

## DUAL 1-OF-4 DECODER/DEMULTIPLEXER

- SCHOTTKY PROCESS FOR HIGH SPEED
- MULTIFUNCTION CAPABILITY
- COMMON ADDRESS INPUTS
- TRUE OR COMPLEMENT DATA DEMULTIPLEXING
- INPUT CLAMP DIODES LIMIT HIGH SPEED TERMINATION EFFECTS
- FULLY TTL AND CMOS COMPATIBLE

### DESCRIPTION

The TTL/MSI T74LS155 and T74LS156 are high speed Dual 1-of-4 Decoder/Demultiplexers. These devices have two decoders with common 2-bit Address inputs and separate gated Enable inputs.

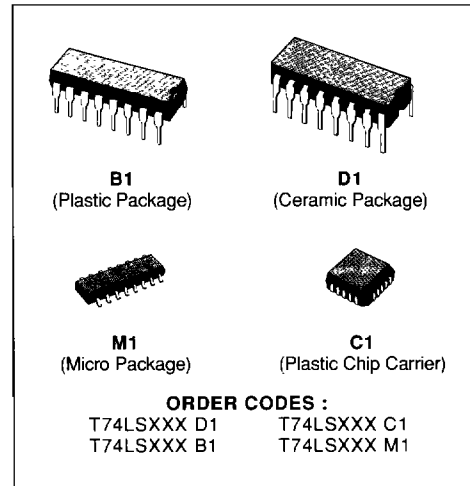
Decoder "a" has an Enable gate with one active HIGH and one active LOW input. Decoder "b" has two active LOW Enable inputs. If the Enable functions are satisfied, one input of each decoder will be LOW as selected by the address inputs. The LS156 has open collector outputs for wired-OR (DOT-

AND) decoding and function generator applications.

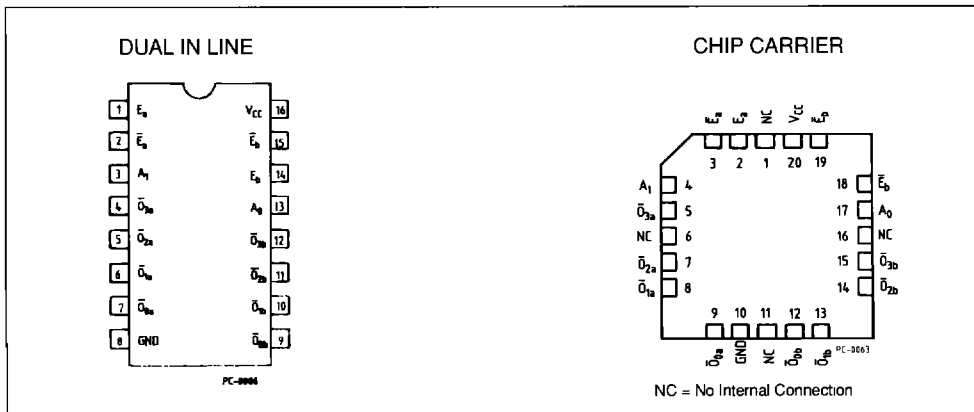
The LS155 and LS156 are fabricated with the Schottky barrier diode process for high speed and are completely compatible with all TTL families.

### PIN NAMES

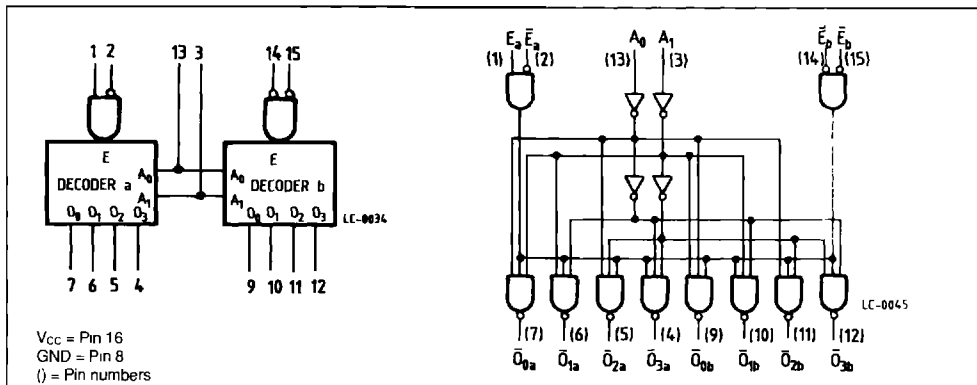
$A_0 - A_1$	ADDRESS INPUTS
$E_a - \bar{E}_b$	ENABLE (active LOW) INPUTS
$\bar{E}_a$	ENABLE (active HIGH) INPUT
$O_0 - O_3$	ACTIVE LOW OUTPUTS



### PIN CONNECTION (top view)



LOGIC SYMBOL AND LOGIC DIAGRAM



ABSOLUTE MAXIMUM RATING

Symbol	Parameter	Value	Unit
V <sub>CC</sub>	Supply Voltage	- 0.5 to 7	V
V <sub>I</sub>	Input Voltage. Applied to Input	LS155	- 0.5 to 15
		LS156	- 1.5 to 5.5
V <sub>O</sub>	Output Voltage. Applied to Output	- 0.5 to 10	V
I <sub>I</sub>	Input Current. into Inputs	- 30 to 5	mA
I <sub>O</sub>	Output Current. into Outputs	50	mA

Stresses in excess of those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions in excess of those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

GUARANTEED OPERATING RANGE

Part Numbers	Supply Voltage			Temperature
	Min.	Typ.	Max.	
T74LS155/156XX	4.75 V	5.0 V	5.25 V	0 °C to + 70 °C

XX = package type.

## FUNCTIONAL DESCRIPTION

The LS155 and LS156 are Dual 1-of-4 Decoder/demultiplexer with common Address inputs and separate gated Enable inputs. When enabled, each decoder section accepts the binary weighted Address inputs ( $A_0$ - $A_1$ ) and provides four mutually exclusive active LOW outputs ( $O_0$ - $O_3$ ). If the Enable requirements of each decoder are not met, all outputs of that decoder are HIGH.

Each decoder section has a 2-input enable gate. The enable gate for Decoder "a" requires one active HIGH input and one active LOW input ( $\bar{E}_a \bullet E_a$ ). In demultiplexing applications, Decoder "a" can accept either true or complemented data by using the

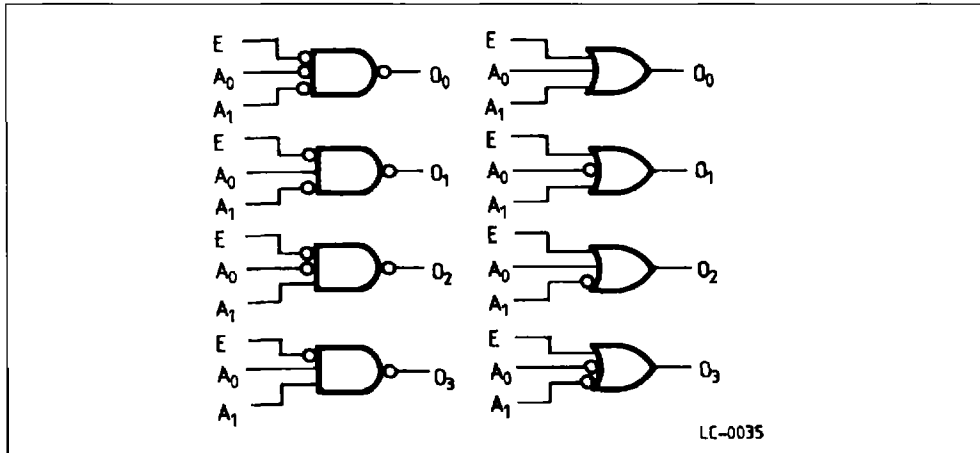
$\bar{E}_a$  or  $\bar{E}_a$  inputs respectively. The enable gate for Decoder "b" requires two active LOW inputs ( $\bar{E}_b \bullet \bar{E}_b$ ). The LS155 or LS156 can be used as a 1-of-8 Decoder/Demultiplexer by tying  $\bar{E}_a$  to  $\bar{E}_b$  and relabeling the common connection as ( $A_2$ ). The other  $\bar{E}_b$  to  $\bar{E}_a$  are connected together to form the common enable.

The LS155 and LS156 can be used to generate all four minterms of two variables. These four minterms are used in some applications replacing multiple gate functions as shown in Fig. 1. The LS156 has the further advantage of being able to AND the minterm functions by tying outputs together. Any number of terms can be wired-AND as shown below.

$$f = (E + A_0 + A_1) \bullet (E + \bar{A}_0 + A_1) \bullet (E + A_0 + \bar{A}_1) \bullet (E + \bar{A}_0 + \bar{A}_1)$$

where  $E = E_a + \bar{E}_a$ ;  $E = E_b + \bar{E}_b$

Figure 1.



## TRUTH TABLE

Address		Enable "a"		Output "a"				Enable "b"		Output "b"			
A <sub>0</sub>	A <sub>1</sub>	E <sub>a</sub>	$\bar{E}_a$	O <sub>0</sub>	O <sub>1</sub>	O <sub>2</sub>	O <sub>3</sub>	$\bar{E}_b$	$\bar{E}_b$	O <sub>0</sub>	O <sub>1</sub>	O <sub>2</sub>	O <sub>3</sub>
X	X	L	X	H	H	H	H	H	X	H	H	H	H
X	X	X	H	H	H	H	H	X	H	H	H	H	H
L	L	H	L	L	H	H	H	L	L	L	H	H	H
H	L	H	L	H	L	H	H	L	L	H	L	H	H
L	H	H	L	H	H	L	H	L	L	H	H	L	H
H	H	H	L	H	H	H	L	L	L	H	H	H	L

H = HIGH Voltage Level  
L = LOW Voltage Level  
X = Don't Care

## DC CHARACTERISTICS OVER OPERATING TEMPERATURE RANGE

Symbol	Parameter	Limits			Test Condition (note 1)	Unit	
		Min.	Typ. (*)	Max.			
V <sub>IH</sub>	Input HIGH Voltage	2.0			Guaranteed Input HIGH Threshold Voltage for All Inputs	V	
V <sub>IL</sub>	Input LOW Voltage			0.8	Guaranteed Input LOW Threshold Voltage for All Inputs	V	
V <sub>CD</sub>	Input Clamp Diode Voltage		- 0.65	- 1.5	V <sub>CC</sub> = MIN, I <sub>IN</sub> = -18 mA	V	
V <sub>OH</sub>	Output HIGH Voltage for LS155 Only	2.7	3.4		V <sub>CC</sub> = MIN, I <sub>OH</sub> = - 400 μA V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> per Truth Table	V	
I <sub>OH</sub>	Output HIGH Current for LS156 Only			100	V <sub>CC</sub> = MIN, V <sub>OH</sub> = - 5.5 V V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> per Truth Table	μA	
V <sub>OL</sub>	Output LOW Voltage		0.25	0.4	I <sub>OL</sub> = 4.0 mA	V <sub>CC</sub> = MIN, V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> per Truth Table	V
			0.35	0.5	I <sub>OL</sub> = 8.0 mA		V
I <sub>IH</sub>	Input HIGH Current			20 0.1	V <sub>CC</sub> = MAX, V <sub>IN</sub> = 2.7 V V <sub>CC</sub> = MAX, V <sub>IN</sub> = 7.0 V	μA mA	
I <sub>IL</sub>	Input LOW Current			- 0.4	V <sub>CC</sub> = MAX, V <sub>IN</sub> = 0.4 V	mA	
I <sub>OS</sub>	Output Short Circuit Current (note 2)	- 20		- 100	V <sub>CC</sub> = MAX, V <sub>OUT</sub> = 0 V	mA	
I <sub>CC</sub>	Power Supply Current		6.0	10	V <sub>CC</sub> = MAX	mA	

Notes : 1. Conditions for testing, not shown in the Table, are chosen to guarantee operation under "worst case" conditions.

2. Not more than one output should be shorted at a time.

(\*) Typical values are at V<sub>CC</sub> = 5.0 V, T<sub>A</sub> = 25 °C.

AC CHARACTERISTICS : T<sub>A</sub> = 25 °C

Symbol	Parameter	Limits				Test Conditions	Unit	
		LS155		LS156				
		Typ.	Max.	Typ.	Max.			
t <sub>PLH</sub> t <sub>PHL</sub>	Propagation Delay, Address to Output	17 19	26 30	31 34	46 51	Fig. 2	V <sub>CC</sub> = 5.0 V C <sub>L</sub> = 15 pF R <sub>L</sub> = 2 kΩ (only LS156)	ns
t <sub>PLH</sub> t <sub>PHL</sub>	Propagation Delay, E <sub>a</sub> or E <sub>b</sub> to Output	10 19	15 30	25 34	40 51	Fig. 3		ns
t <sub>PLH</sub> t <sub>PHL</sub>	Propagation Delay, E <sub>a</sub> to Output	18 18	27 27	32 32	48 48	Fig. 2		ns

## AC WAVEFORMS

Figure 2.

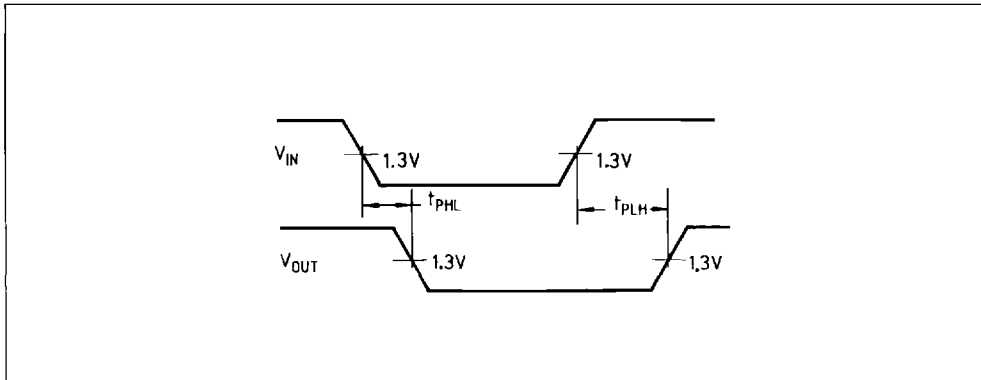


Figure 3.

