


HARRIS
SEMICONDUCTOR

HM-6642

T-46-13-25

January 1992

512 x 8 CMOS PROM

Features

- Low Power Standby and Operating Power
 - ICCSB100 μ A
 - ICCOP20mA at 1MHz
- Fast Access Time. 120/200ns
- Industry Standard Pinout
- Single 5.0 Volt Supply
- CMOS/TTL Compatible Inputs
- Field Programmable
- Synchronous Operation
- On-Chip Address Latches
- Separate Output Enable

Description

The HM-6642 is a 512 x 8 CMOS NiCr fusible link Programmable Read Only Memory in the popular 24 pin, byte wide pinout. Synchronous circuit design techniques combine with CMOS processing to give this device high speed performance with very low power dissipation.

On-chip address latches are provided, allowing easy interfacing with recent generation microprocessors that use multiplexed address/data bus structures, such as the 8085. The output enable controls, both active low and active high, further simplify microprocessor system interfacing by allowing output data bus control independent of the chip enable control. The data output latches allow the use of the HM-6642 in high speed pipelined architecture systems, and also in synchronous logic replacement functions.

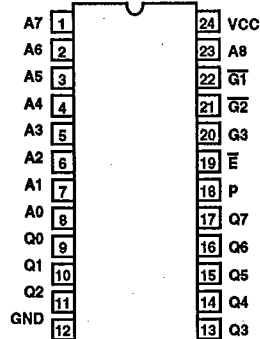
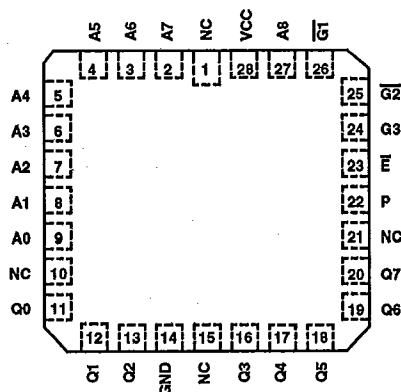
Applications for the HM-6642 CMOS PROM include low power handheld microprocessor based instrumentation and communications systems, remote data acquisition and processing systems, processor control store, and synchronous logic replacement.

All bits are manufactured storing a logical "0" and can be selectively programmed for a logical "1" at any bit location.

Ordering Information

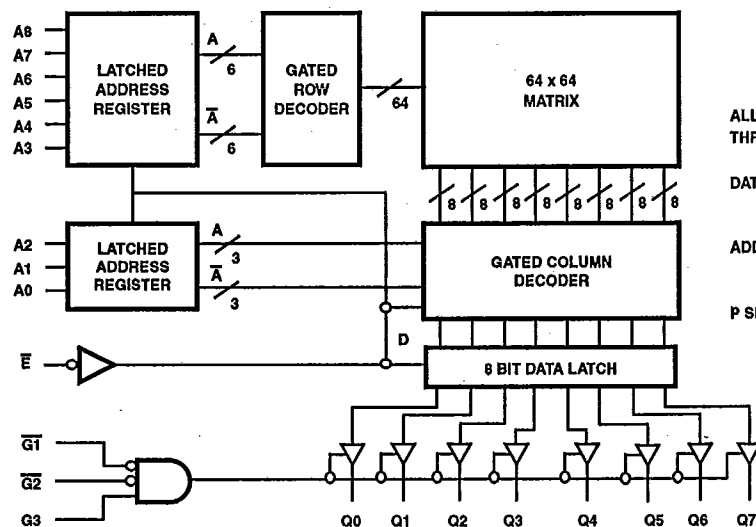
PACKAGE	TEMPERATURE RANGE	120ns	200ns
Ceramic DIP	-40°C to +85°C	HM1-6642B-9	HM1-6642-9
		HM1-6642B/883	HM1-6642/883
	-55°C to +125°C	5962-8869002JA	5962-8869001JA
SLIM	-40°C to +85°C	HM6-6642B-9	HM6-6642-9
		HM6-6642B/883	HM6-6642/883
	-55°C to +125°C	5962-8869002LA	5962-8869001LA
LCC	-40°C to +85°C	HM4-6642B-9	HM4-6642-9
		HM4-6642B/883	HM4-6642/883
	-55°C to +125°C	5962-88690023A	5962-88690013A

* Respective /883 specifications are included at the end of this datasheet.

Pinouts24 LEAD DIP
TOP VIEW28 LEAD LCC
TOP VIEW**PIN DESCRIPTION**

PIN	DESCRIPTION
NC	No Connect
A0-A8	Address Inputs
$\bar{E}$	Chip Enable
Q	Data Output
VCC	Power (+5V)
$\bar{G1}, \bar{G2}, \bar{G3}$	Output Enable
P*	Program Enable

* P should be hardwired to GND except during programming.

Functional Diagram

ALL LINES POSITIVE LOGIC -ACTIVE HIGH

THREE STATE BUFFERS:

A HIGH $\rightarrow$ OUTPUT ACTIVE

DATA LATCHES:

L HIGH $\rightarrow$ Q = D

Q LATCHES ON RISING EDGE OF $\bar{E}$

ADDRESS LATCHES AND GATED DECODERS:

LATCH ON FALLING EDGE OF $\bar{E}$

GATE ON FALLING EDGE OF $\bar{E}$

P SHOULD BE HARDWIRED TO GND EXCEPT DURING PROGRAMMING

Programming

Introduction

The HM-6642 is a 512 word by 8-bit field Programmable Read Only Memory utilizing nirome fusible links as programmable memory elements. Selected memory locations are permanently changed from their manufactured state, of all low (VOL) to a logical high (VOH), by the controlled application of programming potentials and pulses. Careful adherence to the following programming specifications will result in high programming yield. Both high VCC (6.0V) and low VCC (4.0V) verify cycles are specified to assure the integrity of the programmed fuse. This programming specification, although complete, does not preclude rapid programming. The worst case programming time required is 37.4 seconds, and typical programming time can be approximately 4 seconds per device.

The chip ($\bar{E}$) and output enable ($\bar{G}$) are used during the programming procedure. On PROMs which have more than one output enable control G3 is to be used. The other output enables must be held in the active, or enabled, state throughout the entire programming sequence. The programmer designer is advised that all pins of the programmer's socket should be at ground potential when the PROM is inserted into the socket. VCC must be applied to the PROM before any input or output pin is allowed to rise*.

Overall Programming Procedure

1. The address of the first bit to be programmed is presented, and latched by the chip enable ($\bar{E}$) falling edge. The output is disabled by taking the output enable $\bar{G}$ Low: The programming pin is enabled by taking (P) high.
2. VCC is raised to the programming voltage level, 12.5V.
3. All data output pins are pulled up to VCC program. Then the data output pin corresponding to the bit to be programmed is pulled low for 100ms. Only one bit should be programmed at a time.
4. The data output pin is returned to VCC, and the VCC pin is returned to 6.0V.
5. The address of the bit is again presented, and latched by a second chip enable falling edge.
6. The data outputs are enabled, and read, to verify that the bit was successfully programmed.
 - a). If verified, the next bit to be programmed is addressed and programmed.
 - b). If not verified, the programs verify sequence is repeated up to 8 times total.
7. After all bits to be programmed have been verified at 6.0V, the VCC is lowered to 4.0V and all bits are verified.
 - a). If all bits verify, the device is properly programmed.
 - b). If any bit fails to verify, the device is rejected.

Programming System Requirements

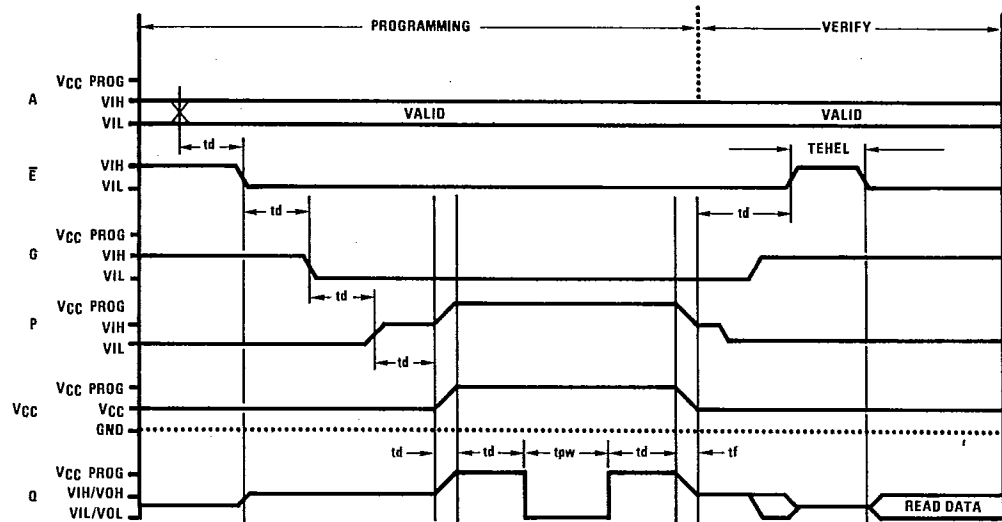
1. The power supply for the device to be programmed must be able to be set to three voltages: 4.0V, 6.0V, 12.5V. This supply must be able to supply 500mA average, and 1A dynamic, currents to the PROM during programming. The power supply rise fall times when switching between voltages must be no quicker than 1ms.
2. The address drivers must be able to supply a VIH of 4.0V and 6.0V and VIL when the system is at programming voltages.*
3. The control input buffers must be able to maintain input voltage levels of $\geq 70\%$ and $\leq 20\%$ VCC for VIH and VIL levels, respectively. Notice that chip enable ($\bar{E}$) and $\bar{G}$ does not require a pull up to programming voltage levels. The program control (P) must switch from ground to VIH and from VIH to the VCC PGM level.*
4. The data input buffers must be able to sink up to 3mA from the PROM's output pins without rising more than 0.7V above ground, be able to hold the other outputs high with a current source capability of 0.5mA to 2.0mA, and not interfere with the reading and verifying of the data output of the PROM. Notice that a bit to be programmed is changed from a low state (VOL) to high (VOH) by pulling low on the output pin. A suggested implementation is open collector TTL buffers (or inverters) with 4.7k Ω pull up resistors to VCC.*

* Never allow any input or output pin to rise more than 0.3V above VCC, or fall more than 0.3V below ground.

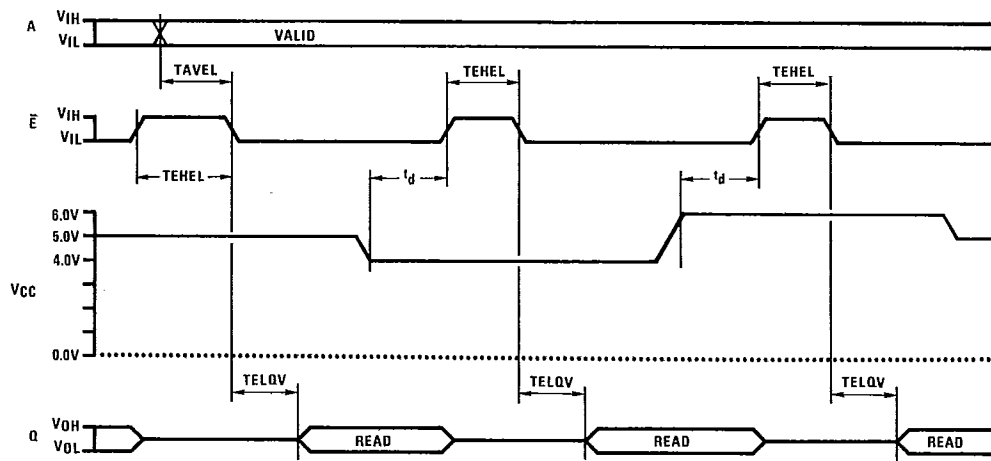
Background Information HM-6642 Programming**PROGRAMMING SPECIFICATIONS**

SYMBOL	PARAMETER	LIMITS			UNITS
		MIN	TYP	MAX	
VCC PROG	Programming VCC	12.0	12.0	12.5	V
VCCN	Operating VCC	4.5	5.5	5.5	V
VCC LV	Special Verify VCC	4.0	-	6.0	V
ICC	System ICC Capability	500	-	-	mA
ICC Peak	Transient ICC Capability	1.0	-	-	A
PROM INPUT PINS					
VOL	Output Low Voltage (To PROM)	-0.3	GND	20% VCC	V
VOH	Output High Voltage (To PROM)	70% VCC	VCC	VCC +0.3	V
IOL	Output Sink Current (At VOL)	0.01	-	-	mA
IOH	Output Source Current (At VOH)	0.01	-	-	mA
PROM DATA OUTPUT PINS					
VOL	Output Low Voltage (To PROM)	-0.3	GND	0.7	V
VOH	Output High Voltage (To PROM)	70% VCC	VCC	VCC +0.3	V
IOL	Output Sink Current (At VOL)	3.0	-	-	mA
IOH	Output Source Current (At VOH)	0.5	1.0	2.0	mA
td	Delay Time	1.0	1.0	-	μs
tr	Rise Time	1.0	10.0	10.0	μs
tf	Fall Time	1.0	10.0	10.0	μs
TEHEL	Chip Enable Pulse Width	500	-	-	ns
TAVEL	Address Valid to Chip Enable Low Time	500	-	-	ns
TELQV	Chip Enable Low to Output Valid Time	-	-	500	ns
tpw	Programming Pulse Width	90	100	110	μs
IIP	Input Leakage at VCC = VCC PROG	-10	+1.0	10	μA
TA	Ambient Temperature	-	25	-	°C

HM-6642 PROGRAMMING CYCLE



HM-6642 POST PROGRAMMING VERIFY CYCLE



Specifications HM-6642

T-46-13-25

Absolute Maximum Ratings

Supply Voltage	+7.0V
Input, Output or I/O Voltage	GND-0.3V to VCC+0.3V
Storage Temperature Range	-65°C to +150°C
Junction Temperature	+175°C
Lead Temperature (Soldering 10s)	+300°C
Typical Derating Factor	5mA/MHz Increase in ICCOP
ESD Classification	Class 1

Reliability Information

Thermal Resistance	θ_{JA}	θ_{JC}
Ceramic DIP Package	52°C/W	20°C/W
Ceramic LCC Package	58°C/W	19°C/W
Maximum Package Power Dissipation at +125°C		
Ceramic DIP Package	0.96W	
Ceramic LCC Package	0.86W	
Gate Count	1680 Gates	

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

Operating Conditions

Operating Voltage Range	+4.5V to +5.5V	Operating Temperature Range	
		HM-6642B-9, HM-6642-9	-40°C to +85°C

DC Electrical Specifications VCC = 5V $\pm$ 1%; T_A = -40°C to +85°C (HM-6642B-9, HM-6642-9)

SYMBOL	PARAMETER	LIMITS		UNITS	TEST CONDITIONS
		MIN	MAX		
ICCSB	Standby Supply Current	-	100	μ A	IO = 0, VI = VCC or GND, VCC = 5.5V
ICCOP	Operating Supply Current (Note 3)	-	20	mA	f = 1MHz, IO = 0, VI = VCC or GND, VCC = 5.5V
II	Input Leakage Current	-1.0	+1.0	μ A	GND $\leq$ VI $\leq$ VCC, VCC = 5.5V
IOZ	Output Leakage Current	-1.0	+1.0	μ A	GND $\leq$ VO $\leq$ VCC, VCC = 5.5V
VIL	Input Low Voltage	-0.3	0.8	V	VCC = 4.5V
VIH	Input High Voltage	2.4	VCC + 0.3	V	VCC = 5.5V
VOL	Output Low Voltage	-	0.4	V	IOL = 3.2mA, VCC = 4.5V
VOH1	Output High Voltage	2.4	-	V	IOH = -1.0mA, VCC = 4.5V
VOH2	Output High Voltage (Note 2)	VCC - 1.0	-	V	IOH = -100 μ A, VCC = 4.5V

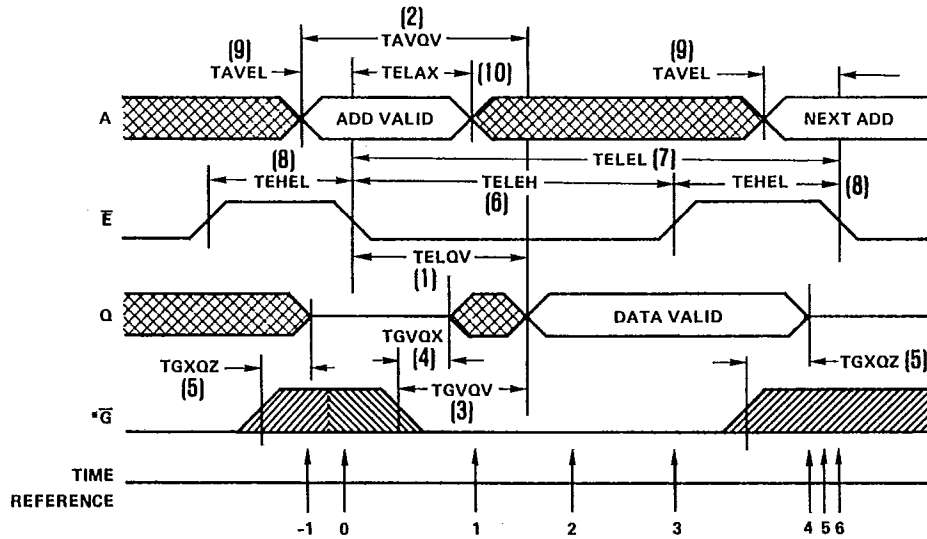
AC Electrical Specifications

SYMBOL	PARAMETER	LIMITS				UNITS	TEST CONDITIONS
		HM-6642B-9		HM-6642-9			
		MIN	MAX	MIN	MAX		
(1) TELQV	Chip Enable Access Time	-	120	-	200	ns	Notes 1, 4
(2) TAVQV	Address Access Time (TAVQV = TELQV + TAVEL)	-	140	-	220	ns	Notes 1, 4
(3) TGVQV	Output Enable Access Time	-	50	-	150	ns	Notes 1, 4
(4) TGVQX	Output Enable Time	5	50	5	150	ns	Notes 2, 4
(5) TGXQZ	Output Disable Time	-	50	-	150	ns	Notes 2, 4
(6) TELEH	Chip Enable Pulse Negative Width	120	-	200	-	ns	Notes 1, 4
(7) TELEL	Read Cycle Time	160	-	350	-	ns	Notes 1, 4
(8) TEHEL	Chip Enable Pulse Positive Width	40	-	150	-	ns	Notes 1, 4
(9) TAVEL	Address Setup Time	20	-	20	-	ns	Notes 1, 4
(10) TELAX	Address Hold Time	25	-	60	-	ns	Notes 1, 4

Capacitance T_A = +25°C

SYMBOL	PARAMETER	LIMITS		UNITS	TEST CONDITIONS
		MIN	MAX		
CI	Input Capacitance (Note 2)	-	10.0	pF	f = 1MHz, All Measurements Reference Device Ground
CO	Output Capacitance (Note 2)	-	12.0	pF	

- NOTES: 1. Input pulse levels: 0 to 3.0V; Input rise and fall times: 5ns (max); Input and output timing reference level: 1.5V; Output load: 1 TTL gate equivalent CL = 50pF (min) - for CL greater than 50pF, access time time is derated by 0.15ns per pF.
 2. Tested at initial design and after major design changes.
 3. Typical derating 5mA/MHz Increase in ICCOP.
 4. VCC = 4.5V and 5.5V

Switching Waveform**READ CYCLE**

* G has the same timing as $\bar{G}$ except signal is inverted.

Test Load Circuit