Appendix D: Parameter Extraction

D.1. Extraction Strategy

The complicated physics in SOI MOSFETs makes parameter extraction quite involved [20]. It is always preferable to have more measurements so that the parameters extracted can have more valid physical meaning. Similar to conventional bulk devices, two basic extraction strategies can be used: single device extraction, and group device extraction. The group device extraction is more popular because of several reasons. In analog circuit, channel length and width scalability is very important. In digital circuit, statistical modeling is often used to predict the circuit performance due to process variation. Hence channel length scalability is also important. Besides, model parameters extracted from group device extraction have better physical meaning than that from single device extraction. In this work, we shall emphasize on group device extraction.

Parameter extraction using body contact devices is highly recommended because parameters related to body effect, impact ionization and leakage currents can be directly extracted [18, 19]. This yields less ambiguity in extracting technology parameters for I-V fitting purposes. In the followings, we suggest a set of measurement suitable for PD devices.

D.2. Suggested I-V Measurement

Measurement set A is used to extract basic MOS I-V parameters. For each body-contacted device :

(A1) I_{ds} vs. V_{gs} @ small V_{ds} with different V_{bs}, V_{es}=0V.

(A2) I_{ds} vs. V_{gs} @ V_{ds}=V_{dd} with different V_{bs}, V_{es}=0V.

(A3) I_{ds} vs. V_{ds} with different V_{gs} and different V_{bs}, V_{es}=0V.

Parameters extracted include threshold voltage, body coefficient, delta L and W, series resistance, mobility, short channel effect, and subthreshold swing. (A2) is used to extract DIBL parameters at subthreshold. (A3) is used to extract saturation velocity, body charge effect, output resistance, body contact resistance and self-heating parameters.

Measurement set C is used to extract impact ionization current parameters. For each body-contacted device :

(C1) I_b vs. V_{gs} @ different V_{ds}, V_{bs}=0V, V_{es}=0V.

(C2) I_b vs. V_{ds} @ different V_{gs}, V_{bs}=0V, V_{es}=0V.

Measurement set D is used to extract MOS temperature dependent parameter. For a long channel body-contacted device:

(D1) I_{ds} vs. V_{gs} @ small V_{ds}, V_{bs}=0V, V_{es}=0V, repeat with several temperatures.

(D2) I_{ds} vs. V_{ds} @ different V_{gs}, V_{bs}=0V, V_{es}=0V, repeat with several temperatures.

Notice that the self-heating parameters have to be extracted from set A.

Measurement set E is used to extract diode parameters. For a long channel body-contacted device or gated diode :

(E1) I_{diode} vs. V_{bs} @ V_{gs}=-1V, V_{es}=0V, repeat with several temperature

Measurement set F is used to extract BJT parameters. For each body-contacted device:

(F1) I_{ds} vs. I_b @ V_{gs}=-1V, V_{es}=0V, V_{ds}=1V.

Measurement set G is used to verify the floating body device data. For each floating-body device :

(G1) I_{ds} vs. V_{gs} @ small V_{ds}.

(G2) I_{ds} vs. V_{gs} @ V_{ds}=V_{dd}.

(G3) I_{ds} vs. V_{ds} @ different V_{gs}.