REVISIONS

LTR	DESCRIPTION	DATE (YR-MO-DA)	APPROVED
A	Figure 1, change to side brazed package outline. Correct the maximum dimension for E1 and S. Editorial changes throughout.	89-01-10	M. A. Frye
B	Changed to reflect MIL-H-38534 processing. Corrections to table I and figures 1 and 2. Editorial changes throughout.	92-01-13	Alan Barone

REV																			
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REV STATUS OF SHEETS	REV	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	

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

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DRAWING APPROVAL DATE
88-09-26

REVISION LEVEL B

DEFENSE ELECTRONICS SUPPLY CENTER
DAYTON, OHIO 45444

MICROCIRCUIT, LINEAR, QUAD, 12-BIT DIGITAL-TO-ANALOG CONVERTER, HYBRID

SIZE	CAGE CODE	5962-88509
A	67268	

SHEET 1

DESC FORM 193
JUL 91

5962-E095

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:

5962-88509	01	X	X
Drawing number	Device type (See 1.2.1)	Case outline (See 1.2.2)	Lead finish per MIL-H-38534

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

Device type	Generic number	Circuit function
01	AD390S	Quad 12 bit DAC (bipolar)
02	AD390T	Quad 12 bit DAC (bipolar)

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

Outline letter	Case outline
X	See figure 1 (28-lead, 1.414" x .610" x .225"), dual-in-line package

1.3 Absolute maximum ratings.

V_{CC} to DGND range	0 V dc to +18 V dc
V_{EE} to DGND range	0 V dc to -18 V dc
Digital inputs (pins 1-12 and 23-28) to DGND	-1.0 V dc to +7 V dc
V_{REFIN} to AGND	V_{EE} to V_{CC}
AGND to DGND	±0.6 V
Outputs (pins 16, 18, 19, 20, 21):	
Shorted to AGND or DGND	Indefinite
Shorted to (V_{CC} or V_{EE})	Momentary
Storage temperature range	-65°C to +150°C
Lead temperature (soldering, 10 seconds)	+300°C
Junction temperature (T_J)	+175°C
Thermal resistance, junction-to-case (Θ_{JC})	8°C/W
Thermal resistance, junction-to-ambient (Θ_{JA})	25°C/W

1.4 Recommended operating conditions.

V_{CC} to DGND	+15 V dc ±10%
V_{EE} to DGND	-15 V dc ±10%
V_{REFIN} to AGND	+10 V dc
Ambient operating temperature range (T_A)	-55°C to +125°C

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.

SPECIFICATIONS

MILITARY

MIL-M-38510 - Microcircuits, General Specification for.
MIL-H-38534 - Hybrid Microcircuits, General Specification for.

STANDARD

MILITARY

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

(Copies of the specifications 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.)

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 Truth tables(s). The truth tables(s) shall be as specified on figure 3.

3.2.4 Timing waveform(s). The timing waveform(s) shall be as specified on figure 4.

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 of supply in QML-38534 (see 6.6 herein). The certificate of compliance submitted to DESC-ECT prior to listing as 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 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 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 MIL-H-38534 and as follows:

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

b. Subgroups 7 and 8 shall include verification of the truth table.

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.

TABLE I. Electrical performance characteristics.

Test	Symbol	Conditions 1/ $-55°C \le T_A \le +125°C$ unless otherwise specified	Device types	Group A subgroups	Limits Min	Limits Max	Unit
Input voltage (high)	V_{IH}	Pins 1 through 12	All	1 2, 3 2/	2.0		V
		Pins 23 through 28	All	1, 2, 3 2/	2.0		
Input voltage (low)	V_{IL}	Pins 1 through 12	All	1 2, 3 2/		0.8	V
		Pins 23 through 28	All	1, 2, 3 2/		0.8	
Input current (high)	I_{IH}	V_{IN} = +5 V Pins 1 through 12	All	1 2, 3 2/		1200	µA
		V_{IN} = +5 V Pins 23 through 28	All	1, 2, 3 2/		1200	
Input current (low)	I_{IL}	V_{IN} = +5 V Pins 1 through 12	All	1 2, 3 2/		400	µA
		V_{IN} = +5 V Pins 23 through 28	All	1, 2, 3 2/		400	
Output voltage range	V_{OUT}	External +10.000 V ref 3/	All	1, 2, 3	-10	+10	V
Gain error	Ae	External +10.000 V ref BC = 111111111111 End-point electrical	01 02 All	4 4 4	-.1 -.05 -.2	+.1 +.05 +.2	% FSR 4/
Gain error temperature coefficient	$T_{C/Ae}$	External +10.000 V ref BC = 111111111111	01 02	5, 6 5, 6	-10 -5	+10 +5	ppm/°C
Offset error	V_{OS}	External +10.000 V ref BC = 000000000000 End-point electrical	01 02 All	1 1 1	-.05 -.025 -.1	+.05 +.025 +.1	% FSR 4/

See footnotes at end of table.

TABLE I. Electrical performance characteristics - Continued.

Test	Symbol	Conditions 1/ $-55°C \le T_A \le +125°C$ unless otherwise specified	Device types	Group A subgroups	Limits Min	Limits Max	Unit
Bipolar zero temperature coefficient	$T_{C/BPZ}$	V_{BPFS} = ±10 V 5/	01 02	2, 3 2, 3	-10 -5	+10 +5	ppm/°C
Differential linearity error	DLE	6/	01 02 All All	1 1 2, 3 1	-.75 -.5 -1 -1	+.75 +.5 +1 +1	LSB
		End-point electrical					
Integral linearity error 7/	LE		01 02 All	1, 2, 3 1, 2, 3 1	-.75 -.5 -1	+.75 +.5 +1	LSB
		End-point electrical					
Power supply voltages	V_{CC}	3/	All	1, 2, 3	+13.5	+16.5	V
	V_{EE}		All	1, 2, 3	-16.5	-13.5	
Power supply current (negative)	I_{CC}	Data input bits = 111111111111 No load	All	1	-100	0	mA
				2, 3 2/	-120	0	
Power supply current (positive)	I_{EE}	Data input bits = 111111111111 No load	All	1		35	mA
				2, 3 2/		35	
Power supply gain sensitivity gain/ $\pm V_S$(V_{CC} and V_{EE})	PSRR	Data input bits = 111111111111 $\pm V_S$ = ±15 V ±10%	All	1	-.006	+.006	% FS per %
				2, 3 2/	-.006	+.006	
Functional tests		See 4.3.1b	All	7, 8			
Chip select pulse width 2/	t_{AW}	See figure 4	All	9, 10, 11	100		ns
Address select low time 2/	t_{WP}	See figure 4	All	9, 10, 11	100		ns

See footnotes at end of table.

TABLE I. Electrical performance characteristics - Continued.

Test	Symbol	Conditions 1/ $-55°C \le T_A \le +125°C$ unless otherwise specified	Device types	Group A subgroups	Limits		Unit
					Min	Max	
Data valid before $\overline{AO}$ rising edge 2/	t_{DW}	See figure 4	All	9, 10, 11	50		ns
Data valid after $\overline{AO}$ rising edge 2/	t_{DH}	See figure 4	All	9, 10, 11	10		ns
Chip select valid before A1 low 2/	t_{AS}	See figure 4	All	9, 10, 11	0		ns
Settling time 2/	t_{SETT}	See figure 4	All	9, 10, 11		8	µs

1/ V_{CC} = +15 V, V_{EE} = -15 V.
2/ Parameter shall be tested as part of device initial characterization and after design and process changes. Parameter shall be guaranteed to the limits specified in table I for all lots not specifically tested.
3/ Verified as test condition while testing other parameters.
4/ Full scale range = 20 V for a ±10 V bipolar range. Full scale range = 10 V for a 0 V to +10 V unipolar range.
5/ Bipolar zero = (BC = 100000000000) - (BC = 000000000000).
6/ Monotonicity is tested over the full military temperature range.
7/ Integral nonlinearity is a measure of the maximum deviation from a straight line passing through the end points of the transfer function.

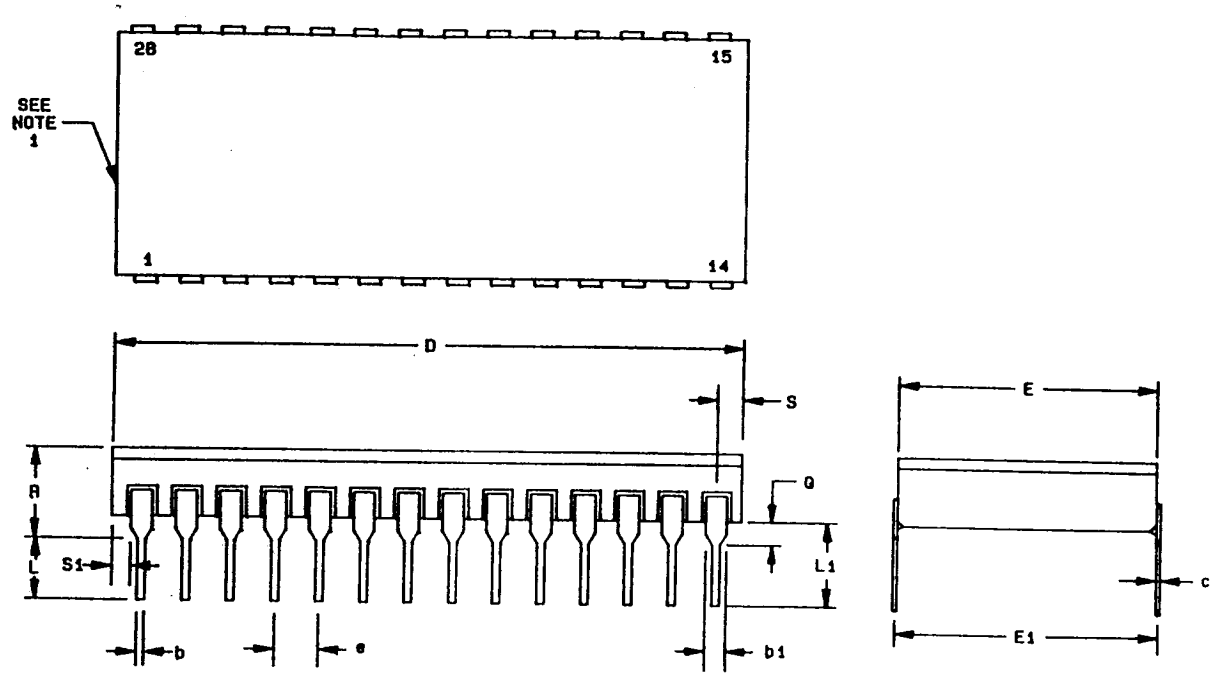


FIGURE 1. Case outline (all device types).

Symbol	Inches		Millimeters		Notes
	Min	Max	Min	Max	
A		.225		5.72	
b	.014	.023	0.36	0.58	
b1	.030	.070	0.76	1.78	2
c	.008	.015	0.20	0.38	
D		1.414		35.92	
E	.580	.610	14.73	15.49	
E1	.590	.620	14.99	15.75	6
e	.100 BSC		2.54 BSC		4, 7
L	.120	.200	3.05	5.08	
L1	.180		4.57		
Q	.015	.075	0.38	1.90	3
S		.098		2.49	5
S1	.005		0.13		5

NOTES:
1. Index area; a notch or a lead one identification mark is located adjacent to lead one.
2. The minimum limit for dimension b1 may be .023 (0.58 mm) for all four corner leads only.
3. Dimension Q shall be measured from the seating plane to the base plane.
4. The basic pin spacing is .100 (2.54 mm) between centerlines.
5. Applies to all four corners.
6. E1 shall be measured at the centerline of all the leads (at stand off).
7. Twenty six spaces.

FIGURE 1. Case outline (all device types) - Continued.

Device types	All
Case outline	X
Terminal number	Terminal connection
1	DB0 (LSB)
2	DB1
3	DB2
4	DB3
5	DB4
6	DB5
7	DB6
8	DB7
9	DB8
10	DB9
11	DB10
12	DB11 (MSB)
13	DGND
14	V_{EE}
15	AGND
16	REF OUTPUT
17	REF INPUT
18	V_{OUT1}
10	V_{OUT2}
20	V_{OUT3}
21	V_{OUT4}
22	V_{CC}
23	$\overline{A1}$
24	$\overline{A0}$
25	$\overline{CS1}$
26	$\overline{CS2}$
27	$\overline{CS3}$
28	CS4

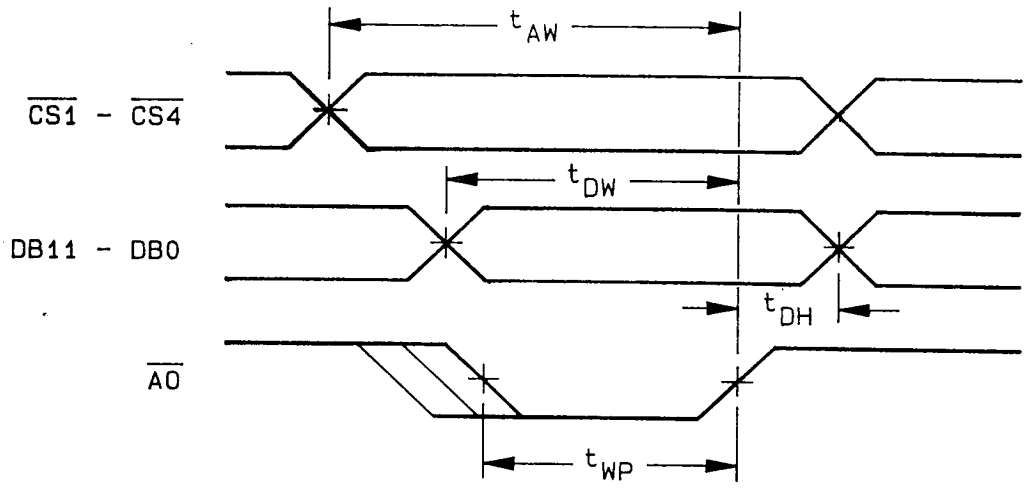
FIGURE 2. Terminal connections (all device types).

Digital input code			Analog output voltage	
0000	0000	0000	-10.000 V	-Full scale
0100	0000	0000	-5.000 V	-1/2 scale
1000	0000	0000	0.000 V	Zero
1000	0000	0001	+4.88 mV	+1 LSB
1100	0000	0000	+5.000 V	+1/2 scale
1111	1111	1111	+9.9951 V	+Full scale - 1 LSB

$\overline{CS1}$	$\overline{CS2}$	$\overline{CS3}$	$\overline{CS4}$	$\overline{A1}$	$\overline{A0}$	Operation
1	1	1	1	X	X	No operation
X	X	X	X	1	1	No operation
0	1	1	1	1	0	Enable 1st rank of DAC 1
1	0	1	1	1	0	Enable 1st rank of DAC 2
1	1	0	1	1	0	Enable 1st rank of DAC 3
1	1	1	0	1	0	Enable 1st rank of DAC 4
0	1	1	1	0	1	Load DAC 1 second rank from first rank
1	0	1	1	0	1	Load DAC 2 second rank from first rank
1	1	0	1	0	1	Load DAC 3 second rank from first rank
1	1	1	0	0	1	Load DAC 4 second rank from first rank
0	0	0	0	0	0	All latches transparent

FIGURE 3. Truth table (all types).

Write cycle number 1 (load first rank from data bus; $\overline{A1}$ = 1)



Write cycle number 2 (load second rank from first rank; $\overline{A0}$ = 1)

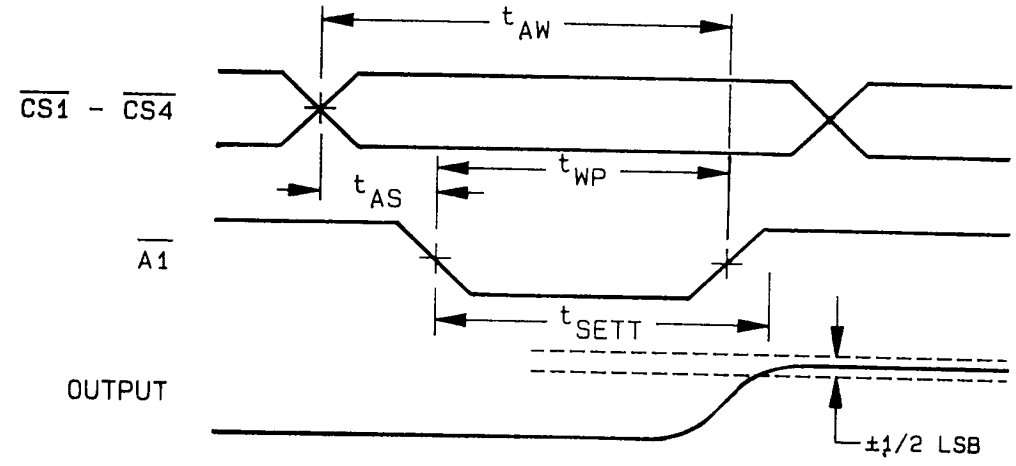


FIGURE 4. Timing waveforms.

TABLE II. Electrical test requirements.

MIL-STD-883 test requirements	Subgroups (per method 5008, group A test table)
Interim electrical parameters	1, 4
Final electrical test parameters	1*, 2, 3, 4, 5, 6, 7, 9
Group A test requirements	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11
Group C end-point electrical parameters	1, 4

* PDA applies to subgroup 1.

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.