|INCH-POUND|

MIL-M-38510/245A
AMENDMENT 2
24 February 1993
SUPERSEDING
AMENDMENT 1
15 JUNE 1990

MILITARY SPECIFICATION

MICROCIRCUITS MEMORY, DIGITAL, CMOS,
4096 BIT, STATIC RANDOM ACCESS MEMORY (SRAM),
BULK SILICON AND SILICON ON SAPPHIRE

This amendment forms a part of MIL-M-38510/245, dated 28 January 1987, and is approved for use by all Departments and Agencies of the Department of Defense.

PAGE 1

TITLE: Delete and substitute as shown above.

* 1.4 Delete and substitute as shown below:

"1.4 Recommended operating conditions.

	Device types 01,02,04	Device type 03	Device types 05,06
Supply voltage (V_{DD} - V_{SS})	4.5 V to 5.5 V	4.5 V to 5.5 V	4.75 V to 5.25 V
Input low (V_{IL}) voltage range	V_{SS}-0.3 V to V_{SS}+0.8 V	V_{SS}-0.3 V to V_{SS}+0.8 V	V_{SS}+0.8 V maximum
Input high (V_{IH}) voltage range	V_{DD}-2.0 V to V_{DD}	$\overline{CE}$, $\overline{W}$: V_{DD}-1.5 V to V_{DD} Others: V_{DD}-2.0 V to V_{DD}	V_{DD}/2 minimum
Case operating temperature range	-55°C to +125°C	-55°C to +125°C	-55°C to +125°C
Timing parameters	(See figure 7)	(See figure 7)	(See figure 7)"

PAGE 2

3.2, delete and substitute:

"3.2 Design, construction, and physical dimensions. The design, construction, and physical dimensions shall be as specified in MIL-M-38510 and herein. At present epoxy die bonding may be performed using qualified conductive silver paste or qualified (nonepoxy) silver filled glass. All epoxies must be qualified to method 5011 of MIL-STD-883". Laser scribing shall be allowed only for SOS technology product and only to the back side of the wafer.

The attached insertable replacement pages listed below are replacements for stipulated pages. When the new pages have been entered in the document, insert the amendment as the cover sheet to the specification.

Replacement page	Page replaced
11	11
12	12
13	Reprinted without change
14	14
15	15
16	16
51	51
52	52

PAGE 4

4.2e, delete second sentence and substitute: "Conditions shall be static, T_A = 125°C, supply voltage at 6.5 V minimum, and a duration of 48 hours minimum for classes S and B. The stress test circuit is figure 3, static I, all ones pattern."

4.2.f(5), delete "7 ±.5" and substitute "6 ±.5".

4.2g(4), delete "7 ±.5" volts and substitute "5.5 ±.5 volts for device types 01 through 04, 6.5 volts minimum for device types 05 and 06".

4.2, add the following paragraph:

"i. The alternate screening procedures of MIL-STD-883, method 5004, shall be permitted as approved by the qualifying activity".

PAGE 5

4.4.2b, delete in its entirety and substitute: "ESDS testing in accordance with method 3015 of MIL-STD-883, shall be performed at initial qualification and after any process or design changes that affect the input protection circuits."

PAGE 7

TABLE I, I_{DDOP}, maximum limits column, device type 05: Delete "4" and substitute "4.5."

* TABLE I, C_I, device types column: delete "04".

* TABLE I, C_I, device types column: add new row and add "04 1/".

* TABLE I, C_I, maximum limits column: add "10" for device type 04.

PAGE 8

TABLE I, t_{ELQV}, maximum limits column, device type 06: Delete "200" and substitute "280".

TABLE I, t_{ELQX}, minimum limits column, device types 01, 02: Delete "10" and substitute "5".

TABLE I, t_{ELQX}, maximum limits column, device types 03, 04: Delete "100" and substitute in minimum limits column "50".

PAGE 9

TABLE I, t_{WLQZ}, test column: Add "1/".

TABLE I, t_{WLQZ}, device type column, device type 04: Delete "1/".

PAGE 10

TABLE I, t_{DVWH}, minimum limits column, device type 06: Delete "75" and substitute "105".

TABLE I, t_{AVQZ}, symbol column, delete "1/" and add "1/" to test column.

PAGE 28

FIGURE 7, t_{ELQX}, minimum column, device types 01, 02: Delete "10" two places and substitute "5" two places.

PAGE 29

FIGURE 7, t_{ELQV}, maximum column, device type 06: Delete "200" and substitute "280".

FIGURE 7, t_{DVWH}, minimum column, device type 06: Delete "75" and substitute "105".

FIGURE 7, t_{ELQX}, maximum column, device types 03 and 04: Delete "100" two places and substitute in minimum column "50" two places.

PAGE 31

TABLE III, PWR DWN and ADD COMP, symbol column: Add "16/" two places.

PAGE 32

TABLE III, TEST 76, minimum columns: Delete "10" three places and substitute "5" three places.

PAGE 35

TABLE III, test 94, minimum columns: Delete "10" three places and substitute "5" three places.

TABLE III, PWR DWN and ADD COMP, symbol column: Add "16/" two places.

TABLE III, test 90, measured terminal column: Delete "Q" and substitute "V_{DD}".

PAGE 38

TABLE III, PWR DWN and functional tests, symbol column: Add "16/" two places.

PAGE 41

* TABLE III, test 89, maximum limits column: Delete "8" and substitute "10".

TABLE III, PWR DWN and functional tests, symbol column: Add "16/" two places.

TABLE III, test 90, measured terminal column: Delete "Q" and substitute "V_{DD}".

PAGE 44

TABLE III, I_{DDOP}, test limits, maximum column: Delete "4.0" and substitute "4.5".

PAGE 48

TABLE III, t_{ELQV}, test limits, maximum column, T_C = +25°C and T_C = -55°C: Delete "160", two places and substitute "200", two places.

TABLE III, t_{ELQV}, test limits, maximum column, T_C = +125°C: Delete "200" and substitute "280".

PAGE 49

Footnotes 10/a and 11/a: Delete "6" and substitute "7".

Footnote 11/c, delete "7" and substitute "5".

PAGE 50

Add the following new footnote: "16/ Tested, but no values are printed for this parameter in variable data".

PAGE 53

* 4.5.5: Delete in its entirety.

* 4.5.6: Delete "4.5.6" and substitute "4.5.5".

PAGE 54

* TABLE VI, Title: Delete "group E end-point electrical parameter limits for RHA devices" and substitute "Post-irradiation end-point electrical parameters. 1/"

* TABLE VI, I_{CCDR}, conditions column, devices 03 through 06: Add "I_{OUT} = 0, V_{IN} = rail voltages" in two places.

* TABLE VI, add footnote 1/ : "The pre-irradiation end-point electrical parameter limit shall be as specified in table III herein at +25°C."

The margins of this amendment are marked with asterisk to indicate where changes (additions, modifications, corrections, deletions) from the previous issue were made. This was done as a convenience only and the Government assumes no liability whatsoever for any inaccuracies in these notations. Bidders and contractors are cautioned to evaluate the requirements of this document based on the entire content irrespective of the marginal notations and relationship to the last previous amendment.

CONCLUDING MATERIAL

Custodians:
Army - ER
Navy - EC
Air Force - 17

Review activities:
Army - AR, MI
Navy - OS, SH, TD
Air Force - 11, 19, 85, 99
DLA - ES

User activities:
Army - SM
Navy - AS, CG, MC

Preparing activity:
Air Force - 17

Agent:
DLA - ES

(Project 5962-1324)

TABLE II. Electrical test requirements.

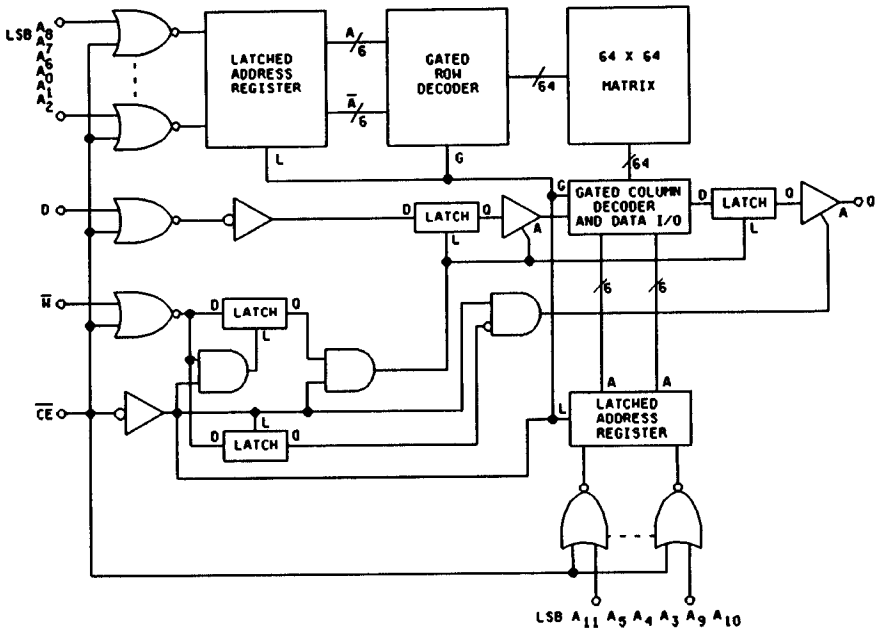
Line no.	MIL-STD-883 test requirements	Class S device 1/ 2/				Class B device 1/ 2/			
		Ref par.	Table 3/ III subgroups	Table IV delta 4/ limits	Test circuit figure	Ref par.	Table 3/ III subgroups	Table IV delta 4/ limits	Test circuit figure
1	Interim electrical parameters method 5004	4.2e	1			4.2e	1		
2	Static burn-in I method 1015	4.2b,e 4.2f(5) 4.5.2			3		Not required		
3	Same as line 1		1*	Δ					
4	Static burn-in II method 1015	4.2f(5) 4.5.2			3	4.2b,g(4) 4.5.2	Not required		
5	Same as line 1	4.2c	1*	Δ					
6	Dynamic burn-in method 1015	4.2b,f(6) 4.5.2	5/		4		5/ Required		4
7	Same as line 1	4.2c	1*	Δ		4.2c	1*	Δ	
8	Final electrical parameters method 5004		1*,2,3, 8,9,10,11				1*,2,3, 8, 9		
9	Group A test requirements method 5005	4.4.1	1,2,3,4, 8,9,10, 11,12			4.4.1	1,2,3,4, 9,10,11		
10	Group B test requirements method 5005	4.4.2 4.5.3	1,2,3,8, 9,10,11	Δ					
11	Group C end-point electrical parameters method 5005					4.4.3 4.5.3	1,2	Δ	
12	Group D end-point electrical parameters method 5005	4.4.4	1,2,3			4.4.4	1,2		
13	Group E test requirements method 1019	4.5.6	Table VI		Table VII	4.5.6	Table VI		Table VII

1/ Blank spaces indicate tests are not applicable.
2/ For subgroups 9, 10, and 11, only the worst value measured per device need be recorded when variables data is required (e.g., during qualification).
3/ (*)indicates PDA applies to subgroup 1 (see 4.2.1).
4/ (Δ)indicates delta limits shall be required, and delta values shall be computed with reference to either the initial recorded electrical parameters (see 4.5.3), or to the previous interim electrical parameters, as indicated to the qualifying activity.
5/ The device manufacturer may, at his option, either perform delta measurements or within 24 hours after burn-in (removal of temperature or bias) perform the final electrical parameter measurements, subgroup A1.

Device types	01, 03, 05	03, 05	02, 04, 06	04, 06
Case outlines	V	K	V	K
Terminal number	Terminal symbol			
1	A_0	NC	A_6	NC
2	A_1	A_0	A_5	A_6
3	A_2	A_1	A_4	A_5
4	A_3	A_2	A_3	A_4
5	A_4	A_3	A_0	A_3
6	A_5	NC	A_1	NC
7	Q	A_4	A_2	A_0
8	$\overline{W}$	A_5	$\overline{CE}$	A_1
9	V_{SS}	Q	V_{SS}	A_2
10	$\overline{CE}$	NC	$\overline{W}$	NC
11	D	$\overline{W}$	D_3/Q_3	$\overline{CS}$
12	A_{11}	V_{SS}	D_2/Q_2	V_{SS}
13	A_{10}	$\overline{CE}$	D_1/Q_1	$\overline{W}$
14	A_9	NC	D_0/Q_0	NC
15	A_8	D	A_9	D_3/Q_3
16	A_7	A_{11}	A_8	D_2/Q_2
17	A_6	A_{10}	A_7	D_1/Q_1
18	V_{DD}	A_9	V_{DD}	D_0/Q_0
19	---	NC	---	NC
20	---	NC	---	NC
21	---	A_8	---	A_9
22	---	A_7	---	A_8
23	---	A_6	---	A_7
24	---	V_{DD}	---	V_{DD}

*FIGURE 1. Terminal connections.

Device types 01 and 03



Device types 02 and 04

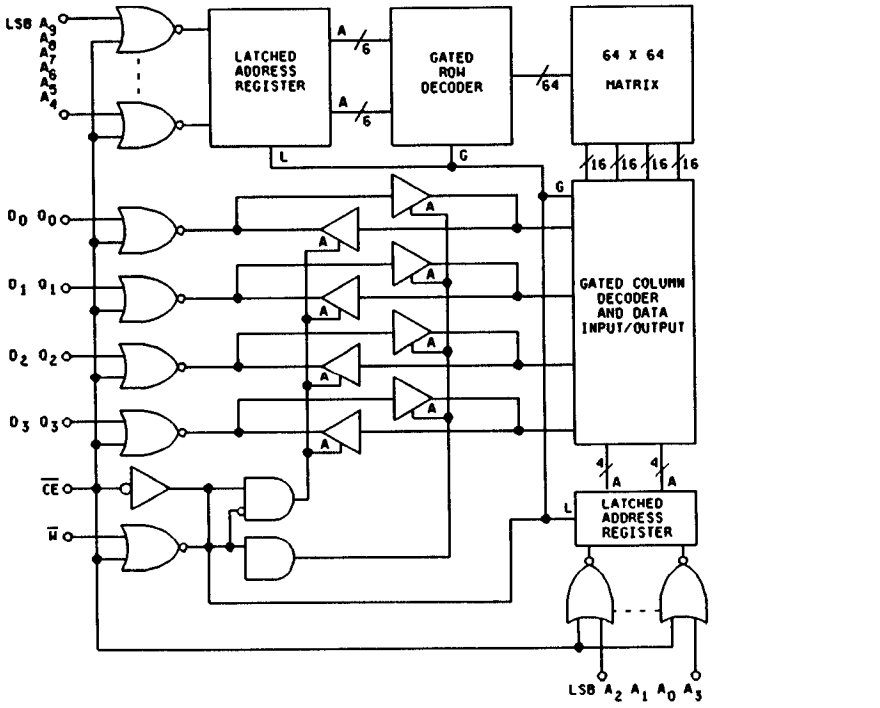
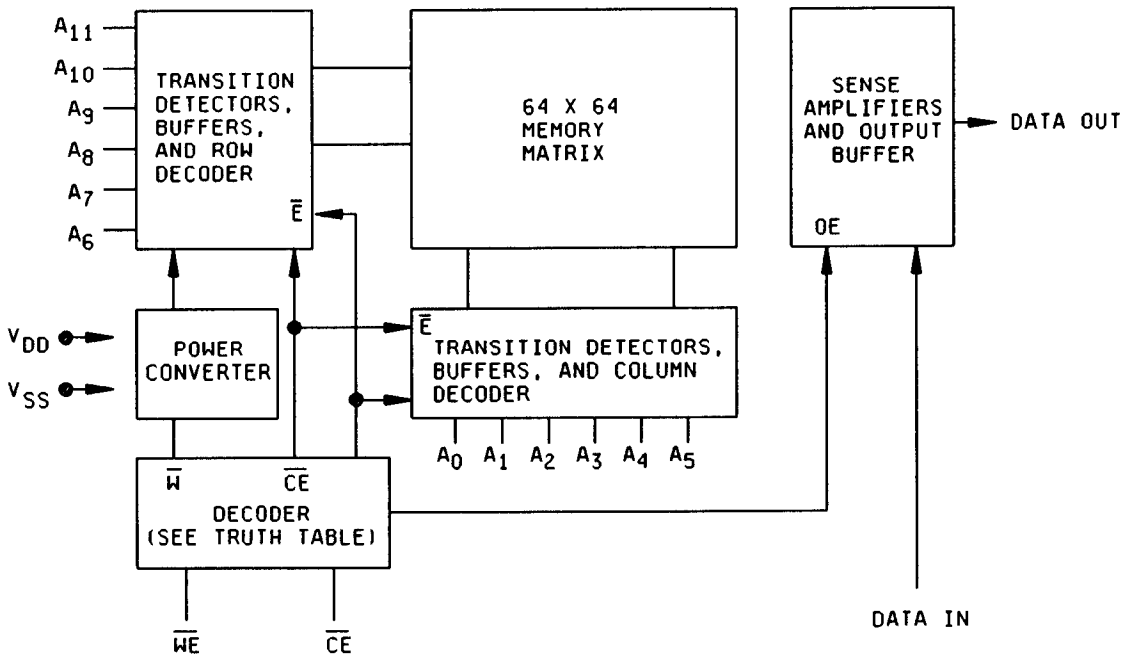


FIGURE 2. Block diagrams.

Device type 05



Device type 06

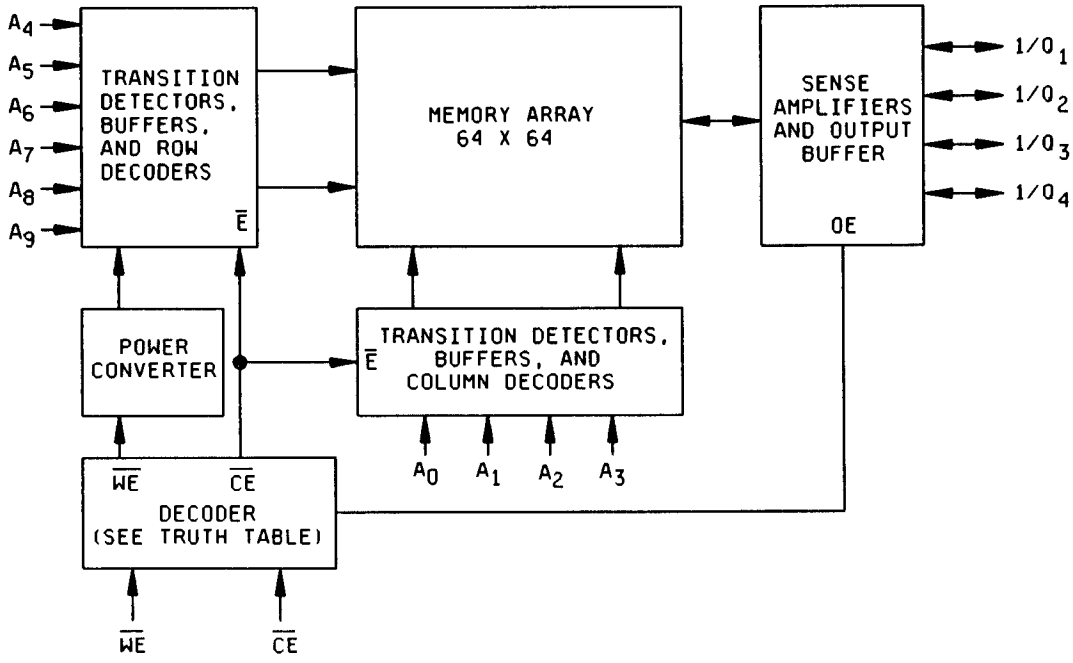
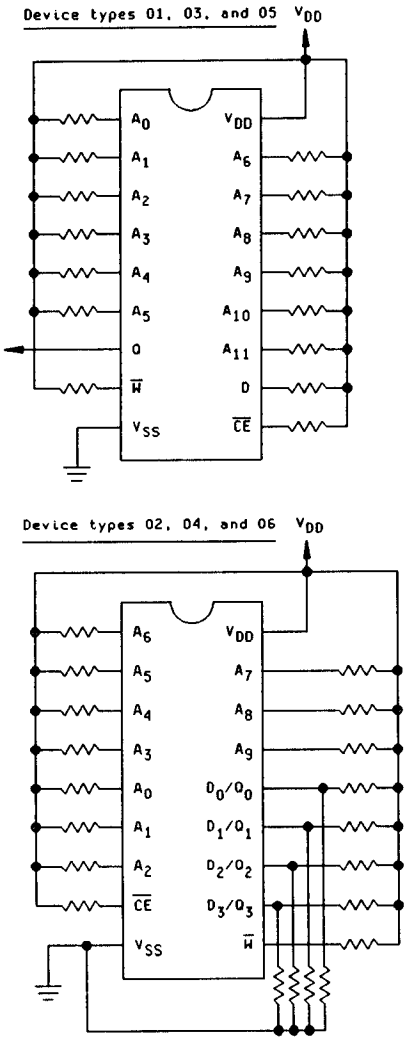


FIGURE 2. Block diagrams - Continued.



Device type	V_{DD} min
01	5.0 V
02	5.0 V
03	6.0 V
04	6.0 V
05	6.5 V
06	6.5 V

NOTES:
1. All inputs are connected through a 1 kΩ to 47 kΩ resistor.
2. 05, 06: For static II burn-in change input connections to V_{SS}
3. 05, 06: All 1's pattern filling array for static I.
4. 05, 06: All 0's pattern filling array for static II.
5. For device types 06: The pull down resistors on the outputs are not required.
6. Output pin device types 01, 03, and 05: Connected either through a resistor to a power supply or directly to a voltage divider across the supply rationed as follows:

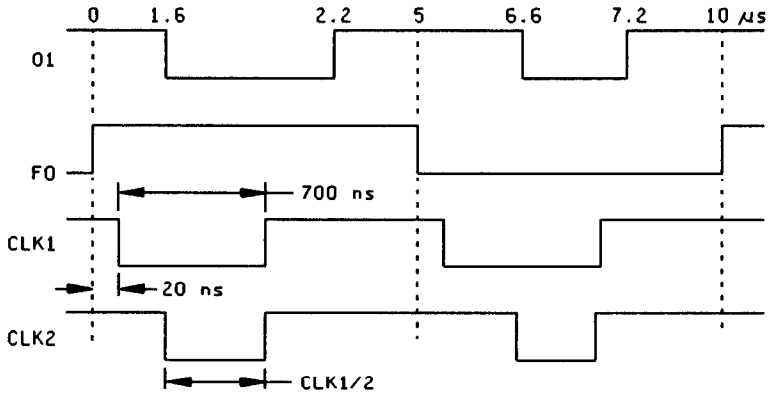
Device type	Q min
01 and 05	$\frac{V_{DD}}{2}$
03	$\frac{V_{DD}}{2.5}$

*FIGURE 3. Static burn-in circuit.

Terminal connection chart (see notes 1 and 2)

Device type	V_{DD} min	A_0	A_1	A_2	A_3	A_4	A_5	A_6	A_7	A_8	A_9	A_{10}	A_{11}	$\overline{CE}$	$\overline{W}$	DO/ Q_0	D1/ Q_1	D2/ Q_2	D3/ Q_3	Q
01	5.0 V	F3	F4	F5	F6	F7	F8	F9	F10	F11	F12	F13	F14	F0	F1	F2				F2
02	5.0 V	F3	F4	F5	F6	F7	F8	F9	F10	F11	F12			F0	F1	F2	F2	F2	F2	
03	6.0 V	F0	F1	F2	F3	F4	F5	F6	F7	F8	F10	F11	F12	CLK1	CLK2					F9
04	6.0 V	F4	F5	F9	F3	F2	F1	F0	F6	F7	F8			CLK2	CLK1	F10	F11	F12	F13	
05	See note 3	F0	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11	F13	01	F12				$\frac{V_{DD}}{2}$
06	See note 3	F0	F1	F2	F3	F4	F5	F6	F7	F8	F9			F14	01	F10	F11	F12	F13	

NOTES:
1. F0 = 100 kHz minimum, F1 = 1/2 F0, F2 = 1/4 F0 ect.



2. Resistors: (all values ±5%)
   Type 01, 02: All input and output pins 47 kΩ.
   Type 03, 04: Same burn-in board both type, with pins 7, 11, 12, 13, and 14 connected through 27 kΩ resistors to frequencies shown in table; 300Ω resistors on other pins.
   Type 05, 06: Pins connected through 2 kΩ to 15 kΩ, depending on pin function, as indicated in table.
3. V_{DD} min = 6.5 V for dynamic burn-in; V_{DD} min = 5.5 V for steady-state life test.

FIGURE 4. Dynamic burn-in and steady-state life test circuit.

4.4.4 Group D inspection. Group D inspection shall be in accordance with table IV of method 5005 of MIL-STD-883. End-point electrical parameters shall be as specified in table II herein.

* 4.4.5 Group E inspection. Group E inspection is required only for parts intended to be marked as radiation hardness assured. RHA levels for device classes B and S shall be M, D, R, and H.

a. End-point electrical parameters shall be as specified in table II herein.

b. For device classes B and S subgroups 1 and 2 of table V method 5005 of MIL-STD-883, shall be tested as appropriate for device construction.

* 4.4.5.1 Total dose irradiation testing. Total dose irradiation testing shall be performed in accordance with MIL-STD-883 method 1019 and as specified herein.

a. Device shall be biased in accordance with table VII herein and meet the postirradiation end-point electrical parameters as defined in table VI herein at +25°C after exposure.

b. Bias may be interrupted for up to 1 minute to remove devices to remote bias fixture. The start and completion of the end-point electrical parameter measurements shall not exceed 1 hour following irradiation.

* 4.4.5.1.1 Accelerated aging test. Accelerated aging shall be performed on all devices requiring a RHA level greater than 5K rads (Si). The post-anneal end-point electrical parameter limits shall be as specified in table III herein and shall be the preirradiation end-point electrical parameter limit at +25°C ±5°C. Testing shall be performed at initial qualification and after any design or process changes which may effect the RHA response of the device.

* 4.4.5.3 Additional information. When specified in the purchase order or contract, a copy of the following additional data shall be supplied.

a. RHA upset levels.
b. RHA delta limits.

4.4.6 Inspection of packaging. The inspection of packaging shall be as specified in MIL-M-38510.

4.5 Methods of inspection. Methods of inspection shall be as specified in the appropriate tables and as follows.

NOTE: In order to prevent "latch-up" during device turn-on and also prevent a high initial operating current (I_{DDOP}), set all device terminals equal to V_{SS}. Raise V_{DD} and $\overline{CE}$ simultaneously to normal system operating V_{DD}. Do not allow V_{IH} at $\overline{CE}$ to exceed V_{DD} +0.3 volts while rising. Not necessary for SOS products.

4.5.1 Voltage and current. All voltages given are referenced to the microcircuit V_{SS} terminal. Currents given are conventional and positive when flowing into the referenced terminal.

4.5.2 Life test, burn-in, cooldown, and electrical test procedure. When devices are measured at +25°C following application of the steady-state life or burn-in test condition, all devices shall be cooled to +35°C prior to removal of bias voltages. Any electrical tests required shall first be performed at -55°C or +25°C prior to any +125°C tests that are required.

4.5.3 Delta measurements. Delta measurements, as specified in table II, shall be made and recorded before and after the required burn-in screens and steady state life tests to determine delta compliance. The electrical parameters to be measured, with associated delta limits are listed in table IV.

TABLE IV. Delta limits at +25°C.

Parameters 1/	Limits 2/			
	01, 02	03	04	05, 06
I_{DD}	+5 μA	+15 μA	+25 μA	+30 μA
V_{OL}	+60 mV	+60 mV	+60 mV	
V_{OH}	-200 mV	-400 mV	-400 mV	
I_{OL}, I_{OH}				±10%
I_{OHZ}, I_{OLZ}				±500 nA
I_{IL}, I_{IH}	±50 nA	±100 nA	±100 nA	

1/ Conditions and mechanization of measurements shall be as specified in table III, subgroup 1.
2/ Delta limits apply to an increase from the initial value (e.g., pre-life test I_{IH} = -120 nA, post-life test I_{IH} = -170 nA).

* 4.5.4 ESDS testing. ESDS testing in accordance with MIL-STD-883, method 3015, will be performed at initial qualification and after any processor design changes affecting input protection circuits.