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Accumulation mode GaAs/AlGaAs 2D electron system with independent control of the channel and contact resistance S.J. MACLEOD, A.M. SEE, University of New South Wales, I. FARRER, D.A. RITCHIE, Cavendish Laboratory, University of Cambridge, U.K, A. LUDWIG, A. WIECK, Ruhr University Bochum, A. HAMILTON, University of New South Wales — Semiconductor-insulator-semiconductor FETs (SISFETs) are an attractive alternative to modulation doped (MD) GaAs/AlGaAs systems. GaAs SISFETs consist of epitaxially grown layers of GaAs then AlGaAs capped with a degenerately doped GaAs layer. The cap acts as an in situ, over-all top-gate which attracts carriers to the GaAs/AlGaAs interface. The MBE grown top-gate eliminates scattering and charge-noise from surface states and unlike Schottky gates, there is no strain between the gate and insulating AlGaAs layer due to similar thermal expansion rates. The absence of a doping layer improves carrier mobility (μ) at low densities (n_s) since in shallow MD devices the doping layer creates an additional long-range random impurity potential. For this reason SISFET devices improve μ at low n_s. However in the low n_s regime the high contact resistance dominates the device resistance, which can limit electrical transport measurements. We fabricate a GaAs 2D electron SISFET with dual-gate architecture to independently control the contact and channel resistance. We characterize our device using standard low-temperature electrical transport measurements. The 2D n_s could be varied from $0.1 - 3 \times 10^{11}\, cm^{-2}$ with a μ of up to $9 \times 10^6\, cm^2 V^{-1} s^{-1}$.

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