

# **Proposed Requirements for Next Generation Platform MOSFET Model**

**Compact Model Council  
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# Basic Structure

- **Core model encompasses as perfect a representation of MOS behavior as is possible**
- **Core model is as efficient as possible**
- **Models phenomena important in present day devices (intrinsic and extrinsic)**
- **Expected to be extendable for future device structures**

# Core Model Requirements

- **As physical a basis as is possible**
- **Physically correct in all operating regions**
- **No unphysical behavior at all**
  - **Perfectly correct for wide/long devices**
  - **Properly symmetric**
  - **No unphysical negative capacitance coefficients or conductances**
  - **No kinks or glitches**

# Core Model Requirements

- **As small a number of physically based, uncorrelated parameters as possible (easily extractable)**
- **Basic parameters should be physical “process” parameters related to structure and to geometry/layout**
- **Empirical parameters for corrections to first order physical behavior**

# Core Model Requirements

- **DC, AC (charge), and noise models**
- **Accurate modeling of IP2 and IP3**
  - With  $V_{ds}$  swinging through zero
- **Gate and substrate current models**
- **Geometry/layout dependence**
  - Rectangular devices only?
  - Core model access for other scaling?
- **Usable for MOS varactor modeling as well as MOSFET modeling**
  - Accurate, physically correct in accumulation

# Extrinsic Requirements

- **Appropriate extrinsics to model parasitic resistances and capacitances**
  - **Physically correct**
  - **Bias dependent**
  - **With proper layout dependence**

# Possible Requirements

- **Stress effects**
  - Comprehensive parameterization w.r.t. layout (trench)
- **Asymmetric source/drain structure**
- **Selectable speed/accuracy trade-off, from one model parameter set**
- **Selectable LF/HF modeling**
  - Intrinsic to model, or expect subckt?

# **Additional Possibilities (separate modules?)**

- **Reliability modeling**
  - Including asymmetry
- **Breakdown**
- **Self-heating**
- **Safe Operating Area (SOA)**
- **Ballistic transport**
  - Continuous transition to DD
- ...

# Comments

- **If we're going to take the next step, don't make it to a expedient but interim solution**
- **Priority should be “get the foundation right” then add modeling of effects on top of that**