

# 74LV139

## Dual 2-to-4 line decoder/demultiplexer

Rev. 04 — 13 December 2007

Product data sheet

### 1. General description

The 74LV139 is a low-voltage Si-gate CMOS device that is pin and function compatible with 74HC139 and 74HCT139.

The 74LV139 is a dual 2-to-4 line decoder/demultiplexer. It has two independent decoders, each accepting two binary weighted inputs ( $nA0$  and  $nA1$ ) and providing four mutually exclusive outputs ( $n\bar{Y}0$  to  $n\bar{Y}3$ ) that are LOW when selected. Each decoder has an active LOW input ( $n\bar{E}$ ). When  $n\bar{E}$  is HIGH, every output is forced HIGH. The enable input can be used as the data input for a 1-to-4 demultiplexer application.

### 2. Features

- Wide operating voltage: 1.0 V to 5.5 V
- Optimized for low voltage applications: 1.0 V to 3.6 V
- Accepts TTL input levels between  $V_{CC} = 2.7$  V and  $V_{CC} = 3.6$  V
- Typical output ground bounce < 0.8 V at  $V_{CC} = 3.3$  V and  $T_{amb} = 25$  °C
- Typical HIGH-level output voltage ( $V_{OH}$ ) undershoot: > 2 V at  $V_{CC} = 3.3$  V and  $T_{amb} = 25$  °C
- Demultiplexing capability
- Two independent 2-to-4 line decoders
- Multifunction capability
- Active LOW mutually exclusive outputs
- ESD protection:
  - ◆ HBM JESD22-A114E exceeds 2000 V
  - ◆ MM JESD22-A115-A exceeds 200 V
- Multiple package options
- Specified from  $-40$  °C to  $+85$  °C and from  $-40$  °C to  $+125$  °C

### 3. Ordering information

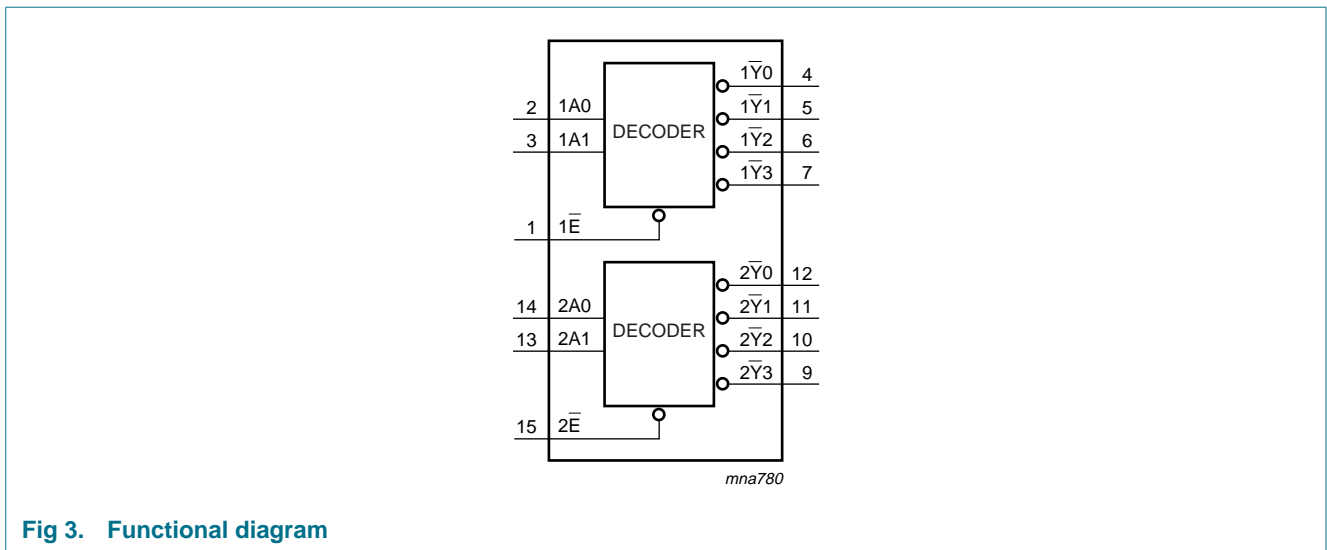
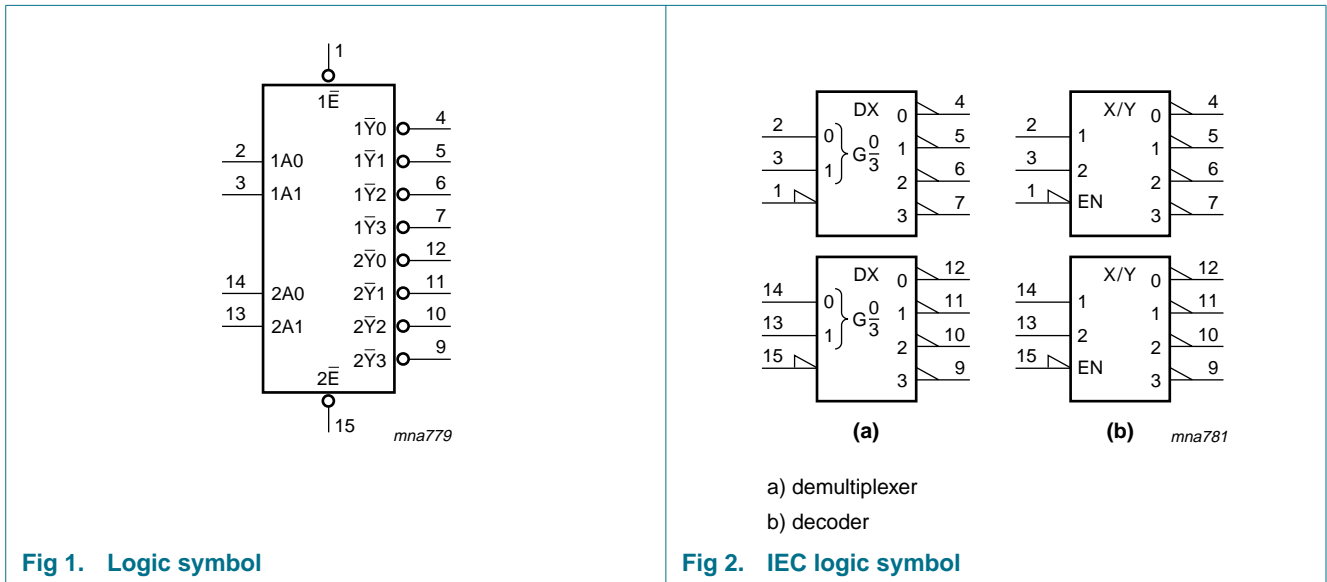
Table 1. Ordering information

Type number	Package			
	Temperature range	Name	Description	Version
74LV139N	$-40$ °C to $+125$ °C	DIP16	plastic dual in-line package; 16 leads (300 mil)	SOT38-4
74LV139D	$-40$ °C to $+125$ °C	SO16	plastic small outline package; 16 leads; body width 3.9 mm	SOT109-1

Table 1. Ordering information ...continued

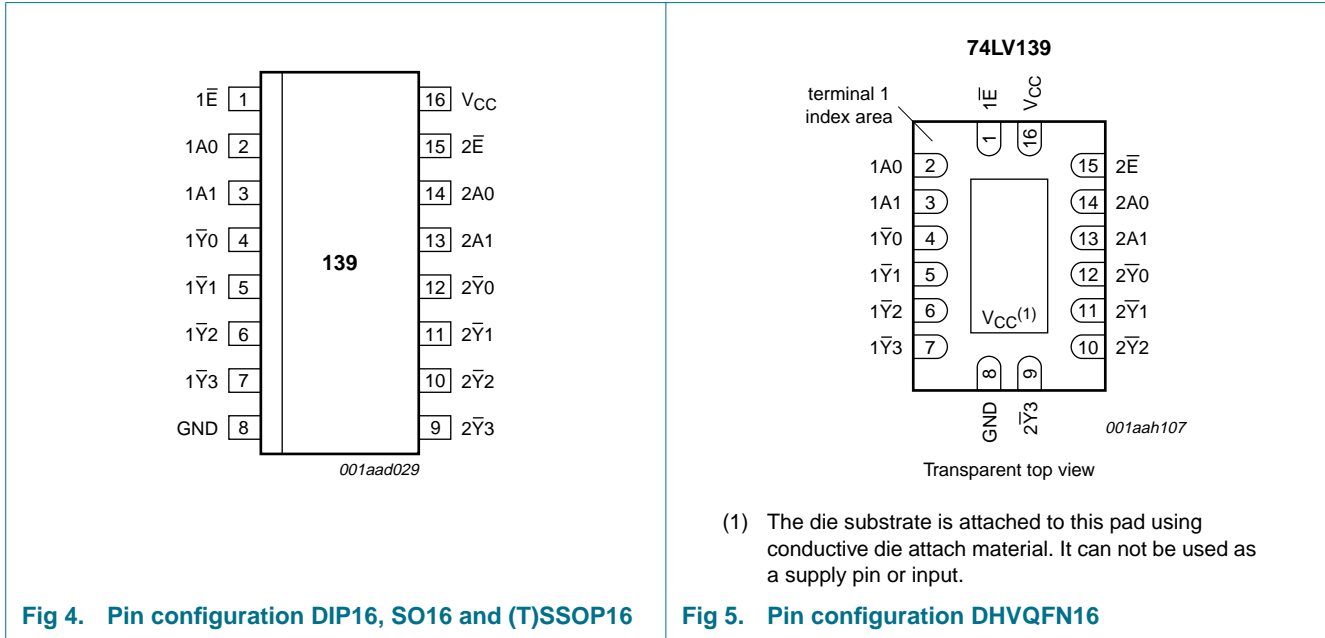
Type number	Package			Version
	Temperature range	Name	Description	
74LV139DB	-40 °C to +125 °C	SSOP16	plastic shrink small outline package; 16 leads; body width 5.3 mm	SOT338-1
74LV139PW	-40 °C to +125 °C	TSSOP16	plastic thin shrink small outline package; 16 leads; body width 4.4 mm	SOT403-1
74LV139BQ	-40 °C to +125 °C	DHVQFN16	plastic dual in-line compatible thermal enhanced very thin quad flat package; no leads; 16 terminals; body 2.5 × 3.5 × 0.85 mm	SOT763-1

### 4. Functional diagram



5. Pinning information

5.1 Pinning



5.2 Pin description

Table 2. Pin description

Symbol	Pin	Description
1E	1	enable input (active LOW)
1A0	2	address input
1A1	3	address input
1Y0	4	output
1Y1	5	output
1Y2	6	output
1Y3	7	output
GND	8	ground (0 V)
2Y3	9	output
2Y2	10	output
2Y1	11	output
2Y0	12	output
2A0	14	address input
2A1	13	address input
2E	15	enable input (active LOW)
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

Input			Output			
nE	nA0	nA1	nY0	nY1	nY2	nY3
H	X	X	H	H	H	H
L	L	L	L	H	H	H
L	H	L	H	L	H	H
L	L	H	H	H	L	H
L	H	H	H	H	H	L

## 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	+7.0	V
$I_{IK}$	input clamping current	$V_I < -0.5\text{ V}$ or $V_I > V_{CC} + 0.5\text{ V}$	[1] -	$\pm 20$	mA
$I_{OK}$	output clamping current	$V_O < -0.5\text{ V}$ or $V_O > V_{CC} + 0.5\text{ V}$	[1] -	$\pm 50$	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 $+125\text{ °C}$			
	DIP16 package		[2] -	750	mW
	SO16 package		[3] -	500	mW
	(T)SSOP16 package		[4] -	500	mW
	DHVQFN16 package		[5] -	500	mW

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

[2]  $P_{tot}$  derates linearly with 12 mW/K above 70 °C.

[3]  $P_{tot}$  derates linearly with 8 mW/K above 70 °C.

[4]  $P_{tot}$  derates linearly with 5.5 mW/K above 60 °C.

[5]  $P_{tot}$  derates linearly with 4.5 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		[1] 1.0	3.3	5.5	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	$V_{CC} = 1.0\text{ V to }2.0\text{ V}$	-	-	500	ns/V
		$V_{CC} = 2.0\text{ V to }2.7\text{ V}$	-	-	200	ns/V
		$V_{CC} = 2.7\text{ V to }3.6\text{ V}$	-	-	100	ns/V
		$V_{CC} = 3.6\text{ V to }5.5\text{ V}$	-	-	50	ns/V

[1] The static characteristics are guaranteed from  $V_{CC} = 1.2\text{ V}$  to  $V_{CC} = 5.5\text{ V}$ , but LV devices are guaranteed to function down to  $V_{CC} = 1.0\text{ V}$  (with input levels GND or  $V_{CC}$ ).

## 9. Static characteristics

**Table 6. Static characteristics**

Voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions	-40 °C to +85 °C			-40 °C to +125 °C		Unit
			Min	Typ <sup>[1]</sup>	Max	Min	Max	
$V_{IH}$	HIGH-level input voltage	$V_{CC} = 1.2\text{ V}$	0.9	-	-	0.9	-	V
		$V_{CC} = 2.0\text{ V}$	1.4	-	-	1.4	-	V
		$V_{CC} = 2.7\text{ V to }3.6\text{ V}$	2.0	-	-	2.0	-	V
		$V_{CC} = 4.5\text{ V to }5.5\text{ V}$	$0.7V_{CC}$	-	-	$0.7V_{CC}$	-	V
$V_{IL}$	LOW-level input voltage	$V_{CC} = 1.2\text{ V}$	-	-	0.3	-	0.3	V
		$V_{CC} = 2.0\text{ V}$	-	-	0.6	-	0.6	V
		$V_{CC} = 2.7\text{ V to }3.6\text{ V}$	-	-	0.8	-	0.8	V
		$V_{CC} = 4.5\text{ V to }5.5\text{ V}$	-	-	$0.3V_{CC}$	-	$0.3V_{CC}$	V
$V_{OH}$	HIGH-level output voltage	$V_I = V_{IH}$ or $V_{IL}$						
		$I_O = -100\ \mu\text{A}; V_{CC} = 1.2\text{ V}$	-	1.2	-	-	-	V
		$I_O = -100\ \mu\text{A}; V_{CC} = 2.0\text{ V}$	1.8	2.0	-	1.8	-	V
		$I_O = -100\ \mu\text{A}; V_{CC} = 2.7\text{ V}$	2.5	2.7	-	2.5	-	V
		$I_O = -100\ \mu\text{A}; V_{CC} = 3.0\text{ V}$	2.8	3.0	-	2.8	-	V
		$I_O = -100\ \mu\text{A}; V_{CC} = 4.5\text{ V}$	4.3	4.5	-	4.3	-	V
		$I_O = -6\text{ mA}; V_{CC} = 3.0\text{ V}$	2.4	2.82	-	2.2	-	V
$I_O = -12\text{ mA}; V_{CC} = 4.5\text{ V}$	3.6	4.2	-	3.5	-	V		

**Table 6. Static characteristics ...continued**  
 Voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions	-40 °C to +85 °C			-40 °C to +125 °C		Unit
			Min	Typ <sup>[1]</sup>	Max	Min	Max	
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> = 100 μA; V <sub>CC</sub> = 1.2 V	-	0	-	-	-	V
		I <sub>O</sub> = 100 μA; V <sub>CC</sub> = 2.0 V	-	0	0.2	-	0.2	V
		I <sub>O</sub> = 100 μA; V <sub>CC</sub> = 2.7 V	-	0	0.2	-	0.2	V
		I <sub>O</sub> = 100 μA; V <sub>CC</sub> = 3.0 V	-	0	0.2	-	0.2	V
		I <sub>O</sub> = 100 μA; V <sub>CC</sub> = 4.5 V	-	0	0.2	-	0.2	V
		I <sub>O</sub> = 6 mA; V <sub>CC</sub> = 3.0 V	-	0.25	0.40	-	0.50	V
		I <sub>O</sub> = 12 mA; V <sub>CC</sub> = 4.5 V	-	0.35	0.55	-	0.65	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	-	-	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	-	-	20.0	-	160	μA
ΔI <sub>CC</sub>	additional supply current	per input; V <sub>I</sub> = V <sub>CC</sub> - 0.6 V; V <sub>CC</sub> = 2.7 V to 3.6 V	-	-	500	-	850	μA
C <sub>I</sub>	input capacitance		-	3.5	-	-	-	pF

[1] Typical values are measured at T<sub>amb</sub> = 25 °C.

## 10. Dynamic characteristics

**Table 7. Dynamic characteristics**  
 GND = 0 V; For test circuit see [Figure 8](#).

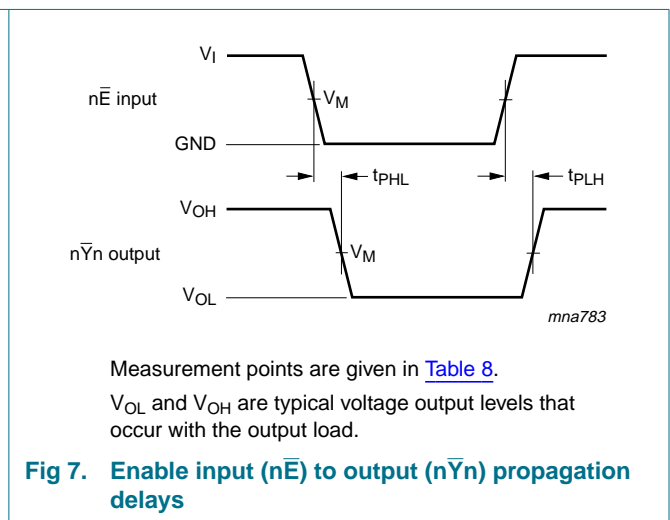
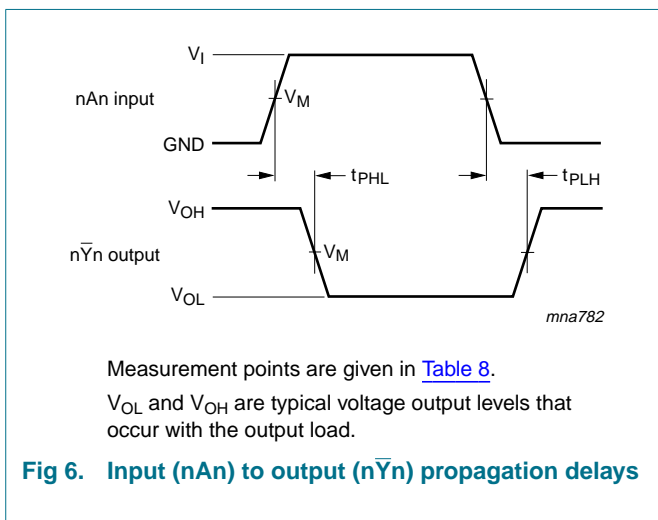
Symbol	Parameter	Conditions	-40 °C to +85 °C			-40 °C to +125 °C		Unit
			Min	Typ <sup>[1]</sup>	Max	Min	Max	
t <sub>pd</sub>	propagation delay	nAn to n $\bar{Y}$ n; see <a href="#">Figure 6</a> <sup>[2]</sup>						
		V <sub>CC</sub> = 1.2 V	-	70	-	-	-	ns
		V <sub>CC</sub> = 2.0 V	-	24	31	-	39	ns
		V <sub>CC</sub> = 2.7 V	-	18	23	-	29	ns
		V <sub>CC</sub> = 3.0 V to 3.6 V; C <sub>L</sub> = 15 pF <sup>[3]</sup>	-	11	-	-	-	ns
		V <sub>CC</sub> = 3.0 V to 3.6 V <sup>[3]</sup>	-	13	18	-	23	ns
		V <sub>CC</sub> = 4.5 V to 5.5 V	-	-	15	-	19	ns
		n $\bar{E}$ n to $\bar{Y}$ n; see <a href="#">Figure 7</a>						
		V <sub>CC</sub> = 1.2 V	-	60	-	-	-	ns
		V <sub>CC</sub> = 2.0 V	-	20	27	-	34	ns
		V <sub>CC</sub> = 2.7 V	-	15	20	-	25	ns
		V <sub>CC</sub> = 3.0 V to 3.6 V; C <sub>L</sub> = 15 pF <sup>[3]</sup>	-	10	-	-	-	ns
		V <sub>CC</sub> = 3.0 V to 3.6 V <sup>[3]</sup>	-	11	16	-	20	ns
		V <sub>CC</sub> = 4.5 V to 5.5 V	-	-	13	-	16	ns

**Table 7. Dynamic characteristics ...continued**  
 GND = 0 V; For test circuit see [Figure 8](#).

Symbol	Parameter	Conditions	-40 °C to +85 °C			-40 °C to +125 °C		Unit
			Min	Typ <sup>[1]</sup>	Max	Min	Max	
C <sub>PD</sub>	power dissipation capacitance	C <sub>L</sub> = 50 pF; f <sub>i</sub> = 1 MHz; V <sub>I</sub> = GND to V <sub>CC</sub>	[4] -	42	-	-	-	pF

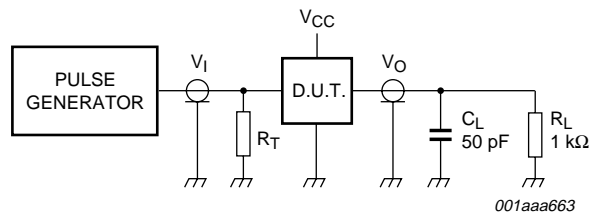
- [1] All typical values are measured at T<sub>amb</sub> = 25 °C.
- [2] t<sub>pd</sub> is the same as t<sub>PLH</sub> and t<sub>PHL</sub>.
- [3] Typical values are measured at nominal supply voltage (V<sub>CC</sub> = 3.3 V).
- [4] C<sub>PD</sub> is used to determine the dynamic power dissipation (P<sub>D</sub> in μW).  
 $P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \Sigma(C_L \times V_{CC}^2 \times f_o)$  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  
 $\Sigma(C_L \times V_{CC}^2 \times f_o)$  = sum of the outputs.

## 11. Waveforms



**Table 8. Measurement points**

Supply voltage V <sub>CC</sub>	Input V <sub>M</sub>	Output V <sub>M</sub>
< 2.7 V	0.5V <sub>CC</sub>	0.5V <sub>CC</sub>
2.7 V to 3.6 V	1.5 V	1.5 V
≥ 4.5 V	0.5V <sub>CC</sub>	0.5V <sub>CC</sub>



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.

$R_L$  = Load resistance.

$C_L$  = Load capacitance including jig and probe capacitance.

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

**Table 9. Test data**

Supply voltage	Input	$t_r, t_f$
$V_{CC}$	$V_I$	
< 2.7 V	$V_{CC}$	≤ 2.5 ns
2.7 V to 3.6 V	2.7 V	≤ 2.5 ns
≥ 4.5 V	$V_{CC}$	≤ 2.5 ns

12. Package outline

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

SOT38-4

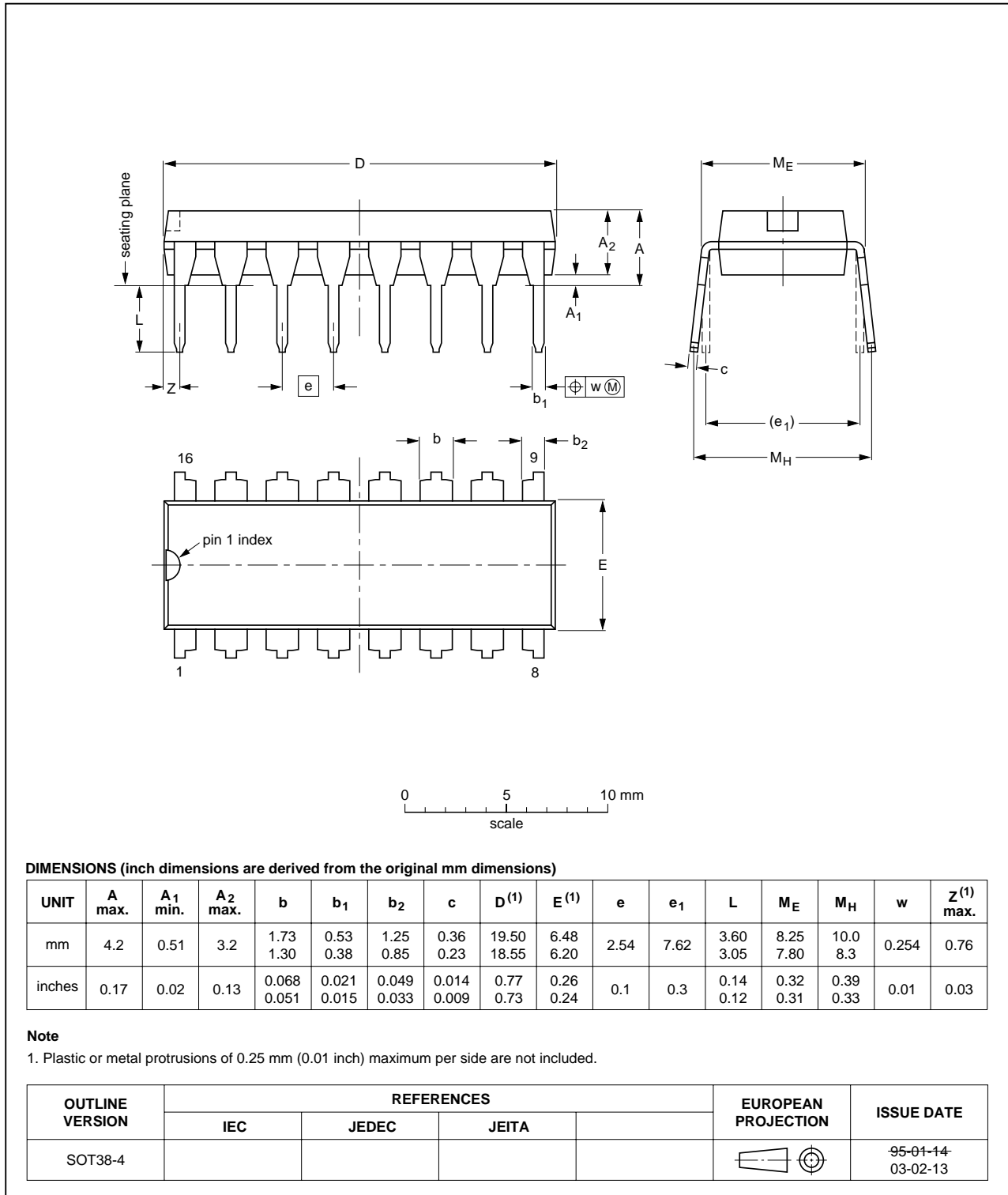


Fig 9. Package outline SOT38-4 (DIP16)

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

SOT109-1

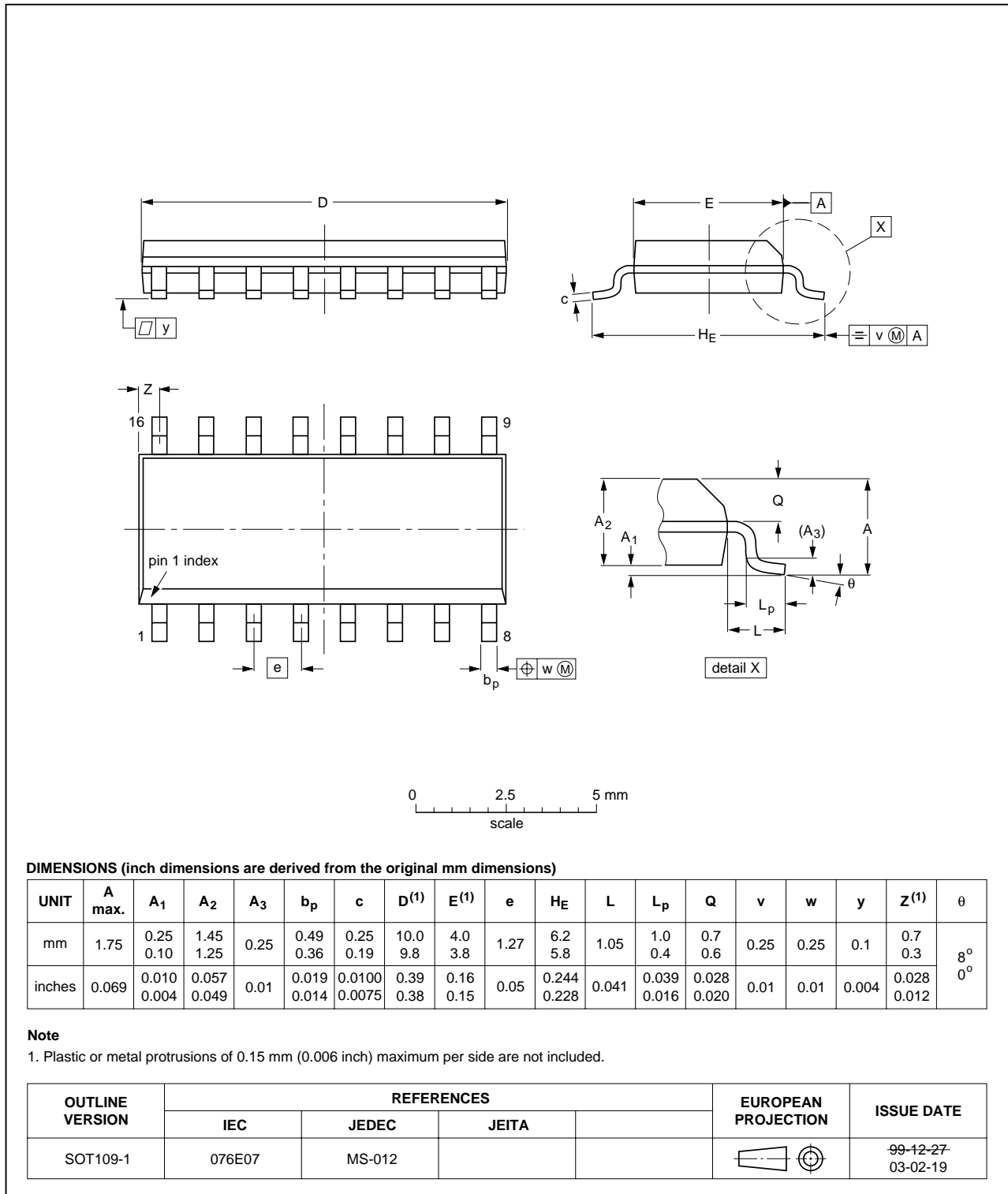


Fig 10. Package outline SOT109-1 (SO16)

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

SOT338-1

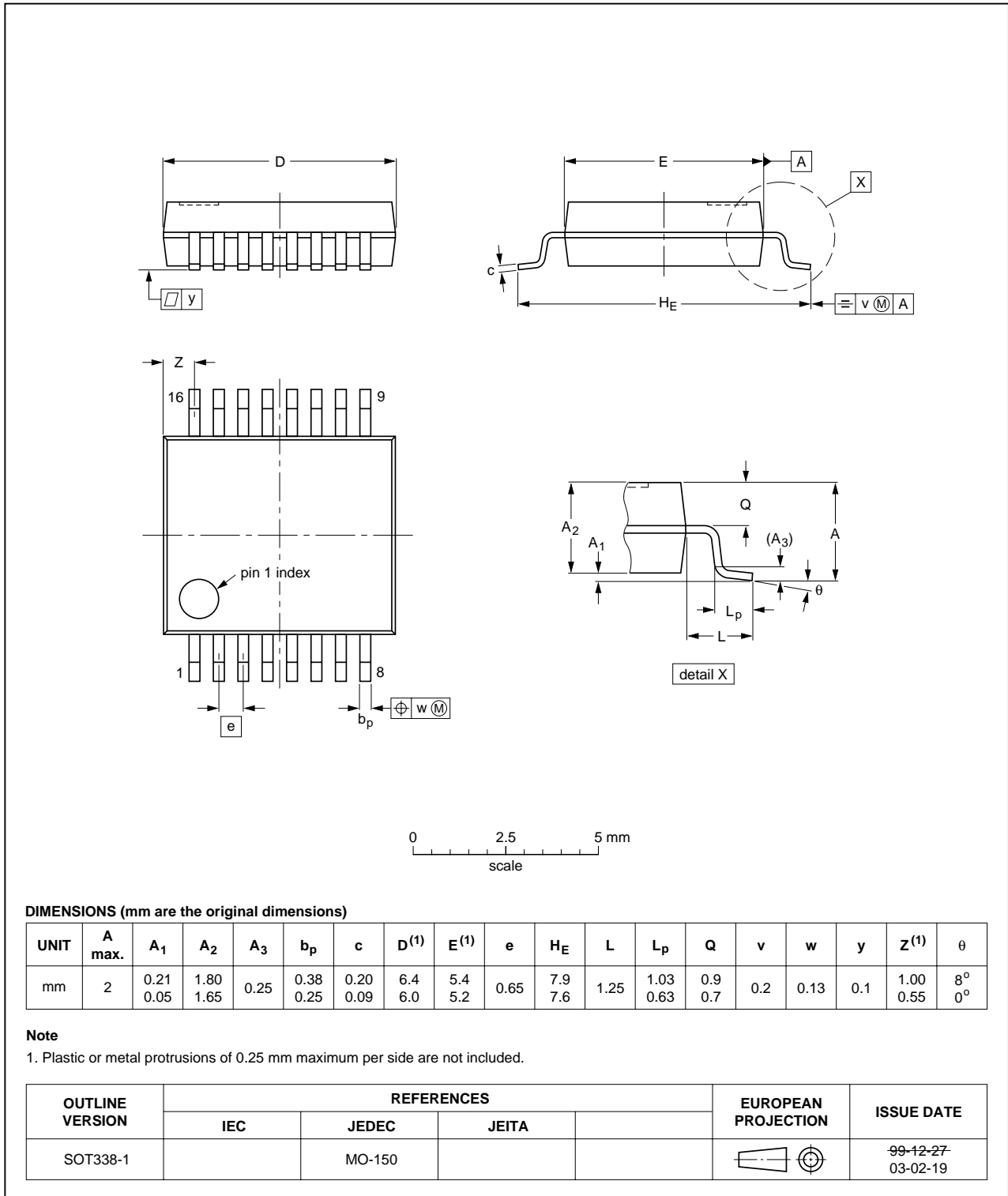


Fig 11. Package outline SOT338-1 (SSOP16)

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

SOT403-1

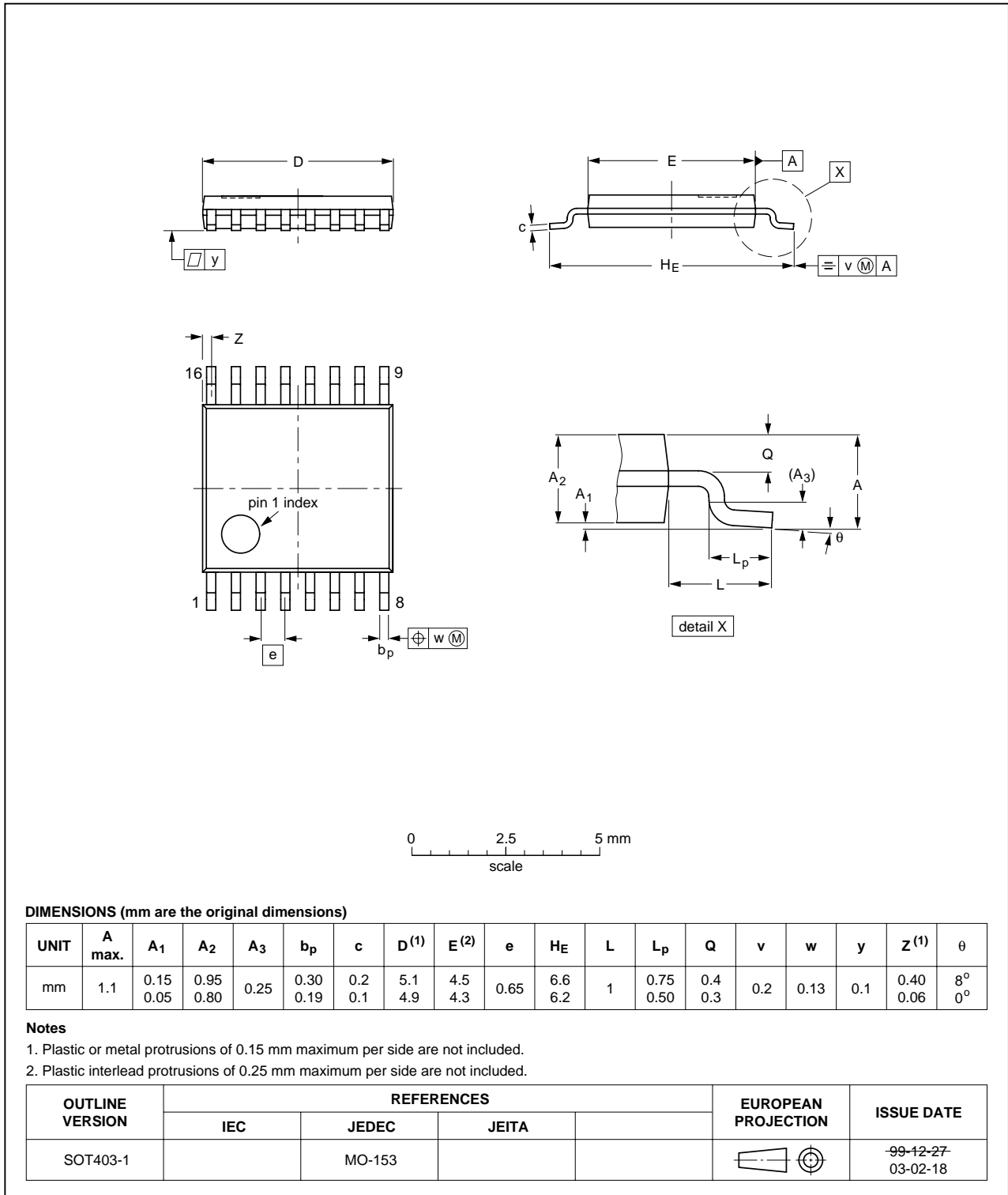


Fig 12. Package outline SOT403-1 (TSSOP16)

DHVQFN16: plastic dual in-line compatible thermal enhanced very thin quad flat package; no leads; 16 terminals; body 2.5 x 3.5 x 0.85 mm

SOT763-1

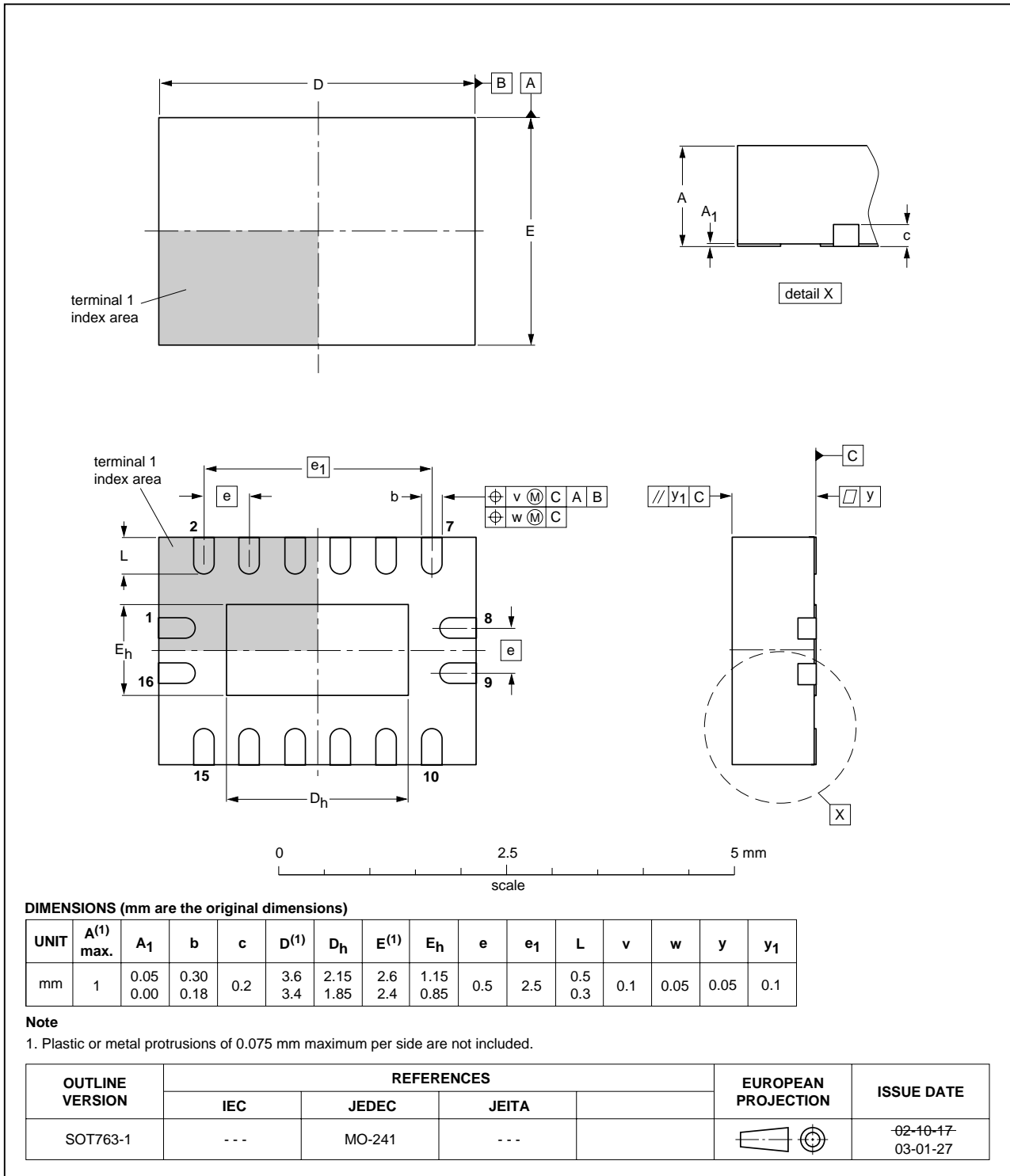


Fig 13. Package outline SOT763-1 (DHVQFN16)

## 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

## 14. Revision history

Table 11. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74LV139_4	20071213	Product data sheet	-	74LV139_3
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>• <a href="#">Section 3</a>: DHVQFN16 package added.</li> <li>• <a href="#">Section 7</a>: derating values added for DHVQFN16 package.</li> <li>• <a href="#">Section 12</a>: outline drawing added for DHVQFN16 package.</li> </ul>			
74LV139_3	20030313	Product specification	-	74LV139_2
74LV139_2	19980428	Product specification	-	74LV139_1
74LV139_1	19970212	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".

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## 17. Contents

<b>1</b>	<b>General description</b> .....	<b>1</b>
<b>2</b>	<b>Features</b> .....	<b>1</b>
<b>3</b>	<b>Ordering information</b> .....	<b>1</b>
<b>4</b>	<b>Functional diagram</b> .....	<b>2</b>
<b>5</b>	<b>Pinning information</b> .....	<b>3</b>
5.1	Pinning .....	3
5.2	Pin description .....	3
<b>6</b>	<b>Functional description</b> .....	<b>4</b>
<b>7</b>	<b>Limiting values</b> .....	<b>4</b>
<b>8</b>	<b>Recommended operating conditions</b> .....	<b>5</b>
<b>9</b>	<b>Static characteristics</b> .....	<b>5</b>
<b>10</b>	<b>Dynamic characteristics</b> .....	<b>6</b>
<b>11</b>	<b>Waveforms</b> .....	<b>7</b>
<b>12</b>	<b>Package outline</b> .....	<b>9</b>
<b>13</b>	<b>Abbreviations</b> .....	<b>14</b>
<b>14</b>	<b>Revision history</b> .....	<b>14</b>
<b>15</b>	<b>Legal information</b> .....	<b>15</b>
15.1	Data sheet status .....	15
15.2	Definitions .....	15
15.3	Disclaimers .....	15
15.4	Trademarks .....	15
<b>16</b>	<b>Contact information</b> .....	<b>15</b>
<b>17</b>	<b>Contents</b> .....	<b>16</b>

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