
TECHNICAL NOTE

PLOTTING INTERNAL DEVICE PARAMETERS

OVERVIEW

It is sometimes desirable to plot internal device parameters such as V_{th} or V_{dsat} of a MOSFET. These values are calculated for each step within the device model code and these values are often useful to the designer so that he can see the region in which the device is operating.

This is possible with SIMetrix using a feature that was previously undocumented. (In fact this feature has been available since version 1.0). This note describes how to use this facility.

PROCEDURE

To plot internal parameters, you must first instruct SIMetrix to save their data. This is done using the `.KEEP` simulator control. This is a command that must be placed in the netlist and so if you are using the schematic editor you must manually place this command in the "F11 window". If you are not familiar with this, the F11 Window is an edit box that is part of the schematic and everything placed in it is passed directly to the simulation netlist. To open it, select the schematic window and press F11. (That of course is where it gets its name from).

The command to enter must be of the form:

```
.KEEP device#parameter
```

Where *device* is the component reference of the device and *parameter* is the name of the internal parameter you wish to plot.

Consider the simple BSIM3 buffer circuit supplied as an example. You can find this under Work\Examples\CMOS\BSIM3_buffer.sxsch. Suppose that you want to plot the V_{dsat} of Q3. You would enter in the F11 window:

```
.KEEP Q3#vdsat
```

You can place this command anywhere as long as it is not placed immediately before a line beginning with '+'. Now run the simulation. When it is finished you can plot the result using the schematic menu Probe|Add Curve... or the command shell menu Graphs and Data|Add Curve... You can either enter `Q3#vdsat` directly in the Y expression box or select it from the "Available vectors" drop down box.

INCREMENTAL PLOTTING

As an alternative, you can tell SIMetrix to incrementally plot the parameters while the simulation is running. To do this the procedure is similar but instead of using `.KEEP` you should use `.GRAPH`. So this is what you would enter for the above example:

```
.GRAPH Q3#vdsat
```

AVAILABLE PARAMETERS

Here is a list of plottable internal parameters for MOSFETs and BJTs:

BSIM3 DEVICES:

gmbs, gm, gds, vdsat, vth, vbs, vgs, vds

MOS1, 2, 3

von, vdsat, gmbs, gm, gbd, gbs

BJT

gpi, gmu, gm, go, gx