Switch RF 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]. The RF switches are metal-insulator-metal structures consisting of a vertical junction made of metal electrodes separated by a 2D material. In this work, we investigate RF switches made with hBN and MoS_2 for 5G and 6G data communication applications. We first fully characterized the devices at DC and RF, then we demonstrated their potential in a real-life scenario by routing a live stream of a full-HD video across the RF switch. 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]. Finally, we used the switch for data communication experiments at carrier frequency f_c=100GHz, demonstrating a high data-rate of 8.5 Gbit.s^{-1} and the routing of a raw (uncompressed) HD-TV data stream.

REFERENCES

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