For:char
Printed on:Mon, Feb 6, 1995 09:48:35
From book:DL121CH4 (5) VIEW
Document:MC74F350 (5) VIEW
Last saved on:Fri, Feb 3, 1995 16:04:28

MOTOROLA

MC54/74F350

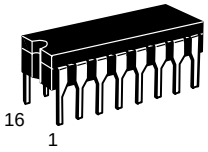
4-BIT SHIFTER (With 3-State Outputs)

The MC54/74F350 is a specialized multiplexer that accepts a 4-bit word and shifts it 0, 1, 2 or 3 places, as determined by two Select (S_0, S_1) inputs. For expansion to longer words, three linking inputs are provided for lower-order bits; thus two packages can shift an 8-bit word, four packages a 16-bit word, etc. Shifting by more than three places is accomplished by paralleling the 3-state outputs of different packages and using the Output Enable ($\overline{OE}$) inputs as a third Select level. With appropriate interconnections, the F350 can perform zero-backfill, sign-extend or end-around (barrel) shift functions.

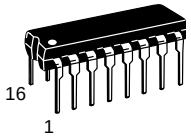
- Linking Inputs for Word Expansion
- 3-State Outputs for Extending Shift Range

4-BIT SHIFTER
(With 3-State Outputs)

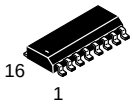
FAST™ SCHOTTKY TTL



J SUFFIX
CERAMIC
CASE 620-09



N SUFFIX
PLASTIC
CASE 648-08



D SUFFIX
SOIC
CASE 751B-03

ORDERING INFORMATION

MC54FXXXJ	Ceramic
MC74FXXXN	Plastic
MC74FXXXD	SOIC

FUNCTIONAL DESCRIPTION

The F350 is operationally equivalent to a 4-input multiplexer with the inputs connected so that the select code causes successive one-bit shifts of the data word. This internal connection makes it possible to perform shifts of 0, 1, 2 or 3 places on words of any length.

A 7-bit data word is introduced at the I_n inputs and is shifted according to the code applied to the select inputs S_0, S_1. Outputs O_0–O_3 are 3-state, controlled by an active-LOW output enable ($\overline{OE}$). When $\overline{OE}$ is LOW, data outputs will follow selected data inputs; when HIGH, the data outputs will be forced to the high-impedance state. This feature allows shifters to be cascaded on the same output lines or to a common bus. The shift function can be logical, with zeros pulled in at either or both ends of the shifting field; arithmetic, where the sign bit is repeated during a shift down; or end around, where the data word forms a continuous loop.

LOGIC EQUATIONS

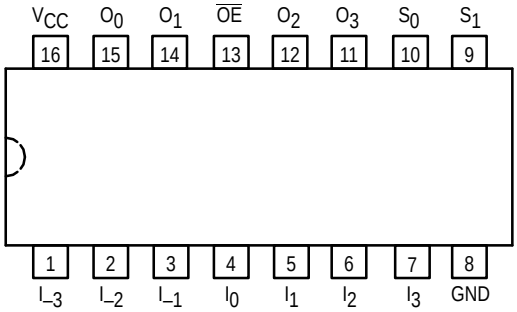
$O_0 = \overline{S}_0\,\overline{S}_1\,I_0 + S_0\,\overline{S}_1\,I_{-1} + \overline{S}_0\,S_1\,I_{-2} + S_0\,S_1\,I_{-3}$
$O_1 = \overline{S}_0\,\overline{S}_1\,I_1 + S_0\,\overline{S}_1\,I_0 + \overline{S}_0\,S_1\,I_{-1} + S_0\,S_1\,I_{-2}$
$O_2 = \overline{S}_0\,\overline{S}_1\,I_2 + S_0\,\overline{S}_1\,I_1 + \overline{S}_0\,S_1\,I_0 + S_0\,S_1\,I_{-1}$
$O_3 = \overline{S}_0\,\overline{S}_1\,I_3 + S_0\,\overline{S}_1\,I_2 + \overline{S}_0\,S_1\,I_1 + S_0\,S_1\,I_0$

TRUTH TABLE

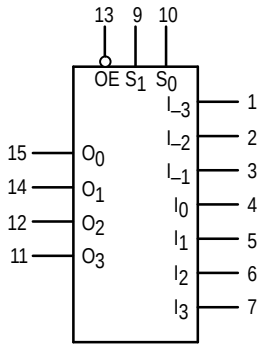
Inputs			Outputs			
$\overline{OE}$	S_1	S_0	O_0	O_1	O_2	O_3
H	X	X	Z	Z	Z	Z
L	L	L	I_0	I_1	I_2	I_3
L	L	H	I_{-1}	I_0	I_1	I_2
L	H	L	I_{-2}	I_{-1}	I_0	I_1
L	H	H	I_{-3}	I_{-2}	I_{-1}	I_0

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

CONNECTION DIAGRAM

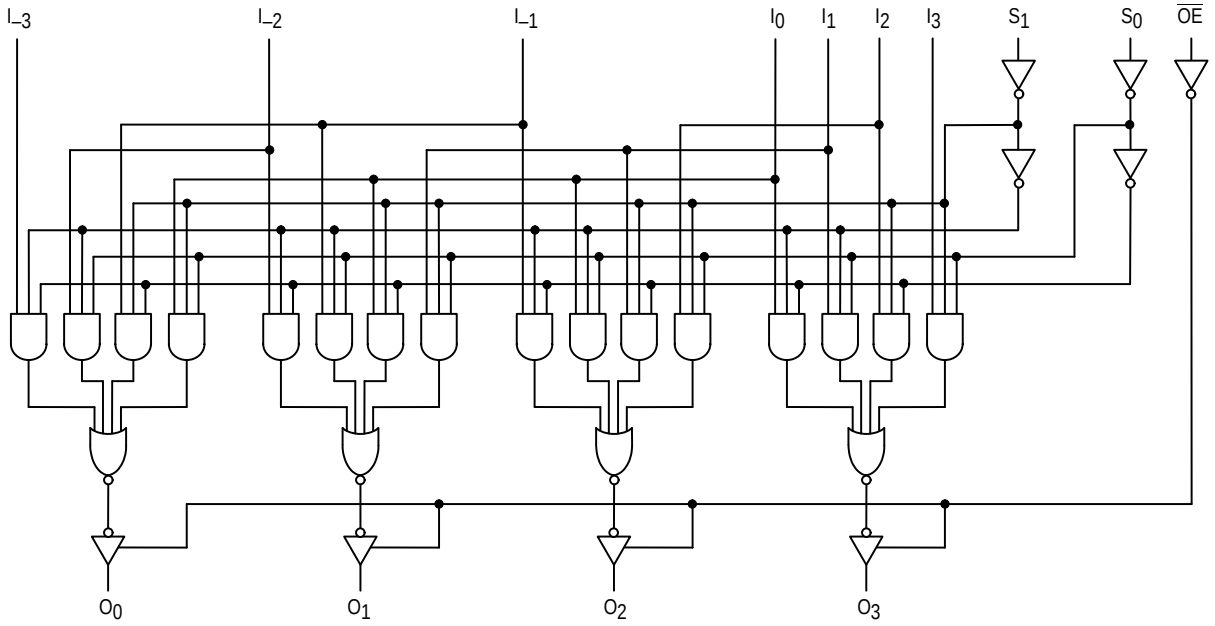


LOGIC SYMBOL



V_{CC} = PIN 16
GND = PIN 8

LOGIC DIAGRAM



GUARANTEED OPERATING RANGES

Symbol	Parameter		Min	Typ	Max	Unit
V_{CC}	Supply Voltage	54, 74	4.5	5.0	5.5	V
T_A	Operating Ambient Temperature Range	54	–55	25	125	°C
		74	0	25	70	
I_{OH}	Output Current — High	54, 74	—	—	–3.0	mA
I_{OL}	Output Current — Low	54, 74	—	—	24	mA

DC CHARACTERISTICS OVER OPERATING TEMPERATURE RANGE (unless otherwise specified)

Symbol	Parameter		Limits Min	Limits Typ	Limits Max	Unit	Test Conditions	
V_{IH}	Input HIGH Voltage		2.0			V	Guaranteed Input HIGH Voltage	
V_{IL}	Input LOW Voltage				0.8	V	Guaranteed Input LOW Voltage	
V_{IK}	Input Clamp Diode Voltage				–1.2	V	I_{IN} = –18 mA	V_{CC} = MIN
V_{OH}	Output HIGH Voltage	54, 74	2.4	3.3		V	I_{OH} = –3.0 mA	V_{CC} = 4.5 V
		74	2.7	3.3		V	I_{OH} = –3.0 mA	V_{CC} = 4.75 V
V_{OL}	Output LOW Voltage			0.35	0.5	V	I_{OL} = 24 mA	V_{CC} = MIN
I_{OZH}	Output OFF Current — HIGH				50	µA	V_{OUT} = 2.7 V	V_{CC} = MAX
I_{OZL}	Output OFF Current — LOW				–50	µA	V_{OUT} = 0.5 V	V_{CC} = MAX
I_{IH}	Input HIGH Current				20	µA	V_{IN} = 2.7 V	V_{CC} = MAX
					100		V_{IN} = 7.0 V	
I_{IL}	Input LOW Current				–1.2	mA	V_{IN} = 0.5 V	V_{CC} = MAX
I_{OS}	Output Short Circuit Current (Note 2)		–60		–150	mA	V_{OUT} = 0 V	V_{CC} = MAX
I_{CCH}	Power Supply Current			22	35	mA	Outputs HIGH	V_{CC} = MAX
I_{CCL}				26	41		Outputs LOW	
I_{CCZ}				26	42		Outputs OFF	

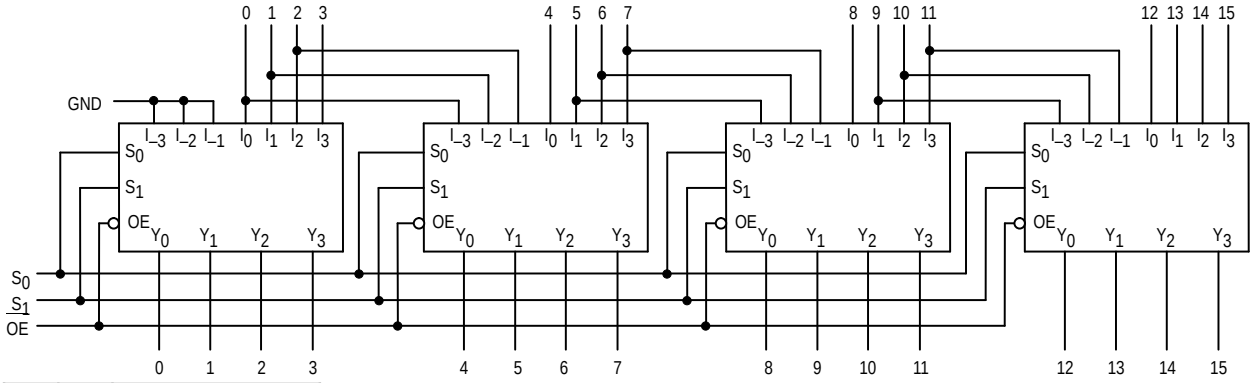
NOTES: 1. For conditions such as MIN or MAX, use the appropriate value specified under guaranteed operating ranges.
2. Not more than one output should be shorted at a time, nor for more than 1 second.

AC CHARACTERISTICS

Symbol	Parameter	54/74F T_A = +25°C V_{CC} = +5.0 V C_L = 50 pF		54F T_A = –55 to +125°C V_{CC} = 5.0 V ±10% C_L = 50 pF		74F T_A = 0 to +70°C V_{CC} = 5.0 V ±10% C_L = 50 pF		Unit
		Min	Max	Min	Max	Min	Max	
t_{PLH} t_{PHL}	Propagation Delay I_n to 0_n	3.0 2.5	6.0 5.5	3.0 2.5	7.5 7.0	3.0 2.5	7.0 6.5	ns
t_{PLH} t_{PHL}	Propagation Delay S_n to O_n	4.0 3.0	10 8.5	4.0 3.0	13.5 10	4.0 3.0	11 9.5	ns
t_{PZH} t_{PZL}	Output Enable Time	2.5 4.0	7.0 9.0	2.5 4.0	10.5 11	2.5 4.0	8.0 10	ns
t_{PHZ} t_{PLZ}	Output Disable Time	2.0 1.5	5.5 5.5	2.0 1.5	7.0 9.0	2.0 1.5	6.5 6.5	ns

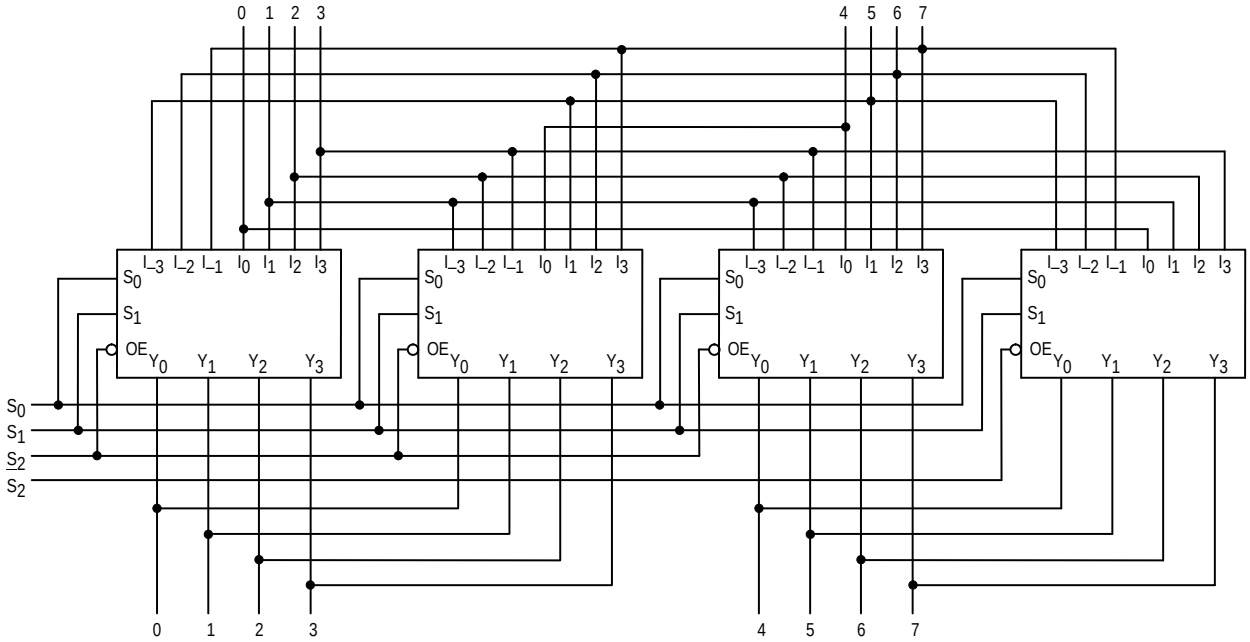
APPLICATIONS

16-Bit Shift-Up 0 to 3 Pieces, Zero Backfill



S_1	S_0	
L	L	NO SHIFT
L	H	SHIFT 1 PLACE
H	L	SHIFT 2 PLACES
H	H	SHIFT 3 PLACES

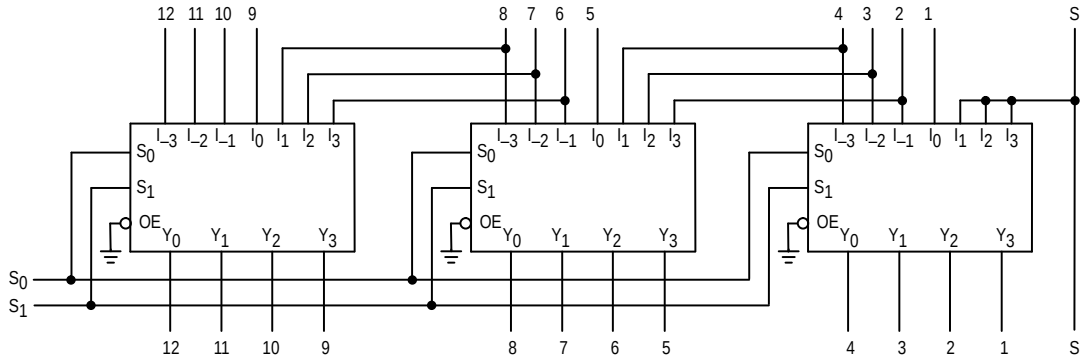
8-Bit End Around Shift 0 to 7 Pieces



S_2	S_1	S_0	
L	L	L	NO SHIFT
L	L	H	SHIFT END AROUND 1
L	H	L	SHIFT END AROUND 2
L	H	H	SHIFT END AROUND 3
H	L	L	SHIFT END AROUND 4

S_2	S_1	S_0	
H	L	H	SHIFT END AROUND 5
H	H	L	SHIFT END AROUND 6
H	H	H	SHIFT END AROUND 7

13-Bit Twos Complement Scaler



S_1	S_0	SCALE
L	L ÷ 8	1/8
L	H ÷ 4	1/4
H	L ÷ 2	1/2
H	H NO CHANGE	1