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# SN54ALS230, SN54ALS231, SN54AS230, SN54AS231 SN74ALS230, SN74ALS231, SN74AS230, SN74AS231 OCTAL BUFFERS AND LINE DRIVERS WITH 3-STATE OUTPUTS

D2661, DECEMBER 1982—REVISED MAY 1986

- Package Options Include Plastic "Small Outline" Packages, Ceramic Chip Carriers, and Standard Plastic and Ceramic 300-mil DIPs
- 'ALS230 and 'AS230 have True and Complementary Outputs
- 'ALS231 and 'AS231 have Complementary G and  $\bar{G}$  Inputs
- 3-State Outputs Drive Bus Lines or Buffer Memory Address Registers
- High Capacitive Drive Capability
- Current Sinking Capability Up to 64 mA
- Dependable Texas Instruments Quality and Reliability

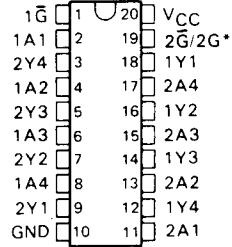
### description

These octal buffers and line drivers are designed specifically to improve the performance of three-state memory address drivers, clock drivers, and bus-oriented receivers and transmitters. The designer has a choice of selected combinations of inverting and noninverting outputs, symmetrical  $\bar{G}$  (active-low output control) inputs, and complementary G and  $\bar{G}$  inputs.

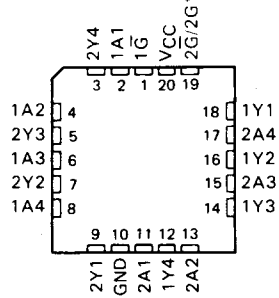
The -1 versions of the SN74ALS' parts are identical to their standard versions except that the recommended maximum  $I_{OL}$  is increased to 48 milliamperes. There are no -1 versions of the SN54ALS' parts.

The SN54' family is characterized for operation over the full military temperature range of  $-55^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ . The SN74' family is characterized for operation from  $0^{\circ}\text{C}$  to  $70^{\circ}\text{C}$ .

SN54ALS', SN54AS' ... J PACKAGE  
SN74ALS', SN74AS' ... DW OR N PACKAGE  
(TOP VIEW)



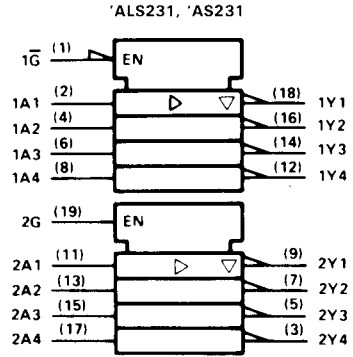
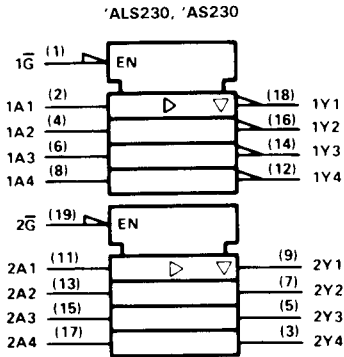
SN54ALS', SN54AS' ... FK PACKAGE  
(TOP VIEW)



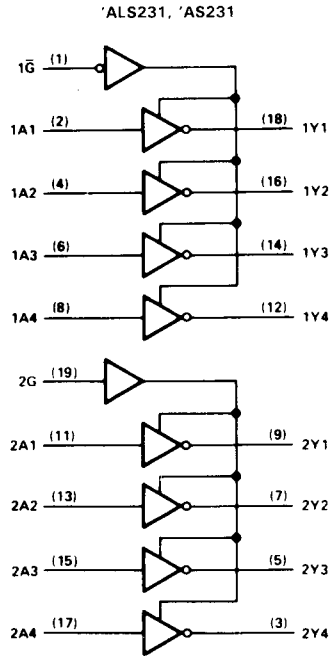
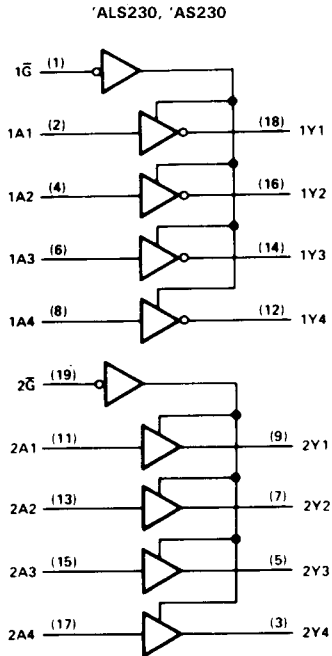
\*2 $\bar{G}$  for 'AS230 or 2G for 'ALS231, 'AS231

**SN54ALS230, SN54ALS231, SN54AS230, SN54AS231  
SN74ALS230, SN74ALS231, SN74AS230, SN74AS231  
OCTAL BUFFERS AND LINE DRIVERS WITH 3-STATE OUTPUTS**

logic symbols†



logic diagrams (positive logic)



†These symbols are in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12. Pin numbers shown are for DW, J, and N packages.

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

Supply voltage, $V_{CC}$ .....	7 V
Input voltage .....	7 V
Voltage applied to a disabled 3-state output .....	5.5 V
Operating free-air temperature range: SN54ALS230 .....	-55°C to 125°C
SN74ALS230 .....	0°C to 70°C
Storage temperature range .....	-65°C to 150°C

**recommended operating conditions**

		SN54ALS230			SN74ALS230			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 <sup>†</sup>	
$T_A$	Operating free-air temperature	-55		125	0		70	°C

<sup>†</sup>The 48 mA limit applies only to the -1 versions and only if  $V_{CC}$  is maintained between 4.75 V and 5.25 V.

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

PARAMETER	TEST CONDITIONS	SN54ALS230			SN74ALS230			UNIT
		MIN	TYP <sup>‡</sup>	MAX	MIN	TYP <sup>‡</sup>	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		
	$V_{CC} = 4.5$ V, $I_{OH} = -12$ mA	2						
	$V_{CC} = 4.5$ V, $I_{OH} = -15$ mA				2			
$V_{OL}$	$V_{CC} = 4.5$ V, $I_{OL} = 12$ mA		0.25	0.4		0.25	0.4	V
	$V_{CC} = 4.5$ V, $I_{OL} = 24$ mA					0.35	0.5	
	$V_{CC} = 4.75$ V, $I_{OL} = 48$ mA (-1 versions)					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
$I_O$ <sup>§</sup>	$V_{CC} = 5.5$ V, $V_O = 2.25$ V	-30		-112	-30		-112	mA
$I_{CC}$	'ALS230	$V_{CC} = 5.5$ V,	Outputs high	7		7		mA
			Outputs low	15		15		
			Outputs disabled	12		12		

<sup>‡</sup>All typical values are at  $V_{CC} = 5$  V,  $T_A = 25$ °C.

<sup>§</sup>The output conditions have been chosen to produce a current that closely approximates one half of the true short-circuit output current,  $I_{OS}$ .

\*ALS230 switching characteristics (see Note 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	V <sub>CC</sub> = 5 V, C <sub>L</sub> = 50 pF, R <sub>1</sub> = 500 Ω, R <sub>2</sub> = 500 Ω, T <sub>A</sub> = 25°C			V <sub>CC</sub> = 4.5 V to 5.5 V, C <sub>L</sub> = 50 pF, R <sub>1</sub> = 500 Ω, R <sub>2</sub> = 500 Ω, T <sub>A</sub> = MIN to MAX			UNIT	
			ALS230			SN54ALS230		SN74ALS230		
			MIN	TYP	MAX	MIN	MAX	MIN		MAX
t <sub>PLH</sub>	A	Y	5			2	7		ns	
t <sub>PHL</sub>			5			2	7			
t <sub>PZH</sub>	$\bar{G}$	Y	9			5.4	12.6		ns	
t <sub>PZL</sub>			10			5	10			
t <sub>PHZ</sub>	$\bar{G}$	Y	5			3	7		ns	
t <sub>PLZ</sub>			6			2.5	8.4			

NOTE 1: Load circuit and voltage waveforms are shown in Section 1.

**2**  
 ALS and AS Circuits

# SN54ALS231, SN74ALS231 OCTAL BUFFERS AND LINE DRIVERS WITH 3-STATE OUTPUTS

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

Supply voltage, $V_{CC}$ .....	7 V
Input voltage .....	7 V
Voltage applied to a disabled 3-state output .....	5.5 V
Operating free-air temperature range: SN54ALS231 .....	-55°C to 125°C
SN74ALS231 .....	0°C to 70°C
Storage temperature range .....	-65°C to 150°C

## recommended operating conditions

		SN54ALS231			SN74ALS231			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			V
$I_{OH}$	High-level output current				-15			mA
$I_{OL}$	Low-level output current				24			mA
					48 <sup>†</sup>			
$T_A$	Operating free-air temperature	-55		125	0		70	°C

<sup>†</sup>The 48 mA limit applies only to the -1 versions and only if  $V_{CC}$  is maintained between 4.75 V and 5.25 V.

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

PARAMETER	TEST CONDITIONS	SN54ALS231			SN74ALS231			UNIT
		MIN	TYP <sup>‡</sup>	MAX	MIN	TYP <sup>‡</sup>	MAX	
$V_{IK}$	$V_{CC} = 4.5 \text{ V}$ , $I_I = -18 \text{ mA}$	-1.2			-1.2			V
$V_{OH}$	$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}$ , $I_{OH} = -0.4 \text{ mA}$	$V_{CC}-2$			$V_{CC}-2$			V
	$V_{CC} = 4.5 \text{ V}$ , $I_{OH} = -3 \text{ mA}$	2.4	3.2		2.4	3.2		
	$V_{CC} = 4.5 \text{ V}$ , $I_{OH} = -12 \text{ mA}$	2						
	$V_{CC} = 4.5 \text{ V}$ , $I_{OH} = -15 \text{ mA}$				2			
$V_{OL}$	$V_{CC} = 4.5 \text{ V}$ , $I_{OL} = 12 \text{ mA}$	0.25			0.4	0.25	0.4	V
	$V_{CC} = 4.5 \text{ V}$ , $I_{OL} = 24 \text{ mA}$				0.35			
	$V_{CC} = 4.75 \text{ V}$ , $I_{OL} = 48 \text{ mA}$ (-1 versions)				0.35			
$I_{OZH}$	$V_{CC} = 5.5 \text{ V}$ , $V_O = 2.7 \text{ V}$				20			$\mu\text{A}$
$I_{OZL}$	$V_{CC} = 5.5 \text{ V}$ , $V_O = 0.4 \text{ V}$				-20			$\mu\text{A}$
$I_I$	$V_{CC} = 5.5 \text{ V}$ , $V_I = 7 \text{ V}$				0.1			mA
$I_{IH}$	$V_{CC} = 5.5 \text{ V}$ , $V_I = 2.7 \text{ V}$				20			$\mu\text{A}$
$I_{IL}$	$V_{CC} = 5.5 \text{ V}$ , $V_I = 0.4 \text{ V}$				-0.1			mA
$I_O$ <sup>§</sup>	$V_{CC} = 5.5 \text{ V}$ , $V_O = 2.25 \text{ V}$	-30		-112	-30		-112	mA
$I_{CC}$	'ALS231	$V_{CC} = 5.5 \text{ V}$ ,	Outputs high	7	11	7	11	mA
			Outputs low	15	22	15	22	
			Outputs disabled	12	19	12	19	

<sup>‡</sup>All typical values are at  $V_{CC} = 5 \text{ V}$ ,  $T_A = 25^\circ\text{C}$ .

<sup>§</sup>The output conditions have been chosen to produce a current that closely approximates one half of the true short-circuit output current,  $I_{OS}$ .

# SN54ALS231, SN74ALS231 OCTAL BUFFERS AND LINE DRIVERS WITH 3-STATE OUTPUTS

'ALS231 switching characteristics (see Note 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	V <sub>CC</sub> = 5 V, C <sub>L</sub> = 50 pF, R <sub>1</sub> = 500 Ω, R <sub>2</sub> = 500 Ω, T <sub>A</sub> = 25°C		V <sub>CC</sub> = 4.5 V to 5.5 V, C <sub>L</sub> = 50 pF, R <sub>1</sub> = 500 Ω, R <sub>2</sub> = 500 Ω, T <sub>A</sub> = MIN to MAX		UNIT		
			'ALS231		SN54ALS231			SN74ALS231	
			TYP	MIN	MAX	MIN		MAX	
t <sub>PLH</sub>	A	Y	5	2	12	2	9	ns	
t <sub>PHL</sub>			5	2	11	2	9		
t <sub>PZH</sub>	1 $\bar{G}$	Y	9	4	17	4	14	ns	
t <sub>PZL</sub>			10	5	21	5	18		
t <sub>PHZ</sub>	1 $\bar{G}$	Y	5	2	12	2	10	ns	
t <sub>PLZ</sub>			6	3	18	3	12		
t <sub>PZH</sub>	2G	Y	11	5	18	5	16	ns	
t <sub>PZL</sub>			12	5	22	5	19		
t <sub>PHZ</sub>	2G	Y	6	2	12	2	10	ns	
t <sub>PLZ</sub>			7	3	19	3	13		

NOTE 1: Load circuit and voltage waveforms are shown in Section 1.

2

ALS and AS Circuits

# SN54AS230, SN54AS231, SN74AS230, SN74AS231 OCTAL BUFFERS AND LINE DRIVERS WITH 3-STATE OUTPUTS

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

Supply voltage, $V_{CC}$ .....	7 V
Input voltage .....	7 V
Voltage applied to a disabled 3-state output .....	5.5 V
Operating free-air temperature range: SN54AS230, SN54AS231 .....	-55°C to 125°C
SN74AS230, SN74AS231 .....	0°C to 70°C
Storage temperature range .....	-65°C to 150°C

recommended operating conditions

	SN54AS230 SN54AS231			SN74AS230 SN74AS231			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

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

PARAMETER	TEST CONDITIONS	SN54AS230 SN54AS231		SN74AS230 SN74AS231		UNIT		
		MIN	TYP <sup>†</sup>	MAX	MIN		TYP <sup>†</sup>	MAX
$V_{IK}$	$V_{CC} = 4.5\text{ V}$ , $I_I = -18\text{ mA}$			-1.2		-1.2	V	
$V_{OH}$	$V_{CC} = 4.5\text{ V to } 5.5\text{ V}$ , $I_{OH} = -2\text{ mA}$	$V_{CC}-2$		$V_{CC}-2$			V	
	$V_{CC} = 4.5\text{ V}$ , $I_{OH} = -3\text{ mA}$	2.4	3.4	2.4	3.4			
	$V_{CC} = 4.5\text{ V}$ , $I_{OH} = -12\text{ mA}$	2.4						
	$V_{CC} = 4.5\text{ V}$ , $I_{OH} = -15\text{ mA}$			2.4				
$V_{OL}$	$V_{CC} = 4.5\text{ V}$ , $I_{OL} = 48\text{ mA}$	0.27	0.55				V	
	$V_{CC} = 4.5\text{ V}$ , $I_{OL} = 64\text{ mA}$			0.31	0.55			
$I_{OZH}$	$V_{CC} = 5.5\text{ V}$ , $V_O = 2.7\text{ V}$	50		50		$\mu\text{A}$		
$I_{OZL}$	$V_{CC} = 5.5\text{ V}$ , $V_O = 0.4\text{ V}$	-50		-50		$\mu\text{A}$		
$I_I$	$V_{CC} = 5.5\text{ V}$ , $V_I = 7\text{ V}$	0.1		0.1		mA		
$I_{IH}$	$V_{CC} = 5.5\text{ V}$ , $V_I = 2.7\text{ V}$	20		20		$\mu\text{A}$		
$I_{IL}$	$V_{CC} = 5.5\text{ V}$ , $V_I = 0.4\text{ V}$	-1		-1		mA		
		-0.5		-0.5				
$I_O^\ddagger$	$V_{CC} = 5.5\text{ V}$ , $V_O = 2.25\text{ V}$	-50	-150	-50	-150	mA		
$I_{CC}$	'AS230	$V_{CC} = 5.5\text{ V}$	Outputs high	16	25	16	25	mA
			Outputs low	55	87	55	87	
			Outputs disabled	29	46	29	46	
	'AS231	$V_{CC} = 5.5\text{ V}$	Outputs high	12	18	12	18	mA
			Outputs low	52	82	52	82	
			Outputs disabled	25	39	25	39	

<sup>†</sup>All typical values are at  $V_{CC} = 5\text{ V}$ ,  $T_A = 25^\circ\text{C}$ .

<sup>‡</sup>The output conditions have been chosen to produce a current that closely approximates one half of the true short-circuit output current,  $I_{OS}$ .

**SN54AS230, SN54AS231, SN74AS230, SN74AS231**  
**OCTAL BUFFERS AND LINE DRIVERS WITH 3-STATE OUTPUTS**

'AS230 switching characteristics (see Note 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V},$ $C_L = 50 \text{ pF},$ $R_1 = 500 \Omega,$ $R_2 = 500 \Omega,$ $T_A = \text{MIN to MAX}$				UNIT
			SN54AS230		SN74AS230		
			MIN	MAX	MIN	MAX	
$t_{PLH}$	1A	1Y	2.5	7	2.5	6.5	ns
$t_{PHL}$			2	6	2	5.7	
$t_{PLH}$	2A	2Y	2.5	9	2.5	6.2	ns
$t_{PHL}$			2	7	2	6.2	
$t_{PZH}$	$\bar{1}G$	1Y	2	7	2	6.4	ns
$t_{PZL}$			2	9	2	8.5	
$t_{PHZ}$			2	5.5	2	5	
$t_{PLZ}$			2	12.5	2	9.5	
$t_{PZH}$			2	10	2	9	
$t_{PZL}$	$\bar{2}G$	2Y	2	8	2	7.5	ns
$t_{PHZ}$			2	6.5	2	6	
$t_{PLZ}$			2	10.5	2	9	

'AS231 switching characteristics (see Note 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V},$ $C_L = 50 \text{ pF},$ $R_1 = 500 \Omega,$ $R_2 = 500 \Omega,$ $T_A = \text{MIN to MAX}$				UNIT
			SN54AS231		SN74AS231		
			MIN	MAX	MIN	MAX	
$t_{PLH}$	A	Y	2	7	2	6.5	ns
$t_{PHL}$			2	6	2	5.7	
$t_{PZH}$	$\bar{1}G$	Y	2	7	2	6.4	ns
$t_{PZL}$			2	9	2	8.5	
$t_{PHZ}$			2	5.5	2	5	
$t_{PLZ}$			2	12.5	2	9.5	
$t_{PZH}$			3	7	3	6	
$t_{PZL}$	G	Y	3	10	3	9	ns
$t_{PHZ}$			3	6.5	3	6	
$t_{PLZ}$			3	13.5	3	7	

NOTE 1. Load circuit and voltage waveforms are shown in Section 1.