

74LS240, 74LS241, S240, S241 Buffers

'240 Octal Inverter Buffer (3-State)
'241 Octal Buffer (3-State)
Product Specification

FUNCTION TABLE, '240

INPUTS				OUTPUTS	
\overline{OE}_a	I_a	\overline{OE}_b	I_b	\overline{Y}_a	\overline{Y}_b
L	L	L	L	H	H
L	H	L	H	L	L
H	X	H	X	(Z)	(Z)

FUNCTION TABLE, '241

INPUTS				OUTPUTS	
\overline{OE}_a	I_a	\overline{OE}_b	I_b	Y_a	Y_b
L	L	H	L	L	L
L	H	H	H	H	H
H	X	L	X	(Z)	(Z)

H = HIGH voltage level
L = LOW voltage level
X = Don't care
(Z) = HIGH impedance (off) state

TYPE	TYPICAL PROPAGATION DELAY	TYPICAL SUPPLY CURRENT (TOTAL)
74LS240	11ns	24mA
74S240	4.5ns	93mA
74LS241	12ns	25mA
74S241	6ns	112mA

ORDERING CODE

PACKAGES	COMMERCIAL RANGE $V_{CC} = 5V \pm 5\%$; $T_A = 0^\circ C$ to $+70^\circ C$
Plastic DIP	N74LS240N, N74S240N N74LS241N, N74S241N
Plastic SOL-20	N74LS240D, N74S240D N74LS241D, N74S241D

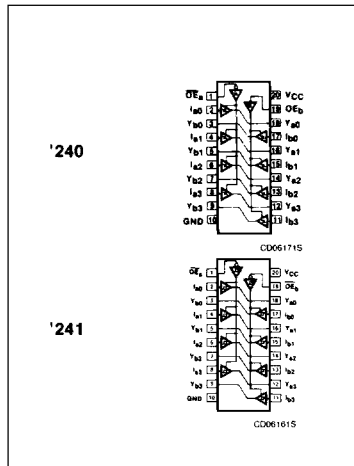
NOTE:
For information regarding devices processed to Military Specifications, see the Signetics Military Products Data Manual.

INPUT AND OUTPUT LOADING AND FAN-OUT TABLE

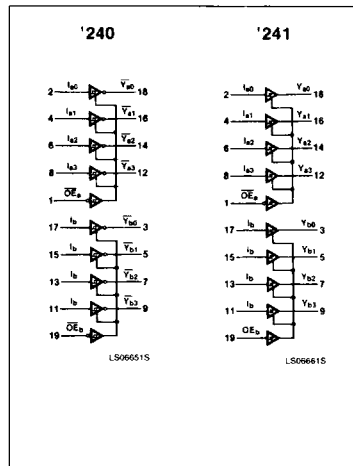
PINS	DESCRIPTION	74S	74LS
$I_{a0} - I_{a3}, I_{b0} - I_{b3}$	Inputs	1Sul	1LSul
$\overline{OE}_a, \overline{OE}_b, OE_b$	Inputs	1Sul	1LSul
All	Outputs	24Sul	32LSul

NOTE:
A 74S unit load (Sul) is 50 μ A I_{IH} and -2.0mA I_{IL} and a 74LS unit load (LSul) is 20 μ A I_{IH} and -0.4mA I_{IL} .

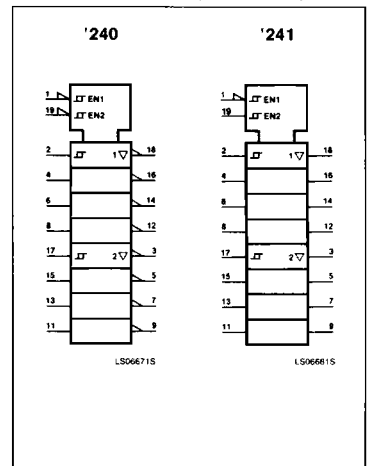
PIN CONFIGURATION



LOGIC SYMBOL



LOGIC SYMBOL (IEEE/IEC)



Buffers

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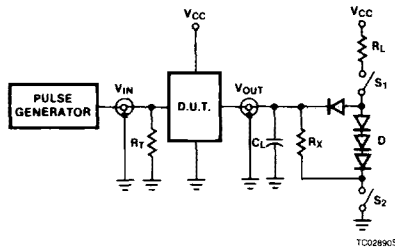
ABSOLUTE MAXIMUM RATINGS (Over operating free-air temperature range unless otherwise noted.)

PARAMETER		74LS	74S	UNIT
V _{CC}	Supply voltage	7.0	7.0	V
V _{IN}	Input voltage	-0.5 to +7.0	-0.5 to +5.5	V
I _{IN}	Input current	-30 to +1	-30 to +5	mA
V _{OUT}	Voltage applied to output in HIGH output state	-0.5 to +V _{CC}	-0.5 to +V _{CC}	V
T _A	Operating free-air temperature range	0 to 70		°C

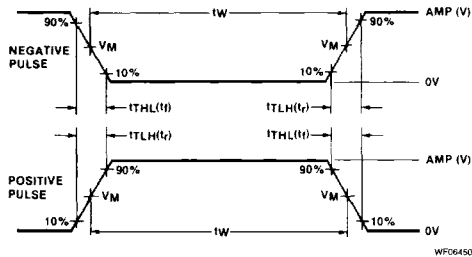
RECOMMENDED OPERATING CONDITIONS

PARAMETER	74LS			74S			UNIT
	Min	Nom	Max	Min	Nom	Max	
V _{CC}	4.75	5.0	5.25	4.75	5.0	5.25	V
V _{IH}	2.0			2.0			V
V _{IL}			+0.8			+0.8	V
I _{IK}			-18			-18	mA
I _{OH}			-15			-15	mA
I _{OL}			24			64	mA
T _A	0		70	0		70	°C
External resistance between any input or V _{CC} and ground							
						40	kΩ

TEST CIRCUITS AND WAVEFORMS



Test Circuit For 3-State Outputs



V_M = 1.3V for 74LS; V_M = 1.5V for all other TTL families.

Input Pulse Definition

SWITCH POSITION

TEST	SWITCH 1	SWITCH 2
t _{PZH}	Open	Closed
t _{PZL}	Closed	Open
t _{PHZ}	Closed	Closed
t _{PLZ}	Closed	Closed

DEFINITIONS

R_L = Load resistor to V_{CC}; see AC CHARACTERISTICS for value.

C_L = Load capacitance includes jig and probe capacitance; see AC CHARACTERISTICS for value.

R_T = Termination resistance should be equal to Z_{OUT} of Pulse Generators.

D = Diodes are 1N916, 1N3064, or equivalent.

t_{TLH}, t_{THL} Values should be less than or equal to the table entries.

FAMILY	INPUT PULSE REQUIREMENTS				
	Amplitude	Rep. Rate	Pulse Width	t _{TLH}	t _{THL}
74	3.0V	1MHz	500ns	7ns	7ns
74LS	3.0V	1MHz	500ns	15ns	6ns
74S	3.0V	1MHz	500ns	2.5ns	2.5ns

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DC ELECTRICAL CHARACTERISTICS (Over recommended operating free-air temperature range unless otherwise noted.)

PARAMETER	TEST CONDITIONS ¹		74LS240,241			74S240, 241			UNIT		
			Min	Typ ²	Max	Min	Typ ²	Max			
ΔV_T Hysteresis ($V_{T+} - V_{T-}$)	$V_{CC} = \text{MIN}$		0.2	0.4		0.2	0.4		V		
V_{OH} HIGH-level output voltage	$V_{CC} = \text{MIN}, V_{IH} = \text{MIN}, V_{IL} = 0.5V, I_{OH} = \text{MAX}$		2.0			2.0			V		
	$V_{CC} = \text{MIN}, V_{IH} = \text{MIN}, V_{IL} = \text{MAX}$	$I_{OH} = -3\text{mA}$	2.4	3.4		2.4	3.4		V		
		$I_{OH} = -1\text{mA} (74S)$				2.7			V		
V_{OL} LOW-level output voltage	$V_{CC} = \text{MIN}, V_{IH} = \text{MIN}, V_{IL} = \text{MAX}$				0.5		0.55		V		
	$I_{OL} = \text{MAX}$				0.4				V		
V_{IK} Input clamp voltage	$V_{CC} = \text{MIN}, I_I = I_{IK}$				-1.5		-1.2		V		
I_{OZH} Off-state output current, HIGH-level voltage applied	$V_{CC} = \text{MAX}, V_{IH} = \text{MIN}, V_{IL} = \text{MAX}$		$V_O = 2.4V$				50		μA		
			$V_O = 2.7V$		20				μA		
I_{OZL} Off-state output current, LOW-level voltage applied	$V_{CC} = \text{MAX}, V_{IH} = \text{MIN}, V_{IL} = \text{MAX}$		$V_O = 0.4V$		-20				μA		
			$V_O = 0.5V$				-50		μA		
I_I Input current at maximum input voltage	$V_{CC} = \text{MAX}$		$V_I = 5.5V$				1.0		mA		
			$V_I = 7.0V$		0.1				mA		
I_{IH} HIGH-level input current	$V_{CC} = \text{MAX}, V_I = 2.7V$				20		50		μA		
I_{IL} LOW-level input current	$V_{CC} = \text{MAX}$	$V_I = 0.4V$				-0.2			mA		
		$V_I = 0.5V$	$I_{a0} - I_{a3}, I_{b0} - I_{b3}$ inputs					-400		μA	
			$\overline{OE}_a, \overline{OE}_b, OE_b$ inputs					-2		mA	
I_{OS} Short-circuit output current ³	$V_{CC} = \text{MAX}$		-40		-130	-80	-180		mA		
I_{CC} Supply current ⁴ (total)	$V_{CC} = \text{MAX}$	I_{CCH}	'LS240		17	27				mA	
				I_{CCL}		26	44				mA
					I_{CCZ}		29	50			
		I_{CCH}	'LS241				17	27			
				I_{CCL}			27	46			
					I_{CCZ}		32	54			
		I_{CCH}	'S240						80	135	
				I_{CCL}					100	150	
					I_{CCZ}				100	150	
		I_{CCH}	'S241						95	160	
				I_{CCL}					120	180	
					I_{CCZ}				120	180	

NOTES:

1. For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions for the applicable type.
2. All typical values are at $V_{CC} = 5V, T_A = 25^\circ\text{C}$.
3. I_{OS} is tested with $V_{OUT} = +0.5V$ and $V_{CC} = V_{CC} \text{ MAX} + 0.5V$. Not more than one output should be shorted at a time and duration of the short circuit should not exceed one second.
4. I_{CC} is measured with outputs open.

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AC ELECTRICAL CHARACTERISTICS $T_A = 25^\circ\text{C}$, $V_{CC} = 5.0\text{V}$

PARAMETER	TEST CONDITIONS	74LS		74S		UNIT
		$C_L = 45\text{pF}$, $R_L = 667\Omega$		$C_L = 50\text{pF}$, $R_L = 90\Omega$		
		Min	Max	Min	Max	
t_{PLH} t_{PHL}	Propagation delay	Waveform 1, '240		14 18	7 7	ns
t_{PLH} t_{PHL}	Propagation delay	Waveform 2, '241		18 18	9 9	ns
t_{PZH}	Enable to HIGH	Waveform 3	LS	23		ns
			'S240		10	ns
			'S241		12	ns
t_{PZL}	Enable to LOW	Waveform 4		30	15	ns
t_{PHZ}	Disable from HIGH	Waveform 3, $C_L = 5\text{pF}$		18	9	ns
t_{PLZ}	Disable from LOW	Waveform 4, $C_L = 5\text{pF}$		25	15	ns

AC WAVEFORMS

