

SN54LS240, SN54LS241, SN54LS244, SN54S240, SN54S241, SN54S244, SN74LS240, SN74LS241, SN74LS244, SN74S240, SN74S241, SN74S244 OCTAL BUFFERS AND LINE DRIVERS WITH 3-STATE OUTPUTS

SDLS144

APRIL 1985—REVISED MARCH 1988

- 3-State Outputs Drive Bus Lines or Buffer Memory Address Registers
- PNP Inputs Reduce D-C Loading
- Hysteresis at Inputs Improves Noise Margins

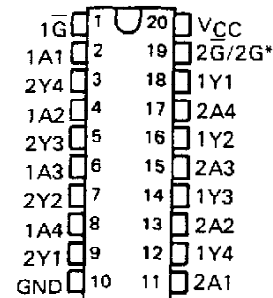
description

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 \bar{G} (active-low output control) inputs, and complementary \bar{G} and \bar{G} inputs. These devices feature high fan-out, improved fan-in, and 400-mV noise-margin. The SN74LS' and SN74S' can be used to drive terminated lines down to 133 ohms.

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 .

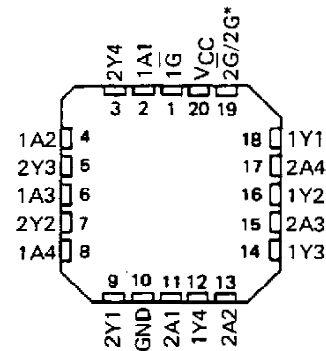
SN54LS', SN54S' ... J OR W PACKAGE
SN74LS', SN74S' ... DW OR N PACKAGE

(TOP VIEW)



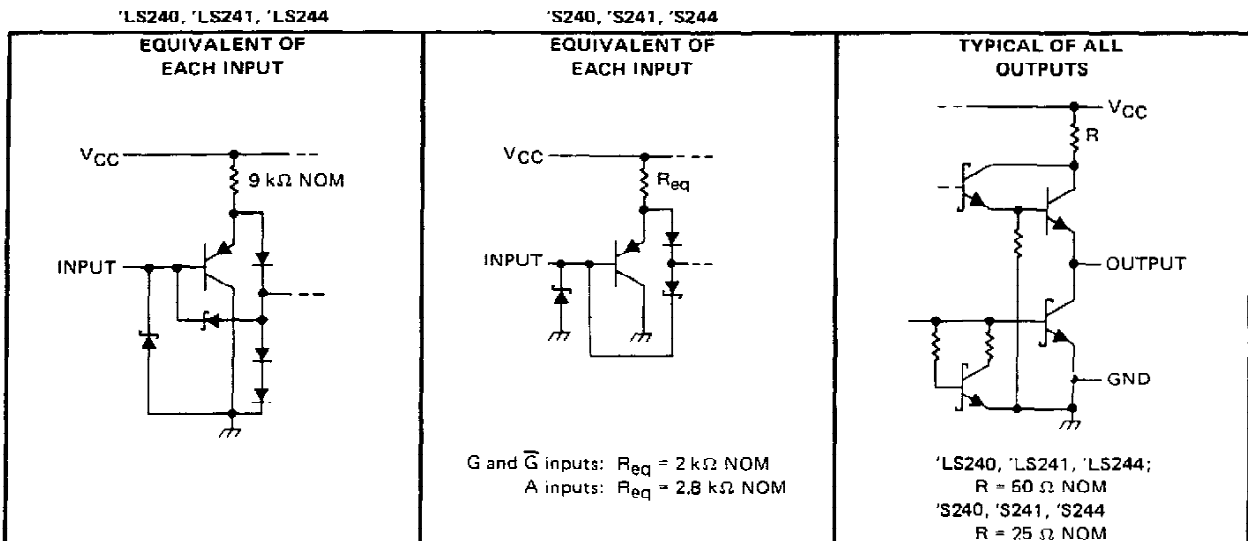
SN54LS', SN54S' ... FK PACKAGE

(TOP VIEW)



*2G for 'LS241 and 'S241 or 2G for all other drivers.

schematics of inputs and outputs



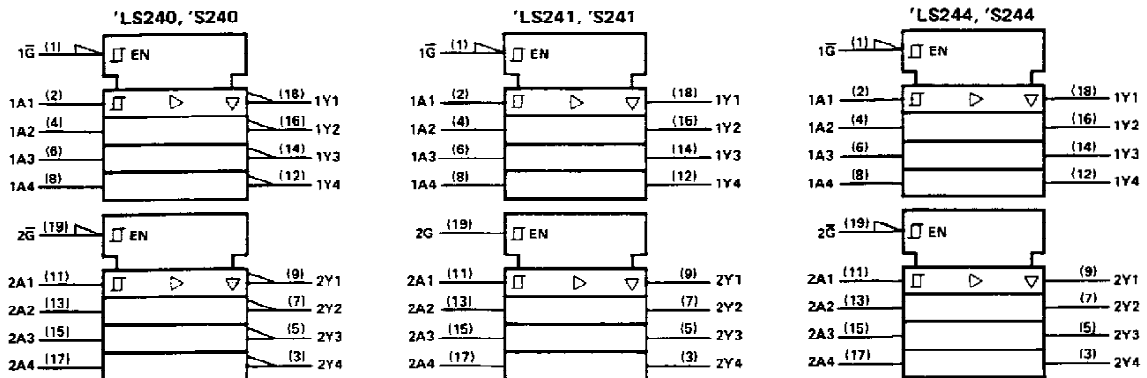
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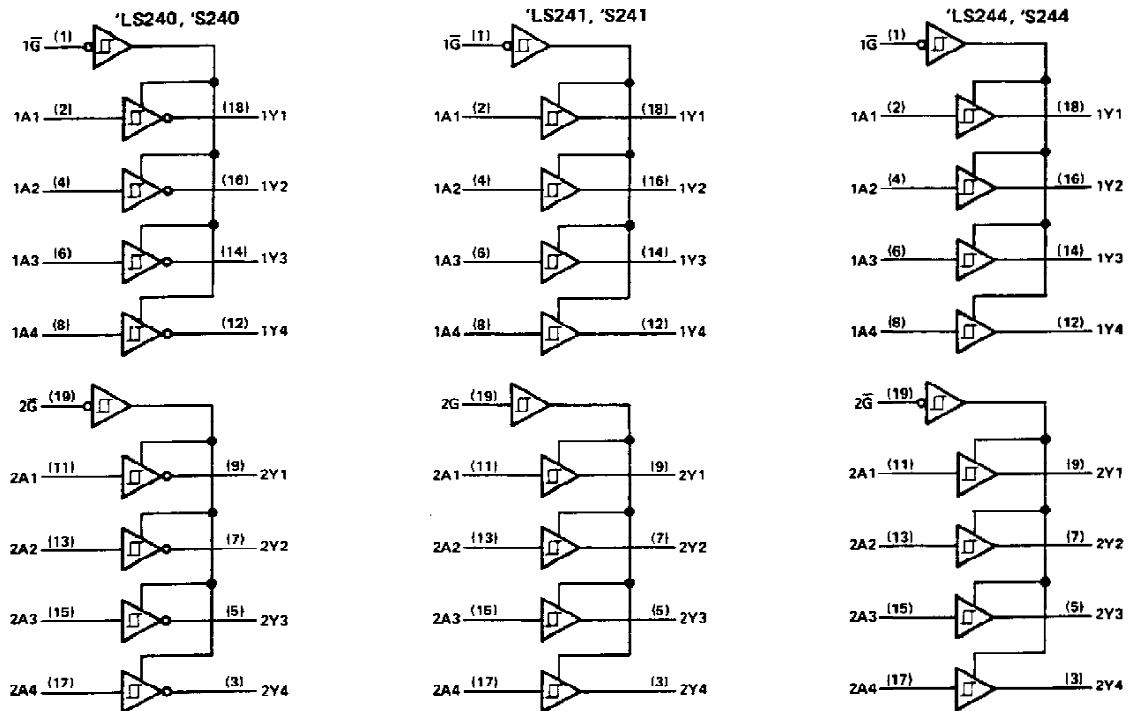
SN54LS240, SN54LS241, SN54LS244, SN54S240, SN54S241, SN54S244, SN74SL240, SN74LS241, SN74LS244, SN74S240, SN74S241, SN74S244 OCTAL BUFFERS AND LINE DRIVERS WITH 3-STATE OUTPUTS

logic symbols†



†These symbols are in accordance with ANSI/IEEE Std. 91-1984 and IEC Publication 617-12.

logic diagrams (positive logic)



Pin numbers shown are for DW, J, N, and W packages.

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

Supply voltage, V_{CC} (see Note 1)	7 V
Input voltage: 'LS Circuits	7 V
'S Circuits	5.5 V
Off-state output voltage	5.5 V
Operating free-air temperature range: SN54LS', SN54S' Circuits	-55°C to 125°C
SN74LS', SN74S' Circuits	0°C to 70°C
Storage temperature range	-65°C to 150°C

NOTE 1: Voltage values are with respect to network ground terminal.

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SN54LS240, SN54LS241, SN54LS244, SN74LS240, SN74LS241, SN74LS244 OCTAL BUFFERS AND LINE DRIVERS WITH 3-STATE OUTPUTS

recommended operating conditions

PARAMETER	SN54LS'			SN74LS'			UNIT
	MIN	NOM	MAX	MIN	NOM	MAX	
V _{CC} Supply voltage (see Note 1)	4.5	5	5.5	4.75	5	5.25	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
T _A Operating free-air temperature	-55		125	0		70	°C

NOTE 1: Voltage values are with respect to network ground terminal.

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

PARAMETER	TEST CONDITIONS†	SN54LS'			SN74LS'			UNIT
		MIN	TYP‡	MAX	MIN	TYP‡	MAX	
V _{IK}	V _{CC} = MIN, I _I = -18 mA			-1.5			-1.5	V
Hysteresis (V _{T+} - V _{T-})	V _{CC} = MIN	0.2	0.4		0.2	0.4		V
V _{OH}	V _{CC} = MIN, V _{IH} = 2 V, V _{IL} = MAX, I _{OH} = -3 mA	2.4	3.4		2.4	3.4		V
	V _{CC} = MIN, V _{IH} = 2 V, V _{IL} = 0.5 V, I _{OH} = MAX	2			2			V
V _{OL}	V _{CC} = MIN, V _{IH} = 2 V, I _{OL} = 12 mA			0.4			0.4	V
	V _{CC} = MIN, V _{IH} = 2 V, I _{OL} = 24 mA						0.5	V
I _{OZH}	V _{CC} = MAX, V _{IH} = 2 V, V _O = 2.7 V			20			20	μA
I _{OZL}	V _{CC} = MAX, V _{IH} = 2 V, V _O = 0.4 V			-20			-20	μA
I _I	V _{CC} = MAX, V _I = 7 V			0.1			0.1	mA
I _{IH}	V _{CC} = MAX, V _I = 2.7 V			20			20	μA
I _{IL}	V _{CC} = MAX, V _I = 0.4 V			-0.2			-0.2	mA
I _{OSS} §	V _{CC} = MAX	-40		-225	-40		-225	mA
I _{CC}	V _{CC} = MAX, Output open	Outputs high	All	17	27	17	27	mA
		Outputs low	'LS240	26	44	26	44	
			'LS241, 'LS244	27	46	27	46	
		All outputs disabled	'LS240	29	50	29	50	
		'LS241, 'LS244	32	54	32	54		

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

‡ All typical values are at V_{CC} = 5 V, T_A = 25°C.

§ Not more than one output should be shorted at a time, and duration of the short-circuit should not exceed one second.

switching characteristics, V_{CC} = 5 V, T_A = 25°C

PARAMETER	TEST CONDITIONS	'LS240			'LS241, 'LS244			UNIT
		MIN	TYP	MAX	MIN	TYP	MAX	
t _{PLH}	R _L = 667 Ω, C _L = 45 pF, See Note 2		9	14		12	18	ns
t _{PHL}			12	18		12	18	ns
t _{PZL}			20	30		20	30	ns
t _{PZH}			15	23		15	23	ns
t _{PLZ}		R _L = 667 Ω, C _L = 5 pF, See Note 2		10	20		10	20
t _{PHZ}			15	25		15	25	ns

NOTE 2: Load circuits and voltage waveforms are shown in Section 1.


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SN54S240, SN54S241, SN54S244, SN74S240, SN74S241, SN74S244, OCTAL BUFFERS AND LINE DRIVERS WITH 3-STATE OUTPUTS

recommended operating conditions

PARAMETER	SN54S'			SN74S'			UNIT	
	MIN	NOM	MAX	MIN	NOM	MAX		
V_{CC} Supply voltage, (see Note 1)	4.5	5	5.5	4.75	5	5.25	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	
External resistance between any input and V_{CC} or ground	40			40			k Ω	
T_A Operating free-air temperature (see Note 3)	-55			125			0	$^{\circ}$ C

NOTES: 1. Voltage values are with respect to network ground terminal.

3. An SN54S241J operating at free-air temperature above 116 $^{\circ}$ C requires a heat sink that provides a thermal resistance from case to free-air $R_{\theta CA}$, of not more than 40 $^{\circ}$ C/W.

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

PARAMETER	TEST CONDITIONS†		SN54S'			SN74S'			UNIT	
			MIN	TYP‡	MAX	MIN	TYP‡	MAX		
V_{IK}	$V_{CC} = \text{MIN}, I_I = -18 \text{ mA}$		-1.2			-1.2			V	
Hysteresis ($V_{T+} - V_{T-}$)	$V_{CC} = \text{MIN}$		0.2	0.4		0.2	0.4		V	
V_{OH}	$V_{CC} = \text{MIN}, V_{IH} = 2 \text{ V}, V_{IL} = 0.8 \text{ V}, I_{OH} = -1 \text{ mA}$					2.7			V	
	$V_{CC} = \text{MIN}, V_{IH} = 2 \text{ V}, V_{IL} = 0.8 \text{ V}, I_{OH} = -3 \text{ mA}$		2.4	3.4		2.4	3.4			
	$V_{CC} = \text{MIN}, V_{IH} = 2 \text{ V}, V_{IL} = 0.5 \text{ V}, I_{OH} = \text{MAX}$		2			2				
V_{OL}	$V_{CC} = \text{MIN}, V_{IH} = 2 \text{ V}, V_{IL} = 0.8 \text{ V}, I_{OL} = \text{MAX}$		0.55			0.55			V	
I_{OZH}	$V_{CC} = \text{MAX}, V_{IH} = 2 \text{ V}, V_{IL} = 0.8 \text{ V}, V_O = 2.4 \text{ V}$		50			50			μ A	
I_{OZL}	$V_{CC} = \text{MAX}, V_{IH} = 2 \text{ V}, V_{IL} = 0.8 \text{ V}, V_O = 0.5 \text{ V}$		-50			-50			μ A	
I_I	$V_{CC} = \text{MAX}, V_I = 5.5 \text{ V}$		1			1			mA	
I_{IH}	$V_{CC} = \text{MAX}, V_I = 2.7 \text{ V}$		50			50			μ A	
I_{IL}	Any A	$V_{CC} = \text{MAX}, V_I = 0.5 \text{ V}$		-400			-400			μ A
	Any G			-2			-2			mA
$I_{OS}§$	$V_{CC} = \text{MAX}$		-50	-225		-50	-225		mA	
I_{CC}	Outputs high	$V_{CC} = \text{MAX},$ Outputs open	'S240		80	123	80	135	mA	
			'S241, 'S244		95	147	95	160		
	Outputs low		'S240		100	145	100	150		
			'S241, 'S244		120	170	120	180		
			'S240		100	145	100	150		
Outputs disabled	'S241, 'S244		120	170	120	180				

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

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

§ Not more than one output should be shorted at a time, and duration of the short-circuit should not exceed one second.



**SN54S240, SN54S241, SN54S244, SN74S240, SN74S241, SN74S244,
OCTAL BUFFERS AND LINE DRIVERS WITH 3-STATE OUTPUTS**

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

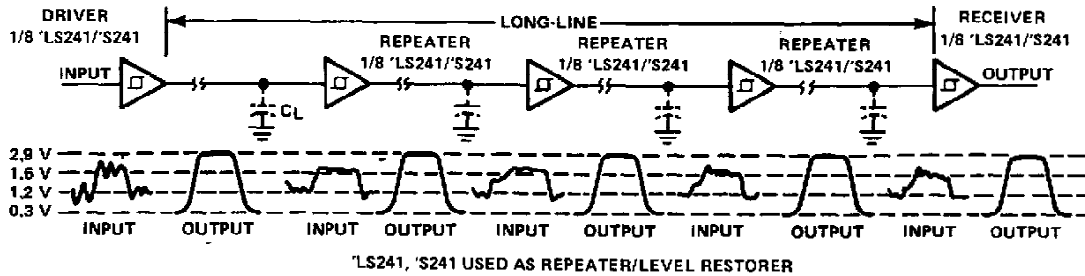
PARAMETER	TEST CONDITIONS	'S240			'S241, 'S244			UNIT
		MIN	TYP	MAX	MIN	TYP	MAX	
t_{PLH}	$R_L = 90\ \Omega$, See Note 4 $C_L = 50\text{ pF}$,	4.5		7		6	9	ns
t_{PHL}		4.5		7		6	9	ns
t_{PZL}		10		15		10	15	ns
t_{PZH}		6.5		10		8	12	ns
t_{PLZ}	$R_L = 90\ \Omega$, See Note 4 $C_L = 5\text{ pF}$,	10		15		10	15	ns
t_{PHZ}		6		9		6	9	ns

NOTE 4: Load circuits and voltage waveforms are shown in Section 1.

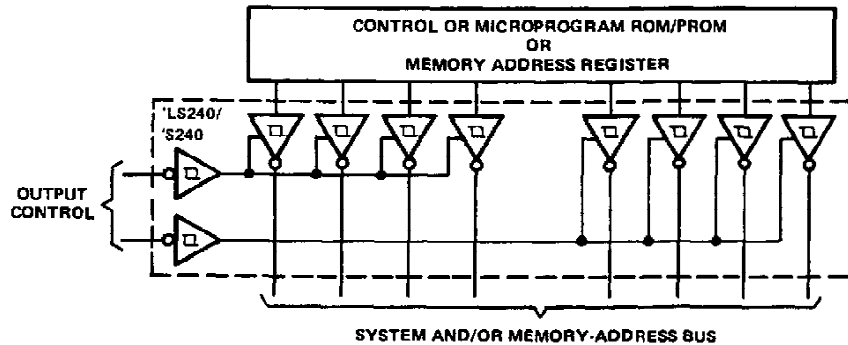
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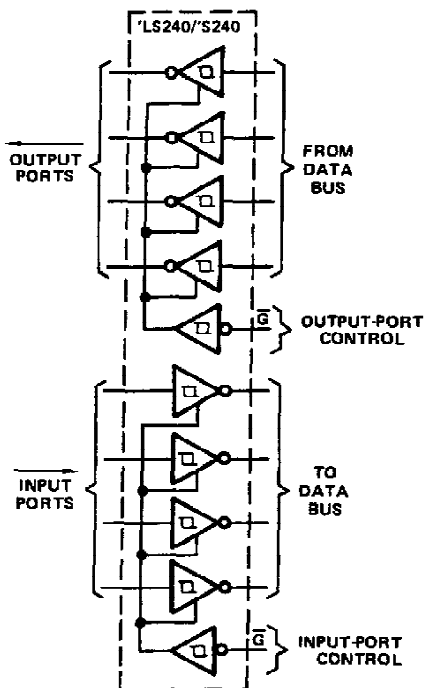
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SN74LS240, SN74LS241, SN74LS244, SN74S240, SN74S241, SN74S244
OCTAL BUFFERS AND LINE DRIVERS WITH 3-STATE OUTPUTS**



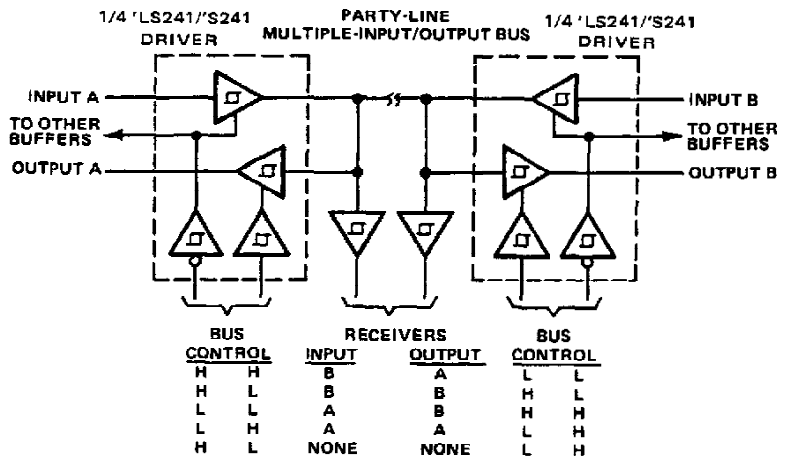
'LS241, 'S241 USED AS REPEATER/LEVEL RESTORER



'LS240/'S240 USED AS SYSTEM AND/OR MEMORY BUS DRIVER—4-BIT ORGANIZATION CAN BE APPLIED TO HANDLE BINARY OR BCD



INDEPENDENT 4-BIT BUS DRIVERS/RECEIVERS IN A SINGLE PACKAGE



PARTY-LINE BUS SYSTEM WITH MULTIPLE INPUTS, OUTPUTS, AND RECEIVERS

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