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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

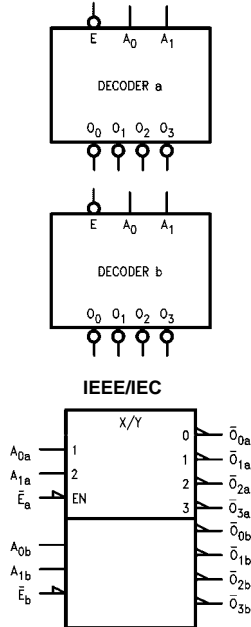
- Multifunction capability
- Two completely independent 1-of-4 decoders
- Active LOW mutually exclusive outputs

### Ordering Code:

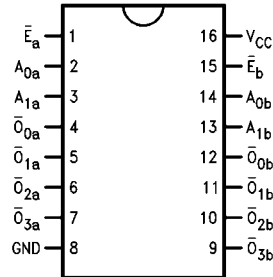
Order Number	Package Number	Package Description
74F139SC	M16A	16-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150 Narrow
74F139SJ	M16D	16-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide
74F139PC	N16E	16-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300 Wide

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

### Logic Symbols



### Connection Diagram



### 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

## Unit Loading/Fan Out

Pin Names	Description	U.L.	Input $I_{IH}/I_{IL}$
		HIGH/LOW	Output $I_{OH}/I_{OL}$
$A_0, A_1$	Address Inputs	1.0/1.0	$20 \mu A/-0.6 \text{ mA}$
$\bar{E}$	Enable Inputs (Active LOW)	1.0/1.0	$20 \mu A/-0.6 \text{ mA}$
$\bar{O}_0-\bar{O}_3$	Outputs (Active LOW)	50/33.3	$-1 \text{ mA}/20 \text{ mA}$

## 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.

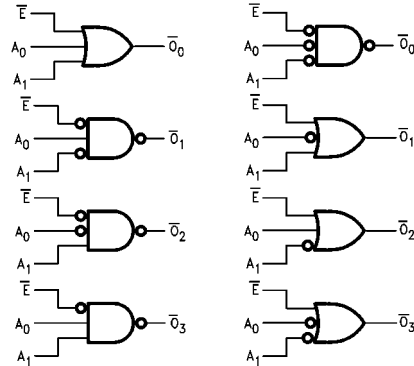
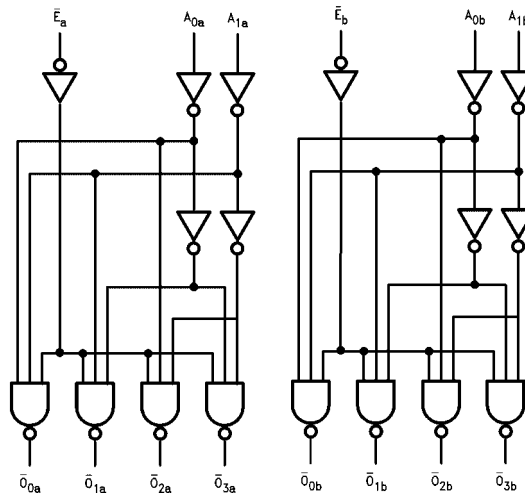


FIGURE 1. Gate Functions (each half)

## 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 <sup>(Note 1)</sup>		Recommended Operating Conditions	
Storage Temperature	-65°C to +150°C	Free Air Ambient Temperature	0°C to +70°C
Ambient Temperature under Bias	-55°C to +125°C	Supply Voltage	+4.5V to +5.5V
Junction Temperature under Bias	-55°C to +150°C		
V <sub>CC</sub> 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 <sub>CC</sub> = 0V)			
Standard Output	-0.5V to V <sub>CC</sub>		
3 STATE Output	-0.5V to +5.5V		
Current Applied to Output in LOW State (Max)	twice the rated I <sub>OL</sub> (mA)		
ESD Last Passing Voltage (Min)	4000V		

**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.

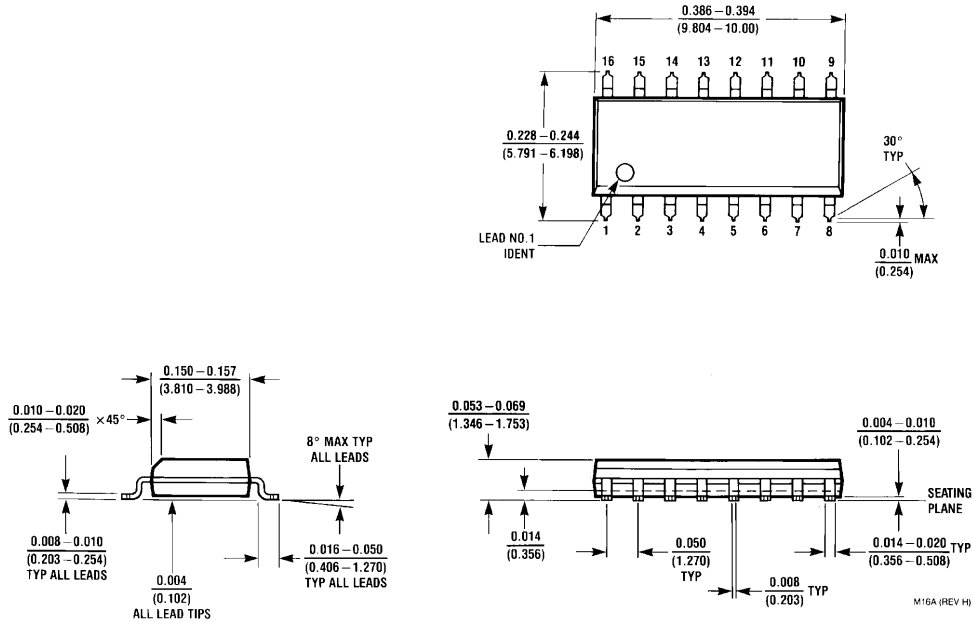
### DC Electrical Characteristics

Symbol	Parameter	Min	Typ	Max	Units	V <sub>CC</sub>	Conditions
V <sub>IH</sub>	Input HIGH Voltage	2.0			V		Recognized as a HIGH Signal
V <sub>IL</sub>	Input LOW Voltage			0.8	V		Recognized as a LOW Signal
V <sub>CD</sub>	Input Clamp Diode Voltage			-1.2	V	Min	I <sub>IN</sub> = -18 mA
V <sub>OH</sub>	Output HIGH Voltage	10% V <sub>CC</sub> 5% V <sub>CC</sub>	2.5 2.7		V	Min	I <sub>OH</sub> = -1 mA I <sub>OH</sub> = -1 mA
V <sub>OL</sub>	Output LOW Voltage	10% V <sub>CC</sub>		0.5	V	Min	I <sub>OL</sub> = 20 mA
I <sub>IH</sub>	Input HIGH Current			5.0	μA	Max	V <sub>IN</sub> = 2.7V
I <sub>BVI</sub>	Input HIGH Current Breakdown Test			7.0	μA	Max	V <sub>IN</sub> = 7.0V
I <sub>CEX</sub>	Output HIGH Leakage Current			50	μA	Max	V <sub>OUT</sub> = V <sub>CC</sub>
V <sub>ID</sub>	Input Leakage Test	4.75			V	0.0	I <sub>ID</sub> = 1.9 μA All Other Pins Grounded
I <sub>OD</sub>	Output Leakage Circuit Current			3.75	μA	0.0	V <sub>IOD</sub> = 150 mV All Other Pins Grounded
I <sub>IL</sub>	Input LOW Current			-0.6	mA	Max	V <sub>IN</sub> = 0.5V
I <sub>OS</sub>	Output Short-Circuit Current	-60		-150	mA	Max	V <sub>OUT</sub> = 0V
I <sub>CC</sub>	Power Supply Current		13	20	mA	Max	

### AC Electrical Characteristics

Symbol	Parameter	T <sub>A</sub> = +25°C V <sub>CC</sub> = +5.0V C <sub>L</sub> = 50 pF			T <sub>A</sub> = 0°C to +70°C V <sub>CC</sub> = +5.0V C <sub>L</sub> = 50 pF		Units
		Min	Typ	Max	Min	Max	
t <sub>PLH</sub>	Propagation Delay	3.5	5.3	7.5	3.0	8.5	ns
t <sub>PHL</sub>	A <sub>0</sub> or A <sub>1</sub> to $\bar{O}_n$	4.0	6.1	8.0	4.0	9.0	
t <sub>PLH</sub>	Propagation Delay	3.5	5.4	7.0	3.5	8.0	ns
t <sub>PHL</sub>	$\bar{E}_1$ to $\bar{O}_n$	3.0	4.7	6.5	3.0	7.5	

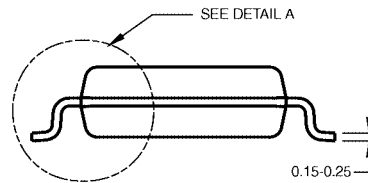
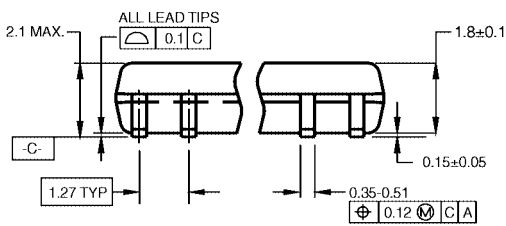
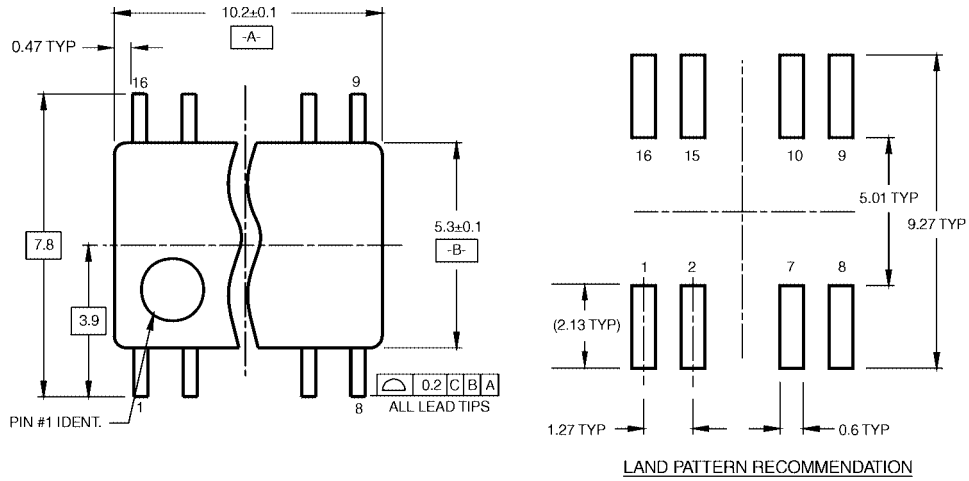
**Physical Dimensions** inches (millimeters) unless otherwise noted



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

M16A (REV H)

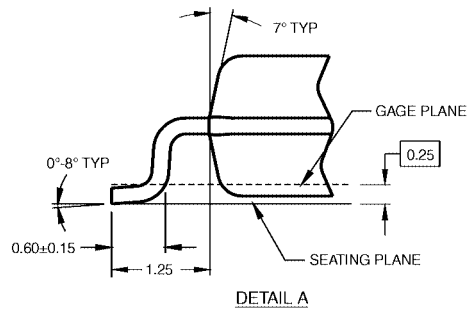
**Physical Dimensions** inches (millimeters) unless otherwise noted (Continued)



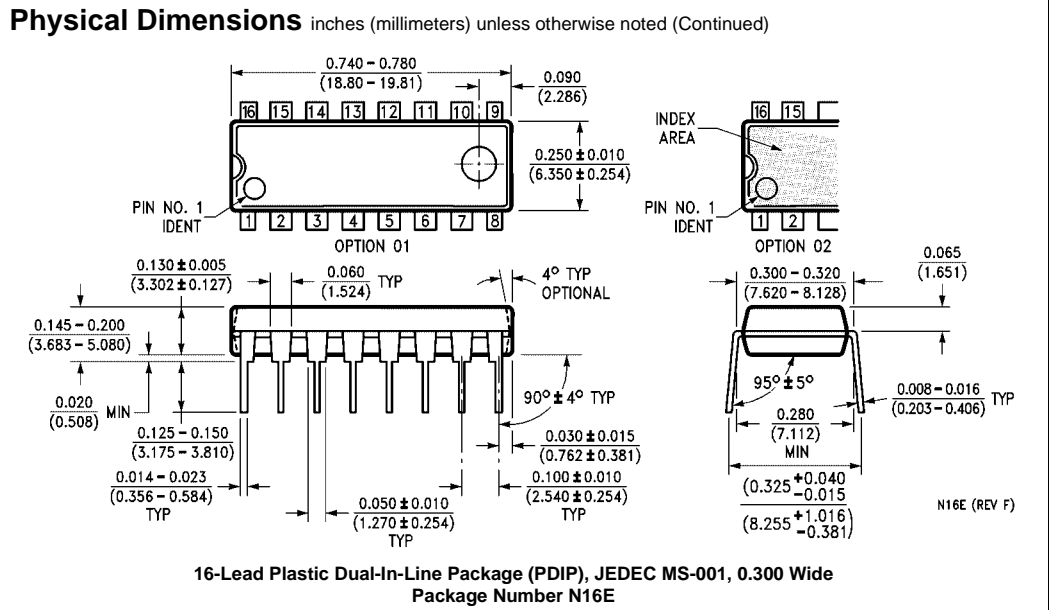
DIMENSIONS ARE IN MILLIMETERS

- NOTES:
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  - B. DIMENSIONS ARE IN MILLIMETERS.
  - C. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS.

M16DRevB1



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



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