BSIM4.5 WPE&LOD

PDKD/TSMC

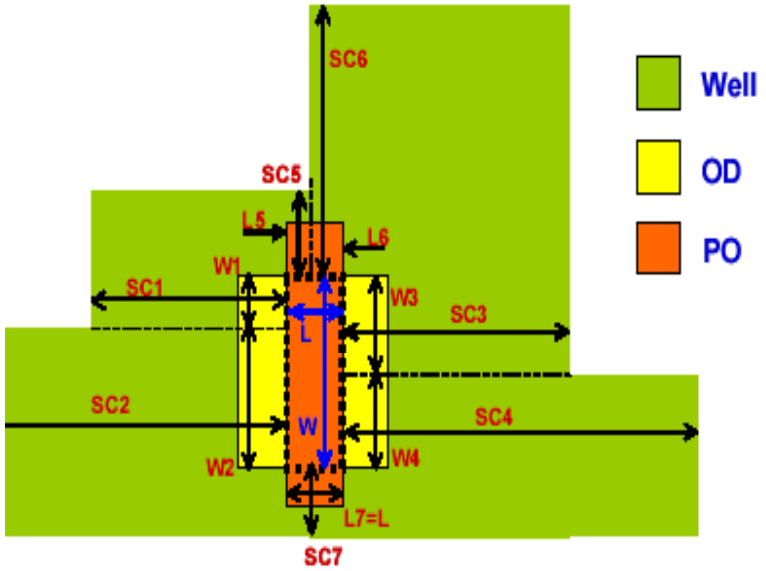
Well Proximity Effect/WPE, BSIM4.5

- **Input: GATE, WELL**
- **Output Property: SCA, SCB, SCC**

$$SCA = \frac{1}{W_{drawn} L_{drawn}} \left[\begin{array}{l} SC_{ref}^{\,2} \sum_{i=1}^{n} \left(W_i \left(\frac{1}{SC_i} - \frac{1}{SC_i + L_{drawn}} \right) \right) + \\ SC_{ref}^{\,2} \sum_{i=n+1}^{n+m} \left(L_i \left(\frac{1}{SC_i} - \frac{1}{SC_i + W_{drawn}} \right) \right) + corners\_A \end{array} \right]$$

$$SCB = \frac{1}{W_{drawn} L_{drawn}} \left[\begin{array}{l} \sum_{i=1}^{n} \left(W_i \left(\begin{array}{l} SC_{ref} \left(\frac{SC_i}{10} + \frac{SC_{ref}}{100} \right) \exp(-10 \frac{SC_i}{SC_{ref}}) - \\ SC_{ref} \left(\frac{SC_i + L_{drawn}}{10} + \frac{SC_{ref}}{100} \right) \exp(-10 \frac{SC_i + L_{drawn}}{SC_{ref}}) \end{array} \right) \right) + \\ \sum_{i=n+1}^{n+m} \left(L_i \left(\begin{array}{l} SC_{ref} \left(\frac{SC_i}{10} + \frac{SC_{ref}}{100} \right) \exp(-10 \frac{SC_i}{SC_{ref}}) - \\ SC_{ref} \left(\frac{SC_i + W_{drawn}}{10} + \frac{SC_{ref}}{100} \right) \exp(-10 \frac{SC_i + W_{drawn}}{SC_{ref}}) \end{array} \right) \right) + corners\_B \end{array} \right]$$

$$SCC = \frac{1}{W_{drawn} L_{drawn}} \left[\begin{array}{l} \sum_{i=1}^{n} \left(W_i \left(\begin{array}{l} SC_{ref} \left(\frac{SC_i}{20} + \frac{SC_{ref}}{400} \right) \exp(-20 \frac{SC_i}{SC_{ref}}) - \\ SC_{ref} \left(\frac{SC_i + L_{drawn}}{20} + \frac{SC_{ref}}{400} \right) \exp(-20 \frac{SC_i + L_{drawn}}{SC_{ref}}) \end{array} \right) \right) + \\ \sum_{i=n+1}^{n+m} \left(L_i \left(\begin{array}{l} SC_{ref} \left(\frac{SC_i}{20} + \frac{SC_{ref}}{400} \right) \exp(-20 \frac{SC_i}{SC_{ref}}) - \\ SC_{ref} \left(\frac{SC_i + W_{drawn}}{20} + \frac{SC_{ref}}{400} \right) \exp(-20 \frac{SC_i + W_{drawn}}{SC_{ref}}) \end{array} \right) \right) + corners\_C \end{array} \right]$$



LOD Effect, SA/SB

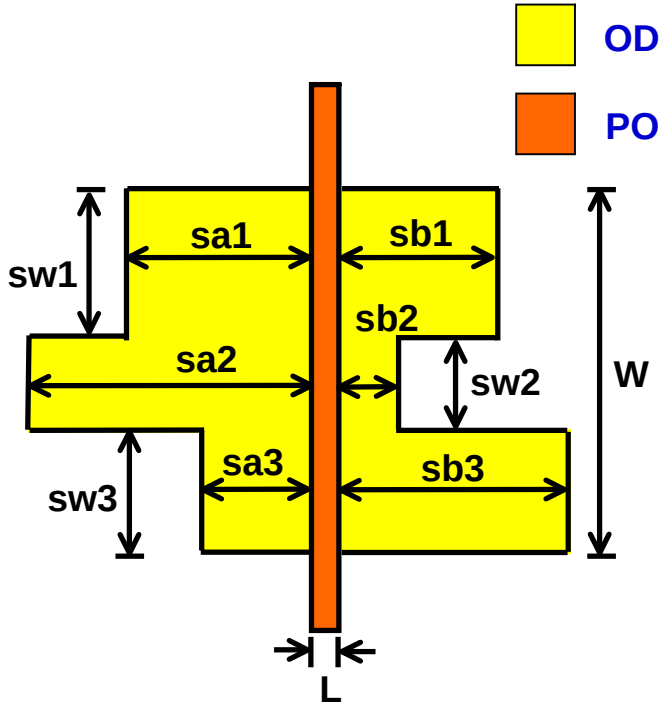
- **Input: OD, GATE**
- **Output Property: SA, SB**

SA:

$$\frac{1}{SA_{eff} + 0.5 \cdot L_{drawn}} = \sum_{i=1}^{n} \frac{sw_i}{W_{drawn}} \cdot \frac{1}{sa_i + 0.5 \cdot L_{drawn}}$$

SB:

$$\frac{1}{SB_{eff} + 0.5 \cdot L_{drawn}} = \sum_{i=1}^{n} \frac{sw_i}{W_{drawn}} \cdot \frac{1}{sb_i + 0.5 \cdot L_{drawn}}$$



Notices

- SRAM cells are fixed layouts and do not extract WPE and LOD properties. These two effects have been covered in the SPICE model.
- Native devices do not extract WPE.
- When SCi > 5 um, the extracted WPE parameters will keep the values at SCi = 5um.