

June 1989

54LS157/DM54LS157/DM74LS157, 54LS158/DM54LS158/DM74LS158 Quad 2-Line to 1-Line Data Selectors/Multiplexers

General Description

These data selectors/multiplexers contain inverters and drivers to supply full on-chip data selection to the four output gates. A separate strobe input is provided. A 4-bit word is selected from one of two sources and is routed to the four outputs. The LS157 presents true data whereas the LS158 presents inverted data to minimize propagation delay time.

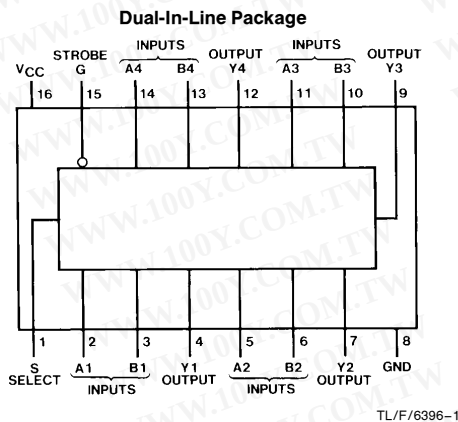
Applications

- Expand any data input point
- Multiplex dual data buses
- Generate four functions of two variables (one variable is common)
- Source programmable counters

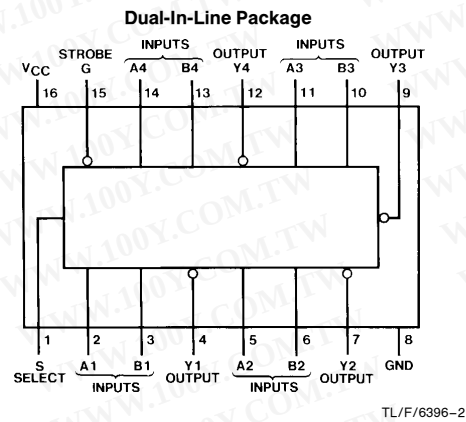
Features

- Buffered inputs and outputs
- Typical Propagation Time
LS157 9 ns
LS158 7 ns
- Typical Power Dissipation
LS157 49 mW
LS158 24 mW
- Alternate Military/Aerospace device (54LS157, 54LS158) is available. Contact a National Semiconductor Sales Office/Distributor for specifications.

Connection Diagrams



Order Number 54LS157DMQB, 54LS157FMBQ,
54LS157LMQB, DM54LS157J, DM54LS157W,
DM74LS157M or DM74LS157N
See NS Package Number E20A, J16A,
M16A, N16E or W16A



Order Number 54LS158DMQB, 54LS158FMBQ,
54LS158LMQB, DM54LS158J, DM54LS158W,
DM74LS158M or DM74LS158N
See NS Package Number E20A, J16A,
M16A, N16E or W16A

Function Table

Strobe	Inputs			Output Y	
	Select	A	B	LS157	LS158
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 Level, L = Low Level, X = Don't Care

54LS157/DM54LS157/DM74LS157, 54LS158/DM54LS158/DM74LS158
Quad 2-Line to 1-Line Data Selectors/Multiplexers

Absolute Maximum Ratings (Note)

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.

Supply Voltage	7V
Input Voltage	7V
Operating Free Air Temperature Range	
DM54LS and 54LS	−55°C to +125°C
DM74LS	0°C to +70°C
Storage Temperature Range	−65°C to +150°C

Note: The "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. The device should not be operated at these limits. The parametric values defined in the "Electrical Characteristics" table are not guaranteed at the absolute maximum ratings. The "Recommended Operating Conditions" table will define the conditions for actual device operation.

Recommended Operating Conditions

Symbol	Parameter	DM54LS157			DM74LS157			Units
		Min	Nom	Max	Min	Nom	Max	
V _{CC}	Supply Voltage	4.5	5	5.5	4.75	5	5.25	V
V _{IH}	High Level Input Voltage	2			2			V
V _{IL}	Low Level Input Voltage			0.7			0.8	V
I _{OH}	High Level Output Current			−0.4			−0.4	mA
I _{OL}	Low Level Output Current			4			8	mA
T _A	Free Air Operating Temperature	−55		125	0		70	°C

'LS157 Electrical Characteristics

over recommended operating free air temperature range (unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ (Note 1)	Max	Units
V _I	Input Clamp Voltage	V _{CC} = Min, I _I = −18 mA			−1.5	V
V _{OH}	High Level Output Voltage	V _{CC} = Min, I _{OH} = Max V _{IL} = Max, V _{IH} = Min	DM54	2.5	3.4	V
			DM74	2.7	3.4	
V _{OL}	Low Level Output Voltage	V _{CC} = Min, I _{OL} = Max V _{IL} = Max, V _{IH} = Min	DM54		0.25	V
			DM74		0.35	
		I _{OL} = 4 mA, V _{CC} = Min	DM74		0.25	
I _I	Input Current @ Max Input Voltage	V _{CC} = Max V _I = 7V	S or G		0.2	mA
			A or B		0.1	
I _{IH}	High Level Input Current	V _{CC} = Max V _I = 2.7V	S or G		40	μA
			A or B		20	
I _{IL}	Low Level Input Current	V _{CC} = Max V _I = 0.4V	S or G		−0.8	mA
			A or B		−0.4	
I _{OS}	Short Circuit Output Current	V _{CC} = Max (Note 2)	DM54	−20	−100	mA
			DM74	−20	−100	
I _{CC}	Supply Current	V _{CC} = Max (Note 3)		9.7	16	mA

Note 1: All typicals are at V_{CC} = 5V, T_A = 25°C.

Note 2: Not more than one output should be shorted at a time, and the duration should not exceed one second.

Note 3: I_{CC} is measured with 4.5V applied to all inputs and all outputs open.

'LS157 Switching Characteristics

at $V_{CC} = 5V$ and $T_A = 25^\circ C$ (See Section 1 for Test Waveforms and Output Load)

Symbol	Parameter	From (Input) To (Output)	R _L = 2 kΩ				Units
			C _L = 15 pF		C _L = 50 pF		
			Min	Max	Min	Max	
t _{PLH}	Propagation Delay Time Low to High Level Output	Data to Y		14		18	ns
t _{PHL}	Propagation Delay Time High to Low Level Output	Data to Y		14		23	ns
t _{PLH}	Propagation Delay Time Low to High Level Output	Strobe to Y		20		24	ns
t _{PHL}	Propagation Delay Time High to Low Level Output	Strobe to Y		21		30	ns
t _{PLH}	Propagation Delay Time Low to High Level Output	Select to Y		23		28	ns
t _{PHL}	Propagation Delay Time High to Low Level Output	Select to Y		27		32	ns

Recommended Operating Conditions

Symbol	Parameter	DM54LS158			DM74LS158			Units
		Min	Nom	Max	Min	Nom	Max	
V_{CC}	Supply Voltage	4.5	5	5.5	4.75	5	5.25	V
V_{IH}	High Level Input Voltage	2			2			V
V_{IL}	Low Level Input Voltage			0.7			0.8	V
I_{OH}	High Level Output Current			-0.4			-0.4	mA
I_{OL}	Low Level Output Current			4			8	mA
T_A	Free Air Operating Temperature	-55		125	0		70	$^\circ C$

'LS158 Electrical Characteristics

over recommended operating free air temperature range (unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ (Note 1)	Max	Units
V_I	Input Clamp Voltage	$V_{CC} = \text{Min}, I_I = -18 \text{ mA}$			-1.5	V
V_{OH}	High Level Output Voltage	$V_{CC} = \text{Min}, I_{OH} = \text{Max}$ $V_{IL} = \text{Max}, V_{IH} = \text{Min}$	DM54	2.5	3.4	V
			DM74	2.7	3.4	
V_{OL}	Low Level Output Voltage	$V_{CC} = \text{Min}, I_{OL} = \text{Max}$ $V_{IL} = \text{Max}, V_{IH} = \text{Min}$	DM54		0.25	V
			DM74		0.35	
		$I_{OL} = 4 \text{ mA}, V_{CC} = \text{Min}$	DM74		0.25	0.4
I_I	Input Current @ Max Input Voltage	$V_{CC} = \text{Max}$ $V_I = 7V$	S or G		0.2	mA
			A or B		0.1	
I_{IH}	High Level Input Current	$V_{CC} = \text{Max}$ $V_I = 2.7V$	S or G		40	μA
			A or B		20	
I_{IL}	Low Level Input Current	$V_{CC} = \text{Max}$ $V_I = 0.4V$	S or G		-0.8	mA
			A or B		-0.4	
I_{OS}	Short Circuit Output Current	$V_{CC} = \text{Max}$ (Note 2)	DM54	-20	-100	mA
			DM74	-20	-100	
I_{CC}	Supply Current	$V_{CC} = \text{Max}$ (Note 3)		4.8	8	mA

Note 1: All typicals are at $V_{CC} = 5V$, $T_A = 25^\circ C$.

Note 2: Not more than one output should be shorted at a time, and the duration should not exceed one second.

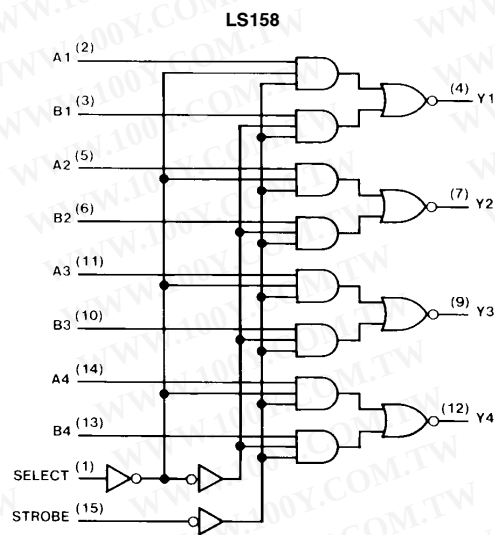
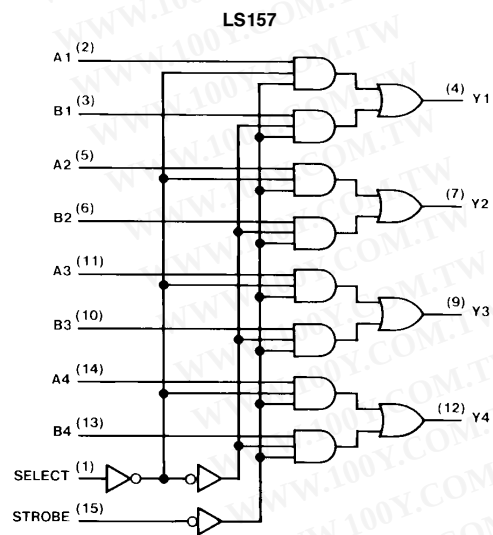
Note 3: I_{CC} is measured with 4.5V applied to all inputs and all outputs open.

LS158 Switching Characteristics

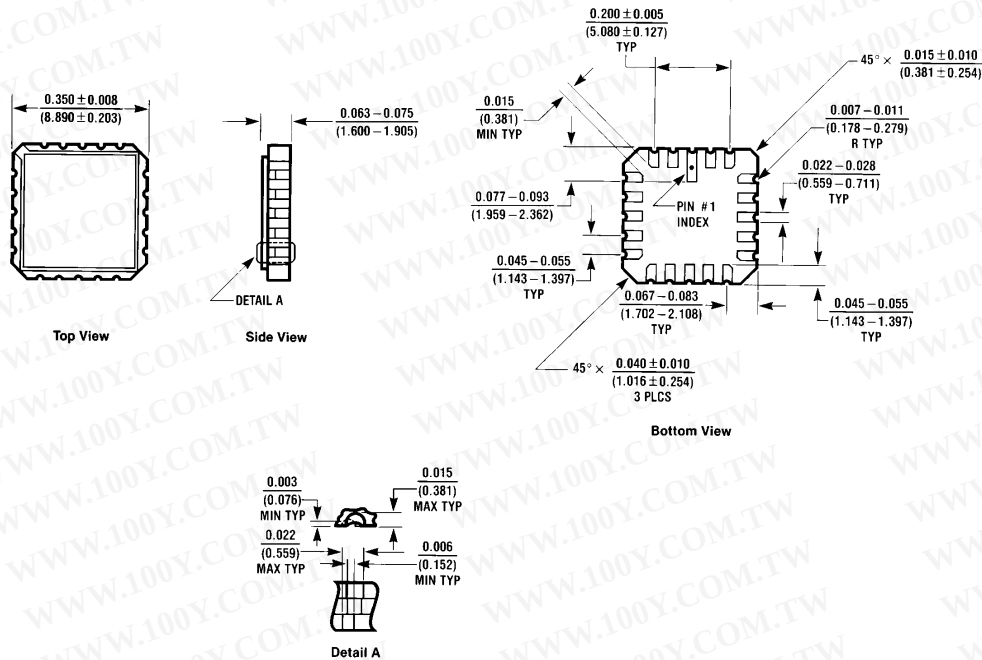
at $V_{CC} = 5V$ and $T_A = 25^\circ C$ (See Section 1 for Test Waveforms and Output Load)

Symbol	Parameter	From (Input) To (Output)	$R_L = 2\text{ k}\Omega$				Units
			$C_L = 15\text{ pF}$		$C_L = 50\text{ pF}$		
			Min	Max	Min	Max	
t_{PLH}	Propagation Delay Time Low to High Level Output	Data to Y		12		18	ns
t_{PHL}	Propagation Delay Time High to Low Level Output	Data to Y		12		21	ns
t_{PLH}	Propagation Delay Time Low to High Level Output	Strobe to Y		17		23	ns
t_{PHL}	Propagation Delay Time High to Low Level Output	Strobe to Y		18		28	ns
t_{PLH}	Propagation Delay Time Low to High Level Output	Select to Y		20		24	ns
t_{PHL}	Propagation Delay Time High to Low Level Output	Select to Y		24		36	ns

Logic Diagrams

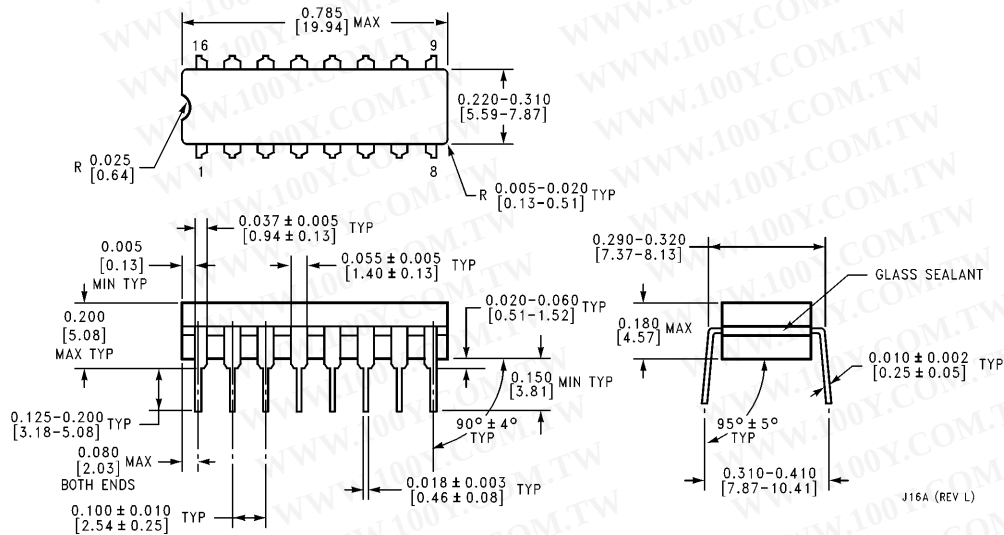


Physical Dimensions inches (millimeters)



Ceramic Leadless Chip Carrier Package (E)
 Order Number 54LS157LMQB or 54LS158LMQB
 NS Package Number E20A

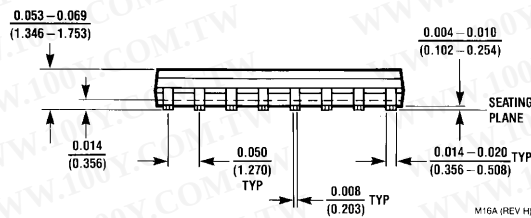
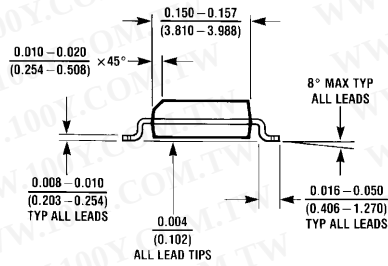
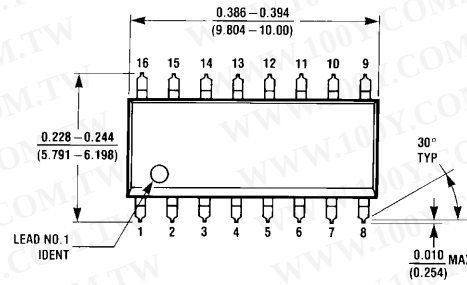
E20A (REV D)



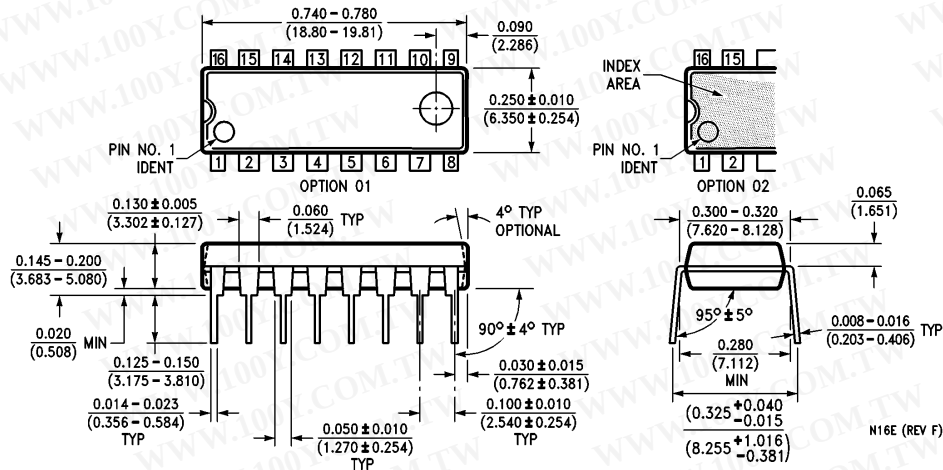
16-Lead Ceramic Dual-In-Line Package (J)
 Order Number 54LS157DMQB, 54LS158DMQB, DM54LS157J or DM54LS158J
 NS Package Number J16A

J16A (REV L)

Physical Dimensions inches (millimeters) (Continued)

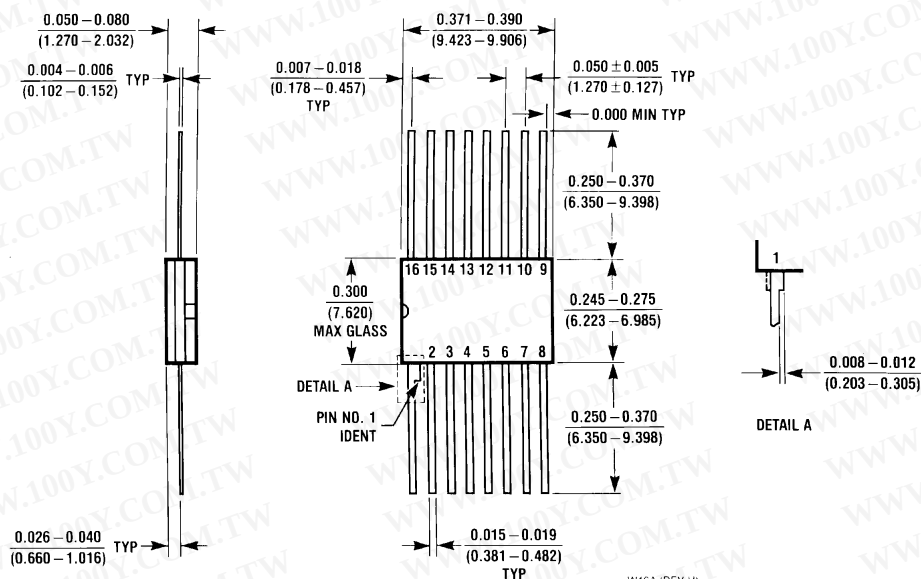


16-Lead Small Outline Molded Package (M)
Order Number DM74LS157M or DM74LS158M
NS Package Number M16A



16-Lead Molded Dual-In-Line Package (N)
Order Number DM74LS157N or DM74LS158N
NS Package Number N16E

Physical Dimensions inches (millimeters) (Continued)



16-Lead Ceramic Flat Package (W)
Order Number 54LS157FMQB, 54LS158FMQB, DM54LS157W or DM54LS158W
NS Package Number W16A

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