

# 74HC237

## 3-to-8 line decoder, demultiplexer with address latches

Rev. 4 — 10 January 2011

Product data sheet

### 1. General description

The 74HC237 is a high-speed Si-gate CMOS device and is pin compatible with low power Schottky TTL (LSTTL). The 74HC237 is specified in compliance with JEDEC standard no. 7A.

The 74HC237 is a 3-to-8 line decoder, demultiplexer with latches at the three address inputs (An). The 74HC237 essentially combines the 3-to-8 decoder function with a 3-bit storage latch. When the latch is enabled ( $\overline{LE} = \text{LOW}$ ), the 74HC237 acts as a 3-to-8 active LOW decoder. When the latch enable ( $\overline{LE}$ ) goes from LOW-to-HIGH, the last data present at the inputs before this transition, is stored in the latches. Further address changes are ignored as long as  $\overline{LE}$  remains HIGH. The output enable input ( $\overline{E1}$  and  $E2$ ) controls the state of the outputs independent of the address inputs or latch operation. All outputs are HIGH unless  $\overline{E1}$  is LOW and  $E2$  is HIGH. The 74HC237 is ideally suited for implementing non-overlapping decoders in 3-state systems and strobed (stored address) applications in bus oriented systems.

### 2. Features and benefits

- Combines 3-to-8 decoder with 3-bit latch
- Multiple input enable for easy expansion or independent controls
- Active HIGH mutually exclusive outputs
- Low-power dissipation
- 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
74HC237N	$-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$	DIP16	plastic dual in-line package; 16 leads (300 mil)	SOT38-4
74HC237D	$-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$	SO16	plastic small outline package; 16 leads; body width 3.9 mm	SOT109-1
74HC237DB	$-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$	SSOP16	plastic shrink small outline package; 16 leads; body width 5.3 mm	SOT338-1



### 4. Functional diagram

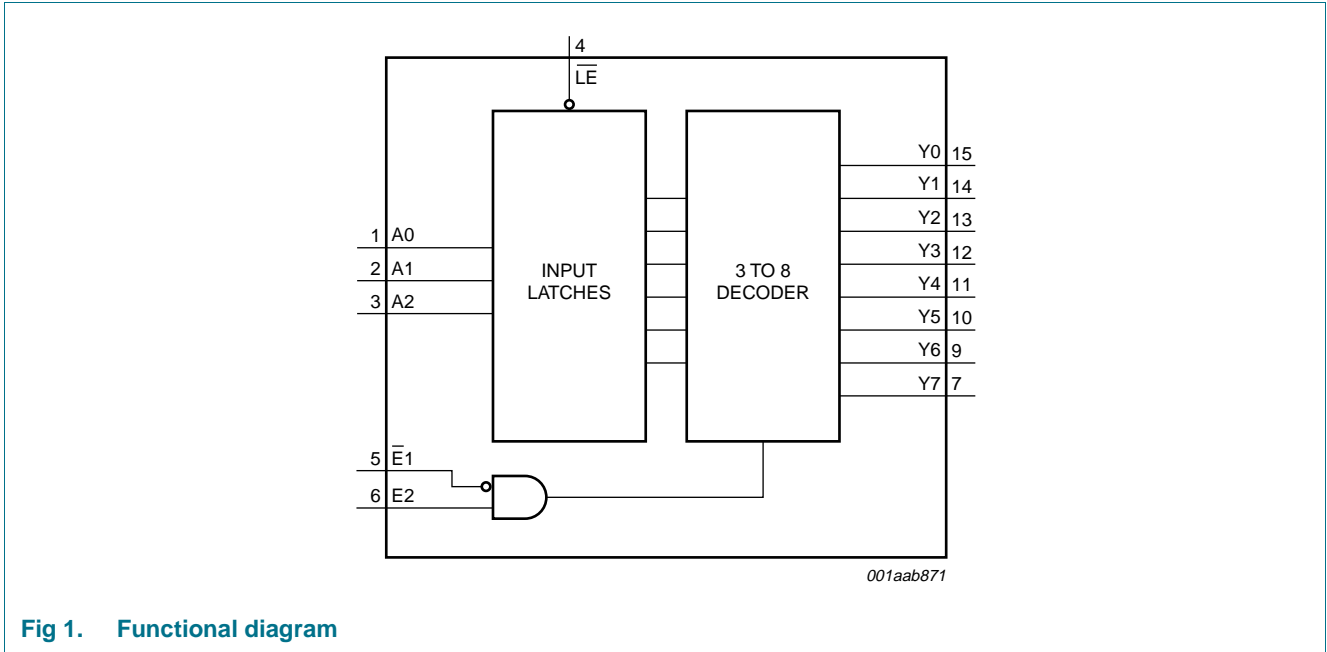


Fig 1. Functional diagram

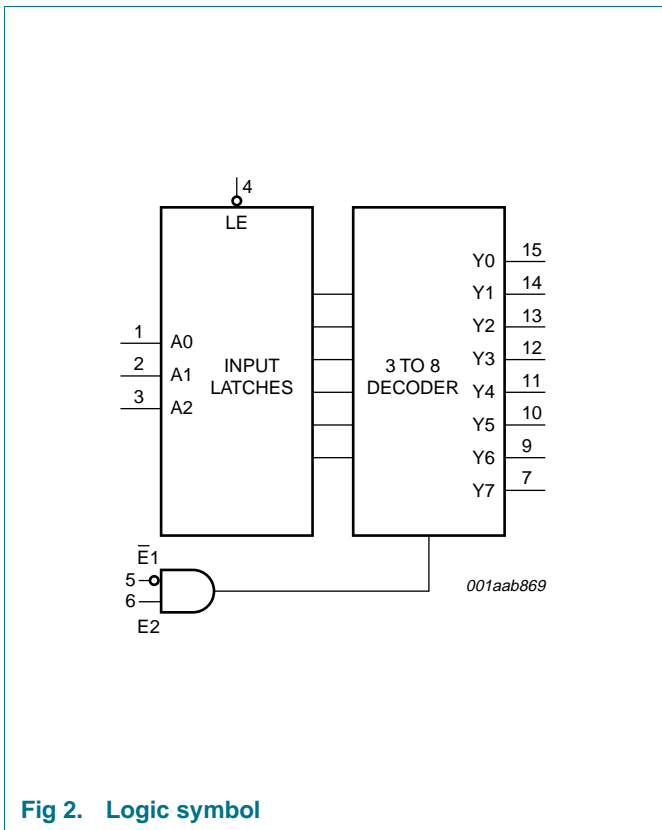


Fig 2. Logic symbol

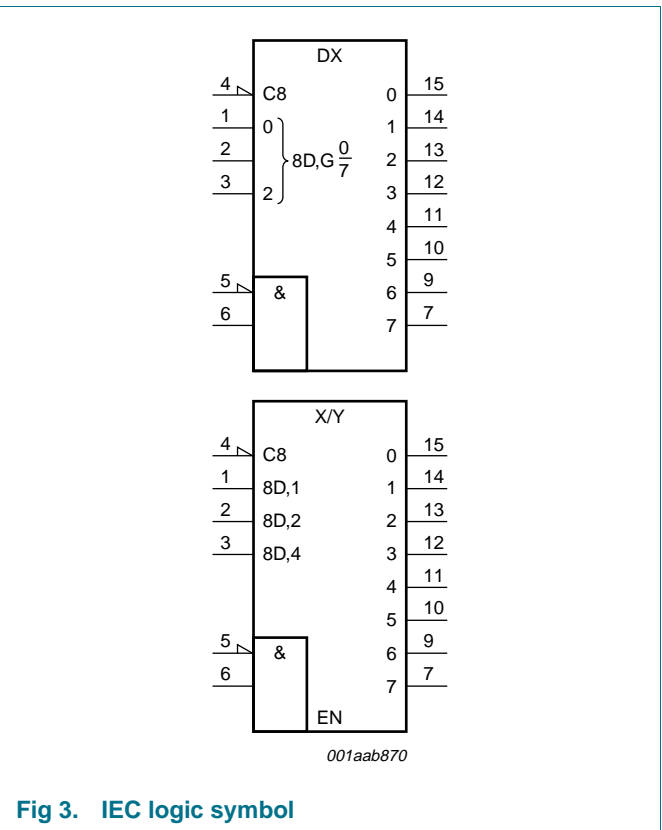


Fig 3. IEC logic symbol

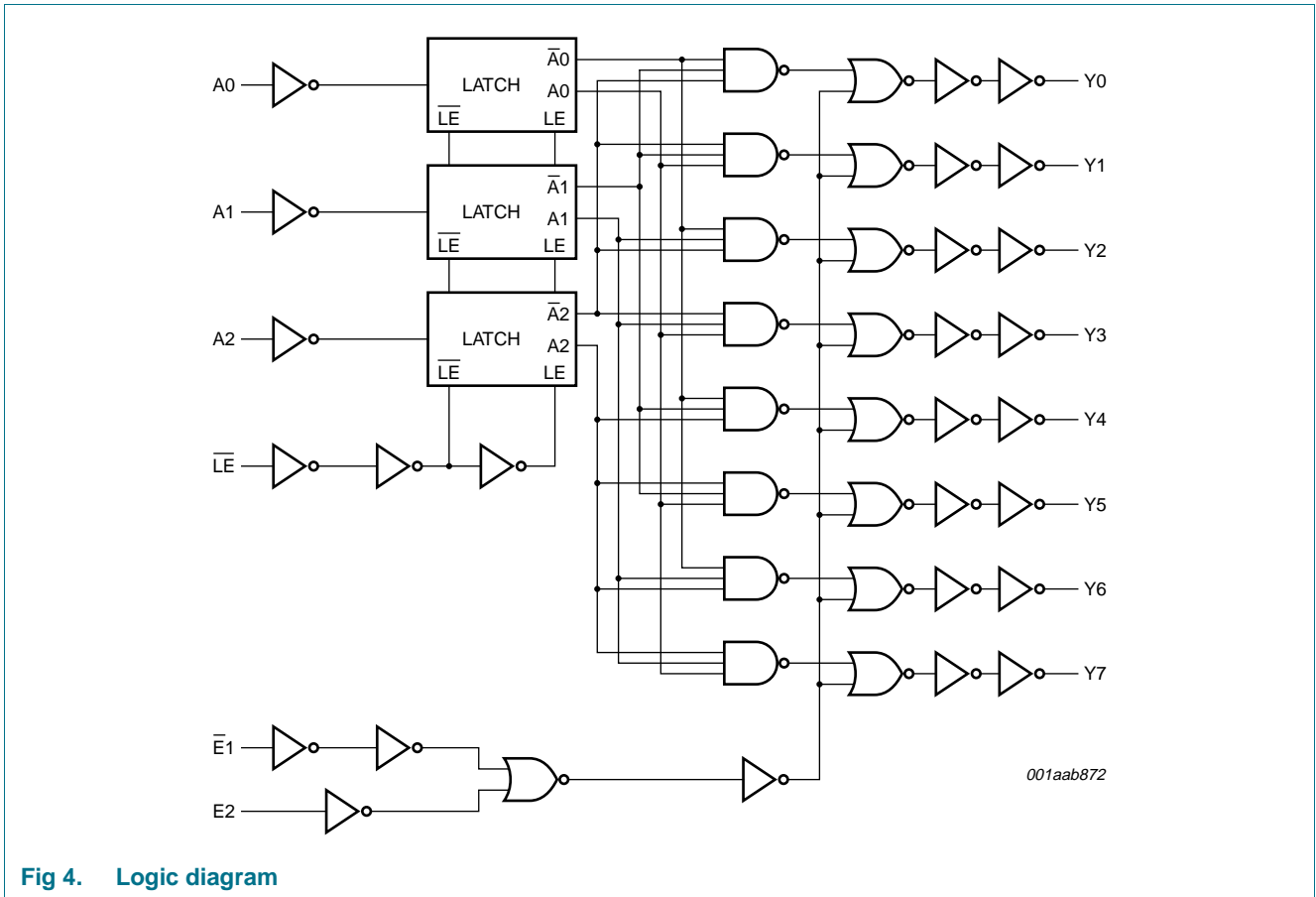


Fig 4. Logic diagram

## 5. Pinning information

### 5.1 Pinning

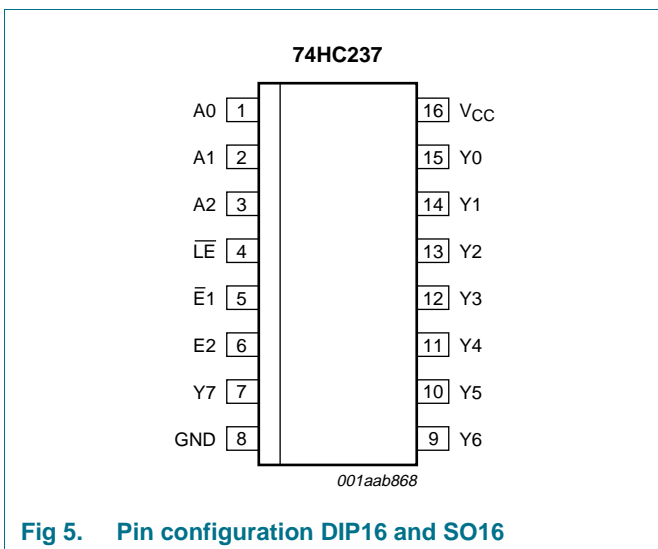


Fig 5. Pin configuration DIP16 and SO16

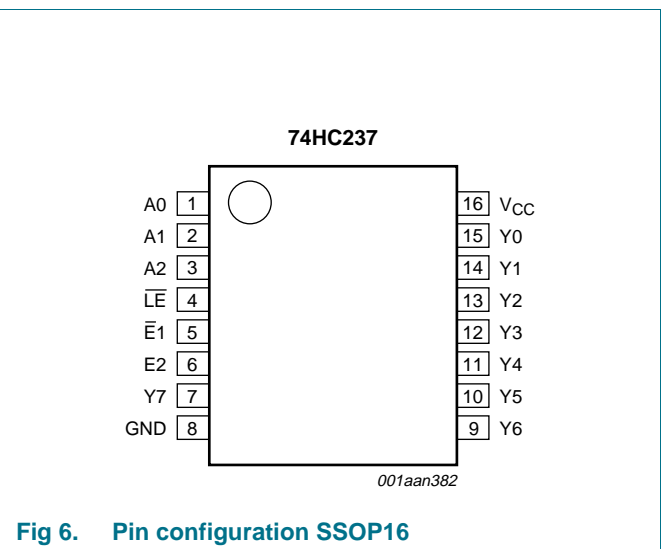


Fig 6. Pin configuration SSOP16

## 5.2 Pin description

Table 2. Pin description

Symbol	Pin	Description
A0 to A2	1, 2, 3	data input
$\overline{LE}$	4	latch enable input (active LOW)
$\overline{E1}$	5	data enable input 1 (active LOW)
E2	6	data enable input 2 (active HIGH)
Y0 to Y7	15, 14, 13, 12, 11, 10, 9, 7	output
GND	8	ground (0 V)
V <sub>CC</sub>	16	supply voltage

## 6. Functional description

Table 3: Function table

Enable			Input			Output							
$\overline{LE}$	$\overline{E1}$	E2	A0	A1	A2	Y0	Y1	Y2	Y3	Y4	Y5	Y6	Y7
H	L	H	X	X	X	stable							
X	H	X	X	X	X	L	L	L	L	L	L	L	L
X	X	L	X	X	X	L	L	L	L	L	L	L	L
L	L	H	L	L	L	H	L	L	L	L	L	L	L
			H	L	L	L	H	L	L	L	L	L	L
			L	H	L	L	L	H	L	L	L	L	L
			H	H	L	L	L	L	H	L	L	L	L
			L	L	H	L	L	L	L	H	L	L	L
			H	L	H	L	L	L	L	L	H	L	L
			L	H	H	L	L	L	L	L	L	H	L
			H	H	H	L	L	L	L	L	L	L	L

[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 <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	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	DIP16 package	[1]	-	750	mW
		SO16 and SSOP16 packages	[2]	-	500	mW

- [1] For DIP16 package:  $P_{tot}$  derates linearly with 12 mW/K above 70 °C.
- [2] For SO16 package:  $P_{tot}$  derates linearly with 8 mW/K above 70 °C.  
For SSOP16 package:  $P_{tot}$  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	Min	Typ	Max	Unit
$V_{CC}$	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
$T_{amb}$	ambient temperature		-40	+25	+125	°C
$\Delta t/\Delta V$	input transition rise and fall rate	$V_{CC} = 2.0\text{ V}$	-	-	625	ns/V
		$V_{CC} = 4.5\text{ V}$	-	1.67	139	ns/V
		$V_{CC} = 6.0\text{ V}$	-	-	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	$T_{amb} = 25\text{ °C}$			$T_{amb} = -40\text{ °C to }+85\text{ °C}$		$T_{amb} = -40\text{ °C to }+125\text{ °C}$		Unit
			Min	Typ	Max	Min	Max	Min	Max	
$V_{IH}$	HIGH-level input voltage	$V_{CC} = 2.0\text{ V}$	1.5	1.2	-	1.5	-	1.5	-	V
		$V_{CC} = 4.5\text{ V}$	3.15	2.4	-	3.15	-	3.15	-	V
		$V_{CC} = 6.0\text{ V}$	4.2	3.2	-	4.2	-	4.2	-	V
$V_{IL}$	LOW-level input voltage	$V_{CC} = 2.0\text{ V}$	-	0.8	0.5	-	0.5	-	0.5	V
		$V_{CC} = 4.5\text{ V}$	-	2.1	1.35	-	1.35	-	1.35	V
		$V_{CC} = 6.0\text{ V}$	-	2.8	1.8	-	1.8	-	1.8	V
$V_{OH}$	HIGH-level output voltage	$V_I = V_{IH}$ or $V_{IL}$								
		$I_O = -20\text{ }\mu\text{A}; V_{CC} = 2.0\text{ V}$	1.9	2.0	-	1.9	-	1.9	-	V
		$I_O = -20\text{ }\mu\text{A}; V_{CC} = 4.5\text{ V}$	4.4	4.5	-	4.4	-	4.4	-	V
		$I_O = -20\text{ }\mu\text{A}; V_{CC} = 6.0\text{ V}$	5.9	6.0	-	5.9	-	5.9	-	V
		$I_O = -4.0\text{ mA}; V_{CC} = 4.5\text{ V}$	3.98	4.32	-	3.84	-	3.7	-	V
	$I_O = -5.2\text{ mA}; V_{CC} = 6.0\text{ V}$	5.48	5.81	-	5.34	-	5.2	-	V	
$V_{OL}$	LOW-level output voltage	$V_I = V_{IH}$ or $V_{IL}$								
		$I_O = 20\text{ }\mu\text{A}; V_{CC} = 2.0\text{ V}$	-	0	0.1	-	0.1	-	0.1	V
		$I_O = 20\text{ }\mu\text{A}; V_{CC} = 4.5\text{ V}$	-	0	0.1	-	0.1	-	0.1	V
		$I_O = 20\text{ }\mu\text{A}; V_{CC} = 6.0\text{ V}$	-	0	0.1	-	0.1	-	0.1	V
		$I_O = 4.0\text{ mA}; V_{CC} = 4.5\text{ V}$	-	0.15	0.26	-	0.33	-	0.4	V
	$I_O = 5.2\text{ mA}; V_{CC} = 6.0\text{ V}$	-	0.16	0.26	-	0.33	-	0.4	V	

**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	
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

## 10. Dynamic characteristics

**Table 7. Dynamic characteristics**

Voltages are referenced to GND (ground = 0 V); C<sub>L</sub> = 50 pF unless otherwise specified; for test circuit see [Figure 10](#).

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	
t <sub>pd</sub>	propagation delay	An to Y <sub>n</sub> ; see <a href="#">Figure 7</a> <sup>[1]</sup>								
		V <sub>CC</sub> = 2.0 V	-	52	160	-	200	-	240	ns
		V <sub>CC</sub> = 4.5 V	-	19	32	-	40	-	48	ns
		V <sub>CC</sub> = 5 V; C <sub>L</sub> = 15 pF	-	16	-	-	-	-	-	ns
		V <sub>CC</sub> = 6.0 V	-	15	27	-	34	-	41	ns
		$\overline{LE}$ to Y <sub>n</sub> ; see <a href="#">Figure 7</a> <sup>[1]</sup>								
		V <sub>CC</sub> = 2.0 V	-	61	190	-	240	-	285	ns
		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
		V <sub>CC</sub> = 6.0 V	-	18	32	-	41	-	48	ns
		$\overline{E1}$ to Y <sub>n</sub> ; see <a href="#">Figure 8</a> <sup>[1]</sup>								
		V <sub>CC</sub> = 2.0 V	-	47	145	-	180	-	220	ns
		V <sub>CC</sub> = 4.5 V	-	17	29	-	36	-	44	ns
		V <sub>CC</sub> = 5 V; C <sub>L</sub> = 15 pF	-	14	-	-	-	-	-	ns
		V <sub>CC</sub> = 6.0 V	-	14	25	-	31	-	38	ns
		t <sub>t</sub>	transition time	E2 to Y <sub>n</sub> ; see <a href="#">Figure 7</a> <sup>[1]</sup>						
V <sub>CC</sub> = 2.0 V	-			47	145	-	180	-	220	ns
V <sub>CC</sub> = 4.5 V	-			17	29	-	36	-	44	ns
V <sub>CC</sub> = 5 V; C <sub>L</sub> = 15 pF	-			14	-	-	-	-	-	ns
V <sub>CC</sub> = 6.0 V	-			14	25	-	31	-	38	ns
Y <sub>n</sub> ; see <a href="#">Figure 7</a> and <a href="#">Figure 8</a> <sup>[2]</sup>										
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		

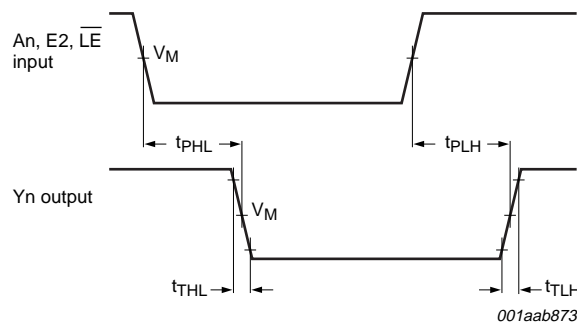
**Table 7. Dynamic characteristics ...continued**

Voltages are referenced to GND (ground = 0 V);  $C_L = 50 \text{ pF}$  unless otherwise specified; for test circuit see [Figure 10](#).

Symbol	Parameter	Conditions	$T_{\text{amb}} = 25 \text{ }^\circ\text{C}$			$T_{\text{amb}} = -40 \text{ }^\circ\text{C}$ to $+85 \text{ }^\circ\text{C}$		$T_{\text{amb}} = -40 \text{ }^\circ\text{C}$ to $+125 \text{ }^\circ\text{C}$		Unit
			Min	Typ	Max	Min	Max	Min	Max	
$t_W$	pulse width	$\overline{\text{LE}}$ HIGH; see <a href="#">Figure 9</a>								
		$V_{\text{CC}} = 2.0 \text{ V}$	50	11	-	65	-	75	-	ns
		$V_{\text{CC}} = 4.5 \text{ V}$	10	4	-	13	-	15	-	ns
		$V_{\text{CC}} = 6.0 \text{ V}$	9	3	-	11	-	13	-	ns
$t_{\text{su}}$	set-up time	An to $\overline{\text{LE}}$ ; see <a href="#">Figure 9</a>								
		$V_{\text{CC}} = 2.0 \text{ V}$	50	6	-	65	-	75	-	ns
		$V_{\text{CC}} = 4.5 \text{ V}$	10	2	-	13	-	15	-	ns
		$V_{\text{CC}} = 6.0 \text{ V}$	9	2	-	11	-	13	-	ns
$t_h$	hold time	An to $\overline{\text{LE}}$ ; see <a href="#">Figure 9</a>								
		$V_{\text{CC}} = 2.0 \text{ V}$	30	3	-	40	-	45	-	ns
		$V_{\text{CC}} = 4.5 \text{ V}$	6	1	-	8	-	9	-	ns
		$V_{\text{CC}} = 6.0 \text{ V}$	5	1	-	7	-	8	-	ns
$C_{\text{PD}}$	power dissipation capacitance	$C_L = 50 \text{ pF}$ ; $f = 1 \text{ MHz}$ ; $V_1 = \text{GND to } V_{\text{CC}}$	[3]	-	60	-	-	-	-	pF

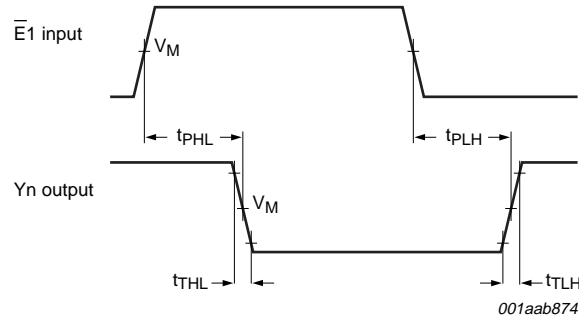
- [1]  $t_{\text{pd}}$  is the same as  $t_{\text{PLH}}$  and  $t_{\text{PHL}}$ .
- [2]  $t_t$  is the same as  $t_{\text{THL}}$  and  $t_{\text{TLH}}$ .
- [3]  $C_{\text{PD}}$  is used to determine the dynamic power dissipation ( $P_D$  in  $\mu\text{W}$ ).  
 $P_D = C_{\text{PD}} \times V_{\text{CC}}^2 \times f_i \times N + \sum(C_L \times V_{\text{CC}}^2 \times f_o)$  where:  
 $f_i$  = input frequency in MHz;  
 $f_o$  = output frequency in MHz;  
 $C_L$  = output load capacitance in pF;  
 $V_{\text{CC}}$  = supply voltage in V;  
 $N$  = number of inputs switching;  
 $\sum(C_L \times V_{\text{CC}}^2 \times f_o)$  = sum of outputs.

## 11. Waveforms



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

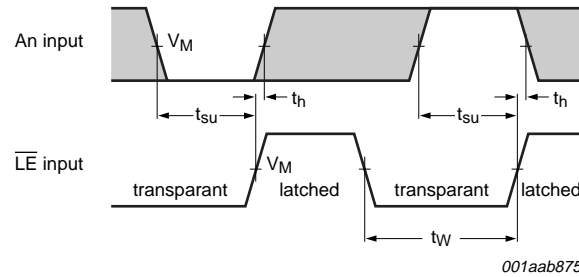
**Fig 7. Propagation delay input (An) and enable inputs (E2,  $\overline{\text{LE}}$ ) to output (Yn) and output transition time**



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

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

**Fig 8. Propagation enable inputs ( $\bar{E}1$ ) to output ( $Yn$ ) and output transition time**



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

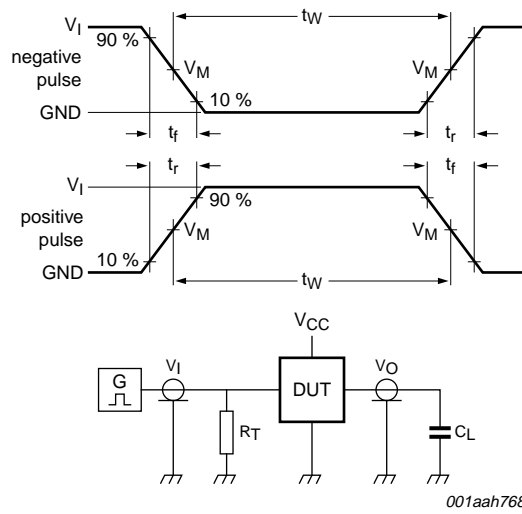
$V_{OL}$  and  $V_{OH}$  are typical voltage output levels that occur with the output load.

**Fig 9. The data input ( $A_n$ ) to latch enable input ( $\bar{LE}$ ) set-up times, latch enable input ( $\bar{LE}$ ) to data input ( $A_n$ ) hold times and latch enable input ( $\bar{LE}$ ) pulse width**

**Table 8. Measurement points**

Type	Input	Output
	$V_M$	$V_M$
74HC237	$0.5V_{CC}$	$0.5V_{CC}$





001aah768

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 10. Test circuit for measuring switching times**

**Table 9. Test data**

Type	Input		Load	Test
	$V_I$	$t_r, t_f$	$C_L$	
74HC237	$V_{CC}$	6.0 ns	15 pF, 50 pF	$t_{PLH}, t_{PHL}$

## 12. Application information

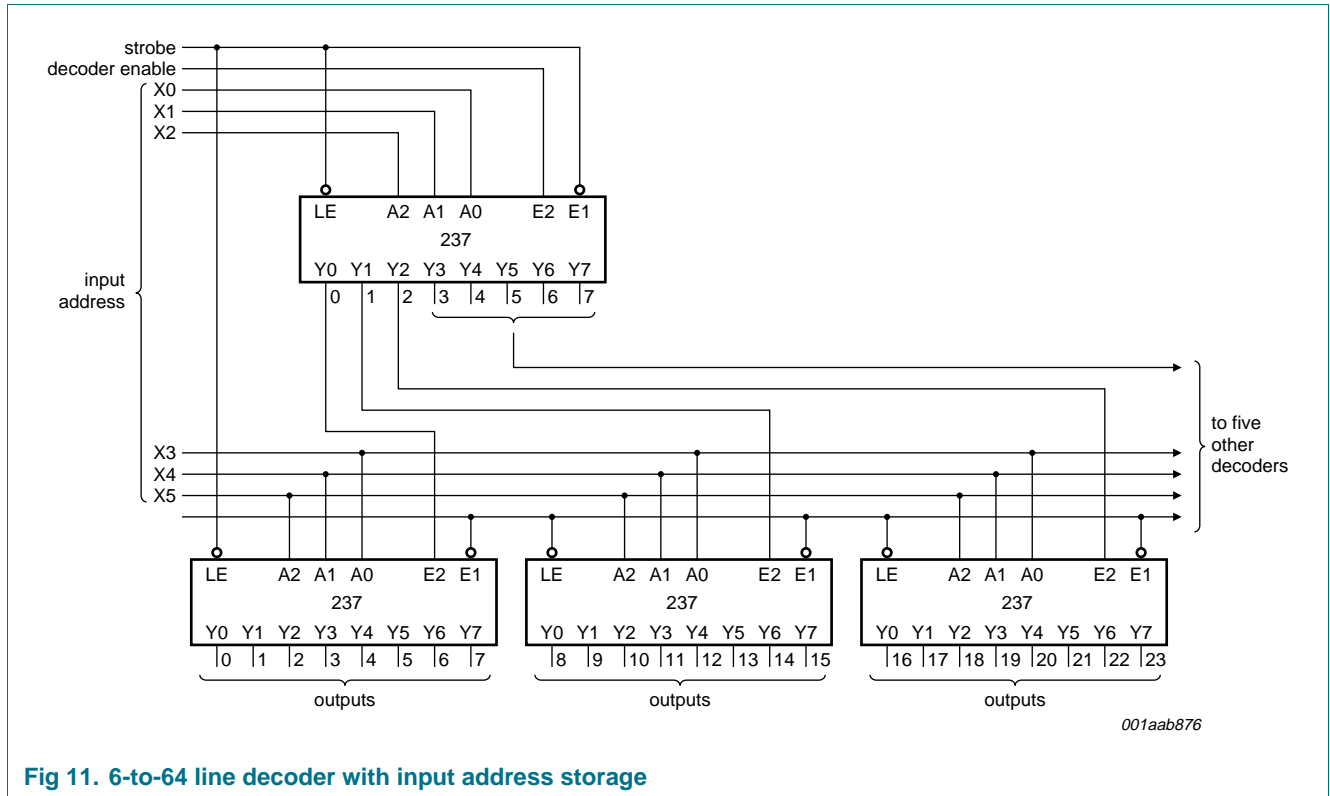


Fig 11. 6-to-64 line decoder with input address storage

13. Package outline

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

SOT38-4

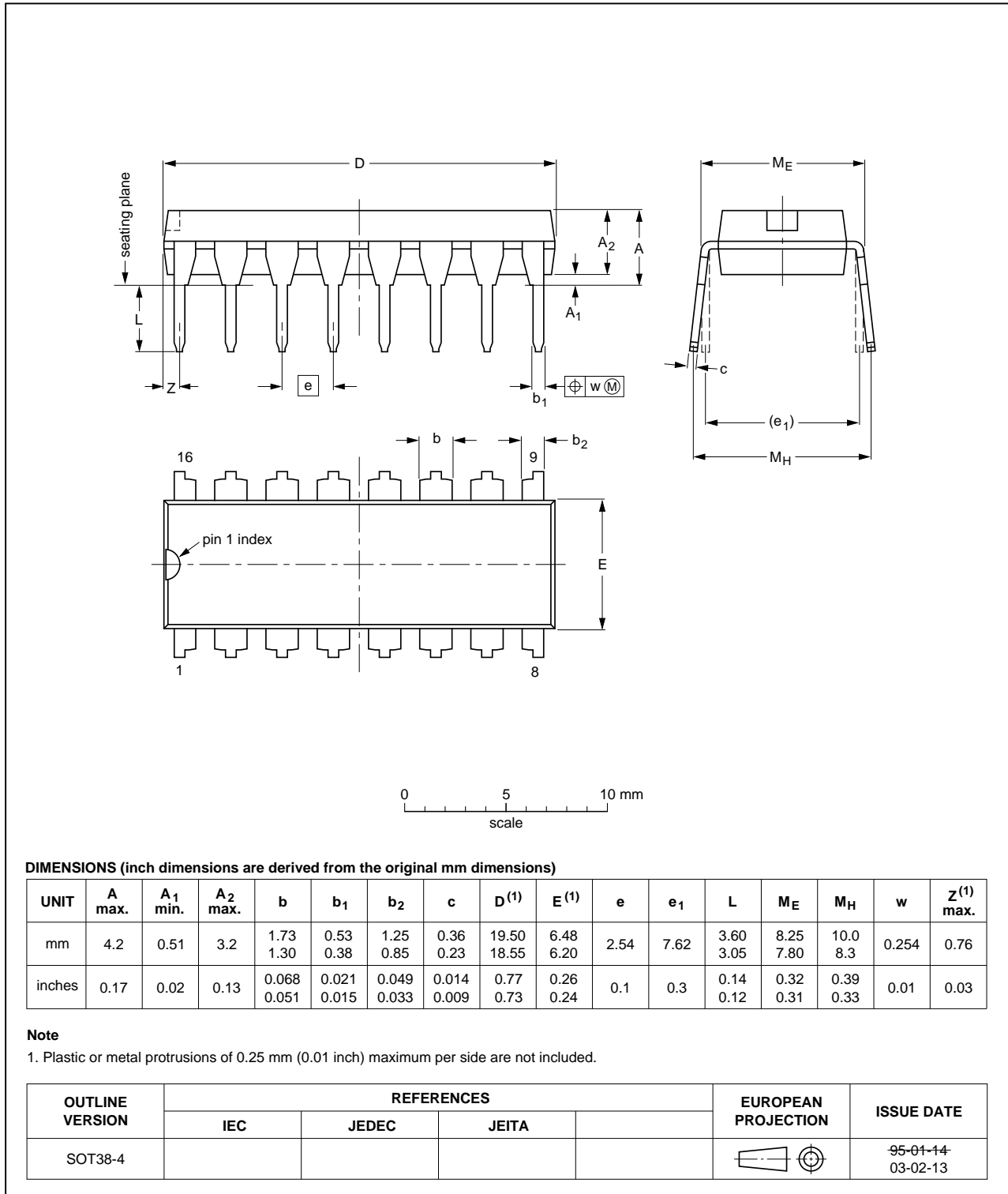


Fig 12. Package outline SOT38-4 (DIP16)

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

SOT109-1

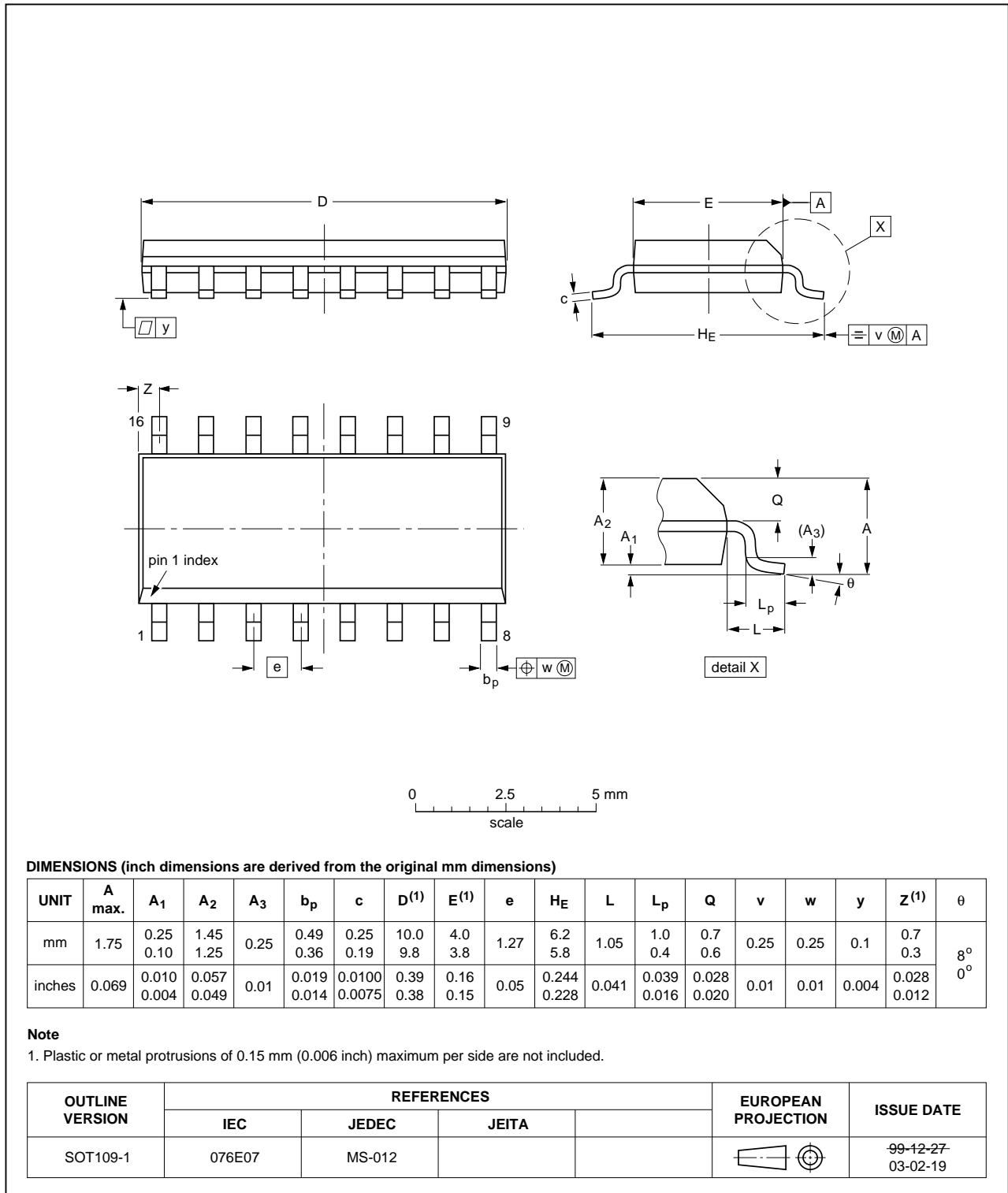


Fig 13. Package outline SOT109-1 (SO16)

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

SOT338-1

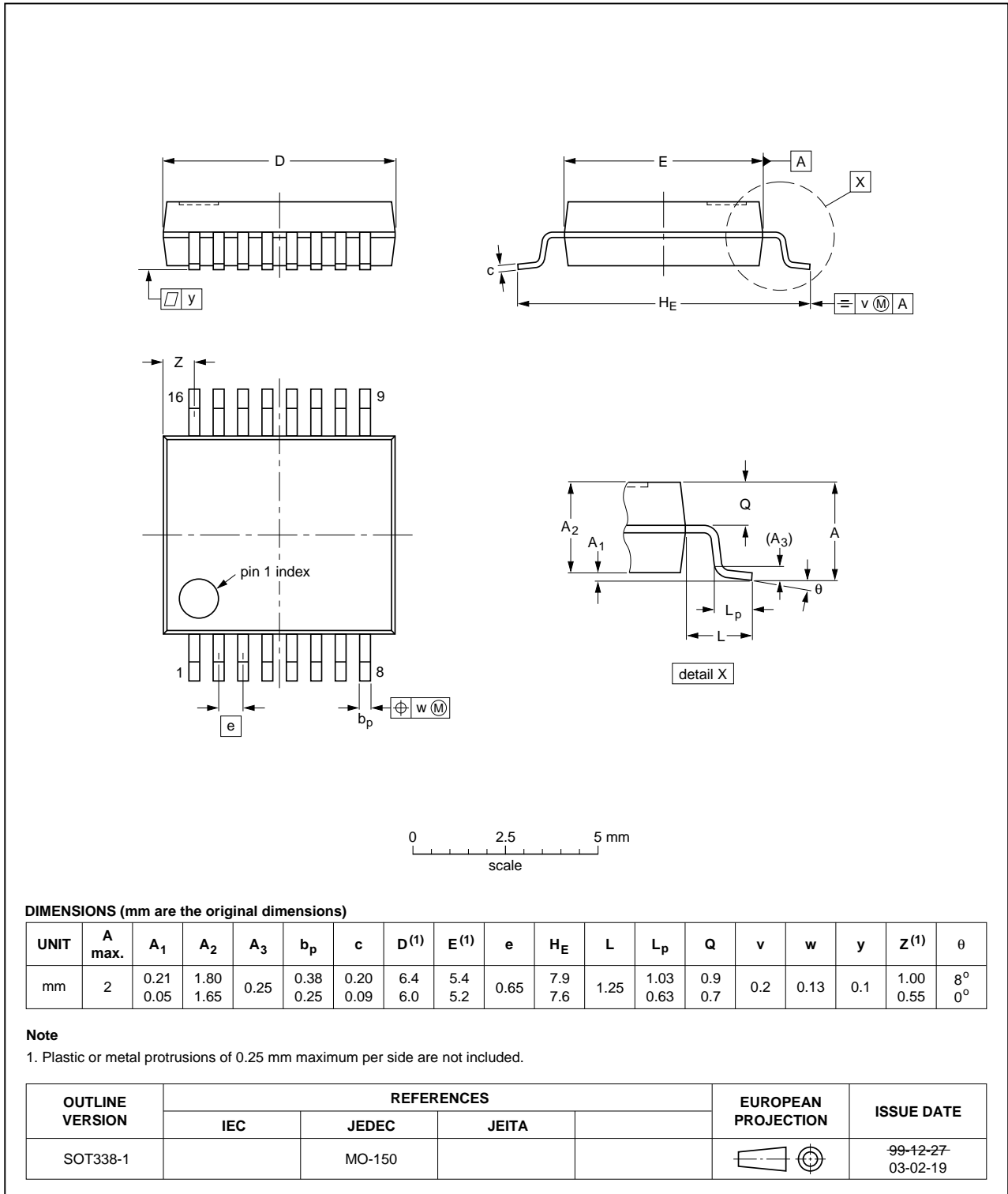


Fig 14. Package outline SOT338-1 (SSOP16)

## 14. 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

## 15. Revision history

Table 11. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74HC237 v.4	20110110	Product data sheet	-	74HC237 v3
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>Corrected the application drawing.</li> </ul>		
74HC237 v3	20041112	Product data sheet	-	74HC_HCT237_CNV v.2
74HC_HCT237_CNV v.2	19970828	Product specification	-	74HC_HCT237 v.1
74HC_HCT237 v.1	19901201	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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