74HC125; 74HCT125

Quad buffer/line driver; 3-state

Rev. 6 — 1 December 2015

Product data sheet

1. General description

The 74HC125; 74HCT125 is a quad buffer/line driver with 3-state outputs controlled by the output enable inputs (nOE). A HIGH on nOE causes the outputs to assume a high impedance OFF-state. Inputs include clamp diodes. This enables the use of current limiting resistors to interface inputs to voltages in excess of V_{CC}.

2. Features and benefits

- Complies with JEDEC standard no. 7A
- Input levels:
 - ◆ The 74HC125: CMOS levels
 - ◆ The 74HCT125: TTL levels
- 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

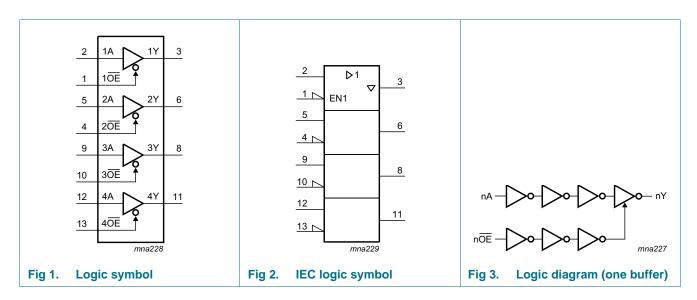
3. Ordering information

Table 1. Ordering information

Type number	Package	Package									
	Temperature range	Name	Description	Version							
74HC125D	–40 °C to +125 °C	SO14	plastic small outline package; 14 leads; body width	SOT108-1							
74HCT125D			3.9 mm								
74HC125DB	-40 °C to +125 °C	SSOP14	plastic shrink small outline package; 14 leads; body	SOT337-1							
74HCT125DB			width 5.3 mm								
74HC125PW	-40 °C to +125 °C	TSSOP14	plastic thin shrink small outline package; 14 leads; body	SOT402-1							
74HCT125PW			width 4.4 mm								

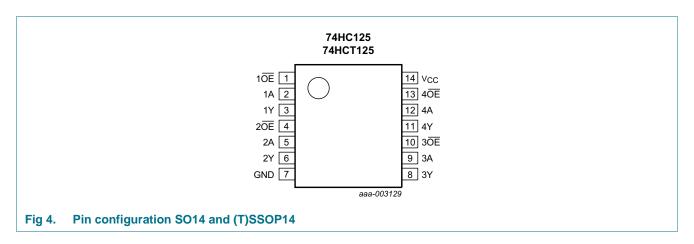


4. Functional diagram



5. Pinning information

5.1 Pinning



5.2 Pin description

Table 2. Pin description

Symbol	Pin	Description
1OE, 2OE, 3OE, 4OE	1, 4, 10, 13	output enable input (active LOW)
1A, 2A, 3A, 4A	2, 5, 9, 12	data input
1Y, 2Y, 3Y, 4Y	3, 6, 8, 11	data output
GND	7	ground (0 V)
V _{CC}	14	supply voltage

6. Functional description

Table 3. Function table[1]

	Input	Output	
nOE	nA	nY	
L	L	L	
	Н	Н	
Н	X	Z	

^[1] H = HIGH voltage level; L = LOW voltage level; X = don't care; Z = high-impedance OFF-state.

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	$V_{I} < -0.5 \text{ V or } V_{I} > V_{CC} + 0.5 \text{ V}$	[1]	-	±20	mA
I _{OK}	output clamping current	$V_{O} < -0.5 \text{ V or } V_{O} > V_{CC} + 0.5 \text{ V}$	[1]	-	±20	mA
Io	output current	$V_{O} = -0.5 \text{ V to } (V_{CC} + 0.5 \text{ V})$		-	±35	mA
I _{CC}	supply current			-	+70	mA
I _{GND}	ground current			-	-70	mA
T _{stg}	storage temperature			-65	+150	°C
P _{tot}	total power dissipation	SO14 and (T)SSOP14 packages	[2]	-	500	mW

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

^[2] For SO14 package: P_{tot} derates linearly with 8 mW/K above 70 °C. For (T)SSOP14 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	74HC125			74HCT125			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 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		25 °C		-40 °C t	o +85 °C	-40 °C to	o +125 °C	Unit
			Min	Тур	Max	Min	Max	Min	Max	
74HC12	5							1		
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
	$\begin{array}{c} \text{input voltage} \\ \hline V_{CC} \\ \hline U_{CC} \\ U_{CC} \\ \hline U_{CC} \\ U_{CC} \\ \hline U_{CC} \\ \hline U_{CC} \\ U_{CC} \\ \hline U_{CC} \\ U_$	V _{CC} = 6.0 V	4.2	3.2	-	4.2	-	4.2	-	V
V _{IL}		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 V	-	2.8	1.8	-	1.8	-	1.8	V
V _{OH}		$V_I = V_{IH}$ or V_{IL}								
output	output voltage	$I_O = -20 \mu A; V_{CC} = 2.0 V$	1.9	2.0	-	1.9	-	1.9	-	V
		$I_O = -20 \mu A; V_{CC} = 4.5 V$	4.4	4.5	-	4.4	-	4.4	-	V
		$I_O = -20 \mu A; V_{CC} = 6.0 V$	5.9	6.0	-	5.9	-	5.9	-	V
		$I_{O} = -6.0 \text{ mA}; V_{CC} = 4.5 \text{ V}$	3.98	4.32	-	3.84	-	3.7	-	V
		$I_{O} = -7.8 \text{ mA}; V_{CC} = 6.0 \text{ V}$	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
		$I_O = 20 \mu A; V_{CC} = 6.0 V$	-	0	0.1	-	0.1	-	0.1	V
		$I_O = 6.0 \text{ mA}; V_{CC} = 4.5 \text{ V}$	-	0.15	0.26	-	0.33	-	0.4	V
		$I_O = 7.8 \text{ mA}; V_{CC} = 6.0 \text{ V}$	-	0.16	0.26	-	0.33	-	0.4	V
I _I	input leakage current	$V_I = V_{CC}$ or GND; $V_{CC} = 6.0 \text{ V}$	-	-	±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; $V_{CC} = 6.0 \text{ V}$	-	-	±0.5	-	±5.0	-	±10.0	μА

 Table 6.
 Static characteristics ...continued

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

Symbol	Parameter	Conditions		25 °C		–40 °C t	o +85 °C	–40 °C t	o +125 °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	25									
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	8.0	-	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	
		$I_O = -6 \text{ mA}$	3.98	4.32	-	3.84	-	3.7	-	V
V_{OL}	LOW-level	$V_I = V_{IH}$ or V_{IL} ; $V_{CC} = 4.5 \text{ V}$								
	output voltage	I _O = 20 μA	-	0	0.1	-	0.1	-	0.1	V
		$I_{O} = 6.0 \text{ mA}$	-	0.16	0.26	-	0.33	-	0.4	V
l _l	input leakage current	$V_I = V_{CC}$ or GND; $V_{CC} = 5.5 \text{ V}$	-	-	±0.1	-	±1.0	-	±1.0	μΑ
l _{OZ}	OFF-state output current	$V_I = V_{IH}$ or V_{IL} ; $V_{CC} = 5.5$ V; $V_O = V_{CC}$ or GND	-	-	±0.5	-	±5.0	-	±10	μΑ
I _{CC}	supply current	$V_I = V_{CC}$ or GND; $I_O = 0$ A; $V_{CC} = 5.5$ V	-	-	8.0	-	80	-	160	μΑ
Δl _{CC}	additional supply current	per input pin; $V_I = V_{CC} - 2.1 \text{ V}; I_O = 0 \text{ A};$ other inputs at V_{CC} or GND; $V_{CC} = 4.5 \text{ V}$ to 5.5 V		100	360	-	450	-	490	μΑ
Cı	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 7.

Symbol	Parameter	Conditions		25 °C		-40 °C	to +85 °C	-40 °C t	o +125 °C	Unit
			Mir	1 Тур	Max	Min	Max	Min	Max	
74HC12	5			'						
t _{pd}	propagation	nA to nY; see Figure 5	1]							
	delay	V _{CC} = 2.0 V	-	30	100	-	125	-	150	ns
		V _{CC} = 4.5 V	-	11	20	-	25	-	30	ns
		V _{CC} = 5 V; C _L = 15 pF	-	9	-	-	-	-	-	ns
		V _{CC} = 6.0 V	-	9	17	-	21	-	26	ns
t _{en}	enable time	nOE to nY; see Figure 6	2]							
		V _{CC} = 2.0 V	-	41	125	-	155	-	190	ns
		V _{CC} = 4.5 V	-	15	25	-	31	-	38	ns
		V _{CC} = 6.0 V	-	12	21	-	26	-	32	ns
t _{dis}	disable time	nOE to nY; see Figure 6	3]							
		V _{CC} = 2.0 V	-	41	125	-	155	-	190	ns
		V _{CC} = 4.5 V	-	15	25	-	31	-	38	ns
		V _{CC} = 6.0 V	-	12	21	-	26	-	32	ns
t _t	transition	nY; see Figure 5	4]							
	time	V _{CC} = 2.0 V	-	14	60	-	75	-	90	ns
		V _{CC} = 4.5 V	-	5	12	-	15	-	18	ns
		V _{CC} = 6.0 V	-	4	10	-	13	-	15	ns
C _{PD}	power dissipation capacitance	$C_L = 50 \text{ pF}; f = 1 \text{ MHz};$ $V_I = \text{GND to } V_{CC}$	5] _	22	-	-	-	-	-	pF

 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 7.

		7							40.00 / 405.00		
Symbol	Parameter	Conditions			25 °C		–40 °C	to +85 °C	–40 °C t	o +125 °C	Unit
				Min	Тур	Max	Min	Max	Min	Max	
74HCT1	25		·								
t _{pd}	propagation	nA to nY; see Figure 5	[1]								
delay	V _{CC} = 4.5 V		-	15	25	-	31	-	38	ns	
		V _{CC} = 5 V; C _L = 15 pF		-	12	-	-	-	-	-	ns
t _{en}	enable time	nOE to nY; see Figure 6	[2]								
		V _{CC} = 4.5 V		-	15	28	-	35	-	42	ns
t _{dis}	disable time	nOE to nY; see Figure 6	[3]								
		V _{CC} = 4.5 V		-	15	25	-	31	-	38	ns
t _t	transition time	nY; see Figure 5	[4]	-	5	12	-	15	-	18	ns
C _{PD}	power dissipation capacitance	C_L = 50 pF; f = 1 MHz; V _I = GND to V _{CC} - 1.5 V	[5]	-	24	-	-	-	-	-	pF

- [1] t_{pd} is the same as t_{PLH} and t_{PHL} .
- [2] t_{en} is the same as t_{PZH} and t_{PZL} .
- [3] t_{dis} is the same as t_{PLZ} and t_{PHZ} .
- [4] t_t is the same as t_{THL} and t_{TLH} .
- [5] C_{PD} is used to determine the dynamic power dissipation (P_D in μW).

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

 f_i = input frequency in MHz;

f_o = output frequency in MHz;

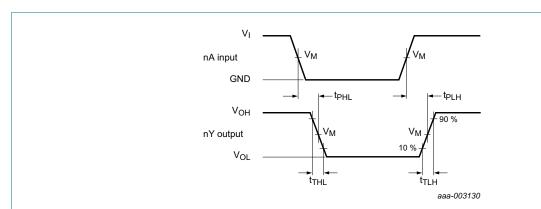
C_L = output load capacitance in pF;

 V_{CC} = supply voltage in V;

N = number of inputs switching;

 $\Sigma (C_L \times V_{CC}^2 \times f_o)$ = sum of 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 5. Propagation delay input (nA) to output (nY)

74HC_HCT125

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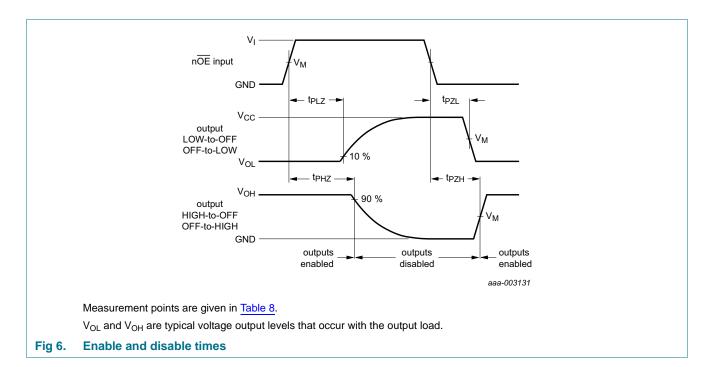
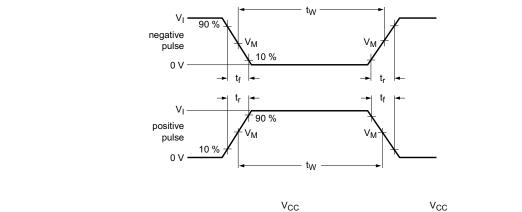
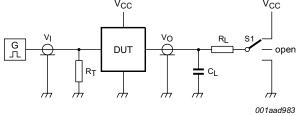


Table 8. Measurement points

Туре	Input	Output
	V _M	V _M
74HC125	0.5V _{CC}	0.5V _{CC}
74HCT125	1.3 V	1.3 V

8 of 16





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 7. Test circuit for measuring switching times

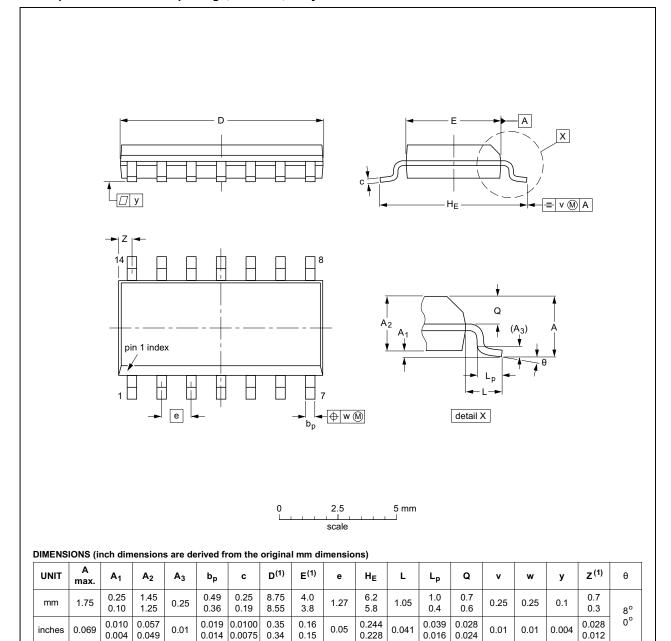
Table 9. Test data

Туре	Input		Load		S1 position		
	VI	t _r , t _f	CL	R _L	t _{PHL} , t _{PLH}	t _{PZH} , t _{PHZ}	t _{PZL} , t _{PLZ}
74HC125	V _{CC}	6 ns	15 pF, 50 pF	1 kΩ	open	GND	V _{CC}
74HCT125	3 V	6 ns	15 pF, 50 pF	1 kΩ	open	GND	V _{CC}

12. Package outline

SO14: plastic small outline package; 14 leads; body width 3.9 mm

SOT108-1



Note

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

OUTLINE VERSION		REFER	EUROPEAN	ISSUE DATE		
	IEC	JEDEC	JEITA		PROJECTION	ISSUE DATE
SOT108-1	076E06	MS-012				99-12-27 03-02-19

Fig 8. Package outline SOT108-1 (SO14)

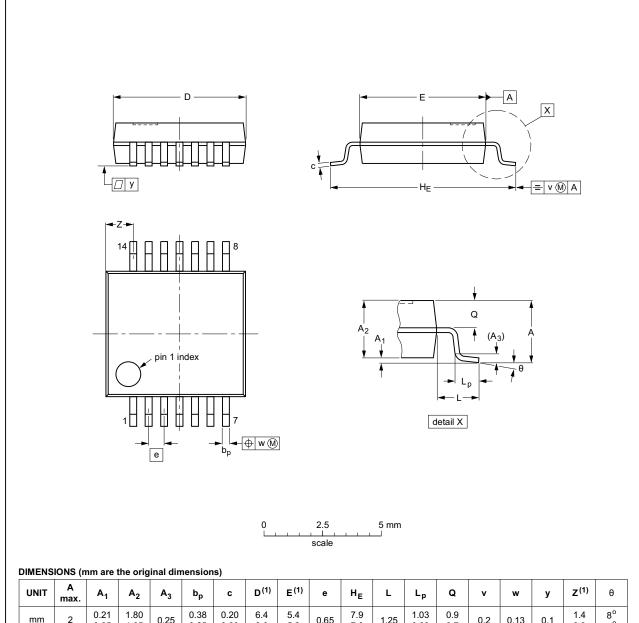
74HC_HCT125

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SSOP14: plastic shrink small outline package; 14 leads; body width 5.3 mm

SOT337-1



_							-,												
	UNIT	A max.	A ₁	A ₂	A ₃	b _p	С	D ⁽¹⁾	E ⁽¹⁾	е	HE	L	Lp	Q	v	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	1.4 0.9	8° 0°

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	
SOT337-1		MO-150				99-12-27 03-02-19	

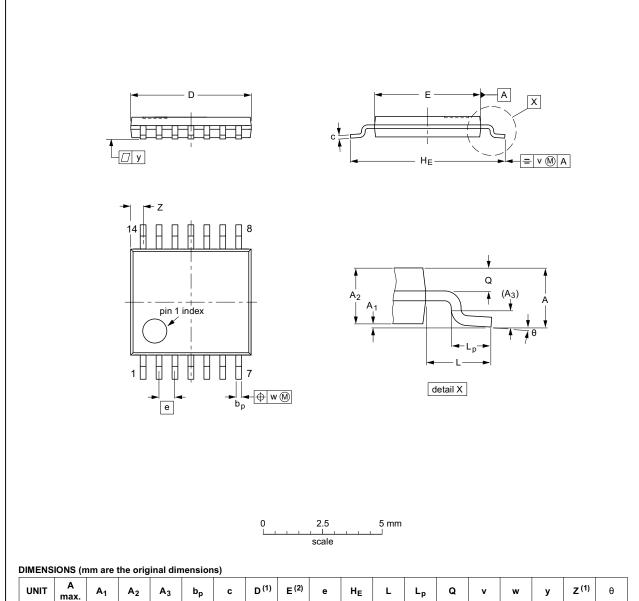
Package outline SOT337-1 (SSOP14)

74HC_HCT125

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TSSOP14: plastic thin shrink small outline package; 14 leads; body width 4.4 mm

SOT402-1



UNIT	A max.	A ₁	A ₂	A ₃	bp	С	D ⁽¹⁾	E (2)	е	HE	L	Lp	Q	v	w	у	Z ⁽¹⁾	θ
mm	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	0.72 0.38	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.

OUTLINE		REFER	EUROPEAN	ISSUE DATE			
VERSION	IEC	JEDEC	JEITA		PROJECTION	ISSUE DATE	
SOT402-1		MO-153				99-12-27 03-02-18	

Fig 10. Package outline SOT402-1 (TSSOP14)

74HC_HCT125

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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_HCT125 v.6	20151201	Product data sheet	-	74HC_HCT125 v.5			
Modifications:	Type numbers	s 74HC125N and 74HCT125N	(SOT27-1) removed	d.			
74HC_HCT125 v.5	20150119	Product data sheet	-	74HC_HCT125 v.4			
Modifications:	• <u>Table 7</u> : Power	er dissipation capacitance cond	dition for 74HCT125	is corrected.			
74HC_HCT125 v.4	20130110	Product data sheet	-	74HC_HCT125 v.3			
Modifications:	New general	description.					
74HC_HCT125 v.3	20120827	Product data sheet	-	74HC_HCT125_CNV 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.							
	Legal texts na	eve been adapted to the new c	ompany name when	е арргорпате.			
74HC_HCT125_CNV v.2	19970827	Product data sheet	-	-			

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"
- [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.nexperia.com.

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For more information, please visit: http://www.nexperia.com

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