

<b>Doc Title</b>	PcDuino User Guide	<b>Number</b>	WMPCD121219
		<b>Version</b>	0.2

# pcDuino User Guide

pcDuino

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<b>Doc Title</b>	PcDuino User Guide	<b>Number</b>	WMPCD121219
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**HISTORY**

<b>Version</b>	<b>Date</b>	<b>Description</b>	<b>Author</b>
0.1	12/07/2012	Initial specification draft	Lifeng Zhao
0.2	1/28/2013	Add I/O interface description	Lifeng Zhao

pcDuino

<b>Doc Title</b>	PcDuino User Guide	<b>Number</b>	WMPCD121219
		<b>Version</b>	0.2

## INDEX

1.	<b>Overview .....</b>	<b>4</b>
2.	<b>Required hardware for all samples in this user guide.....</b>	<b>7</b>
3.	<b>pcDuino board I/O interface description.....</b>	<b>9</b>
4.	<b>PcDuino firmware and software update procedure.....</b>	<b>10</b>
5.	<b>Use PcDuino as an mini PC platform.....</b>	<b>12</b>
6.	<b>Use PcDuino as an high performance Hardware platform.....</b>	<b>13</b>
5.1	Guide of individual Hardware samples .....	13
5.1.1	UART .....	13
5.1.2	ADC .....	15
5.1.3	PWM Sample .....	17
5.1.4	GPIO Sample .....	19
5.1.5	I2C Sample .....	21
5.1.6	SPI Sample.....	23
7.	<b>Exception list .....</b>	<b>错误！未定义书签。</b>

pcDuino

<b>Doc Title</b>	PcDuino User Guide	<b>Number</b>	WMPCD121219
		<b>Version</b>	0.2

## 1. Overview

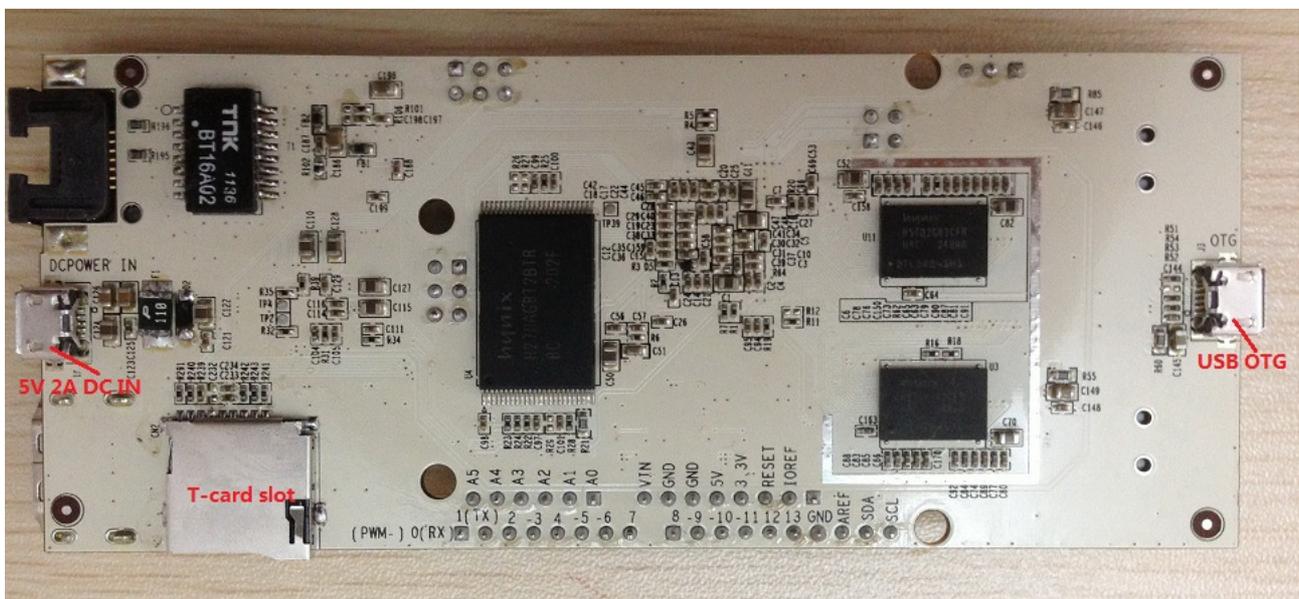
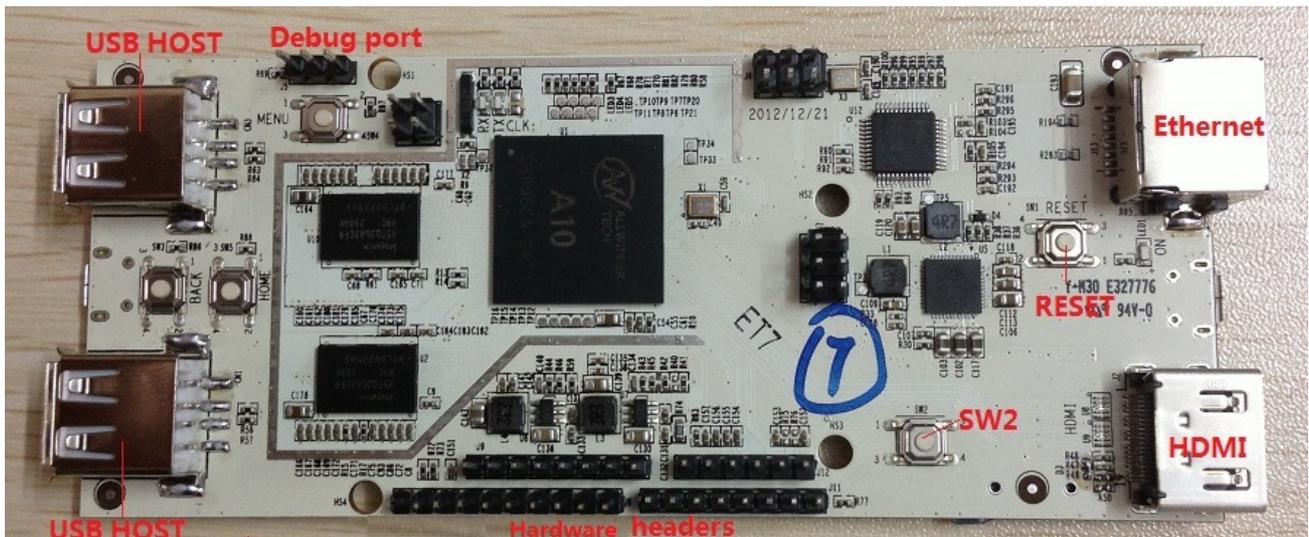
**PcDuino** is a high performance, cost effective mini PC platform that runs PC like OS such as Ubuntu Linux. It outputs its screen to HDMI enabled TV or monitor via the built in HDMI interface. It is specially targeted for the fast growing demands from the open source community, that is, a platform could run full blown PC like OS with easy to use tool chain and compatible with the popular Arduino ecosystem such as Arduino Shields and open source projects etc.

The hardware specification for pcDuino is as follows:

Items	Details
CPU	AllWinner A10 SoC, 1GHz ARM Cortex A8
GPU	OpenGL ES2.0, OpenVG 1.1 Mali 400 core
DRAM	1GB DDR3
Onboard Storage	2GB Flash, macro SD card slot for up to 32GB
Video Output	HDMI 720p or 1080p 60Hz
OS	Linux3.0 + Ubuntu12.10
Extension Interface	Arduino Headers
Network interface	USB WiFi extension (not included)
Power	5V 2A

The following are top and bottom views for pcDuino.

Doc Title	PcDuino User Guide	Number	WMPCD121219
		Version	0.2



PcDuino targets for two markets primarily, i.e., the Raspberry Pi mini PC market and Arduino market as open-source electronics prototyping platform. With pcDuino, user could do lots of fun stuff including but not limited to the follows:

- Learn or teach to program
- Interface with hardware
- Use Internet browser or Office from Ubuntu
- Learn Ubuntu linux
- Play movie
- Play game
- DIY projects

Compared with Raspberry Pi, pcDuino has several competitive advantages in terms of CPU/GPU performance,

<b>Doc Title</b>	PcDuino User Guide	<b>Number</b>	WMPCD121219
		<b>Version</b>	0.2

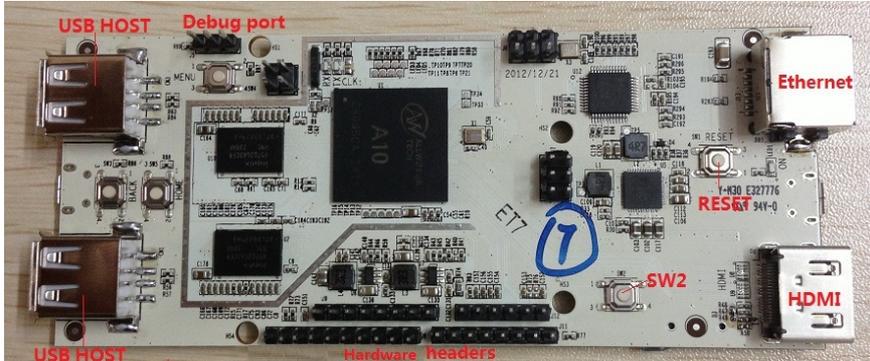
hardware interface, compatibility (due to SD card) and HTML5 and flash support.

Items	Raspberry Pi	PcDuino	Advantages
CPU	750MHz ARM11 Single Core (ARM v6)	1GHz ARM Cortex A8 (ARM v7)	Faster and advanced CPU core
GPU	OpenGL ES2.0, OpenVG 1.1, Broadcom Videocore	OpenGL ES2.0, OpenVG 1.1, Mali 400 core	Faster GPU core
Onboard Flash	None	2GB Flash	Always boot, no boot issue due to SD card compatibility
Extension Interface	No	Hardware Headers	Need purchase expensive Raspberry Hardware bridge
HTML5 and Flash support	No	Yes	Important for Internet browser and programming

Doc Title	PcDuino User Guide	Number	WMPCD121219
		Version	0.2

## 2. Required hardware for all samples in this user guide

PcDuino board



micro-USB port power adaptor ( 5V, 2000mA)



Display with HDMI port



HDMI cable



USB keyboard (must)

USB Hub and USB mouse ( optional but strongly recommended )

<b>Doc Title</b>	PcDuino User Guide	<b>Number</b>	WMPCD121219
		<b>Version</b>	0.2



Some Dupont Lines to connect pcDuino with test devices



**Note:**

Before run the following samples, Connect pcDuino with the devices correctly:

Straberry USB host port => USB hub => keyboard & mouse

Straberry HDMI port => HDMI cable => HDMI display

pcDuino

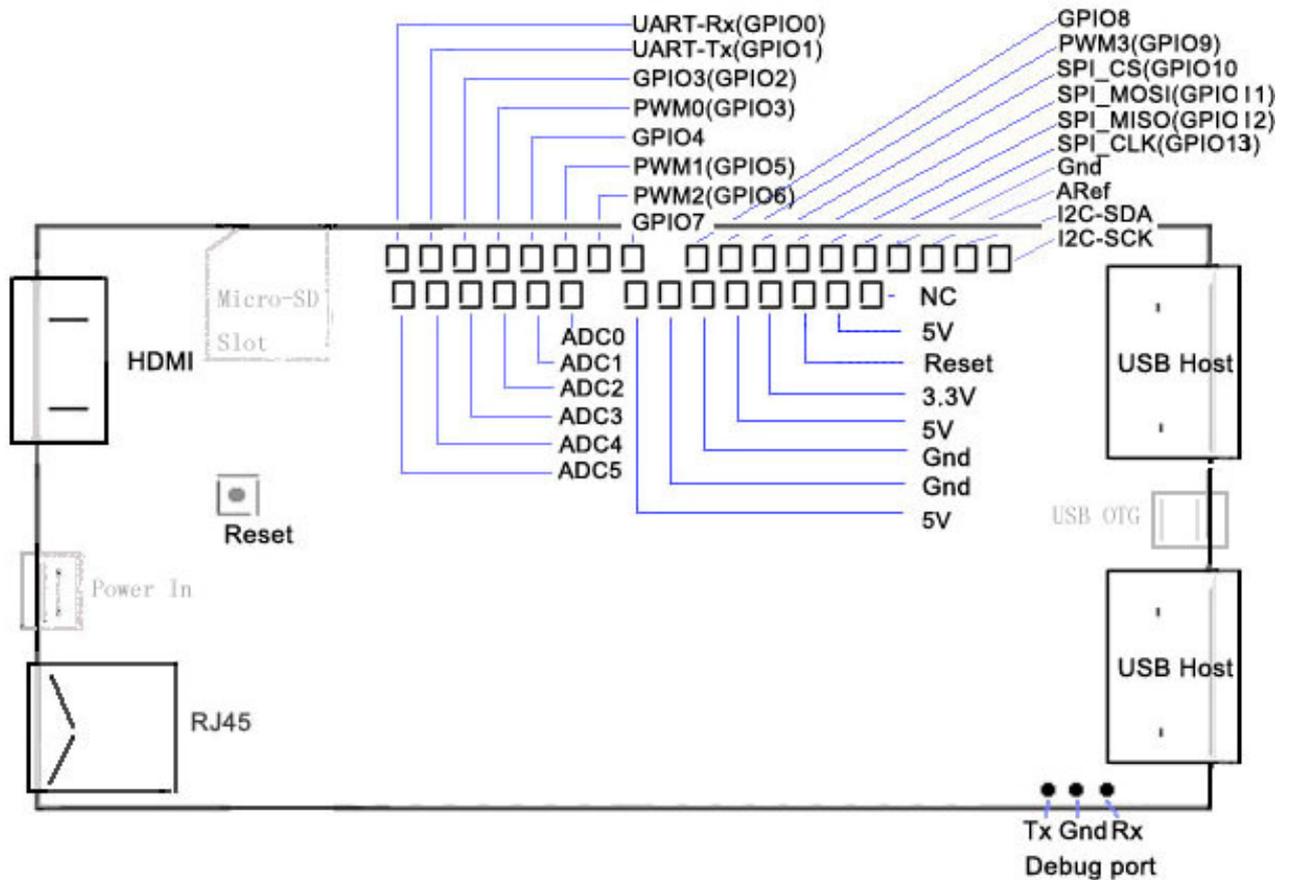
Doc Title	PcDuino User Guide	Number	WMPCD121219
		Version	0.2

### 3. pcDuino board I/O interface description

Here is the list of I/O interfaces on pcDuino board.

1. 14 digital pins for GPIO
2. One UART RX, one UART TX
3. Two PWM pins
4. Six ADC pins
5. Four SPI pins
6. Two I2C pins

It supports to connect any Arduino shield with pcDuino via any of the above I/O interfaces. It allows to use pcDuino with the same code used in Arduino.



<b>Doc Title</b>	PcDuino User Guide	<b>Number</b>	WMPCD121219
		<b>Version</b>	0.2

#### 4. PcDuino firmware and software update procedure

PcDuino could boot from NAND or mini-SD card. There is the factory prebuilt code in the NAND flash. To update the factory prebuilt code, please follow the following procedures carefully.

##### Steps to burn the whole system to NAND flash

A PC tool called “Livesuit” is provided to burn the firmware from PC to the on board flash. Livesuite requires a USB to min-USB cable that connects the PC to the USB OTG port on board.

##### Note:

To run livesuite for the first time, you need to install USB driver under livesuite directory.

To do this, After power on press “sw1(reset)” and “sw2” key to enter the force-update process.

For more detailed usage of livesuite, please check Livesuite manual which is under livesuite software directory.

Steps:

1. Copy Ubuntu(Ubuntu.ext4, env\_nandd.fex, update.sh) to the root directory of your usb disk , and plugin the USB disk to pcDuino .
2. Open the LiveSuit software, and select the firmware .
3. Connect pcDuino board to PC with USB OTG cable .
4. During upgrade, you will be asked to install the USB Driver twice if it not installed yet. The driver file is “usbdrv.inf” in the folder “usbDriver”, which is located at the installation path of “LiveSuit” .
5. The whole system will updated from usb disk automatically, it takes about 10 minutes.

##### Steps to update software from usb disk

Most of the time, users do not need to update whole system, only some components need to update for bugfix or new features support.

1. Copy update package to usb disk (for example: update\_fm.sh, update.tgz )
2. Power on pcDuino board
3. Plugin the usb disk to pcDuino usb host port
4. Open a terminal after login to Ubuntu
5. Run commands to update the package

```
$ cd /media/*/
$ bash ./update_fm.sh
```

##### Note:

If the udisk has more than one partition, enter the whole path which the partition including update package is mounted, for example “cd /media/Volumn”. If you don’t know which partition to choose, open “File Manager” to check it.

The name of update script (update\_fm.sh) and update package(update.tgz) may be different for different release version.

<b>Doc Title</b>	PcDuino User Guide	<b>Number</b>	WMPCD121219
		<b>Version</b>	0.2

**Steps to burn the firmware to mini-SD card**

Another tool called “PhoenixCard” is provided to do this job. This tool makes the process to burn the firmware to SD card very easy. Please see the document under the software directory for more details.

*pcDuino*

<b>Doc Title</b>	PcDuino User Guide	<b>Number</b>	WMPCD121219
		<b>Version</b>	0.2

## 5. Use PcDuino as an mini PC platform

PcDuino supports customized Ubuntu linux 12.10 that is specially optimized for running on ARM cortex platform with limited DRAM and NAND flash support. The device could be operated with the USB mouse and keyboard. The supported application list consists of the follows:

Items	Details
Terminal	<ul style="list-style-type: none"> <li>● Use build in "LXTerminal" application from desktop</li> <li>● Launch terminal application, run standard linux commands or vi editor etc.</li> <li>● Launch C/C++ compile (use gcc), assembly and execution</li> </ul>
File browser	<ul style="list-style-type: none"> <li>● Use build in File Manager from desktop</li> <li>● Used for typical file management</li> </ul>
Internet browser	<ul style="list-style-type: none"> <li>● Use chromium web browser from desktop</li> <li>● Support HTML5</li> </ul>
Office viewer and editor	<ul style="list-style-type: none"> <li>● Use Document Viewer from desktop for PDF file view</li> <li>● Use Gnumeric from desktop for Excel file view and edit</li> <li>● Use AbiWord from desktop for Word file view and edit</li> </ul>
Movie player	<ul style="list-style-type: none"> <li>● Use MPlayer from desktop</li> <li>● Could playback audio, video and image</li> </ul>

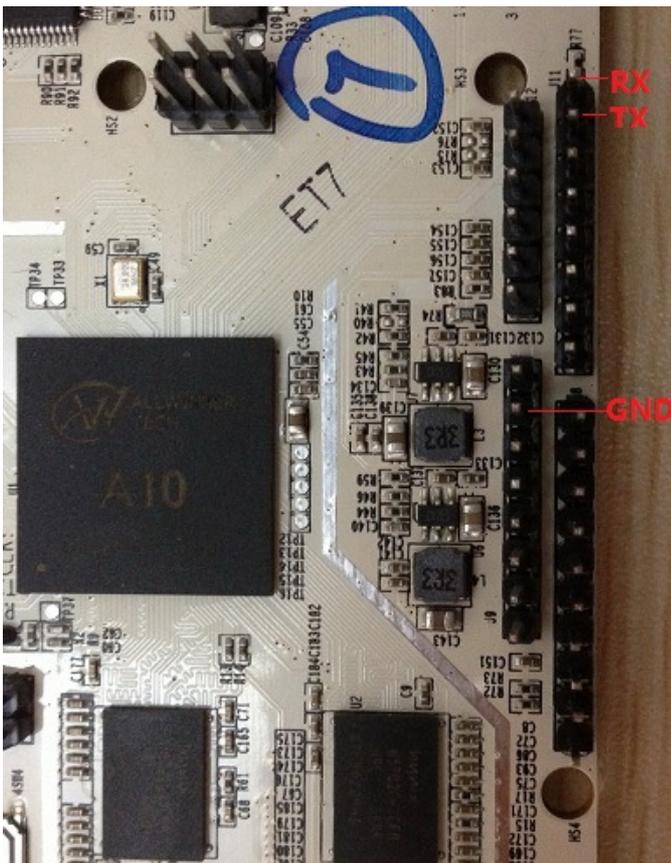
PcDuino has no build in WiFi and you could get one WiFi dongle which is included in pcDuino toolkit.

Doc Title	PcDuino User Guide	Number	WMPCD121219
		Version	0.2

## 6. Use PcDuino as an high performance Hardware platform

### 5.1 Guide of individual Hardware samples

#### 5.1.1 UART



#### Hardware required:

USB to serial Cable (e.g. PL2303).



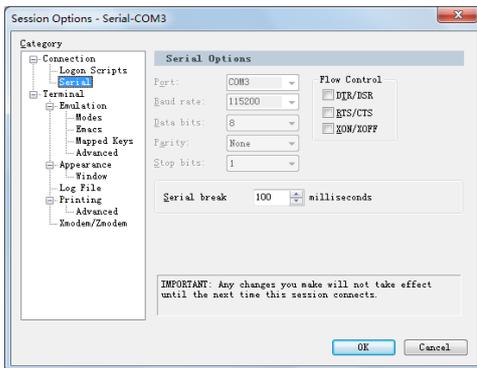
#### Test steps:

Doc Title	PcDuino User Guide	Number	WMPCD121219
		Version	0.2

- a) Plugin USB-to-serial cable to PC USB port and install USB driver if needed.



- b) Set uart tool on PC ( baud rate 115200)  
for example: sercureCRT



- c) Connect USB-to-serial cable to pcDuino before power on

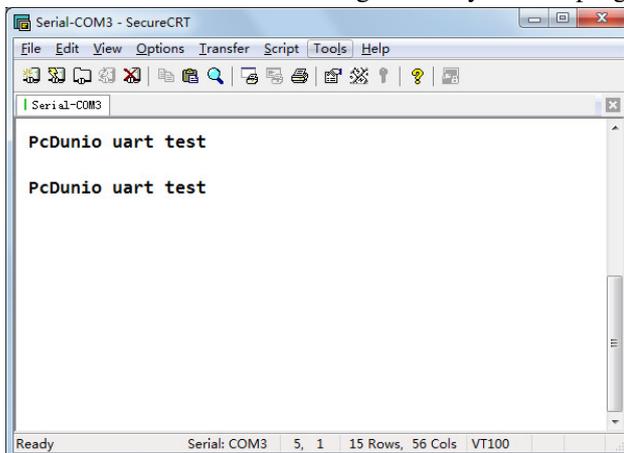
USB-to-serial      PcDuino  
GND ----- GND  
RX ----- PIN1(TX)

- d) Open a Terminal after login to Ubuntu  
e) Run uart test sample with the following commands in the terminal window

```
$ cd /home/pcDuino/sample/test
$ ./uart_test "pcDuino uart test"
```

**Note:** do not input the symbol "\$", you can replace the message "PcDuino uart test" by your own.

- f) PC uart tool will receive messages sent by the test program

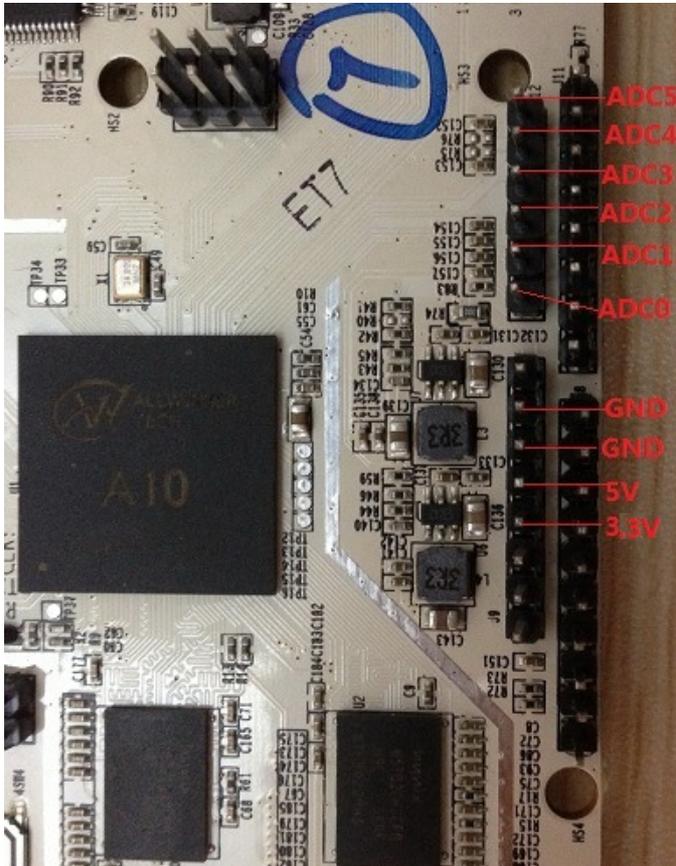


- g) Press "Ctrl" and "C" on keyboard to stop the test process

Doc Title	PcDuino User Guide	Number	WMPCD121219
		Version	0.2

## 5.1.2 ADC

ADC0 and ADC1 are 6 bits resolution.



### Hardware required:

1.5V Battery



### Test Steps:

- Connect the battery to pcDuino before power on
 

Battery	PcDuino
N -----	GND
P -----	ADC0 or ADC1
- Connect usb power adaptor to power on

<b>Doc Title</b>	PcDuino User Guide	<b>Number</b>	WMPCD121219
		<b>Version</b>	0.2

- c) Open a Terminal after login to Ubuntu
- d) Run adc test sample with the following commands in the terminal window

```
$ cd /home/pcDuino/sample/test
$ ./adc_test 0
```

**Note:** do not input the symbol “\$”, if the device connects to ADC1, run “./adc\_test 1” instead
- e) the test program will print out the raw adc value (about 40-50 depend on the battery voltage)

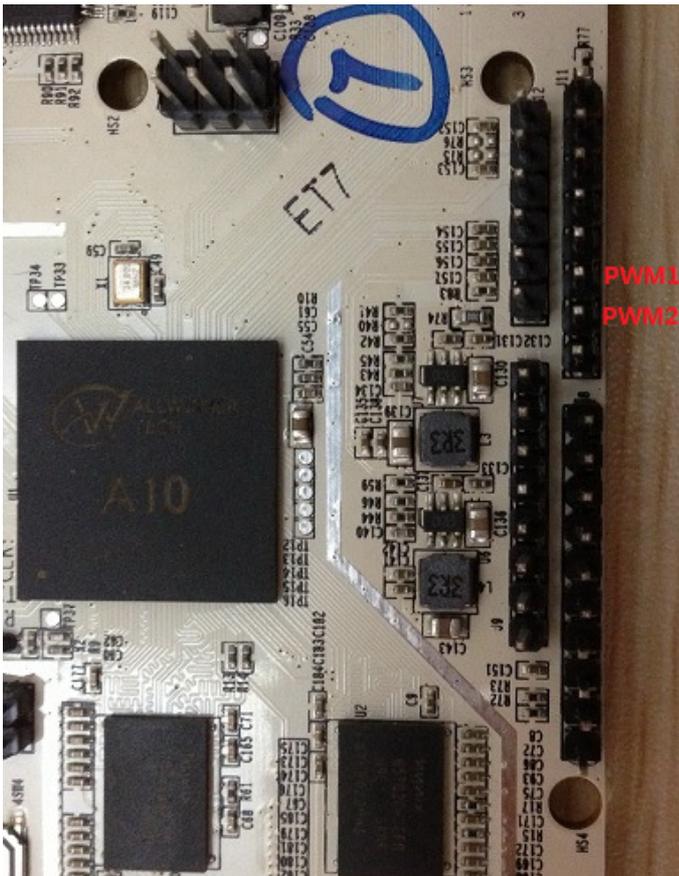
pcDuino

Doc Title	PcDuino User Guide	Number	WMPCD121219
		Version	0.2

### 5.1.3 PWM Sample

#### PWM

There are two PWM interfaces, PWM1 and PWM2 are hardware PWM and can support up to 24MHz frequency.



#### Hardware required:

A buzzer



#### Test Steps:

1. Connect the buzzer to pcDuino before power on

<b>Doc Title</b>	PcDuino User Guide	<b>Number</b>	WMPCD121219
		<b>Version</b>	0.2

GND(N) ----- GND

VCC(P) ----- PWM1 (any pin of PWM1-PWM2)

2. Connect usb power adaptor to power on
3. Open a Terminal after login to Ubuntu
4. Run pwm sample with the following commands in the terminal window

```
$ cd /home/pcDuino/sample/test
```

```
$ ./pwm_test 1
```

**Note:**

do not input the symbol “\$”, if the buzzer connects to another pin, replace the PWM\_ID with the one buzzer connected(example: if the buzzer connects to PWM2, then run “./pwm\_test 2” instead).

5. the test program will make the buzzer generating audio signal, and you can hear the sound.

pcDuino

Doc Title	PcDuino User Guide	Number	WMPCD121219
		Version	0.2

### 5.1.4 GPIO Sample

There are 14 GPIOs. Sometimes, some GPIO will be mux as other PIN, such as SPI



#### Hardware required:

An LED Module



A Button Module

<b>Doc Title</b>	PcDuino User Guide	<b>Number</b>	WMPCD121219
		<b>Version</b>	0.2



### Test Steps:

1. Connect the LED to pcDuino before power on

Button		PcDuino
GND/-	-----	GND
S	-----	GPIO1 (any pin of GPIO0-13)

LED		PcDuino
GND/-	-----	GND
S	-----	GPIO0 (any pin of GPIO0-13)

2. Connect usb power adaptor to power on
3. Open a Terminal after login to Ubuntu
4. Run gpio sample with the following commands in the terminal window

```
$ cd /home/pcDuino/sample/test
$ ./io_test 1 0
```

#### Note:

Test program Usage:

```
$/io_test BUTTON_PIN_NUM LED_PIN_NUM
```

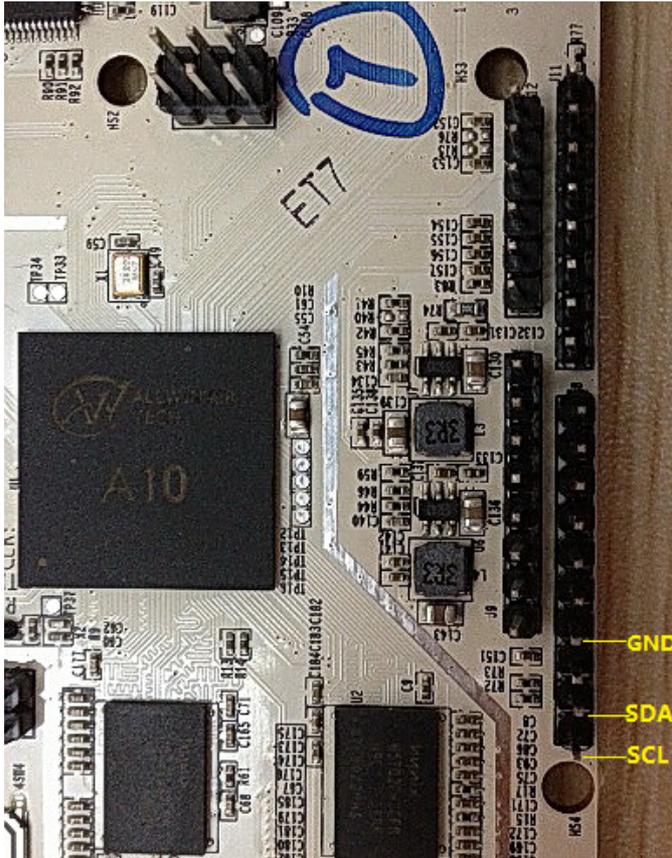
do not input the symbol "\$", if the Button/LED connects to another pin, replace the BUTTON\_PIN\_NUM/LED\_PIN\_NUM with the one which the button/LED connected(example: if the Button connects to GPIO5, LED connects to GPIO10, then run "./io\_test 5 10" instead).

5. Press/Release the button to turn on/off the LED.

Doc Title	PcDuino User Guide	Number	WMPCD121219
		Version	0.2

## 5.1.5 I2C Sample

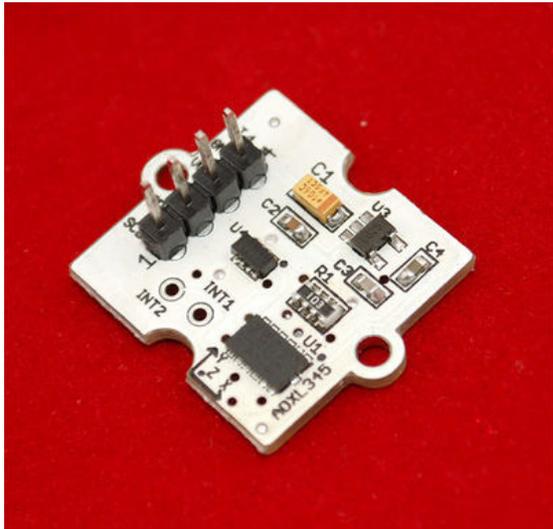
I2C (Two wire)



### Hardware required:

ADXL-345 Triple-Axis Analog Accelerometer

<b>Doc Title</b>	PcDuino User Guide	<b>Number</b>	WMPCD121219
		<b>Version</b>	0.2



#### Test steps:

- Connect the ADXL-345 device to pcDuino before power on
 

ADXL-345	PcDuino	
GND	-----	GND
VCC	-----	3.3V
SDA	-----	SDA
SCL	-----	SCL
- Connect usb power adaptor to power on
- Open a Terminal after login to Ubuntu
- Run adxl345 test sample with the following commands in the terminal window
 

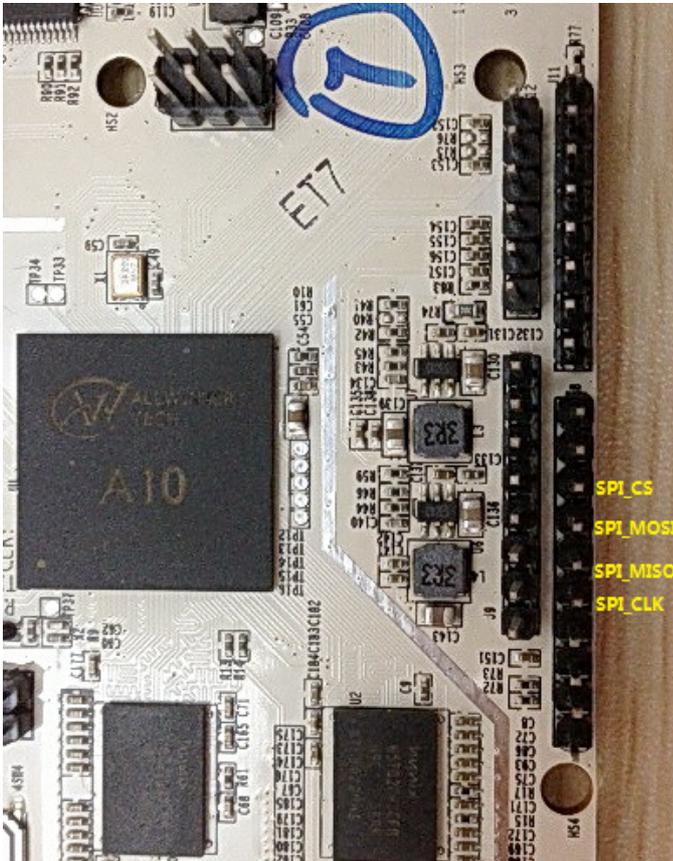
```
$ cd /home/pcDuino/sample/test
$ ./adxl345_test
```

Note: do not input the symbol "\$"
- the test program will print out the x, y, z value of adxl345, change the direction of the test device and the output value will change too
 

```
x=0, y=1, z=108
x=9, y=45, z=116
x=1, y=59, z=10
x=0, y=0, z=0
x=10, y=0, z=95
x=0, y=0, z=8
x=0, y=0, z=7
x=0, y=0, z=99
x=0, y=0, z=95
```

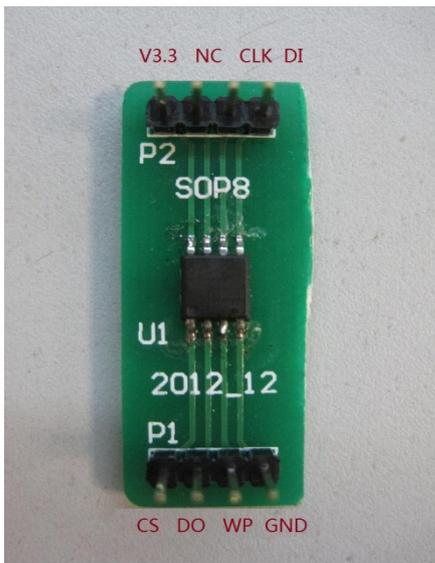
Doc Title	PcDuino User Guide	Number	WMPCD121219
		Version	0.2

### 5.1.6 SPI Sample



**Hardware required:**

An SPI flash test module ( for example: M25P16 )



<b>Doc Title</b>	PcDuino User Guide	<b>Number</b>	WMPCD121219
		<b>Version</b>	0.2

**Test steps:**

- a) Connect the spi flash to pcDuino before power on

SPI Flash	PcDuino
GND	----- GND
V3.3	----- 3.3V
DO	----- SPI0_MISO
DI	----- SPI0_MOSI
CS	----- SPI0_CS
CLK	----- SPI0_CLK

- b) Connect usb power adaptor to power on

- c) Open a Terminal after login to Ubuntu

- d) Run spi test sample with the following commands in the terminal window

```
$ cd /home/pcDuino/sample/test
```

```
$ ./spi_test
```

Note: do not input the symbol "\$"

- e) the test program will print out the flash chip id (for M25P16, chip id is 0xef2015):

```
spi flash ID=0xef2015
```

**Note:**

Some PADs of SPI bus are sharing with GPIO function, if you have done GPIO test but not RESET before executing “./spi\_test “ command, you may get invalid ID value.

- 1.