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This revision described below has been authorized for the document listed.			
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		3. DODAAC	
4. ORIGINATOR	b. ADDRESS (Street, City, State, Zip Code) Defense Electronics Supply Center 1507 Wilmington Pike Dayton, OH 45444-5765	5. CAGE CODE 67268	6. NOR NO. 5962-R213-94
a. TYPED NAME (First, Middle Initial, Last) N. A.		7. CAGE CODE 67268	8. DOCUMENT NO. 83002
9. TITLE OF DOCUMENT MICROCIRCUIT, LINEAR, HYBRID, 12-BIT DIGITAL-TO-ANALOG, RANGE PROGRAMABLE VOLTAGE OUTPUT CONVERTER, SILICON		10. REVISION LETTER	
		a. CURRENT E	b. NEW F
		11. ECP NO. N. A.	
12. CONFIGURATION ITEM (OR SYSTEM) TO WHICH ECP APPLIES All			
13. DESCRIPTION OF REVISION Sheet 1: Revisions ltr column; add "F". Revisions description column; add "Changes in accordance with NOR 5962-R213-94". Revisions date column; add "94-06-17". Revision level block; change "E" to "F". Rev status of sheets; For sheets 1 and 4 change "E" to "F". Sheet 4: TABLE I, V_{REF} , conditions column; delete "-200 μ A" and substitute "+200 μ A". Revision level block; change "E" to "F".			
14. THIS SECTION FOR GOVERNMENT USE ONLY			
a. (X one)	<input checked="" type="checkbox"/>	(1) Existing document supplemented by the NOR may be used in manufacture.	
	<input type="checkbox"/>	(2) Revised document must be received before manufacturer may incorporate this change.	
	<input type="checkbox"/>	(3) Custodian of master document shall make above revision and furnish revised document.	
b. ACTIVITY AUTHORIZED TO APPROVE CHANGE FOR GOVERNMENT		c. TYPED NAME (First, Middle Initial, Last)	
d. TITLE Chief, Electronic Components Branch	e. SIGNATURE Kendall A. Cottongim		f. DATE SIGNED (YYMMDD) 94-06-17
15a. ACTIVITY ACCOMPLISHING REVISION DESC-ELDT	b. REVISION COMPLETED (Signature) Gary Zahn		c. DATE SIGNED (YYMMDD) 94-06-17

REVISIONS

LTR	DESCRIPTION	DATE (YR-MO-DA)	APPROVED
A	Add vendor FSCM 51640 technical and editorial changes throughout.	85-01-15	M. A. Frye
B	Page 2, add case outline D-3. Page 9, change eligibility requirement paragraph 3.7. Editorial changes throughout.	85-11-11	M. A. Frye
C	Page 4, table I, change I_{IH} from $\pm 40 \mu A$ to $\pm 250 \mu A$. Change to standard military drawing format. Change code identification number to 67268. Editorial changes throughout.	89-02-03	M. A. Frye
D	Delete vendor CAGE 13919. Package X not available from approved source. Changed to reflect MIL-H-38534 processing. Editorial changes throughout.	90-07-09	W. Heckman
E	Technical changes to tables I and II. Editorial changes throughout.	92-10-03	Alan Barone

THE FRONT PAGE OF THIS DRAWING HAS BEEN REPLACED

CURRENT CAGE CODE 67268

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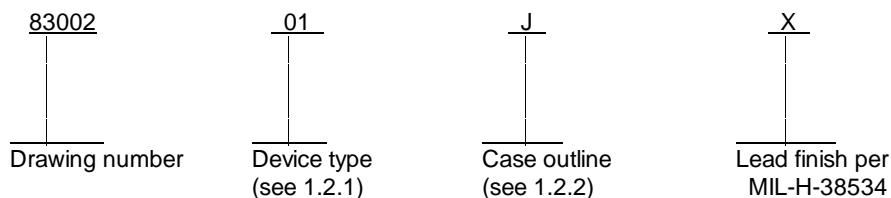
REV STATUS OF SHEETS	REV	E	E	E	E	E	E	E	E	C	E	E				
	SHEET	1	2	3	4	5	6	7	8	9	10					

<p align="center">STANDARDIZED MILITARY DRAWING</p> <p align="center">THIS DRAWING IS AVAILABLE FOR USE BY ALL DEPARTMENTS AND AGENCIES OF THE DEPARTMENT OF DEFENSE</p> <p align="center">AMSC N/A</p>	PMIC N/A	PREPARED BY Gary Zahn	DEFENSE ELECTRONICS SUPPLY CENTER DAYTON, OHIO 45444	
		CHECKED BY William E. Shoup		
		APPROVED BY M.A. Hauck		
		DRAWING APPROVAL DATE 82-08-09		
		REVISION LEVEL E		
	MICROCIRCUITS, LINEAR, HYBRID, 12-BIT DIGITAL-TO-ANALOG RANGE PROGRAMMABLE VOLTAGE OUTPUT CONVERTER, SILICON	SIZE A	CAGE CODE 14933	83002
SHEET 1 OF 10				

1. SCOPE

1.1 Scope. This drawing describes device requirements for class H hybrid microcircuits to be processed in accordance with MIL-H-38534.

1.2 Part or Identifying Number (PIN). The complete PIN shall be as shown in the following example:



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

<u>Device type</u>	<u>Generic number</u>	<u>Circuit function</u>
01	DAC 87 (Hybrid)	D/A converter, 12-bit with output voltage ranges as follows: 0 V to +5 V unipolar 0 V to +10 V unipolar -2.5 V to +2.5 V bipolar -5 V to +5 V bipolar -10 V to +10 V bipolar

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

<u>Outline letter</u>	<u>Description designator</u>	<u>Terminals</u>	<u>Package style</u>
J	CDIP1-T24	24	dual-in-line
X	See figure 2	24	dual-in-line

1.3 Absolute maximum ratings.

Positive supply voltage V_{CC} to digital return	18 V
Negative supply voltage V_{EE} to digital return	-18 V
Positive supply voltage V_{DD} to digital return	7 V
Digital input voltage to digital return	0 V to V_{DD}
Output short circuit duration (to ground only)	25 ms
Lead temperature (soldering, 60 seconds)	+300°C
Storage temperature	-65°C to +150°C
Junction temperature (T_J)	+175°C
Thermal resistance, junction-to-case (Θ_{JC}):	
Case J	See MIL-M-38510, appendix C
Case X	7°C/W
Thermal resistance, junction-to-ambient (Θ_{JA}):	
Case J	50°C/W
Case X	37°C/W

1.4 Recommended operating conditions.

Positive supply voltage range (V_{CC})	14.5 V to 15.5 V
Negative supply voltage range (V_{EE})	-15.5 V to -14.5 V
Positive supply voltage range (V_{DD})	4.5 V to 5.5 V
Ambient operating temperature range (T_A)	-55°C to +125°C

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2. APPLICABLE DOCUMENTS

2.1 Government specifications and standard. Unless otherwise specified, the following specifications 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-H-38534 - Hybrid Microcircuits, General Specification for.

STANDARDS

MILITARY

MIL-STD-883 - Test Methods and Procedures for Microelectronics.
MIL-STD-1835 - Microcircuits Case Outlines.

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

2.2 Order of precedence. In the event of a conflict between the text of this drawing and the references cited herein, the text of this drawing shall take precedence.

3. REQUIREMENTS

3.1 Item requirements. The individual item requirements shall be in accordance with MIL-H-38534 and as specified herein.

3.2 Design, construction, and physical dimensions. The design, construction, and physical dimensions shall be as specified in MIL-H-38534 and herein.

3.2.1 Terminal connections. The terminal connections shall be as specified on figure 1.

3.2.2 Case outline(s). The case outline(s) shall be in accordance with 1.2.2 herein.

3.3 Electrical performance characteristics. Unless otherwise specified herein, the electrical performance characteristics are as specified in table I and shall apply over the full specified operating temperature range.

3.4 Electrical test requirements. The electrical test requirements shall be the subgroups specified in table II. The electrical tests for each subgroup are described in table I.

3.5 Marking. Marking shall be in accordance with MIL-H-38534. The part shall be marked with the PIN listed in 1.2 herein. In addition, the manufacturer's PIN may also be marked as listed in QML-38534 (see 6.6 herein).

3.6 Manufacturer eligibility. In addition to the general requirements of MIL-H-38534, the manufacturer of the part described herein shall submit for DESC-ECT review and approval electrical test data (variables format) on 22 devices from the initial quality conformance inspection group A lot sample, produced on the certified line, for each device type listed herein. The data should also include a summary of all parameters manually tested, and for those which, if any, are guaranteed.

3.7 Certificate of compliance. A certificate of compliance shall be required from a manufacturer in order to be listed as an approved source of supply in QML-38534 (see 6.6 herein). The certificate of compliance submitted to DESC-ECT prior to listing as an approved source of supply shall affirm that the manufacturer's product meets the requirements of MIL-H-38534 and the requirements herein.

3.8 Certificate of conformance. A certificate of conformance as required in MIL-H-38534 shall be provided with each lot of microcircuits delivered to this drawing.

4. QUALITY ASSURANCE PROVISIONS

4.1 Sampling and inspection. Sampling and inspection procedures shall be in accordance with MIL-H-38534.

Table with 4 columns: Standardized Military Drawing info, Size A, Revision Level E, and Sheet 3.

TABLE I. Electrical performance characteristics.

Test	Symbol	Conditions -55° C ≤ T _A ≤ +125° C unless otherwise specified	Group A subgroups	Limits		Unit
				Min	Max	
Resolution				12		Bits
Supply current from V _{CC}	I _{CC}	Input bits = 0111 1111 1111 V _{CC} = 15 V, T _A = +25° C	1	1	30	mA
Supply current from V _{EE}	I _{EE}	Input bits = 0111 1111 1111 V _{EE} = -15 V, T _A = +25° C	1	-45	-1	mA
Supply current from V _{DD}	I _{DD}	Input bits = 0111 1111 1111 V _{DD} = 5 V, T _A = +25° C	1		25	mA
Input low current	I _{IL}	V _{IN} (logic) = 0 V, V _{DD} = 5.5 V, V _{CC} = 15.0 V, (each input measured separately), T _A = +25° C	1	-1.6		mA
Input high current	I _{IH}	V _{IN} (logic) = 2.4 V, V _{DD} = 5.5 V, V _{CC} = 15.0 V, T _A = +25° C	1	-250	+250	μA
		V _{IN} (logic) = 5.5 V, V _{DD} = 5.5 V, V _{CC} = 15.0 V, T _A = +25° C (each input measured separately)		-1	+500	μA
Output short circuit current	I _{OSC}	Input bits = 1111 1111 1111 T _A = +25° C	7	-40		mA
Reference voltage	V _{REF}	I ₀ = -200 μA, T _A = +25° C	1	5.89	6.60	V
Reference voltage drift	$\frac{dV_{REF}}{dT}$	1/	2, 3	-20	+20	PPM/° C
Unipolar offset voltage error	V _{OS}	Input bits = 1111 1111 1111 Unipolar, VFSR = 10 V, 2/ (Initial) (End-point) T _A = +25° C	1	-2	+2	LSB
				-3	+3	LSB
Unipolar offset voltage drift	$\frac{dV_{OS}}{dT}$	3/	2, 3	-0.012	+0.012	LSB/° C

See footnotes at end of table.

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TABLE I. Electrical performance characteristics - Continued.

Test	Symbol	Conditions -55°C ≤ T _A ≤ +125°C unless otherwise specified	Group A subgroups	Limits		Unit
				Min	Max	
Gain error <u>4</u> /	AE	Input bits = 0000 0000 0000 to input bits = 1111 1111 1111 Unipolar, VFSR = 10 V (Initial) (End point) T _A = +25°C	1	-1 -25	+1 +25	% %
Gain error drift	dAE — dT	<u>1</u> /	2, 3	-20	+20	PPM/°C
Bipolar gain error	BPAE	Input bits = 0000 0000 0000 to input bits = 1111 1111 1111 T _A = +25°C	1	-1	+1	%
Bipolar offset error	BPOE	Input bits = 1111 1111 1111 (Initial) (End-point) T _A = +25°C	1	-4 -6	+4 +6	LSB LSB
Bipolar offset error drift	dBPOE — dT	<u>1</u> /	2, 3	-0.8	+0.8	LSB/°C
Bipolar zero error	BZE	Inputs bits = 1111 1111 1111 T _A = +25°C	1	-2	+2	LSB
Bipolar zero error drift	dBZE — dT	<u>1</u> /	2, 3	-0.4	+0.4	LSB/°C
Power supply sensitivity at full scale	+PSS1	Input bits = 0000 0000 0000 +14.5 V ≤ V _{CC} ≤ +15.0 V +15.0 V ≤ V _{CC} ≤ +15.5 V	1, 2, 3 <u>5</u> /	-16 -16	+16 +16	LSB/%PS LSB/%PS
Power supply sensitivity at full scale	+PSS2	Input bits = 0000 0000 0000 +4.5 V ≤ V _{DD} ≤ +5.0 V +5.0 V ≤ V _{DD} ≤ +5.5 V	1, 2, 3 <u>5</u> /	-16 -16	+16 +16	LSB/%PS LSB/%PS
Power supply sensitivity from V _{EE} at full scale	-PSS	Input bits = 0000 0000 0000 -15.5 V ≤ V _{EE} ≤ -15.0 V -15.0 V ≤ V _{EE} ≤ -14.5 V	1, 2, 3 <u>5</u> /	-16 -16	+16 +16	LSB/%PS LSB/%PS

See footnotes at end of table.

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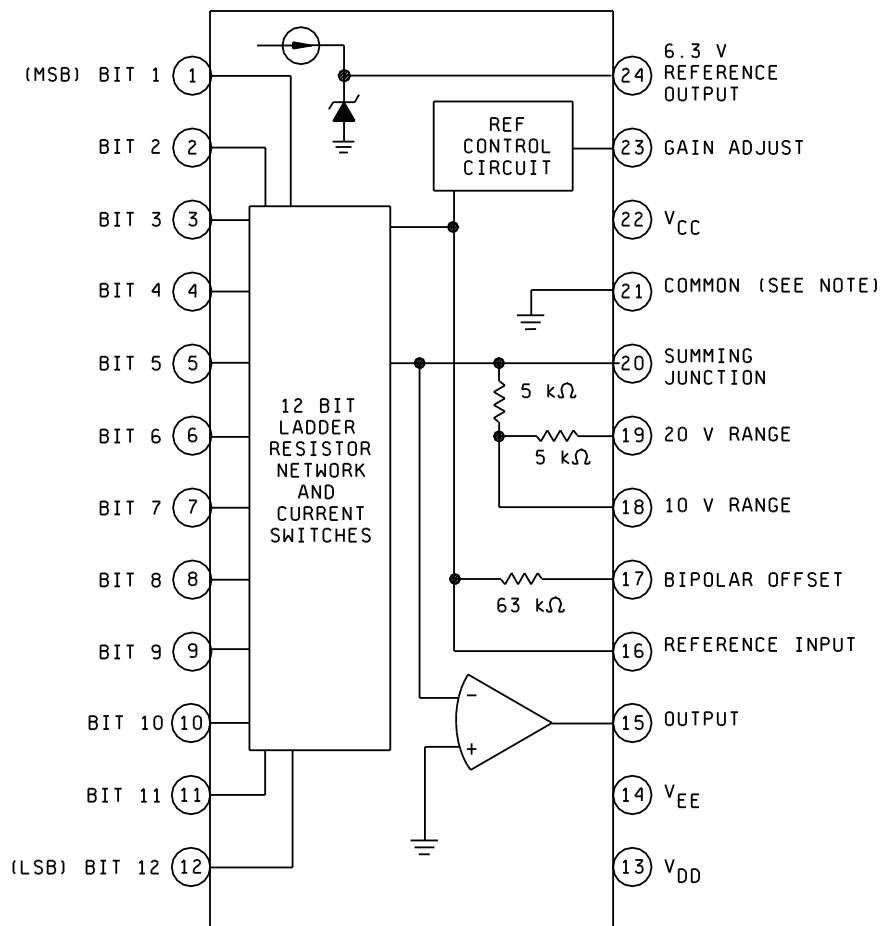
TABLE I. Electrical performance characteristics - Continued.

Test	Symbol	Conditions -55°C ≤ T _A ≤ +125°C unless otherwise specified	Group A subgroups	Limits		Unit
				Min	Max	
Integral linearity error	LE	(Abbreviated codes test) <u>6/</u> (Initial) (End-point)	1, 2, 3	-0.5 -1.5	+0.5 +1.5	LSB LSB
Differential linearity error	DLE	(Abbreviated codes test)	1, 2, 3	-1.0	+1.0	LSB
Integral linearity error	LE	(All codes test)	7, 8 <u>5/</u>	-0.5	+0.5	LSB
Settling time	t _{SLH}	Input bits = 1111 1111 1111 to input bits = 0000 0000 0000 20 V to ±1/2 LSB 20 V to ±1 LSB Input bits = 1111 1111 1111 to input bits = 1111 1111 1110 1 LSB to ±1/2 LSB	9, 10, 11 <u>5/</u>		7 6 3	μs μs μs
Settling time	t _{SHL}	Input bits = 0000 0000 0000 to input bits = 1111 1111 1111 20 V to ±1/2 LSB 20 V to ±1 LSB Input bits = 1111 1111 1110 to input bits = 1111 1111 1111 1 LSB to ±1/2 LSB	9, 10, 11 <u>5/</u>		7 6 3	μs μs μs
Output noise voltage	NO	All inputs = 1111 1111 1111 10 Hz ≤ BW ≤ 100 kHz T _A = +25°C			100	μV rms

- 1/ Calculations for dV_{OS}/dT, dAE/dT, dBPOE/dT and dBZE/dT are determined from measurements made at +125°C, +25°C, and -55°C for V_{OS}, AE, BPOE, and BZE, respectively.
- 2/ Unless otherwise stated, all tests are performed in the bipolar mode over a -10 V to +10 V range. The scale factor is VFSR/4096 LSB (i.e., for VFSR = 20 V, the scale factor is 20 V/4096 LSB = 4.88 mV/LSB).
- 3/ Unless otherwise specified, V_{CC} = 15.0 V, V_{EE} = -15.0 V, V_{DD} = 5.0 V, logic "0" = 0.8 V, logic "1" = 2.0 V, VFSR = 20 V, -55°C ≤ T_A ≤ +125°C, bipolar operation, load resistance R_L = 2 kΩ.
- 4/ The gain error of a 12-bit D/A converter in percent of full scale range corresponds to gain error in LSB units by the following relationship: 0.20 percent x 4096 LSB/100 percent = 8.92 LSB.
- 5/ These parameters in subgroups 2, 3, 7, 8, 9, 10, and 11 shall be tested as part of initial characterization and after design and process changes.
- 6/ The abbreviated integral linearity error test shown for subgroups 1, 2, and 3 shall represent the minimum number of tests required. The manufacturer shall add additional tests or calculations to assure that the worst positive and negative error values, as determined by the abbreviated test, are within 150 milliLSB of the worst positive and negative error values, as determined by the all codes test for subgroups 7 and 8.

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Device type 01



NOTE: Pin 21 is connected to the case.

FIGURE 1. Terminal connections for case outlines J and X.

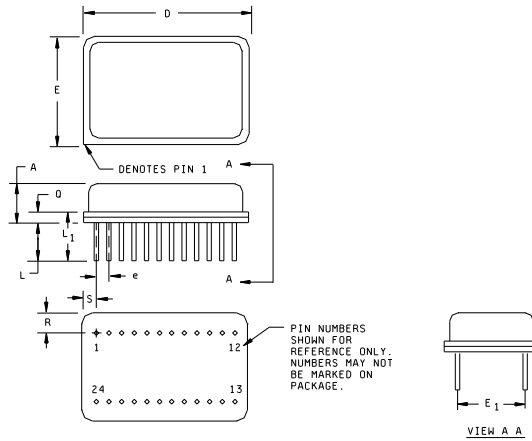
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DAYTON, OHIO 45444

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REVISION LEVEL
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Symbol	Inches		Millimeters		Notes
	Min	Max	Min	Max	
A	.170	.250	4.318	6.35	
b	.016	.021	0.406	0.533	9
D	1.365	1.385	34.67	35.18	5
E	.790	.810	20.07	20.57	5
E ₁	.590	.610	14.99	15.49	8
e	.100 BSC		2.54 BSC		6, 10
L		.285	3.18	7.62	
L ₁	.150	.300			
Q		.015		0.381	4
R	.080	.110	2.032	2.794	7
S	.125	.150	3.175	3.81	7

NOTES:

1. Dimensions are in inches.
2. Metric equivalents are given for general information only.
3. The manufacturer's identification shall not be used as a pin one identification mark.
4. Dimensions Q shall be measured from the seating plane to the base plane.
5. This dimensions allows for off-center lid overrun.
6. The basic pin spacing is .100 (2.54 mm) between center lines. Each pin center line shall be located within ± 0.010 (0.25 mm) of its exact to pins 1 and 24.
7. Applies to all four corners (leads 1, 12, 13, 24).
8. E₁ shall be measured at the center line of the leads.
9. All leads- increase maximum limit by .003 (0.08 mm) measured at the center of the flat, when lead finish A or B is applied.
10. Twenty-two spaces.
11. Leads in true position within .010 (0.25 mm) R at MMC at seating plane.

FIGURE 2. Case outline X.

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TABLE II. Electrical test requirements.

MIL-STD-883 test requirements	Subgroups (per method 5008, group A test table)
Interim electrical parameters	---
Final electrical test parameters	1*, 2, 3, 9
Group A test requirements	1, 2, 3, 7, 8, 9, 10, 11
Group C end-point electrical parameters	1, 2, 3

* PDA applies to subgroup 1.

4.2 Screening. Screening shall be in accordance with MIL-H-38534. The following additional criteria shall apply:

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

(1) Test condition A, B, C, or D using the circuit submitted with the certificate of compliance (see 3.7 herein).

(2) T_A as specified in accordance with table I of method 1015 of MIL-STD-883.

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.

4.3 Quality conformance inspection. Quality conformance inspection shall be in accordance with MIL-H-38534 and as specified herein.

4.3.1 Group A inspection. Group A inspection shall be in accordance with table X of method 5008 of MIL-H-38534 and as follows:

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

b. Subgroups 4, 5, and 6 shall be omitted.

4.3.2 Group B inspection. Group B inspection shall be in accordance with MIL-H-38534.

4.3.3 Group C inspection. Group C inspection shall be in accordance with MIL-H-38534 and as follows:

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

b. Steady-state life test conditions, method 1005 of MIL-STD-883.

(1) Test condition A, B, C, or D using the circuit submitted with the certificate of compliance (see 3.7 herein).

(2) T_A as specified in accordance with table I of method 1005 of MIL-STD-883.

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

4.3.4 Group D inspection. Group D inspection shall be in accordance with MIL-H-38534.

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5. PACKAGING

5.1 Packaging requirements. The requirements for packaging shall be in accordance with MIL-H-38534.

6. NOTES

6.1 Intended use. Microcircuits conforming to this drawing are intended for original equipment design applications and logistic support of existing equipment.

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

6.3 Configuration control of SMD's. All proposed changes to existing SMD's will be coordinated with the users of record for the individual documents. This coordination will be accomplished in accordance with MIL-STD-481 using DD Form 1693, Engineering Change Proposal (Short Form).

6.4 Record of users. Military and industrial users shall inform Defense Electronics Supply Center when a system application requires configuration control and the applicable SMD. DESC will maintain a record of users and this list will be used for coordination and distribution of changes to the drawings. Users of drawings covering microelectronics devices (FSC 5962) should contact DESC-ECT, telephone (513) 296-6047.

6.5 Comments. Comments on this drawing should be directed to DESC-ECT, Dayton, Ohio 45444, or telephone (513) 296-5374.

6.6 Approved sources of supply. Approved sources of supply are listed in QML-38534. Additional sources will be added to QML-38534 as they become available. The vendors listed in QML-38534 have agreed to this drawing and a certificate of compliance (see 3.7 herein) has been submitted to and accepted by DESC-ECT.

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