



TECHNICAL MANUAL  
FOR  
24V/12V REGULATOR  
N420



S.P. RADIO A/S · AALBORG · DENMARK

## 1 GENERAL DESCRIPTION

The regulator is a general purpose 24V DC to 13.2V DC regulator, e.g. to be used for supply of VHF radiotelephones.

The regulator is a serial regulator with excellent noise performance.

### 1.1 TECHNICAL DATA

The regulator is controlled from the connected VHF unit by the on/off button.

Input Voltage	21.6 to 31.2V DC
Output Voltage	13.2V DC
Output Current	Max. 8A DC
Operation Temperature Range	15°C to +55°C
Fuse	8 Amp. 5 x 20mm
Current from on/off Terminal	Less than 15 mA DC

## 1.2 PRINCIPLE OF OPERATION

The regulator is a linear serial regulator where most of the loss is dissipated in resistors. It is provided with a terminal for remote shut-down. If the on/off terminal is connected to the -terminal, the regulator is on. If the on/off terminal is disconnected, the regulator is off.

### 1.3 CIRCUIT DESCRIPTION

The output voltage is regulated by the integrated voltage regulator IC1. The output voltage is 12V DC plus the forward voltage over diodes D5 and D6: approx. 13.2V DC in total if T4 is conducting. If the output voltage drops the current through IC1 and R5 increases. An increase in voltage across R5 will result in an increase in current in T1 and the resistors R10 - R23 resulting in an increase in the output current. T1 delivers most of the output current and FC1 only a small driver current.

If the input voltage is low and the output current is high, the voltage across R10 - R23 results in T1 going into saturation. The voltage across R4 increases and when the voltage across R4 and  $V_{BE}$  of T1 is greater than approx. 1 Volt, T3 starts to conduct base current to T1. This transistor then shunts the remaining current to the output, bypassing R10 - R23.

When the input voltage and the output current are high, T1 is nearly saturated. When the input voltage is low and the output current is high, the resistors R1 - R3 will result in saturation of both T1 and T2. The combination of T1 in saturation and T2 delivering the remaining output current divides the total loss, so the main loss is in the resistors giving low loss in the semi-conductors and a lower junction temperature, resulting in a higher reliability for the whole regulator.

T4 is used to switch the regulator ON and OFF. If the ON/OFF input is disconnected T4 is OFF and the base currents to T1 and T2 are zero and the current through IC1 will also be reduced to zero. The stand-by current consumption is then less than 10 micro amp. If the ON/OFF input is connected to - input, T4 goes into saturation and the regulator starts.

In case of a short-circuit over the output R5 and D3 limits the current through IC1 and T4 to approx. 250 mA and R1 - R3 and D3 limits the current through T1 and T2 to approx. 15 Amp. The temperature of the

cooling surface will increase and activate the thermal protection circuit inside IC1 and lower the output voltage, even though a short-circuit of the output should be avoided.

The diode D1 protects against reverse input voltage. A fuse will blow in case of reverse input.

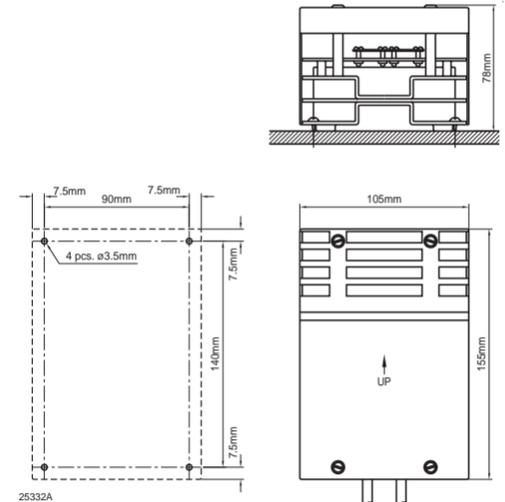
## 1.4 PARTS LIST

REGULATOR	ECI A/S	5-0-24613G	600416	
POSITION	DESCRIPTION	MANUFACTOR	TYPE	PART NO.
C1	CAPACITOR ELECTROLYTIC 47uF -10/+50% 63V	ERO	EB 00 FL 247 J	14.552
C2	CAPACITOR MKT 0.22uF 10% 63V	ERO	MKT1818	11.090
C3	CAPACITOR MKT 0.22uF 10% 63V	ERO	MKT1818	11.090
C4	CAPACITOR ELECTROLYTIC 47uF -10/+50% 63V	ERO	EB 00 FL 247 J	14.552
C5	CAPACITOR MKT 100nF 10% 100VDC	PHILIPS	2222 371 28104	11.180
D1	DIODE	MOTOROLA	MR750	25.219
D2	DIODE SCHOTTKY	THOMSON-CSF	BAT43	27.600
D3	DIODE ZENER	PHILIPS	BZX79C7V5	26.539
D5	DIODE 1N4148 HIGH SPEED	PHILIPS	1N4148-143	25.131
D6	DIODE 1N4148 HIGH SPEED	PHILIPS	1N4148-143	25.131
F1	FUSE 8AF 250V Ø5x20mm	ELU	171 100 8AF	45.561
IC1	VOLTAGE REGULATOR +12V	MOTOROLA	MC7812CT	31.260
R1	RESISTOR POWER 1R0 OHM 10% 6.5W	VITROHM	1R0 10% TYPE 296-0	05.725
R2	RESISTOR POWER 1R0 OHM 10% 6.5W	VITROHM	1R0 10% TYPE 296-0	05.725
R3	RESISTOR POWER 1R0 OHM 10% 6.5W	VITROHM	1R0 10% TYPE 296-0	05.725
R4	RESISTOR 47 OHM 5% 0.6W	BEYSCHLAG	MBB 0207-00-BX-47R	03.167
R5	RESISTOR PMF 27 OHM 5% 3W	PHILIPS	2322 195 13279	04.660
R6	RESISTOR MF 1k0 OHM 5% 0.4W	PHILIPS	2322 181 53102	01.200
R7	RESISTOR MF 1k0 OHM 5% 0.4W	PHILIPS	2322 181 53102	01.200
R8	RESISTOR MF 10k OHM 5% 0.4W	PHILIPS	2322 181 53103	01.225
R9	RESISTOR 2.2 KOHM 5% 0.6W	DRALORIC	SMA 0207 STK100-2K	03.208
R10	RESISTOR POWER 6R8 OHM 10% 6.5W	VITROHM	6R8 10% TYPE 296-0	05.730
R11	RESISTOR POWER 6R8 OHM 10% 6.5W	VITROHM	6R8 10% TYPE 296-0	05.730
R12	RESISTOR POWER 6R8 OHM 10% 6.5W	VITROHM	6R8 10% TYPE 296-0	05.730
R13	RESISTOR POWER 6R8 OHM 10% 6.5W	VITROHM	6R8 10% TYPE 296-0	05.730
R14	RESISTOR POWER 6R8 OHM 10% 6.5W	VITROHM	6R8 10% TYPE 296-0	05.730
R15	RESISTOR POWER 6R8 OHM 10% 6.5W	VITROHM	6R8 10% TYPE 296-0	05.730
R16	RESISTOR POWER 6R8 OHM 10% 6.5W	VITROHM	6R8 10% TYPE 296-0	05.730
R17	RESISTOR POWER 6R8 OHM 10% 6.5W	VITROHM	6R8 10% TYPE 296-0	05.730
R18	RESISTOR POWER 6R8 OHM 10% 6.5W	VITROHM	6R8 10% TYPE 296-0	05.730
R19	RESISTOR POWER 6R8 OHM 10% 6.5W	VITROHM	6R8 10% TYPE 296-0	05.730
R20	RESISTOR POWER 6R8 OHM 10% 6.5W	VITROHM	6R8 10% TYPE 296-0	05.730
R21	RESISTOR POWER 6R8 OHM 10% 6.5W	VITROHM	6R8 10% TYPE 296-0	05.730
R22	RESISTOR POWER 6R8 OHM 10% 6.5W	VITROHM	6R8 10% TYPE 296-0	05.730
R23	RESISTOR POWER 6R8 OHM 10% 6.5W	VITROHM	6R8 10% TYPE 296-0	05.730
T1	TRANSISTOR DARLINGTON	TEXAS	MJ2501	29.235
T2	TRANSISTOR DARLINGTON	TEXAS	MJ2501	29.235
T3	TRANSISTOR AF BC547B NPN TO-92	PHILIPS	BC547B	28.067
T4	TRANSISTOR BD140-10	AEG	BD140-10	29.066



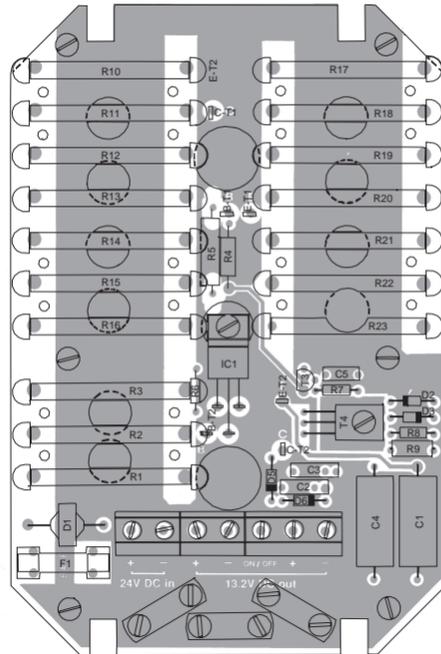
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## DIMENSION AND DRILLING PLAN

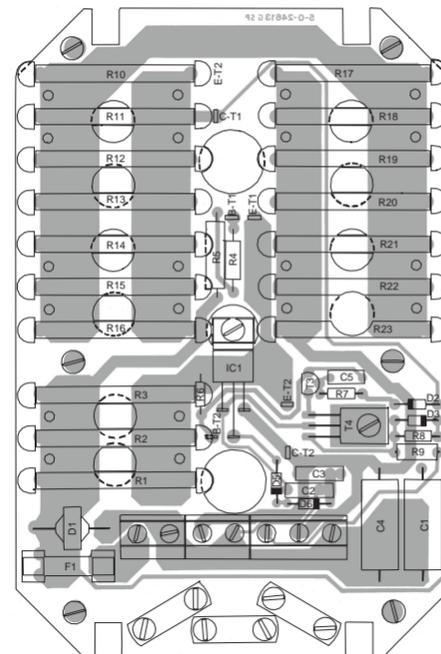


The regulator must only be mounted vertically.  
Free distance must be kept to allow circulation.

## COMPONENT LOCATION

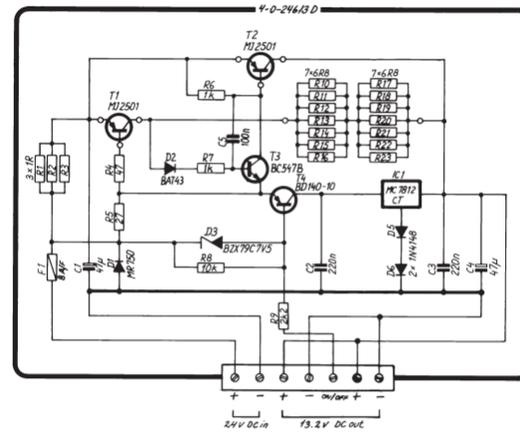


View from component side with upper side tracks.  
PCB rev. 24613G



View from component side with lower side tracks.

## DIAGRAM



This diagram is valid for PCB rev. 24613G