

# 74HC138; 74HCT138

3-to-8 line decoder/demultiplexer; inverting

Rev. 4 — 27 June 2012

Product data sheet

## 1. General description

---

The 74HC138; 74HCT138 is a high-speed Si-gate CMOS device and is pin compatible with Low-power Schottky TTL (LSTTL).

The 74HC138; 74HCT138 decoder accepts three binary weighted address inputs ( $A_0$ ,  $A_1$  and  $A_2$ ) and when enabled, provides 8 mutually exclusive active LOW outputs ( $\bar{Y}_0$  to  $\bar{Y}_7$ ).

The 74HC138; 74HCT138 features three enable inputs: two active LOW ( $\bar{E}_1$  and  $\bar{E}_2$ ) and one active HIGH ( $E_3$ ). Every output is HIGH unless  $\bar{E}_1$  and  $\bar{E}_2$  are LOW and  $E_3$  is HIGH.

This multiple enable function allows easy parallel expansion of the 74HC138; 74HCT138 to a 1-of-32 (5 lines to 32 lines) decoder with just four 74HC138; 74HCT138 ICs and one inverter.

The 74HC138; 74HCT138 can be used as an eight output demultiplexer by using one of the active LOW enable inputs as the data input and the remaining enable inputs as strobes. Permanently tie unused enable inputs to their appropriate active HIGH- or LOW-state.

The 74HC138; 74HCT138 is identical to the 74HC238; 74HCT238 but has inverting outputs.

## 2. Features and benefits

---

- Demultiplexing capability
- Multiple input enable for easy expansion
- Complies with JEDEC standard no. 7A
- Ideal for memory chip select decoding
- Active LOW mutually exclusive outputs
- ESD protection:
  - ◆ HBM EIA/JESD22-A114F exceeds 2000 V
  - ◆ MM EIA/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	
74HC138N	-40 °C to +125 °C	DIP16	plastic dual in-line package; 16 leads (300 mil)	SOT38-4
74HCT138N				
74HC138D	-40 °C to +125 °C	SO16	plastic small outline package; 16 leads; body width 3.9 mm	SOT109-1
74 HCT138D				
74HC138DB	-40 °C to +125 °C	SSOP16	plastic shrink small outline package; 16 leads; body width 5.3 mm	SOT338-1
74HCT138DB				
74HC138PW	-40 °C to +125 °C	TSSOP16	plastic thin shrink small outline package; 16 leads; body width 4.4 mm	SOT403-1
74HCT138PW				
74HC138BQ	-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
74HCT138BQ				

## 4. Functional diagram

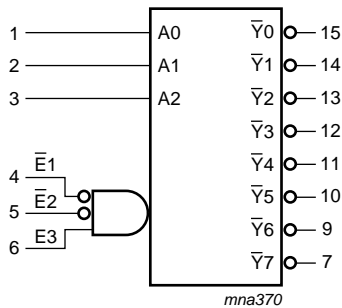


Fig 1. Logic symbol

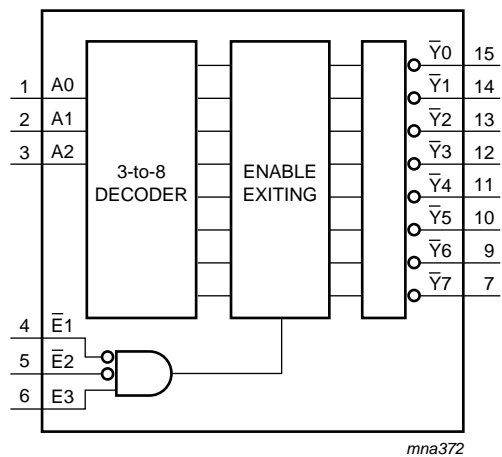


Fig 2. Functional diagram

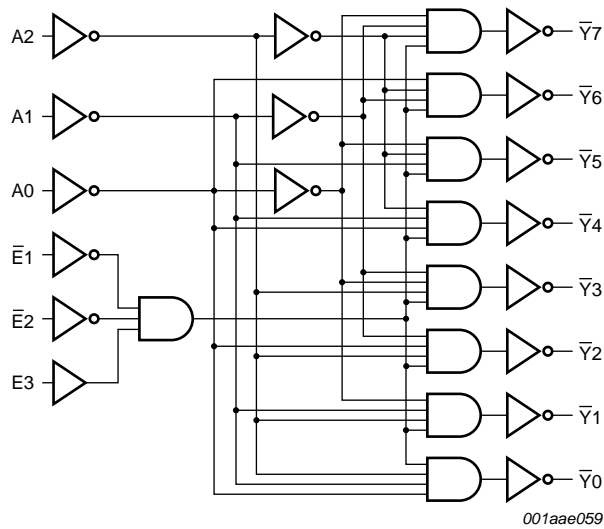


Fig 3. Logic diagram

## 5. Pinning information

### 5.1 Pinning

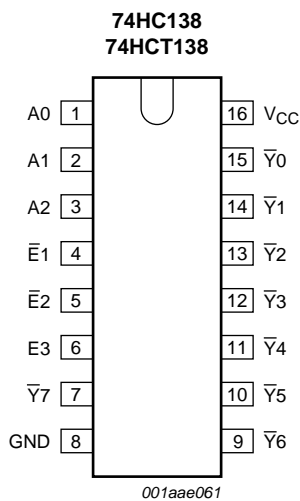
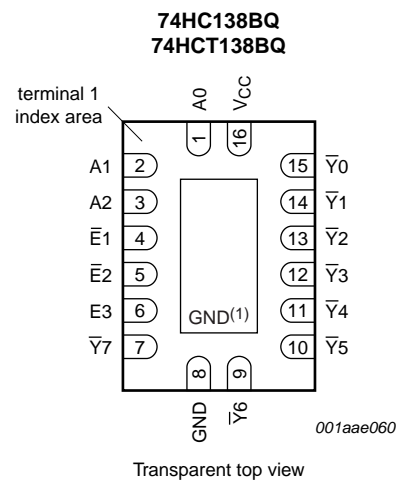


Fig 4. Pin configuration DIP16, SO16, SSOP16 and TSSOP16



- (1) The die substrate is attached to this pad using conductive die attach material. It cannot be used as supply pin or input.

Fig 5. Pin configuration DHVQFN16

## 5.2 Pin description

Table 2. Pin description

Symbol	Pin	Description
A0, A1, A2	1, 2, 3	address input A0, A1, A2
$\bar{E}1, \bar{E}2$	4, 5	enable input $\bar{E}1, \bar{E}2$ (active LOW)
E3	6	enable input E3 (active HIGH)
$\bar{Y}0, \bar{Y}1, \bar{Y}2, \bar{Y}3, \bar{Y}4, \bar{Y}5, \bar{Y}6, \bar{Y}7$	15, 14, 13, 12, 11, 10, 9, 7	output $\bar{Y}0, \bar{Y}1, \bar{Y}2, \bar{Y}3, \bar{Y}4, \bar{Y}5, \bar{Y}6, \bar{Y}7$ (active LOW)
GND	8	ground (0 V)
V <sub>CC</sub>	16	positive supply voltage

## 6. Functional description

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

Control			Input			Output							
$\bar{E}1$	$\bar{E}2$	E3	A2	A1	A0	$\bar{Y}7$	$\bar{Y}6$	$\bar{Y}5$	$\bar{Y}4$	$\bar{Y}3$	$\bar{Y}2$	$\bar{Y}1$	$\bar{Y}0$
H	X	X	X	X	X	H	H	H	H	H	H	H	H
X	H	X											
X	X	L											
L	L	H	L	L	L	H	H	H	H	H	H	H	L
			L	L	H	H	H	H	H	H	H	L	H
			L	H	L	H	H	H	H	H	L	H	H
			L	H	H	H	H	H	H	L	H	H	H
			H	L	L	H	H	H	L	H	H	H	H
			H	L	H	H	H	L	H	H	H	H	H
			H	H	L	H	L	H	H	H	H	H	H
			H	H	H	L	H	H	H	H	H	H	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 <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>	quiescent supply current		-	50	mA
I <sub>GND</sub>	ground current		-	-50	mA
T <sub>stg</sub>	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				
	DIP16 package		[1] -	750	mW
	SO16 package		[2] -	500	mW
	SSOP16 package		[3] -	500	mW
	TSSOP16 package		[3] -	500	mW
	DHVQFN16 package		[4] -	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.

[4] For DHVQFN16 packages: P<sub>tot</sub> 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	74HC138			74HCT138			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>74HC138</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

**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	
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>OZ</sub>	OFF-state output current	per input pin; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; V <sub>O</sub> = V <sub>CC</sub> or GND; other inputs at V <sub>CC</sub> or GND; V <sub>CC</sub> = 6.0 V; I <sub>O</sub> = 0 A		-	-	±0.5	-	±5.0	-	±10
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

**74HCT138**

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>OZ</sub>	OFF-state output current	per input pin; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; V <sub>O</sub> = V <sub>CC</sub> or GND; other inputs at V <sub>CC</sub> or GND; V <sub>CC</sub> = 5.5 V; I <sub>O</sub> = 0 A		-	-	±0.5	-	±5.0	-	±10
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

**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		
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; An inputs	-	150	540	-	675	-	735	μA
			per input pin; $\bar{E}n$ inputs	-	125	450	-	562.5	-	612.5	μA
			per input pin; E3 input	-	100	360	-	450	-	490	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 8](#).

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	

For type 74HC138

t <sub>pd</sub>	propagation delay	An to $\bar{Y}n$ ; see <a href="#">Figure 6</a> <sup>[1]</sup>								
		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> = 5 V; C <sub>L</sub> = 15 pF	-	12	-	-	-	-	-	ns
		V <sub>CC</sub> = 6.0 V	-	12	26	-	33	-	38	ns
		E3 to $\bar{Y}n$ ; see <a href="#">Figure 6</a> <sup>[1]</sup>								
		V <sub>CC</sub> = 2.0 V	-	47	150	-	190	-	225	ns
		V <sub>CC</sub> = 4.5 V	-	17	20	-	38	-	45	ns
		V <sub>CC</sub> = 5 V; C <sub>L</sub> = 15 pF	-	14	-	-	-	-	-	ns
		V <sub>CC</sub> = 6.0 V	-	14	26	-	33	-	38	ns
		$\bar{E}n$ to $\bar{Y}n$ ; see <a href="#">Figure 7</a> <sup>[1]</sup>								
		V <sub>CC</sub> = 2.0 V	-	47	150	-	190	-	225	ns
V <sub>CC</sub> = 4.5 V	-	17	20	-	38	-	45	ns		
V <sub>CC</sub> = 5 V; C <sub>L</sub> = 15 pF	-	14	-	-	-	-	-	ns		
V <sub>CC</sub> = 6.0 V	-	14	26	-	33	-	38	ns		
t <sub>t</sub>	transition time	$\bar{Y}n$ ; see <a href="#">Figure 6</a> and <a href="#">Figure 7</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
C <sub>PD</sub>	power dissipation capacitance	C <sub>L</sub> = 50 pF; f = 1 MHz; V <sub>I</sub> = GND to V <sub>CC</sub> <sup>[3]</sup>	-	67	-	-	-	-	-	pF

**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 8](#).

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	
<b>For type 74HCT138</b>										
$t_{pd}$	propagation delay	An to $\bar{Y}_n$ ; see <a href="#">Figure 6</a> <a href="#">[1]</a>								
		$V_{CC} = 4.5\text{ V}$	-	20	35	-	44	-	53	ns
		$V_{CC} = 5\text{ V}; C_L = 15\text{ pF}$	-	17	-	-	-	-	-	ns
		E3 to $\bar{Y}_n$ ; see <a href="#">Figure 6</a> <a href="#">[1]</a>								
		$V_{CC} = 4.5\text{ V}$	-	18	40	-	50	-	60	ns
		$V_{CC} = 5\text{ V}; C_L = 15\text{ pF}$	-	19	-	-	-	-	-	ns
		$\bar{E}_n$ to $\bar{Y}_n$ ; see <a href="#">Figure 7</a> <a href="#">[1]</a>								
		$V_{CC} = 4.5\text{ V}$	-	19	40	-	50	-	60	ns
		$V_{CC} = 5\text{ V}; C_L = 15\text{ pF}$	-	19	-	-	-	-	ns	
$t_t$	transition time	$\bar{Y}_n$ ; see <a href="#">Figure 6</a> and <a href="#">Figure 7</a> <a href="#">[2]</a>								
		$V_{CC} = 4.5\text{ V}$	-	7	15	-	19	-	22	ns
$C_{PD}$	power dissipation capacitance	$C_L = 50\text{ pF}; f = 1\text{ MHz}; V_1 = \text{GND to } V_{CC}$ <a href="#">[3]</a>	-	67	-	-	-	-	-	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;

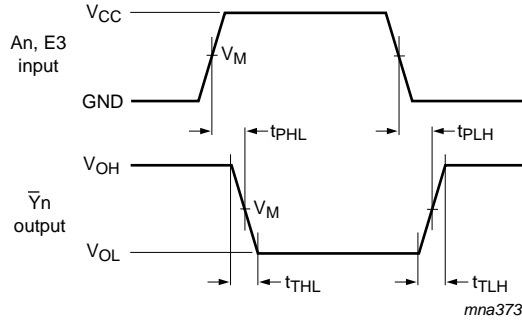
$V_{CC}$  = supply voltage in V;

$N$  = number of inputs switching;

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

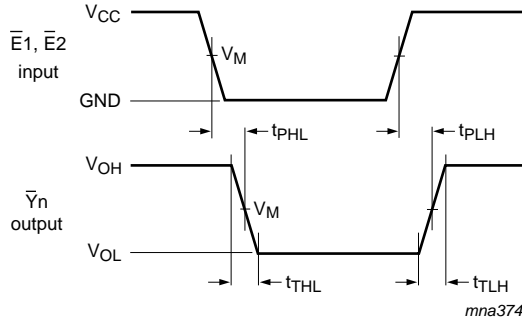


11. Waveforms



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

**Fig 6. Propagation delay input (An) and enable input (E3) to output ( $\bar{Y}_n$ ) and transition time output ( $\bar{Y}_n$ )**

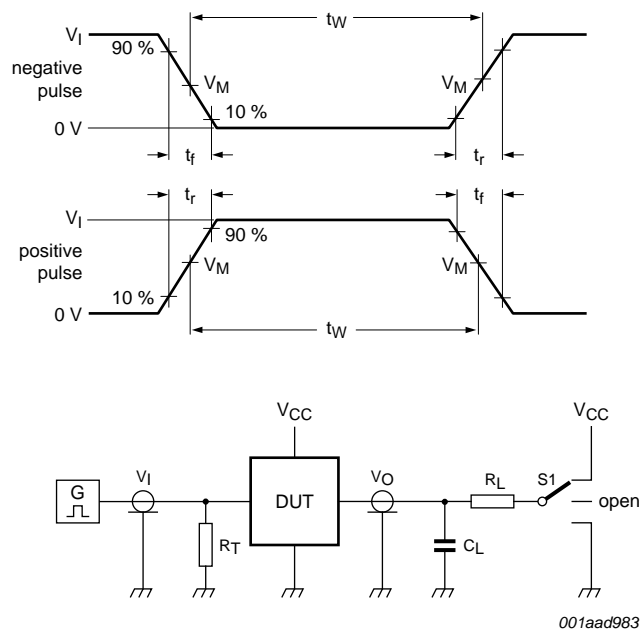


Measurement points are given in [Table 8](#).  
 $V_{OL}$  and  $V_{OH}$  are typical voltage output levels that occur with the output load.

**Fig 7. Propagation delay enable input ( $\bar{E}_n$ ) to output ( $\bar{Y}_n$ ) and transition time output ( $\bar{Y}_n$ )**

**Table 8. Measurement points**

Type	Input	Output
	$V_M$	$V_M$
74HC138	$0.5V_{CC}$	$0.5V_{CC}$
74HCT138	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 8. Load circuitry for measuring switching times**

**Table 9. Test data**

Type	Input		Load		S1 position		
	$V_I$	$t_r, t_f$	$C_L$	$R_L$	$t_{PHL}, t_{PLH}$	$t_{PZH}, t_{PHZ}$	$t_{PZL}, t_{PLZ}$
74HC138	$V_{CC}$	6 ns	15 pF, 50 pF	1 k $\Omega$	open	GND	$V_{CC}$
74HCT138	3 V	6 ns	15 pF, 50 pF	1 k $\Omega$	open	GND	$V_{CC}$

12. Package outline

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

SOT38-4

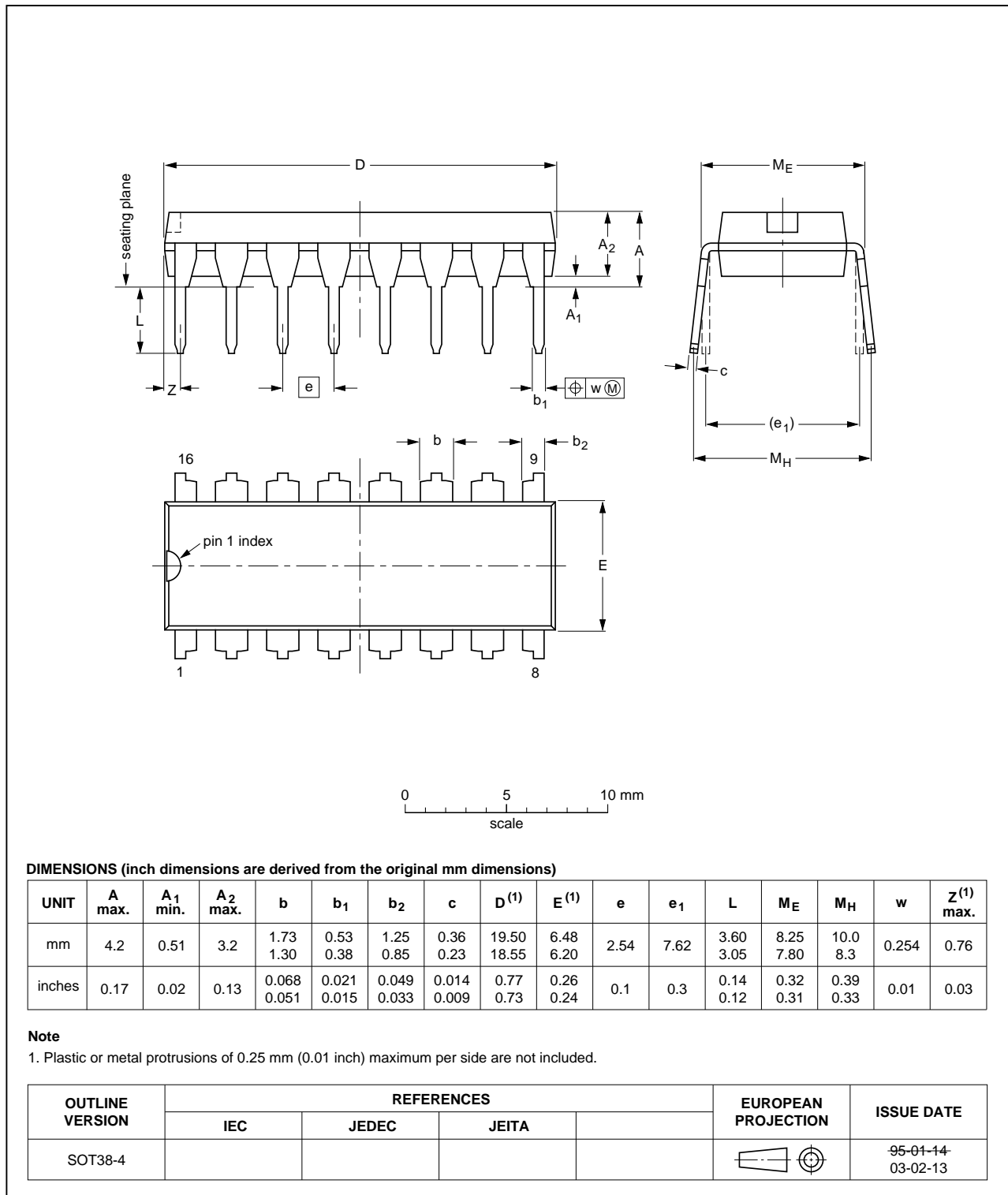


Fig 9. Package outline SOT38-4 (DIP16)

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

SOT109-1

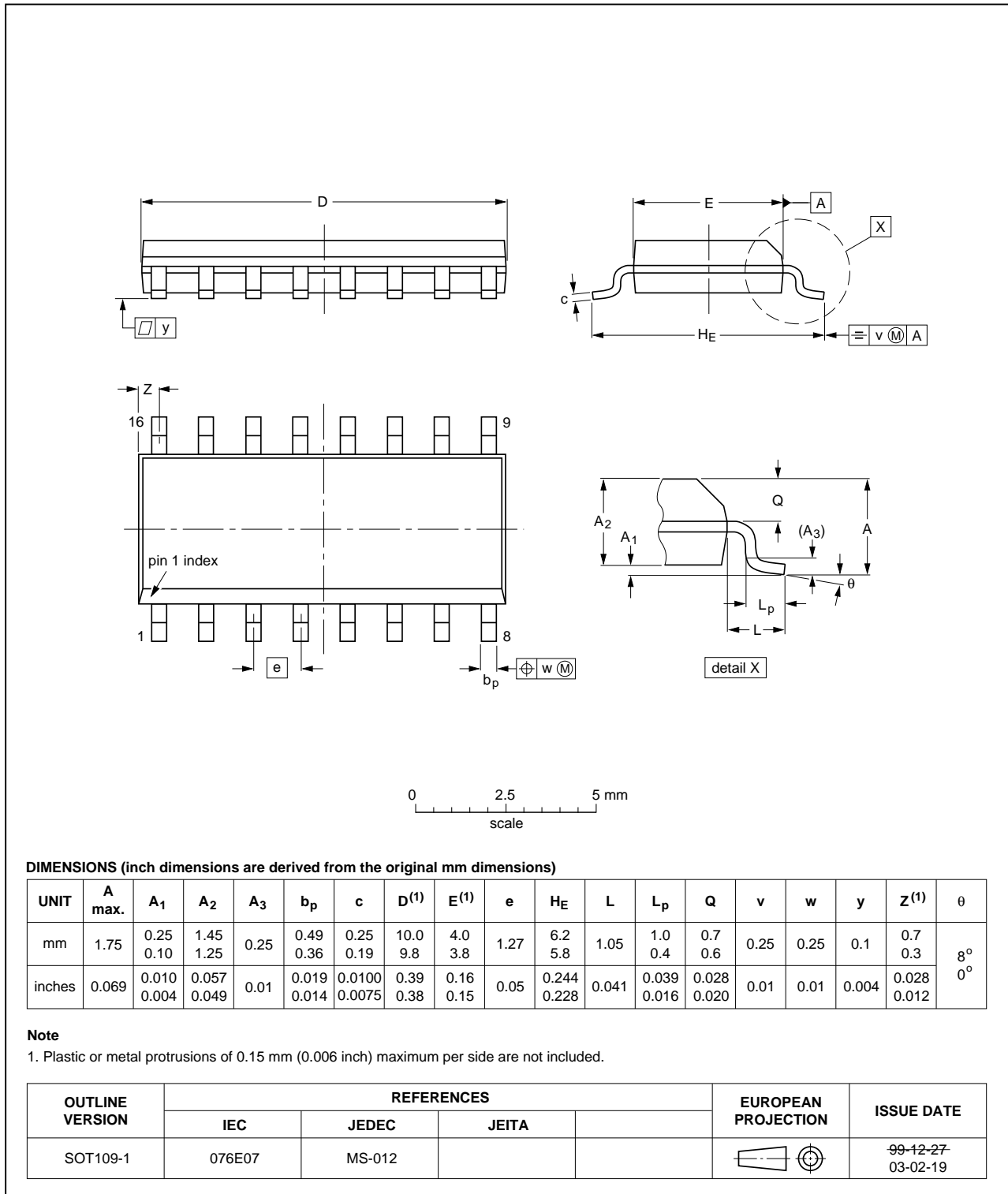


Fig 10. Package outline SOT109-1 (SO16)

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

SOT403-1

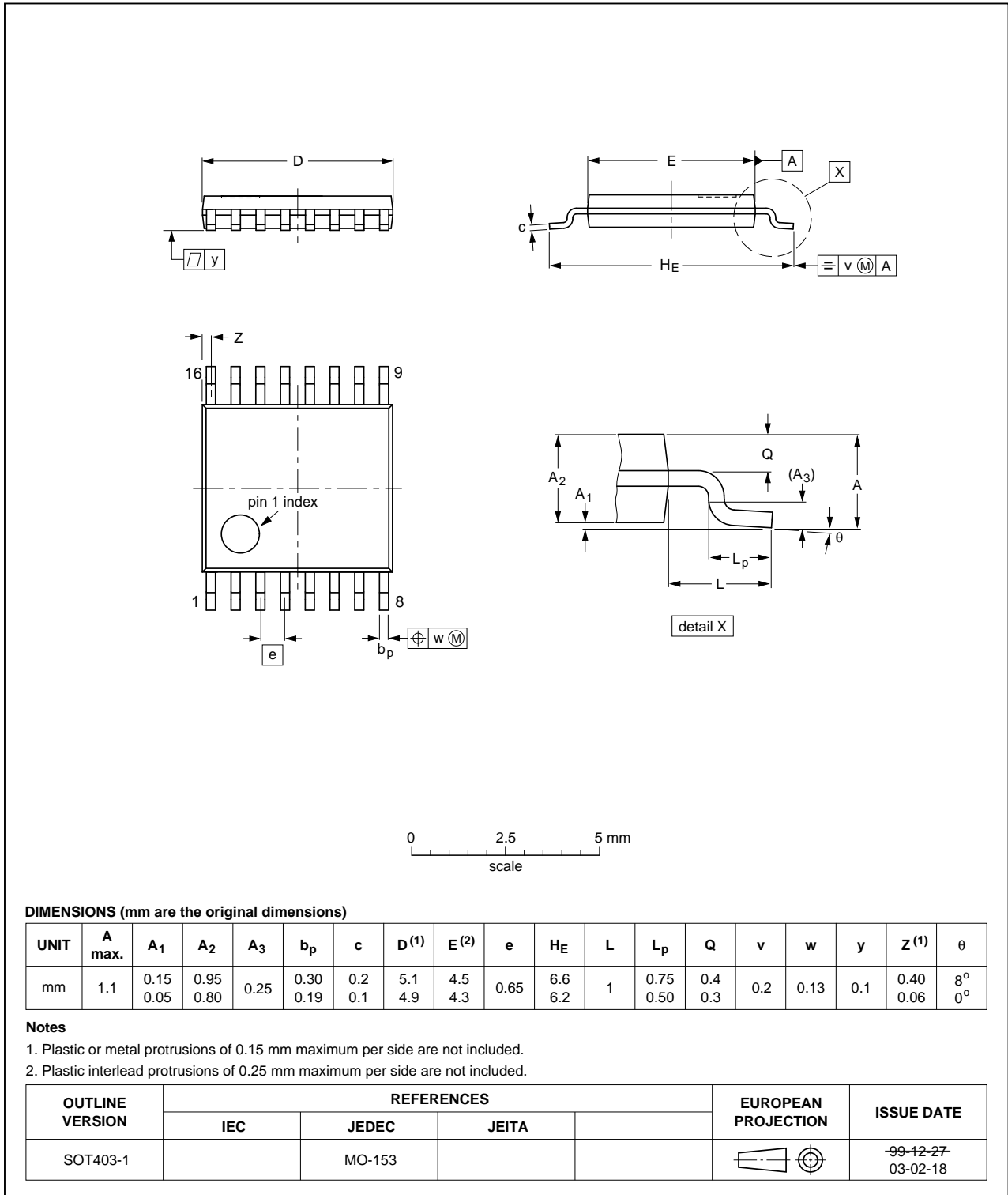


Fig 11. Package outline SOT403-1 (TSSOP16)

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

SOT338-1

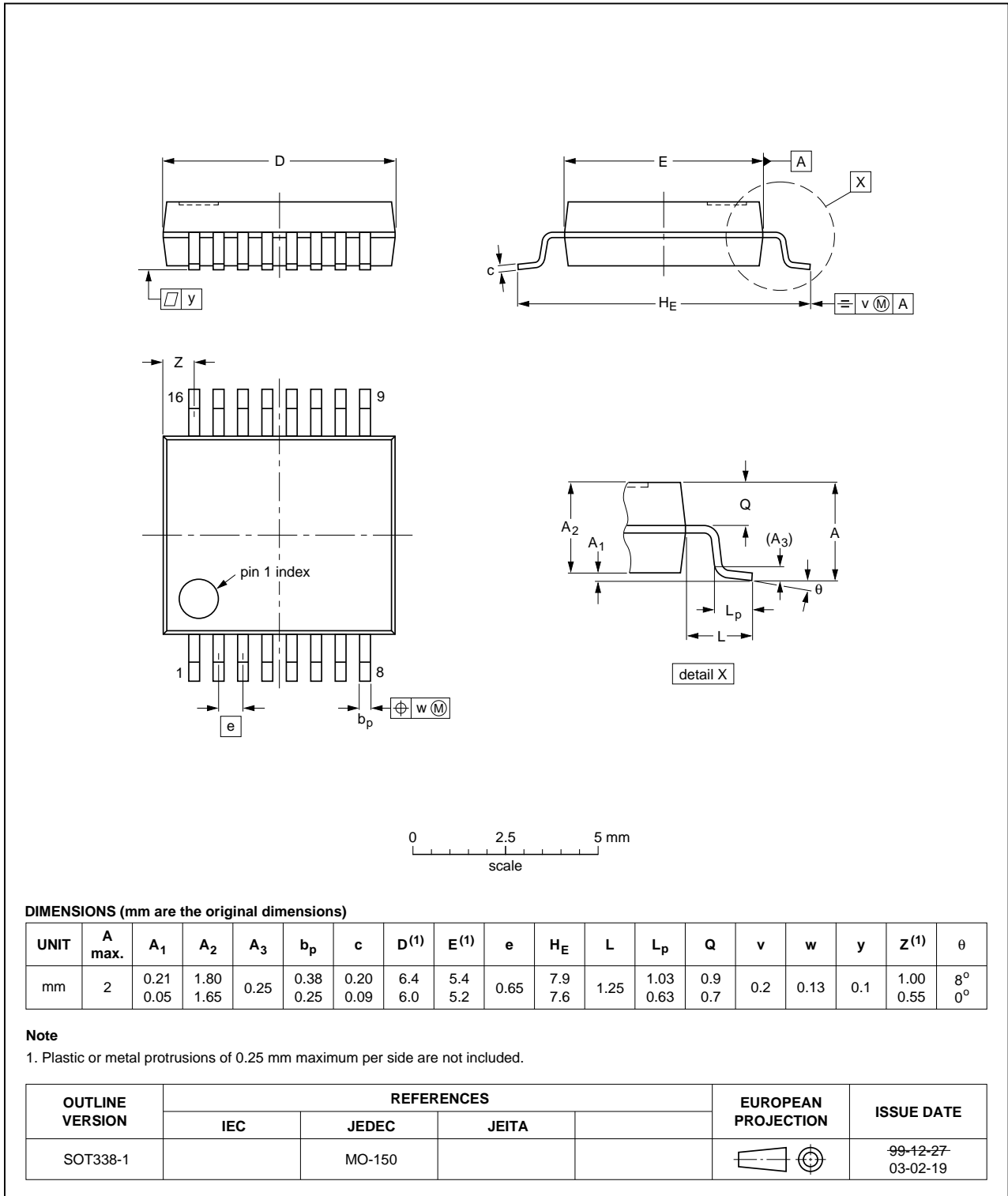


Fig 12. Package outline SOT338-1 (SSOP16)

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

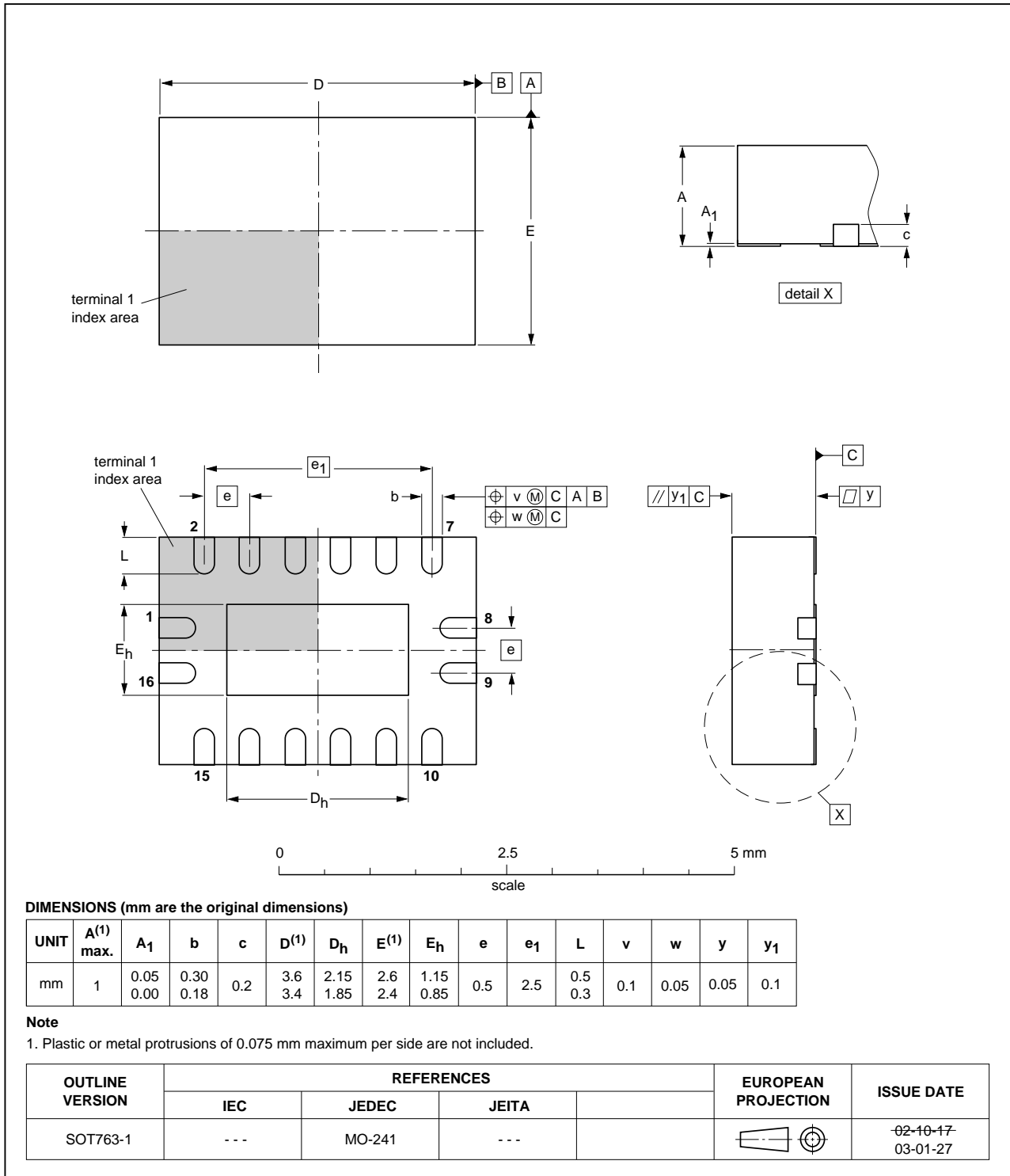


Fig 13. Package outline SOT763-1 (DHVQFN16)

## 13. Abbreviations

Table 10. Abbreviations

Acronym	Description
CMOS	Complementary Metal Oxide Semiconductor
DUT	Device Under Test
ESD	ElectroStatic Discharge
HBM	Human Body Model
LSTTL	Low-power Schottky Transistor-Transistor Logic
MM	Machine Model

## 14. Revision history

Table 11. Revision history

Document ID	Release date	Data sheet status	Change notice	Doc. number	Supersedes
74HC_HCT138 v.4	20120627	Product data sheet	-	-	74HC_HCT138 v.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>SOT38-1 changed to SOT38-4.</li> </ul>				
74HC_HCT138 v.3	20051223	Product data sheet	-	-	74HC_HCT138_CNV v.2
Modifications:	<ul style="list-style-type: none"> <li>The format of this data sheet has been redesigned to comply with the new presentation and information standard of Philips Semiconductors.</li> <li><a href="#">Section 3 "Ordering information"</a>, <a href="#">Section 5 "Pinning information"</a> and <a href="#">Section 12 "Package outline"</a>: Added DHVQFN package information</li> <li><a href="#">Section 9 "Static characteristics"</a>: Added from the family specification</li> </ul>				
74HC_HCT138_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>.

### 15.2 Definitions

**Draft** — The document is a draft version only. The content is still under internal review and subject to formal approval, which may result in modifications or additions. NXP Semiconductors does not give any representations or warranties as to the accuracy or completeness of information included herein and shall have no liability for the consequences of use of such information.

**Short data sheet** — A short data sheet is an extract from a full data sheet with the same product type number(s) and title. A short data sheet is intended for quick reference only and should not be relied upon to contain detailed and full information. For detailed and full information see the relevant full data sheet, which is available on request via the local NXP Semiconductors sales office. In case of any inconsistency or conflict with the short data sheet, the full data sheet shall prevail.

**Product specification** — The information and data provided in a Product data sheet shall define the specification of the product as agreed between NXP Semiconductors and its customer, unless NXP Semiconductors and customer have explicitly agreed otherwise in writing. In no event however, shall an agreement be valid in which the NXP Semiconductors product is deemed to offer functions and qualities beyond those described in the Product data sheet.

### 15.3 Disclaimers

**Limited warranty and liability** — Information in this document is believed to be accurate and reliable. However, NXP Semiconductors does not give any representations or warranties, expressed or implied, as to the accuracy or completeness of such information and shall have no liability for the consequences of use of such information. NXP Semiconductors takes no responsibility for the content in this document if provided by an information source outside of NXP Semiconductors.

In no event shall NXP Semiconductors be liable for any indirect, incidental, punitive, special or consequential damages (including - without limitation - lost profits, lost savings, business interruption, costs related to the removal or replacement of any products or rework charges) whether or not such damages are based on tort (including negligence), warranty, breach of contract or any other legal theory.

Notwithstanding any damages that customer might incur for any reason whatsoever, NXP Semiconductors' aggregate and cumulative liability towards customer for the products described herein shall be limited in accordance with the *Terms and conditions of commercial sale* of NXP Semiconductors.

**Right to make changes** — NXP Semiconductors reserves the right to make changes to information published in this document, including without limitation specifications and product descriptions, at any time and without notice. This document supersedes and replaces all information supplied prior to the publication hereof.

**Suitability for use** — NXP Semiconductors products are not designed, authorized or warranted to be suitable for use in life support, life-critical or safety-critical systems or equipment, nor in applications where failure or malfunction of an NXP Semiconductors product can reasonably be expected to result in personal injury, death or severe property or environmental damage. NXP Semiconductors and its suppliers accept no liability for inclusion and/or use of NXP Semiconductors products in such equipment or applications and therefore such inclusion and/or use is at the customer's own risk.

**Applications** — Applications that are described herein for any of these products are for illustrative purposes only. NXP Semiconductors makes no representation or warranty that such applications will be suitable for the specified use without further testing or modification.

Customers are responsible for the design and operation of their applications and products using NXP Semiconductors products, and NXP Semiconductors accepts no liability for any assistance with applications or customer product design. It is customer's sole responsibility to determine whether the NXP Semiconductors product is suitable and fit for the customer's applications and products planned, as well as for the planned application and use of customer's third party customer(s). Customers should provide appropriate design and operating safeguards to minimize the risks associated with their applications and products.

NXP Semiconductors does not accept any liability related to any default, damage, costs or problem which is based on any weakness or default in the customer's applications or products, or the application or use by customer's third party customer(s). Customer is responsible for doing all necessary testing for the customer's applications and products using NXP Semiconductors products in order to avoid a default of the applications and the products or of the application or use by customer's third party customer(s). NXP does not accept any liability in this respect.

**Limiting values** — Stress above one or more limiting values (as defined in the Absolute Maximum Ratings System of IEC 60134) will cause permanent damage to the device. Limiting values are stress ratings only and (proper) operation of the device at these or any other conditions above those given in the Recommended operating conditions section (if present) or the Characteristics sections of this document is not warranted. Constant or repeated exposure to limiting values will permanently and irreversibly affect the quality and reliability of the device.

**Terms and conditions of commercial sale** — NXP Semiconductors products are sold subject to the general terms and conditions of commercial sale, as published at <http://www.nxp.com/profile/terms>, unless otherwise agreed in a valid written individual agreement. In case an individual agreement is concluded only the terms and conditions of the respective agreement shall apply. NXP Semiconductors hereby expressly objects to applying the customer's general terms and conditions with regard to the purchase of NXP Semiconductors products by customer.

**No offer to sell or license** — Nothing in this document may be interpreted or construed as an offer to sell products that is open for acceptance or the grant, conveyance or implication of any license under any copyrights, patents or other industrial or intellectual property rights.

**Export control** — This document as well as the item(s) described herein may be subject to export control regulations. Export might require a prior authorization from competent authorities.

**Non-automotive qualified products** — Unless this data sheet expressly states that this specific NXP Semiconductors product is automotive qualified, the product is not suitable for automotive use. It is neither qualified nor tested in accordance with automotive testing or application requirements. NXP Semiconductors accepts no liability for inclusion and/or use of non-automotive qualified products in automotive equipment or applications.

In the event that customer uses the product for design-in and use in automotive applications to automotive specifications and standards, customer (a) shall use the product without NXP Semiconductors' warranty of the product for such automotive applications, use and specifications, and (b) whenever customer uses the product for automotive applications beyond

NXP Semiconductors' specifications such use shall be solely at customer's own risk, and (c) customer fully indemnifies NXP Semiconductors for any liability, damages or failed product claims resulting from customer design and use of the product for automotive applications beyond NXP Semiconductors' standard warranty and NXP Semiconductors' product specifications.

**Translations** — A non-English (translated) version of a document is for reference only. The English version shall prevail in case of any discrepancy between the translated and English versions.

## 15.4 Trademarks

Notice: All referenced brands, product names, service names and trademarks are the property of their respective owners.

## 16. Contact information

For more information, please visit: <http://www.nxp.com>

For sales office addresses, please send an email to: [salesaddresses@nxp.com](mailto:salesaddresses@nxp.com)

## 17. Contents

<b>1</b>	<b>General description</b> .....	<b>1</b>
<b>2</b>	<b>Features and benefits</b> .....	<b>1</b>
<b>3</b>	<b>Ordering information</b> .....	<b>2</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 .....	4
<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>7</b>
<b>11</b>	<b>Waveforms</b> .....	<b>9</b>
<b>12</b>	<b>Package outline</b> .....	<b>11</b>
<b>13</b>	<b>Abbreviations</b> .....	<b>16</b>
<b>14</b>	<b>Revision history</b> .....	<b>16</b>
<b>15</b>	<b>Legal information</b> .....	<b>17</b>
15.1	Data sheet status .....	17
15.2	Definitions .....	17
15.3	Disclaimers .....	17
15.4	Trademarks .....	18
<b>16</b>	<b>Contact information</b> .....	<b>18</b>
<b>17</b>	<b>Contents</b> .....	<b>19</b>

Please be aware that important notices concerning this document and the product(s) described herein, have been included in section 'Legal information'.

© NXP B.V. 2012.

All rights reserved.

For more information, please visit: <http://www.nxp.com>

For sales office addresses, please send an email to: [salesaddresses@nxp.com](mailto:salesaddresses@nxp.com)

Date of release: 27 June 2012

Document identifier: 74HC\_HCT138