512 Bit Electrically Alterable Read Only Memory

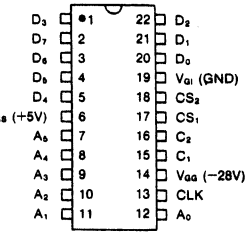
FEATURES

- 64 word x 8 bit organization
- 6 bit binary addressing
- +5, −28V power supplies
- Word Alterable
- 10 year data storage for ER2055 (at +70°C)
- 1 year data storage for ER2055 IR (at +85°C) and ER2055 HR (at +125°C)
- TTL compatible with pull-up resistors on inputs
- Tri-state outputs
- Read Time: 2μs (ER2055), 4μs (ER2055 IR and ER2055 HR)
- Write/Erase Time: 50ms (ER2055), 100ms (ER2055 HR)
- No voltage switching required
- 2 chip selects
- Two extended temperature ranges:
  −40°C to +85°C (Industrial) Part # ER2055 IR
  −55°C to +125°C (Hi-Rel) Part # ER2055 HR

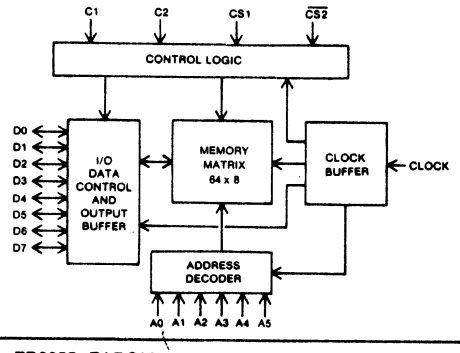
PIN CONFIGURATION

22 LEAD DUAL IN LINE

Top View



BLOCK DIAGRAM



DESCRIPTION

The ER2055 is a fully decoded 64 x 8 electrically erasable and reprogrammable ROM. Write, erase, and read voltages are switched internally via a 2-bit code applied to C1 and C2.

Data is stored by applying negative writing pulses that selectively tunnel charge into the oxide-nitride interface of the gate insulator of the 512 MNOS memory transistors. When the writing voltage is removed the charge trapped at the interface is manifested as a negative shift in the threshold voltage of the selected memory transistors.

OPERATION

Data is stored in a two transistor memory cell. After the cell is preconditioned by an erase signal (which causes a positive shift in the threshold of both transistors), data is written into one of the transistors making its threshold more negative. A sensing flip flop is used to read the memory cell and presents a logic high or low to the output depending on which transistor is "written".

The ER2055 EAROM may be operated with V_{SS} between +5 and +10 volts for either TTL or CMOS compatibility. The negative power supply, V_{GG}, should be adjusted so that the difference between V_{SS} and V_{GG} is always 33 volts.

It is important to note two things: first, that an erase is required before a write to precondition the cell, and second, that after an erase, both transistors will have the same threshold voltage and valid data will not be present at the output.

The ER2055 EAROM uses dynamic edge triggered circuits internally. This requires either a mode change, a clock or a transition of the chip selects between successive operations. Thus successive operations in the same mode must be separated by transition of one of these four lines. Clock pulses are not normally required during erase or write operations, but are needed for successive operations if the chip select is held high, i.e., applications where one EAROM is used.

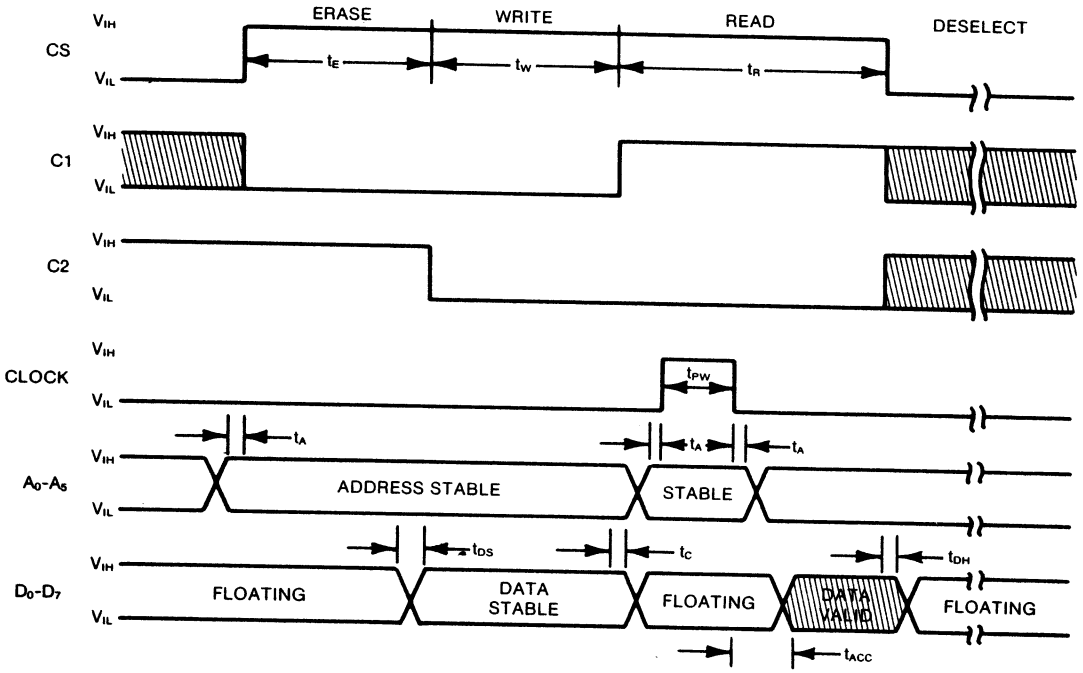
In using the read clock to refresh the outputs during a read operation a minimal frequency is recommended to insure that the read cycle lifetime between writes (N_{RA}) is kept to a maximum.

The ER2055 IR and ER2055 HR are screened to Mil Std. 883B/method 5004.1/level B, pre-cap visual inspection, environmental testing, burn-in and external visual. They are available in 28 lead ceramic dual in line packages.

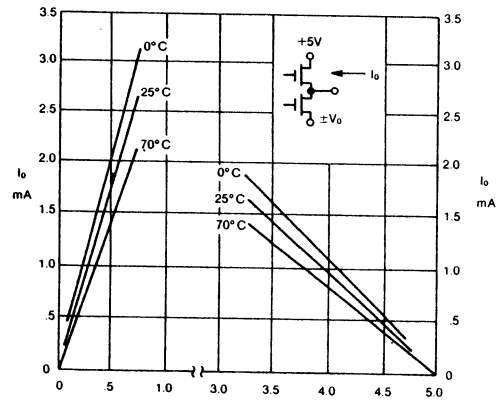
PIN FUNCTIONS

A_0-A_5	6-Bit Word Address
D_0-D_7	Data input and output pins
CS1, $\overline{CS2}$	Chip Selects Chip selected at logic "1" on CS1 and logic "0" on $\overline{CS2}$. When chip is not selected, outputs are open circuit, read; write and erase are disabled. Power is reduced.
C1, C2	Mode Control Inputs C1 C2 0 1 Erase Mode: stored data is erased at addressed location. 1 0 Read Mode: addressed data read after clock pulse. Output data retained at output pins until next read operation. 0 0 Write Mode: input data written at addressed location. Clock not required.
CLK	Clock Input. Pulse to logic "1" for read operation. Data will remain valid for 20 to 60 seconds; the outputs will then become open circuit until another clock pulse is received.
V_{SS}	Substrate supply. Normally at +5 volts.
V_{GI}	Ground Input.
V_{GG}	Power Supply Input. Normally at -28 volts.

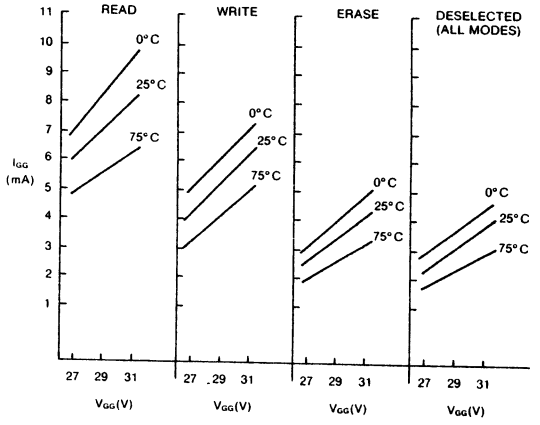
TIMING DIAGRAM



TYPICAL OUTPUT CHARACTERISTICS



TYPICAL SUPPLY CURRENT VS POWER SUPPLY VOLTAGE



ELECTRICAL CHARACTERISTICS

Maximum Ratings*

All inputs and outputs (with respect to Vss) ..... -35V to +0.3V
Storage temperature ..... -65°C to +150°C
Soldering temperature of leads (10 seconds) ..... +300°C

*Exceeding these ratings could cause permanent damage. Functional operation of these devices at these conditions is not implied—operating ranges are specified below.

Standard Conditions (for TTL Compatibility)

V_{SS} = +5V±5%
V_{GG} = -28V±5%
V_{GI} = GND
Operating Temperature T_A = 0°C to +70°C for ER2055
T_A = −40°C to +85°C for ER2055 IR
T_A = −55°C to +125°C for ER2055 HR
Output Load = 100pF, 1 TTL load

		ER2055			ER2055 IR/ER2055 HR				
Characteristics	**Sym**	**Min.**	**Typ.****	**Max.**	**Min.**	**Typ.****	**Max.**	**Units**	**Conditions**
DC CHARACTERISTICS									
Input Logic "1"	V_{IH}	V_{SS} −1.5	—	V_{SS} +0.3	V_{SS} −1.5	—	V_{SS} +0.3	V	
Input Logic "0"	V_{IL}	V_{SS} −15	—	0.8	V_{SS} −10	—	0.6	V	
Output Logic "1"	V_{OH}	V_{SS} −1.5	—	—	V_{SS} −1.5	—	—	V	I_{OH} = 100μA
Output Logic "0"	V_{OL}	—	—	0.6	—	—	0.6	V	I_{OL} = 1.6mA for V_{SS} = 5V
Input Leakage	I_L	—	2	10	—	2	10	μA	V_{IN} = V_{SS} −15
Output Leakage	I_O	—	2	10	—	2	10	μA	Chip deselected
Power Supply Current									
Read	I_{GG}	—	8	10	—	8	13	mA	I_{SS} approx. I_{GG}
Write	I_{GG}	—	6	7	—	6	9	mA	I_{SS} approx. I_{GG}
Erase	I_{GG}	—	4	6	—	4	8	mA	I_{SS} approx. I_{GG}
Deselected	I_{GG}	—	3	4	—	3	6	mA	I_{SS} approx. I_{GG}
AC CHARACTERISTICS									
Access Time	t_{ACC}	—	—	2.0	—	—	4.0	μs	
Clock Pulse width	t_{PW}	2.0	—	20.0	2.0	—	20.0	μs	
Erase Cycle Time	t_E	50	—	200.0	100	—	200.0	ms	
Write Cycle Time	t_W	50	—	200.0	100	—	200.0	ms	
Read Cycle Time	t_R	5.0	—	24.0	6.0	—	25.0	μs	
Address to Clock Time	t_A	50	—	—	50	—	—	ns	
Data Set Up Time	t_{DS}	50	—	—	50	—	—	ns	
Data Hold Time	t_{DH}	50	—	—	50	—	—	ns	
Control to Address & Data Change	t_C	0	—	—	0	—	—	ns	
Number of Reads/Word Refresh	N_{RA}	10^{11}	—	—	10^{11}	—	—		
Number of Erase/Write Cycles	N_W	10^6	—	—	10^5	—	—	—	
Input Capacitance, all pins	C_{IO}	—	6	10	—	6	10	pF	
Unpowered Data Storage Time	t_S	10	—	—	1	—	—	Years	at max. temperature
Power Dissipation Read Cycle	P_D	—	450	500	—	450	500	mW	at 25°C V_{SS} = +5, V_{GG} = −29
	P_D	not applicable			—	—	500	mW	at 125°C V_{SS} = +5, V_{GG} = −29
	P_D	not applicable			—	—	600	mW	at −55°C V_{SS} = +5, V_{GG} = −29
Pulse Rise, fall time	t_{R1} t_F	10	—	100	10	—	100	ns	

**Typical values are at +25°C and nominal voltages.

EAROM