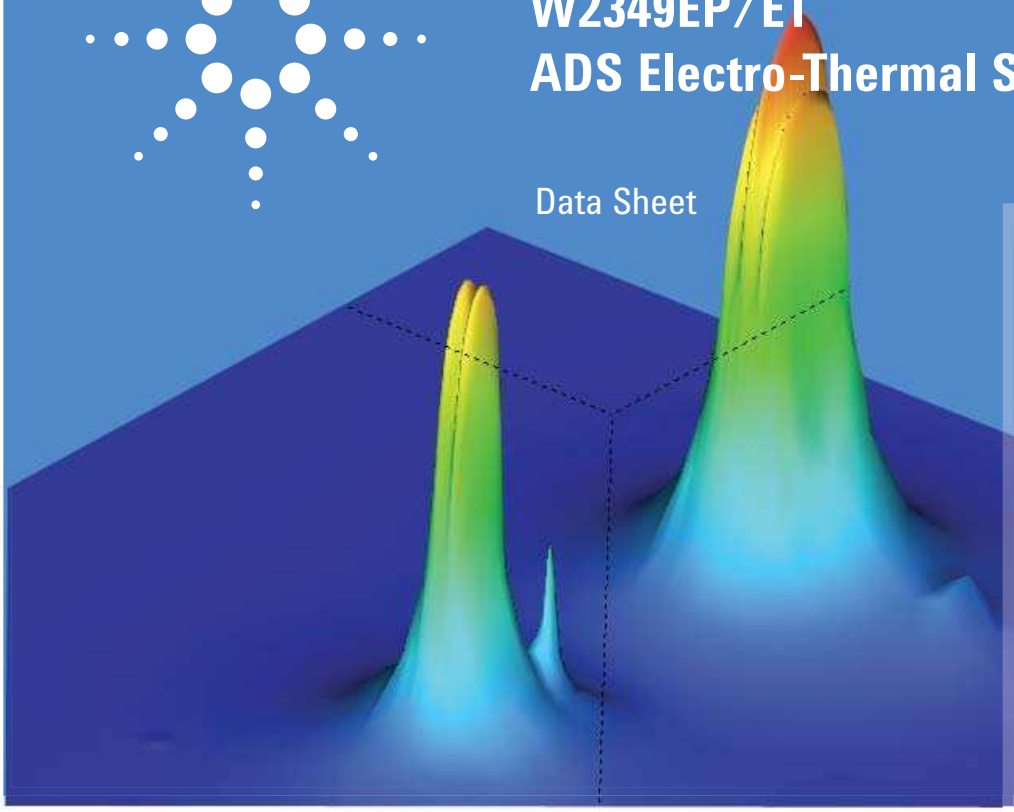
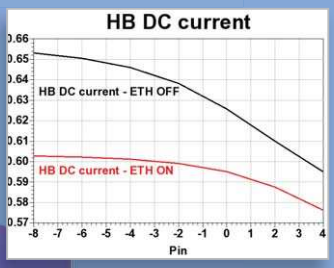
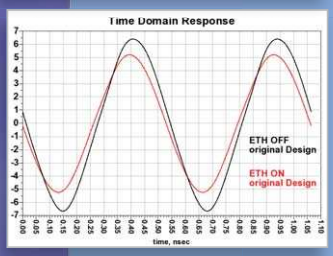
Agilent EEsof EDA

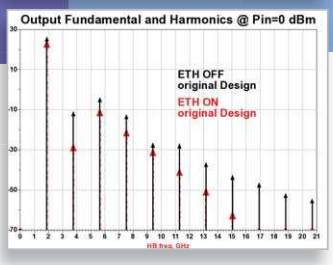
W2349EP/ET
ADS Electro-Thermal Simulator

Data Sheet









Temperature-Aware Circuit Simulation for RFIC and MMIC Design

As higher power devices are integrated into smaller packages, thermal issues cause performance degradation, reliability problems, and even failures. Modeling thermal effects can be challenging for IC designers. Existing thermal solvers are not well integrated into IC design tools, requiring manual and error-prone data transfer between the layout environment, thermal solver and circuit simulators.

The Advanced Design System (ADS) Electro-Thermal Simulator provides a full 3-D thermal solver that is tightly integrated with the ADS layout environment and circuit simulators. Simply add the Electro-Thermal controller to the ADS schematic, start a circuit simulation and the integrated thermal solver will run in the background. No more manual export of IC layouts to stand-alone thermal solvers; no more manual import of temperature data into the circuit simulators.

Key Benefits

- **Accuracy**
  Circuit simulation results now include thermal effects
- **Efficiency**
  Directly integrated into ADS; no need to transfer data to stand-alone thermal solvers
- **Speed**
  Mature, high-capacity thermal solver technology that has been tested on System-on-Chip (SoC) designs with thousands of components

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Simulation Flow

The following steps illustrate the use of the ADS Electro-Thermal Simulator.

1. An IC design is created in ADS with schematic and layout views.

2. A simulation test bench is created by placing controllers for one or more of the ADS circuit simulators in an ADS schematic.

3. An Electro-Thermal controller is added to the schematic, and settings for the thermal solver are adjusted (Figures 1a and 1b).

4. A simulation is initiated, which launches both the circuit simulator and thermal solver.

5. The circuit simulator computes initial power dissipation values for each device in the circuit, and provides this to the thermal solver.

6. The thermal solver computes initial temperature values for each device and provides this back to the circuit simulator.

7. The circuit simulator and thermal solver iterate until the power dissipation and temperature values converge to a final solution.

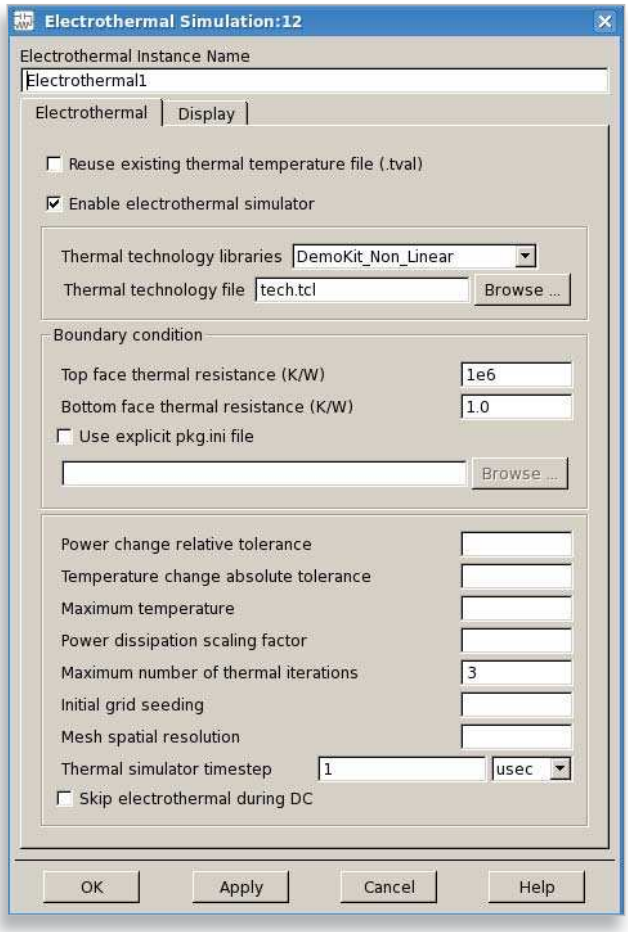


Figure 1b. Adjusting thermal solver settings.

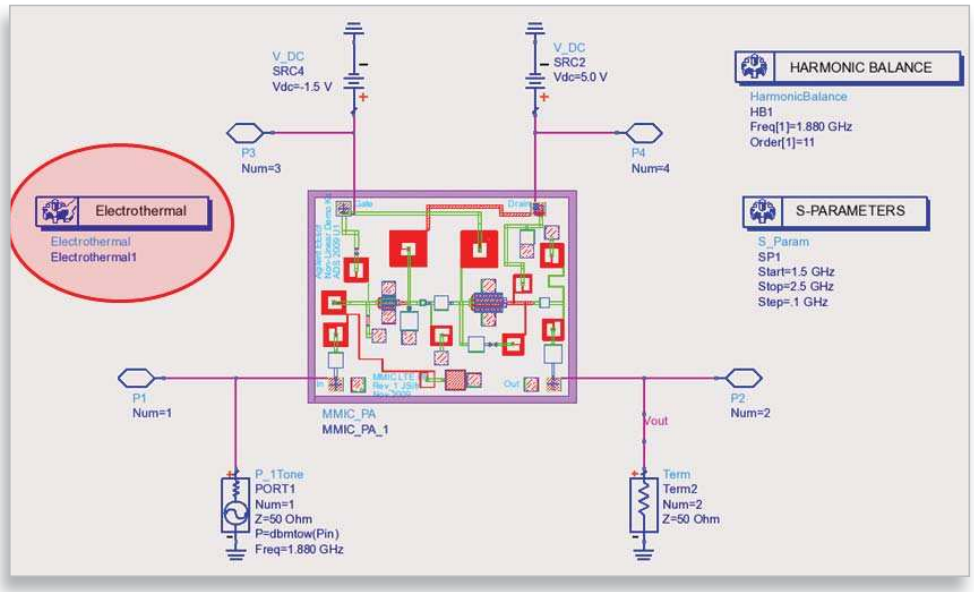


Figure 1a. The Electro-Thermal controller is used to setup and launch the thermal solver together with the circuit simulator.

8 Thermal results can be visualized with 2-D and 3-D temperature plots (Figure 2).

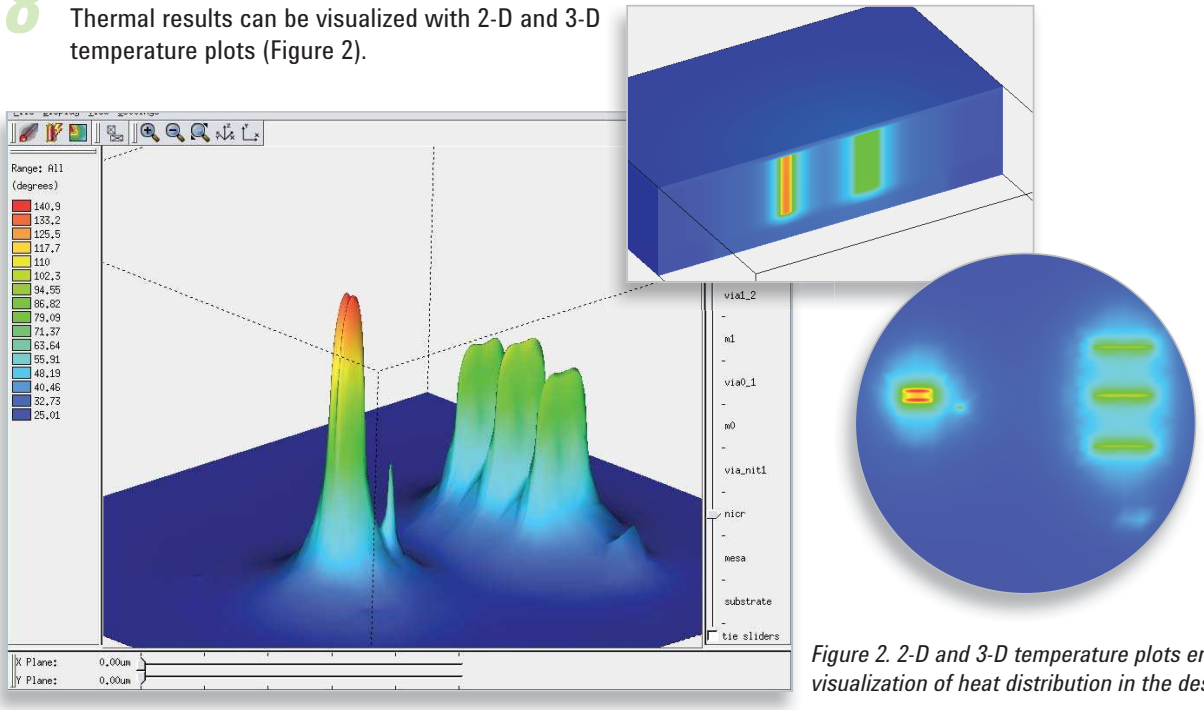
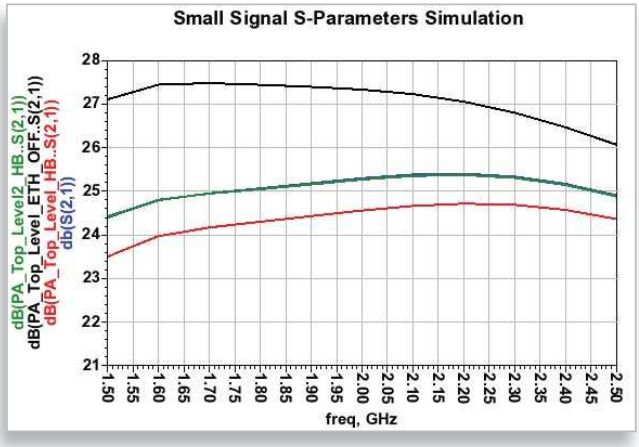
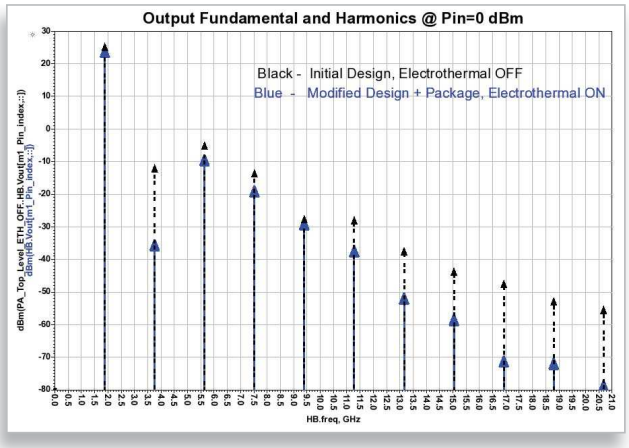


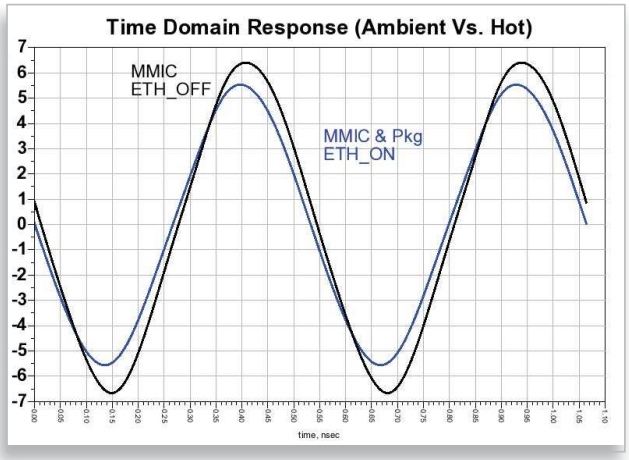
Figure 2. 2-D and 3-D temperature plots enable visualization of heat distribution in the design.

9 Circuit simulation results can be viewed to determine the effect of temperature rise on performance (Figure 3).

10 Final temperature values for each device can be reviewed to determine if maximum temperature limits have been exceeded.







Black – Initial design, electrothermal OFF
Red – Initial design, electrothermal ON
Green – Modify FET2 layout, electrothermal ON
Blue – Modified design + package, electrothermal ON

Figure 3. Temperature-aware circuit simulation results are available in the frequency- and time-domain.

Key Features

- Support for steady-state (Harmonic Balance, DC, AC, and S-parameter) analyses
- Support for Transient and Circuit Envelope analyses
- Support for a wide range of GaAs, GaN, Si, SiGe, and other process technologies
- 2-D and 3-D temperature maps, including "movie mode" for transient simulations
- Thermal effects of the IC package, and even printed circuit board (PCB), can be included using one of two methods:
  - Including the package/PCB in the ADS layout design
  - Specifying boundary conditions at the IC interface that represent the overall thermal conductivities of the package/PCB

Requirements

- OS platform support: Linux 64-bit (Windows® support may be offered in a future release)
- An electrothermal simulation requires a synchronized IC schematic/layout design in ADS
- IC Process Design Kit requirements:
  - Thermal tech file that specifies thermal properties of each process layer
  - Heat source indicators for each IC layout component

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