Abstracts

Ion-Implanted High Microwave Power Indium Phosphide Transistors

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Indium phosphide (InP) metal-insulator-semiconductor field-effect transistors (MISFET's) have demonstrated substantially higher output power density at microwave frequencies compared to gallium arsenide metal-semiconductor field-effect transistors (MESFET's). Presented here are the microwave characteristics from an investigation of encapsulated rapid thermal annealing (RTA) for the fabrication of InP power MISFET's with ion-implanted source, drain, and active channel regions. The MISFET's had a gate length of 1.4 µm. They were made with individual gate finger widths of 100 or 125 µm, and six to ten gate fingers per device were used to make MISFET's with total gate widths of 0.75, 0.8, or 1 mm. The source and drain contact regions and the channel region of the MISFET's were fabricated using silicon implants in semi-insulating InP at energies from 60 to 360 keV with doses from 1 x 10/sup 12/ to 5.6 x 10/sup 14/ cm/sup -2/. The implants were activated using RTA at 700° C for 30 s in N/sub 2/ or H/sub 2/ ambients using a silicon nitride encapsulant. The channel region was chemically recessed prior to depositing approximately 1000 Å of SiO/sub 2/ for the gate insulator. The high power and high efficiency InP MISFET's were characterized at 9.7 GHz, and the output microwave power density for the RTA conditions used was as high as 2.4 W/mm. For a 1 W input at 9.7 GHz gains up to 3.7 dB were observed, with an associated power-added efficiency of 29 percent. The output power density achieved was 70 percent greater than has been achieved with GaAs MESFET's.

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