

## 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

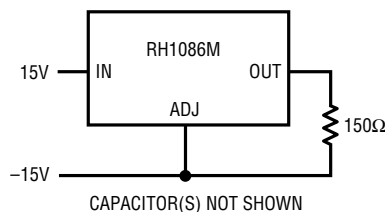
Power Dissipation .....	Internally Limited
Input-to-Output Voltage Differential .....	25V
Operating Junction Temperature Range	
Control Section .....	-55°C to 150°C
Power Transistor .....	-55°C to 200°C
Storage Temperature Range .....	-65°C to 150°C
Lead Temperature (Soldering, 10 sec) .....	300°C

### PRECONDITIONING

100% Thermal Limit Burn-In

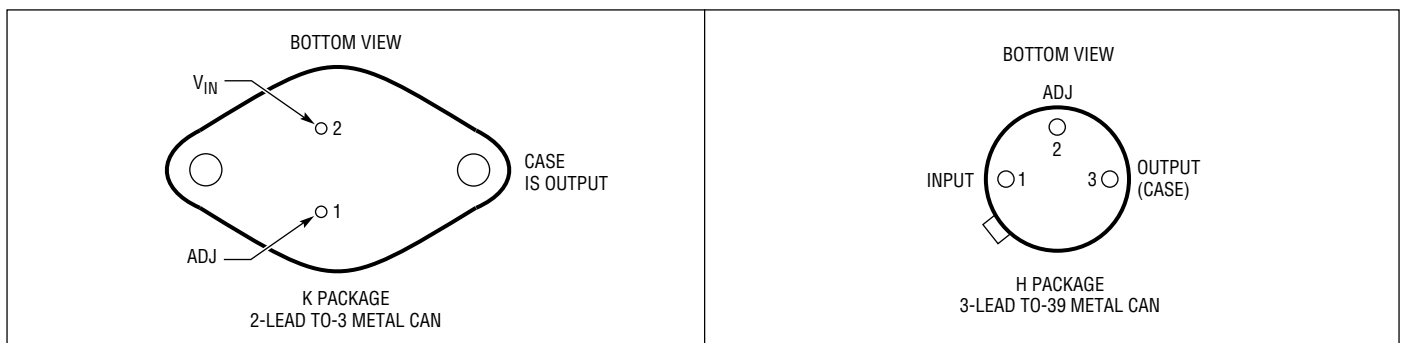
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### BURN-IN CIRCUIT



RH1086 BI

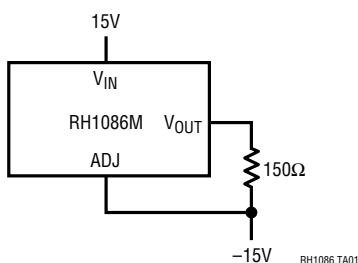
### PACKAGE INFORMATION



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
	$10\text{mA} \leq I_{OUT} \leq I_{FULL\ LOAD}$ , $1.5\text{V} \leq (V_{IN} - V_{OUT}) \leq 15\text{V}$	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	$(V_{IN} - V_{OUT}) = 3\text{V}$ , $10\text{mA} \leq I_{OUT} \leq I_{FULL\ LOAD}$	1,2,5			0.3	1			0.4	2,3	%
Dropout Voltage	$\Delta V_{REF} = 1\%$ , $I_{OUT} = 1.5\text{A}$ (K) $\Delta V_{REF} = 1\%$ , $I_{OUT} = 0.5\text{A}$ (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	$f = 120\text{Hz}$ , $C_{ADJ} = 25\mu\text{F}$ , $C_{OUT} = 25\mu\text{F}$ Tantalum, $I_{OUT} = I_{FULL\ LOAD}$ $(V_{IN} - V_{OUT}) = 3\text{V}$	5	60			4	60			5,6	dB
Adjust Pin Current					55 120				120	2,3	$\mu\text{A}$
Adjust Pin Current Change	$10\text{mA} \leq I_{OUT} \leq I_{FULL\ LOAD}$ , $1.5\text{V} \leq (V_{IN} - V_{OUT}) \leq 15\text{V}$	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 (% of $V_{OUT}$ )	$10\text{Hz} \leq f \leq 10\text{kHz}$				0.003						%
Thermal Resistance 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
	$10\text{mA} \leq I_{OUT} \leq I_{FULL\ LOAD}$ $1.5\text{V} \leq (V_{IN} - V_{OUT}) \leq 15\text{V}$	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)	$I_{OUT} = 10\text{mA}$ $1.5\text{V} \leq (V_{IN} - V_{OUT}) \leq 15\text{V}$		0.2		0.21		0.23		0.25		0.3	%
Load Regulation (Notes 1, 2, 5)	$(V_{IN} - V_{OUT}) = 3\text{V}$ $10\text{mA} \leq I_{OUT} \leq I_{FULL\ LOAD}$		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) $\Delta V_{REF} = 1\%$ , $I_{OUT} = 0.5\text{A}$ (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)	$10\text{mA} \leq I_{OUT} \leq I_{FULL\ LOAD}$ $1.5\text{V} \leq (V_{IN} - V_{OUT}) \leq 15\text{V}$		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

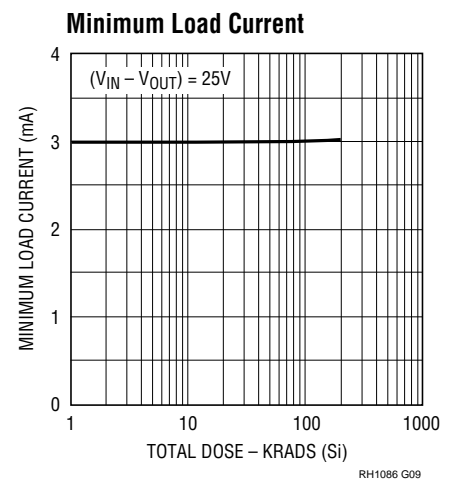
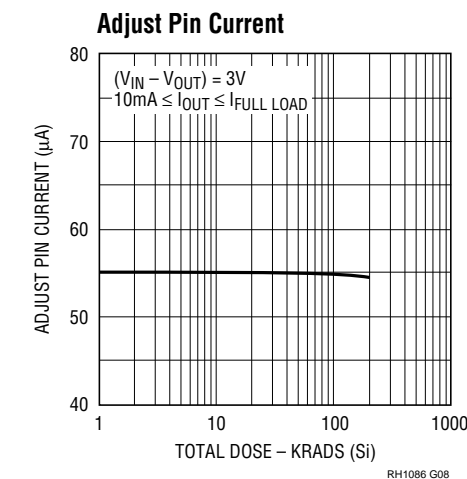
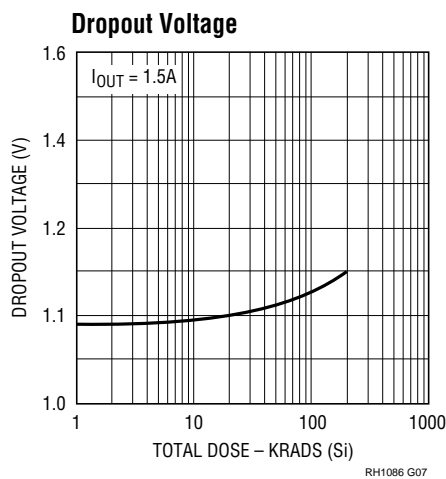
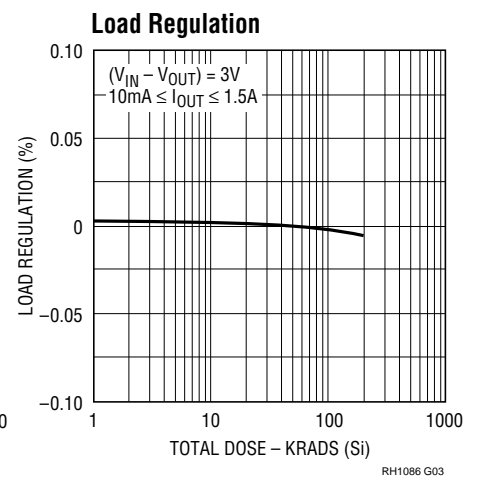
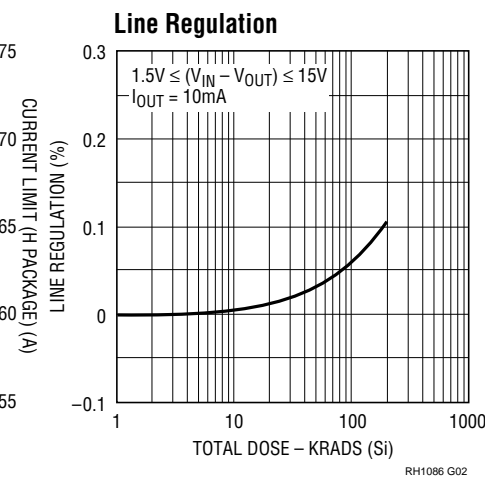
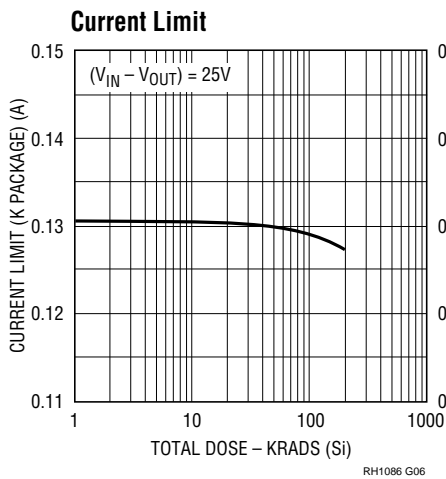
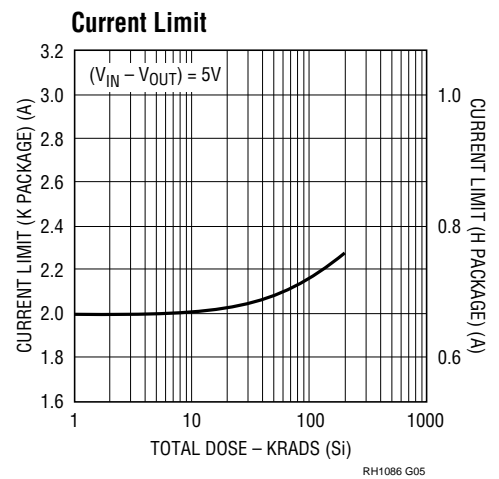
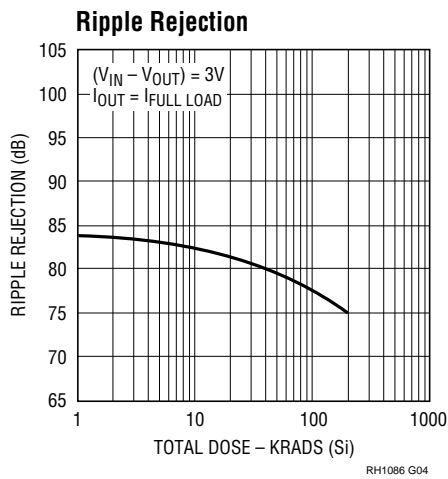
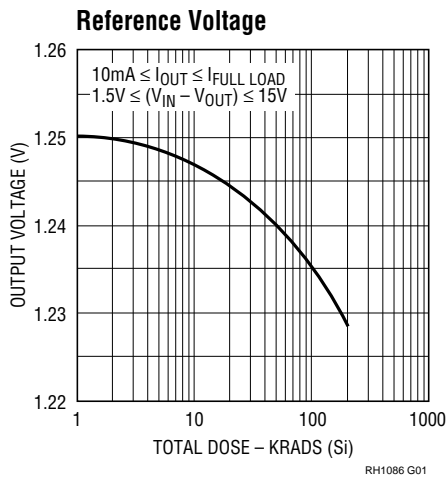
\* PDA Applies to subgroup 1. See PDA Test Notes.

**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