

Evaluation Board and Kit

Getting Started

TLE985x EvalBoard

TLE9855 EvalKit

April 2019



Agenda

1

Evaluation Board and Kit Overview

2

Product Information and Available Documentation

3

Toolchain Installation

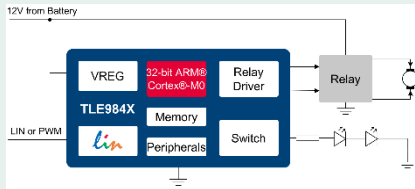
4

Getting Started

TLE985x Overview

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

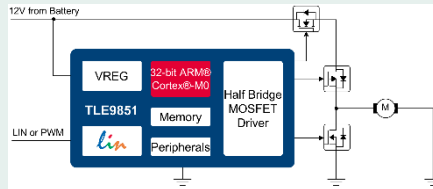
Smart Relay IC DC Motor



TLE9842/3/4

- > Window Lift
- > Sunroof
- > Wiper

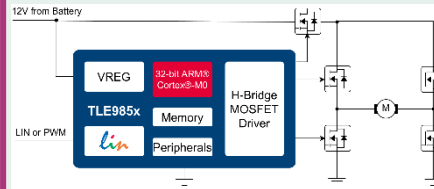
Smart Half Bridge



TLE9845/TLE9851

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

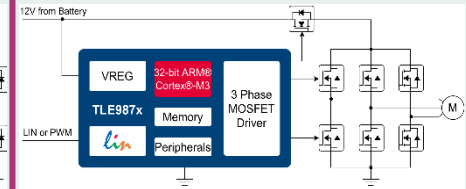
Smart H-Bridge Driver



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

Evaluation Board and Kit Overview

TLE985x – Evaluation Board

- › 2-Phase N-MOS Bridge
- › Single Shunt in GND path
- › Integrated LIN transceiver
- › 4 push buttons
- › Debug LEDs
- › Onboard Segger J-Link Debugger
- › EvalBoard-PC connector: USB
- › uIO stick connector

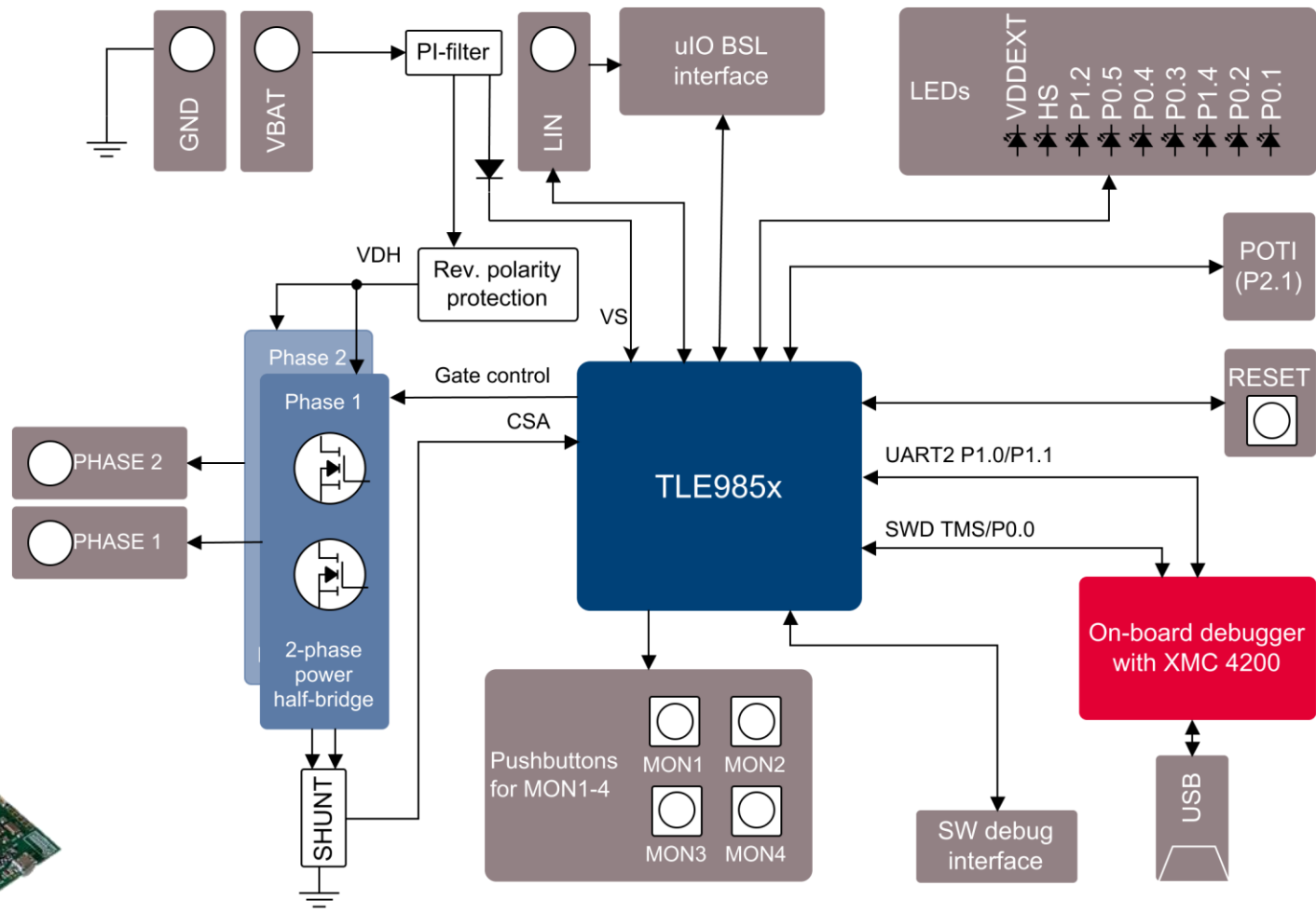


TLE9855 – Evaluation Kit

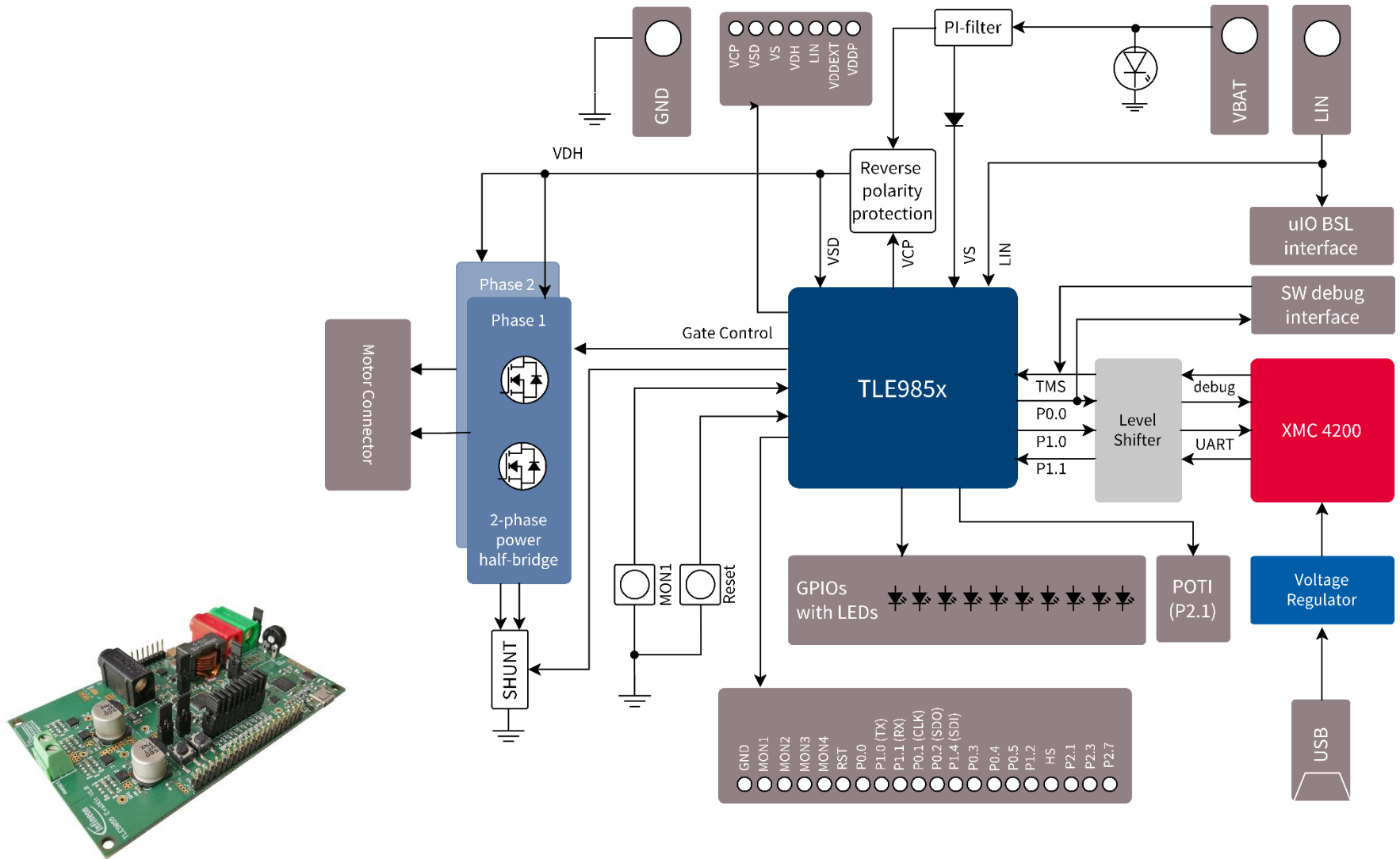
- › 2-Phase N-MOS Bridge
- › Single Shunt in GND path
- › Integrated LIN transceiver
- › Debug LEDs
- › Onboard Segger J-Link Debugger
- › EvalKit-PC connector: USB



TLE985x EvalBoard Overview



TLE9855 EvalKit Overview



Agenda

1

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2

Product Information and Available Documentation

3

Toolchain Installation

4

Getting Started

TLE985x: Documentation

Collaterals and Brochures

- Product Brief
- Selection Guides
- Motor Drive eBook

- [Link to family page](#)

Technical Material

- Datasheet
- Application Notes
- Getting Started
- PCB Design Data
- User Manual

- [Link to Documents](#)

Evaluation Boards

- Evaluation Board
- Evaluation Kit

- [Link to Boards](#)

Software & Tools

- Config Wizard
- Keil μ Vision5
- Software Examples
- Infineon Toolbox

- [Link to Software & Tools](#)

> 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

- Overview
- Highlights
- Details
- Documents
- Boards
- Tools & Software
- Videos
- Partners
- Applications
- 4** 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

- Overview
- 5** Highlights
- Details
- Documents
- Boards
- Tools & Software
- Videos
- Partners
- Applications
- Support

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

1 Subscribe to Newsletter

2 Where to Buy

3 Tools, Finders and Selectors

4 Support

5 Forum

Agenda

1

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2

Product Information and Available Documentation

3

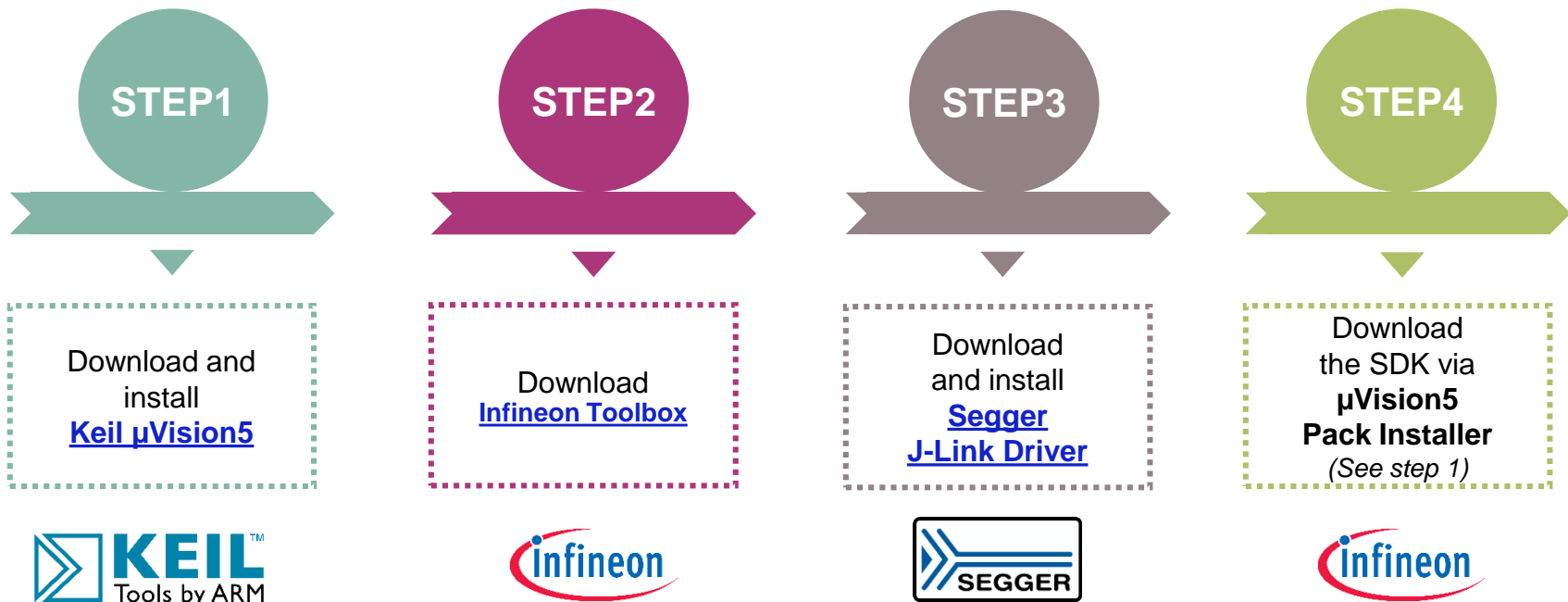
Toolchain Installation

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.



Arm® Keil μVision is an integrated development environment which consists of code editor, compiler and debugger.

Infineon provides the Infineon Toolbox which is designed to install and use Infineon plugins and tools.

SEGGER J-Link is a widely used driver for on-board or stand-alone debuggers.

The Embedded Power Software Development Kit (SDK) is a low level driver library which can be downloaded within “Keil μVision” via the “Pack Installer”.

Toolchain installation: 1/4

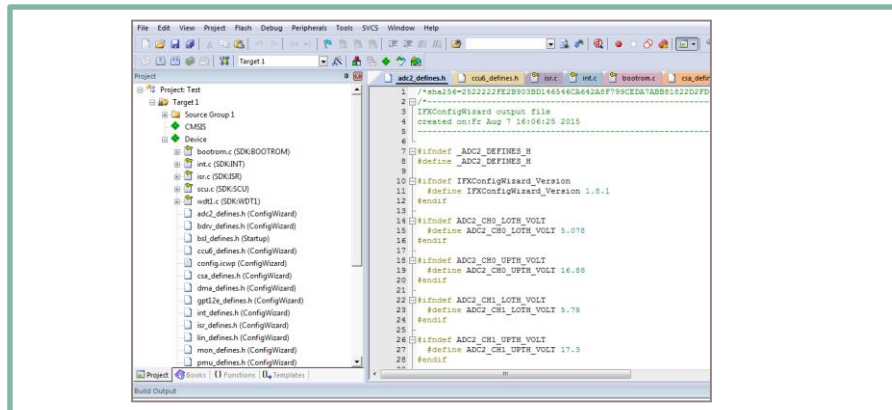


Keil μVision5

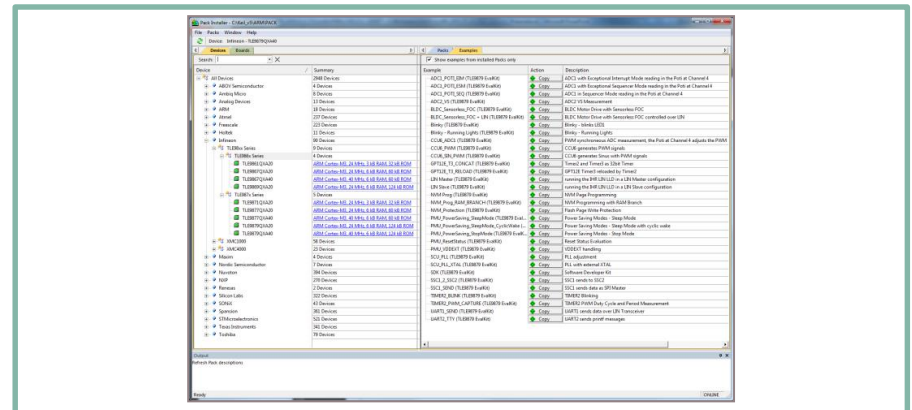
- Code Editor & Online Debugger
- Evaluation version can handle up to 32K

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

Main Window



Pack Installer



Toolchain installation: 2/4



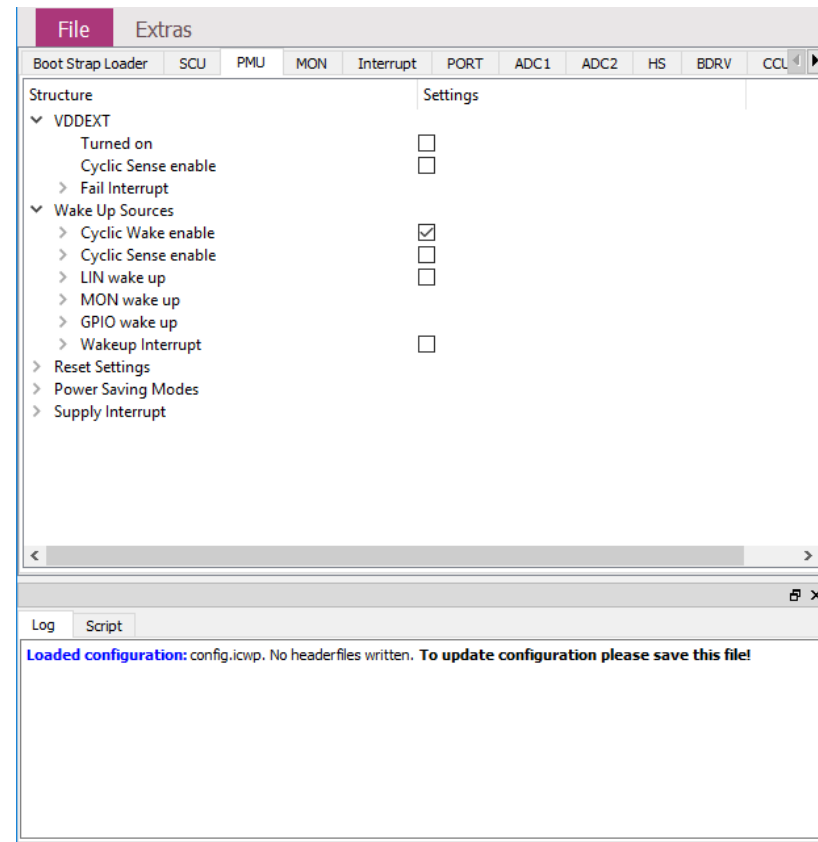
Infineon **Config Wizard**

Configuration of chip modules

Device description for TLE985x included

Installation from Infineon Toolbox

TLE985x supported by Keil μ Vision 5

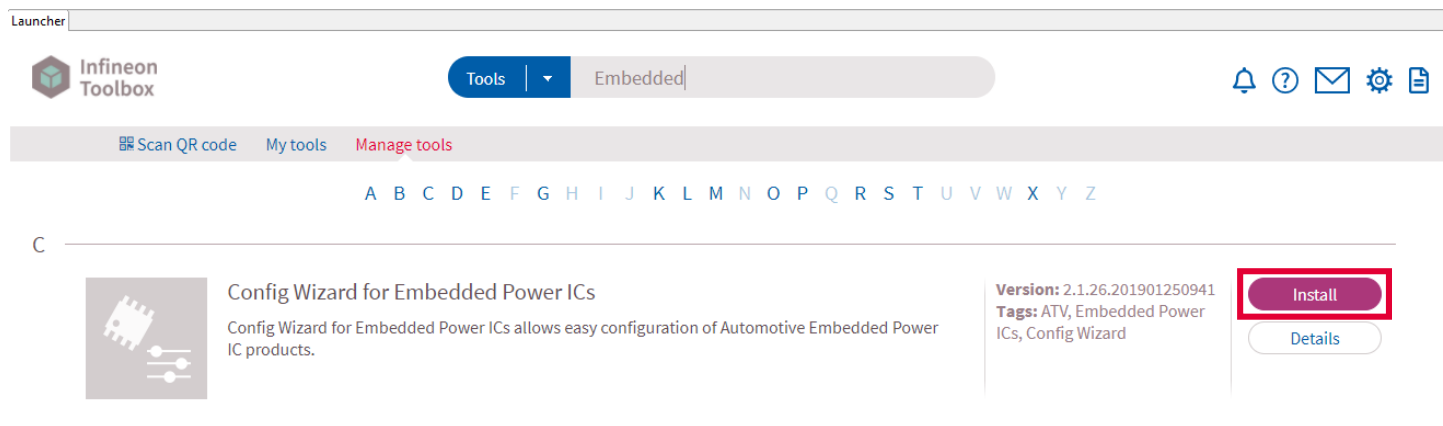


Toolchain installation: 2/4



Infineon Toolbox: Config Wizard for Embedded Power ICs:

- Install the “[Infineon Toolbox](#)”^(*) 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”



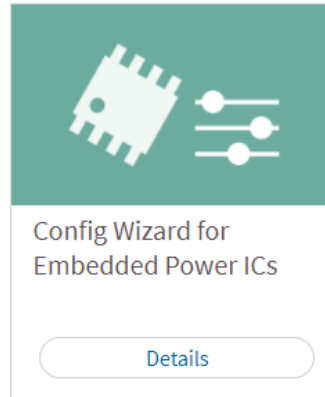
^(*) For more details about the Infineon Toolbox installation, please read the [Installation Manual](#).

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



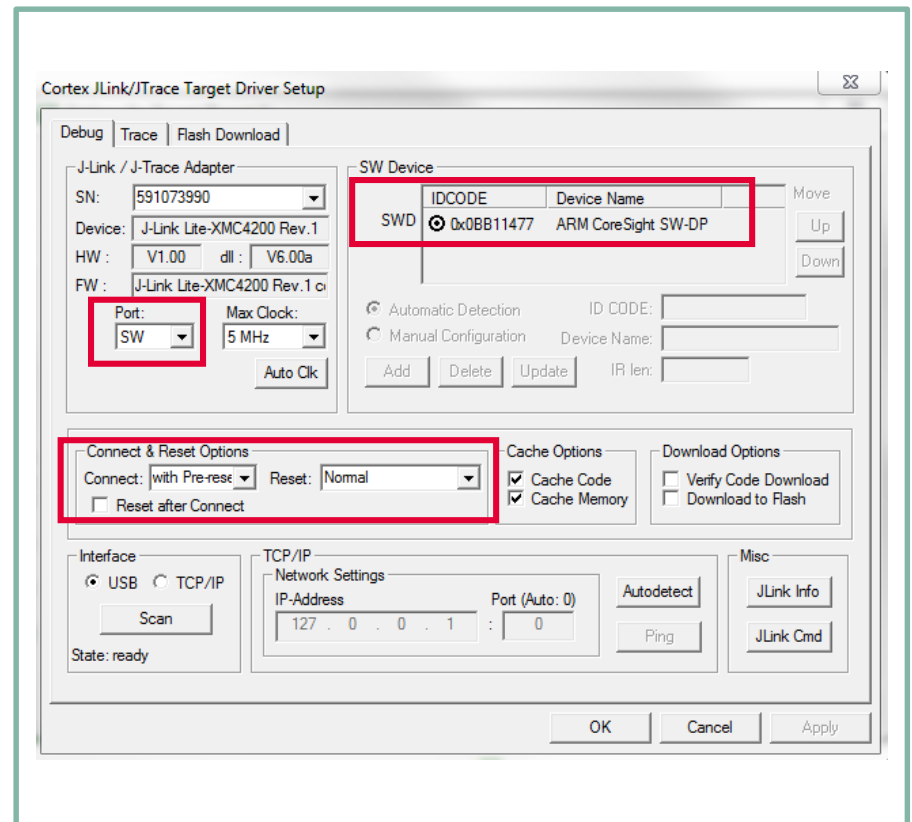
3. Close the Config Wizard and the toolbox

Toolchain installation: 3/4



Segger J-LINK-Lite driver:

- Driver for 'on-board' or 'stand-alone' debugger
- Install driver from:
<https://www.segger.com/jlink-software.html>

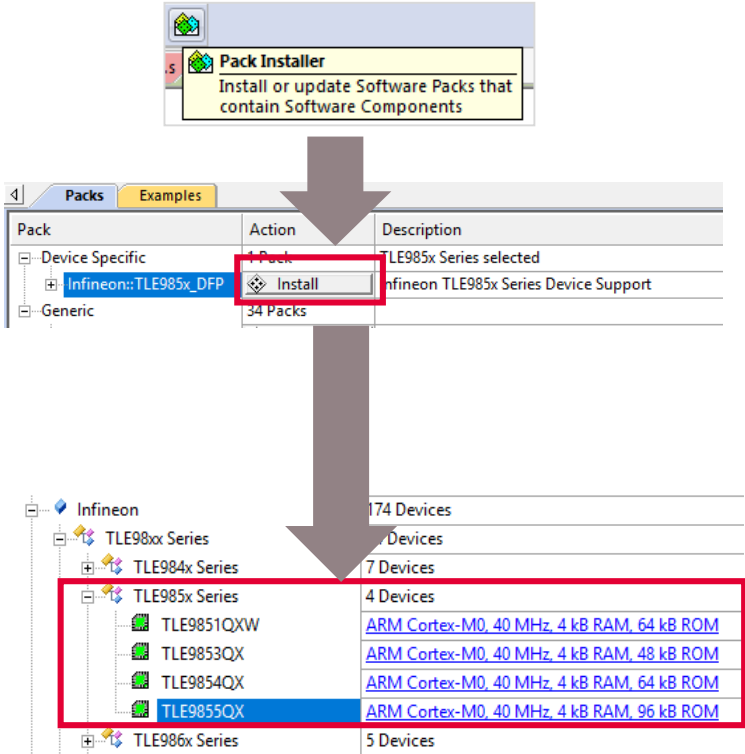


Toolchain installation: 4/4



PACK-file TLE985x for μ Vision5:

- Device database for all TLE985x variants
- Device support for flashing/erasing TLE985x
- Device description for TLE985x for Config Wizard
- Includes SDK (Software Development Kit)
- If the TLE985x SDK is not available in the pack installer, you can load it from a local file using the “File->Import” menu.



The screenshot shows the Pack Installer window with the following table:

Pack	Action	Description
Device Specific	1 Pack	TLE985x Series selected
Infineon::TLE985x_DFP	Install	Infineon TLE985x Series Device Support
Generic	34 Packs	

The lower part of the screenshot shows the device tree with the following table:

Infineon	Devices
TLE980x Series	174 Devices
TLE984x Series	7 Devices
TLE985x Series	4 Devices
TLE9851QXW	ARM Cortex-M0, 40 MHz, 4 kB RAM, 64 kB ROM
TLE9853QX	ARM Cortex-M0, 40 MHz, 4 kB RAM, 48 kB ROM
TLE9854QX	ARM Cortex-M0, 40 MHz, 4 kB RAM, 64 kB ROM
TLE9855QX	ARM Cortex-M0, 40 MHz, 4 kB RAM, 96 kB ROM
TLE986x Series	5 Devices

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1

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2

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3

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4

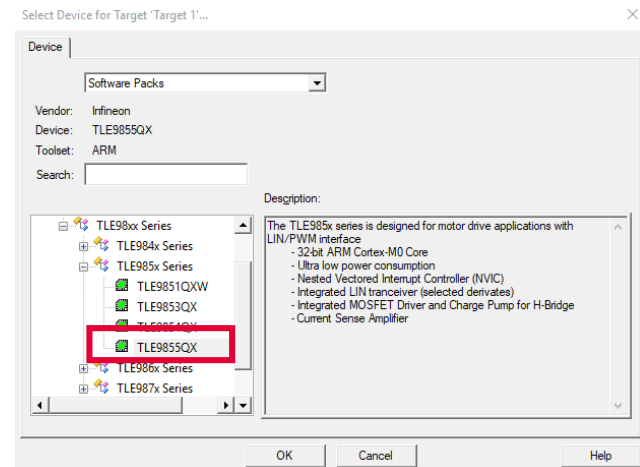
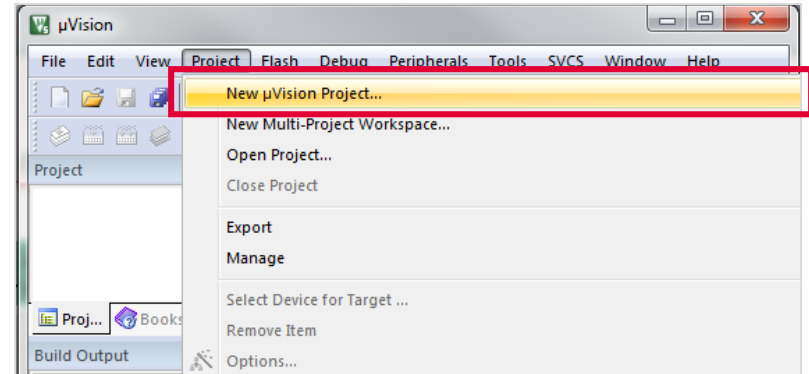
Getting Started

Getting Started: Infineon Embedded Power SDK Keil μ Vision5 Template

1) Create a new Project

- > Open Keil mdk
- > Go to \rightarrow Project
 \rightarrow new μ Vision Project
- > Name project: “TLE9855QX_test”

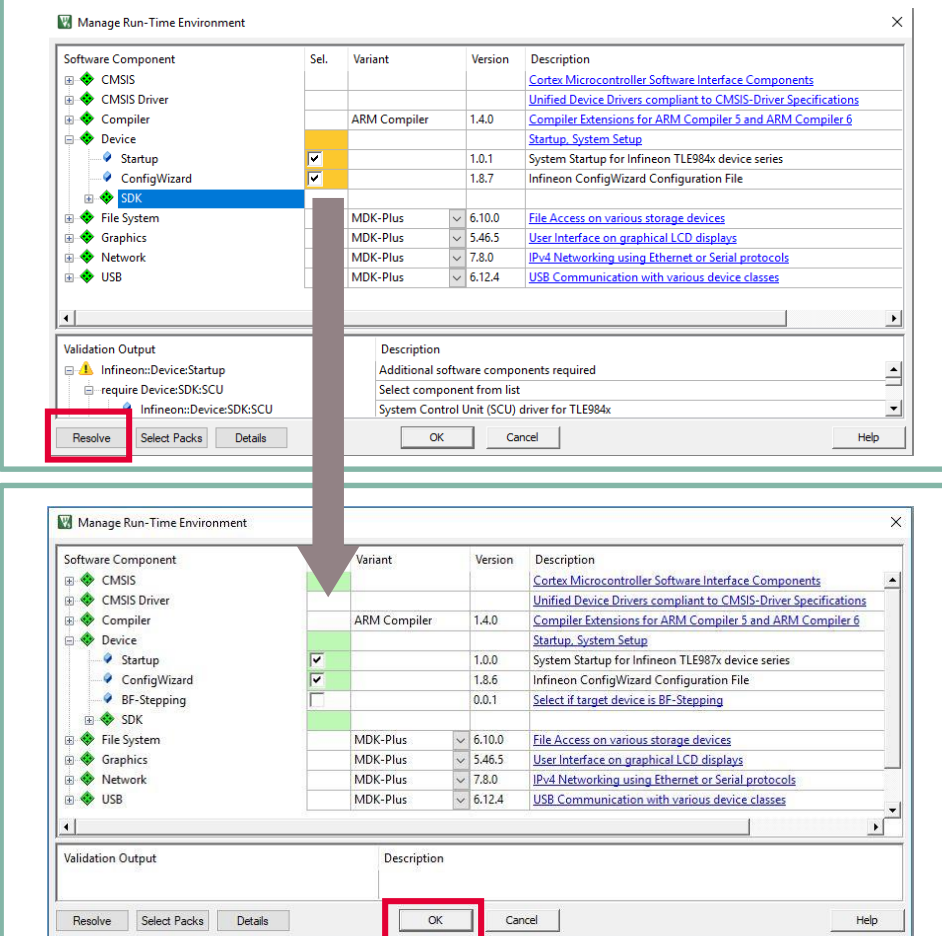
- > Select Device:
 - Infineon
 - TLE98xx Series
 - TLE985x Series
 - TLE9855QX



Getting Started: Infineon Embedded Power SDK Keil µVision5 Template

2) Configuration of Run-Time Environment

- > Expand: “Device”
 - Check: Startup
 - Check: ConfigWizard
- > “Sel.” window background is **orange**
- > Press: “Resolve”
- > “Sel.” window background is now **green**
- > Expand “SDK”
 - Check “TIMER2x”
- > Continue with “OK”



The image displays two screenshots of the 'Manage Run-Time Environment' dialog box in Keil µVision5. The top screenshot shows the 'Device' component expanded, with 'Startup' and 'ConfigWizard' checked. The 'Sel.' column for these components is highlighted in orange. A red box highlights the 'Resolve' button. The bottom screenshot shows the same dialog after clicking 'Resolve'. The 'Sel.' column for 'Startup' and 'ConfigWizard' is now highlighted in green. A red box highlights the 'OK' button.

Software Component	Sel.	Variant	Version	Description
CMSIS				Cortex Microcontroller Software Interface Components
CMSIS Driver				Unified Device Drivers compliant to CMSIS-Driver Specifications
Compiler		ARM Compiler	1.4.0	Compiler Extensions for ARM Compiler 5 and ARM Compiler 6
Device				Startup_System Setup
Startup	<input checked="" type="checkbox"/>		1.0.1	System Startup for Infineon TLE984x device series
ConfigWizard	<input checked="" type="checkbox"/>		1.8.7	Infineon ConfigWizard Configuration File
File System		MDK-Plus	6.10.0	File Access on various storage devices
Graphics		MDK-Plus	5.46.5	User Interface on graphical LCD displays
Network		MDK-Plus	7.8.0	IPv4 Networking using Ethernet or Serial protocols
USB		MDK-Plus	6.12.4	USB Communication with various device classes

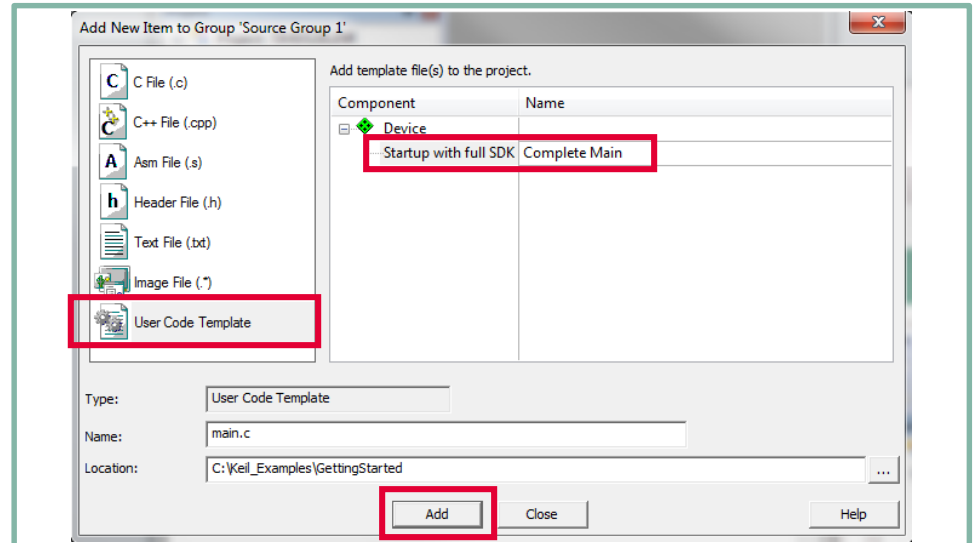
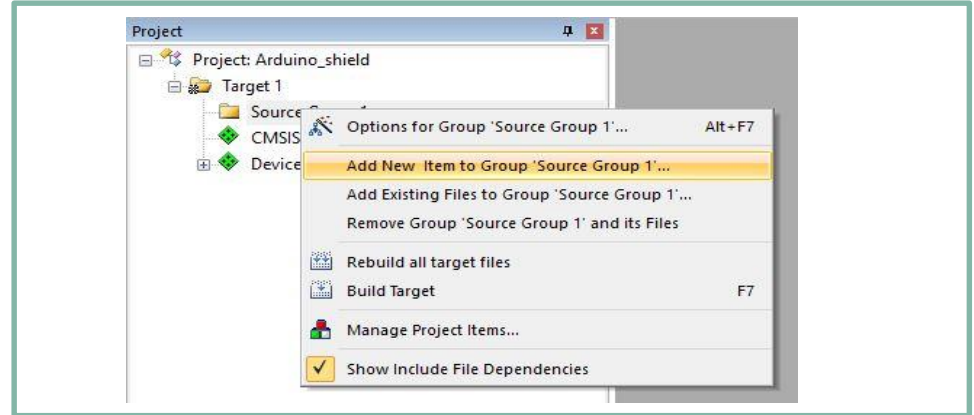
Validation Output: Infineon::Device:Startup, require Device:SDK:SCU, Infineon::Device:SDK:SCU

Description: Additional software components required, Select component from list, System Control Unit (SCU) driver for TLE984x

Getting Started: Infineon Embedded Power SDK Keil μ Vision5 Template

3) Using 'Main' template

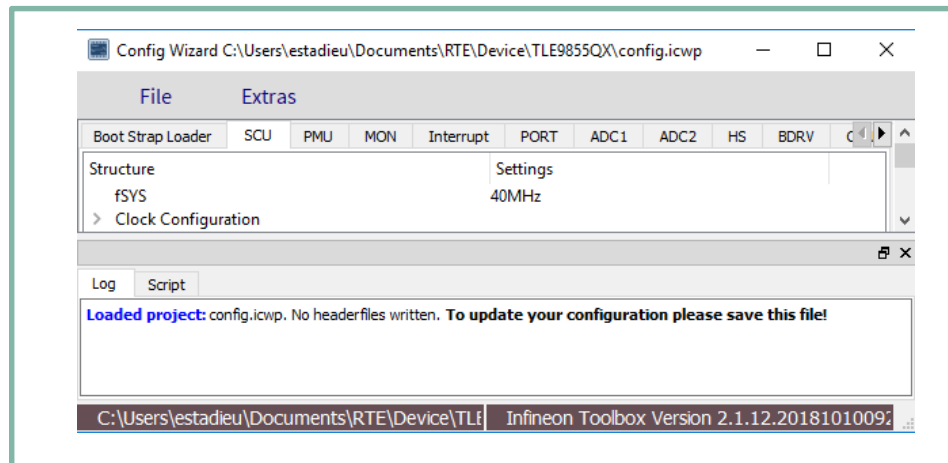
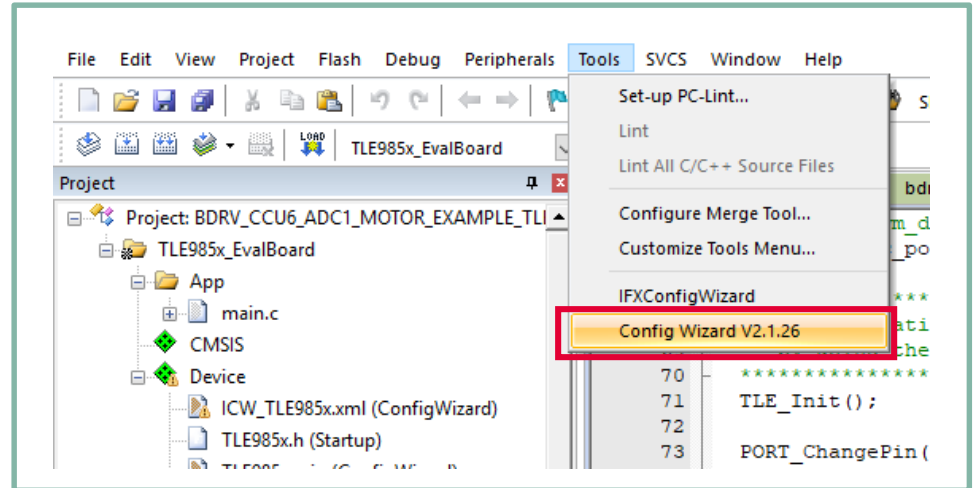
- › Expand: “Target 1”
- › Right click on:
“Source Group 1”
- › Choose: Add New Item to
Group “Source Group 1”
- › Choose “User Code
Template”
- › Expand “Device”
- › Choose:
“Startup”
- › Continue with “Add”



Getting Started: Infineon Embedded Power SDK Keil μ Vision5 Template

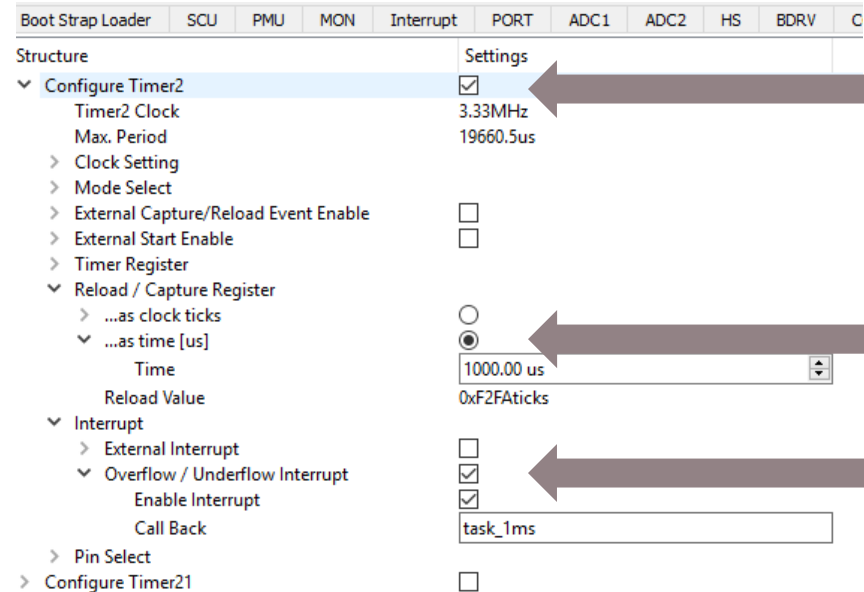
4) Using Config Wizard V2

- › Open Config Wizard by choosing Tools > Config Wizard V2
- › Config Wizard will open in a separate window



5) Using Config Wizard V2: Timer2 Configuration

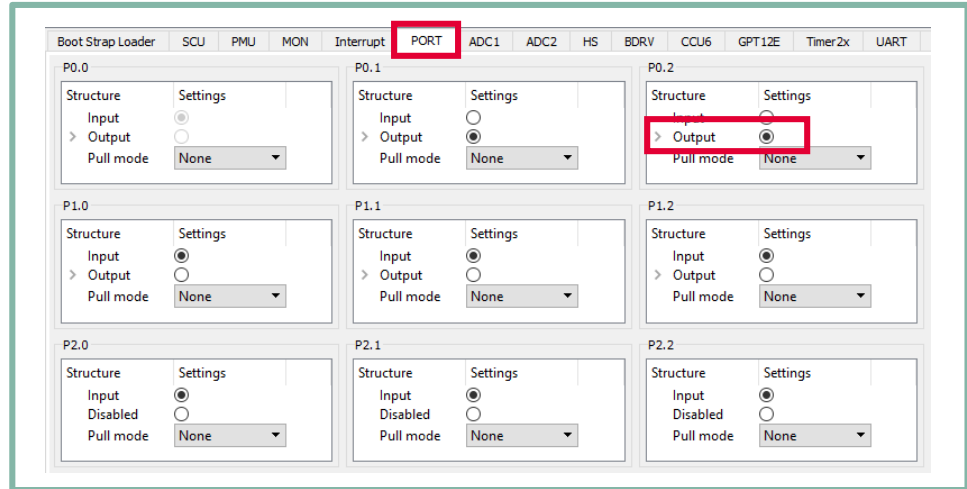
- > Open “Timer 2x” section
- > Enable “Configure Timer” checkbox
- > Go to: “Reload / Capture Register”
 - Enter “1000” μ s
- > Go to: “Interrupt”
 - Enable Overflow Interrupt
 - Type “task_1ms” in “Call Back” line



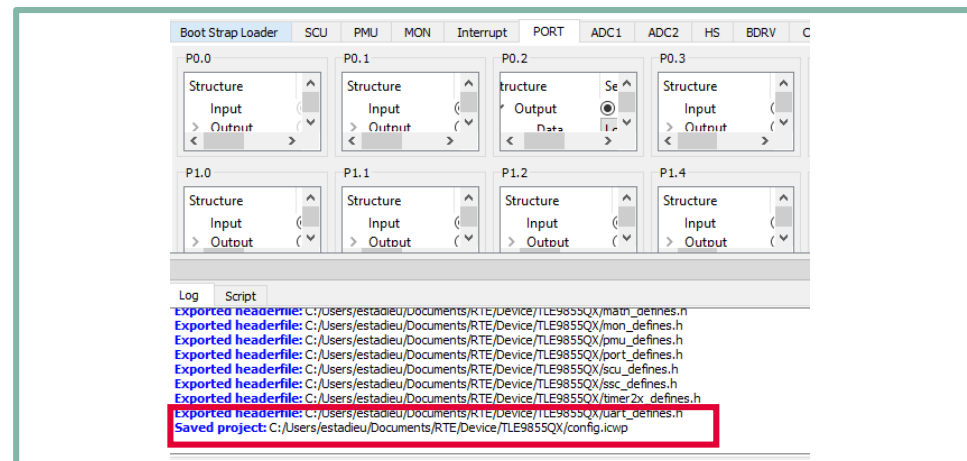
Boot Strap Loader	SCU	PMU	MON	Interrupt	PORT	ADC1	ADC2	HS	BDRV	C
Structure										Settings
v Configure Timer2										<input checked="" type="checkbox"/>
Timer2 Clock										3.33MHz
Max. Period										19660.5us
> Clock Setting										
> Mode Select										
> External Capture/Reload Event Enable										<input type="checkbox"/>
> External Start Enable										<input type="checkbox"/>
> Timer Register										
v Reload / Capture Register										
> ...as clock ticks										<input type="radio"/>
v ...as time [us]										<input checked="" type="radio"/>
Time										1000.00 us
Reload Value										0xF2FAticks
v Interrupt										
> External Interrupt										<input type="checkbox"/>
v Overflow / Underflow Interrupt										<input checked="" type="checkbox"/>
Enable Interrupt										<input checked="" type="checkbox"/>
Call Back										task_1ms
> Pin Select										
> Configure Timer21										<input type="checkbox"/>

6) Using Config Wizard V2: Port Configuration

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



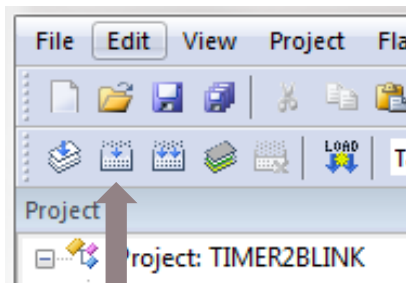
- › Save with “File” -> “Save”



Getting Started: Infineon Embedded Power SDK Keil μ Vision5 Template

7) Finish Code in “main.c”

- › Go to Keil MDK
- › Start Timer2 before the “for(;;)” loop
- › Write function definition of interrupt callback
- › Use API function “PORT_ChangePin()”
- › “Save” and “Build” project



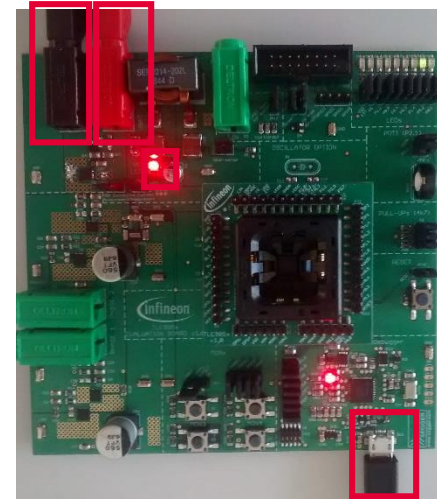
```
82 | /*****  
83 | ** place your application code here  
84 | *****/  
85 | TIMER2_Start ();  
86 | /*****  
87 | ** main endless loop  
88 | *****/  
89 | for (;;)   
90 | {
```

```
55 | /*****  
56 | ** Private Function Declarations  
57 | *****/  
58 | void task_lms () {  
59 |     PORT_ChangePin(0x02, PORT_ACTION_TOGGLE);  
60 | }
```

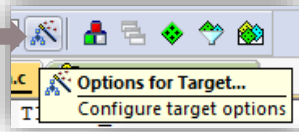
Getting Started: Infineon Embedded Power SDK Keil µVision5 Template

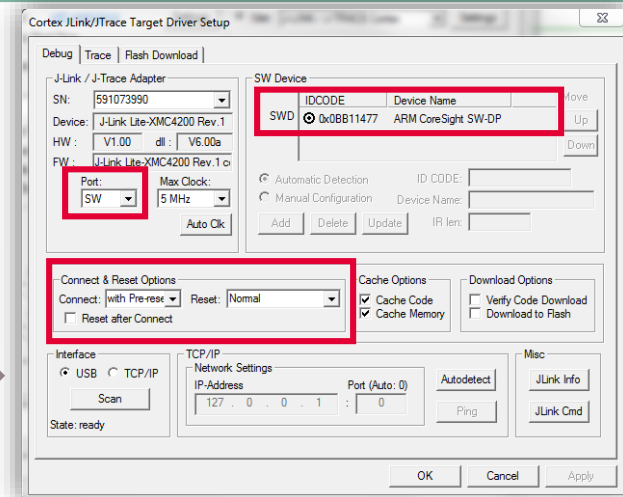
8) Power up Evaluation board

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



9) Connect Debugger

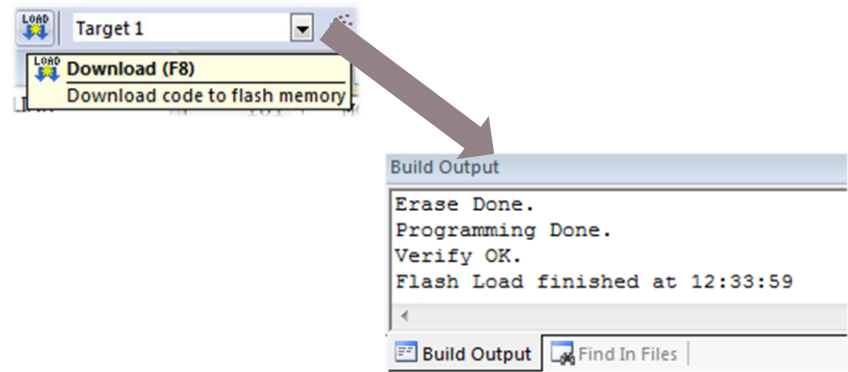
- › Go to 
- › Choose:
 - Debug->use: J-Link
 - Go to “Settings”
- › SWD connection established when “IDCODE” is visible



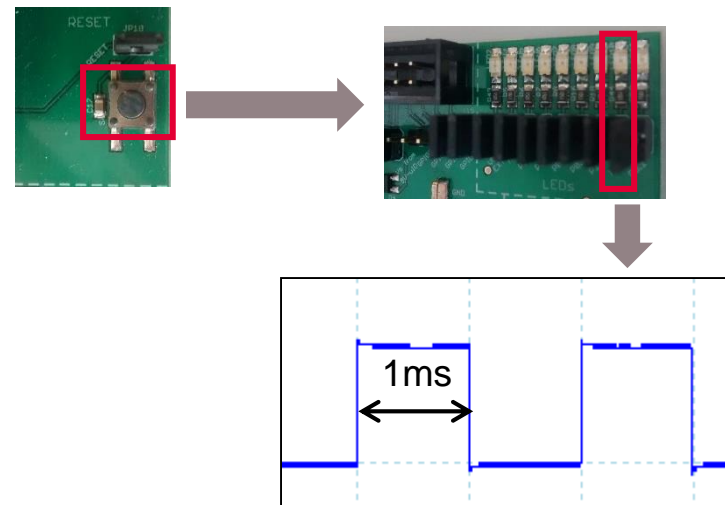
Getting Started: Infineon Embedded Power SDK Keil μ Vision5 Template

10) Download and run code

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

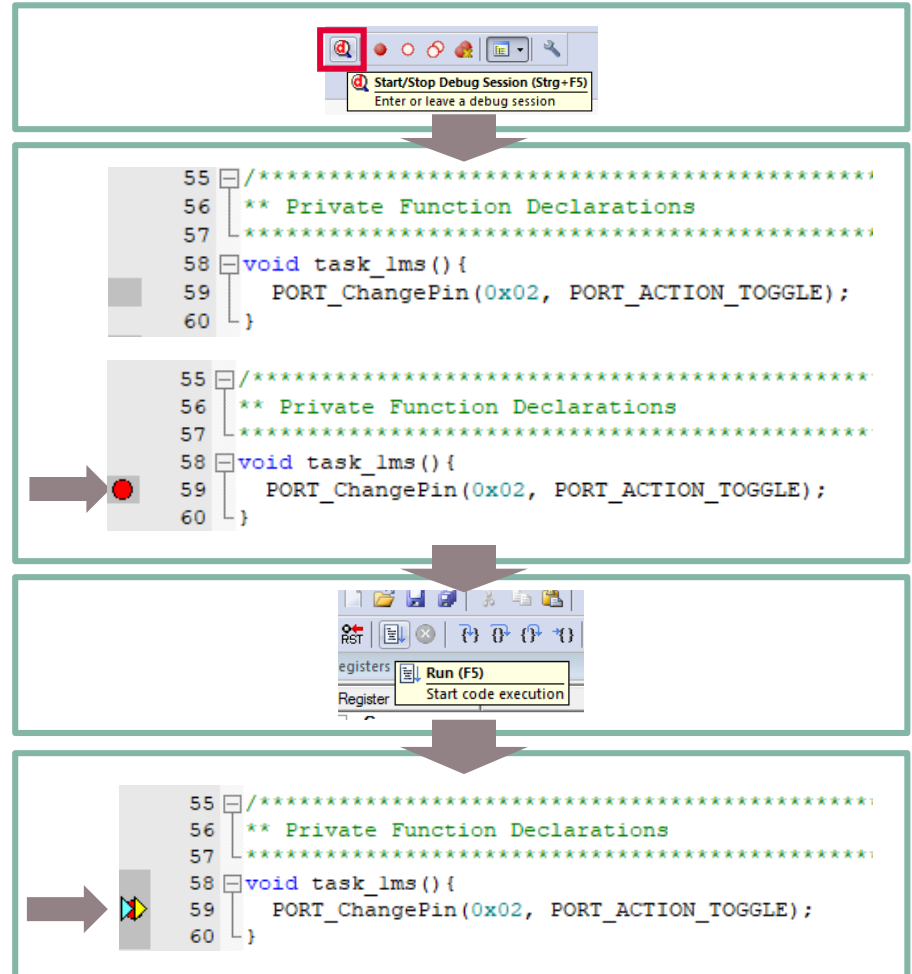


- › Press: “Reset” button on Evaluation Kit
- › LED on Port “P0.2” will light up
- › Port toggle every 1ms



11) 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



The sequence of screenshots illustrates the process of setting a breakpoint and starting a debug session:

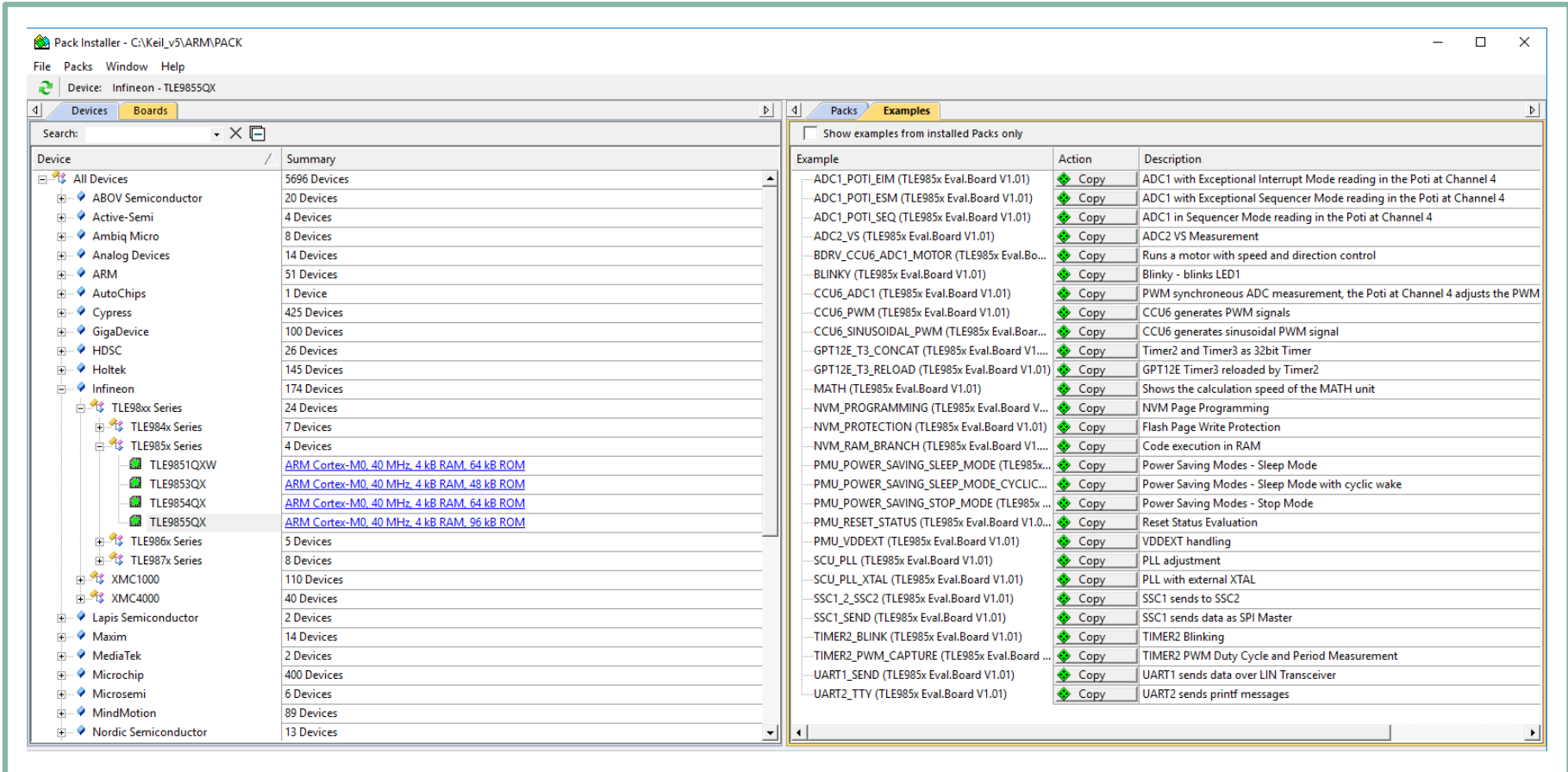
- Start/Stop Debug Session:** A dialog box with the title "Start/Stop Debug Session (Strg+F5)" and the text "Enter or leave a debug session" is shown. A red box highlights the "Start" button (a play icon).
- Setting a Breakpoint:** The code editor shows a function definition:

```
55 /*****  
56  ** Private Function Declarations  
57  *****/  
58 void task_lms() {  
59     PORT_ChangePin(0x02, PORT_ACTION_TOGGLE);  
60 }
```

 A red dot is placed in the dark grey margin to the left of line 59, indicating a breakpoint.
- Running the Program:** A toolbar is shown with the "Run (F5)" button highlighted. A tooltip above the button says "Run (F5) Start code execution".
- Execution Stopped:** The code editor shows the same function definition. A yellow arrow points to the line containing the breakpoint (line 59), indicating that execution has stopped at that point.

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 TLE9855QX selected. The right pane shows a table of example code snippets.

Example	Action	Description
ADC1_POTI_EIM (TLE985x Eval.Board V1.01)	Copy	ADC1 with Exceptional Interrupt Mode reading in the Poti at Channel 4
ADC1_POTI_ESM (TLE985x Eval.Board V1.01)	Copy	ADC1 with Exceptional Sequencer Mode reading in the Poti at Channel 4
ADC1_POTI_SEQ (TLE985x Eval.Board V1.01)	Copy	ADC1 in Sequencer Mode reading in the Poti at Channel 4
ADC2_VS (TLE985x Eval.Board V1.01)	Copy	ADC2 VS Measurement
BDRV_CCU6_ADC1_MOTOR (TLE985x Eval.Bo...	Copy	Runs a motor with speed and direction control
BLINKY (TLE985x Eval.Board V1.01)	Copy	Blinky - blinks LED1
CCU6_ADC1 (TLE985x Eval.Board V1.01)	Copy	PWM synchronous ADC measurement, the Poti at Channel 4 adjusts the PWM
CCU6_PWM (TLE985x Eval.Board V1.01)	Copy	CCU6 generates PWM signals
CCU6_SINUSOIDAL_PWM (TLE985x Eval.Boar...	Copy	CCU6 generates sinusoidal PWM signal
GPT12E_T3_CONCAT (TLE985x Eval.Board V1...	Copy	Timer2 and Timer3 as 32bit Timer
GPT12E_T3_RELOAD (TLE985x Eval.Board V1.01)	Copy	GPT12E Timer3 reloaded by Timer2
MATH (TLE985x Eval.Board V1.01)	Copy	Shows the calculation speed of the MATH unit
NVM_PROGRAMMING (TLE985x Eval.Board V...	Copy	NVM Page Programming
NVM_PROTECTION (TLE985x Eval.Board V1.01)	Copy	Flash Page Write Protection
NVM_RAM_BRANCH (TLE985x Eval.Board V1...	Copy	Code execution in RAM
PMU_POWER_SAVING_SLEEP_MODE (TLE985x...	Copy	Power Saving Modes - Sleep Mode
PMU_POWER_SAVING_SLEEP_MODE_CYCLIC...	Copy	Power Saving Modes - Sleep Mode with cyclic wake
PMU_POWER_SAVING_STOP_MODE (TLE985x ...)	Copy	Power Saving Modes - Stop Mode
PMU_RESET_STATUS (TLE985x Eval.Board V1.0...	Copy	Reset Status Evaluation
PMU_VDDEXT (TLE985x Eval.Board V1.01)	Copy	VDDEXT handling
SCU_PLL (TLE985x Eval.Board V1.01)	Copy	PLL adjustment
SCU_PLL_XTAL (TLE985x Eval.Board V1.01)	Copy	PLL with external XTAL
SSC1_2_SSC2 (TLE985x Eval.Board V1.01)	Copy	SSC1 sends to SSC2
SSC1_SEND (TLE985x Eval.Board V1.01)	Copy	SSC1 sends data as SPI Master
TIMER2_BLINK (TLE985x Eval.Board V1.01)	Copy	TIMER2 Blinking
TIMER2_PWM_CAPTURE (TLE985x Eval.Board ...)	Copy	TIMER2 PWM Duty Cycle and Period Measurement
UART1_SEND (TLE985x Eval.Board V1.01)	Copy	UART1 sends data over LIN Transceiver
UART2_TTY (TLE985x Eval.Board V1.01)	Copy	UART2 sends printf messages



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