Specifications for the Attitude Control and Determination System-XCubeSat

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Contents

Chapter 1

Introduction

The objective of this document is to summarize in one place the specifications related to the software of the Attitude Control and Determination System, henceforth ADCS of the nano-satellite X-CubeSat developed by the students of cole Polytechnique, Paris. We have divided the document into the following sections

- Definition of the architecture of the ADCS
- External Interfaces available on the ADCS
- Sensors and peripherals on the ADCS
- Data formats used for computing
- Protocols for testing

This document shall be useful for all people currently concerned with the conception of the ADCS and eventually for students who will take over the project in the months to come. This document is however, far from being complete and additions, corrections and deletions will be made till the day of delivery.

Chapter 2

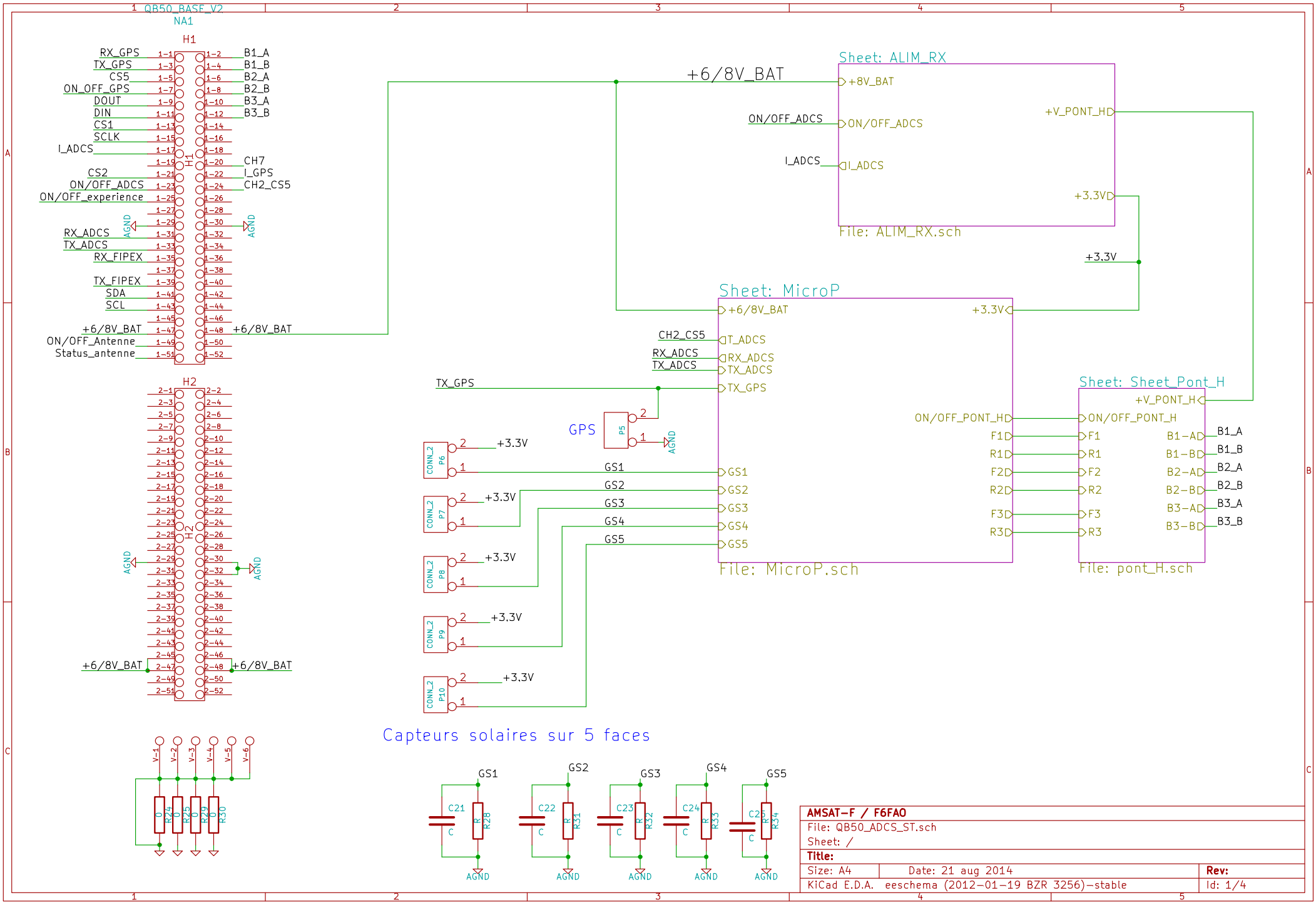
Architecture of the ADCS

The ADCS uses a microprocessor manufactured by ST Microelectronics based on the ARM Cortex-M4 Architecture. The model used is STM 32F405 RGT6

The available interfaces, sensors and other peripherals available on the ADCS are:

- 32 MB External Memory
- 7(or 9) sun sensors
- Magnetometer
- Gyrometer
- H-Bridges to modulate power to the magneto-torquers
- A Serial interface with the On-Board Computer (*Ordinateur de Bord* henceforth, ODB)

Following is the complete plan for the ADCS: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CS5
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DOUT
DIN
CS1
SCLK
I_ADCS
CS2
ON/OFF_ADCS
ON/OFF_experience
RX_ADCS
TX_ADCS
RX_FIPEX
TX_FIPEX
SDA
SCL
+6/8V_BAT
ON/OFF_Antenne
Status_antenne
B1_A
B1_B
B2_A
B2_B
B3_A
B3_B
CH7
I_GPS
CH2_CS5
AGND
H2
+6/8V_BAT
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+8V_BAT
ON/OFF_ADCS
I_ADCS
+V_PONT_H
+3.3V
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+3.3V
CH2_CS5
T_ADCS
RX_ADCS
TX_ADCS
TX_GPS
GPS
P5
CONN_2
P6
P7
P8
P9
P10
GS1
GS2
GS3
GS4
GS5
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+V_PONT_H
ON/OFF_PONT_H
F1
R1
F2
R2
F3
R3
B1-A
B1-B
B2-A
B2-B
B3-A
B3-B
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Capteurs solaires sur 5 faces
V-1
V-2
V-3
V-4
V-5
V-6
R24
R25
R29
R30
C21
C22
C23
C24
C25
R28
R31
R32
R33
R34
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Date: 21 aug 2014
Rev:
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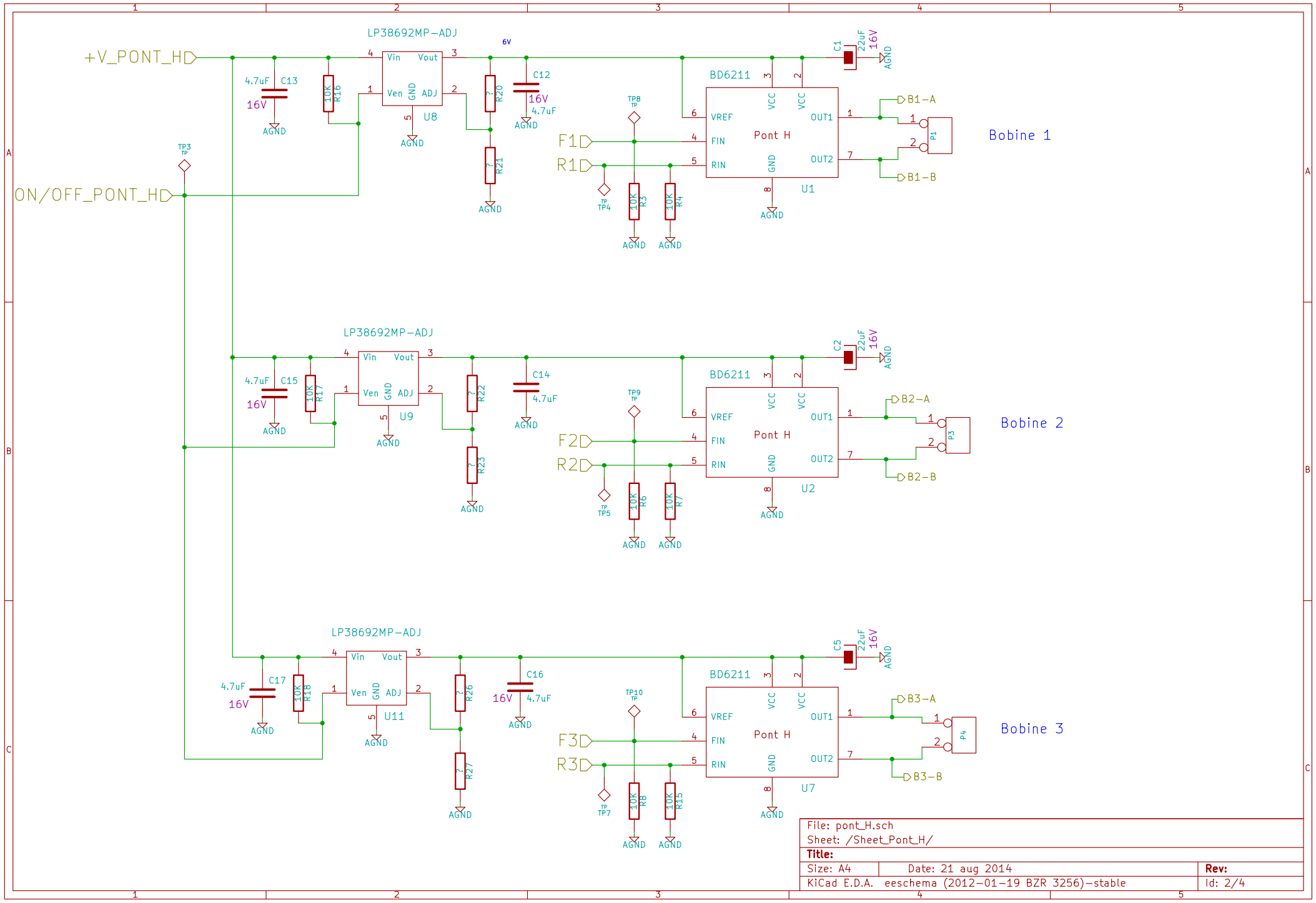
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ON/OFF_PONT_H
LP38692MP-ADJ
6V
4.7uF C13
16V
AGND
10K R16
Vin Vout
Ven GND ADJ
U8
? R20
? R21
C12
16V 4.7uF
TP3
TP8
TP4
F1
R1
10K R3
10K R4
BD6211
VREF FIN RIN
VCC VCC
OUT1 OUT2
GND
Pont H
U1
C1 22uF 16V
B1-A
B1-B
P1
Bobine 1
LP38692MP-ADJ
4.7uF C15
16V
10K R17
U9
? R22
? R23
C14
4.7uF
TP9
TP5
F2
R2
10K R6
10K R7
U2
C2 22uF 16V
B2-A
B2-B
P3
Bobine 2
LP38692MP-ADJ
4.7uF C17
16V
10K R18
U11
? R26
? R27
C16
16V 4.7uF
TP10
TP7
F3
R3
10K R8
10K R15
U7
C5 22uF 16V
B3-A
B3-B
P4
Bobine 3
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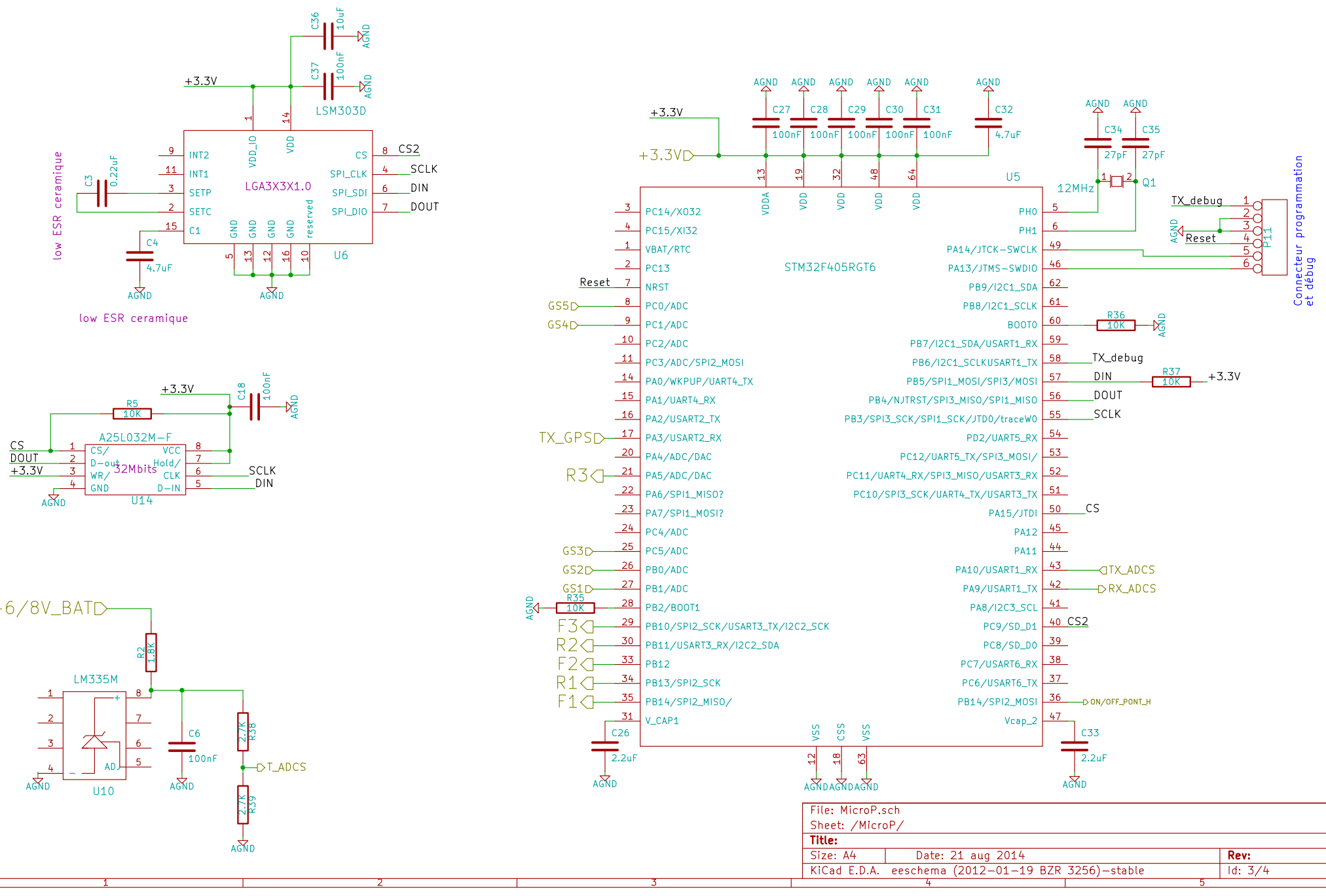
+3.3V
C36
10uF
C37
100nF
AGND
LSM303D
INT2
INT1
SETP
SETC
C1
VDD_IO
VDD
CS
SPI_CLK
SPI_SDI
SPI_DIO
reserved
GND
CS2
SCLK
DIN
DOUT
C3
0.22uF
low ESR ceramique
C4
4.7uF
U6
low ESR ceramique
+3.3V
R5
10K
C18
100nF
A25L032M-F
CS/
D-out
WR/
GND
VCC
Hold/
CLK
D-IN
32Mbits
U14
+6/8V_BAT
R2
1.8K
LM335M
ADJ
C6
100nF
R38
2.7K
T_ADCS
R39
2.7K
U10
C27
C28
C29
C30
C31
C32
100nF
4.7uF
C34
C35
27pF
12MHz
Q1
U5
STM32F405RGT6
VDDA
VDD
VSS
CSS
PC14/XO32
PC15/XI32
VBAT/RTC
PC13
NRST
PC0/ADC
PC1/ADC
PC2/ADC
PC3/ADC/SPI2_MOSI
PA0/WKPUP/UART4_TX
PA1/UART4_RX
PA2/USART2_TX
PA3/USART2_RX
PA4/ADC/DAC
PA5/ADC/DAC
PA6/SPI1_MISO?
PA7/SPI1_MOSI?
PC4/ADC
PC5/ADC
PB0/ADC
PB1/ADC
PB2/BOOT1
PB10/SPI2_SCK/USART3_TX/I2C2_SCK
PB11/USART3_RX/I2C2_SDA
PB12
PB13/SPI2_SCK
PB14/SPI2_MISO/
V_CAP1
PH0
PH1
PA14/JTCK-SWCLK
PA13/JTMS-SWDIO
PB9/I2C1_SDA
PB8/I2C1_SCLK
BOOT0
PB7/I2C1_SDA/USART1_RX
PB6/I2C1_SCLKUSART1_TX
PB5/SPI1_MOSI/SPI3/MOSI
PB4/NJTRST/SPI3_MISO/SPI1_MISO
PB3/SPI3_SCK/SPI1_SCK/JTDO/traceWO
PD2/UART5_RX
PC12/UART5_TX/SPI3_MOSI/
PC11/UART4_RX/SPI3_MISO/USART3_RX
PC10/SPI3_SCK/UART4_TX/USART3_TX
PA15/JTDI
PA12
PA11
PA10/USART1_RX
PA9/USART1_TX
PA8/I2C3_SCL
PC9/SD_D1
PC8/SD_D0
PC7/USART6_RX
PC6/USART6_TX
PB14/SPI2_MOSI
Vcap_2
Reset
GS5
GS4
TX_GPS
R3
GS3
GS2
GS1
R35
10K
F3
R2
F2
R1
F1
C26
2.2uF
C33
2.2uF
R36
10K
R37
10K
TX_debug
DIN
DOUT
SCLK
CS
CS2
TX_ADCS
RX_ADCS
ON/OFF_PONT_H
P11
Connecteur programmation
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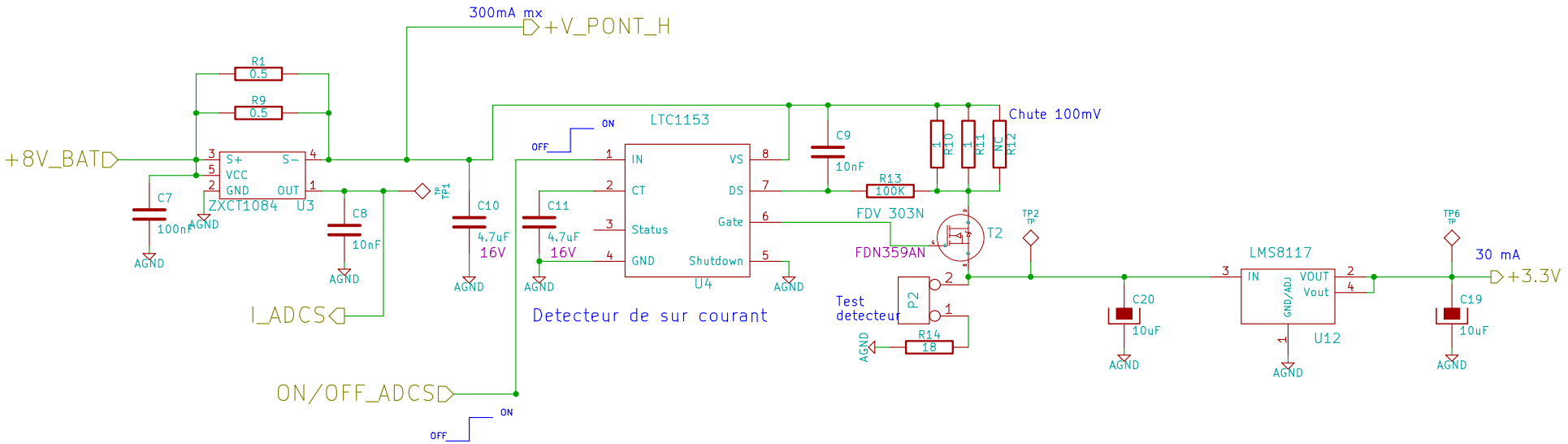

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Chapter 3

External interfaces

Chapter 4

Sensors and peripherals

Chapter 5

Data formats

Chapter 6

Testing