

# GPIO

## Basics

<https://wiki.openwrt.org/doc/hardware/port gpio>

## Pin define

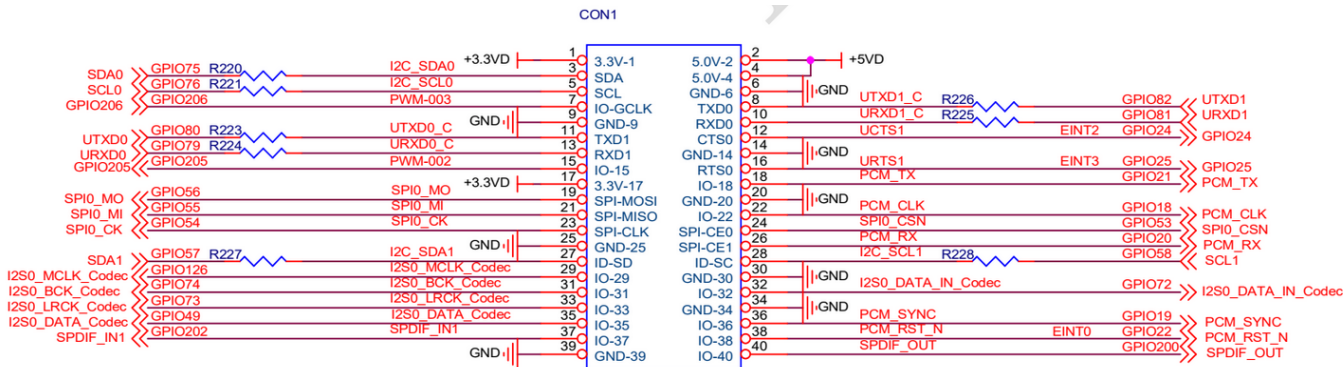










































image taken from bpi-r2 schematics

| Sparefunction | Mainfunction | pin# | xxxxxxxxxxxxxxxxxxxxxx |   |   |    | pin# | Mainfunction   | Sparefunction            |
|---------------|--------------|------|------------------------|---|---|----|------|----------------|--------------------------|
| -             | 3V3          | 1    | 1                      |    |    | 2  | 2    | 5V             | -                        |
| I2C_SDA0      | GPIO 75      | 3    | 3                      |    |    | 4  | 4    | 5V             | -                        |
| I2C_SCL0      | GPIO 76      | 5    | 5                      |    |    | 6  | 6    | GND            | -                        |
| PWM3          | GPIO 206     | 7    | 7                      |    |    | 8  | 8    | GPIO 82        | UART1 TX                 |
| -             | GND          | 9    | 9                      |    |    | 10 | 10   | GPIO 81        | UART1 RX                 |
| UART0 TX      | GPIO 80      | 11   | 11                     |    |    | 12 | 12   | UCTS1 / INT2   | GPIO 24 (*)              |
| UART0 RX      | GPIO 79      | 13   | 13                     |    |    | 14 | 14   | GND            | -                        |
| PWM2          | GPIO 205     | 15   | 15                     |    |    | 16 | 16   | GPIO 25 / INT3 | URTS1                    |
| -             | 3V3          | 17   | 17                     |    |    | 18 | 18   | GPIO 21        | PCM_TX                   |
| SPI0_MO       | GPIO 56      | 19   | 19                     |    |    | 20 | 20   | GND            | -                        |
| SPI0_MI       | GPIO 55      | 21   | 21                     |    |    | 22 | 22   | GPIO 18        | PCM_CLK                  |
| SPI0_CK       | GPIO 54      | 23   | 23                     |    |    | 24 | 24   | GPIO 53        | SPI0_CSN                 |
| -             | GND          | 25   | 25                     |    |    | 26 | 26   | GPIO 20        | PCM_RX                   |
| I2C_SDA1      | GPIO 57      | 27   | 27                     |  |  | 28 | 28   | GPIO 58        | I2C_SCL1                 |
|               | GPIO 126     | 29   | 29                     |  |  | 30 | 30   | GND            | -                        |
| I2S0_BCK      | GPIO 74      | 31   | 31                     |  |  | 32 | 32   | GPIO 72        | I2S0_DATA_IN             |
| I2S0_LRCK     | GPIO 73 (?)  | 33   | 33                     |  |  | 34 | 34   | GND            | -                        |
| I2S0_DATA     | GPIO 49 (M)  | 35   | 35                     |  |  | 36 | 36   | GPIO 19        | PCM_SYNC                 |
| SPDIF_IN1     | GPIO 202     | 37   | 37                     |  |  | 38 | 38   | INT0           | GPIO 22 (*) / PCM_RST_IN |
| -             | GND          | 39   | 39                     |  |  | 40 | 40   | GPIO 200       | SPDIF_OUT                |

|        | main           | spare               |
|--------|----------------|---------------------|
| Pin 1  | 3V3            | -                   |
| Pin 2  | 5V             | -                   |
| Pin 3  | GPIO 75        | I2C_SDA0            |
| Pin 4  | 5V             | -                   |
| Pin 5  | GPIO 76        | I2C_SCL0            |
| Pin 6  | GND            | -                   |
| Pin 7  | GPIO 206       | PWM3                |
| Pin 8  | GPIO 82        | UART1 TX            |
| Pin 9  | GND            | -                   |
| Pin 10 | GPIO 81        | UART1 RX            |
| Pin 11 | GPIO 80        | UART0 TX            |
| Pin 12 | Int2           | GPIO 24 (*) / UCTS1 |
| Pin 13 | GPIO 79        | UART0 RX            |
| Pin 14 | GND            | -                   |
| Pin 15 | GPIO 205       | PWM2                |
| Pin 16 | GPIO 25 / Int3 | URTS1               |

|               | main        | spare                    |
|---------------|-------------|--------------------------|
| <b>Pin 17</b> | 3V3         | -                        |
| <b>Pin 18</b> | GPIO 21     | PCM_TX                   |
| <b>Pin 19</b> | GPIO 56     | SPI0_MO                  |
| <b>Pin 20</b> | GND         | -                        |
| <b>Pin 21</b> | GPIO 55     | SPI0_MI                  |
| <b>Pin 22</b> | GPIO 18     | PCM_CLK                  |
| <b>Pin 23</b> | GPIO 54     | SPI0_CK                  |
| <b>Pin 24</b> | GPIO 53     | SPI0_CSN                 |
| <b>Pin 25</b> | GND         | -                        |
| <b>Pin 26</b> | GPIO 20     | PCM_RX                   |
| <b>Pin 27</b> | GPIO 57     | I2C_SDA1                 |
| <b>Pin 28</b> | GPIO 58     | I2C_SCL1                 |
| <b>Pin 29</b> | GPIO 126    |                          |
| <b>Pin 30</b> | GND         | -                        |
| <b>Pin 31</b> | GPIO 74     | I2S0_BCK                 |
| <b>Pin 32</b> | GPIO 72     | I2S0_DATA_IN             |
| <b>Pin 33</b> | GPIO 73 (?) | I2S0_LRCK                |
| <b>Pin 34</b> | GND         | -                        |
| <b>Pin 35</b> | GPIO 49 (M) | I2S0_DATA                |
| <b>Pin 36</b> | GPIO 19     | PCM_SYNC                 |
| <b>Pin 37</b> | GPIO 202    | SPDIF_IN1                |
| <b>Pin 38</b> | INT0        | GPIO 22 (*) / PCM_RST_IN |
| <b>Pin 39</b> | GND         | -                        |
| <b>Pin 40</b> | GPIO 200    | SPDIF_OUT                |

(\*) special GPIO need memory-patch and mode-set in 4.4.70

(?) currently not working

(M) mode-setting needed

## Kernel 4.4.70

### Access standard GPIO

```
root@bpi-r2:~# GPIO=/sys/devices/platform/1000b000.pinctrl/mt_gpio
root@bpi-r2:~# echo "mode 25 0" >$GPIO #not needed for every GPIO
root@bpi-r2:~# echo "dir 25 1" >$GPIO
root@bpi-r2:~# echo "out 25 1" >$GPIO
```

works with LED on Pin 14 (-) and Pin 16 (+), incl. resistor (220 Ohm)

### Access special GPIO

for the GPIOs 22/(23??)/24 it is necessary to set a register (siehe [issue#17](#) comment #15)

## mwrite

```

root@bpi-r2:~# ./mwrite /dev/mem 0x10005b10 0x00000038
./mwrite offset : 10005b10, val : 00000038
b6f03b10
root@bpi-r2:~# GPIO=/sys/devices/platform/1000b000.pinctrl/mt_gpio
root@bpi-r2:~# echo "dir 24 1" >$GPIO
root@bpi-r2:~# echo "out 24 1" >$GPIO
root@bpi-r2:~# echo "mode 24 0" >$GPIO

```

for GPIO24 (pin 12) i have to set mode to 0

## Kernel 4.14

GPIO\_SYSFS and CONFIG\_DEBUG\_GPIO must be set in Kernel-Config (.config)

### Access standard GPIO

```

root@bpi-r2# mount -t debugfs none /sys/kernel/debug
root@bpi-r2# cat /sys/kernel/debug/pinctrl/1000b000.pinctrl/gpio-ranges
GPIO ranges handled:
0: 1000b000.pinctrl GPIOs [232 - 511] PINS [0 - 279] #base=232, first value
of GPIOs
root@bpi-r2# GPIO_NO=$((232+25)) #base + number of gpio
root@bpi-r2# echo $GPIO_NO
257
root@bpi-r2# echo $GPIO_NO > /sys/class/gpio/export

```

Pin 14=GND/16=GPIO25 (+)

### GPIO as Output

```

root@bpi-r2# echo out > /sys/class/gpio/gpio${GPIO_NO}/direction
root@bpi-r2# echo 1 > /sys/class/gpio/gpio${GPIO_NO}/value
root@bpi-r2# echo 0 > /sys/class/gpio/gpio${GPIO_NO}/value

```

used for LED+resistor (220 Ohm) on Pin 14=GND/16=GPIO25 (+)

### GPIO as Input

now try with high-active button-circuit on GPIO 200 (pin 40 between button and resistor, using pin 39 as GND [resistor] and pin 17 as 3v3-vcc)

```

[10:54] root@bpi-r2:~# echo in > /sys/class/gpio/gpio${GPIO_NO}/direction
[10:56] root@bpi-r2:~# cat /sys/class/gpio/gpio${GPIO_NO}/value

```

```
0 #button not pressed
[10:56] root@bpi-r2:~# cat /sys/class/gpio/gpio${GPIO_NO}/value
1 #button pressed
[10:56] root@bpi-r2:~# cat /sys/class/gpio/gpio${GPIO_NO}/value
0 #button not pressed
#check every 1/4s
watch -n 0.25 cat /sys/class/gpio/gpio${GPIO_NO}/value
```

## Special GPIO

memory-hack (like in 4.4.70) not needed

here example for GPIO24 (pin12):

```
root@bpi-r2# GPIO_NO=$((232+24))
root@bpi-r2# echo $GPIO_NO > /sys/class/gpio/export
root@bpi-r2# echo out > /sys/class/gpio/gpio${GPIO_NO}/direction
root@bpi-r2# echo 1 > /sys/class/gpio/gpio${GPIO_NO}/value
```

LED becomes on :)

## on-board LEDs

on-board leds used here are near the power-socket (not next to gpio)

<http://forum.banana-pi.org/t/control-on-board-leds/4287/13>

on ⇒

```
echo 1 > /sys/class/leds/bpi-r2:isink:green/brightness
```

off ⇒

```
echo 0 > /sys/class/leds/bpi-r2:isink:green/brightness
```

blink (creates delay\_on/off-nodes for frequency) ⇒

```
echo timer > /sys/class/leds/bpi-r2:isink:green/trigger
```

change blink frequency (on and off time in ms) ⇒

```
echo 100 > /sys/class/leds/bpi-r2:isink:green/delay_on
echo 100 > /sys/class/leds/bpi-r2:isink:green/delay_off
```

in my tests, green is blinking by default (red+blue are simply on/off), i don't know how to disable blinking of green led

```
L=/sys/class/leds/bpi-r2\:isink
```

```
echo 0 > $L:red/brightness      #goes off
echo 1 > $L:red/brightness      #goes on
echo 0 > $L:green/brightness    #goes off
echo 1 > $L:green/brightness    #starts blinking
```

## UART

### change DTS(i)

with Kernel 4.4.x the DeviceTree-sections are missing, these can be copied from a newer Kernel (dtsi). in the \*bpi\*.dts or \*bananapi\*.dts set state to enabled

definitions in the mt7623.dtsi:

<http://elixir.free-electrons.com/linux/v4.13-rc7/source/arch/arm/boot/dts/mt7623.dtsi>

now in bananapi.dts set „status=okay“ for your desired uart

notice that in mt7623.dtsi first must come uart2 then the others, else after uboot-message „Starting Kernel“ no more output is shown

Uart3 can be [routed to UCTS2/URTS2](#). These ports are next to Debug-UART-connector ([here](#))

### port preferences

```
#show preferences of serial port (replace ttyS2 with your port or ttyUSB0 if
a USB2serial-adapter is used):
stty -F /dev/ttyS2 -a

#set speed to 9600 baud, 8 bits, 1 stop bit, no parity:
stty -F /dev/ttyS2 9600 cs8 -cstopb -parenb

#deactivate processing (character conversion,linebreaks,...)
stty -F /dev/ttyS2 -opost

#raw Modus
stty -F /dev/ttyS2 raw
```

### Usage

```
pin 8/10 = uart1 (tx/rx) = 11003000
pin 11/13 = uart0 (tx/rx) = 11002000
```

```
#!/bin/bash
DEV=/dev/ttyS2
#stty -F ${DEV} sane
#stty -F ${DEV} 9600 cs8 -cstopb -parenb -crtscts -echo
```

```

stty -F ${DEV} 9600 cs8 -cstopb -parenb raw -echo

dmesg | grep "ttyS.*MMIO" | sed 's/^\[.*\] \(\d*.*\) at.*$/\1/'

echo "11002000 = uart0 (tx/rx) = pin 11/13"
echo "11003000 = uart1 (tx/rx) = pin 8/10"

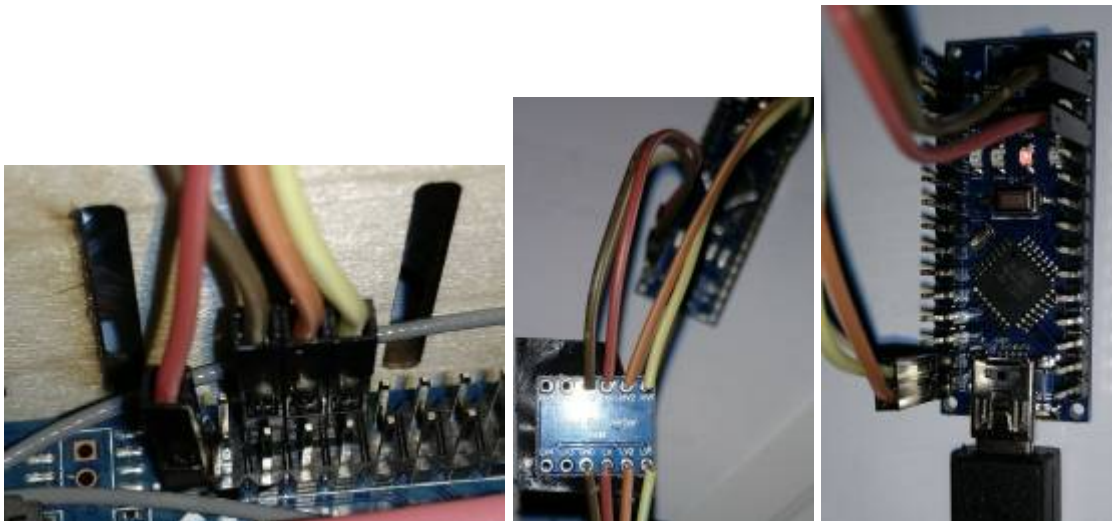
echo "using $DEV"
echo "send data using \"echo \"AT\" >$DEV\""

while read line; do
# if [[ -n "$line" ]]; then
    echo "["$(date "+%Y-%m-%d %H:%M:%S")"] received: "$line
# fi
done <<(cat $DEV)

echo "AT" >/dev/ttyS2

```

simple example for Arduino (Nano)



| PI      |       | Levelshifter |     | Arduino |     |
|---------|-------|--------------|-----|---------|-----|
| 1 (3V3) | ----- | LV           | HV  | -----   | 5V  |
| 6 (GND) | ----- |              | GND | -----   | GND |
| 8 (TX)  | ----- | LV2          | HV2 | -----   | RX  |
| 10 (RX) | ----- | LV1          | HV1 | -----   | TX  |

## PWM

kernel-option PWM\_MEDIATEK must be set (module possible), depends on PWM(=y)

using gpio 206 (pin 7) as pwm3

```

echo 3 >/sys/class/pwm/pwmchip0/export
echo 200000 >/sys/class/pwm/pwmchip0/pwm3/period

```

```
echo 100000 >/sys/class/pwm/pwmchip0/pwm3/duty_cycle
echo 1 >/sys/class/pwm/pwmchip0/pwm3/enable
```

<https://www.kernel.org/doc/Documentation/pwm.txt>

period The total period of the PWM signal (read/write). Value is in nanoseconds and is the sum of the active and inactive time of the PWM.  
duty\_cycle The active time of the PWM signal (read/write). Value is in nanoseconds and must be less than the period.

```
period=200000ns=200ms=5kHz
duty_cycle=100000ns=1/2 period=50% high + 50% low Signal
```

currently output has the wrong frequency (1kHz instead of 5kHz) see [forum](#) and [issue](#)

2018-03-02: frequency is now right: [Commit in 4.14-main](#)

## SPI

<http://forum.banana-pi.org/t/bpi-r2-spi-communication/4779/27>

## I2C

[how to add a i2c RTC](#)

```
apt-get install i2c-tools
```

in ubuntu 18.4 you need to add universe to /etc/apt/sources.list

```
[17:13] root@bpi-r2:~# modprobe i2c-dev
[17:14] root@bpi-r2:~# i2cdetect -y 0
```

added an rtc ds1307 (with removed pullups) to i2c0 (I2C\_SDA0=pin3, I2C\_SCL0=pin5, 5V=pin4, GND=pin6)

```
#!/bin/bash
modprobe i2c-dev
modprobe rtc-ds1307
echo ds1307 0x68 > /sys/class/i2c-adapter/i2c-0/new_device
#cat /sys/class/i2c-dev/i2c-0/device/0-0068/rtc/rtc0/time
#read rtc
hwclock -r
#set system-clock to rtc-value
#hwclock -s
#set rtc to system-time
#hwclock -w
```



# 1Wire

thanks to user [phil from bpi-r2-forum](#)

To enable w1-gpio on GPIO 19 add the following to the main node of mt7623n-bananapi-bpi-r2.dts

```
w1 {
    pinctrl-names = "default";
    compatible = "w1-gpio";
    gpios = <&pio 19 0>;
    status = "okay";
};
```

dts for kernel 4.9 with 1wire-node

add settings to kernel config

```
CONFIG_W1=m
CONFIG_W1_MASTER_GPIO=m
CONFIG_W1_SLAVE_THERM=m
```

and recompile the kernel

Your devices should now show up at /sys/bus/w1/devices/

## GPS-PPS

<http://mtnstormdaq.com/blog/2012/10/gps-pps-use-as-a-time-reference/>

[phil on bpi-r2-forum](#) got pps working with kernel 4.9

[HW-module](#)

adding this to main-section of mt7623n-bananapi-bpi-r2.dts:

```
pps {
    pinctrl-names = "default";
    compatible = "pps-gpio";
    gpios = <&pio 72 0>;
    status = "okay";
};
```

modified 4.9 dts

and add this options in the kernel-config for GPIO PPS support:

```
CONFIG_PPS=m
```

```
CONFIG_PPS_CLIENT_LDISC=m  
CONFIG_PPS_CLIENT_GPIO=m
```

## thermal

not really gpio, but i wont spend an own page

```
cat /sys/class/thermal/thermal_zone0/temp
```

<http://forum.banana-pi.org/t/lm-sensors-support/4145/30>

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