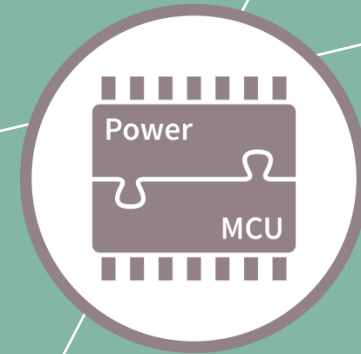


# Evaluation Board and Kit Getting Started

Toolchain Setup for:

- TLE9879\_EVALKIT
- TLE9869\_EVALKIT
- TLE987x\_EVALB\_JLINK
- TLE986x\_EVALB\_JLINK



February 2019



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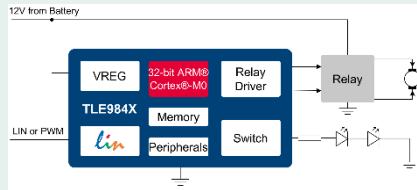
4

Getting Started

# Infineon Embedded Power ICs

## Infineon Embedded Power ICs Product Portfolio based on Arm® Cortex®-M processor

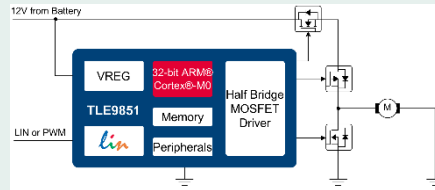
### Smart Relay IC DC Motor



#### TLE9842/3/4

- > Window Lift
- > Sunroof
- > Wiper

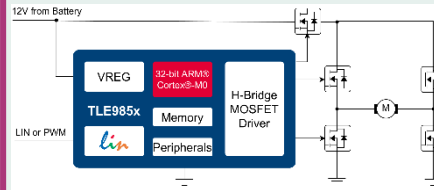
### Smart Half Bridge



#### TLE9845/TLE9851

- > HVAC Fan
- > Engine Cooling Fan
- > Fuel Pump
- > Water Pump

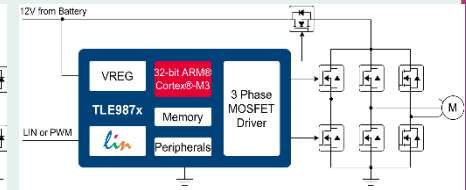
### Smart H-Bridge Driver



#### TLE985x/TLE986x

- > Window Lift
- > Sunroof
- > Wiper
- > Power Folding Roof
- > Power Sliding Door
- > Power trunk/ tailgate

### Smart BLDC Driver IC



#### TLE987x

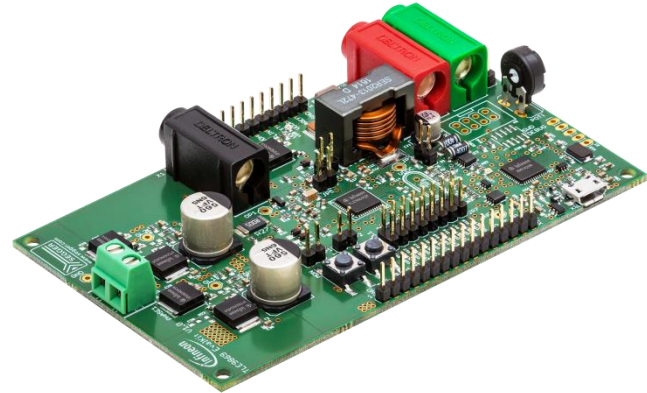
- > Fuel Pump
- > HVAC Fan
- > Engine Cooling Fan
- > Water Pump
- > Oil Pump
- > Sunroof
- > Wiper

# Infineon Embedded Power IC: Evaluation Board and Kit Overview

## TLE9869QX – Evaluation Kit

- › 2-Phase N-MOS Bridge
- › Single Shunt in GND path
- › integrated LIN (inside device)
- › Virtual Com Port via J-Link
- › Debug LEDs
- › Onboard Segger J-Link Debugger

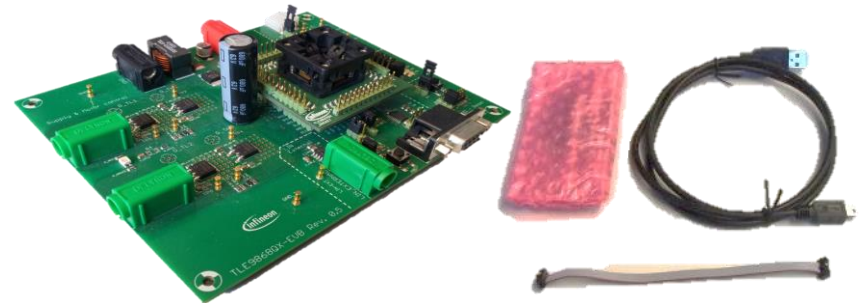
TLE9869 EVALKIT : **SP001388252**



## TLE986x – 2-Phase Board with Socket

- › H-Bridge N-MOS Bridge
- › integrated LIN
- › external LIN Trx
- › RS232
- › Debug LEDs
- › Debug Connector SWD
- › J-link Lite debugger

TLE986x EVALB\_JLINK : **SP001253678**

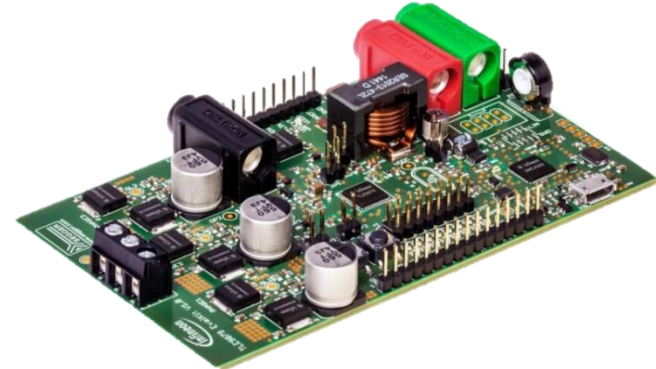


# Infineon Embedded Power IC: Evaluation Board and Kit Overview

## TLE9879QX – Evaluation Kit

- › 3-Phase N-MOS Bridge
- › Single Shunt in GND path
- › integrated LIN (inside device)
- › Virtual Com Port via J-Link
- › Debug LEDs
- › Onboard Segger J-Link Debugger

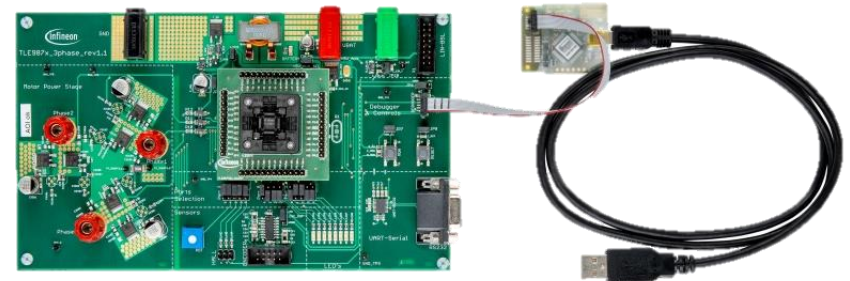
TLE9879 EVALKIT : **SP001389172**



## TLE987x – 3-Phase Board with Socket

- › 3-Phase N-MOS Bridge
- › integrated LIN
- › external LIN Trx
- › RS232
- › Debug LEDs
- › Debug Connector SWD
- › J-link Lite debugger

TLE987x EVALB\_JLINK : **SP001253680**



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# Product Information links

Overview	<ul style="list-style-type: none"><li>&gt; <a href="#">Product Brief</a></li><li>&gt; <a href="#">Selection Guides</a></li><li>&gt; <a href="#">Product Presentations</a></li></ul>	<ul style="list-style-type: none"><li>&gt; <a href="#">Embedded Power IC overview</a></li><li>&gt; <a href="#">TLE986xQX Overview</a></li><li>&gt; <a href="#">TLE987xQX Overview</a></li></ul>
Technical Material	<ul style="list-style-type: none"><li>&gt; <a href="#">Datasheets</a></li><li>&gt; <a href="#">Application Notes</a></li><li>&gt; <a href="#">Getting Started</a></li><li>&gt; <a href="#">PCB Design Data</a></li></ul>	<ul style="list-style-type: none"><li>&gt; <a href="#">TLE986xQX Documents</a></li><li>&gt; <a href="#">TLE987xQX Documents</a></li></ul>
Evaluation Boards	<ul style="list-style-type: none"><li>&gt; <a href="#">Evaluation Boards</a></li><li>&gt; <a href="#">Application Kits</a></li></ul>	<ul style="list-style-type: none"><li>&gt; <a href="#">Kits and Boards overview</a></li><li>&gt; <a href="#">Information about TLE9879 Evalkit</a></li><li>&gt; <a href="#">Information about TLE9869 Evalkit</a></li></ul>
Software & Tools	<ul style="list-style-type: none"><li>&gt; <a href="#">Config Wizard</a></li><li>&gt; <a href="#">Keil µVision5</a></li><li>&gt; <a href="#">Software Examples</a></li></ul>	<ul style="list-style-type: none"><li>&gt; <a href="#">Link to Software &amp; Tools</a></li></ul>
Videos	<ul style="list-style-type: none"><li>&gt; <a href="#">Technical Videos</a></li></ul>	<ul style="list-style-type: none"><li>&gt; <a href="#">Link to Videos</a></li></ul>



# Support

## Online tools and services



> infineon.com/embeddedpower



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> Home > Products > Microcontroller (MCU) > 32-bit Embedded Power ICs based on ARM® Cortex® M

## 32-bit Embedded Power ICs based on ARM® Cortex® M

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**Support**

32-bit Embedded Power ICs based on ARM® Cortex® M subcategories

> Relay Driver IC with Integrated ARM® Cortex® M0

> H-Bridge Driver IC with Integrated ARM® Cortex® M3

> Half-Bridge Driver IC with Integrated ARM® Cortex® M0

> 3-Phase Bridge Driver IC with Integrated ARM® Cortex® M3

Infineon 32-bit Embedded Power ICs based on ARM® Cortex®-M are designed for automotive motor control solutions. They integrate on single die the 32-bit microcontroller, the non-volatile flash memory, the analog and mixed signal peripherals, the communication interfaces along with the driving stages needed for either relay, half-bridge or full-bridge DC and BLDC motor applications.

Bridge Driver with a current controlled output stage, flexible charge- and discharge current settings and several diagnostic functions allows optimizing your system with our products. These highly integrated products save space and energy, improve the overall system reliability through advanced diagnosis features and reduce the overall cost due to a minimum number of components. They are perfectly fit with a range of motor control applications where a small package form factor and a minimum number of external components are essential. Such applications include window lift, sunroof, wiper, fuel pump, HVAC fans, engine cooling fan and water pumps, to name but a few.

32-bit core for complex software solutions with Direct Memory Access (DMA) Controller up to 14 channels ensure high performance for applications.

> Home > Products > Microcontroller (MCU) > 32-bit Embedded Power ICs based on ARM® Cortex® M

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AppNote for Reverse Polarity Protection

> Learn more

TLE986x/TLE987x BridgeDriver AppNote

> Learn more

FAQ Application Note for TLE984xQX

> Learn more

Solution Finder for Automotive Applications

> Learn more

5

Find answers to your technical questions and use our technical support community

Explore our Infineon Forum for Embedded Power ICs >

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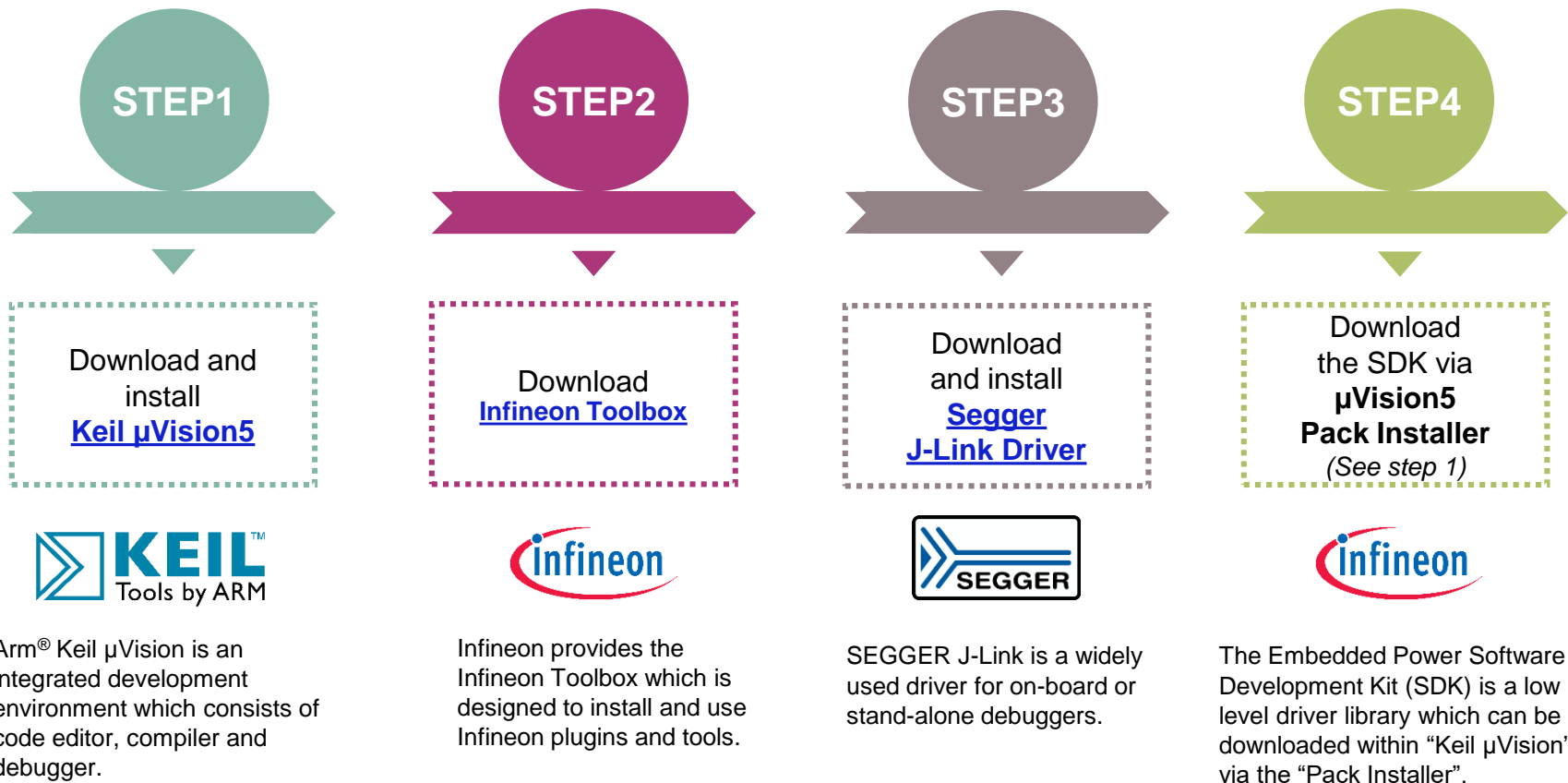
Toolchain installation

4

Getting Started

# Toolchain installation: General Overview

- Infineon Embedded Power ICs are supported by a complete development tool chain provided by Infineon and third party vendors. The tool chain includes compilers, debuggers, evaluation boards, LIN low level drivers and configuration tools as well as a variety of example software code.



# Toolchain installation: 1/4



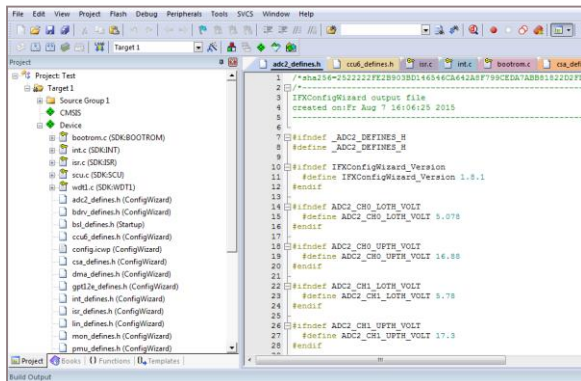
## Keil μVision5

- Code Editor & Online Debugger
- Evaluation version can handle up to 32K

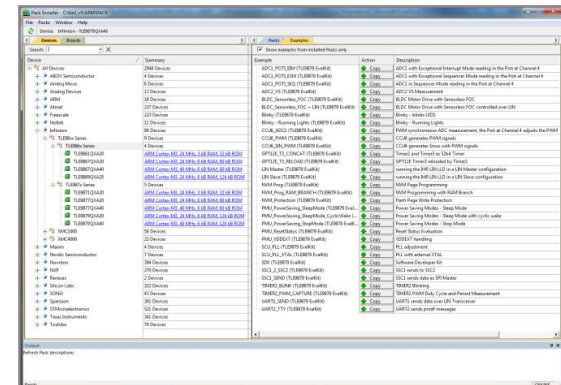


Download from:  
<https://www.keil.com/demo/eval/arm.htm>

## Main Window



## Pack Installer



# Toolchain installation: 2/4



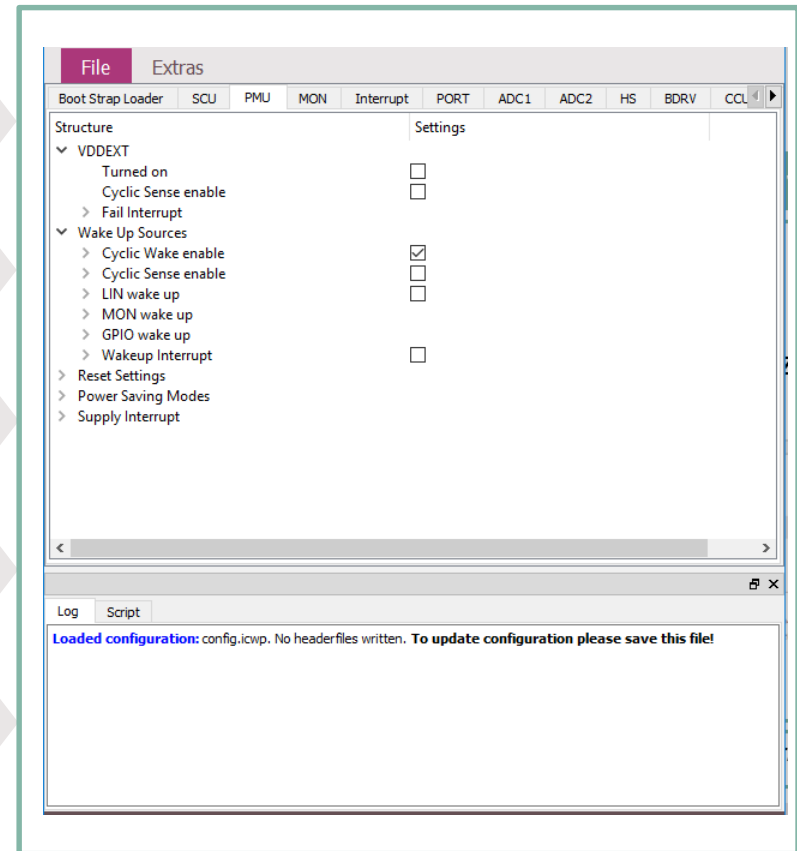
Infineon **Config Wizard**

Configuration of chip modules

Device description for  
TLE986x/TLE987x included

Installation from Infineon Toolbox

TLE986x/7x supported by Keil  $\mu$ Vision 5

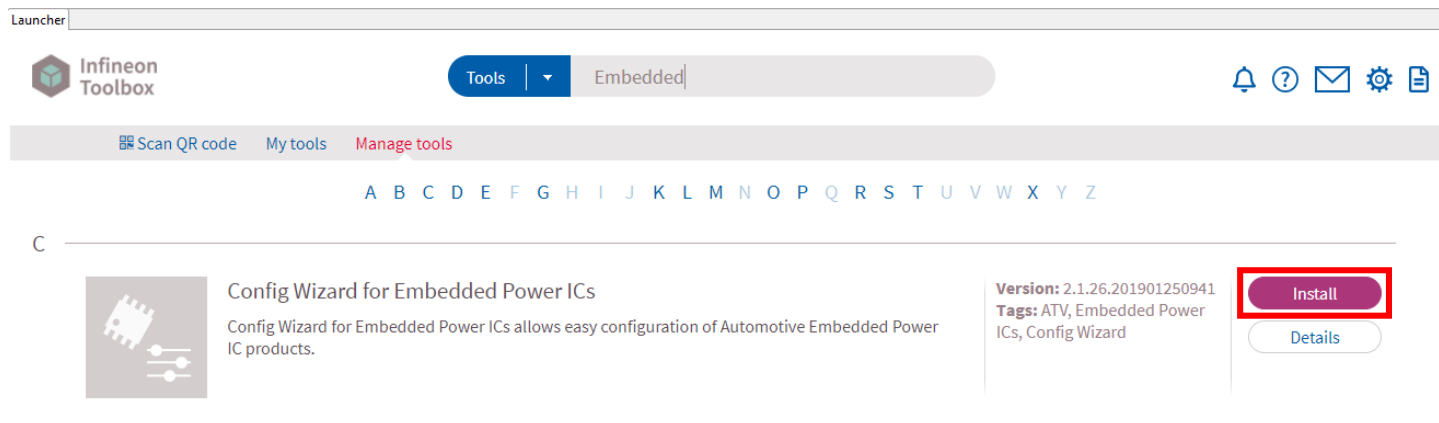


# Toolchain installation: 2/4



## Infineon Toolbox: Config Wizard for Embedded Power ICs:

- Install the “[Infineon Toolbox](#)”<sup>(\*)</sup> and start the tool
- Within the Infineon Toolbox:
  1. Select the tab “Manage tools”, search for “Config Wizard for Embedded Power ICs” and click “Install”



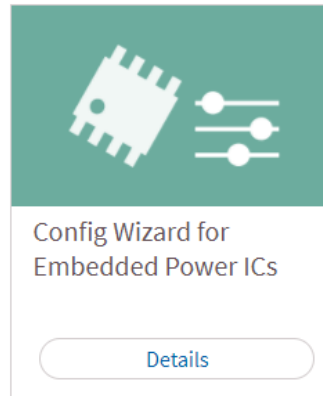
<sup>(\*)</sup> For more details about the Infineon Toolbox installation, please read the [Installation Manual](#).

## Toolchain installation: 2/4



### Infineon Toolbox: Config Wizard for Embedded Power ICs:

2. Start “Config Wizard for Embedded Power ICs” once to trigger the integration into Keil



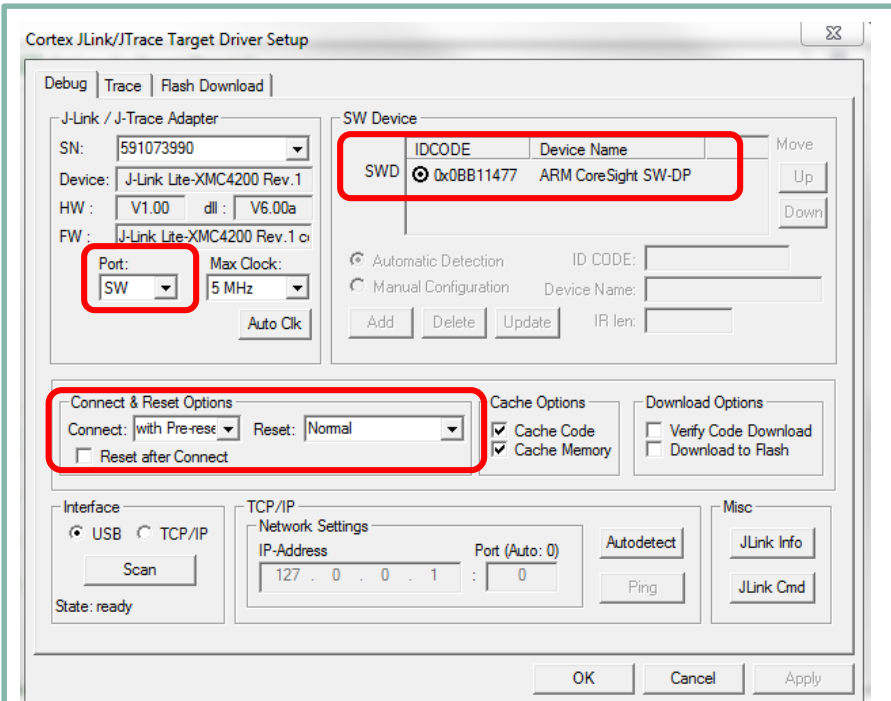
3. Close the Config Wizard and the toolbox

# Toolchain installation: 3/4



## Segger J-LINK-Lite driver:

- > Driver for 'on-board' or 'stand-alone' debugger
- > Install driver from:  
[https://www.segger.com/downloads/jlink/JLink\\_Windows.exe](https://www.segger.com/downloads/jlink/JLink_Windows.exe)



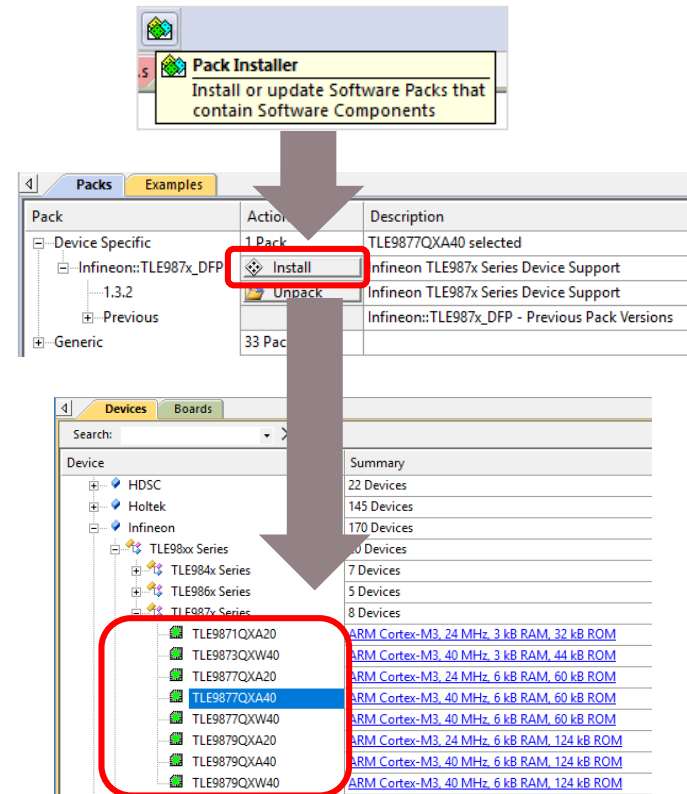


# Toolchain installation: 4/4



## PACK-file TLE986x and TLE987x for $\mu$ Vision5:

- > Device database for all TLE98xx ICs
- > Device support for flashing/erasing
- > SFR description for register debugging
- > Device description for Config Wizard
- > Includes SDK (Software Development Kit)
- > Example code included



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# Getting Started: Infineon Embedded Power SDK

## Keil $\mu$ Vision5 Template

- › Creating new project with Infineon SDK
- › Writing code

## Infineon Config Wizard

- › Initialize modules
- › Timers
- › GPIOs

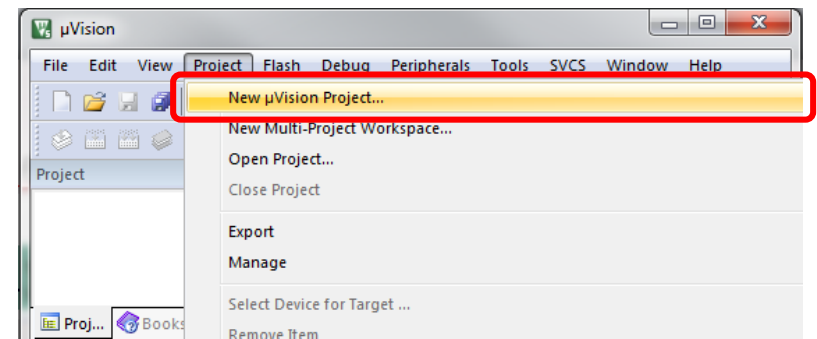
## J-Link Configuration

- › Connect device
- › Program flash
- › Using debug window

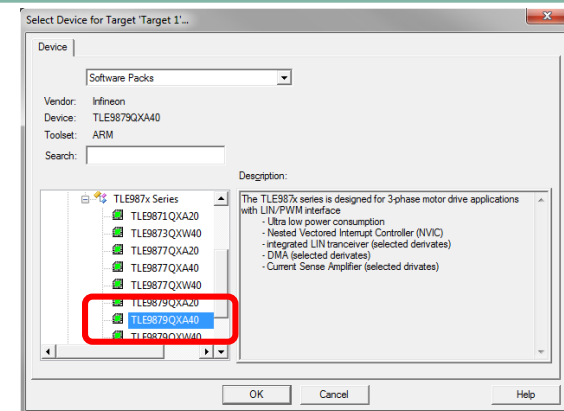
# Getting Started: Infineon Embedded Power SDK Keil $\mu$ Vision5 Template

## 1) Create new Project

- › Open Keil mdk
- › Go to ->Project  
->new  $\mu$ Vision Project
- › Name project: ("TIMER2\_BLINK")



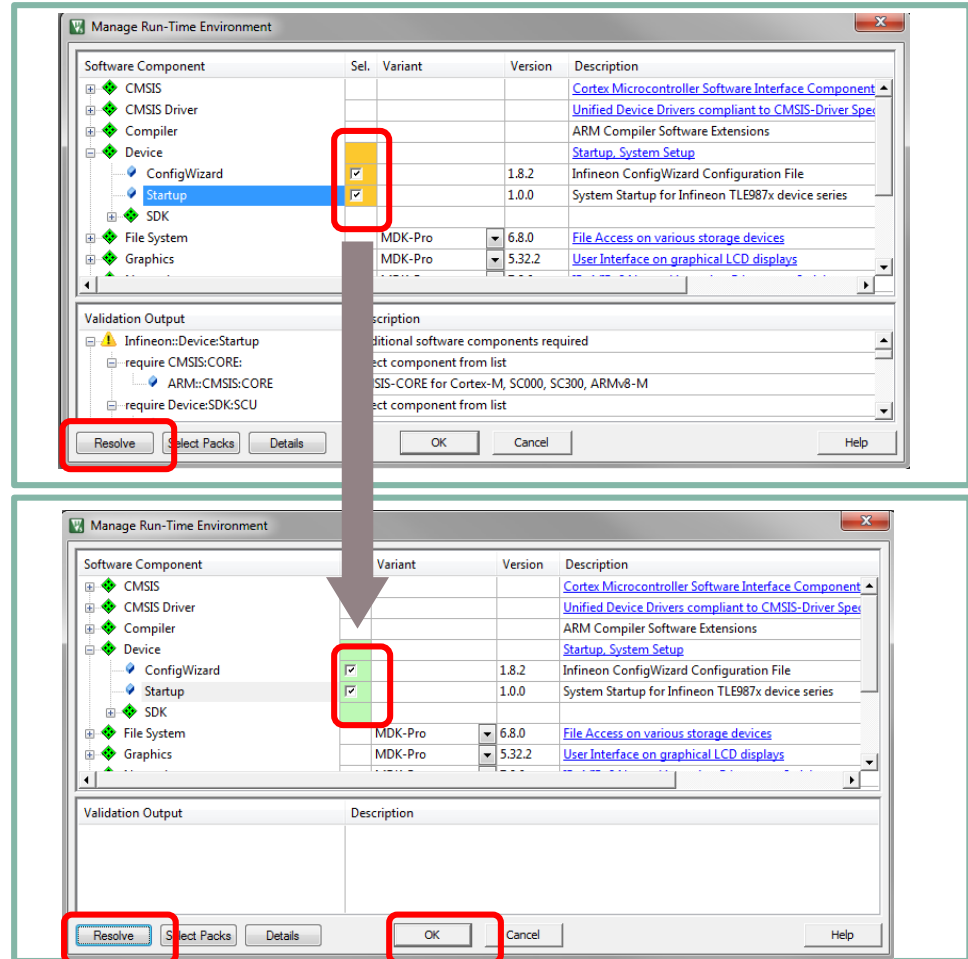
- › Select Device
  - › i.e. TLE9879QXA40



# Getting Started: Infineon Embedded Power SDK Keil µVision5 Template

## 2) Configuration of Run-Time Environment

- › Expand: “Device”
  - › Check: Config Wizard
  - › Check: Startup
- › “Sel.” window background is **orange**
- › Press: “Resolve”
- › “Sel.” window background is now **green**
- › Continue with “OK”

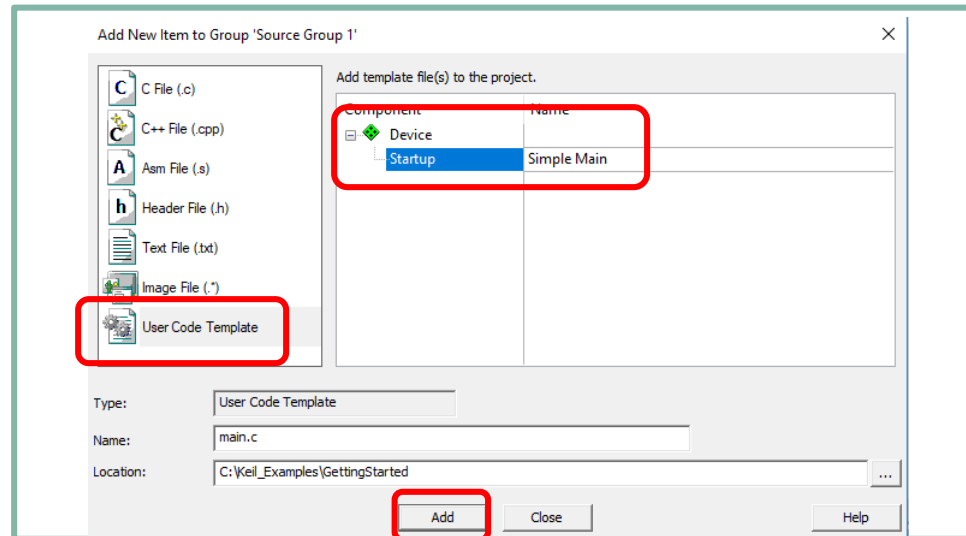
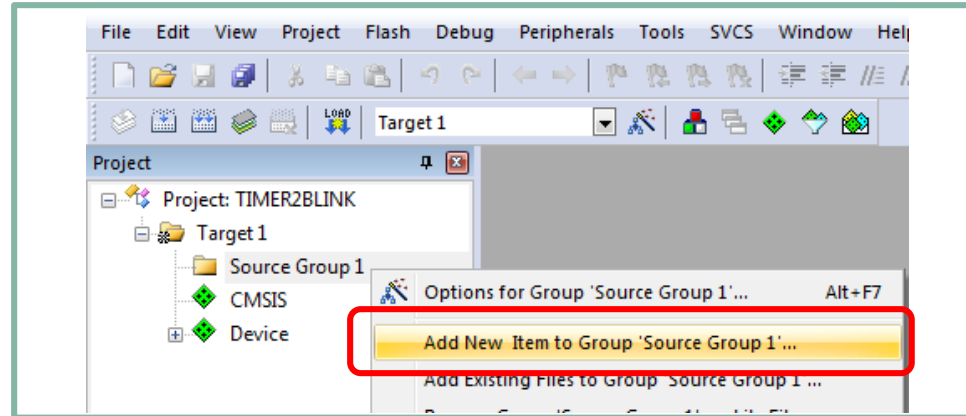


# Getting Started: Infineon Embedded Power SDK

## Keil $\mu$ Vision5 Template

### 3) Using easy “Main” template

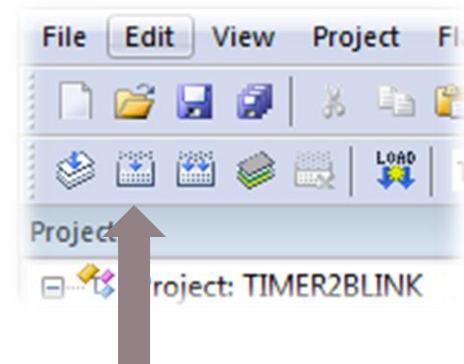
- › Expand: “Target 1”
- › Right click on: “Source Group 1”
- › Choose “Add New Item to Group ‘Source Group 1’”
- › Choose “User Code Template”
- › Expand “Device”
- › Choose: “Startup”
- › Continue with “Add”



# Getting Started: Infineon Embedded Power SDK Keil $\mu$ Vision5 Template

## 4) Compile Project

- > Compile Project:
  - > Press “Build” Button or press “F7”
- > Project “Build Output” window shows  
0 Error(s) , 0 Warning(s)

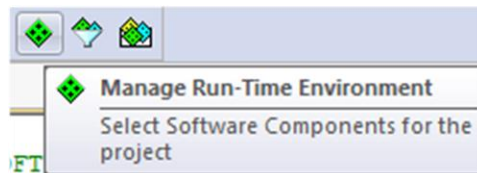


```
Build Output
compiling main.c...
compiling port.c...
compiling timer2x.c...
linking...
Program Size: Code=1512 RO-data=164 RW-data=16 ZI-data=608
".\Objects\Getting_Started.axf" - 0 Error(s), 0 Warning(s).
Build Time Elapsed: 00:00:02
```

# Getting Started: Infineon Embedded Power SDK Keil µVision5 Template

## 5) Adding Modules from Run-Time Environment

› Go to:



› Enter "Device-> SDK" Section

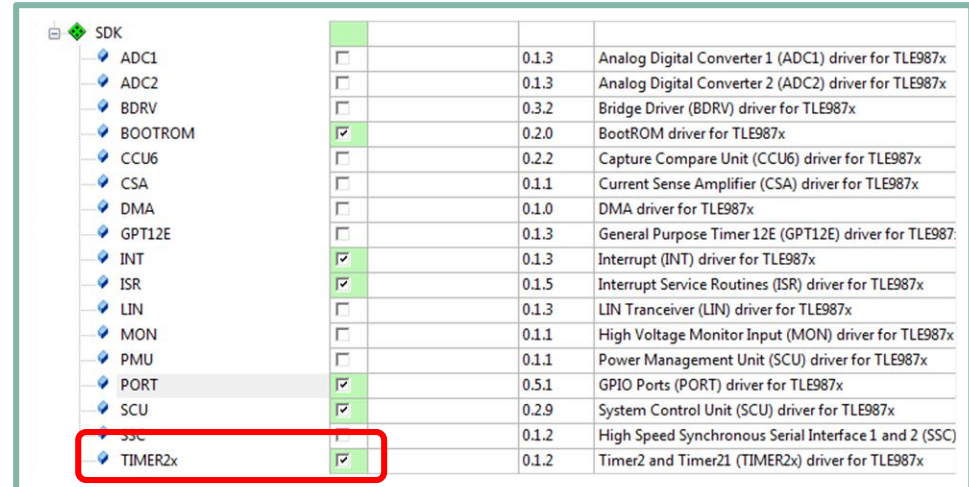
› Select "Timer2x"

› Press "OK"

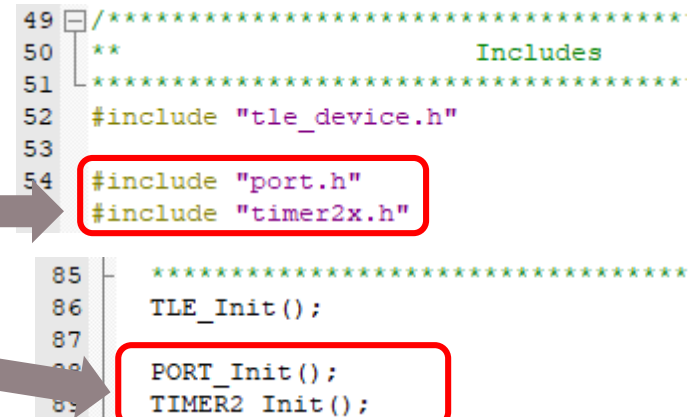
› Add Code to main.c:

› Include Libraries

› Initialize Modules



Component	Version	Description
ADC1	0.1.3	Analog Digital Converter 1 (ADC1) driver for TLE987x
ADC2	0.1.3	Analog Digital Converter 2 (ADC2) driver for TLE987x
BDRV	0.3.2	Bridge Driver (BDRV) driver for TLE987x
BOOTROM	0.2.0	BootROM driver for TLE987x
CCU6	0.2.2	Capture Compare Unit (CCU6) driver for TLE987x
CSA	0.1.1	Current Sense Amplifier (CSA) driver for TLE987x
DMA	0.1.0	DMA driver for TLE987x
GPT12E	0.1.3	General Purpose Timer 12E (GPT12E) driver for TLE987x
INT	0.1.3	Interrupt (INT) driver for TLE987x
ISR	0.1.5	Interrupt Service Routines (ISR) driver for TLE987x
LIN	0.1.3	LIN Transceiver (LIN) driver for TLE987x
MON	0.1.1	High Voltage Monitor Input (MON) driver for TLE987x
PMU	0.1.1	Power Management Unit (SCU) driver for TLE987x
PORT	0.5.1	GPIO Ports (PORT) driver for TLE987x
SCU	0.2.9	System Control Unit (SCU) driver for TLE987x
SSC	0.1.2	High Speed Synchronous Serial Interface 1 and 2 (SSC)
TIMER2x	0.1.2	Timer2 and Timer21 (TIMER2x) driver for TLE987x



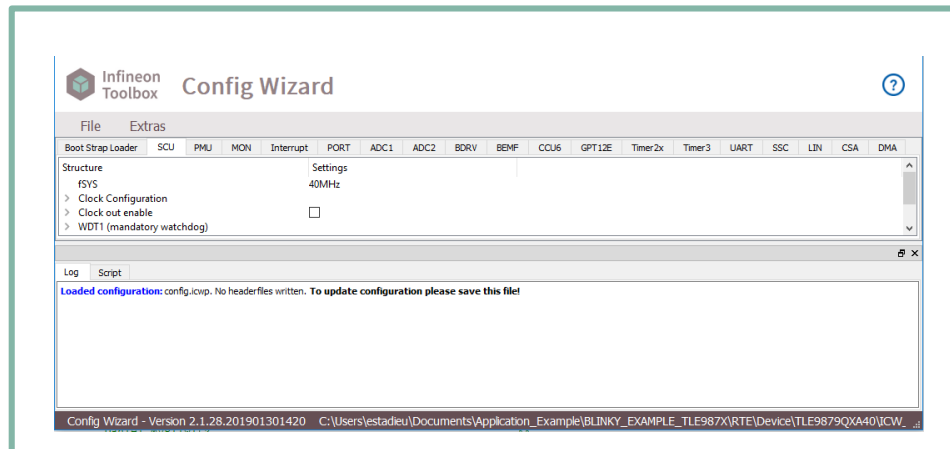
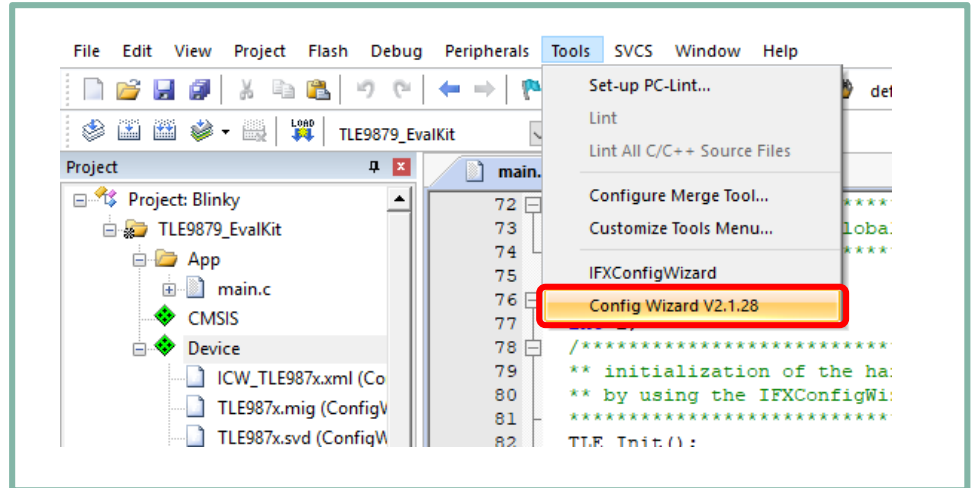
```
49 /*****  
50 ** Includes  
51 *****/  
52 #include "tler_device.h"  
53  
54 #include "port.h"  
55 #include "timer2x.h"  
  
85  
86 TLE_Init();  
87  
88 PORT_Init();  
89 TIMER2_Init();
```



# Getting Started: Infineon Embedded Power SDK Keil µVision5 Template

## 6) Using Config Wizard v2

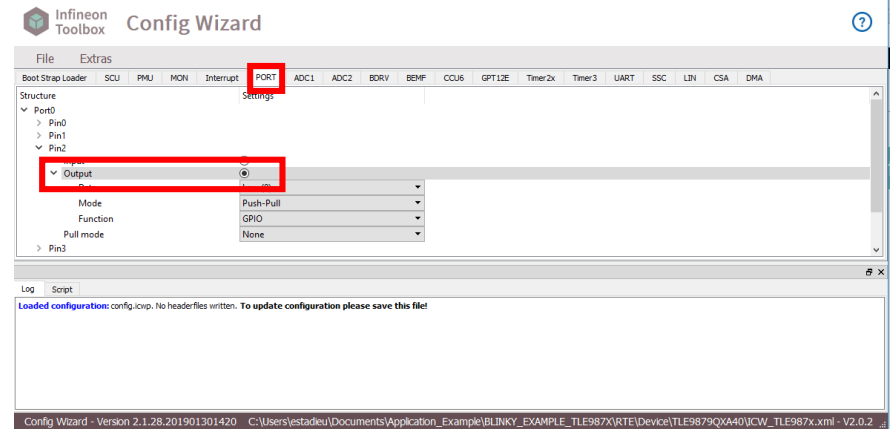
- › Open Config Wizard by choosing Tools > Config Wizard v2
- › Config Wizard will open in a separate window



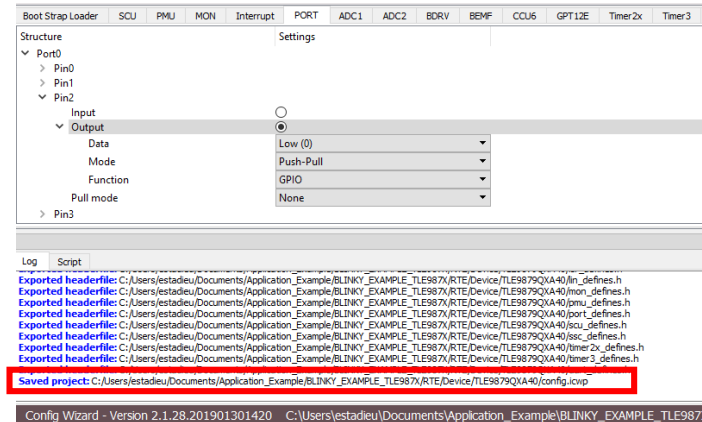
# Getting Started: Infineon Embedded Power SDK Keil µVision5 Template

## 7) Using Config Wizard v2: Port Configuration

- › Select “PORT” section
- › Go to the “P0.2” section
- › Configure pin to “Output” mode



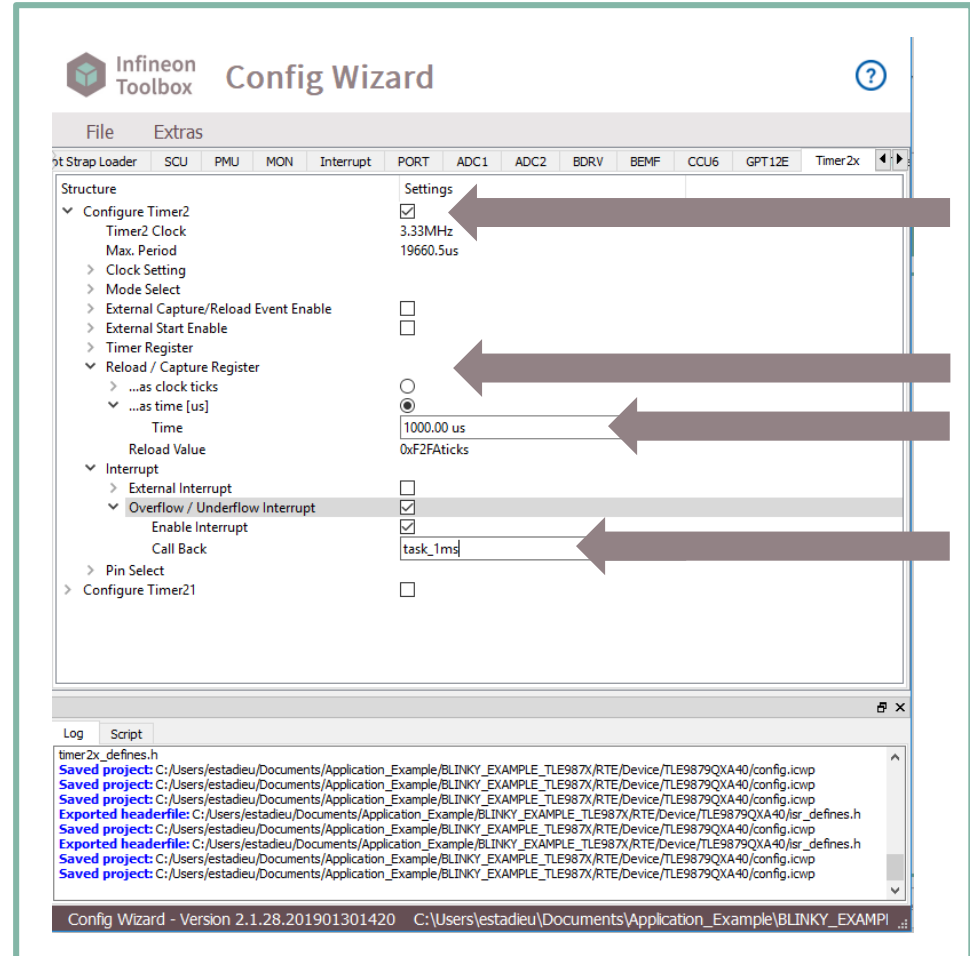
- › Save with “File” -> “Save”



# Getting Started: Infineon Embedded Power SDK Keil µVision5 Template

## 8) Using Config Wizard v2: Timer2 Configuration

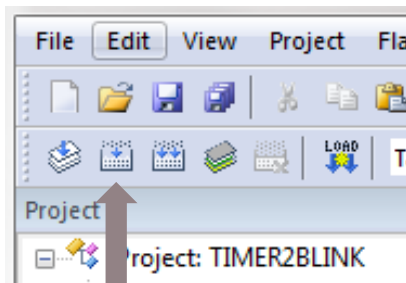
- › Open “Timer 2x” section
- › Enable “Configure Timer” checkbox
- › Go to:  
“Reload / Capture Register”
  - › Enter “1000” µs
- › Go to: “Interrupt”
  - › Enable Overflow Interrupt
  - › Type “task\_1ms” in  
“Call Back” line
- › Save with “File” -> “Save”



# Getting Started: Infineon Embedded Power SDK Keil µVision5 Template

## 9) Edit “main.c”

- › Go to Keil MDK
- › Start Timer2 before the “for (;;)” loop
- › Write function definition of Interrupt call back
- › Use API function “PORT\_ChangePin()”
- › “Save” and “Build” project



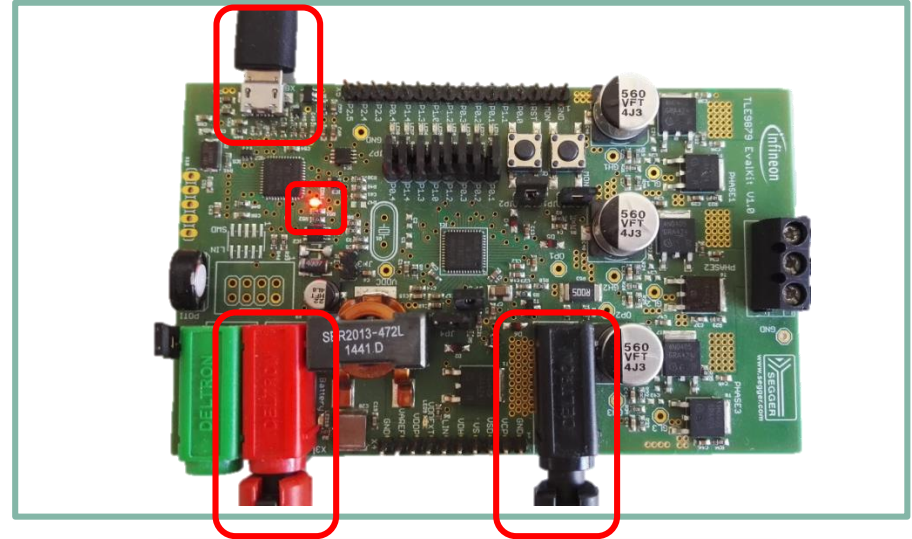
```
119  /** place your application code here
120
121  TIMER2_Start();
122
123  /** main endless loop
124
125  /*lint -e716 info while(1) ... */ \
126  /*lint -e9036 Supressing MISRA 2012 Rule 14.4
127  while (1)
128  /*lint -e9036 */
129  /*lint -e716 */
130  {
131
```

```
146  /** Private Function Defi
147
148
149  void task_lms(void)
150  {
151  PORT_ChangePin(0x02, PORT_ACTION_TOGGLE);
152  }
153
```

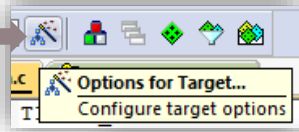
# Getting Started: Infineon Embedded Power SDK Keil µVision5 Template

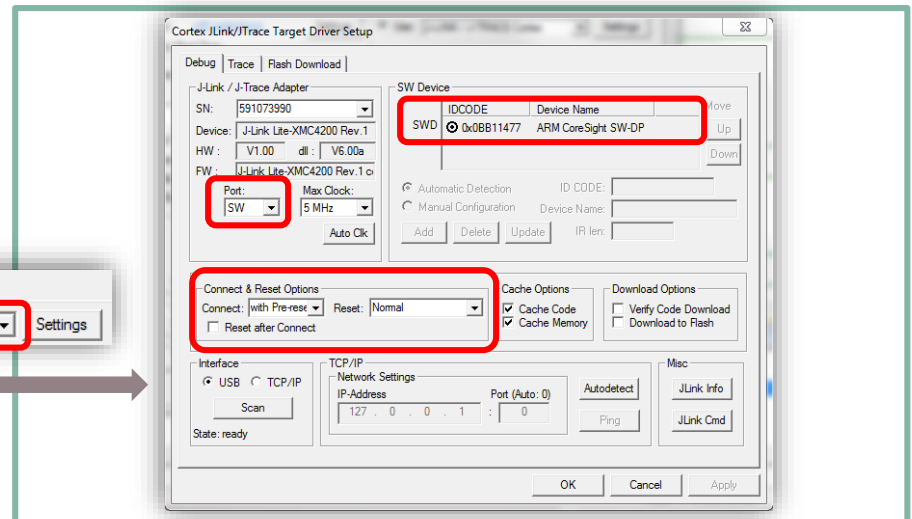
## 10) Power up Evaluation board

- › Connect micro USB cable
- › Supply board via banana jacks (VBAT, GND)
- › Debug LED lights up



## 11) Connect Debugger

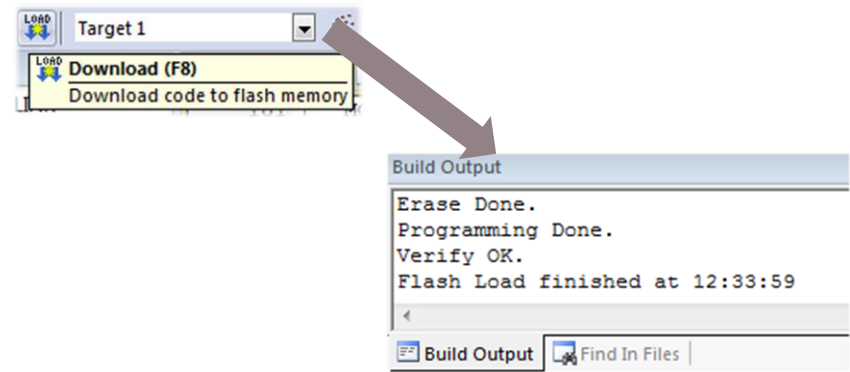
- › Go to 
- › Choose:
  - › Debug->use: J-Link
  - › Go to “Settings”
- › SWD connection established when “IDCODE” is visible



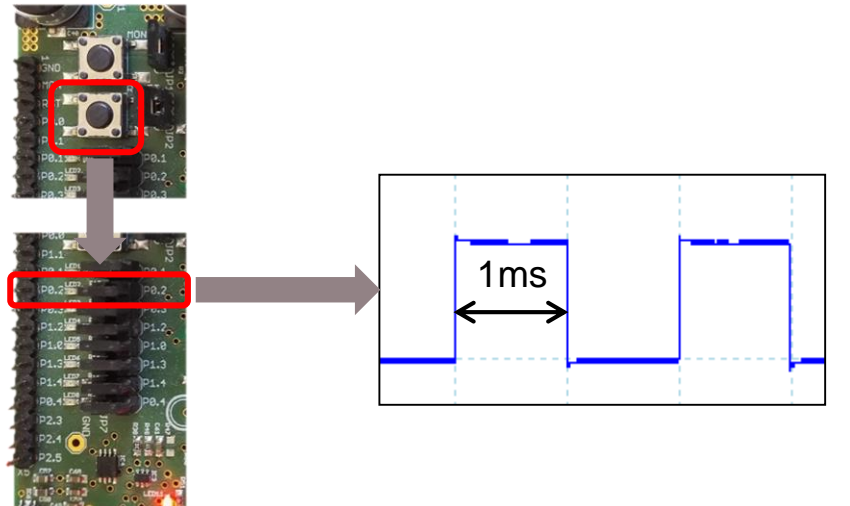
# Getting Started: Infineon Embedded Power SDK Keil $\mu$ Vision5 Template

## 12) Download and run code

- › Press: “Load”- button or Press: “F8”
- › “Flash Load finished” is shown in “Build Output” window



- › Press: “Reset” button on Evaluation Board
- › LED on Port “P0.2” will light up
- › Port toggle every 1ms

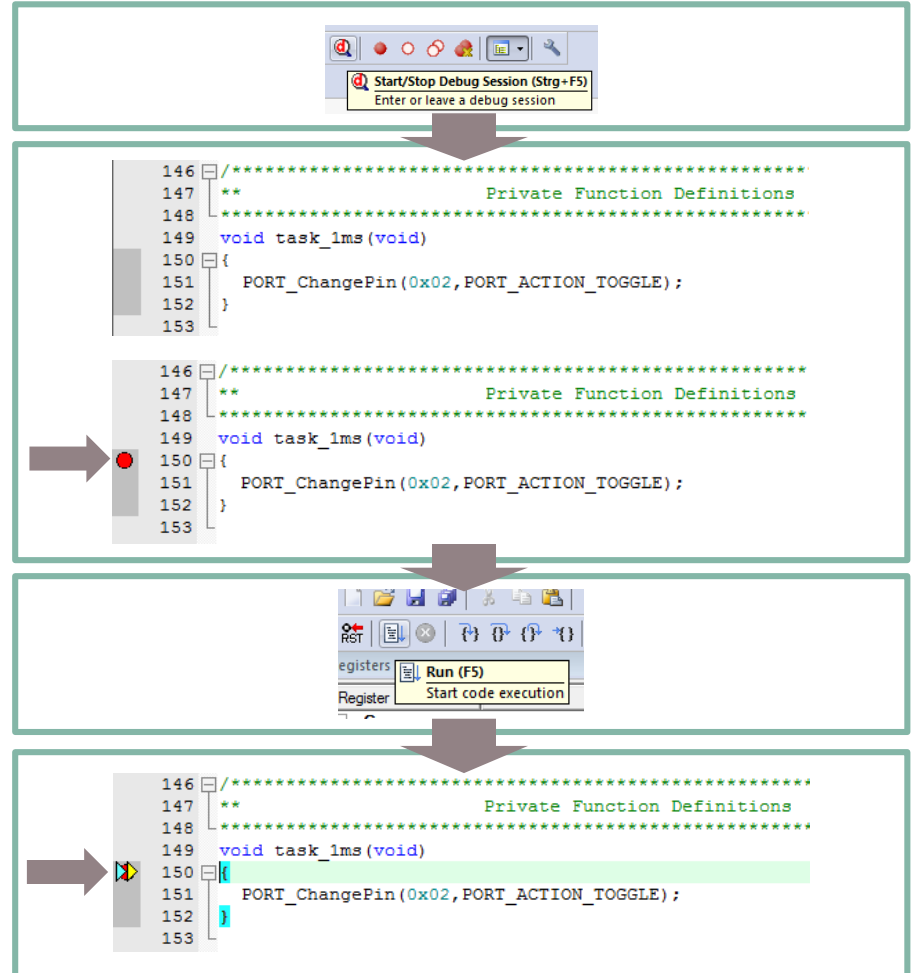


# Getting Started: Infineon Embedded Power SDK

## Keil $\mu$ Vision5 Template

### 13) Use Runtime Debug

- › Enter “Debug Session”
- › Left click at the dark grey area left of the code, to place a “breakpoint”
- › Hit “Run” or press “F5” to start execution
- › Code execution stops at breakpoint
- › In this example:
  - › Every time “Run” is pressed: “P0.2” toggles



# Getting Started: Infineon Embedded Power SDK Example Code



## Infineon Example Code available in “Pack Installer”

The screenshot shows the Pack Installer application interface. The left pane displays a tree view of devices, with the Infineon TLE9879QXA40 selected. The right pane shows a list of example codes with their descriptions and actions.

Example	Action	Description
ADC1_POTI_EIM (TLE9879 EvalKit)	Copy	ADC1 with Exceptional Interrupt Mode reading in the Poti at Channel 4
ADC1_POTI_ESM (TLE9879 EvalKit)	Copy	ADC1 with Exceptional Sequencer Mode reading in the Poti at Channel 4
ADC1_POTI_SEQ (TLE9879 EvalKit)	Copy	ADC1 in Sequencer Mode reading in the Poti at Channel 4
ADC2_VS (TLE9879 EvalKit)	Copy	ADC2 VS Measurement
BLDC_Block_Commutation_HALL (TLE9879 EvalKit)	Copy	BLDC Motor Drive with Block Commutation with HALL Sensor
BLDC_Block_Commutation_HALL + LIN (TLE9879 EvalKit)	Copy	BLDC Motor Drive with Block Commutation with HALL Sensor controlled over LIN
BLDC_Sensorless_FOC (TLE9879 EvalKit)	Copy	BLDC Motor Drive with Sensorless FOC
BLDC_Sensorless_FOC + LIN (TLE9879 EvalKit)	Copy	BLDC Motor Drive with Sensorless FOC controlled over LIN
Blinky (TLE9879 EvalKit)	Copy	Blinky - blinks LED1
Blinky - Running Lights (TLE9879 EvalKit)	Copy	Blinky - Running Lights
CCU6_ADC1 (TLE9879 EvalKit)	Copy	PWM synchronous ADC measurement, the Poti at Channel 4 adjusts the PWM
CCU6_PWM (TLE9879 EvalKit)	Copy	CCU6 generates PWM signals
CCU6_SIN_PWM (TLE9879 EvalKit)	Copy	CCU6 generates Sinus with PWM signals
DMA_ADC1_Sequence (TLE9879 EvalKit)	Copy	ADC1 triggers DMA after sequence is done
DMA_SPI (TLE9879 EvalKit)	Copy	Sends data through SPI using DMA
DMA_UART_TTY (TLE9879 EvalKit)	Copy	UART2 sends data triggered by DMA
GPT12E_T3_CONCAT (TLE9879 EvalKit)	Copy	Timer2 and Timer3 as 32bit Timer
GPT12E_T3_RELOAD (TLE9879 EvalKit)	Copy	GPT12E Timer3 reloaded by Timer2
LIN_Master (TLE9879 EvalKit)	Copy	running the IHR LIN LLD in a LIN Master configuration
LIN_Slave (TLE9879 EvalKit)	Copy	running the IHR LIN LLD in a LIN Slave configuration
PMU_Data_Flash_Handling (TLE9879 EvalKit)	Copy	NVM Data Flash page write with error handling
NVM_Prog (TLE9879 EvalKit)	Copy	NVM Page Programming
NVM_Prog_RAM_BRANCH (TLE9879 EvalKit)	Copy	NVM Programming with RAM Branch
NVM_Protection (TLE9879 EvalKit)	Copy	Flash Page Write Protection
PMU_PowerSaving_SleepMode (TLE9879 EvalKit)	Copy	Power Saving Modes - Sleep Mode
PMU_PowerSaving_SleepMode_CyclicWake (TLE9879 EvalKit)	Copy	Power Saving Modes - Sleep Mode with cyclic wake
PMU_PowerSaving_StopMode (TLE9879 EvalKit)	Copy	Power Saving Modes - Stop Mode
PMU_ResetStatus (TLE9879 EvalKit)	Copy	Reset Status Evaluation
PMU_VDDEXT (TLE9879 EvalKit)	Copy	VDDEXT handling
SCU_PLL (TLE9879 EvalKit)	Copy	PLL adjustment
SCU_PLL_XTAL (TLE9879 EvalKit)	Copy	PLL with external XTAL
SDK (TLE9879 EvalKit)	Copy	Software Developer Kit
SSC1_2_SSC2 (TLE9879 EvalKit)	Copy	SSC1 sends to SSC2
SSC1_SEND (TLE9879 EvalKit)	Copy	SSC1 sends data as SPI Master
TIMER2_BLINK (TLE9879 EvalKit)	Copy	TIMER2 Blinking
TIMER2_PWM_CAPTURE (TLE9879 EvalKit)	Copy	TIMER2 PWM Duty Cycle and Period Measurement
UART1_SEND (TLE9879 EvalKit)	Copy	UART1 sends data over LIN Transceiver
UART2_TTY (TLE9879 EvalKit)	Copy	UART2 sends printf messages





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