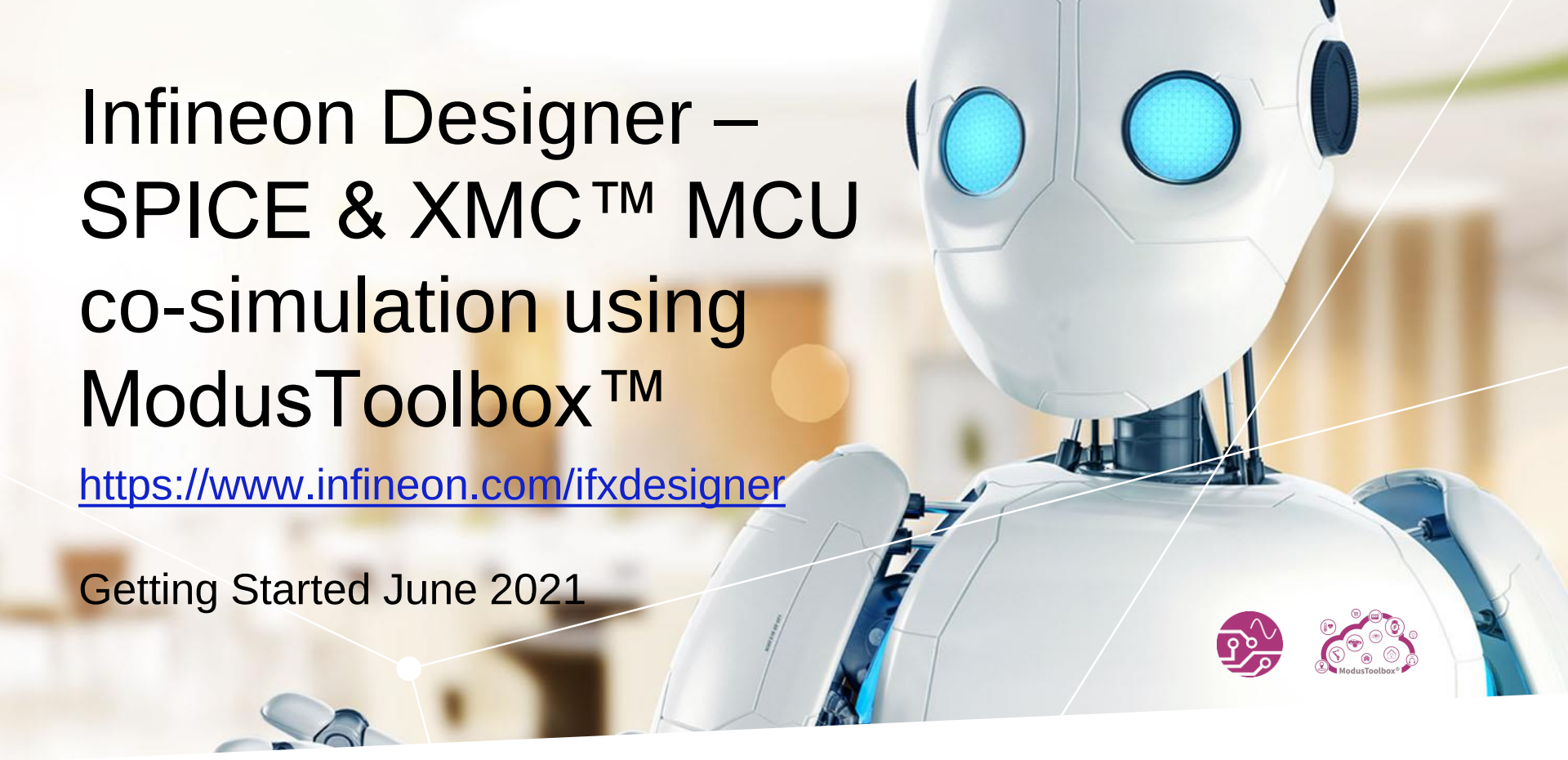
Infineon Designer – SPICE & XMC™ MCU co-simulation using ModusToolbox™

https://www.infineon.com/ifxdesigner

Getting Started June 2021



Infineon Digital Platforms Software & Tools

Agenda

1. Infineon: the link between the real and the digital world
2. Infineon Designer introduction
3. Infineon Designer – SPICE & XMC™ MCU co-simulation using ModusToolbox™
4. Summary

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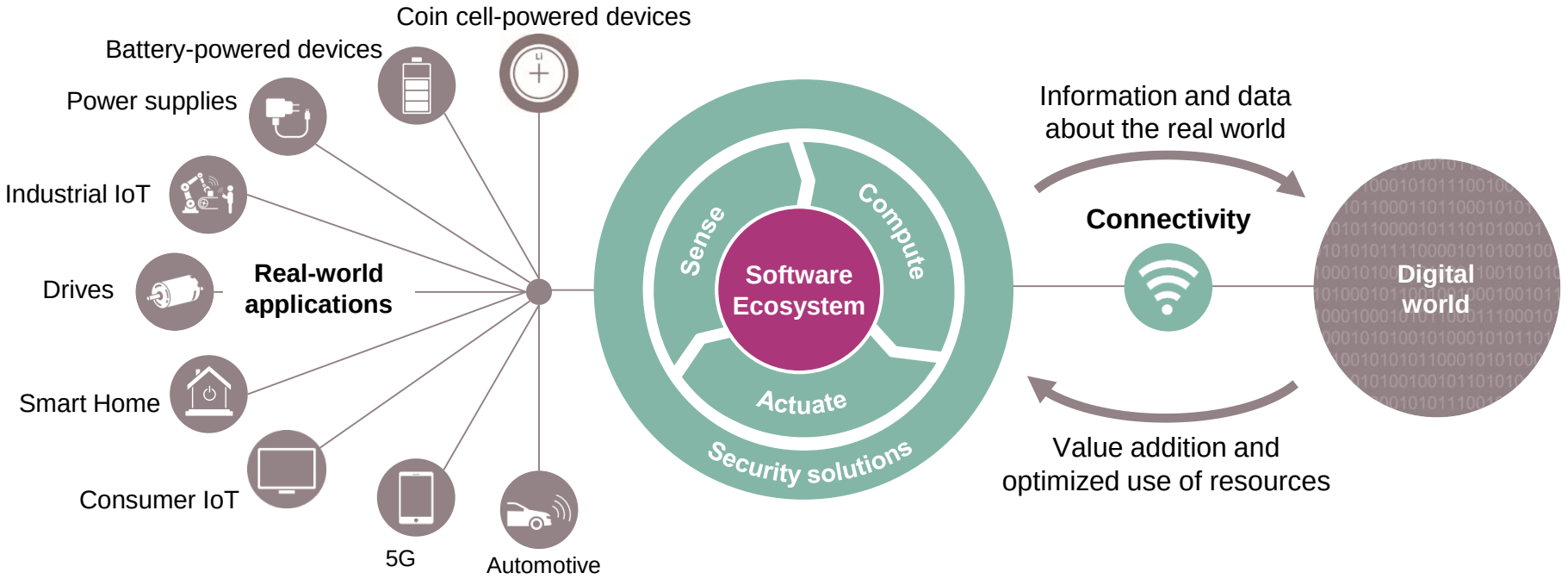
Infineon Vision: We are the link between the real and the digital world

Part of your life. Part of tomorrow.

Infineon offers a unique portfolio linking the real and the digital world

https://www.infineon.com



Sense: sensors | Compute: microcontrollers, memories | Actuate: power semiconductors | Security Solutions | Connectivity: Wi-Fi, Bluetooth, USB

Software & Tools help developers to shorten design-in time

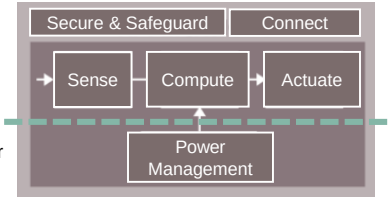
https://softwaretools.infineon.com

Infineon Toolbox (Developer Center) https://softwaretools.infineon.com

Selection Tools Solution Finder

Signal Path

Power Path



Data Path

- ✓ easy
- ✓ safe
- ✓ green
- ✓ connected

Sense	Actuate	Compute	Secure & Safeguard	Connect

Simulation Tools Aspects: Online / Offline

› Does the sensor switch at the right position?	› What is the overall efficiency? › Does my design not overheat?	› Is my design stable? › Does my software run w/o errors?
Magnetic design	**Thermal design**	**Electrical design** / **Software design**
Sensor Tools (3D, Angle & Hall sensors) python	IPOSIM (IGBT, Bipolar, SiC) Motor Simulator (IGBT, IPM) OPTIREG™ (PMIC) PowerEsim (SMPS) plecs MATLAB SIMULINK EasyAPE PRO (ATV Body Power)	Infineon Designer (MOSFET, IGBT, Gate Driver, Voltage Regulator, Audio Class D, MCU) PowerDesk (DC-DC PoL) TINA TINA Spice, PSpice, SIMetrix, [Ltspice[1]]

[1] switches & diodes only

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Infineon Designer - Online SPICE Engine

https://www.infineon.com/ifxdesigner

- 650+ application circuits (lighting, power supplies, motor control, computing DC-DC PoL, Audio etc.)
- Accurate transient and system efficiency simulation powered by TINA SPICE engine
- Full-featured circuit editor with Infineon SPICE library for free
- Export to Altium PCB design and export of the BoM (Bill of Materials)
- Fast parameter configuration with design tool for better evaluation experience
- Digital/analog co-simulation (e.g. Microcontroller code debugging)

Infineon Designer Server Infrastructure

Infineon servers

www.infineon.com/ifxdesigner

Online

Offline

DesignSoft servers

www.tinacloud.com

Internet

Compatible

TINA WEB-BASED CIRCUIT DESIGN & ANALYSIS Cloud

PC, Mac, Tablet, Smartphone
Available in 22 languages

Upgrade

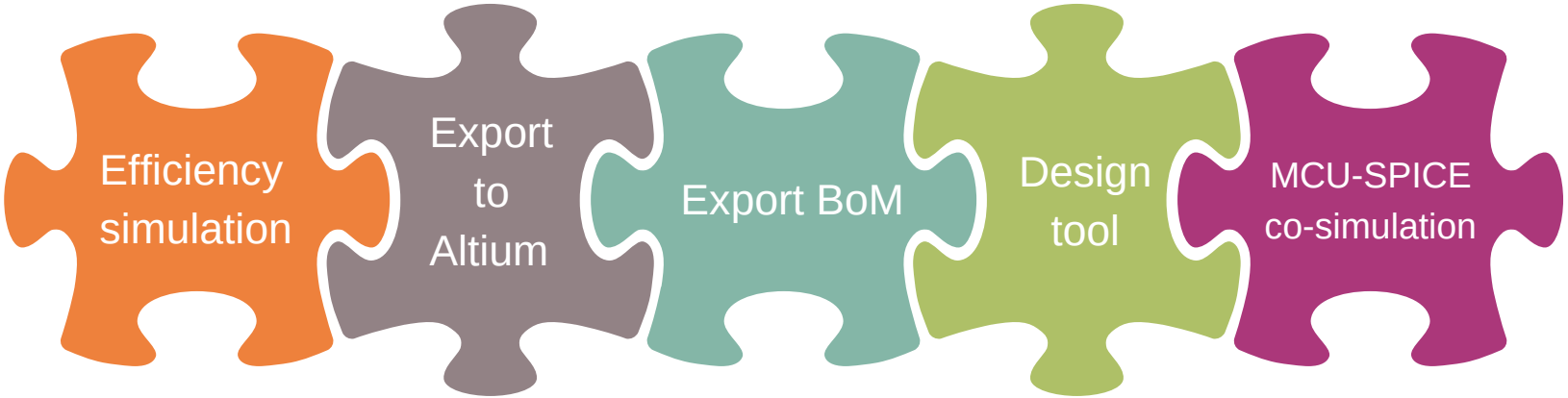
TINA V12

TINA Industrial version

Online

Offline

Infineon Designer Features



- Component losses
- Component junction temperature
- Steady-state system efficiency

- Infineon product footprints
- Passive component footprints
- Altium PCB project with schematic

- Detailed BoM including type, value, footprint, part number, description, manufacturer and more
- Export to excel or print to PDF

- Fast configuration of circuit variables and global parameters
- Individual function programming

- Support of XMC1000, (PSoC® 4/6 under evaluation)
- Instruction Cycle accurate co-simulation
- DAVE™ support
- New: available for XMC1400: ModusToolbox™ support

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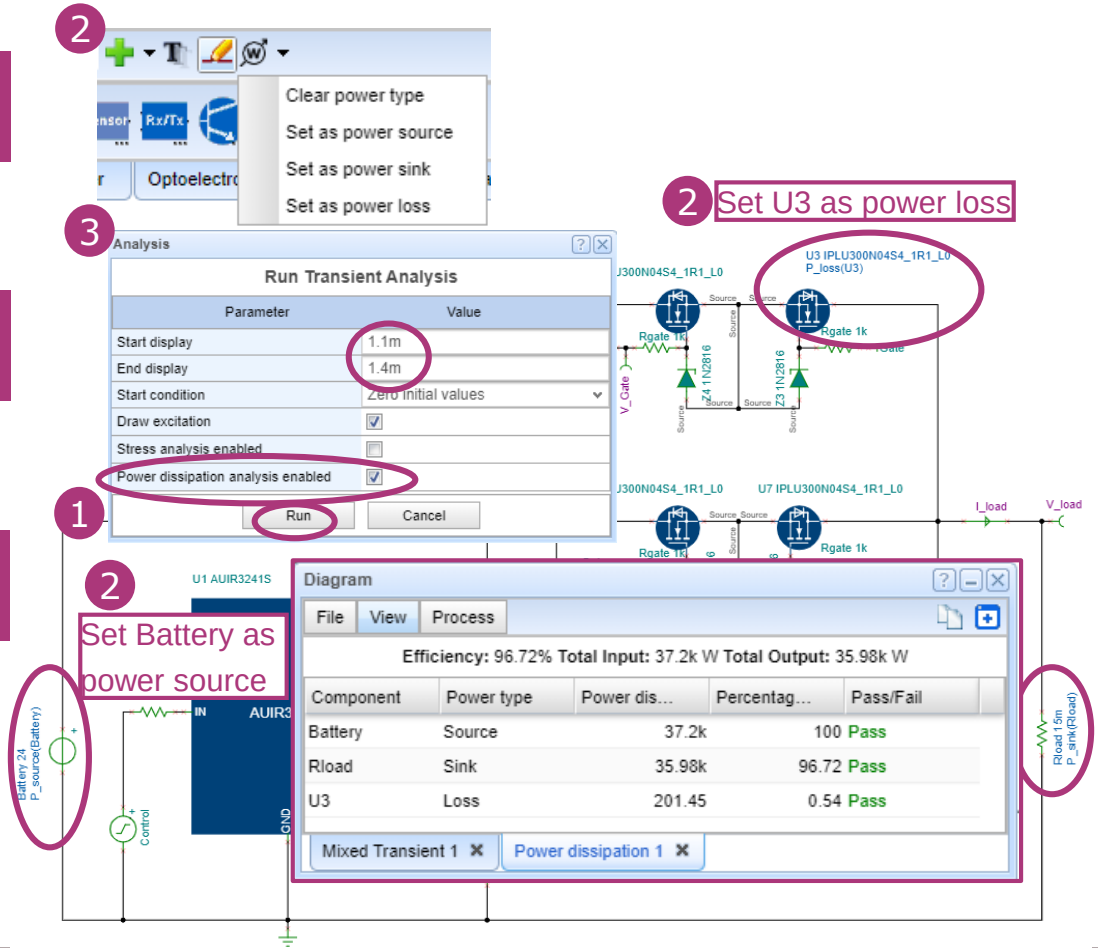
Thermal & System Efficiency Simulation

24V Automotive Battery Switch Demonstrator

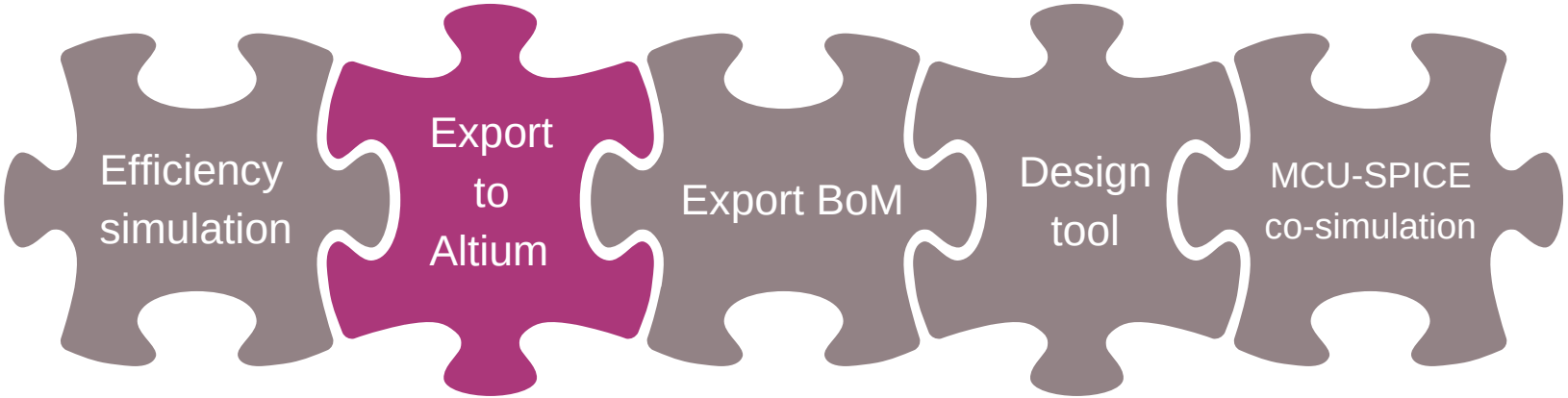
1. Open circuit and login with myInfineon account

2. Check & set the power types of components

3. Set transient analysis and run simulation



Infineon Designer Features



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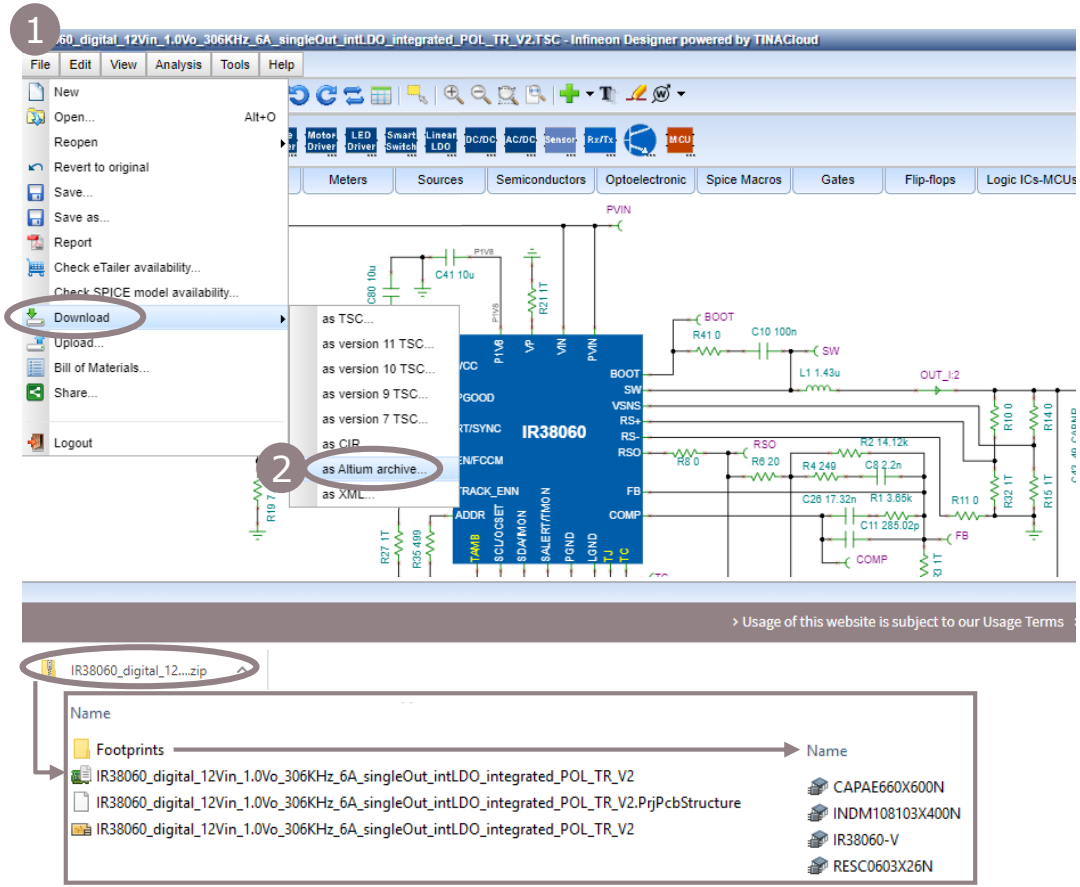
Export to Altium PCB

1.0V 6A Single Output Integrated PoL Solution IR38060

1. Open circuit and login with myInfineon account

2. Download as Altium archive and check



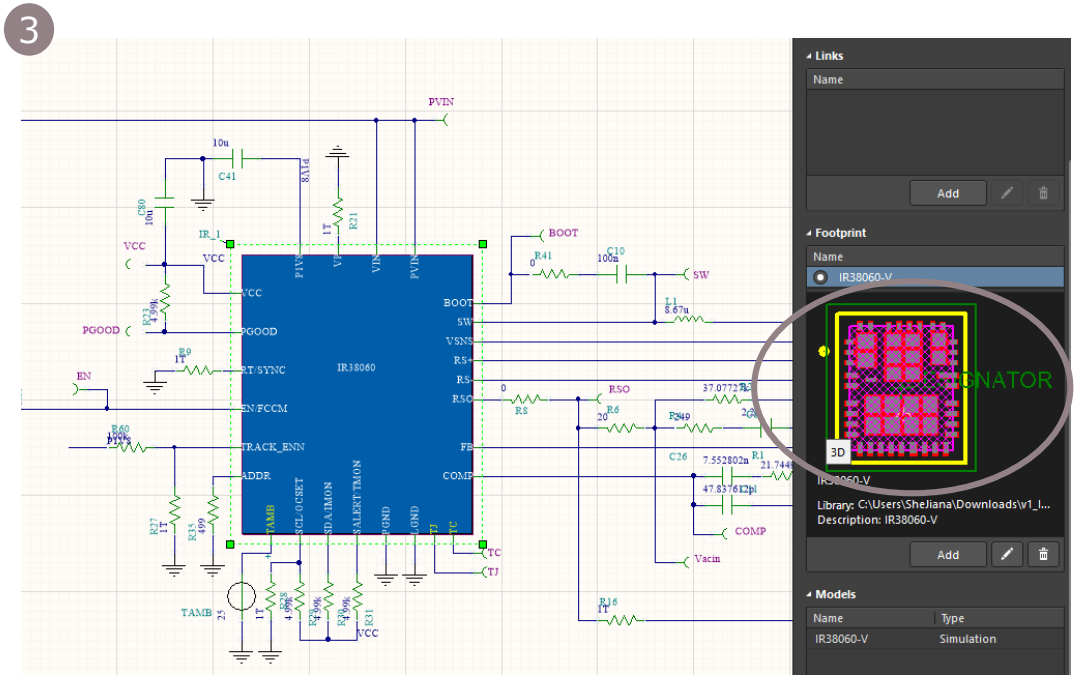
Export to Altium PCB

1.0V 6A Single Output Integrated PoL Solution IR38060

1. Open circuit and login with myInfineon account

2. Download as Altium archive and check

3. Open project in Altium and start PCB design



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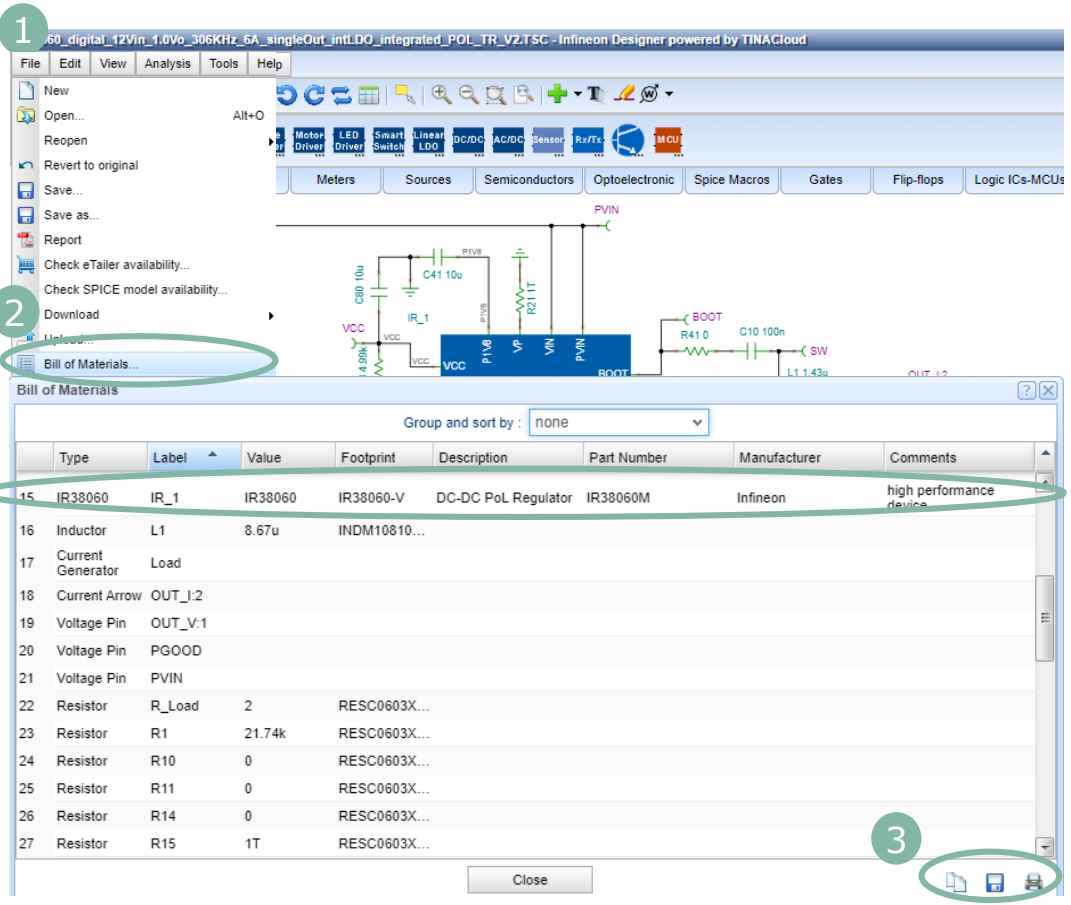
Export the Bill of Materials

1.0V 6A Single Output Integrated PoL Solution IR38060

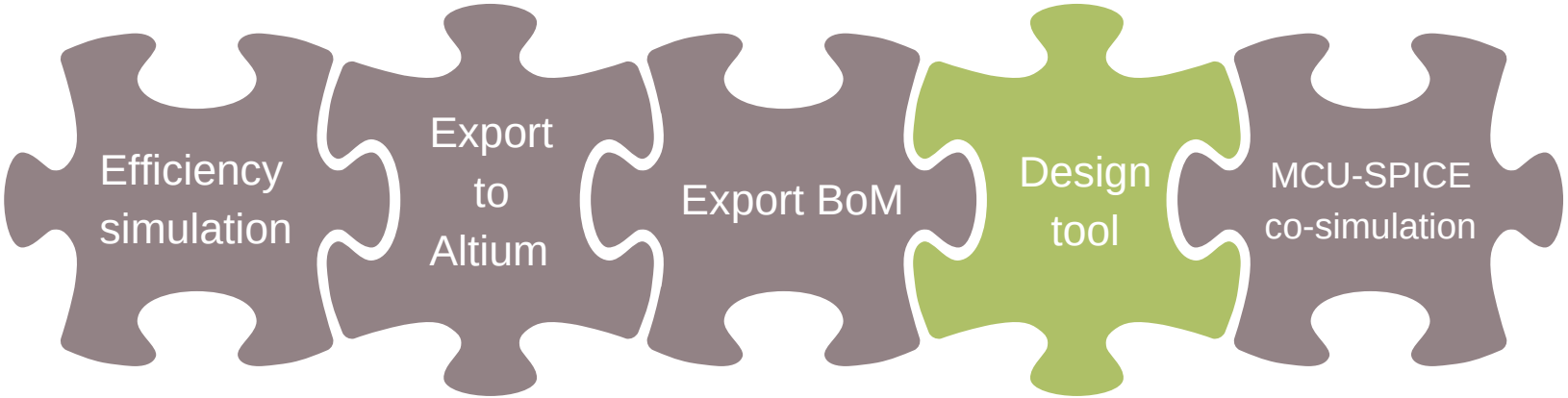
1. Open circuit and login with myInfineon account

2. Open the Bill of Materials, check details

3. Save to Excel .csv



Infineon Designer Features



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- Coming soon: ModusToolbox™ support

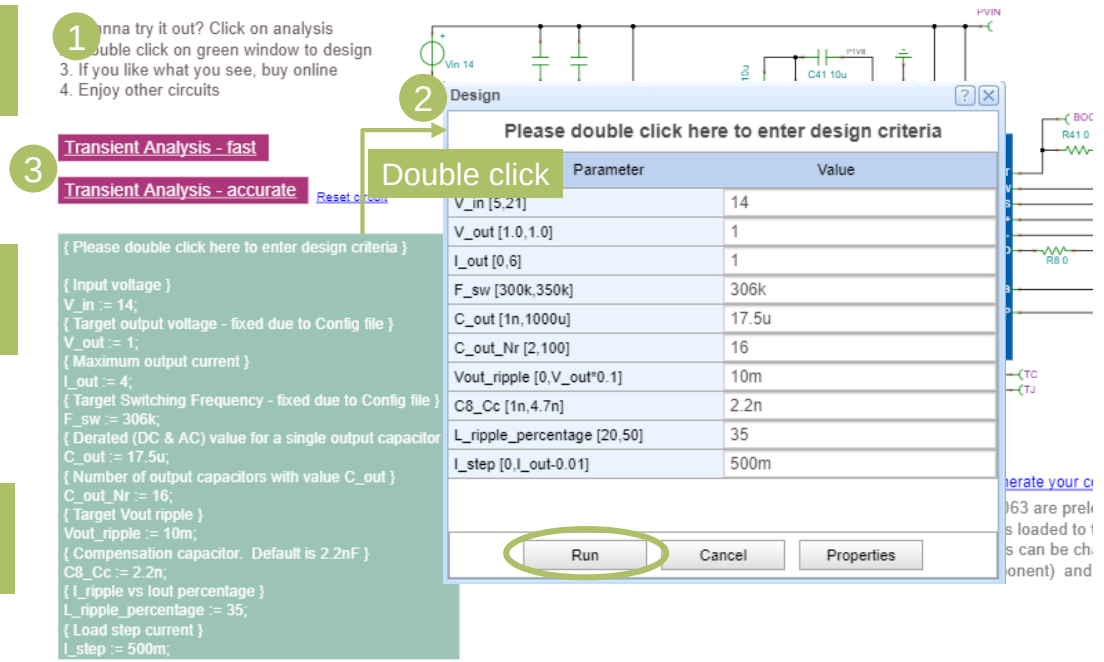
Use Design Tool - Parameter Setting & Calculation

1.0V 6A Single Output Integrated PoL Solution IR38060

1. Open circuit and login with myInfineon account

2. Open design tool, set parameters and Run

3. Simulate again



› Design Tool (advanced mode see appendix)
- Easier parameter setting
- Faster value calculation for all circuit components set by defined formulas & scripts

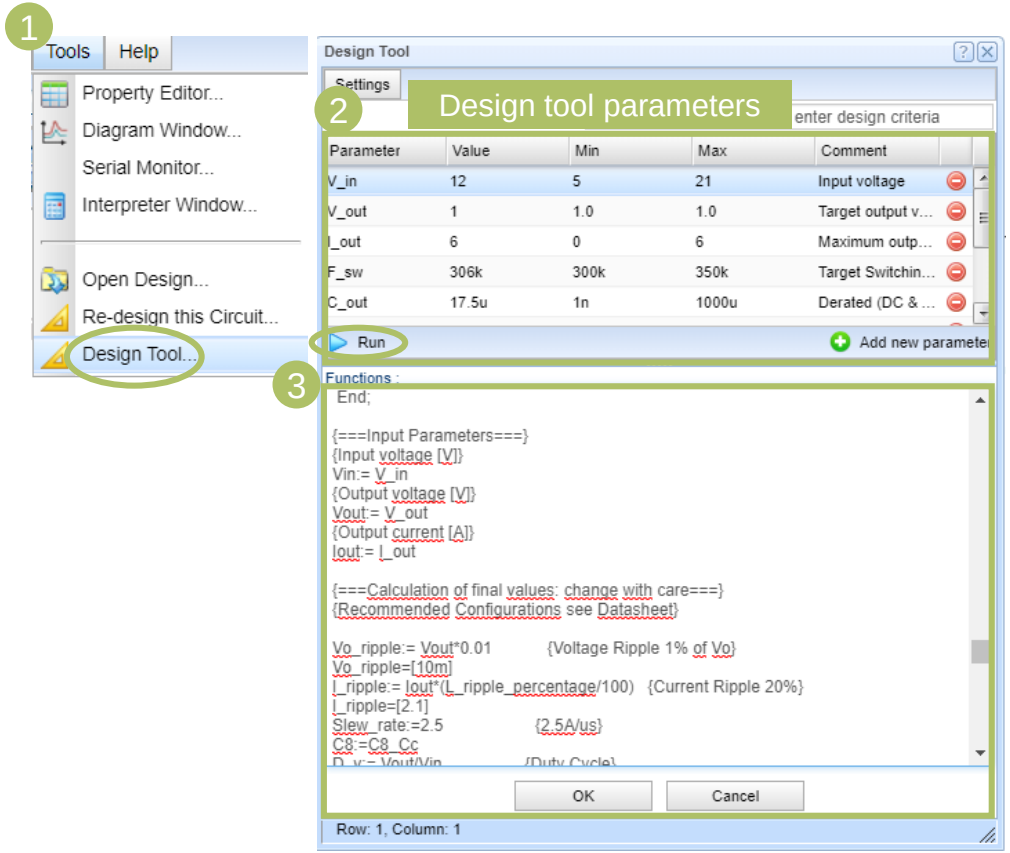
Design Tool – Setup & Programming

1.0V 6A Single Output Integrated PoL Solution IR38060

1. Open Menu >> Tools >> Design Tool…

2. Create parameters for user interpreter window

3. Assign values, create formulas and scripts



Assign values

1. Assign parameter value to component

Vin:=V_in

Vin → component label

:= → value assignment

V_in → design tool parameter

2. Assign parameter value to local variable

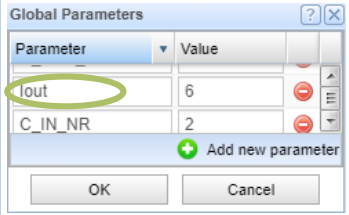
```
Vout_scale_loop:=Vout_scale_loop_calc(Vout)
Vout_scale_loop=[1]
Vref:=Vout*Vout_scale_loop
```

Vout:=V_out

Vout → local variable used in calculations

V_out → design tool parameter

3. Assign parameter value to circuit global parameter



Iout:=I_out

Iout → global variable

I_out → design tool parameter

Create formulas and scripts

Functions : 1

```
{*****Calculate Inductor*****}
L1:=(Vin-Vout)* (Vout/(Vin*F_sw*I_ripple))
L1:= Round(L1*100000000)/100000000
L1=[1.43u]
rL1:=rL1_calc(L1)
rL1=[2.9m]

{*****Calculate Voltage Divider for Enable*****}
R19:=Ren_calc(Vin)
R19:=Round(R19*100)/100
R19=[7.4319k]
```

1. formulas

- Support math. operators: + - * / () etc...
- Support math. functions: e.g sqrt(), Round(), etc...
- := → value assignment
- = → display value (e.g. calculated results)
- {} → comment

Functions : 2

```
{*****PhaseMargin*****}
Function CompType_PM(CompType);
 Begin
  If CompType=4 Then Begin
   CompType_PM:=75;
  End
  Else Begin
   CompType_PM:=0
  End
 End;
```

2. Assign parameter value to local variable

- Supoort Pascal scripting
- Support math. operators: + - * / () etc...
- Support math. functions: e.g sqrt(), Round(), etc...
- := → value assignment
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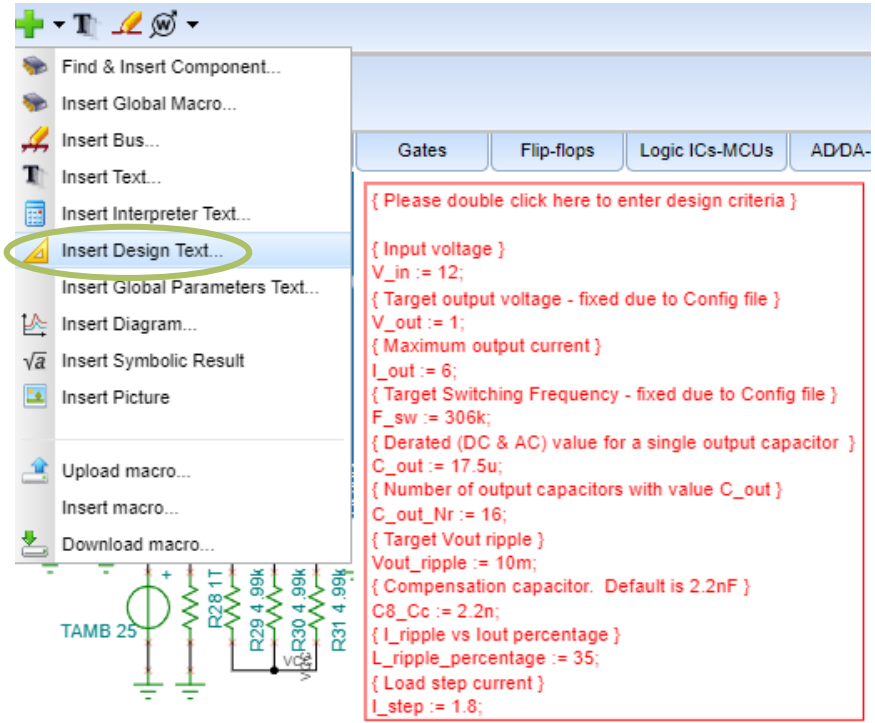
Insert Design Text (Interpreter Window) for quick access



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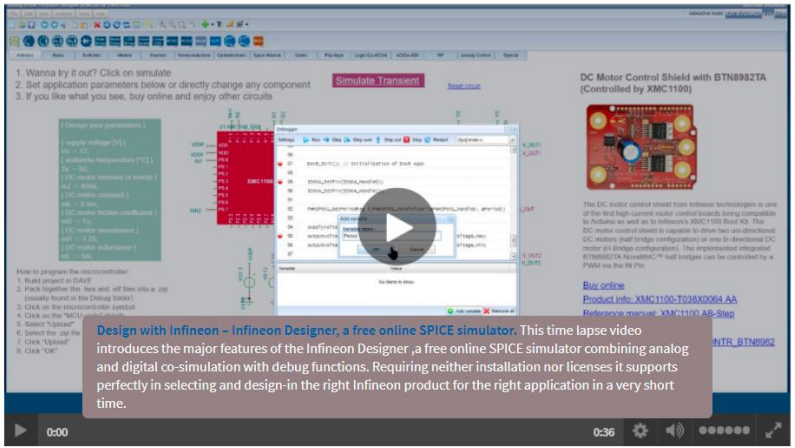
All MCU Circuits

- https://www.infineon.com/cms/en/tools/landing/ifxdesigner.html?search=true&keyword=microcontroller

- Video Getting Started Infineon Designer MCU



› Home › Tools › Infineon Tools

Infineon Designer – Online SPICE Simulator

› **Infineon Designer** is the first online prototyping engine combining analog and digital simulation functionalities in an internet application. Requiring a web browser only, it is a perfect match for supporting customers in selecting the right product for a defined application. Infineon Designer works intuitively in a very short time, and neither installation nor licenses are needed. Please start with one of the following application circuits.

Infineon Designer is powered by TINACloud the online circuit analyzer of DesignSoft. You can upgrade to the full version of › TINACloud or its offline version › TINA here: › https://www.tina.com/tinaupgrade

Showing 1 to 18 of 18 entries (filtered from 656 total entries) microcontroller

Circuit Reset All	Application Select	Product Category Select	Product Configuration	Description
24V smart High Side Switch shield with PROFET™ BTT6030-2ERA and BTT6020-1ERA for Arduino	Automotive power	Smart Switch Microcontroller	• BTT6030-2ERA • BTT6020-1ERA • XMC1100-T038X0064 AB • 24V_SHIELD_BTT6030	Read more
Stepper Motor Control Shield with IFX9201 & XMC1300 using Fullstep, Halfstep or Microstepping modes	Motor control	Motor Driver Microcontroller	• IFX9201SG • XMC1302-T038X0200 AB • KIT_XMC1300_IFX9201	Read more
12V DC Motor Control with BTN8982TA and XMC1100 for one uni-directional DC brushed motor	Motor control	Motor Driver Microcontroller	• XMC1100-T038F0064 AB • BTN8982TA	Read more
12V DC Motor Control Shield with BTN8982TA and XMC1100 for two uni-directional or one bi-directional DC brushed motor	Motor control	Motor Driver Microcontroller	• XMC1100-T038F0064 AB • BTN8982TA • DC-MOTORCONTR_BTN8982	Read more
48V inverse buck LED driver for RGB color controlling with BSR606N and XMC1200	LED lighting	Power MOSFET Microcontroller	• XMC1200-T038F0200 AB • BSR606N • KIT_LED_XMC1202_AS_01	Read more

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Solution: Digital Twin Circuit Simulation
simulate first on virtual system before building the real hardware

1 build application code project in ModusToolbox™

2 upload .elf .hex to simulator

.elf .hex

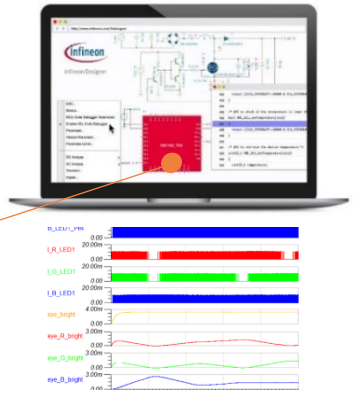
3 co-simulate XMC™ w/ SPICE

Value Proposition MCU co-simulation

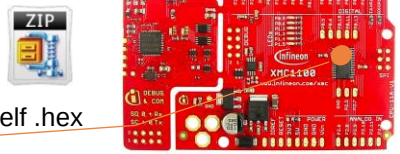
- **Time-to-market**: start developing before you have the hardware kit
- **Safety**: test on virtual system will not harm engineer or destroy hardware
- **Cost**: exploration of design space cheaper than building hardware many times
- **Security**: CCS controller lack a debug interface so code debugging can be only

4 run on real hardware kit

Simulation: Digital Twin



Real System



.elf .hex

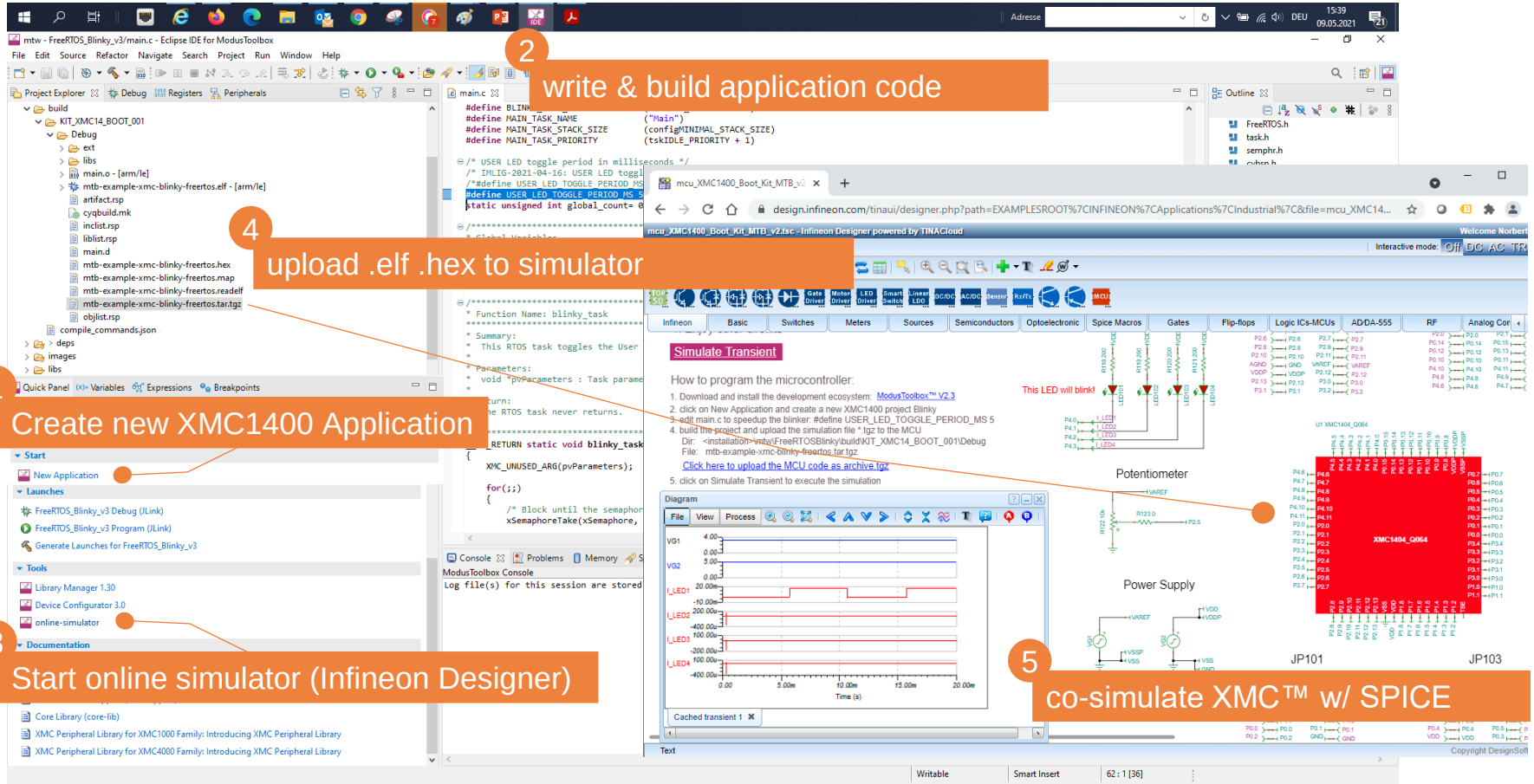
New Software Ecosystem: ModusToolbox™ Supporting XMC1400

https://softwaretools.infineon.com/tools?q=modus

Value Proposition

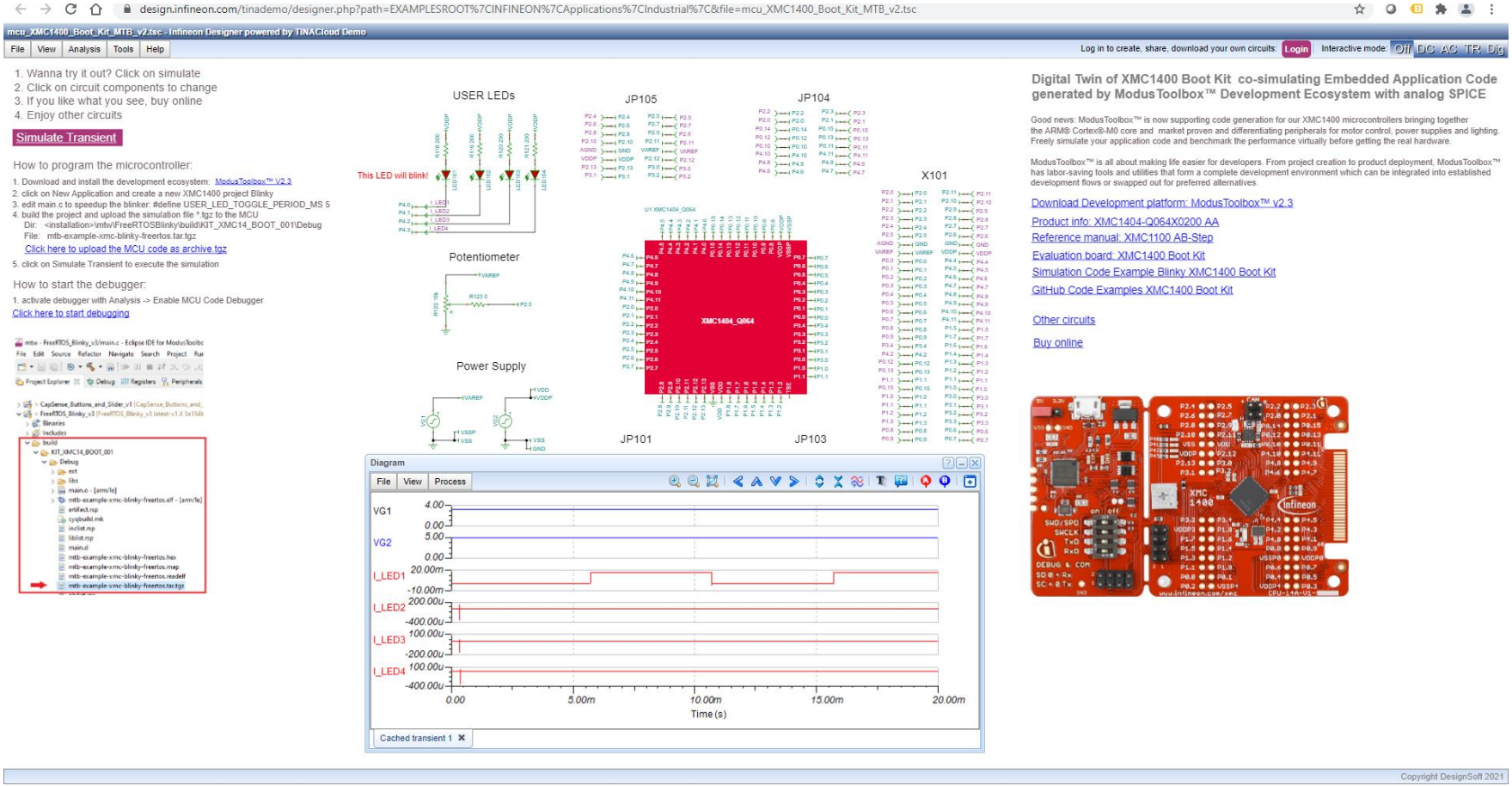
- **Flexible:** You can use any IDE in your own workflow (Eclipse, GNU Make, IAR Embedded Workbench, KEIL µVision; Visual Studio Code)
- **Cross platform**: Linux, macOS, Windows
- **GitHub software ecosystem driven by manifests**: Create a project with the latest version using Project Creator independent of any IDE and export to any IDE
- **Library Manager** Add, update, or remove libraries with the Library Manager
- **Kit & Board Support**: Includes board support packages (BSPs). Every release of every library is readily available
- **Tools & Configurators:** to set things up Device, CapSense, QSPI, Smart I/O, USB, Bluetooth, Segment LCD

ModusToolbox™ Design Flow



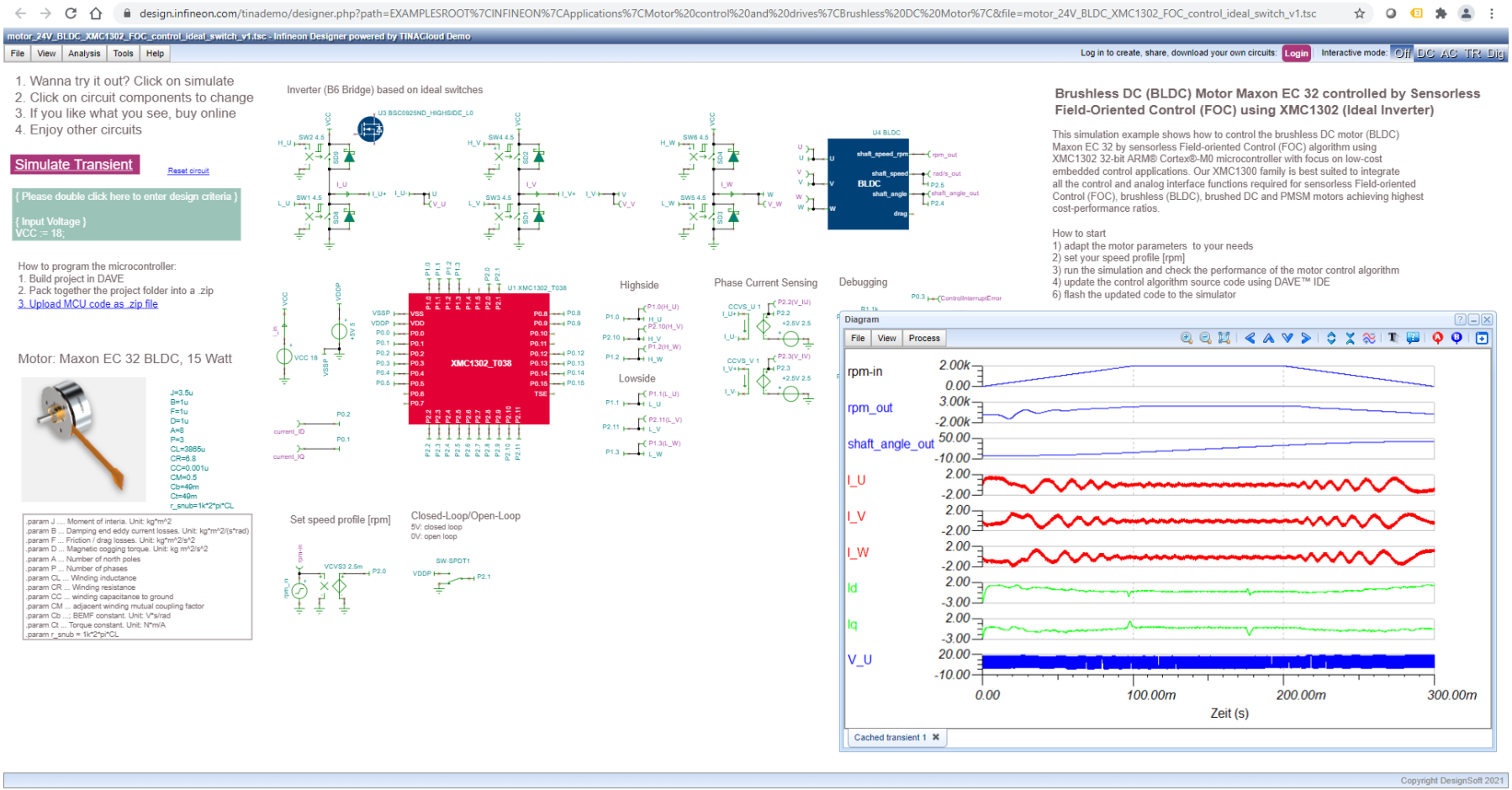
Demo 1: ModusToolbox™ IoT/Binky XMC1400

Start circuit design



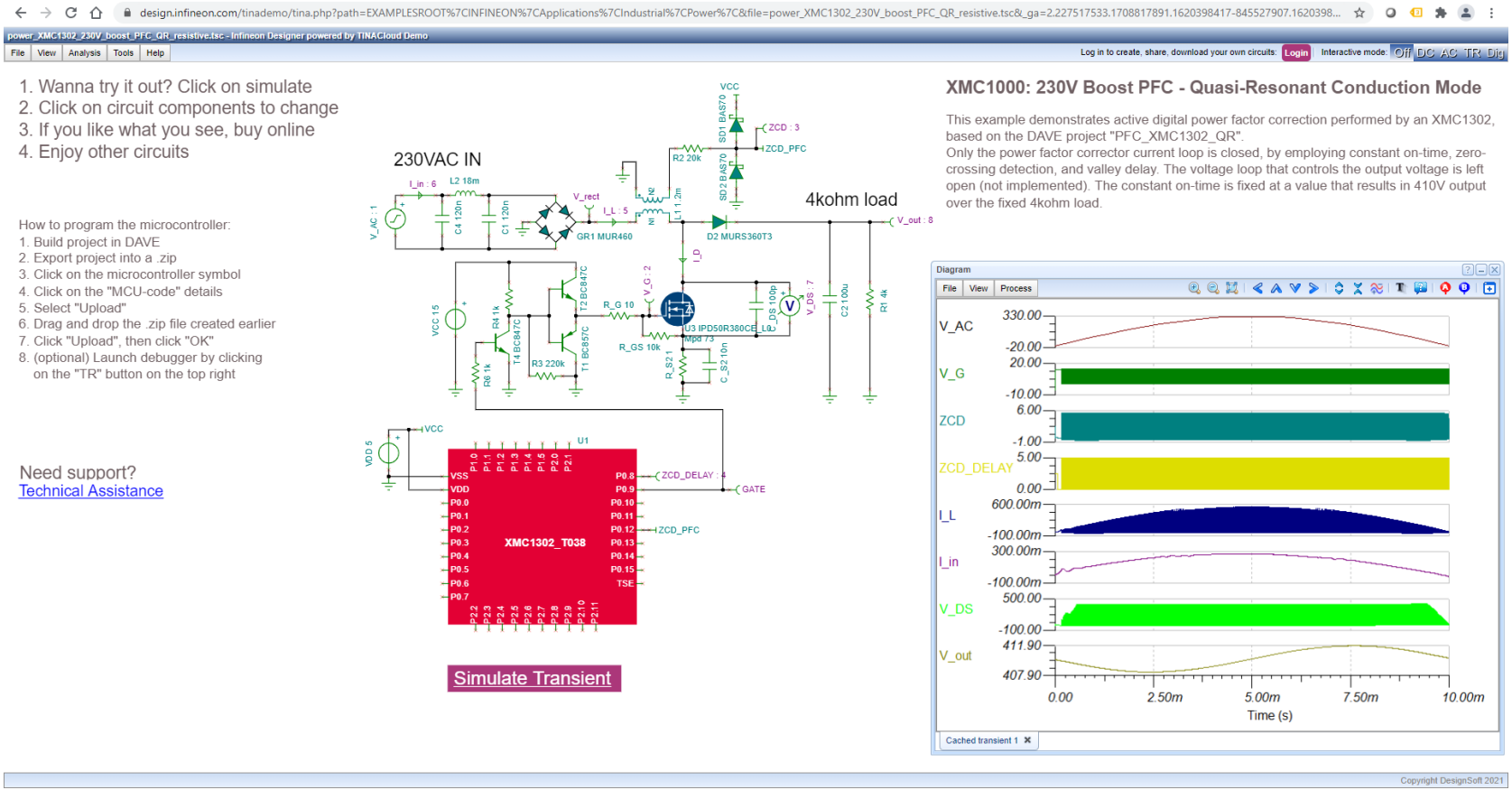
Demo 2: DAVE™ Motor Control/FOC XMC1300

Start circuit design



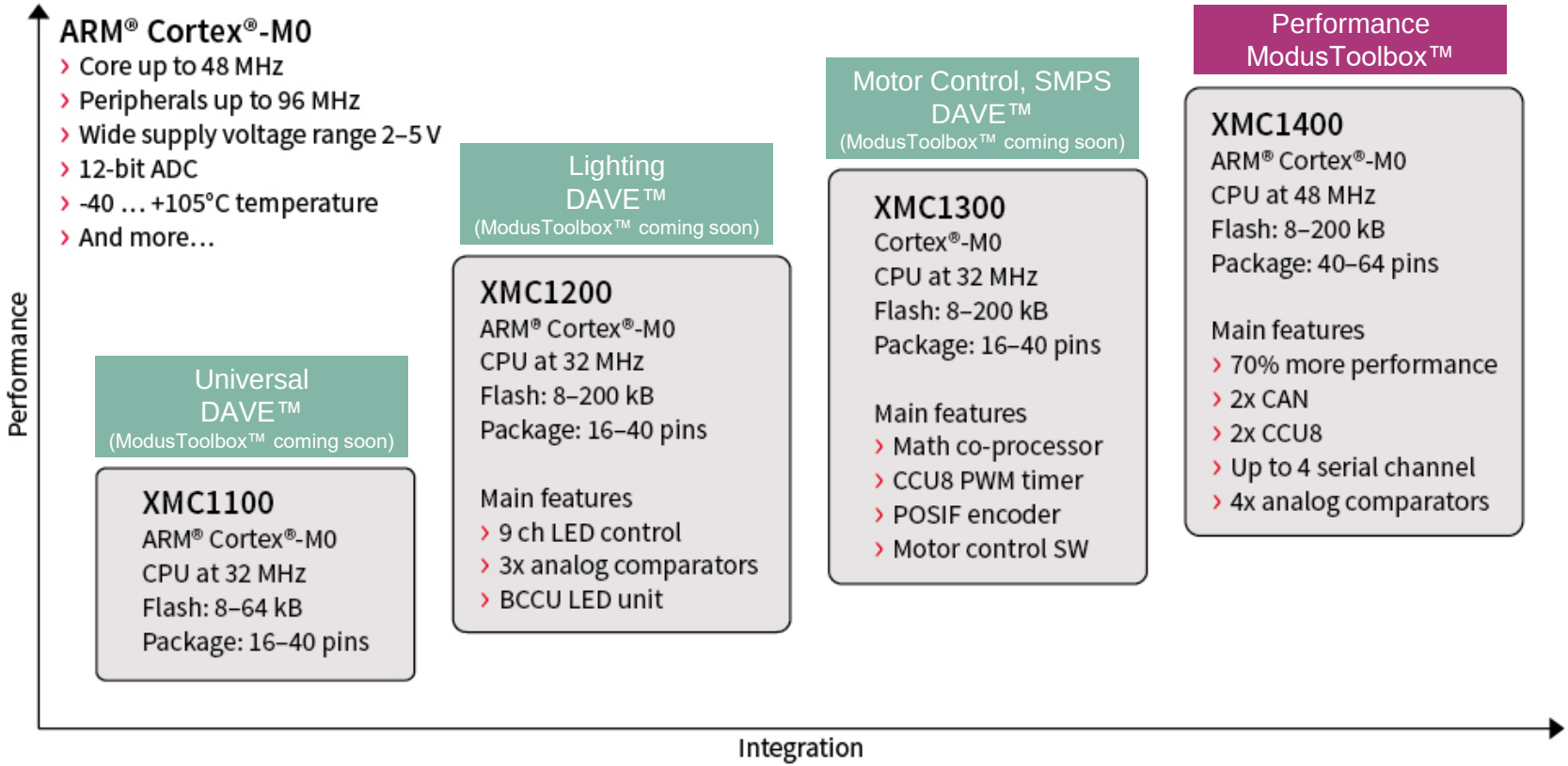
Demo 3: DAVE™ Power Supply/PFC XMC1300

Start circuit design



Simulation: 32-bit XMC1000™ Industrial MCU Arm® Cortex®-M

https://www.infineon.com/cms/en/product/microcontroller/32-bit-industrial-microcontroller-based-on-arm-cortex-m/?redirId=41403#!simulation



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Summary: what to remember…

Use Infineon Designer SPICE simulator to check the electrical & thermal performance of your products & solutions

Use ModusToolbox™ ecosystem to enable rapid development of Infineon MCUs, covering connected IoT applications like motor control, power supply and cloud-connected solutions

Combine both to co-simulate & debug MCU software together with hardware by using Infineon Designer – online SPICE simulator integrated into ModusToolbox™

More to come in December 2021, New integrated webpage release with all software & tools as one interface to customers (Infineon Toolbox/Developer Center)

Resource List & Support
https://www.infineon.com/tools

Finder Tools

- Infineon Solution Finder
- Infineon Product Finder
- Infineon Evaluation Board Finder
- Infineon Simulation Models

Hardware Simulation Tools

Thermal design

- Infineon IPOSIM Power Simulation for Power Modules and Disk Devices
- Infineon Power Simulation for Integrated Power Modules (IPM) powered by PLECS
- Infineon Power Simulation for discrete IGBTs powered by PLECS

Electrical & software design

- Infineon Designer powered by TINACloud
- PowerEsim Simulation for Switched-Mode Power Supply (SMPS)

Magnetic design

- Infineon Magnetic Sensor Design Tools

Software & Tools

- Infineon Toolbox (future: Infineon Developer Center)

Software Development Tools

- ModusToolbox™ Software and Tools
- TriCore™ Development Tools for AURIX™ 32-bit Automotive Microcontroller based on TriCore™
- DAVE™ Development Platform for XMC™ 32-bit Industrial Microcontroller based on ARM® Cortex®-M

Infineon Support & Distribution Partners

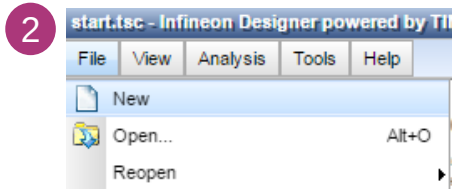
- Technical Support Center
- Forums Cypress Developer Community
- Newsletter for Engineers
- Orderable Part Number (OPN) Finder
- Where to Buy your Products

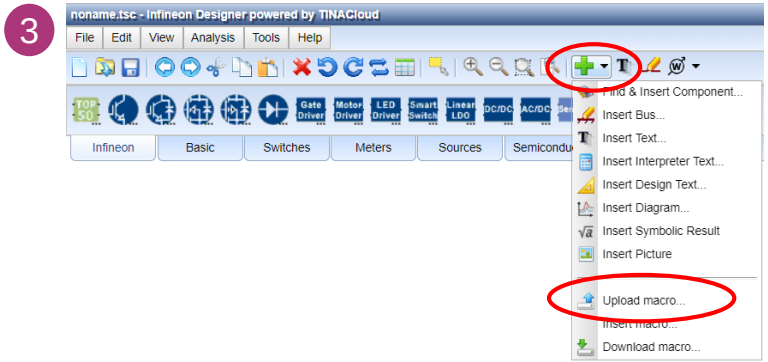
Part of your life. Part of tomorrow.

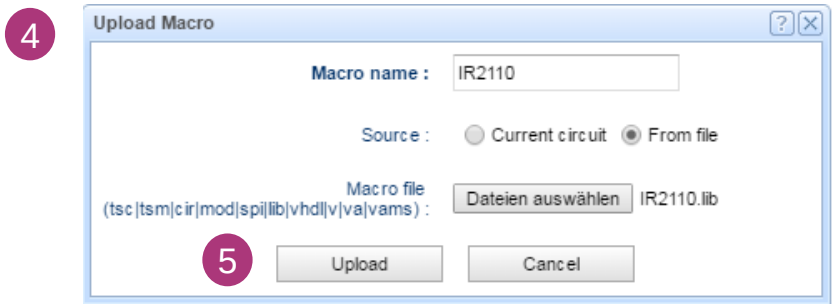
Tips & Tricks

Enlarge the editor area	› Menu >> View >> Full-screen (full-screen & remove banner) › F11 (Browser full-screen) › Component view
Edit circuit	› Zoom-in/out: mouse scroll, or key [Shift ⇧] + drag for zoom-in › Wire connection: see demonstration › Multi-selection: see demonstration › Circuit view shifting: see demonstration
Search text	› Key combination [Ctrl] + [F] • Search components in circuit editor • Search variable in design tool editor
Solve artifacts	› browser and server caching issues • revert to original (Menu >> File >> Revert to original) • change language (Menu >> View >> Language)
Import additional SPICE models	› First menu bar  >> Upload macros… › Then menu bar  >> Insert macros…
More features offline	› Menu >> Help >> Order or Upgrade… › Upgrade to TINA Industrial offline version: www.tina.com

How To Import A SPICE Model (Part 1/2)





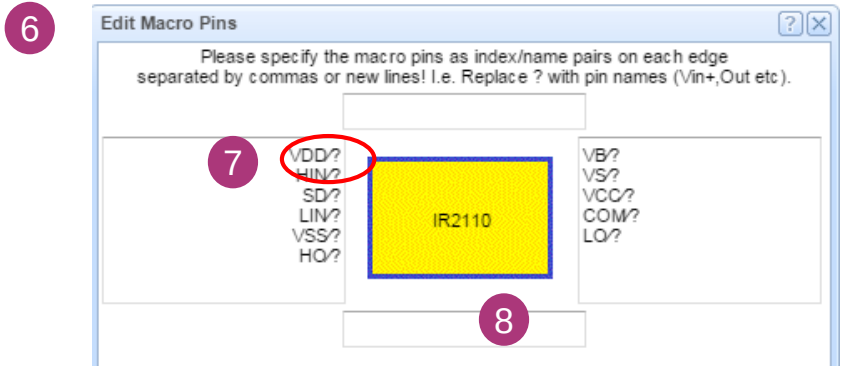


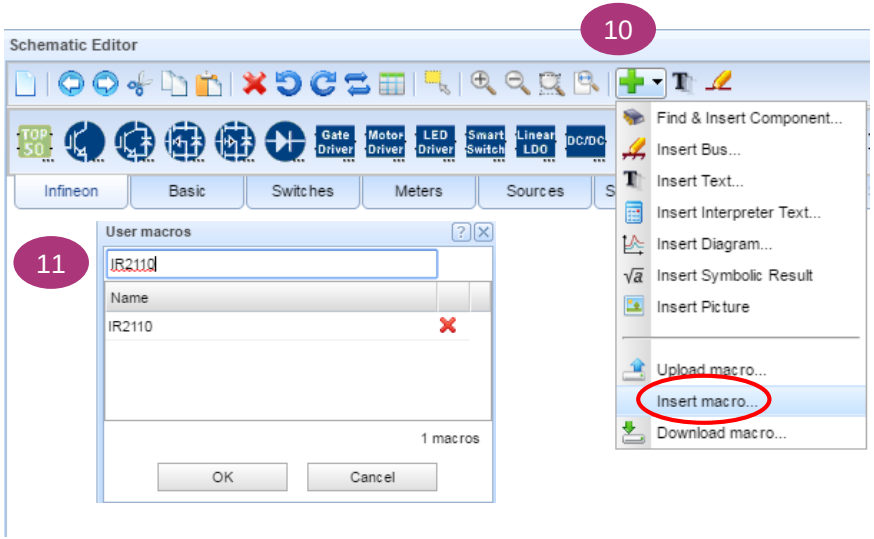
1. Login with your myInfineon account
2. Select File -> New, create a new circuit
3. Click menu bar symbol and click “Upload macro…”
4. Name your model, select “from file”, and browse to your SPICE model in .SUBCKT format
5. Click on “Upload”

Example Model OrCAD Capture for IR2110

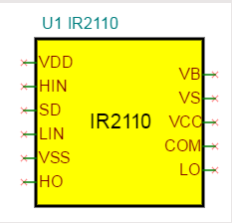
```
.SUBCKT IR2110 VDD HIN  SD
LIN  VSS HO  VB VS VCC COM
LO
+PARAMS:
+       T1=-40 T2=25
T3=125
...
.ENDS   IR2110
```

How To Import a SPICE Model (Part 2/2)





6. Edit symbol pin layout
7. Optional: Replace “?” with new pin name in symbol
   Example: VDD/? -> VDD/VDD
8. Optional: place pins on top, left, right, bottom
9. Click on OK to upload macro
10. Click menu bar symbol and click “Insert macro…”
11. Select IR2110 macro and place it on your schematic



12. Finalize your circuit and Save it with “Save -> Save as”
13. Test your circuit