WBZ451HPE Curiosity Board User's Guide

EV79Y91A

Introduction

The WBZ451HPE Curiosity Board is an efficient and modular development platform that supports rapid prototyping and demonstrates the features, capabilities and interfaces of Microchip's Bluetooth® Low Energy and Zigbee® RF Module.

The WBZ451HPE Curiosity Board:

- Offers integrated programming/debugging features using the PICkit™ On-board 4 (PKOB4) debugger interface
- Requires only a USB Type-C™ cable to power-up, program, and debug the WBZ451HPE module
- Includes a mikroBUS™ Click™ header, which helps the users to expand the functionalities by connecting to various MikroElektronika mikroBUS Click adapter boards
- Enables rapid prototyping by utilizing the Bluetooth Low Energy and Zigbee-enabled RF Module
- Two Xplained PRO (XPRO) headers for connecting various XPRO boards and for accessing the available General Purpose Input Output (GPIO) for customer use

The WBZ451HPE Curiosity Board supports a variety of applications:

- Wireless lighting
- Industrial automation, Home automation and Internet of Things (IoT)
- Other Bluetooth Low Energy or Zigbee and proprietary applications
- Thread

Features

- WBZ451HPE Bluetooth® Low Energy and 802.15.4 RF Module
- USB or Li-Po Battery Powered
- On-Board Programmer/Debug Circuit Using PKoB4 Based on Microchip SAME70 MCU
- Microchip MCP73871 Li-Ion/LiPo Battery Charger with Power Path Management
- On-Board USB to UART Serial Converter with Hardware Flow Control Based on Microchip MCP2200
- mikroBUS™ Socket to Expand Functionality using MikroElektronika Click™ Adapter Boards
- RGB LED Controlled Using Pulse Width Modulation (PWM)
- One Reset Switch
- One User-Configurable Switch
- One User LED
- 32.768 kHz Crystal
- Microchip SST26VF064B, 64-Mbit External Quad Serial Peripheral Interface (QSPI) Flash Memory
- Microchip MCP9700A, Low-Power Analog Voltage Temperature Sensor
- 10-Pin ARM® Serial Wire Debug (SWD) Header for External Programmer/Debugger
- Two XPRO Headers

For more details, refer to 3. Hardware.

Table of Contents

1. Quick References

1.1 Reference Documentation

For further details, refer to the following:

- *MPLAB® XC32 C/C++ Compiler User's Guide* (DS50001686)
- *MPLAB® X IDE User's Guide* (DS50002027)
- *MPLAB® Snap In-Circuit Debugger Information Sheet* (DS50002787)
- *MCP1727 1.5A, Low Voltage, Low Quiescent Current LDO Regulator Data Sheet* (DS21999)
- *SST26VF064B/SST26VF064BA, 2.5V/3.0V 64-Mbit Serial Quad I/O™ (SQI™) Flash Memory Data Sheet* (DS20005119)
- *MCP73871, Stand-Alone System Load Sharing and Li-Ion/Li-Polymer Battery Charge Management Controller Data Sheet* (DS20002090)
- *MCP9700A, Low-Power Linear Active Thermistor IC Data Sheet* (DS20001942)
- *Universal Serial Bus Specification and Associated Documents* (www.usb.org)
- *mikroBUS™ Specification*(www.mikroe.com/mikrobus)
- *PIC32CX-BZ2 and WBZ45 Family Data Sheet* (DS70005504)

1.2 Hardware Prerequisites

- WBZ451HPE Curiosity Board
- USB Type-A male to USB USB Type-C cable
- Li-Ion Polymer Battery with 4.2V for battery-powered application
- Bluetooth-enabled Smartphone:
  - Android™ device
  - iOS® device: iPhone®

1.3 Software Prerequisites

- MPLAB® Integrated Development Environment (MPLAB X IDE) tool (version 6.20 or later)
- MPLAB XC32 Compiler (version 4.35 or later)
- PKOB4 Tool Pack (version 1.14.1168 or later)
- Released Out-of-Box (OOB) demo

1.4 Acronyms and Abbreviations

Table 1-1. Acronyms and Abbreviations

Acronyms and Abbreviations	Description
ADC	Analog-to-Digital Converter
BOM	Bill of Material
DBG	Debug
DNP	Do Not Populate
GPIO	General Purpose Input Output
I^2C	Inter-Integrated Circuit
ICD	In-Circuit Debugger
IoT	Internet of Things
LDO	Low-Dropout
LED	Light Emitting Diode

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Acronyms and Abbreviations	Description
MCU	Microcontroller
NC	Not Connected
OOB	Out-of-Box
PCB	Printed Circuit Board
PKOB	PICKit™ On-Board
PPS	Peripheral Pin Select
PWM	Pulse Width Modulation
QSPI	Quad Serial Peripheral Interface
RTCC	Real Time Clock and Calendar
RX	Receiver
SCL	Serial Clock
SDA	Serial Data
SMD	Surface Mount Device
SoC	System-on-Chip
SPI	Serial Peripheral Interface
SWD	Serial Wire Debug
TX	Transmitter
UART	Universal Asynchronous Receiver-Transmitter
USB	Universal Serial Bus
WP#	Write Protect

2. Kit Overview

The WBZ451HPE Curiosity Board contains a WBZ451HPE module. All the signals from the WBZ451HPE module are connected to on-board features of the Curiosity Board for flexibility and rapid prototyping.

Figure 2-1. WBZ451HPE Curiosity Board (EV79Y91A) – Top View

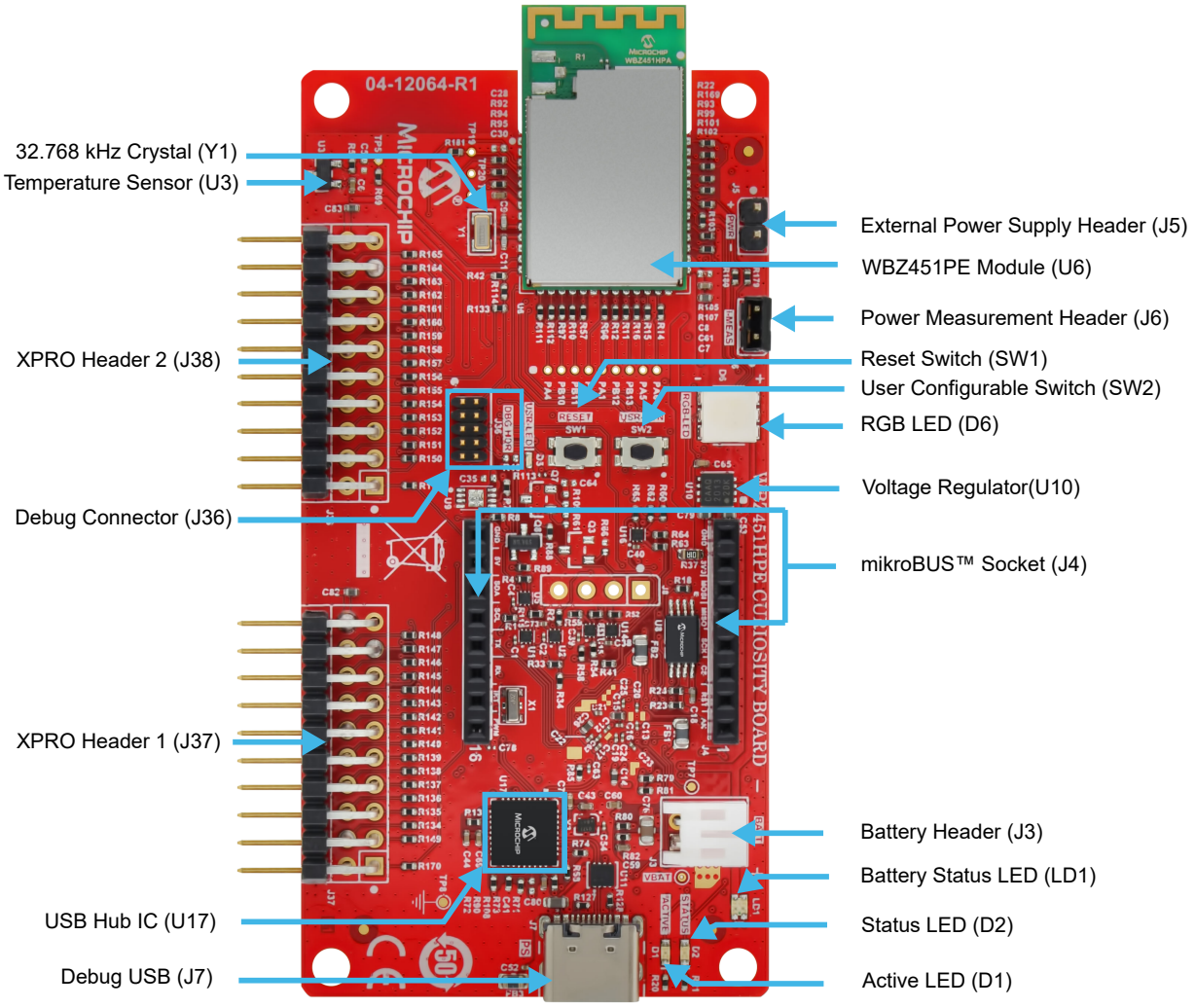
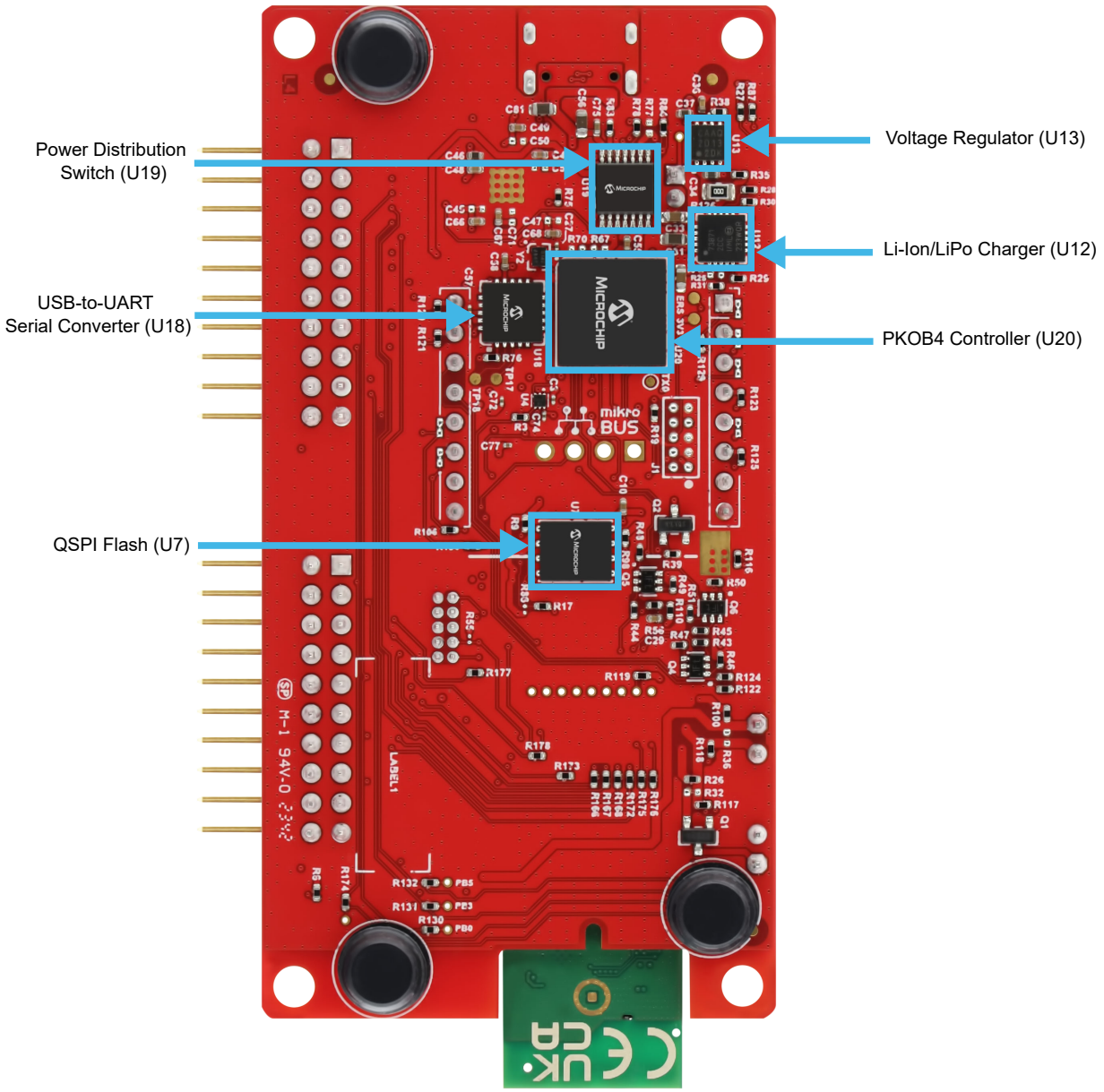


Figure 2-2. WBZ451HPE Curiosity Board (EV79Y91A) – Bottom View



2.1 Kit Contents

The EV79Y91A (WBZ451HPE Curiosity Board) kit contains the following:

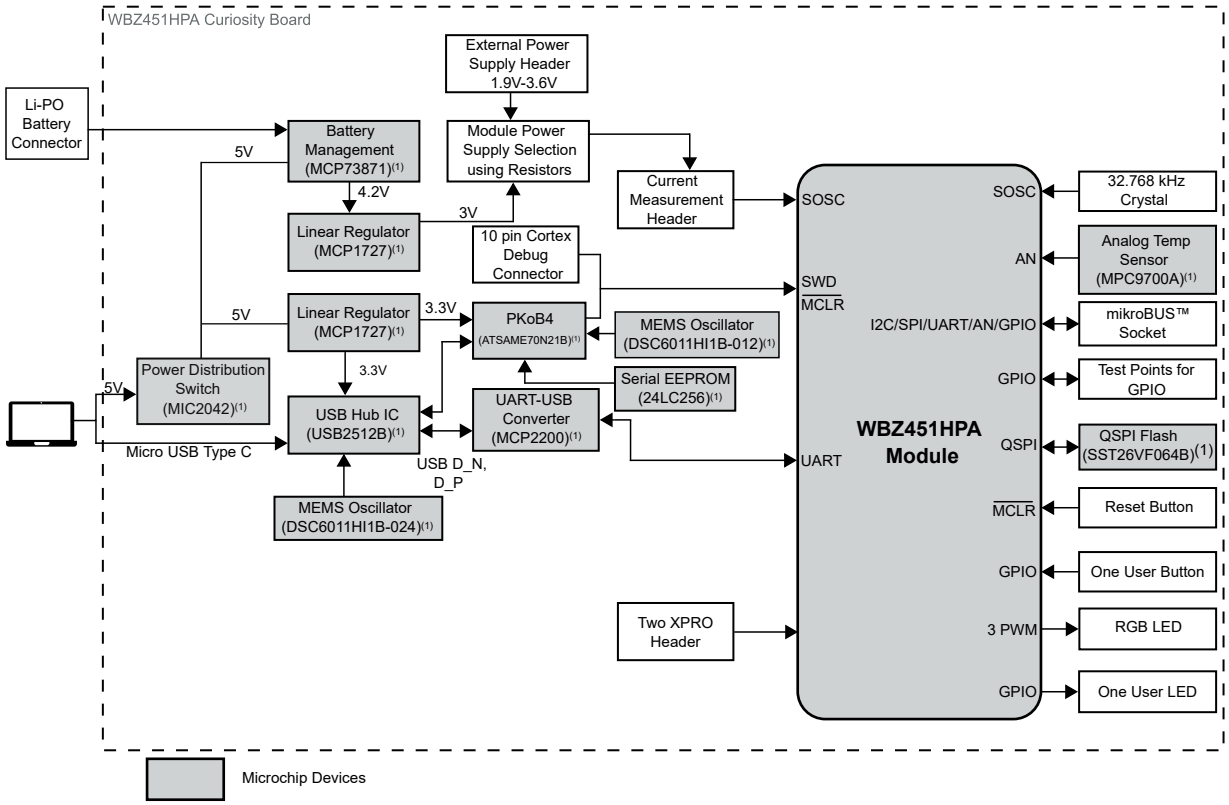
- A WBZ451HPE module mounted on the WBZ451HPE Curiosity Board
- A USB Type-A male to USB Type-C cable

Note: If any of the above items are missing in the kit, go to support.microchip.com or contact your local Microchip Sales office. In this user guide, there is a list of Microchip offices for sales and services provided on the last page.

3. Hardware

This chapter describes the hardware features of the WBZ451HPE Curiosity Board.

Figure 3-1. WBZ451HPE Curiosity Board Block Diagram



Note:

1. Using Microchip's total system solution, which includes complementary devices, software drivers and reference designs, is highly recommended to ensure the proven performance of the WBZ451HPE Curiosity Boards. For more details, go to support.microchip.com or contact your local Microchip Sales office.

Table 3-1. Microchip Components used in WBZ451HPE Curiosity Board

S.No.	Designator	Manufacturer Part Number	Description
1	Q2, Q8	TN2106K1-G	MCHP ANALOG MOSFET N-CH TN2106 60V 280mA 360mW 2.5R SOT23-3
2	U3	MCP9700AT-E/TT	MCHP ANALOG TEMPERATURE SENSOR -40C to +150C MCP9700AT-E/TT SOT-23-3
3	U6	WBZ451HPE-I	Long Range BLE/ZIGBEE WBZ451HPE-I Module with PCB antenna
4	U7	SST26VF064B-104I/MF	MCHP SERIAL FLASH SST26VF064B-104I/MF WDFN-8

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S.No.	Designator	Manufacturer Part Number	Description
5	U8	24LC256T-E/ST	MCHP MEMORY SERIAL EEPROM 256k I2C 24LC256T-E/ST TSSOP-8
6	U10, U13	MCP1727-3302E/MF	MCHP ANALOG LDO 3.3V MCP1727-3302E/MF
7	U12	MCP73871-2CCI/ML	MCHP ANALOG BATTERY CHARGER MCP73871-2CCI/ML QFN-20
8	U17	USB2512B-I/M2	MCHP INTERFACE USB 2.0 HUB CTRLR USB2512B-I/M2 SQFN-36
9	U18	MCP2200-I/MQ	MCHP INTERFACE USB UART MCP2200-I/MQ QFN-20
10	U19	MIC2042-1YTS	MCHP ANALOG POWER SWITCH 5.5V 3A MIC2042-1YTS TSSOP-14
11	U20	ATSAME70N21B-CNT	MCHP MCU 32-BIT 300MHz 2MB 384K x 8 ATSAME70N21B-CNT TFBGA-100
12	Y2	DSC6011HI1B-012.0000	MCHP CMOS OSCILLATOR 12MHz DSC6011HI1B-012.0000 SMD VFLGA-4
13	Y3	DSC6011HI1B-024.0000	MCHP CMOS OSCILLATOR 24MHz DSC6011HI1B-024.0000 SMD VFLGA-4

3.1 Power Supply

The WBZ451HPE Curiosity Board can be powered using any of the following sources:

1. The USB supplies power to the WBZ451HPE Curiosity Board using a USB Type-A male to USB Type-C cable connected to the Debug USB Type-C connector (J7).
2. 4.2V Li-ion/Li-Po battery kit includes the following components:
   - Connected to J3, JST PH, 2-pin, 2 mm pitch and right-angle male battery header
   - Crimp-style connector ensures battery polarity according to ± marking on the Curiosity Board
   - Battery is not included in the kit
   - Minimum recommended battery capacity is 400 mAh, with a battery charge voltage of 4.2V

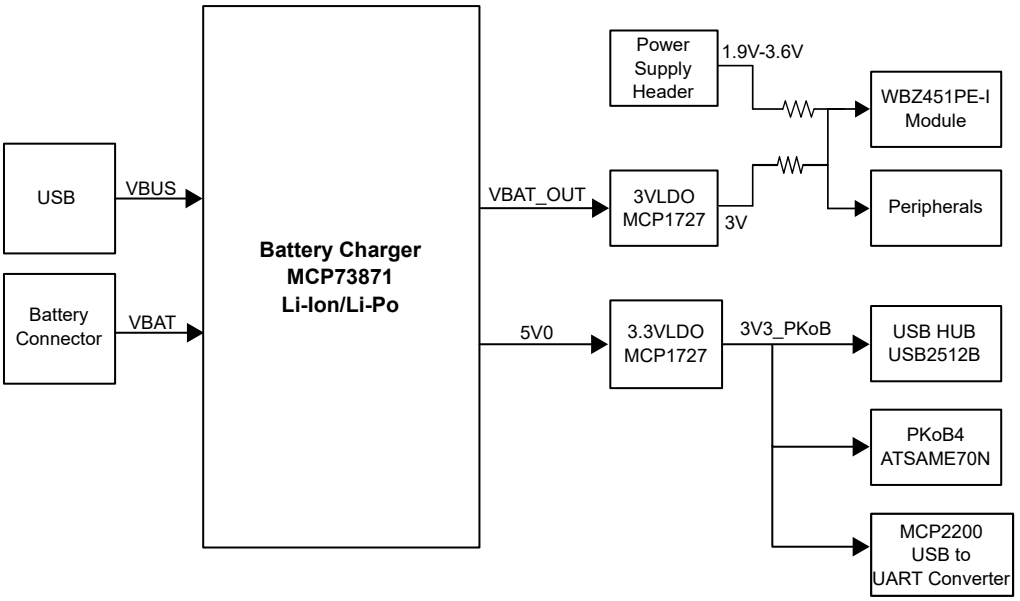
   Battery management circuit automatically handles selection between USB power supply and battery supply.

   The following are the two on-board MCP1727 voltage regulators on the WBZ451HPE Curiosity Board that power the circuitry on-board.

   - U10 – Generates 3.3V that powers the WBZ451HPE-I module along with the associated circuits
   - U13 – Generates 3.3V that powers the USB hub IC (U201), PKOB4 main controller (U300), along with the associated circuits that connect the PKOB4 debugger to a host PC and MCP2200 USB to UART converter

   For more details on the U10 and U13 voltage regulators, refer to the *MCP1727 1.5A, Low Voltage, Low Quiescent Current LDO Regulator Data Sheet* (DS21999).

Figure 3-2. WBZ451HPE Curiosity Board Power Supply Block Diagram

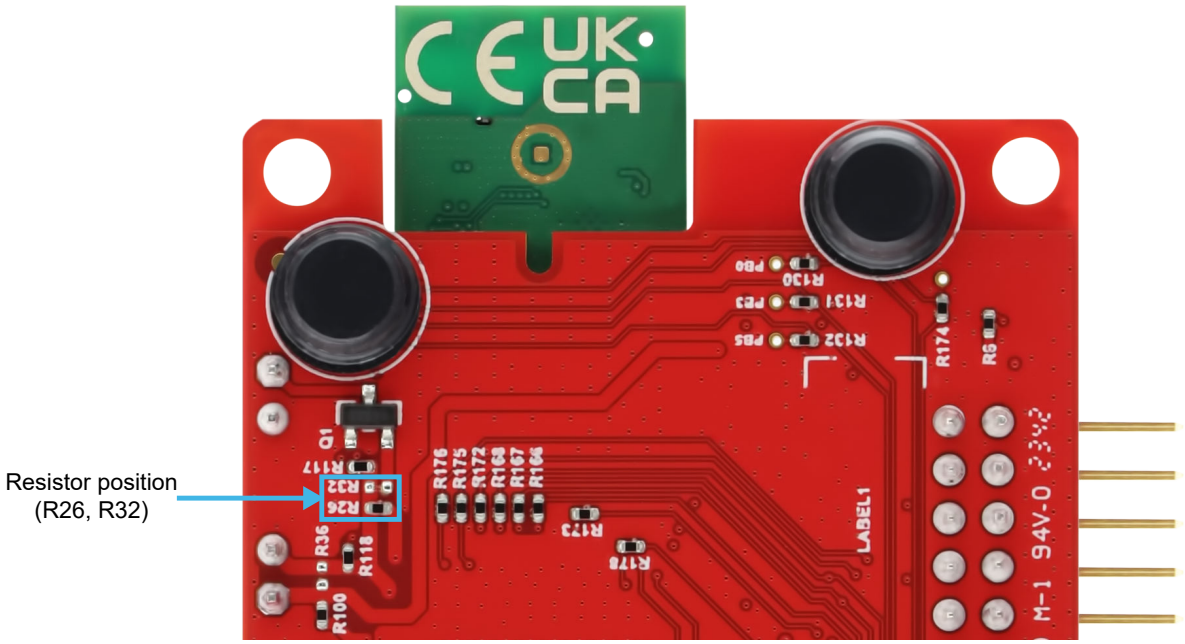


3. The WBZ451HPE module and associated peripherals can also be powered from:
   - External power supply header (J5) using external power supply (1.9-3.6V) for testing at different voltage levels apart from the default supply of 3V from the on-board regulator. To use the external power supply header, disconnect the on-board 3.3V supply according to the following table:

Table 3-2. Resistor Option to Select the WBZ451HPE Module Power Supply

On-board 3.3V Regulator	External Power Supply
Mount R26	Do not mount R26
Do not mount R32	Mount R32

Figure 3-3. Resistor Position to Select the WBZ451HPE Module Power Supply



Note: The maximum available current from the Debug USB Type-C connector (J7) is limited to 500 mA. The current is shared between charging the external battery (if connected) and powering the target application section.

3.2 Li-Po Battery Charger

A 4.2V, Li-Po battery connected to the 2-pin, 2 mm pitch right-angle male battery header can be charged using Battery Management IC MCP73871-2CC (U12) from the USB power supply at 100 mA fast charge current.

The battery management circuit automatically handles the selection between the USB power supply and battery supply. The current is shared between charging the battery (if connected) and powering the target application section. For more details on the MCP73871 Li-ion/Li-Po battery charger, refer to the *Stand-Alone System Load Sharing and Li-Ion/Li-Polymer Battery Charge Management Controller Data Sheet* (DS20002090).

Table 3-3. Battery Charger Status LED (LD1)

LED Color	Function
Red (charging)	The battery is charged by the USB when the USB is plugged-in.
Red (discharging)	The battery voltage is low. Triggers, if the voltage is under 3.1V.
Green	Fully charged

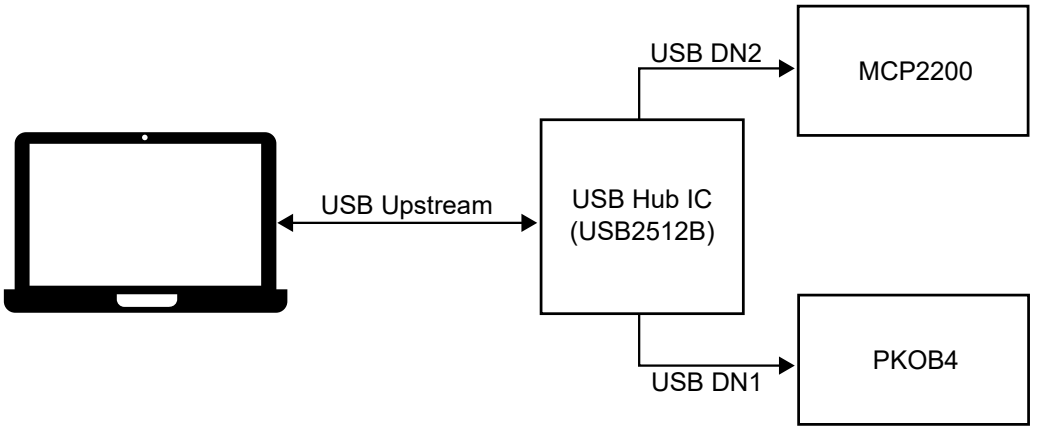
3.3 Power Measurement Header (J6)

To measure the power input to the WBZ451HPE module, 1x2, 2.54 mm male pin header with shunt connector (I-MEAS, J6) is provided. Remove the jumper (JP1) from J6 and connect an ammeter across its pins to measure the current. An optional shunt resistor (R36) is available but not mounted by default (DNP). For current profiling, in terms of voltage using a voltage probe, mount R36 and measure the voltage drop across the shunt resistor.

3.4 USB Connectivity using Microchip USB 2.0 Hub Controller

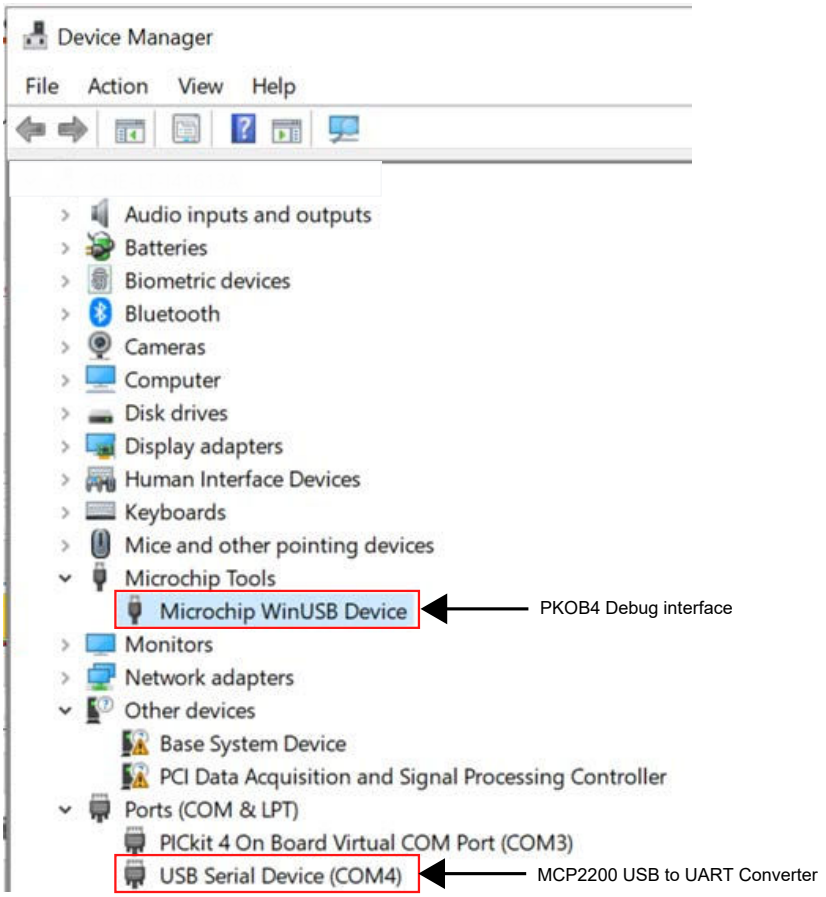
The WBZ451HPE Curiosity Board has two USB end device PKOB4 and MCP2200. Both these USB devices are accessible to the upstream PC via a common USB connector using Microchip USB 2.0 High Speed Hub Controller USB2512B providing the user with more ease of use.

Figure 3-4. USB Connectivity using Hub Controller



When the WBZ451HPE Curiosity Board is plugged into the upstream PC using a USB Type-C cable, the device enumeration is as shown in the following figure for the PKOB4 and MCP2200.

Figure 3-5. Device Manager



3.5 PICkit On-Board 4 (PKOB4) and Debugger/Programmer Selection

The WBZ451HPE Curiosity Board includes an integrated programmer and debugger MPLAB® PICkit™ On-Board 4 (PKOB4). This new generation of In-Circuit Debugger, requires no additional programming/debugging tool to get started.

Features and capabilities of PKOB4:

- Connects to a computer through high-speed USB 2.0 (480 Mbits/s) cable
- Programs the device using MPLAB X IDE or MPLAB IPE
- Supports multiple hardware and software breakpoints, stopwatch and source code file debugging
- Debugs the application in real time
- Sets breakpoints based on the internal events
- Monitors the internal file registers
- Debugs at full speed
- Configures the pin drivers
- Field-upgradeable through an MPLAB X IDE firmware download
- Indicates debugger status through on-board LEDs, demonstrating the development board's functionality and features

The PKOB4 on the WBZ451HPE Curiosity Board provides support for programming and debugging of the target device (WBZ451HPE module) through the USB Type-C™ connector (J7) from the Host PC.

Notes:

- As the WBZ451HPE module supports the UART interface, the WBZ451HPE Curiosity Board employs a USB-UART Virtual COM Port instead of the standard PKOB4 Virtual COM Port. The on-board MCP2200 (U18) acts as a USB to the UART converter with hardware flow control support.
- The data gateway interface feature of PKOB4 is not used in the WBZ451HPE Curiosity Board.

By default, the on-board debugger (PKOB4) is connected to the programming pins (SWDIO and SWDCLK) of the WBZ451HPE module.

The voltage level translators are provided on signals between the PKOB4 and WBZ451HPE module for supporting target voltage from 1.9-3.6V.

Two PKOB4 LEDs indicate:

- Green (D1) – ACTIVE indicator
- Yellow (D2) – STATUS indicator

In addition, the Curiosity Board supports external debuggers, such as MPLAB ICD5 by connecting to the Debug Connector (J36).

The WBZ451HPE programming/debugging through PKOB4 and external debugger is supported at the target voltage of 3V and at room temperature. For more details, refer to the *PIC32CX-BZ2 Family Silicon Errata Sheet* (DS80001043).

The Debug Connector (J36) follows the standard ARM® SWD 10 pinout. For more details on the debug header schematics, refer to Figure 5-22. MPLAB ICD5 can be connected to the Debug (DBG) header using the Debugger Adapter Board (AC102015). For more details, refer to www.microchip.com/DevelopmentTools/ProductDetails/AC102015.

Table 3-4. SWD Debug Connector Details

Pin Number of DBG Header	Pin Name	Description
1	VCC	WBZ451HPE, also for other instances of RF module power supply
2	SWDIO	PB9, SWD programming data
3	GND	Ground
4	SWCLK	PB8, SWD programming clock
5	GND	Ground
6	SWO	PB7, optional trace output
7	NC	No connection
8	NC	No connection
9	GND	Ground
10	RESET	RF module's Reset NMCLR pin

3.6 USB-UART Virtual COM Port

The WBZ451HPE Curiosity Board has an on-board MCP2200 (U18) that acts as a USB-to-UART converter with hardware flow control support. It enables the user to connect to the Host PC through the USB Type-C connector (J7). MCP2200 supports UART baud rates from 300-1000 kbps. Voltage level translators are provided on signals between the MCP2200 and WBZ451HPE module for supporting target voltage from 1.9-3.6V when powered externally.

Table 3-5. USB Serial Converter Pin Assignment

Pin on MCP2200	Pin on WBZ451HPE Module	Description
TX	PA6, SERCOM0_PAD1	UART RX pin of the WBZ451HPE module

.....continued		
Pin on MCP2200	**Pin on WBZ451HPE Module**	**Description**
RX	PA5, SERCOM0_PAD0	UART TX pin of the WBZ451HPE module
RTS	PA4, SERCOM0_PAD3	UART CTS pin of the WBZ451HPE module
CTS	PA3, SERCOM0_PAD2	UART RTS pin of the WBZ451HPE module

3.7 mikroBUS Socket (J4)

A mikroBUS socket (J4) expands the functionality of the WBZ451HPE Curiosity Board using the MikroElektronika Click adapter boards.

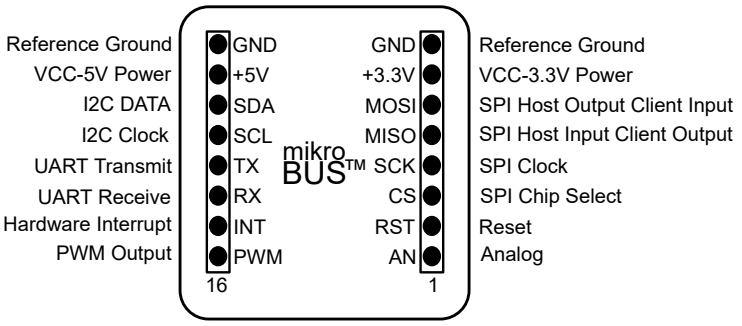
The mikroBUS connector consists of:

- Pair of 1x8 female headers with proprietary pin configuration and silkscreen markings
- The pinout consists of three groups of communications pins:
  - Serial Peripheral Interface (SPI)
  - Universal Asynchronous Receiver/Transmitter (UART)
  - Inter-Integrated Circuit (I^2C)
- Two power groups
  - 3.3V, Ground power line
  - 5V, Ground power line
- Four additional pins
  - Pulse Width Modulation (PWM)
  - Reset Pin (RST)
  - Interrupt
  - Analog

Note: For a complete listing of the Click boards, refer to www.mikroe.com/click.

The GPIO pins for the mikroBUS sockets are assigned to route I^2C, SPI peripherals and other GPIO pins as follows.

Figure 3-6. mikroBUS™ Pinout Diagram



Note: The mikroBUS pinout diagram is reversed to align with the WBZ451HPE Curiosity Board

Table 3-6. mikroBUS™ Socket Pinout Details

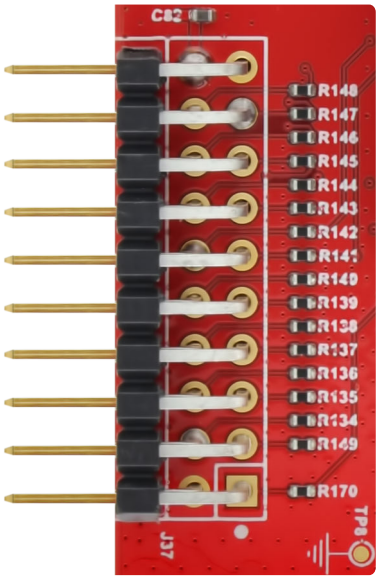
Pin Number	Pin Name	Pin on WBZ451HPE Module	Description
1	AN	PB6, AN	ADC analog input
2	$\overline{RST}$	PB2	General purpose I/O pin

.....continued			
Pin Number	**Pin Name**	**Pin on WBZ451HPE Module**	**Description**
3	$\overline{CS}$	PB13, SERCOM2_PAD3	Client select pin for SPI (or) General purpose I/O pin
4	SCK	PB3, SERCOM_PAD0	SPI clock
5	MISO	PB5, SERCOM2_PAD2	SPI host input client output
6	MOSI	PB4, SERCOM2_PAD1	SPI host output client input
7	+3.3V	+3.3V	3.3V power
8	GND	GND	Ground
9	GND	GND	Ground
10	+5V	+5V	5V power
11	SDA	PA7, SERCOM1_PAD0	I^2C data
12	SCL	PA8, SERCOM1_PAD1	I^2C clock
13	TX	PA14, SERCOM3_PAD0	UART TX
14	RX	PA13, SERCOM3_PAD2	UART RX
15	INT	PA2	Interrupt pin (or) GPIO pin. Shared with PWM pin
16	PWM	PB7	PWM pin (or) GPIO pin. Shared with Interrupt (INT) pin

3.8 XPRO Header (J37)

Figure 3-7. XPRO Header 1 (J37) Pinout

XPRO Header 1 Pinout Top View



XPRO Header 1 Pinout Diagram

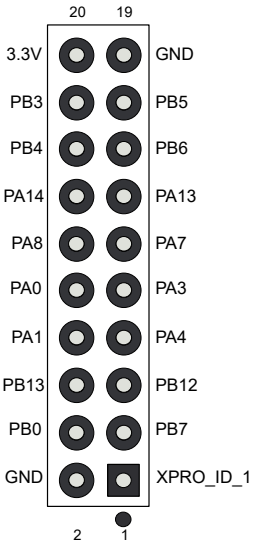
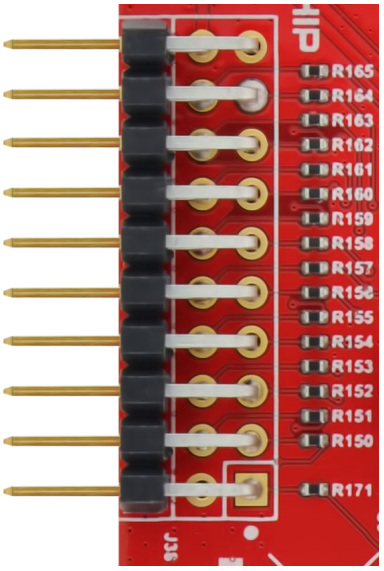


Figure 3-8. XPRO Header 2 (J38) Pinout

XPRO Header 2 Pinout Top View



XPRO Header 2 Pinout Diagram

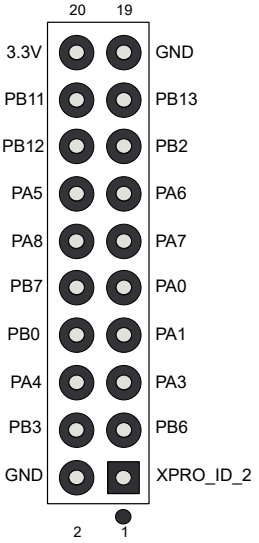


Table 3-7. XPRO Header

Pin Number	Pin Name	Pin on WBZ451HPE Module (XPRO Header 1) J37	Pin on WBZ451HPE Module (XPRO Header 2) J38
1	ID	XPRO_ID_1	XPRO_ID_2
2	GND	GND	GND
3	AN1	PB7	PB6
4	AN3	PB0	PB3
5	GPIO1	PB12	PA3
6	GPIO2	PB13	PA4
7	PWM1	PA4	PA1
8	PWM2	PA1	PB0
9	IRQ/GPIO	PA3	PA0
10	SPI_SS1	PA0	PB7
11	I2C SDA	PA7	PA7
12	I2C SCL	PA8	PA8
13	UART_RX	PA13	PA6
14	UART_TX	PA14	PA5
15	SPI_SS2	PB6	PB2
16	SPI_MOSI	PB4	PB12
17	SPI_MISO	PB5	PB13
18	SPI_SCK	PB3	PB11
19	GND	GND	GND
20	+3.3V	3.3V	3.3V

Notes:

1. Add 0Ω resistor to Temperature sensor for isolation
2. Add 0Ω resistor to RGB LED lines for isolation

3.9 Switches

The following switches are available on the WBZ451HPE Curiosity Board:

- Reset switch (SW1)
- User configurable switch (SW2)

In the Idle state, the level of the Reset switch is pulled high using the external pull-up resistor and, when the switch is pressed, it drives the level of the switch to low and resets the WBZ451HPE module.

The user-configurable switch is also pulled high using the external pull-up resistor. When the switch is pressed, it drives the level of the switch to low.

Table 3-8. Switches Description

Switch Name	Pin on WBZ451HPE Module	Description
Reset (SW1)	NMCLR	Reset switch (SW1) connected to NMCLR pin
USR-BTN (SW2)	PB4	User configurable switch (SW2)

3.10 LEDs

3.10.1 User LED (D5)

One user-programmable blue indicator LED (D5) is available on the WBZ451HPE Curiosity Board, and this LED can be turned ON or OFF using the connected GPIO pin PB7. Drive the pin to a high level to turn OFF the LED and drive the pin to a low level to turn ON the LED.

Important: PB7 also functions as an SWO pin on the WBZ451HPE module. During a programming/debug session with MPLAB X IDE, this pin is always driven low by the WBZ451HPE module, thus, causing the user LED to turn ON during the entire DEBUG session. When the DEBUG session is exited, this pin resumes normal operation.

3.10.2 RGB LED (D6)

Three PWM signals from the WBZ451HPE module are connected to RGB LED (D6) on the WBZ451HPE Curiosity Board.

Table 3-9. RGB LED Pin Description

Color	Pin on WBZ451HPE
Red	PB0
Green	PB3
Blue	PB5

3.11 Temperature Sensor (U3)

Analog output from the temperature sensor (Microchip MCP9700A, U3) within the voltage range of 2.3-5.5V is connected to one of the analog pins (PB6, AN2) of the ADC channel on the WBZ451HPE module. For more details, refer to the *MCP9700A, Low-Power Linear Active Thermistor IC Data Sheet* (DS20001942).

3.12 QSPI Serial Flash

The WBZ451HPE Curiosity Board has an on-board 64-Mb, 2.3-3.6V Serial Quad I/O (SQI) Flash SST26VF064B (U7) memory for storage of data. A default SST26VF064B at power-up enables the

Write Protect (WP#) and HOLD# pins and disables the SIO2 and SIO3 pins allowing for SPI protocol operations without register configuration. Register configuration is required to switch to Quad I/O operation with QSPI.

Table 3-10. QSPI Flash Pin Description

QSPI Flash	Pin on WBZ451HPE Module	Description
CE#	PB10, QSPI_CS	QSPI chip select
SO/SIO1	PB13, QSPI_DATA1	QSPI data channel 1
WP#/SIO2	PA0, QSPI_DATA2	QSPI data channel 2
VSS	GND	Ground
SI/SIO0	PB12, QSPI_DATA0	QSPI data channel 0
SCK	PB11, QSPI_SCK	QSPI clock
HOLD#/SIO3	PA1, QSPI_DATA3	QSPI data channel 3
VDD	TVDD	TVDD

3.13 32.768 kHz Secondary Oscillator

The 32.768 kHz crystal is connected to SOSC pins (PA11 and PA12) of the WBZ451HPE module.

3.14 WBZ451HPE Module

For more details on the WBZ451HPE module pinout details, refer to the *PIC32CX-BZ2 and WBZ45 Family Data Sheet* (DS70005504).

Note: The user can configure the Peripheral Pin Select (PPS) pins for any of the supported peripheral functions based on the end user application.

3.15 Limitations of Using Battery and External Power Supply

Battery Power:

The battery management circuit is designed for a 4.2V battery going to a downstream 3V regulator. When the battery voltage is near to the required minimum input voltage of the regulator, it may affect the regulated output. It is recommended to use a fully-charged battery for evaluation and recharge the battery as soon as the low battery output indicator is turned ON at 3.1V.

External Power Supply Header:

The WBZ451HPE Curiosity Board is designed to evaluate the WBZ451HPE module and associated peripherals with an on-board 3V regulator by default. The following limitations apply to the circuitry if the WBZ451HPE module and associated circuitry is powered from external power supply header at other voltages:

- QSPI Serial Flash SST26VF064B (U6) – Standard operating voltage for the QSPI serial Flash is 2.3-3.6V.
- Temperature Sensor MPC9700A (U3) – Standard operating voltage for the temperature sensor is 2.3-3.6V.
- User LED (D5) – Designed for 3V operation; LED brightness at lower voltages will be dull or no glow. To increase the emitted light level, the value of the series resistor (R42) can be lowered.
- RGB Lighting LED (D6) – RGB lightning LED is powered from VBAT net. It requires either a USB or battery power supply to be functional.

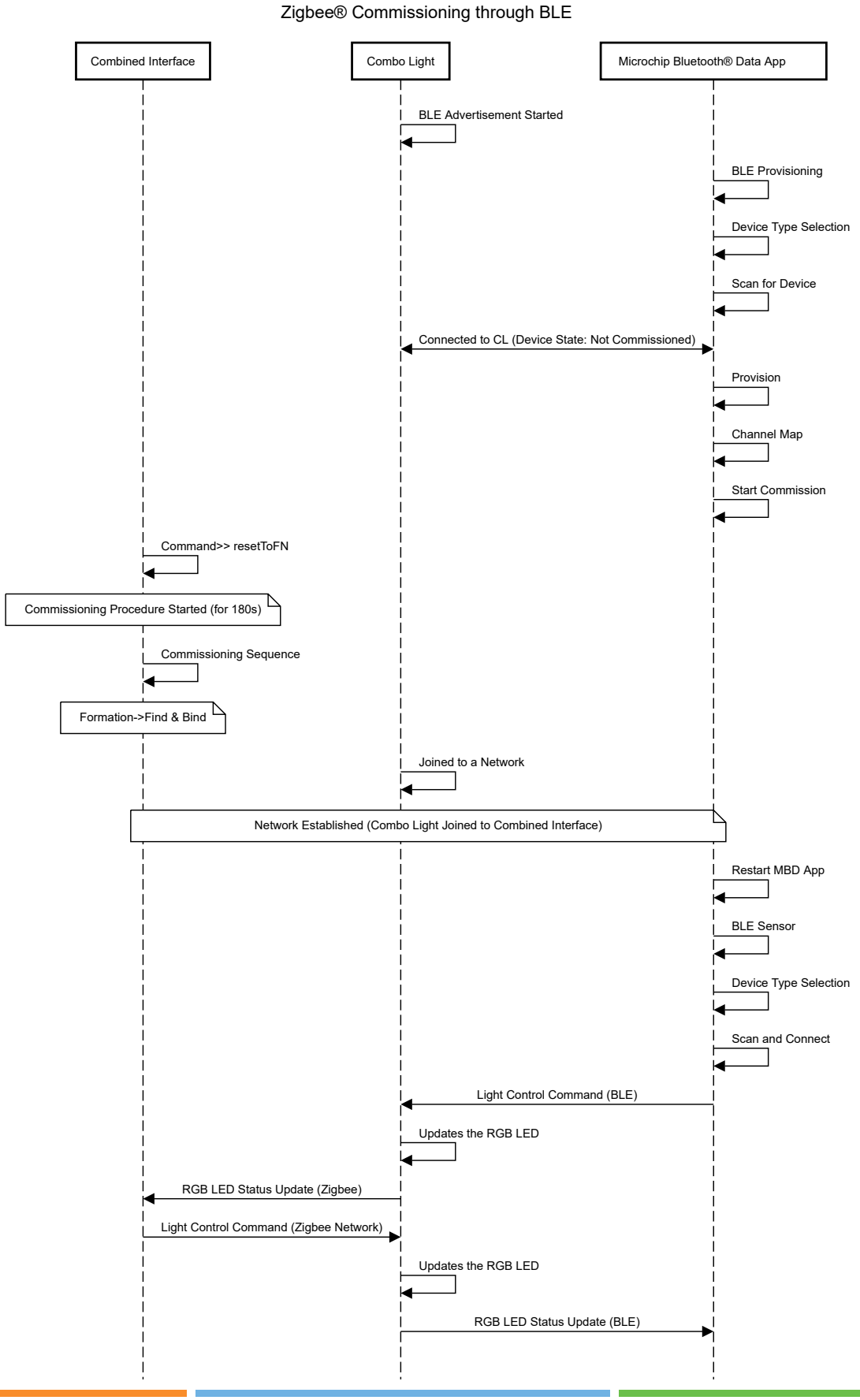
4. WBZ451HPE Curiosity Board Out of Box Demo

The ble_zigbee_light_prov demo application is pre-programmed on the Curiosity board.

This application operationalizes a variety of concepts related to Bluetooth Low Energy, Zigbee and Multiprotocol (Bluetooth Low Energy and Zigbee) technologies.

For more details of the Out-of-Box (OOB) demo source code and demo guide, refer to the Preprogrammed Demo Software.

Figure 4-1. Demo Application Sequence Diagram



5. Appendix A: Reference Circuit

5.1 WBZ451HPE Curiosity Board Reference Schematics

Figure 5-1. Power Distribution Switch for PKoB4

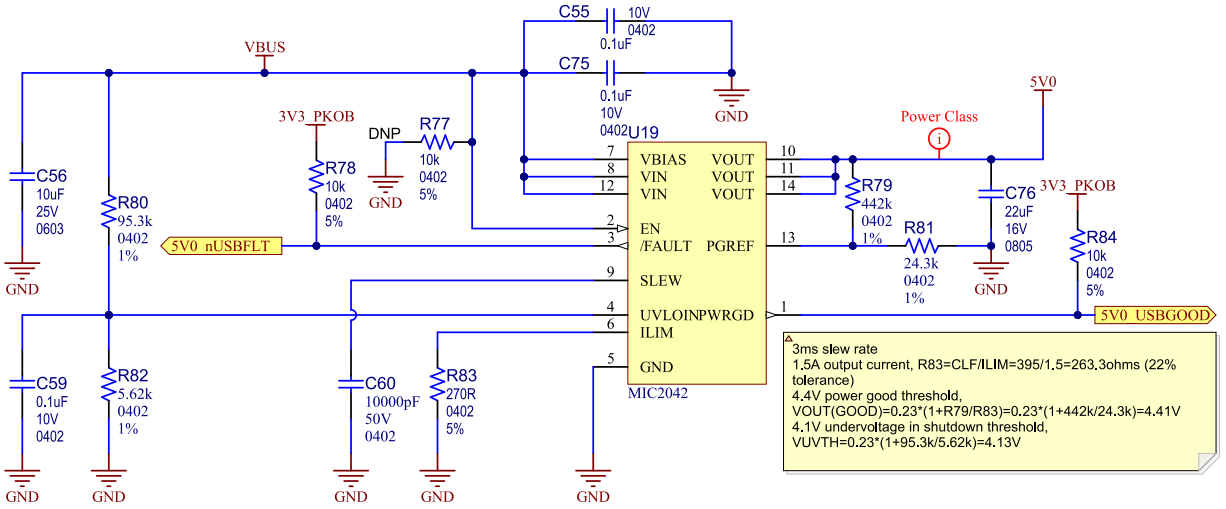


Figure 5-2. Li-Po Battery Connector/Charger

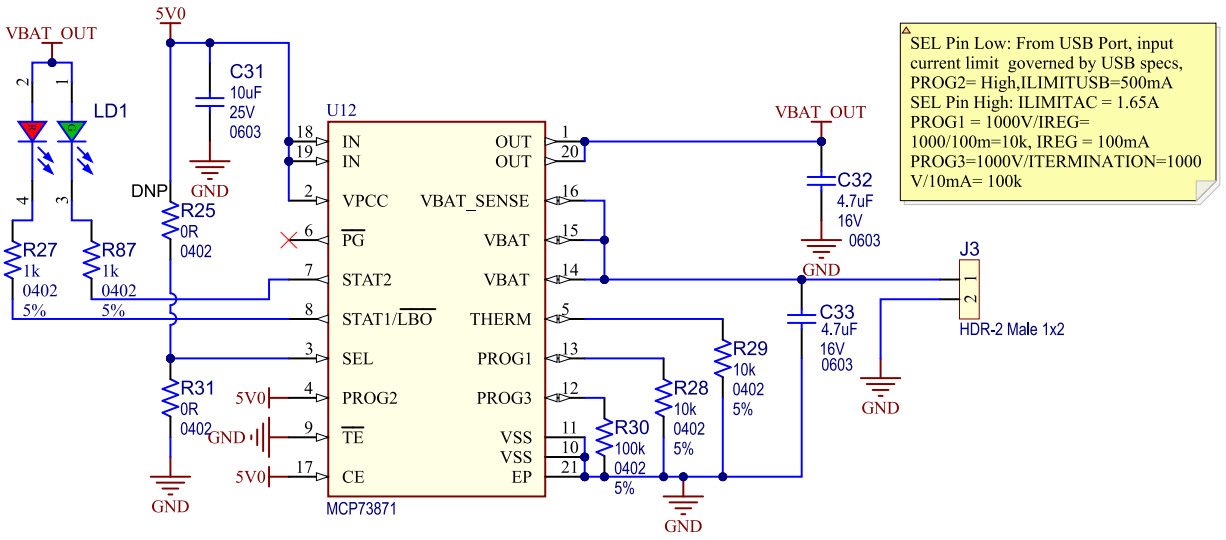


Figure 5-3. PKOB 3.3V Regulator

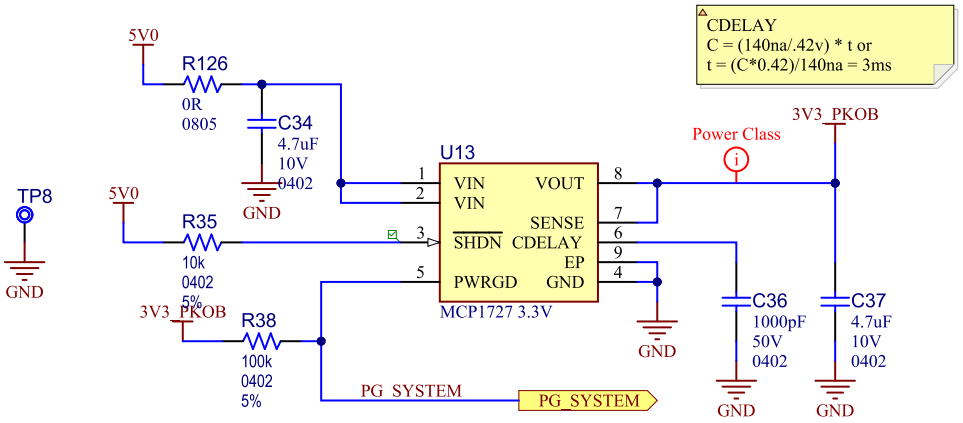


Figure 5-4. Target 3.3V Regulator

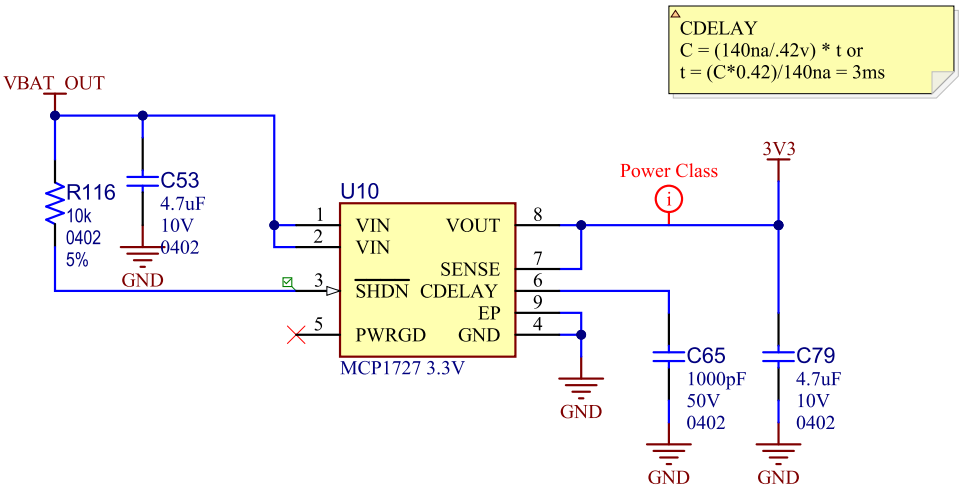


Figure 5-5. External Power Supply

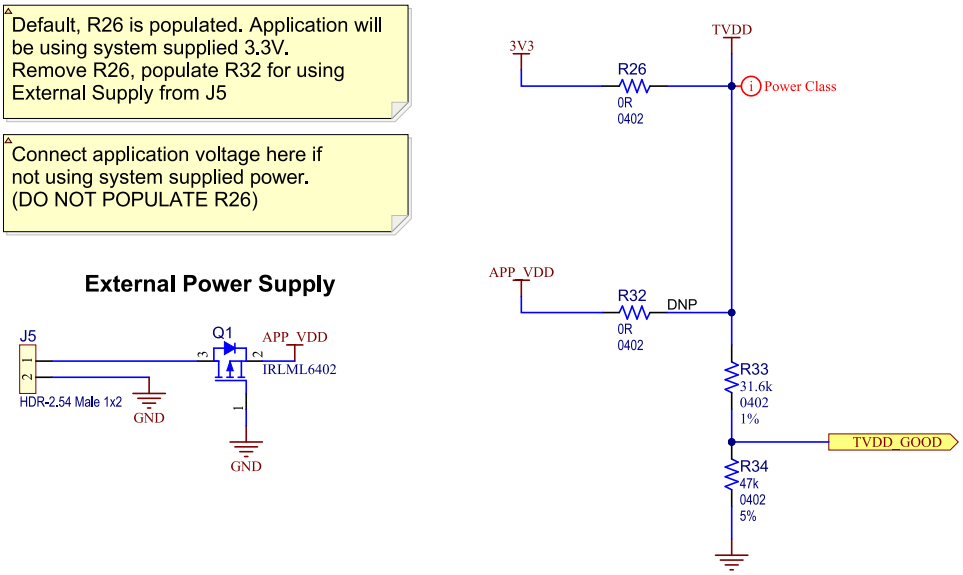
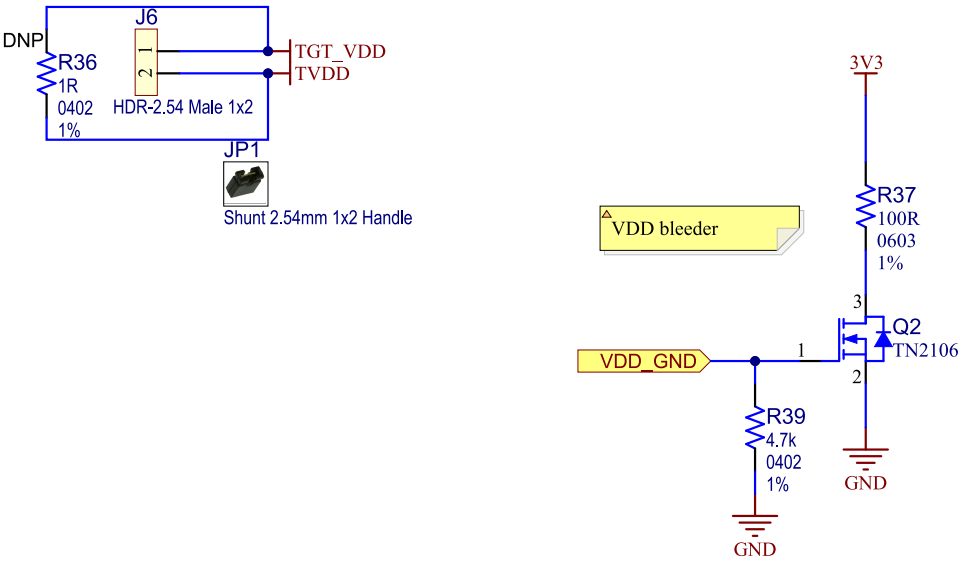


Figure 5-6. TGT Current Measurement Header



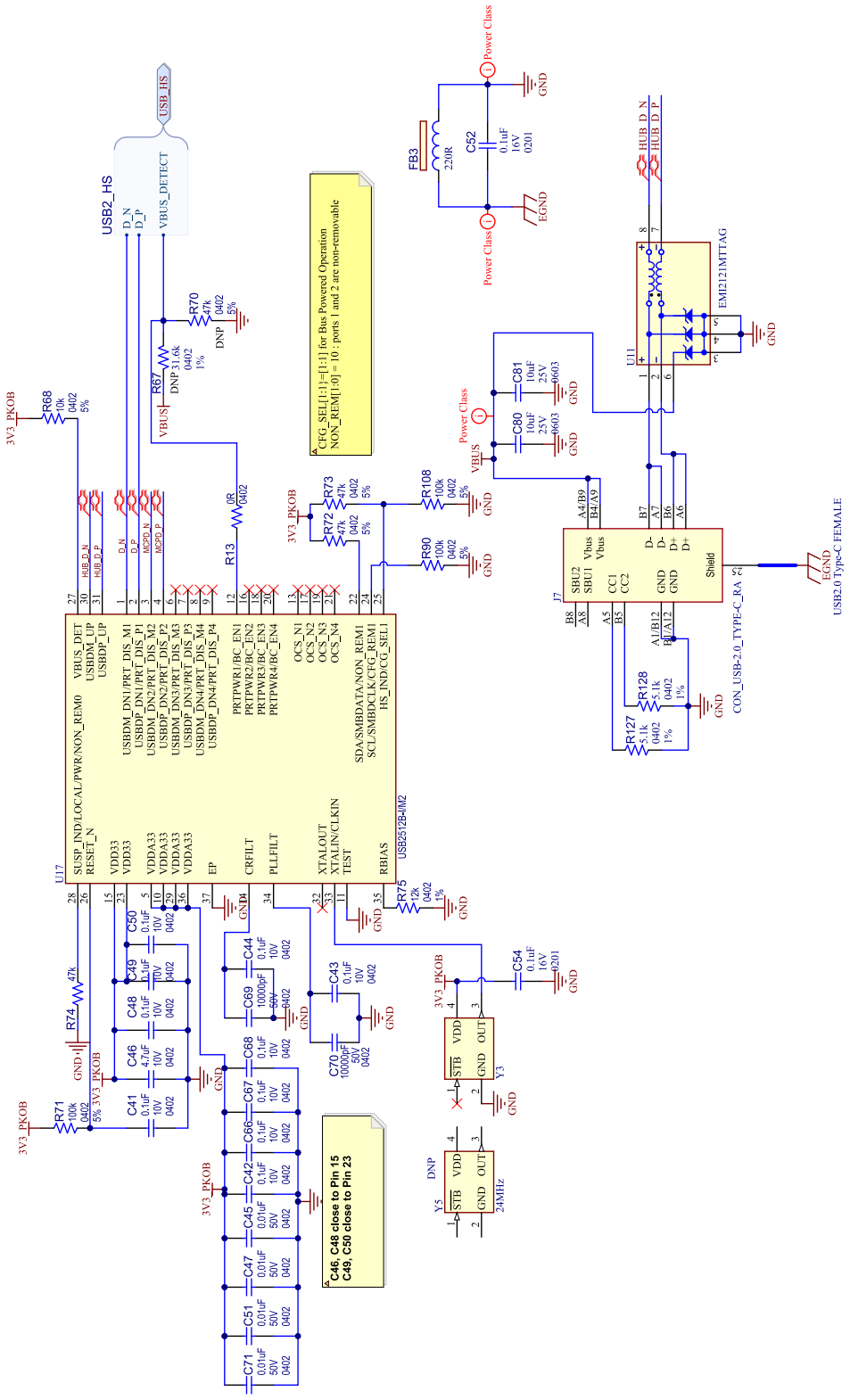


Figure 5-7. USB High Speed Hub

Figure 5-8. MCP2200 USB UART Converter

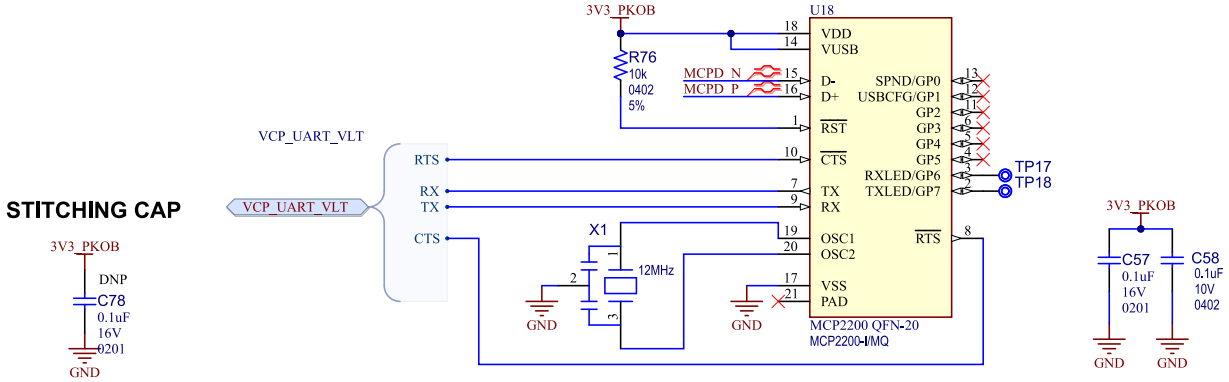
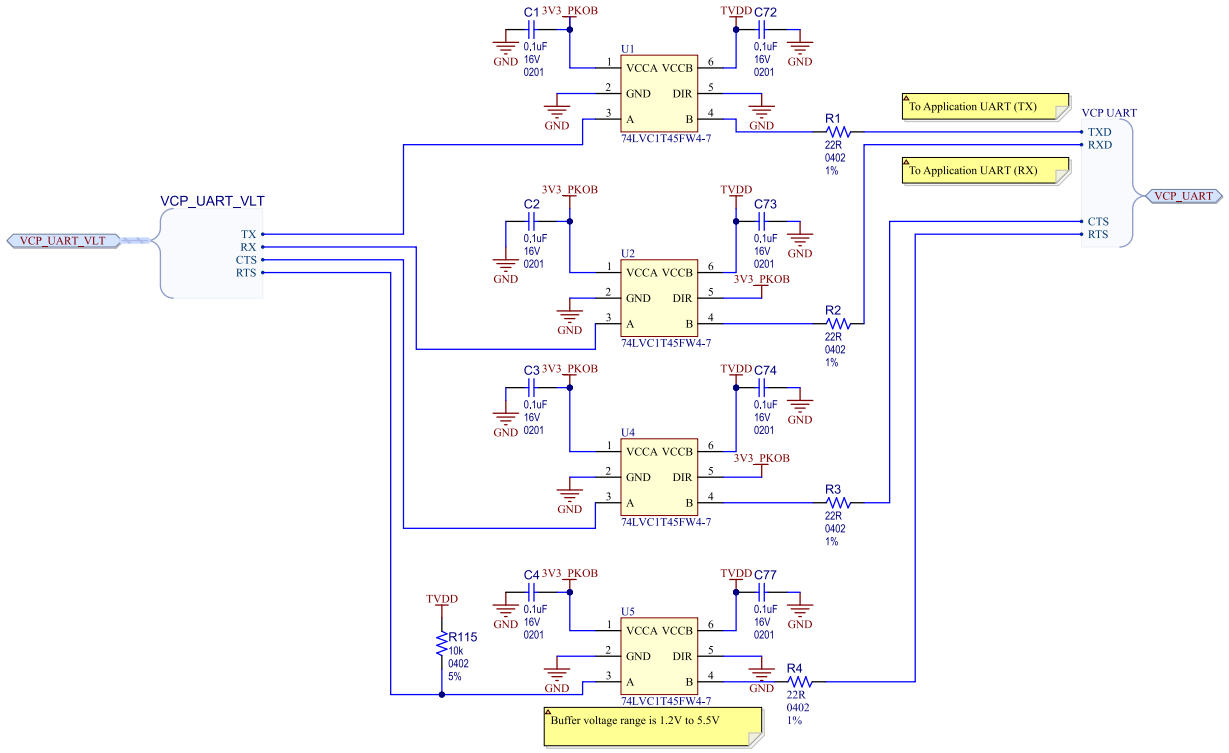


Figure 5-9. Application Virtual Comm Port



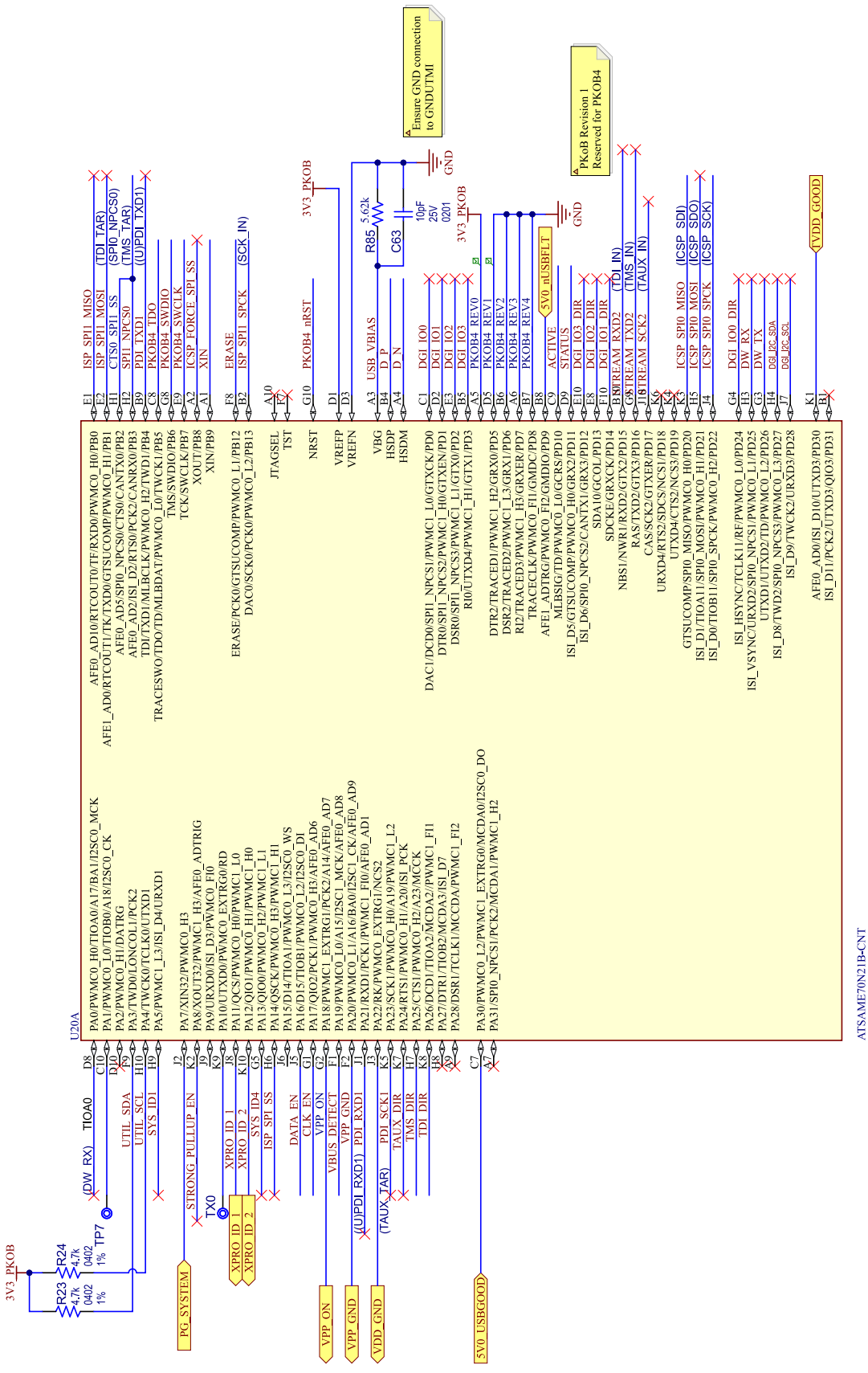


Figure 5-10. PKoB4 Main Micro 1 of 2

Figure 5-11. PKoB4 Main Micro 2 of 2

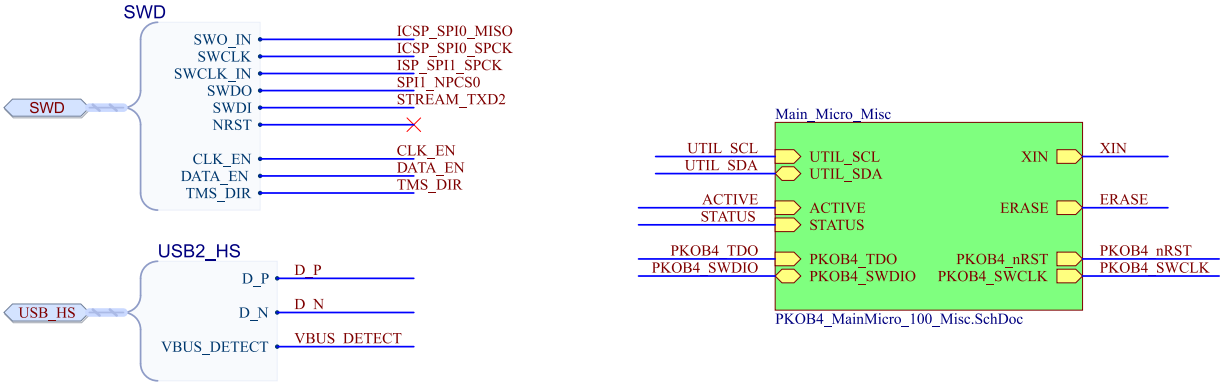


Figure 5-12. PKoB4 Debug Header Misc 1 of 2

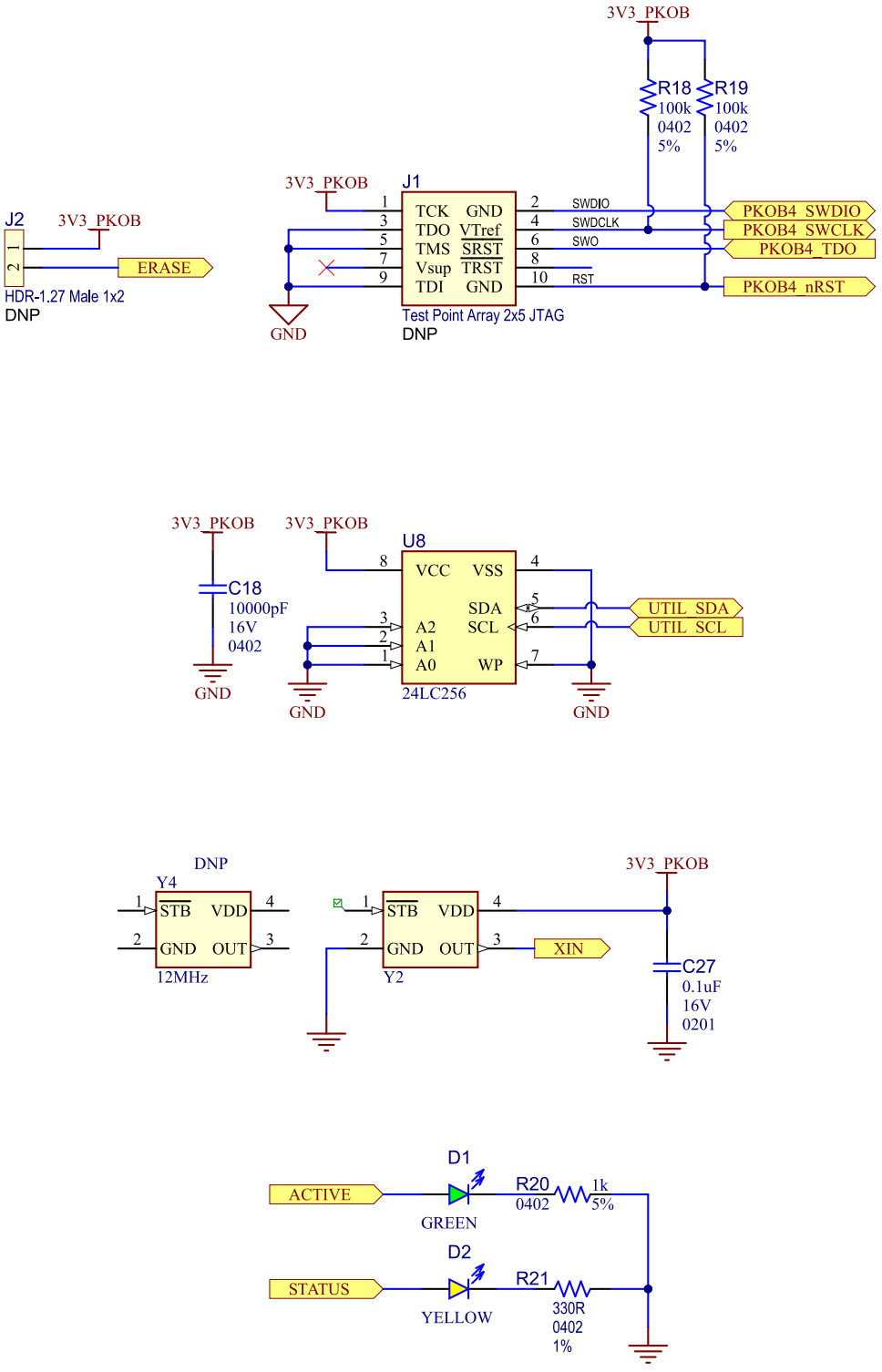


Figure 5-13. PKoB4 Debug Header Misc 2 of 2

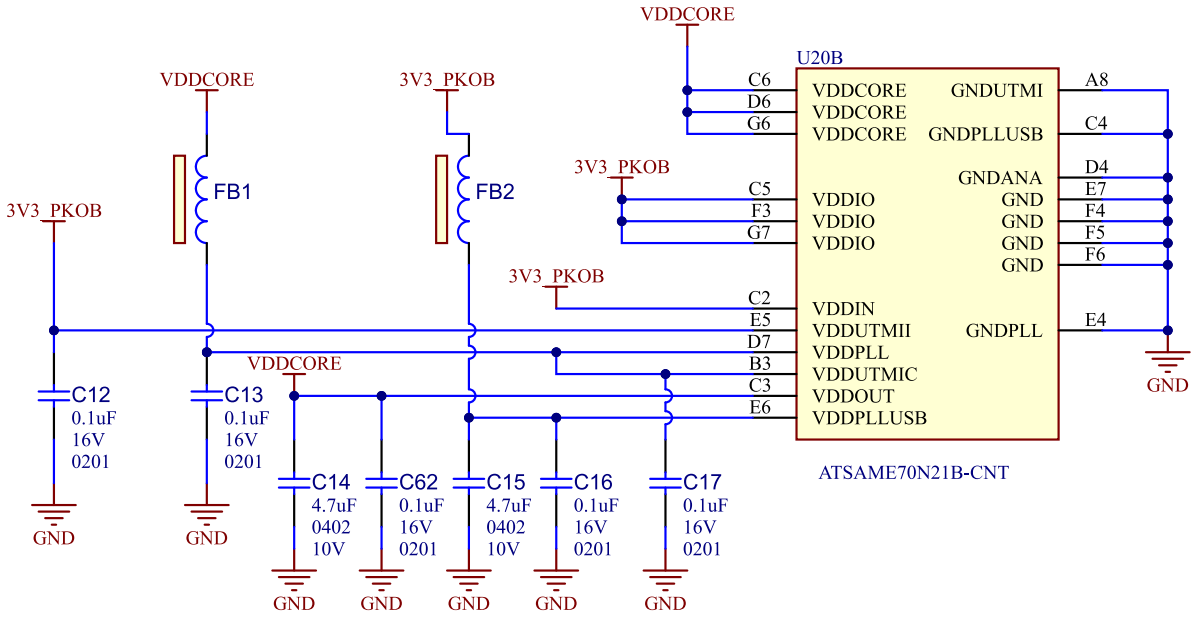


Figure 5-14. VDDCORE Bypass Caps

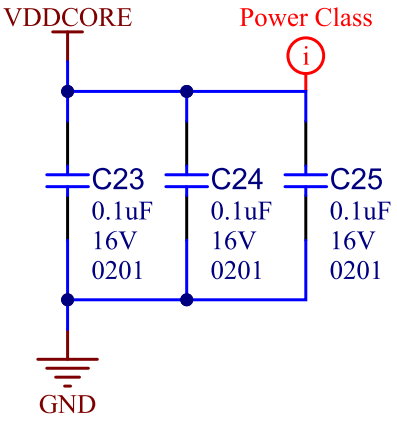


Figure 5-15. VDDIO Bypass Caps

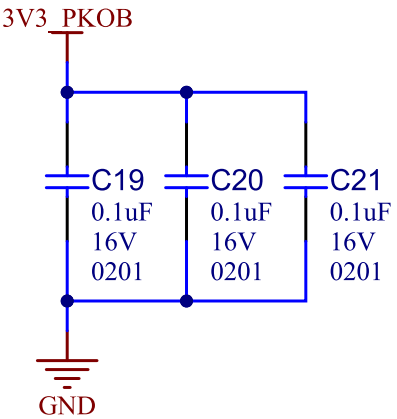
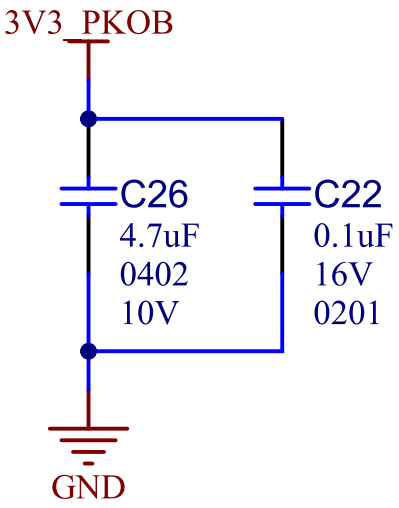


Figure 5-16. VDDIN Cap



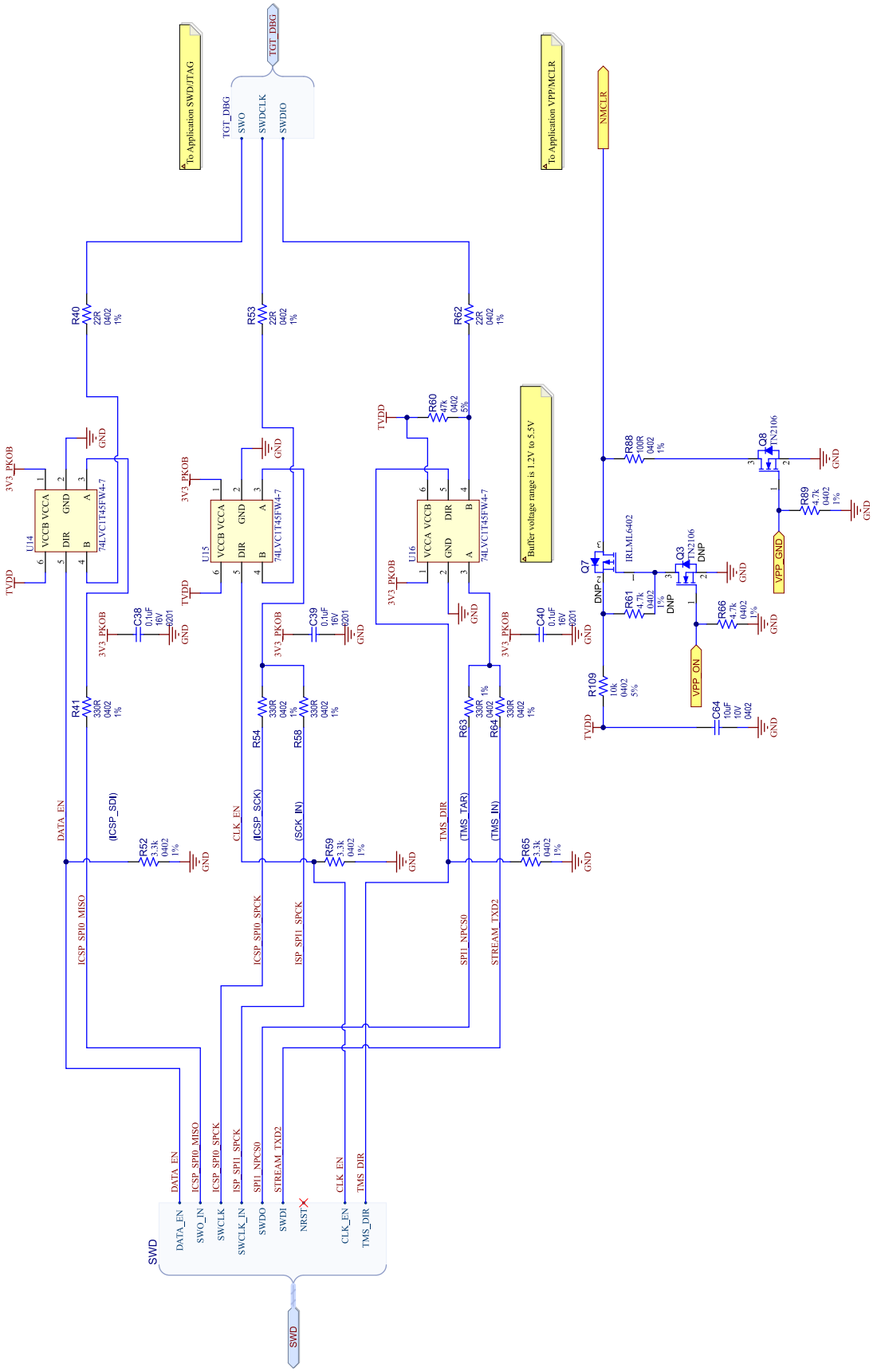


Figure 5-17. Serial Wire Debug

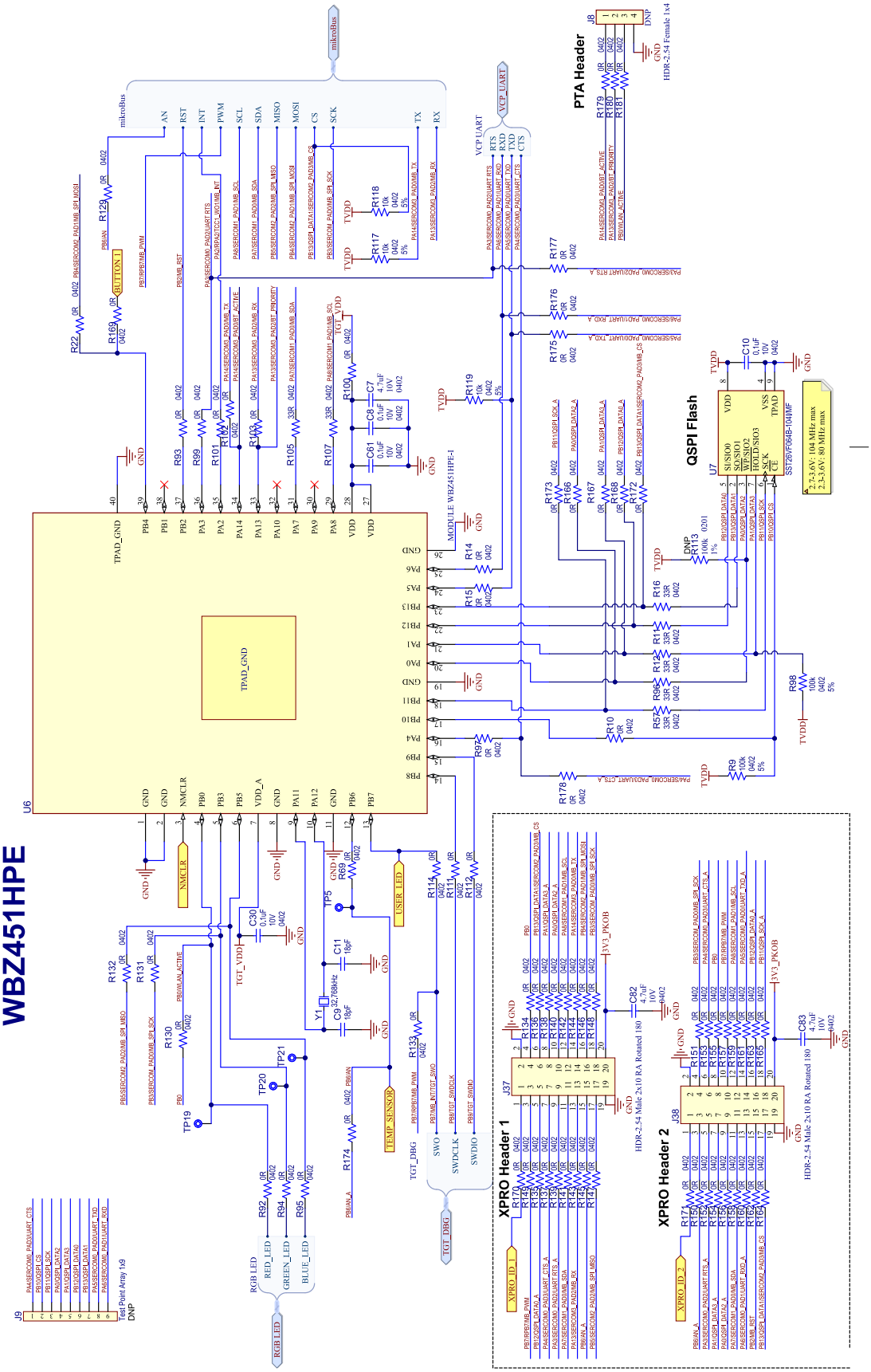


Figure 5-18. WBZ451HPE Curiosity Board

Figure 5-19. mikroBUS Click Host with Crypto IC

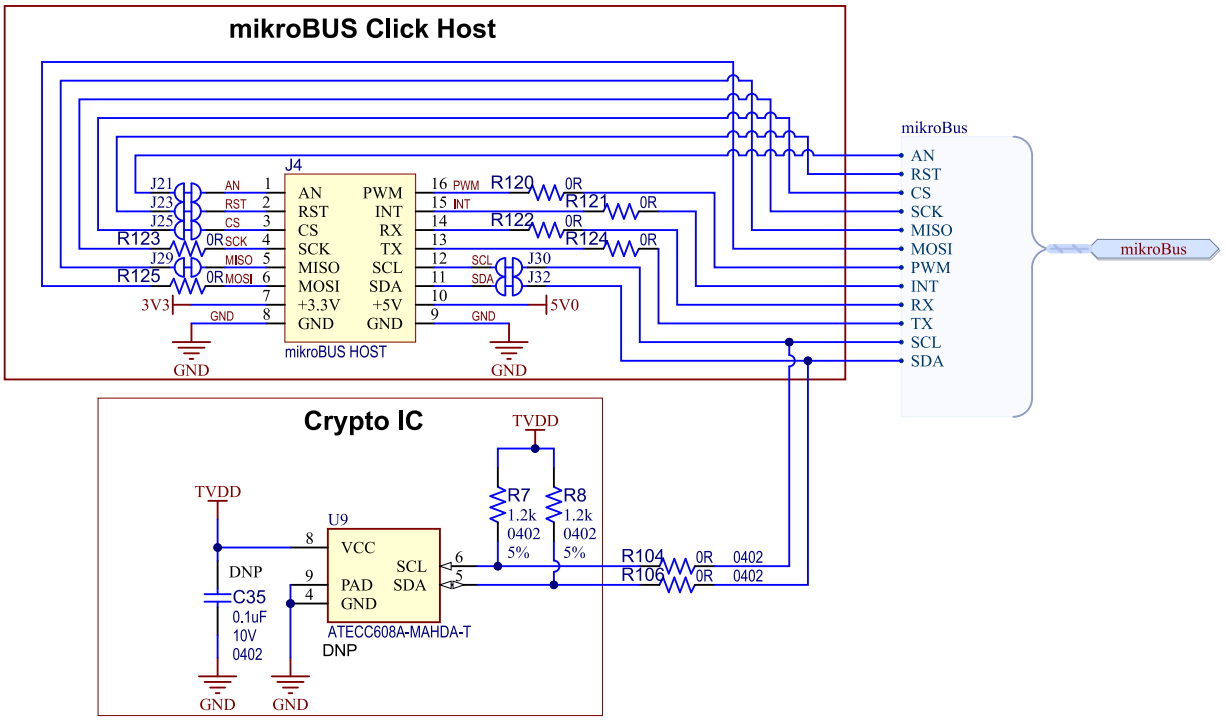


Figure 5-20. RGB LED

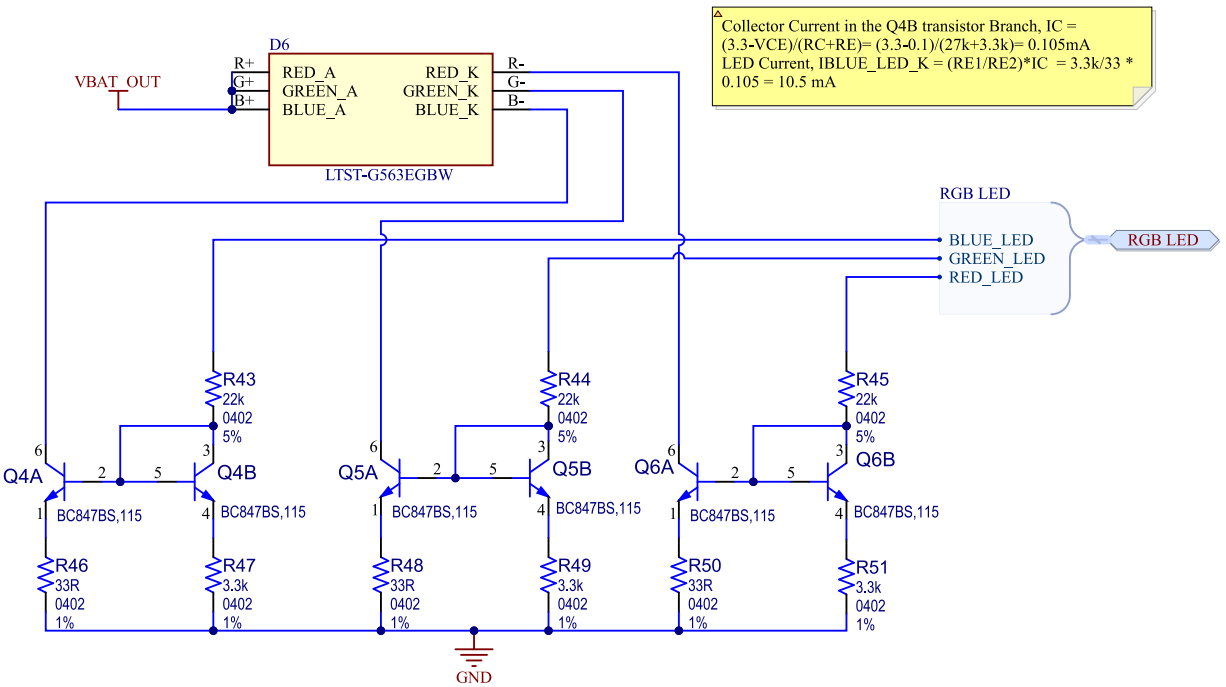


Figure 5-21. Temperature Sensor

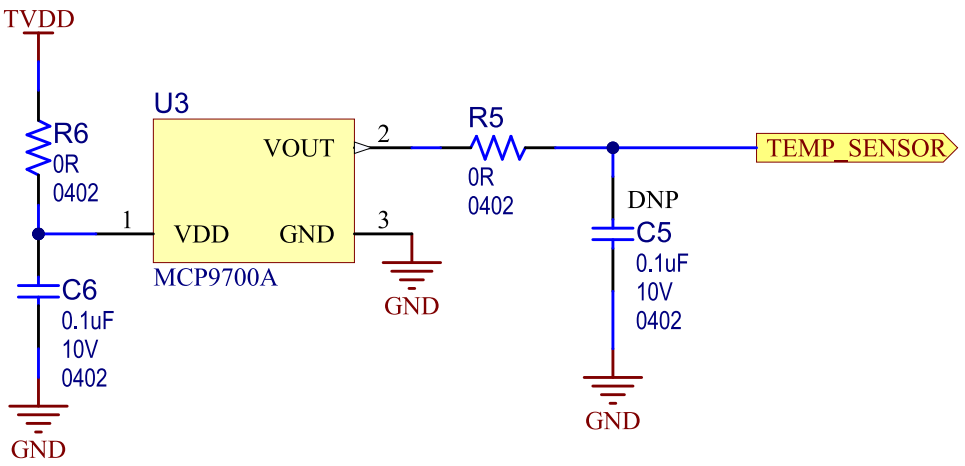


Figure 5-22. Debug Header with Reset Button and User Button

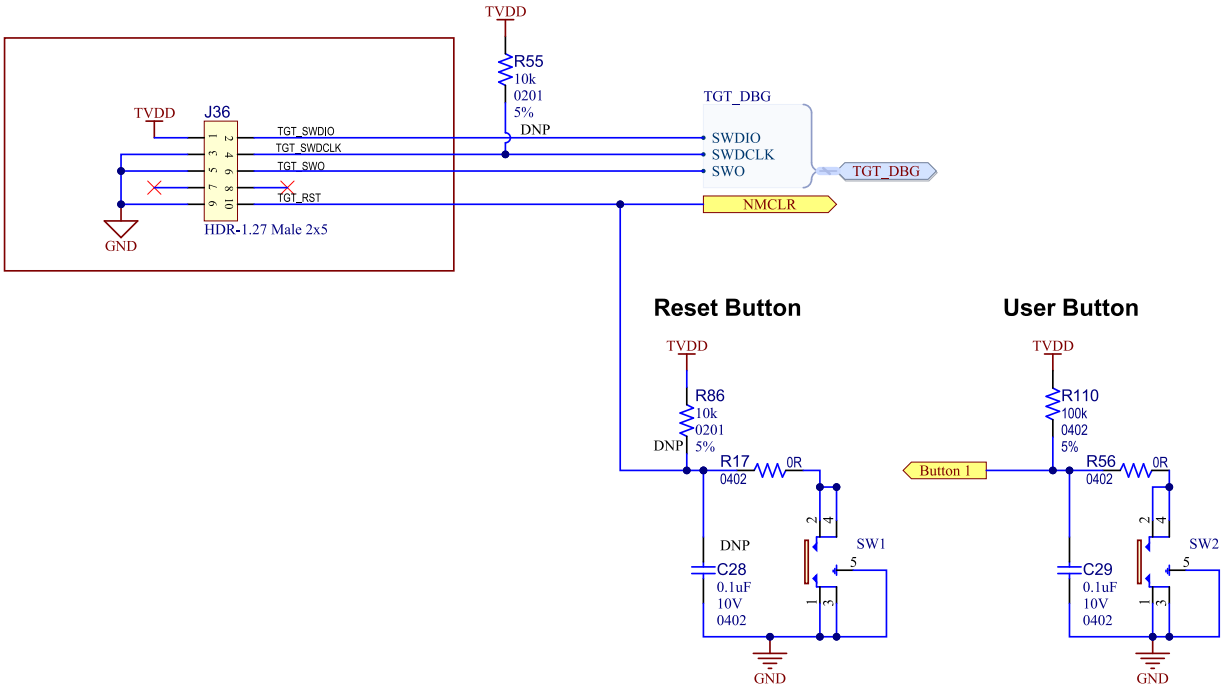
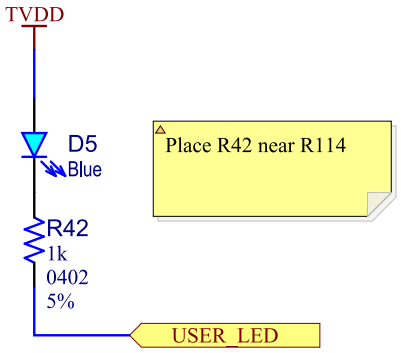


Figure 5-23. User LED



6. Appendix B: Regulatory Approval

This equipment (WBZ451HPE Curiosity Board/EV79Y91A) is an evaluation kit and not a finished product. It is intended for laboratory evaluation purposes only. It is not directly marketed or sold to the general public through retail; it is only sold through authorized distributors or through Microchip. Using this requires a significant engineering expertise towards understanding of the tools and relevant technology, which can be expected only from a person who is professionally trained in the technology.

Regulatory compliance settings have to follow the WBZ451HPE module certifications. The following regulatory notices are to cover the requirements under the regulatory approval.

6.1 United States

The WBZ451HPE Curiosity Board (EV79Y91A) contains the WBZ451HPE module, which has received Federal Communications Commission (FCC) CFR47 Telecommunications, Part 15 Subpart C “Intentional Radiators” single-modular approval in accordance with Part 15.212 Modular Transmitter approval.

Contains FCC ID: 2ADHKWBZ451H

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Important: FCC Radiation Exposure Statement
This equipment complies with FCC radiation exposure limits set forth for uncontrolled environment. The antenna(s) used for this transmitter must be installed to provide a separation distance of at least 8 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter. This transmitter is restricted for use with the specific antenna(s) tested in this application for certification.

CAUTION Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

6.2 Canada

The WBZ451HPE Curiosity Board (EV79Y91A) contains the WBZ451HPE module, which has been certified for use in Canada under Innovation, Science and Economic Development Canada (ISED, formerly Industry Canada) Radio Standards Procedure (RSP) RSP-100, Radio Standards Specification (RSS) RSS-Gen and RSS-247.

Contains IC: 20266-WBZ451H

This device contains license-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's license-exempt RSS(s). Operation is subject to the following two conditions:

1. This device may not cause interference;
2. This device must accept any interference, including interference that may cause undesired operation of the device.

L'émetteur/récepteur exempt de licence contenu dans le présent appareil est conforme aux CNR d'Innovation, Sciences et Développement économique Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes:

1. L'appareil ne doit pas produire de brouillage;
2. L'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

⚠ WARNING

This equipment complies with radio frequency exposure limits set forth by Innovation, Science and Economic Development Canada for an uncontrolled environment. This equipment should be installed and operated with a minimum distance of 20 cm between the device and the user or bystanders.

Cet équipement est conforme aux limites d'exposition aux radiofréquences définies par d'Innovation, Sciences et Développement économique Canada pour un environnement non contrôlé. Cet équipement doit être installé et utilisé avec un minimum de 20 cm de distance entre le dispositif et l'utilisateur ou des tiers.

6.3 Europe

This equipment (EV79Y91A) has been assessed under the Radio Equipment Directive (RED) for use in European Union countries. The product does not exceed the specified power ratings, antenna specifications and/or installation requirements as specified in the user manual. A Declaration of Conformity is issued for each of these standards and kept on file as described in Radio Equipment Directive (RED).

Simplified EU Declaration of Conformity

Hereby, Microchip Technology Inc. declares that the radio equipment type [EV79Y91A] is in compliance with Directive 2014/53/EU.

The full text of the EU declaration of conformity is available at www.microchip.com/en-us/development-tool/EV79Y91A (See *Conformity Documents*).

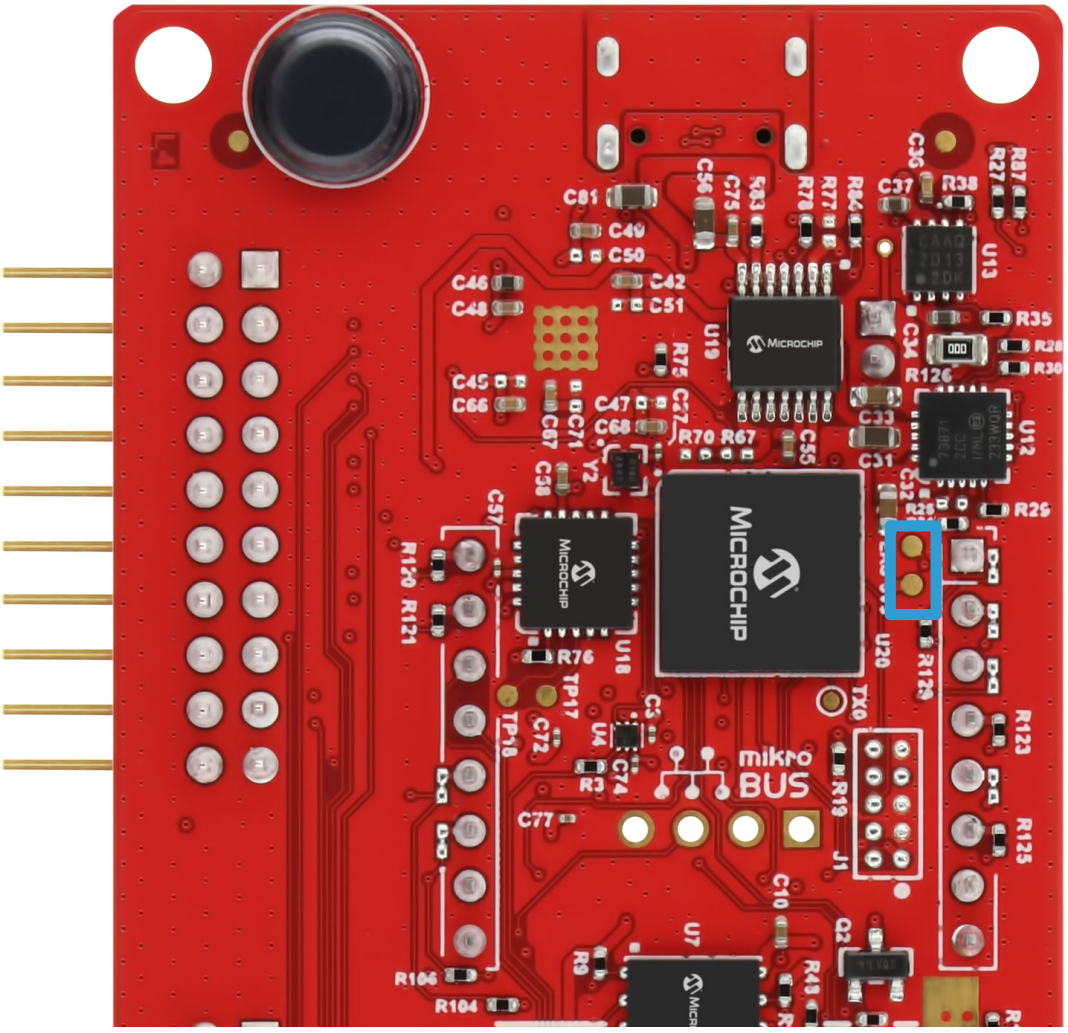
7. Appendix C: PKOB4 Recovery Method

When the MPLAB PICkit On-Board 4 is not responding, in rare cases, the user can recover its operation by following these steps:

WARNING Only use this utility to restore the hardware tool boot firmware to its factory state. Use only if the hardware tool no longer functions on any machine.

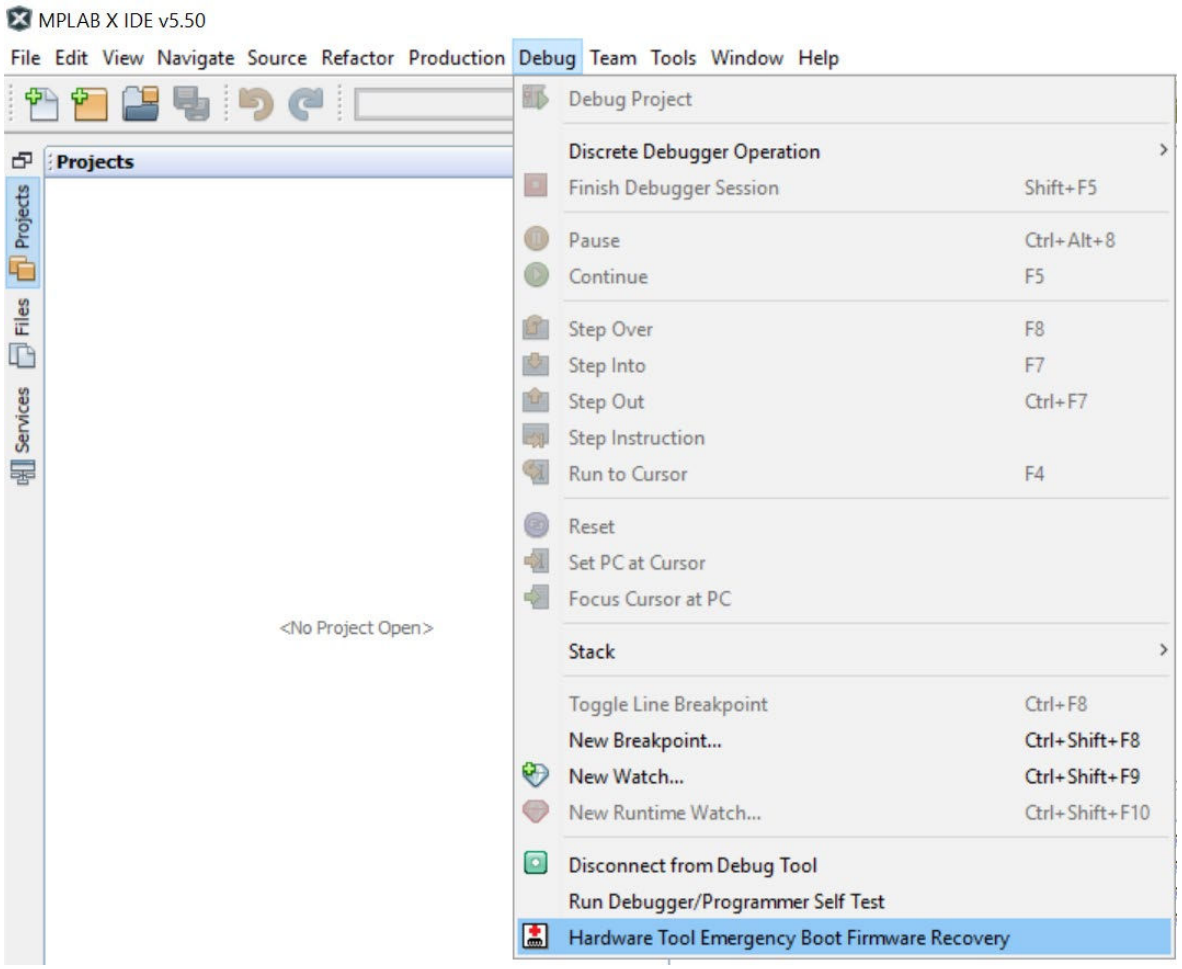
1. With the WBZ451HPE Curiosity Board still being powered, short the two pads for approximately ten seconds.

Figure 7-1. Location of Pads to Short



2. Open the latest version of MPLAB X. For more details, refer to 1.3. Software Prerequisites.
3. Navigate to *Debug>Hardware Tool Emergency Boot Firmware Recovery*.

Figure 7-2. Hardware Tool Emergency Boot Firmware Recovery



4. Follow the directions on the screen. This resets the tool back to the factory conditions.
   Note: For additional information on the MPLAB PKOB4, refer to the *MPLAB® PICkit™ 4 In-Circuit Debugger User's Guide* (DS50002751) and *MPLAB® Snap In-Circuit Debugger User's Guide* (DS50002787).

8. Document Revision History

The revision history describes the changes that were implemented in the document. The changes are listed by revision, starting with the most current publication.

Table 8-1. Document Revision History

Revision	Date	Section	Description
A	05/2024	Document	Initial revision

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