GAPuino V1.1 User's Manual

Greenwaves Technolgies

Version 1.0

Contents

1 Introduction

Greenwaves Technologies has designed the GAPuino board in order to facilitate the development of application prototypes using GAP8. GAPuino can be used as a replacement for a standard Arduino Uno board. GAPuino can connect to most 3.3V or 5V Arduino Uno compatible Shields.

2 Description

The following picture shows the top side of the GAPuino board

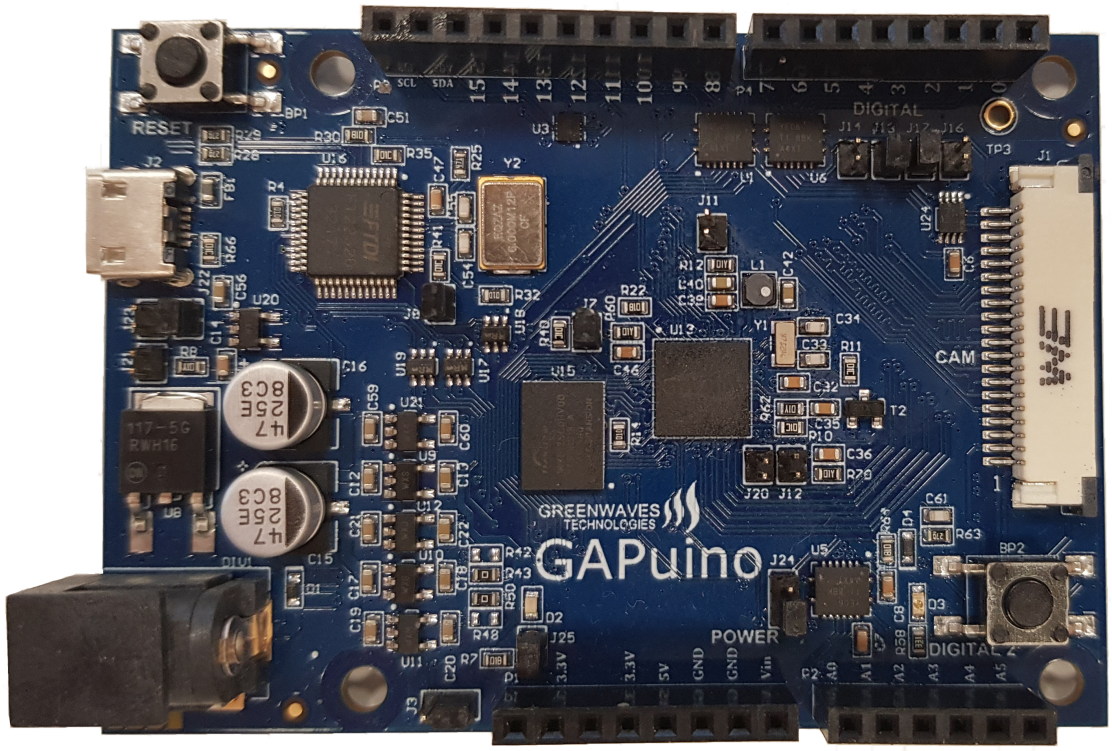

Figure 1: GAPuino top

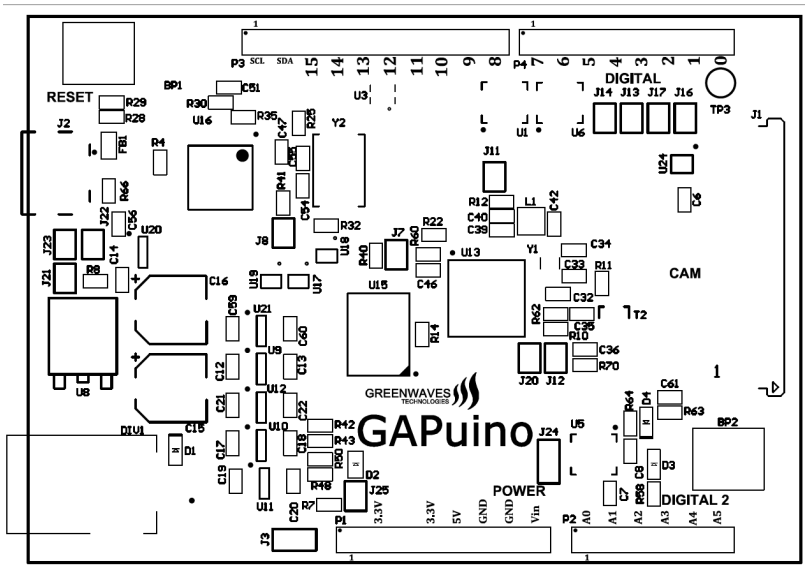

Figure 2: GAPuino top assembly

The following picture shows the bottom side of the GAPuino board

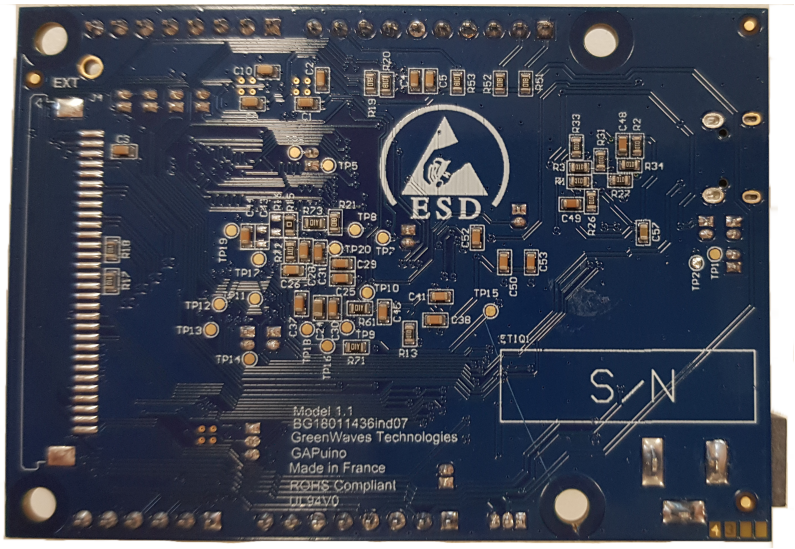

Figure 3: GAPuino bottom

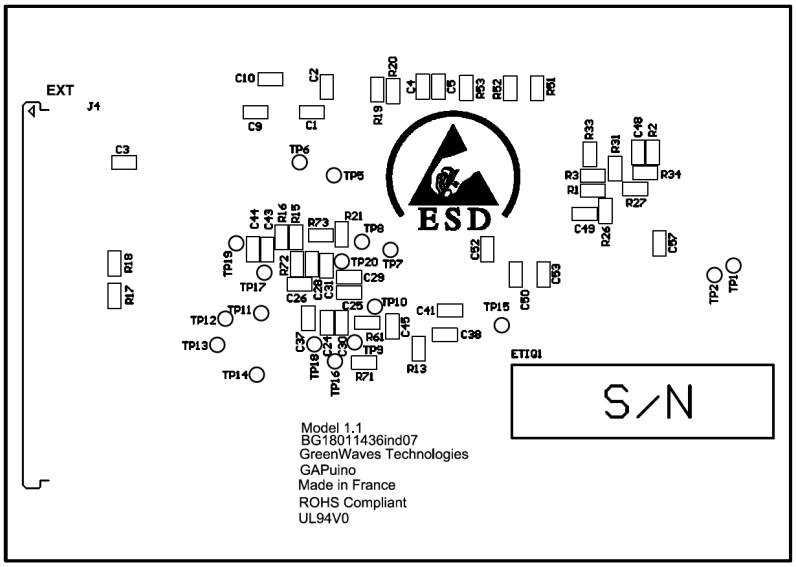

Figure 4: GAPuino Bottom assembly

The following table describes the numbered blocks in the previous picture :

Number	Bloc	Remarks
1	Reset Button	
2	USB Connector	GAPuino can be powered by a USB port.
3	DC Connector	GAPuino can be powered by a DC power supply (7V-15V)
4	GAP8	The GAP8 IoT Application Processor
5	Camera connector	GAPuino can be connected to a camera via its parallel CPI interface (HSYNC, VSYNC, PCLK, DATA[7:0]
6,7,8,9	Arduino Connectors	GAPuino interface to the Arduino ecosystem
10	FT2232	This device allows connection of both the UART and JTAG ports of GAP8 to a PC
11	HyperFlash/RAM	
12	Green Led	power Indicator
13	Blue Led	user led
14	Push Button	user button

3 Configuration

The boards embeds 15 jumpers to configure the board.

3.1 Jumper J3

This jumper enable to configure the voltage of the Arduino connectors pins : either 3.3V or 5V

Pos	Description
1-2	Arduino Interface is 5V (VD is set to 5V)
2-3	Arduino Interface is 3.3V (VD is set to 3.3V)

3.2 Jumper J24

This jumper enable to route either Arduino connector pin P2.1 or the push button to GPIO_A0_A3 of GAP8

Pos	Description
1-2	Push button is connected to GPIO_A0_A3
2-3	Arduino connector pin P2.1 is connected to GPIO_A0_A3

3.3 Jumper J25

This jumper enable to connect or not the green led D2 (power Indicator)

Pos	Description
opened	Led D2 is disconnected
shorted	Led D2 is connected

3.4 Jumper J12

This jumper enable to connect or not the R12 resistor (GAP8 internal voltage regulator input current measurement)

Pos	Description
opened	R12 resistor can be used as current sensor
shorted	R12 resistor can not be used as current sensor

3.5 Jumpers J13/J14

These 2 jumpers enable to use Arduino connector pin P4.7 either as an UART signal or an I2S0 signal so these 2 jumpers should not be shorted at the same time.

Pos	Description
J13 shorted	Arduino connector pin P4.7 is routed to I2S0 data input of GAP8
J14 shorted	Arduino connector pin P4.7 is routed to UART TX of GAP8

3.6 Jumpers J16/J17

These 2 jumpers enable to use Arduino connector pin P4.8 either as an UART signal or an I2S1 signal so these 2 jumpers should not be shorted at the same time.

Pos	Description
J13 shorted	Arduino connector pin P4.8 is routed to I2S1 data input of GAP8
J14 shorted	Arduino connector pin P4.8 is routed to UART RX of GAP8

3.7 Jumpers J7/J8

These 2 jumpers enable to use Arduino connector pins or USB bridge as the UART pins connected to GAP8 UART_RX and UART_TX. These 2 jumpers should be opened or shortened at the same time.

Pos	Description
J7 opened	GAP8 UART_RX is disconnected to the FTDI USB bridge
J7 shorted	GAP8 UART_RX is connected to the FTDI USB bridge

Pos	Description
J8 opened	GAP8 UART_TX is disconnected to the FTDI USB bridge
J8 shorted	GAP8 UART_TX is connected to the FTDI USB bridge

3.8 Jumpers J12/J20

These 2 jumpers enable to select wich tnesion (0V or 2.5V) is connected to LVDS_VDDIO. These 2 jumpers must not be shorted at the same time.

Pos	Description
J12 shorted	2.5V is connected to LVDS_VDDIO
J20 shorted	0V is connected to LVDS_VDDIO

3.9 Jumpers J21/J22/J23

These 3 jumpers enable to select a 5V input of Gapuino (among USB/Vin regulator/Arduino connector Pin P1.5). Arduino connector Pin P1.5 can be used as a 5V input of 5V output to the Arduino Shields connected to GApuino

Pos	Description
J21 shorted	Vin regulator is connected the 5V power signal of Gapuino
J22 shorted	USB 5V is connected the 5V power signal of Gapuino
J23 shorted	Arduino connector Pin P1.5 is connected the 5V power signal of Gapuino

4 Special Features

4.1 Power consumption monitoring

Several test points and resistors are provided to monitor voltages and currents.

Pos	Description
TP1-TP2-R8 or J11	Monitor the voltage and current consummed by the whole board execpt USB bridge subsystem
TP5-PT6-R12	Monitor the voltage and current flowing into the internal DC/DC regulator
TP7-PT8-R60	Monitor the voltage and current flowing into GAP8 CAM_VDDIO
TP9-PT10-R61	Monitor the voltage and current flowing into GAP8 SPIM_VDDIO
TP11-PT12-R62	Monitor the voltage and current flowing into GAP8 SAFE_VDDIO
TP13-PT14-R70	Monitor the voltage and current flowing into GAP8 LVDS_VDDIO
TP15-PT16-R71	Monitor the voltage and current flowing into GAP8 XTAL_AVDD
TP17-PT18-R72	Monitor the voltage and current flowing into GAP8 SOC power domain
TP19-PT20-R73	Monitor the voltage and current flowing into GAP8 CLUSTER power domain

5 Connector pin-out

5.1 Camera Connector

The following table describes the J1 connector. The digital signals of J1 are relative to 1.8V.

Pin	Description
1	1.8V
2	3.3V
3	5V
4	GND
5	CAM_PCLK
6	CAM_HSYNC
7	CAM_DATA0
8	CAM_DATA1
9	CAM_DATA2
10	CAM_DATA3
11	CAM_DATA4
12	CAM_DATA5
13	CAM_DATA6
14	CAM_DATA7
15	CAM_VSYNC
16	CAM_SDA
17	CAM_SCL
18	GND
19	TIMER0_CH0
20	TIMER0_CH1

5.2 LVDS Connector

The following table describes the J4 connector. The differential pairs of J4 are relative to 2.5V. The digital signals of J4 are relative to 1.8V.

Pin	Description
1	VBAT
2	5V
3	3.3V
4	2.5V
5	GND
6	RF_TX_P
7	RF_TX_N
8	GND
9	RF_TXCLK_P
10	RF_TXCLK_N
11	GND
12	RF_RXD_P
13	RF_RXD_N
14	GND
15	RF_RXCLK_P
16	RF_RXCLK_N
17	GND
18	SPMI1_MISO
19	SPIM1_MOSI
20	SPIM1_CS0
21	SPIM1_SCK
22	ORCA_TXSYNC/A0
23	ORCA_TRSYNC/A1
24	ORCA_TXI/A2
25	ORCA_TXQ/A3
26	ORCA_RXI/A4
27	ORCA_RXQ/A5
28	GND
29	TIMER0_CH2
30	TIMER0_CH3

5.3 Arduino Connectors

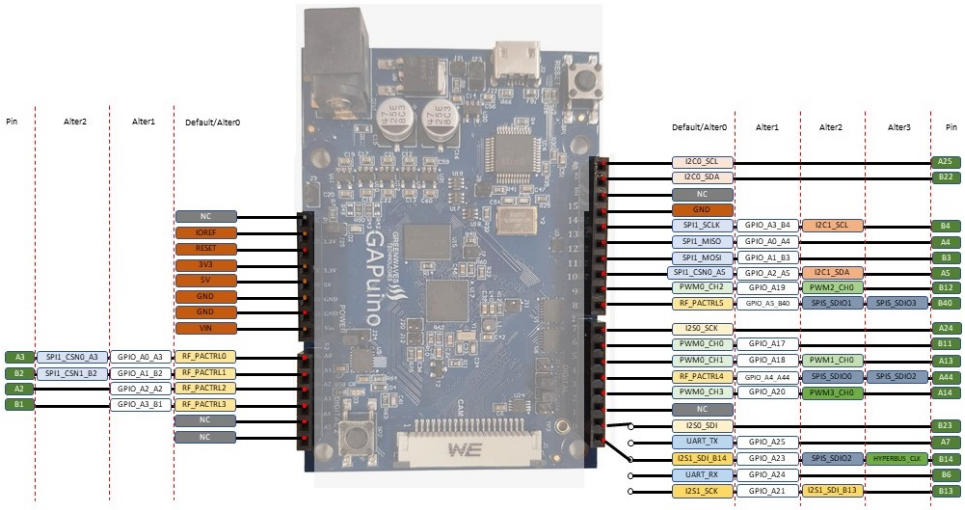

Figure 5: GAPuino Connectors

The following table describes the P1 connector.

Pin	Description
1	NC
2	NC
3	NC
4	3.3V
5	5V
6	GND
7	GND
8	NC

The following table describes the P2 connector. The digital signals of P2 are relative to VD (3.3V or 5V).

Pin	Description
1	ORCA_TXSYNC/A0
2	ORCA_TRSYNC/A1
3	ORCA_TXI/A2
4	ORCA_TXQ/A3
5	NC
6	NC

The following table describes the P3 connector. The digital signals of P3 are relative to VD (3.3V or 5V).

Pin	Description
1	I2C0_SCL
2	I2C0_SDA
3	NC
4	GND
5	SPMI1_SCK
6	SPIM1_MISO
7	SPIM1_MOSI
8	SPIM1_CS0
9	TIMER0_CH2
10	ORCA_RXQ/A5

The following table describes the P4 connector. The digital signals of P4 are relative to VD (3.3V or 5V).

Pin	Description
1	I2S0_SCK
2	TIMER0_CH0
3	TIMER0_CH1
4	ORCA_RXI/A4
5	TIMER0_CH3
6	NC
7	I2S0_SDI
8	I2S1_SDI

6 Getting Started

Once the board is configured, you can connect it to a USB port and download the SDK. For more information on how to download and install the GAP8 SDK please refer to the documentation at https://greenwaves-technologies/sdk.

7 How to use the QVGA camera module

Refer to the picture below. Connect the flat cable to the camera connector. Pull the gray tabs (indicated by the red arrows in the picture) on the connector *gently* away from the board, insert the cable and then *gently* push the gray tabs in again. Pay attention to the orientation of the cable. The contacts on the camera cable should face upwards (towards the top of the connector). See the image below.

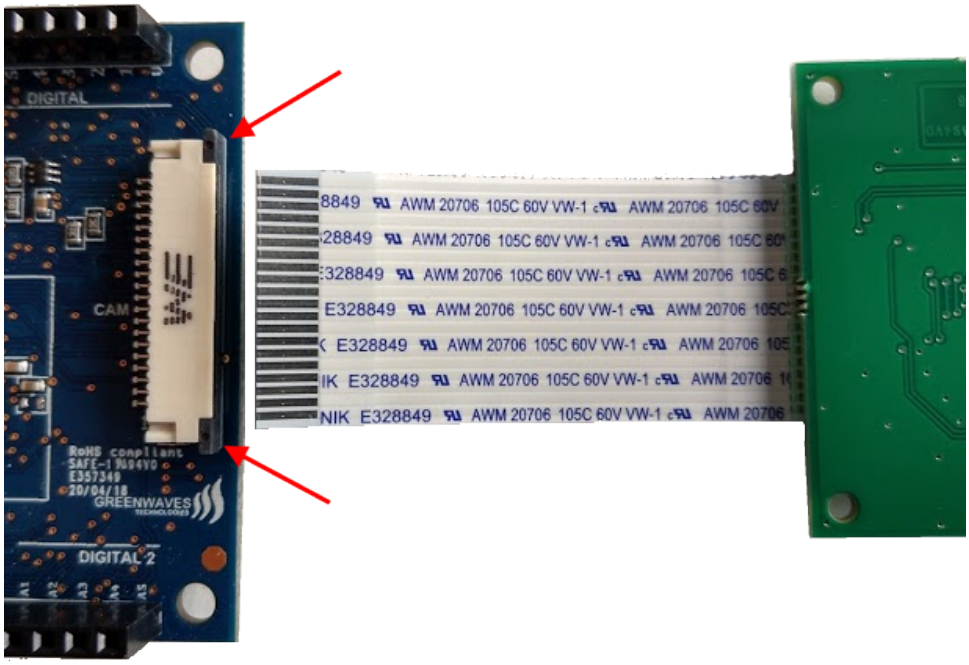

Figure 6: CPI Connector Orientation

Navigate to the camera example :

```
cd gap_sdk/examples/pulp-examples/periph/camera/camera_himax
```

Compile and run :

```
make clean all run
```

When you are ready push the ENTER key on your PC. An image is captured and transfered to your PC.

8 How to use the GAP8 Multisensor board

The GAP8 Multisensor Board provides you with a collection of sensors that can be used in sensor fusion experiments: temperature, pressure, 3 axis acceleration, 3 axis gyroscope, time of flight and 4 digital microphones.

Please refer to the Multisensor board documentation for more details.

9 How to measure power consumptions

GAPuino has several test points that can be used to directly measure GAP8's power consumption. A 1-ohm resistor is connected between each pair of test points so that current can be directly measured.

A basic measurement for a program that executes continuously can be made by connecting avoltmeter probes to a test point pair. Once your program is running the measured voltage will equal the consumed current.

Then measure the voltage on the test point by connecting one of the voltmeter probes to ground (onthe Arduino connector P1.6 or P1.7). Multiply the 2 values and you have the power consumption. You can make a more detailed measurement using an oscilloscope instead of a voltmeter. Solder 2 wires to a pair of test points. Connect the differential probe of your oscilloscope. Carry out the same measurement as in the basic method. If your operation is intermittent then you can measurethe power profile

9.1 Current into Internal DC/DC regulator

Solder 2 wires connected to TP5 and TP6 and connect to a multimeter

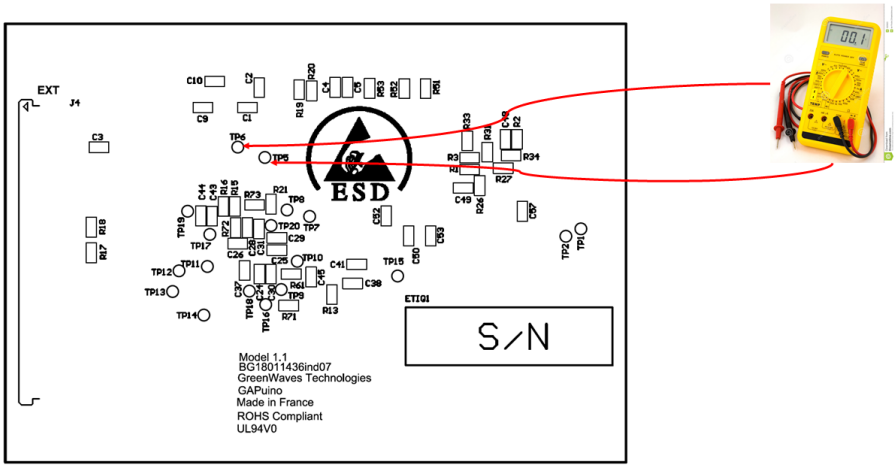

Figure 7: GAPuino TP5 TP6

or connect a multimeter to J11

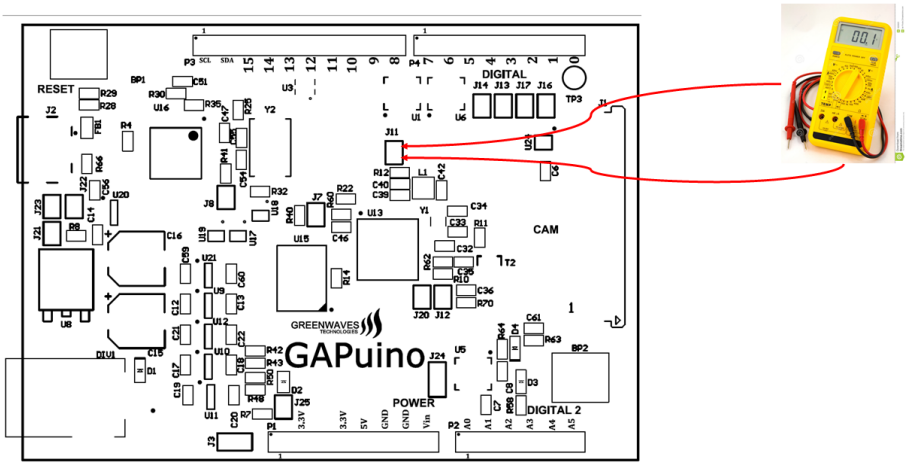

Figure 8: GAPuino JP11

9.2 Current into the cluster

Solder 2 wires connected to TP19 and TP20 and connect to a multimeter

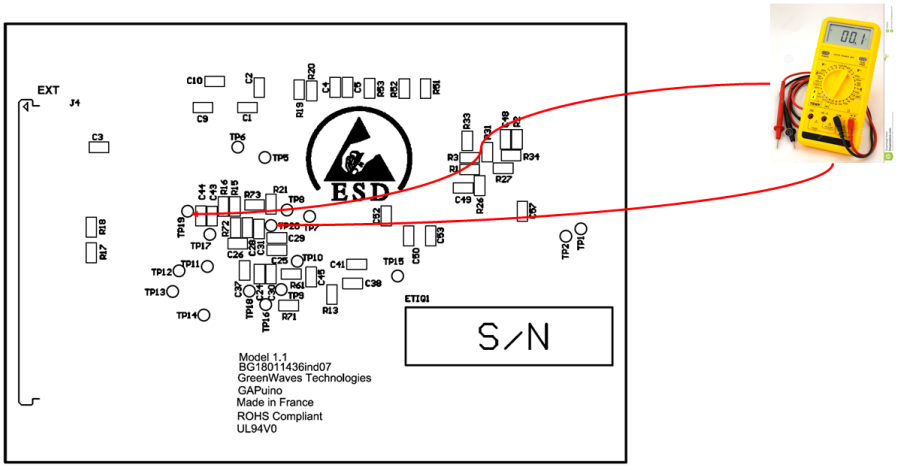

Figure 9: GAPuino TP19 TP20

9.3 Current into the Fabric controler

Solder 2 wires connected to TP17 and TP18 and connect to a multimeter

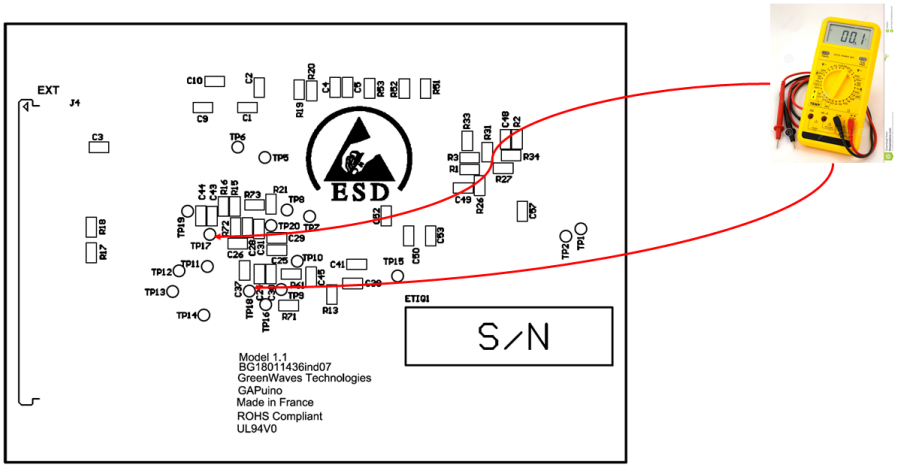

Figure 10: GAPuino TP17 TP18

9.4 Current into cam_VDDIO

Solder 2 wires connected to TP7 and TP8 and connect to a multimeter

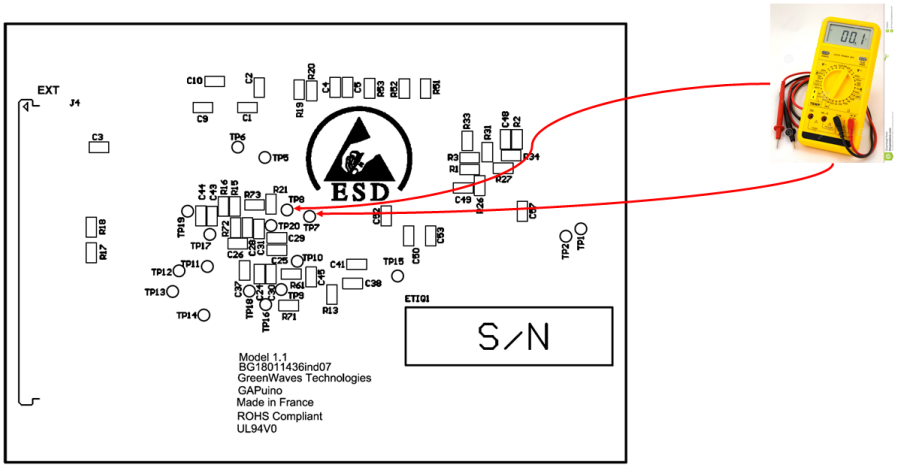

Figure 11: GAPuino TP7 TP8

9.5 Current into spim_VDDIO

Solder 2 wires connected to TP9 and TP10 and connect to a multimeter

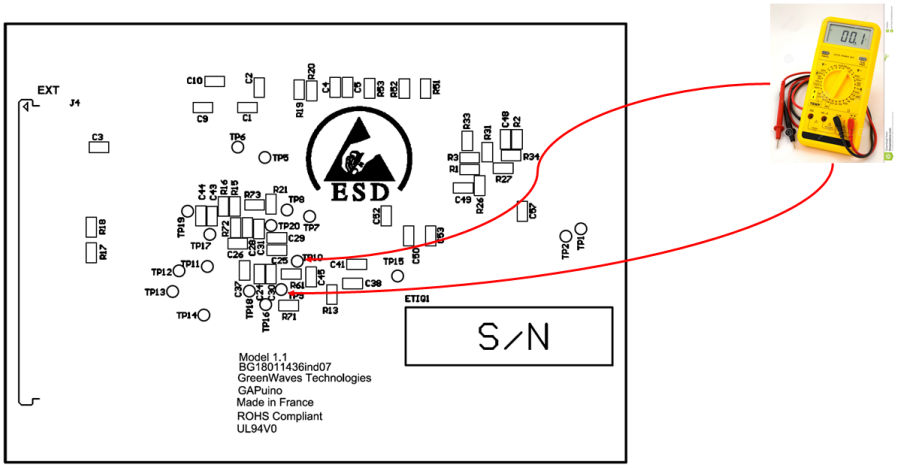

Figure 12: GAPuino TP9 TP10

9.6 Current into safe_VDDIO

Solder 2 wires connected to TP11 and TP12 and connect to a multimeter

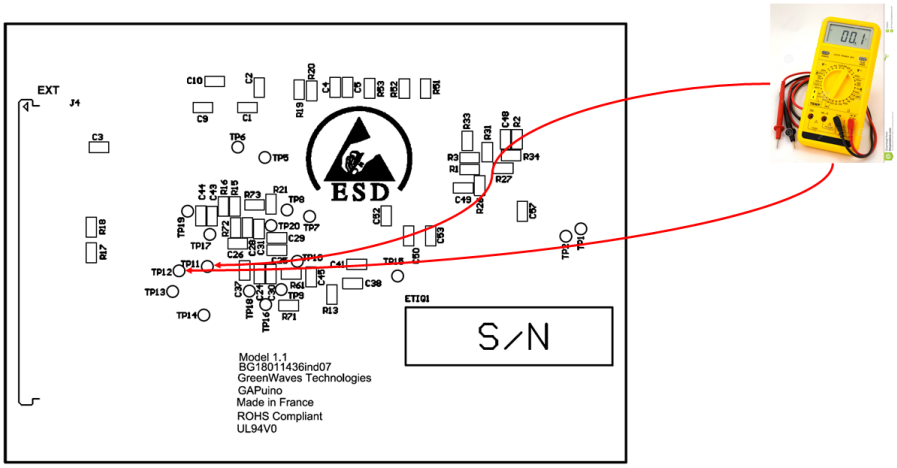

Figure 13: GAPuino TP11 TP12

9.7 Current into lvds VDDIO

Solder 2 wires connected to TP13 and TP14 and connect to a multimeter

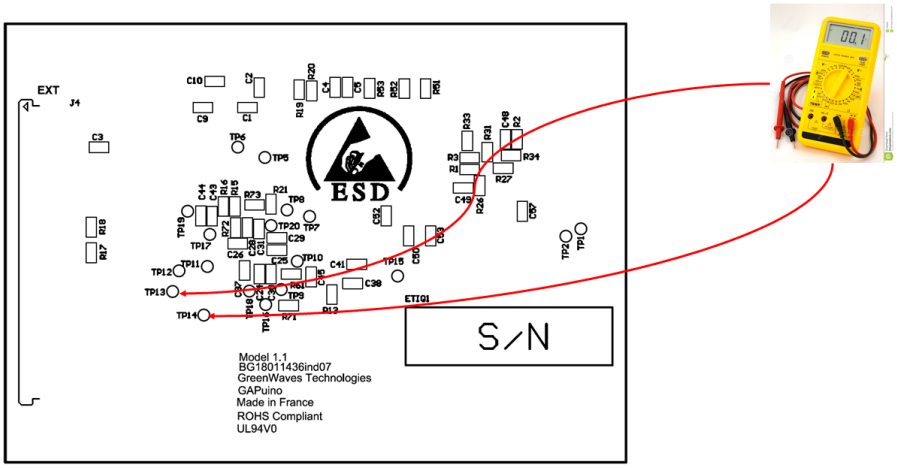

Figure 14: GAPuino TP13 TP14“

9.8 Current into xtal_AVDD

Solder 2 wires connected to TP15 and TP16 and connect to a multimeter

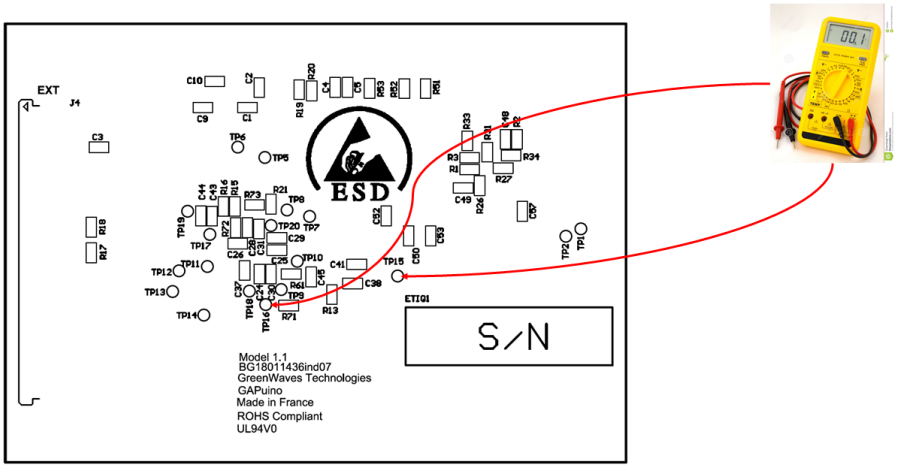

Figure 15: GAPuino TP15 TP16

10 Errata

The model number of the board can be seen on that bottom side.

10.1 Model 1.1

11 History

Version	Date	Remarks
1.0	2019 08 31	Initial draft version