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

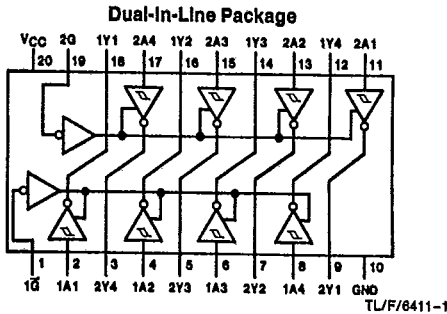
## General Description

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.

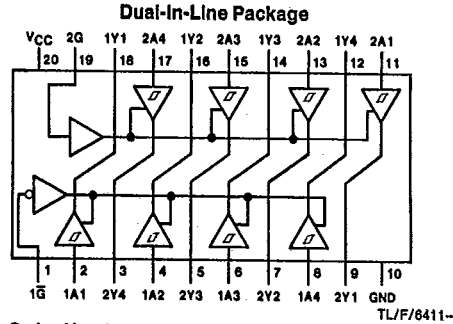
## Features

- TRI-STATE outputs drive bus lines directly
- PNP inputs reduce DC loading on bus lines
- Hysteresis at data inputs improves noise margins
- Typical  $I_{OL}$  (sink current)
  - 54LS 12 mA
  - 74LS 24 mA
- Typical  $I_{OH}$  (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

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

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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

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**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 I <sub>OL</sub> = Max	DM74 DM54 DM74		0.4 0.4 0.5	V	
I <sub>OZH</sub>	Off-State Output Current, High Level Voltage Applied	V <sub>CC</sub> = Max V <sub>IL</sub> = Max V <sub>IH</sub> = Min				20	μA	
I <sub>OZL</sub>	Off-State Output Current, Low Level Voltage Applied					-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	mA	
			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.

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**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 <sub>PLH</sub>	Propagation Delay Time Low to High Level Output	C <sub>L</sub> = 45 pF R <sub>L</sub> = 667Ω	LS240	14	ns
			LS241	18	
t <sub>PHL</sub>	Propagation Delay Time High to Low Level Output	C <sub>L</sub> = 45 pF R <sub>L</sub> = 667Ω	LS240	18	ns
			LS241	18	
t <sub>PZL</sub>	Output Enable Time to Low Level	C <sub>L</sub> = 45 pF R <sub>L</sub> = 667Ω	LS240	30	ns
			LS241	30	
t <sub>PZH</sub>	Output Enable Time to High Level	C <sub>L</sub> = 45 pF R <sub>L</sub> = 667Ω	LS240	23	ns
			LS241	23	
t <sub>PLZ</sub>	Output Disable Time from Low Level	C <sub>L</sub> = 5 pF R <sub>L</sub> = 667Ω	LS240	25	ns
			LS241	25	
t <sub>PHZ</sub>	Output Disable Time from High Level	C <sub>L</sub> = 5 pF R <sub>L</sub> = 667Ω	LS240	18	ns
			LS241	18	
t <sub>PLH</sub>	Propagation Delay Time Low to High Level Output	C <sub>L</sub> = 150 pF R <sub>L</sub> = 667Ω	LS240	18	ns
			LS241	21	
t <sub>PHL</sub>	Propagation Delay Time High to Low Level Output	C <sub>L</sub> = 150 pF R <sub>L</sub> = 667Ω	LS240	22	ns
			LS241	22	
t <sub>PZL</sub>	Output Enable Time to Low Level	C <sub>L</sub> = 150 pF R <sub>L</sub> = 667Ω	LS240	33	ns
			LS241	33	
t <sub>PZH</sub>	Output Enable Time to High Level	C <sub>L</sub> = 150 pF R <sub>L</sub> = 667Ω	LS240	26	ns
			LS241	26	

Note: 54LS Output load is C<sub>L</sub> = 50 pF for t<sub>PLH</sub>, t<sub>PHL</sub>, t<sub>PZL</sub> and t<sub>PZH</sub>.