

54F/74F189 64-Bit Random Access Memory with TRI-STATE® Outputs

General Description

The 'F189 is a high-speed 64-bit RAM organized as a 16-word by 4-bit array. Address inputs are buffered to minimize loading and are fully decoded on-chip. The outputs are TRI-STATE and are in the high impedance state whenever the Chip Select (\overline{CS}) input is HIGH. The outputs are active only in the Read mode and the output data is the complement of the stored data.

Features

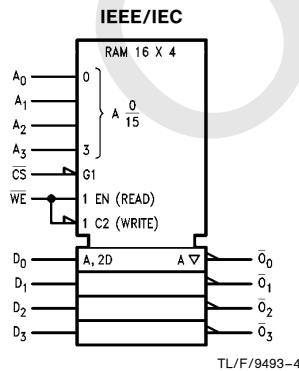
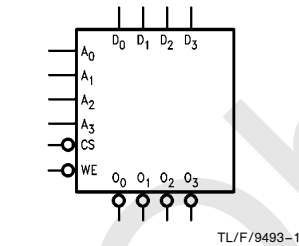
- TRI-STATE outputs for data bus applications
- Buffered inputs minimize loading
- Address decoding on-chip
- Diode clamped inputs minimize ringing
- Available in SOIC, (300 mil only)

Commercial	Military	Package Number	Package Description
74F189PC		N16E	16-Lead (0.300" Wide) Molded Dual-In-Line
	54F189DL (Note 2)	J16A	16-Lead Ceramic Dual-In-Line
74F189SC (Note 1)		M16A	16-Lead (0.150" Wide) Molded Small Outline, JEDEC
74F189SJ (Note 1)		M16D	16-Lead (0.300" Wide) Molded Small Outline, EIAJ
	54F189FL (Note 2)	W16A	16-Lead Cerpack
	54F189LL (Note 2)	E20A	20-Lead Ceramic Leadless Chip Carrier, Type C

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

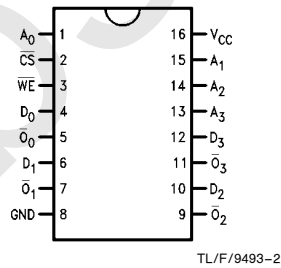
Note 2: Military grade device with environmental and burn-in processing. Use suffix = DLQB, FLQB and LLQB.

Logic Symbols

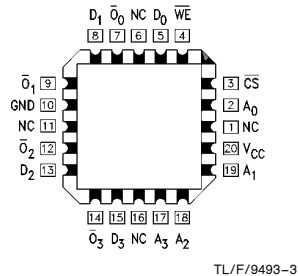


Connection Diagrams

Pin Assignment for DIP, SOIC and Flatpak



Pin Assignment for LCC



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Unit Loading/Fan Out

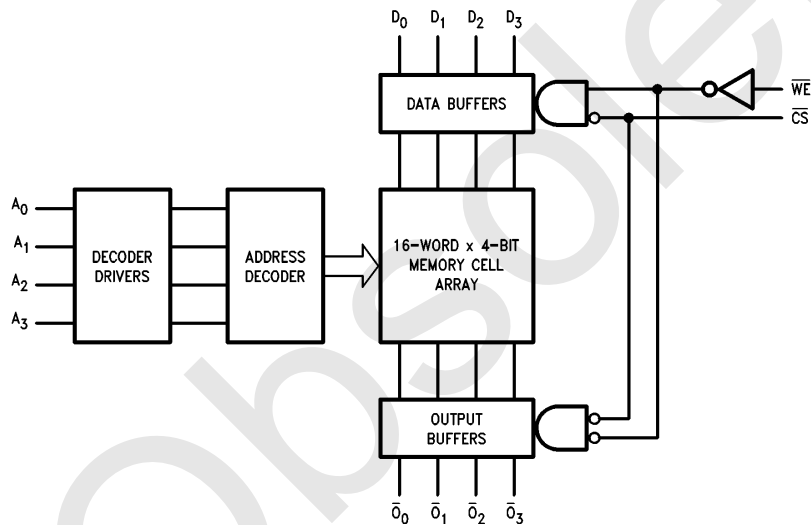
Pin Names	Description	54F/74F	
		U.L. HIGH/LOW	Input I_{IH}/I_{IL} Output I_{OH}/I_{OL}
A_0-A_3	Address Inputs	1.0/1.0	$20 \mu A / -0.6 \text{ mA}$
\overline{CS}	Chip Select Input (Active LOW)	1.0/1.0	$20 \mu A / -1.2 \text{ mA}$
\overline{WE}	Write Enable Input (Active LOW)	1.0/1.0	$20 \mu A / -0.6 \text{ mA}$
D_0-D_3	Data Inputs	1.0/1.0	$20 \mu A / -0.6 \text{ mA}$
$\overline{O}_0-\overline{O}_3$	Inverted Data Outputs	150/40 (33.3)	$-3.0 \text{ mA} / 24 \text{ mA}$ (20 mA)

Function Table

Inputs		Operation	Condition of Outputs
\overline{CS}	\overline{WE}		
L	L	Write	High Impedance
L	H	Read	Complement of Stored Data
H	X	Inhibit	High Impedance

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

Block Diagram



TL/F/9493-5

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)

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} 54F 10% V _{CC} 74F 10% V _{CC} 74F 10% V _{CC} 74F 5% V _{CC} 74F 5% V _{CC}	2.5 2.4 2.5 2.4 2.7 2.7			V	Min	I _{OH} = -1 mA I _{OH} = -3 mA I _{OH} = -1 mA I _{OH} = -3 mA I _{OH} = -1 mA I _{OH} = -3 mA
V _{OL}	Output LOW Voltage	54F 10% V _{CC} 74F 10% V _{CC}	0.5 0.5			V	Min	I _{OL} = 20 mA I _{OL} = 24 mA
I _{IH}	Input HIGH Current	54F 74F	20.0 5.0			μA	Max	V _{IN} = 2.7V
I _{BVI}	Input HIGH Current Breakdown Test	54F 74F	100 7.0			μA	Max	V _{IN} = 7.0V
I _{CEX}	Output HIGH Leakage Current	54F 74F	250 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 -1.2			mA	Max	V _{IN} = 0.5V (except \overline{CS}) V _{IN} = 0.5V (\overline{CS})
I _{OZH}	Output Leakage Current		50			μA	Max	V _{OUT} = 2.7V
I _{OZL}	Output Leakage Current		-50			μA	Max	V _{OUT} = 0.5V
I _{OS}	Output Short-Circuit Current		-60 -150			mA	Max	V _{OUT} = 0V
I _{ZZ}	Bus Drainage Test		500			μA	0.0V	V _{OUT} = 5.25V
I _{CCZ}	Power Supply Current		37 55			mA	Max	V _O = HIGH Z

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}	Access Time, HIGH or LOW A _n to \overline{O}_n	10.0	18.5	26.0	9.0	32.0	10.0	27.0	ns
		8.0	13.5	19.0	8.0	23.0	8.0	20.0	
t _{PZH} t _{PZL}	Access Time, HIGH or LOW \overline{CS} to \overline{O}_n	3.5	6.0	8.5	3.5	10.5	3.5	9.5	ns
		5.0	9.0	13.0	5.0	15.0	5.0	14.0	
t _{PHZ} t _{PLZ}	Disable Time, HIGH or LOW \overline{CS} to \overline{O}_n	2.0	4.0	6.0	2.0	8.0	2.0	7.0	ns
		3.0	5.5	8.0	2.5	10.0	3.0	9.0	
t _{PZH} t _{PZL}	Write Recovery Time, HIGH or LOW \overline{WE} to \overline{O}_n	6.5	15.0	28.0	6.5	37.5	6.5	29.0	ns
		6.5	11.0	15.5	6.5	17.5	6.5	16.5	
t _{PHZ} t _{PLZ}	Disable Time, HIGH or LOW \overline{WE} to \overline{O}_n	4.0	7.0	10.0	3.5	12.0	4.0	11.0	ns
		5.0	9.0	13.0	5.0	15.0	5.0	14.0	

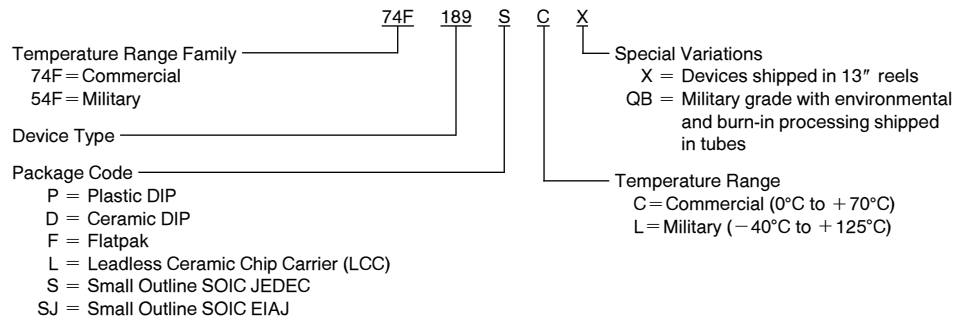
AC Operating Requirements

Symbol	Parameter	74F		54F		74F		Units
		T _A = +25°C V _{CC} = +5.0V		*T _A , V _{CC} = Mil		T _A , V _{CC} = Com		
		Min	Max	Min	Max	Min	Max	
t _s (H) t _s (L)	Setup Time, HIGH or LOW A _n to \overline{WE}	0		0		0		ns
		0		0		0		
t _h (H) t _h (L)	Hold Time, HIGH or LOW A _n to \overline{WE}	2.0		2.0		2.0		ns
		2.0		2.0		2.0		
t _s (H) t _s (L)	Setup Time, HIGH or LOW D _n to \overline{WE}	10.0		11.0		10.0		ns
		10.0		11.0		10.0		
t _h (H) t _h (L)	Hold Time, HIGH or LOW D _n to \overline{WE}	0		2.0		0		ns
		0		2.0		0		
t _s (L)	Setup Time, LOW \overline{CS} to \overline{WE}	0		0		0		ns
t _h (L)	Hold Time, LOW \overline{CS} to \overline{WE}	6.0		7.5		6.0		
t _w (L)	\overline{WE} Pulse Width, LOW	6.0		15.0		6.0		ns

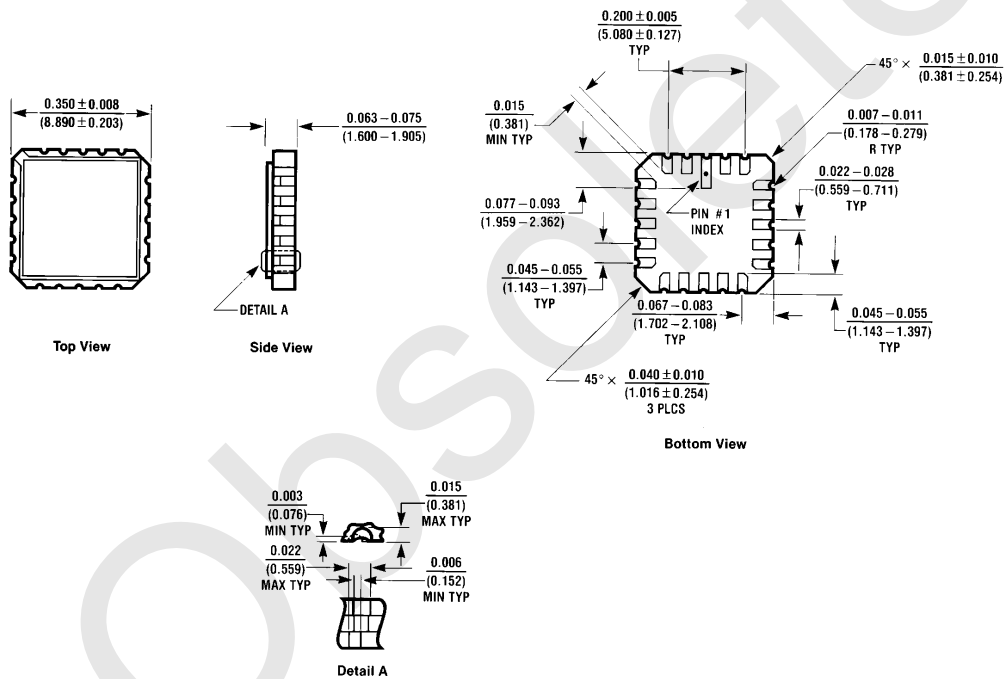
*T_A = -55°C to +125°C

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:



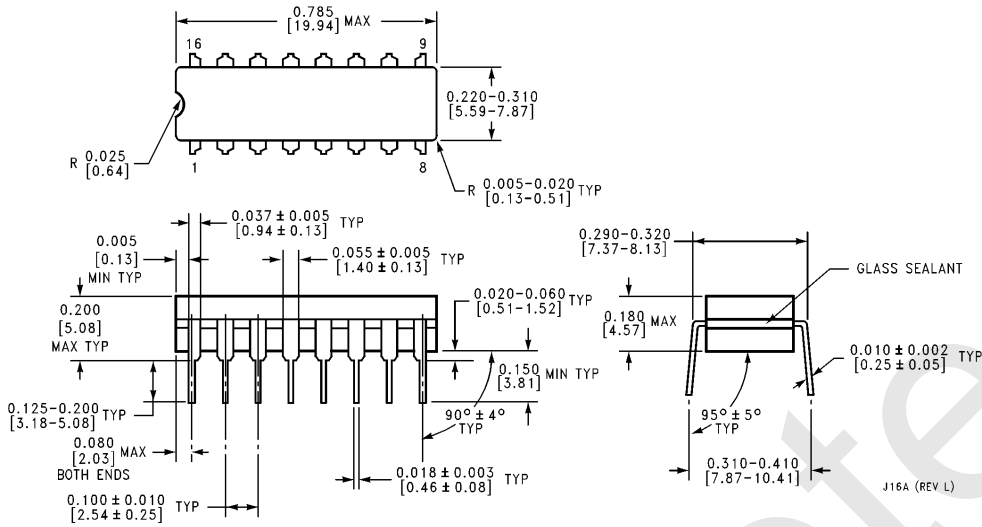
Physical Dimensions inches (millimeters)



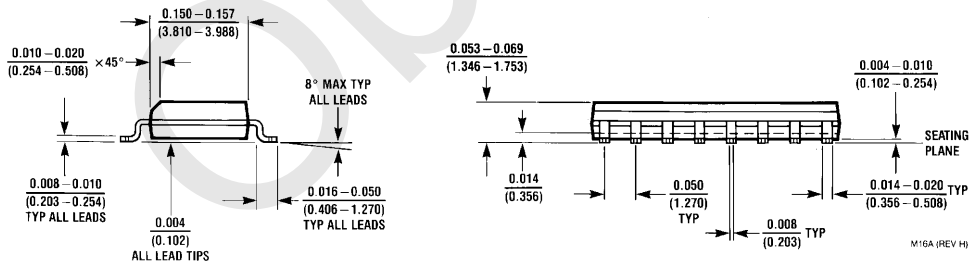
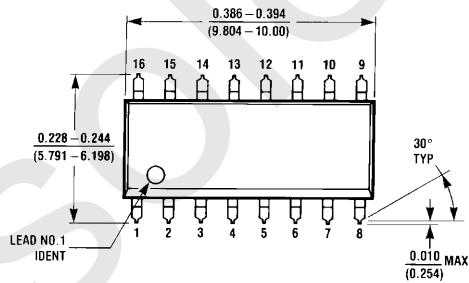
**20-Lead Ceramic Leadless Chip Carrier (L)
NS Package Number E20A**

E20A (REV. D)

Physical Dimensions inches (millimeters) (Continued)

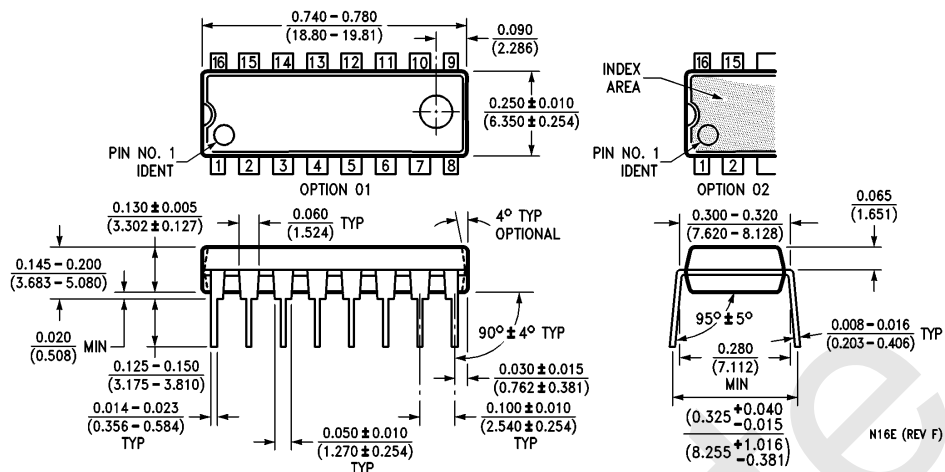


16-Lead Ceramic Dual-In-Line Package (D)
NS Package Number J16A

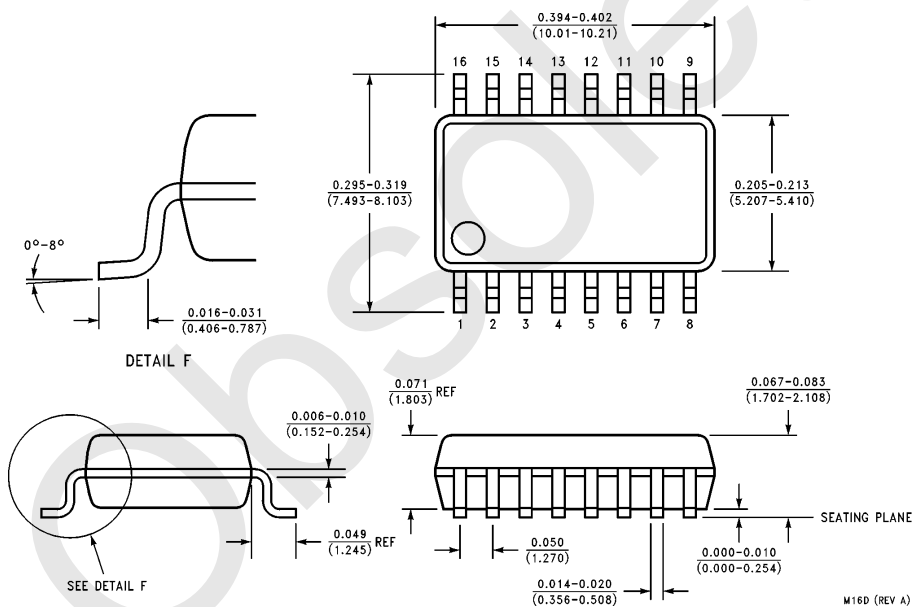


16-Lead (0.150" Wide) Molded Small Outline Package, JEDEC (S)
NS Package Number M16A

Physical Dimensions inches (millimeters) (Continued)

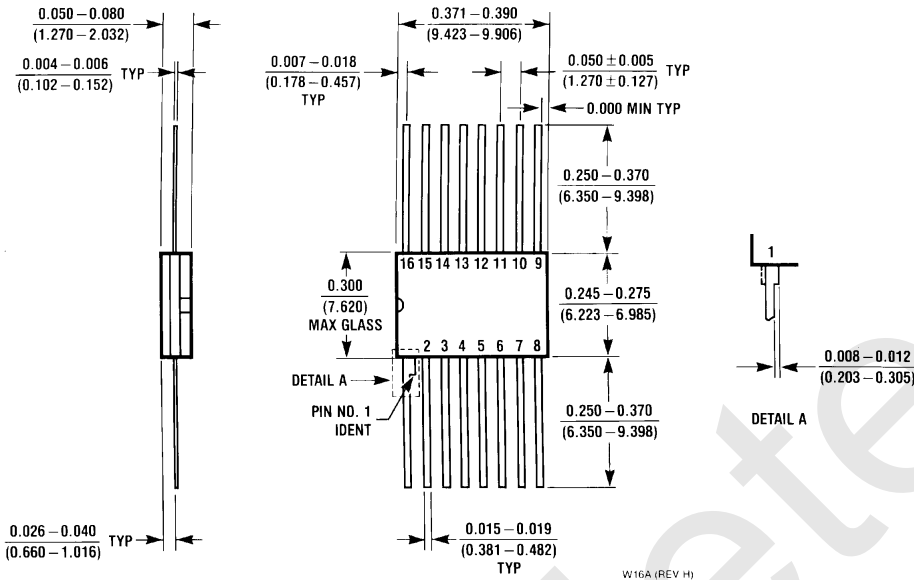


16-Lead (0.300" Wide) Molded Dual-In-Line Package (P)
NS Package Number N16E



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

Physical Dimensions inches (millimeters) (Continued)



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

W16A (REV H)

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