National Semiconductor

August 1995

74F148
8-Line to 3-Line Priority Encoder

General Description

The 'F148 provides three bits of binary coded output representing the position of the highest order active input, along with an output indicating the presence of any active input. It is easily expanded via input and output enables to provide priority encoding over many bits.

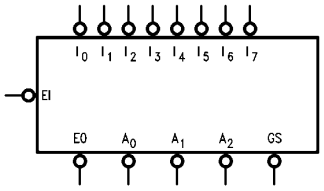
Features

- Encodes eight data lines in priority
- Provides 3-bit binary priority code
- Input enable capability
- Signals when data is present on any input
- Cascadable for priority encoding of n bits

Commercial	Package Number	Package Description
74F148PC	N16E	16-Lead (0.300″ Wide) Molded Dual-In-Line
74F148SC (Note 1)	M16A	16-Lead (0.150″ Wide) Molded Small Outline, JEDEC
74F148SJ (Note 1)	M16D	16-Lead (0.300″ Wide) Molded Small Outline, EIAJ

Note 1: Devices also available in 13″ reel. Use Suffix = SCX and SJX.

Logic Symbols



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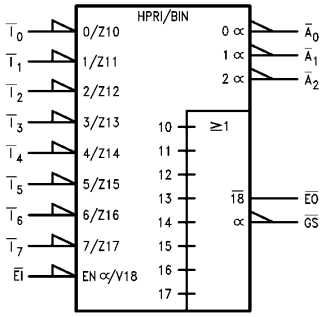
IEEE/IEC



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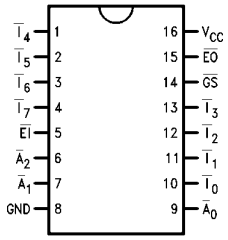
Connection Diagram

Pin Assignment for SOIC and DIP



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Unit Loading/Fan Out

Pin Names	Description	74F	
		U.L. HIGH/LOW	Input I_{IH}/I_{IL} Output I_{OH}/I_{OL}
$\overline{I}_0$	Priority Input (Active LOW)	1.0/1.0	20 μA/ −0.6 mA
$\overline{I}_1$–$\overline{I}_7$	Priority Inputs (Active LOW)	1.0/2.0	20 μA/ −1.2 mA
$\overline{EI}$	Enable Input (Active LOW)	1.0/1.0	20 μA/ −0.6 mA
$\overline{EO}$	Enable Output (Active LOW)	50/33.3	−1 mA/20 mA
$\overline{GS}$	Group Signal Output (Active LOW)	50/33.3	−1 mA/20 mA
$\overline{A}_0$–$\overline{A}_2$	Address Outputs (Active LOW)	50/33.3	−1 mA/20 mA

Functional Description

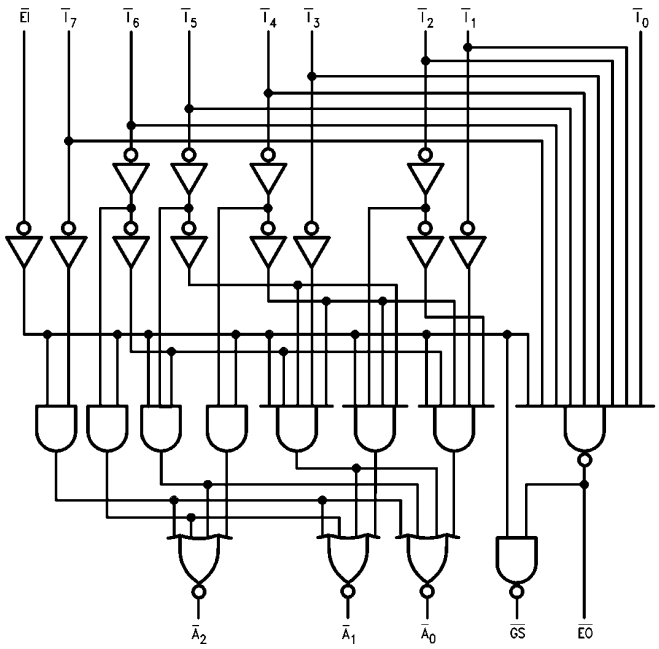
The ’F148 8-input priority encoder accepts data from eight active LOW inputs ($\overline{I}_0$–$\overline{I}_7$) and provides a binary representation on the three active LOW outputs. A priority is assigned to each input so that when two or more inputs are simultaneously active, the input with the highest priority is represented on the output, with input line 7 having the highest priority. A HIGH on the Enable Input ($\overline{EI}$) will force all outputs to the inactive (HIGH) state and allow new data to settle without producing erroneous information at the outputs.A Group Signal output ($\overline{GS}$) and Enable Output ($\overline{EO}$) are provided along with the three priority data outputs ($\overline{A}_2$, $\overline{A}_1$, $\overline{A}_0$). $\overline{GS}$ is active LOW when any input is LOW: this indicates when any input is active. $\overline{EO}$ is active LOW when all inputs are HIGH. Using the Enable Output along with the Enable Input allows cascading for priority encoding on any number of input signals. Both $\overline{EO}$ and $\overline{GS}$ are in the inactive HIGH state when the Enable Input is HIGH.

Truth Table

Inputs									Outputs				
$\overline{EI}$	$\overline{I}_0$	$\overline{I}_1$	$\overline{I}_2$	$\overline{I}_3$	$\overline{I}_4$	$\overline{I}_5$	$\overline{I}_6$	$\overline{I}_7$	$\overline{GS}$	$\overline{A}_0$	$\overline{A}_1$	$\overline{A}_2$	$\overline{EO}$
H	X	X	X	X	X	X	X	X	H	H	H	H	H
L	H	H	H	H	H	H	H	H	H	H	H	H	L
L	X	X	X	X	X	X	X	L	L	L	L	L	H
L	X	X	X	X	X	X	L	H	L	H	L	L	H
L	X	X	X	X	X	L	H	H	L	L	H	L	H
L	X	X	X	X	L	H	H	H	L	H	H	L	H
L	X	X	X	L	H	H	H	H	L	L	L	H	H
L	X	X	L	H	H	H	H	H	L	H	L	H	H
L	X	L	H	H	H	H	H	H	L	L	H	H	H
L	L	H	H	H	H	H	H	H	L	H	H	H	H

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

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)

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
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

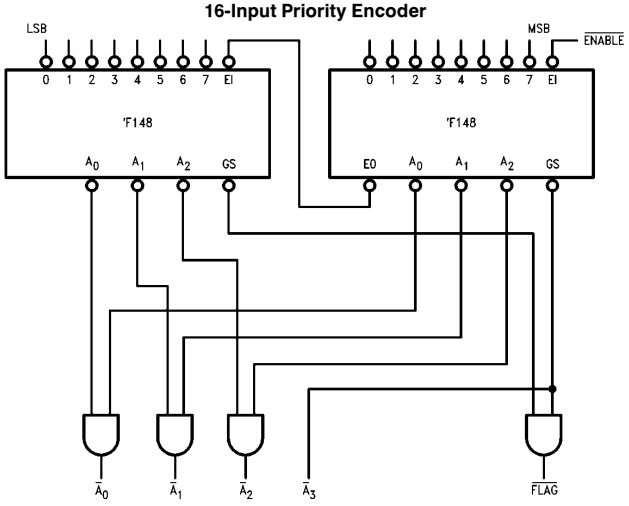
Free Air Ambient Temperature	
Commercial	0°C to +70°C
Supply Voltage	
Commercial	+4.5V to +5.5V

DC Electrical Characteristics

Symbol	Parameter		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	74F 10% V_{CC}	2.5			V	Min	I_{OH} = −1 mA
		74F 5% V_{CC}	2.7					I_{OH} = −1 mA
V_{OL}	Output LOW Voltage	74F 10% V_{CC}			0.5	V	Min	I_{OL} = 20 mA
I_{IH}	Input HIGH Current	74F			5.0	μA	Max	V_{IN} = 2.7V
I_{BVI}	Input HIGH Current Breakdown Test	74F			7.0	μA	Max	V_{IN} = 7.0V
I_{CEX}	Output High Leakage Current	74F			50	μA	Max	V_{OUT} = V_{CC}
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 ($\bar{I}_0$, $\overline{EI}$)
					−1.2	mA		V_{IN} = 0.5V ($\bar{I}_1$–$\bar{I}_7$)
I_{OS}	Output Short-Circuit Current		−60		−150	mA	Max	V_{OUT} = 0V
I_{CCH}	Power Supply Current				35	mA	Max	V_O = HIGH
I_{CCL}	Power Supply Current				35	mA	Max	V_O = LOW

Application

16-Input Priority Encoder



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AC Electrical Characteristics

Symbol	Parameter	74F $T_A = +25°C$, $V_{CC} = +5.0V$, $C_L = 50$ pF			74F T_A, V_{CC} = Com, $C_L = 50$ pF		Units
		Min	Typ	Max	Min	Max	
t_{PLH} t_{PHL}	Propagation Delay $\overline{I}_n$ to $\overline{A}_n$	3.0 3.0	7.0 8.0	9.0 10.5	3.0 3.0	10.0 12.0	ns
t_{PLH} t_{PHL}	Propagation Delay $\overline{I}_n$ to $\overline{EO}$	2.5 2.5	5.0 5.5	6.5 7.5	2.5 2.5	7.5 8.5	ns
t_{PLH} t_{PHL}	Propagation Delay $\overline{I}_n$ to $\overline{GS}$	2.5 2.5	7.0 6.0	9.0 8.0	2.5 2.5	10.0 9.0	ns
t_{PLH} t_{PHL}	Propagation Delay $\overline{EI}$ to $\overline{A}_n$	2.5 2.5	6.5 6.0	8.5 8.0	2.5 2.5	9.5 9.0	ns
t_{PLH} t_{PHL}	Propagation Delay $\overline{EI}$ to $\overline{GS}$	2.5 2.5	5.0 6.0	7.0 7.5	2.5 2.5	8.0 8.5	ns
t_{PLH} t_{PHL}	Propagation Delay $\overline{EI}$ to $\overline{EO}$	2.5 3.0	5.5 8.0	7.0 10.5	2.5 3.0	8.0 12.0	ns

Ordering Information

The device number is used to form part of a simplified purchasing code where the package type and temperature range are defined as follows:

74F 148 S C X

Temperature Range Family
74F = Commercial

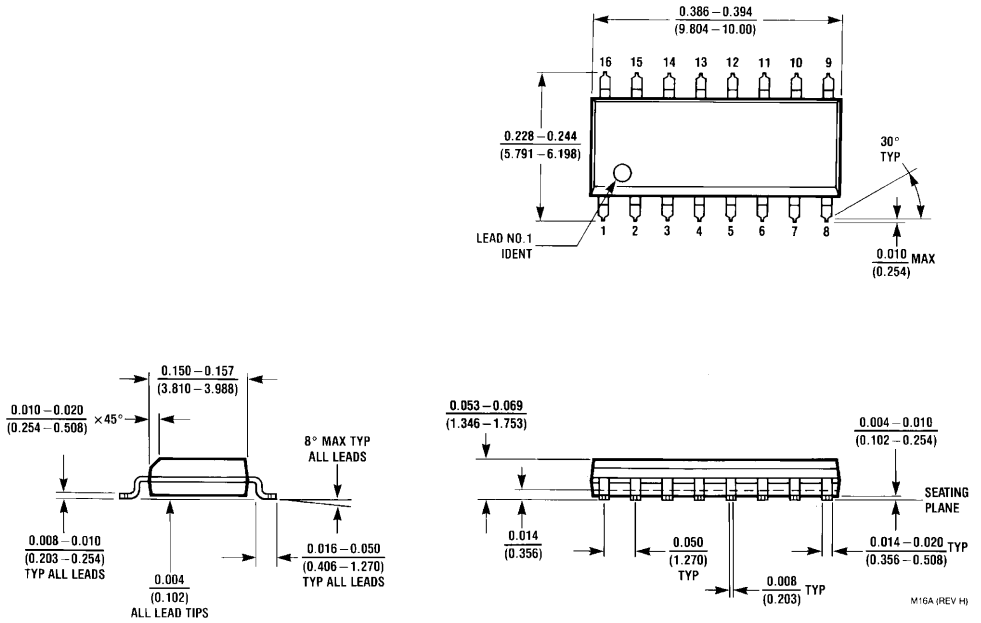
Device Type

Package Code
P = Plastic DIP
S = Small Outline SOIC JEDEC
SJ = Small Outline SOIC EIAJ

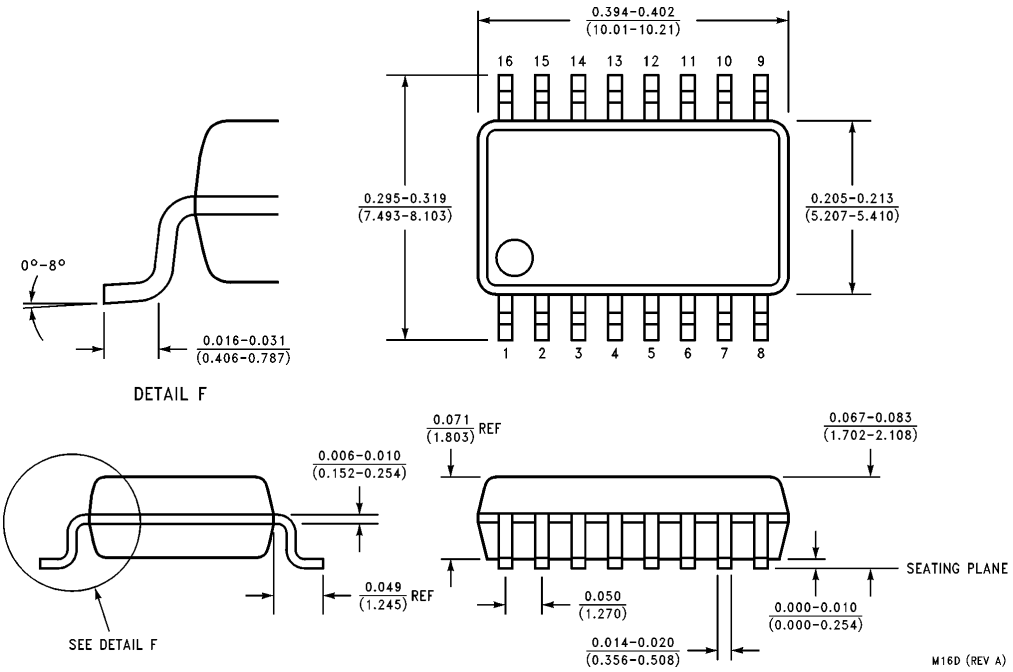
Special Variations
X = Devices shipped in 13″ reel

Temperature Range
C = Commercial (0°C to +70°C)

Physical Dimensions inches (millimeters)

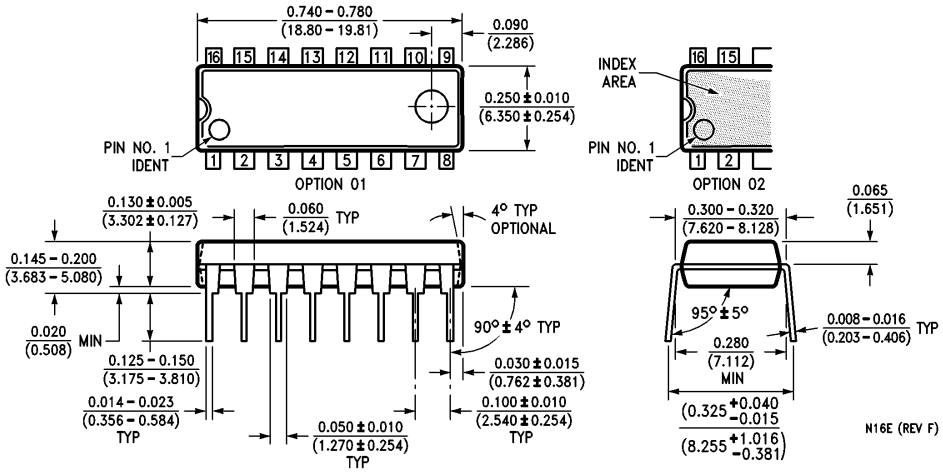


16-Lead (0.150″ Wide) Molded Small Outline Package, JEDEC (S)
NS Package Number M16A



16-Lead (0.150″ Wide) Molded Small Outline Package, EIAJ (SJ)
NS Package Number M16D

Physical Dimensions inches (millimeters) (Continued)



16-Lead (0.300″ Wide) Molded Dual-In-Line Package (P)
NS Package Number N16E

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