Metal-Insulator-Graphene RF Diodes: From Devices to Integrated Circuits

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Abstract

Graphene based electronics is very appealing due to its high carrier mobility, which could lead to high performance radiofrequency (RF) or terahertz (THz) devices and circuits. Integrated circuits based on graphene are desired to realize such ambitious applications. Usually for RF integrated circuits, active components such as transistors are highly demanded. Unfortunately graphene base transistors are usually not good ones. Therefore, some alternatives such as diode based electronics become very attractive for graphene based electronics over the last years.

Here we present metal-insulator-graphene (MIG) diodes, which are fabricated with scalable thin-film process [1]. Such MIG diodes show high responsivity for microwave on-wafer power detection. Therefore it is used also for different integrated circuits, such as power detectors, mixers etc. [2-4]. Very recently, a one-dimensional geometry MIG diode is also realized, shown in Figure 2. Due to the reduction of the device parasitic capacitance such diodes show free space power detection up to hundreds of GHz.

The MIG diodes provide a new way to integrate graphene into RF electronics.

References

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[3] M. Saeed, A. Hamed, Z. Wang et al., IEEE Trans. Microw. Theory Tech., 66 (2018) 2018
[4] M. Saeed, A. Hamed, Z. Wang et al., IEEE Electron Device Lett., 39 (2018) 1104

Figures

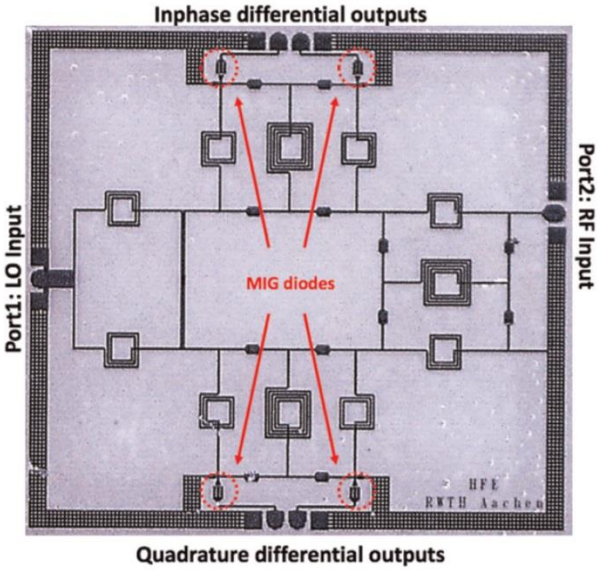

Figure 1: A sixport receiver based on MIG diodes. The process is based on an in house MMIC process with passive components such as resistors, capacitors and inductors.

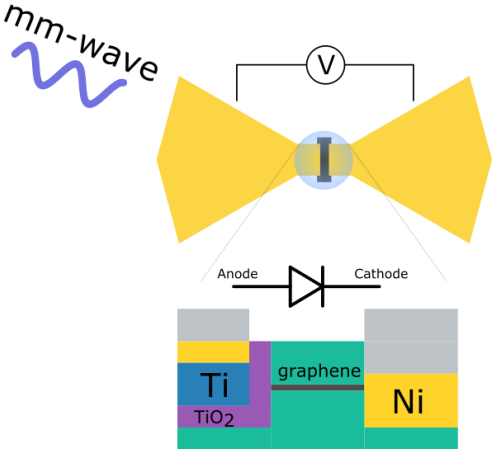

Figure 2: 1D-MIG diode for free space THz power detection.