

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

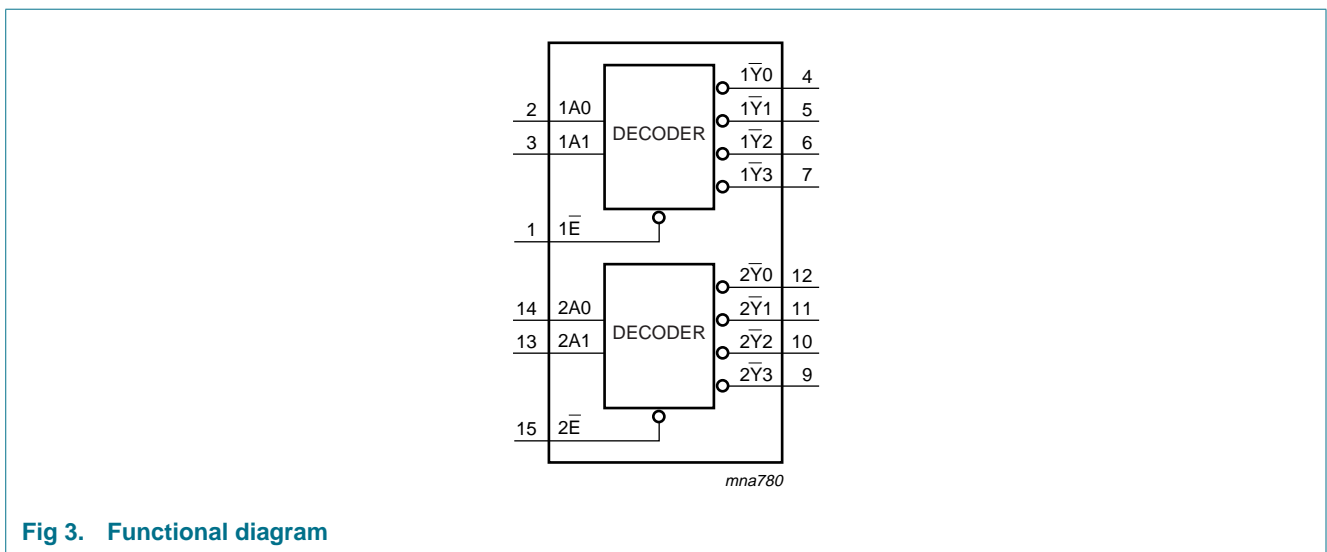
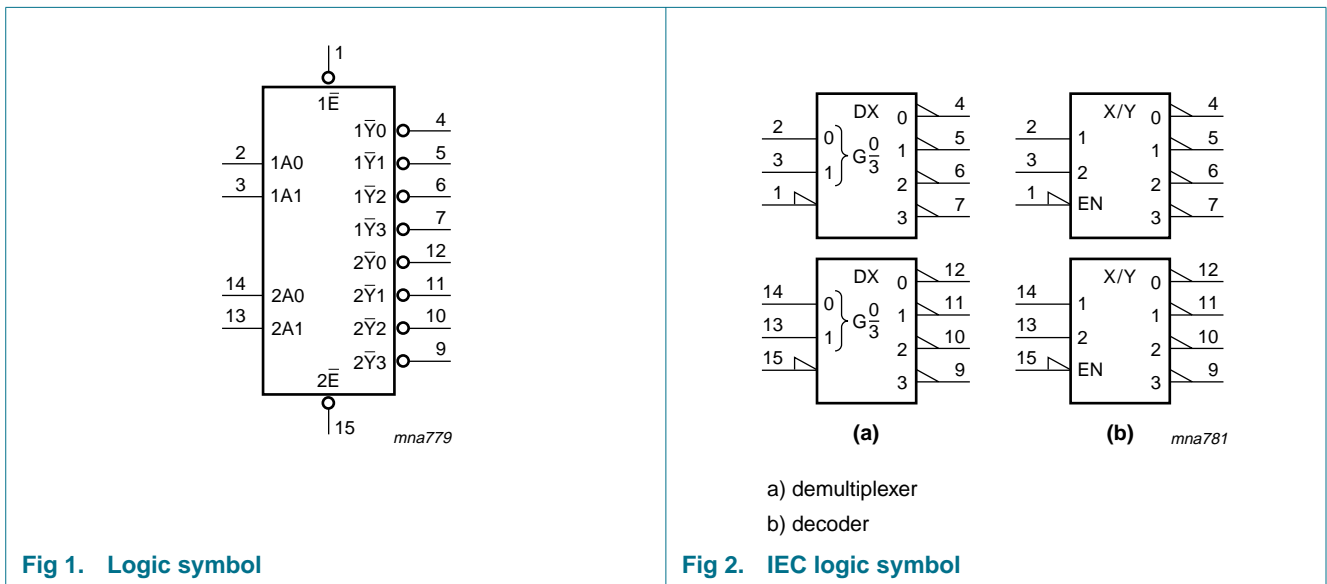
Table 1. Ordering information

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

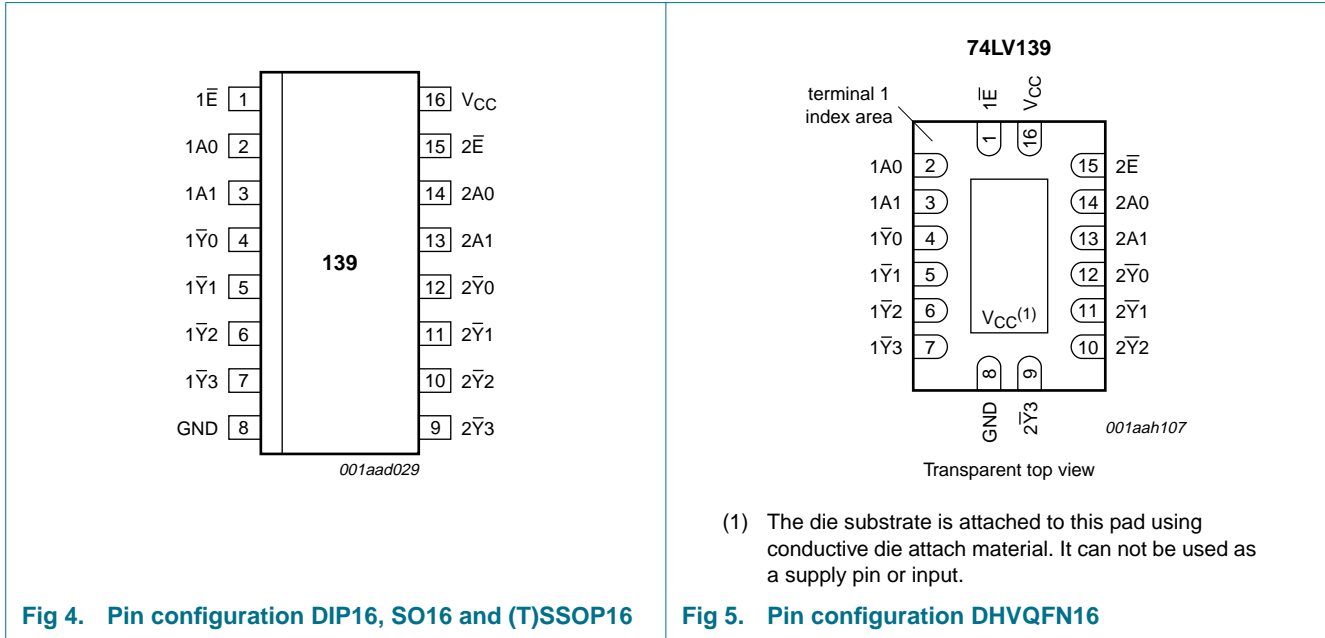
Type number	Package			Version
	Temperature range	Name	Description	
74LV139DB	-40 °C to +125 °C	SSOP16	plastic shrink small outline package; 16 leads; body width 5.3 mm	SOT338-1
74LV139PW	-40 °C to +125 °C	TSSOP16	plastic thin shrink small outline package; 16 leads; body width 4.4 mm	SOT403-1
74LV139BQ	-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 _{CC}	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 V or V _I > V _{CC} + 0.5 V	[1] -	±20	mA
I _{OK}	output clamping current	V _O < -0.5 V or V _O > V _{CC} + 0.5 V	[1] -	±50	mA
I _O	output current	V _O = -0.5 V to (V _{CC} + 0.5 V)	-	±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 °C to +125 °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 ^[1]	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 ^[1]	Max	Min	Max	
V _{OL}	LOW-level output voltage	V _I = V _{IH} or V _{IL}						
		I _O = 100 μA; V _{CC} = 1.2 V	-	0	-	-	-	V
		I _O = 100 μA; V _{CC} = 2.0 V	-	0	0.2	-	0.2	V
		I _O = 100 μA; V _{CC} = 2.7 V	-	0	0.2	-	0.2	V
		I _O = 100 μA; V _{CC} = 3.0 V	-	0	0.2	-	0.2	V
		I _O = 100 μA; V _{CC} = 4.5 V	-	0	0.2	-	0.2	V
		I _O = 6 mA; V _{CC} = 3.0 V	-	0.25	0.40	-	0.50	V
		I _O = 12 mA; V _{CC} = 4.5 V	-	0.35	0.55	-	0.65	V
I _I	input leakage current	V _I = V _{CC} or GND; V _{CC} = 5.5 V	-	-	1.0	-	1.0	μA
I _{CC}	supply current	V _I = V _{CC} or GND; I _O = 0 A; V _{CC} = 5.5 V	-	-	20.0	-	160	μA
ΔI _{CC}	additional supply current	per input; V _I = V _{CC} - 0.6 V; V _{CC} = 2.7 V to 3.6 V	-	-	500	-	850	μA
C _I	input capacitance		-	3.5	-	-	-	pF

[1] Typical values are measured at T_{amb} = 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 ^[1]	Max	Min	Max	
t _{pd}	propagation delay	nAn to n \bar{Y} n; see Figure 6 ^[2]						
		V _{CC} = 1.2 V	-	70	-	-	-	ns
		V _{CC} = 2.0 V	-	24	31	-	39	ns
		V _{CC} = 2.7 V	-	18	23	-	29	ns
		V _{CC} = 3.0 V to 3.6 V; C _L = 15 pF ^[3]	-	11	-	-	-	ns
		V _{CC} = 3.0 V to 3.6 V ^[3]	-	13	18	-	23	ns
		V _{CC} = 4.5 V to 5.5 V	-	-	15	-	19	ns
		n \bar{E} n to \bar{Y} n; see Figure 7						
		V _{CC} = 1.2 V	-	60	-	-	-	ns
		V _{CC} = 2.0 V	-	20	27	-	34	ns
		V _{CC} = 2.7 V	-	15	20	-	25	ns
		V _{CC} = 3.0 V to 3.6 V; C _L = 15 pF ^[3]	-	10	-	-	-	ns
		V _{CC} = 3.0 V to 3.6 V ^[3]	-	11	16	-	20	ns
		V _{CC} = 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 ^[1]	Max	Min	Max	
C _{PD}	power dissipation capacitance	C _L = 50 pF; f _i = 1 MHz; V _I = GND to V _{CC}	[4] -	42	-	-	-	pF

- [1] All typical values are measured at T_{amb} = 25 °C.
- [2] t_{pd} is the same as t_{PLH} and t_{PHL}.
- [3] Typical values are measured at nominal supply voltage (V_{CC} = 3.3 V).
- [4] C_{PD} is used to determine the dynamic power dissipation (P_D 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_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
 $\Sigma(C_L \times V_{CC}^2 \times f_o)$ = sum of the outputs.

11. Waveforms

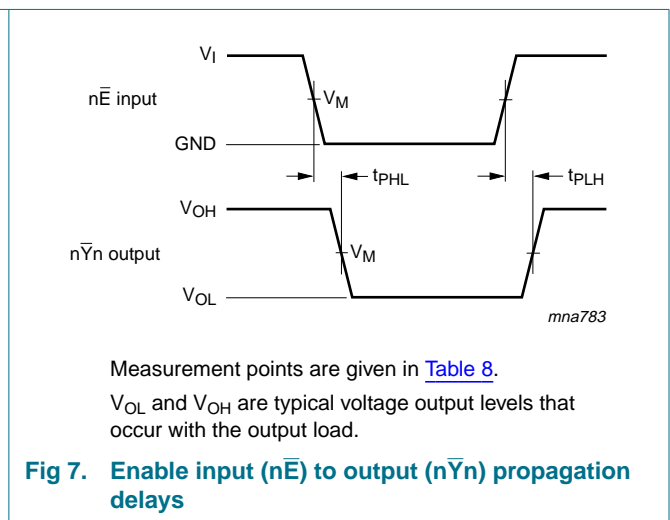
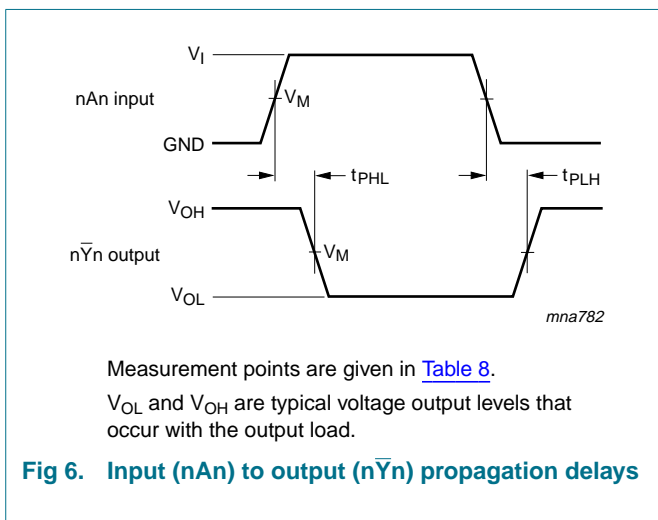
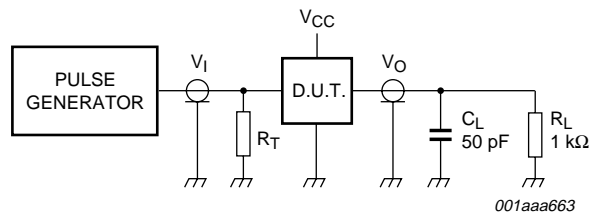


Table 8. Measurement points

Supply voltage V _{CC}	Input V _M	Output V _M
< 2.7 V	0.5V _{CC}	0.5V _{CC}
2.7 V to 3.6 V	1.5 V	1.5 V
≥ 4.5 V	0.5V _{CC}	0.5V _{CC}



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

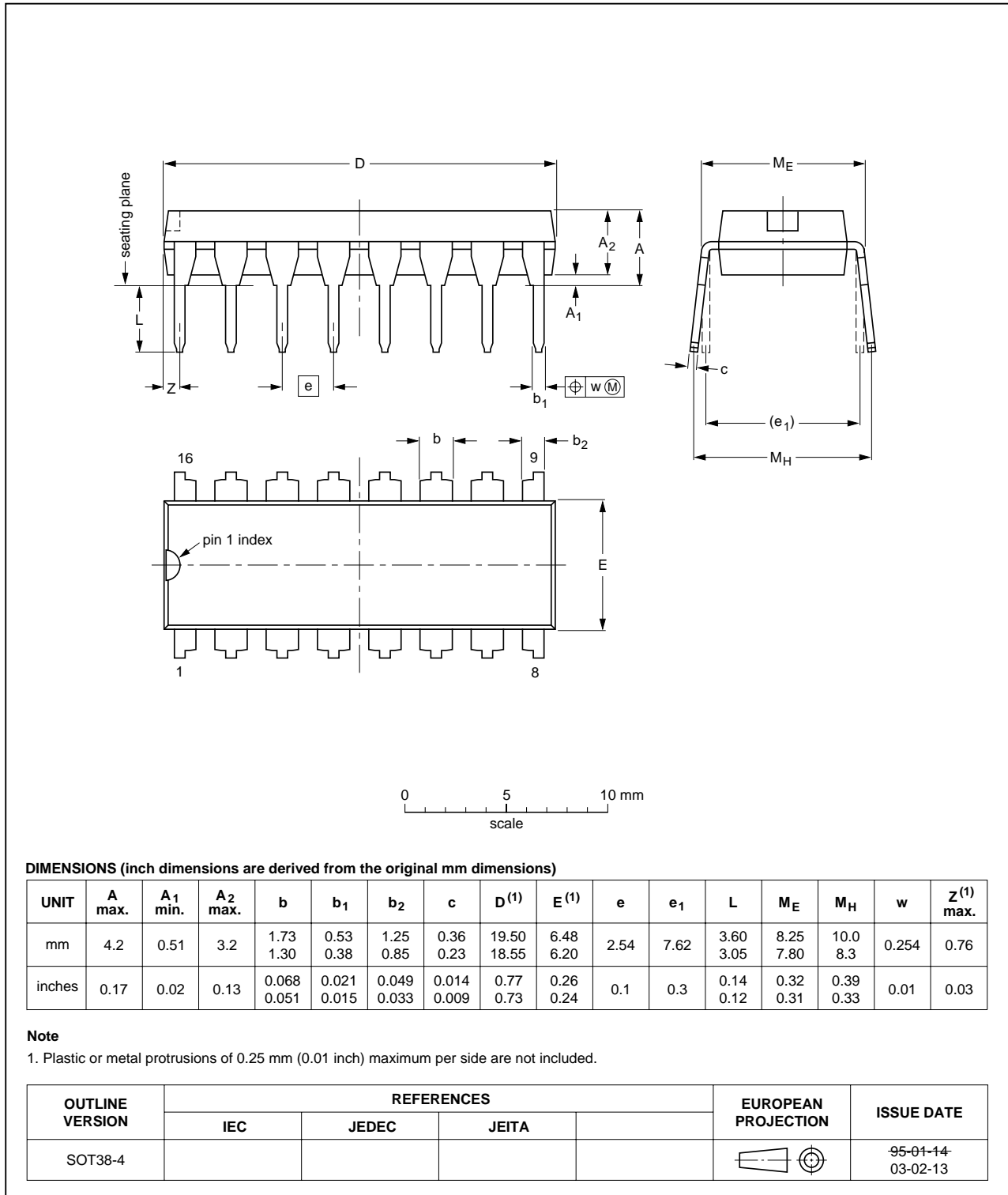


Fig 9. Package outline SOT38-4 (DIP16)

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

SOT109-1

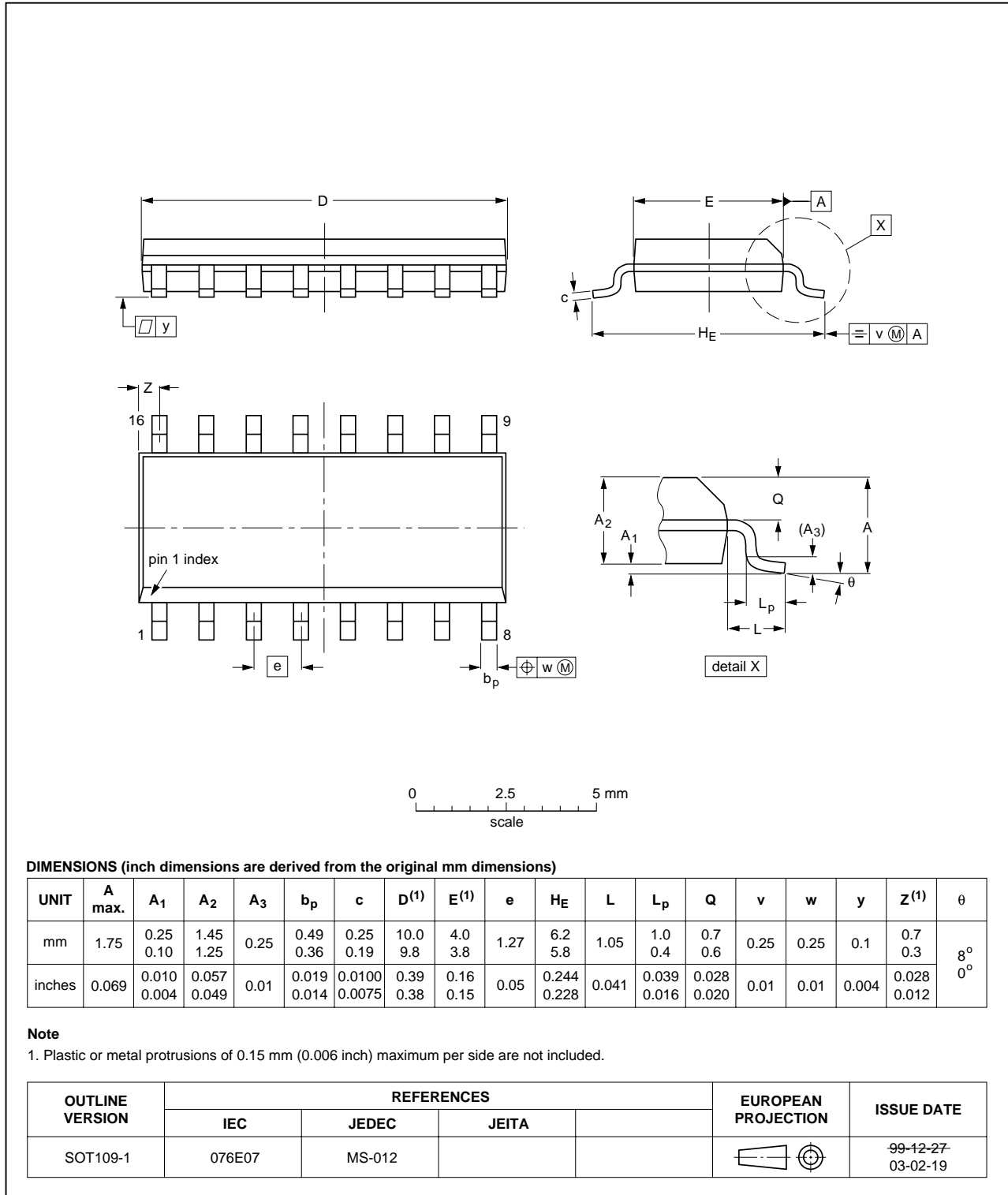


Fig 10. Package outline SOT109-1 (SO16)

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

SOT338-1

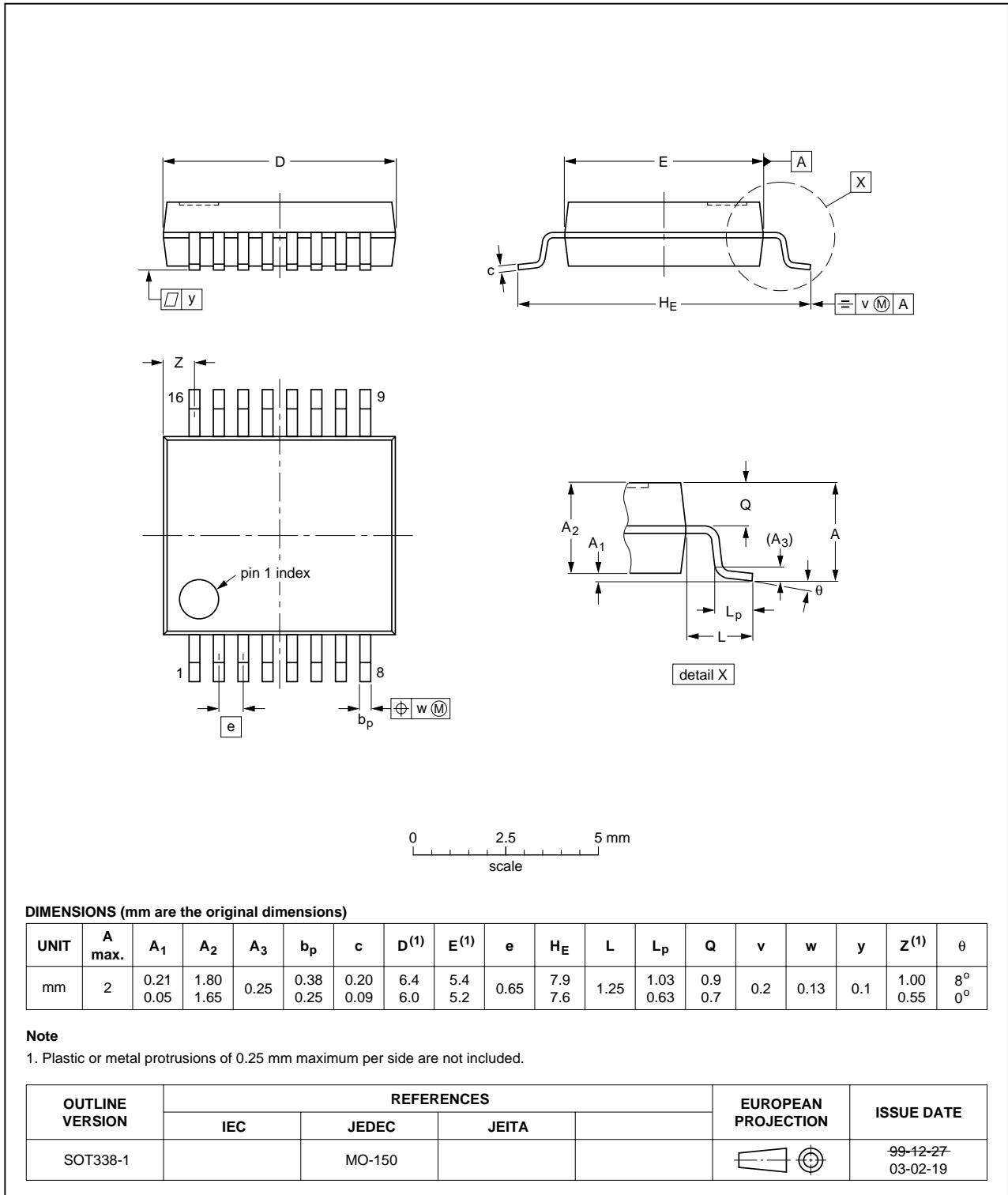


Fig 11. Package outline SOT338-1 (SSOP16)

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

SOT403-1

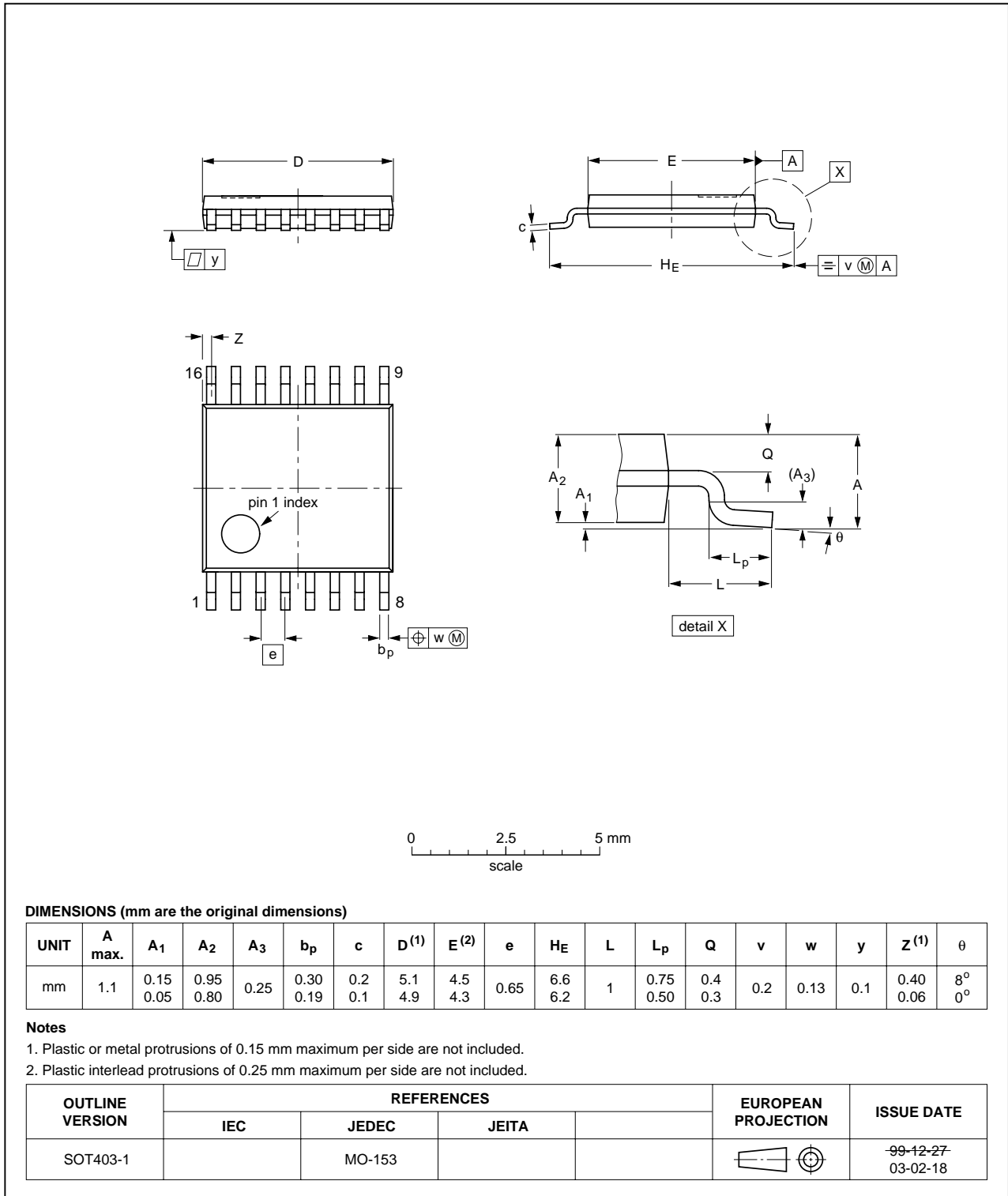


Fig 12. Package outline SOT403-1 (TSSOP16)

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

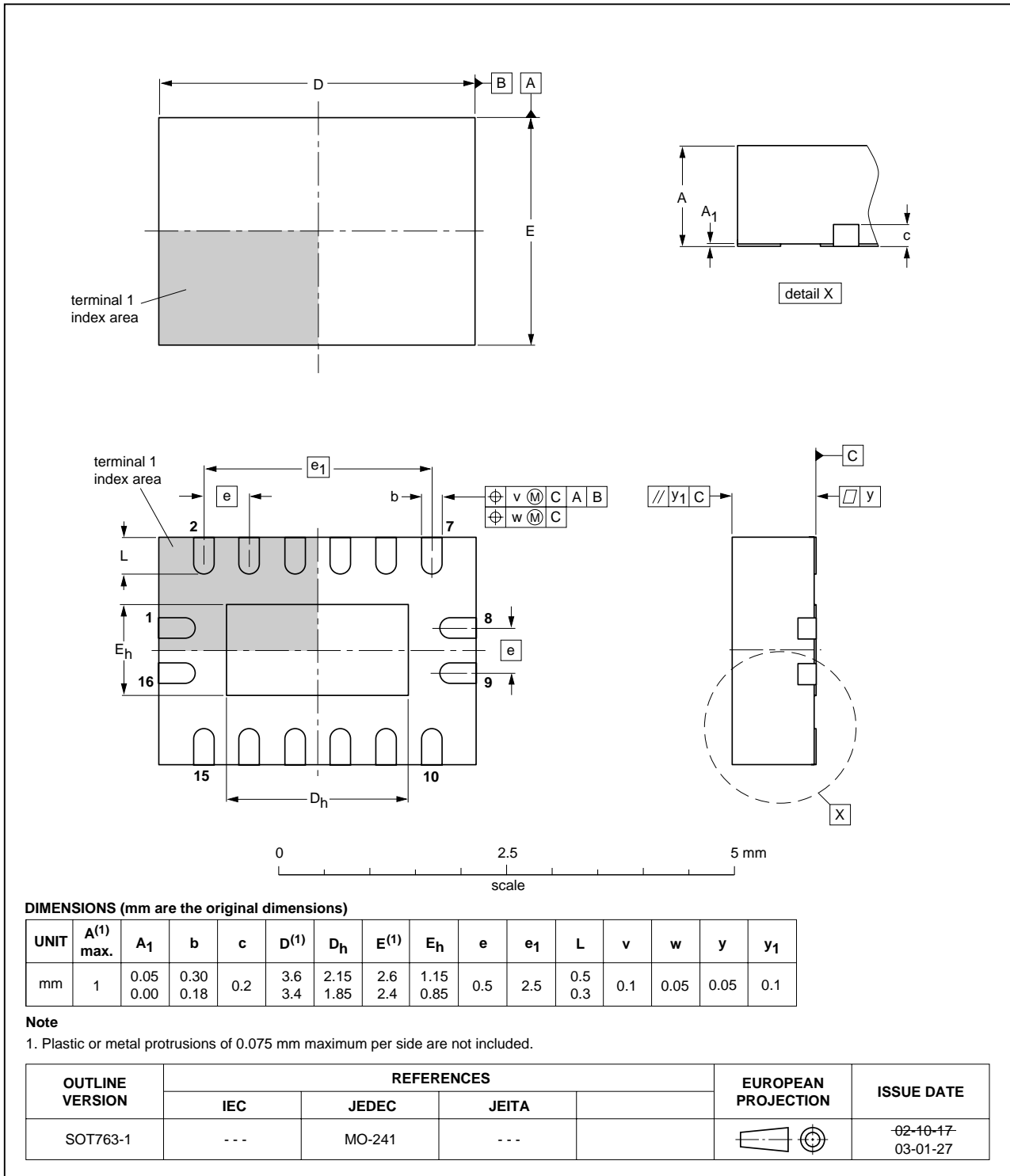


Fig 13. Package outline SOT763-1 (DHVQFN16)

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"> • The format of this data sheet has been redesigned to comply with the new identity guidelines of NXP Semiconductors. • Legal texts have been adapted to the new company name where appropriate. • Section 3: DHVQFN16 package added. • Section 7: derating values added for DHVQFN16 package. • Section 12: outline drawing added for DHVQFN16 package. 			
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 ^{[1][2]}	Product status ^[3]	Definition
Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
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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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