

Public Abstract

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Performance Analysis of High Power Photoconductive Switch at Elevated Temperature

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This project deals with the analysis of high power radio frequency effects on a non-linear opposed contact GaAs photoconductive semiconductor switch, used in high power microwave generation. Specifically, effects of heating on the contacts and the bulk were studied. The changes in the I-V characteristics before and after heating the switches were analyzed. For heating effects, a power density input had been taken from an electromagnetic code and the simulations were performed at a temperature of 330 K. The carrier conduction process during the on-state operation of the device showed current controlled negative resistivity behavior at elevated temperature, due to heating of contacts and the bulk.

Analysis shows that filamentary conduction results in thermal runaway that severely affects and damages the device. Further simulations were also done on a 6H-SiC photoconductive semiconductor switch and another configuration of the GaAs switch by the inclusion of an n+ layer at the cathode. Similar results were obtained for these switches under the effect of RF heating. In summary, we can say that the RF heating effects on the photoconductive switches is very damaging and the breakdown voltages had been observed to be much less compared to the operating voltages.