

January 1995

54F/74F164A Serial-In, Parallel-Out Shift Register

General Description

The 'F164A is a high-speed 8-bit serial-in/parallel-out shift register. Serial data is entered through a 2-input AND gate synchronous with the LOW-to-HIGH transition of the clock. The device features an asynchronous Master Reset which clears the register, setting all outputs LOW independent of the clock. The 'F164A is a faster version of the 'F164.

Features

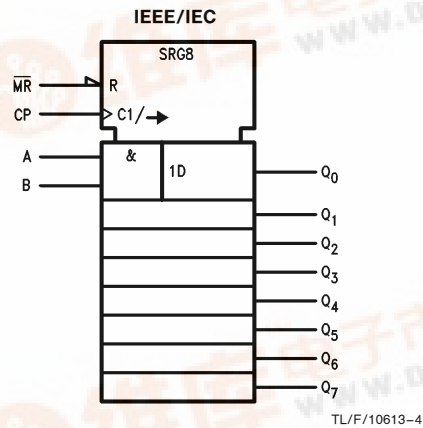
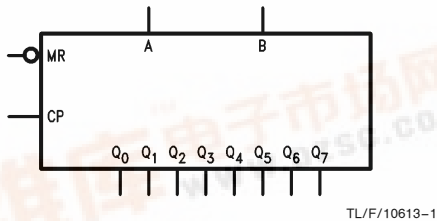
- Typical shift frequency of 90 MHz
- Asynchronous Master Reset
- Gated serial data input
- Fully synchronous data transfers
- Guaranteed 4000V min ESD protection
- 'F164A is a faster version of the 'F164

Commercial	Military	Package Number	Package Description
74F164APC		N14A	14-Lead (0.300" Wide) Molded Dual-In-Line
	54F164ADM (Note 2)	J14A	14-Lead Ceramic Dual-In-Line
74F164ASC (Note 1)		M14A	14-Lead (0.150" Wide) Molded Small Outline, JEDEC
74F164ASJ (Note 1)		M14D	14-Lead (0.300" Wide) Molded Small Outline, EIAJ
	74F164AFM (Note 2)	W14B	14-Lead Cerpack
	74F164ALM (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

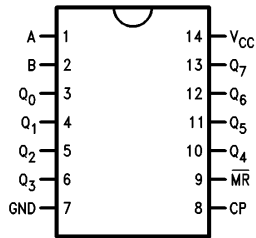


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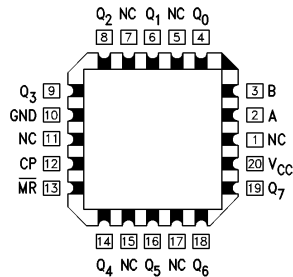
Connection Diagrams

Pin Assignment for
DIP, SOIC and Flatpak



TL/F/10613-2

Pin Assignment
for LCC



TL/F/10613-3

Unit Loading/Fan Out

Pin Names	Description	54F/74F	
		U.L. HIGH/LOW	Input I _{IH} /I _{IL} Output I _{OH} /I _{OL}
A, B	Data Inputs	1.0/1.0	20 μ A/ -0.6 mA
CP	Clock Pulse Input (Active Rising Edge)	1.0/1.0	20 μ A/ -0.6 mA
$\overline{\text{MR}}$	Master Reset Input (Active LOW)	1.0/1.0	20 μ A/ -0.6 mA
Q ₀ -Q ₇	Outputs	50/33.3	-1 mA/20 mA

Functional Description

The 'F164A is an edge-triggered 8-bit shift register with serial data entry and an output from each of the eight stages. Data is entered serially through one of two inputs (A or B); either of these inputs can be used as an active HIGH Enable for data entry through the other input. An unused input must be tied HIGH.

Each LOW-to-HIGH transition on the Clock (CP) input shifts data one place to the right and enters into Q₀ the logical AND of the two data inputs (A • B) that existed before the rising clock edge. A LOW level on the Master Reset ($\overline{\text{MR}}$) input overrides all other inputs and clears the register asynchronously, forcing all Q outputs LOW.

Mode Select Table

Operating Mode	Inputs			Outputs	
	$\overline{\text{MR}}$	A	B	Q ₀	Q ₁ -Q ₇
Reset (Clear)	L	X	X	L	L-L
Shift	H	l	l	L	q ₀ -q ₆
	H	l	h	L	q ₀ -q ₆
	H	h	l	L	q ₀ -q ₆
	H	h	h	H	q ₀ -q ₆

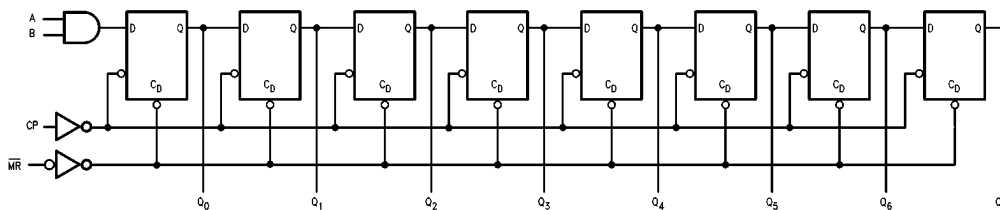
H(h) = HIGH Voltage Levels

L(l) = LOW Voltage Levels

X = Immaterial

q_n = Lower case letters indicate the state of the referenced input or output one setup time prior to the LOW-to-HIGH clock transition.

Logic Diagram



TL/F/10613-5

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					V		Recognized as a LOW Signal
V _{CD}	Input Clamp Diode Voltage					V	Min	I _{IN} = -18 mA
V _{OH}	Output HIGH Voltage	54F 10% V _{CC} 74F 10% V _{CC} 74F 5% V _{CC}	2.5 2.5 2.7			V	Min	I _{OH} = -1 mA I _{OH} = -1 mA I _{OH} = -1 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} = 20 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 _{ID} = 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 _{CC}	Power Supply Current		35 55			mA	Max	CP = HIGH MR = GND, A, B = GND

AC Electrical Characteristics

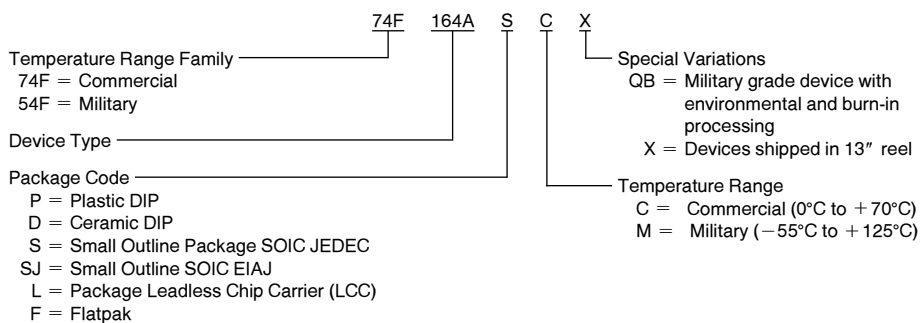
Symbol	Parameter	74F			54F		74F		Units
		T _A = +25°C V _{CC} = +5.0V C _L = 50 pF			T _A , V _{CC} = Mil C _L = 50 pF		T _A , V _{CC} = Com C _L = 50 pF		
		Min	Typ	Max	Min	Max	Min	Max	
f _{max}	Maximum Clock Frequency	80	120		60		80		MHz
t _{PLH} t _{PHL}	Propagation Delay CP to Q _n	3.0 3.5	4.8 5.0	7.5 8.0	2.5 3.0	9.0 8.5	3.0 3.5	7.5 8.0	ns
t _{PHL}	Propagation Delay MR to Q _n	5.0	7.0	10.0	4.0	12.5	5.0	10.5	ns

AC Operating Requirements

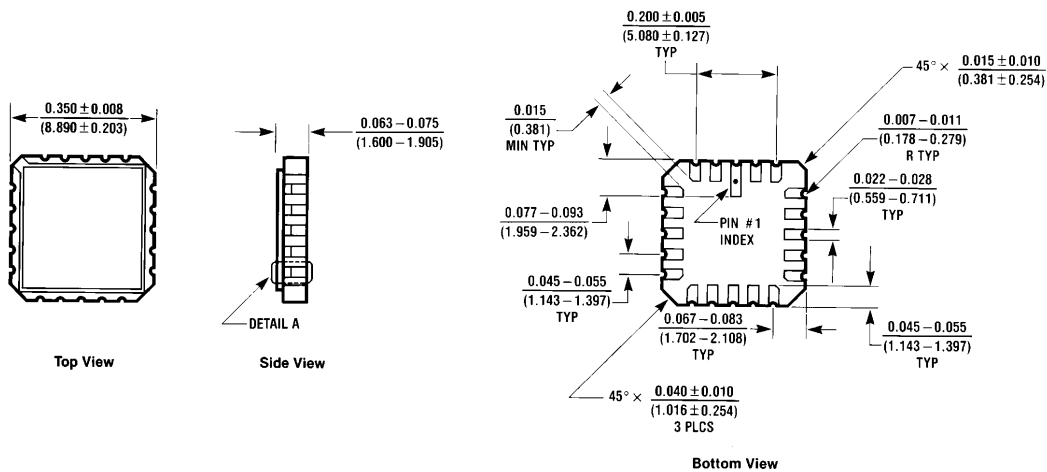
Symbol	Parameter	74F		54F		74F		Units
		T _A = +25°C V _{CC} = +5.0V		T _A , V _{CC} = Mil		T _A , V _{CC} = Com		
		Min	Max	Min	Max	Min	Max	
t _s (H) t _s (L)	Setup Time, HIGH or LOW A or B to CP	4.5 4.0		5.5 4.0		4.5 4.0		ns
t _h (H) t _h (L)	Hold Time, HIGH or LOW A or B to CP	1.0 1.0		1.0 1.0		1.0 1.0		ns
t _w (H) t _w (L)	CP Pulse Width HIGH or LOW	4.0 7.0		4.0 7.0		4.0 7.0		ns
t _w (L)	MR Pulse Width, LOW	4.0		5.0		4.0		ns
t _{rec}	Recovery Time MR to CP	5.0		6.5		5.0		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:

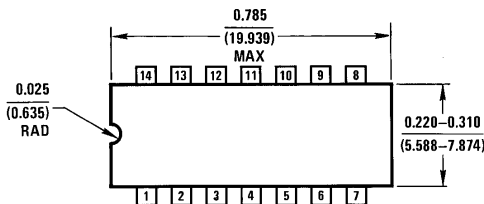


Physical Dimensions inches (millimeters)



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

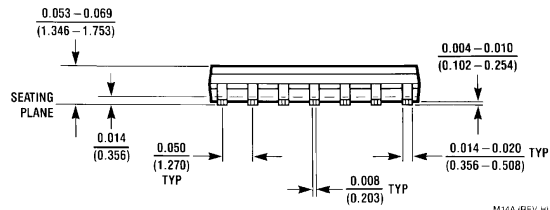
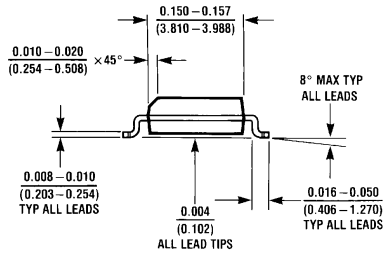
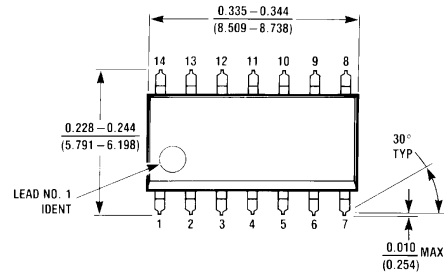
E20A (REV D)



14-Lead Ceramic Dual-In-Line Package (D)
NS Package Number J14A

J14A (REV G)

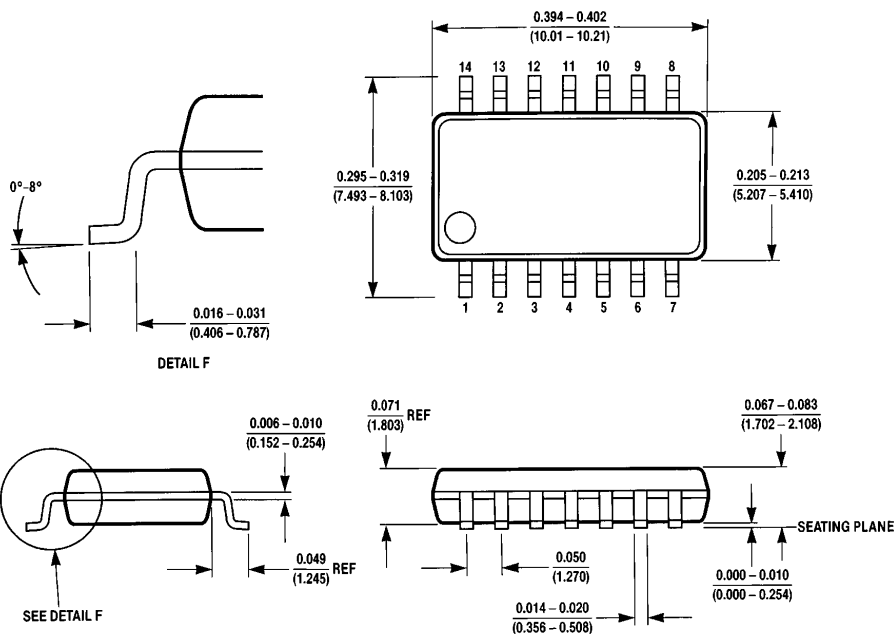
Physical Dimensions inches (millimeters) (Continued)



**14-Lead (0.150" Wide) Molded Small Outline Package, JEDEC (S)
NS Package Number M14A**

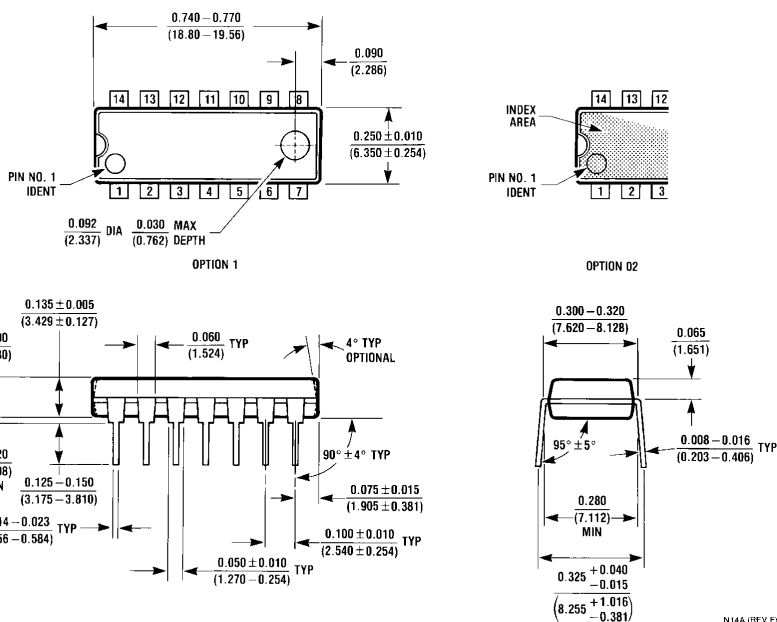
M14A (REV H)

Physical Dimensions inches (millimeters) (Continued)



M14D (REV A)

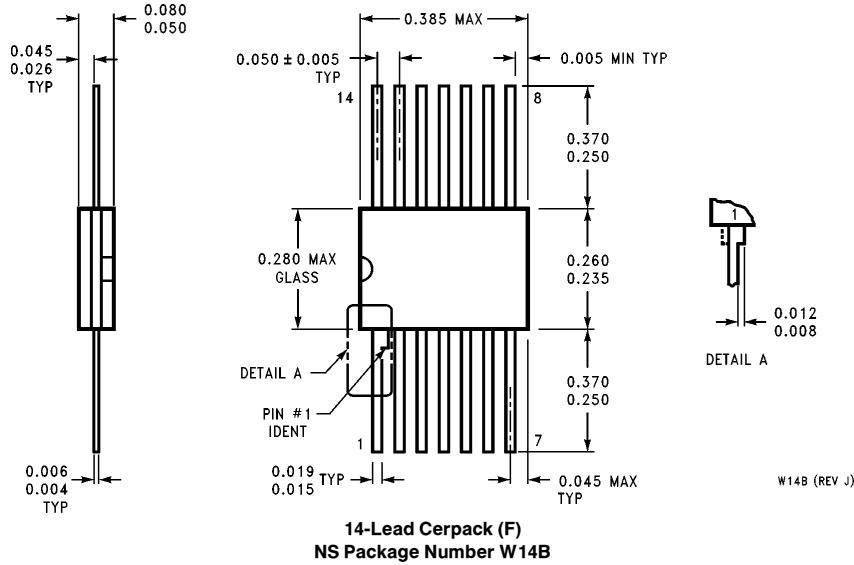
14-Lead (0.300" Wide) Molded Small Outline Package, EIAJ (SJ)
NS Package Number M14D



N14A (REV F)

14-Lead (0.300" Wide) Plastic Dual-In-Line Package (P)
NS Package Number N14A

Physical Dimensions inches (millimeters) (Continued)



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