REVISIONS			
LTR	DESCRIPTION	DATE (YR-MO-DA)	APPROVED

REV																				
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REV STATUS	REV														
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 C. Jones

APPROVED BY
Raymond Monnin

DRAWING APPROVAL DATE
01-11-30

REVISION LEVEL

STANDARD MICROCIRCUIT DRAWING

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

AMSC N/A

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

MICROCIRCUIT, HYBRID, LINEAR, 3.3 VOLT, SINGLE CHANNEL, DC-DC CONVERTER

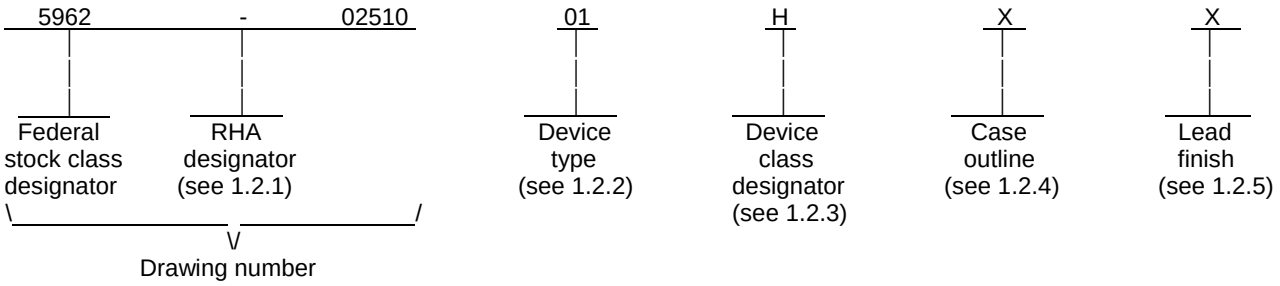
SIZE	CAGE CODE	
A	**67268**	**5962-02510**

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	MHF+283R3S/883, MHF+283R3SF/883	DC-DC converter, 8 W, 3.3 V output
02	SMHF283R3S, SMHF283R3SF	DC-DC converter, 8 W, 3.3 V output

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	8	Dual-in-line
Z	See figure 1	8	Flange mount

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):	
Device types 01 and 02 (non-RHA)	8 W
Device type 02 (RHA levels L and R)	9 W
Output power	8.23 W
Lead soldering temperature (10 seconds)	+300°C
Storage temperature range	-65°C to +150°C

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.)

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.

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.

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 no external sync, C_L = 0 unless otherwise specified	Group A subgroups	Device types	Limits		Unit
					Min	Max	
Output voltage	V_{OUT}	I_{OUT} = 2.4 A dc	1	01,02	3.27	3.33	V dc
			2,3		3.20	3.40	
		L, R	1,2,3	02	3.10	3.50	
Output current	I_{OUT}	V_{IN} = 16 V dc to 40 V dc	1,2,3	01, 02		2400	mA
		L, R	1,2,3	02		2400	
V_{OUT} ripple voltage	V_{RIP}	I_{OUT} = 2.4 A BW = 10 kHz to 2 MHz	1	01		80	mVp-p
				02		160	
			2,3	01,02		240	
		L, R	1,2,3	02		350	
V_{OUT} line regulation	VR_{LINE}	V_{IN} =16 V dc to 40 V dc I_{OUT} = 2.4 A	1,2,3	01,02		100	mV
		L, R	1,2,3	02		200	
V_{OUT} load regulation	VR_{LOAD}	I_{OUT} = 0 to 2.4 A	1,2,3	01,02		50	mV
		L, R	1,2,3	02		100	
Input current	I_{IN}	I_{OUT} = 0 A, Inhibit (pin 1) = 0 V dc	1,2,3	01,02		12	mA
		L, R	1,2,3	02		15	
		I_{OUT} = 0 A, Inhibit (pin 1) = open	1, 2, 3	01		40	
				02		65	
		L, R	1,2,3	02		100	
I_{IN} ripple current	I_{RIP}	I_{OUT} = 2.4 A, BW = 10 kHz to 10 MHz	1	01,02		80	mAp-p
			2,3	01,02		120	
		L, R	1,2,3	02		150	

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 no external sync, C_L = 0 unless otherwise specified	Group A subgroups	Device types	Limits		Unit
					Min	Max	
Efficiency	Eff	I_{OUT} = 2.4 A	1	01,02	70		%
			2,3	01,02	67		
		L, R	1,2,3	02	62		
Isolation	ISO	Input to output or any pin to case (except pin 6) at 500V dc, T_C = +25°C	1	01,02	100		MΩ
		L, R	1	02	100		
Short circuit power dissipation,	P_D	$P_D = P_{IN}$ - total P_{OUT}	1,2,3	01,02		8	W
		L, R	1,2,3	02		9	
Switching frequency	F_S	I_{OUT} = 2.4 A	4	01,02	500	600	kHz
			5,6	01,02	480	620	
		L, R	4,5,6	02	400	700	
External sync range 2/	F_{SYNC}	I_{OUT} = 2.4 A, TTL level to pin 5	4,5,6	01,02	500	600	kHz
		L, R	4,5,6	02	500	600	
V_{OUT} step load transient 3/	V_{TLOAD}	50% load to/from 100% load	4,5,6	01,02	-400	+400	mV pk
		L, R	4,5,6	02	-1200	+1200	
V_{OUT} step load transient recovery 3/ 4/ 5/	TT_{LOAD}	50% load to/from 100% load	4,5,6	01,02		300	µs
		L, R	4,5,6	02		1200	
V_{OUT} step line transient 4/ 6/	V_{TLINE}	Input step 16 V dc to/from 40 V dc, I_{OUT} = 2.4 A	4,5,6	01,02	-800	+800	mV pk
		L, R	4,5,6	02	-1500	+1500	

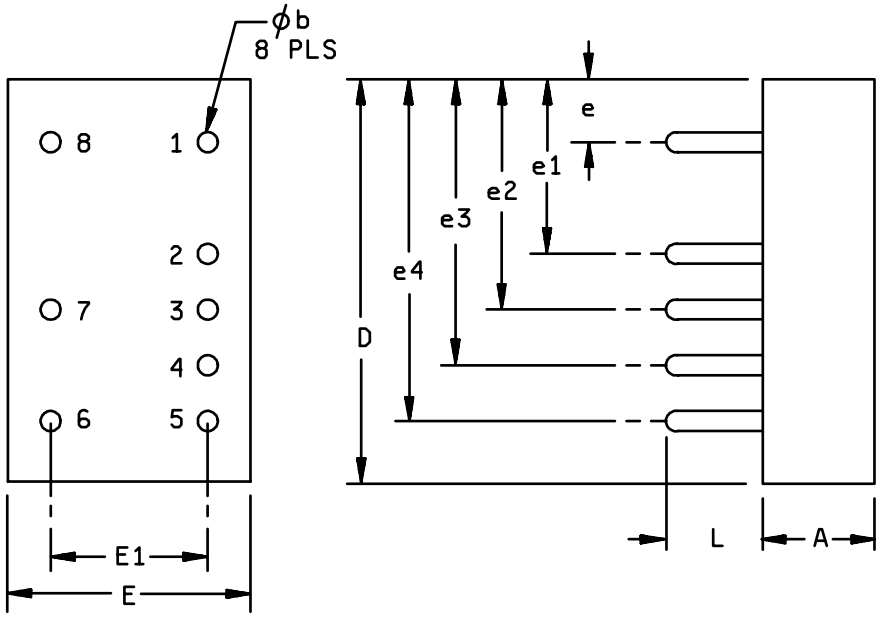
See footnotes at end of table.

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, no external sync, C_L = 0 unless otherwise specified	Group A subgroups	Device types	Limits		Unit
					Min	Max	
V_{OUT} step line transient recovery 4/ 5/	TT_{LINE}	Input step 16 V dc to/from 40 V dc, I_{OUT} = 2.4 A	4,5,6	01,02		1.2	ms
		L, R	4,5,6	02		2.4	
Start up overshoot 4/	$Vton_{OS}$	I_{OUT} = 2.4 A, V_{IN} = 0 to 28 V dc	4,5,6	01,02		300	mV pk
		L, R	4,5,6	02		1500	
Start up delay 7/	Ton_D	I_{OUT} = 2.4 A, V_{IN} = 0 to 28 V dc	4,5,6	01,02		25	ms
		L, R	4,5,6	02		100	
Load fault recovery 4/	Tr_{LF}	I_{OUT} = 2.4 A	4,5,6	01,02		30	ms
		L, R	4,5,6	02		100	
Capacitive load 4/ 8/	C_L	No effect on dc performance, T_C = +25°C	4	01,02		300	µF
		L, R	4	02		300	

1/ Post irradiation testing shall be in accordance with 4.3.5 herein.
2/ A TTL level waveform (V_{IH} = 4.5 V minimum, V_{IL} = 0.8 V maximum) with a 50% ±10% duty cycle applied to the sync input pin (pin 5) within the sync range frequency shall cause the converter's switching frequency to become synchronous with the frequency applied to the sync input pin (pin 5).
3/ Load step transition time greater than 10 µs.
4/ 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.
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 (pin 1) 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.

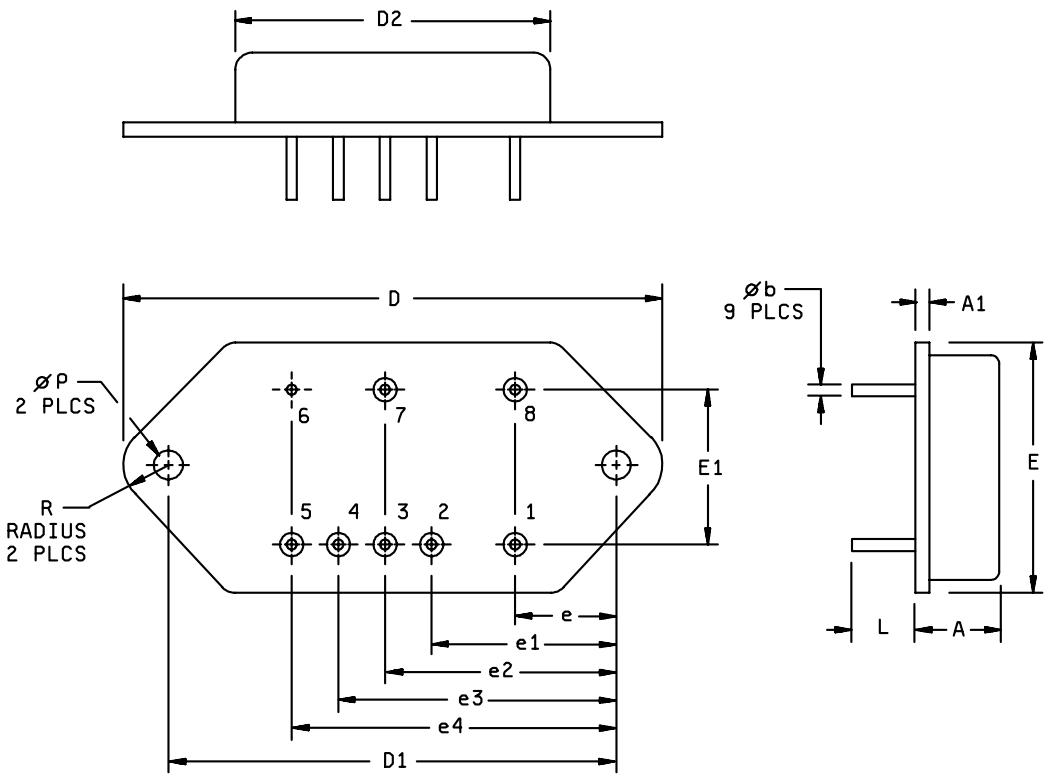


Symbol	Millimeters		Inches	
	Min	Max	Min	Max
A		8.38		.330
ϕb	0.64	0.89	.025	.035
D	36.70	28.32	1.445	1.455
e	5.08	5.33	.200	.210
e1	12.08	12.95	.500	.510
e2	17.78	18.03	.700	.710
e3	22.86	23.11	.900	.910
e4	27.94	28.19	1.100	1.110
E	28.32	28.57	1.115	1.125
E1	20.19	20.44	.795	.805
L	6.09	6.60	.240	.260

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 units shall take precedence.
2. Pin numbers are for reference only.
3. Device weight: 30 grams.

FIGURE 1. Case outline(s).

Case outline Z.



Symbol	Millimeters		Inches	
	Min	Max	Min	Max
A		8.38		.330
A1	0.94	1.45	.037	.057
ϕb	0.64	0.89	.025	.035
D		50.80		2.000
D1	43.82	44.07	1.725	1.735
D2		36.83		1.450
e	8.64	8.89	.340	.350
e1	16.26	16.51	.640	.650
e2	21.37	21.59	.840	.850
e3	26.41	26.67	1.040	1.050
e4	31.50	31.75	1.240	1.250
E		28.70		1.130
E1	20.07	20.57	.790	.810
L	6.09	6.60	.240	.260
ϕp	3.20	3.30	.126	.130
R	3.18	3.43	.125	.135

NOTES:
1. The case outline Z 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 units shall take precedence.
2. Pin numbers are for reference only.
3. Device weight: 30 grams maximum.

FIGURE 1. Case outline(s) - continued.

Device types	01 and 02
Case outlines	X and Z
Terminal number	Terminal symbol
1	Inhibit
2	No connection
3	Output return
4	Output
5	Sync input
6	Case ground
7	Input return
8	Input

FIGURE 2. Terminal connections.

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 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 dose 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 with 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: 01-11-30

Approved sources of supply for SMD 5962-02510 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/
5962-0251001HXA	50821	MHF+283R3S/883
5962-0251001HXC	50821	MHF+283R3S/883
5962-0251001HZA	50821	MHF+283R3SF/883
5962-0251001HZC	50821	MHF+283R3SF/883
5962-0251002HXA	50821	SMHF283R3S/HO
5962-0251002HXC	50821	SMHF283R3S/HO
5962-0251002HZA	50821	SMHF283R3SF/HO
5962-0251002HZC	50821	SMHF283R3SF/HO
5962L0251002HXA	50821	SMHF283R3S/HL
5962L0251002HXC	50821	SMHF283R3S/HL
5962L0251002HZA	50821	SMHF283R3SF/HL
5962L0251002HZC	50821	SMHF283R3SF/HL
5962R0251002HXA	50821	SMHF283R3S/HR
5962R0251002HXC	50821	SMHF283R3S/HR
5962R0251002HZA	50821	SMHF283R3SF/HR
5962R0251002HZC	50821	SMHF283R3SF/HR
5962L0251002KXA	50821	SMHF283R3S/KL
5962L0251002KXC	50821	SMHF283R3S/KL
5962L0251002KZA	50821	SMHF283R3SF/KL
5962L0251002KZC	50821	SMHF283R3SF/KL
5962R0251002KXA	50821	SMHF283R3S/KR
5962R0251002KXC	50821	SMHF283R3S/KR
5962R0251002KZA	50821	SMHF283R3SF/KR
5962R0251002KZC	50821	SMHF283R3SF/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