A novel Depletion-layer-Extended Transistor (DET) for the RF switch circuit is proposed in a CMOS process, which significantly reduces junction capacitance and increases GND-path resistance in the Si-substrate, with a new impurity profiling. This transistor can be simultaneously formed with the conventional transistor with only the addition of one mask-step. By utilizing the DETs, a low 1.4dB of insertion-loss, 5GHz transmit/receive switch in a 0.18μm CMOS process is realized.