REVISIONS

LTR	DESCRIPTION	DATE (YR-MO-DA)	APPROVED
A	Made technical changes to table I. Corrected figure 1 to change a 28-lead package to a 24-lead package. Editorial changes throughout.	91-05-07	W. Heckman
B	Added case outline X. Editorial changes throughout.	93-07-30	K. Cottongim

REV																			
SHEET																			
REV																			
SHEET																			

REV STATUS OF SHEETS														
REV	B	B	B	B	B	B	B	B	B	B	B	B	B	B
SHEET	1	2	3	4	5	6	7	8	9	10	11	12	13	14

PMIC N/A

STANDARDIZED MILITARY DRAWING

THIS DRAWING IS AVAILABLE FOR USE BY ALL DEPARTMENTS AND AGENCIES OF THE DEPARTMENT OF DEFENSE

AMSC N/A

PREPARED BY Steve Duncan

CHECKED BY Robert M. Heber

APPROVED BY William K. Heckman

DRAWING APPROVAL DATE

REVISION LEVEL B

DEFENSE ELECTRONICS SUPPLY CENTER
DAYTON, OHIO 45444

MICROCIRCUIT, LINEAR, ANALOG TO DIGITAL CONVERTER, HIGH SPEED, 12-BIT, HYBRID

SIZE	CAGE CODE	5962-89584
A	67268	

SHEET 1 OF 14

DESC FORM 193
JUL 91

9004708 0010345 310

5962-E396-93

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

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(s) shall identify the circuit function as follows:

Device type	Generic number	Circuit function
01	MN5210	A/D converter, high speed, 12-bit, 0 V to -10 V internal reference
02	MN5213	A/D converter, high speed, 12-bit, 0 V to -10 V external reference
03	MN5211	A/D converter, high speed, 12-bit, -5 V to +5 V internal reference
04	MN5214	A/D converter, high speed, 12-bit, -5 V to +5 V external reference
05	MN5212	A/D converter, high speed, 12-bit, -10 V to +10 V internal reference
06	MN5215	A/D converter, high speed, 12-bit, -10 V to +10 V external reference
07	MN5216	A/D converter, high speed, 12-bit, 0 V to +10 V internal reference

1.2.2 Case outline(s). The case outline(s) shall be as designated in MIL-STD-1835 and as follows:

Outline letter	Descriptive designator	Terminals	Package style
X	See figure 1	24	dual-in-line package
Y	See figure 1	24	dual-in-line package

1.2.3 Lead finish. The lead finish shall be as specified in MIL-H-38534. Finish letter "X" shall not be marked on the microcircuit or its packaging. The "X" designation is for use in specifications when lead finishes A, B, and C are considered acceptable and interchangeable without preference.

1.3 Absolute maximum ratings. 1/

Positive supply voltage (V_{CC})	+18 V dc
Negative supply voltage (V_{EE})	-18 V dc
Logic supply voltage (V_{LOG})	+7 V dc
Analog input voltage	±25 V dc
Digital input voltage	+5.5 V dc
Digital output voltage	$+V_{LOG}$
Reference input voltage (V_{REF})	0 to -15 V dc (Ext. ref. only)
Lead temperature (soldering, 60 seconds)	+300°C
Junction temperature (T_J)	+175°C
Thermal resistance:	
Junction-to-case (Θ_{JC})	6°C/W
Junction-to-ambient (Θ_{JA})	33°C/W

1.4 Recommended operating conditions.

Positive supply voltage range (V_{CC})	+14.55 V dc to +15.45 V dc
Negative supply voltage range (V_{EE})	-14.55 V dc to -15.45 V dc
Logic supply voltage range (V_{LOG})	+4.5 V dc to +5.5 V dc
External reference (V_{REF}):	
Device types 02, 04, 06	-10.0 V dc
Ambient operating temperature range (T_A)	-55°C to +125°C

1/ Stresses above the absolute maximum rating may cause permanent damage to the device. Extended operation at the maximum levels may degrade performance and affect reliability.

2. APPLICABLE DOCUMENTS

2.1 Government specification and standards. Unless otherwise specified, the following specification and standards 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 - Microcircuit 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 Case outline(s). The case outline(s) shall be in accordance with 1.2.2 herein.

3.2.2 Terminal connections. The terminal connections shall be as specified on figure 2.

3.2.3 Logic diagram(s). The logic diagram(s) shall be as specified on figure 3.

3.2.4 Timing diagram. The timing table shall be as specified on figure 4.

3.2.5 Digital output codes. The digital output codes shall be as specified on figure 5.

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).

TABLE I. Electrical performance characteristics.

Test	Symbol	Conditions 1/ $-55°C \le T_C \le +125°C$ unless otherwise specified	Group A subgroups	Device type	Limits		Unit
					Min	Max	
Power supply current from V_{CC}	I_{CC}	V_{CC} = 15.45 V, V_{IN} (analog) = max positive input voltage +0.5 V, output code = 0000 0000 0000	1, 2, 3	All	3	28	mA
		V_{CC} = 15.45 V, V_{IN} (analog) = max negative input voltage -0.5 V, output code = 1111 1111 1111			3	28	mA
Power supply current from V_{EE}	I_{EE}	V_{EE} = -15.45 V, V_{IN} (analog) = max positive input voltage +0.5 V, output code = 0000 0000 0000		01,03 05,07	-1	-25	mA
		V_{EE} = -15.45 V, V_{IN} (analog) = max negative input voltage -0.5 V, output code = 1111 1111 1111		02,04 06	-1	-25	mA
Power supply current from V_{LOG}	I_{LOG}	V_{LOG} = 5.5 V, V_{IN} (analog) = max positive input voltage +0.5 V, output code = 0000 0000 0000		All	1	42	mA
		V_{LOG} = 5.5 V, V_{IN} (analog) = max negative input voltage -0.5 V, output code = 1111 1111 1111			1	42	mA
Reference input	I_{REF}	V_{REF} = -10 V, V_{IN} (analog) = max positive input voltage +0.5 V		02,04 06	-0.1	-2	mA
		V_{REF} = -10 V, V_{IN} (analog) = max negative input voltage -0.5 V			-0.1	-2	mA
Power dissipation	P_D			All		915	mW
Input low current	I_{IL}	V_{IN} (logic) = 0.3 V		All	-0.05	-0.4	mA
Input high current	I_{IH}	V_{IN} (logic) = 2.4 V		All	0	40	µA
		V_{IN} (logic) = 5.5 V			0	1	mA
Output short circuit	I_{OS}	V_{IN} (logic) = max negative input voltage -0.5 V, output code = 1111 1111 1111 (test one output at a time)		All	-4	-35	mA

See footnotes at end of table.

TABLE I. Electrical performance characteristics - Continued.

Test	Symbol	Conditions 1/ $-55°C \le T_C \le +125°C$ unless otherwise specified	Group A subgroups	Device type	Limits		Unit
					Min	Max	
Output logic voltage levels	V_{OH}	$I_L = -80\ \mu A$	1, 2, 3	All	2.4		V
	V_{OL}	$I_L = 3.2$ mA				0.3	V
Serial/parallel	S_O	Set V_{IN} for output code = 1000 0000 0000, serial output code exactly equals parallel output code	4, 5, 6		PASS/FAIL		
Bit transition linearity error (end-point) 2/	T_{LE}	ΔV_{CC} (max) = ΔV_{EE} (max) = ±.015, abbreviated test			-0.50	+0.50	LSB
Major carry errors	M_{CE}	ΔV_{CC} (max) = ΔV_{EE} (max) = ±.015 800-7FF (HEX) to 002-001 (HEX)			-0.9	+1.5	LSB
		7FF-&FE (HEX) to 001-000 (HEX)			-0.9	+1.5	LSB
Power supply sensitivity to V_{CC}	$+P_{SS1}$	V_{CC} = +14.55 V, +15.45 V, output transition = 0000 0000 000ϕ 3/			-0.02	+0.02	%FSR/%V_S
Power supply sensitivity to V_{EE}	$-P_{SS1}$	V_{EE} = -14.55 V, -15.45 V, output transition = 0000 0000 000ϕ 3/			-0.05	+0.05	%FSR/%V_S
Power supply sensitivity to V_{LOG}	$+P_{SS2}$	V_{LOG} = +4.5 V, +5.5 V, output transition = 0000 0000 000ϕ 3/			-1	+1	%FSR/%V_S
Bit transition linearity error (end-point)	T_{LE}	ΔV_{CC} (max) = ΔV_{EE} (max) = ±.015, all codes test			-0.75	+0.75	LSB
Conversion time	t_c	4/	9, 10, 11			13	µs
Clock input	t_{PWH}	Logic 1 = 2.4 V Logic 0 = 0.3 V 1/			175		ns
	t_{PWH}				125		ns

See footnotes at end of table.

TABLE I. Electrical performance characteristics - Continued.

1/ Unless otherwise specified, V_{CC} = +15 V dc ±5 percent, V_{CC} = -15 V dc ±5 percent, and V_{LOG} = +5 V dc ±10 percent.

2/ The abbreviated bit transition linearity error test shown for subgroups 4, 5, and 6 shall represent the minimum number of tests required. The manufacturer shall add additional test and/or calculations to assure that the worst positive and negative error values, as determined by the abbreviated test, are within 150 milli LSB, of the worst positive and negative values, as determined by the all codes test for subgroups 7 and 8.

3/ ϕ represents the transition point between two adjacent code-words (i.e.: 0000 0000 0000 and 0000 0000 0001 or 0111 1111 1111 and 1000 0000 0000).

4/ The listed conversion time is for test purposes and is based on a maximum clock frequency of 923 kHz.

3.6 Manufacturer eligibility. In addition to the general requirements of MIL-H-38534, the manufacturer of the part described herein shall maintain the electrical test data (variables format) from the initial quality conformance inspect on 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. This data shall be maintained under document revision level control by the manufacturer and be made available to the preparing activity (DESC-EC) upon request.

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-EC 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.

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

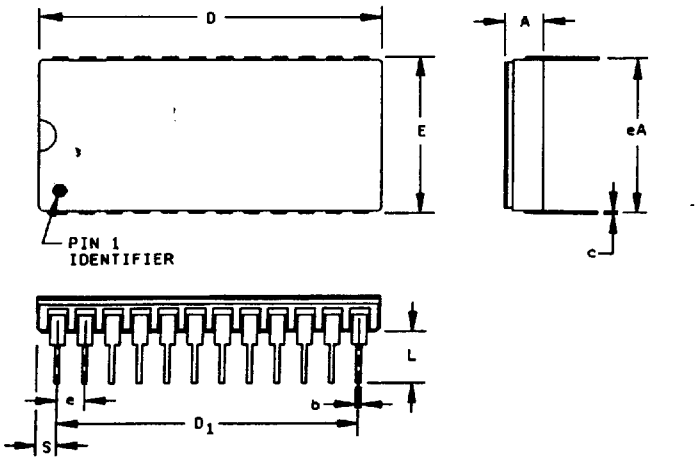
a. Burn-in test, method 1015 of MIL-STD-883.

(1) Test condition A, B, C, or D. The test circuit shall be maintained by the manufacturer under document revision level control and shall be made available to either DESC-EC or the acquiring activity upon request. Also, the test circuit shall specify the inputs, outputs, biases, and power dissipation, as applicable, in accordance with the intent specified in test method 1015 of MIL-STD-883.

(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.

Case outline X

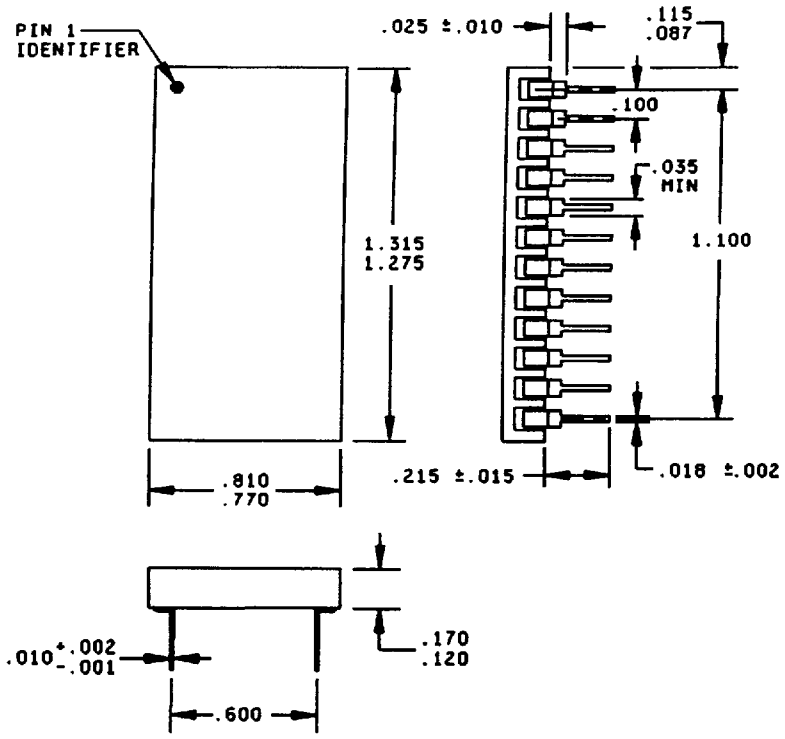


Symbol	Millimeters		Inches	
	Min	Max	Min	Max
A	----	4.65	----	.183
b	0.381	0.483	.015	.019
c	0.203	0.305	.008	.012
D	31.24	32.26	1.230	1.270
D_1	27.81	28.07	1.095	1.105
E	----	15.75	----	.620
e	2.54 BSC		.100 BSC	
eA	15.11	15.37	.595	.605
L	4.45	5.21	.175	.205
S	1.65	2.03	.065	.080

NOTE: The U.S. government preferred system of measurement is the metric SI. This case outline was designed using inch-pound units of measurement. In case of problems involving conflicts between the metric and inch-pound units, the inch-pound units shall rule.

FIGURE 1. Case outline.

Case outline Y



mm	Inches
0.03	.001
0.05	.002
0.25	.010
0.38	.015
0.46	.018
0.63	.025
0.89	.035
2.21	.087
2.54	.100
2.92	.115
3.05	.120
4.32	.170
5.46	.215
15.24	.600
19.56	.770
20.57	.810
27.94	1.100
32.38	1.275
33.40	1.315

NOTES:
1. Dimensions are in inches.
2. Metric equivalents are given for general information only.
3. Unless otherwise specified, tolerances are ±.005 (0.13 mm).

FIGURE 1. Case outline - Continued.

Case outline	X and Y
Terminal number	Terminal symbol
1	Start convert
2	V_{LOG}
3	Serial output
4	Bit 6
5	Bit 5
6	Bit 4
7	Bit 3
8	Bit 2
9	Bit 1 (MSB)
10	NC
11	Ground (see note 2)
12	V_{REF} (see note 1)
13	V_{EE}
14	Analog input
15	V_{CC}
16	Bit 12 (LSB)
17	Bit 11
18	Bit 10
19	Bit 9
20	Bit 8
21	Bit 7
22	Status (E.O.C.)
23	Ground (see note 2)
24	Clock input

NOTES:
1. For device types 02, 04, 06, a -10 V external reference is applied to pin 12. No other connection shall be made to pin 12. For device types 01, 03, 05, and 07 terminal is reference output of -6.3 V.
2. The units two ground pins (pins 11 and 23) must be connected together as close to the package as possible, and preferably should be connected to a large analog ground plane underneath the package. If these commons must be run separately, a non-polarized 0.01 μF bypass capacitor should be connected between pins 11 and 23 as close to the unit as possible and wide conductor runs should be employed.

FIGURE 2. Terminal connections (all devices).

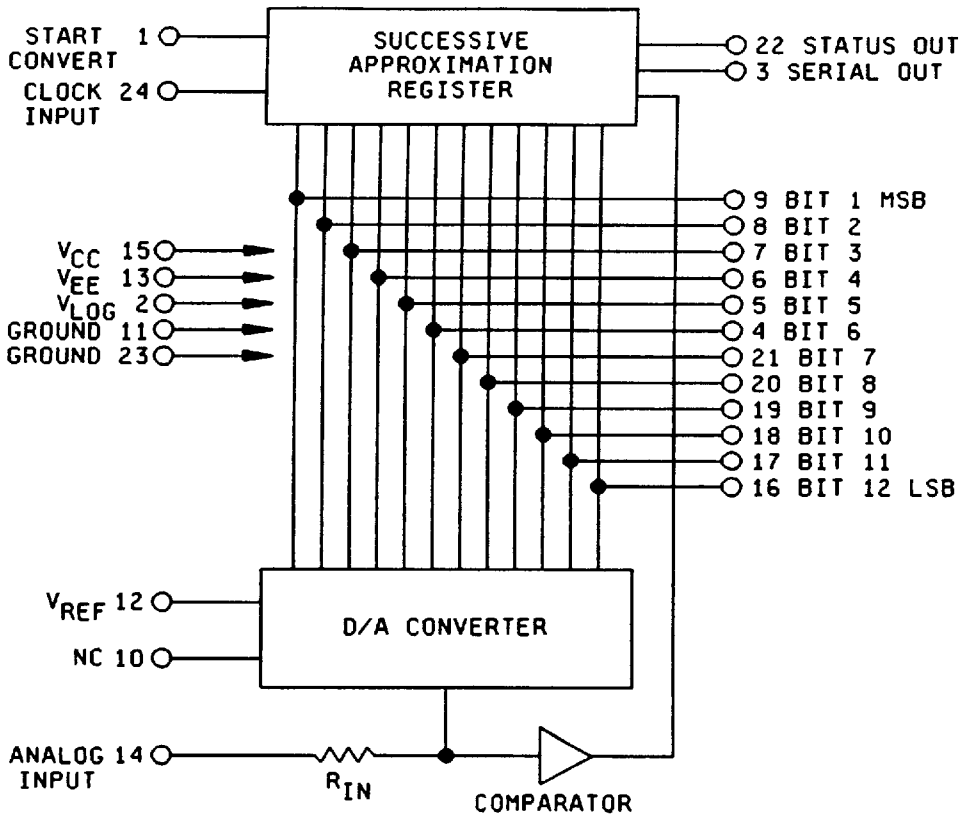
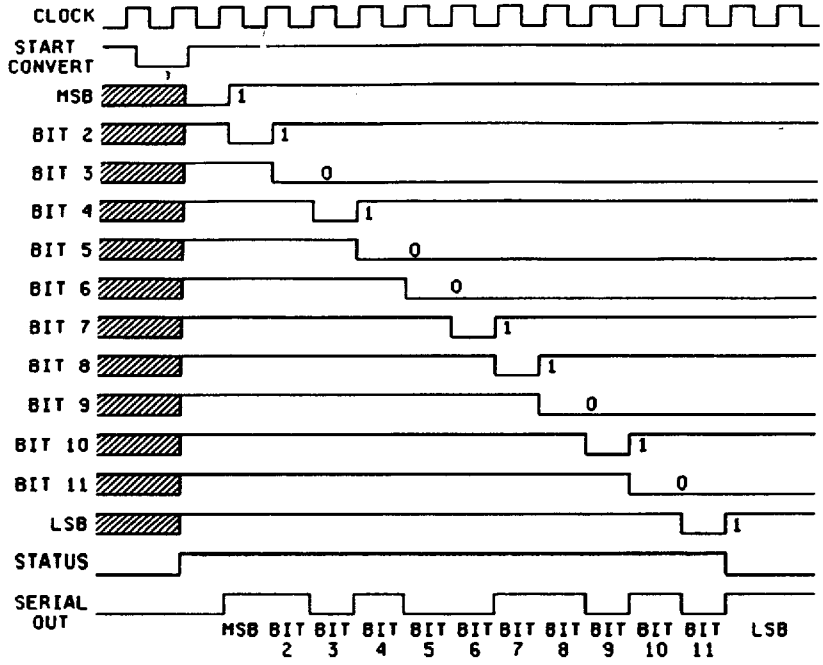


FIGURE 3. Logic diagram.



NOTES:

1. Operation shown is for the digital work 1101 0011 0101 which corresponds to 1.7432 V on the 0 to +10 V input range (07).
2. Conversion time is defined as the width of the status (E.O.C.) pulse.
3. The converter is reset (MSB = "0", all other bits = "1") by holding the start convert low during a low to high clock transition. The start convert must be low for a minimum of 25 ns prior to the clock transition. Holding the start low will hold the converter in the reset state. Actual conversion will begin on the next rising clock edge after the start has returned high.
4. The delay between the resetting clock edge and status actually rising to a "1" is 160 ns maximum.
5. The start convert may be brought low at any time during a conversion to reset and begin converting again.
6. Both serial and parallel data bits become valid on the same rising clock edges. Serial data is valid on subsequent falling clock edges, and these edges can be used to clock serial data into receiving registers.
7. Output data will be valid 30 ns (maximum) after the status (E.O.C.) output has returned low. Parallel output data will remain valid and the status output low until another conversion is initiated.
8. For continuous conversion, connect the status output (pin 22) to the start convert input (pin 1).
9. When the converter is initially "powered up" it may come on at any point in the conversion cycle.

FIGURE 4. Timing diagram.

Analog input				Digital output
01 and 02	03 and 04	05 and 06	07	MSB LSB
0.0000 V	+5.0000 V	+10.0000 V	+10.0000 V	0000 0000 0000
0.0024 V	+4.9976 V	+9.9951 V	+9.9976 V	0000 0000 000ϕ*
-4.9976 V	+0.0024 V	+0.0049 V	+5.0024 V	0111 1111 111ϕ*
-5.0000 V	0.0000 V	0.0000 V	+5.0000 V	$\phi\phi\phi\phi$ $\phi\phi\phi\phi$ $\phi\phi\phi\phi$*
-5.0024 V	-0.0024 V	-0.0049 V	+4.9976 V	1000 0000 000ϕ*
-9.9976 V	-4.9976 V	-9.9951 V	+0.0024 V	1111 1111 111ϕ*
-10.0000 V	-5.0000 V	-10.0000 V	0.0000 V	1111 1111 1111

* Voltages given are the theoretical values for the transitions indicated. Ideally with the converter continuously converting, the output bits indicated as ϕ will change from "1" to "0" or "0" to "1" as the input voltage passes through the level indicated.

FIGURE 5. Digital output codes.

TABLE II. Electrical test requirements.

MIL-H-38534 test requirements	Subgroups (in accordance with MIL-H-38534, group A test table)
Interim electrical parameters	1, 4
Final electrical test parameters	1*, 2, 3, 4, 5, 6
Group A test requirements	1, 2, 3, 4, 5, 6 ,7 8, 9, 10, 11
Group C end-point electrical parameters	1, 2, 3

* PDA applies to subgroup 1.

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 MIL-H-38534 and as follows:

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

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, method 1005 of MIL-STD-883.

(1) Test condition A, B, C, or D. The test circuit shall be maintained by the manufacturer under document revision level control and shall be made available to either DESC-EC or the acquiring activity upon request. Also, the test circuit shall specify the inputs, outputs, biases, and power dissipation, as applicable, in accordance with the intent specified in test method 1005 of MIL-STD-883.

(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.

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 use for Government microcircuit applications (original equipment), design applications, and logistics purposes.

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-973 using DD Form 1692, Engineering Change Proposal.

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-EC, telephone (513) 296-6047.

6.5 Comments. Comments on this drawing should be directed to DESC-EC, Dayton, Ohio 45444, or telephone (513) 296-5373.

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-EC.