Timing is everything. Fast, pulsed illumination with precise controllable delay ($\tau$) captures "snapshot" images at any time in the device thermal transient.

During thermoreflectance imaging, the device under test is excited electrically.

During calibration of thermoreflectance coefficients, the device is electrically passive. Sample surface temperature is measured by micro-thermocouple.

**Spatial resolution.** Thermoreflectance imaging microscopy measures temperature for a broad range of device size scales. Based on visible wavelength probe illumination, temperature can be measured with 200 nanometer spatial resolution.

**Temporal resolution.** Transient thermoreflectance reveals the time evolution of temperature distribution in integrated structures. Time resolution of 800 picoseconds has been achieved. Time resolved thermal information can be used to estimate temperature dependent material properties and inspect fast thermal effects critical to device performance and reliability.

**A thermal picture is worth a thousand words**

Integrated structures are diverse, and each microthermal image tells a unique story. Temperature distribution reveals current and heat flow through a structure. Thermoreflectance images are snapshots of the electrical, thermal and mechanical properties of micro/nanoscale devices.

**Bake 10 microseconds or until internal temperature reaches...**

Self-heating in a transistors, a typical micro-device application, creates temperature gradients within a few microseconds. High power transistor array self-heating spreads several millimeters in Si substrate.

**The big thermal picture**

**...and the small one**

Fast transient self-heating distribution in HEMT device under high power pulses.

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