

## 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-to-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 10 $\mu$ F output capacitor is required on this new device. However, this is usually included in most regulator designs.


The wafer lots are processed to Linear Technology Corporation's in-house Class S flow-to-yield circuits usable in stringent military applications.

### ABSOLUTE MAXIMUM RATINGS

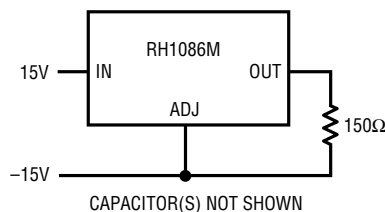
|  |                    |
|--|--------------------|
| Power Dissipation .....                    | Internally Limited |
| Input-to-Output Voltage Differential ..... | 25V                |
| Operating Junction Temperature Range       |                    |
| Control Section .....                      | -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

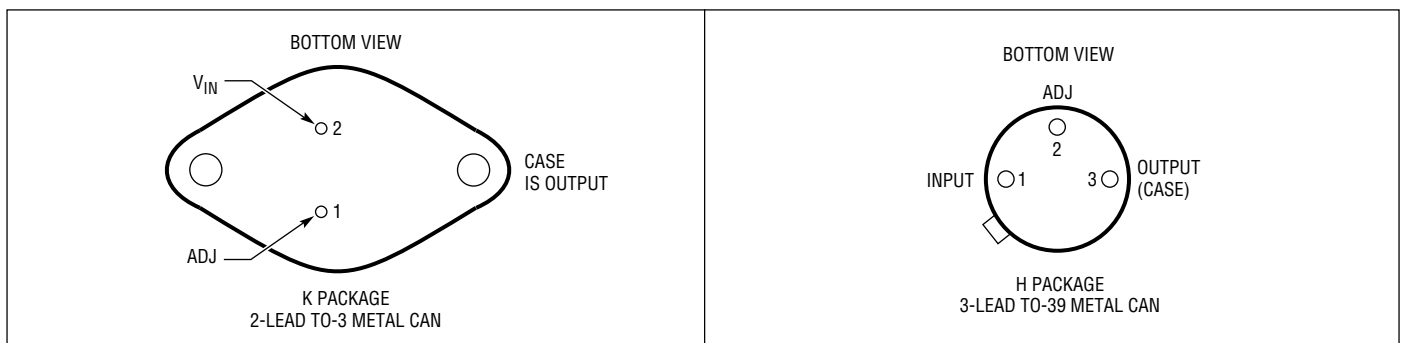
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### BURN-IN CIRCUIT



RH1086 BI

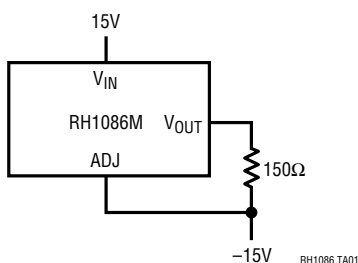
### PACKAGE INFORMATION



Note: For ordering information contact LTC.

**TABLE 1: ELECTRICAL CHARACTERISTICS** (Preirradiation)

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

**Total Dose Bias Circuit**

**TABLE 1A: ELECTRICAL CHARACTERISTICS** (Postirradiation)  $T_A = 25^\circ\text{C}$  unless otherwise noted.

| PARAMETER                          | CONDITIONS   | 10KRAD(Si) |       | 20KRAD(Si) |       | 50KRAD(Si) |       | 100KRAD(Si) |       | 200KRAD(Si) |       | UNITS         |
|------------------------------------|--|------------|-------|------------|-------|------------|-------|-------------|-------|-------------|-------|---------------|
|                                    |  | MIN        | MAX   | MIN        | MAX   | MIN        | MAX   | MIN         | MAX   | MIN         | MAX   |               |
| Reference Voltage (Note 5)         | $I_{OUT} = 10\text{mA}$ ( $V_{IN} - V_{OUT} = 3\text{V}$ (K))  | 1.234      | 1.258 | 1.230      | 1.257 | 1.225      | 1.253 | 1.220       | 1.247 | 1.205       | 1.241 | V             |
|                                    | $10\text{mA} \leq I_{OUT} \leq I_{FULL\ LOAD}$<br>$1.5\text{V} \leq (V_{IN} - V_{OUT}) \leq 15\text{V}$      | 1.220      | 1.275 | 1.219      | 1.275 | 1.215      | 1.275 | 1.210       | 1.275 | 1.20        | 1.275 | V             |
| Line Regulation (Notes 1, 2)       | $I_{OUT} = 10\text{mA}$<br>$1.5\text{V} \leq (V_{IN} - V_{OUT}) \leq 15\text{V}$                             |            | 0.2   |            | 0.21  |            | 0.23  |             | 0.25  |             | 0.3   | %             |
| Load Regulation (Notes 1, 2, 5)    | $(V_{IN} - V_{OUT}) = 3\text{V}$<br>$10\text{mA} \leq I_{OUT} \leq I_{FULL\ LOAD}$                           |            | 0.3   |            | 0.3   |            | 0.3   |             | 0.3   |             | 0.3   | %             |
| Dropout Voltage (Note 3)           | $\Delta V_{REF} = 1\%$ , $I_{OUT} = 1.5\text{A}$ (K)<br>$\Delta V_{REF} = 1\%$ , $I_{OUT} = 0.5\text{A}$ (H) |            | 1.5   |            | 1.51  |            | 1.52  |             | 1.55  |             | 1.575 | V             |
| Current Limit                      | $(V_{IN} - V_{OUT}) = 5\text{V}$ (K)   | 1.5        |       | 1.5        |       | 1.5        |       | 1.5         |       | 1.5         |       | A             |
|                                    | $(V_{IN} - V_{OUT}) = 25\text{V}$ (K)  | 0.05       |       | 0.049      |       | 0.048      |       | 0.047       |       | 0.045       |       | A             |
|                                    | $(V_{IN} - V_{OUT}) = 5\text{V}$ (H)   | 0.5        |       | 0.5        |       | 0.5        |       | 0.5         |       | 0.5         |       | A             |
|                                    | $(V_{IN} - V_{OUT}) = 25\text{V}$ (H)  | 0.020      |       | 0.019      |       | 0.019      |       | 0.018       |       | 0.017       |       | A             |
| Minimum Load Current               | $(V_{IN} - V_{OUT}) = 25\text{V}$  |            | 10    |            | 10    |            | 10    |             | 10    |             | 10    | mA            |
| Adjust Pin Current                 |  |            | 120   |            | 120   |            | 120   |             | 120   |             | 120   | $\mu\text{A}$ |
| Adjust Pin Current Change (Note 5) | $10\text{mA} \leq I_{OUT} \leq I_{FULL\ LOAD}$<br>$1.5\text{V} \leq (V_{IN} - V_{OUT}) \leq 15\text{V}$      |            | 5     |            | 5     |            | 5     |             | 5     |             | 5     | $\mu\text{A}$ |

**Note 1:** 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 2:** 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 3:** 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<sup>®</sup>1086 data sheet.

**Note 4:** Guaranteed by design, characterization, or correlation to other tested parameters.

**Note 5:**  $I_{FULL\ LOAD}$  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            |

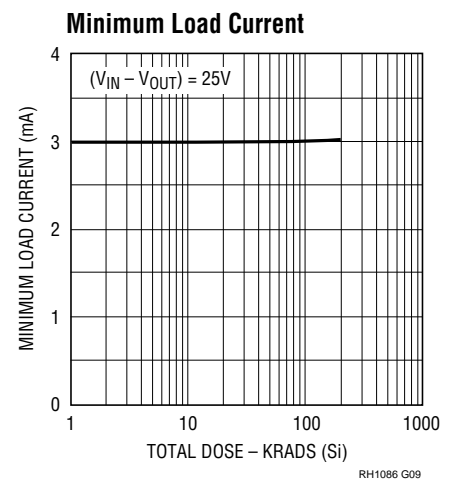
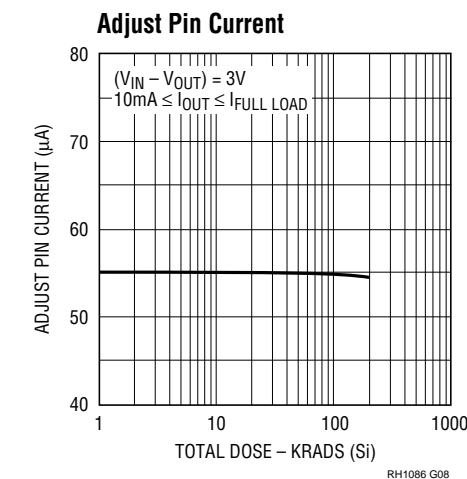
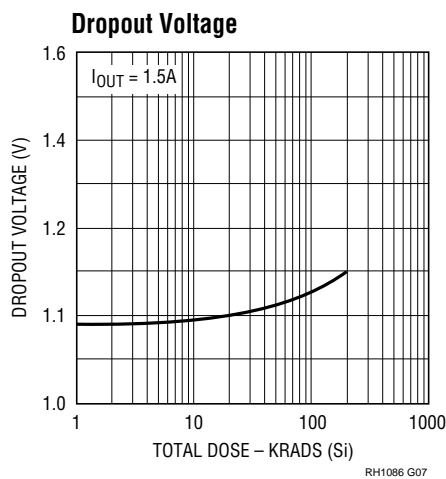
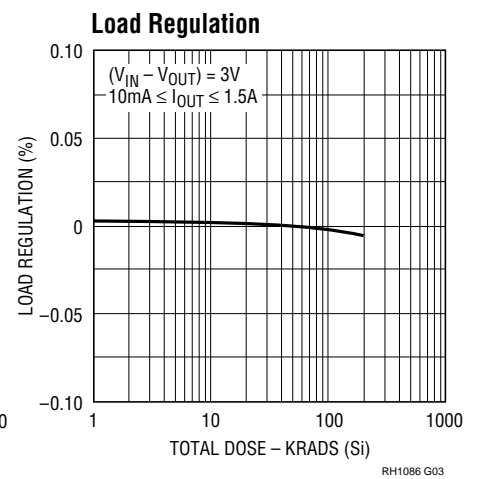
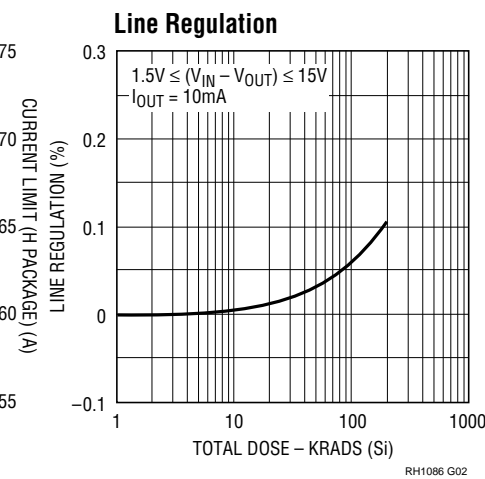
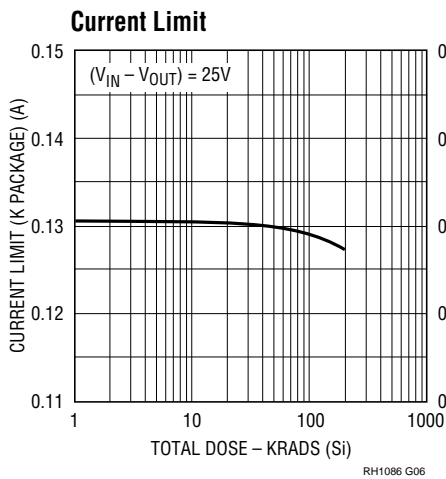
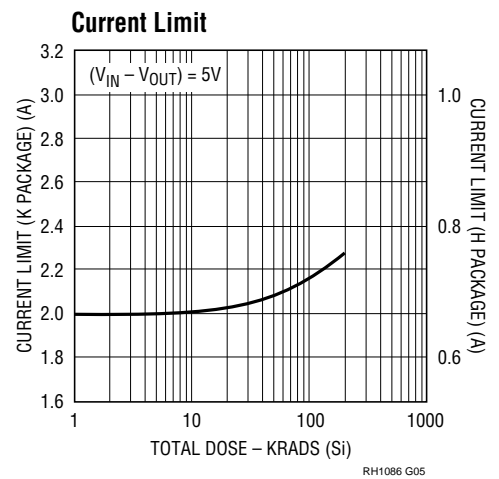
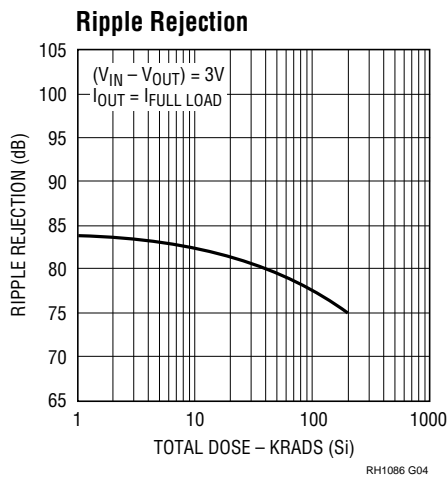
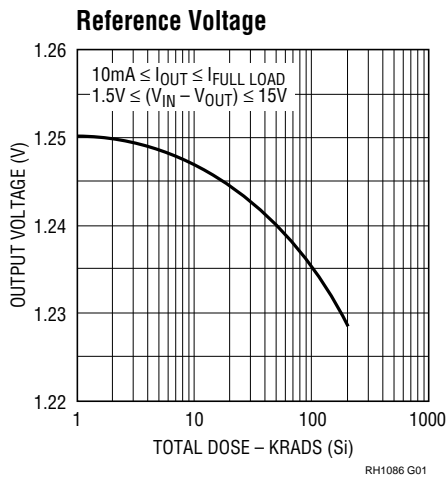
\* PDA Applies to subgroup 1. See PDA Test Notes.

**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.

# TYPICAL PERFORMANCE CHARACTERISTICS



I.D. No. 66-11-1086