

## MM54C95/MM74C95 4-Bit Right-Shift Left-Shift Register

### General Description

This 4-bit shift register is a monolithic complementary MOS (CMOS) integrated circuit composed of four D flip-flops. This register will perform right-shift or left-shift operations dependent upon the logical input level to the mode control. A number of these registers may be connected in series to form an N-bit right-shift or left-shift register.

When a logical "0" level is applied to the mode control input, the output of each flip-flop is coupled to the D input of the succeeding flip-flop. Right-shift operation is performed by clocking at the clock 1 input, and serial data entered at the serial input, clock 2 and parallel inputs A through D are inhibited. With a logical "1" level applied to the mode control, outputs to succeeding stages are decoupled and parallel loading is possible, or with external interconnection, shift-left operation can be accomplished by connecting the output of each flip-flop to the parallel input of the previous flip-flop and serial data is entered at input D.

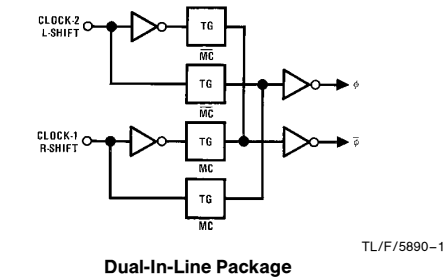
### Features

- Medium speed operation 10 MHz (typ.)
- High noise immunity  $V_{CC} = 10V, C_L = 50 \text{ pF}$
- Low power 0.45  $V_{CC}$  (typ.)
- Tenth power TTL compatible 100 nW/(typ.)
- Wide supply voltage range Drive 2 LTTL loads
- Synchronous parallel load 3V to 15V
- Parallel inputs and outputs from each flip-flop
- Negative edge triggered clocking
- The MM54C95/MM74C95 follows the MM54L95/MM74L95 Pinout

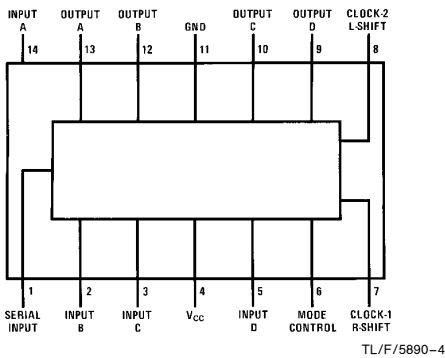
### Applications

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

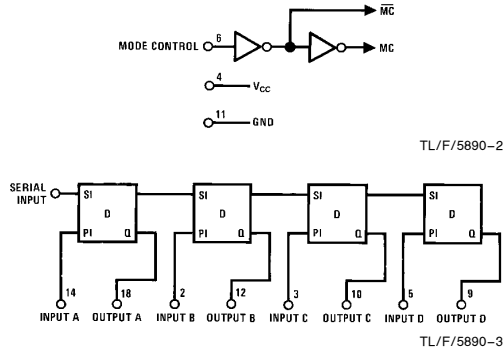
### Block and Connection Diagrams



Dual-In-Line Package



Order Number MM54C95 or MM74C95



Mode Control = 0 for Right Shift  
Mode Control = 1 for Left Shift or Parallel Load

## Absolute Maximum Ratings (Note 1)

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.

Voltage at any Pin	-0.3V to $V_{CC} + 0.3V$
Operating Temperature Range ( $T_A$ )	
MM54C95	-55°C to +125°C
MM74C95	-40°C to +85°C

Storage Temperature ( $T_S$ )	-65°C to +150°C
Maximum $V_{CC}$ Voltage	18V
Power Dissipation ( $P_D$ )	
Dual-In-Line	700 mW
Small Outline	500 mW
Operating $V_{CC}$ Range	+3V to +15V
Lead Temperature ( $T_L$ )	
(Soldering, 10 seconds)	260°C

## DC Electrical Characteristics Min/Max limits apply across temperature range unless otherwise noted

Symbol	Parameter	Conditions	Min	Typ	Max	Units
<b>CMOS TO CMOS</b>						
$V_{IN(1)}$	Logical "1" Input Voltage	$V_{CC} = 5V$ $V_{CC} = 10V$	3.5 8.0			V V
$V_{IN(0)}$	Logical "0" Input Voltage	$V_{CC} = 5V$ $V_{CC} = 10V$			1.5 2.0	V V
$V_{OUT(1)}$	Logical "1" Output Voltage	$V_{CC} = 5V$ $V_{CC} = 10V$	4.5 9.0			V V
$V_{OUT(0)}$	Logical "0" Output Voltage	$V_{CC} = 5V$ $V_{CC} = 10V$			0.5 1.0	V V
$I_{IN(1)}$	Logical "1" Input Current	$V_{CC} = 15V$			1.0	$\mu A$
$I_{IN(0)}$	Logical "0" Input Current	$V_{CC} = 15V$	-1.0			$\mu A$
$I_{CC}$	Supply Current	$V_{CC} = 15V$		0.050	300	$\mu A$
<b>LOW POWER TTL/CMOS INTERFACE</b>						
$V_{IN(1)}$	Logical "1" Input Voltage	54C, $V_{CC} = 4.5V$ 74C, $V_{CC} = 4.75V$	$V_{CC} - 1.5$ $V_{CC} - 1.5$			V V
$V_{IN(0)}$	Logical "0" Input Voltage	54C, $V_{CC} = 4.5V$ 74C, $V_{CC} = 4.75V$			0.8 0.8	V V
$V_{OUT(1)}$	Logical "1" Output Voltage	54C, $V_{CC} = 4.5V, I_O = 360 \mu A$ 74C, $V_{CC} = 4.75V, I_O = 360 \mu A$	2.4 2.4			V V
$V_{OUT(0)}$	Logical "0" Output Voltage	54C, $V_{CC} = 4.5V, I_O = 360 \mu A$ 74C, $V_{CC} = 4.75V, I_O = 360 \mu A$			0.4 0.4	V V
<b>OUTPUT DRIVE (See 54C/74C Family Characteristics Data Sheet)</b>						
$I_{SOURCE}$	Output Source Current	$V_{CC} = 5V, V_{IN(0)} = 0V$ $T_A = 25^\circ C, V_{OUT} = 0V$	-1.75			mA
$I_{SOURCE}$	Output Source Current	$V_{CC} = 10V, V_{IN(0)} = 0V$ $T_A = 25^\circ C, V_{OUT} = 0V$	-8.0			mA
$I_{SINK}$	Output Sink Current	$V_{CC} = 5V, V_{IN(1)} = 5V$ $T_A = 25^\circ C, V_{OUT} = V_{CC}$	1.75			mA
$I_{SINK}$	Output Sink Current	$V_{CC} = 10V, V_{IN(1)} = 10V$ $T_A = 25^\circ C, V_{OUT} = V_{CC}$	8.0			mA

**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.

## AC Electrical Characteristics\* $T_A = 25^\circ\text{C}$ , $C_L = 50\text{ pF}$ , unless otherwise noted

Symbol	Parameter	Conditions	Min	Typ	Max	Units
$t_{pd}$	Propagation Delay Time to a Logical "0" or Logical "1" from Clock to Q or Q	$V_{CC} = 5\text{V}$ $V_{CC} = 10\text{V}$		200 80	400 160	ns ns
$t_{S0}$ , $t_{S1}$	Time Prior to Clock Pulse that Data must be Preset	$V_{CC} = 5\text{V}$ $V_{CC} = 10\text{V}$	60 25	30 10		ns ns
$t_{H0}$ , $t_{H1}$	Time After Clock Pulse that Data must be Held	$V_{CC} = 5\text{V}$ $V_{CC} = 10\text{V}$	25 10	10 50		ns ns
$t_{PW}$	Minimum Clock Pulse Width ( $t_{WL} = t_{WH}$ )	$V_{CC} = 5\text{V}$ $V_{CC} = 10\text{V}$		100 50		ns ns
$t_{SM}$	Time Prior to Clock Pulse that Mode Control must be Preset	$V_{CC} = 5\text{V}$ $V_{CC} = 10\text{V}$	200 100	100 50		ns ns
$f_{MAX}$	Maximum Input Clock Frequency	$V_{CC} = 5\text{V}$ $V_{CC} = 10\text{V}$	3 6.5	5 10		MHz MHz
$C_{IN}$	Input Capacitance	Any Input (Note 2)		5		pF
$C_{PD}$	Power Dissipation Capacitance	(Note 3)		100		pF

\*AC Parameters are guaranteed by DC correlated testing.

**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.

**Note 2:** Capacitance is guaranteed by periodic testing.

**Note 3:**  $C_{PD}$  determines the no load AC power consumption of any CMOS device. For complete explanation, see 54C/74C Family Characteristics, Application Note AN-90.

## Function Table

Mode Control	Inputs							Outputs			
	Clocks		Serial	Parallel				$Q_A$	$Q_B$	$Q_C$	$Q_D$
	2 (L)	1 (R)		A	B	C	D				
H	H	X	X	X	X	X	X	$Q_{A0}$	$Q_{B0}$	$Q_{C0}$	$Q_{D0}$
H	↓	X	X	a	b	c	c	a	b	c	d
H	↓	X	X	$Q_{Bn}^\dagger$	$Q_{Cn}^\dagger$	$Q_{Dn}^\dagger$	d	$Q_{Bn}$	$Q_{Cn}$	$Q_{Dn}$	d
L	L	H	X	X	X	X	X	$Q_{A0}$	$Q_{B0}$	$Q_{C0}$	$Q_{D0}$
L	X	↓	H	X	X	X	X	H	$Q_{An}$	$Q_{Bn}$	$Q_{Cn}$
L	X	↓	L	X	X	X	X	L	$Q_{An}$	$Q_{Bn}$	$Q_{Cn}$
↑	L	L	X	X	X	X	X	$Q_{A0}$	$Q_{B0}$	$Q_{C0}$	$Q_{D0}$
↓	L	L	X	X	X	X	X	$Q_{A0}$	$Q_{B0}$	$Q_{C0}$	$Q_{D0}$
↓	L	H	X	X	X	X	X	$Q_{A0}$	$Q_{B0}$	$Q_{C0}$	$Q_{D0}$
↑	H	L	X	X	X	X	X	$Q_{A0}$	$Q_{B0}$	$Q_{C0}$	$Q_{D0}$
↑	H	H	X	X	X	X	X	$Q_{A0}$	$Q_{B0}$	$Q_{C0}$	$Q_{D0}$
↑	L	H	X	X	X	X	X	Undefined			
↓	H	L	X	X	X	X	X	Operating Conditions			

†Shifting left requires external connection of  $Q_B$  to A,  $Q_C$  to B, and  $Q_D$  to C. Serial data is entered at input D.

H = high level (steady state), L = low level (steady state), X = irrelevant (any input, including transitions)

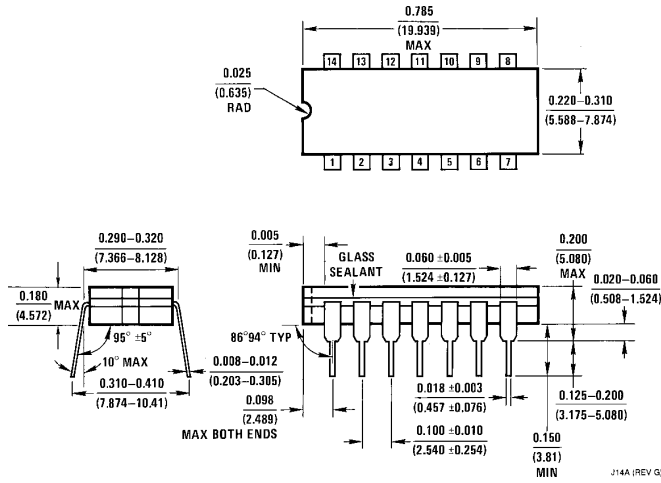
↓ = transition from high to low level, ↑ = transition from low to high level.

a, b, c, d = the level of steady-state input at inputs A, B, C or D, respectively.

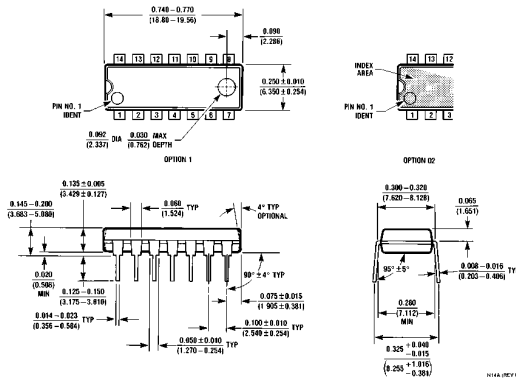
$Q_{A0}$ ,  $Q_{B0}$ ,  $Q_{C0}$ ,  $Q_{D0}$  = the level of  $Q_A$ ,  $Q_B$ ,  $Q_C$  or  $Q_D$  respectively, before the indicated steady-state input conditions were established.

$Q_{An}$ ,  $Q_{Bn}$ ,  $Q_{Cn}$ ,  $Q_{Dn}$  = the level of  $Q_A$ ,  $Q_B$ ,  $Q_C$  or  $Q_D$  respectively, before the most recent transition of the clock.

**Physical Dimensions** inches (millimeters)



**Ceramic Dual-In-Line Package (J)**  
**Order Number MM54C95J or MM74C95J**  
**NS Package Number J14A**



**Molded Dual-In-Line Package (N)**  
**Order Number MM54C95N or MM74C95N**  
**NS Package Number N14A**

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