



Infiniteon XMC™ Microcontroller Co-Simulation

IPCEI on ME - Important Project of Common European Interest on Microelectronics

Infiniteon Technologies AG

2025-04-14



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IPCEI Homepage

<https://www.infineon.com/cms/austria/en/IPCEI-on-ME>



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IPCEI on ME

Infineon Technologies Austria – Part of IPCEI Microelectronics

Infineon's power semiconductors are deployed in key markets such as automotive, energy, digital and industrial equipment. These power electronics solutions also drive innovation in environmental sustainability, energy-efficiency and reduction of CO₂ emissions.

Infineon's IPCEI spillover activities include the following areas:

- **STEM education and talent**
Infineon Austria will actively involve educational institutions and STEM talent, from pupils to PhDs.



2

PhD collaboration

Student internships

University collaboration

Knowledge hub

Online workshops & webinars

Contact

3

Event	Date	Time	
Microcontroller Co-Simulation	18.10.2023	10:00 - 11:00	> More information
		New time!	
Digital Power Supply Simulation	18.10.2023	11:00 - 12:00	> More information
		New time!	
Online LCC development tool	28.11.2023	13:00 - 14:00	> More information

Quick design of a flyback converter	28.11.2023	14:00 - 15:00	> More information
Application driven development Part I: USB-PowerDelivery	13.12.2023	14:00 – 15:00	> More information
Application driven development Part II: Embedded Coding	13.12.2023	15:00 - 16:00	> More information
Application driven development Part III: Cloud Co-Simulation	13.12.2023	16:00 - 17:00	> More information

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Driving decarbonization and digitalization. Together.



Semiconductors are crucial to solve the energy challenges of our time and shape the digital transformation.

This is why Infineon is committed to actively driving decarbonization and digitalization.

As a global semiconductor leader in power systems and IoT, we enable game-changing solutions for green and efficient energy, clean and safe mobility, as well as smart and secure IoT.

We make life easier, safer, and greener.
Together with our customers and partners.
For a better tomorrow.

Infineon is a global leader in power systems and IoT

Global leader

in automotive, power management,
energy efficient technologies and IoT

~58,060

employees¹

Market position

Automotive

#1

TechInsights,
April 2024

Power

#1

Omdia,
October 2024

Microcontroller

#1

Omdia,
March 2025

¹ As of 30 September 2024



Infineon at a glance

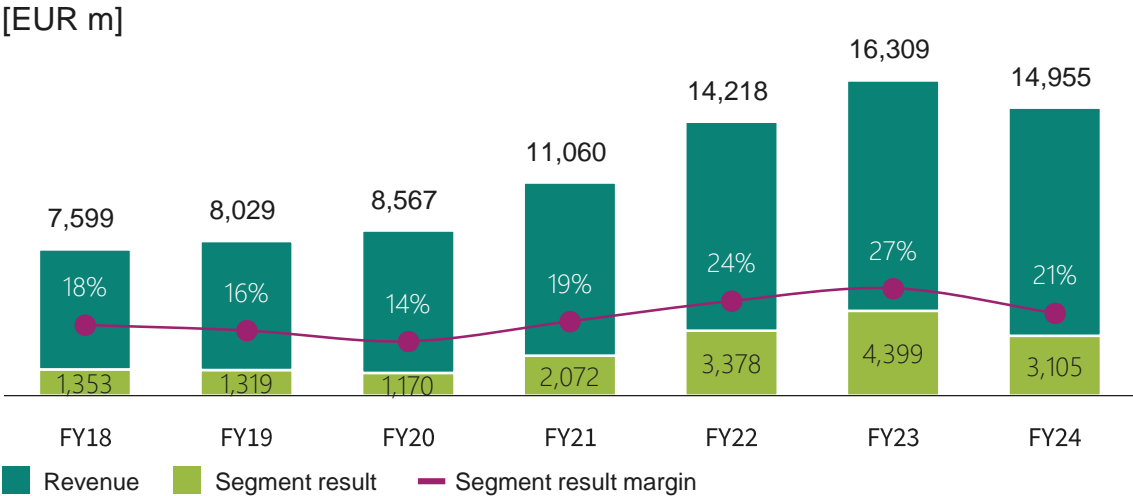
Growth areas

Energy
green and efficient

Mobility
clean and safe

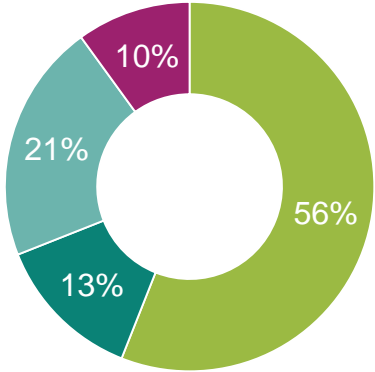
IoT
smart and secure

Financials



FY24 revenue by segment¹

- Automotive (ATV)
- Green Industrial Power (GIP)
- Power & Sensor Systems (PSS)
- Connected Secure Systems (CSS)

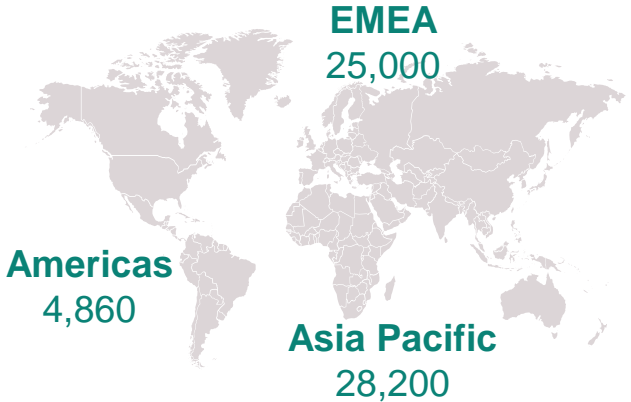


Employees¹

58,060
employees worldwide

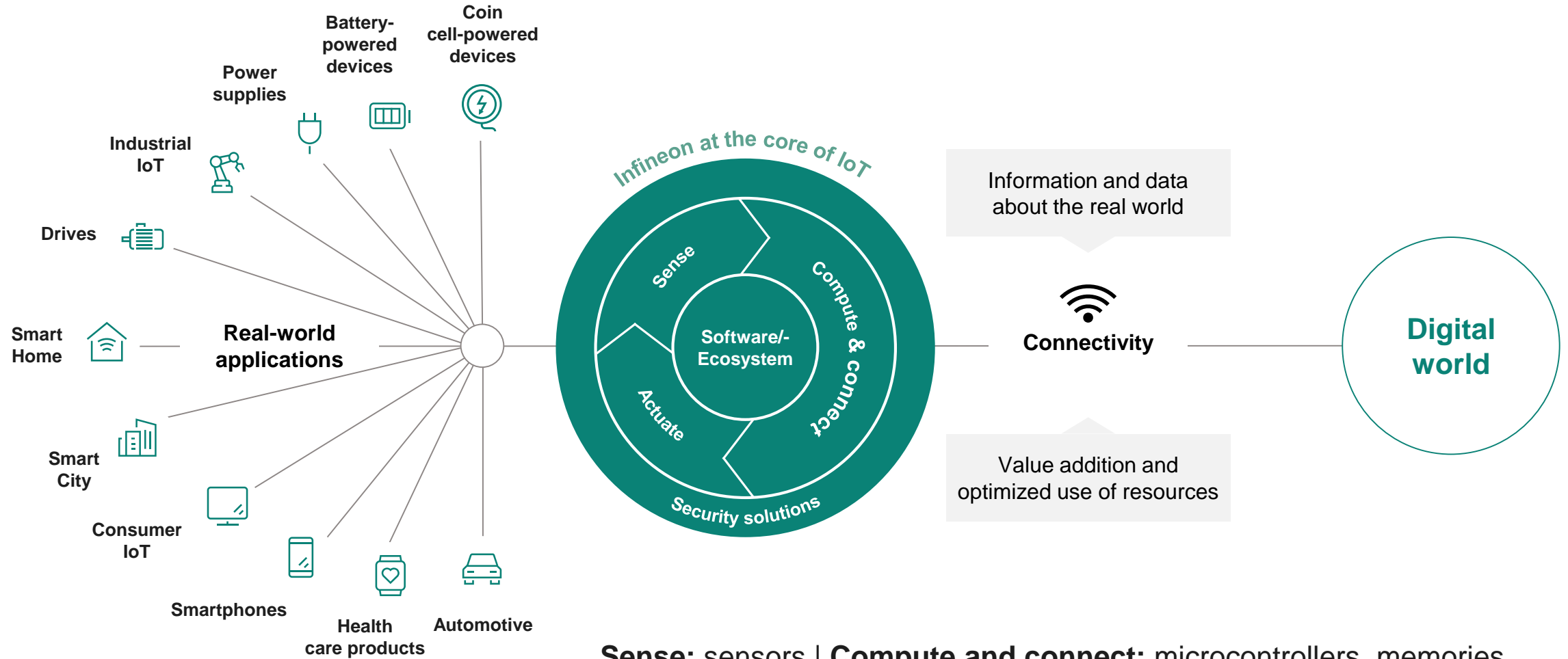
71
R&D and

15
manufacturing locations²



For further information: [Infineon Annual Report](#).
¹ 2024 Fiscal year (as of 30 September 2024) | ² As of 30 September 2024

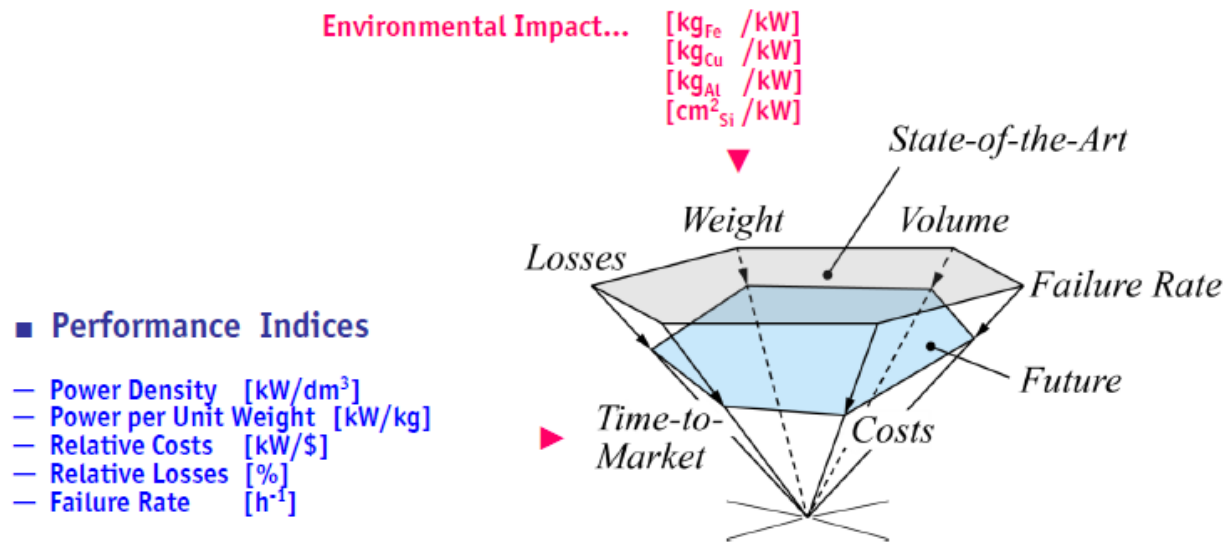
Infineon at the core of IoT – Driving digitalization by serving strongly growing multi-application markets



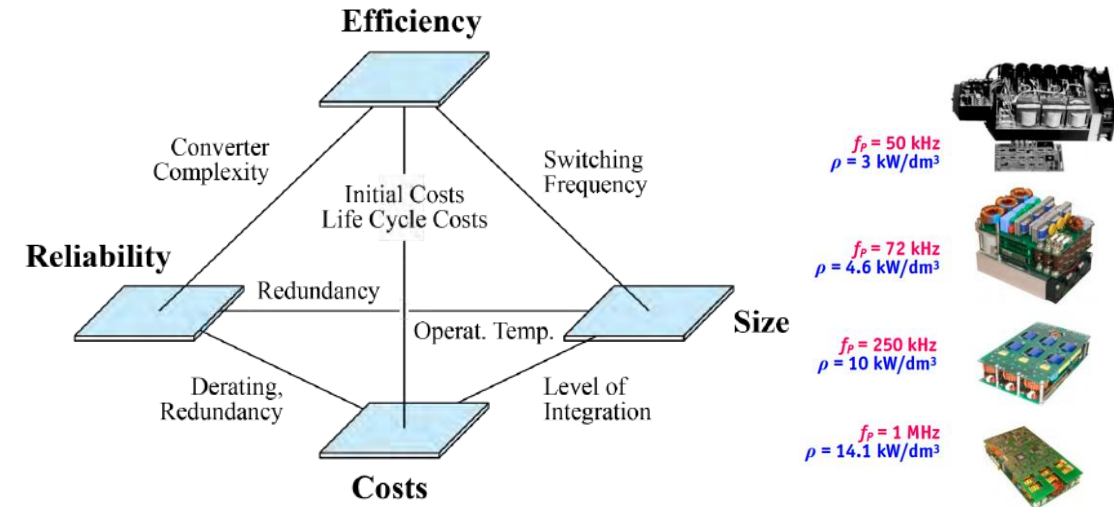
Sense: sensors | **Compute and connect:** microcontrollers, memories, Wi-Fi, Bluetooth, BLE, USB | **Actuate:** Power semiconductors

Power Converter Optimization Challenge

Design Space Exploration



Trade-off Finding



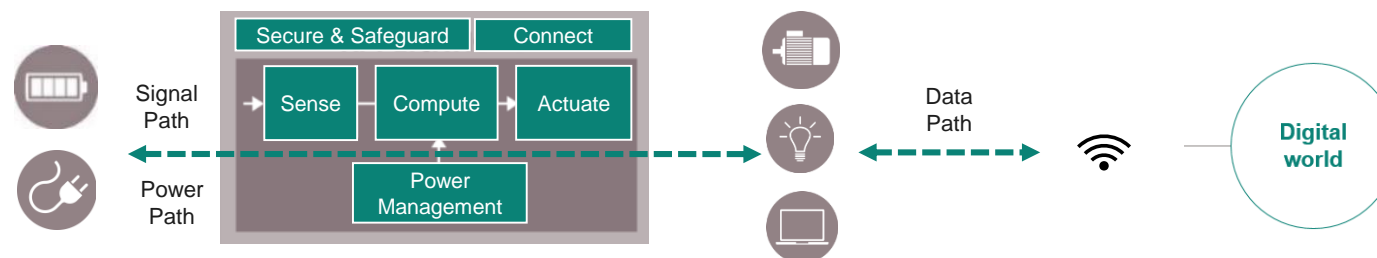
- [\[Burkart Kolar1\]](#) Ralph M. Burkart & Johann W. Kolar: Tutorial Advanced Modeling and Multi-Objective Optimization / Evaluation of SiC Converter Systems, ETH Zurich, Power Electronic Systems Laboratory

Simulation Platforms: proven way to design-win

Infineon Developer Center
<https://softwaretools.infineon.com>

Selection Tools
[Solution Finder](#)

Simulation Tools
 Aspects
 Online
 Offline



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

Sense	Compute	Actuate	Connect	Secure & Safeguard
<ul style="list-style-type: none"> › Does the sensor switch at the right position? 	<ul style="list-style-type: none"> › Is my design stable? › Does my software run w/o errors? 	<ul style="list-style-type: none"> › What is the overall efficiency? › Does my design not overheat? 	<ul style="list-style-type: none"> › Is my solution safe? › Is my solution secure? 	
Magnetic design	Electrical design		Thermal design	
	Software design (Controller)		Software Design (Protocols, Safety/Security)	
Sensor Tools (3D, Angle & Hall sensors)	Infineon Designer (MOSFET, IGBT, Gate Driver IC, Voltage Regulator, Audio Class D, MCU) 		 	
	 TINA Spice, PSpice, SIMetrix, [LTspice ¹]		 ModusToolbox™ AURIX™ Development Studio	

¹ Discrete switches & diodes only

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Infinite Designer - Online SPICE Engine

<https://www.infineon.com/cms/en/about-infineon/press/market-news/2016/INFXX201610-008.html>



Online prototyping made easy with Infineon Designer

Oct 27, 2016 | Market News

Munich, Germany – October 27, 2016 – Starting at electronica 2016, Infineon Technologies AG (FSE: IFX / OTCQX: IFNNY) introduces Infineon Designer: 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.

Infineon Designer features a wealth of application circuits in the domain of Industrial Power, Lighting, Motor Control and Mobile/Rf frontend design. It enables analog/digital co-simulation of the 32-bit XMC1000 industrial microcontroller ARM® Cortex®-M0 series, using the free-of-charge code generation platform DAVE™. The digital prototyping engine Infineon Designer aims at making the transition from idea to functional system as smooth and fast as possible. It allows for prototyping a “soft evaluation board” with all functional parameters. In an early stage, hardware for testing and iterations can thus be saved.


The prototyping tool is based on the easy-to-use TINACloud environment from > [DesignSoft](#), who partnered with Infineon in this project. TINACloud is the online version of the TINA circuit simulation software running on multiple platforms such as PC, laptop, mobile, and tablets. Analog circuits are modeled in SPICE and can be co-simulated with digital systems using hardware description languages such as VHDL and Verilog or C language. For a greater market penetration, the frontend supports multiple languages.

Infineon Designer can be accessed at > www.infineon.com/ifxdesigner by November 8, 2016. At electronica 2016, Infineon will demonstrate the functionality of the prototyping engine with Arduino shields for > [lighting](#) and > [motor control](#) applications and compare the results with real hardware. The demonstration is part of the “Maker’s corner”.


Infineon at electronica 2016 (November 8–11, 2016, Munich, Germany)

The world is getting smarter and more connected by the day. At electronica 2016 Infineon presents exciting demos and product solutions that are making tomorrow’s cars, factories and homes smart, secure and energy-efficient. New products and demos can be discovered at

Press Contact

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T +49 89 234 25869
> [Send E-mail](#)

Download

 **Infineon-Designer**
JPG | 838 kb | 2126 x 1535 px
> [more](#)

- › Launched at Electronica 2016
- › Online, no installation, no license fee, easy to use
- › 1000+ 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)

Infinite Designer Server Infrastructure

www.infineon.com/ifxdesigner



Infinite Server

www.infineon.com/ifxdesigner



Demo mode

No registration needed (no circuit editor)

<https://design.infineon.com/tinademo/designer.php>

Expert mode

Please register [here](#) (full version):

<https://design.infineon.com/tinaui/designer.php>

Registration to myInfineon

<https://www.infineon.com/cms/en/myInfineon/benefits/>

DesignSoft Server

www.tinacloud.com

Upgrade



Industrial version



TINA-TI
SPICE-based analog simulation program

Firewall

Online
DesignSoft
Excellence in Computer Aided Design and Educational Software

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 family
- › Instruction cycle accurate co-simulation including peripheral support
- › ModusToolbox™ replacing DAVE™ IDE for code generation
- › New: XMC4400 simulation

Infineon Designer Features



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Thermal & System Efficiency Simulation

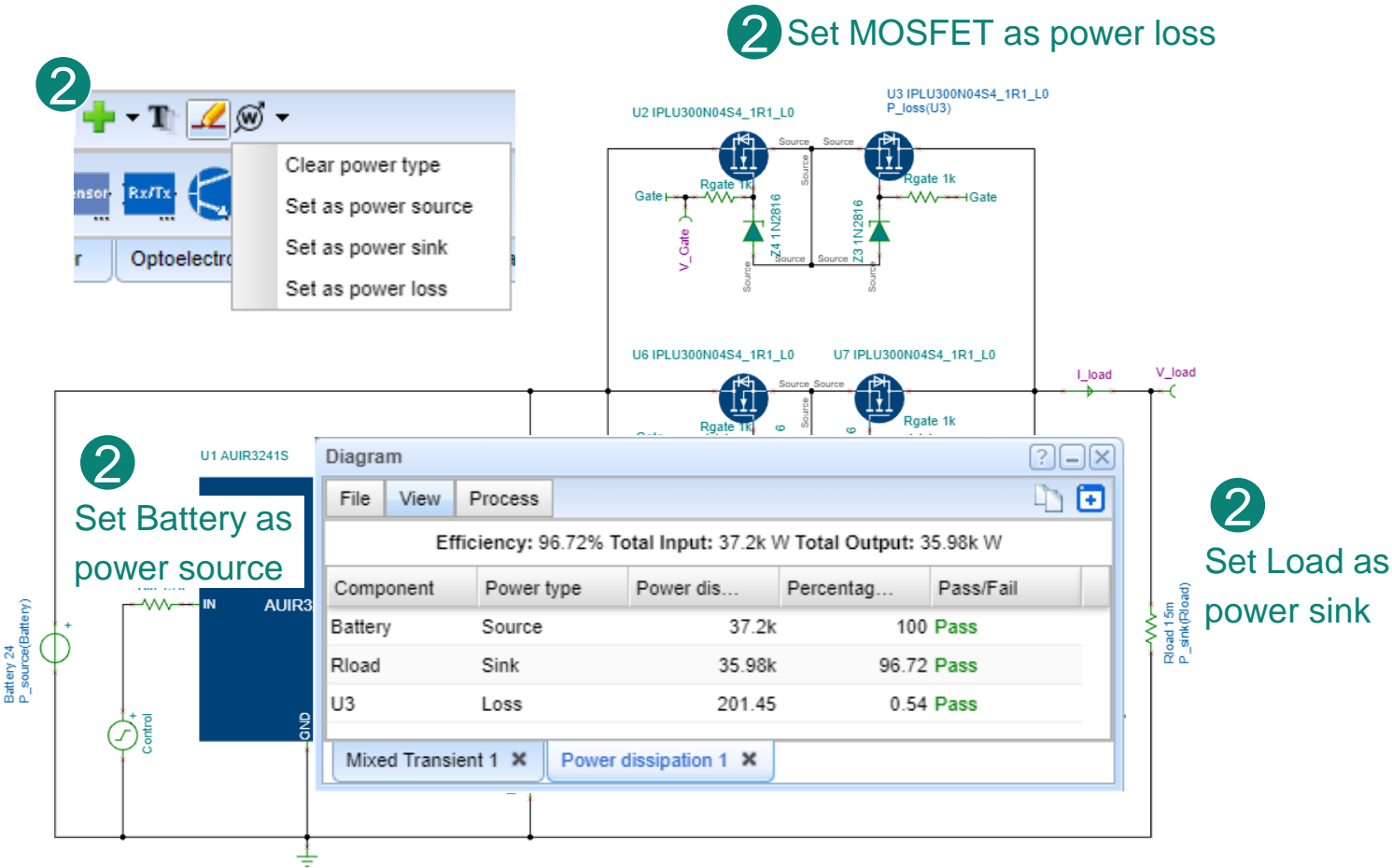
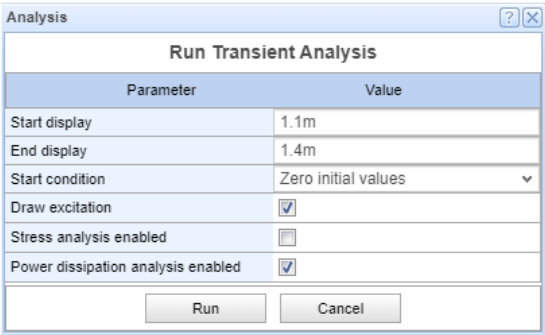
24V Automotive Battery Switch Demonstrator



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



- | | | | | |
|----------------------------------|-------------------------------------|--|---|---|
| › Component losses | › Infineon product footprints | › Detailed BoM including type, value, footprint, part number, description, manufacturer and more | › Fast configuration of circuit variables and global parameters | › Support of XMC1000 family |
| › Component junction temperature | › Passive component footprints | › Export to excel or print to PDF | › Individual function programming | › Instruction cycle accurate co-simulation including peripheral support |
| › Steady-state system efficiency | › Altium PCB project with schematic | | | › ModusToolbox™ replacing DAVE™ IDE for code generation |
| | | | | › New: XMC4400 simulation |

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

1

60_digital_12Vin_1.0Vo_306KHz_6A_singleOut_intLDO_integrated_POL_TR_V2.TSC - Infineon Designer powered by TINACloud

File Edit View Analysis Tools Help

New Open... Reopen Revert to original Save... Save as... Report Check eTailer availability... Check SPICE model availability... Download Upload... Bill of Materials... Share... Logout

as TSC... as version 11 TSC... as version 10 TSC... as version 9 TSC... as version 7 TSC... as CIR as Altium archive... as XML...

2

IR38060

Usage of this website is subject to our Usage Terms

IR38060_digital_12....zip

Name	Name
IR38060_digital_12Vin_1.0Vo_306KHz_6A_singleOut_intLDO_integrated_POL_TR_V2	CAPAE660X600N
IR38060_digital_12Vin_1.0Vo_306KHz_6A_singleOut_intLDO_integrated_POL_TR_V2.PrjPcbStructure	INDM108103X400N
IR38060_digital_12Vin_1.0Vo_306KHz_6A_singleOut_intLDO_integrated_POL_TR_V2	IR38060-V
	RESC0603X26N

Export to Altium PCB

1.0V 6A Single Output Integrated PoL Solution IR38060

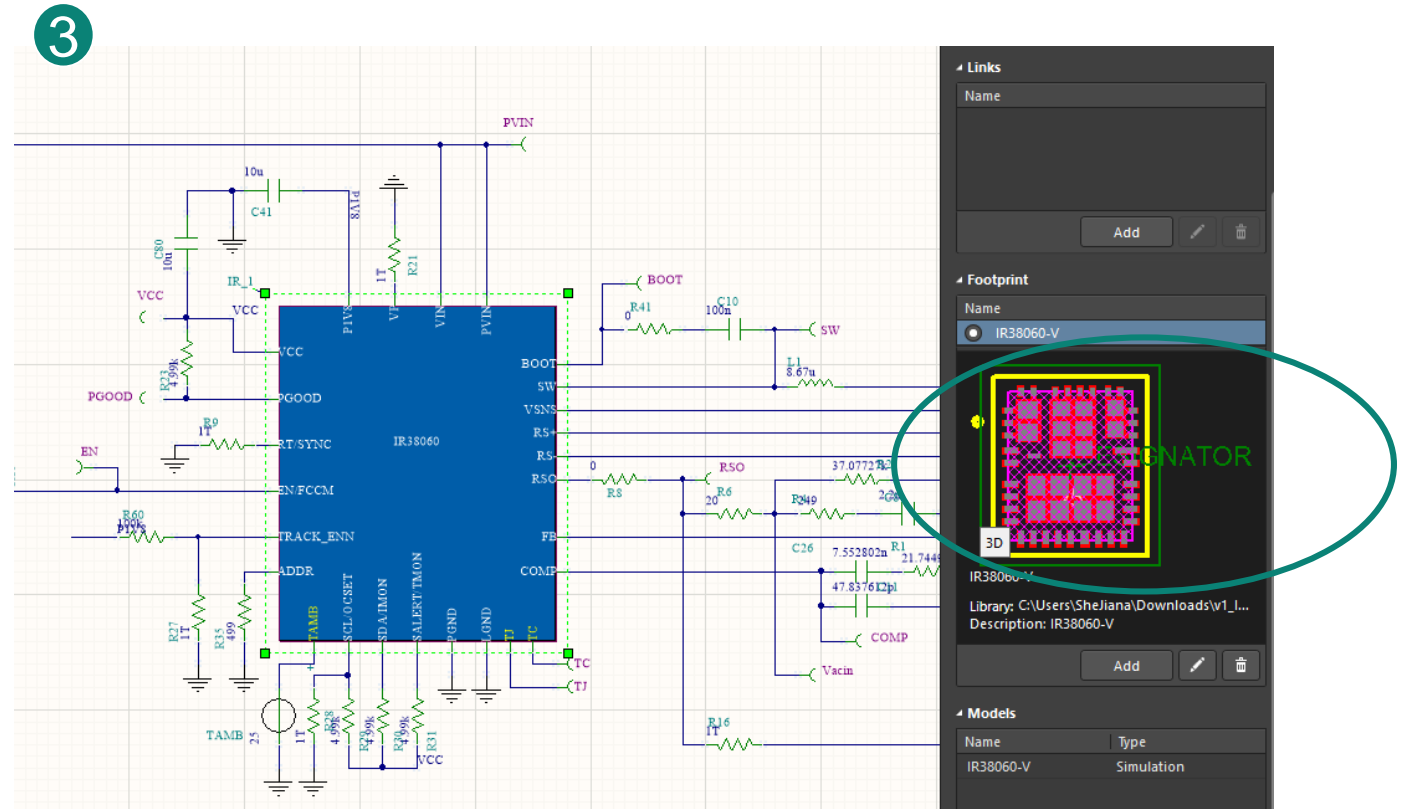
1. Open circuit and login with myInfineon account



2. Download as Altium archive and check



3. Open project in Altium and start PCB design



Infineon Designer Features



- | | | | | |
|----------------------------------|-------------------------------------|--|---|---|
| › Component losses | › Infineon product footprints | › Detailed BoM including type, value, footprint, part number, description, manufacturer and more | › Fast configuration of circuit variables and global parameters | › Support of XMC1000 family |
| › Component junction temperature | › Passive component footprints | › Export to excel or print to PDF | › Individual function programming | › Instruction cycle accurate co-simulation including peripheral support |
| › Steady-state system efficiency | › Altium PCB project with schematic | | | › ModusToolbox™ replacing DAVE™ IDE for code generation |
| | | | | › New: XMC4400 simulation |

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

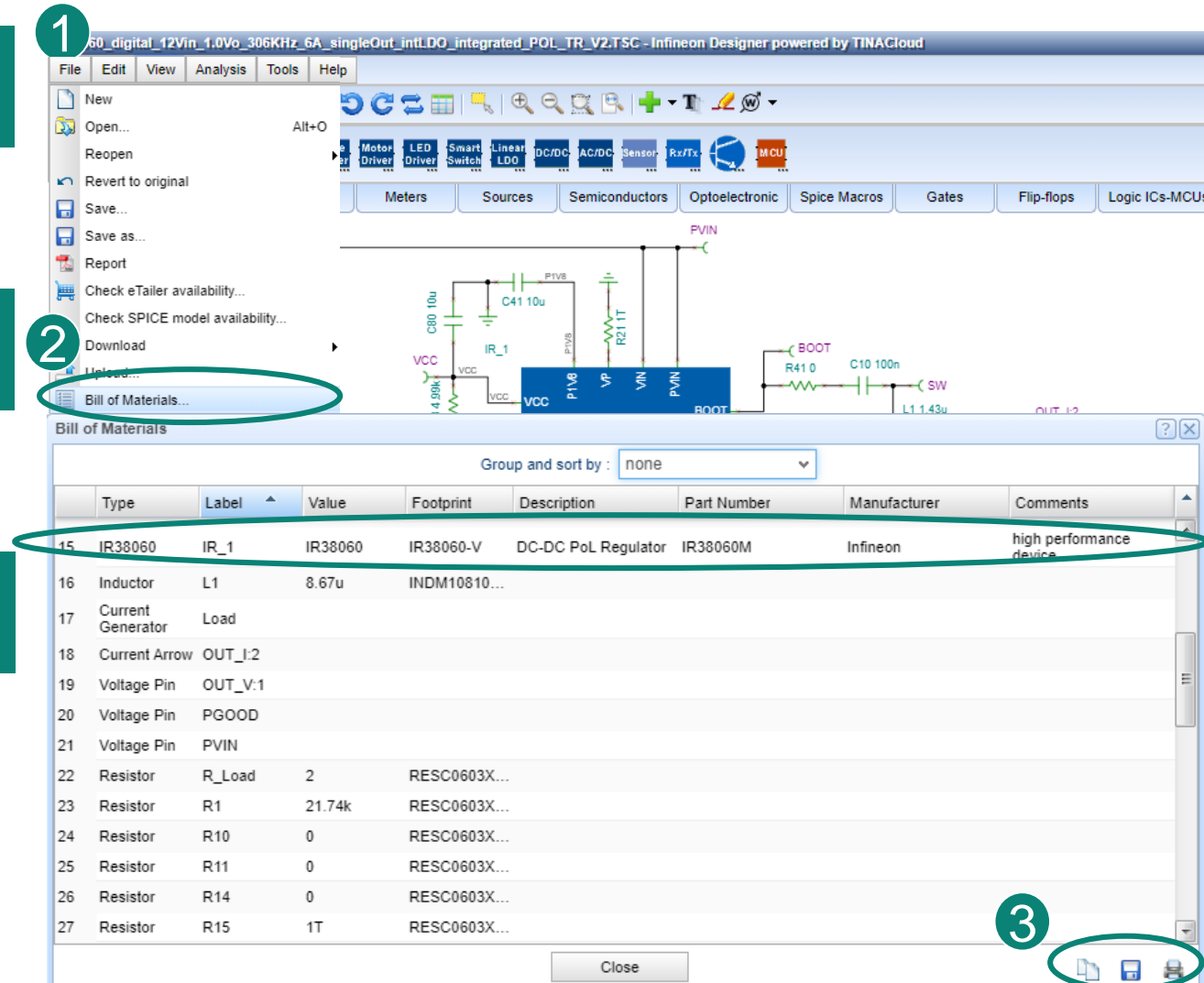
3. Save to Excel .csv



1

2

3



Type	Label	Value	Footprint	Description	Part Number	Manufacturer	Comments
15	IR38060	IR_1	IR38060	DC-DC PoL Regulator	IR38060M	Infineon	high performance device
16	Inductor	L1	8.67u	INDM10810...			
17	Current Generator	Load					
18	Current Arrow	OUT_I:2					
19	Voltage Pin	OUT_V:1					
20	Voltage Pin	PGOOD					
21	Voltage Pin	PVIN					
22	Resistor	R_Load	2	RESC0603X...			
23	Resistor	R1	21.74k	RESC0603X...			
24	Resistor	R10	0	RESC0603X...			
25	Resistor	R11	0	RESC0603X...			
26	Resistor	R14	0	RESC0603X...			
27	Resistor	R15	1T	RESC0603X...			

Infineon Designer Features



- | | | | | |
|----------------------------------|-------------------------------------|--|---|---|
| › Component losses | › Infineon product footprints | › Detailed BoM including type, value, footprint, part number, description, manufacturer and more | › Fast configuration of circuit variables and global parameters | › Support of XMC1000 family |
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| | | | | › New: XMC4400 simulation |

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

1. Wanna try it out? Click on analysis
2. Double click on green window to design
3. If you like what you see, buy online
4. Enjoy other circuits

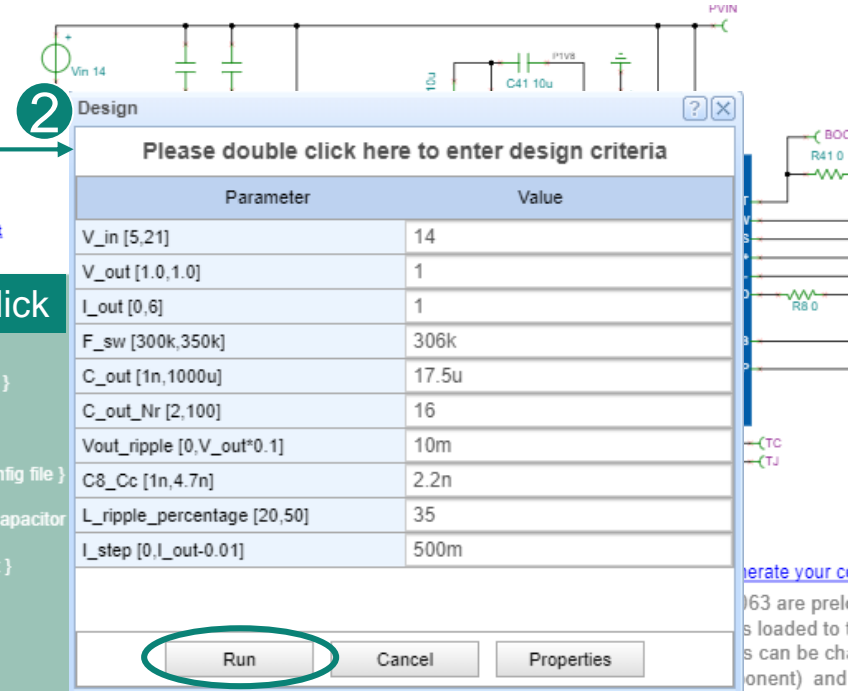
Transient Analysis - fast

Transient Analysis - accurate

Reset circuit

Double click

```
{ Please double click here }  
{ Input voltage }  
V_in := 14;  
{ Target output voltage - fixed due to Config file }  
V_out := 1;  
{ Maximum output current }  
I_out := 4;  
{ Target Switching Frequency - fixed due to Config file }  
F_sw := 306k;  
{ Derated (DC & AC) value for a single output capacitor }  
C_out := 17.5u;  
{ Number of output capacitors with value C_out }  
C_out_Nr := 16;  
{ Target Vout ripple }  
Vout_ripple := 10m;  
{ Compensation capacitor. Default is 2.2nF }  
C8_Cc := 2.2n;  
{ L_ripple vs Iout percentage }  
L_ripple_percentage := 35;  
{ Load step current }  
I_step := 500m;
```



The screenshot shows a circuit diagram with components like Vin 14, C41 10u, and P1V8. A 'Design' dialog box is open, prompting the user to double-click to enter design criteria. The dialog contains a table of parameters and their values.

Parameter	Value
V_in [5,21]	14
V_out [1.0,1.0]	1
I_out [0,6]	1
F_sw [300k,350k]	306k
C_out [1n,1000u]	17.5u
C_out_Nr [2,100]	16
Vout_ripple [0,V_out*0.1]	10m
C8_Cc [1n,4.7n]	2.2n
L_ripple_percentage [20,50]	35
I_step [0,I_out*0.01]	500m

At the bottom of the dialog, there are three buttons: 'Run' (circled in red), 'Cancel', and 'Properties'.

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

Infineon Designer Features



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Digital Twin Circuit Simulation

simulate first on virtual system before building the real hardware

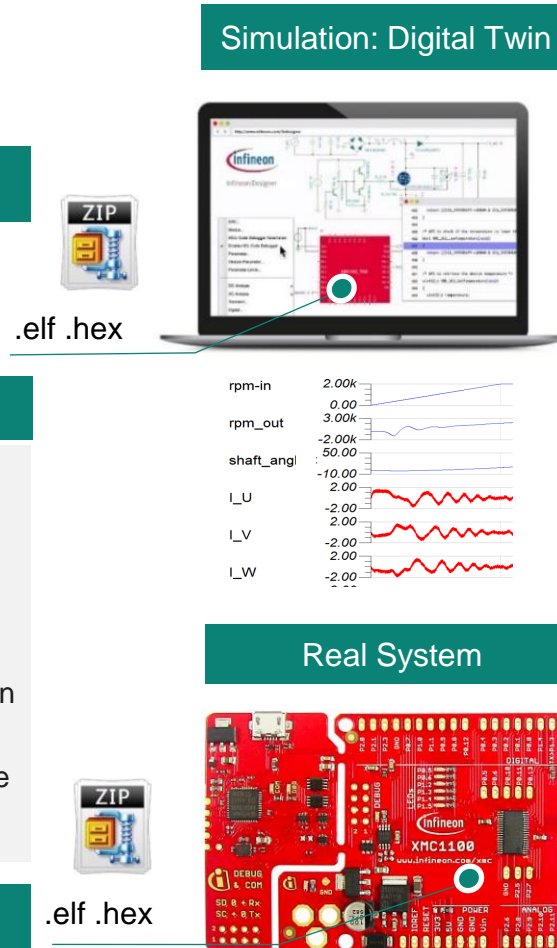
1 build application code project in ModusToolbox™ or DAVE™ IDE

2 upload .elf .hex to simulator

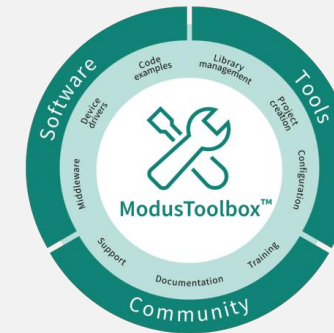
3 co-simulate XMC™ w/ SPICE

1. Value Proposition MCU co-simulation
2. Time-to-market: start developing before you have the hardware kit
3. Safety: test on virtual system will not harm engineer or destroy hardware
4. Cost: exploration of design space cheaper than building hardware many times
5. Security: CSS controller lack a debug interface so code debugging can be only

4 run on real hardware kit



<https://www.infineon.com/modustoolbox>



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™ Example

Digital Twin of XMC1400 Boot Kit co-simulating Application Code generated by ModusToolbox™



1 Create new XMC1400 Application

2 write & build application code

3 Start online simulator (Infineon Designer)

4 upload .elf .hex to simulator

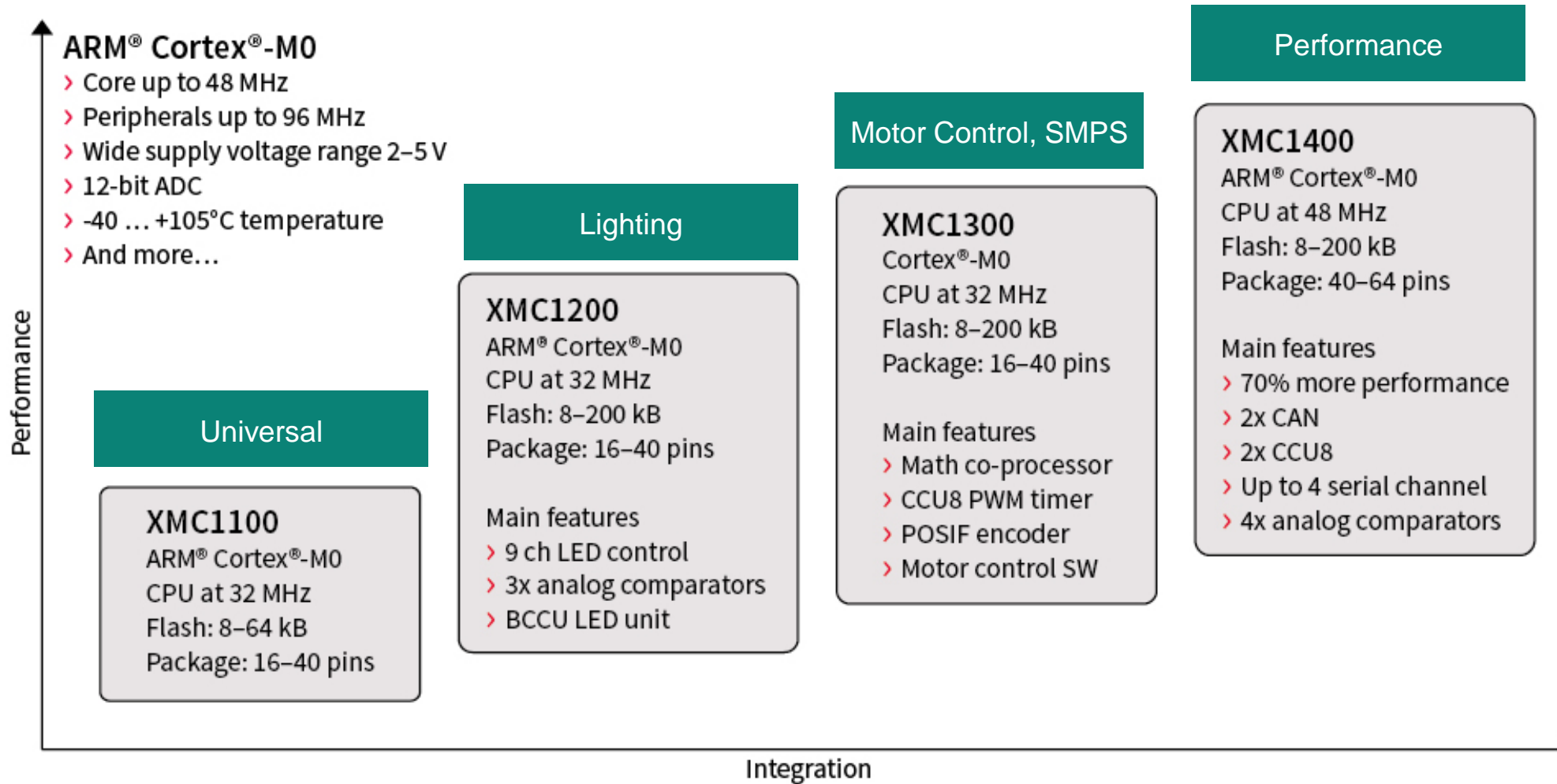
5 co-simulate XMC™ w/ SPICE

The image displays a workflow for creating and co-simulating an XMC1400 application. It includes the ModusToolbox IDE for writing and building application code, and the Infineon Designer for uploading the code to the simulator and co-simulating it with SPICE. The workflow is numbered 1 through 5, corresponding to the steps: Create new XMC1400 Application, write & build application code, Start online simulator (Infineon Designer), upload .elf .hex to simulator, and co-simulate XMC™ w/ SPICE.

The IDE shows the project structure, source code, and build output. The Designer shows the hardware schematic, simulation results, and the XMC1400 Q064 component.

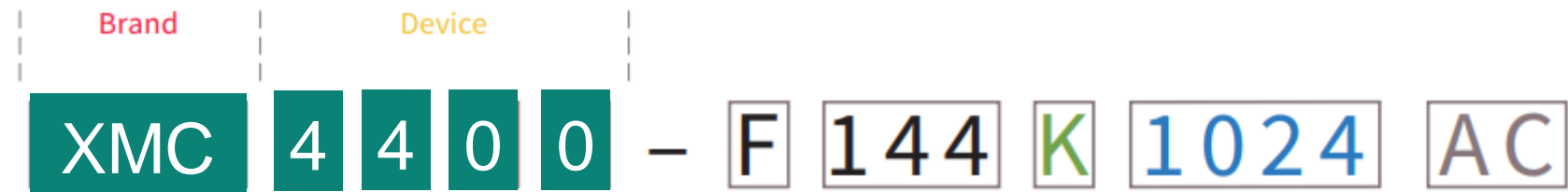
Simulation: 32-bit XMC1000™ Industrial MCU Arm® Cortex®-M

<https://www.infineon.com/xmc>



New: 32-bit XMC4400™ Industrial MCU Arm® Cortex®-M

<https://www.infineon.com/xmc>



ARM® Cortex®-M4F	Frequency [MHz]	Memory		Analog			Timer/PWM					Connectivity							Package
				ADC 12 bit / S&H	Number of channels	DAC 12 bit	CCU4 (4 ch)	CCU8 (4 ch)	HRPWM (150 ps)	POSIF	ΔΣ demodulator	USIC	CAN2.0B	USB	Ethernet	EtherCAT	SDIO/SD/MMC	External Bus Unit (EBU)	
XMC41x	80	Flash RAM	64–128 kB 20 kB	2/2	up to 9	2 ch	2x	1x	●	●	–	4x	up to 2	●	–	–	–	–	VQFN-48 TQFP-64
XMC42x	80	Flash RAM	256 kB 40 kB	2/2	up to 9	2 ch	2x	1x	●	●	–	4x	2x	●	–	–	–	–	VQFN-48 TQFP-64
XMC43x	144	Flash RAM	256 kB 128 kB	2/2	14	2 ch	2x	1x	–	–	–	4x	2x	●	●	●	●	–	LQFP-100
XMC44x	120	Flash RAM	256–512 kB 80 kB	4/4	up to 18	2 ch	4x	2x	●	2x	4 ch	4x	2x	●	●	–	–	–	TQFP-64 LQFP-100
XMC45x	120	Flash RAM	512 kB–1 M 128–160 kB	4/4	up to 26	2 ch	4x	2x	–	2x	4 ch	4x	up to 3	●	●	–	●	●	LQFP-100/144 LFBGA-144
XMC47x	144	Flash RAM	1.5–2 MB 276–352 kB	4/4	up to 26	2 ch	4x	2x	–	2x	4 ch	6x	6x	●	●	–	●	●	LFBGA-196
XMC48x	144	Flash RAM	1–2 MB 276–352 kB	4/4	up to 26	2 ch	4x	2x	–	2x	4 ch	6x	6x	●	●	●	●	●	LQFP-100/144 LFBGA-196
Supply voltage range 3.13 to 3.63 V																			
Temperature range –40°C ... 85°C/125°C																			

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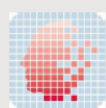
ModusToolbox™ replacing DAVE™

Legacy: DAVE™

Software complexity in embedded systems grows faster than Moore's law.



XMC™ Link
Isolated Debug Probe,
based on SEGGER
J-Link
Technology

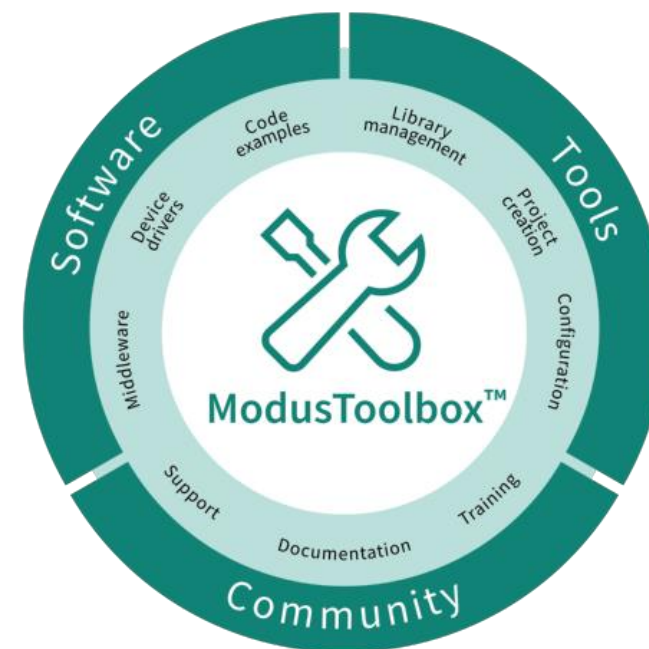



Digital Application Virtual Engineer

- › **Free** Eclipse CDT based IDE using GNU C-Compiler
- › **Code generation** with **graphical user interface** (GUI)
*Configurable and reusable code repository consist of **XMC™ Lib** (for all peripherals), **DAVE™ APPs**, and **EXAMPLES***
- › Automatic assignment of chip resources (resolver)
- › Debugger and Flash loader
- › **All XMC™ MCUs** powered by ARM® Cortex®-M supported
- › XMC™ Lib and DAVE™ APPs **tested** with GCC compiler, ARM® compiler, and TASKING compiler **released for** Altium, ARM/KEIL, Atollic, DAVE™, IAR Systems, and Rowley



New: ModusToolbox™



<https://softwaretools.infineon.com/tools?q=dave>

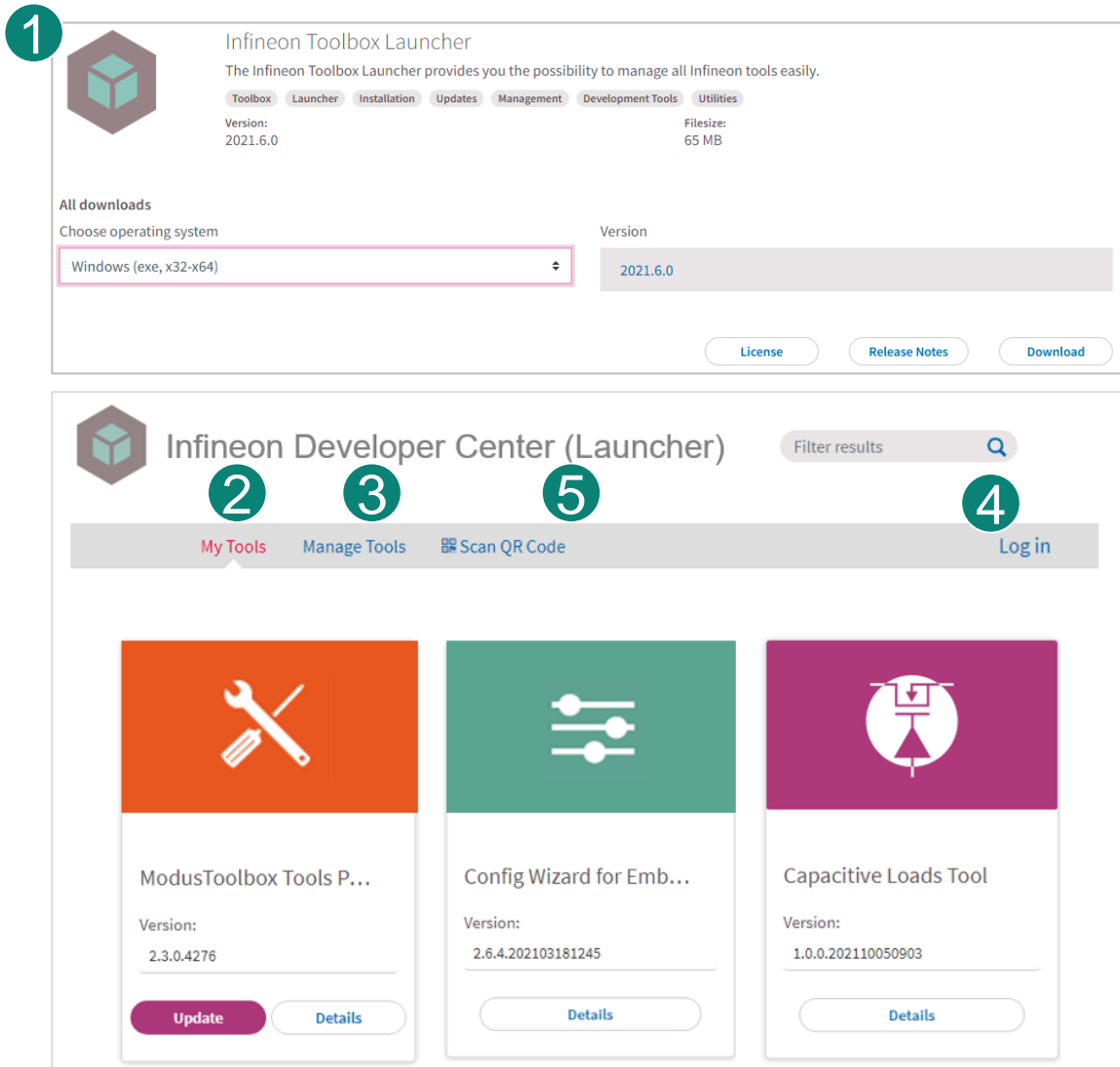
<https://www.infineon.com/modustoolbox>

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Step 1: download launcher utility and manage tools

<https://softwaretools.infineon.com/tools/com.ifx.tb.launcher2>



The screenshot shows the Infineon Toolbox Launcher website. At the top, there's a header with the Infineon logo and the title 'Infineon Toolbox Launcher'. Below this, a description states: 'The Infineon Toolbox Launcher provides you the possibility to manage all Infineon tools easily.' There are tabs for 'Toolbox', 'Launcher', 'Installation', 'Updates', 'Management', 'Development Tools', and 'Utilities'. The 'Launcher' tab is selected. Below the tabs, it shows 'Version: 2021.6.0' and 'Filesize: 65 MB'. A section titled 'All downloads' has a dropdown for 'Choose operating system' (set to 'Windows (exe, x32-x64)') and a 'Version' dropdown (set to '2021.6.0'). At the bottom of this section are buttons for 'License', 'Release Notes', and 'Download'. Below this is the 'Infineon Developer Center (Launcher)' section. It has a search bar 'Filter results' and a 'Log in' button. There are three tabs: 'My Tools' (annotated with a green circle 2), 'Manage Tools' (annotated with a green circle 3), and 'Scan QR Code' (annotated with a green circle 5). Below the tabs are three tool cards: 'ModusToolbox Tools P...' (Version: 2.3.0.4276, with 'Update' and 'Details' buttons), 'Config Wizard for Emb...' (Version: 2.6.4.202103181245, with 'Details' button), and 'Capacitive Loads Tool' (Version: 1.0.0.202110050903, with 'Details' button). A green circle 4 is placed over the 'Log in' button.

1. Install Launcher Utility
2. Download and install the Infineon Developer Center launcher (former Toolbox) utility: <https://softwaretools.infineon.com/tools/com.ifx.tb.launcher2>
3. The launcher utility on your computer from the Windows Start menu. It has 3 tabs
4. My Tools: here you find all the tools you installed. You start them and get informed about the latest updates
5. Manage Tools: here you can download more tools
6. Important: please login and allow admin rights before installing a new tool
7. Scan QR Code: this is for the registration of evaluation boards and new projects in [MySpace](#)

Step 2: install ModusToolbox™ from Infineon Developer Center

<https://softwaretools.infineon.com/tools/com.ifx.tb.tool.modustoolbox>



1. Login

2. Install

3. Download

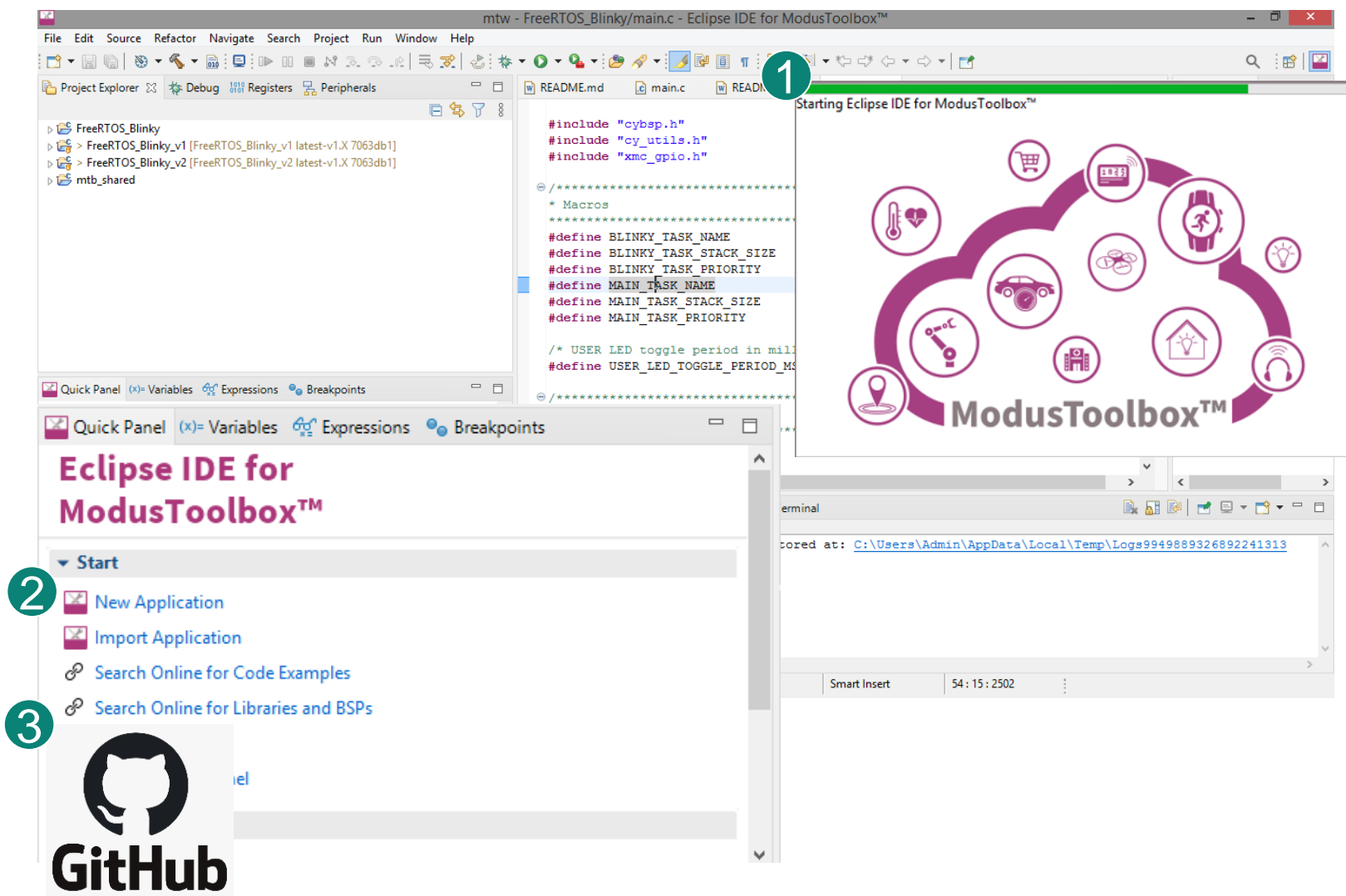
Linux (tar.gz, x64)

macOS (pkg, x32-x64)

Windows (exe, x64)

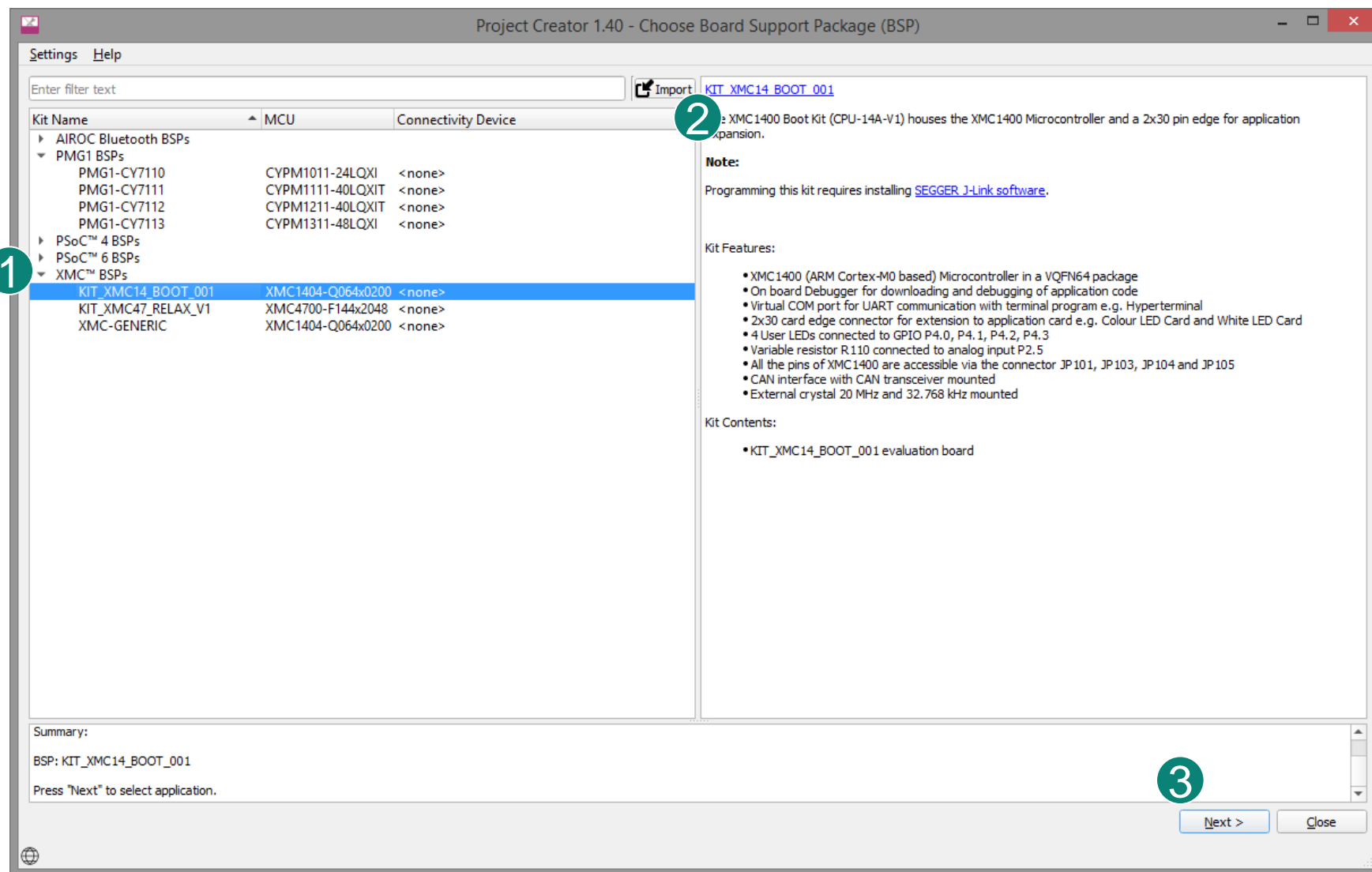
1. Important: please login with your **myInfineon account** and allow admin rights before installing
2. Install (recommended): this will install the tool in the launcher utility where you can easily manage all tools and get informed if there is an update
3. Download: use this for downloading the installer for another operating system than Windows (e.g., Linux, macOS, etc.)

Step 3: start ModusToolbox™ (using Eclipse IDE)



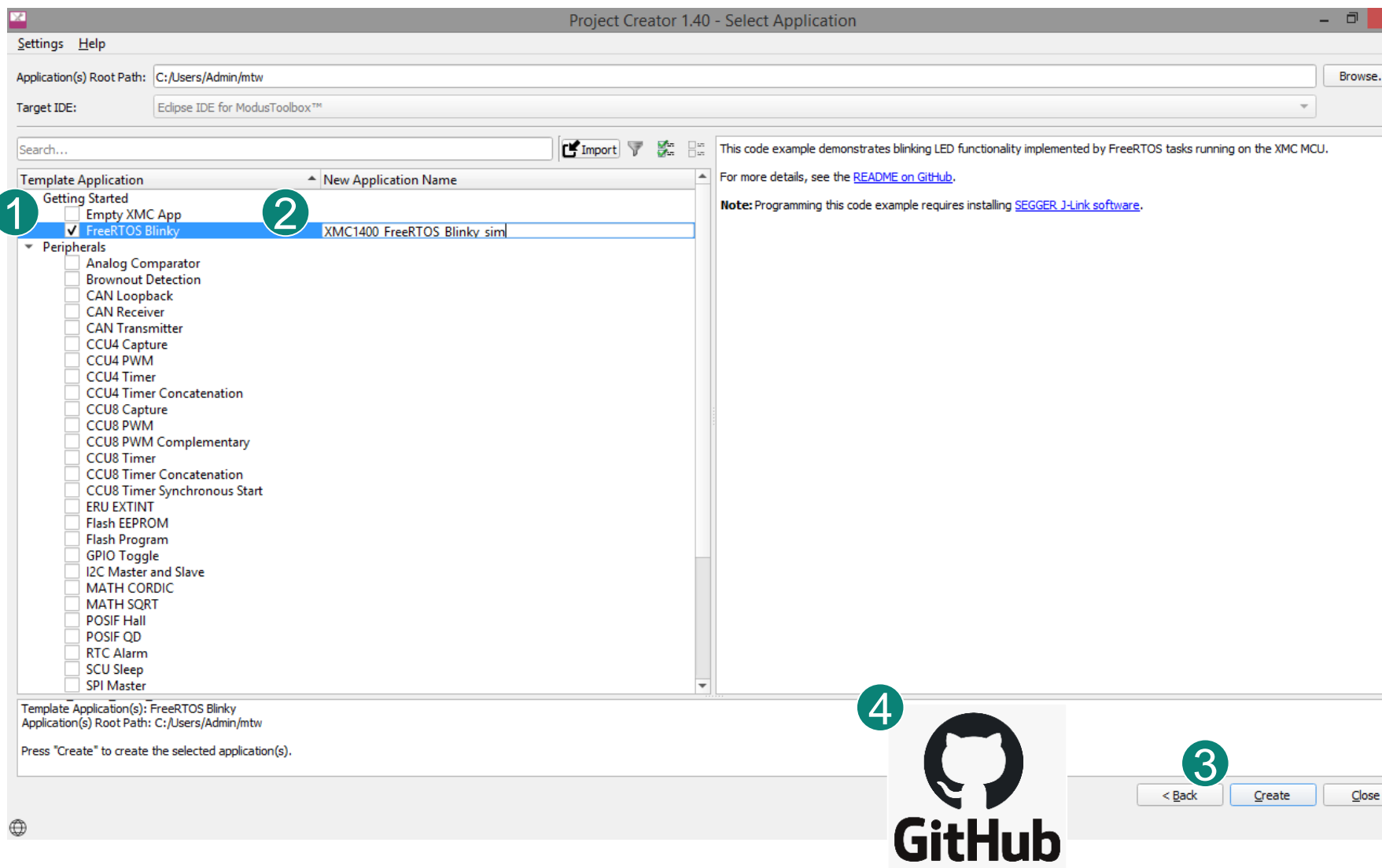
1. Start Eclipse IDE with project and start panels
2. In Quick Panel under Start click on New Application which opens the Project Creator window (please look for window in background)
3. Connection to GitHub to fetch code examples

Step 4a: select Target Platform



1. Select target platform XMC™ Board Support Packages (BSP)
2. Select KIT_XMC14_BOOT_001
3. Click on Next to select code examples

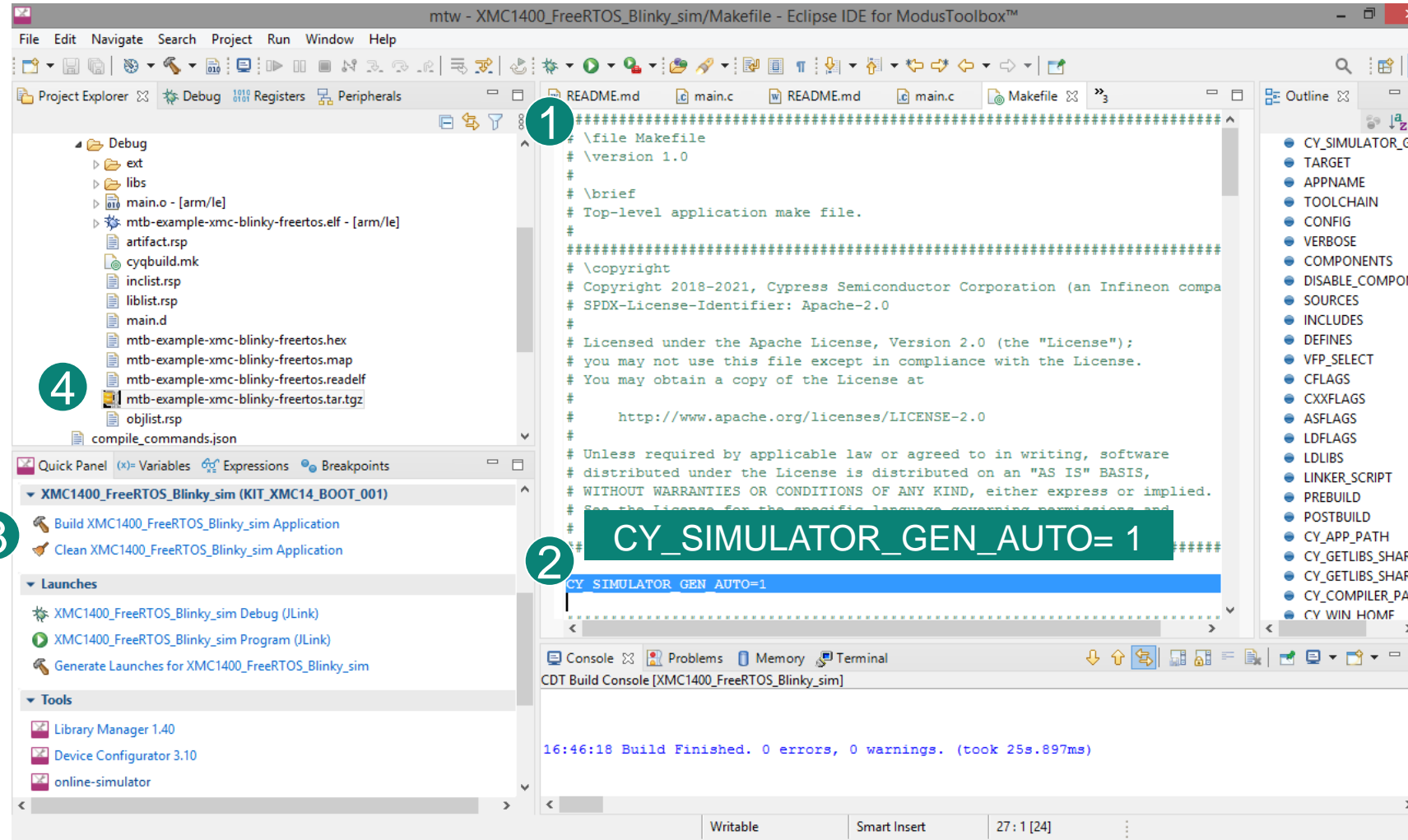
Step 4b: Select Code Example from GitHub



1. Select the code example FreeRTOS Blinky
2. Set a New Application Name as you like
3. Click on Create
4. This will take some time since a GitHub clone is done – please wait until

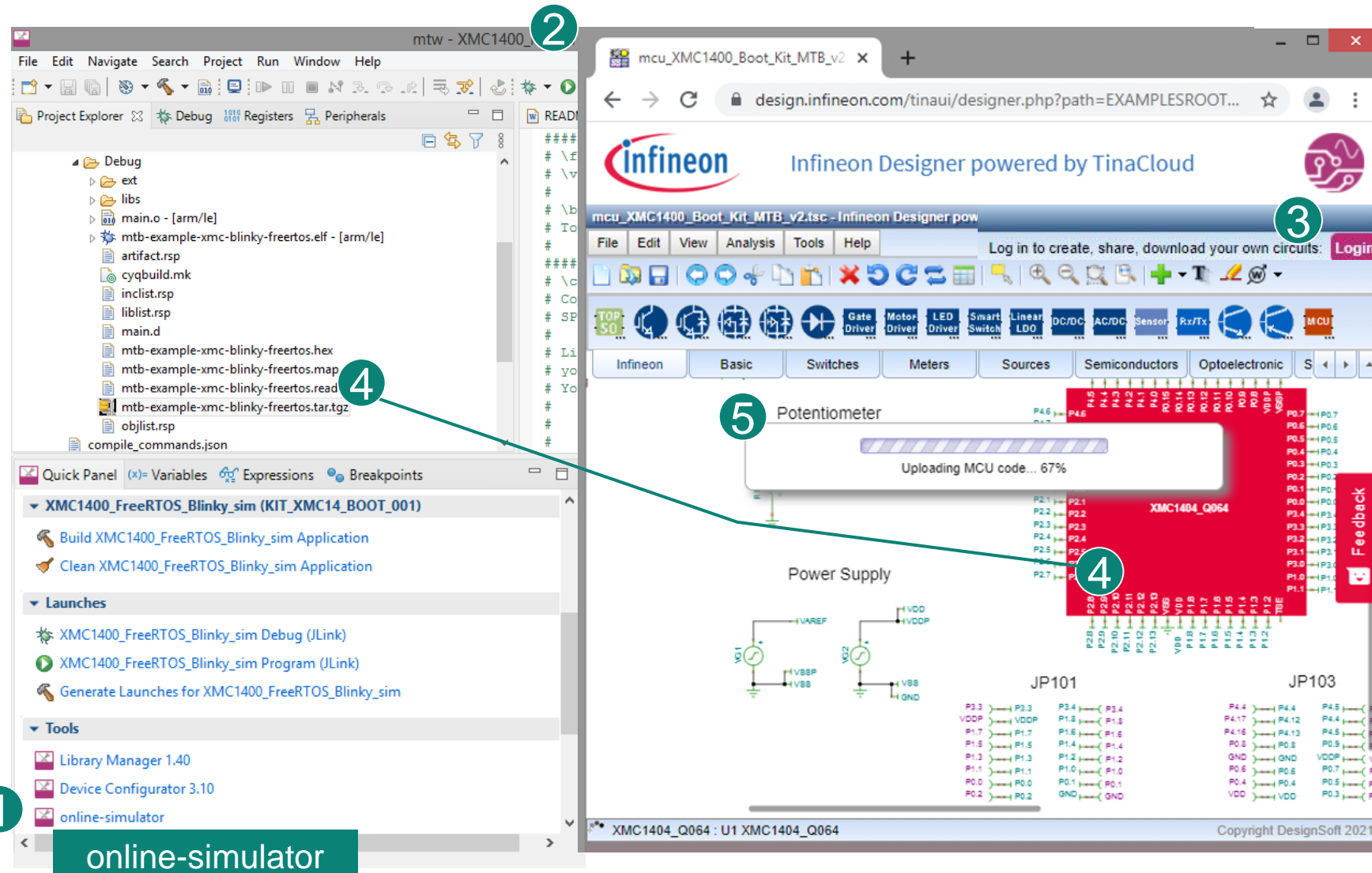
Step 5: wait until GitHub clone is finished – build project

Makefile: Set CY_SIMULATOR_GEN_AUTO= 1



1. Open Makefile
2. Set value for generation of simulation image
CY_SIMULATOR_GEN_AUTO= 1
3. Speed-up blinking of LED to 5 ms
4. Build project
5. In Debug folder the image has been created
6. Result: **Mtb-example-xmc-blinky-freertos.tar.tgz**

Step 6: start Infineon Designer simulator – upload code Digital Twin of XMC1400 Boot Kit co-simulating



The screenshot displays the Infineon Designer simulator interface. On the left, the 'Project Explorer' shows the file structure for 'mtw - XMC1400'. The 'Quick Panel' at the bottom left lists various tools, with 'online-simulator' highlighted. The main workspace shows a circuit diagram of the XMC1400 Q064 microcontroller. A progress bar at the top of the workspace indicates 'Uploading MCU code... 67%'. A green line with numbered callouts (1-5) highlights the steps: 1. Selecting 'online-simulator' in the Quick Panel; 2. Clicking on the 'online-simulator' button in the Quick Panel; 3. Clicking on the 'Login' button in the Infineon Designer interface; 4. Dragging and dropping the .tar.tgz file onto the XMC1400 Q064 microcontroller; 5. The progress bar showing the upload status.

1. online-simulator

1. In Quick Panel under Tools click on online-simulator
2. It will open the online simulation kit: [Digital Twin of XMC1400 Boot Kit co-simulating](#)
3. Please [login](#) in order to upload code
4. Drag and drop .tar.tgz image on XMC microcontroller
5. Upload code

Step 7: simulate Transient and check result

mcu_XMC1400_Boot_Kit_MTB_v2 x +

design.infineon.com/tinaui/designer.php?path=EXAMPLESROOT%7CINFINEON%7CApplications%7CIndustrial%7C&file=mcu_XMC1400_Boot_Kit_MTB_v2.tsc

Infineon

Infineon Designer powered by TinaCloud

mcu_XMC1400_Boot_Kit_MTB_v2.tsc - Infineon Designer powered by TINACLOUD

File Edit View Analysis Tools Help

Infineon Basic Switches Meters Sources Semic

1. Wanna try it out? Click on simulate

2. Click on circuit components to change

3. If you like what you see, buy online

4. Enjoy other circuits

1 Simulate Transient

How to program the microcontroller:

- Download and install the development ecosystem: [ModusToolbox](#)
- click on New Application and create a new XMC1400 project (e.g. ...)
- in the Makefile set: CY_SIMULATOR_GEN_AUTO=1
- in the main.c speedup the blinking: #define USER_LED_TOGGLI
- build the project and upload the simulation file *.tgz to the MCU
Dir: <installation>\mtw\FreeRTOSBlinky\build\KIT_XMC14_BO
File: mtb-example-xmc-blinky-freertos.tar.tgz
[Click here to upload the MCU code as archive.tgz](#)
- click on Simulate Transient to execute the simulation

Diagram

File View Process

VG1 4.00 0.00 5.00 0.00

VG2 5.00 0.00

I_LED1 20.00m -10.00m

I_LED2 200.00u -400.00u

I_LED3 100.00u -200.00u

I_LED4 100.00u -400.00u

Time (s) 0.00 5.00m 10.00m 15.00m 20.00m

4

	Time	VG1	VG2	I_LED1	I_LED2	I_LED3	I_LED4
A	5.7m	3.3	5	5.64p	7.28p	7.28p	6.37p
B	10.72m	3.3	5	8.41m	6.37p	6.37p	5.91p
B-A	5.02m	0	0	8.41m	-909.5f	-909.5f	-454.5f
Freq. & Slope	199.2	0	0	1.67	-181.17p	-181.17p	-90.54p

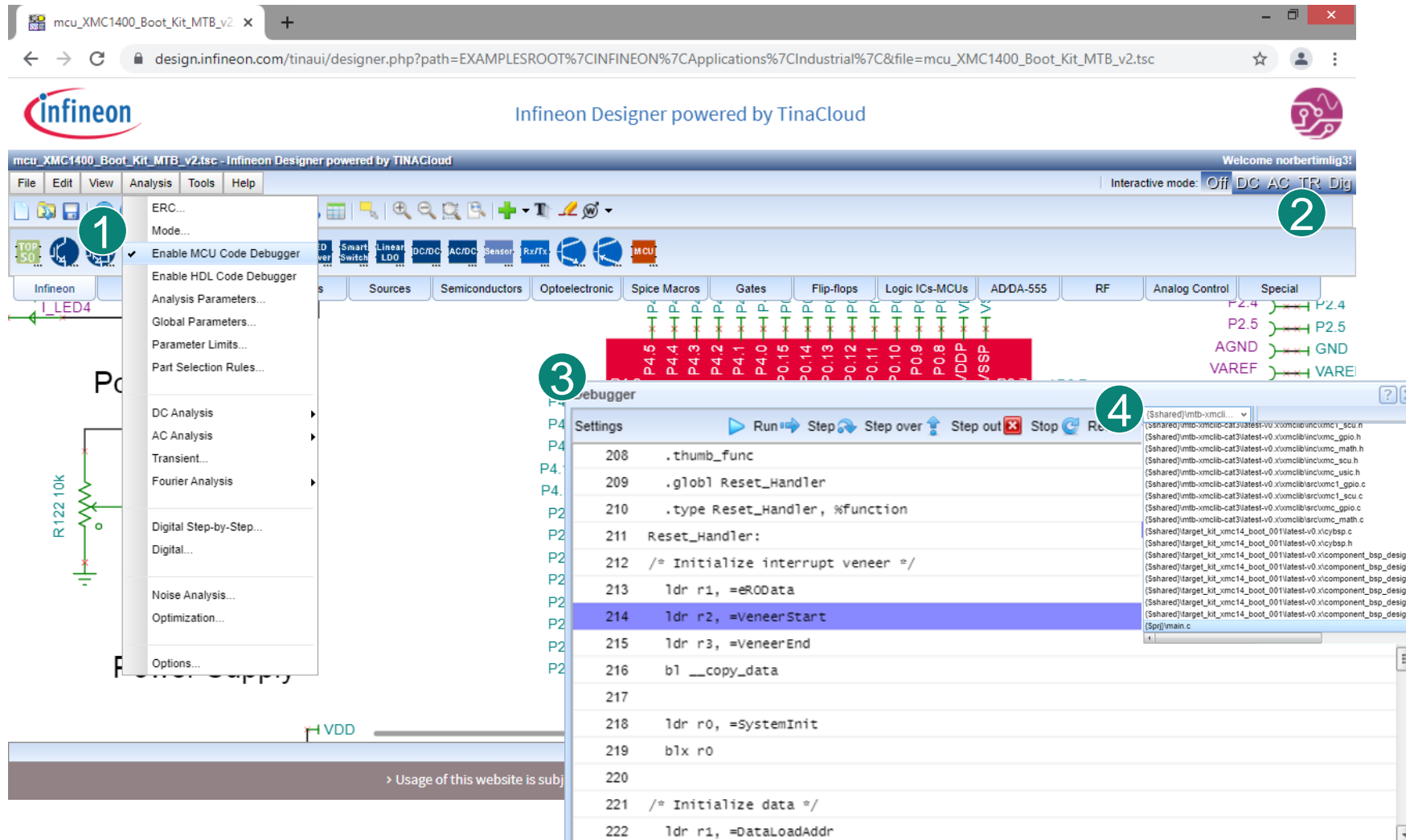
Cached transient 1 x

Copy

> Usage of this website is subject to our Usage Terms > Imprint > Contact > Privacy Policy > Glossary

1. Click on simulate Transient to start the simulation
2. Check the results in the diagram window
3. Result: I_LED1 toggles in 5 ms
4. Use cursor to verify other signal

Step 8: debug code in interactive mode



1. Select the Analysis menu and Enable MCU Code Debugger
2. Click on TR to start interactive mode
3. Wait until debugger window opens
4. Inspect code in files

Step 9: set breakpoints and inspect variables

The screenshot shows the Infineon Designer interface with the following components:

- Debugger Window:**
 - Settings:** Shows the current file as `{$prj}\main.c`.
 - Code Editor:** Displays C code with a breakpoint (red dot) set at line 144: `result = cybsp_init();`. The code includes initialization and semaphore creation logic.
 - Variable Watch:** A table at the bottom left shows the variable `result` with a value of `0`.

Variable	Value
result	0
- Hardware Window:** On the right, it shows the pin configuration for the `XMC1404_Q064` device, including pins P0.0 through P4.14 and power pins VDD, VSS, and TSE.

Numbered callouts in the image indicate the steps:

1. Select `main.c` in the Settings.
2. Set a breakpoint on line 144.
3. Run the program to reach the breakpoint.
4. Add the variable `result` to the watch list.
5. Inspect the variable `result`, which has a value of 0.

1. Select main.c
2. Set breakpoint
3. Run to breakpoint
4. Add variable
5. Inspect variable result=0

Step 10: select other circuits

<https://www.infineon.com/ifxdesigner>

1 > Home > 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>

2

Showing 1 to 25 of 25 entries (filtered from 750 total entries)

Circuit	Application	Product Category	Product Configuration	Description
Reset All	Select	Select		
Digital Twin of XMC1400 Boot Kit co-simulating Embedded Application Code generated by ModusToolbox™ Development Ecosystem along with analog SPICE circuits	LED lighting Motor control Power supplies	Microcontroller	<ul style="list-style-type: none">XMC1404-Q064X0200 AAKIT_XMC14_BOOT_001	Read more
Brushless DC (BLDC) Motor controlled by Sensorless Field-Oriented Control (FOC) using XMC1302 32-bit ARM® Cortex®-M0 microcontroller (Ideal Inverter)	Motor control	Microcontroller	<ul style="list-style-type: none">XMC1302-T038X0200 ABKIT_XMC1X_AK_MOTOR_001	Read more
Brushless DC (BLDC) Motor controlled by Sensorless Field-Oriented Control (FOC) using XMC1302 with MOSFET Inverter OptiMOS™ BSC0925ND and	Motor control	Microcontroller MOSFET	<ul style="list-style-type: none">XMC1302-T038X0200 ABBSC0925NDIR2301	Read more

3

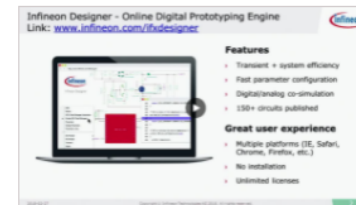
Download Getting Started Guide
02_00 | Jun 24, 2021 | PDF | 3.11
mb

Why to use Infineon Designer



> [Why to use Infineon Designer](#)

Infineon Designer – Introduction

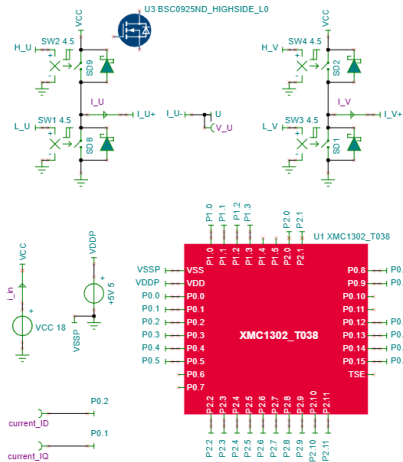


> [Infineon Designer – Introduction](#)

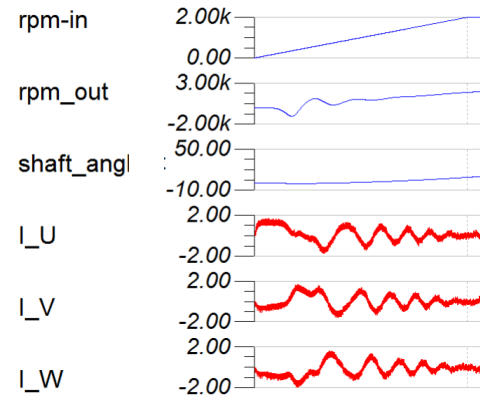
1. Open landing page
<https://www.infineon.com/ifxdesigner>
2. Search for XMC circuit in table
3. Select BLDC motor example with FOC control running on XMC1302

Exercise: Brushless DC (BLDC) Motor controlled by Sensorless Field-Oriented Control (FOC) using XMC™ microcontroller

1 2 Simulate Transient

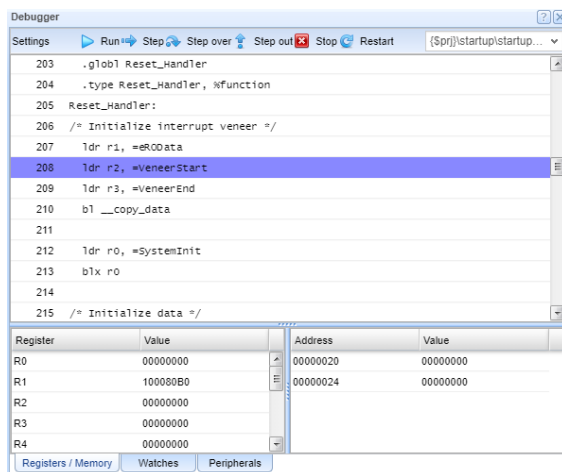


3



4

Interactive mode: Off DC AC TR Dig



6

Motor: Maxon EC 32 BLDC, 15 Watt



J=3.5u
B=1u
F=1u
D=1u
A=8
P=3
CL=3865u
CR=6.8
CC=0.001u
CM=0.5
Cb=49m
Ct=49m
r_snub=1k*2*pi*CL

```
.param J ... Moment of inertia. Unit: kg*m^2
.param B ... Damping end eddy current losses. Unit: kg*m^2/(s*rad)
.param F ... Friction / drag losses. Unit: kg*m^2/s^2
.param D ... Magnetic cogging torque. Unit: kg m^2/s^2
.param A ... Number of north poles
.param P ... Number of phases
.param CL ... Winding inductance
.param CR ... Winding resistance
.param CC ... winding capacitance to ground
.param CM ... adjacent winding mutual coupling factor
.param Cb ... BEMF constant. Unit: V*s/rad
.param Ct ... Torque constant. Unit: N*m/A
.param r_snub = 1k*2*pi*CL
```

- open application circuit: [Brushless DC \(BLDC\) Motor controlled by Sensorless Field-Oriented Control \(FOC\) using XMC1302 32-bit ARM® Cortex®-M0 microcontroller \(Ideal Inverter\)](#)
- simulate the circuit using Simulate Transient
- check the results
 - rpm ramp-up/ramp-down profile
 - 3 phase currents
- Enable the debugger mode
 - Analysis -> Enable MCU Code Debugger
 - View -> Preference -> Draw diagram in interactive mode
 - In the task bar: start the debugger window by click on Interactive mode: TR

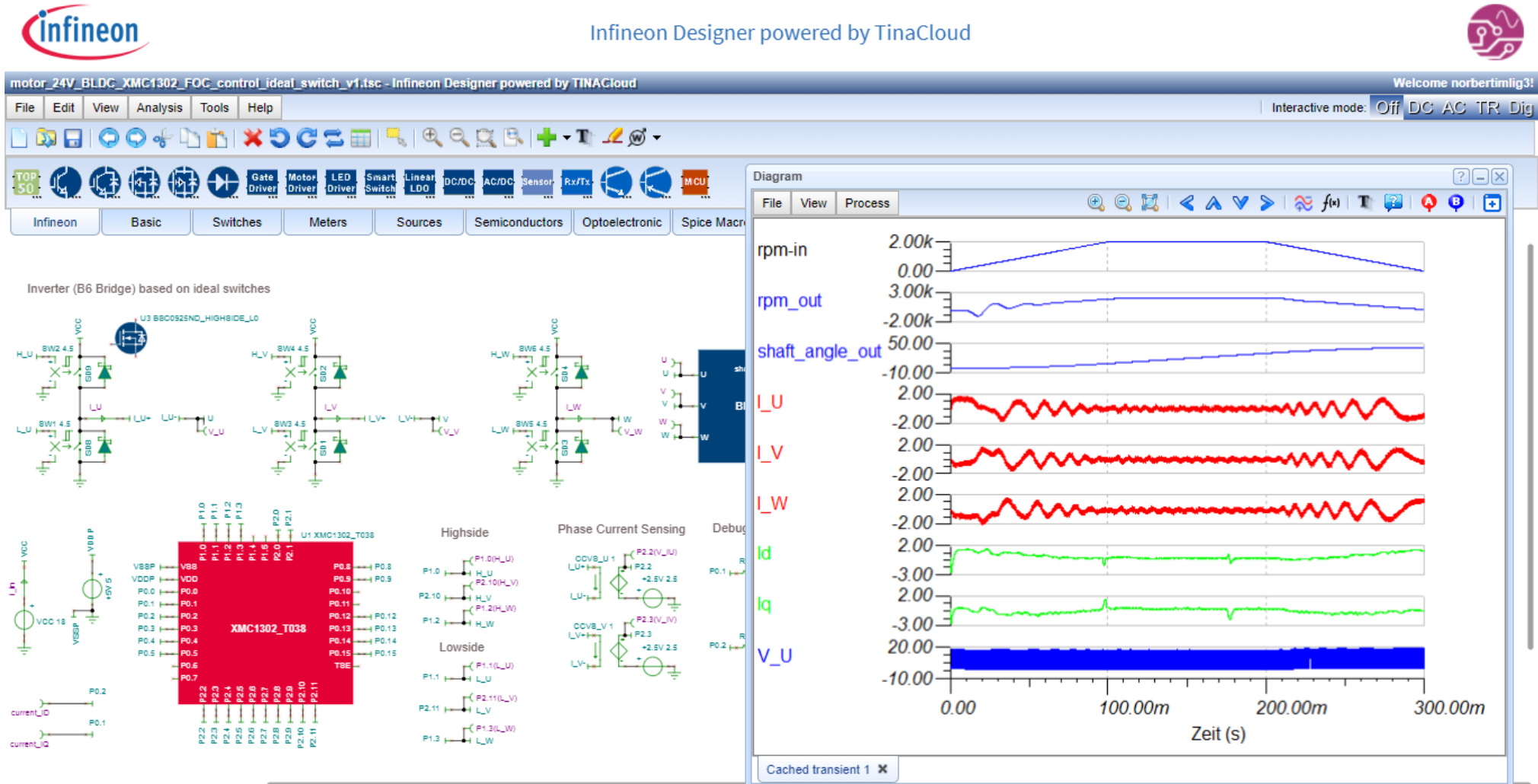
Your task

- Step through the code and select the main.c file and set a breakpoint in main() function
 - run to the breakpoint
 - add variables in the watch window
 - temperature dependency
- Change the motor parameter to your needs and simulate again

Bonus task

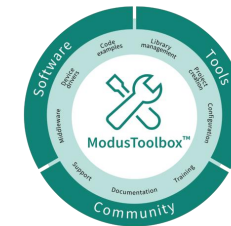
- Install [DAVE™ IDE](#) software and change the [FOC code examples](#)
- Simulate with real MOSFETs [Brushless DC \(BLDC\) Motor controlled by Sensorless Field-Oriented Control \(FOC\) using XMC1302 with MOSFET Inverter OptiMOS™ BSC0925ND and high-side and low-side Gate Driver IC IR2301](#)
- Explore stepper motor example: [Stepper Motor Control Shield with IFX9201 & XMC1300 using Fullstep, Halfstep or Microstepping modes](#)
- Simulate [PINUS Multicopter Board V2 with XMC1100, IR2301 and BSC0925ND](#)

Exercise: Brushless DC (BLDC) Motor controlled by Sensorless Field-Oriented Control (FOC) using XMC1302



Demo & Exercise Summary

- Demo: we installed ModusToolbox™ and used the code example Blinky based on the real time FreeRTOS
 - set value for generation of simulation image
CY_SIMULATOR_GEN_AUTO= 1
 - speed-up blinking of LED to 5 ms
 - started the online simulation circuit [Digital Twin of XMC1400 Boot Kit co-simulating](#)
 - uploaded the generate .elf/.hex image [Mtb-example-xmc-blinky-freertos.tar.tgz](#)
 - started a transient simulation
- Results:
 - verified blinking LED of 5ms with cursor
 - verified uploaded code by starting interactive debugger
- Conclusion: Digital co-simulation has many advantages as reducing a) Time-to-market: start developing before you have the hardware kit, b) Safety: test on virtual system will not harm engineer or destroy hardware, c) cost: exploration of design space cheaper than building hardware many times
- Exercise: Brushless DC (BLDC) Motor controlled by Sensorless Field-Oriented Control (FOC) using XMC™ microcontroller
 - you co-simulated the software FOC code running on an XMC™ microcontroller
 - you debugged the code compiled by DAVE™
- Infineon Designer (SPICE) is the tool of choice when co-simulating analog and digital microcontroller
- All Simulation models are available for download on the product pages
- Where to go from here
 - Install [DAVE™ IDE](#) software and change the [FOC code examples](#)
 - Simulate with real MOSFETs [Brushless DC \(BLDC\) Motor controlled by Sensorless Field-Oriented Control \(FOC\) using XMC1302 with MOSFET Inverter OptiMOS™ BSC0925ND and high-side and low-side Gate Driver IC IR2301](#)



.elf .hex

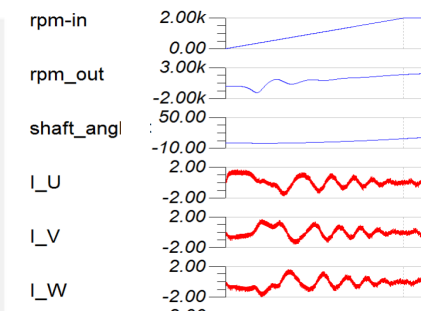
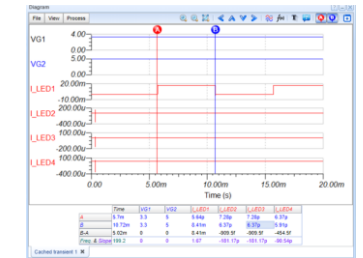


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Tips & Tricks

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 - › 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 Log in to save, share, download circuits: [Login](#)

2 start.tsc - Infineon Designer powered by Ti

File View Analysis Tools Help

New

Open... Alt+O

Reopen

3 noname.tsc - Infineon Designer powered by TINACloud

File Edit View Analysis Tools Help

Find & Insert Component...

Insert Bus...

Insert Text...

Insert Interpreter Text...

Insert Design Text...

Insert Diagram...

Insert Symbolic Result

Insert Picture

Upload macro...

Insert macro...

Download macro...

4 Upload Macro

Macro name : IR2110

Source : ☐ Current circuit ☒ From file

Macro file (tsc|tsm|cir|mod|spi|lib|vhd|v|va|vams) : Dateien auswählen IR2110.lib

5 Upload Cancel

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:

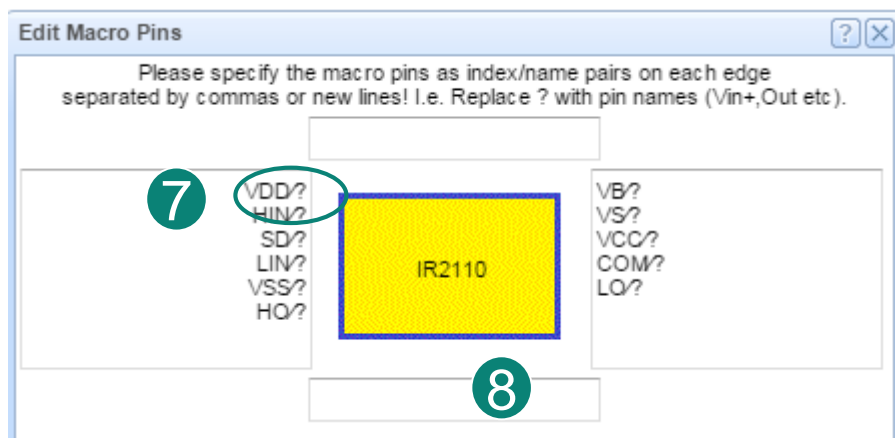
+      T1=-40 T2=25
T3=125


...

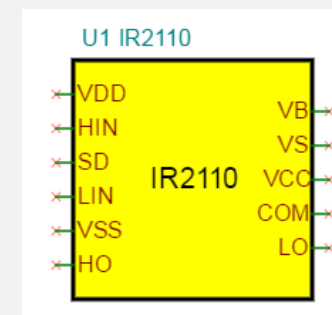
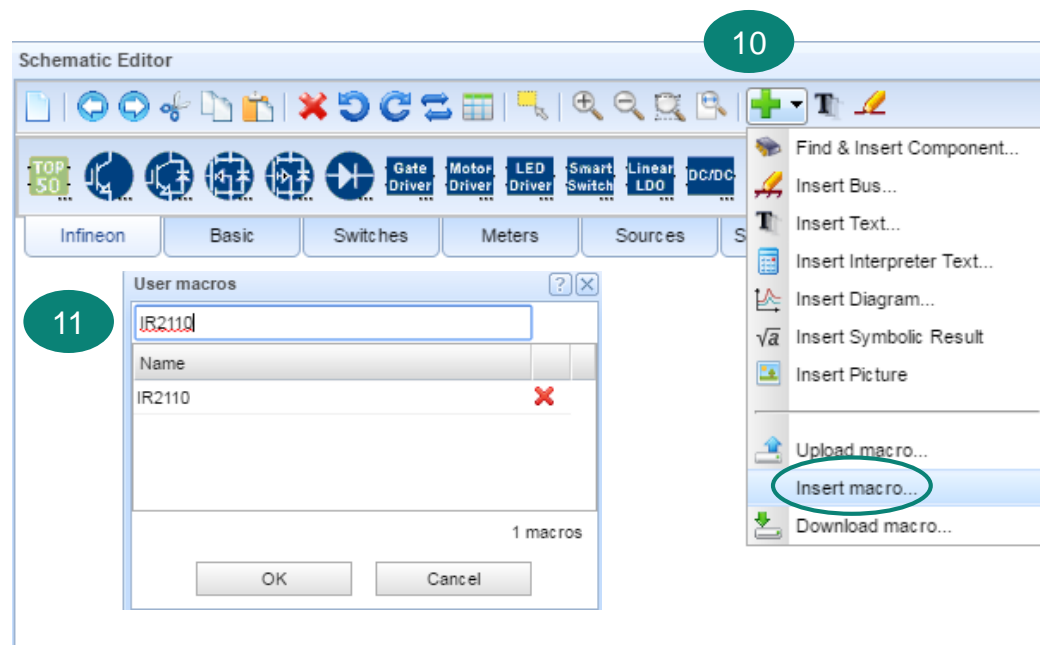
.ENDS IR2110
```


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

6



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



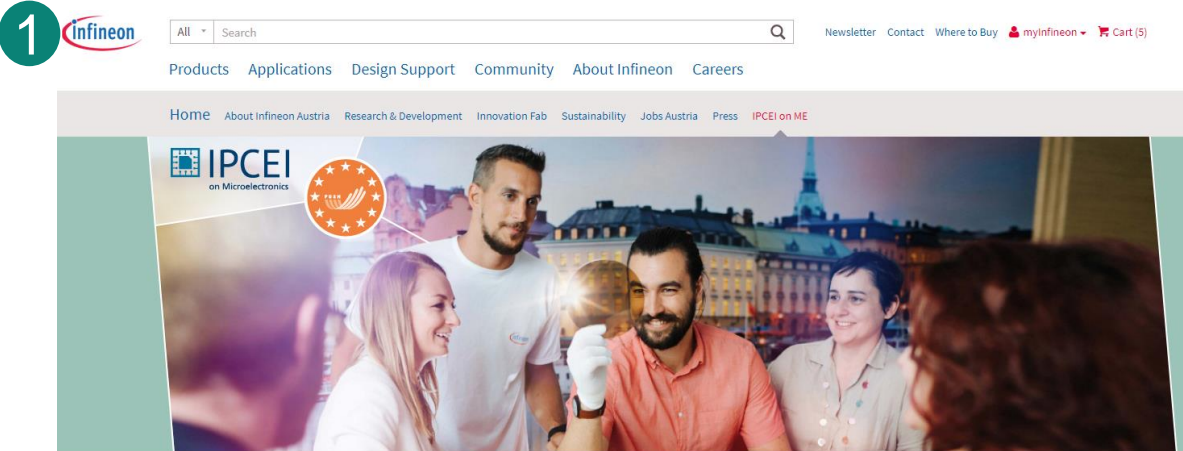
7. Finalize your circuit and Save it with “Save -> Save as”
8. Test your circuit
- 9.

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Thank you an see you soon in our next webinar

<https://www.infineon.com/cms/austria/en/IPCEI-on-ME>

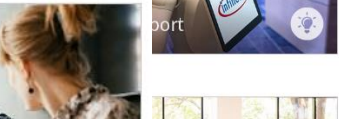


Infineon Technologies Austria – Part of IPCEI Microelectronics

Infineon's power semiconductors are deployed in key markets such as automotive, energy, digital and industrial equipment. These power electronics solutions also drive innovation in environmental sustainability, energy-efficiency and reduction of CO₂ emissions.

Infineon's IPCEI spillover activities include the following areas:

- **STEM education and talent**
Infineon Austria will actively involve educational institutions and STEM talent, from pupils to PhDs.



3	Event	Date	Time	
	Microcontroller Co-Simulation	18.10.2023	10:00 - 11:00	> More information
			New time!	
	Digital Power Supply Simulation	18.10.2023	11:00 - 12:00	> More information
			New time!	
	Online LCC development tool	28.11.2023	13:00 - 14:00	> More information

Quick design of a flyback converter	28.11.2023	14:00 - 15:00	> More information
Application driven development Part I: USB-PowerDelivery	13.12.2023	14:00 - 15:00	> More information
Application driven development Part II: Embedded Coding	13.12.2023	15:00 - 16:00	> More information
Application driven development Part III: Cloud Co-Simulation	13.12.2023	16:00 - 17:00	> More information



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www.youtube.com/c/InfineonTechnologiesAG

