REVISIONS			
LTR	DESCRIPTION	DATE (YR-MO-DA)	APPROVED
A	Figure 1, change to side braze 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
C	Changes in accordance with NOR 5962-R009-93.	92-11-03	Kendall A. Cottongim
D	Update drawing boilerplate.	02-06-28	Raymond Monnin

THE ORIGINAL FIRST PAGE OF THE DRAWING HAS BEEN REPLACED.

REV																				
SHEET																				
REV																				
SHEET																				

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

PMIC N/A	PREPARED BY Donald R. Osborne	**DEFENSE SUPPLY CENTER COLUMBUS** **POST OFFICE BOX 3990** **COLUMBUS, OHIO 43216-5000** **http://www.dscc.dla.mil**
STANDARD MICROCIRCUIT DRAWING THIS DRAWING IS AVAILABLE FOR USE BY ALL DEPARTMENTS AND AGENCIES OF THE DEPARTMENT OF DEFENSE AMSC N/A	CHECKED BY D. H. Johnson	
	APPROVED BY Michael A. Frye	MICROCIRCUIT, HYBRID, LINEAR, QUAD, 12-BIT, DIGITAL-TO-ANALOG CONVERTER
	DRAWING APPROVAL DATE 88-09-26	
	REVISION LEVEL D	SIZE A CAGE CODE **67268** **5962-88509** SHEET 1 OF 13

DSCC FORM 2233
APR 97

5962-E460-02

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-PRF-38534 and a choice of case outlines and lead finishes are available and are reflected in the Part or Identifying Number (PIN).

1.2 PIN. The 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 (see 1.2.3)

1.2.1 Device type(s). The device type(s) 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) are as designated in MIL-STD-1835 and as follows:

Outline letter	Descriptive designator	Terminals	Package style
X	See figure 1	28	Dual-in-line

1.2.3 Lead finish. The lead finish shall be as specified in MIL-PRF-38534.

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	-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 specification, standards, and handbooks. The following specification, standards, and handbooks form a part of this drawing to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DoDISS) and supplement thereto, cited in the solicitation.

SPECIFICATION

DEPARTMENT OF DEFENSE

MIL-PRF-38534 - Hybrid Microcircuits, General Specification for.

STANDARDS

DEPARTMENT OF DEFENSE

MIL-STD-883 - Test Method Standard Microcircuits.
MIL-STD-1835 - Interface Standard Electronic Component Case Outlines.

HANDBOOKS

DEPARTMENT OF DEFENSE

MIL-HDBK-103 - List of Standard Microcircuit Drawings.
MIL-HDBK-780 - Standard Microcircuit Drawings.

(Unless otherwise indicated, copies of the specification, standards, and handbooks are available from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

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 takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 Item requirements. The individual item performance requirements for device class H shall be in accordance with MIL-PRF-38534. Compliance with MIL-PRF-38534 may include the performance of all tests herein or as designated in the device manufacturer's Quality Management (QM) plan or as designated for the applicable device class. Therefore, the tests and inspections herein may not be performed for the applicable device class (see MIL-PRF-38534). Furthermore, the manufacturers may take exceptions or use alternate methods to the tests and inspections herein and not perform them. However, the performance requirements as defined in MIL-PRF-38534 shall be met for the applicable device class.

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

3.2.1 Case outline(s). The case outline(s) shall be in accordance with 1.2.2 herein and figure 1.

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

3.2.3 Truth table(s). The truth table(s) data 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 defined in table I.

3.5 Marking of device(s). Marking of device(s) shall be in accordance with MIL-PRF-38534. The device shall be marked with the PIN listed in 1.2 herein. In addition, the manufacturer's vendor similar PIN may also be marked.

3.6 Data. In addition to the general performance requirements of MIL-PRF-38534, the manufacturer of the device described herein shall maintain the electrical test data (variables format) from the initial quality conformance inspection group A lot sample, for each device type listed herein. Also, the data should 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 (DSCC-VA) upon request.

3.7 Certificate of compliance. A certificate of compliance shall be required from a manufacturer in order to supply to this drawing. The certificate of compliance (original copy) submitted to DSCC-VA shall affirm that the manufacturer's product meets the performance requirements of MIL-PRF-38534 and herein.

3.8 Certificate of conformance. A certificate of conformance as required in MIL-PRF-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-PRF-38534 or as modified in the device manufacturer's Quality Management (QM) plan. The modification in the QM plan shall not affect the form, fit, or function as described herein.

4.2 Screening. Screening shall be in accordance with MIL-PRF-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 DSCC-VA 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.

TABLE I. Electrical performance characteristics.

Test	Symbol	Conditions 1/ $-55°C \le T_A \le +125°C$ unless otherwise specified	Group A subgroups	Device type	Limits		Unit
					Min	Max	
Input voltage (high)	V_{IH}	Pins 1 through 12	1	All	2.0		V
			2, 3 2/				
		Pins 23 through 28 3/	1, 2, 3 2/	All	2.0		
Input voltage (low)	V_{IL}	Pins 1 through 12	1	All		0.8	V
			2, 3 2/				
		Pins 23 through 28 3/	1, 2, 3 2/	All		0.8	
Input current (high)	I_{IH}	V_{IN} = +5 V Pins 1 through 12	1	All		1200	µA
			2, 3 2/				
		V_{IN} = +5 V Pins 23 through 28	1, 2, 3 2/	All		1200	
Input current (low)	I_{IL}	V_{IN} = 0 V Pins 1 through 12	1	All		400	µA
			2, 3 2/				
		V_{IN} = 0 V Pins 23 through 28	1, 2, 3 2/	All		400	
Output voltage range	V_{OUT}	External +10.000 V ref 4/	1, 2, 3	All	-10	+10	V
Gain error	Ae	External +10.000 V ref BC = 111111111111 End-point electrical	4 4 4	01 02 All	-.1 -.05 -.2	+.1 +.05 +.2	% FSR 5/
Gain error temperature coefficient	T_C/Ae	External +10.000 V ref BC = 111111111111	5,6 5,6	01 02	-10 -5	+10 +5	ppm/°C
Offset error	V_{OS}	External +10.000 V ref BC = 000000000000 End-point electrical	1 1 1	01 02 All	-.05 -.025 -.1	+.05 +.025 +.1	% FSR 5/

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	Group A subgroups	Device type	Limits		Unit
					Min	Max	
Bipolar zero temperature coefficient	T_C/BPZ	V_{BPFS} = ±10 V 6/	2,3 2,3	01 02	-10 -5	+10 +5	ppm /°C
Differential linearity error	DLE	7/ End-point electrical	1 1 2,3 1	01 02 All All	-.75 -.5 -1 -1	+.75 +.5 +1 +1	LSB
Integral linearity error 8/	LE	 End-point electrical	1,2,3 1,2,3 1	01 02 All	-.75 -.5 -1	+.75 +.5 +1	LSB
Power supply voltages	V_{CC}	4/	1, 2, 3	All	+13.5	+16.5	V
	V_{EE}		1, 2, 3	All	-16.5	-13.5	
Power supply current (negative)	I_{EE}	Data input bits 111111111111 no load	1	All	-100	0	mA
			2,3 2/		-120	0	
Power supply current (positive)	I_{CC}	Data input bits 111111111111 no load	1	All		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%	1	All	-.006	+.006	% FS per %
			2,3 2/		-.006	+.006	
Functional tests		See 4.3.1b	7,8	All			
Chip select pulse width 2/	t_{AW}	See figure 4	9,10,11	All	100		ns
Address select low time 2/	t_{WP}	See figure 4	9,10,11	All	100		ns

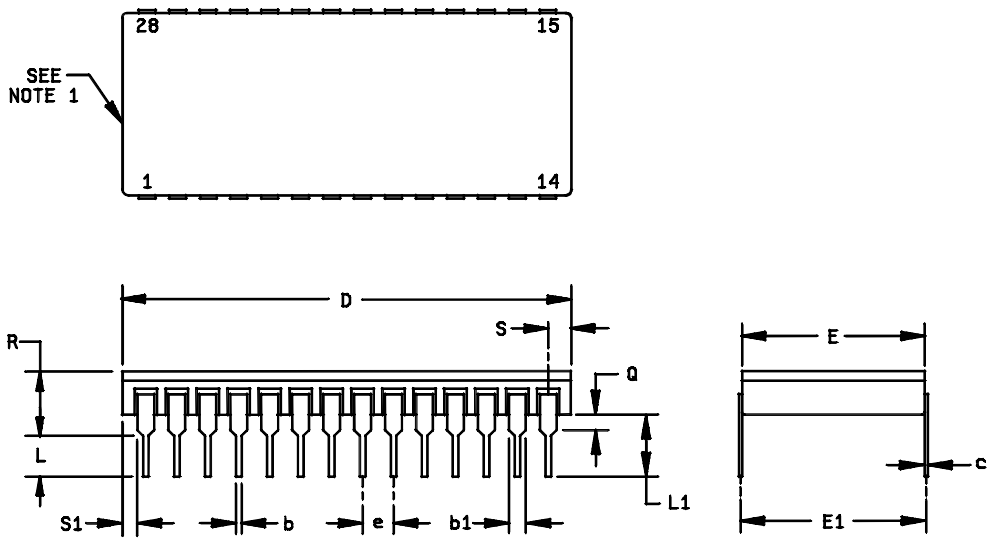
See footnotes at end of table.

TABLE I. Electrical performance characteristics - Continued.

Test	Symbol	Conditions 1/ $-55°C \le T_A \le +125°C$ unless otherwise specified	Group A subgroups	Device type	Limits		Unit
					Min	Max	
Data valid before $\overline{AO}$ rising edge 2/	t_{DW}	See figure 4	9,10,11	All	50		ns
Data valid after $\overline{AO}$ rising edge 2/	t_{DH}	See figure 4	9,10,11	All	10		ns
Chip select valid before A1 low 2/	t_{AS}	See figure 4	9,10,11	All	0		ns
Settling time 2/	t_{SETT}	See figure 4	9,10,11	All		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/ The maximum limit for pin 24 is three times the specified maximum limit for pins 23, 25, 26, 27, and 28.
4/ Verified as test condition while testing other parameters.
5/ 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.
6/ Bipolar zero = (BC = 100000000000) - (BC = 000000000000).
7/ Monotonicity is tested over the full military temperature range.
8/ Integral nonlinearity is a measure of the maximum deviation from a straight line passing through the end points of the transfer function.

Case outline X.



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	
E_1	.590	.620	14.99	15.75	6
e	.100 BSC		2.54 BSC		4, 7
L	.120	.200	3.05	5.08	
L_1	.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. Dimensions 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. E_1 shall be measured at the center line of all the leads (at stand off).
7. Twenty-six spaces.
8. The U.S. government preferred system of measurement is the metric SI. This item 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 take precedence.

FIGURE 1. Case outline (all device types).

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}
19	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).

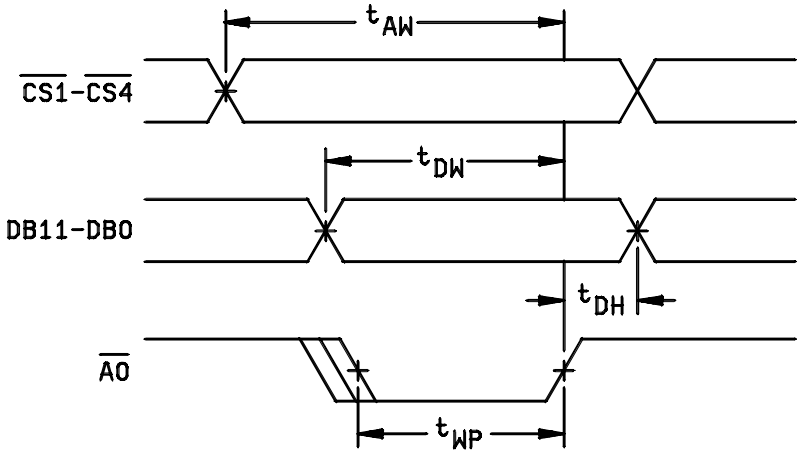
Digital input code	Analog output voltage	
0000 0000 0000	-10.000 V	-Full Scale
0100 0000 0000	-5.000 V	-1/2 scale
1000 0000 0000	0.000 V	Zero
1000 0000 0001	+4.88 mV	+1 LSB
1100 0000 0000	+5.000 V	+1/2 scale
1111 1111 1111	+9.9951 V	+Full scale - 1 LSB

$\overline{CS1}$	$\overline{CS2}$	$\overline{CS3}$	$\overline{CS4}$	$\overline{A1}$	$\overline{A0}$	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 device types).

DEVICE TYPES 01 AND 02

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)

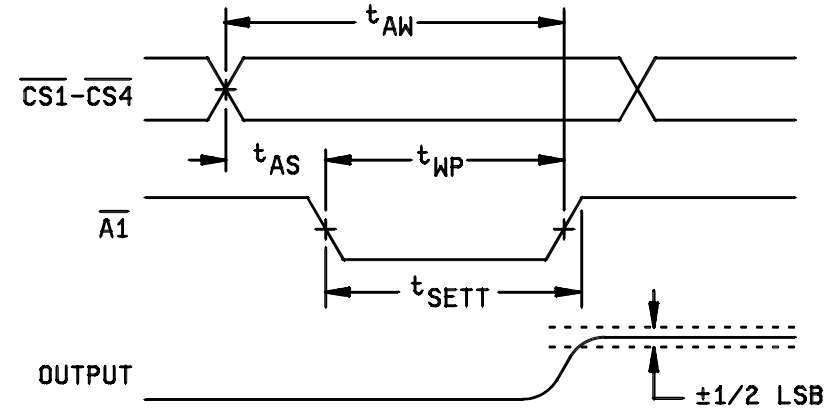


FIGURE 4. Timing waveforms.

TABLE II. Electrical test requirements.

MIL-PRF-38534 test requirements	Subgroups (in accordance with MIL-PRF-38534, group A test table)
Interim electrical parameters	1,4
Final electrical 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.

4.3 Conformance and periodic inspections. Conformance inspection (CI) and periodic inspection (PI) shall be in accordance with MIL-PRF-38534 and as specified herein.

4.3.1 Group A inspection (CI). Group A inspection shall be in accordance with MIL-PRF-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 (PI). Group B inspection shall be in accordance with MIL-PRF-38534.

4.3.3 Group C inspection (PI). Group C inspection shall be in accordance with MIL-PRF-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 DSCC-VA 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 (PI). Group D inspection shall be in accordance with MIL-PRF-38534.

5. PACKAGING

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

6.4 Record of users. Military and industrial users shall inform Defense Supply Center Columbus when a system application requires configuration control and the applicable SMD. DSCC 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 microelectronic devices (FSC 5962) should contact DSCC-VA, telephone (614) 692-0544.

6.5 Comments. Comments on this drawing should be directed to DSCC-VA, Post Office Box 3990, Columbus, Ohio 43216-5000, or telephone (614) 692-0536.

6.6 Sources of supply. Sources of supply are listed in MIL-HDBK-103 and QML-38534. The vendors listed in MIL-HDBK-103 and QML-38534 have submitted a certificate of compliance (see 3.7 herein) to DSCC-VA and have agreed to this drawing.

STANDARD MICROCIRCUIT DRAWING BULLETIN

DATE: 02-06-28

Approved sources of supply for SMD 5962-88509 are listed below for immediate acquisition information only and shall be added to MIL-HDBK-103 and QML-38534 during the next revisions. MIL-HDBK-103 and 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 DSCC-VA. This bulletin is superseded by the next dated revisions of MIL-HDBK-103 and QML-38534.

Standard microcircuit drawing PIN 1/	Vendor CAGE number	Vendor similar PIN 2/
5962-8850901XA	34031	AD390SD/883B
5962-8850901XC	34031	AD390SD/883B
5962-8850902XA	34031	AD390TD/883B
5962-8850902XC	34031	AD390TD/883B

1/ The lead finish shown for each PIN representing a hermetic package is the most readily available from the manufacturer listed for that part. If the desired lead finish is not listed contact the Vendor to determine its availability.

2/ 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	Vendor name and address
34031	Analog Devices, Incorporated 7910 Triad Center Drive Greensboro, NC 27409-9605