UG594: EFR32xG26 Explorer Kit User's Guide

The EFR32xG26 Explorer Kit is an ultra-low cost, small form factor development and evaluation platform for the EFR32MG26 Wireless System-on-Chip.

The EFR32xG26 Explorer Kit is focused on rapid prototyping and concept creation of IoT applications. It is designed around the EFR32MG26 SoC, which is an ideal device family for developing energy-friendly connected IoT applications.

The kit features a USB interface, an on-board SEGGER J-Link debugger, two user-LEDs and two buttons, and support for hardware add-on boards via a mikroBus socket and a Qwiic connector. The hardware add-on support allows developers to create and prototype applications using a virtually endless combination of off-the-shelf boards from MIKROE, SparkFun, Adafruit, and Seeed Studio.

TARGET DEVICE

- EFR32MG26 Wireless System-on-Chip (EFR32MG26B510F3200IM48-B)
- High-performance 2.4 GHz radio
- 32-bit ARM® Cortex®-M33 with 78 MHz maximum operating frequency
- 3200 kB flash and 512 kB RAM

KIT FEATURES

- 2x User LEDs and push buttons
- 28-pin 2.54 mm breakout pads
- mikroBUS™ socket
- Qwiic® connector
- SEGGER J-Link on-board debugger
- Virtual COM port
- Packet Trace Interface (PTI)
- USB-powered

SOFTWARE SUPPORT

- Simplicity Studio™

ORDERING INFORMATION

- xG26-EK2709A

Table of Contents

1. Introduction

The EFR32xG26 Explorer Kit has been designed to inspire customers to make IoT devices with the Silicon Labs EFR32MG26 Wireless System-on-Chip. The kit includes a mikroBUS™ socket and Qwiic® connector, allowing users to add features to the kit with a large selection of off-the-shelf boards.

Programming the EFR32xG26 Explorer Kit is easily done using a USB Type-C cable and the on-board J-Link debugger. A USB virtual COM port provides a serial connection to the target application, and the Packet Trace Interface (PTI) offers invaluable debug information about transmitted and received packets in wireless links. The EFR32xG26 Explorer Kit is supported in Simplicity Studio™ and a Board Support Package (BSP) is provided to give application developers a flying start.

External hardware is connected to the EFR32xG26 Explorer Kit by using the 28 breakout pads which present peripherals from the EFR32MG26 Wireless SoC such as I^2C, SPI, UART, and GPIOs. The mikroBUS socket allows inserting mikroBUS add-on boards which interface with the EFR32MG26 through SPI, UART, or I^2C. The Qwiic connector can be used to connect hardware from the Qwiic Connect System through I^2C.

1.1 Kit Contents

The following items are included in the box:

- 1x EFR32xG26 Explorer Kit board (BRD2709A)

1.2 Getting Started

Detailed instructions for how to get started with your new EFR32xG26 Explorer Kit can be found on the Silicon Labs web page: https://www.silabs.com/dev-tools

1.3 Hardware Content

The following key hardware elements are included on the EFR32xG26 Explorer Kit:

- EFR32MG26 Wireless SoC with 78 MHz operating frequency, 3200 kB kB flash, and 512 kB RAM
- 2.4 GHz matching network and ceramic antenna for wireless transmission
- Two LEDs and two push buttons
- On-board SEGGER J-Link debugger for easy programming and debugging, which includes a USB virtual COM port and Packet Trace Interface (PTI)
- MikroBUS socket for connecting click boards™ and other mikroBUS add-on boards
- Qwiic connector for connecting Qwiic Connect System hardware
- Breakout pads for GPIO access and connection to external hardware
- Reset button

1.4 Kit Hardware Layout

EFR32xG26 Explorer Kit layout is shown below.

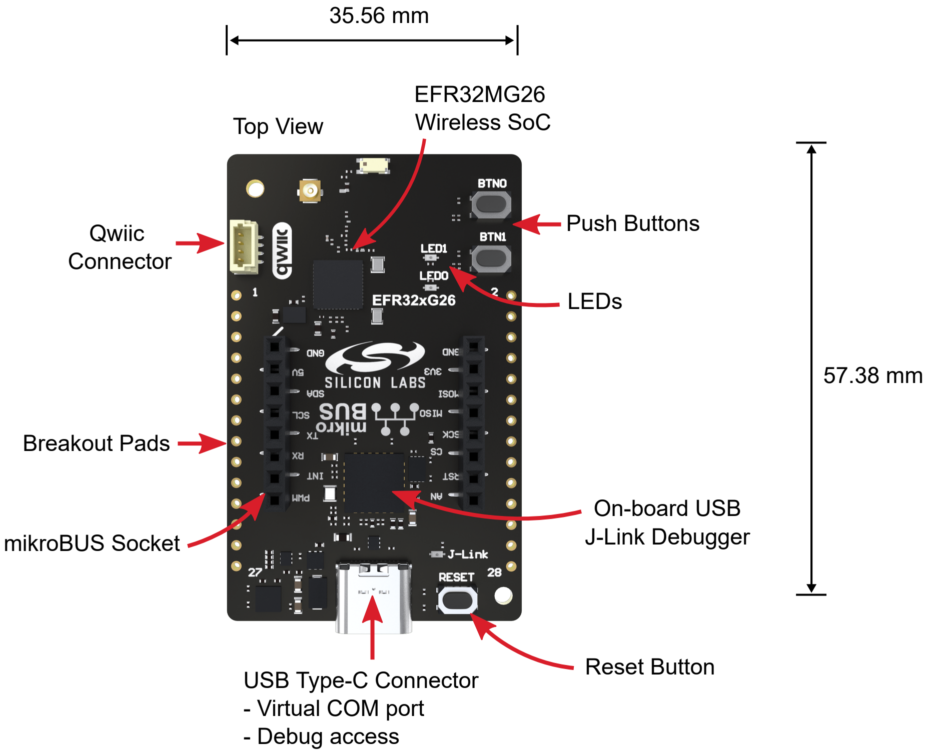

Figure 1.1. EFR32xG26 Explorer Kit Hardware Layout

2. Specifications

2.1 Recommended Operating Conditions

Table 2.1. Recommended Operating Conditions

Parameter	Symbol	Min	Typ	Max	Unit
USB Supply Input Voltage	V_{USB}	–	+5.0	–	V
Supply Input Voltage (VMCU supplied externally)	V_{VMCU}		+3.3		V

2.2 Current Consumption

The operating current of the board greatly depends on the application and the amount of external hardware connected. The table below attempts to give some indication of typical current consumptions for the EFR32MG26 and the on-board debugger. Note that the numbers are taken from the data sheets for the devices. For a full overview of the conditions that apply for a specific number from a data sheet, the reader is encouraged to read the specific data sheet.

Table 2.2. Current Consumption

Parameter	Symbol	Condition	Typ	Unit
EFR32MG26 Current Consumption[1]	I_{MG26}	MCU current consumption in EM0 mode with all peripherals disabled (module supply voltage = 3.0 V, VSCALE2, 39 MHz crystal, CPU running Prime from flash at 25 °C)	50.5	µA/MHz
		Radio system current consumption in receive mode, active packet reception (VDD = 3.0 V, MCU in EM1 and all MCU peripherals disabled, HCLK = 39 MHz, 1Mbit/s, 2GFSK, f = 2.4 GHz at 25 °C)	5.8	mA
		Radio system current consumption in transmit mode (VDD = 3.0 V, MCU in EM1 and all MCU peripherals disabled, HCLK = 39 MHz, f = 2.4 GHz, CW, 10 dBm output power at 25 °C)	19	mA
On-board Debugger Sleep Current Consumption [2]	I_{DBG}	On-board debugger current consumption when USB cable is not inserted (EFM32GG12 EM4S mode current consumption)	80	nA

1 From EFR32MG26 data sheet

2 From EFM32GG12 data sheet

3. Hardware

The core of the EFR32xG26 Explorer Kit is the EFR32MG26 Wireless System-on-Chip. Refer to section 1.4 Kit Hardware Layout for placement and layout of the hardware components.

3.1 Block Diagram

An overview of the EFR32xG26 Explorer Kit is illustrated in the figure below.

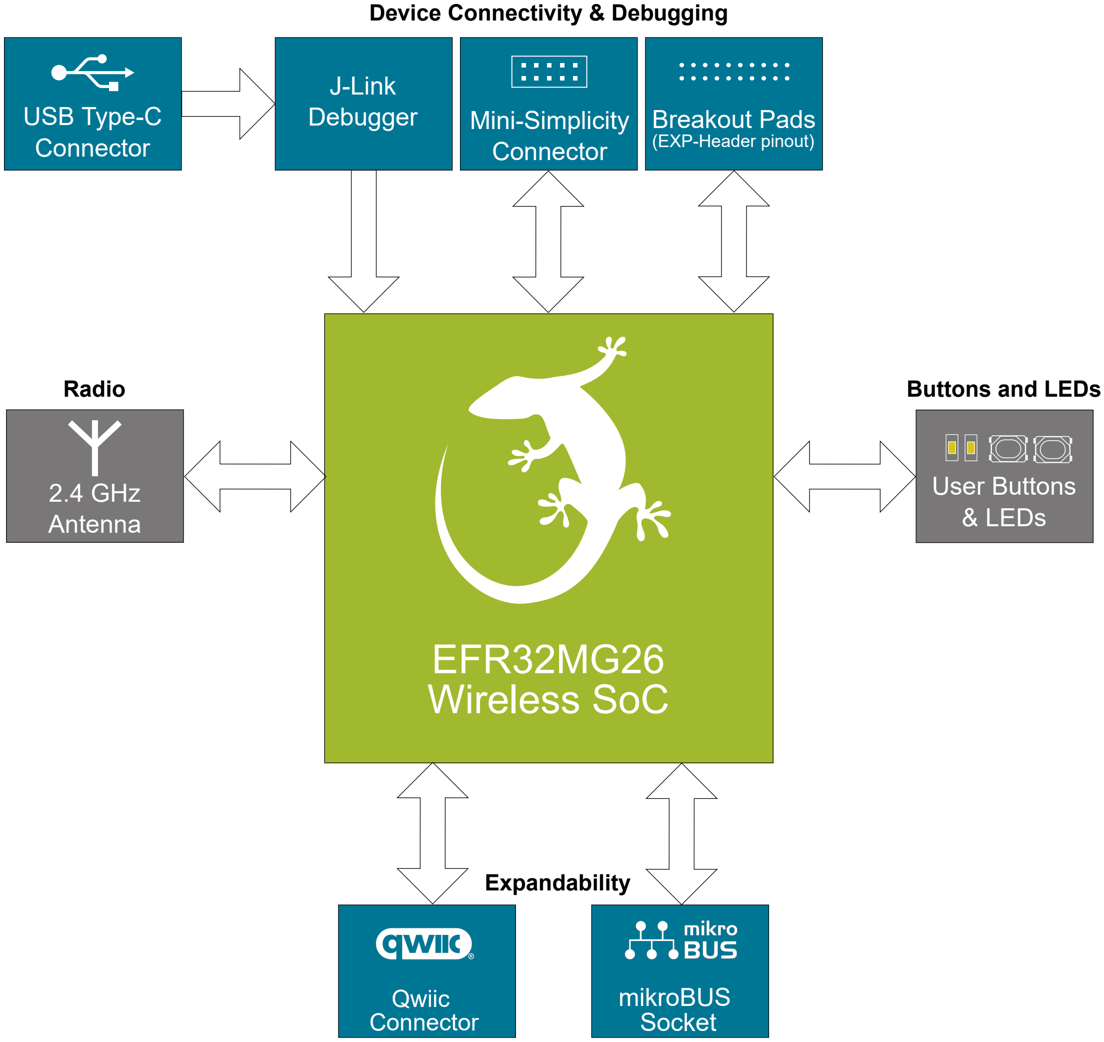

Figure 3.1. Kit Block Diagram

3.2 Power Supply

The kit is powered by the debug USB cable as illustrated in the figure below.

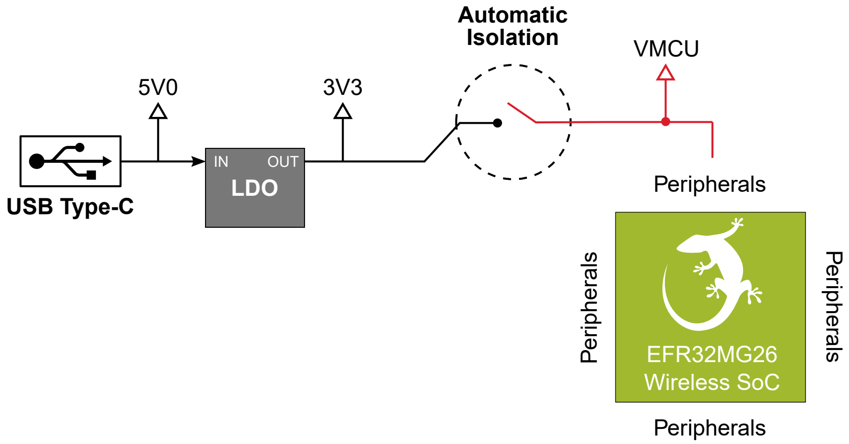

Figure 3.2. EFR32xG26 Explorer Kit Power Topology

The 5 V power net on the USB bus is regulated down to 3.3 V using a low-dropout regulator (LDO). An automatic isolation circuit isolates the LDO when the USB cable is not plugged in.

Power can be injected externally on the VMCU net if the USB cable is removed and no other power sources are present on the kit. Failure to follow this guideline can cause power conflicts and damage the LDO.

3.3 EFR32MG26 Reset

The EFR32MG26 can be reset by a few different sources:

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

3.4 Push Button and LED

The kit has two user push buttons, marked BTN0 and BTN1, that are connected to GPIOs on the EFR32MG26. The buttons are connected to pin PB00 and PB01, respectively, and they are debounced by an RC filter with a time constant of 1 ms. The logic state of a button is high while that button is not being pressed, and low when it is pressed.

The kit also features two yellow LEDs, marked LED0 and LED1, that are controlled by GPIO pins on the EFR32MG26. The LEDs are connected to pin PC08 and PC09, respectively, in an active-high configuration.

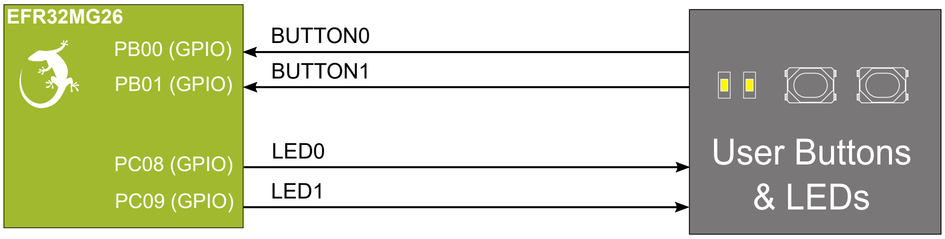

Figure 3.3. Buttons and LEDs

3.5 On-board Debugger

The EFR32xG26 Explorer Kit contains a microcontroller separate from the EFR32MG26 Wireless SoC that provides the user with an on-board J-Link debugger through the USB Type-C port. This microcontroller is referred to as the "on-board debugger", and is not programmable by the user. When the USB cable is removed, the on-board debugger goes into a very low power shutoff mode (EM4S), consuming around 80 nA typically (EFM32GG12 data sheet number).

In addition to providing code download and debug features, the on-board debugger also presents a virtual COM port for general purpose application serial data transfer.

The figure below shows the connections between the target EFR32MG26 device and the on-board debugger.

Refer to section 4. Debugging for more details on debugging.

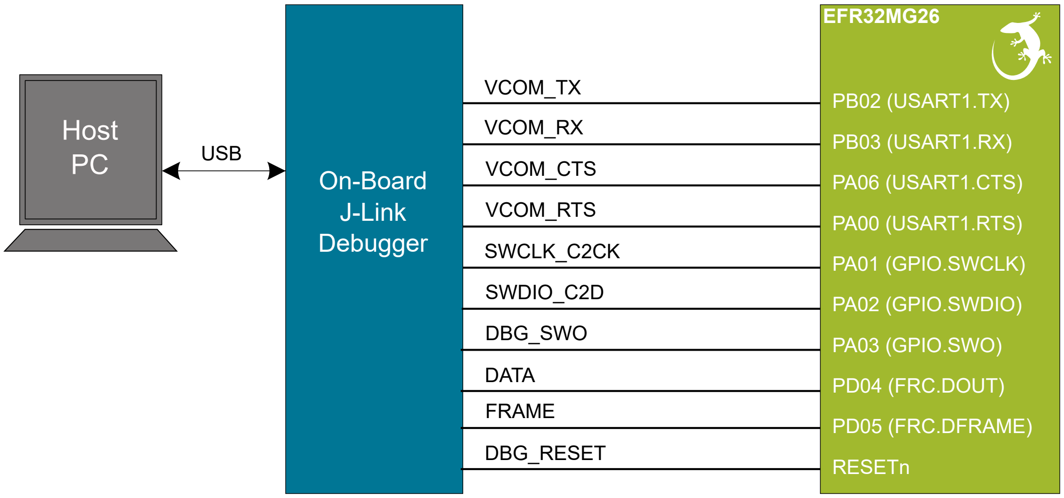

Figure 3.4. On-Board Debugger Connections

3.6 Connectors

The EFR32xG26 Explorer Kit features a USB Type-C connector, 28 breakout pads, a mikroBUS connector for connecting mikroBUS add-on boards, and a Qwiic connector for connecting Qwiic Connect System hardware. The connectors are placed on the top side of the board, and their placement and pinout are shown in the figure below. For additional information on the connectors, see the following sub chapters.

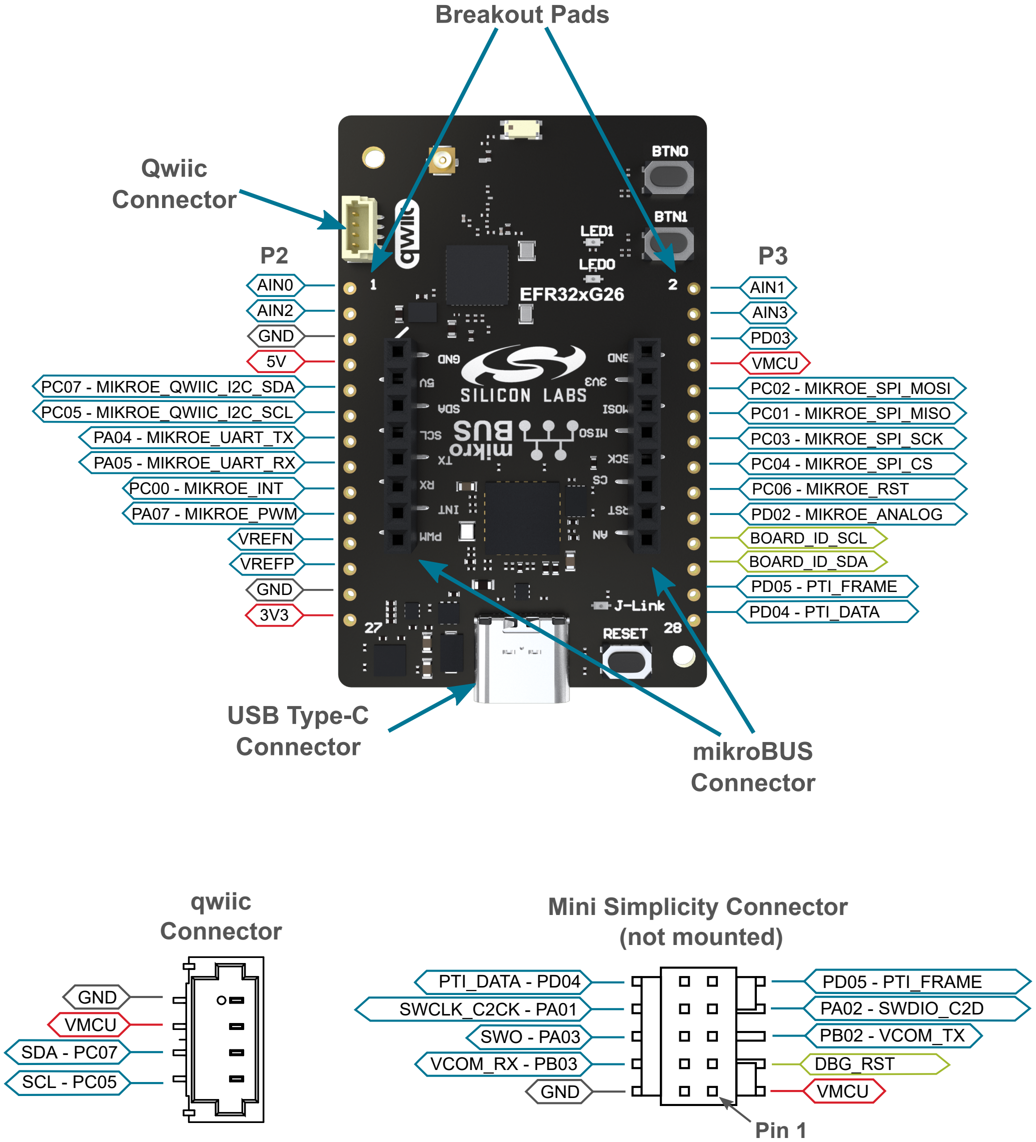

Figure 3.5. EFR32xG26 Explorer Kit Connectors

3.6.1 Breakout Pads

Twenty-eight breakout pads are provided and allow connection of external peripherals. There are 14 pads on the left side of the board, and 14 pads on the right. The breakout pads contain a number of I/O pins that can be used with most of the EFR32MG26 Wireless SoC's features. Additionally, the VMCU (main board power rail), 3V3 (LDO regulator output), and 5V power rails are also exposed on the pads.

The pin-routing on the Wireless SoC is very flexible, so most peripherals can be routed to any pin. However, pins may be shared between the breakout pads and other functions on the EFR32xG26 Explorer Kit. The table below includes an overview of the breakout pads and functionality that is shared with the kit.

Table 3.1. Breakout Pads Pinout

Pin	Connection	Shared Feature	Peripheral Mapping
Left-side Breakout Pins			
1	AIN0	—	AIN0
3	AIN2	—	AIN2
5	GND	Ground	
7	5V	Board USB voltage	
9	PC07	QWIIC_I2C_SDA, MIKROE_I2C_SDA	I2C_SDA
11	PC05	QWIIC_I2C_SCL, MIKROE_I2C_SCL	I2C_SCL
13	PA04	MIKROE_TX	UART_TX
15	PA05	MIKROE_RX	UART_RX
17	PC00	MIKROE_INT	EXT_INT
19	PA07	MIKROE_PWM	PWM
21	VREFN	—	ADC VREF Negative Input
23	VREFP	—	ADC VREF Positive Input
25	GND	Ground	
27	3V3	Board controller supply	
Right-side Breakout Pins			
2	AIN1	—	AIN1
4	AIN3	—	AIN3
6	PD03	—	GPIO
8	VMCU	EFR32MG26 voltage domain	
10	PC02	MIKROE_MOSI	SPI_MOSI
12	PC01	MIKROE_MISO	SPI_MISO
14	PC03	MIKROE_SCK	SPI_SCLK
16	PC04	MIKROE_CS	SPI_CS
18	PC06	MIKROE_RST	GPIO
20	PD02	MIKROE_AN	AIN
22	BOARD_ID_SCL	Connected to Board Controller for identification of add-on boards.	
24	BOARD_ID_SDA	Connected to Board Controller for identification of add-on boards.	
26	PD05	PTI_FRAME	PTI_FRAME

Pin	Connection	Shared Feature	Peripheral Mapping
28	PD04	PTI_DATA	PTI_DATA

3.6.2 Mini Simplicity Connector

The Mini Simplicity Connector (not mounted) is a 10-pin, 1.27 mm pitch connector that allows the use of an external debugger such as the one found on a Silicon Labs Wireless Starter Kit mainboard. The pinout of the connector on the board is described in the table below with the names being referenced from the EFR32MG26.

Table 3.2. Mini Simplicity Connector Pin Descriptions

Pin number	Function	Connection	Description
1	AEM	VMCU	Target voltage on the debugged application. May be supplied and monitored by the AEM on an external debugger.
2	GND	GND	Ground
3	RST	RESET	EFR32MG26 reset
4	VCOM_RX	PB03	Virtual COM Rx
5	VCOM_TX	PB02	Virtual COM Tx
6	SWO	PA03	Serial Wire Output
7	SWDIO	PA02	Serial Wire Data
8	SWCLK	PA01	Serial Wire Clock
9	PTI_FRAME	PD05	Packet Trace Frame
10	PTI_DATA	PD04	Packet Trace Data

3.6.3 MikroBUS Socket

The EFR32xG26 Explorer Kit features a mikroBUS socket compatible with mikroBUS add-on boards. MikroBUS add-on boards can expand the functionality of the kit with peripherals such as sensors and LCDs. Add-on boards follow the mikroBUS socket pin mapping and communicate with the on-kit EFR32MG26 through UART, SPI, or I^2C. Several GPIOs are exposed on the mikroBUS socket. MikroBUS add-on boards can be powered by the 5V or VMCU power rails, which are available on the mikroBUS socket.

The pinout of the EFR32MG26 on the kit is made such that all required peripherals are available on the mikroBUS socket. The I^2C signals are, however, shared with the Qwiic connector.

When inserting a mikroBUS add-on board, refer to the orientation notch on the EFR32xG26 Explorer Kit, shown in the figure below, to ensure correct orientation. Add-on boards have a similar notch that needs to be lined up with the one shown below.

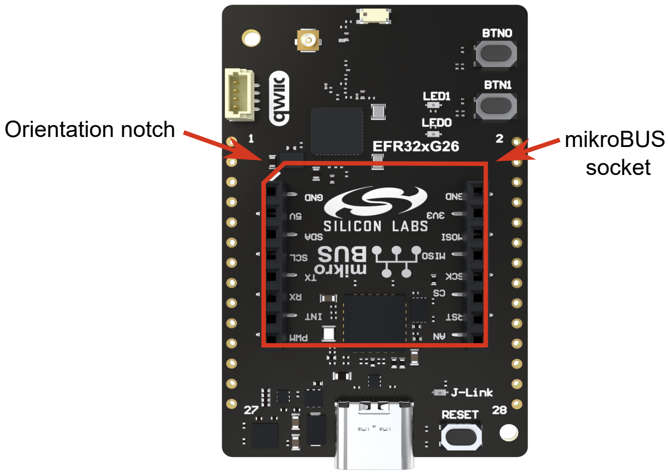

Figure 3.6. mikroBUS Add-on Board Orientation

The table below gives an overview of the mikroBUS socket pin connections to the EFR32MG26.

Table 3.3. mikroBUS Socket Pinout

mikroBUS Pin Name	mikroBUS Pin Function	Connection	Shared Feature	Suggested Peripheral Mapping
AN	Analog	PD02	—	IADC0
RST	Reset	PC06	—	—
CS	SPI Chip Select	PC04	—	USARTx.CS
SCK	SPI Clock	PC03	—	USARTx.CLK
MISO	SPI Main Input Secondary Output	PC01	—	USARTx.RX
MOSI	SPI Main Output Secondary Input	PC02	—	USARTx.TX
PWM	PWM Output	PA07	—	TIMER0.CCx
INT	Hardware Interrupt	PC00	—	—
RX	UART Receive	PA05	—	USARTx.RX
TX	UART Transmit	PA04	—	USARTx.TX
SCL	I2C Clock	PC05	QWIIC_I2C_SCL	I2Cx.SCL
SDA	I2C Data	PC07	QWIIC_I2C_SDA	I2Cx.SDA

mikro-BUS Pin Name	mikroBUS Pin Function	Connection	Shared Feature	Suggested Peripheral Mapping
3V3	VCC 3.3V power	VMCU	EFR32MG26 voltage domain	
5V	VCC 5V power	5V	Board USB voltage	
GND	Reference Ground	GND	Ground	

3.6.4 Qwiic Connector

The EFR32xG26 Explorer Kit features a Qwiic connector compatible with Qwiic Connect System hardware. The Qwiic connector provides an easy way to expand the functionality of the EFR32xG26 Explorer Kit with sensors, LCDs, and other peripherals over the I^2C interface. The Qwiic connector is a 4-pin polarized JST connector, which ensures the cable is inserted the right way.

Qwiic Connect System hardware is daisy chain-able as long as each I^2C device in the chain has a unique I^2C address.

Note: The Qwiic I^2C lines are shared with the on-board I^2C sensors.

The Qwiic connector and its connections to Qwiic cables and the EFR32MG26 are illustrated in the figure below.

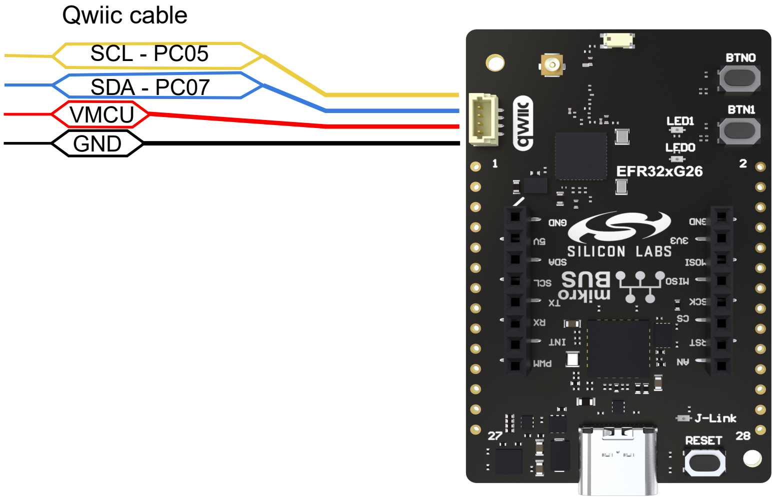

Figure 3.7. Qwiic Connector

The table below gives an overview of the Qwiic connections to the EFR32MG26.

Table 3.4. Qwiic Connector Pinout

Qwiic Pin	Connection	Shared Feature	Suggested Peripheral Mapping
Ground	GND	Ground	
3.3V	VMCU	EFR32MG26 voltage domain	
SDA	PC07	MIKROE_I2C_SDA	I2Cx.SDA
SCL	PC05	MIKROE_I2C_SCL	I2Cx.SCL

3.6.5 Debug USB Type-C Connector

The debug USB port can be used for uploading code, debugging, and as a Virtual COM port. More information is available in section 4. Debugging.

4. Debugging

The EFR32xG26 Explorer Kit contains an on-board SEGGER J-Link Debugger that interfaces to the target EFR32MG26 using the Serial Wire Debug (SWD) interface. The debugger allows the user to download code and debug applications running in the target EFR32MG26. Additionally, it provides a virtual COM port (VCOM) to the host computer that is connected to the target device's serial port for general purpose communication between the running application and the host computer. The on-board debugger is accessible through the USB Type-C connector.

4.1 On-board Debugger

The on-board debugger is a SEGGER J-Link debugger running on an EFM32 Giant Gecko. The debugger is directly connected to the debug and VCOM pins of the target EFR32MG26.

When the debug USB cable is inserted, the on-board debugger is automatically activated and takes control of the debug and VCOM interfaces. This means that debug and communication will **not** work with an external debugger connected at the same time. The on-board LDO is also activated, providing power to the board.

4.2 Virtual COM Port

The virtual COM port is a connection to a UART of the target EFR32MG26 and allows serial data to be sent and received from the device. The on-board debugger presents this as a virtual COM port on the host computer that shows up when the USB cable is inserted.

Data is transferred between the host computer and the debugger through the USB connection, which emulates a serial port using the USB Communication Device Class (CDC). From the debugger, the data is passed on to the target device through a physical UART connection.

The serial format is 115200 bps, 8 bits, no parity, and 1 stop bit by default.

Note: Changing the baud rate for the COM port on the PC side does not influence the UART baud rate between the debugger and the target device.

5. 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.

6. Kit Revision History and Errata

6.1 Revision History

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

Figure 6.1. Revision Info

Table 6.1. Kit Revision History

Kit Revision	Released	Description
A00	29 August 2024	New kit introduction of xG26-EK2709A.

6.2 Errata

There are no known errata at present.

7. Board Revision History and Errata

7.1 Revision History

The board revision can be found laser printed on the board, and the board revision history is summarized in the following table.

Table 7.1. Board Revision History

Revision	Released	Description
A02	29 August 2024	Initial production release.

7.2 Errata

There are no known errata at present.

8. Document Revision History

Revision 1.0

November 2024

- Initial document release.

Simplicity Studio

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