REVISIONS			
LTR	DESCRIPTION	DATE (YR-MO-DA)	APPROVED
A	Added RHA and class K devices. Added RHA requirements in 4.3.5. Redrew entire document. -sld	98-09-18	K.A. Cottongim
B	Add case outlines Y and Z. Table I, I_{IN} maximum limit, change from 4 mA to 5 mA.	99-07-12	R. Monnin

REV																			
SHEET																			
REV																			
SHEET																			

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

STANDARD MICROCIRCUIT DRAWING

THIS DRAWING IS AVAILABLE FOR USE BY ALL DEPARTMENTS AND AGENCIES OF THE DEPARTMENT OF DEFENSE

AMSC 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
P. O. BOX 3990
COLUMBUS, OHIO 43216-5000

MICROCIRCUIT, HYBRID, LINEAR, 15 VOLT, SINGLE CHANNEL, DC/DC CONVERTER

SIZE	CAGE CODE	
A	**67268**	**5962-93094**

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 (lowest high reliability), class H (high reliability), and class K, (highest reliability) and a choice of case outlines and lead finishes 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:

5962	-	93094	01	H	X	X
Federal stock class designator	RHA designator (see 1.2.1)		Device type (see 1.2.2)	Device class designator (see 1.2.3)	Case outline (see 1.2.4)	Lead finish (see 1.2.5)

Drawing number

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.

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

Device type	Generic number	Circuit function
01	MSA2815S/883, MGA2815S	DC-DC converter, 5 W, +15 V output
02	SMSA2815S	DC-DC converter, 5 W, +15 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) shall be 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 rating 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 handbook. The following specification, standards, and handbook 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 Methods and Procedures for Microelectronics.
MIL-STD-973 - Configuration Management.
MIL-STD-1835 - Microcircuit Case Outlines.

HANDBOOK

DEPARTMENT OF DEFENSE

MIL-HDBK-780 - Standard Microcircuit Drawings.

(Unless otherwise indicated, copies of the specification, standards, and handbook 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). Futhermore, 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 1.2.4 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 as listed in 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_C 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} = 28V dc ±0.5 V unless otherwise specified	Group A subgroups	Device type	Limits Min	Limits Max	Unit
Output voltage	V_{OUT}	I_{OUT} = 333 mA	1	01,02	14.85	15.15	V dc
			2,3	01,02	14.40	15.60	
		L,R	1,2,3	02	13.8	16.2	
Output current	I_{OUT}	V_{IN} = 16, 28, and 40 V dc	1,2,3	01,02		333	A
		L,R	1,2,3	02		333	
Output ripple 2/ voltage	V_{RIP}	I_{OUT} = 333 mA, B.W. = 10 kHz to 2 MHz	1	01		170	mV p-p
				02		600	
			2,3	01		250	
				02		900	
		L,R	1,2,3	02		1350	
Line regulation	VR_{LINE}	I_{OUT} = 333 mA, V_{IN} = 16 and 40 V dc	1,2,3	01,02		50	mV
		L,R	1,2,3	02		100	
Load regulation	VR_{LOAD}	I_{OUT} = 0 to 333 mA	1,2,3	01,02		50	mV
		L,R	1,2,3	02		100	
Input current	I_{IN}	I_{OUT} = 0, inhibit pin (pin 5) = 0	1,2,3	01,02		5	mA
		L,R		02		12	
		I_{OUT} = 0, inhibit pin (pin 5) = open		01		44	
				02		60	
		L,R		02		100	
Input ripple current	I_{RIP}	I_{OUT} = 333 mA B. W. = 10 kHz to 10 MHz	1	01		100	mAp-p
				02		200	
			2,3	01		150	
				02		300	
		L,R	1,2,3	02		500	

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} = 28V dc ±0.5 V unless otherwise specified	Group A subgroups	Device type	Limits Min	Limits Max	Unit
Efficiency	Eff	I_{OUT} = 333 mA	1	01	71		%
				02	69		
			2,3	01	69		
				02	65		
		L,R	1,2,3	02	61		
Isolation	ISO	Input to output or any pin to case except pin 8, T_C = +25°C	1	01,02	100		MΩ
		L,R		02	100		
Internal power dissipation, load fault	P_D	Short circuit	1	01,02		1.8	W
			2,3			2.0	
		L,R	1,2,3	02		3	
Switching frequency	F_S	I_{OUT} = 333 mA	4	01,02	450	600	kHz
			5,6	01,02	400	660	
		L,R	4,5,6	02	400	700	
Output response to step transient load changes 3/	VO_{TLOAD}	50 percent load to/from 100 percent load	4	01	-500	+500	mV pk
				02	-1000	+1000	
			5,6	01	-1500	+1500	
				02	-3000	+3000	
		L,R	4,5,6	02	-4000	+4000	
Recovery time, step transient load changes 3/ 4/	TT_{LOAD}	50 percent load to/from 100 percent load	4	01		500	µs
				02		1000	
			5,6	01		3500	
				02		4500	
		L,R	4,5,6	02		5	ms

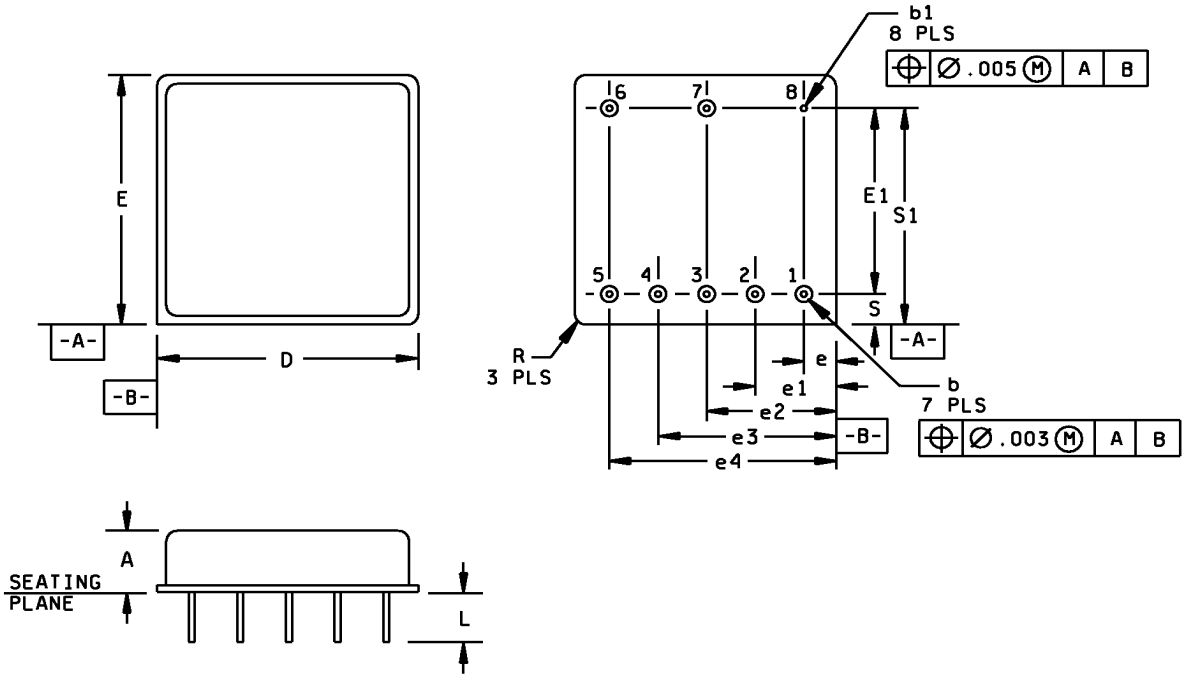
See footnotes at end of table.

TABLE I. Electrical performance characteristics - Continued.

Test	Symbol	Conditions 1/ $-55°C \le T_C \le +125°C$ V_{IN} = 28V dc ±0.5V unless otherwise specified	Group A subgroups	Device type	Limits Min	Limits Max	Unit
Output response to transient step line changes 3/ 5/	VO_{TLINE}	Input step from 16 V dc to 40 V dc, I_{OUT} = 333 mA	4,5,6	01,02	-500	+500	mV pk
		L,R		02	-1500	+1500	
		Input step from 40 V dc to 16 V dc, I_{OUT} = 333 mA		01,02	-500	+500	
		L,R		02	-1500	+1500	
Recovery time to transient step line changes 4/ 5/ 6/	TT_{LINE}	Input step from 16 V dc to 40 V dc, I_{OUT} = 333 mA	4,5,6	01		1.3	ms
				02		1.3	
		L,R		02		2.6	
		Input step from 40 V dc to 16 V dc, I_{OUT} = 333 mA		01		1.3	
				02		1.3	
		L,R		02		2.6	
Turn-on overshoot 5/	$Vton_{OS}$	V_{IN} = 0 to 28 V dc, I_{OUT} = 333 mA	4,5,6	01,02		500	mV pk
		L,R		02		1000	
Turn-on delay 4/ 7/	Ton_D	V_{IN} = 0 to 28 V dc, I_{OUT} = 333 mA	4,5,6	01		30	ms
				02		75	
		L,R		02		150	
Load fault recovery 3/ 5/	Tr_{LF}	I_{OUT} = 333 mA	4,5,6	01		30	ms
				02		75	
		L,R	4,5,6	02		150	
Capacitive load 5/ 8/	C_L	No effect on dc performance, T_C = +25°C	4	01,02		500	µF
		L,R	4	02		500	

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

Case outline X.

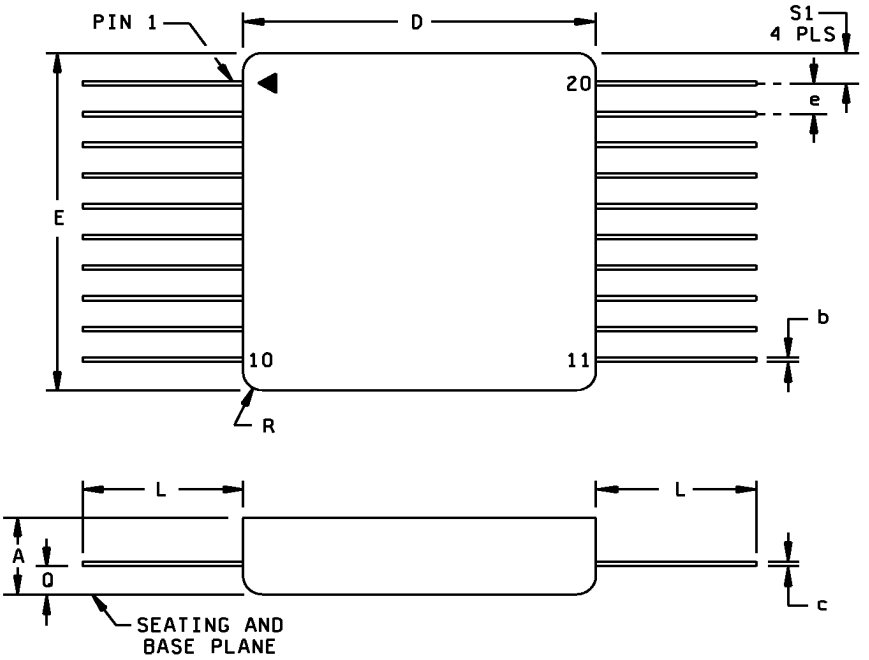


Symbol	Millimeters		Inches	
	Min	Max	Min	Max
A		6.86		0.270
b	1.79 DIA		0.070 DIA	
b1	0.64 DIA		0.025 DIA	
D/E		27.31		1.075
E1	20.19	20.45	0.795	0.805
e/S	3.23	3.48	0.127	0.137
e1	8.31	8.56	0.327	0.337
e2	13.39	13.64	0.527	0.537
e3	18.47	18.72	0.727	0.737
e4/S1	23.55	23.80	0.927	0.937
L		5.59		0.220
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 rule.
2. Pin numbers are for reference only.
3. Device weight: 15 grams maximum.

FIGURE 1. Case outline(s).

Case outline Y.

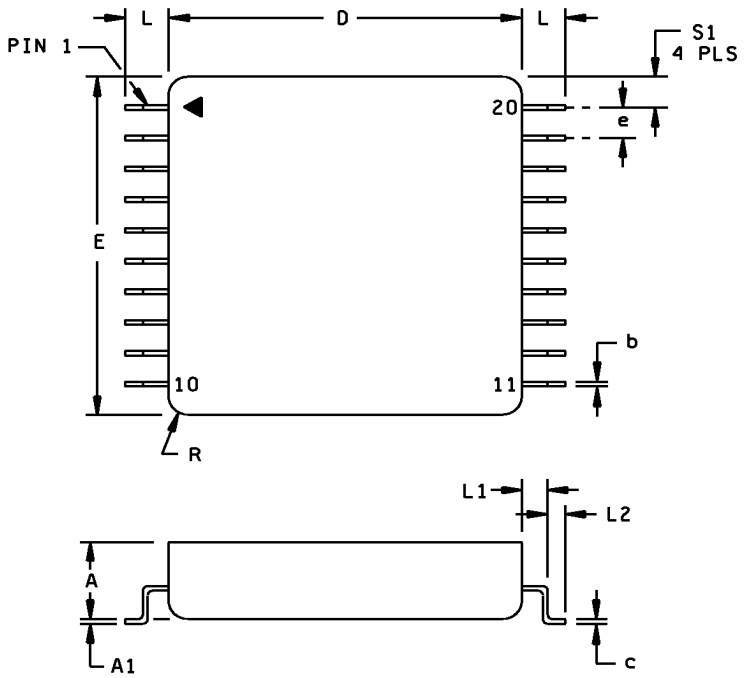


Symbol	Millimeters		Inches	
	Min	Max	Min	Max
A		6.36		0.250
b	0.30	0.56	0.012	0.022
c	0.20	0.41	0.008	0.016
D/E	27.81	28.07	1.095	1.105
e	2.54 BSC		0.100 BSC	
L	12.7 TYP		0.500 TYP	
Q	1.78	2.29	0.070	0.090
R		1.52		0.060
S1	2.29	2.79	0.090	0.110

NOTES:
1. The U.S. government preferred system of measurement is the metric SI. This case outline 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 rule.
2. Lead identification 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		6.36		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 case outline 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 rule.
2. Lead identification 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	Positve input	Output return
3	Positive 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	Positive output	
12	Positive output	
13	Positive 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
Post irradiation end-point electrical parameters for 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_C 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 dose rate is in accordance with condition C of method 1019 of MIL-STD-883.

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 enviroment, 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-STD-973 using DD Form 1692, Engineering Change Proposal.

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, P. O. Box 3990, Columbus, Ohio 43216-5000, or telephone (614) 692-0512.

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

STANDARD MICROCIRCUIT DRAWING SOURCE APPROVAL BULLETIN

DATE: 99-07-12

Approved sources of supply for SMD 5962-93094 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 DSCC-VA. This bulletin is superseded by the next dated revision of QML-38534.

Standard microcircuit drawing PIN 1/	Vendor CAGE number	Vendor similar PIN 2/
5962-9309401HXA	50821	MSA2815S/883
5962-9309401HXC	50821	MSA2815S/883
5962-9309401HYA	50821	MGA2815SY/883
5962-9309401HYC	50821	MGA2815SY/883
5962-9309401HZA	50821	MGA2815SZ/883
5962-9309401HZC	50821	MGA2815SZ/883
5962-9309402HXA	50821	SMSA2815S/HO
5962-9309402HXC	50821	SMSA2815S/HO
5962L9309402HXA	50821	SMSA2815S/HL
5962L9309402HXC	50821	SMSA2815S/HL
5962R9309402HXA	50821	SMSA2815S/HR
5962R9309402HXC	50821	SMSA2815S/HR
5962L9309402KXA	50821	SMSA2815S/KL
5962L9309402KXC	50821	SMSA2815S/KL
5962R9309402KXA	50821	SMSA2815S/KR
5962R9309402KXC	50821	SMSA2815S/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 this information bulletin.