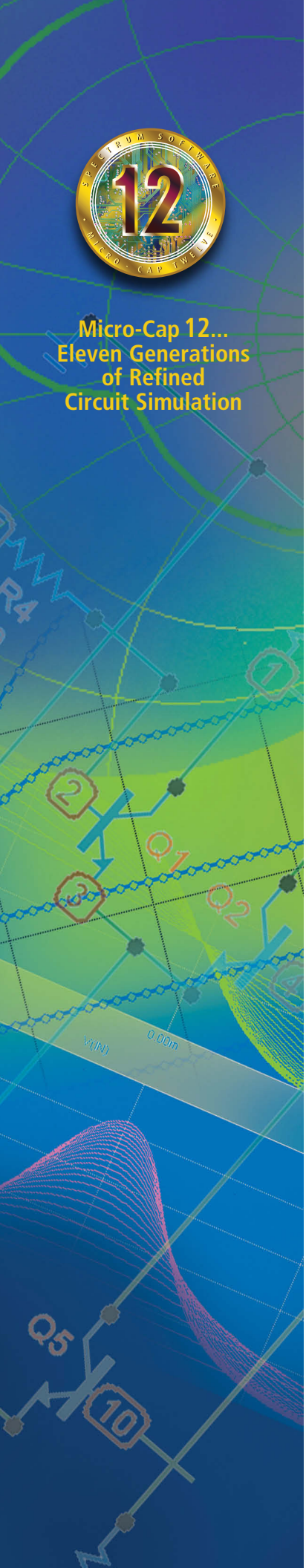
MICRO-CAP 12 Analog/Digital Simulator

Electronic Circuit Analysis Program

INDUSTRIAL-STRENGTH SIMULATION

spectrum



Micro-Cap 12 is an integrated schematic editor and mixed analog / digital simulator that provides an interactive sketch and simulate environment for electronics engineers. It has seen twelve generations of refinement since its release in 1982. It blends a modern, intuitive interface with robust numerical algorithms to produce unparalleled levels of simulation power and ease of use.

Fast

Algorithmic improvements, optimized code, and an integrated interface contribute to the stunning speed of Micro-Cap 12.

Extensive Features

- 64-bit version for large circuits
- Multi-page hierarchical schematic editor
- PSpice™, SPICE3, and many HSPICE™ commands and models supported
- Threading support for multiple CPUs and faster simulations
- Native digital simulation engine
- Periodic Steady State analysis
- Integral circuit optimizer with multiple optimization methods
- Worst Case analysis with RSS, Monte Carlo, and Extreme Value Analysis
- Smoke / Stress analysis
- Harmonic and intermodulation distortion analysis
- Stability analysis for linear systems
- Integrated active and passive filter design function
- Parts library with over 33,000 parts
- Analog and digital behavioral modeling
- Schematic waveform probing
- On-schematic voltage/state, current, power, and condition display
- Dynamic analysis updates waveforms and curves as you edit
- During the run plotting
- Smith charts / polar plots
- Multidimensional parameter stepping
- Monte Carlo analysis
- Integrated spreadsheet that recognizes simulation values
- 3D plotting
- .Measure and Performance Function plots
- Optimizing parts modeler
- Gummel-Poon, Mextram and Modella bipolar models
- Berkeley BSIM 1, BSIM 2, BSIM3, and BSIM4 MOSFET models
- EKV V2.6 MOSFET model
- Hefner IGBT model
- IBIS model translator
- Animated LEDs, switches, bars, meters, relays, stoplights, and DC motors
- Jiles-Atherton nonlinear magnetics model
- PCB interface to popular packages
- LAN version for collaborative projects

Easy to use

The graphical, user-friendly interface is easy to learn and use. Familiar SPICE models, plus extensions, are easy to apply. Over 400 sample circuit files illustrate common circuit applications.

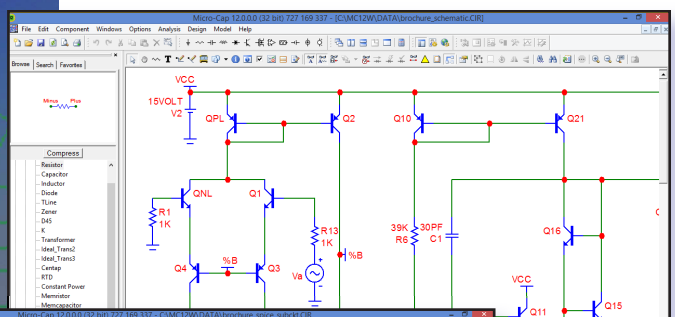
Affordable

You can easily spend three times the cost of Micro-Cap without matching its power, speed, and ease of use.

Guaranteed

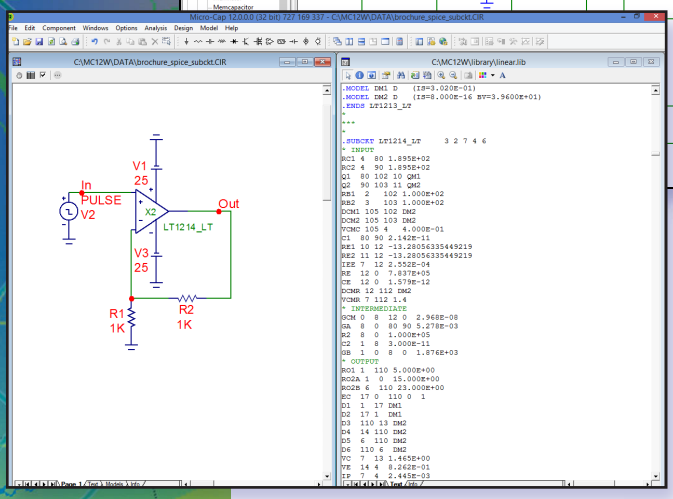
Micro-Cap comes with a full, unconditional, 30 day money-back guarantee.

PRINCIPAL FEATURES



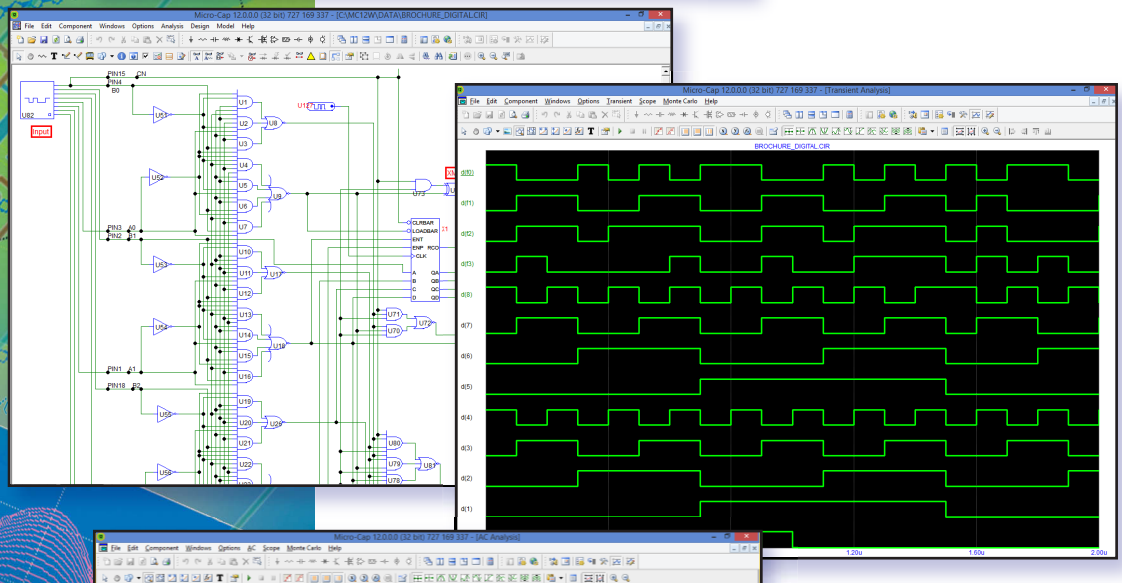
Integrated schematic editor and simulator

The hierarchical schematic editor makes it easy to sketch a circuit. Once a circuit is created, you can do Transient, AC, DC Transfer Function, Distortion, Stability, Smoke / Stress, or Worst Case analysis. The schematic editor features stepping, scaling, panning, multiple-object selection, three axes rotation, mirroring, drag copying, and clipboard functions, with multistage undo and redo. Probe the schematic with the mouse to display curves and waveforms, or use Dynamic Analysis mode to see waveforms change as you edit the circuit.



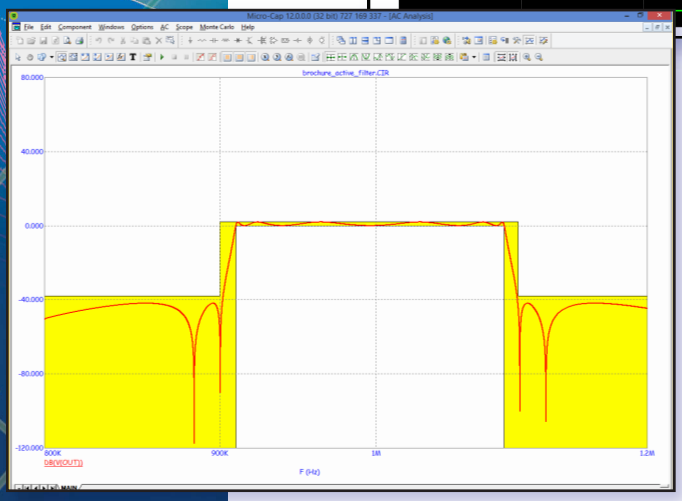
SPICE compatible models and simulator

Micro-Cap reads, writes, creates, and analyzes standard SPICE text files as well as its own schematic files. You can use the schematic editor to create schematics or the text editor to build SPICE text file circuits. Micro-Cap can analyze either format and can use text file subcircuit models in schematics. Micro-Cap also creates SPICE files from its own schematics.



Native digital simulator

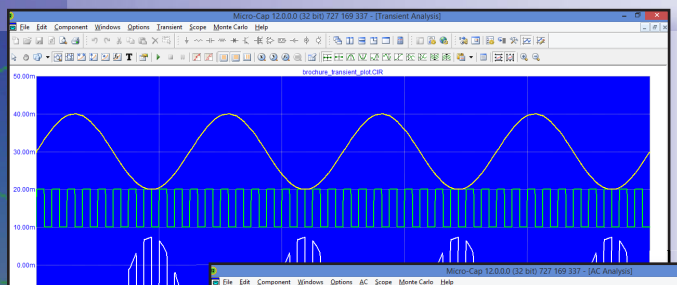
The internal 5-state, event-driven digital simulator lets you run digital or mixed mode simulations using your own models or those from our extensive digital library.



Active and passive filter designer

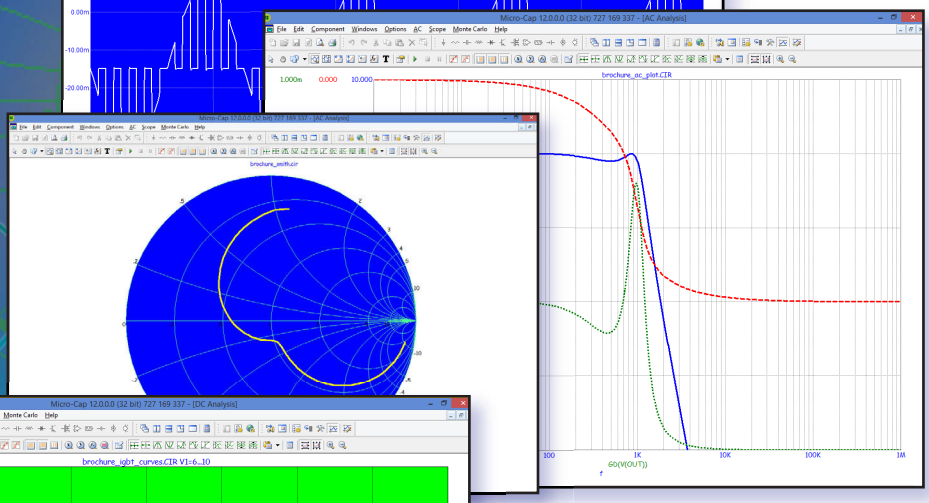
The active filter designer creates low pass, high pass, band pass, notch, and delay filters with Bessel, Butterworth, Chebyshev, inverse-Chebyshev, or elliptic responses in both polynomial and schematic form. Individual stages can be chosen from many topologies, including Sallen-Key, MFB, Tow Thomas, Fleischer-Tow, KHN, and Acker-Mossberg. The passive filter designer creates low pass, high pass, band pass, and notch filters with Butterworth, Chebyshev, or elliptic responses in several circuit configurations.

ANALYSIS



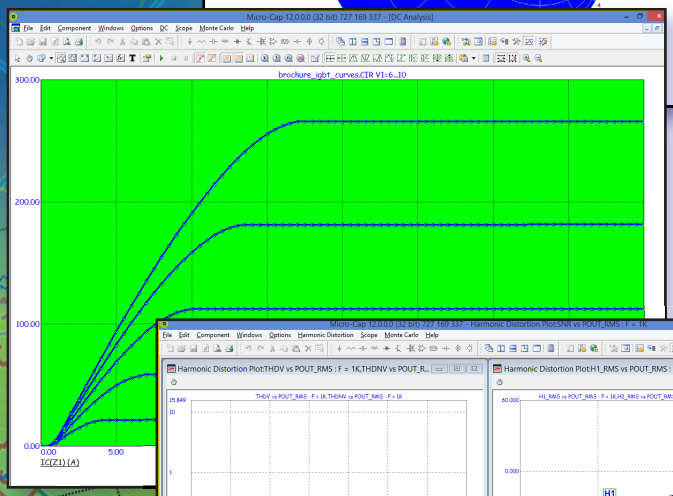
Transient analysis-for time-domain waveforms

You can plot digital state, voltage, current, power, energy, charge, capacitance, inductance, B field, and H field. A variety of variables and mathematical functions simplify plots.



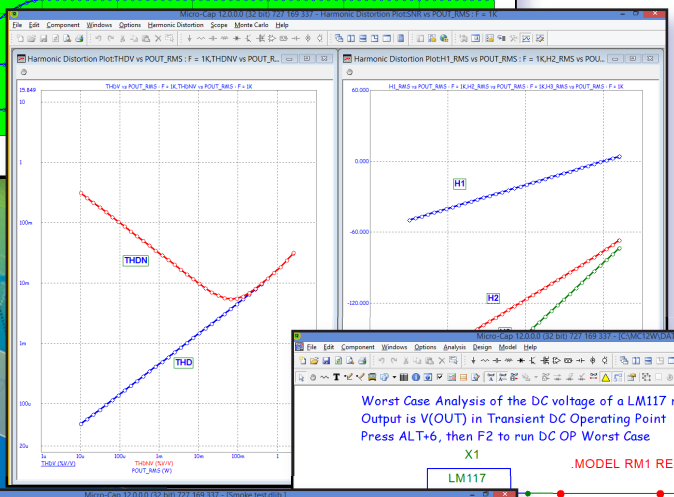
AC analysis-for small signal behavior

With AC analysis you can plot voltage or current and produce Bode plots, Nyquist diagrams, Nichols charts, Smith charts, polar plots, and noise. Real, imaginary, magnitude, phase, and group delay operators make analysis and plotting easy.



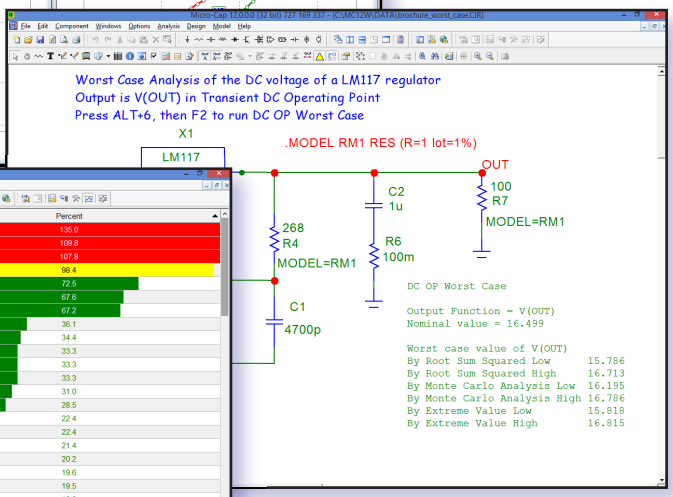
DC analysis- for large signal DC behavior

You can use DC analysis for various plots, including transfer functions, where one source is varied, and device IV curves, where two sources are varied. Transfer function plots help to determine DC offset, bias, and overall amplifier DC gain.



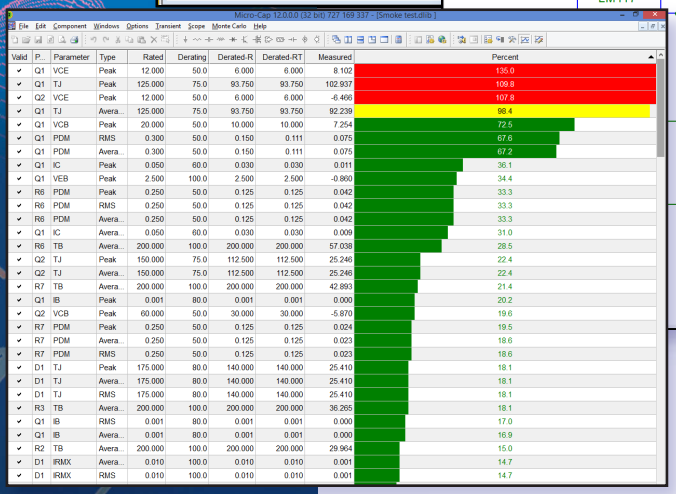
Distortion analysis

Harmonic distortion analysis creates plots of THD, THDN, SINAD, SNR, and Hn. Intermodulation creates plots of H1, IM2, and IM3. Any of these can be plotted vs. F, VIN, VOUT, PIN, and POUT.



Worst Case analysis

This feature computes the worst case values of critical design parameters based upon RSS (root-sum-of-squares), Monte Carlo analysis, and Extreme Value Analysis. It helps you verify that your design will work under worst case conditions.

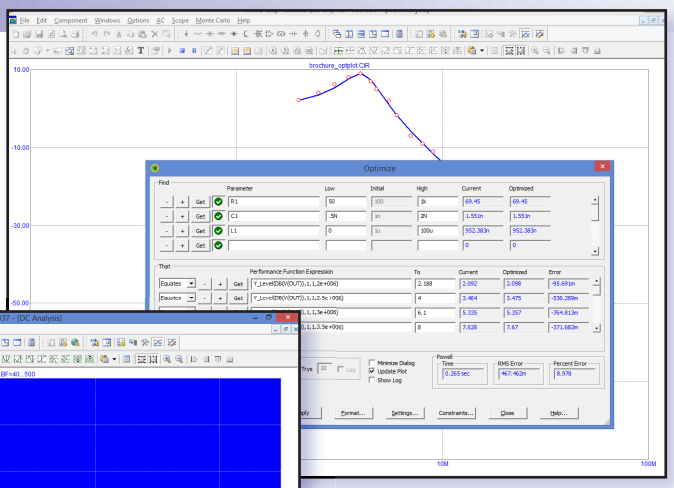


Valid	P...	Parameter	Type	Rated	Derating	Derated-R	Derated-RT	Measured	Percent
✔	Q1	VCE	Peak	12.000	50.0	6.000	6.000	8.102	135.0
✔	Q1	TJ	Peak	125.000	75.0	93.750	93.750	102.937	109.8
✔	Q2	VCE	Peak	12.000	50.0	6.000	6.000	-6.466	107.8
✔	Q1	TJ	Avera...	125.000	75.0	93.750	93.750	92.239	98.4
✔	Q1	VCB	Peak	20.000	50.0	10.000	10.000	7.254	72.5
✔	Q1	PDM	RMS	0.300	50.0	0.150	0.111	0.075	67.6
✔	Q1	PDM	Avera...	0.300	50.0	0.150	0.111	0.075	67.2
✔	Q1	IC	Peak	0.050	60.0	0.030	0.030	0.011	36.1
✔	Q1	VEB	Peak	2.500	100.0	2.500	2.500	-0.860	34.4
✔	R6	PDM	Peak	0.250	50.0	0.125	0.125	0.042	33.3
✔	R6	PDM	RMS	0.250	50.0	0.125	0.125	0.042	33.3
✔	R6	PDM	Avera...	0.250	50.0	0.125	0.125	0.042	33.3
✔	Q1	IC	Avera...	0.050	60.0	0.030	0.030	0.009	31.0
✔	R6	TB	Avera...	200.000	100.0	200.000	200.000	57.038	28.5
✔	Q2	TJ	Peak	150.000	75.0	112.500	112.500	25.246	22.4
✔	Q2	TJ	Avera...	150.000	75.0	112.500	112.500	25.246	22.4
✔	R7	TB	Avera...	200.000	100.0	200.000	200.000	42.893	21.4
✔	Q1	IB	Peak	0.001	80.0	0.001	0.001	0.000	20.2
✔	Q2	VCB	Peak	60.000	50.0	30.000	30.000	-5.870	19.6
✔	R7	PDM	Peak	0.250	50.0	0.125	0.125	0.024	19.5
✔	R7	PDM	Avera...	0.250	50.0	0.125	0.125	0.023	18.6
✔	R7	PDM	RMS	0.250	50.0	0.125	0.125	0.023	18.6
✔	D1	TJ	Peak	175.000	80.0	140.000	140.000	25.410	18.1
✔	D1	TJ	Avera...	175.000	80.0	140.000	140.000	25.410	18.1
✔	D1	TJ	RMS	175.000	80.0	140.000	140.000	25.410	18.1
✔	R3	TB	Avera...	200.000	100.0	200.000	200.000	36.265	18.1
✔	Q1	IB	RMS	0.001	80.0	0.001	0.001	0.000	17.0
✔	Q1	IB	Avera...	0.001	80.0	0.001	0.001	0.000	16.9
✔	R2	TB	Avera...	200.000	100.0	200.000	200.000	29.964	15.0
✔	D1	IRMX	Avera...	0.010	100.0	0.010	0.010	0.001	14.7
✔	D1	IRMX	RMS	0.010	100.0	0.010	0.010	0.001	14.7

Smoke / Stress analysis

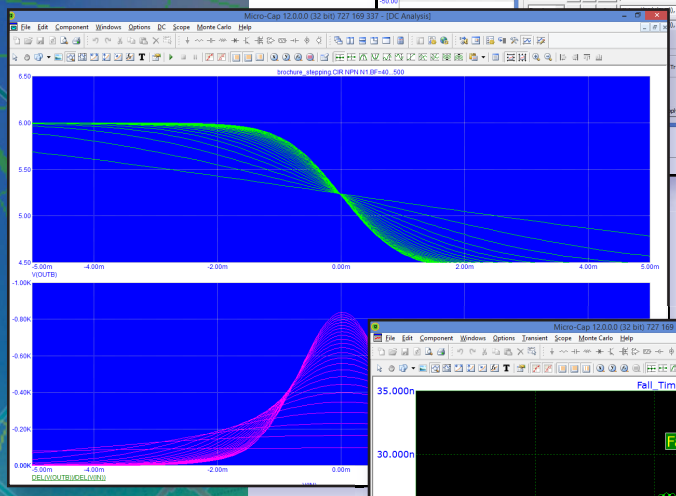
Smoke estimates component stress due to junction temperature, power dissipation, secondary breakdowns, excessive voltage and current levels.

DESIGN OPTIMIZATION



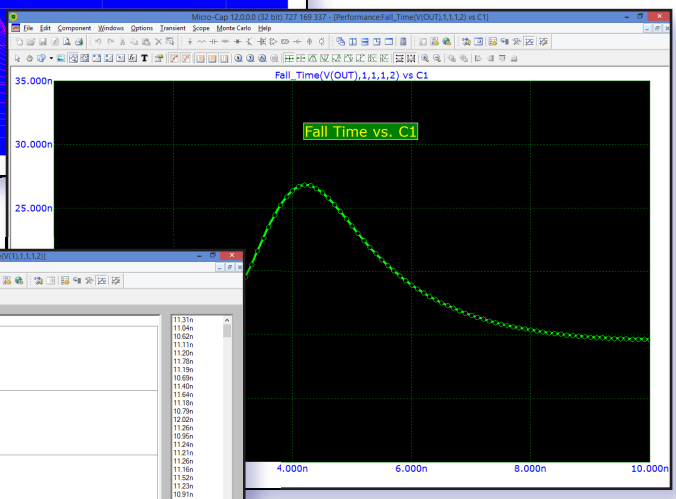
Optimizer-for fine tuning designs

The integral optimizer tunes parameters to maximize any performance function or to fit any curve, handling many kinds of design optimization problems.



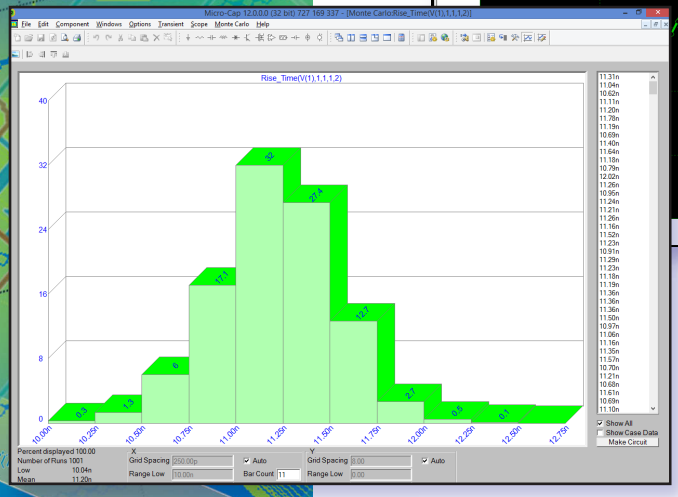
Parameter stepping- for parameter dependence

Step parameters to see how circuit behavior is affected. Try different designs, explore limits, and tailor performance.



Performance Plots-for parameter sensitivity

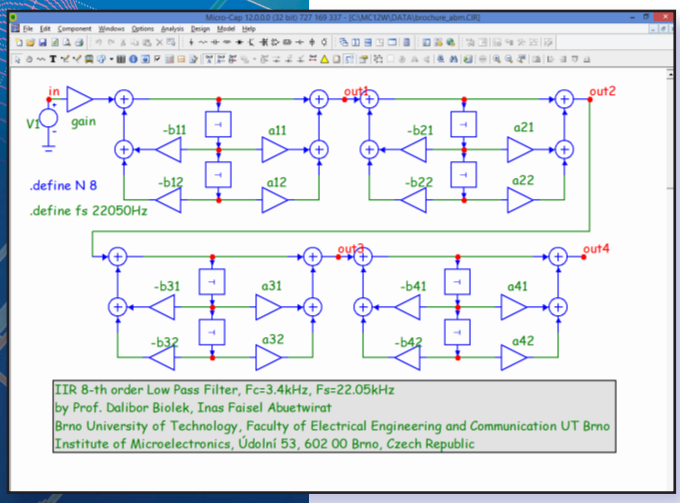
You can directly measure and plot performance characteristics versus circuit parameters. Performance parameters include rise time, fall time, pulse width, frequency, period, peak, bandwidth, phase and gain margin, and many more.



Monte Carlo-for design centering

Monte Carlo routines construct hundreds of circuits, each containing parts with parameters picked from distributions you choose. This helps identify circuit problems and improves production yield. You can use both absolute and relative tolerances and worst case, Gaussian, or uniform distributions.

MODELING

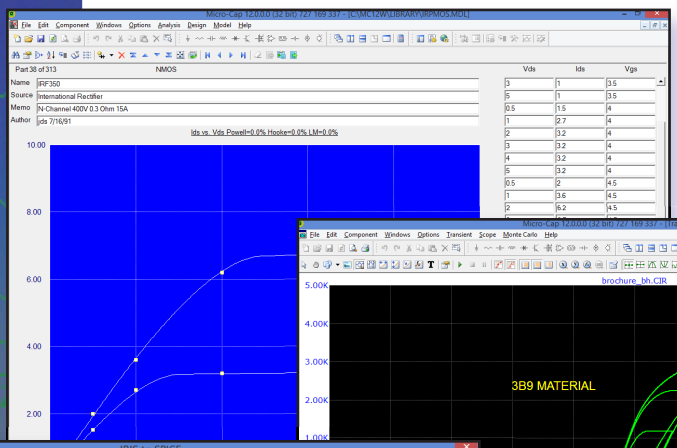


Analog behavioral modeling-what if analysis

Analog behavioral modeling-for system level simulation Laplace sources let you describe the S-plane linear transfer function of a circuit block. Function sources let you model instantaneous nonlinear behavior. The source can be a mathematical function of any other circuit variable, such as a node voltage or a device current.

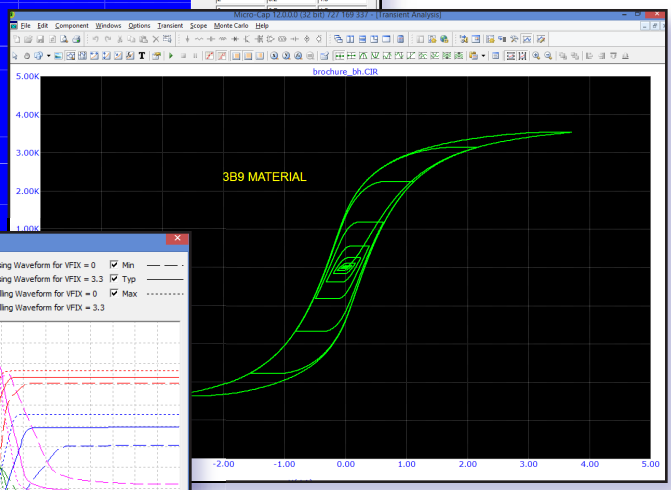
Expressions can also be used for resistor, capacitor, and inductor values. Here are some sample expressions:

*G*b0/(s^2+b1*s+b0)*	*Low pass filter*
-k(v(p)-v(c)+u*(v(g)-v(c)))^1.5*	*Triode*
VZ+tempco(TEMP-28)*	*Reference source*
*Sin(2*pi*T)*Exp(-T)*	*Damped sine wave*



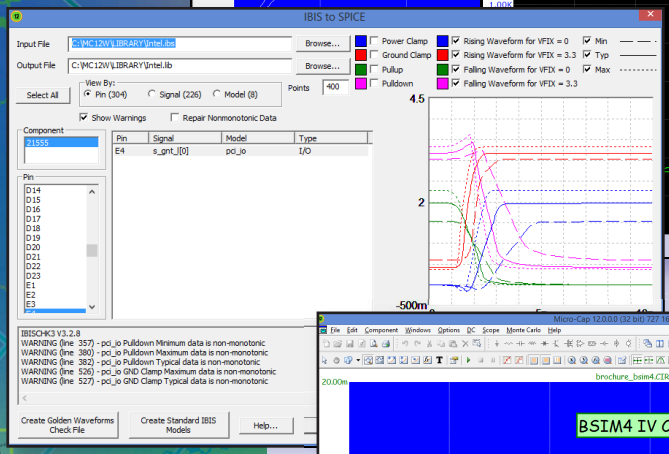
MODEL-for optimized device models

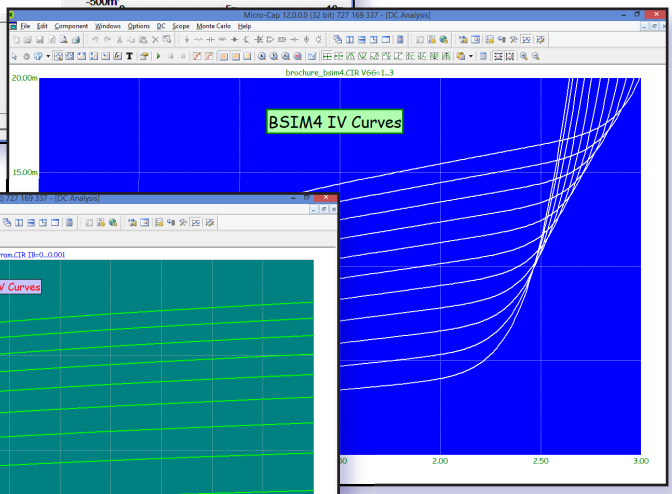
If you can't find what you need in our huge library, you can use MODEL, to produce optimized model parameters from data sheet values or graphs.



Nonlinear magnetics model

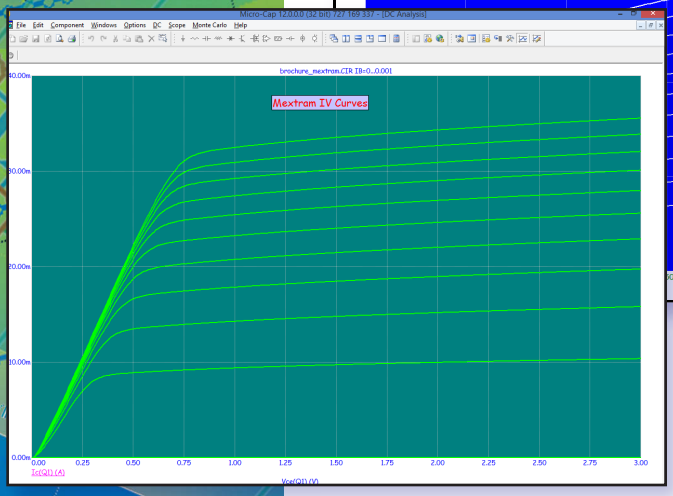
The Jiles-Atherton magnetics model lets you analyze nonlinear behavior of cores, reactors, and transformers. You can plot the current, voltage, flux, inductance, and B and H fields. The parts library includes models for common ferrite materials.





IBIS translator

Micro-Cap 12 translates IBIS models into SPICE models which accurately reproduce the IBIS Golden Waveforms.



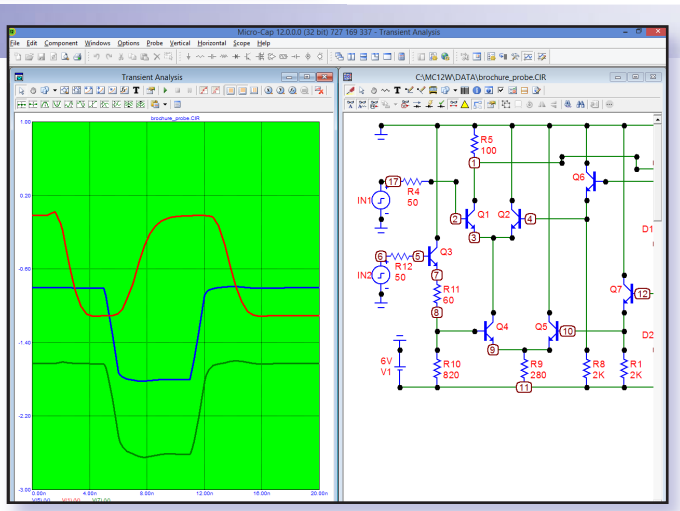
Advanced MOSFET models

Micro-Cap includes the EKV 2.6 and four BSIM models, BSIM1, BSIM2, BSIM3v3.3, and BSIM4.7 for advanced work with short channel devices. Short-distance matching and binning are provided for advanced modeling.

Advanced bipolar models

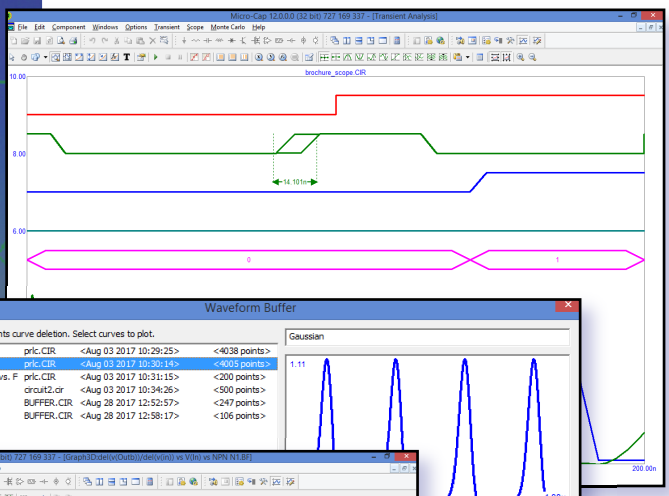
In addition to the standard Gummel-Poon bipolar model, Micro-Cap offers the Modella and Mextram models for advanced simulation of bipolar devices.

DISPLAY AND PLOTTING



Direct schematic waveform probing

MC12 lets you probe circuits directly for waveforms. Simply point the mouse at a device or circuit node and click. You can plot states, voltage, current, power, energy, charge, capacitance, flux, inductance, B or H field. The probe can display transient, AC, or DC analysis results.



Scope-easy review of waveforms

This feature lets you zoom, pan, size, scale, tag data points, inspect values, and use performance functions to analyze waveforms and curves. You can magnify a waveform, read out its value, check its slope, find a peak, compare it to another waveform, or measure its rise time, fall time, width, period, frequency, peak-topeak value, and many other performance functions.

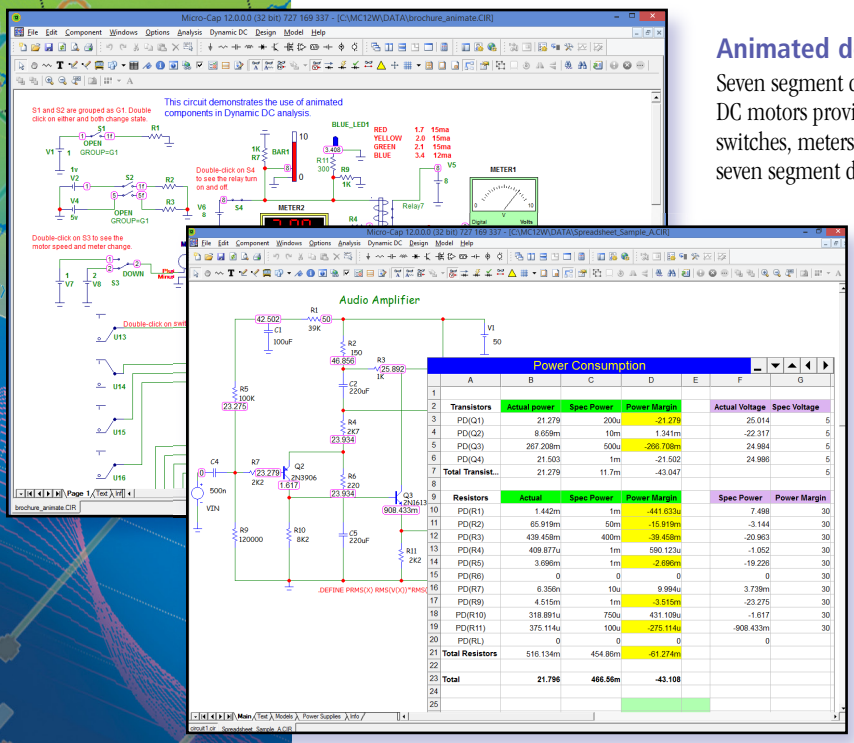
Waveform Buffer

This feature saves curves and waveforms for future analysis, display, and comparison. Curves can be saved manually or automatically up to a specified memory limit.

3D plots-design visualization

Plot an expression or performance function versus any two stepped parameters to show temperature or parameter effects.

ADDITIONAL FEATURES



Animated devices-visualization and interaction

Seven segment displays, LEDs, switches, bars, meters, relays, stoplights, and DC motors provide visualization and interaction. Mouse clicks open and close switches, meters read DC voltage and current, relays open and close, seven segment displays respond to digital input states.

Integrated spreadsheet-data manipulation and display

Built-in spreadsheets can use any variable or expression that is legal in an analysis plot. Prepare custom reports or analyses. Wildcard expressions afford easy access to many similar variables (e.g. I([C@]) = current through each capacitor).

Large device library

With over 33,000 parts in the device model library, you'll be able to quickly find most digital parts, and analog parts like diodes, MOSFETs, BJTs, OPAMPs, IGBTs, JFETs, magnetic cores, crystals, and SCRs.

Extensive mathematical operators and variables

Operators include arithmetic, trigonometric, hyperbolic, Boolean, relational, integration, differentiation, and FFT or signal processing types. You can even do Bessel functions and infinite series expressions. Variables include voltage, current, power, energy, charge, flux, capacitance, resistance, inductance, B field, and H field. Device variables include lead currents and lead-to-lead voltages, such as base current and base-emitter voltage of an NPN.

Device models

Analog primitives

- Battery voltage source
- Voltage source (SPICE format)
- Current source (SPICE format)
- Pulse voltage source
- Sine voltage source
- User-defined file source
- Resistor
- Capacitor
- Inductor
- Diode
- SPICE E, F, G, H sources
- Linear dependent two port source
- Transmission line (lossy or ideal)
- Transformer
- K device (magnetic coupling)
- Bipolar junction transistor (3 models)
  - Gummel-Poon
  - Mextram
  - Modella
- MOSFET models (13 models)
  - Original levels 1, 2, and 3
  - BSIM, BSIM2, BSIM3v3.3, BSIM4.7
  - EKV V 2.6
  - Philips MOS 12, 20, 31, 40, and PSP 122
- Hefner IGBT model
- OPAMP
- GaAsFET (4 models)
  - Curtice
  - Raytheon or Statz
  - TriQuint
  - Parker-Skellern
- JFET
- Analog behavioral sources
  - Laplace function (S-domain expressions)
  - Laplace table (S-domain tabular functions)
  - Function (Time-domain algebraic expressions)
  - Table (Time-domain tabular functions)
- Z transform source
- Sample and hold source
- S-Y-Z-H-G-T-ABCD parameter N-port model
- Switches (3 types)
- Timer function block
- 100+ macro blocks

Digital primitives

- Standard and tri-state gates
  - Buffer
  - Inverter
  - And
  - Or
  - Nand
  - Nor
  - Xor
  - NXor
- Edge-triggered flip-flops
  - K type
  - D type
- Gated flip-flops and latches
  - SR
  - Latch
- Digital loads
  - Pullup
  - Pulldown
- Delay line
- Programmable logic array
- Analog to digital converter
- Digital to analog converter
- Analog to digital interface
- Digital to analog interface
- Digital behavioral modeling
  - Logic expression
  - Pin delay
  - Constraint checker
- Stimulus generators

Animation primitives

These versatile devices use motion and color to indicate state behavior and respond to mouse clicks.

- Analog / digital voltmeter/ammeter
- Analog color LED
- Analog color bar
- DC Motor
- Digital LED
- Digital switch
- DPDT, DPST, SPST switches
- Relay
- Seven segment
- Traffic light

Extensive help system

- 20,000+ lines of on-line help is context sensitive, indexed, and topically arranged for easy learning.
- Over 500 error messages help you pinpoint circuit problems. Most error messages come with a "More" button for additional description of the nature of the problem.
- Over 400 sample circuits give you plenty of exam ples to learn design and simulation techniques.
- Over 120 Help Bar notes describe program features as you move the mouse over them.
- Over 20 live demos illustrate the workings of the program.

spectrum

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