INNOVATION PARTNERSHIPS
UNIVERSITY OF MICHIGAN

Semiconductor Active Area Temperature Measurement

TECHNOLOGY NUMBER: 2023-587

OVERVIEW

Accurate temperature measurement in wide-bandgap semiconductors for optimal performance

- Uses electrical parameters instead of physical sensors for precise temperature readings
- Applicable in electric vehicles, aerospace, and wireless power systems for thermal management

BACKGROUND

The importance of accurately measuring temperature in wide-bandgap power semiconductors has increased with their extensive applications in fields like electric vehicles and aerospace. Historically, methods like thermocouples and Raman spectroscopy were used for this purpose. However, thermocouples face accuracy issues due to their reliance on physical contact points, limiting their proximity to the semiconductor's active heat-generating areas. Optical methods, such as Raman thermometry, require costly equipment and clear optical access. These limitations create a significant need for alternatives that can offer precise temperature measurements without the drawbacks of physical contact or high expenses. Improved temperature management can enhance device efficiency and longevity, as temperature increases are often a limiting factor for power density in wide-bandgap semiconductors.

INNOVATION

Researchers at the University of Michigan have developed thermal measurement technology that leverages temperature-sensitive electrical parameters (TSEP) to measure temperature in wide-bandgap semiconductors. By using a vector of three TSEPs, determined by biasing the gate-source voltage at weak, moderate, and strong inversion regions, this method provides a highly accurate temperature reading of the active areas in GaN FETs without the need for traditional physical sensors. The approach reduces errors associated with thermal resistance and proximity that affect conventional techniques. Potential applications include improved thermal management for systems utilizing wide-bandgap semiconductors such as in electric vehicles, hybrid and electric aircraft, and wireless power transfer systems. This advancement offers a cost-effective, precise, and scalable solution for optimizing the performance and reliability of these systems.

ADDITIONAL INFORMATION

REFERENCES

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Category
Hardware
Engineering & Physical Sciences
Semiconductor, MEMS, and Electronics

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INTELLECTUAL PROPERTY

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