

Direct Extraction of InP/GaAsSb/InP DHBT Equivalent-Circuit Elements From S-Parameters Measured at Cut-Off and Normal Bias Conditions - DTU Orbit (08/11/2017)

Direct Extraction of InP/GaAsSb/InP DHBT Equivalent-Circuit Elements From S-Parameters Measured at Cut-Off and Normal Bias Conditions

A unique direct parameter extraction method for the small-signal equivalent-circuit model of InP/GaAsSb/InP double heterojunction bipolar transistors (DHBTs) is presented. S -parameters measured at cut-off bias are used, at first, to extract the distribution factor X_{0} for the base-collector capacitance at zero collector current and the collector-to-emitter overlap capacitance C_{ceo} present in InP DHBT devices. Low-frequency S -parameters measured at normal bias conditions then allows the extraction of the external access resistances R_{bx} , R_{e} , and R_{cx} as well as the intrinsic HBT elements of the device. The terminal inductances of the device are extracted from high frequency S -parameters by employing the intrinsic HBT elements extracted at low-frequency. Compared to other published direct parameter extraction techniques the proposed method is developed specifically for III-V based HBTs and avoids S -parameters measured at the critical open-collector bias condition. The method is applied to an $1.5\text{-}\mu\text{m}$ emitter width InP/GaAsSb/InP DHBT device and leads to excellent prediction of the measured S -parameters in the 250 MHz – 65 GHz frequency range.

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