

# 74HC4538; 74HCT4538

## Dual retriggerable precision monostable multivibrator

Rev. 03 — 8 June 2009

Product data sheet

### 1. General description

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The 74HC4538; 74HCT4538 are high-speed Si-gate CMOS devices and are pin compatible with Low-power Schottky TTL (LSTTL). They are specified in compliance with JEDEC standard no. 7A.

The 74HC4538; 74HCT4538 are dual retriggerable-resettable monostable multivibrators. Each multivibrator has an active LOW trigger/retrigger input ( $n\bar{A}$ ), an active HIGH trigger/retrigger input ( $nB$ ), an overriding active LOW direct reset input ( $n\bar{CD}$ ), an output ( $nQ$ ) and its complement ( $n\bar{Q}$ ), and two pins ( $nREXT/CEXT$  and  $nCEXT$ ) for connecting the external timing components  $C_{EXT}$  and  $R_{EXT}$ . Typical pulse width variation over the specified temperature range is  $\pm 0.2\%$ .

The multivibrator may be triggered by either the positive or the negative edges of the input pulse. The duration and accuracy of the output pulse are determined by the external timing components  $C_{EXT}$  and  $R_{EXT}$ . The output pulse width ( $t_W$ ) is equal to  $0.7 \times R_{EXT} \times C_{EXT}$ . The linear design techniques guarantee precise control of the output pulse width. A LOW level at  $n\bar{CD}$  terminates the output pulse immediately. Schmitt trigger action on pins  $n\bar{A}$  and  $nB$  makes the circuit highly tolerant of slower rise and fall times.

### 2. Features

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- Tolerant of slow trigger rise and fall times
- Separate reset inputs
- Triggering from falling or rising edge
- Multiple package options
- ESD protection:
  - ◆ HBM JESD22-A114E exceeds 2000 V
  - ◆ MM JESD22-A115-A exceeds 200 V
- 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. Ordering information

Table 1. Ordering information

Type number	Package			Version
	Temperature range	Name	Description	
74HC4538N	-40 °C to +125 °C	DIP16	plastic dual in-line package; 16-leads (300 mil)	SOT38-4
74HCT4538N				
74HC4538D	-40 °C to +125 °C	SO16	plastic small outline package; 16 leads; body width 3.9 mm	SOT109-1
74HCT4538D				
74HC4538DB	-40 °C to +125 °C	SSOP16	plastic shrink small outline package; 16 leads; body width 5.3 mm	SOT338-1
74HCT4538DB				
74HC4538PW	-40 °C to +125 °C	TSSOP16	plastic thin shrink small outline package; 16 leads; body width 4.4 mm	SOT403-1
74HCT4538PW				

### 4. Functional diagram

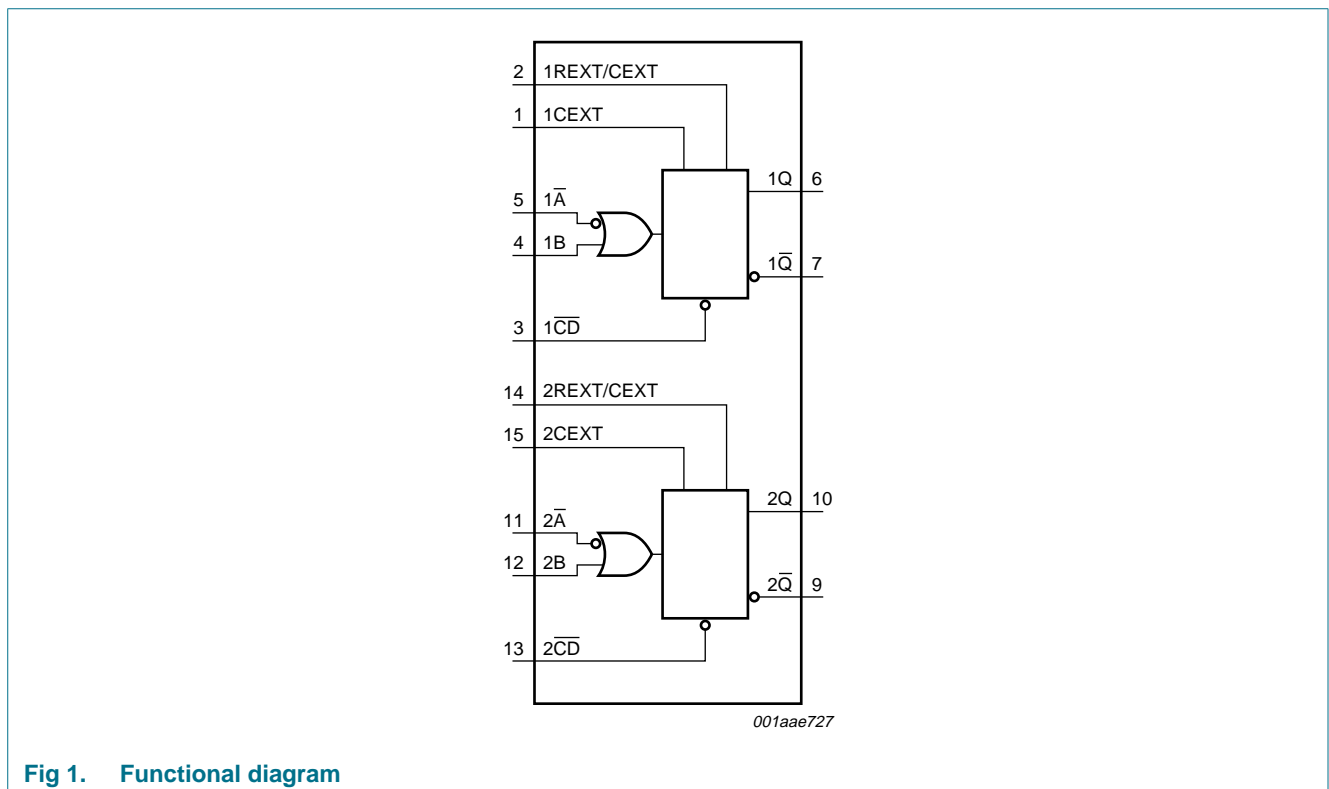


Fig 1. Functional diagram

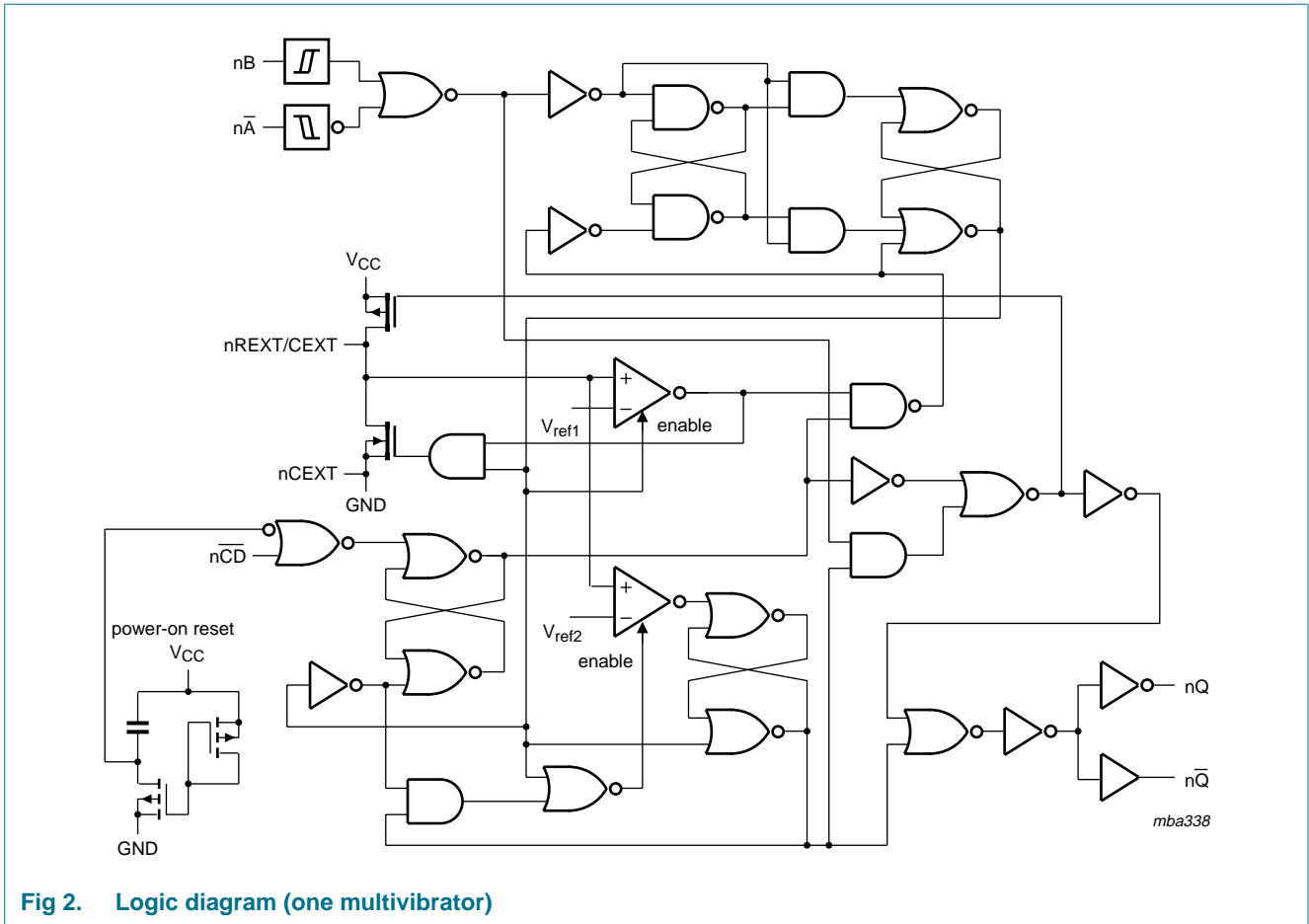


Fig 2. Logic diagram (one multivibrator)

5. Pinning information

5.1 Pinning

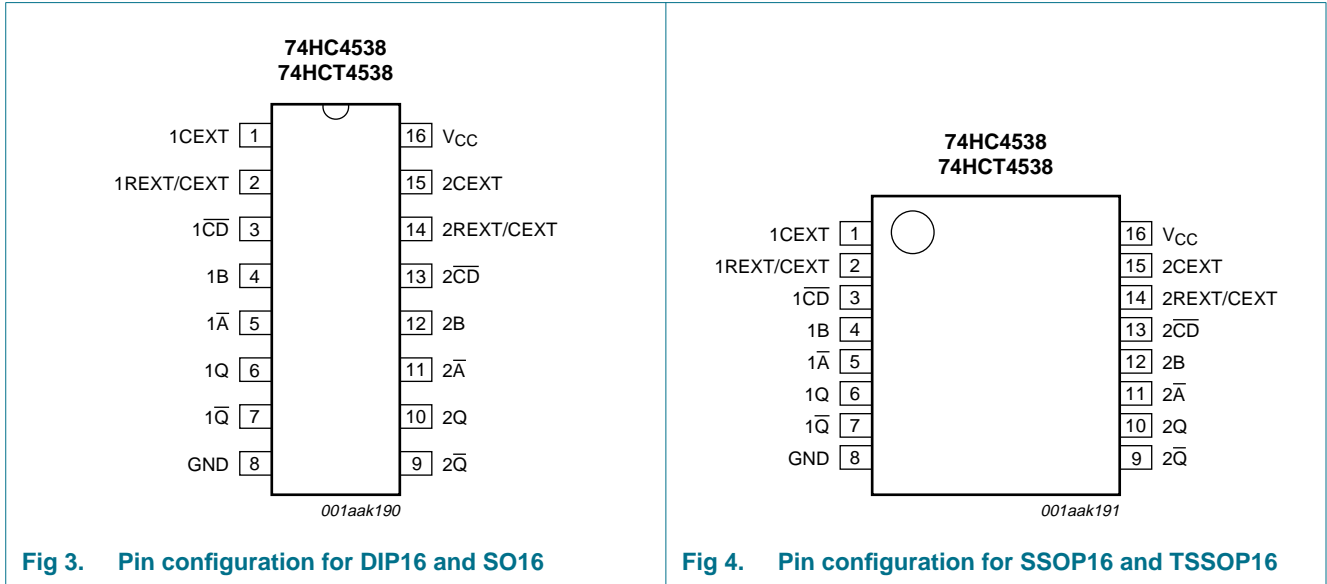


Fig 3. Pin configuration for DIP16 and SO16

Fig 4. Pin configuration for SSOP16 and TSSOP16

5.2 Pin description

Table 2. Pin description

Symbol	Pin	Description
1CEXT, 2CEXT	1, 15	external capacitor connection (always connected to ground)
1REXT/CEXT, 2REXT/CEXT	2, 14	external capacitor/resistor connection
1CD, 2CD	3, 13	direct reset input (active LOW)
1B, 2B	4, 12	input (LOW to HIGH triggered)
1A, 2A	5, 11	input (HIGH to LOW triggered)
1Q, 2Q	6, 10	output
1Q, 2Q	7, 9	complementary output (active LOW)
GND	8	ground (0 V)
V <sub>CC</sub>	16	supply voltage

## 6. Functional description

Table 3. Function table

Inputs			Outputs	
n $\bar{A}$	nB	n $\bar{CD}$	nQ	n $\bar{Q}$
↓	L	H		
H	↑	H		
X	X	L	L	H

[1] H = HIGH voltage level; L = LOW voltage level; X = don't care;  
 ↑ = positive-going transition; ↓ = negative-going transition;

= one HIGH level output pulse, with the pulse width determined by C<sub>EXT</sub> and R<sub>EXT</sub>;

= one LOW level output pulse, with the pulse width determined by C<sub>EXT</sub> and R<sub>EXT</sub>.

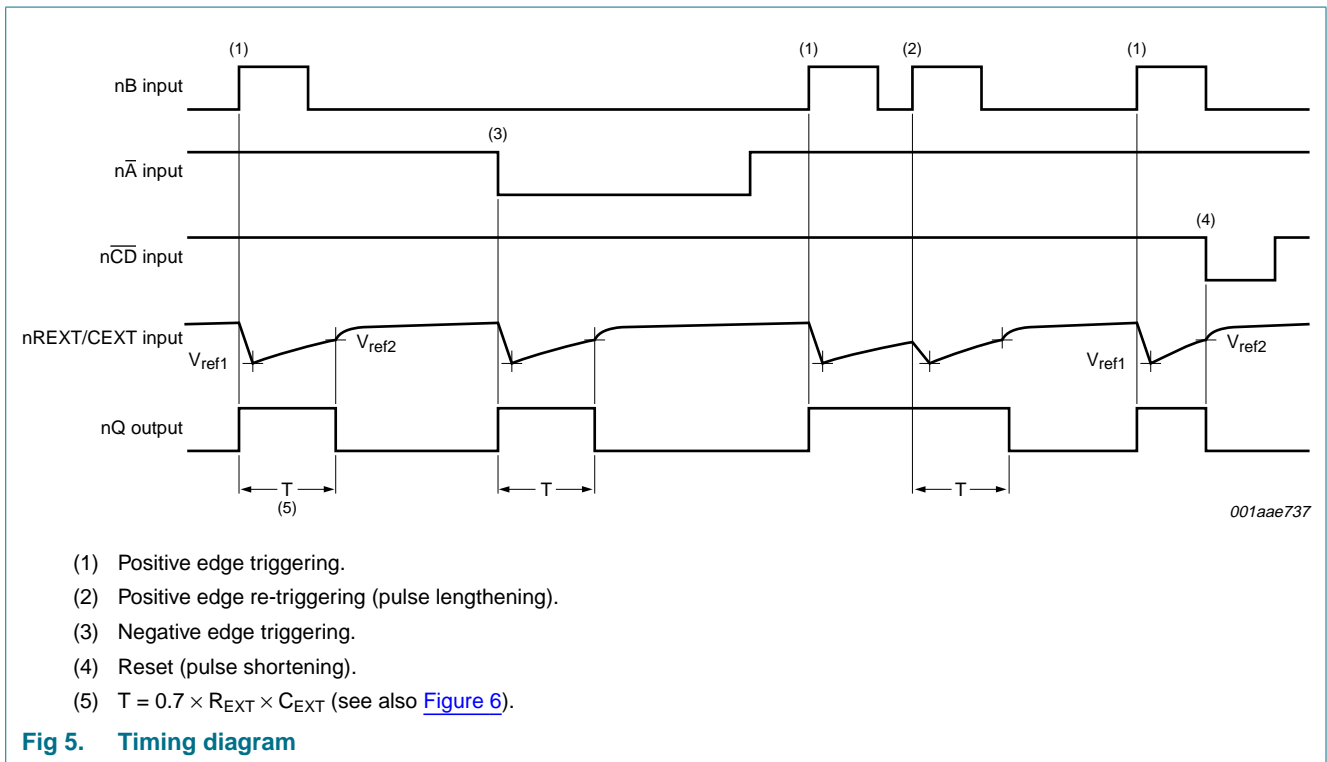


Fig 5. Timing diagram

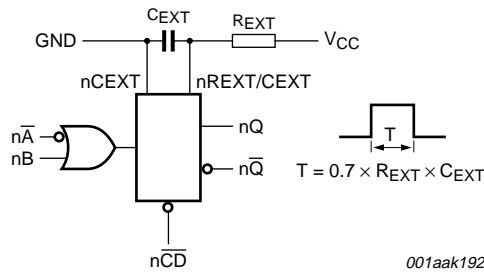


Fig 6. Connection of the external timing components R<sub>EXT</sub> and C<sub>EXT</sub>

## 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	+7.0	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	[1]	±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	[1]	±20	mA	
I <sub>O</sub>	output current	V <sub>O</sub> = -0.5 V to 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				
		DIP16 package	[2]	-	750	mW
		SO16 package	[3]	-	500	mW
		(T)SSOP16 package	[4]	-	500	mW

[1] The input and output voltage ratings may be exceeded if the input and output current ratings are observed.

[2] P<sub>tot</sub> derates linearly with 12 mW/K above 70 °C.

[3] P<sub>tot</sub> derates linearly with 8 mW/K above 70 °C.

[4] P<sub>tot</sub> derates linearly with 5.5 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	74HC4538			74HCT4538			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>74HC4538</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
	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
		pin nREXT/CEXT; V <sub>I</sub> = 2.0 V or GND; other inputs at V <sub>CC</sub> or GND; V <sub>CC</sub> = 6.0 V <a href="#">[1]</a>	-	-	±0.5	-	±5	-	±10	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	
$I_{CC}$	supply current	$V_I = V_{CC}$ or GND; $I_O = 0$ A; $V_{CC} = 6.0$ V	-	-	8.0	-	80	-	160	$\mu$ A
$C_I$	input capacitance		-	3.5	-	-	-	-	-	pF
<b>74HCT4538</b>										
$V_{IH}$	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								
		$I_O = -20$ $\mu$ A	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								
		$I_O = 20$ $\mu$ A; $V_{CC} = 4.5$ 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
$I_I$	input leakage current	$V_I = V_{CC}$ or GND; $V_{CC} = 5.5$ V	-	-	$\pm 0.1$	-	$\pm 1$	-	$\pm 1$	$\mu$ A
		pin nREXT/CEXT; $V_I = 2.0$ V or GND; other inputs at $V_{CC}$ or GND; $V_{CC} = 5.5$ V [1]	-	-	$\pm 0.5$	-	$\pm 5$	-	$\pm 10$	$\mu$ A
$I_{CC}$	supply current	$V_I = V_{CC}$ or GND; $I_O = 0$ A; $V_{CC} = 5.5$ V	-	-	8.0	-	80	-	160	$\mu$ A
$\Delta I_{CC}$	additional supply current	$V_I = V_{CC} - 2.1$ V; $I_O = 0$ A; other inputs at $V_{CC}$ or GND; $V_{CC} = 4.5$ V to 5.5 V								
		pin n $\overline{A}$ , nB	-	50	180	-	225	-	245	$\mu$ A
		pin n $\overline{CD}$	-	65	234	-	293	-	319	$\mu$ A
$C_I$	input capacitance		-	3.5	-	-	-	-	-	pF

[1] This measurement can only be carried out after a trigger pulse is applied.



## 10. Dynamic characteristics

**Table 7. Dynamic characteristics**

Voltages are referenced to GND (ground = 0 V); for test circuit see [Figure 9](#).

Symbol	Parameter	Conditions	25 °C			-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Typ <sup>[1]</sup>	Max	Min	Max	Min	Max	
<b>74HC4538</b>										
t <sub>PLH</sub>	LOW to HIGH propagation delay	n $\bar{A}$ , nB to nQ; see <a href="#">Figure 7</a>								
		V <sub>CC</sub> = 2.0 V	-	85	265	-	330	-	400	ns
		V <sub>CC</sub> = 4.5 V	-	31	53	-	66	-	80	ns
		V <sub>CC</sub> = 5.0 V; C <sub>L</sub> = 15 pF	-	27	-	-	-	-	-	ns
		V <sub>CC</sub> = 6.0 V	-	25	45	-	56	-	68	ns
		n $\bar{CD}$ to n $\bar{Q}$ ; see <a href="#">Figure 7</a>								
		V <sub>CC</sub> = 2.0 V	-	83	265	-	340	-	400	ns
t <sub>PHL</sub>	HIGH to LOW propagation delay	n $\bar{A}$ , nB to n $\bar{Q}$ ; see <a href="#">Figure 7</a>								
		V <sub>CC</sub> = 2.0 V	-	83	265	-	330	-	400	ns
		V <sub>CC</sub> = 4.5 V	-	30	53	-	66	-	80	ns
		V <sub>CC</sub> = 5.0 V; C <sub>L</sub> = 15 pF	-	27	-	-	-	-	-	ns
		V <sub>CC</sub> = 6.0 V	-	24	45	-	56	-	68	ns
		n $\bar{CD}$ to nQ; see <a href="#">Figure 7</a>								
		V <sub>CC</sub> = 2.0 V	-	80	265	-	330	-	400	ns
t <sub>t</sub>	transition time	nQ and n $\bar{Q}$ ; see <a href="#">Figure 7</a> <sup>[2]</sup>								
		V <sub>CC</sub> = 2.0 V	-	19	75	-	95	-	119	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

**Table 7. Dynamic characteristics ...continued**  
 Voltages are referenced to GND (ground = 0 V); for test circuit see [Figure 9](#).

Symbol	Parameter	Conditions	25 °C			-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Typ <sup>[1]</sup>	Max	Min	Max	Min	Max	
t <sub>w</sub>	pulse width	n $\bar{A}$ LOW; see <a href="#">Figure 8</a>								
		V <sub>CC</sub> = 2.0 V	80	17	-	100	-	120	-	ns
		V <sub>CC</sub> = 4.5 V	16	6	-	20	-	24	-	ns
		V <sub>CC</sub> = 6.0 V	14	5	-	17	-	20	-	ns
		nB HIGH; see <a href="#">Figure 8</a>								
		V <sub>CC</sub> = 2.0 V	80	17	-	100	-	120	-	ns
		V <sub>CC</sub> = 4.5 V	16	6	-	20	-	24	-	ns
		V <sub>CC</sub> = 6.0 V	14	5	-	17	-	20	-	ns
		n $\overline{CD}$ LOW; see <a href="#">Figure 8</a>								
		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	nQ and n $\overline{Q}$ HIGH or LOW; see <a href="#">Figure 8</a>								
		V <sub>CC</sub> = 5.0 V; C <sub>EXT</sub> = 0.1 μF; R <sub>EXT</sub> = 10 kΩ	630	700	770	602	798	595	805	μs
		n $\overline{CD}$ to n $\bar{A}$ , nB; see <a href="#">Figure 8</a>								
		V <sub>CC</sub> = 2.0 V	35	6	-	45	-	55	-	ns
t <sub>rtrig</sub>	retrigger time	V <sub>CC</sub> = 4.5 V	7	2	-	9	-	11	-	ns
		V <sub>CC</sub> = 6.0 V	6	2	-	8	-	9	-	ns
		n $\bar{A}$ , nB; see <a href="#">Figure 8</a> ; X = C <sub>EXT</sub> / (4.5 × V <sub>CC</sub> )								
R <sub>EXT</sub>	external timing resistor	V <sub>CC</sub> = 2.0 V	10	-	1000	-	-	-	-	kΩ
		V <sub>CC</sub> = 5.0 V	2	-	1000	-	-	-	-	kΩ
		C <sub>EXT</sub>	external timing capacitor	no limits						
C <sub>PD</sub>	power dissipation capacitance	per multivibrator; V <sub>I</sub> = GND to V <sub>CC</sub>	<sup>[3]</sup>	-	136	-	-	-	-	pF

**Table 7. Dynamic characteristics ...continued**  
 Voltages are referenced to GND (ground = 0 V); for test circuit see [Figure 9](#).

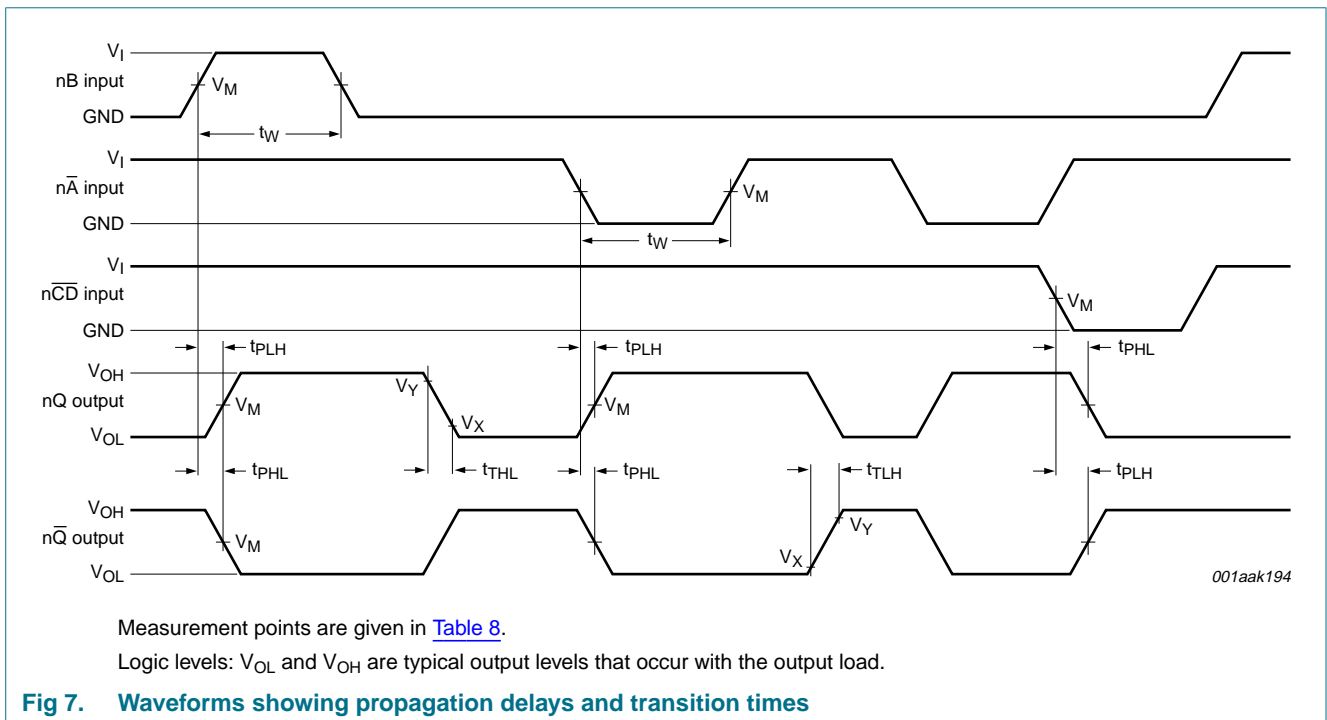
Symbol	Parameter	Conditions	25 °C			-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Typ <sup>[1]</sup>	Max	Min	Max	Min	Max	
<b>74HCT4538</b>										
t <sub>PLH</sub>	LOW to HIGH propagation delay	n $\bar{A}$ , nB to nQ; see <a href="#">Figure 7</a>								
		V <sub>CC</sub> = 4.5 V	-	35	60	-	75	-	90	ns
		V <sub>CC</sub> = 5.0 V; C <sub>L</sub> = 15 pF	-	30	-	-	-	-	-	ns
t <sub>PHL</sub>	HIGH to LOW propagation delay	n $\bar{A}$ , nB to n $\bar{Q}$ ; see <a href="#">Figure 7</a>								
		V <sub>CC</sub> = 4.5 V	-	35	60	-	75	-	90	ns
		V <sub>CC</sub> = 5.0 V; C <sub>L</sub> = 15 pF	-	30	-	-	-	-	-	ns
t <sub>t</sub>	transition time	n $\bar{CD}$ to n $\bar{Q}$ ; see <a href="#">Figure 7</a>								
		V <sub>CC</sub> = 4.5 V	-	35	60	-	75	-	90	ns
		nQ and n $\bar{Q}$ ; see <a href="#">Figure 7</a> <sup>[2]</sup>								
t <sub>w</sub>	pulse width	n $\bar{A}$ LOW; see <a href="#">Figure 8</a>								
		V <sub>CC</sub> = 4.5 V	20	11	-	25	-	30	-	ns
		nB HIGH; see <a href="#">Figure 8</a>								
		V <sub>CC</sub> = 4.5 V	16	5	-	20	-	24	-	ns
		n $\bar{CD}$ LOW; see <a href="#">Figure 8</a>								
t <sub>rec</sub>	recovery time	nQ and n $\bar{Q}$ HIGH or LOW; see <a href="#">Figure 8</a>								
		V <sub>CC</sub> = 5.0 V; C <sub>EXT</sub> = 0.1 μF; R <sub>EXT</sub> = 10 kΩ	630	700	770	602	798	595	805	μs
		V <sub>CC</sub> = 4.5 V	7	2	-	9	-	11	-	ns
t <sub>trig</sub>	retrigger time	n $\bar{A}$ , nB; see <a href="#">Figure 8</a> ; X = C <sub>EXT</sub> / (4.5 × V <sub>CC</sub> )								
		V <sub>CC</sub> = 4.5 V	-	80 + X	-	-	-	-	-	ns
R <sub>EXT</sub>	external timing resistor	V <sub>CC</sub> = 5.0 V	2	-	1000	-	-	-	-	kΩ
C <sub>EXT</sub>	external timing capacitor	V <sub>CC</sub> = 5.0 V	no limits							

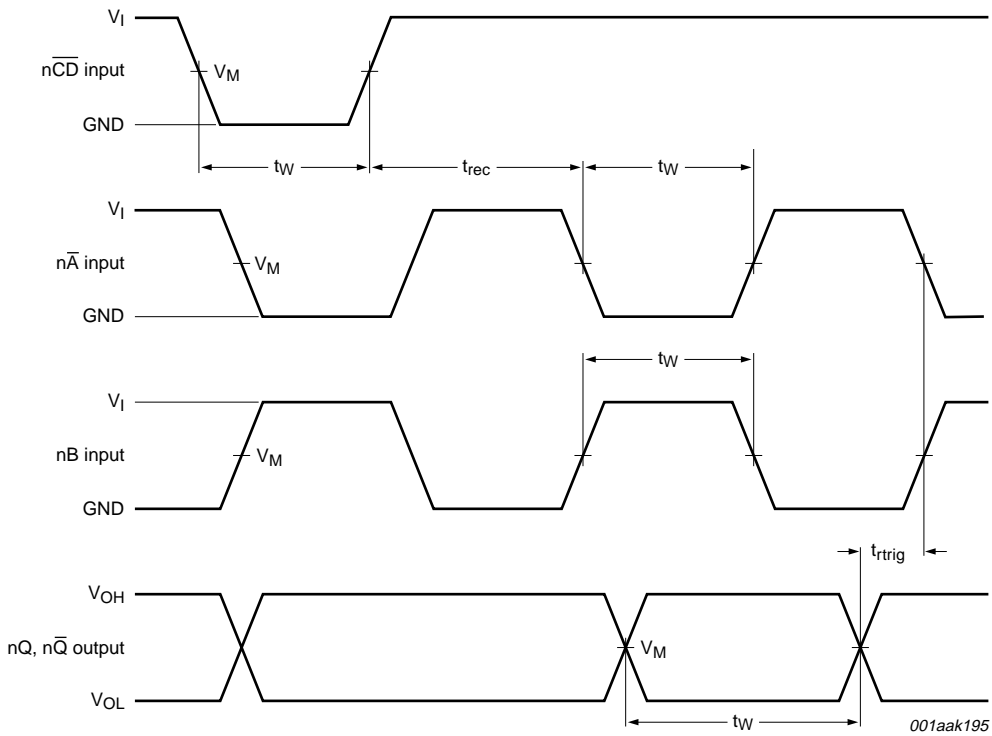
**Table 7. Dynamic characteristics ...continued**  
 Voltages are referenced to GND (ground = 0 V); for test circuit see [Figure 9](#).

Symbol	Parameter	Conditions	25 °C			-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Typ <sup>[1]</sup>	Max	Min	Max	Min	Max	
C <sub>PD</sub>	power dissipation capacitance	per multivibrator; V <sub>I</sub> = GND to (V <sub>CC</sub> - 1.5 V)	-	138	-	-	-	-	-	pF

- [1] Typical values are measured at nominal supply voltage (V<sub>CC</sub> = 3.3 V and V<sub>CC</sub> = 5.0 V).
- [2] t<sub>t</sub> is the same as t<sub>THL</sub> and t<sub>TLH</sub>.
- [3] C<sub>PD</sub> is used to determine the dynamic power dissipation (P<sub>D</sub> in μW).  
 $P_D = C_{PD} \times V_{CC}^2 \times f_i \times \Sigma(C_L \times V_{CC}^2 \times f_o) + 0.48 \times C_{EXT} \times V_{CC}^2 \times f_o + D \times 0.8 \times V_{CC}$  where:  
 f<sub>i</sub> = input frequency in MHz;  
 f<sub>o</sub> = output frequency in MHz;  
 Σ(C<sub>L</sub> × V<sub>CC</sub><sup>2</sup> × f<sub>o</sub>) = sum of the outputs;  
 C<sub>L</sub> = output load capacitance in pF;  
 V<sub>CC</sub> = supply voltage in V;  
 D = duty cycle factor in %;  
 C<sub>EXT</sub> = external timing capacitance in pF.

## 11. Waveforms





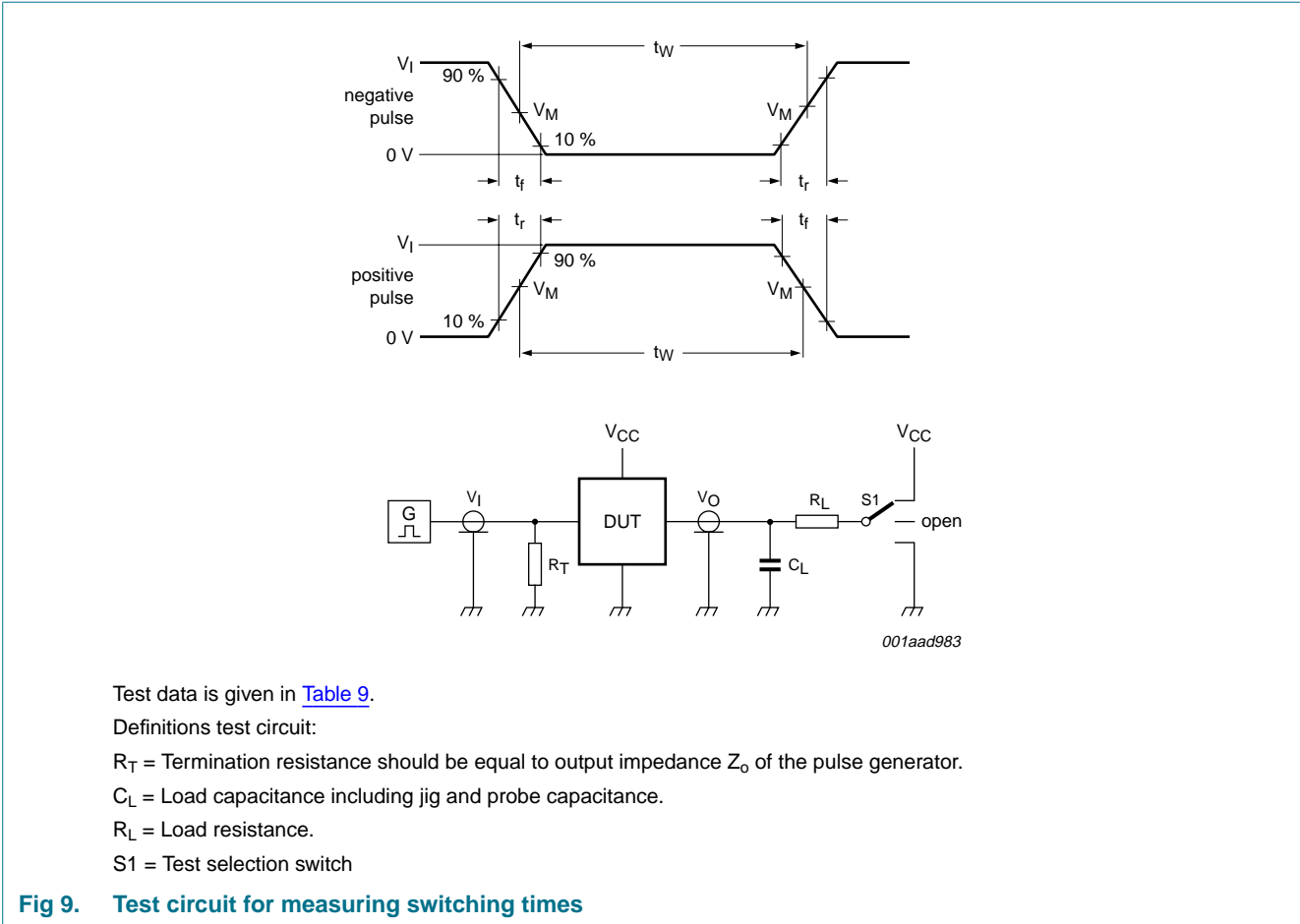
Measurement points are given in [Table 8](#).

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

**Fig 8. Waveforms showing  $n\overline{A}$ ,  $nB$ ,  $nQ$ ,  $n\overline{Q}$  pulse widths, recovery and retrigger times**

**Table 8. Measurement points**

Type	Input	Output		
	$V_M$	$V_M$	$V_X$	$V_Y$
74HC4538	$0.5V_{CC}$	$0.5V_{CC}$	$0.1V_{CC}$	$0.9V_{CC}$
74HCT4538	1.3 V	1.3 V	$0.1V_{CC}$	$0.9V_{CC}$



**Table 9. Test data**

Type	Input		Load		S1 position
	$V_I$	$t_r, t_f$	$C_L$	$R_L$	$t_{PHL}, t_{PLH}$
74HC4538	$V_{CC}$	6 ns	15 pF, 50 pF	1 k $\Omega$	open
74HCT4538	3 V	6 ns	15 pF, 50 pF	1 k $\Omega$	open

## 12. Application information

### 12.1 Power-down considerations

A large capacitor ( $C_{EXT}$ ) may cause problems when powering-down the monostable due to energy stored in this capacitor. When a system containing this device is powered-down or rapid decrease of  $V_{CC}$  to zero occurs, the monostable may sustain damage, due to the capacitor discharging through the input protection diodes. To avoid this possibility, use a damping diode ( $D_{EXT}$ ) preferably a germanium or Schottky type diode able to withstand large current surges and connect as shown in [Figure 10](#)

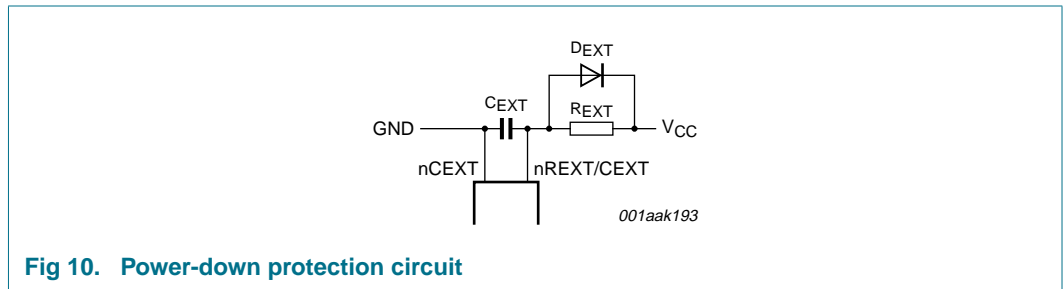


Fig 10. Power-down protection circuit

### 12.2 Graphs

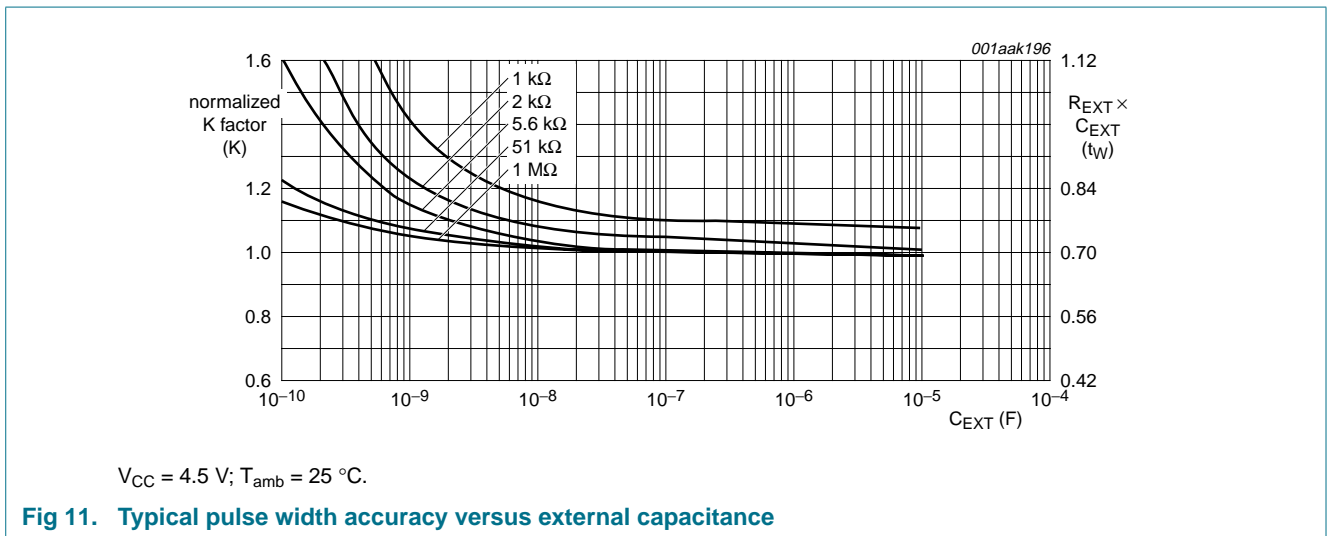
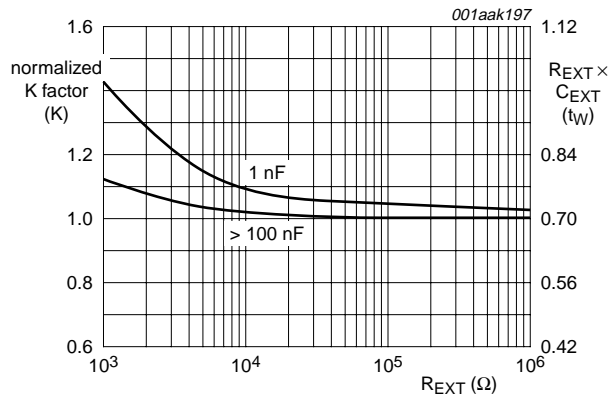
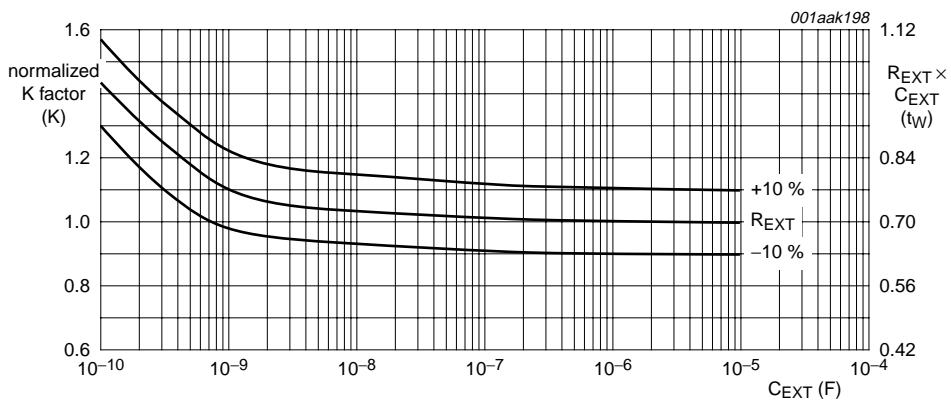


Fig 11. Typical pulse width accuracy versus external capacitance



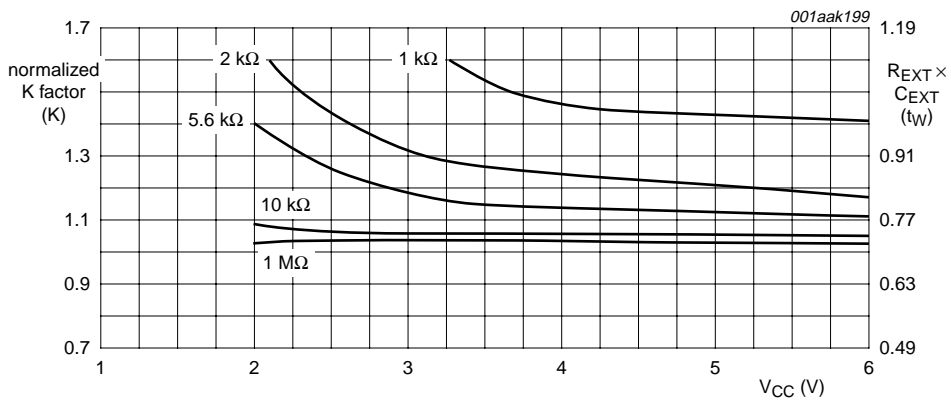
$V_{CC} = 4.5 \text{ V}; T_{amb} = 25 \text{ }^\circ\text{C}.$

**Fig 12. Typical pulse width accuracy versus external resistance**



$V_{CC} = 4.5 \text{ V}; R_{EXT} = 10 \text{ k}\Omega; T_{amb} = 25 \text{ }^\circ\text{C}.$

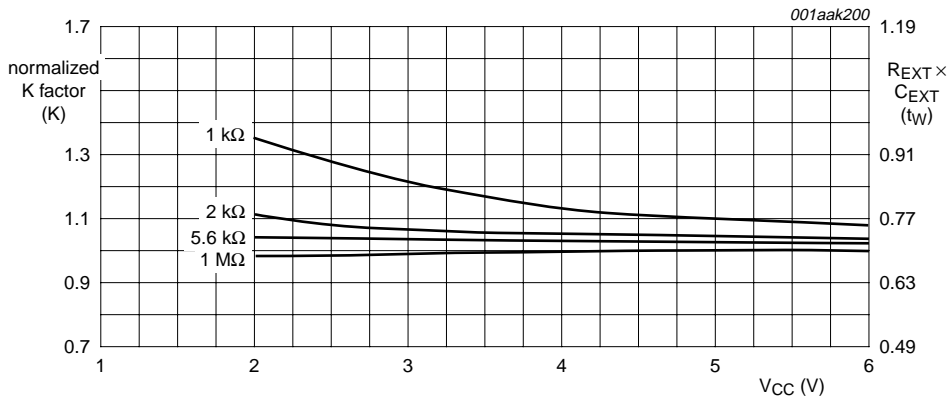
**Fig 13. Typical pulse width accuracy versus external capacitance**



$C_{EXT} = 1 \text{ nF}; T_{amb} = 25 \text{ }^\circ\text{C}.$

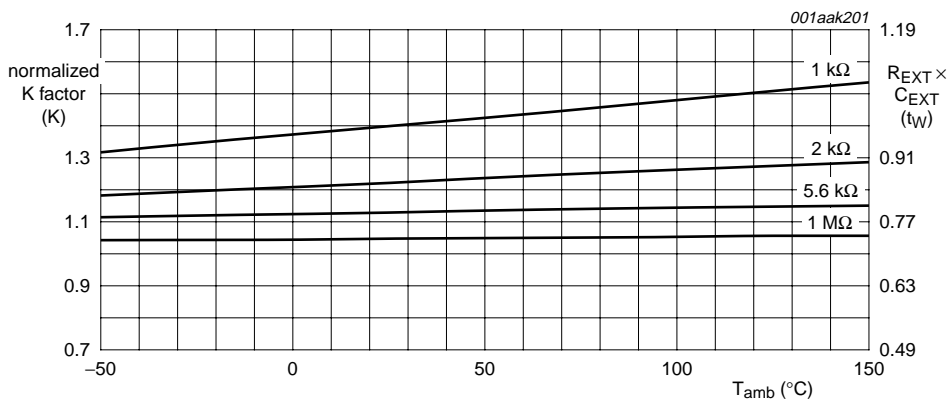
**Fig 14. Typical pulse width accuracy versus power supply**





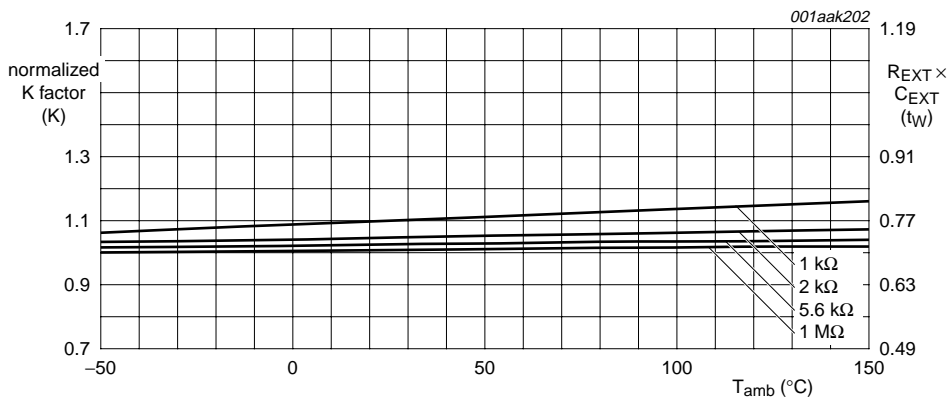
C<sub>EXT</sub> = 100 nF; T<sub>amb</sub> = 25 °C.

Fig 15. Typical pulse width accuracy versus power supply



V<sub>CC</sub> = 4.5 V; C<sub>EXT</sub> = 1 nF; T<sub>amb</sub> = 25 °C.

Fig 16. Typical pulse width accuracy versus temperature



V<sub>CC</sub> = 4.5 V; C<sub>EXT</sub> = 1 μF; T<sub>amb</sub> = 25 °C.

Fig 17. Typical pulse width accuracy versus temperature

13. Package outline

DIP16: plastic dual in-line package; 16 leads (300 mil)

SOT38-4

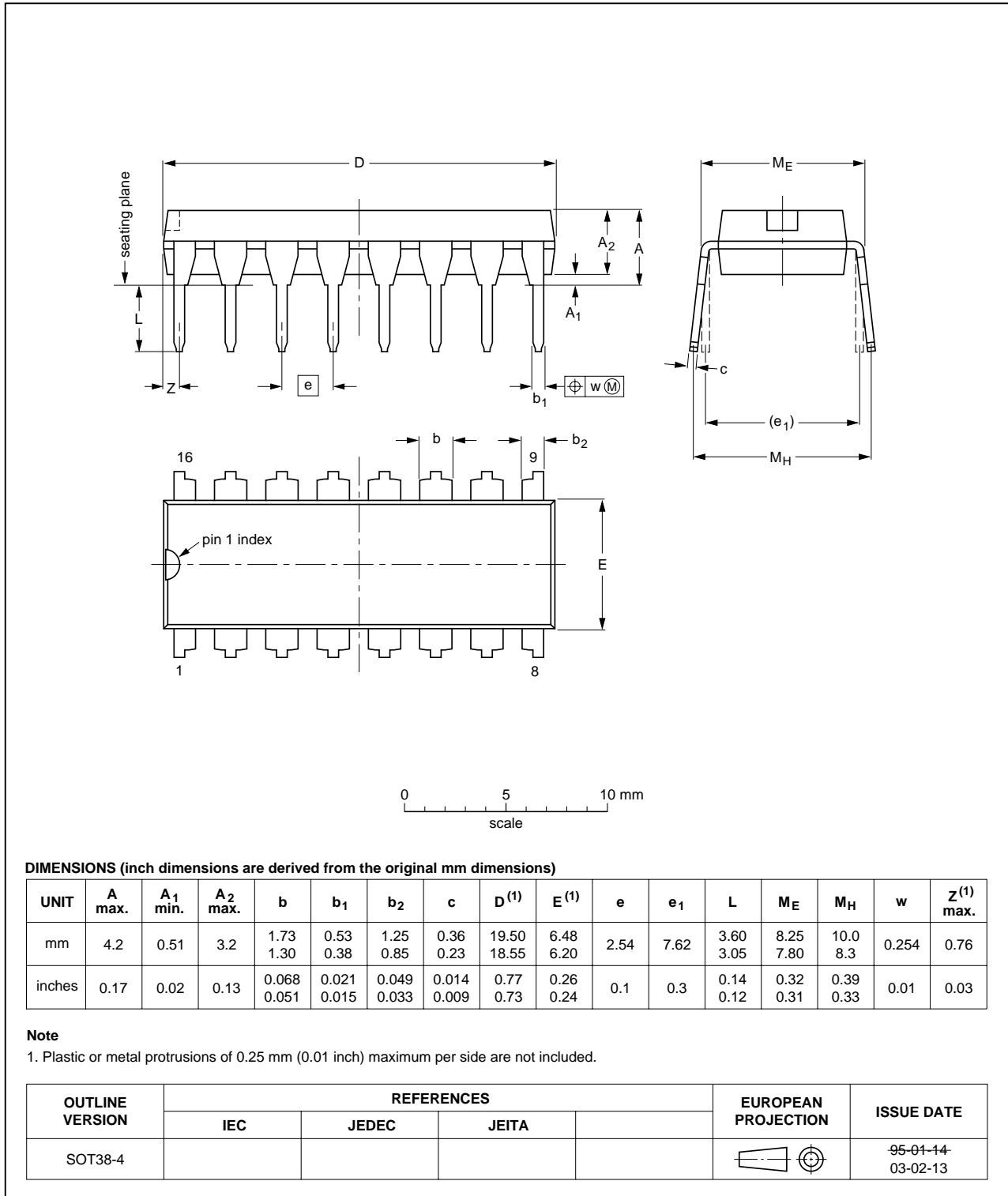


Fig 18. Package outline SOT38-4 (DIP16)

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

SOT109-1

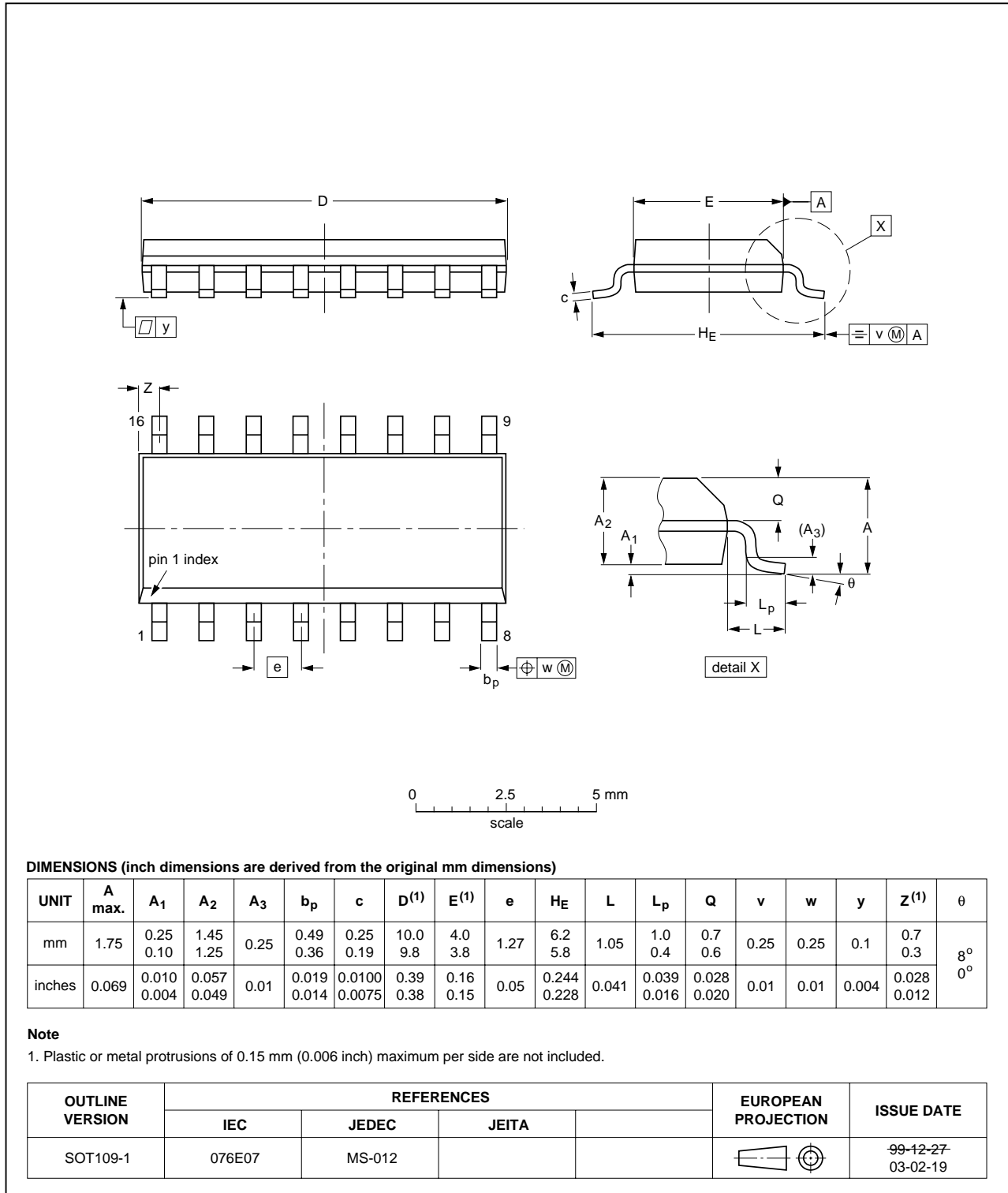


Fig 19. Package outline SOT109-1 (SO16)

SSOP16: plastic shrink small outline package; 16 leads; body width 5.3 mm

SOT338-1

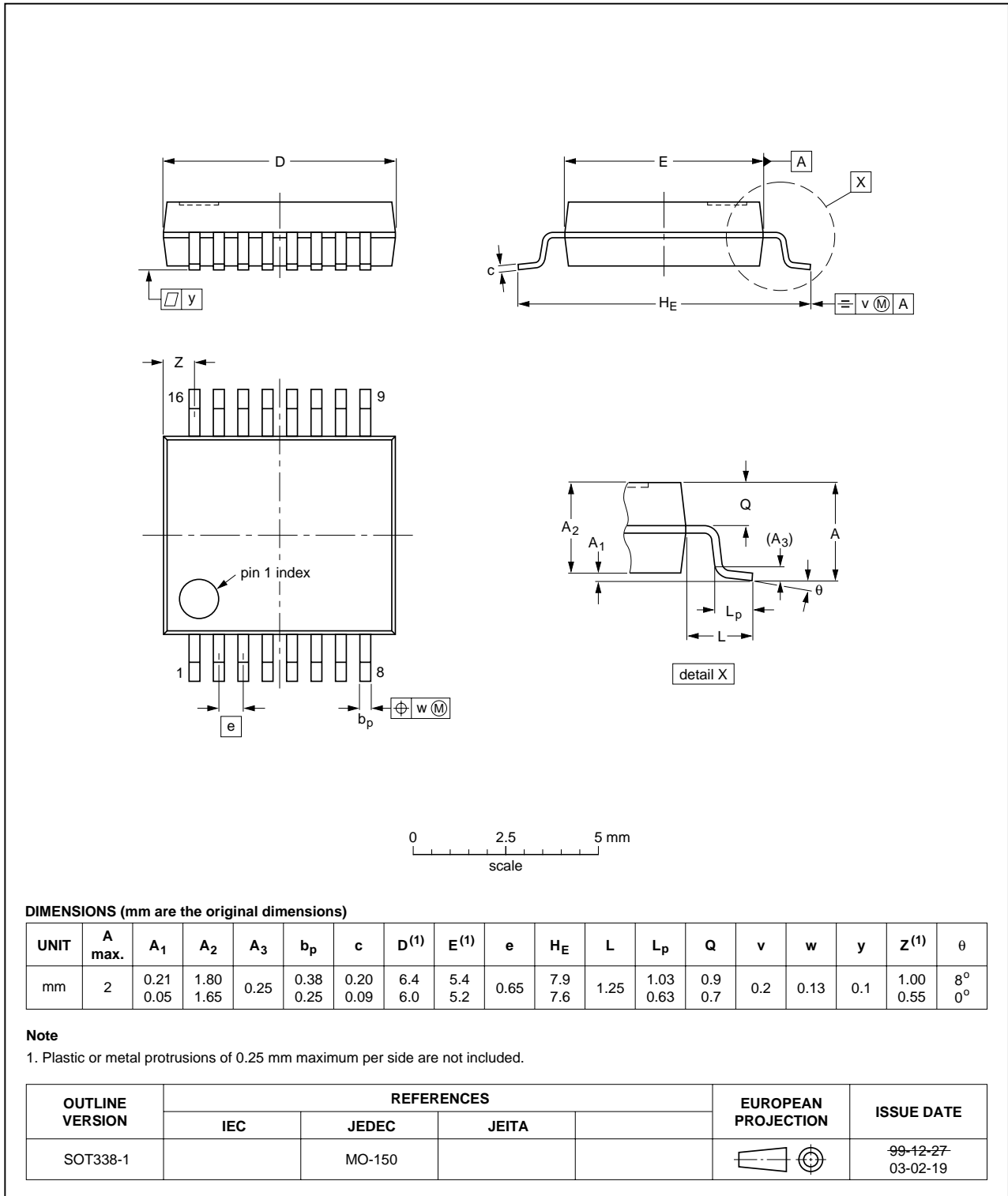


Fig 20. Package outline SOT338-1 (SSOP16)

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

SOT403-1



Fig 21. Package outline SOT403-1 (TSSOP16)

## 14. Abbreviations

Table 10. 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
TTL	Transistor-Transistor Logic

## 15. Revision history

Table 11. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74HC_HCT4538_3	20090608	Product data sheet	-	74HC_HCT4538_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> <li>Pin names changed throughout.</li> <li>Section <a href="#">Section 7</a>, <a href="#">Section 8</a> and <a href="#">Section 9</a> added, taken from the 74HC/T HCMOS Family characteristics/specification (March 1988).</li> <li>Test circuit added: <a href="#">Figure 9</a>.</li> <li>Quick reference data incorporated in to <a href="#">Section 9</a> and <a href="#">Section 10</a>.</li> <li>Package information added for DIP16, SO16, SSOP16 and TSSOP16 packages.</li> </ul>		
74HC_HCT4538_CNV_2	19970902	Product specification	-	-

## 16. Legal information

### 16.1 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".

[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>.

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