a leap ahead
Many unsolved problems in HV MOS Transistor modeling

Accuracy of HV SPICE models are not comparable to standard MOS
Different Devices and Requirement

RF LD MOS

- Accurate modeling of frequency dependency

Lateral HV MOS

Vertical HV MOS
HV Transistor Model Requirements (first order)

- DC & AC characteristic
- Symmetrical and unsymmetrical, source & drain res and cap.
- Voltage up to 120V & Temperature behavior up to 180°C
- Physical parameter set (Statistical Corner & MC Modeling)
- Self heating effects
- Noise Modeling (1/f, thermal, (gate induced ))
- Simple and comprehensible parameter extraction.
HV Transistor Model Requirements II

- Capable of creating statistical models
- Substrate current modeling
- Transient behavior RF characteristics (in a limited subset of applications)
- Parasitic modeling (parasitic bipolar, body diode recovery)
- Breakdown characteristics
- Scalable over the drain extension length.
Model Solutions

Sub-circuits (Macro model):
- Compatible to all simulators
- Higher simulation time, convergence

Compact Model with internal node:
- Node solved internally or from the simulator
- Higher simulation time, convergence

Compact Model:
- Combination of the low voltage MOS region with the high voltage drift region without internal node.
- Short computation time

An Improved LDMOS Transistor Model That Accurately Predicts Capacitance for all Bias Conditions

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Press Release

Synopsys' HSPICE High-Voltage MOS Transistor Model Adopted by UMC

Strength of our level 66 HVMOS

a) a global model for high Vgs and low Vgs at the same time
b) easier to extract the model card and easier to verify
c) much more accuracy with BSIM-4 based methodology

-Level 66 is not public domain
BCD (Bipolar CMOS DMOS) means more than LDMOS

- N-LDMOS
- N-VDMOS
- P-MOS
- HV NPN, PNP
- Lateral PNP, NPN
- .... 5V, 12V, 20V, 50V, 80, 120v,.....
- HV characterization of passives
- High temperature modeling for Automotive applications
- HV modeling of the parasitics

Roadmap Differentiation and Emerging Trends in BCD Technology

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- The CMC is in fact beginning to look into standardization of HV MOS models.
- Yutao Ma of Cadence is leading this effort which is just getting underway.