

# 74HC175; 74HCT175

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

Rev. 7 — 14 March 2024

Product data sheet

## 1. General description

The 74HC175; 74HCT175 is a quad positive-edge triggered D-type flip-flop with individual data inputs ( $D_n$ ) and complementary outputs ( $Q_n$  and  $\overline{Q_n}$ ). The common clock (CP) and master reset ( $\overline{MR}$ ) inputs load and reset all flip-flops simultaneously. The D-input that meets the set-up and hold time requirements on the LOW-to-HIGH clock transition will be stored in the flip-flop and appear at the Q output. A LOW on  $\overline{MR}$  causes the flip-flops and outputs to be reset LOW. 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

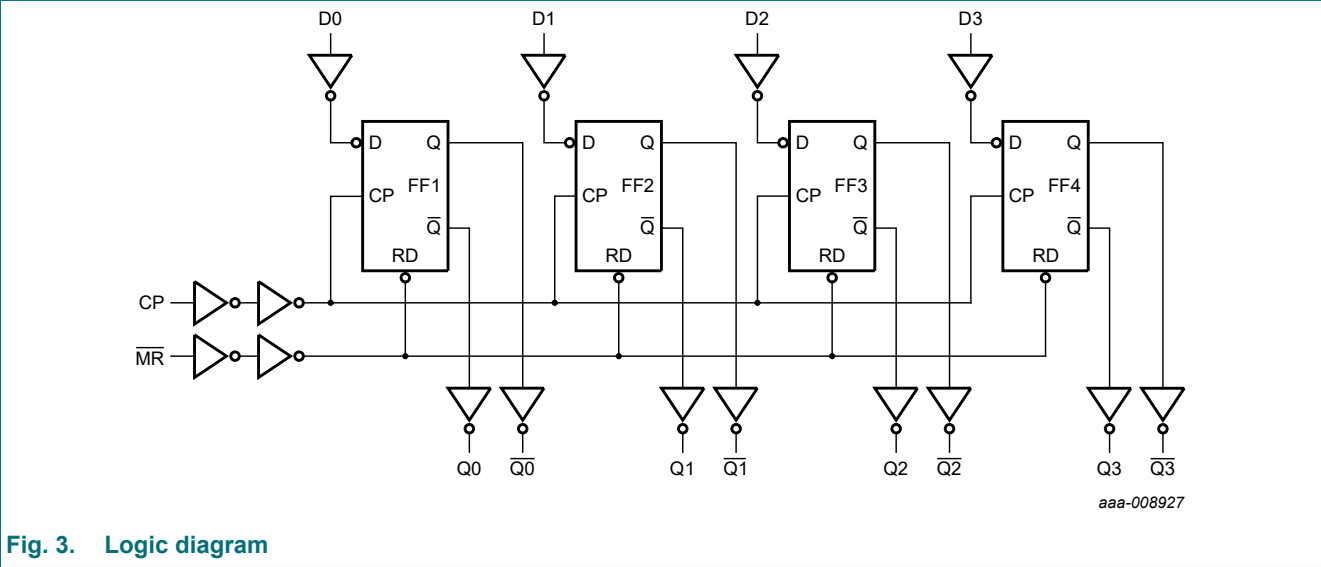
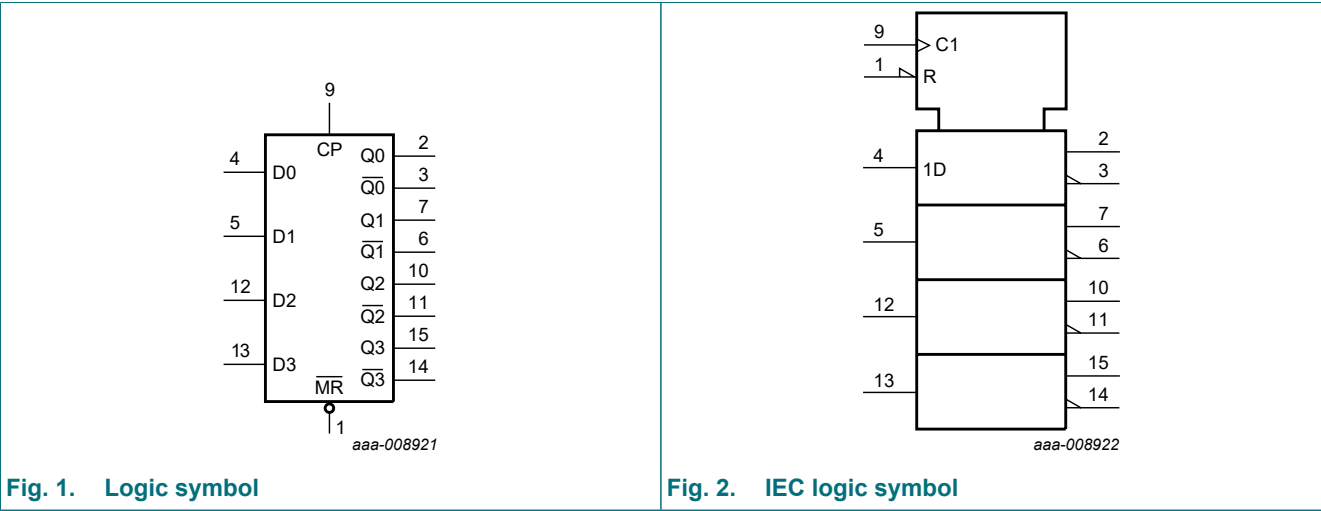
- Input levels:
  - For 74HC175: CMOS level
  - For 74HCT175: TTL level
- Four edge-triggered D-type flip-flops
- Asynchronous master reset
- Complies with JEDEC standard no. 7A
- ESD protection:
  - HBM: ANSI/ESDA/JEDEC JS-001 class 2 exceeds 2000 V
  - CDM: ANSI/ESDA/JEDEC JS-002 class C3 exceeds 1000 V
- Specified from -40 °C to +85 °C and -40 °C to +125 °C.

## 3. Ordering information

Table 1. Ordering information

Type number	Package			
	Temperature range	Name	Description	Version
<a href="#">74HC175D</a>	-40 °C to +125 °C	SO16	plastic small outline package; 16 leads; body width 3.9 mm	<a href="#">SOT109-1</a>
<a href="#">74HCT175D</a>				
<a href="#">74HC175PW</a>	-40 °C to +125 °C	TSSOP16	plastic thin shrink small outline package; 16 leads; body width 4.4 mm	<a href="#">SOT403-1</a>
<a href="#">74HCT175PW</a>				

4. Functional diagram



5. Pinning information

5.1. Pinning

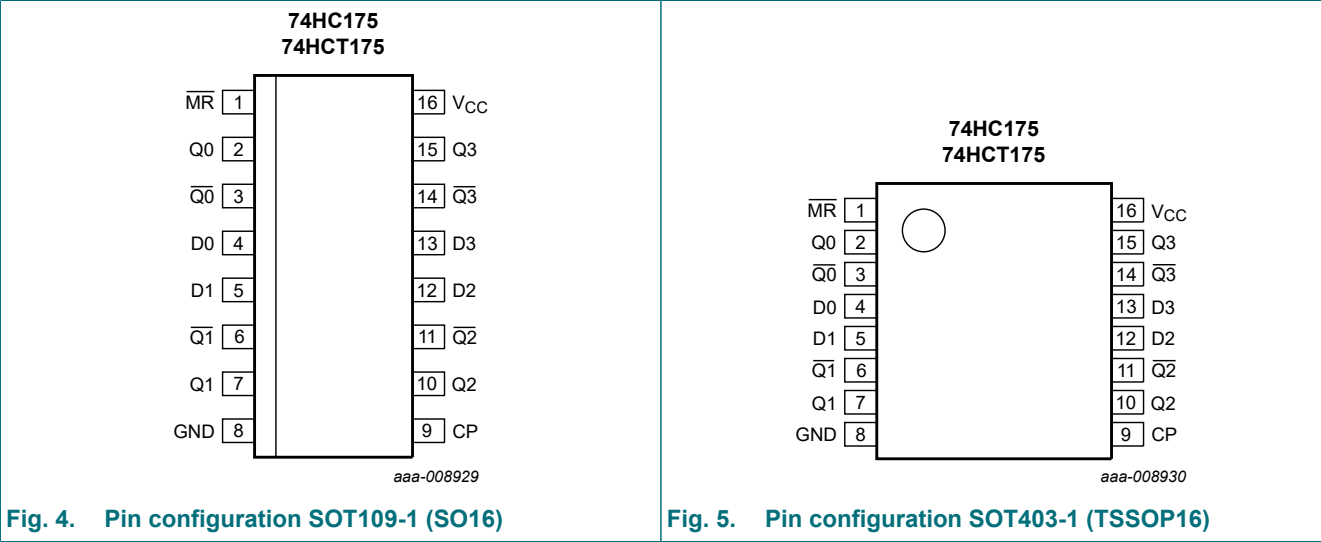


Fig. 4. Pin configuration SOT109-1 (SO16)

Fig. 5. Pin configuration SOT403-1 (TSSOP16)

5.2. Pin description

Table 2. Pin description

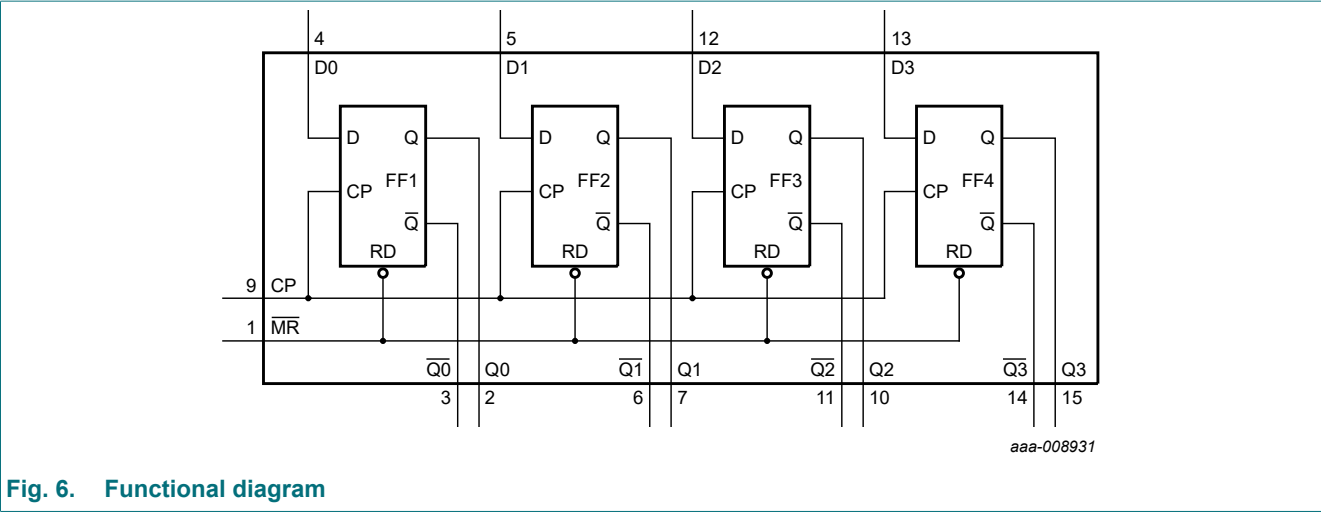
Symbol	Pin	Description
MR	1	asynchronous master reset input (active LOW)
Q0 to Q3	2, 7, 10, 15	flip-flop output
Q0̄ to Q3̄	3, 6, 11, 14	complementary flip-flop output
D0 to D3	4, 5, 12, 13	data input
GND	8	ground (0 V)
CP	9	clock input (LOW-to-HIGH edge-triggered)
VCC	16	positive supply voltage

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 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.

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



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	V
I <sub>IK</sub>	input clamping current	V <sub>I</sub> < -0.5 V or V <sub>I</sub> > V <sub>CC</sub> + 0.5 V	-	±20	mA
I <sub>OK</sub>	output clamping current	V <sub>O</sub> < -0.5 V or V <sub>O</sub> > V <sub>CC</sub> + 0.5 V	-	±20	mA
I <sub>O</sub>	output current	-0.5 V < V <sub>O</sub> < V <sub>CC</sub> + 0.5 V	-	±25	mA
I <sub>CC</sub>	supply current		-	50	mA
I <sub>GND</sub>	ground current		-50	-	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 [1]	-	500	mW

[1] For SOT109-1 (SO16) package: P<sub>tot</sub> derates linearly with 12.4 mW/K above 110 °C.  
For SOT403-1 (TSSOP16) package: P<sub>tot</sub> derates linearly with 8.5 mW/K above 91 °C.

8. Recommended operating conditions

Table 5. Recommended operating conditions

Voltages are referenced to GND (ground = 0 V)

Symbol	Parameter	Conditions	74HC175			74HCT175			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	
74HC175										
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
		I <sub>O</sub> = -5.2 mA; V <sub>CC</sub> = 6.0 V	5.48	5.81	-	5.34	-	5.2	-	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
C <sub>I</sub>	input capacitance		-	3.5	-	-	-	-	-	pF

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

Symbol	Parameter	Conditions	25 °C			-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
74HCT175										
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								
		Dn input	-	40	144	-	180	-	196	µA
		CP input	-	60	216	-	270	-	294	µA
		MR input	-	100	360	-	450	-	490	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 Fig. 10

Symbol	Parameter	Conditions	25 °C			-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
74HC175										
t <sub>pd</sub>	propagation delay	CP to Qn, $\overline{Q}$ n; see <a href="#">Fig. 7</a> [1]								
		V <sub>CC</sub> = 2.0 V	-	55	175	-	220	-	265	ns
		V <sub>CC</sub> = 4.5 V	-	20	35	-	44	-	53	ns
		V <sub>CC</sub> = 5 V; C <sub>L</sub> = 15 pF	-	17	-	-	-	-	-	ns
		V <sub>CC</sub> = 6.0 V	-	16	30	-	37	-	45	ns
t <sub>PHL</sub>	HIGH to LOW propagation delay	MR to Qn, $\overline{Q}$ n; see <a href="#">Fig. 8</a>								
		V <sub>CC</sub> = 2.0 V	-	50	150	-	190	-	225	ns
		V <sub>CC</sub> = 4.5 V	-	18	30	-	38	-	45	ns
		V <sub>CC</sub> = 5 V; C <sub>L</sub> = 15 pF	-	15	-	-	-	-	-	ns
		V <sub>CC</sub> = 6.0 V	-	14	26	-	33	-	38	ns

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

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>t</sub>	transition time	Qn output; see Fig. 7 [2]								
		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	-	16	-	19	ns
t <sub>W</sub>	pulse width	CP input HIGH or LOW; see Fig. 7								
		V <sub>CC</sub> = 2.0 V	80	22	-	100	-	120	-	ns
		V <sub>CC</sub> = 4.5 V	16	8	-	20	-	24	-	ns
		V <sub>CC</sub> = 6.0 V	14	6	-	17	-	20	-	ns
		MR input LOW; see Fig. 8								
		V <sub>CC</sub> = 2.0 V	80	19	-	100	-	120	-	ns
		V <sub>CC</sub> = 4.5 V	16	7	-	20	-	24	-	ns
		V <sub>CC</sub> = 6.0 V	14	6	-	17	-	20	-	ns
t <sub>rec</sub>	recovery time	MR to CP; see Fig. 8								
		V <sub>CC</sub> = 2.0 V	5	-33	-	5	-	5	-	ns
		V <sub>CC</sub> = 4.5 V	5	-12	-	5	-	5	-	ns
		V <sub>CC</sub> = 6.0 V	5	-10	-	5	-	5	-	ns
t <sub>su</sub>	set-up time	Dn to CP; see Fig. 9								
		V <sub>CC</sub> = 2.0 V	80	3	-	100	-	120	-	ns
		V <sub>CC</sub> = 4.5 V	16	1	-	20	-	24	-	ns
		V <sub>CC</sub> = 6.0 V	14	1	-	17	-	20	-	ns
t <sub>h</sub>	hold time	Dn to CP; see Fig. 9								
		V <sub>CC</sub> = 2.0 V	25	2	-	30	-	40	-	ns
		V <sub>CC</sub> = 4.5 V	5	0	-	6	-	8	-	ns
		V <sub>CC</sub> = 6.0 V	4	0	-	5	-	7	-	ns
f <sub>max</sub>	maximum frequency	CP input; see Fig. 7								
		V <sub>CC</sub> = 2.0 V	6	25	-	4.8	-	4	-	MHz
		V <sub>CC</sub> = 4.5 V	30	75	-	24	-	20	-	MHz
		V <sub>CC</sub> = 5 V; C <sub>L</sub> = 15 pF	-	83	-	-	-	-	-	MHz
		V <sub>CC</sub> = 6.0 V	35	89	-	28	-	24	-	MHz
C <sub>PD</sub>	power dissipation capacitance	per package; V <sub>I</sub> = GND to V <sub>CC</sub> [3]	-	32	-	-	-	-	-	pF

Symbol	Parameter	Conditions	25 °C			-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
74HCT175										
t <sub>pd</sub>	propagation delay	CP to Qn, $\overline{Qn}$ ; see <a href="#">Fig. 7</a> [1]								
		V <sub>CC</sub> = 4.5 V	-	19	33	-	41	-	50	ns
		V <sub>CC</sub> = 5 V; C <sub>L</sub> = 15 pF	-	16	-	-	-	-	-	ns
t <sub>PHL</sub>	HIGH to LOW propagation delay	MR to Qn; see <a href="#">Fig. 8</a>								
		V <sub>CC</sub> = 4.5 V	-	22	38	-	48	-	57	ns
		V <sub>CC</sub> = 5 V; C <sub>L</sub> = 15 pF	-	19	-	-	-	-	-	ns
		$\overline{MR}$ to $\overline{Qn}$ ; see <a href="#">Fig. 8</a>								
		V <sub>CC</sub> = 4.5 V	-	19	35	-	44	-	53	ns
		V <sub>CC</sub> = 5 V; C <sub>L</sub> = 15 pF	-	16	-	-	-	-	-	ns
t <sub>t</sub>	transition time	Qn output; see <a href="#">Fig. 7</a> [2]								
		V <sub>CC</sub> = 4.5 V	-	7	15	-	19	-	22	ns
t <sub>W</sub>	pulse width	CP input HIGH or LOW; see <a href="#">Fig. 7</a>								
		V <sub>CC</sub> = 4.5 V	20	12	-	25	-	30	-	ns
		MR input LOW; see <a href="#">Fig. 8</a>								
		V <sub>CC</sub> = 4.5 V	20	11	-	25	-	30	-	ns
t <sub>rec</sub>	recovery time	MR to CP; see <a href="#">Fig. 8</a>								
		V <sub>CC</sub> = 4.5 V	5	-10	-	5	-	5	-	ns
t <sub>su</sub>	set-up time	Dn to CP; see <a href="#">Fig. 9</a>								
		V <sub>CC</sub> = 4.5 V	16	5	-	20	-	24	-	ns
t <sub>h</sub>	hold time	Dn to CP; see <a href="#">Fig. 9</a>								
		V <sub>CC</sub> = 4.5 V	5	0	-	5	-	5	-	ns
f <sub>max</sub>	maximum frequency	CP input; see <a href="#">Fig. 7</a>								
		V <sub>CC</sub> = 4.5 V	25	49	-	20	-	17	-	MHz
		V <sub>CC</sub> = 5 V; C <sub>L</sub> = 15 pF	-	54	-	-	-	-	-	MHz
C <sub>PD</sub>	power dissipation capacitance	per package; V <sub>I</sub> = GND to V <sub>CC</sub> - 1.5 V [3]	-	34	-	-	-	-	-	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  $\mu\text{W}$ ).

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

$f_i$  = input frequency in MHz;

$f_o$  = output frequency in MHz;

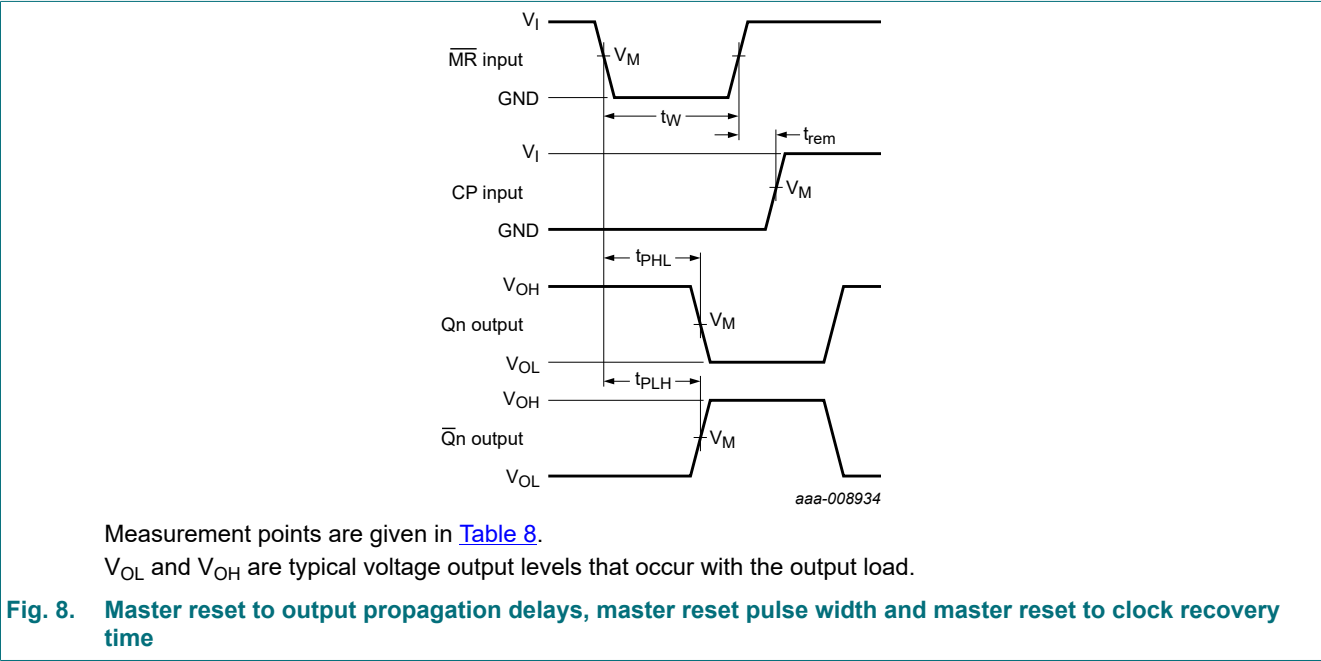
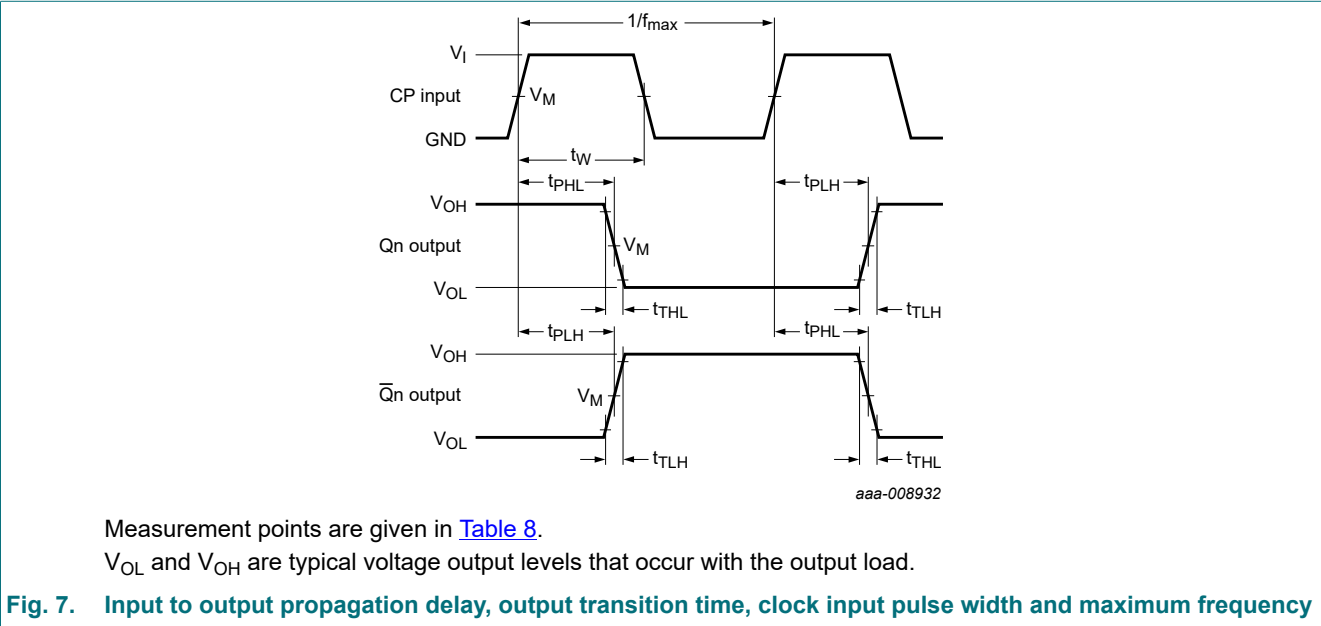
$\sum (C_L \times V_{CC}^2 \times f_o)$  = sum of outputs;

$C_L$  = output load capacitance in pF;

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



10.1. Waveforms and test circuit



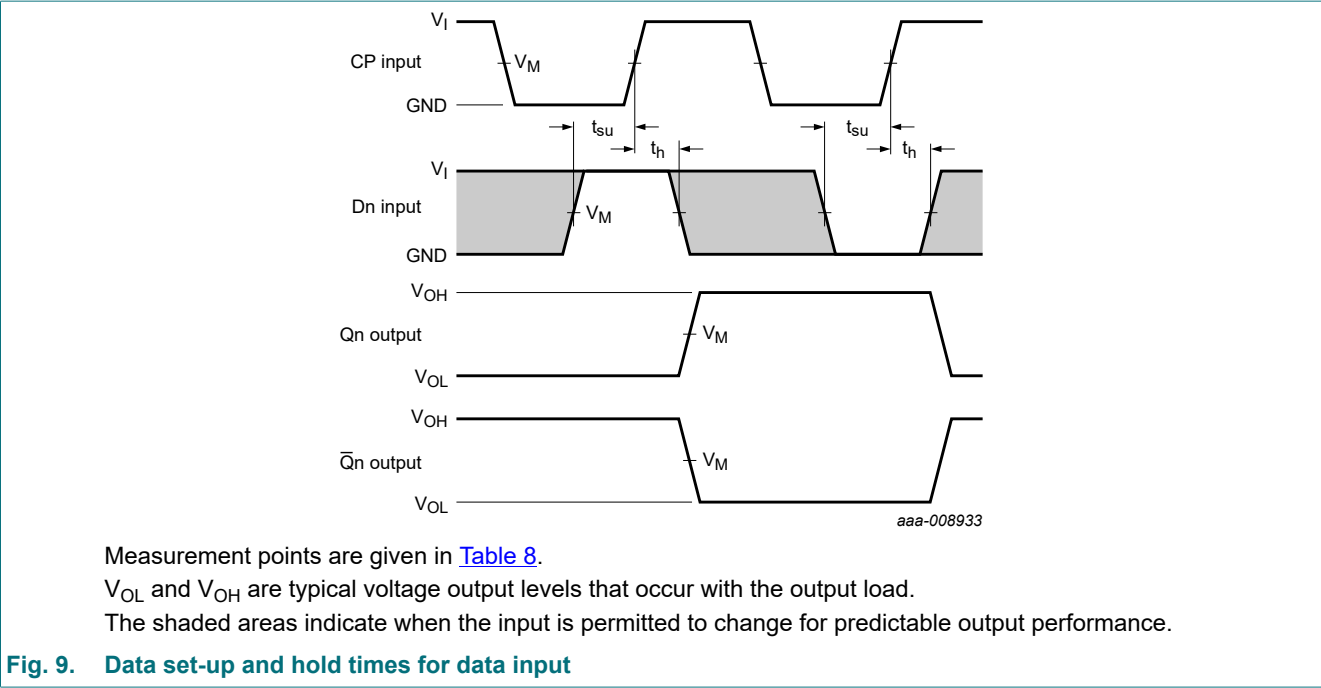
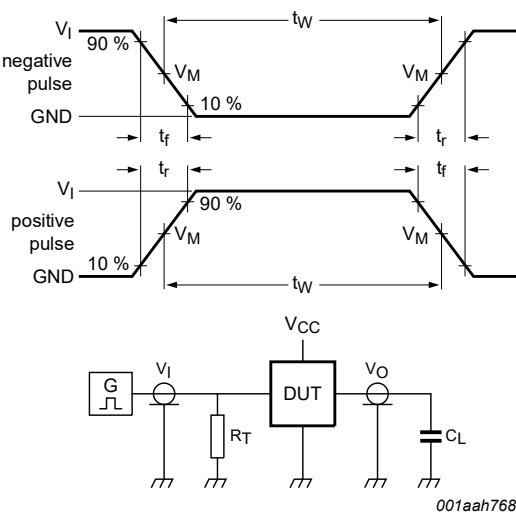


Table 8. Measurement points

Type	Input		Output
	$V_I$	$V_M$	$V_M$
74HC175	$V_{CC}$	$0.5V_{CC}$	$0.5V_{CC}$
74HCT175	3 V	1.3 V	1.3 V



Test data is given in [Table 9](#).  
Definitions for 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.  
 $R_L$  = Load resistance.

Fig. 10. Test circuit for measuring switching times

Table 9. Test data

Type	Input		Load		Test
	$V_I$	$t_r, t_f$	$C_L$	$R_L$	
74HC175	$V_{CC}$	6 ns	15 pF, 50 pF	1 k $\Omega$	$t_{PLH}, t_{PHL}$
74HCT175	3 V	6 ns	15 pF, 50 pF	1 k $\Omega$	$t_{PLH}, t_{PHL}$

11. Package outline

SO16: plastic small outline package; 16 leads; body width 3.9 mm

SOT109-1

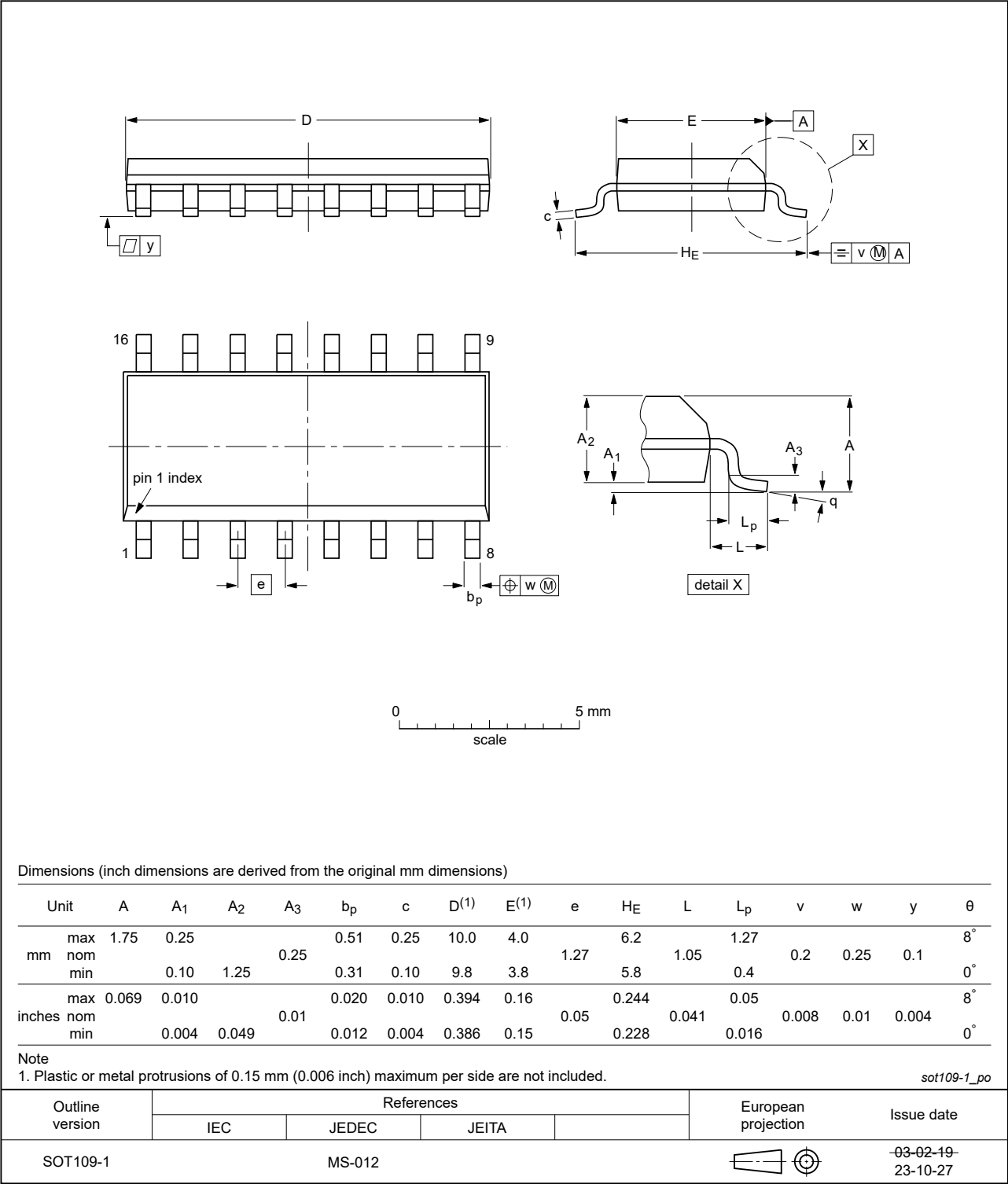


Fig. 11. Package outline SOT109-1 (SO16)

TSSOP16: plastic thin shrink small outline package; 16 leads; body width 4.4 mm

SOT403-1

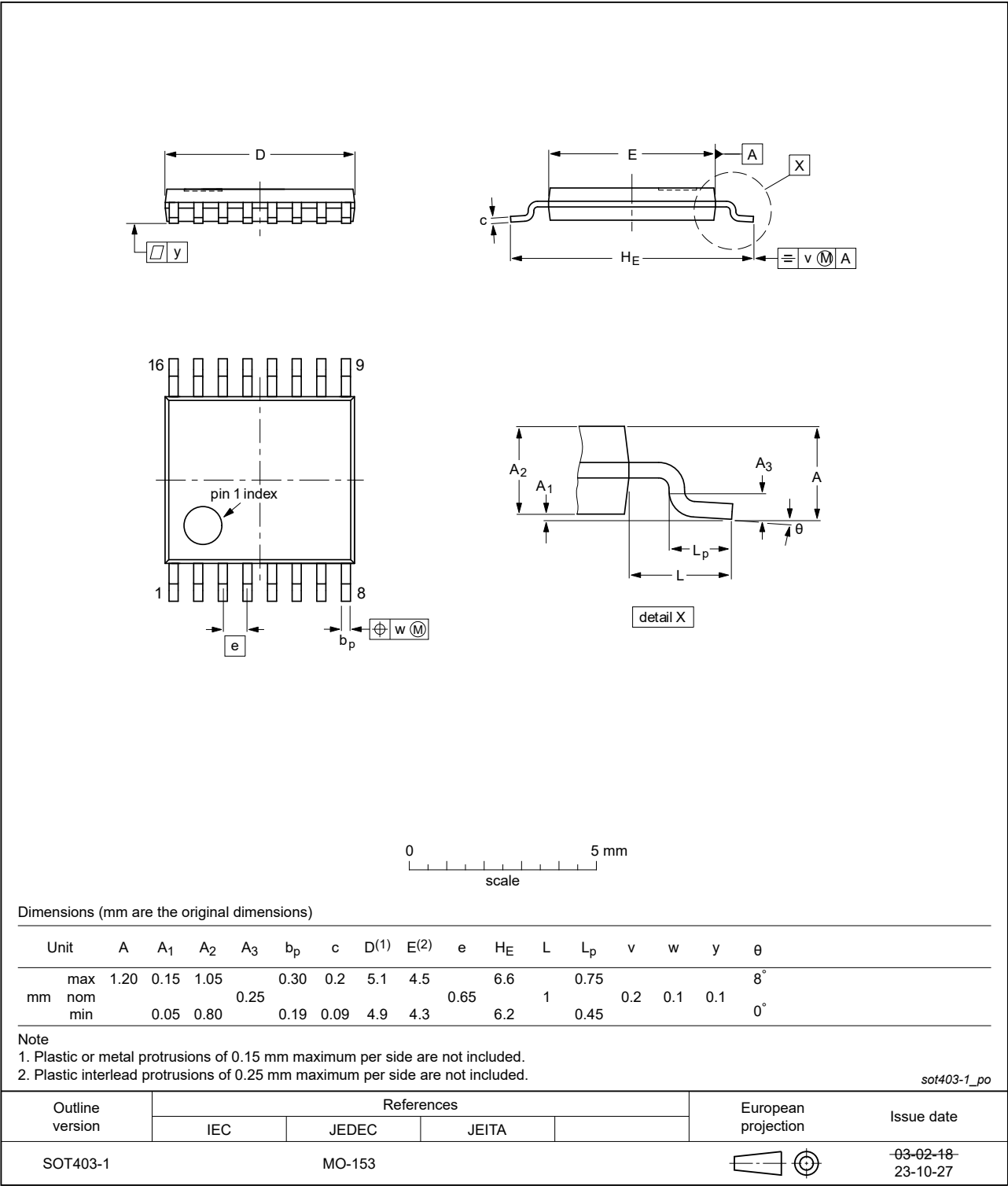


Fig. 12. Package outline SOT403-1 (TSSOP16)

12. Abbreviations

Table 10. Abbreviations

Acronym	Description
CDM	Charged Device Model
CMOS	Complementary Metal-Oxide Semiconductor
DUT	Device Under Test
ESD	ElectroStatic Discharge
HBM	Human Body Model
TTL	Transistor-Transistor Logic

13. Revision history

Table 11. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74HC_HCT175 v.7	20240314	Product data sheet	-	74HC_HCT175 v.6
Modifications:	<ul style="list-style-type: none"><li>• <a href="#">Fig. 11</a>, <a href="#">Fig. 12</a>: Aligned SO and TSSOP package outline drawings to JEDEC MS-012 and MO-153.</li><li>• <a href="#">Section 2</a>: ESD specification updated according to the latest JEDEC standard.</li></ul>			
74HC_HCT175 v.6	20210204	Product data sheet	-	74HC_HCT175 v.5
Modifications:	<ul style="list-style-type: none"><li>• The format of this data sheet has been redesigned to comply with the identity guidelines of Nexperia.</li><li>• Legal texts have been adapted to the new company name where appropriate.</li><li>• Type numbers 74HC175DB and 74HCT175DB (SOT338-1 / SSOP16) removed.</li><li>• <a href="#">Section 7</a>: Derating values for P<sub>tot</sub> total power dissipation updated.</li></ul>			
74HC_HCT175 v.5	20160129	Product data sheet	-	74HC_HCT175 v.4
Modifications:	<ul style="list-style-type: none"><li>• Type numbers 74HC175N and 74HCT175N (SOT38-4) removed.</li></ul>			
74HC_HCT175 v.4	20140408	Product data sheet	-	74HC_HCT175 v.3
Modifications:	<ul style="list-style-type: none"><li>• General description corrected (errata).</li></ul>			
74HC_HCT175 v.3	20140331	Product data sheet	-	74HC_HCT175_CNV_2
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_HCT175_CNV_2	19980708	Product specification	-	-

## 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.

- [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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Date of release: 14 March 2024