

# 74HC257; 74HCT257

Quad 2-input multiplexer; 3-state

Rev. 05 — 13 January 2010

Product data sheet

## 1. General description

The 74HC257; 74HCT257 are high-speed Si-gate CMOS devices and are pin compatible with Low-power Schottky TTL (LSTTL).

The 74HC257 and 74HCT257 have four identical 2-input multiplexers with 3-state outputs, which select 4 bits of data from two sources and are controlled by a common data select input (S).

The data inputs from source 0 (1I0 to 4I0) are selected when input S is LOW and the data inputs from source 1 (1I1 to 4I1) are selected when S is HIGH. Data appears at the outputs (1Y to 4Y) in true (non-inverting) form from the selected inputs.

The 74HC257 and 74HCT257 are the logic implementation of a 4-pole, 2-position switch, where the position of the switch is determined by the logic levels applied to S. The outputs are forced to a high-impedance OFF-state when  $\overline{OE}$  is HIGH.

The logic equations for the outputs are:

$$1\bar{Y} = \overline{OE} \cdot (1I1 \cdot S \cdot 1I0 \cdot \bar{S})$$

$$2\bar{Y} = \overline{OE} \cdot (2I1 \cdot S \cdot 2I0 \cdot \bar{S})$$

$$3\bar{Y} = \overline{OE} \cdot (3I1 \cdot S \cdot 3I0 \cdot \bar{S})$$

$$4\bar{Y} = \overline{OE} \cdot (4I1 \cdot S \cdot 4I0 \cdot \bar{S})$$

Except for their non-inverting (true) outputs the 74HC257; 74HCT257 are identical to the 74HC258.

## 2. Features

- Non-inverting data path
- 3-state outputs interface directly with system bus
- Complies with JEDEC standard no. 7A
- ESD protection:
  - ◆ HBM JESD22-A114E exceeds 2000 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			Version
	Temperature range	Name	Description	
74HC257N 74HCT257N	-40 °C to +125 °C	DIP16	plastic dual in-line package; 16 leads (300 mil)	SOT38-4
74HC257D 74HCT257D	-40 °C to +125 °C	SO16	plastic small outline package; 16 leads; body width 3.9 mm	SOT109-1
74HC257DB 74HCT257DB	-40 °C to +125 °C	SSOP16	plastic shrink small outline package; 16 leads; body width 5.3 mm	SOT338-1
74HC257PW 74HCT257PW	-40 °C to +125 °C	TSSOP16	plastic thin shrink small outline package; 16 leads; body width 4.4 mm	SOT403-1

## 4. Functional diagram

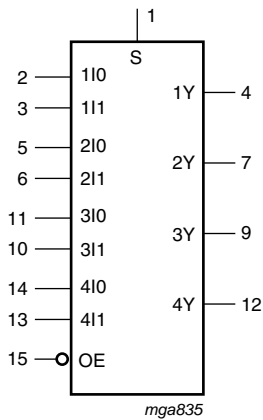


Fig 1. Logic symbol

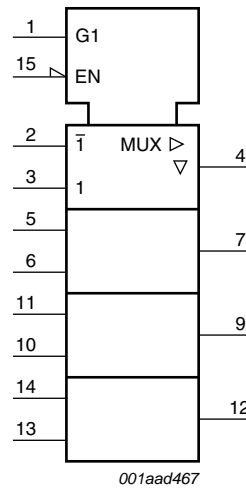


Fig 2. IEC logic symbol

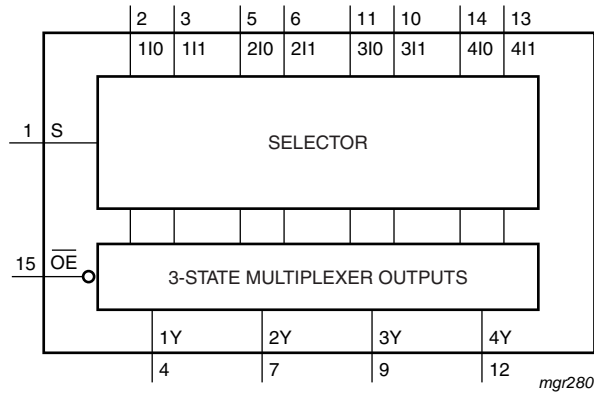


Fig 3. Functional diagram

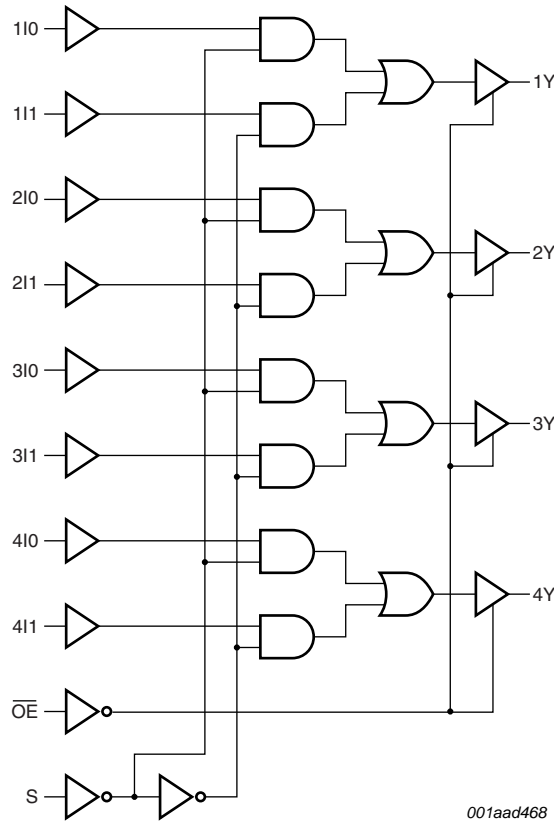


Fig 4. Logic diagram

## 5. Pinning information

### 5.1 Pinning

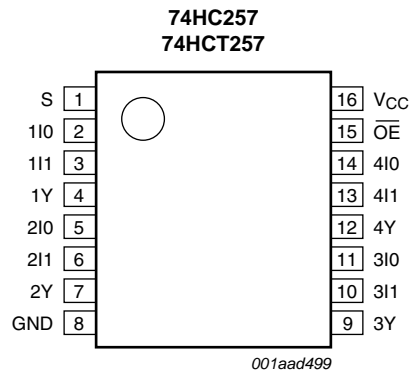


Fig 5. Pin configuration DIP16, SO16, SSOP16 and TSSOP16

### 5.2 Pin description

Table 2. Pin description

Symbol	Pin	Description
S	1	common data select input
1I0 to 4I0	2, 5, 11, 14	data input from source 0
1I1 to 4I1	3, 6, 10, 13	data input from source 1
1Y to 4Y	4, 7, 9, 12	3-state multiplexer output
GND	8	ground (0 V)
$\overline{OE}$	15	3-state output enable input (active LOW)
V <sub>CC</sub>	16	supply voltage

## 6. Functional description

### 6.1 Function table

Table 3. Function table<sup>[1]</sup>

Control		Input		Output
$\overline{OE}$	S	nI0	nI1	nY
H	X	X	X	Z
L	H	X	L	L
L	H	X	H	H
L	L	L	X	L
L	L	H	X	H

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

## 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	$V_I < -0.5$ V or $V_I > V_{CC} + 0.5$ V	-	$\pm 20$	mA
$I_{OK}$	output clamping current	$V_O < -0.5$ V or $V_O > V_{CC} + 0.5$ V	-	$\pm 20$	mA
$I_O$	output current	$V_O = -0.5$ V to $V_{CC} + 0.5$ V	-	$\pm 35$	mA
$I_{CC}$	supply current		-	+70	mA
$I_{GND}$	ground current		-	-70	mA
$T_{stg}$	storage temperature		-65	+150	°C
$P_{tot}$	total power dissipation				
	DIP16 package		[1] -	750	mW
	SO16 package		[2] -	500	mW
	SSOP16 package		[3] -	500	mW
	TSSOP16 package		[3] -	500	mW

[1] For DIP16 packages: above 70 °C,  $P_{tot}$  derates linearly with 12 mW/K.

[2] For SO16 packages: above 70 °C,  $P_{tot}$  derates linearly with 8 mW/K.

[3] For SSOP16 and TSSOP16 packages: above 60 °C,  $P_{tot}$  derates linearly with 5.5 mW/K.

## 8. Recommended operating conditions

**Table 5. Recommended operating conditions**

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Type 74HC257</b>						
$V_{CC}$	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
$\Delta t/\Delta V$	input transition rise and fall rates	$V_{CC} = 2.0$ V	-	-	625	ns
		$V_{CC} = 4.5$ V	-	1.67	139	ns
		$V_{CC} = 6.0$ V	-	-	83	ns
$T_{amb}$	ambient temperature		-40	-	+125	°C
<b>Type 74HCT257</b>						
$V_{CC}$	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
$\Delta t/\Delta V$	input transition rise and fall rates	$V_{CC} = 4.5$ V	-	1.67	139	ns
$T_{amb}$	ambient temperature		-40	-	+125	°C

## 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>74HC257</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> = -6.0 mA; V <sub>CC</sub> = 4.5 V	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>								
		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> = 6.0 mA; V <sub>CC</sub> = 4.5 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> = 6.0 V	-	-	±0.1	-	±1.0	±1.0	±1.0	μA
		V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; V <sub>O</sub> = V <sub>CC</sub> or GND; V <sub>CC</sub> = 6.0 V	-	-	±0.5	-	±5.0	±10.0	±10.0	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	160	μA
C <sub>i</sub>	input capacitance		-	3.5	-					pF
<b>74HCT257</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
V <sub>OL</sub>	LOW-level output voltage	I <sub>O</sub> = -6 mA	3.98	4.32	-	3.84	-	3.7	-	V
		V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; V <sub>CC</sub> = 4.5 V				-	0.1	-	0.1	
		I <sub>O</sub> = 20 μA	-	0	0.1	-	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	-	±5.0	-	±10	μA
		I <sub>O</sub> = 6.0 mA	-	0.15	0.26	-	±1.0	-	±1.0	V

**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 <sub>oZ</sub>	OFF-state output current	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; V <sub>CC</sub> = 5.5 V; V <sub>O</sub> = V <sub>CC</sub> or GND per input pin; other inputs at V <sub>CC</sub> or GND; I <sub>O</sub> = 0 A	-	-	±0.5	-	80	-	160	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					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; nI0, nI1 inputs	-	40	144	-	180	-	196	μA
		per input pin; $\overline{\text{OE}}$ input	-	135	486	-	608	-	662	μA
		per input pin; S input	-	70	252	-	315	-	343	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); For test circuit see [Figure 8](#).

Symbol	Parameter	Conditions	25 °C		-40 °C to +85 °C	-40 °C to +125 °C	Unit
			Typ	Max	Max	Max	

### 74HC257

t <sub>pd</sub>	propagation delay	nI0 to nY or nI1 to nY; see <a href="#">Figure 6</a>						
		V <sub>CC</sub> = 2.0 V	36	110	140	165	ns	
		V <sub>CC</sub> = 4.5 V	13	22	28	33	ns	
		V <sub>CC</sub> = 5.0 V; C <sub>L</sub> = 15 pF	11	-	-	-	ns	
		V <sub>CC</sub> = 6.0 V	10	19	24	28	ns	
		S to nY; see <a href="#">Figure 6</a>						
		V <sub>CC</sub> = 2.0 V	47	150	190	225	ns	
		V <sub>CC</sub> = 4.5 V	17	30	38	45	ns	
		V <sub>CC</sub> = 5.0 V; C <sub>L</sub> = 15 pF	14	-	-	-	ns	
		V <sub>CC</sub> = 6.0 V	14	26	33	38	ns	
t <sub>en</sub>	enable time	$\overline{\text{OE}}$ to nY; see <a href="#">Figure 7</a>						
		V <sub>CC</sub> = 2.0 V	33	150	190	225	ns	
		V <sub>CC</sub> = 4.5 V	12	30	38	45	ns	
		V <sub>CC</sub> = 6.0 V	10	26	33	38	ns	
t <sub>dis</sub>	disable time	$\overline{\text{OE}}$ to nY; see <a href="#">Figure 7</a>						
		V <sub>CC</sub> = 2.0 V	41	150	190	225	ns	
		V <sub>CC</sub> = 4.5 V	15	30	38	45	ns	
		V <sub>CC</sub> = 6.0 V	12	26	33	38	ns	

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

Voltages are referenced to GND (ground = 0 V); For test circuit see [Figure 8](#).

Symbol	Parameter	Conditions	25 °C		-40 °C to +85 °C	-40 °C to +125 °C	Unit
			Typ	Max	Max	Max	
t <sub>t</sub>	transition time	see <a href="#">Figure 6</a> <span style="float:right">[4]</span>					
		V <sub>CC</sub> = 2.0 V	14	60	75	90	ns
		V <sub>CC</sub> = 4.5 V	5	12	15	18	ns
		V <sub>CC</sub> = 6.0 V	4	10	13	15	ns
C <sub>PD</sub>	power dissipation capacitance	per multiplexer; V <sub>I</sub> = GND to V <sub>CC</sub> <span style="float:right">[5]</span>	45	-			pF
<b>74HCT257</b>							
t <sub>pd</sub>	propagation delay	nI0 to nY or nI1 to nY; see <a href="#">Figure 6</a> <span style="float:right">[1]</span>					
		V <sub>CC</sub> = 4.5 V	16	30	38	45	ns
		V <sub>CC</sub> = 5.0 V; C <sub>L</sub> = 15 pF	13	-	-		ns
		S to nY; see <a href="#">Figure 6</a>					
		V <sub>CC</sub> = 4.5 V	20	35	44	53	ns
		V <sub>CC</sub> = 5.0 V; C <sub>L</sub> = 15 pF	17	-			ns
t <sub>en</sub>	enable time	$\overline{OE}$ to nY; V <sub>CC</sub> = 4.5 V; see <a href="#">Figure 7</a> <span style="float:right">[2]</span>	15	30	38	45	ns
t <sub>dis</sub>	disable time	$\overline{OE}$ to nY; V <sub>CC</sub> = 4.5 V; see <a href="#">Figure 7</a> <span style="float:right">[3]</span>	16	30	38	45	ns
t <sub>t</sub>	transition time	V <sub>CC</sub> = 4.5 V; see <a href="#">Figure 6</a> <span style="float:right">[4]</span>	5	12	15	18	ns
C <sub>PD</sub>	power dissipation capacitance	per multiplexer; V <sub>I</sub> = GND to V <sub>CC</sub> <span style="float:right">[5]</span>	45	-			pF

[1] t<sub>pd</sub> is the same as t<sub>PHL</sub>, t<sub>PLH</sub>.

[2] t<sub>en</sub> is the same as t<sub>PZH</sub>, t<sub>PZL</sub>.

[3] t<sub>dis</sub> is the same as t<sub>PHZ</sub>, t<sub>PLZ</sub>.

[4] t<sub>t</sub> is the same as t<sub>THL</sub>, t<sub>TLH</sub>.

[5] C<sub>PD</sub> is used to determine the dynamic power dissipation (P<sub>D</sub> in μW).

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

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;

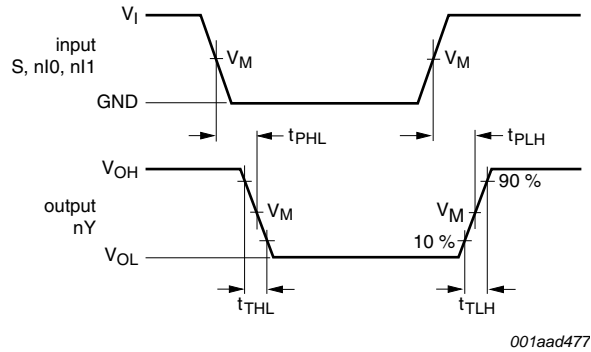
V<sub>CC</sub> = supply voltage in V;

N = number of inputs switching;

∑(C<sub>L</sub> × V<sub>CC</sub><sup>2</sup> × f<sub>o</sub>) = sum of outputs.

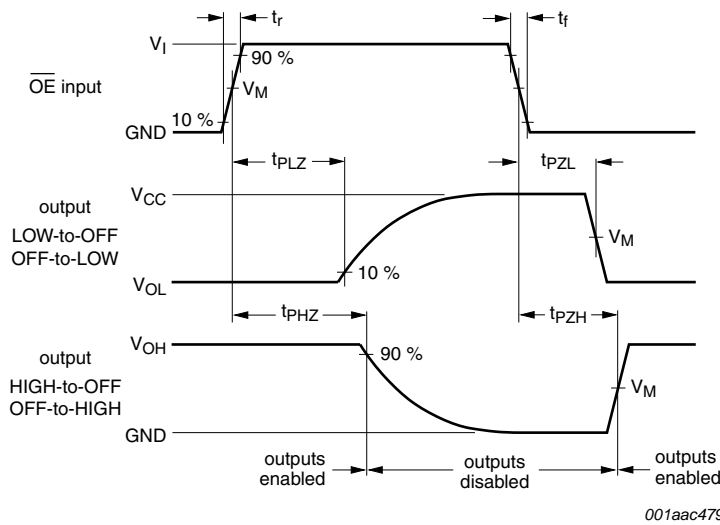


11. Waveforms



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

**Fig 6. Propagation delays input (S, nI0, nI1) to output (nY) and output (nY) transition times**

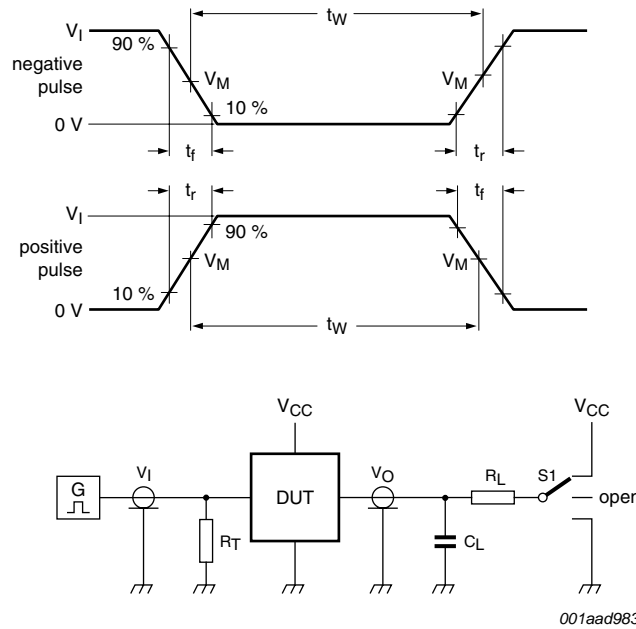


Measurement points are given in [Table 8](#).  
 $V_{OL}$  and  $V_{OH}$  are typical voltage output levels that occur with the output load.

**Fig 7. 3-state output enable and disable times**

**Table 8. Measurement points**

Type	Input	Output
	$V_M$	$V_M$
74HC257	$0.5V_{CC}$	$0.5V_{CC}$
74HCT257	1.3 V	1.3 V



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

**Fig 8. Test circuit for switching times**

**Table 9. Test data**

Type	Input		Load		Switch position		
	$V_I$	$t_r, t_f$	$C_L$	$R_L$	$t_{PHL}, t_{PLH}$	$t_{PZH}, t_{PHZ}$	$t_{PZL}, t_{PLZ}$
74HC257	$V_{CC}$	6 ns	50 pF	1 k $\Omega$	open	GND	$V_{CC}$
74HCT257	3 V	6 ns	50 pF	1 k $\Omega$	open	GND	$V_{CC}$

12. Package outline

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

SOT38-4

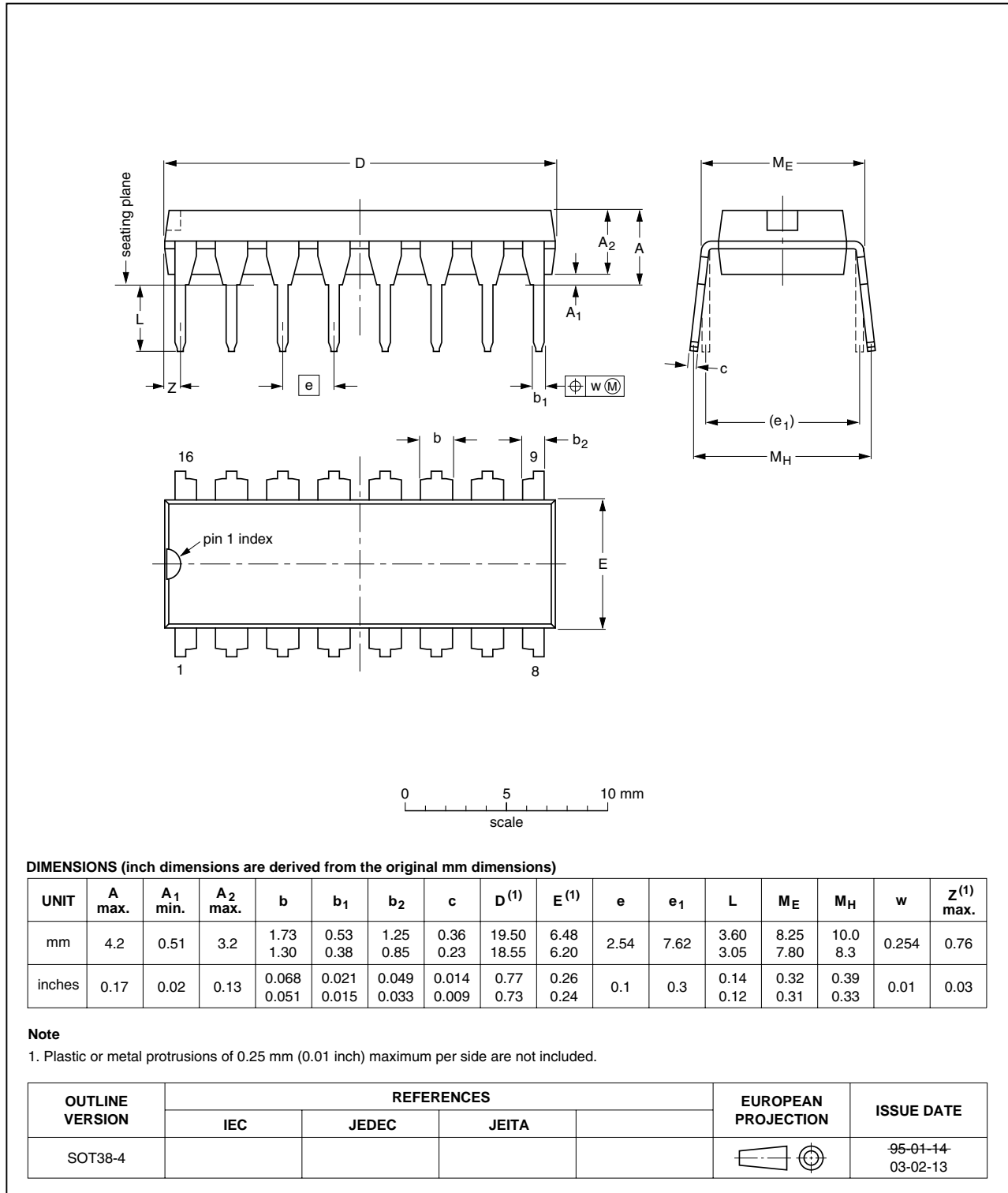


Fig 9. Package outline SOT38-4 (DIP16)

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

SOT109-1

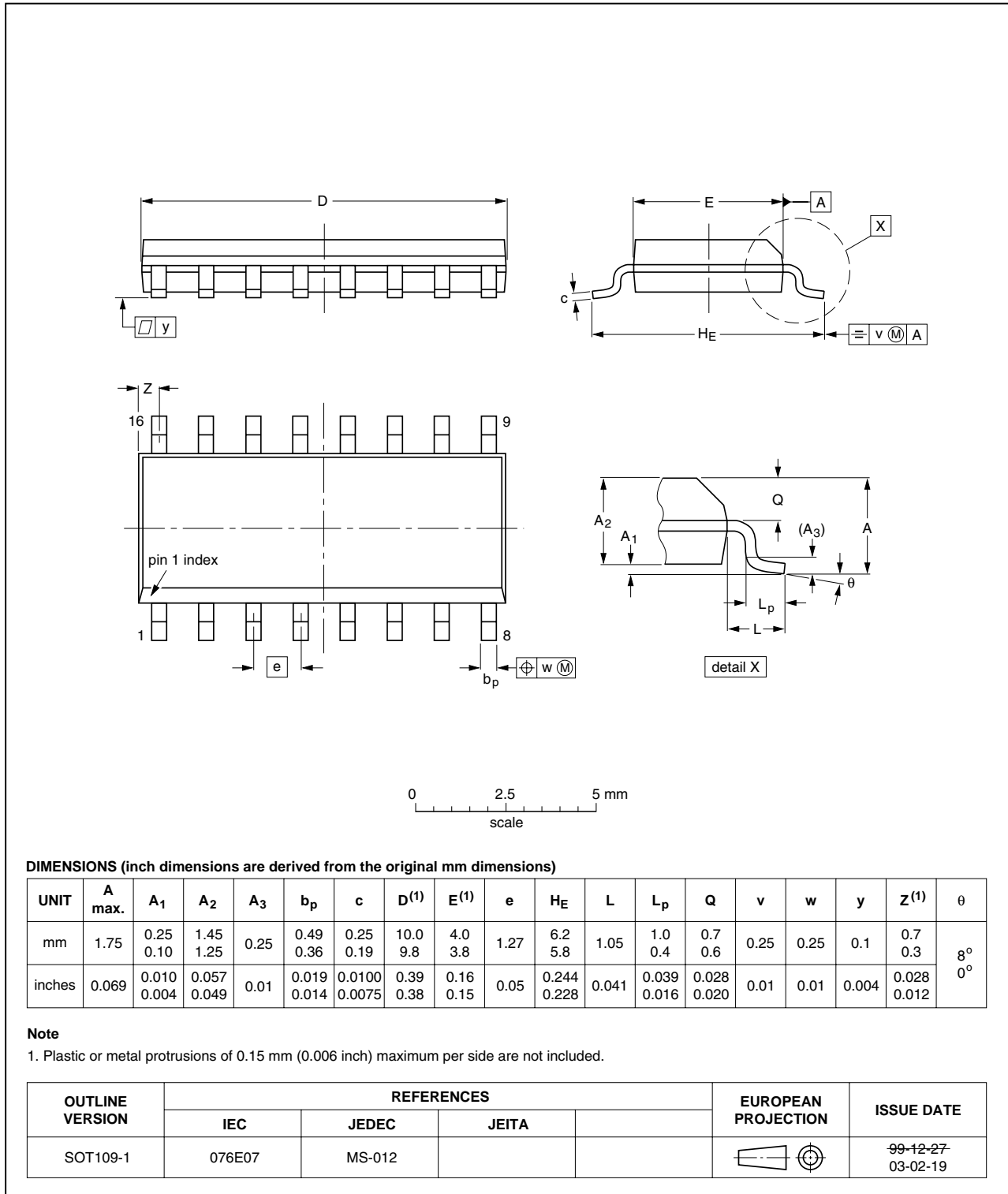


Fig 10. Package outline SOT109-1 (SO16)

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

SOT338-1

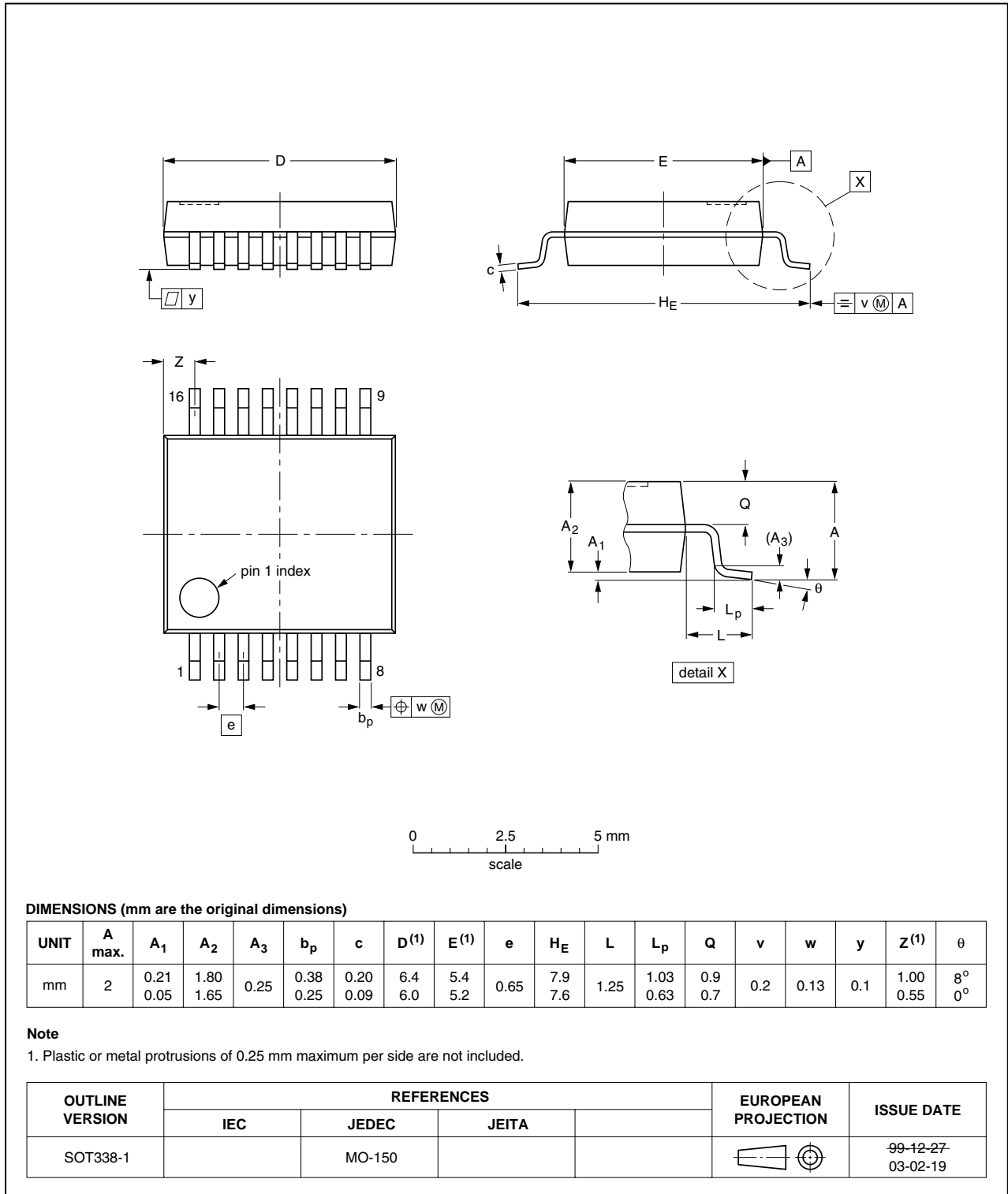


Fig 11. Package outline SOT338-1 (SSOP16)

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

SOT403-1

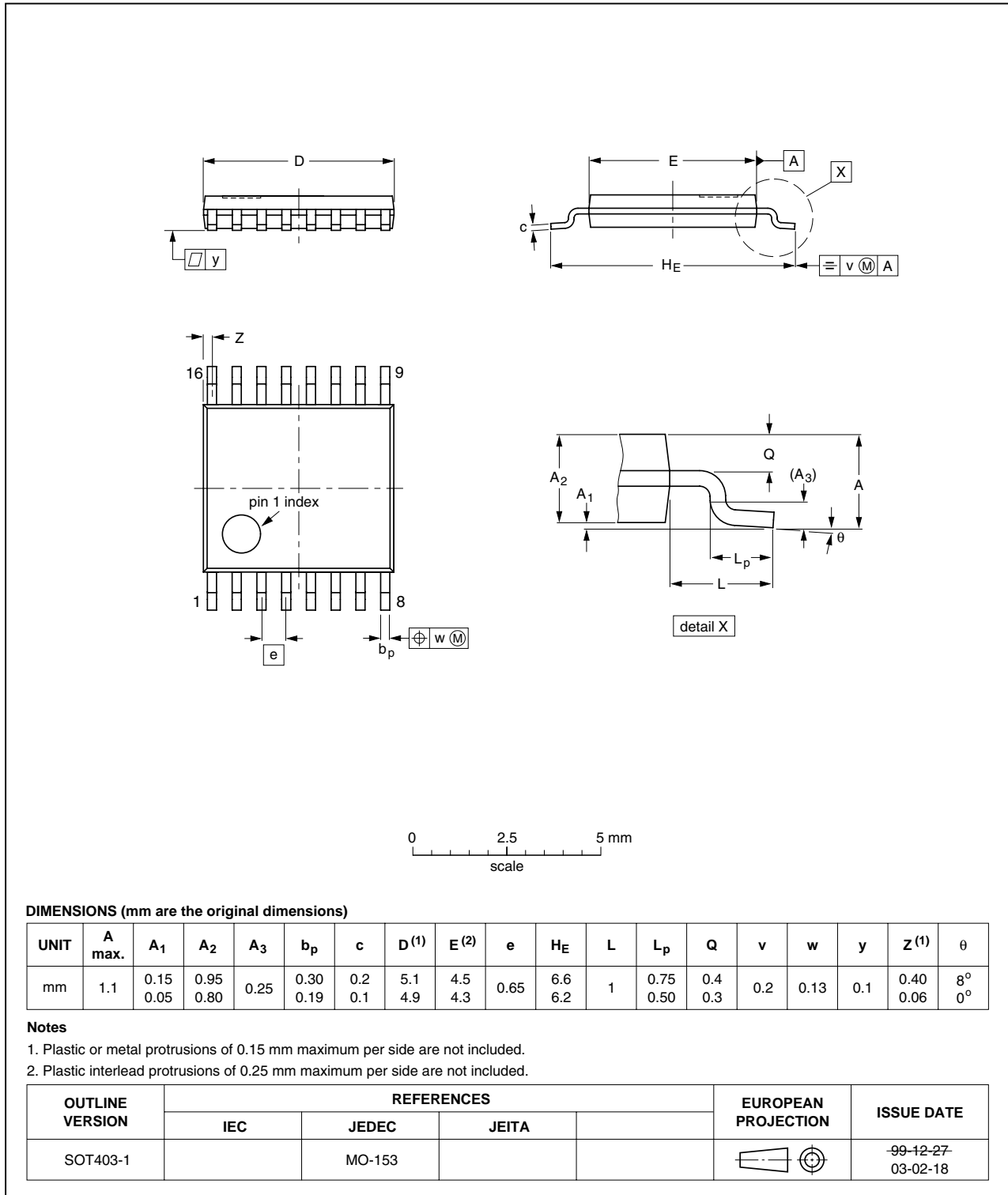


Fig 12. Package outline SOT403-1 (TSSOP16)

## 13. Revision history

Table 10. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74HC_HCT257_5	20100113	Product data sheet	-	74HC_HCT257_4
Modifications:	• <a href="#">Table 7 "Dynamic characteristics"</a> : changed $\overline{3OE}$ to $\overline{OE}$			
74HC_HCT257_4	20090608	Product data sheet	-	74HC_HCT257_3
74HC_HCT257_3	20050920	Product data sheet	-	74HC_HCT257_CNV_2
74HC_HCT257_CNV_2	19980930	Product specification	-	-

## 14. Legal information

### 14.1 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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