Sheet1
alimentation

VPA_EN

Sheet2
user_interface

| LCD_SCK |
| LCD_MOSI |
| LCD_MISO |
| LCD_LCD_nCS |
| LCD_SD_nCS |
| LCD_D/nC |
| LCD_nRESET |
| LCD_BL |

nBTN1_OUT
nBTN2_OUT

FT230_TXD
FT230_RXD
FT230_nRTS
FT230_nCTS

Sheet3
microcontroller

GPIO_PIO1_12

FC6_SCK
FC6_MOSI
FC6_MISO
FC6_SSEL1
LCD_SD_nCS
LCD_D/nC
LCD_nRESET
LCD_BL

PINT1
PINT2

FC3_TXD
FC3_RXD
FC3_nRTS
FC3_nCTS

FC1_SCK
FC1_MOSI
FC1_MISO
FC1_SSEL0

GPIO_PIO0_1
INT0

ADC0_CH4
ADC0_CH3

GPIO_PIO1_9

ADC0_CH8

FC7_SSEL1
FC7_SSEL2
FC7_SSEL3
FC7_SCK
FC7_MOSI

GPIO_PIO0_25
GPIO_PIO0_26

Sheet4
rf_interface

rfid_reader_SCK
rfid_reader_MOSI
rfid_reader_MISO
rfid_reader_nCS

rfid_reader_EN
rfid_reader_IRQ

rfid_reader_OAD
rfid_reader_OAD2

rfid_reader_CLSYS

RF_OUT_20dbm
RF_OUT_0dbm

RX_P
RX_N

rfid_reader_ADC

Sheet5
ext_power_amplifier

RF_20dbm
RF_0dbm

PA_SWITCH_EXT_AMP_OUTPUT
PA_SWITCH_20dbm_FIXED_OUTPUT

LP_FILTER_OUT

Sheet6    coupling

RX_P
RX_N

RF_DETECTOR

DIR_COUPLER_INPUT

DTC1_EN
DTC2_EN
DTC3_EN
DTC_SCK
DTC_MOSI

FD1          FD2          FD3
FID1X2R    FID1X2R    FID1X2R

PTH1    PTH2    PTH3    PTH4

GND      GND      GND      GND
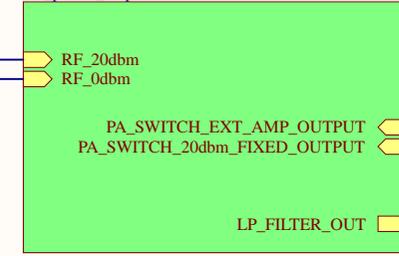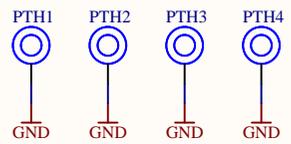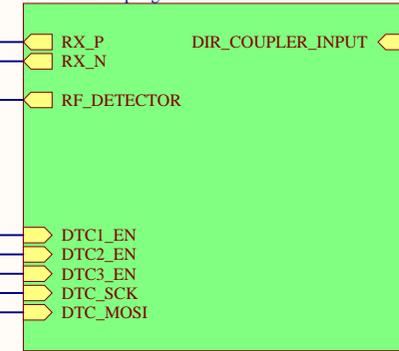
| Title | *RFID UHF READER* | |
|---|---|---|
| Size: A4 | Number:* | Revision:2.0 |
| Date: 20/02/2022 | Time: 20:20:12 | Sheet 1 of 7 |
| File: D:\rfid_uhf_baseStation_V2\baseStation\baseStation.SchDoc | | |

*
Hepia
Gaetan Passeri
TB 2020-2021
*

ALTIUM

Oscillator

3V3
FB2 1k
U7 TCXO 20.000MHZ
VCC OUT
GND GND
C40 100nF
GND
C21 220nF
R17 NC
X1 20 MHZ
C38 11pF
R18 NC
C39 11pF
GND
TP7 OSCO
TP8 OSCI

R25 15k
TP9
LF_CEXT
C41 3n9F
C42 150pF
GND GND

3V6
C37 0.47uF
FB3 330R
FB4 1k
VEXT_PA
VEXT
C43 10uF
GND
C50 2u2F
GND
C51 2u2F
GND
3V3
C52 100nF Low ESL
GND

3V3
R45 10k
TP11
TP10 TP12 TP13 TP15

rfid_reader_EN
rfid_reader_nCS
rfid_reader_SCK
rfid_reader_MOSI
rfid_reader_MISO
rfid_reader_IRQ
rfid_reader_CLSYS
rfid_reader_ADC
rfid_reader_OAD
rfid_reader_OAD2

from uC DAC output
to uC ADC inputs

R26

U8 ST25RU3993

VEXT 11
VEXT_PA 14
VDD_IO 38

EN 31
NCS 33
SCLK 37
MOSI 35
MISO 34
IRQ 32
CLSYS 36
ADC 39
OAD 27
OAD2 26
OSCI 29
OSCO 30
LF_CEXT 45
CD1 41
CD2 40
AGD 42

VOSC 43
VDD_A 44
VDDLF 46
VDD_PA 13
VDD_D 28
VDD_B 12
CBIB 9
COMP_A 47
COMN_A 48
COMP_B 5
COMN_B 5
VDD_LFI 3
VDD_TXPAB 7
VDD_MIX 10
CBV 8
MIX_INP 4
MIX_INN 6

ST25RU3993
UHF RFID
Integrated Reader IC

EP 49

TP16 TP20
TP17 TP18 TP19

C57 2u2F  C58 120pF  C59 2u2F  C60 120pF  C61 2u2F  C62 120pF
GND

C67 2u2F  C68 30pF  C69 2u2F  C70 30pF  C71 2u2F  C72 120pF
GND

C76 2u2F  C77 100nF Low ESL  C78 2u2F  C79 30pF  C80 2u2F  C81 100nF Low ESL  C82 2u2F  C83 100nF Low ESL
GND

C87 10nF  C88 10nF  C89 10nF  C90 10nF
C91 2u2F  C92 100nF Low ESL  C93 2u2F  C94 100nF Low ESL
GND

VSN 15  VSN 18  VSN 19  VSN 22  VSN 25  VSS/MIXS_IN 50
GND

RFOPX 24  RFO_P
RFONX 23  RFO_N
PAOUT_P 20 21  PAOUT_P
PAOUT_N 16 17  PAOUT_N
MIX_INP 4  IN_P
MIX_INN 6  IN_N

VDD_B
C53 120pF  L1 30nH  100ohm  C54 82pF  100ohm  TX_P
VDD_B
C55 120pF  L2 30nH  100ohm  C56 82pF  100ohm  TX_N

T1
B1 UB 1
NC 6 GND 2
B2 GND 5
BD0810J50100A00
GND

50ohm
J2 COAX JACK
I O
GND GND
RF_OUT_0dbm
50ohm

VDD_PA
C63 120pF  L3 30nH  50ohm  C64 15pF  L4 3n6F  50ohm  C66 5p6F
C65 1p2F  GND
GND

VDD_PA
C74 120pF  L5 30nH  50ohm  C75 15pF  L6 3n6F  50ohm  C85 5p6F
C84 1p2F  GND
GND

T2
B1 GND 2
NC 6 UB 1
B2 GND 5
Balun

50ohm  C73 82pF
J3 COAX JACK
I O
GND GND
RF_OUT_20dbm
50ohm

100ohm  C86 82pF  100ohm  RX_P
100ohm  C95 82pF  100ohm  RX_N

VDD_PA
VDD_D
VDD_B

# RFID UHF READER — microcontroller schematic (Sheet 3 of 7)

U3 — LPC54114J256BD64QL

Power / decoupling (top):
- FB5 1k (3V3)
- FB6 1k (3V3)
- C22 100nF, C23 10nF, C24 100nF, C25 10nF, C26 100nF, C27 10nF, C28 100nF, C29 10nF
- C30 100nF, C31 10uF
- VDD pins: 56, 34, 8, 24; VDDA pin 23
- GND/GND

**Left side (pins / nets):**

Flexcomm6 - SPI
- FC6_SCK — 41 — PIO0_7/FC6_SCK
- FC6_MOSI — 39 — PIO0_5/FC6_MOSI
- FC6_MISO — 40 — PIO0_6/FC6_MISO
- FC6_SSEL1 — 42 — PIO1_11/FC6_SSEL1

GPIO_LCD_MODULE
- LCD_D/nC — 46 — PIO0_11/D/nC
- LCD_nRESET — 45 — PIO0_10/nRESET
- LCD_SD_nCS — 44 — PIO0_9/SD_nCS
- LCD_BL — 43 — PIO0_8/BL

Flexcomm3 - UART
- FC3_TXD — 48 — PIO0_13/FC3_TXD
- FC3_RXD — 47 — PIO0_12/FC3_RXD
- FC3_nRTS — 50 — PIO0_15/FC3_nRTS
- FC3_nCTS — 49 — PIO0_14/FC3_nCTS

UI_Buttons_PINT1/2
- PINT1 — 37 — PIO0_3/PINT1
- PINT2 — 38 — PIO0_4/PINT2

- GPIO_LED_D — 36 — PIO0_2
- GPIO_LED_C — 58 — PIO0_18
- GPIO_LED_B — 59 — PIO0_19
- GPIO_LED_A — 60 — PIO0_20
- 61 — PIO0_21
- 63 — PIO0_22
- PIO0_23
- GPIO_PIO1_12 — 51 — PIO1_12
- VPA_EN — 54 — PIO1_13
- 57 — PIO1_14
- 62 — PIO1_15
- 1 — PIO1_16
- 10 — PIO1_17
- PIO0_31 — 13 — PIO0_31
- SWDIO/PIO0_17 — 53 — SWDIO/ PIO0_17
- SWCLK/PIO0_16 — 52 — SWCLK/ PIO0_16
- nRESET — 64 — nRESET
- USB_DM — 6 — USB_DM
- USB_DP — 5 — USB_DP

USB LPC not used

**Right side (pins / nets):**

Flexcomm1 - SPI
- PIO1_10/FC1_SCK — 30 — FC1_SCK
- PIO0_29/FC1_MOSI — 11 — FC1_MOSI
- PIO0_30/FC1_MISO — 12 — FC1_MISO
- PIO0_24/FC1_SSEL0 — 2 — FC1_SSEL0

GPIO_RFID_Reader
- PIO0_1_GPIO_EN — 32 — GPIO_PIO0_1
- PIO0_0/INT0 — 31 — INT0
- PIO1_9/GPIO_CLSYS — 29 — GPIO_PIO1_9
- PIO1_0/ADC0_CH3 — 14 — ADC0_CH3
- PIO1_1/ADC0_CH4 — 15 — ADC0_CH4

SWITCH_RF_OUT_SRC
- PIO0_25/GPIO_SW_RF_1 — 3 — GPIO_PIO0_25
- PIO0_26/GPIO_SW_RF_2 — 4 — GPIO_PIO0_26

Flexcomm7 - SPI
- PIO1_6/FC7_SCK — 26 — FC7_SCK
- PIO1_7/FC7_MOSI — 27 — FC7_MOSI
- PIO1_8/FC7_MISO — 28 — FC7_MISO ✕
- PIO1_4/FC7_SSEL1 — 18 — FC7_SSEL1
- PIO1_3/FC7_SSEL2 — 17 — FC7_SSEL2
- PIO1_2/FC7_SSEL3 — 16 — FC7_SSEL3

GPIO_COUPLING
- PIO1_5/ADC0_CH8 — 19 — ADC0_CH8

- VREFP — 22
- VREFN — 21
- RTCXIN — 33
- RTCXOUT — 35

R43 10k, R44 10k (3V3)
FB8 1k (3V3)
C32 100nF, C33 100nF, C34 10uF — GND
C35 22pF, C36 22pF — GND
Y3 32.768kHz
TP21

**Bottom left:**
- R29 680R, R30 680R, R31 680R, R32 680R
- D6 LED, D7 LED, D8 LED, D9 LED — GND
- R7 10K, R8 10K, R1 10K (3V3)
- R9 10K (3V3)
- P1 (3V3)
- TP22 TP23 TP24
- TP28 — GND
- D1 BAT54W-HG3-08
- SW1 FSM4JSMA, C1 100nF — GND
- SW4 FSM4JSMA, C2 100nF — GND
- TP25, TP14
- TP26 TP27

**VSS / bottom:**
- VSSA — 20 — GND
- VSS — 25 — GND
- VSS — 55 — GND
- VSS — 9 — GND

VPA

C96
0.47uF
GND

C97
0.47uF

C98
10uF
GND

C99
2u2F
GND

R27
100R

R28
0R

R33
0R

U9
TQP9107

VCC    VBIAS    VPD1    VPD2
2       1        12      11

RFIN                     RFOUT
13                        7

Exposed Pad
14

NC  NC  NC  NC  NC  NC  NC
3    4    5    6    8    9   10

GND

RF_0dbm

GND

50ohm
PA_OUT

J4 COAX JACK
I        O
GND  GND

GND

RF_20dbm

C102
82pF

50ohm

50ohm

C100
82pF

50ohm

GND

50ohm

S1
6  RF1          V1   1
5  GND    RFC        2
7  EP
4  RF2          V2   3
SP2T

TP29

PA_SWITCH_EXT_AMP_OUTPUT

50ohm

C100
82pF
LP_FILTER_IN

50ohm

T3    LOWPASS FILTER
IN              OUT   4
8

GND GND GND GND   NC NC
1   3   5   7     6  2

GND

50ohm
LP_FILTER_OUT

TP30

PA_SWITCH_20dbm_FIXED_OUTPUT

## RFID UHF READER

*Hepia*
*Gaetan Passeri*
*TB 2020-2021*

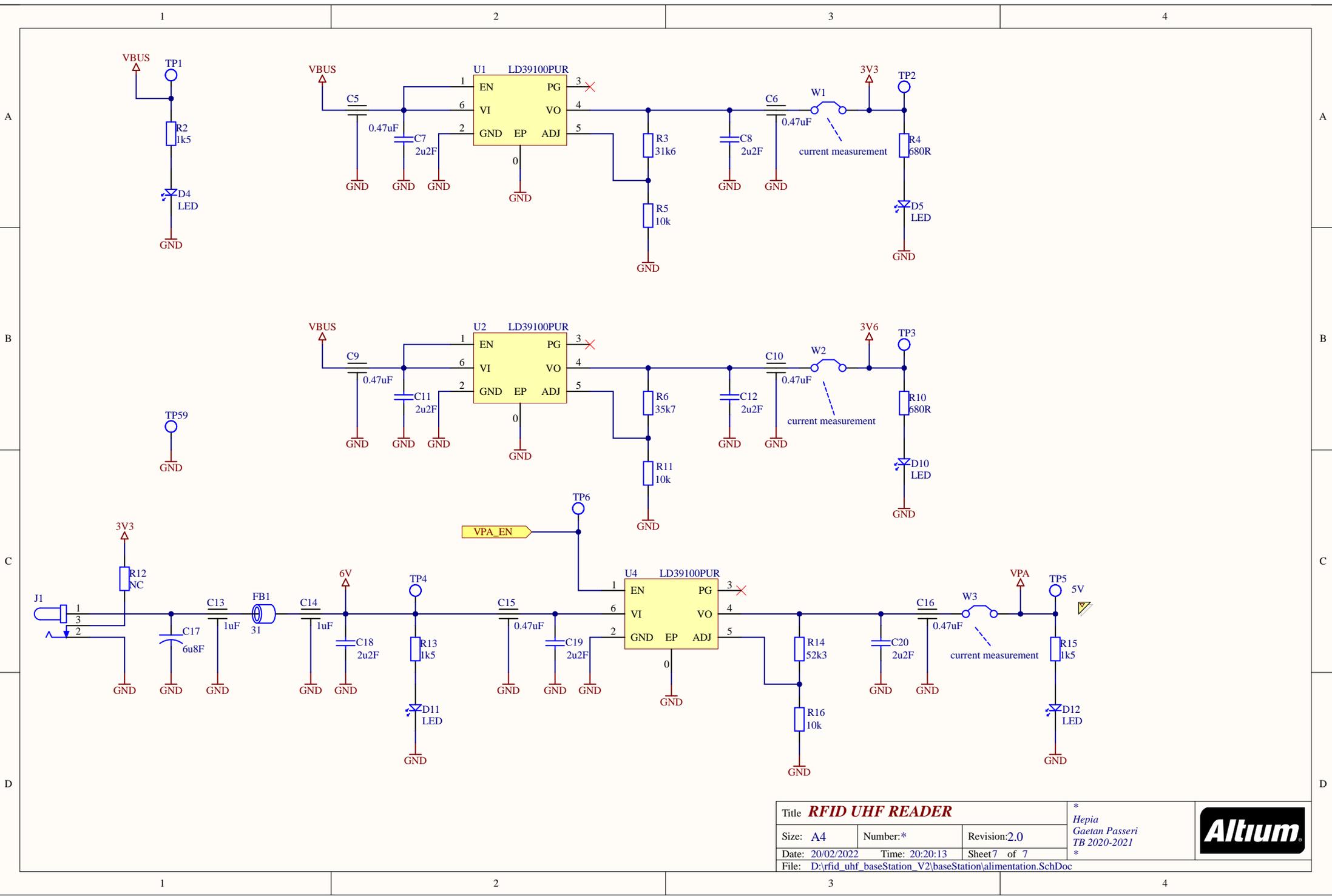| Title | **RFID UHF READER** | | |
|---|---|---|---|
| Size: A4 | Number:* | | Revision: 2.0 |
| Date: 20/02/2022 | Time: 20:20:13 | Sheet 5 of 7 | |
| File: D:\rfid_uhf_baseStation_V2\baseStation\coupling.SchDoc | | | |

Labels and components visible:

DIR_COUPLER_INPUT — 50ohm — R34 249R — R36 62R — R37 62R

T4 — Input / Coupled / GND — Direct / Isolated / GND — 20 dB Dir Coupler

R38 51.1R — TX_RX — 50ohm — J5

T5 — Input / Coupled / GND — Direct / Isolated / GND — 10dB Dir Coupler — CCC

J6 COAX JACK — I / O — GND / GND

T6 — UB / GND / GND — B1 / NC / B2 — RX_N — RX_P — BD0810J50100A00

U10 Log Detect — RFIN / /SHDN / CLPF — VCC / OUT / GND / GND / NC

C111 120pF — C112 2u2F — 3V3 — C103 2n2F — TP54 — RF_DETECTOR

TP31 — TP53 — DTC_SCK — SCK — DTC_MOSI — MOSI

R39 52.3R — 50ohm

CCC — 50ohm — C104 1p6F — R40 0R — 50ohm

U11 PE64906MLAA-Z — VDD / SEN / SCLK / SDAT / GND / GND — RF_neg / RF_neg / RF_pos / RF_pos

DTC3_EN — 3V3 — C105 2u2F — C106 120pF — TP55 — SCK / MOSI

L7 6n8H — GND

U12 PE64906MLAA-Z — RF_neg / RF_neg — RF_pos / RF_pos — VDD / SEN / SCLK / SDAT / GND / GND

L8 6n2H — R41 110R — R42 100R

3V3 — C109 2u2F — C110 120pF — SCK / MOSI — TP57 — DTC2_EN

U13 PE64906MLAA-Z — RF_neg / RF_neg — VDD / SEN / SCLK / SDAT / GND / GND — RF_pos / RF_pos

DTC1_EN — 3V3 — C107 2u2F — C108 120pF — TP56 — SCK / MOSI

# RFID UHF READER

| Column | 1 | 2 | 3 | 4 |
|--------|---|---|---|---|

**U5** — FT230XQ-R

- VBUS
- R19 NC
- TP32
- TP33 TP34
- TP35
- TP36 TP37 TP38 TP39

P2:
- 1 VBUS
- 2 D-
- 3 D+
- 4 ID
- 5 GND
- SHIELD
- SHIELD
- SHIELD
- SHIELD
- SHIELD
- SHIELD

FB7

R3n 27R
R20 27R

- 10 VCC
- 7 USB_DM
- 6 USB_DP
- 8 3V3OUT
- 1 VCCIO
- 9 nRESET

- TXD 15 → FT230_TXD
- RXD 2 ← FT230_RXD
- nRTS 16 → FT230_nRTS
- nCTS 4 ← FT230_nCTS
- CBUS0/TXDEN 12
- CBUS1/nRXLED 11 → D2 LED R21 680R 3V3OUT
- CBUS2/nTXLED 5 → D3 LED R22 680R 3V3OUT
- CBUS3/nSLEEP 14

3V3OUT
TP40

C44 10nF
C45 47pF
C46 47pF
C47 4u7F
C48 100nF
C49 100nF

GND GND GND GND GND GND GND

GND 3 / GND 13 / GND 17

GND GND GND

## Buttons

- 3V3
- TP43
- R23 10k
- SW2 FSM4JSMA
  - 1 — 2
  - 3 — 4
- C3 100nF
- nBTN1_OUT

- 3V3
- TP44
- R24 10k
- SW3 FSM4JSMA
  - 1 — 2
  - 3 — 4
- C4 100nF
- nBTN2_OUT

GND GND GND GND

TP52
GND

## U6 — Adafruit_1480

- BL 10 — TP41 → LCD_BL
- SCCK 9 — TP42 → LCD_SCK
- MISO 8 — TP45 → LCD_MISO
- MOSI 7 — TP46 → LCD_MOSI
- nLCD_CS 6 — TP47 → LCD_LCD_nCS
- nSD_CS 5 — TP48 → LCD_SD_nCS > for future applications
- nRESET 4 — TP49 → LCD_nRESET
- D/nC 3 — TP50 → LCD_D/nC
- VCC 2 — TP51 → 3V3
- GND 1 — GND