Equations are for the n-channel MOSFET. For the p-channel device, reverse the directions of all current labels and reverse the order of subscripts involving node labels, i.e. $V_{DS}$ becomes $V_{SD}$. If the body is connected to the source, set $\chi = 0$ in all equations. For the corresponding JFET equations, omit the body lead, set $\chi = 0$, and replace $K$ with $\beta$, where $\beta = \beta_0 (1 + \lambda V_{DS})$. When more than one equation is given, either may be used.

\[ i_D = K (v_{GS} - V_{TO})^2 = I_{DSS} \left(1 - \frac{v_{GS}}{V_{TO}}\right)^2 \]

\[ I_{DSS} = KV_{TO}^2 \]

\[ i_G = 0 \]

\[ i_S = i_D \]

\[ K = K_0 (1 + \lambda V_{DS}) \]

\[ K_0 = \frac{k'}{2} \frac{W}{L} \]

\[ k' = \mu C_{ox} \]

\[ v_{DS} \geq v_{GS} - V_{TO} \]

\[ i_d' = i_s' = g_m v_{gs} + g_{mb} v_{bs} \]

\[ g_m = 2 \sqrt{K I_D} = \frac{-2}{V_{TO}} \sqrt{I_D I_{DSS}} \]

\[ g_{mb} = \chi g_m \]

\[ \chi = \frac{\gamma}{2 \sqrt{\phi - V_{BS}}} \]

\[ r_0 = \frac{\lambda^{-1} + V_{DS}}{I_D} \]

\[ r_s = \frac{1}{g_m} \]

\[ r_s' = \frac{r_s}{1 + \chi} \]

\[ i_{d(sc)} = G_{mg} v_{tg} - G_{ms} v_{ts} \]

\[ G_{mg} = \frac{1}{1 + \chi} \]

\[ G_{ms} = \frac{1}{R_t + r_s' r_0} \]

\[ r_{id} = r_0 \left(1 + \frac{R_t}{r_s'}\right) + R_t \]

\[ v_{s(oc)} = \frac{v_{tg}}{1 + \chi} \]

\[ r_{is} = \frac{r_s' r_0 + R_{td}}{r_s' + r_0} \]

For the $r_0$ approximations, assume $r_0 \to \infty$ in all equations except the one for $r_{id}$. 
