Voltage Regulator

VRG8669

2.5A ULDO Adjustable Positive Voltage Regulator

Datasheet

Cobham.com/HiRel

November 2, 2017

The most important thing we build is trust

FEATURES

- Manufactured using LINEAR TECHNOLOGY Space Qualified RH3083 die
- Radiation performance
  - Total dose: 100 krad(Si), Dose rate = 50 rad(Si)/s
  - ELDRS: 100 krad(Si), Dose rate ≤ 0.01 rad(Si)/s
- Current Limit with Foldback and Over-temperature protection
- Input voltage range: 1.2V to 23V
- Output voltage adjustable: 0V to 18V
- Outputs may be paralleled for higher current
- Post irradiated Dropout voltage @ +25°C, $V_{CONTROL}$ ≥ 2 Volts:
  - 0.66V @ 2.5Amps
  - 0.225V @ 1.0Amps
- Output current: 2.5Amps
- Packaging – Hermetic Ceramic
  - Hermetic Surface Mount Power
  - 5 Pads, .550"L x .301"W x .127"Ht
  - Weight - 2.0 gm max
- Designed for aerospace and high reliability space applications
- **Radiation Hardness Assurance Plan: DLA Certified to MIL-PRF-38534, Appendix G.**

DESCRIPTION

The VRG8669 consists of a Positive Adjustable (RH3083) ULDO voltage regulator capable of supplying 2.5Amps over the output voltage range as defined under recommended operating conditions. The VRG8669 offers excellent line and load regulation specifications and ripple rejection. Dropout (V_{IN} - V_{OUT}) decreases at lower load currents.

The VRG8669 serves a wide variety of applications including SCSI-2 Active Terminator, High Efficiency Linear Regulators, Post Regulators for Switching Supplies, Constant Current Regulators, Battery Chargers and Microprocessor Supply.

The VRG8669 has been specifically designed to meet exposure to radiation environments and is configured for an SMD power package. It is guaranteed operational with a case operating temperature from -55°C to +125°C. Available screened to MIL-STD-883, the VRG8669 is ideal for demanding military and space applications.

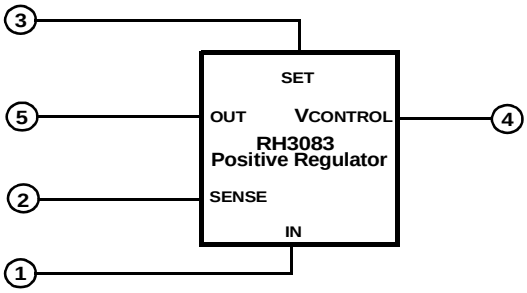


FIGURE 1 – BLOCK DIAGRAM / SCHEMATIC

ABSOLUTE MAXIMUM RATINGS

Parameter (Voltages are Relative to V_{OUT})	Rating	Units
Input Voltage	+18, -0.3	V_{DC}
Input Voltage (No Overload or Short Circuit)	+23, -0.3	V_{DC}
$V_{CONTROL}$	±28	V_{DC}
SET Pin Current	±25	mA
SET Pin Voltage	±10	V_{DC}
Output Short Circuit Duration	Indefinite	-
Lead temperature (soldering 10 Sec)	300	°C
ESD 1/	2,000 - 3,999	V
Operating Junction Temperature Range	-55 to +150	°C
Storage Temperature Range	-65 to +150	°C
Thermal Resistance (Junction to Case) Θ_{JC}	2.5	°C/W

1/ Meets ESD testing per MIL-STD-883, method 3015, Class 2.
NOTICE: Stresses above those listed under "Absolute Maximum Ratings" 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
Input Voltage (Voltages are Relative to V_{OUT})	1 to 23	V_{DC}
$V_{CONTROL}$ (Voltages are Relative to V_{OUT})	1.6 to 25	V_{DC}
Input Output Differential	0.5 to 18	V_{DC}
Case Operating Temperature Range	-55 to +125	°C

ELECTRICAL PERFORMANCE CHARACTERISTICS

Unless otherwise specified: -55°C ≤ Tc ≤ +125°C.

Parameter	Symbol	Conditions ($P \leq P_{MAX}$)	Temp	Min	Max	Units
Set Pin Current	I_{REF}	V_{IN} = 2V, $V_{CONTROL}$ = 3V, Vout = 1V 1 mA ≤ I_{LOAD} ≤ 2.5A, 2/	All	49.0	51.5	µA
		V_{IN} = 1V, $V_{CONTROL}$ = 2V, I_{LOAD} = 1mA 1/ 3/ 4/	25°C	49	51	
Output Offset Voltage (V_{OUT} - V_{SET})	V_{OS}	V_{IN} = 2V, $V_{CONTROL}$ = 3V, V_{OUT} = 1V, I_{LOAD} = 1mA 2/	All	-6.0	6.0	mV
		V_{IN} = 1V, $V_{CONTROL}$ = 2V, I_{LOAD} = 1mA 1/ 3/ 4/	25°C	-4.5	4.5	

ELECTRICAL PERFORMANCE CHARACTERISTICS

Unless otherwise specified: -55°C ≤ Tc ≤ +125°C.

Parameter	Symbol	Conditions (P ≤ PMAX)	Temp	Min	Max	Units
Line Regulation	ΔVOS	2V ≤ VIN ≤ 24V, 3V ≤ VCONTROL ≤ 26V, VOUT = 1V, ILOAD = 1mA 2/	25°C	-0.07	0.07	mV/V
		2V ≤ VIN ≤ 24V, 3V ≤ VCONTROL ≤ 26V, VOUT = 1V, ILOAD = 5mA 2/	-55°C +125°C	-0.07	0.07	
		1V ≤ VIN ≤ 23V, 2V ≤ VCONTROL ≤ 25V, ILOAD = 1mA 1/ 3/ 4/	25°C	-0.03	0.03	
Load Regulation	ΔVOS	VIN = 2V, VCONTROL = 3V, VOUT = 1V, ILOAD = 5mA to 2.5A 2/	All	-10.0	10.0	mV
		ILOAD = 5mA to 2.5A 1/ 3/ 4/	25°C	-3.5	3.5	
VCONTROL Dropout Voltage 5/	VCDROP	ILOAD = 2.5A, VIN = 2V 2/	All	-	1.65	V
		ILOAD = 2.5A, VIN = 1V 1/ 3/ 4/	25°C	-	1.53	
		ILOAD = 1A, VIN = 1V 1/ 3/ 4/	25°C	-	1.48	
VIN Dropout Voltage 5/	VINDROP	ILOAD = 2.5A, VCONTROL = 3V 2/	All	-	0.75	V
		ILOAD = 2.5A, VCONTROL = 2V 1/ 3/ 4/	25°C	-	0.66	
		ILOAD = 1.0A, VCONTROL = 2V 1/ 3/ 4/	25°C		0.225	
Current Limit	IMAX	VIN = VCONTROL = +5V, VOUT = 1V, 30msec pulsed 2/ 6/	25°C	2.8	-	A
		VIN = VCONTROL = +5V, VSET = 0V, VOUT = -0.1V 1/ 3/ 4/	25°C			
Minimum Load Current 1/ 3/ 4/	IMIN	VCONTROL = 25V, VIN = 23V	All	-	1.0	mA
Ripple Rejection 2/	-	VIN = 13V, VOUT = 10V, VCONTROL = 3V, VAC = 1VP-P, ILOAD = 0.2A, f = 120Hz, COUT = 10µF, CSET = 0.1µF	All	60	-	dB

Notes:
1/ Specification reflects Total Dose exposure to 100 krad(Si) @+25°C.
2/ Production test conditions: VIN and VCONTROL are the supply voltages applied during testing, referenced to ground.
3/ Irradiation test conditions: VIN and VCONTROL are relative to VOUT. See the Linear Technology (RH3083) datasheet for +25°C limits to determine deviations due to irradiation.
4/ Not production tested. Shall be guaranteed by design, characterization, or correlation to other tested parameters.
5/ Dropout results from either minimum control voltage, VCONTROL, or minimum input voltage, VIN, both specified with respect to VOUT. These specifications represent the minimum input-to-output differential voltage required to maintain regulation.
6/ Pulsed @ <10% duty cycle @ +25°C for characterization only.

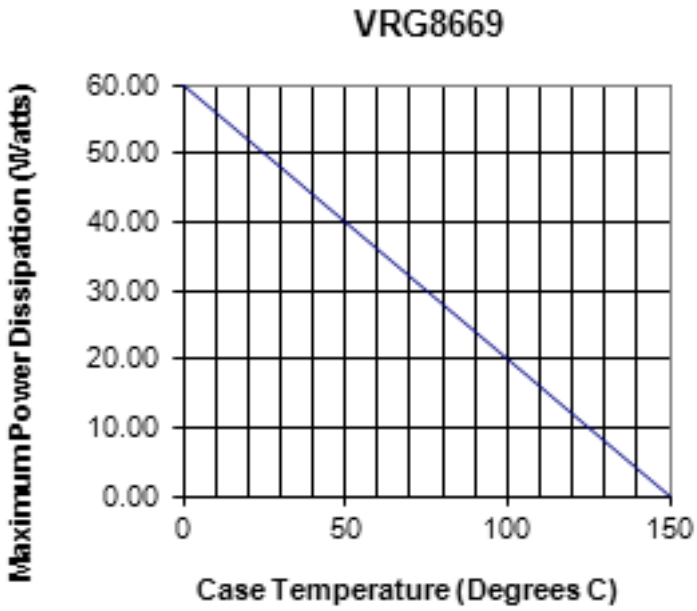


FIGURE 2 – MAXIMUM POWER vs CASE TEMPERATURE

The maximum Power dissipation is limited by the thermal shutdown function of the regulator chip in the VRG8669. The graph above represents the achievable power before the chip shuts down. The line in the graph represents the maximum power dissipation of the VRG8669. This graph is based on the maximum junction temperature of 150°C and a thermal resistance (Θ_{JC}) of 2.5°C/W.

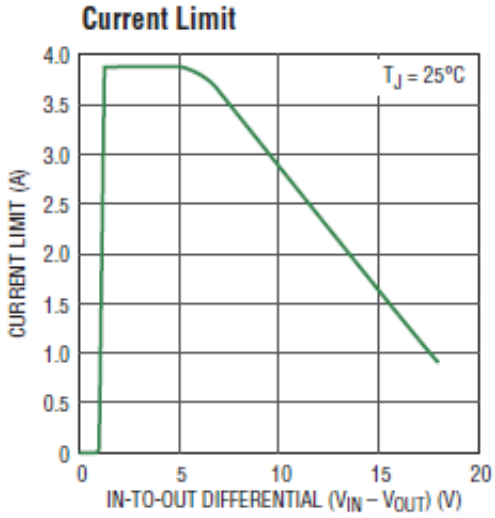


FIGURE 3 – RH3083 TYPICAL CURRENT LIMIT

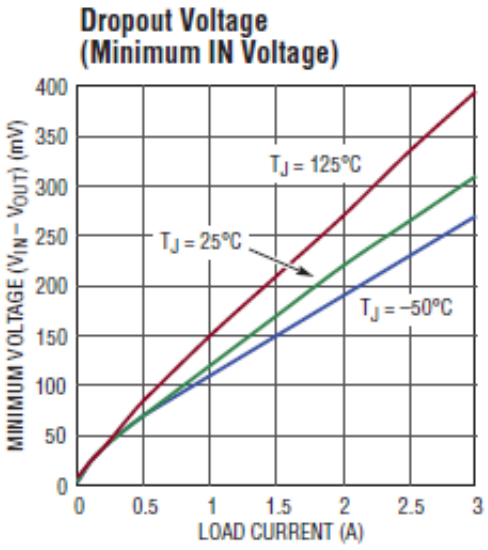


FIGURE 4 – RH3083 TYPICAL DROPOUT VOLTAGE CURVE ($V_{CONTROL}$ ≥ 1.6V)

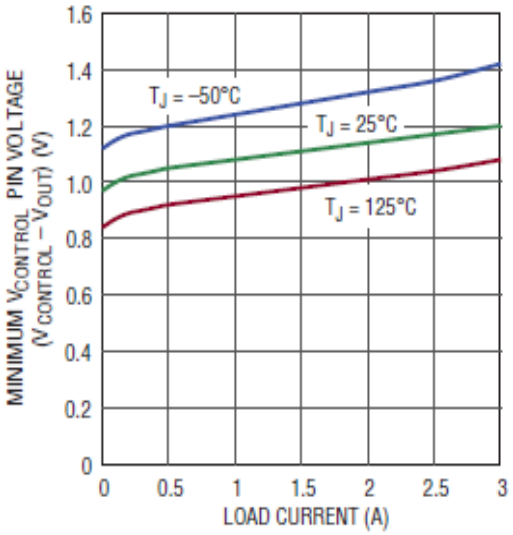


FIGURE 5 – RH3083 TYPICAL VCONTROL DROPOUT

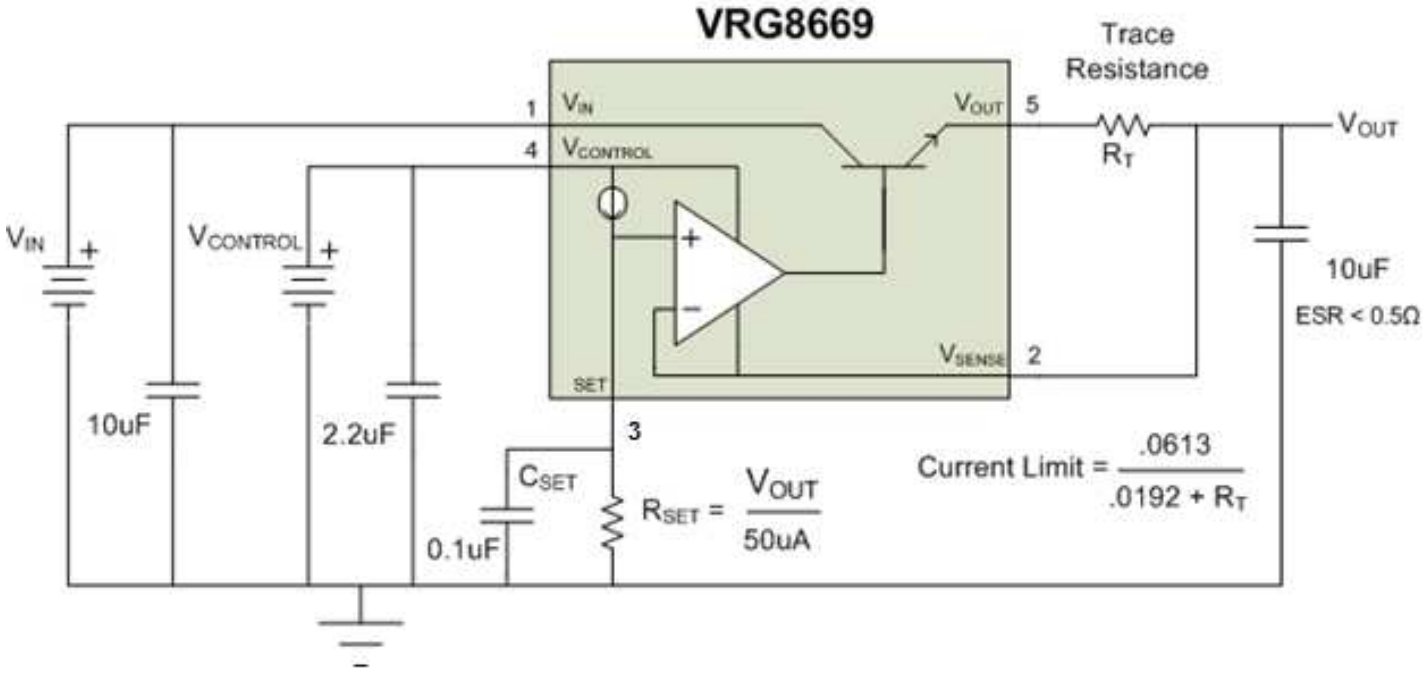
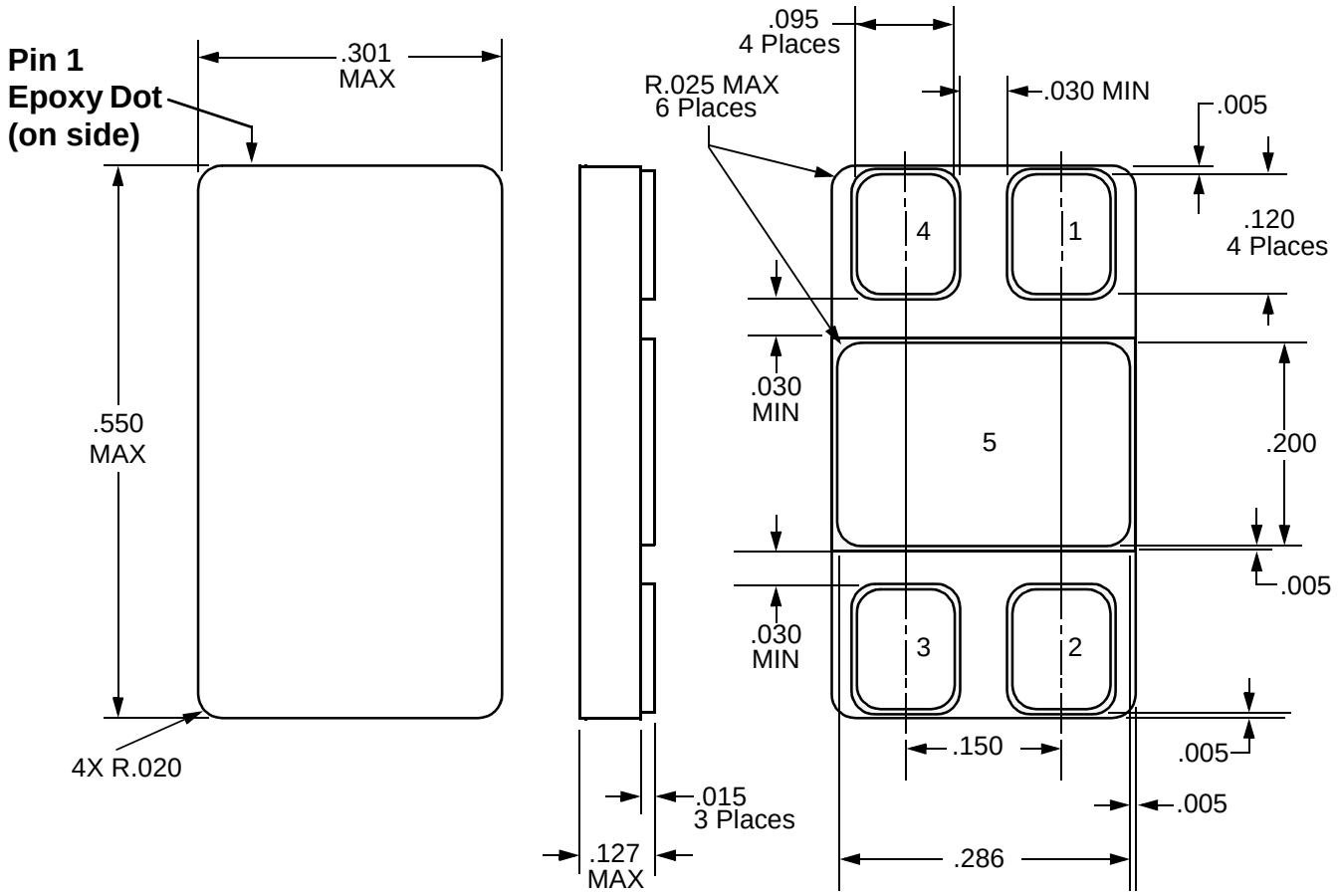


FIGURE 6 – BASIC VRG8669 ADJUSTABLE REGULATOR APPLICATION



NOTES:

1. Package & Lid are electrically isolated from signal pads

FIGURE 7 – PACKAGE OUTLINE — SURFACE MOUNT

ORDERING INFORMATION

Model	DLA SMD #	Screening	Package
VRG8669-7	-	Commercial Flow, +25°C testing only	SMD Power Pkg
VRG8669-S	-	Military Temperature, -55°C to +125°C Screened in accordance with the individual Test Methods of MIL-STD-883 for Space Applications	
VRG8669-901-1S	5962R1420101KYC	In accordance with DLA Certified RHA Program Plan to RHA Level "R", 100 krad(Si)	
VRG8669-901-2S	5962R1420101KYA		

REVISION HISTORY

Date	Revision	Change Description
03/31/2016	G	Import into Cobham format
06/21/2016	H	Add note 5/ to Load Regulation in the Electrical Performance Characteristics Table. Change Load Reg Iload to 1.0 to align with Note 5. Align Dimensions in Features with Package Outline.
11/2/2017	J	Change the heading from 'Released Datasheet' to 'Datasheet', Change the Features items to match LT publication for TID, ELDRS and Output, Revise the Absolute Max table, the Recommended table and the Electrical Performance Table to break out the irradiation conditions and apply the actual production test conditions. Update the Notes section.

Datasheet Definition

Advanced Datasheet - Product In Development

Preliminary Datasheet - Shipping Prototype

Datasheet - Shipping QML & Reduced Hi-Rel

For detailed performance characteristic curves, applications information and typical applications, see the latest LINEAR TECHNOLOGY datasheet for their RH3083, which is available on-line at www.linear.com.

EXPORT CONTROL:

This product is controlled for export under the Export Administration Regulations (EAR), 15 CFR Parts 730-774.
A license from the Department of Commerce may be required prior to the export of this product from the United States.

Cobham Semiconductor Solutions
35 S. Service Road
Plainview, NY 11803

E: info-ams@cobham.com
T: 800 645 8862

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