Hardware PWM

Introduction

For pin position, numbers and names, please refer to the pinmap.

ODROID-N2

J2 - 2x20 PINS

WE SHOULD CHECK THE PIN MAP!!!

Default Pin State	GPIO & Export No	Net Name	Pin Number	Pin Number	Net Name	GPIO & Export No	Default Pin State
-	-	3.3V	1	2	5.0V	-	-
I(P/D)	GPIOX.17 (#493)	I2C0_SDA	3	4	5.0V	-	-
I(P/U)	GPIOX.18 (#494)	I2C0_SCL	5	6	GND	-	-
I(P/D)	GPIOA.13 (#473)		7	8	TXD1	GPIOX.12 (#488)	I(P/U)
-	-	GND	9	10	RXD1	GPIOX.13 (#489)	I(P/U)
I(P/U)	GPIOX.3 (#479)		11	12	PWM_E	GPIOX.16 (#492)	I(P/U)
I(P/U)	GPIOX.4 (#480)		13	14	GND	-	-
I(P/U)	GPIOX.7 (#483)	PWM_F	15	16		GPIOX.0 (#476)	I(P/U)
-	-	3.3V	17	18		GPIOX.1 (#477)	I(P/U)
I(P/U)	GPIOX.8 (#484)	SPI0_MOSI	19	20	GND	-	-
I(P/U)	GPIOX.9 (#485)	SPI0_MISO	21	22		GPIOX.2 (#478)	I(P/U)
I(P/U)	GPIOX.11 (#487)	SPI0_CLK	23	24	SPI0_SS0	GPIOX.10 (#486)	I(P/U)
-	-	GND	25	26	SPI0_SS1	GPIOA.4 (#464)	I(P/D)
I(P/U)	GPIOA.14 (#474)	I2C1_SDA	27	28	I2C1_SCL	GPIOA.15 (#475)	I(P/U)
I(P/U)	GPIOX.14 (#490)		29	30	GND	-	-
I(P/U)	GPIOX.15 (#491)		31	32		GPIOA.12 (#472)	I(P/D)
I(P/U)	GPIOX.5 (#481)	PWM_C	33	34	GND	-	-

Default Pin State	GPIO & Export No	Net Name	Pin Number	Pin Number	Net Name	GPIO & Export No	Default Pin State
I(P/D)	GPIOX.6 (#482)	PWM_D	35	36		GPIOX.19 (#495)	-
		ADC.AIN3	37	38	REF 1.8V		
-	-	GND	39	40	ADC.AIN2		

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J2 - 2x20 PINS

Default Pin State	GPIO & Export No	Net Name	Pin Number	Pin Number	Net Name	GPIO & Export No	Default Pin State
-	-	3.3V	1	2	5.0V	-	-
I(P/D)	GPIOX.17 (#493)	I2C0_SDA	3	4	5.0V	-	-
I(P/U)	GPIOX.18 (#494)	I2C0_SCL	5	6	GND	-	-
I(P/D)	GPIOX.5 (#481)		7	8	TXD1	GPIOX.12 (#488)	I(P/U)
-	-	GND	9	10	RXD1	GPIOX.13 (#489)	I(P/U)
I(P/U)	GPIOX.3 (#479)		11	12	PWM_E	GPIOX.16 (#492)	I(P/U)
I(P/U)	GPIOX.4 (#480)		13	14	GND	-	-
I(P/U)	GPIOX.7 (#483)	PWM_F	15	16		GPIOX.0 (#476)	I(P/U)
-	-	3.3V	17	18		GPIOX.1 (#477)	I(P/U)
I(P/U)	GPIOX.8 (#484)	SPI0_MOSI	19	20	GND	-	-
I(P/U)	GPIOX.9 (#485)	SPI0_MISO	21	22		GPIOX.2 (#478)	I(P/U)
I(P/U)	GPIOX.11 (#487)	SPI0_SCLK	23	24	SPI0_CS0	GPIOX.10 (#486)	I(P/U)
-	-	GND	25	26	SPI0_CS1	GPIOH.6 (#433)	I(P/D)
I(P/U)	GPIOA.14 (#474)	I2C1_SDA	27	28	I2C1_SCL	GPIOA.15 (#475)	I(P/U)
I(P/U)	GPIOX.14 (#490)		29	30	GND	-	-
I(P/U)	GPIOX.15 (#491)		31	32		GPIOH.7 (#434)	I(P/D)
I(P/U)	GPIOX.6 (#482)	PWM_A	33	34	GND	-	-
I(P/D)	GPIOX.19 (#495)	PWM_B	35	36		GPIOH.5 (#432)	-
		ADC.AIN2	37	38	REF 1.8V		
-	-	GND	39	40	ADC.AIN0		

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Enable PWM

Before using the PWM, you should enable the pwm by the dtbo.
Please check the DTBO page

PWM Hardware Pin-map

You can access each PWM pin using sysfs interface.

The following table shows the pwm pins availables.

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The pwm chip number is based on the below table.
The top index show your dtbo selection.

	PWM_CD Only	**PWM_EF Only**	**PWM_CD & PWM_EF**
PWM_CD	pwmchip4	X	pwmchip4
PWM_EF	X	pwmchip4	pwmchip8

Hardware connection			Linux kernel sysfs control		
PWM	gpio	40-pin num.	pwmchip	pwm_pins	export command /sys/class/pwm/
PWM_C	GPIOX.5	33	pwmchip<num>	0	echo 0 > pwmchip<num>/export
PWM_D	GPIOX.6	35	pwmchip<num>	1	echo 1 > pwmchip<num>/export
PWM_E	GPIOX.16	12	pwmchip<num>	0	echo 0 > pwmchip<num>/export
PWM_F	GPIOX.7	15	pwmchip<num>	1	echo 1 > pwmchip<num>/export

pwmchip#NUM can be found in /sys/class/pwm/

```
root@odroid:~$ cd /sys/class/pwm/
root@odroid:/sys/class/pwm# ls
pwmchip0  pwmchip12  pwmchip16  pwmchip4  pwmchip8
root@odroid:/sys/class/pwm#
```

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The pwm chip number is based on the below table.
The top index show your dtbo selection.

	PWM_AB Only	**PWM_EF Only**	**PWM_AB & PWM_EF**
PWM_AB	pwmchip0	X	pwmchip0
PWM_EF	X	pwmchip0	pwmchip4

Hardware connection			Linux kernel sysfs control		
PWM	gpio	40-pin num.	pwmchip	pwm_pins	export command /sys/class/pwm/
PWM_A	GPIOX.6	33	pwmchip<num>	1	echo 1 > pwmchip<num>/export
PWM_B	GPIOX.19	35	pwmchip<num>	0	echo 0 > pwmchip<num>/export
PWM_E	GPIOX.16	12	pwmchip<num>	0	echo 0 > pwmchip<num>/export
PWM_F	GPIOX.7	15	pwmchip<num>	1	echo 1 > pwmchip<num>/export

pwmchip#NUM can be found in /sys/class/pwm/

```
root@odroid:~$ cd /sys/class/pwm/
root@odroid:/sys/class/pwm# ls
pwmchip0  pwmchip4  pwmchip8
root@odroid:/sys/class/pwm#
```

Driver usage

The Example tested on the ODROID-N2.

You can control this pwm via simple sysfs entries.
This example uses pin number 12 which is connected to the GPIO_16(GPIOX_16).
Output PWM_E to GPIOX_16 pin.

Various SYSFS Attributes

- Request the device

```
root@odroid:~$ cd /sys/class/pwm/
root@odroid:/sys/class/pwm# echo 0 > pwmchip4/export
root@odroid:/sys/class/pwm# cd pwmchip4
root@odroid:/sys/class/pwm/pwmchip4# ls
device  export  npwm  power  pwm0  subsystem  uevent  unexport
root@odroid:/sys/class/pwm/pwmchip4#
```

- Free the device

```
root@odroid:~$ cd /sys/class/pwm/
root@odroid:/sys/class/pwm# echo 0 > pwmchip4/unexport
root@odroid:/sys/class/pwm# cd pwmchip4/
root@odroid:/sys/class/pwm/pwmchip4# ls
device  export  npwm  power  subsystem  uevent  unexport
```

period

The total period of the PWM signal.
Value is in nanoseconds and is the sum of the active and inactive time of the PWM.
The default is zero. If the period is zero, other sysfs of pwm cannot be changed.
Must change 'period' first.
Example
If the period is 1 ms, enter

```
root@odroid:/sys/class/pwm/pwmchip4/pwm0# echo 1000000 > period
```

The period will set to 1 ms and PWM Frequency will be 1 kHz.

enable

Enable/Disable the PWM channel

- Enable the PWM

```
root@odroid:/sys/class/pwm/pwmchip4/pwm0# echo 1 > enable
```

- Disable the PWM

```
root@odroid:/sys/class/pwm/pwmchip4/pwm0# echo  > enable
```

duty_cycle

The active time of the PWM signal.
Value is in nanoseconds and must be less than the period.

```
root@odroid:/sys/class/pwm/pwmchip4/pwm0# echo 500000 > duty_cycle
```

Polarity

The polarity of the PWM signal.
Value is the string “normal” or “inversed”.
If the polarity is “normal”, the PWM signal is high during the active time(duty_cycle) and is low during the other time(period - duty_cycle).
Example

- To set polarity to normal

```
root@odroid:/sys/class/pwm/pwmchip4/pwm0# echo "normal" > polarity
```

- To set polarity to inversed

```
root@odroid:/sys/class/pwm/pwmchip4/pwm0# echo "inversed" > polarity
```

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