



**THE DATASHEET OF  
74HC251N,652**



# 74HC251; 74HCT251

8-input multiplexer; 3-state

Rev. 7 — 14 March 2024

Product data sheet

## 1. General description

The 74HC251; 74HCT251 is an 8-bit multiplexer with eight binary inputs (I0 to I7), three select inputs (S0 to S2) and an output enable input ( $\overline{OE}$ ). The select inputs select one of the eight binary inputs and route it to the complementary outputs (Y and  $\overline{Y}$ ). A HIGH on  $\overline{OE}$  causes the outputs to assume a high-impedance OFF-state. Inputs include clamp diodes that enable the use of current limiting resistors to interface inputs to voltages in excess of  $V_{CC}$ .

## 2. Features and benefits

- Wide supply voltage range from 2.0 V to 6.0 V
- CMOS low power dissipation
- High noise immunity
- Latch-up performance exceeds 100 mA per JESD 78 Class II Level B
- Complies with JEDEC standards:
  - JESD8C (2.7 V to 3.6 V)
  - JESD7A (2.0 V to 6.0 V)
- Input levels:
  - For 74HC251: CMOS level
  - For 74HCT251: TTL level
- Non-inverting data path
- 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 from -40 °C to +125 °C

## 3. Ordering information

Table 1. Ordering information

Type number	Package			Version
	Temperature range	Name	Description	
<a href="#">74HC251D</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="#">74HCT251D</a>				
<a href="#">74HC251PW</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="#">74HCT251PW</a>				

### 4. Functional diagram

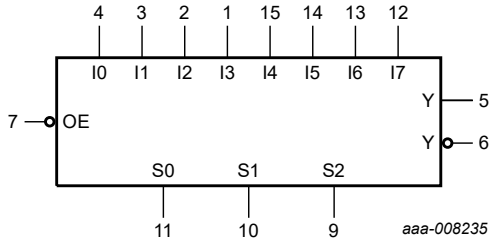


Fig. 1. Logic symbol

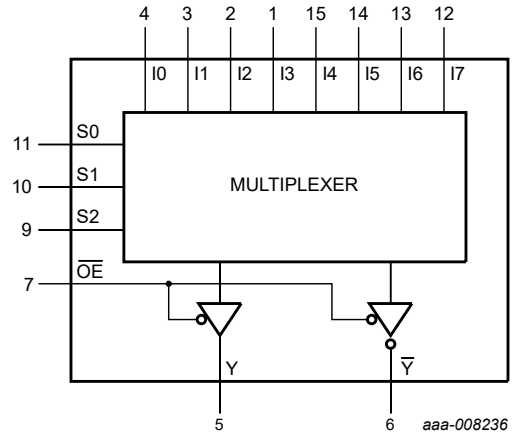


Fig. 2. Functional diagram

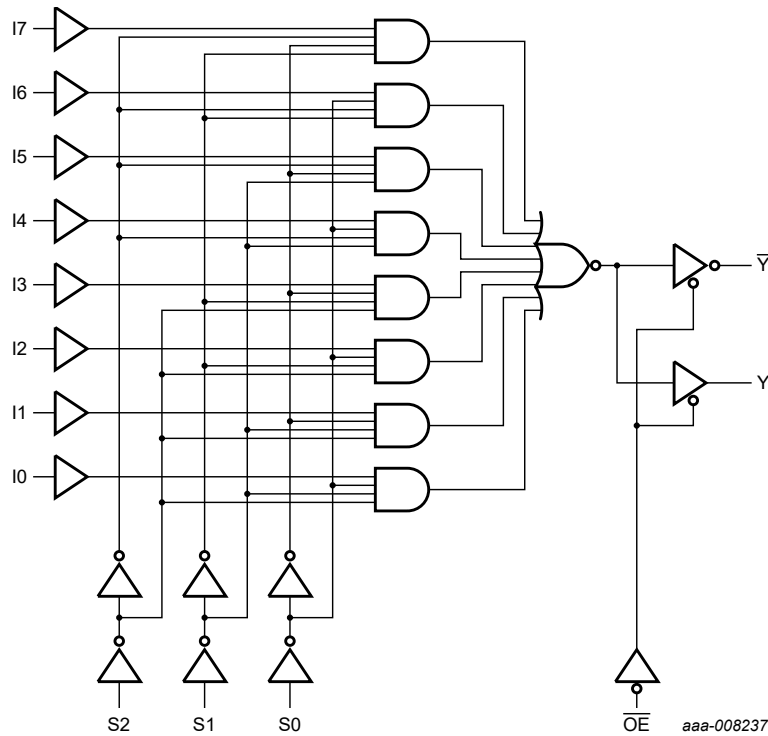
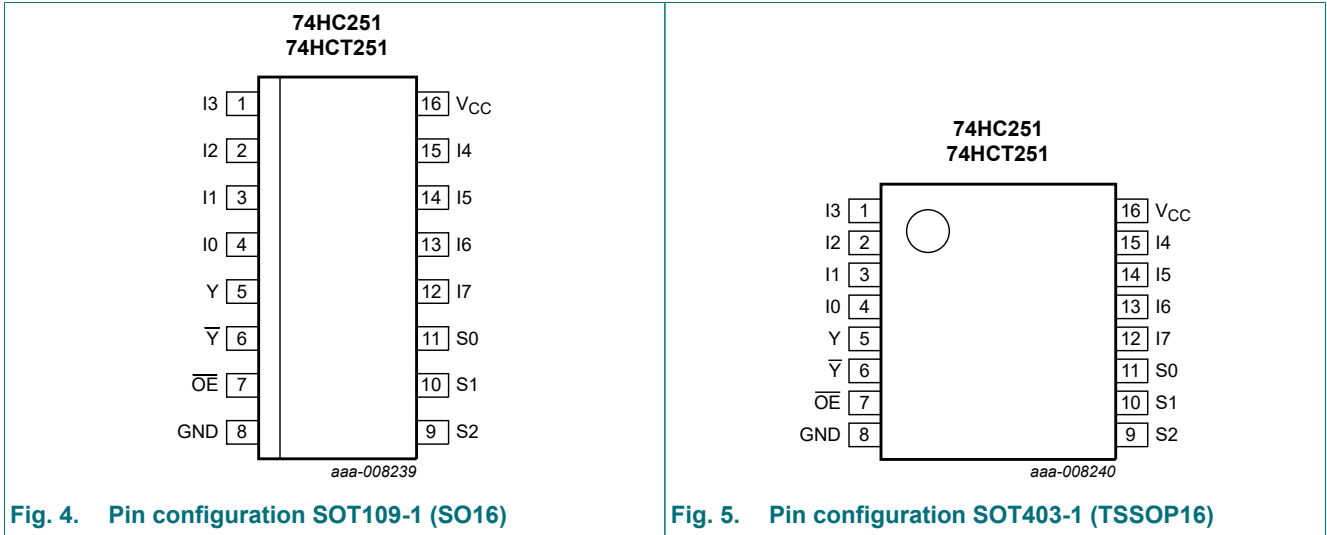


Fig. 3. Logic diagram

## 5. Pinning information

### 5.1. Pinning



### 5.2. Pin description

Table 2. Pin description

Symbol	Pin	Description
I0, I1, I2, I3, I4, I5, I6, I7	4, 3, 2, 1, 15, 14, 13, 12	data inputs
Y	5	multiplexer output
$\bar{Y}$	6	complementary multiplexer output
$\overline{OE}$	7	output enable input (active LOW)
GND	8	ground (0 V)
S0, S1, S2	11, 10, 9	common data select inputs
V <sub>CC</sub>	16	supply voltage

## 6. Functional description

**Table 3. Function table**

*H = HIGH voltage level; L = LOW voltage level; X = don't care; Z = high-impedance OFF-state.*

Input												Output	
OE	S2	S1	S0	I0	I1	I2	I3	I4	I5	I6	I7	Y	Y
H	X	X	X	X	X	X	X	X	X	X	X	Z	Z
L	L	L	L	L	X	X	X	X	X	X	X	H	L
L	L	L	L	H	X	X	X	X	X	X	X	L	H
L	L	L	H	X	L	X	X	X	X	X	X	H	L
L	L	L	H	X	H	X	X	X	X	X	X	L	H
L	L	H	L	X	X	L	X	X	X	X	X	H	L
L	L	H	L	X	X	H	X	X	X	X	X	L	H
L	L	H	H	X	X	X	L	X	X	X	X	H	L
L	L	H	H	X	X	X	H	X	X	X	X	L	H
L	H	L	L	X	X	X	X	L	X	X	X	H	L
L	H	L	L	X	X	X	X	H	X	X	X	L	H
L	H	L	H	X	X	X	X	X	L	X	X	H	L
L	H	L	H	X	X	X	X	X	H	X	X	L	H
L	H	H	L	X	X	X	X	X	X	L	X	H	L
L	H	H	L	X	X	X	X	X	X	H	X	L	H
L	H	H	H	X	X	X	X	X	X	X	L	H	L
L	H	H	H	X	X	X	X	X	X	X	H	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
$V_{CC}$	supply voltage		-0.5	+7	V
$I_{IK}$	input clamping current	$V_I < -0.5\text{ V}$ or $V_I > V_{CC} + 0.5\text{ V}$	-	$\pm 20$	mA
$I_{OK}$	output clamping current	$V_O < -0.5\text{ V}$ or $V_O > V_{CC} + 0.5\text{ V}$	-	$\pm 20$	mA
$I_O$	output current	$V_O = -0.5\text{ V}$ to $(V_{CC} + 0.5\text{ V})$	-	$\pm 25$	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 $+125\text{ °C}$	[1]	500	mW

- [1] For SOT109-1 (SO16) package:  $P_{tot}$  derates linearly with 12.4 mW/K above 110 °C.  
For SOT403-1 (TSSOP16) package:  $P_{tot}$  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	74HC251			74HCT251			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	+25	+125	-40	+25	+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>74HC251</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		

Symbol	Parameter	Conditions	25 °C			-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
$I_I$	input leakage current	$V_I = V_{CC}$ or GND; $V_{CC} = 6.0$ V	-	-	$\pm 0.1$	-	$\pm 1.0$	-	$\pm 1.0$	$\mu$ A
$I_{OZ}$	OFF-state output current	$V_I = V_{IH}$ or $V_{IL}$ ; $V_O = V_{CC}$ or GND; $V_{CC} = 6.0$ V	-	-	$\pm 0.5$	-	$\pm 5.0$	-	$\pm 10.0$	$\mu$ A
$I_{CC}$	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>74HCT251</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
		$I_O = -4$ 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	-	0	0.1	-	0.1	-	0.1	V
		$I_O = 4.0$ mA	-	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	-	-	$\pm 0.1$	-	$\pm 1.0$	-	$\pm 1.0$	$\mu$ A
$I_{OZ}$	OFF-state output current	$V_I = V_{IH}$ or $V_{IL}$ ; $V_O = V_{CC}$ or GND; $V_{CC} = 5.5$ V	-	-	$\pm 0.5$	-	$\pm 5.0$	-	$\pm 10$	$\mu$ 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; other inputs at $V_{CC}$ or GND; $V_{CC} = 4.5$ V to 5.5 V; $I_O = 0$ A								
		per input pin; $I_n$ inputs	-	100	360	-	450	-	490	$\mu$ A
		per input pin; $\overline{OE}$ input	-	150	540	-	675	-	735	$\mu$ A
		per input pin; $S_n$ input	-	150	540	-	675	-	735	$\mu$ A
$C_I$	input capacitance		-	3.5	-					pF

## 10. Dynamic characteristics

**Table 7. Dynamic characteristics**

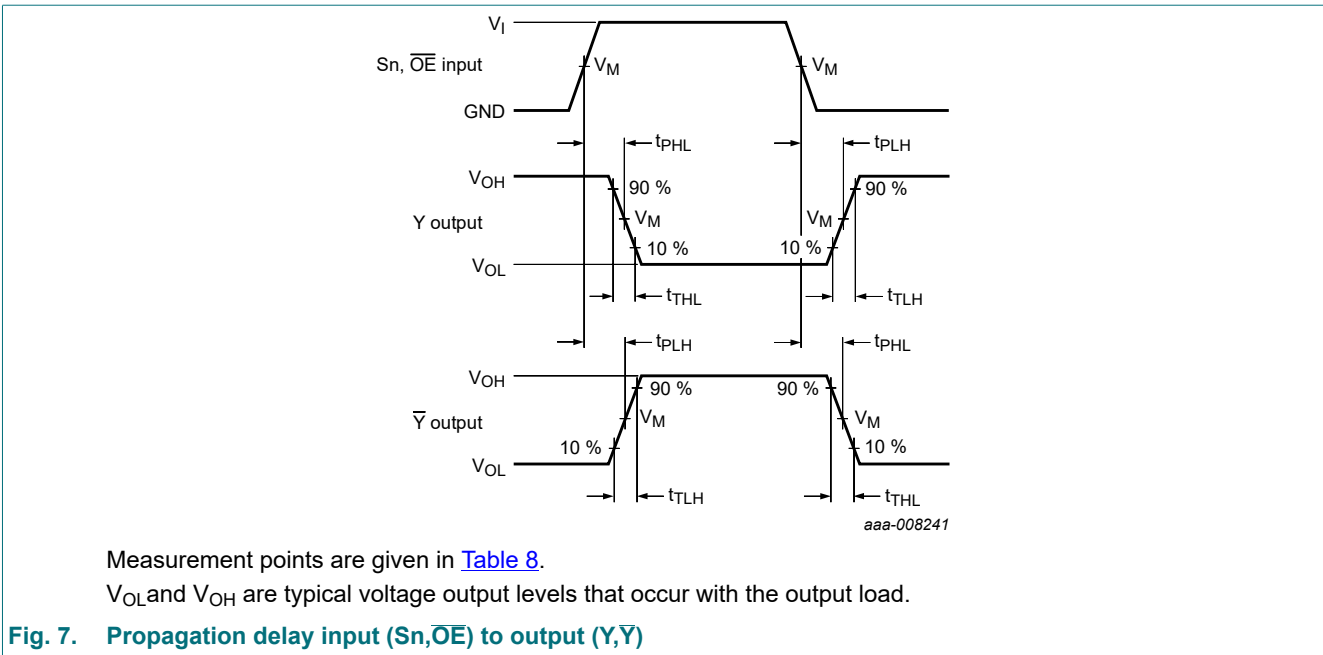
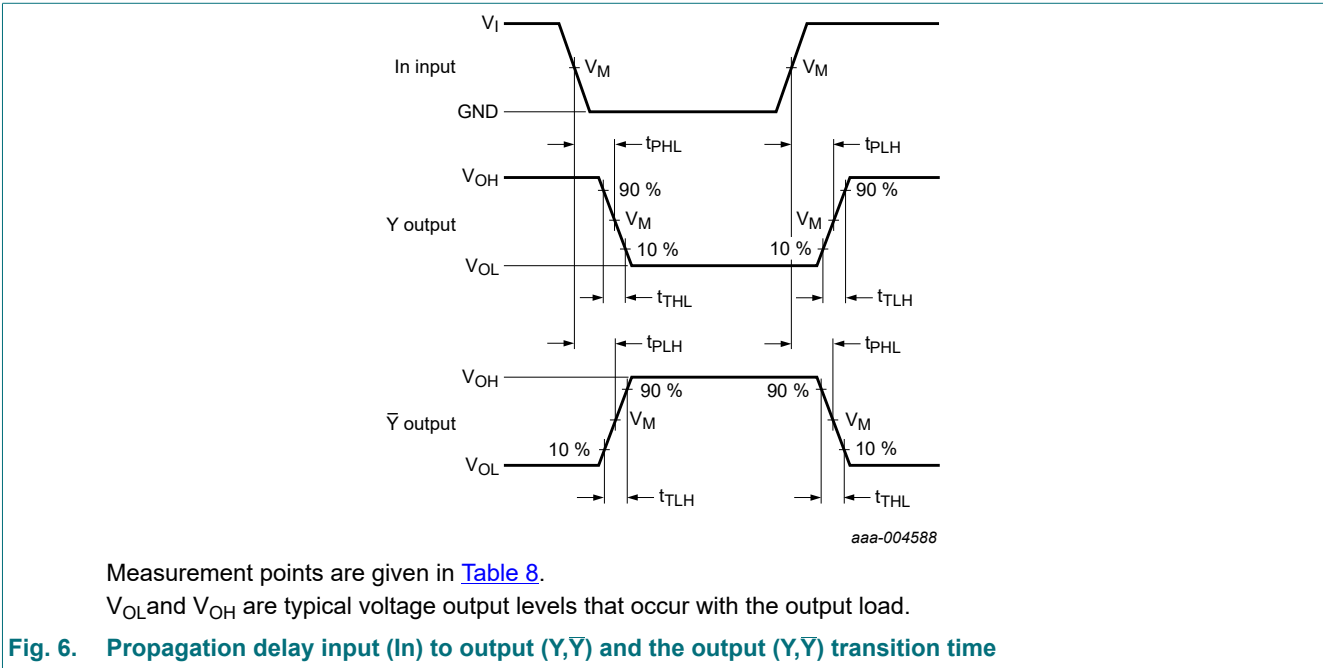
Voltages are referenced to GND (ground = 0 V);  $C_L = 50$  pF unless otherwise specified; for test circuit, see Fig. 9.

Symbol	Parameter	Conditions	25 °C			-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
<b>74HC251</b>										
$t_{pd}$	propagation delay	In to Y; see Fig. 6 [1]								
		$V_{CC} = 2.0$ V	-	50	170	-	215	-	255	ns
		$V_{CC} = 4.5$ V	-	18	34	-	43	-	51	ns
		$V_{CC} = 5$ V; $C_L = 15$ pF	-	15	-	-	-	-	-	ns
		$V_{CC} = 6.0$ V	-	14	29	-	37	-	43	ns
		In to $\bar{Y}$ ; see Fig. 6 [1]								
		$V_{CC} = 2.0$ V	-	55	175	-	220	-	265	ns
		$V_{CC} = 4.5$ V	-	20	35	-	44	-	53	ns
		$V_{CC} = 5$ V; $C_L = 15$ pF	-	17	-	-	-	-	-	ns
		$V_{CC} = 6.0$ V	-	16	30	-	37	-	45	ns
		Sn to Y; see Fig. 7 [1]								
		$V_{CC} = 2.0$ V	-	66	205	-	255	-	310	ns
		$V_{CC} = 4.5$ V	-	24	41	-	51	-	62	ns
		$V_{CC} = 5$ V; $C_L = 15$ pF	-	20	-	-	-	-	-	ns
		$V_{CC} = 6.0$ V	-	19	35	-	43	-	53	ns
		Sn to $\bar{Y}$ ; see Fig. 7 [1]								
$V_{CC} = 2.0$ V	-	69	205	-	255	-	310	ns		
$V_{CC} = 4.5$ V	-	25	41	-	51	-	62	ns		
$V_{CC} = 5$ V; $C_L = 15$ pF	-	21	-	-	-	-	-	ns		
$V_{CC} = 6.0$ V	-	20	35	-	43	-	53	ns		
$t_{en}$	enable time	$\overline{OE}$ to Y, $\bar{Y}$ ; see Fig. 8 [2]								
		$V_{CC} = 2.0$ V	-	36	140	-	175	-	210	ns
		$V_{CC} = 4.5$ V	-	13	28	-	35	-	42	ns
		$V_{CC} = 6.0$ V	-	10	24	-	30	-	36	ns
$t_{dis}$	disable time	$\overline{OE}$ to Y, $\bar{Y}$ ; see Fig. 8 [3]								
		$V_{CC} = 2.0$ V	-	39	140	-	170	-	210	ns
		$V_{CC} = 4.5$ V	-	14	28	-	35	-	42	ns
		$V_{CC} = 6.0$ V	-	11	24	-	30	-	36	ns
$t_t$	transition time	Y, $\bar{Y}$ ; see Fig. 6 [4]								
		$V_{CC} = 2.0$ V	-	19	75	-	95	-	110	ns
		$V_{CC} = 4.5$ V	-	7	15	-	19	-	22	ns
		$V_{CC} = 6.0$ V	-	6	13	-	16	-	19	ns
$C_{PD}$	power dissipation capacitance	$C_L = 50$ pF; $f = 1$ MHz; $V_I = GND$ to $V_{CC}$ [5]	-	44	-	-	-	-	-	pF

Symbol	Parameter	Conditions	25 °C			-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
<b>74HCT251</b>										
t <sub>pd</sub>	propagation delay	In to Y; see Fig. 6 [1]								
		V <sub>CC</sub> = 4.5 V	-	22	35	-	44	-	53	ns
		V <sub>CC</sub> = 5 V; C <sub>L</sub> = 15 pF	-	19	-	-	-	-	-	ns
		In to $\bar{Y}$ ; see Fig. 6 [1]								
		V <sub>CC</sub> = 4.5 V	-	22	35	-	44	-	53	ns
		V <sub>CC</sub> = 5 V; C <sub>L</sub> = 15 pF	-	19	-	-	-	-	-	ns
		Sn to Y; see Fig. 7 [1]								
		V <sub>CC</sub> = 4.5 V	-	24	44	-	55	-	66	ns
		V <sub>CC</sub> = 5 V; C <sub>L</sub> = 15 pF	-	20	-	-	-	-	-	ns
		Sn to $\bar{Y}$ ; see Fig. 7 [1]								
V <sub>CC</sub> = 4.5 V	-	25	44	-	55	-	66	ns		
V <sub>CC</sub> = 5 V; C <sub>L</sub> = 15 pF	-	21	-	-	-	-	-	ns		
t <sub>en</sub>	enable time	$\overline{OE}$ to Y, $\bar{Y}$ ; see Fig. 8 [2]								
		V <sub>CC</sub> = 4.5 V	-	13	28	-	35	-	42	ns
		V <sub>CC</sub> = 5 V; C <sub>L</sub> = 15 pF	-	13	-	-	-	-	-	ns
t <sub>dis</sub>	disable time	$\overline{OE}$ to Y, $\bar{Y}$ ; see Fig. 8 [3]								
		V <sub>CC</sub> = 4.5 V	-	14	28	-	35	-	42	ns
		V <sub>CC</sub> = 5 V; C <sub>L</sub> = 15 pF	-	18	-	-	-	-	-	ns
t <sub>t</sub>	transition time	Y, $\bar{Y}$ ; see Fig. 6 [4]								
		V <sub>CC</sub> = 4.5 V	-	7	15	-	19	-	22	ns
C <sub>PD</sub>	power dissipation capacitance	C <sub>L</sub> = 50 pF; f = 1 MHz; V <sub>I</sub> = GND to V <sub>CC</sub> - 1.5 V [5]	-	46	-	-	-	-	-	pF

- [1] t<sub>pd</sub> is the same as t<sub>PLH</sub> and t<sub>PHL</sub>.
- [2] t<sub>en</sub> is the same as t<sub>PZH</sub> and t<sub>PZL</sub>.
- [3] t<sub>dis</sub> is the same as t<sub>PLZ</sub> and t<sub>PHZ</sub>.
- [4] t<sub>t</sub> is the same as t<sub>THL</sub> and t<sub>TLH</sub>.
- [5] C<sub>PD</sub> is used to determine the dynamic power dissipation (P<sub>D</sub> in μW).  
 $P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \sum(C_L \times V_{CC}^2 \times f_o)$  where:  
 f<sub>i</sub> = input frequency in MHz;  
 f<sub>o</sub> = output frequency in MHz;  
 C<sub>L</sub> = output load capacitance in pF;  
 V<sub>CC</sub> = supply voltage in V;  
 N = number of inputs switching;  
 $\sum(C_L \times V_{CC}^2 \times f_o)$  = sum of outputs.

10.1. Waveforms and test circuit



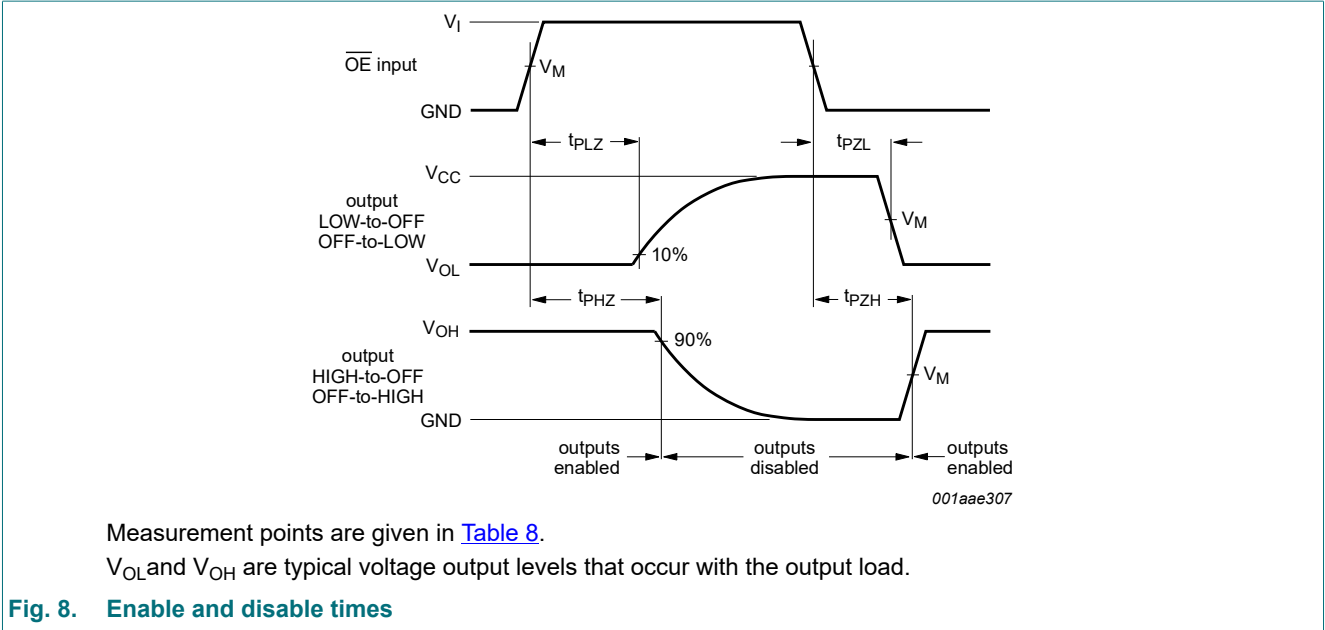


Table 8. Measurement points

Type	Input	Output
	$V_M$	$V_M$
74HC251	$0.5V_{CC}$	$0.5V_{CC}$
74HCT251	1.3 V	1.3 V

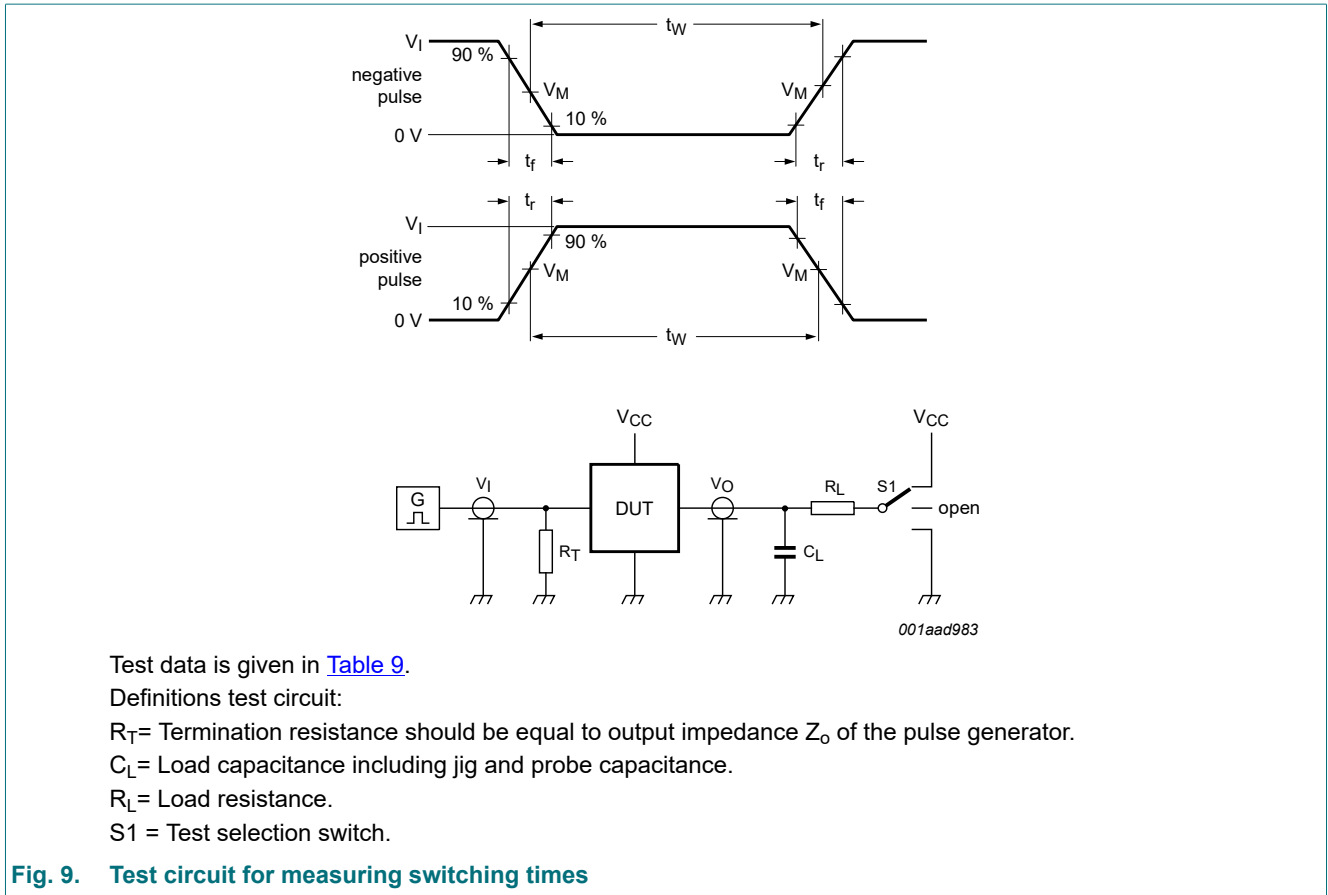


Fig. 9. Test circuit for measuring switching times

Table 9. Test data

Type	Input		Load		S1 position		
	$V_I$	$t_r, t_f$	$C_L$	$R_L$	$t_{PHL}, t_{PLH}$	$t_{PZH}, t_{PHZ}$	$t_{PZL}, t_{PLZ}$
74HC251	$V_{CC}$	6 ns	15 pF, 50 pF	1 k $\Omega$	open	GND	$V_{CC}$
74HCT251	3 V	6 ns	15 pF, 50 pF	1 k $\Omega$	open	GND	$V_{CC}$

11. Package outline

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

SOT109-1

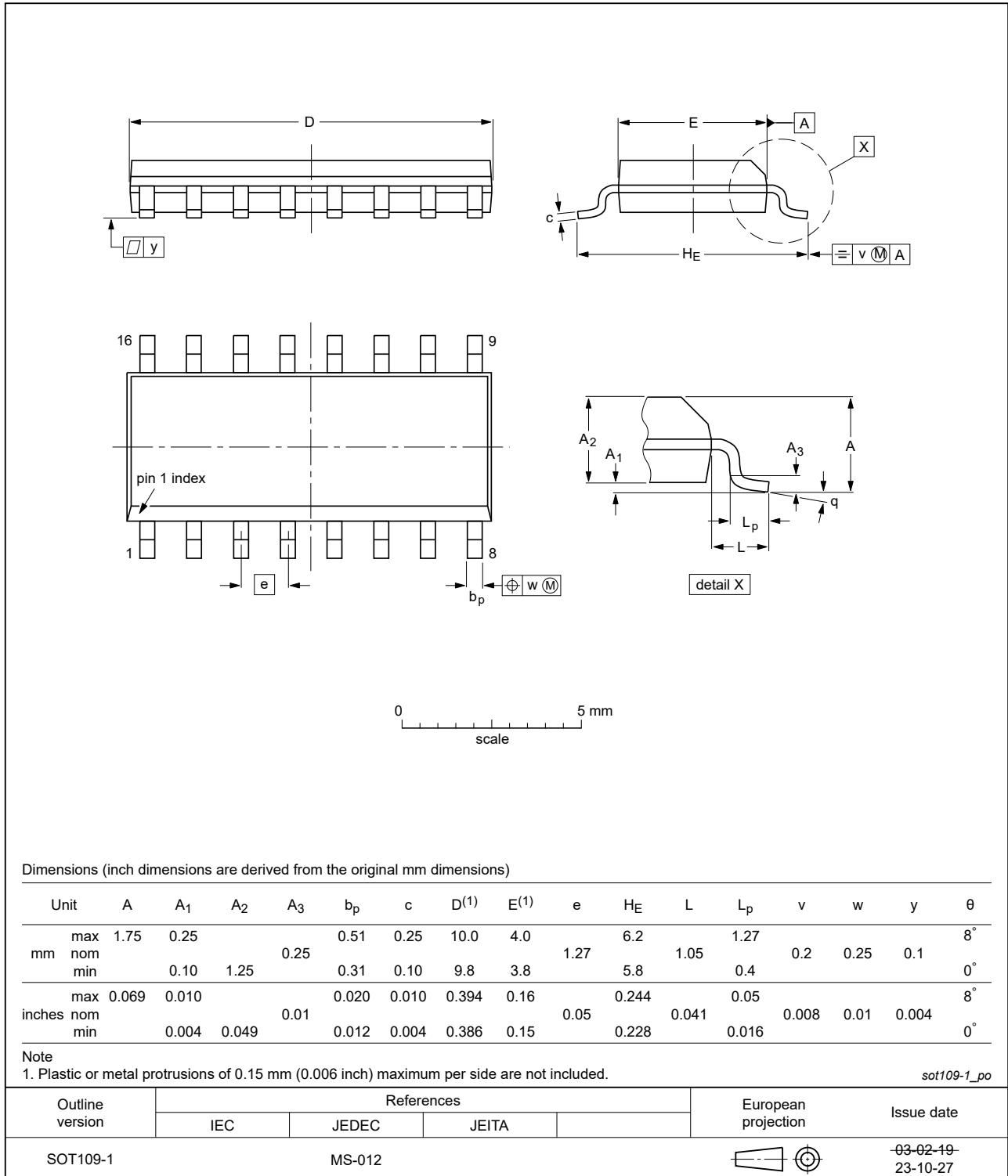


Fig. 10. Package outline SOT109-1 (SO16)

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

SOT403-1

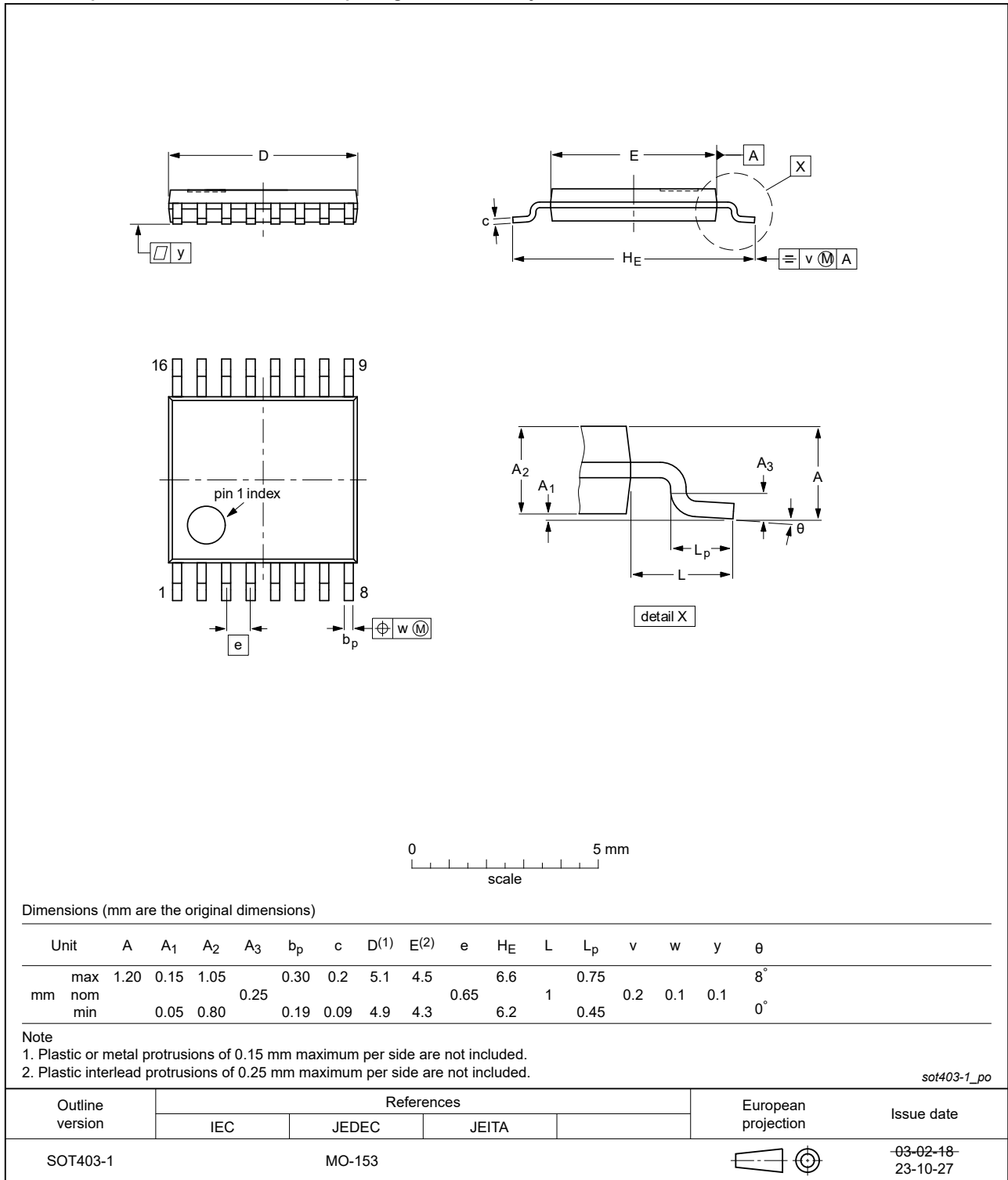


Fig. 11. Package outline SOT403-1 (TSSOP16)

## 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_HCT251 v.7	20240314	Product data sheet	-	74HC_HCT251 v.6
Modifications:	<ul style="list-style-type: none"> <li>• <a href="#">Fig. 10, Fig. 11</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_HCT251 v.6	20210208	Product data sheet	-	74HC_HCT251 v.5
Modifications:	<ul style="list-style-type: none"> <li>• <a href="#">Section 2</a> updated.</li> <li>• Type numbers 74HC251DB and 74HCT251DB (SOT338-1 / SSOP16) removed.</li> <li>• <a href="#">Table 7</a>: Conditions for <math>C_{PD}</math> have changed for 74HCT251. (errata)</li> </ul>			
74HC_HCT251 v.5	20190715	Product data sheet	-	74HC_HCT251 v.4
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>• <a href="#">Table 4</a>: Derating values for <math>P_{tot}</math> total power dissipation have changed.</li> </ul>			
74HC_HCT251 v.4	20160201	Product data sheet	-	74HC_HCT251 v.3
Modifications:	<ul style="list-style-type: none"> <li>• Type numbers 74HC251N and 74HCT251N (SOT38-4) removed.</li> </ul>			
74HC_HCT251 v.3	20130709	Product data sheet	-	74HC_HCT251_CNV v.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_HCT251_CNV v.2	19970828	Product specification	-	

## 14. Legal information

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Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
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- [2] The term 'short data sheet' is explained in section "Definitions".
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