

HIGH SPEED VARACTOR DIODE SWITCHES FOR PULSED RADAR AND AMPLITUDE MODULATION REFLECTOMETRY

G.P. Ermak

Institute of Radiophysics and Electronics of NAS of Ukraine

12 Ak. Proskura Str., 310085 Kharkov, Ukraine

E- mail: ermak@ire.kharkov.ua

In modern pulsed radar and amplitude modulation reflectometry of fusion plasma the high speed PIN switches and PIN attenuators are used. But they do not provide the switching speed more than 2-3 ns and amplitude modulation speed more than 300 MHz. This limits the resolution in the measurement of the distances to the plasma which strongly depend on the speed of the switches. The ultrafast varactor diode switches and voltage-control variable attenuators has been designed for the use in pulsed radar and AM reflectometry in a millimeter-wave band. They are single pole, single throw waveguide units which are available in the 18-150 GHz frequency range. The switches / attenuators provides the pulses up to 0.25 ns and the amplitude modulation rates up to 5 GHz.

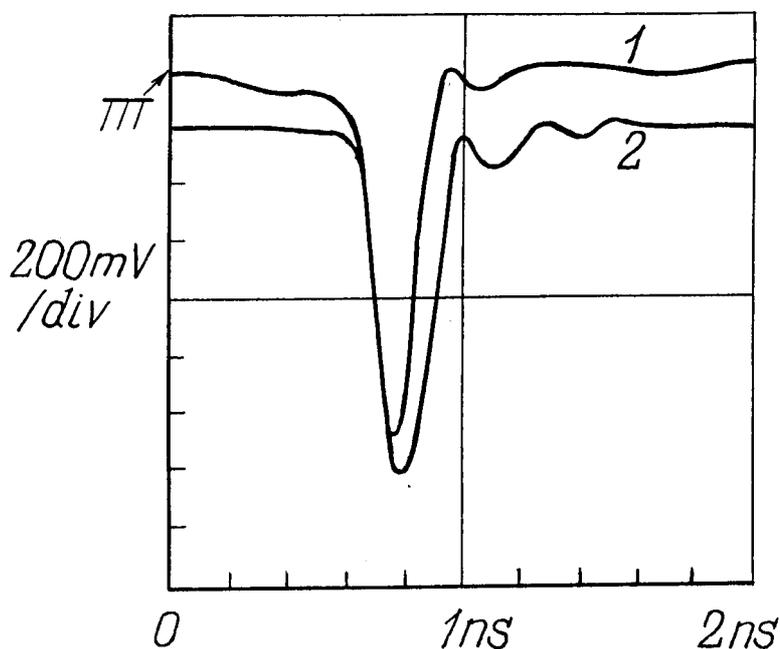


Fig. 1.

Operation bandwidth of the switch is about ± 1.5 GHz , ON/OFF ratio is up to 30 dB. Isolation over 30 dB can be achieved, but at the cost of reducing the operation bandwidth.

The insertion loss of the switches and attenuators is of 1.5-2 dB. The results of testing of the 57 GHz switch with 200 mW IMPATT oscillator are presented in Fig. 1.

The curve 1 is a driving pulse, and the curve 2 is the RF pulse generated by the switch. The duration of the driving pulse is 150 ps and the duration of the RF pulse is about 250 ps. The driving pulse was measured by a detector with a negative output. For comparison, the driving and RF pulses are shown at the same polarity. Logic level “0” corresponds to isolation and logic level “1” corresponds to transmission. This condition can be changed to opposite.

The switches match well with the pulse driver which provides amplitude of driving pulses < 5 Volt on 50 Ohm load and have adjustment of bias from -0.5 Volt till +0.5 Volt.

Figure 2 shows the changing of the output power (attenuation) of the switch/attenuator at the changing of the bias voltage.

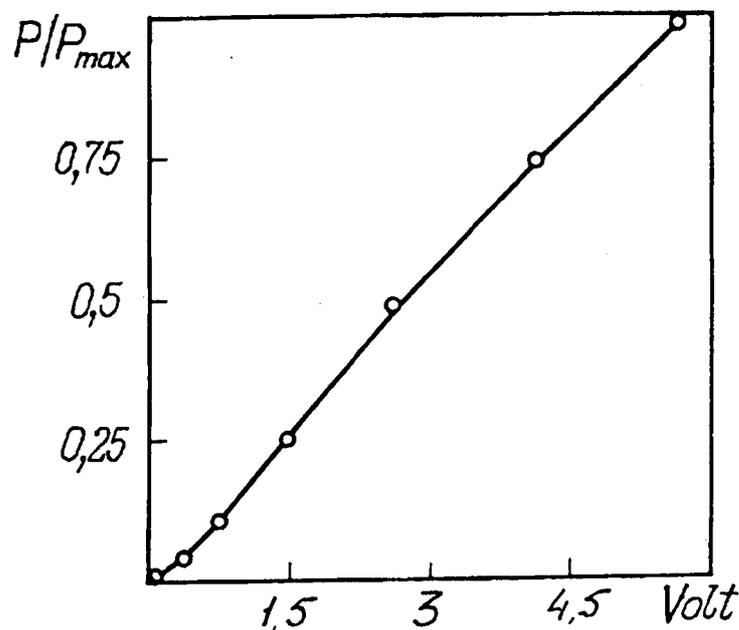


Fig. 2.

These switches can handle high input power levels up to 5 Watt in CW mode. So they can be used as modulators, pulse shapers or variable attenuators with high power CW and pulsed mm wave oscillators. At this time the switches are used in four-channel pulsed radar reflectometer developed in FOM Institute for Plasma Physics, the Netherlands [1,2].

Acknowledgement. Author expresses his gratitude to Dr. C.A.J. Hugenholtz from Rijnhuizen-Institute of Plasma Physics, the Netherlands for assistance in testing of the switches.

References

- [1] C.A.J. Hugenholtz and S.H. Heijnen: Rev. Sci. Instrum. **62** (1991) 1100.
- [2] S.H. Heijnen, M.R. de Baar, A.J.H. Donne, M.J. van de Pol, C.A.J. Hugenholtz and the RTP team: Rev. Sci. Instrum. **66** (1995) 419.