

XMM Optical Monitor

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Blue Detector High Voltage Electronics Design

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XmmOm High voltage converter

Application

Biassing for the blue detector tube is achieved using 3 low to high voltage converters. The converters are connected as shown in figure 1 to achieve the correct operating potentials. Each converter output voltage is variable to achieve optimum detector performance. Control signals into each converter are balanced analogue for interference suppression.

Construction

Electronic design was challenging in that the three converters had to fit into a small volume of approximately 11x11x11cm. To do this we have placed the converters into individual trays so having three converter trays stacked one upon the other, see figure 2.

Interconnection between converters are made external to the trays via 25 way MDM type connectors while high voltage outputs are on the opposite side of the trays. Control, monitor and supply lines are made via a 25 way D-type connector and distribution/filter board on top of the converters forming the fourth tray.

Electronics

Each converter has basically the same circuit topology with variations in feedback and multiplier circuitry, see figure 3.

Voltage conversion is produced by the pulse width modulation technique. For reduced component count the 1525 PWM i.c. was used running off a 11 volt supply. Requiring few external components the 1525 drives the switching transistor via a capacitor/diode network designed to enhance the switching speed of the transistor at 25KHz the operating frequency of the converter. It is necessary to have the switching frequency as high as possible so that component sizes can be as small as possible, however converter efficiency reduces with increased frequency so 25KHz was chosen as a compromise between component size and converter efficiency.

The transistor switch is loaded with a step-up transformer designed at MSSL for high frequency operation with good primary to secondary isolation. The switch is protected with a snubber network designed to keep switching losses to a minimum.

A twenty five volt switch supply is stepped up to 500 volts across the secondary terminals which in turn are loaded with a capacitor/diode multiplier; each stage of the multiplier will develop a maximum of one thousand volts and the number of stages varies from tray to tray.

Resistive potential dividers follow ripple reducing filters and are used to obtain a low voltage feedback signal and voltage monitoring of the output potential. All high voltage resistors are custom made for MSSL to high precision and stability specifications.

Operational amplifiers from i.c. type LM124 are used for control and feedback signal processing. Comparators from i.c. type LM139 are incorporated for circuit and system protection against incorrect biassing commands.

Figure 4 shows the printed circuit layout for one of the trays. Low voltage components are kept to the bottom right hand corner with the transformer in the bottom left hand corner, the multiplier above and high voltage resistors along the top. The complete circuit can be built using double sided board. To improve tray to tray high voltage insulation the multiplier and HV resistors are surface mounted.

FIGURE 1
Multiplier Biasing using 3 Converters.

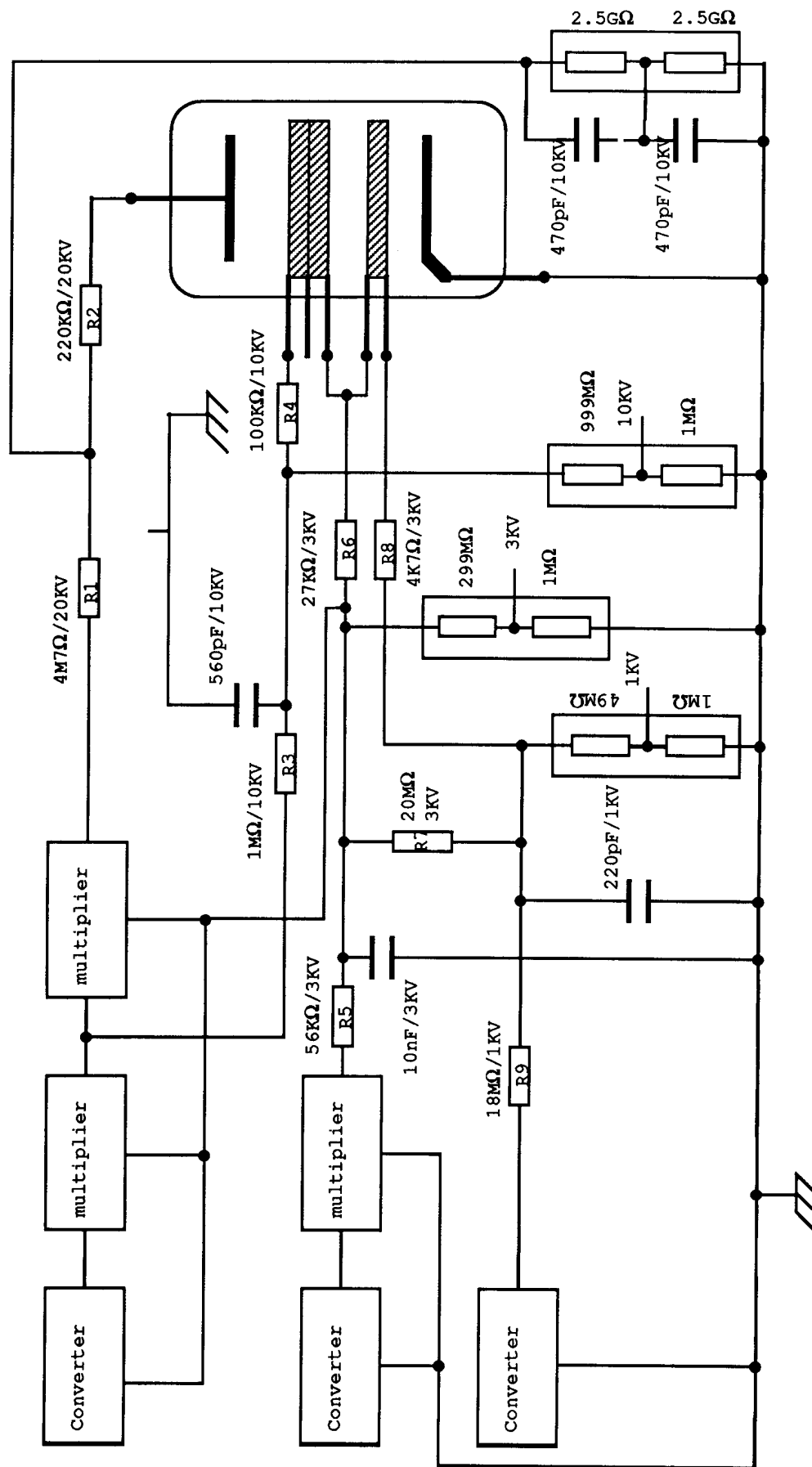


FIGURE 2.—CONVERTER ASSEMBLY.

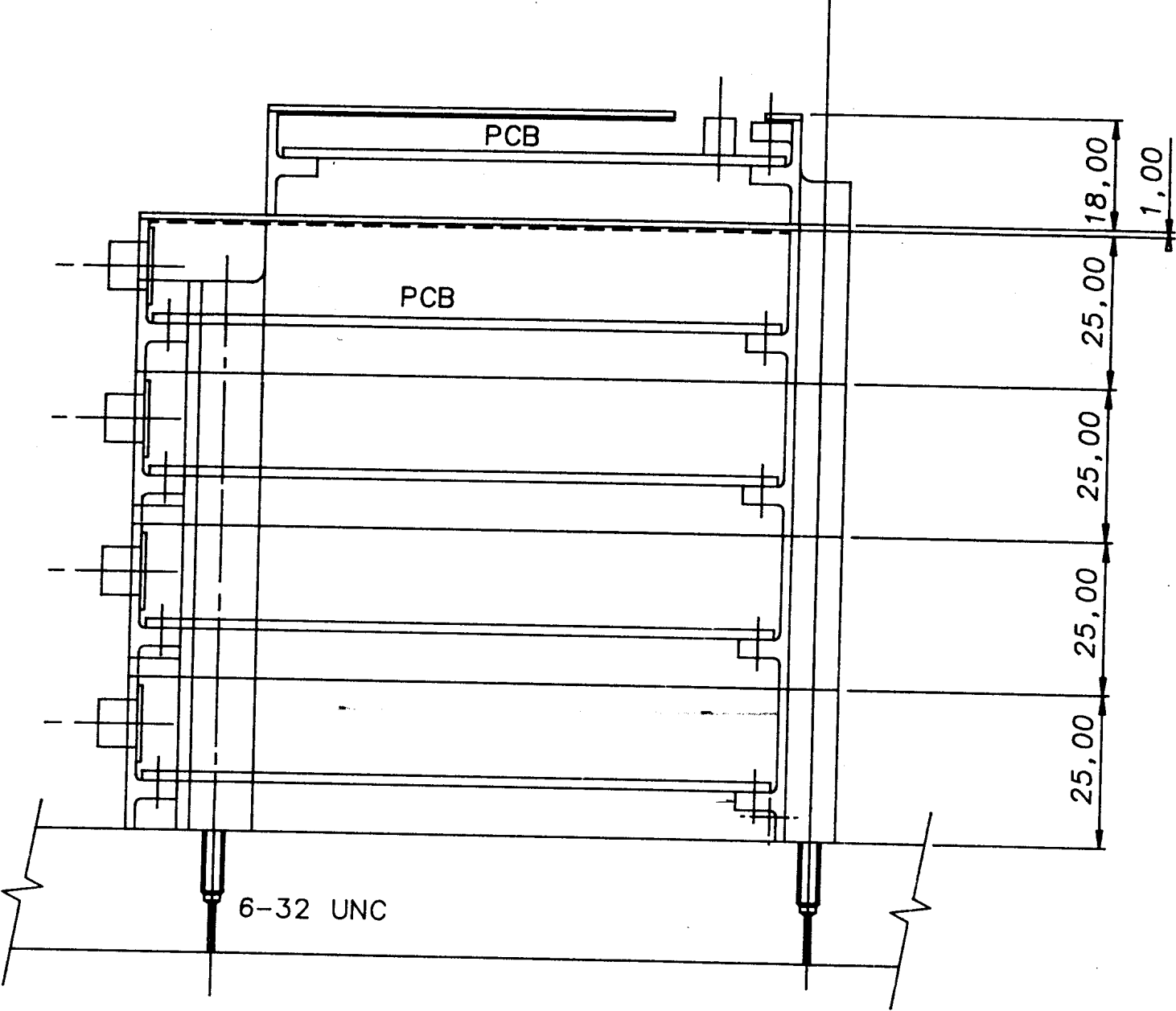
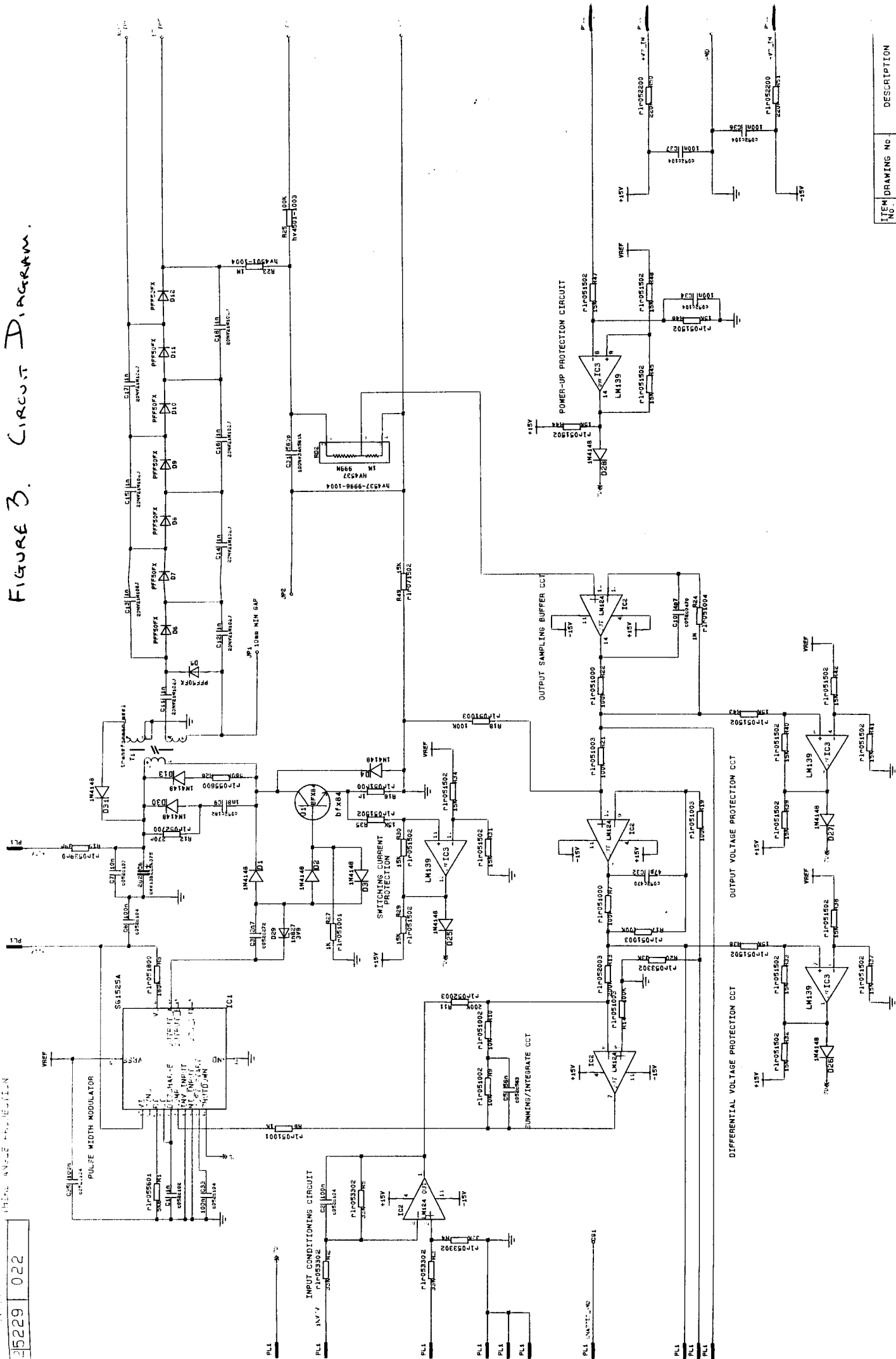
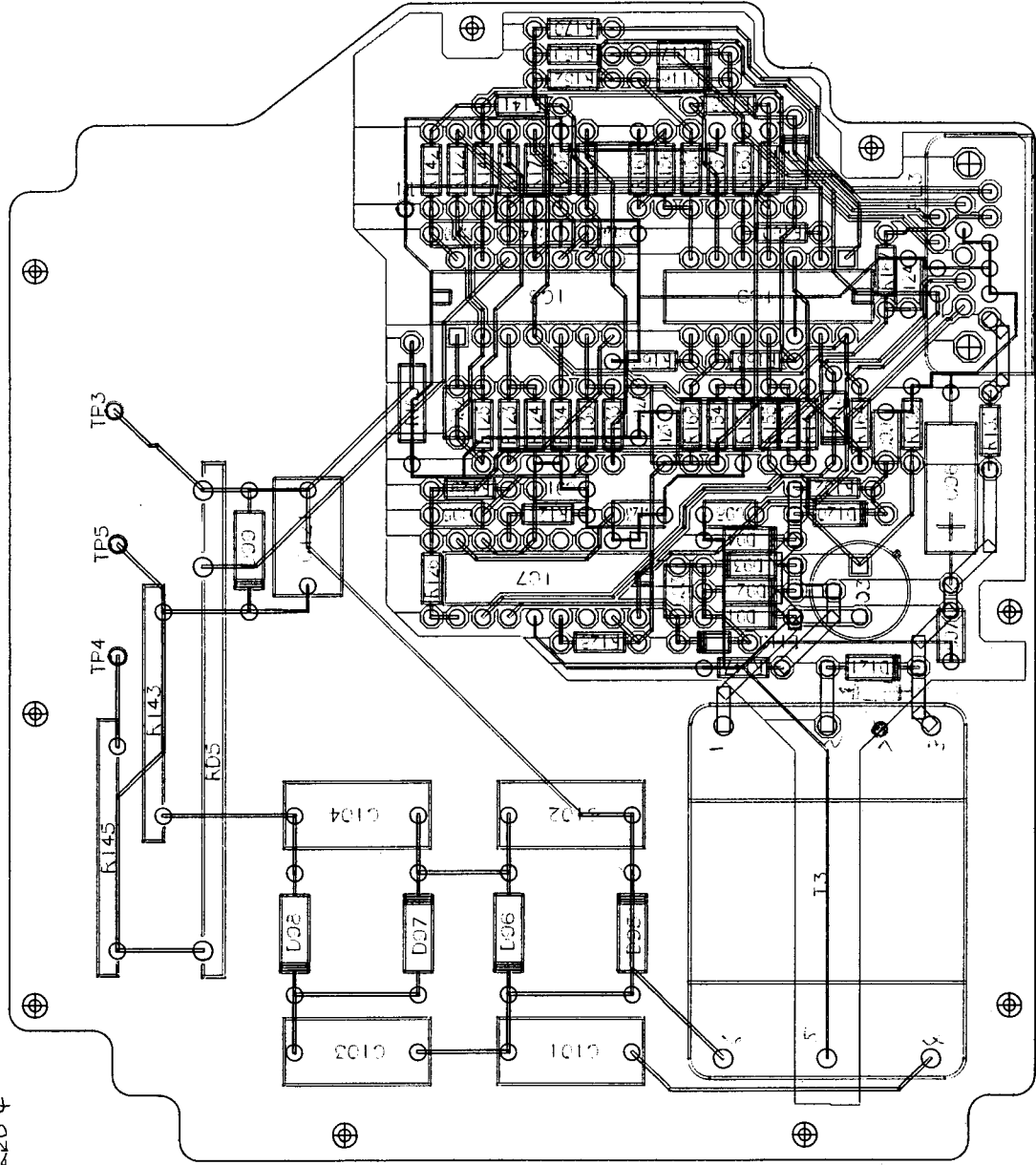


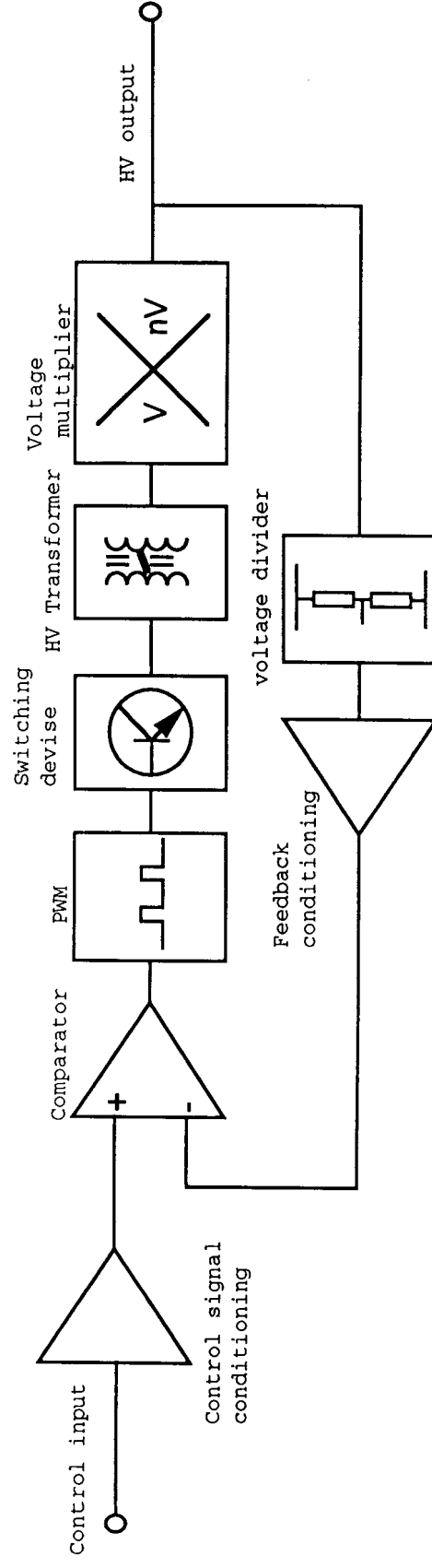
FIGURE 3. CIRCUIT DIAGRAM.



HVP50
Boards 4



Block Diagram of XmmOm High Voltage Converter



Multiplier Biassing using 3 Converters.

