WEBONICS

Web Based ON Semiconductor Integrated Circuit Simulation Development

ELECOMP Capstone Design Project 2017-2018

Sponsoring Company:

ON Semiconductor Corp
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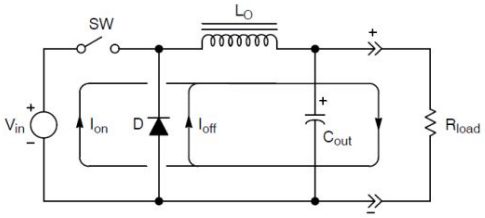

Company Background:

ON Semiconductor (formerly Motorola SCI [Semiconductor Components Industries] purchased the former Cherry Semiconductor in 2000. Cherry Semiconductors strong automotive focused portfolio fit into the long term growth plans of the company.

Since the acquisition, the ON Semiconductor, EG (East Greenwich) has developed integrated circuit solutions into the world automotive markets finding homes for its products in all the big players in the automotive world (GM, Ford, Chrysler, BMW, Mercedes Benz, Audi).

Presently, the East Greenwich facility is divided into 3 groups dedicated to 3 integrated circuit functionalities. These include switching regulators, drivers, and SmartFETs. We are part of a large organization with of more than 30,000 employees.

Technical Directors:

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Project Motivation:

Customers often need to simulate their system designs for confirmation of design intent and insured final product manufacturability. Presently the industry has focused on an array of SPICE (Simulation Program with Integrated Circuit Emphasis) based simulation products to accomplish this goal. These products include a multitude of variations including PSPICE (ON Semi preference), LTSPICE and TINASPICE. These products can often be fraught with issues with convergence and unacceptable simulation times.

After simulations, questions about results can arise that requires interface between and applications engineer in the factory and the customer in the field. Now files need to be transferred and simulations rerun at a different location. These interactions are not always streamlined and a lot of time is wasted just correlating between two simulations at two different locations.

System Vision, a product of Mentor Graphics allows for a cloud based simulation resolving the issue of multiple location based simulations. The modeling language used is VHDL-AMS. The baseline of the product definition has been developed, but further work is needed to enhance the final product and integrate multiple integrated circuits into the solution. This product will ultimately reside on our web site.

Mentor Graphics also provides our integrated circuit layout tools in East Greenwich and provides support for their products. Mentor Graphics has proven to provide excellent service to their products and is available for any type of questions involving their products.

Anticipated Best Outcome:

Software Simulation

The baseline products for simulation include the switching regulator products, but ideally, these would cover several additional devices across the range of products. The targeted products defined in the pilot phase of products include the following. Potential device numbers are listed for internal reference only. Information is not available on our web site for these devices as products are currently under development.

1) PMU (multiple output Power Management Units) Regulators (aka switching regulator products with additional functionality) [NCV8981930, NCV97401]
2) SMPS (switch mode power supplies) supporting a business unit in Belgium. [NCV6356]
3) Drivers [NCV84016, NCV7538]
4) LED Drivers [TBD]
5) LDO (low drop-out linear voltage regulators) [NCV48220]

Applications

Additional applications have been identified and documented as similar simulatable schematics.

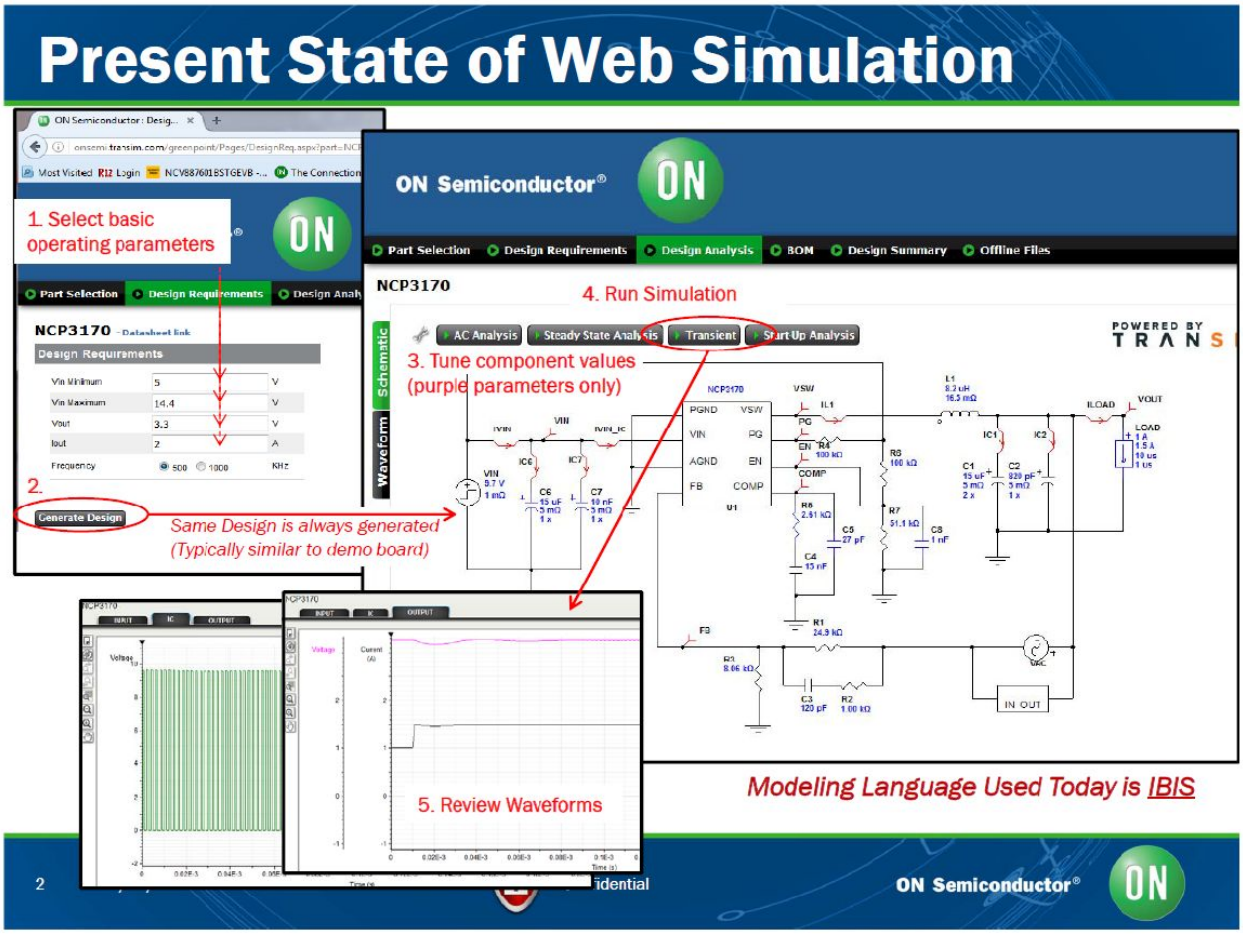
PCB Development

Devices without demo boards have been defined, laid out and manufactured for use with the software simulator. Demo boards would also require a user's manual along with supporting documents including a basic test procedure for the board.

Project Details:

The simulation tool will ultimately reside on our web site and look similar to the graphic below. Reference our web site for additional details on the functionality of the NCP3170 shown in the example. The NCP3170 is a 3A buck switching regulator.
http://www.onsemi.com/PowerSolutions/product.do?id=NCP3170

1. Select basic operating parameters.
2. Same Design is always generated (Typically similar to demo board).
3. Tune component values.
4. Run Simulation
5. Review Waveforms.



Software tasks:

Use the VHDL-AMS environment to define the behavior of the integrated circuits behavior functionality for both its analog and digital signature.

Hardware tasks:

Use PADS PCB layout tool to create demo boards

Composition of Team:

Two engineering students
One dual major Computer Engineer / Electrical Engineer
One Electrical Engineer

Skills Required:

Electrical Engineering:

- Strong understanding of circuit fundamentals and power electronics
- Understanding of basic switching regulators (Buck, Boost, SEPIC)
- PCB layout experience

Computer Engineering:

- Strong Programming Fundamentals
- Familiarity with VHDL
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Anticipated Best Outcome's Impact on Company's Business:

The customer experience at ON Semiconductor will be improved through the simplification process for system design using these web based design tools. Ease of use will drive the customer (especially in rapidly growing foreign countries) to us rather than the competition boosting sales and revenue.

Broader Implications of the Best Outcome on the Company's Industry:

This tool could gain company wide acceptance further enhancing our product experience in other ON Semiconductor business units.