

## 74F253 Dual 4-Input Multiplexer with 3-STATE Outputs

### General Description

The 74F253 is a dual 4-input multiplexer with 3-STATE outputs. It can select two bits of data from four sources using common select inputs. The output may be individually switched to a high impedance state with a HIGH on the respective Output Enable ( $\overline{OE}$ ) inputs, allowing the outputs to interface directly with bus oriented systems.

### Features

- Multifunction capability
- Non-inverting 3-STATE outputs
- Guaranteed 4000V minimum ESD protection

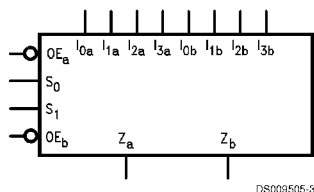
### Ordering Code:

Commercial	Military	Package Number	Package Description
74F253PC		N16E	16-Lead (0.300" Wide) Molded Dual-In-Line
	54F253DM (Note 2)	J16A	16-Lead Ceramic Dual-In-Line
74F253SC (Note 1)		M16A	16-Lead (0.150" Wide) Molded Small Outline, JEDEC
74F253SJ (Note 1)		M16D	16-Lead (0.300" Wide) Molded Small Outline, EIAJ
	54F253FM (Note 2)	W16A	16-Lead Cerpack
	54F253LL (Note 2)	E20A	20-Lead Ceramic Leadless Chip Carrier, Type C

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

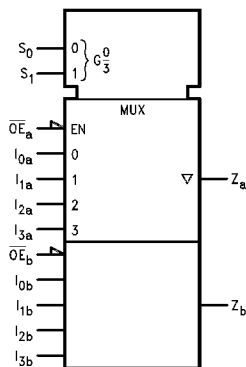
Note 2: Military grade device with environmental and burn-in processing. Use suffix = DMQB, FMQB and LMQB.

### Logic Symbols



DS009505-3

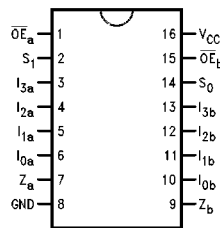
#### IEEE/IEC



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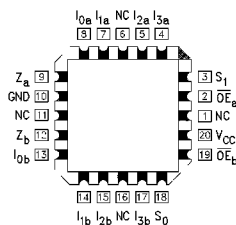
### Connection Diagrams

#### Pin Assignment for DIP, SOIC and Flatpak



DS009505-1

#### Pin Assignment for LCC



DS009505-2

## Unit Loading/Fan Out

Pin Names	Description	54F/74F	
		U.L. HIGH/LOW	Input $I_{IH}/I_{IL}$ Output $I_{OH}/I_{OL}$
$I_{0a}-I_{3a}$	Side A Data Inputs	1.0/1.0	20 $\mu A$ /-0.6 mA
$I_{0b}-I_{3b}$	Side B Data Inputs	1.0/1.0	20 $\mu A$ /-0.6 mA
$S_0-S_1$	Common Select Inputs	1.0/1.0	20 $\mu A$ /-0.6 mA
$\overline{OE}_a$	Side A Output Enable Input (Active LOW)	1.0/1.0	20 $\mu A$ /-0.6 mA
$\overline{OE}_b$	Side B Output Enable Input (Active LOW)	1.0/1.0	20 $\mu A$ /-0.6 mA
$Z_a, Z_b$	3-STATE Outputs	150/40(33.3)	-3 mA/24 mA (20 mA)

## Functional Description

This device contains two identical 4-input multiplexers with 3-STATE outputs. They select two bits from four sources selected by common Select inputs ( $S_0, S_1$ ). The 4-input multiplexers have individual Output Enable ( $\overline{OE}_a, \overline{OE}_b$ ) inputs which, when HIGH, force the outputs to a high impedance (High Z) state. This device 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 shown below:

$$Z_a = \overline{OE}_a \cdot (I_{0a} \cdot \overline{S}_1 \cdot \overline{S}_0 + I_{1a} \cdot \overline{S}_1 \cdot S_0 + I_{2a} \cdot S_1 \cdot \overline{S}_0 + I_{3a} \cdot S_1 \cdot S_0)$$

$$Z_b = \overline{OE}_b \cdot (I_{0b} \cdot \overline{S}_1 \cdot \overline{S}_0 + I_{1b} \cdot \overline{S}_1 \cdot S_0 + I_{2b} \cdot S_1 \cdot \overline{S}_0 + I_{3b} \cdot S_1 \cdot S_0)$$

If the outputs of 3-STATE devices are tied together, all but one device must be in the high impedance state to avoid high currents that would exceed the maximum ratings. Designers should ensure that Output Enable signals to 3-STATE devices whose outputs are tied together are designed so that there is no overlap.

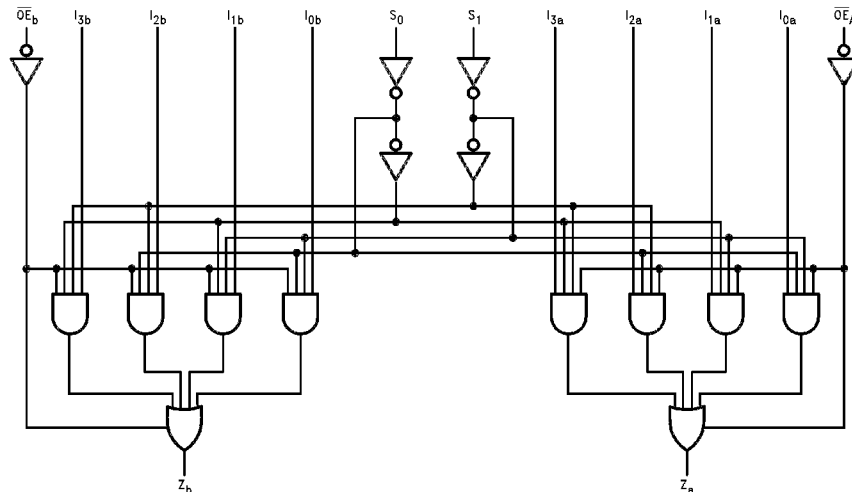
## Truth Table

Select Inputs		Data Inputs				Output Enable	Output
$S_0$	$S_1$	$I_0$	$I_1$	$I_2$	$I_3$	$\overline{OE}$	$Z$
X	X	X	X	X	X	H	Z
L	L	L	X	X	X	L	L
L	L	H	X	X	X	L	H
H	L	X	L	X	X	L	L
H	L	X	H	X	X	L	H
L	H	X	X	L	X	L	L
L	H	X	X	H	X	L	H
H	H	X	X	X	L	L	L
H	H	X	X	X	H	L	H

Address inputs  $S_0$  and  $S_1$  are common to both sections.

H = HIGH Voltage Level  
L = LOW Voltage Level  
X = Immaterial  
Z = High Impedance

## Logic Diagram



DS008505-4

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 3)

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 <sub>CC</sub> Pin Potential to Ground Pin	-0.5V to +7.0V
Input Voltage (Note 4)	-0.5V to +7.0V
Input Current (Note 4)	-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

## 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

**Note 3:** 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 4:** Either voltage limit or current limit is sufficient to protect inputs.

## DC Electrical Characteristics

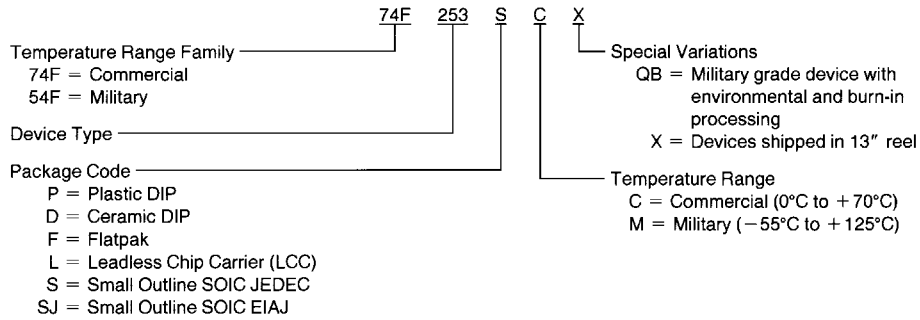
Symbol	Parameter	54F/74F			Units	V <sub>CC</sub>	Conditions
		Min	Typ	Max			
V <sub>IH</sub>	Input HIGH Voltage	2.0			V		Recognized as a HIGH Signal
V <sub>IL</sub>	Input LOW Voltage	0.8			V		Recognized as a LOW Signal
V <sub>CD</sub>	Input Clamp Diode Voltage	-1.2			V	Min	I <sub>IN</sub> = -18 mA
V <sub>OH</sub>	Output HIGH Voltage	54F 10% V <sub>CC</sub>	2.5		V	Min	I <sub>OH</sub> = -1 mA
		54F 10% V <sub>CC</sub>	2.4				I <sub>OH</sub> = -3 mA
		74F 10% V <sub>CC</sub>	2.5				I <sub>OH</sub> = -1 mA
		74F 10% V <sub>CC</sub>	2.4				I <sub>OH</sub> = -3 mA
		74F 5% V <sub>CC</sub>	2.7				I <sub>OH</sub> = -1 mA
74F 5% V <sub>CC</sub>	2.7		I <sub>OH</sub> = -3 mA				
V <sub>OL</sub>	Output LOW Voltage	54F 10% V <sub>CC</sub>	0.5		V	Min	I <sub>OL</sub> = 20 mA
		74F 10% V <sub>CC</sub>	0.5				I <sub>OL</sub> = 24 mA
I <sub>IH</sub>	Input HIGH Current	54F	20.0		μA	Max	V <sub>IN</sub> = 2.7V
		74F	5.0				
I <sub>BVI</sub>	Input HIGH Current Breakdown Test	54F	100		μA	Max	V <sub>IN</sub> = 7.0V
		74F	7.0				
I <sub>CEx</sub>	Output HIGH Leakage Current	54F	250		μA	Max	V <sub>OUT</sub> = V <sub>CC</sub>
		74F	50				
V <sub>ID</sub>	Input Leakage Test	74F	4.75		V	0.0	I <sub>ID</sub> = 1.9 μA All Other Pins Grounded
I <sub>OD</sub>	Output Leakage Circuit Current	74F	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>OZH</sub>	Output Leakage Current	50			μA	Max	V <sub>OUT</sub> = 2.7V
I <sub>OZL</sub>	Output Leakage Current	-50			μA	Max	V <sub>OUT</sub> = 0.5V
I <sub>OS</sub>	Output Short-Circuit Current	-60		-150	mA	Max	V <sub>OUT</sub> = 0V
		-100		-225			
I <sub>ZZ</sub>	Bus Drainage Test	500			μA	0.0V	V <sub>OUT</sub> = V <sub>CC</sub>
I <sub>CCCH</sub>	Power Supply Current	11.5	16		mA	Max	V <sub>O</sub> = HIGH
I <sub>CCCL</sub>	Power Supply Current	16	23		mA	Max	V <sub>O</sub> = LOW
I <sub>CCZ</sub>	Power Supply Current	16	23		mA	Max	V <sub>O</sub> = HIGH Z

## AC Electrical Characteristics

Symbol	Parameter	74F			54F		74F		Units
		T <sub>A</sub> = +25°C V <sub>CC</sub> = +5.0V C <sub>L</sub> = 50 pF			T <sub>A</sub> , V <sub>CC</sub> = Mil C <sub>L</sub> = 50 pF		T <sub>A</sub> , V <sub>CC</sub> = Com C <sub>L</sub> = 50 pF		
		Min	Typ	Max	Min	Max	Min	Max	
t <sub>PLH</sub>	Propagation Delay	4.5	8.5	11.5	3.5	15.0	4.5	13.0	ns
t <sub>PHL</sub>	S <sub>n</sub> to Z <sub>n</sub>	3.0	6.5	9.0	2.5	11.0	3.0	10.0	
t <sub>PLH</sub>	Propagation Delay	3.0	5.5	7.0	2.5	9.0	3.0	8.0	ns
t <sub>PHL</sub>	I <sub>n</sub> to Z <sub>n</sub>	2.5	4.5	6.0	2.5	8.0	2.5	7.0	
t <sub>PZH</sub>	Output Enable Time	3.0	6.0	8.0	2.5	10.0	3.0	9.0	ns
t <sub>PZL</sub>		3.0	6.0	8.0	2.5	10.0	3.0	9.0	
t <sub>PHZ</sub>	Output Disable Time	2.0	3.7	5.0	2.0	6.5	2.0	6.0	
t <sub>PLZ</sub>		2.0	4.4	6.0	2.0	8.0	2.0	7.0	

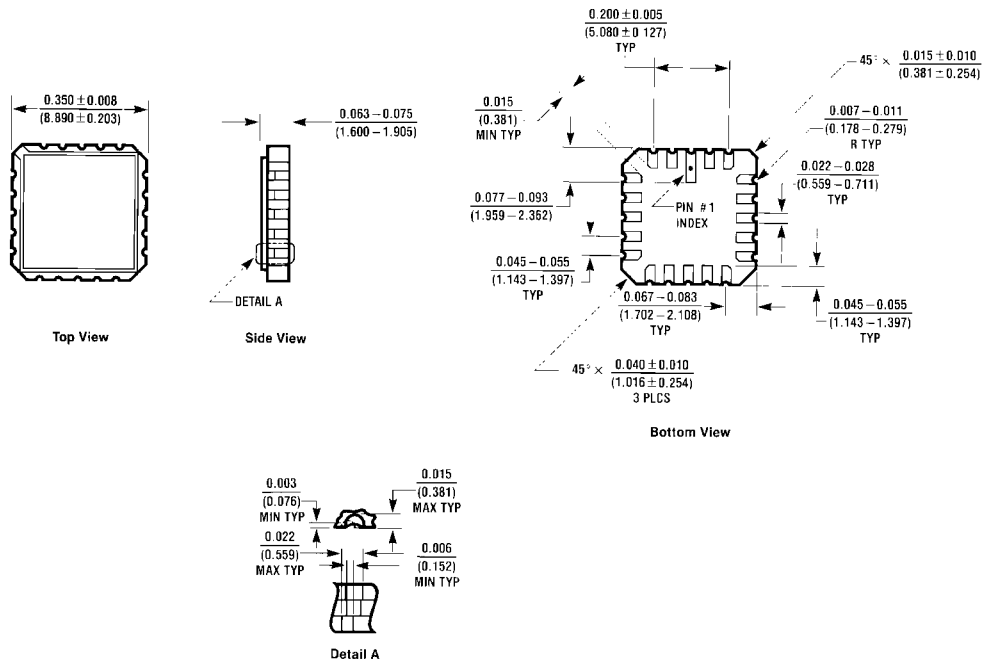
## Ordering Information

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



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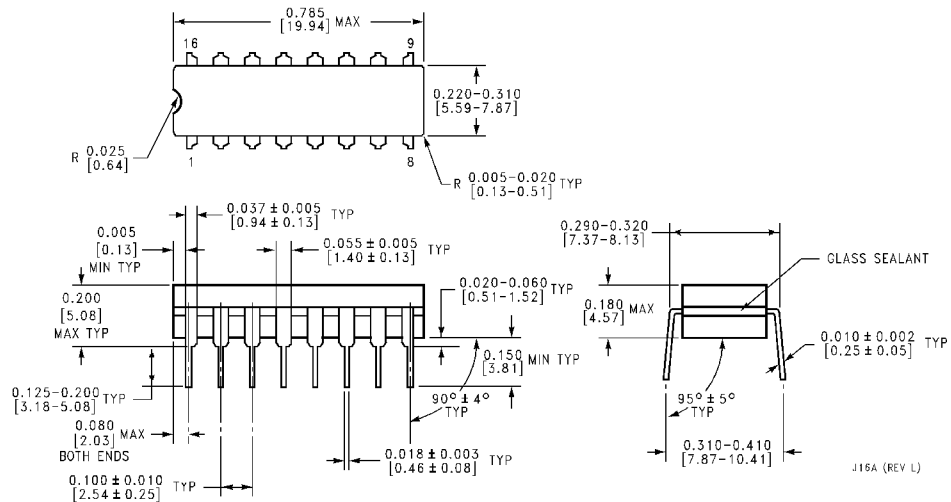
## Physical Dimensions inches (millimeters) unless otherwise noted



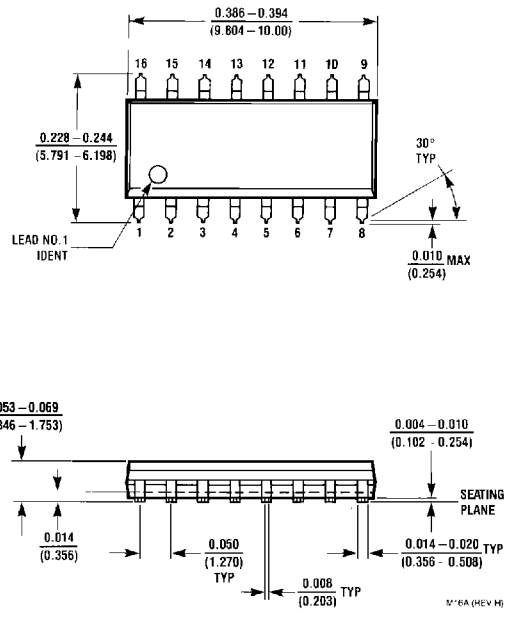
L20A (REV. 01)

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

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

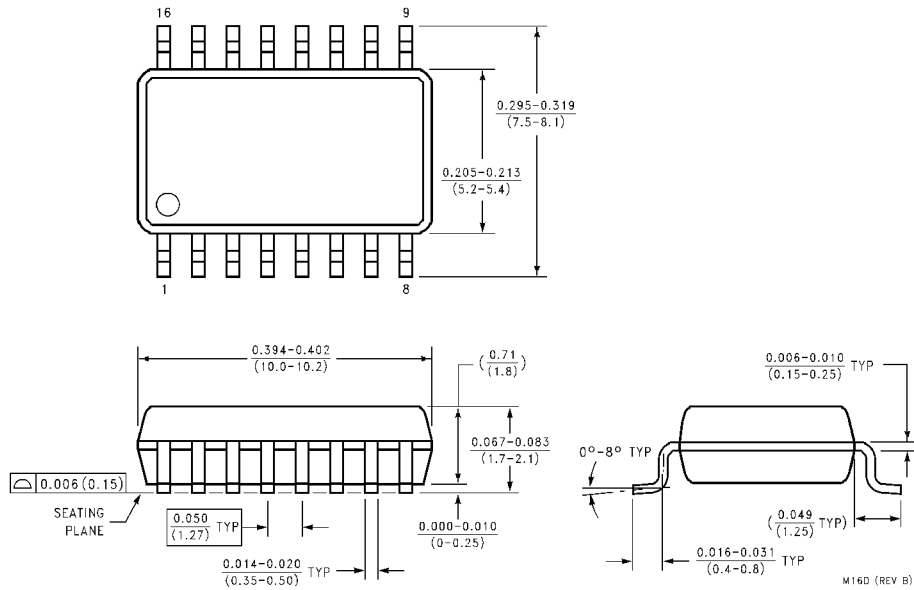


**16-Lead Ceramic Dual-In-Line Package (D)**  
Package Number J16A

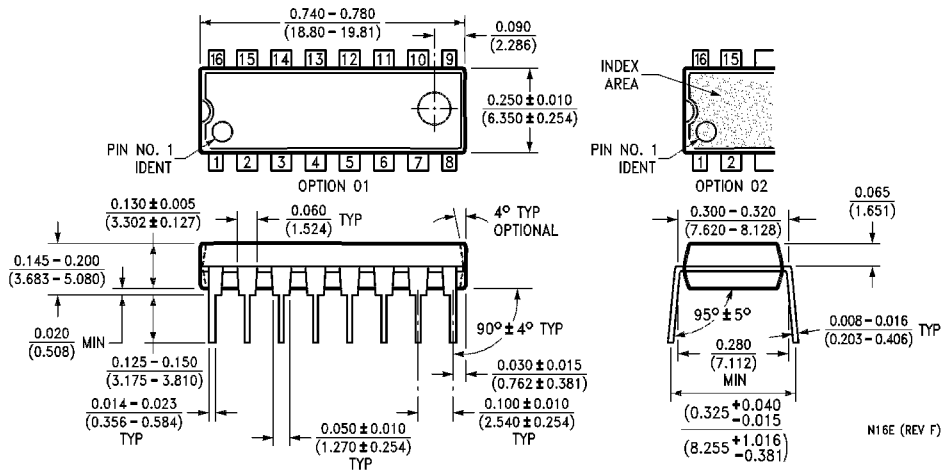


**16-Lead (0.150" Wide) Molded Small Outline Package, JEDEC (S)**  
Package Number M16A

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



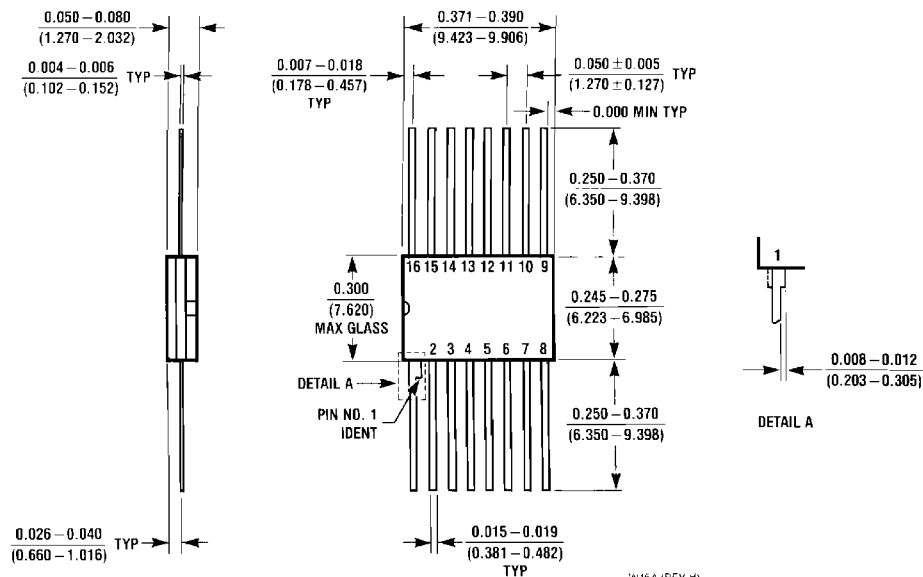
**16-Lead (0.300" Wide) Molded Small Outline Package, EIAJ (SJ)**  
Package Number M16D



**16-Lead (0.300" Wide) Molded Dual-In-Line Package (P)**  
Package Number N16E

74F253 Dual 4-Input Multiplexer with 3-STATE Outputs

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



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

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