74HC1G125; 74HCT1G125

Bus buffer/line driver; 3-state

Rev. 6 — 6 September 2017 Product data sheet

1 General description

The 74HC1G125; 74HCT1G125 is a single buffer/line driver with 3-state output. 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

- Wide supply voltage range from 2.0 V to 6.0 V
- Input levels:
  - For 74HC1G125: CMOS level
  - For 74HCT1G125: TTL level
- Low power dissipation
- Symmetrical output impedance
- High noise immunity
- Balanced propagation delays
- ESD protection
  - HBM EIA/JESD22-A114-C exceeds 2000V
  - MM EIA/JESD22-A115-A exceeds 200V
- Specified from −40 °C to 85 °C and −40 °C to 125 °C

3 Ordering information

Table 1. Ordering information

Type number	Package			
	Temperature range	Name	Description	Version
74HC1G125GW	-40 °C to +125 °C	TSSOP5	plastic thin shrink small outline package; 5 leads; body width 1.25 mm	SOT353-1
74HCT1G125GW				
74HC1G125GV	-40 °C to +125 °C	SC-74A	plastic surface mounted package; 5 leads	SOT753
74HCT1G125GV				

4 Marking

Table 2. Marking

Type number	Marking code [1]
74HC1G125GW	HM
74HCT1G125GW	TM

Type number	Marking code [1]
74HC1G125GV	H25
74HCT1G125GV	T25

[1] The pin 1 indicator is located on the lower left corner of the device, below the marking code.

5 Functional diagram

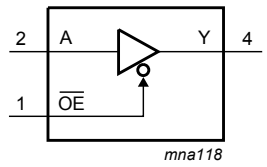


Figure 1. Logic symbol

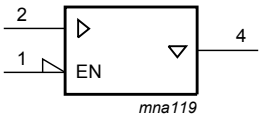


Figure 2. IEC logic symbol

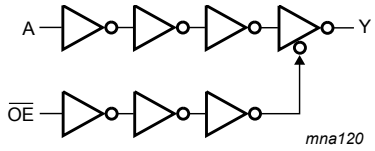


Figure 3. Logic diagram

6 Pinning information

6.1 Pinning

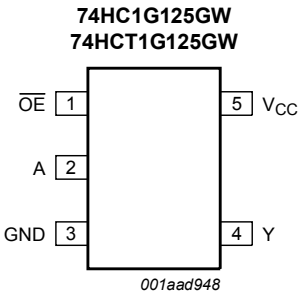


Figure 4. Pin configuration TSSOP5

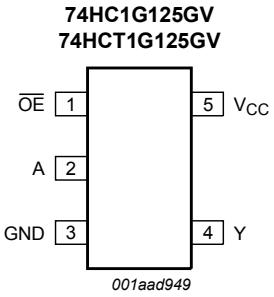


Figure 5. Pin configuration SC-74A

6.2 Pin description

Table 3. Pin description

Symbol	Pin	Description
$\overline{OE}$	1	output enable input (active LOW)
A	2	data input
GND	3	ground (0 V)
Y	4	data output
V_{CC}	5	supply voltage

7 Functional description

Table 4. Function table [1]

Control	Input	Output
$\overline{OE}$	A	Y
L	L	L
L	H	H
H	X	Z

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

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	+7.0	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]	-	±20	mA
I_O	output current	$V_O = -0.5$ V to $(V_{CC} + 0.5$ V)	[1]	-	±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	T_{amb} = -40 °C to +125 °C	[2]	-	200	mW

[1] The input and output voltage ratings may be exceeded if the input and output current ratings are observed.
[2] Above 55 °C the value of P_{tot} derates linearly with 2.5 mW/K.

9 Recommended operating conditions

Table 6. Recommended operating conditions

Voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions	74HC1G125			74HCT1G125			Unit
			Min	Typ	Max	Min	Typ	Max	
V_{CC}	supply voltage		2.0	5.0	6.0	4.5	5.0	5.5	V
V_I	input voltage		0	-	V_{CC}	0	-	V_{CC}	V
V_O	output voltage		0	-	V_{CC}	0	-	V_{CC}	V
T_{amb}	ambient temperature		-40	+25	+125	-40	+25	+125	°C
$\Delta t/\Delta V$	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 V	-	-	83	-	-	-	ns/V

10 Static characteristics

Table 7. Static characteristics 74HC1G125

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

Symbol	Parameter	Conditions	T_{amb} = −40 °C to +85 °C			T_{amb} = −40 °C to +125 °C		Unit
			Min	Typ[1]	Max	Min	Max	
V_{IH}	HIGH-level input voltage	V_{CC} = 2.0 V	1.5	1.2	-	1.5	-	V
		V_{CC} = 4.5 V	3.15	2.4	-	3.15	-	V
		V_{CC} = 6.0 V	4.2	3.2	-	4.2	-	V
V_{IL}	LOW-level input voltage	V_{CC} = 2.0 V	-	0.8	0.5	-	0.5	V
		V_{CC} = 4.5 V	-	2.1	1.35	-	1.35	V
		V_{CC} = 6.0 V	-	2.8	1.8	-	1.8	V
V_{OH}	HIGH-level output voltage	V_I = V_{IH} or V_{IL}						
		I_O = -20 µA; V_{CC} = 2.0 V	1.9	2.0	-	1.9	-	V
		I_O = -20 µA; V_{CC} = 4.5 V	4.4	4.5	-	4.4	-	V
		I_O = -20 µA; V_{CC} = 6.0 V	5.9	6.0	-	5.9	-	V
		I_O = -6.0 mA; V_{CC} = 4.5 V	3.84	4.32	-	3.7	-	V
		I_O = -7.8 mA; V_{CC} = 6.0 V	5.34	5.81	-	5.2	-	V
V_{OL}	LOW-level output voltage	V_I = V_{IH} or V_{IL}						
		I_O = 20 µA; V_{CC} = 2.0 V	-	0	0.1	-	0.1	V
		I_O = 20 µA; V_{CC} = 4.5 V	-	0	0.1	-	0.1	V
		I_O = 20 µA; V_{CC} = 6.0 V	-	0	0.1	-	0.1	V
		I_O = 6.0 mA; V_{CC} = 4.5 V	-	0.15	0.33	-	0.4	V
		I_O = 7.8 mA; V_{CC} = 6.0 V	-	0.16	0.33	-	0.4	V
I_I	input leakage current	V_I = V_{CC} or GND; V_{CC} = 6.0 V	-	-	1.0	-	1.0	µA
I_{OZ}	OFF-state output current	V_I = V_{IH} or V_{IL}; V_O = V_{CC} or GND; V_{CC} = 6.0 V	-	-	5	-	10	µA
I_{CC}	supply current	V_I = V_{CC} or GND; I_O = 0 A; V_{CC} = 6.0 V	-	-	10	-	20	µA
C_I	input capacitance		-	1.5	-	-	-	pF

[1] All typical values are measured at T_{amb} = 25 °C.

Table 8. Static characteristics 74HCT1G125

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

Symbol	Parameter	Conditions	T_{amb} = −40 °C to +85 °C			T_{amb} = −40 °C to +125 °C		Unit
			Min	Typ[1]	Max	Min	Max	
V_{IH}	HIGH-level input voltage	V_{CC} = 4.5 V to 5.5 V	2.0	1.6	-	2.0	-	V
V_{IL}	LOW-level input voltage	V_{CC} = 4.5 V to 5.5 V	-	1.2	0.8	-	0.8	V
V_{OH}	HIGH-level output voltage	V_I = V_{IH} or V_{IL}; V_{CC} = 4.5 V						
		I_O = -20 μA	4.4	4.5	-	4.4	-	V
		I_O = -6.0 mA	3.84	4.32	-	3.7	-	V
V_{OL}	LOW-level output voltage	V_I = V_{IH} or V_{IL}; V_{CC} = 4.5 V						
		I_O = 20 μA	-	0	0.1	-	0.1	V
		I_O = 6.0 mA	-	0.16	0.33	-	0.4	V
I_I	input leakage current	V_I = V_{CC} or GND; V_{CC} = 5.5 V	-	-	1.0	-	1.0	μA
I_{OZ}	OFF-state output current	V_I = V_{IH} or V_{IL}; V_O = V_{CC} or GND; V_{CC} = 5.5 V	-	-	5	-	10	μA
I_{CC}	supply current	V_I = V_{CC} or GND; I_O = 0 A; V_{CC} = 5.5 V	-	-	10	-	20	μA
ΔI_{CC}	additional supply current	V_I = V_{CC} - 2.1 V; I_O = 0 A; V_{CC} = 4.5 V to 5.5 V	-	-	500	-	850	μA
C_I	input capacitance		-	1.5	-	-	-	pF

[1] All typical values are measured at T_{amb} = 25 °C.

11 Dynamic characteristics

Table 9. Dynamic characteristics

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

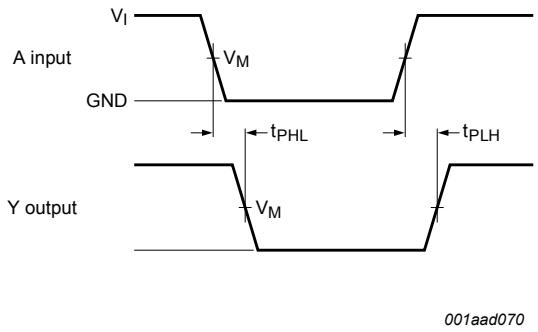
Symbol	Parameter	Conditions	T_{amb} = -40 °C to +125 °C				Unit
			Min	Typ[1]	Max +85 °C	Max +125 °C	
74HC1G125							
t_{pd}	propagation delay	A to Y; see Figure 6 [2]					
		V_{CC} = 2.0 V	-	24	125	150	ns
		V_{CC} = 4.5 V	-	10	25	30	ns
		V_{CC} = 5 V; C_L = 15 pF	-	9	-	-	ns
		V_{CC} = 6.0 V	-	8	21	26	ns
t_{en}	enable time	$\overline{OE}$ to Y; see Figure 7 [2]					
		V_{CC} = 2.0 V	-	19	155	190	ns
		V_{CC} = 4.5 V	-	9	31	38	ns
		V_{CC} = 6.0 V	-	7	26	32	ns
t_{dis}	disable time	$\overline{OE}$ to Y; see Figure 7 [2]					
		V_{CC} = 2.0 V	-	18	155	190	ns
		V_{CC} = 4.5 V	-	12	31	38	ns
		V_{CC} = 6.0 V	-	11	26	32	ns
C_{PD}	power dissipation capacitance	V_I = GND to V_{CC} [3]	-	30	-	-	pF
74HCT1G125							
t_{pd}	propagation delay	A to Y; see Figure 6 [2]					
		V_{CC} = 4.5 V	-	11	30	36	ns
		V_{CC} = 5 V; C_L = 15 pF	-	10	-	-	ns
t_{en}	enable time	V_{CC} = 4.5 V; $\overline{OE}$ to Y; see Figure 7 [2]	-	10	35	42	ns
t_{dis}	disable time	V_{CC} = 4.5 V; $\overline{OE}$ to Y; see Figure 7 [2]	-	11	31	38	ns
C_{PD}	power dissipation capacitance	V_I = GND to V_{CC} - 1.5 V [3]	-	27	-	-	pF

[1] All typical values are measured at T_{amb} = 25 °C.

[2] t_{pd} is the same as t_{PLH} and t_{PHL}.
t_{en} is the same as t_{PZL} and t_{PZH}.
t_{dis} is the same as t_{PLZ} and t_{PHZ}.

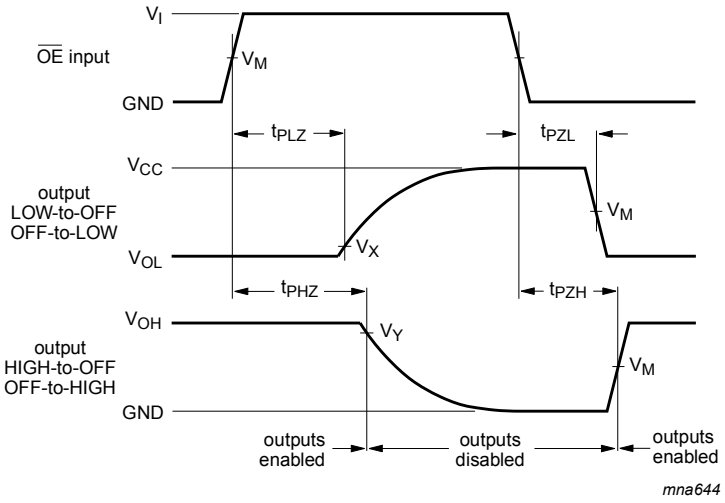
[3] C_{PD} is used to determine the dynamic power dissipation (P_D in µW).
$P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \Sigma(C_L \times V_{CC}^2 \times f_o)$ where:
f_i = input frequency in MHz;
f_o = output frequency in MHz;
C_L = output load capacitance in pF;
V_{CC} = supply voltage in V;
N = number of inputs switching;
$\Sigma(C_L \times V_{CC}^2 \times f_o)$ = sum of the outputs.

11.1 Waveforms and test circuit



Measurement points are given in Table 10.

Figure 6. Propagation delay data input (A) to output (Y)



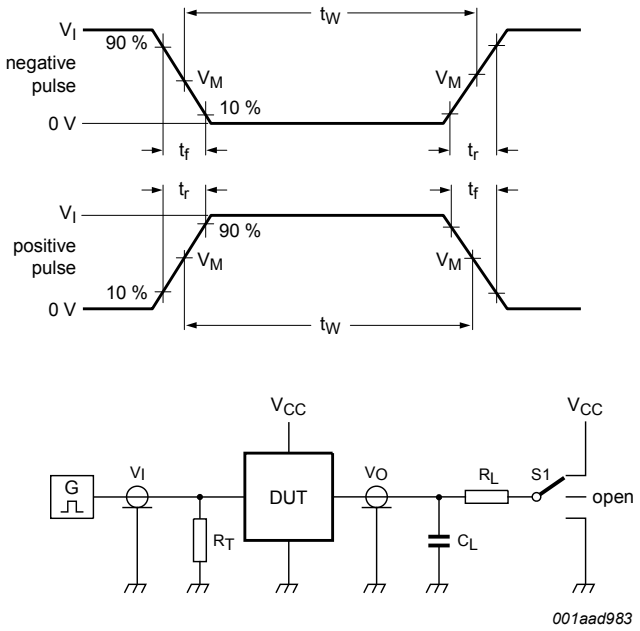
Measurement points are given in Table 10.

V_{OL} and V_{OH} are typical output voltage levels that occur with the output load.

Figure 7. Enable and disable times

Table 10. Measurement points

Type	Input	Output		
	V_M	V_M	V_X	V_Y
74HC1G125	$0.5V_{CC}$	$0.5V_{CC}$	V_{OL} + 0.3 V	V_{OH} - 0.3 V
74HCT1G125	1.3 V	1.3 V	V_{OL} + 0.3 V	V_{OH} - 0.3 V



Test data is given in Table 11.

Definitions for test circuit:

R_T = Termination resistance should be equal to the 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

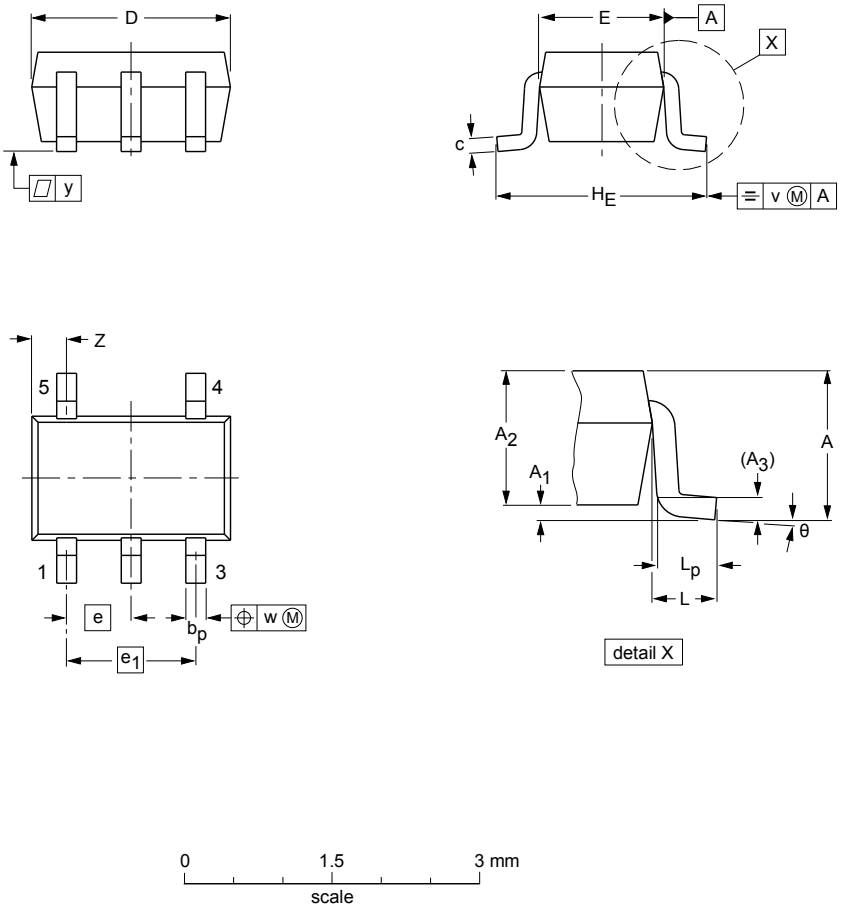
Figure 8. Test circuit for measuring switching times

Table 11. Test data

Type	Input		Load		S1 position		
	V_I	t_r, t_f	C_L	R_L	t_{PLH}, t_{PHL}	t_{PZH}, t_{PHZ}	t_{PZL}, t_{PLZ}
74HC1G125	V_{CC}	6 ns	15 pF, 50 pF	1 kΩ	open	GND	V_{CC}
74HCT1G125	3 V	6 ns	15 pF, 50 pF	1 kΩ	open	GND	V_{CC}

12 Package outline

TSSOP5: plastic thin shrink small outline package; 5 leads; body width 1.25 mm **SOT353-1**



DIMENSIONS (mm are the original dimensions)

UNIT	A max.	A_1	A_2	A_3	b_p	c	$D^{(1)}$	$E^{(1)}$	e	e_1	H_E	L	L_p	v	w	y	$Z^{(1)}$	θ
mm	1.1	0.1 0	1.0 0.8	0.15	0.30 0.15	0.25 0.08	2.25 1.85	1.35 1.15	0.65	1.3	2.25 2.0	0.425	0.46 0.21	0.3	0.1	0.1	0.60 0.15	7° 0°

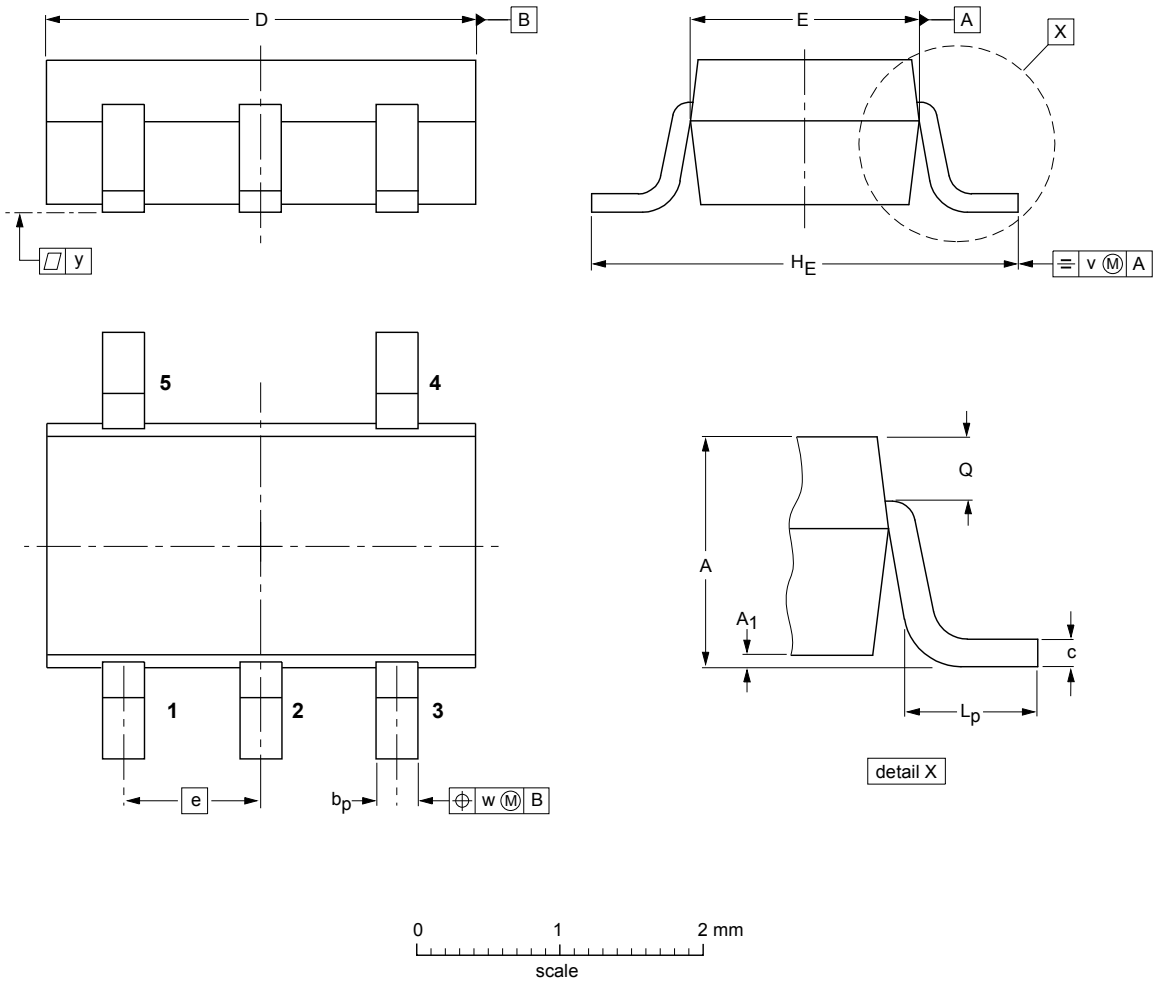
Note

1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT353-1		MO-203	SC-88A			~~00-09-01~~ 03-02-19

Figure 9. Package outline SOT353-1 (TSSOP5)

Plastic surface-mounted package; 5 leads **SOT753**



DIMENSIONS (mm are the original dimensions)

UNIT	A	A_1	b_p	c	D	E	e	H_E	L_p	Q	v	w	y
mm	1.1 0.9	0.100 0.013	0.40 0.25	0.26 0.10	3.1 2.7	1.7 1.3	0.95	3.0 2.5	0.6 0.2	0.33 0.23	0.2	0.2	0.1

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT753			SC-74A			~~02-04-16~~ 06-03-16

Figure 10. Package outline SOT753 (SC-74A)

13 Abbreviations

Table 12. 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 13. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74HC_HCT1G125 v.6	20170906	Product data sheet	-	74HC_HCT1G125 v.5
Modifications:	• The format of this data sheet has been redesigned to comply with the identity guidelines of Nexperia. • Legal texts have been adapted to the new company name where appropriate.			
74HC_HCT1G125 v.5	20051223	Product data sheet	ECN05_085	74HC_HCT1G125 v.4
Modifications:	• The format of this data sheet has been redesigned to comply with the new presentation and information standard of Philips Semiconductors. • In Table 5 Limiting values – I_O: changed max value ±12.5 into ±35 – I_{CC}: changed max value 25 into 70 – I_{GND}: changed max value -25 into -70 • In Table 7 Static characteristics 74HC1G125 – V_{OH}: changed condition I_O = -2.0 mA into I_O = -6.0 mA and min value from 4.13 into 3.84 – V_{OH}: changed condition I_O = -2.6 mA into I_O = -7.8 mA and min value from 5.63 into 5.34 – V_{OL}: changed condition I_O = 2.0 mA into I_O = 6.0 mA – V_{OL}: changed condition I_O = 2.6 mA into I_O = 7.8 mA – V_{OH}: changed condition I_O = -2.0 mA into I_O = -6.0 mA – V_{OL}: changed condition I_O = 2.0 mA into I_O = 6.0 mA • In Table 8 Static characteristics 74HCT1G125 – V_{OH}: changed condition I_O = -2.0 mA into I_O = -6.0 mA and min value from 4.13 into 3.84 – V_{OL}: changed condition I_O = 2.0 mA into I_O = 6.0 mA and typ value from 0.15 into 0.16 – V_{OH}: changed condition I_O = -2.0 mA into I_O = -6.0 mA – V_{OL}: changed condition I_O = 2.0 mA into I_O = 6.0 mA			
74HC_HCT1G125 v.4	20040727	Product specification	-	74HC_HCT1G125 v.3
74HC_HCT1G125 v.3	20020517	Product specification	-	74HC_HCT1G125 v.2
74HC_HCT1G125 v.2	20010302	Product specification	-	74HC_HCT1G125 v.1
74HC_HCT1G125 v.1	19981110	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".
[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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