MOTOROLA

SN54/74LS170

4 x 4 REGISTER FILE OPEN-COLLECTOR

The TTL/MSI SN54/74LS170 is a high-speed, low-power 4 x 4 Register File organized as four words by four bits. Separate read and write inputs, both address and enable, allow simultaneous read and write operation.

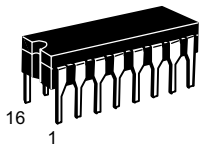
Open-collector outputs make it possible to connect up to 128 outputs in a wired-AND configuration to increase the word capacity up to 512 words. Any number of these devices can be operated in parallel to generate an n-bit length.

The SN54/74LS670 provides a similar function to this device but it features 3-state outputs.

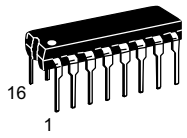
- Simultaneous Read/Write Operation
- Expandable to 512 Words of n-Bits
- Typical Access Time of 20 ns
- Low Leakage Open-Collector Outputs for Expansion
- Typical Power Dissipation of 125 mW

4 x 4 REGISTER FILE OPEN-COLLECTOR

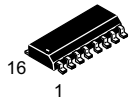
LOW POWER SCHOTTKY



J SUFFIX
CERAMIC
CASE 620-09



N SUFFIX
PLASTIC
CASE 648-08

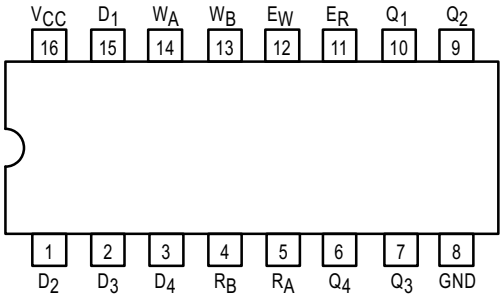


D SUFFIX
SOIC
CASE 751B-03

ORDERING INFORMATION

SN54LSXXXJ	Ceramic
SN74LSXXXN	Plastic
SN74LSXXXD	SOIC

CONNECTION DIAGRAM DIP (TOP VIEW)



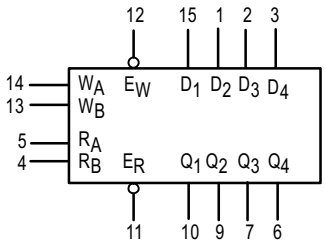
NOTE:
The Flatpak version has the same pinouts (Connection Diagram) as the Dual In-Line Package.

PIN NAMES

		LOADING (Note a) HIGH	LOW
$D_1 - D_4$	Data Inputs	0.5 U.L.	0.25 U.L.
$\overline{W}_A$, W_B	Write Address Inputs	0.5 U.L.	0.25 U.L.
E_W	Write Enable (Active LOW) Input	1.0 U.L.	0.5 U.L.
$\overline{R}_A$, R_B	Read Address Inputs	0.5 U.L.	0.25 U.L.
E_R	Read Enable (Active LOW) Input	1.0 U.L.	0.5 U.L.
$Q_1 - Q_4$	Outputs (Note b)	Open-Collector	5 (2.5) U.L.

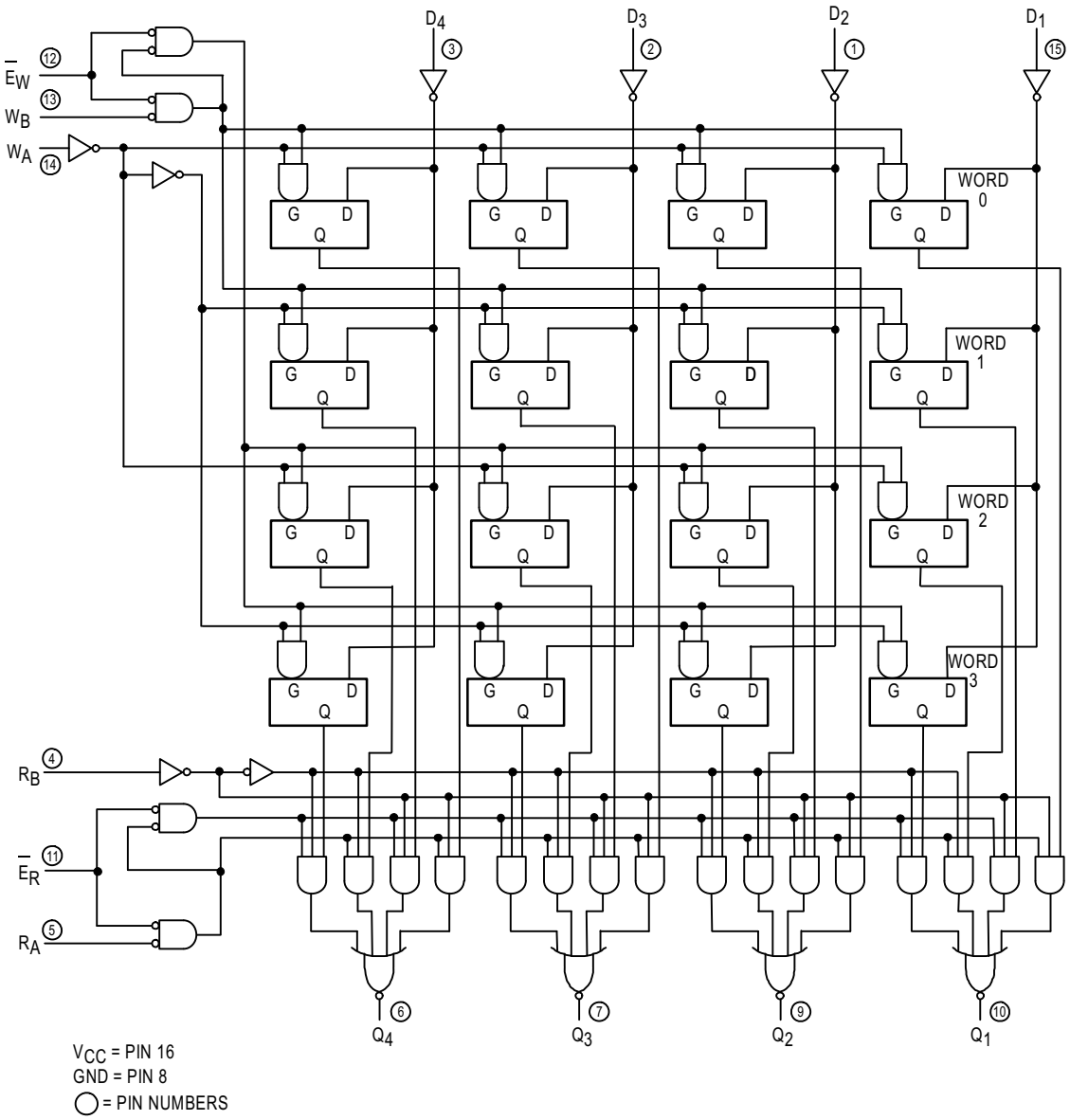
NOTES:
a. 1 TTL Unit Load (U.L.) = 40 μA HIGH/1.6 mA LOW.
b. The Output LOW drive factor is 2.5 U.L. for Military (54) and 5 U.L. for Commercial (74) Temperature Ranges. The Output HIGH drive must be supplied by an external resistor to V_{CC}.

LOGIC SYMBOL



V_{CC} = PIN 16
GND = PIN 8

LOGIC DIAGRAM



WRITE FUNCTION TABLE (SEE NOTES A, B, AND C)

WRITE INPUTS			WORD			
W_B	W_A	$\overline{E}_W$	0	1	2	3
L	L	L	Q = D	Q_0	Q_0	Q_0
L	H	L	Q_0	Q = D	Q_0	Q_0
H	L	L	Q_0	Q_0	Q = D	Q_0
H	H	L	Q_0	Q_0	Q_0	Q = D
X	X	H	Q_0	Q_0	Q_0	Q_0

READ FUNCTION TABLE (SEE NOTES A AND D)

READ INPUTS			OUTPUTS			
R_B	R_A	$\overline{E}_R$	Q_1	Q_2	Q_3	Q_4
L	L	L	W0B1	W0B2	W0B3	W0B4
L	H	L	W1B1	W1B2	W1B3	W1B4
H	L	L	W2B1	W2B2	W2B3	W2B4
H	H	L	W3B1	W3B2	W3B3	W3B4
X	X	H	H	H	H	H

NOTES: A. H = HIGH Level. L = LOW Level, X = Irrelevant.
B. (Q = D) = The four selected internal flip-flop outputs will assume the states applied to the four external data inputs.
C. Q_0 = the level of Q before the indicated input conditions were established.
D. W_{0B1} = The first bit of word 0, etc.

GUARANTEED OPERATING RANGES

Symbol	Parameter		Min	Typ	Max	Unit
V_{CC}	Supply Voltage	54 74	4.5 4.75	5.0 5.0	5.5 5.25	V
T_A	Operating Ambient Temperature Range	54 74	−55 0	25 25	125 70	°C
V_{OH}	Output Voltage — High	54, 74			5.5	V
I_{OL}	Output Current — Low	54 74			4.0 8.0	mA

DC CHARACTERISTICS OVER OPERATING TEMPERATURE RANGE (unless otherwise specified)

Symbol	Parameter		Limits Min	Limits Typ	Limits Max	Unit	Test Conditions	
V_{IH}	Input HIGH Voltage		2.0			V	Guaranteed Input HIGH Voltage for All Inputs	
V_{IL}	Input LOW Voltage	54			0.7	V	Guaranteed Input LOW Voltage for All Inputs	
		74			0.8			
V_{IK}	Input Clamp Diode Voltage			−0.65	−1.5	V	V_{CC} = MIN, I_{IN} = −18 mA	
I_{OH}	Output HIGH Current	54, 74			100	μA	V_{CC} = MIN, V_{OH} = MAX	
V_{OL}	Output LOW Voltage	54, 74		0.25	0.4	V	I_{OL} = 4.0 mA	V_{CC} = V_{CC} MIN, V_{IN} = V_{IL} or V_{IH} per Truth Table
		74		0.35	0.5	V	I_{OL} = 8.0 mA	
I_{IH}	Input HIGH Current Any D, R, W E_R, E_W				20 40	μA	V_{CC} = MAX, V_{IN} = 2.4 V	
	Any D, R, W E_R, E_W				0.1 0.2	mA	V_{CC} = MAX, V_{IN} = 7.0 V	
I_{IL}	Input LOW Current Any D, R, W E_R, E_W				−0.4 −0.8	mA	V_{CC} = MAX, V_{IN} = 0.4 V	
I_{CC}	Power Supply Current				40	mA	V_{CC} = MAX	

AC CHARACTERISTICS (T_A = 25°C)

Symbol	Parameter	Limits			Unit	Test Conditions	
		Min	Typ	Max			
t_{PLH} t_{PHL}	Propagation Delay, Negative-Going $\overline{E}_R$ to Q Outputs		20 20	30 30	ns	Figure 1	V_{CC} = 5.0 V C_L = 15 pF R_L = 2.0 kΩ
t_{PLH} t_{PHL}	Propagation Delay, R_A or R_B to Q Outputs		25 24	40 40	ns	Figure 2	
t_{PLH} t_{PHL}	Propagation Delay, Negative-Going $\overline{E}_W$ to Q Outputs		30 26	45 40	ns	Figure 1	
t_{PLH} t_{PHL}	Propagation Delay, Data Inputs to Q Outputs		30 22	45 35	ns	Figure 1	

AC SETUP REQUIREMENTS (T_A = 25°C)

Symbol	Parameter	Limits			Unit	Test Conditions
		Min	Typ	Max		
t_W	Pulse Width, $\overline{E}_R$, $\overline{E}_W$	25			ns	V_{CC} = 5.0 V R_L = 2.0 kΩ
t_s	Setup Time, Data to $\overline{E}_W$	10			ns	
t_s	Setup Time, W_A, W_B to $\overline{E}_W$	15			ns	
t_h	Hold Time, Data to $\overline{E}_W$	15			ns	
t_h	Hold Time, W_A, W_B to $\overline{E}_W$	5.0			ns	
t_{LATCH}	Latch Time	25			ns	

VOLTAGE WAVEFORMS

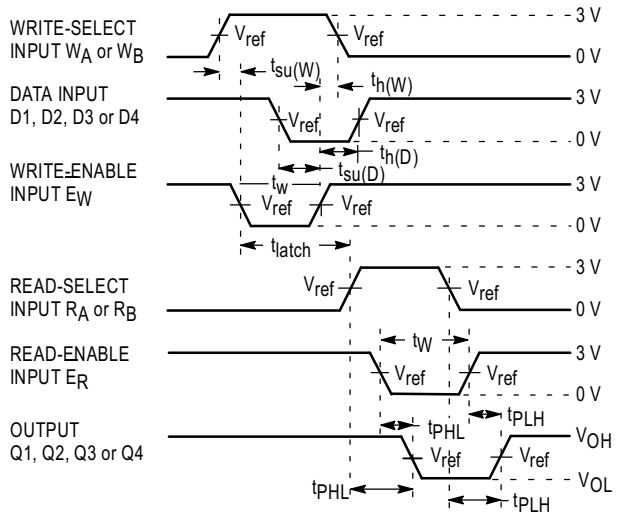


Figure 1

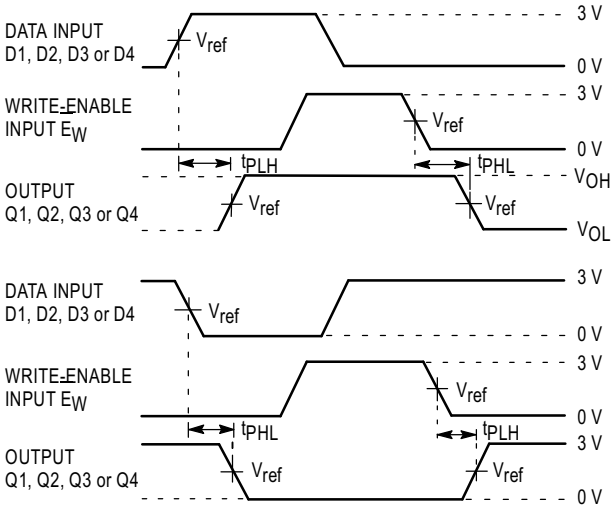


Figure 2