Product Model Temperature Parameters

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Transistor Thermal Parameters

- This presentation is an overview of the thermal parameters used in all RF Division product models. It is intended as an introduction to using these thermal parameters effectively in power amplifier design.

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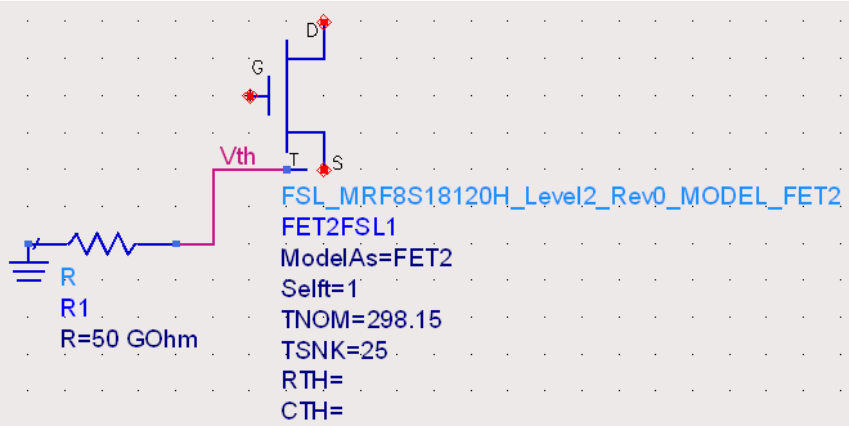
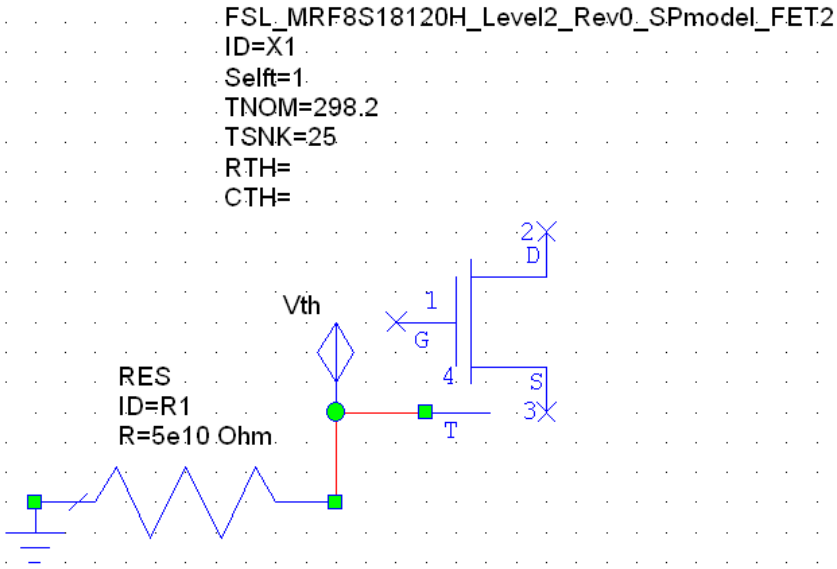
FET^2 Discrete Product Example

- Agilent ADS SPDK



- AWR MWO PDK



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FET^2 Thermal Parameters

- What are the definitions of the temperature parameters?
  - Selft is the self-heating enable control
    - Default of 1 or On
  - TNOM is the nominal temperature at which the model was extracted in Kelvin
    - Default of 298.15K
  - TSNK is the model temperature during simulation in Celsius
    - Default of 25 ºC
  - RTH is the total thermal resistance in ºC per Watt
    - Default of 1.0e-6 ºC/W
  - CTH is the total thermal capacitance in Joules per Celsius
    - Default of 1.0e-6 J/ºC

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FET² Thermal Parameters

- What values should we use for operation at ambient temp=25 ºC?
  - Selft of 1
  - TNOM of 298.15K
  - TSNK of 25 ºC
  - The RTH value should be representative of the device plus the customer thermal interface to their board
  - The CTH value should be representative of the device plus the customer thermal interface to their board

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FET^2 Thermal Parameter Usage

- How does putting a TSNK > TNOM effect the model?
  - The critical value is the delta between TSNK and TNOM

- What is the best way to use the T pin?
  - Load this thermal, T, pin with a large-value resistor.
  - The voltage measured at this thermal pin is the temperature rise above the heat sink, TSNK, temperature value in Celsius.

- What is the best way to look at memory effects due to thermal changes?
  - During a simulation, monitor the voltage at the thermal node.

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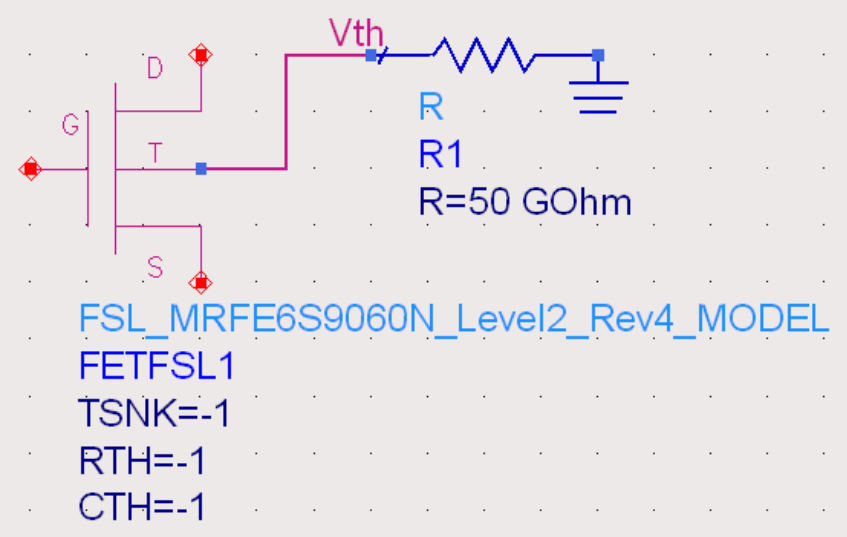
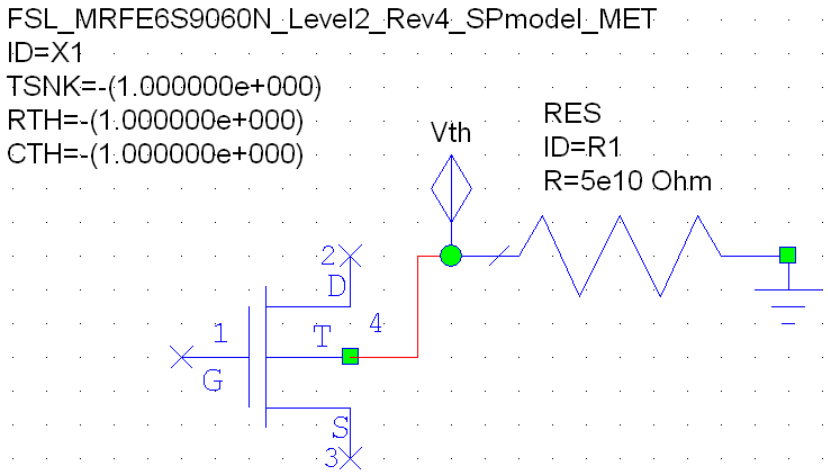
MET Discrete Product Example

- Agilent ADS SPDK
- AWR MWO PDK





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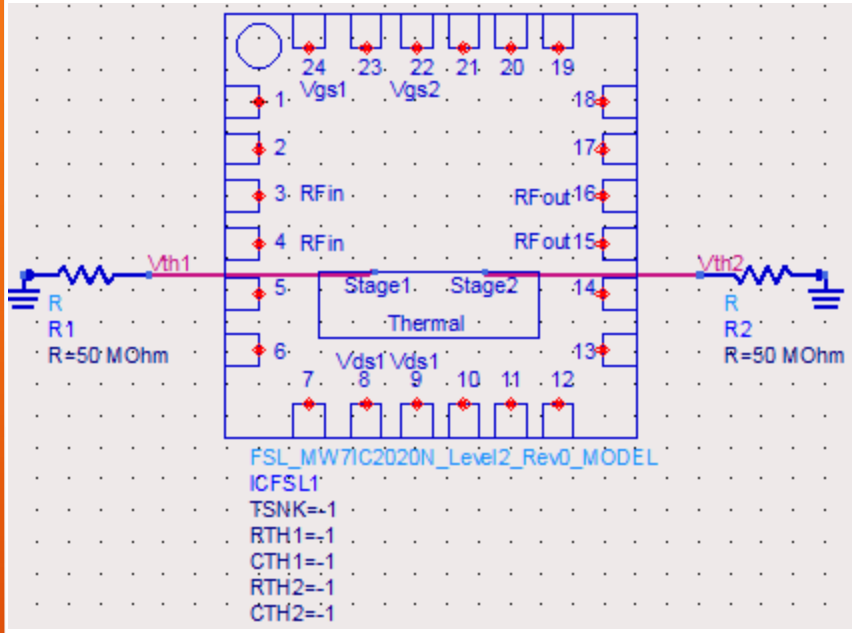
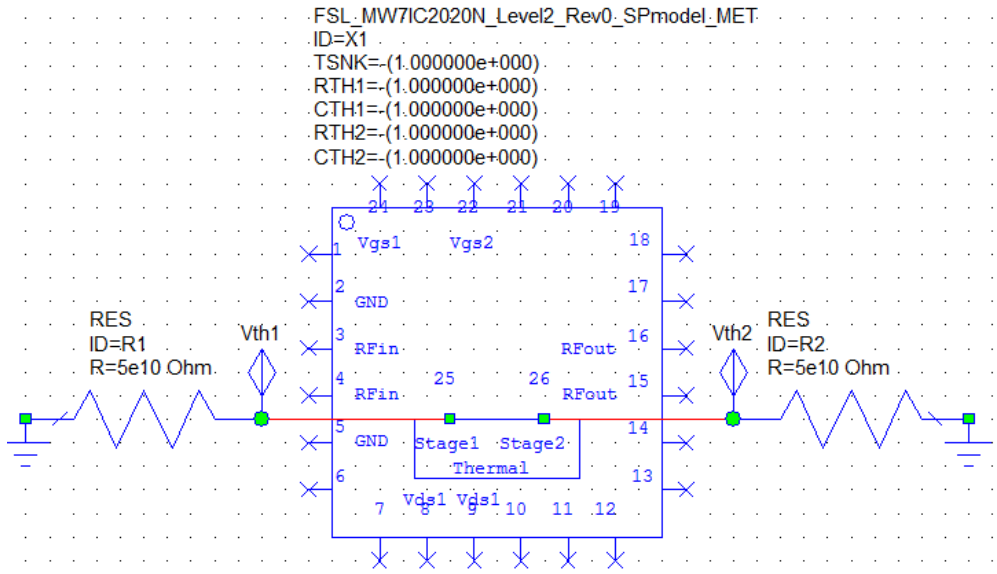
MET RFIC Product Example

- Agilent ADS SPDK
- AWR MWO PDK





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MET Thermal Parameters

- What are the definitions of the temperature parameters?
  - TSNK is the model temperature during simulation in Celsius
    - Default of -1
  - RTH is the total thermal resistance in ºC per Watt
    - Default of -1
  - CTH is the total thermal capacitance in Joules per Celsius
    - Default of -1

- What values should we use for operation at ambient temp=25C?
  - TSNK of 25 ºC
  - The RTH value should be representative of the device plus the customer thermal interface to their board.
  - The CTH value should be representative of the device plus the customer thermal interface to their board.

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MET Thermal Parameter Usage

- What do the values of -1 mean?
  - This input causes the MET model to use the default values included in the model parameters file.
    - TSNK = 25 ºC
    - RTH = 0.0 ºC/W
    - CTH = 1.0e-7 Joules/ºC

- What is the best way to use the T pin?
  - Load this thermal, T, pin with a large-value resistor.
  - The voltage measured at this thermal pin is the junction temperature rise above the heat sink, TSNK, temperature value in Celsius.

- What is the best way to look at memory effects due to thermal changes?
  - During a simulation, monitor the voltage at the thermal node.

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Usage Summary

- FET^2 and MET Models
  - TSNK is the simulation model temperature in Celsius
  - RTH is the total thermal resistance in ºC per Watt
    - RTH value should be representative of the device plus the customer thermal interface to their board.
  - CTH is the total thermal capacitance in Joules per Celsius
    - CTH value should be representative of the device plus the customer thermal interface to their board.
  - Load the thermal, T, pin with a large-value resistor.
    - The voltage measured at this thermal, T, pin is the junction temperature rise above the heat sink, TSNK, temperature value in Celsius.
    - During simulations, monitor the voltage at the thermal node for temperature caused memory effects.

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