



# XC111-XR111 Evaluation Kit

XC111 Evaluation Board, XR111 Sensor Board

User Guide



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(XC111 Evaluation Board, XR111 Sensor Board)

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## Table of Contents

1.	Overview of the XC111-XR111 Evaluation Kit .....	4
1.1	Introduction .....	4
1.2	Getting Started.....	4
2.	Software for the EVK .....	5
2.1	SW download.....	5
2.2	SW API Description .....	5
3.	The EVK Hardware .....	6
3.1	XC111 Connector Board .....	7
3.1.1	Overview .....	7
3.1.2	Power.....	8
3.1.3	Electrical Schematics.....	9
3.1.4	List of Materials.....	14
3.1.5	Pinning.....	15
3.2	XR111 Sensor Board.....	16
3.2.1	Overview .....	16
3.2.2	Electrical Schematics.....	17
3.2.3	List of Materials.....	18
3.2.4	Pinning.....	18
4	Design considerations .....	20
5	Safety.....	21
5.1	Electrostatic precautions .....	21
6	Regulatory Information .....	22
7	Revision History.....	23
8	Disclaimer .....	24

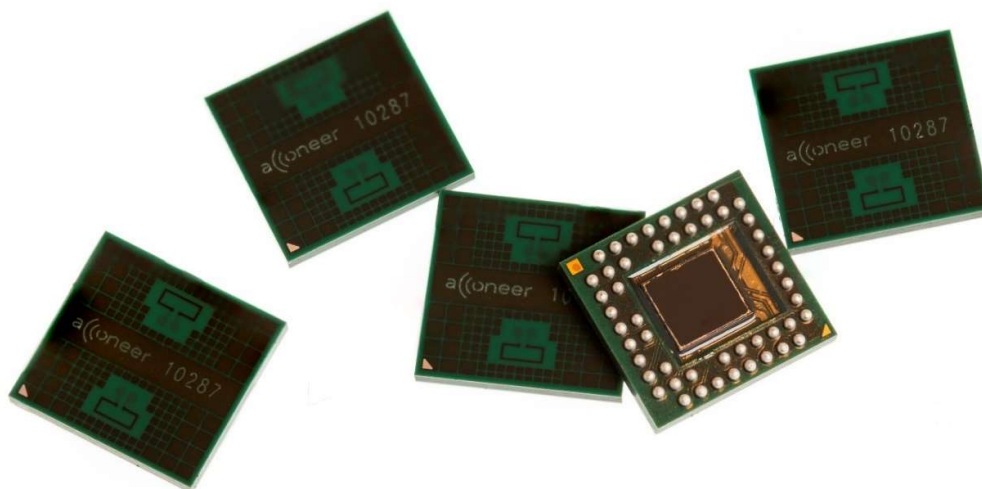


# 1. Overview of the XC111-XR111 Evaluation Kit

## 1.1 Introduction

The XC111-XR111 Evaluation Kit (The EVK) is a development platform featuring Acconeer's A111. This is an optimized low-power, high-precision 60 GHz radar in one package solution with integrated Baseband, RF front-end and Antenna.

The A111 is based on pulsed coherent radar technology (PCR). It has leading-edge patented sensor technology and 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 mm<sup>2</sup>.



The A111 can measure absolute distance with mm accuracy up to a range of 2m with a continuous sweep update frequency of up to 1500 Hz.

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

The EVK consists of

- 1 XC111 Connector board with the possibility to connect up to 4 Radar sensor boards.
- 1 XR111 Which is Acconeer's sensor board featuring A111.

The EVK does not contain any processor or micro controller. It was designed for use with a Raspberry Pi 3.

## 1.2 Getting Started

A Quick Installation Guide is available at <https://youtu.be/sj9Rxb7WshI>

This short instruction video will ensure a smooth setup and installation. For more information on retrieving the Acconeer SW, please refer to the next chapter.



## 2. Software for the EVK

### 2.1 SW download

The SW is available for downloading at <https://www.acconeer.com/products>

### 2.2 SW API Description

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

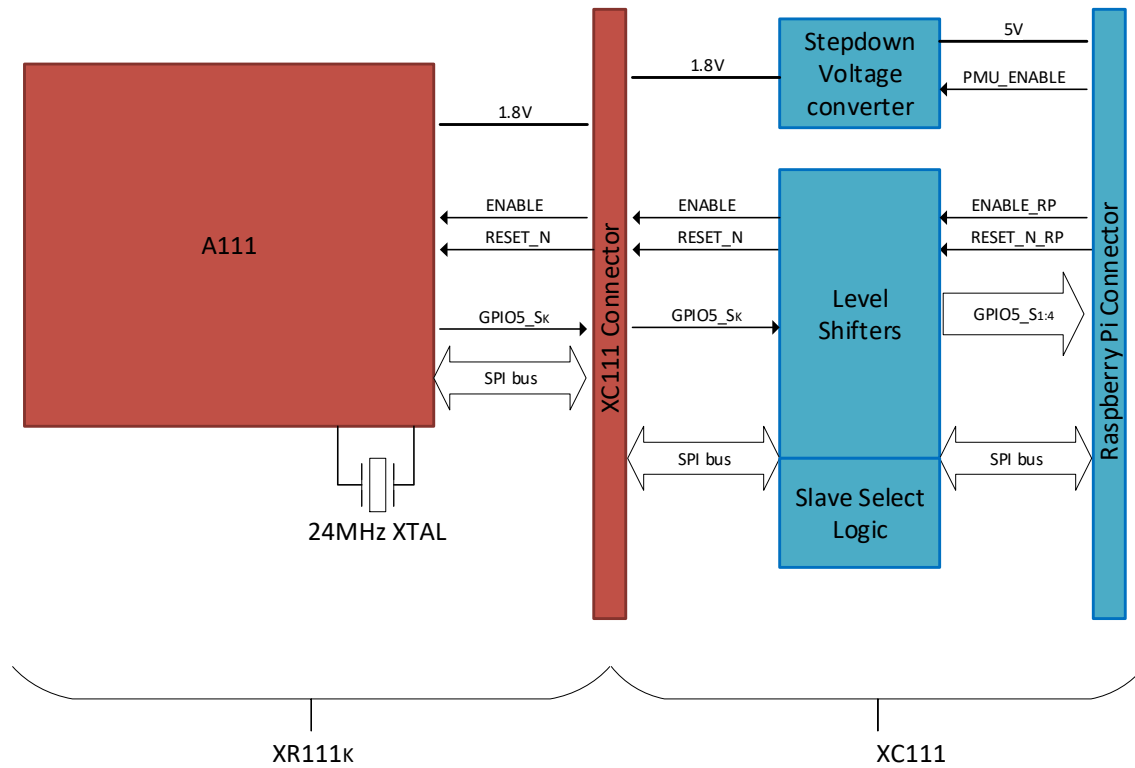
Open the SW zip file downloaded from Acconeer's download site. In the file structure, please locate /doc.

doc/ contains API documentation in HTML format – simply open doc/html/index.html.



### 3. The EVK Hardware

Figure 1 shows a block diagram for the EVK



K=Sensor Number, 1-4

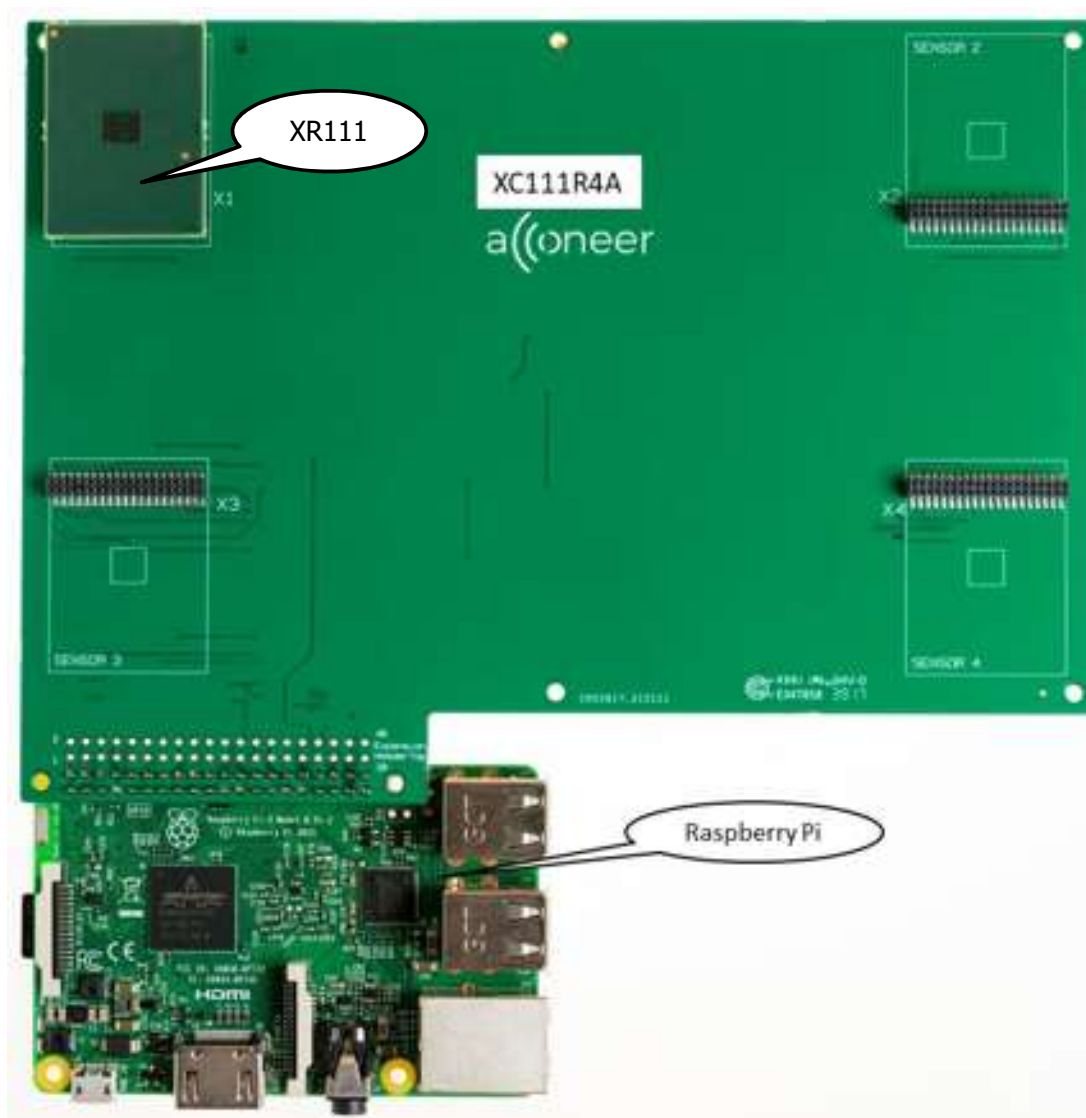


### 3.1 XC111 Connector Board

The XC111 is Acconeer’s Connector board and part of the EVK.

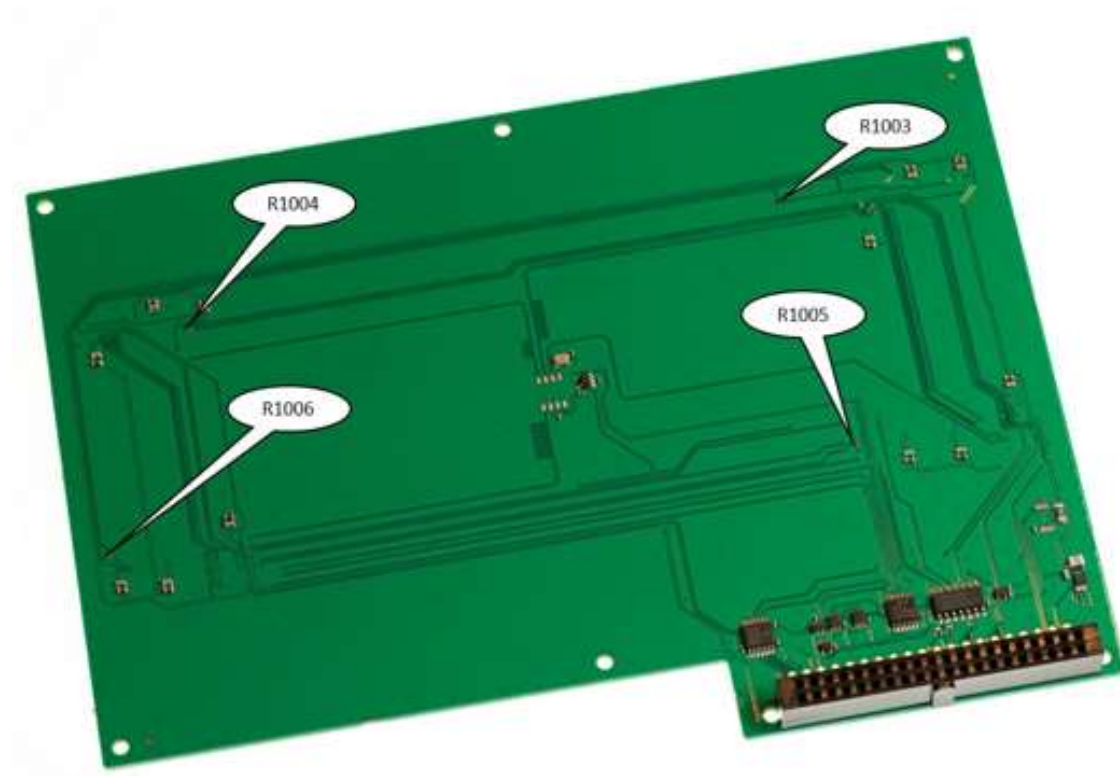
#### 3.1.1 Overview

Picture 1 shows the XC111 connector board, front side, including one XR111 Sensor Board, and with a Raspberry Pi connected.





Picture 2 shows the reverse side of the XC111. R1003-R1106 shows the resistors connected to the GPIO for measurement purposes.



### 3.1.2 Power

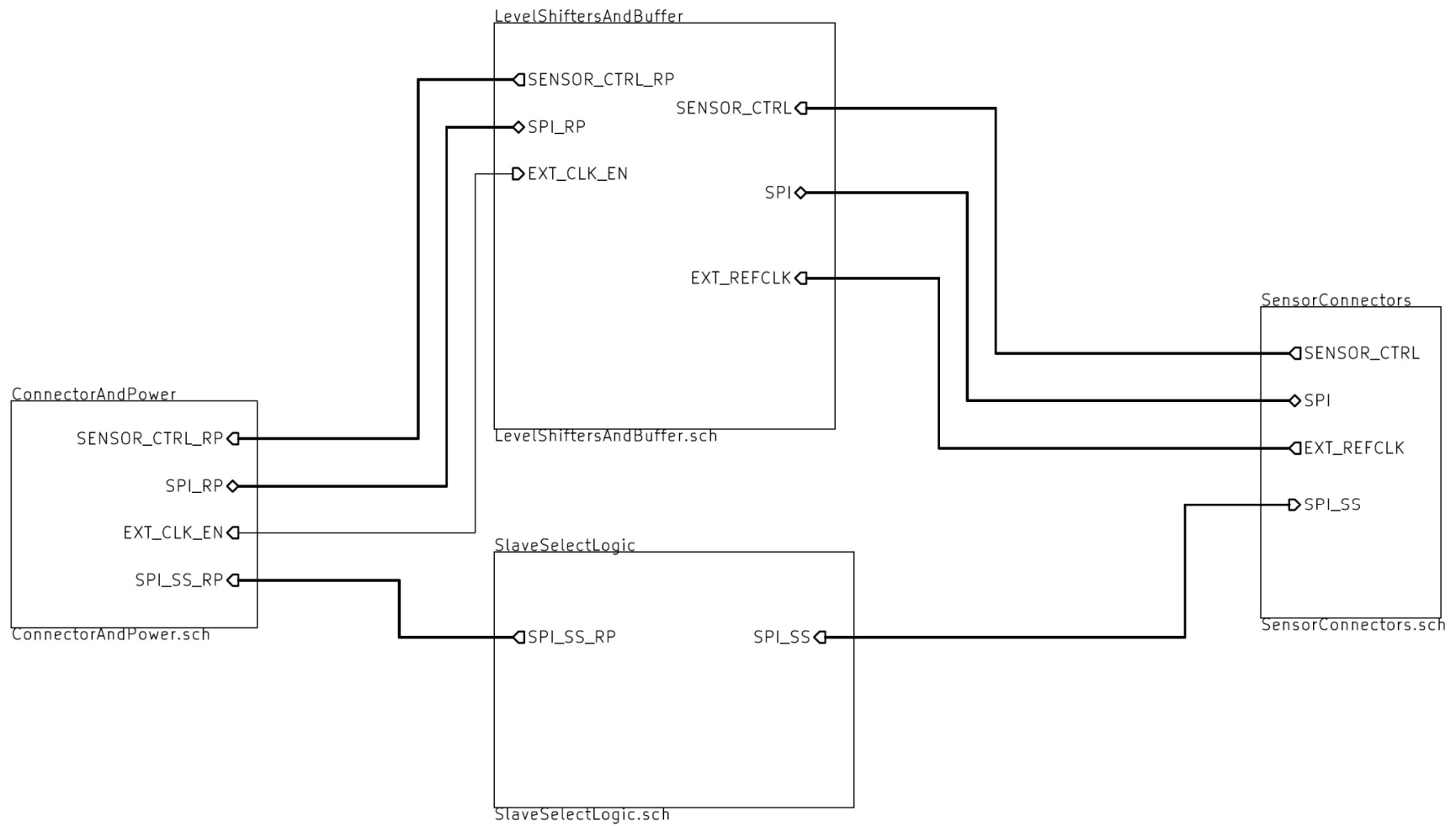
The Evaluation Kit is powered through the Raspberry Pi. When the power LED on the Raspberry Pi is lit, the Evaluation board is powered on and ready for use.

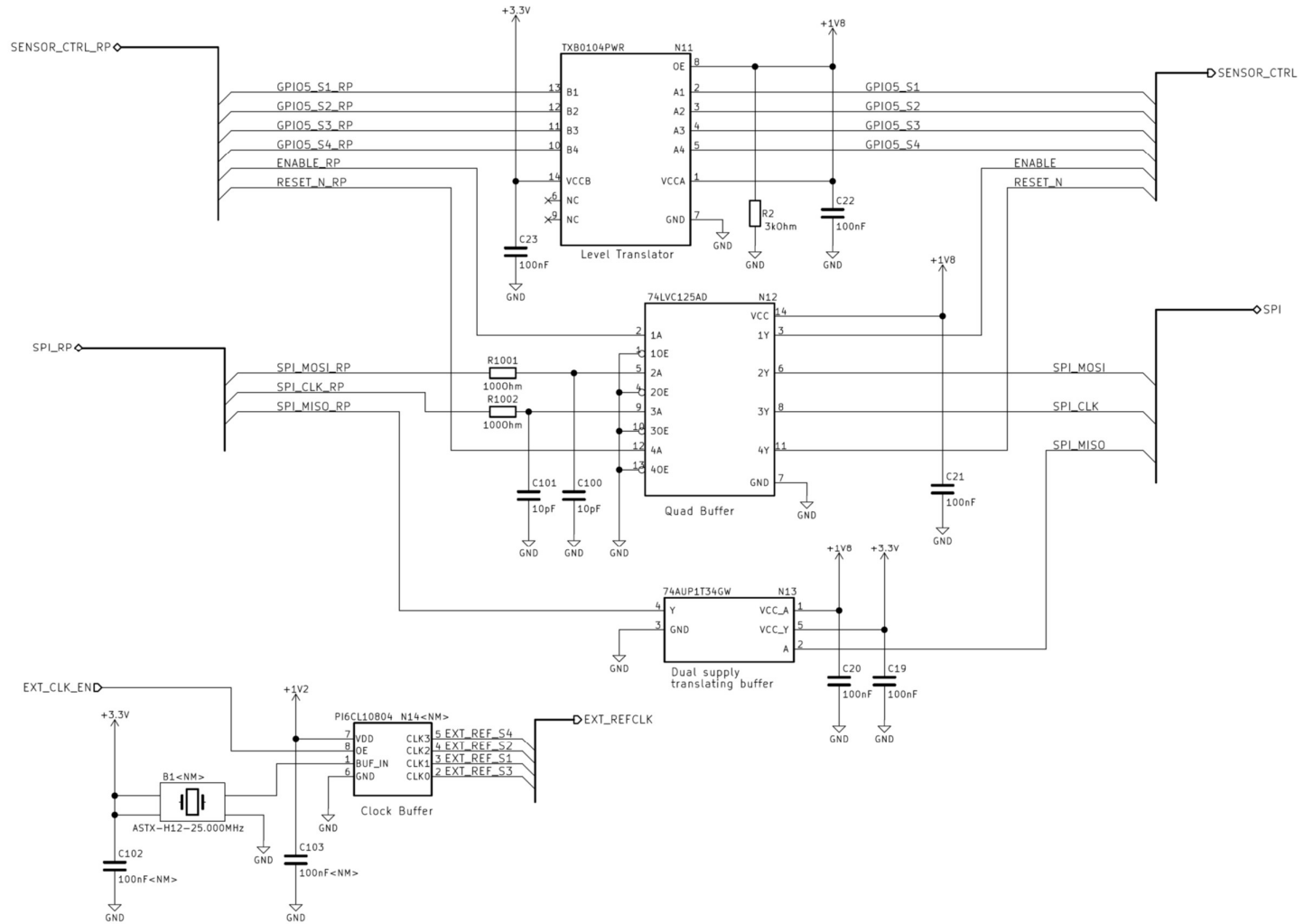


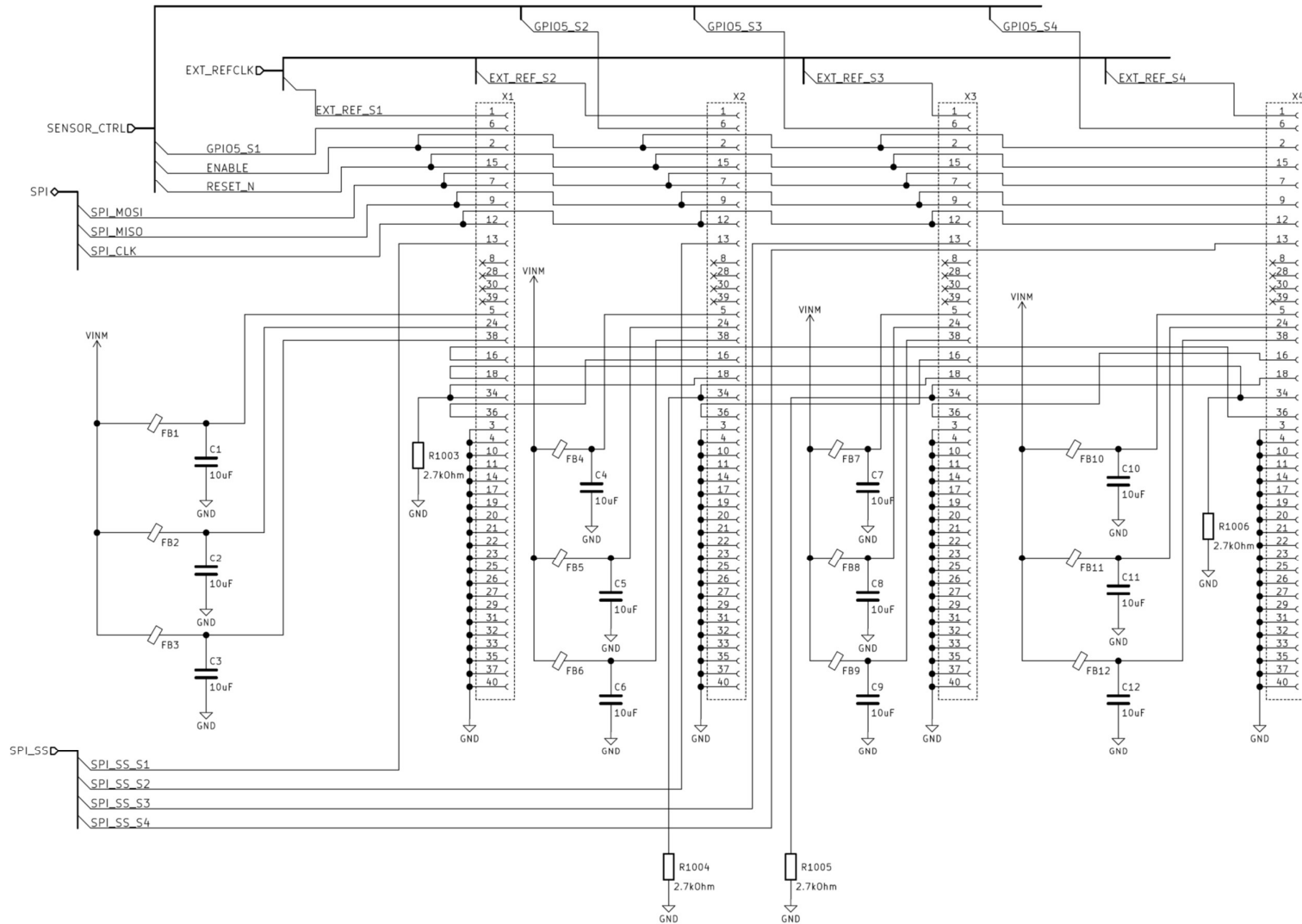


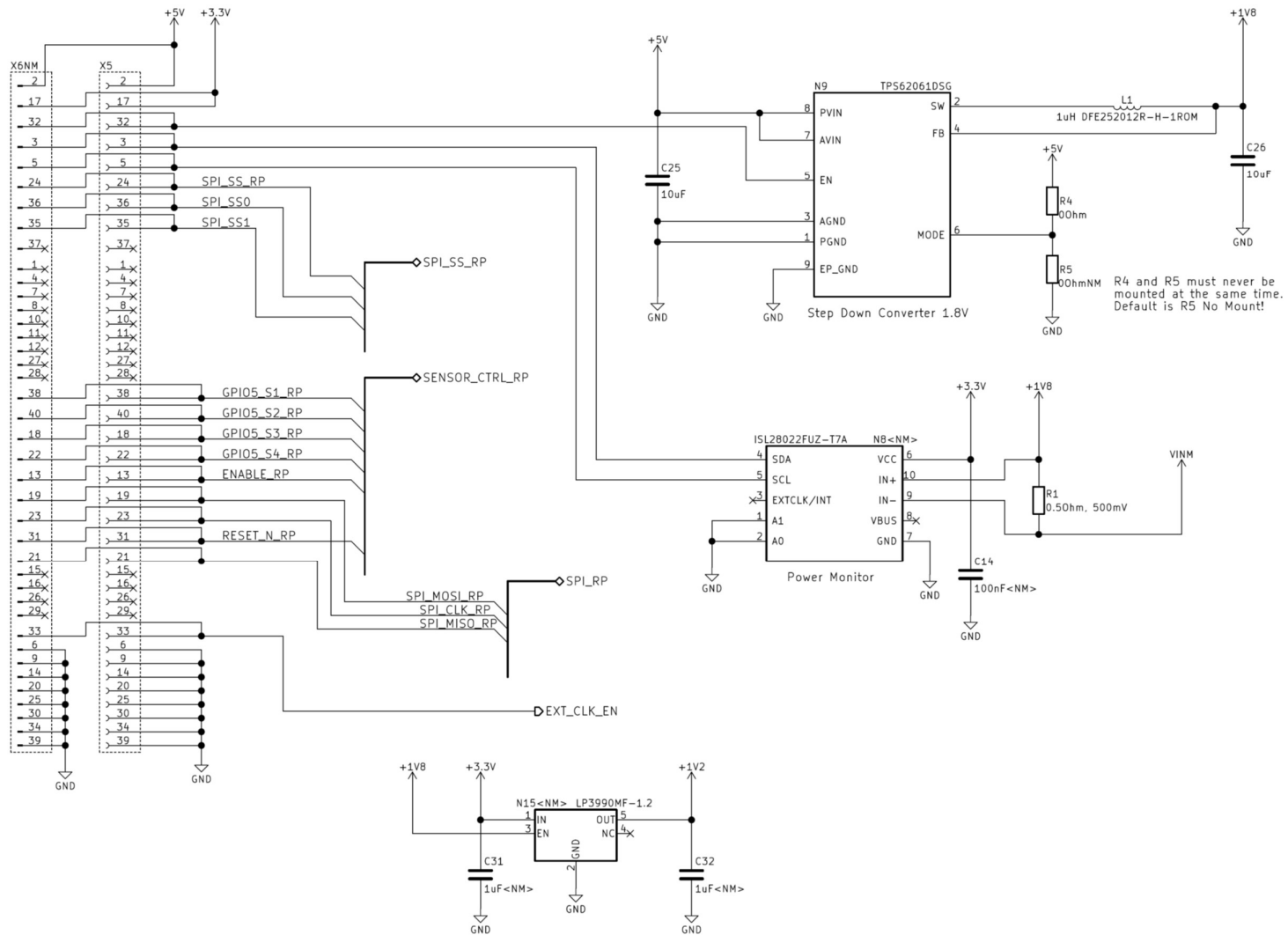
### 3.1.3 Electrical Schematics

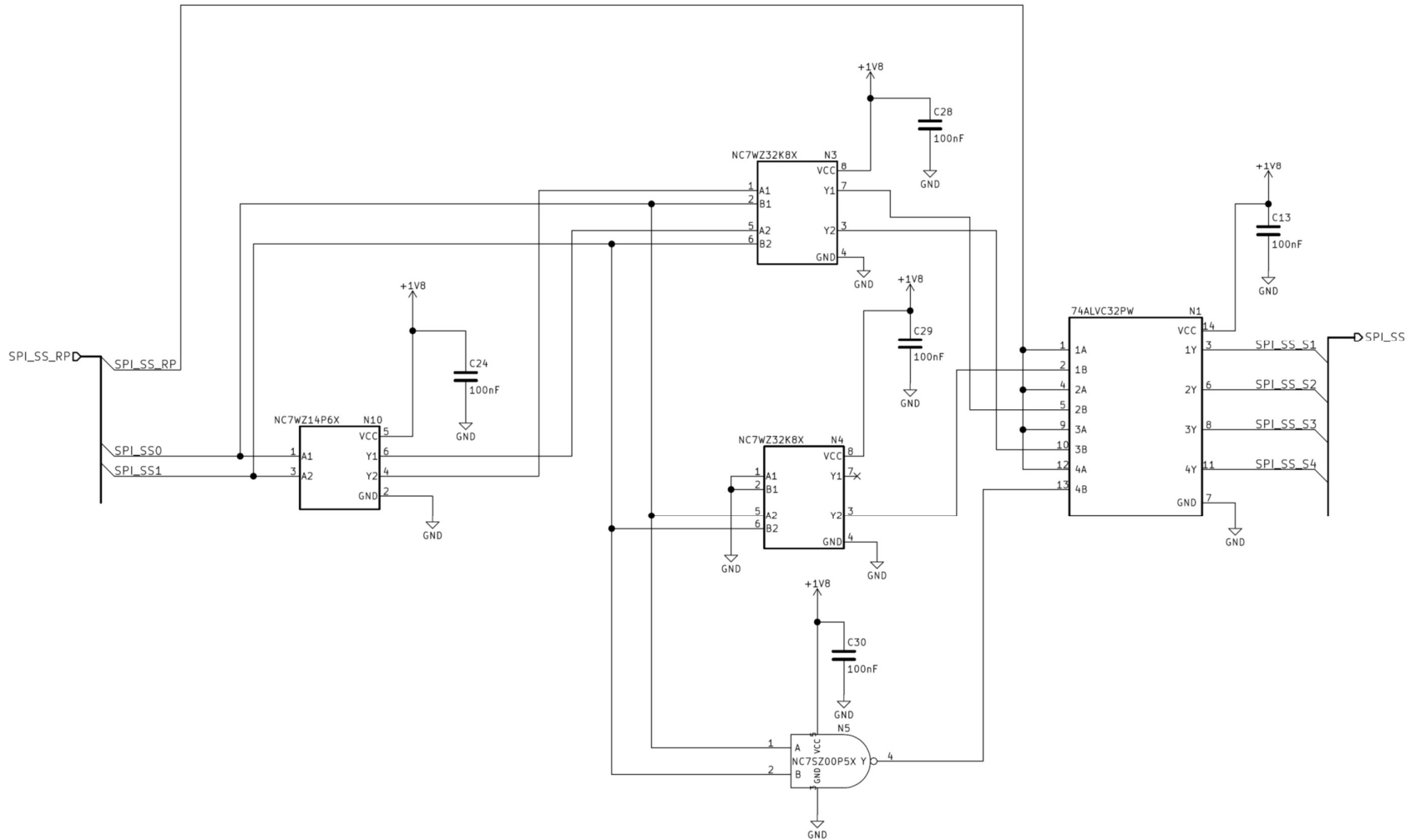
On the following pages, please find the electrical schematics for the XC111.













### 3.1.4 List of Materials

Table 1 shows the BOM for the XC111

Component ref.	Part Number	QTY	Value	Comment
N1	74ALVC32PW	1		
N13	74AUP1T34GW	1		
N12	74LVC125AD	1		
X1-X4	20021321-00040T4LF	4	2X20pin, 1.27 pitch	
B1	ASTX-H12-25.000MHz	1		
C102,C103	CAPM1005_055_1	2	100nF	
C13,C14,C19- C24,C28-C30	CAPM1005_055_1	11	100nF	
C31,C32	CAPM1005_055_1	2	1uF	
C100,C101	CAPM1005_055_1	2	10pF	
C1-C12,C25,C26	CAPM1608_090_1	14	10uF	
X5	CON_HDR_2X20_254_1_REVERSE	1		
X6	CON_HDR_2X20_254_2	1		
FB1-FB12	FB_M1608_090_1	12		
L1	INDM2520_120_1	1	1uH	
N8	ISL28022FUZ-T7A	1		
N15	LP3990MF-1.2/NOPB	1		
N5	NC7SZ00P5X	1		
N10	NC7WZ14P6X	1		
N3,N4	NC7WZ32K8X	2		
N14	PI6CL10804	1		
R4	RESM1005_040_1	1	0R	
R5	RESM1005_040_1	1	0R	
R2	RESM1005_040_1	1	3k	
R1003-R1006	RESM1005_055_1	4	2.7k	
R1001,R1002	RESM1005_055_1	2	100R	
R1	RESM3216_070_1	1	0.5R	
N9	TPS62061DSG	1		
N11	TXB0104PWR	1		



### 3.1.5 Pinning

Figure 3 shows the PIN connections for XC111.

Pin Number	Description
1	Not Connected
2	+5V
3	I2C_SDA connected to power monitoring circuit.
4	Not Connected
5	I2C_SCL connected to power monitoring circuit.
6	GND
7	Not Connected
8	Not Connected
9	GND
10	Not Connected
11	Not Connected
12	Not Connected
13	Sensor Enable
14	GND
15	Not Connected
16	Not Connected
17	+3.3V
18	Sensor 3 GPIO5
19	SPI_MOSI
20	GND
21	SPI_MISO
22	Sensor 4 GPIO5
23	SPI_CLK
24	SPI_SS_RP (In combination with SPI_SS0 and SPI_SS1, this signal selects which sensor the SPI bus shall communicate with.)
25	GND
26	Not Connected
27	Not Connected
28	Not Connected
29	Not Connected
30	GND
31	RESET_N
32	PMU_ENABLE (Enables 5V to 1.8V voltage converter)
33	Clock Buffer Enable

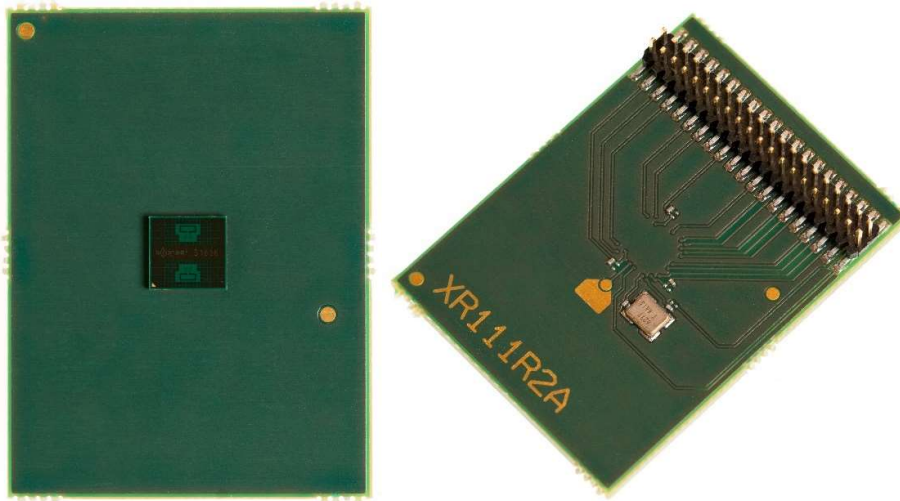


Pin Number	Description
34	GND
35	SPI_SS1 (In combination with SPI_SS0 and SPI_SS_RP, this signal selects which sensor the SPI bus shall communicate with.)
36	SPI_SS0 (In combination with SPI_SS1 and SPI_SS_RP, this signal selects which sensor the SPI bus shall communicate with.)
37	Not Connected
38	Sensor 1 GPIO5
39	GND
40	Sensor 2 GPIO5

## 3.2 XR111 Sensor Board

### 3.2.1 Overview

Picture 3 shows the XR111. The leftmost picture shows the front side of the XR111, with the A111 mounted centrally, and the rightmost picture shows the reverse side of the XR111.









### 3.2.3 List of Materials

Table 1 shows the BOM for the XR111

Component Ref.	Part Number	QTY	Value	Comment
X1	20021121-00040T4LF	1		
N1	A111R2A	1		
C11-C12	CAPM0603_033_1	2	8pF	
C13-C15	CAPM0603_033_1	3	100nF	
C17-C19	CAPM0603_033_1	3		
TP_1	TESTPOINT	1		
B1	TSX-3225	1		24MHz

### 3.2.4 Pinning

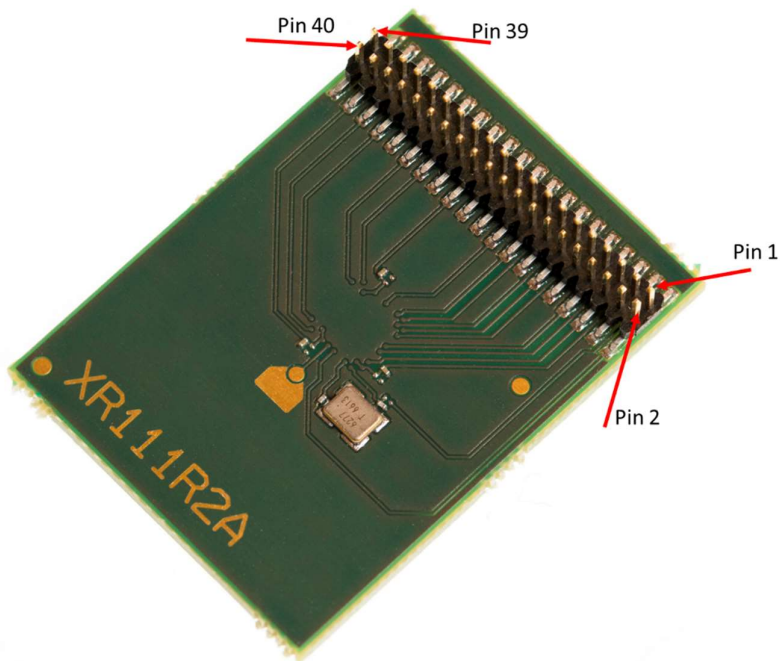
Table 2 shows the PIN connections for XR111.

Pin Number	Description
1	External Reference Clock (if used)
2	Sensor Enable
3	GND
4	GND
5	VIO
6	GPIO5
7	SPI_MOSI
8	GPIO4
9	SPI_MISO
10	GND
11	GND
12	SPI_CLK
13	SPI_SS
14	GND
15	RESET_N
16	GPIO2
17	GND
18	GPIO1
19	GND
20	GND
21	GND
22	GND
23	GND



Pin Number	Description
24	VIO
25	GND
26	GND
27	GND
28	Pin B1 (NC)
29	GND
30	Pin A2 (NC)
31	GND
32	GND
33	GND
34	GPIO0
35	GND
36	GPIO3
37	GND
38	VIO
39	Not Connected
40	GND

In the picture below, the pinning of the XR111 connector is shown:





## 4 Design considerations

The EVK was designed for sensor evaluation purposes only. Should you want to design a product, it is strongly recommended to carefully read and follow the A111 data sheet. The Evaluation Kit is not optimized for product development.



## 5 Safety

### 5.1 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.



## 6 Regulatory Information

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.



## 7 Revision History

Date	Revision	Changes
2018-02-02	1	Original version
2018-02-14	1.1	
2018-04-09	1.2	Updated Figure 1, block diagram. XTAL frequency changed from 26MHz to 24MHz.
2018-04-16	1.3	Updated XR111 Schematic so that the crystal oscillator has 24MHz frequency and not 26MHz. Updated XR111 BOM with comment that the crystal oscillator frequency is 24 MHz.
2018-05-04	1.4	Updated Chapter 3.2.2 Table 1, BOM for XR111. X1 part number was updated since it contained a typo.
2018-05-07	1.5	Updated typos in chapters 3.1.4 and 3.2.4.
2018-08-10	1.6	Added picture of XR111 pinning to chapter 3.2.4.



## 8 Disclaimer

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