REVISIONS			
LTR	DESCRIPTION	DATE (YR-MO-DA)	APPROVED
A	Add case outlines Y and Z. Table I, I_{IN} maximum limit , change from 4, mA to 5 mA.	99-07-12	Raymond Monnin
B	Add device type 02, class K, and radiation hardness assurance (RHA) requirements for levels L and R.	00-10-23	Raymond Monnin

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
Gary Zahn

CHECKED BY
Michael C. Jones

APPROVED BY
Kendall A. Cottongim

DRAWING APPROVAL DATE
93-12-06

REVISION LEVEL
B

DEFENSE SUPPLY CENTER COLUMBUS
POST OFFICE BOX 3990
COLUMBUS, OHIO 43216-5000

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, SINGLE CHANNEL, DC-DC CONVERTER

SIZE	CAGE CODE	
A	**67268**	**5962-93093**

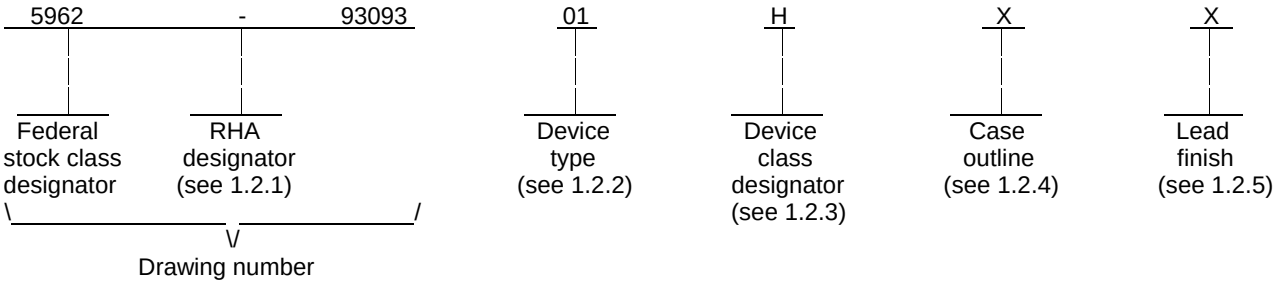
SHEET 1 OF 13

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

1. SCOPE

1.1 Scope. This drawing documents five product assurance classes, class D (lowest reliability), class E, (exceptions), class G (lowered high reliability), class H (high reliability), and class K, (highest reliability) and 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. Device classes H and K 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. Only the RHA levels specified herein are available. See 4.3.5.

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

Device type	Generic number	Circuit function
01	MSA2812S/883, MGA2812S	DC-DC converter, 5 W, +12 V output
02	SMSA2812S	DC-DC converter, 5 W, +12 V output

1.2.3 Device class designator. This device class designator shall be a single letter identifying the product assurance level as follows:

Device class	Device performance documentation
D, E, G, H, or K	Certification and qualification to MIL-PRF-38534

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	8	Dual-in-line
Y	See figure 1	20	Flat pack
Z	See figure 1	20	Flat pack with formed leads

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

1.3 Absolute maximum ratings. 1/

Input voltage range	-0.5 V dc to +50 V dc
Power dissipation (P_D)	3.1 W
Output power	5.2 W
Lead soldering temperature (10 seconds)	+300°C
Storage temperature range	-65°C to +150°C

1/ 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.

1.4 Recommended operating conditions.

Input voltage range	+16 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 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 for Microcircuit Case Outlines.

HANDBOOKS

DEPARTMENT OF DEFENSE

MIL-HDBK-103 - List of Standard Microcircuit Drawings (SMD's).
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 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. Therefore, the tests and inspections herein may not be performed for the applicable device class (see MIL-PRF-38534). Furthermore, the manufacturer 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 1.2.4 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 in MIL-HDBK-103 and QML-38534.

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/ $-55°C \le T_C \le +125°C$ V_{IN} = 28 V dc ±0.5 V, C_L = 0 unless otherwise specified	Group A subgroups	Device types	Limits		Unit
					Min	Max	
Output voltage	V_{OUT}	I_{OUT} = 417 mA	1	01,02	11.88	12.12	V dc
			2,3		11.52	12.48	
		L, R	1,2,3	02	11.4	12.6	
Output current	I_{OUT}	V_{IN} = 16 V dc to 40 V dc	1,2,3	01, 02		417	mA
		L, R	1,2,3	02		417	
V_{OUT} ripple voltage	V_{RIP}	I_{OUT} = 417 mA BW = 10 kHz to 2 MHz	1	01,02		200	mVp-p
			2,3			300	
		L, R	1,2,3	02		400	
V_{OUT} line regulation	VR_{LINE}	V_{IN} =16 V dc to 40 V dc I_{OUT} = 417 mA	1,2,3	01,02		50	mV
		L, R	1,2,3	02		100	
V_{OUT} load regulation	VR_{LOAD}	I_{OUT} = 0 to 417 mA	1,2,3	01,02		50	mV
		L, R	1,2,3	02		100	
Input current	I_{IN}	I_{OUT} = 0 A, Inhibit (see figure 2) = 0	1,2,3	01,02		5	mA
		L, R	1,2,3	02		8	
		I_{OUT} = 0 A, Inhibit (see figure 2) = open	1, 2, 3	01,02		42	
		L, R	1,2,3	02		100	
I_{IN} ripple current	I_{RIP}	I_{OUT} = 417 mA, BW = 10 kHz to 10 MHz	1	01,02		100	mAp-p
			2,3	01		150	
			2,3	02		100	
		L, R	1,2,3	02		200	

See footnotes at end of table.

TABLE I. Electrical performance characteristics - Continued

Test	Symbol	Conditions 1/ $-55°C \le T_C \le +125°C$ V_{IN} = 28 V dc ±0.5 V, C_L = 0 unless otherwise specified	Group A subgroups	Device types	Limits		Unit
					Min	Max	
Efficiency	Eff	I_{OUT} = 417 mA	1	01	70		%
				02	68		
			2, 3	01	68		
				02	64		
		L, R	1,2,3	02	60		
Isolation	ISO	Input to output or any pin to case except the case ground (see figure 2) at 500V dc T_C = +25°C	1	01,02	100		MΩ
		L, R	1	02	100		
Capacitive load 2/ 3/	C_L	No effect on dc performance, T_C = +25°C	4	01,02		500	µF
		L, R	4	02		500	
Short circuit power dissipation	P_D	Short circuit	1	01,02		1.9	W
			2,3	01,02		2.1	
		L, R	1,2,3	02		2.5	
Switching frequency	F_S	I_{OUT} = 417 mA	4	01,02	450	600	kHz
			5,6		400	660	
		L, R	4,5,6	02	380	700	
V_{OUT} step load transient 4/	V_{TLOAD}	50% load to/from 100% load	4	01,02	-375	+375	mV pk
			5,6	01	-1100	+1100	
			5,6	02	-400	+400	
		L, R	4,5,6	02	-750	+750	

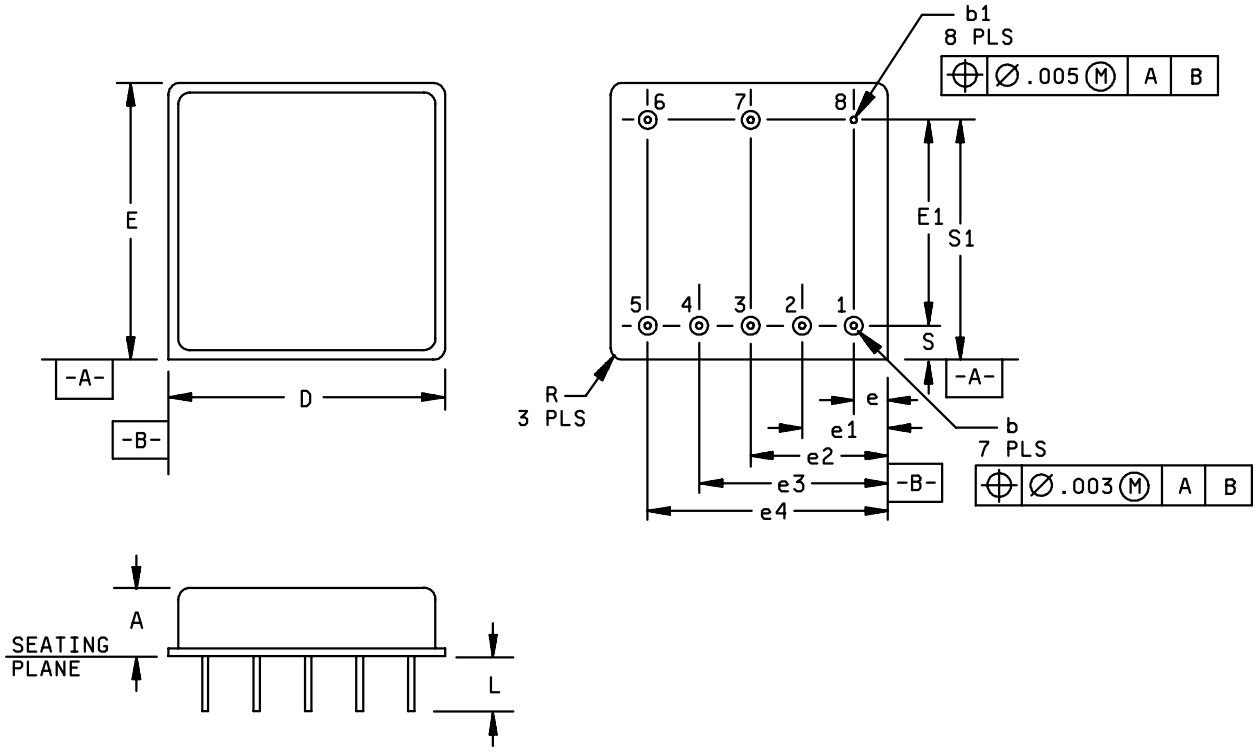
See footnotes at end of table.

TABLE I. Electrical performance characteristics - Continued

Test	Symbol	Conditions 1/ $-55°C \le T_C \le +125°C$, V_{IN} = 28 V dc ±0.5 V, C_L = 0 unless otherwise specified	Group A subgroups	Device types	Limits		Unit
					Min	Max	
V_{OUT} step load transient recovery 3/ 4/ 5/	TT_{LOAD}	50% load to/from 100% load	4	01		500	us
			5,6	01		3000	
			4,5,6	02		100	
		L, R	4,5,6	02		200	
V_{OUT} step line transient 3/ 6/	V_{TLINE}	Input step 16 V dc to/from 40 V dc, I_{OUT} = 417 mA	4,5,6	01,02	-1000	+800	mV pk
		L, R	4,5,6	02	-1100	+1100	
V_{OUT} step line transient recovery 3/ 5/	TT_{LINE}	Input step 16 V dc to/from 40 V dc, I_{OUT} = 417 mA	4,5,6	01		1300	µs
				02		800	
		L, R	4,5,6	02		800	
Start up overshoot 3/	$Vton_{OS}$	I_{OUT} = 417 mA	4,5,6	01,02		500	mV pk
		L, R	4,5,6	02		500	
Start up delay 7/	Ton_D	I_{OUT} = 417 mA	4,5,6	01,02		30	ms
		L, R	4,5,6	02		30	
Load fault recovery 3/	Tr_{LF}	I_{OUT} = 417 mA	4,5,6	01,02		30	ms
		L, R	4,5,6	02		30	

1/ Post irradiation testing shall be in accordance with 4.3.5 herein.
2/ Capacitive load may be any value from 0 to the maximum limit without compromising dc performance.
3/ Parameter shall be tested as part of device characterization and after design and process changes. Thereafter, parameters shall be guaranteed to the limits specified in table I.
4/ Load step transition time is 10 µs maximum.
5/ Recovery time is measured from the initiation of the transient until V_{OUT} has returned to within ±1 percent of V_{OUT} final value.
6/ Input step transition time greater than 10 µs.
7/ Start up delay time measurement is either for a step application of power at the input or the removal of a ground signal from the inhibit pin (see figure 2) while power is applied to the input.

Case outline X.

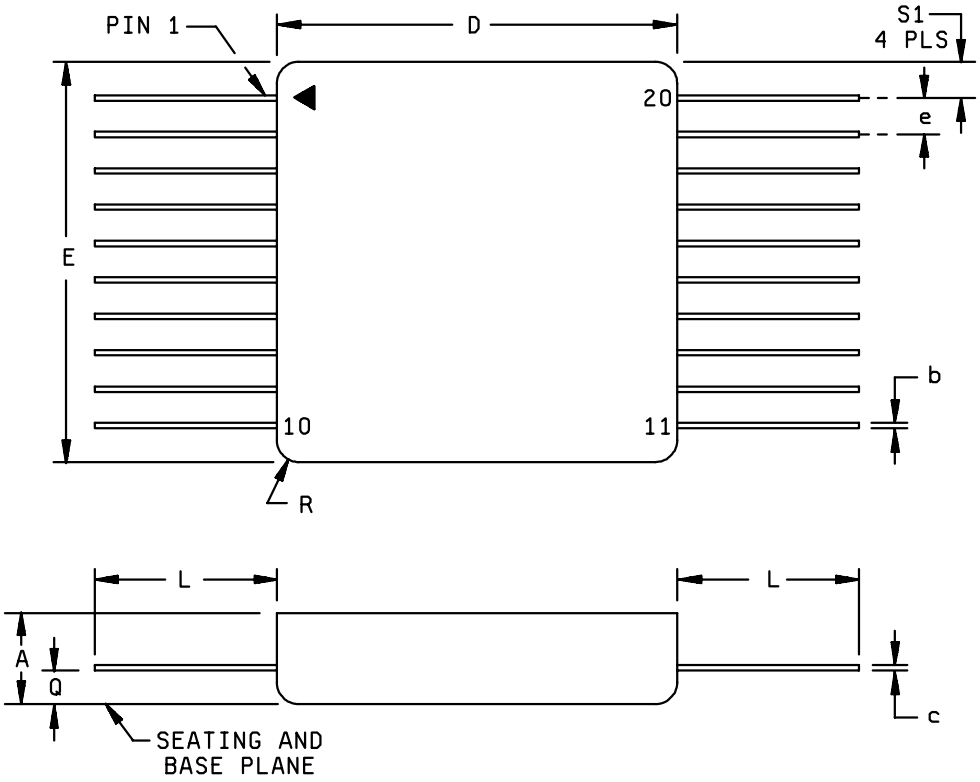


Symbol	Millimeters		Inches	
	Min	Max	Min	Max
A		6.86		0.270
b	1.78 DIA		0.070 DIA	
b1	0.64 DIA		0.025 DIA	
D/E		27.31		1.075
E1	20.19	20.45	0.795	0.805
e/S	3.23	3.48	0.127	0.137
e1	8.31	8.56	0.327	0.337
e2	13.39	13.64	0.527	0.537
e3	18.47	18.72	0.727	0.737
e4/S1	23.55	23.80	0.927	0.937
L		5.59		0.220
R	1.14	1.40	0.045	0.055

NOTES:
1. 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.
2. Pin numbers are for reference only.
3. Case outline X weight: 15 grams maximum.

FIGURE 1. Case outline(s).

Case outline Y.

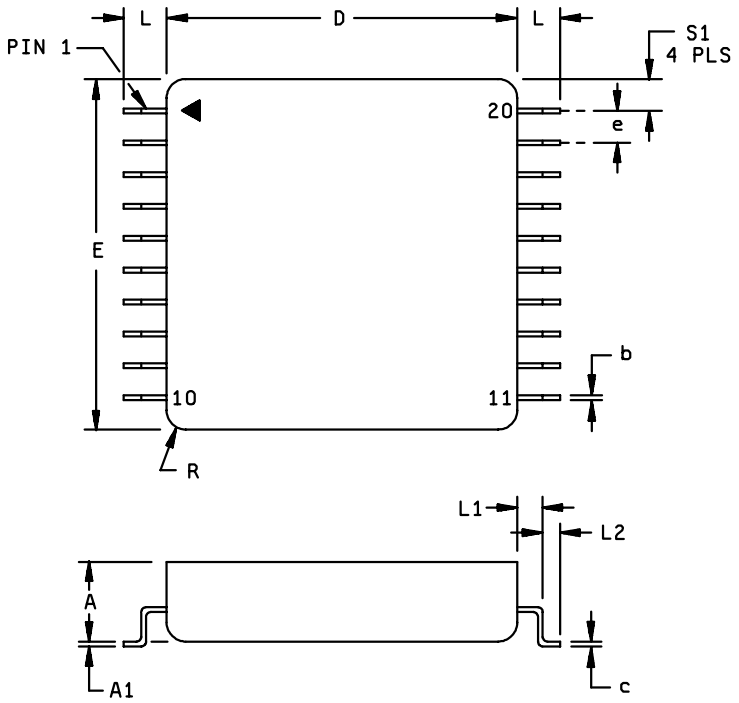


Symbol	Millimeters		Inches	
	Min	Max	Min	Max
A		6.35		0.250
b	0.30	0.56	0.012	0.022
c	0.20	0.41	0.008	0.016
D/E	27.81	28.07	1.095	1.105
e	2.54 BSC		0.100 BSC	
L	12.70 TYP		0.500 TYP	
Q	1.78	2.29	0.070	0.090
R		1.52		0.060
S1	2.29	2.79	0.090	0.110

NOTES:
1. 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.
2. Pin numbers are for reference only.
3. Case outline Y weight: 15 grams maximum.

FIGURE 1. Case outline(s) - Continued.

Case outline Z.



Symbol	Millimeters		Inches	
	Min	Max	Min	Max
A		6.35		0.250
A1	0.13	0.51	0.005	0.020
b	0.30	0.56	0.012	0.022
c	0.20	0.41	0.008	0.016
D/E	27.81	28.07	1.095	1.105
e	2.54 BSC		0.100 BSC	
L	3.43 REF		0.135 REF	
L1	1.52	2.03	0.060	0.080
L2	1.14	1.65	0.045	0.065
R		1.52		0.060
S1	2.29	2.79	0.090	0.110

NOTES:
1. 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.
2. Pin numbers are for reference only.
3. Case outline Z weight: 15 grams maximum.

FIGURE 1. Case outline(s) - Continued.

Device types	01	01 and 02
Case outlines	Y and Z	X
Terminal number	Terminal symbol	Terminal symbol
1	Inhibit	Output
2	Input	Output return
3	Input	No connection
4	No connection	No connection
5	Input common	Inhibit
6	Input common	Input
7	Case ground	Input return
8	Case ground	Case ground
9	No connection	
10	No connection	
11	Output	
12	Output	
13	Output	
14	Output common	
15	Output common	
16	Output common	
17	No connection	
18	No connection	
19	Case ground	
20	Case ground	

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	
Final electrical parameters	1*, 2, 3, 4, 5, 6
Group A test requirements	1, 2, 3, 4, 5, 6
Group C end-point electrical parameters	1
End-point electrical parameters for radiation hardness assurance (RHA) devices	1, 2, 3, 4, 5, 6

* 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, 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 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.

4.3.5. Radiation hardness assurance (RHA). RHA qualification is required only for those devices with the RHA designator as specified herein.

	RHA level L	RHA level R	Units
Total ionizing dose tolerance level	50	100	kRad (Si)
Single event upset survival level (LET)	No guarantee	40	MeV

a. Radiation does rate is in accordance with condition C of method 1019 of MIL-STD-883. Unless otherwise specified, components are tested at a rate of 9 rad(Si)/s, in accordance method 1019 of MIL-STD-750 or MIL-STD-883, as applicable.

b. The manufacturer shall perform a worst-case and radiation susceptibility analysis on the device. This analysis shall show that the minimum performance requirements of each component has adequate design margin under worst-case operating conditions (extremes of line voltage, temperatures, load, frequency, radiation environment, etc.). This analysis guarantees the post-irradiation parameter limits specified in table I.

c. RHA testing shall be performed at the component level for initial device qualification, and after design changes that may affect the RHA performance of the device. As an alternative to testing, components may be procured to manufacturer radiation guarantees that meet the minimum performance requirements. Component radiation performance guarantees shall be established in compliance with MIL-PRF-19500, Group D or MIL-PRF-38535, Group E, as applicable. For components with less than adequate performance margin, component lot radiation acceptance screening shall be performed.

d. The manufacturer shall establish procedures controlling component radiation testing, and shall establish radiation test plans used to implement component lot qualification during procurement. Test plans and test reports shall be filed and controlled in accordance with the manufacturer's configuration management system.

e. The device manufacturer shall designate a RHA program manager to oversee component lot qualification, and to monitor design changes for continued compliance to RHA requirements.

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) 692-0512.

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: 00-10-23

Approved sources of supply for SMD 5962-93093 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/
5962-9309301HXA	50821	MSA2812S/883
5962-9309301HXC	50821	MSA2812S/883
5962-9309301HYA	50821	MGA2812S/883
5962-9309301HYC	50821	MGA2812S/883
5962-9309301HZA	50821	MGA2812SZ/883
5962-9309302HXA	50821	SMSA2812S/HO
5962-9309302HXC	50821	SMSA2812S/HO
5962L9309302HXA	50821	SMSA2812S/HL
5962L9309302HXC	50821	SMSA2812S/HL
5962R9309302HXA	50821	SMSA2812S/HR
5962R9309302HXC	50821	SMSA2812S/HR
5962L9309302KXA	50821	SMSA2812S/KL
5962L9309302KXC	50821	SMSA2812S/KL
5962R9309302KXA	50821	SMSA2812S/KR
5962R9309302KXC	50821	SMSA2812S/KR

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
50821	Interpoint Corporation 10301 Willows Road Redmond, WA 98073-9705

The information contained herein is disseminated for convenience only and the Government assumes no liability whatsoever for any inaccuracies in the information bulletin.