FAIRCHILD SEMICONDUCTOR™

October 1989
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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

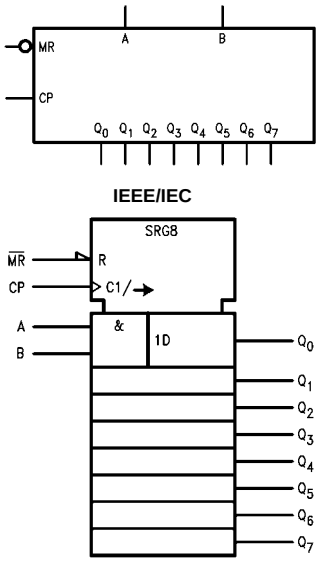
- Typical shift frequency of 90 MHz
- Asynchronous Master Reset
- Gated serial data input
- Fully synchronous data transfers
- 74F164A is a faster version of the 74F164

Ordering Code:

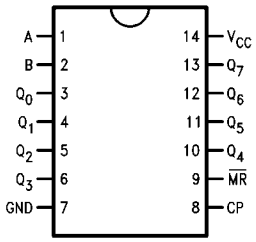
Order Number	Package Number	Package Description
74F164ASC	M14A	14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-120, 0.150 Narrow
74F164ASJ	M14D	14-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide
74F164APC	N14A	14-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300 Wide

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 µA/–0.6 mA
CP	Clock Pulse Input (Active Rising Edge)	1.0/1.0	20 µA/–0.6 mA
$\overline{MR}$	Master Reset Input (Active LOW)	1.0/1.0	20 µA/–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.

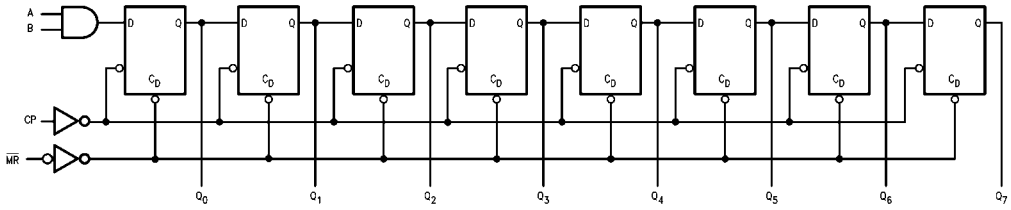
Each LOW-to-HIGH transition on the Clock (CP) input shifts data one place to the right and enters into Q_0 the logical AND of the two data inputs (A • B) that existed before the rising clock edge. A LOW level on the Master Reset ($\overline{MR}$) input overrides all other inputs and clears the register 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_{CC} 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_{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)
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_{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_{CC}	Power Supply Current			35	55	mA	Max	CP = HIGH $\overline{MR}$ = GND, A, B = GND

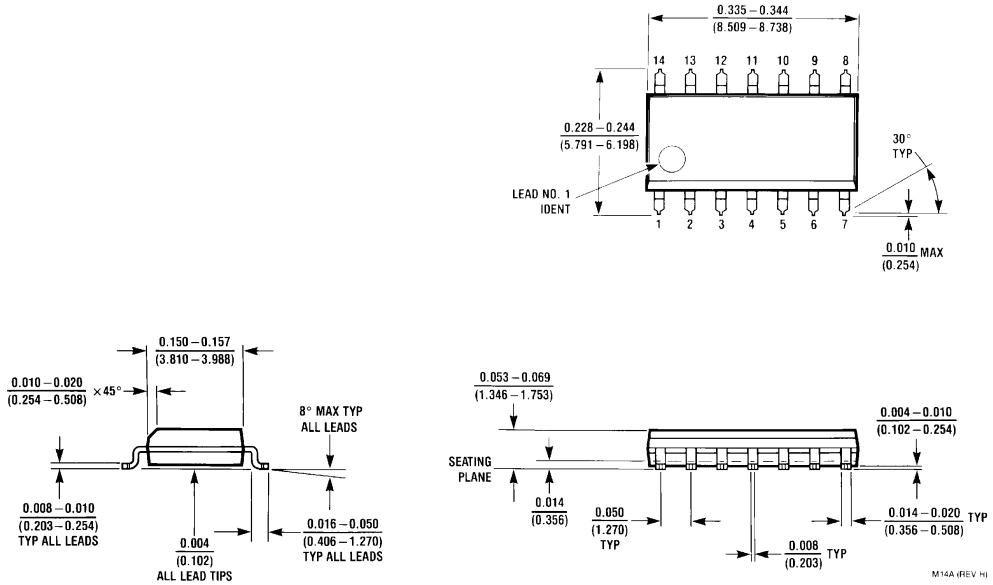
AC Electrical Characteristics

Symbol	Parameter	$T_A = +25°C$, $V_{CC} = +5.0V$, $C_L = 50$ pF			$T_A = -55°C$ to $+125°C$, $V_{CC} = 5.0V$, $C_L = 50$ pF		$T_A = 0°C$ to $+70°C$, $V_{CC} = 5.0V$, $C_L = 50$ pF		Units
		Min	Typ	Max	Min	Max	Min	Max	
f_{MAX}	Maximum Clock Frequency	80	120		60		80		MHz
t_{PLH}	Propagation Delay	3.0	4.8	7.5	2.5	9.0	3.0	7.5	ns
t_{PHL}	CP to Q_n	3.5	5.0	8.0	3.0	8.5	3.5	8.0	
t_{PHL}	Propagation Delay $\overline{MR}$ to Q_n	5.0	7.0	10.0	4.0	12.5	5.0	10.5	ns

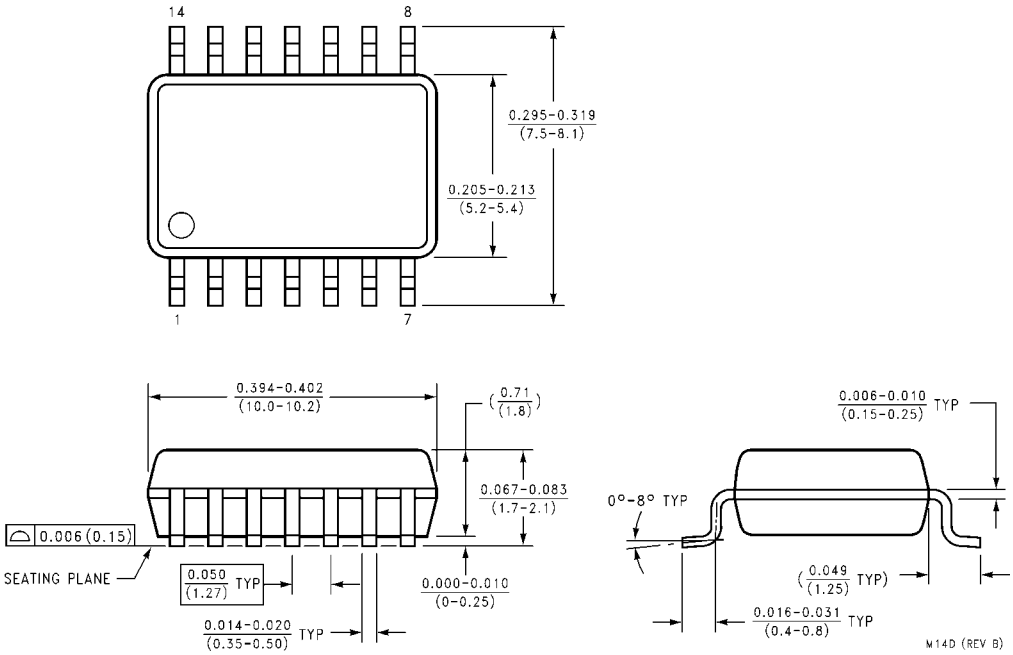
AC Operating Requirements

Symbol	Parameter	$T_A = +25°C$, $V_{CC} = +5.0V$		$T_A = -55°C$ to $+125°C$, $V_{CC} = 5.0V$		$T_A = 0°C$ to $+70°C$, $V_{CC} = 5.0V$		Units
		Min	Max	Min	Max	Min	Max	
$t_S(H)$	Setup Time, HIGH or LOW	4.5		5.5		4.5		ns
$t_S(L)$	A or B to CP	4.0		4.0		4.0		
$t_H(H)$	Hold Time, HIGH or LOW	1.0		1.0		1.0		
$t_H(L)$	A or B to CP	1.0		1.0		1.0		
$t_W(H)$	CP Pulse Width	4.0		4.0		4.0		ns
$t_W(L)$	HIGH or LOW	7.0		7.0		7.0		
$t_W(L)$	$\overline{MR}$ Pulse Width, LOW	4.0		5.0		4.0		ns
t_{REC}	Recovery Time $\overline{MR}$ to CP	5.0		6.5		5.0		ns

Physical Dimensions inches (millimeters) unless otherwise noted

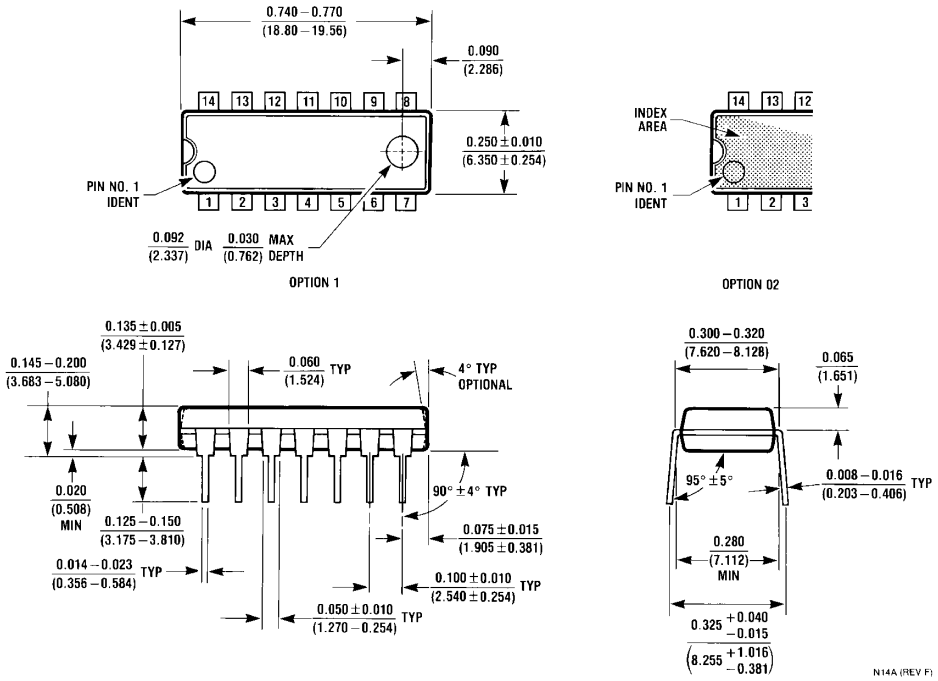


14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-120, 0.150 Narrow
Package Number M14A



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

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



14-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300 Wide
Package Number N14A