



Entry module EVK hardware user guide

- XE132



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Acconeer AB



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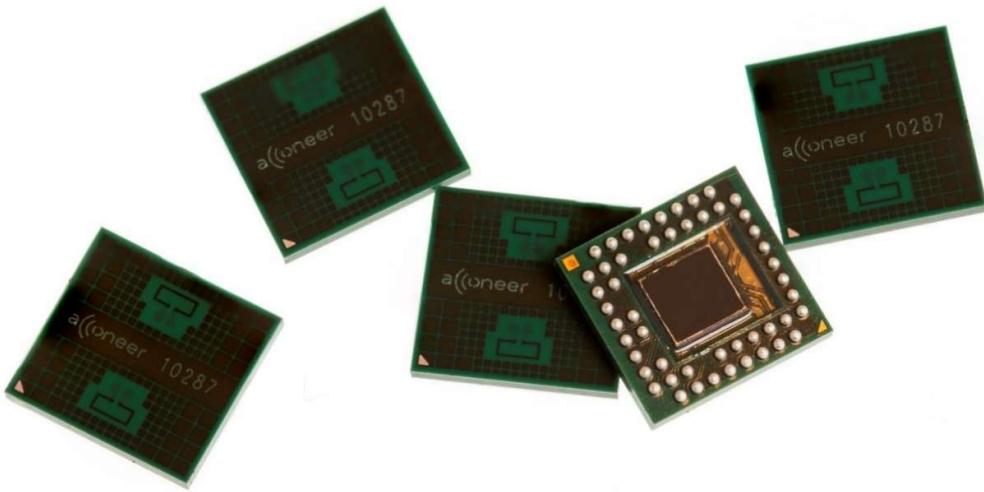
1. Overview of the XE132 Entry Module Evaluation Kit

1.1. Introduction

The XE132 Entry Module Evaluation Kit (The EVK) is a development platform targeting straightforward use cases where small size, low cost and low power is key.

The EVK features Acconeer's XM132 Entry module, including the A111 radar sensor. The A111 radar sensor is an optimized low-power, high-precision 60 GHz radar with antenna in package (AiP) and integrated baseband. Together with the ARM® Cortex®-M0+ STM32G0 MCU, the XM132 Entry module becomes a cost- and size-optimized low-power radar sensor.

The A111 is based on pulsed coherent radar technology (PCR). It has leading-edge patented sensor technology with pico-second time resolution. The A111 sets a new benchmark as far as power consumption and distance accuracy are concerned and it comes fully integrated in a small package of 29 mm².



The A111 can measure absolute distance with mm accuracy up to a range of 2 m with a continuous sweep update frequency of up to 600 Hz. With the use of a dielectric lens the range can be significantly longer.

The A111, 60 GHz radar is not compromised by natural sources of interference such as noise, dust, color, direct or indirect light.

The EVK consists of:

- 1 XE132 Evaluation board with an XM132 Entry module soldered onto it.

1.2. Getting Started

A Quick Installation Guide is available at <https://youtu.be/PTcQ0FpRz7E>

This short instruction video will ensure a smooth setup and installation. As an alternative you can also find a guide in pdf-format at <https://developer.acconeer.com>.



2. Software for the EVK

2.1. SW download

The SW is available for download at <https://developer.acconeer.com>. Here you will find both a Software Development Kit and a Module Server version. SW User Guides can be downloaded at the same site.

2.2. SW API Description

The Acconeer SW comes with an API (Application Programming Interface). Acconeer provides several service-oriented example and reference applications, as well as customer guidelines for application development when utilizing the API. All APIs provided by Acconeer are documented.

Unzip the SW zip file downloaded from Acconeer's download site. In the file structure, please locate /doc folder from where API documentation in HTML format is found at doc/html/index.html.



3. The EVK Hardware

In Figure 1 the block-diagram of the XE132 is shown. Figure 2 shows the XM132 block-diagram.

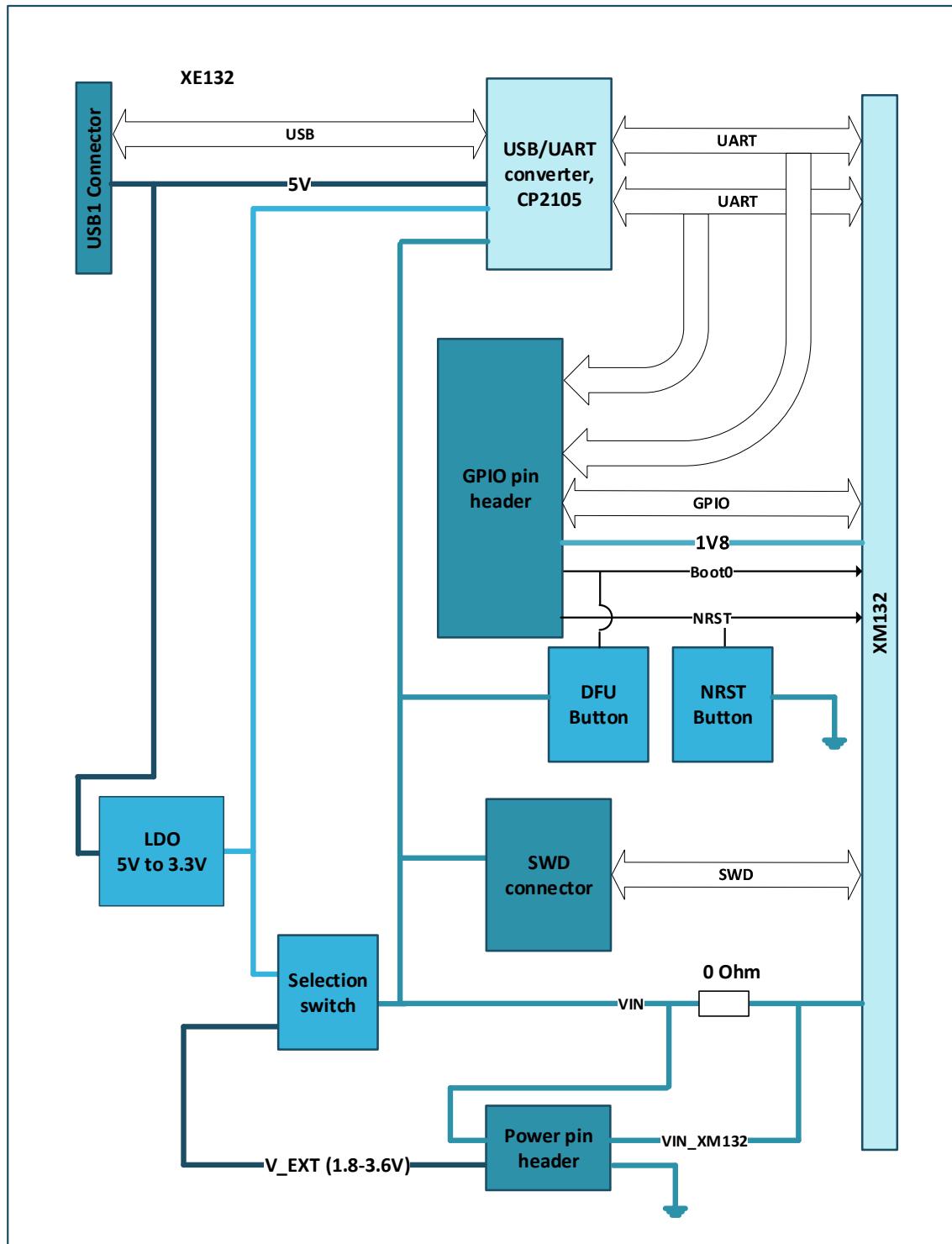


Figure 1 The block-diagram of the XE132.

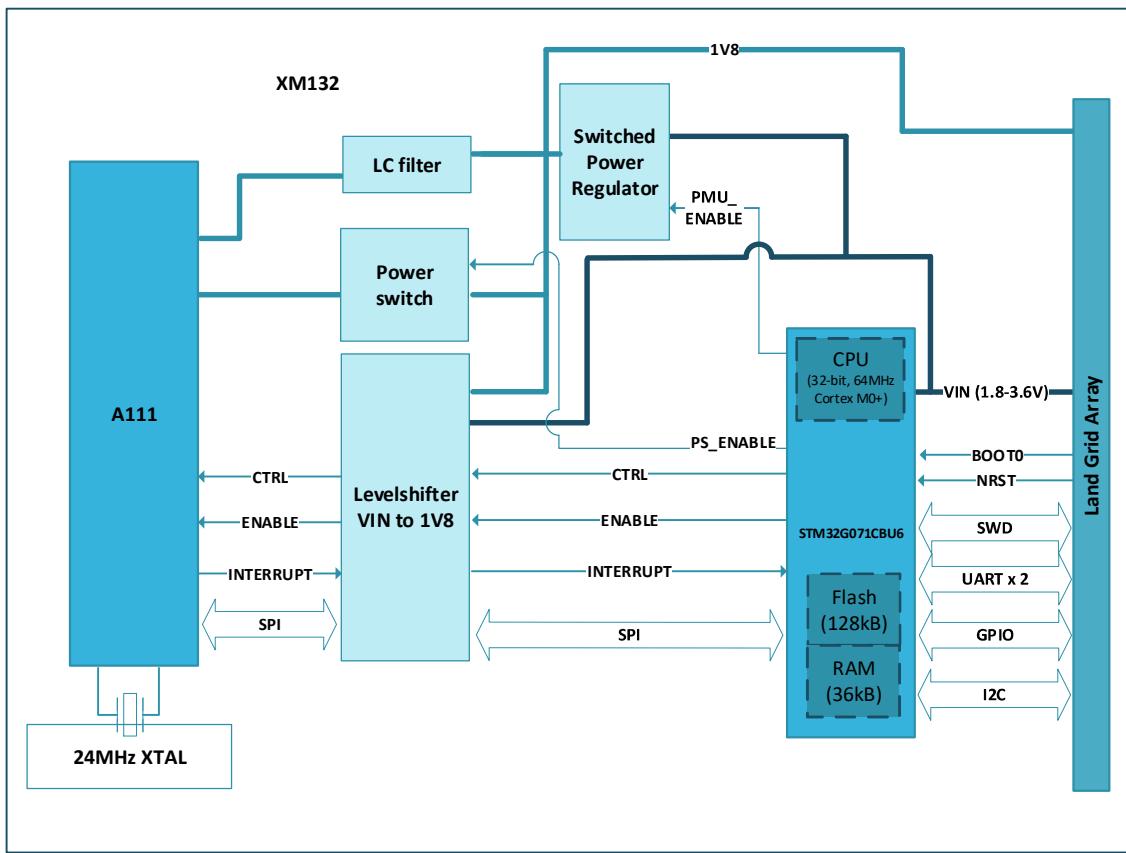


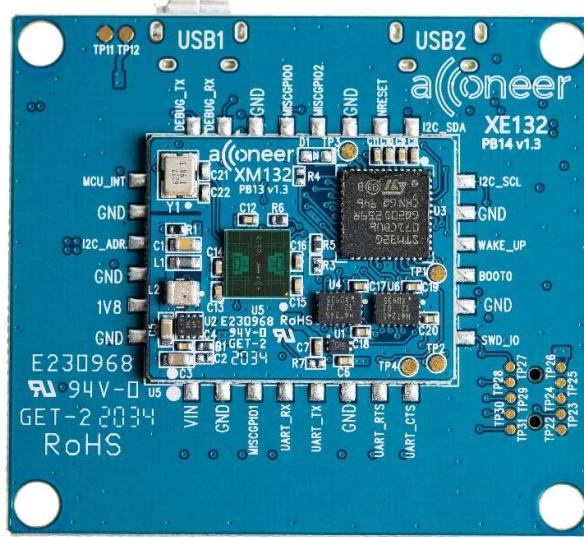
Figure 2. The block-diagram of XM132.



3.1. XE132 Evaluation Board

3.1.1. Overview

The XE132 is an evaluation board including the XM132 Entry module. It makes the interfaces from the XM132 module accessible for evaluation and debug. It also enables flashing of the XM132 via USB-UART or SW-DP. The XM132 Entry module is included in the XE132 Evaluation board. In Picture 1 you will find the XE132 top side where the XM132 is mounted. Picture 2 shows the bottom side of XE132.





3.1.2. Power

The XE132 is powered via the USB connector J1 and/or via the pin header J3. 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.

The XM132 module mounted on the XE132 can be powered either from a 3.3V LDO (U4) which is supplied from the USB 5V power domain or from “V_EXT” in the J3 pin header. V_EXT should be between 1.8V to 3.6V. Typical value of V_EXT is 3.3V.

The power source for XM132 is determined by the setting of the switch “S1”. When the LED D1 on the XE132 is lit, the XM132 is powered. If power is supplied via V_EXT and the switch S1 is in position “V_EXT”, both the components on XE132 and XM132 are supplied from the external power supply.

It should be noted that regardless if “V_EXT” or “3.3V” is used to power XM132, the LED D1 will consume power since it is connected to “VIN”. If one wants to measure only the current consumed by XM132, power should be supplied to XM132 via the pin “VIN_XM132” in pin header J3. In this case, R25 should be unmounted and S1 should be placed in position “3.3V”. This way, all components on XE132 are supplied from the 3.3V LDO, but XM132 is supplied from the external power supply. D1 will not indicate if XM132 is powered after R25 has been removed.

The intention of the power pin header J3 is that it can be used both for supplying power to XM132 and for measuring current over a measurement resistor (R25). R25 is a 0 Ohm resistor, but the customer can change it to a low-value resistor with high accuracy in order to perform very accurate measurements of the XM132 current. See Table 3 for the pin assignment of pin header J3.

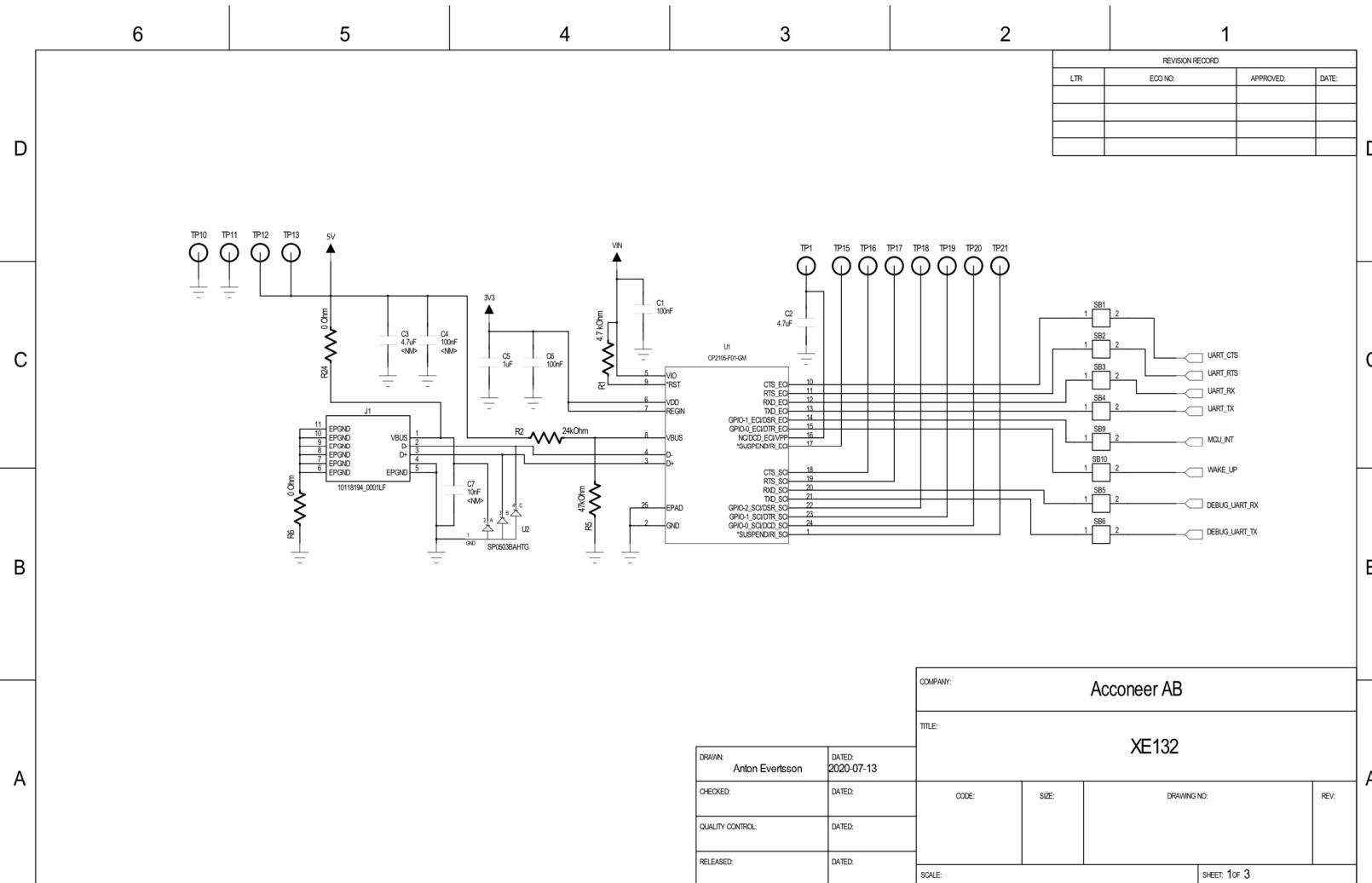
3.1.3. Not Mounted Components

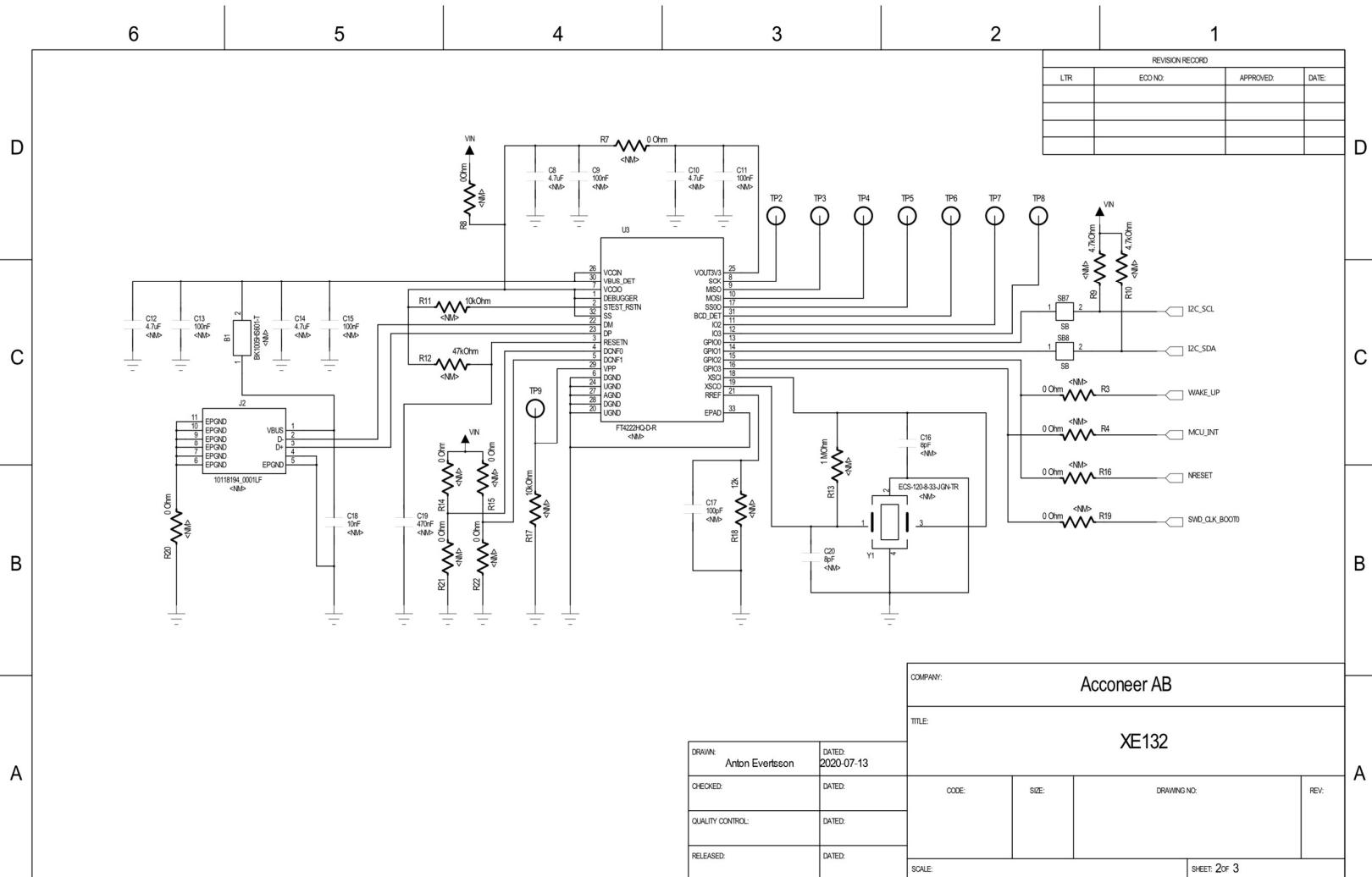
As can be seen in the schematic in chapter 3.1.4, USB connector J2 and several other components are “No Mount”. These components are related to the FTDI I2C-USB bridge chip FT4222H which can be mounted on the PCB. It was added for internal Acconeer use, but customers are of course free to mount these components if they wish. The I2C interface is also accessible in pin header J7. Refer to Table 5.

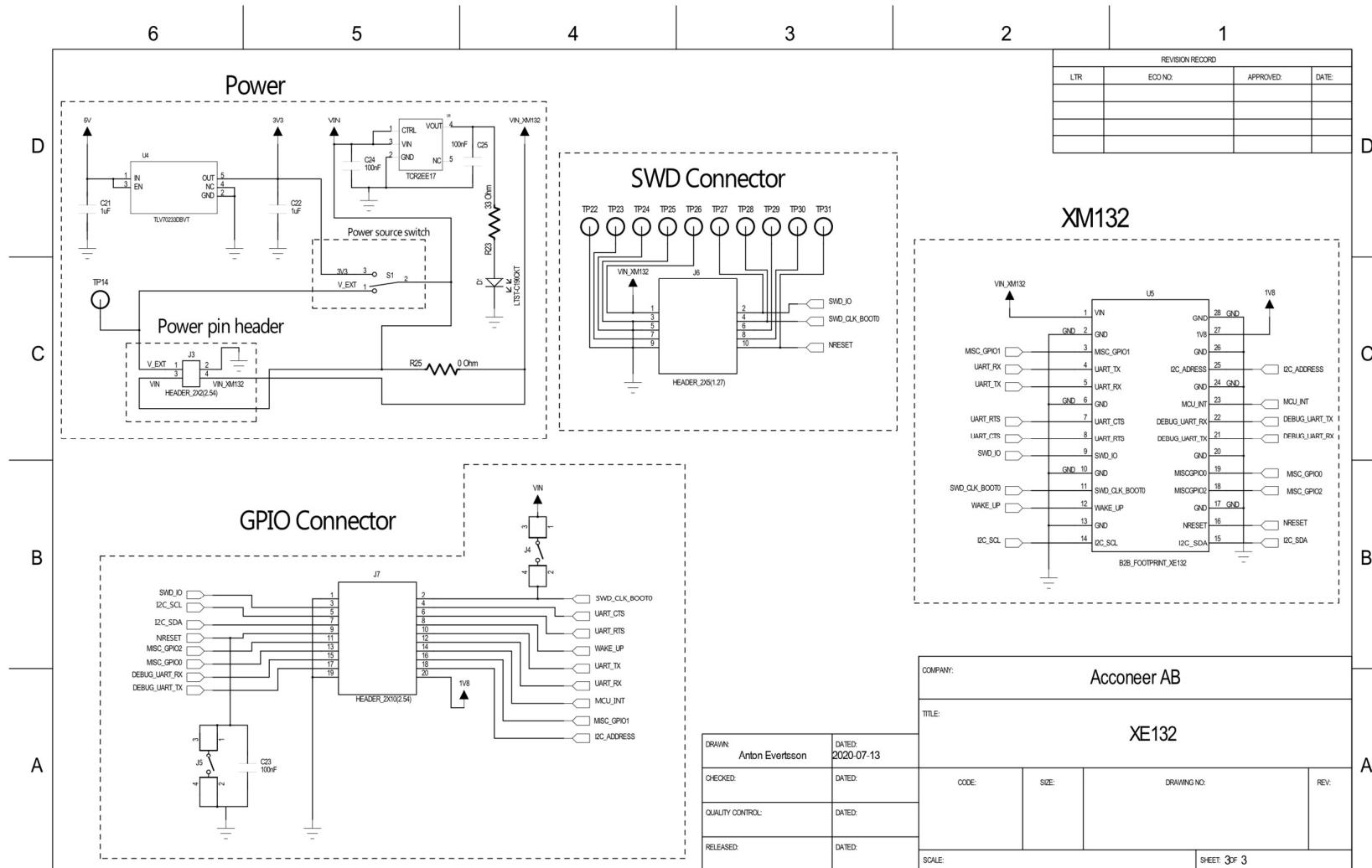


3.1.4. Electrical Schematics

On the following pages, please find the Electrical Schematics for XE132:









3.1.5. Bill of Material

Table 1 shows the BOM for the XE132

Table 1 The BOM for the XE132.

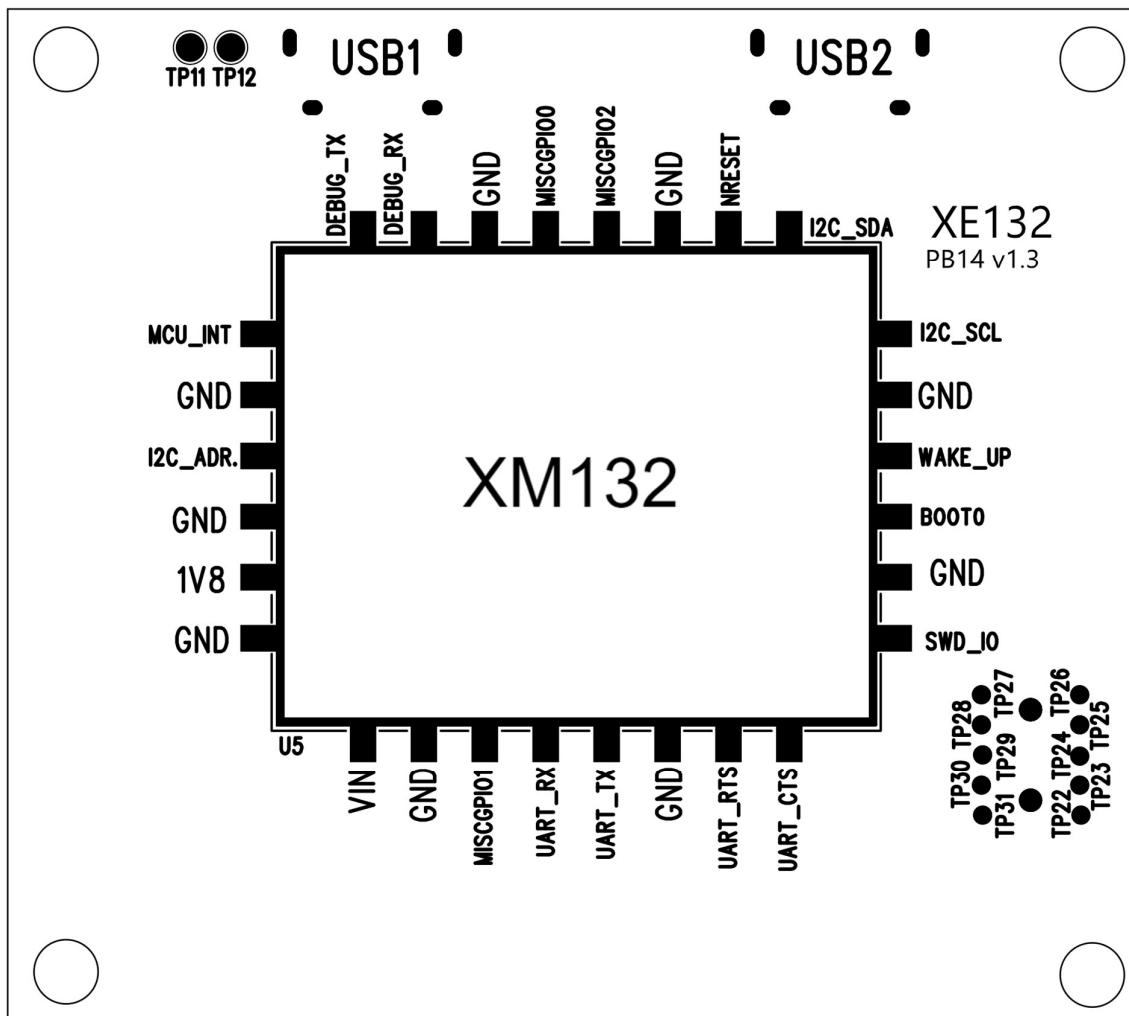
Component Ref.	Specification	QTY	Value	Comment
C1, C6, C23, C24, C25	Chip Capacitor 0402,X7R,100nF,10%,50V	5	100nF	
C2	Chip Capacitors 4.7uF 10V X5R 0402	1	4.7uF	
R6, R24, R25	Chip Resistor,0402,5%,0R	3	0Ohm	
C5, C21, C22	Chip Capacitors 0402 X5R 1uF 10% 10V	3	1uF	
R1	Chip Resistor 0402,5%,4.7K	1	4.7kOhm	
R5	Chip Resistor,0402,5%,47K	1	47kOhm	
J4, J5	Tactile switch: KMR741NG-ULC-LFS	2		Manufacturer: C&K
J1	Micro USB 2.0 B Receptacle STD 10118194-0001LF	1		Manufacturer: Amphenol
R23	Chip Resistor,0402,5%,33R	1	33Ohm	
R2	Chip Resistor,0402,5%,24K	1	24kOhm	
U2	TVS Diode 30kV SOT143-4 SP0503BAHTG	1		Manufacturer: Littelfuse Inc.
U1	IC USB-UART Transfer QFN-24 CP2105-F01-GM	1		Manufacturer: Silicon Labs
U4	IC LDO 3.3 V 100 Ma DBV TLV70233DBVT	1		Manufacturer: TI
U5	XM132 Entry Radar Sensor Module	1		Manufacturer: Acconeer AB
U6	IC LDO 1.8V 200mA TCR2EE17,LM(CT	1		Manufacturer: Toshiba
D1	LED red clear chip smd LTST-C190CKT	1		Manufacturer: Lite-On Inc
S1	JS102011JCQN, SWITCH SLIDE SPDT 300MA 6V	1		Manufacturer: C&K
J6	SMD HEADER 2X5 Pitch 1.27MM FTS-105	1		Manufacturer: Samtec
J3	SMD HEADER 2X2 Pitch 2.54mm TSM-102	1		Manufacturer: Samtec
J7	SMD HEADER 2X10 Pitch 2.54MM TSM-110	1		Manufacturer: Samtec



3.1.6. Component Placement Drawing

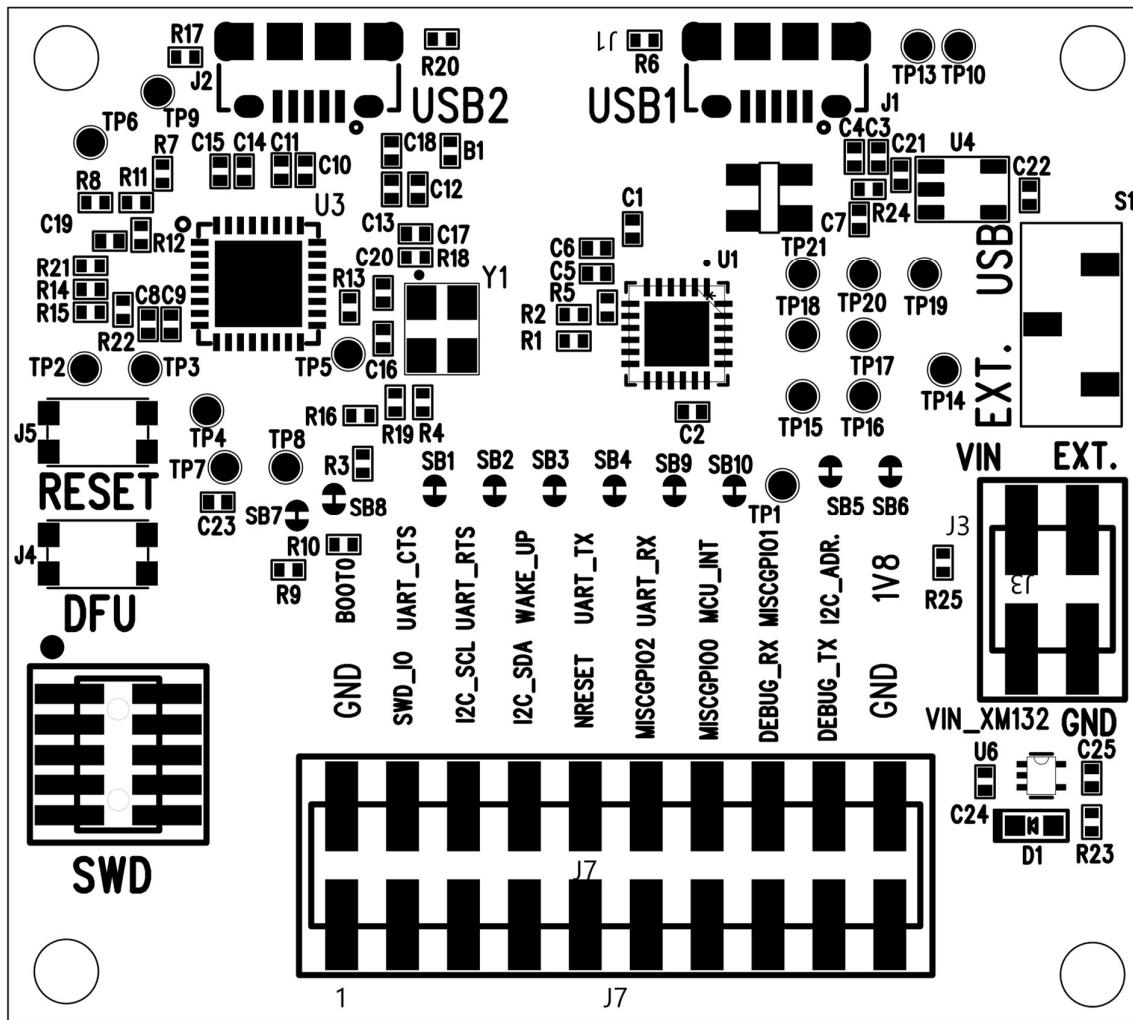
The component placement drawing of XE132 is found below.

Top Side:





Bottom Side:



3.1.7. Connectors

USB (J1)

USB is used as power supply for the XB132 as well as for flashing and communicating over UART. USB is connected to the Silicon Labs chip CP2105 which converts the UART interfaces from XM132 into USB data signals. The pinout of J1 is shown in Table 2.

Table 2. The pinout of J1.

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



Power pin header (J3)

The power pin header J3 provides the possibility to supply the XM132 board with power from an external power supply. In Table 3, the pin assignment of J3 is shown:

Table 3. The pin assignment of the power pin header J3.

Pin Number	Signal	Pin Number	Signal
1	V_EXT	2	GND
3	VIN	4	VIN_XM132

2x5 JTAG/SWD pin header (J6)

The 2x5 JTAG/SWD pin header (1.27mm pitch) contains the signals needed for flashing the XM132 MCU via the SWD interface. The pinout matches that of the Cortex 10-pin JTAG/SWD Connector and is found in Table 4.

Table 4. The pinout of J6.

Pin Number	Signal	Pin Number	Signal
1	VIN_XM132	2	SWD_IO
3	GND	4	SWD_CLK_BOOT0
5	GND	6	NC (no TRACESWO available)
7	NC	8	NC
9	GND	10	NRESET

2x10 pin header (J7)

The 2x10 pin header (2.54mm pitch) contains miscellaneous GPIOs from the XM132 as well as 1V8 (output from switched power regulator on XM132). The pinout is found in Table 5.

Table 5. The pinout of J7.

Pin Number	Signal	Pin Number	Signal
1	GND	2	SWD_CLK_BOOT0
3	SWD_IO	4	UART_CTS
5	I2C_SCL	6	UART_RTS
7	I2C_SDA	8	WAKE_UP
9	NRESET	10	UART_TX
11	MISC_GPIO2	12	UART_RX
13	MISC_GPIO0	14	MCU_INT
15	DEBUG_UART_RX	16	MISC_GPIO1
17	DEBUG_UART_TX	18	I2C_ADDRESS
19	GND	20	1V8



Switches and buttons

There is one switch on XE132. S1 determines if XM132 is powered from the 3.3V LDO (U4) on XE132 or from an external power supply via pin header J3 (V_EXT).

There are two buttons on the XE132. J4, DFU (Device Firmware Upgrade), controls the signal “BOOT0” on the XM132. Button J5 controls the “NRESET” signal on XM132. In Table 6 the state of the buttons and the corresponding signal states are listed.

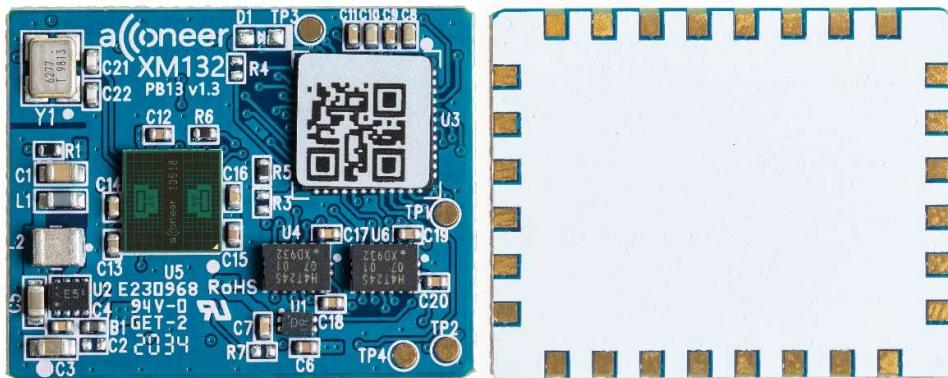
Table 6. The states of the buttons J4 and J5.

Button	Open (default)	Closed
J4	BOOT=0	BOOT0=1
J5	NRESET=1	NRESET=0

3.2. XM132 Entry Module

3.2.1. Overview

The XM132 Entry Module is included in the XE132 design and soldered on the top side of the XE132 via a Land Grid Array pattern on the bottom side of the XM132 PCB. In the schematic below, this Land Grid Array pattern is called “B2B LGA Connector”. In Picture 3 below the top and bottom side of XM132 is shown.

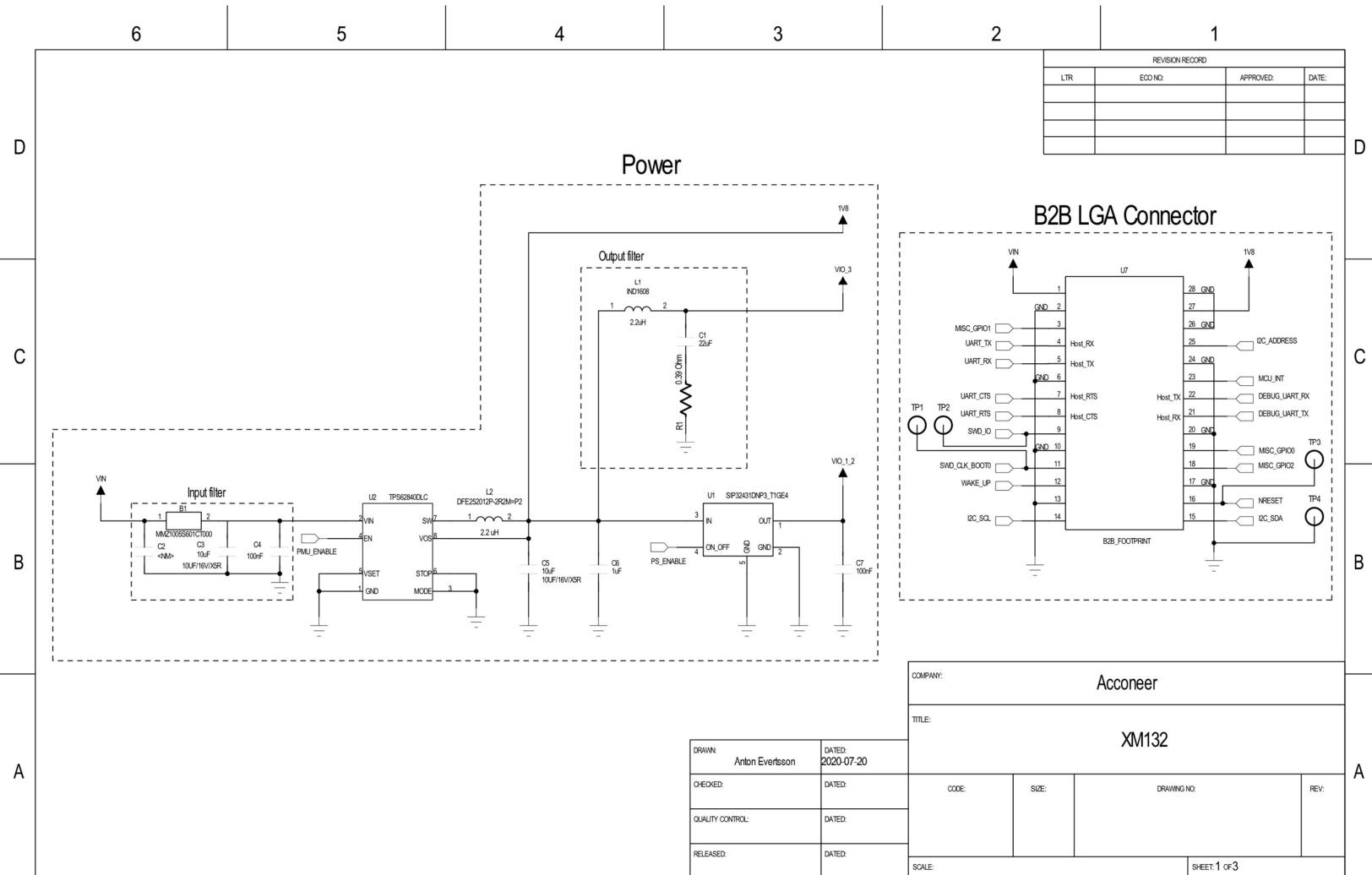


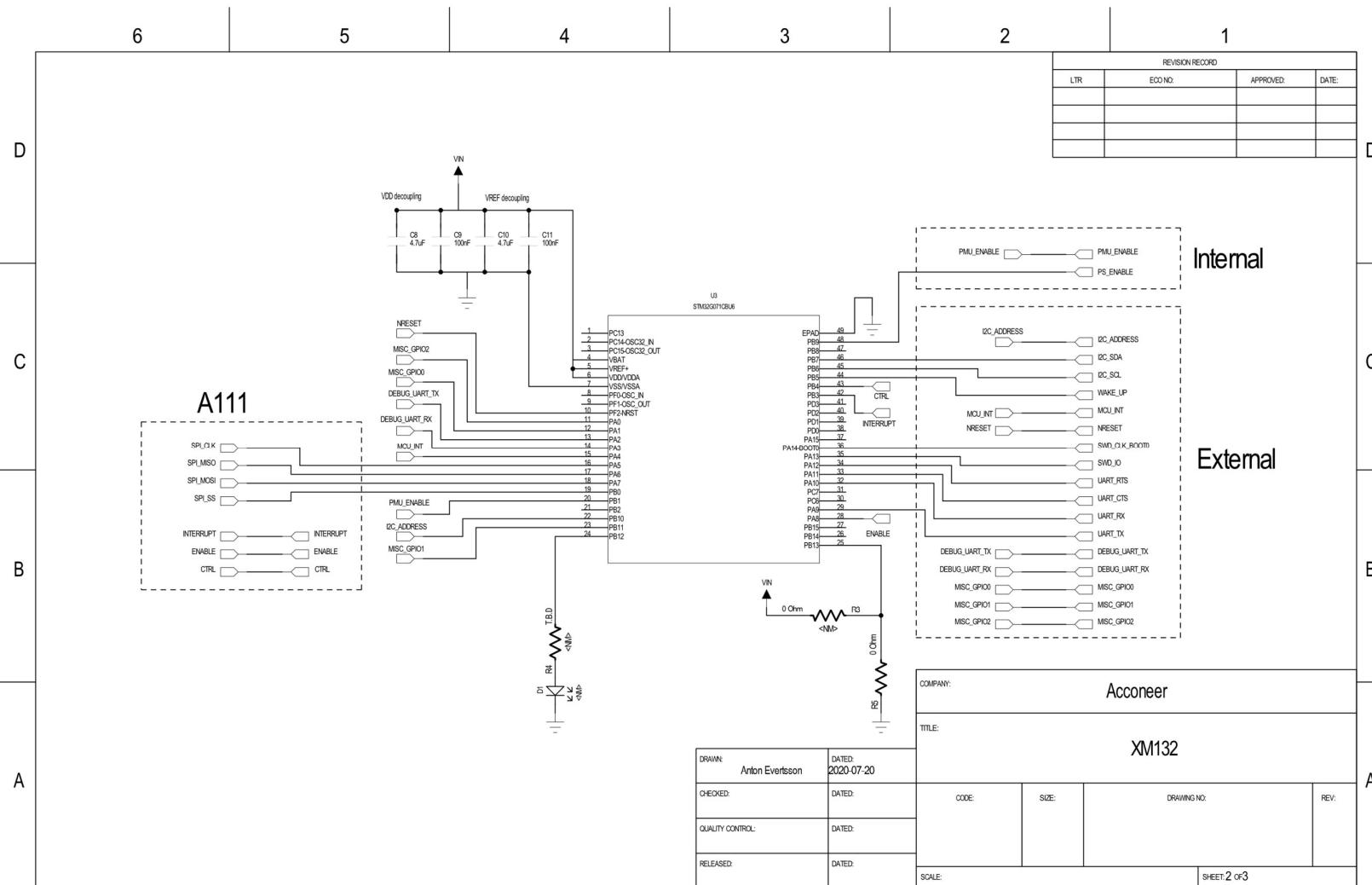
Picture 3 The XM132 top side (left) and bottom side (right)

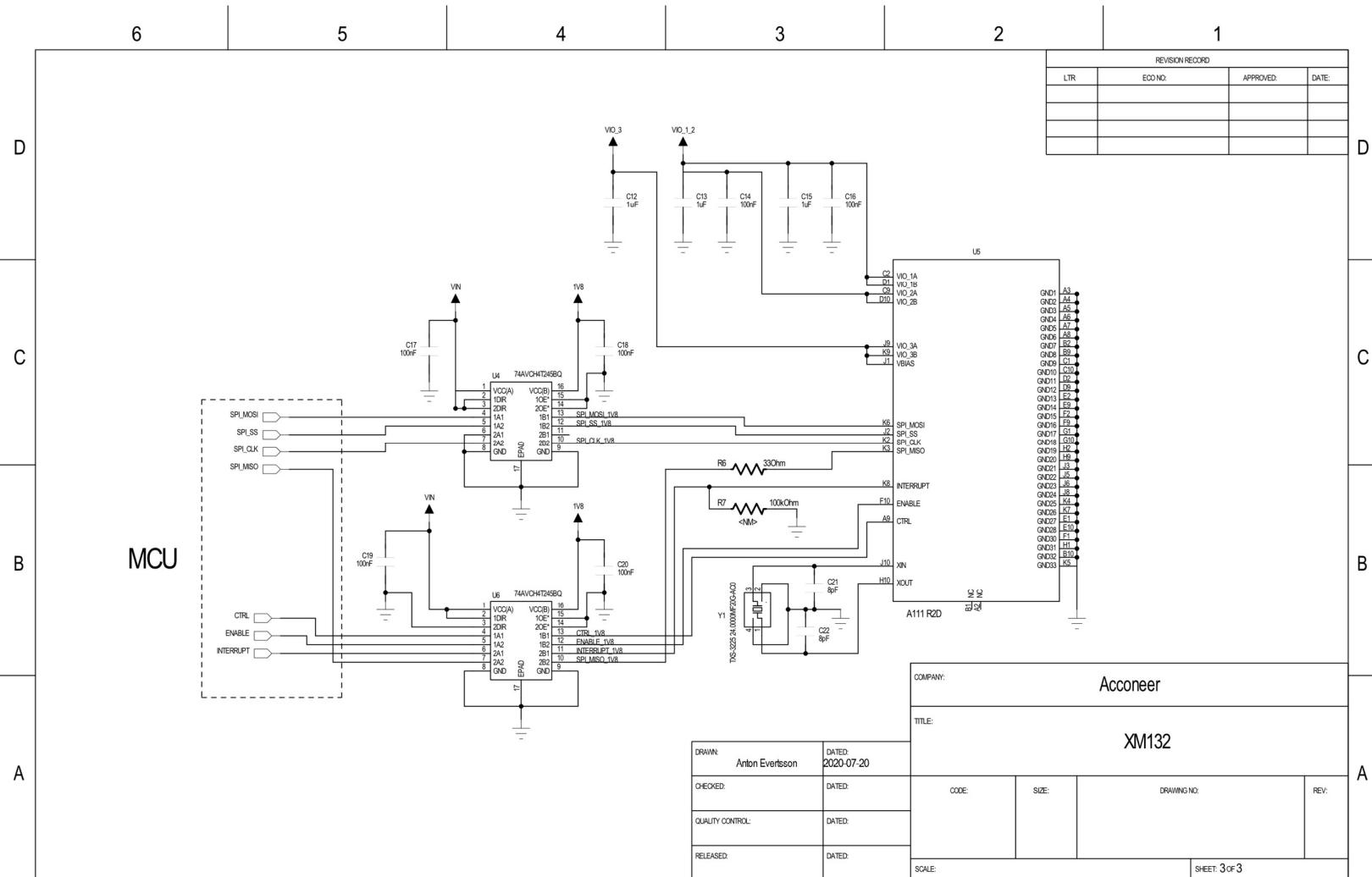


Electrical Schematics

On the following pages, please find the Electrical Schematics for XM132:









3.2.2. Bill of Material

Table 7 shows the BOM for the XM132.

Table 7. The BOM For XM132.

Component Ref.	Specification	QTY	Value	Comment
C1	22uF,10V,X5R,0603	1		
C3, C5	10uF,16V,X5R,0603	2		
C4, C7, C9, C11, C14, C16, C17, C18, C19, C20	Chip Capacitor 0402,X7R,100nF,10%,50V	10	100nF	
C6, C12, C13, C15	Chip Capacitors 0402 X5R 1UF 10% 10V	4	1uF	
C8, C10	Chip Capacitors 4.7uF 10V X5R 0402	2	4.7uF	
C21, C22	Chip Capacitor 0402 COG 8pF 5% 50V	2	8pF	
R1	Chip Resistor 0402 5% 0.39R	1	0.39Ohm	
R5	Chip Resistor,0402,5%,0R	1	0Ohm	
R6	Chip Resistor,0402,5%,33R	1	33Ohm	
L1	IND1608,Inductors 2.2uH 20% ,500mA	1	2.2uH	TDK: MLZ1608N2R2LT000
L2	2520,2.2UH 20%,-40~+125°C	1	2.2uH	Abracan LLC: ASMPH-1008-2R2M-T Alternative: Murata: DFE252012P-2R2M=P2
B1	Ferrite Bead, 0402	1		TDK: MMZ1005S601CT000
Y1	24MHz,10ppm,Crystal,9pF, ESR 40Ohms	1	24MHz	Epson: TSX-3225 24.0000MF20G-AC
U1	Ultra-Low Leakage Load Switch	1		Vishay: SIP32431DNP3-T1GE4
U2	Switched Voltage Regulator	1		TI: TPS62840DLCR
U3	MCU STM32G071CBU6 32-bit LQFP48	1		ST Microelectronics: STM32G071CBU6
U4, U6	Bidirectional Voltage Level Translator, 74AVCH4T245BQ SOT763-1	2		Nexperia: 74AVCH4T245BQ
U5	Radar Sensor 60GHz A111R2D BGA	1		Acconeer AB: A111 R2D

3.2.3. Component Placement Drawing

In Figure 3 the component placement drawing of XM132 top side is shown. No components mounted on the bottom side.



Top side:

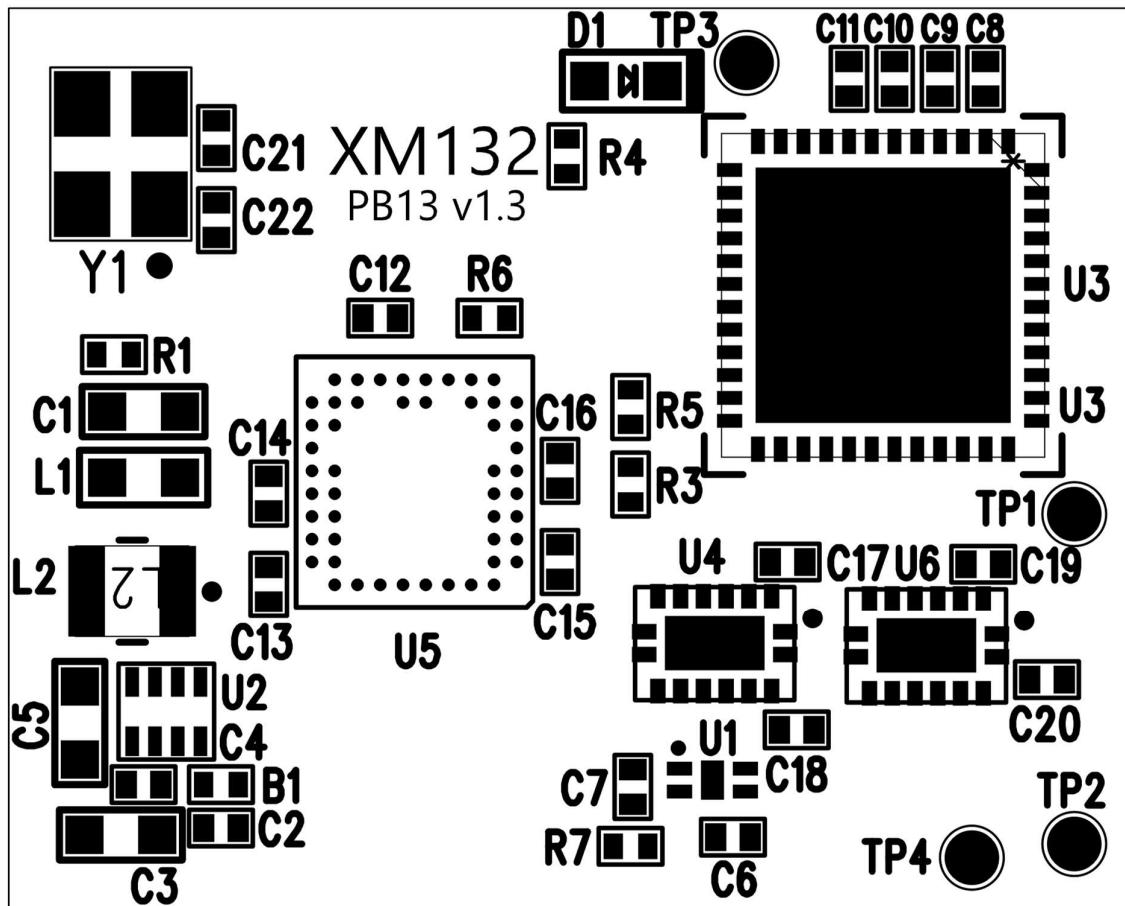


Figure 3. XM132 top side

3.2.4. Land Grid Array Pinning

In Table 8 the LGA pinning (U7) is shown.

Table 8. The pinning of the XM132 Land Grid Array.

Pin Number	Signal	Comment
1	VIN	1.8-3.6V, typical 3.3V
2	Ground	
3	MISC_GPIO1	
4	UART_TX	Connect to UART_RX on host side.
5	UART_RX	Connect to UART_TX on host side.
6	Ground	



7	UART_CTS	Connect to UART_RTS on host side.
8	UART_RTS	Connect to UART_CTS on host side.
9	SWD_IO	
10	Ground	
11	SWD_CLK_BOOT0	SWD_CLK and BOOT0 pin. Pulling BOOT0 high during boot of module will start the embedded boot loader.
12	WAKE_UP	Could be used by host to wake up XM132 MCU.
13	Ground	
14	I2C_SCL	
15	I2C_SDA	
16	NRESET	Reset of XM132 MCU.
17	Ground	
18	MISC_GPIO2	
19	MISC_GPIO0	
20	Ground	
21	DEBUG_UART_TX	Connect to UART_RX on host side.
22	DEBUG_UART_RX	Connect to UART_TX on host side.
23	MCU_INT	Could be used to send interrupt from XM132 MCU to host.
24	Ground	
25	I2C_ADDRESS	For configuration of I2C address.
26	Ground	
27	1V8	Output from XM132 switched power regulator.
28	Ground	



4. Safety

4.1. Electrostatic precautions



Please take electrostatic precautions, including using ground straps, when using the EVK or any of its components. An electrostatic discharge could damage the device.



5. Regulatory Information

Regulatory Compliance for XM132. The current status:

- USA – FCC, Federal Communication Commission: Not Performed
- Japan - Technical Regulations of Radio Law of Japan: Not Performed
- EU - Electromagnetic Compatibility Directive: Not Performed
- South Korea – Kc, Korea certification: Not Performed

Independent of XM132 regulatory status it is the user's responsibility to ensure that any regulatory requirements, applicable to any region, are followed in the region the device is being used.

Regulatory Compliance for A111. The current status:

- USA – FCC, Federal Communication Commission: Not Performed
- Japan - Technical Regulations of Radio Law of Japan: Not Performed
- EU - Electromagnetic Compatibility Directive: Not Performed
- South Korea – Kc, Korea certification: Not Performed

Independent of A111 regulatory status it is the user's responsibility to ensure that any regulatory requirements, applicable to any region, are followed in the region the device is being used.



6. Revision History

Date	Revision	Changes
2020-08-31	1.0	Original version
2021-02-05	1.1	Updated XE132 schematic, corrected naming in U2 B2B footprint.



7. Disclaimer

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