

54F/74F158A Quad 2-Input Multiplexer

General Description

The 'F158A is a high speed quad 2-input multiplexer. It selects four bits of data from two sources using the common Select and Enable inputs. The four outputs present the selected data in the inverted form. The 'F158A can also generate any four of the 16 different functions of two variables.

Features

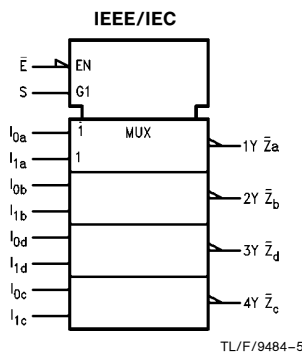
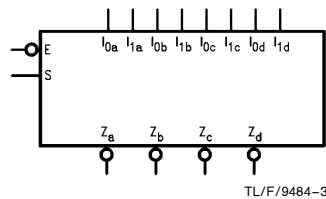
- Guaranteed 4000V minimum ESD protection

| Commercial | Military | Package Number | Package Description |
|--------------------|--------------------|----------------|---|
| 74F158APC | | N16E | 16-Lead (0.300" Wide) Molded Dual-In-Line |
| | 54F158ADM (Note 2) | J16A | 16-Lead Ceramic Dual-In-Line |
| 74F158ASC (Note 1) | | M16A | 16-Lead (0.150" Wide) Molded Small Outline, JEDEC |
| 74F158ASJ (Note 1) | | M16D | 16-Lead (0.300" Wide) Molded Small Outline, EIAJ |
| | 54F158AFM (Note 2) | W16A | 16-Lead Cerpack |
| | 54F158ALM (Note 2) | E20A | 20-Lead Ceramic Leadless Chip Carrier, Type C |

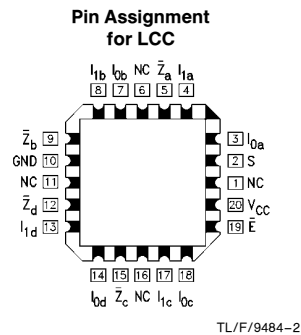
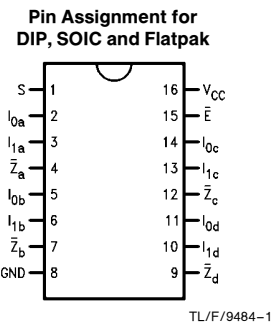
Note 1: Devices also available in 13" reel. Use suffix = SCX and SJX.

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

Logic Symbols



Connection Diagrams



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Unit Loading/Fan Out

| Pin Names | Description | 54F/74F | |
|-----------------------|---------------------------|------------------|---|
| | | U.L. HIGH/LOW | Input I_{IH}/I_{IL} Output I_{OH}/I_{OL} |
| $I_{0a}-I_{0d}$ | Source 0 Data Inputs | 1.0/1.0 | 20 μ A/ -0.6 mA |
| $I_{1a}-I_{1d}$ | Source 1 Data Inputs | 1.0/1.0 | 20 μ A/ -0.6 mA |
| \bar{E} | Enable Input (Active LOW) | 1.0/1.0 | 20 μ A/ -0.6 mA |
| S | Select Input | 1.0/1.0 | 20 μ A/ -0.6 mA |
| $\bar{Z}_a-\bar{Z}_d$ | Inverted Outputs | 50/33.3 | -1 mA/20 mA |

Functional Description

The 'F158A quad 2-input multiplexer selects four bits of data from two sources under the control of a common Select input (S) and presents the data in inverted form at the four outputs. The Enable input (\bar{E}) is active LOW. When \bar{E} is HIGH, all of the outputs (\bar{Z}) are forced HIGH regardless of all other inputs. The 'F158A is the logic implementation of a 4-pole, 2-position switch where the position of the switch is determined by the logic levels supplied to the Select input.

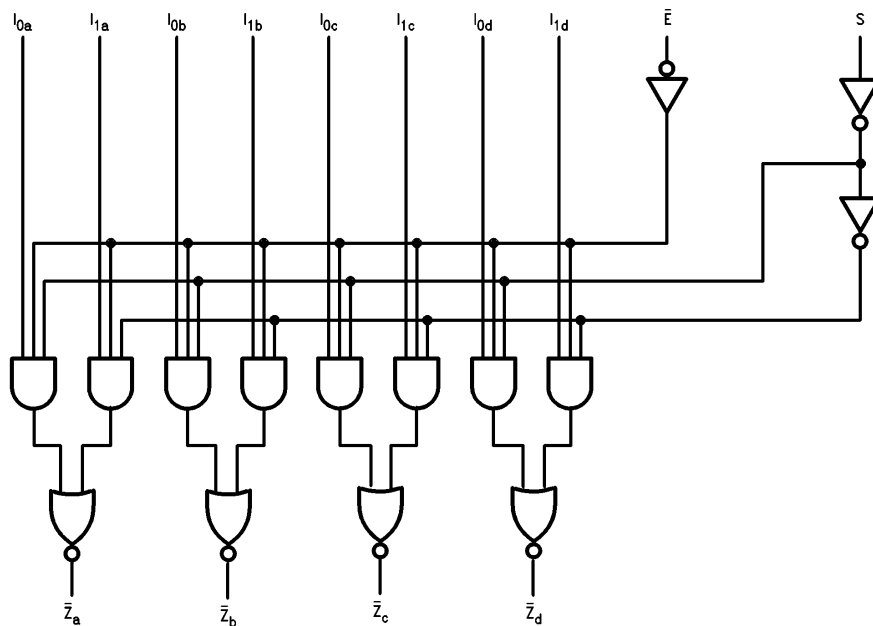
A common use of the 'F158A is the moving of data from two groups of registers to four common output busses. The particular register from which the data comes is determined by the state of the Select input. A less obvious use is as a function generator. The 'F158A can generate four functions of two variables with one variable common. This is useful for implementing gating functions.

Truth Table

| Inputs | | | | Outputs |
|-----------|---|-------|-------|-----------|
| \bar{E} | S | I_0 | I_1 | \bar{Z} |
| H | X | X | X | H |
| L | L | L | X | H |
| L | L | H | X | L |
| L | H | X | L | H |
| L | H | X | H | L |

H = HIGH Voltage Level
 L = LOW Voltage Level
 X = Immaterial
 $\bar{Z}_n = \bar{E} \times (I_{1n} S + I_{0n} \bar{S})$

Logic Diagram



TL/F/9484-4

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 |
| 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) |
| 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.

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

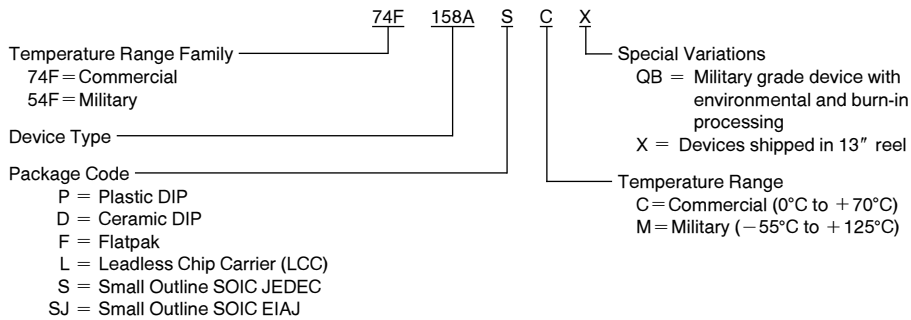
| Symbol | Parameter | 54F/74F | | | Units | V _{CC} | Conditions |
|------------------|-----------------------------------|-------------------------|------|------|-------|-----------------|---|
| | | Min | Typ | Max | | | |
| V _{IH} | Input HIGH Voltage | 2.0 | | | V | | Recognized as a HIGH Signal |
| 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 I _{OH} = -1 mA I _{OH} = -1 mA |
| | | 74F 10% V _{CC} | 2.5 | | | | |
| | | 74F 5% V _{CC} | 2.7 | | | | |
| V _{OL} | Output LOW Voltage | 54F 10% V _{CC} | | 0.5 | V | Min | I _{OL} = 20 mA I _{OL} = 20 mA |
| | | 74F 10% V _{CC} | | 0.5 | | | |
| 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 _{CCH} | Power Supply Current | | 10 | 15 | mA | Max | V _O = HIGH |
| I _{CCL} | Power Supply Current | | 15 | 25 | mA | Max | V _O = LOW |

AC Electrical Characteristics

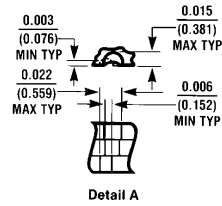
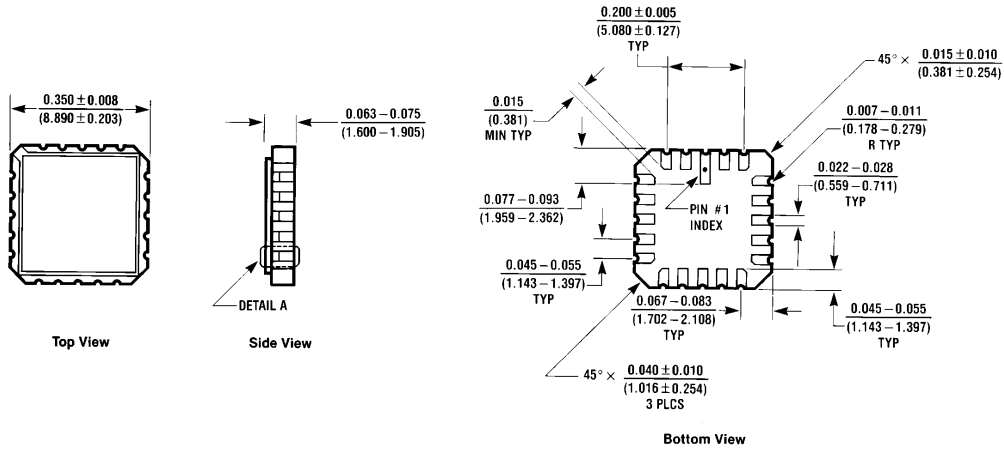
| Symbol | Parameter | 74F | | | 54F | | 74F | | Units |
|--------------------------------------|--|---|------------|------------|--|-------------|--|------------|-------|
| | | T _A = +25°C V _{CC} = +5.0V C _L = 50 pF | | | T _A , V _{CC} = Mil C _L = 50 pF | | T _A , V _{CC} = Com C _L = 50 pF | | |
| | | Min | Typ | Max | Min | Max | Min | Max | |
| t _{PLH} t _{PHL} | Propagation Delay S to \bar{Z}_n | 3.0 2.5 | 5.5 4.5 | 8.5 6.5 | 3.0 2.5 | 10.5 8.0 | 3.0 2.5 | 9.5 7.0 | ns |
| t _{PLH} t _{PHL} | Propagation Delay \bar{E} to \bar{Z}_n | 2.5 2.0 | 4.5 4.0 | 6.0 6.0 | 2.5 2.0 | 8.0 7.0 | 2.5 2.0 | 7.0 6.5 | ns |
| t _{PLH} t _{PHL} | Propagation Delay I _n to \bar{Z}_n | 2.5 1.5 | 4.0 2.5 | 5.9 4.0 | 2.5 1.0 | 8.5 5.0 | 2.5 1.5 | 7.0 4.5 | 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:

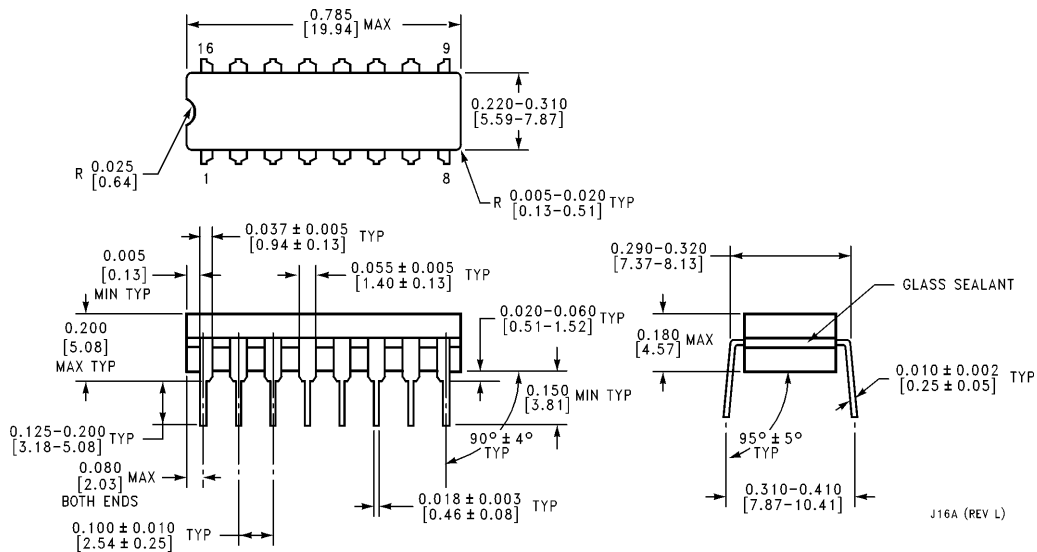


Physical Dimensions inches (millimeters)



20-Lead Ceramic Leadless Chip Carrier (L)
 NS Package Number E20A

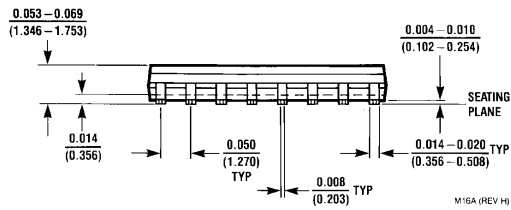
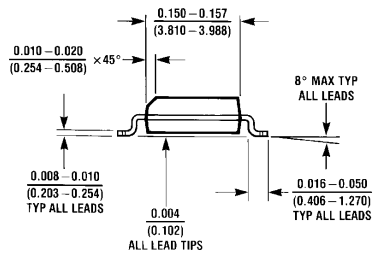
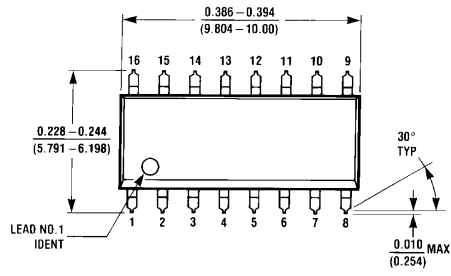
E20A (REV D)



16-Lead Ceramic Dual-In-Line Package (D)
 NS Package Number J16A

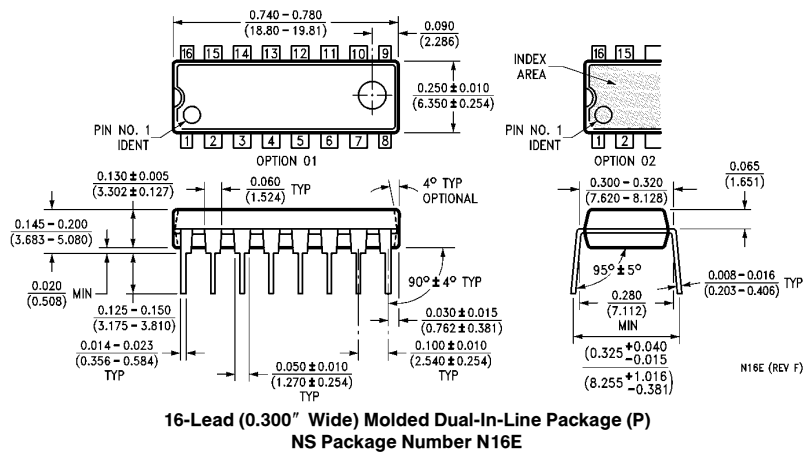
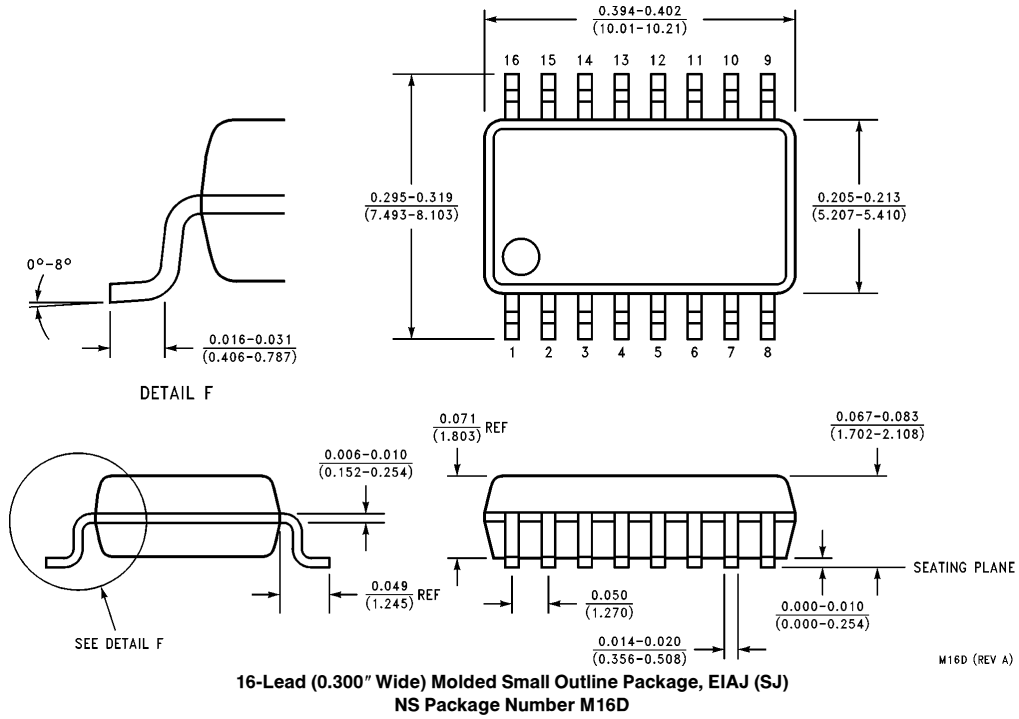
J16A (REV L)

Physical Dimensions inches (millimeters) (Continued)

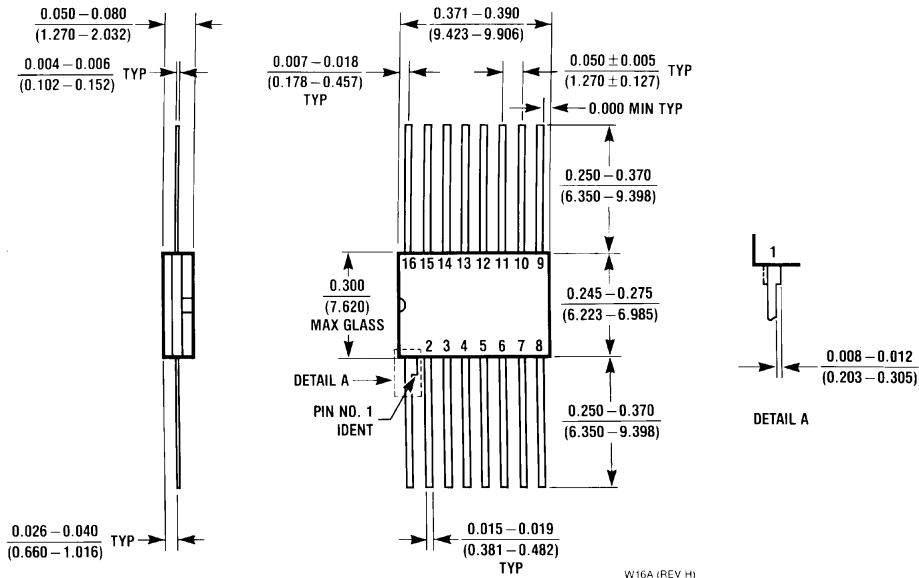


**16-Lead (0.150" Wide) Molded Small Outline Package, JEDEC (S)
NS Package Number M16A**

Physical Dimensions inches (millimeters) (Continued)



Physical Dimensions inches (millimeters) (Continued)



**16-Lead Ceramic Flatpak (F)
NS Package Number W16A**

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