# 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 1OE and 2OE. A HIGH level at pin 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 °C to +85 °C and from -40 °C to +125 °C

## 3. Ordering information

Table 1. Ordering information

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



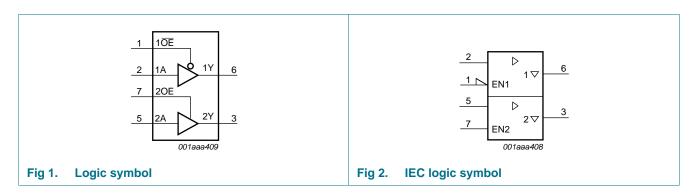
### 4. Marking

#### Table 2. Marking

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

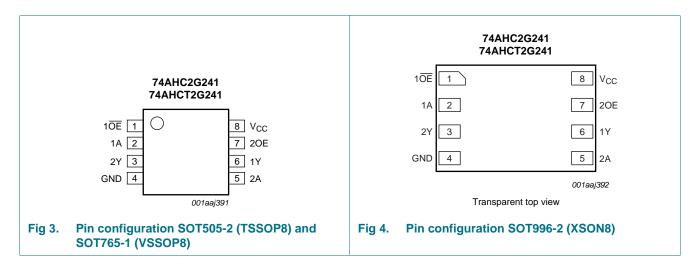
<sup>[1]</sup> The pin 1 indicator is located on the lower left corner of the device, below the marking code.

## 5. Functional diagram



## 6. Pinning information

#### 6.1 Pinning



#### 6.2 Pin description

Table 3. Pin description

Symbol	Pin	Description
1 <del>OE</del>	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
20E	7	output enable input (active HIGH)
V <sub>CC</sub>	8	supply voltage

## 7. Functional description

Table 4. Function table[1]

Input			Input		Output
1OE	1A	1Y	20E	2A	2Y
L	L	L	Н	L	L
L	Н	Н	Н	Н	Н
Н	Χ	Z	L	Χ	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
$V_{I}$	input voltage		-0.5	+7.0	V
I <sub>IK</sub>	input clamping current	$V_1 < -0.5 \text{ V}$	<u>[1]</u> –20	-	mA
I <sub>OK</sub>	output clamping current	$V_O < -0.5 \text{ V or } V_O > V_{CC} + 0.5 \text{ V}$	<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		<b>−75</b>	-	mA
T <sub>stg</sub>	storage temperature		-65	+150	°C
P <sub>tot</sub>	total power dissipation	$T_{amb}$ = -40 °C to +125 °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	AHC2G2	41	74	Unit		
			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
Δt/ΔV	input transition rise	$V_{CC}$ = 3.3 V $\pm$ 0.3 V	-	-	100	-	-	-	ns/V
	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 1	to +85 °C	-40 °C to +125 °C		Unit
			Min	Тур	Max	Min	Max	Min	Max	
74AHC2	G241									
V <sub>IH</sub>	HIGH-level	$V_{CC} = 2.0 \text{ V}$	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	V <sub>CC</sub> = 2.0 V	-	-	0.5	-	0.5	-	0.5	V
	input voltage	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
l <sub>l</sub>	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

74AHC\_AHCT2G241

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

Symbol	Parameter	Conditions		25 °C		-40 °C 1	to +85 °C	-40 °C t	o +125 °C	Unit
			Min	Тур	Max	Min	Max	Min	Max	
Cı	input capacitance	'	-	1.5	10	-	10	-	10	pF
74AHCT	2G241									
$V_{IH}$	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
		$I_0 = -8.0 \text{ mA}$	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	$I_{O} = 50 \mu A$	-	0	0.1	-	0.1	-	0.1	V
		$I_0 = 8.0 \text{ mA}$	-	-	0.36	-	0.44	-	0.55	V
$I_{OZ}$	OFF-state output current	$V_I = V_{CC}$ or GND; $V_{CC} = 5.5 \text{ V}$	-	-	0.25	-	2.5	-	10	μΑ
Iį	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
$\Delta I_{CC}$	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 t	o +125 °C	Unit
				Min	Тур	Max	Min	Max	Min	Max	
74AHC2	G241							•		•	
t <sub>pd</sub>	propagation	nA to nY; see Figure 5	<u>[1]</u>								
	delay	$V_{CC} = 3.0 \text{ V to } 3.6 \text{ V}$	[2]								
		$C_L = 15 pF$		-	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]								
		$C_L = 15 pF$		-	3.4	5.5	1.0	6.5	1.0	7.0	ns
		$C_L = 50 pF$		-	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.

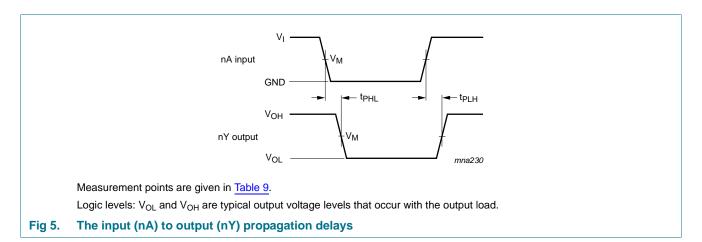
Symbol	Parameter	Conditions			25 °C		-40 °C 1	to +85 °C	-40 °C t	to +125 °C	Unit
				Min	Тур	Max	Min	Max	Min	Max	
en	enable time	1OE to 1Y; see Figure 6	<u>[1]</u>					ı			
		$V_{CC} = 3.0 \text{ V to } 3.6 \text{ V}$	[2]								
		C <sub>L</sub> = 15 pF		-	5.0	8.0	1.0	9.5	1.0	11.5	ns
		$C_L = 50 pF$		-	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
		2OE to 2Y; see Figure 7	<u>[1]</u>								
		$V_{CC} = 3.0 \text{ V to } 3.6 \text{ V}$	[2]								
		C <sub>L</sub> = 15 pF		-	4.9	8.0	1.0	9.5	1.0	10.0	ns
		$C_{L} = 50 \text{ pF}$		-	7.0	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		-	3.6	5.6	1.0	6.3	1.0	7.0	ns
		$C_{L} = 50 \text{ pF}$		-	5.4	8.0	1.0	9.0	1.0	9.5	ns
dis	disable time	1OE to 1Y; see Figure 6	[1]								
		$V_{CC} = 3.0 \text{ V to } 3.6 \text{ V}$	[2]								
		C <sub>L</sub> = 15 pF		-	6.0	9.7	1.0	11.5	1.0	12.5	ns
		$C_{L} = 50 \text{ pF}$		-	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
		$C_{L} = 50 \text{ pF}$		-	5.7	8.8	1.0	10.0	1.0	11.0	ns
		2OE to 2Y; see Figure 7	[1]								
		$V_{CC} = 3.0 \text{ V to } 3.6 \text{ V}$	[2]								
		C <sub>L</sub> = 15 pF		-	6.3	9.7	1.0	11.5	1.0	12.5	ns
		$C_{L} = 50 \text{ pF}$		-	9.0	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		-	4.3	6.8	1.0	8.0	1.0	8.5	ns
		$C_{L} = 50 \text{ pF}$		-	6.1	8.8	1.0	10.0	1.0	11.0	ns
$C_{PD}$	power dissipation capacitance	per buffer; $C_L = 50 \text{ pF}$ ; $f_i = 1 \text{ MHz}$ ; $V_I = \text{GND to } V_{CC}$	<u>[4]</u>	-	10	-	-	-	-	-	рF
4AHCT	•										
pd	propagation	nA to nY; see Figure 5	[1]								
μu	delay	$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}$	[3]								
		$C_1 = 15 \text{ pF}$		-	3.4	5.5	1.0	6.5	1.0	7.0	ns
		$C_1 = 50 \text{ pF}$			4.7	7.5	1.0	8.5	1.0	9.5	ns

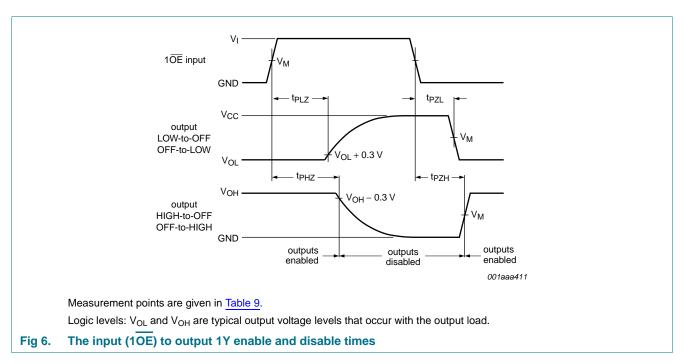
Table 8. Dynamic characteristics ...continued GND = 0 V; for test circuit see <u>Figure 8</u>.

Symbol	Parameter	Conditions			25 °C		-40 °C 1	to +85 °C	-40 °C t	o +125 °C	Unit
				Min	Тур	Max	Min	Max	Min	Max	
t <sub>en</sub>	enable time	1OE to 1Y; see Figure 6	<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	6.5	ns
		$C_L = 50 pF$		-	5.1	7.5	1.0	8.5	1.0	9.5	ns
		2OE to 2Y; see Figure 7	[1]								
		$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}$	[3]								
		$C_{L} = 15  pF$		-	3.4	5.6	1.0	6.3	1.0	6.5	ns
		$C_L = 50 pF$		-	4.8	7.5	1.0	9.0	1.0	9.5	ns
t <sub>dis</sub>	disable time	1OE to 1Y; see Figure 6	[1]								
		$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}$	[3]								
		$C_{L} = 15  pF$		-	4.5	6.8	1.0	8.0	1.0	8.5	ns
		$C_L = 50 pF$		-	6.1	8.8	1.0	10.0	1.0	11.0	ns
		2OE to 2Y; see Figure 7	[1]								
		$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}$	[3]								
		C <sub>L</sub> = 15 pF		-	4.0	6.8	1.0	8.0	1.0	8.5	ns
		$C_{L} = 50 \text{ pF}$		-	5.7	8.8	1.0	10.0	1.0	11.0	ns
$C_{PD}$	power dissipation capacitance	per buffer; $C_L = 50 \text{ pF}$ ; $f_i = 1 \text{ MHz}$ ; $V_I = \text{GND to } V_{CC}$	<u>[4]</u>	-	10	-	-	-	-	-	pF

- [1]  $t_{pd}$  is the same as  $t_{PLH}$  and  $t_{PHL}$ .
  - $t_{\text{en}}$  is the same as  $t_{\text{PZL}}$  and  $t_{\text{PZH}}.$
  - $t_{\text{dis}}$  is the same as  $t_{\text{PLZ}}$  and  $t_{\text{PHZ}}$ .
- [2] Typical values are measured at  $V_{CC}$  = 3.3 V.
- [3] Typical values are measured at  $V_{CC}$  = 5.0 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<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





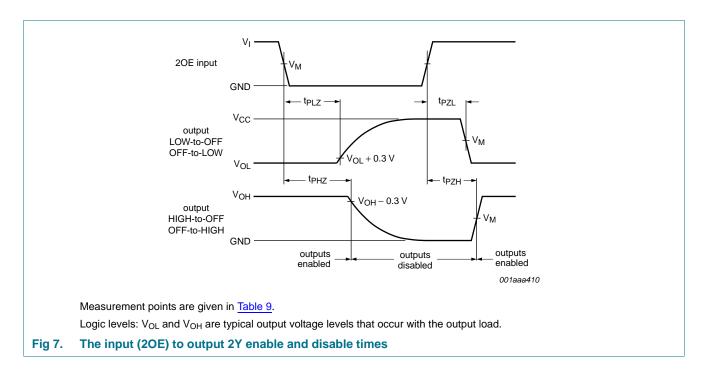
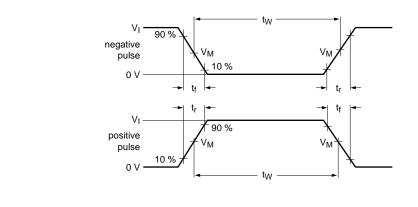
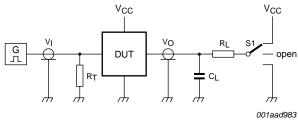


Table 9. Measurement points

Туре	Input	Output
	V <sub>M</sub>	V <sub>M</sub>
74AHC2G241	0.5V <sub>CC</sub>	0.5V <sub>CC</sub>
74AHCT2G241	1.5 V	0.5V <sub>CC</sub>

9 of 17





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>	
74AHC2G241	$V_{CC}$	$\leq$ 3 ns	15 pF, 50 pF	1 k $\Omega$	open	GND	V <sub>CC</sub>	
74AHCT2G241	3 V	≤ 3 ns	15 pF, 50 pF	1 kΩ	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 SOT505-2

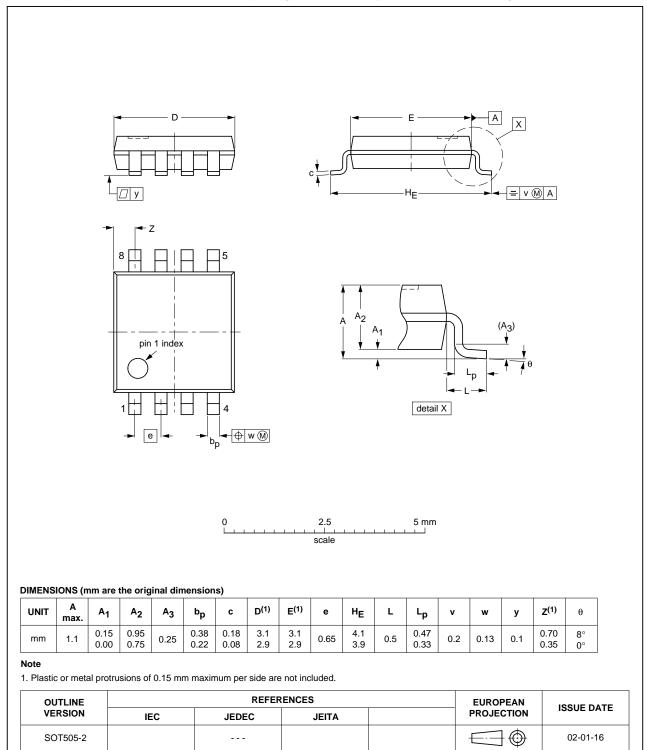
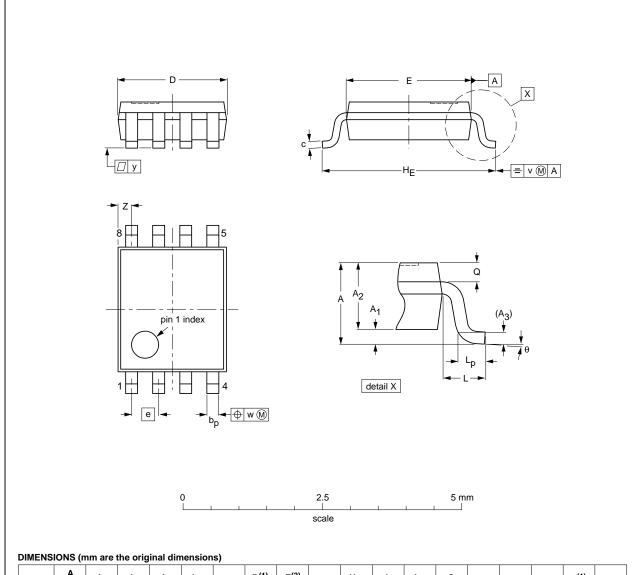


Fig 9. Package outline SOT505-2 (TSSOP8)

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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	Lр	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.
   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\_AHCT2G241

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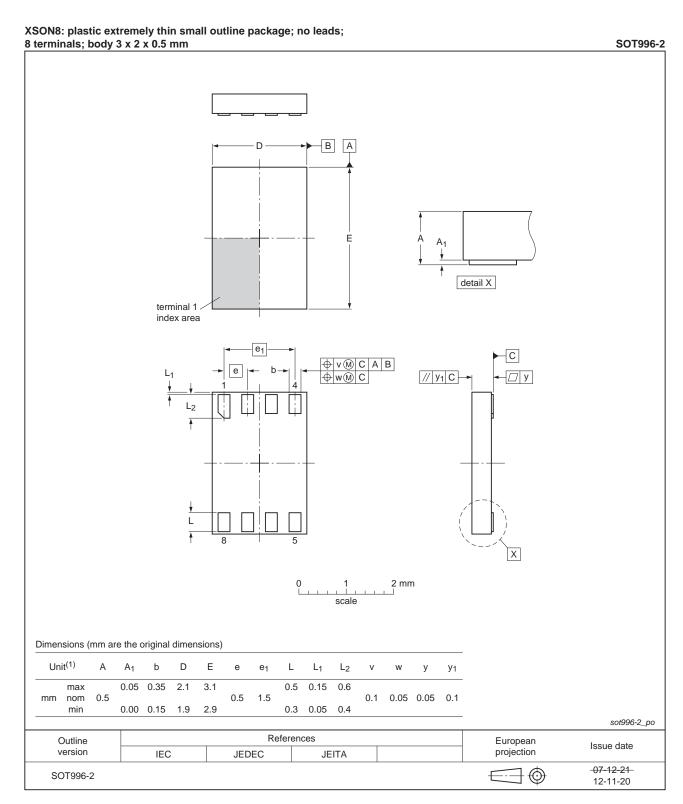


Fig 11. Package outline SOT996-2 (XSON8)

74AHC\_AHCT2G241

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## 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> <li>For type nun XSON8.</li> </ul>	nber 74AHC2G241GD and	I 74AHCT2G241GD XS	ON8U has changed to
74AHC_AHCT2G241 v.2	20090113	Product data sheet	-	74AHC_AHCT2G241 v.1
Modifications:		of this data sheet has been f NXP Semiconductors.	redesigned to comply v	vith the new identity
	<ul> <li>Legal texts h</li> </ul>	nave been adapted to the r	new company name who	ere appropriate.
	<ul> <li>Added type</li> </ul>	number 74AHC2G241GD	and 74AHCT2G241GD	(XSON8U package).
74AHC_AHCT2G241 v.1	20040310	Product data	-	-

### 15. Legal information

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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"
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Dual buffer/line driver: 3-state

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Dual buffer/line driver; 3-state

#### 17. 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
8	Limiting values	3
9	Recommended operating conditions	4
10	Static characteristics	4
11	Dynamic characteristics	ţ
12	Waveforms	8
13	Package outline	11
14	Revision history 1	4
15	Legal information 1	ţ
15.1	Data sheet status	Ę
15.2	Definitions	Ę
15.3	Disclaimers	Ę
15.4	Trademarks1	6
16	Contact information 1	(
17	Contents 1	-

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