February 10, 2010

Radiation Performance Data Package

VRG8663-S

VRG8663-S, DSCC SMD Part Number: 5962-0920702KYC

Voltage regulator,
negative (RH1185), adjustable

Prepared by:

Aeroflex Plainview, Inc.
35 South Service Road
Plainview, NY 11803

1. Part Descriptions:

1.1 VRG8663-S

1.1.1 Voltage regulator, negative (RH1185), adjustable, 5-Pad, SMD-0.5 style surface mount.

2. Applicable Documents

2.1	Appendix A:	Data Sheet:	SCD8663	ADJUSTABLE NEGATIVE LDO VOLTAGE REGULATOR
2.2	Appendix B:	Die Spec:	05-08-5232	MICROCIRCUIT, LINEAR, RH1185MK DICE NEGATIVE ADJUSTABLE LDO REGULATOR WITH CURRENT LIMIT
2.3	Appendix C:	Report:	March 2, 2009	SINGLE EVENT EFFECTS TEST REPORT SUMMARY: LDO REGULATORS
2.4	Appendix D:	DSCC SMD:	5962-09207	MICROCIRCUIT, HYBRID, VOLTAGE REGULATOR, LOW DROPOUT, NEGATIVE, ADJUSTABLE

3. Radiation Performance

3.1 Total Dose: 100 krads(Si), Dose rate = 50 - 300 rads(Si)/s

3.1.1 See Appendix B: RH1185 per IC manufacturer's Die Specification.
3.1.2 Every wafer lot is subjected to RLAT testing at the stated total dose and dose rate.

3.2 SEU: Tested up to 60 MeV-cm^2/mg

3.2.1 See Appendix C: Lockheed Martin, Newtown: Single Event Effects Test Report Summary: LDO Regulators.

3.3 SEL: Immune up to 60 MeV-cm^2/mg

3.3.1 See Appendix C: Lockheed Martin, Newtown: Single Event Effects Test Report Summary: LDO Regulators.

3.4 ELDRS: ESTIMATED: 50 krads(Si), Dose rate = 10 mrads(Si)/s

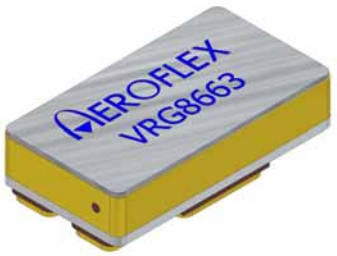
3.4.1 Testing in process as of February 4, 2010. Estimated completion date: March 12, 2010.

Standard Products

VRG8663
Low Drop Out (LDO) Adjustable Regulator
Negative Voltage
Radiation Tolerant

www.aeroflex.com/voltreg

March 3, 2009



FEATURES

- Manufactured using Linear Technology Corporation ® Space Qualified RH1185 die
- Radiation performance
  - Total dose: 100 krads(Si), Dose rate = 50 - 300 rads(Si)/s
- Thermal shutdown
- Output voltage adjustable: -2.37 to -25V
- Dropout voltage: 1.05V at 3.0Amps
- 5-Terminal
- Output current: 3A
- Voltage reference: -2.370V ±3%
- Load regulation: 0.8% max
- Line regulation: 0.02% max
- Ripple rejection: >60dB
- Packaging
  - Hermetic Surface Mount Power Package
  - 5 Pads, .301"W x .550"L x .130"Ht max
  - Weight - 1.2 gm max
- Designed for aerospace and high reliability space applications
- DSCC SMD 5962-09207 pending

Note: Aeroflex Plainview does not currently have a DSCC certified Radiation Hardened Assurance Program.

DESCRIPTION

The Aeroflex Plainview VRG8663 consists of a Negative Adjustable (RH1185) LDO voltage regulator capable of supplying 3.0Amps over the output voltage range as defined under recommended operating conditions. The VRG8663 offers excellent line and load regulation specifications and ripple rejection. Dropout (V_{IN} - V_{OUT}) decreases at lower load currents.

The VRG8663 serves a wide variety of applications including High Efficiency Linear Regulators, Post Regulators for Switching Supplies, Constant Current Regulators, Battery Chargers and Microprocessor Supply.

The VRG8663 has been specifically designed to meet exposure to radiation environments and is configured for a SMD power package. It is guaranteed operational from -55°C to +125°C. Available screened to MIL-STD-883, the VRG8663 is ideal for demanding military and space applications.

For detailed performance characteristic curves, applications information and typical applications see the latest Linear Technology Corporation ® data sheets for their RH/LT1185, which is available on-line at www.linear.com.

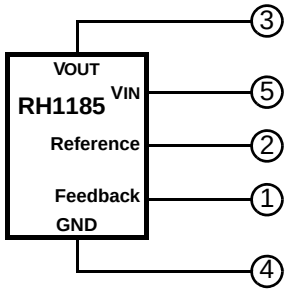


FIGURE 1 – BLOCK DIAGRAM / SCHEMATIC

ABSOLUTE MAXIMUM RATINGS

PARAMETER	RANGE	UNITS
Input Voltage	-35	V_{DC}
Lead temperature (soldering 10 Sec)	300	°C
Input Output Differential	30	V_{DC}
Feedback & Reference Voltage	-7	V_{DC}
Output Voltage	-30	V_{DC}
ESD	2000 1/	V
Operating Junction Temperature Range	-55 to +150	°C
Storage Temperature Range	-65 to +150	°C

NOTICE: Stresses above those listed under "Absolute Maximums Rating" may cause permanent damage to the device. These are stress rating only; functional operation beyond the "Operation Conditions" is not recommended and extended exposure beyond the "Operation Conditions" may effect device reliability.

RECOMMENDED OPERATING CONDITIONS

PARAMETER	RANGE	UNITS
Output Voltage Range	-2.45 to -25	V_{DC}
Input Output Differential	1 to 28	V_{DC}
Case Operating Temperature Range	-55 to +125	°C

ELECTRICAL PERFORMANCE CHARACTERISTICS 2/

PARAMETER	SYM	CONDITIONS ($P \leq P_{MAX}$)	MIN	MAX	UNITS
Reference Voltage (At pin 6) 7/	V_{REF}	$1mA \leq I_{OUT} \leq 3A$, $V_{IN} - V_{OUT} = 1.2V$ to $28V$, $V_{OUT} = -5V$	-2.29	-2.45	V
Dropout Voltage 4/	V_{DROP}	$I_{OUT} = 0.5A$, $V_{OUT} = -5V$	-	0.425	V
		$I_{OUT} = 3A$, $V_{OUT} = -5V$	-	1.05	V
Line Regulation 8/	$\frac{\Delta V_{OUT}}{\Delta V_{IN}}$	$1.0V \leq V_{IN} - V_{OUT} \leq 20V$, $V_{OUT} = -5V$	-	0.02	%/V
Load Regulation 8/	$\frac{\Delta V_{OUT}}{\Delta I_{OUT}}$	$5mA \leq I_{OUT} \leq 3A$, $V_{IN} - V_{OUT} = 1.5V$ to $10V$, $V_{OUT} = -5V$	-	0.8	%
Minimum Input Voltage 5/	$V_{IN\ MIN}$	$I_{OUT} = 3A$, $V_{OUT} = V_{REF}$	-	-4.50	V
Internal Current Limit (See Figure 4)	I_{CL}	$1.5V \leq V_{IN} - V_{OUT} \leq 10V$	3.3	4.55	A
		$V_{IN} - V_{OUT} = 15V$	2.0	4.5	A
		$V_{IN} - V_{OUT} = 20V$	1.0	3.1	A
		$V_{IN} - V_{OUT} = 28V$	0.2	1.6	A
External Current Limit	I_{LIM}	$R_{LIM} = 5K\Omega$ 10/	2.7	3.7	A
		$R_{LIM} = 15K\Omega$ 10/	0.9	1.6	A
Quiescent Supply Current 6/	I_Q	$I_{OUT} = 5mA$, $V_{OUT} = V_{REF}$, $-4V \leq V_{IN} \leq -25V$	-	3.5	mA

ELECTRICAL PERFORMANCE CHARACTERISTICS 2/ (con't)

PARAMETER	SYM	CONDITIONS ($P \leq P_{MAX}$)	MIN	MAX	UNITS
Supply Current Change with Load	$I_{Q\Delta}$	$V_{IN} - V_{OUT} = V_{SAT}$ 9/	-	35	mA/A
		$V_{IN} - V_{OUT} \geq 2V$	-	21	mA/A
Ripple Rejection	-	I_{OUT} = 1.0A, V_{IN} - V_{OUT} = 3V, f = 120Hz,	60	-	dB
Thermal Regulation (See application info LT1185) 3/	-	$V_{IN} - V_{OUT}$ = 10V, I_{OUT} = 5mA to 2A, T_C = +25°C	-	0.014	%/W
Thermal Resistance (Junction to Case)	Θ_{JC}		-	3	°C/W

Notes

1. Meets ESD testing per MIL-STD-883, method 3015, Class 2.
2. Unless otherwise specified, these specifications apply for post radiation and -55°C ≤ Tc ≤ +125°C.
3. Not tested. Shall be guaranteed by design, characterization, or correlation to other tested parameters.
4. Dropout voltage is tested by reducing input voltage until the output drops 1% below its nominal value. Tests are done at 0.5A and 3A. The power transistor looks basically like a pure resistance in this range so that minimum differential at any intermediate current can be calculated by interpolation; $V_{DROPOUT}$ = 0.25V + (0.25Ω x I_{OUT}). For load current less than 0.5A, see Figure 3.
5. "Minimum input voltage" is limited by base emitter voltage drive of the power transistor section, not saturation as measured in Note 4. For output voltages below 4V, "minimum input voltage" specification may limit dropout voltage before transistor saturation limitation.
6. Supply current is measured on the ground pin, and does not include load current, R_{LIM}, or output divider current.
7. The 25W power level is guaranteed for an input-output voltage of 8.3V to 17V. At lower voltages the 3Amp limit applies, and at higher voltages the internal power limiting may restrict regulator power below 25W.
8. Line and load regulation are measured on a pulse basis with a pulse width of 2ms, to minimize heating. DC regulation will be affected by thermal regulation and temperature coefficient of the reference.
9. V_{SAT} is the maximum specified dropout voltage: 0.25V + (0.25 x I_{OUT}).
10. Current limit is programmed with a resistor from REF pin to GND pin. R_{LIM} = 15KΩ/I_{LIM}.

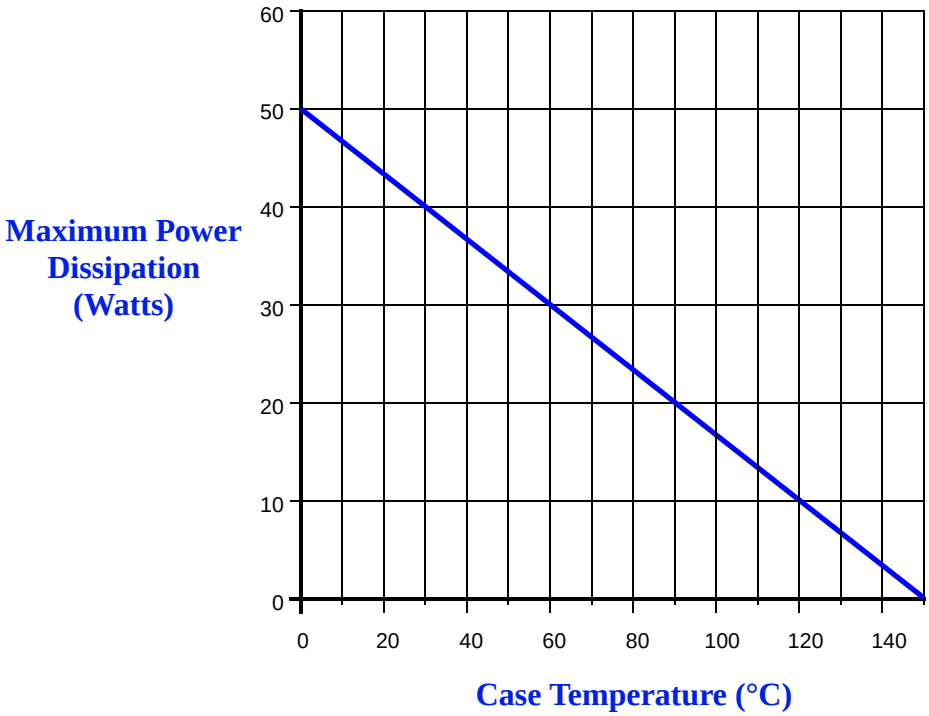


FIGURE 2 – MAXIMUM POWER vs CASE TEMPERATURE

The maximum Power dissipation is limited by the thermal shutdown function of the regulator chip in the VRG8663. The graph above represents the achievable power before the chip shuts down. The line in the graph represents the maximum power dissipation of the VRG8663 This graph is based on the maximum junction temperature of 150°C and a thermal resistance (Θ_{JC}) of 3°C/W.

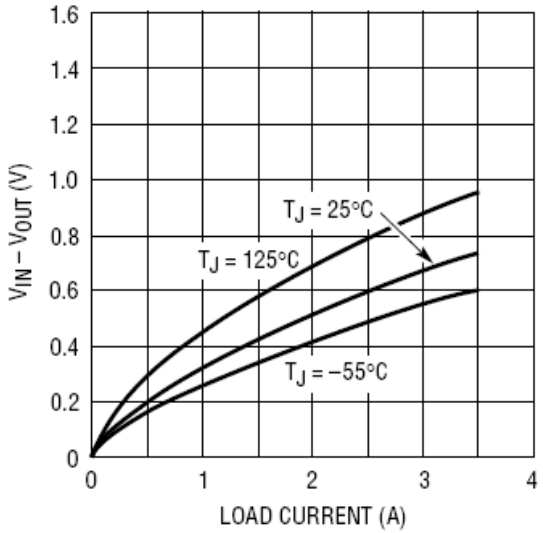


FIGURE 3 – RH1185 DROPOUT VOLTAGE TYPICAL CURVE

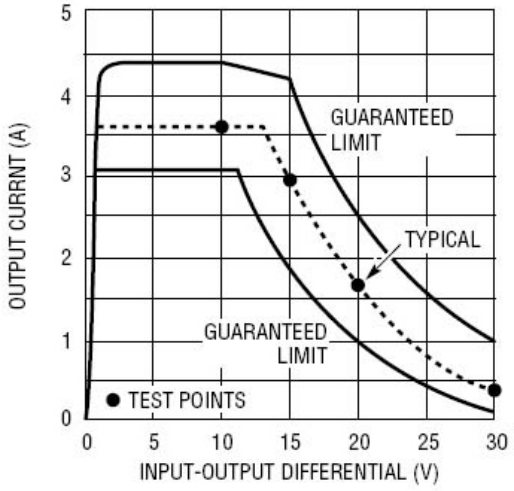


FIGURE 4 – RH1185 INTERNAL CURRENT LIMIT

The RH1185 output voltage is set by two external resistors. The internal reference voltage is trimmed to 2.37V so that a standard 1% 2.37k resistor (R1) can be used to set divider current at 1mA. R2 is then selected from:

$$R2 = \frac{(V_{OUT} - 2.37)\ R1}{V_{REF}}$$

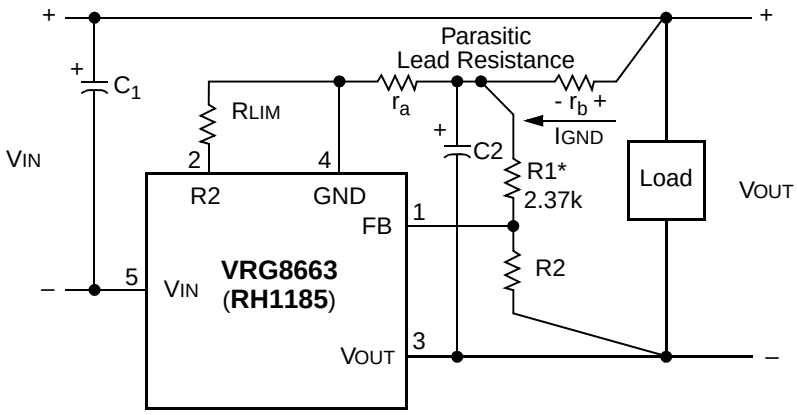
for R1 = 2.37k and V_{REF} = 2.37V, this reduces to:

$$R2 = V_{OUT} - 2.37$$

suggested values of 1% resistors are shown below:

VOUT	R2 when R1 = 2.37k
2.5V	130Ω
3.3V	930Ω
5V	2.67k
12V	9.76k
15V	12.7k

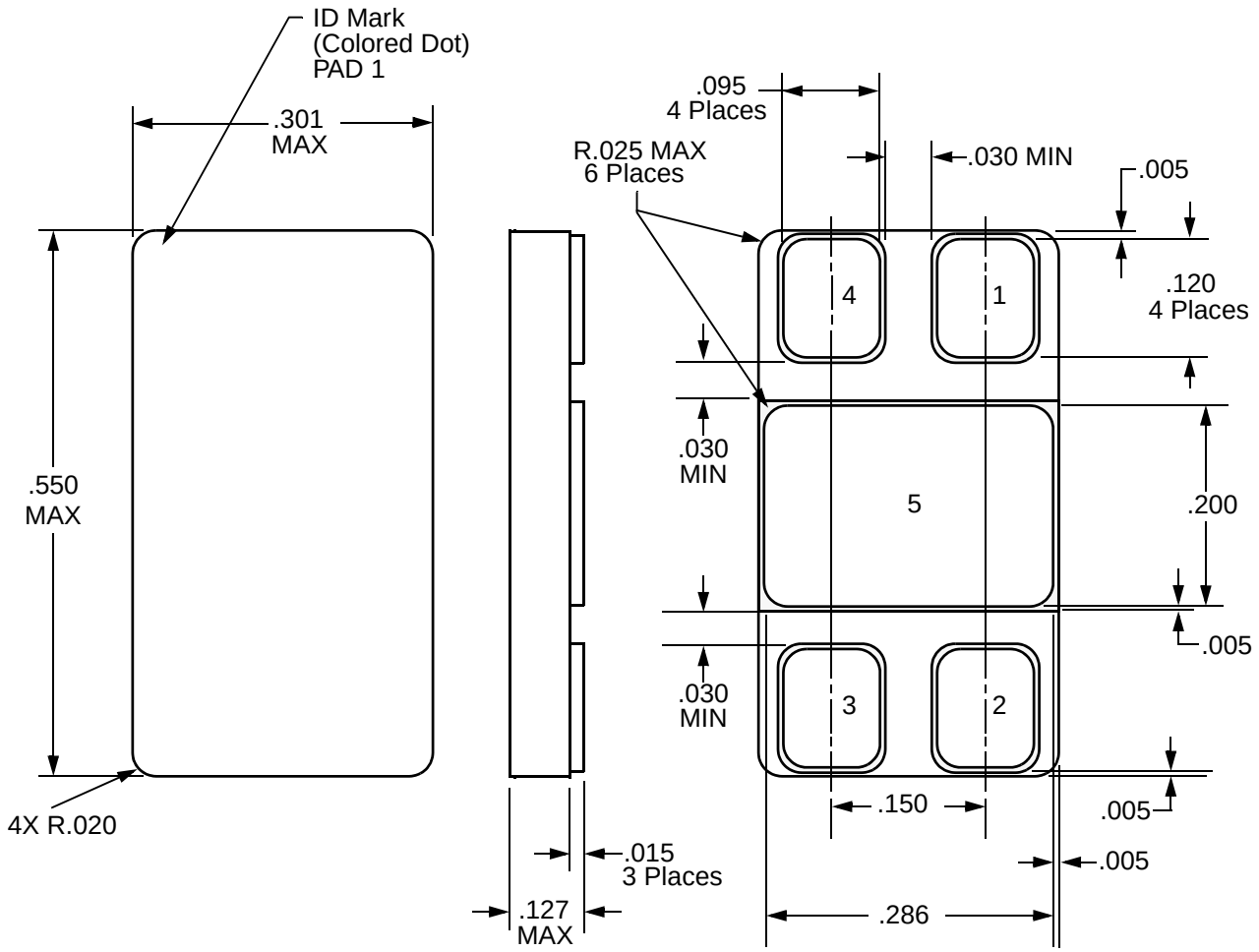
SETTING OUTPUT VOLTAGE



*R1 should be connected directly to ground lead, not to the load, so that r_a = 0Ω. This limits the output voltage error to (I_{GND})(r_b). Errors created by r_a are multiplied by (1 + R2/R1). Note that V_{OUT} increases with increasing ground pin current. R2 should be connected directly to load for remote sensing. C1 = C2 ≥ 2µF Tantalum.

R1 & R2 LOCATION & PROPER CONNECTION OF POSITIVE SENSE LEAD

FIGURE 5 – BASIC VRG8663 ADJUSTABLE REGULATOR APPLICATION



NOTE: Package & Lid are electrically isolated from signal pads.

FIGURE 6 – PACKAGE OUTLINE — SURFACE MOUNT

ORDERING INFORMATION

MODEL	DSCC SMD #	SCREENING	PACKAGE
VRG8663-S	-	Military Temperature, -55°C to +125°C Screened in accordance with MIL-PRF-38534, Class K.	SMD Power Pkg
VRG8663-7	-	Commercial Flow, +25°C testing only	
VRG8663-201-1S VRG8663-201-2S	5962-0920702KYC 5962-0920702KYA	In accordance with DSCC SMD	

EXPORT CONTROL:

This product is controlled for export under the International Traffic in Arms Regulations (ITAR). A license from the U.S. Department of State is required prior to the export of this product from the United States.

EXPORT WARNING:

Aeroflex's military and space products are controlled for export under the International Traffic in Arms Regulations (ITAR) and may not be sold or proposed or offered for sale to certain countries. (See ITAR 126.1 for complete information.)

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AEROFLEX
A passion for performance.

Our passion for performance is defined by three attributes represented by these three icons: solution-minded, performance-driven and customer-focused

REVISION RECORD		
REV	DESCRIPTION	DATE
0	INITIAL RELEASE	06/02/98
A	PAGE 11, FIGURES 6, 7, CHANGED θja AND θjc.	09/24/99
B	PAGE 3, PARAGRAPH 3.8 CHANGED VERBIAGE ADDED "HEREIN" AFTER TABLE 1. PAGE 4, PARAGRAPH 5.0 CHANGED VERBIAGE ADDED "HEREIN" AFTER TABLE 3. PARAGRAPH 5.2 ADDED "HEREIN" AFTER TABLE 2. PARAGRAPH 6.2 ADDED "HEREIN" AFTER TABLE 3. PAGE 5, 6.3 CHANGED VERBIAGE ADDED "HEREIN" AFTER TABLE 3.	03/07/01
C	• REMOVED THE "M" FROM THE DEVICE TITLE, THROUGHOUT THE SPEC, TO MATCH THE DATA SHEET AND RPL. • PAGE 3, PARAGRAPH 3.6 CHANGED TO REFLECT ONLY FIGURE 1 FOR BOTH DEVICE OPTIONS. PARAGRAPH 3.7.1, CHANGED THE DOSAGE RATE FROM "APPROXIMATELY 20 RADS PER SECOND" TO "LESS THAN OR EQUAL TO 10 RADS PER SECOND". PARAGRAPH 3.7.3, NOW REFLECTS TOTAL DOSE BIAS AS FIGURE 2. • PAGE 4, PARAGRAPH 5.5, NOW REFLECTS BURN-IN CIRCUITS AS FIGURES 3 AND 4. PARAGRAPH 5.6, NOW REFLECTS CASE OUTLINES AS FIGURES 5 AND 6. PARAGRAPH 5.7, NOW REFLECTS TERMINAL CONNECTIONS AS FIGURES 7 AND 8. PARAGRAPH 6.1 CHANGED QUALITY ASSURANCE PROVISIONS TO STATE THAT LTC IS QML CERTIFIED AND THAT RAD HARD CANDIDATES ARE ASSEMBLED ON QUALIFIED CLASS S MANUFACTURING LINES. • PAGES 6 THROUGH 12, ALL FIGURE TITLES CHANGED TO HAVE DEVICE OPTIONS AND PACKAGE TYPES AT TOP OF PAGE, AND HAVE ALL FIGURES AT BOTTOM OF PAGE. • CONVERSION OF SPECIFICATION FROM WORD PERFECT TO MICROSOFT WORD.	07/16/02

CAUTION: ELECTROSTATIC DISCHARGE SENSITIVE PART

REVISION	PAGE NO.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
INDEX	REVISION	**G**	**G**	**G**	**G**	**G**	**G**	**G**	**G**	**G**	**G**	**G**	**G**	**G**	**G**	**G**	**G**

				LINEAR TECHNOLOGY CORPORATION MILPITAS, CALIFORNIA
	ORIG			TITLE: **MICROCIRCUIT, LINEAR, RH1086BHK, 0.5A AND RH1086BKK, 1.5A, LOW DROPOUT POSITIVE REGULATOR DICE**
	DSGN			
	ENGR			
	MFG			
	CM			
	QA			SIZE / CAGE CODE / DRAWING NUMBER / REV
	PROG			**64155** / **05-08-5134** / **G**
APPLICATION	FUNCT	SIGNOFFS	DATE	CONTRACT:

FOR OFFICIAL USE ONLY

REVISION RECORD		
REV	DESCRIPTION	DATE
D	CHANGED RH1086H TO RH1086BHK AND RH1086K TO RH1086BKK THROUGHOUT SPEC.	10/28/03
E	• PAGE 3, CHANGED INITIAL RATE OF RADS TO 240 RADS/SEC.	03/22/05
F	• PAGE 4, PARAGRAPH 3.7.1 CHANGED VERBIAGE. • PAGE 5, PARAGRAPH 5.8 CHANGED ALLOY 42 TO ALLOY 52 TO3 PACKAGE REQUIREMENT.	05/21/08
G	• **PAGE 10, FIGURE 4 STATIC BURN-IN CIRCUIT CHANGED TO 04-06-0302 PER ENG.** • **PAGE 16, CHANGED RH CANNED SAMPLE TABLE III FOR QUALIFYING DICE SALES ADDED TEMPERATURE CYCLE, CONSTANT ACCELERATION & REMOVED PIND TEST.**	

1.0 SCOPE:

1.1 This specification defines the performance and test requirements for a microcircuit processed to a space level manufacturing flow.

2.0 APPLICABLE DOCUMENTS:

2.1 Government Specifications and Standards: the following documents listed in the Department of Defense Index of Specifications and Standards, of the issue in effect on the date of solicitation, form a part of this specification to the extent specified herein.

SPECIFICATIONS:

MIL-PRF-38535	Integrated Circuits (Microcircuits) Manufacturing, General Specification for
MIL-STD-883	Test Method and Procedures for Microcircuits
MIL-STD-1835	Microcircuits Case Outlines

2.2 Order of Precedence: In the event of a conflict between the documents referenced herein and the contents of this specification, the order of precedence shall be this specification, MIL-PRF-38535 and other referenced specifications.

3.0 REQUIREMENTS:

3.1 General Description: This specification details the requirements for the **RH1086BHK, 0.5A and RH1086BKK, 1.5A**, Low Dropout Positive Regulator Dice and Element Evaluation Test Samples, processed to space level manufacturing flow as specified herein.

3.2 Part Number:

3.2.1 OPTION 1 – RH1086BHK Dice

3.2.2 OPTION 2 – RH1086BKK Dice

3.3 **Special Handling of Dice:** Rad Hard dice require special handling as compared to standard IC dice. Rad Hard dice are susceptible to surface damage due to the absence of silicon nitride passivation as on standard dice. Silicon nitride protects the dice surface from scratches by it's hard and dense properties. The passivation on Rad Hard dice is silicon dioxide which is much "softer" than silicon nitride.

LTC recommends that dice handling be performed with extreme care so as to protect the dice surface from scratches. If the need arises to move the die around from the chip tray, use a Teflon tipped vacuum wand. This wand can be made by pushing a small diameter of Teflon tubing onto the tip of a steel tipped wand. The inside diameter of the Teflon tip should match the dice size for efficient pickup. The tip of the Teflon should be cut square and flat to ensure good vacuum to dice surface. Ensure the Teflon tip remains clean from debris by inspecting under stereo scope. During die attach, care must be exercised to ensure no tweezers touch the top of the dice.

3.4 The Absolute Maximum Ratings:

Power Dissipation	Internally Limited
Input to Output Voltage Differential	25V
Operating Junction Temperature Range	
Control Section	-55°C to +150°C
Power Transistor	-55°C to +200°C
Storage Temperature Range	-65°C to +150°C
Lead Temperature (Soldering, 10 sec)	300°C

3.5 Design, Construction, and Physical Dimensions: Detail design, construction, physical dimensions, and electrical requirements shall be specified herein.

3.6 Outline Dimensions and Pad Functions: Dice outline dimensions, pad functions, and locations shall be specified in **Figure 1**.

3.7 Radiation Hardness Assurance (RHA):

3.7.1 The manufacturer shall perform a lot sample test as an internal process monitor for total dose radiation tolerance. The sample test is performed with MIL-STD-883 TM1019 Condition A as a guideline..

3.7.2 For guaranteed radiation performance to MIL-STD-883, Method 1019, total dose irradiation, the manufacturer will provide certified RAD testing and report through an independent test laboratory when required as a customer purchase order line item.

3.7.3 Total dose bias circuit is specified in **Figure 2**.

3.8 Wafer (or Dice) Probe: Dice shall be 100% probed at Ta = +25°C to the limits shown in **Table I** herein. All reject dice shall be removed from the lot. This testing is normally performed prior to dicing the wafer into chips. Final specifications after assembly are sample tested during the element evaluation.

3.9 Wafer Lot Acceptance: Wafer lot acceptance shall be in accordance with MIL-PRF-38535, Appendix A, except for the following: Top side glassivation thickness shall be a **minimum of 4KÅ.**

3.10 Wafer Lot Acceptance Report: SEM is performed per MIL-STD-883, Method 2018. Copies of SEM photographs shall be supplied with the Wafer Lot Acceptance Report as part of a Space Data Pack when specified as a customer purchase order line item.

3.11 Traceability: Wafer Diffusion Lot and Wafer traceability shall be maintained through Quality Conformance Inspection.

4.0 QUALITY CONFORMANCE INSPECTION: Quality Conformance Inspection shall consist of the tests and inspections specified herein.

5.0 SAMPLE ELEMENT EVALUATION: A sample from **each wafer supplying dice** shall be assembled and subjected to element evaluation per **Table III** herein.

5.1 100 Percent Visual Inspection: All dice supplied to this specification shall be inspected in accordance with MIL-STD-883, Method 2010, Condition A. All reject dice shall be removed from the lot.

5.2 Electrical Performance Characteristics for Element Evaluation: The electrical performance characteristics shall be as specified in **Table I** and **Table II** herein.

5.3 Sample Testing: Each wafer supplying dice for delivery to this specification shall be subjected to element evaluation sample testing. No dice shall be delivered until all the lot sample testing has been performed and the results found to be acceptable unless the customer supplies a written approval for shipment prior to completion of wafer qualification as specified in this specification.

5.4 Part Marking of Element Evaluation Sample Includes**:**

5.4.1 LTC Logo

5.4.2 LTC Part Number

5.4.3 Date Code

5.4.4 Serial Number

5.4.5 ESD Identifier per MIL-PRF-38535, Appendix A

5.4.6 Diffusion Lot Number

5.4.7 Wafer Number

5.5 Burn-In Requirement: Burn-In circuit for TO39 package is specified in **Figure 3** and Burn-In circuit for TO3 package is specified in **Figure 4.**

5.6 Mechanical/Packaging Requirements: Case Outline and Dimensions are in accordance with **Figure 5** and **Figure 6.**

5.7 Terminal Connections: The terminal connections shall be as specified in **Figure 7** and **Figure 8.**

5.8 Lead Material and Finish: The lead material and finish shall be Kovar for device option 1 and Alloy 52 for device option 2, with hot solder dip (Finish letter A) in accordance with MIL-PRF-38535.

6.0 VERIFICATION (QUALITY ASSURANCE PROVISIONS)

6.1 Quality Assurance Provisions: Quality Assurance provisions shall be in accordance with MIL-PRF-38535. Linear Technology is a QML certified company and all Rad Hard candidates are assembled on qualified Class S manufacturing lines.

6.2 Sampling and Inspection: Sampling and Inspection shall be in accordance with **Table III** herein.

6.3 Screening: Screening requirements shall be in accordance with **Table III** herein.

6.4 Source Inspection:

6.4.1 The manufacturer will coordinate Source Inspection at wafer lot acceptance and pre-seal internal visual.

6.4.2 The procuring activity has the right to perform source inspection at the supplier's facility prior to shipment for each lot of deliverables when specified as a customer purchase order line item. This may include wafer lot acceptance, die visual, and final data review.

6.5 Deliverable Data: Deliverable data that will ship with devices when a Space Data Pack is ordered:

6.5.1 Lot Serial Number Sheets identifying all Canned Sample devices accepted through final inspection by serial number.

6.5.2 100% attributes (completed element evaluation traveler).

6.5.3 Element Evaluation variables data, including Burn-In and Op Life

6.5.4 SEM photographs (3.10 herein)

6.5.5 Wafer Lot Acceptance Report (3.9 herein)

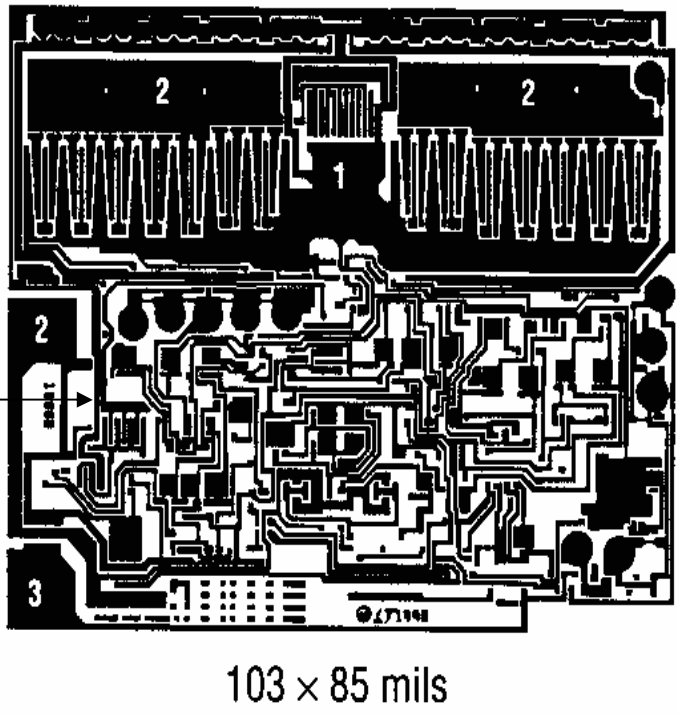
6.5.6 A copy of outside test laboratory radiation report if ordered

6.5.7 Certificate of Conformance certifying that the devices meet all the requirements of this specification and have successfully completed the mandatory tests and inspections herein.

Note: Items 6.5.1 and 6.5.7 will be delivered as a minimum, with each shipment.

7.0 Packaging Requirements: Packaging shall be in accordance with Appendix A of MIL-PRF-38535. All dice shall be packaged in multicavity containers composed of conductive, anti-static, or static dissipative material with an external conductive field shielding barrier.

DICE OUTLINE DIMENSIONS AND PAD FUNCTIONS
OPTION 1, RH1086BHK, 0.5A DICE AND OPTION 2, RH1086BKK, 1.5A DICE



PAD FUNCTION

1. V_{IN}
2. V_{OUT}
3. ADJUST

Connect Backside Substrate to Pad #2

"H" OR "K" (DEPENDING ON THE DEVICE OPTION) WILL BE REFLECTED HERE

FIGURE 1

TOTAL DOSE BIAS CIRCUIT

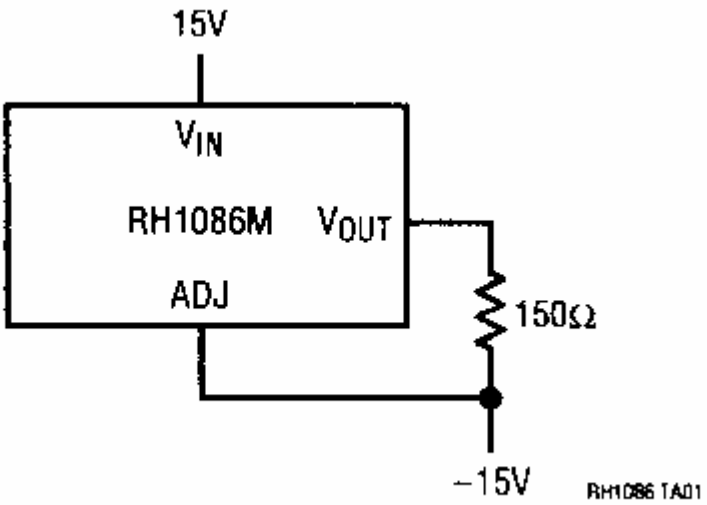
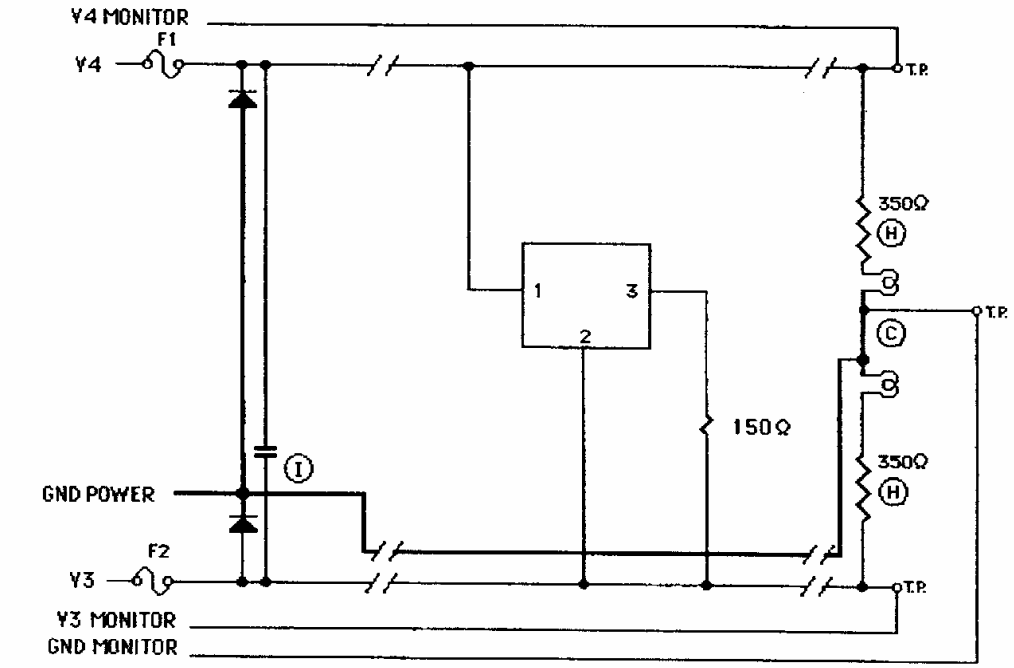
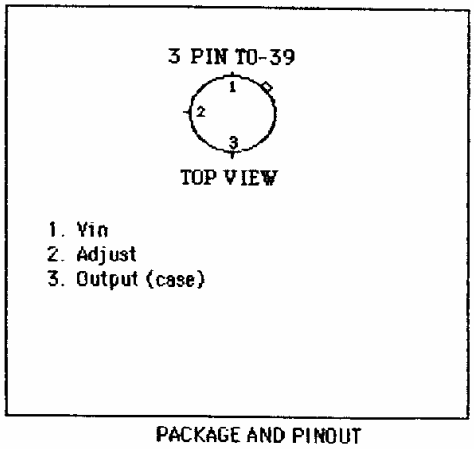


FIGURE 2

TO39 STATIC BURN-IN CIRCUIT
OPTION 1, T039 METAL CAN / 3 LEADS



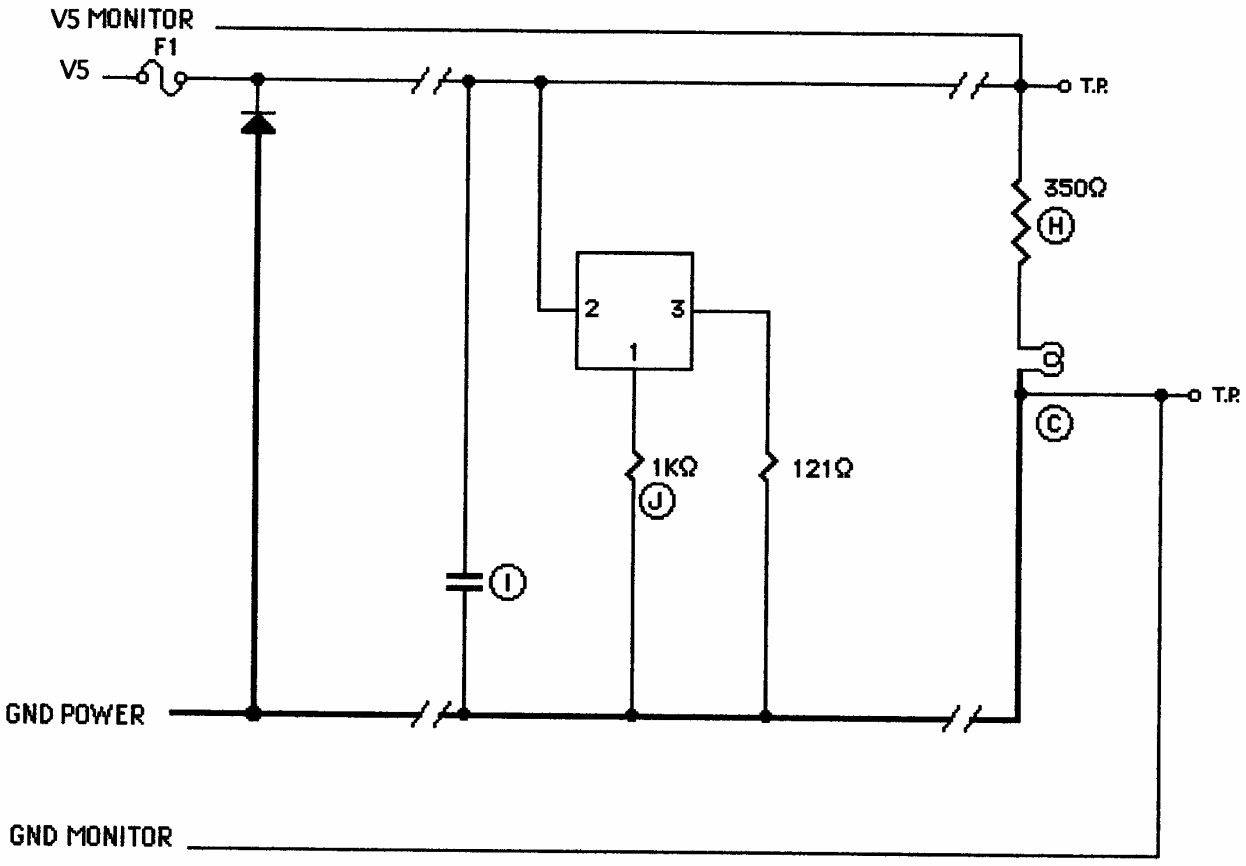
NOTES:
1. Unless otherwise specified, component tolerances shall be per military specification.
2. Tj = 174°C maximum.
3. Ta = 125°C.
4. Burn-in Voltages: V4 = +15V to +16.5V
   V3 = -15V to -16.5V



PACKAGE AND PINOUT

FIGURE 3

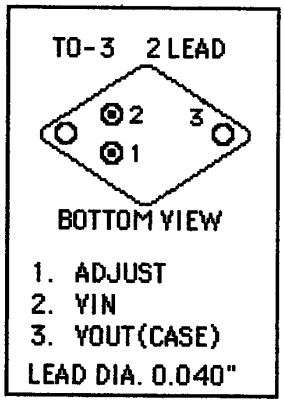
STATIC BURN-IN CIRCUIT
OPTION #2, TO3 / 2 LEADS



NOTES:

Unless otherwise specified, component tolerances shall be per military specification.

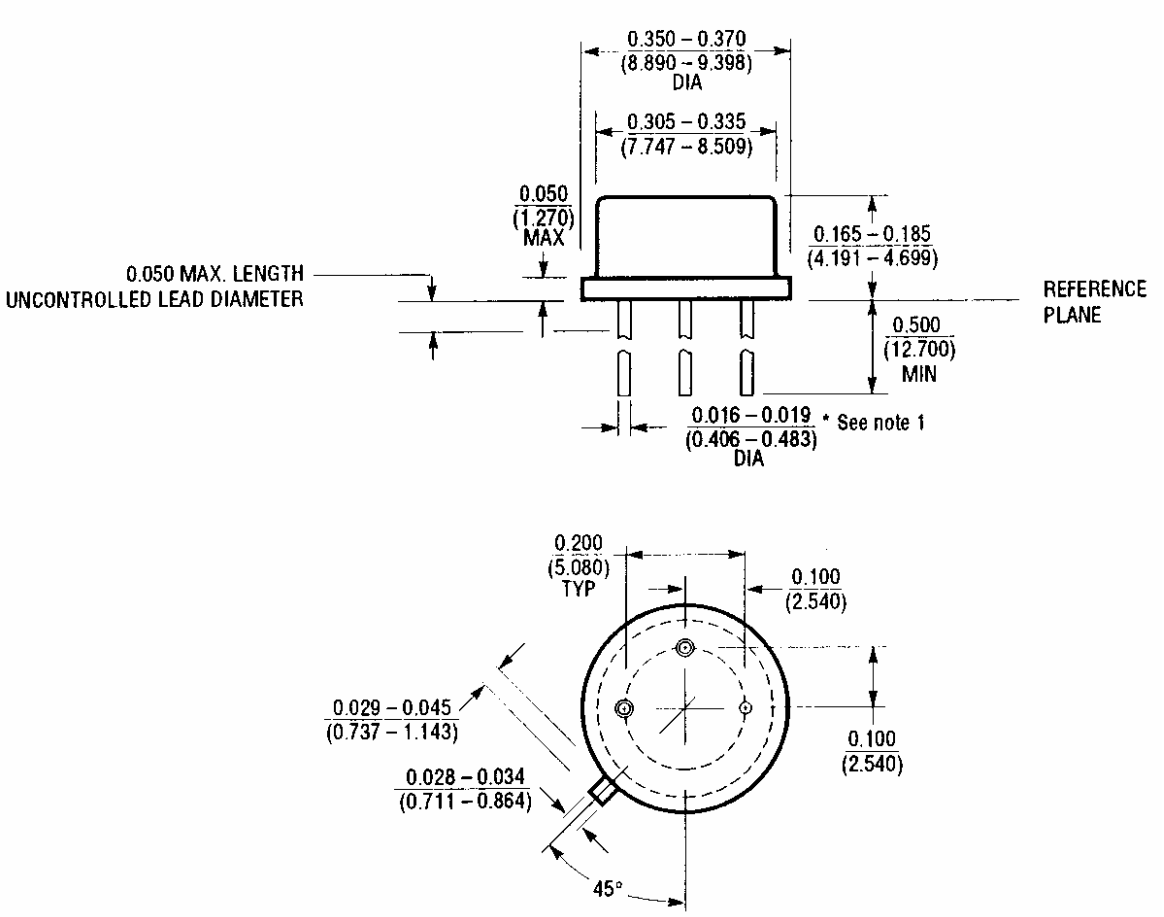
For RH1086:
Burn-In Voltage to be V5 = +23V to +25V
Tj = 168 °C max at Ta of 150 °C.
Tj = 143 °C max at Ta of 125 °C.



PACKAGE AND PINOUT

FIGURE 4

DEVICE OPTION # 1
(H) TO39 METAL CAN / 3 LEADS CASE OUTLINE

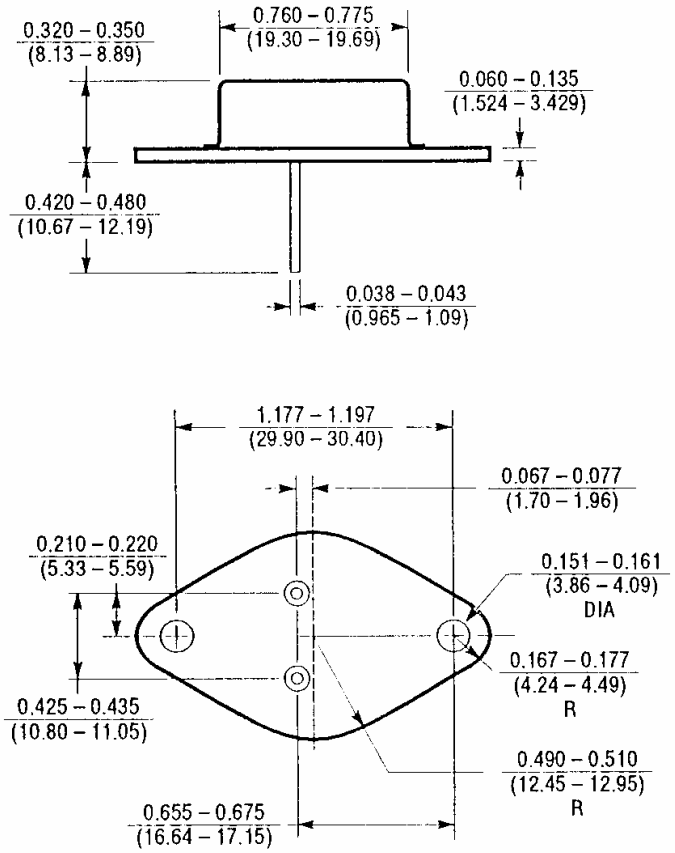


NOTE: 1. FOR SOLDER DIP LEAD FINISH, LEAD DIAMETER IS 0.016 – 0.024 (0.406 – 0.610)

FIGURE 5

θja = +150°C/W
θjc = +40°C/W

DEVICE OPTION # 2
(K) TO3 METAL CAN / 2 LEADS CASE OUTLINE



θja = +35°C/W
θjc = +3°C/W

FIGURE 6

TERMINAL CONNECTIONS
DEVICE OPTION #1, TO39 / 3 LEAD METAL CAN

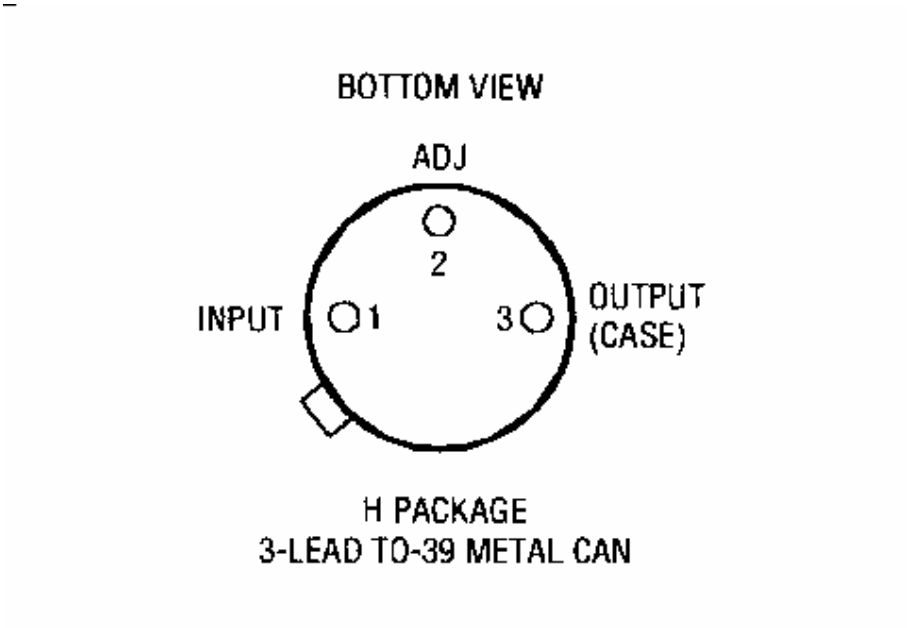


FIGURE 7

DEVICE OPTION #2, TO3 / 2 LEAD METAL CAN

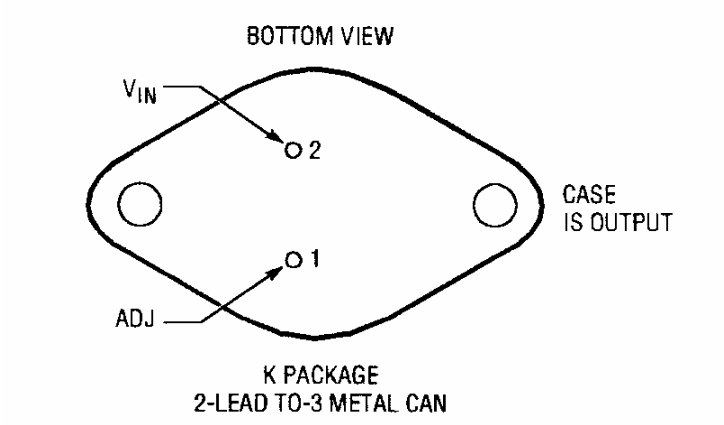


FIGURE 8

TABLE I DICE ELECTRICAL CHARACTERISTICS – Element Evaluation (Note 1)

PARAMETER	CONDITIONS	RH1086K (Note 6) MIN	RH1086K (Note 6) MAX	RH1086H (Note 6) MIN	RH1086H (Note 6) MAX	UNITS
Reference Voltage	I_{OUT} = 10mA, T_J = 25°C, ($V_{IN} - V_{OUT}$) = 3V	1.238	1.262			V
	1.5V ≤ ($V_{IN} - V_{OUT}$) = 15V	1.225	1.270	1.225	1.270	V
Line Regulation	I_{LOAD} = 10mA, 1.5V ≤ ($V_{IN} - V_{OUT}$) ≤ 15V T_J = 25°C		0.2		0.2	%
Load Regulation	($V_{IN} - V_{OUT}$) = 3V, 10mA ≤ I_{OUT} ≤ 1.5A T_J = 25°C (0.5A for RH1086H) (Notes 1, 2, 5, 6)		0.3		0.3	%
Dropout Voltage ($V_{IN} - V_{OUT}$)	ΔV_{OUT}, ΔV_{REF} = 1%, I_{OUT} = 1.5A (0.5A for RH1086H) (Notes 3, 5, 6)		1.5		1.25	V
Current Limit	($V_{IN} - V_{OUT}$) = 5V	1.5		0.5		A
	($V_{IN} - V_{OUT}$) = 25V (Note 5)	0.050		0.020		A
Mininum Load Current	($V_{IN} - V_{OUT}$) = 25V (Note 4)		10		10	mA
Ripple Rejection	f = 120Hz, C_{OUT} = 25µF Tantalum I_{OUT} = 1.5A, (I_{OUT} = 0.5A for RH1086H) C_{ADJ} = 25µF, ($V_{IN} - V_{OUT}$) = 3V (Note 5, 6)	60		60		dB
Adjust Pin Current	T_J = 25°C		120		120	µA
Adjust Pin Current Change	10mA ≤ I_{OUT} ≤ 1.5A (0.5A for RH1086H) 1.5V ≤ ($V_{IN} - V_{OUT}$) ≤ 15V (Note 5, 6)		5		5	µA

Note 1: See thermal regulation specifications for changes in output voltage due to heating effects. Load and line regulation are measured at a constant junction temperature by low duty cycle pulse testing. Load regulation is measured at the output lead ≈ 1/8" from the package.

Note 2: Line and load regulation are guaranteed up to the maximum power dissipation of 15W for the RH1086K, 3W for the RH1086H. Power dissipation is determined by the input/output differential and the output current. Guaranteed maximum power dissipation will not be available over the full input/output voltage range. See Short Circuit Current Curve in the LT1086 Series standard data sheet for available output current.

Note 3: Dropout voltage is specified over the full output current range of the device. Test points and limits are shown on the Dropout Voltage Curve in the LT1086 Series standard data sheet.

Note 4: Minimum load current is defined as the minimum output current required to maintain regulation. At 25V input/output differential the device is guaranteed to regulate if the output current is greater than 10mA.

Note 5: Guaranteed by design but not tested at wafer sort.

Note 6: For compliance with 883 revision C current density spec. RH1086K is derated to 1.0A max load operation.

TABLE II ELECTRICAL CHARACTERISTICS (POSTIRRADIATION)

T_A = 25°C unless otherwise noted.

PARAMETER	CONDITIONS	10KRAD(Si) MIN	10KRAD(Si) MAX	20KRAD(Si) MIN	20KRAD(Si) MAX	50KRAD(Si) MIN	50KRAD(Si) MAX	100KRAD(Si) MIN	100KRAD(Si) MAX	200KRAD(Si) MIN	200KRAD(Si) MAX	UNITS
Reference Voltage (Note 5)	I_{OUT} = 10mA ($V_{IN} - V_{OUT}$) = 3V (K)	1.234	1.258	1.230	1.257	1.225	1.253	1.220	1.247	1.205	1.241	V
	10mA ≤ I_{OUT} ≤ $I_{FULL\ LOAD}$ 1.5V ≤ ($V_{IN} - V_{OUT}$) ≤ 15V	1.220	1.275	1.219	1.275	1.215	1.275	1.210	1.275	1.20	1.275	V
Line Regulation (Notes 1, 2)	I_{OUT} = 10mA 1.5V ≤ ($V_{IN} - V_{OUT}$) ≤ 15V		0.2		0.21		0.23		0.25		0.3	%
Load Regulation (Notes 1, 2, 5)	($V_{IN} - V_{OUT}$) = 3V 10mA ≤ I_{OUT} ≤ $I_{FULL\ LOAD}$		0.3		0.3		0.3		0.3		0.3	%
Dropout Voltage (Note 3)	ΔV_{REF} = 1%, I_{OUT} = 1.5A (K) ΔV_{REF} = 1%, I_{OUT} = 0.5A (H)		1.5		1.51		1.52		1.55		1.575	V
Current Limit	($V_{IN} - V_{OUT}$) = 5V (K) ($V_{IN} - V_{OUT}$) = 25V (K) ($V_{IN} - V_{OUT}$) = 5V (H) ($V_{IN} - V_{OUT}$) = 25V (H)	1.5 0.05 0.5 0.020		1.5 0.049 0.5 0.019		1.5 0.048 0.5 0.019		1.5 0.047 0.5 0.018		1.5 0.045 0.5 0.017		A A A A
Minimum Load Current	($V_{IN} - V_{OUT}$) = 25V		10		10		10		10		10	mA
Adjust Pin Current			120		120		120		120		120	µA
Adjust Pin Current Change (Note 5)	10mA ≤ I_{OUT} ≤ $I_{FULL\ LOAD}$ 1.5V ≤ ($V_{IN} - V_{OUT}$) ≤ 15V		5		5		5		5		5	µA

Note 1: See thermal regulation specifications for changes in output voltage due to heating effects. Line and load regulation are measured at a constant junction temperature by low duty cycle pulse testing.

Note 2: Line and load regulation are guaranteed up to the maximum power dissipation of 15W for RH1086MK and 3W for the RH1086MH. Power dissipation is determined by the input/output differential voltage and the output current. Guaranteed maximum power dissipation will not be available over the full input/output voltage range.

Note 3: Dropout voltage is specified over the full output current range of the device. Test points and limits are shown on the Dropout Voltage curve in the LT®1086 data sheet.

Note 4: Guaranteed by design, characterization, or correlation to other tested parameters.

Note 5: $I_{FULL\ LOAD}$ is defined in the Current Limit curves in the standard data sheet. For compliance with 883 revision C current density specifications, the RH1086MK is derated to 1A.

TABLE III RH ELEMENT EVALUATION TABLE QUALLIFICATION OF DICE SALES

RH CANNED SAMPLE TABLE FOR QUALIFYING DICE SALES

SUBGROUP	CLASS K/S	CLASS H/B	OPERATION	MIL-STD-883 METHOD	MIL-STD-883 CONDITION	QUANTITY (ACCEPT NUMBER)
1	X		SEM	2018	N/A	REF. METHOD 2018 FOR S/S
2	X	X	ELEMENT ELECTRICAL (WAFER SORT @ 25°C)			100%
3	X	X	ELEMENT VISUAL (2nd OP)	2010	A	100%
4	X	X	INTERNAL VISUAL (3rd OP)	2010	A	ASSEMBLED PARTS ONLY
	X		DIE SHEAR MONITOR	2019		
	X		BOND PULL MONITOR	2011		
5	X		STABILIZATION BAKE	1008	C	ASSEMBLED PARTS ONLY
	X		TEMPERATURE CYCLE	1010	C	
	X		CONSTANT ACCELERATION	2001	E	
	X		FINE LEAK	1014	A	
	X		GROSS LEAK	1014	C	
6	X		FIRST ROOM ELECTRICAL - READ & RECORD (REPLACE ANY ASSEMBLY-RELATED REJECTS)			43 (3)
	X		ELECT. READ & RECORD @ +125°C or +150°C, -55°C			
	X		BURN-IN: +125°C/240 hrs. or +150°C/120 hrs.	1015	+125°C MINIMUM 240 HOURS	
	X		POST BURN-IN ELECTRICAL @ 25°C READ & RECORD			
	X		PRE OP-LIFE ELECTRICAL @ 25°C READ & RECORD			
	X		OPERATING LIFE: +125°C/1000 hrs. or +150°C/500 hrs.	1005	+125°C MINIMUM 1000 HOURS	
	X		POST OP-LIFE ELECT. (R&R 25°C, +125°C or +150°C, -55°C)			
7	X	X	WIRE BOND EVALUATION	2011		15 (0) or 25 (1) - # of wires

NOTE: LTC is not qualified to process to MIL-PRF-38534. This is an LTC imposed element evaluation that follows MIL-STD-883 test methods and conditions. Please note the quantity and accept number from a Sample Size Series of 15%, accept on 3, and note that the actual sample and accept number does not begin until Subgroup 6.

NOTE: Tests within Subgroup 5 may be performed in any sequence.

NOTE: LTC's radiation tolerant (RH) die has a topside glassivation thickness of 4KÅ minimum.

NOTE: Sample sizes on the travelers may be larger than that indicated in the above table; however, the larger sample size is to accommodate extra units for replacement devices in the event of equipment or operator error and for assembly related rejects in Subgroup 6, and for Wire Bond Evaluation, Subgroup 7. The larger sample size is at all times kept segregated and, if used for qualification, has all the required processing imposed.

REVISION RECORD		
REV	DESCRIPTION	DATE
0	INITIAL RELEASE	02/11/09
A	**RH1185MK DICE/DWF DATA SHEET AMENDED. PAGE 11, PRE-IRRADIATION ELECTRICAL TEST LIMITS CHANGED REFERENCE VOLTAGE FROM -1.1V MIN, 1.1V MAX TO -2.344V MIN., -2.396V MAX, WITH A TYPICAL OF -2.37 V.**	**12/02/09**

CAUTION: ELECTROSTATIC DISCHARGE SENSITIVE PART

REVISION	PAGE NO.	1	2	3	4	5	6	7	8	9	10	11	12	13			
INDEX	REVISION	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**			
REVISION	PAGE NO.																
INDEX	REVISION																

				LINEAR TECHNOLOGY CORPORATION MILPITAS, CALIFORNIA		
	ORIG			TITLE:		
	DSGN			**MICROCIRCUIT, LINEAR, RH1185MK DICE NEGATIVE REGULATOR WITH ADJUSTABLE CURRENT LIMIT**		
	ENGR					
	MFG					
	CM					
	QA			SIZE	CAGE CODE	DRAWING NUMBER / REV
	PROG				**64155**	**05-08-5232** / **A**
APPLICATION	FUNCT	SIGNOFFS	DATE	CONTRACT:		

FOR OFFICIAL USE ONLY

1.0 SCOPE:

1.1 This specification defines the performance and test requirements for a microcircuit processed to a space level manufacturing flow.

2.0 APPLICABLE DOCUMENTS:

2.1 Government Specifications and Standards: the following documents listed in the Department of Defense Index of Specifications and Standards, of the issue in effect on the date of solicitation, form a part of this specification to the extent specified herein.

SPECIFICATIONS:

MIL-PRF-38535	Integrated Circuits (Microcircuits) Manufacturing, General Specification for
MIL-STD-883	Test Method and Procedures for Microcircuits
MIL-STD-1835	Microcircuits Case Outlines

2.2 Order of Precedence: In the event of a conflict between the documents referenced herein and the contents of this specification, the order of precedence shall be this specification, MIL-PRF-38535 and other referenced specifications.

3.0 REQUIREMENTS:

3.1 General Description: This specification details the requirements for the RH1185MK, DICE and Element Evaluation Test Samples, processed to space level manufacturing flow as specified herein.

3.2 Part Number: **RH1185MKDice**

3.3 **Special Handling of Dice:** Rad Hard dice require special handling as compared to standard IC dice. Rad Hard dice are susceptible to surface damage due to the absence of silicon nitride passivation as on standard dice. Silicon nitride protects the dice surface from scratches by its hard and dense properties. The passivation on Rad Hard dice is silicon dioxide which is much “softer” than silicon nitride.

LTC recommends that dice handling be performed with extreme care so as to protect the dice surface from scratches. If the need arises to move the die around from the chip tray, use a Teflon tipped vacuum wand. This wand can be made by pushing a small diameter of Teflon tubing onto the tip of a steel tipped wand. The inside diameter of the Teflon tip should match the dice size for efficient pickup. The tip of the Teflon should be cut square and flat to ensure good vacuum to dice surface. Ensure the Teflon tip remains clean from debris by inspecting under stereo scope.

During die attach, care must be exercised to ensure no tweezers touch the top of the dice.

3.4 The Absolute Maximum Ratings:

Input Voltage	35V
Input - Output Differential	30V
FB Voltage	7V
REF Voltage	7V
Output Voltage	30V
Output Reverse Voltage	2V
Operating Ambient Temperature Range	-55°C to 125°C
Operating Junction Temperature Range	
Control Section	-55°C to +150°C
Power Transistor Section	-55°C to +175°C
Storage Temperature Range	-65°C to +150°C
Lead Temperature (Soldering, 10 sec)	+300°C

3.5 Design, Construction, and Physical Dimensions: Detail design, construction, physical dimensions, and electrical requirements shall be specified herein.

3.6 Outline Dimensions and Pad Functions: Dice outline dimensions, pad functions, and locations shall be specified in **Figure 1**.

3.7 Radiation Hardness Assurance (RHA):

3.7.1 The manufacturer shall perform a lot sample test as an internal process monitor for total dose radiation tolerance. The sample test is performed with MIL-STD-883 TM1019 Condition A as a guideline.

3.7.2 For guaranteed radiation performance to MIL-STD-883, Method 1019, total dose irradiation, the manufacturer will provide certified RAD testing and report through an independent test laboratory when required as a customer purchase order line item.

3.7.3 Total dose bias circuit is specified in **Figure 2**.

3.8 Wafer (or Dice) Probe: Dice shall be 100% probed at Ta = +25°C to the limits shown in **Table I** herein. All reject dice shall be removed from the lot. This testing is normally performed prior to dicing the wafer into chips. Final specifications after assembly are sample tested during the element evaluation.

3.9 Wafer Lot Acceptance: Wafer lot acceptance shall be in accordance with MIL-PRF-38535, Appendix A, except for the following: Top side glassivation thickness shall be a **minimum of 4KÅ.**

3.10 Wafer Lot Acceptance Report: SEM is performed per MIL-STD-883, Method 2018. Copies of SEM photographs shall be supplied with the Wafer Lot Acceptance Report as part of a Space Data Pack when specified as a customer purchase order line item.

3.11 Traceability: Wafer Diffusion Lot and Wafer traceability shall be maintained through Quality Conformance Inspection.

4.0 QUALITY CONFORMANCE INSPECTION: Quality Conformance Inspection shall consist of the tests and inspections specified herein.

5.0 SAMPLE ELEMENT EVALUATION: A sample from **each wafer supplying dice** shall be assembled and subjected to element evaluation per **Table III** herein.

5.1 100 Percent Visual Inspection: All dice supplied to this specification shall be inspected in accordance with MIL-STD-883, Method 2010, Condition A. All reject dice shall be removed from the lot.

5.2 Electrical Performance Characteristics for Element Evaluation: The electrical performance characteristics shall be as specified in **Table I** and **Table II** herein.

5.3 Sample Testing: Each wafer supplying dice for delivery to this specification shall be subjected to element evaluation sample testing. No dice shall be delivered until all the lot sample testing has been performed and the results found to be acceptable unless the customer supplies a written approval for shipment prior to completion of wafer qualification as specified in this specification.

5.4 Part Marking of Element Evaluation Sample Includes**:**

5.4.1 LTC Logo

5.4.2 LTC Part Number

5.4.3 Date Code

5.4.4 Serial Number

5.4.5 ESD Identifier per MIL-PRF-38535, Appendix A

5.4.6 Diffusion Lot Number

5.4.7 Wafer Number

5.5 Burn-In Requirement: Burn-In circuit for TO3 package is specified in **Figure 3**.

5.6 Mechanical/Packaging Requirements: Case Outline and Dimensions are in accordance with **Figure 4.**

5.7 Terminal Connections: The terminal connections shall be as specified in **Figure 5.**

5.8 Lead Material and Finish: The lead material and finish shall be alloy 52 with hot solder dip (Finish letter A) in accordance with MIL-PRF-38535.

6.0 VERIFICATION (QUALITY ASSURANCE PROVISIONS)

6.1 Quality Assurance Provisions: Quality Assurance provisions shall be in accordance with MIL-PRF-38535. Linear Technology is a QML certified company and all Rad Hard candidates are assembled on qualified Class S manufacturing lines.

6.2 Sampling and Inspection: Sampling and Inspection shall be in accordance with **Table III** herein.

6.3 Screening: Screening requirements shall be in accordance with **Table III** herein.

6.4 Source Inspection:

6.4.1 The manufacturer will coordinate Source Inspection at wafer lot acceptance and pre-seal internal visual.

6.4.2 The procuring activity has the right to perform source inspection at the supplier's facility prior to shipment for each lot of deliverables when specified as a customer purchase order line item. This may include wafer lot acceptance, die visual, and final data review.

6.5 Deliverable Data: Deliverable data that will ship with devices when a Space Data Pack is ordered:

6.5.1 Lot Serial Number Sheets identifying all Canned Sample devices accepted through final inspection by serial number.

6.5.2 100% attributes (completed element evaluation traveler).
6.5.3 Element Evaluation variables data, including Burn-In and Op Life

6.5.4 SEM photographs (3.10 herein)

6.5.5 Wafer Lot Acceptance Report (3.9 herein)

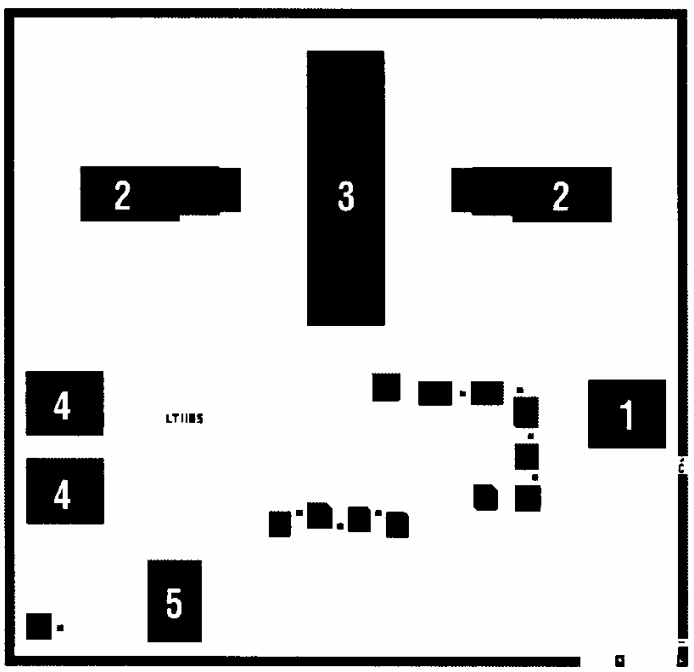
6.5.6 A copy of outside test laboratory radiation report if ordered

6.5.7 Certificate of Conformance certifying that the devices meet all the requirements of this specification and have successfully completed the mandatory tests and inspections herein.

Note: Items 6.5.1 and 6.5.7 will be delivered as a minimum, with each shipment.

7.0 Packaging Requirements: Packaging shall be in accordance with Appendix A of MIL-PRF-38535. All dice shall be packaged in multicavity containers composed of conductive, anti-static, or static dissipative material with an external conductive field shielding barrier.

DICE OUTLINE DIMENSIONS AND PAD FUNCTIONS



PAD FUNCTION

1. REF
2. V_{IN}
3. V_{OUT}
4. GND
5. FB

110mils × 116mils
Backside metal: Alloyed Gold Layer
Backside Potential: V_{IN} Pads 2

FIGURE 1

TOTAL DOSE BIAS CIRCUIT

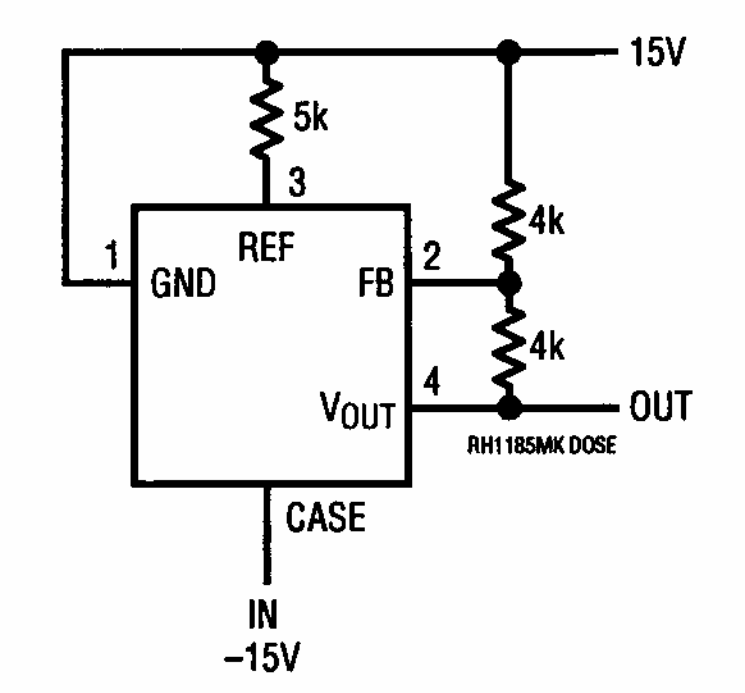
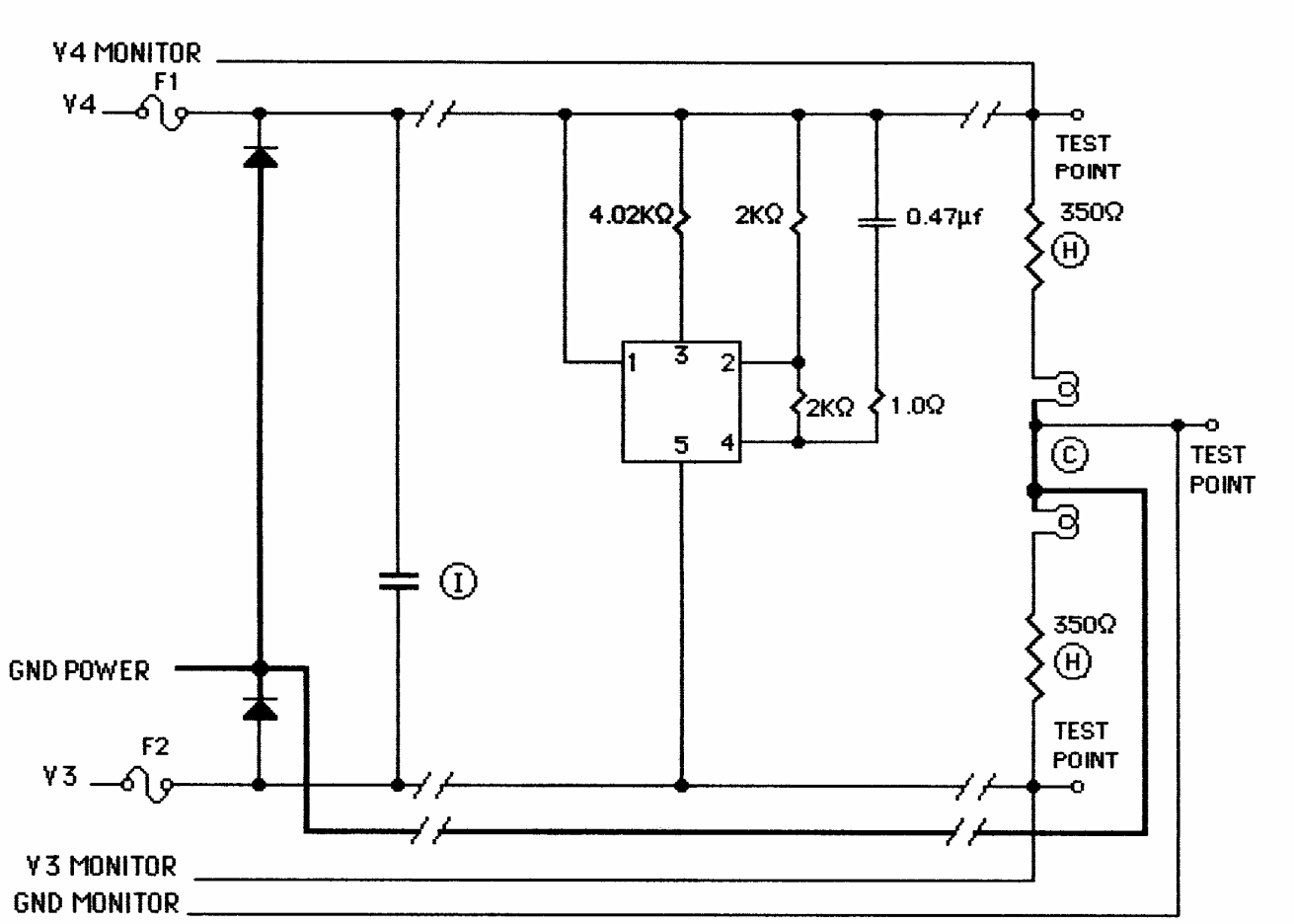


FIGURE 2

BURN-IN CIRCUIT

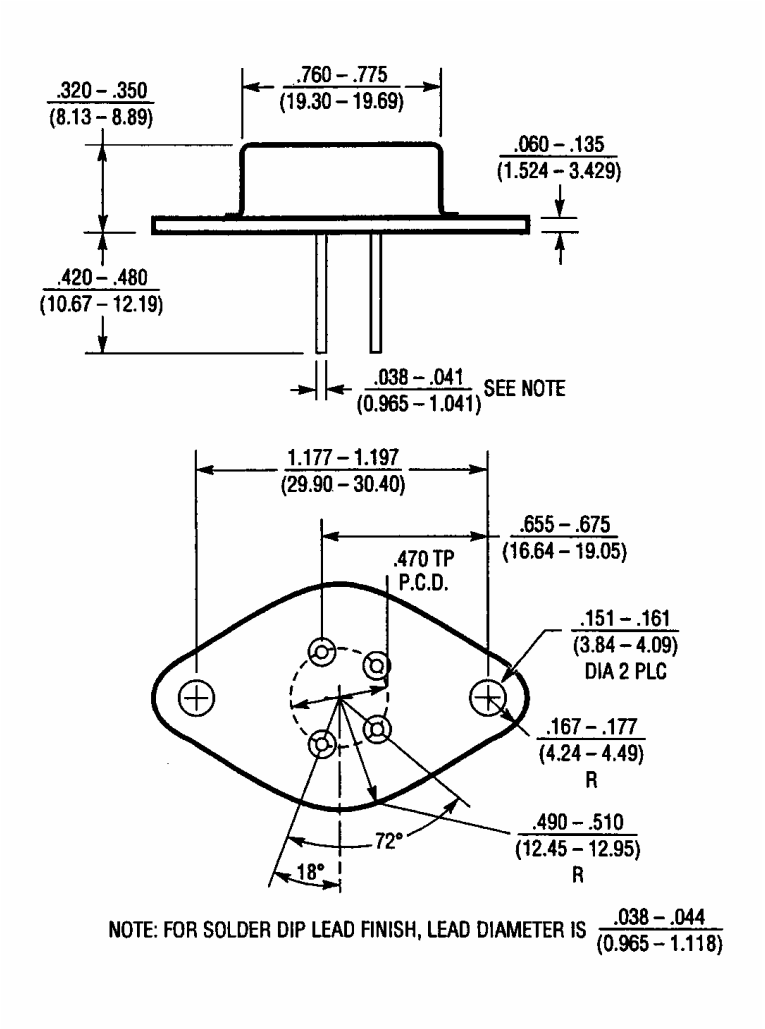


NOTES:

1. Unless otherwise specified, component tolerances shall be per military specification.
2. Tj = 163°C maximum.
3. Ta = 150 °C.
4. Burn-in voltages: V4 = +15V to +16.5V
   V3 = -15V to -16.5V

FIGURE 3

TO3, 4 LEADS, CASE OUTLINE



θja = +35°C/W

θjc = +3°C/W

FIGURE 4

TERMINAL CONNECTIONS

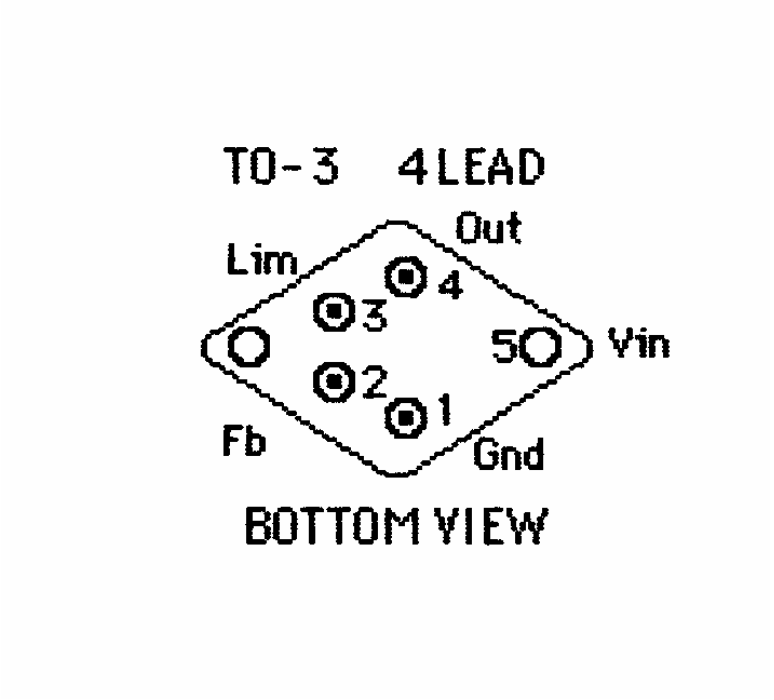


FIGURE 5

TABLE I DICE ELECTRICAL CHARACTERISTICS – Element Evaluation (Note 1)

V_{IN} = 7.4V, V_{OUT} = 5V, I_{OUT} = 1mA, R_{LIM} = 4.02k, unless otherwise noted.

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
Reference Voltage (at FB Pin, Note 2)	$V_{IN} - V_{OUT}$ = 5V, $V_{OUT} = V_{REF}$	–2.344	–2.37	–2.396	V
Feedback Pin Bias Current	$V_{OUT} = V_{REF}$			2	µA
Dropout Voltage (Note 3)	I_{OUT} = 0.5A, V_{OUT} = 5V I_{OUT} = 3A, V_{OUT} = 5V			0.4 1.05	V V
Line Regulation (Note 6)	$V_{IN} - V_{OUT}$ = 1V to 20V, V_{OUT} = 5V			0.01	%/V
Minimum Input Voltage (Note 4)	I_{OUT} = 1A, $V_{OUT} = V_{REF}$			4.5	V
Internal Current Limit (Note 8)	$V_{IN} - V_{OUT}$ = 1.5V $V_{IN} - V_{OUT}$ = 20V $V_{IN} - V_{OUT}$ = 30V	3.3 1 0.2		4.2 2.6 1	A A A
External Current Limit (Note 7)	R_{LIM} = 5k, V_{OUT} = 1V R_{LIM} = 15k, V_{OUT} = 1V	2.7 0.9		3.3 1.1	A A
Quiescent Supply Current (Note 5)	I_{OUT} = 5mA, $V_{OUT} = V_{REF}$, 4V ≤ V_{IN} ≤ 25V			3.5	mA
REF Pin Shutoff Current		11		19	µA

Note 1: Dice are probe tested at 25°C to the limits shown except for high current tests. Dice are tested under low current conditions which assure full load current specifications when assembled in packaging systems approved by Linear Technology. For absolute maximum ratings, typical specifications, performance curves and finished product specifications, please refer to the standard product RH data sheet.

Note 2: Testing is done using a pulsed low duty cycle technique. See thermal regulation specifications in the LT1185 data sheet for output changes due to heating effects.

Note 3: Dropout voltage is tested by reducing input voltage until the output drops 1% below its nominal value. Tests are done at 0.5A and 3A. The power transistor looks basically like a pure resistance in this range so that minimum differential at any intermediate current can be calculated by interpolation; $V_{DROPOUT} = 0.25V + 0.25\Omega \bullet I_{OUT}$. For load current other than 0.5A and 3.0A, see the graph in the LT1185 data sheet.

Note 4: Minimum input voltage is limited by base emitter voltage drive of the power transistor section, not saturation as measured in Note 3. For output voltages below 4V, minimum input voltage specification may limit dropout voltage before transistor saturation limit.

Note 5: Supply current is measured on the ground pin, and does not include load current, R_{LIM}, or output divider current.

Note 6: Line regulation is measured on a pulse basis with a pulse width of ≈2ms to minimize heating. DC regulation will be affected by thermal regulation and temperature coefficient of the reference. See the Applications Information section of the LT1185 data sheet for details.

Note 7: External current limit is programmed with a resistor from REF pin to GND pin. The value is $15K \bullet A/I_{LIMIT}$.

Note 8: For $V_{IN} - V_{OUT}$ = 1.5V, V_{IN} = 5V and V_{OUT} = 3.5V. For all other current limit tests V_{OUT} = 1V.

TABLE II ELECTRICAL CHARACTERISTICS – Post-Irradiation (Note 5)

PARAMETER AND CONDITONS	10KRAD(Si) MIN	10KRAD(Si) MAX	20KRAD(Si) MIN	20KRAD(Si) MAX	50KRAD(Si) MIN	50KRAD(Si) MAX	100KRAD(Si) MIN	100KRAD(Si) MAX	200KRAD(Si) MIN	200KRAD(Si) MAX	UNITS
Reference Voltage Tolerance $V_{IN} - V_{OUT}$ = 5V, $V_{OUT} = V_{REF}$	–1.2	1.2	–1.2	1.2	–1.5	1.5	–1.5	1.5	–2	2	%
Reference Voltage Tolerance $V_{IN} - V_{OUT}$ = 1.2V to V_{IN} = 30V, 1mA ≤ I_{OUT} ≤ 3A, P_D ≤ 25W (Note 6), V_{OUT} = 5V, $T_{MIN} \le T_J \le T_{MAX}$ (Note 9)	–3	3	–3	3	–3.2	3.2	–3.5	3.5	–4	4	%
Feedback PIn Bias Current, $V_{OUT} = V_{REF}$		2		2		2.5		3		3	µA
Dropout Voltage (Note 3) I_{OUT} = 0.5A, V_{OUT} = 5V I_{OUT} = 3A, V_{OUT} = 5V		0.4 1		0.4 1		0.4 1		0.425 1.05		0.45 1.1	V V
Load Regulation (Note 7) I_{OUT} = 5mA to 3A $V_{IN} - V_{OUT}$ = 1.5V to 10V, V_{OUT} = 5V		0.3		0.4		0.5		0.8		1	%
Line Regulation, Absolute Value (Note 7) $V_{IN} - V_{OUT}$ = 1V to 20V, V_{OUT} = 5V		0.01		0.01		0.01		0.02		0.05	%/V
Minimum Input Voltage (Note 4) I_{OUT} = 1A, $V_{OUT} = V_{REF}$ I_{OUT} = 3A, $V_{OUT} = V_{REF}$		3.9 4.4		3.9 4.4		3.9 4.4		4 4.5		4 4.5	V V
Internal Current Limit (Note 12) 1.5V ≤ $V_{IN} - V_{OUT}$ ≤ 10V $V_{IN} - V_{OUT}$ = 15V $V_{IN} - V_{OUT}$ = 20V $V_{IN} - V_{OUT}$ = 30V	3.3 2 1 0.2	4.3 4.3 2.7 1	3.3 2 1 0.2	4.3 4.3 2.75 1.15	3.3 2 1 0.2	4.4 4.35 2.85 1.3	3.3 2 1 0.2	4.55 4.5 3.1 1.6	3.3 2 1 0.2	4.75 4.7 3.3 2	A A A A
External Current Limit (Note 11) R_{LIM} = 5k R_{LIM} = 15k	2.7 0.9	3.3 1.1	2.7 0.9	3.4 1.25	2.7 0.9	3.5 1.4	2.7 0.9	3.7 1.6	2.7 0.9	3.9 1.9	A A
Quiescent Supply Current I_{OUT} = 5mA, $V_{OUT} = V_{REF}$, 4V ≤ V_{IN} ≤ 25V		3.5		3.5		3.5		3.5		3.5	mA
Supply Current Change With Load $V_{IN} - V_{OUT} = V_{SAT}$ $V_{IN} - V_{OUT} \ge 2V$		25 15		27 16		30 18		35 21		45 27	mA/A mA/A
REF Pin Shutoff Current	10	19	9	19	7	19	5	19	1	19	µA

Note 1: Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device. Exposure to any Absolute Maximum Rating condition for extended periods may affect device reliability and lifetime.

Note 2: Reference voltage is guaranteed both at nominal conditions (no load, 25°C) and at worst-case conditions of load, line, power and temperature.

Note 3: Dropout voltage is tested by reducing input voltage until the output drops 1% below its nominal value. Tests are done at 0.5A and 3A. The power transistor looks basically like a pure resistance in this range so that minimum differential at any intermediate current can be calculated by interpolation; $V_{DROPOUT} = 0.25V + 0.25\Omega \bullet I_{OUT}$. For load current other than 0.5A and 3.0A, see graph in LT1185 data sheet.

Note 4: "Minimum input voltage" is limited by base emitter voltage drive of the power transistor section, not saturation as measured in Note 3. For output voltages below 4V, "minimum input voltage" specification may limit dropout voltage before transistor saturation limitation.

Note 5: Supply current is measured on the ground pin, and does not include load current, R_{LIM}, or output divider current.

Note 6: The 25W power level is guaranteed for an input-output voltage of 8.3V to 17V. At lower voltages the 3A limit applies, and at higher voltages the internal power limiting may restrict regulator power below 25W. See graph of Internal Current Limit in LT1185 data sheet.

Note 7: Line and load regulation are measured on a pulse basis with a pulse width of ≈2ms, to minimize heating. DC regulation will be affected by thermal regulation and temperature coefficient of the reference. See applications Information section of LT1185 data sheet for details.

Note 8: Guaranteed by design and correlation to other tests, but not tested.

Note 9: T_{JMIN} = –55°C for the RH1185MK. Power transistor area and control circuit area have different maximum junction temperatures. Control area limit is T_{JMAX} = 150°C for the RH1185MK. Power area limit is 175°C for RH1185MK.

Note 10: V_{SAT} is the maximum specified dropout voltage; $0.25V + 0.25\Omega \bullet I_{OUT}$.

Note 11: Current limit is programmed with a resistor from REF pin to GND pin. The value is 15k • A/I-limit.

Note 12: For $V_{IN} - V_{OUT}$ = 1.5V, V_{IN} = 5V and V_{OUT} = 3.5V. For all other current limit tests, V_{OUT} = 1.0V

TABLE III RH ELEMENT EVALUATION TABLE QUALIFICATION OF DICE SALES

RH CANNED SAMPLE TABLE FOR QUALIFYING DICE SALES

SUBGROUP	CLASS K/S	CLASS H/B	OPERATION	MIL-STD-883 METHOD	MIL-STD-883 CONDITION	QUANTITY (ACCEPT NUMBER)
1	X		SEM	2018	N/A	REF. METHOD 2018 FOR S/S
2	X	X	ELEMENT ELECTRICAL (WAFER SORT @ 25°C)			100%
3	X	X	ELEMENT VISUAL (2nd OP)	2010	A	100%
4	X	X	INTERNAL VISUAL (3rd OP)	2010	A	ASSEMBLED PARTS ONLY
	X		DIE SHEAR MONITOR	2019		
	X		BOND PULL MONITOR	2011		
5	X		STABILIZATION BAKE	1008	C	ASSEMBLED PARTS ONLY
	X		TEMPERATURE CYCLE	1010	C	
	X		CONSTANT ACCELERATION	2001	E	
	X		FINE LEAK	1014	A	
	X		GROSS LEAK	1014	C	
6	X		FIRST ROOM ELECTRICAL - READ & RECORD (REPLACE ANY ASSEMBLY-RELATED REJECTS)			43 (3)
	X		ELECT. READ & RECORD @ +125°C or +150°C, -55°C			
	X		BURN-IN: +125°C/240 hrs. or +150°C/120 hrs.	1015	+125°C MINIMUM 240 HOURS	
	X		POST BURN-IN ELECTRICAL @ 25°C READ & RECORD			
	X		PRE OP-LIFE ELECTRICAL @ 25°C READ & RECORD			
	X		OPERATING LIFE: +125°C/1000 hrs. or +150°C/500 hrs.	1005	+125°C MINIMUM 1000 HOURS	
	X		POST OP-LIFE ELECT. (R&R 25°C, +125°C or +150°C, -55°C)			
7	X	X	WIRE BOND EVALUATION	2011		15 (0) or 25 (1) - # of wires

NOTE: LTC is not qualified to process to MIL-PRF-38534. This is an LTC imposed element evaluation that follows MIL-STD-883 test methods and conditions. Please note the quantity and accept number from a Sample Size Series of 15%, accept on 3, and note that the actual sample and accept number does not begin until Subgroup 6.

NOTE: Tests within Subgroup 5 may be performed in any sequence.

NOTE: LTC's radiation tolerant (RH) die has a topside glassivation thickness of 4KÅ minimum.

NOTE: Sample sizes on the travelers may be larger than that indicated in the above table; however, the larger sample size is to accommodate extra units for replacement devices in the event of equipment or operator error and for assembly related rejects in Subgroup 6, and for Wire Bond Evaluation, Subgroup 7. The larger sample size is at all times kept segregated and, if used for qualification, has all the required processing imposed.

Aeroflex Plainview
SEE TEST REPORT SUMMARY: LDO REGULATORS

Date: Monday, March 02, 2009

Subject: Summary of SEE Test data for VRG8651 Hybrid Devices
Details: The VRG8651 consists of one LTC **RH1086** Positive Voltage LDO Regulator and one LTC **RH1185** Negative LDO Voltage Regulator. These ICs are used in the following Aeroflex Voltage Regulator products: **VRG8651, VRG8652, VRG8657, VRG8658, VRG8662, and VRG8663**

Test was performed on February 24, 2009 at Texas A & M university cyclotron. Steve Moyer, Tony Ward and Surinder Seehra participated in the test from LMCSS Newtown. Other participants were Dan Clymer from Space System Company Denver (customer representative) and Bill Stapor of Stapor Research, representative from Government Program Office.

Four Hybrids containing both RH1185 and RH1086 devices were irradiated with Argon, Krypton and Xenon ions with LET ranging from 5.6 to 60 MeV-cm2/mg. The fluence of ions was 1 E+06 during the single event transient (SET) test and was 1 E+07 ions during the Single Event Latchup (SEL) test. Tests were performed on both unfiltered devices and filtered devices. Unfiltered devices present data for any application of devices, whereas the filtered devices represented ACSS application. Devices were irradiated under both applications of $\pm$ 8 volts and $\pm$ 15 volts.

Single Event Transients Data

Unfiltered Devices
When irradiated with xenon ions (LET = 40 to 60 MeV-cm2/mg) the RH1185 devices experienced many transients with an amplitude of up to 10 Volts for a duration of up to 10 us. The amplitude and duration of transients decreased when irradiated with ions of lower LET.

The RH1086 devices experienced transients with amplitude of up to 13 volts for a period of up to 50 uS. The amplitude and duration of transients decreased when irradiated with ions of lower LET.

Filtered Devices
When irradiated with ions of LET of up to 60 MeV-cm2/mg, the RH1185 devices experienced no transients. However, RH1086 devices experienced occasional very small transients. The effect of these transients needs to be determined.

Single Event Latchup (SEL) data
The SEL test was performed by irradiating both RH1185 and RH1086 devices with Xenon ions with an LET of 40 MeV-cm2/mg at ion fluence of 1 E+07 ions/cm2. The LET of the ions was then increased to 60 MeV-cm2/mg and with the same fluence of 1 E+07 ions/cm2. In each case, very little change in power supply current was observed indicating **no latch-up for both the devices**.

It is concluded that the filter seems to do its job of filtering nearly all the transients. Some transients were observed for the RH1086 devices. The effects of these transients need to be determined. **In addition, none of the devices suffered from Single Event Latchup.**

Surinder S. Seehra
Senior Staff Engineer
Lockheed Martin Commercial Space Systems
100 Campus Drive, Newtown, PA 18940

REVISIONS			
LTR	DESCRIPTION	DATE (YR-MO-DA)	APPROVED
A	Corrected title mis-spelling. Added cage code 88379 for device type 02. Removed footnote 3 from the Standrard Microcircuit Drawing Bulletin. -sld	10-01-20	Charles F. Saffle

REV																				
SHEET																				
REV																				
SHEET																				

REV STATUS OF SHEETS																
REV	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
SHEET	1	2	3	4	5	6	7	8	9	10	11	12	13	14		

PMIC N/A

PREPARED BY
Steve Duncan

CHECKED BY
Greg Cecil

APPROVED BY
Charles F. Saffle

DRAWING APPROVAL DATE
09-12-01

REVISION LEVEL
A

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
COLUMBUS, OHIO 43218-3990
http://www.dscc.dla.mil/

MICROCIRCUIT, HYBRID, VOLTAGE REGULATOR LOW DROPOUT, POSITIVE AND NEGATIVE, ADJUSTABLE

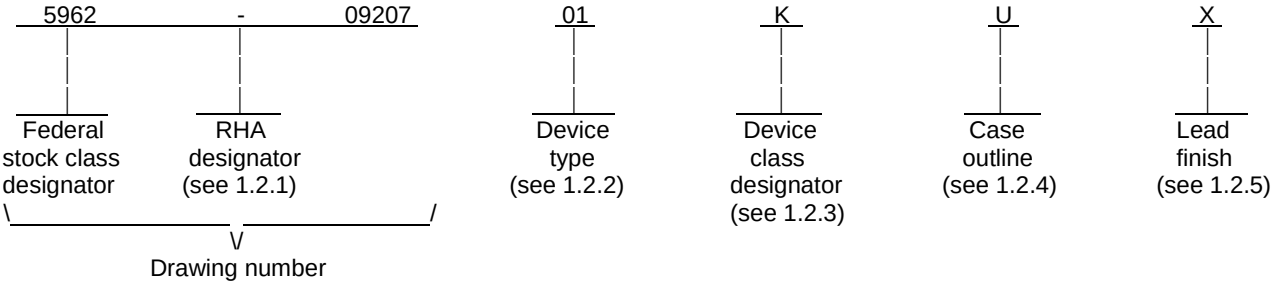
SIZE	CAGE CODE	
A	**67268**	**5962-09207**

SHEET 1 OF 14

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	8662	Voltage regulator, positive, low dropout, adjustable
02	8663	Voltage regulator, negative, low dropout, adjustable

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	3	Bottom terminal chip carrier, ceramic
Y	See figure 1	5	Bottom terminal chip carrier, ceramic

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

1.3 Absolute maximum ratings. 1/

Input voltage:	
Positive regulator:	
Device type 01	$25+V_{REF}$
Negative regulator:	
Device type 02	-35 V
Input-Output differential voltage:	
Positive regulator:	
Device type 01	25 V
Negative regulator:	
Device type 02	30 V
DC output current:	
Positive regulator:	
Device type 01	1.5 A
Operating junction temperature range	-55°C to +150°C
Junction temperature (T_J)	+150°C
Thermal resistance, junction-to-case (θ_{JC}) each regulator	3°C/W
Lead temperature (soldering, 10 seconds)	300°C
Storage temperature range	-65°C to +150°C

1.4 Recommended operating conditions.

Output voltage range:	
Postive voltage regulator:	
Device type 01	+1.275 V to +23 V dc
Negative voltage regulator:	
Device type 02	-2.45 V to -28 V dc
Case operating temperature range (T_C)	-55°C to +125°C

2. APPLICABLE DOCUMENTS

2.1 Government specification, standards, and handbooks. The following specification, standards, and handbooks form a part of this drawing to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

DEPARTMENT OF DEFENSE SPECIFICATIONS

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

DEPARTMENT OF DEFENSE STANDARDS

MIL-STD-883 - Test Method Standard Microcircuits.
MIL-STD-1835 - Interface Standard Electronic Component Case Outlines.

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.

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

2.2 Order of precedence. In the event of a conflict between the text of this drawing and the references cited herein, the text of this drawing takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

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 shall 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 Block diagram. The block diagram shall be as specified on figure 3.

3.2.4 Maximum power dissipation verses case temperature chart. The maximum power dissipation verses case temperature is specified on figure 4.

3.3 Electrical performance characteristics. Unless otherwise specified herein, the electrical performance characteristics are as specified in table I and shall apply over the full specified operating temperature range.

3.4 Electrical test requirements. The electrical test requirements shall be the subgroups specified in table II. The electrical tests for each subgroup are defined in table I.

3.5 Marking of device(s). Marking of device(s) shall be in accordance with MIL-PRF-38534. The device shall be marked with the PIN listed in 1.2 herein. In addition, the manufacturer's vendor similar PIN may also be marked.

3.6 Data. In addition to the general performance requirements of MIL-PRF-38534, the manufacturer of the device described herein shall maintain the electrical test data (variables format) from the initial quality conformance inspection group A lot sample, for each device type listed herein. Also, the data should include a summary of all parameters manually tested, and for those which, if any, are guaranteed. This data shall be maintained under document revision level control by the manufacturer and be made available to the preparing activity (DSCC-VA) upon request.

3.7 Certificate of compliance. A certificate of compliance shall be required from a manufacturer in order to supply to this drawing. The certificate of compliance (original copy) submitted to DSCC-VA shall affirm that the manufacturer's product meets the performance requirements of MIL-PRF-38534 and herein.

3.8 Certificate of conformance. A certificate of conformance as required in MIL-PRF-38534 shall be provided with each lot of microcircuits delivered to this drawing.

TABLE I. Electrical performance characteristics.

Test	Symbol	Conditions $-55°C \le T_C \le +125°C$ $P \le P_{MAX}$, I_{OUT} = 0.5 A unless otherwise specified	Group A subgroups	Device types	Limits		Unit
					Min	Max	
POSITIVE REGULATOR							
Reference voltage	V_{REF}	1.5 V ≤ (V_{IN} - V_{OUT}) ≤ 15 V, I_{LOAD} = 10 mA	1,2,3	01	1.210	1.275	V
Line regulation 1/	$\frac{\Delta VOUT}{\Delta VIN}$	1.5 V ≤ (V_{IN} - V_{OUT}) ≤ 15 V, I_{LOAD} = 10 mA	1,2,3	01		0.25	%
Load regulation 1/	$\frac{\Delta VOUT}{\Delta IOUT}$	10 mA ≤ I_{OUT} ≤ 1.0 A, (V_{IN} - V_{OUT}) = 3 V	1,2,3	01		0.4	%
Thermal regulation		30 ms pulse, T_C = +25°C	1	01		0.04	%/W
Dropout voltage	V_{DROP}	ΔV_{REF} = 1%, I_{OUT} = 1.0 A	1,2,3	01		1.30	V
Ripple rejection		I_{OUT} = 1.0 A, (V_{IN} - V_{OUT}) = 3 V, f = 120 Hz, C_{ADJ} = C_{OUT} = 25 µF	1,2,3	01	60		dB
Adjustment pin current	I_{ADJ}	T_C = +25°C	1	01		120	µA
Adjustment pin current change	ΔI_{ADJ}	10 mA ≤ I_{OUT} ≤ 1.0 A, 1.5 V ≤ (V_{IN} - V_{OUT}) ≤ 15 V	1,2,3	01		5	µA
Minimum load current 2/	I_{MIN}	(V_{IN} - V_{OUT}) = 25 V	1,2,3	01		10	mA
V_{REF} Long term stability 2/	$\frac{\Delta VOUT}{\Delta TIME}$	Burn-in: T_C = +125°C at 1000 hours minimum, tested at +25°C	1	01		0.3	%
NEGATIVE REGULATOR							
Reference voltage	V_{REF}	V_{IN} - V_{OUT} = -1.2 V to -28 V, 1 mA ≤ I_{OUT} ≤ 3 A, V_{OUT} = -5 V	1,3	02	-2.29	-2.45	V
Dropout Voltage	V_{DROP}	I_{OUT} = 0.5 A, V_{OUT} = -5 V	1,2,3	02		-0.425	V
		I_{OUT} = 3 A, V_{OUT} = -5 V				-1.05	

See footnotes at end of table.

TABLE I. Electrical performance characteristics - Continued.

Test	Symbol	Conditions $-55°C \le T_C \le +125°C$ $P \le P_{MAX}$, I_{OUT} = 0.5 A unless otherwise specified	Group A subgroups	Device types	Limits		Unit
					Min	Max	
NEGATIVE REGULATOR - CONTINUED							
Ripple rejection		I_{OUT} = 1.0 A, $(V_{IN} - V_{OUT})$ = 3 V, f = 120 Hz, $C_{ADJ} = C_{OUT}$ = 25 µF	1,2,3	02	60		dB
Line regulation 1/	$\frac{\Delta VOUT}{\Delta VIN}$	1 V $\le (V_{IN} - V_{OUT}) \le$ 20 V, V_{OUT} = -5 V	1,2,3	02		0.02	%/V
Load regulation 1/	$\frac{\Delta VOUT}{\Delta IOUT}$	5 mA $\le I_{OUT} \le$ 3 A, $(V_{IN} - V_{OUT})$ = -1.5 V to -10 V, V_{OUT} = -5 V	1,2,3	02		0.8	%
Thermal regulation 2/		$V_{IN} - V_{OUT}$ = 10 V, I_{OUT} = 5 mA to 2 A, T_C = +25°C	1	02		0.014	%/W
Minimum input voltage	V_{IN} MIN	I_{OUT} = 3 A, $V_{OUT} = V_{REF}$	1,2,3	02		-4.5	V
Internal Current limit	I_{MAX}	-1.5 V $\le (V_{IN} - V_{OUT}) \le$ -10 V, T_C = +25°C	1	02	3.3	4.55	A
		$(V_{IN} - V_{OUT})$ =-15 V, T_C = +25°C			2.0	4.5	
		$(V_{IN} - V_{OUT})$ = -20 V, T_C = +25°C			1.0	3.1	
		$(V_{IN} - V_{OUT})$ = -30 V , T_C = +25°C 2/			0.2	1.6	
External current limit	I_{LIM}	R_{LIM} = 5 kΩ	1,2,3	02	2.7	3.7	A
		R_{LIM} = 15 kΩ			0.9	1.75	
Quiescent supply current	I_Q	I_{OUT} = 5 mA, $V_{OUT} = V_{REF}$, (-4 V $\le V_{IN} \le$ -25 V)	1,2,3	02		3.5	mA
Supply current change with load	$I_{Q\Delta}$	$(V_{IN} - V_{OUT})$ = .25 V +(.25Ω x I_{OUT})	1,2,3	02		35	mA/A
		$(V_{IN} - V_{OUT}) \ge$ -2 V				21	

1/ Regulation is measured at a constant junction temperature, using pulse testing with a low duty cycle. Changes in output voltage due to heating effects are covered under the specification for thermal regulation. Measurements taken at the output lead must be adjusted for lead resistance.

2/ Parameter shall be tested at intial device characterization and after design or process changes. Parameter shall be guaranteed to the limits specified in table I for all lots not specifically tested.

Case X

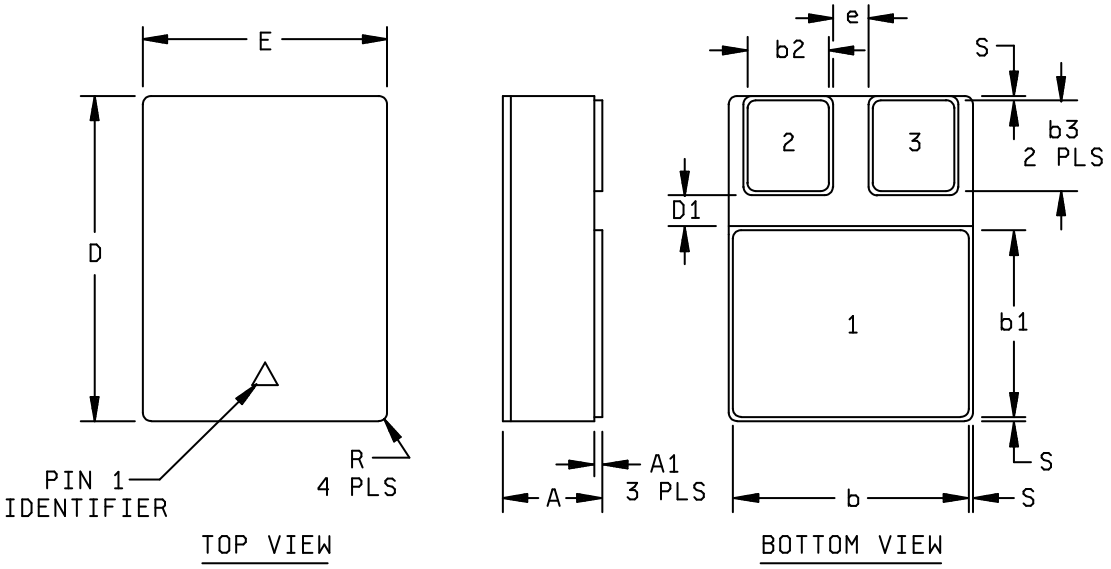


FIGURE 1. Case outline(s).

STANDARD MICROCIRCUIT DRAWING	SIZE A		5962-09207
DEFENSE SUPPLY CENTER COLUMBUS COLUMBUS, OHIO 43218-3990		REVISION LEVEL A	SHEET 7

Symbol	Inches		Millimeters	
	Min	Max	Min	Max
A		.127		3.23
A1	.010	.020	.25	.51
b	.281	.291	7.14	7.39
b1	.220	.230	5.59	5.84
b2	.090	.100	2.29	2.54
b3	.115	.125	2.92	3.18
D		.405		10.29
D1	.030		7.62	
E		.301		7.65
e	.030		7.62	
R	.015	.025	.38	.64
S		.010		.25

NOTE:
1. The U.S. 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. The package and lid are electrically isolated.

FIGURE 1. Case outline(s) - Continued.

Case Y

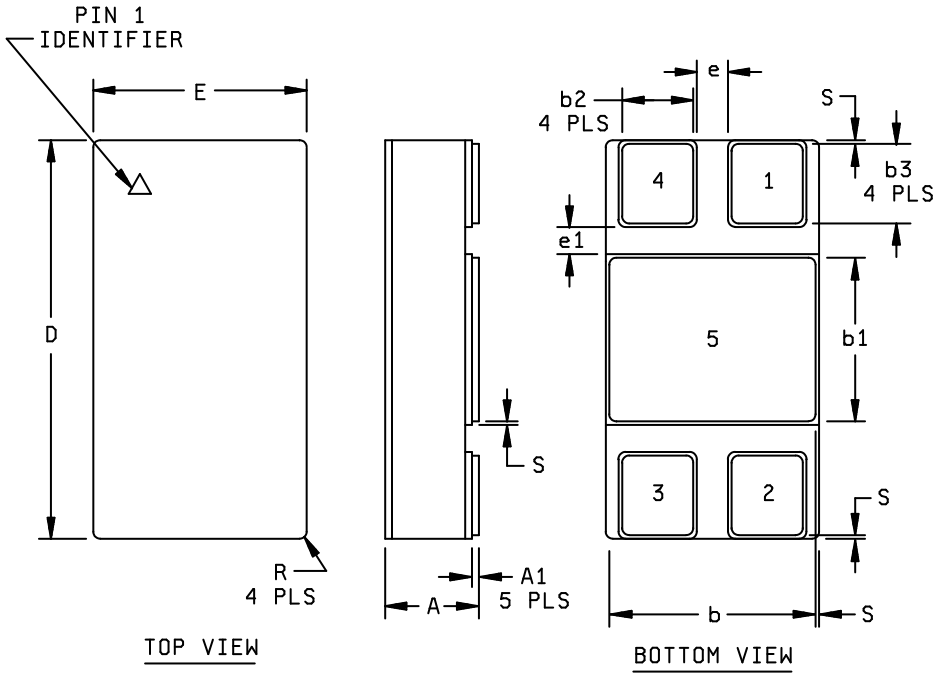


FIGURE 1. Case outlines(s) - Continued.

Symbol	Inches		Millimeters	
	Min	Max	Min	Max
A		.127		3.23
A1	.010	.020	.25	.51
b	.281	.291	7.14	7.39
b1	.220	.230	5.59	5.84
b2	.090	.100	2.29	2.54
b3	.115	.125	2.92	3.18
D		.550		12.83
E		.301		7.65
e	.030		7.62	
e1	.030		7.62	
R	.015	.025	.38	.64
S		.010		.25

NOTE:
1. The U.S. 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. The package and lid are electrically isolated.

FIGURE 1. Case outline(s) - Continued.

Device types	01	02
Case outlines	X	Y
Terminal number	Terminal symbol	
1	POS V_{OUT}	NEG Feedback
2	POS V_{IN}	NEG Reference
3	POS Adj	NEG V_{OUT}
4	---	NEG Gnd
5	---	NEG V_{IN}

FIGURE 2. Terminal connections.

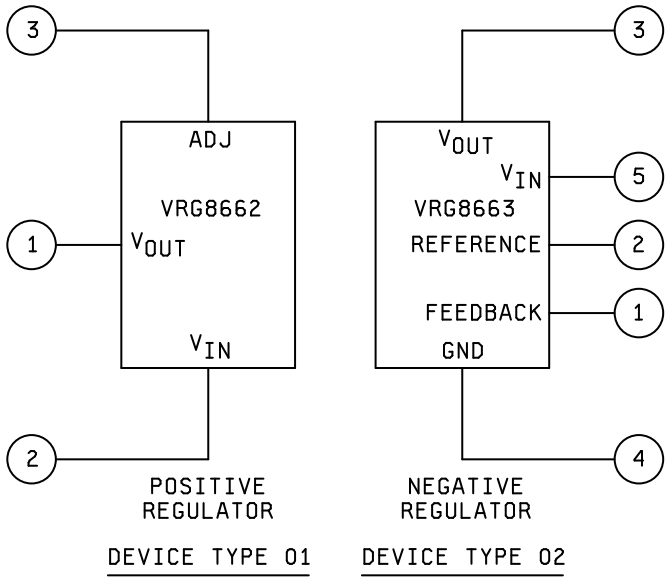


FIGURE 3. Block diagram.

Case Temperature (°C)	Maximum power dissipation (Watts)
0	50.00
5	48.33
10	46.67
15	45.00
20	43.33
25	41.67
30	40.00
35	38.33
40	36.67
45	35.00
50	33.33
55	31.67
60	30.00
65	28.33
70	26.67
75	25.00
80	23.33
85	21.67
90	20.00
95	18.33
100	16.67
105	15.00
110	13.33
115	11.67
120	10.00
125	8.33
130	6.67
135	5.00
140	3.33
145	1.67
150	0.00

FIGURE 4. Maximum power dissipation verses case temperature chart.

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
Group A test requirements	1,2,3
Group C end-point electrical parameters	1,2,3
End-point electrical parameters for Radiation Hardness Assurance (RHA) devices	Not applicable

* PDA applies to subgroup 1.

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 DSCC-VA or the acquiring activity upon request. Also, the test circuit shall specify the inputs, outputs, biases, and power dissipation, as applicable, in accordance with the intent specified in method 1015 of MIL-STD-883.

(2) T_A as specified in accordance with table I of method 1015 of MIL-STD-883.

b. Interim and final electrical test parameters shall be as specified in table II herein, except interim electrical parameter tests prior to burn-in are optional at the discretion of the manufacturer.

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 4, 5, 6, 7, 8A, 8B, 9, 10, and 11 shall be omitted.

4.3.2 Group B inspection (PI). Group B inspection shall be in accordance with MIL-PRF-38534.

4.3.3 Group C inspection (PI). Group C inspection shall be in accordance with MIL-PRF-38534 and as follows:

a. End-point electrical parameters shall be as specified in table II herein.

b. Steady-state life test, method 1005 of MIL-STD-883.

(1) Test condition A, B, C, or D. The test circuit shall be maintained by the manufacturer under document revision level control and shall be made available to either DSCC-VA or the acquiring activity upon request. Also, the test circuit shall specify the inputs, outputs, biases, and power dissipation, as applicable, in accordance with the intent specified in method 1005 of MIL-STD-883.

(2) T_A as specified in accordance with table I of method 1005 of MIL-STD-883.

(3) Test duration: 1,000 hours, except as permitted by method 1005 of MIL-STD-883.

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

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

5. PACKAGING

5.1 Packaging requirements. The requirements for packaging shall be in accordance with MIL-PRF-38534.

6. NOTES

6.1 Intended use. Microcircuits conforming to this drawing are intended for use for Government microcircuit applications (original equipment), design applications, and logistics purposes.

6.2 Replaceability. Microcircuits covered by this drawing will replace the same generic device covered by a contractor-prepared specification or drawing.

6.3 Configuration control of SMD's. All proposed changes to existing SMD's will be coordinated as specified in MIL-PRF-38534.

6.4 Record of users. Military and industrial users shall inform Defense Supply Center Columbus (DSCC) when a system application requires configuration control and the applicable SMD. DSCC will maintain a record of users and this list will be used for coordination and distribution of changes to the drawings. Users of drawings covering microelectronic devices (FSC 5962) should contact DSCC-VA, telephone (614) 692-0544.

6.5 Comments. Comments on this drawing should be directed to DSCC-VA, Columbus, Ohio 43218-3990, or telephone (614) 692-1081.

6.6 Sources of supply. Sources of supply are listed in MIL-HDBK-103 and QML-38534. The vendors listed in MIL-HDBK-103 and QML-38534 have submitted a certificate of compliance (see 3.7 herein) to DSCC-VA and have agreed to this drawing.

STANDARD MICROCIRCUIT DRAWING BULLETIN

DATE: 10-01-20

Approved sources of supply for SMD 5962-09207 are listed below for immediate acquisition information only and shall be added to MIL-HDBK-103 and QML-38534 during the next revisions. MIL-HDBK-103 and QML-38534 will be revised to include the addition or deletion of sources. The vendors listed below have agreed to this drawing and a certificate of compliance has been submitted to and accepted by DSCC-VA. This information bulletin is superseded by the next dated revisions of MIL-HDBK-103 and QML-38534. DSCC maintains an online database of all current sources of supply at http://www.dscc.dla.mil/Programs/Smcr/.

Standard microcircuit drawing PIN 1/	Vendor CAGE number	Vendor similar PIN 2/
5962-0920701KXA 5962-0920701KXC	88379 88379	VRG8662-201-2S VRG8662-201-1S
5962-0920702KYA 5962-0920702KYC	88379 88379	VRG8663-201-2S VRG8663-201-1S

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/ This part is not available at this time.

Vendor CAGE number	Vendor name and address
88379	Aeroflex Plainview Incorporated, (Aeroflex Microelectronics Solutions) 35 South Service Road Plainview, NY 11803-4193