Adjustable 2.8A Single Resistor Low Dropout Regulator

RH3083MW

1.0 SCOPE

This specification documents the detail requirements for space qualified product manufactured on Analog Devices, Inc.'s QML certified line per MIL-PRF-38535 Class V except as modified herein.

The manufacturing flow described in the ADI STANDARD SPACE PRODUCTS PROGRAM brochure is to be considered a part of this specification. http://www.analog.com/space

This data specifically details the space grade version of this product. A more detailed operational description and a complete data sheet for commercial product grades can be found at http://www.analog.com/LT3083.

2.0 Part Number

The complete part number(s) of this specification follows:

Specific Part Number	Description
RH3083MW	Adjustable 2.8A Single Resistor Low Dropout Regulator

3.0 Case Outline

The case outline(s) are as designated in MIL-STD-1835 and as follows:

Outline Letter	Descriptive Designator	Terminals	Lead Finish	Package style
X	CDFP3-F16	16- lead	Hot Solder Dip	Bottom Brazed Flat Pack

FUNCTIONAL BLOCK DIAGRAM 1/

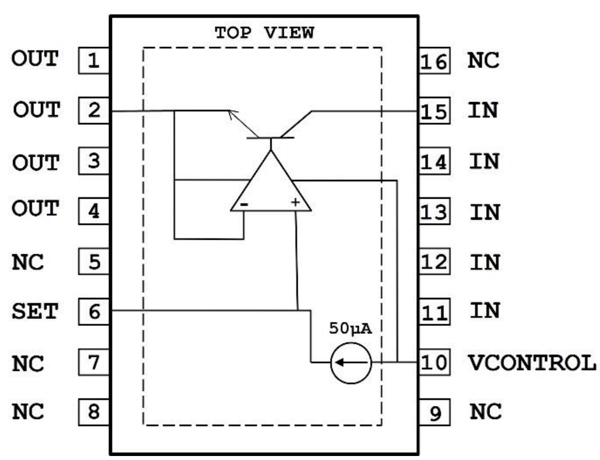

Figure 1 – Functional Block Diagram

1/ Package top view

One Analog Way, Wilmington, MA 01887, U.S.A.
Tel: 781.329.4700 www.analog.com
Fax: 800.262.5643

Package: X			
Pin Number	Terminal Symbol	Pin Type	Pin Description
1, 2, 3, 4, Package Base 1/	OUT	OUTPUT	Output
5, 7, 8, 9,16	NC	No Connect	No Connection
6	SET	INPUT	Non-inverting input to the error amplifier and the regulation set-point
10	$V_{CONTROL}$	INPUT	Bias Supply
11, 12, 13, 14, 15	IN	INPUT	Power Input

Figure 2 - Terminal Connections

1/ The package bottom has an exposed metal pad that must be connected to the printed circuit board (PCB) output.

4.0 Specifications

4.1. Absolute Maximum Ratings 1/

CONTROL Pin Voltage ......±28V
IN Pin Voltage ......18V, –0.3V
No Overload or Short-Circuit ...... 23V, –0.3V
SET Pin Current......±25mA
SET Pin Voltage......±10V
Output Short-Circuit Duration ......Indefinite
Operating Junction Temperature Range (T_J)......–55°C to 125°C
Storage Temperature Range ......–65°C to 150°C
Maximum Junction Temperature ......165°C
Thermal Resistance: Junction to Ambient (θ_{JA}) ......78.73°C/W
Thermal Resistance: Junction to Case (θ_{JC}) ......3.86°C/W
Lead Temperature (Soldering, 10sec) ......300°C
ESD Sensitivity (CDM) ......Class C3
ESD Sensitivity (HBM) ......Class 2

4.2. Recommended Operating Conditions

Ambient operating temperature range (T_A) ......-55 °C to +125 °C

4.3. Nominal Operating Performance Characteristics (25 °C)

Error Amplifier RMS Output Noise 2/......40uV$_{RMS}$
Reference Current RMS Output Noise 10Hz ≤ f ≤ 100kHz 2/ ......1nA$_{RMS}$

4.4. Radiation Features

Maximum total dose available (50-300 rads(Si)/s) ......100 krads(Si)

1/ Stresses above those listed under Absolute Maximum Ratings may cause permanent damage to the device. This is a stress rating only; functional operation of the device at these or any other conditions outside of those indicated in the operation sections of this specification is not implied. Exposure to absolute maximum ratings for extended periods may affect device reliability.
2/ Output noise is lowered by adding a small capacitor across the voltage setting resistor. Adding this capacitor bypasses the voltage setting resistor shot noise and reference current noise; output noise is then equal to error amplifier noise (see the Applications Information section of commercial datasheet).

TABLE I – ELECTRICAL PERFORMANCE CHARACTERISTICS

Parameter See notes at end of table	Symbol	Conditions 1/ Unless otherwise specified		Sub-Group	Limit Min	Limit Max	Units
SET Pin Current 2/	I_{SET}	V_{IN} = 1V, $V_{CONTROL}$ = 2V, I_{LOAD} = 1mA, T_J = 25°C		1	49.5	50.5	uA
			M, D, P, L, R	1	49.5	50.5	uA
		V_{IN} ≥ 1V, $V_{CONTROL}$ ≥ 2V, 5mA ≤ I_{LOAD} ≤ 2.8A		2,3	49	51.5	uA
Output Offset Voltage (V_{OUT} – V_{SET}) VOS	V_{OS}	V_{IN} = 1V, $V_{CONTROL}$ = 2V, I_{LOAD} = 1mA		1	-4	4	mV
			M, D, P, L, R	1	-4	4	mV
		V_{IN} = 1V, $V_{CONTROL}$ = 2V, I_{LOAD} = 5mA		2,3	-6	6	mV
Load Regulation	ΔI_{SET}	ΔI_{LOAD} = 1mA to 2.8A		1	-200	200	nA
			M, D, P, L, R	1	-200	200	nA
		ΔI_{LOAD} = 5mA to 2.8A		2,3	-300	300	nA
	ΔV_{OS}	ΔI_{LOAD} = 1mA to 2.8A		1	-3	3	mV
			M, D, P, L, R	1	-3	3	mV
		ΔI_{LOAD} = 5mA to 2.8A		2,3	-4	4	mV
Line Regulation	ΔI_{SET}	V_{IN} = 1V to 23V, $V_{CONTROL}$ = 2V to 25V, I_{LOAD} = 1mA		1	-8	8	nA/V
			M, D, P, L, R	1	-8	8	nA/V
		V_{IN} = 1V to 23V, $V_{CONTROL}$ = 2V to 25V, I_{LOAD} = 5mA		2,3	-10	10	nA/V
	ΔV_{OS}	V_{IN} = 1V to 23V, $V_{CONTROL}$ = 2V to 25V, I_{LOAD} = 1mA		1	-0.02	0.02	mV/V
			M, D, P, L, R	1	-0.02	0.02	mV/V
		V_{IN} = 1V to 23V, $V_{CONTROL}$ = 2V to 25V, I_{LOAD} = 5mA		2,3	-0.05	0.05	mV/V
Minimum Load Current		V_{IN} = 1V, $V_{CONTROL}$ = 2V		1,2,3		500	uA
		V_{IN} = 23V, $V_{CONTROL}$ = 25V		1,2,3		1.0	mA
$V_{CONTROL}$ Dropout Voltage		I_{LOAD} = 100mA		1		1.4	V
				2,3		1.55	V
			M, D, P, L, R	1		1.45	V
		I_{LOAD} = 1A		1		1.45	V
				2,3		1.6	V
			M, D, P, L, R	1		1.45	V
		I_{LOAD} = 2.8A		1		1.5	V
				2,3		1.65	V
			M, D, P, L, R	1		1.5	V

Parameter See notes at end of table	Symbol	Conditions 1/ Unless otherwise specified		Sub-Group	Limit Min	Limit Max	Units
V_{IN} Dropout Voltage		I_{LOAD} = 100mA		1,2,3		35	mV
			M, D, P, L, R	1		35	mV
		I_{LOAD} = 1A		1		220	mV
				2,3		280	mV
			M, D, P, L, R	1		220	mV
		I_{LOAD} = 2.8A		1		650	mV
				2,3		750	mV
			M, D, P, L, R	1		650	mV
$V_{CONTROL}$ Pin Current		I_{LOAD} = 100mA		1,2,3		10	mA
			M, D, P, L, R	1		10	mA
		I_{LOAD} = 1A		1		35	mA
				2,3		40	mA
			M, D, P, L, R	1		35	mA
		I_{LOAD} = 2.8A		1		80	mA
				2,3		90	mA
			M, D, P, L, R	1		80	mA
Current Limit		V_{IN} = 5V, $V_{CONTROL}$ = 5V,		1,2,3	2.8	4.3	A
		V_{SET} = 0V, V_{OUT} = −0.1V	M, D, P, L, R	1	2.8	4.3	A
Ripple Rejection		f = 120Hz V_{RIPPLE} = 0.5V_{P-P}, I_L = 0.1A, C_{SET} = 0.1µF, C_{OUT} = 10µF		4	80		dB
Thermal Regulation, I_{SET}		10ms Pulse		4		0.3	%/W

Table I Notes:

1/ Device supplied to this drawing have been characterized through all levels M, D, P, L, R of irradiation. However, device is only tested at the "R" level. Pre and Post irradiation values are identical unless otherwise specified in Table I. When performing post irradiation electrical measurements for any RHA level, T_A = +25°C.

2/ The SET pin is clamped to the output with diodes through 1k resistors. These resistors and diodes will only carry current under transient overloads.

TABLE IIA – ELECTRICAL TEST REQUIREMENTS:

Test Requirements	Subgroups (in accordance with MIL-PRF-38535, Table III)
Interim Electrical Parameters	1, 4
Final Electrical Parameters	1, 2, 3, 4, 5, 6 1/ 2/
Group A Test Requirements	1, 2, 3, 4, 5, 6
Group C end-point electrical parameters	1, 2, 3, 4, 5, 6 2/
Group D end-point electrical parameters	1, 4
Group E end-point electrical parameters	1

Table IIA Notes:
1/ PDA applies to Table I subgroup 1 and 4 and Table IIB delta parameters.
2/ See Table IIB for delta parameters.

TABLE IIB – LIFE TEST/BURN-IN DELTA LIMITS (1/,2/,3/)

V_{IN} = 1V, $V_{CONTROL}$ = 2V, I_{LOAD} = 1mA			
Parameter	**Symbol**	**Delta**	**Units**
Set Pin Current	I_{SET}	±10	%

Table IIB Notes:
1/ 240-hour burn-in and 1000-hour life test end point electrical parameters.
2/ Deltas are performed at T_A = +25 °C only.
3/ Product is tested in accordance with conditions in Table I.

5.0 Burn-In Life Test, and Radiation

5.1. Burn-In Test Circuit, Life Test Circuit

5.1.1. The test conditions and circuit shall be maintained by the manufacturer under document revision level control and shall be made available to the preparing or acquiring activity upon request. The test circuit shall specify the inputs, outputs, biases, and power dissipation, as applicable, in accordance with the intent specified in method 1015 test condition B of MIL-STD-883.

5.1.2. HTRB is not applicable for this drawing.

6.0 MIL-PRF-38535 QMLV Exceptions

6.1 Wafer Fabrication

WLA per MIL-STD-883 TM 5007 and SEM inspection per MIL-STD-883 TM2018 are not available for this product.

7.0 Application Notes

7.1 Application Information

When longer supply lines, filters, current sense resistors, or other impedances exist between the supply and the input to the RH3083MW, input bypassing should be reviewed if stability concerns are seen. Just as output capacitance supplies the instantaneous changes in load current for output transients until the regulator is able to respond, input capacitance supplies local power to the regulator until the main supply responds. When impedance separates the RH3083MW from its main supply, the local input can droop so that the output follows. The entire circuit may break into oscillations, usually characterized by larger amplitude oscillations on the input and coupling to the output. Low ESR, ceramic input bypass capacitors are acceptable for applications without long input leads. However, applications connecting a power supply to an RH3083MW circuit's IN and GND pins with long input wires combined with low ESR, ceramic input capacitors are prone to voltage spikes, reliability concerns and application-specific board oscillations. The input wire inductance found in many battery powered applications, combined with the low ESR ceramic input capacitor, forms a high-Q LC resonant tank circuit. In some instances, this resonant frequency beats against the output current dependent LDO bandwidth and interferes with proper operation. Simple circuit modifications/solutions are then required. This behavior is not indicative of RH3083MW instability, but is a common ceramic input bypass capacitor application issue.

7.2 Load Regulation

The RH3083MW is a floating device. No ground pin exists on the packages. Thus, the IC delivers all quiescent current and drive current to the load. Therefore, it is not possible to provide true remote load sensing. The connection resistance between the regulator and the load determines load regulation performance. The data sheet's load regulation specification is Kelvin sensed at the package's pins. Negative-side sensing is a true Kelvin connection by returning the bottom of the voltage setting resistor to the negative side of the load (see Figure 3).

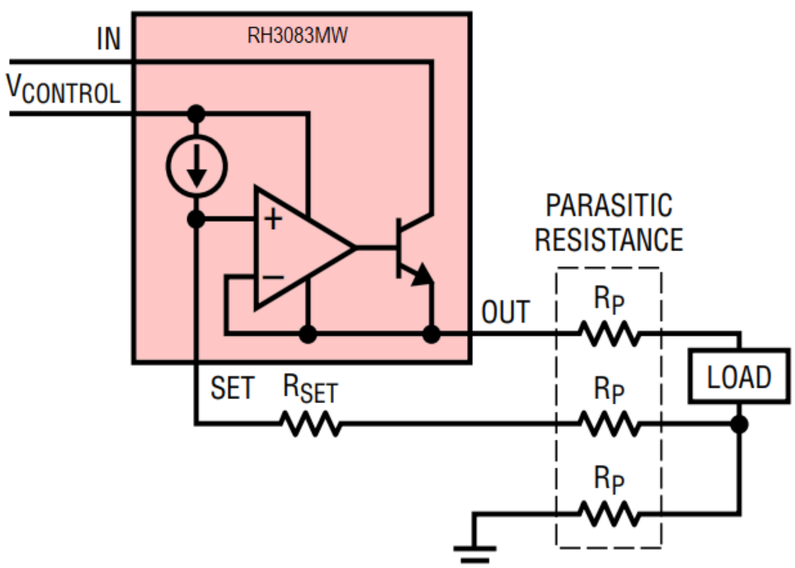

Figure 3 - Connections for Best Load Regulation

8.0 Package Outline Dimensions

The W package and outline dimensions can also be found at http://www.analog.com or upon request.

ORDERING GUIDE

Model	Temperature Range	Package Description	Package Option
RH3083MW	−55°C to +125°C	16-FLATPACK- THERMALLY ENHANCED BBFP	CDFP3-F16

Revision History		
Rev	**Description of Change**	**Date**
A	Initial Production Release	14-Sept-23
B	Change RH3083S to RH3083MW Update Figure 3	04-Dec-23

Printed in the U.S.A. 12/23

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