N *a t i o n a l* **S** *e m i c o n d u c t o r*

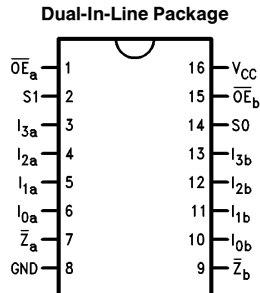# DM74LS353
Dual 4-Input Multiplexer with TRI-STATE® Outputs

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
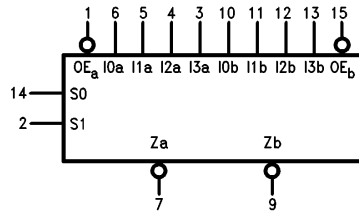- Schottky process for high speed
- Multifunction capability

Connection Diagram

Dual-In-Line Package

TL/F/10185-1

Order Number DM74LS353M or DM74LS353N
See NS Package Number M16A or N16E

Logic Symbol

TL/F/10185-2

V_{CC} = Pin 16
GND = Pin 8

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)
$\overline{Z}_a$, $\overline{Z}_b$	TRI-STATE Outputs (Inverted)

Absolute Maximum Ratings (Note)

Supply Voltage	7V
Input Voltage	7V
Operating Free Air Temperature Range	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	Min	Nom	Max	Units
V_{CC}	Supply Voltage	4.75	5	5.25	V
V_{IH}	High Level Input Voltage	2			V
V_{IL}	Low Level Input Voltage			0.8	V
I_{OH}	High Level Output Current			-2.6	mA
I_{OL}	Low Level Output Current			24	mA
T_A	Free Air Operating Temperature	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	2.7			V
V_{OL}	Low Level Output Voltage	$V_{CC} =$ Min, $I_{OL} =$ Max, $V_{IH} =$ Min			0.5	V
		$I_{OL} = 4$ mA, $V_{CC} =$ Min			0.4	
I_I	Input Current @ Max Input Voltage	$V_{CC} =$ Max, $V_I = 7$V			0.1	mA
I_{IH}	High Level Input Current	$V_{CC} =$ Max, $V_I = 2.7$V			20	μA
I_{IL}	Low Level Input Current	$V_{CC} =$ Max, $V_I = 0.4$V			-0.4	mA
I_{OS}	Short Circuit Output Current	$V_{CC} =$ Max (Note 2)	-30		-130	mA
I_{CCL}	Supply Current Outputs HIGH	$V_{CC} =$ Max, In, Sn, $\overline{OE}$n $=$ GND			12	mA
I_{CCZ}	Supply Current Outputs OFF	$V_{CC} =$ Max, $\overline{OE}$n $= 4.5$V In, Sn $=$ GND			14	mA
I_{OZH}	TRI−STATE Output OFF Current HIGH	$V_{CC} = V_{CCH}$ $V_{OZH} = 2.7$V			20	μA
I_{OZL}	TRI−STATE Output OFF Current LOW	$V_{CC} = V_{CCH}$ $V_{OZL} = 0.4$V			-20	μA

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

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

Switching Characteristics

$V_{CC} = +5.0V$, $T_A = +25°C$

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

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 (S0, S1). 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.

$$\overline{Z_a} = \overline{\overline{OEa} \bullet (I0a \bullet \overline{S1} \bullet \overline{S0} + I1a \bullet \overline{S1} \bullet S0 + I2a \bullet S1 \bullet \overline{S0} + I3a \bullet S1 \bullet S0)}$$

$$\overline{Z_b} = \overline{\overline{OE_b} \bullet (I0b \bullet \overline{S1} \bullet \overline{S0} + I1b \bullet \overline{S1} \bullet S0 + I2b \bullet S1 \bullet \overline{S0} + I3b \bullet S1 \bullet S0)}$$

Truth Table

Select Inputs		Data Inputs				Output Enable	Output
S0	S1	I0	I1	I2	I3	$\overline{OE}$	$\overline{Z}$
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

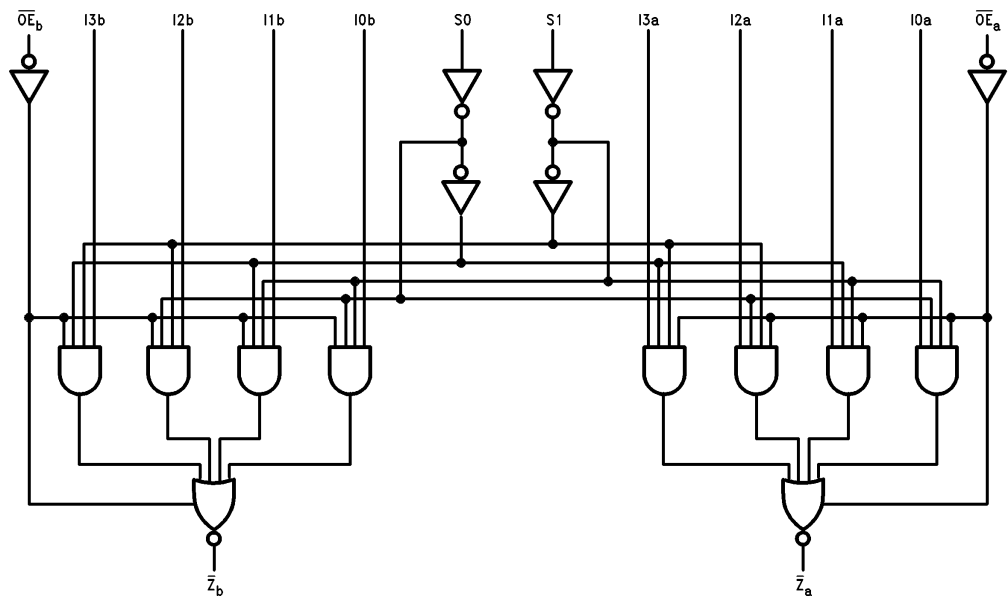Address inputs S0 and S1 are common to both sections.

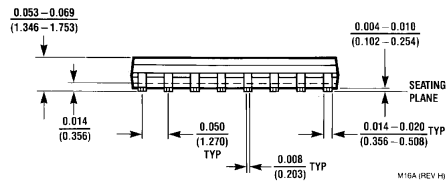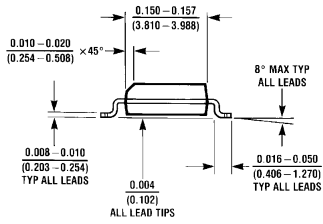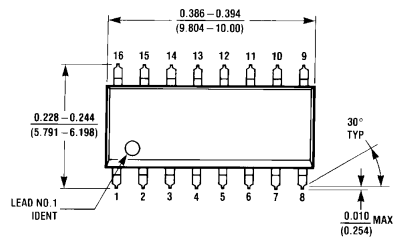H = HIGH Voltage Level
L = LOW Voltage Level
X = Immaterial
(Z) = High Impedance

Logic Diagram

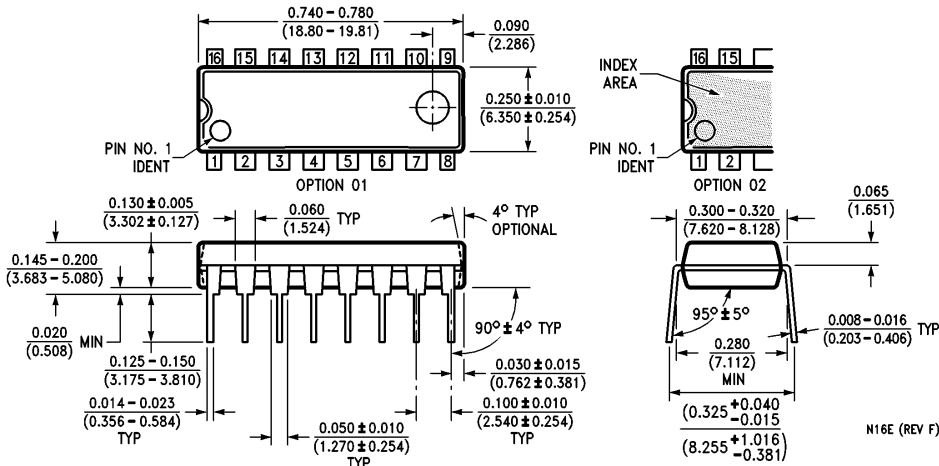$\overline{OE}_b$ I3b I2b I1b I0b S0 S1 I3a I2a I1a I0a $\overline{OE}_a$

$\overline{Z}_b$

$\overline{Z}_a$

TL/F/10185–3

4

Physical Dimensions inches (millimeters)

0.386 − 0.394
(9.804 − 10.00)

16 15 14 13 12 11 10 9

0.228 − 0.244
(5.791 − 6.198)

30°
TYP

LEAD NO.1
IDENT

1 2 3 4 5 6 7 8

0.010
(0.254) MAX

0.150 − 0.157
(3.810 − 3.988)

0.010 − 0.020
(0.254 − 0.508) ×45°

8° MAX TYP
ALL LEADS

0.008 − 0.010
(0.203 − 0.254)
TYP ALL LEADS

0.004
(0.102)
ALL LEAD TIPS

0.016 − 0.050
(0.406 − 1.270)
TYP ALL LEADS

0.053 − 0.069
(1.346 − 1.753)

0.004 − 0.010
(0.102 − 0.254)

SEATING
PLANE

0.014
(0.356)

0.050
(1.270)
TYP

0.014 − 0.020
(0.356 − 0.508) TYP

0.008
(0.203) TYP

M16A (REV H)

16-Lead Small Outline Molded Package (M)
Order Number DM74LS353M
NS Package Number M16A

Physical Dimensions inches (millimeters) (Continued)

0.740 – 0.780
(18.80 – 19.81)

0.090
(2.286)

INDEX
AREA

16 15 14 13 12 11 10 9

0.250 ± 0.010
(6.350 ± 0.254)

PIN NO. 1
IDENT

1 2 3 4 5 6 7 8

OPTION 01

16 15

PIN NO. 1
IDENT

1 2

OPTION 02

0.065
(1.651)

0.130 ± 0.005
(3.302 ± 0.127)

0.060
(1.524) TYP

4° TYP
OPTIONAL

0.300 – 0.320
(7.620 – 8.128)

0.145 – 0.200
(3.683 – 5.080)

0.020
(0.508) MIN

0.125 – 0.150
(3.175 – 3.810)

90° ± 4° TYP

95° ± 5°

0.008 – 0.016
(0.203 – 0.406) TYP

0.014 – 0.023
(0.356 – 0.584)
TYP

0.050 ± 0.010
(1.270 ± 0.254)
TYP

0.030 ± 0.015
(0.762 ± 0.381)

0.100 ± 0.010
(2.540 ± 0.254)
TYP

0.280
(7.112)
MIN

$(0.325^{+0.040}_{-0.015})$

$(8.255^{+1.016}_{-0.381})$

N16E (REV F)

16-Lead Molded Dual-In-Line Package (N)
Order Number DM74LS353N
NS Package Number N16E