

# 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  $-40\text{ }^{\circ}\text{C}$  to  $+85\text{ }^{\circ}\text{C}$  and from  $-40\text{ }^{\circ}\text{C}$  to  $+125\text{ }^{\circ}\text{C}$
- 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 ( $C = 200\text{ pF}$ ,  $R = 0\text{ }\Omega$ )

## 3. Ordering information

Table 1. Ordering information

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



4. Marking

Table 2. Marking

Type number	Marking code <sup>[1]</sup>
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

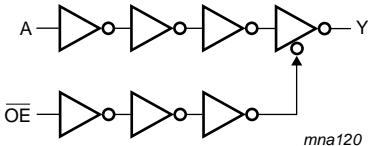


Fig 3. Logic diagram

6. Pinning information

6.1 Pinning

74HC1G125-Q100  
74HCT1G125-Q100

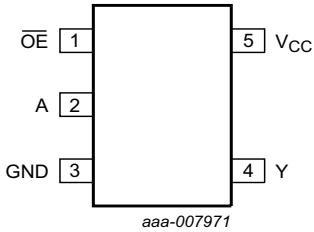


Fig 4. Pin configuration

## 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<sup>[1]</sup>

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	$V_I < -0.5\text{ V}$ 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
$I_O$	output current	$V_O = -0.5\text{ V}$ to $(V_{CC} + 0.5\text{ V})$	[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	$T_{amb} = -40\text{ °C}$ to $+125\text{ °C}$	[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 <sub>CC</sub>	supply voltage		2.0	5.0	6.0	4.5	5.0	5.5	V
V <sub>I</sub>	input voltage		0	-	V <sub>CC</sub>	0	-	V <sub>CC</sub>	V
V <sub>O</sub>	output voltage		0	-	V <sub>CC</sub>	0	-	V <sub>CC</sub>	V
T <sub>amb</sub>	ambient temperature		-40	+25	+125	-40	+25	+125	°C
$\Delta t/\Delta V$	input transition rise and fall rate	V <sub>CC</sub> = 2.0 V	-	-	625	-	-	-	ns/V
		V <sub>CC</sub> = 4.5 V	-	-	139	-	-	139	ns/V
		V <sub>CC</sub> = 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 <sub>amb</sub> = -40 °C to +85 °C [1]						
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> = -6.0 mA; V <sub>CC</sub> = 4.5 V	3.84	4.32	-	V
V <sub>OL</sub>	LOW-level output voltage	I <sub>O</sub> = -7.8 mA; V <sub>CC</sub> = 6.0 V	5.34	5.81	-	V
		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>I</sub>	input leakage current	I <sub>O</sub> = 6.0 mA; V <sub>CC</sub> = 4.5 V	-	0.15	0.33	V
		I <sub>O</sub> = 7.8 mA; V <sub>CC</sub> = 6.0 V	-	0.16	0.33	V
		V <sub>I</sub> = V <sub>CC</sub> or GND; V <sub>CC</sub> = 6.0 V	-	-	1.0	µA
I <sub>OZ</sub>	OFF-state output current	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; V <sub>O</sub> = V <sub>CC</sub> or GND; V <sub>CC</sub> = 6.0 V	-	-	5	µA
I <sub>CC</sub>	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	-	-	10	µA
C <sub>I</sub>	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
<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> = -6.0 mA; V <sub>CC</sub> = 4.5 V	3.7	-	-	V
		I <sub>O</sub> = -7.8 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> = 6.0 mA; V <sub>CC</sub> = 4.5 V	-	-	0.4	V
		I <sub>O</sub> = 7.8 mA; V <sub>CC</sub> = 6.0 V	-	-	0.4	V
I <sub>I</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>OZ</sub>	OFF-state output current	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; V <sub>O</sub> = V <sub>CC</sub> or GND; V <sub>CC</sub> = 6.0 V	-	-	10	µA
I <sub>CC</sub>	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	-	-	20	µA

[1] All typical values are measured at T<sub>amb</sub> = 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
<b>T<sub>amb</sub> = -40 °C to +85 °C[1]</b>						
V <sub>IH</sub>	HIGH-level input voltage	V <sub>CC</sub> = 4.5 V to 5.5 V	2.0	1.6	-	V
V <sub>IL</sub>	LOW-level input voltage	V <sub>CC</sub> = 4.5 V to 5.5 V	-	1.2	0.8	V
V <sub>OH</sub>	HIGH-level output voltage	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; V <sub>CC</sub> = 4.5 V				
		I <sub>O</sub> = -20 µA	4.4	4.5	-	V
		I <sub>O</sub> = -6.0 mA	3.84	4.32	-	V
V <sub>OL</sub>	LOW-level output voltage	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; V <sub>CC</sub> = 4.5 V				
		I <sub>O</sub> = 20 µA	-	0	0.1	V
		I <sub>O</sub> = 6.0 mA	-	0.16	0.33	V
I <sub>I</sub>	input leakage current	V <sub>I</sub> = V <sub>CC</sub> or GND; V <sub>CC</sub> = 5.5 V	-	-	1.0	µA
I <sub>OZ</sub>	OFF-state output current	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; V <sub>O</sub> = V <sub>CC</sub> or GND; V <sub>CC</sub> = 5.5 V	-	-	5	µA
I <sub>CC</sub>	supply current	V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0 A; V <sub>CC</sub> = 5.5 V	-	-	10	µA
ΔI <sub>CC</sub>	additional supply current	V <sub>I</sub> = V <sub>CC</sub> - 2.1 V; I <sub>O</sub> = 0 A; V <sub>CC</sub> = 4.5 V to 5.5 V	-	-	500	µA
C <sub>I</sub>	input capacitance		-	1.5	-	pF
<b>T<sub>amb</sub> = -40 °C to +125 °C</b>						
V <sub>IH</sub>	HIGH-level input voltage	V <sub>CC</sub> = 4.5 V to 5.5 V	2.0	-	-	V
V <sub>IL</sub>	LOW-level input voltage	V <sub>CC</sub> = 4.5 V to 5.5 V	-	-	0.8	V
V <sub>OH</sub>	HIGH-level output voltage	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; V <sub>CC</sub> = 4.5 V				
		I <sub>O</sub> = -20 µA	4.4	-	-	V
		I <sub>O</sub> = -6.0 mA	3.7	-	-	V
V <sub>OL</sub>	LOW-level output voltage	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; V <sub>CC</sub> = 4.5 V				
		I <sub>O</sub> = 20 µA	-	-	0.1	V
		I <sub>O</sub> = 6.0 mA	-	-	0.4	V
I <sub>I</sub>	input leakage current	V <sub>I</sub> = V <sub>CC</sub> or GND; V <sub>CC</sub> = 5.5 V	-	-	1.0	µA
I <sub>OZ</sub>	OFF-state output current	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; V <sub>O</sub> = V <sub>CC</sub> or GND; V <sub>CC</sub> = 5.5 V	-	-	10	µA
I <sub>CC</sub>	supply current	V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0 A; V <sub>CC</sub> = 5.5 V	-	-	20	µA
ΔI <sub>CC</sub>	additional supply current	V <sub>I</sub> = V <sub>CC</sub> - 2.1 V; I <sub>O</sub> = 0 A; V <sub>CC</sub> = 4.5 V to 5.5 V	-	-	850	µA

[1] All typical values are measured at T<sub>amb</sub> = 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
<b>T<sub>amb</sub> = -40 °C to +85 °C</b> <sup>[1]</sup>						
t <sub>pd</sub>	propagation delay	A to Y; see <a href="#">Figure 5</a>	<a href="#">[2]</a>			
		V <sub>CC</sub> = 2.0 V	-	24	125	ns
		V <sub>CC</sub> = 4.5 V	-	10	25	ns
		V <sub>CC</sub> = 5 V; C <sub>L</sub> = 15 pF	-	9	-	ns
t <sub>en</sub>	enable time	$\overline{\text{OE}}$ to Y; see <a href="#">Figure 6</a>	<a href="#">[2]</a>			
		V <sub>CC</sub> = 2.0 V	-	19	155	ns
		V <sub>CC</sub> = 4.5 V	-	9	31	ns
		V <sub>CC</sub> = 6.0 V	-	7	26	ns
t <sub>dis</sub>	disable time	$\overline{\text{OE}}$ to Y; see <a href="#">Figure 6</a>	<a href="#">[2]</a>			
		V <sub>CC</sub> = 2.0 V	-	18	155	ns
		V <sub>CC</sub> = 4.5 V	-	12	31	ns
		V <sub>CC</sub> = 6.0 V	-	11	26	ns
C <sub>PD</sub>	power dissipation capacitance	V <sub>I</sub> = GND to V <sub>CC</sub>	<a href="#">[3]</a>	-	30	pF
<b>T<sub>amb</sub> = -40 °C to +125 °C</b>						
t <sub>pd</sub>	propagation delay	A to Y; see <a href="#">Figure 5</a>	<a href="#">[2]</a>			
		V <sub>CC</sub> = 2.0 V	-	-	150	ns
		V <sub>CC</sub> = 4.5 V	-	-	30	ns
		V <sub>CC</sub> = 6.0 V	-	-	26	ns
t <sub>en</sub>	enable time	$\overline{\text{OE}}$ to Y; see <a href="#">Figure 6</a>	<a href="#">[2]</a>			
		V <sub>CC</sub> = 2.0 V	-	-	190	ns
		V <sub>CC</sub> = 4.5 V	-	-	38	ns
		V <sub>CC</sub> = 6.0 V	-	-	32	ns
t <sub>dis</sub>	disable time	$\overline{\text{OE}}$ to Y; see <a href="#">Figure 6</a>	<a href="#">[2]</a>			
		V <sub>CC</sub> = 2.0 V	-	-	190	ns
		V <sub>CC</sub> = 4.5 V	-	-	38	ns
		V <sub>CC</sub> = 6.0 V	-	-	32	ns

[1] All typical values are measured at T<sub>amb</sub> = 25 °C.

[2] t<sub>pd</sub> is the same as t<sub>PLH</sub> and t<sub>PHL</sub>.

t<sub>en</sub> is the same as t<sub>PZL</sub> and t<sub>PZH</sub>.

t<sub>dis</sub> is the same as t<sub>PLZ</sub> and t<sub>PHZ</sub>.

[3] C<sub>PD</sub> is used to determine the dynamic power dissipation (P<sub>D</sub> 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<sub>i</sub> = input frequency in MHz;

f<sub>o</sub> = output frequency in MHz;

C<sub>L</sub> = output load capacitance in pF;

V<sub>CC</sub> = 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);  $C_L = 50$  pF unless otherwise specified; for test circuit see [Figure 7](#)

Symbol	Parameter	Conditions	Min	Typ <sup>[1]</sup>	Max	Unit
<b><math>T_{amb} = -40</math> °C to <math>+85</math> °C</b>						
$t_{pd}$	propagation delay	A to Y; see <a href="#">Figure 5</a>	<a href="#">[2]</a>			
		$V_{CC} = 4.5$ 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 <a href="#">Figure 6</a>	<a href="#">[2]</a>	-	10	35 ns
$t_{dis}$	disable time	$V_{CC} = 4.5$ V; $\overline{OE}$ to Y; see <a href="#">Figure 6</a>	<a href="#">[2]</a>	-	11	31 ns
$C_{PD}$	power dissipation capacitance	$V_I = GND$ to $V_{CC} - 1.5$ V	<a href="#">[3]</a>	-	27	pF
<b><math>T_{amb} = -40</math> °C to <math>+125</math> °C</b>						
$t_{pd}$	propagation delay	$V_{CC} = 4.5$ V; A to Y; see <a href="#">Figure 5</a>	<a href="#">[2]</a>	-	-	36 ns
$t_{en}$	enable time	$V_{CC} = 4.5$ V; $\overline{OE}$ to Y; see <a href="#">Figure 6</a>	<a href="#">[2]</a>	-	-	42 ns
$t_{dis}$	disable time	$V_{CC} = 4.5$ V; $\overline{OE}$ to Y; see <a href="#">Figure 6</a>	<a href="#">[2]</a>	-	-	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  $\mu W$ ).

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

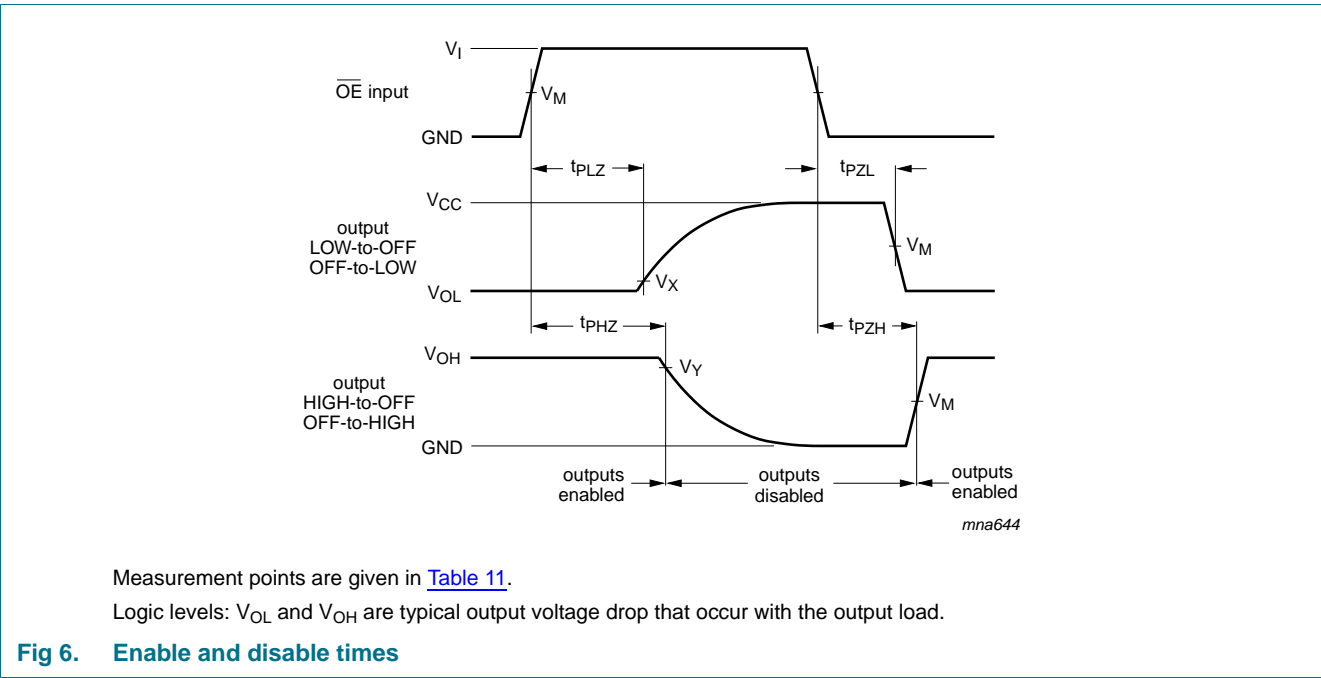
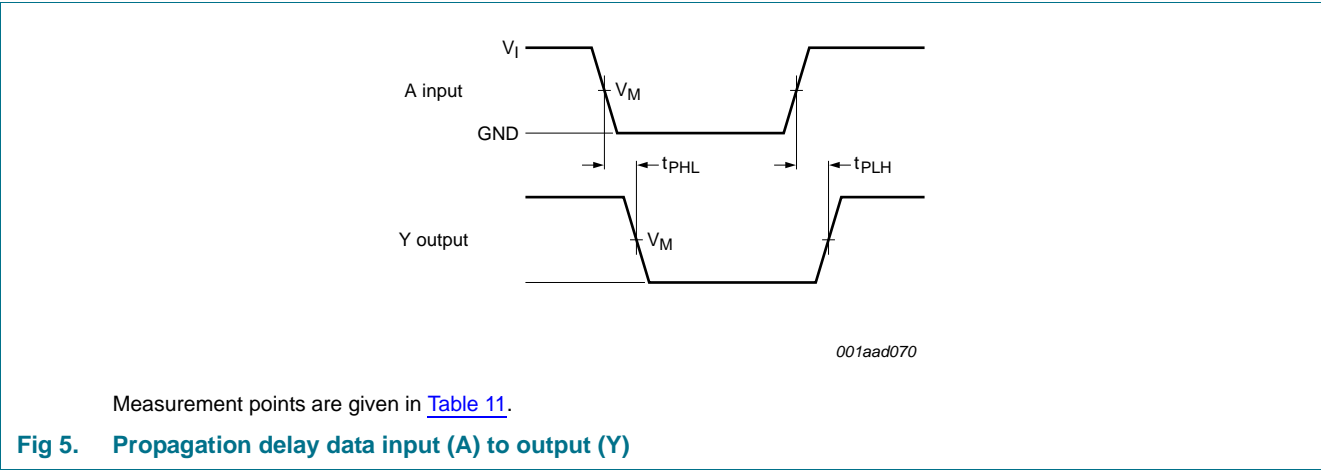


Table 11. Measurement points

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

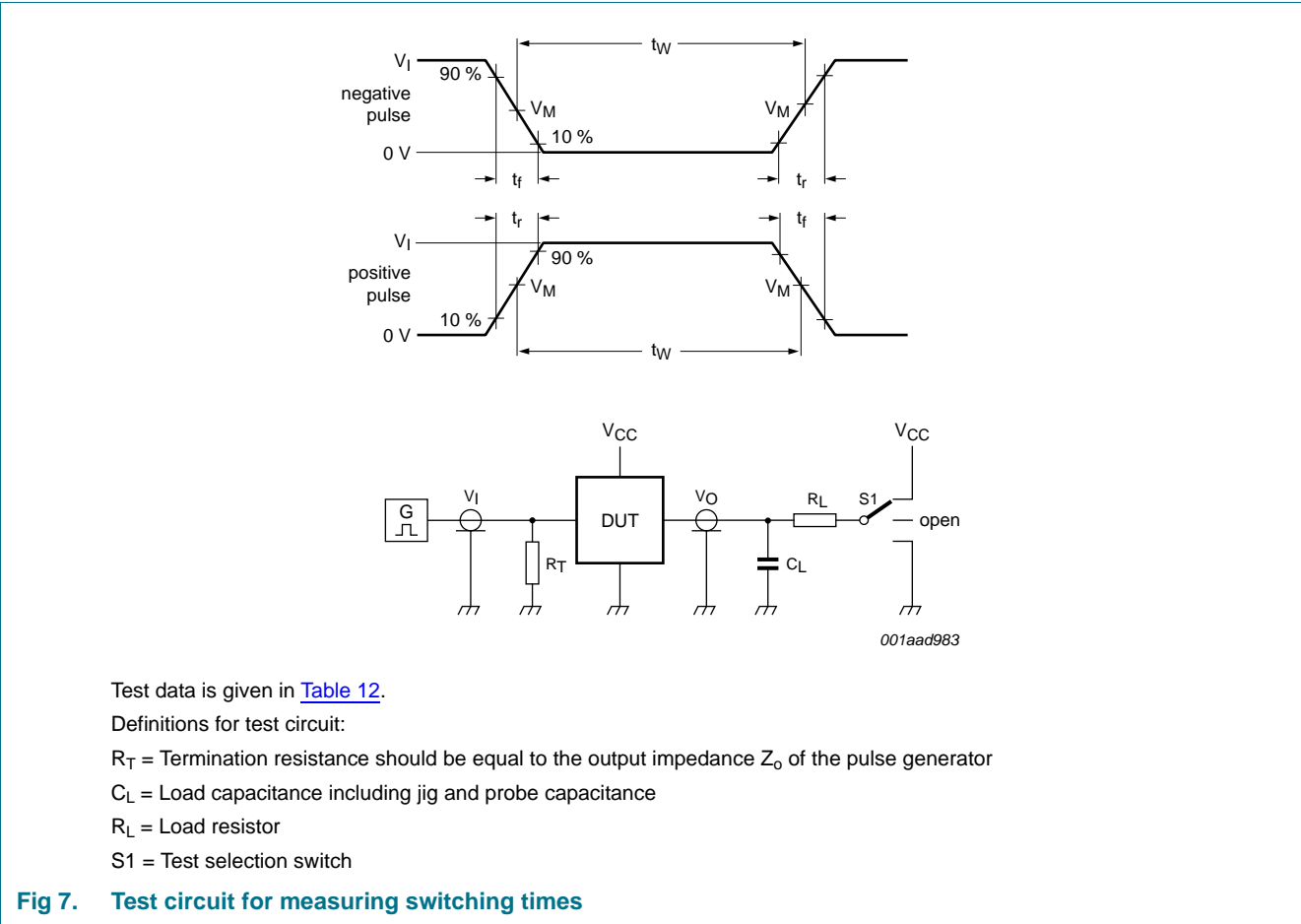
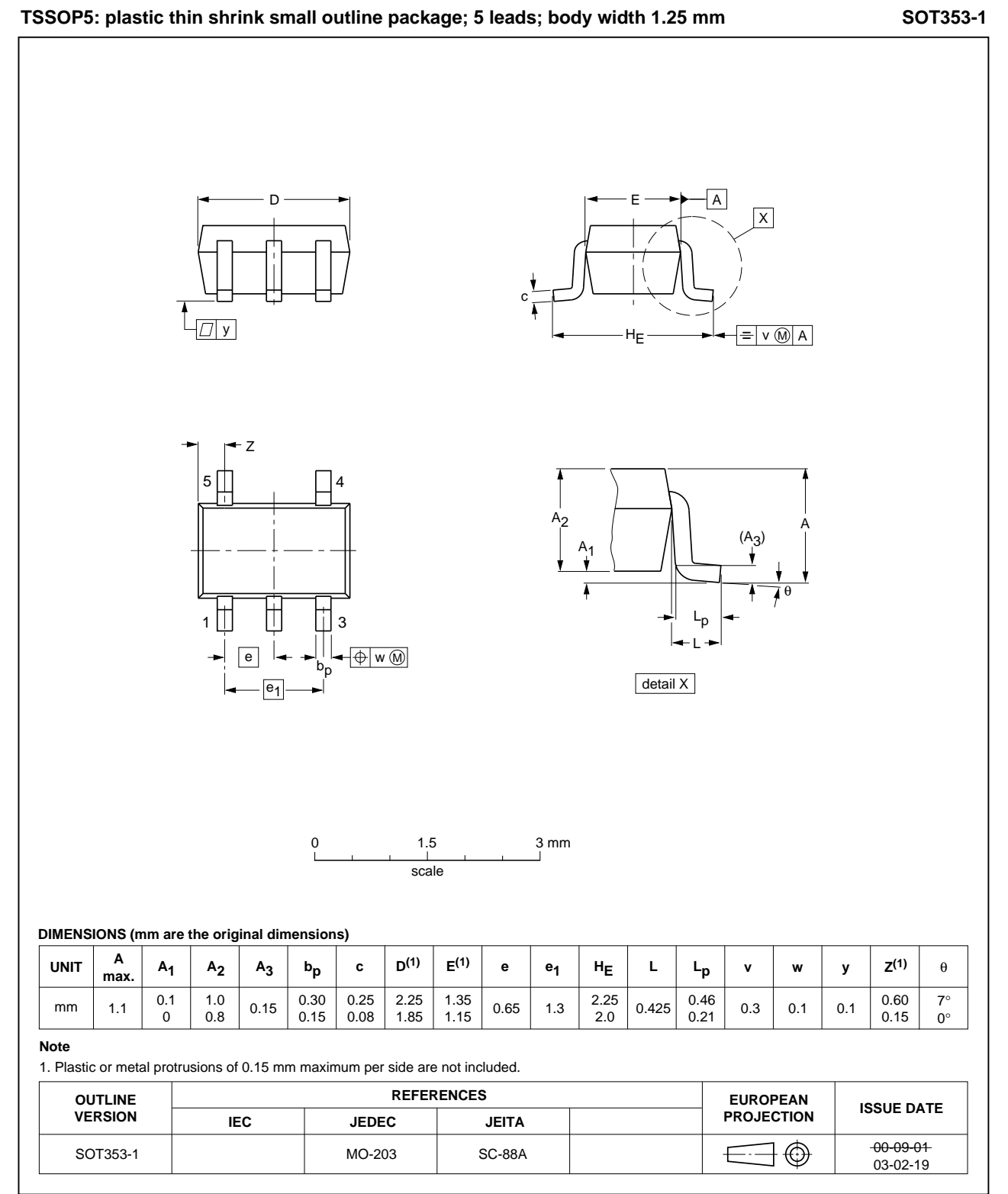


Table 12. Test data

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 k $\Omega$	open	GND	$V_{CC}$
74HCT1G125-Q100	3 V	6 ns	15 pF, 50 pF	1 k $\Omega$	open	GND	$V_{CC}$

13. Package outline



Plastic surface-mounted package; 5 leads

SOT753

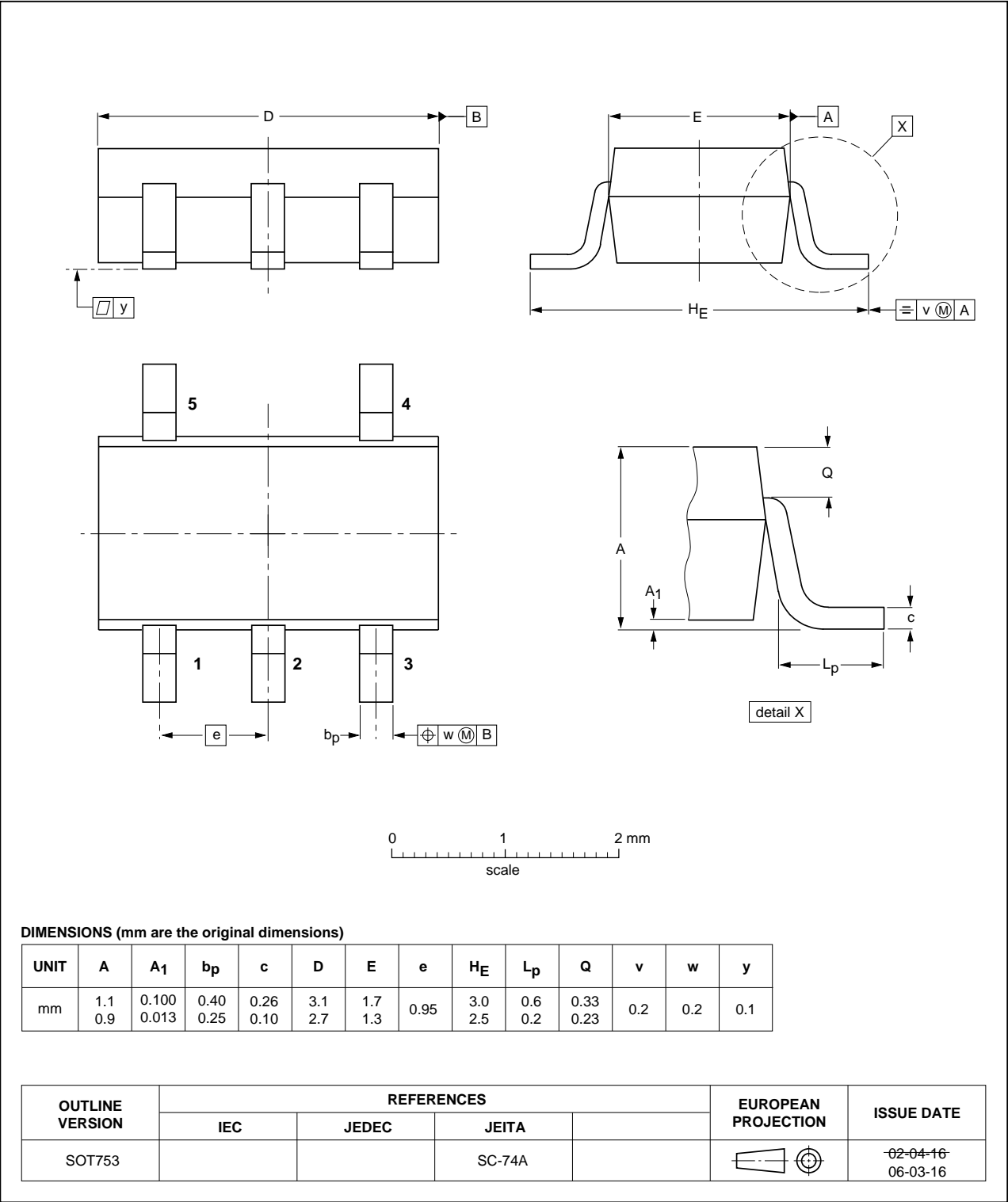


Fig 9. Package outline SOT753 (SC-74A)

## 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 <sup>[1][2]</sup>	Product status <sup>[3]</sup>	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.nxp.com>.

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