# 0.5A and 1.5A Low Dropout Positive Adjustable Regulators

## DESCRIPTION

The RH1086M positive adjustable regulator is designed to provide 0.5A for the H package and 1.5A for the K package with higher efficiency than currently available devices. All internal circuitry is designed to operate down to 1V input-output differential and the dropout voltage is fully specified as a function of load current. Dropout is guaranteed at a maximum of 1.5V at maximum output current, decreasing at lower load currents. On-chip trimming adjusts the output voltage to 1%. Current limit is also trimmed, minimizing the stress on both the regulator and power source circuitry under overload conditions.

The RH1086M is pin compatible with older 3-terminal regulators. A 10µF output capacitor is required on this new device. However, this is usually included in most regulator designs.

The wafer lots are processed to ADI in-house Class S flow-to-yield circuits usable in stringent military applications.

## ABSOLUTE MAXIMUM RATINGS

**(Note 1)**

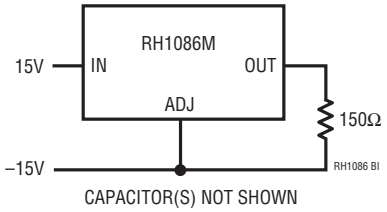
Power Dissipation ..... Internally Limited
Input-to-Output Voltage Differential ..... 25V
Operating Junction Temperature Range
  Control Section ..... –55°C to 150°C
  Power Transistor ..... –55°C to 200°C
Storage Temperature Range ..... –65°C to 150°C
Lead Temperature (Soldering, 10 sec) ..... 300°C

## PRECONDITIONING

100% Thermal Limit Burn-In

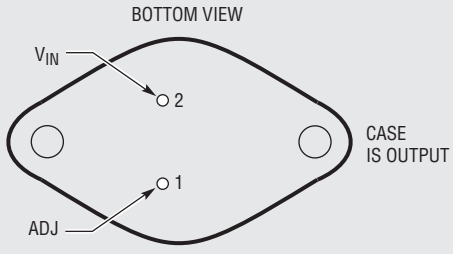


## BURN-IN CIRCUIT



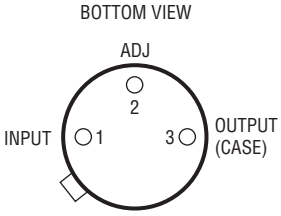

CAPACITOR(S) NOT SHOWN

## PACKAGE INFORMATION




K PACKAGE
2-LEAD TO-3 METAL CAN

**OBSOLETE PACKAGE: FOR REFERENCE ONLY**




H PACKAGE
3-LEAD TO-39 METAL CAN

**FINAL SPECIFICATIONS SUBJECT TO CHANGE**

**Note: For ordering information contact ADI.**

Rev. E

## TABLE 1: ELECTRICAL CHARACTERISTICS (Preirradiation)

**Device is characterized at the TID levels below. Device is production tested at 100kRad(si).**

| PARAMETER | CONDITIONS | NOTES | $T_A$ = 25°C MIN | TYP | MAX | SUB-GROUP | –55°C ≤ $T_A$ ≤ 125°C MIN | TYP | MAX | SUB-GROUP | UNITS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Reference Voltage | $I_{OUT}$ = 10mA, ($V_{IN}$ – $V_{OUT}$) = 3V (K) | | 1.238 | | 1.262 | 1 | | | | | V |
| | 10mA ≤ $I_{OUT}$ ≤ $I_{FULL\ LOAD}$, 1.5V ≤ ($V_{IN}$ – $V_{OUT}$) ≤ 25V | 6 | 1.225 | | 1.270 | | 1.225 | | 1.270 | 2,3 | V |
| Line Regulation | $I_{LOAD}$ = 10mA, 1.5V ≤ ($V_{IN}$ – $V_{OUT}$) ≤ 15V | 2, 3 | | | 0.2 | 1 | | | 0.2 | 2,3 | % |
| Load Regulation | ($V_{IN}$ – $V_{OUT}$) = 3V, 10mA ≤ $I_{OUT}$ ≤ $I_{FULL\ LOAD}$ | 2, 3, 6 | | | 0.3 | 1 | | | 0.4 | 2,3 | % |
| Dropout Voltage | $\Delta V_{REF}$ = 1%, $I_{OUT}$ = 1.5A (K)<br>$\Delta V_{REF}$ = 1%, $I_{OUT}$ = 0.5A (H) | 4<br>4 | | | 1.5<br>1.25 | 1<br>1 | | | 1.5<br>1.25 | 2,3<br>2,3 | V<br>V |
| Current Limit | ($V_{IN}$ – $V_{OUT}$) = 5V (K)<br>($V_{IN}$ – $V_{OUT}$) = 5V (H)<br>($V_{IN}$ – $V_{OUT}$) = 25V (K)<br>($V_{IN}$ – $V_{OUT}$) = 25V (H) | | 1.5<br>0.5<br>0.05<br>0.020 | | | 1<br>1<br>1<br>1 | 1.5<br>0.5<br>0.05<br>0.020 | | | 2,3<br>2,3<br>2,3<br>2,3 | A<br>A<br>A<br>A |
| Minimum Load Current | ($V_{IN}$ – $V_{OUT}$) = 25V | | | | 10 | 1 | | | 10 | 2,3 | mA |
| Thermal Regulation | $T_A$ = 25°C, 30ms Pulse | | | | 0.04 | 4 | | | | | %/W |
| Ripple Rejection | f = 120Hz, $C_{ADJ}$ = 25µF, $C_{OUT}$ = 25µF Tantalum, $I_{OUT}$ = $I_{FULL\ LOAD}$, ($V_{IN}$ – $V_{OUT}$) = 3V | 6 | 60 | | | 4 | 60 | | | 5,6 | dB |
| Adjust Pin Current | $T_J$ = 25°C | | | 55 | 120 | 1 | | | 120 | 2,3 | µA |
| Adjust Pin Current Change | 10mA ≤ $I_{OUT}$ ≤ $I_{FULL\ LOAD}$, 1.5V ≤ ($V_{IN}$ – $V_{OUT}$) ≤ 15V | 6 | | | 5 | 1 | | | 5 | 2,3 | µA |
| Temperature Stability | | | | 0.5 | | | | 0.5 | | | % |
| Long Term Stability | $T_A$ = 125°C, 1000 Hours | 5 | | 0.3 | | | | | | | % |
| RMS Output Noise (% of $V_{OUT}$) | 10Hz ≤ f ≤ 10kHz | | | 0.003 | | | | | | | % |
| Thermal Resistance Junction-to-Case | Control Circuitry (K)<br>Control Circuitry (H)<br>Power Transistor (K)<br>Power Transistor (H) | 5<br>5<br>5<br>5 | | 1.7<br>15.0<br>4.0<br>20.0 | | | | | | | °C/W<br>°C/W<br>°C/W<br>°C/W |

## TABLE 1A: ELECTRICAL CHARACTERISTICS (Postirradiation)

**$T_A$ = 25°C, unless otherwise noted. Device is characterized at the TID levels below. Device is production tested at 100kRad(si).**

| 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 6) | $I_{OUT}$ = 10mA ($V_{IN}$ – $V_{OUT}$) = 3V (K) | 1.234 | 1.262 | 1.230 | 1.262 | 1.225 | 1.262 | 1.220 | 1.262 | 1.205 | 1.262 | V |
| | 10mA ≤ $I_{OUT}$ ≤ $I_{FULL\ LOAD}$<br>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 2, 3) | $I_{OUT}$ = 10mA<br>1.5V ≤ ($V_{IN}$ – $V_{OUT}$) ≤ 15V | | 0.2 | | 0.21 | | 0.23 | | 0.25 | | 0.3 | % |
| Load Regulation (Notes 2, 3, 6) | ($V_{IN}$ – $V_{OUT}$) = 3V<br>10mA ≤ $I_{OUT}$ ≤ $I_{FULL\ LOAD}$ | | 0.3 | | 0.3 | | 0.3 | | 0.3 | | 0.3 | % |
| Dropout Voltage (Note 4) | $\Delta V_{REF}$ = 1%, $I_{OUT}$ = 1.5A (K)<br>$\Delta V_{REF}$ = 1%, $I_{OUT}$ = 0.5A (H) | | 1.5<br>1.25 | | 1.51<br>1.26 | | 1.52<br>1.27 | | 1.55<br>1.29 | | 1.575<br>1.32 | V<br>V |
| Current Limit | ($V_{IN}$ – $V_{OUT}$ ) = 5V (K)<br>($V_{IN}$ – $V_{OUT}$ ) = 25V (K)<br>($V_{IN}$ – $V_{OUT}$ ) = 5V (H)<br>($V_{IN}$ – $V_{OUT}$ ) = 25V (H) | 1.5<br>0.05<br>0.5<br>0.020 | | 1.5<br>0.049<br>0.5<br>0.019 | | 1.5<br>0.048<br>0.5<br>0.019 | | 1.5<br>0.047<br>0.5<br>0.018 | | 1.5<br>0.045<br>0.5<br>0.017 | | A<br>A<br>A<br>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 6) | 10mA ≤ $I_{OUT}$ ≤ $I_{FULL\ LOAD}$<br>1.5V ≤ ($V_{IN}$ – $V_{OUT}$) ≤ 15V | | 5 | | 5 | | 5 | | 5 | | 5 | 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:** 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 3:** 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 4:** 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 5:** Guaranteed by design, characterization, or correlation to other tested parameters.

**Note 6:** $I_{FULL\ LOAD}$ 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 2: ELECTRICAL TEST REQUIREMENTS

| MIL-STD-883 TEST REQUIREMENTS | SUBGROUP |
|---|---|
| Final Electrical Test Requirements (Method 5004) | 1*,2,3,4,5,6 |
| Group A Test Requirements (Method 5005) | 1,2,3,4,5,6 |
| Group C and D End Point Electrical Parameters (Method 5005) | 1 |

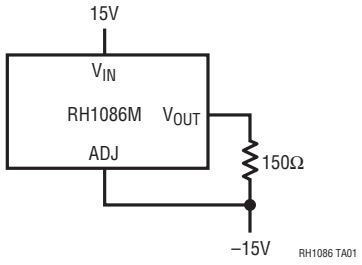
*PDA applies to subgroup 1. See PDA Test Notes.

**PDA Test Notes**

The PDA is specified as 5% based on failures from group A, subgroup 1, tests after cooldown as the final electrical test in accordance with method 5004 of MIL-STD-883 Class B. The verified failures of group A, subgroup 1, after burn-in divided by the total number of devices submitted for burn-in in that lot shall be used to determine the percent for the lot.

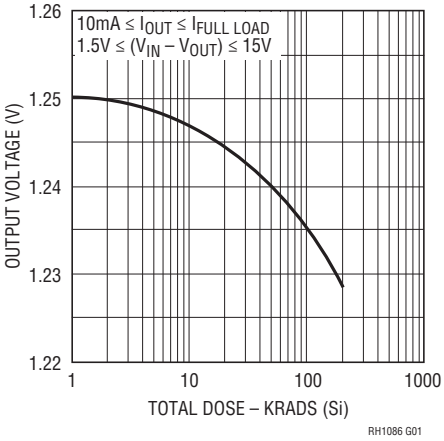
Linear Technology Corporation reserves the right to test to tighter limits than those given.

## TOTAL DOSE BIAS CIRCUIT

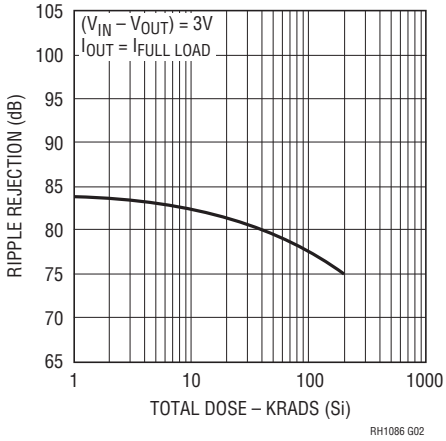


# TYPICAL PERFORMANCE CHARACTERISTICS

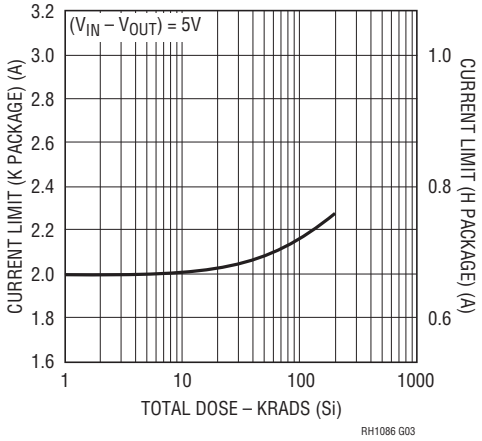
### Reference Voltage



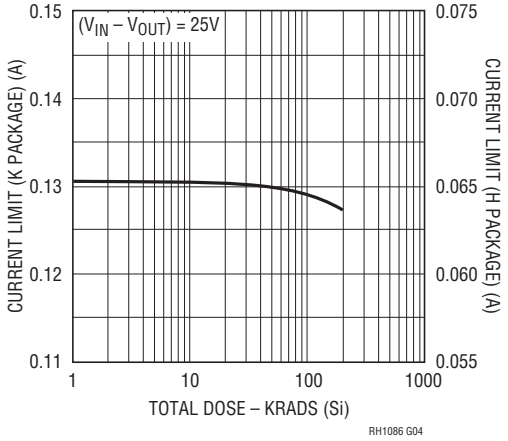

### Ripple Rejection



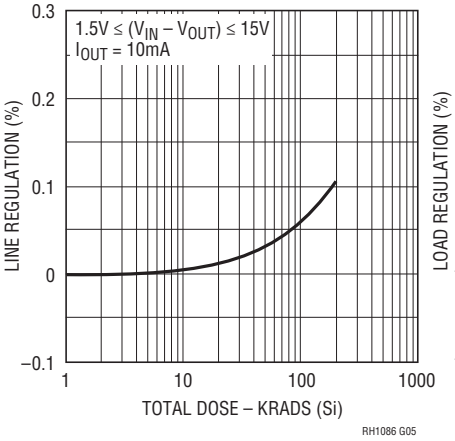

### Current Limit



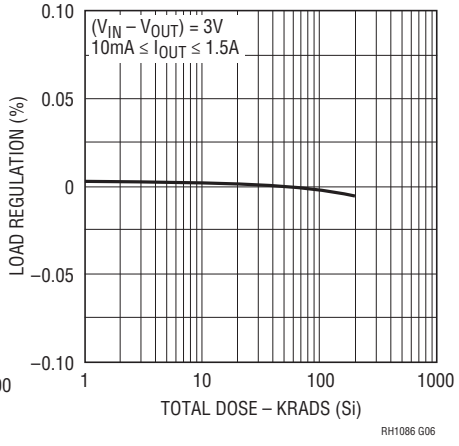

### Current Limit



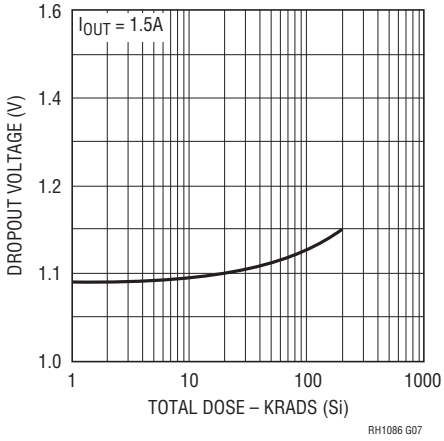

### Line Regulation



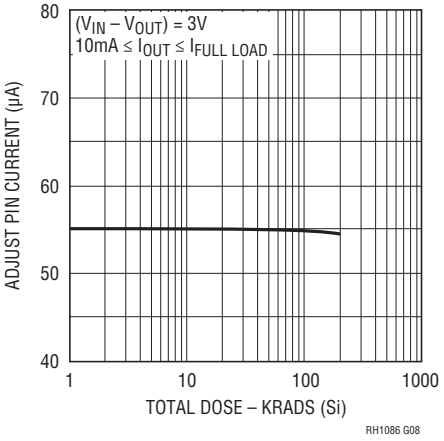

### Load Regulation



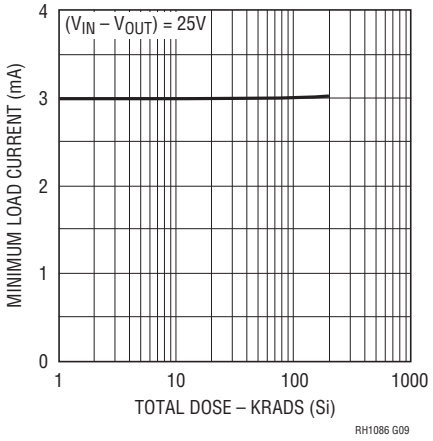

### Dropout Voltage




### Adjust Pin Current




### Minimum Load Current



## REVISION HISTORY (Revision history begins at Rev B)

| REV | DATE | DESCRIPTION | PAGE NUMBER |
|---|---|---|---|
| B | 10/10 | Updated Reference Voltage vs Postirradiation Limits in Table 1A: Electrical Characteristics | 3 |
| C | 4/11 | Updated Dropout Voltage in Table 1 and Table 1A | 2, 3 |
| D | 1/19 | Obsolete K Package | 1 |
| E | 7/23 | Updated art title in the Electrical Characteristics section | 2, 3 |