DATASHEET

REV J: 04/05/22

SCD8609

Dual 1.5A Adjustable Negative Voltage Regulators

VRG8609/10

Features

- Manufactured using Linear Technology Corporation ® Space Qualified RH137 die
- Radiation performance
  - Total dose: 100 krad(Si), Dose rate = 50-300 rad(Si)/s
  - ELDRS: 50 krad(Si), Dose rate ≤ 10 mrad(Si)/S
- Thermal shutdown
- Output voltage adjustable: -1.25V to -27V
- 3-Terminal
- Output current: 1.5A
- Voltage reference: -1.25V
- Load regulation: 1.0% max
- Line regulation: 0.05% max
- Ripple rejection: >66dB
- Packaging – Hermetic metal
  - Thru-hole or Surface mount
  - 6 Leads, .655"L x .415"W x .200"Ht
  - Power package
  - Weight - 5 gm max
- Designed for aerospace and high reliability space applications
- **Radiation Hardness Assurance Plan: DLA Certified to MIL-PRF-38534, Appendix G.**

Description

The VRG8609/10 consists of two negative (RH137) voltage regulators each capable of supplying in excess of 1.5Amps over the output voltage range as defined under recommended operating conditions. Each regulator is exceptionally easy to set-up, requiring only 2 external resistors to set the output voltage. The module design has been optimized for excellent regulation and low thermal transients. There is full electrical isolation between the regulators and each regulator to the package.

Further, the VRG8609/10 features internal current limiting, thermal shutdown and safe-area compensation, making them virtually blowout-proof against overloads. The VRG8609/10 serves a wide variety of applications including local on-card regulation, programmable output voltage regulation or precision current regulation.

The VRG8609/10 has been specifically designed to meet exposure to radiation environments. The VRG8609 is configured for a Thru-Hole 6 lead metal power package and the VRG8610 is configured for a Surface Mount 6 lead metal power package. It is guaranteed operational from -55°C to +125°C. Available screened to MIL-STD-883, the VRG8609/10 is ideal for demanding military and space applications.

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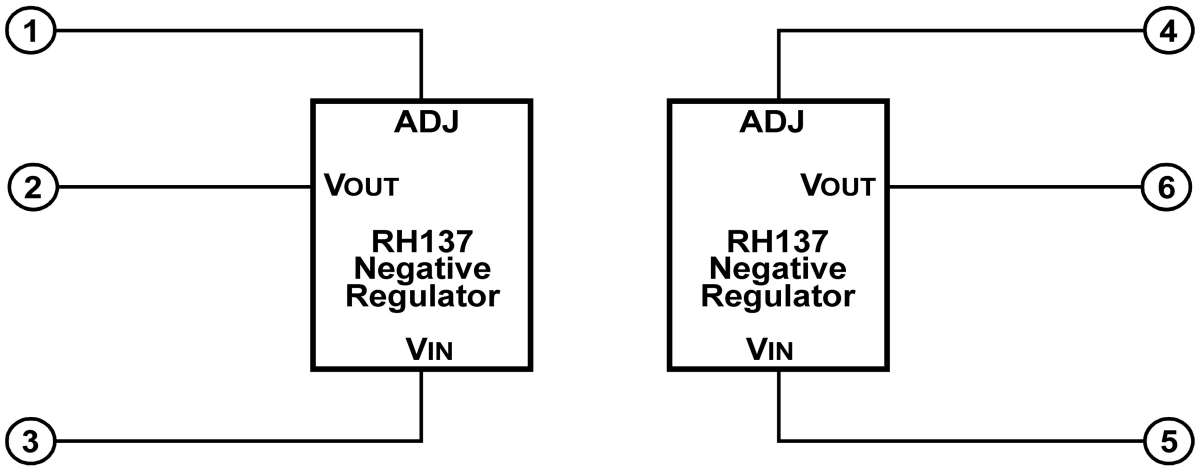

Figure 1 - Block Diagram / Schematic

Absolute Maximum Ratings

Parameter	Range	Units
Operating (Junction) Temperature Range	-55 to +150	°C
Lead Temperature (soldering, 10 sec)	300	°C
Storage Temperature Range	-65 to +150	°C
Input-Output Voltage Differential	30 (Neg)	V
Thermal Resistance (junction to case Θ_{JC}) each, Pos. & Neg.	5	°C/W
ESD Rating	1.999 1/	KV

1) Meets ESD testing per MIL-STD-883, method 3015, Class 1C.

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 affect device reliability.

Recommended Operating Conditions

Parameter	Range	Units
Output Voltage Range	-1.3 to -27	V_{DC}
Case Operating Temperature Range	-55 to +125	°C

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Electrical Performance Characteristics 1/

Parameter	SYM	Conditions ($P \le P_{MAX}$)	MIN	MAX	Units
Reference Voltage 4/	V_{REF}	$3V \le (V_{IN} - V_{OUT}) \le V_{DIFF\ MAX}$, $10mA \le I_{OUT} \le I_{MAX}$	-1.200	-1.300	V
Line Regulation 2/, 4/	$\frac{\Delta V_{OUT}}{\Delta V_{IN}}$	$3V \le (V_{IN} - V_{OUT}) \le 30V$, $I_{OUT} = 10mA$	-	0.05	%/V
Load Regulation 2/, 4/	$\frac{\Delta V_{OUT}}{\Delta V_{IN}}$	$10mA \le I_{OUT} \le I_{MAX}$, $V_{OUT} \le 5V$ $10mA \le I_{OUT} \le I_{MAX}$, $V_{OUT} \ge 5V$	- -	25 1.0	mV %
Thermal Regulation		$I_{OUT} = 1.5A$, $(V_{IN} - V_{OUT}) = 13.3V$, 20ms Pulse, 20W, Tc = +25°C	-	0.02	%/W
Ripple Rejection		$V_{OUT} = -10V$, f = 120Hz, $C_{ADJ} = 10\mu F$	66	-	dB
Adjustment Pin Current 4/	I_{ADJ}	$I_{OUT} = 10mA$, $3V \le (V_{IN} - V_{OUT}) \le 30V$	-	100	µA
Adjustment Pin Current Change 4/	ΔI_{ADJ}	$3V \le (V_{IN} - V_{OUT}) \le 30V$, $10mA \le I_{OUT} \le I_{MAX}$	-	5	µA
Minimum Load Current 3/ 4/	I_{MIN}	$(V_{IN} - V_{OUT}) = 30V$	-	5	mA
		$(V_{IN} - V_{OUT}) \le 10V$		3	
Current Limit 4/	I_{MAX}	$(V_{IN} - V_{OUT}) \le 15V$	1.5	-	A
		$(V_{IN} - V_{OUT}) = 30V$, 5/	0.24	-	
Long Term Stability 3/	$\frac{\Delta V_{OUT}}{\Delta V_{TIME}}$	Tc = +125°C	-	1	%
Thermal Resistance, each Regulator (Junction to Case) 3/	Θ_{JC}		-	5	°C/W

Notes:

1) Unless otherwise specified, these specifications apply for, (Vin - Vout) = 5V, Iout = 0.5A and -55°C < Tc < +125°C.
2) 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.
3) Not tested. Shall be guaranteed to the specified limits.
4) Specification derated to reflect High Dose Rate (1019 condition A) to 100 krad(Si) and Low Dose Rate (1019 condition D) to 50 krad(Si), @ +25°C.
5) Pulsed @ < 10% duty cycle @ +25°C.

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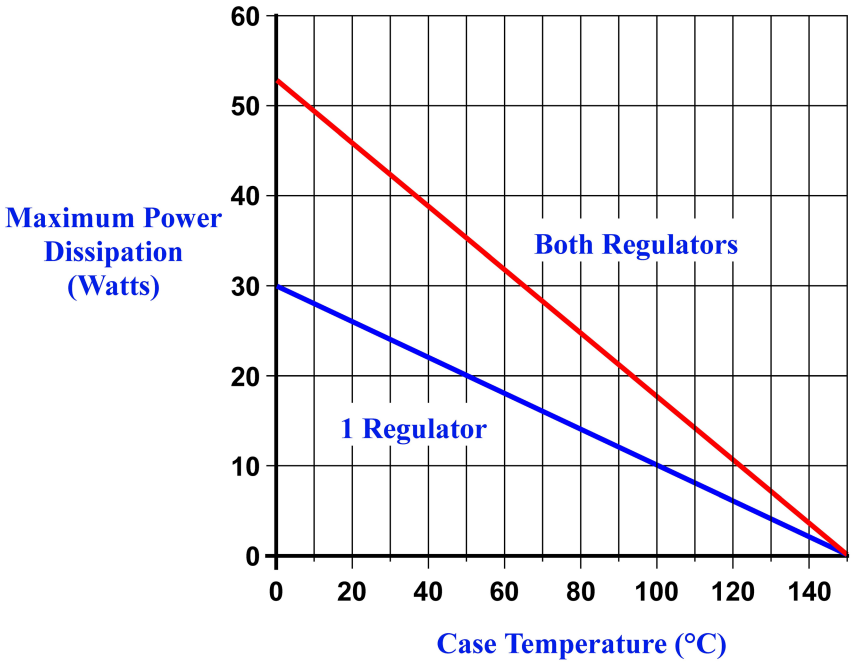

Figure 2 - Maximum Power vs Case Temperature

The maximum Power dissipation is limited by the thermal shutdown function of each regulator chip in the VRG8609/10. The graph above represents the achievable power before the chip shuts down. The first line in the graph represents the maximum power dissipation of the VRG8609/10 with one regulator on (the other off) and the other line represents both regulators on dissipating equal power. If both regulators are on and one regulator is dissipating more power that the other, the maximum power dissipation of the VRG8609/10 will fall between the two lines. This graph is based on the maximum junction temperature of 150°C and a thermal resistance (Θ_{JC}) of 5°C/W.

Adjustable Regulator

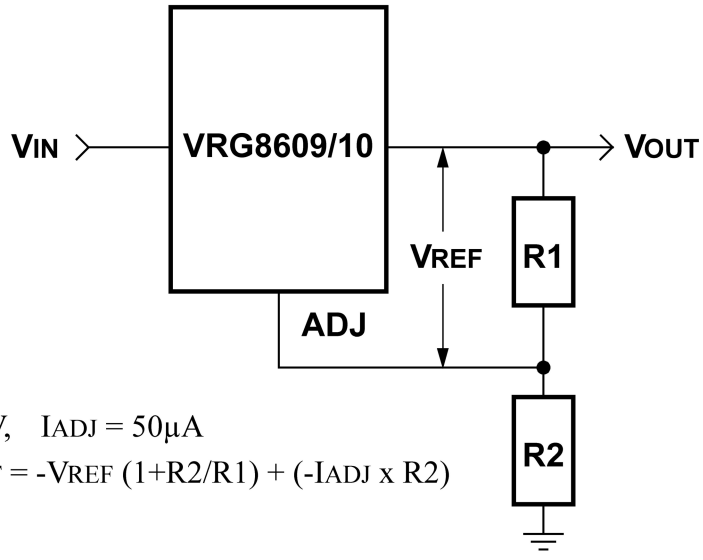

Figure 3 - Typical Applications

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Table I - PIN Numbers vs Function

PIN	Function
1	NEG _ADJ_1
2	NEG _V_{OUT}_1
3	NEG _V_{IN}_1
4	NEG _ADJ_2
5	NEG _V_{IN}_2
6	NEG _V_{OUT}_2

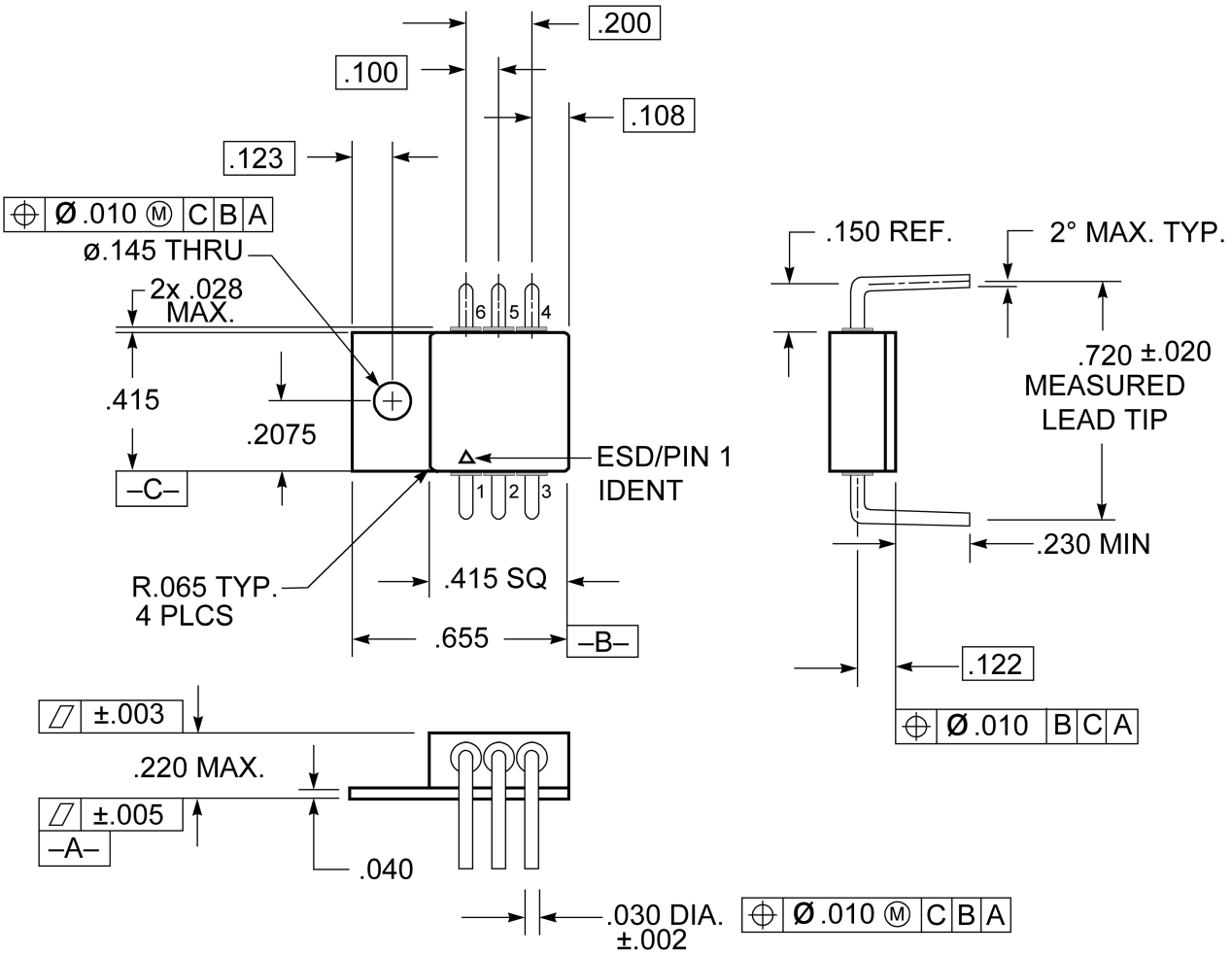

Figure 4 - Package Outline — Thru-Hole Power Package

Notes:

1) Dimension Tolerance: ±.005 inches
2) Package contains BeO substrate
3) Case electrically isolated

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Table II - PIN Numbers vs Function

PIN	Function
1	NEG _ADJ_1
2	NEG _V_{OUT}_1
3	NEG _V_{IN}_1
4	NEG _ADJ_2
5	NEG _V_{IN}_2
6	NEG _V_{OUT}_2

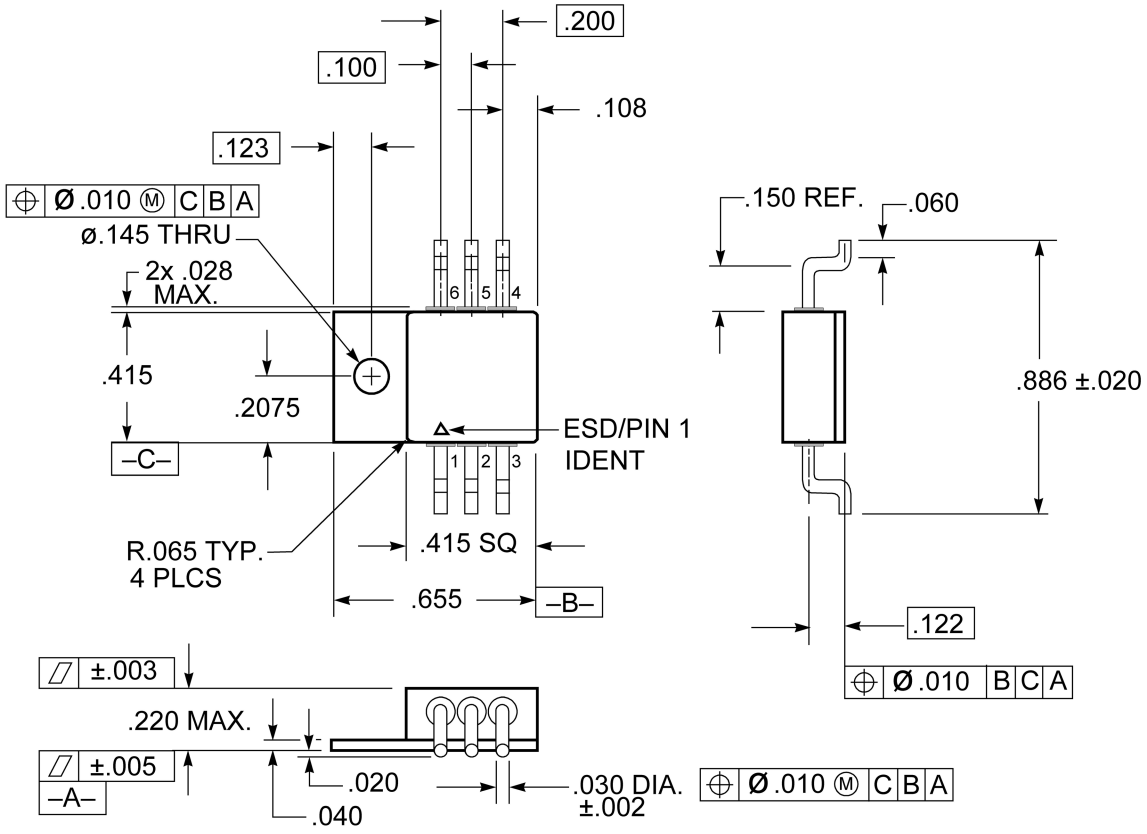

Figure 5 - Package Outline — Surface Mount Power Package

Notes:

1) Dimension Tolerance: ±.005 inches
2) Package contains BeO substrate
3) Case electrically isolated

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Ordering Information

Model	DLA SMD #	Screening	Package
VRG8609-7	-	Commercial Flow, +25°C testing only	6 Lead Thru-Hole Power Pkg
VRG8609-S	-	Military Temperature, -55°C to +125°C Screened in accordance with the individual Test Methods of MIL-STD-883 for Space Applications	
VRG8609-201-1S	5962-0521904KXC	In accordance with DLA SMD	
VRG8609-201-2S	5962-0521904KXA		
VRG8609-901-1S	5962R0521904KXC	In accordance with DLA Certified RHA Program Plan to RHA level "R", 100 krad(Si)	
VRG8609-901-2S	5962R0521904KXA		
VRG8610-7	-	Commercial Flow, +25°C testing only	6 Lead Surface Mount Power Pkg
VRG8610-S	-	Military Temperature, -55°C to +125°C Screened in accordance with the individual Test Methods of MIL-STD-883 for Space Applications	
VRG8610-201-1S	5962-0521904KYC	In accordance with DLA SMD	
VRG8610-201-2S	5962-0521904KYA		
VRG8610-901-1S	5962R0521904KYC	In accordance with DLA Certified RHA Program Plan to RHA level "R", 100 krad(Si)	
VRG8610-901-2S	5962R0521904KYA		

Revision History

Date	Revision	Change Description
03/24/2016	F	Import into CAES format

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Revision History

Date	Revision	Change Description
03/26/2021	H	Revised per ECN 23566.

Datasheet Definitions

	DEFINITION
Advanced Datasheet	CAES reserves the right to make changes to any products and services described herein at any time without notice. The product is still in the development stage and the datasheet **is subject to change**. Specifications can be **TBD** and the part package and pinout are **not final**.
Preliminary Datasheet	CAES reserves the right to make changes to any products and services described herein at any time without notice. The product is in the characterization stage and prototypes are available.
Datasheet	Product is in production and any changes to the product and services described herein will follow a formal customer notification process for form, fit or function changes.

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