# Analysis of InP/InGaAs/InP Double Heterojunction Bipolar Junction Transistor

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# Abstract:

In this brief, the numerical simulations of InP/InGaAs/InP double heterojunction bipolar junction transistor (DHBT) are performed. The DC and high frequency characteristics are examined and presented. The gummel plot is used to represent DC characteristics, and further DC current gain is calculated. The collector current ( $I_C$ ), base current ( $I_B$ ), ratio of  $I_C$  and  $I_B$ , and unilateral power gain is calculated.

Keywords: DHBT; DC current gain; I<sub>C</sub>; I<sub>B</sub>.

## **1. Introduction:**

The heterojunction devices have been extensively used to utilize their inherent properties in electronic applications [1], [2], [11], [12], [3]–[10]. The numerical simulations of InP/InGaAs/InP double heterojunction bipolar junction transistor (DHBT) are performed. InGaAs and InP materials are used in the structure to utilize their wide bandgap property. The DC and high frequency characteristics are examined and presented. The gummel plot is used to represent DC characteristics, and further DC current gain is calculated. The I<sub>C</sub>, I<sub>B</sub>, ratio of I<sub>C</sub> and I<sub>B</sub>, and unilateral power gain is calculated.

# 2. Model description:

Fig. 1 represents the structure of double heterojunction bipolar junction transistor. InGaAs and InP materials are used in the structure to utilize their wide bandgap property.



Fig. 1: Structure of device

# 3. Methodology:

The structure is prepared using Silvaco Atlas (TCAD). The different band gap materials are used to utilize their exciting features.

## 4. Results and Discussions:

Fig. 2 represents the calculation of  $I_C$  and  $I_B$ . Fig. 3 represents the ratio of  $I_C$  and  $I_B$ . Fig. 4 represents the calculation of current gain. Fig. 5 represents the calculation of unilateral power gain. The numerical simulations of InP/InGaAs/InP double heterojunction bipolar junction transistor (DHBT) are performed. The DC and high frequency characteristics are examined and presented. The gummel plot is used to represent DC characteristics, and further DC current gain is calculated. The  $I_C$ ,  $I_B$ , ratio of  $I_C$  and  $I_B$ , and unilateral power gain is calculated.





### 5. Conclusion:

The numerical simulations of InP/InGaAs/InP double heterojunction bipolar junction transistor (DHBT) are performed. The DC and high frequency characteristics are examined and presented. The gummel plot is used to represent DC characteristics, and further DC current gain is calculated. The  $I_C$ ,  $I_B$ , ratio of  $I_C$  and  $I_B$ , and unilateral power gain is calculated.

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