

REVISIONS

LTR	DESCRIPTION	DATE (YR-MO-DA)	APPROVED
A	Made corrections to table I and figure 1. Changed drawing to reflect MIL-H-38534 processing. Editorial changes throughout.	91-04-22	W. Heckman

REV																				
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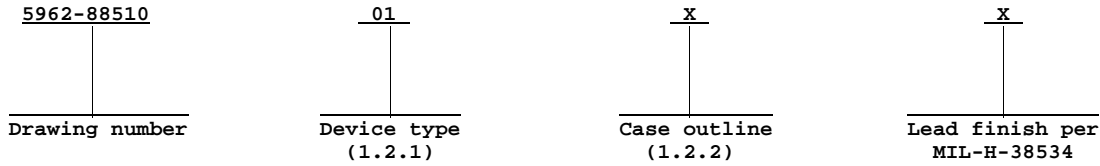
REV STATUS OF SHEETS	REV	A	A	A	A	A	A	A	A	A	A	A	A				
	SHEET	1	2	3	4	5	6	7	8	9	10	11					

<p>PMIC N/A</p> <p align="center">STANDARDIZED MILITARY DRAWING</p> <p>THIS DRAWING IS AVAILABLE FOR USE BY ALL DEPARTMENTS AND AGENCIES OF THE DEPARTMENT OF DEFENSE</p> <p align="center">AMSC N/A</p>	PREPARED BY Donald R. Osborne	<p align="center">DEFENSE ELECTRONICS SUPPLY CENTER DAYTON, OHIO 45444</p>		
	CHECKED BY Ray Monnin			
	APPROVED BY Michael Frye	MICROCIRCUIT, LINEAR, QUAD, 12-BIT, DIGITAL-TO-ANALOG CONVERTER, HYBRID		
	DRAWING APPROVAL DATE 6 SEPTEMBER 1988			
	REVISION LEVEL A			
		SHEET 1 OF 11		

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:

<u>Device type</u>	<u>Generic number</u>	<u>Circuit function</u>
01	AD394S	Quad 12 bit DAC (bipolar)
02	AD394T	Quad 12 bit DAC (bipolar)
03	AD395S	Quad 12 bit DAC (unipolar)
04	AD395T	Quad 12 bit DAC (unipolar)

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

<u>Outline letter</u>	<u>Case outline</u>
X	See figure 1 (28-lead, 1.575" x .810" x .225"), dual-in-line package

1.3 Absolute maximum ratings.

+V _S to DGND - - - - -	-0.3 V dc to +17 V dc
-V _S to DGND - - - - -	+0.3 V dc to -17 V dc
Digital inputs (pins 1 through 16) to DGND - - -	-0.3 V dc to +7 V dc
V _{REFIN} to AGND - - - - -	±25 V dc
AGND to DGND - - - - -	-0.3 V dc to ±V _S
Outputs (pins 18, 21, 24, and 27):	
Shorted to AGND or DGND - - - - -	Indefinite
Shorted to ±V _S - - - - -	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 _S to DGND - - - - -	±15 V dc ±10%
V _{REFIN} to AGND - - - - -	+10 V dc
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.

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 Timing diagram(s). The timing diagram(s) shall be as specified on figure 2.

3.2.2 Terminal connections. The terminal connections shall be as specified on figure 3.

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

3.2.4 Truth table(s). The truth table(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 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-ECC 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.

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TABLE I. Electrical performance characteristics.

Test	Symbol	Conditions <u>1</u> / -55°C ≤ T _A ≤ +125°C unless otherwise specified	Device types	Group A subgroups	Limits		Unit
					Min	Max	
Input voltage high	V _{IH}	Pins 1 through 16	All	1	2.4		V
				2,3 <u>2</u> /	2.4		
Input voltage low	V _{IL}	Pins 1 through 16	All	1		0.8	V
				2,3 <u>2</u> /		0.8	
Input current high	I _{IH}	V _{IN} = +5 V	All	1		40	μA
				2,3 <u>2</u> /		40	
Input current low	I _{IL}	V _{IN} = 0 V	All	1		40	μA
				2,3 <u>2</u> /		40	
Output voltage range	V _{OUT}	External +10.000 V ref BC = 111111111111 to 000000000000	1,2	1,2,3 <u>3</u> /	-10	+10	V
			3,4	1,2,3 <u>3</u> /	-10	0	V
Gain error	Ae	External +10.000 V ref BC = 111111111111 End-point electrical	1,3	4		.1	±% fs <u>4</u> /
			2,4	4		.05	
			All	4		.2	
Gain error temperature coefficient	TC/Ae	External +10.000 V ref BC = 111111111111	1,3	5,6		10	±ppm/ °C
			2,4	5,6		5	
Offset error	V _{OS}	External +10.000 V ref BC = 000000000000 End-point electrical	1,3	1		.05	±% fs <u>4</u> /
			2,4	1		.025	
			All	1		.1	
Offset temperature coefficient	TC/BPZ	External +10.000 V ref BC = 000000000000	1,3	2,3		10	±ppm/ °C
			2,4	2,3		5	

See footnotes at end of table.

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TABLE I. Electrical performance characteristics - Continued.

Test	Symbol	Conditions <u>1/</u> -55°C ≤ T _A ≤ +125°C unless otherwise specified	Device types	Group A subgroups	Limits		Unit
					Min	Max	
Differential linearity error	DLE	<u>5/ 6/</u> End-point electrical	1,3	1		.75	±LSB
			2,4	1		.5	
			All	2,3		1	
			All	1		1.5	
Integral linearity error <u>7/</u>	ILE	<u>8/</u> End-point electrical	1,3	1,2,3		.75	±LSB
			2,4	1,2,3		.5	
			All	1		1	
Digital feed-through <u>9/</u>	DFTe	See figure 4 T _A = +25°C	All	4	- .5	+ .5	±LSB
Power supply voltages	+V _S -V _S			1,2,3	-15	+15	V
Negative supply current	I _{EE}	Data input bits = 1111111111 No load T _A = +25°C	All	1		28	mA
Positive supply current	I _{CC}	Data input bits = 1111111111 No load T _A = +25°C	All	1		22	mA
Power supply gain sensitivity gain/ V _S (+V _S and -V _S)	+PSRR	Data input bits = 1111111111 +V _S = +15 V ±10% T _A = +25°C	All	1		.006	±% fs per %
	-PSRR	Data input bits = 1111111111 -V _S = -15 V ±10% T _A = +25°C	All	1		.006	±% fs per %
Functional tests		See 4.3.1b	All	<u>7</u> <u>8 2/</u>			
Chip select pulse width <u>2/</u>	t _{CS}	See figure 2	All	9,10,11		170	ns

See footnotes at end of table.

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TABLE I. Electrical performance characteristics - Continued.

Test	Symbol	Conditions ^{1/} -55°C ≤ T _A ≤ +125°C unless otherwise specified	Device types	Group A subgroups	Limits		Unit
					Min	Max	
Data setup time ^{2/}	t _{DS}	See figure 2	All	9,10,11	150		ns
Data hold time ^{2/}	t _{DH}	See figure 2	All	9,10,11	5		
Settling time ^{2/}	t _{SETT}		All	9,10,11		15	μs

1/ ±V_S = ±15 V dc.

2/ Parameter shall be tested as part of device initial characterization and after design and process changes and therefore shall be guaranteed to the limits specified in table I.

3/ This parameter is verified as a 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/ Monotonicity is tested over the full military temperature range.

6/ Differential linearity is measured at the following codes to code-1: Codes = 1, 2, 4, 8, 16, 32, 64, 128, 256, 512, 1024, and 2048.

7/ Integral nonlinearity is a measure of the maximum deviation from a straight line passing through the end points of the transfer function.

8/ Integral linearity is measured at the following codes: Codes = 1, 2, 4, 8, 16, 32, 64, 128, 256, 512, 768, 1024, 1280, 1536, 1792, 2048, 2304, 2560, 2816, 3072, 3328, 3584, and 3840.

9/ Digital feed-through is defined as the change in DAC's outputs steady-state value as a result of the same DAC's inputs digitally being driven from all 1's to all 0's with CS = 1.

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-ECC 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 and conducted on all devices prior to quality conformance inspection. The following additional criteria shall apply:

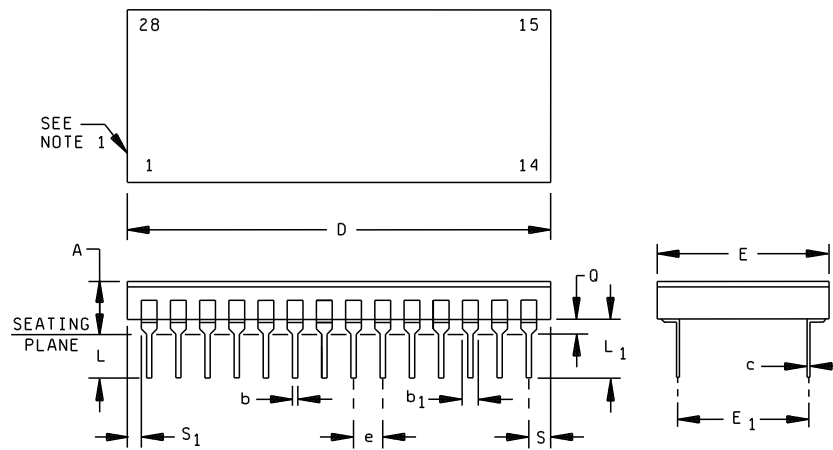
a. Burn-in test, method 1015 of MIL-STD-883.

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

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Symbol	Inches		Millimeters		Notes
	Min	Max	Min	Max	
A		.225		5.72	
b	.014	.023	0.36	0.58	
b ₁	.030	.070	0.76	1.78	2
c	.008	.015	0.20	0.38	
D		1.575		40.00	
E	.770	.810	19.56	20.57	

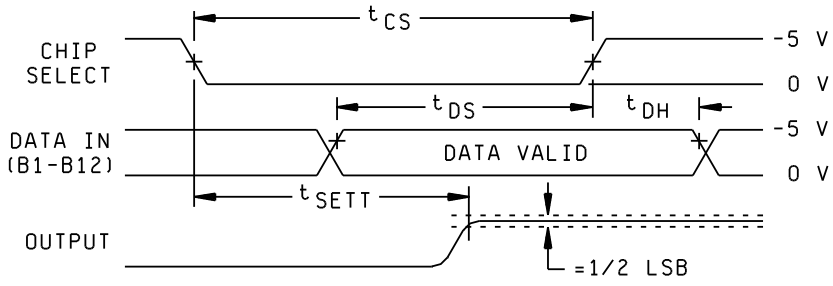
Symbol	Inches		Millimeters		Notes
	Min	Max	Min	Max	
E ₁	.590	.610	14.99	15.50	6
e	.100 BSC		2.54 BSC		4, 7
L	.125	.200	3.18	5.08	
L ₁	.180		4.57		
Q	.015	.060	0.38	1.52	3
s		.137		3.48	5
s ₁	.100		0.13		5

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 0.023" (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 base pin spacing is 0.100" (2.54 mm) between centerlines.
5. Applies to all four corners.
6. E₁ shall be measured at the centerline of all the leads at the standoffs.
7. Twenty-six spaces.

FIGURE 1. Case outline.

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NOTES:

1. $t_r = t_f = 20$ ns. All input signal rise and fall times measured from 10 percent to 90 percent of V_{DD} (+5 V typical).
2. Timing measurement reference level is $(V_{IH} - V_{IL})/2$.

MODE SELECTION

Write mode
 CS low DAC respond to
 Data bus (B1-B12) inputs

Hold mode
 CS high data bus (B1-B12)
 locked_out DAC holds last data present
 when CS assumed high state

FIGURE 2. Timing diagram.

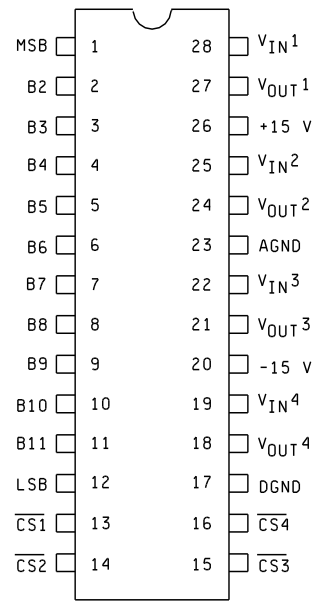


FIGURE 3. Terminal connections.

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$\overline{CS1}$	$\overline{CS2}$	$\overline{CS3}$	$\overline{CS4}$	Operation
1	1	1	1	All DACs latched
0	1	1	1	Load DAC 1 from data bus
1	0	1	1	Load DAC 2 from data bus
1	1	0	1	Load DAC 3 from data bus
1	1	1	0	Load DAC 4 from data bus
0	0	0	0	All DACs simultaneously loaded

FIGURE 4. Truth table.

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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 be sufficient to verify the truth table (see figure 4).

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 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 II. Electrical test requirements.

MIL-STD-883 test requirements	Subgroups (per method 5008, group A test table)
Interim electrical parameters	1
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.
 ** Subgroups 8, 9, 10, and 11 shall be tested as part of device characterization and after design and process changes and therefore shall be guaranteed to the limits specified in table I.

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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-ECC, telephone (513) 296-8527.

6.5 Comments. Comments on this drawing should be directed to DESC-ECC, Dayton, Ohio 45444, or telephone (513) 296-8525.

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-ECC.

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STANDARDIZED MILITARY DRAWING SOURCE APPROVAL BULLETIN

DATE: 91-04-22

Approved sources of supply for SMD 5962-88510 are listed below for immediate acquisition only and shall be added to QML-38534 during the next revision. QML-38534 will be revised to include the addition or deletion of sources. The vendors listed below have agreed to this drawing and a certificate of compliance has been submitted to and accepted by DESC-ECC. This bulletin is superseded by the next dated revision of QML-38534.

Standardized military drawing PIN	Vendor CAGE number	Vendor similar PIN <u>1</u> /
5962-8851001XX	51640	AD394SD/883B
5962-8851002XX	51640	AD394TD/883B
5962-8851003XX	51640	AD395SD/883B
5962-8851004XX	51640	AD395TD/883B

1/ Caution. Do not use this number for item acquisition. Items acquired to this number may not satisfy the performance requirements of this drawing.

Vendor CAGE number

51640

Vendor name and address

Analog Devices
Microelectronics Division
831 Woburn Street
Wilmington, MA 01887

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