



Quotation Request.

Characterization and Modeling

Submitted by :

| | | | |
|----------------------------|-------------------------|-------------------------|----------------------------|
| <u>Company Name :</u> | <u>Phone :</u> + | <u>Web :</u> _____ | <u>Email :</u> _____ |
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| <u>Adress :</u> | | | |
| <u>Other Information :</u> | <u>Quotation Date :</u> | <u>Request Date :</u> | <u>Date model Needed :</u> |

Submitted to :

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Contact

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| | |
|--------------------|--|
| <u>Date :</u> | |
| <u>Reference :</u> | |

Summary

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1. Overview.

- Using specific setup and software, AMCAD-Engineering provides you rapid and dedicated RF/microwave characterization and modeling services.
- Measurement results could be provided under customized formats.
- Our non-linear models are validated by Load Pull Power measurements and implemented in the customer EDA tool.

2. Type of Device to be Modeled or Characterized :

| | |
|--------------------------------------|--|
| Component size & geometry | |
| | |
| | |

For active devices, we need information about maximum current/voltage/Pdiss ratings, general electrical characteristics and layout drawing of the device and/or its package board geometry (if applicable).

| | | | | | | |
|---|-----------------------------------|------------------------------|--|---------------------------------|--|---------------------------------|
| Transistor or Diode Configuration | <input type="checkbox"/> CS(CE) | | | | | |
| Device Format | <input type="checkbox"/> Wafer | <input type="checkbox"/> HBT | <input type="checkbox"/> JFET | <input type="checkbox"/> MESFET | <input type="checkbox"/> HEMT/PHEMT | <input type="checkbox"/> MOSFET |
| Data Sheet Available? | <input type="checkbox"/> NO | <input type="checkbox"/> YES | | | <input type="checkbox"/> Other (Specify) : | |
| RF Wafer Probe Compatibility? | <input type="checkbox"/> YES | | <input type="checkbox"/> Chip * | | <input type="checkbox"/> Packaged * | |
| Are on-wafer calibration standards available? | <input type="checkbox"/> No | | <input type="checkbox"/> Yes, will provide | | <input type="checkbox"/> Yes, specify Web site | |
| S Parameters files available to de-embed the measurements? | <input type="checkbox"/> No | | <input type="checkbox"/> Yes, will provide | | Specify: | |
| Type and Size | Wafer, Reticule or Chip Size → | | <input type="checkbox"/> Yes | | Probe Pitch (e.g. 150um) → | |

* Additional Information about the Device format:

3. Compact Model Extraction

3.1 - Measurement used for model extraction

- **IV Measurements**

| | | | | |
|--|----------------------------------|-------|-----------------------|------|
| Biasing mode | Quiescent bias point | | DC mode / Pulsed mode | |
| | Vin0 (V) | | | |
| | Vout0 (V) | | | |
| | | Start | Stop | Step |
| | Vin (V) | | | |
| | Vout (V) | | | |
| | Vin pulse width (µs) | | | |
| | Vout pulse width (µs) | | | |
| Duty Cycle (%) | | | | |
| Stop Conditions | Min Reverse Input Current (mA) : | | | |
| | Max Forward Input Current (mA) : | | | |
| | Max Output Current (mA) : | | | |
| | Max Mean power consumption (W): | | | |
| | Max Peak power consumption (W): | | | |
| Temperature (°C) | | | | |
| Remove Bias Tee for Ron measurement | YES / NO | | | |
| Dispersion study** | | | | |
| Circuits*** | | | | |

* : Delete when inappropriate

** : Should we perform a dispersion study? How many samples should be tested?

*** : Specify Address to send back the devices after characterization (address...)?

- **S-parameter measurements**

| | | | |
|------------------------------------|------------------|-------------|------------|
| Fundamental Frequency (GHz) | Start (GHz) | Stop (GHz) | Step (GHz) |
| | | | |
| RF mode * | CW mode | | |
| | Pulse width (µs) | Pulsed mode | |
| | Duty cycle (%) | | |
| Dispersion study** | | | |
| Circuits*** | | | |
| Temperature (°C) | | | |

* : Delete when inappropriate

** : Should we perform a dispersion study? How many samples should be tested?

*** : Specify Address to send back the devices after characterization (address...)?

3.2 - Measurement used for model validation

- Load pull Measurements

| | | | |
|-------------------------------|---|-------------|-------------|
| Transistor Description | Size | | |
| | Type | | |
| | Max Pout expected (dBm) | | |
| Frequency (GHz) | | | |
| One Tone LP | Fundamental Frequency : | | |
| Two Tone LP | Fundamental Frequency : Tone Spacing: | | |
| Temperature (°C) | | | |
| RF mode * | CW mode | Pulsed mode | |
| | Pulse width (µs) | | |
| | Duty cycle (%) | | |
| Biasing mode | | DC mode | Pulsed mode |
| | Vout (V) | | |
| | Iout (A) | | |
| | Approximated Vin (V) | | |
| | V _{out} out of pulse (V) | | |
| | V _{out} pulse width (µs) | | |
| | V _{in} out of pulse (V) | | |
| | V _{in} pulse width (µs) | | |
| Input matching* | Ex: 50 Ohms , Max P _{in} (Gamma _{in} *), etc. | | |
| Optimization Target * | For example, Max Pout, PAE; etc. | | |
| Harmonics to measures | F0 | 2F0 | 3F0 |
| Harmonics to controls | F0 | 2F0 | 3F0 |
| Stop conditions | Iout Max: | | |
| | Iin Max: | | |
| | Dissipated Power Max: | | |
| | Gain compression Max (linear / max gain): | | |
| Dispersion study** | | | |
| Deliverable | | | |
| Circuits*** | | | |

* : Delete when inappropriate

** : Should we perform a dispersion study? How many samples should be tested?

*** : Specify Address to send back the devices after characterization (address...)?

- Time Domain LP measurement / NVNA

| | | | |
|-------------------------------|---|-------------|-------------|
| Transistor Description | Size | | |
| | Type | | |
| | Max Pout expected (dBm) | | |
| Frequency (GHz) | | | |
| One Tone LP | Fundamental Frequency : | | |
| Two Tone LP | Fundamental Frequency : Tone Spacing: | | |
| Temperature (°C) | | | |
| RF mode * | CW mode | Pulsed mode | |
| | Pulse width (µs) | | |
| | Duty cycle (%) | | |
| Biasing mode | | DC mode | Pulsed mode |
| | Vout (V) | | |
| | Iout (A) | | |
| | Approximated Vin (V) | | |
| | V _{out} out of pulse (V) | | |
| | V _{out} pulse width (µs) | | |
| | V _{in} out of pulse (V) | | |
| | V _{in} pulse width (µs) | | |
| Input matching* | Ex: 50 Ohms , Max P _{in} (Gamma _{in} *), etc. | | |
| Optimization Target * | For example, Max Pout, PAE; etc. | | |
| Harmonics to measures | F0 | 2F0 | 3F0 |
| Harmonics to controls | F0 | 2F0 | 3F0 |
| Stop conditions | Iout Max: | | |
| | Iin Max: | | |
| | Dissipated Power Max: | | |
| | Gain compression Max (linear / max gain): | | |
| Dispersion study** | | | |
| Deliverable | | | |
| Circuits*** | | | |

* : Delete when inappropriate

** : Should we perform a dispersion study? How many samples should be tested?

*** : Specify Address to send back the devices after characterization (address...)?

3.3- Compact Model Validation :

The model validation will be provided by comparison between measurement and simulation results:

- Pulsed or Continuous IV characteristics
- Pulsed or Continuous S Parameter measurements
- Load Pull Measurement
 - Best Matching / PAE
 - Best Matching / Pout
- NVNA Measurement

Other (Specify):

4. Behavioral Model Extraction (EPHD) :

| | | | |
|-------------------------------|---|-------------|-------------|
| Transistor Description | Size | | |
| | Type | | |
| | Max Pout expected (dBm) | | |
| One Tone LP | Fundamental Frequency : | | |
| Temperature (°C) | | | |
| RF mode * | CW mode | Pulsed mode | |
| | Pulse width (µs) | | |
| | Duty cycle (%) | | |
| Biasing mode | | DC mode | Pulsed mode |
| | Vout (V) | | |
| | Iout (A) | | |
| | Approximated Vin (V) | | |
| | V _{out} out of pulse (V) | | |
| | V _{out} pulse width (µs) | | |
| | V _{in} out of pulse (V) | | |
| | V _{in} pulse width (µs) | | |
| Input matching* | Ex: Max Transducer Gain (linear, saturated, etc): | 50 Ohms | |
| Optimization Target * | For example, Max Pout, PAE; etc. | | |
| Harmonics to measures | F0 | 2F0 | 3F0 |
| Harmonics to controls | F0 | 2F0 | 3F0 |
| Stop conditions | Iout Max: | | |
| | Iin Max: | | |
| | Dissipated Power Max: | | |
| | Gain compression Max (linear / max gain): | | |
| Dispersion study** | | | |

* : Delete when inappropriate

** : Should we perform a dispersion study? How many samples should be tested?

Definition of the RF Circuit Simulator that will be used the model

ADS (Keysight):

Microwave Office (NI):

PLEASE E-MAIL TO: contact@amcad-engineering.com