

# Am25LS157 • Am54LS/74LS157

# Am25LS158 • Am54LS/74LS158

## Quadrule 2-Line To 1-Line Data Selectors/Multiplexers

### DISTINCTIVE CHARACTERISTICS

- Selects four of eight data inputs with single select line and overriding strobe
- Inverting 'LS158 and Non-inverting 'LS157 configurations
- Standard TTL outputs
- Am25LS devices offer the following improvements over Am54/74LS
  - Higher speed
  - 50mV lower  $V_{OL}$
  - Twice the fan-out over military range
  - 440 $\mu$ A source current at HIGH output
- 100% product assurance screening to MIL-STD-883 requirements

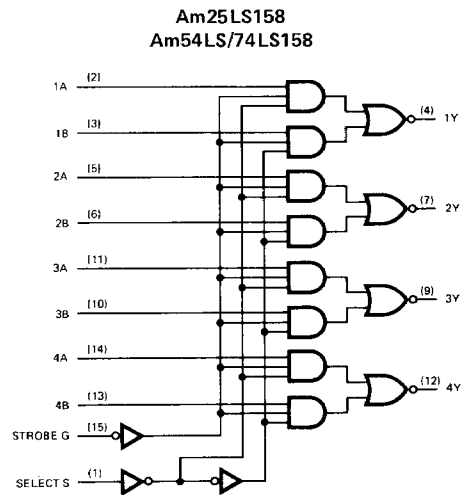
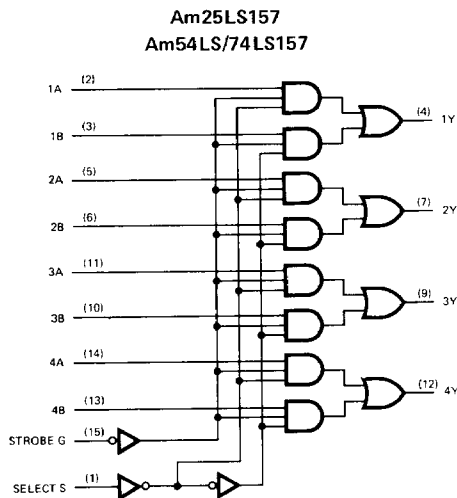
### FUNCTIONAL DESCRIPTION

These data selectors/multiplexers are used to select a 4-bit word from one of two sources. The four outputs at the Am25LS157 present true data with respect to the input data. The four outputs of the Am25LS158 present inverted data with respect to the inputs and also minimize propagation delay. A common active-HIGH strobe (active-LOW enable) is provided on all devices.

A single select line, S, is used to select one of the two multiplexer input words. When the select is LOW, the A input word is present at the output. When the select is HIGH, the B input word is present at the output.

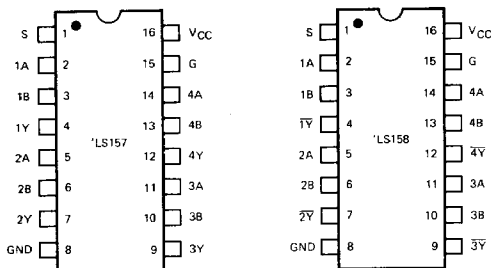
The Am54LS/74LS157 and 158 are standard performance versions of the Am25LS157 and 158. See appropriate electrical characteristic tables for detailed Am25LS improvements.

### LOGIC DIAGRAMS



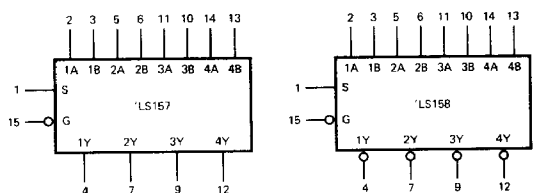
### CONNECTION DIAGRAMS

#### Top Views



Note: Pin 1 is marked for orientation.

### LOGIC SYMBOL



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

## Am25LS157 • Am25LS158

## ELECTRICAL CHARACTERISTICS

The Following Conditions Apply Unless Otherwise Specified:

COM'L  $T_A = 0^\circ\text{C to } +70^\circ\text{C}$   $V_{CC} = 5.0\text{V} \pm 5\%$  (MIN. = 4.75V MAX. = 5.25V)MIL  $T_A = -55^\circ\text{C to } +125^\circ\text{C}$   $V_{CC} = 5.0\text{V} \pm 10\%$  (MIN. = 4.50V MAX. = 5.50V)

## DC CHARACTERISTICS OVER OPERATING RANGE

Parameters	Description	Test Conditions (Note 1)	Min.	Typ. (Note 2)	Max.	Units
$V_{OH}$	Output HIGH Voltage	$V_{CC} = \text{MIN.}, I_{OH} = -440\mu\text{A}$ $V_{IN} = V_{IH} \text{ or } V_{IL}$	MIL	2.5	3.4	Volts
			COM'L	2.7	3.4	
$V_{OL}$	Output LOW Voltage	$V_{CC} = \text{MIN.}$ $V_{IN} = V_{IH} \text{ or } V_{IL}$	$I_{OL} = 4\text{mA}$		0.4	Volts
			$I_{OL} = 8\text{mA}$		0.45	
$V_{IH}$	Input HIGH Level	Guaranteed input logical HIGH voltage for all inputs	2			Volts
$V_{IL}$	Input LOW Level	Guaranteed input logical LOW voltage for all inputs	MIL		0.7	Volts
			COM'L		0.8	
$V_I$	Input Clamp Voltage	$V_{CC} = \text{MIN.}, I_{IN} = -18\text{mA}$			-1.5	Volts
$I_{IL}$	Input LOW Current	$V_{CC} = \text{MAX.}, V_{IN} = 0.4\text{V}$	S or G		-0.36	mA
			A or B		-0.4	
$I_{IH}$	Input HIGH Current	$V_{CC} = \text{MAX.}, V_{IN} = 2.7\text{V}$	S or G		20	$\mu\text{A}$
			A or B		20	
$I_I$	Input HIGH Current	$V_{CC} = \text{MAX.}, V_{IN} = 7.0\text{V}$	S or G		0.1	mA
			A or B		0.1	
$I_{SC}$	Output Short Circuit Current (Note 3)	$V_{CC} = \text{MAX.}$	-15		-85	mA
$I_{CC}$	Power Supply Current	$V_{CC} = \text{MAX.}$ (Note 4)	LS157		9.7	mA
			LS158		4.8	

- Notes: 1. For conditions shown as MIN. or MAX., use the appropriate value specified under Electrical Characteristics for the applicable device type.  
 2. Typical limits are at  $V_{CC} = 5.0\text{V}$ ,  $25^\circ\text{C}$  ambient and maximum loading.  
 3. Not more than one output should be shorted at a time. Duration of the short circuit test should not exceed one second.  
 4.  $I_{CC}$  is measured with all outputs open and 4.5 V applied to all inputs.

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## Am54LS/74LS157 • Am54LS/74LS158

## ELECTRICAL CHARACTERISTICS

The Following Conditions Apply Unless Otherwise Specified:

COM'L  $T_A = 0^\circ\text{C to } +70^\circ\text{C}$   $V_{CC} = 5.0\text{V} \pm 5\%$  (MIN. = 4.75V MAX. = 5.25V)MIL  $T_A = -55^\circ\text{C to } +125^\circ\text{C}$   $V_{CC} = 5.0\text{V} \pm 10\%$  (MIN. = 4.50V MAX. = 5.50V)

## DC CHARACTERISTICS OVER OPERATING RANGE

Parameters	Description	Test Conditions (Note 1)	Min.	Typ. (Note 2)	Max.	Units
$V_{OH}$	Output HIGH Voltage	$V_{CC} = \text{MIN.}, I_{OH} = -400\mu\text{A}$ $V_{IN} = V_{IH} \text{ or } V_{IL}$	Am54LS	2.5	3.4	Volts
			Am74LS	2.7	3.4	
$V_{OL}$	Output LOW Voltage	$V_{CC} = \text{MIN.}$ $V_{IN} = V_{IH} \text{ or } V_{IL}$	All, $I_{OL} = 4\text{mA}$		0.4	Volts
			74LS only, $I_{OL} = 8\text{mA}$		0.5	
$V_{IH}$	Input HIGH Level	Guaranteed input logical HIGH voltage for all inputs	2			Volts
$V_{IL}$	Input LOW Level	Guaranteed input logical LOW voltage for all inputs	Am54LS		0.7	Volts
			Am74LS		0.8	
$V_I$	Input Clamp Voltage	$V_{CC} = \text{MIN.}, I_{IN} = -18\text{mA}$			-1.5	Volts
$I_{IL}$	Input LOW Current	$V_{CC} = \text{MAX.}, V_{IN} = 0.4\text{V}$	S or G		-0.8	mA
			A or B		-0.4	
$I_{IH}$	Input HIGH Current	$V_{CC} = \text{MAX.}, V_{IN} = 2.7\text{V}$	S or G		40	$\mu\text{A}$
			A or B		20	
$I_I$	Input HIGH Current	$V_{CC} = \text{MAX.}, V_{IN} = 7.0\text{V}$	S or G		0.2	mA
			A or B		0.1	
$I_{SC}$	Output Short Circuit Current (Note 3)	$V_{CC} = \text{MAX.}$	-15		-100	mA
$I_{CC}$	Power Supply Current	$V_{CC} = \text{MAX.}$ (Note 4)	LS157		9.7	mA
			LS158		4.8	

- Notes: 1. For conditions shown as MIN. or MAX., use the appropriate value specified under Electrical Characteristics for the applicable device type.  
 2. Typical limits are at  $V_{CC} = 5.0\text{V}$ ,  $25^\circ\text{C}$  ambient and maximum loading.  
 3. Not more than one output should be shorted at a time. Duration of the short circuit test should not exceed one second.  
 4.  $I_{CC}$  is measured with all outputs open and 4.5 V applied to all inputs.

# Am25LS/54LS/74LS157/158

## MAXIMUM RATINGS (Above which the useful life may be impaired)

Storage Temperature	-65°C to +150°C
Temperature (Ambient) Under Bias	-55°C to +125°C
Supply Voltage to Ground Potential (Pin 16 to Pin 8) Continuous	-0.5 V to +7.0 V
DC Voltage Applied to Outputs for HIGH Output State	-0.5V to +V <sub>CC</sub> max.
DC Input Voltage	-0.5 V to +7.0 V
DC Output Current, Into Outputs	30mA
DC Input Current	-30mA to +5.0mA

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#### SWITCHING CHARACTERISTICS

(T<sub>A</sub> = +25°C, V<sub>CC</sub> = 5.0V)

Parameters	Description		Am25LS			Am54LS/74LS			Units	Test Conditions
			Min.	Typ.	Max.	Min.	Typ.	Max.		
t <sub>PLH</sub>	Data to Output	LS157		8	12		9	14	ns	C <sub>L</sub> = 15pF R <sub>L</sub> = 2.0kΩ
		LS158		5	9		7	12		
t <sub>PHL</sub>	Data to Output	LS157		8	12		9	14	ns	
		LS158		7	11		7	12		
t <sub>PLH</sub>	Strobe to Output	LS157		12	18		13	20	ns	
		LS158		8	12		11	17		
t <sub>PHL</sub>	Strobe to Output	LS157		10	16		14	21	ns	
		LS158		11	17		12	18		
t <sub>PLH</sub>	Select to Output	LS157		15	23		15	23	ns	
		LS158		13	20		13	20		
t <sub>PHL</sub>	Select to Output	LS157		14	21		18	27	ns	
		LS158		14	21		16	24		

### Am25LS ONLY SWITCHING CHARACTERISTICS OVER OPERATING RANGE\*

Parameters	Description		Am25LS COM'L		Am25LS MIL		Units	Test Conditions
			Min.	Max.	Min.	Max.		
t <sub>PLH</sub>	Data to Output	LS157		20		23	ns	C <sub>L</sub> = 50pF R <sub>L</sub> = 2.0kΩ
		LS158		16		18		
t <sub>PHL</sub>	Data to Output	LS157		20		23	ns	
		LS158		18		21		
t <sub>PLH</sub>	Strobe to Output	LS157		28		32	ns	
		LS158		20		23		
t <sub>PHL</sub>	Strobe to Output	LS157		25		29	ns	
		LS158		26		30		
t <sub>PLH</sub>	Select to Output	LS157		34		39	ns	
		LS158		30		35		
t <sub>PHL</sub>	Select to Output	LS157		31		36	ns	
		LS158		31		36		

\*AC performance over the operating temperature range is guaranteed by testing defined in Group A, Subgroup 9.

#### DEFINITION OF FUNCTIONAL TERMS

1A, 2A, 3A, 4A The data inputs for the 4-bits of the A word.

1B, 2B, 3B, 4B The data inputs for the 4-bits of the B word.

1Y, 2Y, 3Y, 4Y The four outputs of the multiplexer. The input data is inverted at the output on the Am25LS158 and non-inverted at the output for the Am25LS157.

G Strobe. When the strobe is HIGH, the four outputs of the Am25LS157 are LOW and the outputs of the Am25LS158 are HIGH. When the strobe is LOW, the devices are enabled to pass data.

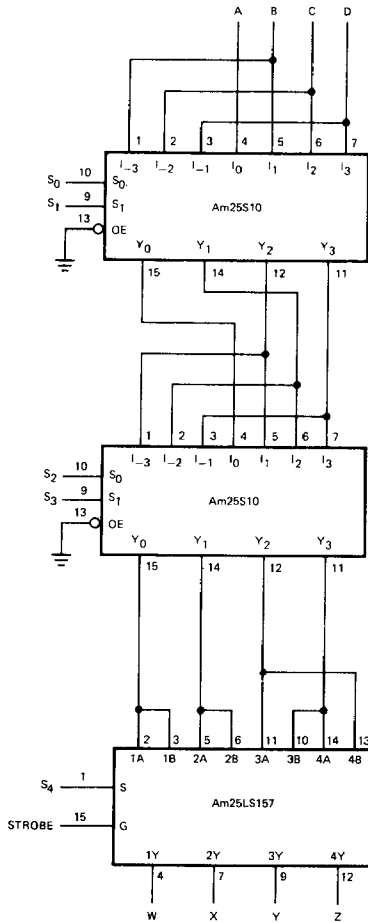
S Select. When the select input is LOW, the A word is present at the output. When the select input is HIGH, the B word is present at the output.

#### FUNCTION TABLE

INPUTS				OUTPUTS	
Strobe G	Select S	Data A	Data B	LS157 Y	LS158 Y
H	X	X	X	L	H
L	L	L	X	L	H
L	L	H	X	H	L
L	H	X	L	L	H
L	H	X	H	H	L

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

APPLICATION

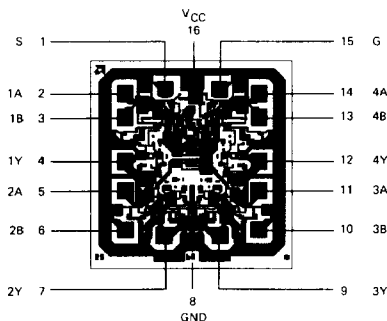


FUNCTION TABLE

State Number	Select					Output			
	S <sub>4</sub>	S <sub>3</sub>	S <sub>2</sub>	S <sub>1</sub>	S <sub>0</sub>	W	X	Y	Z
0	0	0	0	0	0	A	C	B	D
1	0	0	0	0	1	D	B	A	C
2	0	0	0	1	0	C	A	D	B
3	0	0	0	1	1	B	D	C	A
4	0	0	1	0	0	D	A	C	B
5	0	0	1	0	1	C	D	B	A
6	0	0	1	1	0	B	C	A	D
7	0	0	1	1	1	A	B	D	C
8	0	1	0	0	0	B	D	A	C
9	0	1	0	0	1	A	C	D	B
10	0	1	0	1	0	D	B	C	A
11	0	1	0	1	1	C	A	B	D
12	0	1	1	0	0	C	B	D	A
13	0	1	1	0	1	B	A	C	D
14	0	1	1	1	0	A	D	B	C
15	0	1	1	1	1	D	C	A	B
16	1	0	0	0	0	State 9			
17	1	0	0	0	1	State 10			
18	1	0	0	1	0	State 11			
19	1	0	0	1	1	State 8			
20	1	0	1	0	0	D	A	B	C
21	1	0	1	0	1	C	D	A	B
22	1	0	1	1	0	B	C	D	A
23	1	0	1	1	1	A	B	C	D
24	1	1	0	0	0	State 3			
25	1	1	0	0	1	State 0			
26	1	1	0	1	0	State 1			
27	1	1	0	1	1	State 2			
28	1	1	1	0	0	C	B	A	D
29	1	1	1	0	1	B	A	D	C
30	1	1	1	1	0	A	D	C	B
31	1	1	1	1	1	D	C	B	A

Two Am25S10 four-bit shifters are used in conjunction with an Am25LS157 multiplexer to perform all possible permutations on four inputs. The number of combinations possible on n items is given as n!. Thus, for n equal to 4, 24 combinations are possible. The Function Table shows all 32 combinations of the 5-bit select code including the 8 redundant states. This connection can be particularly useful in security systems and certain random number generation schemes. The eight redundant states can be placed at other select field locations through proper design.

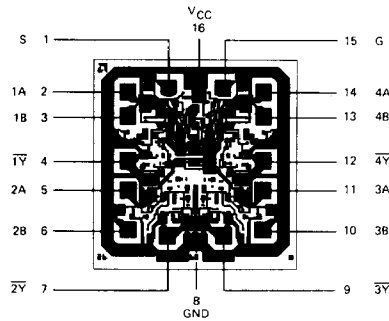
Am25LS157  
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DIE SIZE 0.057" X 0.057"

Metallization and Pad Layouts

Am25LS158  
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DIE SIZE 0.057" X 0.057"