74AHC2G241; 74AHCT2G241

Dual buffer/line driver; 3-state

Rev. 02 — 13 January 2009 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 $1\overline{OE}$ and 2OE. A HIGH level at pin $1\overline{OE}$ 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

- 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			
	Temperature range	Name	Description	Version
74AHC2G241DP	–40 °C to +125 °C	TSSOP8	plastic thin shrink small outline package; 8 leads; body width 3 mm; lead length 0.5 mm	SOT505-2
74AHCT2G241DP				
74AHC2G241DC	–40 °C to +125 °C	VSSOP8	plastic very thin shrink small outline package; 8 leads; body width 2.3 mm	SOT765-1
74AHCT2G241DC				
74AHC2G241GD	–40 °C to +125 °C	XSON8U	plastic extremely thin small outline package; no leads; 8 terminals; UTLP based; body $3 \times 2 \times 0.5$ mm	SOT996-2
74AHCT2G241GD				

4. Marking

Table 2. Marking

Type number	Marking code
74AHC2G241DP	A241
74AHCT2G241DP	C241
74AHC2G241DC	A41
74AHCT2G241DC	C41
74AHC2G241GD	A41
74AHCT2G241GD	C41

5. Functional diagram

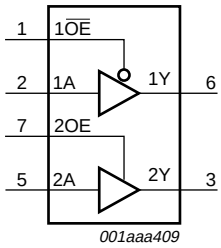


Fig 1. Logic symbol

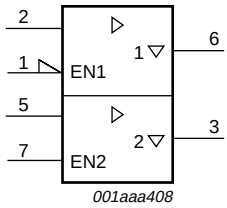


Fig 2. IEC logic symbol

6. Pinning information

6.1 Pinning

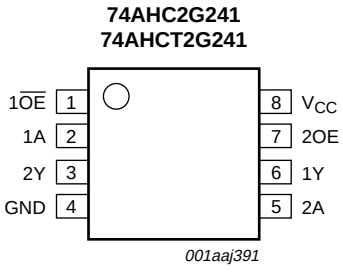


Fig 3. Pin configuration SOT505-2 (TSSOP8) and SOT765-1 (VSSOP8)

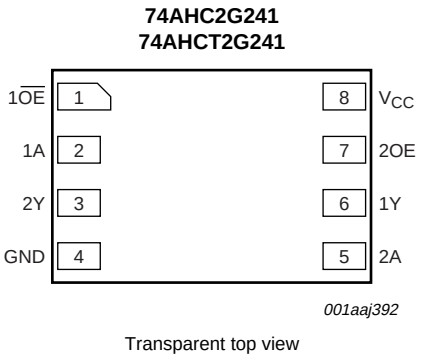


Fig 4. Pin configuration SOT996-2 (XSON8U)

6.2 Pin description

Table 3. Pin description

Symbol	Pin	Description
$1\overline{OE}$	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[1]

Input		Output	Input		Output
$1\overline{OE}$	**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	[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	-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	[2]	-	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 XSON8U 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_{CC}	supply voltage		2.0	5.0	5.5	4.5	5.0	5.5	V
V_I	input voltage		0	-	5.5	0	-	5.5	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} = 3.3 V ± 0.3 V	-	-	100	-	-	-	ns/V
		V_{CC} = 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	
74AHC2G241										
V_{IH}	HIGH-level input voltage	V_{CC} = 2.0 V	1.5	-	-	1.5	-	1.5	-	V
		V_{CC} = 3.0 V	2.1	-	-	2.1	-	2.1	-	V
		V_{CC} = 5.5 V	3.85	-	-	3.85	-	3.85	-	V
V_{IL}	LOW-level input voltage	V_{CC} = 2.0 V	-	-	0.5	-	0.5	-	0.5	V
		V_{CC} = 3.0 V	-	-	0.9	-	0.9	-	0.9	V
		V_{CC} = 5.5 V	-	-	1.65	-	1.65	-	1.65	V
V_{OH}	HIGH-level output voltage	V_I = V_{IH} or V_{IL}								
		I_O = –50 µA; V_{CC} = 2.0 V	1.9	2.0	-	1.9	-	1.9	-	V
		I_O = –50 µA; V_{CC} = 3.0 V	2.9	3.0	-	2.9	-	2.9	-	V
		I_O = –50 µA; V_{CC} = 4.5 V	4.4	4.5	-	4.4	-	4.4	-	V
		I_O = –4.0 mA; V_{CC} = 3.0 V	2.58	-	-	2.48	-	2.40	-	V
		I_O = –8.0 mA; V_{CC} = 4.5 V	3.94	-	-	3.8	-	3.70	-	V
V_{OL}	LOW-level output voltage	V_I = V_{IH} or V_{IL}								
		I_O = 50 µA; V_{CC} = 2.0 V	-	0	0.1	-	0.1	-	0.1	V
		I_O = 50 µA; V_{CC} = 3.0 V	-	0	0.1	-	0.1	-	0.1	V
		I_O = 50 µA; V_{CC} = 4.5 V	-	0	0.1	-	0.1	-	0.1	V
		I_O = 4.0 mA; V_{CC} = 3.0 V	-	-	0.36	-	0.44	-	0.55	V
		I_O = 8.0 mA; V_{CC} = 4.5 V	-	-	0.36	-	0.44	-	0.55	V
I_{OZ}	OFF-state output current	V_I = V_{CC} or GND; V_{CC} = 5.5 V	-	-	0.25	-	2.5	-	10	µA
I_I	input leakage current	V_I = 5.5 V or GND; V_{CC} = 0 V to 5.5 V	-	-	0.1	-	1.0	-	2.0	µA
I_{CC}	supply current	V_I = V_{CC} or GND; I_O = 0 A; V_{CC} = 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_I	input capacitance		-	1.5	10	-	10	-	10	pF
74AHCT2G241										
V_{IH}	HIGH-level input voltage	V_{CC} = 4.5 V to 5.5 V	2.0	-	-	2.0	-	2.0	-	V
V_{IL}	LOW-level input voltage	V_{CC} = 4.5 V to 5.5 V	-	-	0.8	-	0.8	-	0.8	V
V_{OH}	HIGH-level output voltage	V_I = V_{IH} or V_{IL}; V_{CC} = 4.5 V								
		I_O = –50 µA	4.4	4.5	-	4.4	-	4.4	-	V
		I_O = –8.0 mA	3.94	-	-	3.8	-	3.70	-	V
V_{OL}	LOW-level output voltage	V_I = V_{IH} or V_{IL}; V_{CC} = 4.5 V								
		I_O = 50 µA	-	0	0.1	-	0.1	-	0.1	V
		I_O = 8.0 mA	-	-	0.36	-	0.44	-	0.55	V
I_{OZ}	OFF-state output current	V_I = V_{CC} or GND; V_{CC} = 5.5 V	-	-	0.25	-	2.5	-	10	µA
I_I	input leakage current	V_I = 5.5 V or GND; V_{CC} = 0 V to 5.5 V	-	-	0.1	-	1.0	-	2.0	µA
I_{CC}	supply current	V_I = V_{CC} or GND; I_O = 0 A; V_{CC} = 5.5 V	-	-	1.0	-	10	-	40	µA
ΔI_{CC}	additional supply current	per input pin; V_I = 3.4 V; other inputs at V_{CC} or GND; I_O = 0 A; V_{CC} = 5.5 V	-	-	1.35	-	1.5	-	1.5	mA
C_I	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	
74AHC2G241											
t_{pd}	propagation delay	nA to nY; see Figure 5	[1]								
		V_{CC} = 3.0 V to 3.6 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 V to 5.5 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 to +85 °C		–40 °C to +125 °C		Unit
				Min	Typ	Max	Min	Max	Min	Max	
t_{en}	enable time	$1\overline{OE}$ to 1Y; see Figure 6	[1]								
		V_{CC} = 3.0 V to 3.6 V	[2]								
		C_L = 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 V to 5.5 V	[3]								
		C_L = 15 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	[1]								
		V_{CC} = 3.0 V to 3.6 V	[2]								
		C_L = 15 pF		-	4.9	8.0	1.0	9.5	1.0	10.0	ns
		C_L = 50 pF		-	7.0	11.5	1.0	13.0	1.0	14.5	ns
		V_{CC} = 4.5 V to 5.5 V	[3]								
		C_L = 15 pF		-	3.6	5.6	1.0	6.3	1.0	7.0	ns
		C_L = 50 pF		-	5.4	8.0	1.0	9.0	1.0	9.5	ns
t_{dis}	disable time	$1\overline{OE}$ to 1Y; see Figure 6	[1]								
		V_{CC} = 3.0 V to 3.6 V	[2]								
		C_L = 15 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 V to 5.5 V	[3]								
		C_L = 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
		2OE to 2Y; see Figure 7	[1]								
		V_{CC} = 3.0 V to 3.6 V	[2]								
		C_L = 15 pF		-	6.3	9.7	1.0	11.5	1.0	12.5	ns
		C_L = 50 pF		-	9.0	13.2	1.0	15.0	1.0	16.5	ns
		V_{CC} = 4.5 V to 5.5 V	[3]								
		C_L = 15 pF		-	4.3	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
C_{PD}	power dissipation capacitance	per buffer; C_L = 50 pF; f_i = 1 MHz; V_I = GND to V_{CC}	[4]	-	10	-	-	-	-	-	pF
74AHCT2G241											
t_{pd}	propagation delay	nA to nY; see Figure 5	[1]								
		V_{CC} = 4.5 V to 5.5 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 to +85 °C		–40 °C to +125 °C		Unit
				Min	Typ	Max	Min	Max	Min	Max	
t_{en}	enable time	$1\overline{OE}$ to 1Y; see Figure 6	[1]								
		V_{CC} = 4.5 V to 5.5 V	[3]								
		C_L = 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 V to 5.5 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_{dis}	disable time	$1\overline{OE}$ to 1Y; see Figure 6	[1]								
		V_{CC} = 4.5 V to 5.5 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 V to 5.5 V	[3]								
		C_L = 15 pF		-	4.0	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 pF; f_i = 1 MHz; V_I = GND to V_{CC}	[4]	-	10	-	-	-	-	-	pF

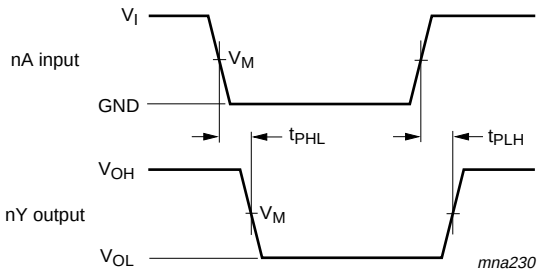
[1] t_{pd} is the same as t_{PLH} and t_{PHL}.
t_{en} is the same as t_{PZL} and t_{PZH}.
t_{dis} is the same as t_{PLZ} and t_{PHZ}.

[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 (µW).
$P_D = C_{PD} \times V_{CC}^2 \times f_i + \sum (C_L \times V_{CC}^2 \times f_o)$ where:
f_i = input frequency in MHz;
f_o = output frequency in MHz;
C_L = output load capacitance in pF;
V_{CC} = supply voltage in Volts.

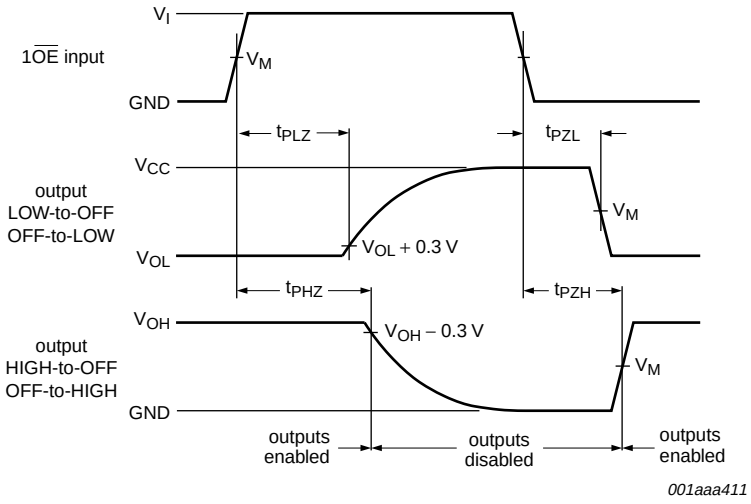
12. Waveforms



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.

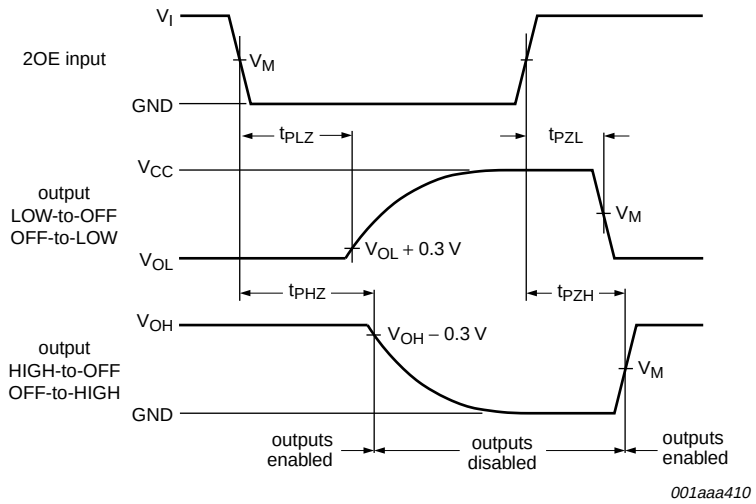
Fig 5. The input (nA) to output (nY) propagation delays



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 ($1\overline{OE}$) to output 1Y enable and disable times



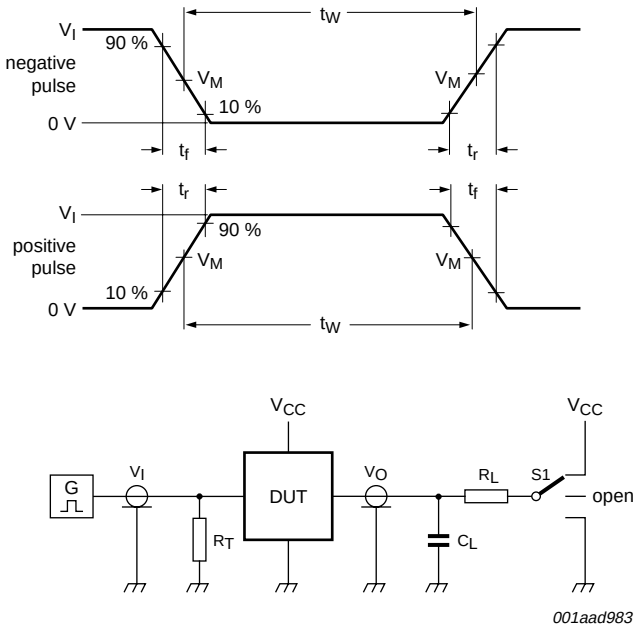
Measurement points are given in Table 9.

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.

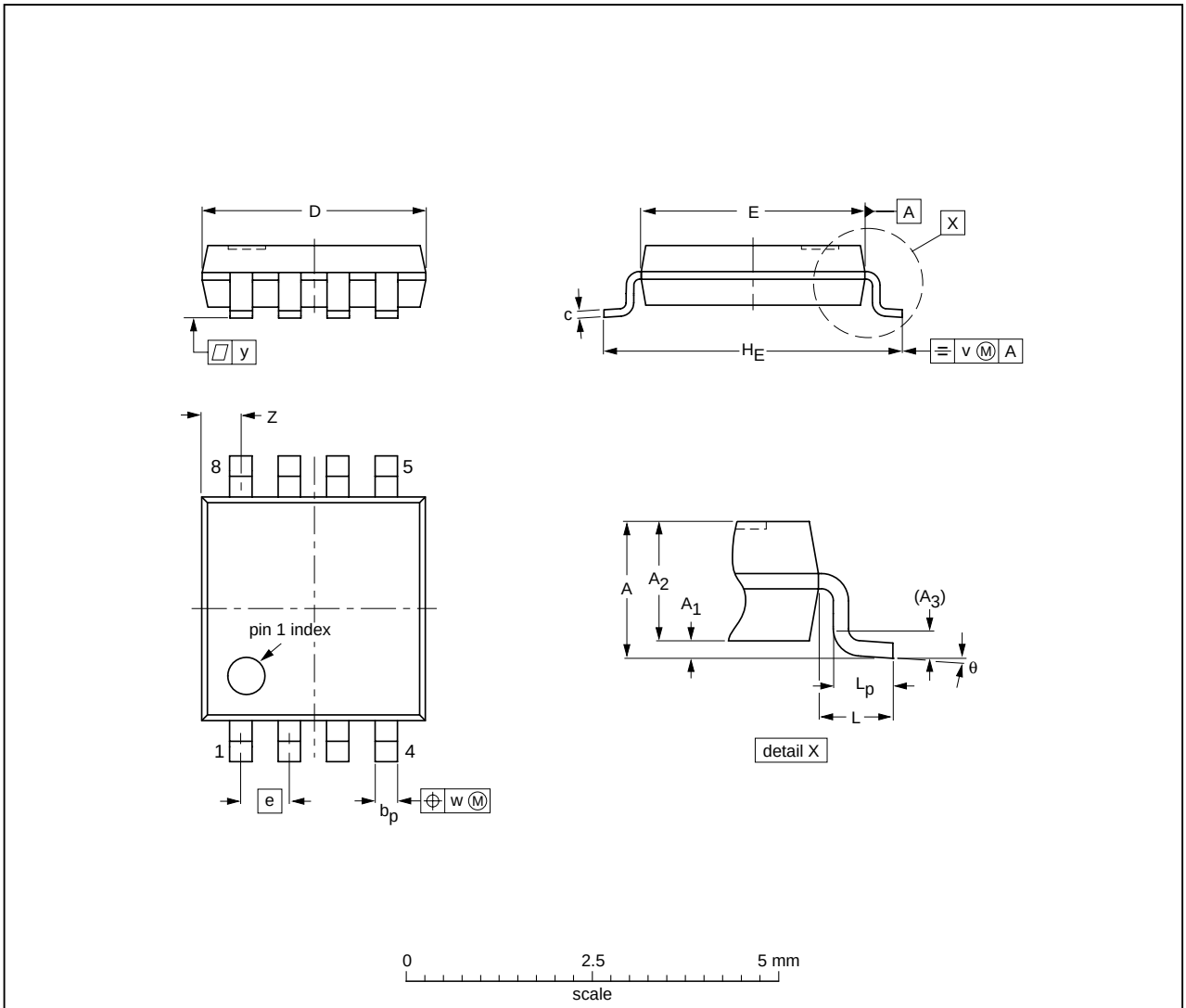
Fig 8. Test circuit for measuring switching times

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}	≤ 3 ns	15 pF, 50 pF	1 kΩ	open	GND	V_{CC}
74AHCT2G241	3 V	≤ 3 ns	15 pF, 50 pF	1 kΩ	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



DIMENSIONS (mm are the original dimensions)

UNIT	A max.	A_1	A_2	A_3	b_p	c	$D^{(1)}$	$E^{(1)}$	e	H_E	L	L_p	v	w	y	$Z^{(1)}$	θ
mm	1.1	0.15 0.00	0.95 0.75	0.25	0.38 0.22	0.18 0.08	3.1 2.9	3.1 2.9	0.65	4.1 3.9	0.5	0.47 0.33	0.2	0.13	0.1	0.70 0.35	8° 0°

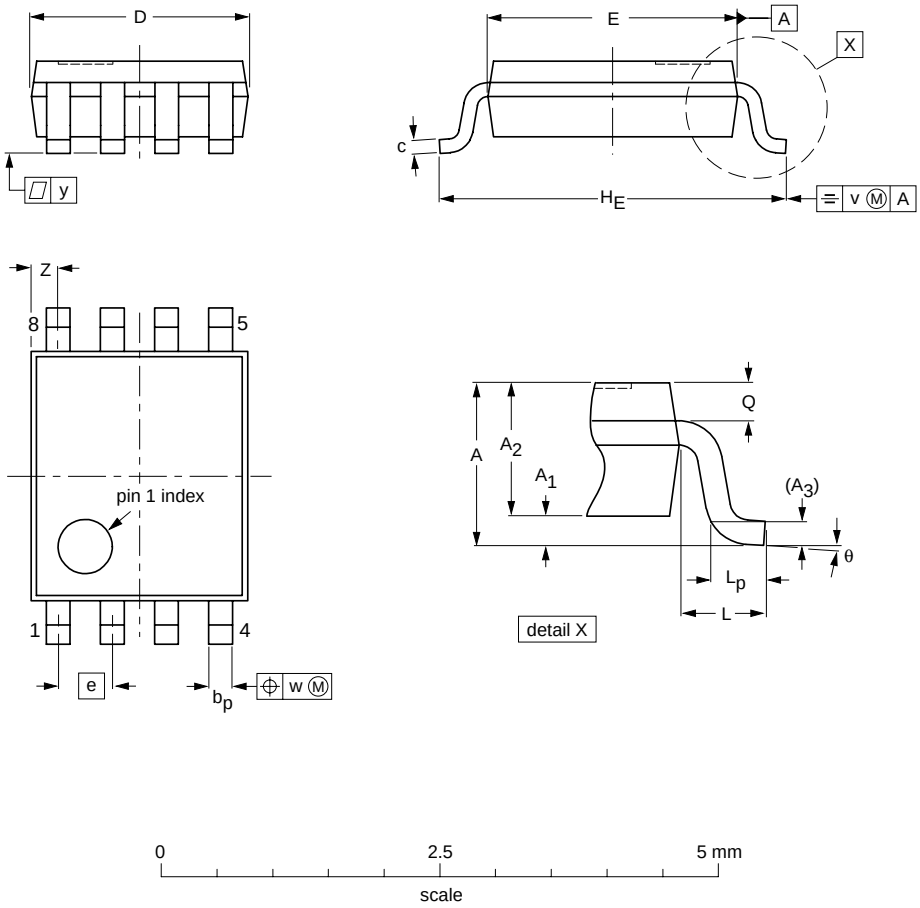
Note

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			
SOT505-2		- - -				02-01-16

Fig 9. Package outline SOT505-2 (TSSOP8)

VSSOP8: plastic very thin shrink small outline package; 8 leads; body width 2.3 mm **SOT765-1**



DIMENSIONS (mm are the original dimensions)

UNIT	A max.	A_1	A_2	A_3	b_p	c	$D^{(1)}$	$E^{(2)}$	e	H_E	L	L_p	Q	v	w	y	$Z^{(1)}$	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°

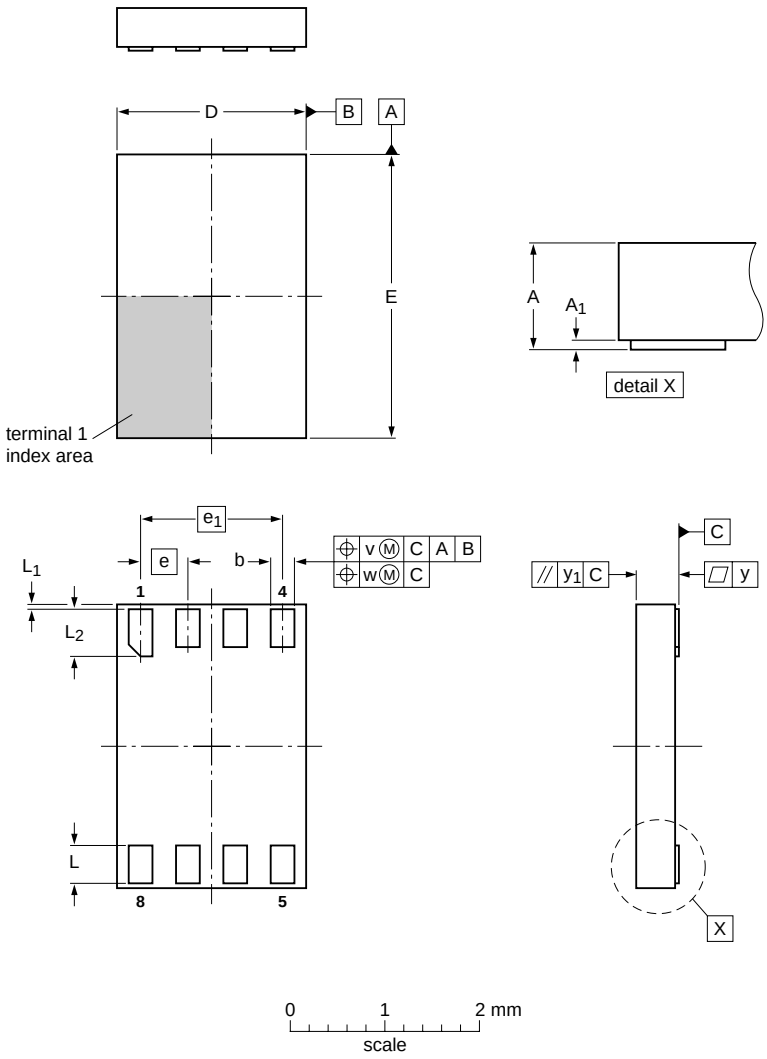
Notes

1. 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 VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT765-1		MO-187				02-06-07

Fig 10. Package outline SOT765-1 (VSSOP8)

XSON8U: plastic extremely thin small outline package; no leads; 8 terminals; UTLP based; body 3 x 2 x 0.5 mm **SOT996-2**



DIMENSIONS (mm are the original dimensions)

UNIT	A max	A_1	b	D	E	e	e_1	L	L_1	L_2	v	w	y	y_1
mm	0.5	0.05 0.00	0.35 0.15	2.1 1.9	3.1 2.9	0.5	1.5	0.5 0.3	0.15 0.05	0.6 0.4	0.1	0.05	0.05	0.1

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT996-2	- - -		- - -			~~07-12-18~~ 07-12-21

Fig 11. Package outline SOT996-2 (XSON8U)

14. Abbreviations

Table 11. Abbreviations

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

15. Revision history

Table 12. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74AHC_AHCT2G241_2	20090113	Product data sheet	-	74AHC_AHCT2G241_1
Modifications:	• The format of this data sheet has been redesigned to comply with the new identity guidelines of NXP Semiconductors. • Legal texts have been adapted to the new company name where appropriate. • Added type number 74AHC2G241GD and 74AHCT2G241GD (XSON8U package).			
74AHC_AHCT2G241_1	20040310	Product data	-	-

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.nxp.com.

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18. Contents

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