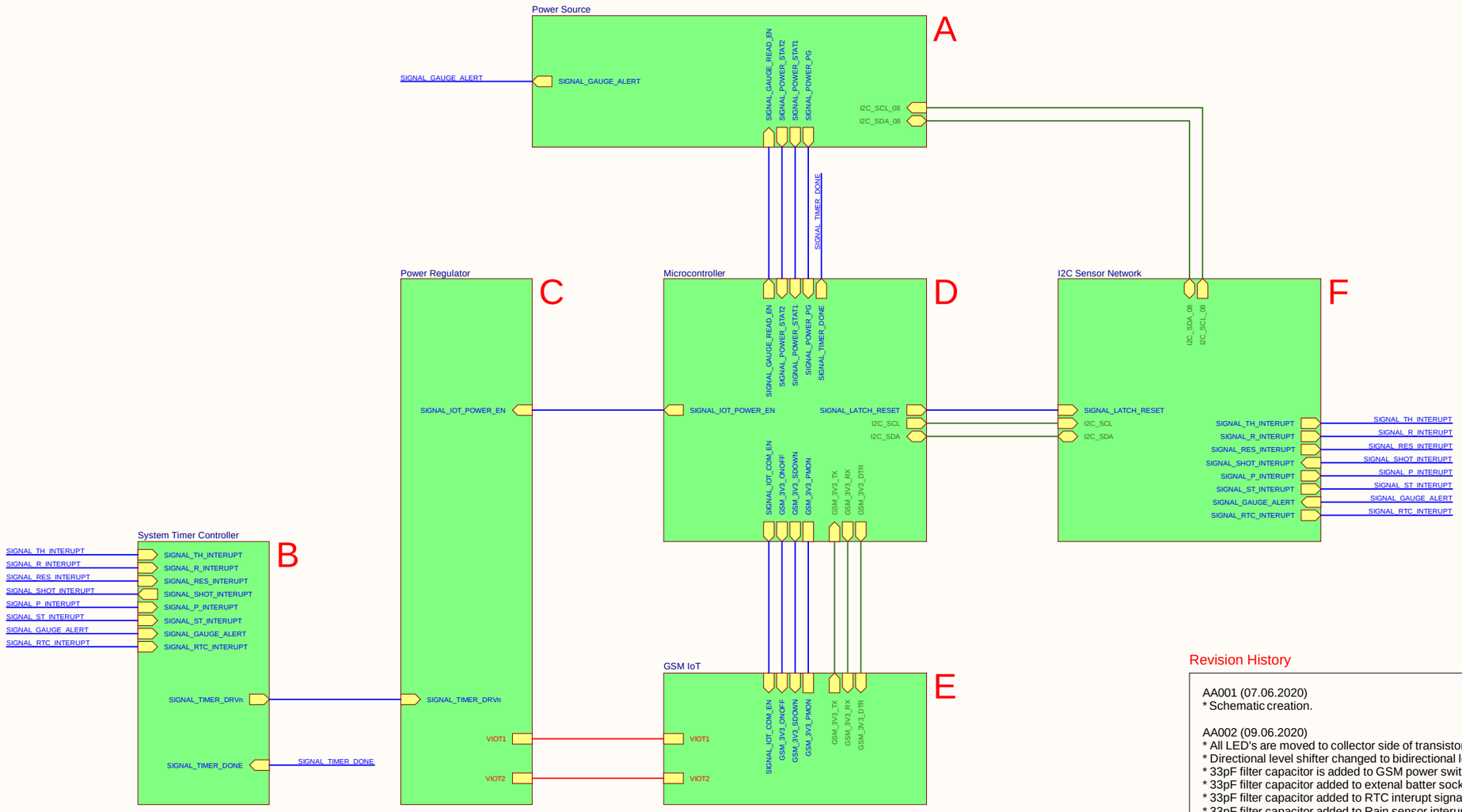
B106 - Weather Station IoT Module



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 extenal batter socket in (BAT+).
* 33pF filter capacitor added to RTC interupt signal.
* 33pF filter capacitor added to Rain sensor interupt signal.
* 33pF filter capacitor added to Pressure sensor interupt 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 complated.
* DTR Signal added.

Title	Weather Station Block Diagram		
Size: A3	**Number:** AA005	**Revision:** B106AA	
Date: 3.07.2020	**Time:** 14:59:36	**Sheet** 1 of 37	
File:	C:\Altium Projects\P101CA\Modules\Electronic\[B106AA]\Design Files\Altium\Schematic\B106AA Block Diagram.SchDoc		

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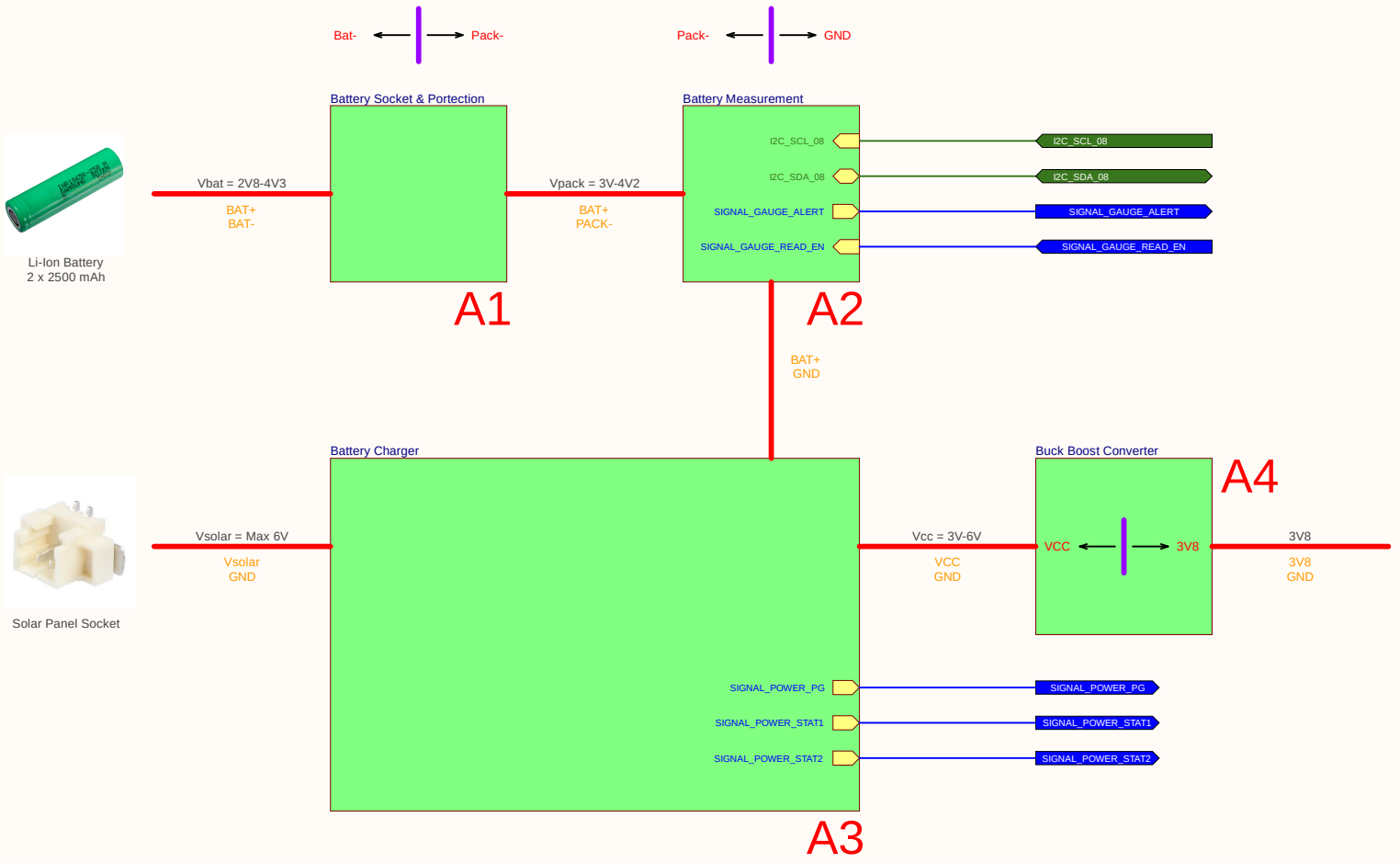

Title	**Power Source & Charger**		
Size: A4	**Number:** AA005	**Revision:** B106AA	
Date: 3.07.2020	**Time:** 14:59:36	**Sheet** 2 of 37	
File: C:\Altium Projects\P101CA\Modules\Electronic\[B106AA]\Design Files\Altium\Schematic\Power Source.SchDoc			

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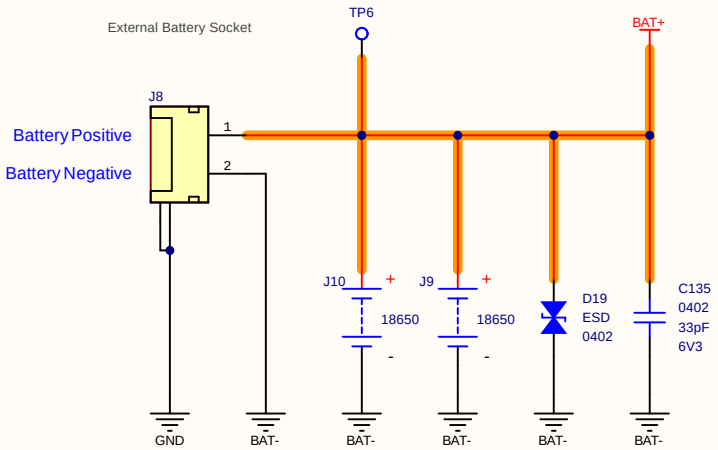
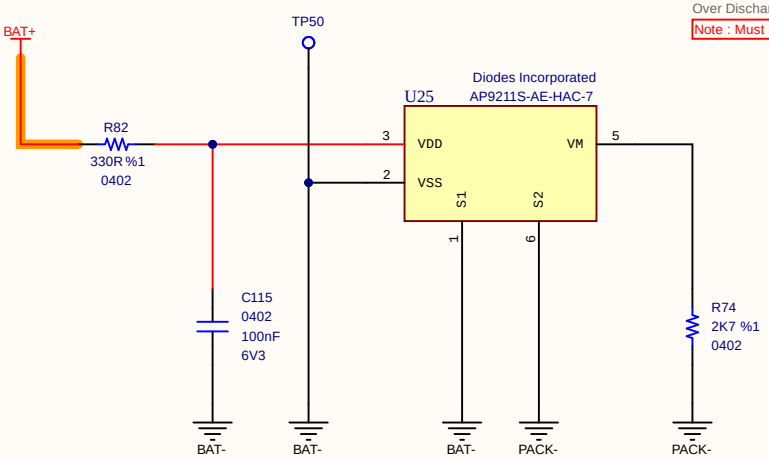


B106AA module have a battery holder for 18650 Lilon battery. System have 2 parallel connected battery system.

Advice : 2x2500mAh VTC6

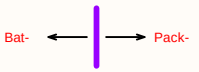


Quiescent Current : 3.0µA

P/N : AP9211XX-AE-HAC-7

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

Note : Must be plug charge on first run.



Vbat = 2V8-4V3

Battery ground isolation for protection.

Vpack = 3V-4V2

A1

Title	**System Battery Feed and Battery Socket**		
Size: A4	**Number:** AA005	**Revision:** B106AA	
Date: 3.07.2020	**Time:** 14:59:36	**Sheet** 3 of 37	
File:	C:\Altium Projects\P101CA\Modules\Electronic\[B106AA]\Design Files\Altium\Schematic\Battery Feed and Socket.SchDoc		

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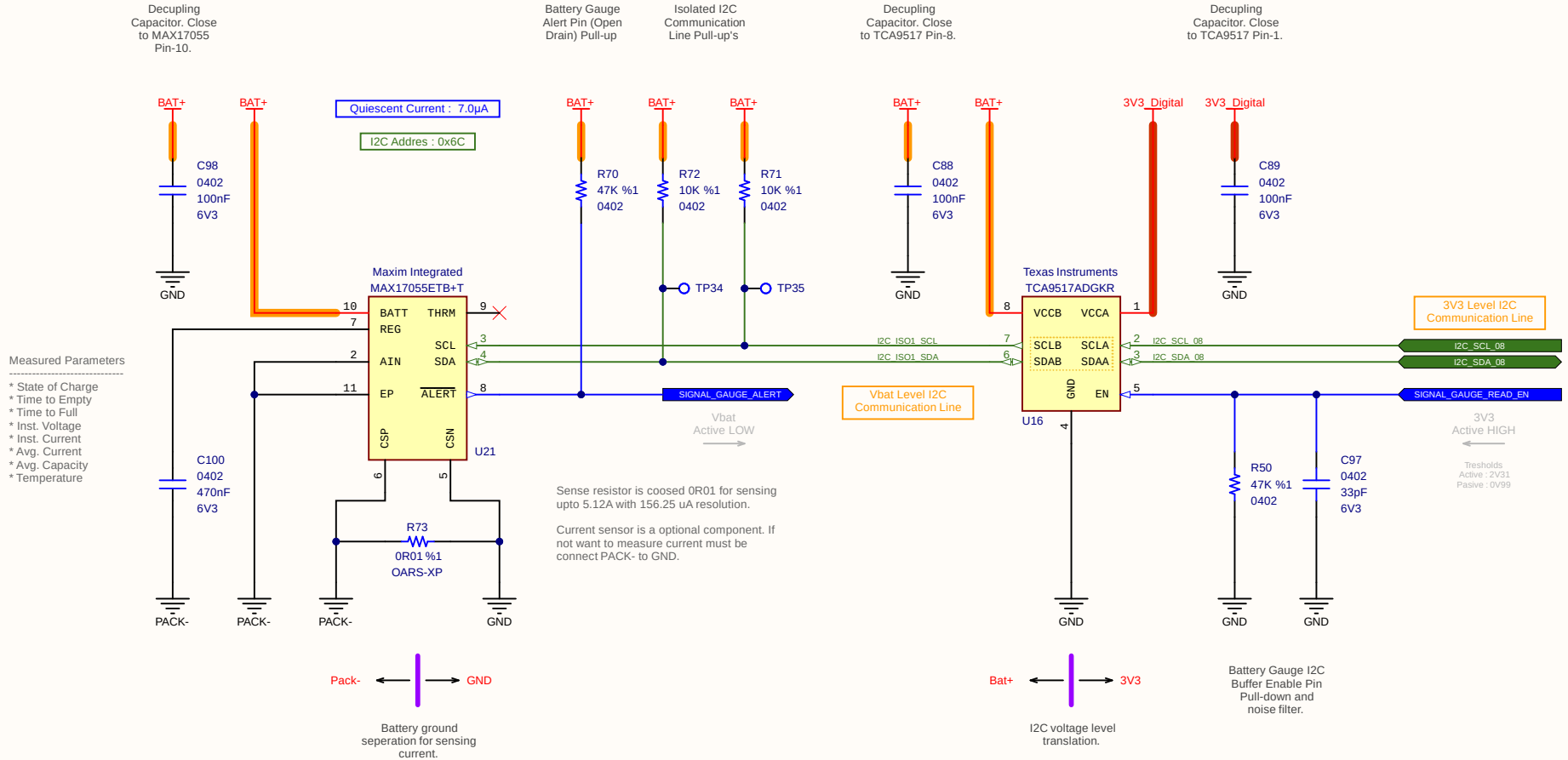
Battery Measurement

I2C Buffer



Title	Battery Measurement With I2C Isolation		
Size: A4	**Number:** AA005	**Revision:** B106AA	
Date: 3.07.2020	**Time:** 14:59:36	**Sheet** 4 of 37	
File: C:\Altium Projects\P101CA\Modules\Electronic\[B106AA]\Design Files\Altium\Schematic\Battery Measurement.SchDoc			

A2

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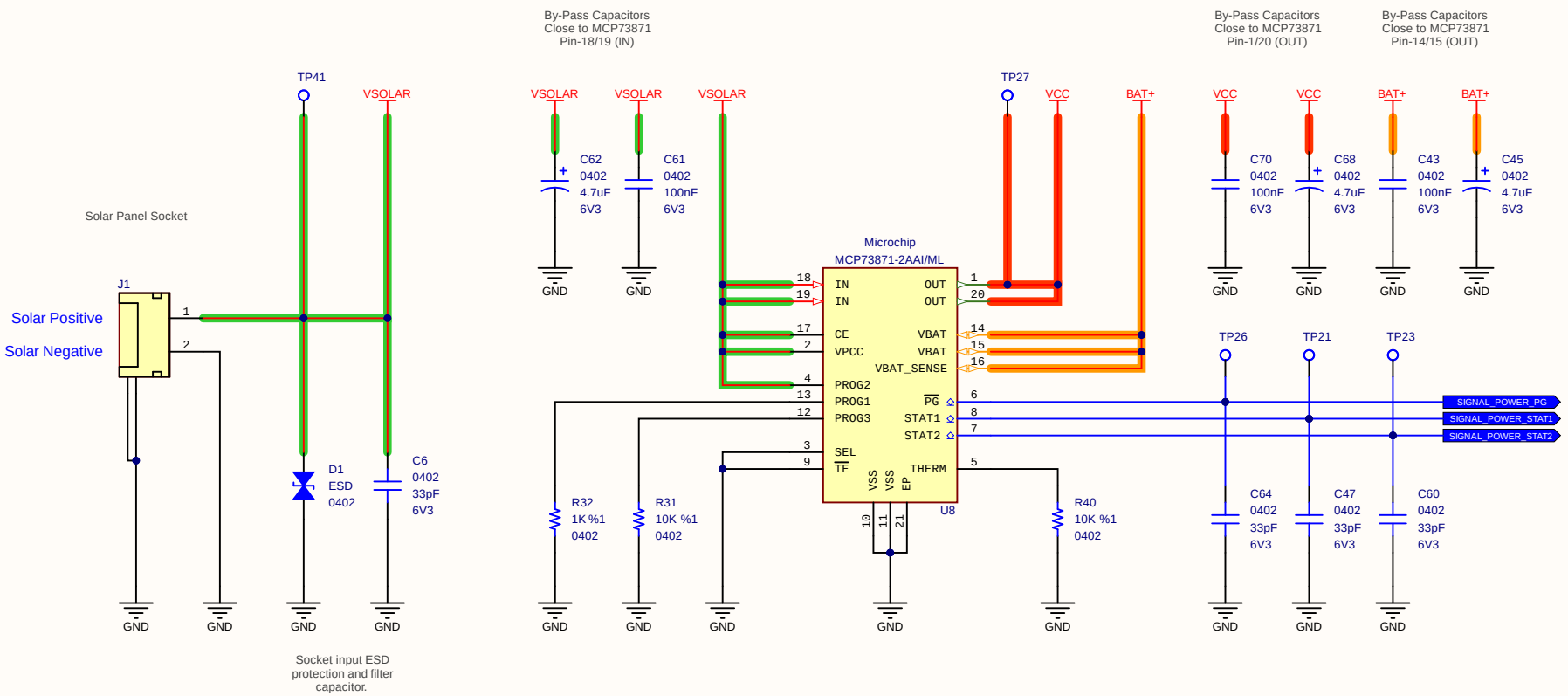

SEL Pin : Input type selection (Low for USB port, High for other type of power source)

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		
Size: A4	**Number:** AA005	**Revision:** B106AA	
Date: 3.07.2020	**Time:** 14:59:36	**Sheet** 5 of 37	
File: C:\Altium Projects\P101CA\Modules\Electronic\[B106AA]\Design Files\Altium\Schematic\Battery Charger.SchDoc			

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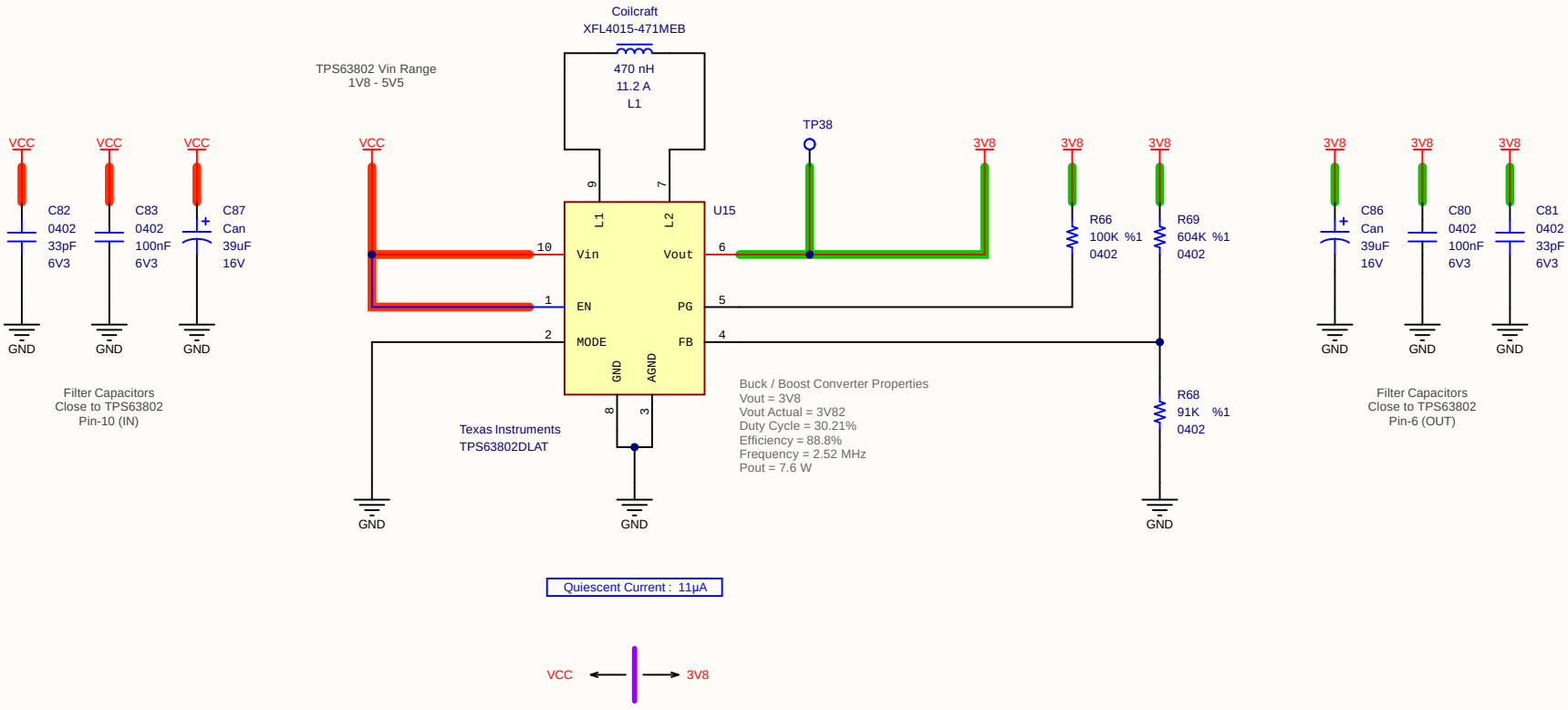

A4

Title	**Buck Boost Converter**		
Size: A4	**Number:** AA005	**Revision:** B106AA	
Date: 3.07.2020	**Time:** 14:59:36	**Sheet** 6 of 37	
File: C:\Altium Projects\P101CA\Modules\Electronic\[B106AA]\Design Files\Altium\Schematic\Buck Boost Converter.SchDoc			

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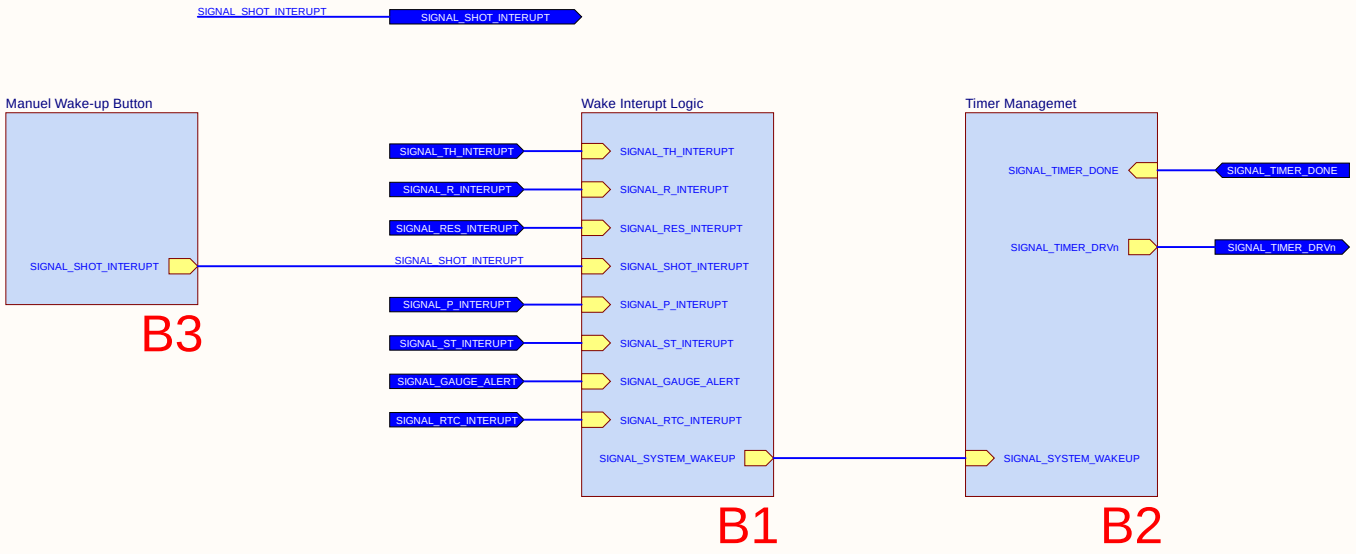

Title	**System Timer Controller**		
Size: A4	**Number:** AA005	**Revision:** B106AA	
Date: 3.07.2020	**Time:** 14:59:36	**Sheet** 7 of 37	
File: C:\Altium Projects\P101CA\Modules\Electronic\[B106AA]\Design Files\Altium\Schematic\System Timer.SchDoc			

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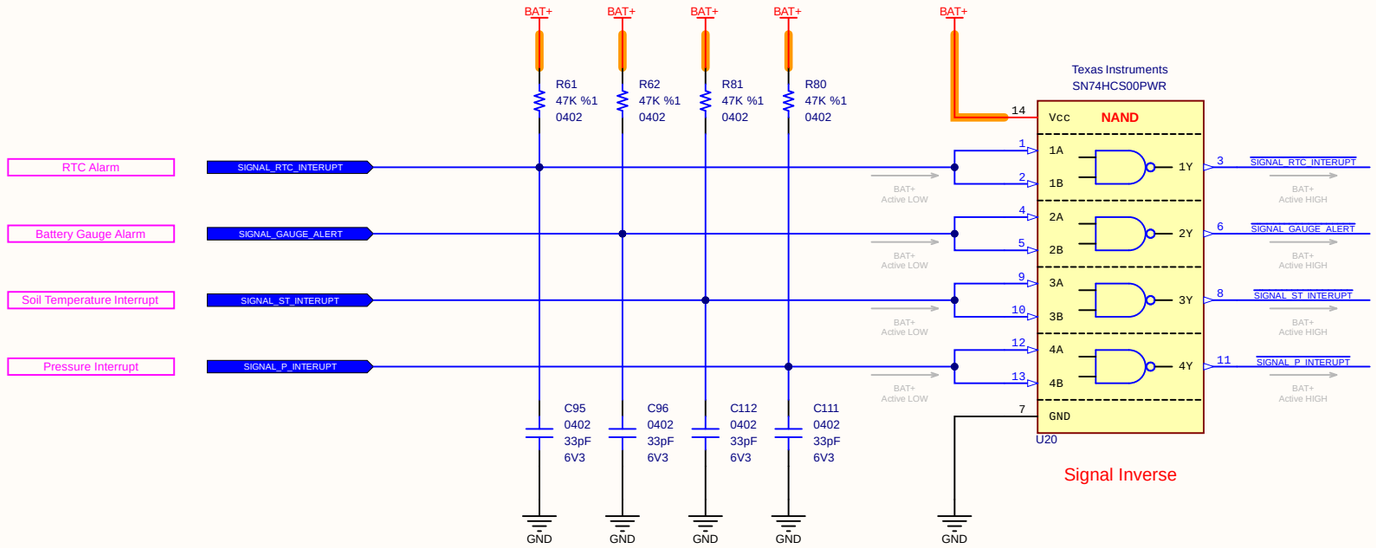

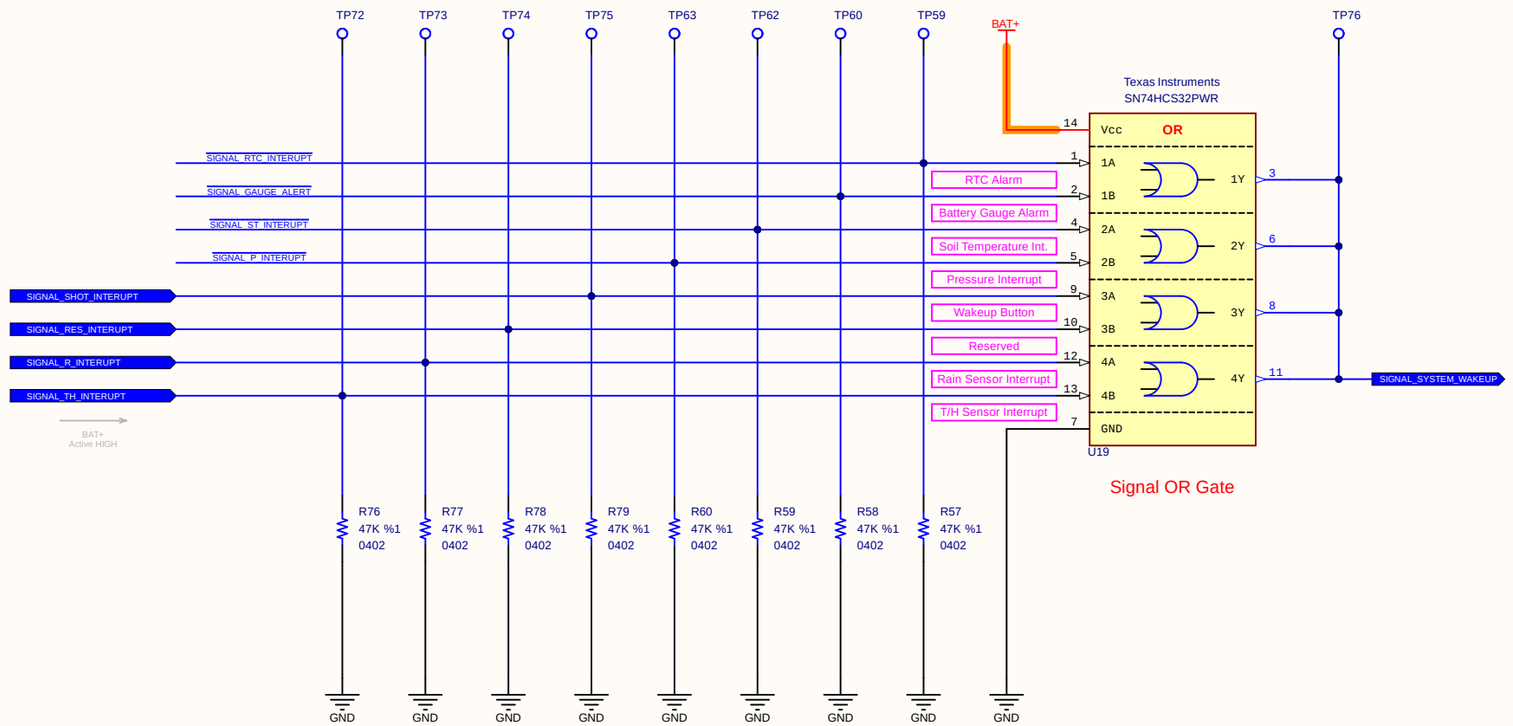

B1

Title	System Wake up Resources Logic Gates		
Size: A3	**Number:** AA005	**Revision:** B106AA	
Date: 3.07.2020	**Time:** 14:59:36	**Sheet** 8 of 37	
File:	C:\Altium Projects\P101CA\Modules\Electronic\[B106AA]\Design Files\Altium\Schematic\System Wake Interupt Logic.SchDoc		

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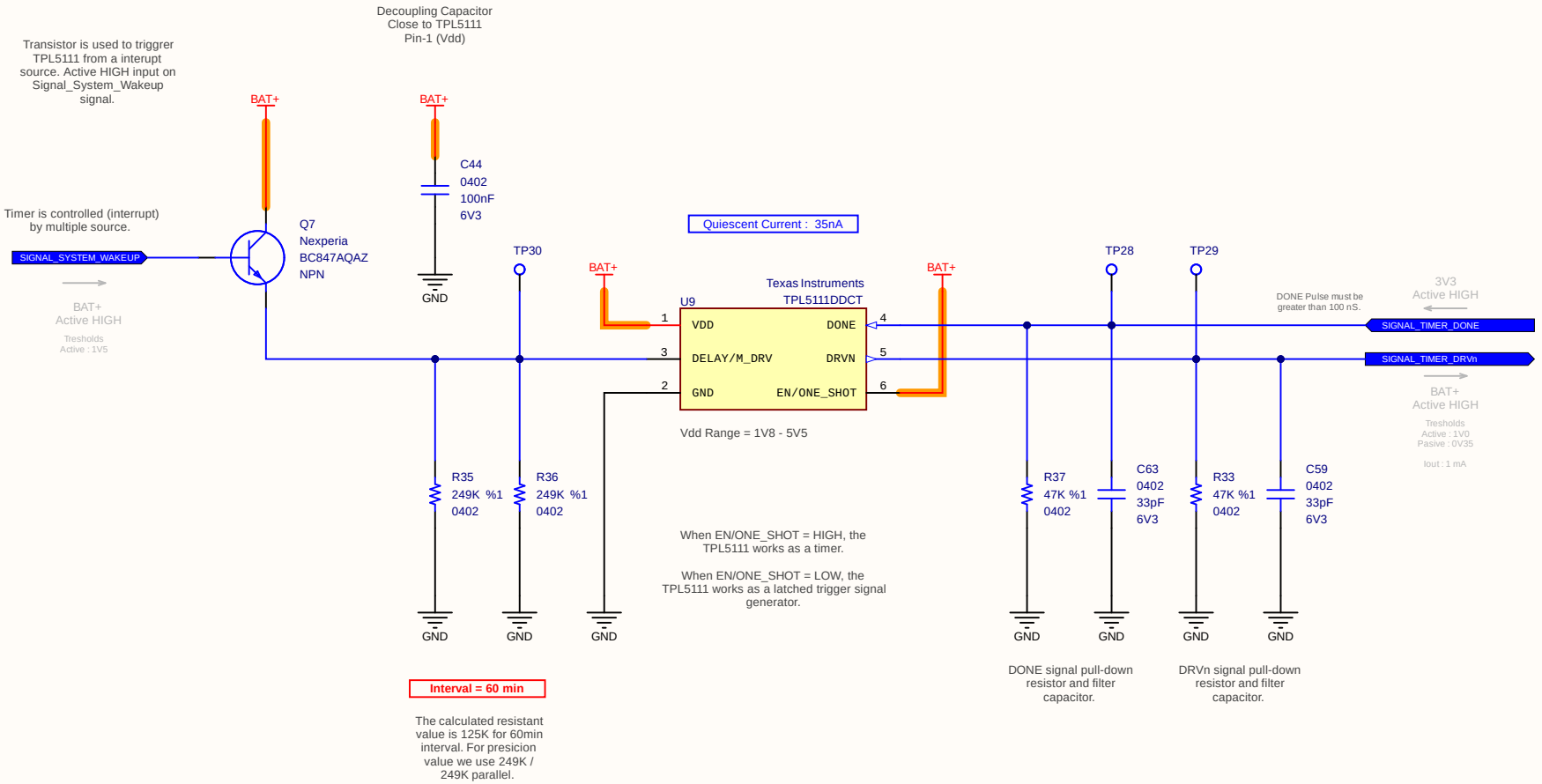

B2

Title	**Sleep Management (Timer)**		
Size: A4	**Number:** AA005	**Revision:** B106AA	
Date: 3.07.2020	**Time:** 14:59:36	**Sheet** 9 of 37	
File: C:\Altium Projects\P101CA\Modules\Electronic\[B106AA]\Design Files\Altium\Schematic\Time Management.SchDoc			

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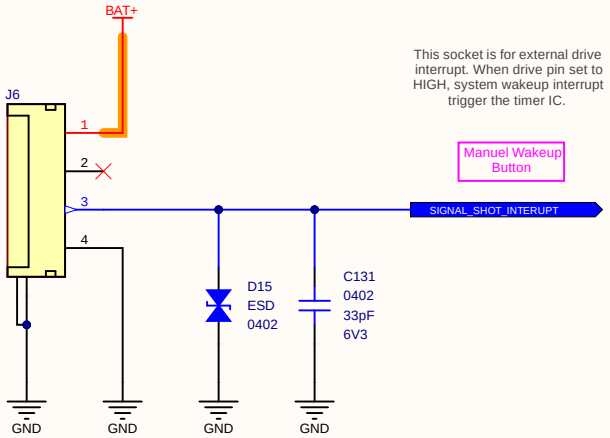
External Wakeup Socket



Socket input ESD protection.

B3

Title	**Manuel Wake-up Button**		
Size: A4	**Number:** AA005	**Revision:** B106AA	
Date: 3.07.2020	**Time:** 14:59:36	**Sheet** 10 of 37	
File: C:\Altium Projects\P101CA\Modules\Electronic\[B106AA]\Design Files\Altium\Schematic\Manuel Wake-up and Latch.SchDoc			

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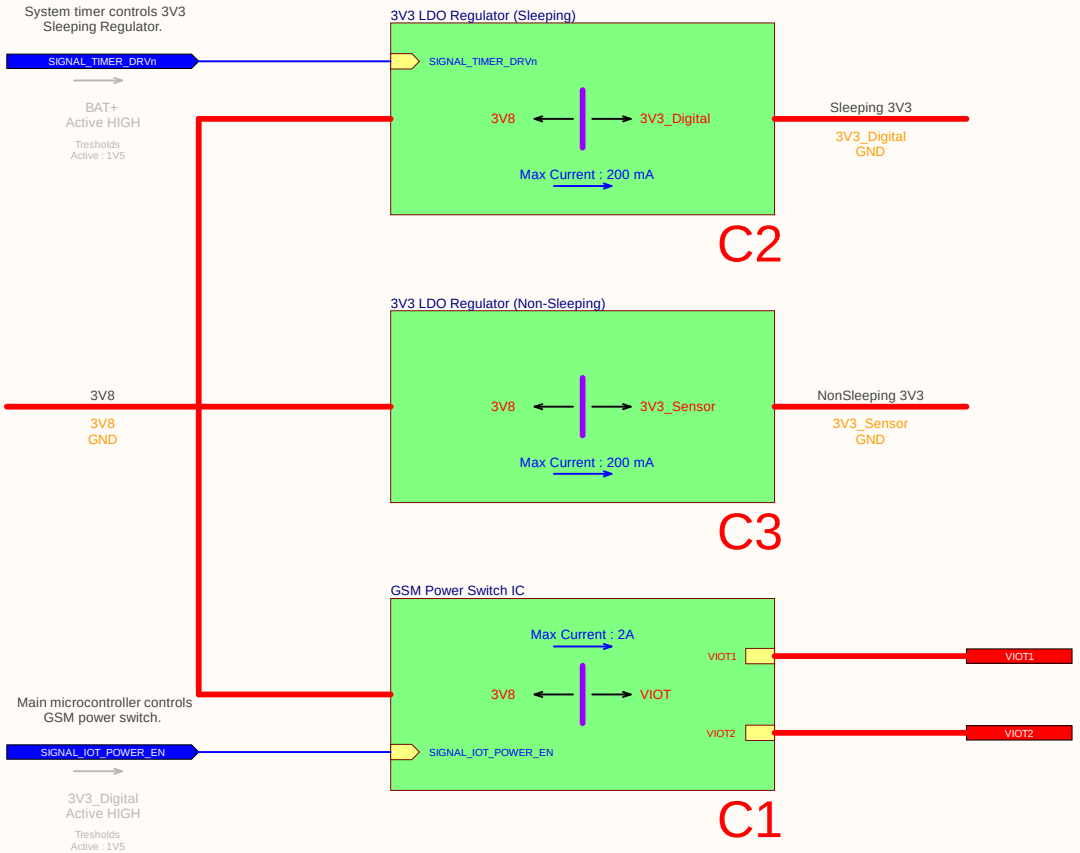

Title	**System Power Regulators & GSM IoT Power Switch**		
Size: A4	**Number:** AA005	**Revision:** B106AA	
Date: 3.07.2020	**Time:** 14:59:37	**Sheet** 11 of 37	
File: C:\Altium Projects\P101CA\Modules\Electronic\[B106AA]\Design Files\Altium\Schematic\Power Regulator.SchDoc			

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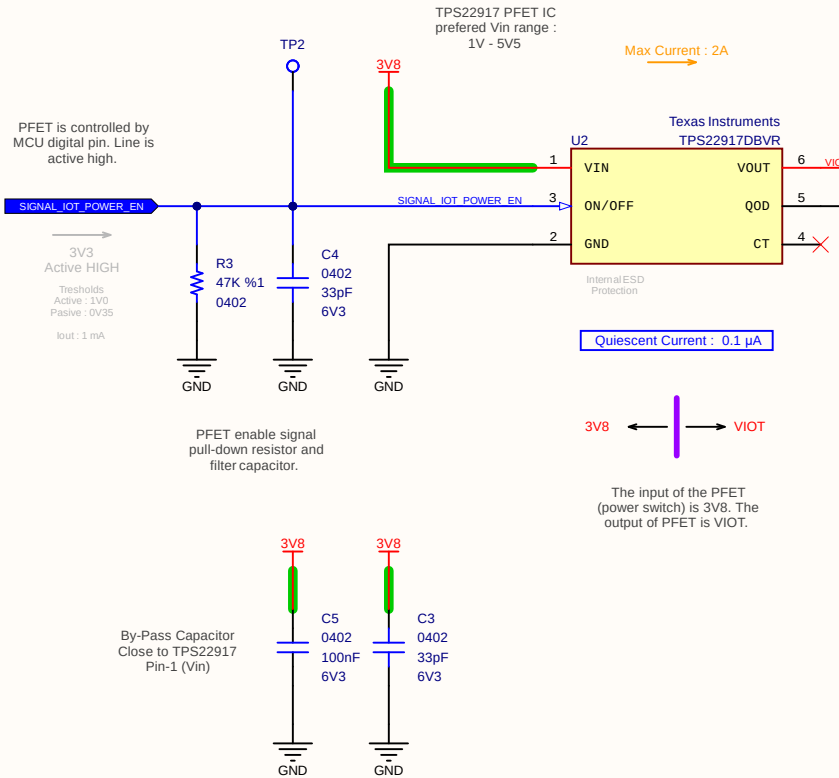
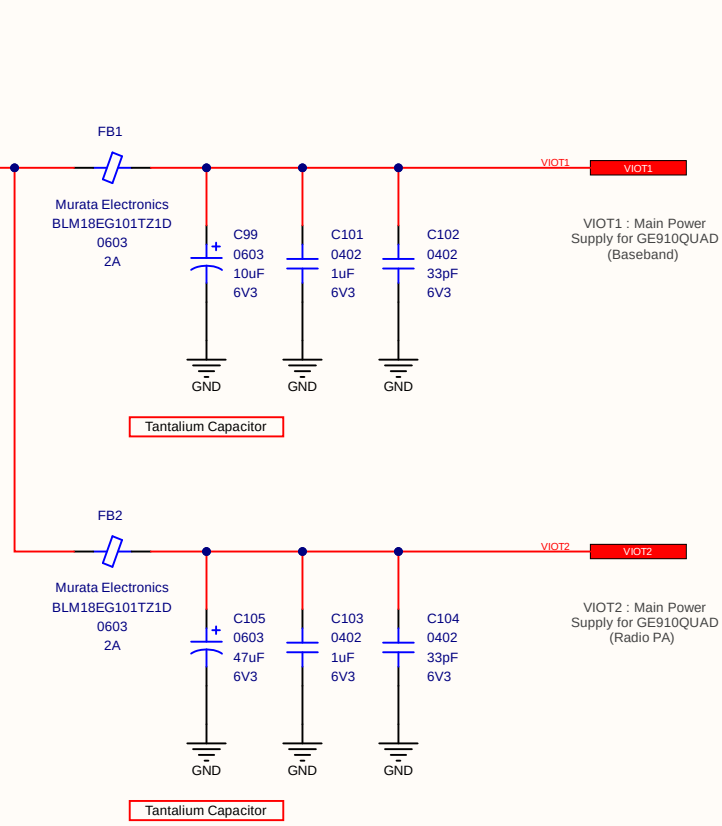
GSM Modem Power Switch



GSM Module Power Filter



C1

Title	GSM Module Power On/Off Switch IC & IoT Power Filter		
Size: A4	**Number:** AA005	**Revision:** B106AA	
Date: 3.07.2020	**Time:** 14:59:37	**Sheet** 12 of 37	
File: C:\Altium Projects\P101CA\Modules\Electronic\[B106AA]\Design Files\Altium\Schematic\GSM Power On-Off Switch IC.SchDoc			

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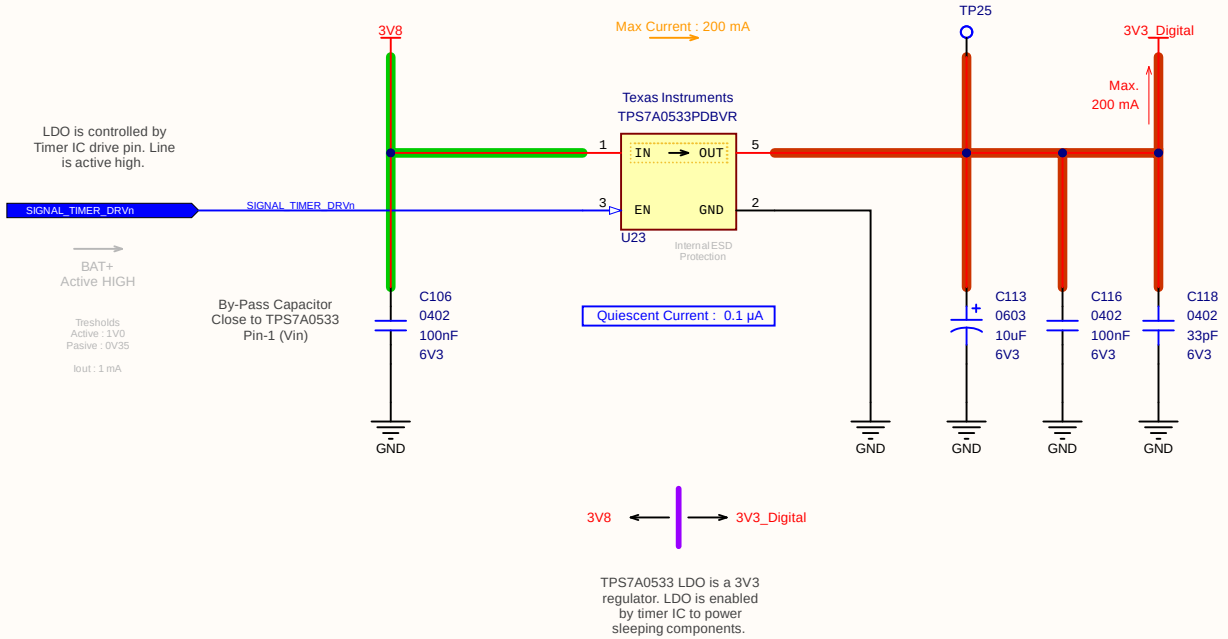

C2

Title	3V3 LDO Voltage Regulator (Sleeping)		
Size: A4	**Number:** AA005	**Revision:** B106AA	
Date: 3.07.2020	**Time:** 14:59:37	**Sheet** 13 of 37	
File: C:\Altium Projects\P101CA\Modules\Electronic\[B106AA]\Design Files\Altium\Schematic\3V3 LDO Regulator (Sleeping).SchDoc			

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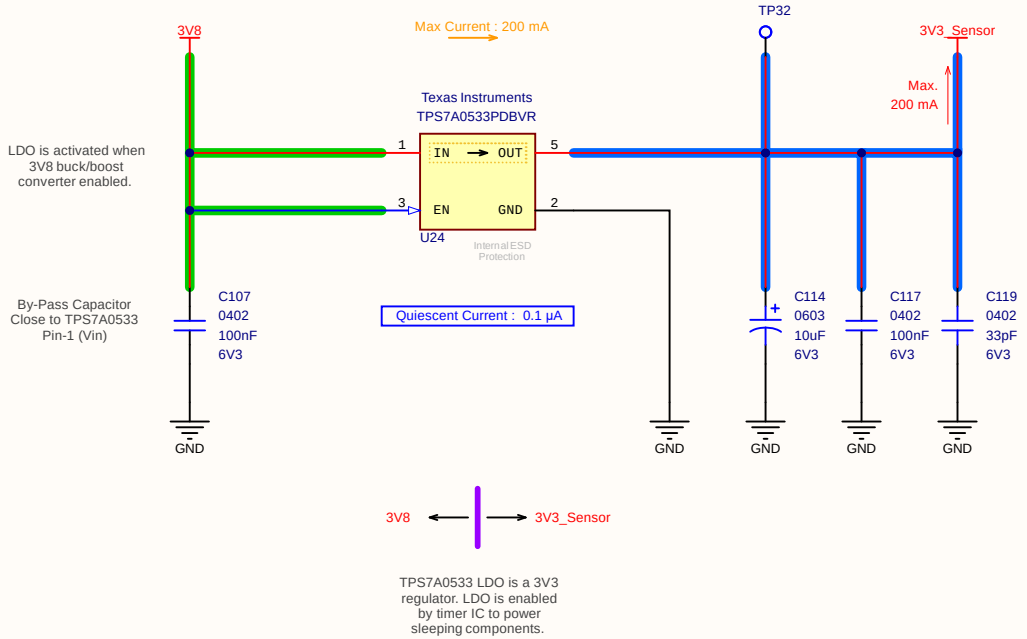
OVOO



C3

Title	3V3 LDO Voltage Regulator (NonSleeping)		
Size: A4	**Number:** AA005	**Revision:** B106AA	
Date: 3.07.2020	**Time:** 14:59:37	**Sheet** 14 of 37	
File: C:\Altium Projects\P101CA\Modules\Electronic\[B106AA]\Design Files\Altium\Schematic\3V3 LDO Regulator (NonSleeping).SchDoc			

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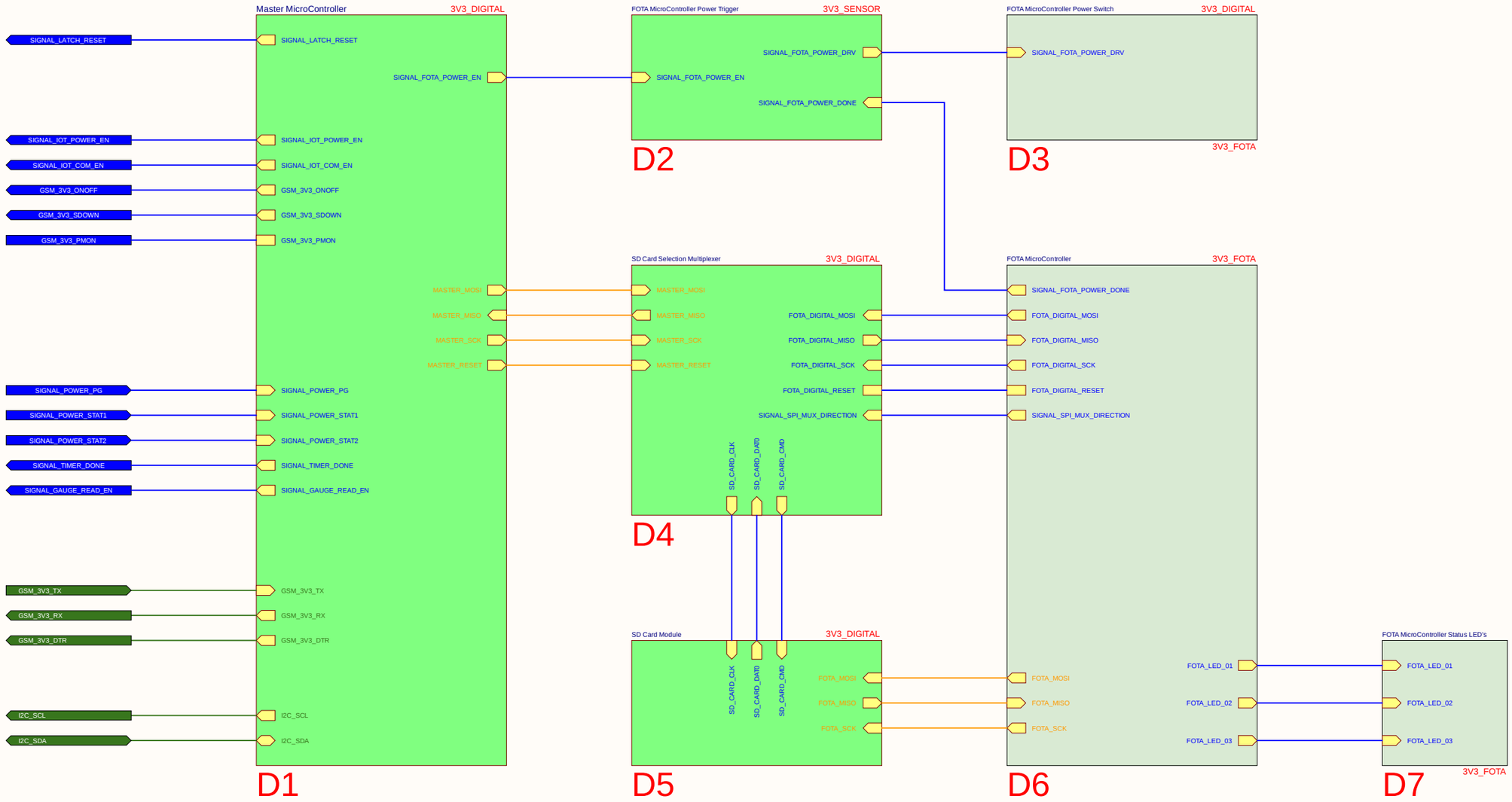
OVOO



Title	Main Microcontroller & FOTA Microcontroller		
Size: A3	**Number:** AA005	**Revision:** B106AA	
Date: 3.07.2020	**Time:** 14:59:37	**Sheet** 15 of 37	
File:	C:\Altium Projects\P101CA\Modules\Electronic\[B106AA]\Design Files\Altium\Schematic\Microcontroller.SchDoc		

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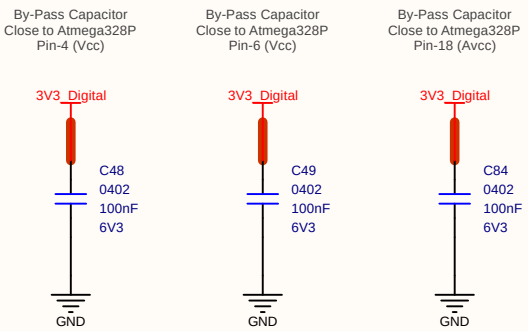
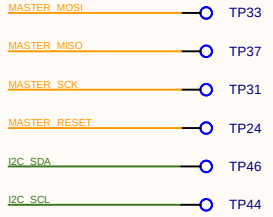
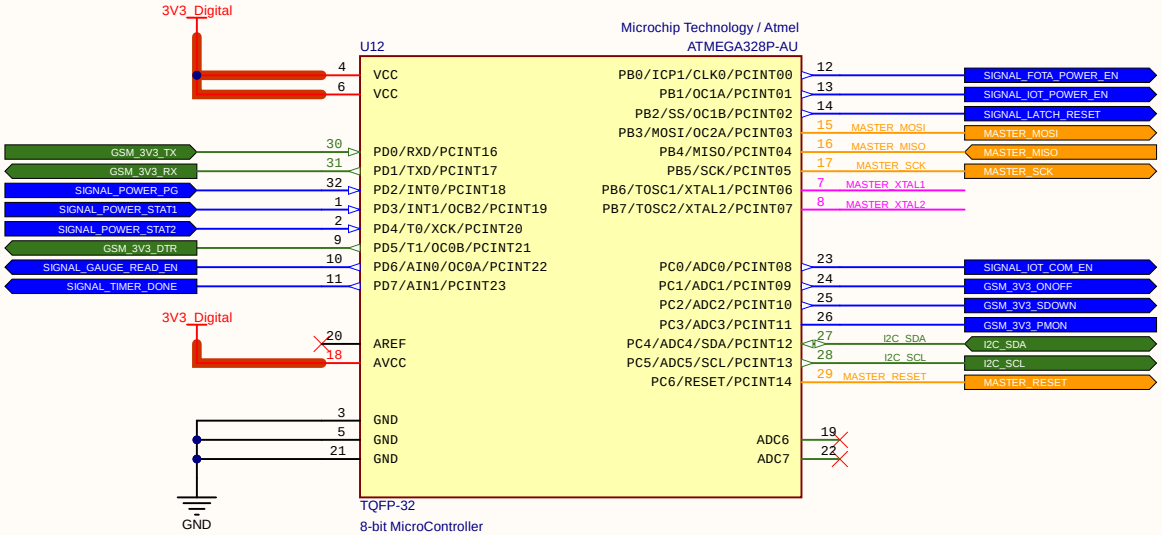
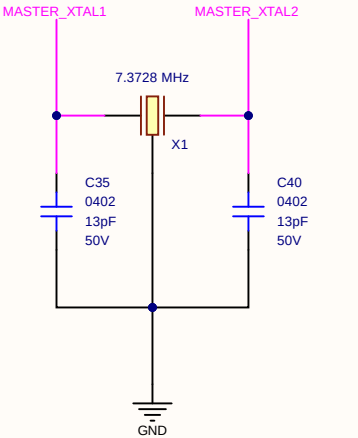
B106AA Module have two on-board MCU.

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.

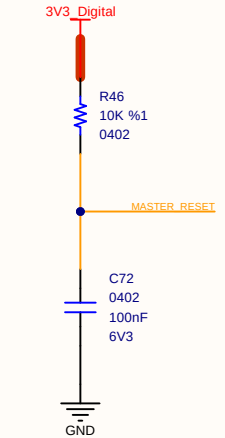








Master MCU is working at 7.3728 Mhz for minimise UART communication errors.



Master MCU Reset Line. Pull-up.

D1

Title	Master MicroController		
Size: A4	**Number:** AA005	**Revision:** B106AA	
Date: 3.07.2020	**Time:** 14:59:37	**Sheet** 16 of 37	
File: C:\Altium Projects\P101CA\Modules\Electronic\[B106AA]\Design Files\Altium\Schematic\Master MicroController.SchDoc			

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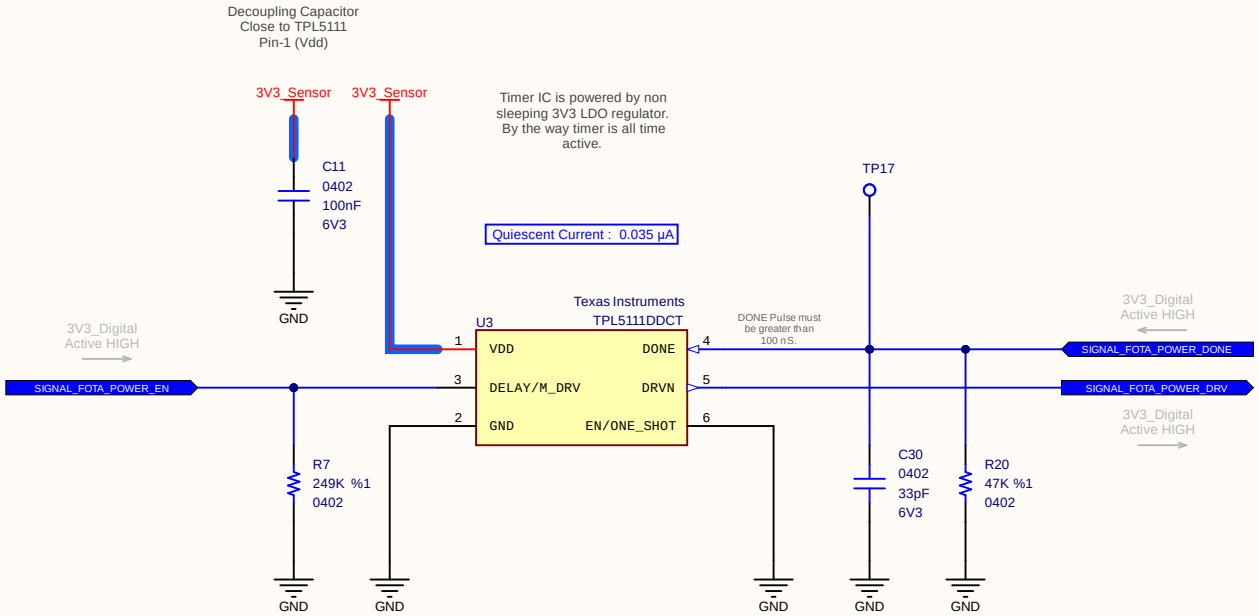

D2

Title	FOTA MicroController Latched Power Trigger		
Size: A4	**Number:** AA005	**Revision:** B106AA	
Date: 3.07.2020	**Time:** 14:59:37	**Sheet** 17 of 37	
File:	C:\Altium Projects\P101CA\Modules\Electronic\[B106AA]\Design Files\Altium\Schematic\FOTA MicroController Power Trigger.SchDoc		

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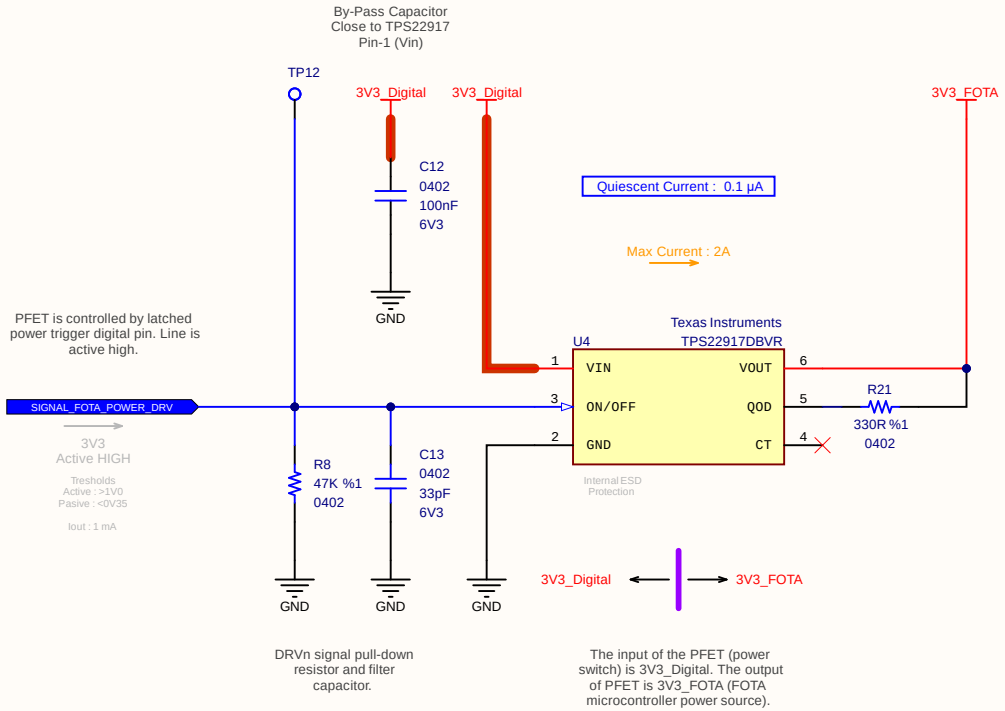

D3

Title	FOTA MicroController Power Switch		
Size: A4	**Number:** AA005	**Revision:** B106AA	
Date: 3.07.2020	**Time:** 14:59:37	**Sheet** 18 of 37	
File:	C:\Altium Projects\P101CA\Modules\Electronic\[B106AA]\Design Files\Altium\Schematic\FOTA MicroController Power Switch.SchDoc		

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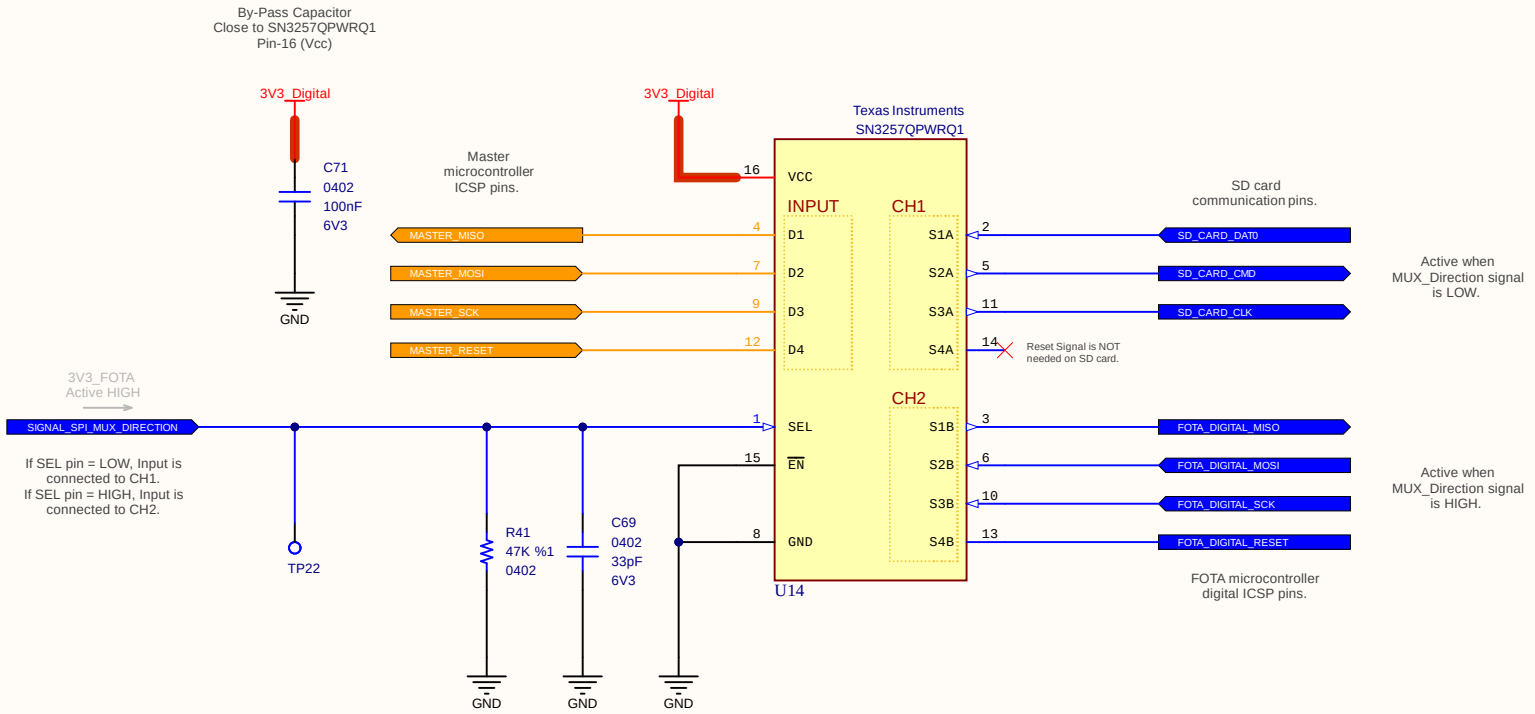

D4

Title	**SD/ICSP Selection Multiplexer**		
Size: A4	**Number:** AA005	**Revision:** B106AA	
Date: 3.07.2020	**Time:** 14:59:37	**Sheet** 19 of 37	
File: C:\Altium Projects\P101CA\Modules\Electronic\[B106AA]\Design Files\Altium\Schematic\SD Card Selection Multiplexer.SchDoc			

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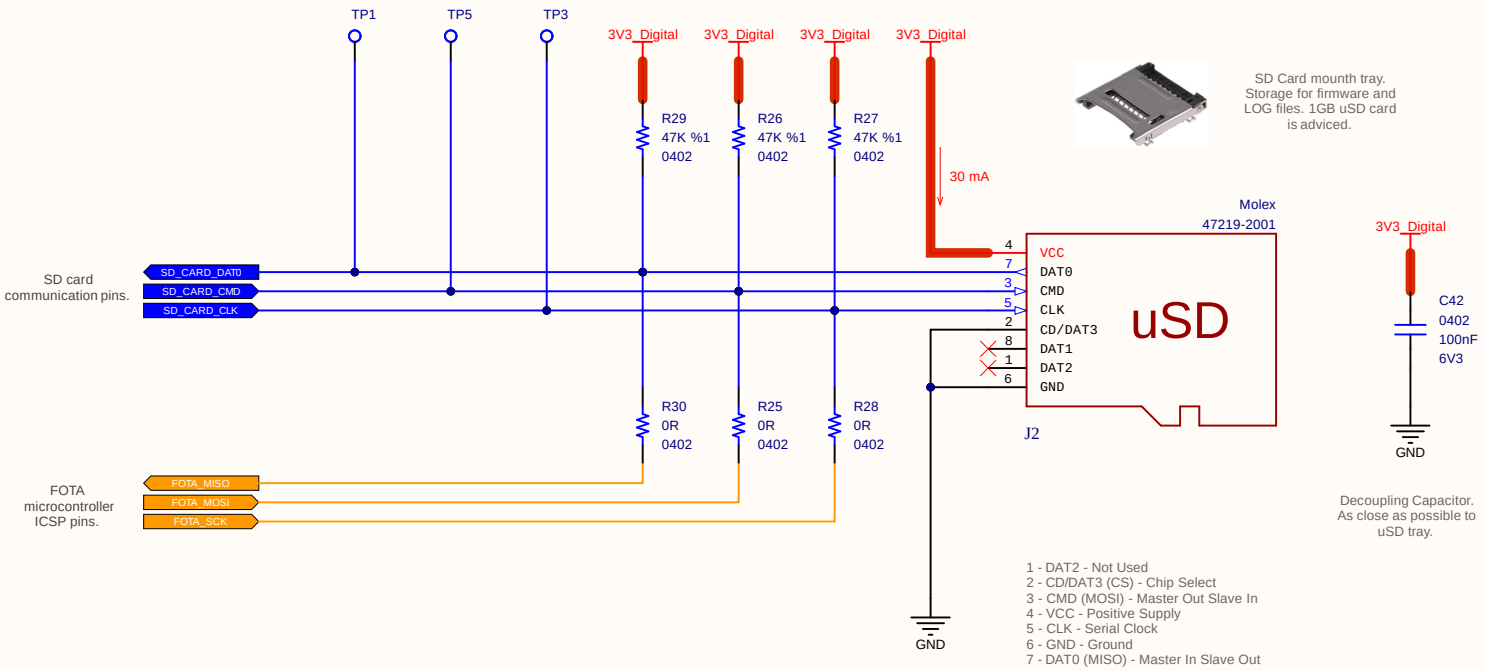
Turkiye



D5

Title	**Micro SD Card Module**		
Size: A4	**Number:** AA005	**Revision:** B106AA	
Date: 3.07.2020	**Time:** 14:59:37	**Sheet** 20 of 37	
File: C:\Altium Projects\P101CA\Modules\Electronic\[B106AA]\Design Files\Altium\Schematic\SD Card Module.SchDoc			

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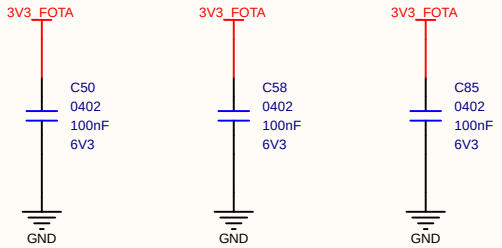
B106AA Module have two on-board MCU.

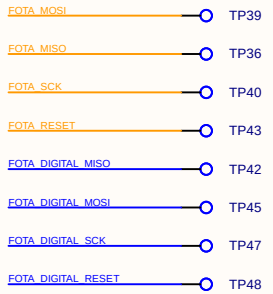
Second microcontroller is a firmware over the air controller. This MCU is burn firmware to the main MCU.

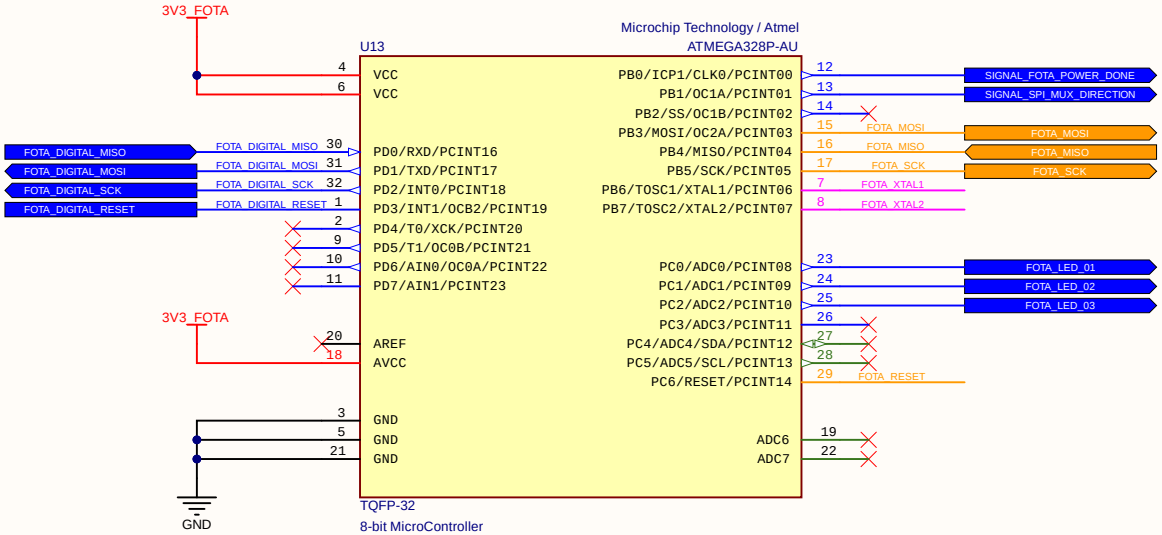
By-Pass Capacitor Close to Atmega328P Pin-4 (Vcc)

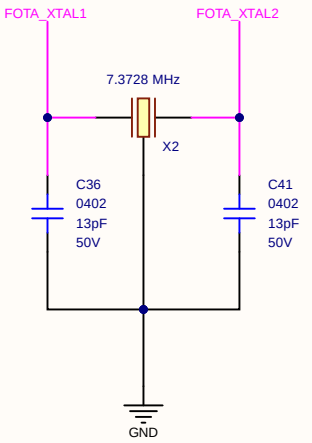
By-Pass Capacitor Close to Atmega328P Pin-6 (Vcc)

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

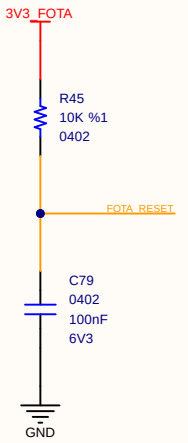








FOTA MCU is working at 7.3728 Mhz.



FOTA MCU Reset Line. Pull-up.

D6

Title	FOTA MicroController		
Size: A4	**Number:** AA005	**Revision:** B106AA	
Date: 3.07.2020	**Time:** 14:59:37	**Sheet** 21 of 37	
File: C:\Altium Projects\P101CA\Modules\Electronic\[B106AA]\Design Files\Altium\Schematic\FOTA MicroController.SchDoc			

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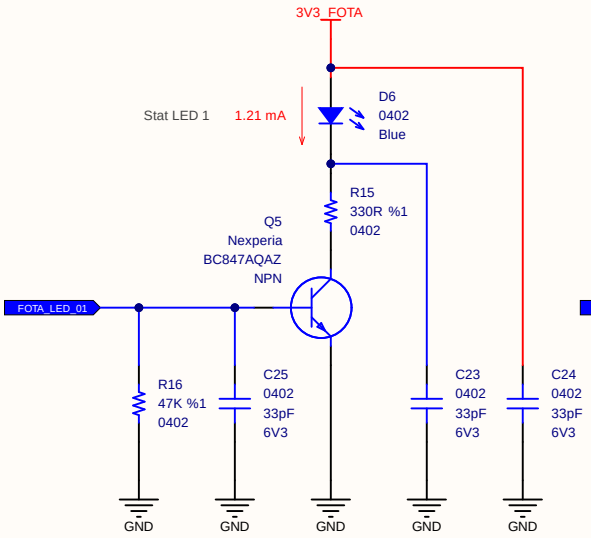
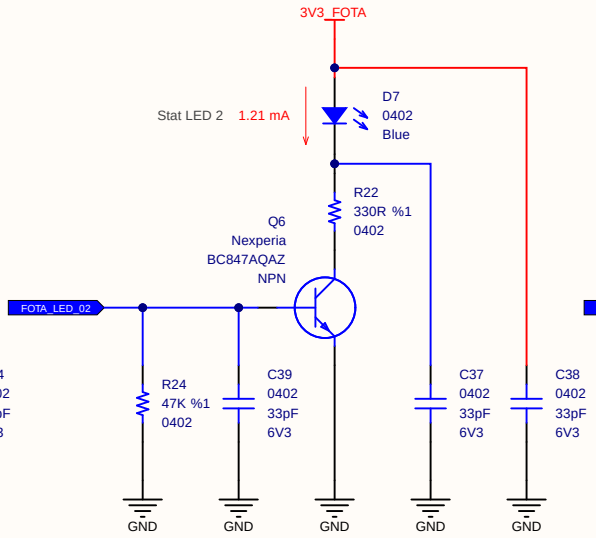
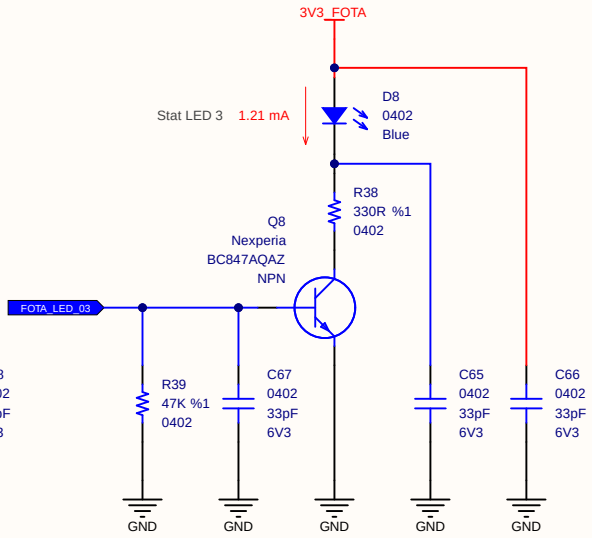


Noise filter capacitors. Place as close as possible to LED.



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		
Size: A4	**Number:** AA005	**Revision:** B106AA	
Date: 3.07.2020	**Time:** 14:59:37	**Sheet** 22 of 37	
File:	C:\Altium Projects\P101CA\Modules\Electronic\[B106AA]\Design Files\Altium\Schematic\FOTA MicroController Status LEDs.SchDoc		

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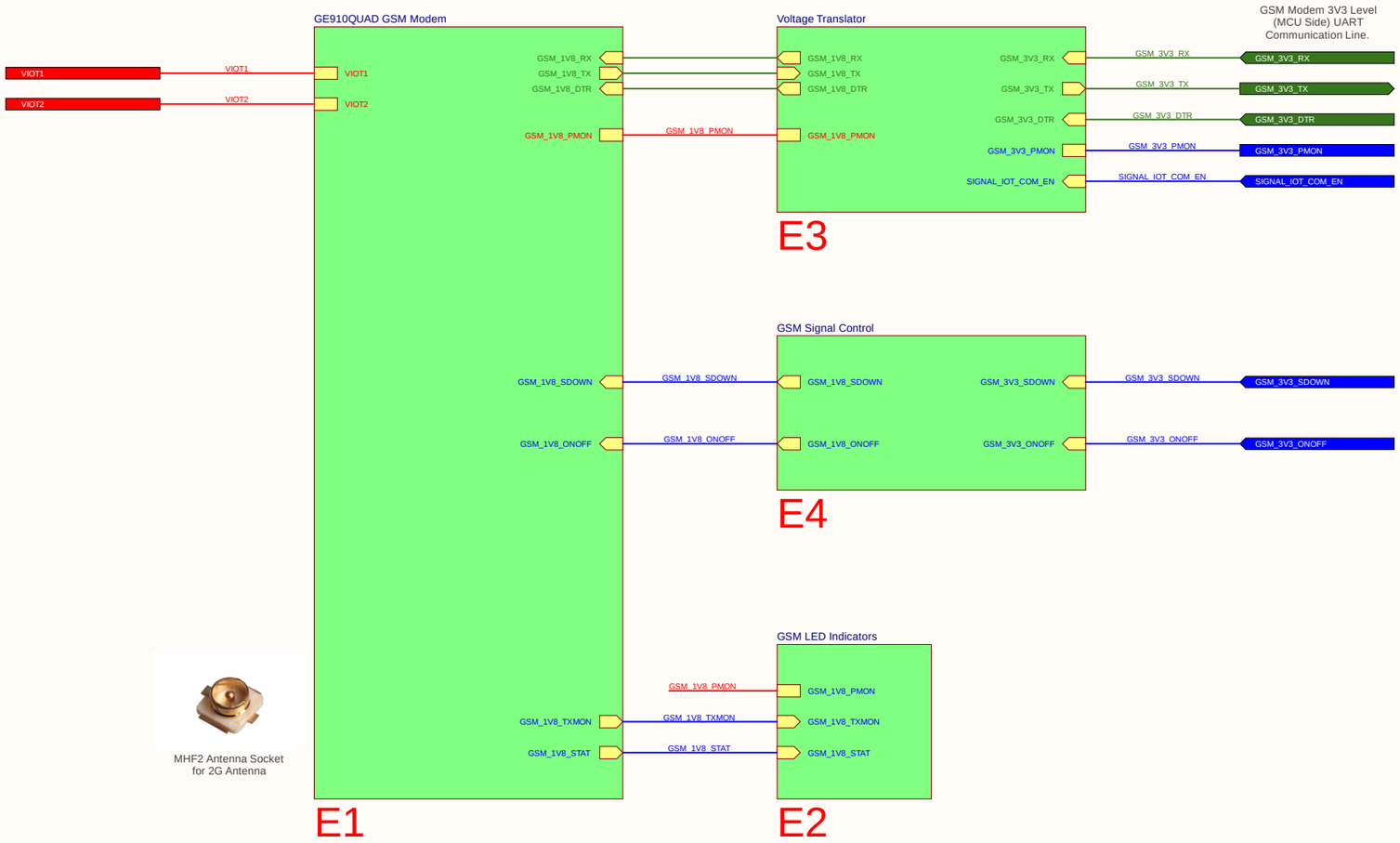
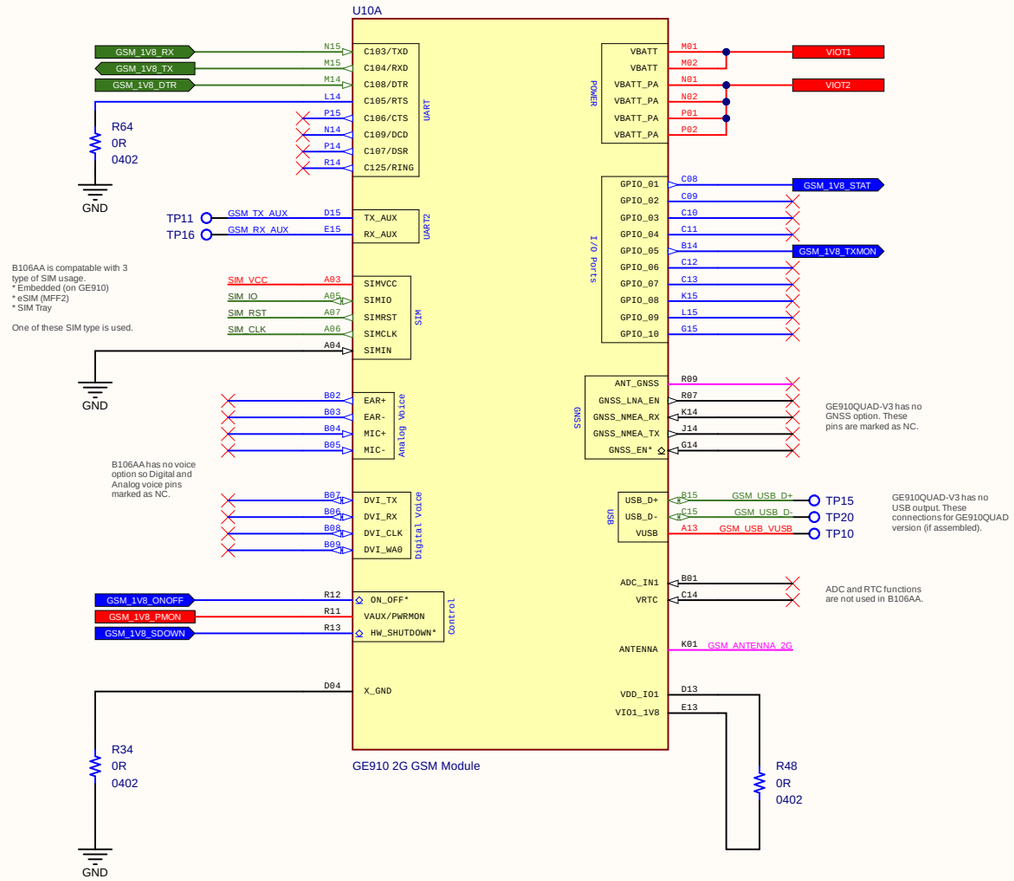
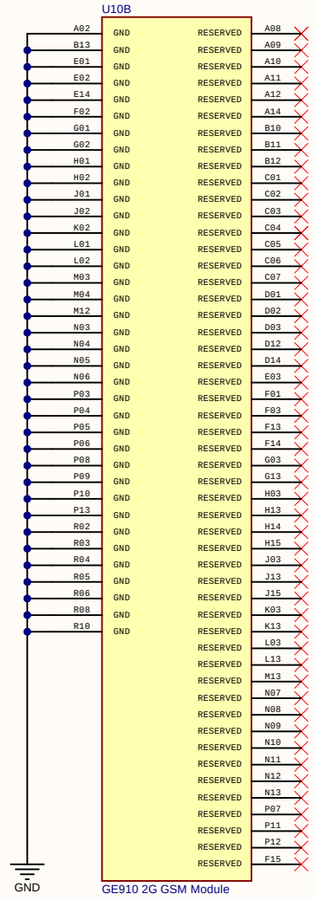


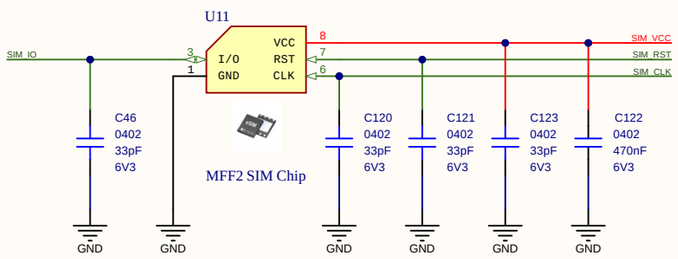
MHF2 Antenna Socket
for 2G Antenna

Title GSM IoT Block Diagram			*Ovoo Electronics* Küçük İhsaniye Mah. Muzaklı Sok. No:15 Meram / Konya Turkiye
Size: A3	**Number:** AA005	**Revision:** B106AA	
Date: 3.07.2020	**Time:** 14:59:37	**Sheet** 23 of 37	
File: C:\Altium Projects\P101CA\Modules\Electronic\[B106AA]\Design Files\Altium\Schematic\GSM IoT.SchDoc			





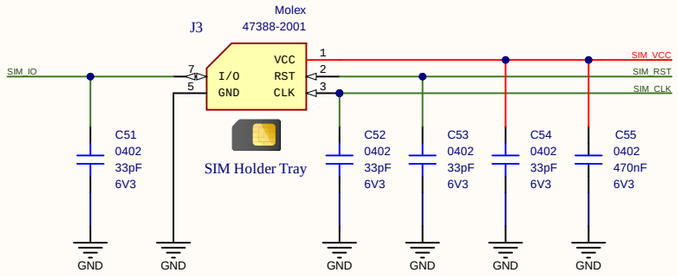
OnBoard eSIM Chip



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

SIM_VCC capacitor is chosed according Telit SIM integration guide.

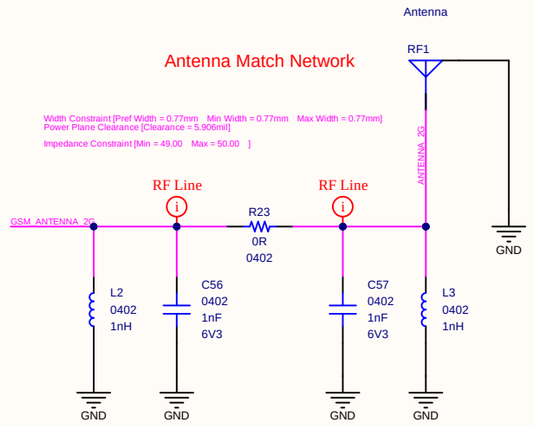
OnBoard Sim Tray



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

SIM_VCC capacitor is chosed according Telit SIM integration guide.

Antenna Match Network

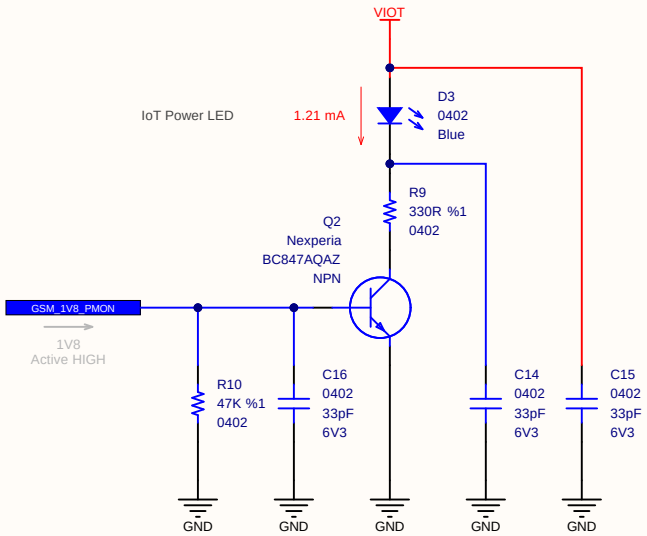


RF Matching network circuit is not placed on production. Only 0R resistor is placed.

E1

Title GE910 GSM Modem & SIM			**Ovoo Electronics** Küçük İhsaniye Mah. Mızraklı Sok. No:15 Meram / Konya Turkiye
Size: A3	**Number:** AA005	**Revision:** B106AA	
Date: 3.07.2020	**Time:** 14:59:37	**Sheet** 24 of 37	
File: C:\Altium Projects\P101CA\Modules\Electronic\[B106AA]\Design Files\Altium\Schematic\GE910QUAD Modem.SchDoc			

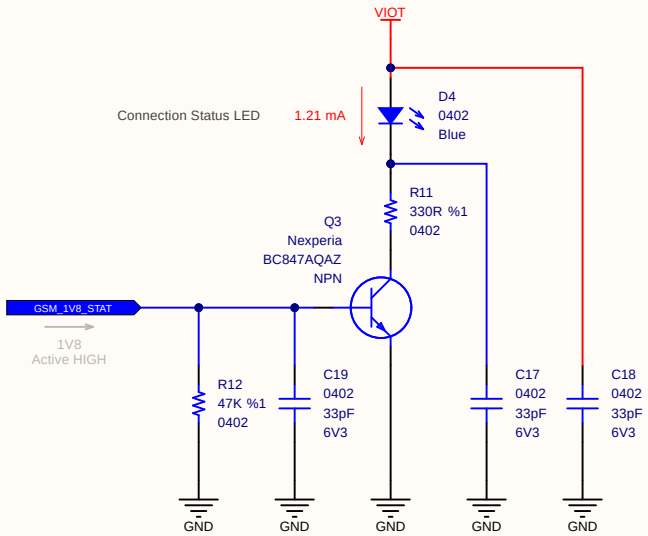
GSM Power Monitor LED



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

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

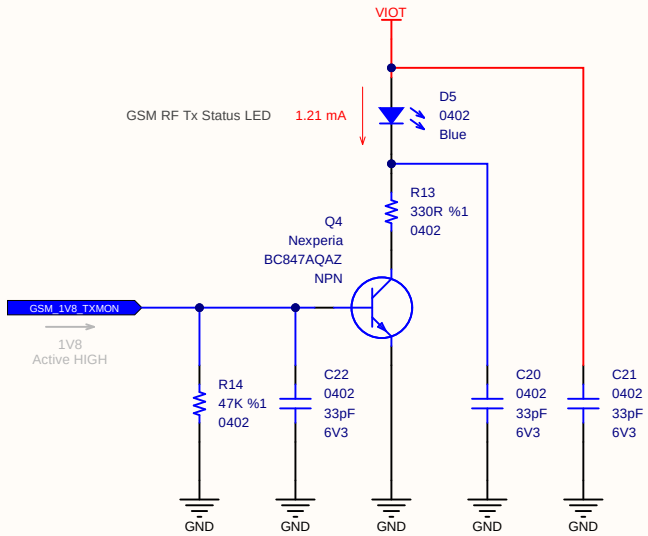
GSM Connection Status LED



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		
Size: A4	**Number:** AA005	**Revision:** B106AA	
Date: 3.07.2020	**Time:** 14:59:38	**Sheet** 25 of 37	
File:	C:\Altium Projects\P101CA\Modules\Electronic\[B106AA]\Design Files\Altium\Schematic\GSM LED Indicators.SchDoc		

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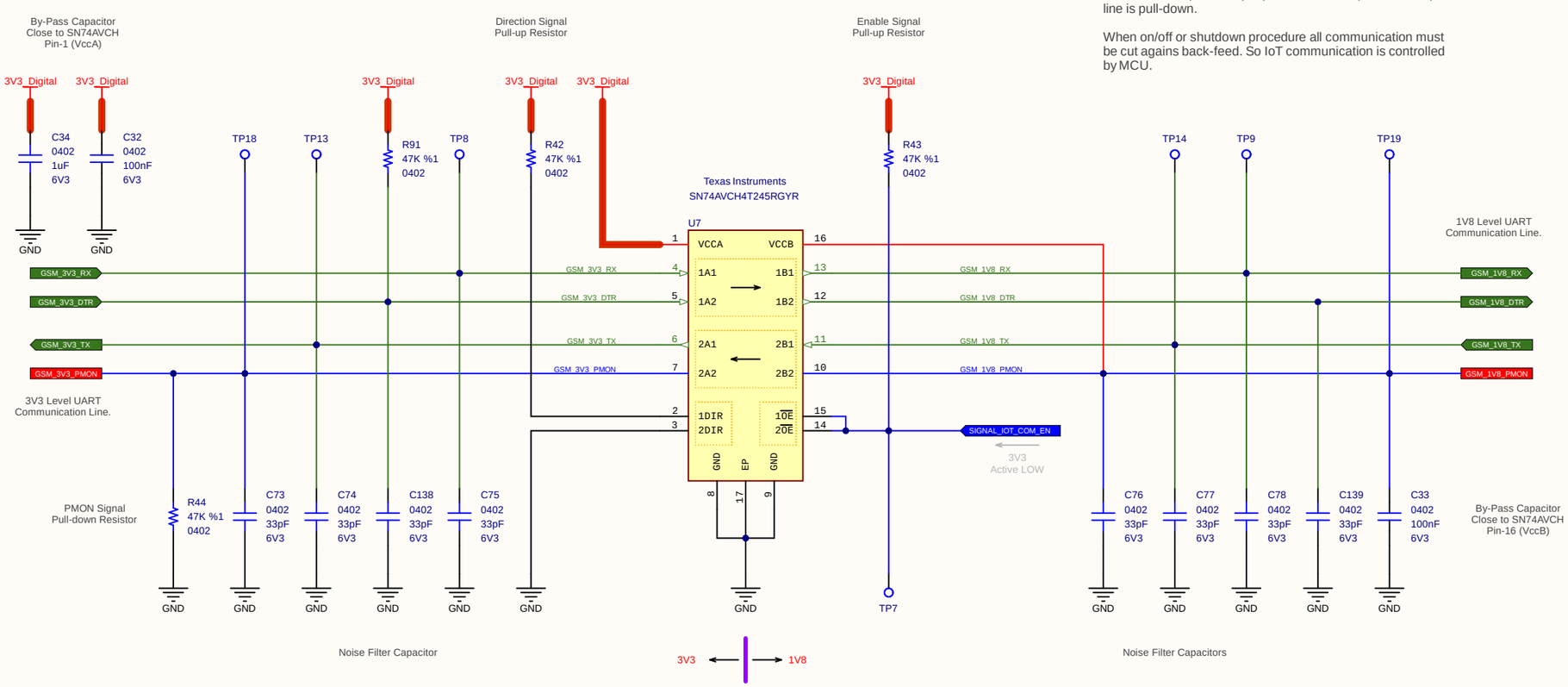
BiDirectional Level Shifter

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

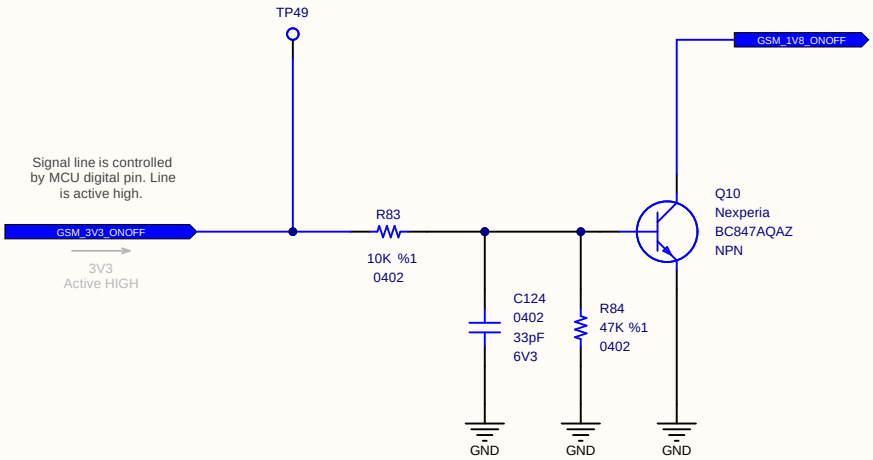
Power Monitor pin is a input pin at MCU side (active HIGH) so line is pull-down.

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

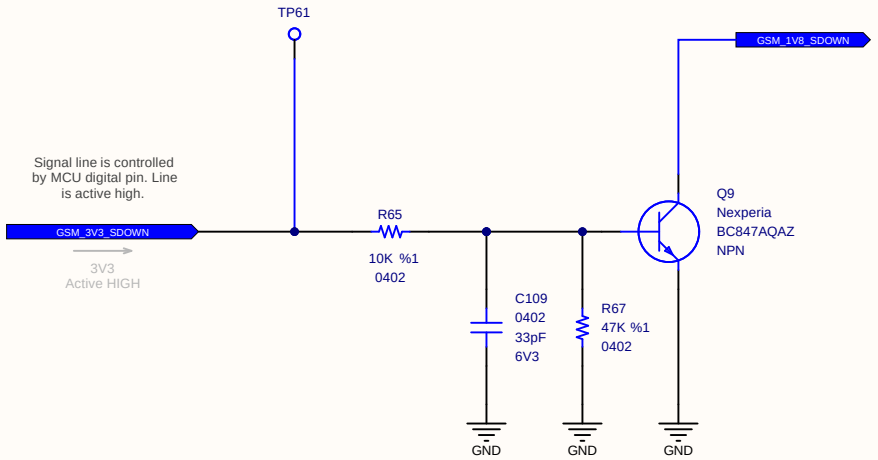


E3	**Title** 3V3 - 1V8 Voltage Level Translator		**Ovoo Electronics** Küçükİhsaniye Mah. Muraklı Sok. No:15 Meram / Konya Turkiye
	Size: A3	**Number:** AA005	**Revision:** B106AA
	Date: 3.07.2020	**Time:** 14:59:38	**Sheet** 26 of 37
	File: C:\Altium Projects\P101CA\Modules\Electronic\[B106AA]\Design Files\Altium\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		
Size: A4	**Number:** AA005	**Revision:** B106AA	
Date: 3.07.2020	**Time:** 14:59:38	**Sheet** 27 of 37	
File:	C:\Altium Projects\P101CA\Modules\Electronic\[B106AA]\Design Files\Altium\Schematic\GSM Signal Control.SchDoc		

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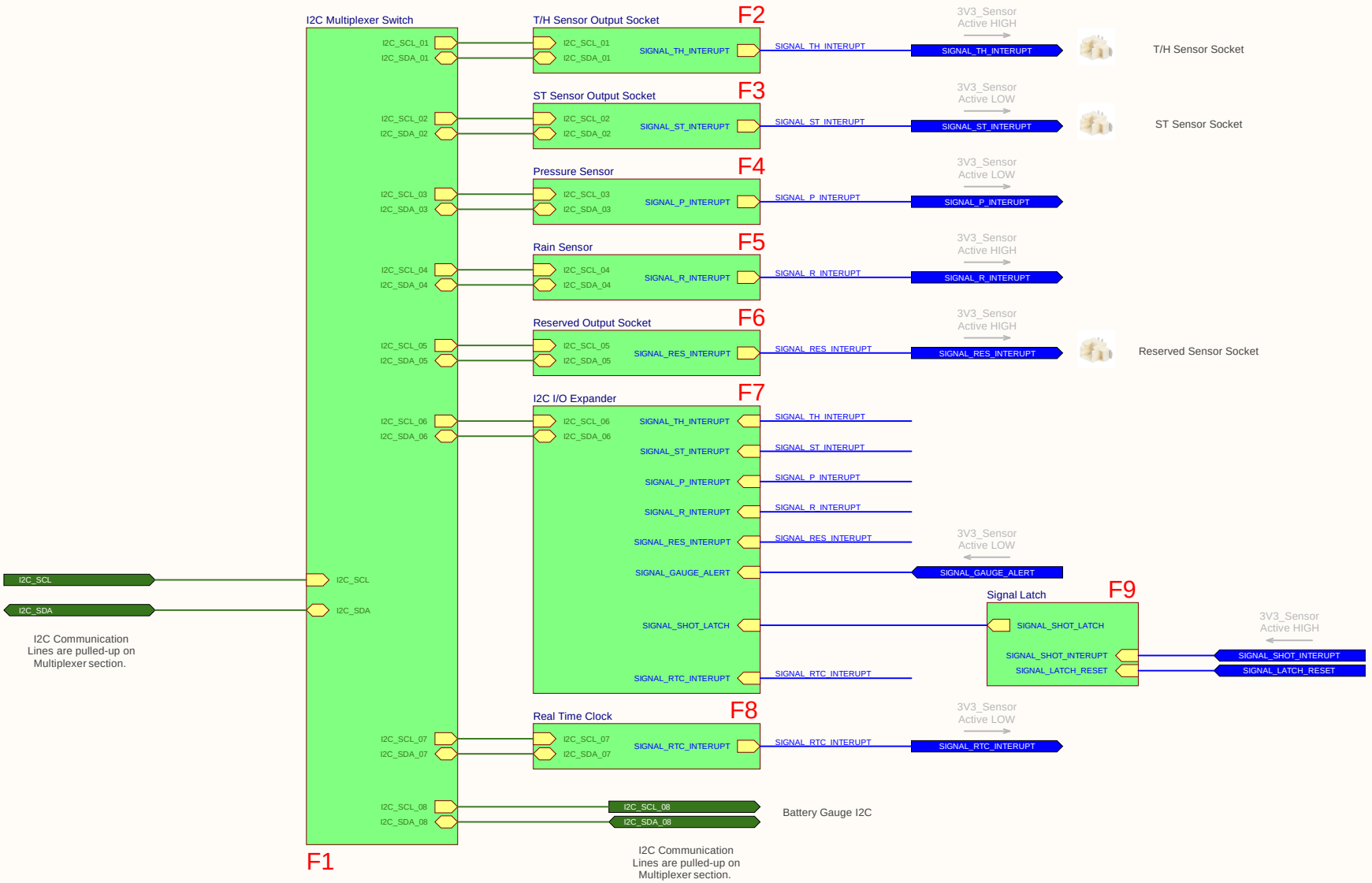

Title	I2C Sensor Network		
Size: A4	**Number:** AA005	**Revision:** B106AA	
Date: 3.07.2020	**Time:** 14:59:38	**Sheet** 28 of 37	
File: C:\Altium Projects\P101CA\Modules\Electronic\[B106AA]\Design Files\Altium\Schematic\I2C Sensor Network.SchDoc			

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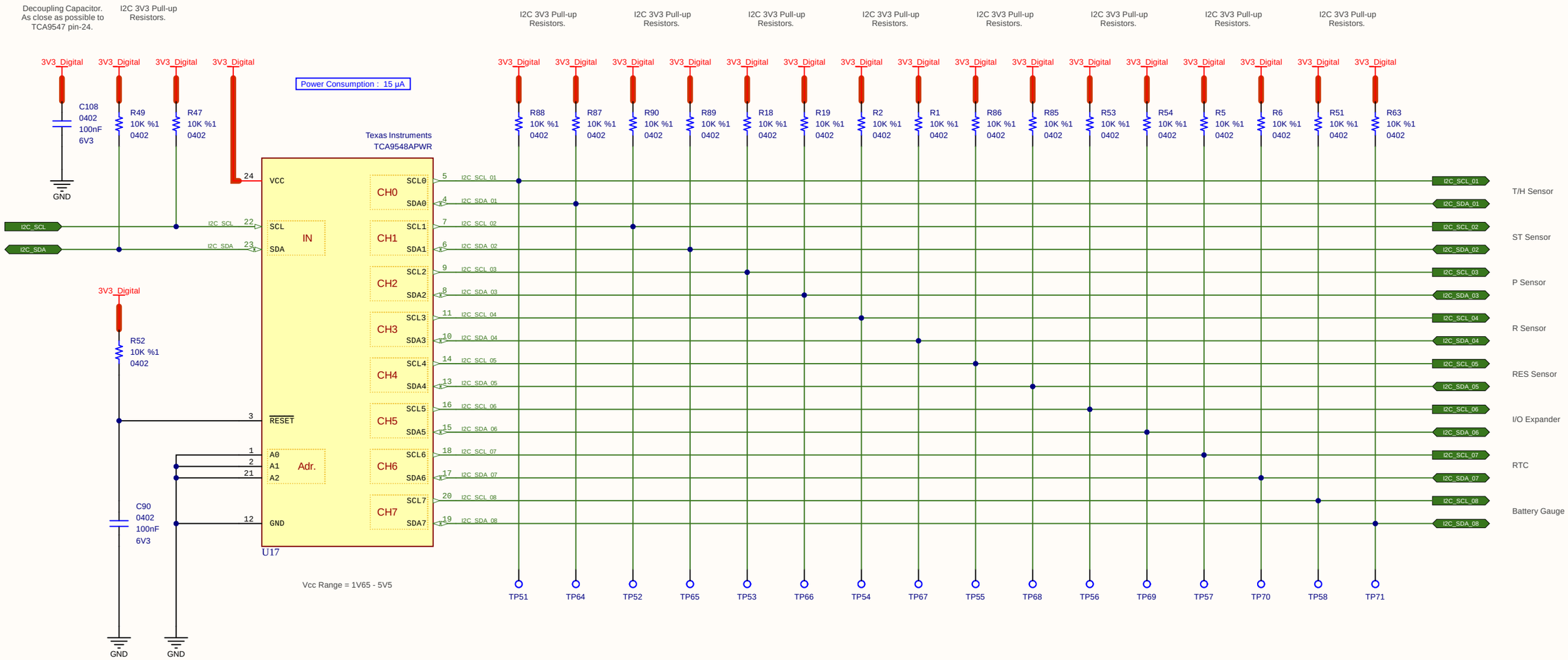
Turkiye



F1

Title	I2C 8 Channel Multiplexer		
Size: A3	**Number:** AA005	**Revision:** B106AA	
Date: 3.07.2020	**Time:** 14:59:38	**Sheet** 29 of 37	
File:	C:\Altium Projects\P101CA\Modules\Electronic\[B106AA]\Design Files\Altium\Schematic\I2C Multiplexer.SchDoc		

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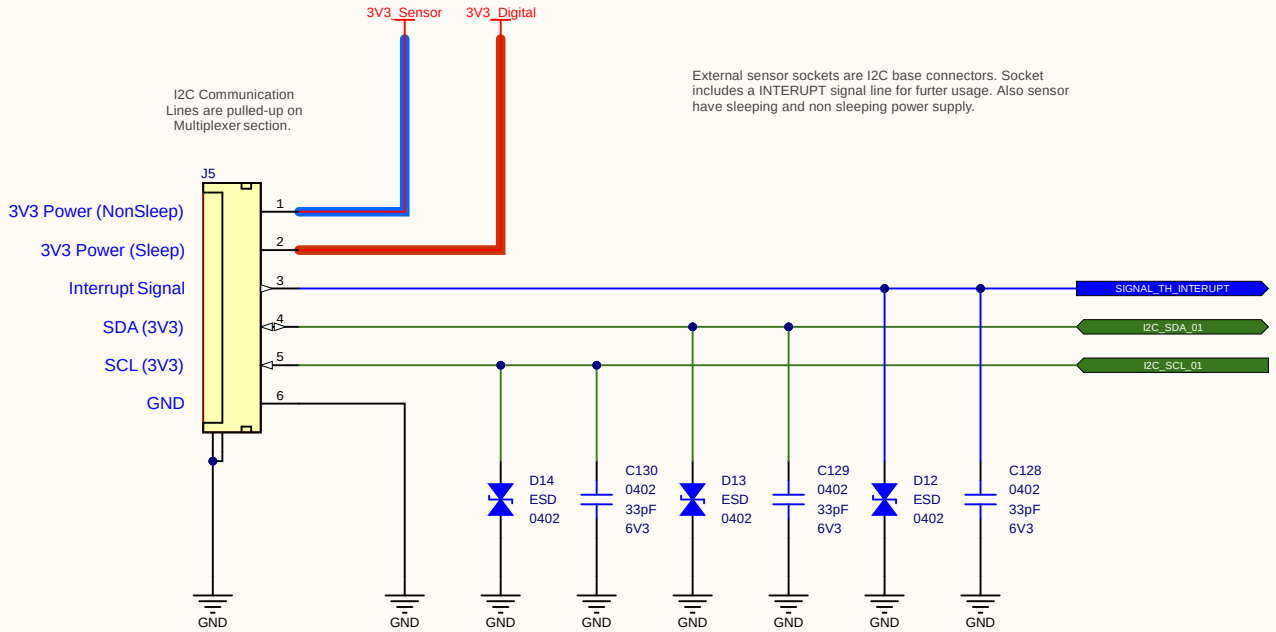
OVOO



F2

Title	Air Temperature & Air Humidity Sensor Output Socket		
Size: A4	**Number:** AA005	**Revision:** B106AA	
Date: 3.07.2020	**Time:** 14:59:38	**Sheet** 30 of 37	
File: C:\Altium Projects\P101CA\Modules\Electronic\[B106AA]\Design Files\Altium\Schematic\TH Sensor Output Socket.SchDoc			

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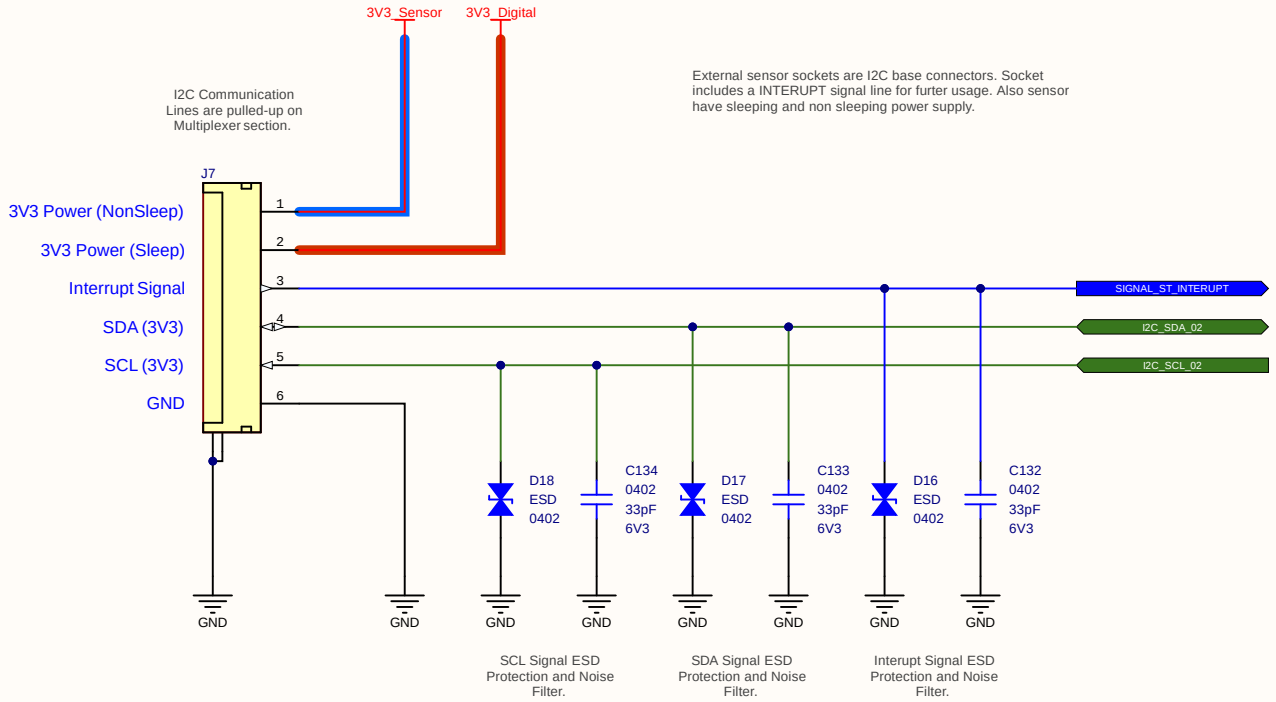
Turkiye



F3

Title	Soil Temperature Sensor Output Socket		
Size: A4	**Number:** AA005	**Revision:** B106AA	
Date: 3.07.2020	**Time:** 14:59:38	**Sheet** 31 of 37	
File: C:\Altium Projects\P101CA\Modules\Electronic\[B106AA]\Design Files\Altium\Schematic\ST Sensor Output Socket.SchDoc			

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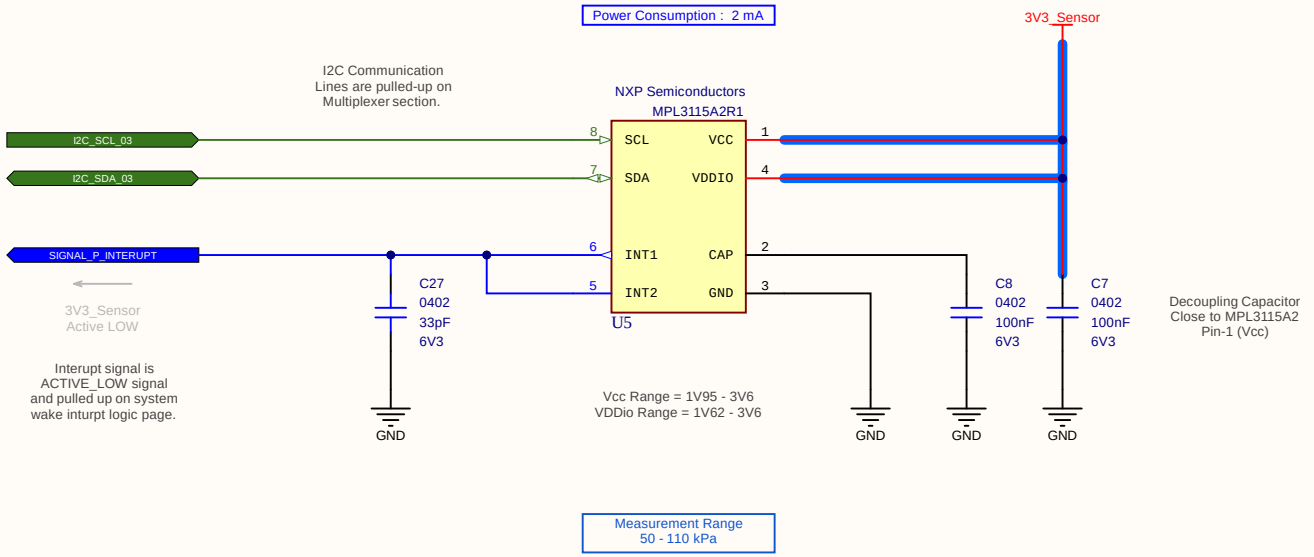

F4

Title	**Pressure Sensor**		
Size: A4	**Number:** AA005	**Revision:** B106AA	
Date: 3.07.2020	**Time:** 14:59:38	**Sheet** 32 of 37	
File: C:\Altium Projects\P101CA\Modules\Electronic\[B106AA]\Design Files\Altium\Schematic\Pressure Sensor.SchDoc			

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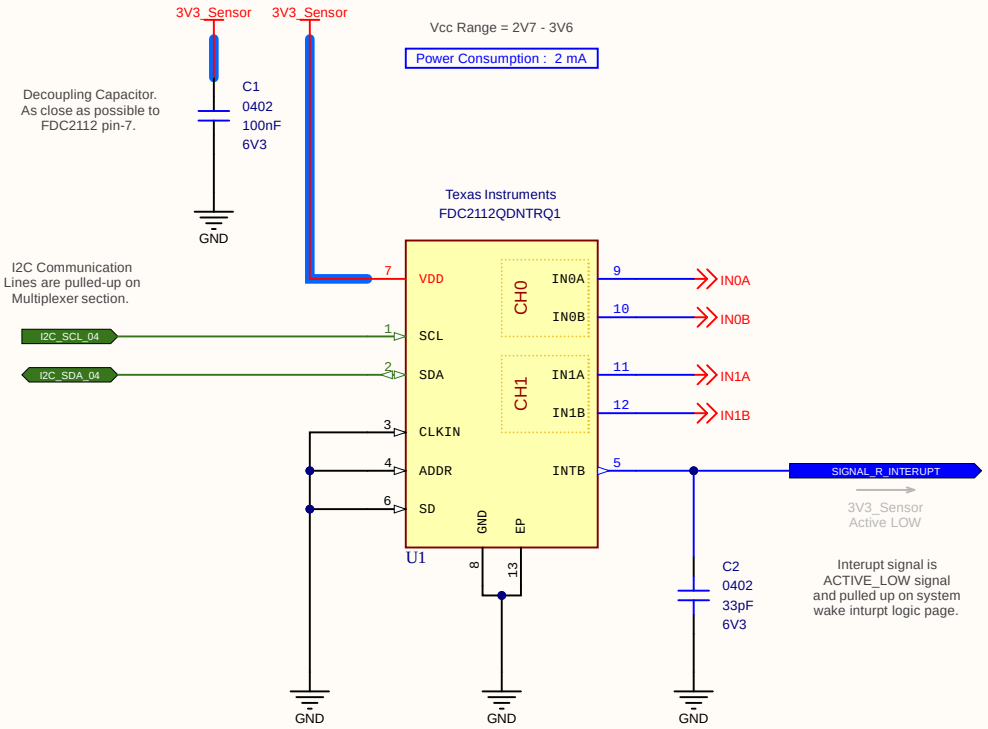
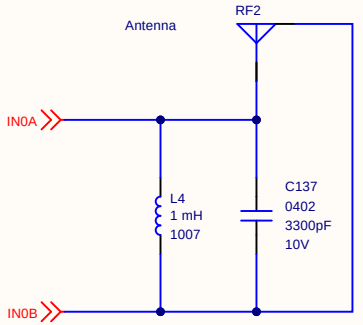
OVOO



Rain Sensor Plate 1

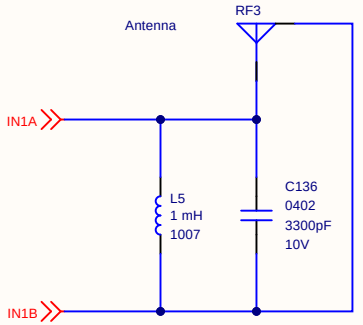


Sense Plate Socket

Sensing plates are connected to B106 with shilded cable. Both side of cable are MHF4 type RF connector. Outher 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



Sense Plate Socket

Sensing plates are connected to B106 with shilded cable. Both side of cable are MHF4 type RF connector. Outher 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		
Size: A4	**Number:** AA005	**Revision:** B106AA	
Date: 3.07.2020	**Time:** 14:59:38	**Sheet** 33 of 37	
File:	C:\Altium Projects\P101CA\Modules\Electronic\[B106AA]\Design Files\Altium\Schematic\Capacitive Rain Sensor.SchDoc		

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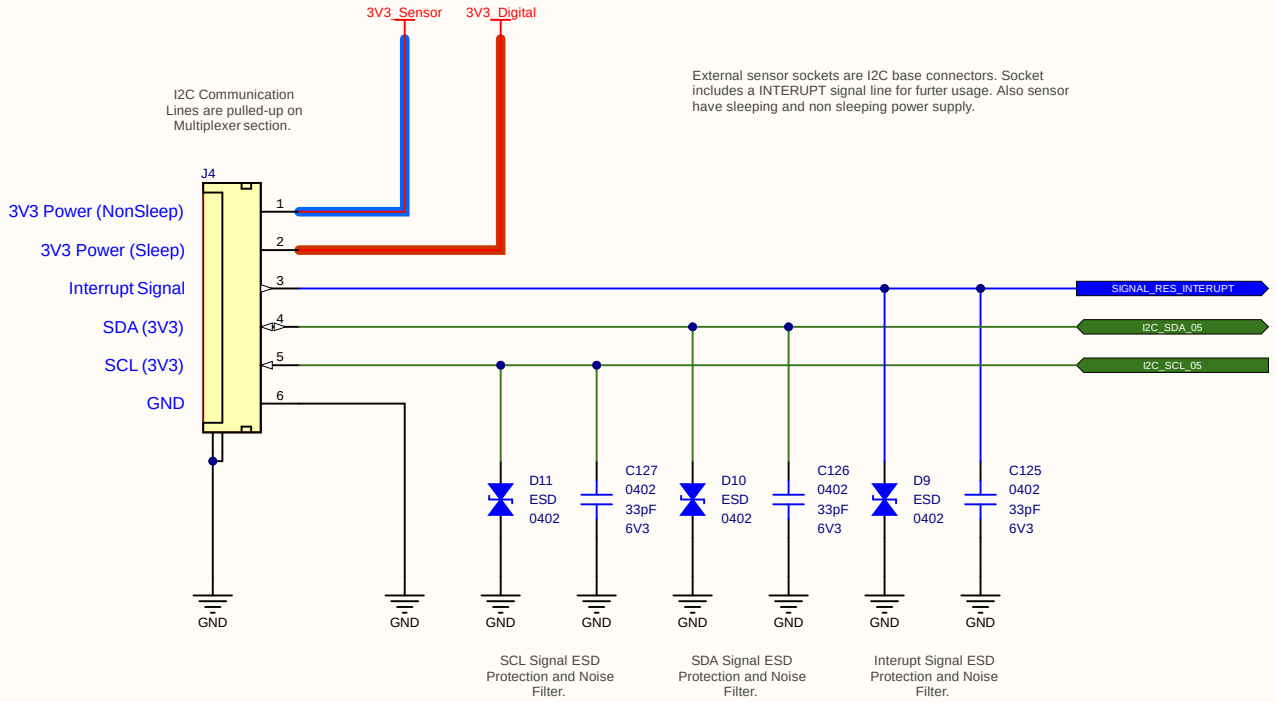

F6

Title	Reserved Sensor Output Socket		
Size: A4	**Number:** AA005	**Revision:** B106AA	
Date: 3.07.2020	**Time:** 14:59:38	**Sheet** 34 of 37	
File: C:\Altium Projects\P101CA\Modules\Electronic\[B106AA]\Design Files\Altium\Schematic\Reserved Sensor Output Socket.SchDoc			

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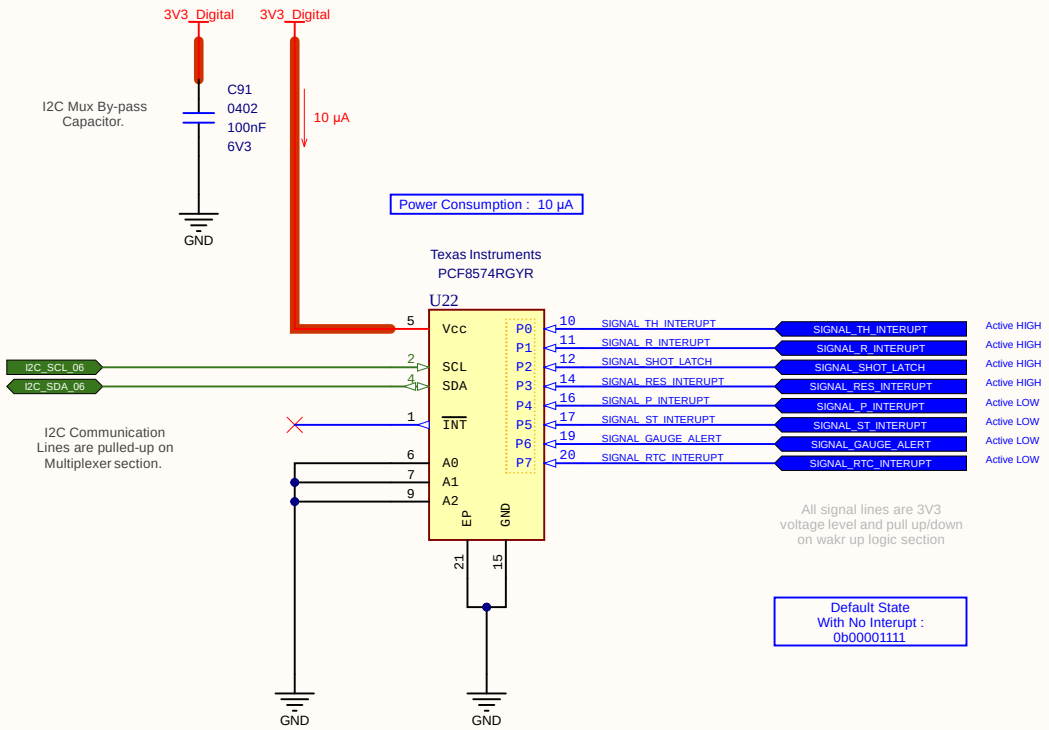

F7

Title	I2C I/O Expander for Reading Interrupts		
Size: A4	**Number:** AA005	**Revision:** B106AA	
Date: 3.07.2020	**Time:** 14:59:38	**Sheet** 35 of 37	
File: C:\Altium Projects\P101CA\Modules\Electronic\[B106AA]\Design Files\Altium\Schematic\I2C IO Expander.SchDoc			

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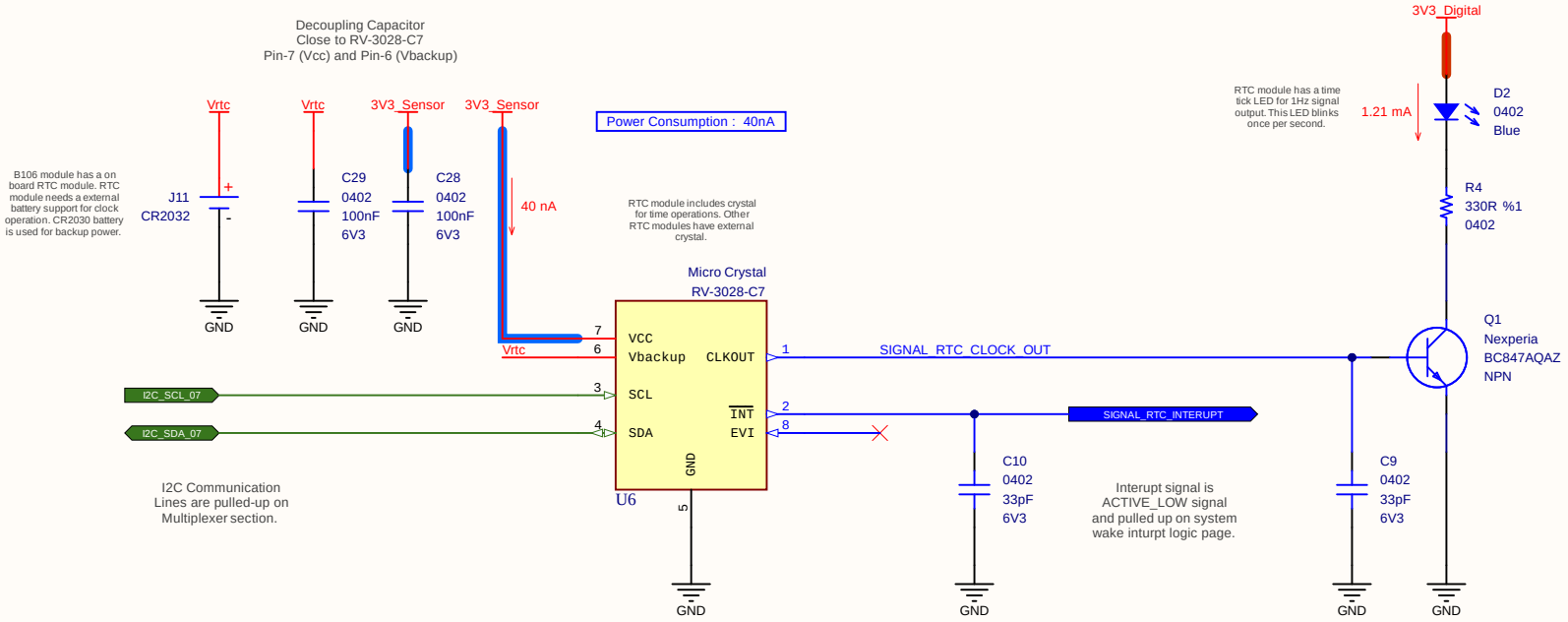

F8

Title	Real Time Clock		
Size: A4	**Number:** AA005	**Revision:** B106AA	
Date: 3.07.2020	**Time:** 14:59:39	**Sheet** 36 of 37	
File: C:\Altium Projects\P101CA\Modules\Electronic\[B106AA]\Design Files\Altium\Schematic\Real Time Clock.SchDoc			

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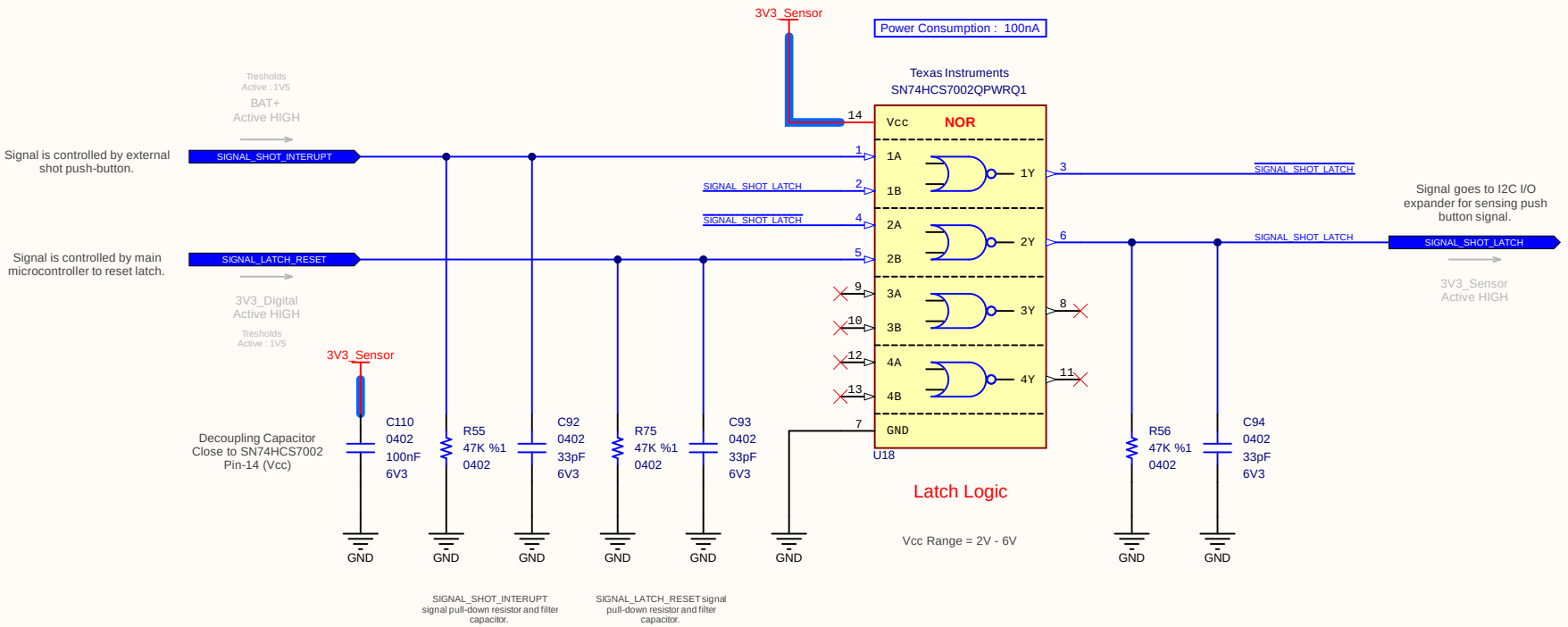

System main timer and wake interupt logic includes manuel shot button interupt for wakeup the system. If user pushes the manuel wakeup button system wakes up and send data.

We want to learn wich interupt wakes up the system. All interupt source are latch up until firmware clear the interupt. But shot button is a push button interupt 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_Interupt) 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		
Size: A4	**Number:** AA005	**Revision:** B106AA	
Date: 3.07.2020	**Time:** 14:59:39	**Sheet** 37 of 37	
File:	C:\Altium Projects\P101CA\Modules\Electronic\[B106AA]\Design Files\Altium\Schematic\Signal Latch Logic.SchDoc		

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