REVISIONS			
LTR	DESCRIPTION	DATE (YR-MO-DA)	APPROVED
E	Figure 1, case outlines Y and Z, change the maximum D/E dimension from 1.105" (28.07 mm") to 1.110" (28.19 mm) and change the R maximum dimension from 0.600" (1.52 mm) to .065" (1.65 mm).	05-04-18	Raymond Monnin
F	Added paragraph 1.5 and note 2. Add paragraph 3.2.3. Table I add new note 2 for enhanced low dose rate effects (renumber remaining notes is sequence). Paragraph 4.3.5.a, add enhanced low dose rate effects. Add RHA level P to device type 02 in paragraphs 1,3, 1.5, 4.3.5 (table), table I, ans SMD bulletin. -gz	07-06-06	Robert M. Heber
G	Added footnote 1 to table II, under group C end-point electricals. Updated drawing paragraphs. Made correction in table I to add device type 02 for TT_{Line} test for the 750 µs limit. -sld	09-08-26	Charles F. Saffle
H	Updated drawing to the latest requirements of MIL-PRF-38534. -sld	15-07-13	Charles F. Saffle
J	Add device type 03. Update to current RHA format. Corrections throughout. -gc	16-10-03	Charles F. Saffle

REV																				
SHEET																				
REV	J	J	J	J	J	J	J													
SHEET	15	16	17	18	19	20	21													
REV STATUS				REV			J	J	J	J	J	J	J	J	J	J	J	J	J	J
OF SHEETS				SHEET			1	2	3	4	5	6	7	8	9	10	11	12	13	14

PMIC N/A

PREPARED BY
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DRAWING APPROVAL DATE
93-12-06

REVISION LEVEL
J

DLA LAND AND MARITIME
COLUMBUS, OHIO 43218-3990
http://www.landandmaritime.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 CHANNEL, DC/DC CONVERTER

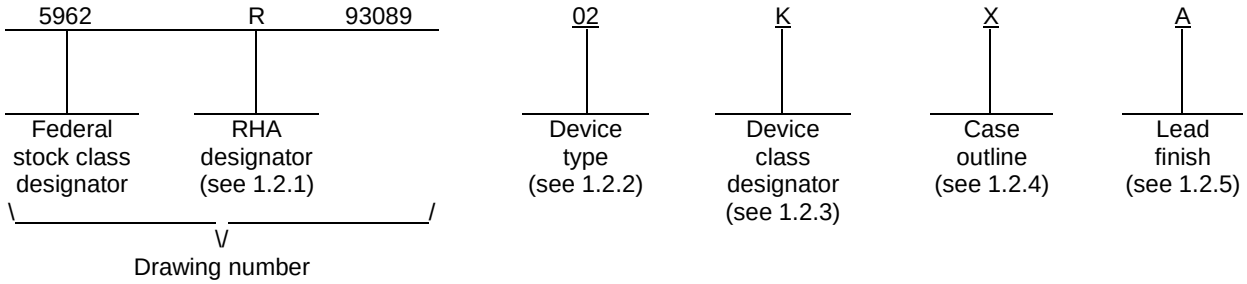
SIZE	CAGE CODE	
A	**67268**	**5962-93089**

SHEET 1 OF 21

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 is as shown in the following example:



1.2.1 Radiation hardness assurance (RHA) designator. RHA marked devices meet the MIL-PRF-38534 specified RHA levels and are 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	MSA2812D/883, MGA2812D/883	DC-DC converter, 5 W, ±12 V outputs
02	SMSA2812D	DC-DC converter, 5 W, ±12 V outputs
03	SMSA2812D	DC-DC converter, 5 W, ±12 V outputs

1.2.3 Device class designator. This device class designator is 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
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 is 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, 02, 03 (non-RHA)	1.9 W
Device types 02,03 (RHA levels P, L, R)	2.0 W
Output power	5.3 W 2/
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

1.5 Radiation features. 3/, 4/

Maximum total dose available (dose rate = 50 - 300 rad(Si)/s):	
Device type 02	100 krad(Si) 5/
Device type 03	50 krad(Si) 6/
Maximum total dose available (dose rate ≤ 10 mrad(Si)/s):	
Device type 02	100 krad(Si) 5/
Single event phenomenon (SEP) effective linear energy transfer (LET):	
No SEL, SEB, SEGR, SEFI	≤ 86 MeV-cm^2/mg 7/
SEU	≤ 86 MeV-cm^2/mg 8/

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.

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.
Input voltage transients up to 50 volts are allowed for no more than 50 milliseconds.
2/ Derate output power linearly above case temperature (T_C) of +125°C to 0 W at +130°C.
3/ See 4.3.5 for the manufacturer's radiation hardness assurance analysis and testing.
4/ Bipolar device types may degrade from displacement damage from radiation which could affect RHA levels. These device types have not been characterized for displacement damage.
5/ A representative device was initially High Dose Rate (HDR) tested using condition A of method 1019 of MIL-STD-883 to 150 krad(Si) to ensure RHA designator level "R" (100 krad(Si)). A representative device has also been Low Dose Rate (LDR) tested using condition D of method 1019 of MIL-STD-883 to 100 krad(Si). A representative device will be re-tested after design or process changes that can affect RHA response of this device.
6/ A representative device was initially High Dose Rate (HDR) tested using condition A of method 1019 of MIL-STD-883 to 75 krad(Si) to ensure RHA designator level "L" (50 krad(Si)). A representative device will be re-tested after design or process changes that can affect RHA response of this device.
7/ Single event testing was performed on a representative device to 86 MeV-cm^2/mg with no latch-up, burn-out, functional interrupts, or gate ruptures exhibited.
8/ Single event upsets (transient voltages) were exhibited to the limit specified. See table IB.

DEPARTMENT OF DEFENSE SPECIFICATION

MIL-PRF-19500 - Semiconductor Devices, General Specification for.
MIL-PRF-38534 - Hybrid Microcircuits, General Specification for.
MIL-PRF-38535 - Integrated Circuits (Microcircuits) Manufacturing, General Specification for.

DEPARTMENT OF DEFENSE STANDARDS

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://quicksearch.dla.mil or from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

2.2 Non-Government publications. The following documents form a part of this document to the extent specified herein.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM F1192 - Standard Guide for the Measurement of Single Event Phenomena (SEP) Induced by Heavy Ion Irradiation of Semiconductor Devices.

(Copies of these documents are available online at http://www.astm.org/)

2.3 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. 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.

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.

3.2.3 Radiation exposure circuit. The radiation exposure circuit shall be maintained by the manufacturer under document revision level control and shall be made available to the preparing and acquiring activity upon request.

3.3 Electrical performance characteristics. Unless otherwise specified herein, the electrical performance characteristics are as specified in table IA 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 IA.

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 (DLA Land and Maritime - 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 DLA Land and Maritime - 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. 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 DLA Land and Maritime - 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.

TABLE IA. Electrical performance characteristics.

Test	Symbol	Conditions 1/ 2/ $-55°C \le T_C \le +125°C$, 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	$+V_{OUT}$	$\pm I_{OUT}$ = 208 mA	1	01,02, 03	11.88	12.12	V
			2,3	01,02, 03	11.52	12.48	
		P,L,R	1,2,3	02	11.2	12.8	
		L		03	11.2	12.8	
	$-V_{OUT}$		1	01,02, 03	-11.76	-12.24	
			2,3	01,02, 03	-11.04	-12.96	
		P,L,R	1,2,3	02	-11.2	-12.8	
		L		03	-11.2	-12.8	
Output current 3/	I_{OUT}	V_{IN} = 16 V dc to 40 V dc	1,2,3	01,02, 03	0.0	333	mA
		P,L,R	1,2,3	02	0.0	333	
		L		03	0.0	333	
V_{OUT} ripple voltage ($\pm V_{OUT}$)	V_{RIP}	$\pm I_{OUT}$ = 208 mA, BW = 10 kHz to 2 MHz	1	01		140	mV p-p
				02,03		300	
			2,3	01		250	
				02,03		500	
		P,L,R	1,2,3	02		500	mV p-p
		L		03		500	

See footnotes at end of table.

TABLE IA. Electrical performance characteristics - Continued.

Test	Symbol	Conditions 1/ 2/ $-55°C \le T_C \le +125°C$, 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} line regulation	VR_{LINE}	±I_{OUT} = 208 mA, V_{IN} = 16 V dc to 40 V dc	1,2,3	01		50	mV
+V_{OUT}				02,03		100	
		P,L,R	1,2,3	02		100	
		L		03		100	
-V_{OUT}			1,2,3	01		180	
				02,03		200	
		P,L,R	1,2,3	02		400	
		L		03		400	
V_{OUT} load regulation	VR_{LOAD}	±I_{OUT} = 0 to 208 mA, both outputs changed simultaneously	1,2,3	01,02, 03		50	mV
+V_{OUT}							
		P,L,R	1,2,3	02		100	
		L		03		100	
-V_{OUT}			1,2,3	01,02, 03		200	
		P,L,R	1,2,3	02		400	
		L		03		400	
Input current	I_{IN}	±I_{OUT} = 0, inhibit pin (pin 1) = 0 V dc	1,2,3	01,02		5	mA
				03		7	
		P,L,R		02		25	
		L		03		25	
		±I_{OUT} = 0, inhibit pin (pin 1) = open		01		58	
				02,03		63	
		P,L,R		02		100	
		L		03		100	

See footnotes at end of table.

TABLE IA. Electrical performance characteristics - Continued

Test	Symbol	Conditions 1/ 2/ $-55°C \le T_C \le +125°C$ V_{IN} = 28 V dc ±0.5 V, C_L = 0 unless otherwise specified		Group A subgroups	Device types	Limits		Unit
						Min	Max	
Input ripple current 4/	I_{RIP}	$\pm I_{OUT}$ = 208 mA, LIN = 2 µH, BW = 10 kHz to 10 MHz		1	01		100	mA p-p
					02,03		200	
				2,3	01		150	
					02,03		300	
			P,L,R	1,2,3	02		500	
			L		03		500	
Efficiency	Eff	$\pm I_{OUT}$ = 208 mA		1	01	69		%
					02,03	67		
				2,3	01	67		
					02,03	65		
			P,L,R	1,2,3	02	60		
			L		03	60		
Isolation	ISO	Input to output or any pin to case, except case ground pin(s), at 500 V dc		1	01,02, 03	100		MΩ
			P,L,R		02	100		
			L		03	100		
Short circuit power dissipation	P_D	$P_D = P_{IN}$ - total P_{OUT}		1	01,02, 03		1.7	W
				2,3			1.9	
			P,L,R	1,2,3	02		2.0	
			L		03		2.0	
Switching frequency	F_S	$\pm I_{OUT}$ = 208 mA		4	01,02, 03	450	600	kHz
				5,6	01,02, 03	400	660	
			P,L,R	4,5,6	02	400	660	
			L		03	400	660	

See footnotes at end of table.

TABLE IA. Electrical performance characteristics - Continued

Test	Symbol	Conditions 1/ 2/ $-55°C \le T_C \le +125°C$, 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 5/ ($\pm V_{OUT}$)	VO_{TLOAD}	50% load to/from 100% load; balanced loads on each output		4	01	-450	+450	mV pk
					02,03	-550	+550	
				5,6	01,02, 03	-1400	+1400	
			P,L,R	4,5,6	02	-3000	+3000	
			L		03	-3000	+3000	
V_{OUT} step load transient recovery 5/ 6/ ($\pm V_{OUT}$)	TT_{LOAD}	50% load to/from 100% load; balanced loads on each output		4	01,02, 03		500	µs
				5,6	01,02, 03		4500	
			P,L,R	4,5,6	02		6000	
			L		03		6000	
V_{OUT} step line transient 7/ 8/	VO_{TLINE}	V_{IN} = 16 V dc to 40 V dc, $\pm I_{OUT}$ = 208 mA		4,5,6	01,02, 03	-500	+500	mV pk
			P,L,R		02	-1000	+1000	
			L		03	-1000	+1000	
		V_{IN} = 40 V dc to 16 V dc, $\pm I_{OUT}$ = 208 mA			01,02, 03	-500	+500	
			P,L,R		02	-1000	+1000	
			L		03	-1000	+1000	
V_{OUT} step line transient recovery 6/ 7/ 8/	TT_{LINE}	V_{IN} = 16 V dc to 40 V dc, $\pm I_{OUT}$ = 208 mA		4,5,6	01,02, 03		750	µs
			P,L,R		02		2000	
			L		03		2000	
		V_{IN} = 40 V dc to 16 V dc, $\pm I_{OUT}$ = 208 mA			01,02, 03		2000	
			P,L,R		02		3000	
			L		03		3000	

See footnotes at end of table.

TABLE IA. Electrical performance characteristics - Continued.

Test	Symbol	Conditions 1/ 2/ $-55°C \le T_C \le +125°C$ V_{IN} = 28 V dc ±0.5 V, C_L = 0 unless otherwise specified	Group A subgroups	Device types	Limits		Unit
					Min	Max	
Start-up delay 9/	Ton_D	V_{IN} = 0 V dc to 28 V dc, $\pm I_{OUT}$ = 208 mA	4,5,6	01,02, 03		30	ms
		P,L,R		02		50	
		L		03		50	
Start-up overshoot 7/	$Vton_{OS}$	V_{IN} = 0 V dc to 28 V dc, $\pm I_{OUT}$ = 208 mA	4,5,6	01,02, 03		500	mV pk
		P,L,R	4,5,6	02		1000	
		L		03		1000	
Load fault recovery 6/ 7/	Tr_{LF}	$\pm I_{OUT}$ = from S.C. to 208 mA	4,5,6	01,02, 03		30	ms
		P,L,R		02		50	
		L		03		50	
Capacitive load, 7/ 10/ (each output)	C_L	No effect on dc performance, T_C = +25°C	4	01,02, 03		100	µF
		P,L,R		02		100	
		L		03		100	

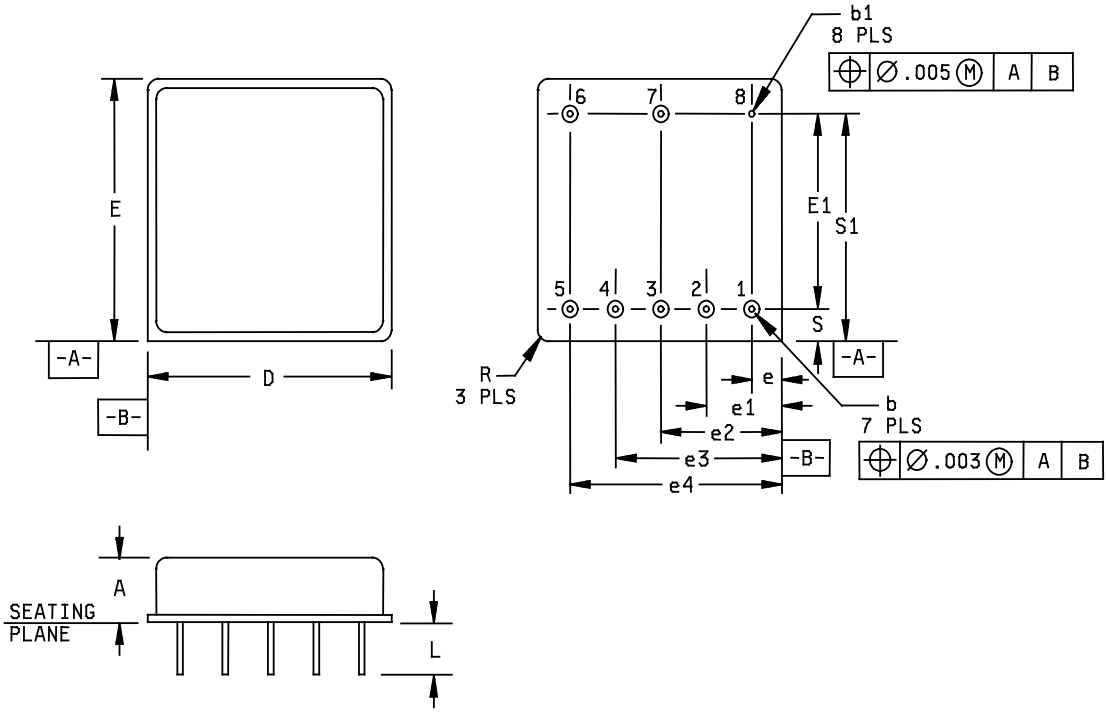
1/ Pre and post irradiation values are identical, unless otherwise specified in table IA. Post irradiation parameters shall be tested in accordance with table II herein.
2/ For device type 02, a representative device was initially High Dose Rate (HDR) tested using condition A of method 1019 of MIL-STD-883 to 150 krad(Si) to ensure RHA designator level "R" (100 krad(Si)). A representative device has also been Low Dose Rate (LDR) tested using condition D of method 1019 of MIL-STD-883 to 100 krad(Si).
For device type 03, a representative device was initially High Dose Rate (HDR) tested using condition A of method 1019 of MIL-STD-883 to 75 krad(Si) to ensure RHA designator level "L" (50 krad(Si)).
3/ The total output power available is 80 percent from either output up to 4 watts, providing the opposite output is simultaneously carrying 20 percent of the total output power. Each output must carry a minimum of 20 percent of the total output power in order to maintain regulation on the negative output.
4/ Measurement is taken with an external input series inductance of 2 µH.
5/ Step load step characterization is performed at 10 microseconds typical..
6/ Recovery time is measured from the initiation of the transient to where $\pm V_{OUT}$ has returned to within ±1 percent of its final value.
7/ Parameter shall be tested as part of device characterization and after design or process changes. These parameters shall be guaranteed to the limits specified in table IA for all lots not specifically tested.
8/ Step line characterization test is performed at 100 microseconds ±20 microseconds.
9/ Start-up 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 while power is applied to the input.
10/ Capacitive load may be any value from 0 to the maximum limit without compromising dc performance.

TABLE IB. SEP test limits. 1/

Device types	SEP	Temperature (TC)	Conditions/Results	Effective linear energy transfer (LET)
02,03	SEL (Destructive)	+25°C	None	≦ 86 MeV-cm^2/mg
02,03	SEB	+25°C	None	≦ 86 MeV-cm^2/mg
02,03	SEGR	+25°C	None	≦ 86 MeV-cm^2/mg
02,03	SEFI	+25°C	None	≦ 86 MeV-cm^2/mg
02,03	SEU (transient Voltages)	+25°C	Maximum +/-300 mV for 700 μs	≦ 86 MeV-cm2/mg

1/ For SEP test conditions, see 4.3.5.1.1.3 herein.

Case outline X.

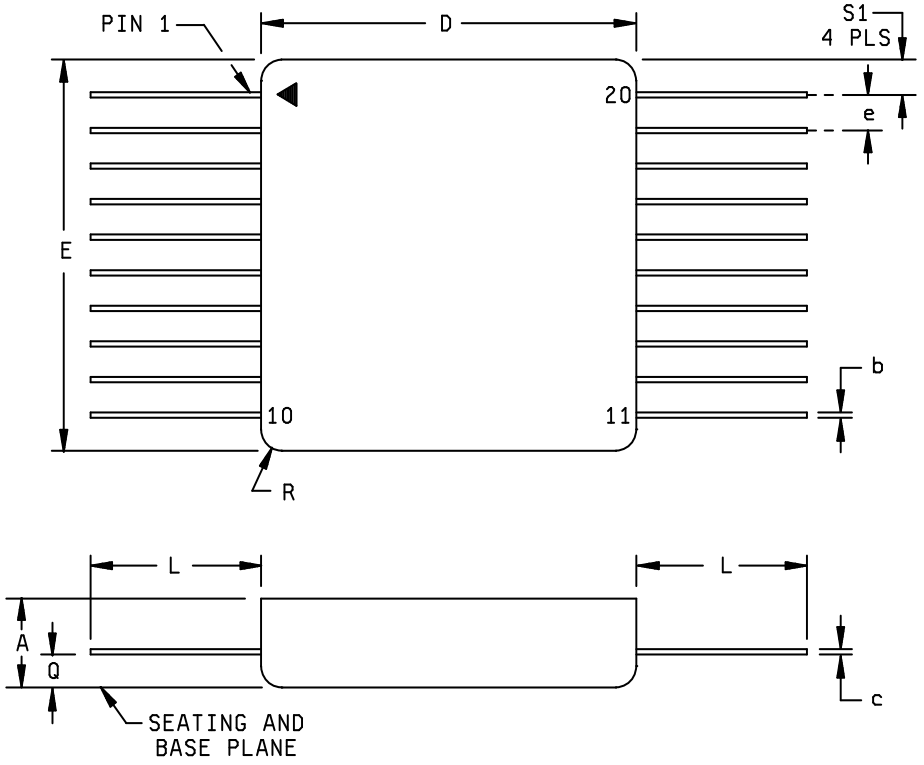


Symbol	Millimeters		Inches	
	Min	Max	Min	Max
A		6.86		.270
b	1.79 DIA		.070 DIA	
b1	0.64 DIA		.025 DIA	
D/E		27.31		1.075
E1	20.19	20.45	.795	.805
e/S	3.23	3.48	.127	.137
e1	8.31	8.56	.327	.337
e2	13.39	13.64	.527	.537
e3	18.47	18.72	.727	.737
e4/S1	23.55	23.80	.927	.937
L		5.59		.220
R	1.14	1.40	.045	.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.

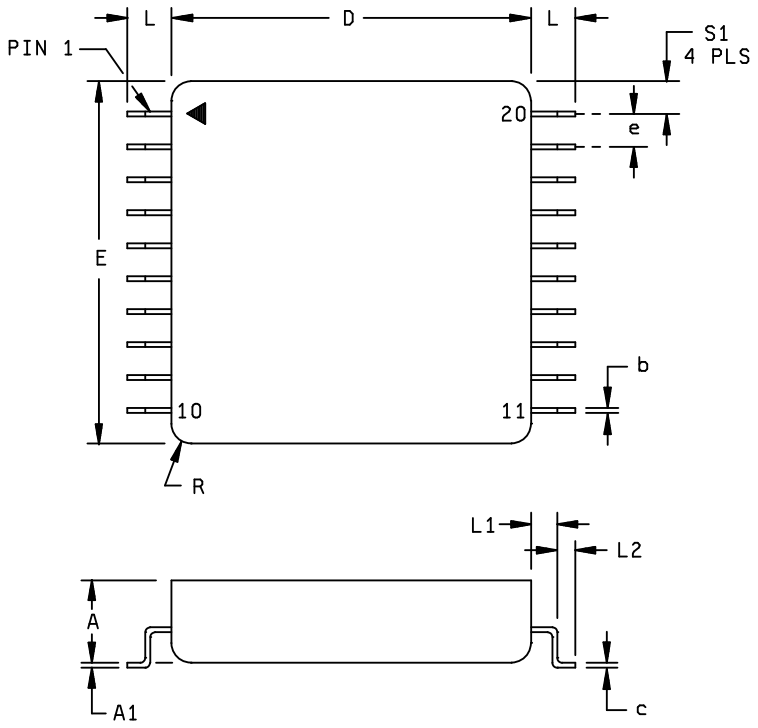


Symbol	Millimeters		Inches	
	Min	Max	Min	Max
A		6.36		.250
b	0.30	0.56	.012	.022
c	0.20	0.41	.008	.016
D/E	27.81	28.19	1.095	1.110
e	2.54 BSC		.100 BSC	
L	12.7 TYP		.500 TYP	
Q	1.78	2.29	.070	.090
R		1.65		.065
S1	2.29	2.79	.090	.110

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		6.36		.250
A1	0.13	0.51	.005	.020
b	0.30	0.56	.012	.022
c	0.20	0.41	.008	.016
D/E	27.81	28.19	1.095	1.110
e	2.54 BSC		.100 BSC	
L	3.43 REF		.135 REF	
L1	1.52	2.03	.060	.080
L2	1.14	1.65	.045	.065
R		1.65		.065
S1	2.29	2.79	.090	.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, 02, and 03
Case outlines	Y and Z	X
Terminal number	Terminal symbol	Terminal symbol
1	Inhibit	Positive output
2	Positive input	Output return
3	Positive input	Negative output
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	Output common	
14	Output common	
15	Negative output	
16	Negative output	
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/	1, 2, 3, 4, 5, 6
End-point electrical parameters for Radiation Hardness Assurance (RHA) devices 2/	1, 2, 3, 4, 5, 6

1/ As a minimum, for all Group C testing performed after (09-08-26) manufacturers shall perform subgroups 1, 2, and 3 from the Group A electrical test table (Table C-Xa of MIL-PRF-38534).
2/ For radiation testing, Group A electrical tests (subgroups 1, 2, 3, 4, 5, and 6) are performed pre and post exposure. For interim electrical tests, subgroups 1, 3, 4, and 6 are performed. Subgroups 2 and 5 (high temperature) are not performed for interim steps in order to minimize the effects of anneal on interim data.
* 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 DLA Land and Maritime - 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.

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. See table IIIA and IIIB.

Table IIIA. Radiation hardness assurance methods table.

RHA method employed	**Active elements tested only as part of the hybrid device.**	**Tested**		**Worst Case Analysis** **Performed using extreme value analysis**				**End points after final dose**	
		Element Level	Hybrid Device Level	Includes temperature effects	Combines temperature and radiation effects	Combines total dose and displacement effects	End-of-life	Element Level	Hybrid device level
	No	Tested See Table IIIB	Tested See Table IIIB	Yes	Yes	No	No	T_C = +25ºC and -55ºC	T_C = +25ºC, +125°C and -55ºC

Table IIIB. Hybrid level and element level test table.

Radiation Test		Total Dose			Heavy Ion	Proton/Neutron
		Low Dose Rate	High Dose Rate (HDR)	ELDRS Characterization	SEP	Displacement Damage (DD)
Hybrid Level Testing		Tested Level P (30 krad(Si))	Tested Level P (45 krad(Si))	No	Tested (86 MeV-cm^2/mg)	Not Tested 1/
		Tested Level L (50 krad(Si)) (Device type 02 only)	Tested Level L (75 krad(Si))			
		Tested Level R (100 krad(Si))	Tested Level R (150 krad(Si))			
Element Level Testing	**CMOS Semiconductor (Power MOSFET)**	No	RHA QML die 2/	No	No	Not Tested 1/
		No 3/	Tested Non QML die 4/	No	No	Not Tested 1/
	Bipolar/Semiconductor Discrete Devices 5/	No	RHA QML die 2/	No	No	Not Tested 1/
		No 3/	Tested Non QML die 4/			
	Bipolar Linear or Mixed Signal Microcircuits 5/	No	RHA QML die 2/	No	No	Not Tested 1/
		No 3/	Tested Non QML die 4/			

1/ This testing will be performed. After the testing is completed this SMD will be updated to include these tests.
2/ Purchased RHA QML die are tested by the die manufacturer at rated dose of 30 krad(Si) for level P, 50 krad(Si) for level L, and 100 krad(Si) for level R.
3/ Hybrid level LDR testing is performed. Element level LDR testing is not performed and may be susceptible to LDR effects.
4/ Non QML die are tested at 1.5X rated dose. 1.5X rated dose is 45 krad(Si) for level P, 75 krad(Si) for level L, and 150 krad(Si) for level R.
5/ Bipolar Junction Transistors (BJT) may not be tested for TID if the design margin for critical parameters are 2X minimum as determined by design analysis.

4.3.5.1 Radiation Hardness Assurance (RHA) inspection. RHA qualification is required for those devices with the RHA designator as specified herein. End-point electrical parameters for radiation hardness assurance (RHA) devices shall be specified in table II. Radiation testing will be in accordance with the qualifying activity (DLA Land and Maritime-VQ) approved plan and with MIL-PRF-38534, Appendix G.

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

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

4.3.5.1.1 Hybrid level radiation qualification.

4.3.5.1.1.1 Qualification by similarity. A family is defined by the family model designator e.g. SMSA. All parts with these designators share a common design and use the same active elements. SMSA2805S/KR (5962R9309202KXC) and SMSA2815S/KR (5962R9309402KXC) were initially characterized and tested for TID at LDR and SMSA2805S/KR (5962R9309202KXC) was characterized and tested for TID at HDR. Device type SMSA2812D/KR (5962R9308902KXC) was characterized for SEP. These characterizations will be repeated on representative devices for any changes that may affect the radiation response of these devices. All other SMSA devices are qualified by similarity.

4.3.5.1.1.2 Total ionizing dose irradiation testing. A representative device is characterized and tested initially and after any design or process change that may affect the RHA response of this device. Devices in the part family, e.g. SMSA, are tested at HDR in accordance with condition A of method 1019 of MIL-STD-883 and at LDR in accordance with condition D of method 1019 of MIL-STD-883. HDR samples are tested to a minimum of 1.5 times the rated dose to ensure rated dose. LDR samples are tested to a minimum of 1 times the rated dose. A minimum of one biased and one unbiased device will be tested for post radiation electrical performance and compared to the electrical parameters of table IA herein, or the applicable SMD.

4.3.5.1.1.3 Single event phenomena (SEP). A minimum of one representative hybrid of the hybrid family is characterized for SEP response at initial qualification and after any design or process change which may affect the RHA response of the device type. Testing shall be performed in accordance with ASTM F1192. Test conditions for SEP are as follows:

a. The ion beam angle of incidence shall be normal to the die surface. No shadowing of the ion beam due to fixturing is allowed.

b. The fluence shall be $\geq 1 \times 10^6$ particles/cm^2.

c. The flux shall be between 10^2 and 10^5 ions/cm^2/s.

d. The particle range shall be ≥ 35 micron in silicon.

e. The characterization is performed at 28 V input with 0, 30, 50, 70 and 100 percent loads. The test temperature shall be +25ºC ±10ºC in air.

f. For SEP test limits, see table IB herein.

4.3.5.1.2 Element level radiation qualification.

4.3.5.1.2.1 Technologies not being tested. Testing is not performed on device technologies including: P/N, Schottky, and Zener diodes, and on small signal bipolar junction transistors that the manufacturer considers to be radiation hardened. Bipolar Junction Transistors (BJT) may not be tested for TID if the design margin for critical parameters are 2X minimum as determined by design analysis.

4.3.5.1.2.2 Total Ionizing Dose Irradiation.

4.3.5.1.2.2.1 Non-QML RHA die. Every initial wafer lot of bipolar / BiCMOS linear or mixed signal semiconductor components will be characterized and tested at HDR in accordance with condition A of method 1019 of MIL-STD-883 to 1.5X the specified total dose. Eleven samples will be tested under the bias condition which produces the greatest parametric shift. P99/90% statistics are applied to the element parameters as compared against limits in the component SCD which are established by the worst case circuit analysis. Low dose rate testing per condition D has been performed at the hybrid level. Component changes may be qualified at hybrid level or the die will be characterized at the element level with condition D of method 1019 of MIL-STD-883. When element level low dose rate testing is performed, ten samples (5 biased and 5 unbiased) will be tested to the specified total dose. P99/90% statistics are applied to the element parameters as compared against limits established by the worst case circuit analysis.

4.3.5.1.2.2.2 QML RHA die. QML component specification sheet parameters (MIL-PRF-38535 Standard Microcircuit Drawing (SMD) or MIL-PRF-19500 JAN specification sheet) are reviewed to ensure that the electrical performance characteristics of these elements meet the requirements of the hybrid device design, at the specified hybrid level for HDR.

4.3.5.2 Radiation Lot Acceptance. Each lot of active elements, except as stated in 4.3.5.1.2.1, shall be evaluated for acceptance in accordance with MIL-PRF-38534 and herein.

4.3.5.2.1 Total Ionizing Dose. All active elements (except as noted in 4.3.5.1.2.1) are either purchased QML RHA die at the radiation level of the hybrid (i.e., P, L, or R) and meet the electrical performance requirements established for the elements at the hybrid device design, or be subject to lot acceptance testing (LAT). LAT consists of HDR testing on every wafer lot in accordance with condition A of method 1019 of MIL-STD-883 to 45 krad(Si) for level P hybrid devices, 75 krad(Si) for level L hybrid devices, and 150 krad(Si) for level R hybrid devices. MOS elements are additionally subjected to accelerated anneal as specified in method 1019 of MIL-STD-883. A minimum of 10 samples will be tested (5 biased and 5 unbiased) unless the worst case test condition has been determined reducing the sample to 5. P99/90% statistics are applied to the element parameter as compared against limits established in the component SCD which are established by worst case circuit analysis for lot acceptance.

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 should inform DLA Land and Maritime when a system application requires configuration control and the applicable SMD to that system. DLA Land and Maritime 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 DLA Land and Maritime-VA, telephone (614) 692-8108.

6.5 Comments. Comments on this drawing should be directed to DLA Land and Maritime-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 DLA Land and Maritime-VA and have agreed to this drawing.

6.7 Additional information. When applicable, a copy of the following additional data shall be maintained and available from the device manufacturer:

a. RHA upset levels.

b. Test conditions (SEP).

c. Occurrence of Latch-up (SEL).

d Occurrence of Burn-out (SEB).

e. Occurrence of Gate Rupture (SEGR).

f. Occurrence of Single Event Functional Interrupt (SEFI).

g. Occurrence of Single Event Upset (SEU).

STANDARD MICROCIRCUIT DRAWING BULLETIN

DATE: 16-10-03

Approved sources of supply for SMD 5962-93089 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 DLA Land and Maritime-VA. This information bulletin is superseded by the next dated revisions of MIL-HDBK-103 and QML-38534. DLA Land and Maritime maintains an online database of all current sources of supply at https://landandmaritimeapps.dla.mil/programs/smcr/.

Standard microcircuit drawing PIN 1/	Vendor CAGE number	Vendor similar PIN 2/
5962-9308901HXA	50821	MSA2812D/883
5962-9308901HXC	50821	MSA2812D/883
5962-9308901HYA	50821	MGA2812D/883
5962-9308901HYC	50821	MGA2812D/883
5962-9308901HZA	50821	MGA2812DZ/883
5962-9308902HXA	3/	SMSA2812D/HO
5962-9308902HXC	3/	SMSA2812D/HO
5962P9308902HXA	50821	SMSA2812D/HP
5962P9308902HXC	50821	SMSA2812D/HP
5962L9308902HXA	3/	SMSA2812D/HL
5962L9308902HXC	3/	SMSA2812D/HL
5962R9308902HXA	50821	SMSA2812D/HR
5962R9308902HXC	50821	SMSA2812D/HR
5962P9308902KXA	50821	SMSA2812D/KP
5962P9308902KXC	50821	SMSA2812D/KP
5962L9308902KXA	3/	SMSA2812D/KL
5962L9308902KXC	3/	SMSA2812D/KL
5962R9308902KXA	50821	SMSA2812D/KR
5962R9308902KXC	50821	SMSA2812D/KR
5962L9308903HXA	50821	SMSA2812D/HL
5962L9308903HXC	50821	SMSA2812D/HL
5962L9308903KXA	50821	SMSA2812D/KL
5962L9308903KXC	50821	SMSA2812D/KL

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.

Vendor CAGE number	Vendor name and address
50821	Crane Electronics, Inc. 10301 Willows Road NE Redmond, WA 98052-2529