

# SN74LS156

## Dual 1-of-4 Decoder/ Demultiplexer

The SN74LS156 is a high speed Dual 1-of-4 Decoder/Demultiplexer. This device has 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 output 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 LS156 is fabricated with the Schottky barrier diode process for high speed and are completely compatible with all ON Semiconductor TTL families.

- Schottky Process for High Speed
- Multifunction Capability
- Common Address Inputs
- True or Complement Data Demultiplexing
- Input Clamp Diodes Limit High Speed Termination Effects
- ESD > 3500 Volts

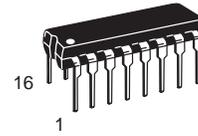
### GUARANTEED OPERATING RANGES

Symbol	Parameter	Min	Typ	Max	Unit
V <sub>CC</sub>	Supply Voltage	4.75	5.0	5.25	V
T <sub>A</sub>	Operating Ambient Temperature Range	0	25	70	°C
V <sub>OH</sub>	Output Voltage – High			5.5	V
I <sub>OL</sub>	Output Current – Low			8.0	mA

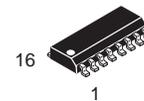


**ON Semiconductor**  
Formerly a Division of Motorola  
<http://onsemi.com>

### LS156–OPEN–COLLECTOR LOW POWER SCHOTTKY



PLASTIC  
N SUFFIX  
CASE 648



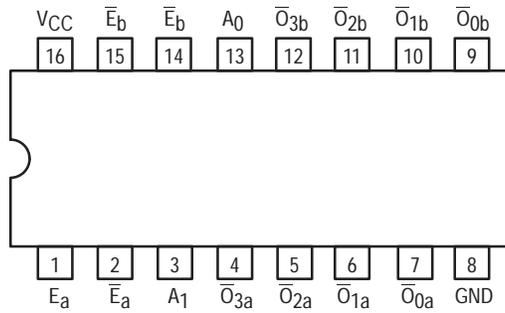
SOIC  
D SUFFIX  
CASE 751B

### ORDERING INFORMATION

Device	Package	Shipping
SN74LS156N	16 Pin DIP	2000 Units/Box
SN74LS156D	16 Pin	2500/Tape & Reel

# SN74LS156

## CONNECTION DIAGRAM DIP (TOP VIEW)



NOTE:  
The Flatpak version has the same pinouts (Connection Diagram) as the Dual In-Line Package.

### PIN NAMES

$A_0, A_1$	Address Inputs
$\bar{E}_a, \bar{E}_b$	Enable (Active LOW) Inputs
$E_a$	Enable (Active HIGH) Input
$\bar{O}_0 - \bar{O}_3$	Active LOW Outputs

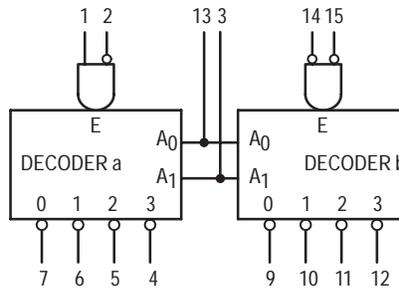
### LOADING (Note a)

	HIGH	LOW
$A_0, A_1$	0.5 U.L.	0.25 U.L.
$\bar{E}_a, \bar{E}_b$	0.5 U.L.	0.25 U.L.
$E_a$	0.5 U.L.	0.25 U.L.
$\bar{O}_0 - \bar{O}_3$	10 U.L.	5 U.L.

### NOTES:

a) 1 TTL Unit Load (U.L.) = 40  $\mu$ A HIGH/1.6 mA LOW.

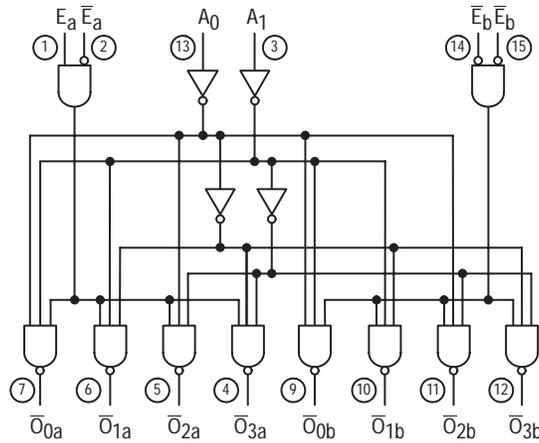
### LOGIC SYMBOL



$V_{CC}$  = PIN 16  
GND = PIN 8

# SN74LS156

## LOGIC DIAGRAM



V<sub>CC</sub> = PIN 16  
 GND = PIN 8  
 ○ = PIN NUMBERS

### FUNCTIONAL DESCRIPTION

The LS156 is a 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<sub>0</sub>, A<sub>1</sub>) and provides four mutually exclusive active LOW outputs ( $\bar{O}_0$ – $\bar{O}_3$ ). 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 ( $E_a \bullet \bar{E}_a$ ). In demultiplexing applications, Decoder “a” can accept either true or complemented data by using the  $\bar{E}_a$  or  $E_a$  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  $E_a$  to  $\bar{E}_b$  and relabeling the common connection as (A<sub>2</sub>). The other  $\bar{E}_b$  and  $\bar{E}_a$  are connected together to form the common enable.

The LS156 can be used to generate all four minterms of two variables. These four minterms are useful in some applications replacing multiple gate functions as shown in

Fig. a. 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.

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

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

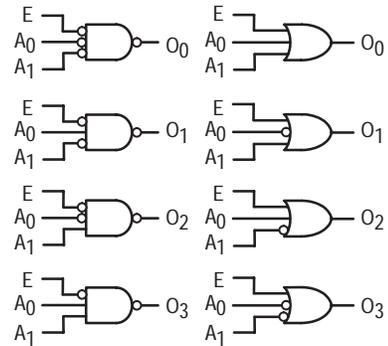


Figure a

### TRUTH TABLE

ADDRESS		ENABLE “a”		OUTPUT “a”				ENABLE “b”		OUTPUT “b”			
A <sub>0</sub>	A <sub>1</sub>	E <sub>a</sub>	$\bar{E}_a$	$\bar{O}_0$	$\bar{O}_1$	$\bar{O}_2$	$\bar{O}_3$	$\bar{E}_b$	$\bar{E}_b$	$\bar{O}_0$	$\bar{O}_1$	$\bar{O}_2$	$\bar{O}_3$
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

# SN74LS156

## DC CHARACTERISTICS OVER OPERATING TEMPERATURE RANGE (unless otherwise specified)

Symbol	Parameter	Limits			Unit	Test Conditions
		Min	Typ	Max		
$V_{IH}$	Input HIGH Voltage	2.0			V	Guaranteed Input HIGH Voltage for All Inputs
$V_{IL}$	Input LOW Voltage			0.8	V	Guaranteed Input LOW Voltage for All Inputs
$V_{IK}$	Input Clamp Diode Voltage		-0.65	-1.5	V	$V_{CC} = \text{MIN}$ , $I_{IN} = -18 \text{ mA}$
$I_{OH}$	Output HIGH Current			100	$\mu\text{A}$	$V_{CC} = \text{MIN}$ , $V_{OH} = \text{MAX}$
$V_{OL}$	Output LOW Voltage		0.25	0.4	V	$I_{OL} = 4.0 \text{ mA}$
			0.35	0.5	V	$I_{OL} = 8.0 \text{ mA}$
$I_{IH}$	Input HIGH Current			20	$\mu\text{A}$	$V_{CC} = \text{MAX}$ , $V_{IN} = 2.7 \text{ V}$
				0.1	mA	$V_{CC} = \text{MAX}$ , $V_{IN} = 7.0 \text{ V}$
$I_{IL}$	Input LOW Current			-0.4	mA	$V_{CC} = \text{MAX}$ , $V_{IN} = 0.4 \text{ V}$
$I_{CC}$	Power Supply Current			10	mA	$V_{CC} = \text{MAX}$

## AC CHARACTERISTICS ( $T_A = 25^\circ\text{C}$ )

Symbol	Parameter	Limits			Unit	Test Conditions
		Min	Typ	Max		
$t_{PLH}$ $t_{PHL}$	Propagation Delay Address, $E_A$ or $E_B$ to Output		25 34	40 51	ns	$V_{CC} = 5.0 \text{ V}$ $C_L = 15 \text{ pF}$ $R_L = 2.0 \text{ k}\Omega$
$t_{PLH}$ $t_{PHL}$	Propagation Delay Address to Output		31 34	46 51	ns	
$t_{PLH}$ $t_{PHL}$	Propagation Delay $E_A$ to Output		32 32	48 48	ns	

## AC WAVEFORMS

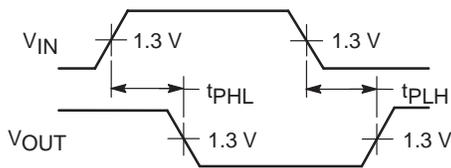


Figure 1.

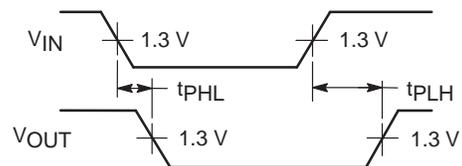
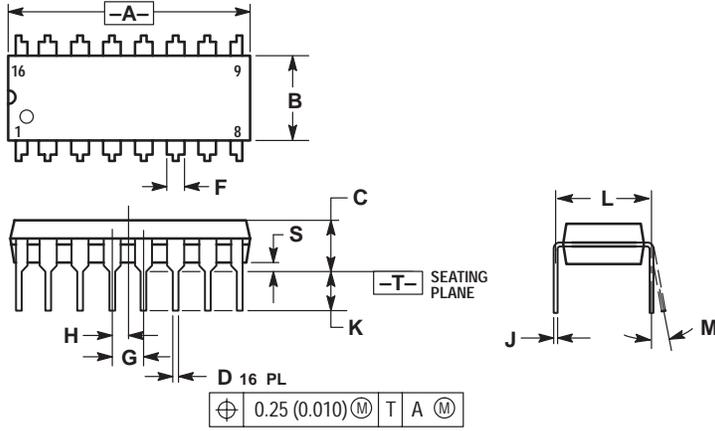


Figure 2.

# SN74LS156

## PACKAGE DIMENSIONS

**N SUFFIX**  
**PLASTIC PACKAGE**  
**CASE 648-08**  
**ISSUE R**



**NOTES:**

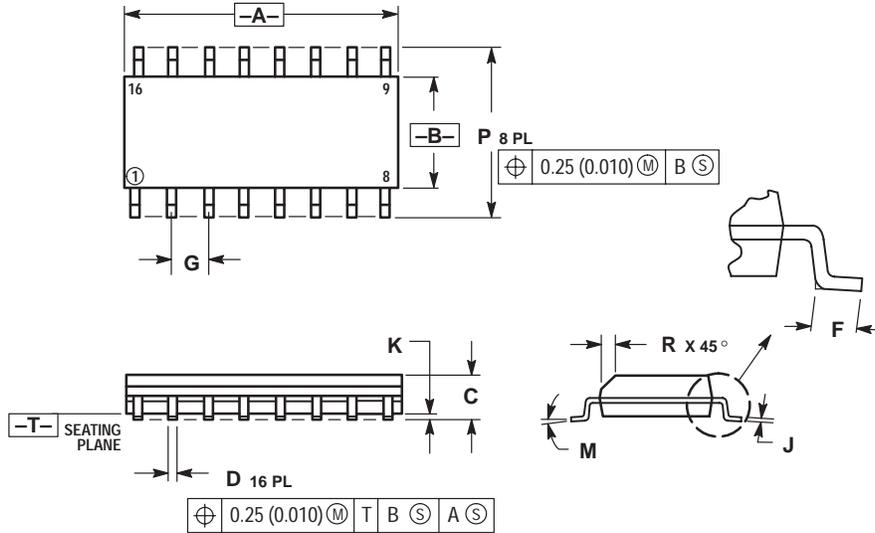
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION L TO CENTER OF LEADS WHEN FORMED PARALLEL.
4. DIMENSION B DOES NOT INCLUDE MOLD FLASH.
5. ROUNDED CORNERS OPTIONAL.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.740	0.770	18.80	19.55
B	0.250	0.270	6.35	6.85
C	0.145	0.175	3.69	4.44
D	0.015	0.021	0.39	0.53
F	0.040	0.70	1.02	1.77
G	0.100 BSC		2.54 BSC	
H	0.050 BSC		1.27 BSC	
J	0.008	0.015	0.21	0.38
K	0.110	0.130	2.80	3.30
L	0.295	0.305	7.50	7.74
M	0° 10°		0° 10°	
S	0.020	0.040	0.51	1.01

# SN74LS156

## PACKAGE DIMENSIONS

### D SUFFIX PLASTIC SOIC PACKAGE CASE 751B-05 ISSUE J



#### NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSIONS A AND B DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
5. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 (0.005) TOTAL IN EXCESS OF THE D DIMENSION AT MAXIMUM MATERIAL CONDITION.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	9.80	10.00	0.386	0.393
B	3.80	4.00	0.150	0.157
C	1.35	1.75	0.054	0.068
D	0.35	0.49	0.014	0.019
F	0.40	1.25	0.016	0.049
G	1.27 BSC		0.050 BSC	
J	0.19	0.25	0.008	0.009
K	0.10	0.25	0.004	0.009
M	0° 7°		0° 7°	
P	5.80	6.20	0.229	0.244
R	0.25	0.50	0.010	0.019

**Notes**

**ON Semiconductor** and  are trademarks of Semiconductor Components Industries, LLC (SCILLC). SCILLC reserves the right to make changes without further notice to any products herein. SCILLC makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does SCILLC assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. "Typical" parameters which may be provided in SCILLC data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. SCILLC does not convey any license under its patent rights nor the rights of others. SCILLC products are not designed, intended, or authorized for use as components in systems intended for surgical implant into the body, or other applications intended to support or sustain life, or for any other application in which the failure of the SCILLC product could create a situation where personal injury or death may occur. Should Buyer purchase or use SCILLC products for any such unintended or unauthorized application, Buyer shall indemnify and hold SCILLC and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that SCILLC was negligent regarding the design or manufacture of the part. SCILLC is an Equal Opportunity/Affirmative Action Employer.

## PUBLICATION ORDERING INFORMATION

### North America Literature Fulfillment:

Literature Distribution Center for ON Semiconductor  
P.O. Box 5163, Denver, Colorado 80217 USA  
**Phone:** 303-675-2175 or 800-344-3860 Toll Free USA/Canada  
**Fax:** 303-675-2176 or 800-344-3867 Toll Free USA/Canada  
**Email:** ONlit@hibbertco.com

**N. American Technical Support:** 800-282-9855 Toll Free USA/Canada

**EUROPE:** LDC for ON Semiconductor – European Support

**German Phone:** (+1) 303-308-7140 (M-F 2:30pm to 5:00pm Munich Time)  
**Email:** ONlit-german@hibbertco.com  
**French Phone:** (+1) 303-308-7141 (M-F 2:30pm to 5:00pm Toulouse Time)  
**Email:** ONlit-french@hibbertco.com  
**English Phone:** (+1) 303-308-7142 (M-F 1:30pm to 5:00pm UK Time)  
**Email:** ONlit@hibbertco.com

**ASIA/PACIFIC:** LDC for ON Semiconductor – Asia Support

**Phone:** 303-675-2121 (Tue-Fri 9:00am to 1:00pm, Hong Kong Time)  
Toll Free from Hong Kong 800-4422-3781  
**Email:** ONlit-asia@hibbertco.com

**JAPAN:** ON Semiconductor, Japan Customer Focus Center  
4-32-1 Nishi-Gotanda, Shinagawa-ku, Tokyo, Japan 141-8549

**Phone:** 81-3-5487-8345  
**Email:** r14153@onsemi.com

**Fax Response Line:** 303-675-2167  
800-344-3810 Toll Free USA/Canada

**ON Semiconductor Website:** <http://onsemi.com>

For additional information, please contact your local  
Sales Representative.