

Cryogenic Temperature Investigation of (InGaAs/InP)Heterojunction Tunnel FETs for Analog and RF Applications

Publisher: IEEE [Cite This](#)  PDF

[Soumya Sen](#) ; [Mamta Khosla](#) ; [Ashish Raman](#) ; [Angshuman Khan](#) ; [Uttam Narendra Thakur](#) ; [Arnab Palui](#) [All Authors](#)

31
Full
Text Views



Abstract

Document Sections

I. Introduction

II. Device Structure and Simulation

III. Results and Discussions

IV. Conclusion and Future Scope

Authors

Figures

References

Keywords

Metrics

More Like This

Abstract:

This manuscript presents a comprehensive investigation of the performance of a Heterostructure Tunnel Field-Effect Transistor (InGaAs/InP) operating under cryogenic temperatures (~ 78 K) with emphasis on DC, analog, and RF characteristics. Device simulations are performed using SILVACO ATLAS TCAD to investigate the underlying device physics and analyze the impact of lattice temperature on carrier transport through parameters such as transfer characteristics, Ion/Ioff ratio, and subthreshold swing (SS). Notably, steeper Ion/Ioff ratios and improved SS are observed at cryogenic temperatures, indicating superior switching behaviour. Furthermore, analog performance is evaluated through transconductance (g_m) and the transconductance gain factor (TGF), while RF performance is analyzed in terms of parasitic capacitances and the cut-off frequency (f_T). Additionally, the impact of interface traps on device behaviour is examined by comparing fresh and degraded devices under both cryogenic and ambient conditions. The findings demonstrate that the heterostructure TFET exhibits enhanced performance and CMOS compatibility at low temperatures, making it a promising candidate for quantum computing applications.

Published in: 2025 13th International Conference on Intelligent Embedded, MicroElectronics, Communication and Optical Networks (IEMECON)

Date of Conference: 08-10 December 2025

DOI: [10.1109/IEMECON69302.2025.11365798](#)

Date Added to IEEE Xplore: 03 February 2026

Publisher: IEEE

▼ ISBN Information:

Conference Location: Jaipur, India

Recommended for You (Beta)

Blockchains: An overview of the technology, circuit...

DASHES—Autonomous and Secure Framework for Connecte...

A Novel Blockchain-Based Strategy for Energy Conservatio...

[Learn More](#)

Sign in to Continue Reading