cadence®

Virtuoso Analog Design Environment Family

Advanced design simulation for fast and accurate verification

The Cadence® Virtuoso® Analog Design Environment family of products provides a comprehensive array of capabilities for the electrical analysis and verification of analog/mixed-signal designs, including the flexibility to integrate into a variety of custom flows. The family includes Virtuoso Analog Design Environment L, Virtuoso Analog Design Environment XL, and Virtuoso Analog Design Environment GXL.

Family Overview

The Virtuoso Analog Design Environment product suite provides all the capabilities required to fully explore, analyze, and verify a design against the user's desired goals. As the industry's leading solution for analog simulation control and management, it allows users to flexibly select the tier that best supports their design goals as they move through the design flow.

Analog Design Environment L provides a quick entry into the analysis process with easy entry and execution of simulations. Analog Design Environment XL extends the L tier capabilities, providing multiple test support, analysis over sweeps, corners, and Monte Carlo, and easy reviewing of all results directly or as a datasheet. Analog Design Environment GXL builds on the Analog Design Environment L and XL capabilities by providing targeted tools that aid with key design challenges with early parasitic analysis, design centering, and designing in multi-technologies.

Additional options allow the user to detect and fix problems caused by layout-dependent effects early in the design cycle, and to access the electrically aware design package that provides insight into the parasitic on a route as it is created.

Family Benefits

- Provides built-in support for all Virtuoso simulators, with integration support for third-party simulators
- Supports multiple test methodologies to fully explore and validate designs
- Accelerates design debug using a variety of built-in analysis tools
- Facilitates early correction via easy evaluation of pre- and post-layout parasitic effects
- Quickly detects and explores circuit problems via a clear visualization cockpit

Family Features at a Glance	ADE L	ADE XL	ADE GXL
Single-test design analysis and exploration	•	•	•
Script support through OCEAN	•	•	•
Support for Cadence's Spectre® family of simulators	•	•	•
Support for third-party simulators	•		
Flexible corners analysis		•	•
Monte Carlo statistical analysis		•	•
Support for electricallly aware design		•	•
Support for Wreal modeling and characterization		•	•
Design centering and yield optimization		•	•
Pre- and post-layout parasitic analysis			•
Development of worst case corners			•
High-yield estimation analysis			•
Mismatch and sensitivity analyses			•

- Offers integrated documentation and fast waveform visualization across all tests
- Supports manual or automated design evaluation and sizing to target specifications
- Provides a tiered set of capabilities to support a variety of design flows and design challenges

Virtuoso Analog Design Environment L Overview

Virtuoso Analog Design Environment L is the entry-level analog design and simulation environment for the Virtuoso custom design platform. Analog Design Environment L is the industry's leading task-based environment for simulating and analyzing full custom, analog, and RF-IC designs. It features a graphical user interface, an integrated waveform display, distributed processing, and interfaces to popular third-party simulators.

Analog Design Environment L provides the foundation to facilitate extended design analysis and validation into the Analog Design Environment XL and Analog Design Environment GXL products.

Benefits

- Reduced learning curve with a simulator-independent environment
- Maximum efficiency in the script-driven mode
- Close integration with Virtuoso Schematic Editor for interactive analysis
- Easy design and test parameterization for fast circuit exploration
- Configurable window for optimum display of relevant data
- Integrated visualization cockpit for exploration of simulation results
- Built-in calculator and extensive list of functions to extract quantifiable results

Features

Easy-to-use interactive simulation environment

The interactive environment has everything users need to set-up, run, and analyze results with any integrated

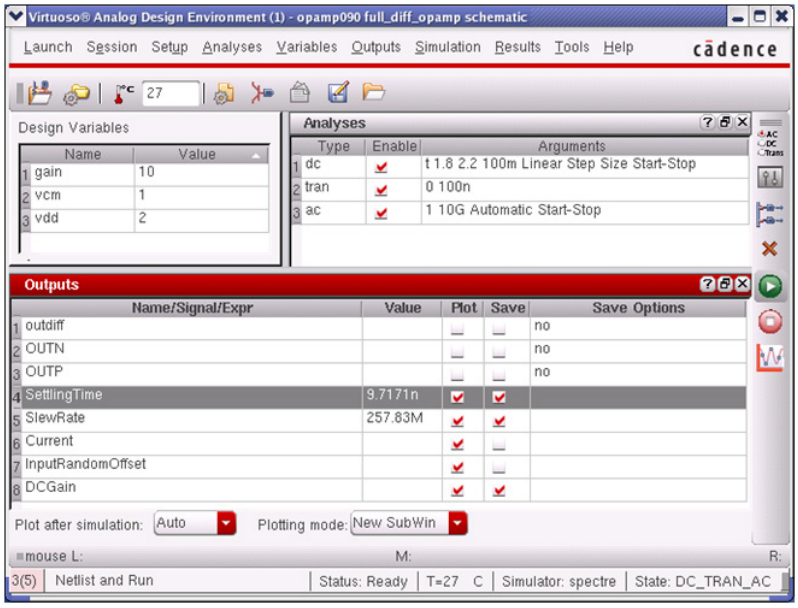

Figure 1: Virtuoso Analog Design Environment L: single-test environment

simulator. It offers a variety of tools for displaying and analyzing results, giving designers the flexibility to visualize and understand the many interdependencies of an analog, RF, or mixed-signal design. These tools allow users to quickly and easily pinpoint critical design parameters and their effect on circuit performance. The environment is flexible enough to take advantage of the Virtuoso Multi-Mode Simulation technology, by making it easy to switch between different simulators without having to re-enter all measurements.

Virtuoso Analog Design Environment L has an extensive scripting language (OCEAN) built in. OCEAN is based on the Cadence SKILL programming language for development of more complex analysis. It can be used to set-up, run, and post process results in a batch-oriented methodology. Lastly, Virtuoso Analog Design Environment L includes the capability to interface with other commercially available and in-house simulators through the OASIS Integrator's Kit.

Built-in waveform display and signal analysis capabilities

The waveform display tool, coupled with an extensive waveform calculator, provides a comprehensive post-simulation analysis environment. The waveform window can handle all types of analog and mixed-signal data, including advanced displays such as noise, corner, statistical, and RF plots. Additionally, it contains a variety of changeable display attributes for the axes, waveform colors, and labels, so you can make professional plots for your reports. Waveform markers and a built-in waveform calculator allow accurate measurement of signals in a variety of different modes, including transient, AC, and RF. The calculator's algebraic expressions can be composed of any combination of input or output voltages or currents.

Integral part of the Virtuoso custom design platform

Virtuoso Analog Design Environment L is an integral part of the Virtuoso custom design platform. It bridges the gap between schematic design and physical layout by providing a simulation environment where the designer can compare designs in both pre- and post-extracted forms, thereby completing the Cadence IC design flow. It supports analog system to IC design methods with complete access to behavioral modeling languages for both simulation and cross-probing for waveform display. Post-simulation operating condition can be easily annotated back to the schematic with net voltages, currents, and device operating information.

Specifications

Interactive simulation environment

- Easy to learn and easy to enter data
- Easy re-use of simulation set-ups
- Clear displays of simulation information
- Cross-probing support for both schematics and layouts
- Design variable support with ability to create dependent expressions
- Auto-plotting and printing of simulation data
- Batch scripting
- Schematic annotation of node voltages and device information
- OASIS integration of a customer proprietary or third-party simulator

Waveform display

- Support of multiple y-axes, strip plots, and Smith charts
- Built-in waveform calculator
- Independent sub-window displays
- Horizontal and vertical measurement markers
- Independent pan and zoom capability
- User-defined labels and titles
- Color and line style controls
- Signal browser
- Color-coordinated cross-probing to schematics

Distributed processing

- Distribution of multiple simulations
- Efficient use of existing computer farms
- Built-in basic load balancing, or interface to other load balancing tools
- Job monitoring and controlling functions
- Graphical user interfaces for set-up and viewing status

Virtuoso Analog Design Environment XL Overview

Virtuoso Analog Design Environment XL is the advanced design and simulation environment for the Virtuoso platform. By supporting extensive exploration of multiple designs against their objective specifications, it sets the standard in thorough, fast, and accurate design verification.

Benefits

- Support of high fault coverage of designs with extensive verification over process environmental and operating conditions
- Analysis support of multiple simulators across multiple tests and conditions for thorough design validation, compiling results in a single easy-to-use database
- Support for corners, parametric sweeps, and Monte Carlo
- Quick color-coded feedback of all results against target specifications
- Optimum analysis throughput with simulation distribution and multi-test management across user-preferred load balancing software
- Simplification of design reviews through integral documentation, specifications, measurement results, and waveforms
- Close integration with Virtuoso Schematic Editor for fast test development and debug

Features

Specification-driven design

To accelerate design verification, Virtuoso Analog Design Environment XL combines specification entry and design management in a single unified cockpit. A specification consists of all required tests, analyses, and operating conditions for validation against a measured set of goals. With Virtuoso Schematic Editor XL, development of multiple tests is easy, along with all the different conditions to validate a design's performance against the target specification. Each Analog Design Environment XL session can be treated as a project, providing access to all the tests, sweeps, corners, scripts, and documentation needed to completely validate a design against the designer's intent.

Flexible simulation management

An overview of all the tests in development is available through the test assistant, which allows easy access to add, delete, and edit all required test configurations and analyses to fully validate a design. These defined tests can be further managed with test configurations that support different testing strategies at different points in the design development/validation flow. By enabling users to create extensive testing, Virtuoso Analog Design Environment XL provides the ability to manage the parallelized

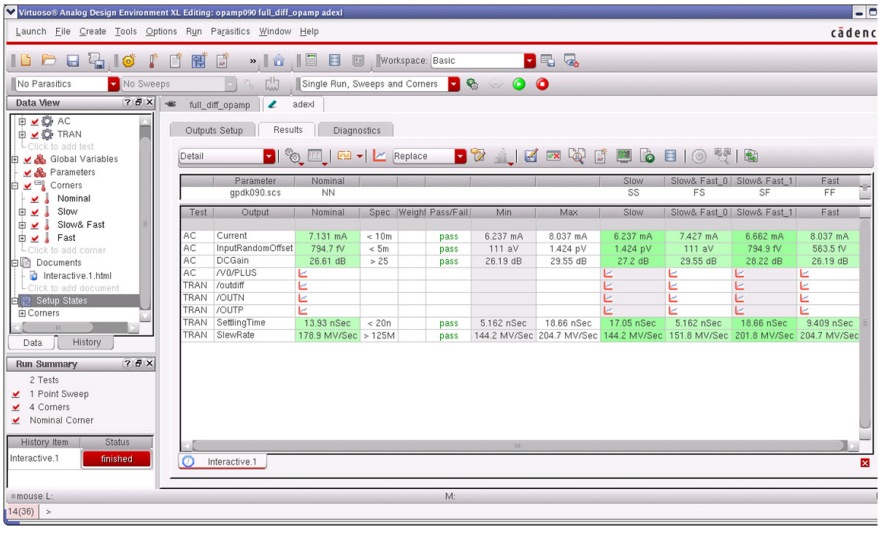

Figure 2: Virtuoso Analog Design Environment XL: multi-test environment

simulations with either the internal load balancing system or an optional third-party solution.

Visual cockpit that eases design verification

An overview of all the tests, simulators used, and analysis conducted (along with any defined variables and corners) is listed in Easy view on the Data view assistant screen. Results of the latest analysis appear in a tabular view on the right side, with color coding to show at a glance the simulation results that pass or fail against the target specification. The results can be reordered or transposed for better visualization. Users can easily explore results in more detail by right-clicking any single result or set of results that pops up in Virtuoso Visualization and Analysis XL, which is included in Analog Design Environment XL. In addition, a history of results is automatically maintained so users can quickly go back to look at previous results or even results from different test configurations.

Integral part of the Virtuoso custom design platform

Virtuoso Analog Design Environment XL builds upon the features and infrastructure of Virtuoso Analog Design Environment L, providing cohesive operation for the user. As a result, Analog Design Environment XL is able to work closely with Virtuoso Schematic Editor and Virtuoso Layout Suite for a complete integrated design flow.

Specifications

Interactive simulation control

- Integration with Analog Design Environment L capabilities for single test operation
- Design exploration with sweeps, corners, and Monte Carlo analysis
- Support of matching and correlation constraints from Virtuoso Schematic Editor XL
- Incremental re-simulation
- Creation and tracking of parametric dependencies among tests for more complex analysis
- Integration with Virtuoso Multi-Mode Simulation
- Ability to save different test configurations for different steps in the testing flow

Results analysis and visualization

- Creation of specifications directly from simulation results
- Quick overview window of test results against target specification
- Cross-probing and annotation to schematics and layout
- Calculator, OCEAN, MDL, and MATLAB measurement strategies
- Integrated Virtuoso Visualization and Analysis XL for fast waveform analysis
- Integral documentation creation and support for text, HTML, and PDF
- History of prior results, with the ability to compare any two sets of data
- Measured results saved along with tests as a lib/cell/view for easy design management

Distributed and batch processing

- Built-in distributed processing, with support for external load balancing software
- Parallel analysis over multiple tests and all required corners
- Batch scripting support through OCEAN XL

Virtuoso Analog Design Environment GXL Overview

Virtuoso Analog Design Environment GXL uses the same advanced design and simulation cockpit as Analog Design Environment XL and includes extended analysis capabilities for more detailed design exploration. A user can choose to launch Analog Design Environment GXL directly or just access the additional analysis capabilities from Analog Design Environment XL.

Benefits

- Extended design exploration with sensitivity and mismatch analysis
- Advanced optimization algorithms to improve design centering and yield
- Built-in parasitic estimation flow that helps to quickly identify parasitic sensitivities prior to layout
- Support for multiple technologies to facilitate multi-chip design analysis
- Generation of Liberty and Wreal models from simulation results for system-level simulation

Features

Extended analysis

To further understand the behavior of a design, users can run sensitivity analysis for identifying weaknesses in a design to process variations and for design

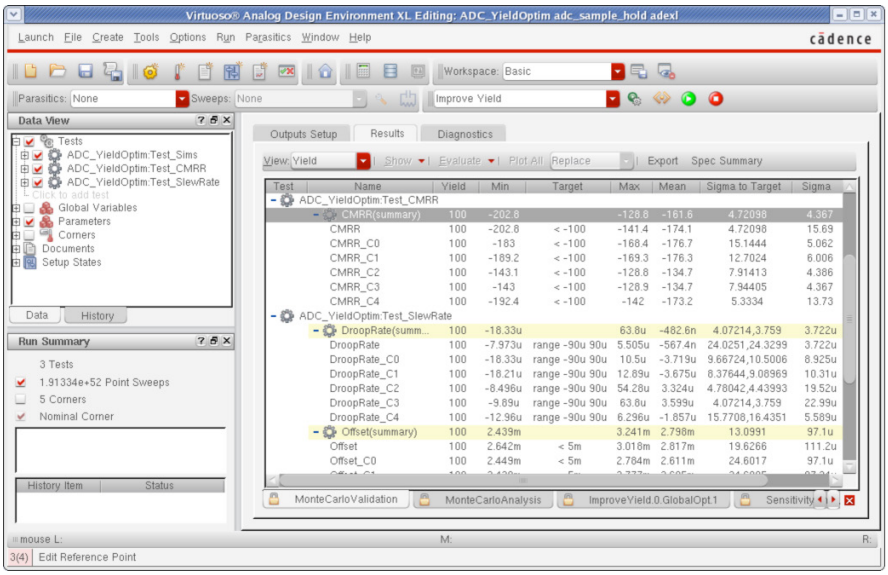

Figure 3: Virtuoso Analog Design Environment GXL: extends analysis into parasitic and yield

sizing. Built upon the statistical analysis capabilities in Analog Design Environment XL, mismatch analysis can be used to further explore the sensitivities of a design against the mismatch over all or a selected set of devices.

Parasitic resimulation

Users can explore parasitic effects early in the design flow with the ability to assign parasitic estimates onto nets and ports of their designs, without editing the schematic. An estimated view is compiled for simulation across all the tests and analysis options available in Analog Design Environment XL or GXL to identify areas to focus on in the design development. Similarly, post-layout extracted designs can be submitted for validation against the design goals or compared against the original parasitic estimates. Parasitic effects can be easily copied from an extracted view back to an estimated view to gain full access to all the debug capabilities in Analog Design Environment.

Design centering

With the set-up of tests and specifications already available in Analog Design Environment XL, users can simply add the ranges of devices they want to explore and use Analog Design Environment GXL optimization engines to find the optimum design. With an array of local and global optimization choices available, the user can control how the optimizer runs to center a design over nominal, all defined corners and with parasitic estimates in place.

Design for yield

Designers can use a series of both global and local optimization methods to center their design values to help maximize yield. For circuits requiring high design margins up to six sigma, the internal design goals are tightened as it optimizes the parametric yield.

Multi-technology support

Technology support is available to aid in the design of complex multi-chip solutions and integrate them into a single package in conjunction with the Cadence Allegro® platform.

Specifications

Extended analyses

- All features and functionality inherited from Virtuoso Analog Design Environment XL
- Sensitivity analysis on design parameters, statistical parameters and design variables
- Mismatch analyses
- Ability to import simulation results to build Liberty models without prior knowledge of the language
- Multiple technology support with Allegro platform to enable system-in-package (SiP) design

Parasitic analysis

- Supports exploration of design parasitic effects before layout
- Adds R,L,C or K parasitic elements without altering the schematic
- Supports post-extracted layouts using full simulation
- Compares pre- and post-layout parasitic effects

Optimization options

- Provides four local and global algorithm choices
- Optimizes nominally or over corners with or without parasitic estimates
- Runs optimization with or without a starting point
- Improves design yield and design centering up to Six Sigma margins

Design inputs

- OpenAccess data objects
- Cadence proprietary languages: OCEAN and MDL
- SPICE netlists
- Circuit design language (CDL)
- SPICE
- VHDL IEEE 1076-1993
- Verilog IEEE 1364
- SKILL
- PSF and PSF XL waveform formats
- SST2 waveform format
- Cadence SKILL

Design outputs

- XML database
- PSF and PSF XL
- SST2
- Comma-Separated Value (CSV)
- Cadence proprietary script language: OCEAN

Platform/OS

- x86 Linux
- IBM AIX

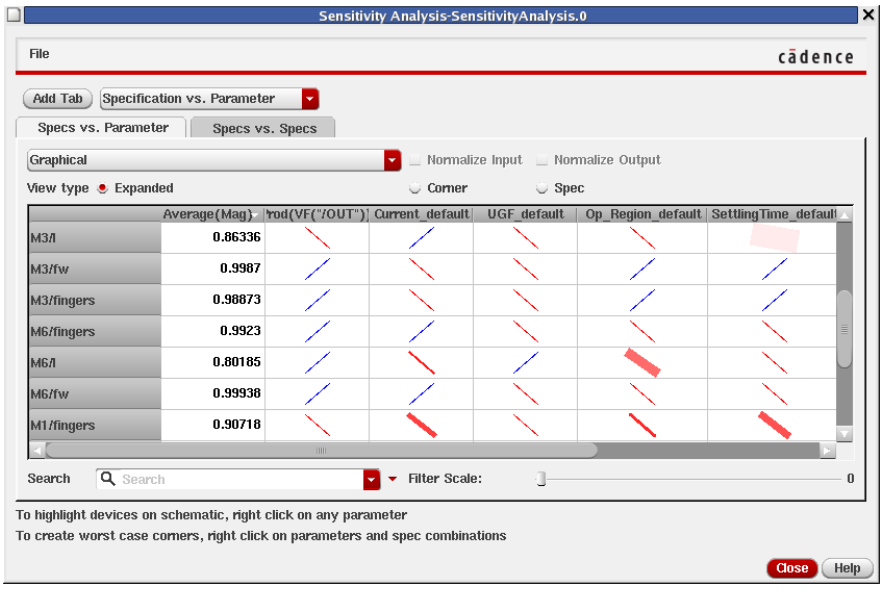

Figure 4: Sensitivity of device parameters to measured goals

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