National Semiconductor

54F/74F352
Dual 4-Input Multiplexer

General Description

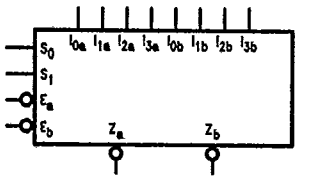
The 'F352 is a very high-speed dual 4-input multiplexer with common Select inputs and individual Enable inputs for each section. It can select two bits of data from four sources. The two buffered outputs present data in the inverted (complementary) form. The 'F352 is the functional equivalent of the 'F153 except with inverted outputs.

Features

- Inverted version of 'F153
- Separate enables for each multiplexer
- Input clamp diode limits high speed termination effects

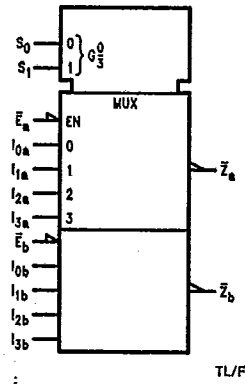
Ordering Code: See Section 5

Logic Symbols



TL/F/9519-3

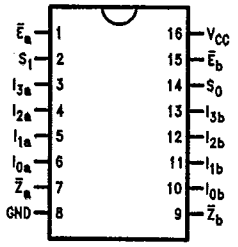
IEEE/IEC



TL/F/9519-5

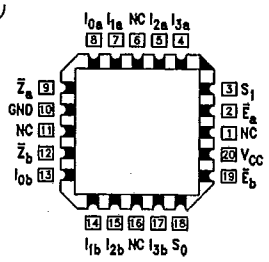
Connection Diagrams

Pin Assignment for DIP, SOIC and Flatpak



TL/F/9519-1

Pin Assignment for LCC



TL/F/9519-2

Unit Loading/Fan Out: See Section 2 for U.L. definitions

Pin Names	Description	54F/74F	
		U.L. HIGH/LOW	Input I_{IH}/I_{IL} Output I_{OH}/I_{OL}
I_{0a}–I_{3a}	Side A Data Inputs	1.0/1.0	20 μA/−0.6 mA
I_{0b}–I_{3b}	Side B Data Inputs	1.0/1.0	20 μA/−0.6 mA
S_0–S_1	Common Select Inputs	1.0/1.0	20 μA/−0.6 mA
$\overline{E}_a$	Side A Enable Input (Active LOW)	1.0/1.0	20 μA/−0.6 mA
$\overline{E}_b$	Side B Enable Input (Active LOW)	1.0/1.0	20 μA/−0.6 mA
$\overline{Z}_a$, $\overline{Z}_b$	Multiplexer Outputs (Inverted)	50/33.3	−1 mA/20 mA

4

T-66-21-51

Functional Description

The 'F352 is a dual 4-input multiplexer. It selects two bits of data from up to four sources under the control of the common Select inputs (S_0, S_1). The two 4-input multiplexer circuits have individual active LOW Enables ($\overline{E}_a$, $\overline{E}_b$) which can be used to strobe the outputs independently. When the Enables ($\overline{E}_a$, $\overline{E}_b$) are HIGH, the corresponding outputs ($\overline{Z}_a$, $\overline{Z}_b$) are forced HIGH.

The logic equations for the outputs are shown below:

$$\overline{Z}_a = \overline{E}_a \bullet (I_{0a} \bullet \overline{S}_1 \bullet \overline{S}_0 + I_{1a} \bullet \overline{S}_1 \bullet S_0 + I_{2a} \bullet S_1 \bullet S_0 + I_{3a} \bullet S_1 \bullet S_0)$$

$$\overline{Z}_b = \overline{E}_b \bullet (I_{0b} \bullet \overline{S}_1 \bullet \overline{S}_0 + I_{1b} \bullet \overline{S}_1 \bullet S_0 + I_{2b} \bullet S_1 \bullet S_0 + I_{3b} \bullet S_1 \bullet S_0)$$

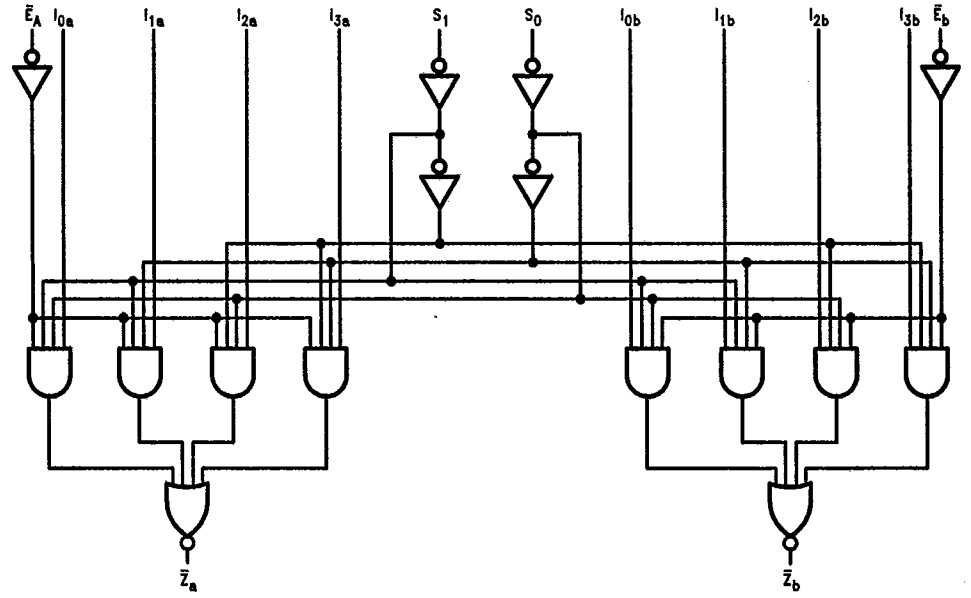
The 'F352 can be used to move data from a group of registers to a common output bus. The particular register from which the data came would be determined by the state of the Select inputs. A less obvious application is as a function generator. The 'F352 can generate two functions of three variables. This is useful for implementing highly irregular random logic.

Truth Table

Select Inputs		Inputs (a or b)					Output
S_0	S_1	$\overline{E}$	I_0	I_1	I_2	I_3	$\overline{Z}$
X	X	H	X	X	X	X	H
L	L	L	L	X	X	X	H
L	L	L	H	X	X	X	L
H	L	L	X	L	X	X	H
H	L	L	X	H	X	X	L
L	H	L	X	X	L	X	H
L	H	L	X	X	H	X	L
H	H	L	X	X	X	L	H
H	H	L	X	X	X	H	L

H = HIGH Voltage Level
L = LOW Voltage Level
X = Immaterial

Logic Diagram



TL/F/9519-4

Please note that this diagram is provided only for the understanding of logic operations and should not be used to estimate propagation delays.

Absolute Maximum Ratings (Note 1)

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

Storage Temperature	−65°C to +150°C
Ambient Temperature under Bias	−55°C to +125°C
Junction Temperature under Bias	−55°C to +175°C
V_{CC} Pin Potential to Ground Pin	−0.5V to +7.0V
Input Voltage (Note 2)	−0.5V to +7.0V
Input Current (Note 2)	−30 mA to +5.0 mA
Voltage Applied to Output in HIGH State (with V_{CC} = 0V)	
Standard Output	−0.5V to V_{CC}
TRI-STATE® Output	−0.5V to +5.5V
Current Applied to Output in LOW State (Max)	twice the rated I_{OL} (mA)

Note 1: Absolute maximum ratings are values beyond which the device may be damaged or have its useful life impaired. Functional operation under these conditions is not implied.

Note 2: Either voltage limit or current limit is sufficient to protect inputs.

Recommended Operating Conditions

T-66-21-51

Free Air Ambient Temperature	
Military	−55°C to +125°C
Commercial	0°C to +70°C
Supply Voltage	
Military	+4.5V to +5.5V
Commercial	+4.5V to +5.5V

DC Electrical Characteristics

Symbol	Parameter		54F/74F Min	54F/74F Typ	54F/74F Max	Units	V_{CC}	Conditions
V_{IH}	Input HIGH Voltage		2.0			V		Recognized as a HIGH Signal
V_{IL}	Input LOW Voltage				0.8	V		Recognized as a LOW Signal
V_{CD}	Input Clamp Diode Voltage				−1.2	V	Min	I_{IN} = −18 mA
V_{OH}	Output HIGH Voltage	54F 10% V_{CC}	2.5			V	Min	I_{OH} = −1 mA
		74F 10% V_{CC}	2.5					I_{OH} = −1 mA
		74F 5% V_{CC}	2.7					I_{OH} = −1 mA
V_{OL}	Output LOW Voltage	54F 10% V_{CC}			0.5	V	Min	I_{OL} = 20 mA
		74F 10% V_{CC}			0.5			I_{OL} = 20 mA
I_{IH}	Input HIGH Current	54F			20.0	μA	Max	V_{IN} = 2.7V
		74F			5.0			
I_{BVI}	Input HIGH Current Breakdown Test	54F			100	μA	Max	V_{IN} = 7.0V
		74F			7.0			
I_{CEX}	Output HIGH Leakage Current	54F			250	μA	Max	V_{OUT} = V_{CC}
		74F			50			
V_{ID}	Input Leakage Test	74F	4.75			V	0.0	I_{ID} = 1.9 μA All Other Pins Grounded
I_{OD}	Output Leakage Circuit Current	74F			3.75	μA	0.0	V_{IOD} = 150 mV All Other Pins Grounded
I_{IL}	Input LOW Current				−0.6	mA	Max	V_{IN} = 0.5V
I_{OS}	Output Short-Circuit Current		−60		−150	mA	Max	V_{OUT} = 0V
I_{CCH}	Power Supply Current			9.3	14	mA	Max	V_O = HIGH
I_{CCL}	Power Supply Current			13.3	20	mA	Max	V_O = LOW

AC Electrical Characteristics: See Section 2 for Waveforms and Load Configurations

Symbol	Parameter	74F $T_A = +25°C$, $V_{CC} = +5.0V$, $C_L = 50$ pF			54F T_A, V_{CC} = Mil, $C_L = 50$ pF		74F T_A, V_{CC} = Com, $C_L = 50$ pF		Units	Fig. No.
		Min	Typ	Max	Min	Max	Min	Max		
t_{PLH} t_{PHL}	Propagation Delay S_n to $\overline{Z}_n$	4.0 3.5	8.0 6.5	11.0 8.5	3.5 3.0	14.0 11.0	3.5 3.0	12.5 9.5	ns	2-3
t_{PLH} t_{PHL}	Propagation Delay $\overline{E}_n$ to $\overline{Z}_n$	3.0 3.0	4.5 5.0	6.0 7.0	2.5 2.5	8.0 9.0	2.5 2.5	7.0 8.0	ns	2-3
t_{PLH} t_{PHL}	Propagation Delay I_n to $\overline{Z}_n$	2.0 1.3	5.2 2.5	7.0 4.0	2.0 1.0	9.0 5.0	2.0 1.0	8.0 4.5	ns	2-3