

INFRARED EMISSION SPECTROSCOPY AS A RELIABILITY TOOL

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ABSTRACT

In this paper we report on a technique based on infrared emission spectroscopy which has been found to be useful for non-contact measurement of the temperature of a hot spot in the gate channel of a GaAs metal/semiconductor field effect transistor (MESFET). The technique was demonstrated on a powered and un-powered GaAs MESFET attaining a spatial resolution of 0.5 μm .

A non-destructive submicron-size spot laser beam provided by an HeNe laser excites an extremely small local area of the gate channel of a GaAs MESFET under various operating conditions. Given the state of the experimental test system, we estimate a spatial resolution of about 0.1 microns and a spectral resolution of about 0.1 Angstroms. This provides 15 - 100 times finer spatial resolution than can be obtained using the best passive IR systems available. The temperature resolution ($< 0.02 \text{ K}/\mu\text{m}$) of this technique is depend upon the spectrometer used, and that it can be improved further.

The information obtained from this technique can be used to estimate device lifetimes for critical applications and for measurement of channel temperature of devices under actual operating conditions. Another potential use of the novel technique can be as a cost-effective prescreening tool for determining the "hot spot" channel temperature of devices under normal operating conditions which can further improve device design, yield enhancement, and reliable operation