

74154, LS154 Decoder/Demultiplexers

1-of-16 Decoder/Demultiplexer
Product Specification

Logic Products

FEATURES

- 16-line demultiplexing capability
- Mutually exclusive outputs
- 2-input enable gate for strobing or expansion

DESCRIPTION

The '154 decoder accepts four active HIGH binary address inputs and provides 16 mutually exclusive active LOW outputs. The 2-input enable gate can be used to strobe the decoder to eliminate the normal decoding "glitches" on the outputs, or it can be used for expansion of the decoder. The enable gate has two AND'ed inputs which must be LOW to enable the outputs.

The '154 can be used as a 1-of-16 demultiplexer by using one of the enable inputs as the multiplexed data input. When the other enable is LOW, the addressed output will follow the state of the applied data.

TYPE	TYPICAL PROPAGATION DELAY	TYPICAL SUPPLY CURRENT (TOTAL)
74154	21ns	34mA
74LS154	15ns	9mA

ORDERING CODE

PACKAGES	COMMERCIAL RANGE $V_{CC} = 5V \pm 5\%$; $T_A = 0^\circ C$ to $+70^\circ C$
Plastic DIP	N74154N, N74LS154N

NOTE:

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

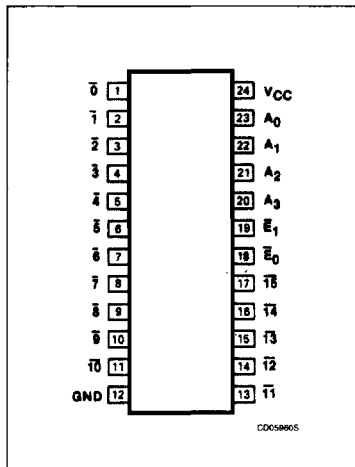
INPUT AND OUTPUT LOADING AND FAN-OUT TABLE

PINS	DESCRIPTION	74	74LS
All	Inputs	1uI	1LSuI
All	Outputs	10uI	10LSuI

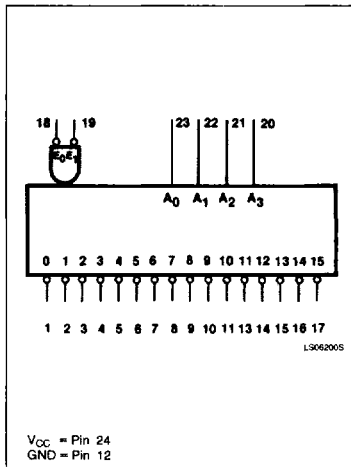
NOTE:

Where a 74 unit load (uI) is understood to be $40\mu A$ I_{IH} and $-1.6mA$ I_{IL} , and a 74LS unit load (LSuI) is $20\mu A$ I_{IH} and $-0.4mA$ I_{IL} .

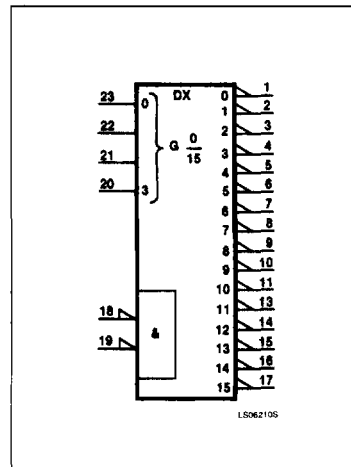
PIN CONFIGURATION



LOGIC SYMBOL



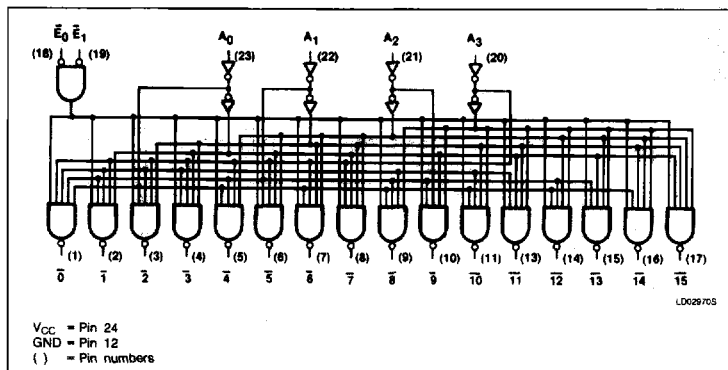
LOGIC SYMBOL (IEEE/IEC)



Decoder/Demultiplexers

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LOGIC DIAGRAM



FUNCTION TABLE

INPUTS						OUTPUT															
E ₀	E ₁	A ₃	A ₂	A ₁	A ₀	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
L	H	X	X	X	X	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
H	L	X	X	X	X	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
H	H	X	X	X	X	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
L	L	L	L	L	L	L	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
L	L	L	L	L	L	H	L	H	H	H	H	H	H	H	H	H	H	H	H	H	H
L	L	L	L	L	H	L	H	H	L	H	H	H	H	H	H	H	H	H	H	H	H
L	L	L	L	L	H	H	H	H	L	H	H	H	H	H	H	H	H	H	H	H	H
L	L	L	L	H	L	L	H	L	H	L	H	H	H	H	H	H	H	H	H	H	H
L	L	L	L	H	H	L	H	L	H	L	H	H	H	H	H	H	H	H	H	H	H
L	L	L	L	H	H	H	L	H	H	L	H	H	H	H	H	H	H	H	H	H	H
L	L	L	L	H	H	H	H	L	H	L	H	H	H	H	H	H	H	H	H	H	H
L	L	L	L	H	L	L	L	H	H	L	H	H	H	H	H	H	H	H	H	H	H
L	L	L	L	H	L	L	L	H	H	L	H	H	H	H	L	H	H	H	H	H	H
L	L	L	L	H	L	L	L	H	H	L	H	H	H	H	H	L	H	H	H	H	H
L	L	L	L	H	L	L	L	H	H	L	H	H	H	H	H	H	L	H	H	H	H
L	L	L	L	H	L	L	L	H	H	L	H	H	H	H	H	H	H	L	H	H	H
L	L	L	L	H	L	L	L	H	H	L	H	H	H	H	H	H	H	H	L	H	H
L	L	L	L	H	L	L	L	H	H	L	H	H	H	H	H	H	H	H	H	L	H
L	L	L	L	H	L	L	L	H	H	L	H	H	H	H	H	H	H	H	H	H	L

H = HIGH voltage level

L = LOW voltage level

X = Don't care

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

PARAMETER	74	74LS	UNIT
V_{CC} Supply voltage	7.0	7.0	V
V_{IN} Input voltage	-0.5 to +5.5	-0.5 to +7.0	V
I_{IN} Input current	-30 to +5	-30 to +1	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

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RECOMMENDED OPERATING CONDITIONS

PARAMETER		74			74LS			UNIT
		Min	Nom	Max	Min	Nom	Max	
V_{CC}	Supply voltage	4.75	5.0	5.25	4.75	5.0	5.25	V
V_{IH}	HIGH-level input voltage	2.0			2.0			V
V_{IL}	LOW-level input voltage			+0.8			+0.8	V
I_{IK}	Input clamp current			-12			-18	mA
I_{OH}	HIGH-level output current			-800			-400	μ A
I_{OL}	LOW-level output current			16			8	mA
T_A	Operating free-air temperature	0		70	0		70	$^{\circ}$ C

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

PARAMETER	TEST CONDITIONS ¹		74154			74LS154			UNIT
			Min	Typ ²	Max	Min	Typ ²	Max	
V_{OH}	HIGH-level output voltage	$V_{CC} = \text{MIN}, V_{IH} = \text{MIN}, V_{IL} = \text{MAX}, I_{OH} = \text{MAX}$	2.4	3.4		2.7	3.4		V
V_{OL}	LOW-level output voltage	$V_{CC} = \text{MIN}, V_{IH} = \text{MIN}, V_{IL} = \text{MAX}, I_{OL} = \text{MAX}$		0.2	0.4		0.35	0.5	V
		$I_{OL} = 4\text{mA (74LS)}$					0.25	0.4	V
V_{IK}	Input clamp voltage	$V_{CC} = \text{MIN}, I_I = I_{IK}$			-1.5			-1.5	V
I_I	Input current at maximum input voltage	$V_{CC} = \text{MAX}, V_I = 5.5\text{V}$			1.0				mA
		$V_I = 7.0\text{V}$						0.1	mA
I_{IH}	HIGH-level input current	$V_{CC} = \text{MAX}, V_I = 2.4\text{V}$			40				μ A
		$V_I = 2.7\text{V}$						20	μ A
I_{IL}	LOW-level input current	$V_{CC} = \text{MAX}, V_I = 0.4\text{V}$			-1.6			-0.4	mA
I_{OS}	Short-circuit output current ³	$V_{CC} = \text{MAX}$	-18		-57	-15		-100	mA
I_{CC}	Supply current ⁴ (total)	$V_{CC} = \text{MAX}$		34	56		9	14	mA

NOTES:

1. For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions for the applicable type.

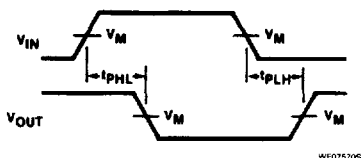
2. All typical values are at $V_{CC} = 5\text{V}$, $T_A = 25^{\circ}\text{C}$.3. I_{OS} is tested with $V_{OUT} = +0.5\text{V}$ and $V_{CC} = V_{CC\text{ MAX}} + 0.5\text{V}$. Not more than one output should be shorted at a time and duration of the short circuit should not exceed one second.4. Measure I_{CC} with all inputs grounded and all outputs open.AC ELECTRICAL CHARACTERISTICS $T_A = 25^{\circ}\text{C}$, $V_{CC} = 5.0\text{V}$

PARAMETER		TEST CONDITIONS	74		74LS		UNIT
			$C_L = 15\text{pF}, R_L = 400\Omega$		$C_L = 15\text{pF}, R_L = 2\text{k}\Omega$		
			Min	Max	Min	Max	
t_{PLH}	Propagation delay	Waveform 1		36		36	ns
t_{PHL}	Address to output			33		33	
t_{PLH}	Propagation delay	Waveform 2		30		30	ns
t_{PHL}	Enable to output			27		27	

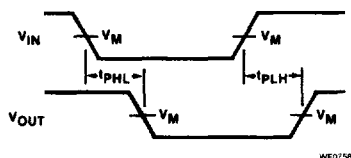
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AC WAVEFORMS

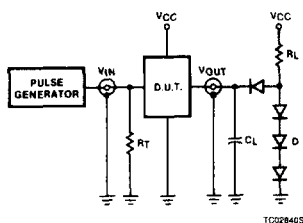

 $V_M = 1.3V$ for 74LS; $V_M = 1.5V$ for all other TTL families.

Waveform 1. Waveform For Inverting Outputs


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

Waveform 2. Waveform For Non-Inverting Outputs

TEST CIRCUITS AND WAVEFORMS



Test Circuit For 74 Totem-Pole Outputs

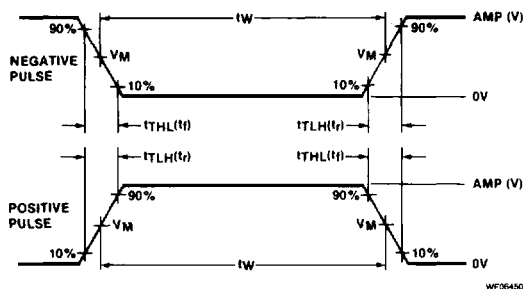
DEFINITIONS

 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.

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

Input Pulse Definition

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