

# 74HC137

3-to-8 line decoder, demultiplexer with address latches;  
inverting

Product data sheet

## 1. General description

The 74HC137 is a high-speed Si-gate CMOS device and is pin compatible with low power Schottky TTL (LSTTL). The 74HC137 is specified in compliance with JEDEC standard no. 7A.

The 74HC137 is a 3-to-8 line decoder, demultiplexer with latches at the three address inputs ( $A_n$ ). The 74HC137 essentially combines the 3-to-8 decoder function with a 3-bit storage latch. When the latch is enabled ( $\overline{LE} = \text{LOW}$ ), the 74HC137 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 74HC137 is ideally suited for implementing non-overlapping decoders in 3-state systems and strobed (stored address) applications in bus oriented systems.

## 2. Features

- Combines 3-to-8 decoder with 3-bit latch
- Multiple input enable for easy expansion or independent controls
- Active LOW mutually exclusive outputs
- Low-power dissipation
- Complies with JEDEC standard no. 7A
- ESD protection:
  - ◆ HBM EIA/JESD22-A114-B exceeds 2000 V
  - ◆ MM EIA/JESD22-A115-A exceeds 200 V.
- Multiple package options
- Specified from  $-40\text{ }^{\circ}\text{C}$  to  $+80\text{ }^{\circ}\text{C}$  and from  $-40\text{ }^{\circ}\text{C}$  to  $+125\text{ }^{\circ}\text{C}$ .

**PHILIPS**

### 3. Quick reference data

**Table 1: Quick reference data**

$GND = 0\text{ V}$ ;  $T_{amb} = 25\text{ °C}$ ;  $t_r = t_f = 6\text{ ns}$ .

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$t_{PHL}$ , $t_{PLH}$	propagation delay	$C_L = 15\text{ pF}$ ; $V_{CC} = 5\text{ V}$				
	An to $\bar{Y}_n$		-	18	-	ns
	$\bar{L}\bar{E}$ to $\bar{Y}_n$		-	17	-	ns
	$\bar{E}1$ to $\bar{Y}_n$		-	15	-	ns
	E2 to $\bar{Y}_n$		-	15	-	ns
$C_i$	input capacitance		-	3.5	-	pF
$C_{PD}$	power dissipation capacitance	$V_i = GND$ to $V_{CC}$	[1]	57	-	pF

[1]  $C_{PD}$  is used to determine the dynamic power dissipation ( $P_D$  in  $\mu\text{W}$ ).

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

### 4. Ordering information

**Table 2: Ordering information**

Type number	Package			Version
	Temperature range	Name	Description	
74HC137N	-40 °C to +125 °C	DIP16	plastic dual in-line package; 16 leads (300 mil)	SOT38-4
74HC137D	-40 °C to +125 °C	SO16	plastic small outline package; 16 leads; body width 3.9 mm	SOT109-1
74HC137DB	-40 °C to +125 °C	SSOP16	plastic shrink small outline package; 16 leads; body width 5.3 mm	SOT338-1

## 8. Limiting values

**Table 5: 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 diode current	$V_I < -0.5\text{ V}$ or $V_I > V_{CC} + 0.5\text{ V}$	-	$\pm 20$	mA
$I_{OK}$	output diode current	$V_O < -0.5\text{ V}$ or $V_O > V_{CC} + 0.5\text{ V}$	-	$\pm 20$	mA
$I_O$	output source or sink current	$V_O = -0.5\text{ V}$ to $V_{CC} + 0.5\text{ V}$	-	$\pm 25$	mA
$I_{CC}, I_{GND}$	$V_{CC}$ or GND current		-	$\pm 50$	mA
$T_{stg}$	storage temperature		-65	+150	°C
$P_{tot}$	power dissipation				
	DIP16 package		[1] -	750	mW
	SO16 and SSOP16 packages		[2] -	500	mW

[1] Above 70 °C:  $P_{tot}$  derates linearly with 12 mW/K.

[2] Above 70 °C:  $P_{tot}$  derates linearly with 8 mW/K.

## 9. Recommended operating conditions

**Table 6: Recommended operating conditions**

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
$t_r, t_f$	input rise and fall times	$V_{CC} = 2.0\text{ V}$	-	-	1000	ns
		$V_{CC} = 4.5\text{ V}$	-	6.0	500	ns
		$V_{CC} = 6.0\text{ V}$	-	-	400	ns
$T_{amb}$	ambient temperature		-40	-	+125	°C

## 10. Static characteristics

**Table 7: Static characteristics**

At recommended operating conditions; voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>T<sub>amb</sub> = 25 °C</b>						
V <sub>IH</sub>	HIGH-level input voltage	V <sub>CC</sub> = 2.0 V	1.5	1.2	-	V
		V <sub>CC</sub> = 4.5 V	3.15	2.4	-	V
		V <sub>CC</sub> = 6.0 V	4.2	3.2	-	V
V <sub>IL</sub>	LOW-level input voltage	V <sub>CC</sub> = 2.0 V	-	0.8	0.5	V
		V <sub>CC</sub> = 4.5 V	-	2.1	1.35	V
		V <sub>CC</sub> = 6.0 V	-	2.8	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	-	V
		I <sub>O</sub> = -20 μA; V <sub>CC</sub> = 4.5 V	4.4	4.5	-	V
		I <sub>O</sub> = -20 μA; V <sub>CC</sub> = 6.0 V	5.9	6.0	-	V
		I <sub>O</sub> = -4 mA; V <sub>CC</sub> = 4.5 V	3.98	4.32	-	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	V
		I <sub>O</sub> = 20 μA; V <sub>CC</sub> = 4.5 V	-	0	0.1	V
		I <sub>O</sub> = 20 μA; V <sub>CC</sub> = 6.0 V	-	0	0.1	V
		I <sub>O</sub> = 4 mA; V <sub>CC</sub> = 4.5 V	-	0.15	0.26	V
I <sub>LI</sub>	input leakage current	V <sub>I</sub> = V <sub>CC</sub> or GND; V <sub>CC</sub> = 6.0 V	-	-	±0.1	μA
		V <sub>CC</sub> = 6.0 V	-	-	8.0	μA
I <sub>CC</sub>	quiescent 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	μA
C <sub>I</sub>	input capacitance		-	3.5	-	pF
<b>T<sub>amb</sub> = -40 °C to +85 °C</b>						
V <sub>IH</sub>	HIGH-level input voltage	V <sub>CC</sub> = 2.0 V	1.5	-	-	V
		V <sub>CC</sub> = 4.5 V	3.15	-	-	V
		V <sub>CC</sub> = 6.0 V	4.2	-	-	V
V <sub>IL</sub>	LOW-level input voltage	V <sub>CC</sub> = 2.0 V	-	-	0.5	V
		V <sub>CC</sub> = 4.5 V	-	-	1.35	V
		V <sub>CC</sub> = 6.0 V	-	-	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	-	-	V
		I <sub>O</sub> = -20 μA; V <sub>CC</sub> = 4.5 V	4.4	-	-	V
		I <sub>O</sub> = -20 μA; V <sub>CC</sub> = 6.0 V	5.9	-	-	V
		I <sub>O</sub> = -4 mA; V <sub>CC</sub> = 4.5 V	3.84	-	-	V
I <sub>O</sub> = -5.2 mA; V <sub>CC</sub> = 6.0 V		5.34	-	-	V	

**Table 7: Static characteristics ...continued**

At recommended operating conditions; voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
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	-	-	0.1	V
		I <sub>O</sub> = 20 μA; V <sub>CC</sub> = 4.5 V	-	-	0.1	V
		I <sub>O</sub> = 20 μA; V <sub>CC</sub> = 6.0 V	-	-	0.1	V
		I <sub>O</sub> = 4 mA; V <sub>CC</sub> = 4.5 V	-	-	0.33	V
		I <sub>O</sub> = 5.2 mA; V <sub>CC</sub> = 6.0 V	-	-	0.33	V
I <sub>LI</sub>	input leakage current	V <sub>I</sub> = V <sub>CC</sub> or GND; V <sub>CC</sub> = 6.0 V	-	-	±1.0	μA
I <sub>CC</sub>	quiescent 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	-	-	80	μA
<b>T<sub>amb</sub> = -40 °C to +125 °C</b>						
V <sub>IH</sub>	HIGH-level input voltage	V <sub>CC</sub> = 2.0 V	1.5	-	-	V
		V <sub>CC</sub> = 4.5 V	3.15	-	-	V
		V <sub>CC</sub> = 6.0 V	4.2	-	-	V
V <sub>IL</sub>	LOW-level input voltage	V <sub>CC</sub> = 2.0 V	-	-	0.5	V
		V <sub>CC</sub> = 4.5 V	-	-	1.35	V
		V <sub>CC</sub> = 6.0 V	-	-	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	-	-	V
		I <sub>O</sub> = -20 μA; V <sub>CC</sub> = 4.5 V	4.4	-	-	V
		I <sub>O</sub> = -20 μA; V <sub>CC</sub> = 6.0 V	5.9	-	-	V
		I <sub>O</sub> = -4 mA; V <sub>CC</sub> = 4.5 V	3.7	-	-	V
		I <sub>O</sub> = -5.2 mA; V <sub>CC</sub> = 6.0 V	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	-	-	0.1	V
		I <sub>O</sub> = 20 μA; V <sub>CC</sub> = 4.5 V	-	-	0.1	V
		I <sub>O</sub> = 20 μA; V <sub>CC</sub> = 6.0 V	-	-	0.1	V
		I <sub>O</sub> = 4 mA; V <sub>CC</sub> = 4.5 V	-	-	0.4	V
		I <sub>O</sub> = 5.2 mA; V <sub>CC</sub> = 6.0 V	-	-	0.4	V
I <sub>LI</sub>	input leakage current	V <sub>I</sub> = V <sub>CC</sub> or GND; V <sub>CC</sub> = 6.0 V	-	-	±1.0	μA
I <sub>CC</sub>	quiescent 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	-	-	160	μA

## 11. Dynamic characteristics

**Table 8: Dynamic characteristics**

$GND = 0\text{ V}$ ;  $t_r = t_f = 6\text{ ns}$ ;  $C_L = 50\text{ pF}$ .

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b><math>T_{amb} = 25\text{ °C}</math></b>						
$t_{PHL}$ , $t_{PLH}$	propagation delay $A_n$ to $\bar{Y}_n$	see <a href="#">Figure 6</a>				
		$V_{CC} = 2.0\text{ V}$	-	58	180	ns
		$V_{CC} = 4.5\text{ V}$	-	21	36	ns
		$V_{CC} = 6.0\text{ V}$	-	17	31	ns
	propagation delay $\bar{L}\bar{E}$ to $\bar{Y}_n$	see <a href="#">Figure 7</a>				
		$V_{CC} = 2.0\text{ V}$	-	55	190	ns
		$V_{CC} = 4.5\text{ V}$	-	20	38	ns
		$V_{CC} = 6.0\text{ V}$	-	16	32	ns
	propagation delay $\bar{E}1$ to $\bar{Y}_n$	see <a href="#">Figure 7</a>				
		$V_{CC} = 2.0\text{ V}$	-	50	145	ns
		$V_{CC} = 4.5\text{ V}$	-	18	29	ns
		$V_{CC} = 6.0\text{ V}$	-	14	25	ns
	propagation delay $E2$ to $\bar{Y}_n$	see <a href="#">Figure 6</a>				
		$V_{CC} = 2.0\text{ V}$	-	50	145	ns
		$V_{CC} = 4.5\text{ V}$	-	18	29	ns
		$V_{CC} = 6.0\text{ V}$	-	14	25	ns
	output transition time	see <a href="#">Figure 6</a>				
		$V_{CC} = 2.0\text{ V}$	-	19	75	ns
		$V_{CC} = 4.5\text{ V}$	-	7	15	ns
		$V_{CC} = 6.0\text{ V}$	-	6	13	ns
$t_W$	$\bar{L}\bar{E}$ pulse width HIGH	see <a href="#">Figure 8</a>				
		$V_{CC} = 2.0\text{ V}$	50	11	-	ns
		$V_{CC} = 4.5\text{ V}$	10	4	-	ns
		$V_{CC} = 6.0\text{ V}$	9	3	-	ns
$t_{su}$	set-up time $A_n$ to $\bar{L}\bar{E}$	see <a href="#">Figure 8</a>				
		$V_{CC} = 2.0\text{ V}$	50	3	-	ns
		$V_{CC} = 4.5\text{ V}$	10	1	-	ns
		$V_{CC} = 6.0\text{ V}$	9	1	-	ns
$t_h$	hold time $A_n$ to $\bar{L}\bar{E}$	see <a href="#">Figure 8</a>				
		$V_{CC} = 2.0\text{ V}$	30	3	-	ns
		$V_{CC} = 4.5\text{ V}$	6	1	-	ns
		$V_{CC} = 6.0\text{ V}$	5	1	-	ns
$C_{PD}$	power dissipation capacitance	$V_I = GND$ to $V_{CC}$	[1] -	57	-	pF

**Table 8: Dynamic characteristics ...continued** $GND = 0\text{ V}$ ;  $t_r = t_f = 6\text{ ns}$ ;  $C_L = 50\text{ pF}$ .

Symbol	Parameter	Conditions	Min	Typ	Max	Unit	
<b><math>T_{\text{amb}} = -40\text{ °C to }+85\text{ °C}</math></b>							
$t_{\text{PHL}}$ , $t_{\text{PLH}}$	propagation delay $A_n$ to $\bar{Y}_n$	see <a href="#">Figure 6</a>					
		$V_{\text{CC}} = 2.0\text{ V}$	-	-	225	ns	
		$V_{\text{CC}} = 4.5\text{ V}$	-	-	45	ns	
	propagation delay $\bar{L}\bar{E}$ to $\bar{Y}_n$	see <a href="#">Figure 7</a>					
		$V_{\text{CC}} = 2.0\text{ V}$	-	-	240	ns	
		$V_{\text{CC}} = 4.5\text{ V}$	-	-	48	ns	
	propagation delay $\bar{E}1$ to $\bar{Y}_n$	see <a href="#">Figure 7</a>					
		$V_{\text{CC}} = 2.0\text{ V}$	-	-	180	ns	
		$V_{\text{CC}} = 4.5\text{ V}$	-	-	36	ns	
	propagation delay $E2$ to $\bar{Y}_n$	see <a href="#">Figure 6</a>					
		$V_{\text{CC}} = 2.0\text{ V}$	-	-	180	ns	
		$V_{\text{CC}} = 4.5\text{ V}$	-	-	36	ns	
$t_{\text{THL}}$ , $t_{\text{TLH}}$	output transition time	see <a href="#">Figure 6</a>					
		$V_{\text{CC}} = 2.0\text{ V}$	-	-	95	ns	
		$V_{\text{CC}} = 4.5\text{ V}$	-	-	19	ns	
$t_w$	$\bar{L}\bar{E}$ pulse width HIGH	see <a href="#">Figure 8</a>					
		$V_{\text{CC}} = 2.0\text{ V}$	65	-	-	ns	
		$V_{\text{CC}} = 4.5\text{ V}$	13	-	-	ns	
$t_{\text{su}}$	set-up time $A_n$ to $\bar{L}\bar{E}$	see <a href="#">Figure 8</a>					
		$V_{\text{CC}} = 2.0\text{ V}$	65	-	-	ns	
		$V_{\text{CC}} = 4.5\text{ V}$	13	-	-	ns	
$t_h$	hold time $A_n$ to $\bar{L}\bar{E}$	see <a href="#">Figure 8</a>					
		$V_{\text{CC}} = 2.0\text{ V}$	40	-	-	ns	
		$V_{\text{CC}} = 4.5\text{ V}$	8	-	-	ns	
		$V_{\text{CC}} = 6.0\text{ V}$	7	-	-	ns	

**Table 8: Dynamic characteristics ...continued**GND = 0 V;  $t_r = t_f = 6$  ns;  $C_L = 50$  pF.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit	
<b>T<sub>amb</sub> = -40 °C to +125 °C</b>							
$t_{PHL}$ , $t_{PLH}$	propagation delay An to $\bar{Y}_n$	see <a href="#">Figure 6</a>					
		$V_{CC} = 2.0$ V	-	-	270	ns	
		$V_{CC} = 4.5$ V	-	-	54	ns	
	propagation delay $\bar{LE}$ to $\bar{Y}_n$	see <a href="#">Figure 7</a>					
		$V_{CC} = 2.0$ V	-	-	285	ns	
		$V_{CC} = 4.5$ V	-	-	57	ns	
	propagation delay $\bar{E}1$ to $\bar{Y}_n$	see <a href="#">Figure 7</a>					
		$V_{CC} = 2.0$ V	-	-	220	ns	
		$V_{CC} = 4.5$ V	-	-	44	ns	
	propagation delay E2 to $\bar{Y}_n$	see <a href="#">Figure 6</a>					
		$V_{CC} = 2.0$ V	-	-	220	ns	
		$V_{CC} = 4.5$ V	-	-	44	ns	
$t_{THL}$ , $t_{TLH}$	output transition time	see <a href="#">Figure 6</a>					
		$V_{CC} = 2.0$ V	-	-	110	ns	
		$V_{CC} = 4.5$ V	-	-	22	ns	
$t_W$	$\bar{LE}$ pulse width HIGH	see <a href="#">Figure 8</a>					
		$V_{CC} = 2.0$ V	-	-	75	ns	
		$V_{CC} = 4.5$ V	-	-	15	ns	
$t_{su}$	set-up time An to $\bar{LE}$	see <a href="#">Figure 8</a>					
		$V_{CC} = 2.0$ V	-	-	75	ns	
		$V_{CC} = 4.5$ V	-	-	15	ns	
$t_h$	hold time An to $\bar{LE}$	see <a href="#">Figure 8</a>					
		$V_{CC} = 2.0$ V	-	-	45	ns	
		$V_{CC} = 4.5$ V	-	-	9	ns	
		$V_{CC} = 6.0$ V	-	-	8	ns	

[1]  $C_{PD}$  is used to determine the dynamic power dissipation ( $P_D$  in  $\mu$ W). $P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \sum(C_L \times V_{CC}^2 \times f_o)$  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;

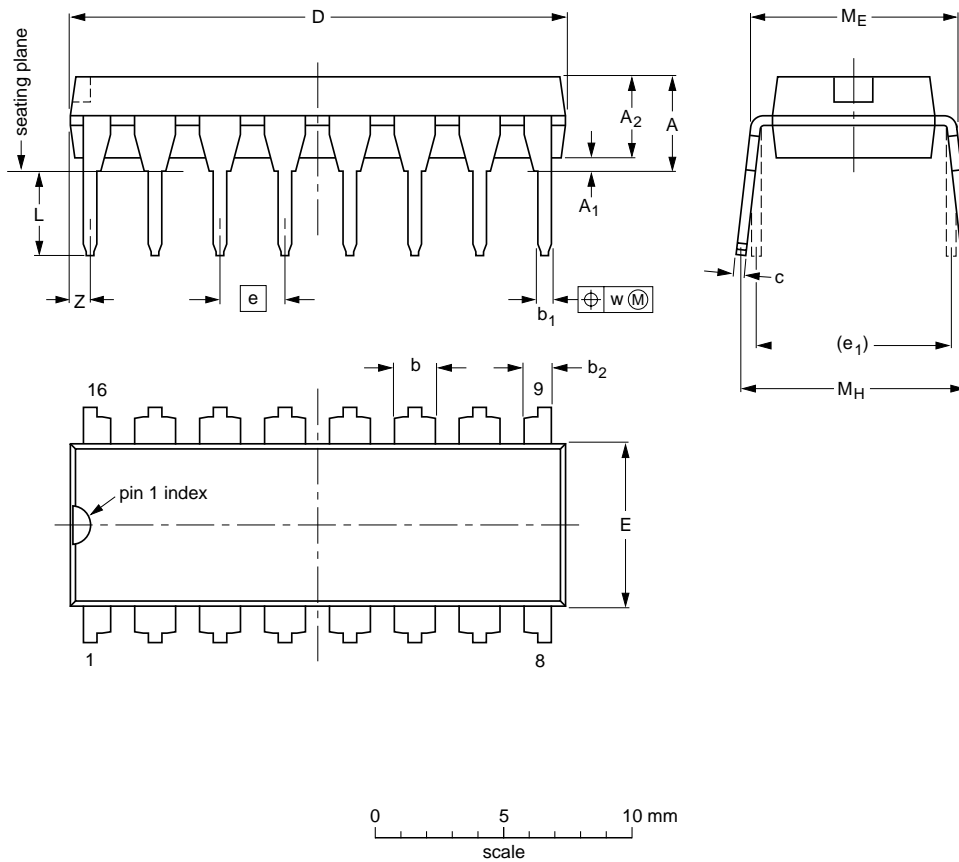
 $\sum(C_L \times V_{CC}^2 \times f_o)$  = sum of outputs.



14. Package outline

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

SOT38-4



DIMENSIONS (inch dimensions are derived from the original mm dimensions)

UNIT	A max.	A <sub>1</sub> min.	A <sub>2</sub> max.	b	b <sub>1</sub>	b <sub>2</sub>	c	D <sup>(1)</sup>	E <sup>(1)</sup>	e	e <sub>1</sub>	L	M <sub>E</sub>	M <sub>H</sub>	w	Z <sup>(1)</sup> max.
mm	4.2	0.51	3.2	1.73 1.30	0.53 0.38	1.25 0.85	0.36 0.23	19.50 18.55	6.48 6.20	2.54	7.62	3.60 3.05	8.25 7.80	10.0 8.3	0.254	0.76
inches	0.17	0.02	0.13	0.068 0.051	0.021 0.015	0.049 0.033	0.014 0.009	0.77 0.73	0.26 0.24	0.1	0.3	0.14 0.12	0.32 0.31	0.39 0.33	0.01	0.03

Note

1. Plastic or metal protrusions of 0.25 mm (0.01 inch) maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION
	IEC	JEDEC	JEITA		
SOT38-4					

Fig 11. Package outline SOT38-4 (DIP16)