REVISIONS			
LTR	DESCRIPTION	DATE (YR-MO-DA)	APPROVED
A	Correct symbol for junction temperature in paragraph 1.3.	98-11-13	K. A. Cottongim
B	Add note to table II, Group C end-point test parameters. -gz	09-03-24	Robert M. Heber

REV																				
SHEET																				
REV																				
SHEET																				

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

PMIC N/A

PREPARED BY
Steve L. Duncan

CHECKED BY
Michael Jones

APPROVED BY
Kendall A. Cottongim

DRAWING APPROVAL DATE
97-10-30

REVISION LEVEL
B

DEFENSE SUPPLY CENTER COLUMBUS
COLUMBUS, OHIO 43218-3990
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

MICROCIRCUIT, HYBRID, LINEAR, ±12 VOLT, DUAL OUTPUT WITH INTEGRAL EMI FILTER, DC/DC CONVERTER

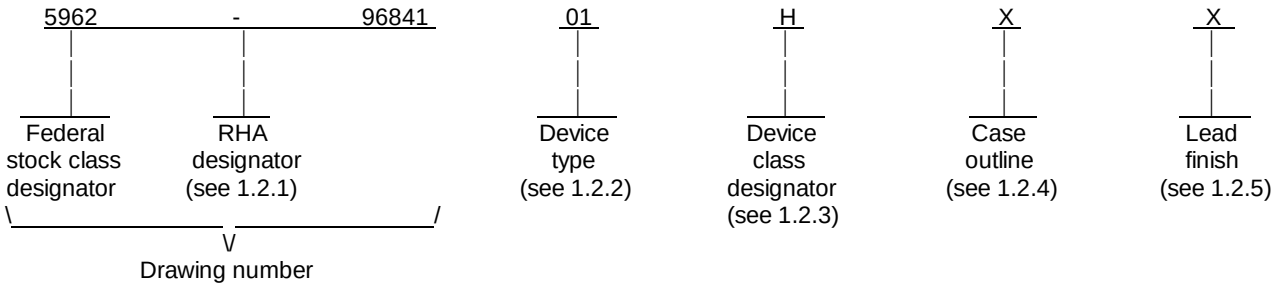
SIZE	CAGE CODE	
A	**67268**	**5962-96841**

SHEET 1 OF 13

1. SCOPE

1.1 Scope. This drawing documents five product assurance classes as defined in paragraph 1.2.3 and MIL-PRF-38534. A choice of case outlines and lead finishes which are available and are reflected in the Part or Identifying Number (PIN). When available, a choice of radiation hardness assurance levels are reflected in the PIN.

1.2 PIN. The PIN shall be as shown in the following example:



1.2.1 Radiation hardness assurance (RHA) designator. RHA marked devices shall meet the MIL-PRF-38534 specified RHA levels and shall be marked with the appropriate RHA designator. A dash (-) indicates a non-RHA device.

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

Device type	Generic number	Circuit function
01	ADDC02812DATV	DC/DC converter, ±12 V, 100 W output, with integral EMI filter and output overvoltage protection

1.2.3 Device class designator. This device class designator shall be a single letter identifying the product assurance level. All levels are defined by the requirements of MIL-PRF-38534 and require QML Certification as well as qualification (Class H, K, and E) or QML Listing (Class G and D). The product assurance levels are as follows:

Device class	Device performance documentation
K	Highest reliability class available. This level is intended for use in space applications.
H	Standard military quality class level. This level is intended for use in applications where non-space high reliability devices are required.
G	Reduced testing version of the standard military quality class. This level uses the Class H screening and In-Process Inspections with a possible limited temperature range, manufacturer specified incoming flow, and the manufacturer guarantees (but may not test) periodic and conformance inspections (Group A, B, C, and D).
E	Designates devices which are based upon one of the other classes (K, H, or G) with exception(s) taken to the requirements of that class. These exception(s) must be specified in the device acquisition document; therefore the acquisition document should be reviewed to ensure that the exception(s) taken will not adversely affect system performance.
D	Manufacturer specified quality class. Quality level is defined by the manufacturers internal, QML certified flow. This product may have a limited temperature range.

1.2.4 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	17	Flat package

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

1.3 Absolute maximum ratings. 1/

Input voltage	+55 V dc
Inhibit voltage range (pin 6)	-0.5 V dc to +50 V dc
Sync voltage range (pin 7)	-0.5 V dc to +8 V dc
Ishare voltage range (pin 8)	-0.5 V dc to +6 V dc
Temp voltage range (pin 9)	-0.3 V dc to +12 V dc
Power dissipation (P_D)	35 W 2/
Output power	100 W 2/
Lead temperature (soldering, 10 seconds)	+300°C
Storage temperature range	-65°C to +150°C
Junction temperature (T_J)	+150°C

1.4 Recommended operating conditions.

Input voltage range (V_{IN})	+18 V dc to +40 V dc
Case operating temperature range (T_C)	-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 cited in the solicitation or contract.

DEPARTMENT OF DEFENSE SPECIFICATION

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

DEPARTMENT OF DEFENSE STANDARDS

MIL-STD-461 - Requirements for the control of Electromagnetic Interference Emissions and Susceptibility.
MIL-STD-704 - Aircraft Electric Power Characteristics.
MIL-STD-883 - Test Method Standard Microcircuits.
MIL-STD-1835 - Interface Standard for Electronic Component Case Outlines.

DEPARTMENT OF DEFENSE HANDBOOKS

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

(Copies of these documents are available online at http://assist.daps.dla.mil/quicksearch/ or 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.

1/ Absolute maximum ratings are limiting values, to be applied individually. Stresses above the absolute maximum ratings may cause permanent damage to the device. Extended operation at the maximum levels may degrade performance and affect reliability.
2/ Case temperature must be maintained at less than or equal to +90°C.

3. REQUIREMENTS

3.1 Item requirements. The individual item performance requirements for device classes D, E, G, H, and K 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. The manufacturer may eliminate, modify or optimize the tests and inspections herein, however the performance requirements as defined in MIL-PRF-38534 shall be met for the applicable device class. In addition, the modification in the QM plan shall not affect the form, fit, or function of the device for the applicable device class. Constant acceleration, method 2001 of MIL-STD-883, is performed at 1200g's for screening (see 4.2.c) and at 2500g's for group C periodic inspection (see 4.3.3.c).

3.1.1 EMI filter. Product includes an integral differential and common-mode EMI filter designed to meet all applicable requirements in MIL-STD-461 when the power converter is installed in a typical system setup. The product has been tested as part of design characterization. Reference the typical EMI curves and test setup indicated in the vendor's commercial data sheet for additional information.

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 1.2.4 herein and figure 1.

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

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. VERIFICATION

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 or by the manufacturer's Quality Management (QM) plan in accordance with appendix B of 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 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.

c. Constant acceleration, method 2001 of MIL-STD-883 is performed at 1200g's.

TABLE I. Electrical performance characteristics.

Test	Symbol	Conditions $-55°C \le T_C \le +90°C$ V_{IN} = 28 V dc ±0.5 V dc, V_{O+} = 12 V dc ±2.0%, C_L = 0 unless otherwise specified	Group A subgroups	Device type	Limits		Unit
					Min	Max	
INPUT CHARACTERISTICS							
Steady state operating input voltage range	V_{IN}	I_O = ±0.42 A to ±4.17 A	1,2,3	01	18	40	V
Abnormal operating input voltage range (per MIL-STD-704) 1/	V_{IN1}	I_O = ±0.42 A to ±3.33 A	1,2,3	01	16	50	V
Input over voltage shutdown	V_{INS}		1,2,3	01	50	55	V
No load input current	I_{IN}	T_C = +25°C	1	01		100	mA
Disabled input current	I_{IN1}		1,2,3	01		2	mA
OUTPUT CHARACTERISTICS 2/ 3/ 4/							
Output voltage (+12 V)	V_{O+}	I_O = ±0.42 A to ±4.17 A V_{IN} = 18 V dc to 40 V dc	1	01	+11.88	+12.12	V
			2,3		+11.76	+12.24	
		I_O = ±0.42 A to ±3.33 A V_{IN} = 16 V dc to 50 V dc	1,2,3		+11.76	+12.24	
		I_O = ±0.83 A, T_C = +125°C, V_{IN} = 28 V, TEMP pin grounded	2		+11.64	+12.36	
Output voltage (-12 V)	V_{O-}	I_O = ±0.42 A to ±4.17 A V_{IN} = 18 V dc to 40 V dc	1	01	-12.24	-11.76	V
			2,3		-12.36	-11.64	
		I_O = ±0.42 A to ±3.33 A V_{IN} = 16 V dc to 50 V dc	1,2,3		-.12.36	-11.64	
		I_O = ±0.83 A, T_C = +125°C, V_{IN} = 28 V, TEMP pin grounded	2		-12.48	-11.52	

See footnotes at end of table.

TABLE I. Electrical performance characteristics - Continued.

Test	Symbol	Conditions $-55°C \le T_C \le +90°C$ V_{IN} = 28 V dc ±0.5 V dc, V_{O+} = 12 V dc ±2.0%, C_L = 0 unless otherwise specified	Group A subgroups	Device type	Limits		Unit
					Min	Max	
OUTPUT CHARACTERISTICS - Continued. 2/ 3/ 4/							
Output ripple noise (regulated output) 5/	V_{RIPREG}	I_O = ±4.17 A, BW = 5 kHz to 2 MHz	4,5,6	01		45	mVp-p
Output ripple noise (cross regulated output) 5/	$V_{RIPXREG}$	I_O = ±4.17 A, BW = 5 kHz to 2 MHz	4,5,6	01		55	mVp-p
Output current (I_O)	I_{OUT}	V_{IN} = 18 V dc to 40 V dc V_O = ±12 V	1,2,3	01	0.833	8.33	A
Output overvoltage protection	OVP	I_O = ±4.17 A, open remote sense connection, T_C = +25°C	7	01		130	$\%V_O$
Output short circuit protection	I_{SCC}	T_C = +25°C	7	01		15.5	A
ISOLATION CHARACTERISTICS							
Isolation	I_{SO}	Input to output or any pin to case at 500 V dc, T_C = +25°C	1	01	100		MΩ
DYNAMIC CHARACTERISTICS							
Output voltage deviation due to step change in load	VT_{LOAD}	I_O = ±2.08 A to ±4.17 A or ±4.17 A to ±2.08 A, di/dt = 0.5 A/µs, T_C = +25°C	4	01		1400	mV
Response time due to step change in load	T_{LOAD}	I_O = ±2.08 A to ±4.17 A or ±4.17 A to ±2.08 A, di/dt = 0.5 A/µs, measured to within 2% of final value, T_C = +25°C	4	01		225	µs
Soft start turn on time	T_{SS}	I_O = ±4.17 A, from INHIBIT high to status high with resistive load, T_C = +25°C	4	01		15	ms

See footnotes at end of table.

TABLE I. Electrical performance characteristics - Continued.

Test	Symbol	Conditions $-55°C \le T_C \le +90°C$ V_{IN} = 28 V dc ±0.5 V dc, V_{O+} = 12 V dc ±2.0%, C_L = 0 unless otherwise specified	Group A subgroups	Device type	Limits		Unit
					Min	Max	
THERMAL CHARACTERISTICS							
Efficiency	Eff	I_O = ±2.5 A	1,2	01	81		%
			3		80		
		I_O = ±4.17 A	1,2		81		
			3		80		
CONTROL CHARACTERISTICS							
Clock frequency	F_S	I_O = ±0.42 A	4,5,6	01	0.85	0.99	MHz
ADJUST (pin 3)	V_{ADJ}	T_C = +25°C	1	01	4.7	4.9	V
STATUS (pin 4) Output high voltage	V_{OHSTAT}	I_{OH} = 400 µA T_C = +25°C	1	01	2.4		V
STATUS (pin 4) Output low voltage	V_{OLSTAT}	I_{OL} = 1 mA T_C = +25°C	1	01		0.7	V
VAUX (pin 5) Output voltage nominal	V_O	Load current = ±4.17 A, I_{AUX} = 5 mA, T_C = +25°C	1	01	13	14	V
INHIBIT (pin 6) Input low voltage	V_{IL}	Unit inhibited, T_C = +25°C	7	01		0.5	V
INHIBIT (pin 6) Input low current	I_{IL}	V_{IL} = 0.5 V, T_C = +25°C	1	01		1.2	mA
INHIBIT (pin 6), Input voltage (open circuit)	V_I	T_C = +25°C	1	01		15	V
SYNC (pin 7), Input high voltage	V_{IH}	T_C = +25°C	4	01	4.0		V
SYNC (pin 7), Input high current	I_{IH}	V_{IH} = 7.0 V, T_C = +25°C	1	01		175	µA

See footnotes at end of table.

TABLE I. Electrical performance characteristics - Continued.

Test	Symbol	Conditions $-55°C \le T_C \le +90°C$ V_{IN} = 28 V dc ±0.5 V dc, V_{O+} = 12 V dc ±2.0%, C_L = 0 unless otherwise specified	Group A subgroups	Device type	Limits		Unit
					Min	Max	
CONTROL CHARACTERISTICS - Continued.							
ISHARE (pin 8)		Load current = ±4.17 A, T_C = +25°C	1	01	2.65	2.85	V
TEMP (pin 9)		T_C = +25°C	1	01	3.5	4.5	V

1/ 50 V upper limit rated for transient condition for up to 50 milliseconds. The 16 V dc lower limit rated for continuous operation during emergency condition.
2/ Outputs are measured at remote sense points.
3/ Unit regulates output voltage at no load.
4/ Output characteristics tested with balanced loads on each output; however, unit operates with unbalanced loads up to 90%10% split.
5/ Regulated output typically performs with less ripple than cross regulated output. Group A tests are performed with V_{O+} regulated and V_{O-} cross regulated.

Case outline X.

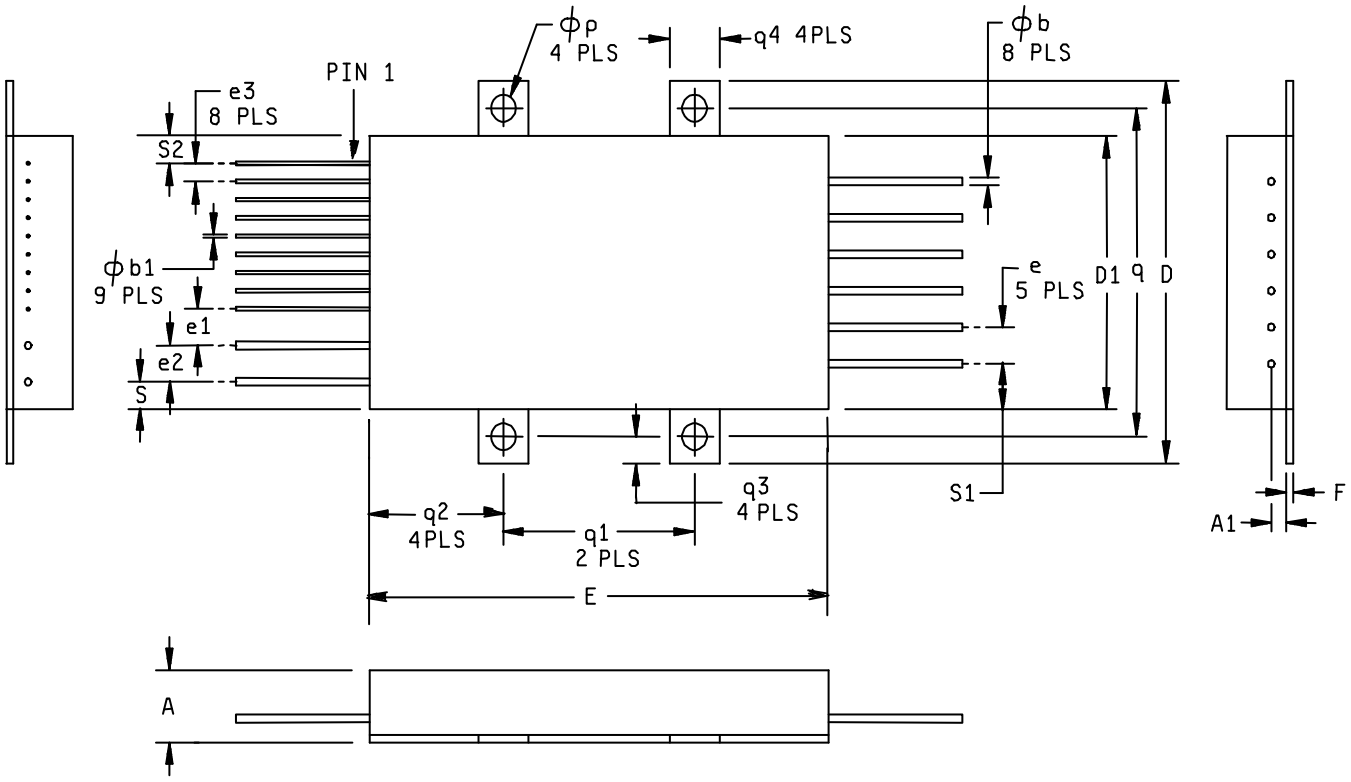


FIGURE 1. Case outline(s).

STANDARD MICROCIRCUIT DRAWING	SIZE A		5962-96841
DEFENSE SUPPLY CENTER COLUMBUS COLUMBUS, OHIO 43218-3990		REVISION LEVEL B	SHEET 9

Case outline X - Continued.

Symbol	Millimeters		Inches	
	Min	Max	Min	Max
A	9.65	10.16	.380	.400
A1	2.03	2.54	.080	.100
øb	.96	1.06	.038	.042
øb1	.40	.50	.016	.020
D	53.09	53.59	2.090	2.110
D1	37.85	38.35	1.490	1.510
e	4.95	5.20	.195	.205
e1	4.95	5.20	.195	.205
e2	4.95	5.20	.195	.205
e3	2.41	2.66	.095	.105
E	69.47	69.98	2.735	2.755
F	.94	1.09	.037	.043
øp	3.65	3.91	.144	.154
q	45.59	45.84	1.795	1.805
q1	28.95	29.21	1.140	1.150
q2	20.07	20.57	.790	.810
q3	3.68	3.93	.145	.155
q4	7.36	7.87	.290	.310
S	3.68	3.93	.145	.155
S1	6.22	6.47	.245	.255
S2	3.68	3.93	.145	.155

NOTES:
1. The case outline X was originally designed using the inch-pound units of measurement, in the event of conflict between the metric and inch-pound units, the inch-pound shall take precedence.
2. Minimum pin length is .740 inches (18.80 mm).
3. All pin-to-sidewall spacing are guaranteed for a minimum of 500 V dc breakdown at standard air pressure.
4. The weight of the finished product is 85 grams maximum.

FIGURE 1. Case outline(s) - Continued.

Device type	01
Case outline	X
Terminal number	Terminal symbol
1	- SENSE
2	+ SENSE
3	ADJUST
4	STATUS
5	VAUX
6	INHIBIT
7	SYNC
8	ISHARE
9	TEMP
10	$- V_{IN}$
11	$+ V_{IN}$
12	$+ V_{OUT}$
13	$+ V_{OUT}$
14	VCOMMON
15	VCOMMON
16	$- V_{OUT}$
17	$- V_{OUT}$

FIGURE 2. Terminal connections.

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
Final electrical parameters	1*, 2, 3, 4, 5, 6, 7
Group A test requirements	1, 2, 3, 4, 5, 6, 7
Group C end-point electrical parameters 1/	1, 2, 3
End-point electrical parameters for radiation hardness assurance (RHA) devices	Not applicable

* PDA applies to subgroup 1.
1/ As a minimum, for all Group C testing performed after March 24, 2009, manufacturers shall perform subgroups 1, 2, and 3 from the Group A electrical test table (Table C-Xa of MIL-PRF-38534).

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 8, 9, 10, and 11 shall be omitted.

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 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.

c. Constant acceleration, method 2001 of MIL-STD-883 is performed at 2500g's.

4.3.4 Group D inspection (PI). Group D inspection shall be in accordance with MIL-PRF-38534.

4.3.5 Radiation Hardness Assurance (RHA) inspection. RHA inspection is not currently applicable to this drawing.

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 as specified in MIL-PRF-38534.

6.4 Record of users. Military and industrial users shall inform Defense Supply Center Columbus (DSCC) 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, Columbus, Ohio 43218-3990, or telephone (614) 692-1081.

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: 09-03-24

Approved sources of supply for SMD 5962-96841 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 information bulletin is superseded by the next dated revisions of MIL-HDBK-103 and QML-38534. DSCC maintains an online database of all current sources of supply at http://www.dscc.dla.mil/Programs/Smcr/.

Standard microcircuit drawing PIN 1/	Vendor CAGE number	Vendor similar PIN 2/
5962-9684101HXC	3/	ADDC02812DATV/QMLH

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.
3/ Not available from an approved source of supply. The last known supplier is listed below.

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