REVISIONS			
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Prepared in accordance with DOD-STD-100

Selected item drawing

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Original date of drawing

7 March 1986

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CHECKED BY

APPROVED BY

DEFENSE ELECTRONICS SUPPLY CENTER
DAYTON, OHIO

TITLE MICROCIRCUITS, DIGITAL, PROGRAM CONTROL UNIT/PUSH-POP STACK, MONOLITHIC SILICON

SIZE	CODE IDENT. NO.	DWG NO.
A	14933	86050

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DESC FORM 144 MAR 76 AMSC N/A

5962-E048

DISTRIBUTION STATEMENT A. Approved for public release; distribution is unlimited.

1. SCOPE

1.1 Scope. This drawing describes the requirements for monolithic silicon, program control unit/push-pop stack, digital microcircuits. This drawing provides a level of microcircuit quality and reliability assurance for acquisition of microcircuits in accordance with MIL-M-38510.

1.2 Part number. The complete part number shall be as shown in the following example:

86050	01	R	X
Drawing number	Device type (1.2.1)	Case outline (1.2.2)	Lead finish (3.3)

1.2.1 Device type. The device type shall identify the circuit function as follows:

Device type	Generic number	Circuit
01	AM2932	Program control unit/push-pop stack

1.2.2 Case outline. The case outlines shall be as designated in appendix C of MIL-M-38510, and as follows:

Outline letter	Case outline
R	D-8 (20-lead, 1/4" x 1-1/16"), dual-in-line package

1.3 Absolute maximum ratings.

Supply voltage range	-0.5 V dc to +7.0 V dc
Input voltage range	-0.5 V dc to +5.5 V dc
DC voltage applied to outputs for high output state	-0.5 V to V_{CC} maximum
DC output current, into outputs	30 mA
DC input current	-30 mA to +5.0 mA
Storage temperature range	-65°C to +150°C
Maximum power dissipation (P_D) 1/	1.15 W
Lead temperature (soldering, 10 seconds)	+300°C
Thermal resistance, junction-to-case (θ_{JC}):	
Case R	14°C/W
Junction temperature (T_J)	+175°C

1.4 Recommended operating conditions.

Supply voltage (V_{CC})	4.5 V dc minimum to 5.5 V dc maximum
Minimum high-level input voltage (V_{IH})	2.0 V dc
Maximum low-level input voltage (V_{IL})	0.8 V dc
Case operating temperature range (T_C)	-55°C to +125°C

1/ Must withstand the added P_D due to short circuit test (e.g., I_{OS}).

2. APPLICABLE DOCUMENTS

2.1 Government specification and standard. Unless otherwise specified, the following specification and standard, of the issue listed in that issue of the Department of Defense Index of Specifications and Standards specified in the solicitation, form a part of this drawing to the extent specified herein.

SPECIFICATION

MILITARY

MIL-M-38510 - Microcircuits, General Specification for.

STANDARD

MILITARY

MIL-STD-883 - Test Methods and Procedures for Microelectronics.

(Copies of the specification and standard required by manufacturers in connection with specific acquisition functions should be obtained from the contracting activity or as directed by the contracting activity.)

3. REQUIREMENTS

3.1 Item requirements. The individual item requirements shall be in accordance with MIL-M-38510, and as specified herein. The country of manufacture requirement of MIL-M-38510 does not apply.

3.2 Design, construction, and physical dimensions. The design, construction, and physical dimensions shall be as specified in MIL-M-38510 and herein.

3.2.1 Design documentation. The design documentation shall be in accordance with MIL-M-38510 and, unless otherwise specified in the contract or purchase order, shall be retained by the manufacturer but be available for review by the acquiring activity or contractor upon request.

3.2.2 Logic diagram and terminal connections. The logic diagram and terminal connnections shall be as specified on figures 1 and 2 respectively.

3.2.3 Truth table. The truth table shall be as specified on figure 3.

3.2.4 Case outline. The case outline shall be in accordance with 1.2.2.

3.3 Lead material and finish. The lead material and finish shall be in accordance with MIL-M-38510.

3.4 Electrical performance characteristics. Unless otherwise specified, the electrical performance characteristics are as specified in table I and apply over the full recommended case operating temperature range.

3.5 Marking. Marking shall be in accordance with MIL-M-38510, except the part number shall be in accordance with 1.2 herein. The Vendor Similar Part Number may also be marked in accordance with 6.8 herein. Both part numbers, when used, shall be printed on the same surface. The "M38510/XXX " part number and the "JAN" or "J" mark shall not be used. Lead finish letter "X" is used only as specified in MIL-M-38510 and shall not be marked on the microcircuit or its packaging. The country of origin shall be marked on the microcircuit.

3.6 Quality assurance requirements. Microcircuits furnished under this drawing shall have been subjected to, and passed all the requirements, tests, and inspections detailed herein including screening and quality conformance inspections.

TABLE I. Electrical performance characteristics.

Test	Symbol	Conditions $-55°C \le T_C \le +125°C$ $4.5\ V \le V_{CC} \le 5.5\ V$			Group A subgroups	Limits		Unit
						Min	Max	
Output high voltage	V_{OH}	V_{CC} = minimum, $V_{IN} = V_{IL}$ or V_{IH}	Y_0, Y_1, Y_2, Y_3 $C_n + 4$ $C_i + 4$	I_{OH} = -1.6 mA	1, 2, 3	2.4		V
			$\overline{FULL}$	I_{OL} = -1.2 mA		2.4		
Output low voltage	V_{OL}	V_{CC} = minimum, $V_{IN} = V_{IL}$ or V_{IH}	Y_0, Y_1, Y_2, Y_3	I_{OL} = 16 mA	1, 2, 3		0.5	V
			$C_n + 4$ $C_i + 4$	I_{OL} = 16 mA			0.5	
			$\overline{FULL}$	I_{OL} = 12 mA			0.5	
Input high level 1/	V_{IH}				1, 2, 3	2.0		V
Input low level 1/	V_{IL}				1, 2, 3		0.8	V
Input clamp voltage	V_I	V_{CC} = minimum, I_{IN} = -18 mA			1, 2, 3		-1.5	V
Input low current	I_{IL}	V_{CC} = maximum, V_{IN} = 0.5 V		D_0-D_3	1, 2, 3		-.360	mA
				I_0-I_3, CP			-.702	
				C_i			-2.0	
				C_n			-3.69	
Input high current	I_{IH}	V_{CC} = maximum, V_{IN} = 2.7 V		D_0-D_3	1, 2, 3		20	µA
				I_0-I_3, CP			40	
				C_i			90	
				C_n			250	
Input high current	I_I	V_{CC} = maximum, V_{IN} = 5.5 V			1, 2, 3		1.0	mA
Output short circuit current 2/	I_{SC}	V_{CC} = maximum			1, 2, 3	-30	-85	mA

See footnotes at end of table.

TABLE I. Electrical performance characteristics - Continued.

Test	Symbol	Conditions $-55°C \le T_C \le +125°C$, $4.5\ V \le V_{CC} \le 5.5\ V$			Group A subgroups	Limits Min	Limits Max	Unit
Output off current	I_{OZL}	V_{CC} = maximum,	Y_0-Y_3	V_{OUT} = 0.5 V	1, 2, 3		-50	µA
	I_{OZH}	$\overline{OE}$ = 2.4 V		V_{OUT} = 2.4 V			50	
Power supply current 3/	I_{CC}	V_{CC} = maximum	T_C = -55°C to +125°C		1, 2, 3		210	mA
			T_C = +125°C				145	
Set-up time 1 4/ C_n	t_{s1}	See figure 4			9, 10, 11	52		ns
Hold time 1 4/ C_n	t_{h1}				9, 10, 11		0	ns
Set-up time 2 4/ C_i	t_{s2}				9, 10, 11	37		ns
Hold time 2 4/ C_i	t_{h2}				9, 10, 11		5	ns
Set-up time 3 4/ D	t_{s3}				9, 10, 11	60		ns
Hold time 3 4/ D	t_{h3}				9, 10, 11		2	ns
Set-up time 4 4/ I_3-I_0	t_{s4}				9, 10, 11	124		ns
Hold time 4 4/ I_3-I_0	t_{h4}				9, 10, 11		0	ns

See footnote at end of table.

TABLE I. Electrical performance characteristics - Continued.

Test	Symbol	Conditions $-55°C \le T_C \le +125°C$ $4.5\ V \le V_{CC} \le 5.5\ V$	Group A subgroups	Limits		Unit
				Min	Max	
Combinational delays 1 through 5		See figure 4	9, 10, 11			
From input I_3- I_0:						
To output: Y	t_{pd1}				88	ns
To output: C_i + 4 5/	t_{pd2}				82	ns
To output: C_i + 4	t_{pd3}				97	ns
To output: C_i + 4 6/	t_{pd4}				87	ns
To output: $\overline{FULL}$	t_{pd5}				78	ns
Combinational delays 6, 7, and 8			9, 10, 11			
From input C_n:						
To output: Y	t_{pd6}				37	ns
To output: C_i + 4	t_{pd7}				30	ns
To output: C_i + 4 5/	t_{pd8}				46	ns
Combinational delays 9 and 10			9, 10, 11			
From input C_i:						
To output: C_i + 4 5/	t_{pd9}				23	ns
To output: C_i + 4 6/	t_{pd10}				23	ns
Combinational delays 11 through 15			9, 10, 11			
From input CP:						
To output: Y	t_{pd11}				74	ns
To output: C_i + 4	t_{pd12}				66	ns
To output: C_i + 4 5/	t_{pd13}				84	ns
to output: C_i + 4	t_{pd14}				45	ns
to output: $\overline{FULL}$	t_{pd15}				60	ns

TABLE I. Electrical performance characteristics - Continued.

Test	Symbol	Conditions $-55°C \le T_C \le +125°C$ $4.5\ V \le V_{CC} \le 5.5\ V$	Group A subgroups	Limits		Unit
				Min	Max	
Combinational delays 16 and 17 From input D: To output: Y To output: C_i + 4 5/	 t_{pd16} t_{pd17}		9, 10, 11		 44 55	 ns ns
Output enable 1 From: I_3-I_0 To: Y	t_{EN1}		9, 10, 11	85		ns
Output disable 1 From: I_3-I_0 To: Y	t_{DIS1}		9, 10, 11		60	ns
Minimum clock low time			9, 10, 11	35		ns
Minimum clock high time			9, 10, 11	35		ns

1/ These input levels provide no guaranteed noise immunity and should only be tested in a static, noise-free environment.
2/ Not more than one output should be shorted at a time. Duration of the short circuit test should not exceed 1 second.
3/ Minimum I_{CC} is at maximum temperature.
4/ All set-up and hold times are relative to clock low-to-high transition.
5/ Instructions 5, 7, 11, 12, 13, 14.
6/ All instructions except 5, 7, 11, 12, 13, 14.

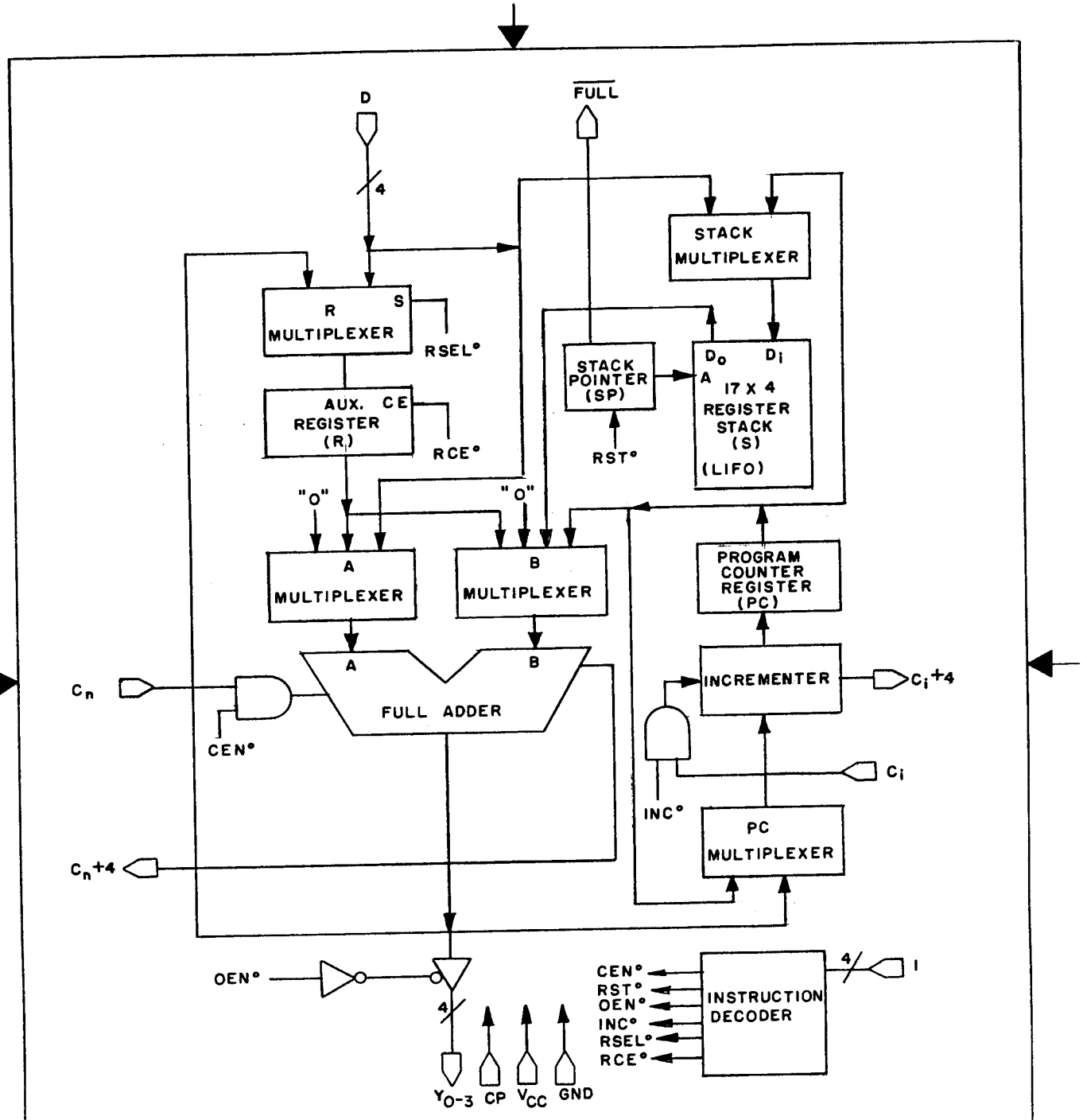

FIGURE 1. Logic diagram.

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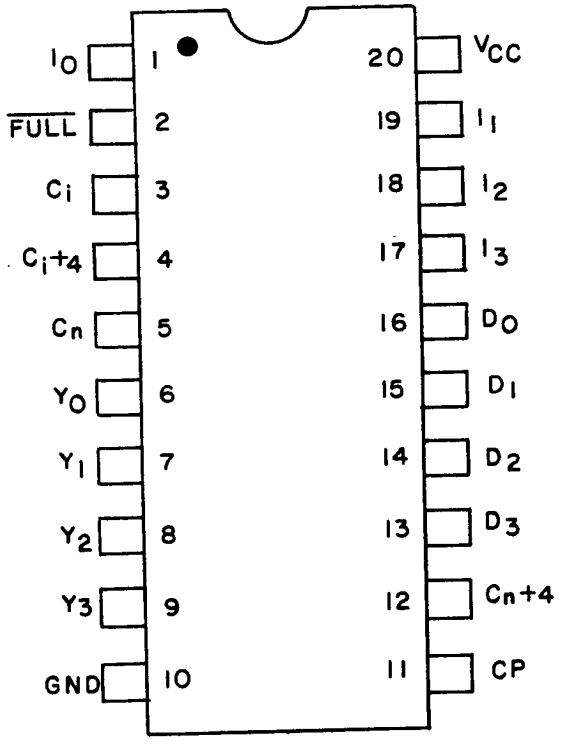

FIGURE 2. Terminal connections.

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INSTRUCTION NUMBER	I_3	I_2	I_1	I_0	MNEMONIC	INSTRUCTION	Y_0 - Y_3	NEXT STATE (AFTER CP ↑) - NOTE 2			
								PC	R	RAM	SP
0	L	L	L	L	PRST	RESET	"0"	"0" + C_n	—	—	RESET
1	L	L	L	H	PSUS	SUSPEND	Z (NOTE 1)	—	—	—	—
2	L	L	H	L	PSHD	PUSH D	PC	PC + C_i	—	D→LOG SP+1	SP+1
3	L	L	H	H	POPS	POP S	S	PC + C_i	—	—	SP−1
4	L	H	L	L	FPC	FETCH PG	PC	PC + C_i	—	—	—
5	L	H	L	H	JMPD	JUMP D	D	D + C_i	—	—	—
6	L	H	H	L	PSHP	PUSH PC	PC	PC + C_i	—	PC→LOG SP+1	SP+1
7	L	H	H	H	RTS	RETURN S	S	S + C_i	—	—	SP−1
8	H	L	L	L	FR	FETCH R	R	PC + C_i	—	—	—
9	H	L	L	H	FPR	FETCH PC + R	PC + R + C_n	PC + C_i	—	—	—
10	H	L	H	L	FPLR	FETCH PC − R	PC	PC + C_i	PC	—	—
11	H	L	H	H	JMPR	JUMP R	R	R + C_i	—	—	—
12	H	H	L	L	JPPR	JUMP PC + R	PC + R + C_n	PC + R + C_n + C_i	—	—	—
13	H	H	L	H	JSBR	JSB R	R	R + C_i	—	PC→LOG SP+1	SP+1
14	H	H	H	L	JSPR	JSB PC + R	PC + R + C_n	PC + R + C_n + C_i	—	PC→LOG SP+1	SP+1
15	H	H	H	H	PLDR	LOAD R	PC	PC + C_i	D	—	—

Notes:

1. Z = High impedance state (outputs "OFF")
2. - = No change.

PC - Program Counter
R - Auxiliary Register
S - Stack Top

SP - Stack Pointer
D - Direct Inputs

*If C_i of the least significant device is HIGH.

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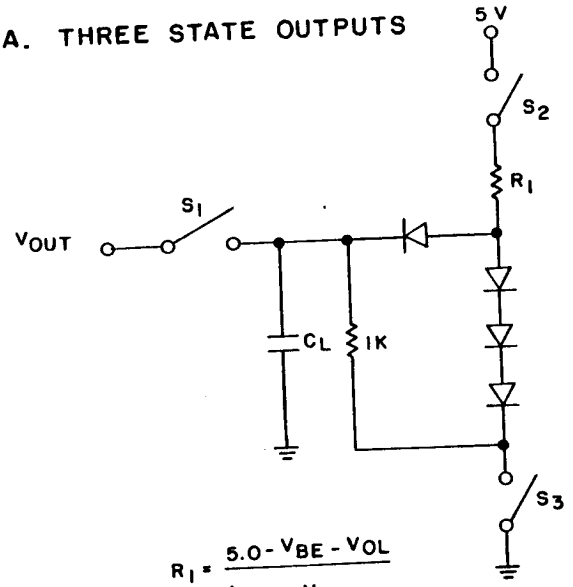
FIGURE 3. Truth table.

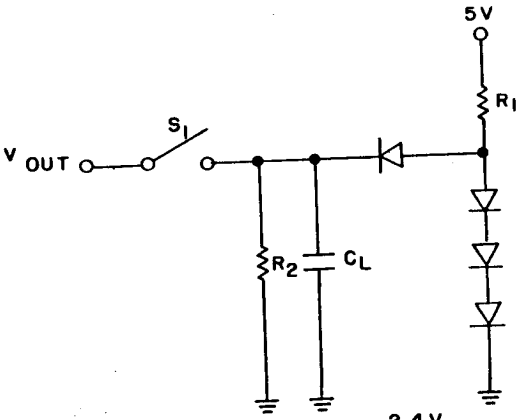
SWITCHING TEST CIRCUIT

A. THREE STATE OUTPUTS



$$R_1 = \frac{5.0 - V_{BE} - V_{OL}}{\frac{I_{OL} + V_{OL}}{1K}}$$

B. NORMAL OUTPUTS



$$R_2 = \frac{2.4V}{I_{OH}}$$

$$R_1 = \frac{5.0 - V_{BE} - V_{OL}}{\frac{I_{OL} + V_{OL}}{R_2}}$$

TEST OUTPUT LOADS

Pin # (DIP)	Pin Label	Test Circuit	R_1	R_2
2	$\overline{FULL}$	B	300	2K
4	$C_i + 4$	B	240	1.5K
6-9	Y_{0-3}	A	240	1K
12	$C_n + 4$	B	240	1.5K

NOTES:

1. C_L = 50pF includes scope probe, wiring and stray capacitances without device in test fixture.
2. S_1, S_2, S_3 are closed during function tests and all AC tests except output enable tests.
3. S_1 and S_3 are closed while S_2 is open for t_{PZH} test.
   S_1 and S_2 are closed while S_3 is open for t_{PZL} test.
4. C_L = 5.0pF for output disabled test.

FIGURE 4. Test circuits.

3.6.1 Screening. Screening shall be in accordance with method 5004, class B of MIL-STD-883 and 4.2 herein.

3.6.2 Qualification. Qualification inspection for the device type specified herein shall not be required.

3.6.3 Quality conformance inspection. Quality conformance inspection shall be in accordance with MIL-M-38510 and 4.4 herein.

3.6.4 Burn-in test circuit documentation. The burn-in test circuit documentation shall be made available to the acquiring activity on request.

3.7 Manufacturer eligibility. To be eligible to supply microcircuits to this drawing, a manufacturer shall have manufacturer certification in accordance with MIL-M-38510 for at least one line and have part I listing on Qualified Products List QPL-38510 for at least one device type (not necessarily the one for which the acquisition of this drawing is to apply).

3.8 Certificate of compliance. A certificate of compliance shall be required from a manufacturer in order to be listed as an approved source of supply (see 6.7 and 6.8).

4. QUALITY ASSURANCE PROVISIONS

4.1 Sampling and inspection. Sampling and inspection procedures shall be in accordance with MIL-M-38510 and method 5005 of MIL-STD-883, except as modified herein.

4.2 Screening. Screening shall be in accordance with method 5004 of MIL-STD-883, and shall be conducted on all devices prior to quality conformance inspection. The following additional criteria shall apply:

a. Burn-in test (method 1015 of MIL-STD-883).

(1) Test condition A, B, C, or D.

(2) T_A = +125°C, minimum.

b. Interim and final electrical test parameters shall be as specified in table II herein, except interim electrical parameter tests prior to burn-in are optional at the discretion of the manufacturer.

c. The percent defective allowable (PDA) shall be as specified in MIL-M-38510.

4.3 Qualification inspection. Qualification inspection for the device type specified herein shall not be required.

4.4 Quality conformance inspection. Quality conformance inspection shall be in accordance with MIL-M-38510 and method 5005 of MIL-STD-883. Groups A and B inspections shall be performed on each inspection lot or as specified in method 5005 of MIL-STD-883. Groups C and D shall be performed on a periodic basis in accordance with MIL-M-38510. Generic test data (see 6.5) may be used to satisfy the requirements for groups C and D inspections. Manufacturers shall keep lot records for 5 years (minimum), monitor for compliance to the prescribed procedures, and observe that satisfactory manufacturing conditions and records on lots are maintained for these devices. The records, including an attributes summary of all screening and quality conformance inspections conducted on each lot shall be available for review by customers at all times.

TABLE II. Electrical test requirements.

MIL-STD-883 test requirements	Subgroups (per method 5005, table I)
Interim electrical parameters (method 5004)	---
Final electrical test parameters (method 5004)	1*, 2, 3, 7, 8, 9, 10, 11
Group A test requirements (method 5005)	1, 2, 3, 7, 8, 9, 10, 11**
Groups C and D end-point electrical parameters (method 5005)	1, 2, 3
Additional electrical subgroups for group C periodic inspections	---

* PDA applies to subgroup 1 (see 4.2c).
** Subgroups 10 and 11, if not tested, shall be guaranteed to the specified limits in table I.

4.4.1 Group A inspection. Group A inspection shall consist of the test subgroups and LTPD values shown in table I of method 5005 of MIL-STD-883, class B, and as follows:

a. Tests shall be as specified in table II herein.

b. Subgroups 4, 5, and 6 in table I, method 5005 of MIL-STD-883 shall be omitted.

4.4.2 Group B inspection. Group B inspection shall consist of the test subgroups and LTPD values shown in table IIb of method 5005 of MIL-STD-883, class B.

4.4.3 Groups C and D inspections. Groups C and D inspections shall consist of the test subgroups and LTPD values shown in tables III and IV, method 5005 of MIL-STD-883, class B, and as follows:

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

b. Steady-state life test (method 1005 of MIL-STD-883) conditions:

(1) Test condition A, B, C, or D.

(2) T_A = +125°C, minimum.

(3) Test duration: 1,000 hours, except as permitted by appendix B of MIL-M-38510 and method 1005 of MIL-STD-883.

5. PACKAGING

5.1 Packaging requirements. The requirements for packaging shall be in accordance with MIL-M-38510.

6. NOTES

6.1 Notes. Only the note "Reevaluation of lot quality" of the notes specified in MIL-M-38510 shall apply to this drawing.

6.2 Intended use. Microcircuits conforming to this drawing are intended for use when military specifications do not exist and qualified military devices that will perform the required function are not available for OEM application. This drawing is intended exclusively to prevent the proliferation of unnecessary duplicate specifications, drawings, and stock catalog listings. When a military specification exists and the product covered by this drawing has been qualified for listing on QPL-38510, this drawing will be inactivated and will not be used for new design. The QPL-38510 product shall be the preferred item for all applications.

6.3 Ordering data. The contract or purchase order should specify the following:

a. Complete part number (see 1.2).

b. Requirements for delivery of one copy of the quality conformance inspection data pertinent to the device inspection lot to be supplied with each shipment by the device manufacturer, if applicable.

c. Requirements for certificate of compliance, if applicable.

d. Requirements for notification of change of product or process to the contracting activity, if applicable.

e. Requirements for special carriers, lead lengths, or lead forming, if applicable. These requirements shall not affect the part number. Unless otherwise specified, these requirements will not apply to direct shipment to the Government.

6.4 Replaceability. Microcircuits covered by this drawing will replace the same generic device covered by a contractor-prepared specification or drawing.

6.5 Generic test data. Generic test data may be used to satisfy the requirements of 4.4.3. Group C generic test data shall be on date codes no more than 1 year old and on a die in the same microcircuit group (see appendix E of MIL-M-38510) with the same material, design, and process and from the same plant as the die represented. Group D generic data shall be on date codes no more than 1 year old and on the same package type (terms, definitions, and symbols of MIL-M-38510) and from the same plant as the package represented. The vendor is required to retain the generic data for a period of not less than 5 years from the date of shipment.

6.6 Comments. Comments on this drawing should be directed to DESC-ECS, Dayton, Ohio 45444, or telephone 513-296-5375.

6.7 Submission of certificate of compliance. The certificate of compliance submitted to DESC-ECS, prior to listing as an approved source of supply in 6.8, shall state that the manufacturer's product meets the provisions for MIL-STD-883 compliant devices and the requirements herein.

6.8 Approved source of supply. An approved source of supply is listed herein. Additional sources will be added as they become available. The vendor listed herein has agreed to this drawing and a certificate of compliance (see 3.8) has been submitted to DESC-ECS.

DESC drawing part number	Vendor FSCM number	Vendor similar part number	Replacement military specification part number
8605001RX	34335	AM2932/BRA	---

Vendor FSCM number	Vendor name and address
34335	Advanced Micro Devices, Incorporated 901 Thompson Place P. O. Box 3453 Sunnyvale, CA 94088