	-	31	ns	
t_{THL} , t_{TLH}	output transition time	see Figure 7					
		$V_{CC} = 2.0$ V	-	-	95	ns	
		$V_{CC} = 4.5$ V	-	-	19	ns	
		$V_{CC} = 6.0$ V	-	-	15	ns	
t_w	pulse width	clock HIGH or LOW	see Figure 7				
			$V_{CC} = 2.0$ V	100	-	-	ns
			$V_{CC} = 4.5$ V	20	-	-	ns
			$V_{CC} = 6.0$ V	17	-	-	ns
	master reset LOW	see Figure 8					
		$V_{CC} = 2.0$ V	75	-	-	ns	
		$V_{CC} = 4.5$ V	15	-	-	ns	
		$V_{CC} = 6.0$ V	13	-	-	ns	

Table 9: Dynamic characteristics 74HC273 ...continued

Voltages are referenced to GND (ground = 0 V); $t_r = t_f = 6$ ns; $C_L = 50$ pF unless otherwise specified; for test circuit see Figure 10.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit	
t_{rec}	recovery time \overline{MR} to CP	see Figure 8					
		$V_{CC} = 2.0$ V	65	-	-	ns	
		$V_{CC} = 4.5$ V	13	-	-	ns	
		$V_{CC} = 6.0$ V	11	-	-	ns	
t_{su}	set-up time Dn to CP	see Figure 9					
		$V_{CC} = 2.0$ V	75	-	-	ns	
		$V_{CC} = 4.5$ V	15	-	-	ns	
		$V_{CC} = 6.0$ V	13	-	-	ns	
t_h	hold time Dn to CP	see Figure 9					
		$V_{CC} = 2.0$ V	3	-	-	ns	
		$V_{CC} = 4.5$ V	3	-	-	ns	
		$V_{CC} = 6.0$ V	3	-	-	ns	
f_{max}	maximum input clock frequency	see Figure 7					
		$V_{CC} = 2.0$ V	4.8	-	-	MHz	
		$V_{CC} = 4.5$ V	24	-	-	MHz	
		$V_{CC} = 6.0$ V	28	-	-	MHz	
$T_{amb} = -40$ °C to $+125$ °C							
t_{PHL} , t_{PLH}	propagation delay CP to Qn	see Figure 7					
		$V_{CC} = 2.0$ V	-	-	225	ns	
		$V_{CC} = 4.5$ V	-	-	45	ns	
		$V_{CC} = 6.0$ V	-	-	38	ns	
t_{PHL}	HIGH-to-LOW propagation delay \overline{MR} to Qn	see Figure 8					
		$V_{CC} = 2.0$ V	-	-	225	ns	
		$V_{CC} = 4.5$ V	-	-	45	ns	
		$V_{CC} = 6.0$ V	-	-	38	ns	
t_{THL} , t_{TLH}	output transition time	see Figure 7					
		$V_{CC} = 2.0$ V	-	-	110	ns	
		$V_{CC} = 4.5$ V	-	-	22	ns	
		$V_{CC} = 6.0$ V	-	-	19	ns	
t_w	pulse width clock HIGH or LOW	see Figure 7					
		$V_{CC} = 2.0$ V	120	-	-	ns	
		$V_{CC} = 4.5$ V	24	-	-	ns	
		$V_{CC} = 6.0$ V	20	-	-	ns	
	master reset LOW	see Figure 8					
		$V_{CC} = 2.0$ V	90	-	-	ns	
$V_{CC} = 4.5$ V		18	-	-	ns		
	$V_{CC} = 6.0$ V	15	-	-	ns		

Table 9: Dynamic characteristics 74HC273 ...continued

Voltages are referenced to GND (ground = 0 V); $t_r = t_f = 6$ ns; $C_L = 50$ pF unless otherwise specified; for test circuit see Figure 10.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
t_{rec}	recovery time \overline{MR} to CP	see Figure 8				
		$V_{CC} = 2.0$ V	75	-	-	ns
		$V_{CC} = 4.5$ V	15	-	-	ns
		$V_{CC} = 6.0$ V	13	-	-	ns
t_{su}	set-up time Dn to CP	see Figure 9				
		$V_{CC} = 2.0$ V	90	-	-	ns
		$V_{CC} = 4.5$ V	18	-	-	ns
		$V_{CC} = 6.0$ V	15	-	-	ns
t_h	hold time Dn to CP	see Figure 9				
		$V_{CC} = 2.0$ V	3	-	-	ns
		$V_{CC} = 4.5$ V	3	-	-	ns
		$V_{CC} = 6.0$ V	3	-	-	ns
f_{max}	maximum input clock frequency	see Figure 7				
		$V_{CC} = 2.0$ V	4.0	-	-	MHz
		$V_{CC} = 4.5$ V	20	-	-	MHz
		$V_{CC} = 6.0$ V	24	-	-	MHz

[1] C_{PD} is used to determine the dynamic power dissipation (P_D in μ W).

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

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;

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

Table 10: Dynamic characteristics 74HCT273

Voltages are referenced to GND (ground = 0 V); $t_r = t_f = 6$ ns; $C_L = 50$ pF unless otherwise specified; for test circuit see Figure 10.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit	
$T_{amb} = 25$ °C							
t_{PHL} , t_{PLH}	propagation delay CP to Qn	see Figure 7					
		$V_{CC} = 4.5$ V	-	16	30	ns	
		$V_{CC} = 5$ V; $C_L = 15$ pF	-	15	-	ns	
t_{PHL}	HIGH-to-LOW propagation delay MR to Qn	see Figure 8					
		$V_{CC} = 4.5$ V	-	23	34	ns	
		$V_{CC} = 5$ V; $C_L = 15$ pF	-	20	-	ns	
t_{THL} , t_{TLH}	output transition time	$V_{CC} = 4.5$ V; see Figure 7	-	7	15	ns	
t_W	pulse width						
		clock HIGH or LOW	$V_{CC} = 4.5$ V; see Figure 7	16	9	-	ns
		master reset LOW	$V_{CC} = 4.5$ V; see Figure 8	16	8	-	ns

Table 10: Dynamic characteristics 74HCT273 ...continued

Voltages are referenced to GND (ground = 0 V); $t_r = t_f = 6$ ns; $C_L = 50$ pF unless otherwise specified; for test circuit see Figure 10.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit	
t_{rec}	recovery time \overline{MR} to CP	$V_{CC} = 4.5$ V; see Figure 8	+10	-2	-	ns	
t_{su}	set-up time Dn to CP	$V_{CC} = 4.5$ V; see Figure 9	12	5	-	ns	
t_h	hold time Dn to CP	$V_{CC} = 4.5$ V; see Figure 9	+3	-4	-	ns	
f_{max}	maximum input clock frequency	see Figure 7					
		$V_{CC} = 4.5$ V	30	56	-	MHz	
		$V_{CC} = 5.0$ V; $C_L = 15$ pF	-	36	-	MHz	
C_{PD}	power dissipation capacitance	per flip-flop; $V_I = GND$ to $(V_{CC} - 1.5$ V) [1]	-	23	-	pF	
$T_{amb} = -40$ °C to $+85$ °C							
t_{PHL} , t_{PLH}	propagation delay CP to Qn	$V_{CC} = 4.5$ V; see Figure 7	-	-	38	ns	
t_{PHL}	HIGH-to-LOW propagation delay \overline{MR} to Qn	$V_{CC} = 4.5$ V; see Figure 8	-	-	43	ns	
t_{THL} , t_{TLH}	output transition time	$V_{CC} = 4.5$ V; see Figure 7	-	-	19	ns	
t_W	pulse width	clock HIGH or LOW	$V_{CC} = 4.5$ V; see Figure 7	20	-	-	ns
		master reset LOW	$V_{CC} = 4.5$ V; see Figure 8	20	-	-	ns
t_{rec}	recovery time \overline{MR} to CP	$V_{CC} = 4.5$ V; see Figure 8	13	-	-	ns	
t_{su}	set-up time Dn to CP	$V_{CC} = 4.5$ V; see Figure 9	15	-	-	ns	
t_h	hold time Dn to CP	$V_{CC} = 4.5$ V; see Figure 9	3	-	-	ns	
f_{max}	maximum input clock frequency	$V_{CC} = 4.5$ V; see Figure 7	24	-	-	MHz	
$T_{amb} = -40$ °C to $+125$ °C							
t_{PHL} , t_{PLH}	propagation delay CP to Qn	$V_{CC} = 4.5$ V; see Figure 7	-	-	45	ns	
t_{PHL}	HIGH-to-LOW propagation delay \overline{MR} to Qn	$V_{CC} = 4.5$ V; see Figure 8	-	-	51	ns	
t_{THL} , t_{TLH}	output transition time	$V_{CC} = 4.5$ V; see Figure 7	-	-	22	ns	
t_W	pulse width	clock HIGH or LOW	$V_{CC} = 4.5$ V; see Figure 7	24	-	-	ns
		master reset LOW	$V_{CC} = 4.5$ V; see Figure 8	24	-	-	ns
t_{rec}	recovery time \overline{MR} to CP	$V_{CC} = 4.5$ V; see Figure 8	15	-	-	ns	
t_{su}	set-up time Dn to CP	$V_{CC} = 4.5$ V; see Figure 9	18	-	-	ns	
t_h	hold time Dn to CP	$V_{CC} = 4.5$ V; see Figure 9	3	-	-	ns	
f_{max}	maximum input clock frequency	$V_{CC} = 4.5$ V; see Figure 7	20	-	-	MHz	

[1] C_{PD} is used to determine the dynamic power dissipation (P_D in μ W).

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

f_i = input frequency in MHz;

f_o = output frequency in MHz;

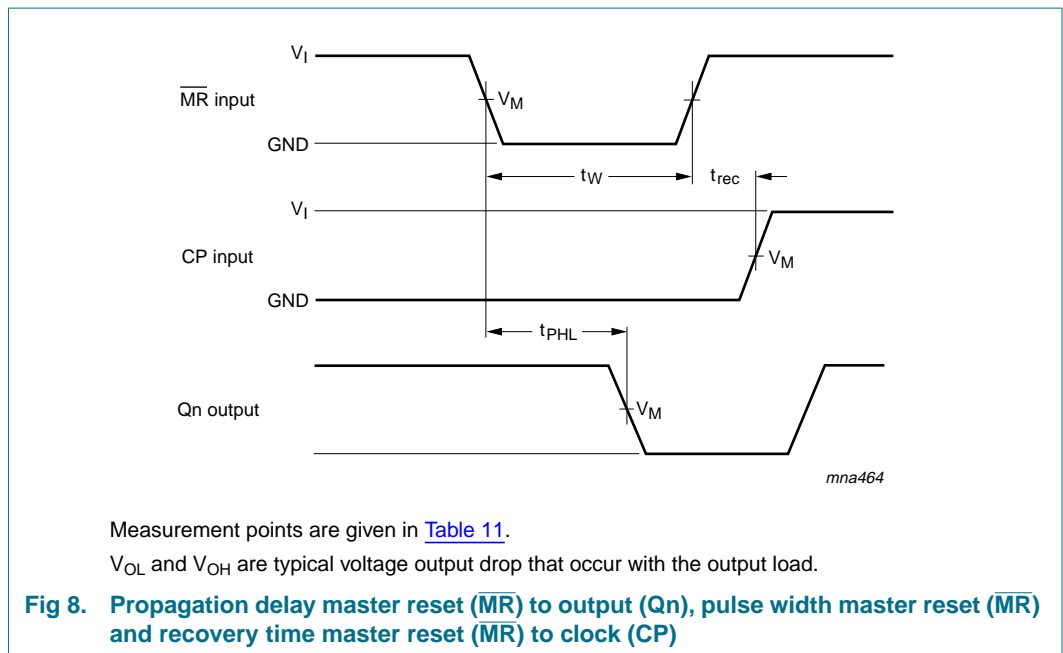
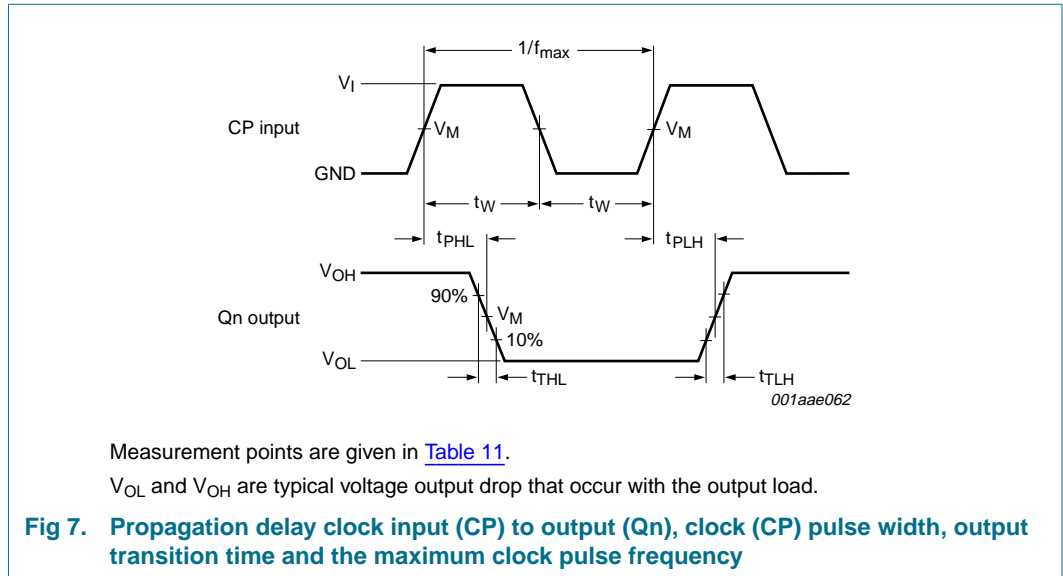
C_L = output load capacitance in pF;

V_{CC} = supply voltage in V;

N = number of inputs switching;

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

12. Waveforms



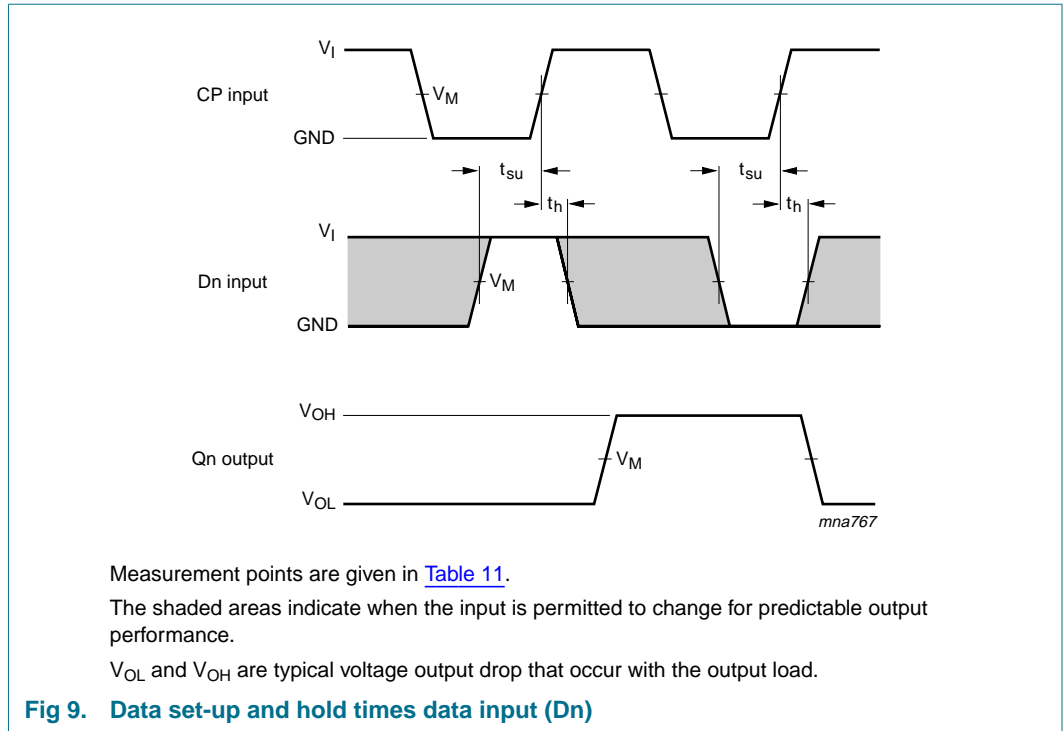


Table 11: Measurement points

Type	Input	Output
	V_M	V_M
74HC273	$0.5V_{CC}$	$0.5V_{CC}$
74HCT273	1.3 V	1.3 V

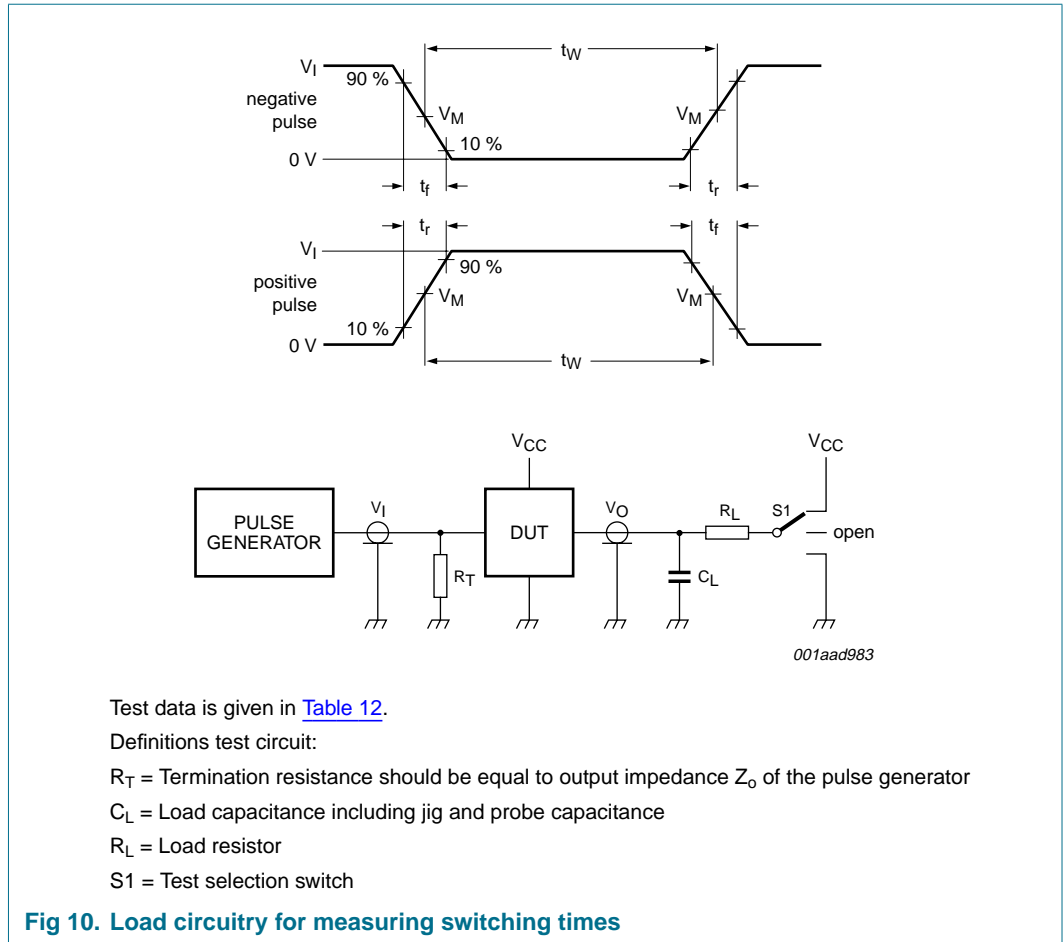


Table 12: Test data

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}
74HC273	V_{CC}	6 ns	15 pF, 50 pF	1 k Ω	open	GND	V_{CC}
74HCT273	3 V	6 ns	15 pF, 50 pF	1 k Ω	open	GND	V_{CC}

13. Package outline

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

SOT146-1

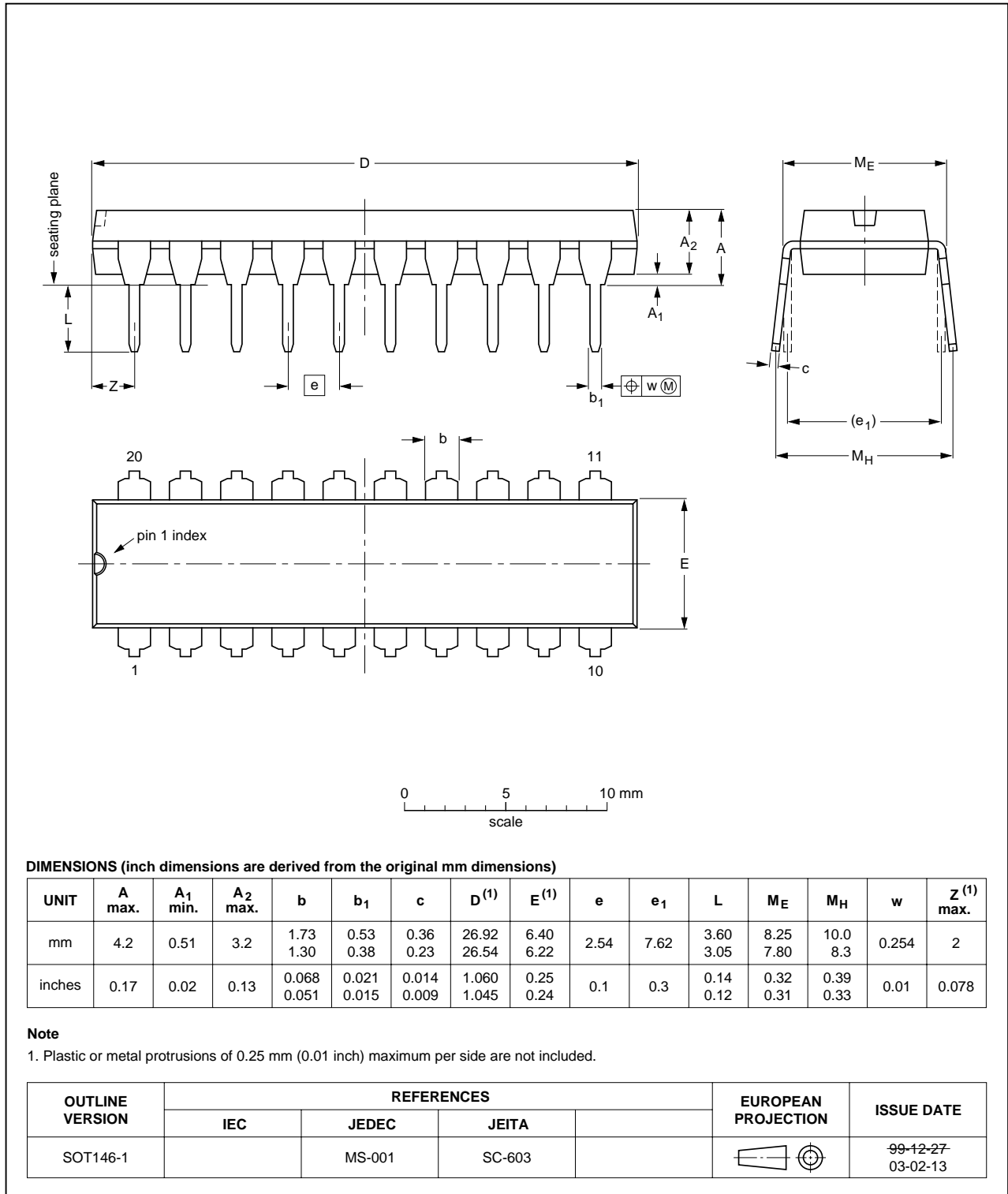


Fig 11. Package outline SOT146-1 (DIP20)

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

SOT163-1

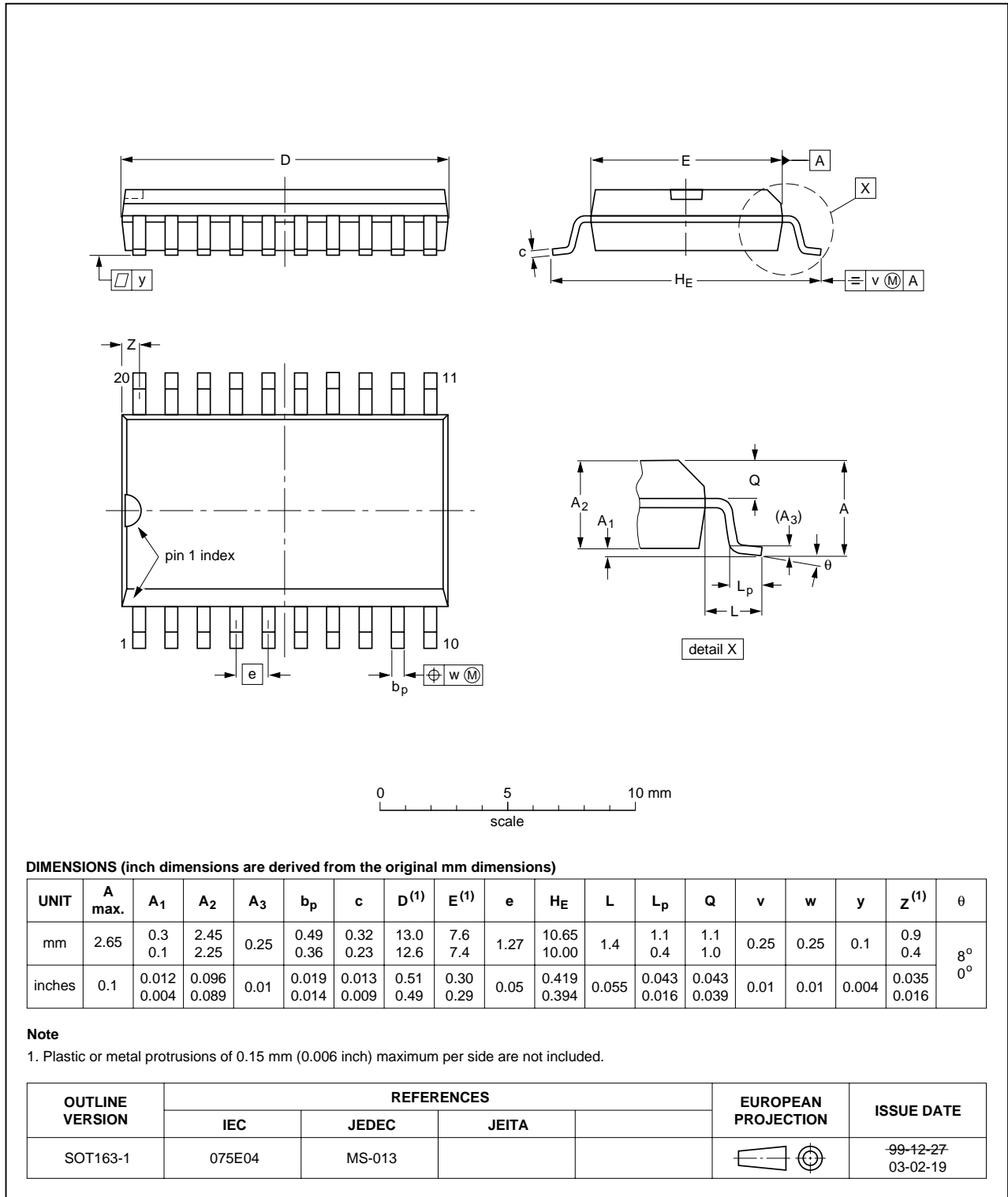


Fig 12. Package outline SOT163-1 (SO20)

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

SOT339-1

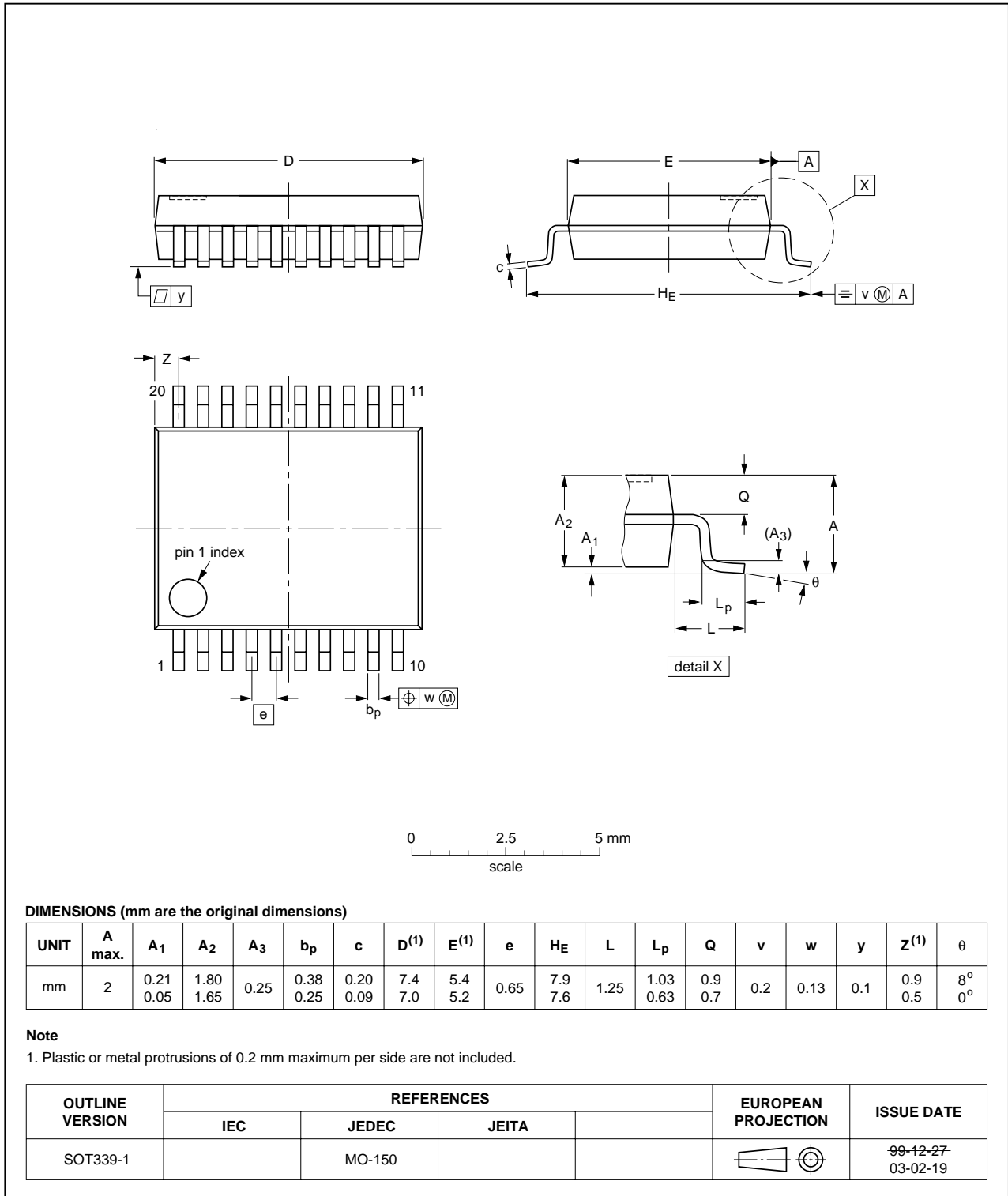


Fig 13. Package outline SOT339-1 (SSOP20)

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

SOT360-1

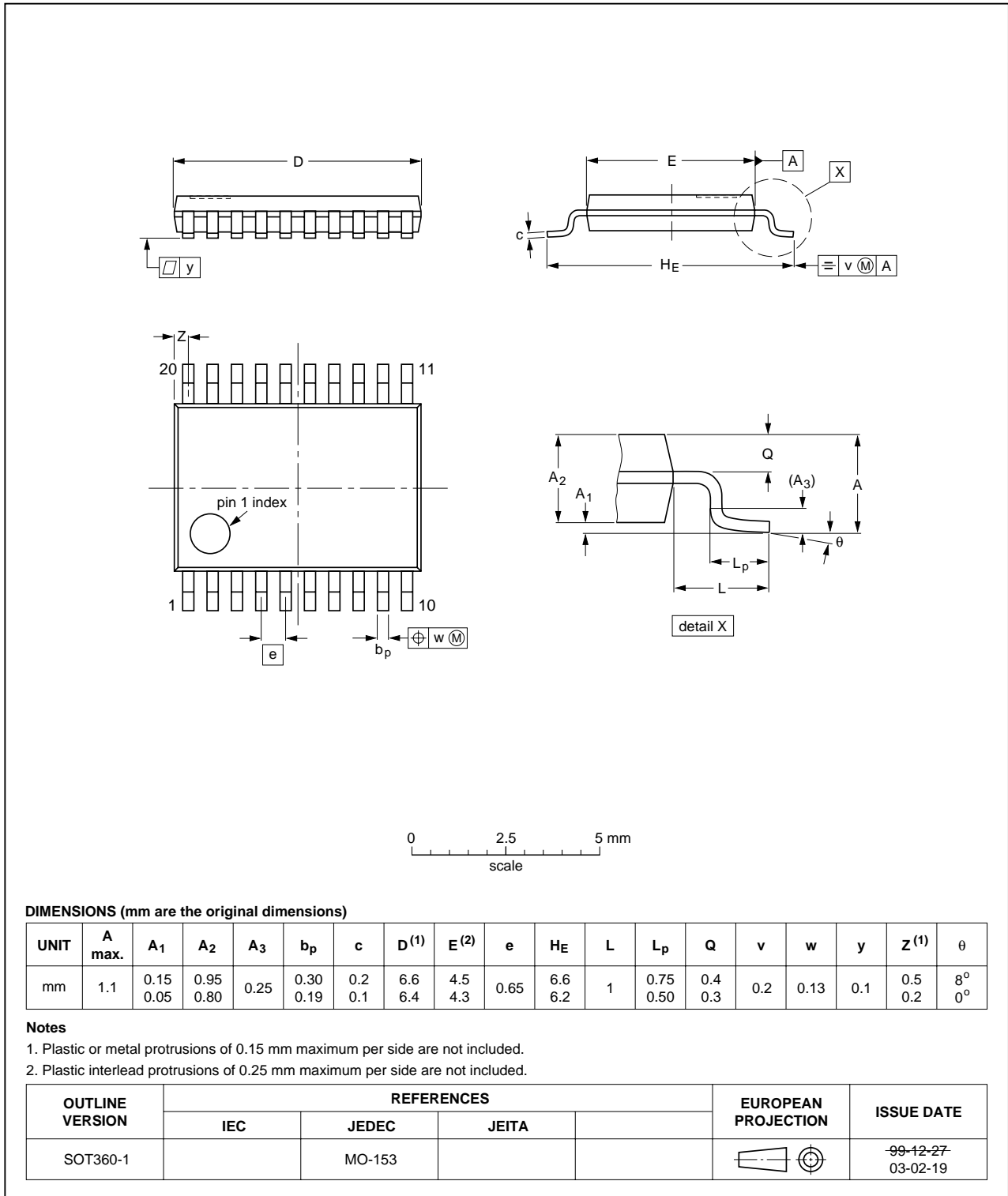


Fig 14. Package outline SOT360-1 (TSSOP20)

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

SOT764-1

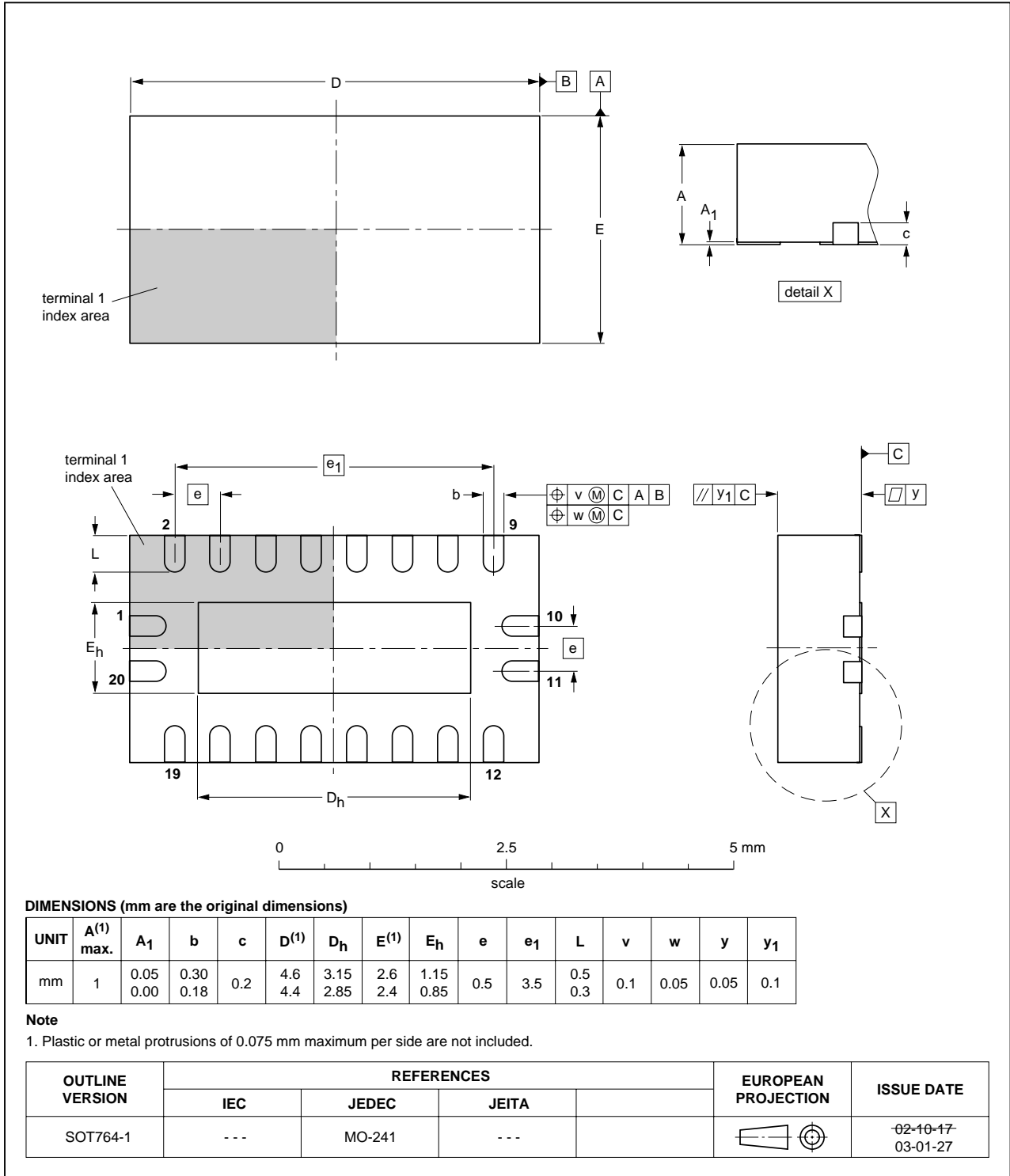


Fig 15. Package outline SOT764-1 (DHVQFN20)

14. Abbreviations

Table 13: Abbreviations

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

15. Revision history

Table 14: Revision history

Document ID	Release date	Data sheet status	Change notice	Doc. number	Supersedes
74HC_HCT273_3	20060124	Product data sheet	-	-	74HC_HCT273_CNV_2
Modifications:					<ul style="list-style-type: none"> The format of this data sheet has been redesigned to comply with the new presentation and information standard of Philips Semiconductors. Section 4 "Ordering information", Section 6 "Pinning information" and Section 13 "Package outline": Added DHVQFN package information Section 10 "Static characteristics": Added from the family specification
74HC_HCT273_CNV_2	19970827	Product specification	-	-	-

16. Data sheet status

Level	Data sheet status ^[1]	Product status ^{[2] [3]}	Definition
I	Objective data	Development	This data sheet contains data from the objective specification for product development. Philips Semiconductors reserves the right to change the specification in any manner without notice.
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[3] For data sheets describing multiple type numbers, the highest-level product status determines the data sheet status.

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Наши контакты:

Телефон: +7 812 627 14 35

Электронная почта: sales@st-electron.ru

Адрес: 198099, Санкт-Петербург,
Промышленная ул, дом № 19, литера Н,
помещение 100-Н Офис 331