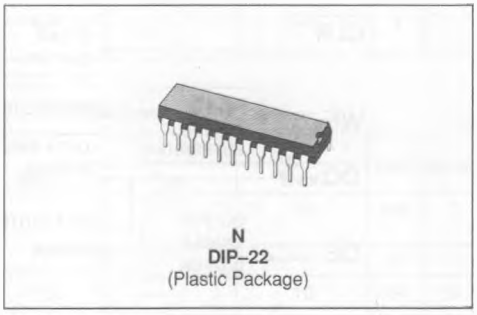
SGS-THOMSON MICROELECTRONICS

MK41H80(N) -20/22/25/35

4K x 4 CMOS TAGRAM™

- 4K x 4 SRAM WITH ONBOARD 4 BIT COMPARATOR
- 20, 22, 25, AND 35ns ADDRESS TO COMPARE ACCESS TIME
- EQUAL ACCESS, READ AND WRITE CYCLE TIMES
- FLASH CLEAR FUNCTION
- 22-PIN, 300 MIL PLASTIC



N
DIP–22
(Plastic Package)

Figure 1 : Pin Connections.

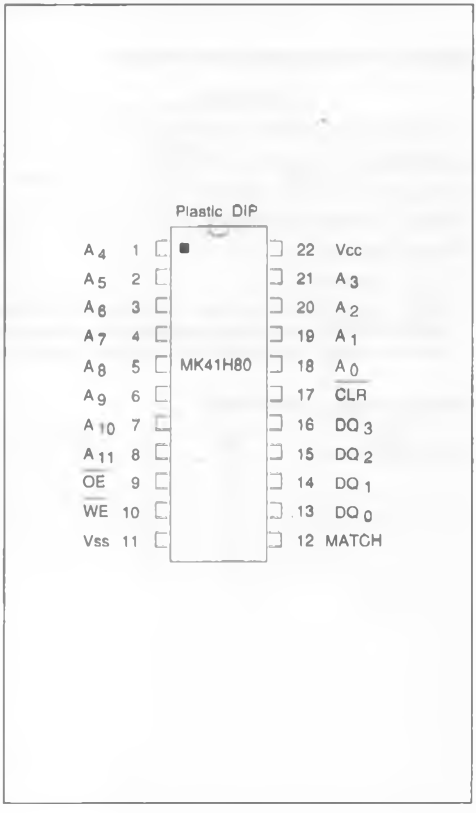
DESCRIPTION

The MK41H80 is a member of SGS-THOMSON Microelectronics 4K x 4 CMOS Static RAM family featuring fully static operation requiring no external clocks or timing strobes. Cycle Time and Compare Access Time are equal. The MK41H80 is powered by a single + 5V ± 10% power supply and the inputs and outputs are fully TTL compatible.

The MK41H80 features an onboard 4 bit comparator that compares RAM contents and current input data. The result is an active high match on the MATCH pin or an active low miss on the MATCH pin. The MATCH pins of several MK41H80's can be nanded together to provide enabling or acknowledging signals to the data cache or processor.

Tag data can be read from the data pins by bringing Output Enable ($\overline{OE}$) low. This will allow data stored in the memory array to be displayed at the Outputs (DQ_0-DQ_3).

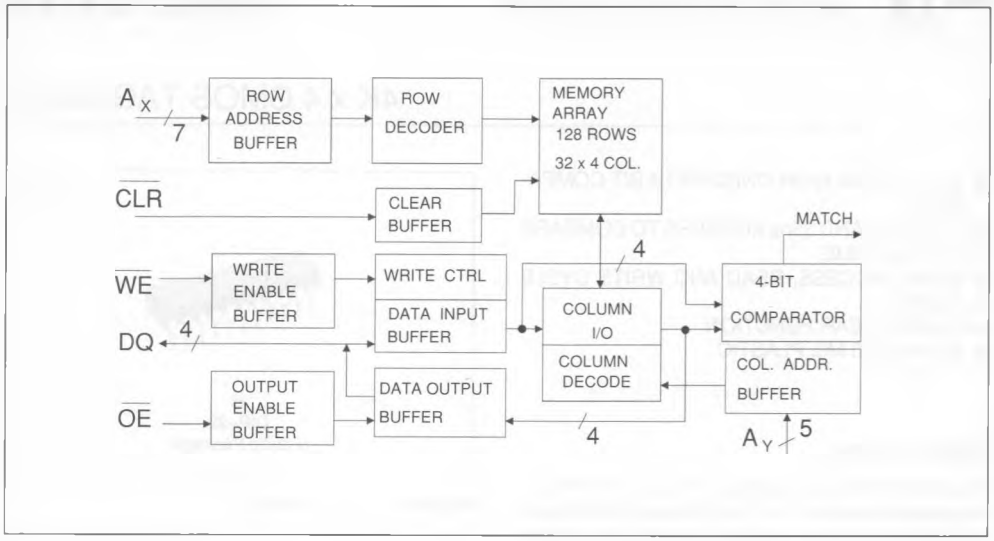
Flash Clear operation is provided on the MK41H80 via the ($\overline{CLR}$) pin. A low applied to the $\overline{CLR}$ pin clears all RAM bits to a logic zero.



PIN NAMES

A_0 - A_{11}	Address Inputs
DQ_0 - DQ_3	Data Input/output
MATCH	Comparator Output
$\overline{WE}$	Write Enable
$\overline{OE}$	Output Enable
$\overline{CLR}$	Flash Clear
V_{CC}	Power (+ 5V)
V_{SS}	Ground

Figure 2 : MK41H80 Block Diagram.



ABSOLUTE MAXIMUM RATINGS*

Parameter	Value	Unit
Voltage on any Terminal Relative to V_{SS}	- 1.0 to + 7.0	V
Operating Temperture T_A (ambient)	0 to + 70	°C
Storage Temperature (ceramic)	- 65 to + 150	°C
Storage Temperature (plastic)	- 55 to +125	°C
Power Dissipation	1	W
Output Currrent per Pin	50	mA

* Stresses greater than 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 operation sectionsof this specification is not implied. Exposure to absolute maximum rating conditions for extended periods of time

TRUTH TABLE (MK41H80)

$\overline{WE}$	$\overline{OE}$	$\overline{CLR}$	Match	Mode
H	H	H	Valid	Compare Cycle
L	X	H	Invalid	Write Cycle
H	L	H	Invalid	Read Cycle
X	X	L	Invalid	Flash Clear Cycle

X = Don't Care

RECOMMENDED DC OPERATING CONDITIONS ($0°C \le T_A \le 70°C$)

Symbol	Parameter	Value			Unit	Notes
		Min.	Typ.	Max.		
V_{CC}	Supply Voltage (referenced to V_{SS})	4.5	5.0	5.5	V	
V_{SS}	Ground	0.0	0.0	0.0	V	
V_{IH}	Input High (logic 1) Voltage, All Inputs (referenced to V_{SS})	2.2		V_{CC} + 0.3	V	
V_{IL}	Input Low (logic 0) Voltage, All Inputs (referenced to V_{SS})	- 0.3		0.8	V	

DC ELECTRICAL CHARACTERISTICS ($0°C \le T_A \le 70°C$) (V_{CC} = 5.0V ±10%)

Symbol	Parameter	Value			Unit	Notes
		Min.	Typ.	Max.		
I_{CC1}	Operating Current - Average Power Supply Operating Current			120	mA	1
I'_{IL}	Input Leakage Current, Any Input	- 1		1	µA	5
I_{OL}	Output Leakage Current	- 10		10	µA	6
V_{OH}	Output High (logic 1) Voltage Referenced to V_{SS} ; I_{OH} = - 4mA	2.4			V	
V_{OL}	Output Low (logic 0) Voltage Referenced to V_{SS} ; I_{OL} = + 8mA			0.4	V	

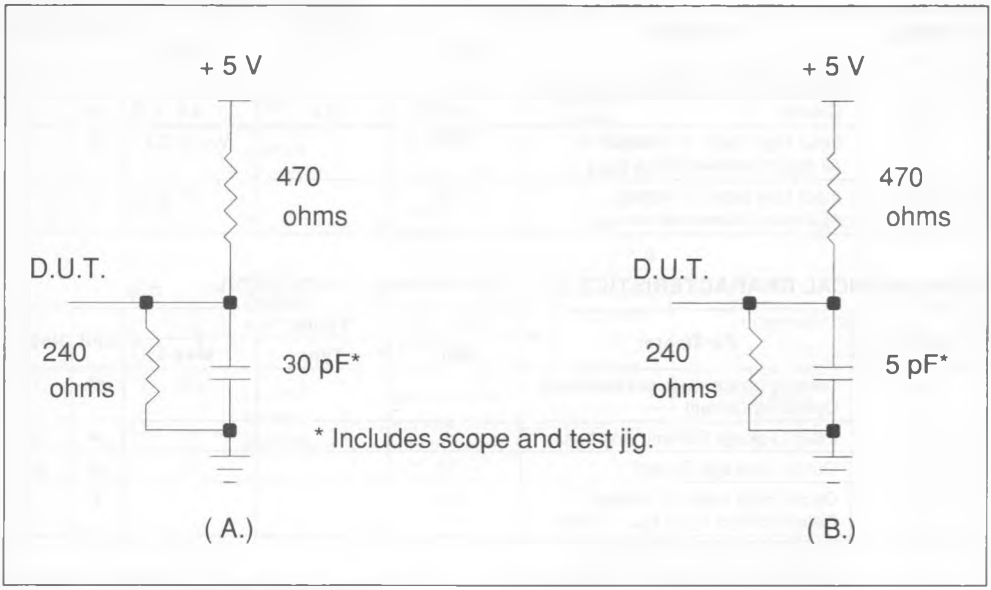
AC ELECTRICAL CHARACTERISTICS ($0°C \le T_A \le +70°C$) (V_{CC} = 5.0V ± 10%)

Symbol	Parameter	Value			Unit	Notes
		Min.	Typ.	Max.		
C_1	Capacitance on any Input Pin		4	5	pF	2
C_2	Capacitance on any Output Pin		8	10	pF	2

AC TEST CONDITIONS

Input Levels..... GND to 3.0V
Transition Times.....5ns
Input and Output Signal Timing Reference Level 1.5V
Ambient Temperature..... 0°C to 70°C
V_{CC}.....5.0V ± 10 percent

Figure 3 : Output Load Circuits.



Notes : 1. All voltages referenced to GND.
2. Measured with GND ≤ V ≤ V_{CC}. Outputs are deselected with exception to MATCH which is always enabled.
3. Measured with load as shown in Figure 3A.
4. Measured with load as shown in Figure 3B.
5. I_{CC1} measured with outputs open, V_{CC} max, f = min. cycle.
6. Output buffer is deselected.
7. Capacitances are sampled, and not 100% tested.

COMPARE, WRITE AND READ TIMING

The MK41H80 employs three signals for device control. The Write Enable (WE) pin enables a Write Cycle if low and either a Compare Cycle or a Read Cycle when high. The OE pin enables a Read Cycle if low or a Compare Cycle if high. The CLR pin enables a Flash Clear Cycle when brought low.

The MK41H80 begins a Compare Cycle with the application of a valid address (see figure 4). A valid MATCH is enabled when OE and WE go high in conjunction with their respective Set Up and Hold times. MATCH will occur t_{ACA} after a valid address, and t_{DCA} after valid Data In. MATCH will then go invalid t_{ACH} after the address changes.

The MK41H80 starts a Write Cycle with stable addresses (see figure 4). OE may be in either logic state. WE may fall with stable addresses, and must remain low until t_{AW} with a duration of t_{WEW}. Data in must be held valid t_{DS} before and t_{DH} after WE goes high. MATCH will be invalid during this cycle.

The MK41H80 begins a Read Cycle with stable addresses and WE high (see figure 4). DQ becomes valid t_{AA} after a valid address, and t_{OEA} after the fall of OE. DQ outputs become invalid t_{OH} after the address becomes invalid or t_{OEZ} after OE is brought high. Ripple through data access may be accomplished by holding OE active low while strobing addresses A_0-A_{11}, and holding CLR and WE high. The MATCH output will be invalid during the Read cycle.

Figure 4 : Compare and Write Cycle.

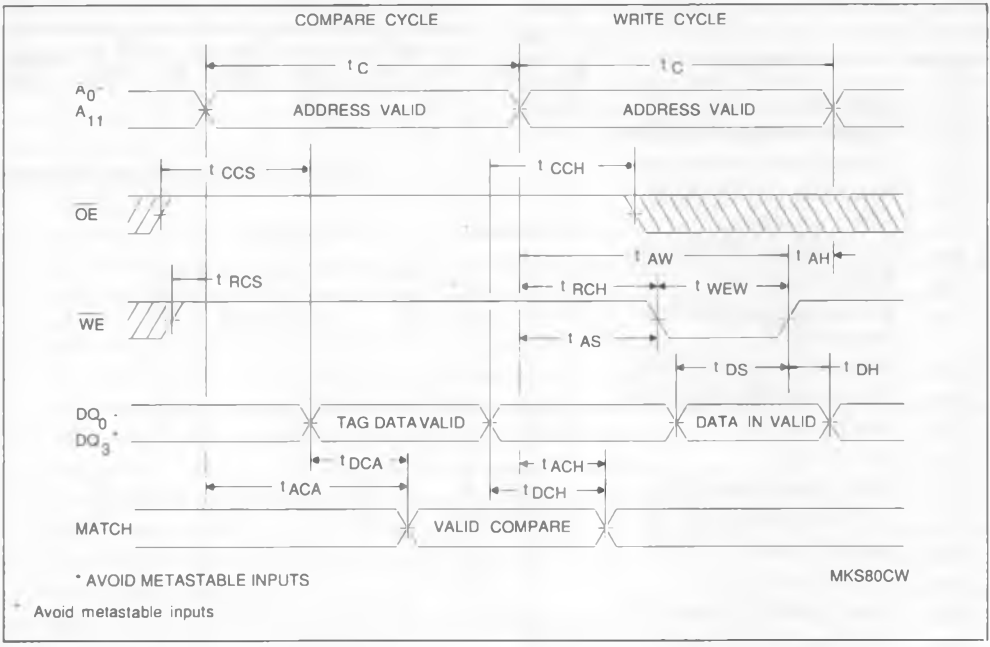
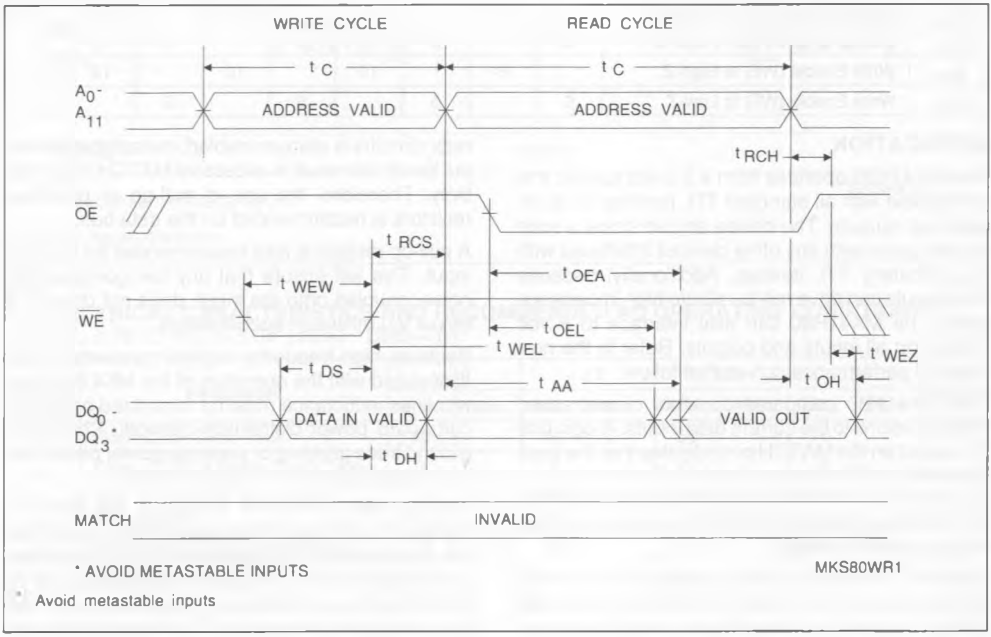


Figure 5 : Write and Read Cycle.



ELECTRICAL CARACTERISTICS AND RECOMMENDED AC OPERATING CONDITIONS

($0°C \leq T_A \leq 70°C$) (V_{CC} = 5.0V ±10%) Units = ns

Symbol	Parameter	- 20		- 22		- 25		- 35		Notes
		Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
t_C	Cycle Time	20		25		25		35		
t_{CCS}	Compare Command Set Up Time	7		8		8		10		
t_{CCH}	Compare Command Hold Time	0		0		0		0		
t_{RCS}	Read Command ($\overline{WE}$) Set Up Time	0		0		0		0		
t_{RCH}	Read Command ($\overline{WE}$) Hold Time	0		0		0		0		
t_{AS}	Address Set-up Time	0		0		0		0		
t_{AW}	Address Stable to End of Write Command ($\overline{WE}$)	16		18		20		30		
t_{AH}	Address Hold Time after End of Write	0		0		0		0		
t_{WEW}	Write Command ($\overline{WE}$) to End of Write	16		18		20		30		
t_{DS}	Data Set Up Time	12		13		13		14		
t_{DH}	Data Hold Time	0		0		0		0		
t_{DCA}	Data Compare Access Time		12		15		15		20	3
t_{ACA}	Address Compare Access Time		20		22		25		35	3
t_{ACH}	Address Compare Hold Time	5		5		5		5		3
t_{DCH}	Data Compare Hold Time	3		3		3		3		3
t_{OEA}	Output Enable ($\overline{OE}$) Access Time		10		10		12		15	3
t_{OH}	Valid Data Out ($\overline{DQ}$) Hold Time	5		5		5		5		3
t_{AA}	Address Access Time		20		22		25		35	3
t_{OEZ}	Output Enable ($\overline{OE}$) to High-Z		7		8		8		10	4
t_{OEL}	Output Enable ($\overline{OE}$) to Low-Z	2		2		2		2		4
t_{WEZ}	Write Enable ($\overline{WE}$) to High-Z		8		10		10		13	4
t_{WEL}	Write Enable ($\overline{WE}$) to Low-Z	5		5		5		5		4

APPLICATION

The MK41H80 operates from a 5.0 volt supply. It is compatible with all standard TTL families on all inputs and outputs. The device should share a solid ground plane with any other devices interfaced with it, particularly TTL devices. Additionally, because the outputs can drive rail-to-rail into high impedance loads, the MK41H80 can also interface to 5 volt CMOS on all inputs and outputs. Refer to the normalized performance curves that follow.

The MK41H80 compares contents of addressed RAM locations to the current data inputs. A logic one (1) output on the MATCH pin indicates that the input data and the RAM contents match. Conversely, a logic zero (0) on the MATCH pin indicates at least one bit difference between the RAM contents and input data generating a miss.

The MATCH output is always at either an active high or low logic level, and does not exhibit a three-state or high impedance characteristic. Since the comparator circuitry is always enabled, metastable data input levels can result in excessive MATCH output activity. Therefore, the use of pull-up or pull-down resistors is recommended on the data bus.

A pull-up resistor is also recommended for the $\overline{CLR}$ input. This will ensure that any low going system noise, coupled onto the input, does not drive $\overline{CLR}$ below V_{IH} minimum specifications.

Because high frequency current transients will be associated with the operation of the MK41H80, power lines inductance must be minimized on the circuit board power distribution network. Power and ground trace gridding or separate power planes can be employed to reduce line inductance.

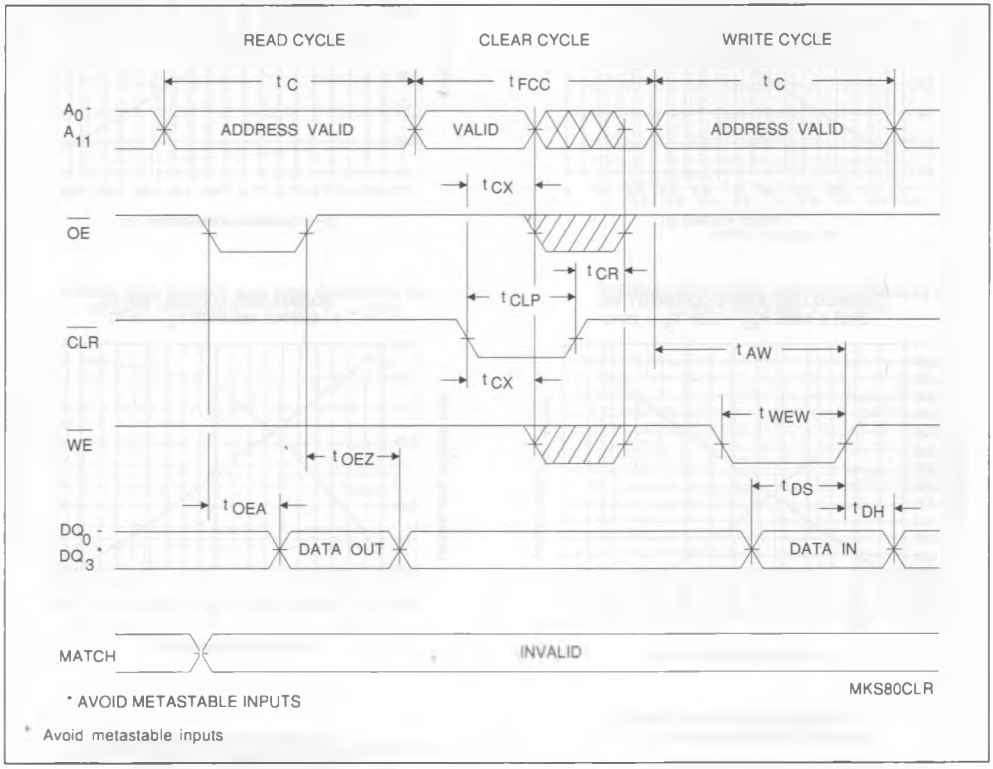
Though often times not thought of as such, the traces on a memory board are basically unterminated, low impedance transmission lines. As such they are subject to signal reflections manifested as noise, undershoots and excessive ringing. Series termination in close proximity to the TTL drivers can improve

driver/signal path impedance matching. While experimentation most often proves to be the only practical approach to selection of series resistors, values in the range of 10 to 33 ohms often prove most suitable.

FLASH CLEAR CYCLE

A Flash Clear Cycle begins as $\overline{CLR}$ is brought low (see figure 5). A Flash Clear sets all 16,384 bits in the RAM to logic zero. Control Inputs will not be recognized from t_{CX} after $\overline{CLR}$ falls to t_{CR} after $\overline{CLR}$ is brought high. $\overline{OE}$ and $\overline{WE}$ are Don't Cares and DQ is High-Z. MATCH will be invalid while $\overline{CLR}$ is low.

Figure 6 : Read–flash Clear–write Cycle.



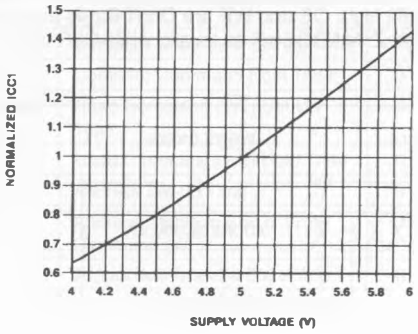
AC ELECTRICAL CARACTERISTICS AND RECOMMENDED AC OPERATING CONDITIONS

($0°C \leq T_A \leq 70°C$) (V_{CC} = 5.0V ±10%) Units = ns.

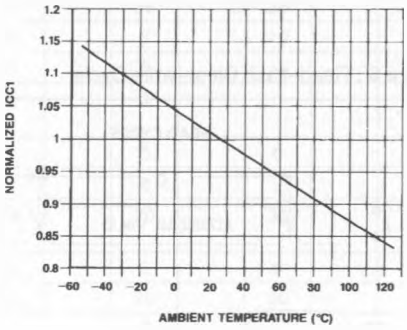
Symbol	Parameter	- 20		- 22		- 25		- 35		Notes
		Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
t_{FCC}	Flash Clear Cycle Time	40		50		50		70		
t_{CX}	Clear ($\overline{CLR}$) to Inputs Don't Care	0		0		0		0		
t_{CR}	End of Clear ($\overline{CLR}$) to Inputs Recognized	0		0		0		0		
t_{CLP}	Flash Clear ($\overline{CLR}$) Pulse Width	36		36		60		60		

NORMALIZED DC AND AC PERFORMANCE CHARACTERISTICS

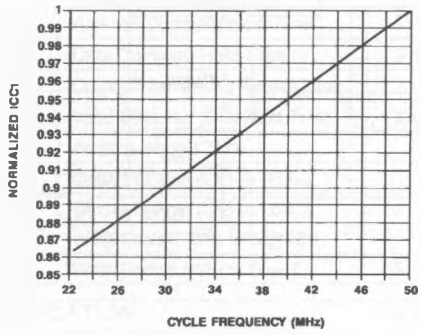
NORMALIZED SUPPLY CURRENT VS.
SUPPLY VOLTAGE T_A = 0°C



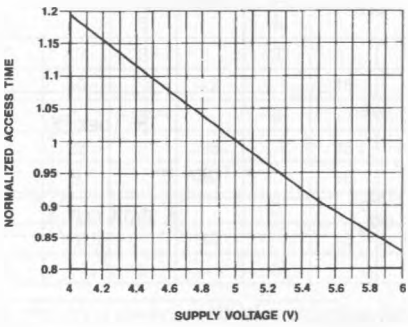
NORMALIZED SUPPLY CURRENT VS.
AMBIENT TEMPERATURE V_{CC} = 5.0V



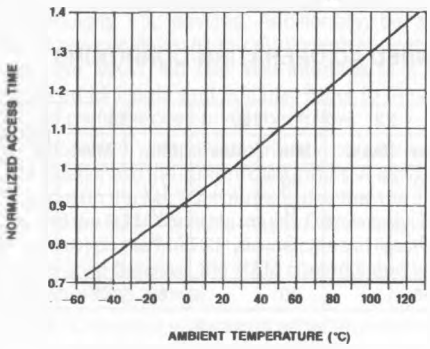
NORMALIZED SUPPLY CURRENT VS.
CYCLE TIME V_{CC} = 5.0V T_A = 25°C



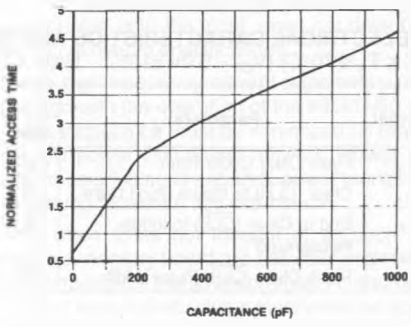
NORMALIZED ACCESS TIME VS.
SUPPLY VOLTAGE T_A = 25°C



NORMALIZED ACCESS TIME VS.
AMBIENT TEMPERATURE V_{CC} = 5.0V

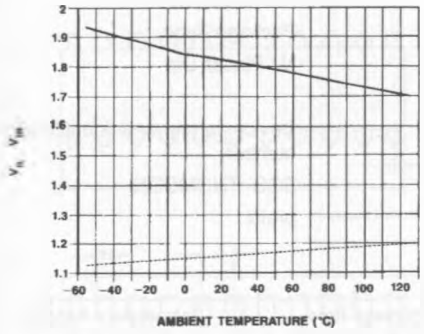


NORMALIZED ACCESS TIME VS.
OUTPUT LOADING V_{CC} = 5.0V T_A = 25°C

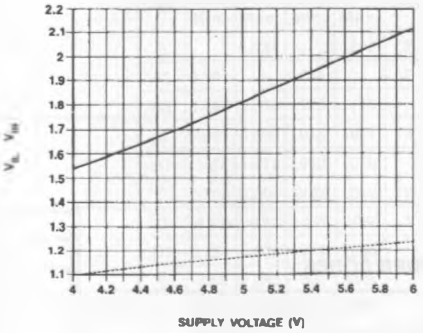


NORMALIZED DC AND AC PERFORMANCE CHARACTERISTICS

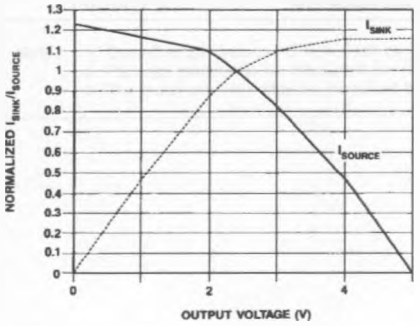
LOGIC THRESHOLD VOLTAGE VS.
AMBIENT TEMPERATURE V_{CC} = 5.0V



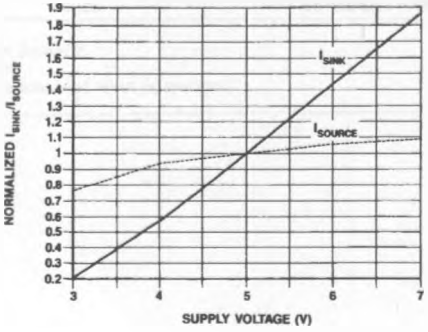
LOGIC THRESHOLD VOLTAGE VS.
SUPPLY VOLTAGE T_A = 25°C



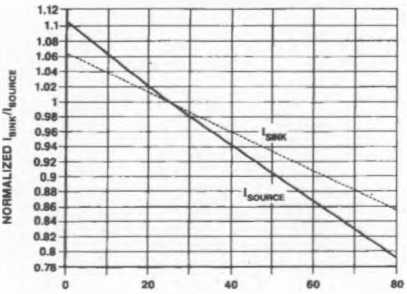
NORMALIZED SOURCE AND SINK CURRENTS VS.
OUTPUT VOLTAGE V_{CC} = 5.0V, T_A = 25°C

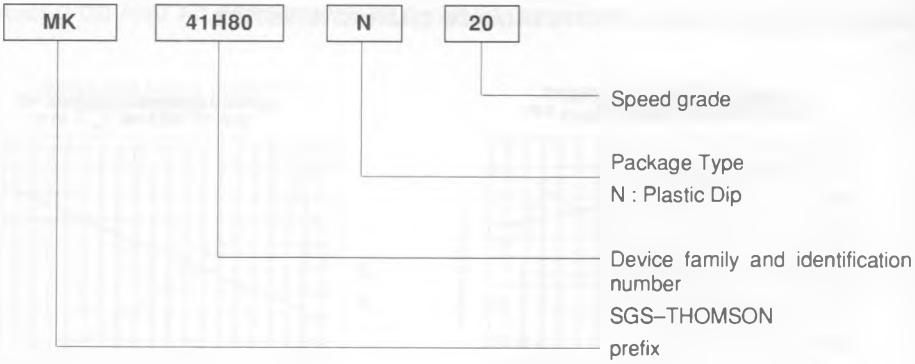


NORMALIZED SOURCE AND SINK CURRENTS VS.
SUPPLY VOLTAGE T_A = 25°C



NORMALIZED SOURCE AND SINK CURRENTS VS.
AMBIENT TEMPERATURE V_{CC} = 5.0V



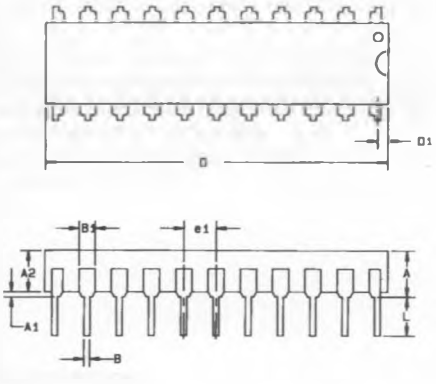


ORDER CODES

Part Number	Access Time	Package Type	Temperature Range
MK41H80N-20	20ns	22 Pin Plastic DIP	0°C to 70°C
MK41H80N-22	22ns	22 Pin Plastic DIP	0°C to 70°C
MK41H80N-25	25ns	22 Pin Plastic DIP	0°C to 70°C
MK41H80N-35	35ns	22 Pin Plastic DIP	0°C to 70°C

PACKAGE DESCRIPTION

22 PIN "N" PACKAGE PLASTIC DIP



Dim.	mm		Inches		Notes
	Min.	Max.	Min.	Max.	
A		5.334		.210	2
A1	0.381		.015		2
A2	3.048	3.556	.120	.140	
B	0.381	0.533	.015	.021	3
B1	1.27	1.778	.050	.070	
C	0.203	0.304	.0008	.012	3
D	25.908	26.67	1.020	1.050	1
D1	0.254	0.635	.010	.025	
E	7.62	8.255	.300	.325	
E1	6.096	6.858	.240	.270	
e1	2.286	2.794	.090	.110	
eA	7.62	10.16	.300	.400	
L	3.048		.120		

Notes : 1. Overall length includes 010 in flash on either end of the package.
2. Package standoff to be measured per jedec requirements.
3. The maximum limit shall be increased by 003 in when solder lead finish is specified.