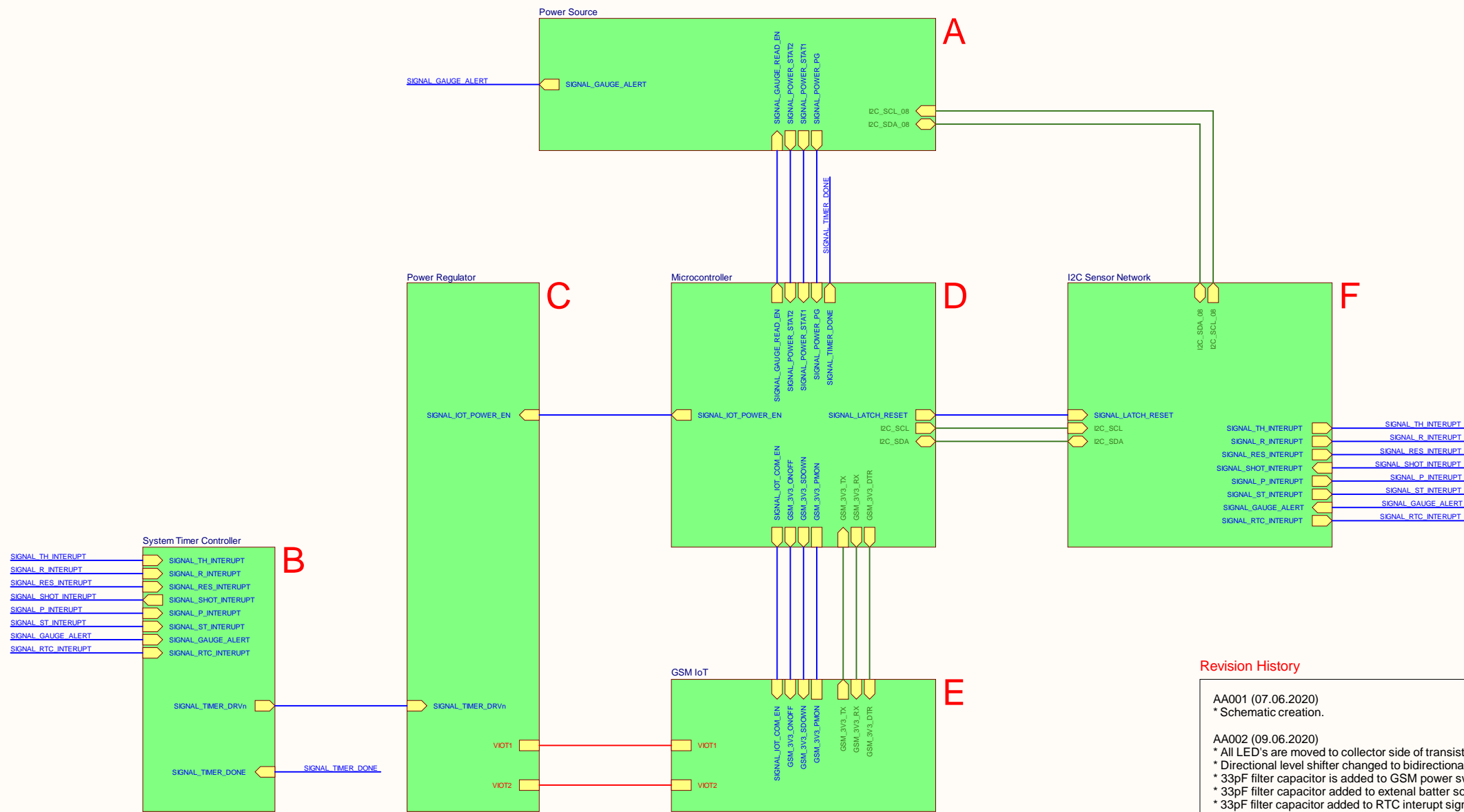
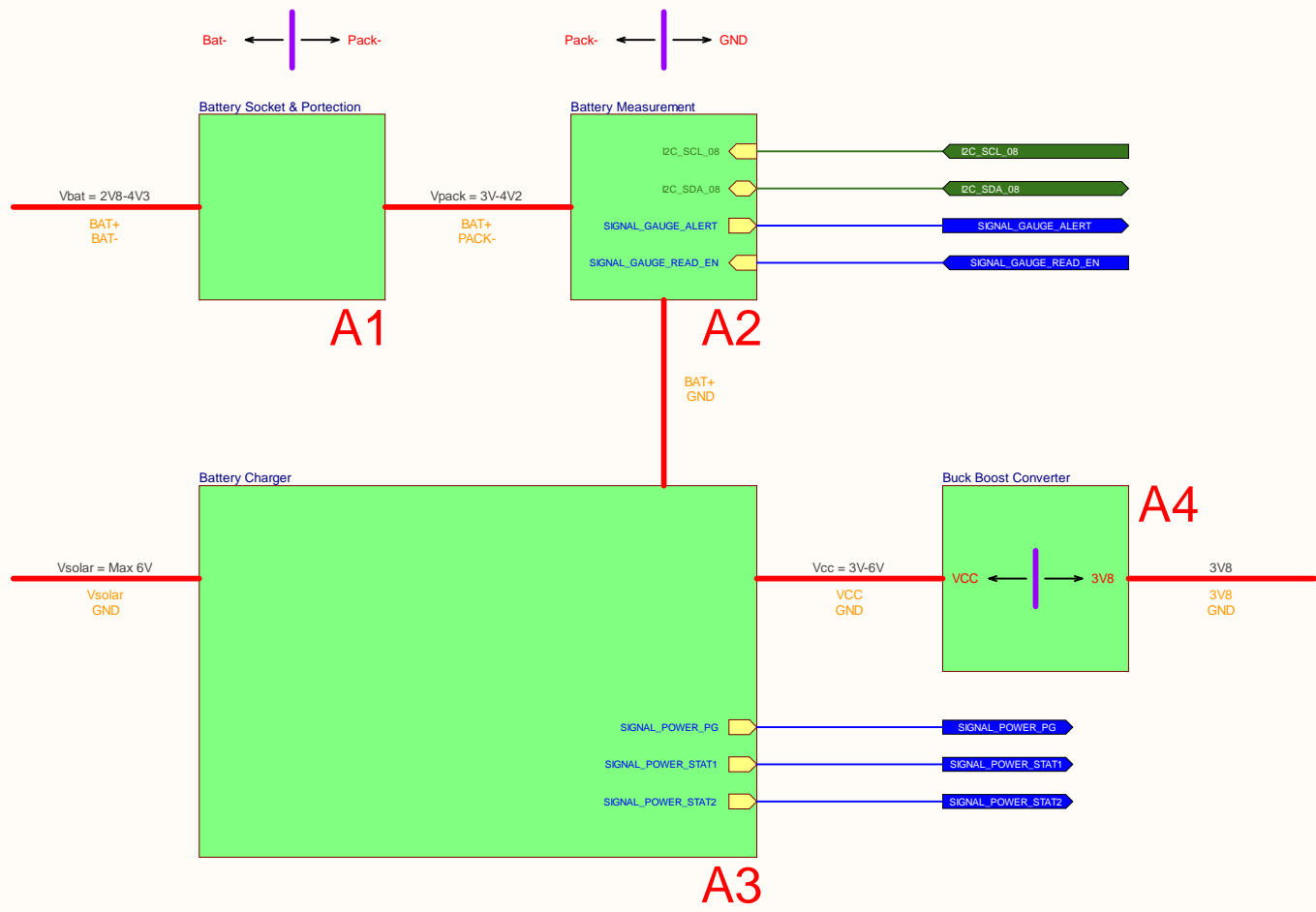


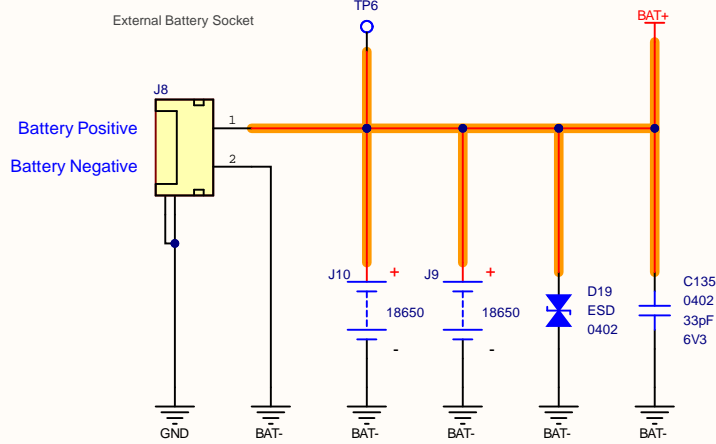
B106 - Weather Station IoT Module



Revision History

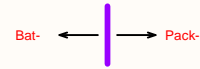
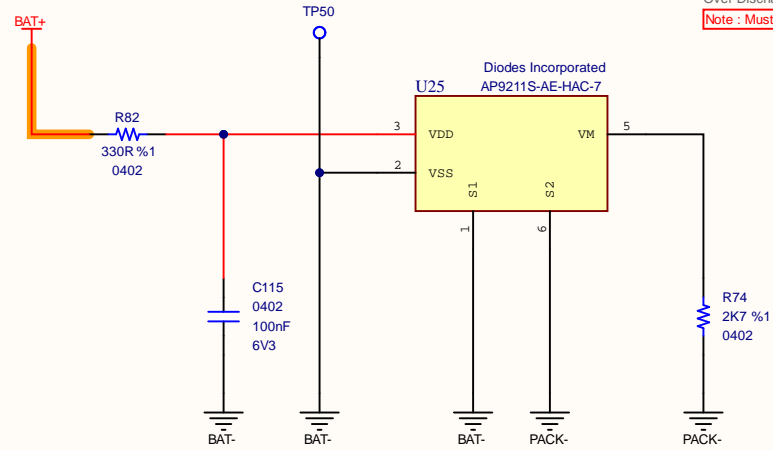
- AA001 (07.06.2020)
* Schematic creation.
- AA002 (09.06.2020)
* All LED's are moved to collector side of transistors.
* Directional level shifter changed to bidirectional level shifter.
* 33pF filter capacitor is added to GSM power switch in and out.
* 33pF filter capacitor added to external batter 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.
- AA004 (22.06.2020)
* PCB Design completed.
* DTR Signal added.





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

Advice : 2x2500mAh VTC6



Battery ground isolation for protection.

Vbat = 2V8-4V3


Vpack = 3V-4V2

P/N : AP9211XX-AE-HAC-7

Over Charge Detection Voltage (Vcu): 4V2
Over Charge Release Voltage (Vcl): 4V1
Over Discharge Detection Voltage (Vdl): 2V5
Over Discharge Release Voltage (Vdu): 3V

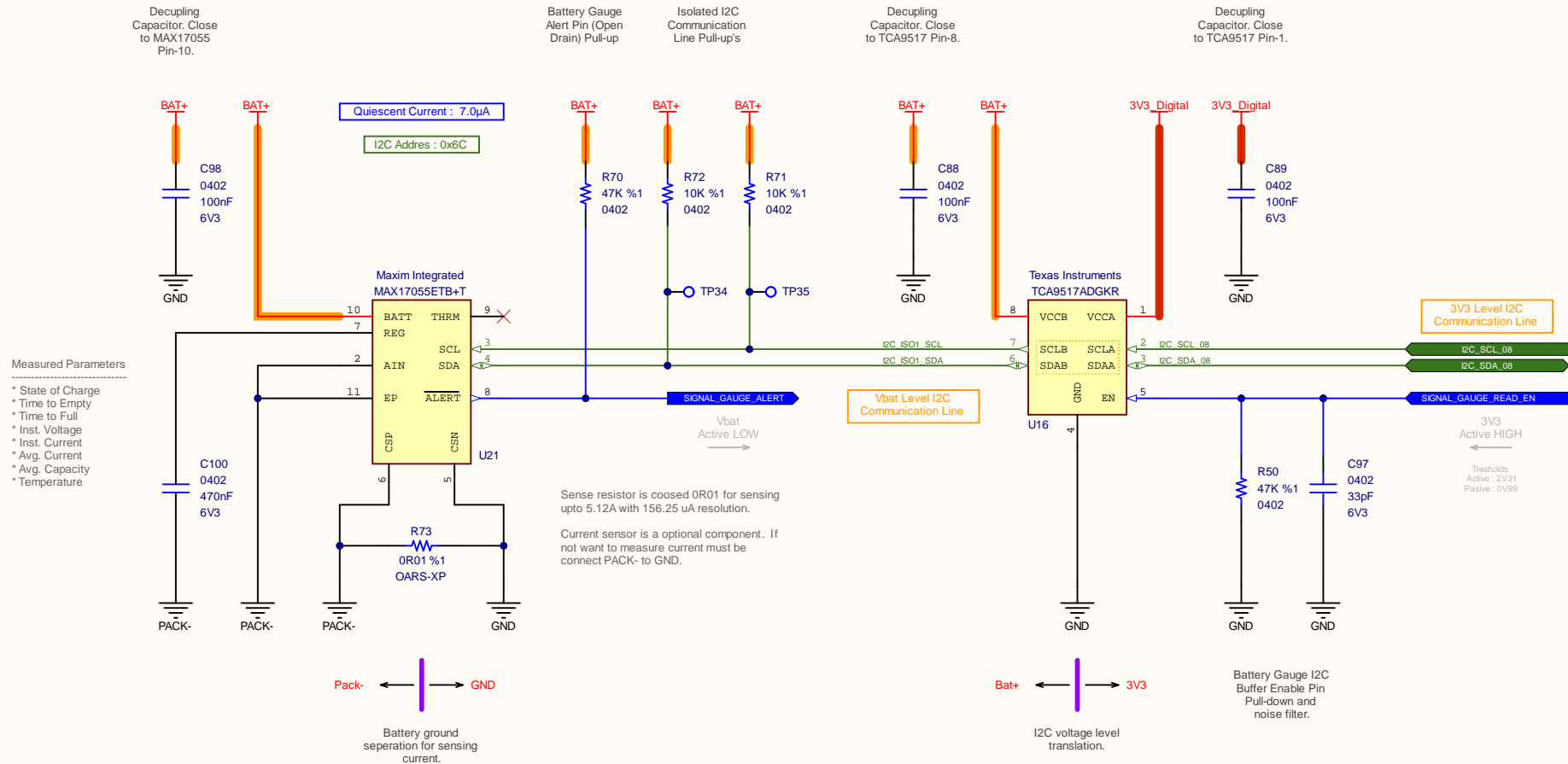
Note : Must be plug charge on first run.

A1


Title System Battery Feed and Battery Socket			Ovoo Electronics		
Size: A4	Number: AA005	Revision: B106AA	Küçük İhsaniye Mah. Mıracık Sok. No:15 Meram / Konya Türkiye		
Date: 11.07.2020	Time: 23:32:05	Sheet 3 of 37			
File: C:\Altium Projects\IP101CA\Modules\Electronic\B106AA\Design Files\Altium\Schematic\Battery Feed and Socket.SchDoc					

Battery Measurement

I2C Buffer



A2

Title Battery Measurement With I2C Isolation			Ovoo Electronics		
Size: A4	Number: AA005	Revision: B106AA	Küçük İhsaniye Mah. Mıracık Sok. No:15 Meram / Konya Türkiye		
Date: 11.07.2020	Time: 23:32:05	Sheet 4 of 37			
File: C:\Altium Projects\IP101CA\Modules\Electronic\B106AA\Design Files\Altium\Schematic\Battery Measurement.SchDoc					

A

B

C

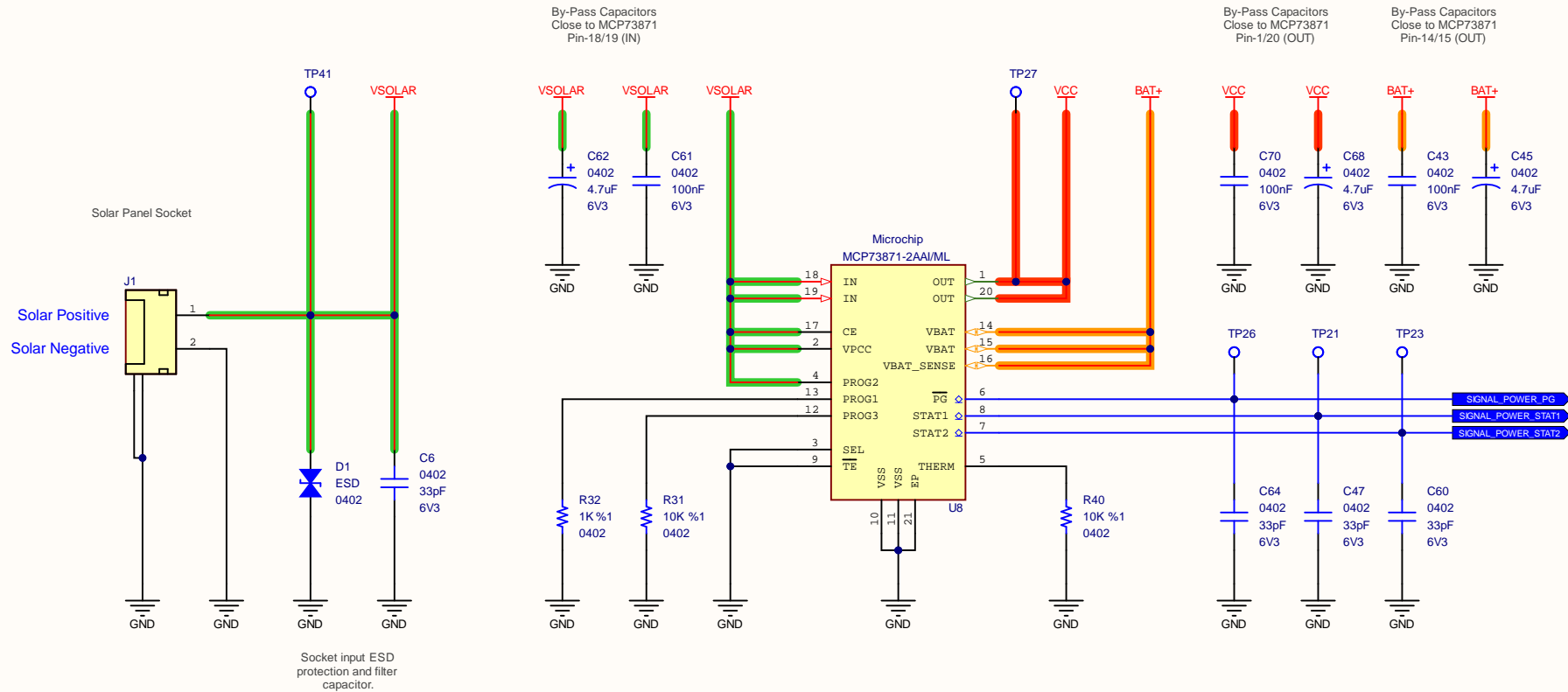
D

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.

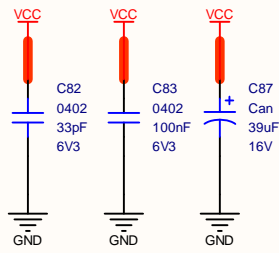
PROG1 Pin : Fast charge current regulation setting with PROG1 = High. Preconditioning set point for both USB port and other type of power source. 1K = 1A charge current limit.

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.

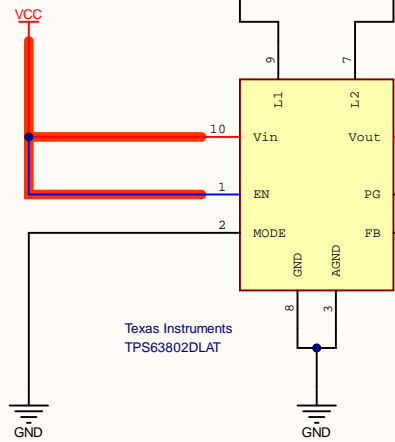
A3

Title Battery Charger			Ovoo Electronics	
Size: A4	Number: AA005	Revision: B106AA	Küçük İhsaniye Mah. Mıracık Sok. No:15 Meram / Konya Türkiye	
Date: 11.07.2020	Time: 23:32:05	Sheet 5 of 37		
File: C:\Altium Projects\IP101CA\Modules\Electronic\B106AA\Design Files\Altium\Schematic\Battery Charger.SchDoc				



Filter Capacitors
Close to TPS63802
Pin-10 (IN)

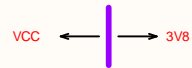
TPS63802 Vin Range
1V8 - 5V5




Texas Instruments
TPS63802DLAT

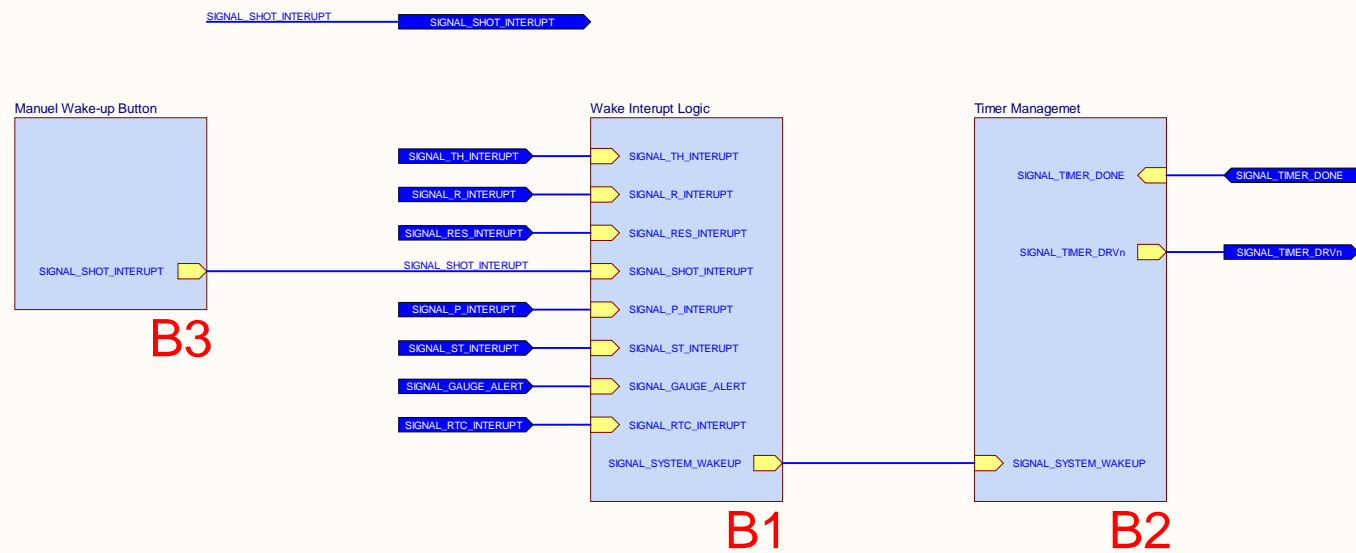
Buck / Boost Converter Properties
Vout = 3V8
Vout Actual = 3V82
Duty Cycle = 30.21%
Efficiency = 88.8%
Frequency = 2.52 MHz
Pout = 7.6 W

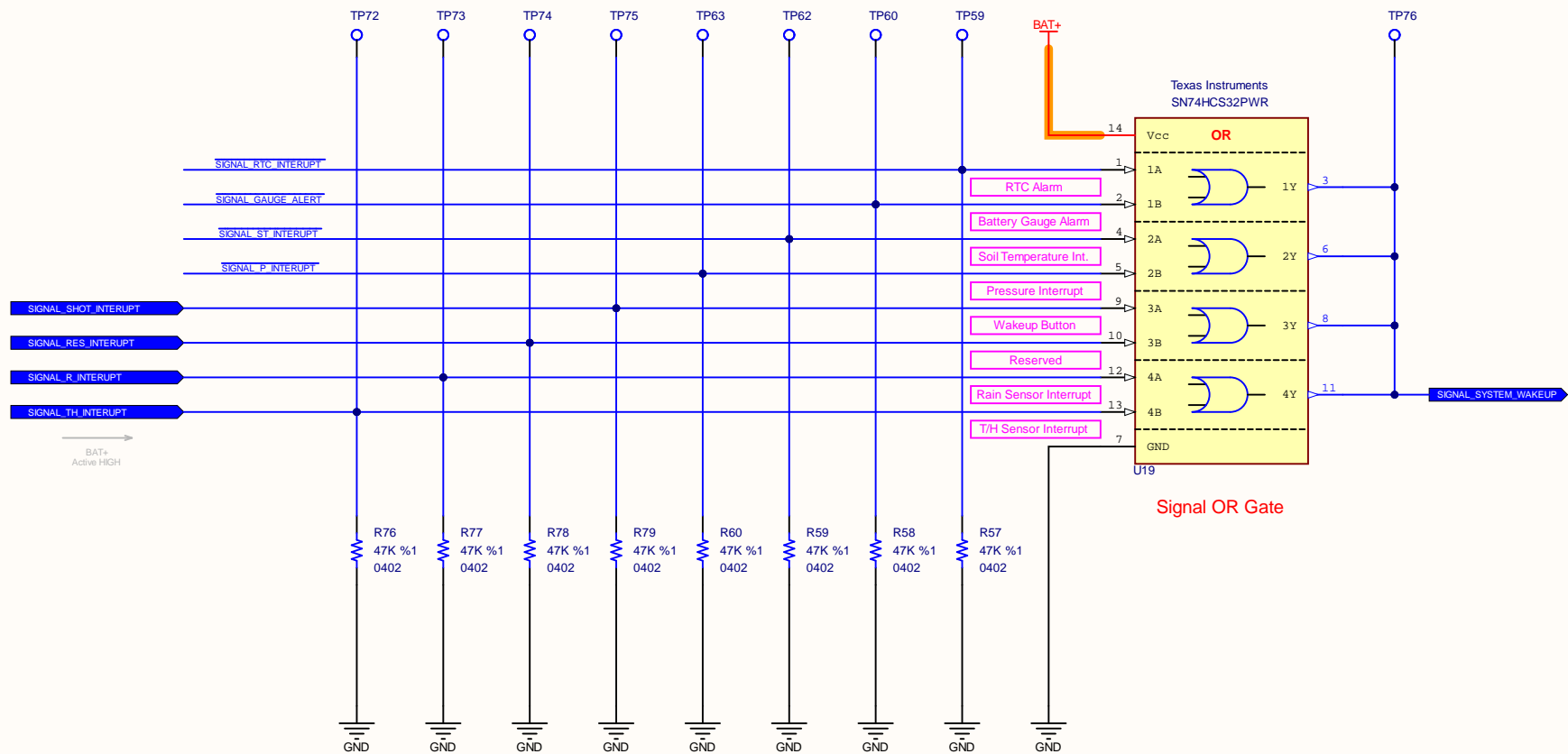
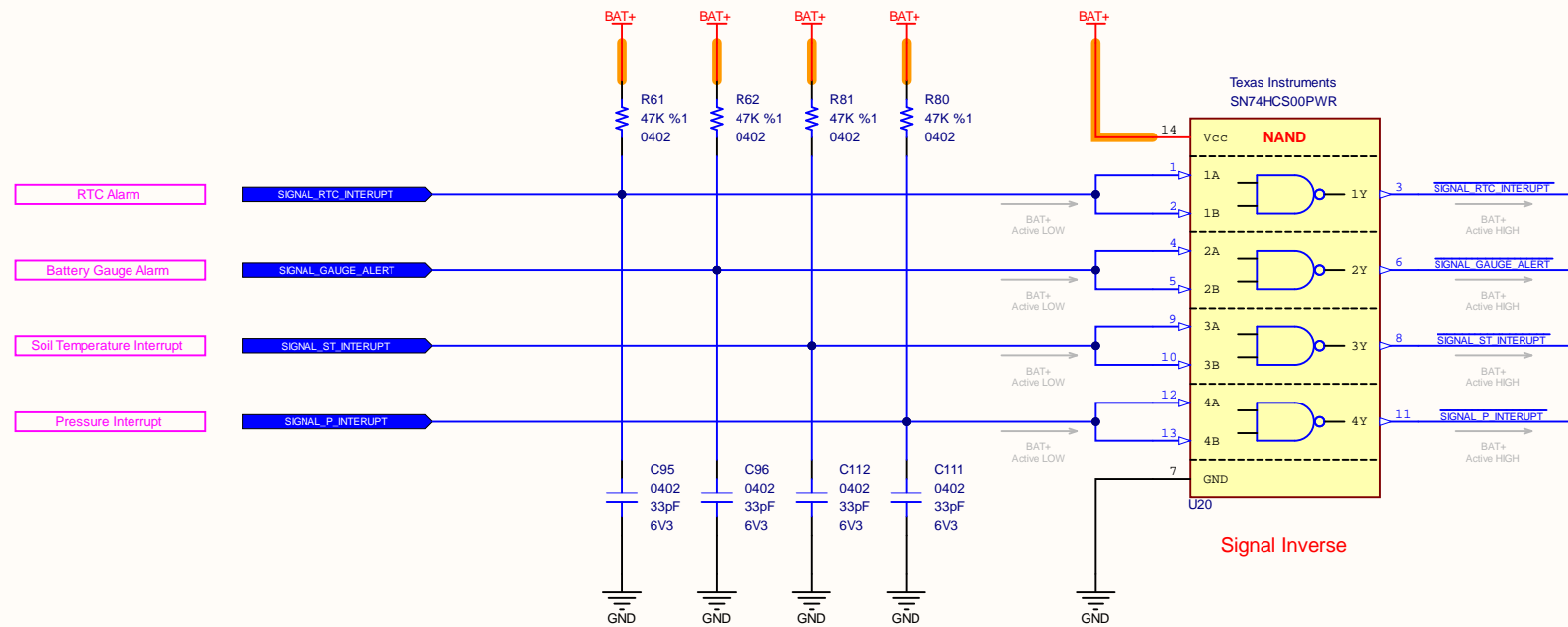
Quiescent Current : 11µA




A4

Title Buck Boost Converter			Ovoo Electronics		
Size: A4	Number: AA005	Revision: B106AA	Küçük İhsaniye Mah. Mıracık Sok. No:15 Meram / Konya Türkiye		
Date: 11.07.2020	Time: 23:32:05	Sheet 6 of 37			
File: C:\Altium Projects\IP101CA\Modules\Electronic\B106AA\Design Files\Altium\Schematic\Buck Boost Converter.SchDoc					

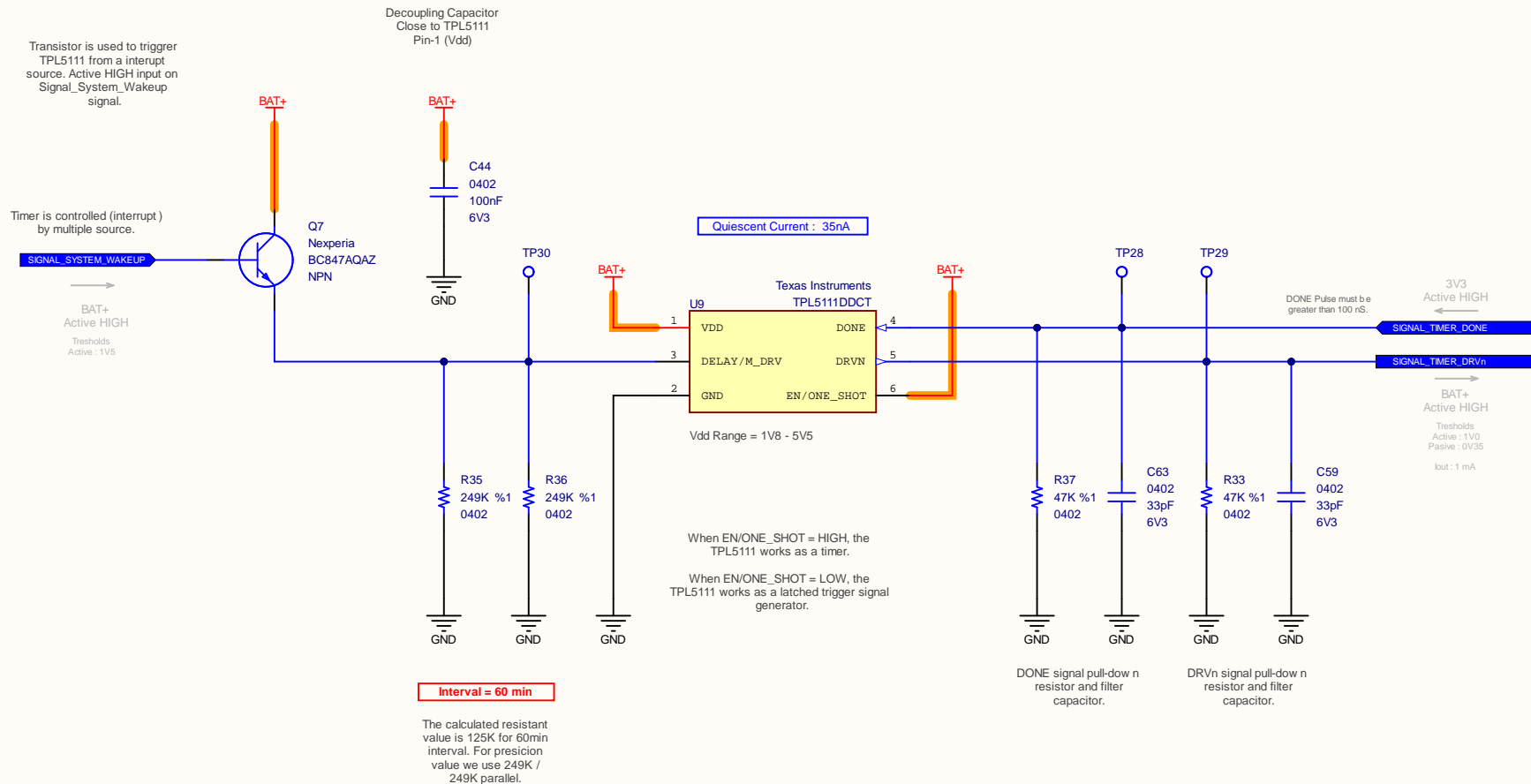





B1

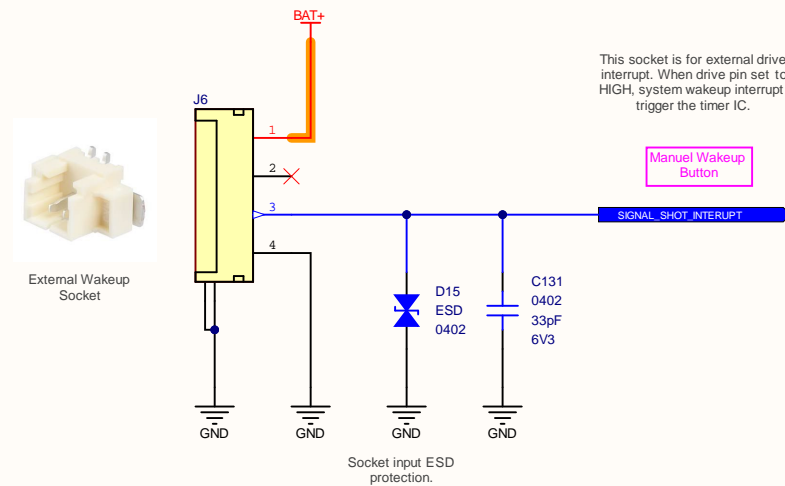
Title System Wake up Resources Logic Gates			Ovoo Electronics	
Size: A3	Number: AA005	Revision: B106AA	<div>Küçük İhsaniye Mah. Mızraklı Sok. No:15 Meram / Konya Türkiye</div> <div></div>	
Date: 11.07.2020	Time: 23:32:05	Sheet 8 of 37		
File: C:\Altium Projects\IP101CAModules\Electronic\B106AA\Design Files\Altium\Schematic\System Wake Interrupt Logic.SchDoc				






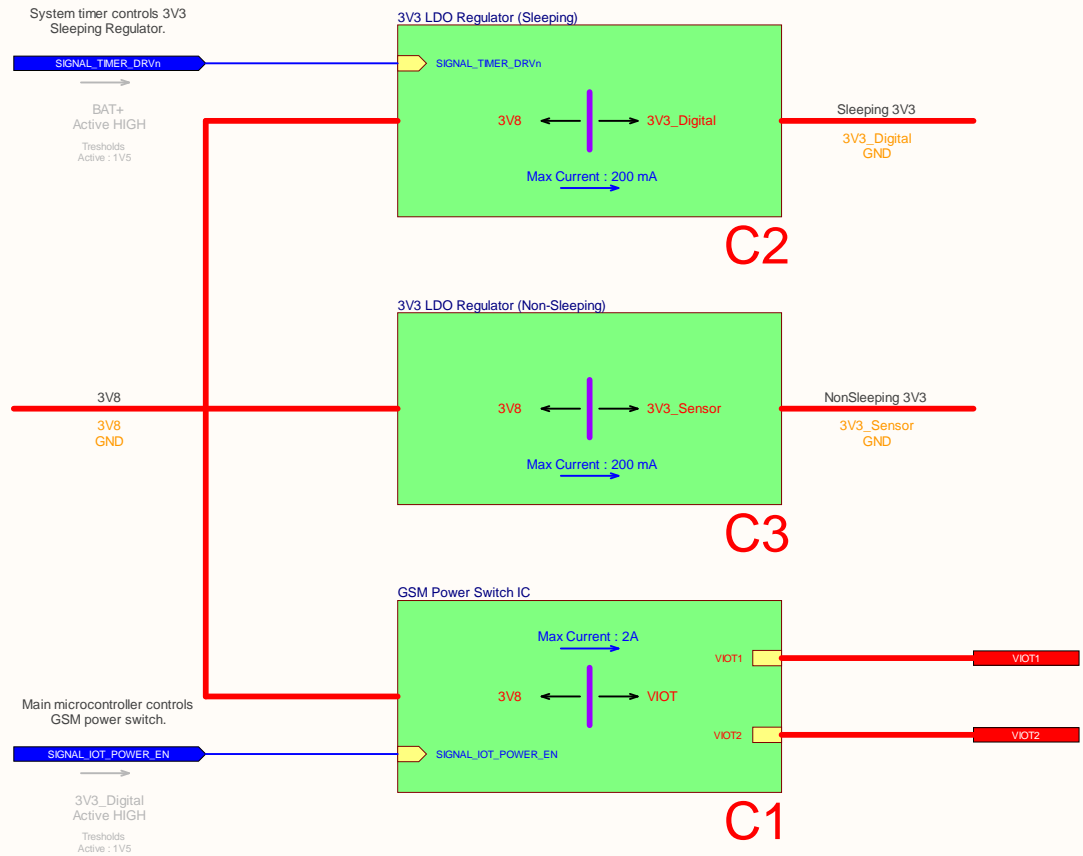
B2

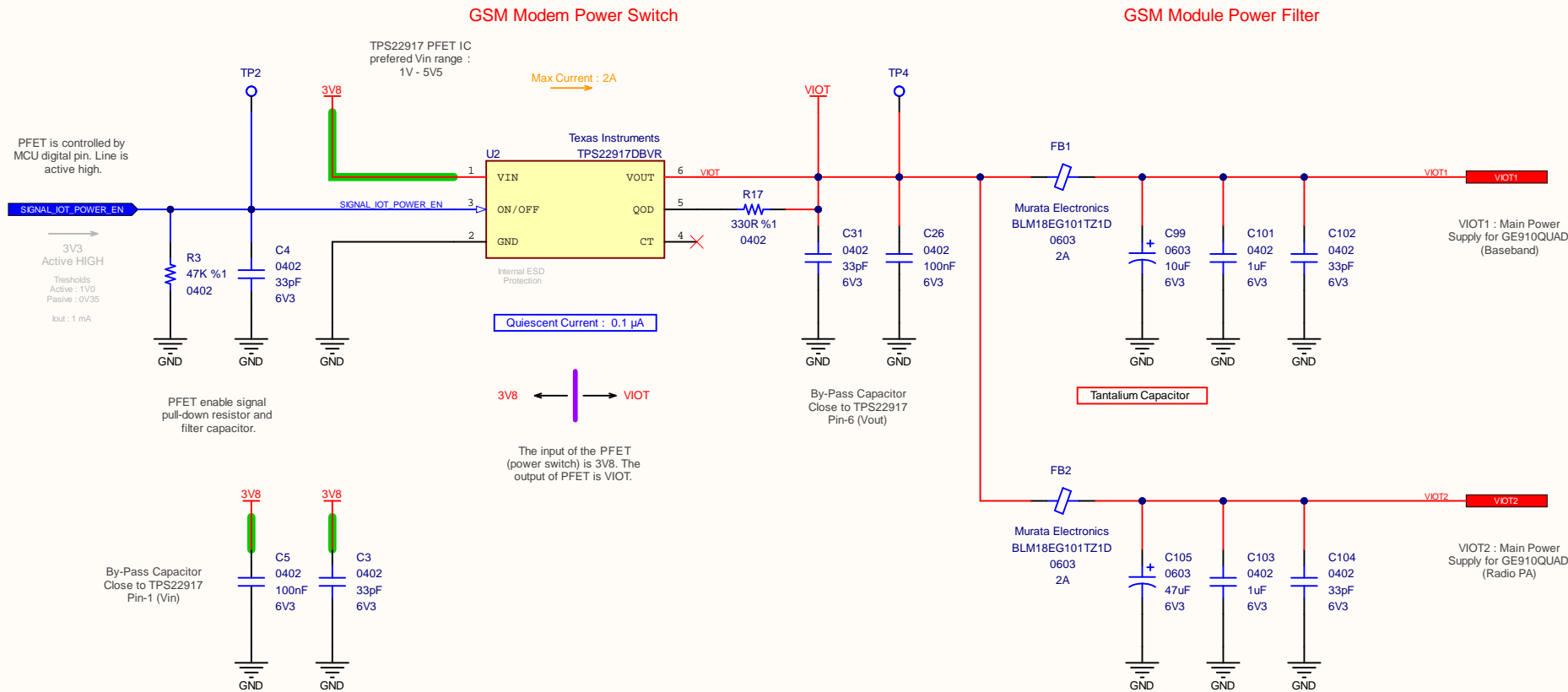
Title Sleep Management (Timer)			Ovoo Electronics		
Size: A4	Number: AA005	Revision: B106AA	Küçük İhsaniye Mah. Mıracık Sok. No:15 Meram / Konya Türkiye		
Date: 11.07.2020	Time: 23:32:05	Sheet 9 of 37			
File: C:\Altium Projects\IP101CAModules\Electronic\B106AA\Design Files\Altium\Schematic\Time Management.SchDoc					



B3

Title Manuel Wake-up Button			Ovoo Electronics Küçük İhsaniye Mah. Mızraklı Sok. No:15 Meram / Konya Türkiye	
Size: A4	Number: AA005	Revision: B106AA		
Date: 11.07.2020	Time: 23:32:05	Sheet 10 of 37		
File: C:\Altium Projects\IP101CA\Modules\Electronic\B106AA\Design Files\Altium\Schematic\Manuel Wake-up and Latch.SchDoc				

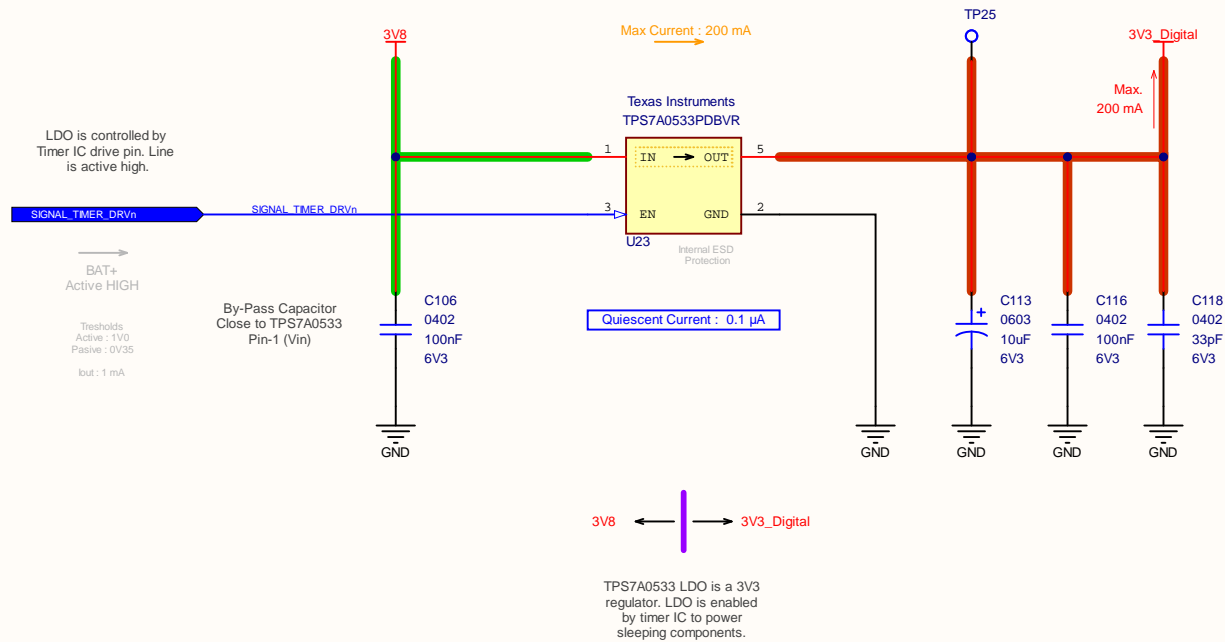





C1

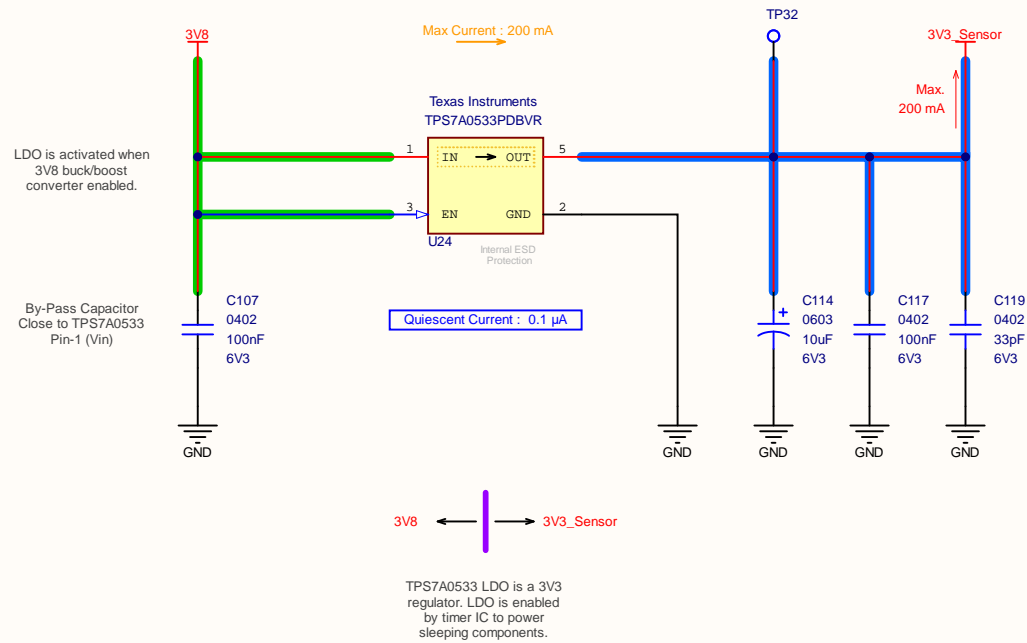
Title GSM Module Power On/Off Switch IC & IoT Power Filter			Ovoo Electronics	
Size: A4	Number: AA005	Revision: B106AA	<div>Küçük İhsaniye Mah. Mızraklı Sok. No:15 Meram / Konya Türkiye</div> <div>öVOO</div>	
Date: 11.07.2020	Time: 23:32:05	Sheet 12 of 37		
File: C:\Altium Projects\IP101CAModules\Electronic\B106AA\Design Files\Altium\Schematic\GSM Power On-Off Switch IC.SchDoc				

ovoo




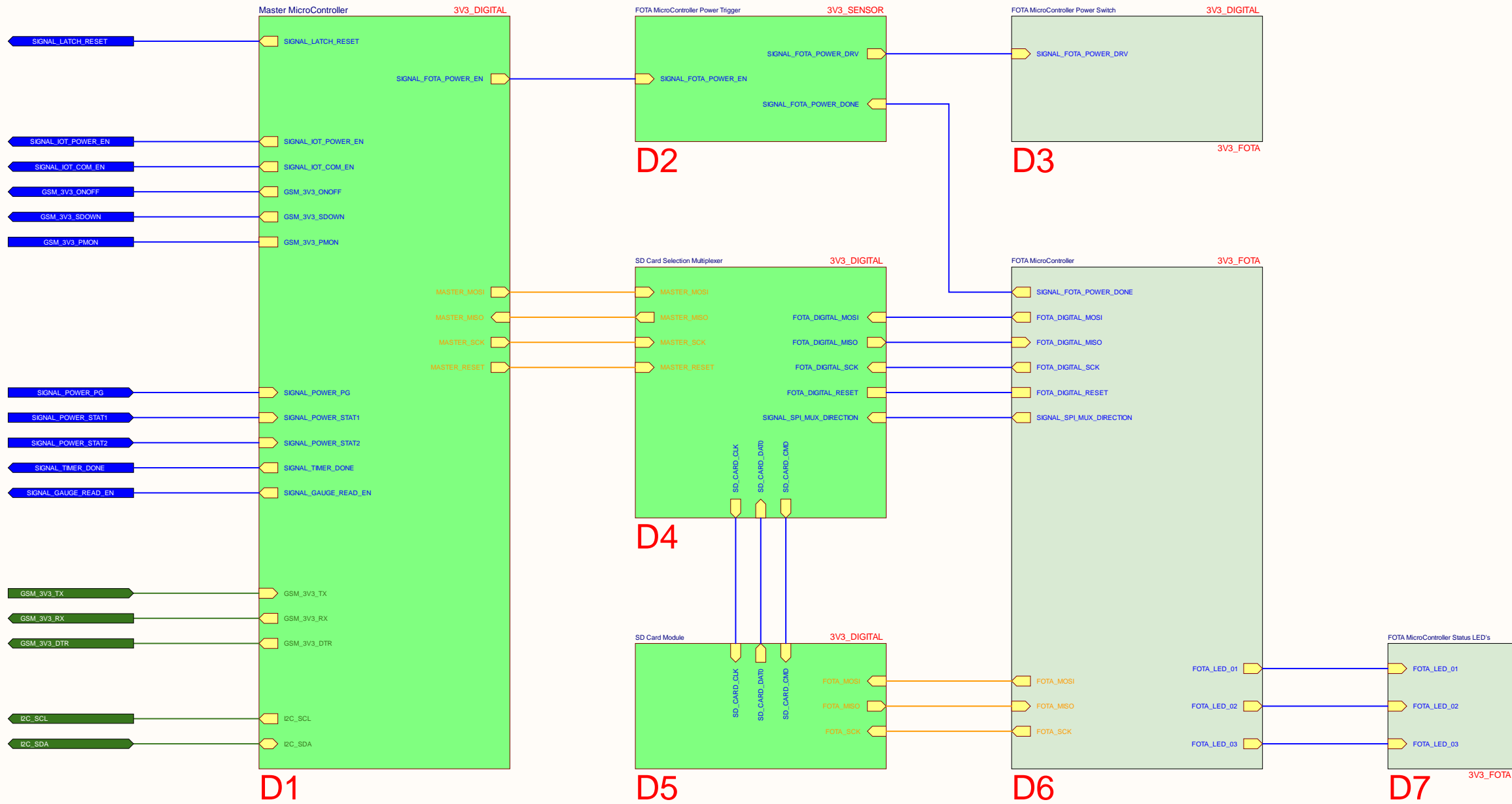
C2

Title 3V3 LDO Voltage Regulator (Sleeping)			<div>Ovoo Electronics</div> <div>Küçük İhsaniye Mah. Mıracık Sok. No:15 Meram / Konya Türkiye</div> <div></div>
Size: A4	Number: AA005	Revision: B106AA	
Date: 11.07.2020	Time: 23:32:05	Sheet 13 of 37	
File: C:\Altium Projects\IP101CA\Modules\Electronic\B106AA\Design Files\Altium\Schematic\3V3 LDO Regulator (Sleeping).SchDoc			



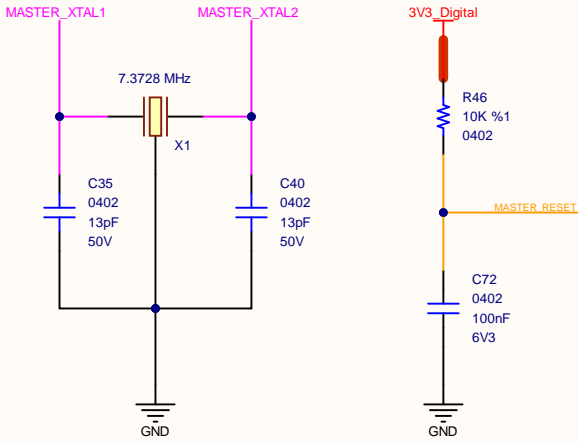
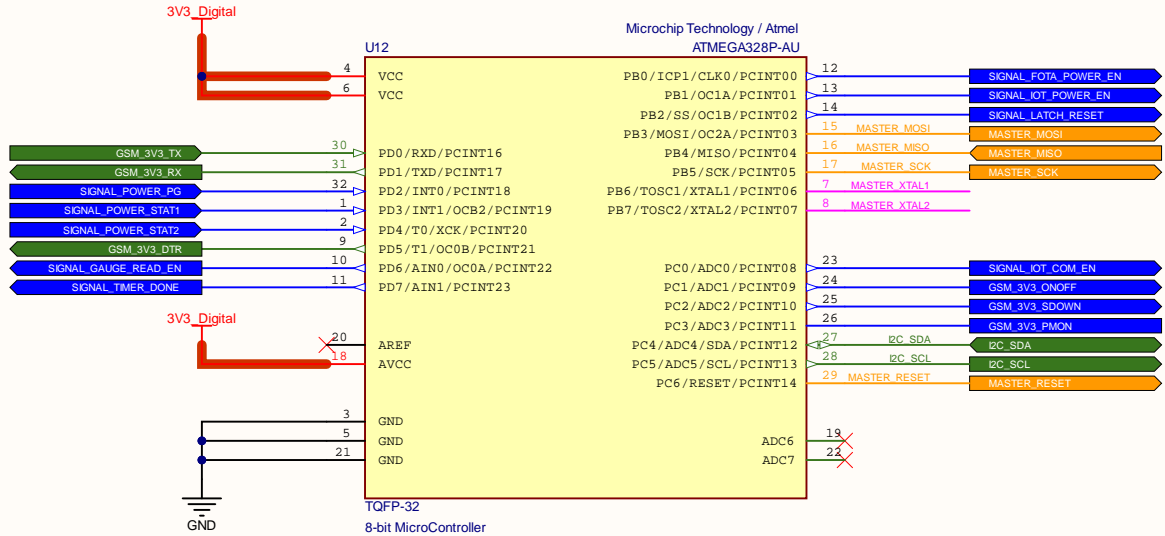
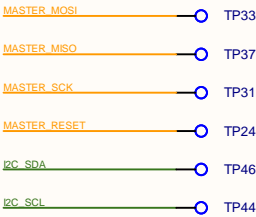
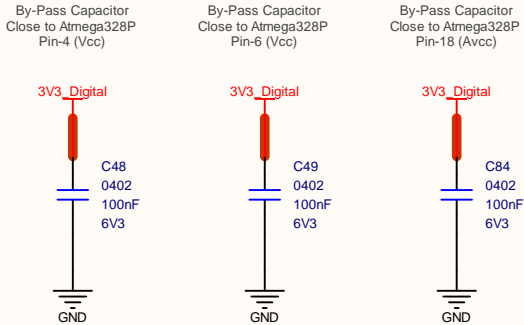
C3

Title 3V3 LDO Voltage Regulator (NonSleeping)			<div>Ovoo Electronics</div> <div>Küçük İhsaniye Mah. Mızraklı Sok. No:15 Meram / Konya Türkiye</div> <div></div>
Size: A4	Number: AA005	Revision: B106AA	
Date: 11.07.2020	Time: 23:32:05	Sheet 14 of 37	
File: C:\Altium Projects\IP101CA\Modules\Electronic\B106AA\Design Files\Altium\Schematic\3V3 LDO Regulator (NonSleeping).SchDoc			



B106AA Module have two on-board MCU.


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.

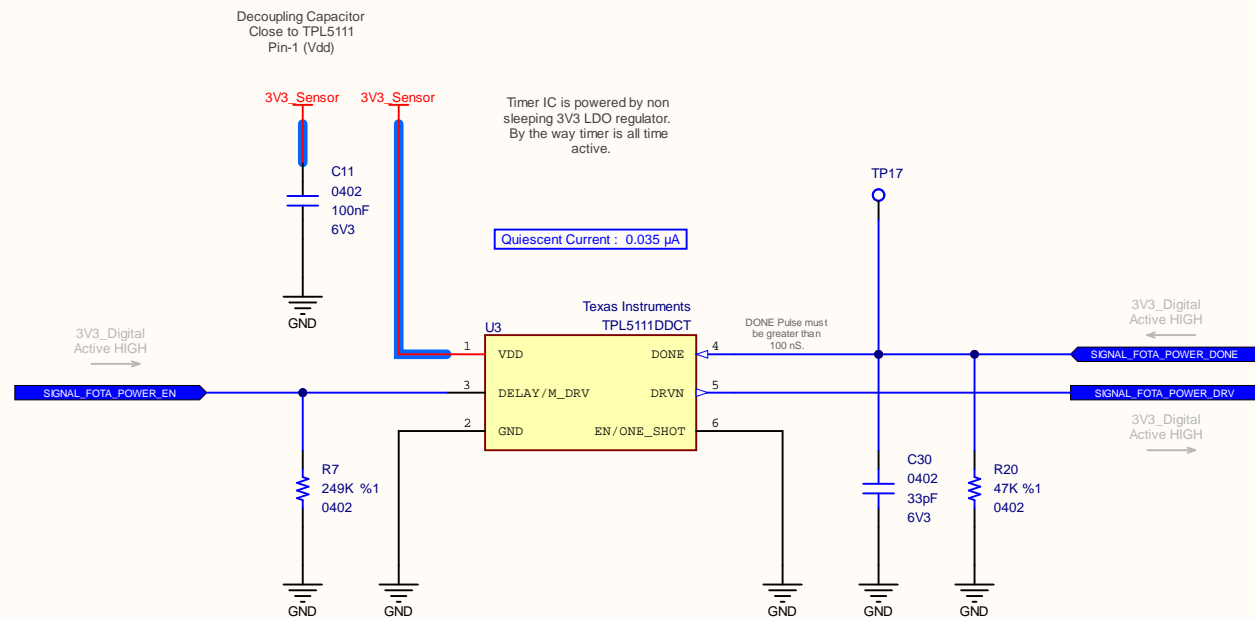


Master MCU is working
at 7.3728 Mhz for
minimise UART
communication errors.

Master MCU Reset Line.
Pull-up.

D1

Title Master MicroController			Ovoo Electronics		
Size: A4	Number: AA005	Revision: B106AA	Küçük İhsaniye Mah. Mıracık Sok. No:15 Meram / Konya Türkiye		
Date: 11.07.2020	Time: 23:32:05	Sheet 16 of 37			
File: C:\Altium Projects\IP101CA\Modules\Electronic\B106AA\Design Files\Altium\Schematic\Master MicroController.SchDoc					




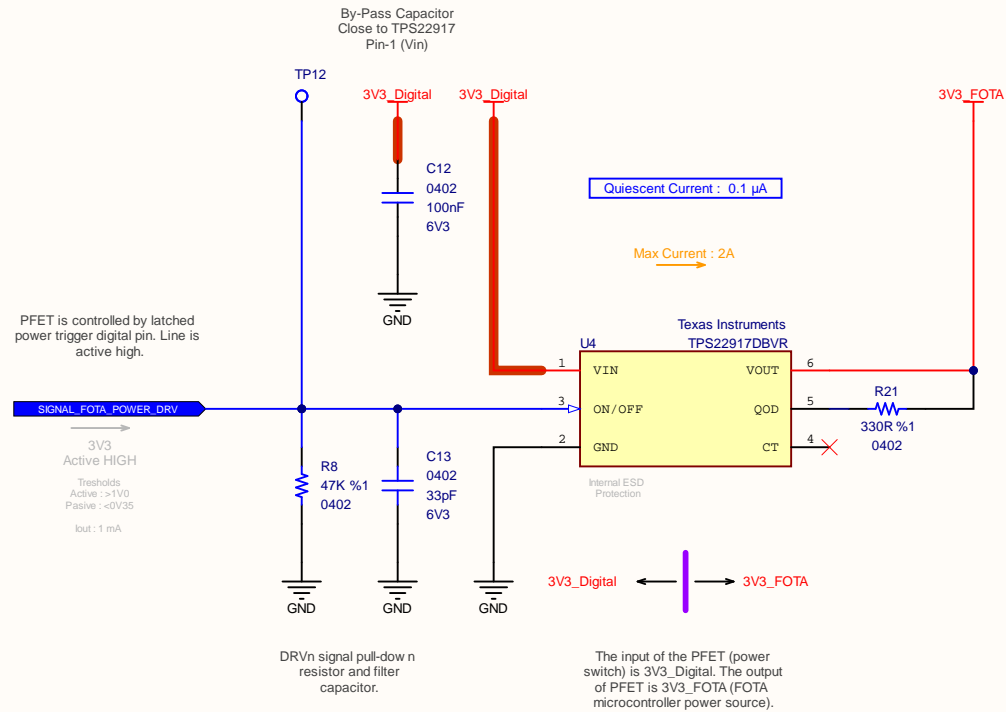
TPL5111 is used for powering FOTA microcontroller. In this mode timer is work on one-shot mode. So the time set resistor is not necessary.

When EN/ONE_SHOT = HIGH, the TPL5111 works as a timer.


When EN/ONE_SHOT = LOW, the TPL511 works as a latched trigger signal generator.

D2

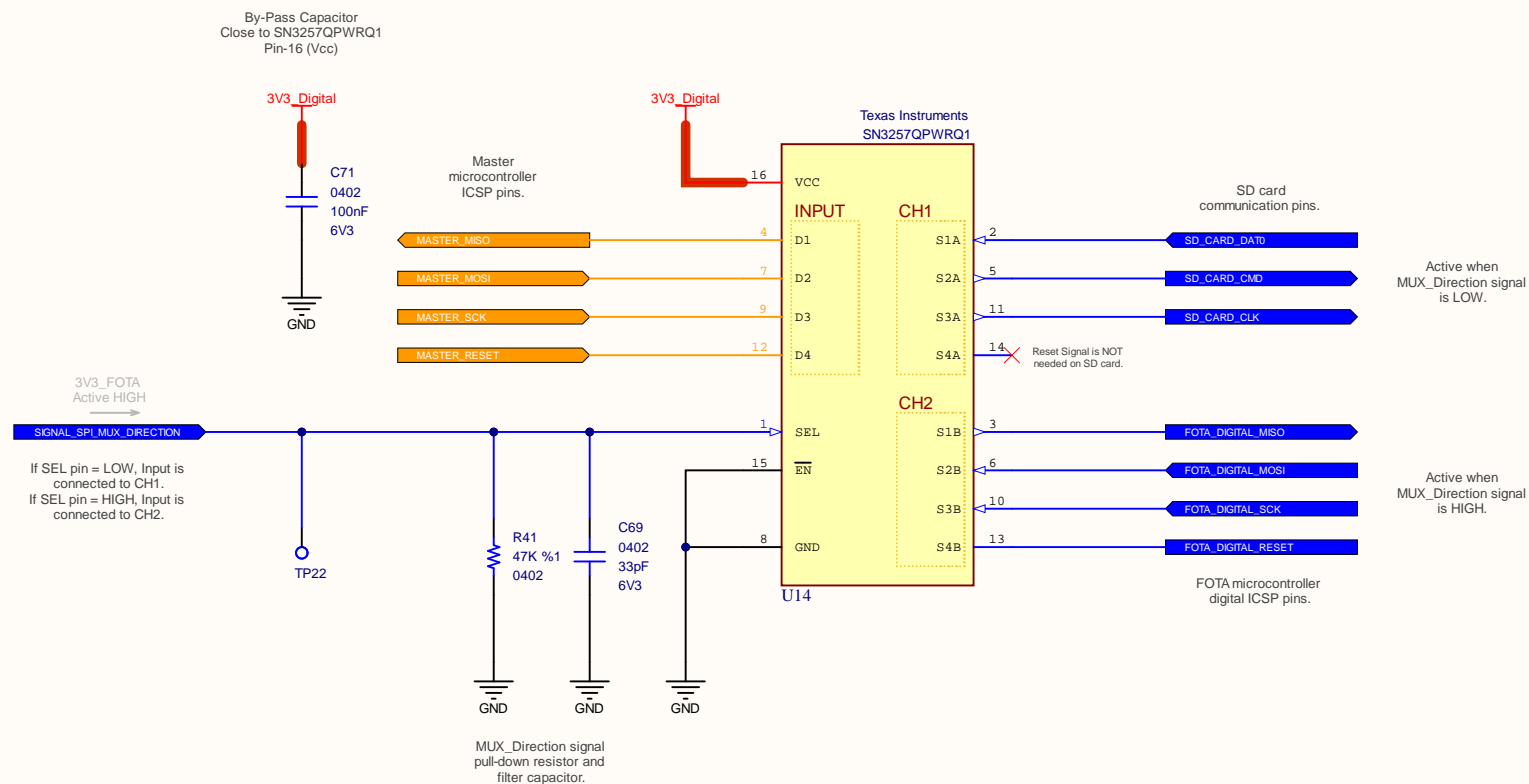
Title: FOTA MicroController Latched Power Trigger			Ovoo Electronics Küçük İhsaniye Mah. Mızraklı Sok. No:15 Meram / Konya Türkiye	
Size: A4	Number: AA005	Revision: B106AA		
Date: 11.07.2020	Time: 23:32:06	Sheet 17 of 37		
File: C:\Altium Projects\P101CA\Modules\Electronic\B106AA\Design Files\Altium\Schematic\FOTA MicroController Power Trigger.SchDoc				




D3

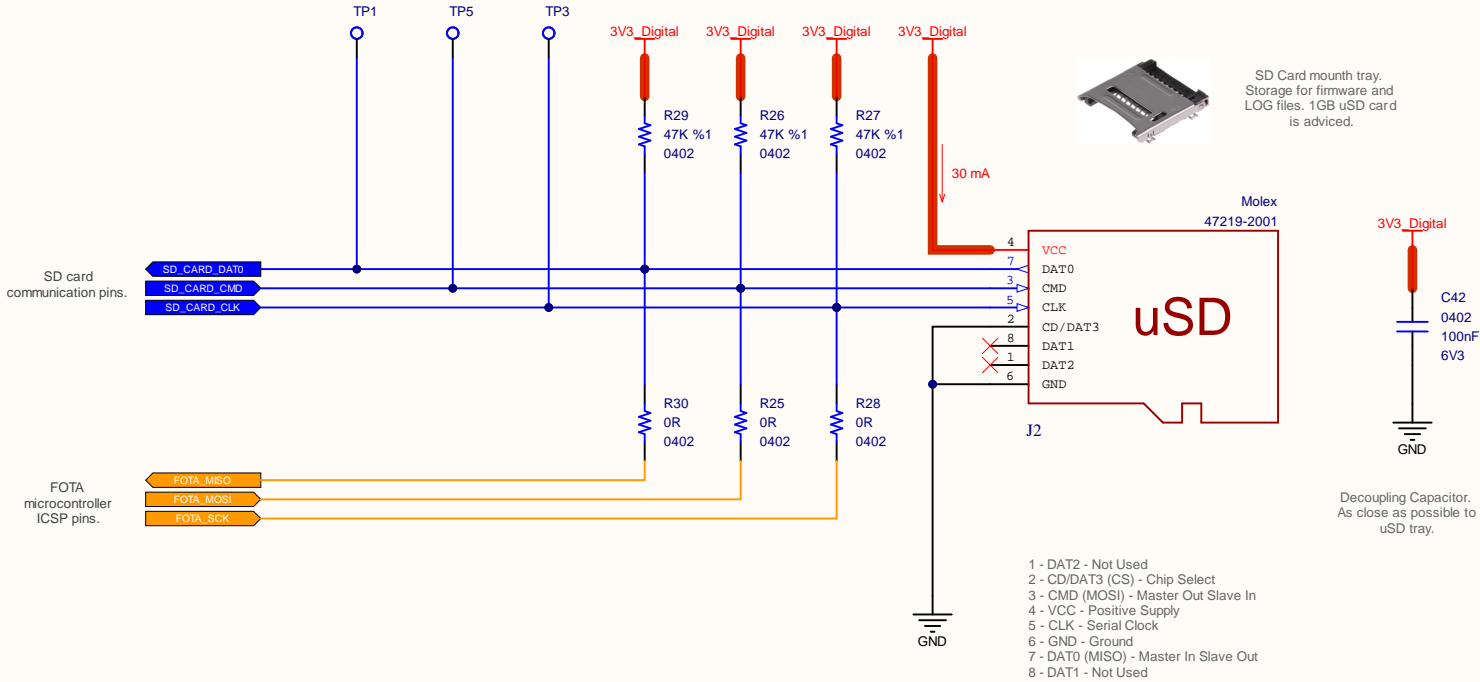
Title FOTA MicroController Power Switch			Ovoo Electronics	
Size: A4	Number: AA005	Revision: B106AA	<div>Küçük İhsaniye Mah. Mıracık Sok. No:15 Meram / Konya Türkiye</div> <div></div>	
Date: 11.07.2020	Time: 23:32:06	Sheet 18 of 37		
File: C:\Altium Projects\IP101CA\Modules\Electronic\B106AA\Design Files\Altium\Schematic\FOTA MicroController Power Switch.SchDoc				






D4

Title SD/ICSP Selection Multiplexer			Ovoo Electronics		
Size: A4	Number: AA005	Revision: B106AA	<div>Küçük İhsaniye Mah. Mıracık Sok. No:15 Meram / Konya Türkiye</div>		
Date: 11.07.2020	Time: 23:32:06	Sheet 19 of 37			
File: C:\Altium Projects\IP101CA\Modules\Electronic\B106AA\Design Files\Altium\Schematic\SD Card Selection Multiplexer.SchDoc					



D5

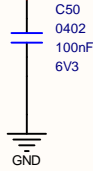
Title Micro SD Card Module			Ovoo Electronics		
Size: A4	Number: AA005	Revision: B106AA	Küçük İhsaniye Mah. Mıracık Sok. No:15 Meram / Konya Türkiye		
Date: 11.07.2020	Time: 23:32:06	Sheet 20 of 37			
File: C:\Altium Projects\IP101CAModules\Electronic\B106AA\Design Files\Altium\Schematic\SD Card Module.SchDoc					

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.

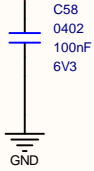
By-Pass Capacitor
Close to Atmega328P
Pin-4 (Vcc)

3V3_FOTA



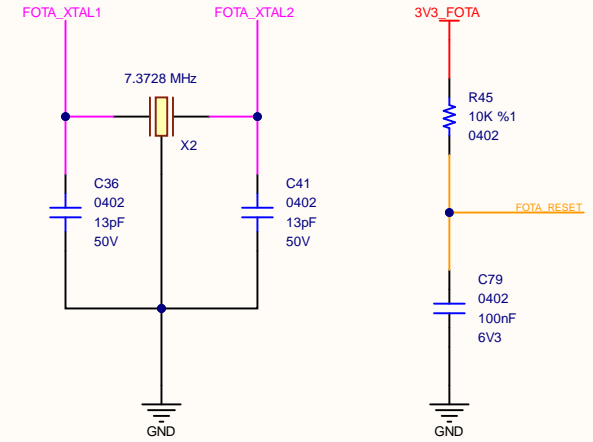
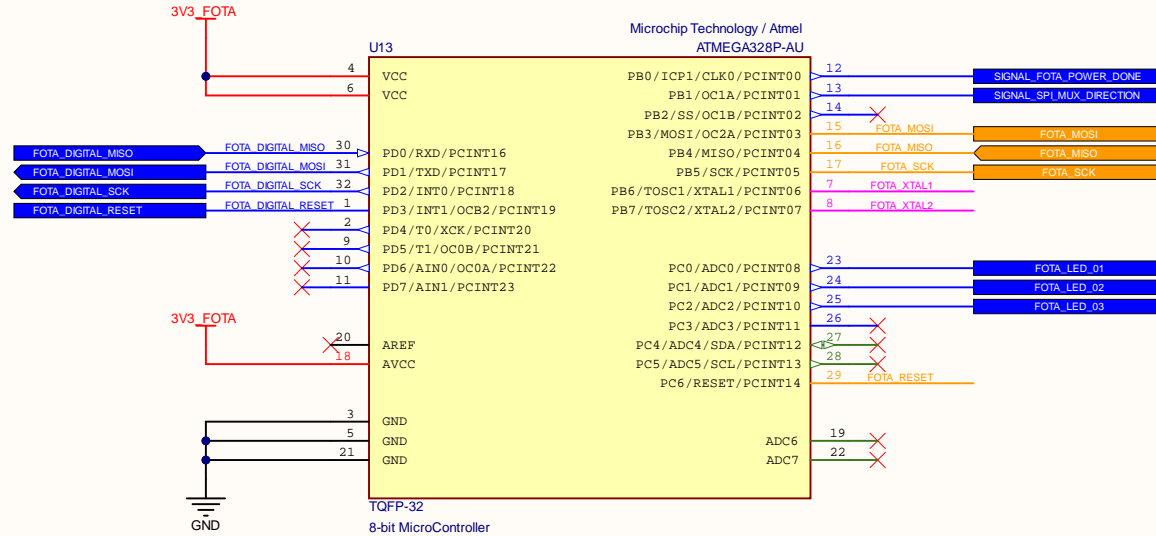
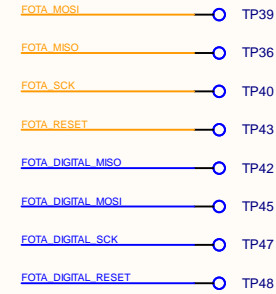
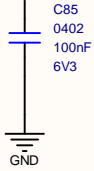
By-Pass Capacitor
Close to Atmega328P
Pin-6 (Vcc)

3V3_FOTA



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


3V3_FOTA

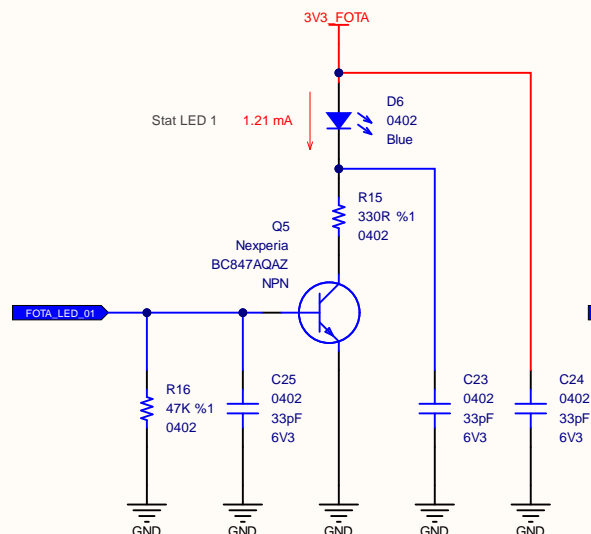


FOTA MCU is working at
7.3728 Mhz.

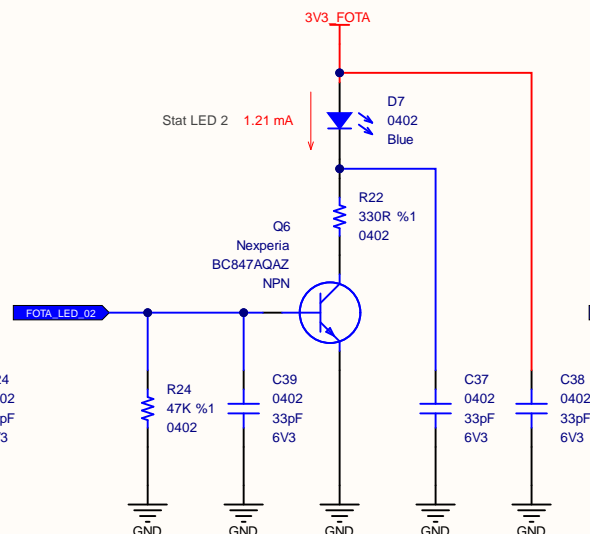
FOTA MCU Reset Line.
Pull-up.

D6

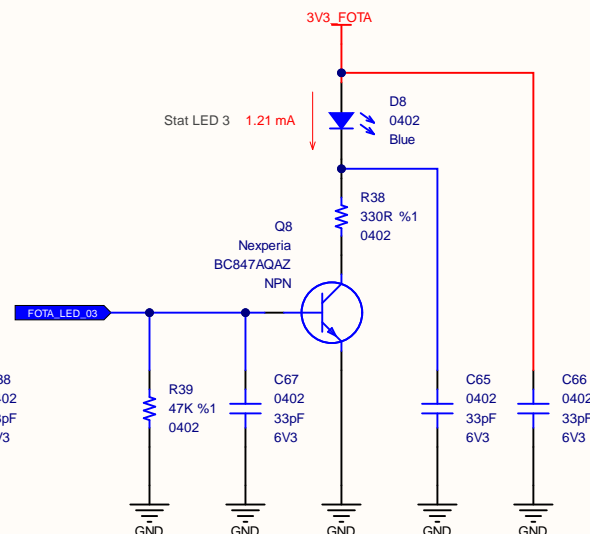
Title FOTA MicroController			Ovoo Electronics		
Size: A4	Number: AA005	Revision: B106AA	Küçük İhsaniye Mah. Mıracık Sok. No:15 Meram / Konya Türkiye		
Date: 11.07.2020	Time: 23:32:06	Sheet 21 of 37			
File: C:\Altium Projects\IP101CA\Modules\Electronic\B106AA\Design Files\Altium\Schematic\FOTA MicroController.SchDoc					



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




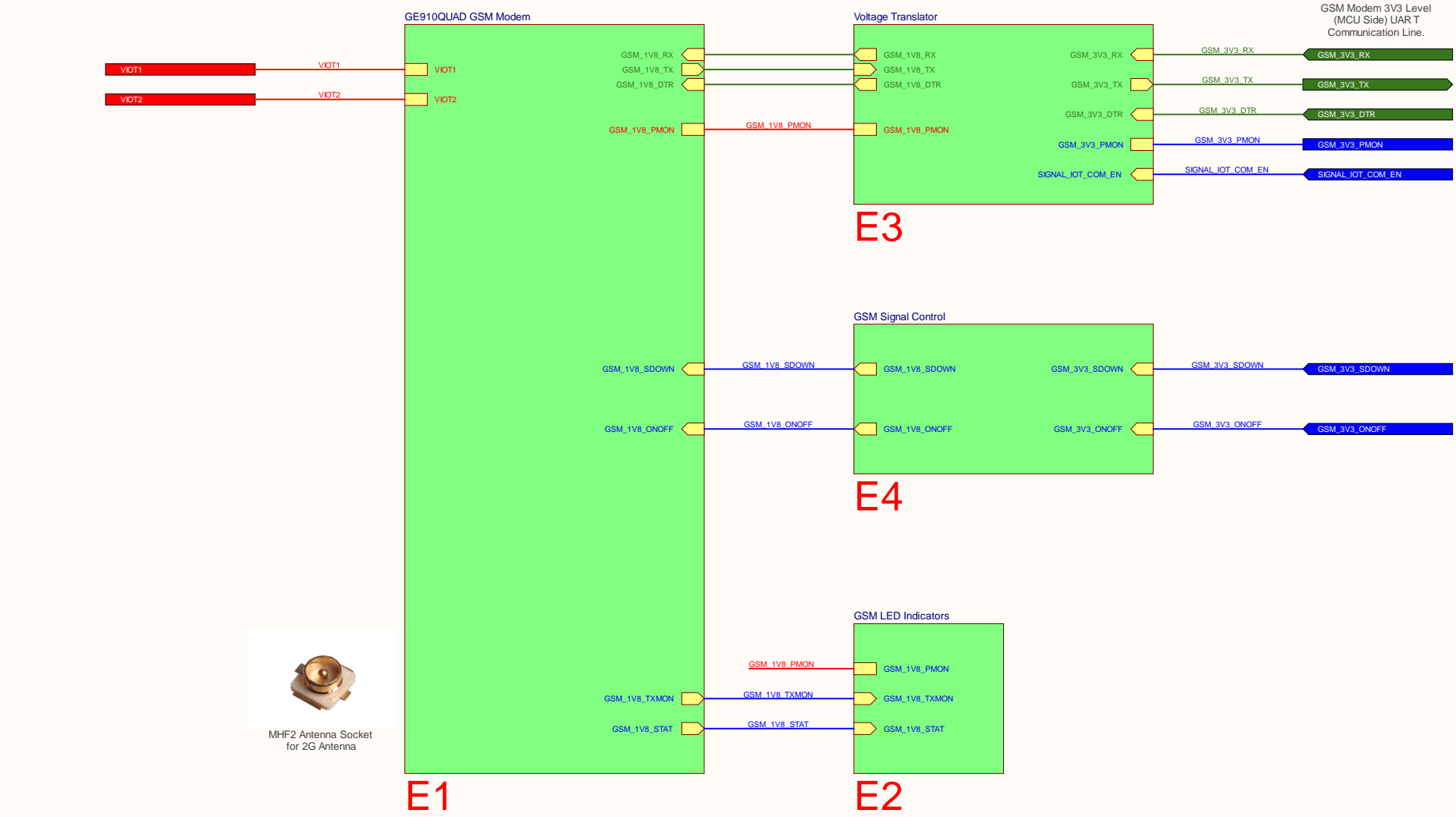
Noise filter capacitors. Place as close as possible to LED.

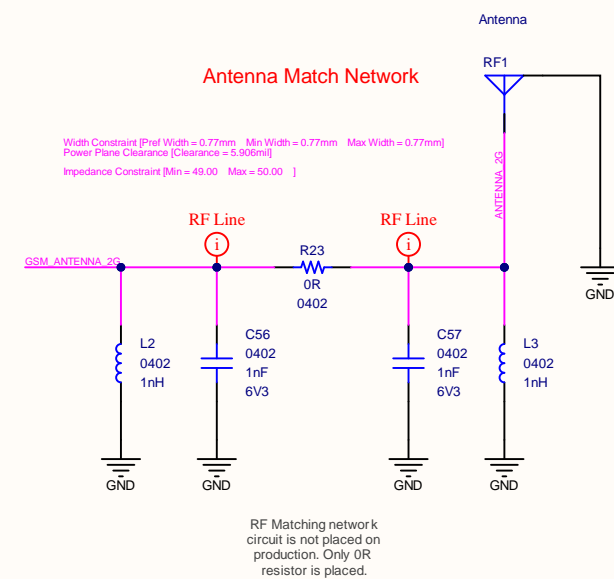
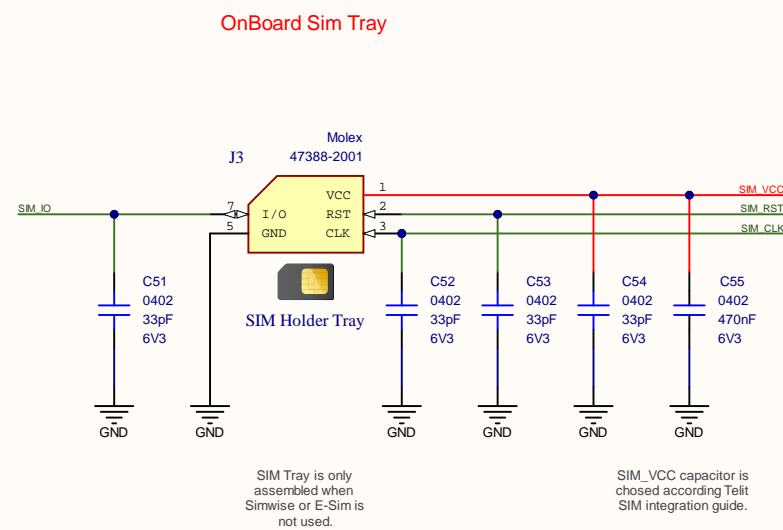
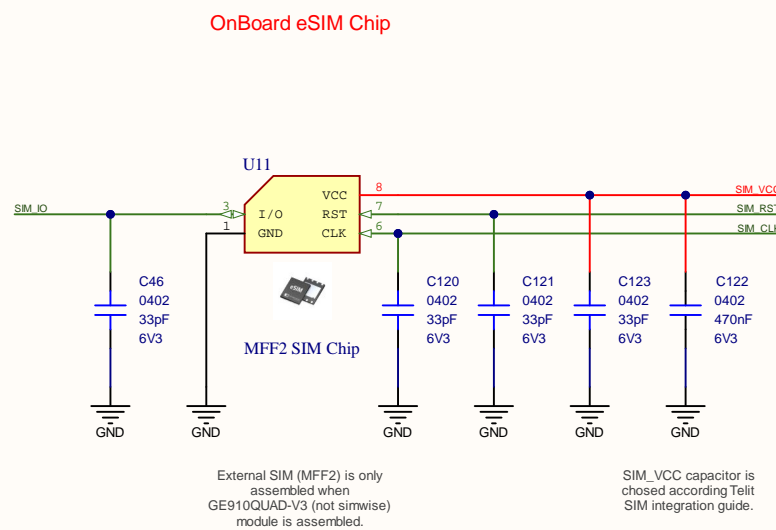
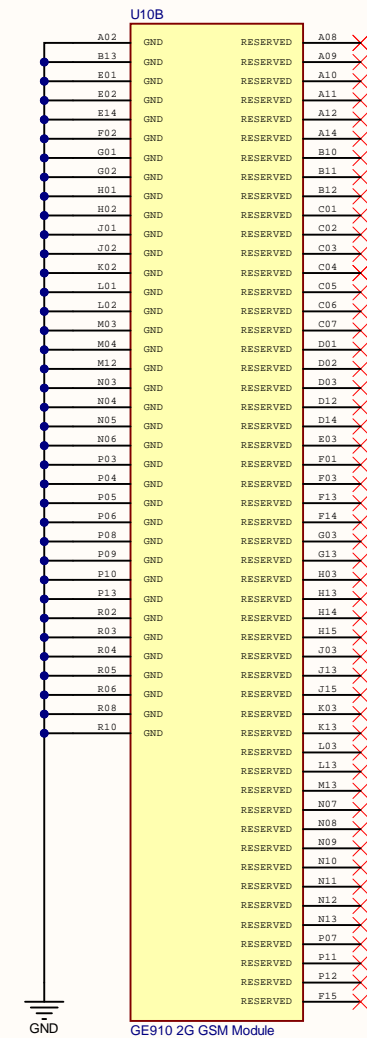
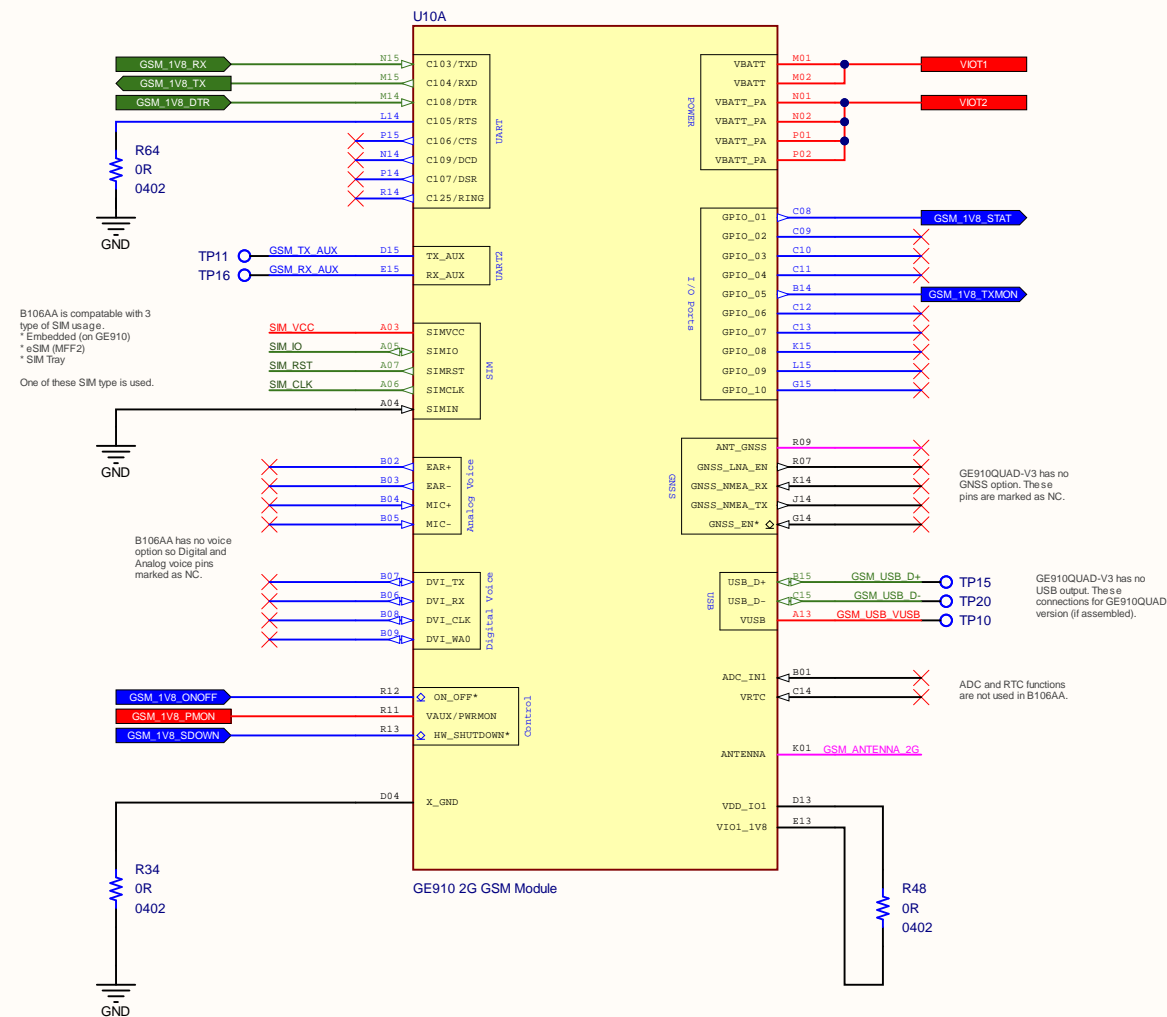


Noise filter capacitors. Place as close as possible to LED.

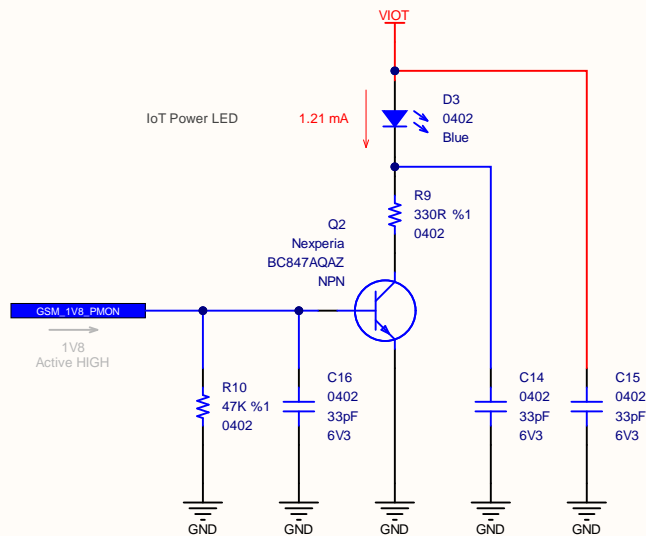
D7

Title FOTA Microcontroller Status LED's			Ovoo Electronics	
Size: A4	Number: AA005	Revision: B106AA	Küçük İhsaniye Mah. Mıracık Sok. No:15 Meram / Konya Türkiye	
Date: 11.07.2020	Time: 23:32:06	Sheet 22 of 37		
File: C:\Altium Projects\IP101CAModules\Electronic\B106AA\Design Files\Altium\Schematic\FOTA MicroController Status LEDs.SchDoc				





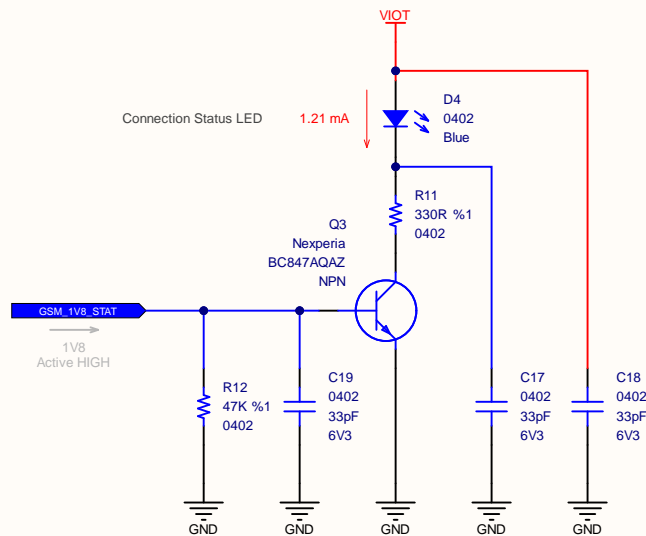
GSM Power Monitor LED



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

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

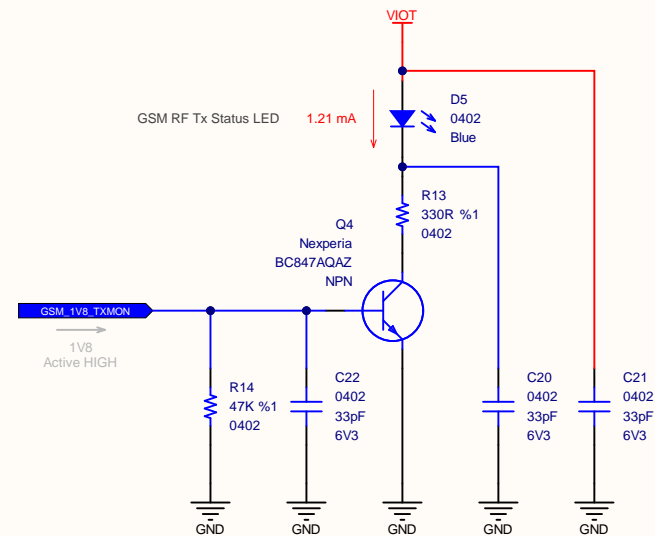
GSM Connection Status LED



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

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

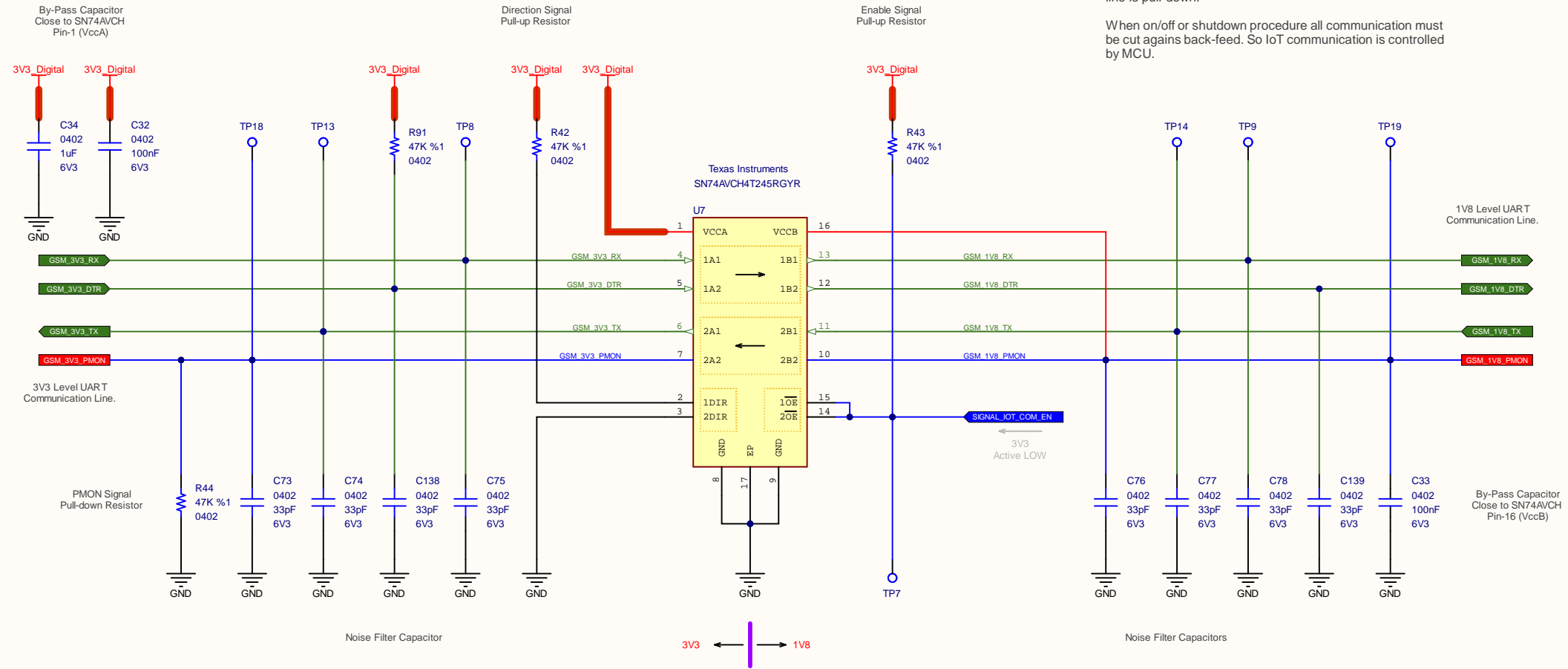
Title GSM Modem Signal Indicator LED's			Ovoo Electronics Küçük İhsaniye Mah. Mıracık Sok. No:15 Meram / Konya Türkiye	
Size: A4	Number: AA005	Revision: B106AA		
Date: 11.07.2020	Time: 23:32:06	Sheet 25 of 37		
File: C:\Altium Projects\IP101CA\Modules\Electronic\B106AA\Design Files\Altium\Schematic\GSM 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.

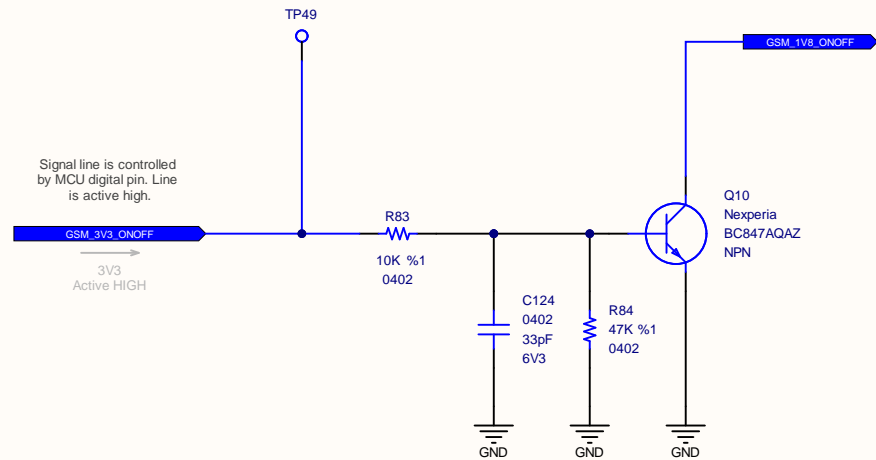
Power Monitor pin is a input pin at MCU side (active HIGH) so line is pull-down.

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

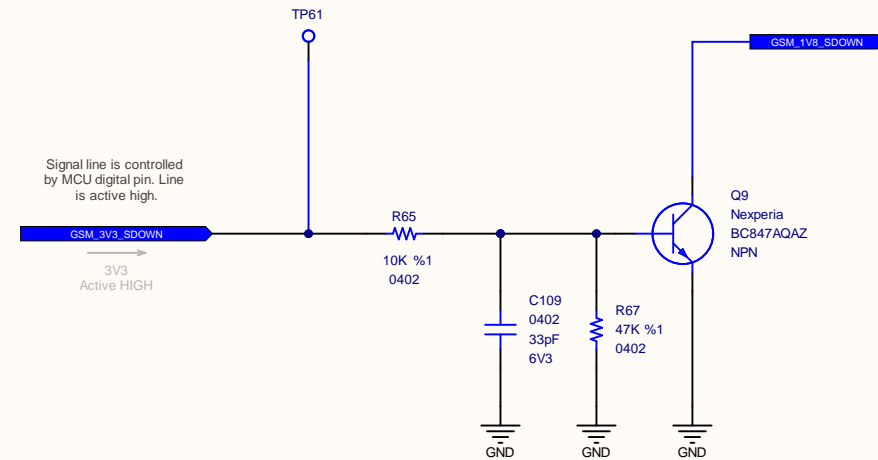


E3

GSM Module On/Off Signal




GSM Module Shut Down Signal

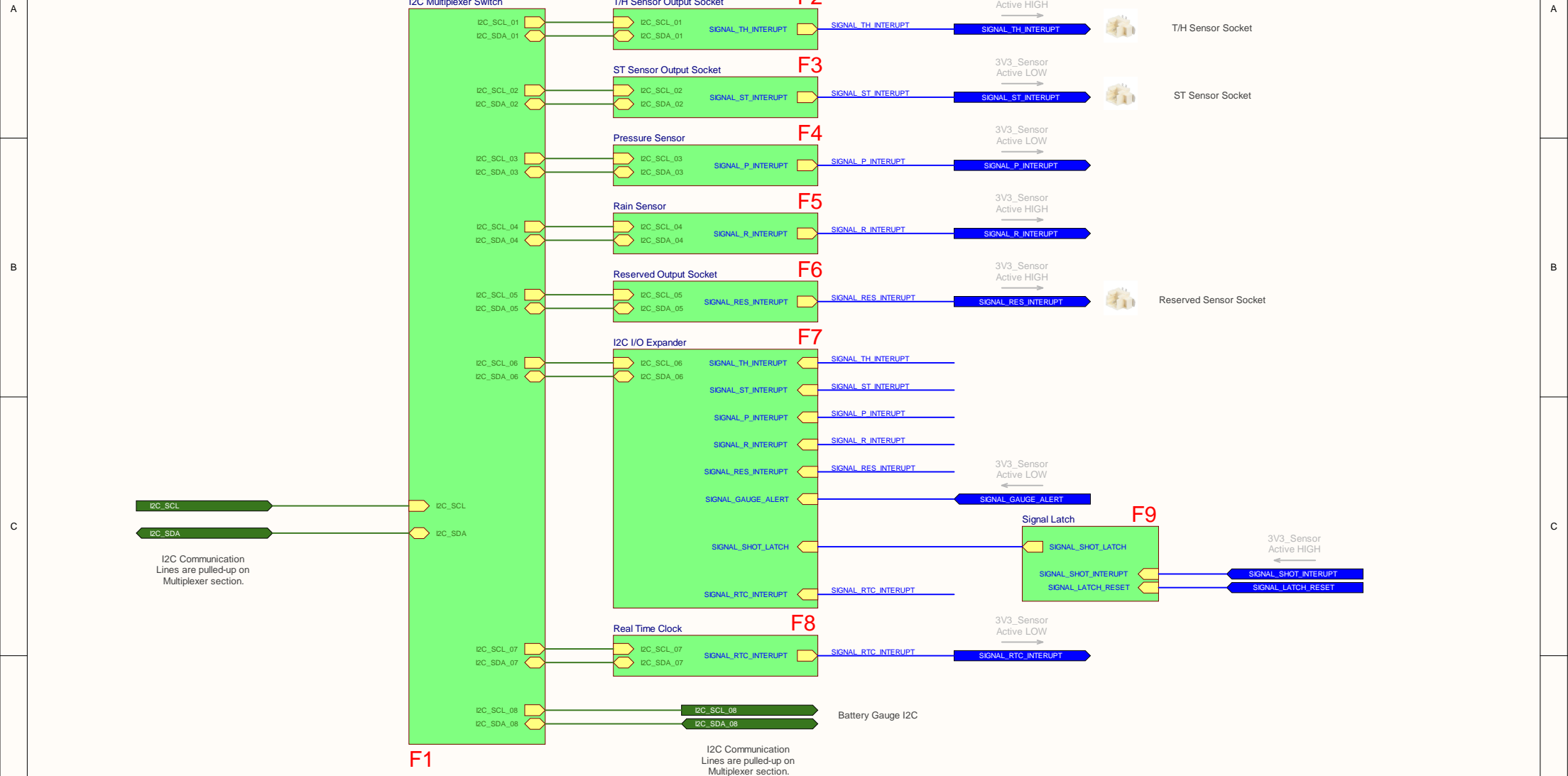



GE910 GSM Modem have an On/Off pin for power on. To turn on the GE910 the pad ON-OFF* must be tied low for at least 5 seconds and then released. The maximum current that can be drained from the ON-OFF* pad is 0.2mA. This pin is a open collector pin so tie this pin to GND via a transistor.

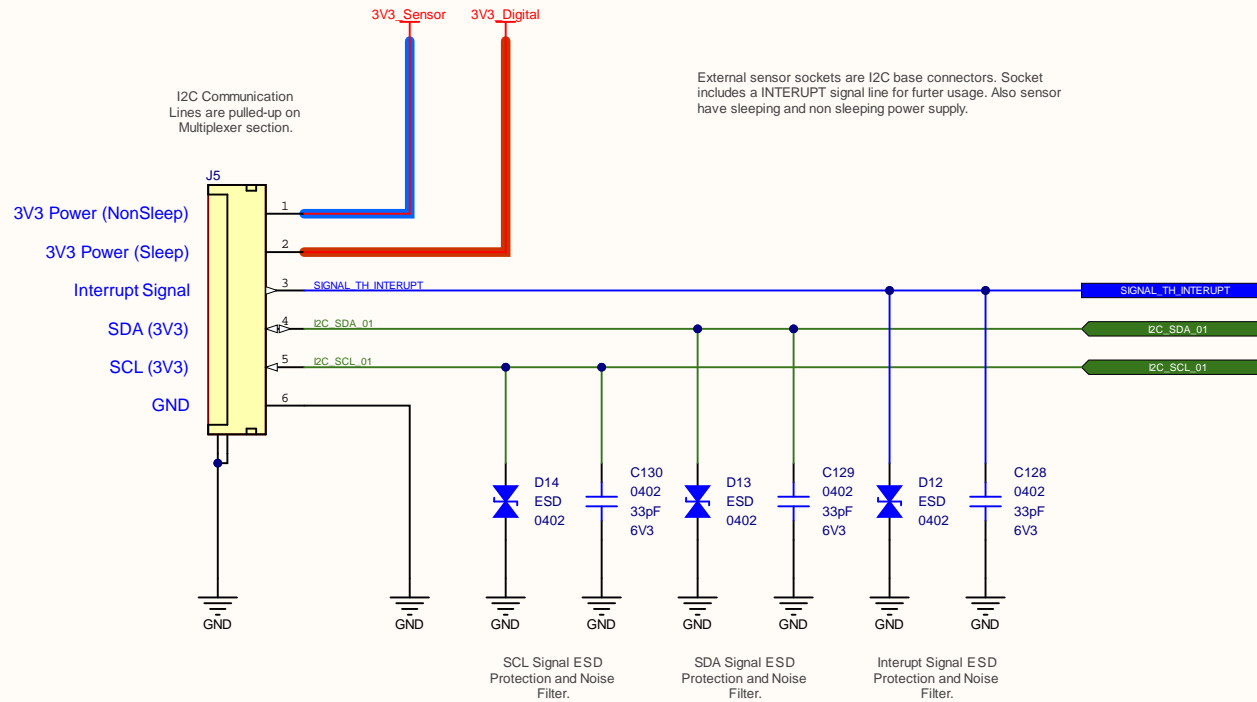
GE910QUAD GSM modem has a "Shut Down" pin for unconditional shut down. The unconditional hardware shutdown must always be implemented on the boards and the software must use it as an emergency exit procedure. To turn off modem tie this pin to GND for 200mS. This pin is a open collector pin so tie this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

E4


Title GSM Control Signal Management			Ovoo Electronics Küçük İhsaniye Mah. Mıracık Sok. No:15 Meram / Konya Türkiye	
Size: A4	Number: AA005	Revision: B106AA		
Date: 11.07.2020	Time: 23:32:06	Sheet 27 of 37		
File: C:\Altium Projects\IP101CA\Modules\Electronic\B106AA\Design Files\Altium\Schematic\GSM_Signal_Control.SchDoc				



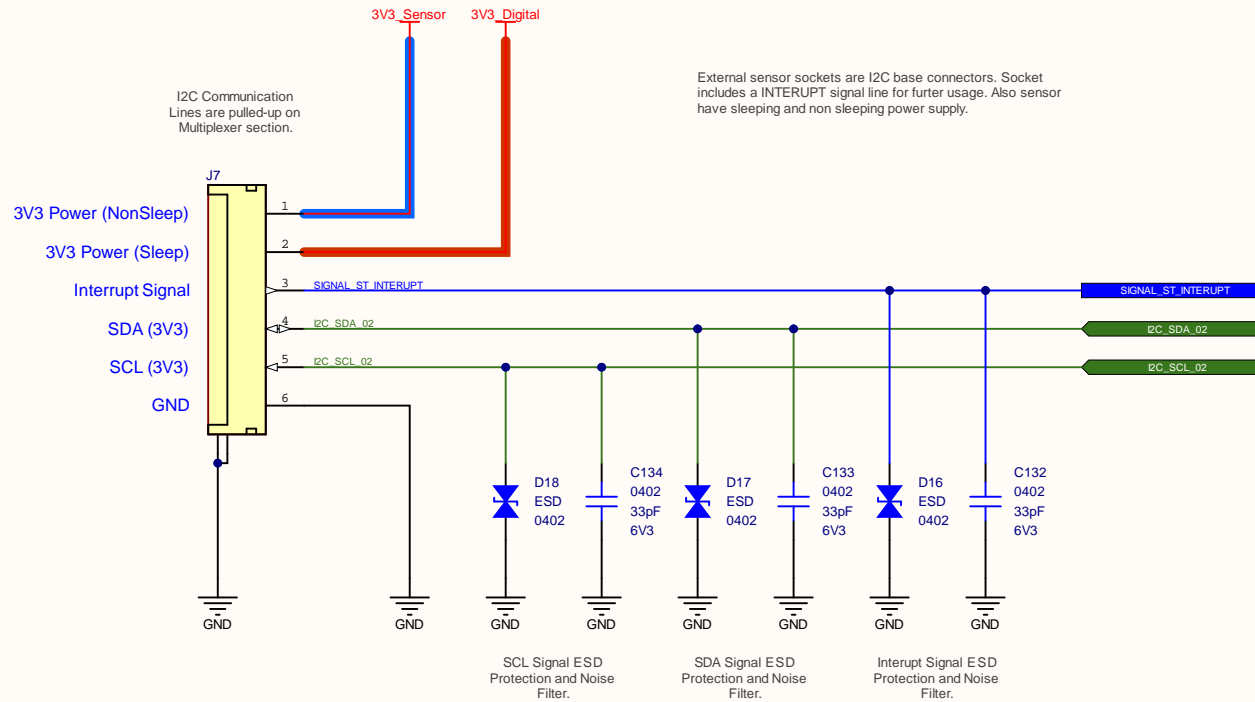
Title I2C Sensor Network			Ovoo Electronics		
Size: A4	Number: AA005	Revision: B106AA	Küçük İhsaniye Mah. Mıracık Sok. No:15 Meram / Konya Türkiye		
Date: 11.07.2020	Time: 23:32:06	Sheet 28 of 37			
File: C:\Altium Projects\IP101CA\Modules\Electronic\B106AA\Design Files\Altium\Schematic\I2C Sensor Network.SchDoc					




F2

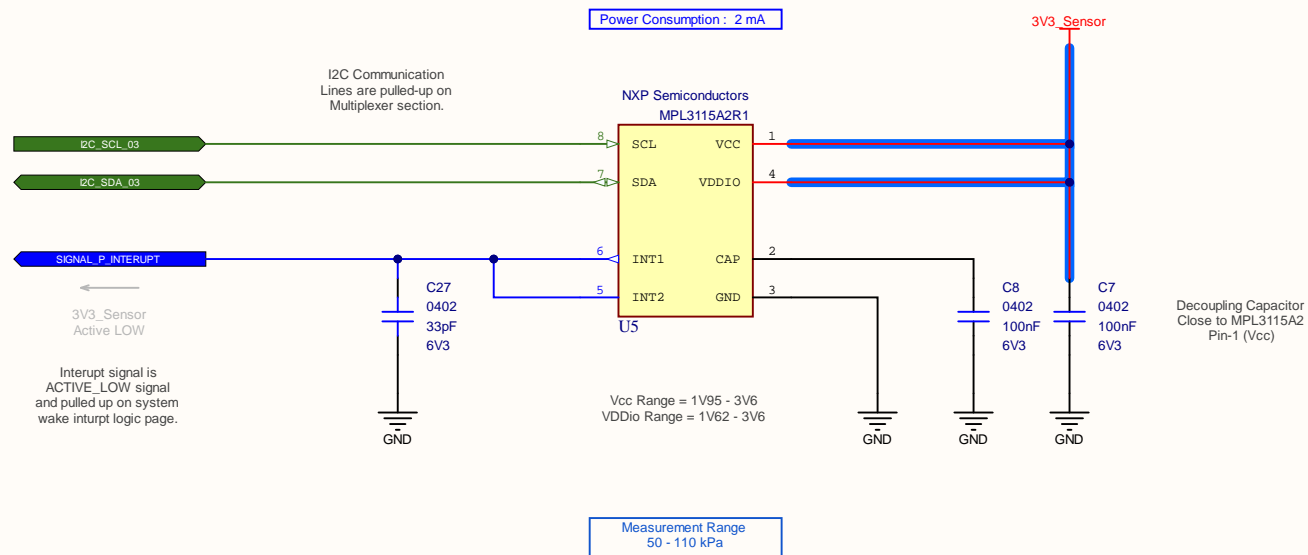
Title Air Temperature & Air Humidity Sensor Output Socket			Ovoo Electronics		
Size: A4	Number: AA005	Revision: B106AA	Küçük İhsaniye Mah. Mıracık Sok. No:15 Meram / Konya Türkiye		
Date: 11.07.2020	Time: 23:32:07	Sheet 30 of 37			
File: C:\Altium Projects\IP101CA\Modules\Electronic\B106AA\Design Files\Altium\Schematic\TH Sensor Output Socket.SchDoc					

Ovoo




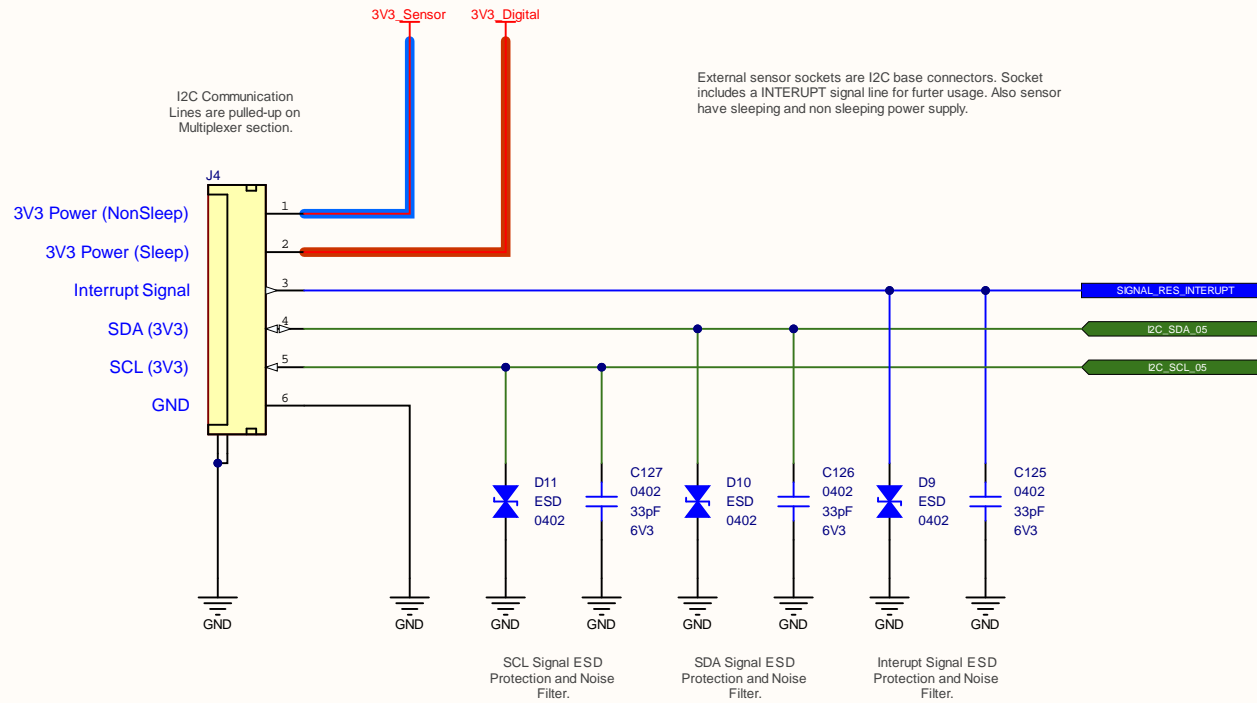
F3

Title Soil Temperature Sensor Output Socket			Ovoo Electronics		
Size: A4	Number: AA005	Revision: B106AA	Küçük İhsaniye Mah. Mıracık Sok. No:15 Meram / Konya Türkiye		
Date: 11.07.2020	Time: 23:32:07	Sheet 31 of 37			
File: C:\Altium Projects\IP101CA\Modules\Electronic\B106AA\Design Files\Altium\Schematic\ST Sensor Output Socket.SchDoc					




F4

Title Pressure Sensor			Ovoo Electronics Küçük İhsaniye Mah. Mıracı Sok. No:15 Meram / Konya Türkiye		
Size: A4	Number: AA005	Revision: B106AA			
Date: 11.07.2020	Time: 23:32:07	Sheet 32 of 37	File: C:\Altium Projects\IP101CA\Modules\Electronic\B106AA\Design Files\Altium\Schematic\Pressure Sensor.SchDoc		



F6

Title Reserved Sensor Output Socket			Ovoo Electronics		
Size: A4	Number: AA005	Revision: B106AA	Küçük İhsaniye Mah. Mıracık Sok. No:15 Meram / Konya Türkiye		
Date: 11.07.2020	Time: 23:32:07	Sheet 34 of 37			
File: C:\Altium Projects\IP101CA\Modules\Electronic\B106AA\Design Files\Altium\Schematic\Reserved Sensor Output Socket.SchDoc					

Ovoo

A

B

C

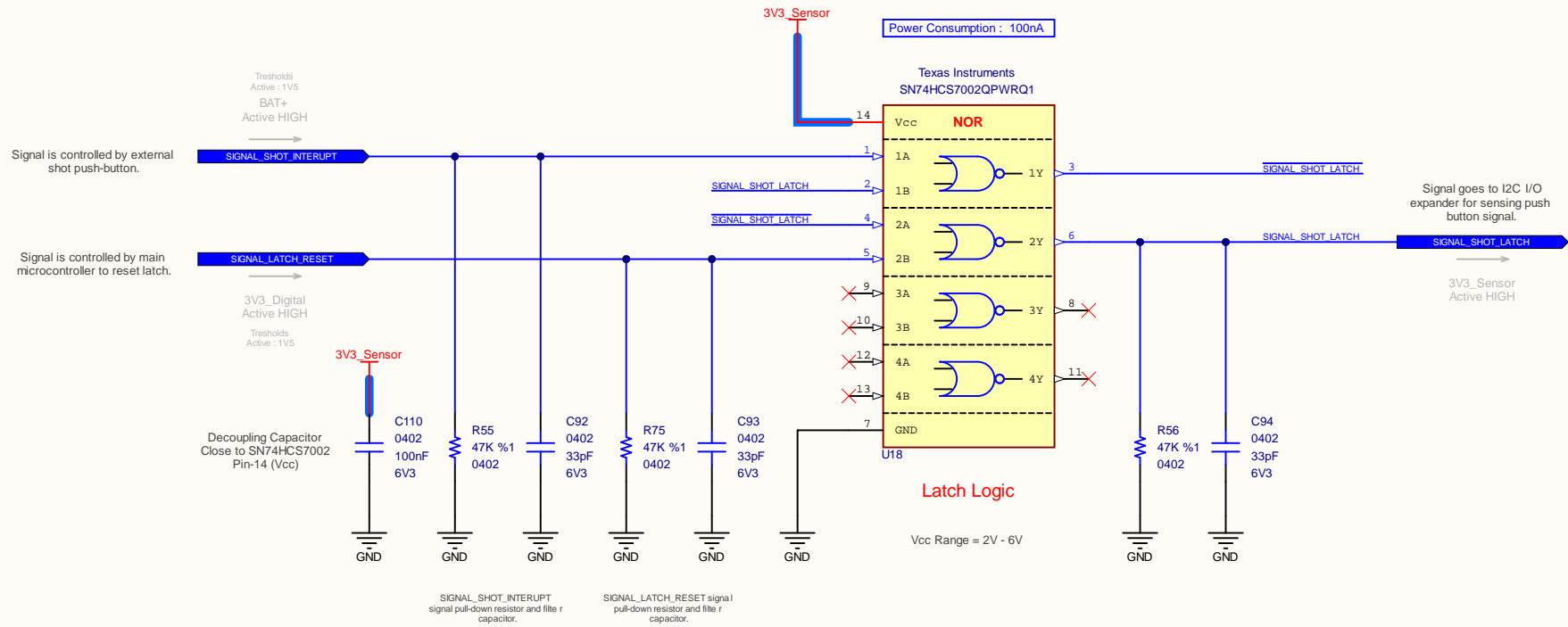
D

A

B

C

D




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

We want to learn which 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 reset signal is received. So all input and output pins are pull-down.

Title Signal Latch Logic			Ovoo Electronics Küçük İhsaniye Mah. Mıracık Sok. No:15 Meram / Konya Türkiye	
Size: A4	Number: AA005	Revision: B106AA		
Date: 11.07.2020	Time: 23:32:07	Sheet 37 of 37		
File: C:\Altium Projects\IP101CA\Modules\Electronic\B106AA\Design Files\Altium\Schematic\Signal Latch Logic.SchDoc				