R87C64
64K (8K × 8) CMOS UV EPROM

PRELIMINARY

DESCRIPTION

The Rockwell R87C64 is an 8K × 8 (65,536 bits) ultraviolet (UV) light erasable programmable read-only-memory (EPROM). It is manufactured using CMOS technology for low power dissipation in both active and standby operating modes.

Initially, and also after erasure, all bits are in the "1" state. Data is programmed by applying 21V to V_{PP} a TTL low to $\overline{E}$, and a 50 ms low pulse on $\overline{P}$ while the desired data is stable on DQ0-DQ7 lines and the address is stable on A0-A12 lines. All bits may be erased to the "1" state by exposure to a UV light source through the transparent window on the top of the device package.

The R87C64 EPROM is ideal for system development or production applications requiring non-volatile memory in either multiple chip or single chip microcomputers with extended bus configurations. The low power requirements especially support applications using the R65C00 CMOS Microcomputer device family.

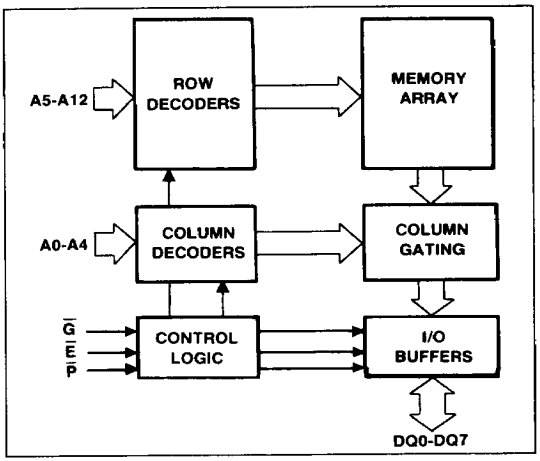
FEATURES

- 8,192 × 8 organization
- JEDEC approved pin-out
- Low Power
  —Active 75 mW (max.)
  —Standby 500 μW (max.)
- Access times: 250 ns, 300 ns and 350 ns (max.)
- Single 5V power supply
- Static operation, no clocks required
- TTL compatible inputs and tri-state outputs during both read and program mode
- Pin compatible with INTEL 2764A EPROM and Rockwell R23C64 and R2364B ROMs.

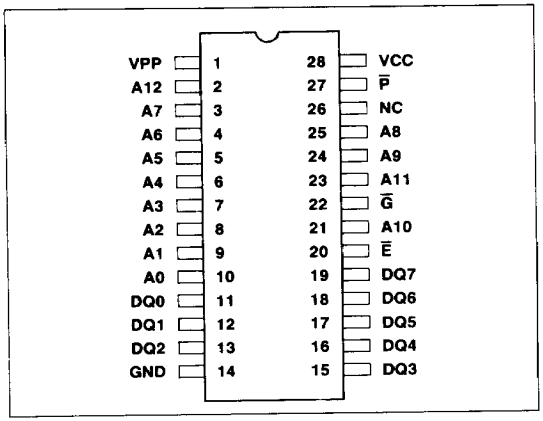
ORDERING INFORMATION

Part Number: R87C64 _ _

Access Time:
25 = 250 ns
30 = 300 ns
35 = 350 ns



R87C64 Block Diagram



R87C64 Pin Configuration

A0-A12	ADDRESSES
$\overline{E}$	CHIP ENABLE
$\overline{G}$	OUTPUT ENABLE
DQ0-DQ7	DATA INPUT/OUTPUT
$\overline{P}$	PROGRAM ENABLE

R87C64 Pin Names

ABSOLUTE MAXIMUM RATINGS*

Parameter	Symbol	Value	Unit
Supply Voltage	V_{CC}	−0.3 to +7.0	Vdc
Input Voltage All, except Vpp during Programming Vpp during Programming	V_{IN}	 −0.3 to V_{CC} +0.3 −0.3 to +22.0	Vdc
Output Voltage	V_{OUT}	−0.3 to V_{CC} +0.3	Vdc
Temperature under Bias	T_A	−10 to +80	°C
Storage Temperature	T_{STG}	−40 to +125	°C
Power Dissipation	P	1.0	W

***NOTE:** 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 extended periods may affect device reliability.

DC OPERATING CHARACTERISTICS DURING READ

V_{CC} = 5.0V ±5%, T_A = 0°C to 70°C (unless otherwise specified)

Symbol	Parameter	Min.	Typ.[3]	Max.	Unit	Test Conditions
V_{OH}	Output High Voltage	2.4		—	V	I_{OH} = −400 µA
V_{OL}	Output Low Voltage	—		0.45	V	I_{OL} = 2.1 mA
V_{IH}	Input High Voltage	2.0		V_{CC} +0.3	V	
V_{IL}	Input Low Voltage	−0.1		0.8	V	
I_{CC1}	V_{CC} Standby Current		2	100	µA	$\overline{E}$ = V_{CC}, $\overline{G}$ = V_{IL}, V_{IN} = 0V or V_{CC}
I_{CC2}	V_{CC} Active Current		2	15	mA	$\overline{E}$ = $\overline{G}$ = V_{IL}, note 4
I_{PP}	V_{PP} Current			100	µA	V_{PP} = V_{CC} max.
I_{IN}	Input Leakage Current			±10	µA	V_{IN} = 0V to V_{CC}
I_O	Output Leakage Current			±10	µA	V_{OUT} = 0V to V_{CC}
C_I	Input Capacitance[2]			7	pF	V_{CC} = 5.0V, chip deselected, pin under test at 0V, T_A = 25°C f = 1 MHz
C_O	Output Capacitance[2]			10	pF	

Notes:
1. Applies only to chip enable with power down standby mode.
2. This parameter is periodically sampled and is not 100% tested.
3. Typical values are for T_A = 25°C and V_{CC} = 5.0V
4. Cycle Time = 1 µs, all pins active, no loads.

DC OPERATING CHARACTERISTICS DURING PROGRAMMING

V_{CC} = 5.0V ±5%, T_A = 20°C to 30°C, V_{PP} = 21.0V ±0.5V

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions
V_{IH}	Input High Voltage	2.0		V_{CC} +0.3	V	
V_{IL}	Input Low Voltage	−0.1		0.8	V	
I_{CC}	V_{CC} Active Current			0.5	mA	$\overline{E}$ = $\overline{P}$ = V_{IL}, $\overline{G}$ = V_{IH}
I_{PP}	V_{PP} Active Current			30	mA	
I_{IN}	Input Leakage Current			10	µA	V_{IN} = 0V to V_{CC}

AC CHARACTERISTICS DURING READ

V_{CC} = 5.0V ± 5%, T_A = 0°C to 70°C (unless otherwise specified)

Symbol	Parameter	R87C64-25			R87C64-35			Unit	Test Conditions[3]
		Min.	Typ.	Max.	Min.	Typ.	Max.		
t_{AVQV}	Address to Data Valid			250			350	ns	$\overline{E} = \overline{G} = V_{IL}$
t_{ELQV}	Chip Enable to Data Valid			250			350	ns	$\overline{G} = V_{IL}$
t_{GLQV}[1]	Output Enable to Data Valid	10		100	10		120	ns	$\overline{E} = V_{IL}$
t_{GHQZ}[2]	Output Enable to High Impedance	0		90	0		100	ns	$\overline{E} = V_{IL}$
t_{AXQX}	Address to Output Hold	0			0			ns	$\overline{E} = \overline{G} = V_{IL}$
t_{EHQZ}	Chip Enable to High Impedance	0		90	0		100	ns	$\overline{G} = V_{IL}$

Notes:
1. $\overline{G}$ may be delayed up to $t_{AVQV}-t_{GLQV}$ after the falling edge of $\overline{E}$ without impact on t_{AVQV}. Data is available at the DQ outputs after a delay of t_{GLQV} from the falling edge of $\overline{G}$, provided that $\overline{E}$ has been low (V_{IL}) and addresses have been valid for at least $t_{AVQV}-t_{GLQV}$.
2. t_{GHQZ} and t_{EHQZ} are specified from $\overline{G}$ or $\overline{E}$, whichever occurs first.
3. Test Conditions:
   Output Load: 1 TTL gate and C_L = 100 pF
   Input Rise and Fall Times: ≤20 ns
   Input Pulse Levels: 0.45V to 2.4V
   Timing Measurement Reference Level: Inputs 1V and 2V
   Outputs 0.8V and 2V

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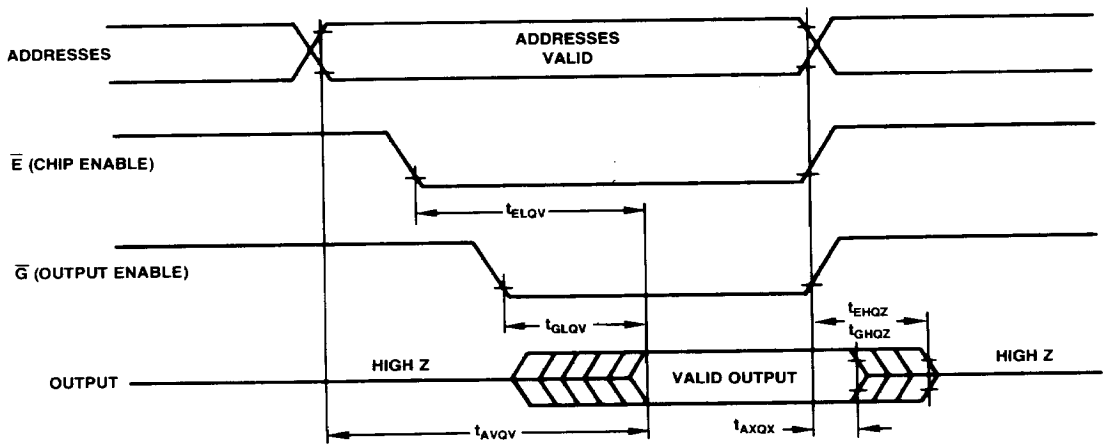
READ TIMING DIAGRAM



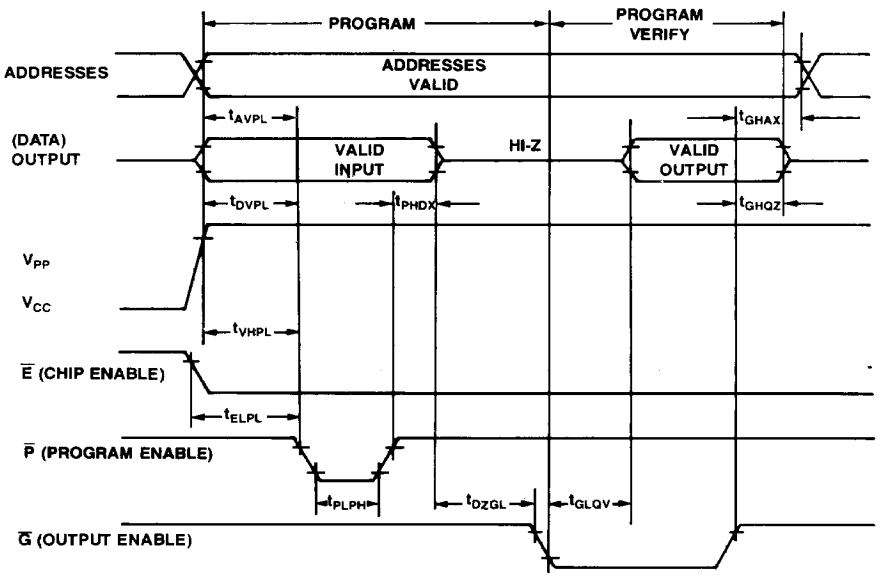
AC CHARACTERISTICS DURING PROGRAM

V_{CC} = 5.0V ± 5%, T_A = 20°C to 30°C (unless otherwise specified)

Symbol	Parameter	Min.	Typ.	Max.	Units
t_{AVPL}	Address set-up time	2			μs
t_{DZGL}	$\overline{G}$ set-up time	2			μs
t_{DVPL}	Data set-up time	2			μs
t_{ELPL}	$\overline{E}$ set-up time	2			μs
t_{VHPL}	V_{PP} set-up time	2			μs
t_{PHDX}	Data hold time	2			μs
t_{GHAX}	Address hold time	0			μs
t_{GLQV}	Output enable to data valid			120	ns
t_{GHQZ}	Output disable to output high impedance	0		100	ns
t_{PLPH}	$\overline{PE}$ pulse width during programming	45	50	55	ms

Notes:
Test Conditions:
Output Load: 1 TTL gate and C_L = 100 pF
Input Rise and Fall Times: ≤20 ns
Input Pulse Levels: 0.45V to 2.4V
Timing Measurement Reference Level: Inputs 1V and 2V
Outputs 0.8V and 2V

PROGRAM TIMING DIAGRAM



OPERATING MODES

The Rockwell R87C64 has five modes of operation (see table 1).

Read Mode

The read mode is governed by two control pins, $\overline{E}$ and $\overline{G}$. In order to obtain data at the outputs, both $\overline{E}$ and $\overline{G}$ must be V_{IL}. $\overline{E}$ is the power control and should be used for device selection. $\overline{G}$ is the output control and should be used to gate data to the output pins. Valid data will appear on the output pins after T_{AVQV}, T_{ELQV} or T_{GLQV} times, depending on which is limiting.

Standby Mode

The standby mode of the R87C64 reduces power dissipation. The R87C64 is placed in the standby mode by making $\overline{E} = V_{IH}$. This is independent of $\overline{G}$ and automatically puts the outputs in their high impedance (High-Z) state.

Program Mode

The R87C64 is in the program mode when V_{PP} is at 21V with $\overline{E}$ input at V_{IL}. The data to be programmed is applied to the data output pins. When the address controls and data are stable, a 50 msec program pulse is applied to the $\overline{P}$ input.

Program Verify Mode

A program verify should be performed on the programmed bits to determine that they were correctly programmed. The verify may be performed with V_{PP} at 21V. Data should be verified to t_{GLQV} after the falling edge of $\overline{G}$.

Program Inhibit Mode

The program inhibit mode allows programming several R87C64 EPROMs simultaneously with different data for each by using E to control which devices respond to the program pulse on $\overline{P}$.

Table 1. Mode Selection

Mode \ Pin	$\overline{E}$ (20)	$\overline{G}$ (22)	$\overline{P}$ (27)	V_{PP} (1)	V_{CC} (28)	DQ0-DQ7 (11-13, 15-19)
Read	V_{IL}	V_{IL}	V_{IH}	+5	+5	Q_{OUT}
Standby	V_{IH}	No Effect	No Effect	+5	+5	High-Z
Program	V_{IL}	No Effect	V_{IL}	+21	+5	D_{In}
Program verify	V_{IL}	V_{IL}	V_{IH}	+21	+5	Q_{OUT}
Program inhibit	V_{IH}	No Effect	No Effect	+21	+5	High-Z
Program inhibit	No Effect	No Effect	V_{IH}	+21	+5	High-Z

Note: No Effect = No effect on selection/enable logic, however, no voltage other than logic levels shall be applied.

ERASURE PROCEDURE

Initially, and after each erasure by ultraviolet light, all bits of the R87C64 are in the "1" state. In Program Mode, "0"s are selectively programmed into the desired bit locations. The only way to change a "0" to a "1" is by ultra-violet light erasure.

The recommended erasure procedure for the R87C64 is exposure to ultra-violet light which has a wavelength of 2537 Angstroms.

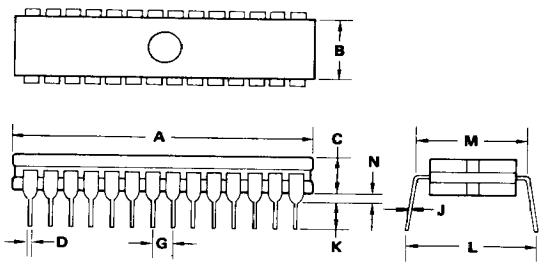
The integrated dose for erasure should be a minimum of 15 W-sec/cm^2. The erasure time with this dosage is 20 minutes using an ultraviolet lamp with a 12000 uW/cm^2 power rating.

Caution

The erasure begins to occur when exposed to light with wavelengths shorter than approximately 4000 Angstroms. Sunlight and certain types of fluorescent lamps have wavelengths in the 3000-4000 Angstroms range.

PACKAGE DIMENSIONS

28-PIN CERDIP



DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	36.32	37.34	1.430	1.470
B	12.95	13.46	0.510	0.530
C	3.68	4.19	0.145	0.165
D	0.41	0.51	0.016	0.020
F	1.27	1.52	0.050	0.060
G	2.54 BSC		0.100 BSC	
J	0.20	0.30	0.008	0.012
J	0.20	0.30	0.008	0.012
K	3.18	4.19	0.125	0.165
L	16.13	17.41	0.635	0.685
M	15.24	15.75	0.600	0.620
N	0.89	1.14	0.035	0.045