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Title:Physical and electrical performance limits of high-speed SiGeC HBTs - Part II: Lateral scaling

Authors:Schröter, Michael (1); Krause, Julia (1); Rinaldi, Niccol (3); Wedel, Gerald (1); Heinemann, Bernd (4); Chevalier, Pascal (5); Chantre, Alain (5)

Author affiliation:(1) Department of Electrical Engineering and Information Technology, Technische Universität Dresden, 01069 Dresden, Germany; (2) University of California San Diego, San Diego, 92093, United States; (3) University of Naples, 80138 Naples, Italy; (4) IHP, 15236 Frankfurt (Oder), Germany; (5) STMicroelectronics, F-38926 Crolles, France

Corresponding author:Schröter, M.(mschroter@ieee.org)

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Abstract:The overall purpose of this paper is the prediction of the ultimate electrical high-frequency performance potential for SiGe C HBTs under the constraints of practical applications. This goal is achieved by utilizing advanced device simulation tools with parameters calibrated to experimental results of most advanced existing technologies. In addition, detailed electrostatic and electrothermal simulations are performed for determining the parasitic capacitances, temperature increase, and safe operating area of aggressively scaled devices. The important figures of merit are then determined from circuit simulation employing an accurate compact model incorporating all relevant physical effects. Based on the vertical profile found in Part I, this paper focuses on achieving a balanced device design by lateral scaling. It is shown that the peak values of (fT, fmax) around (1, 1.5) THz may be achievable. Such a performance limit provides still significant headroom for further developing existing processes and makes SiGe C HBTs well-suitable for highly integrated millimeter-wave applications operating within the low-end of the terahertz gap.

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