TEMIC

Semiconductors

M65608E

128 K × 8 Very Low Power CMOS SRAM Rad Tolerant

Introduction

The M65608E is a very low power CMOS static RAM organized as 131072×8 bits.

TEMIC brings the solution to applications where fast computing is as mandatory as low consumption, such as aerospace electronics, portable instruments, or embarked systems.

Utilizing an array of six transistors (6T) memory cells, the M65608E combines an extremely low standby

supply current (Typical value = 0.2 µA) with a fast access time at 30 ns over the full military temperature range. The high stability of the 6T cell provides excellent protection against soft errors due to noise.
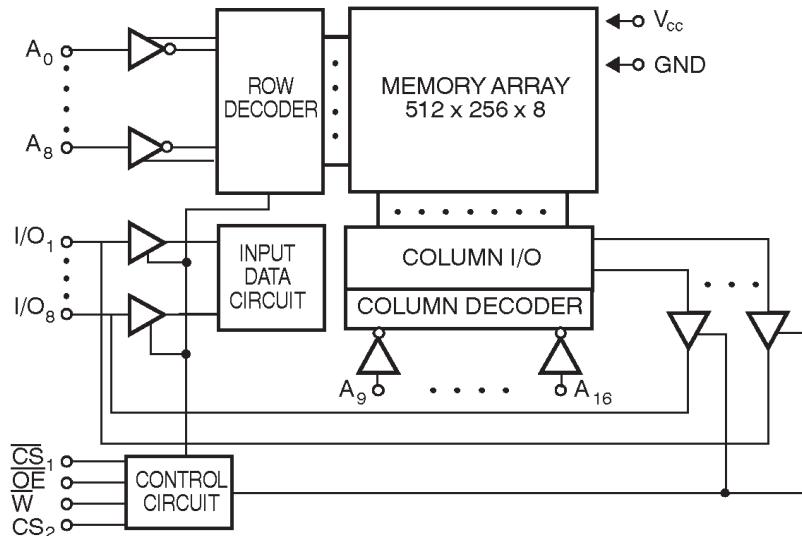
The M65608E is processed according to the methods of the latest revision of the MIL STD 883 (class B or S), ESA SCC 9000 or QML.

Features

- Access time: 30, 45 ns
- Very low power consumption
  active : 250 mW (Typ)
  standby : 1 µW (Typ)
  data retention : 0.5 µW (Typ)
- Wide temperature Range : –55 To +125°C
- 400 Mils width package

- TTL compatible inputs and outputs
- Asynchronous
- Single 5 volt supply
- Equal cycle and access time
- Gated inputs :
 no pull-up/down
  resistors are required
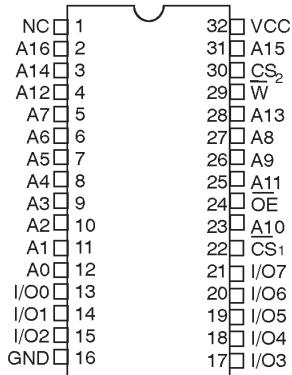
Interface

Block Diagram

M65608E

Pin Configuration

32 pins DIL side-brazed   400 MILS
32 pins Flatpack   400 MILS

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        ┌───────⌣───────┐
  NC  ─┤ 1          32 ├─ VCC
 A16  ─┤ 2          31 ├─ A15
 A14  ─┤ 3          30 ├─ CS₂
 A12  ─┤ 4          29 ├─ W
  A7  ─┤ 5          28 ├─ A13
  A6  ─┤ 6          27 ├─ A8
  A5  ─┤ 7          26 ├─ A9
  A4  ─┤ 8          25 ├─ A11
  A3  ─┤ 9          24 ├─ OE
  A2  ─┤ 10         23 ├─ A10
  A1  ─┤ 11         22 ├─ CS₁
  A0  ─┤ 12         21 ├─ I/O7
 I/O0 ─┤ 13         20 ├─ I/O6
 I/O1 ─┤ 14         19 ├─ I/O5
 I/O2 ─┤ 15         18 ├─ I/O4
 GND  ─┤ 16         17 ├─ I/O3
        └───────────────┘
```

Pin Names

A0–A16	Address inputs
I/O0–I/O7	Data Input/Output
$\overline{CS_1}$	Chip select 1
CS_2	Chip select 2
$\overline{W}$	Write Enable
$\overline{OE}$	Output Enable
V_{CC}	Power
GND	Ground

Truth Table

$\overline{CS_1}$	CS_2	$\overline{W}$	$\overline{OE}$	INPUTS/ OUTPUTS	MODE
H	X	X	X	Z	Deselect/ Power-down
X	L	X	X	Z	Deselect/ Power Down
L	H	H	L	Data Out	Read
L	H	L	X	Data In	Write
L	H	H	H	Z	Output Disable

L = low, H = high, X = H or L, Z = high impedance.

Electrical Characteristics

Absolute Maximum Ratings

Supply voltage to GND potential : . . . . - 0.5 V + 7.0 V

DC input voltage : . . . . GND – 0,3 V to VCC + 0,3

DC output voltage high Z state : . . . . . . GND – 0,3 V to VCC + 0,3

Storage temperature : . . . . –65 °C to + 150 °C

Output current into outputs (low) : . . . . 20 mA

Electro statics discharge voltage : . . . . > 2 001 V
(MIL STD 883D method 3015.3)

Operating Range

	OPERATING VOLTAGE	OPERATING TEMPERATURE
Military	5 V ± 10 %	– 55 °C to + 125 °C

Recommended DC Operating Conditions

PARAMETER	DESCRIPTION	MINIMUM	TYPICAL	MAXIMUM	UNIT
Vcc	Supply voltage	4.5	5.0	5.5	V
Gnd	Ground	0.0	0.0	0.0	V
VIL	Input low voltage	GND – 0.3	0.0	0.8	V
VIH	Input high voltage	2.2	–	V_{CC} + 0.3	V

Capacitance

PARAMETER	DESCRIPTION	MINIMUM	TYPICAL	MAXIMUM	UNIT
Cin (1)	Input low voltage	–	–	8	pF
Cout (1)	Output high volt	–	–	8	pF

Note :   1. Guaranteed but not tested.

DC Parameters

PARAMETER	DESCRIPTION	MINIMUM	TYPICAL	MAXIMUM	UNIT
IIX (2)	Input leakage current	– 1	–	1	µA
IOZ (2)	Output leakage current	– 1	–	1	µA
VOL (3)	Output low voltage	–	–	0.4	V
VOH (4)	Output high voltage	2.4	–	–	

Notes :   2. Gnd < Vin < Vcc, Gnd < Vout < Vcc Output Disabled.
         3. Vcc min. IOL = 8.0 mA.
         4. Vcc min. IOH = –4.0 mA.

Consumption

SYMBOL	DESCRIPTION	65608 – 30	65608 – 45	UNIT	VALUE
ICCSB (5)	Standby supply current	2.5	2.5	mA	max
ICCSB$_1$ (6)	Standby supply current	300	300	μA	max
ICCOP (7)	Dynamic operating current	150	120	mA	max

Notes : 5. $\overline{CS}_1 \geq$ VIH or CS$_2 \leq$ VIL and $\overline{CS}_1 \leq$ VIL.
6. $\overline{CS}_1 \geq$ Vcc – 0.3 V or, CS$_2 <$ Gnd + 0.3 V and $\overline{CS}_1 \leq$ 0.2 V
7. F = 1/TAVAV, Iout = 0 mA, $\overline{W} = \overline{OE} =$ VIH, Vin = Gnd/Vcc, Vcc max.

AC Parameters

Input pulse levels : . . . . Gnd to 3.0 V

Input rise : . . . . 5 ns

Input timing reference levels : . . . . 1.5 V

Output loading IOL/IOH (see figure 1a and 1b) : . . . . + 30 pF

AC Test Loads Waveforms
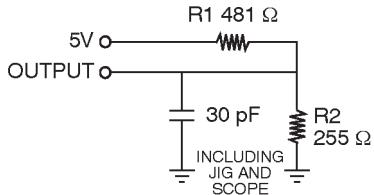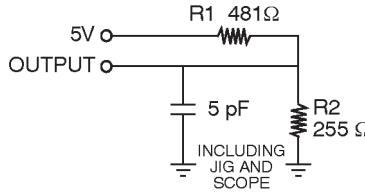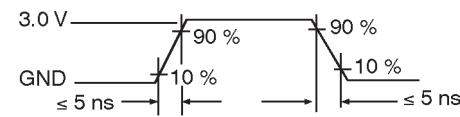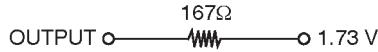

Figure 1a   **Figure 1b**   **Figure 2**

Equivalent to : THEVENIN EQUIVALENT
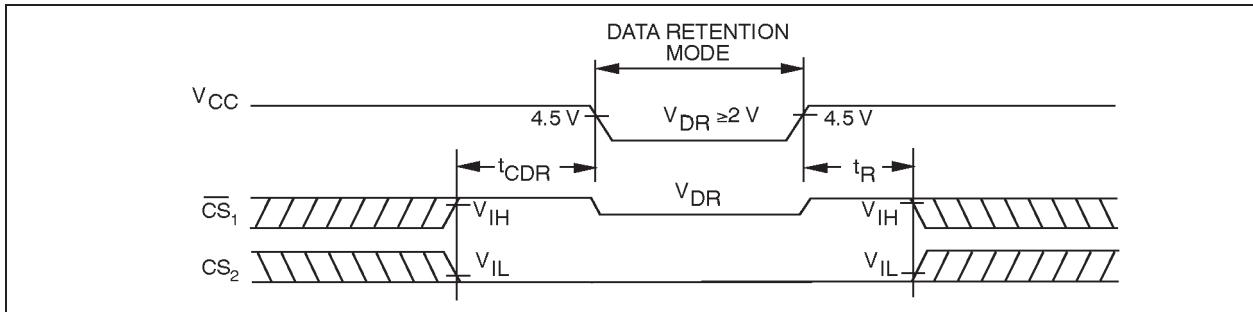

Data Retention Mode

MHS CMOS RAM's are designed with battery backup in mind. Data retention voltage and supply current are guaranteed over temperature. The following rules insure data retention :

1. . During data retention chip select $\overline{CS}_1$ must be held high within VCC to VCC -0.2 V or, chip select CS$_2$ must be held low within GND to GND + 0.2 V.

2. Output Enable ($\overline{OE}$) should be held high to keep the RAM outputs high impedance, minimizing power dissipation.

3. During power up and power down transitions $\overline{CS}_1$ and $\overline{OE}$ must be kept between VCC + 0.3 V and 70 % of VCC, or with CS$_2$ between GND and GND - 0.3 V.

4. The RAM can begin operation > 45 ns after Vcc reaches the minimum operation voltages (4.5 V).

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Timing

Data Retention Characteristics

PARAMETER	DESCRIPTION	MINIMUM	TYPICAL $T_A = 25\ °C$	MAXIMUM			UNIT
VCCDR	Vcc for data retention	2.0	–	–			V
TCDR	Chip deselect to data retention time	0.0	–	–			ns
TR	Operation recovery time	TAVAV (9)	–	–			ns
ICCDR1 (10)	Data retention current @ 2.0 V : M-65608	–	0.1			150	µA
ICCDR2 (10)	Data retention current @ 3.0 V : M-65608	–	0.2			200	µA

Notes : 9. TAVAV = Read cycle time.
10. $\overline{CS}_1$ = Vcc or $CS_2 = \overline{CS}_1$ = GND, Vin = Gnd/Vcc, this parameter is only tested at Vcc = 2 V.

Write Cycle
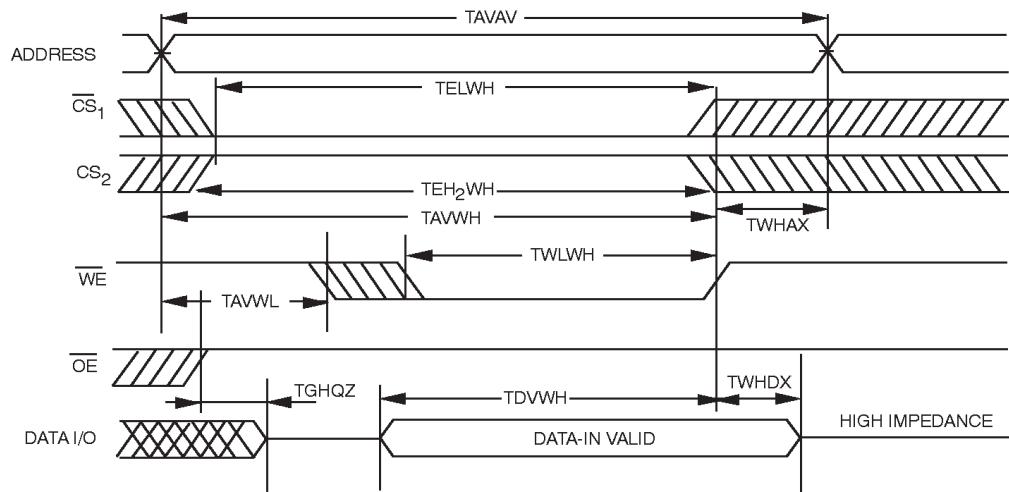
SYMBOL	PARAMETER	65608 – 30	65608 – 45	UNIT	VALUE
TAVAW	Write cycle time	30	45	ns	min
TAVWL	Address set-up time	0	0	ns	min
TAVWH	Address valid to end of write	22	35	ns	min
TDVWH	Data set-up time	18	25	ns	min
TE_1LWH	$\overline{CS}_1$ low to write end	22	35	ns	min
TE_2HWH	CS_2 high to write end	22	35	ns	min
TWLQZ	Write low to high Z (11)	8	15	ns	max
TWLWH	Write pulse width	22	35	ns	min
TWHAX	Address hold from to end of write	0	0	ns	min
TWHDX	Data hold time	0	0	ns	min
TWHQX	Write high to low Z (11)	0	0	ns	min

Read Cycle
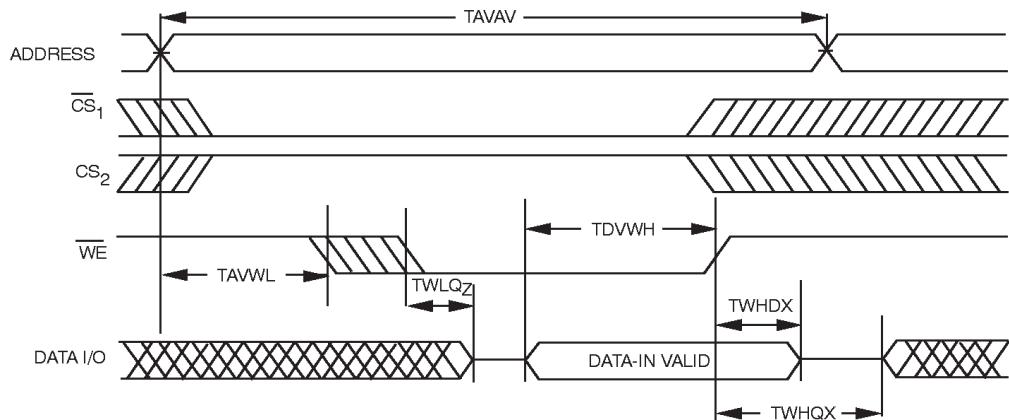
SYMBOL	PARAMETER	65608 – 30	65608 – 45	UNIT	VALUE
TAVAV	Read cycle time	30	45	ns	min
TAVQV	Address access time	30	45	ns	max
TAVQX	Address valid to low Z	5	5	ns	min
TE_1LQV	Chip-select$_1$ access time	30	45	ns	max
TE_1LQX	$\overline{CS}_1$ low to low Z (11)	3	3	ns	min
TE_1HQZ	$\overline{CS}_1$ high to high Z (11)	18	20	ns	max
TE_2HQV	Chip-select$_2$ access time	30	45	ns	max
TE_2HQX	CS_2 high to low Z (11)	3	3	ns	min
TE_2LQZ	CS_2 low to high Z (11)	18	20	ns	max
TGLQV	Output Enable access time	12	15	ns	max
TGLQX	$\overline{OE}$ low to low Z (11)	0	0	ns	min
TGHQZ	$\overline{OE}$ high to high Z (11)	8	15	ns	max

Notes : 11. Parameters guaranteed, not tested, with output loading 5 pF. (see fig. 1.b.).
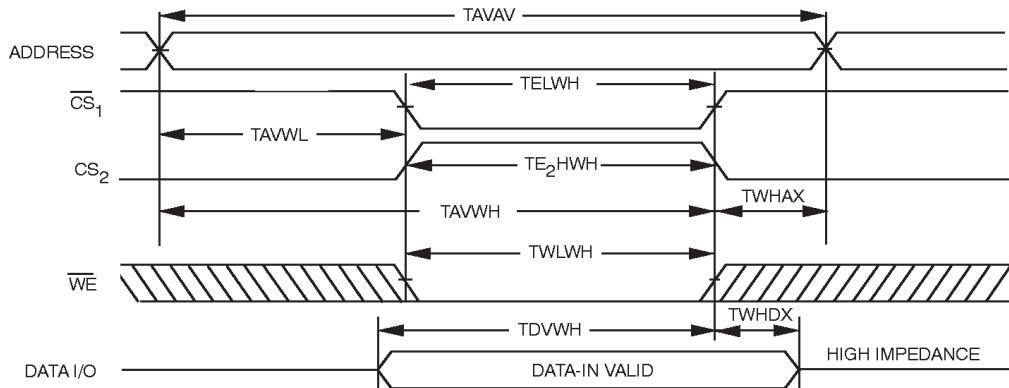
Write Cycle 1. $\overline{W}$ Controlled. $\overline{OE}$ High During Write

## Write Cycle 2. $\overline{W}$ Controlled. $\overline{OE}$ Low
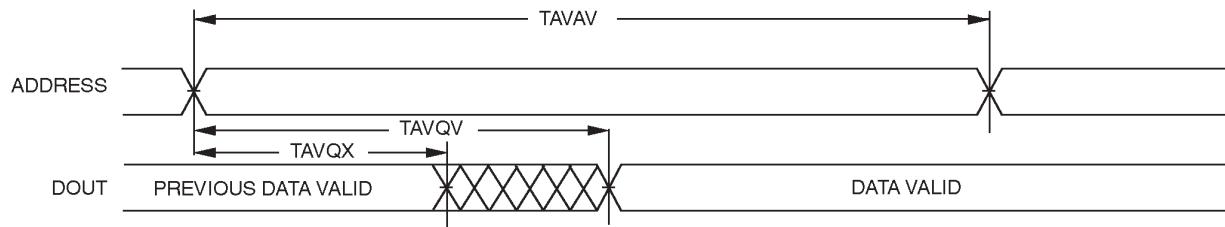
## Write Cycle 3. $\overline{CS}_1$ or $\overline{CS}_2$ Controlled.
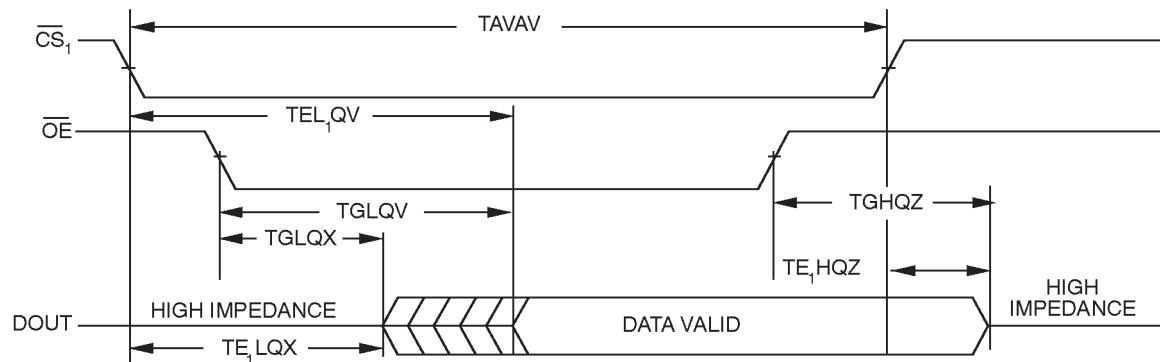
Note : 12. The internal write time of the memory is defined by the overlap of $\overline{CS}_1$ Low and CS_2 HIGH and $\overline{W}$ LOW. Both signals must be actived to initiate a write and either signal can terminate a write by going in actived. The data input setup and hold timing should be referenced to the actived edge of the signal that terminates the write.
Data out is high impedance if $\overline{OE}$ = VIH.

Read Cycle nb 1

TAVAV

ADDRESS

TAVQV

TAVQX

DOUT   PREVIOUS DATA VALID   DATA VALID

Read Cycle nb 2

$\overline{CS}_1$

TAVAV

$\overline{OE}$

TEL_1QV

$TGLQV$

$TGLQX$

$TGHQZ$

TE_1HQZ

DOUT   HIGH IMPEDANCE   DATA VALID   HIGH IMPEDANCE

TE_1LQX

Read Cycle nb 3

CS_2

TAVAV

$\overline{OE}$

TE_2HQV

$TGLQV$

$TGLQX$

$TGHQZ$

TE_2LQZ

DOUT   HIGH IMPEDANCE   DATA VALID   HIGH IMPEDANCE

TE_2HQX
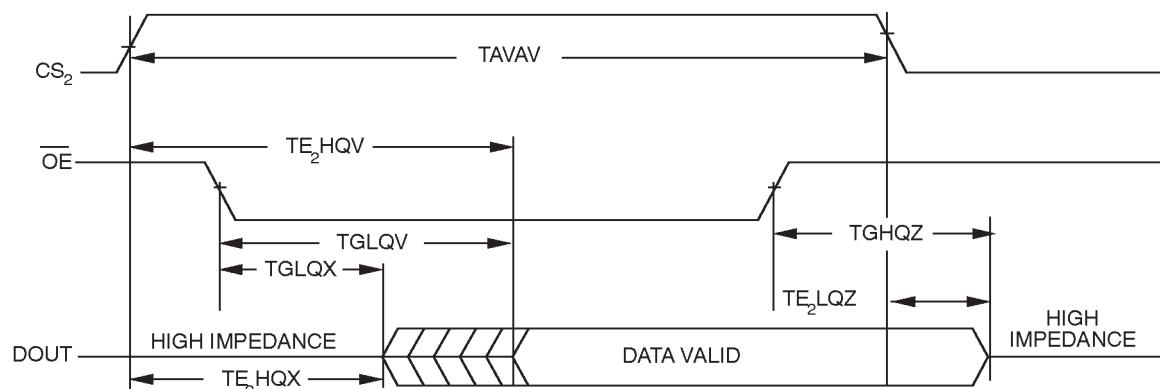
M65608E

Ordering Information

TEMPERATURE RANGE	PACKAGE	DEVICE	GRADE	SPEED	FLOW
M **M**	**DJ**	**– 65608E**	**V**	**– 45**	**/883**

M = Military   –55° to +125°C
S = Space   –55° to +125°C

V = Very low power

30 ns
45 ns

C9 =   Side Brazed 32 pins 400 mils
DJ =   Flat Package 32 pins 400 mils
0 =   die

blank	=	MHS standards
/883	=	MIL-STD 883 Class B or S
SB/SC	=	SCC 9000 level B/C
MQ	=	QML–Q
SV	=	QML–V

128K × 8
STATIC RAM