FAIRCHILD SEMICONDUCTOR™

April 1988
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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

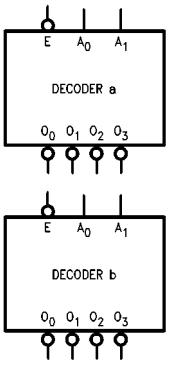
- Multifunction capability
- Two completely independent 1-of-4 decoders
- Active LOW mutually exclusive outputs

Ordering Code:

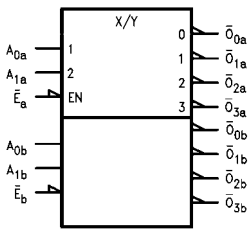
Order Number	Package Number	Package Description
74F139SC	M16A	16-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150 Narrow
74F139SJ	M16D	16-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide
74F139PC	N16E	16-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300 Wide

Devices also available in Tape and Reel. Specify by appending the suffix letter "X" to the ordering code.

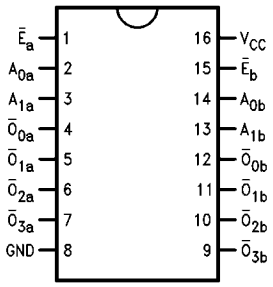
Logic Symbols



IEEE/IEC



Connection Diagram



Truth Table

Inputs			Outputs			
$\overline{E}$	A_0	A_1	$\overline{O}_0$	$\overline{O}_1$	$\overline{O}_2$	$\overline{O}_3$
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

Unit Loading/Fan Out

Pin Names	Description	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
$\overline{E}$	Enable Inputs (Active LOW)	1.0/1.0	20 μA/–0.6 mA
$\overline{O}_0$–$\overline{O}_3$	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 ($\overline{O}_0$–$\overline{O}_3$). Each decoder has an active LOW enable ($\overline{E}$). When $\overline{E}$ 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.

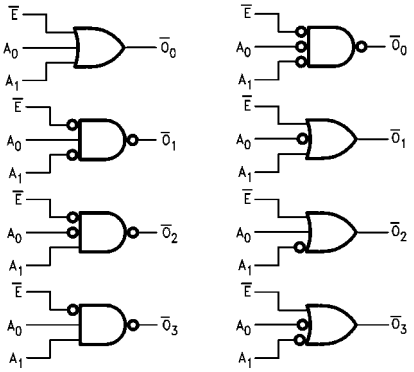
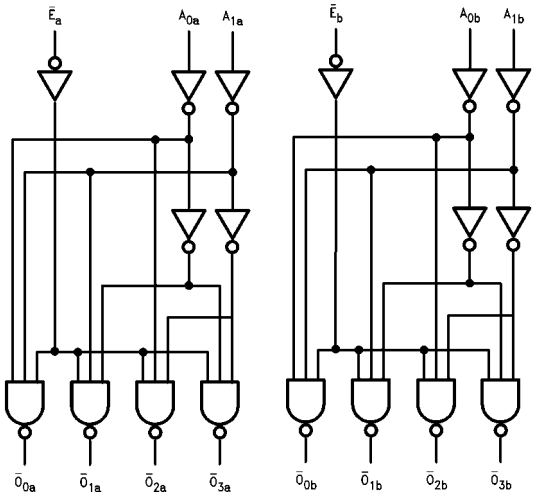


FIGURE 1. Gate Functions (each half)

Logic Diagram



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)

Storage Temperature	–65°C to +150°C
Ambient Temperature under Bias	–55°C to +125°C
Junction Temperature under Bias	–55°C to +150°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}
3 STATE Output	–0.5V to +5.5V
Current Applied to Output	
in LOW State (Max)	twice the rated I_{OL} (mA)
ESD Last Passing Voltage (Min)	4000V

Recommended Operating Conditions

Free Air Ambient Temperature	0°C to +70°C
Supply Voltage	+4.5V to +5.5V

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.

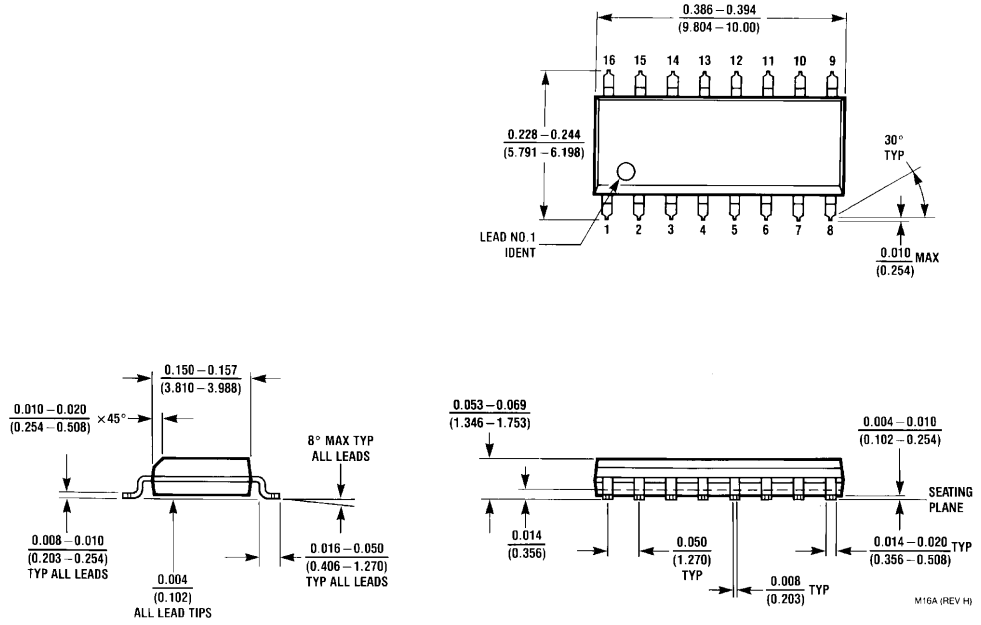
DC Electrical Characteristics

Symbol	Parameter		Min	Typ	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	10% V_{CC}	2.5			V	Min	I_{OH} = –1 mA
		5% V_{CC}	2.7					I_{OH} = –1 mA
V_{OL}	Output LOW Voltage	10% V_{CC}			0.5	V	Min	I_{OL} = 20 mA
I_{IH}	Input HIGH Current				5.0	µA	Max	V_{IN} = 2.7V
I_{BVI}	Input HIGH Current Breakdown Test				7.0	µA	Max	V_{IN} = 7.0V
I_{CEX}	Output HIGH Leakage Current				50	µA	Max	V_{OUT} = V_{CC}
V_{ID}	Input Leakage Test		4.75			V	0.0	I_{ID} = 1.9 µA All Other Pins Grounded
I_{OD}	Output Leakage Circuit Current				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	

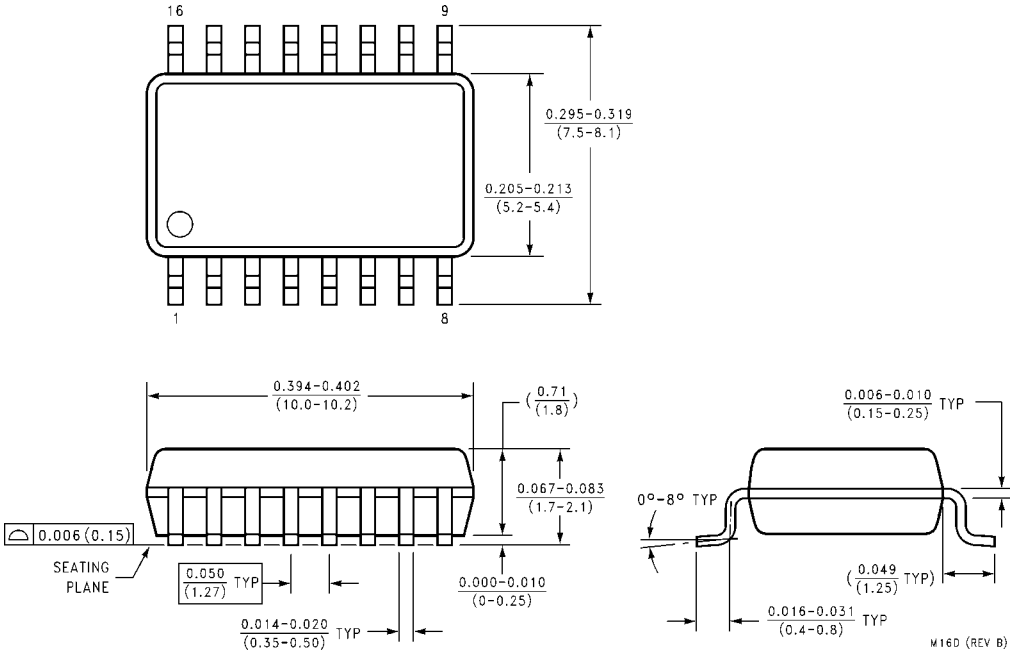
AC Electrical Characteristics

Symbol	Parameter	T_A = +25°C, V_{CC} = +5.0V, C_L = 50 pF			T_A = 0°C to +70°C, V_{CC} = +5.0V, C_L = 50 pF		Units
		Min	Typ	Max	Min	Max	
t_{PLH}	Propagation Delay	3.5	5.3	7.5	3.0	8.5	ns
t_{PHL}	A_0 or A_1 to $\overline{O}_n$	4.0	6.1	8.0	4.0	9.0	
t_{PLH}	Propagation Delay	3.5	5.4	7.0	3.5	8.0	ns
t_{PHL}	$\overline{E}_1$ to $\overline{O}_n$	3.0	4.7	6.5	3.0	7.5	

Physical Dimensions inches (millimeters) unless otherwise noted

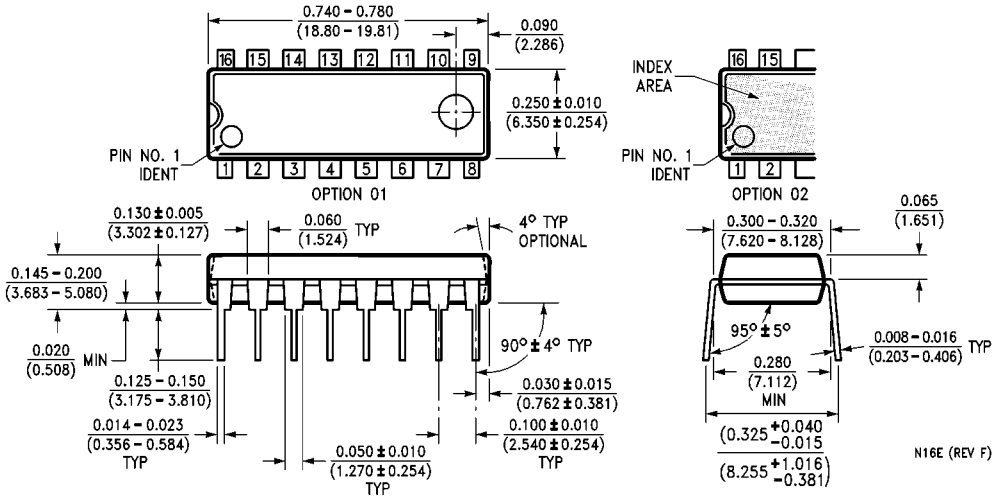


16-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150 Narrow
Package Number M16A



16-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide
Package Number M16D

Physical Dimensions inches (millimeters) unless otherwise noted (Continued)



16-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300 Wide
Package Number N16E