Rockwell

R87C32
32K (4K × 8) CMOS UV EPROM

PRELIMINARY

FEATURES

- 4096 × 8 organization
- JEDEC approved pin-out
- Low Power
  - —Active: 132 mW (max.)
  - —Standby: 525 μW (max.)
- Access time
  - —R87C32-45 450 ns (max.)
  - —R87C32-35 350 ns (max.)
- Single 5V power supply
- Static operation
  - —no clocks required
- Inputs and tri-state outputs TTL compatible during both read and program mode
- Standard 24-pin dual-in-line package
  - —Pin compatible with INTEL 2732A EPROM

ORDERING INFORMATION

Part Number: R87C32__

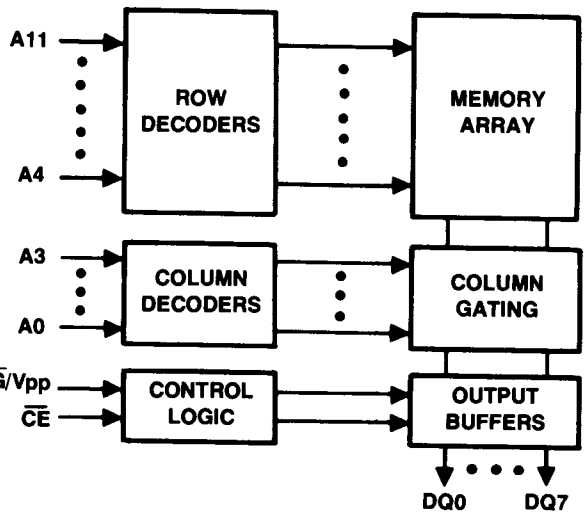
Access Time:
35 = 350 ns
45 = 450 ns

DESCRIPTION

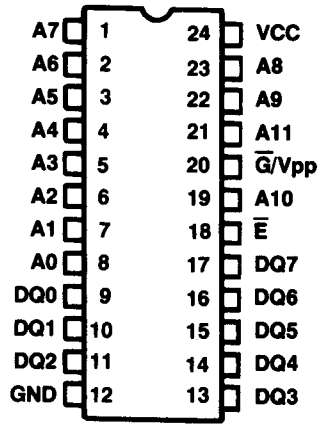
The Rockwell R87C32 is a 4K × 8 (32,768 bits) ultraviolet (UV) light erasable programmable Read-Only-Memory (EPROM). It is manufactured using CMOS technology for low power dissipation in both active and standby operating modes. Single 5V operation allows simple circuit design in runtime environments.

Initially, all bits are in the "1" state. Programming is performed by applying 21V to $\overline{G}$/Vpp and a 50 ms "0" level to $\overline{E}$ while the desired data is stable on DQ0-DQ7 lines and the address is stable on A0-A11 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 R87C32 EPROM is ideal for system development or low volume 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.



R87C32 Block Diagram



R87C32 Pin Configuration

A0-A11	ADDRESSES
$\overline{E}$	CHIP ENABLE
$\overline{G}$/Vpp	OUTPUT ENABLE/PROGRAM
DQ0-DQ7	DATA OUTPUT

R87C32 Pin Names

ABSOLUTE MAXIMUM RATINGS*

Parameter	Symbol	Value	Unit
Supply Voltage	V_{CC}	−0.3 to +7.0	Vdc
Input Voltage All, except $\overline{G}$/Vpp during Programming $\overline{G}$/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.

OPERATING CONDITIONS

Parameter	Read Mode	Program Mode
V_{CC} Supply Voltage	5V ± 5%	5V ± 5%
V_{PP} Supply Voltage		21V ± 0.5V
Temperature Range	0 to 70°C	0 to 70°C

DC OPERATING CHARACTERISTICS

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

Symbol	Parameter	Min.	Typ.	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}	V	
V_{IL}	Input Low Voltage	−0.1		0.8	V	
I_{CC1}	V_{CC} Standby Current			100	μA	$\overline{E}$ = V_{CC}, $\overline{G}$ = 0V, V_{IN} = 0V or V_{CC}
I_{CC2}	V_{CC} Active Current			25	mA	$\overline{E}$ = $\overline{G}$ = V_{IL}
I_{PP}	V_{PP} Supply Current			30	mA	$\overline{E}$ = V_{IL}, $\overline{G}$/V_{PP} = V_{PP}
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}

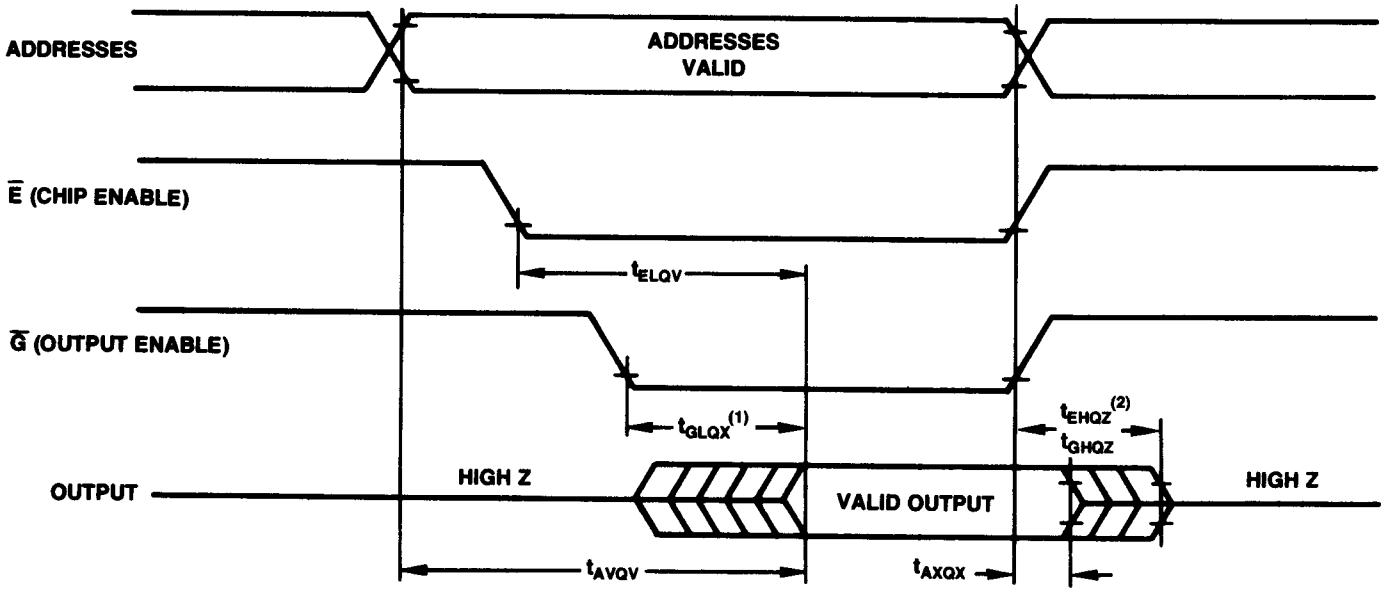
AC CHARACTERISTICS DURING READ

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

Symbol	Parameter	R87C32-35			R87C32-45			Unit	Test Conditions
		Min.	Typ.	Max.	Min.	Typ.	Max.		
t_{AVQV}	Address to Data Valid			350			450	ns	$\overline{E} = \overline{G} = V_{IL}$
t_{ELQV}	Chip Enable to Data Valid			350			450	ns	$\overline{G} = V_{IL}$
t_{GLQX} (1)	Output Enable to Data Valid			120			120	ns	$\overline{E} = V_{IL}$
t_{GHQZ} (2)	Output Enable to High Impedance	0		100	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		100	0		100	ns	$\overline{G} = V_{IL}$

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

READ TIMING DIAGRAM



Notes:
1. $\overline{G}$ may be delayed up to $t_{AVQV} - t_{GLQX}$ after the falling edge of $\overline{E}$ without impact on t_{AVQV}.
2. t_{GHQZ}, t_{EHQZ} is specified from $\overline{G}$ or $\overline{E}$, whichever occurs first.

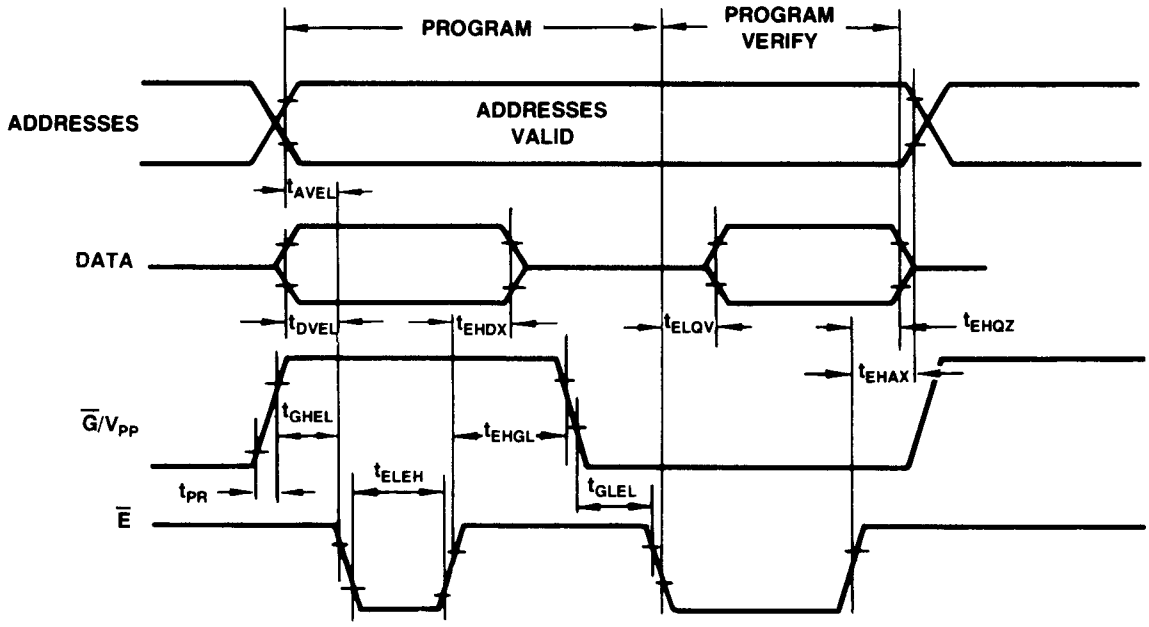
AC CHARACTERISTICS DURING PROGRAM

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

Symbol	Parameter	Min.	Typ.	Max.	Units
t_{AVEL}	Address set-up time	2			μs
t_{GHEL}	$\overline{G}$ set-up time	2			μs
t_{DVEL}	Data set-up time	2			μs
t_{EHAX}	Address hold time	0			μs
t_{EHGL}	$\overline{G}$ hold time	2			μs
t_{EHDX}	Data hold time	2			μs
t_{EHQZ}	Output disable to output Hi-Z delay	0		100	ns
t_{ELQV}	Data valid from $\overline{E}$			1	μs
t_{ELEH}	$\overline{E}$ pulse width during programming	45	50	55	ms
t_{PR}	$\overline{G}$ pulse rise time during programming	50			ns
t_{GLEL}	V_{PP} recovery time	2			μs

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 R87C32 has five modes of operation (see table 1) and is pin compatible with Intel's 2732A.

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} or T_{ELQV} times, depending on which is limiting.

The standby mode of the R87C32 reduces power dissipation. The R87C32 is placed in the standby mode by making $\overline{E} = V_{IH}$. This is independent of G and automatically puts the outputs in their high impedance (High-Z) state.

The R87C32 is in the programming mode when $\overline{G}/V_{PP}$ is at 21V. The data to be programmed is applied to the data output pins. When the address and data are stable, a 50 msec program pulse is applied to the $\overline{E}$ input. Erasing the R87C32 for reprogramming is accomplished by exposing it to an ultraviolet light source for approximately 20 minutes.

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

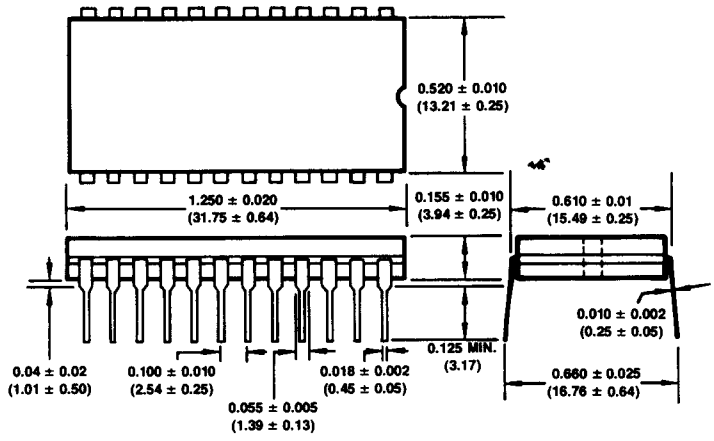
The program inhibit mode allows programming several R87C32 EPROMs simultaneously with different data for each by controlling which devices receive the program pulse on the $\overline{E}$ pin.

Table 1. Mode Selection

Pin / Mode	$\overline{E}$ (18)	$\overline{G}/V_{PP}$ (20)	V_{CC} (24)	DQ0-DQ7 (9-11, 13-17)
Read	V_{IL}	V_{IL}	+5	D_{OUT}
Standby	V_{IH}	Don't care	+5	High-Z
Program	Pulsed V_{IH} to V_{IL}	V_{PP}	+5	D_{IN}
Program verify	V_{IL}	V_{IL}	+5	D_{OUT}
Program inhibit	V_{IH}	V_{PP}	+5	High-Z

PACKAGING DIAGRAM

24-PIN CERDIP



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