XB122 Breakout Board Product Brief

XB122 Breakout Board Product Brief

Proprietary and Confidential

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Version 1.2: 2021-04-21

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1 Introduction

This document describes the Acconeer XB122 breakout board for the XM122 IoT module. The breakout board provides an interface for the XM122 IoT module so that it can easily be flashed and debugged. It also has an internal power supply as well as a battery holder to be able to develop battery driven IoT applications.

For More information please read:

- XM122 Data Sheet
- XM122_XB122 User Guide

2 XB122 Breakout Board

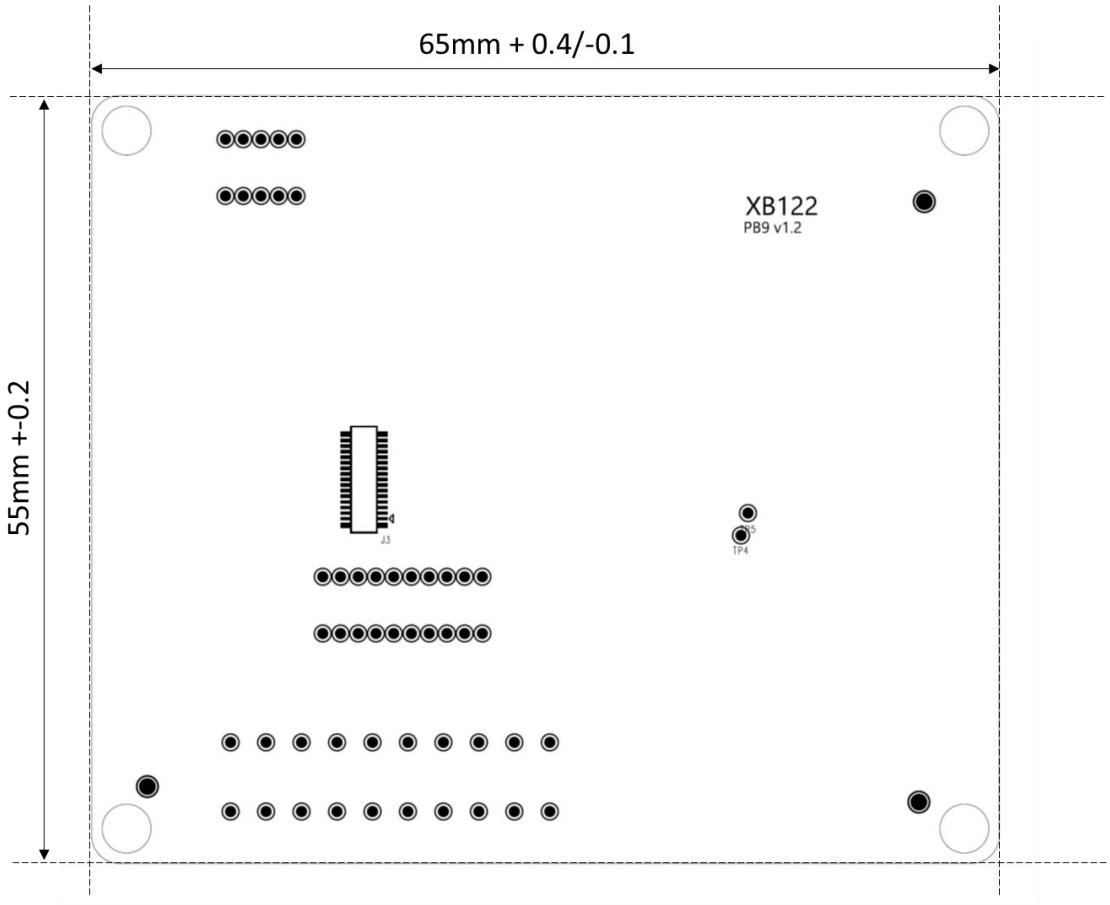
2.1 Overview

The XB122 breakout board for the XM122 module is designed to make the interfaces from the XM122 module accessible for evaluation and debug. With the XB122 breakout board, flashing of XM122 can be done either via the USB to UART interface or the SWD/JTAG interface. The XM122 is connected to the XB122 via a board-to-board connector on the top side of the XB122 PCB.

In addition to the board-to-board connector for the XM122, the XB122 comprises a USB micro B receptacle, a 2x5 pin header and a 2x10 pin header. There are two buttons on the XB122, marked DFU and NRST. The NRST button is connected to the reset pin of the nRF52840 MCU and the DFU is used for “Device Firmware Update”. An LDO, a CR2477 coin cell battery connector and a FTDI chip that converts USB into UART is also available on the board.

The picture below shows the XB122 radar module breakout board. The leftmost picture shows the front side of the XB122, with the board-to-board connector for the XM122 module, and the rightmost picture shows the reverse side of the XB122.

The picture below shows the dimensions of the XB122.



The thickness of the PCB is 0.8mm +- 0.2 mm. The diameter of the holes is 3.2mm.

The block diagram of XB122 is found in Figure 1 below.

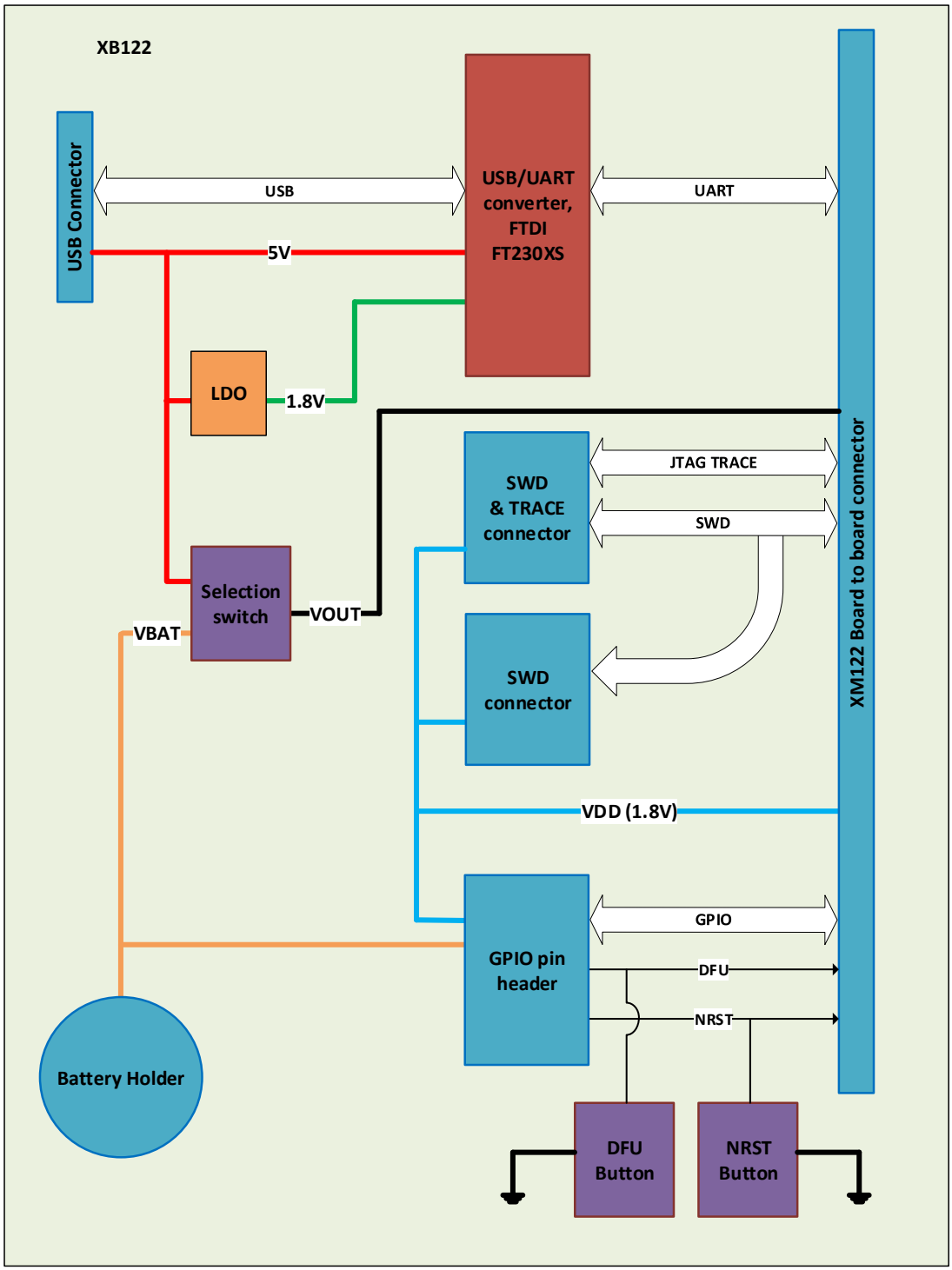


Figure 1. The block diagram of XB122.

2.2 Power

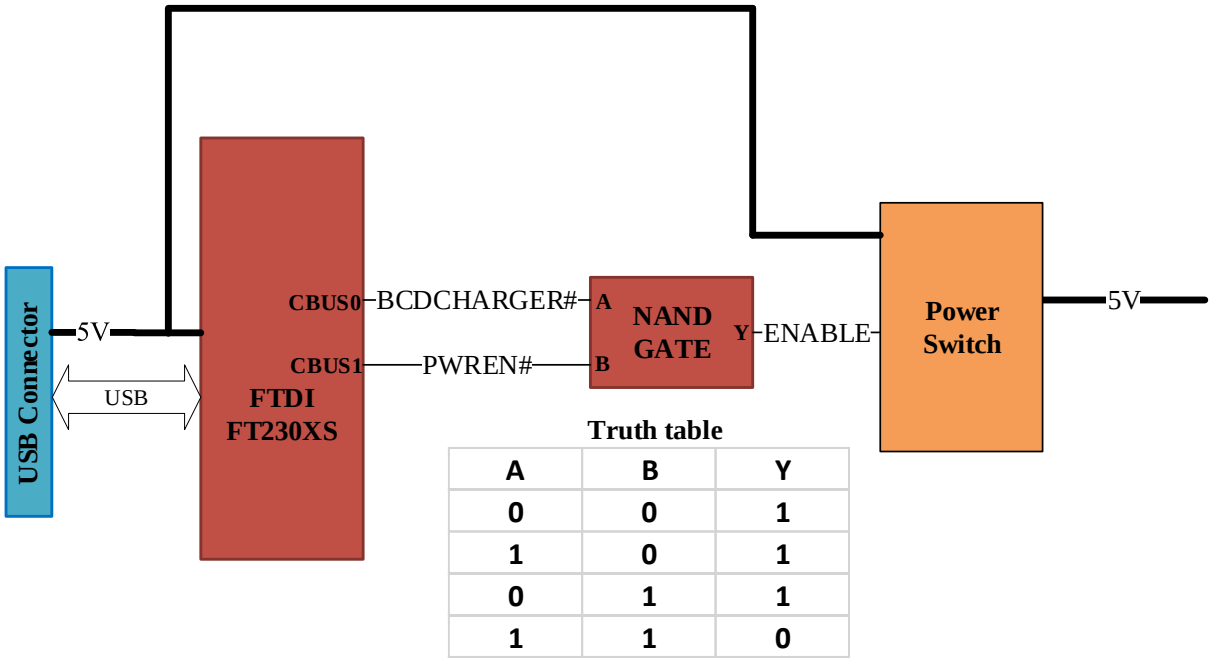
The XB122 is powered via the USB connector. The USB 5V power domain supplies the USB-UART chip (U1). If the USB-UART interface is not used, a dedicated USB charger can be used.

When the LED D1 on the XB122 is lit, the USB-UART chip is powered and ready to use. If SW1 is set to “USB” it also means that XM122 is powered and ready to use (if connected to the board-to-

board connector on the top side of XB122). Alternatively, if SW1 is set to “BATTERY”, the XM122 is powered from a CR2477 battery. However, the internal XB122 circuitry is still powered from the USB so that the battery power is only dedicated to the XM122 module. A CR2477 battery is not provided with EVK.

The 5 V from the USB connector is supplied directly to the USB-UART chip 5V input. It also powers an LDO (Low Drop-Out power regulator) that generates 1.8V for the USB-UART chip GPIOs.

The ENABLE signal of the power switch (U2) is controlled by GPIOs on the USB-UART chip FT230XS. As shown in Figure 2, the GPIOs “CBUS0” and “CBUS1” are connected to a NAND gate (U3) which in turn enables the power switch. “CBUS0” is configured as “BCDCHARGER#” and “CBUS1” is configured as “PWREN#” as default.



Truth table

A	B	Y
0	0	1
1	0	1
0	1	1
1	1	0

Figure 2. Block Diagram showing the logic control of the Power Switch ENABLE signal.

“BCDCHARGER#” will output a logic “0” if a USB Dedicated Charger is detected. This means that the XB122 can be powered from a USB Dedicated Charger if no data is to be sent. “PWREN#” will output a logic “0” as soon as the FT230XS has been configured by the USB host. This prevents excess current being drawn by the XM122 during USB enumeration of FT230XS, since no power will be available for the XM122 until USB enumeration is completed. For details regarding the configuration of FT230XS refer to chapter 2.5.

If the USB host on the external processing unit enters suspend mode, PWREN# will be set high and the powerswitch will be disabled. It is therefore important to ensure that the external processor USB host doesn’t enter suspend mode unintentionally.

2.3 Connectors

USB (J1)

USB is used as power supply for the XB122 and the XM122 as well as for flashing and communicating over UART. USB is connected to the FTDI chip FT230XS which converts the UART interface from XM122 into USB data signals. The pinout of J1 is shown in Table 1.

Table 1. The pinout of J1.

Pin Number	Signal
1	VBUS
2	D-
3	D+
4	ID (GND)
5	GND

30 pin board-to-board connector (J3)

The 30-pin board-to-board connector is intended to connect the XM122 to the XB122. The pinout is found in Table 2.

Table 2. The pinout of J3.

Pin Number	Signal	Pin Number	Signal
1	GPIO P0.23[1]	2	GND
3	GND	4	VOUT
5	GPIO P0.21[1]	6	VOUT
7	GND	8	GND
9	GPIO P0.24[1]	10	GPIO P0.04
11	GND	12	GPIO P0.11 / TRACEDATA2
13	GPIO P0.22[1]	14	GPIO P0.12 / TRACEDATA1
15	GND	16	VDD (Regulated 1.8V output voltage)
17	GPIO P0.06 / UART_TX	18	nRESET
19	GPIO P0.16 / UART_RX	20	SWDIO
21	GND	22	SWO / GPIO P1.00 / TRACEDATA0
23	GPIO P0.07 / TRACECLK	24	GND
25	GPIO P1.09 / TRACEDATA3	26	SWDCLK

[1] On XB122, the routing of GPIOs P0.23, P0.21, P0.24 and P0.22 between J3 and J5 has been optimized for SPI interface configuration.

Pin Number	Signal	Pin Number	Signal
27	GPIO P0.20 / UART_CTS	28	GND
29	GPIO P0.19 / UART_RTS	30	GPIO P0.25 / DFU

2x5 JTAG/SWD pin header (J4)

The 2x5 JTAG/SWD pin header (1.27 mm pitch) contains the signals needed for flashing the XM122 MCU via the SWD interface. The pinout matches that of the Cortex 10-pin JTAG/SWD Connector and is found in Table 3.

Table 3. The pinout of J4.

Pin Number	Signal	Pin Number	Signal
1	1.8V	2	SWDIO
3	GND	4	SWDCLK
5	GND	6	TRACESWO
7	NC	8	NC
9	GND	10	NRST

2x10 pin header (J5)

The J5 pin header is a miscellaneous 2x10 pin header (2.54 mm pitch) and provides a connection to the XM122 GPIOs as well as VBAT. The pinout is found in Table 4.

Table 4. The pinout of J5.

Pin Number	Signal	Pin Number	Signal
1	GPIO P0.23	2	GND
3	GND	4	VBAT
5	GPIO P0.21	6	GPIO P0.11/ TRACE2
7	GND	8	GPIO P0.12/ TRACE1
9	GPIO P0.24	10	GPIO P0.19/ UART_RTS
11	GND	12	GPIO P0.20/ UART_CTS
13	GPIO P0.22	14	GPIO P0.25/ DFU
15	GPIO P0.06/ UART_TX	16	GPIO P0.04
17	GPIO P0.16/ UART_RX	18	VDD (Regulated 1.8V output voltage)
19	nRESET	20	GND

2.4 Switches and buttons

There is one switch on XB122. SW1 determines if XM122 is powered from the USB 5V power domain or from a CR2477 coin cell battery. In Table 5 the position of the switch and the corresponding power source output is shown.

Table 5. The connected terminal of the switch SW1 and corresponding VOUT.

Connected Terminal	VOUT = 5V	VOUT = VBAT
1	TRUE	FALSE
2	FALSE	TRUE

There are two buttons on the XB122. SW2 controls the signal “DFU” (Device Firmware Upgrade) connected to XM122 and SW3 controls “NRST” connected to the XM122. In Table 6 the state of the buttons and the corresponding signal states are listed.

Table 6. The states of the switches SW2 and SW3.

Button	Open (default)	Closed
SW2	DFU=1	DFU=0
SW3	NRST=1	NRST=0

2.5 FTDI FT230XS USB-UART (U1)

The FT230XS is a USB 2.0 Full Speed compatible USB to serial UART converter. It is integrated on the XB122 to enable communication with the XM122 UART via USB interface. For details regarding the FT230XS refer to the datasheet [1]. For details regarding how to use the XB122 to communicate with XM122, refer to the XB122_XM122 User Guide.

The connections of the FT230XS UART interface pins are described in Table 7.

Table 7. The FT230XS UART interface pins.

FT230XS Pin Name	XB122 Connection	Comment
TXD	P0.06_UART_TX	Connected via a solder bridge. Solder bridge is closed as default.
RXD	P0.16_UART_RX	Connected via a solder bridge. Solder bridge is closed as default.
RTS	P0.19_UART_RTS	Connected via a solder bridge. Solder bridge is closed as default.
CTS	P0.20_UART_CTS	Connected via a solder bridge. Solder bridge is closed as default.

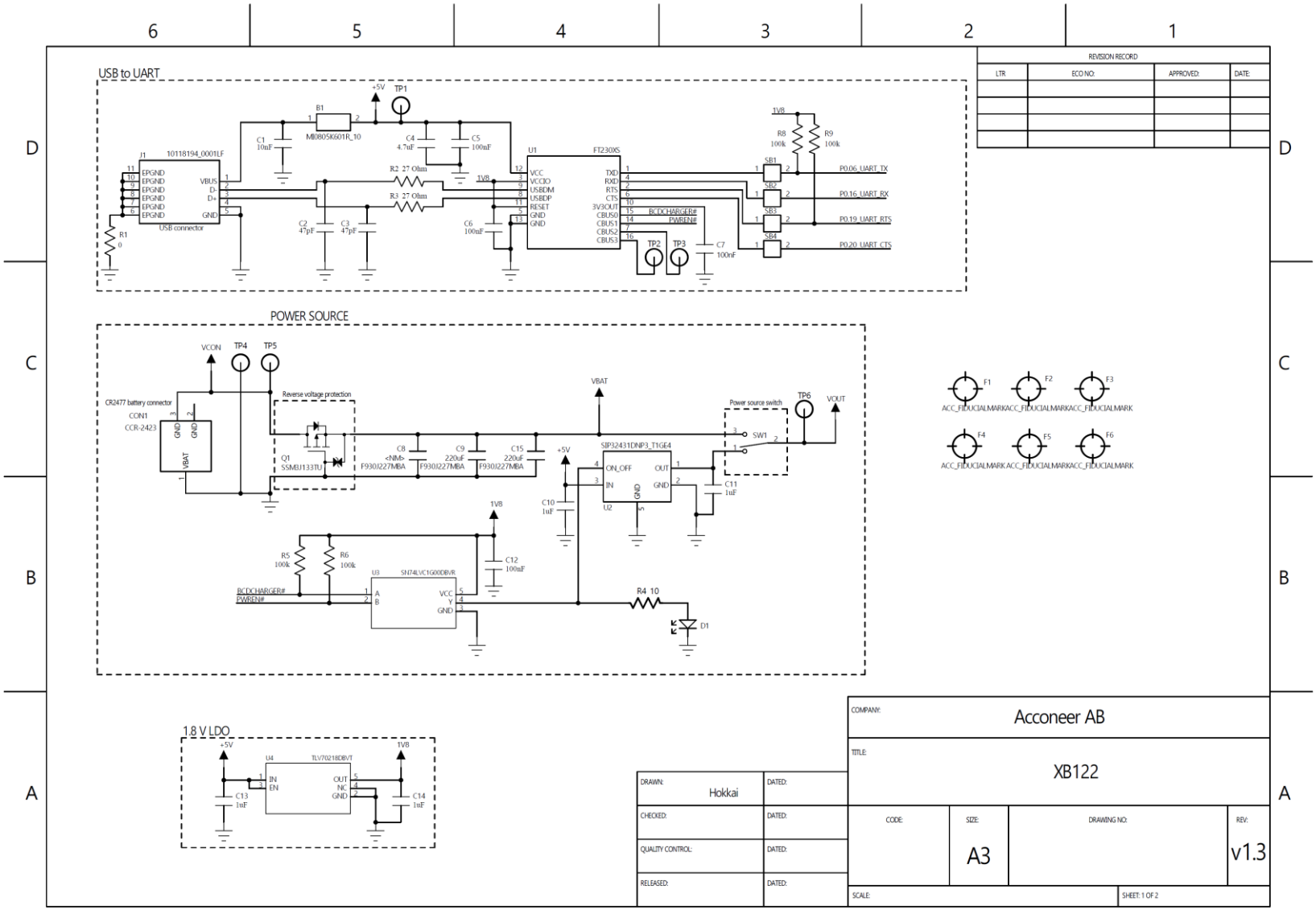
Except for the UART interface there are four GPIOs on the FT230XS. The usage and XB122 default configuration of the GPIOs are listed in Table 8. The GPIOs can be flashed via the USB interface by using the program FTPROG from FTDI. For details, refer to the FT230XS datasheet [1].

Table 8. The FT230XS GPIOs.

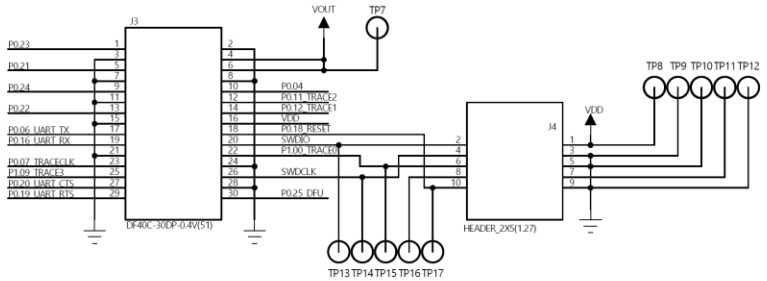
FT230XS Pin Name	XB122 Usage	Comment
CBUS0	BCDCHARGER#	Will output “0” if a USB dedicated charger is detected on USB1.
CBUS1	PWREN#	Will output “0” when the FT230XS has been configured by the USB host. Will output “1” during USB enumeration of FT230XS and if the USB host goes into suspend mode.
CBUS2	GPIO driving low, available on testpoint	For future use. Could be reconfigured via FT Prog.
CBUS3	GPIO tristate, available on testpoint	For future use. Could be reconfigured via FT Prog.

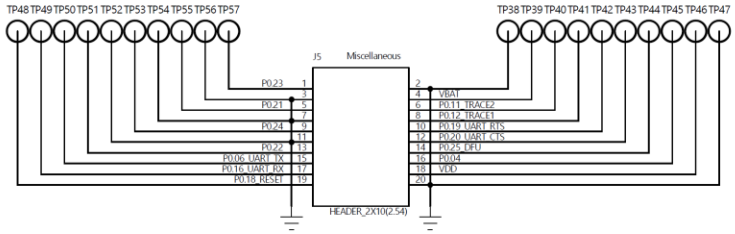
2.6 Electrical Schematics

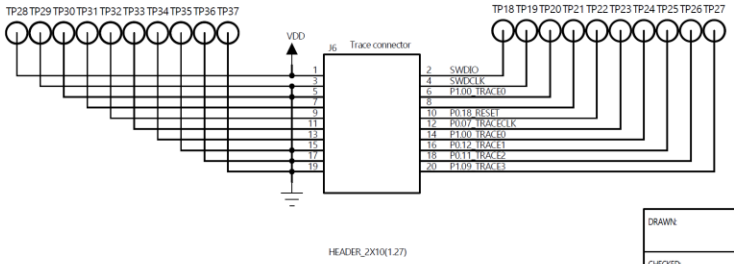
The electrical schematics for the XB122 are found on the following pages:


6
5
4
3
2
1
D
C
B
A
USB to UART
+5V
TP1
B1
MI0805K601R_10
C1
10nF
C4
4.7uF
C5
100nF
J1
10118194_0001LF
USB connector
EPGND
VBUS
D-
D+
GND
R1
0
R2 27 Ohm
R3 27 Ohm
C2
47pF
C3
47pF
1V8
C6
100nF
U1
FT230XS
VCC
VCCIO
USBDM
USBDP
RESET
GND
TXD
RXD
RTS
CTS
3V3OUT
CBUS0
CBUS1
CBUS2
CBUS3
BCDCHARGER#
PWREN#
TP2
TP3
C7
100nF
R8
100k
R9
100k
SB1
SB2
SB3
SB4
P0.06_UART_TX
P0.16_UART_RX
P0.19_UART_RTS
P0.20_UART_CTS
POWER SOURCE
VCOIN
TP4
TP5
CR2477 battery connector
CON1
CCR-2423
VBAT
Reverse voltage protection
Q1
SSMBJ133TU
C8
<NM>
C9
220uF
F930J227MBA
C15
220uF
F930J227MBA
VBAT
Power source switch
TP6
VOUT
SW1
SIP32431DNP3_T1GE4
ON_OFF
IN
OUT
GND
U2
C10
1uF
C11
1nF
R5
100k
R6
100k
U3
SN74LVC1G00DBVR
C12
100nF
R4 10
D1
ACC_FIDUCIALMARK
F1
F2
F3
F4
F5
F6
1.8 V LDO
U4
TLV70218DBVT
IN
EN
OUT
NC
C13
1uF
C14
1uF
REVISION RECORD
LTR
ECO NO:
APPROVED:
DATE:
DRAWN:
Hokkai
DATED:
CHECKED:
QUALITY CONTROL:
RELEASED:
COMPANY:
Acconeer AB
TITLE:
XB122
CODE:
SIZE:
A3
DRAWING NO:
REV:
v1.3
SCALE:
SHEET: 1 OF 2

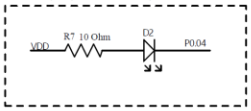
REVISION RECORD			
LTR	ECO NO:	APPROVED:	DATE:



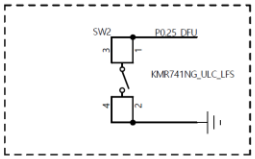




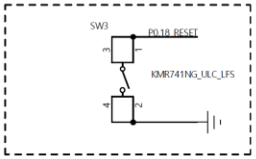
General purpose LED output



Device firmware update (DFU) button



MCU reset button

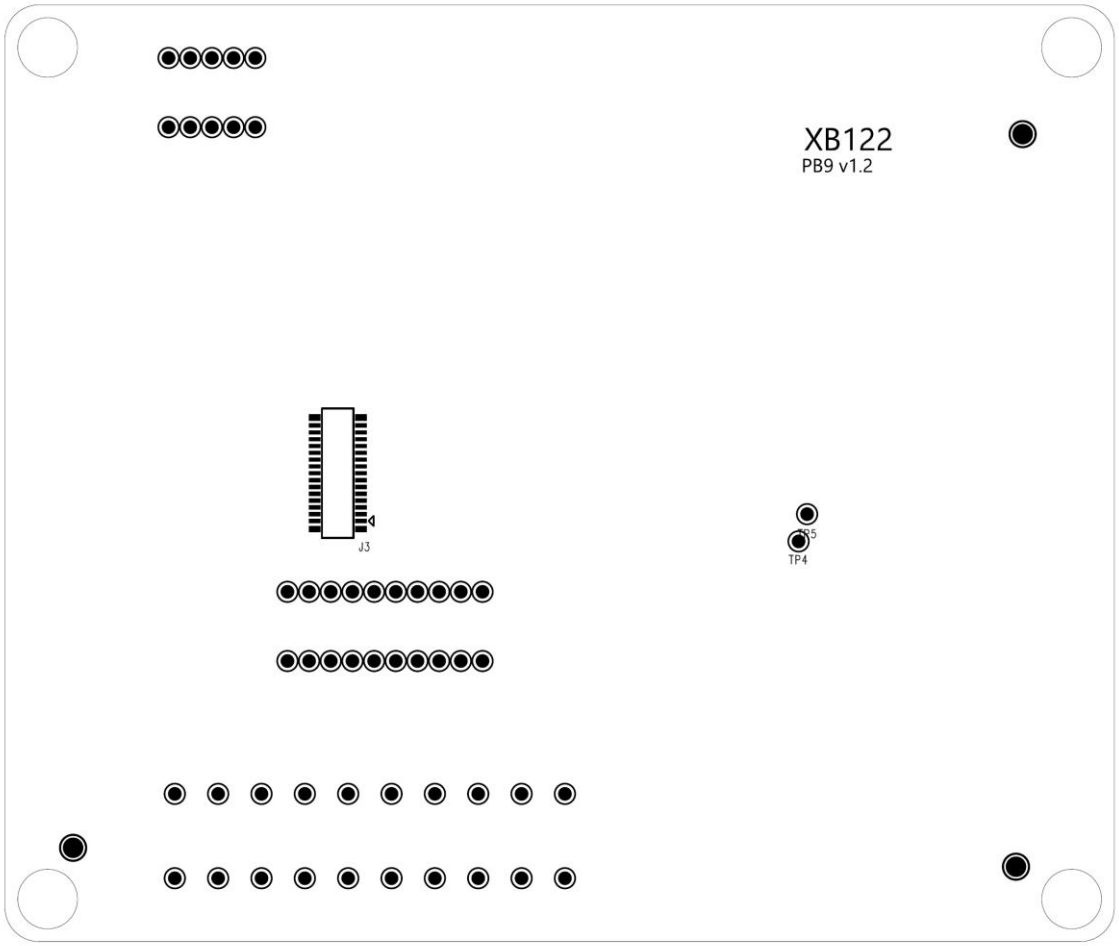


DRAWN: Hokkai	DATED:	COMPANY: Acconeer AB	
CHECKED:	DATED:	TITLE: XB122	
QUALITY CONTROL:	DATED:	CODE:	SIZE: A3 / DRAWING NO: / REV: v1.3
RELEASED:	DATED:	SCALE:	SHEET: 2 OF 2

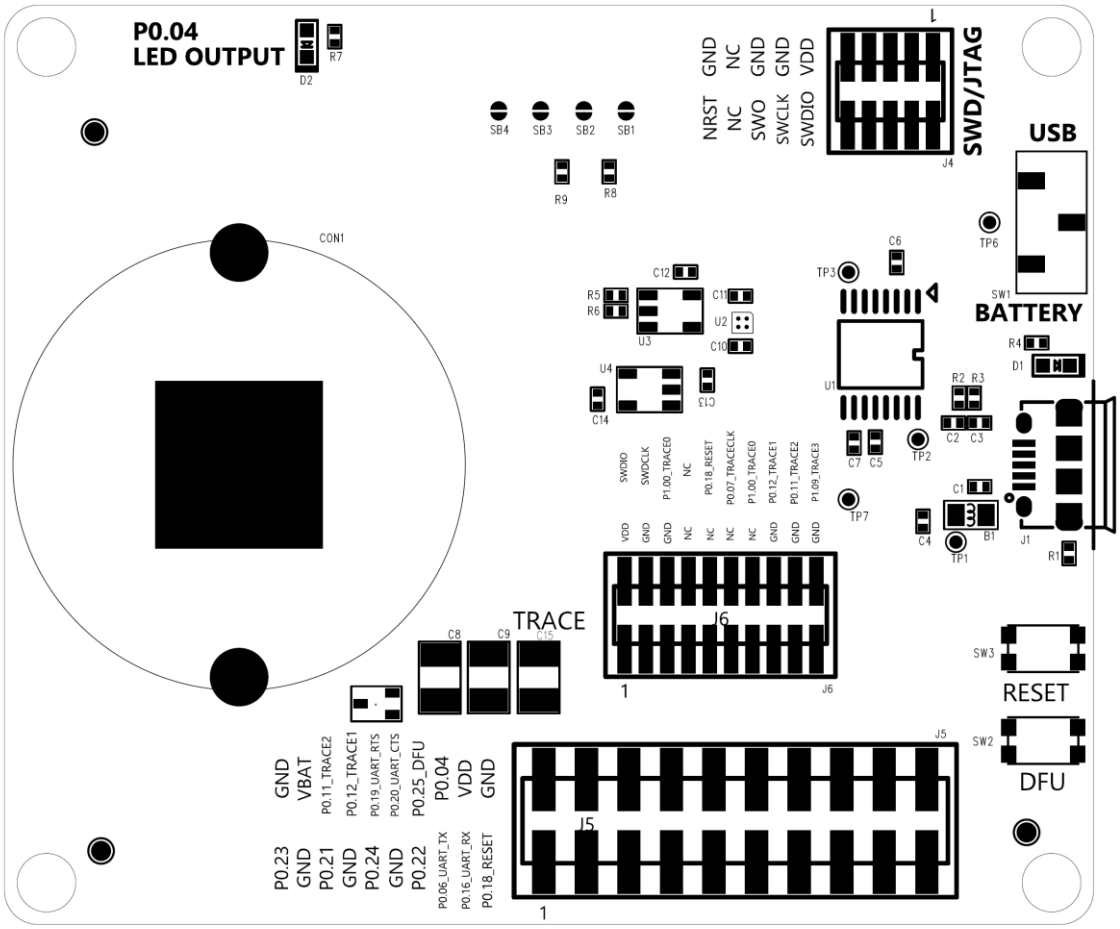
2.7 Component Placement Drawing

The component placement drawing of XB122 is found below.

Top Side:



Bottom Side:



2.8 Bill of Material

Table 9 shows the BOM for XB122.

Table 9. The BOM of XB122.

Component Ref.	Specification	QTY	Value	Comment
B1	MI0805K601R-10/Ferrite Bead	1		Manufacturer: LAIRD
C1	10/NF/K/16V/X7R/1005	1	10nF	
C2,C3	47/PF/J/50V/C0G/1005	2	47pF	
C4	4.7/UF/M/10V/X5R/1005	1	4.7uF	
C5,C6,C7,C12	100/NF/K/50V/X7R/1005	4	100nF	
C9,C15	220/UF/M/6.3V/NP0/3528	2		Manufacturer: AVX Part number: F930J227MBA
C10,C11,C13,C14	1/UF/K/10V/X5R/1005	4	1uF	
CON1	CR2477 battery holder	1		Manufacturer: RTLECS Part number: CCR2423

D1,D2	631nm LED RED CLEAR CHIP SMD	2		LTST-C193KRKT-5A
J1	Micro B USB 2.0 Receptacle	1		Manufacturer: Amphenol Part number: 10118194_0001LF
J3	DF40C-30DP-0.4V51	1		Manufacturer: Hirose
J4	10 position pin header, 1.27mm	1		Manufacturer: SAMTEC Part number: FTSH-105-01-F-DV-P-TR
J5	20 position pin header, 2.54mm	1		Manufacturer: SAMTEC Part number: TSM-110-01-F-DV-P-TR
J6	20 position pin header, 1.27mm	1		Manufacturer: SAMTEC Part number: FTSH-110-01-F-DV-P-TR
R1	0/OHM/J/1005	1	0 Ohm	
R2,R3	27/OHM/F/1005	2	27 Ohm	
R4,R7	10/OHM/F/1005	2	10 Ohm	
R5,R6,R8,R9	100/KOHM/F/1005	4	100 kOhm	
SW1	SPDT Switch	1		Manufacturer: C&K Part Number: JS102011JCQN
SW2,SW3	Switch	2		Manufacturer: C&K Part number: KMR741NG ULC LFS
U1	FT230XS-R/USB to UART bridge	1		
U2	TPS22916BYFPR	1		
U3	SN74LVC1G00DBVR	1		
U4	TLV70218DBVT	1		
Q1	SSM3J133TU	1		

3 References

1. FT230XS datasheet: https://www.ftdichip.com/Support/Documents/DataSheets/ICs/DS_FT230X.pdf

4 Revision History

Date	Version	Changes
2019-10-02	1.0	Original Version
2020-01-22	1.1	Updated Table 2, Table 4 and Table 7 with correct signal names for UART. Updated chapter 2.6, “Electrical Schematics” with correct net names for UART signals.
2021-04-21	1.2	ISO 14001 update

5 Disclaimer

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