- **3-State Outputs Drive Bus Lines or Buffer Memory Address Registers**
- **pnp Inputs Reduce dc Loading**
- **Package Options Include Plastic Small-Outline (DW) Packages, Ceramic Chip Carriers (FK), and Standard Plastic (N) and Ceramic (J) 300-mil DIPs**
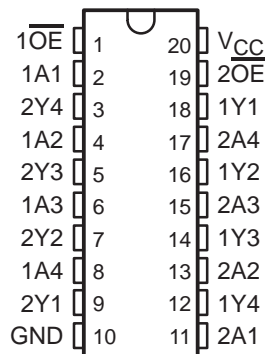
description

These octal buffers/drivers are designed specifically to improve both the performance and density of 3-state memory address drivers, clock drivers, and bus-oriented receivers and transmitters. When these devices are used with the ′ALS241, ′AS241A, ′ALS244, and ′AS244A, the circuit designer has a choice of selected combinations of inverting and noninverting outputs, symmetrical active-low output-enable ($\overline{OE}$) inputs, and complementary OE and $\overline{OE}$ inputs. These devices feature high fan-out and improved fan-in.
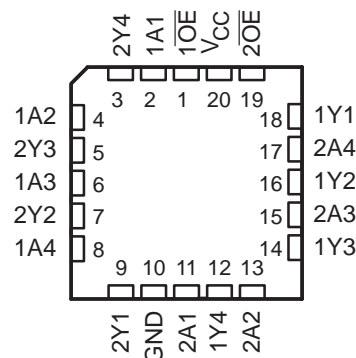
The -1 version of SN74ALS240A is identical to the standard version, except that the recommended maximum I_{OL} for the -1 version is 48 mA. There is no -1 version of the SN54ALS240A.

The SN54ALS240A and SN54AS240A are characterized for operation over the full military temperature range of −55°C to 125°C. The SN74ALS240A and SN74AS240A are characterized for operation from 0°C to 70°C.

SN54ALS240A, SN54AS240A . . . J PACKAGE
SN74ALS240A, SN74AS240A . . . DW OR N PACKAGE
(TOP VIEW)

1$\overline{OE}$	1		20	V$_{CC}$
1A1	2		19	2$\overline{OE}$
2Y4	3		18	1Y1
1A2	4		17	2A4
2Y3	5		16	1Y2
1A3	6		15	2A3
2Y2	7		14	1Y3
1A4	8		13	2A2
2Y1	9		12	1Y4
GND	10		11	2A1

SN54ALS240A, SN54AS240A . . . FK PACKAGE
(TOP VIEW)

Top pins: 2Y4 (3), 1A1 (2), 1$\overline{OE}$ (1), V$_{CC}$ (20), 2$\overline{OE}$ (19)

1A2	4	18 1Y1
2Y3	5	17 2A4
1A3	6	16 1Y2
2Y2	7	15 2A3
1A4	8	14 1Y3

Bottom pins: 2Y1 (9), GND (10), 2A1 (11), 1Y4 (12), 2A2 (13)

FUNCTION TABLE
(each buffer)

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

TEXAS INSTRUMENTS

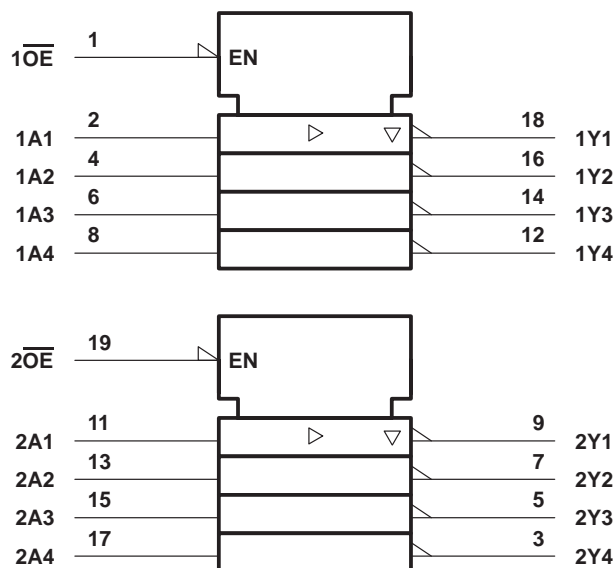POST OFFICE BOX 655303 ● DALLAS, TEXAS 75265

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SN54ALS240A, SN54AS240A, SN74ALS240A, SN74AS240A
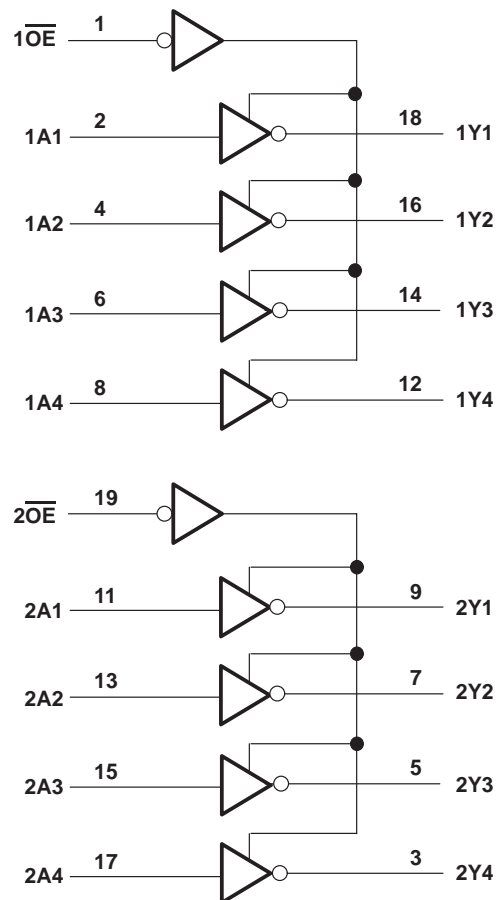# OCTAL BUFFERS/DRIVERS
WITH 3-STATE OUTPUTS

SDAS214C – DECEMBER 1982 – REVISED AUGUST 1995

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, V_{CC} . . . . 7 V
Input voltage, V_I . . . . 7 V
Voltage applied to a disabled 3-state output . . . . 5.5 V
Operating free-air temperature range, T_A: SN54ALS240A . . . . −55°C to 125°C
                                              SN74ALS240A . . . . 0°C to 70°C
Storage temperature range . . . . −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.

recommended operating conditions

			SN54ALS240A			SN74ALS240A			UNIT
			MIN	NOM	MAX	MIN	NOM	MAX	
V_{CC}	Supply voltage		4.5	5	5.5	4.5	5	5.5	V
V_{IH}	High-level input voltage		2			2			V
V_{IL}	Low-level input voltage				0.7			0.8	V
I_{OH}	High-level output current				−12			−15	mA
I_{OL}	Low-level output current				12			24	mA
								48†	
T_A	Operating free-air temperature		−55		125	0		70	°C

† Applies only to the -1 version and only if V_{CC} is between 4.75 V and 5.25 V

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

PARAMETER	TEST CONDITIONS		SN54ALS240A			SN74ALS240A			UNIT
			MIN	TYP‡	MAX	MIN	TYP‡	MAX	
V_{IK}	V_{CC} = 4.5 V,	I_I = −18 mA			−1.2			−1.2	V
V_{OH}	V_{CC} = 4.5 V to 5.5 V,	I_{OH} = −0.4 mA	V_{CC} −2			V_{CC} −2			V
	V_{CC} = 4.5 V	I_{OH} = −3 mA	2.4	3.2		2.4	3.2		
		I_{OH} = −12 mA	2						
		I_{OH} = −15 mA				2			
V_{OL}	V_{CC} = 4.5 V	I_{OL} = 12 mA		0.25	0.4		0.25	0.4	V
		I_{OL} = 24 mA					0.35	0.5	
		I_{OL} = 48 mA†					0.35	0.5	
I_{OZH}	V_{CC} = 5.5 V,	V_O = 2.7 V			20			20	µA
I_{OZL}	V_{CC} = 5.5 V,	V_O = 0.4 V			−20			−20	µA
I_I	V_{CC} = 5.5 V,	V_I = 7 V			0.1			0.1	mA
I_{IH}	V_{CC} = 5.5 V,	V_I = 2.7 V			20			20	µA
I_{IL}	V_{CC} = 5.5 V,	V_I = 0.4 V			−0.1			−0.1	mA
I_O§	V_{CC} = 5.5 V,	V_O = 2.25 V	−20		−112	−30		−112	mA
I_{CC}	V_{CC} = 5.5 V	Outputs high		4	11		4	11	mA
		Outputs low		13	23		13	23	
		Outputs disabled		14	25		14	25	

† Applies only to the -1 version and only if V_{CC} is between 4.75 V and 5.25 V
‡ All typical values are at V_{CC} = 5 V, T_A = 25°C.
§ The output conditions have been chosen to produce a current that closely approximates one half of the true short-circuit output current, I_{OS}.

switching characteristics (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	V_{CC} = 4.5 V to 5.5 V, C_L = 50 pF, R1 = 500 Ω, R2 = 500 Ω, T_A = MIN to MAX†				UNIT
			SN54ALS240A		SN74ALS240A		
			MIN	MAX	MIN	MAX	
t_{PLH}	A	Y	2	22	2	9	ns
t_{PHL}			2	11	2	9	
t_{PZH}	$\overline{OE}$	Y	4	34	5	13	ns
t_{PZL}			5	26	5	18	
t_{PHZ}	$\overline{OE}$	Y	1	15	2	10	ns
t_{PLZ}			3	24	3	12	

† For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.

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

Supply voltage, V_{CC} . . . . 7 V
Input voltage, V_I . . . . 7 V
Voltage applied to a disabled 3-state output . . . . 5.5 V
Operating free-air temperature range, T_A: SN54AS240A . . . . −55°C to 125°C
                                                          SN74AS240A . . . . 0°C to 70°C
Storage temperature range . . . . −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.

recommended operating conditions

		SN54AS240A			SN74AS240A			UNIT
		MIN	NOM	MAX	MIN	NOM	MAX	
V_{CC}	Supply voltage	4.5	5	5.5	4.5	5	5.5	V
V_{IH}	High-level input voltage	2			2			V
V_{IL}	Low-level input voltage			0.8			0.8	V
I_{OH}	High-level output current			−12			−15	mA
I_{OL}	Low-level output current			48			64	mA
T_A	Operating free-air temperature	−55		125	0		70	°C

TEXAS
INSTRUMENTS

POST OFFICE BOX 655303 • DALLAS, TEXAS 75265

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

PARAMETER		TEST CONDITIONS		SN54AS240A MIN	TYP†	MAX	SN74AS240A MIN	TYP†	MAX	UNIT
V_{IK}		V_{CC} = 4.5 V,	I_I = −18 mA			−1.2			−1.2	V
V_{OH}		V_{CC} = 4.5 V to 5.5 V	I_{OH} = −2 mA	V_{CC} −2			V_{CC} −2			V
			I_{OH} = −3 mA	2.4	3.4		2.4	3.4		
		V_{CC} = 4.5 V	I_{OH} = −12 mA	2.4						
			I_{OH} = −15 mA				2.4			
V_{OL}		V_{CC} = 4.5 V	I_{OL} = 48 mA		0.27	0.55				V
			I_{OL} = 64 mA					0.31	0.55	
I_{OZH}		V_{CC} = 5.5 V,	V_O = 2.7 V			50			50	µA
I_{OZL}		V_{CC} = 5.5 V,	V_O = 0.4 V			−50			−50	µA
I_I		V_{CC} = 5.5 V,	V_I = 7 V			0.1			0.1	mA
I_{IH}		V_{CC} = 5.5 V,	V_I = 2.7 V			20			20	µA
I_{IL}	A inputs	V_{CC} = 5.5 V,	V_I = 0.4 V			−1			−1	mA
	$\overline{OE}$ inputs					−0.5			−0.5	
I_O‡		V_{CC} = 5.5 V,	V_O = 2.25 V	−50		−150	−50		−150	mA
I_{CC}		V_{CC} = 5.5 V	Outputs high		11	17		11	17	mA
			Outputs low		51	75		51	75	
			Outputs disabled		24	38		24	38	

† All typical values are at V_{CC} = 5 V, T_A = 25°C.
‡ The output conditions have been chosen to produce a current that closely approximates one half of the true short-circuit output current, I_{OS}.

switching characteristics (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	V_{CC} = 4.5 V to 5.5 V, C_L = 50 pF, R1 = 500 Ω, R2 = 500 Ω, T_A = MIN to MAX§ SN54AS240A MIN	MAX	SN74AS240A MIN	MAX	UNIT
t_{PLH}	A	Y	1	7	1	6.5	ns
t_{PHL}			1.2	6.5	1.2	6.5	
t_{PZH}	$\overline{OE}$	Y	1	7	1	6.4	ns
t_{PZL}			1.1	9.5	1.1	9	
t_{PHZ}	$\overline{OE}$	Y	1.2	5.5	1.2	5	ns
t_{PLZ}			1.5	12.5	1.5	9.5	

§ For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.

PARAMETER MEASUREMENT INFORMATION
SERIES 54ALS/74ALS AND 54AS/74AS DEVICES

LOAD CIRCUIT FOR BI-STATE TOTEM-POLE OUTPUTS

LOAD CIRCUIT FOR OPEN-COLLECTOR OUTPUTS

LOAD CIRCUIT FOR 3-STATE OUTPUTS

$R_L = R1 = R2$

VOLTAGE WAVEFORMS SETUP AND HOLD TIMES

VOLTAGE WAVEFORMS PULSE DURATIONS

VOLTAGE WAVEFORMS ENABLE AND DISABLE TIMES, 3-STATE OUTPUTS

VOLTAGE WAVEFORMS PROPAGATION DELAY TIMES

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. When measuring propagation delay items of 3-state outputs, switch S1 is open.
      D. All input pulses have the following characteristics: PRR ≤ 1 MHz, $t_r = t_f = 2$ ns, duty cycle = 50%.
      E. The outputs are measured one at a time with one transition per measurement.

Figure 1. Load Circuits and Voltage Waveforms

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