



# 54LS240/DM54LS240/DM74LS240, 54LS241/DM54LS241/DM74LS241 Octal TRI-STATE® Buffers/Line Drivers/Line Receivers

## General Description

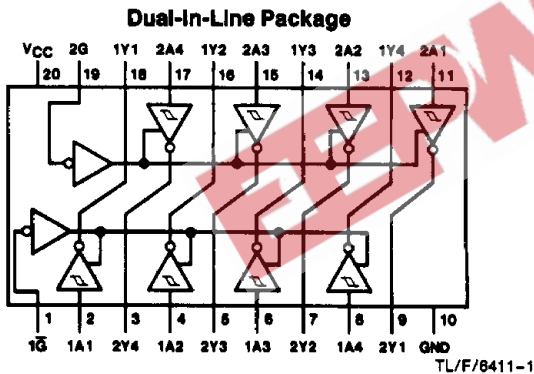
These buffers/line drivers are designed to improve both the performance and PC board density of TRI-STATE buffers/drivers employed as memory-address drivers, clock drivers, and bus-oriented transmitters/receivers. Featuring 400 mV of hysteresis at each low current PNP data line input, they provide improved noise rejection and high fanout outputs and can be used to drive terminated lines down to 133Ω.

## Features

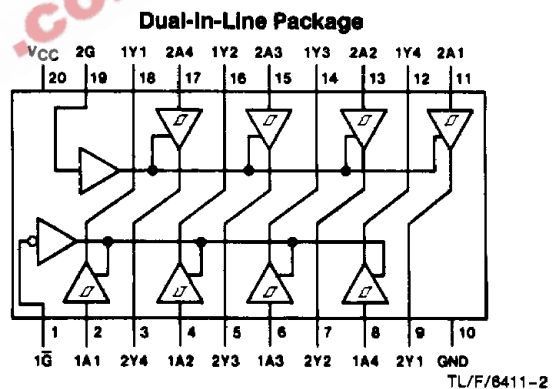
- TRI-STATE outputs drive bus lines directly
- PNP inputs reduce DC loading on bus lines
- Hysteresis at data inputs improves noise margins
- Typical I<sub>OL</sub> (sink current)
  - 54LS 12 mA
  - 74LS 24 mA

- Typical I<sub>OH</sub> (source current)
  - 54LS -12 mA
  - 74LS -15 mA
- Typical propagation delay times
  - Inverting 10.5 ns
  - Noninverting 12 ns
- Typical enable/disable time 18 ns
- Typical power dissipation (enabled)
  - Inverting 130 mW
  - Noninverting 135 mW
- Alternate Military/Aerospace devices (54LS240/54LS241) are available. Contact a National Semiconductor Sales Office/Distributor for specifications.

## Connection Diagrams



Order Number 54LS240DMQB, 54LS240FMQB,  
54LS240LMQB, DM54LS240J,  
DM74LS240WM or DM74LS240N  
See NS Package Number E20A, J20A,  
M20B, N20A or W20A



Order Number 54LS241DMQB, 54LS241FMQB,  
54LS241LMQB, DM54LS241J,  
DM74LS241WM or DM74LS241N  
See NS Package Number E20A, J20A,  
M20B, N20A or W20A

## Function Tables

LS240

Inputs		Output
$\bar{G}$	A	Y
L	L	H
L	H	L
H	X	Z

LS241

Inputs				Outputs	
G	$\bar{G}$	1A	2A	1Y	2Y
X	L	L	X	L	
X	L	H	X	H	
X	H	X	X	Z	
H	X	X	L		L
H	X	X	H		H
L	X	X	X		Z

L = Low Logic Level  
H = High Logic Level  
X = Either Low or High Logic Level  
Z = High Impedance

**Absolute Maximum Ratings** (Note)

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.

Supply Voltage	7V
Input Voltage	7V
Operating Free Air Temperature Range	
DM54LS, 54LS	-55°C to +125°C
DM74LS	0°C to +70°C
Storage Temperature Range	-65°C to +150°C

Note: The "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. The device should not be operated at these limits. The parametric values defined in the "Electrical Characteristics" table are not guaranteed at the absolute maximum ratings. The "Recommended Operating Conditions" table will define the conditions for actual device operation.

**Recommended Operating Conditions**

Symbol	Parameter	DM54LS240, 241			DM74LS240, 241			Units
		Min	Nom	Max	Min	Nom	Max	
V <sub>CC</sub>	Supply Voltage	4.5	5	5.5	4.75	5	5.25	V
V <sub>IH</sub>	High Level Input Voltage	2			2			V
V <sub>IL</sub>	Low Level Input Voltage			0.7			0.8	V
I <sub>OH</sub>	High Level Output Current			-12			-15	mA
I <sub>OL</sub>	Low Level Output Current			12			24	mA
T <sub>A</sub>	Free Air Operating Temperature	-55		125	0		70	°C

**Electrical Characteristics** over recommended operating free air temperature range (unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ (Note 1)	Max	Units
V <sub>I</sub>	Input Clamp Voltage	V <sub>CC</sub> = Min, I <sub>I</sub> = -18 mA			-1.5	V
HYS	Hysteresis (V <sub>T+</sub> - V <sub>T-</sub> ) Data Inputs Only	V <sub>CC</sub> = Min	0.2	0.4		V
V <sub>OH</sub>	High Level Output Voltage	V <sub>CC</sub> = Min, V <sub>IH</sub> = Min V <sub>IL</sub> = Max, I <sub>OH</sub> = -1 mA	DM74	2.7		V
		V <sub>CC</sub> = Min, V <sub>IH</sub> = Min V <sub>IL</sub> = Max, I <sub>OH</sub> = -3 mA	DM54/DM74	2.4	3.4	
		V <sub>CC</sub> = Min, V <sub>IH</sub> = Min V <sub>IL</sub> = 0.5V, I <sub>OH</sub> = Max	DM54/DM74	2		
V <sub>OL</sub>	Low Level Output Voltage	V <sub>CC</sub> = Min V <sub>IL</sub> = Max V <sub>IH</sub> = Min	I <sub>OL</sub> = 12 mA	DM74		0.4
			I <sub>OL</sub> = Max	DM54		0.4
				DM74		0.5
I <sub>OZH</sub>	Off-State Output Current, High Level Voltage Applied	V <sub>CC</sub> = Max V <sub>IL</sub> = Max	V <sub>O</sub> = 2.7V		20	μA
I <sub>OZL</sub>	Off-State Output Current, Low Level Voltage Applied	V <sub>IH</sub> = Min	V <sub>O</sub> = 0.4V		-20	μA
I <sub>I</sub>	Input Current at Maximum Input Voltage	V <sub>CC</sub> = Max, V <sub>I</sub> = 7V (DM74) V <sub>I</sub> = 10V (DM54)			0.1	mA
I <sub>IH</sub>	High Level Input Current	V <sub>CC</sub> = Max, V <sub>I</sub> = 2.7V			20	μA
I <sub>IL</sub>	Low Level Input Current	V <sub>CC</sub> = Max, V <sub>I</sub> = 0.4V			-0.2	mA
I <sub>OS</sub>	Short Circuit Output Current	V <sub>CC</sub> = Max (Note 2)	-40		-225	mA
I <sub>CC</sub>	Supply Current	V <sub>CC</sub> = Max, Outputs Open	Outputs High	LS240, LS241	13	23
			Outputs Low	LS240	26	44
				LS241	27	46
			Outputs Disabled	LS240	29	50
LS241	32	54				

Note 1: All typicals are at V<sub>CC</sub> = 5V, T<sub>A</sub> = 25°C.

Note 2: Not more than one output should be shorted at a time, and the duration should not exceed one second.

**Switching Characteristics** at  $V_{CC} = 5V$  and  $T_A = 25^\circ C$  (See Section 1 for Test Waveforms and Output Load)

Symbol	Parameter	Conditions		DM54LS	DM74LS	Units
				Max	Max	
$t_{PLH}$	Propagation Delay Time Low to High Level Output	$C_L = 45 \text{ pF}$ $R_L = 667\Omega$	LS240	18	14	ns
			LS241	18	18	
$t_{PHL}$	Propagation Delay Time High to Low Level Output	$C_L = 45 \text{ pF}$ $R_L = 667\Omega$	LS240	18	18	ns
			LS241	18	18	
$t_{PZL}$	Output Enable Time to Low Level	$C_L = 45 \text{ pF}$ $R_L = 667\Omega$	LS240	30	30	ns
			LS241	30	30	
$t_{PZH}$	Output Enable Time to High Level	$C_L = 45 \text{ pF}$ $R_L = 667\Omega$	LS240	23	23	ns
			LS241	23	23	
$t_{PLZ}$	Output Disable Time from Low Level	$C_L = 5 \text{ pF}$ $R_L = 667\Omega$	LS240	25	25	ns
			LS241	25	25	
$t_{PHZ}$	Output Disable Time from High Level	$C_L = 5 \text{ pF}$ $R_L = 667\Omega$	LS240	18	18	ns
			LS241	18	18	
$t_{PLH}$	Propagation Delay Time Low to High Level Output	$C_L = 150 \text{ pF}$ $R_L = 667\Omega$	LS240		18	ns
			LS241		21	
$t_{PHL}$	Propagation Delay Time High to Low Level Output	$C_L = 150 \text{ pF}$ $R_L = 667\Omega$	LS240		22	ns
			LS241		22	
$t_{PZL}$	Output Enable Time to Low Level	$C_L = 150 \text{ pF}$ $R_L = 667\Omega$	LS240		33	ns
			LS241		33	
$t_{PZH}$	Output Enable Time to High Level	$C_L = 150 \text{ pF}$ $R_L = 667\Omega$	LS240		26	ns
			LS241		26	

Note: 54LS Output load is  $C_L = 50 \text{ pF}$  for  $t_{PLH}$ ,  $t_{PHL}$ ,  $t_{PZL}$  and  $t_{PZH}$ .