

## 74F164A Serial-In, Parallel-Out Shift Register

### General Description

The 74F164A 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 74F164A is a faster version of the 74F164.

### Features

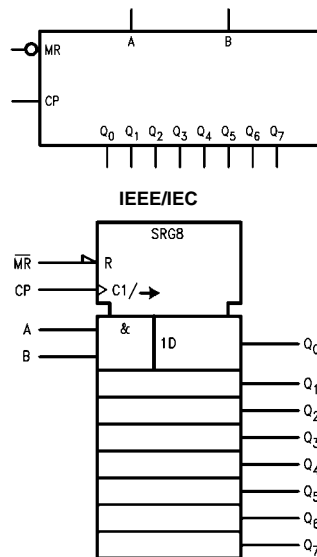
- Typical shift frequency of 90 MHz
- Asynchronous Master Reset
- Gated serial data input
- Fully synchronous data transfers
- 74F164A is a faster version of the 74F164

### Ordering Code:

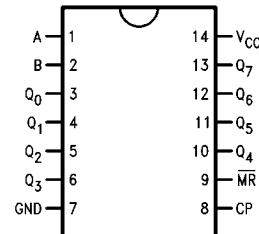
Order Number	Package Number	Package Description
74F164ASC	M14A	14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-120, 0.150 Narrow
74F164ASJ	M14D	14-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide
74F164APC	N14A	14-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300 Wide

Devices also available in Tape and Reel. Specify by appending the suffix letter "X" to the ordering code.

### Logic Symbols



### Connection Diagram



## Unit Loading/Fan Out

Pin Names	Description	U.L. HIGH/LOW	Input $I_{IH}/I_{IL}$ Output $I_{OH}/I_{OL}$
A, B	Data Inputs	1.0/1.0	20 $\mu$ A/-0.6 mA
CP	Clock Pulse Input (Active Rising Edge)	1.0/1.0	20 $\mu$ A/-0.6 mA
$\overline{MR}$	Master Reset Input (Active LOW)	1.0/1.0	20 $\mu$ A/-0.6 mA
$Q_0$ - $Q_7$	Outputs	50/33.3	-1 mA/20 mA

## Functional Description

The 74F164A 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  $Q_0$  the logical AND of the two data inputs ( $A \cdot B$ ) that existed before the rising clock edge. A LOW level on the Master Reset ( $\overline{MR}$ ) input overrides all other inputs and clears the register asynchronously, forcing all Q outputs LOW.

## Mode Select Table

Operating Mode	Inputs			Outputs	
	$\overline{MR}$	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	$q_0$ - $q_6$

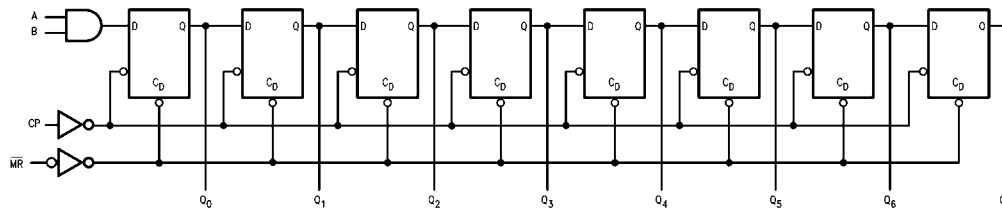
H(h) = HIGH Voltage Levels

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



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 <sub>CC</sub> Pin Potential to Ground Pin	−0.5V to +7.0V
Input Voltage (Note 1)	−0.5V to +7.0V
Input Current (Note 1)	−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	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 <sub>CC</sub>	Conditions
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	10% V <sub>CC</sub> 5% V <sub>CC</sub>	2.5 2.7		V	Min	I <sub>OH</sub> = −1 mA I <sub>OH</sub> = −1 mA
V <sub>OL</sub>	Output LOW Voltage	10% V <sub>CC</sub>		0.5	V	Min	I <sub>OL</sub> = 20 mA
I <sub>IH</sub>	Input HIGH Current			5.0	μA	Max	V <sub>IN</sub> = 2.7V
I <sub>BVI</sub>	Input HIGH Current Breakdown Test			7.0	μA	Max	V <sub>IN</sub> = 7.0V
I <sub>CEX</sub>	Output HIGH Leakage Current			50	μA	Max	V <sub>OUT</sub> = V <sub>CC</sub>
V <sub>ID</sub>	Input Leakage Test	4.75			V	0.0	I <sub>ID</sub> = 1.9 μA All other pins grounded
I <sub>OD</sub>	Output Leakage Circuit Current			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>OS</sub>	Output Short-Circuit Current	−60		−150	mA	Max	V <sub>OUT</sub> = 0V
I <sub>CC</sub>	Power Supply Current		35	55	mA	Max	CP = HIGH MR = GND, A, B = GND

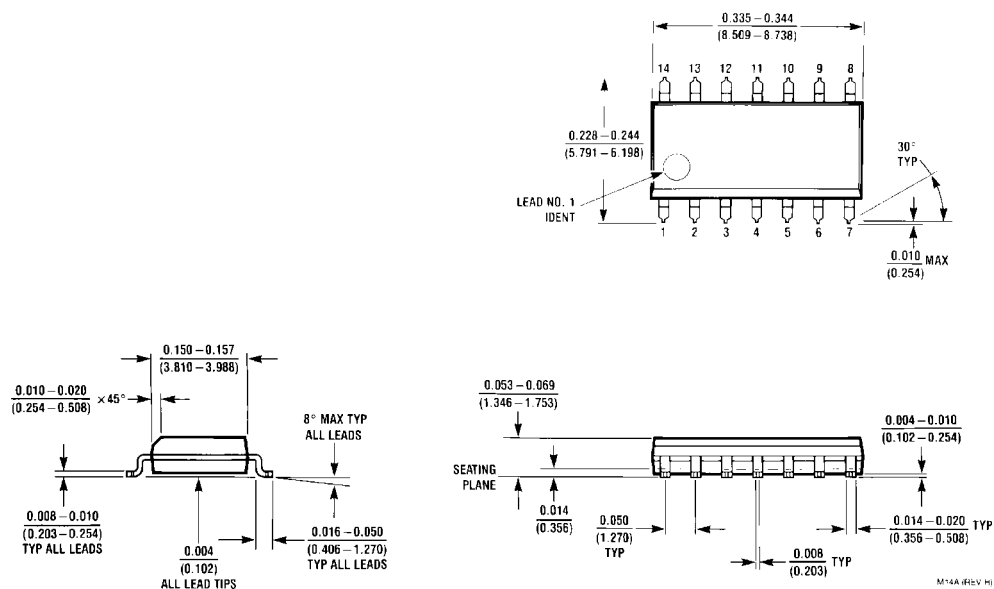
## AC Electrical Characteristics

Symbol	Parameter	T <sub>A</sub> = +25°C V <sub>CC</sub> = +5.0V C <sub>L</sub> = 50 pF			T <sub>A</sub> = -55°C to +125°C V <sub>CC</sub> = 5.0V C <sub>L</sub> = 50 pF		T <sub>A</sub> = 0°C to +70°C V <sub>CC</sub> = 5.0V C <sub>L</sub> = 50 pF		Units
		Min	Typ	Max	Min	Max	Min	Max	
f <sub>MAX</sub>	Maximum Clock Frequency	80	120		60		80		MHz
t <sub>PLH</sub>	Propagation Delay CP to Q <sub>n</sub>	3.0	4.8	7.5	2.5	9.0	3.0	7.5	ns
t <sub>PHL</sub>	Propagation Delay MR to Q <sub>n</sub>	3.5	5.0	8.0	3.0	8.5	3.5	8.0	
t <sub>PHL</sub>	Propagation Delay MR to Q <sub>n</sub>	5.0	7.0	10.0	4.0	12.5	5.0	10.5	ns

## AC Operating Requirements

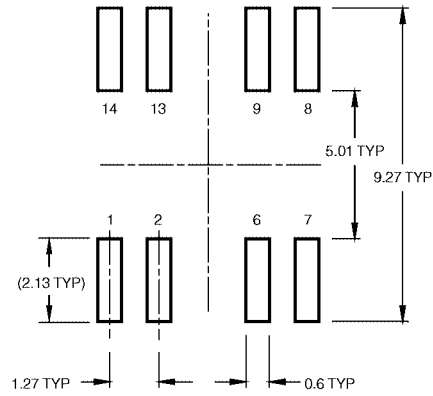
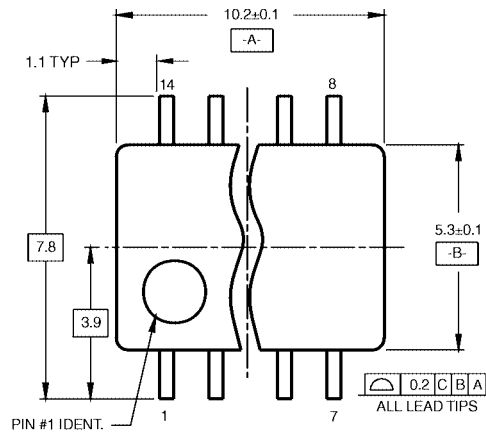
Symbol	Parameter	T <sub>A</sub> = +25°C V <sub>CC</sub> = +5.0V		T <sub>A</sub> = -55°C to +125°C V <sub>CC</sub> = 5.0V		T <sub>A</sub> = 0°C to +70°C V <sub>CC</sub> = 5.0V		Units
		Min	Max	Min	Max	Min	Max	
t <sub>S</sub> (H)	Setup Time, HIGH or LOW	4.5		5.5		4.5		ns
t <sub>S</sub> (L)	A or B to CP	4.0		4.0		4.0		
t <sub>H</sub> (H)	Hold Time, HIGH or LOW	1.0		1.0		1.0		
t <sub>H</sub> (L)	A or B to CP	1.0		1.0		1.0		ns
t <sub>W</sub> (H)	CP Pulse Width	4.0		4.0		4.0		
t <sub>W</sub> (L)	HIGH or LOW	7.0		7.0		7.0		ns
t <sub>W</sub> (L)	MR Pulse Width, LOW	4.0		5.0		4.0		ns
t <sub>REC</sub>	Recovery Time MR to CP	5.0		6.5		5.0		ns

# Physical Dimensions inches (millimeters) unless otherwise noted

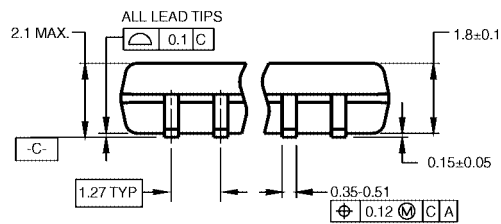


**14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-120, 0.150 Narrow  
Package Number M14A**

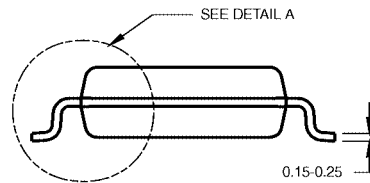
# Physical Dimensions inches (millimeters) unless otherwise noted (Continued)



LAND PATTERN RECOMMENDATION



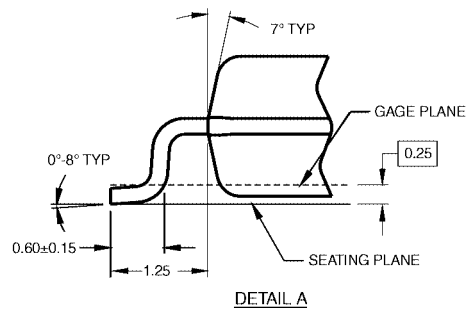
DIMENSIONS ARE IN MILLIMETERS



## 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.

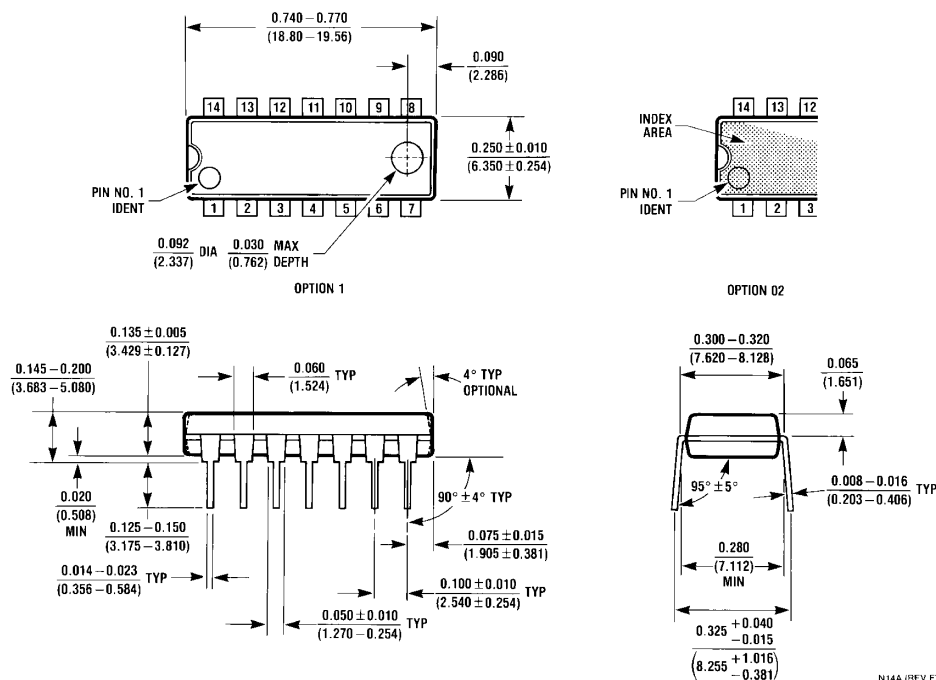
M14DRevB1



DETAIL A

**14-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide  
Package Number M14D**

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



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