

Modella

LATERAL PNP BIPOLAR MODEL

Dedicated Lateral PNP Model

The MODEL-Lateral model developed by Philips N.V. provides an accurate model dedicated to lateral PNP devices.

This model is based on a totally new approach, accounting for the complex bi-dimensional structure of lateral transistors. Modella allows the simulation of lateral devices using real physically based parameters, instead of using less accurate empirically-modified models, such as Gummel-Poon. With Modella, lateral PNP bipolars do not lack an accurate model anymore.

Major Improvements

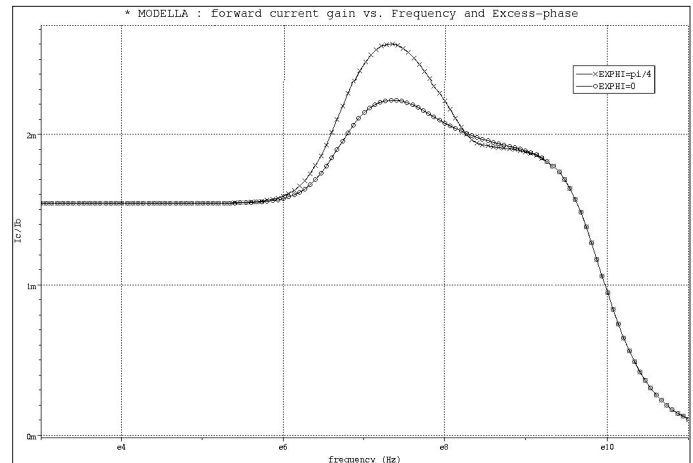
Modella benefits from the following improvements with regard to the older Gummel-Poon model:

- More complex resistive network, using more internal nodes
- Separation of bottom and sidewall components, describing the 2D structure of the transistor
- No nonphysical parameter (for example, current crowding is modeled, using only one parameter)
- Symmetry of the equivalent circuit, thanks to a split base resistance
- Equations derived from PNP formulations
- No iterative process used in equations, resulting in short simulation times

Physically-Based Lateral Bipolar Model

Modella accounts for the bi-dimensional structure of lateral PNP devices, modeling physical effects such as:

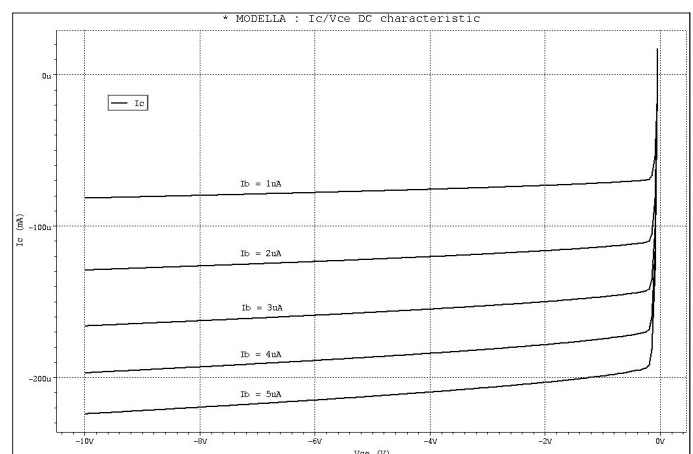
- Explicit modeling of inactive regions
- Excess-phase shift for current and storage charges
- Charge storage
- Temperature
- High-injection
- Built-in electric field in base region
- Bias-dependent Early effect
- Low-level non-ideal base currents
- Hard and quasi saturation
- Weak avalanche
- Current crowding and conductivity modulation of the base resistance
- Hot carrier effects in the collector epilayer
- Split base-collector depletion capacitance



Influence of excess-phase on current gain

Silvaco Implementation

- Modella is compatible with VZERO and BYPASS options in order to achieve great speed performance
- Internal warnings and diagnostics provide valuable information to help finding convergence issues
- User-friendly parameters checking: user is kept aware of every clipped parameter
- Device internal variables (currents, conductances, charges...) can easily be accessed like any other parameter
- Modella model is part of the SmartLib™ product-independent model library. It can be accessed within SmartSpice™ as level 500



Ic vs. Vce characteristic

SILVACO