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.

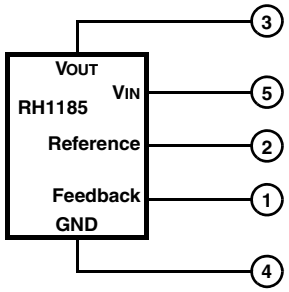


FIGURE 1 – BLOCK DIAGRAM / SCHEMATIC

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
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

ELECTRICAL PERFORMANCE CHARACTERISTICS 2/ (con't)

PARAMETER	SYM	CONDITIONS ($P \leq P_{MAX}$)	MIN	MAX	UNITS
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}.

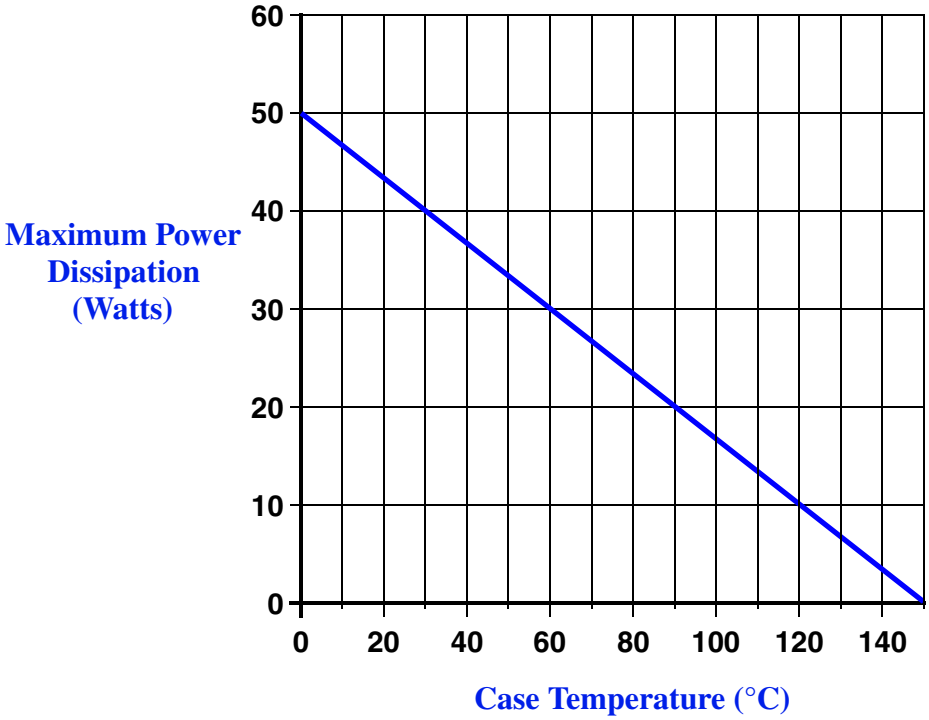


FIGURE 2 – MAXIMUM POWER vs CASE TEMPERATURE

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.

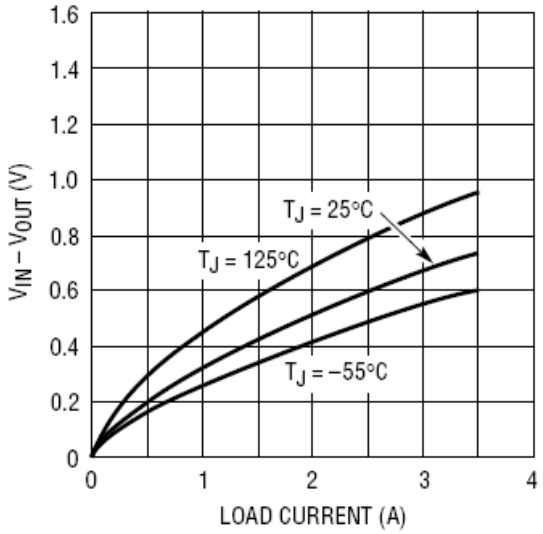


FIGURE 3 – RH1185 DROPOUT VOLTAGE TYPICAL CURVE

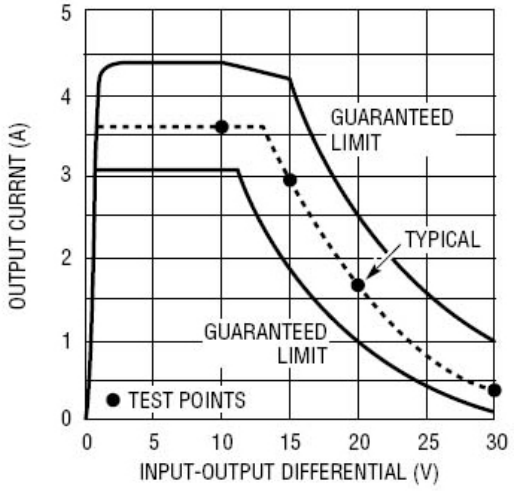


FIGURE 4 – RH1185 INTERNAL CURRENT LIMIT

The RH1185 output voltage is set by two external resistors. 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:

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

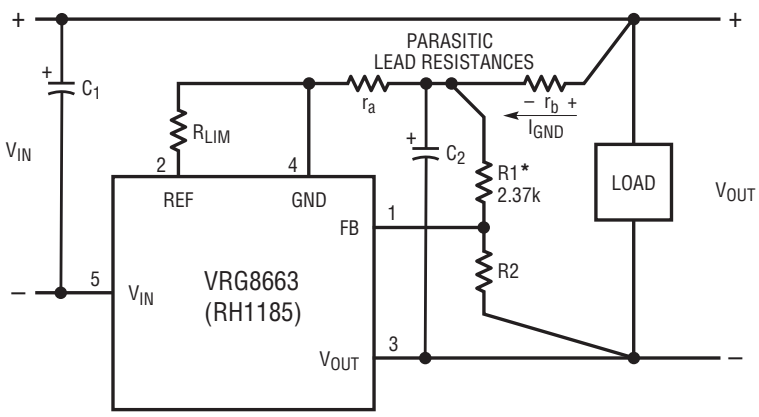
for R1 = 2.37k and V_{REF} = 2.37V, this reduces to:

$$R2 = \frac{V_{OUT} - 2.37}{10^{-3}}$$

suggested values of 1% resistors are shown.

V_{OUT}	R2 WHEN R1 = 2.37k
2.5V	130Ω
3.3V	930Ω
5V	2.67k
12V	9.76k
15V	12.7k

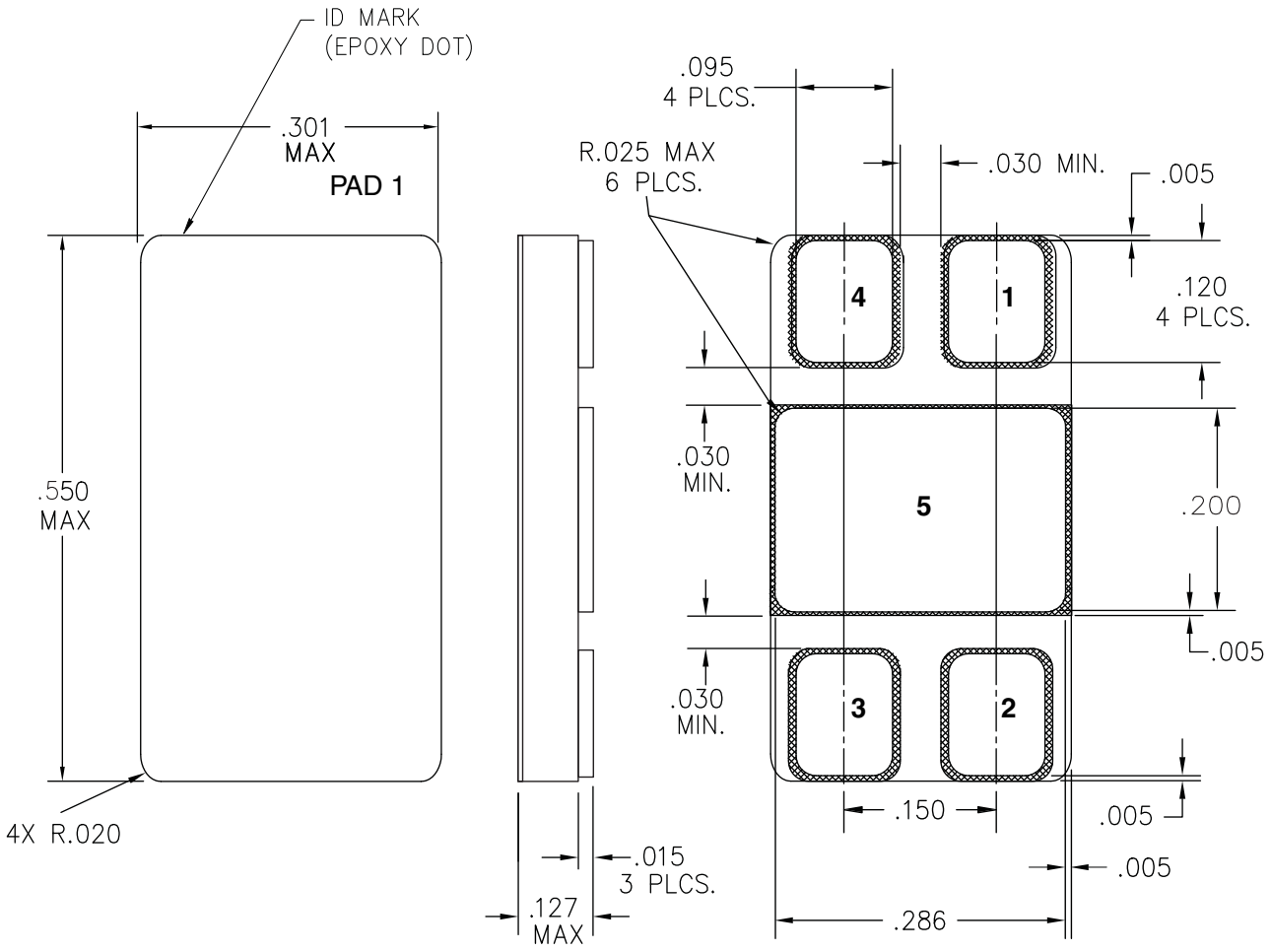
SETTING OUTPUT VOLTAGE



*R1 SHOULD BE CONNECTED DIRECTLY TO GROUND LEAD, NOT TO THE LOAD, SO THAT $r_a \approx 0\Omega$. 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.)

PLAINVIEW, NEW YORK
Toll Free: 800-THE-1553
Fax: 516-694-6715

INTERNATIONAL
Tel: 805-778-9229
Fax: 805-778-1980

NORTHEAST
Tel: 603-888-3975
Fax: 603-888-4585

SE AND MID-ATLANTIC
Tel: 321-951-4164
Fax: 321-951-4254

WEST COAST
Tel: 949-362-2260
Fax: 949-362-2266

CENTRAL
Tel: 719-594-8017
Fax: 719-594-8468

www.aeroflex.com info-ams@aeroflex.com

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