

Dual 2.5A ULDO Adjustable Positive Voltage Regulators

VRG8697/98

Features

- Manufactured using Linear Technology Corporation® Space Qualified RH3083 die
- Radiation performance
 - Total dose: 100 krad(Si), Dose rate = 50-300 rad(Si)/s
 - ELDRS: 50 krad(Si), Dose rate ≤ 0.01 rad(Si)/s
- Two-Independent voltage regulators
- Current Limit with Foldback
- Over-temperature protection
- Input voltage range: 1.0V to 23V
- Output voltage adjustable: 0V to 22V
- Outputs may be paralleled for higher current
- Post Radiated Dropout voltage, $V_{CONTROL} \geq 2.0V$:
 - 0.75V @ 2.5Amps
 - 0.28V @ 1.0Amps
- Output current: 2.5Amps
- Packaging – Hermetic Meter Power Package
 - Thru-hole or Surface mount
 - 8 Leads, .755"L x .415"W x .200"Ht
 - Weight - 6 gm max
- Designed for aerospace and high reliability space applications
- **Radiation Hardness Assurance Plan: DLA Certified to MIL-PRF-38534, Appendix G.**

Description

The VRG8697/8698 consists of two Positive Adjustable (RH3083) ULDO voltage regulators each capable of supplying 2.5Amps over the output voltage range as defined under recommended operating conditions. The VRG8697/8698 offers excellent line and load regulation specifications and ripple rejection. There is full electrical isolation between the regulators and each regulator to the package.

The VRG8697/8698 has been specifically designed to meet exposure to radiation environments. The VRG8697 is configured for a Thru-Hole 8 lead metal power package and the VRG8698 is configured for a Surface Mount 8 lead metal power package. It is guaranteed operational with a case operating temperature from -55°C to +125°C. Available screened in accordance with MIL-PRF-38534, the VRG8697/8698 is ideal for demanding military and space applications.

Dropout ($V_{IN} - V_{OUT}$) decreases at lower load currents for both regulators.

VRG8697/98

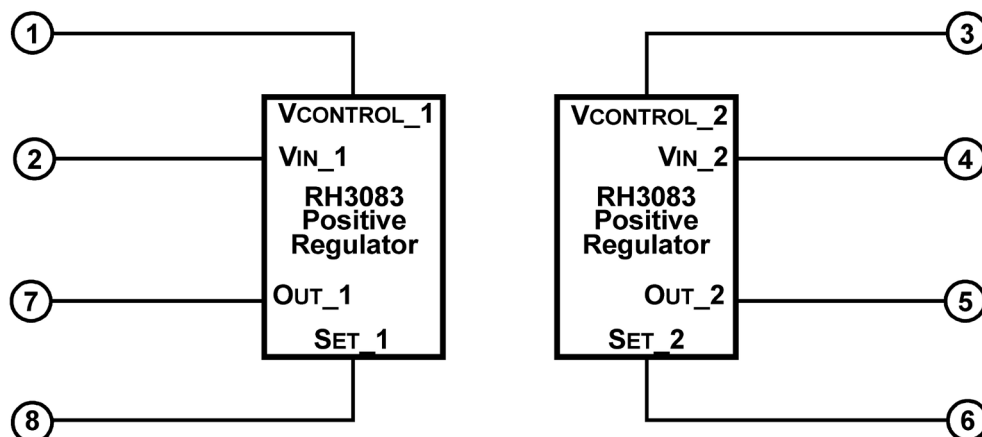


Figure 1: Block Diagram / Schematic

Absolute Maximum Ratings

| Parameter (Voltage is Relative to V_{OUT}) | Rating | Units |
|---|---------------|---------------|
| Input Voltage (No Overload or Short Circuit) | +23 | V_{DC} |
| $V_{CONTROL}$ | +28 | V_{DC} |
| Output Short Circuit Duration | Indefinite | - |
| Lead temperature (soldering 10 Sec) | 300 | $^{\circ}C$ |
| Input Output Differential | 18 | V_{DC} |
| ESD <u>1</u> / | 2,000 - 3,999 | V |
| Operating Junction Temperature Range | -55 to +150 | $^{\circ}C$ |
| Storage Temperature Range | -65 to +150 | $^{\circ}C$ |
| Thermal Resistance (Junction to Case) θ_{JC} | 4 | $^{\circ}C/W$ |

1/ Meets ESD testing per MIL-STD-883, method 3015, Class 2.

Notice:

- 1) 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 |
|---|-------------|-------------|
| Output Voltage Range | 0 to 22 | V_{DC} |
| Input Output Differential | 0.5 to 18 | V_{DC} |
| Case Operating Temperature Range | -55 to +125 | $^{\circ}C$ |
| Input Voltage (Voltages are Relative to V_{OUT}) | 1 to 23 | V |
| $V_{CONTROL}$ (Voltages are Relative to V_{OUT}) | 1.6 to 28 | V |

VRG8697/98

Electrical Performance Characteristics

Unless otherwise specified: $-55^{\circ}\text{C} \leq T_c \leq +125^{\circ}\text{C}$

| Parameter | Symbol | Conditions ($P \leq P_{MAX}$) | MIN | MAX | Units |
|---|-----------------|--|-------|------|---------------|
| Set Pin Current | I_{REF1} | $1.0\text{mA} \leq I_{LOAD} \leq 2.5\text{A}$, $V_{IN} \geq 2\text{V}$, $V_{CONTROL} \geq 3\text{V}$ | 49.0 | 51.5 | μA |
| Set Pin Current <u>1/</u> | I_{REF2} | $V_{IN} = 2\text{V}$, $V_{CONTROL} = 3\text{V}$, $I_{LOAD} = 1\text{mA}$, $T_c = 25^{\circ}\text{C}$ | 49 | 51 | μA |
| Output Offset Voltage ($V_{OUT} - V_{SET}$) <u>1/</u> | V_{OS} | $V_{IN} = 2\text{V}$, $V_{CONTROL} = 3\text{V}$, $I_{LOAD} = 1\text{mA}$, | -6.0 | 6.0 | mV |
| Line Regulation <u>1/</u> | ΔV_{OS} | $1\text{V} \leq V_{IN} \leq 23\text{V}$, $2\text{V} \leq V_{CONTROL} \leq 25\text{V}$, $I_{LOAD} = 1\text{mA}$, $T_c = +25^{\circ}\text{C}$ | -0.07 | 0.07 | mV/V |
| Load Regulation <u>1/</u> | ΔV_{OS} | $(V_{IN} - V_{OUT}) = 3\text{V}$, $I_{LOAD} = 5\text{mA}$ to 2.5A , $T_c = 25^{\circ}\text{C}$ | -10.0 | 10.0 | mV |
| $V_{CONTROL}$ Dropout Voltage <u>2/</u> | V_{CDROP} | $I_{LOAD} = 2.5\text{A}$ | - | 1.65 | V |
| | | $I_{LOAD} = 1.0\text{A}$ <u>1/</u> | - | 1.60 | |
| V_{IN} Dropout Voltage <u>2/</u> | V_{INDROP} | $I_{LOAD} = 2.5\text{A}$ | - | 0.75 | V |
| | | $I_{LOAD} = 1.0\text{A}$ <u>1/</u> | - | 0.28 | |
| Current Limit <u>3/</u> | I_{MAX} | $V_{IN} = V_{CONTROL} = +5\text{V}$, $V_{SET} = 0\text{V}$, $V_{OUT} = +0.4\text{V}$ | 2.6 | - | A |
| Minimum Load Current <u>1/</u> <u>4/</u> | I_{MIN} | $V_{CONTROL} = 25\text{V}$, $V_{IN} = 23\text{V}$ | - | 1.0 | mA |
| Ripple Rejection | - | $I_{LOAD} = 0.2\text{A}$, $(V_{IN} - V_{OUT}) = 3\text{V}$, $f = 120\text{Hz}$, $C_{OUT} = 10\mu\text{F}$, $C_{SET} = 0.1\mu\text{F}$ | 60 | - | dB |

Notes:

- 1) Specification derated to reflect Total Dose exposure to 100 krad(Si) @+25°C.
- 2) Dropout results from either minimum control voltage, $V_{CONTROL}$, or minimum input voltage, V_{IN} , both specified with respect to V_{OUT} . These specifications represent the minimum input-to-output differential voltage required to maintain regulation.
- 3) Pulsed @ <10% duty cycle @ +25°C for characterization only.
- 4) Not tested. Shall be guaranteed to the specified limits.

VRG8697/98

VRG8697

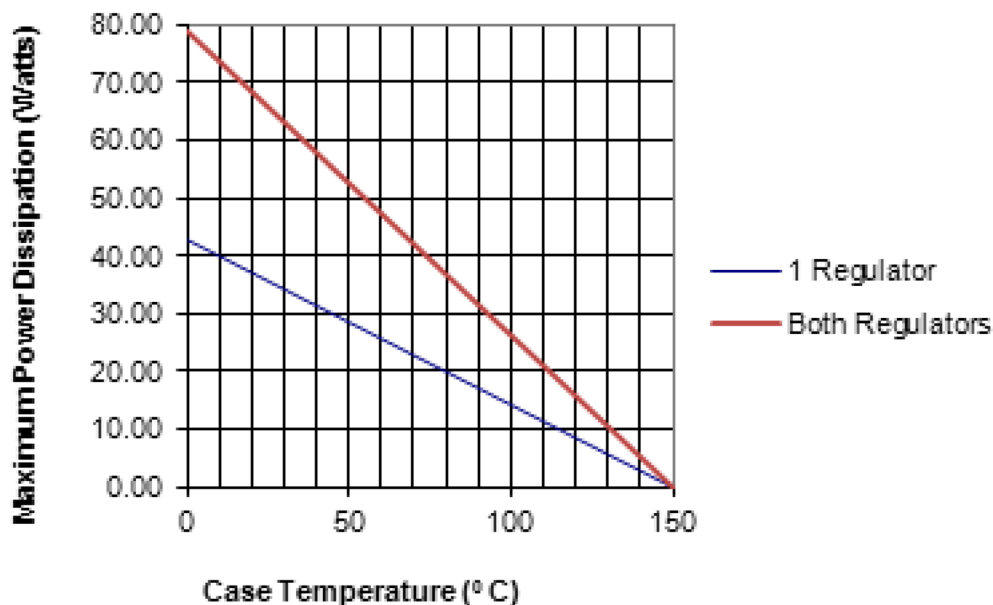


Figure 2 - Maximum Power vs Case Temperature

The maximum Power dissipation is limited by the thermal shutdown function of each regulator chip in the VRG8697/8698. 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 VRG8697/8698 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 than the other, the maximum power dissipation of the VRG8607/08 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 4°C/W.

VRG8697/98

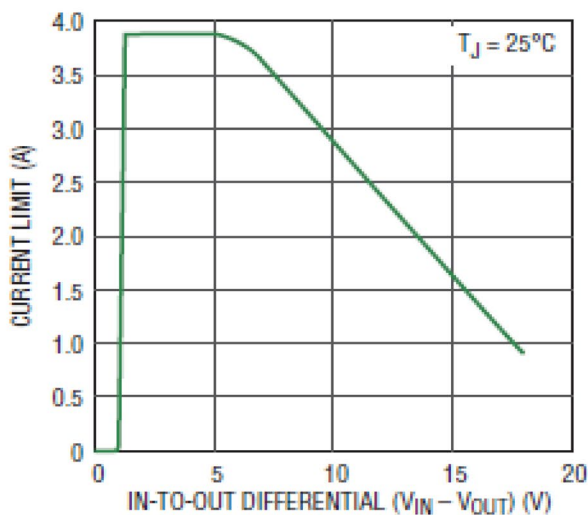


Figure 3 - RH3083 Typical Current Limit

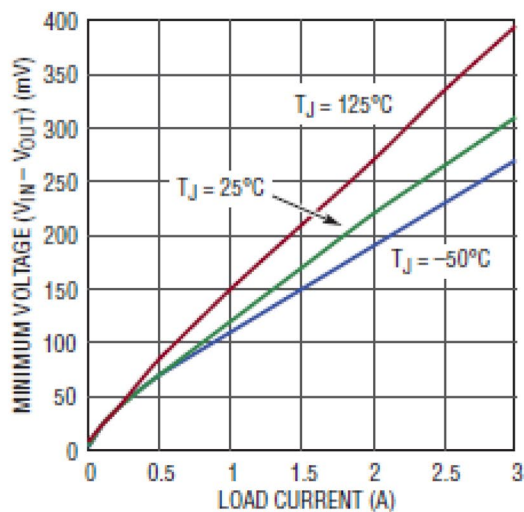


Figure 4 - RH3083 Typical Dropout Voltage Curve ($V_{CONTROL} \geq 1.65V$)

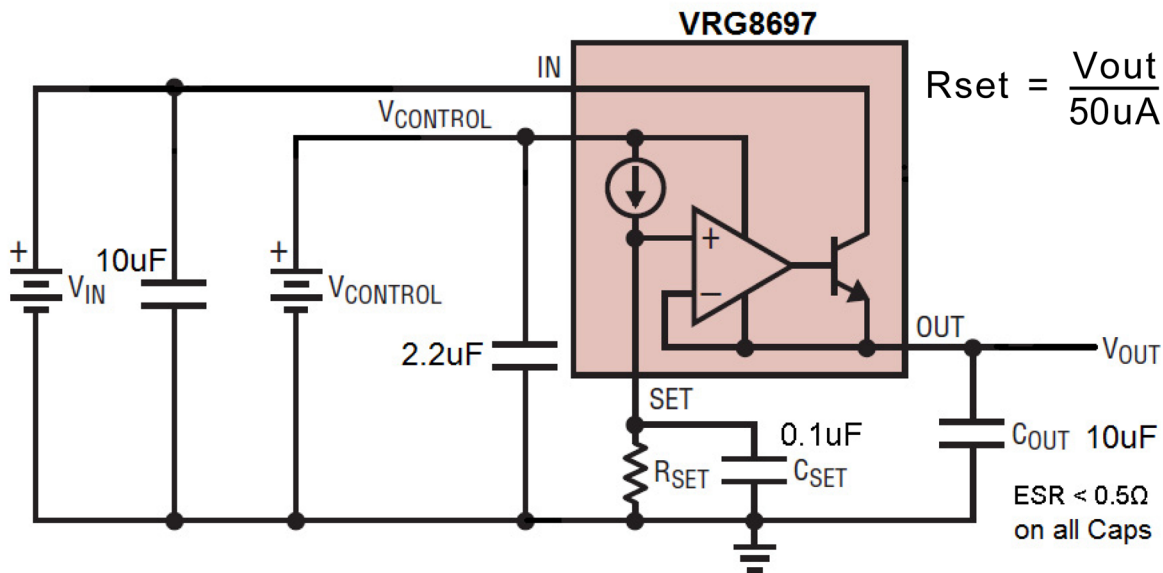


Figure 5 - Basic VRG8697 Adjustable Regulator Application

VRG8697/98

Table I – Pin Numbers vs Function

| Pin | Function |
|-----|------------------------|
| 1 | V _{CONTROL_1} |
| 2 | V _{IN_1} |
| 3 | V _{CONTROL_2} |
| 4 | V _{IN_2} |
| 5 | OUT_2 |
| 6 | SET_2 |
| 7 | OUT_1 |
| 8 | SET_1 |

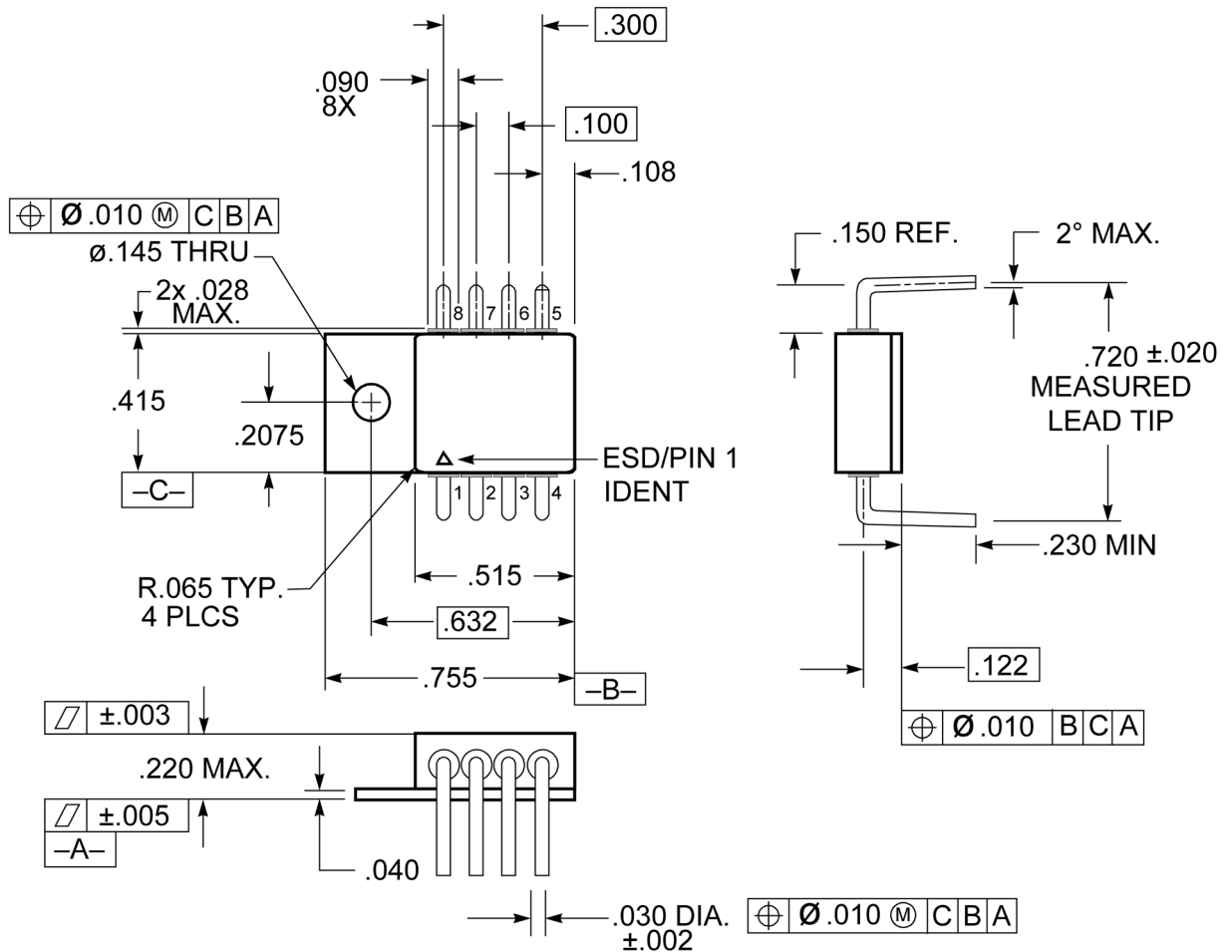


Figure 6 - VRG8697 Package Outline – Thru-Hole Power Package

Notes:

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

VRG8697/98

Table II – Pin Numbers vs Function

| Pin | Function |
|-----|------------------------|
| 1 | V _{CONTROL_1} |
| 2 | V _{IN_1} |
| 3 | V _{CONTROL_2} |
| 4 | V _{IN_2} |
| 5 | O _{UT_2} |
| 6 | S _{ET_2} |
| 7 | O _{UT_1} |
| 8 | S _{ET_1} |

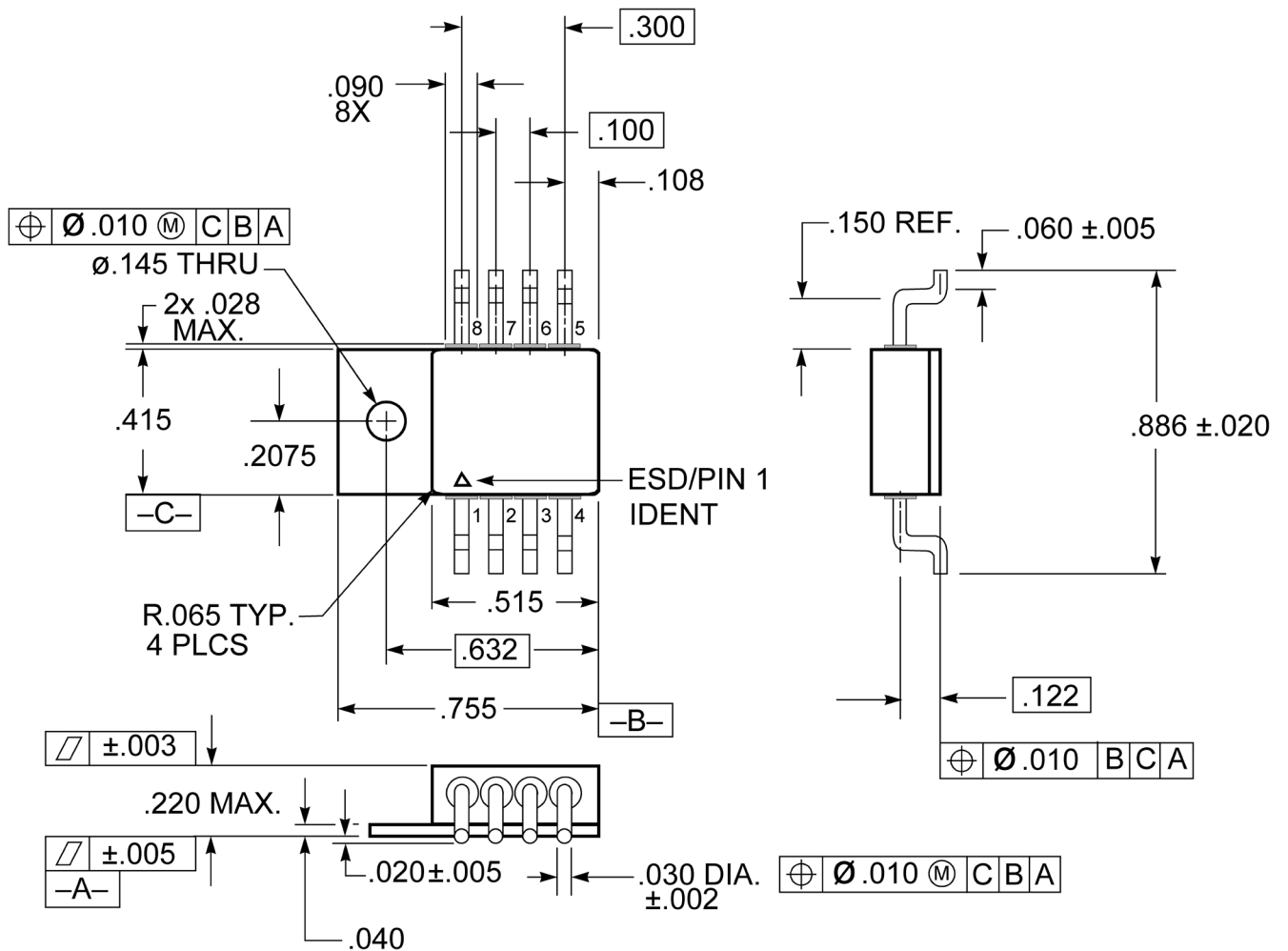


Figure 7 - VRG8698 Package Outline - Surface Mount Power Package

Notes:

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

VRG8697/98

Ordering Information

| Model | DLA SMD # | Screening | Package |
|------------------|-----------------|--|--------------------------------|
| VRG8697-7 | - | Commercial Flow, +25°C testing only | 8-Lead Thru-Hole Power Pkg |
| VRG8697 - 901-1S | 5962R1420201KUC | In accordance with DLA Certified RHA Program Plan to RHA Level "R", 100 krad(Si) | |
| VRG8697 - 901-2S | 5962R1420201KUA | | |
| VRG8698-7 | | Commercial Flow, +25°C testing only | 8-Lead Surface-Mount Power Pkg |
| VRG8698- 901-1S | 5962R1420201KZC | In accordance with DLA Certified RHA Program Plan to RHA Level "R", 100 krad(Si) | |
| VRG8698- 901-2S | 5962R1420201KZA | | |

Revision History

| Date | Revision | Change Description |
|------------|----------|-------------------------|
| 03/31/2016 | F | Import into CAES format |



VRG8697/98

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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