Chapter 11: Asymmetric MOS Junction Diode Models

11.1 Junction Diode IV Model

In BSIM4, there are three junction diode IV models. When the IV model selector *dioMod* is set to 0 ("resistance-free"), the diode IV is modeled as resistance-free with or without breakdown depending on the parameter values of *XJBVS* or *XJBVD*. When *dioMod* is set to 1 ("breakdown-free"), the diode is modeled exactly the same way as in BSIM3v3.2 with current-limiting feature in the forward-bias region through the limiting current parameters *IJTHSFWD* or *IJTHDFWD*; diode breakdown is not modeled for *dioMod* = 1 and *XJBVS*, *XJBVD*, *BVS*, and *BVD* parameters all have no effect. When *dioMod* is set to 2 ("resistance-and-breakdown"), BSIM4 models the diode breakdown with current limiting in both forward and reverse operations. In general, setting *dioMod* to 1 produces fast convergence.

11.1.1 Source/Body Junction Diode

In the following, the equations for the source-side diode are given. The model parameters are shown in Appendix A.

- *dioMod* = 0 (resistance-free)

$$I_{bs} = I_{sbs} \left[\exp\left(\frac{qV_{bs}}{NJS \cdot k_B TNOM} \right) - 1 \right] \cdot f_{breakdown} + V_{bs} \cdot G_{\min}$$

(11.1)