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V-BAND InP GUNN DIODE

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Abstract

The n^+-n-n^+ InP wafers are continually grown by VPE. An integral heat sink process is utilized to fabricate CW InP Gunn diodes with multiple-layer n^+-n-n^+, which operate in V-band. The rf performance of the diode is determined using a coaxial waveguide cavity. CW output powers of 151 mW at 50.6 GHz and 147 mW at 58.3 GHz have been achieved with efficiencies of 2.48% and 2.54%, respectively.

Summary

An n^+-n-n^+ structure CW InP Gunn diode operated in V-band has been produced using a multiple-layer epitaxial wafer continually grown in an $In/PCl_3/H_2$ system. The active layer obtained exhibits a flat doping profile with a concentration of 8×10^{15} cm^{-3}, a thickness of 2.7 μm, and a mobility of 3500 cm^2/Vs. The diode is processed using an integral heat sink. Both epi n^+ and substrate n^+ sides are metallized with AuGeNi:Au and only one-step heating treatment is performed after mesas have been defined and etched by photolithography. A Au heat sink is plated about 50 μm thick. The InP wafer is thinned to approximately 15 μm using a two-step etching method with HCl and Br_2+C_2H_5OH etch, resulting in lower high-frequency skin loss of the diode. Mesas are etched using a light-sensitive $FeCl_3$ etch with least lateral etching, providing abrupt edges and good uniformity of mesas (diameter of 70-80 μm). The chip is packaged in NSR type WD-085 microwave package using cross-gold ribbon bonding. Diode rf performance is determined using a coaxial waveguide cavity. CW output powers of 151 mW at 50.6 GHz and 147 mW at 58.3 GHz have been achieved with conversion efficiencies of 2.48% and 2.54%, respectively.

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