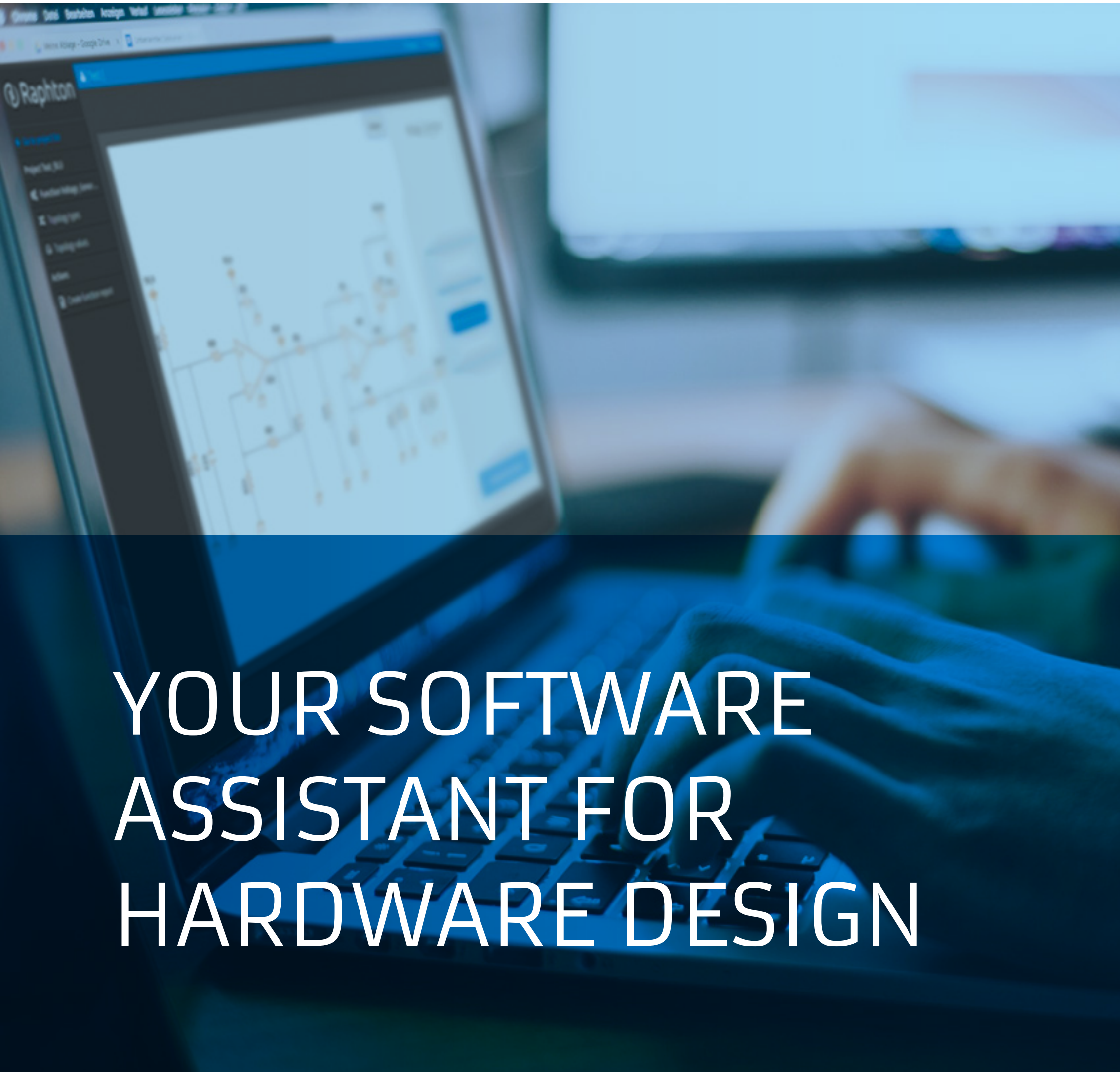
Raphton

Technical brochure



YOUR SOFTWARE ASSISTANT FOR HARDWARE DESIGN

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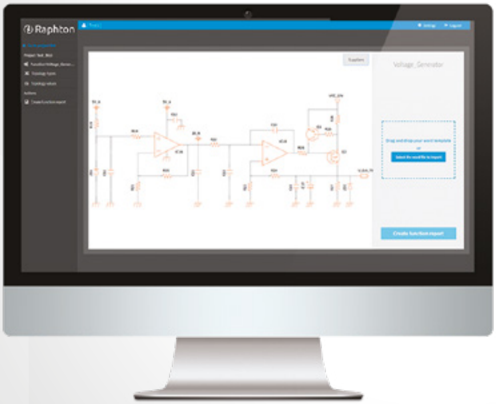


RAPHTON ANALYZER IS AN INNOVATIVE SOFTWARE ASSISTANT FOR ELECTRONIC DESIGNERS.

It enables designers to perform an exhaustive worst case analysis based on datasheet models using a fully automated process.

Built with the user in mind, Raphton's ergonomic interface is meant to make it easier for every user, experienced or not, to interact with the assistant.

MAIN FEATURES

Raphton's main purpose is to generate a worst case analysis report for any given schematic.

This report is fully customizable, in terms of content and layout.

Raphton performs the following worst case analyses for any given environment on operating points:

- Voltages
- Currents
- Power dissipations
- System outputs
- Operating point finding

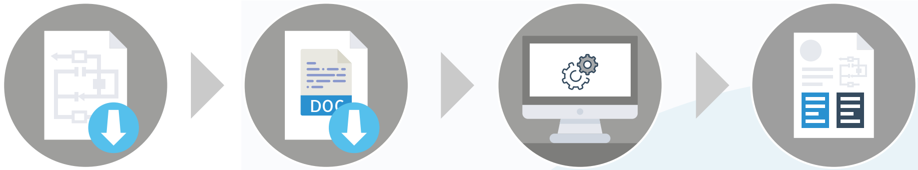
HOW DOES IT WORK?

To generate an analysis report, Raphton will need the following inputs:

- Spice netlist or schematic (CAD file), Zuken CR5000/CR8000 supported
- Components list and characteristics (Excel file)
- Analysis report template (Word file)

Raphton

RAPHTON'S WORKFLOW



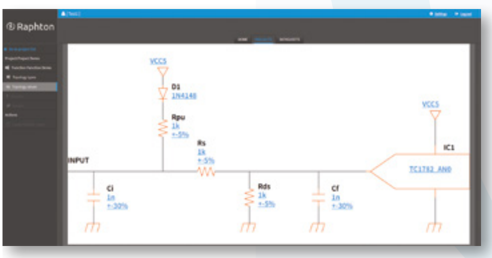
IMPORT SCHEMATIC & COMPONENTS DATA — IMPORT REPORT TEMPLATE — LAUNCH ANALYSIS — DOWNLOAD REPORT

Import schematic & components data: Choose your schematic file and characteristics file, Raphton will import them and do the matching automatically.

Import report template: A report template is a word document that defines the content and the layout of your report. Each analysis is simply described by a tag that will be recognized and calculated by Rapthon. Simply drag&drop your word template to link it to your electronic function.

Launch analysis: just click on "Generate report". If needed, you can modify suppliers for the components before starting the analysis.

Download report: Once the report is ready, you can download and open it.



RAPHTONSHEETS DATABASE

In order to ensure accuracy and consistency with datasheets' information, all calculations are based on a database of Raphtonsheets.

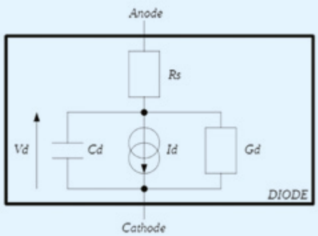
Raphtonsheets are digitalized datasheets that can be computed by Raphton's algorithms. They are generated from PDF datasheets through a lossless process.

Today's Raphtonsheets database include resistors, capacitors, diodes, zeners, AOPs, bipolars, MOS, digital transistors, LEDs and optocouplers from different suppliers.

The component models are built from contractual datasheets using physics equations. The digitalization of the datasheet curves is a lossless process: the PDF contains vectorial data for each curve that we are able to extract.

The process: The PDF is cropped to include the areas that contain the curves, the scale and name of series is defined and finally the information is used by our systems to create the model. This process is of high precision. The results are verified by comparing the source of data and the new model, the accuracy is determined from this comparison.

Example: The diode can be represented by the Shockley's equation and the Rs, Gd, Cd parameters.



$$Id = Is \cdot \left(e^{\frac{q \cdot Vd}{n \cdot k \cdot T}} - 1\right)$$

$k = 1{,}3806503\,e^{-23}\,J \cdot K^{-1}$ (Boltzmann's constant)
$q = 1{,}602176\,e^{-19}$ Coulomb (elementary charge)
$T = 273{,}15 + \theta$
Is: saturation current
n: emission coefficient
Rs: serial resistance
Gd: conductance
Cd: junction capacitance

CIRCUIT SOLVING

Raphton integrates the following innovations for circuit solving:

> In Raphton, circuits are represented with matrices. The matrix size is reduced with the Nodal Analysis formulation. The nodes voltage is obtained by a LU factorization and the Newton Raphson algorithm for nonlinear elements of the circuit.

> The branch's current is deduced with a simple ohmic law in a postprocessing phase. Power dissipation or other calculations can also be done by the postprocessing.

> The derivatives within the Jacobian matrix are computed with the Automatic Differentiation. This enables eliminating the round-off errors due to the discretization process necessary for example in the numerical differentiation.

Automatic Differentiation	$\frac{dy}{dx} = \frac{dy}{dz} \cdot \frac{dz}{dx}$	Numerical Differentiation	$\frac{f(x+h) - f(x)}{h}$

> Computation are made with quadruple precision so to minimize round-off errors. Using this method, the results are more accurate and reliable. For example, in intermediate calculations, if we subtract two numbers which have practically the same value, we don't lose significant digits, contrary to a simple double.

Example: 1,000000000000001-1,000000000000002= 1e-15 (≠ 0)

WORST CASE FINDING

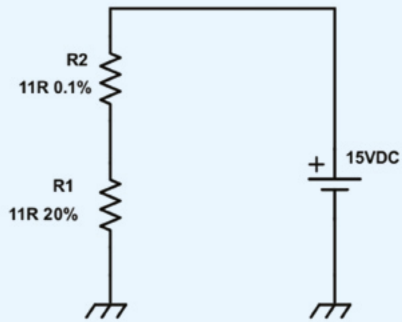
Raphton's algorithms are natively built for worst case finding.

With Raphton, you can identify the real worst cases, whether they're reached on extreme values of component tolerances or not. Raphton finds the real worst cases even if the measured quantity does not vary monotonically throughout the range of tolerances.

A very simple example of this phenomenon is a power measurement in a voltage divider consisting of 2 resistors with the same typical value but different tolerances.

The R1 max power measurement with extreme values methodology will provide:

$$P_{R1\_MAX} = R1_{max} \times \left(\frac{15V}{R1_{max}+R2_{min}}\right)^2 = 5.076\ W$$

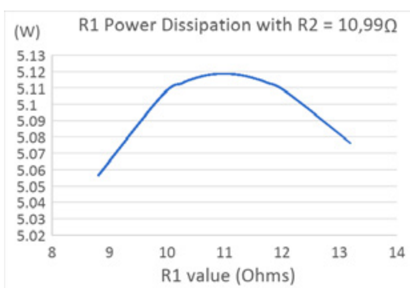


Raphton's result will be 5.119W, because the real worst case is not for an extreme value, but for the value of $R1_{WC}=R2_{min}$:

$$P_{R1\_MAX} = R1_{WC} \times \left(\frac{15V}{R1_{WC}+R2_{min}}\right)^2 = 5{,}119\ W$$

The explanation can easily be visualized into a graphical representation:

This function is not monotonic in the range of R1 tolerance



Raphton VS SIMULATORS

	Simulator	Raphton
Usage	**Design exploration**	**Design verification**
Component database	**Non contractual, Typical**	**Digital Datasheet**
Users profile	**Experienced**	**All designers**
Technical reports generation	**No**	**Yes**

AVAILABLE ANALYSES

Analysis	Description
Voltage	Computes the Typical, Minimum and/or Maximum voltage on any branch
Current	Computes the Typical, Minimum and/or Maximum current on any node
Power dissipation	Computes the Typical, Minimum and/or Maximum power dissipation for any component
System analysis	Computes the Typical, Minimum and/or Maximum physical output for any component: luminous intensity, ADC converted value, etc...
Operating point finding	Finds the voltage or current stimuli corresponding to a target operating point

Already trusted by Continental and other major manufacturers.

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