74HC1G125-Q100; 74HCT1G125-Q100

Bus buffer/line driver; 3-state

Rev. 1 — 18 June 2013 | Product data sheet

1. General description

The 74HC1G125-Q100; 74HCT1G125-Q100 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}.

This product has been qualified to the Automotive Electronics Council (AEC) standard Q100 (Grade 1) and is suitable for use in automotive applications.

2. Features and benefits

- Automotive product qualification in accordance with AEC-Q100 (Grade 1)
  - Specified from –40 °C to +85 °C and from –40 °C to +125 °C
- Input levels:
  - For 74HC1G125-Q100: CMOS level
  - For 74HCT1G125-Q100: TTL level
- Symmetrical output impedance
- High noise immunity
- Low power consumption
- Balanced propagation delays
- ESD protection:
  - MIL-STD-883, method 3015 exceeds 2000 V
  - HBM JESD22-A114F exceeds 2000 V
  - MM JESD22-A115-A exceeds 200 V (C = 200 pF, R = 0 Ω)

3. Ordering information

Table 1. Ordering information

Type number	Package			
	Temperature range	Name	Description	Version
74HC1G125GW-Q100	–40 °C to +125 °C	TSSOP5	plastic thin shrink small outline package; 5 leads; body width 1.25 mm	SOT353-1
74HCT1G125GW-Q100				
74HC1G125GV-Q100	–40 °C to +125 °C	SC-74A	plastic surface mounted package; 5 leads	SOT753
74HCT1G125GV-Q100				

nexperia

4. Marking

Table 2. Marking

Type number	Marking code[1]
74HC1G125GW-Q100	HM
74HCT1G125GW-Q100	TM
74HC1G125GV-Q100	H25
74HCT1G125GV-Q100	T25

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

5. Functional diagram

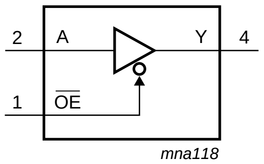


Fig 1. Logic symbol

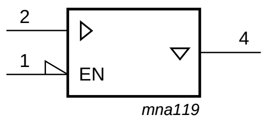


Fig 2. IEC logic symbol

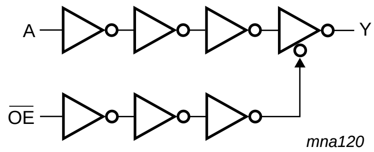


Fig 3. Logic diagram

6. Pinning information

6.1 Pinning

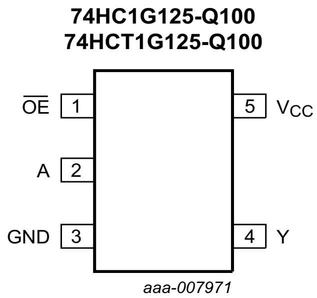


Fig 4. Pin configuration

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

7.1 Function table

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-Q100			74HCT1G125-Q100			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	-	-	139	-	-	139	ns/V
		V_{CC} = 6.0 V	-	-	83	-	-	-	ns/V

10. Static characteristics

Table 7. Static characteristics 74HC1G125-Q100

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

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

Table 7. Static characteristics 74HC1G125-Q100 *...continued*

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
T_{amb} = –40 °C to +125 °C						
V_{IH}	HIGH-level input voltage	V_{CC} = 2.0 V	1.5	-	-	V
		V_{CC} = 4.5 V	3.15	-	-	V
		V_{CC} = 6.0 V	4.2	-	-	V
V_{IL}	LOW-level input voltage	V_{CC} = 2.0 V	-	-	0.5	V
		V_{CC} = 4.5 V	-	-	1.35	V
		V_{CC} = 6.0 V	-	-	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	-	-	V
		I_O = –20 μA; V_{CC} = 4.5 V	4.4	-	-	V
		I_O = –20 μA; V_{CC} = 6.0 V	5.9	-	-	V
		I_O = –6.0 mA; V_{CC} = 4.5 V	3.7	-	-	V
		I_O = –7.8 mA; V_{CC} = 6.0 V	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	-	-	0.1	V
		I_O = 20 μA; V_{CC} = 4.5 V	-	-	0.1	V
		I_O = 20 μA; V_{CC} = 6.0 V	-	-	0.1	V
		I_O = 6.0 mA; V_{CC} = 4.5 V	-	-	0.4	V
		I_O = 7.8 mA; V_{CC} = 6.0 V	-	-	0.4	V
I_I	input leakage current	V_I = V_{CC} or GND; V_{CC} = 6.0 V	-	-	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	-	-	10	μA
I_{CC}	supply current	V_I = V_{CC} or GND; I_O = 0 A; V_{CC} = 6.0 V	-	-	20	μA

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

Table 8. Static characteristics 74HCT1G125-Q100

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
T_{amb} = –40 °C to +85 °C[1]						
V_{IH}	HIGH-level input voltage	V_{CC} = 4.5 V to 5.5 V	2.0	1.6	-	V
V_{IL}	LOW-level input voltage	V_{CC} = 4.5 V to 5.5 V	-	1.2	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	-	V
		I_O = –6.0 mA	3.84	4.32	-	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	V
		I_O = 6.0 mA	-	0.16	0.33	V
I_I	input leakage current	$V_I = V_{CC}$ or GND; V_{CC} = 5.5 V	-	-	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	μA
I_{CC}	supply current	$V_I = V_{CC}$ or GND; I_O = 0 A; V_{CC} = 5.5 V	-	-	10	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	μA
C_I	input capacitance		-	1.5	-	pF
T_{amb} = –40 °C to +125 °C						
V_{IH}	HIGH-level input voltage	V_{CC} = 4.5 V to 5.5 V	2.0	-	-	V
V_{IL}	LOW-level input voltage	V_{CC} = 4.5 V to 5.5 V	-	-	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	-	-	V
		I_O = –6.0 mA	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	-	-	0.1	V
		I_O = 6.0 mA	-	-	0.4	V
I_I	input leakage current	$V_I = V_{CC}$ or GND; V_{CC} = 5.5 V	-	-	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	-	-	10	μA
I_{CC}	supply current	$V_I = V_{CC}$ or GND; I_O = 0 A; V_{CC} = 5.5 V	-	-	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	-	-	850	μA

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

11. Dynamic characteristics

Table 9. Dynamic characteristics 74HC1G125-Q100

Voltages are referenced to GND (ground = 0 V); CL = 50 pF unless otherwise specified; for test circuit see Figure 7

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

[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.

Table 10. Dynamic characteristics 74HCT1G125-Q100

Voltages are referenced to GND (ground = 0 V); CL = 50 pF unless otherwise specified; for test circuit see Figure 7

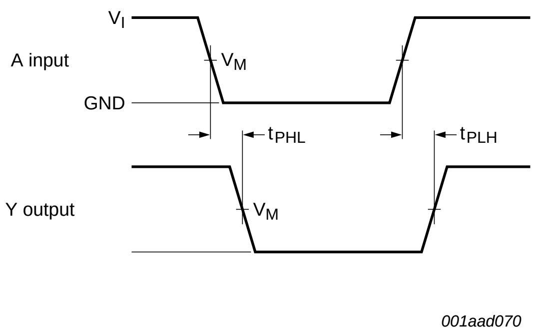
Symbol	Parameter	Conditions		Min	Typ[1]	Max	Unit
T_{amb} = –40 °C to +85 °C							
t_{pd}	propagation delay	A to Y; see Figure 5	[2]				
		V_{CC} = 4.5 V		-	11	30	ns
		V_{CC} = 5 V; C_L = 15 pF		-	10	-	ns
t_{en}	enable time	V_{CC} = 4.5 V; $\overline{OE}$ to Y; see Figure 6	[2]	-	10	35	ns
t_{dis}	disable time	V_{CC} = 4.5 V; $\overline{OE}$ to Y; see Figure 6	[2]	-	11	31	ns
C_{PD}	power dissipation capacitance	V_I = GND to V_{CC} – 1.5 V	[3]	-	27	-	pF
T_{amb} = –40 °C to +125 °C							
t_{pd}	propagation delay	V_{CC} = 4.5 V; A to Y; see Figure 5	[2]	-	-	36	ns
t_{en}	enable time	V_{CC} = 4.5 V; $\overline{OE}$ to Y; see Figure 6	[2]	-	-	42	ns
t_{dis}	disable time	V_{CC} = 4.5 V; $\overline{OE}$ to Y; see Figure 6	[2]	-	-	38	ns

[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}.

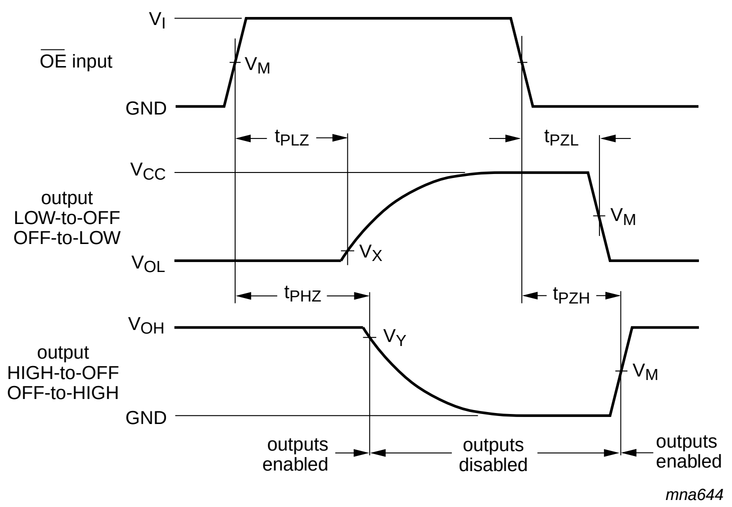
[3] C_{PD} is used to determine the dynamic power dissipation (P_D in μW).
$P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \Sigma(C_L \times V_{CC}^2 \times f_o)$ where:
f_i = input frequency in MHz;
f_o = output frequency in MHz;
C_L = output load capacitance in pF;
V_{CC} = supply voltage in V;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

12. Waveforms



Measurement points are given in Table 11.

Fig 5. Propagation delay data input (A) to output (Y)



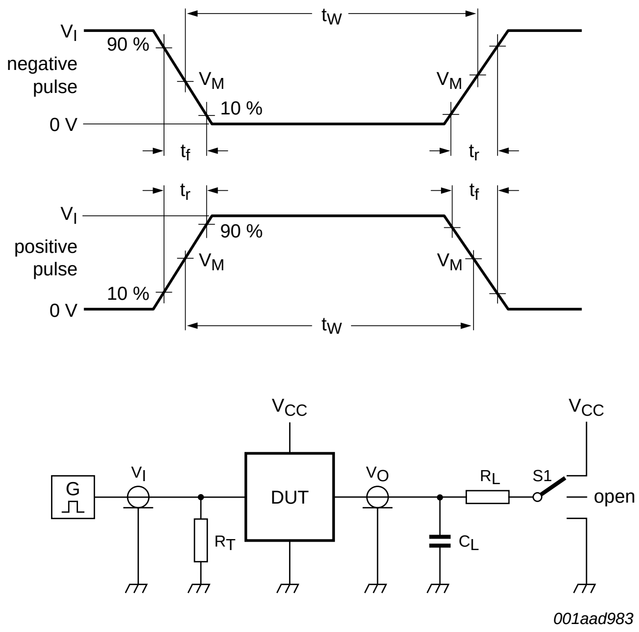
Measurement points are given in Table 11.

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

Fig 6. Enable and disable times

Table 11. Measurement points

Type	Input	Output		
	V_M	V_M	V_X	V_Y
74HC1G125-Q100	$0.5V_{CC}$	$0.5V_{CC}$	$V_{OL} + 0.3$ V	$V_{OH} - 0.3$ V
74HCT1G125-Q100	1.3 V	1.3 V	$V_{OL} + 0.3$ V	$V_{OH} - 0.3$ V



Test data is given in Table 12.

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 resistor

S1 = Test selection switch

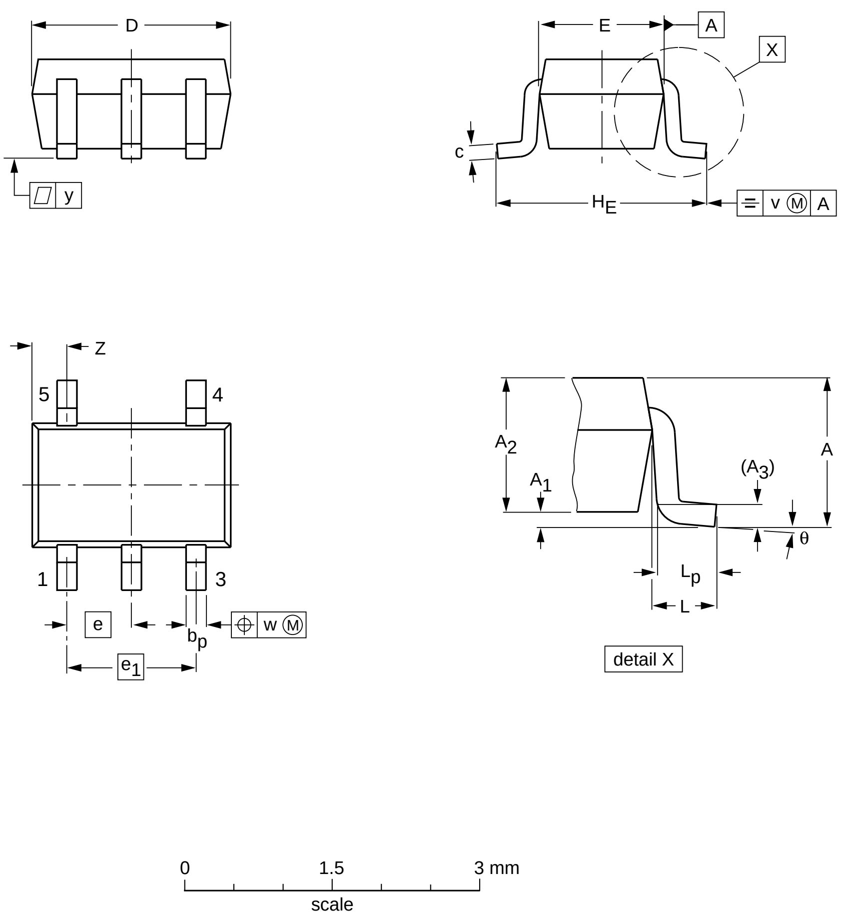
Fig 7. Test circuit for measuring switching times

Table 12. 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-Q100	V_{CC}	6 ns	15 pF, 50 pF	1 kΩ	open	GND	V_{CC}
74HCT1G125-Q100	3 V	6 ns	15 pF, 50 pF	1 kΩ	open	GND	V_{CC}

13. 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°

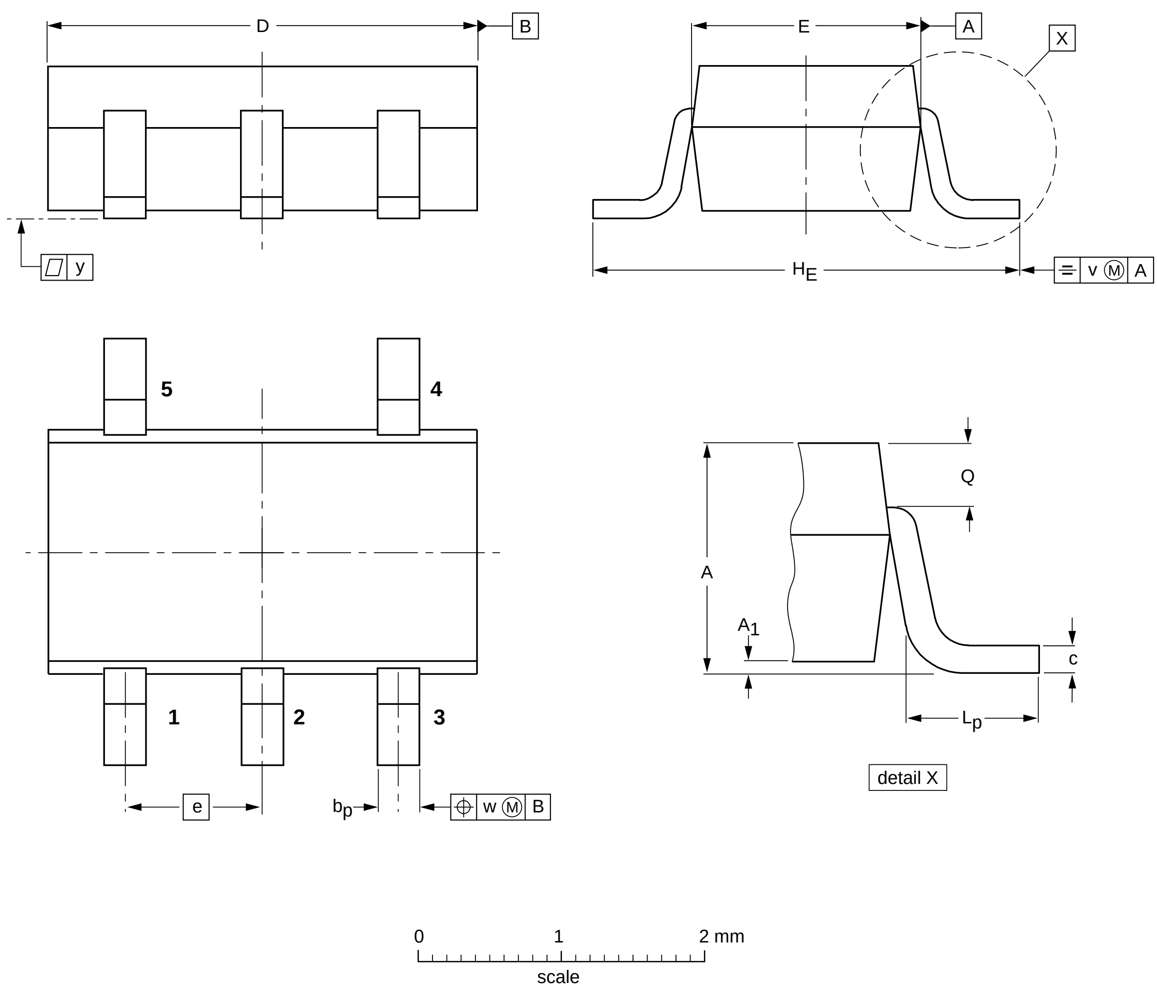
Note

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

Fig 8. 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

Fig 9. Package outline SOT753 (SC-74A)

14. Abbreviations

Table 13. Abbreviations

Acronym	Description
CMOS	Complementary Metal Oxide Semiconductor
ESD	ElectroStatic Discharge
HBM	Human Body Model
TTL	Transistor-Transistor Logic
MM	Machine Model

15. Revision history

Table 14. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74HC_HCT1G125_Q100 v.1	20130618	Product data sheet	-	-

16. Legal information

16.1 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.

16.2 Definitions

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16.4 Trademarks

17. Contact information

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18. Contents

1 General description 1
2 Features and benefits 1
3 Ordering information 1
4 Marking 2
5 Functional diagram 2
6 Pinning information 2
6.1 Pinning 2
6.2 Pin description 3
7 Functional description 3
7.1 Function table 3
8 Limiting values 3
9 Recommended operating conditions 4
10 Static characteristics 4
11 Dynamic characteristics 7
12 Waveforms 9
13 Package outline 11
14 Abbreviations 13
15 Revision history 13
16 Legal information 14
16.1 Data sheet status 14
16.2 Definitions 14
16.3 Disclaimers 14
16.4 Trademarks 15
17 Contact information 15
18 Contents 16

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