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Mechanical Flip-Chip for Ultra-High Electron Mobility Devices KEYAN BENNACEUR, SIMON BILODEAU, BENJAMIN SCHMIDT, SAMUEL GAUCHER, McGill University, DOMINIQUE LAROCHE, MIKE LILLY, JOHN RENO, Sandia National Laboratories, KEN WEST, LOREN PFEIFFER, Princeton University, GUILLAUME GERVAIS, McGill University — We present a novel "flip-chip" microfabrication method that was used to make a quantum point contact (QPC) on a two-dimensional electron gas (2DEG) without any fabrication process on the 2DEG. Electrostatic gates are of paramount importance for the physics of devices based on 2DEG since they allow depletion of electrons in selected areas. This field-effect gating enables the fabrication of a wide range of devices such as, electron interferometers and quantum dots. To fabricate these gates, processing is usually performed on the 2DEG, which is in many cases detrimental to its electron mobility. Our approach does not require any processing of the 2DEG material leaving it pristine and reusable. It relies on processing a separate wafer that is then mechanically mounted on the 2DEG material in a flip-chip fashion. This technique proved successful to fabricate QPC on GaAs/AlGaAs materials with high electron mobility ranging from 1e6 to 1e7 cm^2V/s. (Bennaceur, K. *et al.* Scientific Reports 5, 13494 (2015)). Sandia National Laboratories is a multi-program laboratory managed and operated by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin Corporation, for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000.

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