

User Guide

Lyra 24P Development Board

Version 2.2

Revision History

| Version | Date | Notes | Contributors | Approver |
|---------|--------------|--|------------------------------|----------------|
| 1.0 | 1 Aug 2023 | First Release | Raj Khatri Dave Drogowski | Jonathan Kaye |
| 1.1 | 27 Mar 2024 | Changed Laird Connectivity to Ezurio | Raj Khatri Dave Drogowski | Jonathan Kaye |
| 2.0 | 1 April 2024 | Ezurio rebranding | Dave Drogowski | Jonathan Kaye |
| 2.1 | 31 May 2024 | Updated BOOT pin number in section 7.4.1 | Greg Leach | Jonathan Kaye |
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1 Overview

The Lyra 24P Development Kit is an ultra-low cost, small form factor development and evaluation platform for the Lyra 24P Wireless Bluetooth® Module.

The Lyra 24P Development Kit is focused on rapid prototyping and concept creation of IoT applications. It is designed around the Lyra 24P Module, based on the **EFR32BG22 System-on-Chip**, 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, one user-LED and button, 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.

| | |
|-----------------|--|
| Module | <ul style="list-style-type: none"> • Lyra 24P Wireless Bluetooth® Module • High performance 2.4 GHz radio • 32-bit ARM® Cortex®-M33 with 76.8 MHz maximum operating frequency • 512 kB flash and 32 kB RAM |
| Features | <ul style="list-style-type: none"> • User LED and push button • 20-pin 2.54 mm breakout pads • mikroBUSTM socket • Qwiic® connector • SEGGER J-Link on-board debugger • Virtual COM port • Packet Trace Interface (PTI) • USB-powered. |
| Software | <ul style="list-style-type: none"> • AT Command Set - Fully featured and extensible, proven over 5+ years. Simplest implementation with all key Wireless Xpress features, proven over 5 years • C Code - Full software development with Silicon Labs SDK and toolchain. Use Simplicity Studio IDE for full functionality of Silicon Labs HW/SW |

2 Ezurio Lyra 24P Part Numbers

| Part Number | Description |
|--------------|--|
| 453-00142-K1 | Lyra 24P Series - Development Kit - Bluetooth PCB Module (10dBm) with integrated antenna |
| 453-00145-K1 | Lyra 24P Series - Development Kit - Bluetooth PCB Module (20dBm) with integrated antenna |
| 453-00148-K1 | Lyra 24P Series - Development Kit - Bluetooth PCB Module (20dBm) with RF Trace Pad |

Applicable to following Lyra 24P part numbers:

| Part Number | Product Description |
|-------------|---|
| 453-00142R | Lyra 24P Series - Bluetooth PCB Module (10dBm) with integrated antenna (Silicon Labs EFR32BG24) - Tape / Reel |
| 453-00142C | Lyra 24P Series - Bluetooth PCB Module (10dBm) with integrated antenna (Silicon Labs EFR32BG24) - Cut / Tape |
| 453-00145R | Lyra 24P Series - Bluetooth PCB Module (20dBm) with integrated antenna (Silicon Labs EFR32BG24) - Tape / Reel |
| 453-00145C | Lyra 24P Series - Bluetooth PCB Module (20dBm) with integrated antenna (Silicon Labs EFR32BG24) - Cut / Tape |
| 453-00148R | Lyra 24P Series - Bluetooth PCB Module (20dBm) with RF Trace Pad (Silicon Labs EFR32BG24) - Tape / Reel |
| 453-00148C | Lyra 24P Series - Bluetooth PCB Module (20dBm) with RF Trace Pad (Silicon Labs EFR32BG24) - Cut / Tape |

3 Kit Contents

All kits contain the following items:

| | |
|--------------------------|---|
| Development Board | Contains soldered Lyra 24P module particular module variant (and exposes all available hardware interfaces). |
| Power Options | USB cable (x1) – Type A to micro type B. Also provides serial via onboard USB – UART chip |
| External Antenna | 2.4GHz FlexPIFA Antenna (Part# 001-0022) (x1) – shipped with 453-00148-K1 Lyra 24P 20dBm RF Trace Pad dev board only. |

4 Main Board – Features

The Lyra 24P Development Kit has been designed to simplify IoT development with the Lyra 24P wireless module. 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 Lyra 24P Development Kit is easily done using a USB Micro-B 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 Lyra 24P Development Kit is supported in Silicon Labs' Simplicity Studio™ and a Board Support Package (BSP) is provided to give application developers a flying start.

Connecting external hardware to the Lyra 24P Development Kit can be done using the 20 breakout pads which present peripherals from the Lyra 24P such as I2C, SPI, UART and GPIOs. The mikroBUS socket allows inserting mikroBUS add-on boards which interface with the Lyra 24P through SPI, UART or I2C. The Qwiic connector can be used to connect hardware from the Qwiic Connect System through I2C.

4.1 Key Features

The following key hardware elements are included on the Lyra 24P Development Kit:

- Lyra 24P Wireless Module with 76.8 MHz operating frequency, 2.4 GHz ceramic antenna for wireless transmission, 1.5 MB flash, and 256 kB RAM
- One LED and one push button
- 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

5 Understanding the Development Board

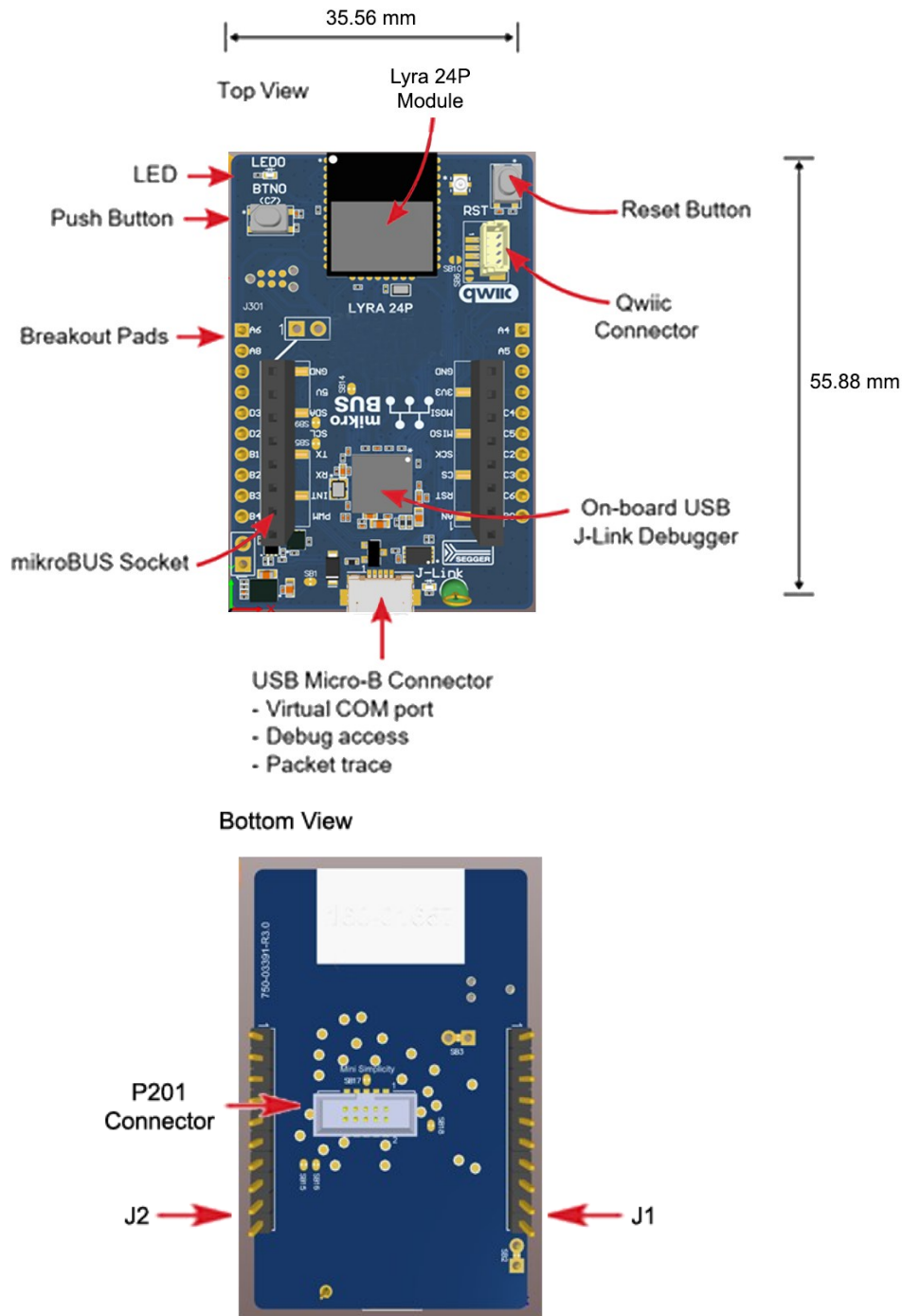


Figure 1: Lyra 24P development board layout

Note: Shown is development board 453-00148-K1. Interfaces are the same for 453-00142-K1, 453-00145-K1, and 453-00148-K1.

6 Specifications

6.1 Recommended Operating Conditions

Table 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} | | +3.31 | | V |
| Operating Temperature | T _{OP} | - | +20 | - | °C |

¹The **typical supply voltage to the Lyra 24P is 3.0 V**, but the maximum voltage is a function of temperature and average lifetime current load. Over a 10-year lifespan, the average lifetime current load should not exceed 60 mA when the supply voltage is 3.3 V. See the [Lyra 24P datasheet](#) for more information.

6.2 Current Consumption

The operating current of the board greatly depends on the application and the amount of external hardware connected. See [Table 2](#) for typical current consumptions for the Lyra 24P and the on-board debugger. Note that the numbers are taken from the data sheets for the devices. For a full overview, see the [Lyra 24P datasheet](#).

Table 2: Current consumption

| Parameter | Symbol | Condition | Typ | Unit |
|--|------------------|--|-------|--------|
| Lyra 24P Current Consumption ¹ | I _{BGM} | MCU current consumption in EM0 mode with all peripherals disabled (module supply voltage = 3.0 V, VSCALE2, 38.4 MHz crystal, CPU running Prime from flash at 25 °C) | 33.9 | µA/MHz |
| | | Radio system current consumption in receive mode, activepacket reception (VDD = 3.0 V, MCU in EM1 and all MCU peripherals disabled, HCLK = 38.4 MHz, 1Mbit/s, 2GFSK, f = 2.4 GHz at 25 °C) | 4.5 | mA |
| | | Radio system current consumption in transmit mode (VDD = 3.0 V, MCU in EM1 and all MCU peripherals disabled, HCLK = 38.4 MHz, f = 2.4 GHz, CW, 10 dBm output power (at 25 °C) | 18.8 | mA |
| | | f = 2.4 GHz, CW, 20 dBm output power (at 25 °C) | 154.8 | 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 [Lyra 24P data sheet](#)

2 From [EFM32GG12 data sheet](#)

7 Functional Blocks

The core of the Lyra 24P Development Kit is the Lyra 24P Bluetooth® Module. Refer to [Understanding the Development Board](#) for placement and layout of the hardware components.

7.1 Hardware Block Diagram

An overview of the Lyra 24P Development Kit is illustrated in the figure below.

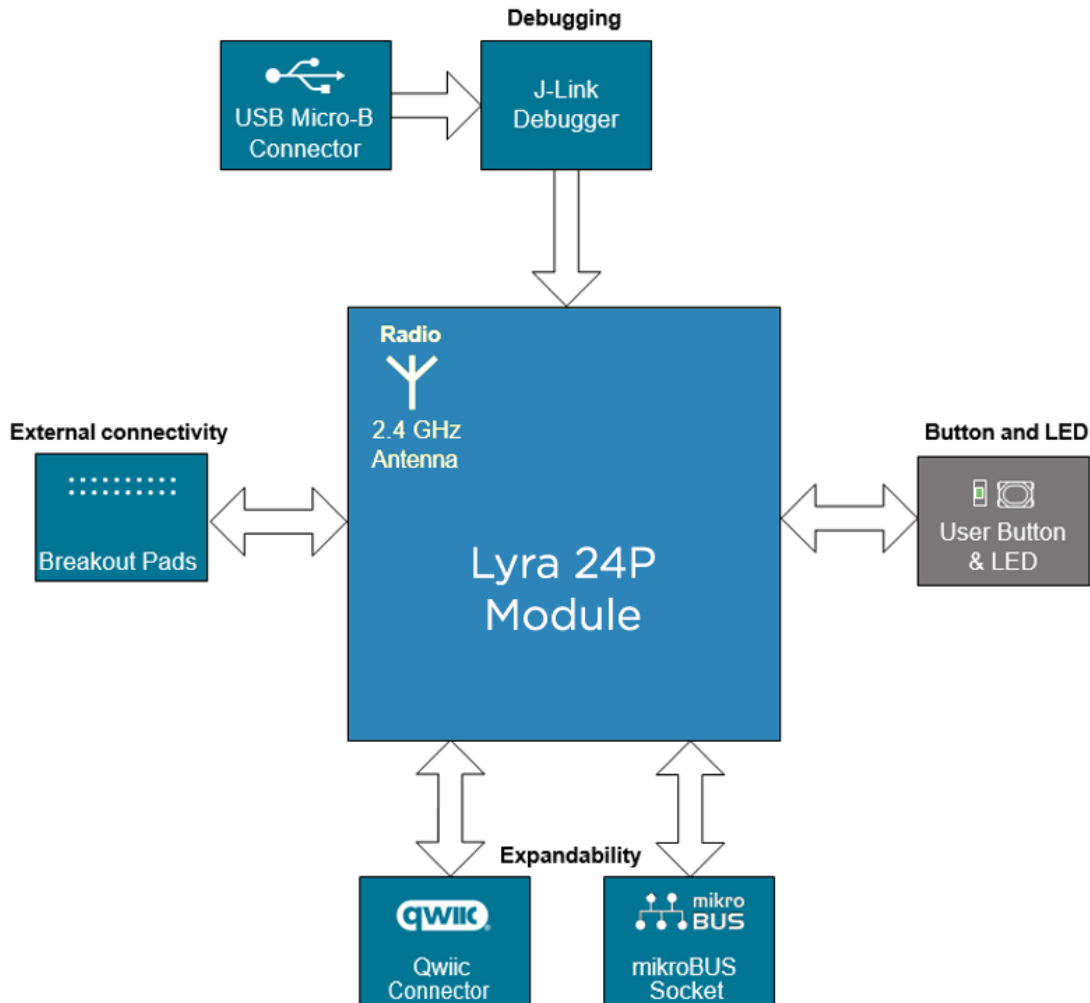


Figure 2: Lyra 24P DVK block diagram

7.2 Power Supply

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

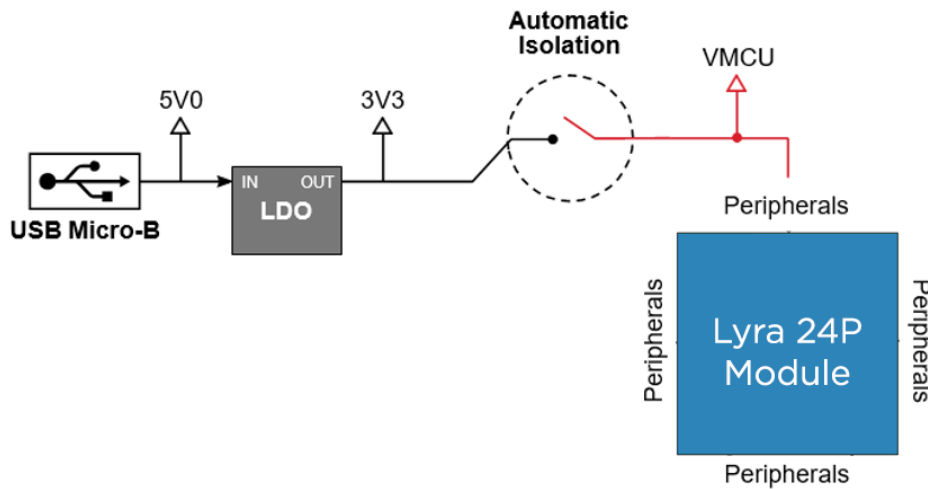


Figure 3: Lyra 24P DVK power diagram

The 5V power net on the USB bus is regulated down to 3.3 V using an LDO (low-dropout regulator). 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.

7.3 Lyra 24P Reset

The Lyra 24P can be reset by a few different sources:

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

7.4 Push Button and LED

The kit has one user push button marked BTN0 and one LED marked LED0 that are each connected to a GPIO on the Lyra 24P. The button is connected to pin PC07 and it is debounced by an RC filter with a time constant of 1 ms. The logic state of the button is high while the button is not being pressed, and low when the button is pressed. The LED is configurable in firmware for user's application. See [BOOT Pin \(PC07\) and BUTTON 0 \(silkscreen BTN0\)](#) usage information.

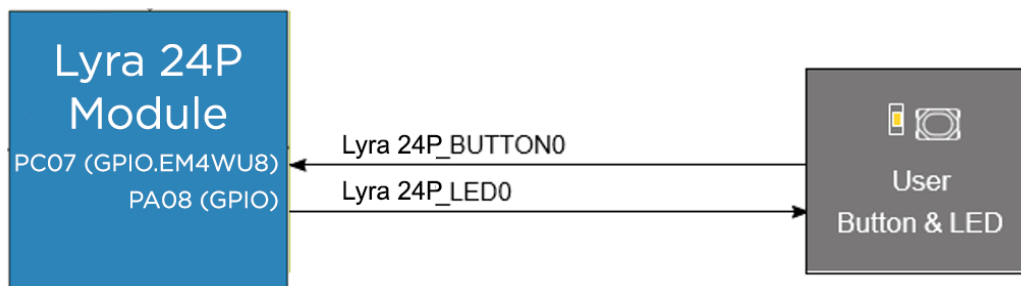


Figure 4: Lyra 24P DVK Button and LED

7.4.1 BOOT Pin (PC07) and BUTTON 0 (silkscreen BTN0)

For the Lyra 24P module the BOOT pin is on PC07 (pin30). On the Lyra dev board BTN0 (Button0) is by default mapped to the BOOT pin for easier use.

The BOOT pin (PC07) is used to determine when execution of the bootloader is required. Upon reset, execution of the bootloader begins. The state of the BOOT pin is read immediately upon start-up of the bootloader. If LOW (BTN0 pressed), execution of the bootloader continues, facilitating firmware update via the UART. If the BOOT pin is HIGH (BTN0 not pressed), the bootloader will stop execution and pass control to the main application firmware.

Please refer to respective DVK schematics and Serial DFU section of User Guide - Firmware Options and Upgrading - Lyra Series for more information at: www.ezurio.com/lyra24-series

7.5 On-Board Debugger

The Lyra 24P Development Kit contains a microcontroller separate from the Lyra 24P that provides the user with an on-board J-Link debugger through the USB Micro-B 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 Packet Trace Interface (PTI) is also supported which offers invaluable debug information about transmitted and received packets in wireless links.

The figure below shows the connections between the target Lyra 24P device and the on-board debugger. See [Debugging](#) section.

Debugging for more details on debugging.

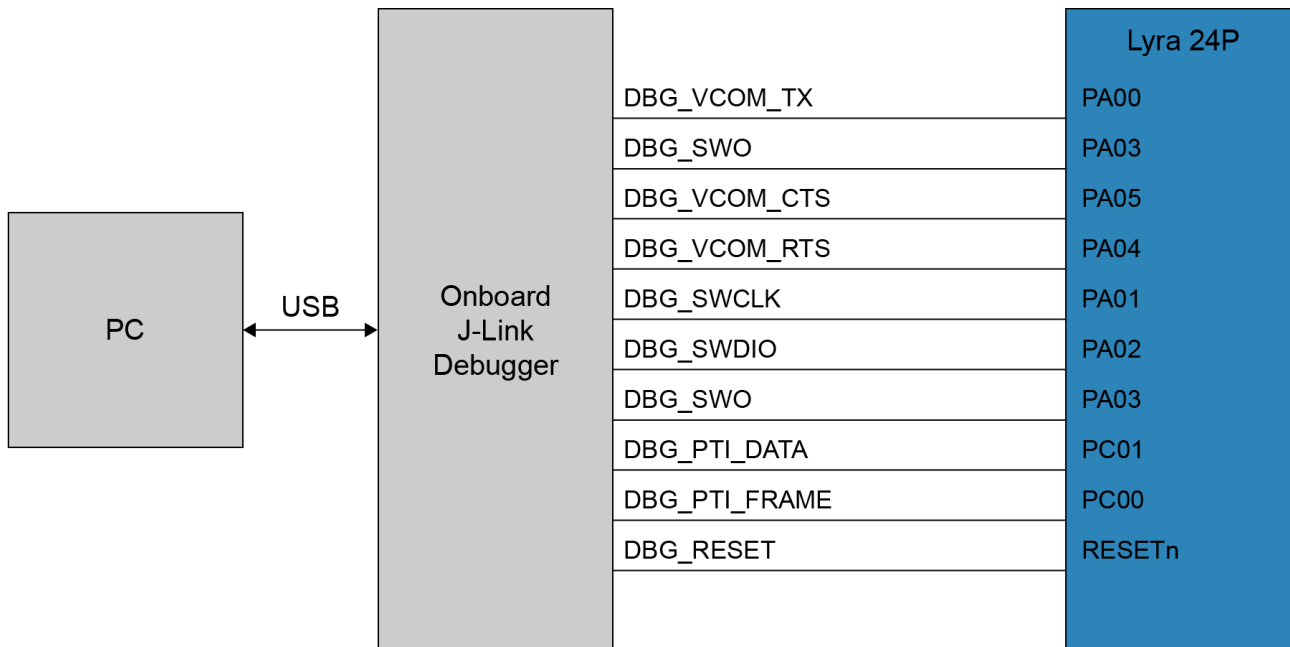


Figure 5: Lyra 24P DVK Debugger Connections

7.6 Hardware Connectors

The Lyra 24P Development Kit features a USB Micro-B connector, 20 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.

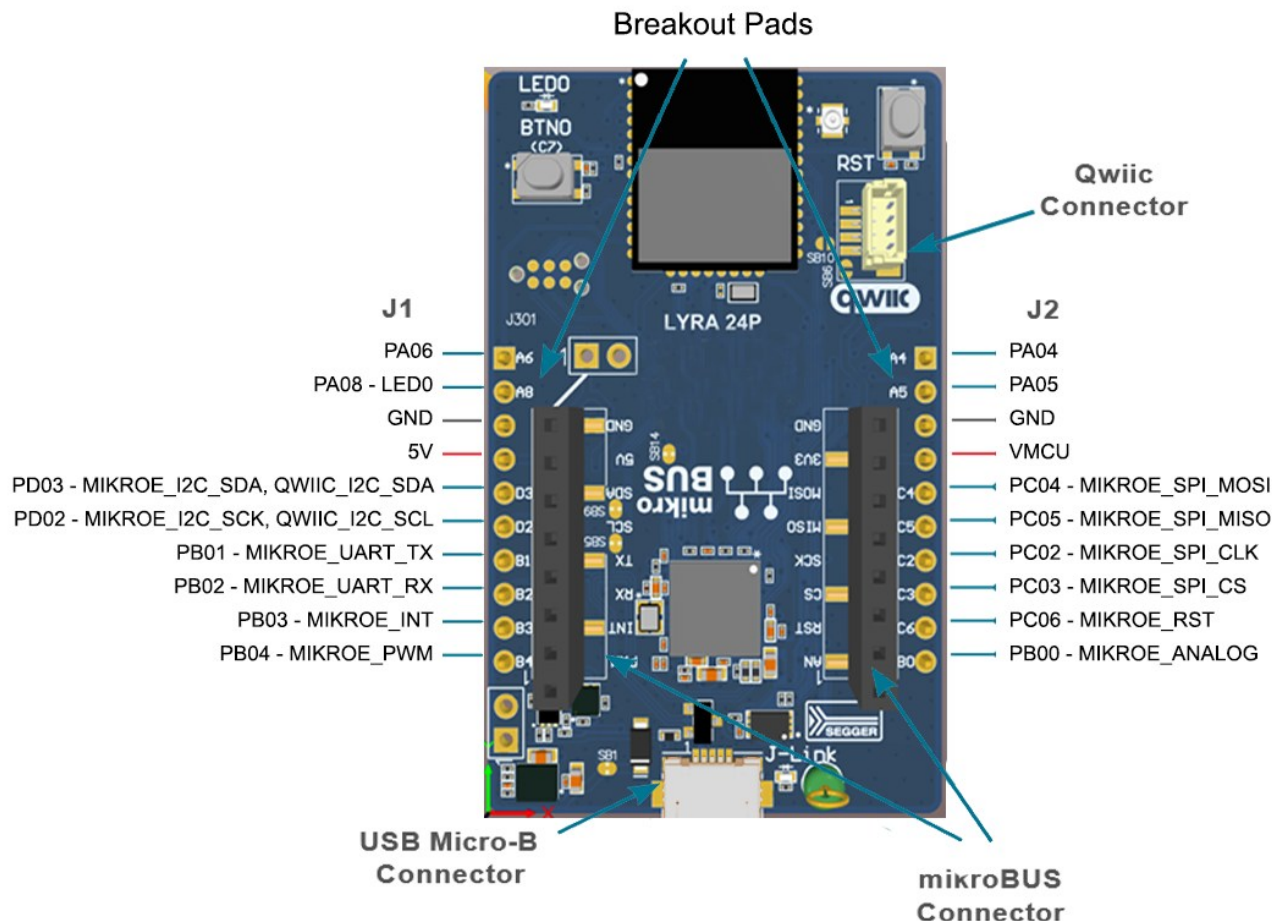


Figure 6: Lyra 24P DVK hardware connectors

7.6.1 Breakout Pads Pinout

Twenty breakout pads are provided and allow connection of external peripherals. There are 10 pads on the left side of the board, and 10 pads on the right. The breakout pads contain a number of I/O pins that can be used with most of the Lyra 24P 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 Lyra 24P 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 Lyra 24P Development Kit. The table below includes an overview of the breakout pads and functionality that is shared with the kit.

Table 3: Lyra 24P DVK Breakout Pads Pinout

| Pin | Connection | Shared Feature |
|---|------------|---------------------------------|
| (Top View) Left Side Breakout Pins (J1) | | |
| 1 | PA06 | BREAKOUT_LEFT1 |
| 2 | PA08 | LED |
| 3 | GND | Ground |
| 4 | 5V | Board USB voltage |
| 5 | PD03 | MikroBUS I2C_SDA, Qwiic I2C_SDA |

| Pin | Connection | Shared Feature |
|--|------------|---|
| 6 | PD02 | MikroBUS I2C_SCL, Qwiic I2C_SCL |
| 7 | PB01 | MikroBUS UART_TX |
| 8 | PB02 | MikroBUS UART_RX |
| 9 | PB03 | MikroBUS INT |
| 10 | PB04 | MikroBUS PWM |
| (Top View) Right Side Breakout Pins (J2) | | |
| 1 | PA04 | DBG_VCOM_RTS via closed solderbridge SB16. BREAKOUT_RIGHT1. |
| 2 | PA05 | DBG_VCOM_CTS via closed solderbridge SB15. BREAKOUT_RIGHT2. |
| 3 | GND | Ground |
| 4 | VMCU | Lyra 24P voltage domain |
| 5 | PC04 | MikroBUS SPI_MOSI |
| 6 | PC05 | MikroBUS SPI_MISO |
| 7 | PC02 | MikroBUS SPI_SCK |
| 8 | PC03 | MikroBUS SPI_CS |
| 9 | PC06 | MikroBUS RST |
| 10 | PB00 | MikroBUS Analog |

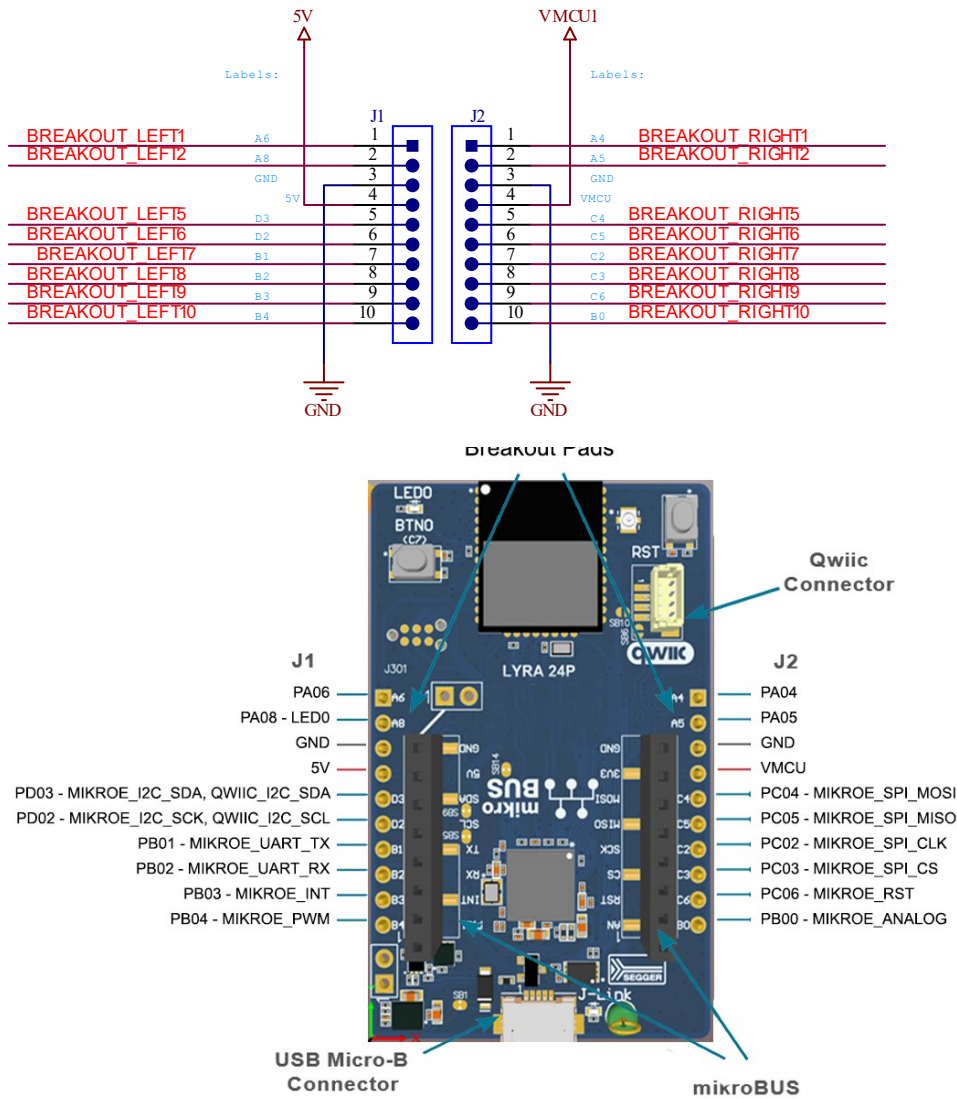
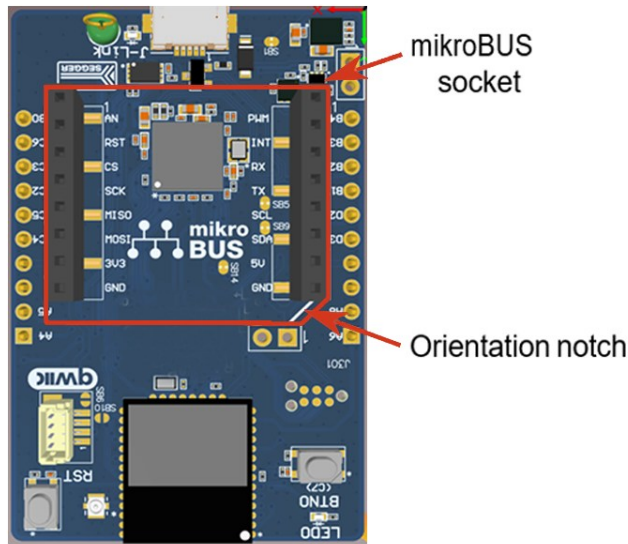


Figure 7: Lyra 24P development board breakout Pads (J1 and J2)

7.6.2 MikroBUS Socket



The Lyra 24P Development 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 communicates with the on-kit Lyra 24P through UART, SPI or I²C. 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 Lyra 24P on the kit is made such that all required peripherals are available on the mikroBUS socket. The I²C signals are, however, shared with the Qwiic connector, and all mikroBUS signals are also routed to adjacent breakout pads.

When inserting a mikroBUS add-on board, refer to the orientation notch on the Lyra 24P Development 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.

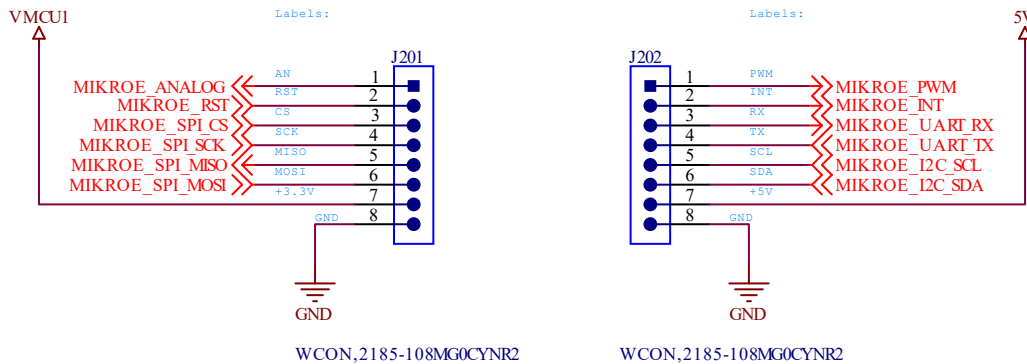


Figure 8: mikroBUS add-on board orientation

The table below gives an overview of the mikroBUS socket pin connections to the Lyra 24P.

Table 4: Pin connections from mikroBUS socket to Lyra 24P

| Pin Name | Pin Function | Connection | Shared Feature | Suggested Mapping |
|----------|----------------------------------|------------|------------------|-------------------|
| AN | Analog | PB00 | BREAKOUT_RIGHT10 | IADC0 |
| RST | Reset | PC06 | BREAKOUT_RIGHT9 | |
| CS | SPI Chip Select | PC03 | BREAKOUT_RIGHT8 | USARTx.CS |
| SCK | SPI Clock | PC02 | BREAKOUT_RIGHT7 | USARTx.CLK |
| MISO | SPI Master Input Slave Output | PC05 | BREAKOUT_RIGHT6 | USARTx.RX |
| MOSI | SPI Master Output Slave Input | PC04 | BREAKOUT_RIGHT5 | USARTx.TX |
| PWM | PWM output | PB04 | BREAKOUT_LEFT10 | TIMER0.CCx |
| INT | Hardware Interrupt | PB03 | BREAKOUT_LEFT9 | |
| RX | UART Receive | PB02 | BREAKOUT_LEFT8 | USARTx.RX |
| TX | UART Transmit | PB01 | BREAKOUT_LEFT7 | USARTx.TX |

| Pin Name | Pin Function | Connection | Shared Feature | Suggested Mapping |
|----------|------------------|---------------------------------------|--|-------------------|
| SCL | I2C Clock | PD02 (via closed solderbridge SB5) | QWIIC_I2C_SCL (via open solder bridge SB6), BREAKOUT_LEFT6 | I2Cx.SCL |
| SDA | I2C Data | PD03 (via closed solderbridge SB9) | QWIIC_I2C_SDA (via open solder bridge SB10), BREAKOUT_LEFT5 | I2Cx.SDA |
| 3V3 | VCC 3.3V power | VMCU | Lyra 24P voltage domain | 3V3 |
| 5V | VCC 5V power | 5V | Board USB voltage | 5V |
| GND | Reference Ground | GND | Ground | GND |

Figure 9 shows Lyra 24P GPIO's PD02 and PD03 are shared with multiple signals, with default the MIKROE_I2C_SCL wired to Lyra 24P PD02 (via closed solder bridge SB5) and MIKROE_I2C_SDA wired to Lyra 24P PD03 (via closed solder bridge SB9).

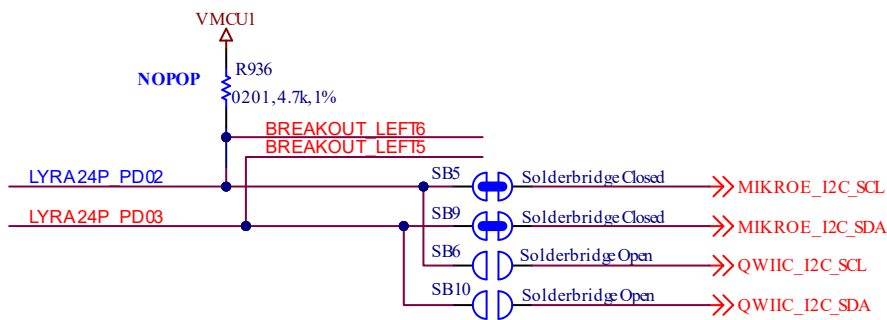


Figure 9: PD02 and PD03 Schematic

7.6.3 QwiicConnector

The Lyra 24P Development Kit features a Qwiic® connector compatible with Qwiic Connect System hardware. The Qwiic connector provides an easy way to expand the functionality of the Lyra 24P Development Kit with sensors, LCDs, and other peripherals over the I²C 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 chainable as long as each I²C device in the chain has a unique I²C address.

Note: The Qwiic I²C connections on the Lyra 24P Development Kit are shared with the mikroBUS I²C signals.

The Qwiic connector and its connections to Qwiic cables and the Lyra 24P are illustrated in the figure below.

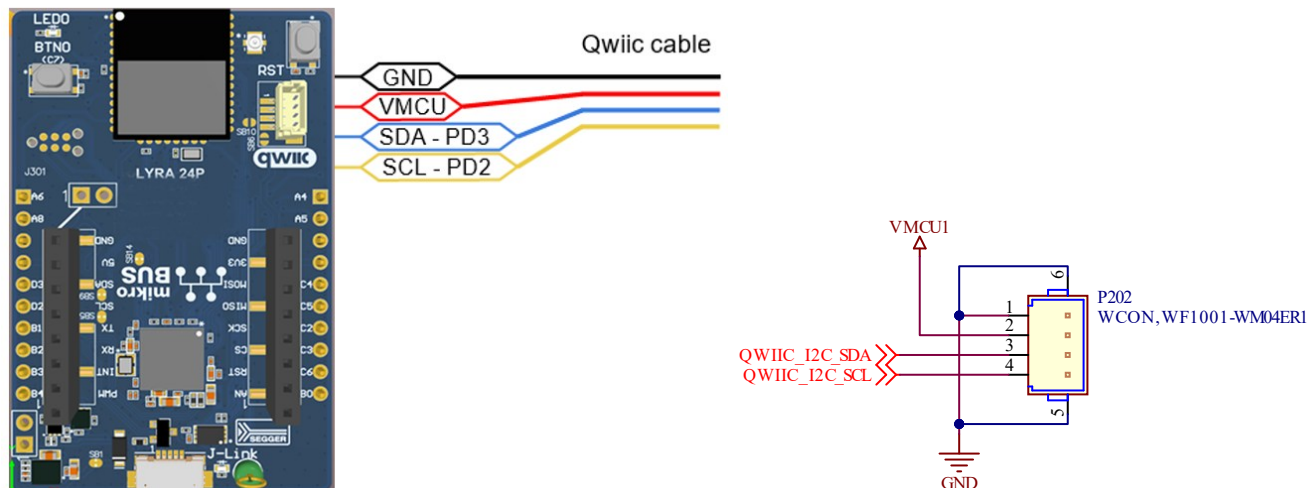


Figure 10: Qwiic connector

The table below gives an overview of the Qwiic connections to the Lyra 24P.

Table 5: Qwiic connections to Lyra 24P

| Qwiic Pin | Connection | Shared Feature | Suggested Peripheral Mapping |
|-----------|--------------------------------------|--|------------------------------|
| Ground | GND | Ground | |
| 3.3V | VMCU | Lyra 24P voltage domain | |
| SDA | PD03 (via open solderbridge SB10) | MIKROE_I2C_SDA (via closed solder bridge SB9), BREAKOUT_LEFT5 | I2Cx.SDA |
| SCL | PD02 (via open solderbridge SB6) | MIKROE_I2C_SCL (via closed solder bridge SB5), BREAKOUT_LEFT6 | I2Cx.SCL |

7.6.4 Debug USB Micro-B Connector

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

8 Debugging

The Lyra 24P Development Kit contains an on-board SEGGER J-Link Debugger that interfaces to the target Lyra 24P using the Serial WireDebug (SWD) interface. The debugger allows the user to download code and debug applications running in the target Lyra 24P. Additionally, it also 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 Packet Trace Interface (PTI) is also supported by the on-board debugger, which offers invaluable debug information about transmitted and received packets in wireless links. The on-board debugger is accessible through the USB Micro-B connector.

8.1 On-Board Debugger

The on-board debugger is a SEGGER J-Link debugger running on an EFM32. The debugger is directly connected to the debug and VCOM pins of the target Lyra 24P.

When the debug USB cable is inserted, the on-board debugger is automatically active 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 which then powers the board. 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). This means that an application running off batteries will not be affected too much by the on-board debugger power consumption. Since the I/O voltage rail of the debugger remains powered in the battery-operated mode, the pins connected to the debug and VCOM interfaces maintain proper isolation and prevent leakage currents.

8.2 Virtual COM Port

The virtual COM port is a connection to a UART of the target Lyra 24P 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. For more information on changing the virtual COM Port settings, please refer to:

<https://www.ezurio.com/documentation/application-note-configuring-lyra-evk-uart-baud-rate>

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.

9 Schematic, Assembly Drawing, 3D Model

Schematic, assembly drawing, 3D model are available on the Lyra Series product page in Documentation->Technical drawings:

<https://www.ezurio.com/wireless-modules/bluetooth-modules/bluetooth-5-modules/lyra-24-series-bluetooth-5-modules>

10 Additional Information

Please contact your local sales representative or our support team for further assistance:

| | |
|--------------------------|---|
| Headquarters | Ezurio 50 S. Main St. Suite 1100 Akron, OH 44308 USA |
| Website | http://www.ezurio.com |
| Technical Support | http://www.ezurio.com/resources/support |
| Sales Contact | http://www.ezurio.com/contact |

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