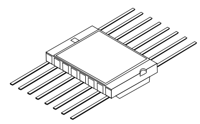
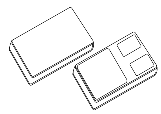
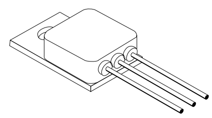
RHFL4913
FIXED VERSION

RAD-HARD POSITIVE FIXED VOLTAGE REGULATORS

- LOW DROPOUT VOLTAGE
- EMBEDDED OVERTEMPERATURE, OVERCURRENT PROTECTIONS
- ADJUSTABLE CURRENT LIMITATION
- OUTPUT OVERLOAD MONITORING/ SIGNALLING
- FIXED 2.5; 3.3V; 5.0V OUTPUT VOLTAGES
- 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 FREE. SUSTAINS 2×10^{14} proton/cm^2, AND 2×10^{14} neutron/cm^2


FPC-16


SMD.5


TO-257

DESCRIPTION

The RHFL4913 Fixed is a high performance Rad Hard Positive Voltage Regulator family.

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.

RHFL4913 Fixed is Qml-V Qualified, DSCC Smd are 5962F02534 / 02535 / 02536 / 02537.

BLOCK DIAGRAM

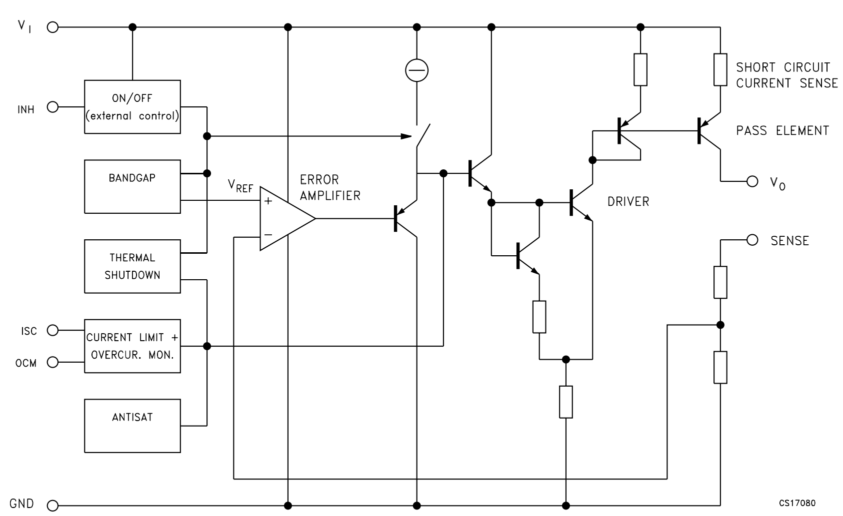


Table 1: Absolute Maximum Ratings (Note 1)

Symbol	Parameter		Value	Unit
V_I	DC Input Voltage, V_I - V_{GROUND}		14	V
I_O	Output Current	RHFL4913S, ESY	3	A
		RHFL4913KP	2	
P_D	T_C = 25°C Power Dissipation		15	W
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.

Table 2: Thermal Data

Symbol	Parameter	FPC-16	TO-257	SMD.5	Unit
$R_{thj\text{-}case}$	Thermal Resistance Junction-case	8.3	8.3	8.3	°C/W
T_{sold}	Maximum soldering Temperature, 10sec.	300			°C

Figure 1: Connection Diagram (Top view, Bottom view for SMD.5)

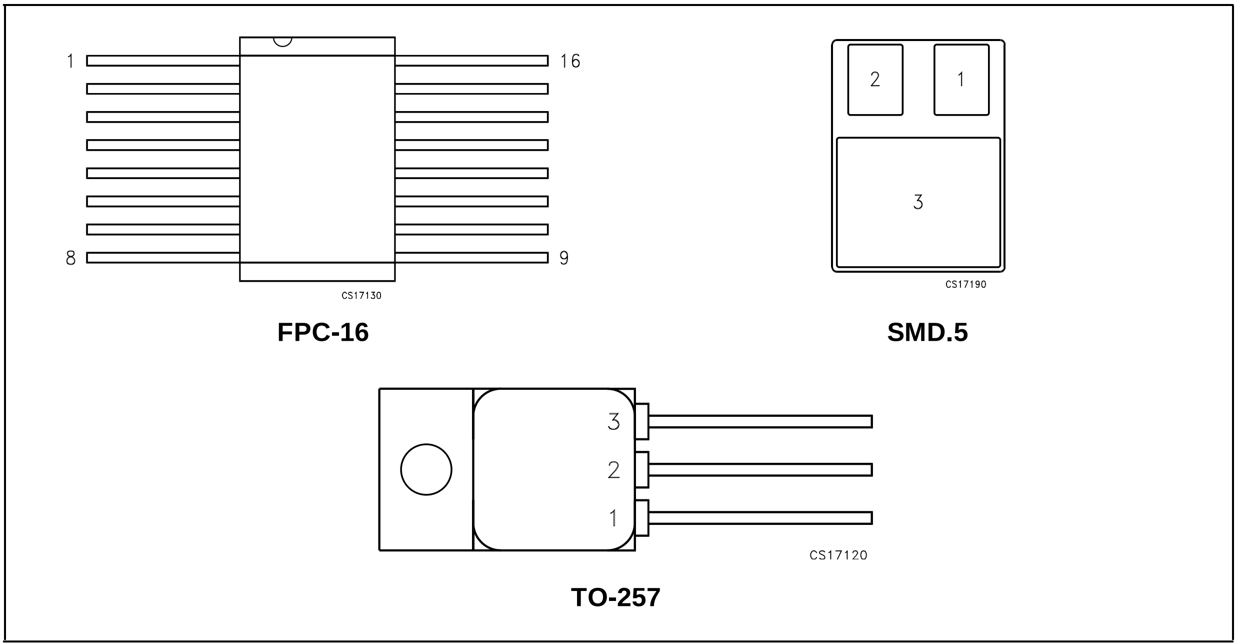


Table 3: Pin Description

PIN N°	FPC-16	SMD.5	TO-257
V_O	1, 2, 6, 7	1	3
V_I	3, 4, 5	2	1
GND	13	3	2
I_{SC}	8		
OCM	10		
INHIBIT	14		
SENSE	16		
NC	9, 11, 12, 15		

Table 4: Ordering Codes

FPC-16	SMD.5	TO-257	SOLDER DIPPING	OUTPUT VOLTAGE
RHFL4913KP25-01V	RHFL4913S25-03V	RHFL4913ESY2505V	GOLD	2.5 V
RHFL4913KP25-02V	RHFL4913S25-04V	RHFL4913ESY2506V	SOLDER	2.5 V
RHFL4913KP30-01V	RHFL4913S30-03V	RHFL4913ESY3005V	GOLD	3.0 V
RHFL4913KP30-02V	RHFL4913S30-04V	RHFL4913ESY3006V	SOLDER	3.0 V
RHFL4913KP33-01V	RHFL4913S33-03V	RHFL4913ESY3305V	GOLD	3.3 V
RHFL4913KP33-02V	RHFL4913S33-04V	RHFL4913ESY3306V	SOLDER	3.3 V
RHFL4913KP50-01V	RHFL4913S50-03V	RHFL4913ESY5005V	GOLD	5.0 V
RHFL4913KP50-02V	RHFL4913S50-04V	RHFL4913ESY5006V	SOLDER	5.0 V

Table 5: Part Number - Smd Equivalence

ST PART NUMBER	SMD PART NUMBER
RHFL4913KP25-01V	5962F0253401VXC
RHFL4913KP25-02V	5962F0253401VXA
RHFL4913KP33-01V	5962F0253501VXC
RHFL4913KP33-02V	5962F0253501VXA
RHFL4913KP50-01V	5962F0253601VXC
RHFL4913KP50-02V	5962F0253601VXA
RHFL4913S25-03V	5962F0253402VYC
RHFL4913S25-04V	5962F0253402VYA
RHFL4913S33-03V	5962F0253502VYC
RHFL4913S33-04V	5962F0253502VYA
RHFL4913S50-03V	5962F0253602VYC
RHFL4913S50-04V	5962F0253602VYA
RHFL4913ESY2505V	5962F0253402VZC
RHFL4913ESY2506V	5962F0253402VZA
RHFL4913ESY3305V	5962F0253502VZC
RHFL4913ESY3306V	5962F0253502VZA
RHFL4913ESY5005V	5962F0253602VZC
RHFL4913ESY5006V	5962F0253602VZA

Note: 3V version is available on request.

Table 6: Environmental Characteristics

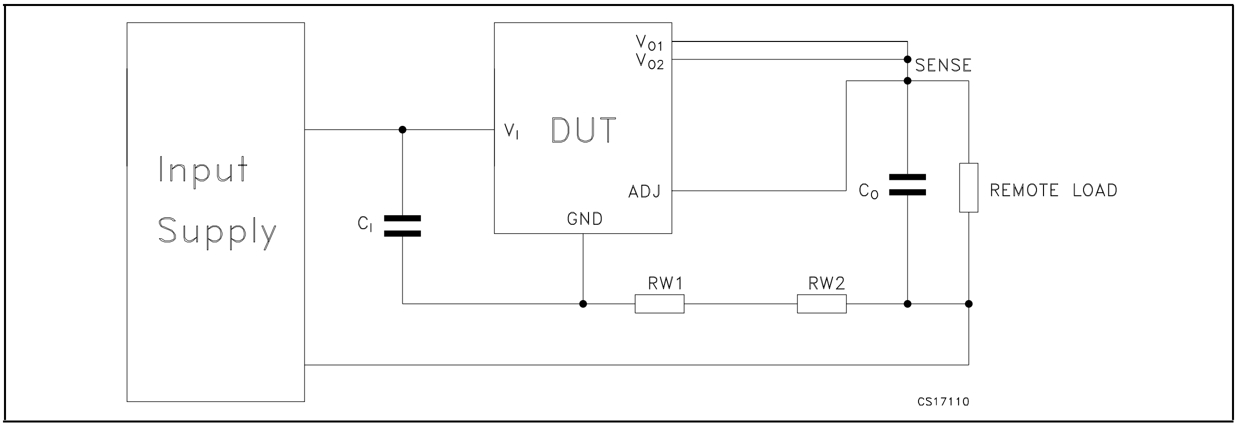
Parameter	Conditions	Typical	Unit
Output Voltage thermal drift	-55°C to 125°C	40	ppm/°C
Output Voltage radiation drift	from 0 krad to 300 krad at 0.55rad/sec	8	ppm/krad
Output Voltage radiation drift	from 0 krad to 300 krad, Mil 1019.5	6	ppm/krad

Table 7: 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_O	Output Voltage accuracy	$V_I = V_O$+2.5V, I_O = 5mA		-2		2	%
I_{SHORT}	Output Current Limit (*)	Adjustable by mask/external resistor			4.5		A
V_O	Operating Output Voltage	I_O = 2 A, 2.5 V output voltage		2.45		2.55	V
V_O	Operating Output Voltage	I_O = 2 A, 3.3 V output voltage		3.23		3.37	V
V_O	Operating Output Voltage	I_O = 2 A, 5.0 V output voltage		4.9		5.1	V
$\Delta V_O/\Delta V_I$	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
	Dropout Voltage	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		
	Dropout Voltage	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.

Figure 2: Application Diagram For Remote Sensins Operation



DEVICE DESCRIPTION

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

Low pin count Package limitations

Some functions (INHIBIT, OCM, SENSE) are not available due to lack of pins. Corresponding die pads are by default connected inside silicon.

SENSE pin

The Load voltage is applied by a Kelvin line connected to SENSE pin: Voltage feed-back comes from the internal divider resistor bridge. Therefore possible output voltages are set by manufacturer mask metal options. SENSE pin is not available in 3pin packages.

INHIBIT ON-OFF Control

By setting INHIBIT pin TTL-High, the Device switches off the Output Current and Voltage. The 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. INHIBIT pin is not available in 3pin packages.

Overtemperature protection

A temperature detector internally monitors the power element junction temperature. The Device goes OFF at approx. 175°C, returning to ON mode when back to approx. 40°C. It is worth noting that when the internal temperature detector reaches 175°C, the active power element can be at 225°C: Device reliability cannot be granted in case of extensive operation under these conditions.

Overcurrent protection

I_{SC} pin. An internal non-fold back Short-Circuit limitation is set with I_{SHORT} > 3.8A (V_O is 0V). This value can be reduced by an external resistor connected between I_{SC} pin and V_I pin, with a typical value range of 10kΩ to 200kΩ. This adjustment feature is not available in 3pin packages. 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 the OCM flag is risen. When no current limitation adjustment is required, I_{SC} pin must be left unbiased (as it is in 3 pin packages).

OCM pin

Goes Low when current limiter starts to be active, otherwise $V_{OCM} = V_I$. It is bufferized and can sink 10mA. OCM pin is internally pulled-up by a 5 kΩ resistor. Not available in 3pin packages.

Alternate to

RHFL4913 Fixed (& custom) Voltages replace all 3-terminal Industry Devices, providing essential benefits
- Lower Drop-Out
- High radiation performance
- Better SVR
- Saving the high stability external setting resistors.

APPLICATION INFORMATION

The RHFL4913 Fixed Voltage is functional as soon as V_I-V_O voltage difference is slightly above the power element saturation voltage. A minimum 0.5mA I_O ensures perfect “no-load” regulation.
All available V_I pins must always be externally interconnected, same thing for all available V_O pins, otherwise Device stability and reliability cannot be granted. All NC pins can be connected to Ground. 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 some series-inductance exists. The effect would be a large transient voltage developed on both Device terminals. It is necessary 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 Fixed Voltage manufactured with very high speed bipolar technology 6GHz f_T transistors), the PCB lay-out must be performed with extreme care, very low inductance, low mutually coupling lines, otherwise high frequency parasitic signals may be picked-up by the Device resulting into self-oscillation. User’s benefit is a SVR performance extended to far higher frequencies.

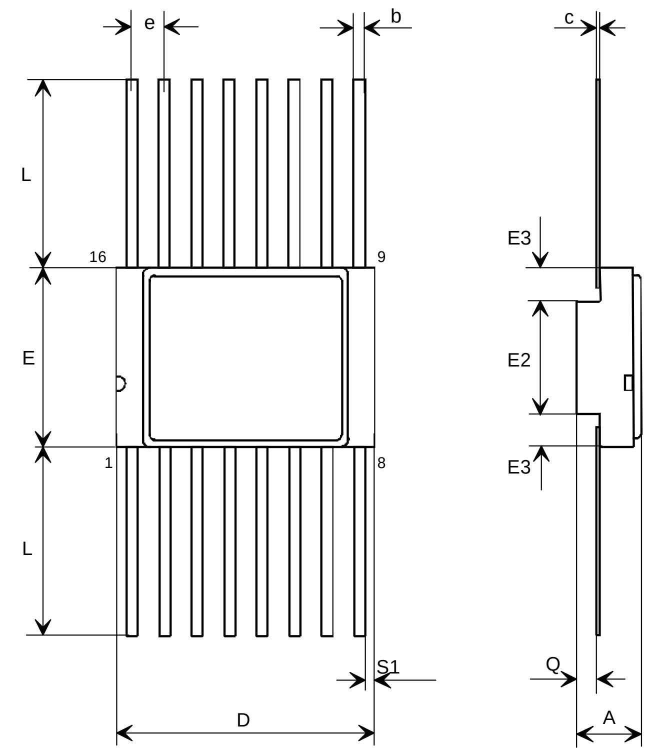
REMOTE SENSING OPERATION

In case the Load is located far from the regulator, it is recommended to comply with the scheme below. To obtain the best regulation, it is in addition essential to care about:
- The wire connecting R2 to the Load end must not be crossed by the Load current (Kelvin sense).

The noise captured by the wires between the Load and the chip could bring a noisy output voltage. In case this happens, it is recommended that shielded cables are used for these connections. The external wrap must be used for connecting the ground of the chip with the Load Ground. It is also recommended to place 1uF tantalum capacitors between Output and Ground close to the device and another next to the Load.

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

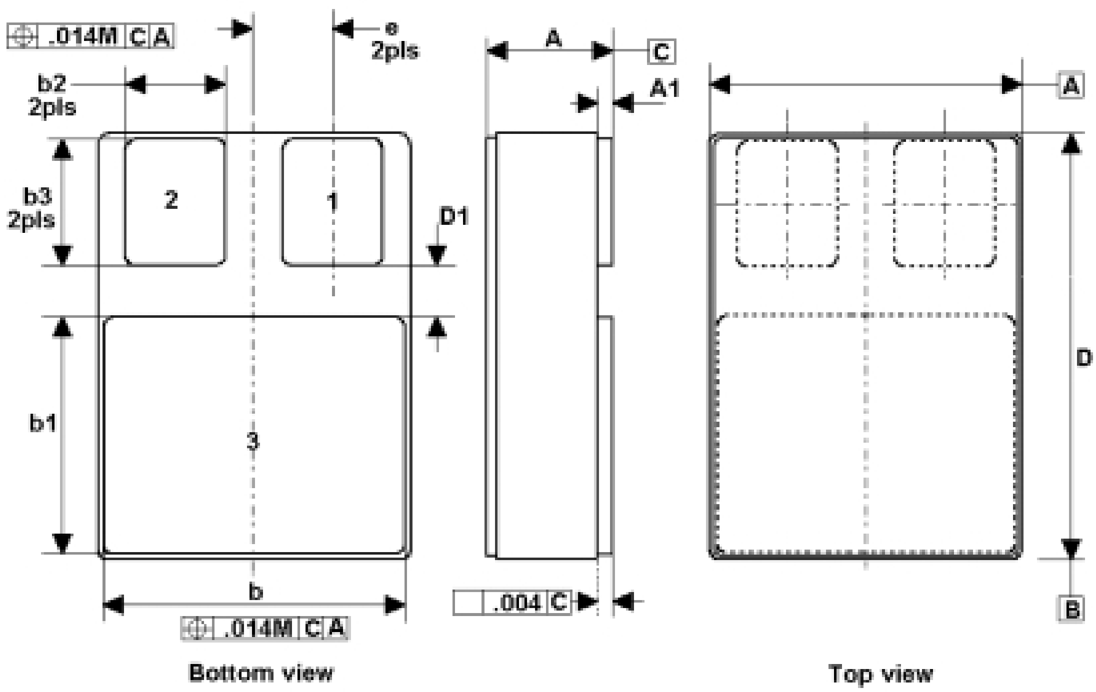
DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A	2.16		2.72	0.085		0.107
b		0.43			0.017	
c		0.13			0.005	
D		9.91			0.390	
E		6.91			0.272	
E2		4.32			0.170	
E3	0.76			0.030		
e		1.27			0.050	
L		6.72			0.265	
Q	0.66		1.14	0.026		0.045
S1	0.13			0.005		



7450901A

SMD.5 MECHANICAL DATA

DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A		3.00			0.118	
A1		0.38			0.015	
b		7.26			0.286	
b1		5.72			0.225	
b2		2.41			0.095	
b3		3.05			0.120	
D		10.16			0.400	
D1	0.76			0.030		
E		7.52			0.296	
e		1.91			0.075	



7386434A

TO-257 MECHANICAL DATA

DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A		10.54			0.415	
B		10.54			0.415	
C		16.64			0.655	
D	4.7		5.33	0.185		0.210
E		1.02			0.40	
F	3.56	3.68	3.81	0.140	0.145	0.150
G		13.51			0.532	
H		5.26			0.207	
I		0.76			0.030	
J		3.05			0.120	
K		2.54			0.100	
L	15.2		16.5	0.598		0.650
M		2.29			0.090	
N			0.71			0.028
R		1.65			0.065	

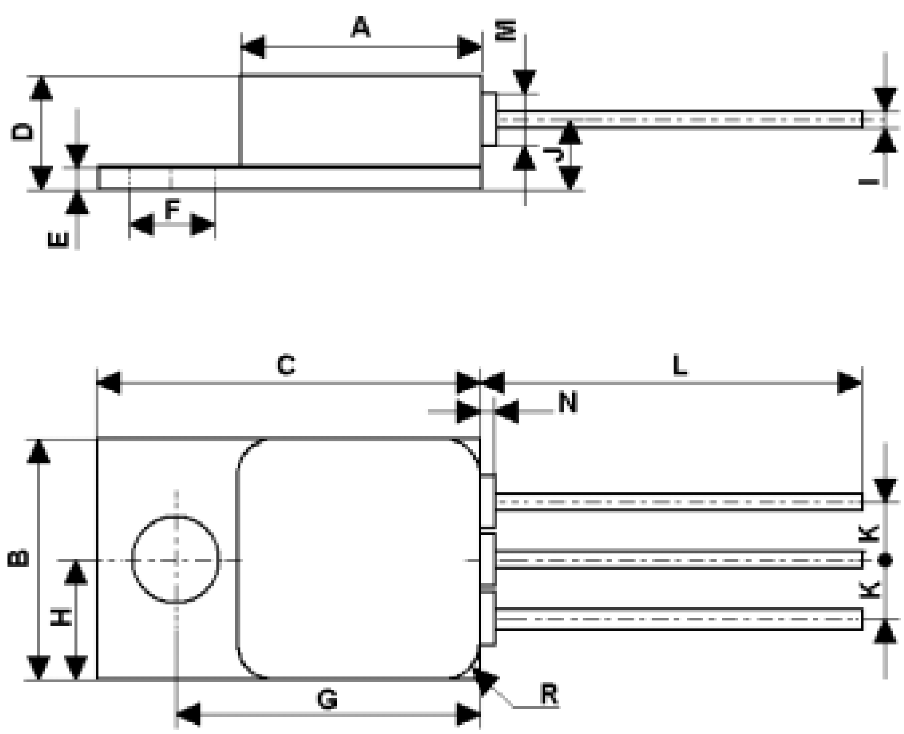


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Table 8: Revision History

Date	Revision	Description of Changes
05-May-2004	5	Mistake in Pin description SMD.5 on Table 3