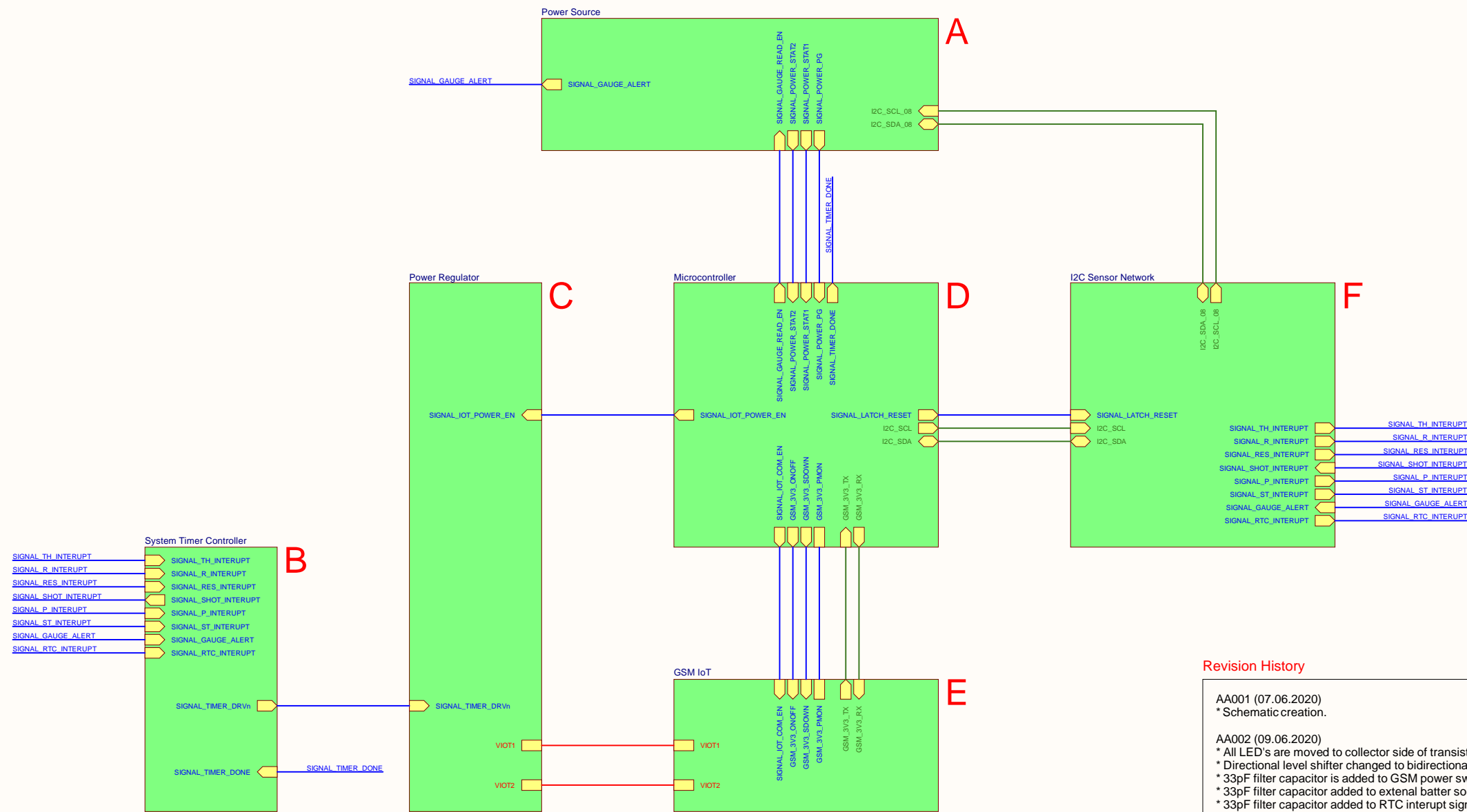


B106 - Weather Station IoT Module



Revision History

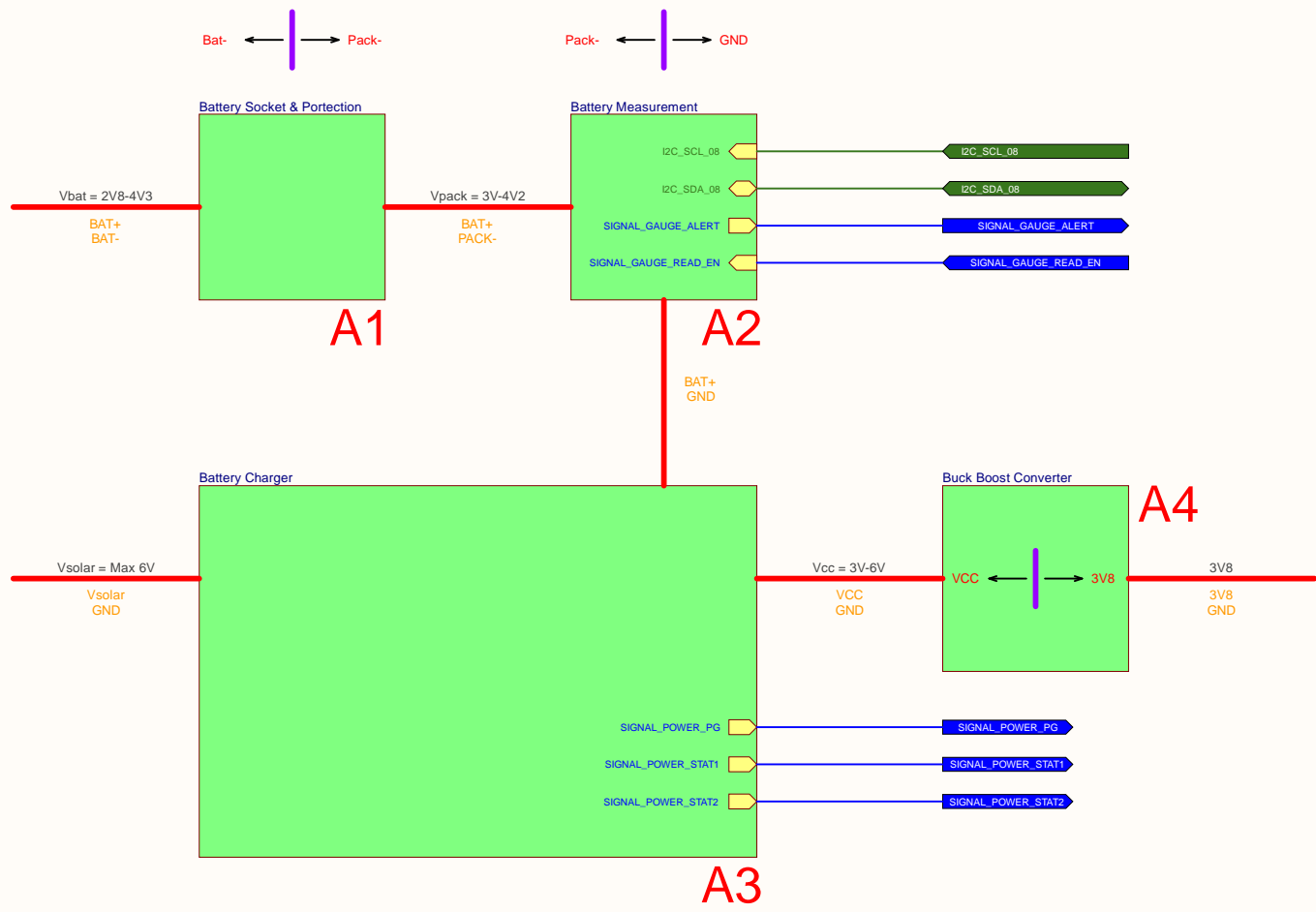
- AA001 (07.06.2020)
* Schematic creation.
- AA002 (09.06.2020)
* All LED's are moved to collector side of transistors.
* Directional level shifter changed to bidirectional level shifter.
* 33pF filter capacitor is added to GSM power switch in and out.
* 33pF filter capacitor added to external batter socket in (BAT+).
* 33pF filter capacitor added to RTC interrupt signal.
* 33pF filter capacitor added to Rain sensor interrupt signal.
* 33pF filter capacitor added to Pressure sensor interrupt signal.
- AA003 (12.06.2020)
* Test points added to required signal lines.
* Noise filter capacitors are added to LED Anode and Cathode.

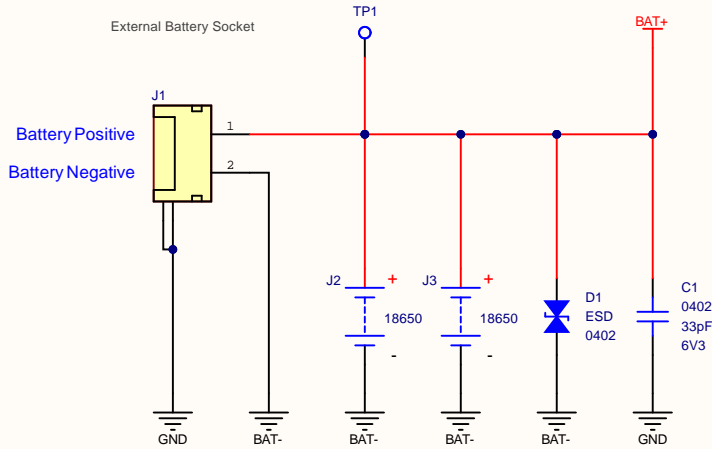


Li-Ion Battery
2 x 2500 mAh



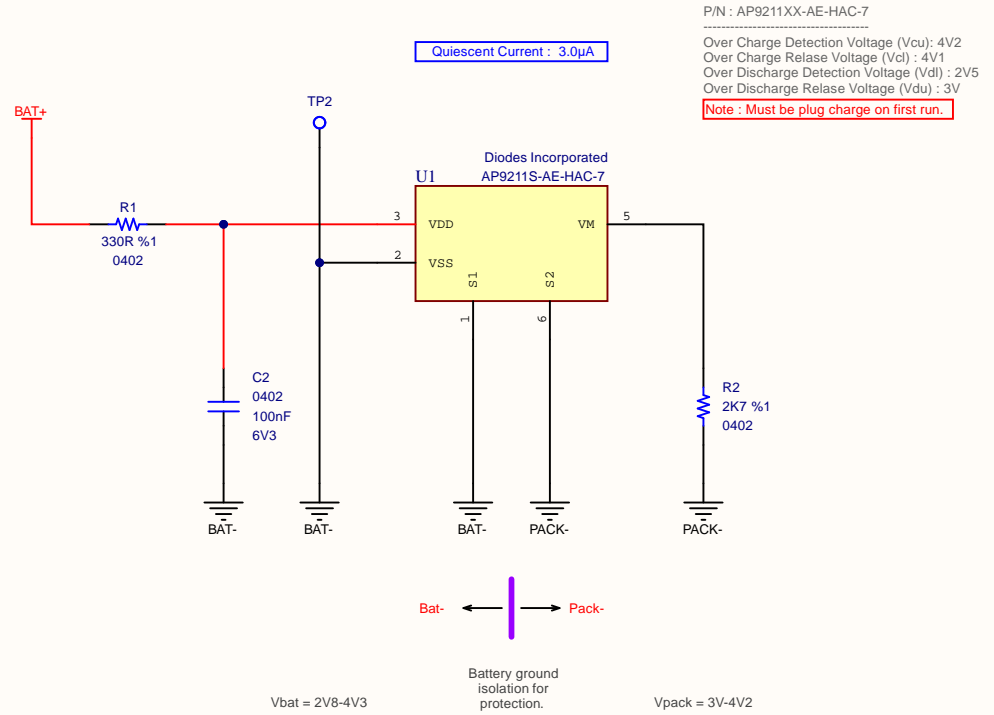
Solar Panel Socket






B106AA module have a battery holder for 18650 Lilon battery.
System have 2 parallel connected battery system.

Advice : 2x2500mAh VTC6

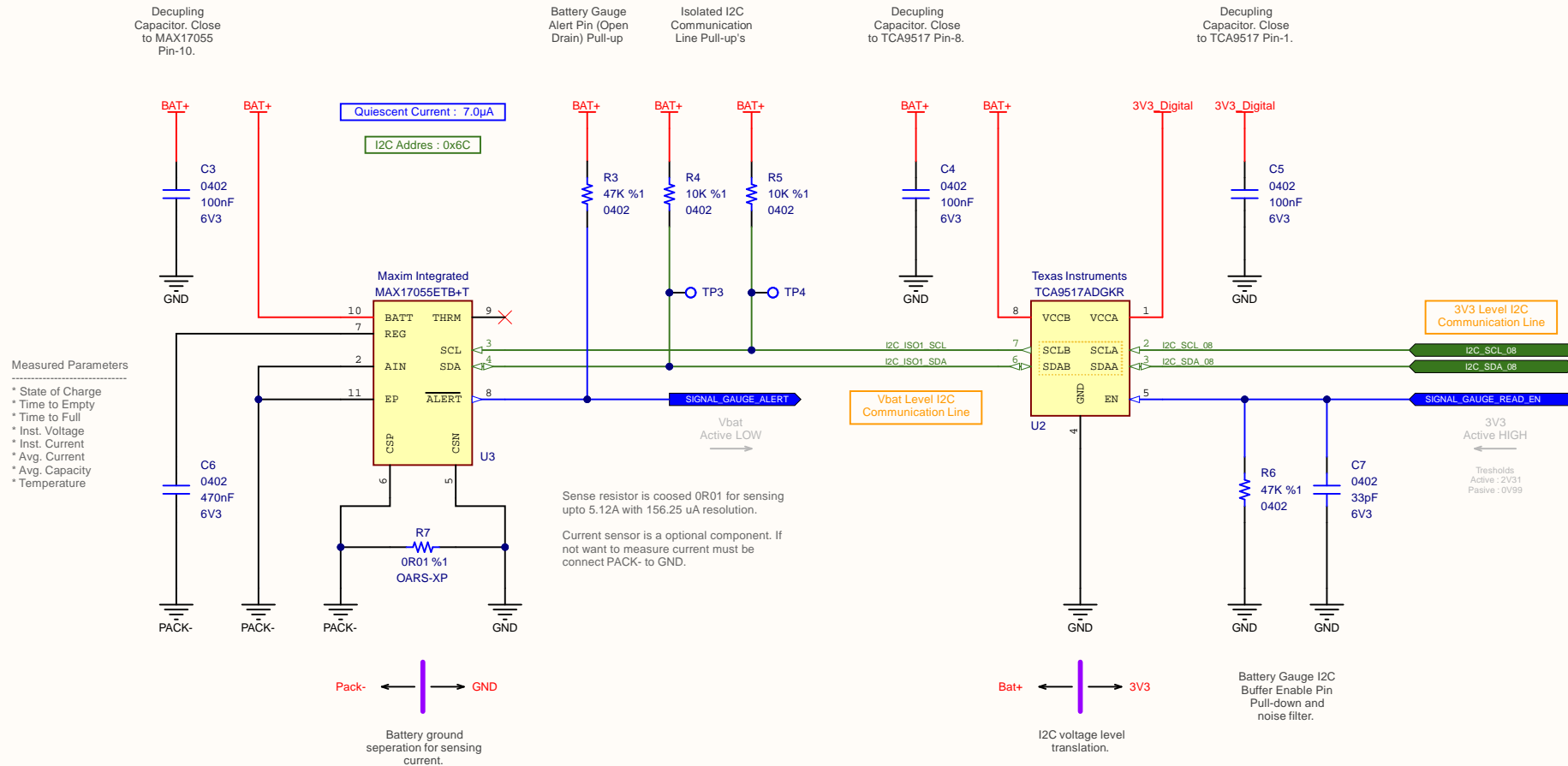


A1


| | | | | | |
|--|-----------------------|-----------------------------|--|--|---|
| Title System Battery Feed and Battery Socket | | | Ovoo Electronics | |  |
| Size: A4 | Number: AA003 | Revision: B106AA | Küçük İnşaniye Mah. Mizraklı Sok. No:15 Meram / Konya Türkiye | | |
| Date: 12.06.2020 | Time: 21:53:02 | Sheet 3 of 37 | | | |
| File: C:\Altium Projects\STF\P102 - Weather Station\Modules\B106AA\Schematic\Battery Feed and Socket.SchDoc | | | | | |

Battery Measurement

I2C Buffer



A2

| | | | | | |
|--|-----------------------|-----------------------------|--|--|---|
| Title Battery Measurement With I2C Isolation | | | Ovoo Electronics | |  |
| Size: A4 | Number: AA003 | Revision: B106AA | Küçük İhsaniye Mah. Mızraklı Sok. No:15 Meram / Konya Türkiye | | |
| Date: 12.06.2020 | Time: 21:53:02 | Sheet 4 of 37 | | | |
| File: C:\Altium Projects\STF\P102 - Weather Station\Modules\B106AA\Schematic\Battery Measurement.SchDoc | | | | | |

A

B

C

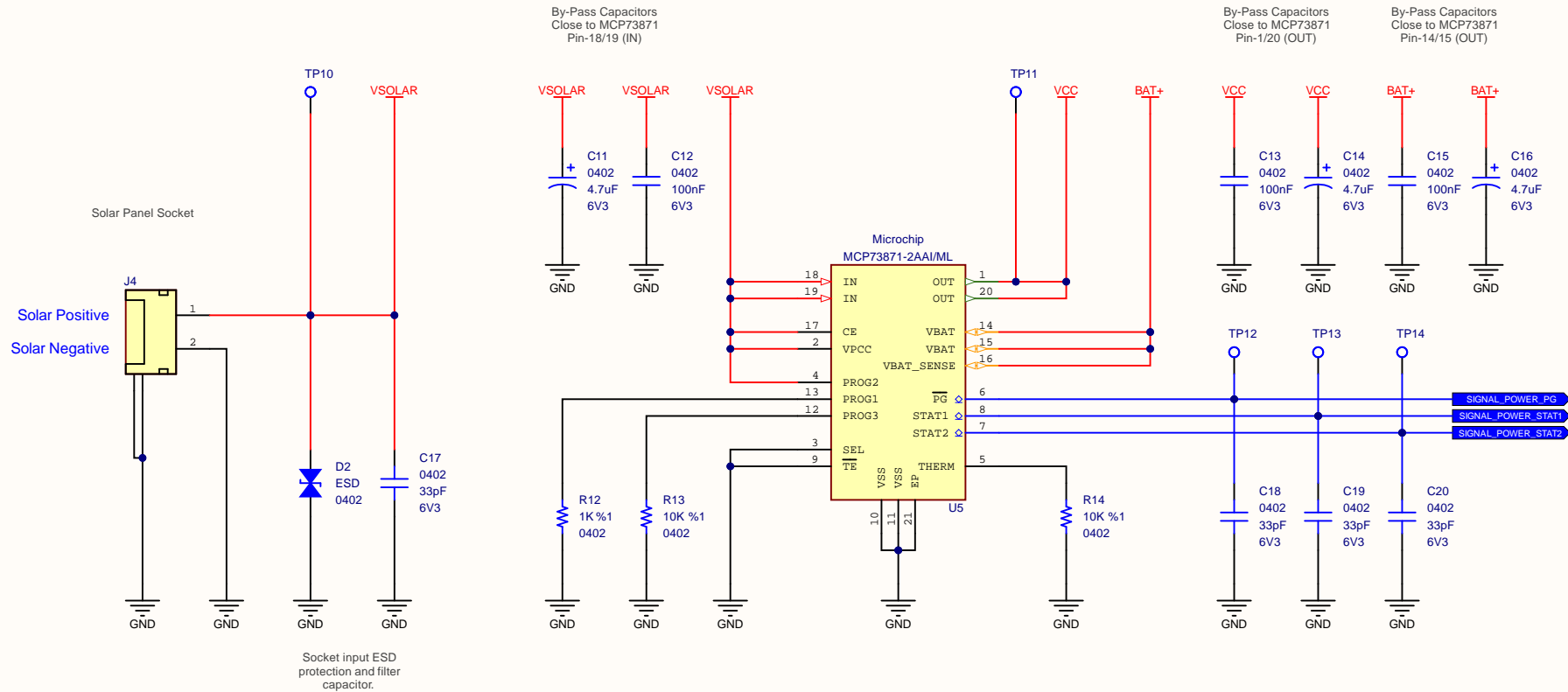
D

A

B

C

D



SEL Pin : Input type selection (Low for USB port, High for other type of power source)


TE Pin : Enables Safety Timer when active Low.

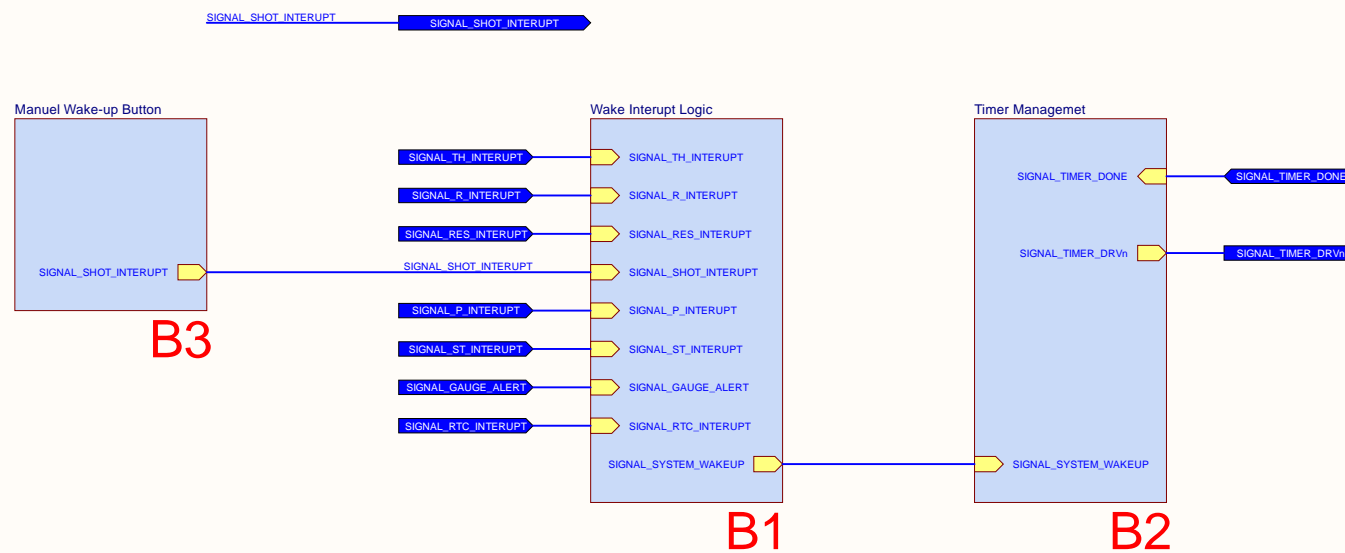
PROG1 Pin : Fast charge current regulation setting with PROG1 = High. Preconditioning set point for both USB port and other type of power source. 1K = 1A charge current limit.

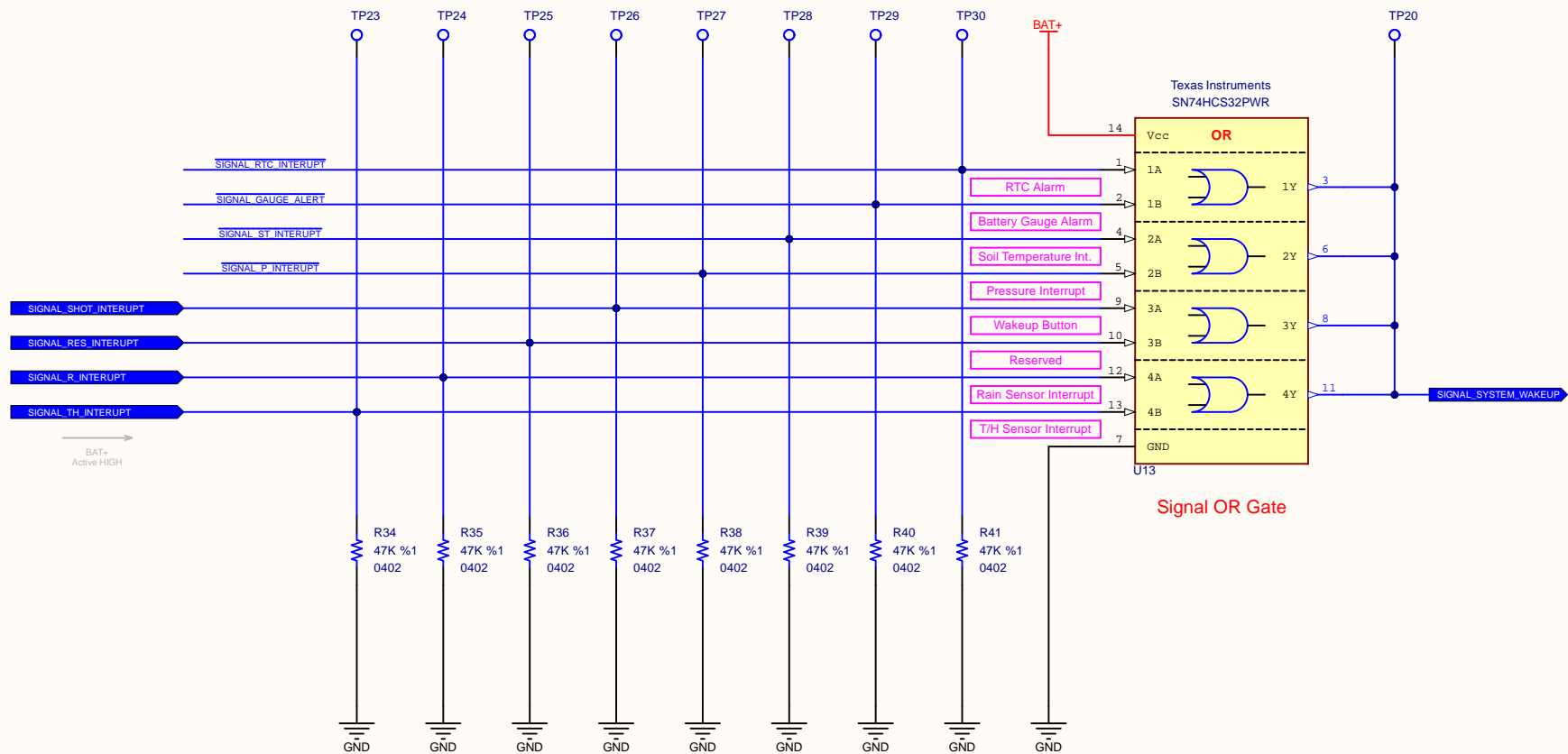
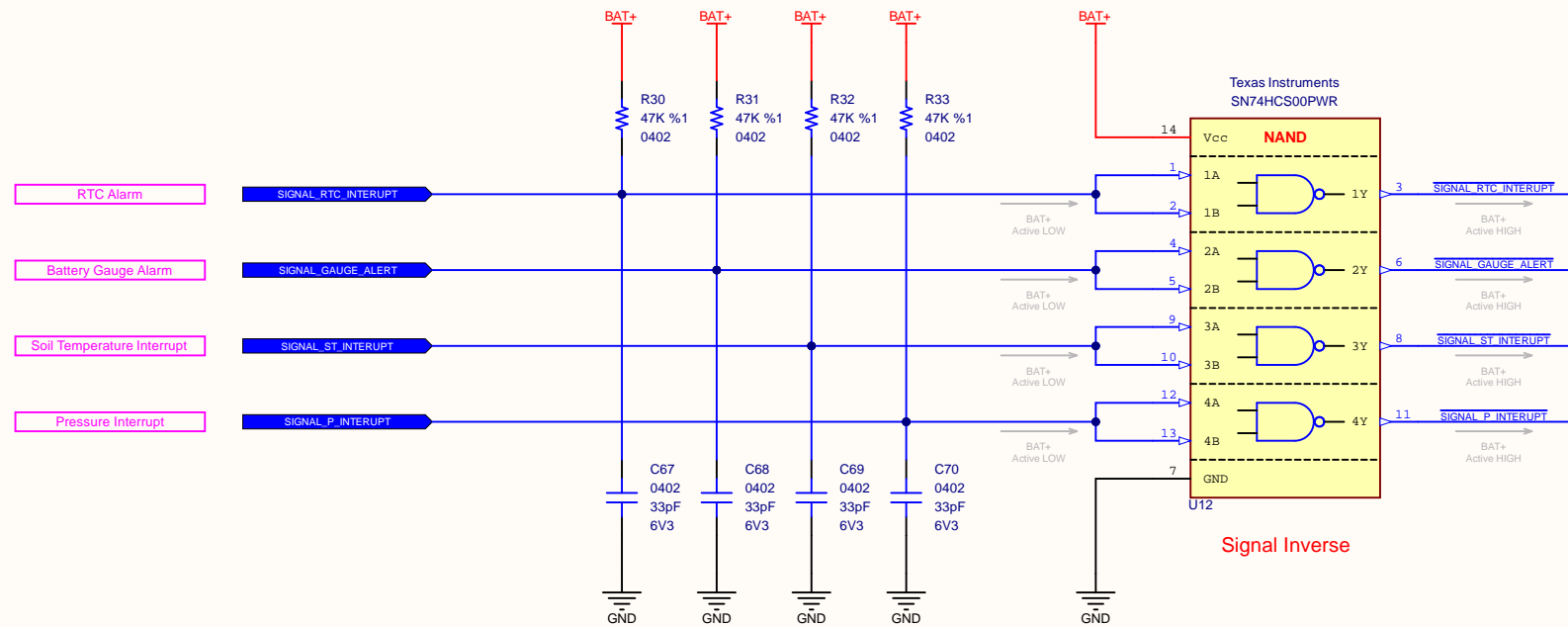
PROG2 Pin : USB port input current limit selection when PROG2 = HIGH. (Low = 100 mA, High = 500 mA)

PROG3 Pin : Termination set point for power source and USB port. Minimum charge current. 10K = 100 mA.


A3

| | | | | | |
|---|-----------------------|-----------------------------|--|--|---|
| Title Battery Charger | | | Ovoo Electronics | |  |
| Size: A4 | Number: AA003 | Revision: B106AA | Küçük İhsaniye Mah. Mızraklı Sok. No:15 Meram / Konya Türkiye | | |
| Date: 12.06.2020 | Time: 21:53:02 | Sheet 5 of 37 | | | |
| File: C:\Altium Projects\STFP102 - Weather Station\Modules\B106AA\Schematic\Battery Charger.SchDoc | | | | | |

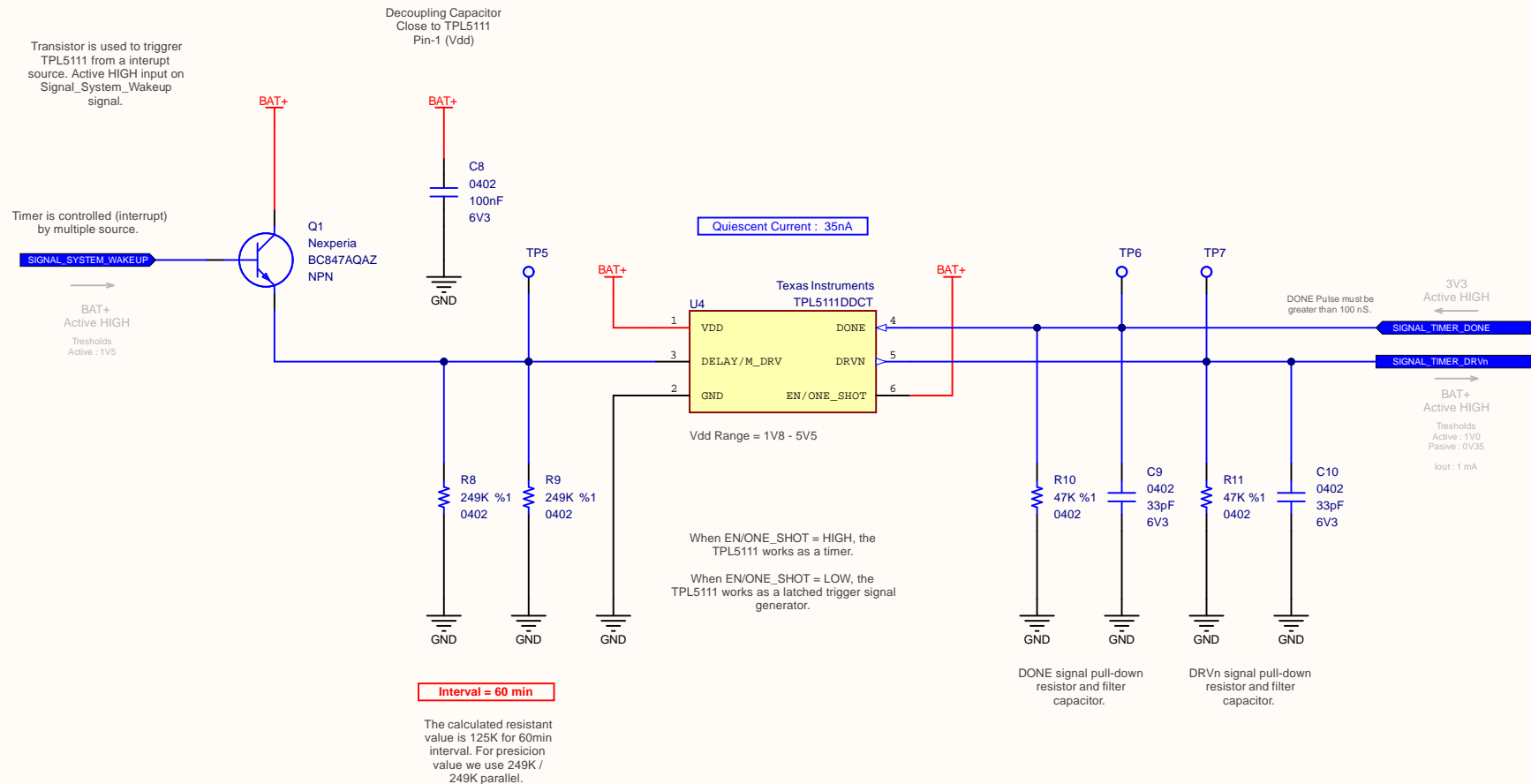




B1

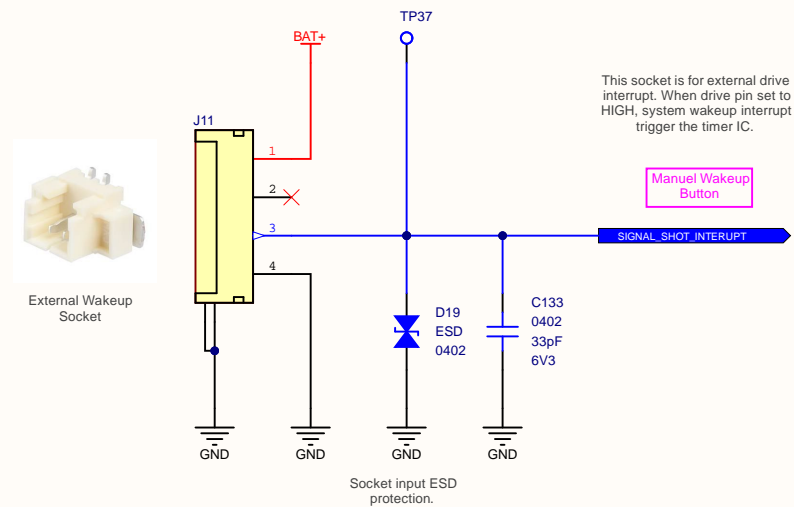
| | | | | | |
|---|-----------------------|-----------------------------|---|--|---|
| Title System Wake up Resources Logic Gates | | | Ovoo Electronics Küçükİhsaniye Mah. Mıracık Sok. No:15 Meram / Konya Türkiye | |  |
| Size: A3 | Number: AA003 | Revision: B106AA | | | |
| Date: 12.06.2020 | Time: 21:53:02 | Sheet 8 of 37 | | | |
| File: C:\Altium Projects\STFP102 - Weather Station\Modules\B106AA\Schematic\System Wake Interrupt Logic.SchDoc | | | | | |
| | | | | | |





B2

| | | | |
|---|-----------------------|-----------------------------|---|
| Title Sleep Management (Timer) | | | Ovoo Electronics Küçük İhsaniye Mah. Mızraklı Sok. No:15 Meram / Konya Türkiye |
| Size: A4 | Number: AA003 | Revision: B106AA | |
| Date: 12.06.2020 | Time: 21:53:02 | Sheet 9 of 37 | |
| File: C:\Altium Projects\STFP102 - Weather Station\Modules\B106AA\Schematic\Time Management.SchDoc | | | |




This socket is for external drive interrupt. When drive pin set to HIGH, system wakeup interrupt trigger the timer IC.

Manuel Wakeup
Button

SIGNAL_SHOT_INTERRUPT

Socket input ESD protection.

B3

| | | | | | |
|---|-----------------------|-----------------------------|--|--|---|
| Title Manuel Wake-up Button | | | Ovoo Electronics | |  |
| Size: A4 | Number: AA003 | Revision: B106AA | Küçük İhsaniye Mah. Mızraklı Sok. No:15 Meram / Konya Türkiye | | |
| Date: 12.06.2020 | Time: 21:53:02 | Sheet 10 of 37 | | | |
| File: C:\Altium Projects\STP\F102 - Weather Station\Modules\B106AA\Schematic\Manuel Wake-up and Latch.SchDoc | | | | | |

Ovoo Electronics

Küçük İhsaniye Mah.
Mızraklı Sok. No:15
Meram / Konya
Türkiye

ÓVÖÖ

Size: A4

Number: AA003

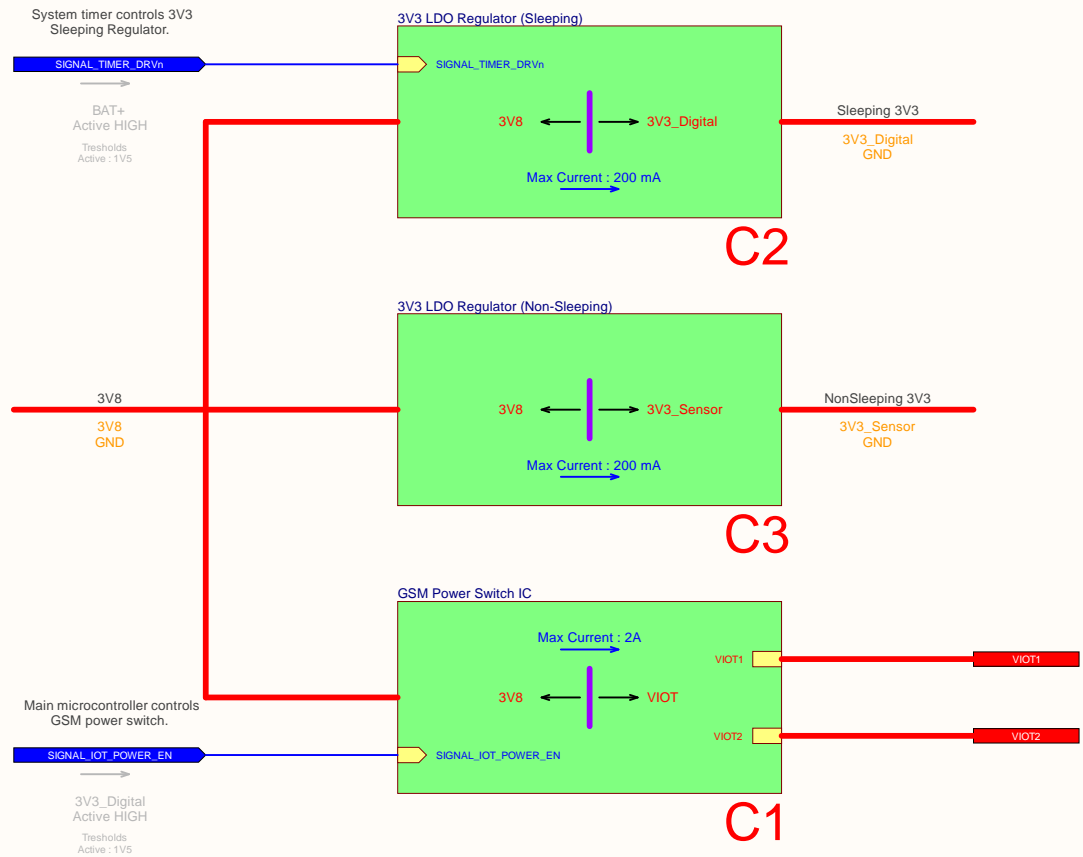
Revision: B106AA


Date: 12.06.2020

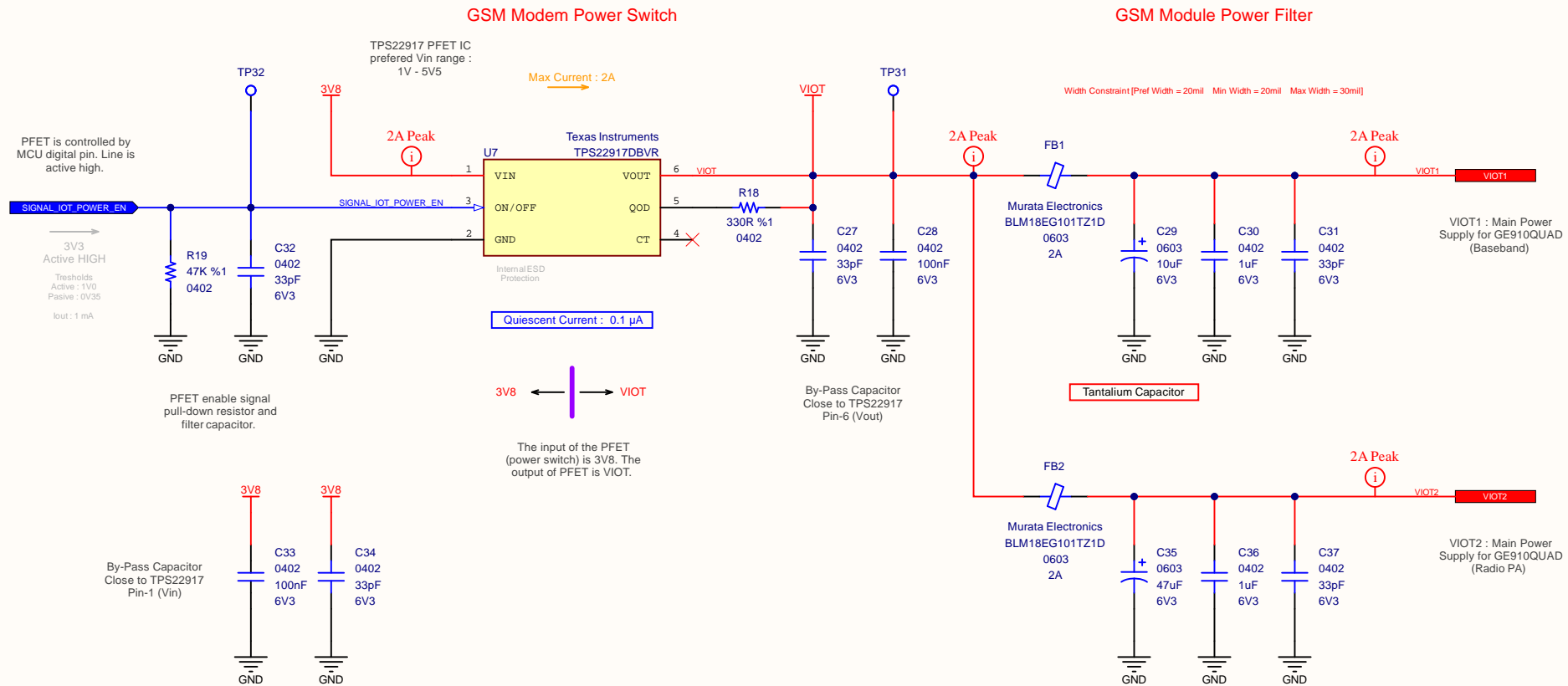
Time: 21:53:02

Sheet 10 of 37


File: C:\Altium Projects\STF/P102 - Weather Station\Modules\B106AA\Schematic\Manuel Wake-up and Latch.SchDoc



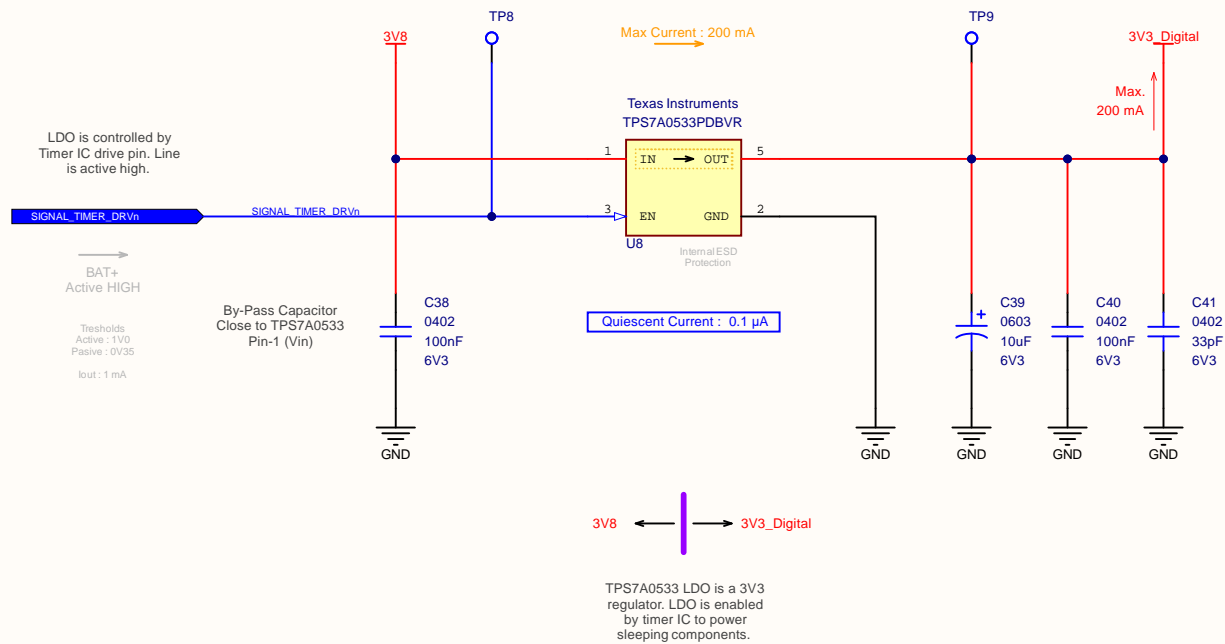
| | | | | |
|--|-----------------------|------------------------------|--|---|
| Title System Power Regulators & GSM IoT Power Switch | | | Ovoo Electronics Küçük İhsaniye Mah. Mızraklı Sok. No:15 Meram / Konya Türkiye |  |
| Size: A4 | Number: AA003 | Revision: B106AA | | |
| Date: 12.06.2020 | Time: 21:53:02 | Sheet 11 of 37 | | |
| File: C:\Altium Projects\STF\P102 - Weather Station\Modules\B106AA\Schematic\Power Regulator.SchDoc | | | | |




C1

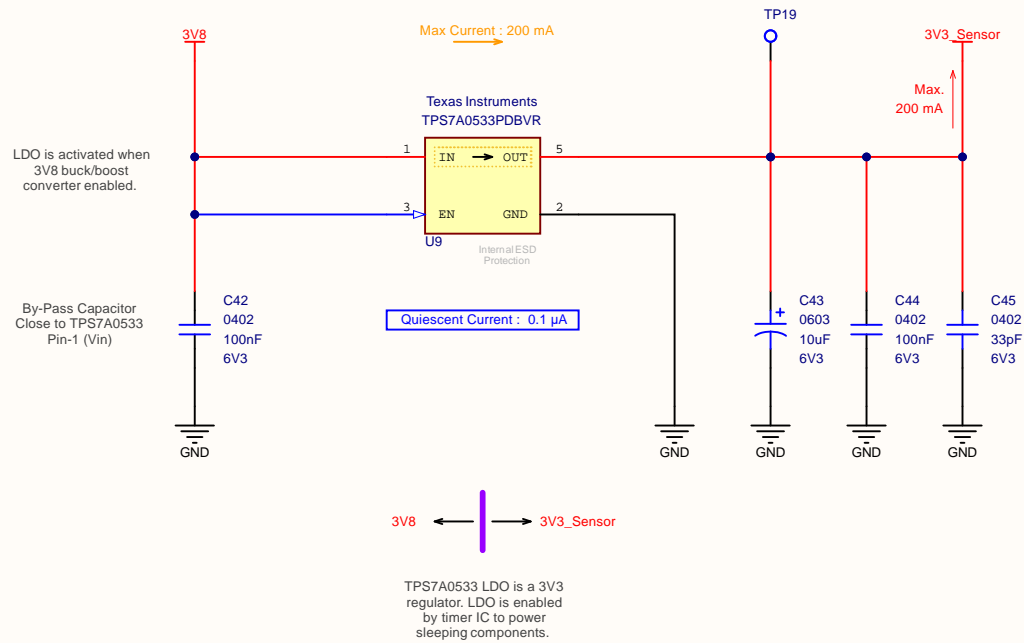
| | | | |
|---|-----------------------|------------------------------|--|
| Title GSM Module Power On/Off Switch IC & IoT Power Filter | | | Ovoo Electronics Küçük İhsaniye Mah. Mızraklı Sok. No:15 Meram / Konya Türkiye  |
| Size: A4 | Number: AA003 | Revision: B106AA | |
| Date: 12.06.2020 | Time: 21:53:02 | Sheet 12 of 37 | |
| File: C:\Altium Projects\STF\P102 - Weather Station\Modules\B106AA\Schematic\GSM Power On-Off Switch IC.SchDoc | | | |

ovoo




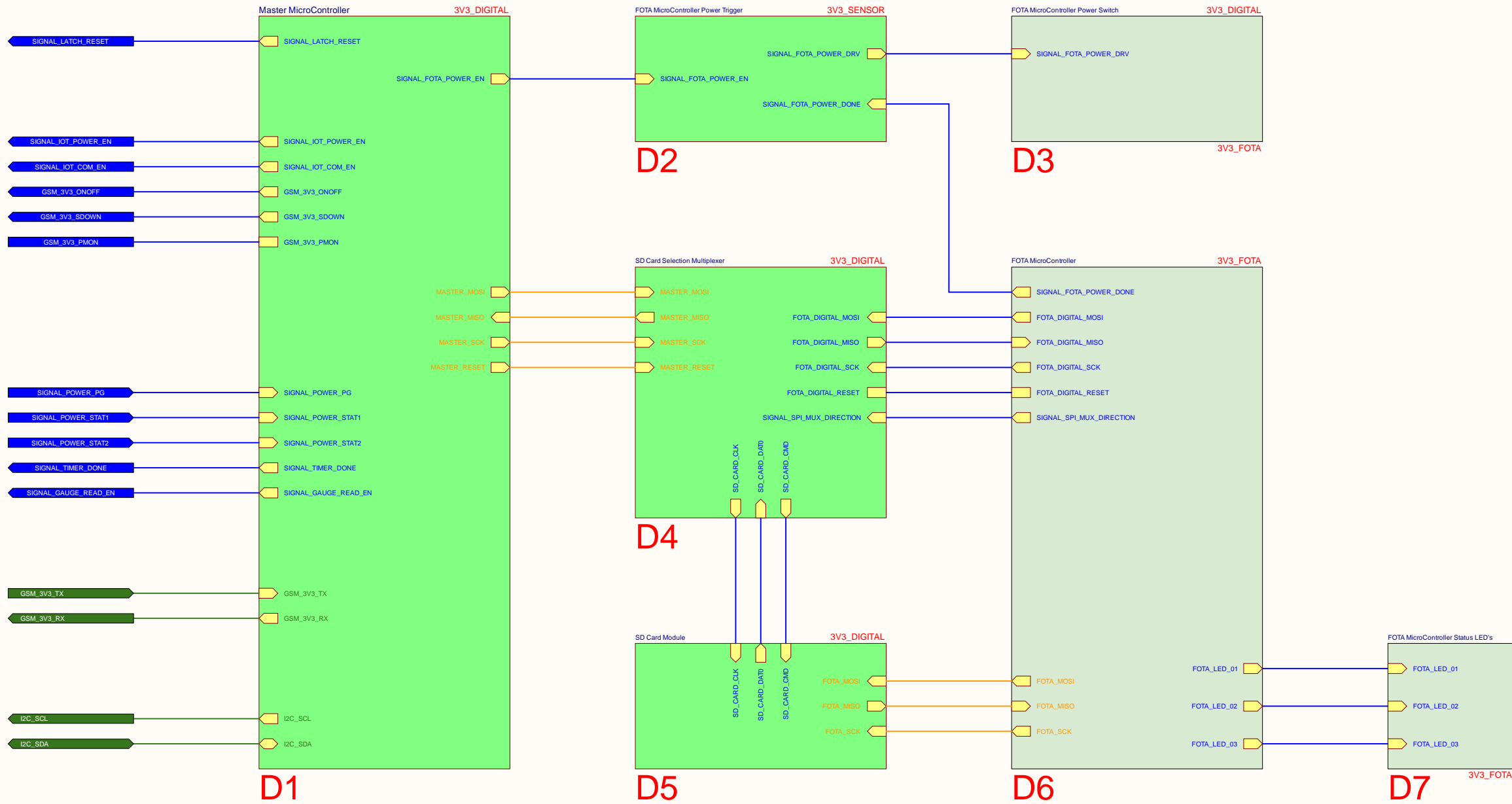
C2

| | | | |
|--|----------------|------------------|---|
| Title 3V3 LDO Voltage Regulator (Sleeping) | | | Ovoo Electronics Küçük İhsaniye Mah. Mızraklı Sok. No:15 Meram / Konya Türkiye  |
| Size: A4 | Number: AA003 | Revision: B106AA | |
| Date: 12.06.2020 | Time: 21:53:03 | Sheet 13 of 37 | |
| File: C:\Altium Projects\STF\P102 - Weather Station\Modules\B106AA\Schematic\3V3 LDO Regulator (Sleeping).SchDoc | | | |

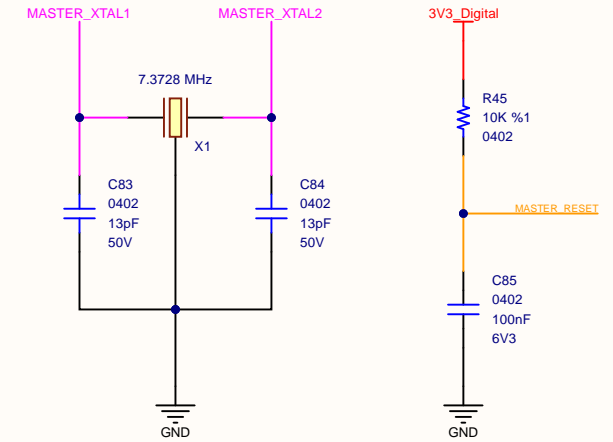
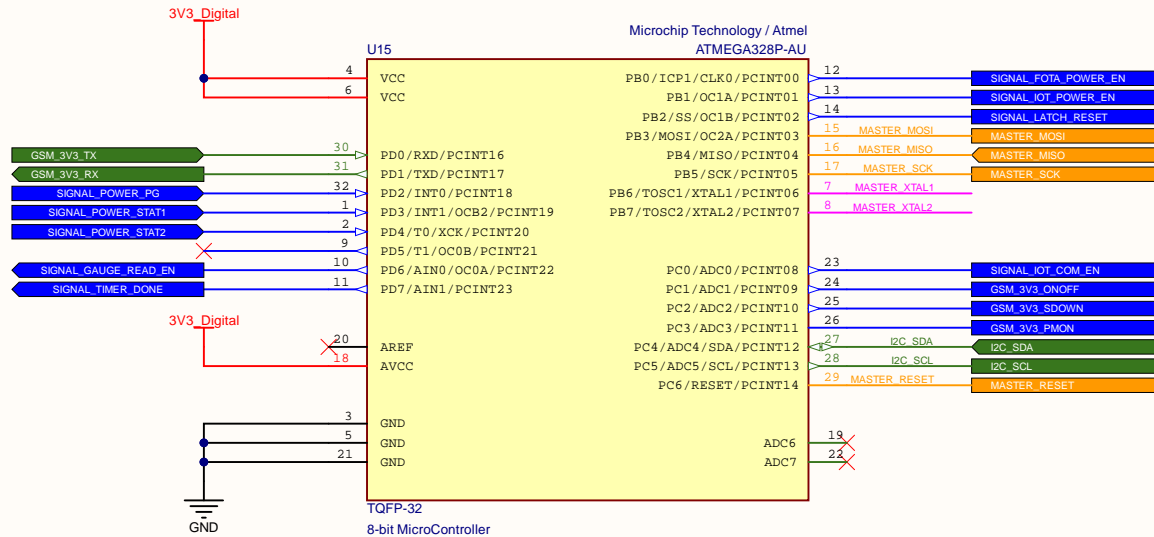
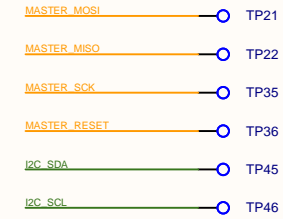
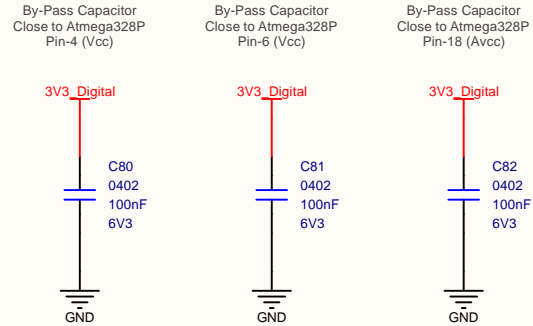


C3

| | | | | |
|---|----------------|------------------|--|---|
| Title 3V3 LDO Voltage Regulator (NonSleeping) | | | Ovoo Electronics Küçük İhsaniye Mah. Mızraklı Sok. No:15 Meram / Konya Türkiye |  |
| Size: A4 | Number: AA003 | Revision: B106AA | | |
| Date: 12.06.2020 | Time: 21:53:03 | Sheet 14 of 37 | | |
| File: C:\Altium Projects\STF\P102 - Weather Station\Modules\B106AA\Schematic\3V3 LDO Regulator (NonSleeping).SchDoc | | | | |




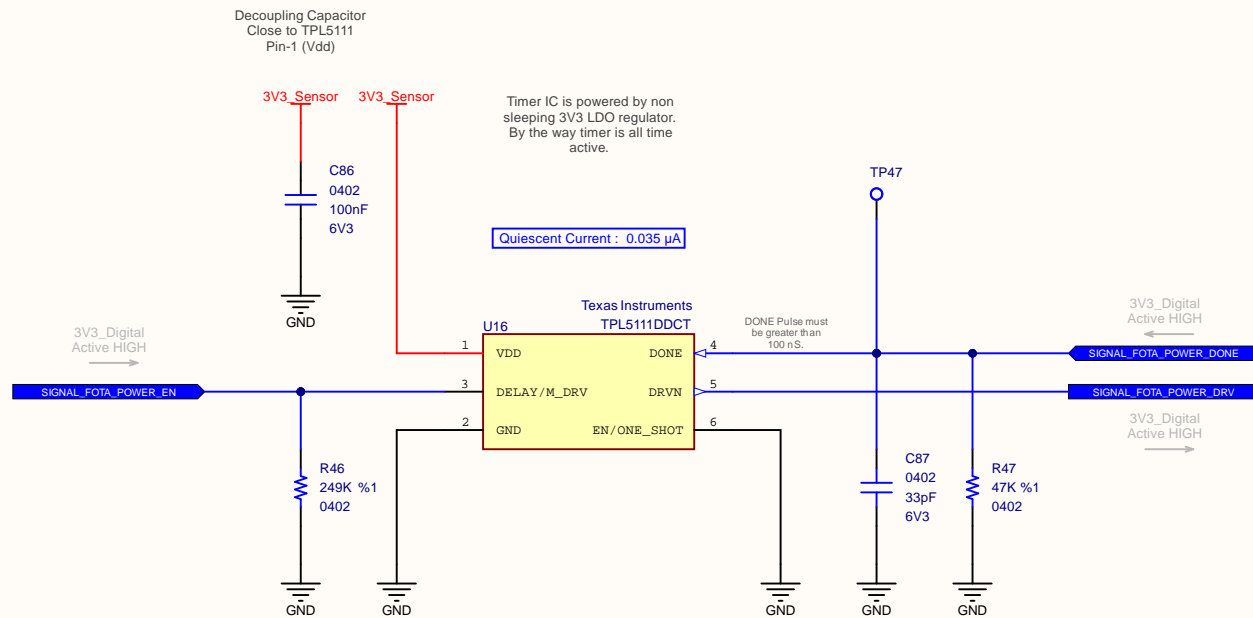
One is master microcontroller for sensor measurement, handling data and communicate with GSM modem (UART). We use ATMEGA328P-AU as master MCU with 7.3728 Mhz external crystal and 3V3 voltage level.




Master MCU Reset Line.
Pull-up.

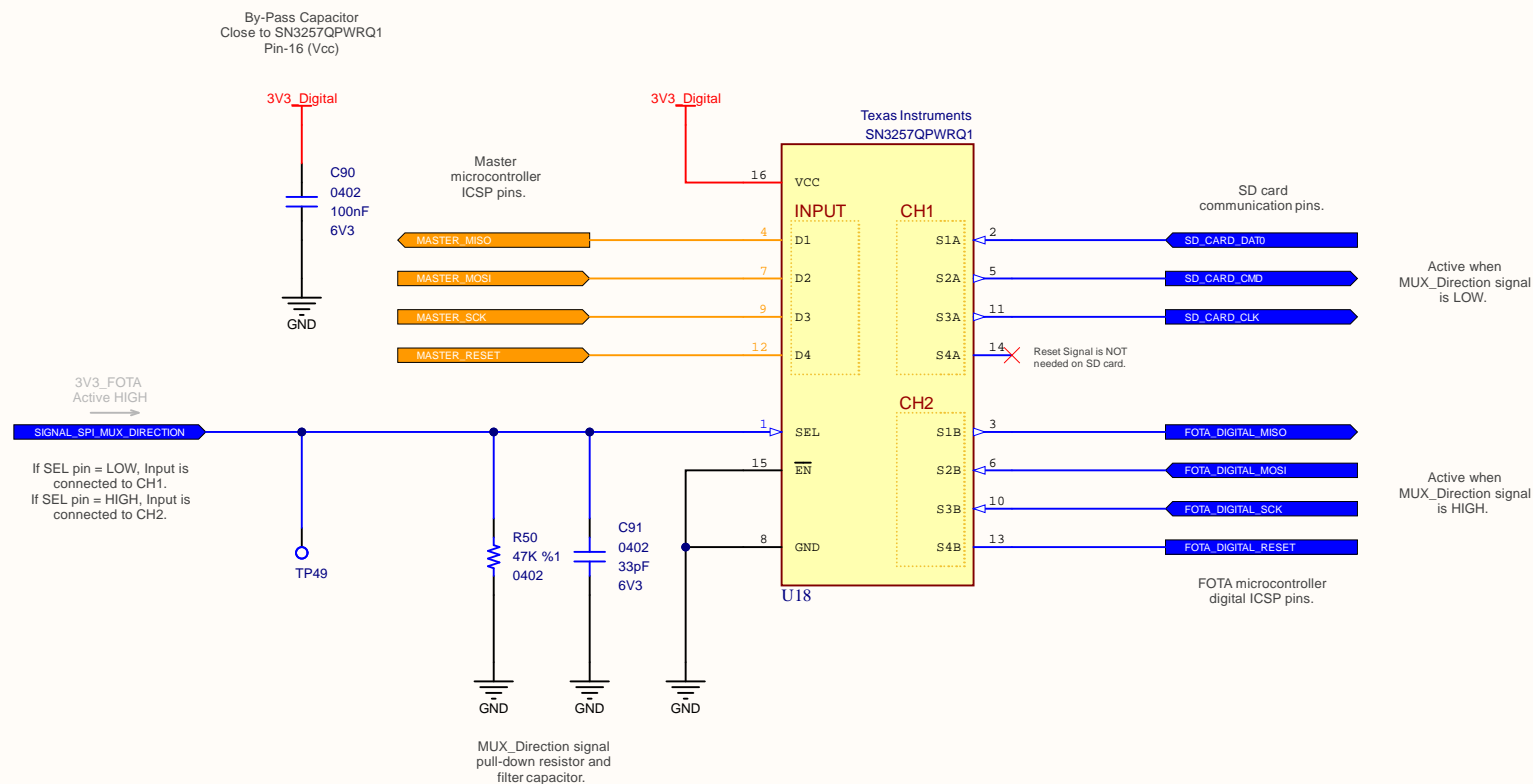
D1

| | | | | |
|--|------------------------------|--|---|--|
| Title Master MicroController | | | Ovoo Electronics Küçükhanıyeh Mah. Mızraklı Sok. No:15 Meram / Konya Türkiye | |
| Date: A4 | Number: AA003 | Revision: B106AA |  | |
| Date: 12.06.2020 | Time: 21:53:03 | Sheet 16 of 37 | | |
| File: C:\Altium Projects\STP\FP102 - Weather Station\Modules\B106AASchematic\Master MicroController.SchDoc | | | | |




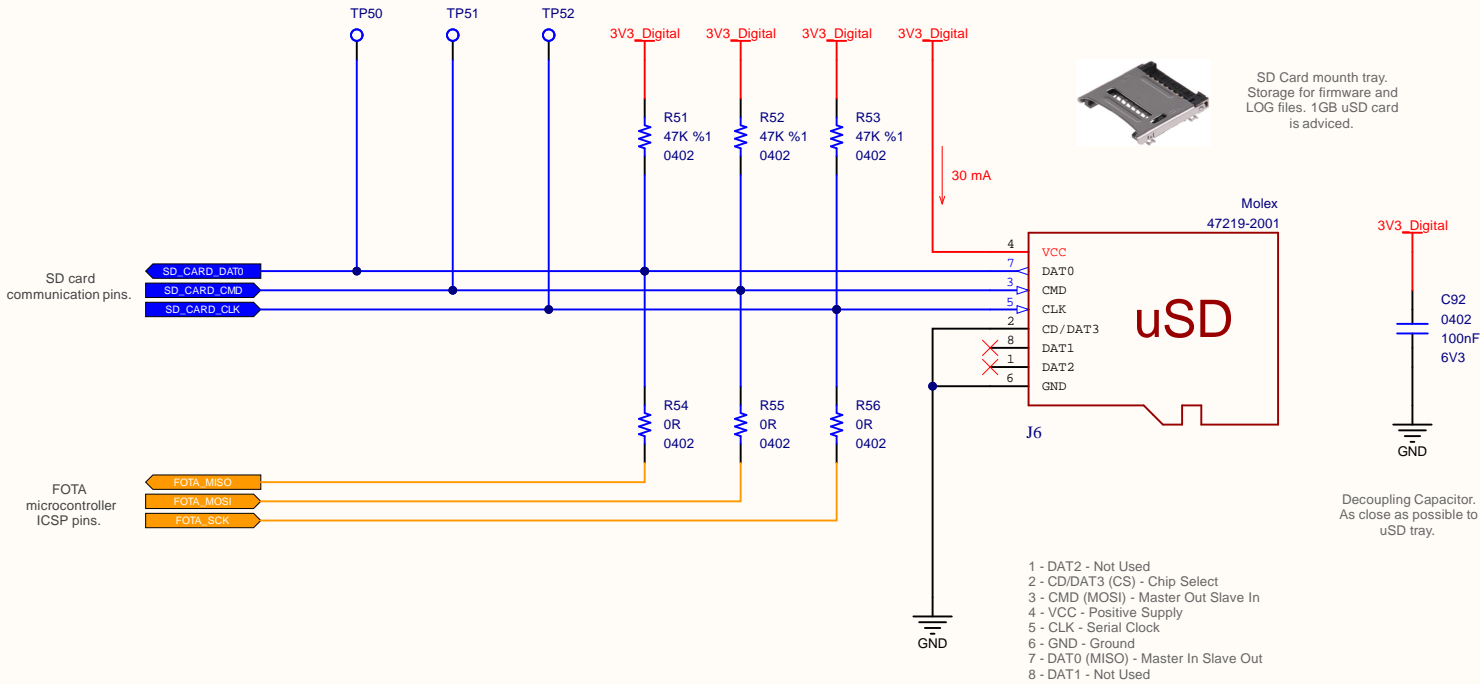
D2

| | | | |
|--|----------------|------------------|---|
| Title: FOTA MicroController Latched Power Trigger | | | Ovoo Electronics Küçük İhsaniye Mah. Mızraklı Sok. No:15 Meram / Konya Türkiye  |
| Size: A4 | Number: AA003 | Revision: B106AA | |
| Date: 12.06.2020 | Time: 21:53:03 | Sheet 17 of 37 | |
| File: C:\Altium Projects\STF\P102 - Weather Station\Modules\B106AA\Schematic\FOTA MicroController Power Trigger.SchDoc | | | |

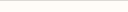


D4

| | | | | | |
|---|----------------|------------------|---|--|---|
| Title SD/ICSP Selection Multiplexer | | | Ovoo Electronics | |  |
| Size: A4 | Number: AA003 | Revision: B106AA | Küçük İhsaniye Mah. Mıracılık Sok. No:15 Meram / Konya Türkiye | | |
| Date: 12.06.2020 | Time: 21:53:03 | Sheet 19 of 37 | | | |
| File: C:\Altium Projects\STFIP102 - Weather Station\Modules\B106AA\Schematic\SD Card Selection Multiplexer.SchDoc | | | | | |



D5

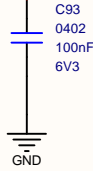
| | | | | | |
|---|-----------------------|------------------------------|---|--|---|
| Title Micro SD Card Module | | | Ovoo Electronics | |  |
| Size: A4 | Number: AA003 | Revision: B106AA | Küçük İhsaniye Mah. Mıracık Sok. No:15 Meram / Konya Türkiye | | |
| Date: 12.06.2020 | Time: 21:53:03 | Sheet 20 of 37 | | | |
| File: C:\Altium Projects\STF\P102 - Weather Station\Modules\B106AA\Schematic\SD Card Module.SchDoc | | | | | |

B106AA Module have two on-board MCU.

Second microcontroller is a firmware over the air controller. This MCU is burn firmware to the main MCU.

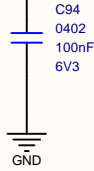
By-Pass Capacitor
Close to Atmega328P
Pin-4 (Vcc)

3V3_FOTA



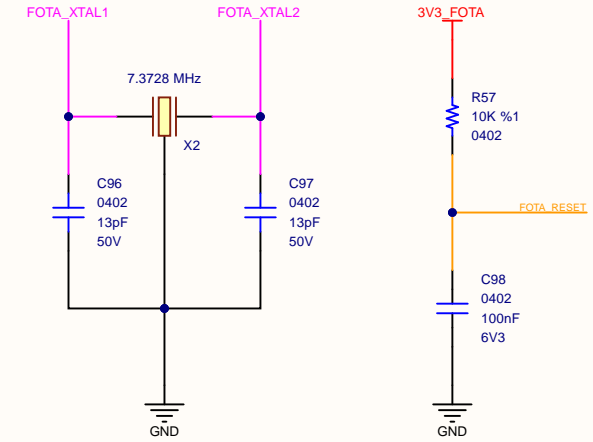
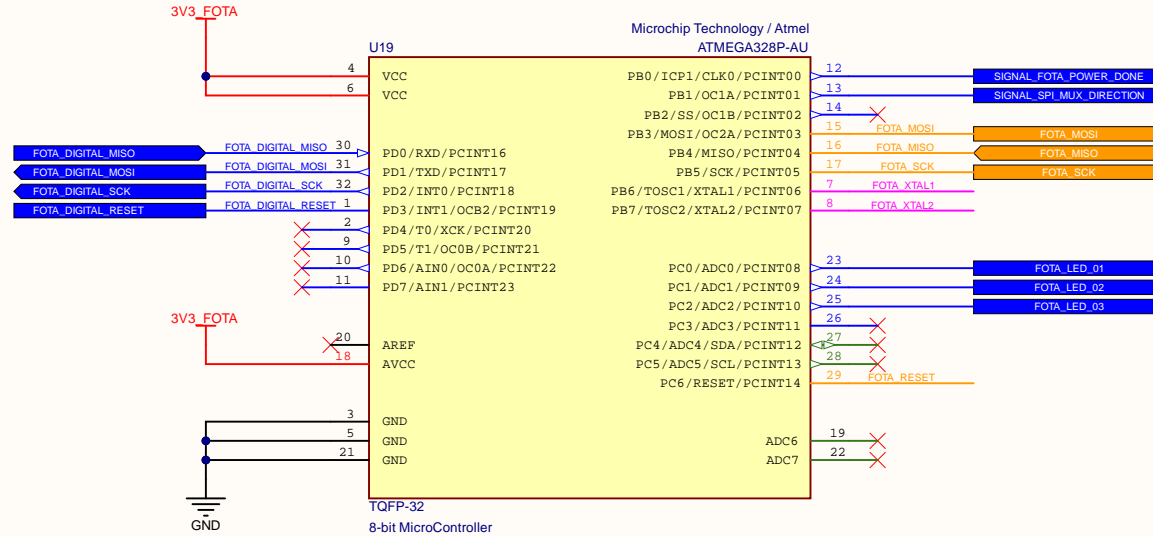
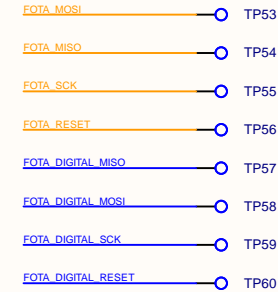
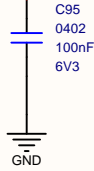
By-Pass Capacitor
Close to Atmega328P
Pin-6 (Vcc)

3V3_FOTA



By-Pass Capacitor
Close to Atmega328P
Pin-18 (Avcc)


3V3_FOTA

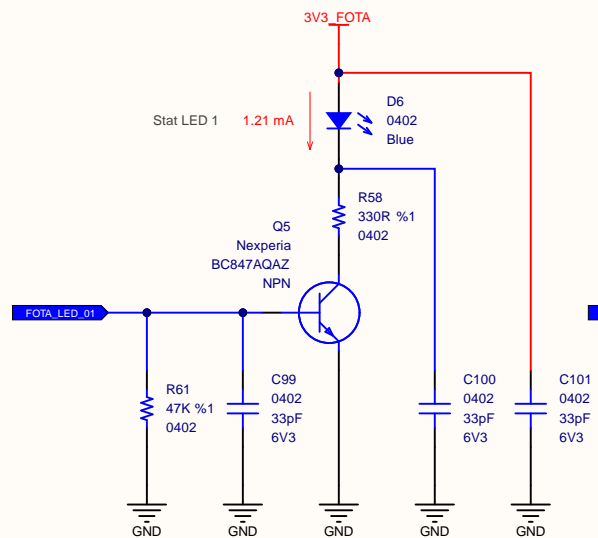


FOTA MCU is working at
7.3728 Mhz.

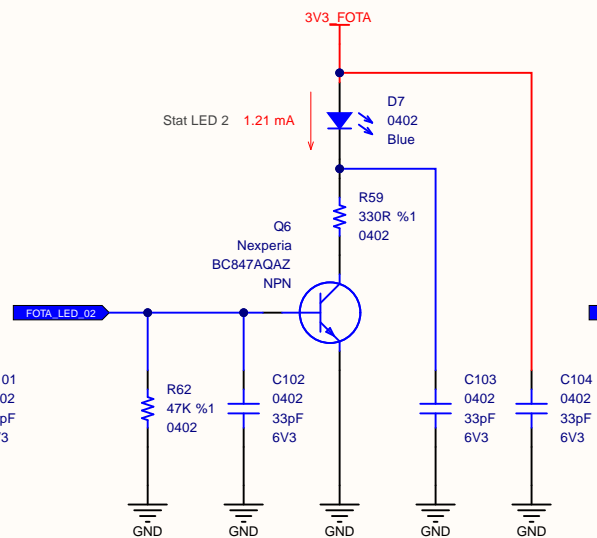
FOTA MCU Reset Line.
Pull-up.

D6

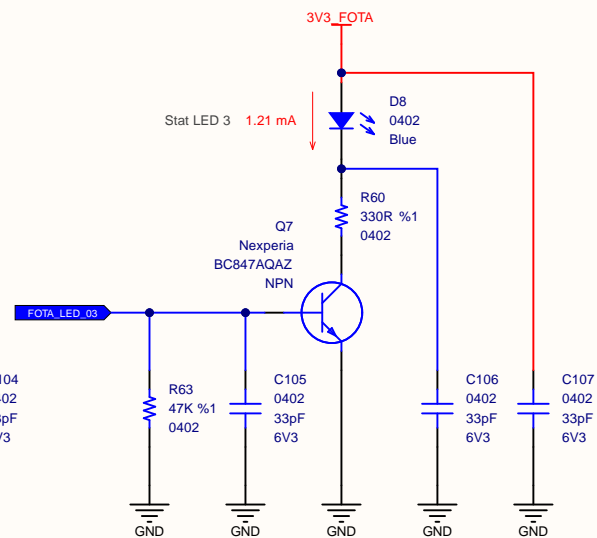
| | | | | | |
|---|-----------------------|------------------------------|---|--|---|
| Title FOTA MicroController | | | Ovoo Electronics Küçük İnşaniye Mah. Mızraklı Sok. No:15 Meram / Konya Türkiye | |  |
| Size: A4 | Number: AA003 | Revision: B106AA | | | |
| Date: 12.06.2020 | Time: 21:53:03 | Sheet 21 of 37 | | | |
| File: C:\Altium Projects\STF\P102 - Weather Station\Modules\B106AA\Schematic\FOTA MicroController.SchDoc | | | | | |



Noise filter capacitors. Place as close as possible to LED.




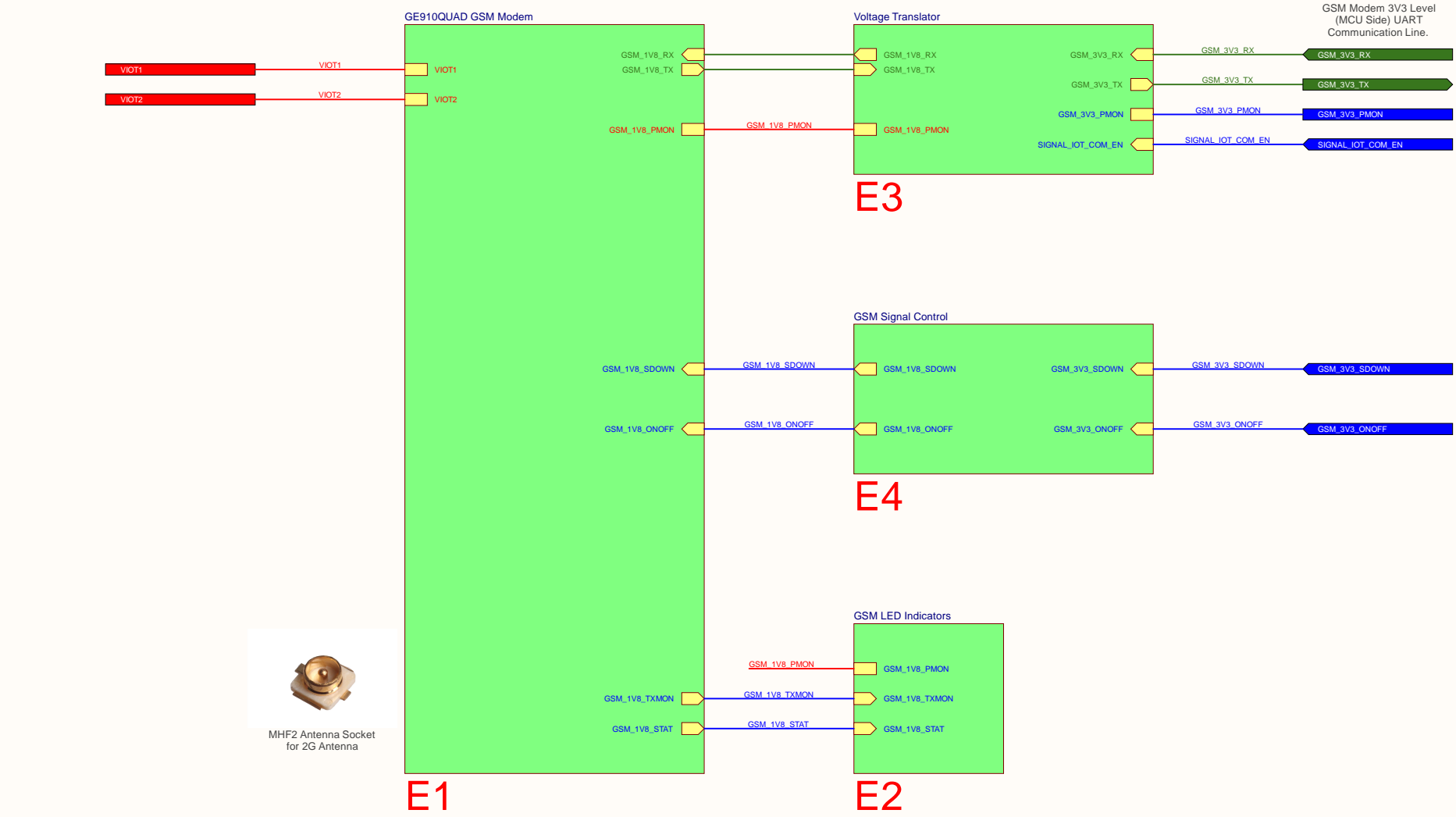
Noise filter capacitors. Place as close as possible to LED.

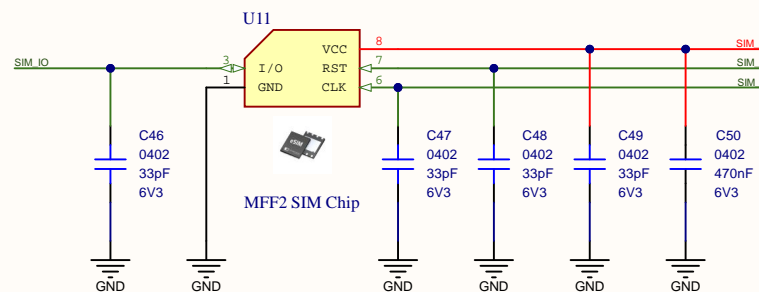
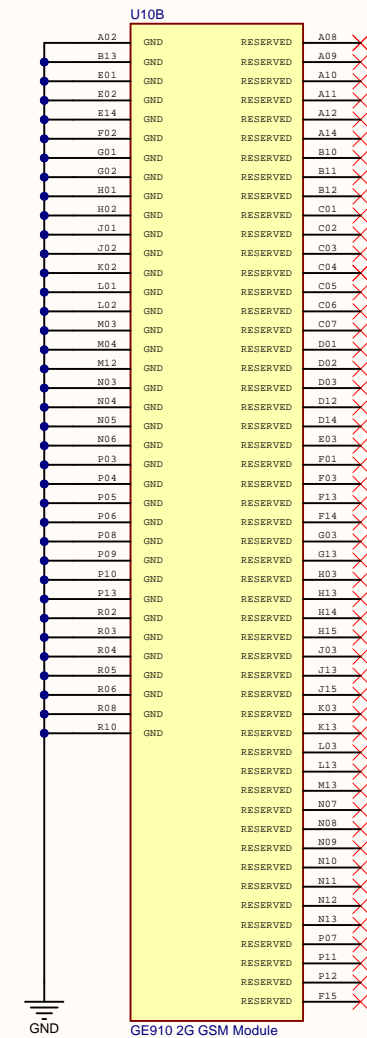
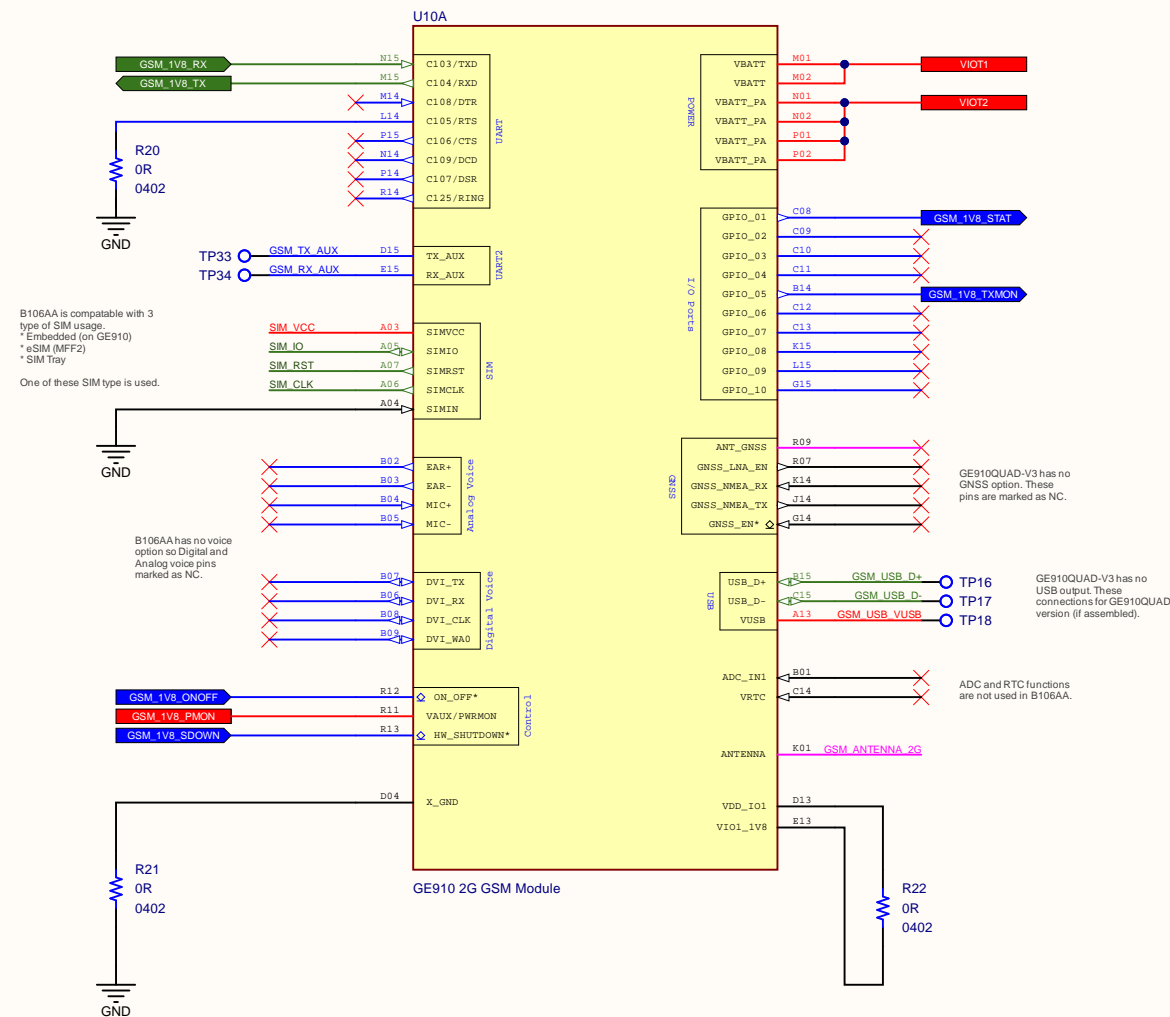


Noise filter capacitors. Place as close as possible to LED.

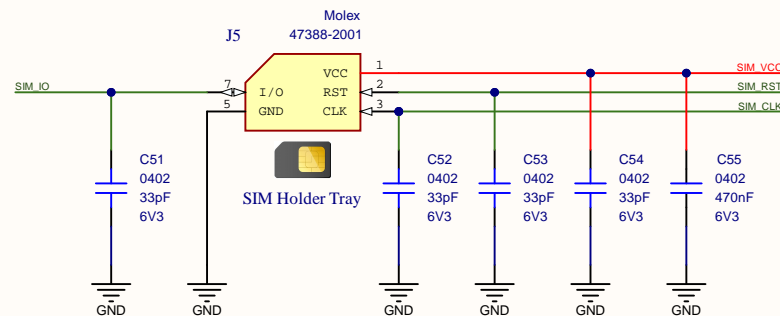
D7

| | | | | |
|---|----------------|------------------|---|---|
| Title FOTA Microcontroller Status LED's | | | Ovoo Electronics |  |
| Size: A4 | Number: AA003 | Revision: B106AA | Küçük İhsaniye Mah. Mıracık Sok. No:15 Meram / Konya Türkiye | |
| Date: 12.06.2020 | Time: 21:53:03 | Sheet 22 of 37 | | |
| File: C:\Altium Projects\STFP102 - Weather Station\Modules\B106AA\Schematic\FOTA MicroController Status LEDs.SchDoc | | | | |



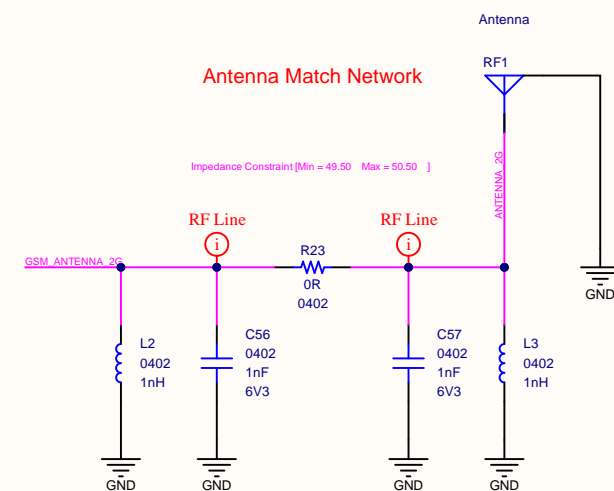


External SIM (MFF2) is only assembled when GE910QUAD-V3 (not simwise) module is assembled.



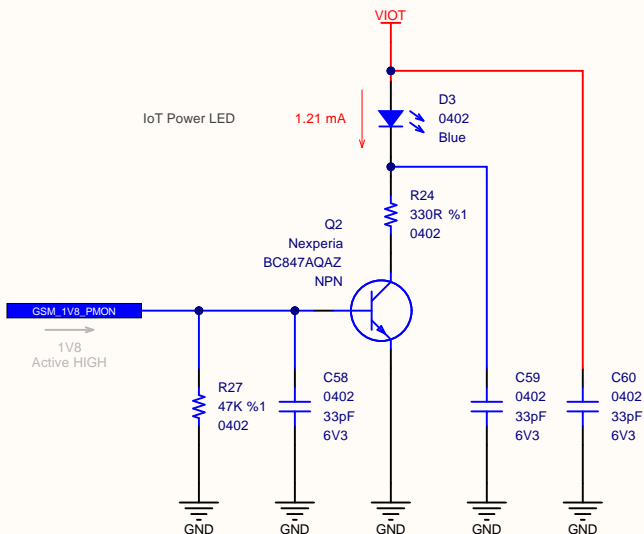
SIM Tray is only assembled when Simwise or E-Sim is not used.

SIM_VCC capacitor is chosen according to Telit SIM integration guide.



RF Matching network circuit is not placed on production. Only 0R resistor is placed.

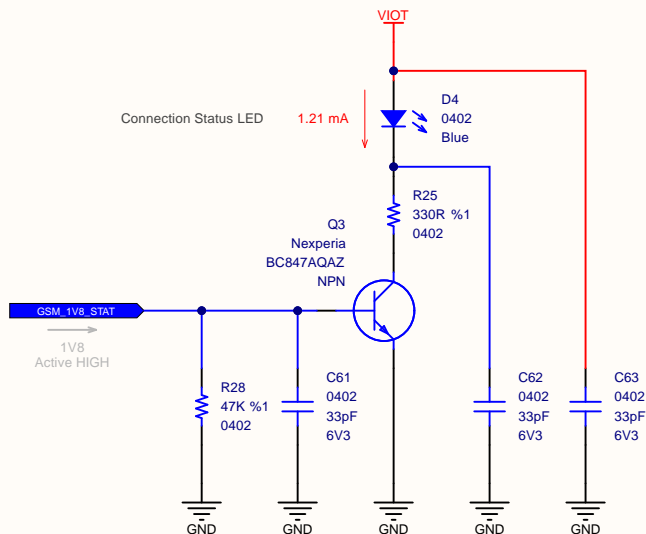
GSM Power Monitor LED



Noise filter capacitors. Place as close as possible to LED.

LED activates when GSM modem powered. This LED is a active HIGH indicator.

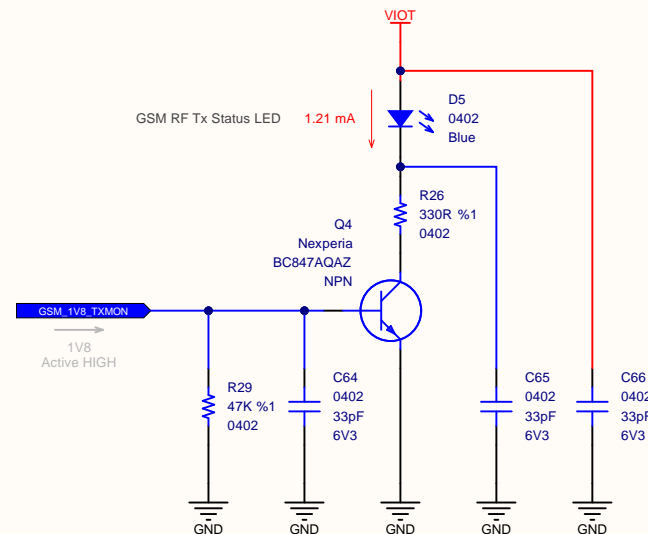
GSM Connection Status LED



Noise filter capacitors. Place as close as possible to LED.

LED activates according to connection. Fast blinking LED is indicates searching GSM connection. Slow blinking LED is indicates GSM connection is established.


RF Tx Monitor LED



Noise filter capacitors. Place as close as possible to LED.

LED activates when GSM modem sending data to internet.

E2

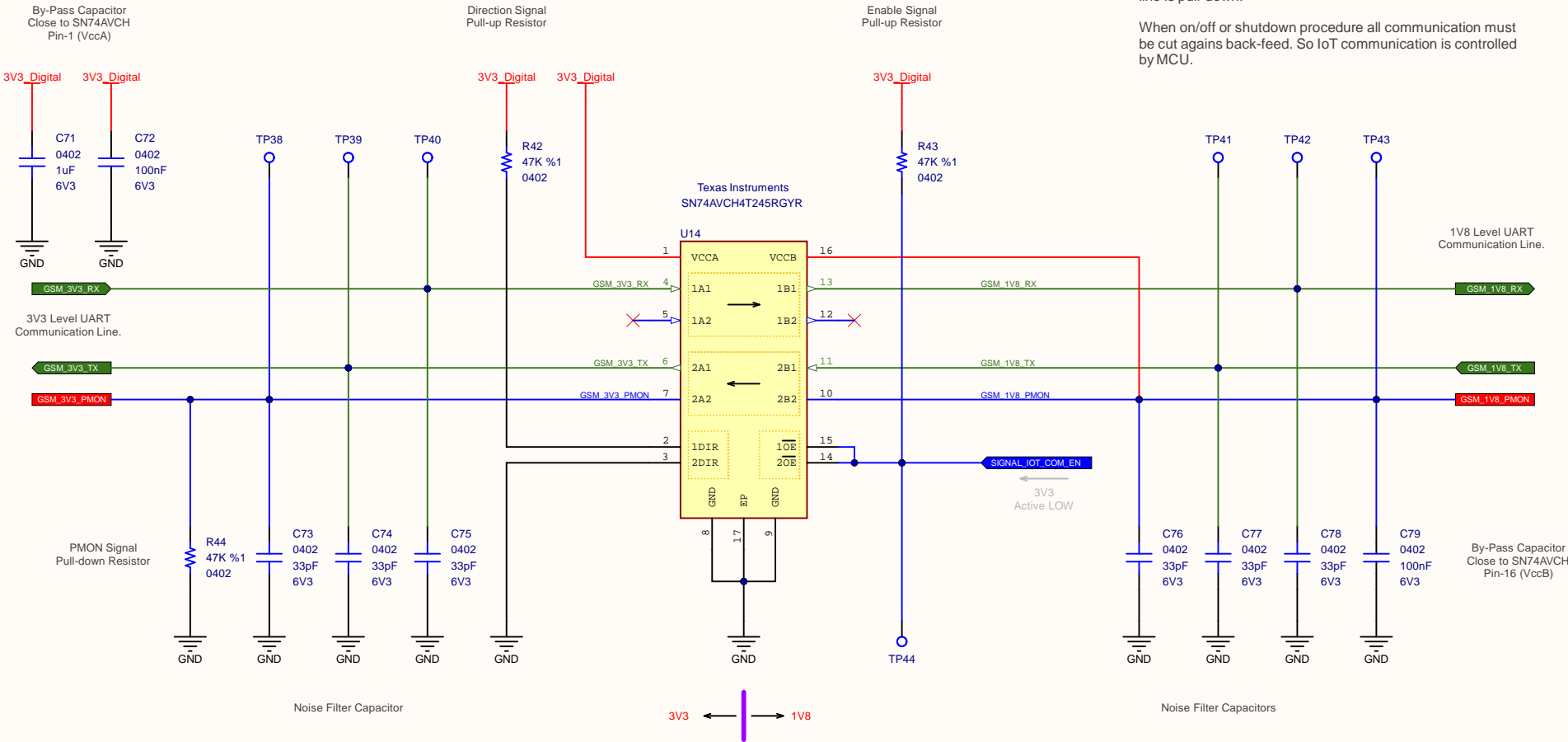
| | | | |
|---|-----------------------|------------------------------|--|
| Title GSM Modem Signal Indicator LED's | | | Ovoo Electronics Küçük İnşaniye Mah. Mızraklı Sok. No:15 Meram / Konya Türkiye  |
| Size: A4 | Number: AA003 | Revision: B106AA | |
| Date: 12.06.2020 | Time: 21:53:03 | Sheet 25 of 37 | |
| File: C:\Altium Projects\STFIP102 - Weather Station\Modules\B106AA\Schematic\GSM LED Indicators.SchDoc | | | |

BiDirectional Level Shifter


Telit GE910QUAD GSM Modem communicates at 1V8 voltage level. This level is translated to 3V3 level with this level shifter.

Power Monitor pin is a input pin at MCU side (active HIGH) so line is pull-down.

When on/off or shutdown procedure all communication must be cut agains back-feed. So IoT communication is controlled by MCU.

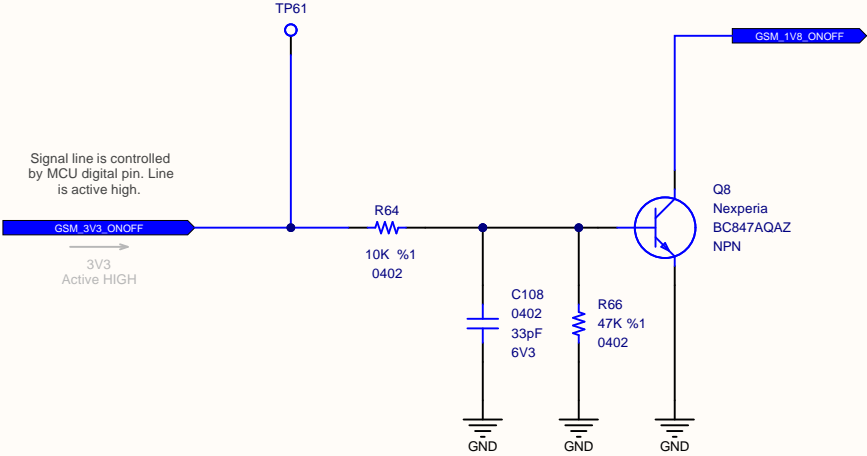


E3

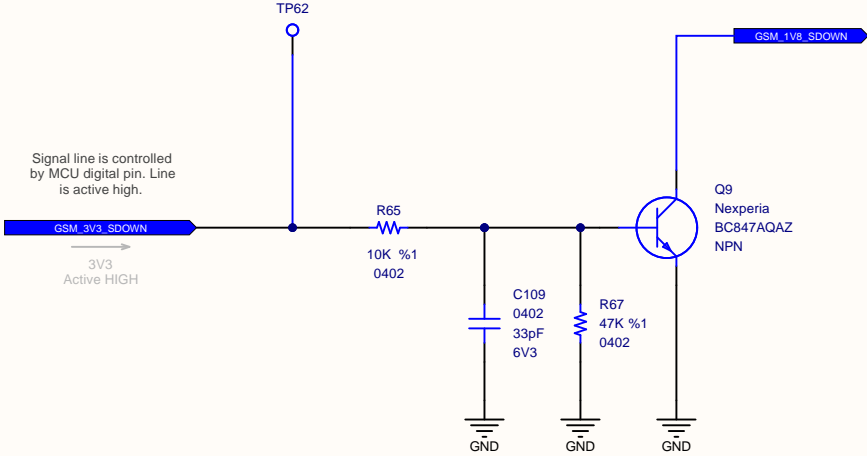
| | | | | |
|--|----------------|------------------|---|---|
| Title 3V3 - 1V8 Voltage Level Translator | | | Ovoo Electronics |  |
| Size: A4 | Number: AA003 | Revision: B106AA | Küçük İhsaniye Mah. Mıracık Sok. No:15 Meram / Konya Türkiye | |
| Date: 12.06.2020 | Time: 21:53:03 | Sheet 26 of 37 | | |
| File: C:\Altium Projects\STF\P102 - Weather Station\Modules\B106AA\Schematic\Bidirectional Voltage Translator.SchDoc | | | | |



GSM Module On/Off Signal




GSM Module Shut Down Signal

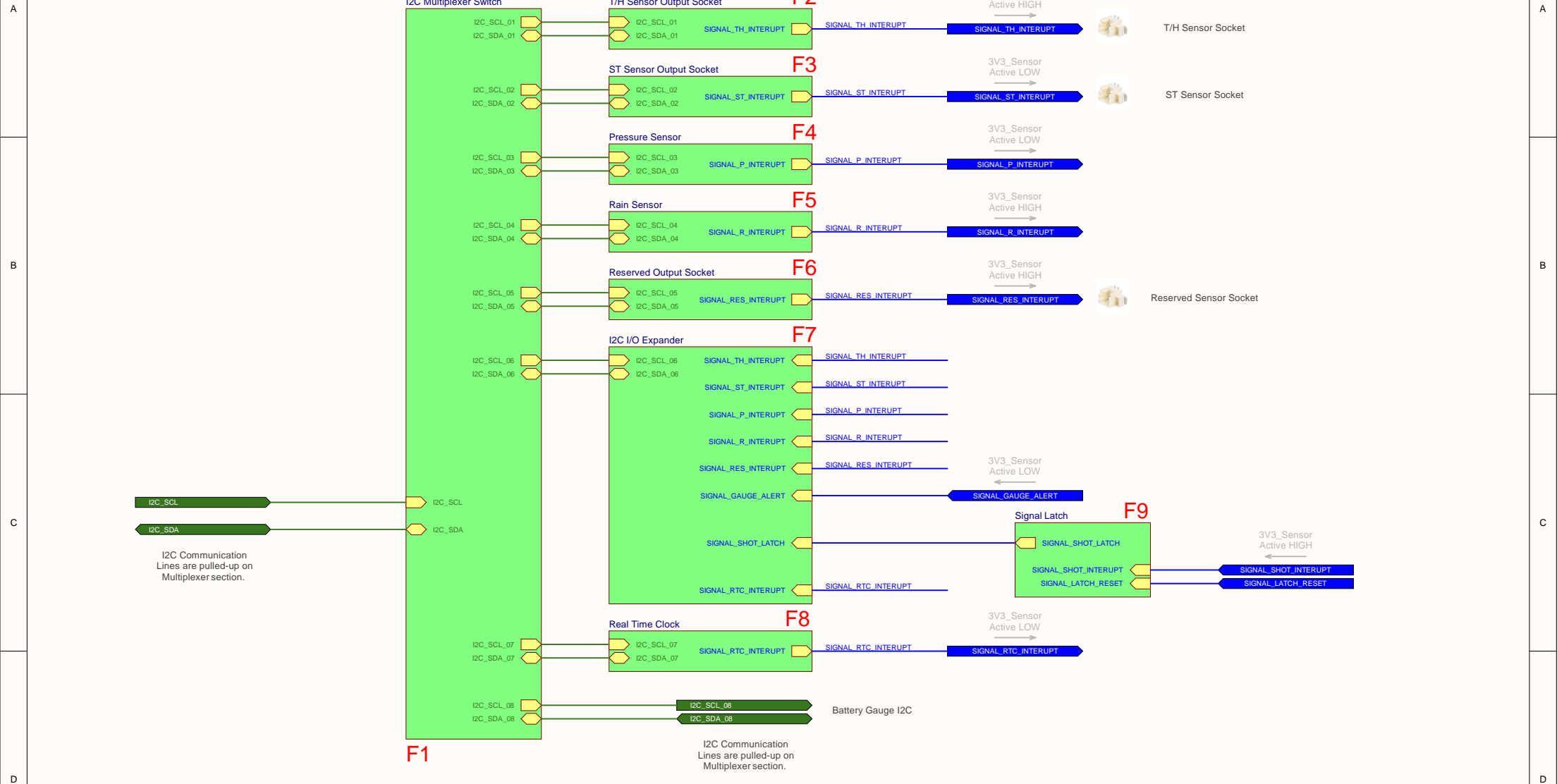



GE910 GSM Modem have an On/Off pin for power on. To turn on the GE910 the pad ON-OFF* must be tied low for at least 5 seconds and then released. The maximum current that can be drained from the ON-OFF* pad is 0.2mA. This pin is a open collector pin so tie this pin to GND via a transistor.

GE910QUAD GSM modem has a "Shut Down" pin for unconditional shut down. The unconditional hardware shutdown must always be implemented on the boards and the software must use it as an emergency exit procedure. To turn off modem tie this pin to GND for 200mS. This pin is a open collector pin so tie this pin to GND via a transistor.

E4

| | | | | |
|--|----------------|------------------|--|---|
| Title GSM Control Signal Management | | | Ovoo Electronics |  |
| Size: A4 | Number: AA003 | Revision: B106AA | Küçük İhsaniye Mah. Mızraklı Sok. No:15 Meram / Konya Türkiye | |
| Date: 12.06.2020 | Time: 21:53:04 | Sheet 27 of 37 | | |
| File: C:\Altium Projects\STF\P102 - Weather Station\Modules\B106AA\Schematic\GSM Signal Control.SchDoc | | | | |



| | | | | | |
|--|----------------|------------------|--|--|---|
| Title I2C Sensor Network | | | Ovoo Electronics | |  |
| Size: A4 | Number: AA003 | Revision: B106AA | Küçük İhsaniye Mah. Mızraklı Sok. No:15 Meram / Konya Türkiye | | |
| Date: 12.06.2020 | Time: 21:53:04 | Sheet 28 of 37 | | | |
| File: C:\Altium Projects\STF\P102 - Weather Station\Modules\B106AA\Schematic\I2C Sensor Network.SchDoc | | | | | |

Decoupling Capacitor.
As close as possible to
TCA9547 pin-24.

I2C 3V3 Pull-up
Resistors.

I2C 3V3 Pull-up
Resistors.

I2C 3V3 Pull-up
Resistors.

I2C 3V3 Pull-up
Resistors.

I2C 3V3 Pull-up
Resistors.

I2C 3V3 Pull-up
Resistors.

I2C 3V3 Pull-up
Resistors.

I2C 3V3 Pull-up
Resistors.


I2C 3V3 Pull-up
Resistors.

Power Consumption : 15 μ A

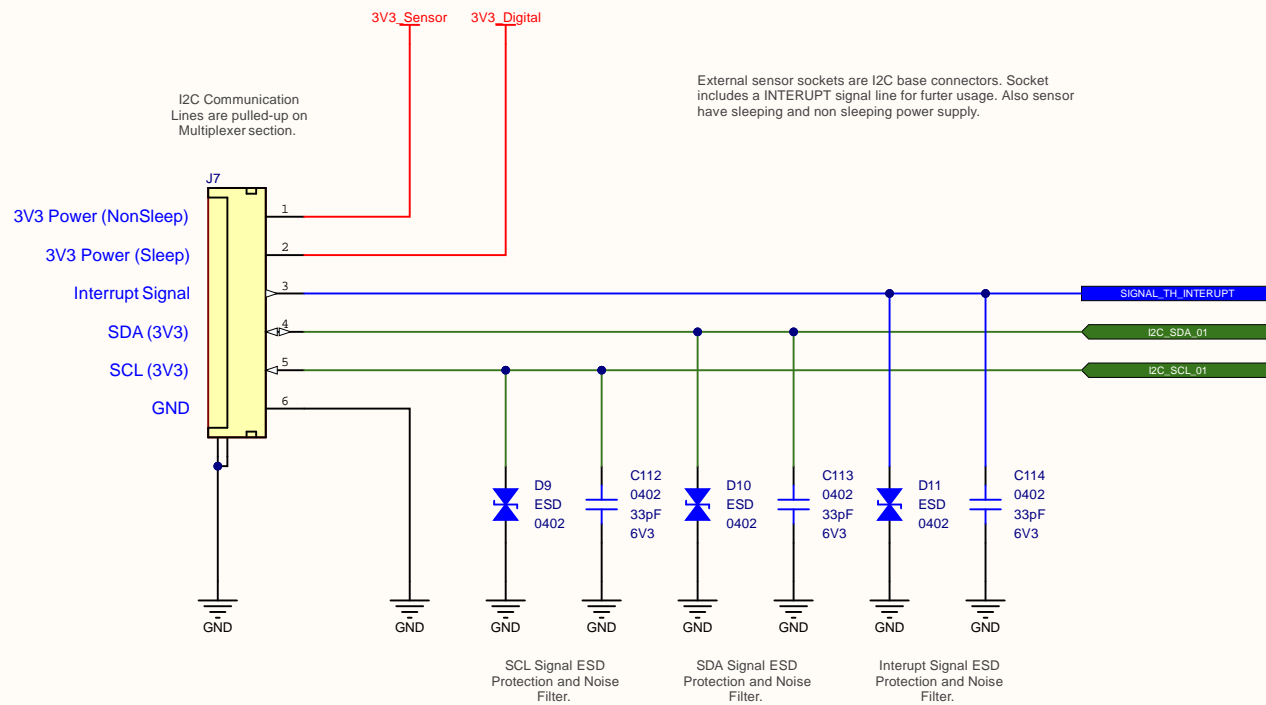
Texas Instruments
TCA9548APWR

Vcc Range = 1V65 - 5V5


F1

| | | | | |
|--|----------------|------------------|--|---|
| Title I2C 8 Channel Multiplexer | | | Ovoo Electronics |  |
| Size: A3 | Number: AA003 | Revision: B106AA | Küçükİhsaniye Mah. Mıracık Sok. No:15 Meram / Konya Türkiye | |
| Date: 12.06.2020 | Time: 21:53:04 | Sheet 29 of 37 | | |
| File: C:\Altium Projects\STFP102 - Weather Station\Modules\B106AA\Schematic\I2C Multiplexer.SchDoc | | | | |
| | | | | |

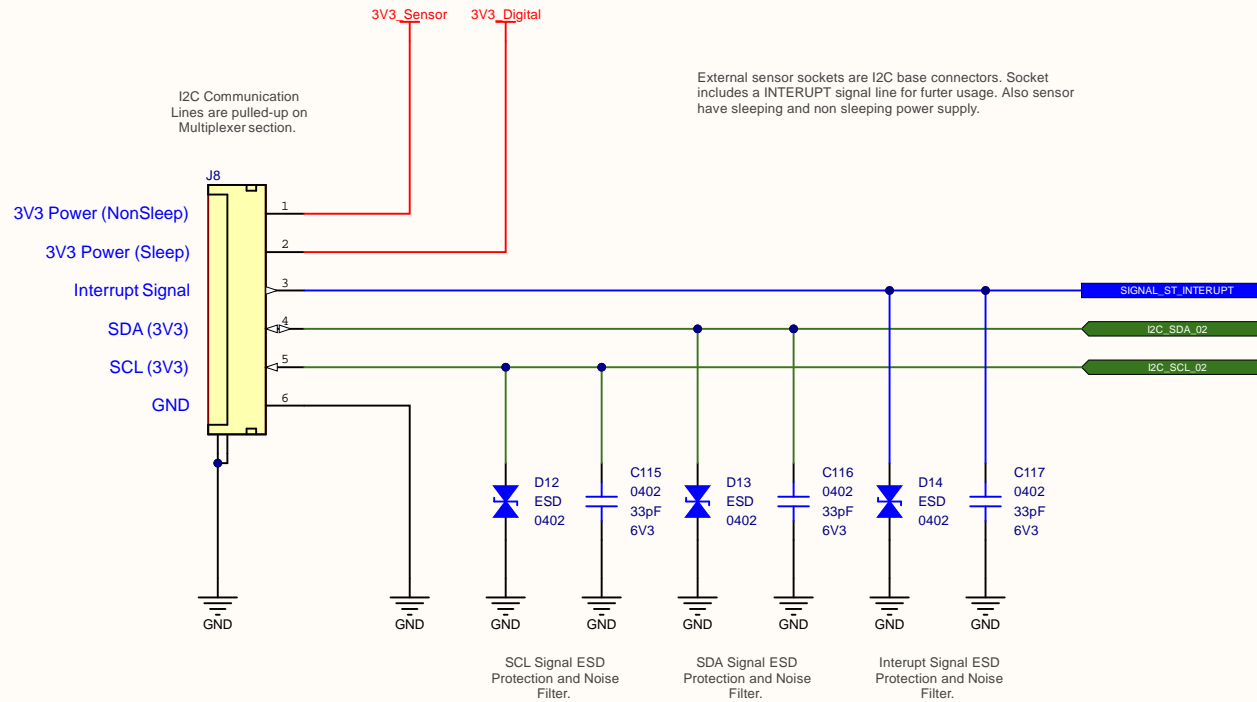





F2

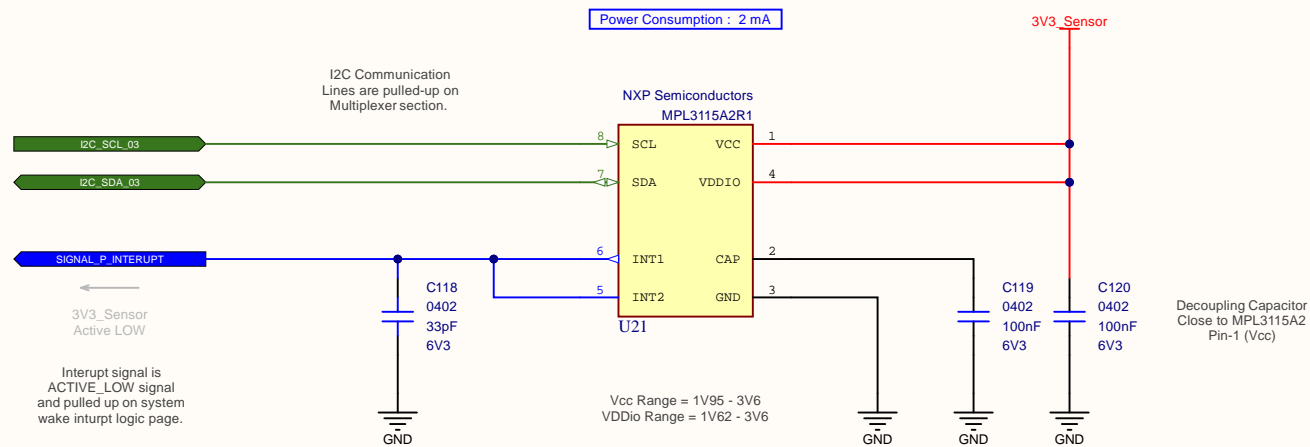
| | | | | | |
|---|-----------------------|------------------------------|--|--|---|
| Title Air Temperature & Air Humidity Sensor Output Socket | | | Ovoo Electronics | |  |
| Size: A4 | Number: AA003 | Revision: B106AA | Küçük İhsaniye Mah. Mızraklı Sok. No:15 Meram / Konya Türkiye | | |
| Date: 12.06.2020 | Time: 21:53:04 | Sheet 30 of 37 | | | |
| File: C:\Altium Projects\STFP102 - Weather Station\Modules\B106AA\Schematic\TH Sensor Output Socket.SchDoc | | | | | |

Ovoo




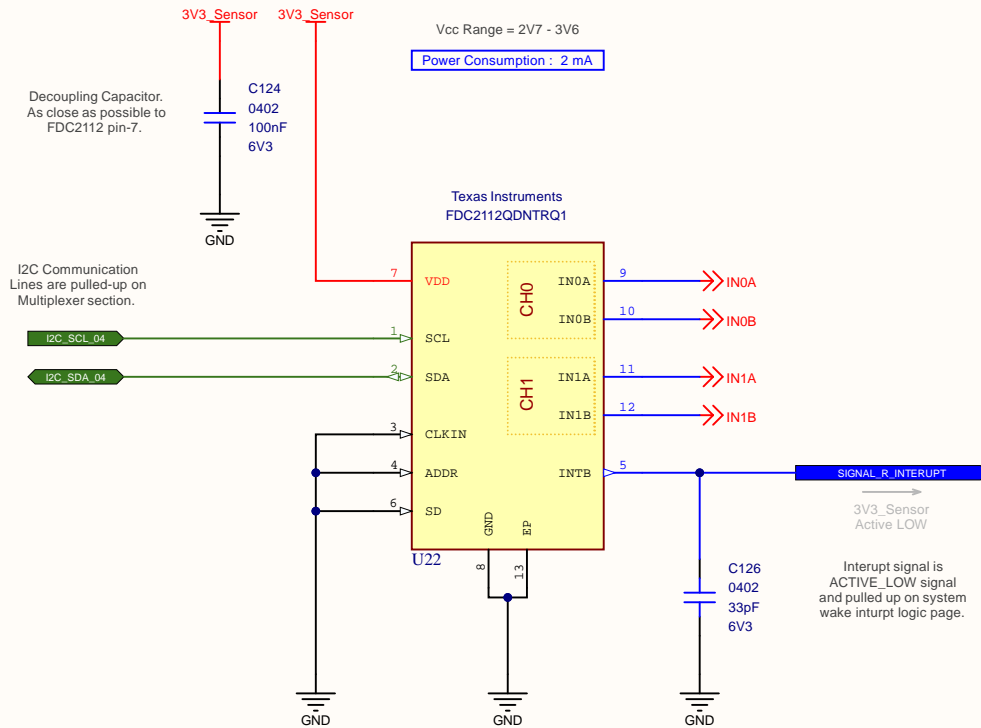
F3

| | | | | | |
|--|-----------------------|------------------------------|--|--|---|
| Title Soil Temperature Sensor Output Socket | | | Ovoo Electronics | |  |
| Size: A4 | Number: AA003 | Revision: B106AA | Küçük İhsaniye Mah. Mızraklı Sok. No:15 Meram / Konya Türkiye | | |
| Date: 12.06.2020 | Time: 21:53:04 | Sheet 31 of 37 | | | |
| File: C:\Altium Projects\STF\P102 - Weather Station\Modules\B106AA\Schematic\ST Sensor Output Socket.SchDoc | | | | | |

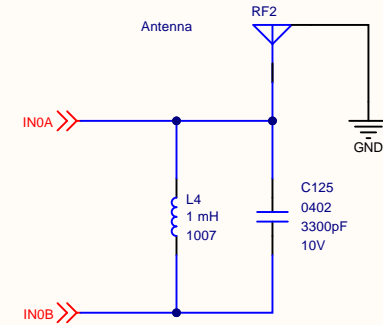


F4

| | | | | | |
|--|-----------------------|------------------------------|--|--|---|
| Title Pressure Sensor | | | Ovoo Electronics | |  |
| Size: A4 | Number: AA003 | Revision: B106AA | Küçük İhsaniye Mah. Mızraklı Sok. No:15 Meram / Konya Türkiye | | |
| Date: 12.06.2020 | Time: 21:53:04 | Sheet 32 of 37 | | | |
| File: C:\Altium Projects\STF\P102 - Weather Station\Modules\B106AA\Schematic\Pressure Sensor.SchDoc | | | | | |
| | | | | | |



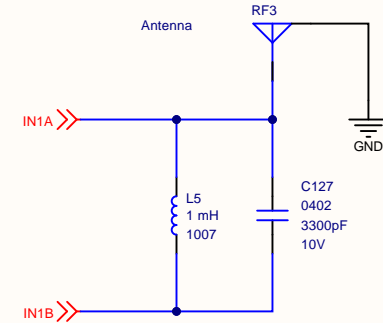
Rain Sensor Plate 1



Sensing plates are connected to
B106 with shielded cable. Both
side of cable are MHF4 type RF
connector. Outer shield of
connector connected to GND.
L-C tank is on B106 side.

Sensing plates are flex PCB and
stick to inside of enclosure.


Rain Sensor Plate 2

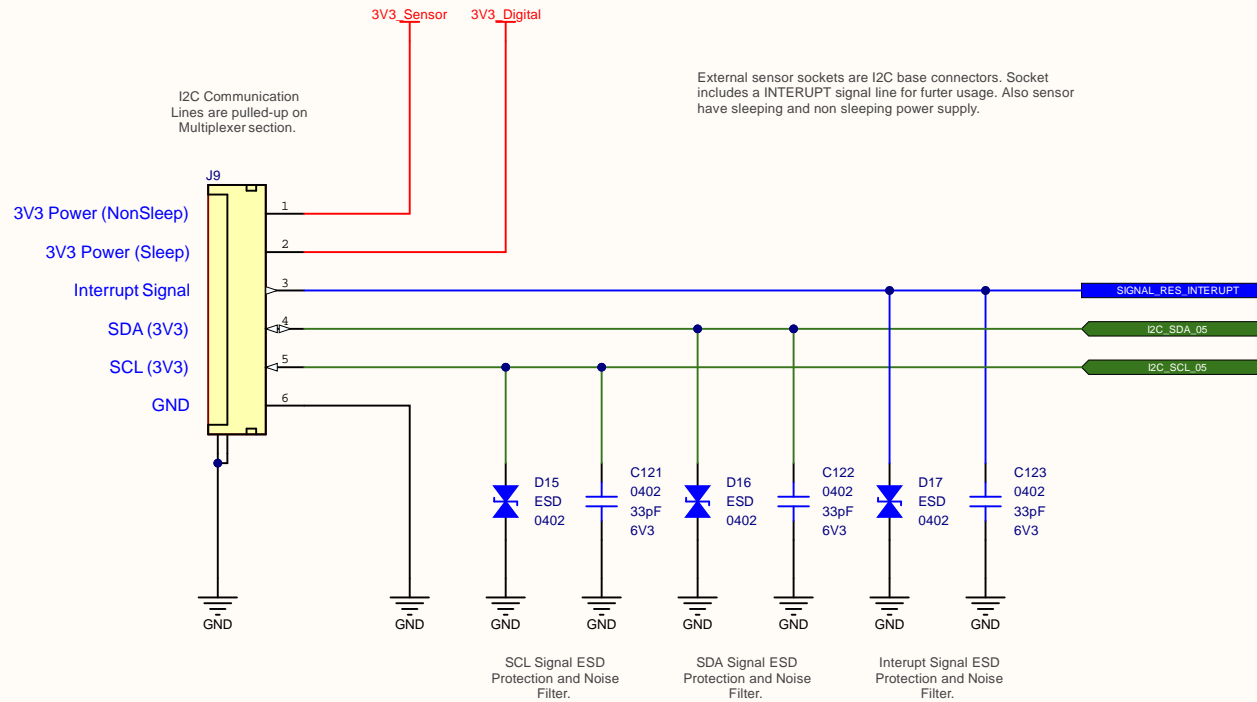


Sensing plates are connected to
B106 with shielded cable. Both
side of cable are MHF4 type RF
connector. Outer shield of
connector connected to GND.
L-C tank is on B106 side.

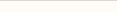
Sensing plates are flex PCB and
stick to inside of enclosure.

F5

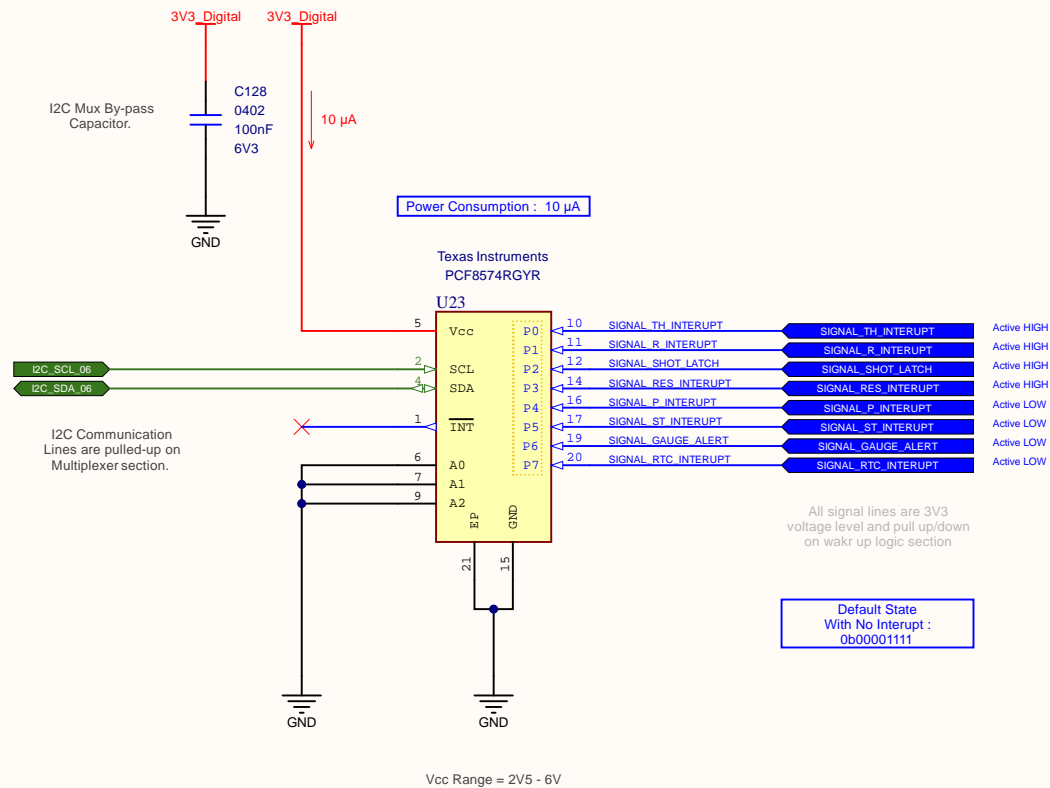
| | | | | |
|---|-----------------------|------------------------------|--|---|
| Title Capacitive Rain Sensor | | | Ovoo Electronics Küçük İhsaniye Mah. Mızraklı Sok. No:15 Meram / Konya Türkiye |  |
| Size: A4 | Number: AA003 | Revision: B106AA | | |
| Date: 12.06.2020 | Time: 21:53:04 | Sheet 33 of 37 | | |
| File: C:\Altium Projects\STF\P102 - Weather Station\Modules\B106AA\Schematic\Capacitive Rain Sensor.SchDoc | | | | |




F6

| | | | | | |
|--|-----------------------|------------------------------|--|--|---|
| Title Reserved Sensor Output Socket | | | Ovoo Electronics | |  |
| Date: A4 | Number: AA003 | Revision: B106AA | Küçük İhsaniye Mah. Mızraklı Sok. No:15 Meram / Konya Türkiye | | |
| Date: 12.06.2020 | Time: 21:53:04 | Sheet 34 of 37 | | | |
| File: C:\Altium Projects\STF\P102 - Weather Station\Modules\B106AA\Schematic\Reserved Sensor Output Socket.SchDoc | | | | | |

Ovoo



F7

| | | | | |
|--|----------------|------------------|--|---|
| Title I2C I/O Expander for Reading Interrupts | | | Ovoo Electronics Küçük İhsaniye Mah. Mızraklı Sok. No:15 Meram / Konya Türkiye |  |
| Size: A4 | Number: AA003 | Revision: B106AA | | |
| Date: 12.06.2020 | Time: 21:53:04 | Sheet 35 of 37 | | |
| File: C:\Altium Projects\STFP102 - Weather Station\Modules\B106AA\Schematic\I2C IO Expander.SchDoc | | | | |

A

B

C

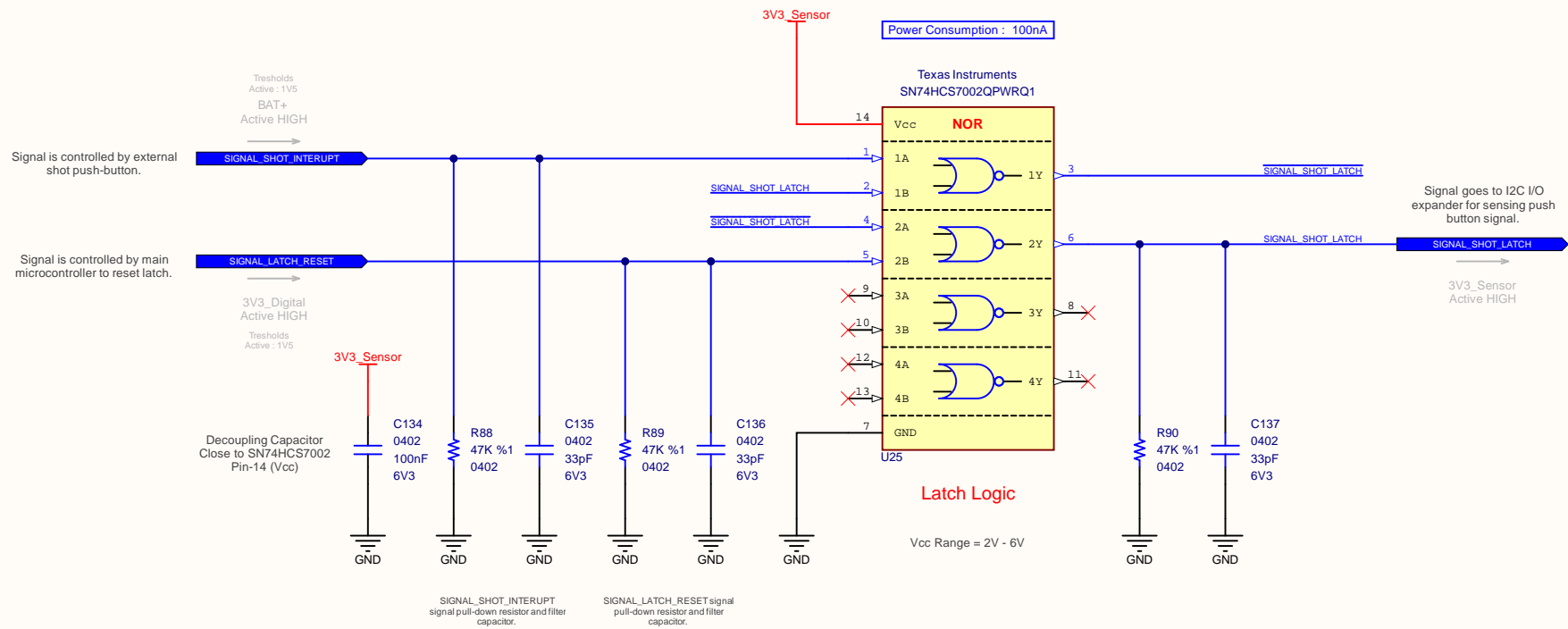
D

A

B

C

D




System main timer and wake interrupt logic includes manuel shot button interrupt for wakeup the system. If user pushes the manuel wakeup button system wakes up and send data.

We want to learn wich interrupt wakes up the system. All interrupt source are latch up until firmware clear the interrupt. But shot button is a push button interrupt so we need to latch the signal for sensing.

SN74HCS7002 is a 4 channel NOR gate for building "SR Latch flip flop". Latch circuit have 2 input (one is set one is reset) and one output.

If set pin (Signal_Shot_Interrupt) goes HIGH output pin (Signal_Shot_Latch) goes HIGH. Output pin latched at HIGH until resep signal is recieved. So all input and output pins are pull-down.

| | | | | |
|--|-----------------------|------------------------------|--|---|
| Title Signal Latch Logic | | | Ovoo Electronics |  |
| Size: A4 | Number: AA003 | Revision: B106AA | Küçük İnşaniye Mah. Mızraklı Sok. No:15 Meram / Konya Türkiye | |
| Date: 12.06.2020 | Time: 21:53:04 | Sheet 37 of 37 | | |
| File: C:\Altium Projects\STFP102 - Weather Station\Modules\B106AA\Schematic\Signal Latch Logic.SchDoc | | | | |