

# 74HC151; 74HCT151

## 8-input multiplexer

Rev. 4 — 11 February 2013

Product data sheet

### 1. General description

The 74HC151; 74HCT151 are 8-bit multiplexer with eight binary inputs (I0 to I7), three select inputs (S0 to S2) and an enable input ( $\bar{E}$ ). One of the eight binary inputs is selected by the select inputs and routed to the complementary outputs (Y and  $\bar{Y}$ ). A HIGH on  $\bar{E}$  forces the output Y LOW and output  $\bar{Y}$  HIGH. Inputs also 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

- Input levels:
  - ◆ For 74HC151: CMOS level
  - ◆ For 74HCT151: TTL level
- Low-power dissipation
- Non-inverting data path
- Specified in compliance with JEDEC standard no. 7A
- ESD protection:
  - ◆ HBM JESD22-A114F exceeds 2 000 V
  - ◆ MM 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. Ordering information

Table 1. Ordering information

Type number	Package			
	Temperature range	Name	Description	Version
74HC151N 74HCT151N	$-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$	DIP16	plastic dual in-line package; 16 leads (300 mil)	SOT38-4
74HC151D 74HCT151D	$-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$	SO16	plastic small outline package; 16 leads; body width 3.9 mm	SOT109-1
74HC151DB 74HCT151DB	$-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$	SSOP16	plastic shrink small outline package; 16 leads; body width 5.3 mm	SOT338-1
74HC151PW 74HCT151PW	$-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$	TSSOP16	plastic thin shrink small outline package; 16 leads; body width 4.4 mm	SOT403-1



4. Functional diagram

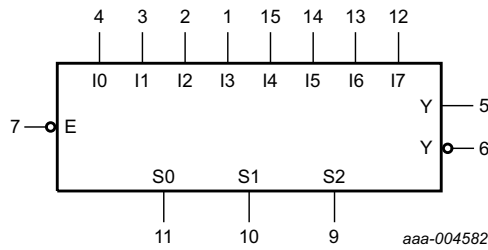


Fig 1. Logic symbol

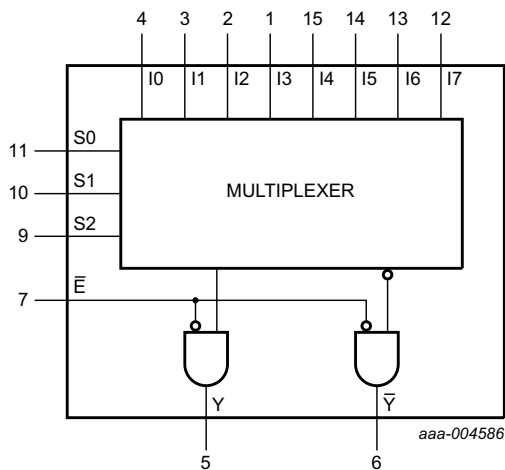


Fig 2. Functional diagram

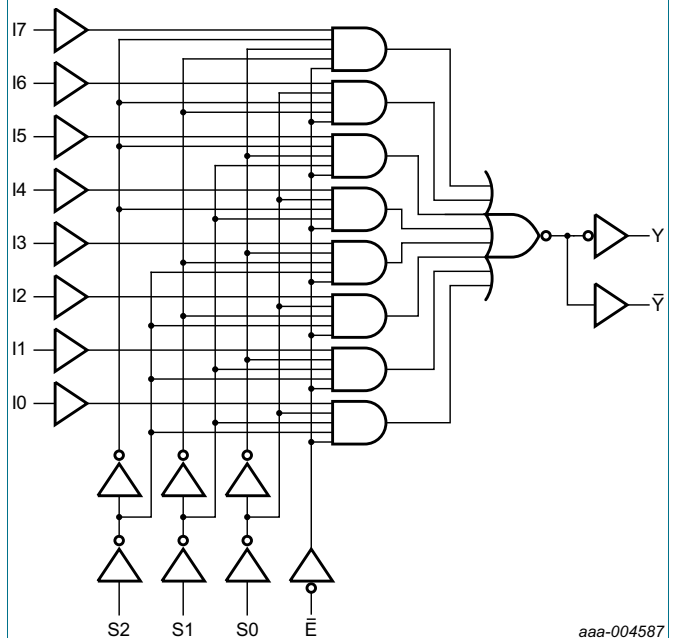


Fig 3. Logic diagram

## 5. Pinning information

### 5.1 Pinning

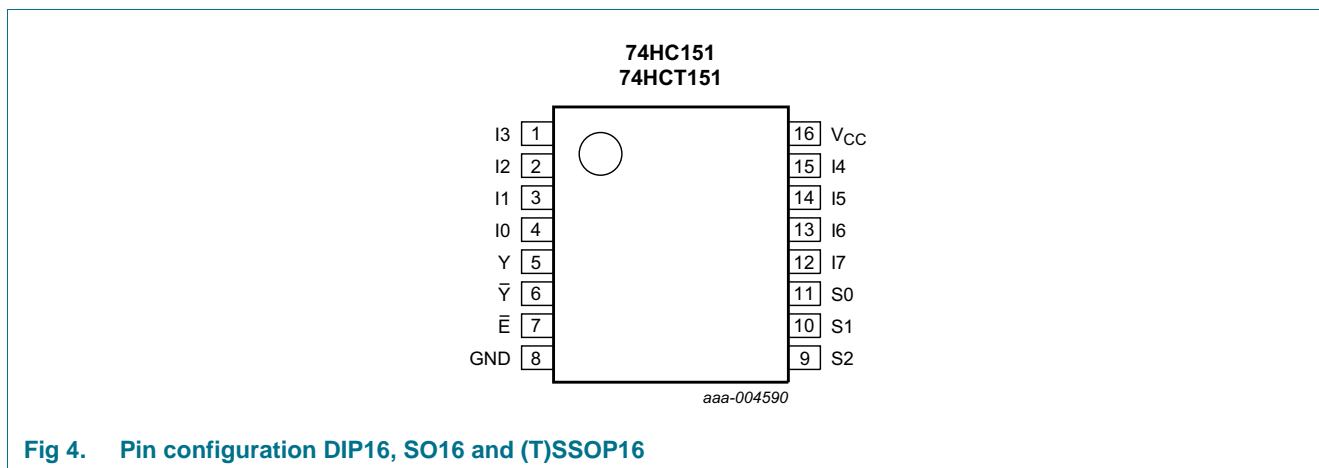


Fig 4. Pin configuration DIP16, SO16 and (T)SSOP16

### 5.2 Pin description

Table 2. Pin description

Symbol	Pin	Description
I0 to I7	4, 3, 2, 1, 15, 14, 13, 12	data inputs
Y	5	multiplexer output
$\bar{Y}$	6	complementary multiplexer output
$\bar{E}$	7	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<sup>[1]</sup>

Input												Output	
$\bar{E}$	S2	S1	S0	I0	I1	I2	I3	I4	I5	I6	I7	$\bar{Y}$	Y
H	X	X	X	X	X	X	X	X	X	X	X	H	L
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

[1] H = HIGH voltage level; L = LOW voltage level; X = don't care.

## 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

**Table 4. 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 <sub>tot</sub>	total power dissipation	T <sub>amb</sub> = -40 °C to +125 °C			
	DIP16 package		[1] -	750	mW
	SO16 package		[2] -	500	mW
	(T)SSOP16 package		[3] -	500	mW

[1] For DIP16 package: P<sub>tot</sub> derates linearly with 12 mW/K above 70 °C.

[2] For SO16 package: P<sub>tot</sub> derates linearly with 8 mW/K above 70 °C.

[3] For SSOP16 and TSSOP16 packages: 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	74HC151			74HCT151			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	T <sub>amb</sub> = 25 °C			T <sub>amb</sub> = -40 °C to +85 °C		T <sub>amb</sub> = -40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
<b>74HC151</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	-	±1.0	-	±1.0	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

**Table 6. Static characteristics ...continued**

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

Symbol	Parameter	Conditions	T <sub>amb</sub> = 25 °C			T <sub>amb</sub> = -40 °C to +85 °C		T <sub>amb</sub> = -40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
<b>74HCT151</b>										
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 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	-	0	0.1	-	0.1	-	0.1	V
		I <sub>O</sub> = 4.0 mA	-	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	-	±1.0	-	±1.0	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	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; I <sub>O</sub> = 0 A								
		per input pin; I <sub>n</sub> inputs	-	45	162	-	203	-	221	μA
		per input pin; $\bar{E}$ input	-	30	108	-	135	-	147	μA
		per input pin; S <sub>n</sub> input	-	150	540	-	675	-	735	μA
C <sub>I</sub>	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 [Figure 7](#).

Symbol	Parameter	Conditions	$T_{amb} = 25\text{ °C}$			$T_{amb} = -40\text{ °C}$ to $+85\text{ °C}$		$T_{amb} = -40\text{ °C}$ to $+125\text{ °C}$		Unit
			Min	Typ	Max	Min	Max	Min	Max	
<b>For type 74HC151</b>										
$t_{pd}$	propagation delay	In to Y; see <a href="#">Figure 5</a> <span style="float:right">[1]</span>								
		$V_{CC} = 2.0\text{ V}$	-	52	170	-	215	-	255	ns
		$V_{CC} = 4.5\text{ V}$	-	19	34	-	43	-	51	ns
		$V_{CC} = 5\text{ V}; C_L = 15\text{ pF}$	-	17	-	-	-	-	-	ns
		$V_{CC} = 6.0\text{ V}$	-	15	29	-	37	-	43	ns
		In to $\bar{Y}$ ; see <a href="#">Figure 5</a> <span style="float:right">[1]</span>								
		$V_{CC} = 2.0\text{ V}$	-	58	185	-	230	-	280	ns
		$V_{CC} = 4.5\text{ V}$	-	21	37	-	46	-	56	ns
		$V_{CC} = 5\text{ V}; C_L = 15\text{ pF}$	-	17	-	-	-	-	-	ns
		$V_{CC} = 6.0\text{ V}$	-	17	31	-	39	-	48	ns
		Sn to Y; see <a href="#">Figure 6</a> <span style="float:right">[1]</span>								
		$V_{CC} = 2.0\text{ V}$	-	61	185	-	230	-	280	ns
		$V_{CC} = 4.5\text{ V}$	-	22	37	-	46	-	56	ns
		$V_{CC} = 5\text{ V}; C_L = 15\text{ pF}$	-	19	-	-	-	-	-	ns
		$V_{CC} = 6.0\text{ V}$	-	18	31	-	39	-	48	ns
		Sn to $\bar{Y}$ ; see <a href="#">Figure 6</a> <span style="float:right">[1]</span>								
		$V_{CC} = 2.0\text{ V}$	-	61	205	-	255	-	310	ns
		$V_{CC} = 4.5\text{ V}$	-	22	41	-	51	-	62	ns
		$V_{CC} = 5\text{ V}; C_L = 15\text{ pF}$	-	19	-	-	-	-	-	ns
		$V_{CC} = 6.0\text{ V}$	-	18	35	-	43	-	53	ns
		$\bar{E}$ to Y; see <a href="#">Figure 6</a>								
		$V_{CC} = 2.0\text{ V}$	-	41	125	-	155	-	190	ns
		$V_{CC} = 4.5\text{ V}$	-	15	25	-	31	-	38	ns
		$V_{CC} = 5\text{ V}; C_L = 15\text{ pF}$	-	12	-	-	-	-	-	ns
$V_{CC} = 6.0\text{ V}$	-	12	21	-	26	-	32	ns		
$\bar{E}$ to $\bar{Y}$ ; see <a href="#">Figure 6</a>										
$V_{CC} = 2.0\text{ V}$	-	47	145	-	180	-	220	ns		
$V_{CC} = 4.5\text{ V}$	-	17	29	-	36	-	44	ns		
$V_{CC} = 5\text{ V}; C_L = 15\text{ pF}$	-	14	-	-	-	-	-	ns		
$V_{CC} = 6.0\text{ V}$	-	14	25	-	31	-	38	ns		
$t_t$	transition time	Y, $\bar{Y}$ ; see <a href="#">Figure 5</a> <span style="float:right">[2]</span>								
		$V_{CC} = 2.0\text{ V}$	-	19	75	-	95	-	110	ns
		$V_{CC} = 4.5\text{ V}$	-	7	15	-	19	-	22	ns
		$V_{CC} = 6.0\text{ V}$	-	6	13	-	16	-	19	ns

**Table 7. Dynamic characteristics ...continued**

Voltages are referenced to GND (ground = 0 V);  $C_L = 50$  pF unless otherwise specified; for test circuit see [Figure 7](#).

Symbol	Parameter	Conditions	$T_{amb} = 25\text{ }^\circ\text{C}$			$T_{amb} = -40\text{ }^\circ\text{C}$ to $+85\text{ }^\circ\text{C}$		$T_{amb} = -40\text{ }^\circ\text{C}$ to $+125\text{ }^\circ\text{C}$		Unit		
			Min	Typ	Max	Min	Max	Min	Max			
$C_{PD}$	power dissipation capacitance	$C_L = 50$ pF; $f = 1$ MHz; $V_I = \text{GND to } V_{CC}$	[3]	-	40	-	-	-	-	pF		
<b>For type 74HCT151</b>												
$t_{pd}$	propagation delay	In to Y; see <a href="#">Figure 5</a>	[1]	-	22	38	-	48	-	57	ns	
		$V_{CC} = 4.5$ V	-	19	-	-	-	-	-	ns		
	In to $\bar{Y}$ ; see <a href="#">Figure 5</a>	$V_{CC} = 4.5$ V	-	22	38	-	48	-	57	ns		
		$V_{CC} = 5$ V; $C_L = 15$ pF	-	19	-	-	-	-	-	ns		
	Sn to Y; see <a href="#">Figure 6</a>	$V_{CC} = 4.5$ V	-	23	41	-	51	-	62	ns		
		$V_{CC} = 5$ V; $C_L = 15$ pF	-	20	-	-	-	-	-	ns		
	Sn to $\bar{Y}$ ; see <a href="#">Figure 6</a>	$V_{CC} = 4.5$ V	-	25	43	-	54	-	65	ns		
		$V_{CC} = 5$ V; $C_L = 15$ pF	-	20	-	-	-	-	-	ns		
	$\bar{E}$ to Y; see <a href="#">Figure 6</a>	$V_{CC} = 4.5$ V	-	16	29	-	36	-	44	ns		
		$V_{CC} = 5$ V; $C_L = 15$ pF	-	13	-	-	-	-	-	ns		
	$\bar{E}$ to $\bar{Y}$ ; see <a href="#">Figure 6</a>	$V_{CC} = 4.5$ V	-	21	36	-	45	-	54	ns		
		$V_{CC} = 5$ V; $C_L = 15$ pF	-	18	-	-	-	-	-	ns		
	$t_t$	transition time	Y, $\bar{Y}$ ; see <a href="#">Figure 5</a>	[2]	-	7	15	-	19	-	22	ns
			$V_{CC} = 4.5$ V	-	7	15	-	19	-	22	ns	
$C_{PD}$	power dissipation capacitance	$C_L = 50$ pF; $f = 1$ MHz; $V_I = \text{GND to } V_{CC}$	[3]	-	40	-	-	-	-	pF		

[1]  $t_{pd}$  is the same as  $t_{PLH}$  and  $t_{PHL}$ .

[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  $\mu\text{W}$ ).

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

$f_i$  = input frequency in MHz;

$f_o$  = output frequency in MHz;

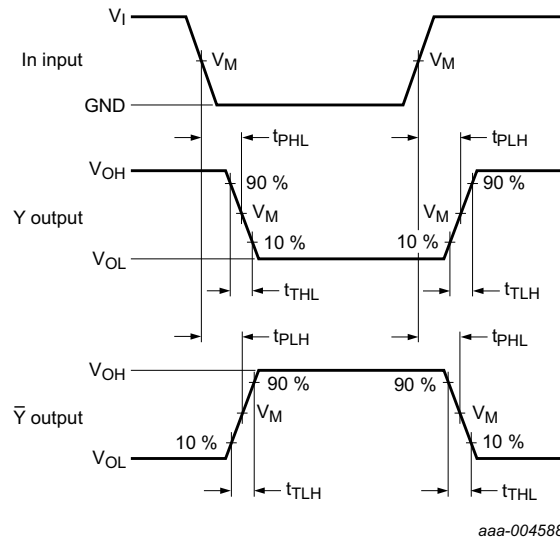
$C_L$  = output load capacitance in pF;

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

$N$  = number of inputs switching;

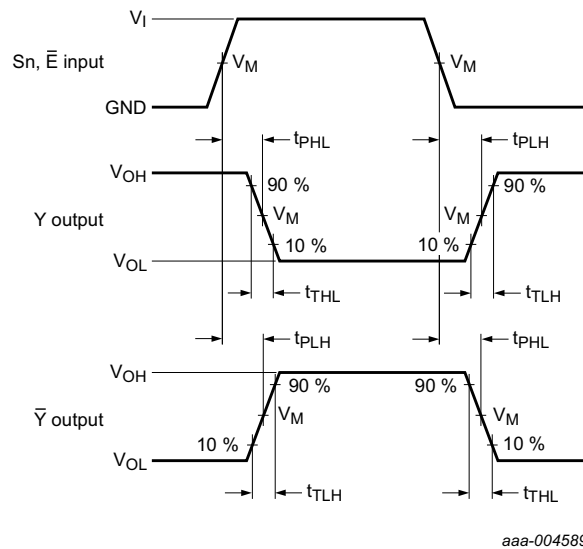
$\sum(C_L \times V_{CC}^2 \times f_o)$  = sum of outputs.

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 5. Propagation delay input (In) to output (Y,  $\bar{Y}$ ) and the output (Y,  $\bar{Y}$ ) transition time**

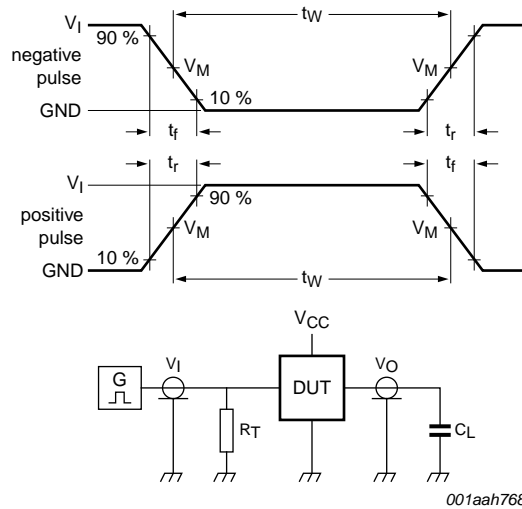


Measurement points are given in [Table 8](#).  
 $V_{OL}$  and  $V_{OH}$  are typical voltage output levels that occur with the output load.

**Fig 6. Propagation delay input (Sn,  $\bar{E}$ ) to output (Y,  $\bar{Y}$ ) and output (Y,  $\bar{Y}$ ) transitions time**

Table 8. Measurement points

Type	Input	Output
	$V_M$	$V_M$
74HC151	$0.5V_{CC}$	$0.5V_{CC}$
74HCT151	1.3 V	1.3 V



Test data is given in [Table 9](#).

Definitions 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.

S1 = Test selection switch.

Fig 7. Test circuit for measuring switching times

Table 9. Test data

Type	Input		Load	Test
	$V_I$	$t_r, t_f$	$C_L$	
74HC151	$V_{CC}$	6.0 ns	15 pF, 50 pF	$t_{PLH}, t_{PHL}$
74HCT151	3.0 V	6.0 ns	15 pF, 50 pF	$t_{PLH}, t_{PHL}$

12. Package outline

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

SOT38-4

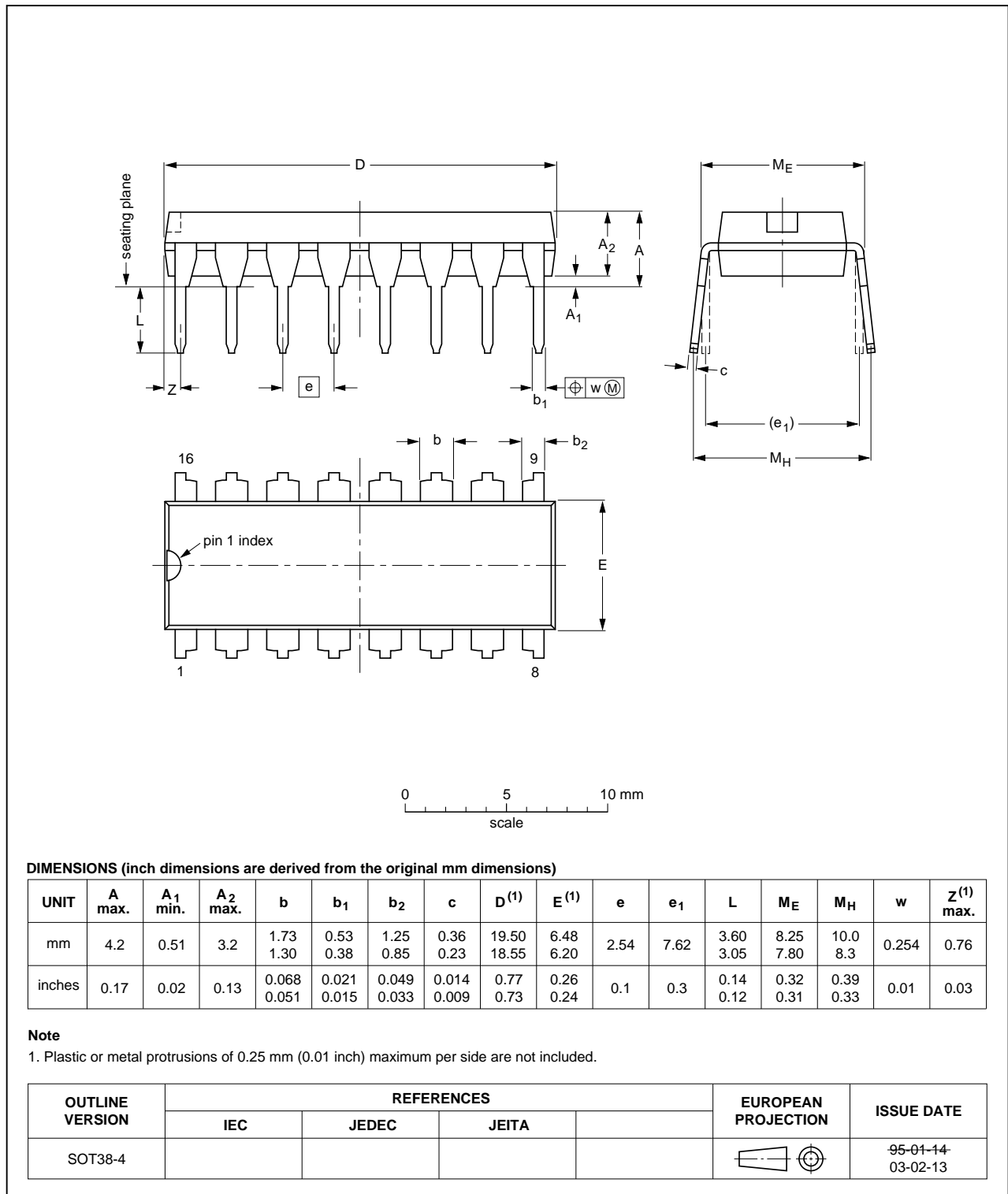


Fig 8. Package outline SOT38-4 (DIP16)

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

SOT109-1

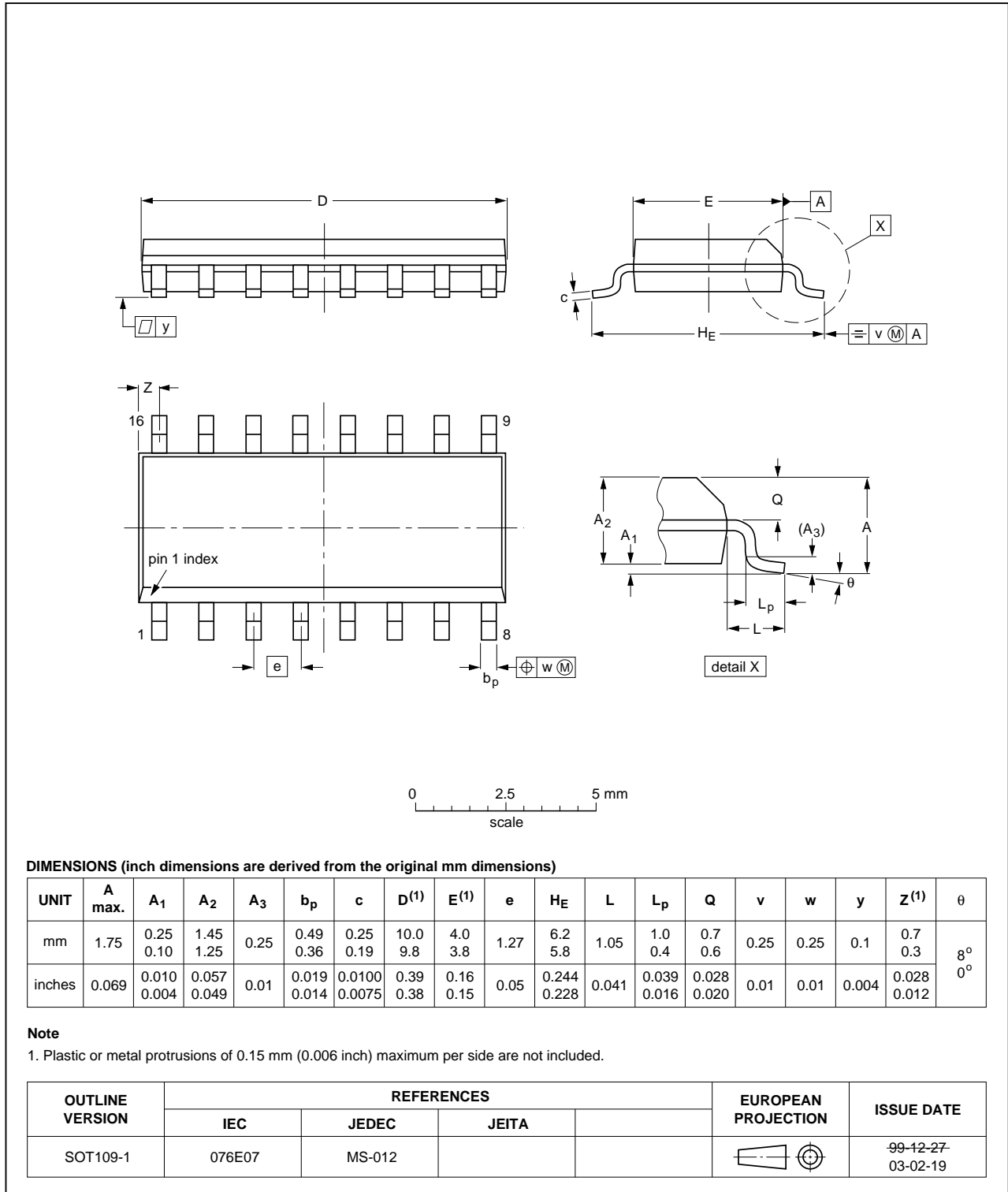


Fig 9. Package outline SOT109-1 (SO16)

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

SOT338-1

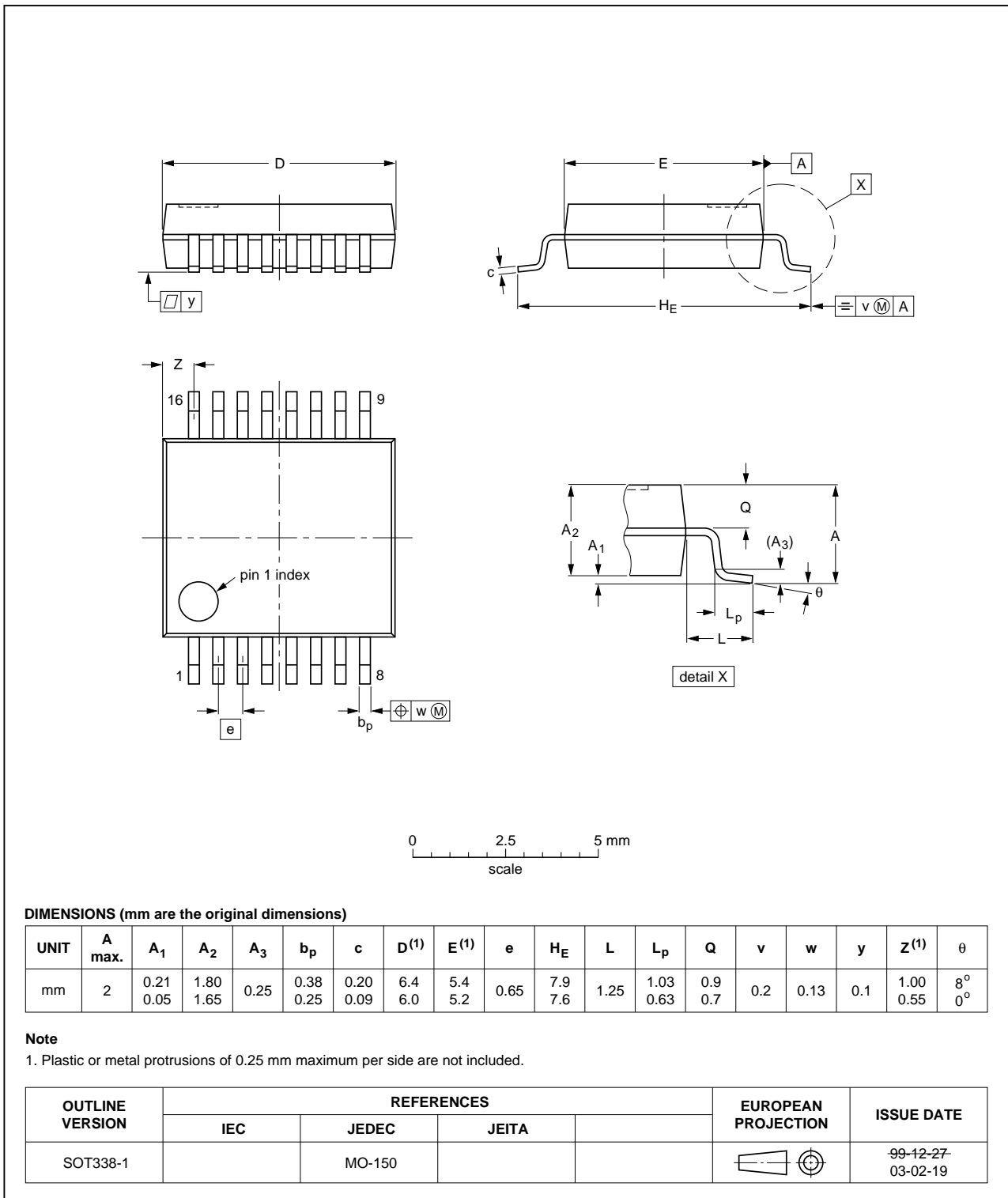


Fig 10. Package outline SOT338-1 (SSOP16)

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

SOT403-1

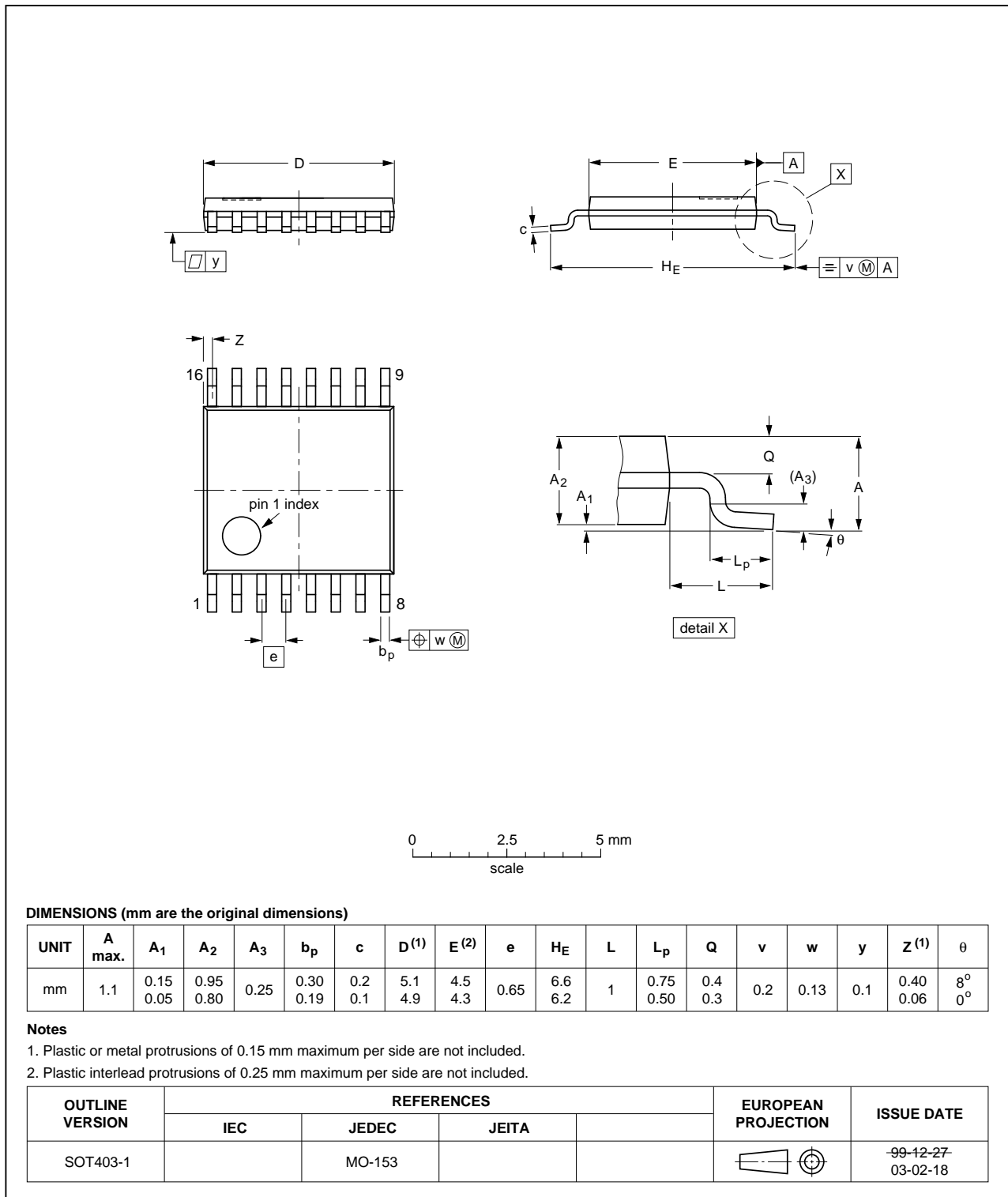


Fig 11. Package outline SOT403-1 (TSSOP16)

## 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
MIL	Military

## 14. Revision history

Table 11. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74HC_HCT151 v.4	20130211	Product data sheet	-	74HC_HCT151 v.3
Modifications:	• New descriptive title (errata).			
74HC_HCT151 v.3	20120919	Product data sheet	-	74HC_HCT151_CNV v.2
74HC_HCT151_CNV v.2	19970827	Product specification	-	

## 15. Legal information

### 15.1 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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