

# MA3864

## RADIATION HARD 8192 x 8 BIT MASK-PROGRAMMABLE ROM

The MA3864 64k Mask Programmable ROM is configured as 8192x8 bits and manufactured using CMOS-SOS high performance, radiation hard, 1.5µm technology.

The design has full static operation with no clock or timing strobe required. Address input buffers are deselected when chip select is in the HIGH state.

Programming is performed during fabrication by customising the penultimate layer of the process. Programming data may be supplied in EPROM or as a data file in the standard INTEL Hex format.

### FEATURES

- 1.5µm CMOS-SOS Technology
- Latch-up Free
- Fast Access Time 60ns Typical
- Total Dose 10<sup>6</sup> Rad(Si)
- Transient Upset >10<sup>11</sup> Rad(Si)/sec
- SEU 4.3 x 10<sup>-11</sup> Errors/bitday
- Single 5V Supply
- Three State Output
- Low Standby Current 100µA Typical
- -55°C to +125°C Operation
- All Inputs and Outputs Fully TTL or CMOS Compatible
- Fully Static Operation
- Programmable at Via Level for Fast Turnaround
- 4 Mask Programmable Chip Selects

Operation Mode	* $\bar{E}$	$\bar{G}$	I/O	Power
Read	L	L	D OUT	
Output Disable	L	H	High Z	
Standby	H X	X X	High Z X	ISB 2

\* $\bar{E}$  is a mask programmed NAND function of E1,E2,E3,E4 and their inverses.

Figure 1: Truth Table

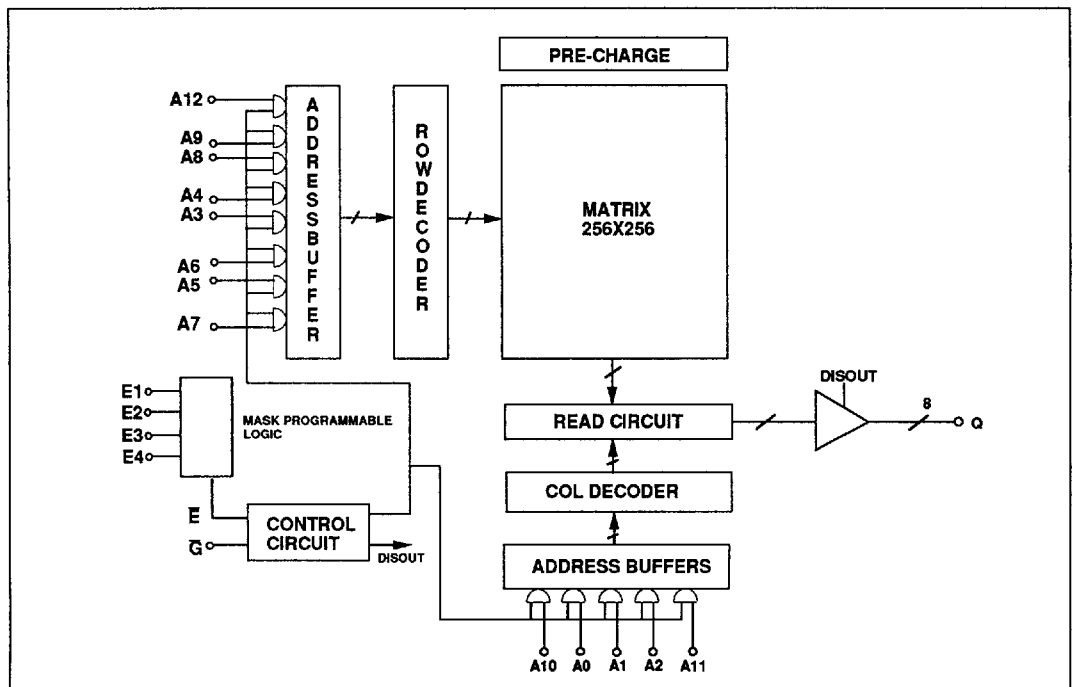


Figure 2: Block Diagram

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## SIGNAL DEFINITIONS

### A0-12

Address input pins which select a particular eight bit word within the memory array.

### Q0-7

Data output pins

### E1, E2, E3, E4

Are mask programmed, to the customer's specification, to form the active LOW chip select function ( $\overline{E}$ ).  $\overline{E}$  is driven by a 4-input NAND gate which has E1,E2,E3,E4 or their inverses as it's

inputs. Unused NAND gate I/Ps will be tied high internally. When chip select ( $\overline{E}$ ) is low, a read is activated. When it is at a high level it defaults the ROM to a precharge condition and holds the data output drivers in a high impedance state.

### $\overline{G}$

Output Enable which when at a high level holds the data output drivers in a high impedance state. When at a low level, data output driver state is defined by  $\overline{CS}$ . If this signal is not used it must be connected to VSS.

## CHARACTERISTICS AND RATINGS

Symbol	Parameter	Min.	Max.	Units
$V_{CC}$	Supply Voltage	-0.5	7.0	V
$V_I$	Input Voltage	-0.3	$V_{DD}+0.3$	V
$T_A$	Operating Temperature	-55	125	°C
$T_S$	Storage Temperature	-65	150	°C

Stresses above those listed may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these conditions, or at any other condition above those indicated in the operations section of this specification, is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

Figure 3: Absolute Maximum Ratings

### Notes for Table 4:

Characteristics apply to pre radiation at  $T_A = -55^\circ\text{C}$  to  $+125^\circ\text{C}$  with  $V_{DD} = 5V \pm 10\%$  and to post 100k Rad(Si) total dose radiation at  $T_A = 25^\circ\text{C}$  with  $V_{DD} = 5V \pm 10\%$  (characteristics at higher radiation levels available on request). GROUP A SUBGROUPS 1, 2, 3.

Symbol	Parameter	Conditions	(Option)	Min.	Typ.	Max.	Units
$V_{DD}$	Supply voltage	-		4.5	5.0	5.5	V
$V_{IH}$	Logical '1' Input Voltage	-	(TTL) (CMOS)	2.0 $0.8 V_{DD}$	- -	$V_{DD}$ $V_{DD}$	V V
$V_{IL}$	Logical '0' Input Voltage	-	(TTL) (CMOS)	$V_{SS}$ $V_{SS}$	- -	0.8 $0.2 V_{DD}$	V V
$V_{OH1}$	Logical '1' Output Voltage	$I_{OH1} = -4\text{mA}$		2.4	-	-	V
$V_{OH2}$	Logical '1' Output Voltage	$I_{OH2} = -3\text{mA}$		$V_{DD} - 0.5$	-	-	V
$V_{OL}$	Logical '0' Output Voltage	$I_{OL} = 8\text{mA}$		-	-	0.4	V
$I_{LI}$	Input Leakage Current	$V_{IN} = V_{DD}$ or $V_{SS}$ all inputs		-	-	$\pm 10$	$\mu\text{A}$
$I_{LO}$	Output Leakage Current	Chip disabled, $V_{OUT} = V_{DD}$ or $V_{SS}$		-	-	$\pm 10$	$\mu\text{A}$
$I_{SB1}$	Selected Static Current (CMOS)	All inputs = $V_{DD} - 0.2\text{V}$ except $\overline{CS} = V_{SS} + 0.2\text{V}$		-	0.1	2	mA
$I_{DD}$	Dynamic Operating Current (CMOS)	$f_{RC} = 1\text{MHz}$ , all inputs switching, $V_{IH} = V_{DD} - 0.2\text{V}$		-	3	10	mA
$I_{SB2}$	Standby Supply Current	$\overline{CS} = V_{DD} - 0.2\text{V}$		-	0.1	2	mA

Figure 4: Electrical Characteristics

## AC CHARACTERISTICS

Conditions of Test for Table 5:

1. Input pulse =  $V_{SS}$  to 4.5V.
2. Times measurement reference level = 1.5V.
3. Input Rise and Fall times  $\leq 5$ ns.
4. Output load 1TTL gate and CL = 60pF.
5. Transition is measured at  $\pm 500$ mV from steady state ( $T_{ELOX}$ ,  $T_{EHOZ}$ ,  $T_{GHOZ}$ ).
6. These parameters are sampled and not 100% tested ( $T_{ELOX}$ ,  $T_{EHOZ}$ ,  $T_{GHOZ}$ ).

Characteristics apply to pre-radiation at  $T_A = -55^\circ\text{C}$  to  $+125^\circ\text{C}$  with  $V_{DD} = 5V \pm 10\%$  and to post 100k Rad(Si) total dose radiation at  $T_A = 25^\circ\text{C}$  with  $V_{DD} = 5V \pm 10\%$ . GROUP A SUBGROUPS 9, 10, 11.

Symbol	Parameter	Min	Max	Units
$T_{AVAX}$	Read Cycle Time	60	-	ns
$T_{AVOQ}$	Address Access Time	-	60	ns
* $T_{ELOV}$	Chip Select Access Time	-	60	ns
$T_{GLOV}$	Output Enable to Output Valid	-	15	ns
$T_{AXOX}$	Output Hold Time for Address Access	15	-	ns
* $T_{ELOX}$	Chip Select Low to Outputs Active	-	30	ns
* $T_{EHOZ}$	Chip Select High to Outputs Hi-Z	-	30	ns
$T_{GHOZ}$	Output Enable High to Output Hi-Z	-	10	ns
$T_{ELEH}$	Chip Select Pulse Width	60	-	ns

\*These functions refer to the action of the internal chip select,  $\bar{E}$ . The timings given are relative to the last of the pins; E1, E2, E3 and E4 to change which causes the specified transitions of  $\bar{E}$ .

Figure 5: Read Cycle AC Electrical Characteristics

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Units
$C_{IN}$	Input Capacitance	$V_I = 0V$	-	3	5	pF
$C_{OUT}$	Output Capacitance	$V_{IO} = 0V$	-	5	7	pF

Note:  $T_A = 25^\circ\text{C}$  and  $f = 1\text{MHz}$ . Data obtained by characterisation or analysis; not routinely measured.

Figure 6: Capacitance

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Symbol	Parameter	Conditions
$F_T$	Basic Functionality	$V_{DD} = 4.5V - 5.5V$ , FREQ = 1MHz $V_{IL} = V_{SS}$ , $V_{IH} = V_{DD}$ , $V_{OL} \leq 1.5V$ , $V_{OH} \geq 1.5V$ TEMP = -55°C to +125°C, GPS PATTERN SET GROUP A SUBGROUPS 7, 8A, 8B

Figure 7: Functionality

Subgroup	Definition
1	Static characteristics specified in Table 4 at +25°C
2	Static characteristics specified in Table 4 at +125°C
3	Static characteristics specified in Table 4 at -55°C
7	Functional characteristics specified in Table 7 at +25°C
8A	Functional characteristics specified in Table 7 at +125°C
8B	Functional characteristics specified in Table 7 at -55°C
9	Switching characteristics specified in Table 5 at +25°C
10	Switching characteristics specified in Table 5 at +125°C
11	Switching characteristics specified in Table 5 at -55°C

Figure 8: Definition of Subgroups

TIMING DIAGRAMS

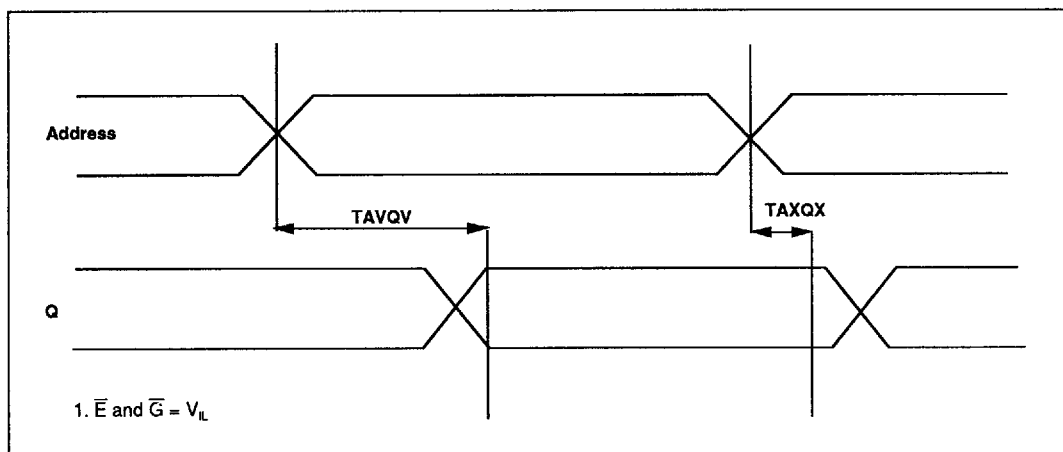


Figure 9: Address Controlled Read Cycle

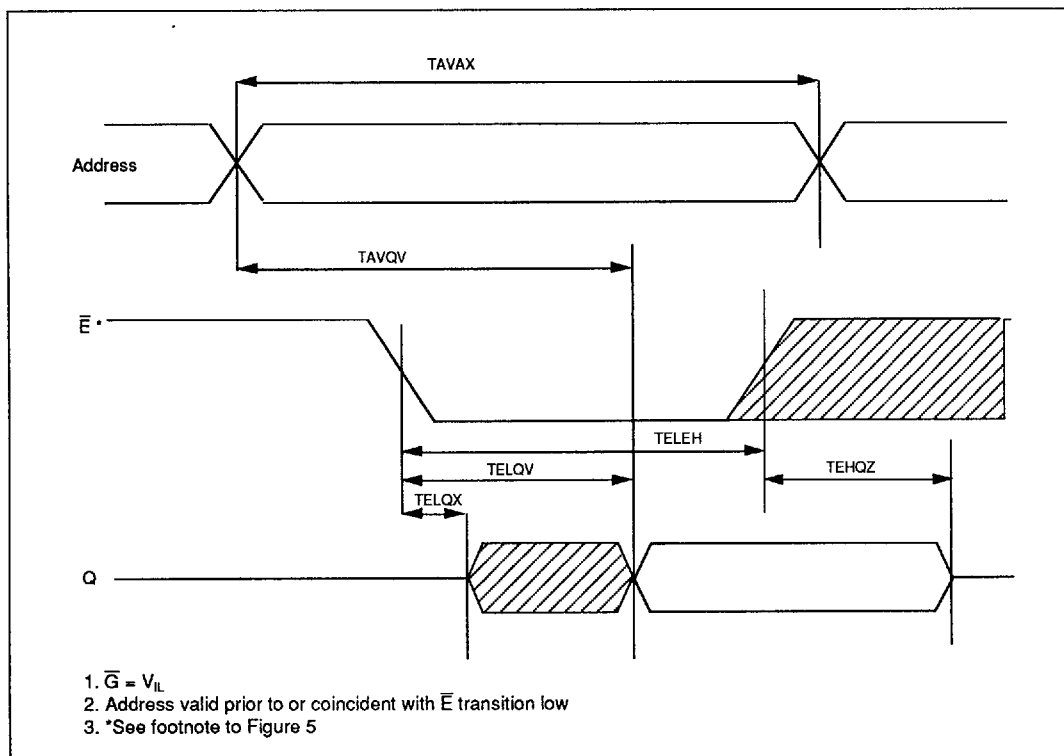


Figure 10: Chip Select Controlled Read Cycle

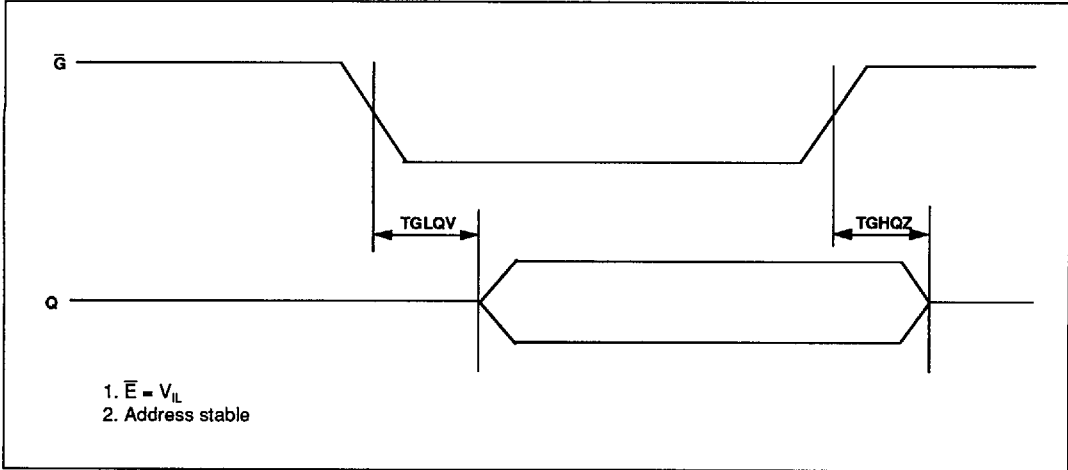


Figure 11: Output Enable Operation

OUTLINES AND PIN ASSIGNMENTS

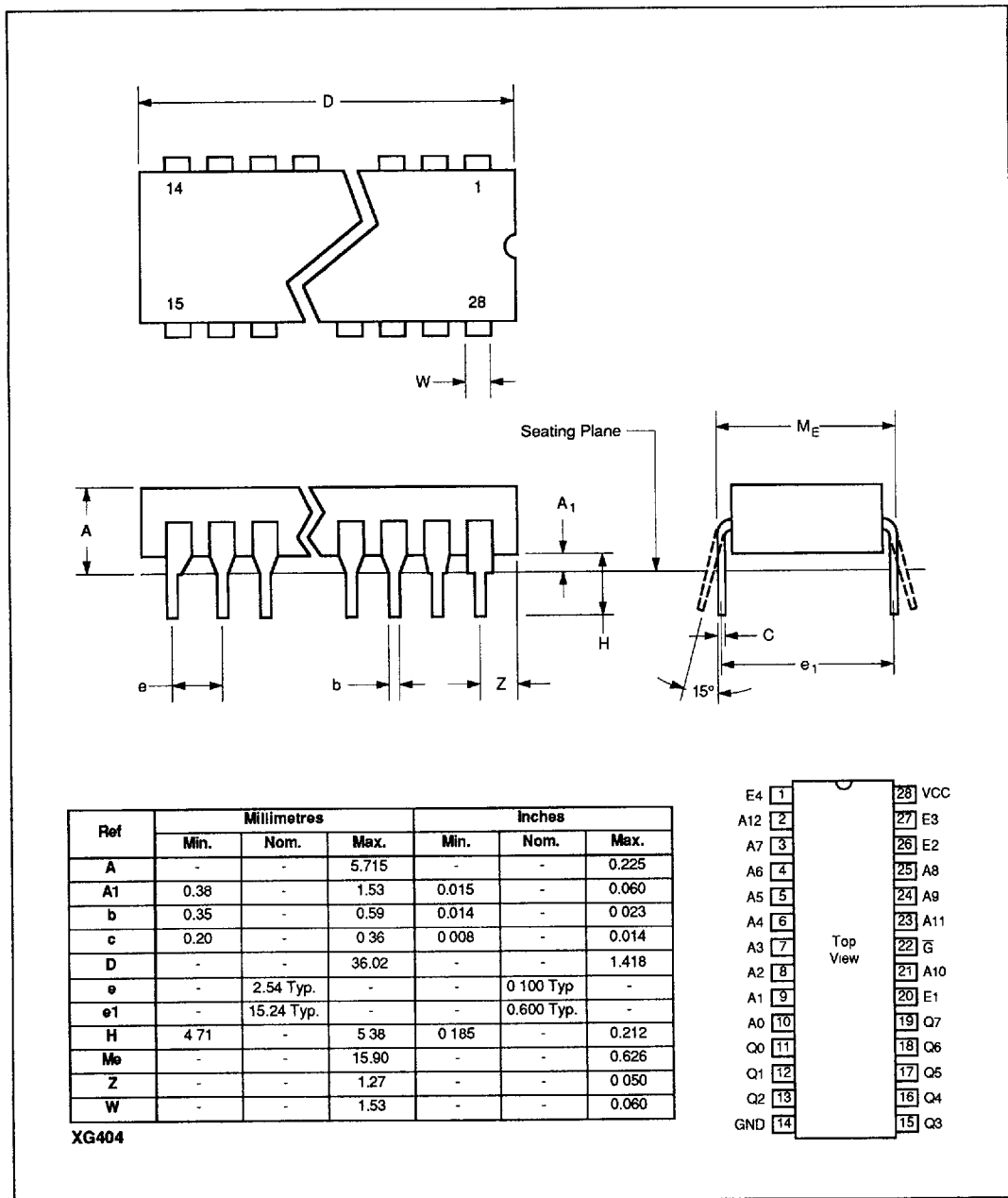
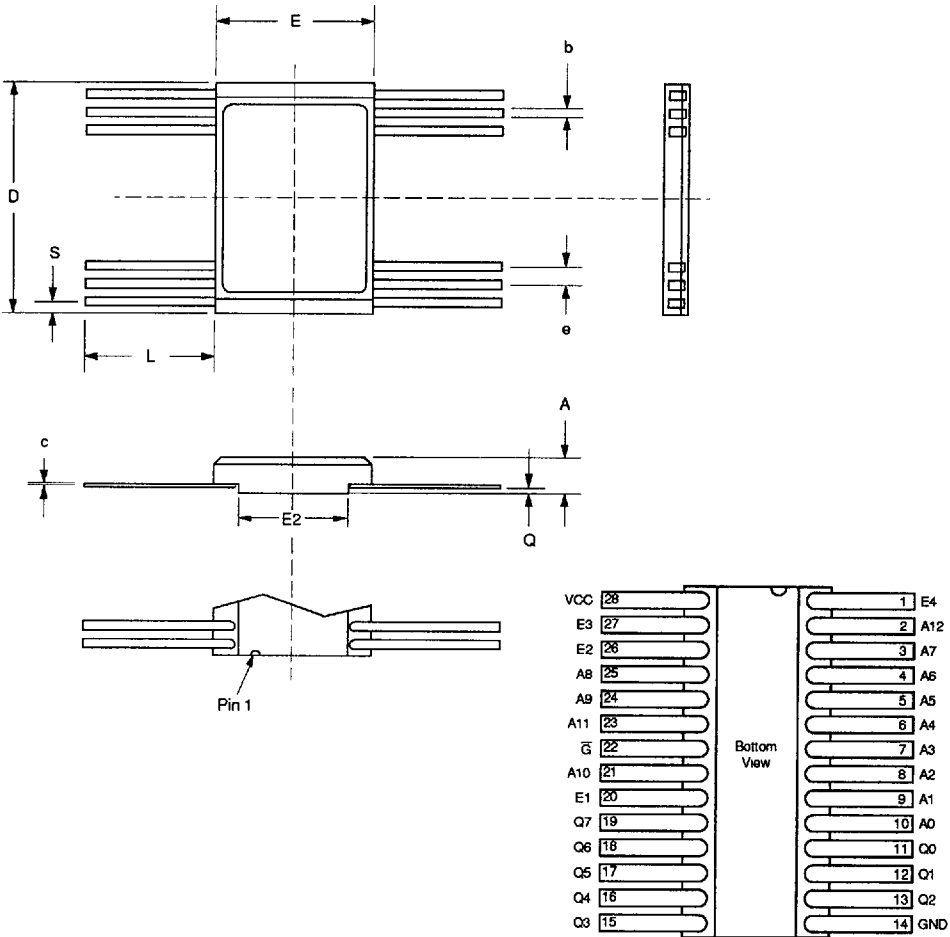


Figure 12: 28-Lead Ceramic DIL (Solder Seal) - Package Style C



Ref	Millimetres			Inches		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	-	-	2.97	-	-	0.117
b	0.381	-	0.482	0.015	-	0.019
c	0.076	-	0.152	0.003	-	0.006
D	18.08	-	18.49	0.712	-	0.728
E	12.50	-	12.9	0.492	-	0.508
E2	9.45	-	9.85	0.372	-	0.388
e	1.143	-	1.40	0.045	-	0.055
L	8.00	-	9.27	0.315	-	0.365
Q	0.66	-	-	0.026	-	-
S	-	-	1.14	-	-	0.045

XG543

Figure 13: 28-Lead Ceramic Flatpack (Solder Seal) - Package Style F

## RADIATION TOLERANCE

### Total Dose Radiation Testing

For product procured to guaranteed total dose radiation levels, each wafer lot will be approved when all sample devices from each lot pass the total dose radiation test.

The sample devices will be subjected to the total dose radiation level (Cobalt-60 Source), defined by the ordering code, and must continue to meet the electrical parameters specified in the data sheet. Electrical tests, pre and post irradiation, will be read and recorded.

GEC Plessey Semiconductors can provide radiation testing compliant with MIL-STD-883 test method 1019, Ionizing Radiation (Total Dose).

Total Dose (Basic function)	1x10 <sup>5</sup> Rad(Si)
Total Dose (Function to specification)	1x10 <sup>6</sup> Rad(Si)
Transient Upset	>10 <sup>11</sup> Rad(Si)/sec
Neutron Hardness (Function to specification)	>10 <sup>15</sup> neutrons/cm <sup>2</sup>
Single Event Upset (GSO 10% worst case)	4.3x10 <sup>11</sup> errors/bit/day
Latch-up	Not possible

Figure 14: Typical Radiation Hardness Parameters

## ORDERING INFORMATION

