



T-66-21-51

54LS353/DM74LS353

Dual 4-Input Multiplexer with TRI-STATE® Outputs

General Description

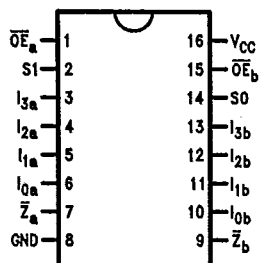
The '353 is a dual 4-input multiplexer with TRI-STATE outputs. It can select two bits of data from four sources using common select inputs. The outputs may be individually switched to a high impedance state with a HIGH on the respective Output ($\overline{OE}$) inputs, allowing the outputs to interface directly with bus oriented systems. It is fabricated with the Schottky barrier diode process for high speed and is completely compatible with all National TTL families.

Features

- Inverted version of 'LS253
- Schottky process for high speed
- Multifunction capability

Connection Diagram

Dual-In-Line Package

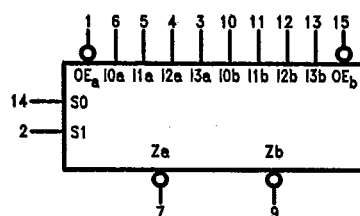


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Order Number 54LS353DMQB, 54LS353FMQB,
DM74LS353M or DM74LS353N

See NS Package Number J16A, M16A, N16E or W16A

Logic Symbol



VCC = Pin 16
GND = Pin 8

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Pin Names	Description
I0a-I3a	Side A Data Inputs
I0b-I3b	Side B Data Inputs
S0, S1	Common Select Inputs
$\overline{OE}_a$	Side A Output Enable Input (Active Low)
$\overline{OE}_b$	Side B Output Enable Input (Active Low)
Z_a, Z_b	TRI-STATE Outputs (Inverted)

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

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.

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Recommended Operating Conditions

Symbol	Parameter	54LS353			DM74LS353			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			-1.0			-2.6	mA
I _{OL}	Low Level Output Current			12			24	mA
T _A	Free Air Operating Temperature	-55		125	0		70	°C

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	54LS	2.5		V
			DM74	2.7		
V _{OL}	Low Level Output Voltage	V _{CC} = Min, I _{OL} = Max, V _{IH} = Min	54LS		0.4	V
			DM74		0.5	
		I _{OL} = 4 mA, V _{CC} = Min	DM74		0.4	
I _I	Input Current @ Max Input Voltage	V _{CC} = Max, V _I = 10V			0.1	mA
I _{IH}	High Level Input Current	V _{CC} = Max, V _I = 2.7V			20	μA
I _{IL}	Low Level Input Current	V _{CC} = Max, V _I = 0.4V			-0.4	mA
I _{OS}	Short Circuit Output Current	V _{CC} = Max (Note 2)	54LS	-30	-130	mA
			DM74	-30	-130	
I _{CCL}	Supply Current Outputs HIGH	V _{CC} = Max, I _n , S _n , $\overline{\text{OEn}}$ = GND			12	mA
I _{CCZ}	Supply Current Outputs OFF	V _{CC} = Max, $\overline{\text{OEn}}$ = 4.5V I _n , S _n = GND			14	mA
I _{OZH}	TRI-STATE Output OFF Current HIGH	V _{CC} = V _{CCH} V _{OZH} = 2.7V			20	μA
I _{OZL}	TRI-STATE Output OFF Current LOW	V _{CC} = V _{CCH} V _{OZL} = 0.4V			-20	μA

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.

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Switching Characteristics $V_{CC} = +5.0V$, $T_A = +25^\circ C$ (See Section 1 for test waveforms and output loads)

Symbol	Parameter	$R_L = 2\text{ k}\Omega$, $C_L = 50\text{ pF}$		Units
		Min	Max	
t_{PLH} t_{PHL}	Propagation Delay Sn to Zn		24 32	ns
t_{PLH} t_{PHL}	Propagation Delay In to Zn		15 15	ns
t_{PZH} t_{PZL}	Output Enable Time $\overline{OE}$ to Zn		18 18	ns
t_{PHZ} t_{PLZ}	Output Disable Time $\overline{OE}$ to Zn		18 18	ns

Functional Description

The LS353 contains two identical 4-input multiplexers with TRI-STATE outputs. They select two bits from four sources selected by common Select Inputs (S_0 , S_1). The 4-input multiplexers have individual Output Enable ($\overline{OE}_a$, $\overline{OE}_b$) inputs which when HIGH, force the outputs to a high impedance (high Z) state. The logic equations for the outputs are shown below:

If the outputs of TRI-STATE devices are tied together, all but one device must be in the high impedance state to avoid high currents that would exceed the maximum ratings. Designers should ensure that Output Enable signals to TRI-STATE devices whose outputs are tied together are designed so that there is no overlap.

$$\overline{Z}_a = \overline{OE}_a \cdot (I_0a \cdot \overline{S}_1 \cdot \overline{S}_0 + I_1a \cdot \overline{S}_1 \cdot S_0 + I_2a \cdot S_1 \cdot \overline{S}_0 + I_3a \cdot S_1 \cdot S_0)$$

$$\overline{Z}_b = \overline{OE}_b \cdot (I_0b \cdot \overline{S}_1 \cdot \overline{S}_0 + I_1b \cdot \overline{S}_1 \cdot S_0 + I_2b \cdot S_1 \cdot \overline{S}_0 + I_3b \cdot S_1 \cdot S_0)$$

Truth Table

Select Inputs		Data Inputs				Output Enable	Output
S_0	S_1	I_0	I_1	I_2	I_3	$\overline{OE}$	$\overline{Z}$
X	X	X	X	X	X	H	(Z)
L	L	L	X	X	X	L	H
L	L	H	X	X	X	L	L
H	L	X	L	X	X	L	H
H	L	X	H	X	X	L	L
L	H	X	X	L	X	L	H
L	H	X	X	H	X	L	L
H	H	X	X	X	L	L	H
H	H	X	X	X	H	L	L

Address Inputs S_0 and S_1 are common to both sections.

H = HIGH Voltage Level

L = LOW Voltage Level

X = Immaterial

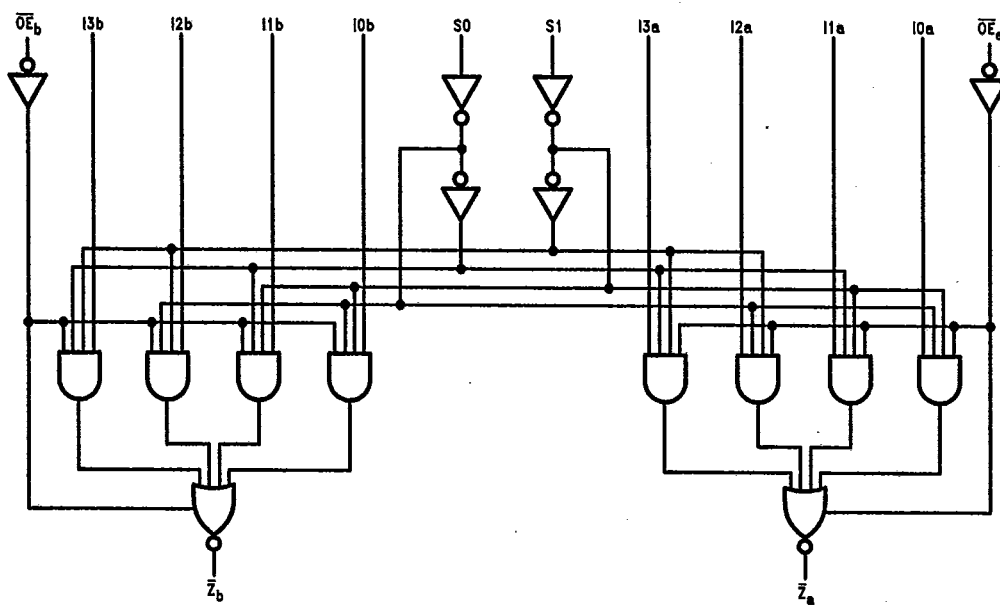
(Z) = High Impedance

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Logic Diagram

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