

54F/74F139

Dual 1-of-4 Decoder/Demultiplexer

General Description

The 'F139 is a high-speed, dual 1-of-4 decoder/demultiplexer. The device has two independent decoders, each accepting two inputs and providing four mutually exclusive active LOW outputs. Each decoder has an active LOW Enable input which can be used as a data input for a 4-output demultiplexer. Each half of the 'F139 can be used as a function generator providing all four minterms of two variables.

Features

- Multifunction capability
- Two completely independent 1-of-4 decoders
- Active LOW mutually exclusive outputs
- Guaranteed 4000V minimum ESD protection

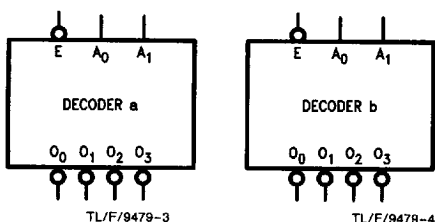
Ordering Code: See Section 11

Commercial	Military	Package Number	Package Description
74F139PC		N16E	16-Lead (0.300" Wide) Molded Dual-In-Line
	54F139DM (Note 2)	J16A	16-Lead Ceramic Dual-In-Line
74F139SC (Note 1)		M16A	16-Lead (0.150" Wide) Molded Small Outline, JEDEC
74F139SJ (Note 1)		M16D	16-Lead (0.300" Wide) Molded Small Outline, EIAJ
	54F139FM (Note 2)	W16A	16-Lead Cerpack
	54F139LM (Note 2)	E20A	20-Lead Ceramic Leadless Chip Carrier, Type C

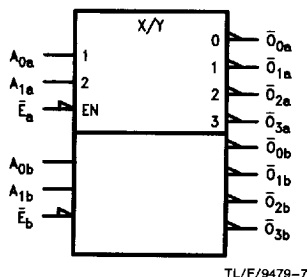
Note 1: Devices also available in 13" reel. Use suffix = SCX and SJX.

Note 2: Military grade device with environmental and burn-in processing. Use suffix = DMOB, FMOB and LMOB.

Logic Symbols

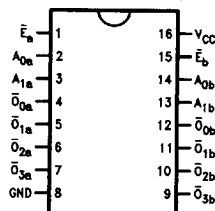


IEEE/IEC

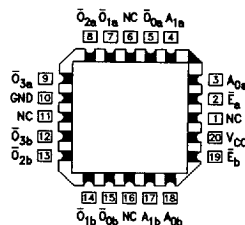


Connection Diagrams

Pin Assignment DIP, SOIC and Flatpak



Pin Assignment for LCC



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}
A_0, A_1	Address Inputs	1.0/1.0	20 μA / -0.6 mA
$\bar{E}$	Enable Inputs (Active LOW)	1.0/1.0	20 μA / -0.6 mA
$\bar{O}_0-\bar{O}_3$	Outputs (Active LOW)	50/33.3	-1 mA/20 mA

Functional Description

The 'F139 is a high-speed dual 1-of-4 decoder/demultiplexer. The device has two independent decoders, each of which accepts two binary weighted inputs (A_0-A_1) and provides four mutually exclusive active LOW Outputs ($\bar{O}_0-\bar{O}_3$). Each decoder has an active LOW enable ($\bar{E}$). When $\bar{E}$ is HIGH all outputs are forced HIGH. The enable can be used

as the data input for a 4-output demultiplexer application. Each half of the 'F139 generates all four minterms of two variables. These four minterms are useful in some applications, replacing multiple gate functions as shown in Figure 1, and thereby reducing the number of packages required in a logic network.

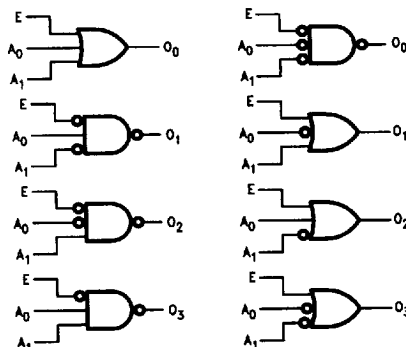
Truth Table

Inputs			Outputs			
$\bar{E}$	A_0	A_1	$\bar{O}_0$	$\bar{O}_1$	$\bar{O}_2$	$\bar{O}_3$
H	X	X	H	H	H	H
L	L	L	L	H	H	H
L	H	L	H	L	H	H
L	L	H	H	H	L	H
L	H	H	H	H	H	L

H = HIGH Voltage Level

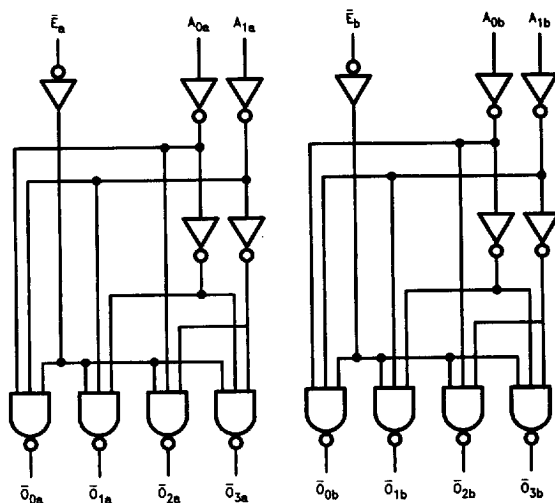
L = LOW Voltage Level

X = Immaterial



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FIGURE 1. Gate Functions (each half)

Logic Diagram


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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
Plastic	-55°C to +150°C

V _{CC} Pin Potential to Ground Pin	-0.5V to +7.0V
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Input Voltage (Note 2)	-0.5V to +7.0V
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Input Current (Note 2)	-30 mA to +5.0 mA
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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)
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ESD Last Passing Voltage (Min)	4000V
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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

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			Units	V _{CC}	Conditions
		Min	Typ	Max			
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 _{CC}	Power Supply Current		13	20	mA	Max	

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

Symbol	Parameter	74F			54F		74F		Units	Fig. No.
		$T_A = +25^{\circ}\text{C}$ $V_{CC} = +5.0\text{V}$ $C_L = 50\text{ pF}$			$T_A, V_{CC} = \text{MII}$ $C_L = 50\text{ pF}$		$T_A, V_{CC} = \text{Com}$ $C_L = 50\text{ pF}$			
		Min	Typ	Max	Min	Max	Min	Max		
t_{PLH} t_{PHL}	Propagation Delay A_0 or A_1 to $\bar{O}_n$	3.5 4.0	5.3 6.1	7.5 8.0	2.5 3.5	12.0 9.5	3.0 4.0	8.5 9.0	ns	2-3
t_{PLH} t_{PHL}	Propagation Delay $\bar{E}_1$ to $\bar{O}_n$	3.5 3.0	5.4 4.7	7.0 6.5	3.0 2.5	9.0 8.0	3.5 3.0	8.0 7.5	ns	2-3