High-Speed Electro-Thermal Measurements in RF Power Amplifiers Using Thermo-Reflectance

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Abstract - This paper presents a method to measure the intra-finger temperature with MHz bandwidth in a transistor of a Radio-Frequency (RF) Power Amplifier (PA). This is done by means of using the thermo-reflectance method. At first, pulsed RF excitation is used to extract the PA electrical and thermal behaviour at different ambient/baseplate temperatures along with the associated dissipation profiles. For this, an RF PA is built with a GaN-on-SiC Wolfspeed CG2H40010F transistor, which also includes a current probe. The temperature distribution across the fingers is extracted. In order to replicate real-scenario operating conditions which determine the operating temperature, high-PAPR signals with bandwidths of 10 kHz, 100 kHz, and 10 MHz are injected. It is found that for the 10 MHz modulated signal, no in-signal temperature fluctuations are observed during the amplification, whereas for 10 kHz a maximum variation of ± 7 ◦C and ± 3 ◦C for a 100 kHz signal is measured.

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