GAPuino User's Manual

Greenwaves Technolgies

Version 1.2

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 (Please note that GAPuino Model 1.0 has some differences in pin voltages and DC power connector polarity versus the Arduino Uno. Please refer to the errata at the end of this document).

2 Description

The following pictures and diagrams show the position of components on the board.
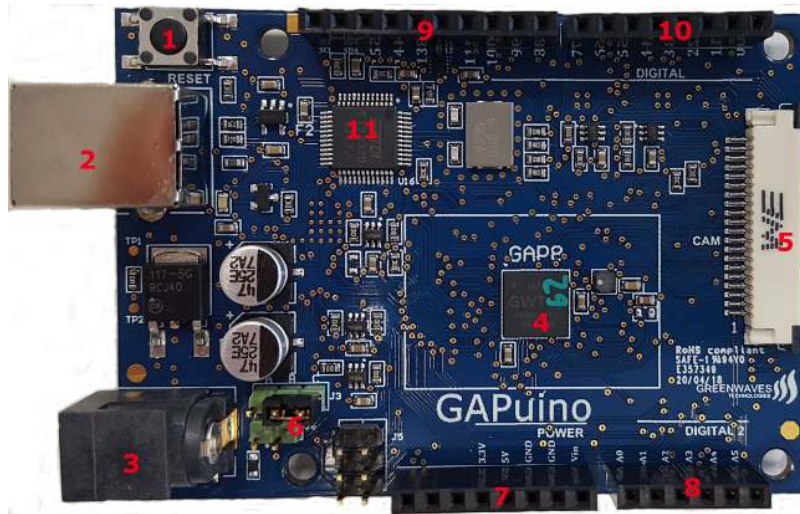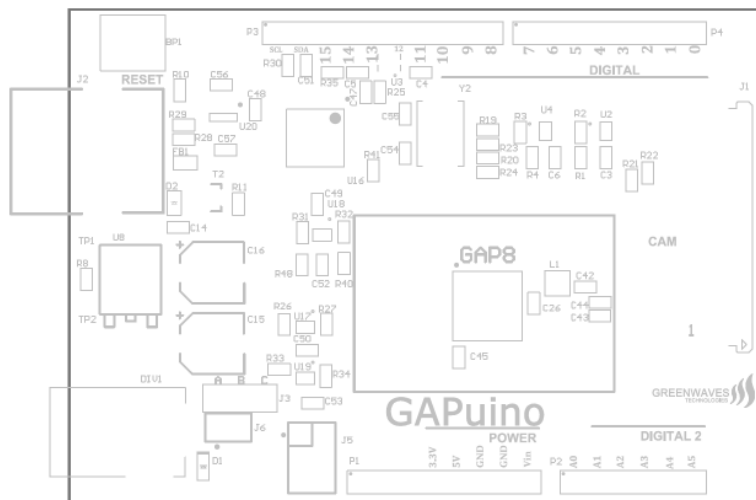

Figure 1: GAPuino top

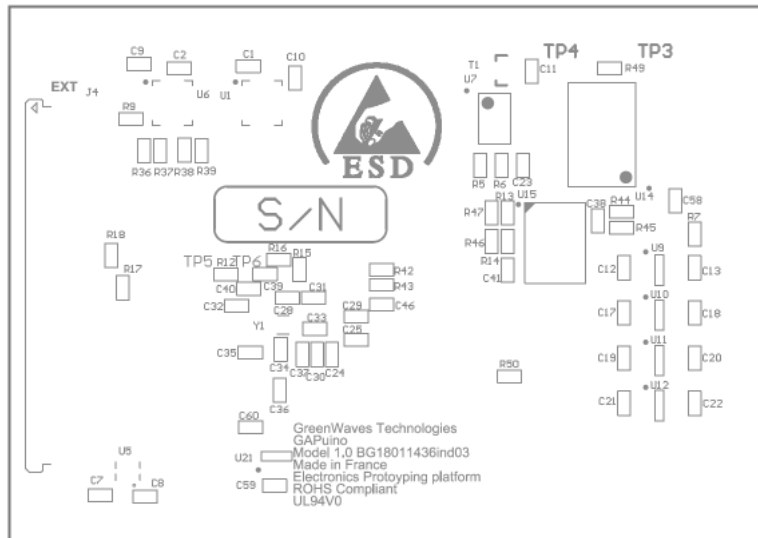Figure 2: GAPuino top components

Figure 3: GAPuino bottom

Figure 4: GAPuino bottom components

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

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	Jumpers	A number of jumpers are provided to configure power supplies and signals
7,8,9,10	Arduino Connectors	GAPuino interface to the Arduino ecosystem
11	FT2232	This device allows connection of both the UART and JTAG ports of GAP8 to a PC
12	HyperFlash/RAM	
13	QSPI Flash	
14	R46/R47	These 2 resistors must be soldered in order to used the Hyperflash/RAM
15	R45	This resistor must be soldered in order to used the QSPI Flash

3 Configuration

The boards embeds a jumper and few 0 ohm resistors to configure the board.

3.1 Jumper J3

Position	Description
B-C	Arduino Interface is 3.3V (VD is set to 3.3V)
A-B	Arduino Interface is 5V (VD is set to 5V)

3.2 Resistors

3.2.1 Resistor R45

Position	Description
Open	S25FS256's chip select signal is disconnected so the flash can not be accessed by GAP8
Soldered	S25FL256's chip select signal is connected so the flash can be accessed by GAP8

R45 should not be used at the same time as R46/R47.

3.2.2 Resistor R46

Position	Description
Open	S71KS512's flash chip select signal is disconnected so the flash can not be accessed by GAP8
Soldered	S71KS512's flash chip select signal is connected so the flash can be accessed by GAP8

R45 should not be used at the same time as R46/R47.

3.2.3 Resistor R47

Position	Description
Open	S71KS512's ram chip select signal is disconnected so the ram can not be accessed by GAP8
Soldered	S71KS512's ram chip select signal is connected so the ram can be accessed by GAP8

R45 should not be used at the same time as R46/R47.

4 Special Features

4.1 Power consumption monitoring

Several test points are provided to monitor voltages and currents.

Position	Description
TP1-TP2	Monitor the voltage and current flowing through the DC connector
PT3-PT4	Monitor the voltage and current flowing through the USB connector
TP5-PT6	Monitor the voltage and current flowing into the internal DC/DC regulator

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	CAM_PCLK
5	CAM_HSYNC
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

Pin	Description
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
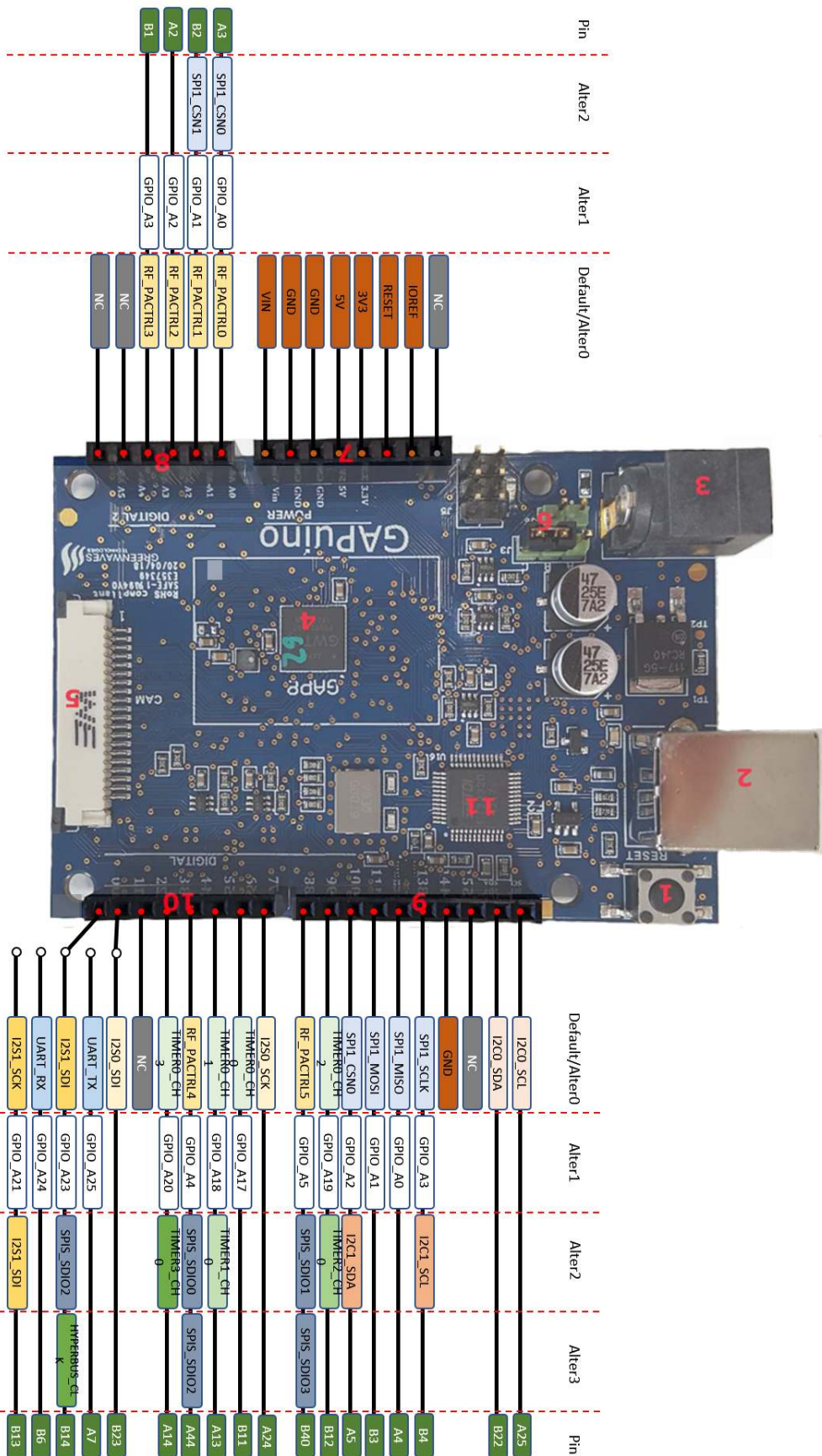
Figure 5: GAPuino Arduino Uno connector

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.
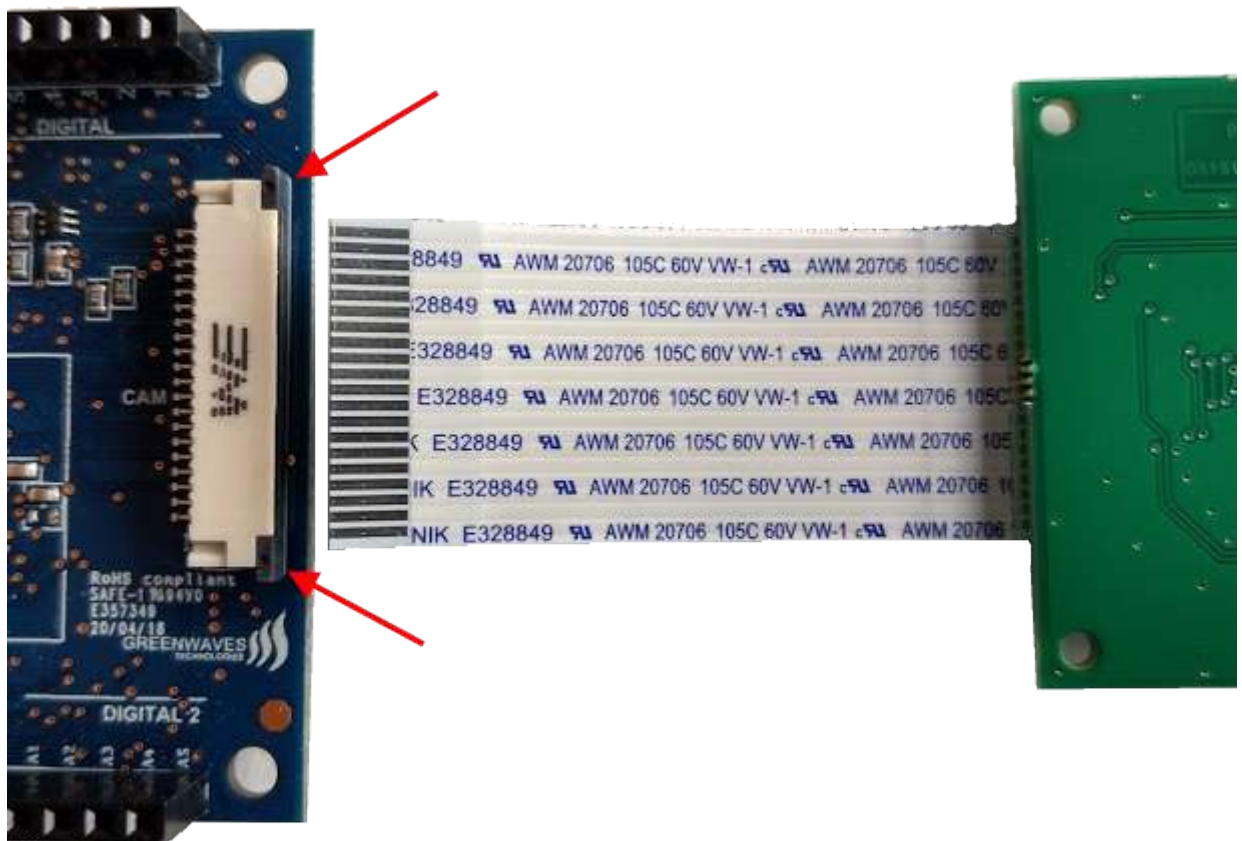

Figure 6: CPI Connector Orientation

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   Measuring GAP8 power consumption on GAPuino

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 a voltmeter 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 (on the 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 measure the power profile.
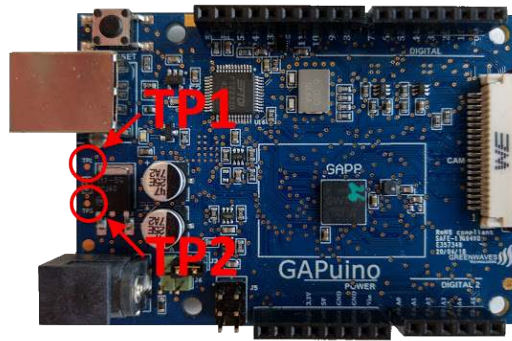

Figure 7: Test front

TP1 and TP2: Test point for measuring the consumption of the whole PCB excluding the FTDI and USB interface
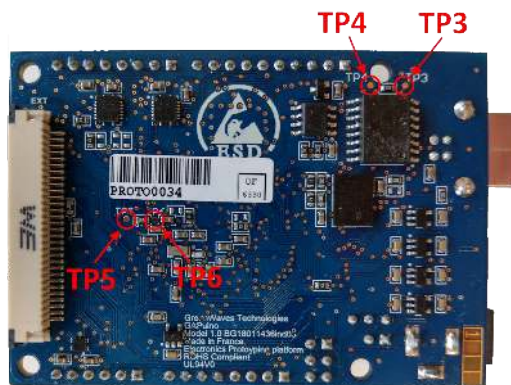

Figure 8: Test back

TP3 and TP4: Test points for measuring the whole board.

TP5 and TP6: Test points for measuring ONLY the GAP8 processor.

10   Errata

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

10.1   Model 1.0

- Polarity of DC connector is inverted from Arduino Uno
- P3.9 is 1.8V instead of 3.3V/5V
- P1.1 is 1.8V instead of 3.3V/5V
- P1.2 is 1.8V instead of 3.3V/5V
- P1.3 is 1.8V instead of 3.3V/5V
- P1.4 is 1.8V instead of 3.3V/5V
- P4.3 is only an input
- P4.5 is only an input

11   History

Version	Date	Remarks
0.1	2018 05 11	Initial draft version
1.0	2018 05 16	Edits and corrections
1.1	2018 06 27	Added power measurement information
1.2	2018 11 21	Added component placement