

# Bipolar Device SPICE Modeling Service Questionnaire

Please fill out the following questionnaire. The data you provide in this form is necessary for Simucad to supply you with high quality SPICE models. If you have any questions please contact:

SPICE Modeling Group  
Phone 408-654-4337  
Fax: 408-330-9293  
email: spicemodeling@simucad.com

## Contact Person in Your Company

(for technical questions)

NAME: \_\_\_\_\_

PHONE: \_\_\_\_\_

FAX: \_\_\_\_\_

email: \_\_\_\_\_

## Package Part or Wafer Information:

For packaged parts please specify package type:

\_\_\_\_\_  
\_\_\_\_\_

For wafer, please specify:

How many wafers will be supplied?: \_\_\_\_\_

Wafer #: \_\_\_\_\_

Lot#: \_\_\_\_\_

Are the devices in a scribeline or in a drop-in test die?: \_\_\_\_\_

\_\_\_\_\_

## Model Type

Please specify the SPICE model type (For example: Gummel Poon, VBIC95, Mextram) \_\_\_\_\_

\_\_\_\_\_

Please specify the circuit simulator(including the version number) for which the models are generated.

\_\_\_\_\_

\_\_\_\_\_

## Bias Conditions

Please specify the typical operating and maximum to apply for MODELING purposes. (Make sure the specified maximum bias conditions are not destructive over the temperature.)

NPN      Vertical PNP      Lateral PNP

Operating VCE (V): \_\_\_\_\_

Operating  $I_{C_{max}}$  (A): \_\_\_\_\_

Operating  $I_{C_{min}}$  (A): \_\_\_\_\_

Maximum VCE (V): \_\_\_\_\_

Please include measured data plots of:  $I_C/V_{CE}$  (5  $I_B$  steps), Gummel-Plot ( $I_C$ ,  $I_B$  vs.  $V_{BE}$ ) and  $BF$  vs.  $I_C$ .

## Temperature Conditions

Please specify the temperature points for devices to be characterized?

(For example: 0 C, 27 C, 85 C, Cold temperature characterization requires packaged parts): \_\_\_\_\_

\_\_\_\_\_

Please specify the temperature range for model validation (simulation only, for example: -40C to 150C): \_\_\_\_\_

\_\_\_\_\_

## Test Chip Information

Please specify the Emitter, Base, Collector areas and RSH for the specified regions.

NPN			Vertical PNP			Lateral PNP		
E	B	C	E	B	C	E	B	C

Area \_\_\_\_\_

RSH \_\_\_\_\_

## AC Modeling

AC modeling of Bipolar devices requires the s-parameters to be measured and FT to be extracted. Simucad can provide s-parameter measurements on packaged part or on wafer. On wafer measurements provide more accurate results and are necessary for devices with FT greater than 1GHZ. For on wafer FT measurements the bipolar devices should be layed out as common emitter configuration (Figure 1). In addition to the actual device an open device structure should be layed out for proper calibration (Figure 2). Base to Emitter and Collector to Emitter pad distance should be 150  $\mu\text{m}$ . (from middle of pad to middle of pad)

Are there special structures (as described above) to measure FT on wafer? (If yes, please indicate the location of these structures on the test chip.)

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What is the expected range for FT? \_\_\_\_\_

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## Deliverables

In addition to the SPICE model parameter set and project report the following measured vs simulated data plots are provided:

BF vs IC

IC vs VCE

IC and IB vs VBE (gummel)

FT vs IC (If AC modeling is requested)

CJE vs VEB (Emitter to Base Junction Cap)

CJC vs VCB (Collector to Base Junction Cap)

CJS vs VCS (Collector to Substrate Junction Cap)

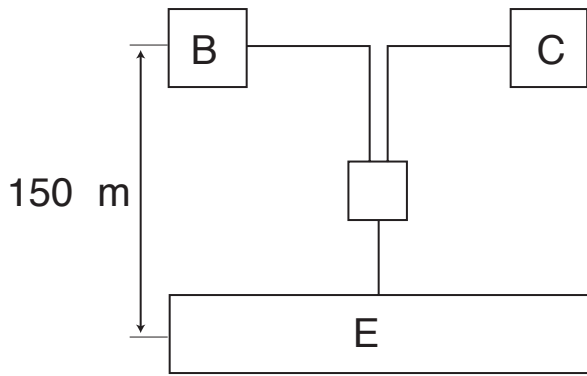


Figure 1. Device layout for FT measurements.

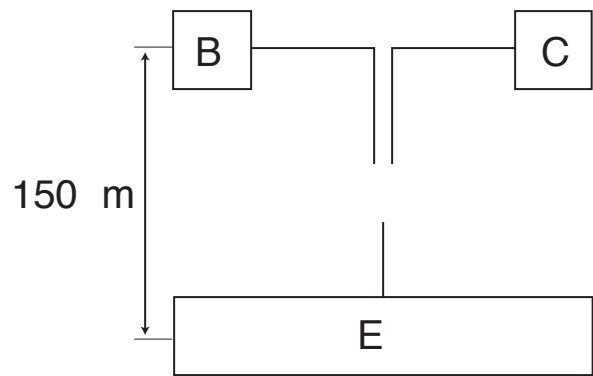


Figure 2. Device open for calibration.



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