175.

Accession number:20113414250379

Title:Schottky diode series resistance and thermal resistance extraction from S-parameter and temperature controlled I-V measurements

Authors:Kiuru, Tero (1); Mallat, Juha (1); Räisänen, Antti V. (1); Närhi, Tapani (2)

Author affiliation:(1) Department of Radio Science and Engineering, Centre of Smart Radios and Wireless Research (SMARAD), Aalto University School of Electrical Engineering, FI-00076 Aalto, Finland; (2) RF Payload Systems Division, European Space Agency (ESA), 2299 AG, Noordwijk, Netherlands

Corresponding author:Kiuru, T.(tero.kiuru@aalto.fi)

Source title:IEEE Transactions on Microwave Theory and Techniques

Abbreviated source title:IEEE Trans. Microwave Theory Tech.

Volume:59

Issue:8

Issue date:August 2011

Publication year:2011

Pages:2108-2116

Article number:5773463

Language:English

ISSN:00189480

CODEN:IETMAB

Document type:Journal article (JA)

Publisher:Institute of Electrical and Electronics Engineers Inc., 445 Hoes Lane / P.O. Box 1331, Piscataway, NJ 08855-1331, United States

Abstract:A new method for extracting the series resistance and thermal resistance of a Schottky diode is presented. The method avoids the inaccuracies caused by the temperature dependence of the saturation current and ideality factor. These are a major concern for traditional extraction methods, especially when the diode under test has a submicrometer anode diameter and is significantly heated up by the bias current. The method uses theoretical models validated with measurements for the temperature-dependent saturation current and ideality factor, and the series resistance values extracted from low-frequency scattering parameter measurements in the high bias current regime. The main focus of this paper is the accurate extraction of the series resistance. For example, the series resistance value extracted with our method for a discrete diode with a 0.8-μm anode diameter is 88% larger than the series resistance extracted using traditional techniques. As a by-product from the extraction algorithm, an estimate for the thermal resistance of the diode is obtained. The method is validated with extensive current-voltage (I-V) and scattering parameter measurements of two different commercially available discrete single anode mixer diodes optimized for terahertz operation. I-V measurements are performed at several controlled ambient temperatures and scattering parameter measurements at one known ambient temperature. © 2011 IEEE.