

# DATA SHEET

**74AC240/74ACT240**  
Octal buffer/line driver;  
inverting (3-State)

Product specification

1997 May 05

## Octal buffer/line driver; inverting (3-State)

74AC240  
74ACT240

## FEATURES

- 74ACT240 has TTL-compatible inputs
- 74AC240 has CMOS-compatible inputs
- 3-State outputs source/sink 24mA
- 3-State outputs drive bus lines or buffer memory address registers
- Meets or exceeds JEDEC standard for 74AC(T)XX family

## DESCRIPTION

The 74AC240/74ACT240 is an octal inverting buffer/line driver with 3-State outputs. The 3-State outputs are controlled by the output enable inputs  $1\overline{OE}$  and  $2\overline{OE}$ . A HIGH on  $n\overline{OE}$  causes the outputs 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.

The '240' is functionally identical to the '244', but the '240' has inverting outputs.

## QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYPICAL			UNIT
			AC		ACT	
			$V_{CC} = 3.3V$	$V_{CC} = 5.0V$	$V_{CC} = 5.0V$	
$t_{PHL}/t_{PLH}$	Propagation delay An to Bn; Bn to An	$C_L = 50pF$	4.5	3.2	4.1	ns
$C_I$	Input capacitance		4.5			pF
$C_{PD}$	Power dissipation capacitance	$V_I = GND$ to $V_{CC}^1$ outputs enabled outputs disabled	26 4		26 3	pF

## NOTE:

1.  $C_{PD}$  is used to determine the dynamic power dissipation ( $P_D$  in  $\mu W$ ):

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

$f_i$  = input frequency in MHz;  $C_L$  = output load capacity in pF;

$f_o$  = output frequency in MHz;  $V_{CC}$  = supply voltage in V;

$\sum (C_L \times V_{CC}^2 \times f_o)$  = sum of outputs.

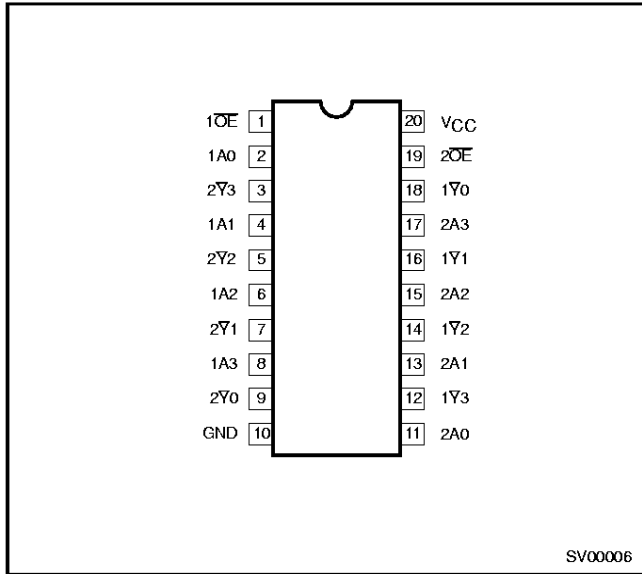
## ORDERING INFORMATION

PACKAGES	TEMPERATURE RANGE	OUTSIDE NORTH AMERICA	NORTH AMERICA	DRAWING NUMBER
20-Pin Plastic SOL	-40°C to +85°C	74AC240D 74ACT240D	74AC240D 74ACT240D	SOT163-1
20-Pin Plastic SSOP Type II	-40°C to +85°C	74AC240DB 74ACT240DB	74AC240DB 74ACT240DB	SOT339-1
20-Pin Plastic TSSOP Type I	-40°C to +85°C	74AC240PW 74ACT240PW	74AC240PW DH 74ACT240PW DH	SOT360-1

# Octal buffer/line driver; inverting (3-State)

74AC240  
74ACT240

## PIN CONFIGURATION

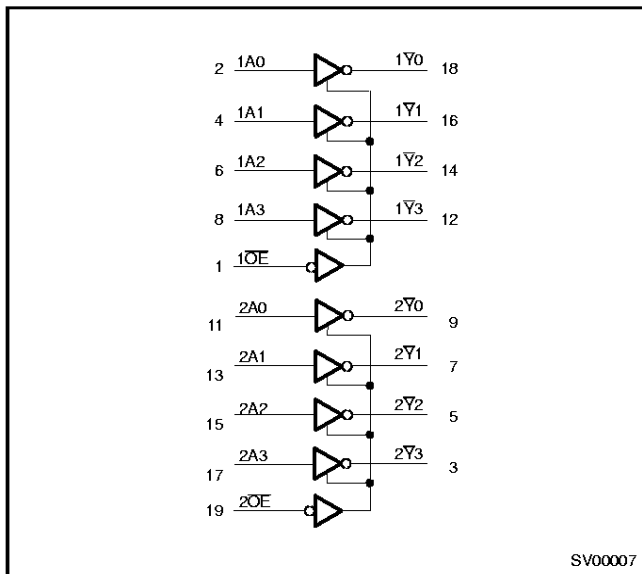


SV00006

## PIN DESCRIPTION

PIN NUMBER	SYMBOL	NAME AND FUNCTION
2, 4, 6, 8	1A0 – 1A3	Data inputs
11, 13, 15, 17	2A0 – 2A3	Data inputs
18, 16, 14, 12	1Y0 – 1Y3	Data outputs
9, 7, 5, 3	2Y0 – 2Y3	Data outputs
1, 19	1OE, 2OE	Output enables
10	GND	Ground (0V)
20	V <sub>CC</sub>	Positive supply voltage

## LOGIC SYMBOL



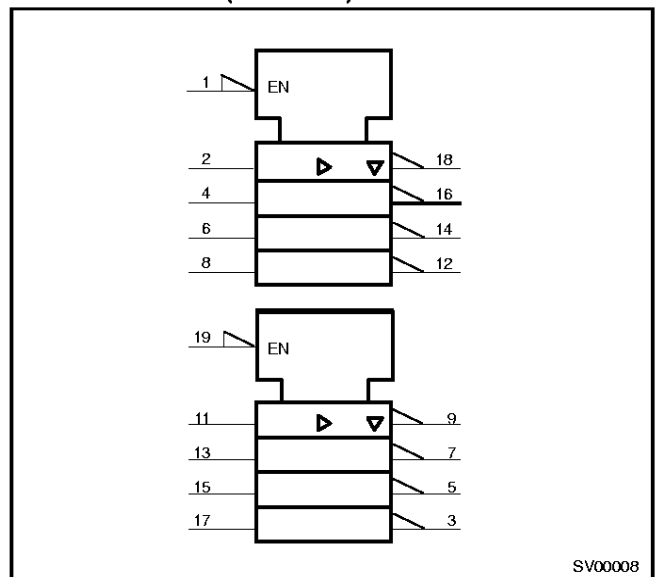
SV00007

## FUNCTION TABLE

INPUTS		OUTPUTS
nOE	nAx	nYx
L	L	H
L	H	L
H	X	Z

H = High voltage level  
L = Low voltage level  
X = Don't care  
Z = High impedance "Off" state

## LOGIC SYMBOL (IEEE/IEC)



SV00008

## Octal buffer/line driver; inverting (3-State)

74AC240  
74ACT240

## RECOMMENDED OPERATING CONDITIONS

SYMBOL	PARAMETER	LIMITS		UNIT
		MIN	MAX	
$V_{CC}$	DC supply voltage for 'AC	2.0	6.0	V
$V_{CC}$	DC supply voltage for 'ACT	4.5	5.5	V
$V_I$	DC input voltage range	0	$V_{CC}$	V
$V_O$	DC output voltage range	0	$V_{CC}$	V
$T_{amb}$	Operating free-air temperature range	-40	+85	°C
$\Delta V/\Delta t$	Minimum input edge rate — AC devices $V_{IN}$ from 30% to 70% of $V_{CC}$ $V_{CC}$ @ 3.3V, 4.5V, 5.5V	125		mV/ns
	— ACT devices $V_{IN}$ from 0.8V to 2.0V $V_{CC}$ @ 4.5V, 5.5V	125		

ABSOLUTE MAXIMUM RATINGS<sup>1</sup>

in accordance with the Absolute Maximum Rating System (IEC134)

Voltages are referenced to GND (ground = 0V)

SYMBOL	PARAMETER	CONDITIONS	RATING	UNIT
$V_{CC}$	DC supply voltage		-0.5 to +7.0	V
$I_{IK}$	DC input diode current	$V_I = -0.5V$	-20	mA
		$V_I = V_{CC} + 0.5V$	+20	
$V_I$	DC input voltage		-0.5 to $V_{CC} + 0.5$	V
$I_{OK}$	DC output diode current	$V_O = -0.5V$	-20	mA
		$V_O = V_{CC} + 0.5V$	+20	
$V_O$	DC output voltage		-0.5 to $V_{CC} + 0.5$	V
$I_O$	DC output source or sink current		± 50	mA
$I_{CC}, I_{GND}$	DC $V_{CC}$ or GND current per output		± 50	mA
$I_{CC}, I_{GND}$	DC $V_{CC}$ or GND current		± 200	mA
$T_{stg}$	Storage temperature range		-65 to 150	°C
$P_{TOT}$	Power dissipation per package — plastic mini-pack (SO) — plastic shrink mini-pack (SSOP and TSSOP)	above +70°C derate linearly with 8 mW/K	500	mW
		above +60°C derate linearly with 5.5 mW/K	500	

## NOTES:

- Stresses beyond those listed may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

## Octal buffer/line driver; inverting (3-State)

74AC240  
74ACT240**DC ELECTRICAL CHARACTERISTICS (74AC240)**

Over recommended operating conditions voltages are referenced to GND (ground = 0V)

SYMBOL	PARAMETER	TEST CONDITIONS	V <sub>CC</sub> (V)	LIMITS			UNIT
				Temp = -40°C to +85°C			
				MIN	TYP <sup>1</sup>	MAX	
V <sub>IH</sub>	HIGH level Input voltage	V <sub>OUT</sub> = 0.1V or (V <sub>CC</sub> - 0.1V)	3.0	2.1	1.5		V
			4.5	3.15	2.25		
			5.5	3.85	2.75		
V <sub>IL</sub>	LOW level Input voltage	V <sub>OUT</sub> = 0.1V or (V <sub>CC</sub> - 0.1V)	3.0		1.5	0.9	V
			4.5		2.25	1.35	
			5.5		2.75	1.65	
V <sub>OH</sub>	HIGH level output voltage	I <sub>OUT</sub> = -50 μA	3.0	2.9	2.99		V
			4.5	4.4	4.49		
			5.5	5.4	5.49		
		V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub> , I <sub>OH</sub> = -12mA <sup>1</sup>	3.0	2.46			V
		V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub> , I <sub>OH</sub> = -24mA <sup>1</sup>	4.5	3.76			
V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub> , I <sub>OH</sub> = -24mA <sup>1</sup>	5.5	4.76					
V <sub>OL</sub>	LOW level output voltage	I <sub>OUT</sub> = 50 μA	3.0		0.01	0.1	V
			4.5		0.01	0.1	
			5.5		0.01	0.1	
		V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub> , I <sub>OL</sub> = 12mA <sup>1</sup>	3.0			0.44	V
		V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub> , I <sub>OL</sub> = 24mA <sup>1</sup>	4.5			0.44	
		V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub> , I <sub>OL</sub> = 24mA <sup>1</sup>	5.5			0.44	
I <sub>IN</sub>	Input leakage current	V <sub>IN</sub> = V <sub>CC</sub> , GND	5.5			± 1.0	μA
I <sub>OZ</sub>	3-State output OFF-state current	V <sub>IN</sub> (OE) = V <sub>IL</sub> , V <sub>IH</sub> V <sub>IN</sub> = V <sub>CC</sub> , GND V <sub>OUT</sub> = V <sub>CC</sub> , GND	5.5			± 2.5	μA
I <sub>OLD</sub> <sup>2</sup>	Dynamic output current <sup>2</sup>	V <sub>OLD</sub> = 1.65V max	5.5	75			mA
I <sub>OHD</sub> <sup>2</sup>	Dynamic output current <sup>2</sup>	V <sub>OHD</sub> = 3.85V min	5.5			-75	mA
I <sub>CC</sub>	Quiescent supply current	V <sub>IN</sub> = V <sub>CC</sub> or GND	5.5			40	μA

**NOTES:**

- All outputs loaded
- Maximum test duration 2.0 ms; one output loaded at a time

## Octal buffer/line driver; inverting (3-State)

74AC240  
74ACT240**DC ELECTRICAL CHARACTERISTICS (74ACT240)**

Over recommended operating conditions voltages are referenced to GND (ground = 0V)

SYMBOL	PARAMETER	TEST CONDITIONS	V <sub>CC</sub> (V)	LIMITS			UNIT
				Temp = -40°C to +85°C			
				MIN	TYP <sup>1</sup>	MAX	
V <sub>IH</sub>	HIGH level Input voltage	V <sub>OUT</sub> = 0.1V or (V <sub>CC</sub> - 0.1V)	4.5	2.0	1.5	V	
			5.5	2.0	1.5		
V <sub>IL</sub>	LOW level Input voltage	V <sub>OUT</sub> = 0.1V or (V <sub>CC</sub> - 0.1V)	4.5		1.5	0.8	V
			5.5		1.5	0.8	
V <sub>OH</sub>	HIGH level output voltage	I <sub>OUT</sub> = -50 μA	4.5	4.4	4.49	V	
			5.5	5.4	5.49		
		V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub> , I <sub>OH</sub> = -24mA <sup>1</sup>	4.5	3.76	3.86	V	
			5.5	4.76	4.86		
V <sub>OL</sub>	LOW level output voltage	I <sub>OUT</sub> = 50 μA	4.5		0.01	0.1	V
			5.5		0.01	0.1	
		V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub> , I <sub>OL</sub> = 24mA <sup>1</sup>	4.5			0.44	V
			5.5			0.44	
I <sub>IN</sub>	Input leakage current	V <sub>IN</sub> = V <sub>CC</sub> , GND	5.5			± 1.0	μA
I <sub>OZ</sub>	3-State output OFF-state current	V <sub>IN</sub> (OE) = V <sub>IL</sub> , V <sub>IH</sub> V <sub>IN</sub> = V <sub>CC</sub> , GND V <sub>OUT</sub> = V <sub>CC</sub> , GND	5.5			± 2.5	μA
ΔI <sub>CC</sub>	Additional quiescent supply current per input pin	V <sub>IN</sub> = V <sub>CC</sub> - 2.1V Other inputs at V <sub>CC</sub> or GND; I <sub>OUT</sub> = 0	5.5			1.5	mA
I <sub>OLD</sub> <sup>2</sup>	Dynamic output current	V <sub>OLD</sub> = 1.65V max	5.5	75			mA
I <sub>OHD</sub> <sup>2</sup>	Dynamic output current	V <sub>OHD</sub> = 3.85V min	5.5			-75	mA
I <sub>CC</sub>	Quiescent supply current	V <sub>IN</sub> = V <sub>CC</sub> or GND	5.5			40	μA

**NOTES:**

1. All outputs loaded
2. Maximum test duration 2.0ms, one output loaded at a time

## Octal buffer/line driver; inverting (3-State)

74AC240  
74ACT240**AC CHARACTERISTICS FOR 74AC240**GND = 0V;  $t_r = t_f = 2.5\text{ns}$ ;  $C_L = 50\text{pF}$ ;  $R_L = 500\Omega$ ; .

SYMBOL	PARAMETER	$V_{CC}^1$ (V)	LIMITS					UNIT	WAVEFORM
			$T_{amb} = +25^\circ\text{C}$			$T_{amb} = -40^\circ\text{C to } +85^\circ\text{C}$			
			MIN	TYP	MAX	MIN	MAX		
$t_{PLH}$	Propagation delay data to output	3.3 5.0	2.0 1.5	4.5 3.2	7.5 5	1.5 1.0	8.5 6	ns	1, 3
$t_{PHL}$	Propagation delay data to output	3.3 5.0	2.0 1.5	4.4 3.2	7.5 5	1.5 1.0	8.5 6	ns	1, 3
$t_{pZH}$	3-State output enable time	3.3 5.0	2.0 1.5	4.6 3.3	9.5 6.5	1.5 1.0	11 7.5	ns	2, 3
$t_{pZL}$	3-State output enable time	3.3 5.0	2.0 1.5	5.8 4.1	9.5 6.5	1.5 1.0	11 7.5	ns	2, 3
$t_{pHZ}$	3-State output disable time	3.3 5.0	2.0 1.5	5 3.3	9.5 6.5	1.5 1.0	10.5 7.5	ns	2, 3
$t_{pLZ}$	3-State output disable time	3.3 5.0	2.0 1.5	4.4 3	9.5 6.5	1.5 1.0	10.5 7.5	ns	2, 3

**NOTE:**

1. Voltage range 3.3V is  $V_{CC} = 3.3\text{V} \pm 0.3\text{V}$   
Voltage range 5.0V is  $V_{CC} = 5.0\text{V} \pm 0.5\text{V}$

**AC CHARACTERISTICS FOR 74ACT240**GND = 0V;  $t_r = t_f = 2.5\text{ns}$ ;  $C_L = 50\text{pF}$ ;  $R_L = 500\Omega$ ; .

SYMBOL	PARAMETER	$V_{CC}^1$ (V)	LIMITS					UNIT	WAVEFORM
			$T_{amb} = +25^\circ\text{C}$			$T_{amb} = -40^\circ\text{C to } +85^\circ\text{C}$			
			MIN	TYP	MAX	MIN	MAX		
$t_{PLH}$	Propagation delay data to output	5.0	2.0	4.1	7.5	1.5	8.5	ns	1, 3
$t_{PHL}$	Propagation delay data to output	5.0	2.0	4.1	7.5	1.5	8.5	ns	1, 3
$t_{pZH}$	3-State output enable time	5.0	2.0	4.2	8.5	1.5	9.5	ns	2, 3
$t_{pZL}$	3-State output enable time	5.0	2.0	5	8.5	1.5	9.5	ns	2, 3
$t_{pHZ}$	3-State output disable time	5.0	2.0	4.4	8	1.5	9	ns	2, 3
$t_{pLZ}$	3-State output disable time	5.0	2.5	4	8	1.5	9	ns	2, 3

**NOTE:**

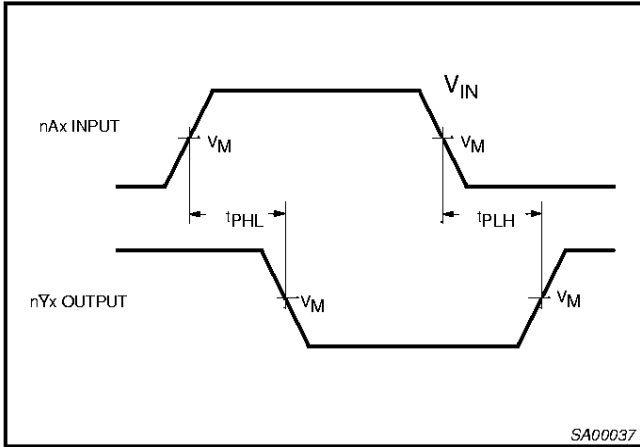
1. These values are at  $V_{CC} = 5.0\text{V} \pm 0.5\text{V}$

# Octal buffer/line driver; inverting (3-State)

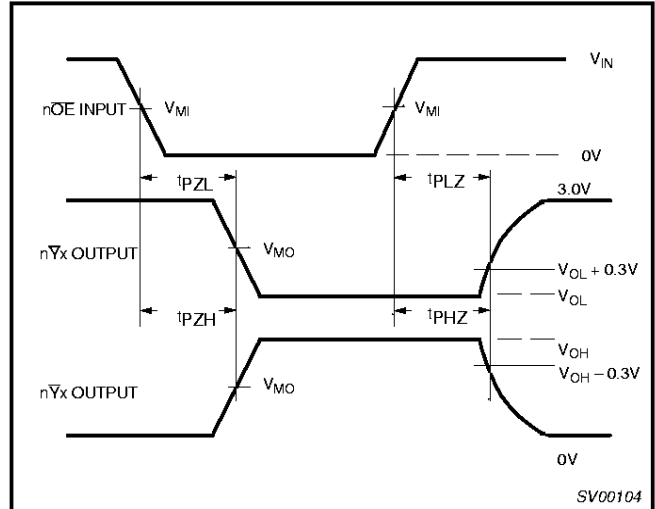
74AC240  
74ACT240

## AC WAVEFORMS

$V_{MI} = 50\% V_{CC}$  for 'AC' devices; 1.5V for 'ACT' devices  
 $V_M = 50\% V_{CC}$  for 'AC'/'ACT' devices



Waveform 1. Input (nAx) to Output (nYx) Propagation Delays



Waveform 2. 3-State Output Enable and Disable Times

## TEST CIRCUIT

Test Circuit for 3-State Outputs

SWITCH POSITION		FAMILY	$V_{IN}$ Input Requirements	$V_m$ Input	$V_m$ Output
TEST	SWITCH				
$t_{PLH}/t_{PHL}$	Open	AC	GND to $V_{CC}$	50% $V_{CC}$	50% $V_{CC}$
$t_{PLZ}/t_{PZL}$	$2 \times V_{CC}$				
$t_{PHZ}/t_{PZH}$	Open	ACT	GND to 3.0V	1.5V	50% $V_{CC}$

**DEFINITIONS**

$R_L$  = Load resistor; see AC CHARACTERISTICS for value.  
 $C_L$  = Load capacitance, see AC characteristics  
 $R_T$  = Termination resistance should be equal to  $Z_{OUT}$  of pulse generators.

Waveform 3. Load circuitry for switching times.

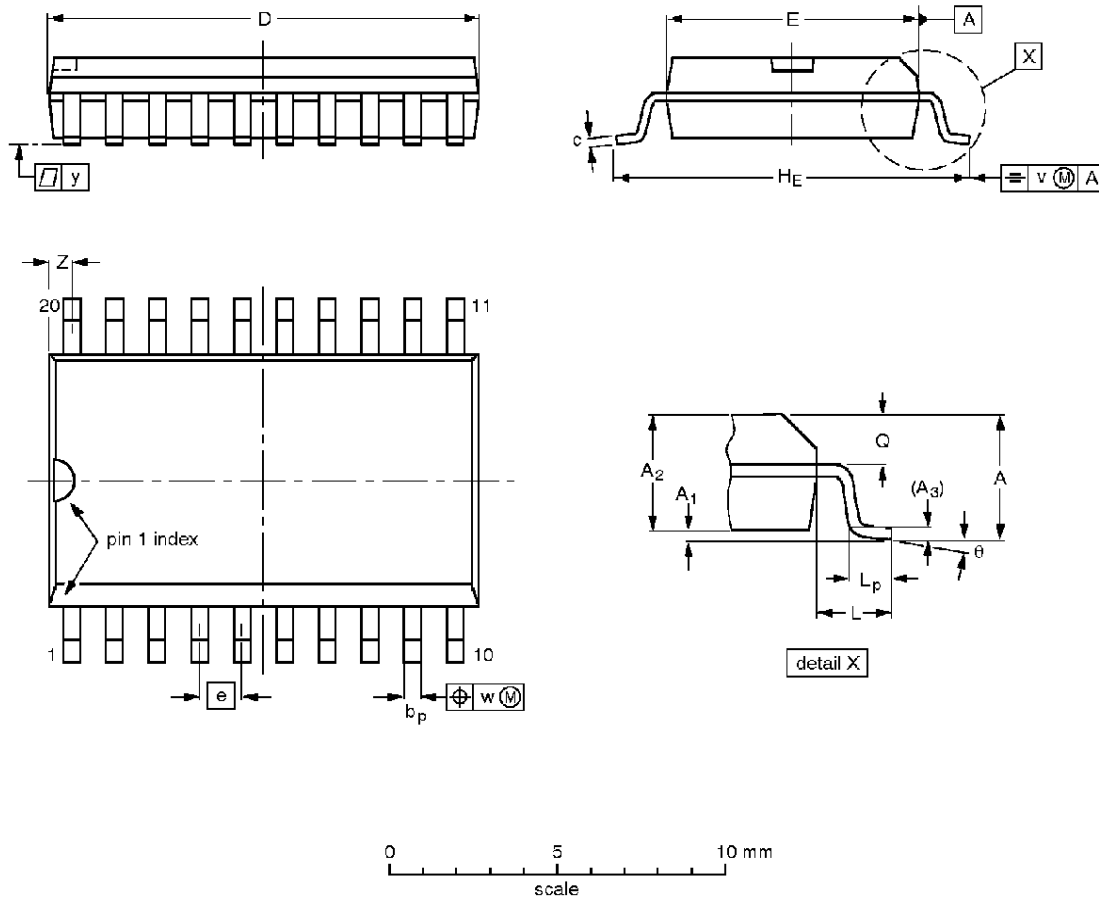


# Octal buffer/line driver; inverting (3-State)

74AC240  
74ACT240

SO20: plastic small outline package; 20 leads; body width 7.5 mm

SOT163-1



**DIMENSIONS (inch dimensions are derived from the original mm dimensions)**

UNIT	A max.	A <sub>1</sub>	A <sub>2</sub>	A <sub>3</sub>	b <sub>p</sub>	c	D <sup>(1)</sup>	E <sup>(1)</sup>	e	H <sub>E</sub>	L	L <sub>p</sub>	Q	v	w	y	Z <sup>(1)</sup>	θ
mm	2.65	0.30 0.10	2.45 2.25	0.25	0.49 0.36	0.32 0.23	13.0 12.6	7.6 7.4	1.27	10.85 10.00	1.4	1.1 0.4	1.1 1.0	0.25	0.25	0.1	0.9 0.4	8° 0°
inches	0.10	0.012 0.004	0.096 0.089	0.01	0.019 0.014	0.013 0.009	0.51 0.49	0.30 0.29	0.050	0.42 0.39	0.055	0.043 0.016	0.043 0.039	0.01	0.01	0.004	0.035 0.016	

**Note**

1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.

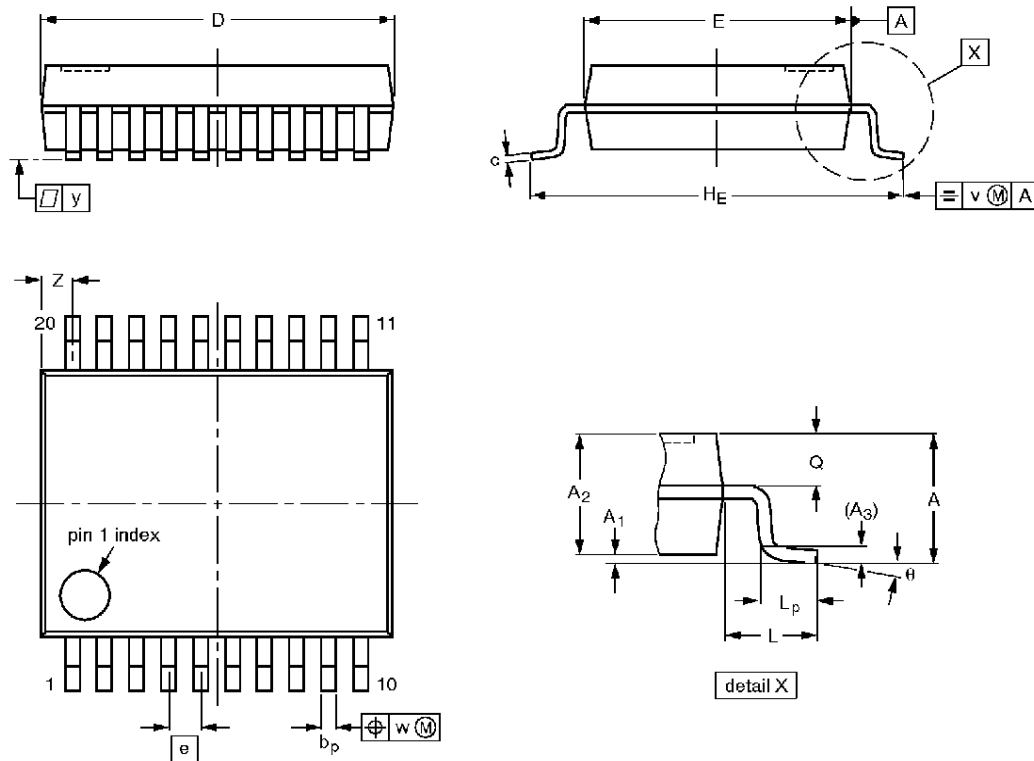
OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT163-1	075E04	MS-013AC				92-11-17 95-01-24

Octal buffer/line driver; inverting (3-State)

74AC240  
74ACT240

SSOP20: plastic shrink small outline package; 20 leads; body width 5.3 mm

SOT339-1



**DIMENSIONS** (mm are the original dimensions)

UNIT	A max.	A <sub>1</sub>	A <sub>2</sub>	A <sub>3</sub>	b <sub>p</sub>	c	D <sup>(1)</sup>	E <sup>(1)</sup>	e	H <sub>E</sub>	L	L <sub>p</sub>	Q	v	w	y	Z <sup>(1)</sup>	θ
mm	2.0	0.21 0.05	1.80 1.65	0.25	0.38 0.25	0.20 0.09	7.4 7.0	5.4 5.2	0.65	7.9 7.6	1.25	1.03 0.63	0.9 0.7	0.2	0.13	0.1	0.9 0.5	8° 0°

**Note**

1. Plastic or metal protrusions of 0.20 mm maximum per side are not included.

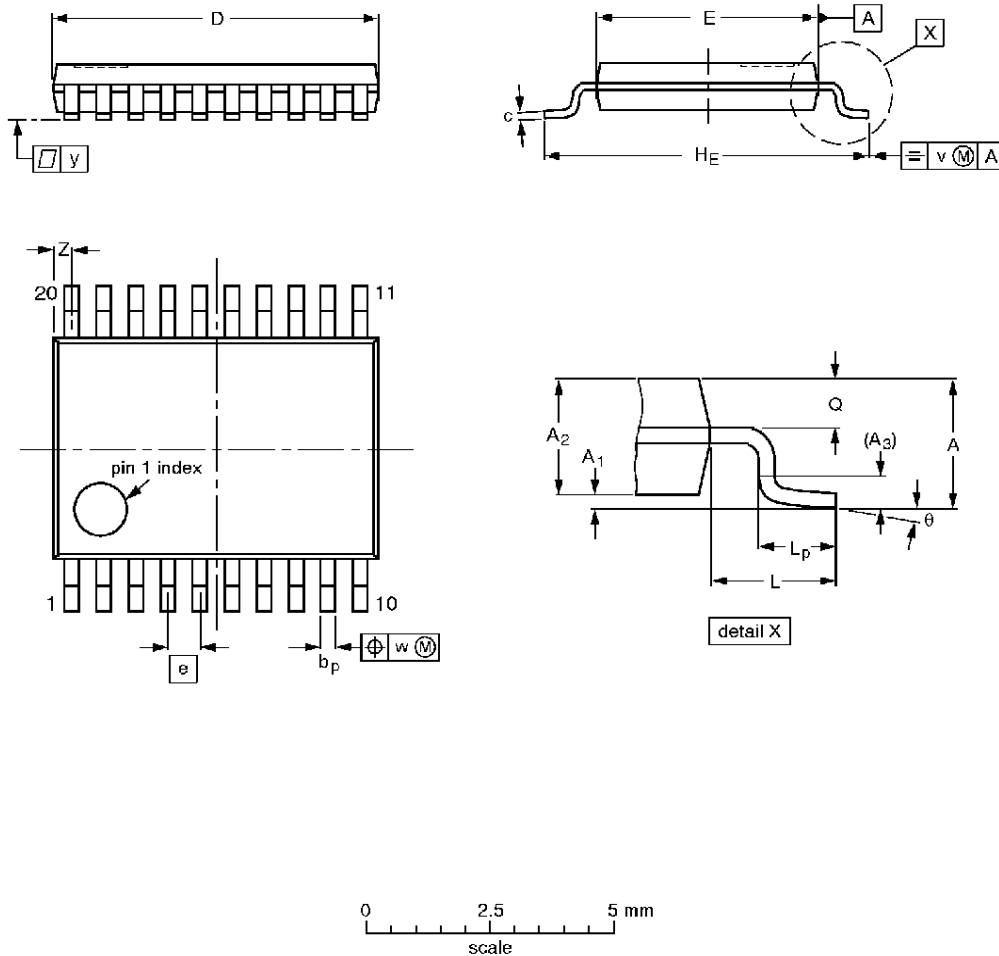
OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT339-1		MO-150AE				93-09-08 95-02-04

Octal buffer/line driver; inverting (3-State)

74AC240  
74ACT240

TSSOP20: plastic thin shrink small outline package; 20 leads; body width 4.4 mm

SOT360-1



**DIMENSIONS (mm are the original dimensions)**

UNIT	A max.	A <sub>1</sub>	A <sub>2</sub>	A <sub>3</sub>	b <sub>p</sub>	c	D <sup>(1)</sup>	E <sup>(2)</sup>	e	H <sub>E</sub>	L	L <sub>p</sub>	Q	v	w	y	z <sup>(1)</sup>	θ
mm	1.10	0.15 0.05	0.95 0.80	0.25	0.30 0.19	0.2 0.1	6.6 6.4	4.5 4.3	0.65	6.6 6.2	1.0	0.75 0.50	0.4 0.3	0.2	0.13	0.1	0.5 0.2	8° 0°

**Notes**

1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.
2. Plastic interlead protrusions of 0.25 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT360-1		MO-153AC				93-06-16 95-02-04

## Octal buffer/line driver; inverting (3-State)

74AC240  
74ACT240

## DEFINITIONS

Data Sheet Identification	Product Status	Definition
<i>Objective Specification</i>	Formative or in Design	This data sheet contains the design target or goal specifications for product development. Specifications may change in any manner without notice.
<i>Preliminary Specification</i>	Preproduction Product	This data sheet contains preliminary data, and supplementary data will be published at a later date. Philips Semiconductors reserves the right to make changes at any time without notice in order to improve design and supply the best possible product.
<i>Product Specification</i>	Full Production	This data sheet contains Final Specifications. Philips Semiconductors reserves the right to make changes at any time without notice, in order to improve design and supply the best possible product.

Philips Semiconductors and Philips Electronics North America Corporation reserve the right to make changes, without notice, in the products, including circuits, standard cells, and/or software, described or contained herein in order to improve design and/or performance. Philips Semiconductors assumes no responsibility or liability for the use of any of these products, conveys no license or title under any patent, copyright, or mask work right to these products, and makes no representations or warranties that these products are free from patent, copyright, or mask work right infringement, unless otherwise specified. Applications that are described herein for any of these products are for illustrative purposes only. Philips Semiconductors makes no representation or warranty that such applications will be suitable for the specified use without further testing or modification.

## LIFE SUPPORT APPLICATIONS

Philips Semiconductors and Philips Electronics North America Corporation Products are not designed for use in life support appliances, devices, or systems where malfunction of a Philips Semiconductors and Philips Electronics North America Corporation Product can reasonably be expected to result in a personal injury. Philips Semiconductors and Philips Electronics North America Corporation customers using or selling Philips Semiconductors and Philips Electronics North America Corporation Products for use in such applications do so at their own risk and agree to fully indemnify Philips Semiconductors and Philips Electronics North America Corporation for any damages resulting from such improper use or sale.

**Philips Semiconductors**  
**811 East Arques Avenue**  
**P.O. Box 3409**  
**Sunnyvale, California 94088-3409**  
**Telephone 800-234-7381**

Philips Semiconductors and Philips Electronics North America Corporation  
register eligible circuits under the Semiconductor Chip Protection Act.  
© Copyright Philips Electronics North America Corporation 1997  
All rights reserved. Printed in U.S.A.