

# 74AHC2G241; 74AHCT2G241

Dual buffer/line driver; 3-state

Rev. 3 — 13 May 2013

Product data sheet

## 1. General description

The 74AHC2G241; 74AHCT2G241 is a high-speed Si-gate CMOS device.

The 74AHC2G241; 74AHCT2G241 is a dual non-inverting buffer/line driver with 3-state outputs. The 3-state outputs are controlled by the output enable inputs  $\overline{1OE}$  and  $2OE$ . A HIGH level at pin  $\overline{1OE}$  causes output 1Y to assume a high-impedance OFF-state. A LOW level at pin  $2OE$  causes output 2Y to assume a high-impedance OFF-state. Schmitt-trigger action at all inputs makes the circuit highly tolerant for slower input rise and fall times.

## 2. Features and benefits

- Symmetrical output impedance
- High noise immunity
- ESD protection:
  - ◆ HBM JESD22-A114E: exceeds 2000 V
  - ◆ MM JESD22-A115-A: exceeds 200 V
  - ◆ CDM JESD22-C101C: exceeds 1000 V
- Low power dissipation
- Balanced propagation delays
- Multiple package options
- Specified from  $-40\text{ }^{\circ}\text{C}$  to  $+85\text{ }^{\circ}\text{C}$  and from  $-40\text{ }^{\circ}\text{C}$  to  $+125\text{ }^{\circ}\text{C}$

## 3. Ordering information

Table 1. Ordering information

Type number	Package			
	Temperature range	Name	Description	Version
74AHC2G241DP 74AHCT2G241DP	$-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$	TSSOP8	plastic thin shrink small outline package; 8 leads; body width 3 mm; lead length 0.5 mm	SOT505-2
74AHC2G241DC 74AHCT2G241DC	$-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$	VSSOP8	plastic very thin shrink small outline package; 8 leads; body width 2.3 mm	SOT765-1
74AHC2G241GD 74AHCT2G241GD	$-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$	XSON8	plastic extremely thin small outline package; no leads; 8 terminals; body $3 \times 2 \times 0.5$ mm	SOT996-2



## 4. Marking

Table 2. Marking

Type number	Marking code <sup>[1]</sup>
74AHC2G241DP	A241
74AHCT2G241DP	C241
74AHC2G241DC	A41
74AHCT2G241DC	C41
74AHC2G241GD	A41
74AHCT2G241GD	C41

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

## 5. Functional diagram

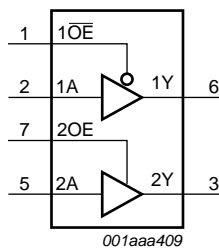


Fig 1. Logic symbol

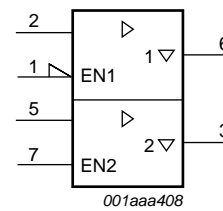


Fig 2. IEC logic symbol

## 6. Pinning information

### 6.1 Pinning

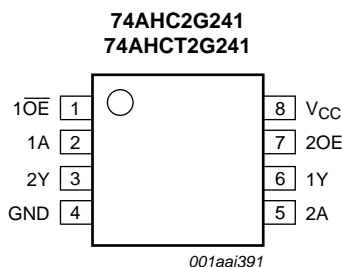


Fig 3. Pin configuration SOT505-2 (TSSOP8) and SOT765-1 (VSSOP8)

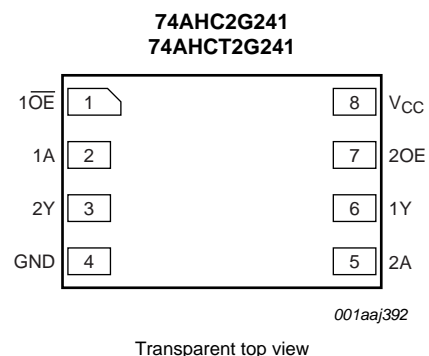


Fig 4. Pin configuration SOT996-2 (XSON8)

## 6.2 Pin description

Table 3. Pin description

Symbol	Pin	Description
$\overline{1OE}$	1	output enable input (active LOW)
1A	2	data input
2Y	3	data output
GND	4	ground (0 V)
2A	5	data input
1Y	6	data output
2OE	7	output enable input (active HIGH)
$V_{CC}$	8	supply voltage

## 7. Functional description

Table 4. Function table<sup>[1]</sup>

Input		Output	Input		Output
$\overline{1OE}$	1A	1Y	2OE	2A	2Y
L	L	L	H	L	L
L	H	H	H	H	H
H	X	Z	L	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
$V_I$	input voltage		-0.5	+7.0	V
$I_{IK}$	input clamping current	$V_I < -0.5$ V	<sup>[1]</sup> -20	-	mA
$I_{OK}$	output clamping current	$V_O < -0.5$ V or $V_O > V_{CC} + 0.5$ V	<sup>[1]</sup> -	±20	mA
$I_O$	output current	$-0.5$ V < $V_O < V_{CC} + 0.5$ V	-	±25	mA
$I_{CC}$	supply current		-	75	mA
$I_{GND}$	ground current		-75	-	mA
$T_{stg}$	storage temperature		-65	+150	°C
$P_{tot}$	total power dissipation	$T_{amb} = -40$ °C to +125 °C	<sup>[2]</sup> -	250	mW

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

[2] For TSSOP8 package: above 55 °C the value of  $P_{tot}$  derates linearly with 2.5 mW/K.  
 For VSSOP8 package: above 110 °C the value of  $P_{tot}$  derates linearly with 8 mW/K.  
 For XSON8 package: above 45 °C the value of  $P_{tot}$  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	74AHC2G241			74AHCT2G241			Unit
			Min	Typ	Max	Min	Typ	Max	
V <sub>CC</sub>	supply voltage		2.0	5.0	5.5	4.5	5.0	5.5	V
V <sub>I</sub>	input voltage		0	-	5.5	0	-	5.5	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
Δt/ΔV	input transition rise and fall rate	V <sub>CC</sub> = 3.3 V ± 0.3 V	-	-	100	-	-	-	ns/V
		V <sub>CC</sub> = 5.0 V ± 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	Typ	Max	Min	Max	Min	Max	
<b>74AHC2G241</b>										
V <sub>IH</sub>	HIGH-level input voltage	V <sub>CC</sub> = 2.0 V	1.5	-	-	1.5	-	1.5	-	V
		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 <sub>IL</sub>	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 <sub>OH</sub>	HIGH-level output voltage	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>								
		I <sub>O</sub> = -50 μA; V <sub>CC</sub> = 2.0 V	1.9	2.0	-	1.9	-	1.9	-	V
		I <sub>O</sub> = -50 μA; V <sub>CC</sub> = 3.0 V	2.9	3.0	-	2.9	-	2.9	-	V
		I <sub>O</sub> = -50 μA; V <sub>CC</sub> = 4.5 V	4.4	4.5	-	4.4	-	4.4	-	V
		I <sub>O</sub> = -4.0 mA; V <sub>CC</sub> = 3.0 V	2.58	-	-	2.48	-	2.40	-	V
		I <sub>O</sub> = -8.0 mA; V <sub>CC</sub> = 4.5 V	3.94	-	-	3.8	-	3.70	-	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> = 50 μA; V <sub>CC</sub> = 2.0 V	-	0	0.1	-	0.1	-	0.1	V
		I <sub>O</sub> = 50 μA; V <sub>CC</sub> = 3.0 V	-	0	0.1	-	0.1	-	0.1	V
		I <sub>O</sub> = 50 μA; V <sub>CC</sub> = 4.5 V	-	0	0.1	-	0.1	-	0.1	V
		I <sub>O</sub> = 4.0 mA; V <sub>CC</sub> = 3.0 V	-	-	0.36	-	0.44	-	0.55	V
		I <sub>O</sub> = 8.0 mA; V <sub>CC</sub> = 4.5 V	-	-	0.36	-	0.44	-	0.55	V
I <sub>OZ</sub>	OFF-state output current	V <sub>I</sub> = V <sub>CC</sub> or GND; V <sub>CC</sub> = 5.5 V	-	-	0.25	-	2.5	-	10	μA
I <sub>I</sub>	input leakage current	V <sub>I</sub> = 5.5 V or GND; V <sub>CC</sub> = 0 V to 5.5 V	-	-	0.1	-	1.0	-	2.0	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	-	-	1.0	-	10	-	40	μA

**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	Typ	Max	Min	Max	Min	Max	
C <sub>I</sub>	input capacitance		-	1.5	10	-	10	-	10	pF
<b>74AHCT2G241</b>										
V <sub>IH</sub>	HIGH-level input voltage	V <sub>CC</sub> = 4.5 V to 5.5 V	2.0	-	-	2.0	-	2.0	-	V
V <sub>IL</sub>	LOW-level input voltage	V <sub>CC</sub> = 4.5 V to 5.5 V	-	-	0.8	-	0.8	-	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> = -50 μA	4.4	4.5	-	4.4	-	4.4	-	V
		I <sub>O</sub> = -8.0 mA	3.94	-	-	3.8	-	3.70	-	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> = 50 μA	-	0	0.1	-	0.1	-	0.1	V
		I <sub>O</sub> = 8.0 mA	-	-	0.36	-	0.44	-	0.55	V
I <sub>OZ</sub>	OFF-state output current	V <sub>I</sub> = V <sub>CC</sub> or GND; V <sub>CC</sub> = 5.5 V	-	-	0.25	-	2.5	-	10	μA
I <sub>I</sub>	input leakage current	V <sub>I</sub> = 5.5 V or GND; V <sub>CC</sub> = 0 V to 5.5 V	-	-	0.1	-	1.0	-	2.0	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	-	-	1.0	-	10	-	40	μA
ΔI <sub>CC</sub>	additional supply current	per input pin; V <sub>I</sub> = 3.4 V; other inputs at V <sub>CC</sub> or GND; I <sub>O</sub> = 0 A; V <sub>CC</sub> = 5.5 V	-	-	1.35	-	1.5	-	1.5	mA
C <sub>I</sub>	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	Typ	Max	Min	Max	Min	Max	
<b>74AHC2G241</b>										
t <sub>pd</sub>	propagation delay	nA to nY; see <a href="#">Figure 5</a>								
		V <sub>CC</sub> = 3.0 V to 3.6 V								
		C <sub>L</sub> = 15 pF	-	4.7	8.0	1.0	9.5	1.0	11.5	ns
		C <sub>L</sub> = 50 pF	-	6.6	11.5	1.0	13.0	1.0	14.5	ns
		V <sub>CC</sub> = 4.5 V to 5.5 V								
		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	-	4.7	7.5	1.0	8.5	1.0	9.5	ns

**Table 8. Dynamic characteristics ...continued**  
*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	Typ	Max	Min	Max	Min	Max	
t <sub>en</sub>	enable time	1OE to 1Y; see Figure 6 [1]								
		V <sub>CC</sub> = 3.0 V to 3.6 V [2]								
		C <sub>L</sub> = 15 pF	-	5.0	8.0	1.0	9.5	1.0	11.5	ns
		C <sub>L</sub> = 50 pF	-	6.9	11.5	1.0	13.0	1.0	14.5	ns
		V <sub>CC</sub> = 4.5 V to 5.5 V [3]								
		C <sub>L</sub> = 15 pF	-	3.6	5.1	1.0	6.0	1.0	6.5	ns
		C <sub>L</sub> = 50 pF	-	4.9	7.5	1.0	8.5	1.0	9.5	ns
		2OE to 2Y; see Figure 7 [1]								
		V <sub>CC</sub> = 3.0 V to 3.6 V [2]								
		C <sub>L</sub> = 15 pF	-	4.9	8.0	1.0	9.5	1.0	10.0	ns
		C <sub>L</sub> = 50 pF	-	7.0	11.5	1.0	13.0	1.0	14.5	ns
		V <sub>CC</sub> = 4.5 V to 5.5 V [3]								
		C <sub>L</sub> = 15 pF	-	3.6	5.6	1.0	6.3	1.0	7.0	ns
		C <sub>L</sub> = 50 pF	-	5.4	8.0	1.0	9.0	1.0	9.5	ns
t <sub>dis</sub>	disable time	1OE to 1Y; see Figure 6 [1]								
		V <sub>CC</sub> = 3.0 V to 3.6 V [2]								
		C <sub>L</sub> = 15 pF	-	6.0	9.7	1.0	11.5	1.0	12.5	ns
		C <sub>L</sub> = 50 pF	-	8.3	13.2	1.0	15.0	1.0	16.5	ns
		V <sub>CC</sub> = 4.5 V to 5.5 V [3]								
		C <sub>L</sub> = 15 pF	-	4.1	6.8	1.0	8.0	1.0	8.5	ns
		C <sub>L</sub> = 50 pF	-	5.7	8.8	1.0	10.0	1.0	11.0	ns
		2OE to 2Y; see Figure 7 [1]								
		V <sub>CC</sub> = 3.0 V to 3.6 V [2]								
		C <sub>L</sub> = 15 pF	-	6.3	9.7	1.0	11.5	1.0	12.5	ns
		C <sub>L</sub> = 50 pF	-	9.0	13.2	1.0	15.0	1.0	16.5	ns
		V <sub>CC</sub> = 4.5 V to 5.5 V [3]								
		C <sub>L</sub> = 15 pF	-	4.3	6.8	1.0	8.0	1.0	8.5	ns
		C <sub>L</sub> = 50 pF	-	6.1	8.8	1.0	10.0	1.0	11.0	ns
C <sub>PD</sub>	power dissipation capacitance	per buffer; C <sub>L</sub> = 50 pF; f <sub>i</sub> = 1 MHz; V <sub>i</sub> = GND to V <sub>CC</sub>	[4]	-	10	-	-	-	-	pF
<b>74AHCT2G241</b>										
t <sub>pd</sub>	propagation delay	nA to nY; see Figure 5 [1]								
		V <sub>CC</sub> = 4.5 V to 5.5 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	-	4.7	7.5	1.0	8.5	1.0	9.5	ns

**Table 8. Dynamic characteristics ...continued**  
*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	Typ	Max	Min	Max	Min	Max	
t <sub>en</sub>	enable time	1OE to 1Y; see Figure 6	[1]							
		V <sub>CC</sub> = 4.5 V to 5.5 V	[3]							
		C <sub>L</sub> = 15 pF	-	3.9	5.1	1.0	6.0	1.0	6.5	ns
		C <sub>L</sub> = 50 pF	-	5.1	7.5	1.0	8.5	1.0	9.5	ns
		2OE to 2Y; see Figure 7	[1]							
		V <sub>CC</sub> = 4.5 V to 5.5 V	[3]							
t <sub>dis</sub>	disable time	1OE to 1Y; see Figure 6	[1]							
		V <sub>CC</sub> = 4.5 V to 5.5 V	[3]							
		C <sub>L</sub> = 15 pF	-	4.5	6.8	1.0	8.0	1.0	8.5	ns
		C <sub>L</sub> = 50 pF	-	6.1	8.8	1.0	10.0	1.0	11.0	ns
		2OE to 2Y; see Figure 7	[1]							
		V <sub>CC</sub> = 4.5 V to 5.5 V	[3]							
C <sub>PD</sub>	power dissipation capacitance	per buffer; C <sub>L</sub> = 50 pF; f <sub>i</sub> = 1 MHz; V <sub>i</sub> = GND to V <sub>CC</sub>	[4]	-	10	-	-	-	-	pF

- [1] 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>.

[2] Typical values are measured at V<sub>CC</sub> = 3.3 V.

[3] Typical values are measured at V<sub>CC</sub> = 5.0 V.

[4] C<sub>PD</sub> is used to determine the dynamic power dissipation P<sub>D</sub> (μW).

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

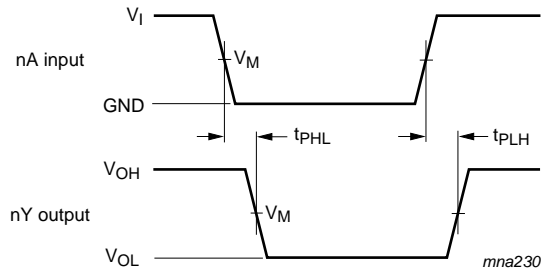
f<sub>i</sub> = input frequency in MHz;

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

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

V<sub>CC</sub> = supply voltage in Volts.

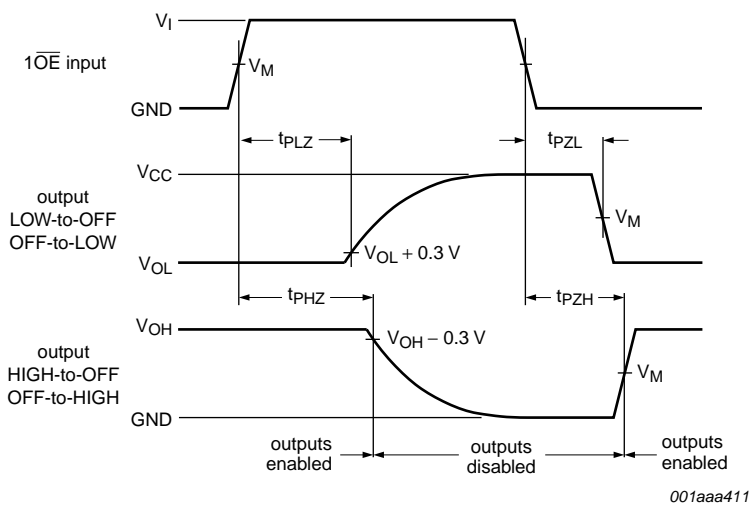
## 12. Waveforms



Measurement points are given in [Table 9](#).

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

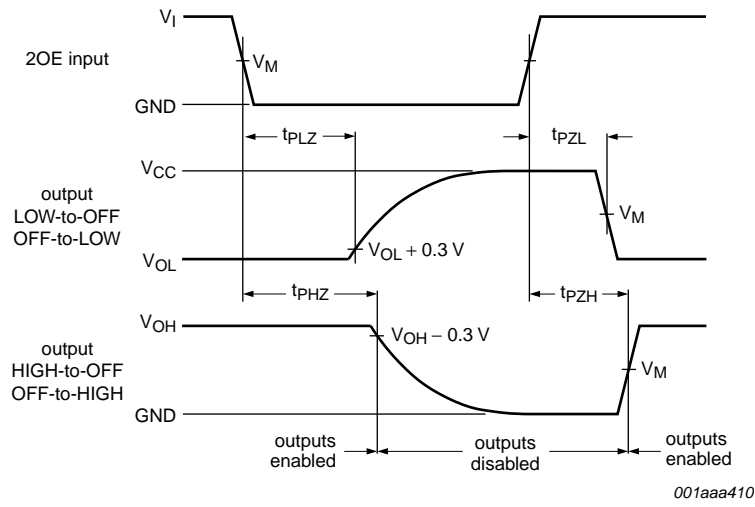
**Fig 5. The input (nA) to output (nY) propagation delays**



Measurement points are given in [Table 9](#).

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

**Fig 6. The input ( $\overline{1OE}$ ) to output 1Y enable and disable times**



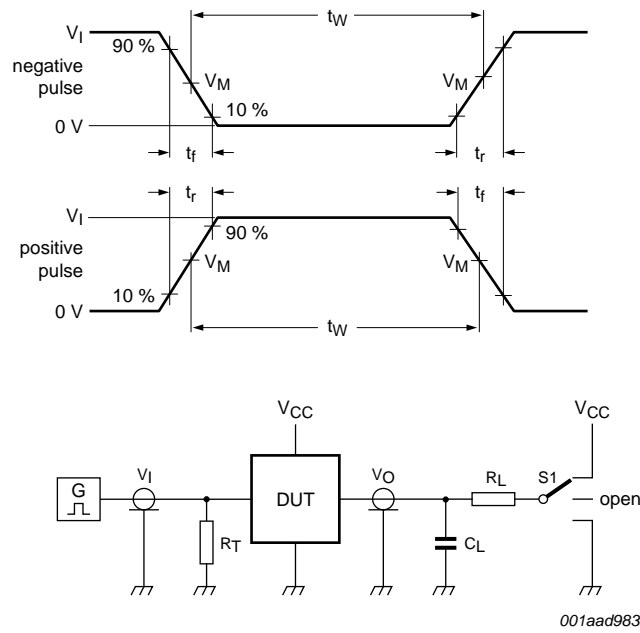
Measurement points are given in [Table 9](#).

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

**Fig 7. The input (2OE) to output 2Y enable and disable times**

**Table 9. Measurement points**

Type	Input	Output
	$V_M$	$V_M$
74AHC2G241	$0.5V_{CC}$	$0.5V_{CC}$
74AHCT2G241	1.5 V	$0.5V_{CC}$



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.

$R_L$  = Load resistance.

S1 = Test selection switch.

**Fig 8. Test circuit for measuring switching times**

**Table 10. Test data**

Type	Input		Load		S1 position		
	$V_I$	$t_r, t_f$	$C_L$	$R_L$	$t_{PHL}, t_{PLH}$	$t_{PZH}, t_{PHZ}$	$t_{PZL}, t_{PLZ}$
74AHC2G241	$V_{CC}$	$\leq 3 \text{ ns}$	15 pF, 50 pF	1 k $\Omega$	open	GND	$V_{CC}$
74AHCT2G241	3 V	$\leq 3 \text{ ns}$	15 pF, 50 pF	1 k $\Omega$	open	GND	$V_{CC}$

13. Package outline

TSSOP8: plastic thin shrink small outline package; 8 leads; body width 3 mm; lead length 0.5 mm SOT505-2

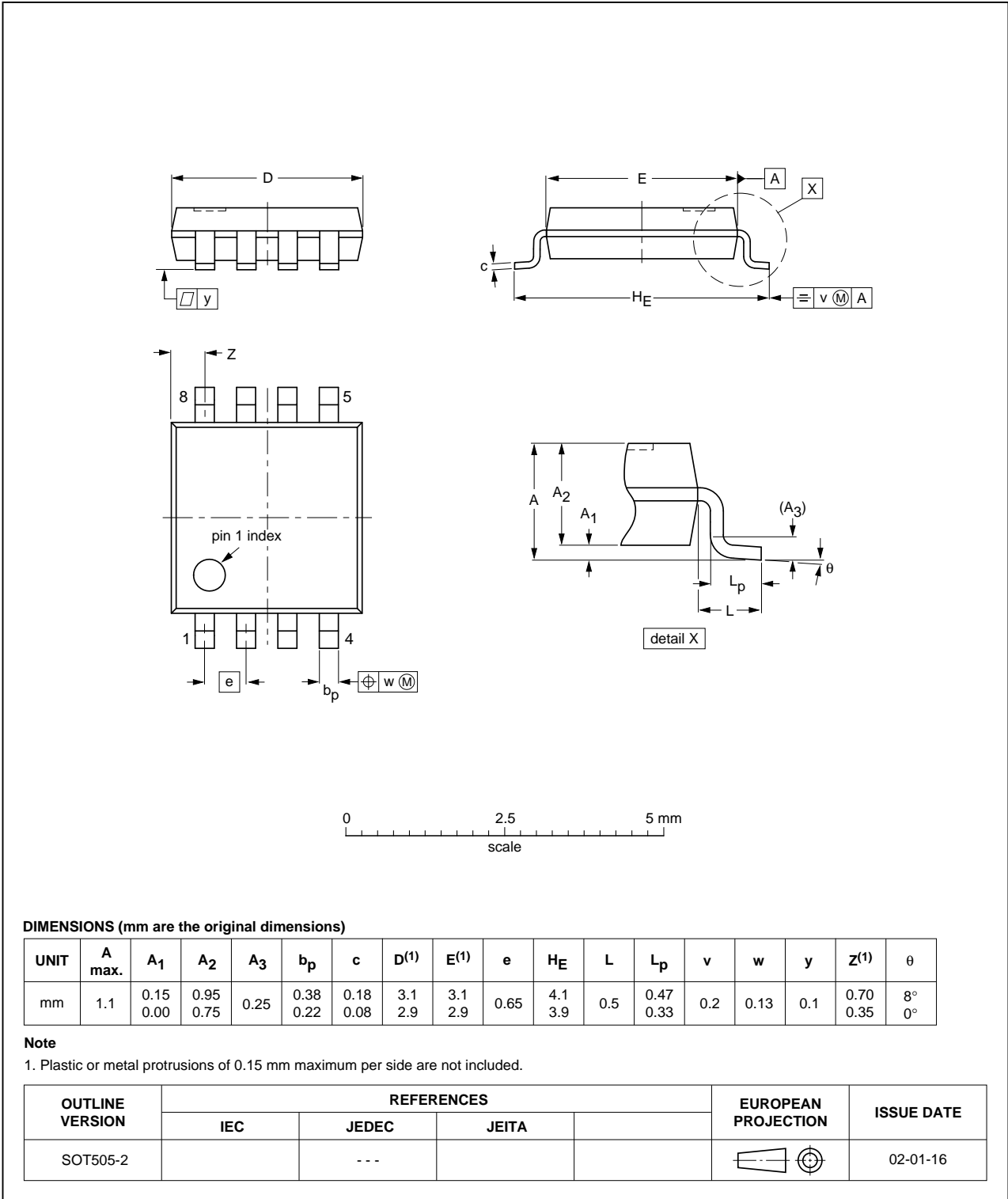


Fig 9. Package outline SOT505-2 (TSSOP8)

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

SOT765-1

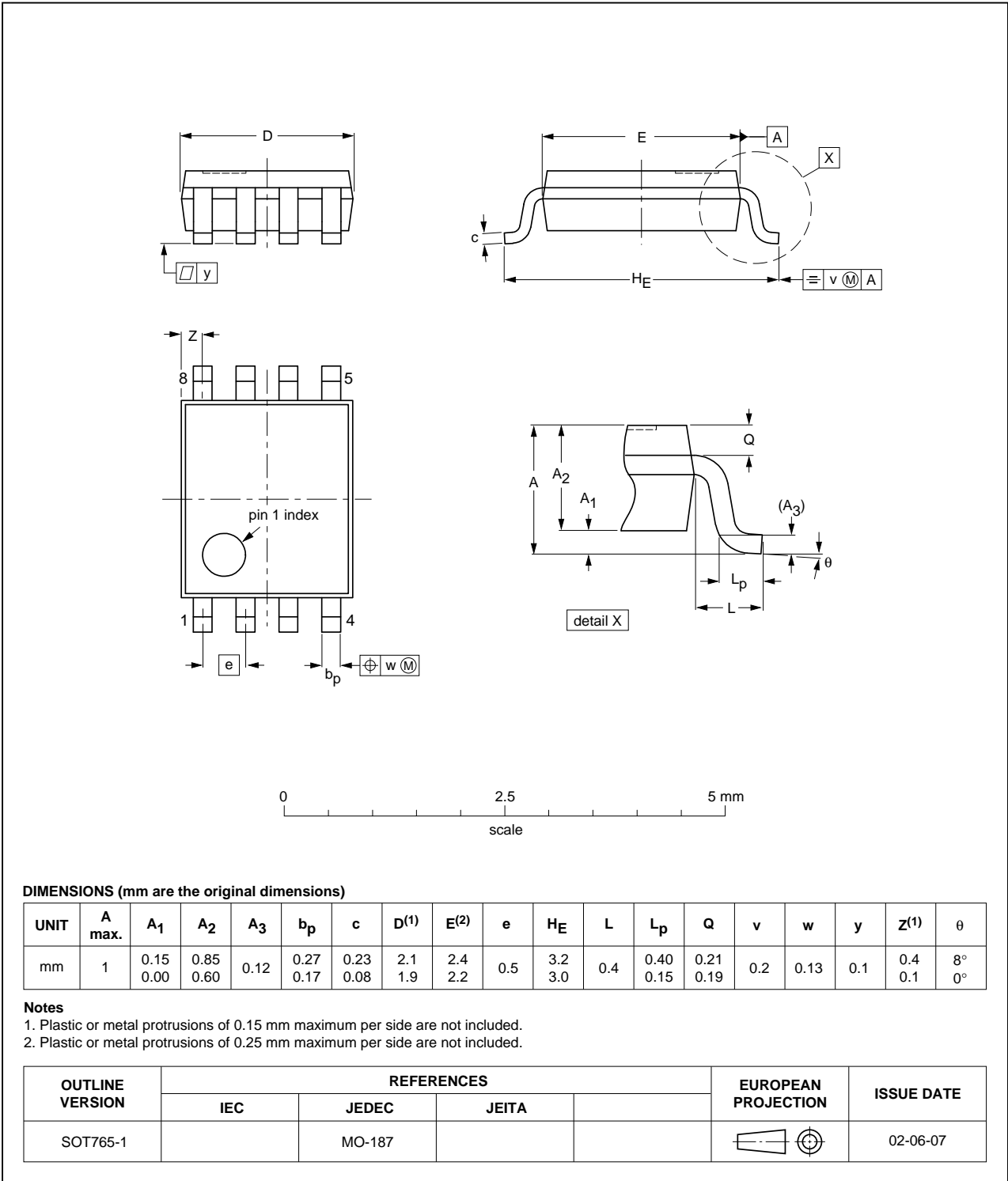


Fig 10. Package outline SOT765-1 (VSSOP8)

XSON8: plastic extremely thin small outline package; no leads;  
8 terminals; body 3 x 2 x 0.5 mm

SOT996-2

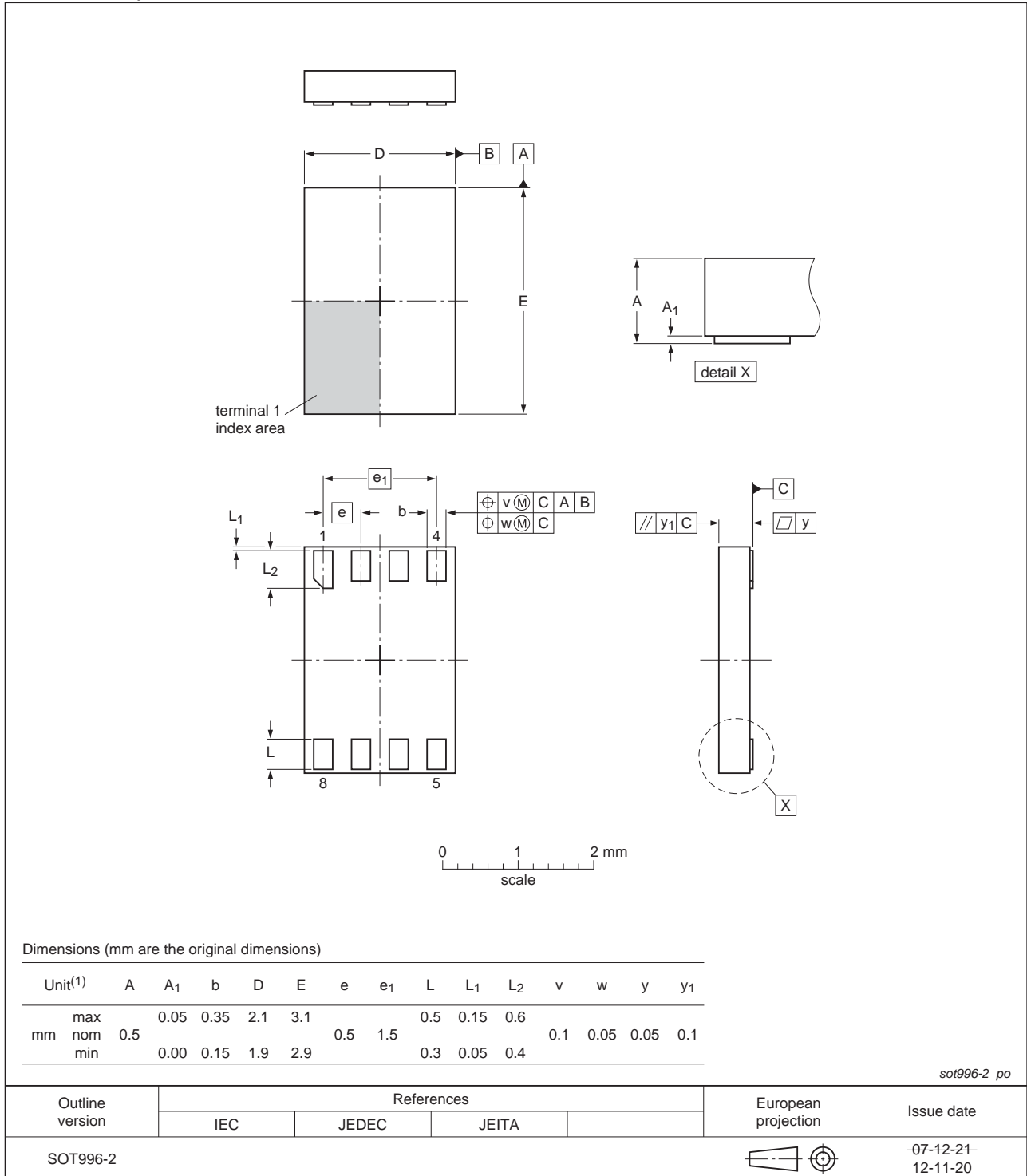


Fig 11. Package outline SOT996-2 (XSON8)

## 14. Revision history

Table 11. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74AHC_AHCT2G241 v.3	20130513	Product data sheet	-	74AHC_AHCT2G241 v.2
Modifications:	<ul style="list-style-type: none"> <li>For type number 74AHC2G241GD and 74AHCT2G241GD XSON8U has changed to XSON8.</li> </ul>			
74AHC_AHCT2G241 v.2	20090113	Product data sheet	-	74AHC_AHCT2G241 v.1
Modifications:	<ul style="list-style-type: none"> <li>The format of this data sheet has been redesigned to comply with the new identity guidelines of NXP Semiconductors.</li> <li>Legal texts have been adapted to the new company name where appropriate.</li> <li>Added type number 74AHC2G241GD and 74AHCT2G241GD (XSON8U package).</li> </ul>			
74AHC_AHCT2G241 v.1	20040310	Product data	-	-

## 15. Legal information

### 15.1 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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