The thermionic emission model gives：



One key is to calculate the equilibrium electron and hole concentrations, In Silvaco guide book (part 3.5.2), this assumes infinite surface recombination velocity (). So we shall calculate the carrier concentration under this condition as the equilibrium concentration. According to the “Selberherr S. Analysis and simulation of semiconductor devices” in page 29, the concentration can be calculated by:



Besides, in the Schottky contacts:



This is the expression in the code. However, some articles (Crowell C R, Sze S M. Current transport in metal-semiconductor barriers[J]. Solid-state electronics, 1966, 9(11-12): 1035-1048.) use this:



If we ignore terms related to the band structure, , this will be same. Besides, the barrier lowering is ignored.