
CHAPTER 3: Unified I-V Model

The development of separate model expressions for such device operation regimes as subthreshold and strong inversion were discussed in Chapter 2. Although these expressions can accurately describe device behavior within their own respective region of operation, problems are likely to occur between two well-described regions or within transition regions. In order to circumvent this issue, a unified model should be synthesized to not only preserve region-specific expressions but also to ensure the continuities of current and conductance *and* their derivatives in *all* transition regions as well. Such high standards are kept in BSIM3v3.2.1 . As a result, convergence and simulation efficiency are much improved.

This chapter will describe the unified I-V model equations. While most of the parameter symbols in this chapter are explained in the following text, a complete description of all I-V model parameters can be found in Appendix A.

3.1 Unified Channel Charge Density Expression

Separate expressions for channel charge density are shown below for subthreshold (Eq. (3.1.1a) and (3.1.1b)) and strong inversion (Eq. (3.1.2)). Both expressions are valid for small V_{ds} .