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| **Title:** | Impact of The Quantum Well for Transportation Characteristics of Al0.3Ga0.7As/GaAs Based Double Barrier Resonant Tunneling Diode | | |
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| **Abstract:** |  |
| The outcome of this research demonstrates the potential impact of varying quantum well widths between 1nm to 9nm of AlGaAs/GaAs based Double Barrier-Resonant Tunneling Diode (DBRTD) model at room temperature 300K on varying current density of the device. Thus, quantum tunneling mechanism results, based on non-equilibrium Green’s function (NEGF) formalization within ballistic limits, show a high peak current of 340.59kA/cm 2 and a maximum power of 3064.78125 W/cm 2 for a quantum well width of 1nm with GaAs RTD and achieves a high peak-to-valley voltage ratio (PVVR) of 0.91 for quantum well width of 8nm and higher peak to valley current ratio (PVCR) of 4 for quantum well width of 3nm was observed, further peak to valley ratio (PVR) and current density can be improved by reduction of scattering. Another key finding highlighted in this paper is due to the narrower quantum well, the peak current and peak voltage shifts to higher values. However, discontinuity was observed in the transition state between 5nm and 6nm of the quantum well. A reduction in the total current by a factor of 5 means that the negative differential resistance (NDR) can be enhanced by the same factor of 5 near the lower quantum well width. But in the transition state, it was observed to be enhanced by a factor of 10 times where the positive differential resistance region 1 (PDR1) and positive differential resistance region 2 (PDR2), and NDR was found highest at approximately 626.96kA/cm 2 , 523.56kA/cm 2 and 523.56kA/cm 2 respectively. Finally, the highest RTD nonlinear capacitance of 21.1fF was anticipated in peak voltage for the transition state. Simulation of the device has been performed with the use of the NEMO5 simulation tool that utilizes a NEGF approach to calculate the charge of the device at two adjacent voltage points which confirms the various results presented in this research. | |