# 74AHC2G125; 74AHCT2G125

Dual buffer/line driver; 3-state

Rev. 3 — 6 May 2013

**Product data sheet** 

### 1. General description

The 74AHC2G125 and 74AHCT2G125 are high-speed Si-gate CMOS devices. They provide a dual non-inverting buffer/line <u>driver</u> with 3-state <u>output</u>. The 3-state output is controlled by the output enable input (nOE). A HIGH at nOE causes the output to assume a high-impedance OFF-state.

The AHC device has CMOS input switching levels and supply voltage range 2 V to 5.5 V.

The AHCT device has TTL input switching levels and supply voltage range 4.5 V to 5.5 V.

#### 2. Features and benefits

- Symmetrical output impedance
- High noise immunity
- Low power dissipation
- Balanced propagation delays
- Multiple package options
- ESD protection:
  - ◆ HBM JESD22-A114E: exceeds 2000 V
  - ♦ MM JESD22-A115-A: exceeds 200 V
  - ◆ CDM JESD22-C101C: exceeds 1000 V
- Specified from -40 °C to +125 °C

## 3. Ordering information

Table 1. Ordering information

Type number	Package										
	Temperature range Nam		Description	Version							
74AHC2G125DP	–40 °C to +125 °C	TSSOP8	plastic thin shrink small outline package; 8 leads;	SOT505-2							
74AHCT2G125DP			body width 3 mm; lead length 0.5 mm								
74AHC2G125DC	–40 °C to +125 °C	VSSOP8	plastic very thin shrink small outline package;	SOT765-1							
74AHCT2G125DC			8 leads; body width 2.3 mm								
74AHC2G125GD	–40 °C to +125 °C	XSON8	plastic extremely thin small outline package; no	SOT996-2							
74AHCT2G125GD			leads; 8 terminals; body 3 × 2 × 0.5 mm								

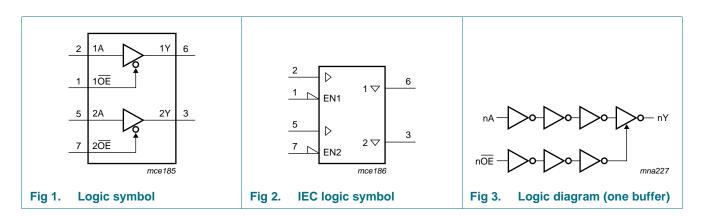


### 4. Marking

#### Table 2. Marking codes

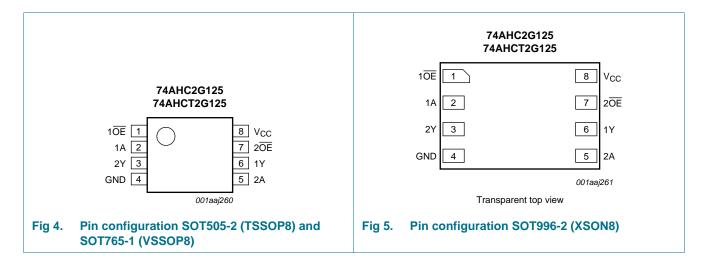
Type number	Marking
74AHC2G125DP	A25
74AHCT2G125DP	C25
74AHC2G125DC	A25
74AHCT2G125DC	C25
74AHC2G125GD	A25
74AHCT2G125GD	C25

## 5. Functional diagram



## 6. Pinning information

### 6.1 Pinning



### 6.2 Pin description

Table 3. Pin description

Symbol	Pin	Description
1 <del>0E</del> , 2 <del>0E</del>	1, 7	output enable input (active LOW)
1A, 2A	2, 5	data input
GND	4	ground (0 V)
1Y, 2Y	6, 3	data output
V <sub>CC</sub>	8	supply voltage

## 7. Functional description

Table 4. Function table[1]

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

<sup>[1]</sup> 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
VI	input voltage		-0.5	+7.0	V
I <sub>IK</sub>	input clamping current	$V_{I} < -0.5 \text{ V}$	<u>[1]</u> –20	-	mA
I <sub>OK</sub>	output clamping current	$V_O$ < $-0.5$ V or $V_O$ > $V_{CC}$ + $0.5$ V	<u>[1]</u> -	±20	mA
Io	output current	$-0.5 \text{ V} < \text{V}_{\text{O}} < \text{V}_{\text{CC}} + 0.5 \text{ V}$	-	±25	mA
I <sub>CC</sub>	supply current		-	75	mA
$I_{GND}$	ground current		-75	-	mA
T <sub>stg</sub>	storage temperature		-65	+150	°C
P <sub>tot</sub>	total power dissipation	$T_{amb} = -40  ^{\circ}\text{C} \text{ to } +125  ^{\circ}\text{C}$	[2] _	250	mW

<sup>[1]</sup> The input and output voltage ratings may be exceeded if the input and output current ratings are observed.

<sup>[2]</sup> For TSSOP8 package: above 55 °C the value of P<sub>tot</sub> derates linearly with 2.5 mW/K. For VSSOP8 package: above 110 °C the value of P<sub>tot</sub> derates linearly with 8 mW/K. For XSON8 package: above 45 °C the value of P<sub>tot</sub> derates linearly with 2.4 mW/K.

## 9. Recommended operating conditions

Table 6. Recommended operating conditions

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

Symbol	Parameter Conditions		74	74AHC2G125			74AHCT2G125		
			Min	Тур	Max	Min	Тур	Max	
$V_{CC}$	supply voltage		2.0	5.0	5.5	4.5	5.0	5.5	V
VI	input voltage		0	-	5.5	0	-	5.5	V
Vo	output voltage		0	-	$V_{CC}$	0	-	$V_{CC}$	V
T <sub>amb</sub>	ambient temperature		-40	+25	+125	-40	+25	+125	°C
$\Delta t/\Delta V$	input transition rise	$V_{CC}$ = 3.3 V $\pm$ 0.3 V	-	-	100	-	-	-	ns/V
a	and fall rate	$V_{CC}$ = 5.0 V $\pm$ 0.5 V	-	-	20	-	-	20	ns/V

### 10. Static characteristics

Table 7. Static characteristics

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

Symbol	Parameter	Conditions		25 °C		-40 °C	to +85 °C	-40 °C to +125 °C		Unit
			Min	Тур	Max	Min	Max	Min	Max	
74AHC2	G125					1				
V <sub>IH</sub>	HIGH-level	V <sub>CC</sub> = 2.0 V	1.5	-	-	1.5	-	1.5	-	V
	input voltage	V <sub>CC</sub> = 3.0 V	2.1	-	-	2.1	-	2.1	-	V
		V <sub>CC</sub> = 5.5 V	3.85	-	-	3.85	-	3.85	-	V
$V_{IL}$	LOW-level input voltage	V <sub>CC</sub> = 2.0 V	-	-	0.5	-	0.5	-	0.5	V
		V <sub>CC</sub> = 3.0 V	-	-	0.9	-	0.9	-	0.9	V
	V <sub>CC</sub> = 5.5 V	-	-	1.65	-	1.65	-	1.65	V	
$V_{OH}$	HIGH-level	$V_I = V_{IH}$ or $V_{IL}$								
	output voltage	$I_{O} = -50 \mu A; V_{CC} = 2.0 V$	1.9	2.0	-	1.9	-	1.9	-	V
		$I_{O} = -50 \mu A; V_{CC} = 3.0 V$	2.9	3.0	-	2.9	-	2.9	-	V
		$I_{O} = -50 \mu A; V_{CC} = 4.5 V$	4.4	4.5	-	4.4	-	4.4	-	V
		$I_O = -4.0 \text{ mA}; V_{CC} = 3.0 \text{ V}$	2.58	-	-	2.48	-	2.40	-	V
		$I_{O} = -8.0 \text{ mA}; V_{CC} = 4.5 \text{ V}$	3.94	-	-	3.8	-	3.70	-	V
$V_{OL}$	LOW-level	$V_I = V_{IH}$ or $V_{IL}$								
	output voltage	$I_O = 50 \mu A; V_{CC} = 2.0 V$	-	0	0.1	-	0.1	-	0.1	V
		$I_O = 50 \mu A; V_{CC} = 3.0 V$	-	0	0.1	-	0.1	-	0.1	V
		$I_O = 50 \mu A; V_{CC} = 4.5 V$	-	0	0.1	-	0.1	-	0.1	V
		$I_O = 4.0 \text{ mA}; V_{CC} = 3.0 \text{ V}$	-	-	0.36	-	0.44	-	0.55	V
		$I_O = 8.0 \text{ mA}; V_{CC} = 4.5 \text{ V}$	-	-	0.36	-	0.44	-	0.55	V
l <sub>OZ</sub>	OFF-state output current	$V_I = V_{CC}$ or GND; $V_{CC} = 5.5 \text{ V}$	-	-	0.25	-	2.5	-	10	μΑ
I <sub>I</sub>	input leakage current	$V_I = 5.5 \text{ V or GND};$ $V_{CC} = 0 \text{ V to } 5.5 \text{ V}$	-	-	0.1	-	1.0	-	2.0	μΑ
I <sub>CC</sub>	supply current	$V_I = V_{CC}$ or GND; $I_O = 0$ A; $V_{CC} = 5.5 \text{ V}$	-	-	1.0	-	10	-	40	μΑ

**Table 7. Static characteristics** ...continued Voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions		25 °C		–40 °C	to +85 °C	-40 °C	to +125 °C	Unit
			Min	Тур	Max	Min	Max	Min	Max	
Cı	input capacitance		-	1.5	10	-	10	-	10	pF
74AHCT	2G125									
$V_{IH}$	HIGH-level input voltage	$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}$	2.0	-	-	2.0	-	2.0	-	V
$V_{IL}$	LOW-level input voltage	$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}$	-	-	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	$I_{O} = -50 \mu A$	4.4	4.5	-	4.4	-	4.4	-	V
		$I_{O} = -8.0 \text{ mA}$	3.94	-	-	3.8	-	3.70	-	V
$V_{OL}$	LOW-level	$V_I = V_{IH}$ or $V_{IL}$ ; $V_{CC} = 4.5 \text{ V}$								
	output voltage	I <sub>O</sub> = 50 μA	-	0	0.1	-	0.1	-	0.1	V
		$I_0 = 8.0 \text{ mA}$	-	-	0.36	-	0.44	-	0.55	V
I <sub>OZ</sub>	OFF-state output current	$V_I = V_{CC}$ or GND; $V_{CC} = 5.5 \text{ V}$	-	-	0.25	-	2.5	-	10	μΑ
II	input leakage current	$V_I = 5.5 \text{ V or GND};$ $V_{CC} = 0 \text{ V to 5.5 V}$	-	-	0.1	-	1.0	-	2.0	μΑ
I <sub>CC</sub>	supply current	$V_I = V_{CC}$ or GND; $I_O = 0$ A; $V_{CC} = 5.5 \text{ V}$	-	-	1.0	-	10	-	40	μΑ
$\Delta I_{CC}$	additional supply current	per input pin; $V_I = 3.4 \text{ V}$ ; other inputs at $V_{CC}$ or GND; $I_O = 0 \text{ A}$ ; $V_{CC} = 5.5 \text{ V}$	-	-	1.35	-	1.5	-	1.5	mA
Cı	input capacitance		-	1.5	10	-	10	-	10	pF

## 11. Dynamic characteristics

**Table 8. Dynamic characteristics** *GND* = 0 *V; for test circuit see Figure 8.* 

Symbol	Parameter	Conditions		25 °C			-40 °C to +85 °C		-40 °C to +125 °C		Unit
				Min	Тур	Max	Min	Max	Min	Max	
74AHC2	G125				•				1		
t <sub>pd</sub> propagation delay	nA to nY; see Figure 6	<u>[1]</u>									
	delay	$V_{CC} = 3.0 \text{ V to } 3.6 \text{ V}$	[2]								
		C <sub>L</sub> = 15 pF		-	4.7	8.0	1.0	9.5	1.0	11.5	ns
		$C_L = 50 pF$		-	6.6	11.5	1.0	13.0	1.0	14.5	ns
	$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}$	[3]									
		C <sub>L</sub> = 15 pF		-	3.4	5.5	1.0	6.5	1.0	7.0	ns
		C <sub>L</sub> = 50 pF		-	4.8	7.5	1.0	8.5	1.0	9.5	ns

**Table 8. Dynamic characteristics** ...continued GND = 0 V; for test circuit see <u>Figure 8</u>.

Symbol	Parameter	Conditions			25 °C		-40 °C	to +85 °C	-40 °C 1	to +125 °C	Unit
				Min	Тур	Max	Min	Max	Min	Max	
t <sub>en</sub>	enable time	nOE to nY; see Figure 7	<u>[1]</u>					1			
		$V_{CC} = 3.0 \text{ V to } 3.6 \text{ V}$	[2]								
		C <sub>L</sub> = 15 pF		-	5.0	8.0	1.0	9.5	1.0	11.5	ns
		$C_L = 50 pF$		-	6.9	11.5	1.0	13.0	1.0	14.5	ns
		$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}$	[3]								
		$C_{L} = 15 \text{ pF}$		-	3.6	5.1	1.0	6.0	1.0	6.5	ns
		$C_L = 50 pF$		-	4.9	7.5	1.0	8.5	1.0	9.5	ns
t <sub>dis</sub>	t <sub>dis</sub> disable time	nOE to nY; see Figure 7	[1]								
		$V_{CC} = 3.0 \text{ V to } 3.6 \text{ V}$	[2]								
		$C_{L} = 15 \text{ pF}$		-	6.0	9.7	1.0	11.5	1.0	12.5	ns
		$C_L = 50 pF$		-	8.3	13.2	1.0	15.0	1.0	16.5	ns
		$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}$	[3]								
		C <sub>L</sub> = 15 pF		-	4.1	6.8	1.0	8.0	1.0	8.5	ns
		$C_L = 50 pF$		-	5.7	8.8	1.0	10.0	1.0	11.0	ns
$C_{PD}$	power dissipation capacitance	per buffer; $C_L = 50 \text{ pF}$ ; $f_i = 1 \text{ MHz}$ ; $V_I = \text{GND to } V_{CC}$	[4]	-	9	-	-	-	-	-	pF
74AHCT	2G125										
t <sub>pd</sub>	propagation	nA to nY; see Figure 6	<u>[1]</u>								
	delay	$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}$	[3]								
		C <sub>L</sub> = 15 pF		-	3.4	5.5	1.0	6.5	1.0	6.5	ns
		$C_L = 50 pF$		-	4.8	7.5	1.0	8.5	1.0	8.5	ns
t <sub>en</sub>	enable time	nOE to nY; see Figure 7	<u>[1]</u>								
		$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}$	[3]								
		C <sub>L</sub> = 15 pF		-	3.9	5.1	1.0	6.0	1.0	6.0	ns
		C <sub>L</sub> = 50 pF		-	5.1	7.5	1.0	8.5	1.0	8.5	ns
t <sub>dis</sub>	disable time	nOE to nY; see Figure 7	<u>[1]</u>								
		$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}$	[3]								
		C <sub>L</sub> = 15 pF		-	4.5	6.8	1.0	8.0	1.0	8.0	ns
		$C_L = 50 pF$		-	6.1	8.8	1.0	10.0	1.0	10.0	ns

 Table 8.
 Dynamic characteristics ...continued

GND = 0 V; for test circuit see <u>Figure 8</u>.

Symbol	Parameter	Conditions	25 °C		-40 °C to +85 °C		-40 °C to +125 °C		Unit		
				Min	Тур	Max	Min	Max	Min	Max	
$C_{PD}$	power dissipation capacitance	per buffer; $C_L = 50 \text{ pF}$ ; $f_i = 1 \text{ MHz}$ ; $V_I = \text{GND to V}_{CC}$	<u>4]</u>	-	11	-	-	-	-	-	pF

[1]  $t_{pd}$  is the same as  $t_{PLH}$  and  $t_{PHL}$ .

 $t_{\text{en}}$  is the same as  $t_{\text{PZL}}$  and  $t_{\text{PZH}}.$ 

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

- [2] Typical values are measured at  $V_{CC} = 3.3 \text{ V}$ .
- [3] Typical values are measured at  $V_{CC} = 5.0 \text{ V}$ .
- [4]  $C_{PD}$  is used to determine the dynamic power dissipation  $P_D$  ( $\mu W$ ).

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

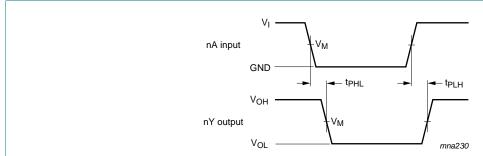
 $f_i$  = input frequency in MHz;

fo = output frequency in MHz;

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

 $V_{CC}$  = supply voltage in Volts.

### 12. Waveforms



Measurement points are given in Table 9.

Logic levels: V<sub>OL</sub> and V<sub>OH</sub> are typical output voltage levels that occur with the output load.

Fig 6. Input (nA) to output (nY) propagation delays

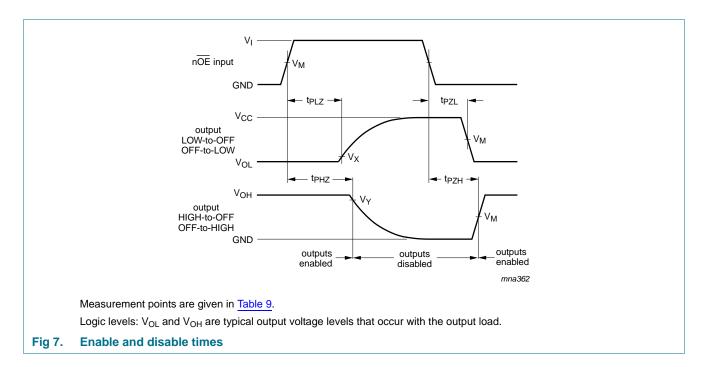
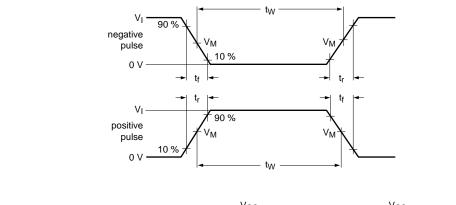
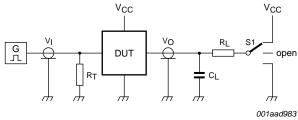


Table 9. Measurement points

Туре	Input	Output						
	V <sub>M</sub>	V <sub>M</sub>	V <sub>X</sub>	V <sub>Y</sub>				
74AHC2G125	0.5V <sub>CC</sub>	0.5V <sub>CC</sub>	$V_{OL} + 0.3 V$	$V_{OH} - 0.3 V$				
74AHCT2G125	1.5 V	0.5V <sub>CC</sub>	$V_{OL} + 0.3 V$	V <sub>OH</sub> – 0.3 V				

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Test data is given in Table 10.

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.

 $R_1$  = Load resistance.

S1 = Test selection switch.

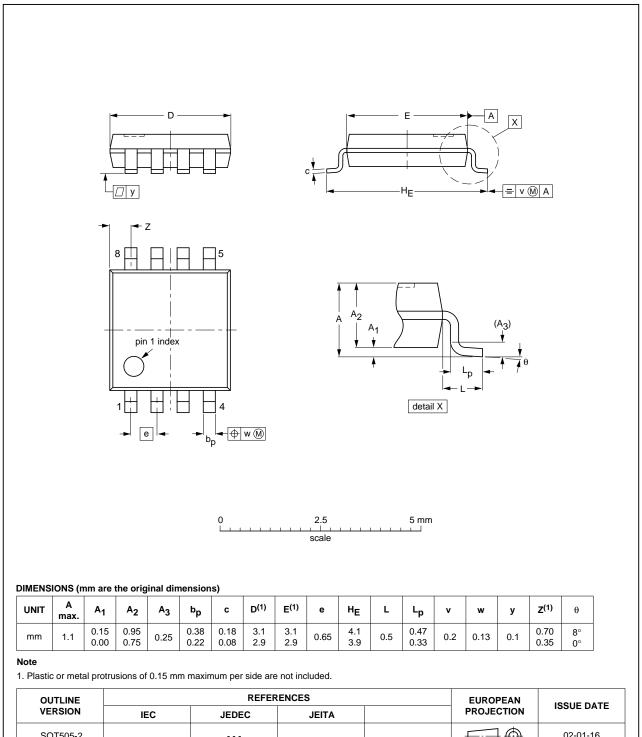
Fig 8. Test circuit for measuring switching times

Table 10. Test data

Туре	Input		Load		S1 position			
	VI	t <sub>r</sub> , t <sub>f</sub>	CL	$R_L$	t <sub>PHL</sub> , t <sub>PLH</sub>	t <sub>PZH</sub> , t <sub>PHZ</sub>	t <sub>PZL</sub> , t <sub>PLZ</sub>	
74AHC2G125	$V_{CC}$	$\leq$ 3 ns	15 pF, 50 pF	1 k $\Omega$	open	GND	V <sub>CC</sub>	
74AHCT2G125	3 V	$\leq$ 3 ns	15 pF, 50 pF	1 k $\Omega$	open	GND	V <sub>CC</sub>	

## 13. Package outline

TSSOP8: plastic thin shrink small outline package; 8 leads; body width 3 mm; lead length 0.5 mm



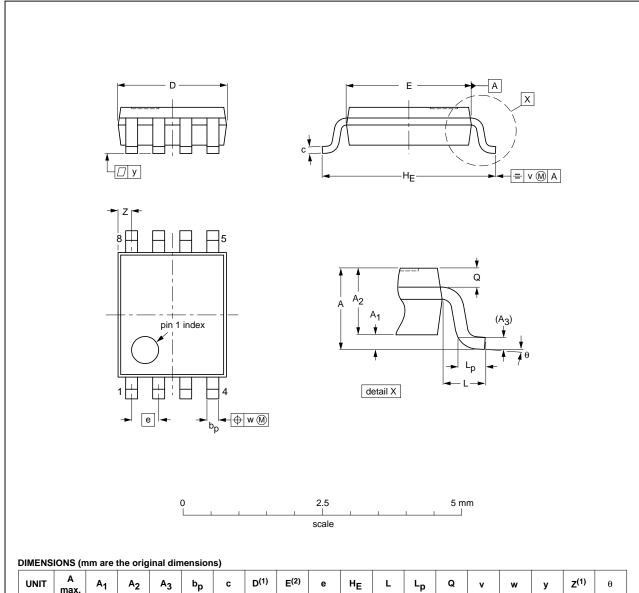
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					02-01-16
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Package outline SOT505-2 (TSSOP8) Fig 9.

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#### VSSOP8: plastic very thin shrink small outline package; 8 leads; body width 2.3 mm

SOT765-1



UNIT	A max.	A <sub>1</sub>	A <sub>2</sub>	А3	bp	С	D <sup>(1)</sup>	E <sup>(2)</sup>	е	HE	L	Lp	Q	v	w	у	Z <sup>(1)</sup>	θ
mm	1	0.15 0.00	0.85 0.60	0.12	0.27 0.17	0.23 0.08	2.1 1.9	2.4 2.2	0.5	3.2 3.0	0.4	0.40 0.15	0.21 0.19	0.2	0.13	0.1	0.4 0.1	8° 0°

#### Notes

- Plastic or metal protrusions of 0.15 mm maximum per side are not included.
- 2. 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	
SOT765-1		MO-187				02-06-07	

Fig 10. Package outline SOT765-1 (VSSOP8)

74AHC\_AHCT2G125

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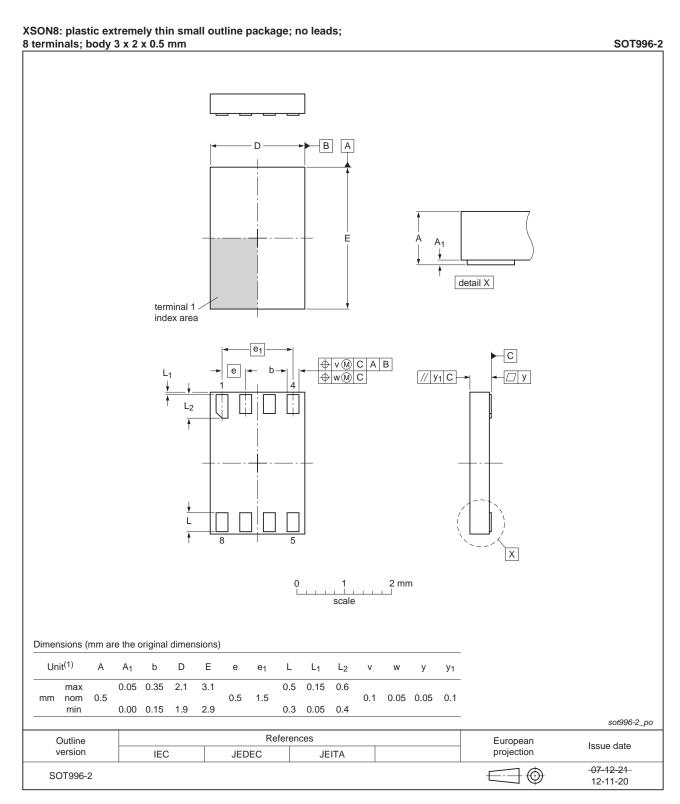


Fig 11. Package outline SOT996-2 (XSON8)

74AHC\_AHCT2G125

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### 14. Abbreviations

#### Table 11. Abbreviations

Acronym	Description
CMOS	Complementary Metal Oxide Semiconductor
CDM	Charged Device Model
DUT	Device Under Test
ESD	ElectroStatic Discharge
HBM	Human Body Model
MM	Machine Model
TTL	Transistor-Transistor Logic

## 15. Revision history

#### Table 12. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74AHC_AHCT2G125 v.3	20130506	Product data sheet	-	74AHC_AHCT2G125 v.2
Modifications:	<ul> <li>For type null XSON8.</li> </ul>	mber 74AHC2G125GD and	174AHCT2G125G	SD XSON8U has changed to
74AHC_AHCT2G125 v.2	20081222	Product data sheet	-	74AHC_AHCT2G125 v.1
Modifications:		of this data sheet has been of NXP Semiconductors.	redesigned to co	mply with the new identity
	<ul> <li>Legal texts</li> </ul>	have been adapted to the r	new company nam	ne where appropriate.
	<ul> <li>Added type</li> </ul>	number 74AHC2G125GD	and 74AHCT2G12	25GD (XSON8U package).
74AHC_AHCT2G125 v.1	20040113	Product specification	-	-

### 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 <a href="http://www.nxp.com">http://www.nxp.com</a>.

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Dual buffer/line driver: 3-state

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#### 17. Contact information

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