

High thermal channel temperature in micro-modules



Article Overview

High thermal channel temperatures in micro-modules arise from concentrated heat fluxes in high-power-density devices, and can be mitigated through optimized microchannel design, flow management, and advanced cooling techniques.

Causes of High Thermal Channel Temperatures

High thermal channel temperatures in micro-modules are primarily caused by extreme heat fluxes in compact, high-power-density devices such as IGBT modules, CPUs, GPUs, and power semiconductors. As device integration increases, the heat generated per unit area rises sharply, often exceeding hundreds of W/cm^2 , creating thermal bottlenecks that can degrade performance, accelerate material aging, and risk thermal failure. In microchannel cooling systems, narrow channels and high flow resistance can further elevate local temperatures if fluid flow is insufficient or uneven.

Design Factors Affecting Temperature

Several microchannel design parameters directly influence thermal performance:

- Channel width and depth: Smaller channels enhance heat transfer due to higher surface area-to-volume ratios but increase pressure drop, which can limit flow and raise temperatures.
- Number of secondary inlets and inlet diameter: Increasing these parameters impr...

Article Content

Thermal Management in Microelectronics Systems

Thermal management refers to the methods and technologies used to control the temperature of electronic devices and systems. In

Thermal Characterization Methods and Applications

Thermal Application Note This application note provides a comprehensive set of considerations for the thermal characterization and

A new model for thermal channel noise of deep-submicron mosfets

Abstract— In this paper, we present a simple analytical model for the thermal channel noise of deep-submicron MOS transistors

Qorvo Application Note

To learn more about micro-Raman measurements of GaN, please refer to the Qorvo App Note, GaN Device Channel Temperature,

Achieving High Thermal Performance in Compact Buck Power Modules

However, modules suffer from extra heat generated by losses in the integrated inductor, and typically have a lower output current

Flow boiling in novel radial microchannels for cooling of electronic ...

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A review on the applications of micro-/mini-channels for battery ...

This review of the literature explores the potentials of liquid micro-/mini-channels to reduce operating temperatures and

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