Absolute Maximum Ratings (Note 1)

Supply Voltage (Note 2)	−0.5V to +7V
Input Voltage (Note 2)	−1.2V to +5.5V
Output Voltage (Note 2)	−0.5V to +5.5V
Storage Temperature	−65°C to +150°C
Lead Temperature (Soldering, 10 seconds)	300°C

Operating Conditions

	Min	Max	Units
Supply Voltage (V_{CC})			
DM77S188, DM77S288	4.5	5.5	V
DM87S188, DM87S288	4.75	5.25	V
Ambient Temperature (T_A)			
DM77S188, DM77S288	−55	+125	°C
DM87S188, DM87S288	0	+70	°C
Logical "0" Input Voltage (Low)	0	0.8	V
Logical "1" Input Voltage (High)	2.0	5.5	V

DC Electrical Characteristics (Note 3)

	Parameter	Conditions	DM77S188, DM77S288			DM87S188, DM87S288			Units
			Min	Typ	Max	Min	Typ	Max	
I_{IL}	Input Load Current, All Inputs	V_{CC} = Max, V_{IN} = 0.45V			−100			−100	μA
I_{IH}	Input Leakage Current, All Inputs	V_{CC} = Max, V_{IN} = 2.7V			25			25	μA
I_I	Input Leakage Current, All Inputs	V_{CC} = Max, V_{IN} = 5.5V			50			50	μA
V_{OL}	Low Level Output Voltage	V_{CC} = Min, I_{OL} = 12 mA		0.35	0.50		0.35	0.45	V
V_{IL}	Low Level Input Voltage				0.80			0.80	V
V_{IH}	High Level Input Voltage		2.0			2.0			V
I_{CEX}	Output Leakage Current (Open-Collector Only)	V_{CC} = Max, V_{CEX} = 2.4V			50			50	μA
		V_{CC} = Max, V_{CEX} = 5.5V			100			100	μA
V_C	Input Clamp Voltage	V_{CC} = Min, I_{IN} = −18 mA		−0.8	−1.2		−0.8	−1.2	V
C_{IN}	Input Capacitance	V_{CC} = 5V, V_{IN} = 2V, T_A = 25°C, 1 MHz		4.0			4.0		pF
C_O	Output Capacitance	V_{CC} = 5V, V_O = 2V, T_A = 25°C, 1 MHz, Output "OFF"		6.0			6.0		pF
I_{CC}	Power Supply Current	V_{CC} = Max, All Inputs Grounded, All Outputs Open		120			120		mA
TRI-STATE PARAMETERS									
I_{SC}	Output Short Circuit Current	V_O = 0V, V_{CC} = Max, (Note 4)	−20		−70	−20		−70	mA
I_{HZ}	Output Leakage (TRI-STATE)	V_{CC} = Max, V_O = 0.45 to 2.4V, Chip Disabled			±50			±50	μA
V_{OH}	Output Voltage High	I_{OH} = −2 mA	2.4	3.2					V
		I_{OH} = −6.5 mA				2.4	3.2		V

AC Electrical Characteristics (With standard load)

	Parameter	Conditions	DM77S188, DM77S288 5V ± 10%; −55°C to +125°C			DM87S188, DM87S288 5V ± 5%, 0°C to +70°C			Units
			Min	Typ	Max	Min	Typ	Max	
t_{AA}	Address Access Time			12	20		12	15	ns
t_{EA}	Enable Access Time			8	12		8	10	ns
t_{ER}	Enable Recovery Time			8	12		8	10	ns

Note 1: Absolute maximum ratings are those values beyond which the device may be permanently damaged. They do not mean that the device may be operated at these values.

Note 2: These limits do not apply during programming. For the programming ratings, refer to the programming instructions.

Note 3: These limits apply over the entire operating range unless stated otherwise. All typical values are for V_{CC} = 5V and T_A = 25°C.

Note 4: During I_{SC} measurement, only one output at a time should be grounded. Permanent damage may otherwise result.

National Semiconductor

Bipolar PROMs

DM77S190/DM87S190, DM77S191/DM87S191 2048 × 8-Bit TTL PROM

General Description

These Schottky memories are organized in the popular 2048 words by 8 bits configuration. Three memory enable inputs are provided to control the output states. When $\overline{E1}$ is low and E2 and E3 are high, the output presents the contents of the selected word.

If $\overline{E1}$ is high, or E2 or E3 are low, it causes all 8 outputs to go to the "OFF" or high impedance state. The memories are available in both open-collector and TRI-STATE® versions.

PROMs are shipped from the factory with lows in all locations. A high may be programmed into any selected location by following the programming instructions.

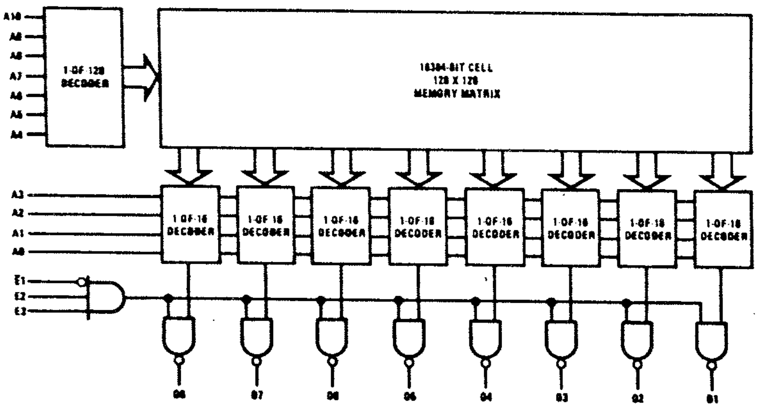
See the last page of this section for detailed programming information.

Features

- Advanced titanium-tungsten (Ti-W) fuses
- Schottky-clamped for high speed
  - Address access—40 ns typ
  - Enable access—20 ns typ
- PNP inputs reduce input loading
- All DC and AC parameters guaranteed over temperature
- Low voltage TRI-SAFE™ programming

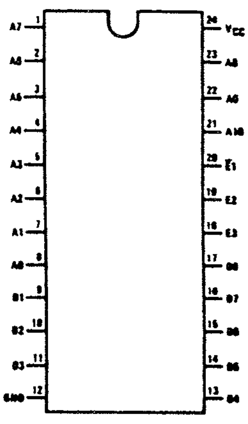
	Military	Commercial	Open-Collector	TRI-STATE	Package
DM87S190		X	X		N, J
DM87S191		X		X	N, J
DM77S190	X		X		J
DM77S191	X			X	J

Block Diagram



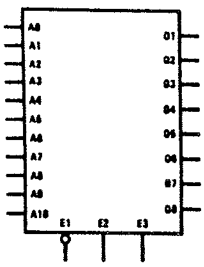
Connection Diagram

Dual-In-Line Package



TOP VIEW

Logic Symbol



Pin Names

$\overline{E1}$ to E3	Enable Inputs
A0 to A10	Address Inputs
O1 to O8	Data Outputs

Order Number DM77S190J, DM77S191J, DM87S190J or DM87S191J
See NS Package J24A

Order Number DM87S190N or DM87S191N
See NS Package N24A

Absolute Maximum Ratings (Note 1)

Supply Voltage (Note 2)	−0.5V to +7V
Input Voltage (Note 2)	−1.2V to +5.5V
Output Voltage (Note 2)	−0.5V to +5.5V
Storage Temperature	−65°C to +150°C
Lead Temperature (Soldering, 10 seconds)	300°C

Operating Conditions

	Min	Max	Units
Supply Voltage (V_{CC})			
DM77S190, DM77S191	4.5	5.5	V
DM87S190, DM87S191	4.75	5.25	V
Ambient Temperature (T_A)			
DM77S190, DM77S191	−55	+125	°C
DM87S190, DM87S191	0	+70	°C
Logical "0" Input Voltage (Low)	0	0.8	V
Logical "1" Input Voltage (High)	2.0	5.5	V

DC Electrical Characteristics (Note 3)

	Parameter	Conditions	DM77S190, DM77S191			DM87S190, DM87S191			Units
			Min	Typ	Max	Min	Typ	Max	
I_{IL}	Input Load Current, All Inputs	V_{CC} = Max, V_{IN} = 0.45V		−10	−150		−10	−100	μA
I_{IH}	Input Leakage Current, All Inputs	V_{CC} = Max, V_{IN} = 2.7V			25			25	μA
I_I	Input Leakage Current, All Inputs	V_{CC} = Max, V_{IN} = 5.5V			50			50	μA
V_{OL}	Low Level Output Voltage	V_{CC} = Min, I_{OL} = 12 mA		0.35	0.50		0.35	0.45	V
V_{IL}	Low Level Input Voltage				0.80			0.80	V
V_{IH}	High Level Input Voltage		2.0			2.0			V
I_{CEX}	Output Leakage Current (Open-Collector Only)	V_{CC} = Max, V_{CEX} = 2.4V			50			50	μA
		V_{CC} = Max, V_{CEX} = 5.5V			100			100	μA
V_C	Input Clamp Voltage	V_{CC} = Min, I_{IN} = −18 mA		−0.8	−1.2		−0.8	−1.2	V
C_{IN}	Input Capacitance	V_{CC} = 5V, V_{IN} = 2V, T_A = 25°C, 1 MHz		4.0			4.0		pF
C_O	Output Capacitance	V_{CC} = 5V, V_O = 2V, T_A = 25°C, 1 MHz, Output "OFF"		6.0			6.0		pF
I_{CC}	Power Supply Current	V_{CC} = Max, All Inputs Grounded, All Outputs Open		120	175		120	175	mA
TRI-STATE PARAMETERS									
I_{SC}	Output Short Circuit Current	V_O = 0V, V_{CC} = Max, (Note 4)	−20		−70	−20		−70	mA
I_{HZ}	Output Leakage (TRI-STATE)	V_{CC} = Max, V_O = 0.45 to 2.4V, Chip Disabled			±50			±50	μA
V_{OH}	Output Voltage High	I_{OH} = −2 mA	2.4	3.2					V
		I_{OH} = −6.5 mA				2.4	3.2		V

AC Electrical Characteristics (With standard load)

	Parameter	Conditions	DM77S190, DM77S191 5V ± 10%; −55°C to +125°C			DM87S190, DM87S191 5V ± 5%, 0°C to +70°C			Units
			Min	Typ	Max	Min	Typ	Max	
t_{AA}	Address Access Time			40	85		40	70	ns
t_{EA}	Enable Access Time			20	35		20	30	ns
t_{ER}	Enable Recovery Time			20	35		20	30	ns

Note 1: Absolute maximum ratings are those values beyond which the device may be permanently damaged. They do not mean that the device may be operated at these values.

Note 2: These limits do not apply during programming. For the programming ratings, refer to the programming instructions.

Note 3: These limits apply over the entire operating range unless stated otherwise. All typical values are for V_{CC} = 5V and T_A = 25°C.

Note 4: During I_{SC} measurement, only one output at a time should be grounded. Permanent damage may otherwise result.

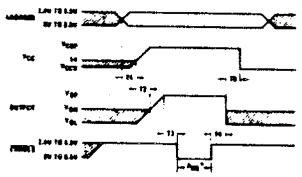
Schottky PROM Programming Procedure

These parts are shipped from the factory with all fuses intact. As a result, the outputs will be low (logical "0") for all addresses. In order to generate a high level on the outputs, the part must be programmed. Information on available programming equipment may be obtained from National. However, if it is desired to build your own programmer, the following conditions must be observed.

1. Programming should be attempted only at temperatures between 15°C and 30°C.
2. Addresses and chip enable pins must be driven from normal TTL logic levels during both programming and verification.
3. Programming will occur at a selected address when V_{CC} is held at 10.5V, the appropriate output is held at 10.5V and the chip is subsequently enabled. To achieve these conditions in the appropriate sequence, the following procedure must be followed:
   a) Select the desired word by applying a high or low level to the appropriate address inputs. Disable the chip by applying a high level to one or both enable inputs.
   b) Increase V_{CC} to 10.5V ±0.5V with the rate of increase being between 1.0 and 10.0V/µs. Since V_{CC} supplies the current to program the fuse as well as the I_{CC} of the device at programming voltage, it must be capable of supplying 750 mA at 11.0V.
   c) Select the output where a high level is desired by raising that output voltage to 10.5V ±0.5V. Limit the rate of increase to a value between 1.0 and 10.0V/µs. This voltage change may occur simultaneously with the increase in V_{CC} but must not precede it. It is critical that only one output at a time be programmed since the internal circuits can only supply programming current to one bit at a time. Outputs not being programmed must be left open or tied to a high impedance source of at least 20 kΩ. (Remember that the outputs of the device are still disabled at this time because the chip enables are high.)
   d) Enable the device by taking both chip enables to a low level. This is done with a pulse of 10µs. The 10µs duration refers to the time that the circuit is enabled. Normal input levels are used and rise and fall times are not critical.
   e) Verify that the bit has been programmed by first removing the programming voltage from the output and then reducing V_{CC} to 4.0V ±0.2V. Verification at a V_{CC} level of 4.0V will guarantee proper output states over the V_{CC} and temperature range of the programmed part. The chip must be enabled to sense the state of the outputs. During verification, the loading of the output must be within specified I_{OL} and I_{OH} limits. Steps b, c and d must be repeated 10 times or until verification that the bit has programmed.
   f) Following verification, apply five additional programming pulses to the bit being programmed. The programming procedure is now complete for the selected bit.
   g) Repeat steps a through f for each bit to be programmed to a high level. If the procedure is performed on an automatic programmer, the duty cycle of V_{CC} at programming voltage must be limited to a maximum of 25%. This is necessary to minimize chip junction temperatures. After all selected bits are programmed, the entire contents of the memory should be verified.

Note: Since only an enabled chip is programmed, it is possible to program these parts at the board level if all programming parameters are complied with.

Programming Waveforms



T1 = 100 ns min

T2 = 5µs min (T2 may be ≥ 0 if V_{CCP} rises at the same rate or faster than V_{OP})

T3 = 100 ns min

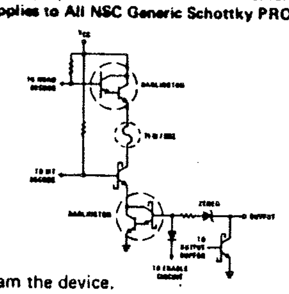
T4 = 100 ns min

T5 = 100 ns min

*P_{WE} is repeated for 5 additional pulses after verification of V_{OH} indicates a bit has programmed

Equivalent Circuit

Programming Equivalent Circuit for One Memory Output
(Applies to All NSC Generic Schottky PROMs)



Programming Parameters

Do not test or you may program the device.

PARAMETERS		CONDITIONS	MIN	RECOMMENDED VALUE	MAX	UNITS
V_{CCP}	Required V_{CC} for Programming		10.0	10.5	11.0	V
I_{CCP}	I_{CC} During Programming	V_{CC} = 11V	600		750	mA
V_{OP}	Required Output Voltage for Programming		10.0	10.5	11.0	V
I_{OP}	Output Current while Programming	V_{OUT} = 11V			20	mA
t_{RR}	Rate of Voltage Change of V_{CC} or Output		1.0		10.0	V/µs
P_{WE}	Programming Pulse Width (Enabled)		9	10	11	µs
V_{CCV}	Required V_{CC} for Verification		3.8	4.0	4.2	V
M_{DC}	Maximum Duty Cycle for V_{CC} at V_{CCP}			25	25	%

HARRIS
SEMICONDUCTOR
PRODUCTS DIVISION
A DIVISION OF HARRIS CORPORATION

HM-76XX

GENERIC PROM FAMILY

JANUARY 1978

Features

- COMMON D.C. ELECTRICAL CHARACTERISTICS AND PROGRAMMING PROCEDURE
- SIMPLE, HIGH SPEED PROGRAMMING PROCEDURE, ONE PULSE/BIT
- EXPANDABLE - "OPEN COLLECTOR" OR "THREE STATE" OUTPUTS AND CHIP ENABLE INPUTS
- INPUTS AND OUTPUTS TTL COMPATIBLE
  - LOW INPUT CURRENT – 250μA LOGIC "0", 40μA LOGIC "1"
  - FULL OUTPUT DRIVE – 16 mA SINK, 2mA SOURCE
- FAST ACCESS TIME – GUARANTEED FOR WORST CASE N^2 SEQUENCING, OVER COMMERCIAL AND MILITARY TEMPERATURE AND VOLTAGE RANGES
- PIN COMPATIBLE WITH INDUSTRY STANDARD PROMs AND ROMs

Organizations

PART NUMBER	*OUTPUT	TOTAL BITS	WORDS x BITS/WORD
HM-7602 HM-7603	OC TS	256	32 x 8
HM-7610 HM-7611	OC TS	1024	256 x 4
HM-7620 HM-7621	OC TS	2048	512 x 4
HM-7640 HM-7641	OC TS	4096	512 x 8
HM-7642 HM-7643 HM-7644	OC TS APU	4096	1024 x 4

*OC – Open Collector
*TS – "Three State"
*APU – Active Pull-Up

Description

The HM-76XX Generic PROMs comprise a completely compatible family having common D.C. electrical characteristics and identical programming requirements. They are fully decoded, high speed, field programmable ROMs and are available in all commonly used organizations, with both open-collector and "Three State" outputs. All bits are manufactured storing a logical "1" (outputs high), and can be selectively programmed for a logical "0" (outputs low).

The nichrome fuse technology is the same as is used in the JAN approved MIL-STD-38510/201 PROM and in all other Harris PROMs.

The field programmable PROM can be custom programmed to any pattern using a simple programming procedure. Schottky Bipolar circuitry provides fast access time, and features temperature and voltage compensation to minimize access time variation.

All pinouts are compatible to industry standard PROMs and ROMs.

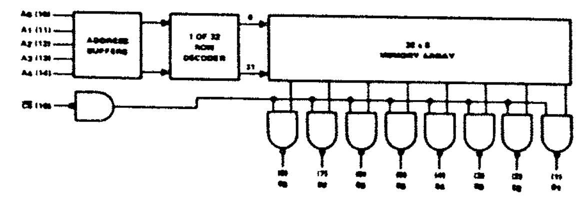
In addition to the conventional storage array, extra test rows and columns are included to assure high programmability, and guarantee parametric and A.C. performance. Fuses in these test rows and columns are blown prior to shipment.

2

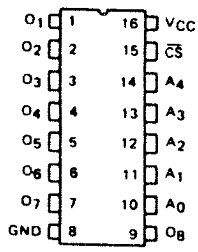
Block Diagrams

Pinouts

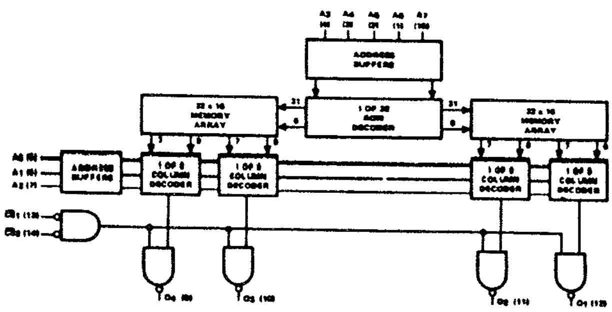
HM-7602/03
32 x 8



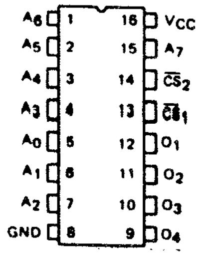
TOP VIEW



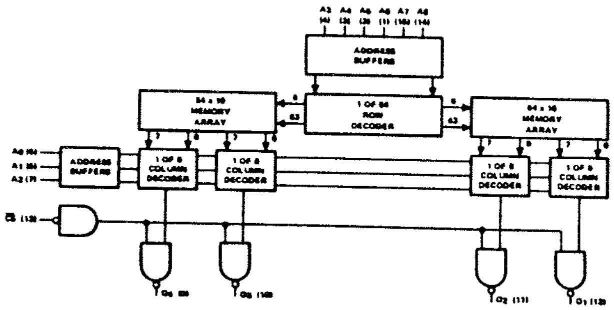
HM-7610/11
256 x 4



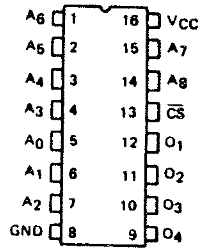
TOP VIEW



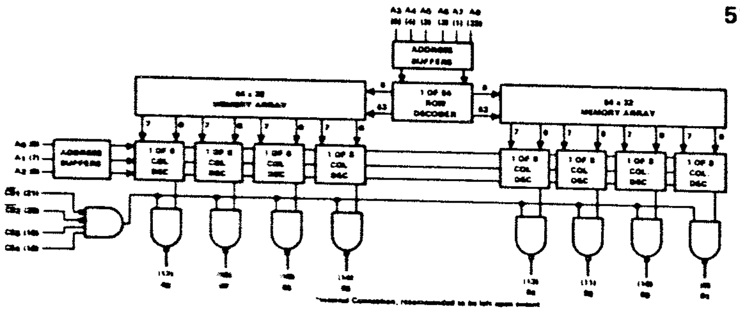
HM-7620/21
512 x 4



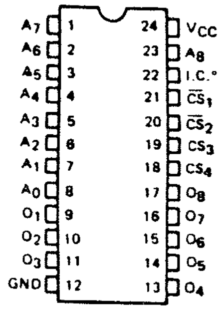
TOP VIEW



HM-7640/41
512 x 8

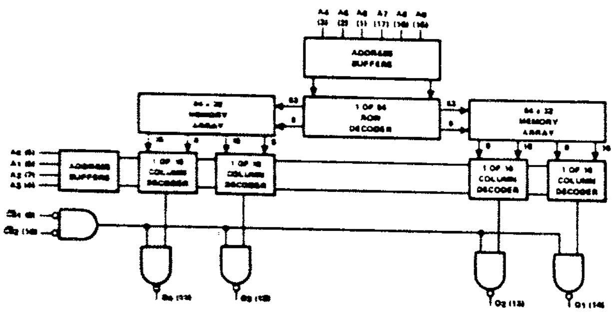


TOP VIEW

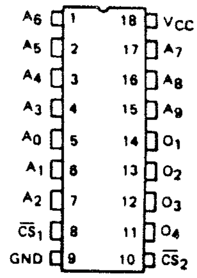


2

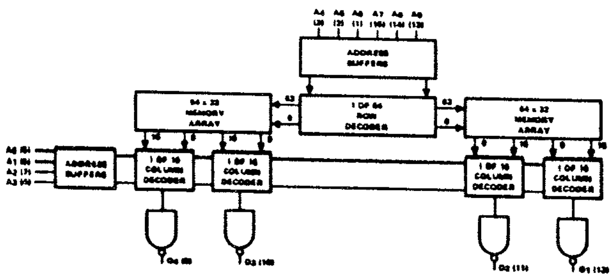
HM-7642/43
1024 x 4



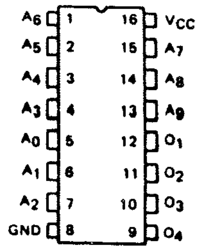
TOP VIEW



HM-7644
1024 x 4



TOP VIEW



Specifications HM-76XX

ABSOLUTE MAXIMUM RATINGS

Output or Supply Voltage (Operating)	-0.3 to +7.0V	Storage Temperature	-65°C to +150°C
Address/Enable Input Voltage	5.5V	Operating Temperature (Ambient)	-55°C to +125°C
Address/Enable Input Current	-20mA	Maximum Junction Temperature	+175°C
Output Sink Current	100mA		

CAUTION: Stresses above those listed under the "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress only rating and functional operation of the device at these or at any other conditions above those indicated in the operational sections of this specification is not implied. (While programming, follow the programming specifications.)

D.C. ELECTRICAL CHARACTERISTICS (Operating)

HM-76XX-5 (V_{CC} = 5.0V ±5%, T_A = 0°C to +75°C)
HM-76XX-2, HM-76XX-8 (V_{CC} = 5.0V ±10%, T_A = -55°C to +125°C)
Typical Measurements are at T_A = 25°C, V_{CC} = +5V

SYMBOL	PARAMETER	OPEN COLLECTOR OUTPUT MIN	OPEN COLLECTOR OUTPUT TYP	OPEN COLLECTOR OUTPUT MAX	THREE STATE OUTPUT MIN	THREE STATE OUTPUT TYP	THREE STATE OUTPUT MAX	UNITS	TEST CONDITIONS
I_{IH} I_{IL}	Address/Enable "1" Input Current (1) "0"	– –	 -50.0	40 -250	– –	 -50.0	40 -250	μA μA	V_{IH} = VCC Max. V_{IL} = 0.45V
V_{IH} V_{IL}	Input Threshold "1" Voltage "0"	2.0	– –	 0.8	2.0	– –	 0.8	V V	VCC = VCC Min. VCC = VCC Max.
V_{OH} V_{OL}	Output Voltage "1" "0"	N/A	 0.35	 0.45	2.4	3.4 0.35	 0.45	V V	I_{OH} = -2.0mA, VCC = VCC Min. I_{OL} = +16mA, VCC = VCC Min.
I_{OHE} I_{OLE}	Output Disabled "1" Current (2) "0"	– –	– –	100 N/A	– –	– –	100 -100	μA μA	VOH, VCC = VCC Max. VOL = +0.3V, VCC = VCC Max.
I_{OH}	Output Leakage (1) "1"	–	–	100	–	–	N/A	μA	VOH, VCC = VCC Max.
VCL	Input Clamp Voltage	–	–	-1.2	–	–	-1.2	V	I_{IN} = -18mA
I_{OS}	Output Short Circuit Current	N/A	–	N/A	-15	–	-100	mA	V_{OUT} = 0.0V One Output Only for a Max. of 1 sec.
ICC	Power Supply Current HM-7602/7603 HM-7610/7611 HM-7620/7621	–	90 90	105 130	–	90 90	105 130	mA	VCC = VCC Max. All Inputs Grounded
	HM-7640/7641	–	125	170	–	125	170	mA	
	HM-7642/7643/7644	–	100	140	–	100	140	mA	

NOTE: (1) Enable current measured using only one enable input to disable the device.
(2) N/A for HM-7644, Active Pull-Up Output.

A.C. ELECTRICAL CHARACTERISTICS (Operating)

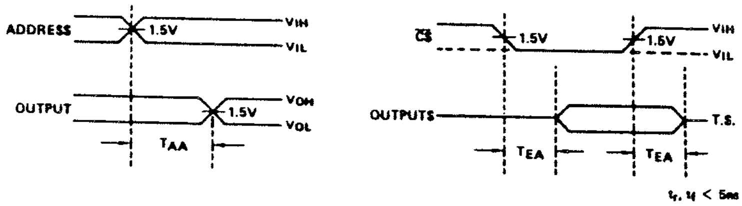
SYMBOL	PARAMETER	HM-76XX-5 V_{CC} – 5V ± 5% T_A – 0° to +75°C TYPICAL	HM-76XX-5 MAXIMUM	HM-76XX-2 HM-76XX-8 V_{CC} – 5V ± 10% T_A – -55°C to +125°C TYPICAL	HM-76XX-2 HM-76XX-8 MAXIMUM	UNITS
TAA TEA	HM-7602/7603	30 20	40 30	30 20	50 40	ns ns
TAA TEA	HM-7610/7611	40 15	60 25	40 15	75 30	ns ns
TAA TEA	HM-7620/7621	45 15	70 25	45 15	85 30	ns ns
TAA TEA	HM-7640/7641	45 30	70 40	45 30	85 50	ns ns
TAA TEA	HM-7642/7643 HM-7644	45 15	60 25	45 15	85 30	ns ns

TAA – Address to Output Access Time
TEA – Chip Enable Access Time (N/A HM-7644)
A.C. Limits Guaranteed for Worst Case N^2 Sequencing

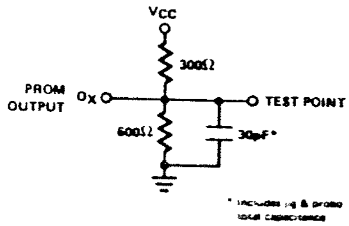
CAPACITANCE: $T_A = 25^oC$

SYMBOL	PARAMETER	MAXIMUM	UNITS	TEST CONDITIONS
CINA, CINCS	Input Capacitance	12	pF	VCC = 5V, VIN = 2.0V, f = 1MHz
COUT	Output Capacitance	12	pF	VCC = 5V, VOUT = 2.0V, f = 1MHz

SWITCHING TIME DEFINITIONS



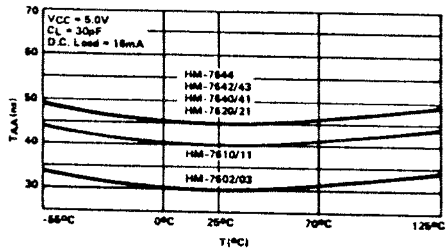
A.C. TEST LOAD



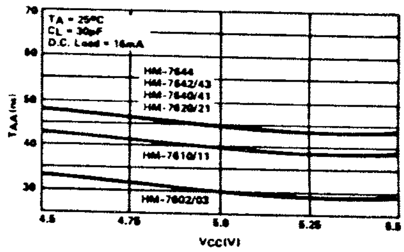
2

TYPICAL A.C. CHARACTERISTICS

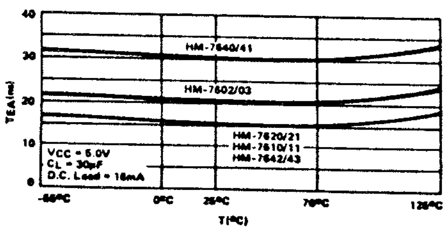
ADDRESS TO OUTPUT DELAY VS. TEMPERATURE



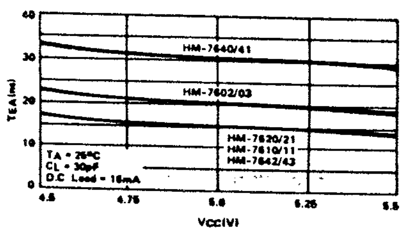
ADDRESS TO OUTPUT DELAY VS. SUPPLY VOLTAGE



CHIP SELECT TO OUTPUT DELAY VS. TEMPERATURE



CHIP SELECT TO OUTPUT DELAY VS. SUPPLY VOLTAGE



Generic PROM Programming

All 76xxx series devices utilize the same programming method which is one of the characteristics that lends to the term "Generic" PROM.

Harris Generic PROMs have the industry's highest programming yield and exhibit an extremely high level of reliability in the field, however, this level of device quality can only be obtained if the PROM has been properly programmed to the data sheet specifications. Outlined below are the key points which deserve attention to assure that programming has been optimumly performed.

- Be certain that you are following the latest revision status of programming specifications.
- If you are utilizing a commercial programmer, be sure that the card set for Harris Generic PROMs is certified for the most recent revision level.
- Have the Programmer calibrated at routine intervals to assure that the electrical and mechanical characteristics are acceptable. This would include such things as:
  - Making certain that the socket which the device is placed into is clean of corrosion and is mechanically sound.
  - Checking ribbon cable connectors for good continuity.
  - Making sure that all voltage levels conform to the programming specifications.
  - Assuring that all pulses are clean of distortion and exhibit the correct timing characteristics.

2

If there is any problem in determining how to follow any of these guidelines, contact a local Harris office for assistance.

PROGRAMMING PROCEDURE

The following is the generic programming procedure which is used for all Harris Generic 76xxx PROMs. Please note that the PD input(s) on power down devices can be considered equivalent to chip enable input(s) during the programming procedure in that they both disable the device. Also, the logic levels required to place the strobe input into the "transparent read" mode (essential during programming) will vary among the various device types.

The HM-76xxx PROMs are manufactured with all bits storing a logical "1" (output high). Any desired bit can be programmed to a logical "0" (output low) by following the simple procedure shown below. One may build his own programmer to satisfy the specifications described in the table, or use any of the commercially available programmers which meet these specifications. This PROM can be programmed automatically or by the manual procedure shown on the next page.

Programming Specifications

SYMBOL	PARAMETER	MINIMUM	RECOMMENDED OR TYPICAL	MAXIMUM	UNITS
V_{IH} V_{IL}	Address Input Voltage (1)	2.4 0.0	5.0 0.4	5.0 0.5	V V
V_{PH} (2) V_{PL} (3)	Programming/Verify Voltage to VCC	12.0 4.5	12.0 4.5	12.5 5.5	V V
I_{ILP}	Programming Input Low Current at V_{PH}	–	-300	-600	μA
tr tf	Programming (VCC) Voltage Rise and Fall Time	1.0 1.0	1.0 1.0	10.0 10.0	μs μs
td	Programming Delay	10	10	100	μs
tp	Programming Pulse Width (4)	90	100	110	us
P.D.C.	Programming Duty Cycle	–	50	90	%
VOPE VOPD	Output Voltage Enable (5) Disable	10.5 4.5	10.5 5.0	11.0 5.5	V V
IOPE	Output Voltage Enable Current	–	–	10.0	mA
T_a	Ambient Temperature	–	25	75	°C

During programming the chip must be disabled for proper operation.

NOTES: 1. No inputs should be left open for V_{IH}.
2. V_{PH} source must be capable of supplying one ampere.
3. It is recommended that dual verification be made at V_{PL} min and V_{PL} max.
4. Note step 11 in programming procedure.
5. Disable condition will be met with output open circuited.

1. If the device has latched outputs (HM-76xxR): apply to the strobe input, the logical level required to place the device into the "transparent read" mode which is essential during programming. The strobe must remain in the "transparent read" mode throughout the entire programming procedure. Consult the individual data sheet of the device concerned to determine whether a logical "0" or a logical "1" is required to meet this condition.

2. Address the PROM with the binary address of the word to be programmed. Address inputs are TTL compatible. An open circuit should not be used to address the PROM.

3. Bring the $\overline{CE}_x$ (PD_x) input(s) high and the CE_x ($\overline{PD}_x$) input(s) low to disable the device. The disabling of the device during programming is an essential step in correctly programming all Harris PROMs. The chip enables are TTL compatible. An open circuit should not be used to disable the device. (Disregard this step for devices which have no chip enable or power down inputs.)

4. Disable the programming circuitry by applying a voltage disable of V_{OPD} to the outputs of the PROM. Any output may be left open to achieve the disable.

5. Raise V_{CC} to V_{PH} with rise time $\leq t_r$.

6. After a delay $\geq t_d$, apply a pulse with amplitude of V_{OPE} and duration of t_p to the output selected for programming. Note that the PROM is manufactured with fuses intact which generate an output high. Programming a fuse will cause the output to be in the V_{IL} state in the verify mode.

7. Other bits in the same word may be programmed while the V_{CC} input is raised to V_{PH} by applying output enable pulses to each output which is to be programmed. The output enable pulses must be separated by a minimum interval of t_d.

8. Lower V_{CC} to 4.5 volts following a delay of t_d from the last programming enable pulse applied to an output.

9. Enable the PROM for verification by applying V_{IL} to $\overline{CE}_x$ (PD_x) and V_{IH} to CE_x ($\overline{PD}_x$).

10. Repeat verification (step 9) at V_{CC} = 5.5 volts.

2