NON-LINEARITY OF RF SWITCH BASED ON 2D MATERIALS

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Recently, nonvolatile switching has been observed in various monolayer and multilayer 2D materials. Besides memory applications, resistive switching is promising for analogue RF switches because of the favorable scaling with the area compared to other emerging technologies [1]. Our RF switches are metal-insulator-metal structures consisting of a vertical junction made of metal electrodes separated by a 2D material. Previous studies show that this RF switches are suitable for 5/6G application [1-2]. The devices are embedded in a coplanar waveguide for RF measurements. The DC measurements show that the switch is in a high-resistance state until the application of a SET voltage (~2V for the MoS_2 device), which brings the device into a low-resistance state. This state persists until a negative bias is applied to RESET the switch to its high-resistance state. We used S-parameter characterization covering the frequency range 0.25-320GHz to extract the small equivalent circuit of the device. From S-parameters, we deduced two main figures of merit of the RF switch: the insertion loss (the power loss due to the device with the switch in the ON state) and the isolation (the attenuation of the power across the switch in the OFF state). The device is non-volatile, with a state retention exceeding 3 months [2]. In this work, we focus on the study of non-linearity of RF switches made with hBN and MoS_2. As show by the IV characterization, the RF switch is non-linear at a sufficiently high bias. To quantify this non-linearity, we apply a signal with 2 tone (F_1=2.365GHz and F_2 = 2.415GHz) through the device and we measure the output power at F_1 and F_2 and we also measure the power at the intermodulation frequency (here $F_{int}= 2F_2-F_1$). From the measured data, we can trace the power for each frequency versus input power and extract the Input Third-order Intercept Point (IIP3), which exceed 46dbm for hBN devices and 20dbm for MoS_2 devices. The measured IIP3 values are in agreement with those obtained with the simulation based on a simple non-linear resistor model.

REFERENCES

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