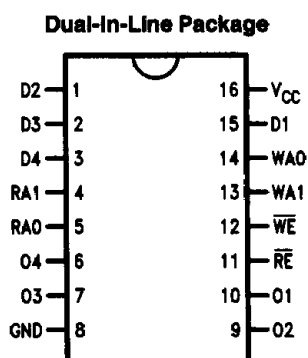# National Semiconductor

54170/DM74170
4 x 4 Register File
with Open-Collector Outputs
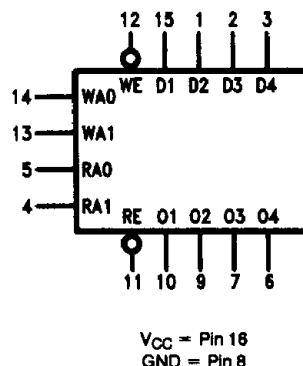
General Description

The '170 contains 16 high speed, low power, transparent D-type latches arranged as four words of four bits each, to function as a 4 x 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.

Connection Diagram

Dual-In-Line Package

D2	1	16	V_{CC}
D3	2	15	D1
D4	3	14	WA0
RA1	4	13	WA1
RA0	5	12	$\overline{WE}$
O4	6	11	$\overline{RE}$
O3	7	10	O1
GND	8	9	O2

TL/F/9783-1

Order Number 54170DMQB, 54170FMQB or DM74170N
See NS Package Number J16A, N16E and W16A

Logic Symbol

TL/F/9783-2

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

4

Absolute Maximum Ratings

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

Supply Voltage   7V

Input Voltage   5.5V

Operating Free Air Temperature Range
   54   −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	54170			DM74170			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			0.8			0.8	V
V_{OH}	High Level Output Voltage			5.5				V
I_{OL}	Low Level Output Current			16			16	mA
T_A	Free Air Operating Temperature	−55		125	0		70	°C
t_s	Setup Time HIGH or LOW D_n to Rising $\overline{WE}$	10			10			ns
t_h	Hold Time HIGH or LOW D_n to Rising $\overline{WE}$	15			15			ns
t_s	Setup Time HIGH or LOW WA_n to Falling $\overline{WE}$	15			15			ns
t_h	Hold Time HIGH or LOW WA_n 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 = −12 mA				−1.5	V
I_{OH}	High Level Output Current	V_{CC} = Min, V_{OH} = Max V_{IL} = Max				30	μA
V_{OL}	Low Level Output Voltage	V_{CC} = Min, I_{OL} = Max V_{IH} = Min			0.2	0.4	V
I_I	Input Current @ Max Input Voltage	V_{CC} = Max, V_I = 5.5V				1	mA
I_{IH}	High Level Input Current	V_{CC} = Max, V_I = 2.4V				40	μA
I_{IL}	Low Level Input Current	V_{CC} = Max, V_I = 0.4V				−1.6	mA
I_{CC}	Supply Current	V_{CC} = Max, RA_n = 0V D_n, $\overline{WE}$, $\overline{RE}$ = 4.5V	54			140	mA
			DM74			150	

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

Switching Characteristics

$V_{CC} = +5.0V$, $T_A = +25°C$ (See Section 2 for waveforms and load configurations)

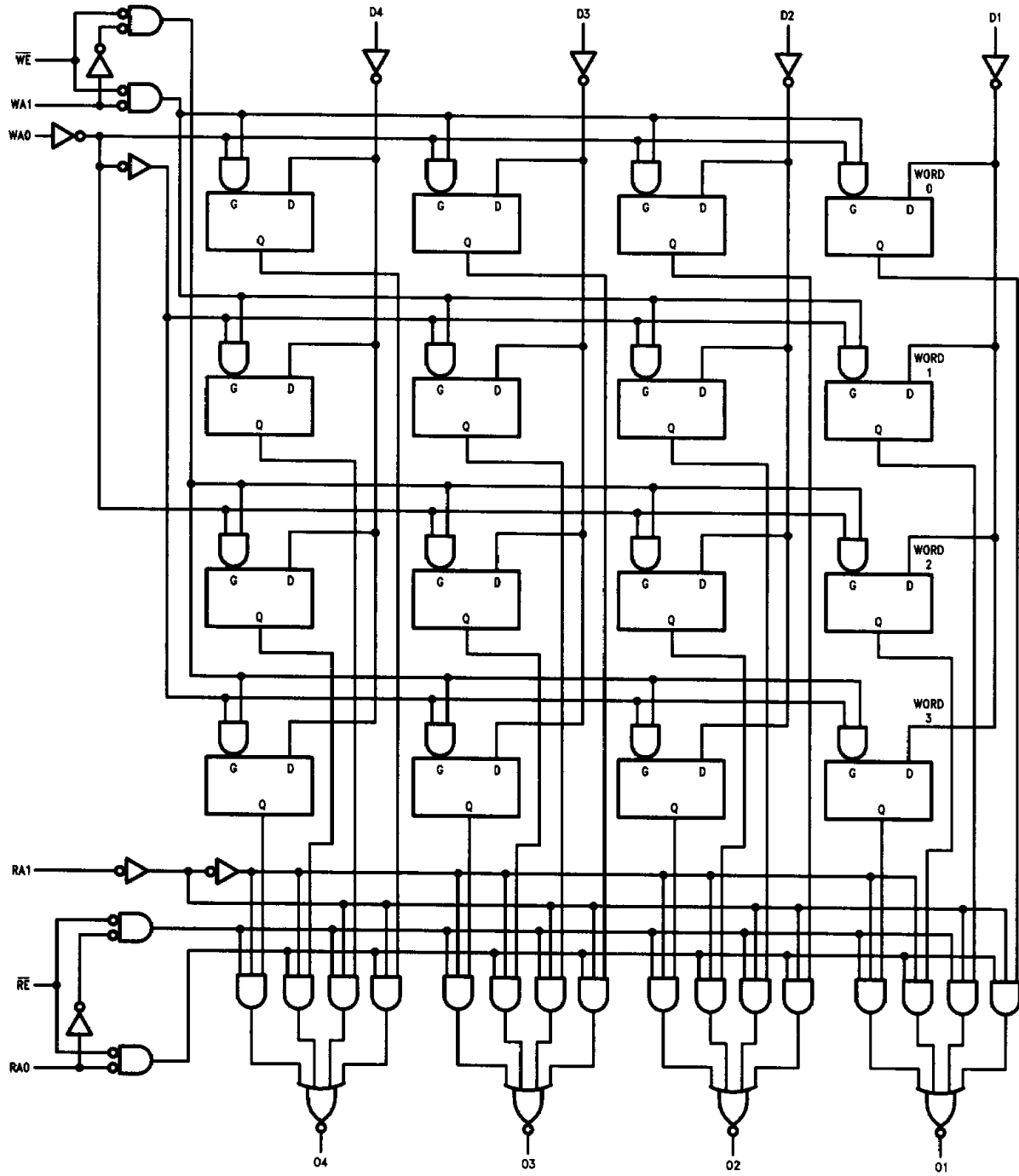| Symbol	Parameter	54/DM74		Units
		$C_L = 15\ pF$ $R_L = 400\Omega$		
		Min	Max	
t_{PLH} t_{PHL}	Propagation Delay* RA_0 or RA_1 to O_n		35 40	ns
t_{PLH} t_{PHL}	Propagation Delay $\overline{RE}$ to O_n		15 30	ns
t_{PLH} t_{PHL}	Propagation Delay $\overline{WE}$ to O_n		40 45	ns
t_{PLH} t_{PHL}	Propagation Delay D_n to O_n		30 45	ns

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

Timing Waveforms
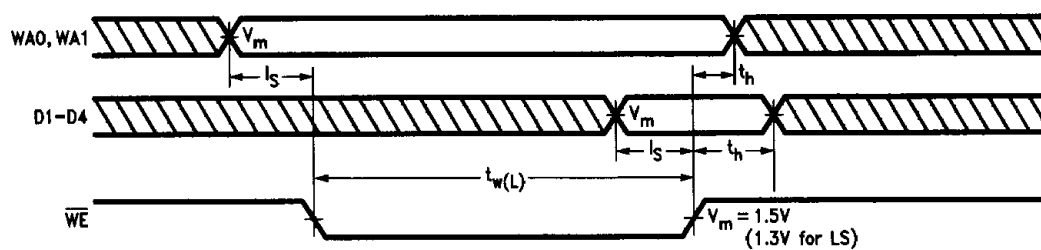
TL/F/9783-4

4

Logic Diagram

TL/F/9783–3

Write Function Table			

<table>
<tr><th colspan="3">Write Inputs</th><th rowspan="2">D Inputs To</th></tr>
<tr><th>$\overline{WE}$</th><th>WA$_1$</th><th>WA$_0$</th></tr>
<tr><td>L</td><td>L</td><td>L</td><td>Word 0</td></tr>
<tr><td>L</td><td>L</td><td>H</td><td>Word 1</td></tr>
<tr><td>L</td><td>H</td><td>L</td><td>Word 2</td></tr>
<tr><td>L</td><td>H</td><td>H</td><td>Word 3</td></tr>
<tr><td>H</td><td>X</td><td>X</td><td>None (Hold)</td></tr>
</table>

Read Function Table

<table>
<tr><th colspan="3">Read Inputs</th><th rowspan="2">Outputs From</th></tr>
<tr><th>$\overline{RE}$</th><th>RA$_1$</th><th>RA$_0$</th></tr>
<tr><td>L</td><td>L</td><td>L</td><td>Word 0</td></tr>
<tr><td>L</td><td>L</td><td>H</td><td>Word 1</td></tr>
<tr><td>L</td><td>H</td><td>L</td><td>Word 2</td></tr>
<tr><td>L</td><td>H</td><td>H</td><td>Word 3</td></tr>
<tr><td>H</td><td>X</td><td>X</td><td>None (HIGH Z)</td></tr>
</table>

H = HIGH Voltage Level   L = LOW Voltage Level   X = Immaterial

National Semiconductor was acquired by Texas Instruments.

This file is the datasheet for the following electronic components:

54170DMQB - http://www.ti.com/product/54170dmqb?HQS=TI-null-null-dscatalog-df-pf-null-wwe

54170FMQB - http://www.ti.com/product/54170fmqb?HQS=TI-null-null-dscatalog-df-pf-null-wwe

DM74170N - http://www.ti.com/product/dm74170n?HQS=TI-null-null-dscatalog-df-pf-null-wwe