National Semiconductor

54LS170/DM74LS170
4 x 4 Register File with Open-Collector Outputs

General Description

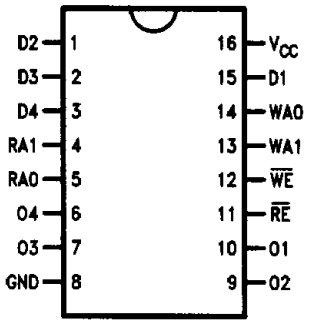
The 'LS170 contains 16 high speed, low power, transparent D-type latches arranged as four words of four bits each, to function as a 4 × 4 register file. Separate read and write inputs, both address and enable, allow simultaneous read and write operation. Open-collector outputs make it possible to connect 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 '670 provides a similar function to this device but it features TRI-STATE® outputs.

Features

- Simultaneous read/write operation
- Expandable to 512 words of n-bits
- Typical access time of 20 ns
- Low leakage open-collector outputs for expansion

Connection Diagram

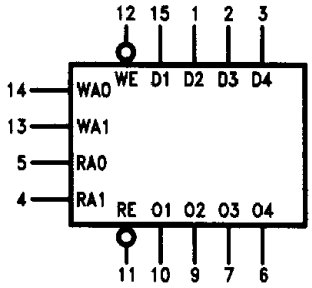
Dual-In-Line Package



TL/F/9820–1

Order Number 54LS170DMQB, 54LS170FMQB, DM74LS170WM or DM74LS170N
See NS Package Number J16A, M16B, N16E or W16A

Logic Symbol



TL/F/9820–2

V_{CC} = Pin 16
GND = Pin 8

Pin Names	Description
D1–D4	Data Inputs
WA0–WA1	Write Address Inputs
$\overline{WE}$	Write Enable Input (Active LOW)
RA0, RA1	Read Address Inputs
$\overline{RE}$	Read Enable Input (Active LOW)
O1–O4	Data Outputs

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	7V
Input Voltage	10V
Operating Free Air Temperature Range	
54LS	−55°C to +125°C
DM74	0°C to +70°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	54LS170			DM74LS170			Units
		Min	Nom	Max	Min	Nom	Max	
V_{CC}	Supply Voltage	4.5	5	5.5	4.75	5	5.25	V
V_{IH}	High Level Input Voltage	2			2			V
V_{IL}	Low Level Input Voltage			0.7			0.8	V
I_{OH}	High Level Output Current			20			20	μA
I_{OL}	Low Level Output Current			4			8	mA
T_A	Free Air Operating Temperature	−55		125	0		70	°C
t_s	Setup Time HIGH or LOW Dn to Rising $\overline{WE}$	10			10			ns
t_h	Hold Time HIGH or LOW Dn to Rising $\overline{WE}$	5.0			5.0			ns
t_s	Setup Time HIGH or LOW WAn to Falling $\overline{WE}$	10			10			ns
t_h	Hold Time HIGH or LOW WAn to Rising $\overline{WE}$	5.0			5.0			ns
$t_w(L)$	$\overline{WE}$ or $\overline{RE}$ Pulse Width LOW	25			25			ns

Electrical Characteristics

Over recommended operating free air temperature range (unless otherwise noted)

Symbol	Parameter	Conditions		Min	Typ (Note 1)	Max	Units
V_I	Input Clamp Voltage	V_{CC} = Min, I_I = −18 mA				−1.5	V
V_{OH}	High Level Output Voltage	V_{CC} = Min, I_{OH} = Max, V_{IL} = Max	54LS	2.0			V
			DM74	2.7	3.4		
V_{OL}	Low Level Output Voltage	V_{CC} = Min, I_{OL} = Max, V_{IH} = Min	54LS			0.4	V
			DM74		0.35	0.5	
		I_{OL} = 4 mA, V_{CC} = Min	DM74		0.25	0.4	
I_I	Input Current @ Max Input Voltage	V_{CC} = Max, V_I = 10V	Dns, RA0, WA0			0.1	mA
			$\overline{WE}$, $\overline{RE}$			0.2	
I_{IH}	High Level Input Current	V_{CC} = Max, V_I = 2.7V	Inputs			20	μA
			$\overline{RE}$, $\overline{WE}$			40	
I_{IL}	Low Level Input Current	V_{CC} = Max, V_I = 0.4V	$\overline{RE}$, $\overline{WE}$	−0.06		−0.8	mA
			RA1, WA1	−0.05		−0.4	
			DATA, RA0, WA0	−0.03		−0.4	
I_{OS}	Short Circuit Output Current	V_{CC} = Max (Note 2)	54LS	−20		−100	mA
			DM74	−20		−100	
I_{CC}	Supply Current	V_{CC} = Max, Dn, $\overline{WE}$, $\overline{RE}$ = 4.5V, WAn, RAn = GND				40	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, and the duration should not exceed one second.

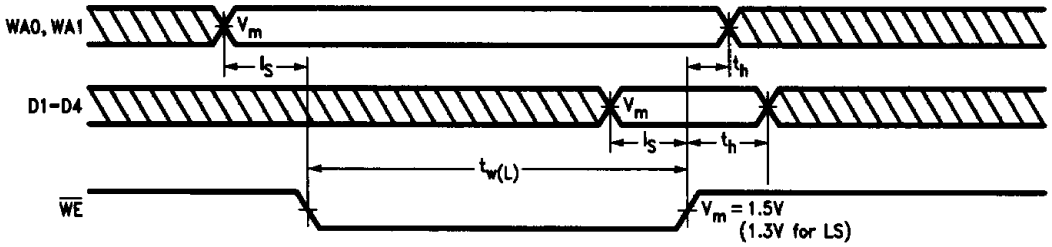
Switching Characteristics

V_{CC} = +5.0V, T_A = +25°C, (See Section 1 for waveforms and load configurations)

Symbol	Parameter	Conditions	R_L = 2k, C_L = 15 pF		Units
			Min	Max	
t_{PLH} t_{PHL}	Propagation Delay* RA0 or RA1 to On			35 35	ns
t_{PLH} t_{PHL}	Propagation Delay $\overline{RE}$ to On			30 30	ns
t_{PLH} t_{PHL}	Propagation Delay $\overline{WE}$ to On			35 35	ns
t_{PLH} t_{PHL}	Propagation Delay Dn to On			35 35	ns

*Measured at least 25 ns after entry of new data at selected location.

Switching Waveforms



TL/F/9820–4

FIGURE a

Write Function Table

Write Inputs			D Inputs to
$\overline{WE}$	WA1	WA0	
L	L	L	Word 0
L	L	H	Word 1
L	H	L	Word 2
L	H	H	Word 3
H	X	X	None (Hold)

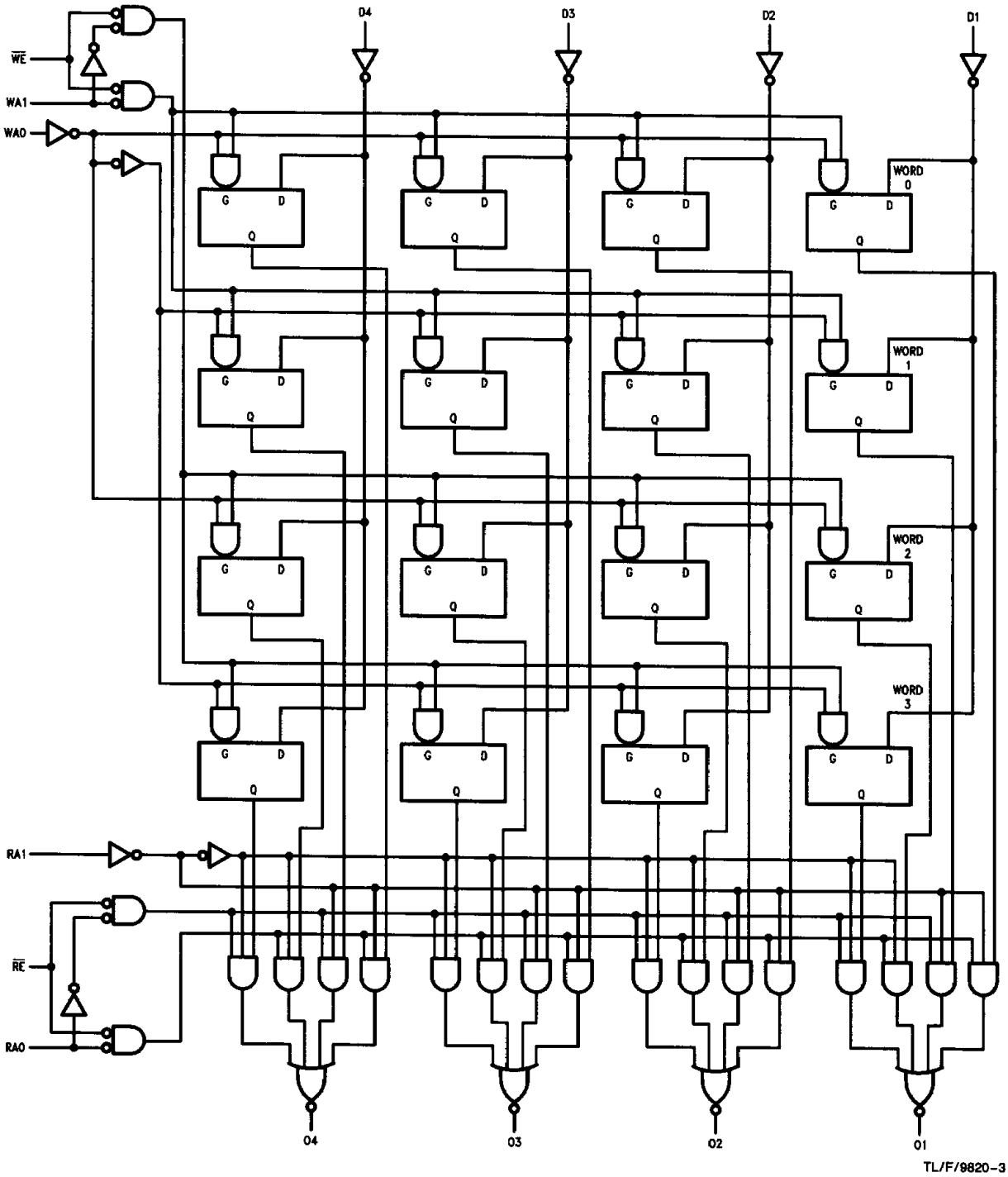
H = HIGH Voltage Level L = LOW Voltage Level

Read Function Table

Read Inputs			Outputs from
$\overline{RE}$	RA1	RA0	
L	L	L	Word 0
L	L	H	Word 1
L	H	L	Word 2
L	H	H	Word 3
H	X	X	None (High Z)

X = Immaterial

Logic Diagram



TL/F/9820–3