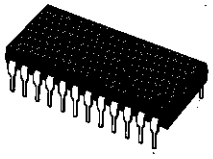
SGS-THOMSON MICROELECTRONICS

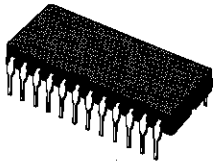
HCC/HCF40208B

4 x 4 MULTIPORT REGISTER

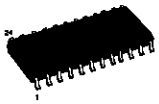
- FOUR 4-BIT REGISTERS
- ONE INPUT AND TWO OUTPUT BUSES
- UNLIMITED EXPANSION IN BIT AND WORD DIRECTIONS
- DATA LINES HAVE LATCHED INPUTS
- 3-STATE OUTPUTS
- SEPARATE CONTROL OF EACH BUS, ALLOWING SIMULTANEOUS INDEPENDENT READING OF ANY OF FOUR REGISTERS ON BUS A AND BUS B AND INDEPENDENT WRITING INTO ANY OF THE FOUR REGISTERS
- 40108B IS PIN-COMPATIBLE WITH INDUSTRY TYPE MC14580
- STANDARDIZED, SYMMETRICAL OUTPUT CHARACTERISTICS
- QUIESCENT CURRENT SPECIFIED AT 20V FOR HCC DEVICE
- 5V, 10V, AND 15V PARAMETRIC RATINGS
- INPUT CURRENT OF 100nA AT 18V AND 25°C FOR HCC DEVICE
- 100% TESTED FOR QUIESCENT CURRENT
- MEETS ALL REQUIREMENTS OF JEDEC TENTATIVE STANDARD N° 13A, "STANDARD SPECIFICATIONS FOR DESCRIPTION OF "B" SERIES CMOS DEVICES"



BEY
(Plastic Package)



BF
(Ceramic Frit Seal Package)



BM1
(Micro Package)

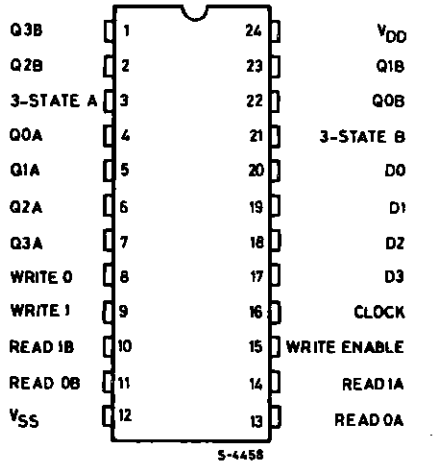
ORDER CODES :

HCC40208BF HCF40208BEY
HCF40208BM1

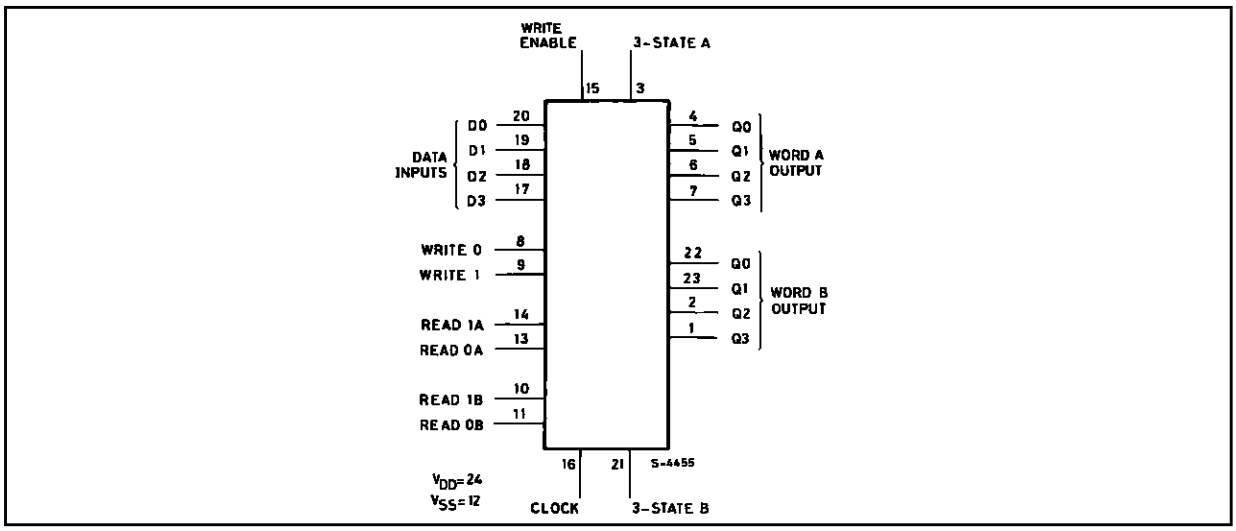
DESCRIPTION

The **HCC40208B** (extended temperature range) and **HCF40208B** (intermediate temperature range) are monolithic integrated circuits, available in 24-lead dual in-line plastic or ceramic package and plastic micro package. The **HCC/HCF40208B** is a 4 x 4 multiport register containing four 4-bit registers, write address decoder, two separate read address decoders, and two 3-state output buses. When the ENABLE input is low, the corresponding output bus is switched, independently of the clock to a high-impedance state. The high-impedance third state provides the outputs with the capability of being connected to the bus lines in a bus-organized system without the need for interface or pull-up components. When the WRITE ENABLE input is high, all data input lines are latched on the positive transition of the CLOCK and the data is entered into the word selected by the write address lines. When WRITE ENABLE is low, the CLOCK is inhibited and no new data is entered. In either case, the contents of any word may be accessed via the read address lines independent of the state of the CLOCK input.

PIN CONNECTIONS



FUNCTIONAL DIAGRAM



ABSOLUTE MAXIMUM RATINGS

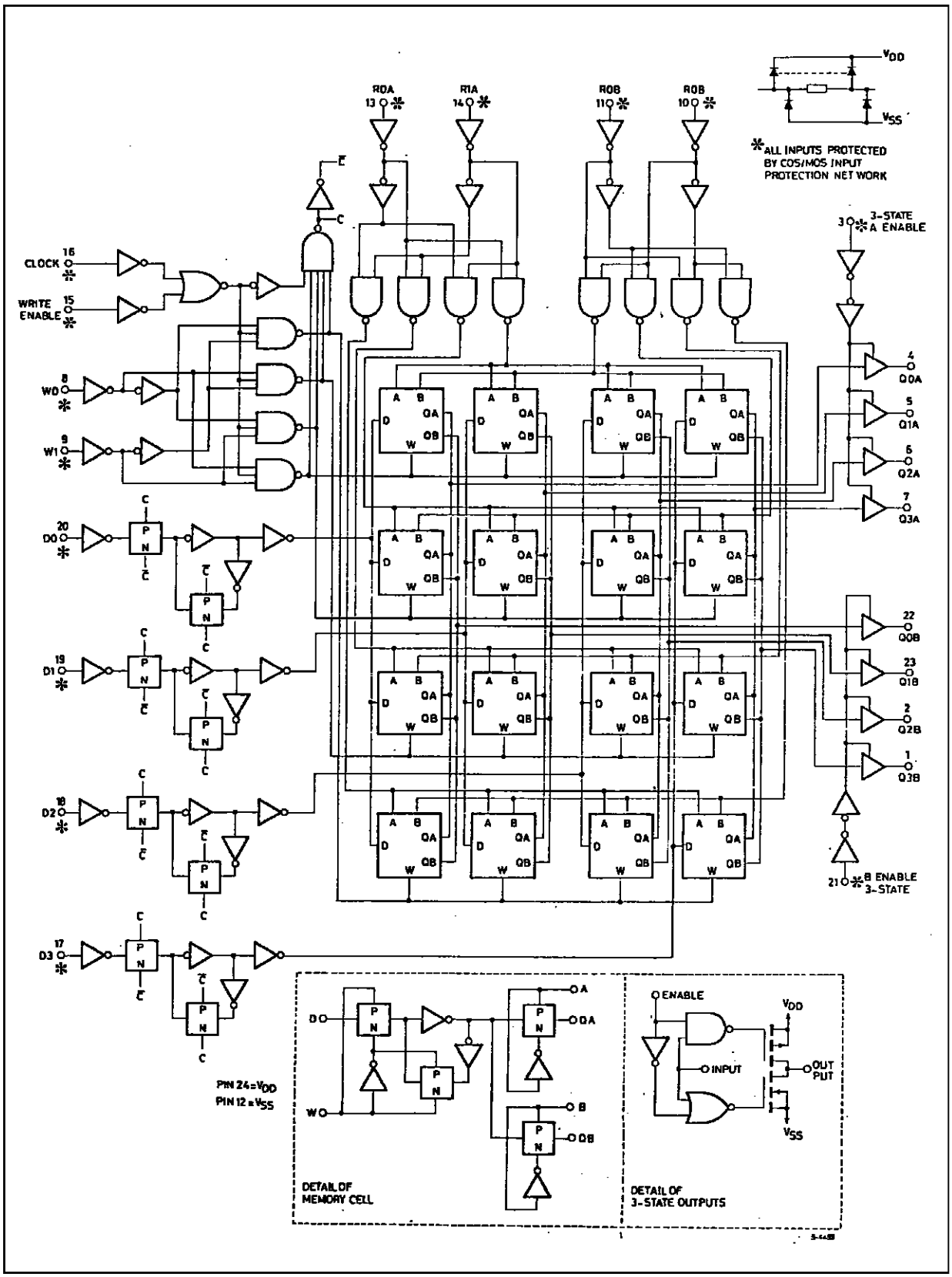
Symbol	Parameter	Value	Unit
V_{DD}*	Supply Voltage : **HCC** Types **HCF** Types	– 0.5 to + 20 – 0.5 to + 18	V V
V_i	Input Voltage	– 0.5 to V_{DD} + 0.5	V
I_I	DC Input Current (any one input)	± 10	mA
P_{tot}	Total Power Dissipation (per package) Dissipation per Output Transistor for T_{op} = Full Package-temperature Range	200 100	mW mW
T_{op}	Operating Temperature : **HCC** Types **HCF** Types	– 55 to + 125 – 40 to + 85	°C °C
T_{stg}	Storage Temperature	– 65 to + 150	°C

Stresses above those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for external periods may affect device reliability.
* All voltages are with respect to V_{SS} (GND).

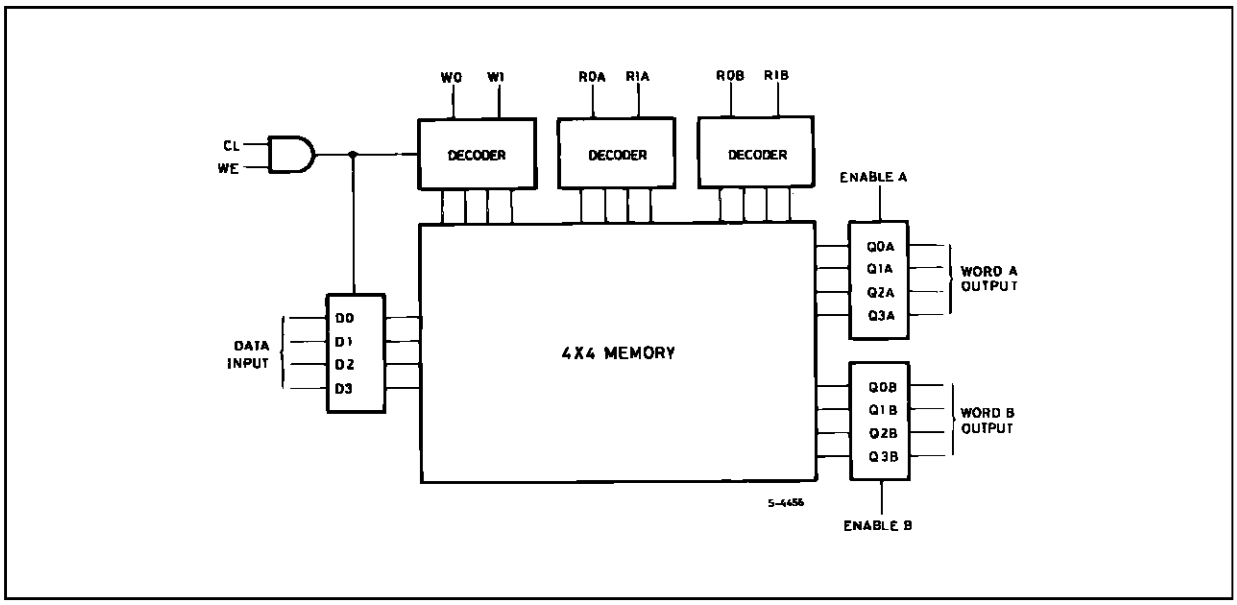
RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Value	Unit
V_{DD}	Supply Voltage : **HCC** Types **HCF** Types	3 to 18 3 to 15	V V
V_I	Input Voltage	0 to V_{DD}	V
T_{op}	Operating Temperature : **HCC** Types **HCF** Types	– 55 to + 125 – 40 to + 85	°C °C

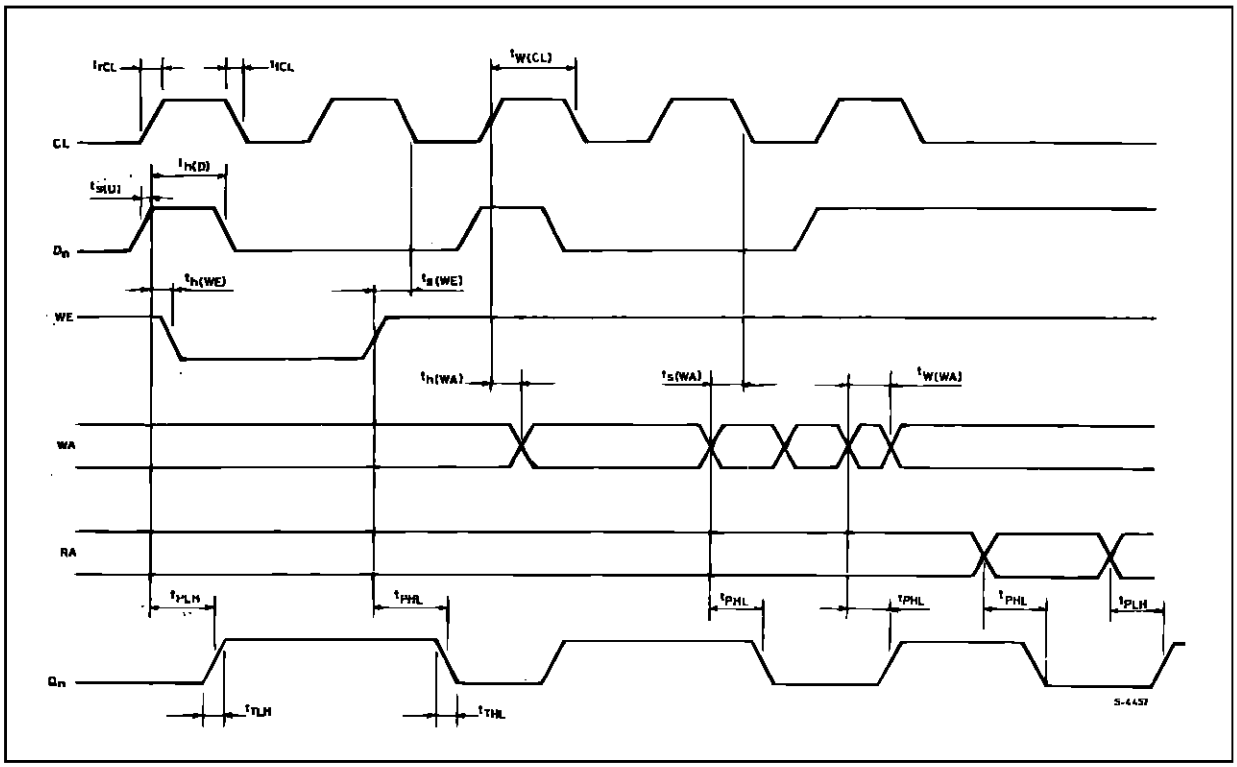
SCHEMATIC DIAGRAM



LOGIC DIAGRAM



TIMING DIAGRAM



TRUTH TABLE

Clock	Write Enable	Write 1	Write 0	Read 1A	Read 0A	Read 1B	Read 0B	Enable A	Enable B	D_n	Q_{nA}	Q_{nB}
_/‾	1	S1	S2	S1	S2	S1	S2	1	1	1	1	1
_/‾	1	S1	S2	S1	S2	S1	S2	1	1	0	0	0
X	X	X	X	X	X	X	X	0	0	X	Z	Z
_/‾	1	0	0	0	1	1	0	1	1	D_n to Word 0	Word 1 Out	Word 2 Out
_/‾	0	0	0	0	1	1	0	1	1	Word 0 Not Altered	Word 1 Out	Word 2 Out
X	X	X	X	1	0	0	1	1	1	X	Word 2 Out	Word 1 Out
‾_	X	X	X	X	X	X	X	1	1	X	NC	NC

1 = HIGH LEVEL, 0 = LOW LEVEL, X = DON'T CARE, Z = HIGH IMPEDANCE.
S1 and S2 refer to input strates of either 1 or 0.

STATIC ELECTRICAL CHARACTERISTICS (over recommended operating conditions)

Symbol	Parameter		Test Conditions V_I (V)	V_O (V)	$\|I_O\|$ (μA)	V_{DD} (V)	Value T_{Low}* Min.	T_{Low}* Max.	25°C Min.	25°C Typ.	25°C Max.	T_{High}* Min.	T_{High}* Max.	Unit
I_L	Quiescent Current	HCC Types	0/ 5			5		5		0.04	5		150	μA
			0/10			10		10		0.04	10		300	
			0/15			15		20		0.04	20		600	
			0/20			20		100		0.08	100		3000	
		HCF Types	0/ 5			5		20		0.04	20		150	
			0/10			10		40		0.04	40		300	
			0/15			15		80		0.04	80		600	
V_{OH}	Output High Voltage		0/ 5		< 1	5	4.95		4.95			4.95		V
			0/10		< 1	10	9.95		9.95			9.95		
			0/15		< 1	15	14.95		14.95			14.95		
V_{OL}	Output Low Voltage		5/0		< 1	5		0.05			0.05		0.05	V
			10/0		< 1	10		0.05			0.05		0.05	
			15/0		< 1	15		0.05			0.05		0.05	
V_{IH}	Input High Voltage			0.5/4.5	< 1	5	3.5		3.5			3.5		V
				1/9	< 1	10	7		7			7		
				1.5/13.5	< 1	15	11		11			11		
V_{IL}	Input Low Voltage			4.5/0.5	< 1	5		1.5			1.5		1.5	V
				9/1	< 1	10		3			3		3	
				13.5/1.5	< 1	15		4			4		4	
I_{OH}	Output Drive Current	HCC Types	0/ 5	2.5		5	– 2		– 1.6	– 3.2		– 1.15		mA
			0/ 5	4.6		5	– 0.64		– 0.51	– 1		– 0.36		
			0/10	9.5		10	– 1.6		– 1.3	– 2.6		– 0.9		
			0/15	13.5		15	– 4.2		– 3.4	– 6.8		– 2.4		
		HCF Types	0/ 5	2.5		5	– 1.53		– 1.36	– 3.2		– 1.1		
			0/ 5	4.6		5	– 0.52		– 0.44	– 1		– 0.36		
			0/10	9.5		10	– 1.3		– 1.1	– 2.6		– 0.9		
			0/15	13.5		15	– 3.6		– 3.0	– 6.8		– 2.4		

* T_{Low} = – 55°C for **HCC** device : – 40°C for **HCF** device.
* T_{High} = + 125°C for **HCC** device : + 85°C for **HCF** device.
The Noise Margin for both "1" and "0" level is : 1V min. with V_{DD} = 5V, 2V min. with V_{DD} = 10V, 2.5V min. with V_{DD} = 15V.
** Forced output disable.

STATIC ELECTRICAL CHARACTERISTICS (continued)

Symbol	Parameter		Test Conditions				Value							Unit
			V_I (V)	V_O (V)	$\|I_O\|$ (μA)	V_{DD} (V)	T_{Low}* Min.	T_{Low}* Max.	25°C Min.	25°C Typ.	25°C Max.	T_{High}* Min.	T_{High}* Max.	
I_{OL}	Output Sink Current	HCC Types	0/ 5	0.4		5	0.64		0.51	1		0.36		mA
			0/10	0.5		10	1.6		1.3	2.6		0.9		
			0/15	1.5		15	4.2		3.4	6.8		2.4		
		HCF Types	0/ 5	0.4		5	0.52		0.44	1		0.36		
			0/10	0.5		10	1.3		1.1	2.6		0.9		
			0/15	1.5		15	3.6		3.0	6.8		2.4		
I_{IH}, I_{IL}	Input Leakage Current	HCC Types	0/18	Any Input		18		± 0.1		$\pm 10^{-5}$	± 0.1		± 1	μA
		HCF Types	0/15			15		± 0.3		$\pm 10^{-5}$	± 0.3		± 1	
I_{OH},I_{OL}**	3-State Output Leakage Current	HCC Types	0/18	0/18		18		± 0.4		$\pm 10^{-4}$	± 0.4		± 12	μA
		HCF Types	0/15	0/15		15		± 1.0		$\pm 10^{-4}$	± 1.0		± 7.5	
C_I	Input Capacitance			Any Input						5	7.5			pF

* T_{Low} = – 55°C for **HCC** device : – 40°C for **HCF** device.
* T_{High} = + 125°C for **HCC** device : + 85°C for **HCF** device.
The Noise Margin for both "1" and "0" level is : 1V min. with V_{DD} = 5V, 2V min. with V_{DD} = 10V, 2.5V min. with V_{DD} = 15V.
** Forced output disable.

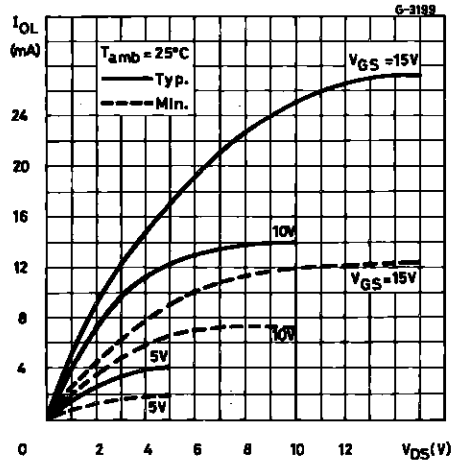
DYNAMIC ELECTRICAL CHARACTERISTICS (T_{amb} = 25°C, C_L = 50pF, R_L = 200kΩ, typical temperature coefficient for all V_{DD} values is 0.3%/°C, all input rise and fall time = 20ns)

Symbol	Parameter	Test Conditions	Value				Unit
			V_{DD} (V)	Min.	Typ.	Max.	
t_{PHL}, t_{PLH}	Propagation Delay Time : Clock to Write Enable to Q		5		360	720	ns
			10		140	280	
			15		100	200	
	Read or Write Address to Q		5		300	600	ns
			10		120	240	
			15		85	170	
t_{PZH}, t_{PHZ}	3-state Disable Delay Time		5		100	200	ns
			10		50	100	
			15		40	80	
t_{PZL}, t_{PLZ}	3-State Disable Delay time		5		130	260	ns
			10		60	120	
			15		50	100	
t_{THL}, t_{TLH}	Output Transition Time		5		100	200	ns
			10		50	100	
			15		40	80	
t_{setup}	Setup Time Data to Clock $t_{s\,(D)}$		5	0	– 95		ns
			10	0	– 35		
			15	0	– 20		
	Write Enable to $\overline{\text{Clock}}$ $t_{s(WE)}$		5	250	125		ns
			10	100	50		
			15	70	35		
	Write Address to $\overline{\text{Clock}}$ $t_{s\,(WA)}$		5	250	125		ns
			10	100	50		
			15	70	35		

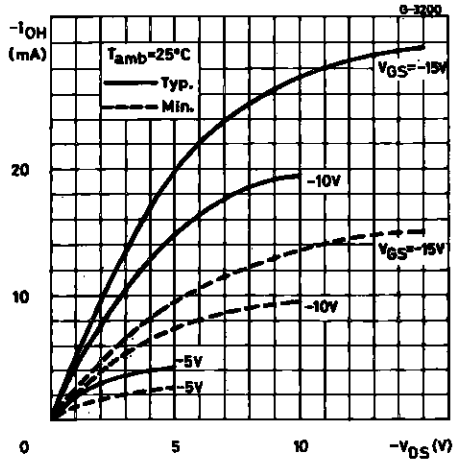
DYNAMIC ELECTRICAL CHARACTERISTICS (continued)

Symbol	Parameter	Test Conditions		Value			Unit
			V_{DD} (V)	Min.	Typ.	Max.	
t_r, t_f	Clock Rise and Fall Time		5			15	µs
			10			5	
			15			5	
t_{hold}	Hold Time Data to Clock $t_{h(D)}$		5	220	110		ns
			10	100	50		
			15	80	40		
	Write Enable to Clock $t_{h(WE)}$		5	270	135		ns
			10	130	65		
			15	80	40		
	Write Address to $\overline{\text{Clock}}$ $t_{s(WA)}$		5	330	165		
			10	140	70		
			15	90	45		
t_W	Clock Pulse Width Clock or Write Enable $t_{W(CL)}$		5	350	175		ns
			10	130	65		
			15	90	45		
	Write Address $t_{W(WA)}$		5	300	150		ns
			10	150	75		
			15	90	45		
f_{CL}	Maximum Clock Input Frequency		5	1.5	3		MHz
			10	3.5	7		
			15	4.5	9		

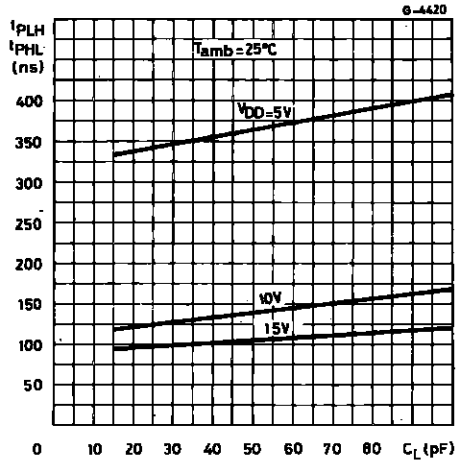
Output Low (sink) Current Characteristics.



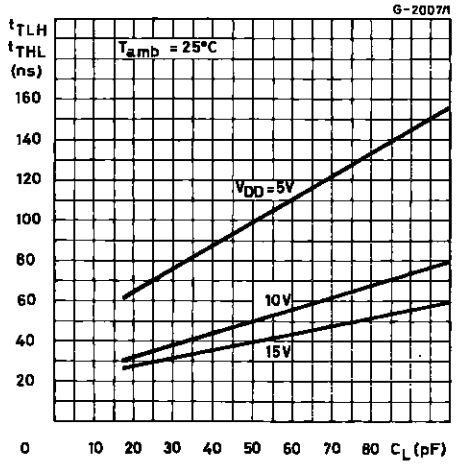
Output High (source) Current Characteristics.



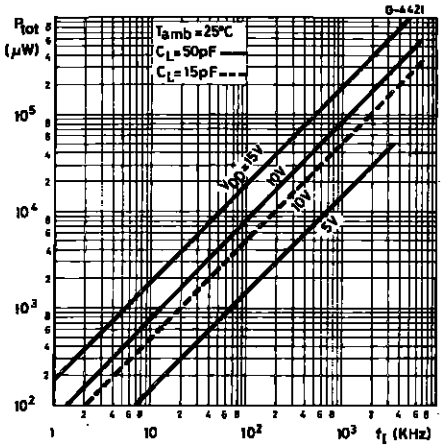
Typical Propagation Delay Time vs. Load Capacitance (CL or WE to Q).



Typical Transition Time vs. Load Capacitance.

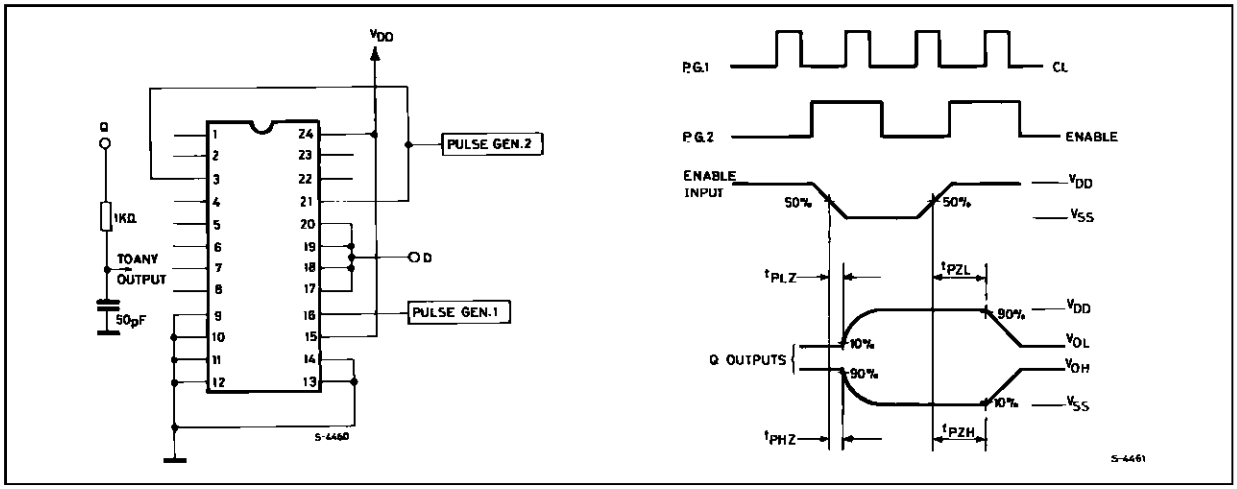


Typical Dynamic Power Dissipation vs. Input Frequency.

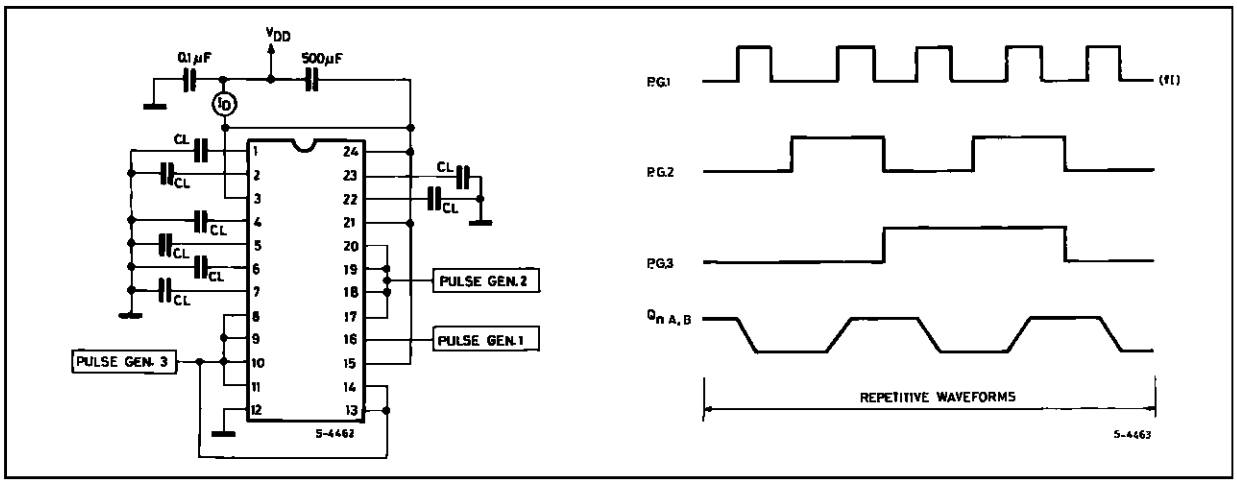


TEST CIRCUITS

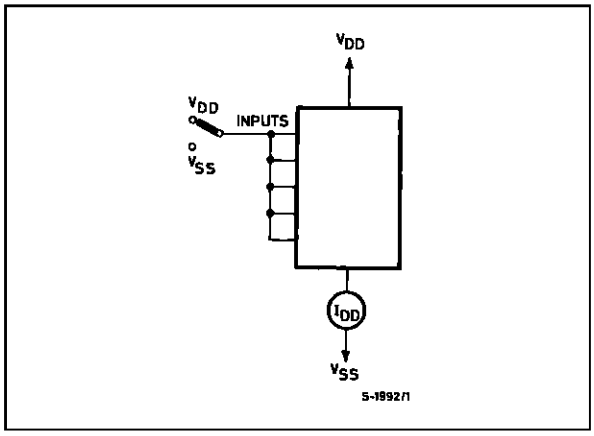
Output-enable-delay-times and Waveforms.



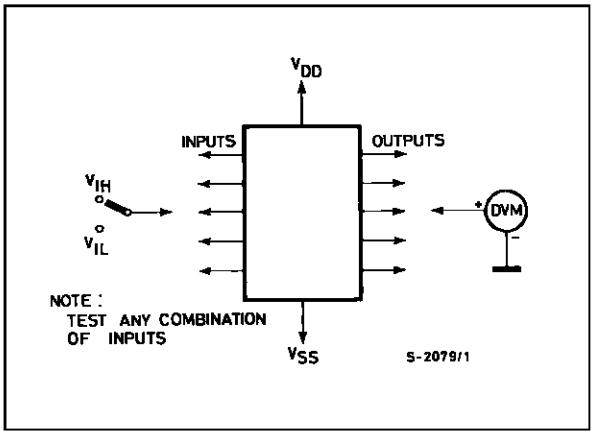
Power-dissipation and Waveforms.



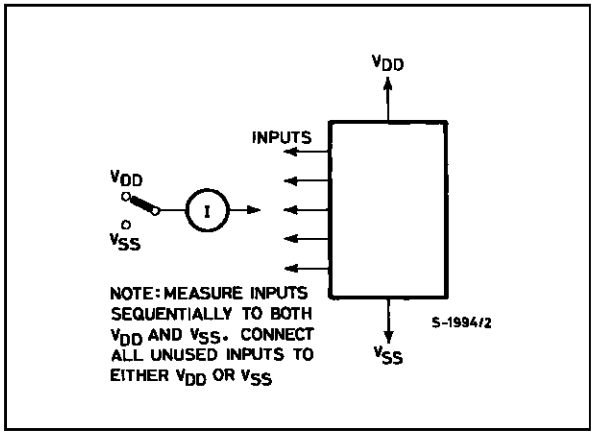
Quiescent Device Current.



Input Voltage.

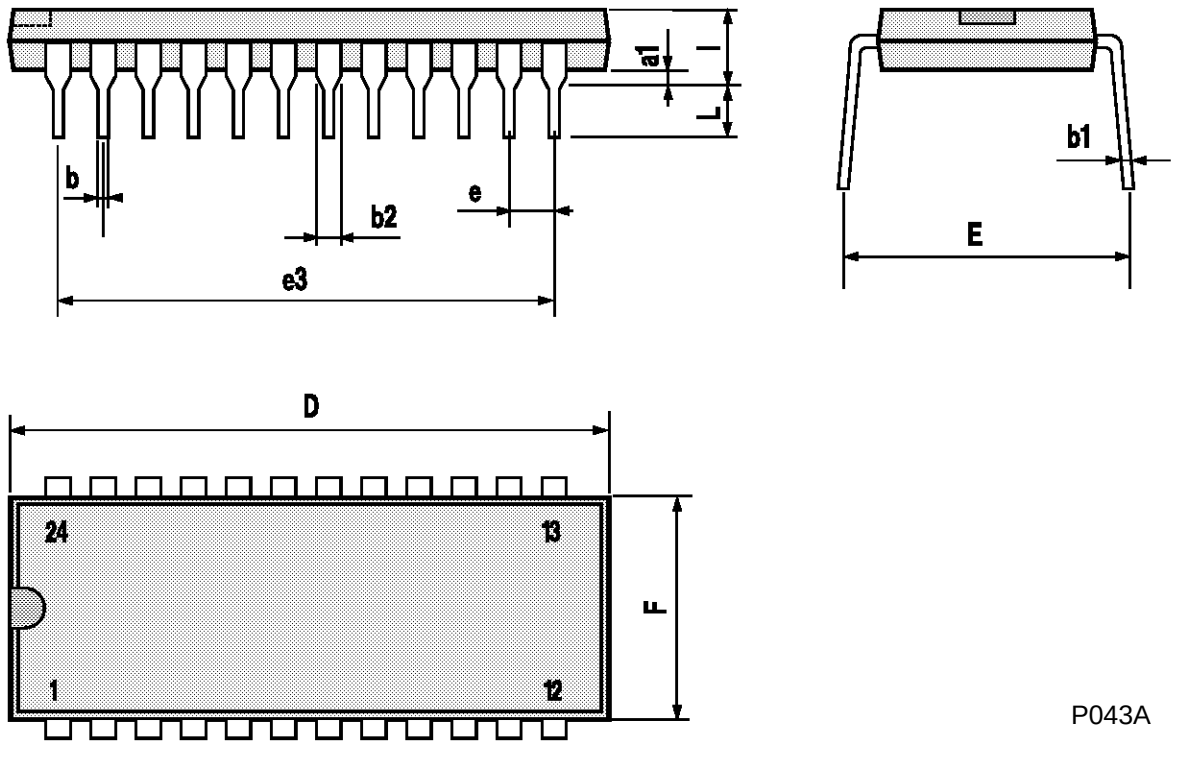


Input Current.



Plastic DIP24 (0.25) MECHANICAL DATA

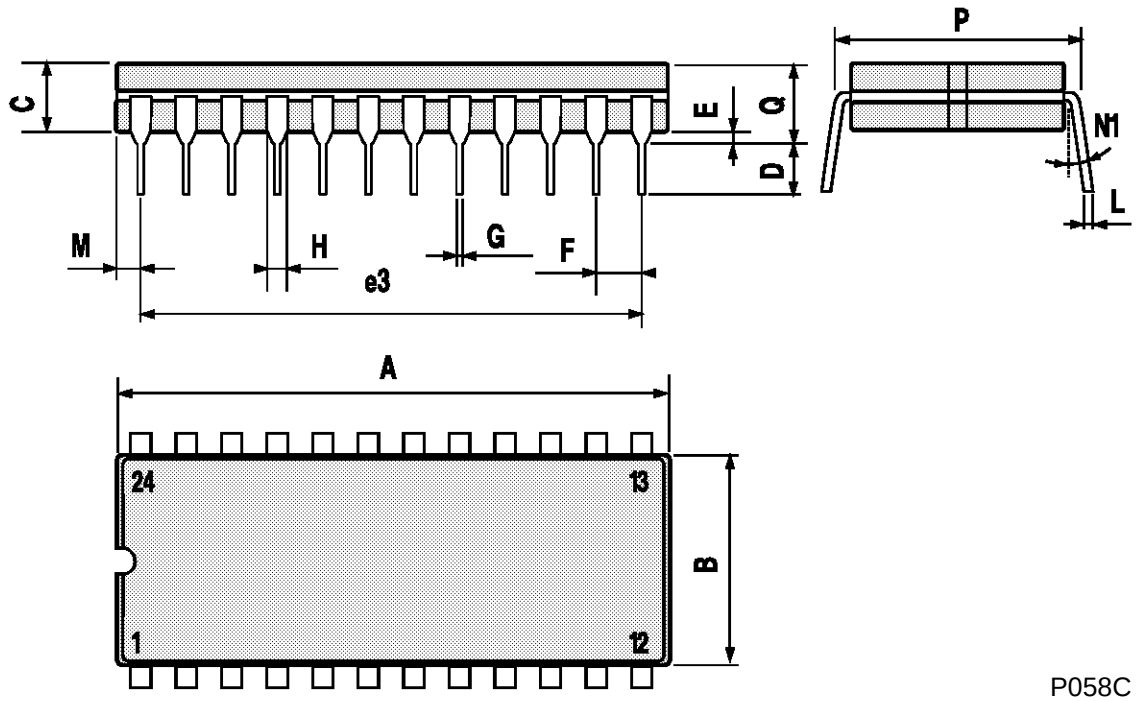
DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
a1		0.63			0.025	
b		0.45			0.018	
b1	0.23		0.31	0.009		0.012
b2		1.27			0.050	
D			32.2			1.268
E	15.2		16.68	0.598		0.657
e		2.54			0.100	
e3		27.94			1.100	
F			14.1			0.555
I		4.445			0.175	
L		3.3			0.130	



P043A

Ceramic DIP24 MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A			32.3			1.272
B	13.05		13.36	0.514		0.526
C	3.9		5.08	0.154		0.200
D	3			0.118		
E	0.5		1.78	0.020		0.070
e3		27.94			1.100	
F	2.29		2.79	0.090		0.110
G	0.4		0.55	0.016		0.022
I	1.17		1.52	0.046		0.060
L	0.22		0.31	0.009		0.012
M	1.52		2.49	0.060		0.098
N1	4° (min.), 15° (max.)					
P	15.4		15.8	0.606		0.622
Q			5.71			0.225



P058C

SO24 MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A			2.65			0.104
a1	0.10		0.20	0.004		0.007
a2			2.45			0.096
b	0.35		0.49	0.013		0.019
b1	0.23		0.32	0.009		0.012
C		0.50			0.020	
c1	45° (typ.)					
D	15.20		15.60	0.598		0.614
E	10.00		10.65	0.393		0.420
e		1.27			0.05	
e3		13.97			0.55	
F	7.40		7.60	0.291		0.299
L	0.50		1.27	0.19		0.050
S	8° (max.)