# 74F153

## *Dual 4-Input Multiplexer*

The F153 is a high-speed dual 4-input multiplexer with common select inputs and individual enable inputs for each section. It can select two lines of data from four sources. The two buffered outputs present data in the true (non-inverted) form. In addition to multiplexer operation, the F153 can generate any two functions of three variables.

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Parts are tested using original factory test programs or Rochester developed test solutions to guarantee product meets or exceeds the OCM data sheet.

## Quality Overview

• ISO-9001
• AS9120 certification
• Qualified Manufacturers List (QML) MIL-PRF-35835
    • Class Q Military
    • Class V Space Level
• Qualified Suppliers List of Distributors (QSLD)
    • Rochester is a critical supplier to DLA and meets all industry and DLA standards.

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*The original manufacturer's datasheet accompanying this document reflects the performance and specifications of the Rochester manufactured version of this device. Rochester Electronics guarantees the performance of its semiconductor products to the original OCM specifications. 'Typical' values are for reference purposes only. Certain minimum or maximum ratings may be based on product characterization, design, simulation, or sample testing.*

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# 74F153
# Dual 4-Input Multiplexer

## General Description

The F153 is a high-speed dual 4-input multiplexer with common select inputs and individual enable inputs for each section. It can select two lines of data from four sources. The two buffered outputs present data in the true (non-inverted) form. In addition to multiplexer operation, the F153 can generate any two functions of three variables.

## Ordering Code:

| Order Number | Package Number | Package Description |
|---|---|---|
| 74F153SC | M16A | 16-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150 Narrow |
| 74F153SJ | M16D | 16-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide |
| 74F153PC | 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
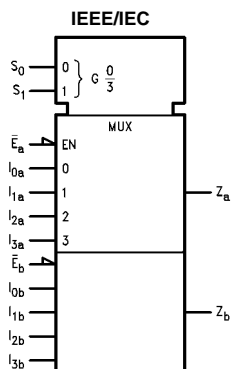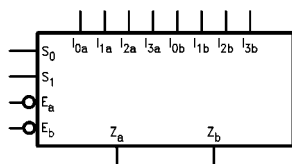


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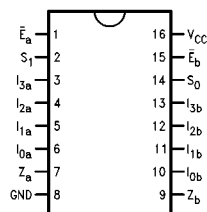
## Unit Loading/Fan Out

| Pin Names | Description | U.L. HIGH/LOW | Input $I_{IH}/I_{IL}$ Output $I_{OH}/I_{OL}$ |
|---|---|---|---|
| $I_{0a}$–$I_{3a}$ | Side A Data Inputs | 1.0/1.0 | 20 µA/–0.6 mA |
| $I_{0b}$–$I_{3b}$ | Side B Data Inputs | 1.0/1.0 | 20 µA/–0.6 mA |
| $S_0$, $S_1$ | Common Select Inputs | 1.0/1.0 | 20 µA/–0.6 mA |
| $\overline{E}_a$ | Side A Enable Input (Active LOW) | 1.0/1.0 | 20 µA/–0.6 mA |
| $\overline{E}_b$ | Side B Enable Input (Active LOW) | 1.0/1.0 | 20 µA/–0.6 mA |
| $Z_a$ | Side A Output | 50/33.3 | –1 mA/20 mA |
| $Z_b$ | Side B Output | 50/33.3 | –1 mA/20 mA |

## Truth Table

| Select Inputs | | Inputs (a or b) | | | | | Output |
|---|---|---|---|---|---|---|---|
| $S_0$ | $S_1$ | $\overline{E}$ | $I_0$ | $I_1$ | $I_2$ | $I_3$ | Z |
| X | X | H | X | X | X | X | L |
| L | L | L | L | X | X | X | L |
| L | L | L | H | X | X | X | H |
| H | L | L | X | L | X | X | L |
| H | L | L | X | H | X | X | H |
| L | H | L | X | X | L | X | L |
| L | H | L | X | X | H | X | H |
| H | H | L | X | X | X | L | L |
| H | H | L | X | X | X | H | H |

H = HIGH Voltage Level
L = LOW
X = Immaterial

## Functional Description

The F153 is a dual 4-input multiplexer. It can select two bits of data from up to four sources under the control of the common Select inputs ($S_0$, $S_1$). The two 4-input multiplexer circuits have individual active LOW Enables ($\overline{E}_a$, $\overline{E}_b$) which can be used to strobe the outputs independently. When the Enables ($\overline{E}_a$, $\overline{E}_b$) are HIGH, the corresponding outputs ($Z_a$, $Z_b$) are forced LOW. The F153 is the logic implementation of a 2-pole, 4-position switch, where the position of the switch is determined by the logic levels supplied to the two Select inputs. The logic equations for the outputs are as follows:

$$Z_a = \overline{E}_a \bullet (I_{0a} \bullet \overline{S}_1 \bullet \overline{S}_0 + I_{1a} \bullet \overline{S}_1 \bullet S_0 + I_{2a} \bullet S_1 \bullet \overline{S}_0 + I_{3a} \bullet S_1 \bullet S_0)$$
$$Z_b = \overline{E}_b \bullet (I_{0b} \bullet \overline{S}_1 \bullet \overline{S}_0 + I_{1b} \bullet \overline{S}_1 \bullet S_0 + I_{2b} \bullet S_1 \bullet \overline{S}_0 + I_{3b} \bullet S_1 \bullet S_0)$$

The F153 can be used to move data from a group of registers to a common output bus. The particular register from which the data came would be determined by the state of the Select inputs. A less obvious application is as a function generator. The F153 can generate two functions of three variables. This is useful for implementing highly irregular random logic.

## Logic Diagram
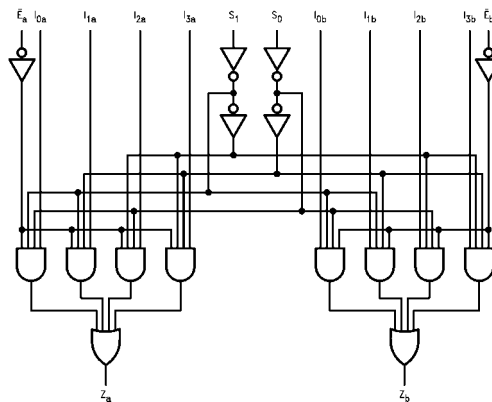


Please note that this diagram is provided only for the understanding of logic operations and should not be used to estimate propagation delays.

## 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) |

## 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.
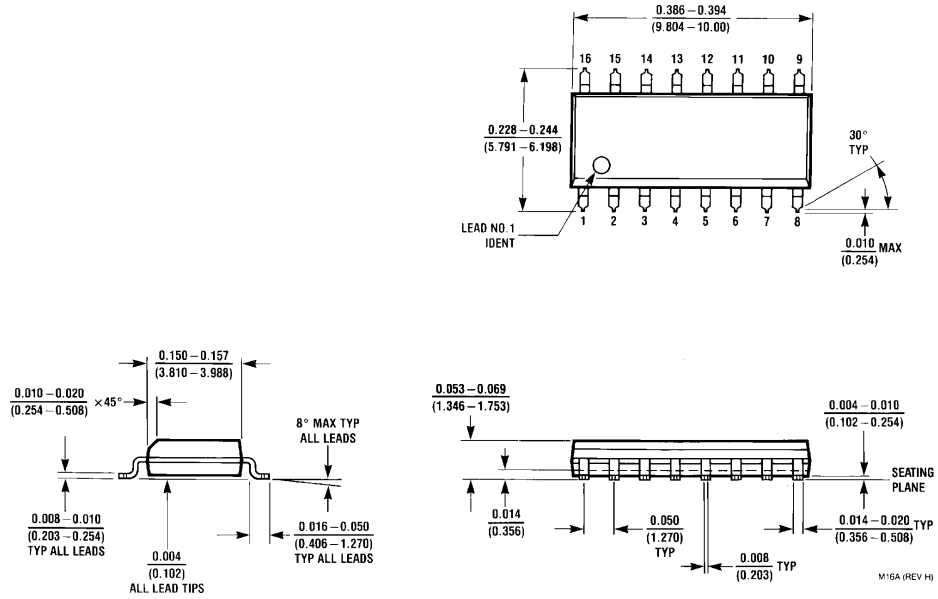
## DC Electrical Characteristics

| 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 |
| $I_{CCL}$ | Power Supply Current | | | 12 | 20 | mA | Max | $V_O$ = LOW |

## 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 | 4.5 | 8.1 | 10.5 | 4.5 | 12.0 | ns |
| $t_{PHL}$ | $S_n$ to $Z_n$ | 3.5 | 7.0 | 9.0 | 3.5 | 10.5 | |
| $t_{PLH}$ | Propagation Delay | 4.5 | 7.1 | 9.0 | 4.5 | 10.5 | ns |
| $t_{PHL}$ | $\overline{E}_n$ to $Z_n$ | 3.0 | 5.7 | 7.0 | 2.5 | 8.0 | |
| $t_{PLH}$ | Propagation Delay | 3.0 | 5.3 | 7.0 | 3.0 | 8.0 | ns |
| $t_{PHL}$ | $I_n$ to $Z_n$ | 2.5 | 5.1 | 6.5 | 2.5 | 7.5 | |

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

0.386 − 0.394
(9.804 − 10.00)

16 15 14 13 12 11 10 9

0.228 − 0.244
(5.791 − 6.198)

30°
TYP

LEAD NO.1
IDENT

1 2 3 4 5 6 7 8

$\dfrac{0.010}{(0.254)}$ MAX

0.150 − 0.157
(3.810 − 3.988)

0.010 − 0.020
(0.254 − 0.508) × 45°

8° MAX TYP
ALL LEADS

$\dfrac{0.008 - 0.010}{(0.203 - 0.254)}$
TYP ALL LEADS

$\dfrac{0.004}{(0.102)}$
ALL LEAD TIPS

0.016 − 0.050
(0.406 − 1.270)
TYP ALL LEADS

0.053 − 0.069
(1.346 − 1.753)

0.004 − 0.010
(0.102 − 0.254)

SEATING
PLANE

$\dfrac{0.014}{(0.356)}$

0.050
(1.270)
TYP

$\dfrac{0.014 - 0.020}{(0.356 - 0.508)}$ TYP

0.008
(0.203) TYP

M16A (REV H)

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

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

10.2±0.1
-A-

0.47 TYP

16

9

7.8

3.9

5.3±0.1
-B-

⌓ | 0.2 | C | B | A
ALL LEAD TIPS

1

8

PIN #1 IDENT.

16    15          10    9

5.01 TYP

9.27 TYP

(2.13 TYP)

1     2          7     8

1.27 TYP

0.6 TYP

LAND PATTERN RECOMMENDATION

ALL LEAD TIPS

2.1 MAX.

⌓ | 0.1 | C

1.8±0.1

-C-

1.27 TYP

0.15±0.05

0.35-0.51

⊕ | 0.12 Ⓜ | C | A

DIMENSIONS ARE IN MILLIMETERS

SEE DETAIL A

0.15-0.25

7° TYP

GAGE PLANE

0°-8° TYP

0.25

0.60±0.15

1.25

SEATING PLANE

DETAIL A
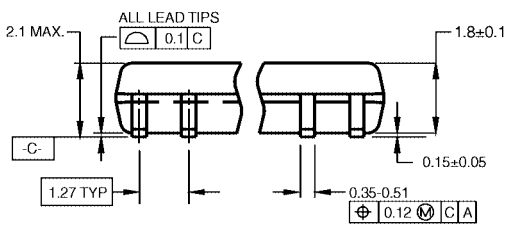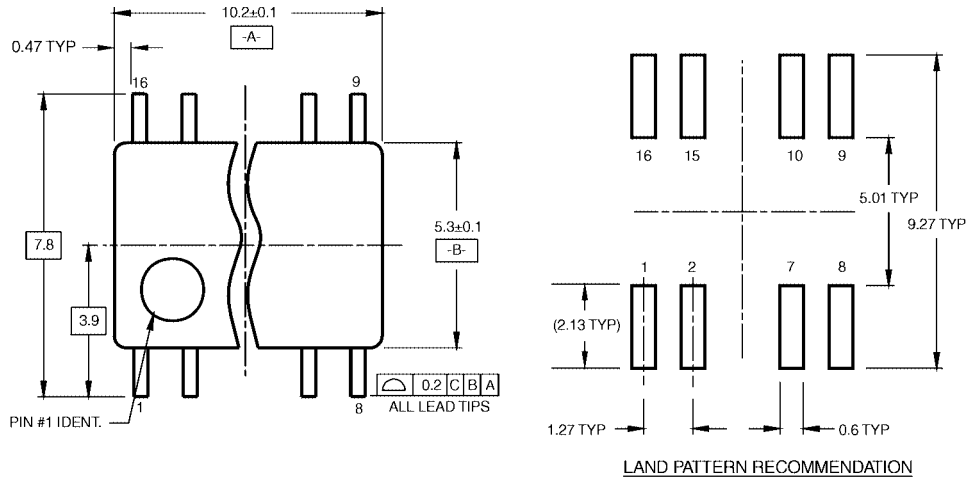
NOTES:
A. CONFORMS TO EIAJ EDR-7320 REGISTRATION, ESTABLISHED IN DECEMBER, 1998.
B. DIMENSIONS ARE IN MILLIMETERS.
C. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS.

M16DRevB1
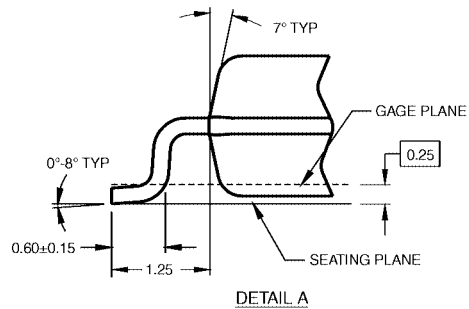
**16-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide**
**Package Number M16D**

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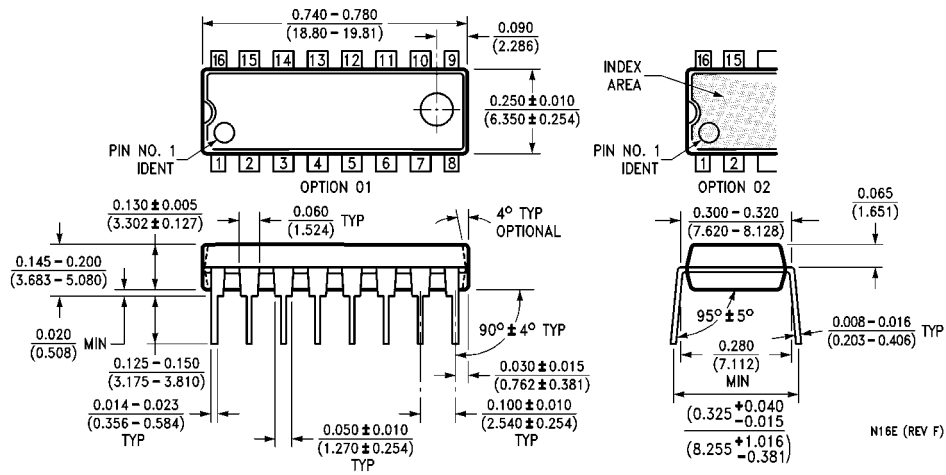


16-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300 Wide
Package Number N16E

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