

# Custom WaveView

## Waveform Viewer and Simulation Post-processing Tool

### Overview

*Custom WaveView™ is a graphical waveform viewer and simulation post-processing tool for analog and mixed-signal ICs. Custom WaveView features fast loading, display scrolling, and zooming of very large waveform files, multiple simulator format support, and a rich set of analog and mixed-signal analysis features.*

### Introduction

Custom WaveView is a full analog and mixed-signal display and analysis environment, reading simulation results from either analog or digital simulators and allowing complete conversion between views. For instance, Custom WaveView can read-in the analog results of an HSPICE® simulation, convert those waveforms to digital (single or multi-bit with user-selectable thresholds) and export those results for use in a digital simulation. Custom WaveView also provides a host of capabilities for displaying, measuring, manipulating and saving simulation results. In addition to multiple panels containing waveforms, Custom WaveView can also display more than one waveform tab allowing the designer to mix-and-match time and frequency domains in a single session.

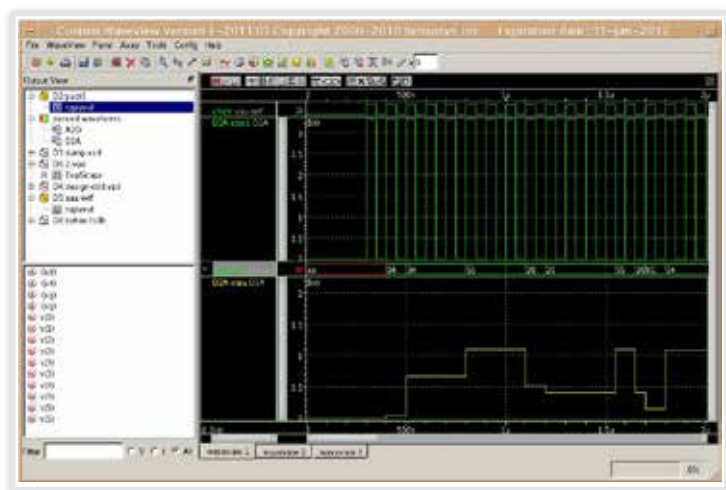


Figure 1: Custom WaveView Main Window

## Features

<b>Waveform Display</b>
Cursors
Monitors
Measurement Tool
<b>Toolboxes and Assistants</b>
Eye Diagrams
DFT/FFT
ADC Design Toolbox
Jitter Toolbox
Waveform Post-processing with the Mixed-Signal Equation Builder
<b>Extensible and Open</b>
Customizable GUI
Industry Standard Design Platform Integrations
All Supported File Formats

## Benefits

- ▶ High-performance waveform database I/O to quickly access large amounts of simulation data
- ▶ Extensive mixed-signal display functions and analysis capabilities to extract measurements from simulation results
- ▶ Single waveform tool for multiple simulators
- ▶ Built-in support for HSPICE .MEASURE command and parametric plots for .ALTER simulations
- ▶ Transient, AC, RF, mixed-signal display and analysis
- ▶ Optional Tcl API for programming complex user post-processing scripts
- ▶ Flexible waveform grouping—add multiple waveform views, either from different simulator runs on the same circuit netlist or from different netlists

## Single Waveform Tool for Multiple Simulators

Custom WaveView is completely integrated with Synopsys' Galaxy Custom Designer® implementation tool and supports cross-probing with the Custom Designer SE schematic editor. Custom WaveView will also read many common SPICE, FastSPICE, and Verilog simulator waveform files from Synopsys, Mentor, and Cadence.

- ▶ Synopsys
  - CustomSim™, FineSim™, FineSim Pro, HSPICE, and VCS®
- ▶ Cadence Design Systems
  - Spectre/RF, UltraSim, and Incisive
- ▶ Mentor Graphics
  - ModelSim, Eldo, ADMS, ADIT, HyperLynx

## Waveform Display

Custom WaveView's advanced user interface allows the user to browse waveform data hierarchies and then drag-and-drop multiple selected signals into a waveform display window. Waveforms in the display window can have one or more non-overlapping panels. Panels in a window can be arranged as either a vertical stack or as independent rows and columns. Rows and columns may be vertical, horizontal, or tiled.

Waveform display includes:

- ▶ Hierarchy browser and signal list
- ▶ Waveform display via data drag-and-drop
- ▶ Signal search with pattern-matching and wildcard; drag-and-drop from search results
- ▶ User-definable Hot Keys
- ▶ Recent Files List
- ▶ Stack or Row column signal display
- ▶ Save and Restore session

Custom WaveView supports many different time and frequency domain waveform types, such as:

- ▶ Analog
- ▶ Digital
- ▶ Smith chart
- ▶ Polar plot
- ▶ 2-D, 3-D sweep
- ▶ Eye diagram
- ▶ Histogram

## Measurements

### *Cursors, Monitors and the Measurement Tool*

#### *Cursors*

Custom WaveView provides an unlimited number of cursors specifically for interactive on-screen measurement of waveforms. Set to either the vertical or horizontal mode, these cursors can be moved around the waveform and display “X-at-Y” information on-screen.

#### *Monitors*

Monitors can be added to the waveform panels to perform more complex measurements. Monitors include Derivative, Inverse Derivative, Delta Value, Cursor Average, Minimum/Maximum/Average, Peak-to-Peak and RMS values of a given waveform.

#### *Measurement Tool*

Custom WaveView's powerful Measurement tool provides a wealth of domain-specific measurements that simplify design analysis. The Measurement tool provides rapid-on waveform display of over 35 types of measurements. Measurements are persistent across sessions and can be “replayed” against a new set of simulation results as needed (see Figure 2). As simulation results change, measurements are updated automatically, presenting the user with the latest information available. The Measurement tool supports many measurements including time domain, frequency domain, statistical, level, S-domain, and RF.

## Eye Diagrams

Custom WaveView's eye diagram capability allows users to easily create a folded eye diagram from complex waveforms. The eye diagram is constructed by automatically extracting the clock cycle, or by reference to an ideal clock, or to an external signal. Once constructed, the Automatic Eye Measurement tool can take eye opening or aperture measurements as well as create a jitter histogram. Figure 3 shows a typical eye diagram with cursors used to measure the eye width.

## Waveform Post-processing

### A-to-D; D-to-A Conversion

Analog waveforms can be converted to single-bit or multi-bit logic waveforms using user-specified threshold criteria (See figure 4). Similarly, logic waveforms can be converted to analog waveforms (see figure 5) based on user-specified analog levels using either fixed-rate sampling or value transition sampling.

## Data Reduction and Export

Redundant data points can be automatically removed based on a user-specified error tolerance. Data can then be exported and saved using several different formats such as tabulated, SPICE PWL, WDF, VCD, and M-file (MatLab).

### DFT/FFT

Custom WaveView supports FFT and DFT operations on time-domain data using various windowing functions (see figure 6). FFT/DFT will also automatically measure the signal-to-noise ratio (SNR), total harmonic distortion (THD), signal-to-noise and distortion ratio (SNDR), and effective number of bits (ENB).

Measurements also include:

- ▶ Snap-to-wave feature
- ▶ Measure update on reload
- ▶ Glitch detection
- ▶ Measurement export (as ".Meas")
- ▶ On-screen measure drawing
- ▶ HSPICE measure tool

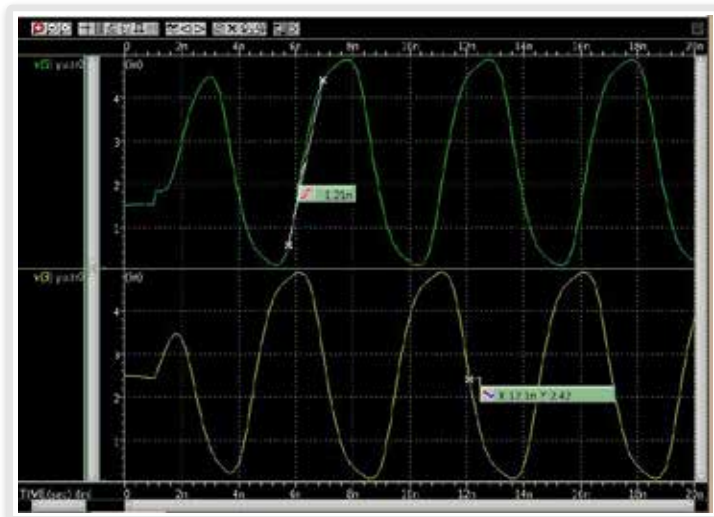


Figure 2: Measurement Tool

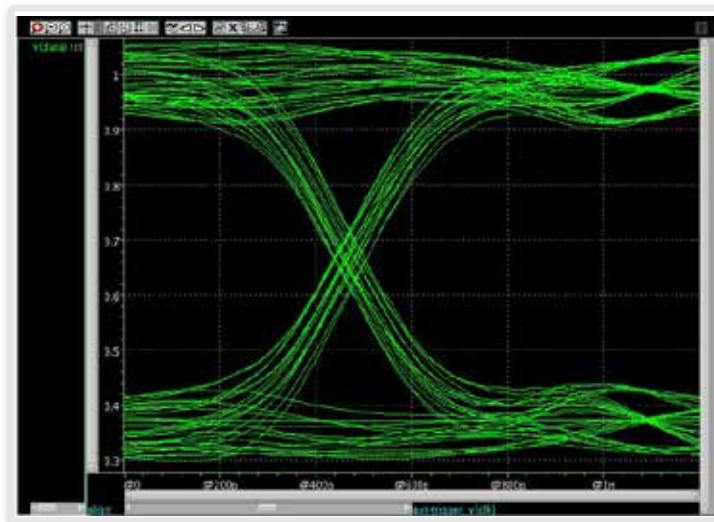


Figure 3: Eye Diagram

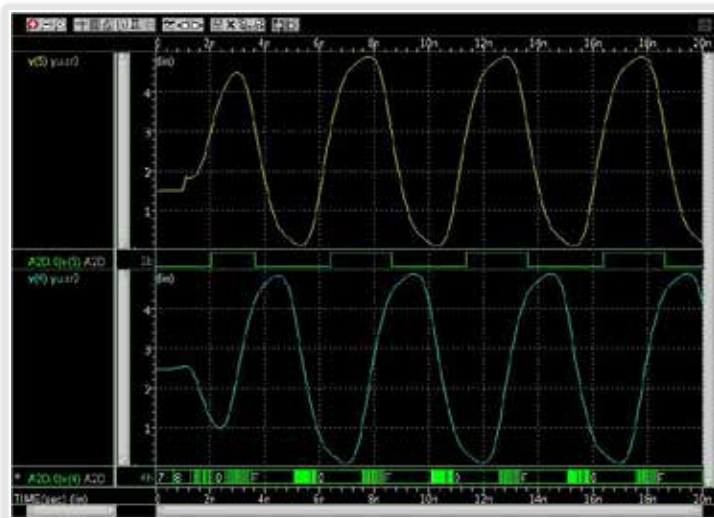


Figure 4: Analog-to-Digital Conversion

## Toolboxes and Assistants

Custom WaveView's toolboxes are provided to simplify specific measurements for a variety of common activities in waveform analysis. Assistants are provided to simplify common tasks that improve accuracy and customer productivity.

### ADC Design Toolbox

Custom WaveView's ADC toolbox (see figure 7) provides the necessary information when working with analog-to-digital converters (ADCs). This toolbox, with a simple drag-and-drop of a waveform, can extract the common measurements required to proof ADC designs including:

#### DC Static Characteristics

Histogram, INL/DNL, min./max. values, and their standard deviations

#### AC Dynamic Characteristics

Using either Coherent or Window Sampling, the ADC toolbox measures noise parameters SNR, THD, SNDR, SFDR and ENOB and the frequency-domain power spectrum

#### Jitter Toolbox

The built-in Jitter-vs.-Time toolbox (see figure 8) can be used to analyze clock jitter between any logic and analog target signal with respect to a reference signal. The reference signal can be an analog or logic signal from simulation output, or an ideal signal defined using the width/period/delay parameters. The jitter can be measured against the rise and fall edges of a reference signal.

## Waveform Post-processing with the Equation Builder

Post-processing calculations using:

- ▶ Graphical Calculator
- ▶ Graphing Language
- ▶ Equation builder

Custom WaveView hosts a powerful, scriptable mixed-signal equation

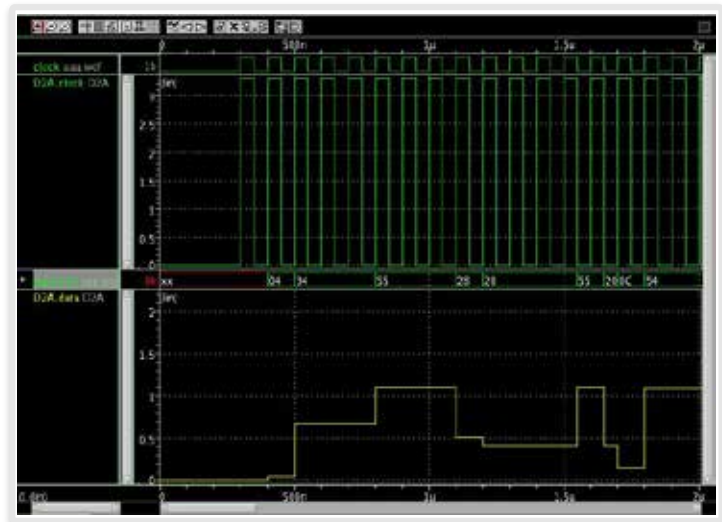


Figure 5: Digital-to-Analog Conversion

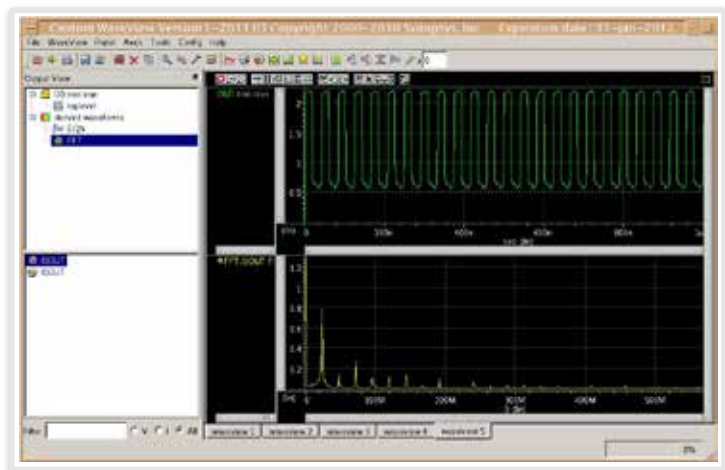


Figure 6: FFT

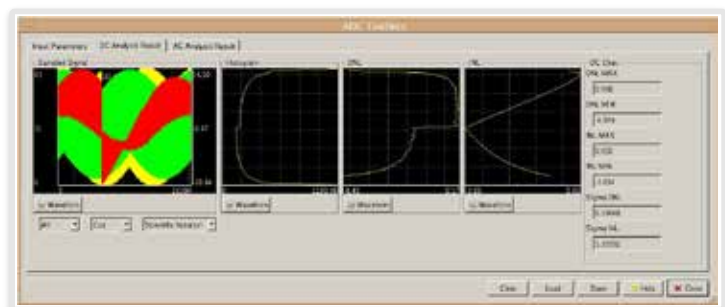


Figure 7: ADC Toolbox



language that can be used to construct any number of custom views of existing waveforms using multi-file, multi-trace mixed-signal data, or to extract stimuli from existing netlist and modify them for the successive simulation runs. The Equation Builder (see Figure 9) contains a large number of built-in mathematic, RF, logic, waveform and measurement functions that can be mixed-and-matched as needed to create custom measurements. These custom measurements can be saved as macros and replayed against any simulation results as needed. Additionally, the Equation Builder contains functions that can shift waveforms in time, making it easy to compare results that occurred at different simulated times. Waveforms can also be smoothed to reduce extra time points and exported to other simulations as stimuli leading to faster analog simulations downstream.

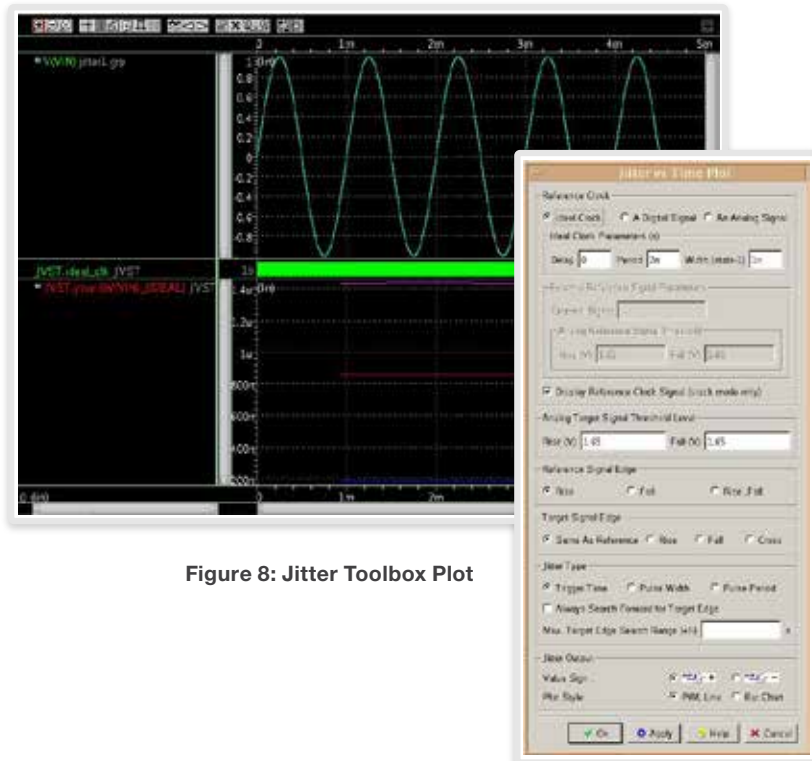


Figure 8: Jitter Toolbox Plot

## Extensible and Open

Custom WaveView is open and extensible and can be controlled in either GUI or Batch mode with scripting. The GUI is also extensible, allowing CAD teams to craft custom measurements and provide them across their organizations through the regular menu system.

## Optional regression Scripting with the Analysis Command Environment

The Analysis Command Environment (ACE) is a Tcl-based extension language that provides near-complete control of Custom WaveView (via the ACE option). The ACE scripting environment contains hundreds of functions and can control the GUI, the waveform panels, the menu system or the measurement capabilities of either tool. Often used by CAD teams to extend the tools, the ACE scripting capability can also be used to perform Regression Scripting, allowing designers

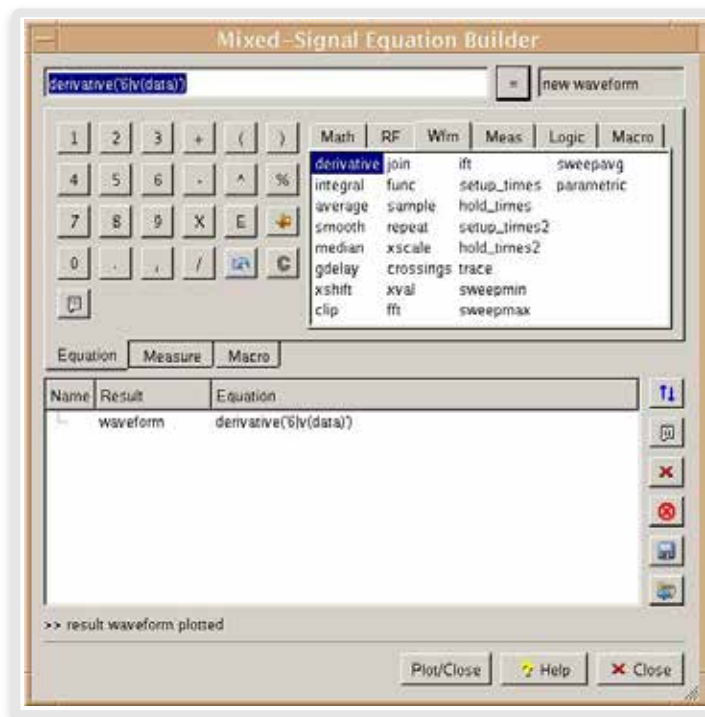


Figure 9: Equation Builder

	CustomExplorer Ultra	CustomExplorer	Custom WaveView
Configuration management	✓		
Corners setup	✓		
Simulation job control	✓		
Results analysis	✓		
AMS debugger	✓		
SPICE debugger	✓	✓	
Waveform compare	✓	✓	
tcl Scripting	✓	✓	(option)
Waveform display	✓	✓	✓

**Table 1: CustomExplorer Family Products and Features**

to make changes to their design and then replay a wide variety of analyses in batch mode, freeing the designer to work on other aspects of the design. Encapsulating these analyses also means sharing best design practices across an organization to improve quality and simplify the collection of data for design reviews.

### Customizable GUI

The GUI is fully customizable, and bind keys can be assigned for any menu function or waveview control button action.

### Industry-standard Design Platform Integrations

Custom WaveView is also integrated into industry-standard design platforms to help maximize designer productivity during the design phase. A native integration of these tools into Synopsys' Custom Designer system helps form a complete environment for analog block authoring in a single platform for both cell-based and custom design. Other design platform integrations include:

- ▶ Cadence Design Systems: Virtuoso® Composer and ADE
- ▶ JEDAT: Asca Circuit Design and Debugging Environment
- ▶ Mentor Graphic: Design Architect® IC

### Supported File Formats

Custom WaveView provides support for over 45 different file formats, providing the highest support of simulation file formats in the industry.

#### Supported Simulator Formats

- ▶ Synopsys
  - CustomSim and CustomSim FT (HSIM, XA and NanoSim – WDF, WDB, .Out and Vector)
  - FineSim, FineSim Pro (FSDB), HSPICE and HSPICE RF (.Tr0, .Ac0, .Sw0... – Binary and ASCII)
  - VCS (VCD and VPD)
  - Saber (AI/PL – Binary and ASCII)
- ▶ Cadence Design Systems
  - Spectre (PSF, WSF—Binary and ASCII)
  - UltraSim (PSF, WSF—Binary and ASCII)
  - PSPICE (DAT)
  - Incisive (VCD)
- ▶ Mentor Graphics
  - ModelSim (WLF)
  - Eldo (COU 4.3, 4.7 and Tr0)
  - ADMS (WDB and JWDB)
  - ADiT (Tr0 and Tb0)
  - HyperLynx (CSV)
- ▶ Others
  - Mathworks (.mat format)
  - Agilent ADS (.ds—Binary and TouchStone S-Parameters—ASCII)

- CSDF (ASCII)
- Novas FSDB (Binary)
- Legend (Tr0 Derivative)
- SmartSPICE (Raw Derivative)
- Five proprietary simulator formats are also available—please contact Synopsys

- ▶ Data Formats
  - BIS Models
  - Tektronix Agilent and Lecroy Scope Data
  - Text table data and Comma Separated Values (CSV)

#### Supported Plot Output File Formats

- ▶ JPEG
- ▶ PostScript
- ▶ EMF
- ▶ PNG
- ▶ BMP

### Platform Support

- ▶ Solaris 32- and 64-bit
- ▶ Red Hat Enterprise Linux version 4 and 5 (AS, ES, WS)
- ▶ SUSE Linux 9.0 and 10.0 and 5 (AS, ES, WS) 9.0 and 10.0
- ▶ Microsoft Windows XP

## Features

### Input File Formats

Cadence Spectre PSF  
Cadence Spectre WSF  
Cadence PSPICE DAT  
Cadence Incisive VCD  
Cadence Ultrasim WDF  
Mentor Eldo cou  
Mentor Eldo WDB  
Mentor ADiT tr0  
Mentor ADiT tb0  
Mentor Eldo JWDB  
Novas FSDB  
Other SPICE raw  
Other Text txt  
Other Text csv  
Synopsys WDF  
Synopsys HSPICE tr#  
Synopsys HSPICE sw#  
Synopsys HSPICE ac#  
Synopsys HSPICE nw#  
Synopsys HSPICE mt#  
Synopsys HSPICE RF .ac#  
Synopsys HSPICE RF .sw#  
Synopsys HSPICE RF .ev#  
Synopsys HSPICE RF .fe#  
Synopsys HSPICE RF .hb#  
Synopsys HSPICE RF .hl#  
Synopsys HSPICE RF .ls#  
Synopsys HSPICE RF .ss#  
Synopsys HSPICE RF .pn#  
Synopsys HSPICE RF .hr#  
Synopsys HSPICE RF .xf#  
Synopsys HSPICE RF .ev#  
Synopsys HSPICE RF .sn#  
Synopsys HSPICE RF .sc#  
Synopsys HSPICE RF .tr#  
Synopsys HSPICE RF Citi  
Synopsys HSPICE RF Touchstone  
Synopsys Starsim xp0  
Synopsys NanoSim out  
Synopsys NanoSim WDF  
Synopsys NanoSim CSDF  
Synopsys HSIM WDF  
Synopsys HSIM out  
Synopsys HSIM hsim  
Synopsys VCS vcd  
Synopsys VCS vpd