74HC139; 74HCT139

Dual 2-to-4 line decoder/demultiplexer Rev. 4 — 11 December 2015

Product data sheet

1. **General description**

The 74HC139; 74HCT139 decodes two binary weighted address inputs (nA0, nA1) to four mutually exclusive outputs ($n\overline{Y}0$ to $n\overline{Y}3$). Each decoder features an enable input (nE). When $n\overline{E}$ is HIGH all outputs are forced HIGH. The enable input can be used as the data input for a 1-to-4 demultiplexer application. Inputs include clamp diodes. This enables the use of current limiting resistors to interface inputs to voltages in excess of V_{CC}.

Features and benefits 2.

- Input levels:
 - ◆ For 74HC139: CMOS level
 - ◆ For 74HCT139: TTL level
- Demultiplexing capability
- 2 independent 2-to-4 decoders
- Multifunction capability
- Suitable for memory decoding, data routing or code conversion
- Complies with JEDEC standard no. 7A
- Active LOW mutually exclusive outputs
- ESD protection:
 - HBM JESD22-A114F 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

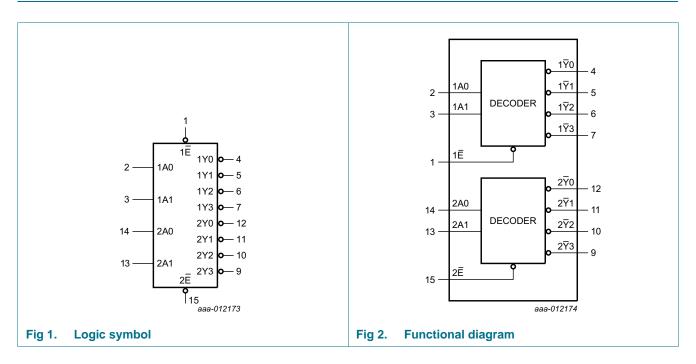
Ordering information

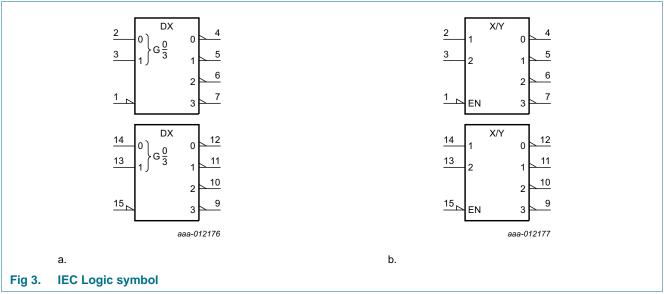
Table 1. **Ordering information**

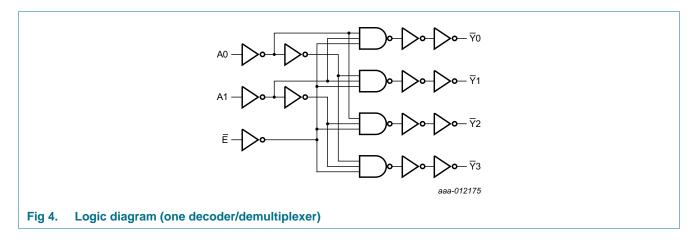
Type number	Package	Package								
	Temperature range	Name	Description	Version						
74HC139D	–40 °C to +125 °C	SO16	plastic small outline package; 16 leads;	SOT109-1						
74 HCT139D			body width 3.9 mm							
74HC139DB	-40 °C to +125 °C	SSOP16	plastic shrink small outline package; 16 leads;	SOT338-1						
74HCT139DB			body width 5.3 mm							
74HC139PW	-40 °C to +125 °C	TSSOP16	, a a a							
74HCT139PW			16 leads; body width 4.4 mm							



4. Functional diagram

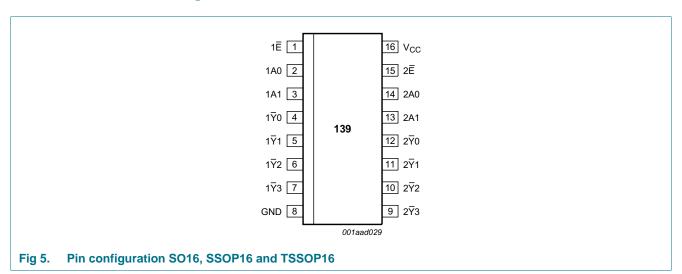






5. Pinning information

5.1 Pinning



5.2 Pin description

Table 2. Pin description

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

6. Functional description

Table 3. Function table[1]

Control	Input		Output	Output					
nE	nA1	nA1 nA0		nY3 nY2		nY0			
Н	Х	X	Н	Н	Н	Н			
L	L	L	Н	Н	Н	L			
L	L	Н	Н	Н	L	Н			
L	Н	L	Н	L	Н	Н			
L	Н	Н	L	Н	Н	Н			

^[1] H = HIGH voltage level;

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	V
I _{IK}	input clamping current	$V_{I} < -0.5 \text{ V or } V_{I} > V_{CC} + 0.5 \text{ V}$		-	±20	mA
I _{OK}	output clamping current	$V_{O} < -0.5 \text{ V or } V_{O} > V_{CC} + 0.5 \text{ V}$		-	±20	mA
Io	output current	$V_{O} = -0.5 \text{ V to } (V_{CC} + 0.5 \text{ V})$		-	±25	mA
I _{CC}	quiescent supply current			-	50	mA
I _{GND}	ground current			-50	-	mA
T _{stg}	storage temperature			-65	+150	°C
P _{tot}	total power dissipation	SO16 package	<u>[1]</u>	-	500	mW
		SSOP16 package	[2]	-	500	mW
		TSSOP16 package	[2]	-	500	mW

^[1] For SO16 package: P_{tot} derates linearly with 8 mW/K above 70 °C.

L = LOW voltage level;

X = don't care.

^[2] For SSOP16 and TSSOP16 packages: 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	74HC139			7	4HCT13	9	Unit
			Min	Тур	Max	Min	Тур	Max	
V _{CC}	supply voltage		2.0	5.0	6.0	4.5	5.0	5.5	V
VI	input voltage		0	-	V _{CC}	0	-	V _{CC}	V
Vo	output voltage		0	-	V _{CC}	0	-	V _{CC}	V
T _{amb}	ambient temperature		-40	+25	+125	-40	+25	+125	°C
Δt/ΔV	input transition rise and fall rate	V _{CC} = 2.0 V	-	-	625	-	-	-	ns/V
		$V_{CC} = 4.5 \text{ V}$	-	1.67	139	-	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	Tai	_{nb} = 25	°C	T _{amb} = -+85		T _{amb} = -40 °C to +125 °C		Unit
			Min	Тур	Max	Min	Max	Min	Max	
74HC139	9									
V _{IH}	HIGH-level	V _{CC} = 2.0 V	1.5	1.2	-	1.5	-	1.5	-	V
	input voltage	V _{CC} = 4.5 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	V _{CC} = 2.0 V	-	0.8	0.5	-	0.5	-	0.5	V
	input voltage	V _{CC} = 4.5 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	$V_I = V_{IH}$ or V_{IL}								
	output voltage	$I_O = -20 \mu A$; $V_{CC} = 2.0 \text{ V}$	1.9	2.0	-	1.9	-	1.9	-	V
		$I_O = -20 \mu A$; $V_{CC} = 4.5 \text{ V}$	4.4	4.5	-	4.4	-	4.4	-	V
		$I_O = -20 \mu A$; $V_{CC} = 6.0 \text{ V}$	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	$V_I = V_{IH}$ or V_{IL}								
	output voltage	$I_O = 20 \mu A; V_{CC} = 2.0 V$	-	0	0.1	-	0.1	-	0.1	V
		$I_O = 20 \mu A; V_{CC} = 4.5 V$	-	0	0.1	-	0.1	-	0.1	V
		$I_O = 20 \mu A; V_{CC} = 6.0 \text{ V}$	-	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
lı	input leakage current	$V_I = V_{CC}$ or GND; $V_{CC} = 6.0 \text{ V}$	-	-	±0.1	-	±1.0	-	±1.0	μΑ
I _{OZ}	OFF-state output current	$V_I = V_{IH}$ or V_{IL} ; $V_O = V_{CC}$ or GND; $V_{CC} = 6.0 \text{ V}$	-	-	±0.5	-	±5.0	-	±10.0	μΑ

74HC_HCT139

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 Table 6.
 Static characteristics ...continued

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

Symbol	Parameter	Conditions	Tai	_{mb} = 25	°C		40 °C to 5 °C		-40 °C to 25 °C	Unit
			Min	Тур	Max	Min	Max	Min	Max	
I _{CC}	supply current	$V_I = V_{CC}$ or GND; $I_O = 0$ A; $V_{CC} = 6.0 \text{ V}$	-	-	8.0	-	80	-	160	μΑ
Cı	input capacitance		-	3.5	-	-	-	-	-	pF
74HCT1	39									
V _{IH}	HIGH-level input voltage	V _{CC} = 4.5 V to 5.5 V	2.0	1.6	-	2.0	-	2.0	-	V
V _{IL}	LOW-level input voltage	V _{CC} = 4.5 V to 5.5 V	-	1.2	0.8	-	0.8	-	0.8	V
V _{OH}	HIGH-level	$V_I = V_{IH}$ or V_{IL} ; $V_{CC} = 4.5 \text{ V}$								
	output voltage	$I_{O} = -20 \mu A$	4.4	4.5	-	4.4	-	4.4	-	V
		$I_O = -4 \text{ mA}$	3.98	4.32	-	3.84	-	3.7	-	V
V _{OL} LOW-level		$V_I = V_{IH}$ or V_{IL} ; $V_{CC} = 4.5 \text{ V}$								
0_	output voltage	I _O = 20 μA	-	0	0.1	-	0.1	-	0.1	V
		$I_{O} = 4.0 \text{ mA}$	-	0.15	0.26	-	0.33	-	0.4	V
lį	input leakage current	$V_I = V_{CC}$ or GND; $V_{CC} = 5.5 \text{ V}$	-	-	±0.1	-	±1.0	-	±1.0	μА
l _{oz}	OFF-state output current	$V_I = V_{IH}$ or V_{IL} ; $V_O = V_{CC}$ or GND; $V_{CC} = 5.5 \text{ V}$	-	-	±0.5	-	±5.0	-	±10	μА
I _{CC}	supply current	$V_I = V_{CC}$ or GND; $I_O = 0$ A; $V_{CC} = 5.5$ V	-	-	8.0	-	80	-	160	μА
Δl _{CC}	additional supply current	$\begin{aligned} V_I &= V_{CC} - 2.1 \text{ V;} \\ \text{other inputs at } V_{CC} \text{ or GND;} \\ V_{CC} &= 4.5 \text{ V to } 5.5 \text{ V;} \\ I_O &= 0 \text{ A} \end{aligned}$								
		per input pin; 1An inputs	-	70	252	-	315	-	343	μΑ
		per input pin; 2An inputs	-	70	252	-	315	-	343	μΑ
		per input pin; nE inputs	-	135	486	-	607.5	-	661.5	μΑ
C _I	input capacitance		-	3.5	-	-	-	-	-	pF

10. Dynamic characteristics

Table 7. Dynamic characteristics

Voltages are referenced to GND (ground = 0 V); $C_L = 50 \text{ pF}$ unless otherwise specified; for test circuit see Figure 8.

Symbol	Parameter	Conditions		T _{an}	_{nb} = 25	°C		= −40 °C ·85 °C	T _{amb} =	= −40 °C 125 °C	Unit
				Min	Тур	Max	Min	Max	Min	Max	
74HC13	9										
t _{pd}	propagation	nAn to nYn; see Figure 6	[1]								
	delay	V _{CC} = 2.0 V		-	39	145	-	180	-	220	ns
		V _{CC} = 4.5 V		-	14	29	-	36	-	44	ns
		$V_{CC} = 5.0 \text{ V}; C_L = 15 \text{ pF}$		-	11	-	-	-	-	-	ns
		V _{CC} = 6.0 V		-	11	25	-	31	-	38	ns
		nE to nYn; see Figure 7	[1]								
		V _{CC} = 2.0 V		-	33	135	-	170	-	205	ns
		V _{CC} = 4.5 V		-	12	27	-	34	-	41	ns
		$V_{CC} = 5.0 \text{ V}; C_L = 15 \text{ pF}$		-	10	-	-	-	-	-	ns
		V _{CC} = 6.0 V		-	10	23	-	29	-	35	ns
t _t transition time		n\overline{Y}n; see Figure 6 and Figure 7	[2]								
		V _{CC} = 2.0 V		-	19	75	-	95	-	110	ns
		V _{CC} = 4.5 V		-	7	15	-	19	-	22	ns
		V _{CC} = 6.0 V		-	6	13	-	16	-	19	ns
C _{PD}	power dissipation capacitance	C_L = 50 pF; f = 1 MHz; V_I = GND to V_{CC}	[3]	-	42	-	-	-	-	-	pF
74HCT1	39	1					I			1	
t _{pd}	propagation	nAn to \overline{Y} n; see Figure 6	[1]								
	delay	V _{CC} = 4.5 V		-	16	34	-	43	-	51	ns
		$V_{CC} = 5.0 \text{ V}; C_L = 15 \text{ pF}$		-	13	-	-	-	-	-	ns
		nE to nYn; see Figure 7	[1]								
		V _{CC} = 4.5 V		-	16	34	-	43	-	51	ns
		$V_{CC} = 5.0 \text{ V}; C_L = 15 \text{ pF}$		-	13	-	-	-	-	-	ns
t _t	transition time	nYn; see Figure 6 and Figure 7	[2]								
		V _{CC} = 4.5 V		-	7	15	-	19	-	22	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 8.

Symbol	Symbol Parameter Conditions			T _{amb} = 25 °C		T _{amb} = -40 °C to +85 °C		T _{amb} = -40 °C to +125 °C		Unit	
				Min	Тур	Max	Min	Max	Min	Max	
C _{PD}	power dissipation capacitance	$C_L = 50 \text{ pF; } f = 1 \text{ MHz;}$ $V_I = \text{GND to } V_{CC} - 1.5 \text{ V}$	3]	-	44	-	-	-	-	-	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 μW).

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

 f_i = input frequency in MHz;

fo = output frequency in MHz;

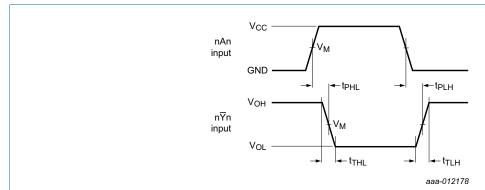
 C_L = output load capacitance in pF;

V_{CC} = supply voltage in V;

N = number of inputs switching;

 $\sum (C_L \times V_{CC}^2 \times f_0) = \text{sum of outputs.}$

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 (nAn) to output (nYn) and transition time output (nYn)

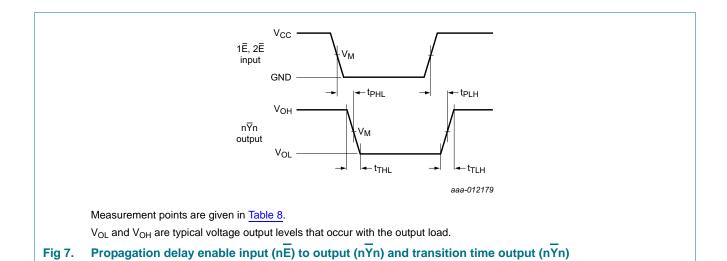
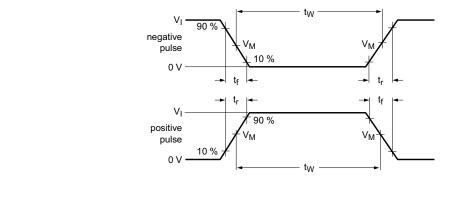
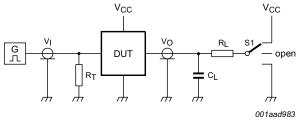


Table 8. Measurement points

Туре	Input	Output
	V _M	V _M
74HC139	0.5V _{CC}	0.5V _{CC}
74HCT139	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. Test circuit for measuring switching times

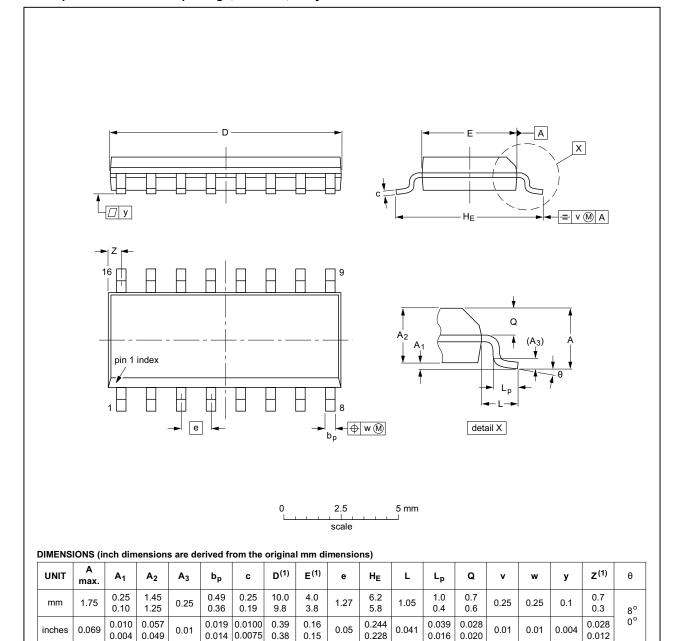
Table 9. Test data

Туре	Input		Load	oad		S1 position			
	VI	t _r , t _f	CL	R _L	t _{PHL} , t _{PLH}	t _{PZH} , t _{PHZ}	t _{PZL} , t _{PLZ}		
74HC139	V _{CC}	6 ns	15 pF, 50 pF	1 kΩ	open	GND	V _{CC}		
74HCT139	3 V	6 ns	15 pF, 50 pF	1 kΩ	open	GND	V _{CC}		

12. Package outline

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

SOT109-1



Note

1. Plastic or metal protrusions of 0.15 mm (0.006 inch) maximum per side are not included.

OUTLINE		REFER	EUROPEAN	ISSUE DATE		
VERSION	IEC	JEDEC	JEITA		PROJECTION	ISSUE DATE
SOT109-1	076E07	MS-012				99-12-27 03-02-19

Fig 9. Package outline SOT109-1 (SO16)

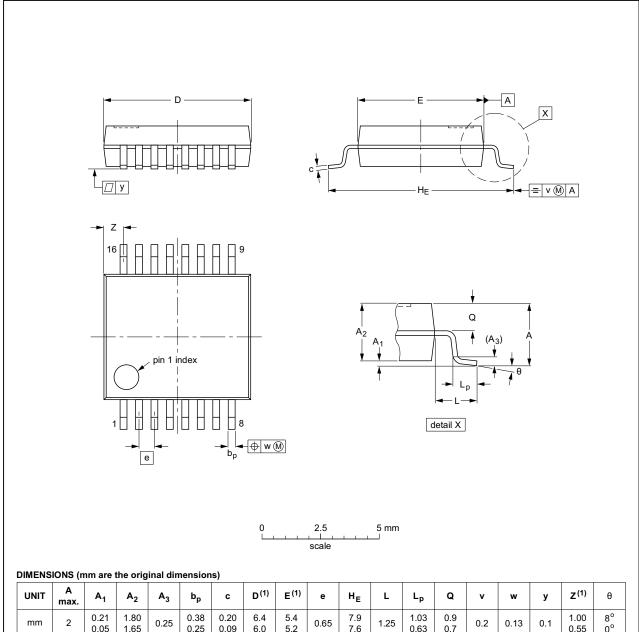
74HC_HCT139

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

SOT338-1



UNIT	A max.	A ₁	A ₂	A ₃	b _p	С	D ⁽¹⁾	E ⁽¹⁾	е	HE	L	Lp	Q	٧	w	у	Z ⁽¹⁾	θ	
mm	2	0.21 0.05	1.80 1.65	0.25	0.38 0.25	0.20 0.09	6.4 6.0	5.4 5.2	0.65	7.9 7.6	1.25	1.03 0.63	0.9 0.7	0.2	0.13	0.1	1.00 0.55	8° 0°	

Note

1. Plastic or metal protrusions of 0.25 mm maximum per side are not included.

OUTLINE		REFER	EUROPEAN	ISSUE DATE			
VERSION	IEC	JEDEC	JEITA		PROJECTION	ISSUE DATE	
SOT338-1		MO-150				99-12-27 03-02-19	

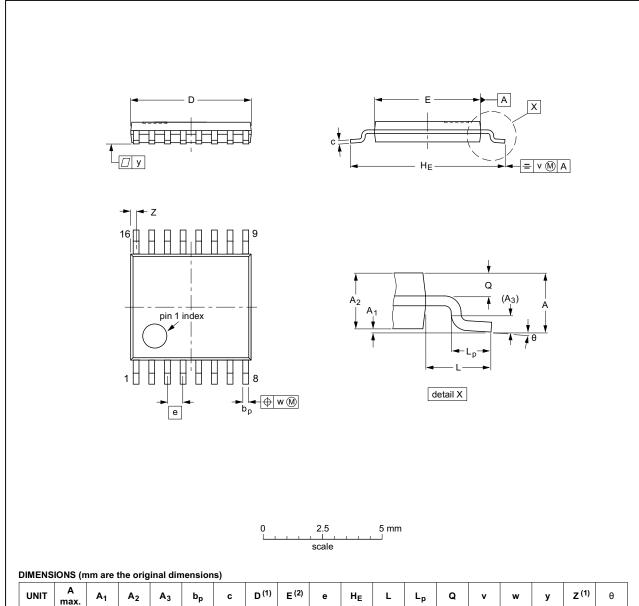
Fig 10. Package outline SOT338-1 (SSOP16)

74HC_HCT139

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

SOT403-1



UNI	IT	A max.	A ₁	A ₂	A ₃	bp	С	D ⁽¹⁾	E (2)	е	HE	L	Lp	Q	٧	w	у	Z ⁽¹⁾	θ
mn	n	1.1	0.15 0.05	0.95 0.80	0.25	0.30 0.19	0.2 0.1	5.1 4.9	4.5 4.3	0.65	6.6 6.2	1	0.75 0.50	0.4 0.3	0.2	0.13	0.1	0.40 0.06	8° 0°

Notes

- 1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.
- 2. Plastic interlead protrusions of 0.25 mm maximum per side are not included.

	REFER	EUROPEAN	ISSUE DATE			
IEC	JEDEC	JEITA		PROJECTION	ISSUE DATE	
	MO-153				99-12-27 03-02-18	
-	IEC	IEC JEDEC		IEC JEDEC JEITA	IEC JEDEC JEITA PROJECTION	

Fig 11. Package outline SOT403-1 (TSSOP16)

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13. Abbreviations

Table 10. Abbreviations

Acronym	Description
CMOS	Complementary Metal-Oxide Semiconductor
DUT	Device Under Test
ESD	ElectroStatic Discharge
НВМ	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			
74HC_HCT139 v.4	20151211	Product data sheet	-	74HC_HCT139 v.3			
Modifications:	Type numbers 74HC139N and 74HCT139N (SOT38-4) removed.						
74HC_HCT139 v.3	20140328	Product data sheet	-	74HC_HCT139 v.2			
Modifications:	 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. 						
74HC_HCT139_CNV v.2	19930927	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.
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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