

SN54AHC240, SN74AHC240 OCTAL BUFFERS/DRIVERS WITH 3-STATE OUTPUTS

SCLS251C – OCTOBER 1995 – REVISED JUNE 1997

- Operating Range 2-V to 5.5-V V_{CC}
- **EPIC™** (Enhanced-Performance Implanted CMOS) Process
- High Latch-Up Immunity Exceeds 250 mA Per JESD 17
- Package Options Include Plastic Small-Outline (DW), Shrink Small-Outline (DB), Thin Shrink Small-Outline (PW), and Ceramic Flat (W) Packages, Ceramic Chip Carriers (FK), and Standard Plastic (N) and Ceramic (J) 300-mil DIPs

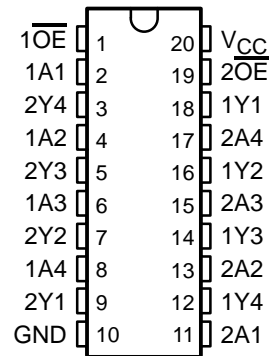
description

These octal buffers/drivers are designed specifically to improve the performance and density of 3-state memory-address drivers, clock drivers, and bus-oriented receivers and transmitters.

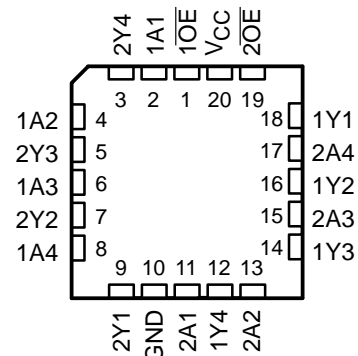
The 'AHC240 are organized as two 4-bit buffers/line drivers with separate output-enable (\overline{OE}) inputs. When \overline{OE} is low, the device passes data from the A inputs to the Y outputs. When \overline{OE} is high, the outputs are in the high-impedance state.

The SN54AHC240 is characterized for operation over the full military temperature range of -55°C to 125°C . The SN74AHC240 is characterized for operation from -40°C to 85°C .

SN54AHC240 ... J OR W PACKAGE
SN74AHC240 ... DB, DW, N, OR PW PACKAGE
(TOP VIEW)



SN54AHC240 ... FK PACKAGE
(TOP VIEW)



FUNCTION TABLE
(each buffer)

INPUTS		OUTPUT
\overline{OE}	A	Y
L	H	L
L	L	H
H	X	Z



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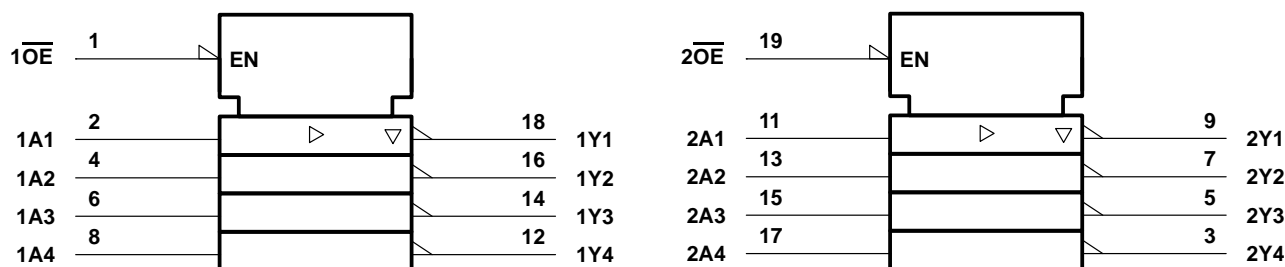
PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.



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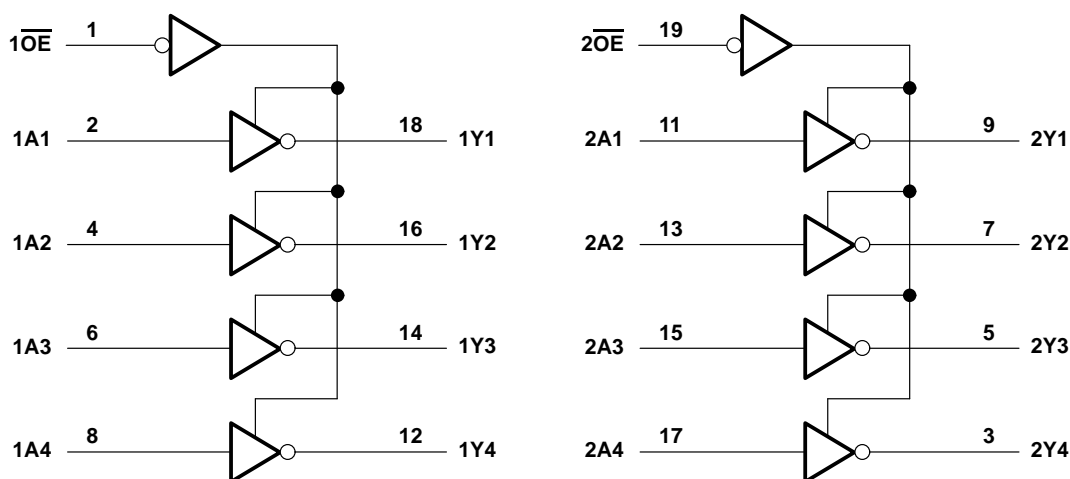
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logic symbol†



† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

logic diagram (positive logic)



absolute maximum ratings over operating free-air temperature range (unless otherwise noted)‡

Supply voltage range, V_{CC}	–0.5 V to 7 V
Input voltage range, V_I (see Note 1)	–0.5 V to 7 V
Output voltage range, V_O (see Note 1)	–0.5 V to $V_{CC} + 0.5$ V
Input clamp current, I_{IK} ($V_I < 0$)	–20 mA
Output clamp current, I_{OK} ($V_O < 0$ or $V_O > V_{CC}$)	±20 mA
Continuous output current, I_O ($V_O = 0$ to V_{CC})	±25 mA
Continuous current through V_{CC} or GND	±75 mA
Package thermal impedance, θ_{JA} (see Note 2):	
DB package	115°C/W
DW package	97°C/W
N package	67°C/W
PW package	128°C/W

Storage temperature range, T_{stg} –65°C to 150°C

‡ Stresses beyond those listed under “absolute maximum ratings” 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.

NOTES: 1. The input and output voltage ratings may be exceeded if the input and output current ratings are observed.
 2. The package thermal impedance is calculated in accordance with JEDEC 51, except for through-hole packages, which use a trace length of zero.

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recommended operating conditions (see Note 3)

			SN54AHC240		SN74AHC240		UNIT
			MIN	MAX	MIN	MAX	
V _{CC}	Supply voltage		2	5.5	2	5.5	V
V _{IH}	High-level input voltage	V _{CC} = 2 V	1.5		1.5		V
		V _{CC} = 3 V	2.1		2.1		
		V _{CC} = 5.5 V	3.85		3.85		
V _{IL}	Low-level input voltage	V _{CC} = 2 V		0.5		0.5	V
		V _{CC} = 3 V		0.9		0.9	
		V _{CC} = 5.5 V		1.65		1.65	
V _I	Input voltage		0	5.5	0	5.5	V
V _O	Output voltage		0	V _{CC}	0	V _{CC}	V
I _{OH}	High-level output current	V _{CC} = 2 V		–50		–50	μA
		V _{CC} = 3.3 V ± 0.3 V		–4		–4	mA
		V _{CC} = 5 V ± 0.5 V		–8		–8	
I _{OL}	Low-level output current	V _{CC} = 2 V		50		50	μA
		V _{CC} = 3.3 V ± 0.3 V		4		4	mA
		V _{CC} = 5 V ± 0.5 V		8		8	
Δt/Δv	Input transition rise or fall rate	V _{CC} = 3.3 V ± 0.3 V		100		100	ns/V
		V _{CC} = 5 V ± 0.5 V		20		20	
T _A	Operating free-air temperature		–55	125	–40	85	°C

NOTE 3: Unused inputs must be held high or low to prevent them from floating.

electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

PARAMETER		TEST CONDITIONS	V _{CC}	T _A = 25°C			SN54AHC240		SN74AHC240		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
V _{OH}		I _{OH} = –50 μA	2 V	1.9	2		1.9		1.9		V
			3 V	2.9	3		2.9		2.9		
			4.5 V	4.4	4.5		4.4		4.4		
		I _{OH} = –4 mA	3 V	2.58			2.48		2.48		
			4.5 V	3.94			3.8		3.8		
V _{OL}		I _{OL} = 50 μA	2 V			0.1		0.1		0.1	V
			3 V			0.1		0.1		0.1	
			4.5 V			0.1		0.1		0.1	
		I _{OL} = 4 mA	3 V			0.36		0.5		0.44	
			4.5 V			0.36		0.5		0.44	
I _I	Data inputs	V _I = V _{CC} or GND	5.5 V			±0.1		±1		±1	μA
	Control inputs					±0.1		±1		±1	
I _{OZ} [†]		V _O = V _{CC} or GND, V _I (OE) = V _{IL} or V _{IH}	5.5 V			±0.25		±2.5		±2.5	μA
I _{CC}		V _I = V _{CC} or GND, I _O = 0	5.5 V			4		40		40	μA
C _i		V _I = V _{CC} or GND	5 V		2.5	10				10	pF
C _o		V _O = V _{CC} or GND	5 V		3.5						pF

[†] The parameter I_{OZ} includes the input leakage current.



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switching characteristics over recommended operating free-air temperature range,
 $V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$ (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	LOAD CAPACITANCE	SN54AHC240				UNIT
				$T_A = 25^\circ\text{C}$			MIN	MAX
				MIN	TYP	MAX		
t_{PLH}^*	A	Y	$C_L = 15\text{ pF}$	5.3	7.5	1	9	ns
t_{PHL}^*				5.3	7.5	1	9	
t_{PZH}^*	\overline{OE}	Y	$C_L = 15\text{ pF}$	6.6	10.6	1	12.5	ns
t_{PZL}^*				6.6	10.6	1	12.5	
t_{PHZ}^*	\overline{OE}	Y	$C_L = 15\text{ pF}$	7.8	11.5	1	12.5	ns
t_{PLZ}^*				7.8	11.5	1	12.5	
t_{PLH}	A	Y	$C_L = 50\text{ pF}$	7.8	11	1	12.5	ns
t_{PHL}				7.8	11	1	12.5	
t_{PZH}	\overline{OE}	Y	$C_L = 50\text{ pF}$	9.1	14.1	1	16	ns
t_{PZL}				9.1	14.1	1	16	
t_{PHZ}	\overline{OE}	Y	$C_L = 50\text{ pF}$	10.3	14	1	16	ns
t_{PLZ}				10.3	14	1	16	

* On products compliant to MIL-PRF-38535, this parameter is ensured but not production tested.

switching characteristics over recommended operating free-air temperature range,
 $V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$ (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	LOAD CAPACITANCE	SN74AHC240				UNIT
				$T_A = 25^\circ\text{C}$			MIN	MAX
				MIN	TYP	MAX		
t_{PLH}	A	Y	$C_L = 15\text{ pF}$	5.3	7.5	1	9	ns
t_{PHL}				5.3	7.5	1	9	
t_{PZH}	\overline{OE}	Y	$C_L = 15\text{ pF}$	6.6	10.6	1	12.5	ns
t_{PZL}				6.6	10.6	1	12.5	
t_{PHZ}	\overline{OE}	Y	$C_L = 15\text{ pF}$	7.8	11.5	1	12.5	ns
t_{PLZ}				7.8	11.5	1	12.5	
t_{PLH}	A	Y	$C_L = 50\text{ pF}$	7.8	11	1	12.5	ns
t_{PHL}				7.8	11	1	12.5	
t_{PZH}	\overline{OE}	Y	$C_L = 50\text{ pF}$	9.1	14.1	1	16	ns
t_{PZL}				9.1	14.1	1	16	
t_{PHZ}	\overline{OE}	Y	$C_L = 50\text{ pF}$	10.3	14	1	16	ns
t_{PLZ}				10.3	14	1	16	

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switching characteristics over recommended operating free-air temperature range,
 $V_{CC} = 5\text{ V} \pm 0.5\text{ V}$ (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	LOAD CAPACITANCE	SN54AHC240				UNIT	
				T _A = 25°C			MIN		MAX
				MIN	TYP	MAX			
t _{PLH} [*]	A	Y	C _L = 15 pF	3.6	5.5	1	6.5	ns	
t _{PHL} [*]				3.6	5.5	1	6.5		
t _{PZH} [*]	\overline{OE}	Y	C _L = 15 pF	4.7	7.3	1	8.5	ns	
t _{PZL} [*]				4.7	7.3	1	8.5		
t _{PHZ} [*]	\overline{OE}	Y	C _L = 15 pF	5.2	7.2	1	8.5	ns	
t _{PLZ} [*]				5.2	7.2	1	8.5		
t _{PLH}	A	Y	C _L = 50 pF	5.1	7.5	1	8.5	ns	
t _{PHL}				5.1	7.5	1	8.5		
t _{PZH}	\overline{OE}	Y	C _L = 50 pF	6.2	9.3	1	10.5	ns	
t _{PZL}				6.2	9.3	1	10.5		
t _{PHZ}	\overline{OE}	Y	C _L = 50 pF	6.7	9.2	1	10.5	ns	
t _{PLZ}				6.7	9.2	1	10.5		

* On products compliant to MIL-PRF-38535, this parameter is ensured but not production tested.

switching characteristics over recommended operating free-air temperature range,
 $V_{CC} = 5\text{ V} \pm 0.5\text{ V}$ (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	LOAD CAPACITANCE	SN74AHC240				UNIT	
				T _A = 25°C			MIN		MAX
				MIN	TYP	MAX			
t _{PLH}	A	Y	C _L = 15 pF	3.6	5.5	1	6.5	ns	
t _{PHL}				3.6	5.5	1	6.5		
t _{PZH}	$\overline{\text{OE}}$	Y	C _L = 15 pF	4.7	7.3	1	8.5	ns	
t _{PZL}				4.7	7.3	1	8.5		
t _{PHZ}	$\overline{\text{OE}}$	Y	C _L = 15 pF	5.2	7.2	1	8.5	ns	
t _{PLZ}				5.2	7.2	1	8.5		
t _{PLH}	A	Y	C _L = 50 pF	5.1	7.5	1	8.5	ns	
t _{PHL}				5.1	7.5	1	8.5		
t _{PZH}	$\overline{\text{OE}}$	Y	C _L = 50 pF	6.2	9.3	1	10.5	ns	
t _{PZL}				6.2	9.3	1	10.5		
t _{PHZ}	$\overline{\text{OE}}$	Y	C _L = 50 pF	6.7	9.2	1	10.5	ns	
t _{PLZ}				6.7	9.2	1	10.5		

output-skew characteristics, $C_L = 50\text{ pF}$ (see Note 4)

PARAMETER	V _{CC}	SN74AHC240				UNIT
		T _A = 25°C		MIN	MAX	
		MIN	MAX			
t _{sk(o)} Output skew	3.3 V ± 0.3 V	1.5		1.5		ns
	5 V ± 0.5 V	1		1		

NOTE 4: Characteristics are determined during product characterization and ensured by design.



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noise characteristics, $V_{CC} = 5\text{ V}$, $C_L = 50\text{ pF}$, $T_A = 25^\circ\text{C}$ (see Note 5)

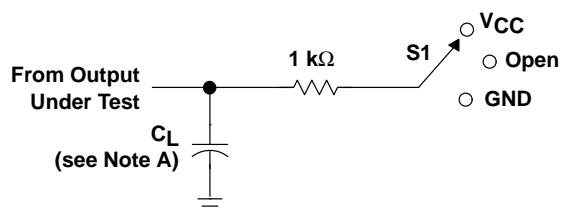
PARAMETER	SN74AHC240			UNIT
	MIN	TYP	MAX	
$V_{OL(P)}$ Quiet output, maximum dynamic V_{OL}		0.6		V
$V_{OL(V)}$ Quiet output, minimum dynamic V_{OL}		-0.6		V
$V_{OH(V)}$ Quiet output, minimum dynamic V_{OH}		4.6		V
$V_{IH(D)}$ High-level dynamic input voltage	3.5			V
$V_{IL(D)}$ Low-level dynamic input voltage			1.5	V

NOTE 5: Characteristics are determined during product characterization and ensured by design for surface-mount packages only.

operating characteristics, $V_{CC} = 5\text{ V}$, $T_A = 25^\circ\text{C}$

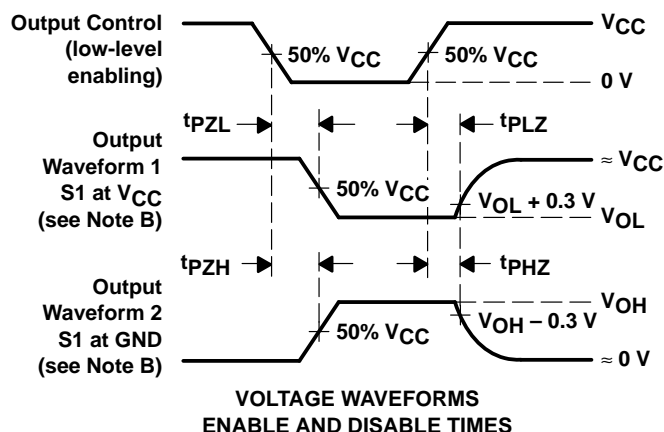
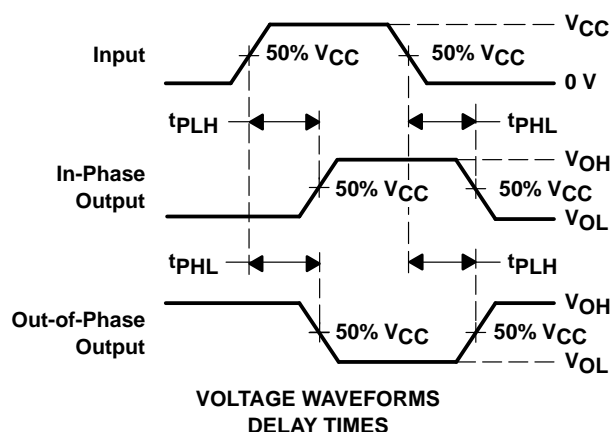
PARAMETER	TEST CONDITIONS	TYP	UNIT
C_{pd} Power dissipation capacitance	No load, $f = 1\text{ MHz}$	10	pF

PARAMETER MEASUREMENT INFORMATION



LOAD CIRCUIT

TEST	S1
t_{PLH}/t_{PHL}	Open
t_{PLZ}/t_{PZL}	V_{CC}
t_{PHZ}/t_{PZH}	GND



NOTES: A. C_L includes probe and jig capacitance.

B. Waveform 1 is for an output with internal conditions such that the output is low except when disabled by the output control.

Waveform 2 is for an output with internal conditions such that the output is high except when disabled by the output control.

C. All input pulses are supplied by generators having the following characteristics: $PRR \leq 1\text{ MHz}$, $Z_O = 50\text{ }\Omega$, $t_r = 3\text{ ns}$, $t_f = 3\text{ ns}$.

D. The outputs are measured one at a time with one input transition per measurement.

Figure 1. Load Circuit and Voltage Waveforms

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