



Is Now Part of



**ON Semiconductor®**

To learn more about ON Semiconductor, please visit our website at

[www.onsemi.com](http://www.onsemi.com)

ON Semiconductor and the ON Semiconductor logo are trademarks of Semiconductor Components Industries, LLC dba ON Semiconductor or its subsidiaries in the United States and/or other countries. ON Semiconductor owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of ON Semiconductor's product/patent coverage may be accessed at [www.onsemi.com/site/pdf/Patent-Marking.pdf](http://www.onsemi.com/site/pdf/Patent-Marking.pdf). ON Semiconductor reserves the right to make changes without further notice to any products herein. ON Semiconductor makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does ON Semiconductor assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using ON Semiconductor products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by ON Semiconductor. "Typical" parameters which may be provided in ON Semiconductor data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. ON Semiconductor does not convey any license under its patent rights nor the rights of others. ON Semiconductor products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use ON Semiconductor products for any such unintended or unauthorized application, Buyer shall indemnify and hold ON Semiconductor and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that ON Semiconductor was negligent regarding the design or manufacture of the part. ON Semiconductor is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

# MM74HC164

## 8-Bit Serial-in/Parallel-out Shift Register

### Features

- Typical operating frequency: 50MHz
- Typical propagation delay: 19ns (clock to Q)
- Wide operating supply voltage range: 2V to 6V
- Low input current: 1µA maximum
- Low quiescent supply current: 80µA maximum (74HC Series)
- Fanout of 10 LS-TTL loads

### General Description

The MM74HC164 utilizes advanced silicon-gate CMOS technology. It has the high noise immunity and low consumption of standard CMOS integrated circuits. It also offers speeds comparable to low power Schottky devices.


This 8-bit shift register has gated serial inputs and CLEAR. Each register bit is a D-type master/slave flip-flop. Inputs A & B permit complete control over the incoming data. A LOW at either or both inputs inhibits entry of new data and resets the first flip-flop to the low level at the next clock pulse. A high level on one input enables the other input which will then determine the state of the first flip-flop. Data at the serial inputs may be changed while the clock is HIGH or LOW, but only information meeting the setup and hold time requirements will be entered. Data is serially shifted in and out of the 8-bit register during the positive going transition of the clock pulse. Clear is independent of the clock and accomplished by a low level at the CLEAR input.

The 74HC logic family is functionally as well as pin-out compatible with the standard 74LS logic family. All inputs are protected from damage due to static discharge by internal diode clamps to  $V_{CC}$  and ground.

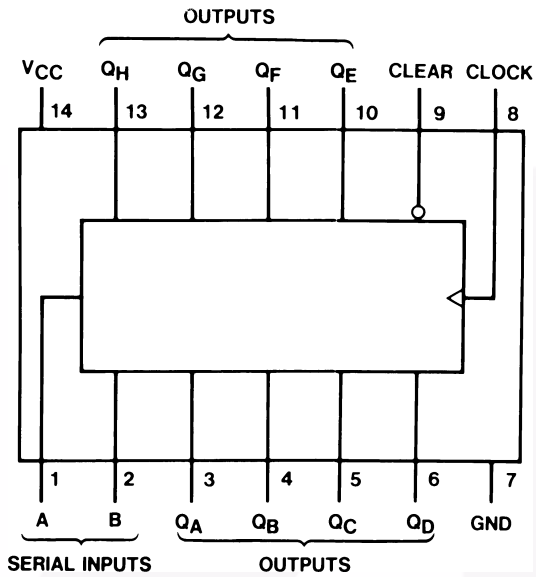
### Ordering Information

Order Number	Package Number	Package Description
MM74HC164M	M14A	14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow
MM74HC164MTC	MTC14	14-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide
MM74HC164N	N14A	14-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300" Wide

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

 All packages are lead free per JEDEC: J-STD-020B standard.

Connection Diagram



Top View

Truth Table

Inputs				Outputs	
Clear	Clock	A	B	Q <sub>A</sub>	Q <sub>B</sub> ... Q <sub>H</sub>
L	X	X	X	L	L ... L
H	L	X	X	Q <sub>AO</sub>	Q <sub>BO</sub> ... Q <sub>HO</sub>
H	↑	H	H	H	Q <sub>An</sub> ... Q <sub>Gn</sub>
H	↑	L	X	L	Q <sub>A</sub> ... Q <sub>Gn</sub>
H	↑	X	L	L	Q <sub>An</sub> ... Q <sub>Gn</sub>

H = HIGH Level (steady state)

L = LOW Level (steady state)

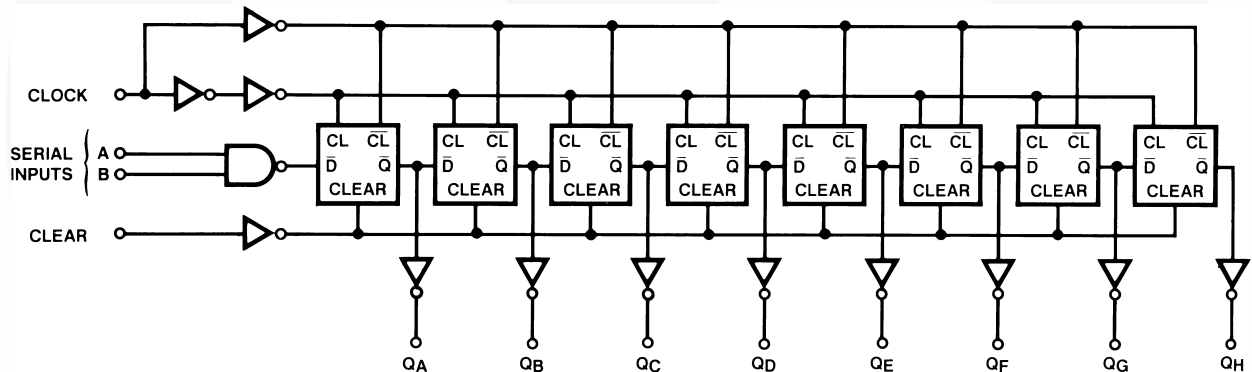
X = Irrelevant (any input, including transitions)

↑ = Transition from LOW-to-HIGH level.

Q<sub>AO</sub>, Q<sub>BO</sub>, Q<sub>HO</sub> = the level of Q<sub>A</sub>, Q<sub>B</sub>, or Q<sub>H</sub>, respectively, before the indicated steady state input conditions were established.

Q<sub>An</sub>, Q<sub>Gn</sub> = The level of Q<sub>A</sub> or Q<sub>G</sub> before the most recent ↑ transition of the clock; indicated a one-bit shift.

Logic Diagram



## Absolute Maximum Ratings<sup>(1)</sup>

Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only.

Symbol	Parameter	Rating
$V_{CC}$	Supply Voltage	-0.5 to +7.0V
$V_{IN}$	DC Input Voltage	-1.5 to $V_{CC}+1.5V$
$V_{OUT}$	DC Output Voltage	-0.5 to $V_{CC}+0.5V$
$I_{IK}, I_{OK}$	Clamp Diode Current	$\pm 20mA$
$I_{OUT}$	DC Output Current, per pin	$\pm 25mA$
$I_{CC}$	DC $V_{CC}$ or GND Current, per pin	$\pm 50mA$
$T_{STG}$	Storage Temperature Range	-65°C to +150°C
$P_D$	Power Dissipation Note 2	600mW
	S.O. Package only	500mW
$T_L$	Lead Temperature (Soldering 10 seconds)	260°C

### Notes:

1. Unless otherwise specified all voltages are referenced to ground.
2. Power Dissipation temperature derating — plastic “N” package: -12mW/°C from 65°C to 85°C.

## Recommended Operating Conditions

The Recommended Operating Conditions table defines the conditions for actual device operation. Recommended operating conditions are specified to ensure optimal performance to the datasheet specifications. Fairchild does not recommend exceeding them or designing to absolute maximum ratings.

Symbol	Parameter	Min.	Max.	Units
$V_{CC}$	Supply Voltage	2	6	V
$V_{IN}, V_{OUT}$	DC Input or Output Voltage	0	$V_{CC}$	V
$T_A$	Operating Temperature Range	-40	+85	°C
$t_r, t_f$	Input Rise or Fall Times $V_{CC} = 2.0V$		1000	ns
	$V_{CC} = 4.5V$		500	ns
	$V_{CC} = 6.0V$		400	ns

### DC Electrical Characteristics<sup>(3)</sup>

Symbol	Parameter	V <sub>CC</sub> (V)	Conditions	T <sub>A</sub> = 25°C		T <sub>A</sub> = -40°C to 85°C	T <sub>A</sub> = -55°C to 125°C	Units
				Typ.	Guaranteed Limits			
V <sub>IH</sub>	Minimum HIGH Level Input Voltage	2.0			1.5	1.5	1.5	V
		4.5			3.15	3.15	3.15	
		6.0			4.2	4.2	4.2	
V <sub>IL</sub>	Maximum LOW Level Input Voltage	2.0			0.5	0.5	0.5	V
		4.5			1.35	1.35	1.35	
		6.0			1.8	1.8	1.8	
V <sub>OH</sub>	Minimum HIGH Level Output Voltage	2.0	V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> ,  I <sub>OUT</sub>   ≤ 20μA	2.0	1.9	1.9	1.9	V
		4.5		4.5	4.4	4.4	4.4	
		6.0		6.0	5.9	5.9	5.9	
		4.5	V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> ,  I <sub>OUT</sub>   ≤ 4.0mA	4.2	3.98	3.84	3.7	
		6.0		V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> ,  I <sub>OUT</sub>   ≤ 5.2mA	5.7	5.48	5.34	
V <sub>OL</sub>	Maximum LOW Level Output Voltage	2.0	V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> ,  I <sub>OUT</sub>   ≤ 20μA		0	0.1	0.1	0.1
		4.5		0	0.1	0.1	0.1	
		6.0		0	0.1	0.1	0.1	
		4.5	V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> ,  I <sub>OUT</sub>   ≤ 4.0mA	0.2	0.26	0.33	0.4	
		6.0		V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> ,  I <sub>OUT</sub>   ≤ 5.2mA	0.2	0.26	0.33	0.4
I <sub>IN</sub>	Maximum Input Current	6.0	V <sub>IN</sub> = V <sub>CC</sub> or GND			±0.1	±1.0	±1.0
I <sub>CC</sub>	Maximum Quiescent Supply Current	6.0	V <sub>IN</sub> = V <sub>CC</sub> or GND, I <sub>OUT</sub> = 0μA		8.0	80	160	μA

#### Note:

3. For a power supply of 5V ±10% the worst case output voltages (V<sub>OH</sub>, and V<sub>OL</sub>) occur for HC at 4.5V. Thus the 4.5V values should be used when designing with this supply. Worst case V<sub>IH</sub> and V<sub>IL</sub> occur at V<sub>CC</sub> = 5.5V and 4.5V respectively. (The V<sub>IH</sub> value at 5.5V is 3.85V.) The worst case leakage current (I<sub>IN</sub>, I<sub>CC</sub>, and I<sub>OZ</sub>) occur for CMOS at the higher voltage and so the 6.0V values should be used.

### AC Electrical Characteristics

V<sub>CC</sub> = 5V, T<sub>A</sub> = 25°C, C<sub>L</sub> = 15pF, t<sub>r</sub> = t<sub>f</sub> = 6ns

Symbol	Parameter	Conditions	Typ.	Guaranteed Limit	Units
f <sub>MAX</sub>	Maximum Operating Frequency			30	MHz
t <sub>PHL</sub> , t <sub>PLH</sub>	Maximum Propagation Delay, Clock to Output		19	30	ns
t <sub>PHL</sub>	Maximum Propagation Delay, Clear to Output		23	35	ns
t <sub>REM</sub>	Minimum Removal Time, Clear to Clock		-2	0	ns
t <sub>S</sub>	Minimum Setup Time, Data to Clock		12	20	ns
t <sub>H</sub>	Minimum Hold Time, Clock to Data		1	5	ns
t <sub>W</sub>	Minimum Pulse Width, Clear or Clock		10	16	ns

## AC Electrical Characteristics

$C_L = 50\text{pF}$ ,  $t_r = t_f = 6\text{ns}$  (unless otherwise specified)

Symbol	Parameter	$V_{CC}$ (V)	Conditions	$T_A = 25^\circ\text{C}$		$T_A = -40^\circ\text{C}$ to $85^\circ\text{C}$	$T_A = -55^\circ\text{C}$ to $125^\circ\text{C}$	Units
				Typ.	Guaranteed Limits			
$f_{\text{MAX}}$	Maximum Operating Frequency	2.0			5	4	3	MHz
		4.5			27	21	18	
		6.0			31	24	20	
$t_{\text{PHL}}, t_{\text{PLH}}$	Maximum Propagation Delay, Clock to Output	2.0		115	175	218	254	ns
		4.5		13	35	44	51	
		6.0		20	30	38	44	
$t_{\text{PHL}}$	Maximum Propagation Delay, Clear to Output	2.0		140	205	256	297	ns
		4.5		28	41	51	59	
		6.0		24	35	44	51	
$t_{\text{REM}}$	Minimum Removal Time, Clear to Clock	2.0		-7	0	0	0	ns
		4.5		-3	0	0	0	
		6.0		-2	0	0	0	
$t_S$	Minimum Setup Time, Data to Clock	2.0		25	100	125	150	ns
		4.5		14	20	25	30	
		6.0		12	17	21	25	
$t_H$	Minimum Hold Time, Clock to Data	2.0		-2	5	5	5	ns
		4.5		0	5	5	5	
		6.0		1	5	5	5	
$t_W$	Minimum Pulse Width Clear or Clock	2.0		22	80	100	120	ns
		4.5		11	16	20	24	
		6.0		10	14	18	20	
$t_{\text{THL}}, t_{\text{TLH}}$	Maximum Output Rise and Fall Time	2.0			75	95	110	ns
		4.5			15	19	22	
		6.0			13	16	19	
$t_r, t_f$	Maximum Input Rise and Fall Time	2.0			1000	1000	1000	ns
		4.5			500	500	500	
		6.0			400	400	400	
$C_{\text{PD}}$	Power Dissipation Capacitance <sup>(4)</sup>	5.0	(per package)	150				pF
$C_{\text{IN}}$	Maximum Input Capacitance			5	10	10	10	pF

### Note:

4.  $C_{\text{PD}}$  determines the no load dynamic power consumption,  $P_D = C_{\text{PD}} V_{\text{CC}}^2 f + I_{\text{CC}} V_{\text{CC}}$ , and the no load dynamic current consumption,  $I_S = C_{\text{PD}} V_{\text{CC}} f + I_{\text{CC}}$ .



**NOTES:**

- A. CONFORMS TO JEDEC REGISTRATION MO-153, VARIATION AB, REF NOTE 6
- B. DIMENSIONS ARE IN MILLIMETERS.
- C. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS
- D. DIMENSIONING AND TOLERANCES PER ANSI Y14.5M, 2009.
- E. LANDPATTERN STANDARD: SOP65P640X110-14M.
- F. DRAWING FILE NAME: MKT-MTC14rev7.





NOTES:

- A. CONFORMS TO JEDEC MS-012, VARIATION AB, ISSUE C
- B. ALL DIMENSIONS ARE IN MILLIMETERS
- C. DIMENSIONS DO NOT INCLUDE MOLD FLASH OR BURRS
- D. LAND PATTERN STANDARD: SOIC127P600X145-14M
- E. CONFORMS TO ASME Y14.5M, 2009
- D. DRAWING FILENAME: MKT-M14Arev14





ON Semiconductor and  are trademarks of Semiconductor Components Industries, LLC dba ON Semiconductor or its subsidiaries in the United States and/or other countries. ON Semiconductor owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of ON Semiconductor's product/patent coverage may be accessed at [www.onsemi.com/site/pdf/Patent-Marking.pdf](http://www.onsemi.com/site/pdf/Patent-Marking.pdf). ON Semiconductor reserves the right to make changes without further notice to any products herein. ON Semiconductor makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does ON Semiconductor assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using ON Semiconductor products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by ON Semiconductor. "Typical" parameters which may be provided in ON Semiconductor data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. ON Semiconductor does not convey any license under its patent rights nor the rights of others. ON Semiconductor products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use ON Semiconductor products for any such unintended or unauthorized application, Buyer shall indemnify and hold ON Semiconductor and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that ON Semiconductor was negligent regarding the design or manufacture of the part. ON Semiconductor is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

## PUBLICATION ORDERING INFORMATION

### LITERATURE FULFILLMENT:

Literature Distribution Center for ON Semiconductor  
19521 E. 32nd Pkwy, Aurora, Colorado 80011 USA  
**Phone:** 303-675-2175 or 800-344-3860 Toll Free USA/Canada  
**Fax:** 303-675-2176 or 800-344-3867 Toll Free USA/Canada  
**Email:** [orderlit@onsemi.com](mailto:orderlit@onsemi.com)

**N. American Technical Support:** 800-282-9855 Toll Free  
USA/Canada  
**Europe, Middle East and Africa Technical Support:**  
Phone: 421 33 790 2910  
**Japan Customer Focus Center**  
Phone: 81-3-5817-1050

**ON Semiconductor Website:** [www.onsemi.com](http://www.onsemi.com)  
**Order Literature:** <http://www.onsemi.com/orderlit>  
For additional information, please contact your local  
Sales Representative