

References

- [1] M. Schröter et al., "Physics- and process-based bipolar transistor modeling for integrated circuit design", *IEEE Journal of Solid-State Circuits*, vol. 34, pp. 1136-1149, 1999.
- [2] [M. Schröter and H.-M. Rein, "A compact physical large-signal model for high-speed bipolar transistors including the high-current region" (in German), NTG meeting, Würzburg, Mai 1986.
- [3] M. Schröter, "Simulation and modelling of the low-frequency base resistance of bipolar transistors in dependence on current and geometry", *IEEE Trans. Electron Dev.*, Vol. 38, pp. 538-544, 1991.
- [4] H.-M. Rein and M. Schröter, "A compact physical large-signal model for high-speed bipolar transistors at high current densities - Part II: Two-dimensional model and experimental results", *IEEE Trans. Electron Dev.*, Vol. 34, pp. 1752-1761, 1987.
- [5] M. Schröter, "A compact physical large-signal model for high-speed bipolar transistors with special regard to high current densities and two-dimensional effects", (in German), Dissertation, Ruhr-University Bochum, Bochum, Germany, Jan. 1988.
- [6] M. Schröter and H.-M. Rein, "Transit time of high-speed bipolar transistors in dependence on operating point, technological parameters, and temperature", *Proc. IEEE Bipolar Circuits and Technology Meeting*, Minneapolis, pp. 85-88, 1991.
- [7] H.-M. Rein and M. Schröter, "Base spreading resistance of square emitter transistors and its dependence on current crowding", *IEEE Trans. Electron Dev.*, Vol. 36, pp. 770-773, 1989.
- [8] M. Schröter, "Simulation and modelling of the low-frequency base resistance of bipolar transistors in dependence on current and geometry", *IEEE Trans. Electron Dev.*, Vol. 38, pp. 538-544, 1991.
- [9] M. Schröter, "Modeling of the low-frequency base resistance of single base contact bipolar transistors", *IEEE Trans. Electron Dev.*, Vol. 39, pp. 1966-1968, 1992.
- [10] H.-M. Rein, M. Schröter, A. Koldehoff, and K. Wörner, "A semi-physical bipolar transistor model for the design of very high-frequency analog ICs", *Proc. IEEE Bipolar and BiCMOS Circuits and Technology Meeting*, Minneapolis, pp. 217-220, 1992.
- [11] A. Koldehoff, M. Schröter, and H.-M. Rein, "A compact bipolar transistor model for very high-frequency applications with special regard to narrow stripes and high current densities", *Solid-State Electron.*, Vol. 36, pp. 1035-1048, 1993.
- [12] M. Schröter and H.-M. Rein, "Investigation of very fast and high-current transients in digital bipolar circuits by using a new compact model and a device simulator", *IEEE J. Solid-State Circuits*, Vol. 30, pp. 551-562, 1995.
- [13] M. Schröter and H.-M. Rein, "Two-dimensional modelling of high-speed bipolar transistors at high current densities using the Integral Charge-Control Relation", *Proc. ESSDERC '84*; see also: *Physica B*, North Holland Phys. Publ. Div., pp. 332-336, 1985.
- [14] H.-M. Rein, H. Stübing, and M. Schröter, "Verification of the Integral Charge-Control Relation for high-speed bipolar transistors at high current densities", *IEEE Trans. Electron Dev.*, Vol. 32, pp. 1070-1076, 1985.
- [15] M. Schröter, "A compact physical large-signal model for high-speed bipolar transistors with special regard to high current densities and two-dimensional effects", (in German), Dissertation, Ruhr-University Bochum, Bochum, Germany, Jan. 1988.

- [16] M. Schröter, M. Friedrich, and H.-M. Rein, "A generalized Integral Charge-Control Relation and its application to compact models for silicon based HBTs", *IEEE Trans. Electron Dev.*, Vol. 40, pp. 2036-2046, 1993.
- [17] H.K. Gummel and H.C. Poon, "An Integral Charge-Control Model for Bipolar Transistors", *BSTJ* Vol. 49, 1970, pp. 827-852.
- [18] P. Antognetti and G. Massobrio, "Semiconductor Device Modeling with SPICE", McGraw-Hill, 1988. (SGPM related material only)
- [19] M. Schröter, "Compact bipolar transistor modeling - Issues and possible solutions", pp. 282-285, WCM, 2003.
- [20] H.-M. Rein, "A simple method for separation of the internal and external (peripheral) currents of bipolar transistors", *Solid-State Electronics*, Vol. 27, pp. 625-632, 1984.
- [21] M. Schröter and D.J. Walkey, "Physical modeling of lateral scaling in bipolar transistors", *IEEE J. Solid-State Circuits*, Vol. 31, pp. 1484-1491, 1996 and Vol. 32, pp. 171, 1998.
- [22] M. Schröter, "High-Frequency Circuit Design Oriented Compact Bipolar Transistor Modeling with HICUM", *IEICE Trans. Electron.*, Vol. E88-C, pp. 1098-1113, 2005.
- [23] H.-M. Rein, "Proper choice of the measuring frequency for determining f_T of bipolar transistors", *Solid-State Electronics*, Vol. 26, pp. 75-82 and p. 929, 1983.
- [24] H.-M. Rein and M. Schröter, "Experimental determination of the internal base sheet resistance of bipolar transistors under forward-bias conditions", *Solid-State Electron.*, Vol. 34, pp. 301-308, 1991.
- [25] T.-Y. Lee and M. Schröter, "Methodology for bipolar transistor model parameter extraction", documentation for the CMC, (<http://www.eigroup.org/cmc>), Feb. 1999.
- [26] T.-Y. Lee et al., "Modeling and parameter extraction of of BJT substrate resistance", *Proc. IEEE Bipolar and BiCMOS Circuits and Technology Meeting*, Minneapolis, pp. 101-104, 1999.
- [27] H.Q. Tran, "Investigation of SiGe heterojunction bipolar transistors with respect to compact modeling for integrated circuit design", MSEE. thesis, Carleton University, Ottawa, Canada, 1997.
- [28] M. Schröter and T.-Y. Lee., "A physics-based minority charge and transit time model for bipolar transistors", *IEEE Trans. Electron Dev.*, vol. 46, pp. 288-300, 1999.
- [29] C.T. Kirk, "A theory of transistor cutoff frequency falloff at high current densities", *IEEE Trans. Electron Dev.*, Vol. 9, pp. 914-920, 1962.
- [30] M. Schröter, (a) "Physical models for high-speed silicon bipolar transistors - A comparison and overview", (in German), Habilitation thesis, 1994 (excerpts are available on request);
- [31] M. Schröter et al., "Physics- and process-based bipolar transistor modeling for integrated circuit design", *IEEE Journal of Solid-State Circuits*, vol. 34, pp. 1136-1149, 1999.
- [32] X.Y. Chen, M.J. Deen, A.D. van Rheezen, Z.X. Yan, and M. Schroter, "Low-frequency noise in npn and pnp double-polysilicon BJTs, effects of temperature and emitter dimensions", *Proc. IEDMS*, pp. - , 1998.
- [33] J. TeWinkel, "Extended charge-control model for bipolar transistors", *IEEE Trans. Electron Dev.*, Vol. 20, pp. 389-394, 1973.
- [34] P.B. Weil and L.P. McNamee "Simulation of excess phase in bipolar transistors", *IEEE Trans. Circ. Syst.*, Vol. 25, pp. 114-116, 1978.
- [35] M.Schroter, A.Mukherjee, "HICUM-productization and support update", October CMC meeting, Boston, 2007.

- [36] M.Schroter, A.Mukherjee, "HICUM-productization and support update", March CMC meeting, Portland, 2008
- [37] R.L. Pritchard, "Transistor Characteristics", McGraw Hill, 1967.
- [38] M. Schröter, Z. Yan, T.-Y Lee, and W. Shi, "A compact tunneling current and collector breakdown model", Proc. IEEE Bipolar Circuits and Technology Meeting, Minneapolis, pp. 203-206, 1998.
- [39] M. Pfost, H.-M. Rein, and T. Holzwarth, "Modeling substrate effects in the design of high-speed Si bipolar ICs", IEEE J. Solid-State Circuits, Vol. 31, pp. 1493-1502, 1996.
- [40] T.-Y. Lee et al., "Modeling and parameter extraction of BJT substrate resistance", Proc. IEEE Bipolar and BiCMOS Circuits and Technology Meeting, Minneapolis, pp. 101-104, 1999.
- [41] P. Sakalas, A. Chakravorty, J. Herricht, M. Schroter, "Compact Modeling of High Frequency Correlated Noise in HBTs", Proc. Bipolar Circuits and Technology Meeting (BCTM), Maastricht (Belgium), pp. 279-282, 2006.
- [42] S. Sze, "Physics of semiconductor devices", Wiley & Sons, New York, 1981.
- [43] S. Lin and C. Salama, "A VBE(T) model with application to bandgap reference design", IEEE Journal of Solid-State Circuits, Vol. 20, pp. 1283-1285, 1985.
- [44] J. Herricht and M. Schroter, "Bandgap reference design considerations and model implications", 3rd European HICUM Workshop, Dresden, Germany, June 2003.
- [45] C. Jacoboni et al., "A review of some charge transport properties of silicon", Solid-State Electronics, Vol. 20, pp. 77-89, 1977.
- [46] C. McAndrew, private communication, 2003.
- [47] P. Mars, "Temperature dependence of avalanche breakdown voltage in pn junctions", Int. J. Electronics, Vol. 32, No. 1, pp. 23-37, 1971.
- [48] W. Maes, K. DeMeyer, and R. Van Overstraeten, "Impact ionization in silicon: a review and update", Solid-State Electron., Vol. 33, pp. 705-718, 1990.
- [49] V. Kunz, C. deGroot, S. Hall, and P. Ashburn., "Polycrystalline Silicon-Germanium emitters for gain control, with application to SiGe HBTs", IEEE Trans. Electron Dev., Vol. 50, pp. 1480-1486, 2003.
- [50] H.-M. Rein and M. Schröter, "Base spreading resistance of square emitter transistors and its dependence on current crowding", IEEE Trans. Electron Dev., Vol. 36, pp. 770-773, 1989.
- [51] R. Dennison and K. Walter, "Local thermal effects in high performance bipolar devices/circuits", Proc. IEEE Bipolar and BiCMOS Circuits and Technology Meeting, Minneapolis, pp. 164-167, 1989.
- [52] B.C. Bouma and A.C. Roelofs, "An Experimental Determination of the Forward-Biased Emitter-Base Capacitance", Solid-State Electron., Vol. 21, 1978, pp. 833-836.
- [53] D. Celi, private communication.
- [54] S. Voinigescu, M. Maliepaard, M. Schröter, P. Schvan and D. Hame, "A scaleable high-frequency noise model for bipolar transistors and its applications in low-noise amplifier design", IEEE J. Solid-State Circuits, Vol. 32, pp. 1430-1439, 1997.
- [55] X.Y. Chen, M.J. Deen, Z.X. Yan, and M. Schroter, "Effects of emitter dimensions on low-frequency noise in double-polysilicon BJTs", Electronics Letters, Vol. 34, No. 2, pp. 219-220, 1998.
- [56] M.J. Deen, S.L. Romyantsev, and M. Schroter, "On the origin of 1/f noise in polysilicon emitter bipolar transistors", J. Appl. Phys., Vol. 85, No. 2, pp. 1192-1195, 1999.

- [57] H.K. Gummel, "On the definition of the cutoff frequency f_T ", Proc. IEEE, Vol. 57, pp. 2159, 1969.
- [58] H.K. Gummel, "A charge-control relation for bipolar transistors", BSTJ, Vol. 49, pp. 115-120, 1970.
- [59] C. Mallerdeau et al., "A 12V BiCMOS technology for mixed analog-digital applications with high performance vertical pnp", Proc. ESSDERC '90, pp. 397-400, 1990.
- [60] D.R. Pehlke, private communication, 1998.
- [61] M. Schroter, "Integral Charge Control Relations" in "The SiGe handbook", ed. by J.Cressler, to be published in 2005
- [62] M. Schröter and T.-Y. Lee, "HICUM - a physics-based scaleable compact bipolar transistor model", presentation to the Compact Model Council, (<http://www.eigroup.org/cmc>), Dec. 1998.
- [63] M. Schröter, D.R. Pehlke and T.-Y. Lee, "Compact modeling of high-frequency distortion in bipolar transistors", Proc. ESSDERC, Leuven, pp. 476-479, 1999.
- [64] M. Schröter, D.R. Pehlke and T.-Y. Lee, "Compact modeling of high-frequency distortion in Si integrated bipolar transistors", IEEE Trans. on Electron Dev., Vol. 47, pp. 1529-1539, 2000.
- [65] H.Q. Tran et al., "Simultaneous extraction of thermal and emitter series resistances in bipolar transistors", Proc. IEEE Bipolar/BiCMOS Circuits and Technology Meeting, Minneapolis, pp. 170-173, 1997.
- [66] M. Schröter, H.-M. Rein, W. Rabe, R. Reimann, H.-J. Wassener and A. Koldehoff, "Physics- and process-based bipolar transistor modeling for integrated circuit design", IEEE Journal of Solid-State Circuits, Vol. 34, pp. 1136-1149, 1999.
- [67] C. McAndrew, private communication.
- [68] C. D. Thurmond, "The standard thermodynamic function of the formation of electrons and holes in Ge, Si, GaAs and GaP", J. Electrochem. Soc., Vol. 122, p. 1133, 1975.
- [69] S. Lin and C. Salama, "A $V_{BE}(T)$ model with application to bandgap reference design", IEEE Journal of Solid-State Circuits, Vol. 20, pp. 1283-1285, 1985.
- [70] D. Celi, private communications, 2004.
- [71] C. Jacoboni et al., "A review of some charge transport properties of silicon", Solid-State Electronics, Vol. 20, pp. 77-89, 1977.
- [72] <http://www.xmodtech.com/Index.html>
- [73] <http://www.xmodtech.com/HICUMWS/>
- [74] M. Schröter and H. Tran, "Two-/Three-dimensional GICCR for Si/SiGe bipolar transistors", NSTI-Nanotech, WCM, pp. 99-104, 2005.
- [75] D. Celi, Private Communication, 2004.
- [76] P.B. Weil and L.P. McNamee "Simulation of excess phase in bipolar transistors", IEEE Trans. Circ. Syst., Vol. 25, pp. 114-116, 1978.
- [77] Colin C. McAndrew, et al, "BJT Modeling with VBIC, Basics and V1.3 Updates", and private communication, 2007.
- [78] G. Coram, private communication, 2007.