

# C-RAM™ 20M radiation-hardened non-volatile RAM

## Non-volatile memory product

The 256K × 20 radiation-hardened non-volatile RAM with a single-bit error correction (SEC) is a high-performance, 524, 288-word × 40-bit random-access, non-volatile memory with industry-standard functionality.

C-RAM die are fabricated with BAE Systems' radiation-hardened, 0.25 μm bulk CMOS technology, and is designed for use in systems operating in radiation environments. This NVRAM operates over an extended temperature range and requires a single 3.3 V ±10 percent power supply.



## System definitions

**A:0-18** Address input pins that select a particular 8-bit word within the memory array.

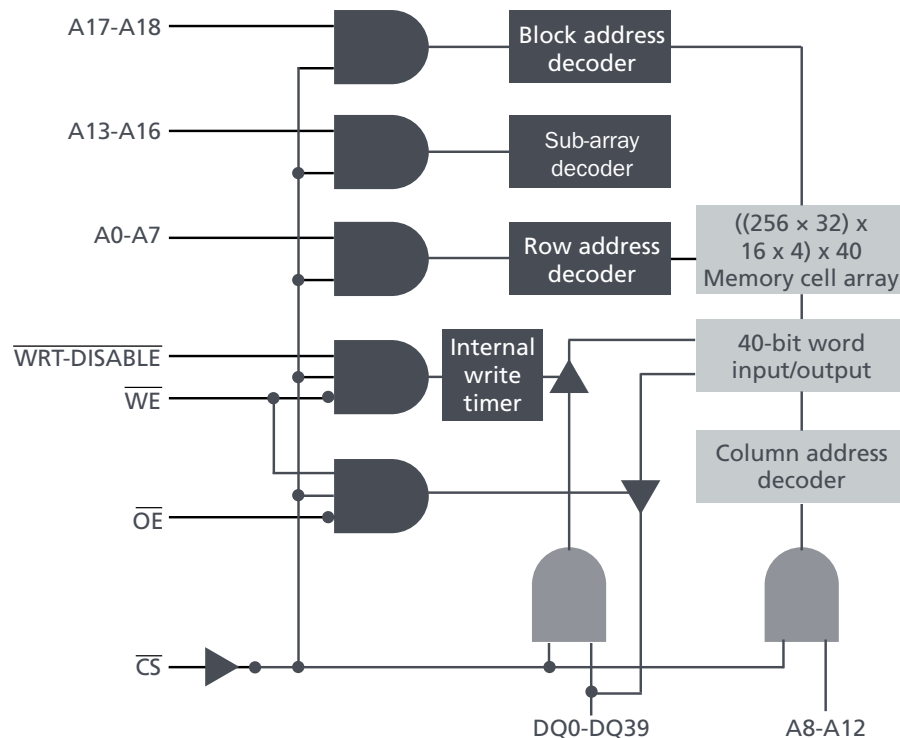
**DQ:0-7** Bi-directional data pins that serve as data outputs during a read operation and as data inputs during a write operation.

**$\overline{CS}$**  Negative-active chip select when low level allows normal read or write operation. When high,  $\overline{CS}$  forces the NVRAM to a precharge condition, holds the data output drivers in a high-impedance state, and disables write operations. If this signal is not used, it must be connected to GND.

**$\overline{WE}$**  Negative-active write-enable. When low (and WRT-DISABLE inactive),  $\overline{WE}$  activates a write operation and holds the data output drivers in a high-impedance state. When high,  $\overline{WE}$  allows normal-read operation.

**$\overline{OE}$**  Negative-active output-enable. When high,  $\overline{OE}$  holds the data output drivers in a high-impedance state. When low, the data output driver state is defined by  $\overline{CS}$  and  $\overline{WE}$ . If this signal is not used, it must be connected to GND.

**$\overline{WRT-DISABLE}$**  Negative-active write-disable. When low (power-on reset, PROM mode, etc.), disables write operations while maintaining read-operation availability. When high,  $\overline{WRT-DISABLE}$  permits write operations. If this signal is not used, it must be connected to VDD.



## C-RAM family of products

### 20 Mb multi-chip module 512K x 40 C-RAM

100-lead flatpack (0.964 x 1.111 inches)

### Also available

2 Mb (256K x 8 with ECC) and 4 Mb (512K x 8) monolithic configurations

## Specifications

### Minimum read cycle times

$\leq 70$  ns

### Minimum write-cycle times

$< 1000$  ns

### Single power supply

3.3 V  $\pm 10$  percent

### Operating temperature range

-40 to 110 degrees Celsius

### Low operating power

755 mW (typical) active read (70 ms)

525 mW (typical) active write (1000 ns)

300 mW (typical) standby (maximum)

### Write cycle endurance

$> 1e5$  cycles

### Data retention

0.1 years at 90 degrees Celsius

0.3 years at 85 degrees Celsius

0.9 years at 80 degrees Celsius

3.1 years at 75 degrees Celsius

11.6 years at 70 degrees Celsius

### Radiation levels

Total ionizing dose:  $> 5 \times 10^5$  rad (Si)

Single event upset:  $< 1 \times 10^{-11}$  upsets/bit day

Neutron fluence:  $> 1 \times 10^{13}$  particles/cm<sup>2</sup>

Latchup-immune:  $\leq 120$  MeV-cm<sup>2</sup>/mg

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