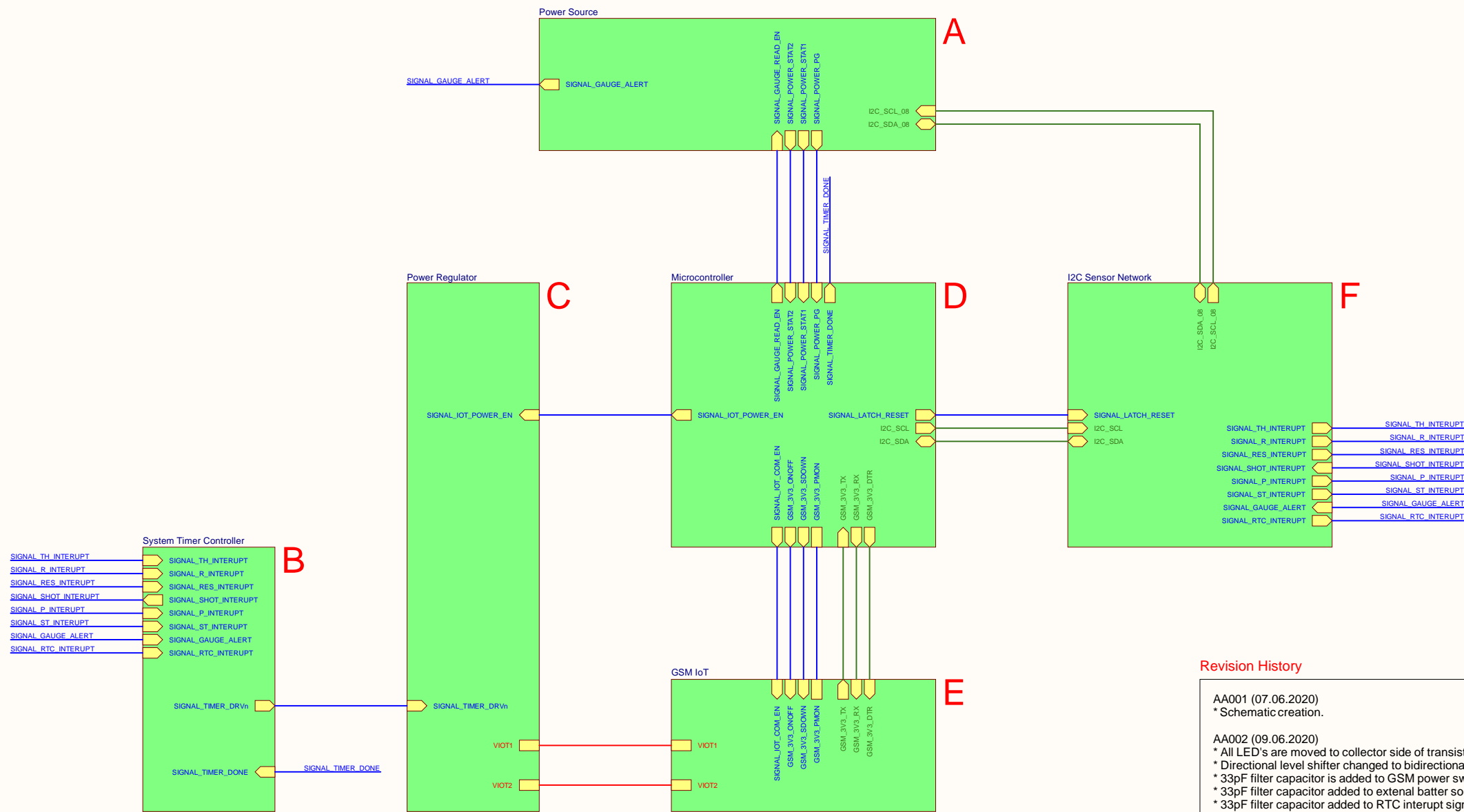


# B106 - Weather Station IoT Module



## Revision History

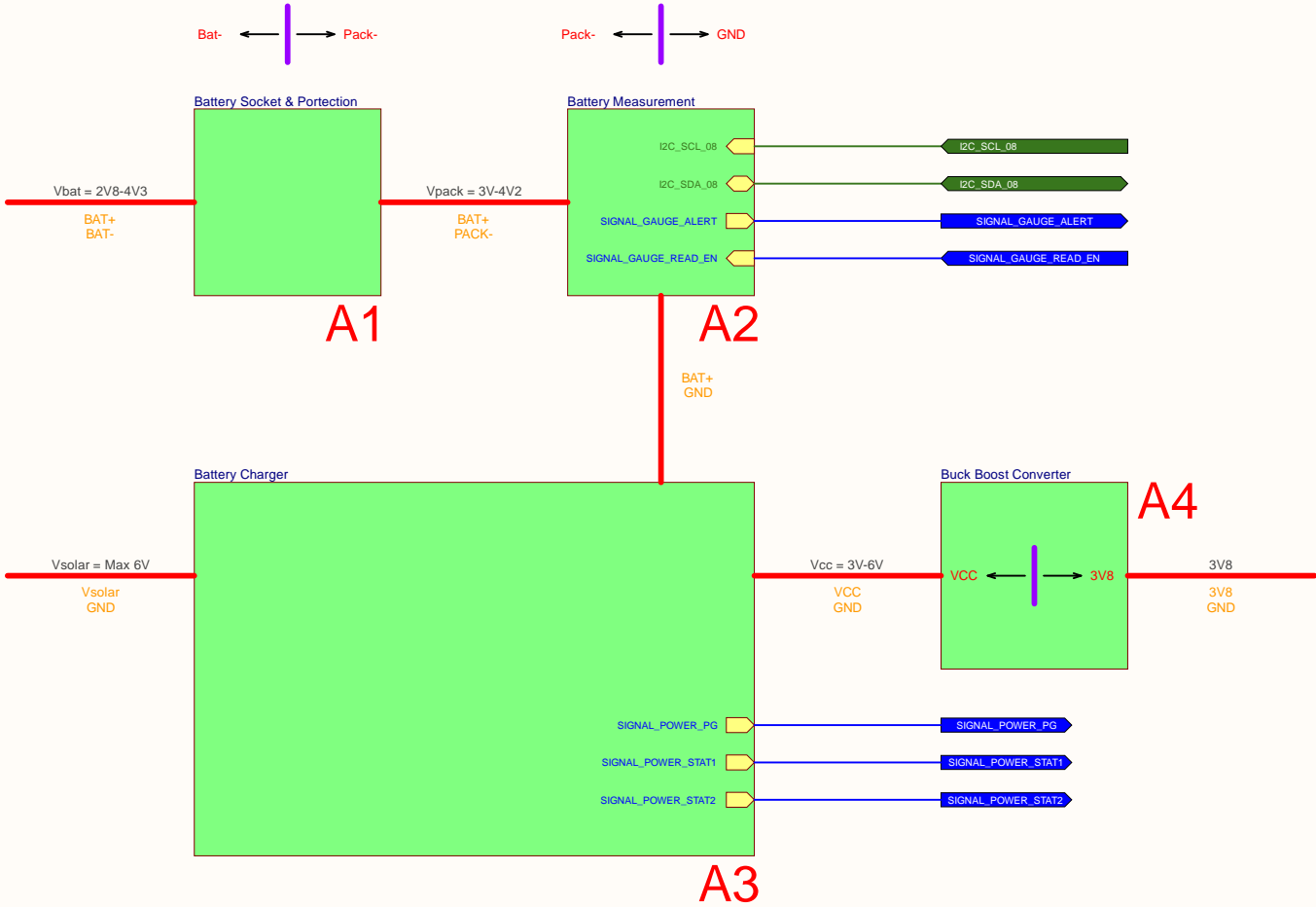
- AA001 (07.06.2020)  
\* Schematic creation.
- AA002 (09.06.2020)  
\* All LED's are moved to collector side of transistors.  
\* Directional level shifter changed to bidirectional level shifter.  
\* 33pF filter capacitor is added to GSM power switch in and out.  
\* 33pF filter capacitor added to 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.

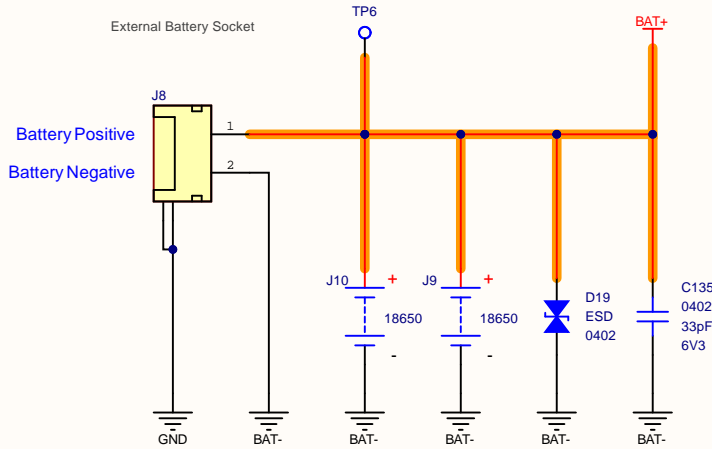


Li-Ion Battery  
2 x 2500 mAh



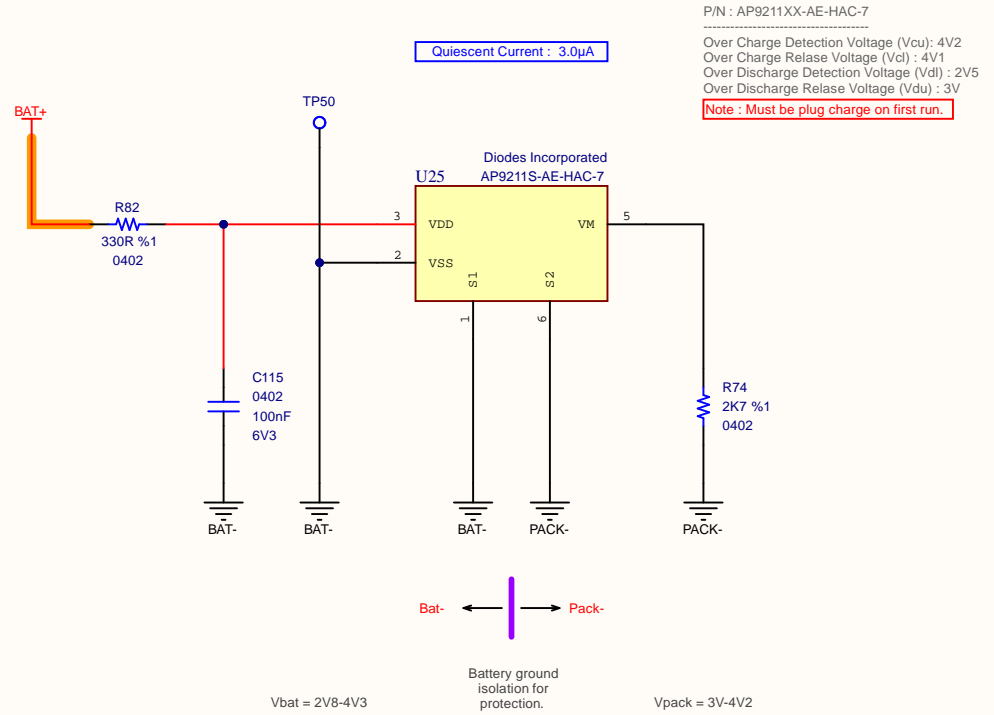
Solar Panel Socket






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

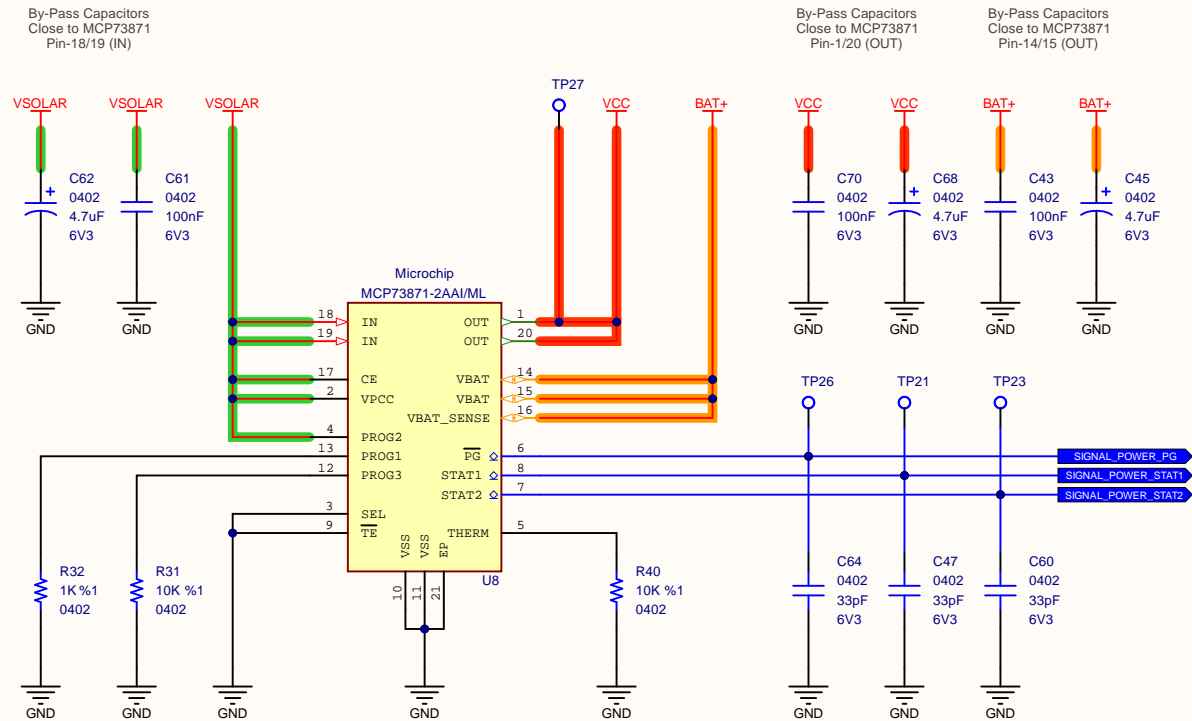
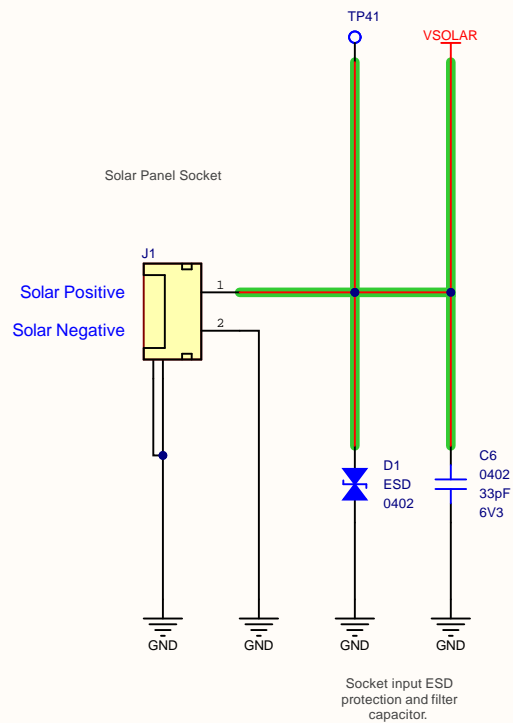
Advice : 2x2500mAh VTC6



A1

Title <b>System Battery Feed and Battery Socket</b>			<b>Ovoo Electronics</b>		
Size: <b>A4</b>	Number: <b>AA005</b>	Revision: <b>B106AA</b>	Küçük İnşaniye Mah. Mızraklı Sok. No:15 Meram / Konya Türkiye		
Date: <b>22.06.2020</b>	Time: <b>04:59:18</b>	Sheet <b>3</b> of <b>37</b>			
File: <b>C:\Altium Projects\STF\P102 - Weather Station\Modules\B106AA\Schematic\Battery Feed and Socket.SchDoc</b>					





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


TE Pin : Enables Safety Timer when active Low.

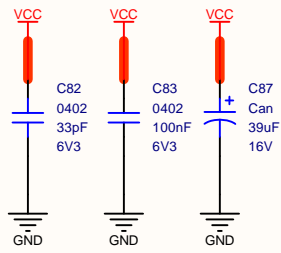
PROG1 Pin : Fast charge current regulation setting with PROG1 = High. Preconditioning set point for both USB port and other type of power source. 1K = 1A charge current limit.

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.

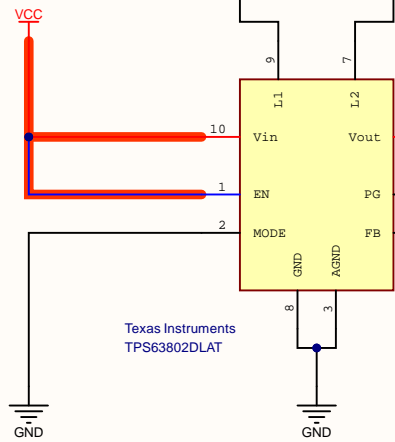
# A3

<b>Title</b> <b>Battery Charger</b>			<b>Ovoo Electronics</b> Küçük İh sanayi Mah. Mızraklı Sok. No:15 Meram / Konya Türkiye		
<b>Size:</b> <b>A4</b>	<b>Number:</b> <b>AA005</b>	<b>Revision:</b> <b>B106AA</b>			
<b>Date:</b> <b>22.06.2020</b>	<b>Time:</b> <b>04:59:18</b>	<b>Sheet</b> <b>5</b> of <b>37</b>			
<b>File:</b> C:\Altium Projects\STP\P102 - Weather Station\Modules\B106AA\Schematic\Battery Charger.SchDoc					



Filter Capacitors  
Close to TPS63802  
Pin-10 (IN)

TPS63802 Vin Range  
1V8 - 5V5

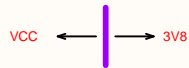


Texas Instruments  
TPS63802DLAT


Coilcraft  
XFL4015-471MEB  
470 nH  
11.2 A  
L1

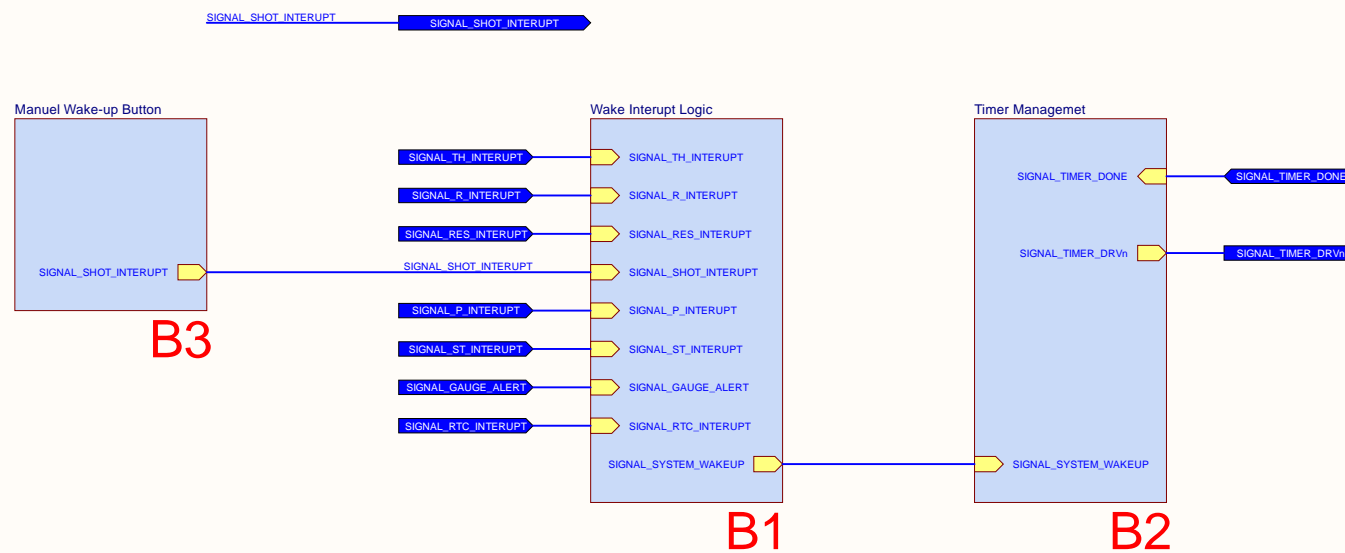
Buck / Boost Converter Properties  
Vout = 3V8  
Vout Actual = 3V82  
Duty Cycle = 30.21%  
Efficiency = 88.8%  
Frequency = 2.52 MHz  
Pout = 7.6 W

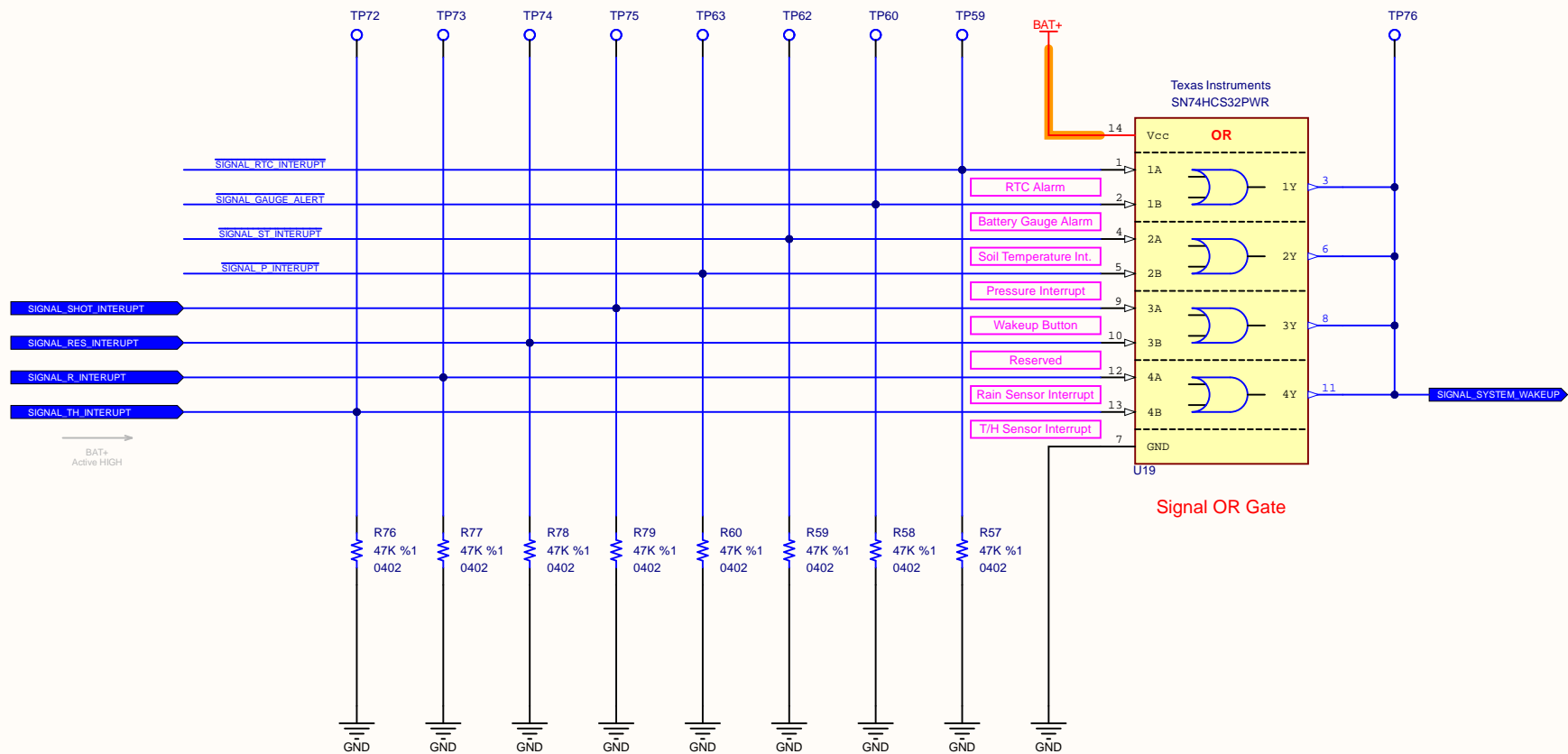
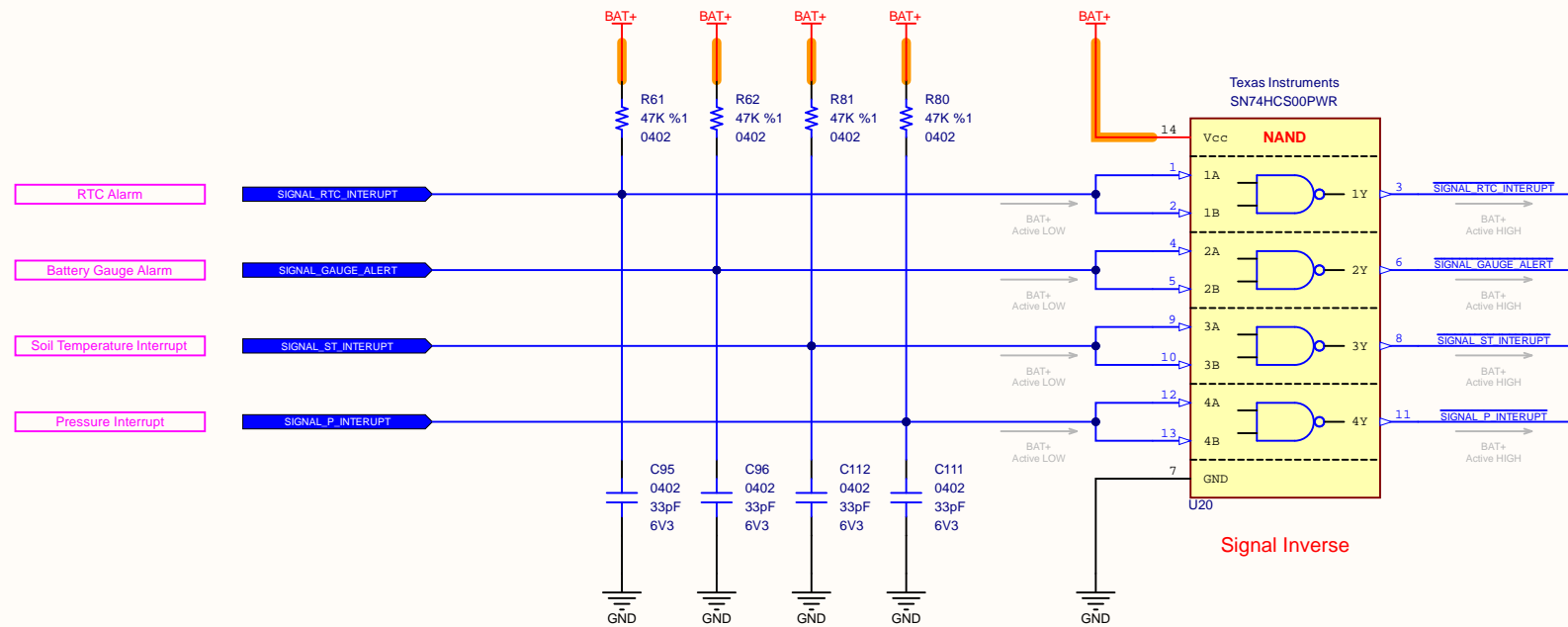
Quiescent Current : 11µA




A4

Title <b>Buck Boost Converter</b>			Ovoo Electronics		
Size: <b>A4</b>	Number: <b>AA005</b>	Revision: <b>B106AA</b>	Küçük İhsaniye Mah. Mıracık Sok. No:15 Meram / Konya Türkiye		
Date: <b>22.06.2020</b>	Time: <b>04:59:18</b>	Sheet <b>6</b> of <b>37</b>	File: <b>C:\Altium Projects\STF\P102 - Weather Station\Modules\B106AA\Schematic\Buck Boost Converter.SchDoc</b>		

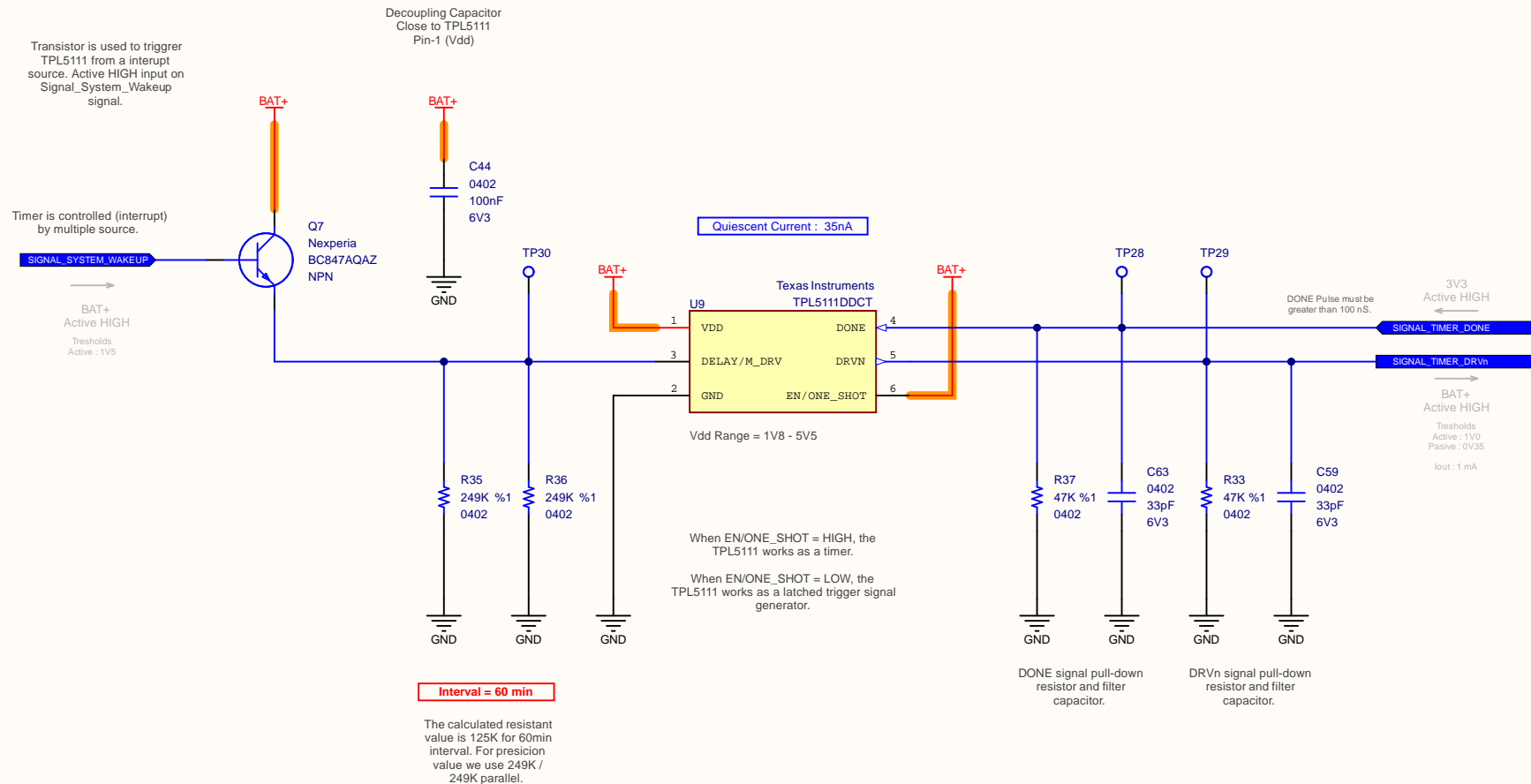




B1

Title <b>System Wake up Resources Logic Gates</b>			Ovoo Electronics		
Size: <b>A3</b>	Number: <b>AA005</b>	Revision: <b>B106AA</b>	Küçükİhsaniye Mah. Mıracık Sok. No:15 Meram / Konya Türkiye		
Date: <b>22.06.2020</b>	Time: <b>04:59:18</b>	Sheet <b>8</b> of <b>37</b>			
File: <b>C:\Altium Projects\STFP102 - Weather Station\Modules\B106AA\Schematic\System Wake Interrupt Logic.SchDoc</b>					

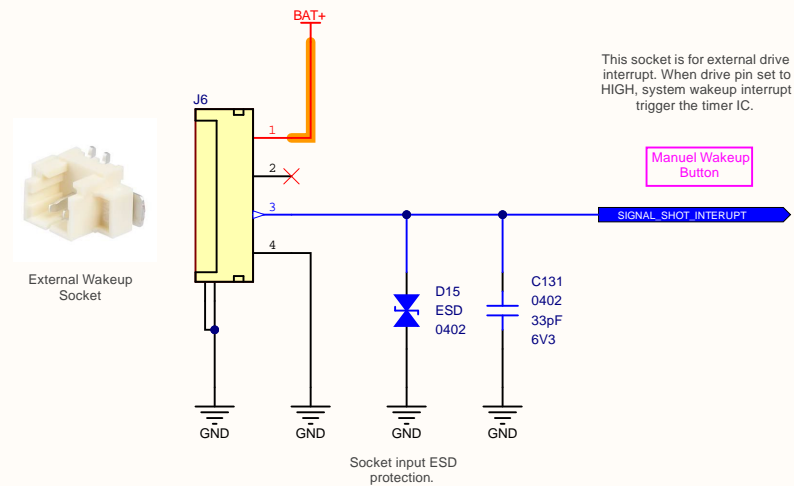





B2

Title <b>Sleep Management (Timer)</b>			<b>Ovoo Electronics</b>	
Size: <b>A4</b>	Number: <b>AA005</b>	Revision: <b>B106AA</b>	Küçük İnşaniye Mah. Mızraklı Sok. No:15 Meram / Konya Türkiye	
Date: <b>22.06.2020</b>	Time: <b>04:59:18</b>	Sheet <b>9</b> of <b>37</b>		
File: <b>C:\Altium Projects\STF\P102 - Weather Station\Modules\B106AA\Schematic\Time Management.SchDoc</b>				

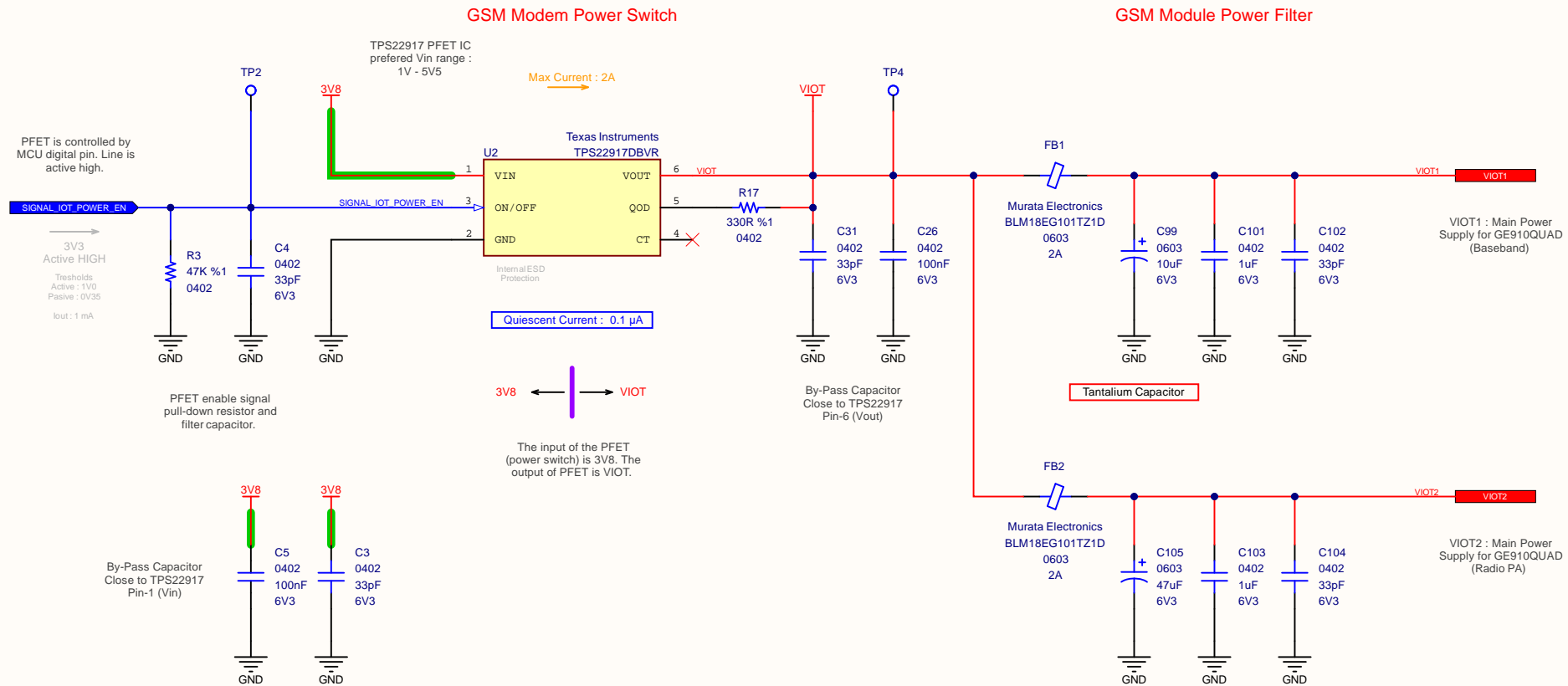
Ovoo




B3

Title Manuel Wake-up Button			Ovoo Electronics		
Size: A4	Number: AA005	Revision: B106AA	Küçük İhsaniye Mah. Mızraklı Sok. No:15 Meram / Konya Türkiye		
Date: 22.06.2020	Time: 04:59:18	Sheet 10 of 37			
File: C:\Altium Projects\STF\IP102 - Weather Station\Modules\B106AA\Schematic\Manuel Wake-up and Latch.SchDoc					

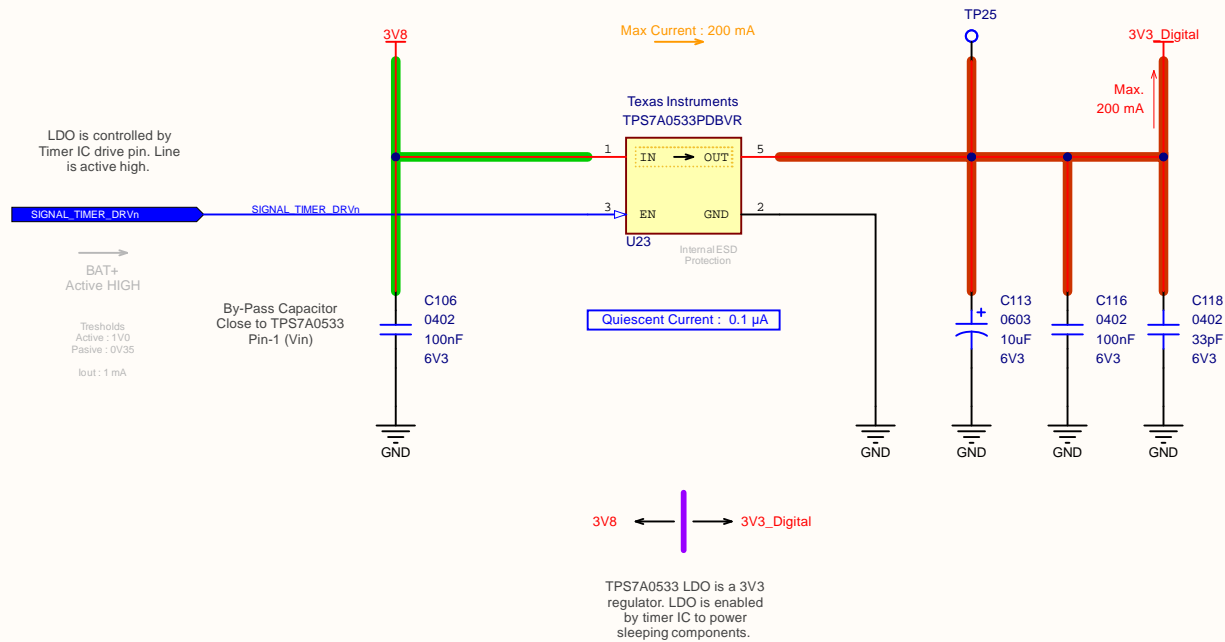




C1

Title <b>GSM Module Power On/Off Switch IC &amp; IoT Power Filter</b>				<b>Ovoo Electronics</b>		
Size: <b>A4</b>		Number: <b>AA005</b>	Revision: <b>B106AA</b>	Küçük İhsaniye Mah. Mızraklı Sok. No:15 Meram / Konya Türkiye		
Date: <b>22.06.2020</b>		Time: <b>04:59:18</b>				
File: <b>C:\Altium Projects\STF\P102 - Weather Station\Modules\B106AA\Schematic\GSM Power On-Off Switch IC.SchDoc</b>		Sheet <b>12</b> of <b>37</b>				

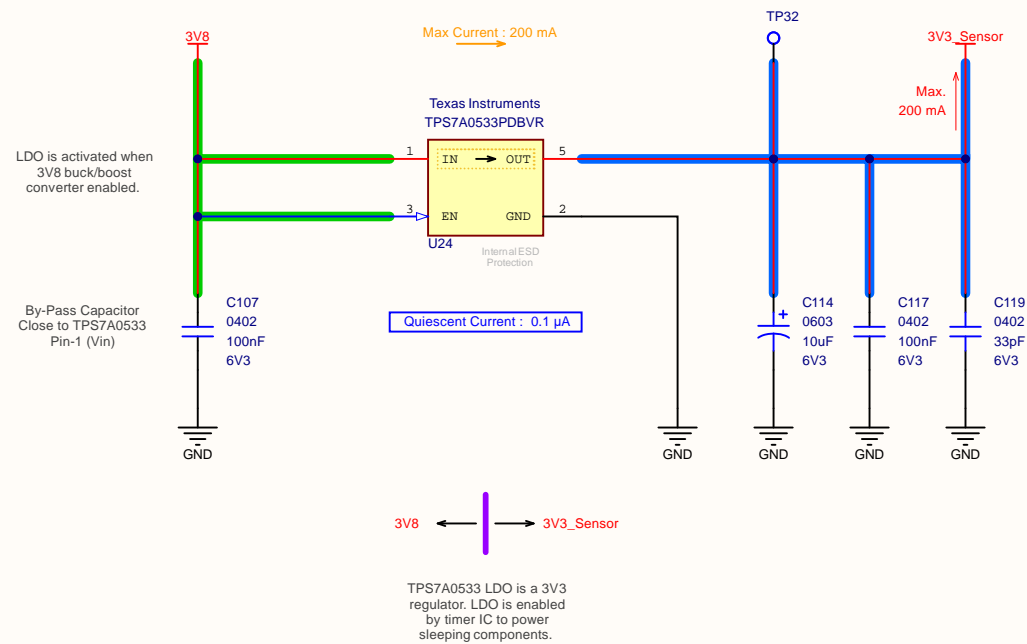
ovoo



C2

Title 3V3 LDO Voltage Regulator (Sleeping)			Ovoo Electronics	
Size: A4	Number: AA005	Revision: B106AA	<div>Küçük İhsaniye Mah. Mızraklı Sok. No:15 Meram / Konya Türkiye</div> <div>ovoo</div>	
Date: 22.06.2020	Time: 04:59:18	Sheet 13 of 37		
File: C:\Altium Projects\STF\P102 - Weather Station\Modules\B106AA\Schematic\3V3 LDO Regulator (Sleeping).SchDoc				

ovoo



LDO is activated when  
3V8 buck/boost  
converter enabled.

By-Pass Capacitor  
Close to TPS7A0533  
Pin-1 (Vin)

C107  
0402  
100nF  
6V3

Texas Instruments  
TPS7A0533PDBVR

U24 Internal ES Protection

Quiescent Current : 0.1  $\mu$ A

TP32

### 3V3\_Sensor

Max.  
200 mA

C114  
0603  
10uF  
6V3


C117  
0402  
100nF  
6V3

C119  
0402  
33pF  
6V3

3V8 ← → 3V3\_Sensor

TPS7A0533 LDO is a 3V3 regulator. LDO is enabled by timer IC to power sleeping components.

C3

<b>Title</b> 3V3 LDO Voltage Regulator (NonSleeping)			<b>Ovoo Electronics</b> Küçük İhsanîye Mah. Mızraklı Sok. No:15 Meram / Konya Türkiye	
<b>Size:</b> A4	<b>Number:</b> AA005	<b>Revision:</b> B106AA		
<b>Date:</b> 22.06.2020	<b>Time:</b> 04:59:18	<b>Sheet</b> 14    of    37		
<b>File:</b> C:\Altium Projects\STP\102 - Weather Station\Modules\B106AA\Schematic\3V3 LDO Regulator (NonSleeping).SchDoc				

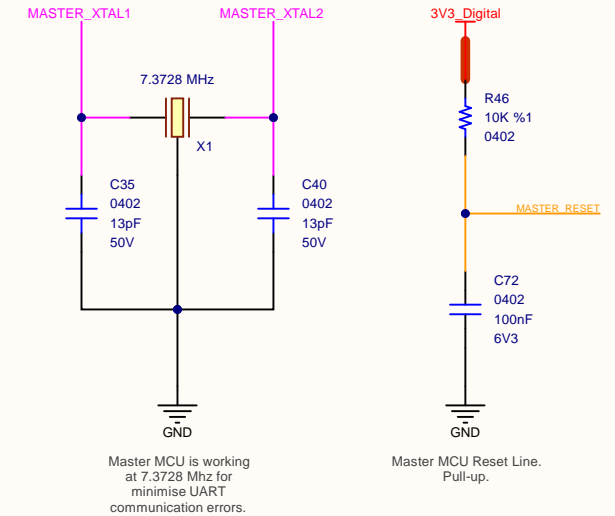
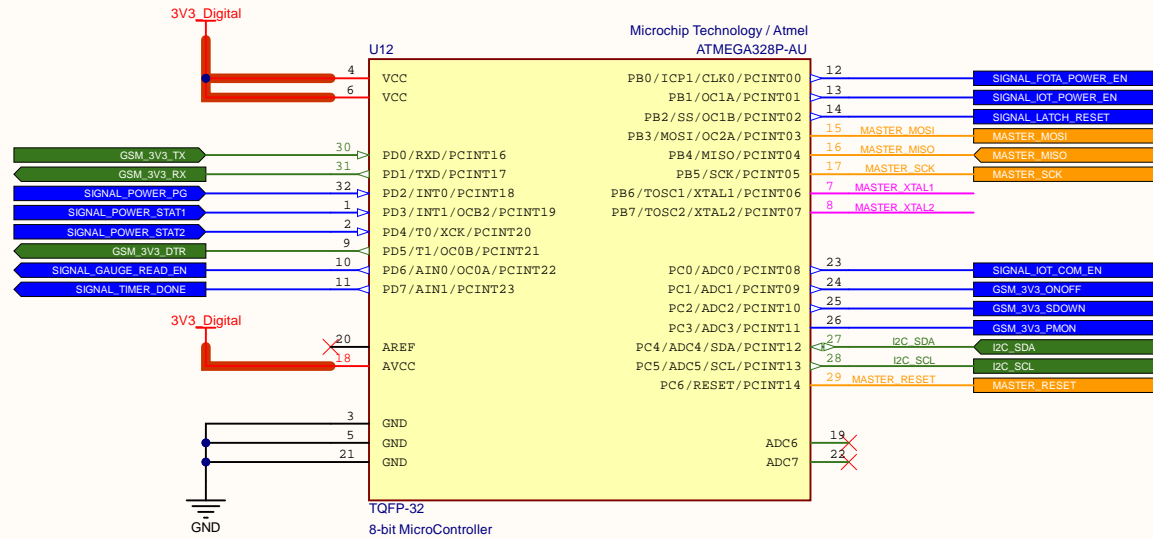
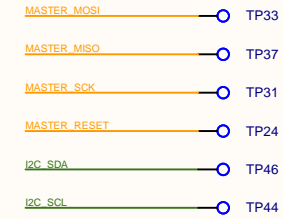
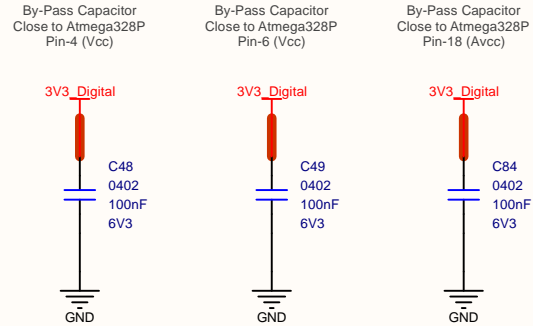
<b>Size:</b> A4	<b>Number:</b> AA005	<b>Revision:</b> B106AA	Mızraklı Sok. No:15 Meram / Konya Türkiye	
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Date: 22.06.2020	Time: 04:59:18	Sheet 14 of 37
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File: C:\Altium Projects\STF\P102 - Weather Station\Modules\B106AA\Schematic\3V3 LDO Regulator (NonSleeping).SchDoc



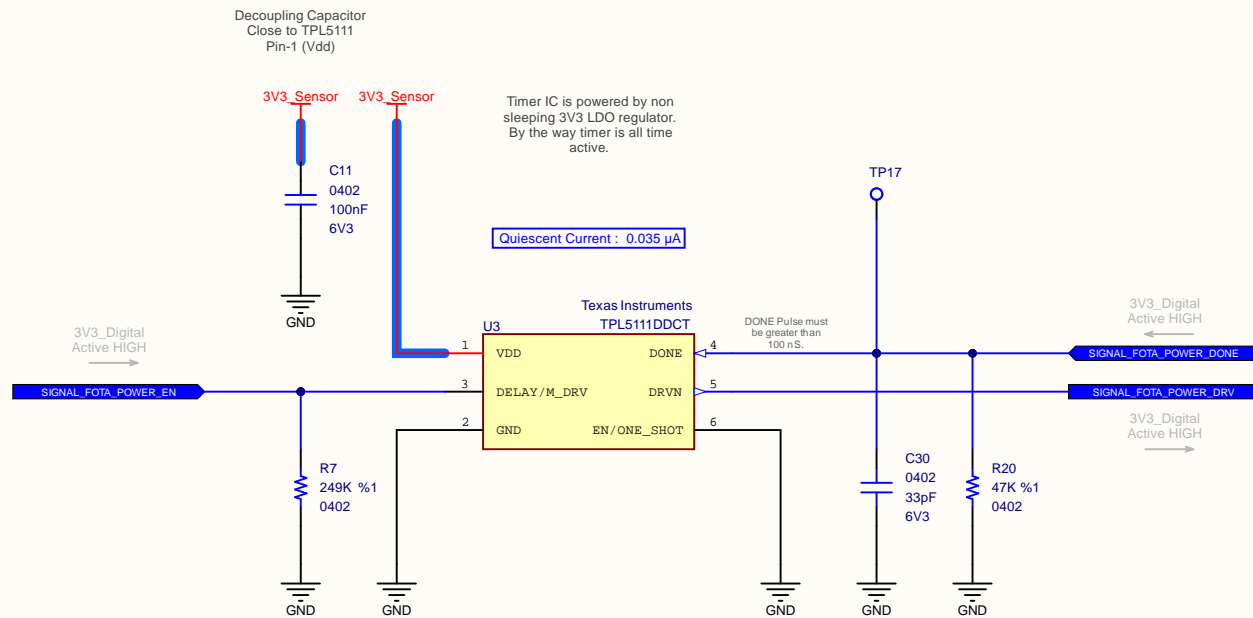
One is master microcontroller for sensor measurement, handling data and communicate with GSM modem (UART). We use ATMEGA328P-AU as master MCU with 7.3728 Mhz external crystal and 3V3 voltage level.



# D1

<b>Title</b> <b>Master MicroController</b>				<b>Ovoo Electronics</b> Küçükhanıyeh Mah. Mızraklı Sok. No:15 Meram / Konya Türkiye		
<b>Size:</b> <b>A4</b>	<b>Number:</b> <b>AA005</b>	<b>Revision:</b> <b>B106AA</b>				
<b>Date:</b> <b>22.06.2020</b>	<b>Time:</b> <b>04:59:18</b>	<b>Sheet</b> <b>16</b> <b>of</b> <b>37</b>				
<b>File:</b> <b>C:\Altium Projects\STP\P102 - Weather Station\Modules\B106AA\Schematic\Master MicroController.SchDoc</b>						






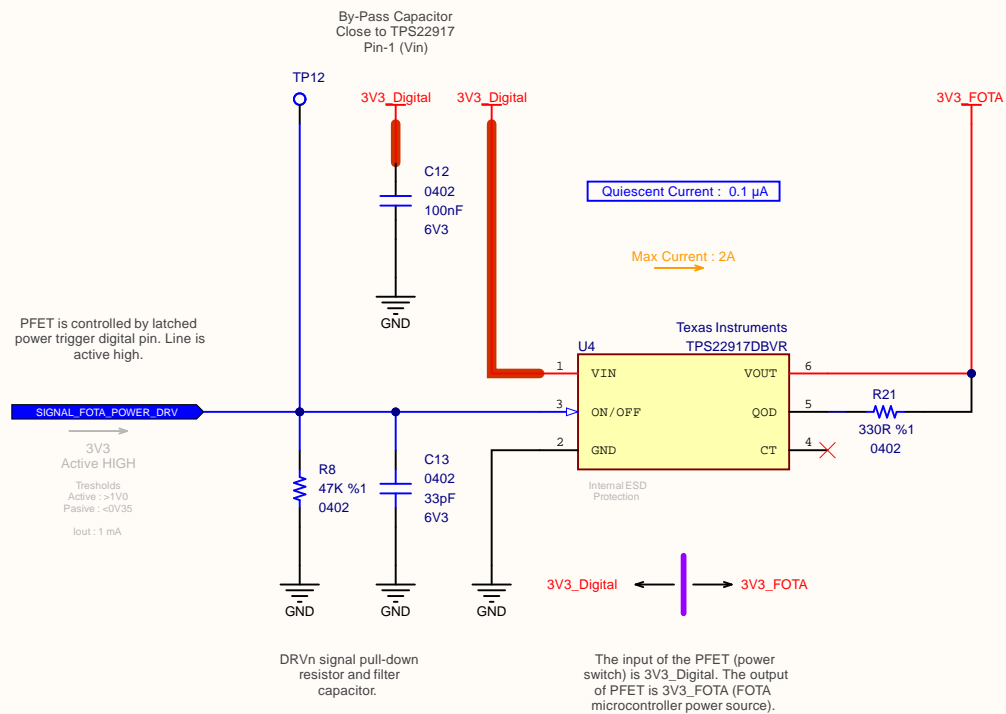
TPL5111 is used for powering FOTA microcontroller. In this mode timer is work on one-shot mode. So the time set resistor is not necessary.

When EN/ONE\_SHOT = HIGH, the TPL5111 works as a timer.


When EN/ONE\_SHOT = LOW, the TPL5111 works as a latched trigger signal generator.

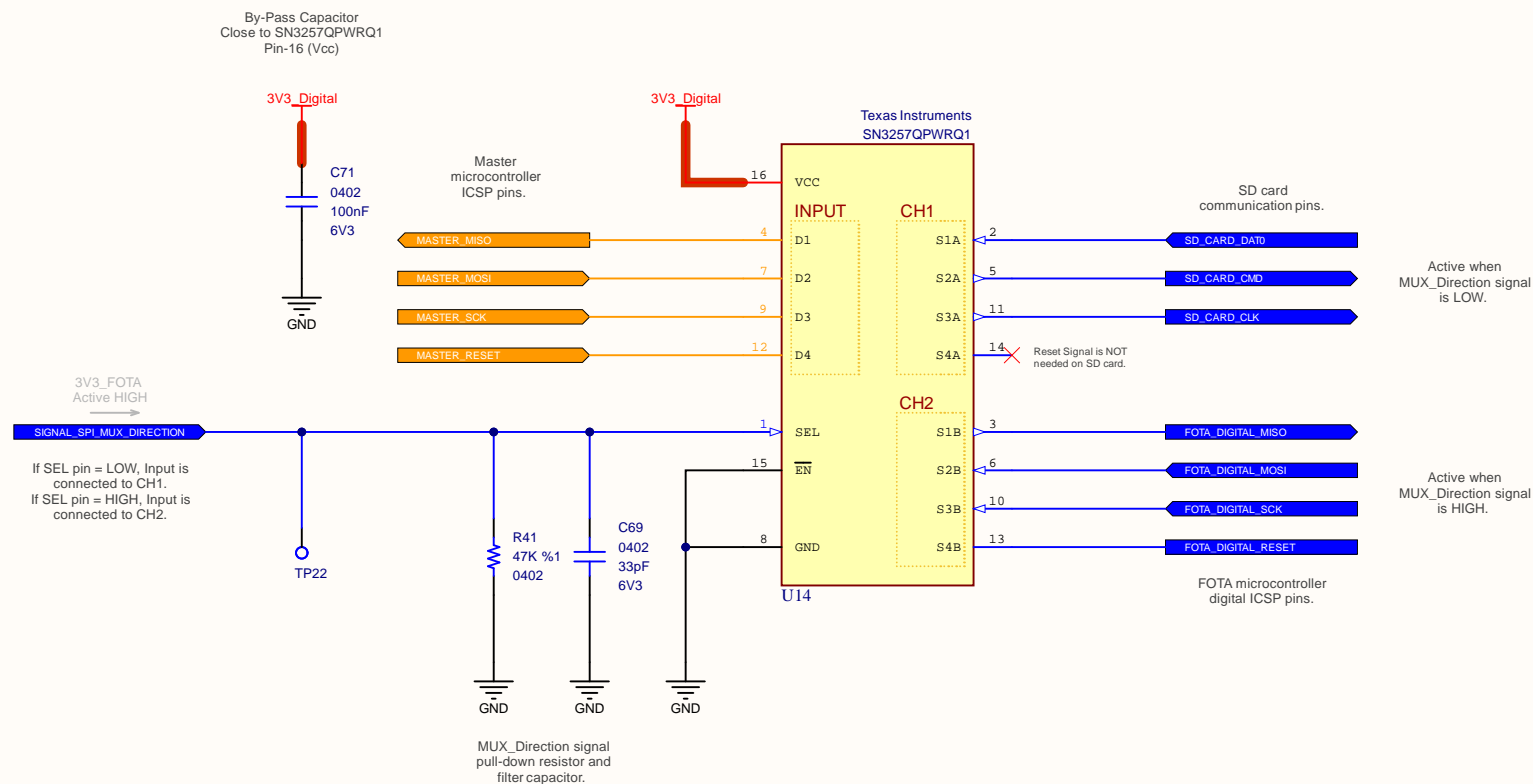
D2

Title <b>FOTA MicroController Latched Power Trigger</b>			Ovoo Electronics		
Size: <b>A4</b>	Number: <b>AA005</b>	Revision: <b>B106AA</b>	Küçük İhsaniye Mah. Mızraklı Sok. No:15 Meram / Konya Türkiye		
Date: <b>22.06.2020</b>	Time: <b>04:59:19</b>	Sheet <b>17</b> of <b>37</b>			
File: <b>C:\Altium Projects\STF\P102 - Weather Station\Modules\B106AA\Schematic\FOTA MicroController Power Trigger.SchDoc</b>					




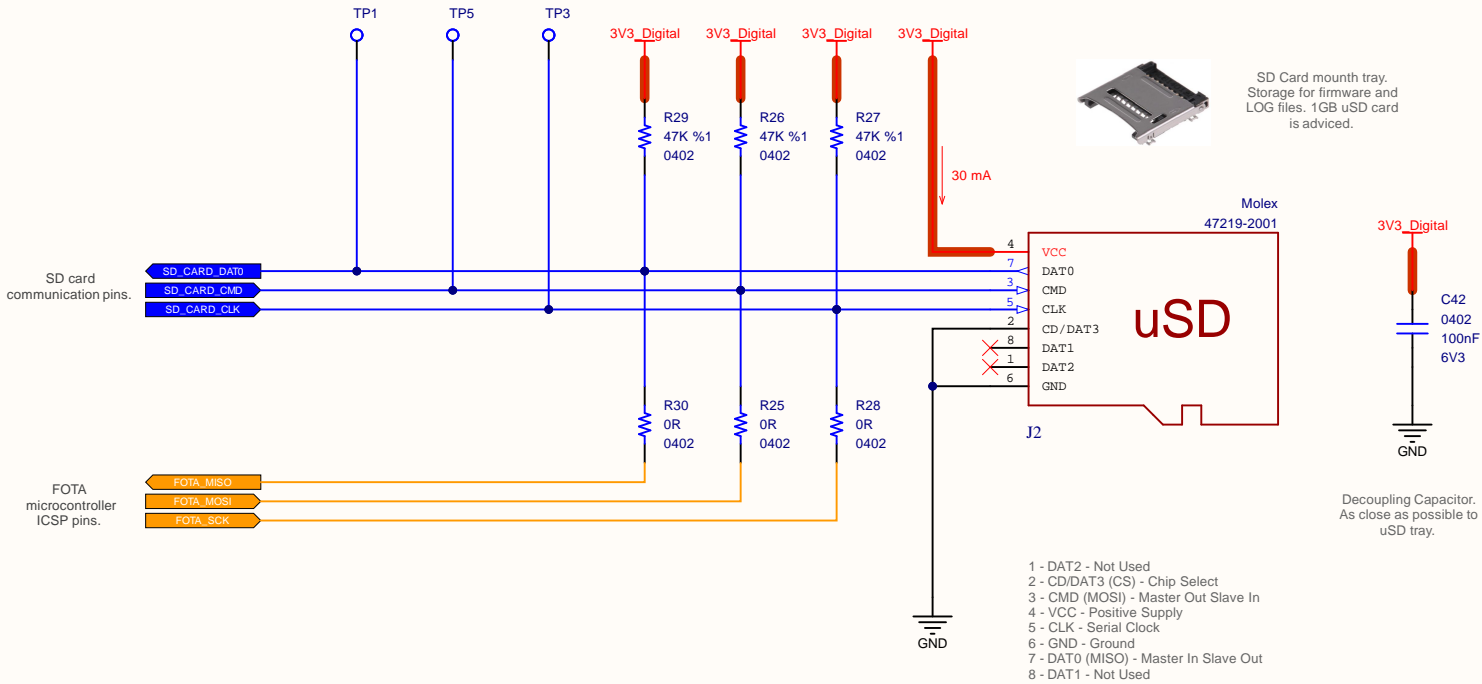
D3

Title FOTA MicroController Power Switch			Ovoo Electronics Küçük İhsaniye Mah. Mızraklı Sok. No:15 Meram / Konya Türkiye	
Size: A4	Number: AA005	Revision: B106AA		
Date: 22.06.2020	Time: 04:59:19	Sheet 18 of 37	File: C:\Altium Projects\STFP102 - Weather Station\Modules\B106AA\Schematic\FOTA MicroController Power Switch.SchDoc	




D4

Title SD/ICSP Selection Multiplexer			Ovoo Electronics Küçük İhsaniye Mah. Mızraklı Sok. No:15 Meram / Konya Türkiye	
Size: A4	Number: AA005	Revision: B106AA		
Date: 22.06.2020	Time: 04:59:19	Sheet 19 of 37		
File: C:\Altium Projects\STF\IP102 - Weather Station\Modules\B106AA\Schematic\SD Card Selection Multiplexer.SchDoc				



D5

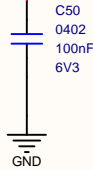
Title <b>Micro SD Card Module</b>			Ovoo Electronics		
Size: <b>A4</b>	Number: <b>AA005</b>	Revision: <b>B106AA</b>	Küçük İnşaniye Mah. Mıracık Sok. No:15 Meram / Konya Türkiye		
Date: <b>22.06.2020</b>	Time: <b>04:59:19</b>	Sheet <b>20</b> of <b>37</b>			
File: <b>C:\Altium Projects\STFP102 - Weather Station\Modules\B106AA\Schematic\SD Card Module.SchDoc</b>					

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.

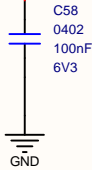
By-Pass Capacitor  
Close to Atmega328P  
Pin-4 (Vcc)

3V3\_FOTA



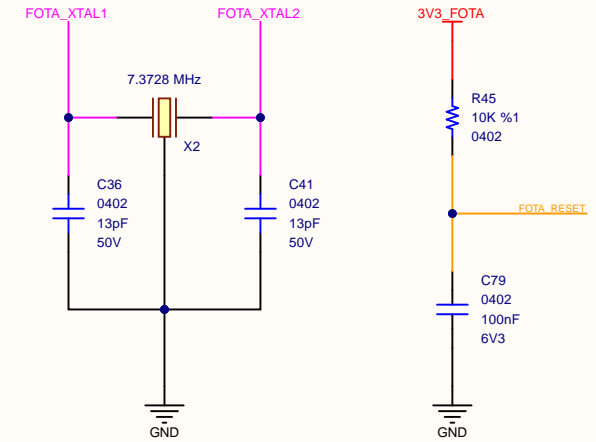
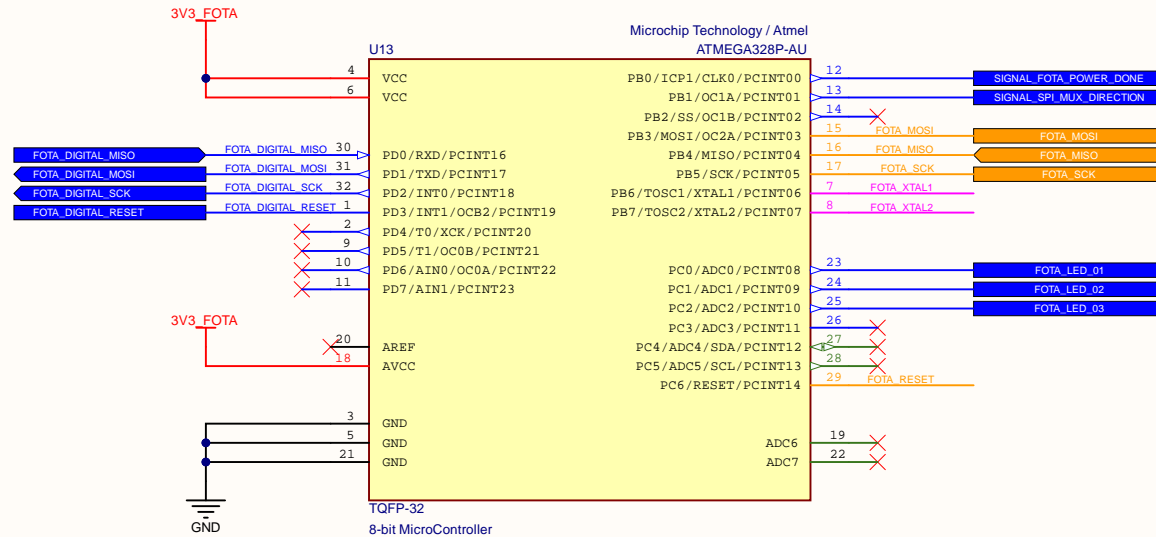
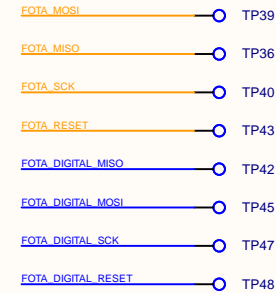
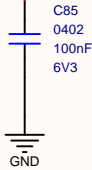
By-Pass Capacitor  
Close to Atmega328P  
Pin-6 (Vcc)

3V3\_FOTA



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


3V3\_FOTA

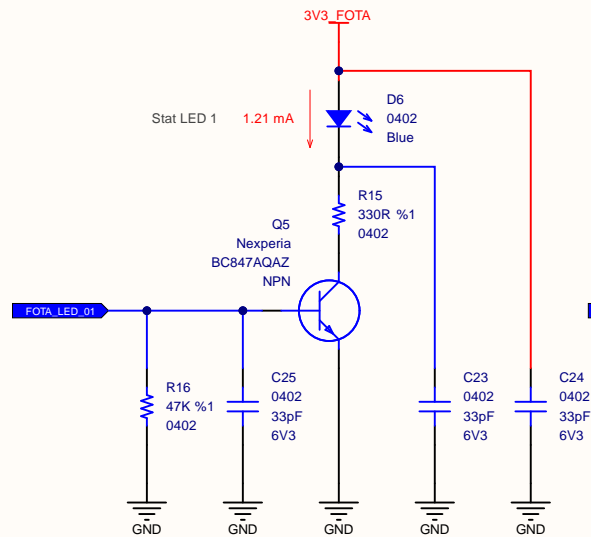


FOTA MCU is working at 7.3728 Mhz.

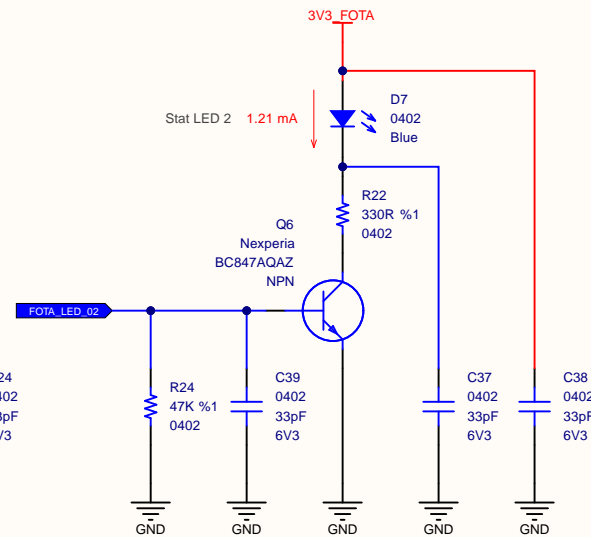
FOTA MCU Reset Line. Pull-up.

D6

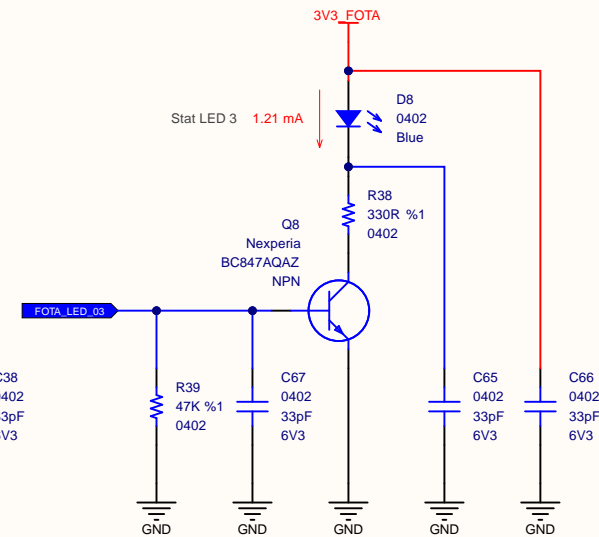
Title <b>FOTA MicroController</b>			<b>Ovoo Electronics</b> Küçük İhsaniye Mah. Mıracılı Sok. No:15 Meram / Konya Türkiye		
Size: <b>A4</b>	Number: <b>AA005</b>	Revision: <b>B106AA</b>			
Date: <b>22.06.2020</b>	Time: <b>04:59:19</b>	Sheet <b>21</b> of <b>37</b>			
File: <b>C:\Altium Projects\STF\P102 - Weather Station\Modules\B106AA\Schematic\FOTA MicroController.SchDoc</b>					



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




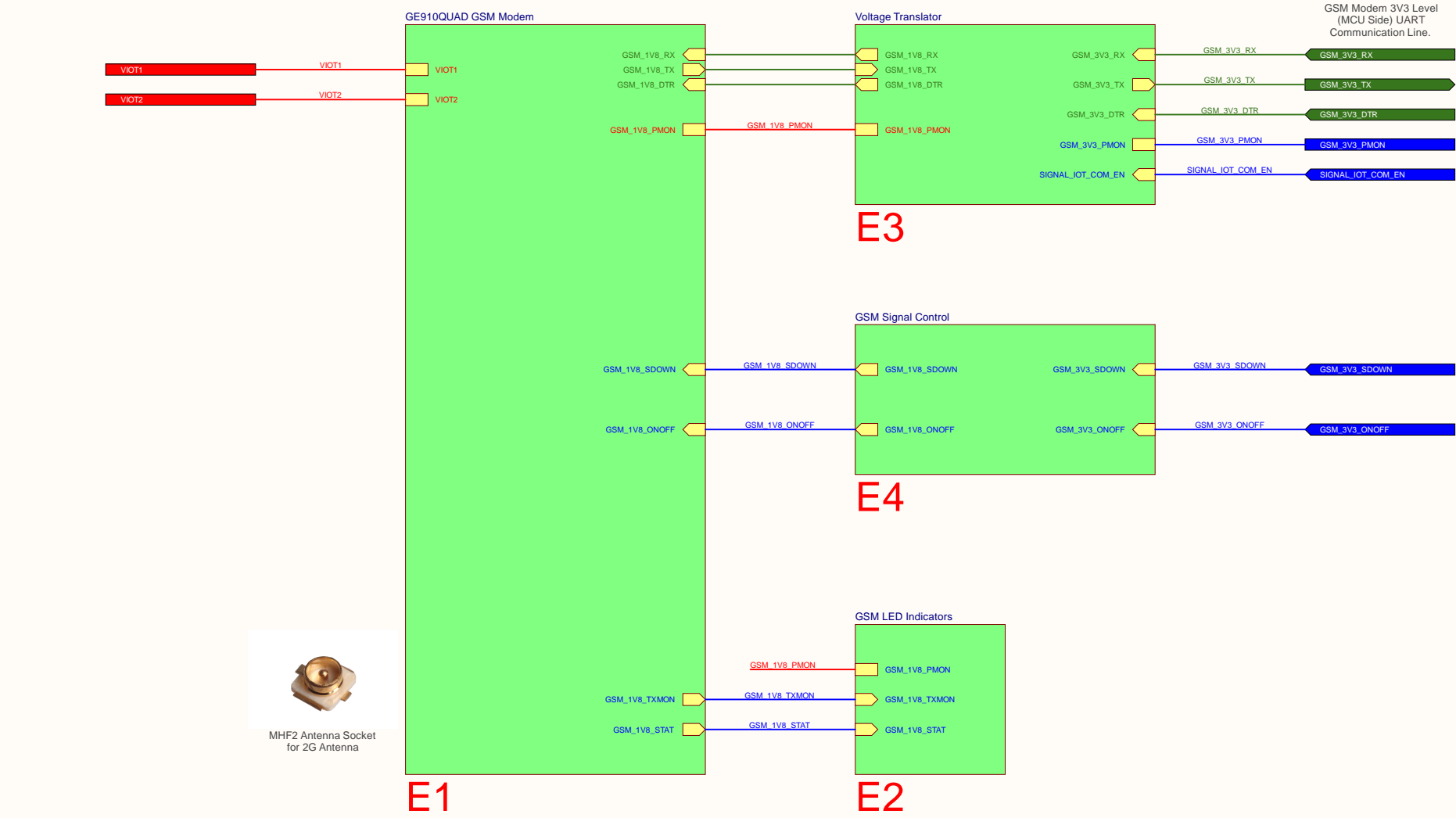
Noise filter capacitors. Place as close as possible to LED.



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

D7

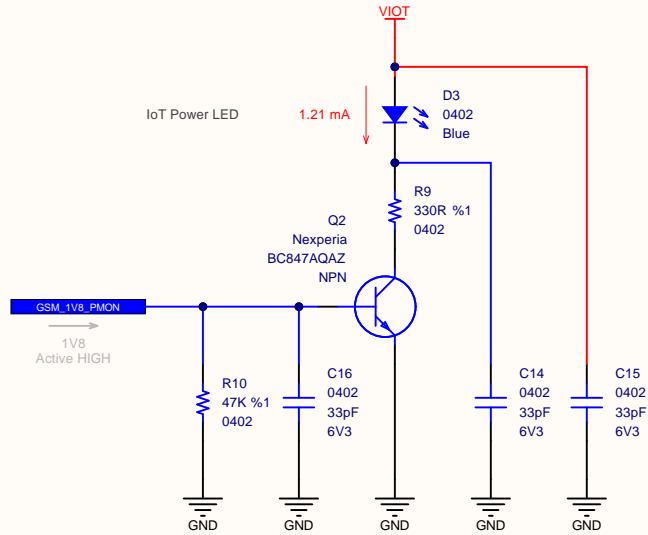
Title <b>FOTA Microcontroller Status LED's</b>			<b>Ovoo Electronics</b>  Küçük İhsaniye Mah. Mızraklı Sok. No:15 Meram / Konya Türkiye	
Size: <b>A4</b>	Number: <b>AA005</b>	Revision: <b>B106AA</b>		
Date: <b>22.06.2020</b>	Time: <b>04:59:19</b>	Sheet <b>22</b> of <b>37</b>		
File: <b>C:\Altium Projects\STFP102 - Weather Station\Modules\B106AA\Schematic\FOTA MicroController Status LEDs.SchDoc</b>				





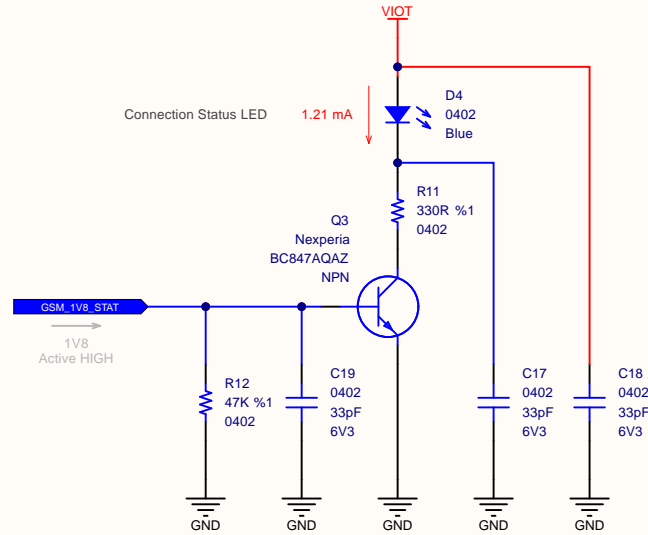


### GSM Power Monitor LED



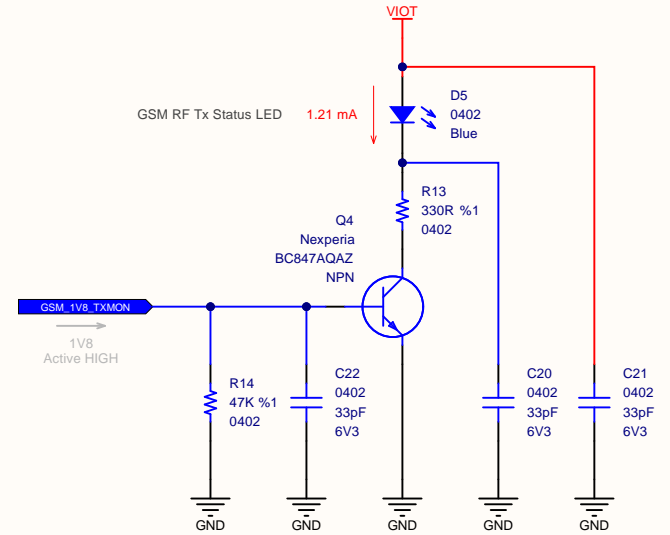
LED activates when GSM modem powered. This LED is a active HIGH indicator.

### GSM Connection Status 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



LED activates when GSM modem sending data to internet.

E2

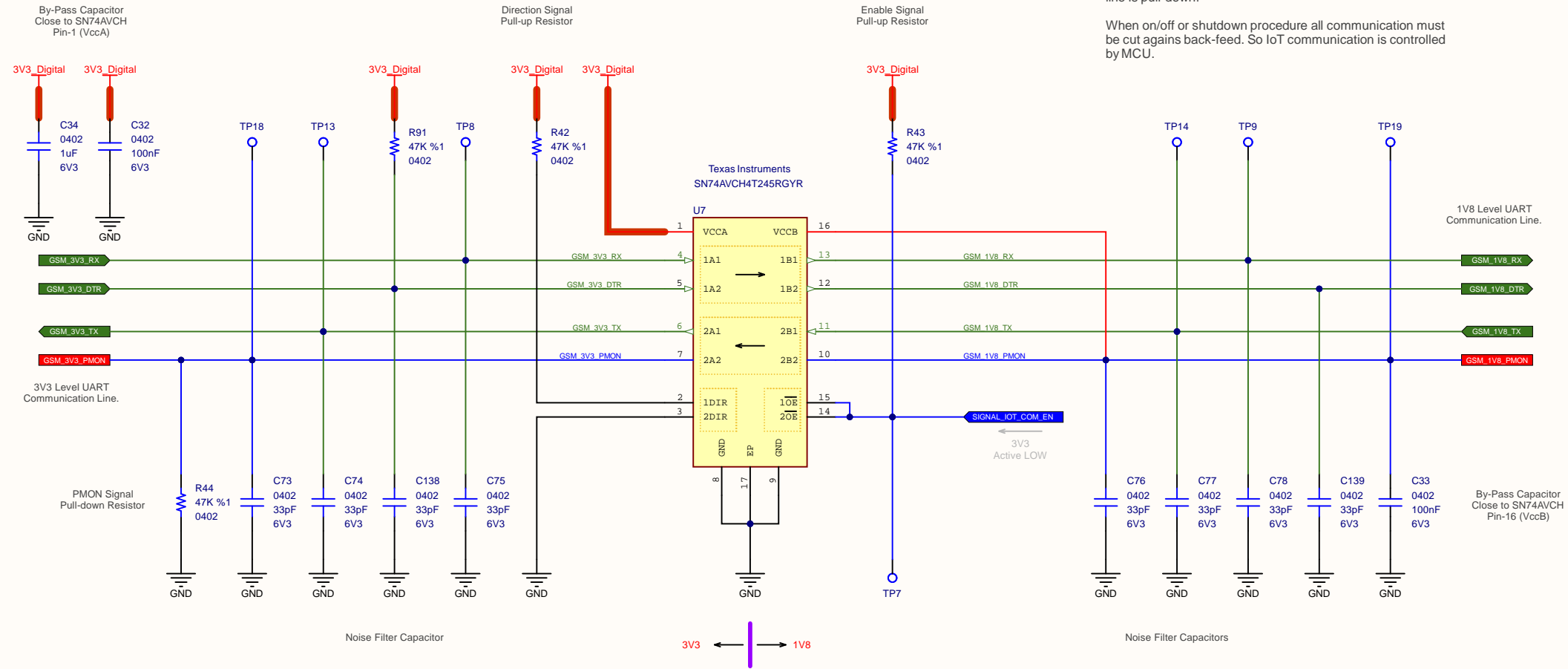
Title <b>GSM Modem Signal Indicator LED's</b>			<b>Ovoo Electronics</b>  Küçük İnşaniye Mah. Mıracık Sok. No:15 Meram / Konya Türkiye	
Size: <b>A4</b>	Number: <b>AA005</b>	Revision: <b>B106AA</b>		
Date: <b>22.06.2020</b>	Time: <b>04:59:19</b>	Sheet <b>25</b> of <b>37</b>		
File: <b>C:\Altium Projects\STFIP102 - Weather Station\Modules\B106AA\Schematic\GSM LED Indicators.SchDoc</b>				

BiDirectional Level Shifter

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

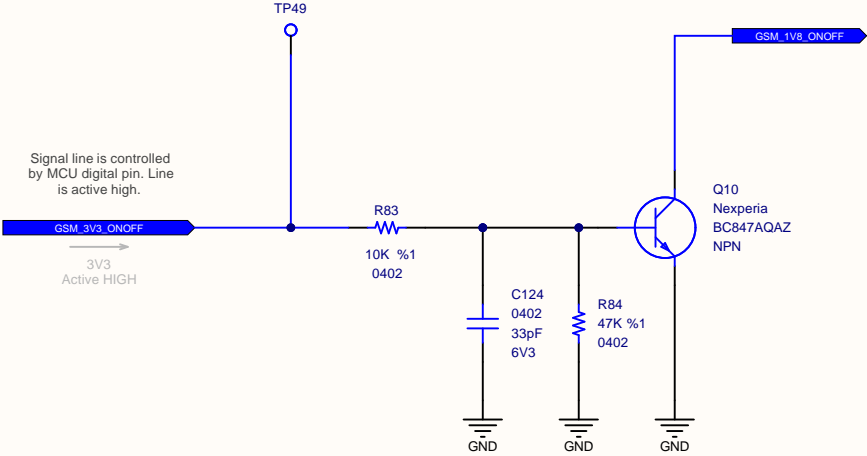
Power Monitor pin is a input pin at MCU side (active HIGH) so line is pull-down.

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

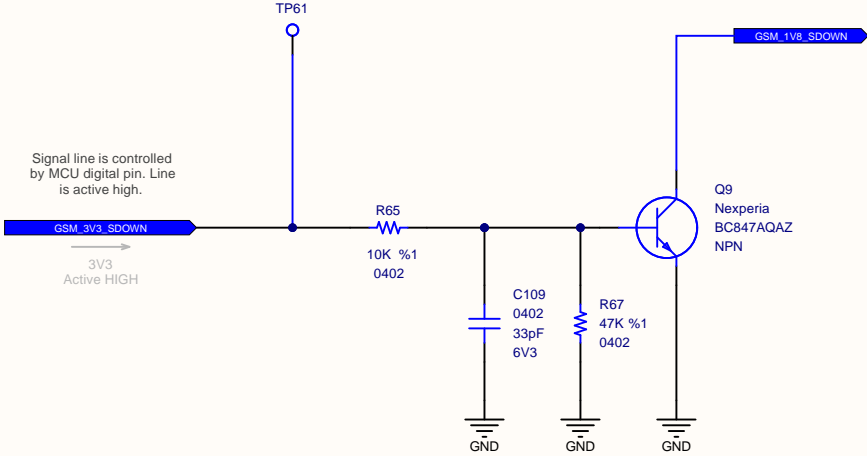


E3

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	
Size: A4	Number: AA005	Revision: B106AA	Küçük İhsaniye Mah. Mızraklı Sok. No:15 Meram / Konya Türkiye	
Date: 22.06.2020	Time: 04:59:19	Sheet 27 of 37		
File: C:\Altium Projects\STF\P102 - Weather Station\Modules\B106AA\Schematic\GSM Signal Control.SchDoc				



A

A

B

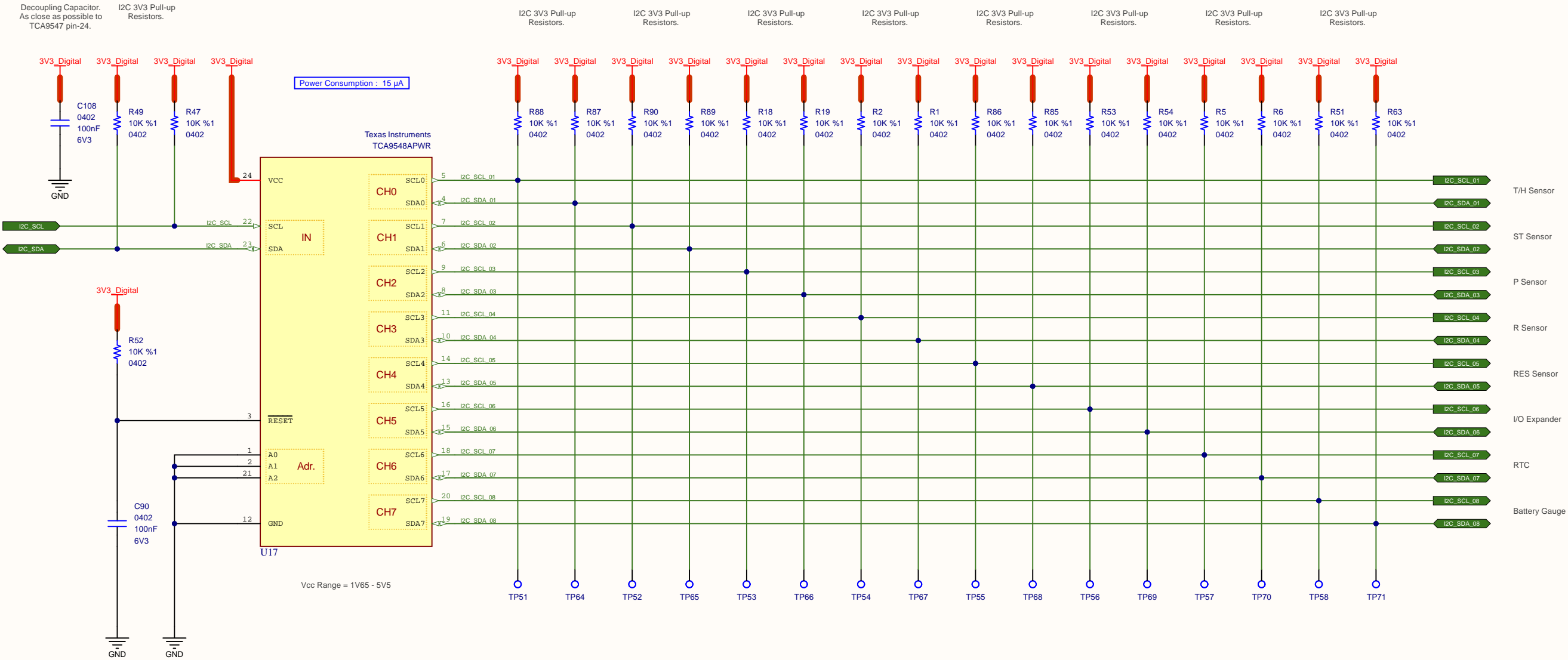
B

C


C

D

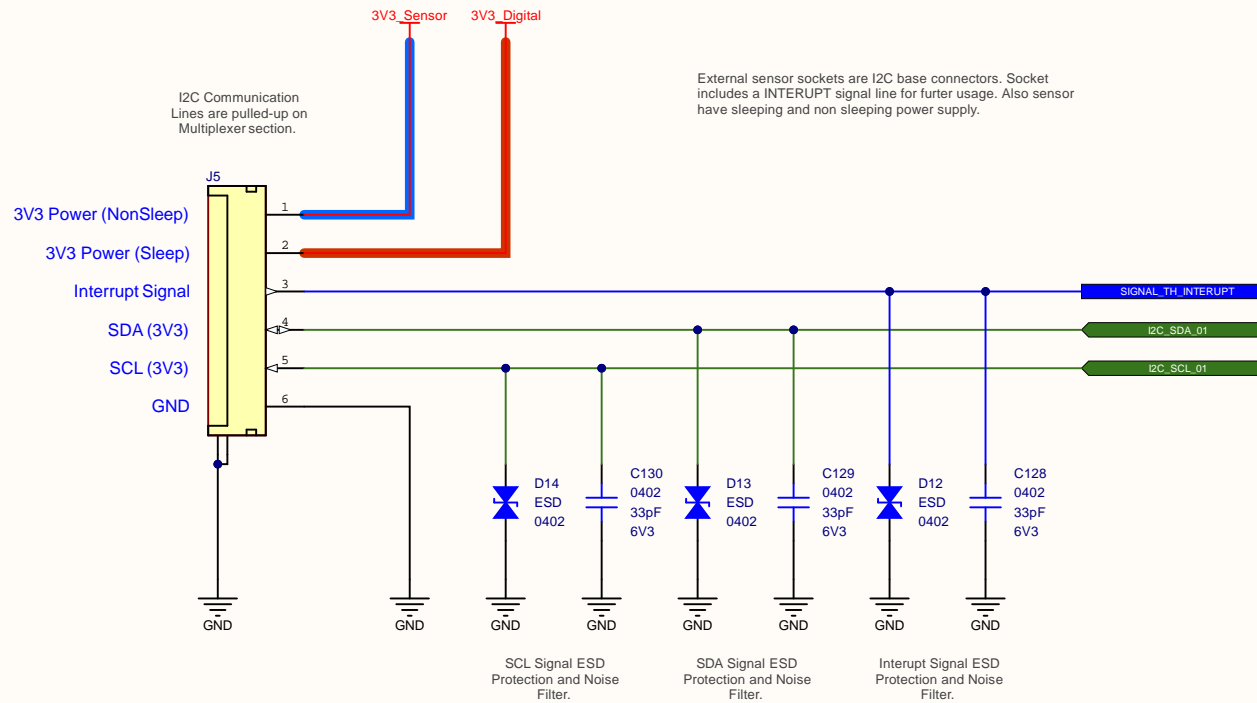
D




F1

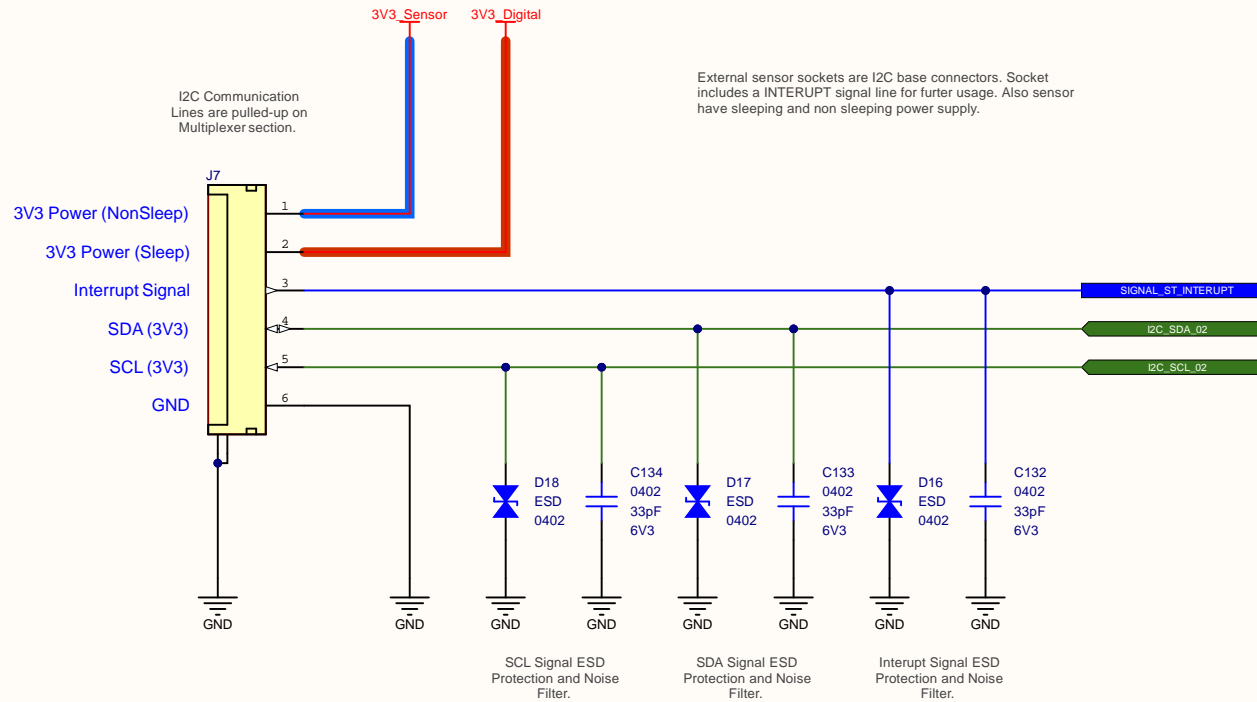
Title I2C 8 Channel Multiplexer			Ovoo Electronics	
Size: A3	Number: AA005	Revision: B106AA	Küçükİhsaniye Mah. Mıracık Sok. No:15 Meram / Konya Türkiye	
Date: 22.06.2020	Time: 04:59:20	Sheet 29 of 37		
File: C:\Altium Projects\STFP102 - Weather Station\Modules\B106AA\Schematic\I2C Multiplexer.SchDoc				






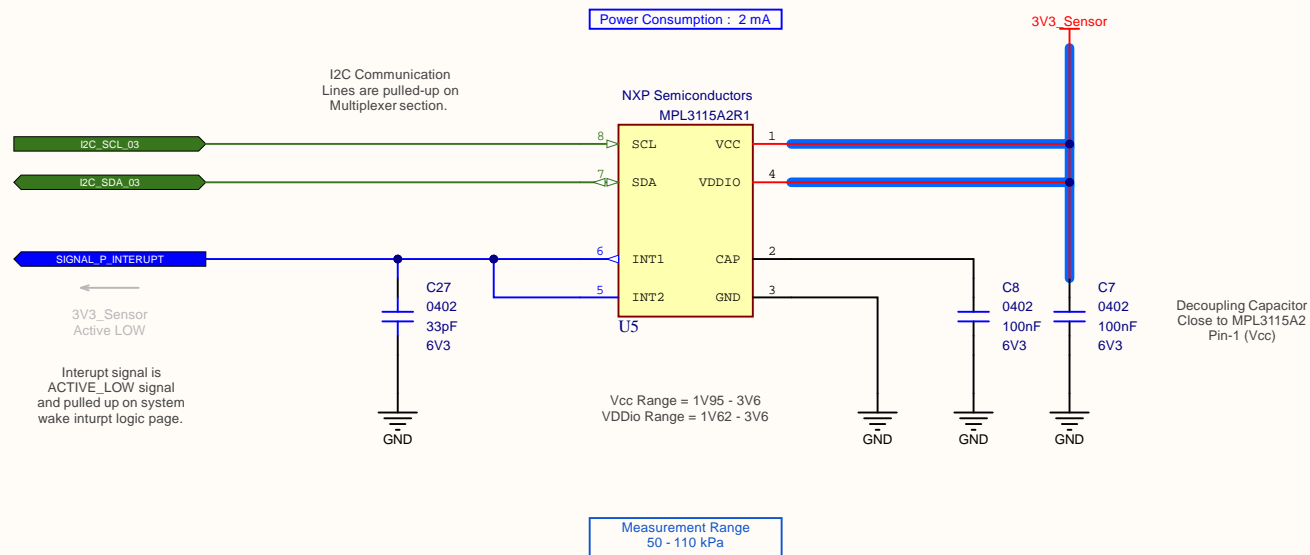
F2

Title <b>Air Temperature &amp; Air Humidity Sensor Output Socket</b>			<b>Ovoo Electronics</b>		
Size: <b>A4</b>	Number: <b>AA005</b>	Revision: <b>B106AA</b>	Küçük İhsaniye Mah. Mızraklı Sok. No:15 Meram / Konya Türkiye		
Date: <b>22.06.2020</b>	Time: <b>04:59:20</b>	Sheet <b>30</b> of <b>37</b>			
File: <b>C:\Altium Projects\STF\P102 - Weather Station\Modules\B106AA\Schematic\TH Sensor Output Socket.SchDoc</b>					




F3

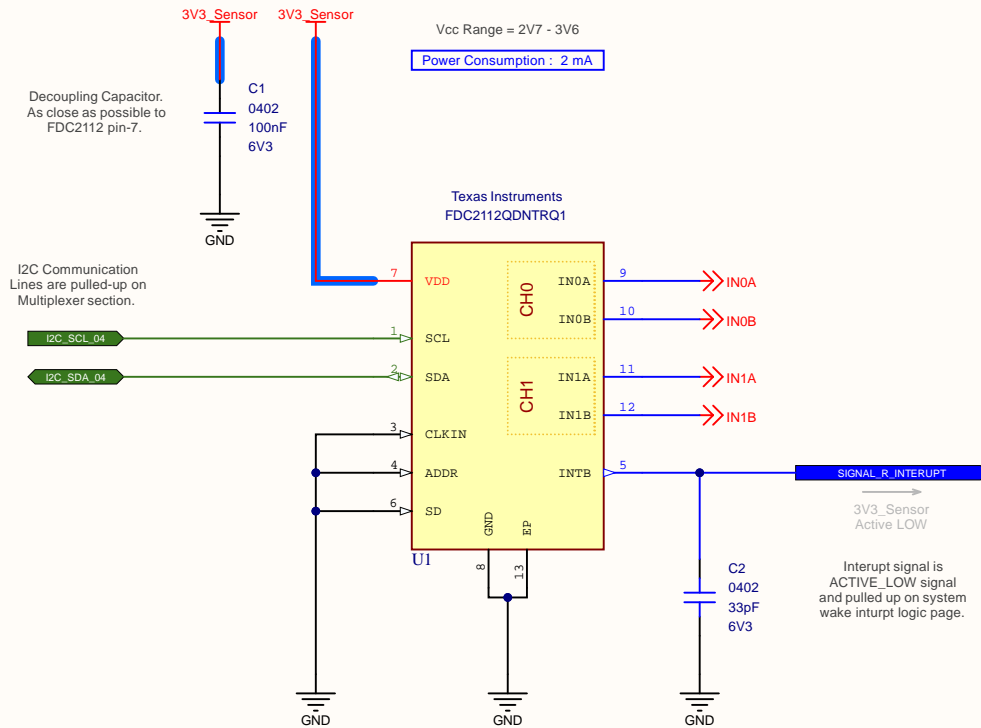
Title <b>Soil Temperature Sensor Output Socket</b>			Ovoo Electronics		
Size: <b>A4</b>	Number: <b>AA005</b>	Revision: <b>B106AA</b>	Küçük İhsaniye Mah. Mızraklı Sok. No:15 Meram / Konya Türkiye		
Date: <b>22.06.2020</b>	Time: <b>04:59:20</b>	Sheet <b>31</b> of <b>37</b>			
File: <b>C:\Altium Projects\STF\P102 - Weather Station\Modules\B106AA\Schematic\ST Sensor Output Socket.SchDoc</b>					



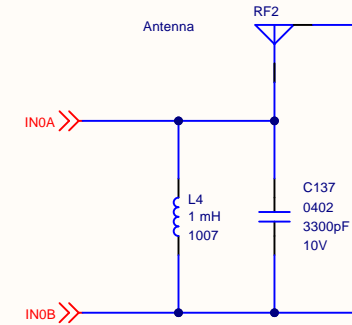
F4

Title <b>Pressure Sensor</b>			Ovoo Electronics Küçük İhsaniye Mah. Mızraklı Sok. No:15 Meram / Konya Türkiye	
Size: <b>A4</b>	Number: <b>AA005</b>	Revision: <b>B106AA</b>		
Date: <b>22.06.2020</b>	Time: <b>04:59:20</b>	Sheet <b>32</b> of <b>37</b>	File: <b>C:\Altium Projects\STF\P102 - Weather Station\Modules\B106AA\Schematic\Pressure Sensor.SchDoc</b>	





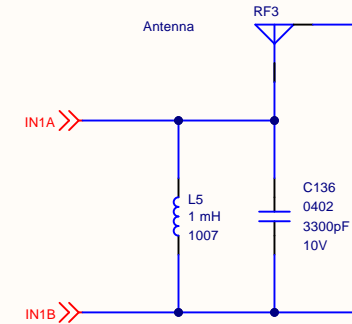
### Rain Sensor Plate 1



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.

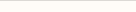
### Rain Sensor Plate 2

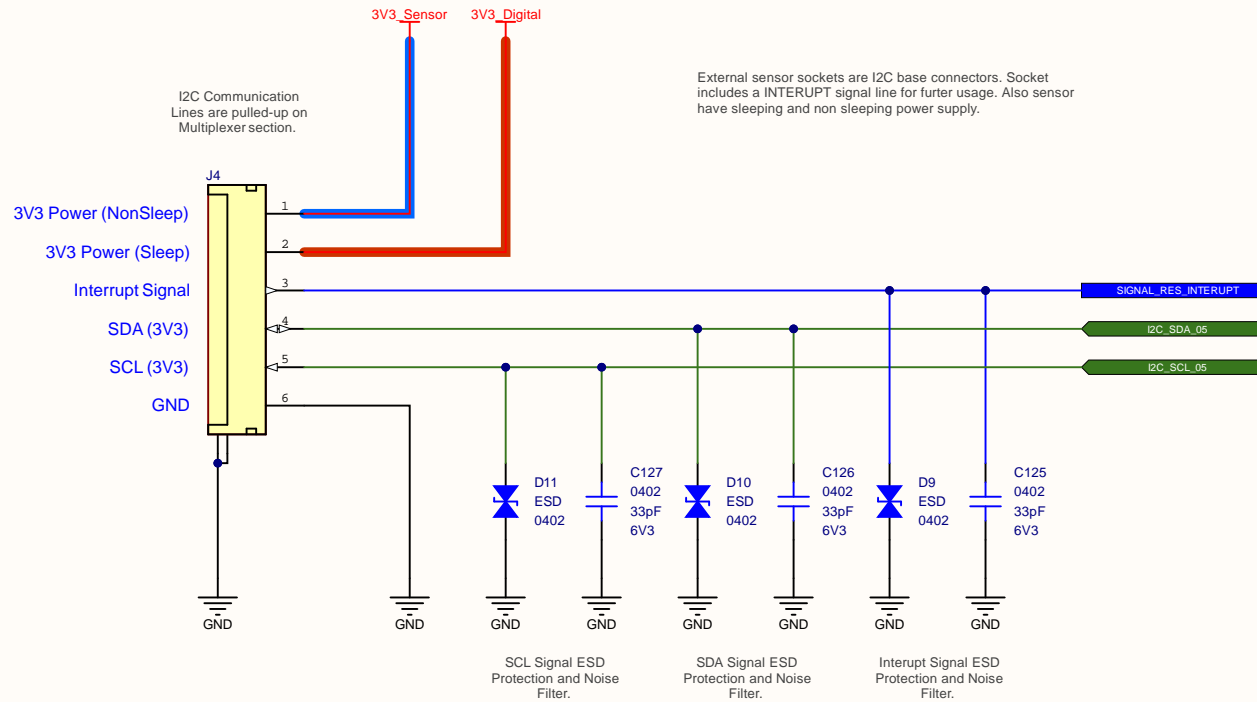


Sensing plates are connected to B106 with shielded cable. Both side of cable are MHF4 type RF connector. Outer shield of connector connected to GND. L-C tank is on B106 side.


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

F5

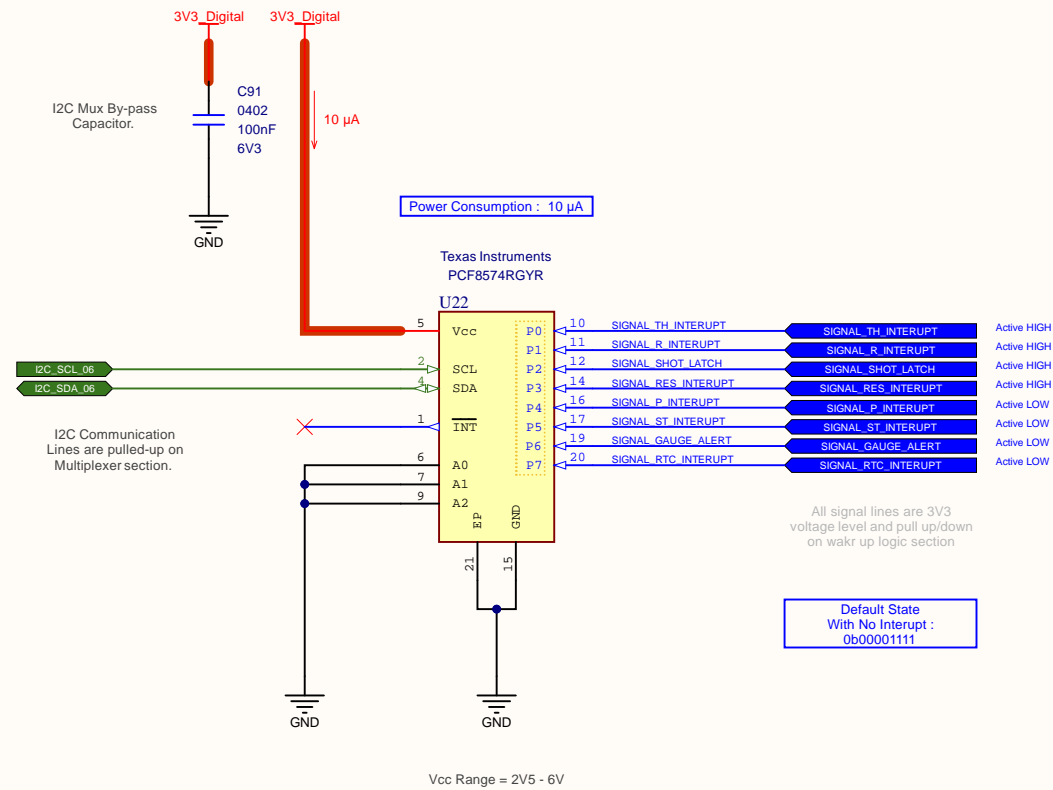
Title <b>Capacitive Rain Sensor</b>			Ovoo Electronics		
Size: <b>A4</b>	Number: <b>AA005</b>	Revision: <b>B106AA</b>	Küçüklhsaniye Mah. Mızraklı Sok. No:15 Meram / Konya Türkiye		
Date: <b>22.06.2020</b>	Time: <b>04:59:20</b>	Sheet <b>33</b> of <b>37</b>			
File: <b>C:\Altium Projects\STF\P102 - Weather Station\Modules\B106AA\Schematic\Capacitive Rain Sensor.SchDoc</b>					




F6

Title <b>Reserved Sensor Output Socket</b>			Ovoo Electronics		
Size: <b>A4</b>	Number: <b>AA005</b>	Revision: <b>B106AA</b>	Küçük İhsaniye Mah. Mızraklı Sok. No:15 Meram / Konya Türkiye		
Date: <b>22.06.2020</b>	Time: <b>04:59:20</b>	Sheet <b>34</b> of <b>37</b>			
File: <b>C:\Altium Projects\STF\P102 - Weather Station\Modules\B106AA\Schematic\Reserved Sensor Output Socket.SchDoc</b>					

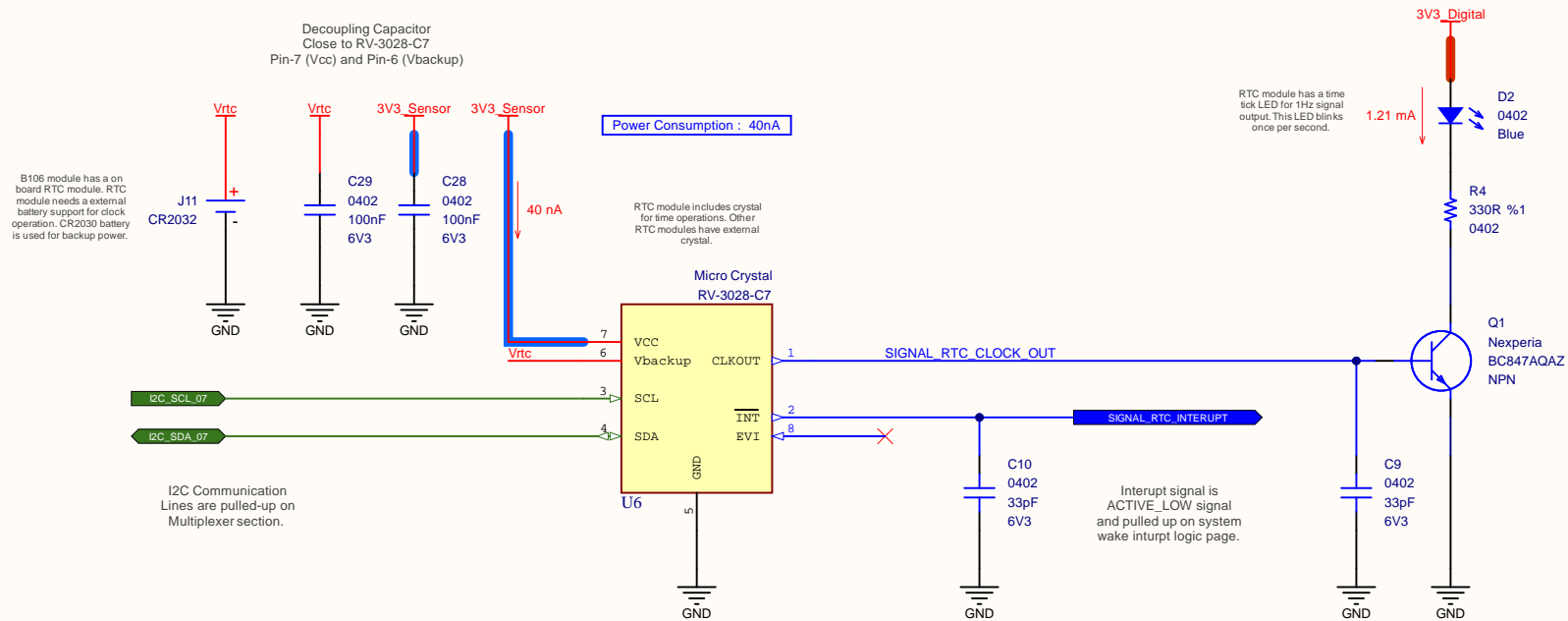
Ovoo




F7

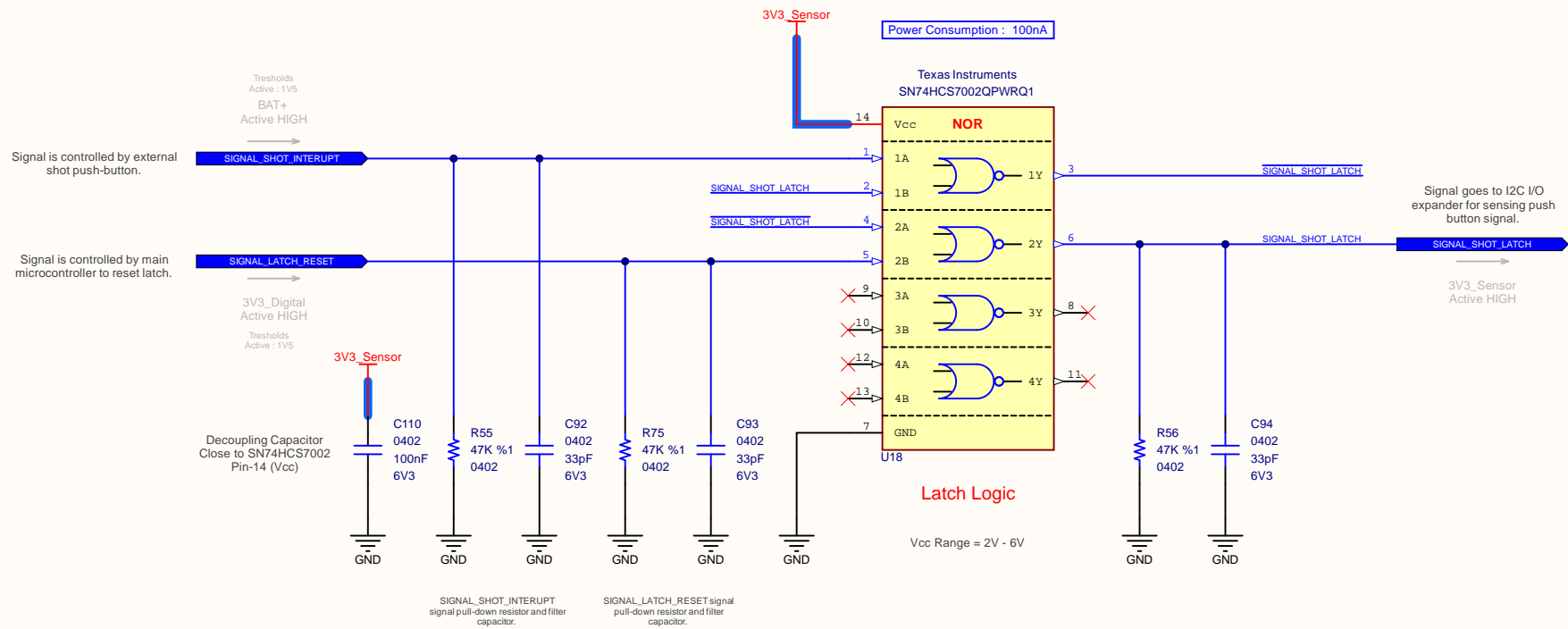
Title I2C I/O Expander for Reading Interrupts			Ovoo Electronics		
Size: A4	Number: AA005	Revision: B106AA	Küçük İhsaniye Mah. Mızraklı Sok. No:15 Meram / Konya Türkiye		
Date: 22.06.2020	Time: 04:59:20	Sheet 35 of 37			
File: C:\Altium Projects\STF\P102 - Weather Station\Modules\B106AA\Schematic\I2C IO Expander.SchDoc					

Ovoo



F8

Title <b>Real Time Clock</b>			Ovoo Electronics  Küçükİhsaniye Mah. Mızraklı Sok. No:15 Meram / Konya Türkiye	
Size: <b>A4</b>	Number: <b>AA005</b>	Revision: <b>B106AA</b>		
Date: <b>22.06.2020</b>	Time: <b>04:59:20</b>	Sheet <b>36</b> of <b>37</b>		
File: <b>C:\Altium Projects\STFP102 - Weather Station\Modules\B106AA\Schematic\Real Time Clock.SchDoc</b>				



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 <b>Signal Latch Logic</b>			<b>Ovoo Electronics</b>  Küçük İnşaniye Mah. Mızraklı Sok. No:15 Meram / Konya Türkiye
Size: <b>A4</b>	Number: <b>AA005</b>	Revision: <b>B106AA</b>	
Date: <b>22.06.2020</b>	Time: <b>04:59:20</b>	Sheet <b>37</b> of <b>37</b>	
File: <b>C:\Altium Projects\STFP102 - Weather Station\Modules\B106AA\Schematic\Signal Latch Logic.SchDoc</b>			