National Semiconductor

June 1989

DM54L95 4-Bit Parallel Access Shift Registers

General Description

These 4-bit registers feature parallel and serial inputs, parallel output, mode control, and two clock inputs. The registers have three modes of operation.

Parallel (broadside) load
Shift right (the direction Q_A toward Q_D)
Shift left (the direction Q_D toward Q_A)

Parallel loading is accomplished by applying the four bits of data and taking the mode control input high. The data is loaded into the associated flip-flops and appears at the outputs after the high-to-low transition of the clock-2 input. During loading, the entry of serial data is inhibited.

Shift right is accomplished on the high-to-low transition of clock 1 when the mode control is low; shift left is accomplished on the high-to-low transition of clock 2 when the mode control is high by connecting the output of each flip-flop to the parallel input of the previous flip-flop (Q_D to input C, etc.) and serial data is entered at input D. The clock input may be applied simultaneously to clock 1 and clock 2 if both modes can be clocked from the same source.

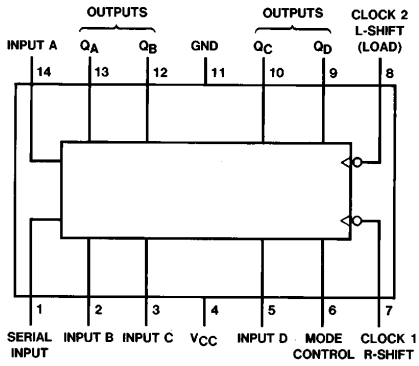
Changes at the mode control input should normally be made while both clock inputs are low; however, conditions described in the last three lines of the truth table will also ensure that register contents are protected.

Features

- Typical maximum clock frequency 14 MHz
- Typical power dissipation mW

Connection Diagram

Dual-In-Line Package



TL/F/6638–1

Order Number DM54L95J or DM54L95W
See NS Package Number J14A or W14B

Function Table

Inputs								Outputs			
Mode Control	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_{AO}	Q_{BO}	Q_{CO}	Q_{DO}
H	↓	X	X	a	b	c	d	a	b	c	d
H	↓	X	X	Q_B†	Q_C†	Q_D†	d	Q_{Bn}	Q_{Cn}	Q_{Dn}	d
L	L	H	X	X	X	X	X	Q_{AO}	Q_{BO}	Q_{CO}	Q_{DO}
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_{AO}	Q_{Bn}	Q_{CO}	Q_{DO}
↓	L	L	X	X	X	X	X	Q_{AO}	Q_{BO}	Q_{CO}	Q_{DO}
↓	L	H	X	X	X	X	X	Q_{AO}	Q_{BO}	Q_{CO}	Q_{DO}
↑	H	L	X	X	X	X	X	Q_{AO}	Q_{BO}	Q_{CO}	Q_{DO}
↑	H	H	X	X	X	X	X	Q_{AO}	Q_{BO}	Q_{CO}	Q_{DO}

†Shifting left requires external connection of Q_B to A, Q_C to B, Q_D to C. Serial data is entered at input D.
H = High Level (Steady State), L = Low Level (Steady State), X = Don't Care (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_{AO}, Q_{BO}, Q_{CO}, Q_{DO} = 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.

RRD-B30M105/Printed in U. S. A.

Absolute Maximum Ratings (Note)

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

Supply Voltage	8V
Input Voltage	5.5V
Operating Free Air Temperature Range	
DM54L	−55°C to +125°C
Storage Temperature Range	−65°C to +150°C

Note: *The "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. The device should not be operated at these limits. The parametric values defined in the "Electrical Characteristics" table are not guaranteed at the absolute maximum ratings. The "Recommended Operating Conditions" table will define the conditions for actual device operation.*

Recommended Operating Conditions

Symbol	Parameter		DM54L95			Units
			Min	Nom	Max	
V_{CC}	Supply Voltage		4.5	5	5.5	V
V_{IH}	High Level Input Voltage		2			V
V_{IL}	Low Level Input Voltage				0.7	V
I_{OH}	High Level Output Current				−0.2	mA
I_{OL}	Low Level Output Current				2	mA
f_{CLK}	Clock Frequency (Note 1)		0		6	MHz
$t_{W(CLK)}$	Pulse Width of Clock (Note 1)		90			ns
t_{SU}	Data Setup Time (Note 1)		50			ns
t_{EN}	Time to Enable Clock (Note 1)	Clock 1	120			ns
		Clock 2	100			ns
t_H	Data Hold Time (Note 1)		0			ns
t_{IN}	Time to Inhibit Clock 1 or Clock 2 (Note 1)		0			ns
T_A	Free Air Operating Temperature		−55		125	°C

Note 1: $T_A = 25°C$ and $V_{CC} = 5V$.

Electrical Characteristics over recommended operating free air temperature (unless otherwise noted)

Symbol	Parameter	Conditions		Min	Typ (Note 1)	Max	Units
V_{OH}	High Level Output Voltage	V_{CC} = Min, I_{OH} = Max V_{IL} = Max, V_{IH} = Min		2.4	3.1		V
V_{OL}	Low Level Output Voltage	V_{CC} = Min, I_{OL} = Max V_{IL} = Max, V_{IH} = Min			0.13	0.3	V
I_I	Input Current @ Max Input Voltage	V_{CC} = Max V_I = 5.5V	Mode			0.2	mA
			Others			0.1	
I_{IH}	High Level Input Current	V_{CC} = Max V_I = 2.4V	Mode			20	μA
			Others			10	
I_{IL}	Low Level Input Current	V_{CC} = Max V_I = 0.3V	Mode			−0.36	mA
			Others			−0.18	
I_{OS}	Short Circuit Output Current	V_{CC} = Max (Note 2)		−3		−15	mA
I_{CC}	Supply Current	V_{CC} = Max (Note 3)			4.8	8	mA

Note 1: All typicals are at $V_{CC} = 5V$, T_A 25°C

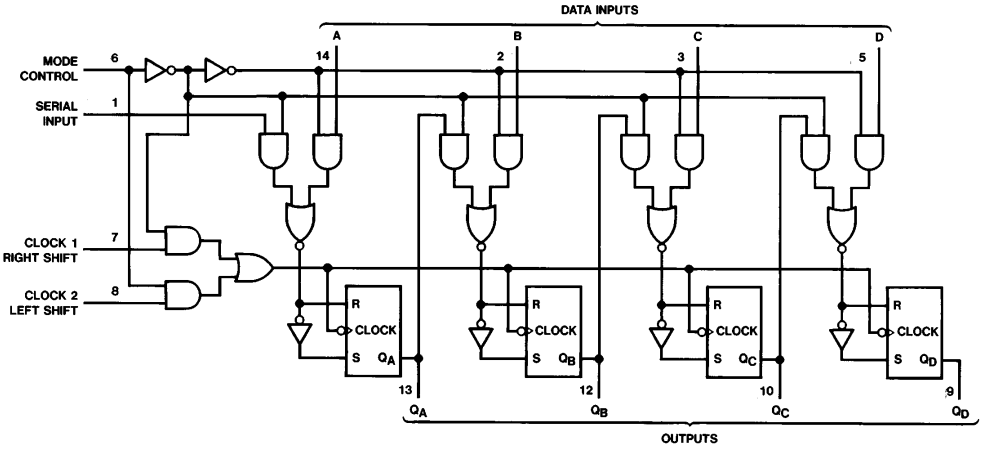
Note 2: Not more than one output should be shorted at a time.

Note 3: I_{CC} is measured with all outputs and serial input open; A, B, C, and D inputs grounded; mode control at 4.5V; and a momentary 3V, then ground, applied to both clock inputs.

Switching Characteristics at V_{CC} = 5V and T_A 25°C (See Section 1 for Test Waveforms and Output Load)

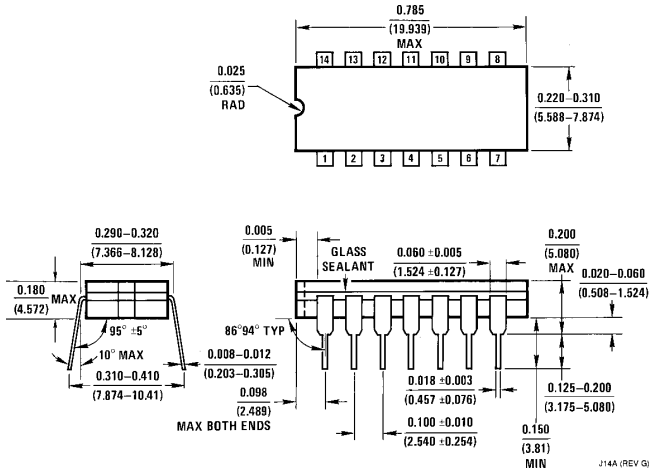
Symbol	Parameter	From (Input) To (Output)	$R_L = 4\Omega$, $C_L = 50$ pF		Units
			Min	Max	
f_{MAX}	Maximum Clock Frequency		6		MHz
t_{PLH}	Propagation Delay Time Low to High Level Output	Clock to Output		90	ns
t_{PHL}	Propagation Delay Time High to Low Level Output	Clock to Output		90	ns

Logic Diagram



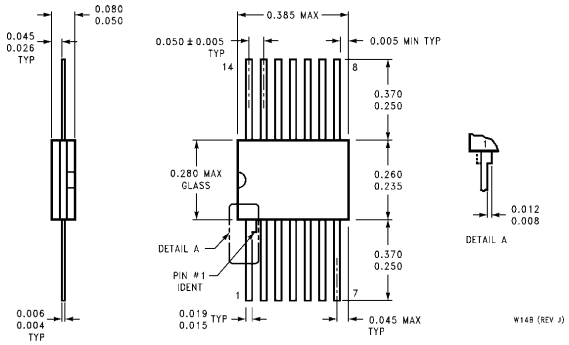
TL/F/6638–2

Physical Dimensions inches (millimeters)



14-Lead Ceramic Dual-In-Line Package (J)
Order Number DM54L95J
NS Package Number J14A

Physical Dimensions inches (millimeters) (Continued)



14-Lead Ceramic Flat Package (W)
Order Number DM54L95W
NS Package Number W14B

LIFE SUPPORT POLICY

NATIONAL'S PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS WRITTEN APPROVAL OF THE PRESIDENT OF NATIONAL SEMICONDUCTOR CORPORATION. As used herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, and whose failure to perform, when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in a significant injury to the user.
2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

National Semiconductor Corporation
1111 West Bardin Road
Arlington, TX 76017
Tel: 1(800) 272-9959
Fax: 1(800) 737-7018

National Semiconductor Europe
Fax: (+49) 0-180-530 85 86
Email: cnjwge@tevm2.nsc.com
Deutsch Tel: (+49) 0-180-530 85 85
English Tel: (+49) 0-180-532 78 32
Français Tel: (+49) 0-180-532 93 58
Italiano Tel: (+49) 0-180-534 16 80

National Semiconductor Hong Kong Ltd.
13th Floor, Straight Block,
Ocean Centre, 5 Canton Rd.
Tsimshatsui, Kowloon
Hong Kong
Tel: (852) 2737-1600
Fax: (852) 2736-9960

National Semiconductor Japan Ltd.
Tel: 81-043-299-2309
Fax: 81-043-299-2408