



**THE DATASHEET OF
SLSTK3402A**



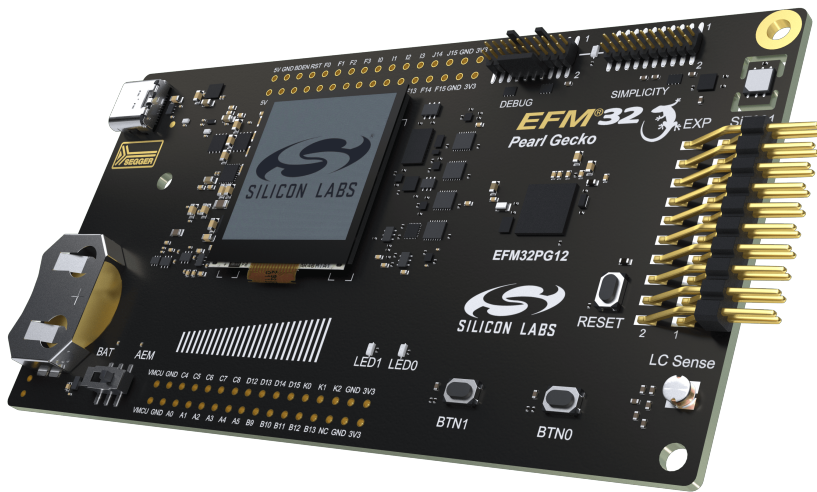
UG257: EFM32PG12 Gecko Starter Kit

User's Guide



The SLSTK3402A is an excellent starting point to become familiar with the EFM32PG12™ Gecko Microcontroller.

The Starter Kit contains sensors and peripherals demonstrating some of the EFM32PG12's many capabilities. The kit provides all necessary tools for developing an EFM32PG12 Gecko application.



TARGET DEVICE

- EFM32PG12 Gecko Microcontroller (EFM32PG12B500F1024GL125-C)
- CPU: 32-bit ARM® Cortex-M4®
- Memory: 1024 kB flash and 256 kB RAM

KIT FEATURES

- USB connectivity
- Advanced Energy Monitor (AEM)
- SEGGER J-Link on-board debugger
- Debug multiplexer supporting external hardware as well as on-board MCU
- Ultra-low-power 128x128 pixel Memory LCD
- Silicon Labs Si7021 Relative Humidity and Temperature Sensor
- Inductive LC sensor
- User LEDs / Pushbuttons
- Capacitive Touch Slider
- 20-pin 2.54 mm header for expansion boards
- Breakout pads for direct access to I/O pins
- Power sources include USB and CR2032 coin cell battery

SOFTWARE SUPPORT

- Simplicity Studio™
- IAR Embedded Workbench
- Keil MDK

Table of Contents

1. Introduction	4
1.1 Description	4
1.2 Features	4
1.3 Getting Started	4
2. Kit Block Diagram	5
3. Kit Hardware Layout	6
4. Connectors	7
4.1 Breakout Pads	7
4.2 EXP Header	9
4.3 Debug Connector (DBG)	11
4.4 Simplicity Connector	12
5. Power Supply and Reset	13
5.1 MCU Power Selection	13
5.2 Board Controller Power	13
5.3 EFM32PG12 Reset	14
6. Peripherals	15
6.1 Push Buttons and LEDs	15
6.2 Memory LCD-TFT Display	16
6.3 Capacitive Touch Slider	17
6.4 LC Sensor	17
6.5 Si7021 Relative Humidity and Temperature Sensor	18
6.6 Virtual COM Port	19
7. Advanced Energy Monitor	20
7.1 Usage	20
7.2 Theory of Operation	20
7.3 Secondary AEM Channel	20
7.4 Accuracy and Performance	20
8. On-Board Debugger	21
8.1 Debug Modes	22
8.2 Debugging During Battery Operation	23
9. Kit Configuration and Upgrades	24
9.1 Firmware Upgrades	24
10. Schematics, Assembly Drawings, and BOM	25
11. Kit Revision History and Errata	26

11.1 Revision History26

11.2 Errata26

12. Document Revision History27

1. Introduction

1.1 Description

The SLSTK3402A is an ideal starting point for application development on the EFM32PG12 Gecko Microcontrollers. The board features sensors and peripherals, demonstrating some of the many capabilities of the EFM32PG12 Gecko Microcontroller. Additionally, the board is a fully featured debugger and energy monitoring tool that can be used with external applications.

1.2 Features

- EFM32PG12 Gecko Microcontroller
 - 1024 kB Flash
 - 256 kB RAM
 - BGA125 package
- Advanced Energy Monitoring system for precise current and voltage tracking
- Integrated Segger J-Link USB debugger/emulator with the possibility to debug external Silicon Labs devices
- 20-pin expansion header
- Breakout pads for easy access to I/O pins
- Power sources include USB and CR2032 battery
- Ultra-low-power 128x128 pixel Memory-LCD
- 2 push buttons and 2 user LEDs connected to EFM32 for user interaction
- 4-segment Capacitive Touch Slider
- LC tank circuit for inductive proximity sensing of metallic objects
- Silicon Labs Si7021 Relative Humidity and Temperature Sensor
- Crystals for LFXO and HFXO: 32.768 kHz and 40.000 MHz.

1.3 Getting Started

Detailed instructions for how to get started with your new SLSTK3402A can be found on the Silicon Labs Web pages:

<https://www.silabs.com/mcu/32-bit/efm32-pearl-gecko>

2. Kit Block Diagram

An overview of the EFM32PG12 Gecko Starter Kit is shown in the figure below.

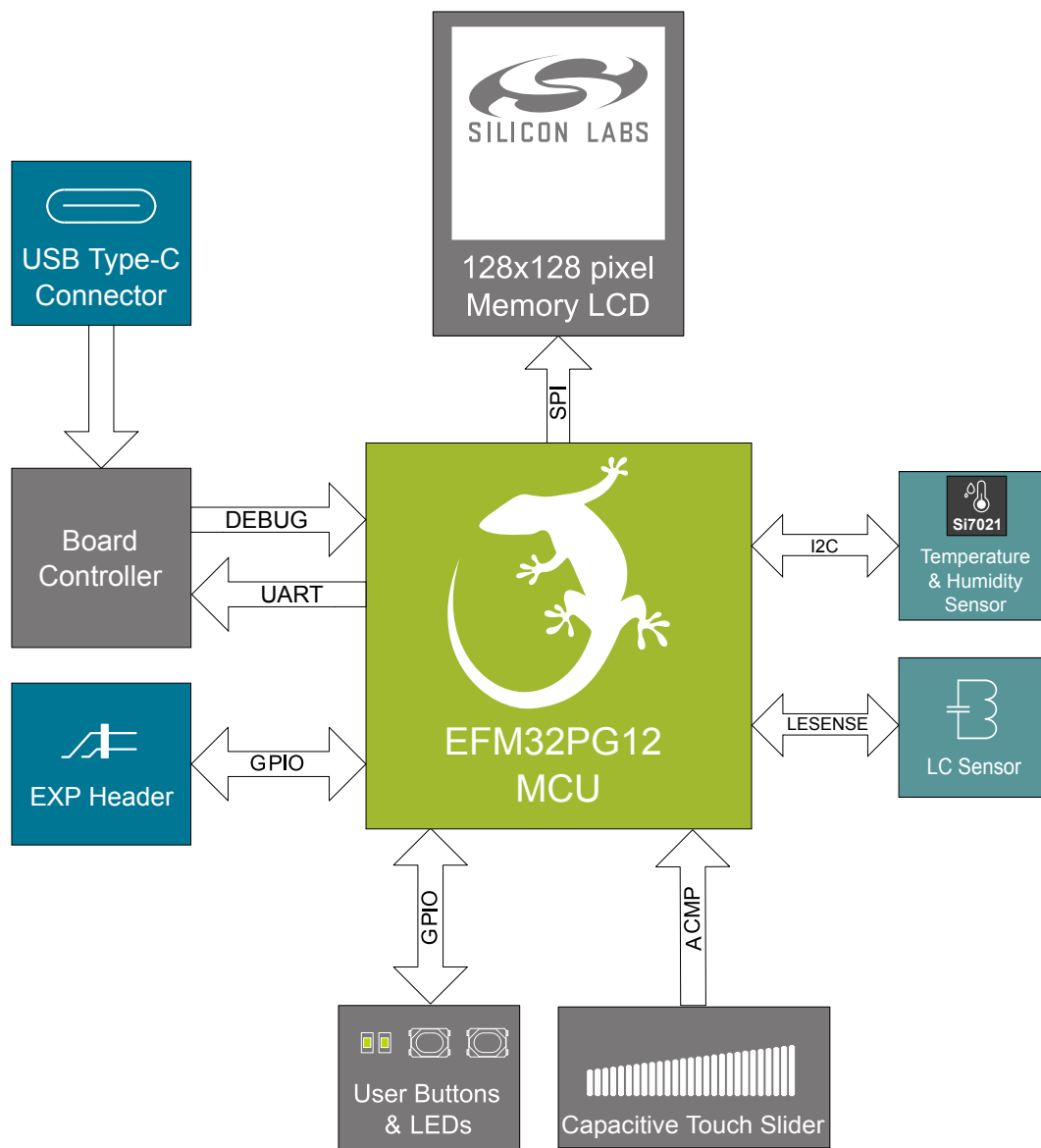


Figure 2.1. Kit Block Diagram

3. Kit Hardware Layout

The EFM32PG12 Gecko Starter Kit layout is shown below.

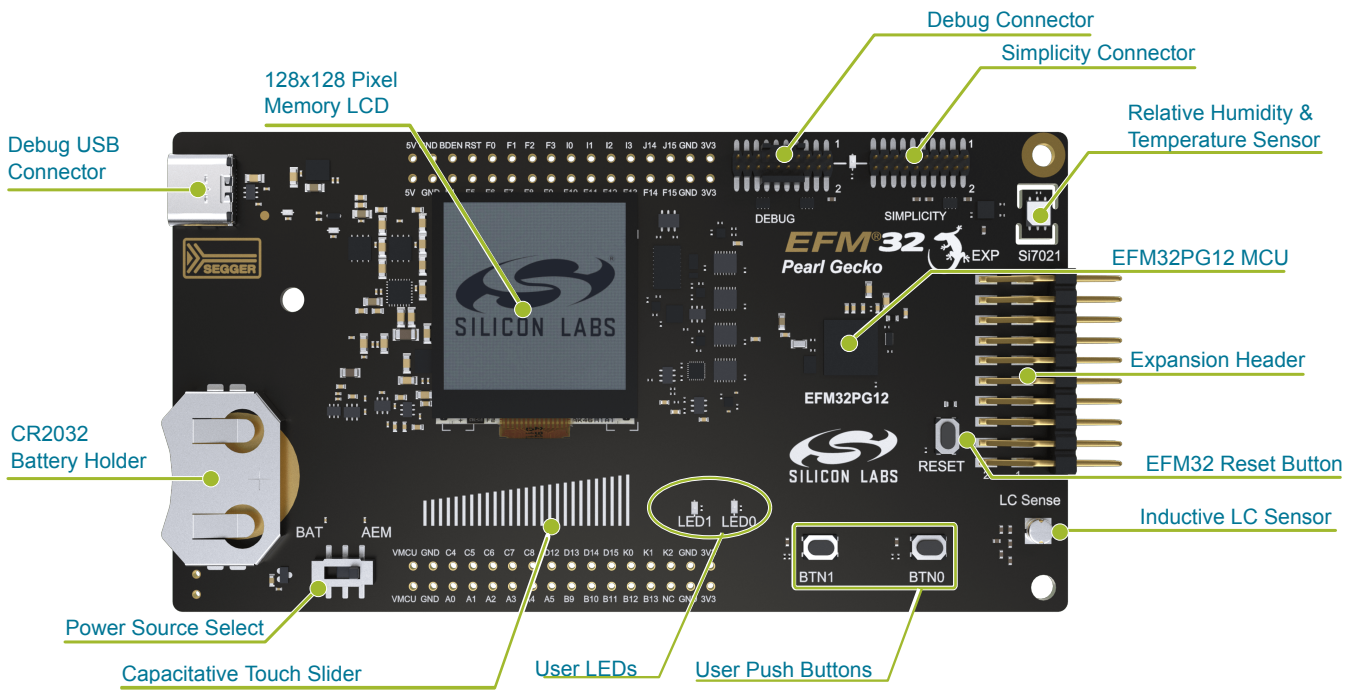


Figure 3.1. SLSTK3402A Hardware Layout

4. Connectors

4.1 Breakout Pads

Most of the EFM32PG12's GPIO pins are available on two pin header rows at the top and bottom edges of the board. These have a standard 2.54 mm pitch, and pin headers can be soldered in if required. In addition to the I/O pins, connections to power rails and ground are also provided. Note that some of the pins are used for kit peripherals or features and may not be available for a custom application without tradeoffs.

The figure below shows the pinout of the breakout pads and the pinout of the EXP header on the right edge of the board. The EXP header is further explained in the next section. The breakout pad connections are also printed in silkscreen next to each pin for easy reference.

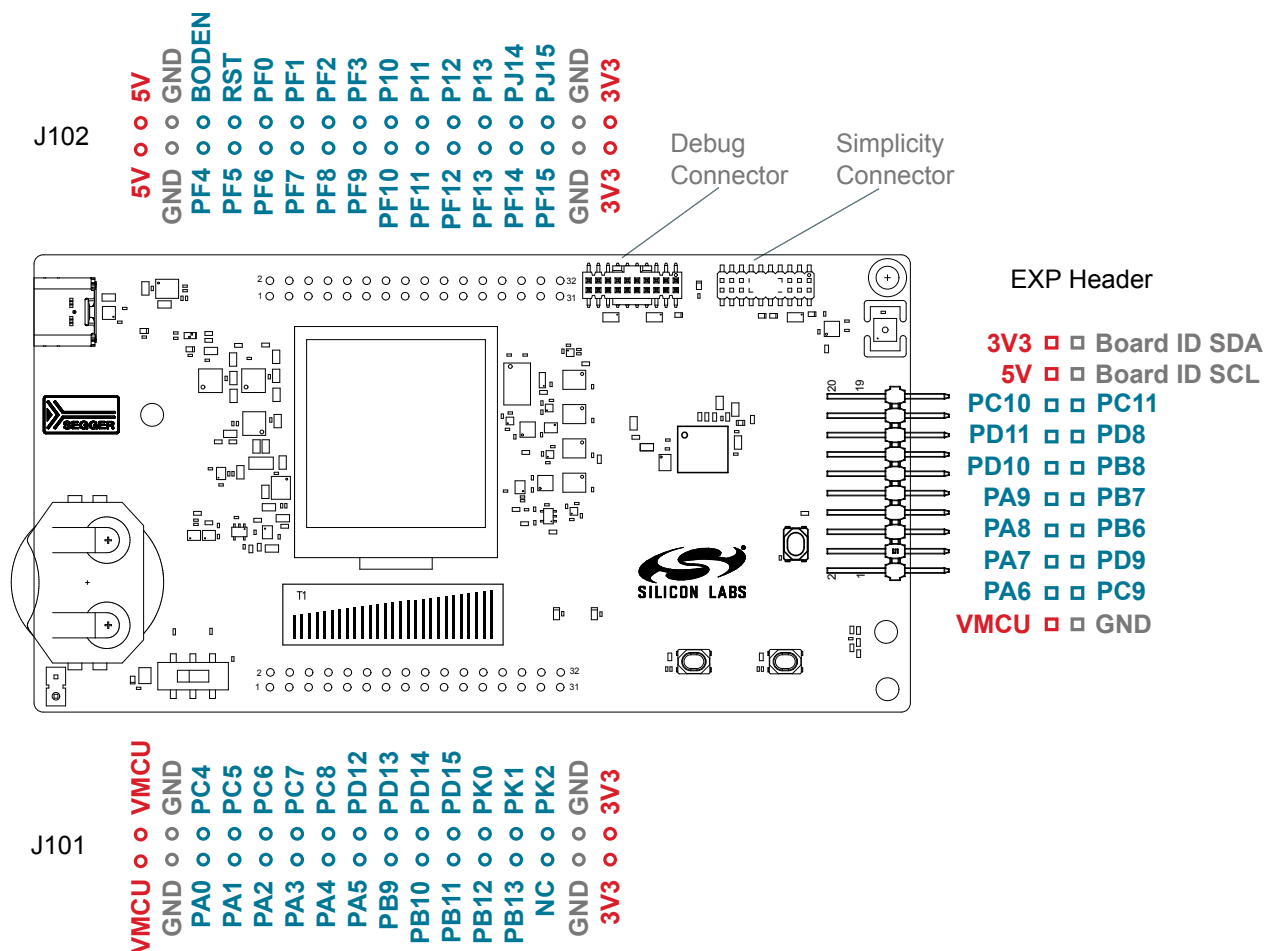


Figure 4.1. Breakout Pads and Expansion Header

The table below shows the pin connections of the breakout pads. It also shows which kit peripherals or features are connected to the different pins.

Table 4.1. Bottom Row (J101) Pinout

Pin	EFM32PG12 I/O Pin	Shared Feature	Pin	EFM32PG12 I/O Pin	Shared Feature
1	VMCU	EFM32PG12 voltage domain (measured by AEM)	2	VMCU	EFM32PG12 voltage domain (measured by AEM)
3	GND	Ground	4	GND	Ground
5	PA0	VCOM_TX	6	PC4	GPIO
7	PA1	VCOM_RX	8	PC5	GPIO

Pin	EFM32PG12 I/O Pin	Shared Feature	Pin	EFM32PG12 I/O Pin	Shared Feature
9	PA2	VCOM_CTS	10	PC6	DISP_SI
11	PA3	VCOM_RTS	12	PC7	GPIO
13	PA4	LES_LC_SENSE	14	PC8	DISP_SCLK
15	PA5	VCOM_ENABLE	16	PD12	DAC_LC_EXCITE
17	PB9	GPIO	18	PD13	DISP_COM
19	PB10	SENSOR_ENABLE	20	PD14	DISP_CS
21	PB11	GPIO	22	PD15	DISP_ENABLE
23	PB12	GPIO	24	PK0	GPIO
25	PB13	GPIO	26	PK1	GPIO
27	NC	–	28	PK2	GPIO
29	GND	Ground	30	GND	Ground
31	3V3	Board controller supply	32	3V3	Board controller supply

Table 4.2. Top Row (J102) Pinout

Pin	EFM32PG12 I/O Pin	Shared Feature	Pin	EFM32PG12 I/O Pin	Shared Feature
1	5V	Board USB voltage	2	5V	Board USB voltage
3	GND	Ground	4	GND	Ground
5	PF4	UIF_LED0	6	BODEN	BODEN
7	PF5	UIF_LED1	8	RST	DEBUG_#RESET_C2CKPS
9	PF6	UIF_BUTTON0	10	PF0	DEBUG_TCK_SWCLK_C2CK
11	PF7	UIF_BUTTON1	12	PF1	DEBUG_TMS_SWDIO_C2D
13	PF8	DEBUG_TRACECLK	14	PF2	DEBUG_TDO_SWO
15	PF9	DEBUG_TRACED0	16	PF3	DEBUG_TDI_C2DPS
17	PF10	DEBUG_TRACED1	18	P10	GPIO
19	PF11	DEBUG_TRACED2	20	P11	GPIO
21	PF12	DEBUG_TRACED3	22	P12	GPIO
23	PF13	GPIO	24	P13	GPIO
25	PF14	GPIO	26	PJ14	GPIO
27	PF15	GPIO	28	PJ15	GPIO
29	GND	Ground	30	GND	Ground
31	3V3	Board controller supply	32	3V3	Board controller supply

4.2 EXP Header

On the right side of the board, an angled 20-pin EXP header is provided to allow connection of peripherals or plugin boards. The connector contains a number of I/O pins that can be used with most of the EFM32PG12 Gecko's features. Additionally, the VMCU, 3V3, and 5V power rails are also exposed.

The connector follows a standard which ensures that commonly used peripherals such as a SPI, UART, and I²C bus are available on fixed locations on the connector. The rest of the pins are used for general purpose I/O. This layout allows the definition of expansion boards that can plug into a number of different Silicon Labs kits.

The figure below shows the EXP header pin assignment for the EFM32PG12 Gecko Starter Kit. Because of limitations in the number of available GPIO pins, some of the EXP header pins are shared with kit features.

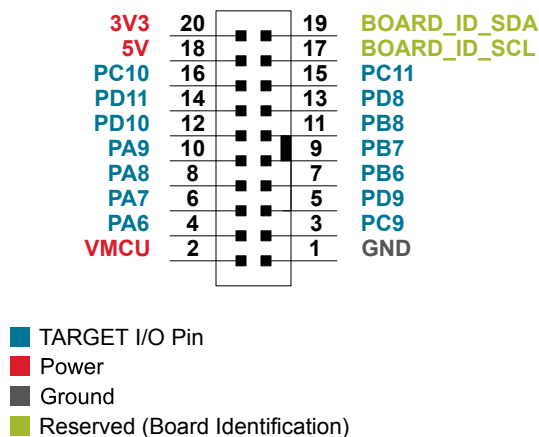


Figure 4.2. EXP Header

Table 4.3. EXP Header Pinout

Pin	Connection	EXP Header Function	Shared Feature	Peripheral Mapping
20	3V3	Board controller supply		
18	5V	Board controller USB voltage		
16	PC10	I2C_SDA	–	I2C0_SDA
14	PD11	UART_RX	–	UART0_RX
12	PD10	UART_TX	–	UART0_TX
10	PA9	US2_CS	–	US2_CS
8	PA8	US2_CLK	–	US2_CLK
6	PA7	US2_RX	–	US2_RX
4	PA6	US2_TX	–	US2_TX
2	VMCU	EFM32PG12 voltage domain, included in AEM measurements.		
19	BOARD_ID_SDA	Connected to Board Controller for identification of add-on boards.		
17	BOARD_ID_SCL	Connected to Board Controller for identification of add-on boards.		
15	PC11	I2C_SCL	–	I2C0_SCL
13	PD8	US3_CS	–	US3_CS
11	PB8	US3_CLK	–	US3_CLK
9	PB7	US3_RX	–	US3_RX

Pin	Connection	EXP Header Function	Shared Feature	Peripheral Mapping
7	PB6	US3_TX	–	US3_TX
5	PD9	PCNT0_S1IN	–	PCNT0_S1IN
3	PC9	PCNT0_S0IN	–	PCNT0_S0IN
1	GND	Ground		

4.3 Debug Connector (DBG)

The Debug Connector serves a dual purpose, depending on the "debug mode", which can be set up using Simplicity Studio. In the "Debug IN" mode this connector allows an external debug emulator to be used with the on-board EFM32PG12. In the "Debug OUT" mode, this connector allows the kit to be used as a debugger towards an external target. In the "Debug MCU" (default) mode, this connector is isolated from the debug interface of both the board controller and the on-board target device.

Because this connector is automatically switched to support the different operating modes, it is only available when the board controller is powered (J-Link USB cable connected). If debug access to the target device is required when the board controller is unpowered, connect directly to the appropriate breakout pins.

The connector pinout follows that of the standard ARM Cortex Debug+ETM 19-pin connector. The pinout is described in detail below. Note that when using the on-board debugger to debug an MCU on an external board, JTAG and ETM functionality are only available if the target device supports it.

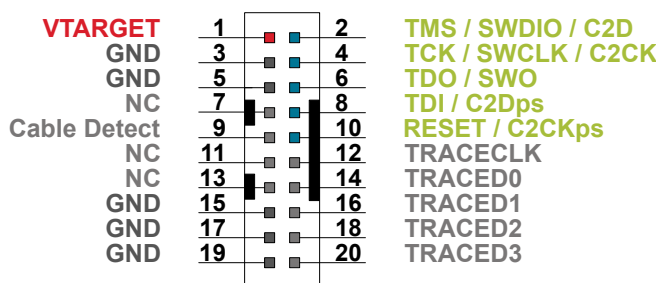


Figure 4.3. Debug Connector

Note that the pinout matches the pinout of an ARM Cortex Debug+ETM connector, but these are not fully compatible because pin 7 is physically removed from the Cortex Debug+ETM connector. Some cables have a small plug that prevent them from being used when this pin is present. If this is the case, remove the plug or use a standard 2x10 1.27 mm straight cable instead.

Table 4.4. Debug Connector Pin Descriptions

Pin Number(s)	Function	Note
1	VTARGET	Target reference voltage. Used for shifting logical signal levels between target and debugger.
2	TMS / SDWIO / C2D	JTAG test mode select, Serial Wire data or C2 data
4	TCK / SWCLK / C2CK	JTAG test clock, Serial Wire clock or C2 clock
6	TDO/SWO	JTAG test data out or Serial Wire Output
8	TDI / C2Dps	JTAG test data in, or C2D "pin sharing" function
10	RESET / C2CKps	Target device reset, or C2CK "pin sharing" function
12	TRACECLK	ETM Trace Clock
14	TRACED0	ETM Trace Data 0
16	TRACED1	ETM Trace Data 1
18	TRACED2	ETM Trace Data 2
20	TRACED3	ETM Trace Data 3
9	Cable detect	Connect to ground
11, 13	NC	Not connected
3, 5, 15, 17, 19	GND	

4.4 Simplicity Connector

The Simplicity Connector featured on the EFM32PG12 Gecko Starter Kit enables advanced debugging features such as the AEM and Virtual COM port to be used towards an external target. The pinout is illustrated in the figure below.

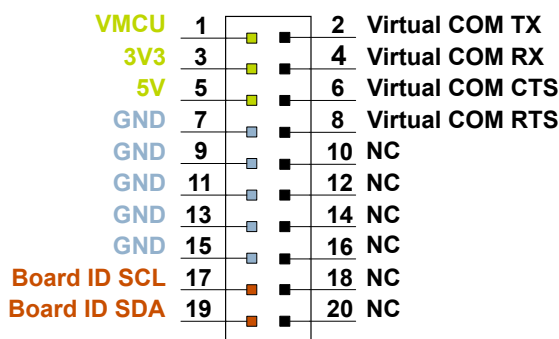


Figure 4.4. Simplicity Connector

The signal names in the figure and the pin description table are referenced from the board controller. This means that VCOM_TX should be connected to the RX pin on the external target, VCOM_RX to the target's TX pin, VCOM_CTS to the target's RTS pin, and VCOM_RTS to the target's CTS pin.

Note: Current drawn from the VMCU voltage pin is included in the AEM measurements, while the 3V3 and 5V voltage pins are not. To monitor the current consumption of an external target with the AEM, put the on-board MCU in its lowest energy mode to minimize its impact on the measurements.

Table 4.5. Simplicity Connector Pin Descriptions

Pin Number(s)	Function	Description
1	VMCU	3.3 V power rail, monitored by the AEM
3	3V3	3.3 V power rail
5	5V	5 V power rail
2	VCOM_TX	Virtual COM TX
4	VCOM_RX	Virtual COM RX
6	VCOM_CTS	Virtual COM CTS
8	VCOM_RTS	Virtual COM RTS
17	BOARD_ID_SCL	Board ID SCL
19	BOARD_ID_SDA	Board ID SDA
10, 12, 14, 16, 18, 20	NC	Not connected
7, 9, 11, 13, 15	GND	Ground

5. Power Supply and Reset

5.1 MCU Power Selection

The EFM32PG12 on the Starter Kit can be powered by one of these sources:

- The debug USB cable
- 3 V coin cell battery

The power source for the MCU is selected with the slide switch in the lower left corner of the Starter Kit. The figure below shows how the different power sources can be selected with the slide switch.

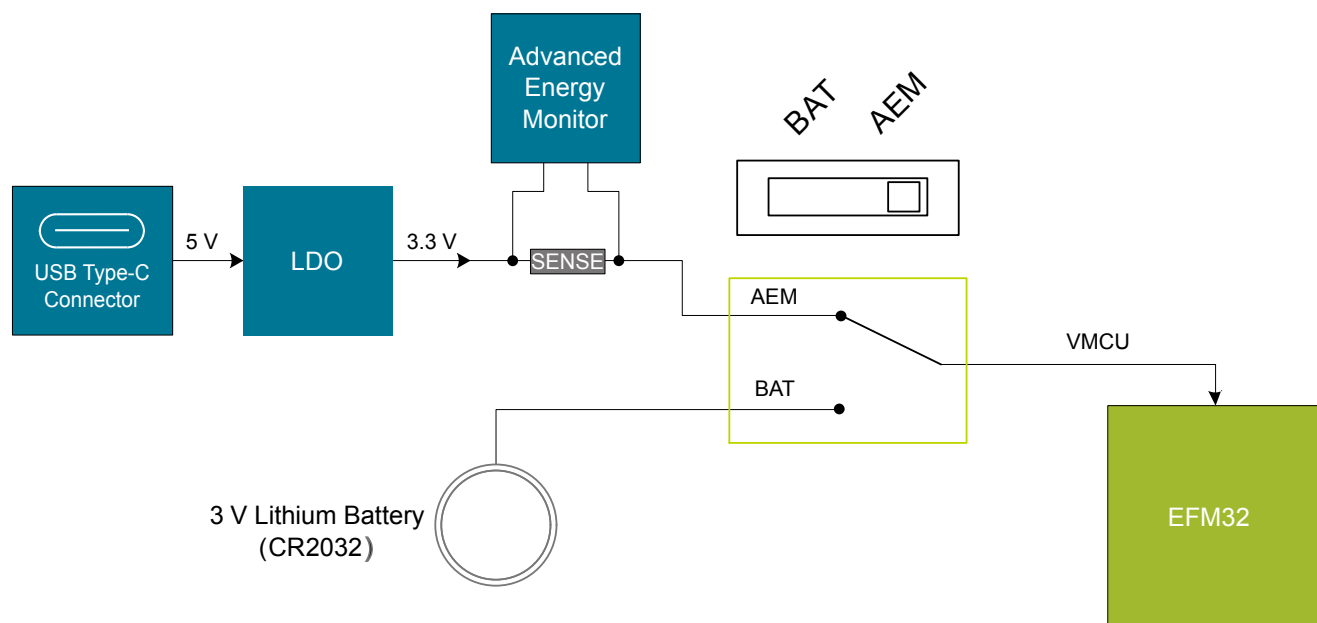


Figure 5.1. Power Switch

With the switch in the **AEM** position, a low noise 3.3 V LDO on the Starter Kit is used to power the EFM32PG12. This LDO is again powered from the debug USB cable. The Advanced Energy Monitor is now connected in series, allowing accurate high-speed current measurements and energy debugging/profiling.

With the switch in the **BAT** position, a 20 mm coin cell battery in the CR2032 socket can be used to power the device. With the switch in this position, no current measurements are active. This is the recommended switch position when powering the MCU with an external power source.

Note: The Advanced Energy Monitor can only measure the current consumption of the EFM32PG12 when the power selection switch is in the **AEM** position.

5.2 Board Controller Power

The board controller is responsible for important features, such as the debugger and the AEM, and is powered exclusively through the USB port in the top left corner of the board. This part of the kit resides on a separate power domain, so a different power source can be selected for the target device while retaining debugging functionality. This power domain is also isolated to prevent current leakage from the target power domain when power to the board controller is removed.

The board controller power domain is not influenced by the position of the power switch.

The kit has been carefully designed to keep the board controller and the target power domains isolated from each other as one of them powers down. This ensures that the target EFM32PG12 device will continue to operate in the **BAT** mode.

5.3 EFM32PG12 Reset

The EFM32PG12 MCU can be reset by a few different sources:

- A user pressing the RESET button
- The on-board debugger pulling the #RESET pin low
- An external debugger pulling the #RESET pin low

In addition to the reset sources mentioned above, a reset to the EFM32PG12 will also be issued during board controller boot-up. This means that removing power to the board controller (unplugging the J-Link USB cable) will not generate a reset but plugging the cable back in will as the board controller boots up.

6. Peripherals

The Starter Kit has a set of peripherals that showcase some of the EFM32PG12 features.

Note that most EFM32PG12 I/Os routed to peripherals are also routed to the breakout pads or the EXP header, which must be taken into consideration when using these I/Os.

6.1 Push Buttons and LEDs

The kit has two user push buttons marked BTN0 and BTN1. They are connected directly to the EFM32PG12 and are debounced by RC filters with a time constant of 1 ms. The buttons are connected to pins PF6 and PF7.

The kit also features two yellow LEDs marked LED0 and LED1 that are controlled by GPIO pins on the EFM32PG12. The LEDs are connected to pins PF4 and PF5 in an active-high configuration.

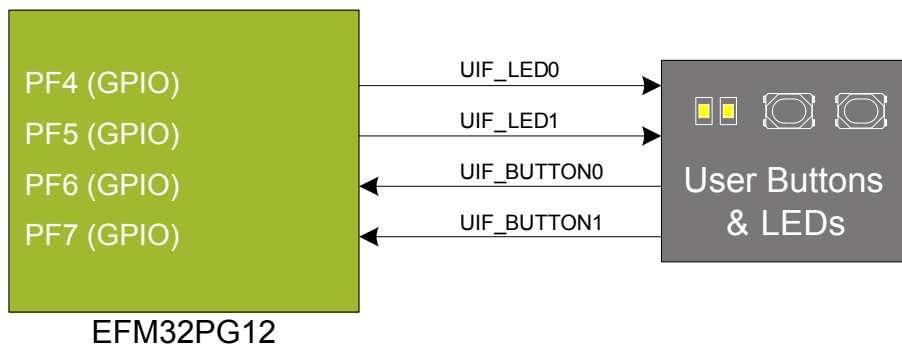


Figure 6.1. Buttons and LEDs

6.2 Memory LCD-TFT Display

A 1.28-inch SHARP Memory LCD-TFT is available on the kit to enable interactive applications to be developed. The display has a high resolution of 128 x 128 pixels and consumes very little power. It is a reflective monochrome display, so each pixel can only be light or dark, and no backlight is needed in normal daylight conditions. Data sent to the display is stored in the pixels on the glass, which means no continuous refreshing is required to maintain a static image.

The display interface consists of a SPI-compatible serial interface and some extra control signals. Pixels are not individually addressable, instead data is sent to the display one line (128 bits) at a time.

The Memory LCD-TFT display is shared with the kit's board controller, allowing the board controller application to display useful information when the user application is not using the display. The user application always controls ownership of the display with the DISP_ENABLE signal:

- DISP_ENABLE = LOW: The board controller has control of the display
- DISP_ENABLE = HIGH: The user application (EFM32PG12) has control of the display

Power to the display is sourced from the target application power domain when the EFM32PG12 controls the display and from the board controller's power domain when the DISP_ENABLE line is low. Data is clocked in on DISP_SI when DISP_CS is high, and the clock is sent on DISP_SCLK. The maximum supported clock speed is 1.1 MHz.

DISP_EXTCOMIN is the "COM Inversion" line. It must be pulsed periodically to prevent static build-up in the display itself. Refer to the LS013B7DH03 documentation for more information on driving the display.

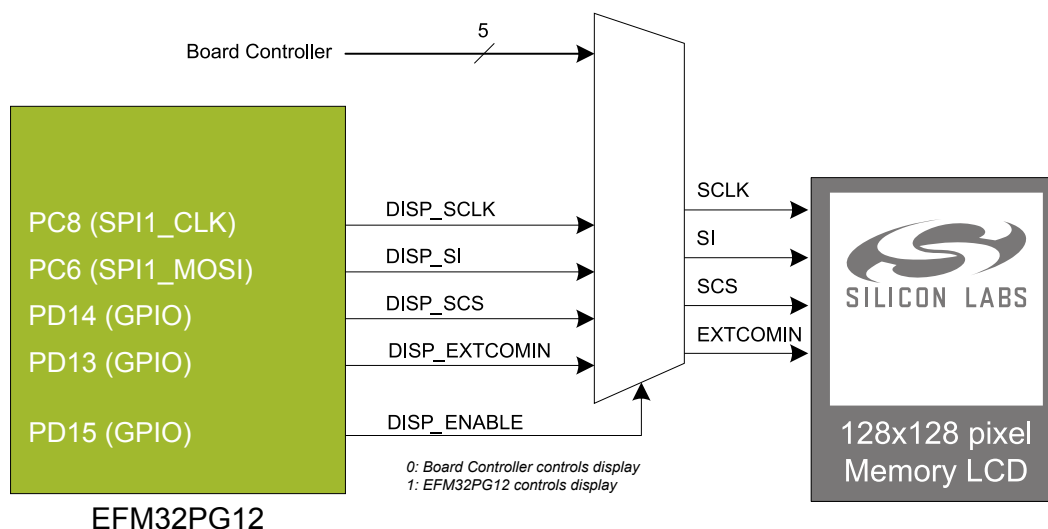


Figure 6.2. 128x128 Pixel Memory LCD

6.3 Capacitive Touch Slider

A touch slider utilizing the capacitive touch capability of the EFM32PG12's analog comparator (ACMP) is located on the bottom side of the board. It consists of four interleaved pads which are connected to PC0, PC1, PC2, and PC3.

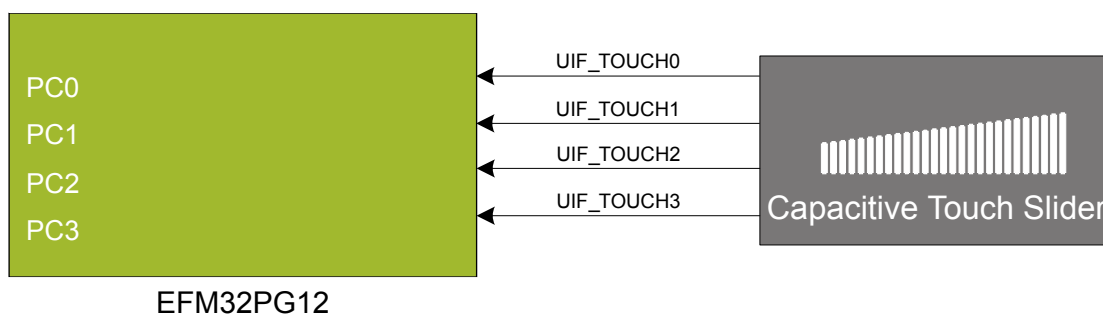


Figure 6.3. Touch Slider

The capacitive touch pads work by sensing changes in the capacitance of the pads when touched by a human finger. Sensing the changes in capacitance is done by setting up the EFM32PG12's analog comparator (ACMP) in capacitive touch sensing mode. For low-power operation, the Low Energy Sensor Interface (LESENSE) can be configured to continuously scan all pads.

Sensing change in capacitance is done by setting up the touch pad as part of an RC relaxation oscillator, where the analog comparator counts the number of oscillations for a fixed period of time.

For more information about usage and theory of low-energy capacitive sensing, refer to application note, "[AN0028: Low Energy Sensor Interface -- Capacitive Sense](#)", which is available in Simplicity Studio or in the document library on the Silicon Labs website.

6.4 LC Sensor

An inductive-capacitive sensor for demonstrating the Low Energy Sensor Interface (LESENSE) is located on the bottom right of the board. The LESENSE peripheral uses the voltage digital-to-analog converter (VDAC) to set up an oscillating current through the inductor and then uses the analog comparator (ACMP) to measure the oscillation decay time. The oscillation decay time will be affected by the presence of metal objects within a few millimeters of the inductor.

The LC sensor can be used for implementing a sensor that wakes up the EFM32PG12 from sleep when a metal object comes close to the inductor, which again can be used as a utility meter pulse counter, door alarm switch, position indicator or other applications where one wants to sense the presence of a metal object.

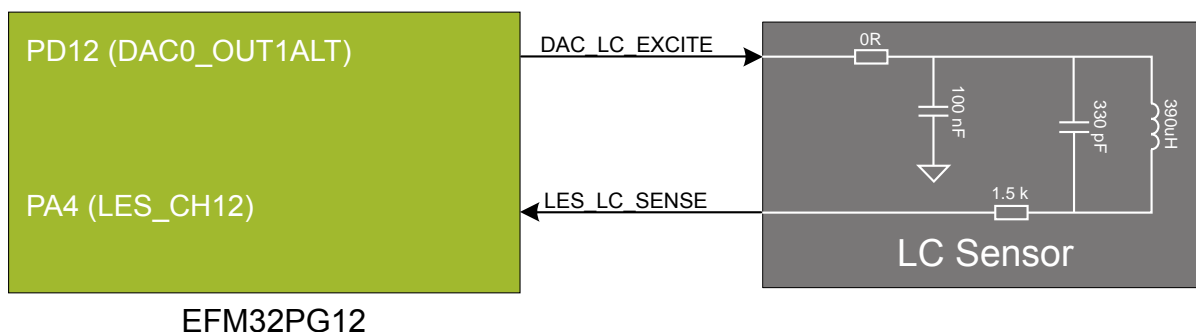


Figure 6.4. LC Metal Sensor

For more information about the LC sensor usage and operation, refer to the application note, "[AN0029: Low Energy Sensor Interface -- Inductive Sense](#)", which is available in Simplicity Studio or in the document library on the Silicon Labs website.

6.5 Si7021 Relative Humidity and Temperature Sensor

The Si7021 I²C relative humidity and temperature sensor is a monolithic CMOS IC integrating humidity and temperature sensor elements, an analog-to-digital converter, signal processing, calibration data, and an I²C Interface. The patented use of industry-standard, low-K polymeric dielectrics for sensing humidity enables the construction of low-power, monolithic CMOS Sensor ICs with low drift and hysteresis and excellent long term stability.

The humidity and temperature sensors are factory-calibrated and the calibration data is stored in the on-chip non-volatile memory. This ensures that the sensors are fully interchangeable with no recalibration or software changes required.

The Si7021 is available in a 3x3 mm DFN package and is reflow solderable. It can be used as a hardware and software-compatible drop-in upgrade for existing RH/temperature sensors in 3x3 mm DFN-6 packages, featuring precision sensing over a wider range and lower power consumption. The optional factory-installed cover offers a low-profile, convenient means of protecting the sensor during assembly (e.g., reflow soldering) and throughout the life of the product, excluding liquids (hydrophobic/oleophobic) and particulates.

The Si7021 offers an accurate, low-power, factory-calibrated digital solution ideal for measuring humidity, dew point, and temperature in applications ranging from HVAC/R and asset tracking to industrial and consumer platforms.

The I²C bus used for the Si7021 is shared with the EXP header. The temperature sensor is normally isolated from the I²C line. To use the sensor, PB10 must be set high. When enabled, the sensor's current consumption is included in the AEM measurements.

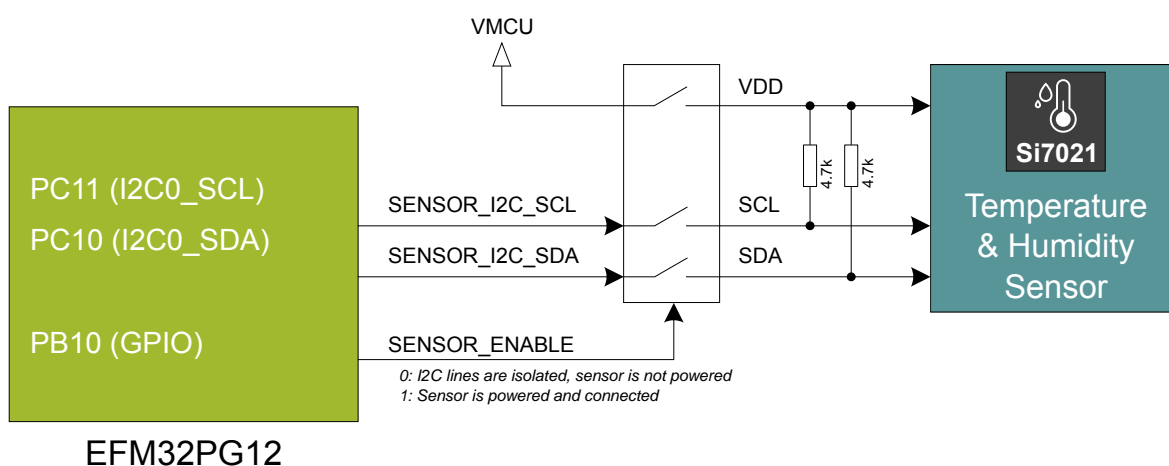


Figure 6.5. Si7021 Relative Humidity and Temperature Sensor

Refer to the Silicon Labs web pages for more information: <http://www.silabs.com/humidity-sensors>.

6.6 Virtual COM Port

An asynchronous serial connection to the board controller is provided for application data transfer between a host PC and the target EFM32PG12, which eliminates the need for an external serial port adapter.

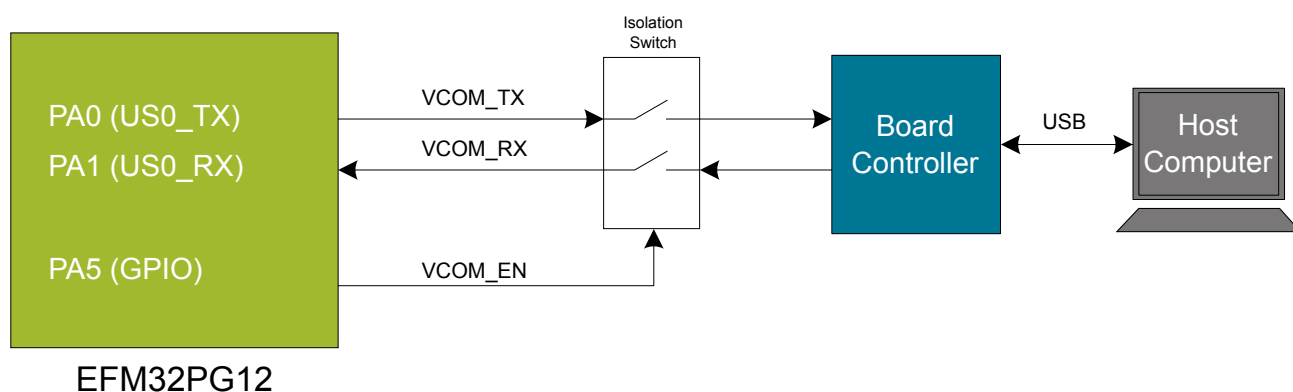


Figure 6.6. Virtual COM Port Interface

The Virtual COM port consists of a physical UART between the target device and the board controller, and a logical function in the board controller that makes the serial port available to the host PC over USB. The UART interface consists of two pins and an enable signal.

Table 6.1. Virtual COM Port Interface Pins

Signal	Description
VCOM_TX	Transmits data from the EFM32PG12 to the board controller
VCOM_RX	Receives data from the board controller to the EFM32PG12
VCOM_ENABLE	Enables the VCOM interface, allowing data to pass through to the board controller

Note: The VCOM port is only available when the board controller is powered, which requires the J-Link USB cable to be inserted.

7. Advanced Energy Monitor

7.1 Usage

The Advanced Energy Monitor (AEM) data is collected by the board controller and can be displayed by the Energy Profiler, available through Simplicity Studio. By using the Energy Profiler, current consumption and voltage can be measured and linked to the actual code running on the EFM32PG12 in realtime.

7.2 Theory of Operation

To accurately measure current ranging from 0.1 μA to 47 mA (114 dB dynamic range), a current sense amplifier is utilized together with a dual gain stage. The current sense amplifier measures the voltage drop over a small series resistor. The gain stage further amplifies this voltage with two different gain settings to obtain two current ranges. The transition between these two ranges occurs around 250 μA . Digital filtering and averaging is done within the board controller before the samples are exported to the Energy Profiler application.

During kit startup, an automatic calibration of the AEM is performed, which compensates for the offset error in the sense amplifiers.

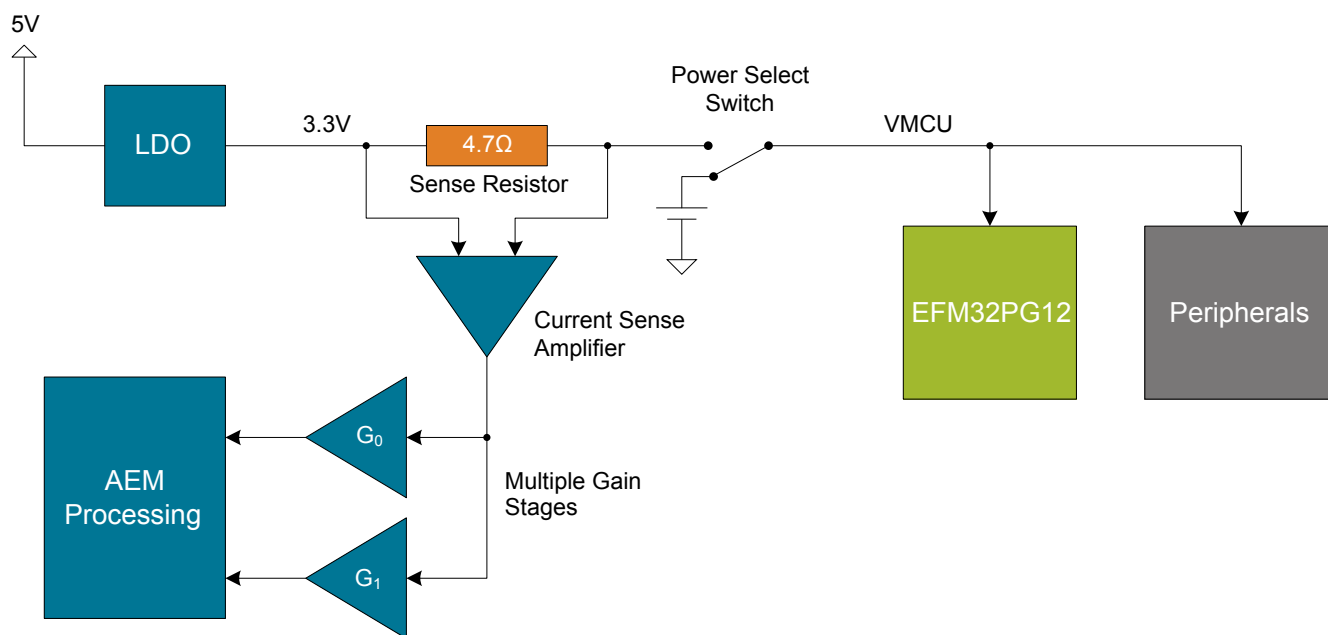


Figure 7.1. Advanced Energy Monitor

7.3 Secondary AEM Channel

The EFM32PG12 Gecko Starter Kit contains a secondary AEM channel in addition to the default one. This secondary channel has a sense resistor on the USB VBUS line connected to the EFM32PG12's USB regulator input, which allows energy monitoring of a bus powered USB application, showcasing the EFM32PG12 Gecko's low-energy USB peripheral.

To use the secondary AEM channel, set the power switch to the "USB" position so that the EFM32PG12 is configured as a bus powered device with the internal USB LDO regulator powering the device's VDD rail. The board controller monitors the switch position and performs an automatic switch-over and calibration when the USB position is selected and a valid voltage is present on the VBUS rail. Both the current and the voltage measurement will now show the VBUS supply instead of the normal 3.3 V supply.

Note that the recalibration that occurs when switching between the "USB" and "AEM" modes on the power switch causes the target EFM32PG12 to lose power for a few seconds.

7.4 Accuracy and Performance

The AEM is capable of measuring currents in the range of 0.1 μA to 47 mA. For currents above 250 μA , the AEM is accurate within 0.1 mA. When measuring currents below 250 μA , the accuracy increases to 1 μA . Although the absolute accuracy is 1 μA in the sub 250 μA range, the AEM is able to detect changes in the current consumption as small as 100 nA. The AEM produces 6250 current samples per second.

8. On-Board Debugger

The SLSTK3402A contains an integrated debugger, which can be used to download code and debug the EFM32PG12. In addition to programming the EFM32PG12 on the kit, the debugger can also be used to program and debug external Silicon Labs EFM32, EFM8, EZR32, and EFR32 devices.

The debugger supports three different debug interfaces used with Silicon Labs devices:

- Serial Wire Debug, which is used with all EFM32, EFR32, and EZR32 devices
- JTAG, which can be used with EFR32 and some EFM32 devices
- C2 Debug, which is used with EFM8 devices

To ensure accurate debugging, use the appropriate debug interface for your device. The debug connector on the board supports all three of these modes.

8.1 Debug Modes

To program external devices, use the debug connector to connect to a target board and set the debug mode to **[Out]**. The same connector can also be used to connect an external debugger to the EFM32PG12 MCU on the kit by setting debug mode to **[In]**.

Selecting the active debug mode is done in Simplicity Studio.

Debug MCU: In this mode, the on-board debugger is connected to the EFM32PG12 on the kit.

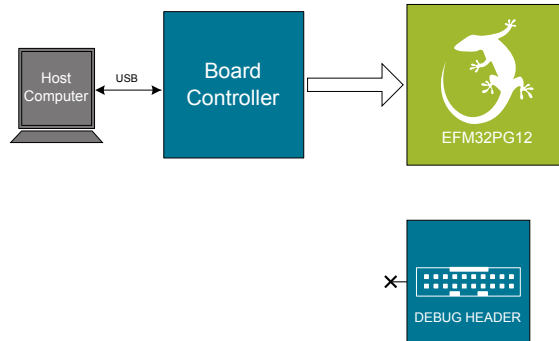


Figure 8.1. Debug MCU

Debug OUT: In this mode, the on-board debugger can be used to debug a supported Silicon Labs device mounted on a custom board.

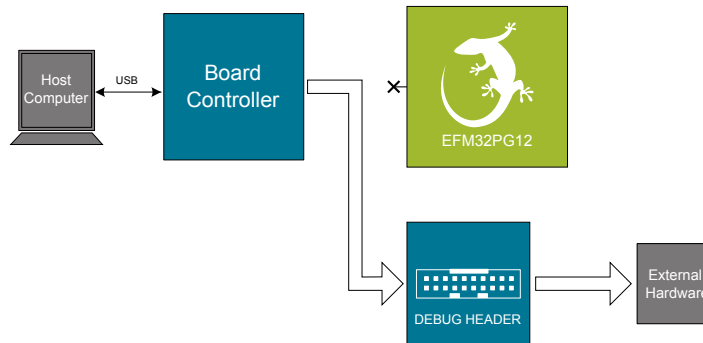


Figure 8.2. Debug OUT

Debug IN: In this mode, the on-board debugger is disconnected and an external debugger can be connected to debug the EFM32PG12 on the kit.

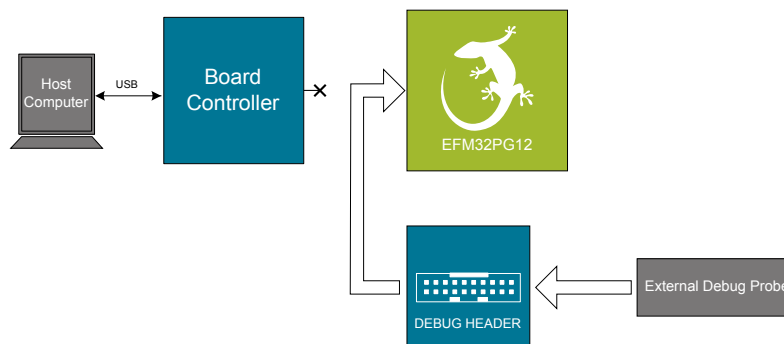


Figure 8.3. Debug IN

Note: For "Debug IN" to work, the kit board controller must be powered through the Debug USB connector.

8.2 Debugging During Battery Operation

When the EFM32PG12 is battery-powered and the J-Link USB is still connected, the on-board debug functionality is available. If the USB power is disconnected, the Debug IN mode will stop working.

If debug access is required when the target is running off another energy source, such as a battery, and the board controller is powered down, make direct connections to the GPIOs used for debugging, which are exposed on the breakout pads.

9. Kit Configuration and Upgrades

The kit configuration dialog in Simplicity Studio allows you to change the J-Link adapter debug mode, upgrade its firmware, and change other configuration settings. To download Simplicity Studio, go to silabs.com/simplicity.

In the main window of the Simplicity Studio's Launcher perspective, the debug mode and firmware version of the selected J-Link adapter are shown. Click the **[Change]** link next to any of these settings to open the kit configuration dialog.

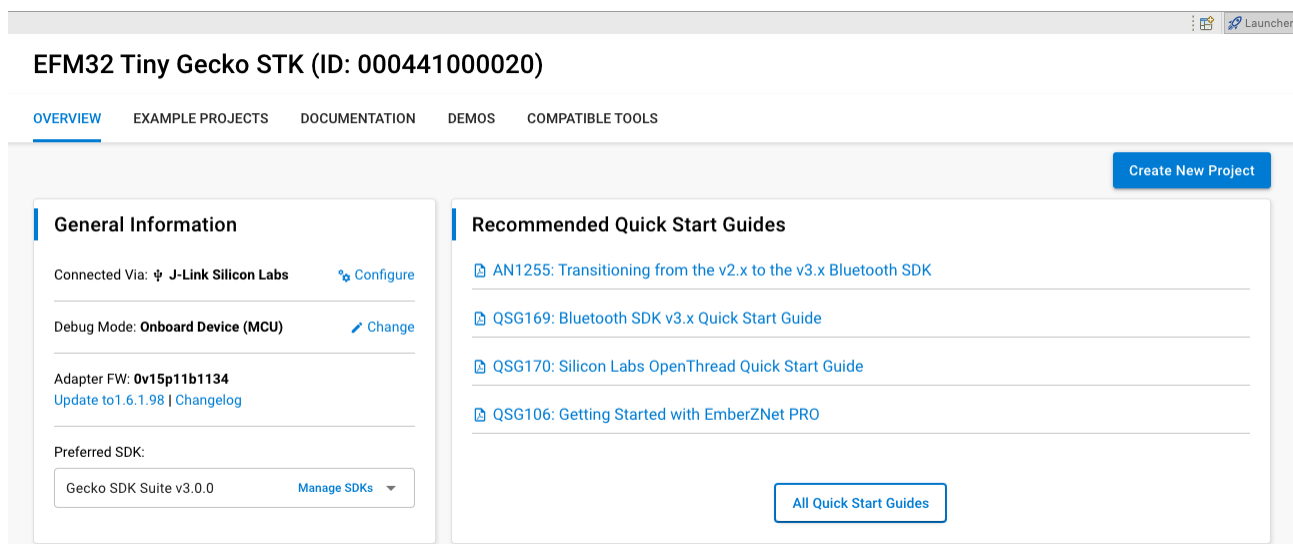


Figure 9.1. Simplicity Studio Kit Information

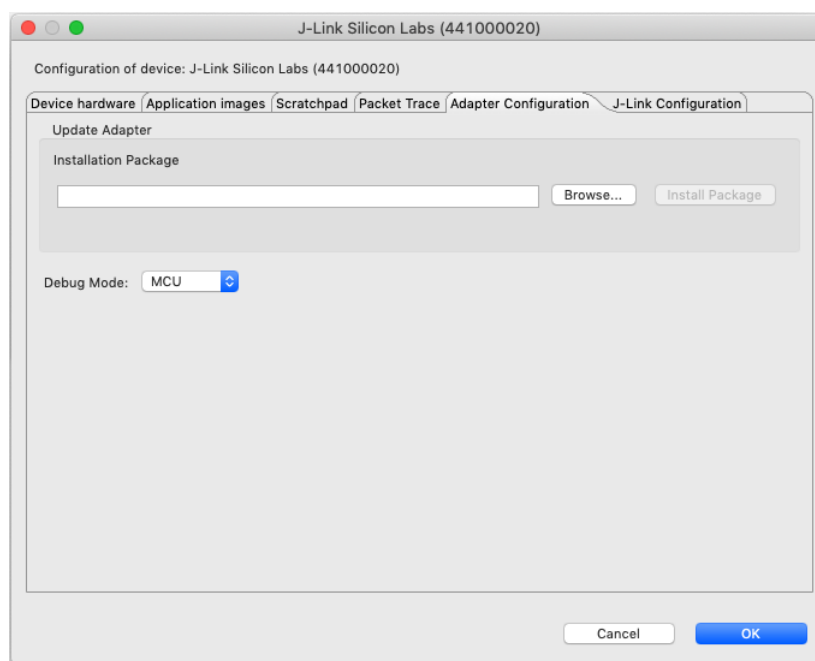


Figure 9.2. Kit Configuration Dialog

9.1 Firmware Upgrades

You can upgrade the kit firmware through Simplicity Studio. Simplicity Studio will automatically check for new updates on startup.

You can also use the kit configuration dialog for manual upgrades. Click the **[Browse]** button in the **[Update Adapter]** section to select the correct file ending in `.emz`. Then, click the **[Install Package]** button.

10. Schematics, Assembly Drawings, and BOM

Schematics, assembly drawings, and bill of materials (BOM) are available through Simplicity Studio when the kit documentation package has been installed. They are also available from the kit page on the Silicon Labs website: silabs.com.

11. Kit Revision History and Errata

11.1 Revision History

The kit revision can be found printed on the box label of the kit, as outlined in the figure below.

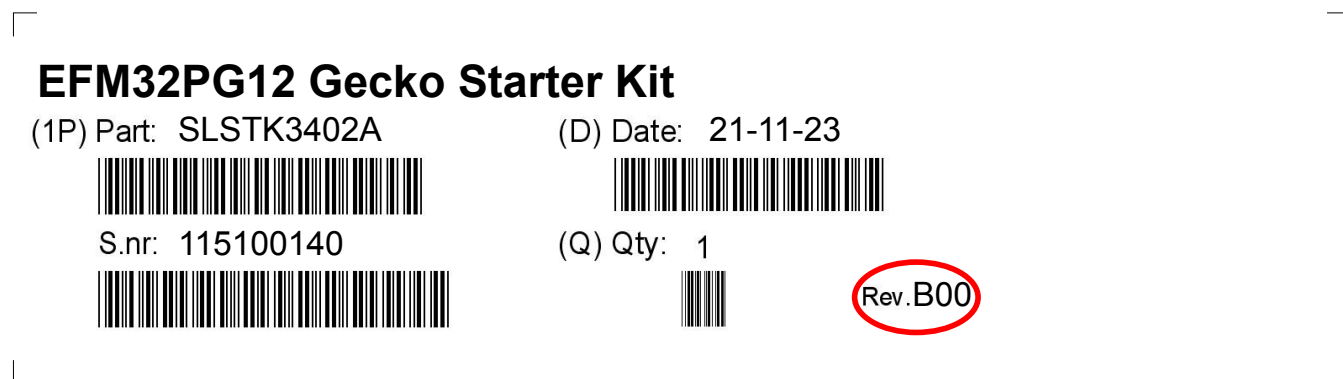


Figure 11.1. Revision Information

Table 11.1. Kit Revision History

Kit Revision	Released	Description
B00	21 November 2023	Updated user guide to reflect new major board revision (BRD2501B_A01).
A02	2 November 2017	BRD2501A revised to A02 due to PG12 MCU rev C.
A01	8 May 2017	Kit revision due to inclusion of PG get started card.
A00	11 January 2017	Initial Kit Revision.

11.2 Errata

There are no known errata at present.

12. Document Revision History

2.00

July, 2024

Updated user guide to reflect new major board revision (BRD2501B).

1.00

January, 2017

Initial document version.

Simplicity Studio

One-click access to MCU and wireless tools, documentation, software, source code libraries & more. Available for Windows, Mac and Linux!



IoT Portfolio
www.silabs.com/IoT



SW/HW
www.silabs.com/simplicity



Quality
www.silabs.com/quality



Support & Community
www.silabs.com/community

Disclaimer

Silicon Labs intends to provide customers with the latest, accurate, and in-depth documentation of all peripherals and modules available for system and software implementers using or intending to use the Silicon Labs products. Characterization data, available modules and peripherals, memory sizes and memory addresses refer to each specific device, and "Typical" parameters provided can and do vary in different applications. Application examples described herein are for illustrative purposes only. Silicon Labs reserves the right to make changes without further notice to the product information, specifications, and descriptions herein, and does not give warranties as to the accuracy or completeness of the included information. Without prior notification, Silicon Labs may update product firmware during the manufacturing process for security or reliability reasons. Such changes will not alter the specifications or the performance of the product. Silicon Labs shall have no liability for the consequences of use of the information supplied in this document. This document does not imply or expressly grant any license to design or fabricate any integrated circuits. The products are not designed or authorized to be used within any FDA Class III devices, applications for which FDA premarket approval is required or Life Support Systems without the specific written consent of Silicon Labs. A "Life Support System" is any product or system intended to support or sustain life and/or health, which, if it fails, can be reasonably expected to result in significant personal injury or death. Silicon Labs products are not designed or authorized for military applications. Silicon Labs products shall under no circumstances be used in weapons of mass destruction including (but not limited to) nuclear, biological or chemical weapons, or missiles capable of delivering such weapons. Silicon Labs disclaims all express and implied warranties and shall not be responsible or liable for any injuries or damages related to use of a Silicon Labs product in such unauthorized applications.

Note: This content may contain offensive terminology that is now obsolete. Silicon Labs is replacing these terms with inclusive language wherever possible. For more information, visit www.silabs.com/about-us/inclusive-lexicon-project

Trademark Information

Silicon Laboratories Inc.[®], Silicon Laboratories[®], Silicon Labs[®], SiLabs[®] and the Silicon Labs logo[®], Bluegiga[®], Bluegiga Logo[®], EFM[®], EFM32[®], EFR, Ember[®], Energy Micro, Energy Micro logo and combinations thereof, "the world's most energy friendly microcontrollers", Redpine Signals[®], WiSeConnect, n-Link, EZLink[®], EZRadio[®], EZRadioPRO[®], Gecko[®], Gecko OS, Gecko OS Studio, Precision32[®], Simplicity Studio[®], Telegesis, the Telegesis Logo[®], USBXpress[®], Zentri, the Zentri logo and Zentri DMS, Z-Wave[®], and others are trademarks or registered trademarks of Silicon Labs. ARM, CORTEX, Cortex-M3 and THUMB are trademarks or registered trademarks of ARM Holdings. Keil is a registered trademark of ARM Limited. Wi-Fi is a registered trademark of the Wi-Fi Alliance. All other products or brand names mentioned herein are trademarks of their respective holders.



Silicon Laboratories Inc.
400 West Cesar Chavez
Austin, TX 78701
USA

www.silabs.com

Looking for pricing, stock, or lifecycle information?

Click below to explore more details on WIN SOURCE:

 [View SLSTK3402A on WIN SOURCE](#)

 [Silicon Labs](#) Information

Optimize Your Supply Chain with WIN SOURCE Solutions

-  Global Sourcing Solution
-  Obsolete Management
-  Cost Control Management
-  Shortage Management
-  Alternative Solution
-  Excess Inventory Management