

# Tech Talks LIVE Schedule – Presentation will begin shortly



Topic	Date
Multiprotocol Wireless: Real Application of Dynamic Multiprotocol	Tuesday, June 9
Wireless Coexistence	Thursday, June 11
Bluetooth Software Structure: Learn the APIs and State Machines	Tuesday, June 16
<b>Add a Peripheral to a Project in No Time: With 32-bit Peripheral GitHub Library</b>	<b>Thursday, June 18</b>
Energy Friendly PMIC with Low Energy Bluetooth BG22	Tuesday, June 23
Talk with an Alexa: Using Zigbee to Connect with an Echo Plus	Thursday, June 25
Z-Wave Software Structure: Learn about Command Classes and Reference Code	Tuesday, June 30
Building a Proper Mesh Test Environment: How This Was Solved in Boston	Thursday, July 2

Please take the 3 question poll while waiting and be entered to receive a BG22 Thunderboard kit.



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# WELCOME



Silicon Labs LIVE:  
Wireless Connectivity  
Tech Talks

A blue background featuring a pattern of white circuit board traces and various electronic components. Overlaid on this pattern are snippets of code in a light blue font, including C and C++ code related to hardware initialization and communication.

# *32 Bit Peripheral Example Library*

JUNE 2020

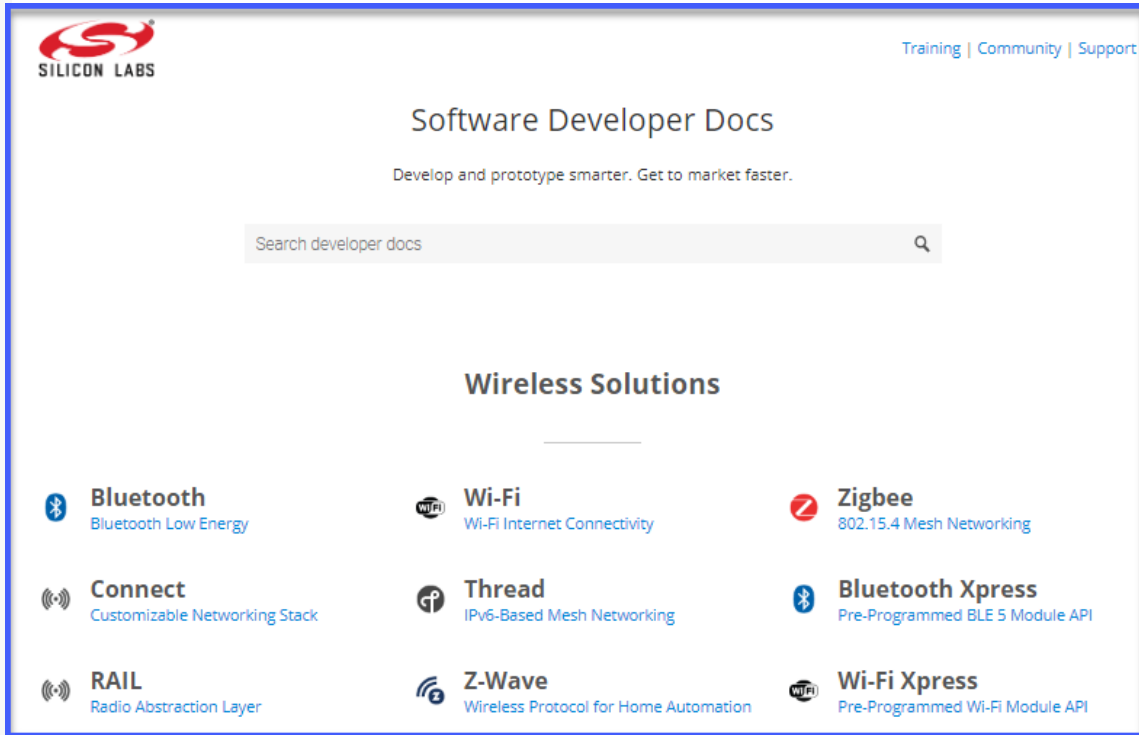


# Overview

- What is the 32-Bit Peripheral Example Library?
- What is EMLIB?
- How to use the Peripheral Examples from [github.com/SiliconLabs](https://github.com/SiliconLabs)
- Live demo of two peripheral example projects
  - i. USART - UART to PC Terminal
  - ii. TIMER - Generate and Measure Square Wave

# 32-Bit Peripheral Example Library

- **WHAT?** Collection of projects that demonstrate all the major modes of operation of our peripherals.
- **WHY?** Provide simple yet modular code examples that can be easily reused in any Silabs MCU, SoC or Module project.
- **HOW MANY?** There are more than 2400 examples.
- **SUPPORTED DEVICES?** EFM32 (MCU) and EFR32 (Wireless SoCs and Modules)



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## Software Developer Docs


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### Wireless Solutions

- Bluetooth**  
Bluetooth Low Energy
- Connect**  
Customizable Networking Stack
- RAIL**  
Radio Abstraction Layer
- Wi-Fi**  
Wi-Fi Internet Connectivity
- Thread**  
IPv6-Based Mesh Networking
- Z-Wave**  
Wireless Protocol for Home Automation
- Zigbee**  
802.15.4 Mesh Networking
- Bluetooth Xpress**  
Pre-Programmed BLE 5 Module API
- Wi-Fi Xpress**  
Pre-Programmed Wi-Fi Module API

### Platform Documentation

EFM32	EFR32	EZR32
32-bit Microprocessors	Wireless SoCs for Bluetooth, Zigbee, Thread, Proprietary 2.4GHz & Sub-GHz, and Z-Wave	Sub-GHz Microprocessors
<ul style="list-style-type: none"><li>EFM32G</li><li>EFM32GG</li><li>EFM32GG11</li><li>EFM32GG12</li><li>EFM32HG</li><li>EFM32JG1</li><li>EFM32JG12</li><li>EFM32LG</li><li>EFM32PG1</li><li>EFM32PG12</li><li>EFM32TG</li><li>EFM32TG11</li><li>EFM32WG</li><li>EFM32ZG</li></ul>	 <ul style="list-style-type: none"><li>BGM1</li><li>BGM13</li><li>BGM21</li><li>EFR32BG1</li><li>EFR32BG12</li><li>EFR32BG13</li><li>EFR32BG14</li><li>EFR32BG21</li><li>EFR32BG22</li><li>EFR32FG1</li><li>EFR32FG12</li><li>EFR32FG13</li><li>EFR32FG14</li><li>EFR32FG22</li><li>EFR32MG1</li><li>EFR32MG12</li><li>EFR32MG13</li><li>EFR32MG14</li><li>EFR32MG21</li><li>EFR32MG22</li><li>MGM1</li><li>MGM12</li><li>MGM13</li><li>MGM21</li><li>EFR32ZG14</li><li>ZGM13</li></ul>	<ul style="list-style-type: none"><li>EZR32HG</li><li>EZR32LG</li><li>EZR32WG</li></ul>
		<b>Wi-Fi</b> Wi-Fi Transceivers and Modules
		<ul style="list-style-type: none"><li>WF200</li><li>WF200S</li><li>WFM200</li><li>WGM160P</li></ul>

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## EFR32BG22 Gecko MCU and Peripheral Software Documentation

You are viewing documentation for version: 5.9 (latest) | 5.8 | [Version History](#)

[Release Notes](#) | [Downloads](#)

This API reference guide covers MCU peripherals, middleware, third-party libraries, and development board support for the EFR32BG22 Gecko MCU. Silicon Labs Radio Abstraction Interface Layer (RAIL) and wireless stack are available on [docs.silabs.com](#).

### MCU Peripherals, Middleware, and Board Support

- [CMSIS-CORE Device headers](#) for the EFR32BG22 Gecko MCU
- [EMLIB Peripheral Library](#)
- [EnergyAware Driver Library](#)
- [Platform Middleware](#)
- [Board Support Package](#)
- [Kit Driver Library](#)

### Third-party Libraries

- [ARM CMSIS](#)
- [ARM mbed TLS](#)

Reference manual, data sheets, application notes, and software examples are available in [Simplicity Studio](#).

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## EFR32 Blue Gecko 22

- ASSERT
- BURTC
- BUS
- CHIP
- CMU
- COMMON
- CORE
- DBG
- EMU
- EUSART
- GPCRC
- GPIO**
- I2C
- IADC
- INT
- LDMA
- LETIMER
- MSC
- PDM
- PRS
- RAMFUNC
- RMU
- RTCC
- SE
- SMU
- SYSTEM
- TIMER
- USART
- VERSION
- WDOG

Get the mode for a GPIO pin.

### Parameters

[in]	port	The GPIO port to access.
[in]	pin	The pin number in the port.

### Returns

The pin mode.

Definition at line 327 of file `em_gpio.c`.

```
void GPIO_PinModeSet ( GPIO_Port_TypeDef port,
                      unsigned int pin,
                      GPIO_Mode_TypeDef mode,
                      unsigned int out
                      )
```

Set the mode for a GPIO pin.

### Parameters

[in]	port	The GPIO port to access.
[in]	pin	The pin number in the port.
[in]	mode	The desired pin mode.
[in]	out	A value to set for the pin in the DOUT register. The DOUT setting is important for some input mode configurations to determine the pull-up/down direction.

Definition at line 278 of file `em_gpio.c`.

References [GPIO\\_PinOutClear\(\)](#), [GPIO\\_PinOutSet\(\)](#), and [gpioModeDisabled](#).

Referenced by [ADC0\\_IRQHandler\(\)](#), [BOARD\\_envSensEnable\(\)](#), [BOARD\\_flashDeepPowerDown\(\)](#), [BOARD\\_gasSensorEnable\(\)](#), [BOARD\\_hallSensorEnable\(\)](#), [BOARD\\_init\(\)](#), [BSP\\_BccPinsEnable\(\)](#), [BSP\\_BusControlModeSet\(\)](#), [BSP\\_EbiInit\(\)](#), [BSP\\_initBoard\(\)](#), [BSP\\_McuBoard\\_DeInit\(\)](#), [BSP\\_McuBoard\\_Init\(\)](#), [BSP\\_McuBoard\\_UsbVbusPowerEnable\(\)](#), [CAPLESENSE\\_setupGPIO\(\)](#), [CMU\\_ClkOutPinConfig\(\)](#), [DBG\\_SWOEnable\(\)](#), [ezradio\\_hal\\_GpioInit\(\)](#), [gpioInit\(\)](#), [I2CSPM\\_Init\(\)](#), [ICM20648\\_spiInit\(\)](#), [initGpio\(\)](#), [KSZ8851SNL\\_SPI\\_Init\(\)](#), [MIC\\_deInit\(\)](#), [MIC\\_init\(\)](#), [MICROSD\\_Deinit\(\)](#), [MICROSD\\_Init\(\)](#), [MSSD\\_Init\(\)](#), [RETARGET\\_SerialEnableFlowControl\(\)](#).

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Austin, TX <http://www.silabs.com>

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**application\_examples**  
Start here to find code examples for Silicon Labs EFM8, EFM32, and EFR32 code examples.  
★ 15 🍴 6

Find a repository... Type: All Language: All

**peripheral\_examples**   
Peripheral examples for Silicon Labs EFM32/EFR32 Series 0, Series 1, and Series 2 devices  
C 🍴 81 ★ 101 🕒 0 📄 0 Updated 2 days ago

**EFRConnect-android**  
This is the source code for the EFR Connect application for Android.  
Java Apache-2.0 🍴 28 ★ 32 🕒 0 📄 0 Updated 15 hours ago

**openthread**  
Forked from openthread/openthread  
OpenThread released by Nest is an open-source implementation of the Thread networking protocol  
C++ BSD-3-Clause 🍴 705 ★ 3 🕒 0 📄 1 Updated yesterday

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# github.com/SiliconLabs/peripheral\_examples

SiliconLabs / peripheral\_examples

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Peripheral examples for Silicon Labs EFM32/EFR32 Series 0, Series 1, and Series 2 devices

55 commits 1 branch 0 packages 0 releases 11 contributors


Branch: master New pull request Create new file Upload files Find file Clone or download

silabs-cohulse Merge pull request #79 in PA\_MCU\_EXTERNAL\_PROJECTS/mcu\_peripheraL... Latest commit b5654dc 5 days ago

series0	Merge pull request #77 in PA_MCU_EXTERNAL_PROJECTS/mcu_peripheraL...	9 days ago
series1	Merge pull request #79 in PA_MCU_EXTERNAL_PROJECTS/mcu_peripheraL...	5 days ago
series2	Merge pull request #77 in PA_MCU_EXTERNAL_PROJECTS/mcu_peripheraL...	9 days ago
README.md	Add EFR32xG22 and migrate AN0012 examples	3 months ago

README.md

**EFM32 and EFR32  
32-bit MCU Peripheral Examples**



This repo contains simple peripheral examples based on emlib for Series 0, Series 1, and Series 2 devices.

# github.com/SiliconLabs/peripheral\_examples/tree/master/series2

Branch: master ▾ peripheral\_examples / series2 / Create new file Upload files Find file History

Dayoung Lee and Dayoung Lee Merge pull request #77 in PA\_MCU\_EXTERNAL\_PROJECTS/mcu\_peripheral\_... Latest commit d502ada 9 days ago

..		
acmp	Merge pull request #77 in PA_MCU_EXTERNAL_PROJECTS/mcu_peripheral_...	9 days ago
burtc/burtc_em4_buram	Merge pull request #77 in PA_MCU_EXTERNAL_PROJECTS/mcu_peripheral_...	9 days ago
cryptoacc	Adds cryptoacc examples. Fixes build error in se_ecdsa project.	3 months ago
emu	Merge pull request #77 in PA_MCU_EXTERNAL_PROJECTS/mcu_peripheral_...	9 days ago
euart	Merge pull request #77 in PA_MCU_EXTERNAL_PROJECTS/mcu_peripheral_...	9 days ago
gpio	Merge pull request #74 in PA_MCU_EXTERNAL_PROJECTS/mcu_peripheral_...	2 months ago
i2c	Fixes GitHub issue #40	last month
iadc	Merge pull request #77 in PA_MCU_EXTERNAL_PROJECTS/mcu_peripheral_...	9 days ago
ldma	Add EFR32xG22 and migrate AN0012 examples	3 months ago
letimer	Add EFR32xG22 and migrate AN0012 examples	3 months ago
msc	Merge pull request #75 in PA_MCU_EXTERNAL_PROJECTS/mcu_peripheral_...	last month
pdm	Add EFR32xG22 and migrate AN0012 examples	3 months ago
prs/prs_logic_unit	Add EFR32xG22 and migrate AN0012 examples	3 months ago
rtcc/rtcc_interrupt	Add EFR32xG22 and migrate AN0012 examples	3 months ago
se	Adds cryptoacc examples. Fixes build error in se_ecdsa project.	3 months ago
timer	Merge pull request #77 in PA_MCU_EXTERNAL_PROJECTS/mcu_peripheral_...	9 days ago
usart	Add EFR32xG22 and migrate AN0012 examples	3 months ago
wdog/wdog_led_toggle	Add EFR32xG22 and migrate AN0012 examples	3 months ago

# peripheral\_examples/tree/master/series2/usart

Branch: master ▾ [peripheral\\_examples](#) / [series2](#) / [usart](#) /

Create new file Upload files Find file History

@silabs Add EFR32xG22 and migrate AN0012 examples ... Latest commit 49e1c52 on Mar 2

..

<a href="#">usart_async_interrupt</a>	Add EFR32xG22 and migrate AN0012 examples	3 months ago
<a href="#">usart_async_polled</a>	Add EFR32xG22 and migrate AN0012 examples	3 months ago
<a href="#">usart_spi_master_dma</a>	Add EFR32xG22 and migrate AN0012 examples	3 months ago
<a href="#">usart_spi_master_interrupt</a>	Add EFR32xG22 and migrate AN0012 examples	3 months ago
<a href="#">usart_spi_master_polled</a>	Add EFR32xG22 and migrate AN0012 examples	3 months ago
<a href="#">usart_spi_slave_dma</a>	Add EFR32xG22 and migrate AN0012 examples	3 months ago
<a href="#">usart_spi_slave_interrupt</a>	Add EFR32xG22 and migrate AN0012 examples	3 months ago
<a href="#">usart_spi_slave_polled</a>	Add EFR32xG22 and migrate AN0012 examples	3 months ago

# peripheral\_examples/tree/master/series2/usart/usart\_async\_polled

Branch: master ▾ peripheral\_examples / series2 / usart / usart\_async\_polled /

@silabs Add EFR32xG22 and migrate AN0012 examples ...

..

📁 SimplicityStudio	Add EFR32xG22 and migrate AN0012 examples
📁 doc	Add EFR32xG22 and migrate AN0012 examples
📁 iar	Add EFR32xG22 and migrate AN0012 examples
📁 src	Add EFR32xG22 and migrate AN0012 examples
📄 readme.txt	Add EFR32xG22 and migrate AN0012 examples

peripheral\_examples / series2 / usart / usart\_async\_polled / SimplicityStudio /

@silabs Add EFR32xG22 and migrate AN0012 examples ...

..

📄 BRD4181A_EFR32xG21_usart_async_polled.slsproj	Implements series 2 peripheral examples
📄 BRD4182A_EFR32xG22_usart_async_polled.slsproj	Add EFR32xG22 and migrate AN0012 examples

Branch: master ▾ peripheral\_examples / series2 / usart / usart\_async\_polled / iar /

@silabs Add EFR32xG22 and migrate AN0012 examples ...

..

📄 EFR32xG21_usart_async_polled.ewd	Implements series 2 peripheral examples
📄 EFR32xG21_usart_async_polled.ewp	Add EFR32xG22 and migrate AN0012 examples
📄 EFR32xG22_usart_async_polled.ewd	Add EFR32xG22 and migrate AN0012 examples
📄 EFR32xG22_usart_async_polled.ewp	Add EFR32xG22 and migrate AN0012 examples
📄 usart_async_polled.eww	Add EFR32xG22 and migrate AN0012 examples

Branch: master ▾ peripheral\_examples / series2 / usart / usart\_async\_polled / src /

@silabs Add EFR32xG22 and migrate AN0012 examples ...

..

📄 main.c	Add EFR32xG22 and migrate AN0012 examples
----------	---

# peripheral\_examples/tree/master/series2/usart/usart\_async\_polled

readme.txt

This project demonstrates polled operation of the USART in asynchronous mode. USART1 is configured for asynchronous operation at 115200 baud with 8 data bits, no parity, and one stop bit (115200N81). The main loop waits until 80 characters or a carriage return are received and then echos these back to the user.

=====  
Peripherals Used:

GPIO  
USART1

The CMU is used indirectly via the USART\_InitAsync() function to calculate the divisor necessary to derive the desired baud rate.

=====  
How To Test:

1. Build the project and download to the Starter Kit.
2. Connect a PC to a USB-to-serial converter, such as the Silicon Labs CP2102N-EK, which provides access to the CMOS level (3V) RX and TX pins.
3. Connect the RX and TX pins on the USB-to-serial converter to pins 14 and 12, respectively on the Expansion Header of the Wireless Starter Kit Mainboard.
4. Open a terminal program and configure it for 115200N81 operation on the serial port assigned to the USB-to-serial converter.
5. Type some characters in the terminal program (they will not show) and press Enter to have the MCU echo them.

=====  
Listed below are the port and pin mappings for working with this example.

Board: Silicon Labs EFR32xG21 2.4 GHz 10 dBm Board (BRD4181A)  
+ Wireless Starter Kit Mainboard (BRD4001A)

Device: EFR32MG21A010F1024IM32 (this code will run unchanged on any EFR32MG21 or EFR32BG211 variant so long as the pins used as present).

PA5 - USART1\_TX (Expansion Header Pin 12)  
PA6 - USART1\_RX (Expansion Header Pin 14)

Device: EFR32MG22C224F512IM40 (this code will run unchanged on any EFR32MG22 or EFR32BG212 variant so long as the pins used as present).

PA5 - USART1\_TX (Expansion Header Pin 12)  
PA6 - USART1\_RX (Expansion Header Pin 14)

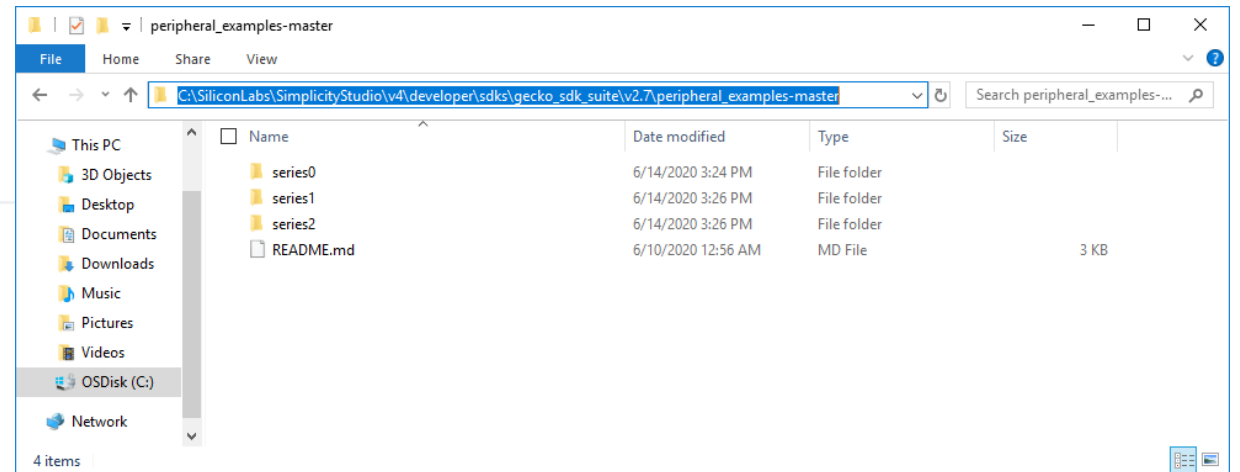
# How to install and use peripheral examples?

## Requirements

1. Desired Silicon Labs Starter Kit
2. Gecko SDK Suite, available via Simplicity Studio
3. This repo, cloned to to `c:\SiliconLabs\SimplicityStudio\v4\developer\sdk\gecko_sdk_suite\v#.#\`, where #.# is the Gecko SDK suite version number
4. Simplicity Studio IDE or IAR Embedded Workbench IDE

## How to import to Simplicity Studio IDE

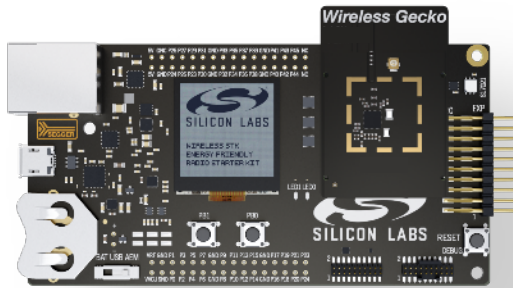
1. In Simplicity Studio:
  - o File -> Import, or
  - o Project -> Import -> MCU Project
2. Navigate to the desired .slsproj file



## How to import to IAR Embedded Workbench IDE

1. Navigate to the desired .eww file and double click

# BG22 Development Kits



**BG22 SoC Starter Kit**  
SLWSTK6021A



**Thunderboard BG22**  
SLTB010A

**SLWSTK6021A**

1x WSTK main boards  
1x SLWRB4182A radio boards (QFN40)  
1x SLWRB4183A radio boards (QFN32)

---

**SLWRB4182A**

BG22 +6 dBm radio board (QFN40)

---

**SLWRB4183A**

BG22 +6 dBm radio board (QFN32)

---

**SLTB010A**

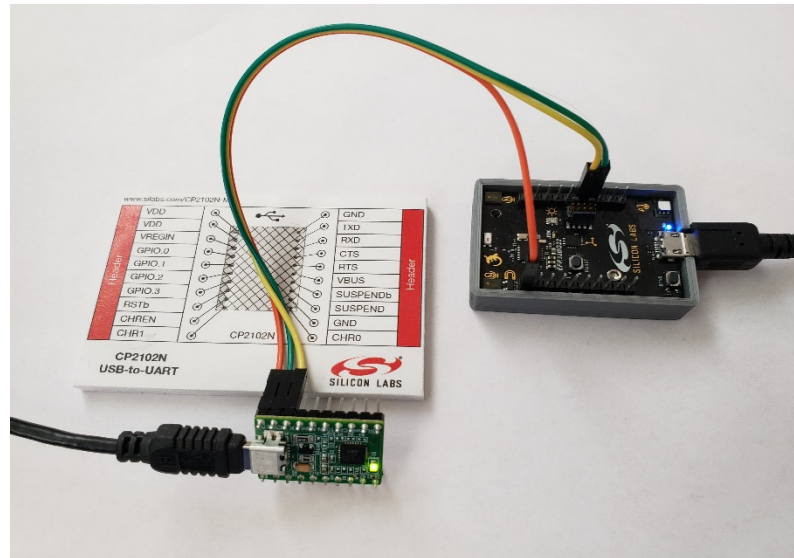
Thunderboard BG22 kit

# Live Demo

## USART Asynchronous Polled Example

### How To Test:

1. Download repository in Simplicity Studio SDK directory.
2. Import project.
3. Build the project and download to the BG22 Thunderboard.
4. Connect the RX and TX pins on the USB-to-serial converter to pins 14 and 12, respectively on the Expansion Header.
5. Connect CP2102N USB to a PC.
6. Open TeraTerm and configure it for 115200N81 operation on the serial port assigned to the USB-to-serial converter.
7. Type some characters in the terminal program (they will not show) and press Enter to have the MCU echo them.





# peripheral\_examples/tree/master/series2/timer

Branch: master ▾ peripheral\_examples / series2 / timer / Create new file Upload files Find file History

Dayoung Lee and Dayoung Lee Merge pull request #77 in PA\_MCU\_EXTERNAL\_PROJECTS/mcu\_peripheral\_exa... Latest commit d502ada 10 days ago

..

timer_dma_edge_capture	Add EFR32xG22 and migrate AN0012 examples	3 months ago
timer_frequency_generation	Add EFR32xG22 and migrate AN0012 examples	3 months ago
timer_input_capture_interrupt	Merge pull request #77 in PA_MCU_EXTERNAL_PROJECTS/mcu_peripheral_exa...	10 days ago
timer_period_measurement_interru...	Add EFR32xG22 and migrate AN0012 examples	3 months ago
timer_period_measurement_polled	Add EFR32xG22 and migrate AN0012 examples	3 months ago
timer_pulse_capture	Add EFR32xG22 and migrate AN0012 examples	3 months ago
timer_pwm_dma	Merge pull request #77 in PA_MCU_EXTERNAL_PROJECTS/mcu_peripheral_exa...	10 days ago
timer_pwm_interrupt	Add EFR32xG22 and migrate AN0012 examples	3 months ago
timer_single_edge_output_compare	Add EFR32xG22 and migrate AN0012 examples	3 months ago
timer_single_pulse_generation_dma	Add EFR32xG22 and migrate AN0012 examples	3 months ago
timer_single_pulse_generation_inte...	Add EFR32xG22 and migrate AN0012 examples	3 months ago
timer_single_pulse_generation_poll...	Add EFR32xG22 and migrate AN0012 examples	3 months ago

# peripheral\_examples/series2/timer/timer\_period\_measurement\_interrupt

Branch: master

[peripheral\\_examples](#) / [series2](#) / [timer](#) / [timer\\_period\\_measurement\\_interrupt](#) /

readme.txt

This project demonstrates period measurement using the TIMER module. TIMER is initialized for input capture on Compare/Capture channel 0 for falling edge capture and interrupts. Upon each interrupt, the captured edge is read from CC0 and compared with the previously captured edge to calculate the period. The measured period is stored in the measuredPeriod global variable in units of microseconds.

Example: for a 1 kHz input signal, the measuredPeriod variable will equal 1000.

Note: The range of frequencies this program can measure accurately is limited. The minimum measurable period is around 3 microseconds, or 333 kHz. At higher frequencies accuracy is diminished due to dropout, and above 333 kHz the interrupt execution time is longer than the signal period. For methods to measure shorter periods, see the timer\_pulse\_capture example.

=====  
Peripherals Used:  
TIMER0 - HFPERCLK (19 MHz for series 2 boards)  
=====

How To Test:  
1. Build the project and download it to the Starter Kit  
2. Connect a periodic signal to the GPIO pin specified below  
3. Go into debug mode and click run  
4. View the measuredPeriod (time period in us) global variable in the debugger  
=====

Listed below are the port and pin mappings for working with this example.

Board: Silicon Labs EFR32xG21 2.4 GHz 10 dBm Board (BRD4181A)  
+ Wireless Starter Kit Mainboard (BRD4001A)  
Device: EFR32MG21A010F1024IM32  
PA6 - TIM0\_CC0 (Expansion Header Pin 14)

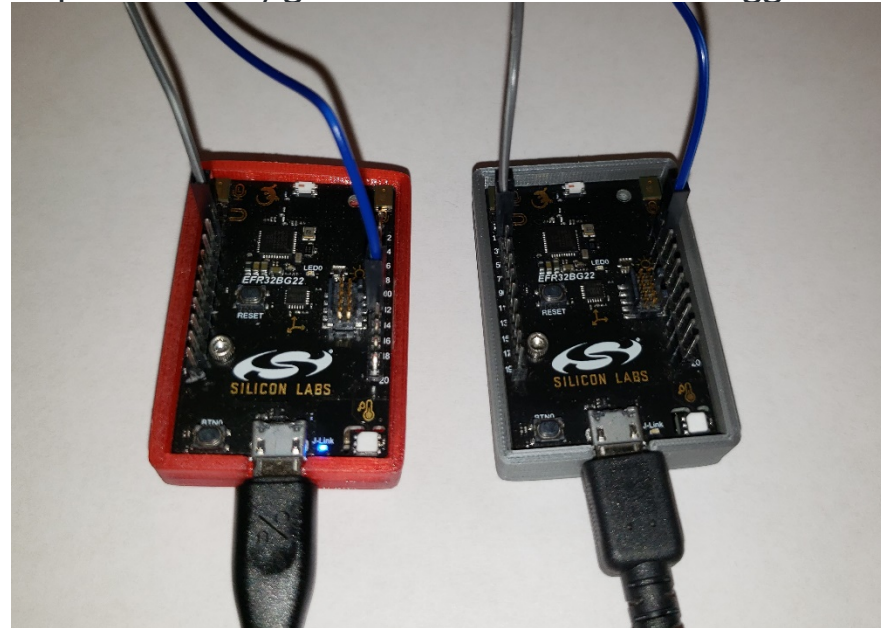
Board: Silicon Labs EFR32xG22 Radio Board (BRD4182A) +  
Wireless Starter Kit Mainboard  
Device: EFR32MG22C224F512IM40  
PA6 - TIM0\_CC0 (Expansion Header Pin 14)

# Live Demo

## Timer Period Measurement Interrupt Example

### How To Test:

1. Import project.
2. Update input pin from A6 to C0.
3. Connect a periodic signal to Pin C0. (1kHz Square Wave)
4. Build the project and debug it on the BG22 Thunderboard.
5. Let MCU run for a short time and then pause the project.
6. View the measuredPeriod (time period in us) global variable in the debugger. Should see value near 1000.



# Conclusions

- Peripheral Examples
  - Easy to use and they demonstrate all major modes of peripheral operation
  - Can easily be copied and used in your project
  - Available on our [github.com/SiliconLabs](https://github.com/SiliconLabs) repository
  - Each example is clearly and fully documented in the `readme.txt` within each project
- EMLIB
  - A low level peripheral support library that provides a unified API for EFM32 and EFR32
  - All firmware written is compatible across all our MCUs and Wireless SoCs and Modules
  - Fully documented at [docs.silabs.com](https://docs.silabs.com)
- EFM32 vs EFR32
  - EFM32 is our MCU Family based on ARM Cortex M Series Cores
  - EFR32 includes our Wireless SoC and Modules which include a Radio and a Cortex MCU

# Additional Info & Important Links

- [https://github.com/SiliconLabs/peripheral\\_examples](https://github.com/SiliconLabs/peripheral_examples)
- <https://docs.silabs.com/>
- <https://docs.silabs.com/mcu/latest/efr32bg22/group-emlib>
- <https://www.silabs.com/documents/public/application-notes/an0918.2-efm32-to-efr32xg2x-migration-guide.pdf>
- <https://www.silabs.com/wireless>
- <https://www.silabs.com/products/development-tools/thunderboard/thunderboard-bg22-kit>
- USB to UART Bridge – CP2102N
  - Product Page: <https://www.silabs.com/interface/usb-bridges/usbxpress>
  - Silabs Eval Kit: [CP2102N-mini-evaluation-kit](#)

# BG22 Virtual Workshop



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# Q & A Session





Thank you

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