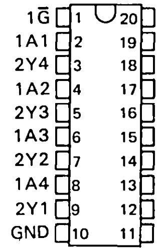
OCTAL BUFFERS AND LINE DRIVERS WITH 3-STATE OUTPUTS

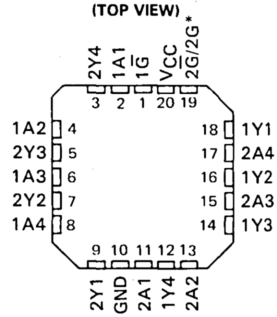
D2661, DECEMBER 1982—REVISED DECEMBER 1983

- **3-State Outputs Drive Bus Lines or Buffer Memory Address Registers**
- **P-N-P Inputs Reduce DC Loading**
- **Dependable Texas Instruments Quality and Reliability**

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



SN54ALS', SN54AS' . . . FH PACKAGE
SN74ALS', SN74AS' . . . FN PACKAGE
(TOP VIEW)



*2G̅ for 'ALS240A, 'AS240 or 2G for 'ALS241A, 'AS241

description

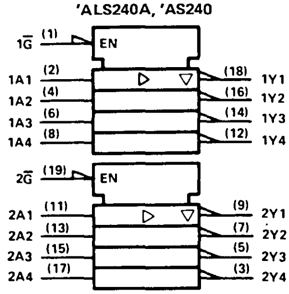
These octal buffers and line drivers are designed specifically to improve both the performance and density of three-state memory address drivers, clock drivers, and bus-oriented receivers and transmitters. The designer has a choice of selected combinations of inverting and noninverting outputs, symmetrical G̅ (active-low output control) inputs, and complementary G and G̅ inputs. These devices feature high fan-out and improved fan-in.

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.

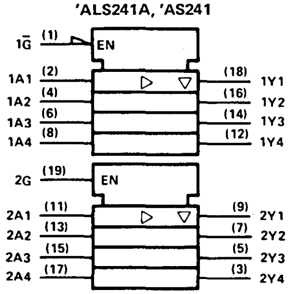
The SN54' family is characterized for operation over the full military temperature range of −55°C to 125°C. The SN74' family is characterized for operation from 0°C to 70°C.

logic symbols

'ALS240A, 'AS240



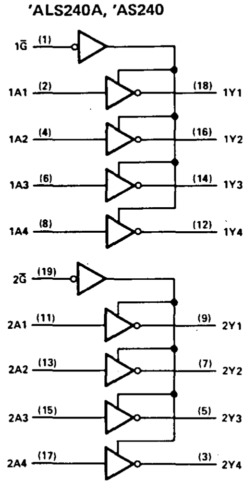
'ALS241A, 'AS241



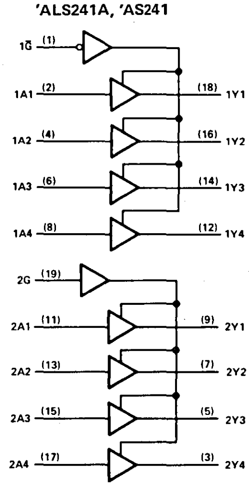
Pin numbers shown are for J and N packages.

logic diagrams (positive logic)

'ALS240A, 'AS240



'ALS241A, 'AS241



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: SN54ALS240A, SN54ALS231A . . . . −55°C to 125°C
SN74ALS240A, SN74ALS241A . . . . 0°C to 70°C
Storage temperature range . . . . −65°C to 150°C

recommended operating conditions

		SN54ALS240A SN54ALS241A			SN74ALS240A SN74ALS241A			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			12			24	mA
							48†	
T_A	Operating free-air temperature	−55		125	0		70	°C

†The extended limits apply only if V_{CC} is maintained between 4.75 V and 5.25 V. The 48 mA limit applies for the SN74ALS240A-1 and SN74ALS241A-1 only.

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

PARAMETER		TEST CONDITIONS		SN54ALS240A SN54ALS241A			SN74ALS240A SN74ALS241A			UNIT
				MIN	TYP‡	MAX	MIN	TYP‡	MAX	
V_{IK}		V_{CC} = 4.5 V,	I_I = −18 mA			−1.5			−1.5	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} = 48 mA for −1 versions)	I_{OL} = 24 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	−30		−112	−30		−112	mA
I_{CC}	'ALS240A	V_{CC} = 5.5 V	Outputs high		4	10		4	10	mA
			Outputs low		13	23		13	23	
			Outputs disabled		14	25		14	25	
	'ALS241A		Outputs high		9	17		9	15	
			Outputs low		15	28		15	26	
			Outputs disabled		17	32		17	30	

†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}.

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'ALS240A switching characteristics (see Note 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	12	2	9	ns
t_{PHL}			2	11	2	9	
t_{PZH}	$\overline{G}$	Y	5	15	5	13	ns
t_{PZL}			5	20	5	18	
t_{PHZ}	$\overline{G}$	Y	2	12	2	10	ns
t_{PLZ}			3	18	3	12	

'ALS241A switching characteristics (see Note 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
			SN54ALS241A		SN74ALS241A		
			MIN	MAX	MIN	MAX	
t_{PLH}	A	Y	3	14	3	11	ns
t_{PHL}			3	13	3	10	
t_{PZH}	$1\overline{G}$	Y	7	25	7	21	ns
t_{PZL}			7	25	7	21	
t_{PHZ}	$1\overline{G}$	Y	2	12	2	10	ns
t_{PLZ}			3	20	3	15	
t_{PZH}	2G	Y	7	25	7	21	ns
t_{PZL}			7	25	7	21	
t_{PHZ}	2G	Y	2	12	2	10	ns
t_{PLZ}			3	20	3	15	

NOTE 1: For load circuit and voltage waveforms, see page 1-12.

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:	SN54AS240, SN54AS241	−55°C to 125°C
	SN74AS240, SN74AS241	0°C to 70°C
Storage temperature range		−65°C to 150°C

recommended operating conditions

		SN54AS240 SN54AS241			SN74AS240 SN74AS241			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		SN54AS240 SN54AS241			SN74AS240 SN74AS241			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} = −2 mA	V_{CC}−2			V_{CC}−2			V
		V_{CC} = 4.5 V,	I_{OH} = −3 mA	2.4	3.4		2.4	3.4		
		V_{CC} = 4.5 V,	I_{OH} = −12 mA	2.4						
		V_{CC} = 4.5 V,	I_{OH} = −15 mA				2.4			
V_{OL}		V_{CC} = 4.5 V,	I_{OL} = 48 mA		0.27	0.55				V
		V_{CC} = 4.5 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}	'AS241 A inputs	V_{CC} = 5.5 V,	V_I = 0.4 V			−1			−1	mA
	All others					−0.5			−0.5	
I_O‡		V_{CC} = 5.5 V,	V_O = 2.25 V	−50		−150	−50		−150	mA
I_{CC}	'AS240	V_{CC} = 5.5 V	Outputs high		11	17		11	17	mA
			Outputs low		51	75		51	75	
			Outputs disabled		24	38		24	38	
	'AS241		Outputs high		22	35		22	35	
			Outputs low		61	90		61	90	
			Outputs disabled		35	56		35	56	

†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}.

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'AS240 switching characteristics (see Note 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
			SN54AS240		SN74AS240		
			MIN	MAX	MIN	MAX	
t_{PLH}	A	Y	2	7	2	6.5	ns
t_{PHL}			2	6	2	5.7	
t_{PZH}	$\overline{G}$	Y	2	7	2	6.4	ns
t_{PZL}			2	9.5	2	9	
t_{PHZ}	$\overline{G}$	Y	2	5.5	2	5	ns
t_{PLZ}			2	12.5	2	9.5	

'AS241 switching characteristics (see Note 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
			SN54AS241		SN74AS241		
			MIN	MAX	MIN	MAX	
t_{PLH}	A	Y	2	9	2	6.2	ns
t_{PHL}			2	7	2	6.2	
t_{PZH}	$1\overline{G}$	Y	2	10	2	9	ns
t_{PZL}			2	8	2	7.5	
t_{PHZ}	$1\overline{G}$	Y	2	6.5	2	6	ns
t_{PLZ}			2	10.5	2	9	
t_{PZH}	2G	Y	3	11	3	10.5	ns
t_{PZL}			3	9.5	3	8.5	
t_{PHZ}	2G	Y	3	7	3	7	ns
t_{PLZ}			3	12	3	12	

NOTE 1: For load circuit and voltage waveforms, see page 1-12.