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A Comparative Study on Optimized Bias Current Density Performance of Cubic ZnB-GaN with Hexagonal 4H-SiC Based Impatts

Authors : Arnab Majumdar, Srimani Sen

Abstract : In this paper, a vivid simulated study has been made on 35 GHz Ka-band window frequency in order to judge and compare the DC and high frequency properties of cubic ZnB-GaN with the existing hexagonal 4H-SiC. A flat profile p⁺pnn⁺ DDR structure of impatt is chosen and is optimized at a particular bias current density with respect to efficiency and output power taking into consideration the effect of mobile space charge also. The simulated results obtained reveals the strong potentiality of impatts based on both cubic ZnB-GaN and hexagonal 4H-SiC. The DC-to-millimeter wave conversion efficiency for cubic ZnB-GaN impatt obtained is 50% with an estimated output power of 2.83 W at an optimized bias current density of 2.5×10⁸ A/m². The conversion efficiency and estimated output power in case of hexagonal 4H-SiC impatt obtained is 22.34% and 40 W respectively at an optimum bias current density of 0.06×10⁸ A/m².

Keywords : cubic ZnB-GaN, hexagonal 4H-SiC, double drift impatt diode, millimetre wave, optimised bias current density, wide band gap semiconductor
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