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Bilayer Graphene-Hexagonal Boron Nitride Heterostructure Negative Differential Resistance Interlayer Tunnel FETs SANGWOO KANG, BABAK FALLAHAZAD, KAYOUNG LEE, HEMA MOVVA, KYOUNGHWAN KIM, CHRIS CORBET, Univ of Texas, Austin, TAKASHI TANIGUCHI, KENJI WATANABE, National Institute for Materials Science, Japan, LUIGI COLOMBO, Texas Instruments Incorporated, LEONARD REGISTER, EMANUEL TUTUC, SANJAY BANERJEE, Univ of Texas, Austin — We present the operation of a vertical tunneling field effect transistor using a stacked double bilayer graphene (BLG) and hexagonal boron nitride (hBN) heterostructure. The device is fabricated with the so-called Van der Waals transfer method with the edges of the top and bottom BLG flakes being rotationally aligned to roughly 60°. The device shows multiple negative differential resistance (NDR) peaks which can be adjusted through the gate bias. Temperature dependent measurements show that the peak width of the differential conductance broadens and the height lowered when the temperature is increased, which is indicative of resonant tunneling. Through electrostatic calculations, it is shown that the multiple peaks occur when the two conduction bands at the K-point of the top and bottom bilayer graphene become aligned at certain bias conditions. It is also shown that by adjusting the rotational alignment of the bands of the top and bottom BLG through an in-plane magnetic field, the conductance peaks can be broadened. In addition, utilizing the NDR characteristic of the device, one-transistor latch or SRAM operation is demonstrated.

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