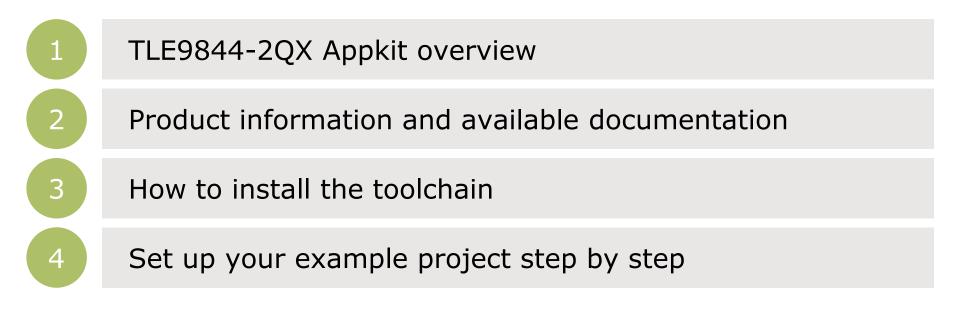
TLE9844-2QX Appkit Getting Started September 2018





Agenda





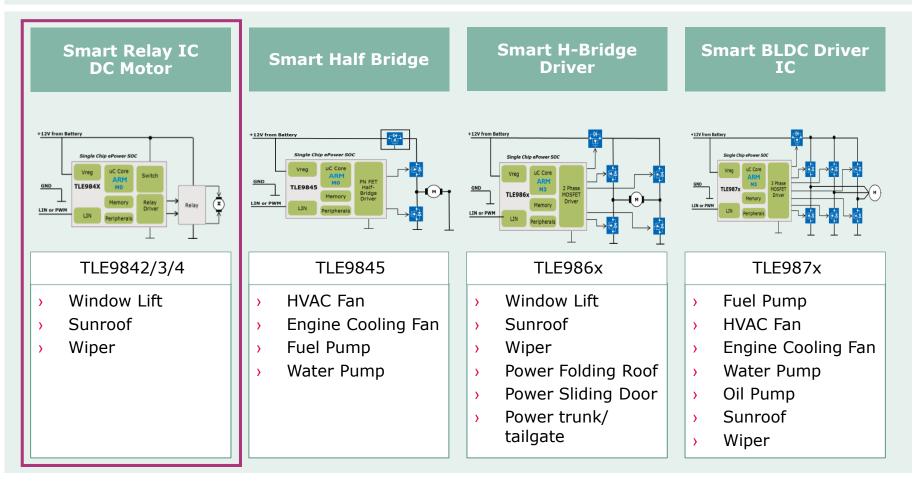
Agenda



Infineon Embedded Power ICs TLE9844-2QX Application Kit



Infineon Embedded Power ICs Product Portfolio based on ARM[®] Cortex[®] M processor





TLE9844-2QX Appkit

The TLE9844-2QX is part of our Embedded Power products and belongs to the relay driver IC family. The TLE9844-2QX Appkit is designed to evaluate relay driven DC Motor applications. The two layers PCB is space and cost optimized to demonstrate an application near solution.

Target Applications

 Automotive Body & Comfort applications such as sunroof and window lift

Summary of Features

- Automotive qualified relay driver IC (TLE9844-2QX) with integrated high-side switches
- > 2-channel relay
- Onboard debug interface

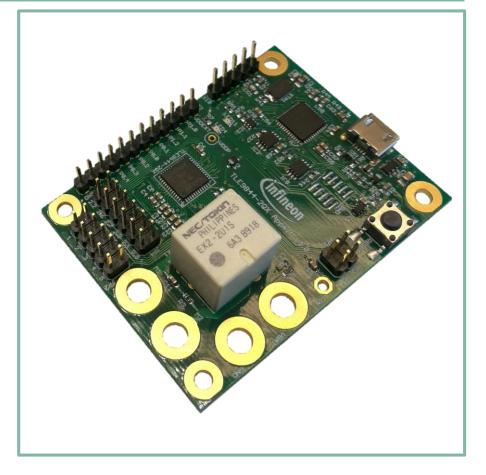
Infineon Embedded Power IC: TLE9844-2QX Application Board



TLE9844-2QX Application Kit

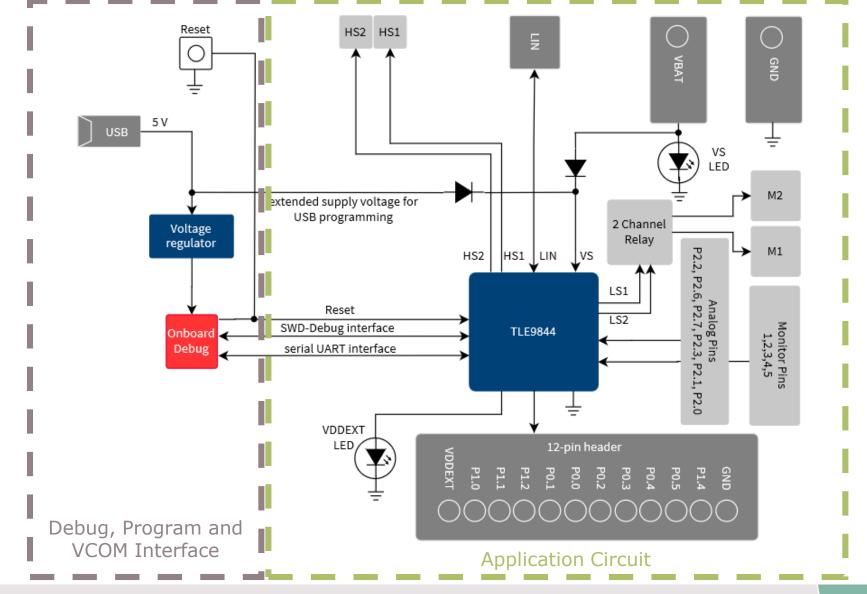
- Voltage supply: typ. 12 V
- > Motor current: max. 20 A
- Infineon Relay Driver IC (ARM[®] Cortex[®] M0 MCU)
- J-Link OB-Debugger with Serial COM Port
- > LIN Interface

TLE9844-2QX_Appkit: **SP002235152**





Block diagram



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Agenda





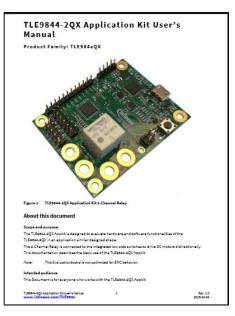
Support for Relay Driver IC with Integrated ARM[®] Cortex[®] M0

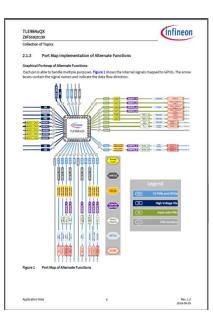


Collaterals and Brochures	 > Product Brief > Selection Guides > Product Presentations 	Link to family page
Technical Material	 > Datasheets > Application Notes > Getting Started > PCB Design Data > User Manuals > Layout Hints 	> Link to Documents
Evaluation Boards	> Evaluation Boards> Application Kits	Link to board pages
Software & Tools	 Config Wizard Keil µVision5 Software Examples 	Link to Software & Tools
Videos	 Technical Videos 	Link to Videos

TLE9844-2QX Application Kit: Documentation

- User Manual for TLE9844-2QX
- Application Note with Application Hints
- > Datasheet



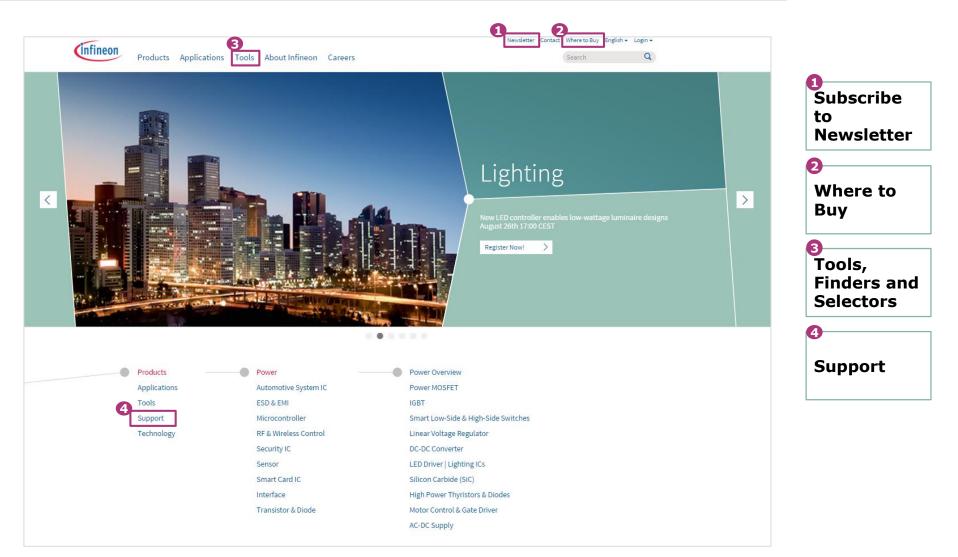




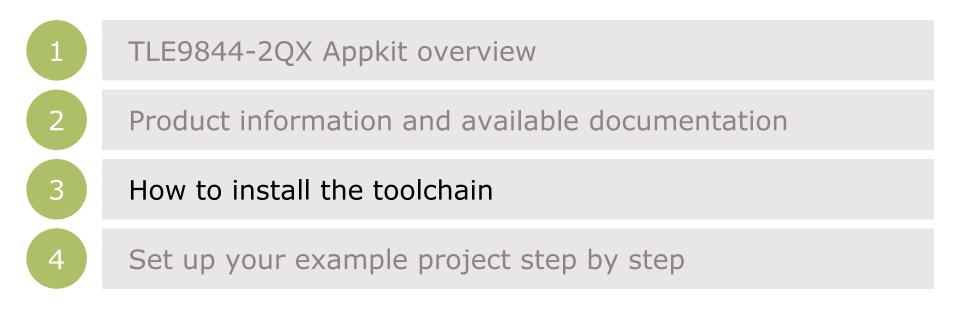


Support Online tools and services





Agenda

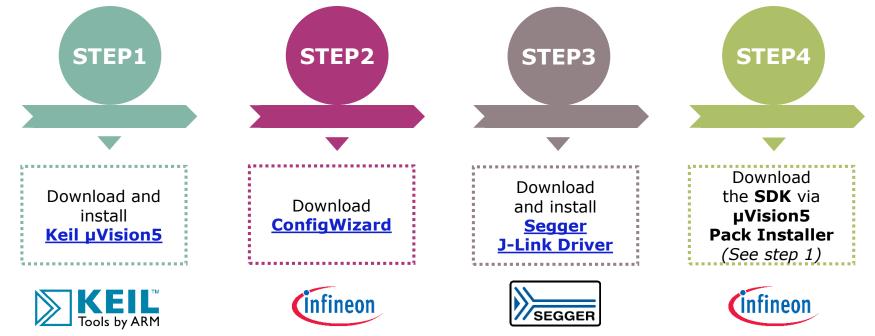


Infineon



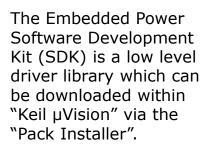
Toolchain installation: General Overview

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 variety of example software code.



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

Infineon provides the ConfigWizard which is designed for configuration of chip modules. ConfigWizard supports easy configuring of Embedded Power peripherals. SEGGER J-Link is a widely used driver for "on-board" or "standalone" debugger.





Toolchain installation: 1/4



KEIL is a trademark and µVision is a registered trademark of ARM Ltd. All rights reserved. This product is protected by US and international laws.

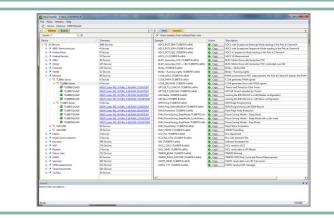
Keil µVision5

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

Download from: https://www.keil.com/demo/eval/a rm.htm

Main Window

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Pack Installer



Toolchain installation: 2/4

Infineon ConfigWizard

Configuration of chip modules

Infineon homepage: ConfigWizard

Latest version: V1.8.7

Device description for TLE984x included

TLE984x supported with Keil µVision 5

IFX	(ConfigW	izard							X
File	Extra	About							
SCU	PMU	MON	Interrupt	PORT	ADC1	ADC2	BDRV	CCU6	
Struct			Settings						
⊿ Pc			settings						
	Pin0								
	Inp	ut	0						
	⊳ Out		0						
			Pull-Down						-
4	Pin1								
	Inp	ut (0						
	⊳ Out	tput 🦉	0						
	Pul	l mode	Pull-Up						•
4	Pin2								
	Inp		0						
	⊳ Out		0						
		l mode	Pull-Down						• ₌
- 1	Pin3		~						
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	Pun Pin4	l mode	Pull-Op						·
	prt1								
	Pin0								
	Inp	ut (0						
	⊳ Out		0						
	Pul	Imode	None						-
4	Pin1								
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	⊳ Out	tput 🦉	0						
	Pul	l mode	None						•
Þ	Pin2								
Þ	1.11.2								-
h	D:/								



Toolchain installation: 3/4

Segger J-LINK-Lite driver:

- Driver for 'on-board' or 'stand-alone' debugger
- Install driver from: <u>https://www.segger.com/downlo</u> <u>ads/jlink/JLink_Windows.exe</u>
- TLE9844-2QX support is included from V5.10 upwards

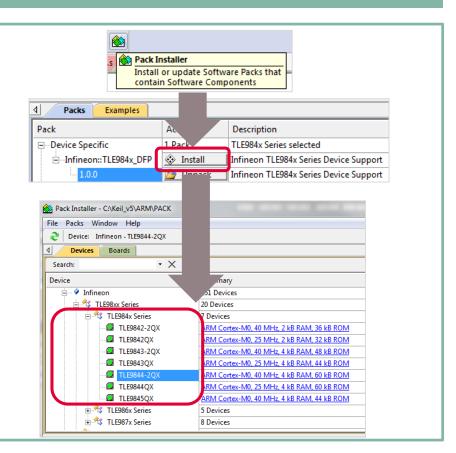
	Frace Flash Download		
	J-Trace Adapter	SW Device	
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Device:	J-Link Lite-XMC4200 Rev.1	SWD Occ0BB11477 ARM Core Sight SW-DP	Up
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	J-Link Lite-XMC4200 Rev.1 c		
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Toolchain installation: 4/4

PACK-file TLE984x for µVision5:

- Device database for all TLE984x variants
- Device support for flashing/erasing TLE984x
- SFR description for register debugging
- Device description for TLE984x for Config Wizard (XML)
- Includes SDK (Software Development Kit)
- Code examples included



Agenda



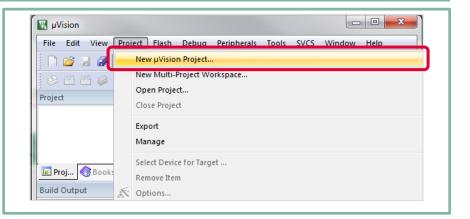




Getting Started: How to create a new project

1) Create a new Project

- > Open Keil mdk
- Go to → Project
 → new µVision Project
- Name project: (`relay_click')
- > Select Device:
 - > Infineon
 - > TLE98xx Series
 - > TLE984x Series
 - > TLE9844-2QX



Select Device for Target 'Target 1' Device	×
Software Packs	
Vendor: <unknown></unknown>	
Device: <unknown> Toolset: <unknown></unknown></unknown>	
Search:	
Des <u>cription</u> :	
	∧
OK Cancel	Help

Getting Started: How to configure your runtime environment



2) Configuration of Run-Time Environment

- > Expand: 'Device'
 - Check: Startup
 - > Check: Config Wizard
- `Sel.' window
 background is orange
- > Press: `Resolve'
- `Sel.' window background is now green
- Expand 'SDK' and activate 'LS' Module



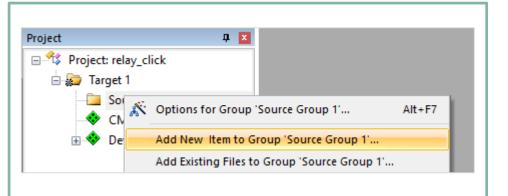
Software Component	Sel.	Variant		Version	Description
					Cortex Microcontroller Software Interface Components
🗉 💠 CMSIS Driver					Unified Device Drivers compliant to CMSIS-Driver Specifications
🗉 🚸 Compiler		ARM Compile	r	1.4.0	Compiler Extensions for ARM Compiler 5 and ARM Compiler 6
🖃 💠 Device					Startup, System Setup
Startup	V			1.0.1	System Startup for Infineon TLE984x device series
ConfigWizard	~			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		Descripti	ion		}
🖃 🦺 Infineon::Device:Startup		Addition	al soft	ware comp	onents required
- require Device:SDK:SCU		Select co	mpon	ent from lis	st
fineon::Device:SDK:SCU		System C	ontro	Unit (SCU)) driver for TLE984x 💌
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Manage Run-Time Environment		riant		Version	×
Manage Run-Time Environment		Triant		Version	Description
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Manage Run-Time Environment Software Component				1.4.0	Description <u>Cortex Microcontroller Software Interface Components</u> Unified Device Drivers compliant to CMSIS-Driver Specifications <u>Compiler Extensions for ARM Compiler 5 and ARM Compiler 6 Statup. System Statup For Infineon TLE984x device series </u>
Manage Run-Time Environment ioftware Component				1.4.0	X Description Cortex Microcontroller Software Interface Components Unified Device Drivers compliant to CMSIS-Driver Specifications Compiler Extensions for ARM Compiler 5 and ARM Compiler 6 Startup. System Setup
Manage Run-Time Environment Software Component	· · · · ·	ARM Compiler		1.4.0 1.0.1 1.8.7	Description <u>Cortex Microcontroller Software Interface Components Unified Device Drivers compliant to CMSIS-Driver Specifications Compiler Extensions for ARM Compiler 5 and ARM Compiler 6 Startup, System Starup System Startup for Infineon TLE984x device series Infineon ConfigWizard Configuration File </u>
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Manage Run-Time Environment Software Component ◆ CMSIS ◆ CMSIS ◆ CMSIS ◆ CMSIS ◆ CMSIS ◆ CMSIS ◆ ConfigWizard ◆ SDK ◆ SDK ◆ Sphics ◆ Network	· · · · ·	ARM Compiler MDK-Plus	-	1.4.0 1.0.1 1.8.7 6.10.0 5.46.5 7.8.0	Description Cortex Microcontroller Software Interface Components Unified Device Drivers compliant to CMSIS-Driver Specifications Compiler Extensions for ARM Compiler 5 and ARM Compiler 6 Startup For Infinen TLE984x device series Infineen ConfigWzard Configuration File File Access on various storage devices User Interface on graphical LCD displays IPv4 Networking using Ethernet or Serial protocols
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Manage Run-Time Environment	· · · · ·	ARM Compiler MDK-Plus MDK-Plus MDK-Plus	> > >	1.4.0 1.0.1 1.8.7 6.10.0 5.46.5 7.8.0	Description Cortex Microcontroller Software Interface Components Unified Device Drivers compliant to CMSIS-Driver Specifications Compiler Extensions for ARM Compiler 5 and ARM Compiler 6 Startup, System Startup for Infineon TLE984x device series Infineon ConfigWizard Configuration File File Access on various storage devices User Interface on graphical LCD displays IPv4 Networking using Ethernet or Serial protocols USB Communication with various device classes
Manage Run-Time Environment Software Component ← CMSIS ← CMSIS Driver ← CMSIS Driver ← ConfigWizard ← Startup ← ConfigWizard ← Startup ← Startup	· · · · ·	ARM Compiler MDK-Plus MDK-Plus MDK-Plus MDK-Plus	> > >	1.4.0 1.0.1 1.8.7 6.10.0 5.46.5 7.8.0	Description Cortex Microcontroller Software Interface Components Unified Device Drivers compliant to CMSIS-Driver Specifications Compiler Extensions for ARM Compiler 5 and ARM Compiler 6 Startup, System Startup for Infineon TLE984x device series Infineon ConfigWizard Configuration File File Access on various storage devices User Interface on graphical LCD displays IPv4 Networking using Ethernet or Serial protocols USB Communication with various device classes
Manage Run-Time Environment Software Component ← CMSIS ← CMSIS Driver ← CMSIS Driver ← ConfigWizard ← Startup ← ConfigWizard ← Startup ← Startup	· · · · ·	ARM Compiler MDK-Plus MDK-Plus MDK-Plus MDK-Plus	> > >	1.4.0 1.0.1 1.8.7 6.10.0 5.46.5 7.8.0	Description Cortex Microcontroller Software Interface Components Unified Device Drivers compliant to CMSIS-Driver Specifications Compiler Extensions for ARM Compiler 5 and ARM Compiler 6 Startup, System Startup for Infineon TLE984x device series Infineon ConfigWizard Configuration File File Access on various storage devices User Interface on graphical LCD displays IPv4 Networking using Ethernet or Serial protocols USB Communication with various device classes



Getting Started: Use standard templates

3) Using easy 'Main' template

- 1. Expand: 'Target 1'
- Right click on: `Source Group 1'
- 3. Choose: Add New Item to Group 'Source Group 1'
- 4. Choose 'User Code Template'
- 5. Expand 'Device'
- 6. Choose: 'Startup'
- 7. Continue with 'Add'



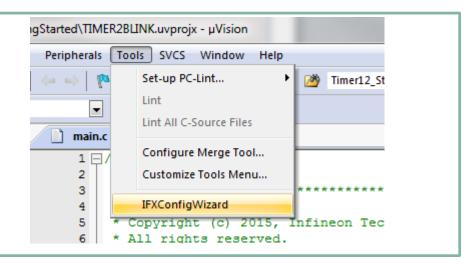
Add New Item	to Group 'Source Group 1'	×
C File (.c	Add template file(s) to the project.	
C++ File	Caponent Name	
A Asm File	Startun Simple Main	
h Header		
Text File		
	de Template	
User Co	de l'emplate	
Turney	User Code Template	
Type:	main.c	
Name:		
Location:	C: Keil_Examples \GettingStarted	



Getting Started: How to use the Config Wizard

4a) Using Config Wizard

- Open Config Wizard by choosing: `Tools → Config Wizard'
- Config Wizard will open in a separate window
- orange status bar indicates a new project
- red status bar indicates unsaved changes
- white status bar indicates saved project



ePower	SCU	PMU	MON	Interrupt	PORT	ADC1	
Structure			Settin	gs			
Device			TLE98	44-2QX			•
		nfiguratio					

Getting Started: How to configure the individual ports



4b) Using Config Wizard: Low Side Switch Configuration

- > Select: 'LS' Chapter
- > Enable `LS1'
- > Expand 'LS1'
- > Expand 'Driver Settings'
- > Check Low Side Driver ON
- Save with
 'File' -> 'Save Project'
- After Saving, status bar turns to white color

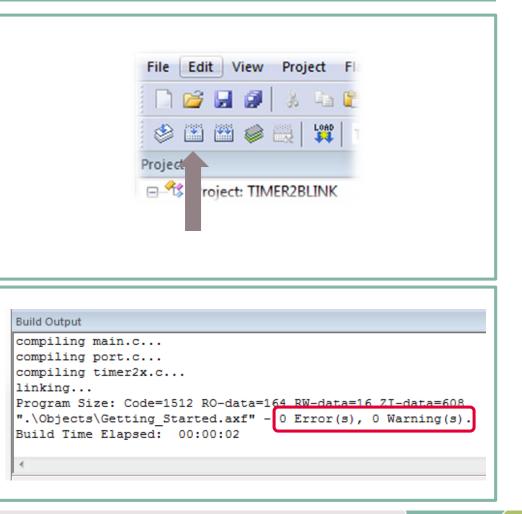
ePower	SCU	PMU	MON	Interrupt	PORT	ADC1	ADC2	HS	LS	CCU6	4
Structure				Settings							
✓ LS1 er	able			\checkmark							
Ƴ Dr	iver Setti	ngs									
	Slew ra	te		slow							
	Open L	oad Dete	ection								
	Low Si	de Driver	ON	\checkmark							
	PWM E	nable									
	_		r Settings								
		ect (PWN	1 Output))							
	terrupt			_							
> LS2 er	able										
				-	F						
ePower	SCU	PMU	MON	Interru	रा	ADC1	ADC2	HS	LS	CCU6	4
ePower Structure	SCU	PMU	MON	Intern	रा	ADC1	ADC2	HS	LS	CCU6	4
		PMU	MON		श	ADC1	ADC2	HS	LS	CCU6	•
Structure ✓ LS1 en			MON	Setting	रा	ADC1	ADC2	HS	LS	CCU6	4
Structure ✓ LS1 en	able	ngs	MON	Setting	रा	ADC1	ADC2	HS	LS	CCU6	4
Structure ✓ LS1 en	able iver Setti Slew ra	ngs		Setting	श	ADC1	ADC2	HS	LS	CCU6	4
Structure ✓ LS1 en	able iver Setti Slew ra Open L Low Sid	ngs te oad Dete de Driver	ection	Setting	रा	ADC1	ADC2	HS	LS	CCU6	4
Structure ✓ LS1 en ✓ Dri	able iver Setti Slew ra Open L Low Sid PWM E	ngs te oad Dete le Driver nable	ection ON	Setting Slow	τ	ADC1	ADC2	HS	LS	CCU6	4
Structure LS1 en Dri Bla	able iver Setti Slew ra Open L Low Sid PWM E anking T	ngs te oad Dete de Driver nable ime Filter	ection ON r Settings	Setting Slow	रा	ADC1	ADC2	HS	LS	CCU6	4
Structure V LS1 en V Dri Bla So	able Slew ra Open L Low Sid PWM E anking T urce Sele	ngs te oad Dete de Driver nable ime Filter	ection ON	Setting Slow	रा	ADC1	ADC2	HS	LS	CCU6	
Structure V LS1 en V Dri Bla So	able Slew ra Open L Low Sid PWM E anking T urce Sele errupt	ngs te oad Dete de Driver nable ime Filter	ection ON r Settings	Setting Slow	R	ADC1	ADC2	HS	LS	CCU6	



Getting Started: How to compile your projects

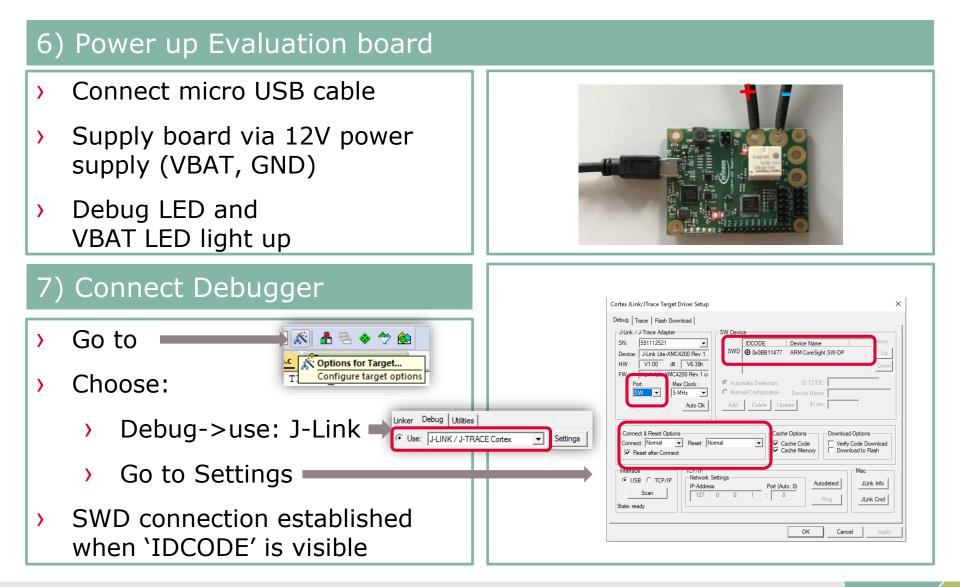
4) Compile Project

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



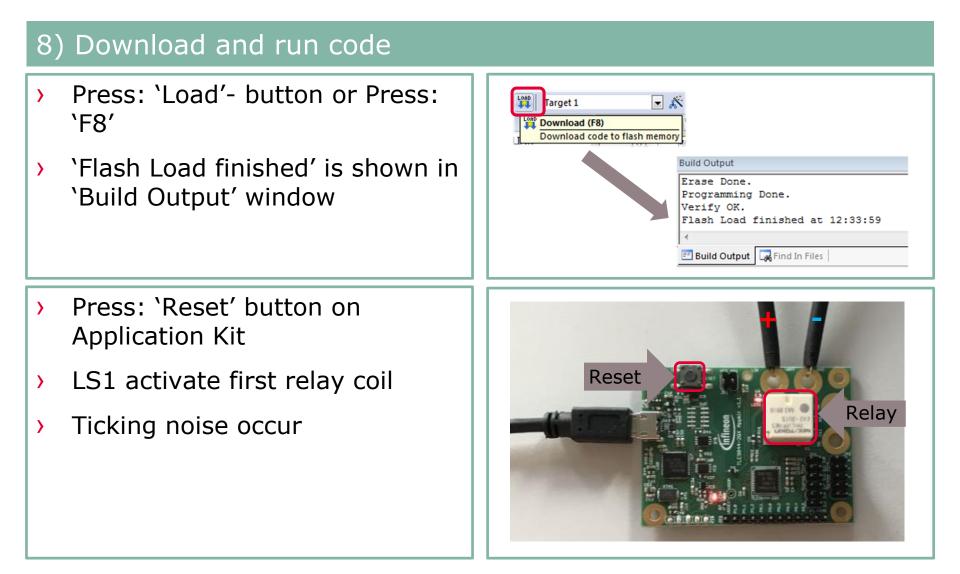
Getting Started: Power up your board and connect the debugger





Getting Started: How to download and run your code







Getting Started: Available example code

Infineon Example Code available in "Pack Installer"

le Packs Window Help		
Device: Infineon - TLE9879OXA40		
Devices Boards		b A Packs Examples
Search:		Show examples from installed Packs only
	4.0	
Device Holtek	∕ Summary	
Holtek	19 Devices	ADC1_POTI_EIM (TLE9879 EvalKit) Copy ADC1 with Exceptional Interrupt Mode reading in the Poti at Channel 4
Infineon	151 Devices 20 Devices	ADCL_POTLESM (TLE9879 Evalkit) Copy ADCL with Exceptional Sequencer Mode reading in the Poti at Channel 4
E 4 TLE984x Series		- ADC1 POTI SEQ (TLE9879 EvalKit) Copy ADC1 in Sequencer Mode reading in the Poti at Channel 4
	7 Devices	- ADC2_VS_(TLE9879 EvalKit) Copy ADC2_VS_Measurement
TLE9842-2QX	ARM Cortex-M0, 40 MHz, 2 kB RAM, 36 kB ROM	BLDC_Block_Commutation_HALL (TLE9879 E Copy BLDC Motor Drive with Block Commution with HALL Sensor
TLE9842QX	ARM Cortex-M0, 25 MHz, 2 kB RAM, 32 kB ROM	BLDC_Block_Commutation_HALL+ LIN (TLE Copy BLDC Motor Drive with Block Commution with HALL Sensor controlled of the sensor controlled of t
TLE9843-2QX	ARM Cortex-M0, 40 MHz, 4 kB RAM, 48 kB ROM	BLDC_Sensorless_FOC (TLE9879 EvalKit) Copy BLDC Motor Drive with Sensorless FOC
TLE9843QX	ARM Cortex-M0, 25 MHz, 4 kB RAM, 44 kB ROM	-BLDC_Sensorless_FOC + LIN (TLE9879 EvalKit) Copy BLDC Motor Drive with Sensorless FOC controlled over LIN
	ARM Cortex-M0, 40 MHz, 4 kB RAM, 60 kB ROM	Blinky (TLE9879 EvalKit) Blinky - blinks LED1
TLE9844QX	ARM Cortex-M0, 25 MHz, 4 kB RAM, 60 kB ROM	Blinky - Running Lights (TLE9879 EvalKit) Scopy Blinky - Running Lights
TLE9845QX	ARM Cortex-M0, 40 MHz, 4 kB RAM, 44 kB ROM	CCU6_ADC1 (TLE9879 EvalKit) PWM synchroneous ADC measurement, the Poti at Channel 4 adjusts the
E 🎋 TLE986x Series	5 Devices	CCU6_PWM (TLE9879 EvalKit)
TLE9861QXA20	ARM Cortex-M3, 24 MHz, 3 kB RAM, 32 kB ROM	CCU6_SIN_PWM (TLE9879 EvalKit)
	ARM Cortex-M3, 24 MHz, 6 kB RAM, 60 kB ROM	DMA ADC1 Sequence (TLE9879 EvalKit)
TLE9867QXA40	ARM Cortex-M3, 40 MHz, 6 kB RAM, 60 kB ROM	DMA SPI (TLE9879 EvalKit) Sends data through SPI using DMA
💷 TLE9867QXW40	ARM Cortex-M3, 40 MHz, 6 kB RAM, 60 kB ROM	DMA UART TTY (TLE9879 EvalKit) Copy UART2 sends data triggered by DMA
TLE9869QXA20	ARM Cortex-M3, 24 MHz, 6 kB RAM, 124 kB ROM	GPT12E_T3_CONCAT (TLE9879 EvalKit) 🔶 Copy Timer2 and Timer3 as 32bit Timer
E 🍂 TLE987x Series	8 Devices	GPT12E_T3_RELOAD (TLE9879 EvalKit) 🚸 Copy GPT12E Timer3 reloaded by Timer2
TLE9871QXA20	ARM Cortex-M3, 24 MHz, 3 kB RAM, 32 kB ROM	LIN Master (TLE9879 EvalKit) 💠 Copy running the IHR LIN LLD in a LIN Master configuration
TLE9873QXW40	ARM Cortex-M3, 40 MHz, 3 kB RAM, 48 kB ROM	LIN Slave (TLE9879 EvalKit) 🚸 Copy running the IHR LIN LLD in a LIN Slave configuration
	ARM Cortex-M3, 24 MHz, 6 kB RAM, 60 kB ROM	NVM Data Flash Handling (TLE9879 EvalKit) 🚸 Copy NVM Data Flash page write with error handling
TLE9877QXA40	ARM Cortex-M3, 40 MHz, 6 kB RAM, 60 kB ROM	NVM Prog (TLE9879 EvalKit) 🔷 Copy NVM Page Programming
🖾 TLE9877QXW40	ARM Cortex-M3, 40 MHz, 6 kB RAM, 60 kB ROM	NVM_Prog_RAM_BRANCH (TLE9879 EvalKit) 🚸 Copy NVM Programming with RAM Branch
	ARM Cortex-M3, 24 MHz, 6 kB RAM, 124 kB ROM	NVM_Protection (TLE9879 EvalKit) 🔶 Copy Flash Page Write Protection
TLE9879QXA40	ARM Cortex-M3, 40 MHz, 6 kB RAM, 124 kB ROM	PMU_PowerSaving_SleepMode (TLE9879 Eval 🚸 Copy Power Saving Modes - Sleep Mode
TLE9879QXW40	ARM Cortex-M3, 40 MHz, 6 kB RAM, 124 kB ROM	PMU_PowerSaving_SleepMode_CyclicWake (💠 Copy Power Saving Modes - Sleep Mode with cyclic wake
	91 Devices	
± 🤧 XMC4000	40 Devices	
🗄 🔗 Maxim	4 Devices	PMU_VDDEXT (TLE9879 EvalKit) Copy VDDEXT handling
🗉 🏈 MediaTek	2 Devices	SCU_PLL (TLE9879 EvalKit) Copy PLL adjustment
🗉 🍳 Microsemi	6 Devices	SCU_PLL_XTAL (TLE9879 EvalKit) Copy PLL with external XTAL
MindMotion	2 Devices	SDK (TLE9879 EvalKit) Software Developer Kit
Nordic Semiconductor	8 Devices	SSC1_2_SSC2 (TLE9879 EvalKit) SSC1 sends to SSC2
Nuvoton	433 Devices	SSC1_SEND (TLE9879 EvalKit) SSC1 sends data as SPI Master
• 🔶 NXP	527 Devices	TIMER2_BLINK (TLE9879 EvalKit)
🛨 🌳 Renesas	3 Devices	TIMER2_PWM_CAPTURE (TLE9879 EvalKit)
Silicon Labs	397 Devices	UARTI_SEND (TLE9879 EvalKit) Copy UARTI_sends data over LIN Transceiver
T SONIX	49 Devices	UART2_TTY (TLE9879 EvalKit) Copy UART2 sends printf messages



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