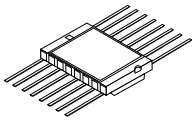
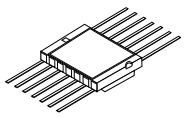
RHFL4913 ADJUSTABLE

RAD-HARD ADJUSTABLE POSITIVE VOLTAGE REGULATOR

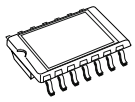
- 1-3 AMPERE LOW DROPOUT VOLTAGE
- EMBEDDED OVERTEMPERATURE, OVERCURRENT PROTECTIONS
- ADJUSTABLE OVERCURRENT LIMITATION
- OUTPUT OVERLOAD MONITORING/ SIGNALLING
- ADJUSTABLE OUTPUT VOLTAGE
- INHIBIT (ON/OFF) TTL COMPATIBLE CONTROL
- PROGRAMMABLE OUTPUT SHORT CIRCUIT CURRENT
- REMOTE SENSING OPERATION
- RADHARD: TESTED UP TO 300krad IN MIL 1019.5 AND LOW DOSE RATE CONDITIONS
- HEAVY IONS SEL, SEU IMMUNE. SUSTAINS $2x10^{14}$ proton/cm^2, AND $2x10^{14}$ neutron/cm^2



FPC-16



FPC-14

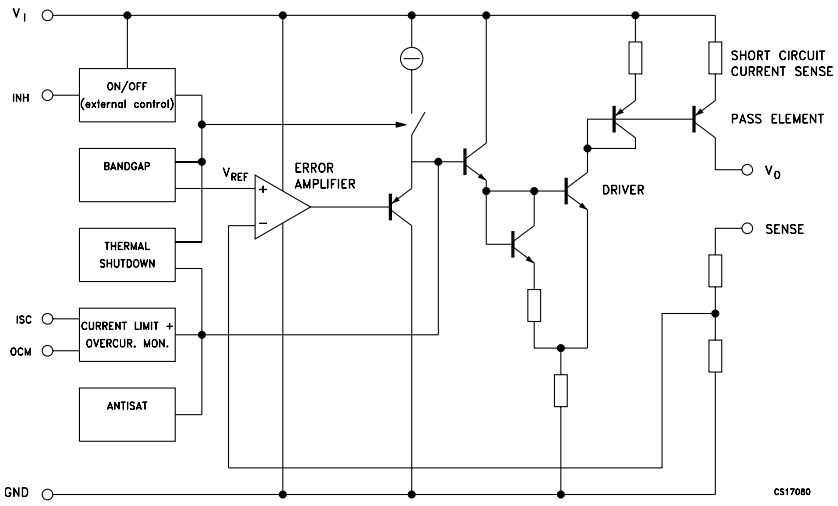


SOC-14

DESCRIPTION

The RHFL4913 ADJUSTABLE is a high performance Rad Hard Adjustable Positive Voltage Regulator.
Available into various hermetic ceramic packages, it is specifically intended for Space and harsh radiation environments. Input supply range is from 3 to 12 volts.
The RHFL4913 ADJUSTABLE is Qml-V Qualified, DSCC Smd is 596202524.

BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATINGS (Note 1)

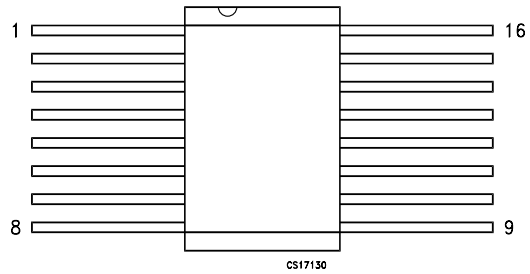
Symbol	Parameter		Value	Unit
V_I	DC Input Voltage, V_I - V_{GROUND}		14	V
V_O	DC Output Voltage Range		1.3 to 9	V
I_O	Output Current	RHFL4913KSOA, KA	1	A
		RHFL4913KPA	2	
P_D	T_C = 25°C Power Dissipation	KSOA, KA versions (14 Pin)	3	W
		KPA, versions (16 Pin)	15	
T_{stg}	Storage Temperature Range		-65 to +150	°C
T_{op}	Operating Junction Temperature Range		-55 to +150	°C
ESD	Electrostatic Discharge Capability		Class 3	

Note 1: Exceeding maximum ratings may damage the device.

THERMAL DATA

Symbol	Parameter	FPC-14	SOC-14	FPC-16	Unit
$R_{thj\text{-}case}$	Thermal Resistance Junction-case Max	42	42	8.3	°C/W
T_{sold}	Maximum soldering Temperature, 10sec.	300			°C

CONNECTION DIAGRAM (Top view)



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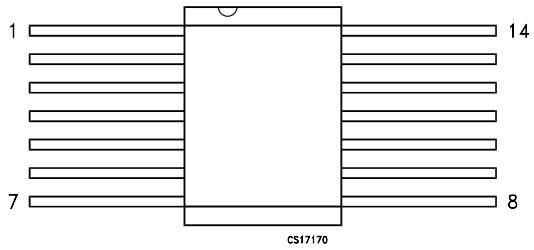
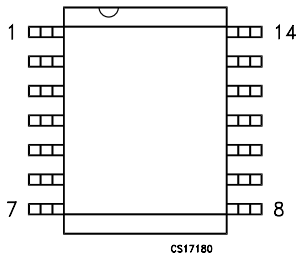


FPC-14



SOC-14

PIN DESCRIPTION

PIN N°	FPC-16	FPC-14	SOC-14
V_O	1, 2, 6, 7	2, 6	2, 6
V_I	3, 4, 5	3, 5	3, 5
GND	13	12	12
I_{SC}	8	7	7
OCM	10	8	8
INHIBIT	14	13	13
ADJ	15	14	14
NC	9, 11, 12, 16	1, 4, 9, 10, 11	1, 4, 9, 10, 11

ORDERING CODES

FPC-14	FPC-16	SOC-14	SOLDER DIPPING	OUTPUT VOLTAGE
RHFL4913KA-05V	RHFL4913KPA-01V	RHFL4913SOA-03V	GOLD	ADJ
RHFL4913KA-06V	RHFL4913KPA-02V	RHFL4913SOA-04V	SOLDER	ADJ

PART NUMBER - SMD EQUIVALENCE

ST PART NUMBER	SMD PART NUMBER
RHFL4913KPA-01V	5962F0252401VXC
RHFL4913KPA-02V	5962F0252401VXA
RHFL4913SOA-03V	5962F0252402VYC
RHFL4913SOA-04V	5962F0252402VYA
RHFL4913KA-05V	5962F0252402VZC
RHFL4913KA-06V	5962F0252402VZA

ENVIRONMENTAL CHARACTERISTICS

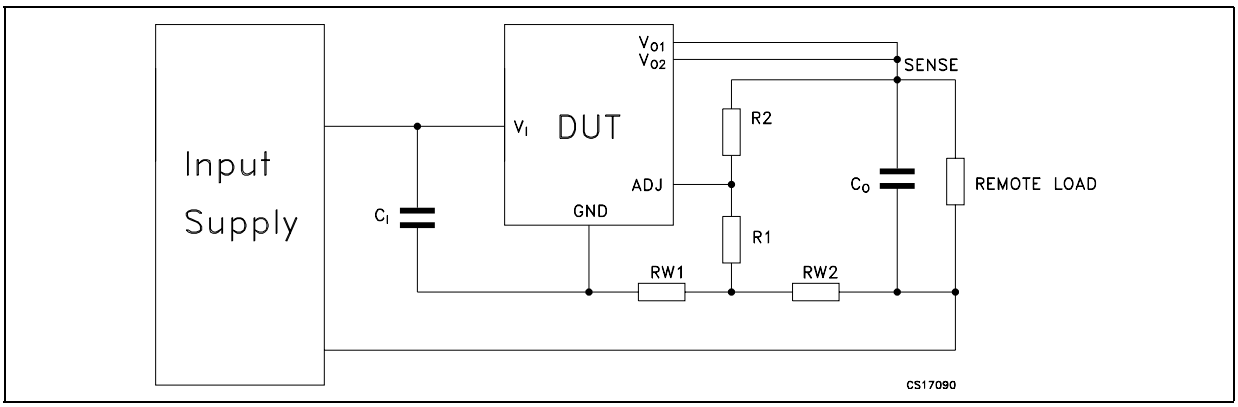
Parameter	Conditions	Typical	Unit
Output Voltage thermal drift	-55°C to 125°C	40	ppm/°C
Output Voltage radiation drift	from 0 krad to 300 krad at 0.55rad/sec	8	ppm/krad
Output Voltage radiation drift	from 0 krad to 300 krad, Mil 1019.5	6	ppm/krad

ELECTRICAL CHARACTERISTICS (T_J = 25°C, $V_I = V_O$+2.5V, $C_I = C_O$ = 1µF, unless otherwise specified)

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Unit
V_I	Operating Input Voltage	I_O = 1A T_J= -55 to 125°C		3		12	V
V_{ADJ}	Adjust Pin Voltage	V_I, V_O, I_O, P_D within Max Rating limits		1.19		1.27	%
I_{SHORT}	Output Current Limit (*)	Adjustable by mask/external resistor			4.5		A
$\Delta V_O/\Delta V_I$	Line Regulation	$V_I = V_O$+2.5V to 12 V, I_O = 5mA				0.35	%
$\Delta V_O/\Delta V_O$	Load Regulation	$V_I = V_O$+2.5V, I_O = 5mA to 400 mA				0.3	%
		$V_I = V_O$+2.5V, I_O = 5mA to 1A				0.5	
Z_{OUT}	Output Impedance	I_O = 100 mA DC and 20 mA rms			100		mΩ
I_q	Quiescent Current	$V_I = V_O$+2.5V, I_O = 5mA On Mode				6	mA
		$V_I = V_O$+2.5V, I_O = 30mA On Mode				8	
		$V_I = V_O$+2.5V, I_O = 300mA On Mode				25	
		$V_I = V_O$+2.5V, I_O = 1A On Mode				60	
		$V_I = V_O$+2V, V_{INH} = 2.4V Off Mode				1	
I_q	Quiescent Current	$V_I = V_O$+2.5V, I_O = 5mA, T_J=-55 to 125°C				6	mA
		$V_I = V_O$+2.5V, I_O = 30mA, T_J=-55 to 125°C				14	
		$V_I = V_O$+2.5V, I_O = 300mA, T_J=-55 to 125°C				40	
		$V_I = V_O$+2.5V, I_O = 1A, T_J=-55 to 125°C				100	
V_d	Dropout Voltage	I_O = 400mA V_O = 2.5 to 9 V, (-55°C)			300	400	V
		I_O = 400mA V_O = 2.5 to 9 V, (25°C)			350	450	
		I_O = 1A V_O = 2.5 to 9 V, (25°C)				650	
		I_O = 2A V_O = 2.5 to 9 V, (25°C)			900		
		I_O = 400mA V_O = 2.5 to 9 V, (125°C)			450	550	
		I_O = 1A V_O = 2.5 to 9 V, (125°C)				800	
		I_O = 2A V_O = 2.5 to 9 V, (125°C)			950		
$V_{INH(ON)}$	Inhibit Voltage	I_O = 5mA, T_J=-55 to 125°C				0.8	V
$V_{INH(OFF)}$	Inhibit Voltage	I_O = 5mA, T_J=-55 to 125°C		2.4			V
SVR	Supply Voltage Rejection	$V_I = V_O$+2.5V ± 0.5V, I_O = 5mA	f = 120Hz	60	70		dB
			f = 33KHz	30	40		
I_{SH}	Shutdown Input Current	V_{INH} = 5 V			15		µA
V_{OCM}	OCM Pin Voltage	Sinked I_{OCM} = 10 mA active low			0.38		V
t_{PLH}	Inhibit Propagation Delay	$V_I = V_O$+2.5V, V_{INH} = 2.4 V, I_O = 400 mA		ON-OFF		20	µS
t_{PHL}				OFF-ON		100	µS
eN	Output Noise Voltage	B= 10Hz to 100KHz I_O = 5mA to 2A			40		µVrms

(*) This value is guaranteed by design. For each application it's strongly recommended to comply with the maximum current limit of the package used.

APPLICATION DIAGRAM FOR REMOTE SENSINS OPERATION



DEVICE DESCRIPTION

The RHFL4913 Adjustable contains a PNP type power element controlled by a signal resulting from amplified comparison between the internal temperature compensated Band-Gap and the fraction of the desired Output Voltage value obtained from an external resistor divider bridge. The device is protected by several functional blocks.

ADJ pin

The Load output voltage feed-back comes from an external divider resistor bridge middle point connected to ADJ pin (allowing all possible output voltage settings as per User's desire) established between Load terminals.

INHIBIT ON-OFF Control

By setting INHIBIT pin TTL-High, the Device switches off the Output Current and Voltage. Device is ON when INHIBIT pin is set Low. Since INHIBIT pin is internally pulled down, it can be left floating in case Inhibit function is not utilized.

Overtemperature protection

A temperature detector internally monitors the power element junction temperature. The Device goes OFF when approx. 175°C are reached, returning to ON mode when back to approx. 40°C. Combined with other protection blocks, it protects the Device from destructive junction temperature excursions in all load conditions. It is worth noting that when internal temperature detector reaches 175°C, the active power element can be at 225°C: Extensive operation under these conditions far exceeds Maximum Operation Ratings and Device reliability cannot be granted.

Overcurrent protection

An internal non-fold back Short-Circuit limitation is set with I_{SHORT} > 3.8A (V_O is 0V). This value can be downwards modified by an external resistor connected between I_{SC} pin and V_I pin, with a typical value range of 10kΩ to 200kΩ. To keep excellent V_O regulation, it is necessary to set I_{SHORT} 1.6 times greater than the maximum desired application I_O. When I_O reaches I_{SHORT} – 300mA, the current limiter overrules Regulation and V_O starts to drop and OCM flag is risen. When no current limit adjustment is required, I_{SC} pin must be left unbiased (as it is in 3pin packages).

OCM pin

Goes Low when current limit starts to be active, otherwise $V_{OCM} = V_I$. It is buffered and can sink 10mA. OCM pin is internally pulled-up by a 5 kΩ resistor.

Alternates to: RHFL4913 is recommended to replace all Industry Positive Regulators due to its exceptional Radiation performance. To replace 3-terminal Industry devices, use RHFL4913 Fixed Voltage versions.

APPLICATION INFORMATION

Adjusting Output Voltage: R2 resistor must be connected between V_O and ADJ. R1 resistor must be connected between ADJ and Ground. Resistor values can be derived from the following formula:

$$V_O = V_{ADJ} \times (R1+ R2) / R1$$

V_{ADJ} is 1.22V, controlled by the internal temperature compensated Band Gap block.
The minimum Output voltage is therefore 1.22V and minimum Input voltage is 3V.

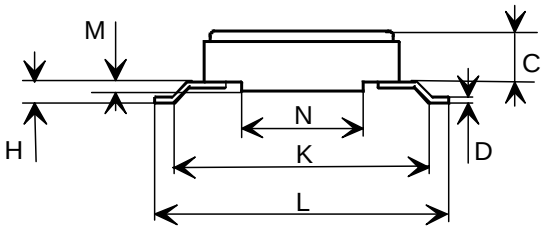
The RHFL4913 Adjustable is functional as soon as V_I - V_O voltage difference is slightly above the power element saturation voltage. The Adjust pin to Ground resistor must not be bigger than 10kΩ to keep the output feed-back error below 0.2%. A minimum 0.5mA I_O must be set to ensure perfect “no-load” regulation. It is advisable to dissipate this current into the divider bridge resistor. All available V_I pins shall always be externally interconnected, same thing for all available V_O pins, otherwise Device stability and reliability cannot be granted. The INHIBIT function switches off the output current in an electronic way, that is very quickly. According to Lenz’s Law, external circuitry reacts with LdI/dt terms which can be of high amplitude in case somewhere an inductance exists. Large transient voltage would develop on both Device terminals. It is advisable to protect the Device with Schottky diodes preventing negative voltage excursions. In the worst case, a 14V Zener diode shall protect the Device Input. The Device has been designed for high stability and low drop out operation: Minimum 1µF input and output tantalum capacitors are therefore mandatory. Capacitor ESR range is from 0.5 Ω to over 20 Ω. Such range turns out to be useful when ESR increases at low temperature. When large transient currents are expected, larger value capacitors are necessary.

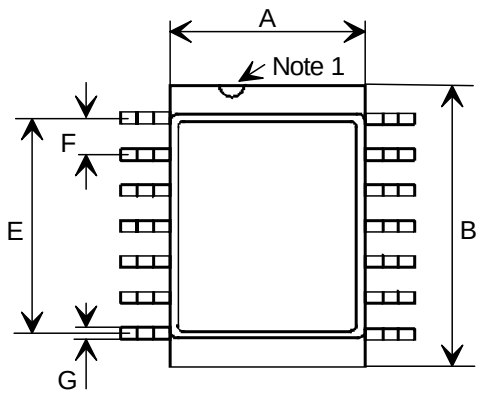
In case of high current operation with expected short-circuit events, caution must be considered relatively to capacitors. They must be connected as close as possible to device terminals. As some tantalum capacitors may permanently fail when submitted to high charge-up surge currents, it is recommended to decouple them with 470nF polyester capacitors.

Being RHFL4913 Adjust manufactured with very high speed bipolar technology (6GHz f_T transistors), the PCB layout must be performed with exceptional care, very low inductance, low mutually coupling lines, otherwise high frequency parasitic signals may be picked-up by the Device resulting into system self-oscillation. The benefit is an SVR performance extended to far higher frequencies.

SOC-14 MECHANICAL DATA

DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A		6.90			0.272	
B		9.95			0.392	
C	1.49		1.95	0.059		0.077
D	0.102	0.127	0.152	0.004	0.005	0.006
E	7.5		7.75	0.295		0.305
F		1.27			0.050	
G		0.43			0.017	
H	0.60		0.90	0.024		0.035
K		9			0.354	
L	10.00		10.65	0.394		0.419
M		0.38			0.015	
N		4.31			0.170	





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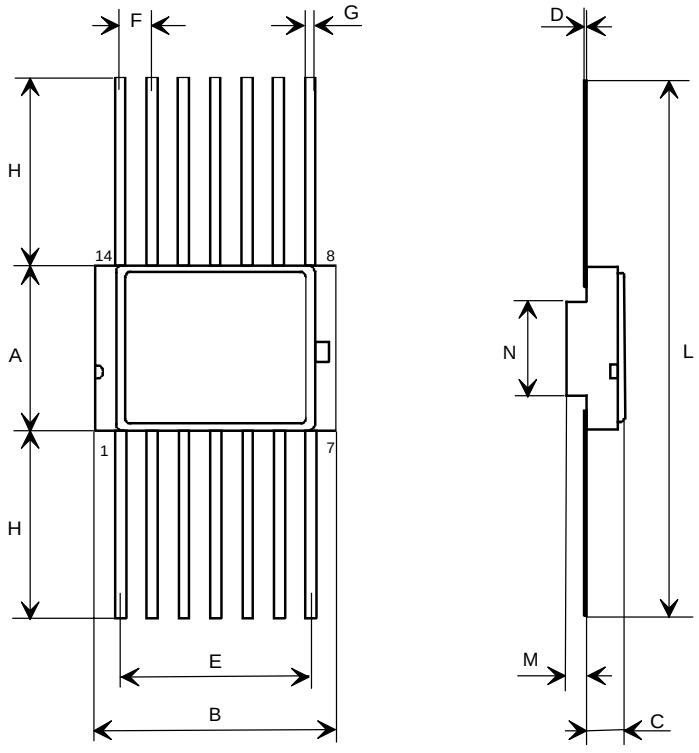
FPC-14 MECHANICAL DATA

DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A		6.9			0.272	
B		9.95			0.392	
C	1.49		1.95	0.059		0.077
D		0.127			0.005	
E		7.62			0.300	
F		1.27			0.050	
G		0.43			0.017	
H		6.0			0.236	
L	18.75		22.0	0.738		0.866
M		0.38			0.015	
N		4.31			0.170	



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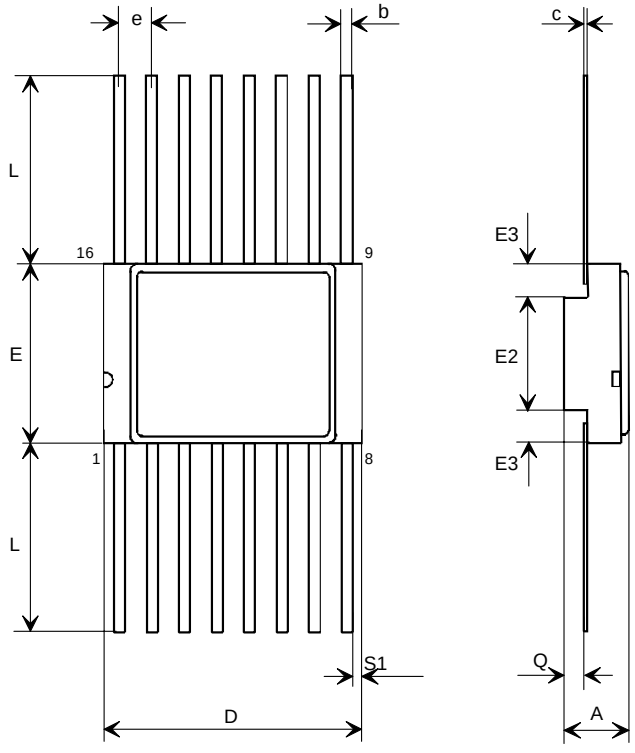
ALN FPC-16 (MIL-STD-1835) MECHANICAL DATA

DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A	2.16		2.72	0.085		0.107
b		0.43			0.017	
c		0.13			0.005	
D		9.91			0.390	
E		6.91			0.272	
E2		4.32			0.170	
E3	0.76			0.030		
e		1.27			0.050	
L		6.72			0.265	
Q	0.66		1.14	0.026		0.045
S1	0.13			0.005		



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