FAIRCHILD SEMICONDUCTOR™

October 1987
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MM74C164
8-Bit Parallel-Out Serial Shift Register

General Description

The MM74C164 shift registers are a monolithic complementary MOS (CMOS) integrated circuit constructed with N- and P-channel enhancement transistors. These 8-bit shift registers have gated serial inputs and clear. Each register bit is a D-type master/slave flip-flop. A high-level input enables the other input which will then determine the state of the flip-flop.

Data is serially shifted in and out of the 8-bit register during the positive going transition of clock pulse. Clear is independent of the clock and accomplished by a low level at the clear input. All inputs are protected against electrostatic effects.

Features

- Supply voltage range: 3V to 15V
- Tenth power TTL compatible: drive 2 LPTTL loads
- High noise immunity: 0.45 V_{CC} (typ.)
- Low power: 50 nW (typ.)
- Medium speed operation: 0.8 MHz (typ.) with 10V supply

Applications

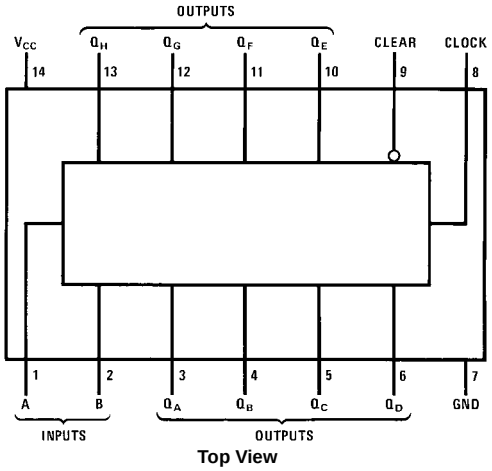
- Data terminals
- Instrumentation
- Medical electronics
- Alarm systems
- Industrial electronics
- Remote metering
- Computers

Ordering Code:

Order Number	Package Number	Package Description
MM74C164M	M14A	14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow
MM74C164N	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.

Connection Diagram



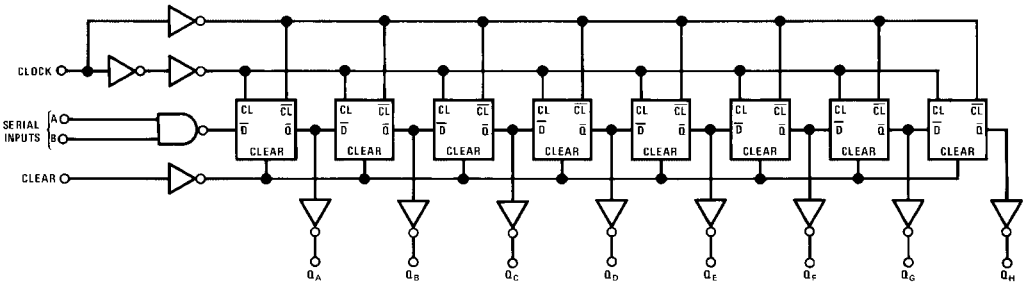
Top View

Truth Table

Serial Inputs A and B

Inputs t_n		Output t_{n+1}
A	B	Q_A
1	1	1
0	1	0
1	0	0
0	0	0

Block Diagram



Absolute Maximum Ratings(Note 1)

Voltage at Any Pin	−0.3V to V_{CC} + 0.3V
Operating Temperature Range	−55°C to +125°C
Storage Temperature Range	−65°C to +150°C
Absolute Maximum V_{CC}	18V
Power Dissipation (P_D)	
Dual-In-Line	700 mW
Small Outline	500 mW
Operating V_{CC} Range	3V to 15V
Lead Temperature	
(soldering, 10 seconds)	260°C

Note 1: "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. Except for "Operating Temperature Range" they are not meant to imply that the devices should be operated at these limits. The table of "Electrical Characteristics" provides conditions for actual device operation.

DC Electrical Characteristics

Min/Max limits apply across temperature range unless otherwise noted

Symbol	Parameter	Conditions	Min	Typ	Max	Units
CMOS TO CMOS						
$V_{IN(1)}$	Logical "1" Input Voltage	V_{CC} = 5V	3.5			V
		V_{CC} = 10V	8.0			
$V_{IN(0)}$	Logical "0" Input Voltage	V_{CC} = 5V			1.5	V
		V_{CC} = 10V			2.0	
$V_{OUT(1)}$	Logical "1" Output Voltage	V_{CC} = 5V, I_O = −10 µA	4.5			V
		V_{CC} = 10V, I_O = −10 µA	9.0			
$V_{OUT(0)}$	Logical "0" Output Voltage	V_{CC} = 5V, I_O = +10 µA			0.5	V
		V_{CC} = 10V, I_O = +10 µA			1.0	
$I_{IN(1)}$	Logical "1" Input Current	V_{CC} = 15V, V_{IN} = 15V		0.005	1.0	µA
$I_{IN(0)}$	Logical "0" Input Current	V_{CC} = 15V, V_{IN} = 0V	−1.0	−0.005		µA
I_{CC}	Supply Current	V_{CC} = 15V		0.05	300	µA
CMOS TO LPTTL INTERFACE						
$V_{IN(1)}$	Logical "1" Input Voltage	V_{CC} = 4.75V	V_{CC} − 1.5			V
$V_{IN(0)}$	Logical "0" Input Voltage	V_{CC} = 4.75V			0.8	V
$V_{OUT(1)}$	Logical "1" Output Voltage	V_{CC} = 4.75V, I_O = −360 µA	2.4			V
$V_{OUT(0)}$	Logical "0" Output Voltage	V_{CC} = 4.75V, I_O = 360 µA			0.4	V
OUTPUT DRIVE (See Family Characteristics Data Sheet) (Short Circuit Current)						
I_{SOURCE}	Output Source Current	V_{CC} = 5V, $V_{IN(0)}$ = 0V	−1.75			mA
		T_A = 25°C, V_{OUT} = 0V				
I_{SOURCE}	Output Source Current	V_{CC} = 10V, $V_{IN(0)}$ = 0V	−8.0			mA
		T_A = 25°C, V_{OUT} = 0V				
I_{SINK}	Output Sink Current	V_{CC} = 5V, $V_{IN(1)}$ = 5V	1.75			mA
		T_A = 25°C, V_{OUT} = V_{CC}				
I_{SINK}	Output Sink Current	V_{CC} = 10V, $V_{IN(1)}$ = 10V	8.0			mA
		T_A = 25°C, V_{OUT} = V_{CC}				

AC Electrical Characteristics (Note 2)

$T_A = 25°C$, $C_L = 50$ pF, unless otherwise noted

Symbol	Parameter	Conditions	Min	Typ	Max	Units
t_{pd1}	Propagation Delay Time to a Logical "0" or a	$V_{CC} = 5V$		230	310	ns
	Logical "1" from Clock to Q	$V_{CC} = 10V$		90	120	
t_{pd0}	Propagation Delay Time to a Logical "0" from	$V_{CC} = 5V$		280	380	ns
	Clear to Q	$V_{CC} = 10V$		110	150	
t_S	Time Prior to Clock Pulse that Data	$V_{CC} = 5V$	200	110		ns
	Must be Present	$V_{CC} = 10V$	80	30		
t_H	Time After Clock Pulse that	$V_{CC} = 5V$	0	0		ns
	Data Must be Held	$V_{CC} = 10V$	0	0		
f_{MAX}	Maximum Clock Frequency	$V_{CC} = 5V$	2.0	3		MHz
		$V_{CC} = 10V$	5.5	8		
t_W	Minimum Clear Pulse Width	$V_{CC} = 5V$		150	250	ns
		$V_{CC} = 10V$		55	90	
t_r, t_f	Maximum Clock Rise and Fall Time	$V_{CC} = 5V$	15			µs
		$V_{CC} = 10V$	5			
C_{IN}	Input Capacitance	Any Input (Note 3)		5		pF
C_{PD}	Power Dissipation Capacitance	(Note 4)		140		pF

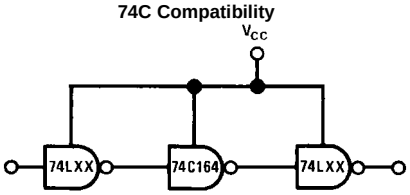
Note 2: AC Parameters are guaranteed by DC correlated testing.

Note 3: Capacitance is guaranteed by periodic testing.

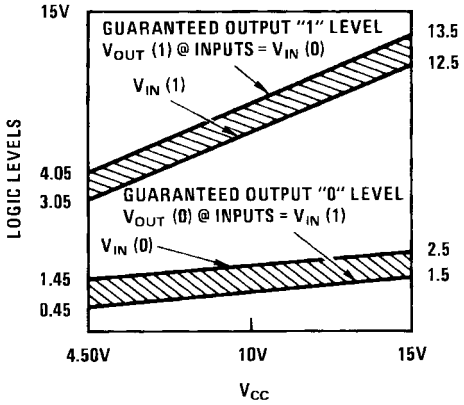
Note 4: C_{PD} determines the no load AC power consumption of any CMOS device. For complete explanation see Family Characteristics application note AN-90.

Typical Applications

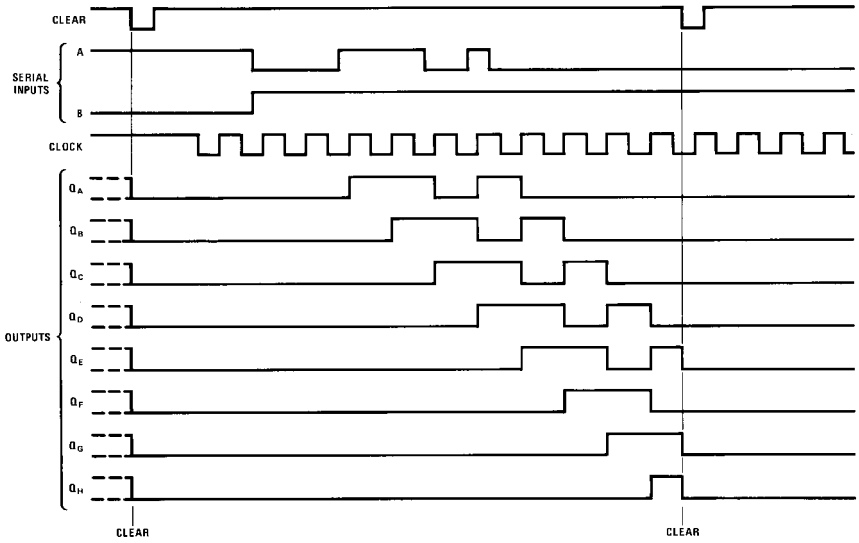
74C Compatibility



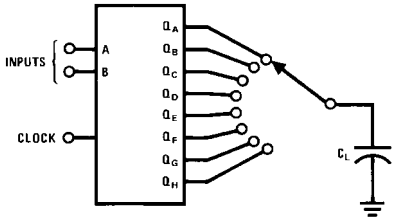
Guaranteed Noise Margin as a Function of V_{CC}



Logic Waveform

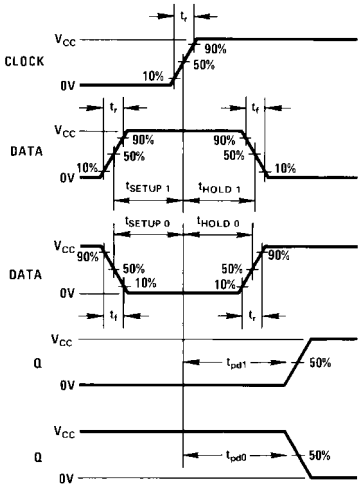


AC Test Circuit

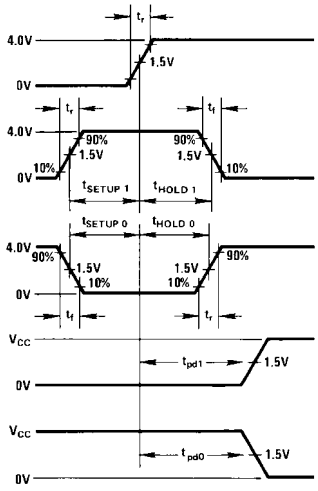


Switching Time Waveforms

CMOS to CMOS

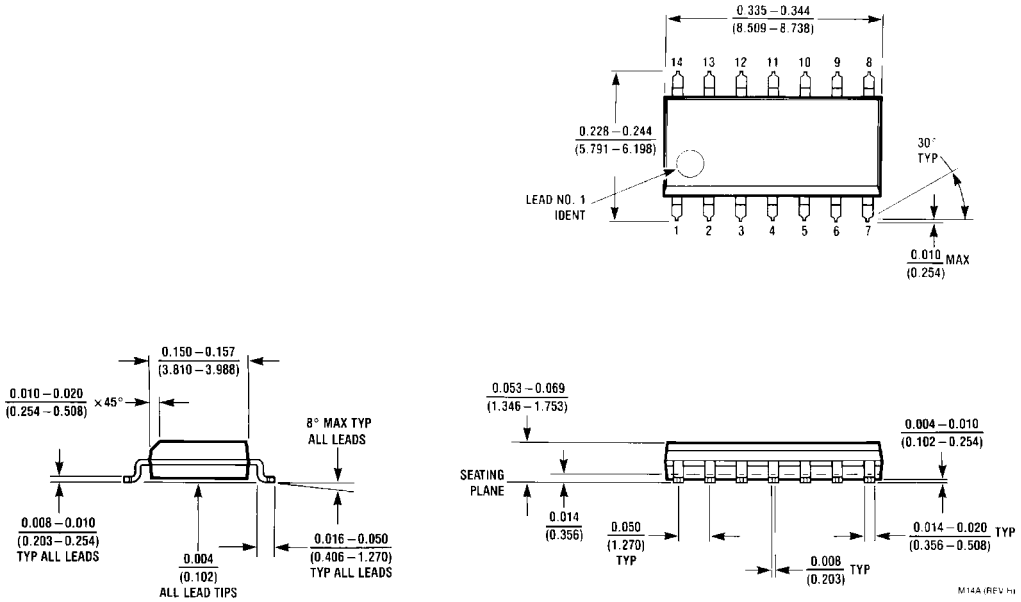


TTL to CMOS



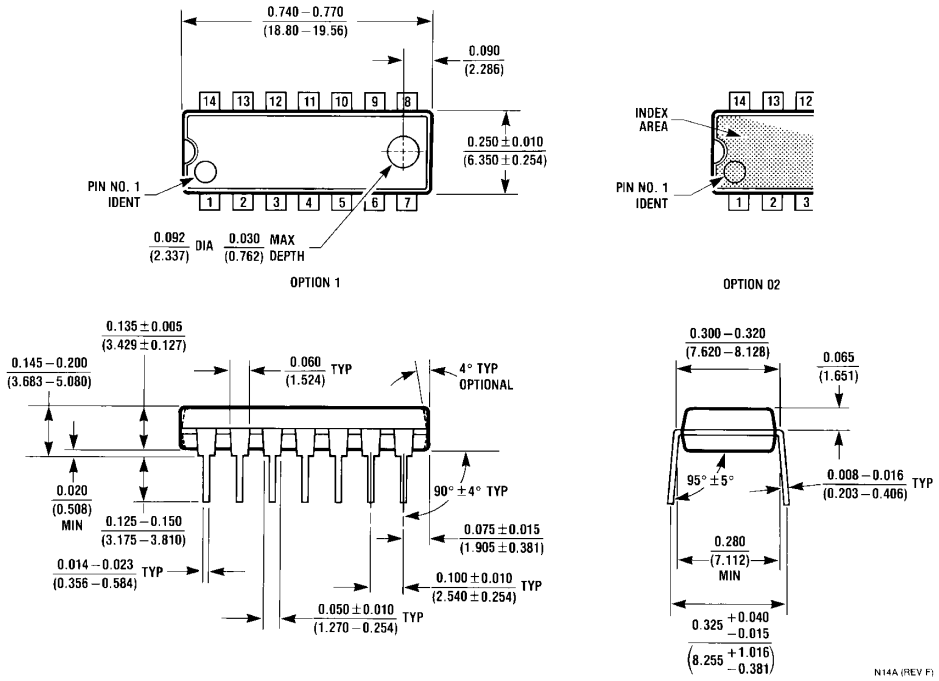
$t_r = t_f = 20$ ns

Physical Dimensions inches (millimeters) unless otherwise noted



14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow
Package Number M14A

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