# **Board for Arduino**

keyestudio

Jun 20, 2022

# MCU DEVELOPMENT BOARD FOR ARDUINO

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#### Introduction:

Keyestudio UNO R3 development board is a microcontroller board based on the ATmega328P (datasheet), fully compatible with ARDUINO UNO REV3. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, 2 ICSP headers and a reset button.

It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.

Note that the two ICSP headers separately used to program the firmware to ATMEGA16U2-MU and ATMEGA328P-PU, but we have programmed the two chips, so generally no need to use them.

The Uno R3 differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega16U2 programmed as a USB-to-serial converter.

The UNO is the best board to get started with electronics and coding. If this is your first experience tinkering with the platform, the UNO is the most robust board you can start playing with.

# tech specs:

Microcontroller	ATmega328P-PU
Operating Voltage	5V
Input Voltage (recommended)	7-12V
Digital I/O Pins	14 (of which 6 provide PWM output)
PWM Digital I/O Pins	6 (D3, D5, D6, D9, D10, D11)
Analog Input Pins	6 (A0-A5)
DC Current per I/O Pin	20 mA
DC Current for 3.3V Pin	50 mA
Flash Memory	32 KB (ATmega328P-PU) of which 0.5 KB used by bootloader
SRAM	2 KB (ATmega328P-PU)
EEPROM	1 KB (ATmega328P-PU)
Clock Speed	16 MHz
LED_BUILTIN	D13



**Dimensions:** 

# **Element and Interfaces:**

Here is an explanation of what every element and interface of the board does:



1	<b>ICSP (In-Circuit Serial Programming) Header</b> In most case, ICSP is the AVRan Arduino micro- program header consisting of MOSI, MISO, SCK, RESET, VCC, and GND. It is often called the SPI (serial peripheral interface) and can be considered an "extension" of the output. In fact, slave the output devices under the SPI bus host. When connecting to PC, program the firmware to ATMEGA328P-PU.
2	<b>Power LED Indicator</b> Powering the Arduino, LED on means that your circuit board is correctly powered on. If LED is off, connection is wrong.
3	<b>Digital I/O</b> Arduino UNO has 14 digital input/output pins (of which 6 can be used as PWM outputs). These pins can be configured as digital input pin to read the logic value (0 or 1). Or used as digital output pin to drive different modules like LED, relay, etc. The pin labeled "" can be used to generate PWM.
4	GND (Ground pin headers) Used for circuit ground
6	AREF Reference voltage (0-5V) for analog inputs. Used with analogReference().
6	SDA IIC communication pin
7	SCL IIC communication pin
8	<b>ICSP (In-Circuit Serial Programming) Header</b> In most case, ICSP is the AVR, an Arduino micro-program header consisting of MOSI, MISO, SCK, RESET, VCC, and GND. Connected to ATMEGA 16U2-MU. When connecting to PC, program the firmware to ATMEGA 16U2-MU.
9	<b>RESET Button</b> You can reset your Arduino board, for example, start the program from the initial status. You can use the RESET button.
10	<b>D13 LED</b> There is a built-in LED driven by digital pin 13. When the pin is HIGH value, the LED is on, when the pin is LOW, it's off.
1	<b>USB Connection</b> Arduino board can be powered via USB connector. All you needed to do is connecting the USB port to PC using a USB cable.
12	ATMEGA 16U2-MU USB to serial chip, can convert the USB signal into serial port signal.
13	<b>TX LED</b> Onboard you can find the label: TX (transmit) When Arduino board communicates via serial port, send the message, TX led flashes.
14	<b>RX LED</b> Onboard you can find the label: RX(receive ) When Arduino board communicates via serial port, receive the message, RX led flashes.
15	<b>Crystal Oscillator</b> Helping Arduino deal with time problems. How does Arduino calculate time? by using a crystal oscillator. The number printed on the top of the Arduino crystal is 16.000H9H. It tells us that the frequency is 16,000,000 Hertz or 16MHz.
16	<b>Voltage Regulator</b> To control the voltage provided to the Arduino board, as well as to stabilize the DC voltage used by the processor and other components. Convert an external input DC7-12V voltage into DC 5V, then switch DC 5V to the processor and other components.
1	<b>DC Power Jack</b> Arduino board can be supplied with an external power DC7-12V from the DC power jack.
18	<b>IOREF</b> Used to configure the operating voltage of microcontrollers. Use it less.
19	<b>RESET Header</b> Connect an external button to reset the board. The function is the same as reset button (labeled 9)
20	<b>Power Pin 3V3</b> A 3.3 volt supply generated by the on-board regulator. Maximum current draw is 50 mA.
21	Power Pin 5V Provides 5V output voltage
22	Vin You can supply an external power input DC7-12V through this pin to Arduino board.
MCU I	<b>DEVELOBBINE AT BOARD FOR ARD DATE</b> inputs, labeled A0 through A5. These pins can read the signal from analog sensors (such as humidity sensor or temperature sensor), and convert it into the digital value that can read by microcontrollers) Can also used as digital pins, A0=D14, A1=D15, A2=D16, A3=D17, A4=D18, A5. D10
	AJ=D17.

**Specialized Functions of Some Pins:** 

- Serial communication: Digital pins 0 (RX) and 1 (TX).
- PWM Interfaces (Pulse-Width Modulation): D3, D5, D6, D9, D10, D11
- External Interrupts: D2 (interrupt 0) and D3 (interrupt 1). These pins can be configured to trigger an interrupt on a low value, a rising or falling edge, or a change in value.
- **SPI communication:** D10 (SS), D11 (MOSI), D12 (MISO), D13 (SCK). These pins support SPI communication using the SPI library.
- IIC communication: A4 (SDA); A5(SCL)

### Warnings:

- The Arduino Uno has a resettable polyfuse that protects your computer's USB ports from shorts and overcurrent. If more than 500 mA is applied to the USB port, the fuse will automatically break the connection until the short or overload is removed.
- Automatic (Software) Reset:

Rather than requiring a physical press of the reset button before an upload, the Arduino Uno board is designed in a way that allows it to be reset by software running on a connected computer.

• The Uno board contains a trace that can be cut to disable the auto-reset. The pads on either side of the trace can be soldered together to re-enable it. It's labeled "RESET-EN". You may also be able to disable the auto-reset by connecting a 110 ohm resistor from 5V to the reset line; see this forum thread for details.

# **Detailed Use with ARDUINO Software as follows:**

### Step1 | Download the Arduino environment (IDE)

When you get the UNO development board, first you should install the Arduino software and driver.

We usually use the Windows software Arduino 1.5.6 version. You can download it from the link below:

https://www.arduino.cc/en/Main/OldSoftwareReleases#1.5.x

Or you can browse the ARDUINO website to download the latest version from this link, https://www.arduino.cc, pop up the following interface.



Then click the SOFTWARE on the browse bar, you will have two options ONLINE TOOLS and DOWNLOADS.



Click **DOWNLOADS**, it will appear the latest software version of ARDUINO 1.8.5 shown as below.

#### Download the Arduino IDE Windows Installer, for Windows XP and up Windows ZIP file for non admin install ARDUINO 1.8.5 Windows app Requires Win 8.1 or 10 The open-source Arduino Software (IDE) makes it easy to Get 🖶 write code and upload it to the board. It runs on Windows, Mac OS X, and Linux. The environment is Mac OS X 10.7 Lion or newer written in Java and based on Processing and other opensource software. Linux 32 bits This software can be used with any Arduino board. Refer to the Getting Started page for Installation Linux 64 bits instructions. Linux ARM Release Notes Source Code Checksums (sha512)

In this software page, on the right side you can see the version of development software for different operating systems. ARDUINO has a powerful compatibility. You should download the software that is compatible with the operating system of your computer.

We will take **WINDOWS system** as an example here. There are also two options under Windows system, one is installed version, the other is non-installed version.

For simple installed version, first click Windows Installer, you will get the following page.

Checksums (sha512)

Windows Installer, for Windows XP and up<br/>Windows ZIP file for non admin installWindows app Requires Win 8.1 or 10<br/>GetMac OS X 10.7 Lion or newerLinux 32 bits<br/>Linux 64 bits<br/>Linux ARMRelease Notes<br/>Source Code

# Contribute to the Arduino Software

Consider supporting the Arduino Software by contributing to its development. (US tax payers, please note this contribution is not tax deductible). Learn more on how your contribution will be used.



This way you just need to click JUST DOWNLOAD, then click the downloaded file to install it.

For non-installed version, first click Windows ZIP file, you will also get the pop-up interface as the above figure.

Click JUST DOWNLOAD, and when the ZIP file is downloaded well to your computer, you can directly unzip the file and click the icon of ARDUINO software to start it.

# Installing Arduino (Windows):

Install Arduino with the exe. Installation package downloaded well.



Click "I Agree" to see the following interface.

Check the components y you don't want to install	n Options
Select components to install:	<ul> <li>Install Arduno software</li> <li>Install USB driver</li> <li>Create Start Menu shortcut</li> <li>Create Desktop shortcut</li> <li>Associate .ino files</li> </ul>
Space required: 420.6MB	
Cancel Nullsoft Insta	all System v3.0 < Back Next >

Click "Next". Pop up the interface below.

folder, dick l installation.	Browse and select another folde	er. To install in a different er. Click Install to start the
Destination Folder		
D:\Arduino		Browse
Space required: 420	.6MB	

You can press Browse... to choose an installation path or directly type in the directory you want. Then click "Install" to initiate installation.

Arduino Setup: Installing	
Extract: cc1plus.exe	
Show details	

Wait for the installing process, if appear the interface of Window Security, just continue to click Install to finish the installation.

💿 Arduino Set	up: Completed		
	d		
Show details			
Cancel	Nullsoft Install System v2,46	< Back	Close

### **Installing Driver:**

Next, we will introduce the driver installation of UNO R3 development board. The driver installation may have slight differences in different computer systems. So in the following let's move on to the driver installation in the WIN 7 system.

The Arduino folder contains both the Arduino program itself and the drivers that allow the Arduino to be connected to your computer by a USB cable. Before we launch the Arduino software, you are going to install the USB drivers.



Plug one end of your USB cable into the Arduino and the other into a USB socket on your computer.

When you connect UNO board to your computer at the first time, right click the icon of your "*Computer*" —> *for* "*Properties*"—> *click the* "*Device manager*", under "Other Devices", you should see an icon for "Unknown device"

\_ 🗆 📈 🚔 Device Manager File Action View Help (= =) 🖬 📔 🖬 😣 4 🚔 1306-PC Batteries Bluetooth Radios D - Computer Disk drives 🖟 📲 Display adapters DVD/CD-ROM drives - 🖓 Human Interface Devices D - Ca IDE ATA/ATAPI controllers Imaging devices >-- Keyboards Mice and other pointing devices b - Monitors > - Network adapters - D Other devices ---- Unknown device Processors > 📲 Sound, video and game controllers > - System devices 👂 - 🏺 Universal Serial Bus controllers

with a little yellow warning triangle next to it. This is your Arduino.

Then right-click on the device and select the top menu option (Update Driver Software...) shown as the figure below.

File Action View Help     Image: Setteries   Image: Setteries <tr< th=""></tr<>		
Image: Section of the seccond of the section of the section of the section of th		
<ul> <li>I306-PC</li> <li>Batteries</li> <li>Bluetooth Radios</li> <li>Computer</li> <li>Disk drives</li> <li>Display adapters</li> <li>DVD/CD-ROM drives</li> <li>Human Interface Devices</li> <li>IDE ATA/ATAPI controllers</li> <li>Imaging devices</li> <li>Keyboards</li> <li>Memory technology driver</li> <li>Mice and other pointing devices</li> <li>Monitors</li> <li>Network adapters</li> <li>Other devices</li> <li>Imaging devices</li> <li>Sound, video</li> <li>System devic</li> <li>Jinable</li> <li>Universal Seri</li> <li>Scan for hardware changes</li> </ul>		
Properties		
Launches the Update Driver Software Wizard for the selected device.		

It will then be prompted to either "Search Automatically for updated driver software" or "Browse my computer for driver software". Shown as below. In this page, select "Browse my computer for driver software".



After that, select the option to browse and navigate to the "drivers" folder of Arduino installation.



Click "Next" and you may get a security warning, if so, allow the software to be installed. Shown as below.



Installation completed, click "Close".



Up to now, the driver is installed well. Then you can right click "*Computer*" —> "*Properties*"—> "*Device manager*", you should see the device shown below.

🚔 Device Manager	- • • ×
File Action View Help	
⊿ –∰ 1306-PC	
Batteries	
Bluetooth Radios	
D 📲 Computer	
Disk drives	
Display adapters	
DVD/CD-ROM drives	
▷ 切詞 Human Interface Devices	
Dearta/ATAPI controllers	
D Imaging devices	
> Keyboards	
Memory technology driver	
Manitors	
Network adapters	
Ports (COM & LPT)	
Arduino UNO R3 (COM3)	
Processors	
Sound, video and game controllers	
System devices	
Universal Serial Bus controllers	
	1

# Introduction for Arduino IDE Toolbar:

Double-click the icon of Arduino software downloaded well, you will get the interface shown below.



(Note: if the Arduino software loads in the wrong language, you can change it in the preferences dialog. See the environment page for details.)

# **Board for Arduino**



The functions of each button on the Toolbar are listed below: http://wiki.keyestudio.com/index.php/File:IDE.png



Verify/Compile	Check the code for errors
Upload	Upload the current Sketch to the Arduino
New	Create a new blank Sketch
Open	Show a list of Sketches
Save	Save the current Sketch
Serial Monitor	Display the serial data being sent from the Arduino

# Step2| Connect the board

Connect the UNO board to your computer using the USB cable. The green power LED should go on.

# Step3| Select the Arduino Board

Open the Arduino IDE, you'll need to click the "Tools", then select the Board that corresponds to your Arduino.



# Step4| Select your serial port

Select the serial device of the Arduino board from the **Tools | Serial Port menu**. This is likely to be COM3 or higher (COM1 and COM2 are usually reserved for hardware serial ports). To find out, you can disconnect your Arduino board and re-open the menu; the entry that disappears should be the Arduino board. Reconnect the board and select that serial port.

Here you should select COM 3 as below.



Note: to avoid errors, the COM Port should keep the same as the Ports shown on Device Manager.





# Step5|Upload the Program

Below is an example program for displaying the Hello World!

Copy and paste the code to the Arduino environment IDE.

```
int val;
int ledpin=13;
void setup()
{
```

(continues on next page)

(continued from previous page)

```
Serial.begin(9600);
pinMode(ledpin,OUTPUT);
}
void loop()
{
void loop()
{
val=Serial.read();
if(val=='R')
{
digitalWrite(ledpin,HIGH);
delay(500);
digitalWrite(ledpin,LOW);
delay(500);
Serial.println("Hello World!");
}
```

Then click verify button to check the errors. If compiling successfully, the message "Done compiling." will appear in the status bar.



After that, click the "Upload" button to upload the code. Wait a few seconds - you should see the RX and TX leds on the board flashing. If the upload is successful, the message "Done uploading." will appear in the status bar. (Note: If you have an Arduino Mini, NG, or other board, you'll need to physically present the reset button on the board imKS0001/mediately before pressing the upload button.)



# Step6|Open the Serial Monitor

After that, click the serial monitor button to open the serial monitor.



Then set the baud rate as 9600, enter an "R" and click Send, you should see the RX led on the board blink once, and then D13 led blink once, finally "Hello World!" is showed on the monitor, the TX led blink once.

СОМЗ	
R	Send
Hello World!	
	<u>\</u>
Autoscroll	No line ending 🔹 9600 baud 🔹

# **Other Links:**

You might also want to look at:

the examples for using various sensors and actuators;

the reference for the Arduino language;

The text of the Arduino getting started guide is licensed under a Creative Commons Attribution-ShareAlike 3.0 License. Code samples in the guide are released into the public domain.

# **Troubleshooting:**

If you have problems, please see the troubleshooting suggestions.

# CHAPTER

ONE

# KS0002 KEYESTUDIO MEGA 2560 R3 DEVELOPMENT BOARD



# Introduction:

Keyestudio Mega 2560 R3 is a microcontroller board based on the ATMEGA2560-16AU , fully compatible with AR-DUINO MEGA 2560 REV3.

It has 54 digital input/output pins (of which 15 can be used as PWM outputs), 16 analog inputs, 4 UARTs (hardware serial ports), a 16 MHz crystal oscillator, a USB connection, a power jack, 2 ICSP headers, and a reset button.

It contains everything needed to support the microcontroller. With its bootloader, program can be downloaded directly with USB and you don't need to use other external programmer.

Just simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.

The Mega 2560 board is compatible with most shields designed for the Uno.

The 2560 R3 differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega16U2 programmed as a USB-to-serial converter.

The MEGA 2560 is designed for more complex projects. With 54 digital I/O pins, 16 analog inputs and a larger space for your sketch, it is the recommended board for 3D printers and robotics projects. This gives your projects plenty of room and opportunities.

# **TECH SPECS:**

Microcontroller	ATMEGA2560-16AU
Operating Voltage	5V
Input Voltage (recommended)	DC 7-12V
Digital I/O Pins	54 (D0-D53)
PWM Digital I/O Pins	15 (D2-D13; D44-D46)
Analog Input Pins	16 (A0-A15)
DC Current per I/O Pin	20 mA
DC Current for 3.3V Pin	50 mA
Flash Memory	256 KB of which 8 KB used by bootloader
SRAM	8 KB
EEPROM	4 KB
Clock Speed	16 MHz
LED_BUILTIN	D13



**Element and Pin Interfaces:** 

**Dimensions:** 



is an explanation of what every element and interface of the board does:

Here

1	<b>Digital I/O</b> Arduino MEGA has 54 digital input/output pins (of which 15 can be used as PWM outputs). These pins can be configured as digital input pin to read the logic value (0 or 1). Or used as digital output pin to drive different modules like LED, relay, etc. Using pinMode(), digitalWrite(), and digitalRead() functions.
2	GND Ground pins
3	AREF Reference voltage (0-5V) for analog inputs. Used with analogReference(). Configures the reference voltage used for analog input (i.e. the value used as the top of the input range).
4	SDA IIC communication pin
5	SCL IIC communication pin
6	<b>ICSP (In-Circuit Serial Programming) Header</b> the AVR, an Arduino micro-program header consisting of MOSI, MISO, SCK, RESET, VCC, and GND. Connected to the ATMEGA16U2-MU. When connecting to PC, program the firmware to ATMEGA16U2-MU.
7	<b>USB Connection</b> Arduino board can be powered via USB connector. All you needed to do is connecting the USB port to PC using a USB cable.
8	<b>D13 LED</b> There is a built-in LED driven by digital pin 13. When the pin is HIGH value, the LED is on, when the pin is LOW, it's off.
9	ATMEGA 16U2-MU USB to serial chip, can convert the USB signal into serial port signal.
1	<b>TX LED</b> Onboard you can find the label: TX (transmit) When Arduino board communicates via serial port, send the message, TX led flashes.
1	<b>RX LED</b> Onboard you can find the label: RX(receive ) When Arduino board communicates via serial port, receive the message, RX led flashes.
12	<b>Crystal Oscillator</b> How does Arduino calculate time? by using a crystal oscillator. The number printed on the top of the Arduino crystal is 16.000H9H. It tells us that the frequency is 16,000,000 Hertz or 16MHz.
13	<b>Voltage Regulator</b> To control the voltage provided to the Arduino board, as well as to stabilize the DC voltage used by the processor and other components. Convert an external input DC7-12V voltage into DC 5V, then switch DC 5V to the processor and other components.
14	<b>DC Power Jack</b> Arduino board can be supplied with an external power DC7-12V from the DC power jack.
15	<b>IOREF</b> This pin on the board provides the voltage reference with which the microcontroller operates. A properly configured shield can read the IOREF pin voltage and select the appropriate power source or enable voltage translators on the outputs for working with the 5V or 3.3V.
16	<b>RESET Header</b> Connect an external button to reset the board. The function is the same as reset button.
1	<b>Power Pin 3V3</b> A 3.3 volt supply generated by the on-board regulator. Maximum current draw is 50 mA.
18	Power Pin 5V Provides 5V output voltage
19	Vin You can supply an external power input DC7-12V through this pin to Arduino board.
20	Analog Pins Onboard has 16 analog inputs, labeled A0 to A15.
2)	<b>RESET Button</b> You can reset your Arduino board, for example, start the program from the initial status. You can use the RESET button.
22	<b>ICSP (In-Circuit Serial Programming) Header</b> the AVR, an Arduino micro-program header consisting of MOSI, MISO, SCK, RESET, VCC, and GND. It is often called the SPI (serial peripheral interface) and can be considered an "extension" of the output. In fact, slave the output devices to the SPI bus host. When connecting to PC, program the firmware to ATMEGA2560-16AU.
8	Microcontroller Each Arduino board has its own microcontroller. You can regard it as the brain of your board. The main IC (integrated circuit) on the Arduino is slightly different from the panel pair. Microcontrollers are usually from ATMEL. Before you load a new program on the Arduino IDE, you must know what IC is on your board. This information can be checked at the top of IC.
- I 🦱	

# **Specialized Functions of Some Pins:**

• Serial Communication: D0 (RX0) and D1 (TX1); Serial 1: D19 (RX1) and D18 (TX1); Serial 2: D17 (RX2) and D16 (TX2); Serial 3: D15 (RX3) and D14 (TX3).

Used to receive (RX) and transmit (TX) TTL serial data. Pins 0 and 1 are also connected to the corresponding pins of the ATmega16U2 USB-to-TTL Serial chip.

• PWM Pins (Pulse-Width Modulation): D2 to D13, and D44 to D46.

Provide 8-bit PWM output with the analogWrite() function.

• External Interrupts: D2 (interrupt 0), D3 (interrupt 1), D18 (interrupt 5), D19 (interrupt 4), D20 (interrupt 3), and D21 (interrupt 2).

These pins can be configured to trigger an interrupt on a low level, a rising or falling edge, or a change in level. See the attachInterrupt() function for details.

• SPI communication: D53 (SS), D52 (SCK), D51 (MOSI), D50 (MISO).

These pins support SPI communication using the SPI library. The SPI pins are also broken out on the ICSP header, which is physically compatible with the Arduino Uno.

• IIC communication: D20 (SDA); D21 (SCL). Support TWI communication using the Wire library.

#### Warnings:

- The Mega 2560 has a resettable polyfuse that protects your computer's USB ports from shorts and overcurrent. If more than 500 mA is applied to the USB port, the fuse will automatically break the connection until the short or overload is removed.
- Automatic (Software) Reset:

Rather than requiring a physical press of the reset button before an upload, the Mega 2560 board is designed in a way that allows it to be reset by software running on a connected computer.

• The Mega 2560 board contains a trace that can be cut to disable the auto-reset. The pads on either side of the trace can be soldered together to re-enable it. It's labeled "RESET-EN". You may also be able to disable the auto-reset by connecting a 110 ohm resistor from 5V to the reset line; see this forum thread for details.

#### Detailed Use with ARDUINO Software as follows:

#### Step1 | Download the Arduino environment (IDE)

When you get the Mega 2560 development board, first you should install the Arduino software and driver.

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Then click the **SOFTWARE** on the browse bar, you will have two options ONLINE TOOLS and DOWNLOADS.



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# Download the Arduino IDE



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system of your computer.

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# Contribute to the Arduino Software

Consider supporting the Arduino Software by contributing to its development. (US tax payers, please note this contribution is not tax deductible). Learn more on how your contribution will be used.



This way you just need to click JUST DOWNLOAD, then click the downloaded file to install it.

For non-installed version, first click Windows ZIP file, you will also get the pop-up interface as the above figure.

Click JUST DOWNLOAD, and when the ZIP file is downloaded well to your computer, you can directly unzip the file and click the icon of ARDUINO software to start it.

#### Installing Arduino (Windows):

Install Arduino with the exe. Installation package downloaded well.

Arduino Setup: License Agreement	Х
Please review the license agreement before installing Arduino. If you accept all terms of the agreement, click I Agree.	
GNU LESSER GENERAL PUBLIC LICENSE	-
Version 3, 29 June 2007	
Copyright (C) 2007 Free Software Foundation, Inc. < <u>http://fsf.org/</u> >	
Everyone is permitted to copy and distribute verbatim copies of this license document, but changing it is not allowed.	
This version of the GNU Lesser General Public License incorporates the terms and conditions of version 3 of the GNU General Public License, supplemented by the additional permissions listed below.	÷
Cancel Nullsoft Install System v3.0	e

Click "I Agree" to see the following interface.

n Options ou want to install and unche Click Next to continue.	eck the components
<ul> <li>✓ Install Arduino softw</li> <li>✓ Install USB driver</li> <li>✓ Create Start Menu si</li> <li>✓ Create Desktop shor</li> <li>✓ Associate .ino files</li> </ul>	vare hortcut rtcut
	n Options ou want to install and unche Click Next to continue.

Click "Next". Pop up the interface below.

folder, dick l installation.	Browse and select another folde	er. To install in a different er. Click Install to start the
Destination Folder		
D:\Arduino		Browse
Space required: 420	.6MB	

You can press Browse... to choose an installation path or directly type in the directory you want. Then click "Install" to initiate installation.

×

Wait for the installing process, if appear the interface of Window Security, just continue to click Install to finish the installation.

💿 Arduino Set	up: Completed		
	d		
Show details			
Cancel	Nullsoft Install System v2,46	< Back	Close

#### **Installing Driver:**

Next, we will introduce the driver installation of Mega 2560 development board. The driver installation may have slight differences in different computer systems. So in the following let's move on to the driver installation in the WIN 7 system.

The Arduino folder contains both the Arduino program itself and the drivers that allow the Arduino to be connected to your computer by a USB cable. Before we launch the Arduino software, you are going to install the USB drivers.



Plug one end of your USB cable into the Arduino and the other into a USB socket on your computer.

When you connect Mega 2560 board to your computer at the first time, right click the icon of your "*Computer*" —> *for* "*Properties*"—> *click the* "*Device manager*", under "Other Devices", you should see an icon for "Unknown device"

\_ 🗆 📈 🚔 Device Manager File Action View Help (= =) 🖬 📔 🖬 😣 4 🚔 1306-PC Batteries Bluetooth Radios D - Computer Disk drives Display adapters DVD/CD-ROM drives - 🖓 Human Interface Devices D - IDE ATA/ATAPI controllers Imaging devices >-- Keyboards Mice and other pointing devices b - Monitors >- Network adapters - D Other devices ..... 🦣 Unknown device Processors > - Sound, video and game controllers > - System devices 👌 - 🏺 Universal Serial Bus controllers

with a little yellow warning triangle next to it. This is your Arduino.

Then right-click on the device and select the top menu option (Update Driver Software...) shown as the figure below.

🚔 Device Manager	• ×
File Action View Help	
1306-PC         Batteries         Disk drives         Disk drives         Display adapters         DVD/CD-ROM drives         Display adapters         DVD/CD-ROM drives         Imaging devices         Imaging devices         Memory technology driver         Mice and other pointing devices         Monitors         Network adapters         Other devices         Unknown         Update Driver Software         Processors         Sound, video         Uninstall         Scan for hardware changes         Properties	
Launches the Update Driver Software Wizard for the selected device.	

It will then be prompted to either "Search Automatically for updated driver software" or "Browse my computer for driver software". Shown as below. In this page, select "Browse my computer for driver software".



After that, select the option to browse and navigate to the "drivers" folder of Arduino installation.



Click "Next" and you may get a security warning, if so, allow the software to be installed. Shown as below.



Installation completed, click "Close".



Up to now, the driver is installed well. Then you can right click "*Computer*" —> "*Properties*"—> "*Device manager*", you should see the device shown below.

🛃 Device Manager	- • ×
File Action View Help	
▲ 🚔 1306-PC	
Batteries	
Computer	
Disk drives	
Display adapters	
DVD/CD-ROM drives	
De ATA/ATAPI controllers	
Imaging devices	
Keyboards	
Memory technology driver	
Mice and other pointing devices	
Network adapters	
Ports (COM & LPT)	
Arduino Mega 2560 R3 (COM7)	
Processors	
Sound, video and game controllers	
🛛 🗍 Universal Serial Bus controllers	

## **Introduction for Arduino IDE Toolbar:**

Double-click the icon of Arduino software downloaded well, you will get the interface shown below.



(Note: if the Arduino software loads in the wrong language, you can change it in the preferences dialog. See the environment page for details.)

#### **Board for Arduino**



The functions of each button on the Toolbar are listed below:



	Check the code for errors
verity/Complie	Check the code for errors
Upload	Upload the current Sketch to the Arduino
New	Create a new blank Sketch
Open	Show a list of Sketches
Save	Save the current Sketch
Serial Monitor	Display the serial data being sent from the Arduino

## Step2| Connect the board

Connect the Mega 2560 board to your computer using the USB cable. The green power LED should go on.

# Step3| Select the Arduino Board

Open the Arduino IDE, you'll need to click the "Tools", then select the Board that corresponds to your Arduino.



#### Step4| Select your serial port

Select the serial device of the Arduino board from the **Tools** | **Serial Port menu**. This is likely to be COM3 or higher (COM1and COM2 are usually reserved for hardware serial ports). To find out, you can disconnect your Arduino board and re-open the menu; the entry that disappears should be the Arduino board. Reconnect the board and select that serial port.

Here you should select COM 7 as below.



Note: to avoid errors, the COM Port should keep the same as the Ports shown on Device Manager.





#### Step5|Upload the Program

Below is an example program for displaying the Hello World!

Copy and paste the code to the Arduino environment IDE.

int val;//define variable val

int ledpin=13;// define digital pin13

void setup()

{

Serial.begin(9600);// set the baud rate at 9600. When connected to a specific device, (e.g. bluetooth), the baud rate needs to be the same with the device.

pinMode(ledpin,OUTPUT);// initialize digital pin 13 as output. When using I/O ports on an Arduino, this kind of set up is always needed.

}

void loop()

{

val=Serial.read();// read the instruction or character from PC to Arduino, and assign them to Val.

if(val=='R')// determine if the instruction or character received is an "R".

{ // if it's "R",

digitalWrite(ledpin,HIGH);// set the LED on digital pin 13 on.

delay(500);

digitalWrite(ledpin,LOW);// set the LED on digital pin 13 off.

delay(500);

Serial.println("Hello World!");// display"Hello World".

}

}

Then click verify button to check the errors. If compiling successfully, the message "Done compiling." will appear in the status bar.



After that, click the "Upload" button to upload the code. Wait a few seconds - you should see the RX and TX leds on the board flashing. If the upload is successful, the message "Done uploading." will appear in the status bar. (Note: If you have an Arduino Mini, NG, or other board, you'll need to physically present the reset button on the board imKS0002/mediately before pressing the upload button.)



#### Step6|Open the Serial Monitor

After that, click the serial monitor button to open the serial monitor.

💿 sketch_jul30a   Arduino 1.5.6-r2	
File Edit Sketch Tools Help	
	Serial Monitor 😰
sketch_jul30a §	1
void setup()	·
{	
Serial.begin(9600);	
pirMode (ledpin, OUTPUT);	
}	
void loop ()	
1	
val=Serial.read();	=
if(val=='R')	
{	
digitalWrite(ledpin, HIGH);	
delay (500);	
digitalWrite(ledpin, LOW);	
delay (500);	
<pre>Serial.println("Hello World!");</pre>	
}	-
<	•

Then set the baud rate as 9600, enter an "R" and click Send, you should see the TX led on the board blink once, and then D13 led blink once, finally "Hello World!" is showed on the monitor, the RX led blink once.



## **Other Links:**

You might also want to look at:

the examples for using various sensors and actuators;

the reference for the Arduino language;

The text of the Arduino getting started guide is licensed under a Creative Commons Attribution-ShareAlike 3.0 License. Code samples in the guide are released into the public domain.

You can download the datasheet from the link:

https://drive.google.com/open?id=1eKufH3g5lYrfX7\_Ew6CS9b-jQ1\_RGtxV

Software Download:

https://drive.google.com/open?id=12D-JkXdNm03Qt4dlPQr3RP6OmgXqpvHc

### **Troubleshooting:**

If you have problems, please see the troubleshooting suggestions.

# CHAPTER

TWO

# KS0172 KEYESTUDIO UNO WITH PIN HEADER DEVELOPMENT BOARD



## Introduction:

keyestudio UNO with pin headers has the same basic functions as keyestudio UNO R3 BOARD. It is a microcontroller board based on the ATMEGA328P-AU, which has the same function as ATMEGA328P(-PU), fully compatible with ARDUINO UNO REV3.

It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, 2 ICSP headers, and a reset button.

This UNO with pin headers makes the improvement based on keyestudio UNO R3 board.

It breaks out all the digital and analog pins in the form of 3PIN headers (G, V, S).

S pins correspond to all 14 digital pins, 6 analog pins. G pins for ground. V pins for VCC. You can control the voltage of VCC via a slide switch for 5V or 3.3V.

When switched to 5V, level on serial communication port is 5V, voltage of pins is 5V. When switched to 3.3V, level on serial communication port is 3.3V, voltage of pins is 3.3V.

It also breaks out two 4PIN headers for serial communication and IIC communication. So it is more easier to connect external sensors and modules.

As for keyestudio UNO R3 board, its voltage-regulator chip is NSP1117. When connect external power, output 5V, drive current is 1A.

But for this keyestudio UNO with headers, its voltage-regulator chip is MP2307DN. When connect external power, output 5V, drive current is 2A.

It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.

#### **TECH SPECS:**

Microcontroller	ATMEGA328P-AU
Operating Voltage	5V
Input Voltage (recommended)	DC 7-12V
Digital I/O Pins	14 (D0-D13)
PWM Digital I/O Pins	6 (D3 D5 D6 D9 D10 D11)
Analog Input Pins	6 (A0-A5)
DC Current per I/O Pin	20 mA
DC Current for 3.3V Pin	50 mA
Flash Memory	32 KB (ATmega328) of which 0.5 KB used by bootloader
SRAM	2 KB
EEPROM	1 KB
Clock Speed	16 MHz
LED_BUILTIN	D13

**Dimensions:** 



H:15mm

### **Element and Interfaces:**

Here is an explanation of what every element and interface of the board does:



1	<b>ICSP (In-Circuit Serial Programming) Header</b> ICSP is the AVR, an Arduino micro-program header consisting of MOSI, MISO, SCK, RESET, VCC, and GND. It is often called the SPI (serial peripheral interface) and can be considered an "extension" of the output. In fact, slave the output devices under the SPI bus host. When connecting to PC, program the firmware to ATMEGA328P-AU.
2	<b>Serial Communication Pin</b> Connect to serial communication. 4Pins (GND, VCC (3.3V or 5V controlled by slide switch), RX, TX)
3	GND Ground pins
4	<b>V Pins</b> (VCC) Power the external sensors and modules. Select the voltage of 3.3V or 5V via a slide switch.
6	<b>Digital I/O</b> It has 14 digital input/output pins, labeled D0 to D13 (of which 6 can be used as PWM outputs). These pins can be configured as digital input pin to read the logic value (0 or 1). Or used as digital output pin to drive different modules like LED, relay, etc. The pin D3, D5, D6, D9, D10, and D11 can be used to generate PWM. For digital port, you can connect through female headers, or through pin headers (labeled S) of 2.54mm pitch.
6	<b>AREF</b> For Analog reference. Sometimes used to set an external reference voltage (0-5V) as the upper limit of analog input pins.
7	SDA IIC communication pin
8	SCL IIC communication pin
0	<b>ICSP</b> ( <b>In-Circuit Serial Programming</b> ) <b>Header</b> ICSP is an AVR, an Arduino micro-program header consisting of MOSI, MISO, SCK, RESET, VCC, and GND. Connected to ATMEGA 16U2-MU. When connecting to PC, program the firmware to ATMEGA 16U2-MU.
1	<b>Microcontroller</b> Each control board has its own microcontroller. You can regard it as the brain of your board. Microcontrollers are usually from ATMEL. Before you load a new program on the Arduino IDE, you must know what IC is on your board. This information can be checked at the top of IC. The microcontroller used in this board is ATMEGA328P-AU.
1	<b>D13 LED</b> There is a built-in LED driven by digital pin 13. When the pin is HIGH value, the LED is on, when the pin is LOW, it's off.
12	<b>TX LED</b> Onboard you can find the label: TX (transmit) When UNO board communicates via serial port, send the message, TX led flashes.
13	<b>RX LED</b> Onboard you can find the label: RX(receive ) When UNO board communicates via serial port, receive the message, RX led flashes.
14	Power LED LED on means that your circuit board is correctly powered on. Otherwise LED is off.
15	<b>USB Connection</b> You can power the board via USB connection. Or can upload the program to the board via USB port. Connect the board to PC using a USB cable via USB port.
16	ATMEGA 16U2-MU USB to serial chip, can convert the USB signal into serial port signal.
17	Slide Switch You can slide the switch to control the voltage of pin V (VCC), 3.3V or 5V.
18	<b>Voltage Regulator</b> To control the voltage provided to the UNO board, as well as to stabilize the DC voltage used by the processor and other components. Convert an external input DC7-12V voltage into DC 5V, then switch DC 5V to the processor and other components, output DC 5V, drive current is 2A.
19	DC Power Jack The board can be supplied with an external power DC7-12V from the DC power jack.
20	<b>IOREF</b> Used to configure the operating voltage of microcontrollers. Use it less.
21	<b>RESET Header</b> Connect an external button to reset the board. The function is the same as reset button.
22	Pin 3V3 Output Provides 3.3V voltage output59
23	Pin 5V Output Provides 5V voltage output
24	Vin You can supply an external voltage input DC7-12V through this pin to the board.



Specialized Functions of Some Pins:

- Serial communication: Digital pins 0 (RX) and 1 (TX).
- PWM Interfaces (Pulse-Width Modulation): D3, D5, D6, D9, D10, D11
- External Interrupts: D2 (interrupt 0) and D3 (interrupt 1). These pins can be configured to trigger an interrupt on a low value, a rising or falling edge, or a change in value.
- SPI communication: D10 (SS), D11 (MOSI), D12 (MISO), D13 (SCK). These pins support SPI communication using the SPI library.
- IIC communication: A4 (SDA); A5(SCL)

\*\* Detailed Test with Arduino Software:\*\*

Step1 | Download the Arduino IDE

When you get the UNO development board, first you should install the Arduino software and driver.

We usually use the Windows software Arduino 1.5.6 version. You can download it from the link below:

https://www.arduino.cc/en/Main/OldSoftwareReleases#1.5.x

Or you can browse the ARDUINO website to download the latest version from this link, https://www.arduino.cc, pop up the following interface.



Then click the **SOFTWARE** on the browse bar, you will have two options ONLINE TOOLS and DOWNLOADS.



Click **DOWNLOADS**, it will appear the latest software version of ARDUINO 1.8.5 shown as below.

# Download the Arduino IDE



In this software page, on the right side you can see the version of development software for different operating systems. ARDUINO has a powerful compatibility. You should download the software that is compatible with the operating system of your computer.

We will take **WINDOWS system** as an example here. There are also two options under Windows system, one is installed version, the other is non-installed version.

For simple installed version, first click Windows Installer, you will get the following page.



# Contribute to the Arduino Software

Consider supporting the Arduino Software by contributing to its development. (US tax payers, please note this contribution is not tax deductible). Learn more on how your contribution will be used.



This way you just need to click JUST DOWNLOAD, then click the downloaded file to install it.

For non-installed version, first click Windows ZIP file, you will also get the pop-up interface as the above figure.

Click JUST DOWNLOAD, and when the ZIP file is downloaded well to your computer, you can directly unzip the file and click the icon of ARDUINO software to start it.

Step2 |Installing Arduino (Windows):

Install Arduino with the exe. Installation package downloaded well.

SNU LESSER	GENERAL PUBLIC	C LICENSE		-
Version 3, 29	June 2007			
Copyright (C	) 2007 Free Soft	ware Foundation,	Inc. < <u>http://fsf.or</u>	<u>a/</u> >
Everyone is p document, b	permitted to copy ut changing it is n	v and distribute ve not allowed.	rbatim copies of thi	is license
This version	of the GNU Lesse	r General Public Li	cense incorporates	the terms

Click "*I Agree*" to see the following interface.

you don't want to install	ou want to install and uncheck the components. . Click Next to continue.
Select components to install:	<ul> <li>Install Arduino software</li> <li>Install USB driver</li> <li>Create Start Menu shortcut</li> <li>Create Desktop shortcut</li> <li>Associate .ino files</li> </ul>
Space required: 420.6MB	

Click "Next". Pop up the interface below.

Setup will install Arduino in the following fol folder, dick Browse and select another fold installation.	der. To install i ler. Click Install	n a different to start the
Destination Folder		- 1
Space required: 420.6MB		
Space available: 44.6GB		*
		1

You can press Browse... to choose an installation path or directly type in the directory you want. Then click "Install" to initiate installation.

🔊 Arduino Setup: Installing		
Extract: cc1plus.exe		
Show details		
Cancel Nullsoft Install System v3.0	< Back	Close

Wait for the installing process, if appear the interface of Window Security, just continue to click Install to finish the installation.

💿 Arduino Setu	ıp: Completed	
Completed	3	
Show details		
Cancel	Nullsoft Install System v2,46	< Back Close

Step3 |Installing Driver:

Next, we will introduce the driver installation of UNO development board. The driver installation may have slight differences in different computer systems. So in the following let's move on to the driver installation in the WIN 7 system.

The Arduino folder contains both the Arduino program itself and the drivers that allow the Arduino to be connected to your computer by a USB cable. Before we launch the Arduino software, you are going to install the USB drivers.



Plug one end of your USB cable into the Arduino and the other into a USB socket on your computer.

When you connect UNO board to your computer at the first time, right click the icon of your "*Computer*" —>*for* "*Properties*"—> *click the* "*Device manager*", under "Other Devices", you should see an icon for "Unknown device" with a little yellow warning triangle next to it. This is your Arduino.



Then right-click on the device and select the top menu option (Update Driver Software...) shown as the figure below.



It will then be prompted to either "Search Automatically for updated driver software" or "Browse my computer for driver software". Shown as below. In this page, select "Browse my computer for driver software".


After that, select the option to browse and navigate to the "drivers" folder of Arduino installation.



Click "Next" and you may get a security warning, if so, allow the software to be installed. Shown as below.



Installation completed, click "Close".



Up to now, the driver is installed well. Then you can right click "*Computer*" —> "*Properties*"—> "*Device manager*", you should see the device shown below.



\*\* Introduction for Arduino IDE Toolbar:\*\*

Double-click the icon of Arduino software downloaded well, you will get the interface shown below.



(Note: if the Arduino software loads in the wrong language, you can change it in the preferences dialog. See the environment page for details.)



The functions of each button on the Toolbar are listed below: http://wiki.keyestudio.com/index.php/File:IDE.png



Verify/Compile	Check the code for errors
Upload	Upload the current Sketch to the Arduino
New	Create a new blank Sketch
Open	Show a list of Sketches
Save	Save the current Sketch
Serial Monitor	Display the serial data being sent from the Arduino

Step2| Connect the board

the board to your computer using the USB cable. The red power LED should go on.

Step3| Select the Arduino Board

Open the Arduino IDE, you'll need to click the "Tools", then select the Board that corresponds to your Arduino.



Step4| Select your serial port

Select the serial device of the Arduino board from the **Tools | Serial Port menu**. This is likely to be COM3 or higher (COM1 and COM2 are usually reserved for hardware serial ports). To find out, you can disconnect your Arduino board and re-open the menu; the entry that disappears should be the Arduino board. Reconnect the board and select that serial port.

Here you should select COM 3 as below.



Note: to avoid errors, the COM Port should keep the same as the Ports shown on Device Manager.





Step5| Upload the Program

Below is an example program for displaying the Hello World!

Copy and paste the code to the Arduino environment IDE.

```
int val;
int ledpin=13;
void setup()
{
  (continues on next page)
```

(continued from previous page)

```
Serial.begin(9600);
pinMode(ledpin,OUTPUT);
}
void loop()
{
val=Serial.read();
if(val=='R')
{
digitalWrite(ledpin,HIGH);
delay(500);
digitalWrite(ledpin,LOW);
delay(500);
Serial.println("Hello World!");
}
```

Then click verify button to check the errors. If compiling successfully, the message "Done compiling." will appear in the status bar.



After that, click the "Upload" button to upload the code. Wait a few seconds - you should see the RX and TX leds on the board flashing. If the upload is successful, the message "Done uploading." will appear in the status bar.



Step6| Open the Serial Monitor

After that, click the serial monitor button to open the serial monitor.



Then set the baud rate as 9600, enter an "R" and click Send, you should see the RX led on the board blink once, and then D13 led blink once, finally "Hello World!" is showed on the monitor, the TX led blink once.

СОМЗ		- <b>D</b> X
R		Send
Hello World!		
V Autoscroll	No line ending 👻	9600 baud 🛛 👻

For Extension:



Other Links:

You can download the datasheet from the link: https://drive.google.com/open?id=1otyBI7as3S5qBd9GZYyVwYdRMLF7qDnr Software Download: https://drive.google.com/open?id=12D-JkXdNm03Qt4dlPQr3RP6OmgXqpvHc You might also want to look at: the reference for the Arduino language; Troubleshooting: If you have problems, please see the troubleshooting suggestions.

CHAPTER

THREE

## KS0173 KEYESTUDIO CH340 NANO DEVELOPMENT BOARD



Description

The processor core of Keyestudio Nano CH340 is ATMEGA328P-AU. It is as same as the official Arduino Nano in addition to driver file and USB to serial chip (CH340G).

It also has 14 digital input / output interfaces (6 of which can be used as PWM output), 8 analog input interfaces, 1 16MHz crystal oscillator, 1 mini USB port, 1 ICSP interface, and a reset button.

The ICSP interface is used to program the Atmega328P-Au. We can supply power with a USB cable, the port VIN GND (DC 7-12V) and GND

#### Specification

Microcontroller: ATMEGA328P-AU Operating Voltage: 5V Input Voltage (recommended): DC 7-12V Digital I/O Pins: 14 (D0-D13) PWM Digital I/O Pins6 (D3 D5 D6 D9 D10 D11) Analog Input Pins: 8(A0-A7) DC Current per I/O Pin: 40 mA Flash Memory: 32 KB of which 2 KB used by bootloader SRAM:2 KB EEPROM: 1 KB Clock Speed:16 MHz LED\_BUILTIN:D13 **Pins** 



H:18mm



1	ICSP	ICSP (In-Circuit Serial Programming) Header ICSP is the AVR, an micro-program header
	Heade	r consisting of MOSI, MISO, SCK, RESET, VCC, and GND. It is often called the SPI (serial
		peripheral interface) and can be considered an "extension" of output. In fact, slave the
		output devices under the SPI bus host. When connecting to PC, program the firmware to
		ATMEGA328P-AU.
2	LED	Onboard you can find the label: RX(receive ) When control board communicates via serial port,
	indi-	receive the message, RX led flashes.
	cator	-
	RX	
3	LED	Onboard you can find the label: TX (transmit) When control board communicates via serial port,
	indi-	send the message, TX led flashes.
	cator	
	ТХ	
4	LED	Power up the control board, LED on, otherwise LED off.
	indi-	
	cator	
	POW	
5	LED	There is a built-in LED driven by digital pin 13. When the pin is HIGH value, the LED is on, when
	indi-	the pin is LOW, it's off.
	cator	
	L	
6	RX0D0	It has 14 digital input/output pins D0-D13 (of which 6 can be used as PWM outputs). These pins
	TX1D1	can be configured as digital input pin to read the logic value (0 or 1). Or used as digital output pin to
	D2-	drive different modules like LED, relay, etc.
	D13	
7	RST	Reset pin: connect external button. The function is the same as RESET button.
8	MEGA	Each board has its own microcontroller. You can regard it as the brain of your board. Microcontrollers
	328P	are usually from ATMEL. Before you load a new program on the Arduino IDE, you must know
		what IC is on your board. This information can be checked at the top surface of IC. The board's
		microcontroller is ATMEGA328P-AU. More info. see the datasheet
9	MINI	The board can be powered via Mini-B USB connection. Also upload the program to the board via
10	USB	USB port.
10	3V3	Provides 3.3 V voltage output
11	рш рге	Patarance external valtage (0.5 valts) for the analog input pine. Used with analog Patarance()
11	AO	The Nano has 8 Analog Ding, labeled A0 through A7
14	AU- A7	The Nano has 6 Analog This, labeled A0 through A7.
13	5V	Provides 5V voltage output
15	nin	riovides 5 v voltage output
14	GND	Ground nin
15	VIN	Input an external voltage DC7-12V to power the board
15	Reset	Used to reset the control board
10	Rut-	Used to reset the control board
	ton	
17	CH340	CUSB-to-serial port chip, converting the USB signal into Serial port signal
18	4MS11	<b>10</b> onvert the external voltage input DC7-12V into DC5V then transfer it to the processor and other
10	A191311	elements
		contents,

3. Specialized Functions of Some Pins:

• Serial communication: 0 (RX) and 1 (TX). Used to receive (RX) and transmit (TX) TTL serial data.

• PWM (Pulse-Width Modulation): D3, D5, D6, D9, D10, D11

- External Interrupts: D2 (interrupt 0) and D3 (interrupt 1). These pins can be configured to trigger an interrupt on a low value, a rising or falling edge, or a change in value. See the attachInterrupt() function for details.
- SPI communication: D10 (SS), D11 (MOSI), D12 (MISO), D13 (SCK).
- IIC communication: A4 (SDA); A5(SCL)

#### Windows System

4.1 Download the Arduino IDE

When getting this control board, we need to install Arduino IDE

Enter the wel	osite https:/	/www.arduino.c	cc/and click SO	FTWARE 🔫	DOW	NLOADS	
PROFESSIONAL	EDUCATION	STORE					Q Search on Arduino.cc
ΘO		HARDWAR	RE SOFTWARE CLO	UD DOCUMENTAT	10N <del>-</del> CC	DMMUNITY - BLC	OG ABOUT
			GETTING STARTED	El Lavardeou El Lavardeou C: Santa Mare	SEARCH SKETCHEOD ORDER BY LAST MODIFIED > Tesi (2) > YunExamples (10)	U U U U U U U U U U U U U U U U U U U	
	[	Downloa	ıds				
		COO Ar	rduino IDE 1.8	8.13		DOWNLOAD OPTI Windows Win 7 a Windows ZIP file	ONS nd newer
		The open-source and upload it to Arduino board.	e Arduino Software (IDE) the board. This softwar	) makes it easy to wr e can be used with a	ite code any	Windows app W Linux 32 bits Linux 64 bits	/in 8.1 or 10 Get 📒
		Refer to the <b>Get</b>	tting Started page for Ir	nstallation instructio	ns.	Linux ARM 32 bits Linux ARM 64 bits	
		SOURCE CODE Active developm See the instructi code archives an they can be verif	nent of the Arduino soft ions for <b>building the co</b> re available <b>here</b> . The ar ified using <b>this</b> gpg key.	ware is <b>hosted by G</b> ide. Latest release so ichives are PGP-sign	<b>itHub</b> . Durce ed so	Mac OS X 10.10 o	r newer ; (sha512)

You can select the latest version—1.8.13. Alternatively, the previous release is your another choice.

In this project, we use 1.8.12 version.

## **Previous Releases**

Download the previous version of the current release, the classic 1.0.x, or old beta releases.

DOWNLOAD OPTIONS

Previous Release (1.8.12)

Arduino 1.0.x Arduino 1.5.x beta Arduino 1.9.x beta

## Previous Release (1.8.12) to enter the new page. As shown below; Click

The Windows installer needs installing manually. Yet, the Windows zip file for non admin installa zip file of Arduino 1.8.12 version, can be directly downloaded and installed.

# Previous IDE Releases

## ARDUINO 1.8.12

Arduino IDE that can be used with any Arduino board, including the Arduino Yún and Arduino DUE. Refer to the Getting Started page for Installation instructions. See the release notes.

Windows Installer Windows ZIP file for non admin install

Mac OS X 10.8 Mountain Lion or newer

Linux 32 bits Linux 64 bits Linux ARM 32 Linux ARM 64

Source

# Contribute to the Arduino Software

Consider supporting the Arduino Software by contributing to its development. (US tax payers, please note this contribution is not tax deductible). Learn more on how your contribution will be used.





For this part, we need to install the driver of Arduino IDE

First, let's attach USB cable to computer. The driver can be installed automatically if the PC system is Windows 10, however, you need to install the driver manually if the PC system is other version.

The USB to serial chip of control board is CH340G, therefore, we will install its driver(usb\_ch341\_3.1.2009.06).

Click Computer— Properties— Device Manager, as shown below:

🗂 Device Manager	—	$\times$
File Action View Help		
V 🛃 DESKTOP-PGHNBN7		
> 🐗 Audio inputs and outputs		
> 🗃 Batteries		
> 💻 Computer		
> 🚃 Disk drives		
> 🏣 Display adapters		
> 🔐 DVD/CD-ROM drives		
> 🐺 Human Interface Devices		
> 📹 IDE ATA/ATAPI controllers		
> 🥅 Keyboards		
> 📗 Mice and other pointing devices		
> 💻 Monitors		
> 🕎 Network adapters		
✓ Cher devices		
😰 USB2.0-Serial		
> 🔁 Print queues		
> Processors		
Software devices		
> 🔟 Sound, video and game controllers		
> Storage controllers		
> E System devices		
> VIIVersal Serial Bus controllers		

Click 📓 USB Serial

and "Update Driver Program"

着 Device Manager	_	×
File Action View Help		
V 🛃 DESKTOP-PGHNBN7		
> 🔟 Audio inputs and outputs		
> 🦢 Batteries		
> 🛄 Computer		
> 👝 Disk drives		
> 🔙 Display adapters		
> PVD/CD-ROM drives		
> 🛺 Human Interface Devices		
> 📷 IDE ATA/ATAPI controllers		
> 🔤 Keyboards		
Mice and other pointing devices		
> Monitors		
> 🕎 Network adapters		
✓ Vother devices		
VSB2.0-Serial		
> Print queue Update driver		
> Processors Disable device		
Software de Uninstall device		
> iii Sound, vide		
> 🕁 Storage cor Scan for hardware changes		
System dev		
> Universal Se		

Jump into the following page and select"Browse my computer for driver software".



Search the usb\_ch341\_3.1.2009.06 folder



After the driver is installed, you need to click Close.

http://wiki.keyestudio.com/index.php/File:Driver\_6.png



Click Computer— Properties— Device Manager, as shown below.

#### 📇 Device Manager

File	А	ction View Help
(		
$\sim$ .	- D	ESKTOP-PGHNBN7
	5 1	Audio inputs and outputs
	> 🍯	Batteries
	,	Computer
	> _	Disk drives
		Display adapters
	> 🛓	DVD/CD-ROM drives
	> 🛱	Human Interface Devices
	> =	DE ATA/ATAPI controllers
	> 🖻	Keyboards
	> (	Mice and other pointing devices
		Monitors
	> 🛓	P Network adapters
•	∠ Ĥ	Ports (COM & LPT)
		SERIAL CH340 (COM3)
	> 10	Print queues
		Processors
	> [	Software devices
	> 1	Sound, video and game controllers
	> 😫	Storage controllers
	> 🖺	System devices
	> ÿ	Universal Serial Bus controllers

## 4.4 Arduino IDE Setting





When downloading the sketch to the board, you must select the correct name of Arduino board that matches the board connected to your computer. As shown below;

🥺 sketch_oct14b	Arduino 1.8.12	_		×		
File Edit Sketch	Tools Help					
	Auto Format	Ct	rl+T			
	Archive Sketch			÷		
sketch_oct14b	Fix Encoding & Reload				Boards Manager	·
<pre>void setup()</pre>	Manage Libraries	Ct	rl+Shift+I		Arduino AVR Boa	ards
// put you	Serial Monitor	Ct	rl+Shift+M		Arduino Yún	
	Serial Plotter	Ct	rl+Shift+L		Arduino Uno	
}					Arduino Duemila	nove or Diecimila
	WIFITUT / WIFININA FIRMWa	re Updater		•	Arduino Nano	
<pre>void loop()</pre>	Board: "Arduino Nano"			4	Arduino Mega o	r Mega 2560
// put you	Processor: "ATmega328P"				Arduino Mega A	DK
1	Port: "COM16"				Arduino Leonard	o
1	Get Board Info		/		Arduino Leonard	o ETH
					Arduino Micro	
	Programmer: AVRISP mkli			1	Arduino Esplora	
	Burn Bootloader			_	Arduino Mini	
					Arduino Ethernet	:
					Arduino Fio	
					Arduino BT	
					LilyPad Arduino	JSB
					LilyPad Arduino	
					Arduino Pro or P	ro Mini
					Arduino NG or o	lder
					Arduino Robot C	ontrol
					Arduino Robot N	lotor
1		Arduino	Nano on COM		Arduino Gemma	



Then select the correct COM port (you can see the corresponding COM port after the driver is successfully installed).





- A- Used to verify whether there is any compiling mistakes or not.
- B- Used to upload the sketch to your Arduino board.
- C- Used to create shortcut window of a new sketch.
- D- Used to directly open an example sketch.
- E- Used to save the sketch.
- F- Used to send the serial data received from board to the serial monitor.
- 4.5 Setting IDE for New Bootloader

Arduino Nano board could burn new and old bootloader. New bootloader is only compatible with 1.8.9 IDE and above. Yet the old one is compatible with all versions.



4.6 Select Your Serial Port

Select the serial device of the Arduino board from the **Tools | Serial Port menu**. **Note:** to avoid errors, the COM Port should keep the same as the Ports shown on Device Manager.

## **Board for Arduino**

\_

×

### 📇 Device Manager

🏟   🖬   🛅	
V 🛃 DESKTOP-PGI	NBN7
> 🐐 Audio inp	ts and outputs
> 🦃 Batteries	
> 💻 Computer	
> 👝 Disk drive	
> 🄙 Display ad	pters
> 🔐 DVD/CD-F	OM drives
> 🗛 Human In	erface Devices
> 📷 ide ata/a	API controllers
> 🔤 Keyboards	
> 🕕 Mice and	ther pointing devices
> 💻 Monitors	
> 🚅 Network a	lapters
V 🛱 Ports (CO	1 & LPT)
📮 USB-S	RIAL CH340 (COM3)
> 📇 Print queu	5
> Processors	
> Software o	2VICes
> 🖉 Sound, vid	20 and game controllers
> 🍇 Storage co	itrollers
> 🗾 System de	iices
> y Universal	



```
4.7 Hello World!
```

Copy the following code in the Arduino IDE.

int val;

int ledpin=13;

```
void setup()
```

{

```
Serial.begin(9600);
```

```
pinMode(ledpin,OUTPUT);
```

```
}
```

```
void loop()
```

```
{
```

104
Х

Ø

 $\land$ 

v

Arduino Nano on COM3

```
val=Serial.read();
if(val=='R')
{
digitalWrite(ledpin,HIGH);
delay(500);
digitalWrite(ledpin,LOW);
delay(500);
Serial.println("Hello World!");
}
}
  💿 sketch_oct15a | Arduino 1.8.12
                                                             _
 File Edit Sketch Tools Help
                   +
      +
           Ŧ
    sketch_oct15a§
  int val;
  int ledpin=13;
  void setup()
  {
  Serial.begin(9600);
  pinMode(ledpin,OUTPUT);
  }
  void loop()
  {
  val=Serial.read();
  if(val=='R')
  {
  digitalWrite(ledpin,HIGH);
  delay(500);
  digitalWrite(ledpin,LOW);
  delay(500);
  Serial.println("Hello World!");
```

19



Then click verify button to check the errors. If compiling successfully, the message "Done compiling." will appear in the status bar.



After that, click the "Upload" button to upload the code. If the upload is successful, the message "Done uploading." will appear in the status bar.

🥺 sketch_oct15a   Arduino 1.8.12	_		×
File Edit Sketch Tools Help			
			ø
sketch_octives			
void setup()			^
{			
<pre>Serial.begin(9600);</pre>			
<pre>pinMode(ledpin,OUTPUT);</pre>			
}			
<pre>void loop()</pre>			
<pre>val=Serial.read();</pre>			
<pre>if(val=='R')</pre>			
£			
<pre>digitalWrite(ledpin,HIGH);</pre>			
delay(500);			
<pre>digitalWrite(ledpin,LOW);</pre>			
delay(500);			
<pre>Serial.println("Hello World!");</pre>			
}			
}			~
Unloading			
Oploading			
Sketch uses 1992 bytes (6%) of program store	age	space.	Maxi ^
Global variables use 200 bytes (9%) of dynam	nic	memory	lea
			×
			>
19	Arduir	no Nano on	сомз



Then click **Local** to open serial monitor and set the baud rate to 9600, enter an "R" and click Send, that is, the computer will send the character R. When NANO board receives it, you should see the RX led on the board flash once, and then D13 led flash once; when keyestudio NANO board sends "Hello World!" to the computer, finally you should see the "Hello World!" is showed on the monitor, and TX led on the board flash once.

ОМЗ	-		×
R			Send
Hello World!			^
			~
Autoscroll Show timestamp Newline V 9600 baud	~ C	lear o	utput

#### MAC System

5.1 Install Arduino IDE on MAC System

The installation instruction is as same as the chapter 4.1, as shown below:

# ARDUINO 1.8.12

Arduino IDE that can be used with any Arduino board, including the Arduino Yún and Arduino DUE. Refer to the Getting Started page for Installation instructions. See the release notes.

Windows Installer Windows ZIP file for non admin install

Mac OS X 10.8 Mountain Lion or newer

Linux 32 bits Linux 64 bits Linux ARM 32 Linux ARM 64

### Source

5.2 Download the CH340 driver

https://fs.keyestudio.com/CH340-MAC

5.3 How to Install the CH340 driver

#### Please refer to the following link:

https://wiki.keyestudio.com/Download\_CH340\_Driver\_on\_MAC\_System

#### 5.4 Setting Arduino IDE

The setting method is as same as the chapter 4.4 except from COM port, as shown below:



Shipping List

Keyestudio NANO ch340\*1pcs

30cm Blue mini USB\*1pcs

Resource:

https://fs.keyestudio.com/KS0173

CHAPTER

FOUR

## KS0247 KEYESTUDIO PRO MINI DEVELOPMENT BOARD



Introduction:

keyestudio Pro Mini is a small microcontroller board based on the ATmega328. (datasheet), intended for use on breadboards and when space is at a premium.

It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 8 analog inputs, a 16 MHz crystal oscillator, and a reset button.

Note that the board is without an on-board USB to Serial connection. To program the Pro Mini, you will need an external USB to Serial module.

The keyestudio pro mini can be powered via the pins 5V GND (DC 5V), or female headers Vin GND (DC 7-9V).

Features:

- Using ATmega328P-AU from Atmel
- 14 digital input/output pins
- 8 analog input pins labeled A0 ~ A7
- TTL level serial pins RX/TX;
- 6 PWM pins (D3, D5, D6, D9, D10, D11)
- Support external DC 7-9V power supply

TECH SPECS:

Microcontroller	ATmega328P-AU
Operating Voltage	5V
Input Voltage (recommended)	DC7-9V
Digital I/O Pins	14 (D0-D13) (of which 6 provide PWM output)
PWM Digital I/O Pins	6 (D3, D5, D6, D9, D10, D11)
Analog Input Pins	8 (A0-A7)
DC Current per I/O Pin	40 mA
Flash Memory	32 KB of which 2 KB used by bootloader
SRAM	2 KB
EEPROM	1 KB
Clock Speed	16 MHz
LED_BUILTIN	D13

Technical Details:

- Dimensions: 40mm x 18mm x 14mm
- Weight: 4.1g



H:14mm only board weight :4.1g

Element and Interfaces:

Here is an explanation of what every element and interface of the board does:





Specialized Functions of Some Pins:

- Serial communication: 0 (RX) and 1 (TX). Used to receive (RX) and transmit (TX) TTL serial data.
- PWM (Pulse-Width Modulation): D3, D5, D6, D9, D10, D11
- External Interrupts: D2 (interrupt 0) and D3 (interrupt 1).
- SPI communication: D10 (SS), D11 (MOSI), D12 (MISO), D13 (SCK).
- IIC communication: A4 (SDA); A5(SCL)

Detailed Using Methods are as follows:

Step1| Download the Arduino IDE

When you get the board, first you should install the Arduino software and driver.

We usually use the Windows software Arduino 1.5.6 version. You can download it from the link below:

#### https://www.arduino.cc/en/Main/OldSoftwareReleases#1.5.x

Or you can browse the ARDUINO website to download the latest version from this link, https://www.arduino.cc, pop up the following interface.



Then click the **SOFTWARE** on the browse bar, you will have two options ONLINE TOOLS and DOWNLOADS.



Click **DOWNLOADS**, it will appear the latest software version of ARDUINO 1.8.5 shown as below.

# Download the Arduino IDE



In this software page, on the right side you can see the version of development software for different operating systems. ARDUINO has a powerful compatibility. You should download the software that is compatible with the operating system of your computer.

We will take **WINDOWS system** as an example here. There are also two options under Windows system, one is installed version, the other is non-installed version.

For simple installed version, first click Windows Installer, you will get the following page.



# Contribute to the Arduino Software

Consider supporting the Arduino Software by contributing to its development. (US tax payers, please note this contribution is not tax deductible). Learn more on how your contribution will be used.



This way you just need to click JUST DOWNLOAD, then click the downloaded file to install it.

For non-installed version, first click Windows ZIP file, you will also get the pop-up interface as the above figure.

Click JUST DOWNLOAD, and when the ZIP file is downloaded well to your computer, you can directly unzip the file and click the icon of ARDUINO software to start it.

Installing Arduino (Windows):

Install Arduino with the exe. Installation package downloaded well.

SNU LESSEF	R GENERAL PUBL	IC LICENSE			*
Version 3, 2	9 June 2007				
Copyright (	C) 2007 Free So	ftware Foundation,	Inc. < <u>http://fsf</u> .	.org/>	
Everyone is document, t	permitted to co out changing it is	py and distribute ve not allowed.	erbatim copies of	this license	
This version	of the GNU Les	ser General Public L	icense incorporat	tes the terms	

Click "I Agree" to see the following interface.

you don't want to install	ou want to install and uncheck the components . Click Next to continue.
Select components to install:	<ul> <li>✓ Install Arduino software</li> <li>✓ Install USB driver</li> <li>✓ Create Start Menu shortcut</li> <li>✓ Create Desktop shortcut</li> <li>✓ Associate .ino files</li> </ul>
Space required: 420.6MB	

Click "Next". Pop up the interface below.

Setup will install Arduino in the following folder. T folder, dick Browse and select another folder. C installation.	o install in a different ick Install to start the
Destination Folder	Browse
Space required: 420.6MB	
Space available: 44.6GB	>

You can press Browse... to choose an installation path or directly type in the directory you want. Then click "Install" to initiate installation.

Arduino Set	up: Installing	
Extract: o	cc1plus.exe	
Show details		

Wait for the installing process, if appear the interface of Window Security, just continue to click Install to finish the installation.

💿 Arduino Setu	ip: Completed		
Completed	1		
Show details			
Cancel	Nullsoft Install System v2.46	< Back	Close

Introduction for Arduino IDE Toolbar:

Double-click the icon of Arduino software downloaded, you will get the interface shown below.



(Note: if the Arduino software loads in the wrong language, you can change it in the preferences dialog. See the environment page for details.)



The functions of each button on the Toolbar are listed below:

http://wiki.keyestudio.com/index.php/File:IDE.png



	Check the code for errors
verny/complie	
Upload	Upload the current Sketch to the Arduino
New	Create a new blank Sketch
Open	Show a list of Sketches
Save	Save the current Sketch
Serial Monitor	Display the serial data being sent from the Arduino

Step2| Connect a USB to Serial Module



program the Pro Mini board, you will need to connect an external USB to Serial module. Different USB to Serial modules might have different driver installation. In the following, we will introduce the use of pro mini with our keyestudio FTDI Basic Program Downloader. See more details here.

Download the Driver Files

То



You can download the driver file from the link below:

https://drive.google.com/open?id=1vj4Is2LokXf3GDGcnumnAPmaI39uPhQk

Installing the Driver

The USB to serial port chip of this module is FT232RL. So you need to install the ft232r usb uart driver. You could click the driver file above to download it.

In different systems, the driver installation might be similar. Here we start to install the driver on the Win7 system.

Plug one end of your USB cable into the module and the other into a USB socket on your computer.

Then right click your "Computer" —> for "Properties"—> click "Device manager", under Other devices, you should see the "USB Serial Port".



Then right-click on the USB Serial Port and select the top menu option (Update Driver Software...) shown as the figure below.

🛃 Device Manager		
File Action View Help		
🧼 🧼 🔤 📑 📔	限 👔 🙀 🕫	
▲ 采IAORONG → ● Computer → Disk drives → ● Display adapters → ● Human Interface De → ● IDE ATA/ATAPI com → ● Monitors → ● Monitors → ● Monitors → ● Network adapters → ● Other devices → ● Other devices → ● Ports (COM & ● ● ● Processors → ● System devices → ● Universal Serial	evices itrollers nting devices Update Driver Software Disable Uninstall Scan for hardware changes Properties	
Launches the Update Driver Sof	ftware Wizard for the selected device.	

http://wiki.keyestudio.com/index.php/File:Driver\_2.png

Then it will be prompted to either "Search Automatically for updated driver software" or "Browse my computer for driver software". Shown as below. In this page, select "Browse my computer for driver software".



After that, select the option to browse and navigate to the "drivers" folder.



Once the driver has been installed, you will get a confirmation message. Installation completed, click "Close". http://wiki.keyestudio.com/index.php/File:Driver\_6.png



Up to now, the driver is installed well. Then you can right click "Computer" —>"Properties"—>"Device manager", you should see the device as the figure shown below.



Step3| Hookup Guide

Driver installation completed, disconnect the module to computer, then connect it to pro mini board using F-F jumper wires. Shown below. The slide switch on the module is used to control the voltage for serial communication. Whether it is set to 5V or 3.3V, it can be programmed with the Pro Mini.



## programming for KEYES PRO MINI control board by using FT232 module.

FTDI Basic Program Downloader	keyestudio pro mini
GND	GND
5V	5V
TXD	RX
RXD	ТХ
DIR	DIR

Connect well the module to pro mini board, then connect the pro mini board to your computer with a mini USB cable. Step4| Select the Arduino Board

Open the Arduino IDE, you'll need to click the "Tools", then select the Board that corresponds to your Arduino.





#### Step5| Select your serial port

Select the serial device of the Arduino board from the **Tools | Serial Port menu**. **Note:** to avoid errors, the COM Port should keep the same as the Ports shown on Device Manager.





Step6| Upload the Code

```
void loop()
{
 val=Serial.read();
if(val=='R')
 {
 digitalWrite(ledpin,HIGH);
 delay(500);
 digitalWrite(ledpin,LOW);
 delay(500);
 Serial.println("Hello World!");
 }
}
```



Then click verify button to check the errors. If compiling successfully, the message "Done compiling." will appear in the status bar.



After that, click the "Upload" button to upload the code. If the upload is successful, the message "Done uploading." will appear in the status bar.



Step7| Open the Serial Monitor

After that, click the button to open the serial monitor.



Then set the baud rate to 9600, enter an "R" and click Send, that is, the computer will send the character R. When pro mini board receives it, you should see the D13 led flash once. "Hello World!" is sent to the computer, so that you should see the "Hello World!" is showed on the monitor.
© COM5		
R		Send
Hello World!		1
		/
Autoscroll	No line ending 🔻	9600 baud 🔻
Resource Links		

Download code and libraries:

https://fs.keyestudio.com/KS0247

You might also want to look at:

the reference for the Arduino language;

Download ARDUINO Software:

https://www.arduino.cc/en/Main/OldSoftwareReleases#1.5.x

Troubleshooting:

If you have problems, please see the troubleshooting suggestions.

### KS0248 KEYESTUDIO LEONARDO R3 DEVELOPMENT BOARD

### Introduction:

The keyestudio Leonardo is a microcontroller board based on the ATmega32u4 (datasheet). It is an easy-to-use open source hardware.

It has 20 digital input/output pins (of which 7 can be used as PWM outputs), 12 analog inputs, a 16 MHz crystal oscillator, a micro USB connection, a power jack, an ICSP header, and a reset button.

It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.

Note that ICSP (In-Circuit Serial Programming) header can not only program the firmware to Atmega32u4, but also be used as SPI communication interface.

The keyestudio Leonardo can be powered via the micro USB connection, or via an external power supply jack (DC 7-12V) or even with female headers Vin /GND (DC 7-12V).

The Leonardo differs from other Arduino boards using separate USB-Serial chip in that the ATmega32u4 has built-in USB communication, eliminating the need for a secondary processor. This allows the Leonardo to appear to a connected computer as a mouse and keyboard.

### TECH SPECS:

Microcontroller	Atmega32u4
Operating Voltage	5V
Input Voltage (recommended)	DC7-12V
Digital I/O Pins	20 (of which 7 provide PWM output)
PWM Digital I/O Pins	7
Analog Input Pins	12
DC Current per I/O Pin	40 mA
DC Current for 3.3V Pin	50 mA
Flash Memory	32 KB (Atmega32u4) of which 4 KB used by bootloader
SRAM	2.5 KB (ATmega32u4)
EEPROM	1 KB (Atmega32u4)
Clock Speed	16 MHz
LED_BUILTIN	D13
Dimensions	71mm*54mm*15mm
Weight	18.4g

Details:

- PCB Dimensions: 71mm\*54mm\*15mm
- Weight: 18.4g



H:15mm only board weight :18.4g

Element and Interfaces:

Here is an explanation of what every element and interface of the board does:



Specialized Functions of Some Pins:

Digi-	D0-D13 and A0-A5 (D18-D23); Note that if the digital pins are not enough, the ICSP pins can
tal I/O	be used as digital pins. MISO (D14); SCK(D15); MOSI (D16).
pins	
Ana-	A0-A5, A6-A11 (on digital pins 4, 6, 8, 9, 10, and 12). That is, D4 (A6)D6 (A7)D8 (A8)D9 (A9)D10
log	(A10) and D12 (A11). Pins A0-A5 appear in the same locations as on the Uno; inputs A6-A11 are on
Inputs	digital i/o pins 4, 6, 8, 9, 10, and 12 respectively. Each analog input provide 10 bits of resolution (i.e.
-	1024 different values). By default the analog inputs measure from ground to 5 volts, though is it possible
	to change the upper end of their range using the AREF pin and the analogReference() function.
PWM	D3, D5, D6, D9, D10, D11 and D13. Provide 8-bit PWM output with the analogWrite() function.
(Pulse-	
Width	
Modu-	
lation)	
Ex-	D3 (interrupt 0); D2 (interrupt 1); D0 (interrupt 2), D1 (interrupt 3) and D7 (interrupt 4). These pins can
ternal	be configured to trigger an interrupt on a low value, a rising or falling edge, or a change in value. See the
Inter-	attachInterrupt() function for details.
rupts	
Serial	D0 (RX) and D1 (TX).
com-	
muni-	
cation	
SPI	On the ICSP header. These pins support SPI communication using the SPI library. Note: the SPI pins are
com-	not connected to any of the digital I/O pins as they are on the Uno. They are only available on the ICSP
muni-	connector. This means that if you have a shield that uses SPI, but does NOT have a 6-pin ICSP connector
cation	that connects to the Leonardo's 6-pin ICSP header, the shield will not work.
AREF	Reference voltage for the analog inputs. Used with analogReference(). Sometimes used to set the external
	reference voltage (0-5 volts) as the upper end of analog input pins.
IOREF	The voltage at which the i/o pins of the board are operating (i.e. VCC for the board). This is 5V on the
	Leonardo. Used to configure the operating voltage of microcontroller.

### Tips:

### • Automatic (Software) Reset:

Rather then requiring a physical press of the reset button before an upload, the Arduino Nano is designed in a way that allows it to be reset by software running on a connected computer.

### • USB Overcurrent Protection:

The Leonardo has a resettable polyfuse that protects your computer's USB ports from shorts and overcurrent. Although most computers provide their own internal protection, the fuse provides an extra layer of protection. If more than 500 mA is applied to the USB port, the fuse will automatically break the connection until the short or overload is removed.

Detailed Use with ARDUINO Software as follows:

Step1| Download the Arduino IDE

When you get the board, first you should install the Arduino software and driver.

We usually use the Windows software Arduino 1.5.6 version. You can download it from the link below:

https://www.arduino.cc/en/Main/OldSoftwareReleases\1.5.x

Or you can browse the ARDUINO website to download the latest version from this link, https://www.arduino.cc, pop up the following interface.



Then click the **SOFTWARE** on the browse bar, you will have two options ONLINE TOOLS and DOWNLOADS.



Click **DOWNLOADS**, it will appear the latest software version of ARDUINO 1.8.5 shown as below.

## Download the Arduino IDE



In this software page, on the right side you can see the version of development software for different operating systems. ARDUINO has a powerful compatibility. You should download the software that is compatible with the operating

system of your computer.

We will take **WINDOWS system** as an example here. There are also two options under Windows system, one is installed version, the other is non-installed version.

For simple installed version, first click Windows Installer, you will get the following page.



# Contribute to the Arduino Software

Consider supporting the Arduino Software by contributing to its development. (US tax payers, please note this contribution is not tax deductible). Learn more on how your contribution will be used.



This way you just need to click JUST DOWNLOAD, then click the downloaded file to install it.

For non-installed version, first click Windows ZIP file, you will also get the pop-up interface as the above figure.

Click JUST DOWNLOAD, and when the ZIP file is downloaded well to your computer, you can directly unzip the file and click the icon of ARDUINO software to start it.

#### Installing Arduino (Windows):

Install Arduino with the exe. Installation package downloaded well.

Please review the license agreement before installing Arduino. If yo accept all terms of the agreement, click I Agree.	bu
SNU LESSER GENERAL PUBLIC LICENSE	•
Version 3, 29 June 2007	
Copyright (C) 2007 Free Software Foundation, Inc. < <u>http://fsf.org/</u> >	
Everyone is permitted to copy and distribute verbatim copies of this license document, but changing it is not allowed.	2
This version of the GNU Lesser General Public License incorporates the tern and conditions of version 3 of the GNU General Public License, supplement by the additional permissions listed below.	ms ed
Cancel Nullsoft Install System v3.0	gree

Click "I Agree" to see the following interface.

Arduino Setup: Installatic	on Options ou want to install and u , Click Next to continue.	uncheck the components
Select components to install:	<ul> <li>✓ Install Arduino s</li> <li>✓ Install USB drive</li> <li>✓ Create Start Me</li> <li>✓ Create Desktop</li> <li>✓ Associate .ino fi</li> </ul>	er en shortcut shortcut iles
Space required: 420.6MB		
Cancel Nullsoft Insta	all System v3.0	< Back Next >

Click "Next". Pop up the interface below.

folder, dick l installation.	Browse and select another folde	er. To install in a different er. Click Install to start the
Destination Folder		
D:\Arduino		Browse
Space required: 420	.6MB	

You can press Browse... to choose an installation path or directly type in the directory you want. Then click "Install" to initiate installation.

Extract: cc1plus.exe		
Show details		
	Co O a sel	Close

Wait for the installing process, if appear the interface of Window Security, just continue to click Install to finish the installation.

💿 Arduino Set	up: Completed		
Complete	d		
Show details			
Cancel	Nullsoft Install System v2,46	< Back	Close

### Introduction for Arduino IDE Toolbar:

Double-click the icon of Arduino software downloaded, you will get the interface shown below.



(Note: if the Arduino software loads in the wrong language, you can change it in the preferences dialog. See the environment page for details.)

### **Board for Arduino**



The functions of each button on the Toolbar are listed below:

http://wiki.keyestudio.com/index.php/File:IDE.png



Verify/Compile	Check the code for errors
Upload	Upload the current Sketch to the Arduino
New	Create a new blank Sketch
Open	Show a list of Sketches
Save	Save the current Sketch
Serial Monitor	Display the serial data being sent from the Arduino

Step2| Installing the Driver

Installed well the Arduino, the next step is to install the driver. The Arduino folder contains both the Arduino program itself and the drivers that allow the Arduino to be connected to your computer with a USB cable.



In different systems, the driver installation is similar. Here we start to install the driver on the Win7 system.

Plug one end of your USB cable into the keyestudio Leonardo and the other into a USB socket on your computer.

When you connect the board to your computer at the first time, right click your "Computer" —> for "Properties"—> click the "Device manager", under Other devices, you should see the "Arduino Leonardo".



http://wiki.keyestudio.com/index.php/File:Driver\_2.png

Then right-click on the Arduino Leonardo and select the top menu option (Update Driver Software...) shown as the figure below.

Bevice Manager			
File Action View Help			
🧼 🔿 🖬 🗐 🗐 🚺 🚺	2 📴 🍕 🚯		
XIAORONG Disk drives Disk drives Display adapters Human Interface Device DE ATA/ATAPI control Keyboards Whice and other pointin Network adapters Network adapters Computer Ports (COM & LPT Processors Sound, video and System devices Universal Serial Bu	es llers g devices Update Driver Software Disable Uninstall Scan for hardware changes Properties		
Launches the Update Driver Softwa	re Wizard for the selected device.		

Then it will be prompted to either "Search Automatically for updated driver software" or "Browse my computer for driver software". Shown as below. In this page, select "Browse my computer for driver software".



After that, select the option to browse and navigate to the "drivers" folder.



Once the software has been installed, you will get a confirmation message. Installation completed, click "Close". http://wiki.keyestudio.com/index.php/File:Driver\_6.png



Up to now, the driver is installed well. Then you can right click "Computer" —>"Properties"—>"Device manager", you should see the device as the figure shown below.



Step3| Connect the board

Connect the Leonardo board to your computer using the USB cable. The power LED should go on.



Step4| Select the Arduino Board

Open the Arduino IDE, you'll need to click the "Tools", then select the Board that corresponds to your Arduino.





Step5| Select your serial port

Select the serial device of the Arduino board from the **Tools | Serial Port menu**. **Note:** to avoid errors, the COM Port should keep the same as the Ports shown on Device Manager.



💿 sketch_aug31a	Arduino 1.5.6-r2		
File Edit Sketch	Tools Help		
sketch_aug31	Auto Format Archive Sketch	Ctrl+T	<u>₽</u>
<pre>void setup() {     // put your se</pre>	Serial Monitor	Ctrl+Shift+M	<b>^</b>
}	Port	۲ ۱	✓ COM3
<pre>void loop() {     // put your ma }</pre>	Programmer Burn Bootloader	•	
•			•
1		Are	duino Leonardo on COM3

```
Step6| Upload the Code
```

```
void loop()
{
 val=Serial.read();
if(val=='R')
 {
 digitalWrite(ledpin,HIGH);
 delay(500);
 digitalWrite(ledpin,LOW);
 delay(500);
 Serial.println("Hello World!");
 }
}
```



Then click verify button to check the errors. If compiling successfully, the message "Done compiling." will appear in the status bar.



After that, click the "Upload" button to upload the code. If the upload is successful, the message "Done uploading." will appear in the status bar.



Step7| Open the Serial Monitor

After that, click the button to open the serial monitor.



Then set the baud rate to 9600, enter an "R" and click Send, that is, the computer will send the character R. When the board receives it, you should see the RX led on the board flash once, and then D13 led flash once; when keyestudio Leonardo R3 board successfully sends "Hello World!" to the computer, you should see the "Hello World!" is showed on the monitor, and TX led on the board flash once.

💿 СОМЗ	
R	Send
Hello World!	Send
V Autoscroll	No line ending V 9600 baud V

Package Included:

- keyestudio Leonardo R3 board \* 1pcs
- Black micro USB cable 1m \* 1pcs



Resource Links:

You can download the datasheet from the link: https://drive.google.com/open?id=1fikRPqsniBHzVaAgCX0QBcCTpWg9BcQP You might also want to look at: the reference for the Arduino language; Download ARDUINO Software: https://www.arduino.cc/en/Main/OldSoftwareReleases\1.5.x Or download the software and driver from the link below: https://drive.google.com/open?id=12D-JkXdNm03Qt4dlPQr3RP6OmgXqpvHc

Troubleshooting:

If you have problems, please see the troubleshooting suggestions.

CHAPTER

SIX

### KS0249 KEYESTUDIO PRO MICRO DEVELOPMENT BOARD



Introduction:

keyestudio PRO MICRO is a microcontroller board based on the ATMEGA32U4-MU. It is an easy-to-use open source hardware.

It has 18 digital input/output pins (of which 5 can be used as PWM outputs), 9 analog inputs, a 16 MHz crystal oscillator, and a micro USB connection.

It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable to get started.

The keyestudio PRO MICRO can be powered via the micro USB connection, or via the interface RAW GND (DC 7-9V).

Note that the operating voltage of PRO MICRO is 3.3V.

The PRO MICRO differs from other Arduino boards using separate USB-Serial chip in that the ATMEGA32U4-MU has built-in USB communication, eliminating the need for a secondary processor.

It is easy to integrate this Micro in everyday objects to make them interactive.

To facilitate the physical design, the board is not welded with pin headers, so you can solder the pin headers by yourself. And the package includes 2pcs of yellow 1\*12 2.54 straight pins and 1m black micro USB cable.

TECH SPECS:

Microcontroller	ATMEGA32U4-MU
RAW	DC 7-9V
VCC	3.3V at 500mA
Operating Voltage	3.3V
Digital I/O Pins	18 (of which 5 provide PWM output)
Analog Input Pins	9
Maximum current for chip	200mA
Maximum current per pin	40mA
Recommended current per pin	20mA
Atmel AVR	8-bit
Flash Memory	32 KB
SRAM	2.5 KB
EEPROM	1 KB
ADC	10-bit
PWM	8-bit

Details:

- PCB Dimensions: 35mm\*18mm\*2mm
- Weight: 2.6g



Element and Interfaces:

Here is an explanation of what every element and interface of the board does:



Specialized Functions of Some Pins:
Digital I/O	RX (D0)TX (D1)D2-D10D14-D16A0-A3(D18-D21)
pins	
Analog	A0-A3, A6-A10 (on digital pins 4, 6, 8, 9, and 10). That is, D4 (A6)D6 (A7)D8 (A8)D9 (A9)D10
Inputs	(A10).
PWM	D3, D5, D6, D9 and D10. Provide 8-bit PWM output with the analogWrite() function.
(Pulse-	
Width	
Modulation)	
External In-	D3 (interrupt 0); D2 (interrupt 1); D0 (interrupt 2), D1 (interrupt 3) and D7 (interrupt 4). These
terrupts	pins can be configured to trigger an interrupt on a low value, a rising or falling edge, or a change
	in value. See the attachInterrupt() function for details.
Serial com-	D0 (RX) and D1 (TX).
munication	
SPI commu-	D14 (MISO); D15 (SCLK); D16 (MOSI)
nication	
I2C commu-	D2 (SDA) and D3 (SCL)
nication	
RAM	Connect the external power DC 7-9V

Detailed Use with ARDUINO Software as follows:

Step1| Download the Arduino IDE

When you get the board, first you should install the Arduino software and driver.

We usually use the Windows software Arduino 1.5.6 version. You can download it from the link below:

https://www.arduino.cc/en/Main/OldSoftwareReleases\1.5.x

Or you can browse the ARDUINO website to download the latest version from this link, https://www.arduino.cc, pop up the following interface.



Then click the **SOFTWARE** on the browse bar, you will have two options ONLINE TOOLS and DOWNLOADS.



Click **DOWNLOADS**, it will appear the latest software version of ARDUINO 1.8.5 shown as below.

#### Download the Arduino IDE Windows Installer, for Windows XP and up Windows ZIP file for non admin install ARDUINO 1.8.5 Windows app Requires Win 8.1 or 10 The open-source Arduino Software (IDE) makes it easy to Get 🖶 write code and upload it to the board. It runs on Windows, Mac OS X, and Linux. The environment is Mac OS X 10.7 Lion or newer written in Java and based on Processing and other opensource software. Linux 32 bits This software can be used with any Arduino board. Refer to the Getting Started page for Installation Linux 64 bits instructions. Linux ARM Release Notes Source Code Checksums (sha512)

In this software page, on the right side you can see the version of development software for different operating systems. ARDUINO has a powerful compatibility. You should download the software that is compatible with the operating system of your computer.

We will take **WINDOWS system** as an example here. There are also two options under Windows system, one is installed version, the other is non-installed version.

For simple installed version, first click Windows Installer, you will get the following page.

Windows Installer, for Windows XP and up Windows ZIP file for non admin install

Windows app Requires Win 8.1 or 10

Mac OS X 10.7 Lion or newer

Linux 32 bits Linux 64 bits Linux ARM

Release Notes Source Code Checksums (sha512)

# Contribute to the Arduino Software

Consider supporting the Arduino Software by contributing to its development. (US tax payers, please note this contribution is not tax deductible). Learn more on how your contribution will be used.



This way you just need to click JUST DOWNLOAD, then click the downloaded file to install it.

For non-installed version, first click Windows ZIP file, you will also get the pop-up interface as the above figure.

Click JUST DOWNLOAD, and when the ZIP file is downloaded well to your computer, you can directly unzip the file and click the icon of ARDUINO software to start it.

#### Installing Arduino (Windows):

Install Arduino with the exe. Installation package downloaded well.



Click "I Agree" to see the following interface.

Check the components y you don't want to install	ou want to install and u . Click Next to continue.	ncheck the c	omponents
Select components to install:	<ul> <li>✓ Install Arduino s</li> <li>✓ Install USB drive</li> <li>✓ Create Start Me</li> <li>✓ Create Desktop</li> <li>✓ Associate .ino fi</li> </ul>	oftware r nu shortcut shortcut les	
Space required: 420.6MB			9
Cancel Nullsoft Insta	all System v3.0	< Back	Next >

Click "Next". Pop up the interface below.

Destination Folder           D:\Arduino         Browse		l.	
D:\Arduino Browse	Destination Fold	er	
	D:\Arduino		Browse
Space required: 420.6MB Space available: 44.6GB	Space required: 4 Space available: 4	20.6MB 4.6GB	

You can press Browse... to choose an installation path or directly type in the directory you want. Then click "Install" to initiate installation.

Wait for the installing process, if appear the interface of Window Security, just continue to click Install to finish the installation.

💿 Arduino Setu	up: Completed		
	4		
Show details			
Cancel	Nullsoft Install System v2.46	< Back	Close

### Introduction for Arduino IDE Toolbar:

Double-click the icon of Arduino software downloaded, you will get the interface shown below.



(Note: if the Arduino software loads in the wrong language, you can change it in the preferences dialog. See the environment page for details.)



The functions of each button on the Toolbar are listed below:

http://wiki.keyestudio.com/index.php/File:IDE.png



Verify/Compile	Check the code for errors
Verify/Complie	
Upload	Upload the current Sketch to the Arduino
New	Create a new blank Sketch
Open	Show a list of Sketches
Save	Save the current Sketch
Serial Monitor	Display the serial data being sent from the Arduino

Step2| Installing the Driver

Installed well the Arduino, the next step is to install the driver. The Arduino folder contains both the Arduino program itself and the drivers that allow the Arduino to be connected to your computer with a USB cable.



In different systems, the driver installation is similar. Here we start to install the driver on the Win7 system.

Plug one end of your USB cable into the keyestudio PRO MICRO and the other into a USB socket on your computer.

When you connect the board to your computer at the first time, right click your "Computer" —> for "Properties"—> click the "Device manager", under Other devices, you should see the "Arduino Micro".

🚔 Device Manager
File Action View Help
A 📲 XIAORONG
⊳ nter Computer
Disk drives
▷ 📲 Display adapters
▷-@;;; Human Interface Devices
▷ · 🕞 IDE ATA/ATAPI controllers
⊳ Ceyboards
Mice and other pointing devices
D - Monitors
Network adapters      Other devices      Arduino Micro      Ports (COM & LPT)      Processors
Sound, video and game controllers
System devices
🔈 📲 Universal Serial Bus controllers

http://wiki.keyestudio.com/index.php/File:Driver\_2.png



right-click on the Arduino Micro and select the top menu option (Update Driver Software...) shown as the figure below.

Then it will be prompted to either "Search Automatically for updated driver software" or "Browse my computer for driver software". Shown as below. In this page, select "Browse my computer for driver software".



After that, select the option to browse and navigate to the "drivers" folder.



Once the software has been installed, you will get a confirmation message. Installation completed, click "Close". http://wiki.keyestudio.com/index.php/File:Driver\_6.png



Up to now, the driver is installed well. Then you can right click "Computer" —> "Properties"—> "Device manager", you should see the device as the figure shown below.



#### Step3| Connect the board

Connect the Pro Micro board to your computer using the USB cable. The power LED should go on.

#### Step4| Select the Arduino Board

Open the Arduino IDE, you'll need to click the "Tools", then select the Board that corresponds to your Arduino.





Step5| Select your serial port

Select the serial device of the Arduino board from the **Tools | Serial Port menu**. **Note:** to avoid errors, the COM Port should keep the same as the Ports shown on Device Manager.





```
Step6| Upload the Code
```

```
void loop()
{
 val=Serial.read();
if(val=='R')
 {
 digitalWrite(ledpin,HIGH);
 delay(500);
 digitalWrite(ledpin,LOW);
 delay(500);
 Serial.println("Hello World!");
 }
}
```



Then click verify button to check the errors. If compiling successfully, the message "Done compiling." will appear in the status bar.



After that, click the "Upload" button to upload the code. If the upload is successful, the message "Done uploading." will appear in the status bar.



Step7| Open the Serial Monitor

After that, click the button to open the serial monitor.



Then set the baud rate to 9600, enter an "R" and click Send, that is, the computer will send the character R. When the board receives it, you should see the RX led on the board flash once, and then D13 led flash once; when keyestudio PRO MICRO successfully sends "Hello World!" to the computer, you should see the "Hello World!" is showed on the monitor, and TX led on the PRO MICRO board flash once.

© COM18	
R	Send
Hello World!	
Autoscroll	No line ending 🔹 9600 baud 💌



Includes:

- keyestudio PRO MICRO\* 1pcs
- Black micro USB cable 1m \* 1pcs
- Yellow Pin headers \* 2pcs

Resource Links:

Download test code and driver:

https://fs.keyestudio.com/KS0249

You might also want to look at:

the reference for the Arduino language;

Download ARDUINO Software:

Package

https://www.arduino.cc/en/Main/OldSoftwareReleases\1.5.x

Troubleshooting:

If you have problems, please see the troubleshooting suggestions.

CHAPTER

SEVEN

## KS0341 KEYESTUDIO UNO COMPATIBLE ADVANCED DEVELOPMENT BOARD



## Introduction:

The keyestudio UNO compatible board Advanced is a microcontroller board based on the ATmega328P (datasheet), fully compatible with keyestudio UNO R3 board and ARDUINO UNO REV3.

It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, 2 ICSP headers and a reset button.

Note that the two ICSP headers are separately used to program the firmware to ATMEGA16U2-MU and ATMEGA328P-PU, but generally the two chips have been programmed well.

It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it via an external DC power jack (DC 7-12V) or via female headers Vin/ GND(DC 7-12V) to get started.

**Note:** the most important difference between this keyestudio UNO compatible board Advanced and keyestudio UNO R3 board is the voltage regulator chip used in the board.

The voltage regulator chip used in keyestudio UNO R3 board is NSP1117. When connect an external power, output 5V, the drive current is 1A.

However, keyestudio UNO compatible board Advanced features the voltage-regulator chip MP2307DN. When connect the external power, output 5V, the drive current can be 2A.

The UNO is the best board to get started with electronics and coding. If this is your first experience tinkering with the platform, the UNO is the most robust board you can start playing with.

	keyestudio	UNO	compatible	board	Ad-	keyestudio	UNO	R3
	vanced					board		
voltage-regulator chip	MP2307DN					NSP1117		
Power Output	5V					5V		
Drive Current (external	2A					1A		
power)								
Drive Current (USB power)	0.5A					0.5A		

keyestudio UNO R3 board:



keyestudio UNO compatible board Advanced:



## TECH SPECS:

Microcontroller	ATmega328P-PU
Operating Voltage	5V
Input Voltage (recommended)	DC7-12V
Digital I/O Pins	14 (D0-D13) (of which 6 provide PWM output)
PWM Digital I/O Pins	6 (D3, D5, D6, D9, D10, D11)
Analog Input Pins	6 (A0-A5)
DC Current per I/O Pin	20 mA
DC Current for 3.3V Pin	50 mA
Flash Memory	32 KB (ATmega328P-PU) of which 0.5 KB used by bootloader
SRAM	2 KB (ATmega328P-PU)
EEPROM	1 KB (ATmega328P-PU)
Clock Speed	16 MHz
LED_BUILTIN	D13

#### Details:

• Dimensions: 75mm x 54mm x 15mm



H:15mm N.W.:27g <sub>Weight:</sub>

27g

Element and Interfaces:

Here is an explanation of what every element and interface of the board does:



1	<b>ICSP (In-Circuit Serial Programming) Header</b> In most case, ICSP is the AVR, an Arduino micro- program header consisting of MOSI, MISO, SCK, RESET, VCC, and GND. It is often called the SPI (serial peripheral interface) and can be considered an "extension" of the output. In fact, slave the output devices under the SPI bus host. When connecting to PC, program the firmware to ATMEGA328P-PU.
2	<b>Power LED Indicator</b> Powering the Arduino, LED on means that your circuit board is correctly powered on. If LED is off, connection is wrong.
3	<b>Digital I/O</b> Arduino UNO has 14 digital input/output pins (of which 6 can be used as PWM outputs). These pins can be configured as digital input pin to read the logic value (0 or 1). Or used as digital output pin to drive different modules like LED, relay, etc. The pin labeled "" can be used to generate PWM.
4	GND ( Ground pin headers) Used for circuit ground
5	AREF Reference voltage (0-5V) for analog inputs. Used with analogReference().
6	SDA IIC communication pin
7	SCL IIC communication pin
8	<b>ICSP (In-Circuit Serial Programming) Header</b> In most case, ICSP is the AVR, an Arduino micro-program header consisting of MOSI, MISO, SCK, RESET, VCC, and GND. Connected to ATMEGA 16U2-MU. When connecting to PC, program the firmware to ATMEGA 16U2-MU.
9	<b>RESET Button</b> You can reset your Arduino board, for example, start the program from the initial status. You can use the RESET button.
0	<b>D13 LED</b> There is a built-in LED driven by digital pin 13. When the pin is HIGH value, the LED is on, when the pin is LOW, it's off.
1	<b>USB Connection</b> Arduino board can be powered via USB connector. All you needed to do is connecting the USB port to PC using a USB cable.
12	ATMEGA 16U2-MU USB to serial chip, can convert the USB signal into serial port signal.
13	<b>TX LED</b> Onboard you can find the label: TX (transmit) When Arduino board communicates via serial port, send the message, TX led flashes.
14	<b>RX LED</b> Onboard you can find the label: RX(receive ) When Arduino board communicates via serial port, receive the message, RX led flashes.
15	<b>Crystal Oscillator</b> How does Arduino calculate time? by using a crystal oscillator. The number printed on the top of the Arduino crystal is 16.000H9H. It tells us that the frequency is 16,000,000 Hertz or 16MHz.
16	<b>Voltage Regulator</b> Convert an external input DC7-12V voltage into DC 5V, then switch DC 5V to the processor and other components. Output DC 5V, the drive current is 2A.
17	<b>DC Power Jack</b> Arduino board can be supplied with an external power DC7-12V from the DC power jack.
18	<b>IOREF</b> Used to configure the operating voltage of microcontrollers. Use it less.
19	<b>RESET Header</b> Connect an external button to reset the board. The function is the same as reset button (labeled 9)
20	<b>Power Pin 3V3</b> A 3.3 volt supply generated by the on-board regulator. Maximum current draw is 50 mA.
21	Power Pin 5V Provides 5V output voltage
22	Vin You can supply an external power input DC7-12V through this pin to Arduino board.
23	Analog Pins Arduino UNO board has 6 analog inputs, labeled A0 through A5. These pins can read the signal from analog sensors (such as humidity sensor or temperature sensor), and convert it into the digital value that
208	can read by microcontrollers) Keyestudio UNO Compatible advanced development board
24	<b>Microcontroller</b> Each Arduino board has its own microcontroller. You can regard it as the brain of your board. The main IC (integrated circuit) on the Arduino is slightly different from the panel pair. Microcon-



Specialized Functions of Some Pins:

- Serial communication: Digital pins 0 (RX) and 1 (TX).
- PWM Interfaces (Pulse-Width Modulation): D3, D5, D6, D9, D10, D11
- External Interrupts: D2 (interrupt 0) and D3 (interrupt 1). These pins can be configured to trigger an interrupt on a low value, a rising or falling edge, or a change in value.
- SPI communication: D10 (SS), D11 (MOSI), D12 (MISO), D13 (SCK). These pins support SPI communication using the SPI library.
- IIC communication: A4 (SDA); A5(SCL)

Tips:

• Automatic (Software) Reset:

Rather than requiring a physical press of the reset button before an upload, the Arduino Uno board is designed in a way that allows it to be reset by software running on a connected computer.

• The Uno board contains a trace that can be cut to disable the auto-reset. The pads on either side of the trace can be soldered together to re-enable it. It's labeled "RESET-EN". You may also be able to disable the auto-reset by connecting a 110 ohm resistor from 5V to the reset line; see this forum thread for details.

Detailed Use with ARDUINO Software as follows:

Step1| Download the Arduino environment (IDE)

When you get the UNO advanced board, first you should install the Arduino software and driver.

We usually use the Windows software Arduino 1.5.6 version. You can download it from the link below:

https://www.arduino.cc/en/Main/OldSoftwareReleases\1.5.x

Or you can browse the ARDUINO website to download the latest version from this link, https://www.arduino.cc, pop up the following interface.



Then click the **SOFTWARE** on the browse bar, you will have two options ONLINE TOOLS and DOWNLOADS.



Click **DOWNLOADS**, it will appear the latest software version of ARDUINO 1.8.5 shown as below.

## Download the Arduino IDE



In this software page, on the right side you can see the version of development software for different operating systems. ARDUINO has a powerful compatibility. You should download the software that is compatible with the operating system of your computer.

We will take **WINDOWS system** as an example here. There are also two options under Windows system, one is installed version, the other is non-installed version.

For simple installed version, first click Windows Installer, you will get the following page.



# Contribute to the Arduino Software

Consider supporting the Arduino Software by contributing to its development. (US tax payers, please note this contribution is not tax deductible). Learn more on how your contribution will be used.



This way you just need to click JUST DOWNLOAD, then click the downloaded file to install it.

For non-installed version, first click Windows ZIP file, you will also get the pop-up interface as the above figure.

Click JUST DOWNLOAD, and when the ZIP file is downloaded well to your computer, you can directly unzip the file and click the icon of ARDUINO software to start it.

#### Installing Arduino (Windows):

Install Arduino with the exe. Installation package downloaded well.

SNU LESSE	R GENERAL PUB	LIC LICENSE		
Version 3, 2	29 June 2007			
Copyright (	C) 2007 Free So	ftware Foundation,	Inc. < <u>http://fsf.or</u>	<u>a/</u> >
Everyone is document,	s permitted to co but changing it is	ppy and distribute ve s not allowed.	rbatim copies of th	nis license
This version	n of the GNU Les	ser General Public Li	cense incorporates	s the terms

Click "*I Agree*" to see the following interface.
you don't want to install	ou want to install and uncheck the components . Click Next to continue.
Select components to install:	<ul> <li>Install Arduino software</li> <li>Install USB driver</li> <li>Create Start Menu shortcut</li> <li>Create Desktop shortcut</li> <li>Associate .ino files</li> </ul>
Space required: 420.6MB	

Click "Next". Pop up the interface below.

Setup will install Arduino in the following folder. folder, dick Browse and select another folder. C installation.	o install in a different ick Install to start the
Destination Folder	Browse
Space required: 420.6MB	
Space available: 44.6GB	>

You can press Browse... to choose an installation path or directly type in the directory you want. Then click "Install" to initiate installation.

💿 Arduino Setup	: Installing		
Extract: cc1	plus.exe		
Show details			
Cancel	Nullsoft Install System v3.0	< Back	Close

Wait for the installing process, if appear the interface of Window Security, just continue to click Install to finish the installation.

💿 Arduino Setu	up: Completed		
Complete	d		
Show details	]		
Cancel	Nullsoft Install System v2.46	< Back	Close

## **Installing Driver:**

Next, we will introduce the driver installation of UNO R3 development board. The driver installation may have slight differences in different computer systems. So in the following let's move on to the driver installation in the WIN 7 system.

The Arduino folder contains both the Arduino program itself and the drivers that allow the Arduino to be connected to your computer by a USB cable. Before we launch the Arduino software, you are going to install the USB drivers.



Plug one end of your USB cable into the Arduino and the other into a USB socket on your computer.

When you connect UNO board to your computer at the first time, right click the icon of your "*Computer*" —>*for* "*Properties*"—> *click the* "*Device manager*", under "Other Devices", you should see an icon for "Unknown device" with a little yellow warning triangle next to it. This is your Arduino.



Then right-click on the device and select the top menu option (Update Driver Software...) shown as the figure below.

🚔 Device Manager	x
File Action View Help	
Image: Second state in the image: Second sta	
Launches the Update Driver Software Wizard for the selected device.	

It will then be prompted to either "Search Automatically for updated driver software" or "Browse my computer for driver software". Shown as below. In this page, select "Browse my computer for driver software".



After that, select the option to browse and navigate to the "drivers" folder of Arduino installation.



Click "Next" and you may get a security warning, if so, allow the software to be installed. Shown as below.



Installation completed, click "Close".



Up to now, the driver is installed well. Then you can right click "*Computer*" —> "*Properties*"—> "*Device manager*", you should see the device shown below.

🚔 Device Manager	
File Action View Help	
a → 1306-PC	
Bluetooth Radios	
⊳ nt Computer	
Disk drives	
Display adapters	
DVD/CD-ROM drives	
▷ - 9詞 Human Interface Devices	
Deg IDE ATA/ATAPI controllers	
Imaging devices	
> - Keyboards	
Memory technology driver	
Monitors	
Network adapters	
Ports (COM & LPT)	
Arduino UNO R3 (COM3)	
Processors	
Sound, video and game controllers	
⊳ -j	
Universal Serial Bus controllers	

## Introduction for Arduino IDE Toolbar:

Double-click the icon of Arduino software downloaded well, you will get the interface shown below.



(Note: if the Arduino software loads in the wrong language, you can change it in the preferences dialog. See the environment page for details.)

## **Board for Arduino**



The functions of each button on the Toolbar are listed below: http://wiki.keyestudio.com/index.php/File:IDE.png



Verify/Compile	Check the code for errors
Upload	Upload the current Sketch to the Arduino
New	Create a new blank Sketch
Open	Show a list of Sketches
Save	Save the current Sketch
Serial Monitor	Display the serial data being sent from the Arduino

Step2| Connect the board

Connect the UNO board to your computer using the USB cable. The green power LED should go on.

Step3| Select the Arduino Board

Open the Arduino IDE, you'll need to click the "Tools", then select the Board that corresponds to your Arduino.



Step4| Select your serial port

Select the serial device of the Arduino board from the **Tools** | **Serial Port menu**. This is likely to be COM3 or higher (COM1 and COM2 are usually reserved for hardware serial ports). To find out, you can disconnect your Arduino board and re-open the menu; the entry that disappears should be the Arduino board. Reconnect the board and select that serial port.



Note: to avoid errors, the COM Port should keep the same as the Ports shown on Device Manager.





Step5| Upload the Program

```
}
void loop()
{
val=Serial.read();
if(val=='R')
{
digitalWrite(ledpin,HIGH);
delay(500);
digitalWrite(ledpin,LOW);
delay(500);
Serial.println("Hello World!");
}
}
```

Then click verify button to check the errors. If compiling successfully, the message "Done compiling." will appear in the status bar.



After that, click the "Upload" button to upload the code. Wait a few seconds - you should see the RX and TX leds on the board flashing. If the upload is successful, the message "Done uploading." will appear in the status bar.



Step6| Open the Serial Monitor

After that, click the serial monitor button to open the serial monitor.



Then set the baud rate as 9600, enter an "R" and click Send, you should see the RX led on the board blink once, and then D13 led blink once, finally "Hello World!" is showed on the monitor, the TX led blink once.

СОМЗ	
R	Send
Hello World!	
	<b>\</b>
V Autoscrol	No line ending 🔻 9600 baud 👻

Package Included:

- Keyestudio UNO Advanced board \* 1pcs
- USB cable \* 1pcs





Other Links:

You might also want to look at:

the examples for using various sensors and actuators;

the reference for the Arduino language;

You can download the datasheet from the link:

https://drive.google.com/open?id=1t6mqdd4EUA4kvwIJrRG-VHU2H9iZEJHF

Software Download:

https://drive.google.com/open?id=12D-JkXdNm03Qt4dlPQr3RP6OmgXqpvHc

Troubleshooting:

If you have problems, please see the troubleshooting suggestions.

CHAPTER

EIGHT

## KS0342 KEYESTUDIO MEGA COMPATIBLE ADVANCED DEVELOPMENT BOARD



## Introduction:

Keyestudio MEGA compatible board Advanced is a microcontroller board based on the ATMEGA2560-16AU , fully compatible with Keyestudio MEGA R3 board and ARDUINO MEGA REV3.

It has 54 digital input/output pins (of which 15 can be used as PWM outputs), 16 analog inputs, 4 UARTs (hardware serial ports), a 16 MHz crystal oscillator, a USB connection, a power jack, 2 ICSP headers, and a reset button.

It contains everything needed to support the microcontroller. With its bootloader, program can be downloaded directly with USB and you don't need to use other external programmer.

Just simply connect it to a computer with a USB cable or power it via an external DC power jack (DC 7-12V) or via female headers Vin /GND (DC 7-12V) to get started.

**Note:** the most important difference between keyestudio MEGA compatible board Advanced and keyestudio MEGA R3 board is the voltage regulator chip used in the board.

The voltage regulator chip used in keyestudio MEGA R3 board is NSP1117. When connect the external power, output 5V, the drive current is 1A.

However, keyestudio MEGA compatible board Advanced features the voltage-regulator chip MP2307DN. When connect the external power, output 5V, the drive current can be 2A.

The MEGA is designed for more complex projects. With 54 digital I/O pins, 16 analog inputs and a larger space for your sketch, it is the recommended board for 3D printers and robotics projects. This gives your projects plenty of room and opportunities.

	keyestudio MEGA compatible board Ad- vanced	keyestudio MEGA R3 board
voltage-regulator chip	MP2307DN	NSP1117
Power Output	5V	5V
Drive Current (external	2A	1A
power)		
Drive Current (USB power)	0.5A	0.5A

## keyestudio MEGA R3 board:



keyestudio MEGA compatible board Advanced:



## TECH SPECS:

Microcontroller	ATMEGA2560-16AU
Operating Voltage	5V
Input Voltage (recommended)	DC 7-12V
Digital I/O Pins	54 (D0-D53)
PWM Digital I/O Pins	15 (D2-D13; D44-D46)
Analog Input Pins	16 (A0-A15)
DC Current per I/O Pin	20 mA
DC Current for 3.3V Pin	50 mA
Flash Memory	256 KB of which 8 KB used by bootloader
SRAM	8 KB
EEPROM	4 KB
Clock Speed	16 MHz
LED_BUILTIN	D13

Details:

- Dimensions: 108mm x 53.5mm x 15mm
- Weight: 33.6g



H:15mm only board weight :33.6g

## **Element and Pin Interfaces:**

Here is an explanation of what every element and interface of the board does:



1	<b>Digital I/O</b> Arduino MEGA has 54 digital input/output pins (of which 15 can be used as PWM outputs). These pins can be configured as digital input pin to read the logic value (0 or 1). Or used as digital output pin to drive different modules like LED, relay, etc. Using pinMode(), digitalWrite(), and digitalRead() functions.
2	GND Ground pins
3	<b>AREF</b> Reference voltage (0-5V) for analog inputs. Used with analogReference(). Configures the reference voltage used for analog input (i.e. the value used as the top of the input range).
4	SDA IIC communication pin
6	SCL IIC communication pin
6	<b>ICSP</b> ( <b>In-Circuit Serial Programming</b> ) <b>Header</b> the AVR, an Arduino micro-program header consisting of MOSI, MISO, SCK, RESET, VCC, and GND. Connected to the ATMEGA16U2-MU. When connecting to PC, program the firmware to ATMEGA16U2-MU.
0	<b>USB Connection</b> Arduino board can be powered via USB connector. All you needed to do is connecting the USB port to PC using a USB cable.
8	<b>D13 LED</b> There is a built-in LED driven by digital pin 13. When the pin is HIGH value, the LED is on, when the pin is LOW, it's off.
9	ATMEGA 16U2-MU USB to serial chip, can convert the USB signal into serial port signal.
10	<b>TX LED</b> Onboard you can find the label: TX (transmit) When Arduino board communicates via serial port, send the message, TX led flashes.
1	<b>RX LED</b> Onboard you can find the label: RX(receive ) When Arduino board communicates via serial port, receive the message, RX led flashes.
12	<b>Crystal Oscillator</b> How does Arduino calculate time? by using a crystal oscillator. The number printed on the top of the Arduino crystal is 16.000H9H. It tells us that the frequency is 16,000,000 Hertz or 16MHz.
13	<b>Voltage Regulator</b> Convert an external input DC7-12V voltage into DC 5V, then switch DC 5V to the processor and other components. Output DC 5V, the drive current is 2A.
14	<b>DC Power Jack</b> Arduino board can be supplied with an external power DC7-12V from the DC power jack.
15	<b>IOREF</b> This pin on the board provides the voltage reference with which the microcontroller operates. A properly configured shield can read the IOREF pin voltage and select the appropriate power source or enable voltage translators on the outputs for working with the 5V or 3.3V.
16	<b>RESET Header</b> Connect an external button to reset the board. The function is the same as reset button.
17	Power Pin 3V3 Provides 3.3V voltage output
18	Power Pin 5V Provides 5V voltage output
19	Vin You can supply an external power input DC7-12V through this pin to Arduino board.
20	Analog Pins Onboard has 16 analog inputs, labeled A0 to A15.
21	<b>RESET Button</b> You can reset your Arduino board, for example, start the program from the initial status. You can use the RESET button.
22	<b>ICSP</b> ( <b>In-Circuit Serial Programming</b> ) <b>Header</b> the AVR, an Arduino micro-program header consisting of MOSI, MISO, SCK, RESET, VCC, and GND. It is often called the SPI (serial peripheral interface) and can be considered an "extension" of the output. In fact, slave the output devices to the SPI bus host. When connecting to PC, program the firmware to ATMEGA2560-16AU.
23	<b>Microcontroller</b> Each Arduino board has its own microcontroller. You can regard it as the brain of your
238	board. The man are the panel pair Microcon the Ardumo is slightly different from the panel pair Microcon to a slightly different from the panel pair Microcon to a trollers are usually from ATMEL. Before you load a new program on the Arduino IDE, you must know what IC is on your board. This information can be checked at the top of IC.
24	Power LED Indicator Powering the Arduino, LED on means that your circuit board is correctly powered



Specialized Functions of Some Pins:

• Serial Communication: D0 (RX0) and D1 (TX1); Serial 1: D19 (RX1) and D18 (TX1); Serial 2: D17 (RX2) and D16 (TX2); Serial 3: D15 (RX3) and D14 (TX3).

Used to receive (RX) and transmit (TX) TTL serial data. Pins 0 and 1 are also connected to the corresponding pins of the ATmega16U2 USB-to-TTL Serial chip.

• PWM Pins (Pulse-Width Modulation): D2 to D13, and D44 to D46.

Provide 8-bit PWM output with the analogWrite() function.

• External Interrupts: D2 (interrupt 0), D3 (interrupt 1), D18 (interrupt 5), D19 (interrupt 4), D20 (interrupt 3), and D21 (interrupt 2).

These pins can be configured to trigger an interrupt on a low level, a rising or falling edge, or a change in level. See the attachInterrupt() function for details.

• SPI communication: D53 (SS), D52 (SCK), D51 (MOSI), D50 (MISO).

These pins support SPI communication using the SPI library. The SPI pins are also broken out on the ICSP header, which is physically compatible with the Arduino Uno.

• IIC communication: D20 (SDA); D21 (SCL). Support TWI communication using the Wire library.

Tips:

• Automatic (Software) Reset:

Rather than requiring a physical press of the reset button before an upload, the MEGA board is designed in a way that allows it to be reset by software running on a connected computer.

• The MEGA board contains a trace that can be cut to disable the auto-reset. The pads on either side of the trace can be soldered together to re-enable it. It's labeled "RESET-EN". You may also be able to disable the auto-reset by connecting a 110 ohm resistor from 5V to the reset line; see this forum thread for details.

Detailed Use with ARDUINO Software as follows:

Step1| Download the Arduino environment (IDE)

When you get the MEGA development board, first you should install the Arduino software and driver.

We usually use the Windows software Arduino 1.5.6 version. You can download it from the link below:

https://www.arduino.cc/en/Main/OldSoftwareReleases\1.5.x

Or you can browse the ARDUINO website to download the latest version from this link, https://www.arduino.cc, pop up the following interface.



Then click the **SOFTWARE** on the browse bar, you will have two options ONLINE TOOLS and DOWNLOADS.



Click **DOWNLOADS**, it will appear the latest software version of ARDUINO 1.8.5 shown as below.

#### Download the Arduino IDE Windows Installer, for Windows XP and up Windows ZIP file for non admin install ARDUINO 1.8.5 Windows app Requires Win 8.1 or 10 The open-source Arduino Software (IDE) makes it easy to Get 🖶 write code and upload it to the board. It runs on Windows, Mac OS X, and Linux. The environment is Mac OS X 10.7 Lion or newer written in Java and based on Processing and other opensource software. Linux 32 bits This software can be used with any Arduino board. Refer to the Getting Started page for Installation Linux 64 bits instructions. Linux ARM **Release Notes** Source Code Checksums (sha512)

In this software page, on the right side you can see the version of development software for different operating systems. ARDUINO has a powerful compatibility. You should download the software that is compatible with the operating system of your computer.

We will take **WINDOWS system** as an example here. There are also two options under Windows system, one is installed version, the other is non-installed version.

For simple installed version, first click Windows Installer, you will get the following page.

Checksums (sha512)

Windows Installer, for Windows XP and up<br/>Windows ZIP file for non admin installWindows app Requires Win 8.1 or 10<br/>GetMac OS X 10.7 Lion or newerLinux 32 bits<br/>Linux 64 bits<br/>Linux ARMRelease Notes<br/>Source Code

# Contribute to the Arduino Software

Consider supporting the Arduino Software by contributing to its development. (US tax payers, please note this contribution is not tax deductible). Learn more on how your contribution will be used.



This way you just need to click JUST DOWNLOAD, then click the downloaded file to install it.

For non-installed version, first click Windows ZIP file, you will also get the pop-up interface as the above figure.

Click JUST DOWNLOAD, and when the ZIP file is downloaded well to your computer, you can directly unzip the file and click the icon of ARDUINO software to start it.

## Installing Arduino (Windows):

Install Arduino with the exe. Installation package downloaded well.



Click "I Agree" to see the following interface.

Arduino Setup: Installation Check the components y you don't want to install	on Options ou want to install and ur . Click Next to continue.	ncheck the con	nponents
Select components to install:	<ul> <li>✓ Install Arduino se</li> <li>✓ Install USB driver</li> <li>✓ Create Start Mer</li> <li>✓ Create Desktop se</li> <li>✓ Associate .ino file</li> </ul>	oftware r nu shortcut shortcut es	
Space required: 420.6MB		2	
Cancel Nullsoft Insta	all System v3.0	< Back	Next >

Click "Next". Pop up the interface below.

folder, dick Browse and s installation.	n the following folder. elect another folder. (	. To install in a differen Click Install to start th	nt Ie
Destination Folder			
D:\Arduino		Browse	<

You can press Browse... to choose an installation path or directly type in the directory you want. Then click "Install" to initiate installation.

Show details		
· · · · · · · · · · · · · · · · · · ·	1 Con 1	Close

Wait for the installing process, if appear the interface of Window Security, just continue to click Install to finish the installation.

💿 Arduino Setup: Completed	
Completed	
Show details	
Cancel Nullsoft Install System v2,46 < Ba	ack Close

## **Installing Driver:**

Next, we will introduce the driver installation of MEGA development board. The driver installation may have slight differences in different computer systems. So in the following let's move on to the driver installation in the WIN 7 system.

The Arduino folder contains both the Arduino program itself and the drivers that allow the Arduino to be connected to your computer by a USB cable. Before we launch the Arduino software, you are going to install the USB drivers.



Plug one end of your USB cable into the Arduino and the other into a USB socket on your computer.

When you connect MEGA board to your computer at the first time, right click the icon of your "*Computer*" —> *for* "*Properties*"—> *click the* "*Device manager*", under "Other Devices", you should see an icon for "Unknown device"

\_ 🗆 📈 🚔 Device Manager File Action View Help (= =) 🖬 📔 🖬 🛝 4 🚔 1306-PC Batteries Bluetooth Radios D - Computer Disk drives Display adapters DVD/CD-ROM drives - 🖓 Human Interface Devices D - IDE ATA/ATAPI controllers Imaging devices >-- Keyboards >------ Memory technology driver Mice and other pointing devices b - Monitors >- Network adapters - D Other devices ...... Unknown device Processors > - Sound, video and game controllers > - System devices 👂 - 🏺 Universal Serial Bus controllers

with a little yellow warning triangle next to it. This is your Arduino.

Then right-click on the device and select the top menu option (Update Driver Software...) shown as the figure below.

A Device Manager	
File Action View Help	
I 1306-PC         Batteries         Display adapters         Display adapters         DVD/CD-ROM drives         Human Interface Devices         Imaging devices         Keyboards         Memory technology driver         Monitors         Network adapters         Other devices         Monitors         Processors         Disable         Uninstall         Sound, video         Properties	
Launches the Update Driver Software Wizard for the selected device.	

It will then be prompted to either "Search Automatically for updated driver software" or "Browse my computer for driver software". Shown as below. In this page, select "Browse my computer for driver software".



After that, select the option to browse and navigate to the "drivers" folder of Arduino installation.


Click "Next" and you may get a security warning, if so, allow the software to be installed. Shown as below.



Installation completed, click "Close".



Up to now, the driver is installed well. Then you can right click "*Computer*" —> "*Properties*"—> "*Device manager*", you should see the device shown below.

🚔 Device Manager	
File Action View Help	
A A 1306-PC	
Bluetooth Radios	
Disk drives	
Display adapters	
\$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$	
<ul> <li>IDE ATA/ATAPI controllers</li> <li>Imaging devices</li> </ul>	
Keyboards	
Microby technology unvertige Mice and other pointing devices	
Monitors	
Ports (COM & LPT)	
Arduino Mega 2560 R3 (COM7)	
Sound, video and game controllers	
> 1 System devices	
Diversal Serial Bus controllers	

# **Introduction for Arduino IDE Toolbar:**

Double-click the icon of Arduino software downloaded well, you will get the interface shown below.



(Note: if the Arduino software loads in the wrong language, you can change it in the preferences dialog. See the environment page for details.)

## **Board for Arduino**



The functions of each button on the Toolbar are listed below: http://wiki.keyestudio.com/index.php/File:IDE.png



Verify/Compile	Check the code for errors
Upload	Upload the current Sketch to the Arduino
New	Create a new blank Sketch
Open	Show a list of Sketches
Save	Save the current Sketch
Serial Monitor	Display the serial data being sent from the Arduino

Step2| Connect the board

Connect the MEGA board to your computer using the USB cable. The power LED should go on.

Step3| Select the Arduino Board

Open the Arduino IDE, you'll need to click the "Tools", then select the Board that corresponds to your Arduino.



Step4| Select your serial port

Select the serial device of the Arduino board from the **Tools** | **Serial Port menu**. This is likely to be COM3 or higher (COM1and COM2 are usually reserved for hardware serial ports). To find out, you can disconnect your Arduino board and re-open the menu; the entry that disappears should be the Arduino board. Reconnect the board and select that serial port.



Note: to avoid errors, the COM Port should keep the same as the Ports shown on Device Manager.





Step5| Upload the Program

Below is an example program for displaying the Hello World!

Copy and paste the code to the Arduino environment IDE.

int val;//define variable val

int ledpin=13;// define digital pin13

void setup()

{

Serial.begin(9600);// set the baud rate at 9600. When connected to a specific device, (e.g. bluetooth), the baud rate needs to be the same with the device.

pinMode(ledpin,OUTPUT);// initialize digital pin 13 as output. When using I/O ports on an Arduino, this kind of set up is always needed.

}

void loop()

{

val=Serial.read();// read the instruction or character from PC to Arduino, and assign them to Val.

if(val=='R')// determine if the instruction or character received is an "R".

{ // if it's "R",

digitalWrite(ledpin,HIGH);// set the LED on digital pin 13 on.

delay(500);

digitalWrite(ledpin,LOW);// set the LED on digital pin 13 off.

delay(500);

Serial.println("Hello World!");// display"Hello World".

}

}

Then click verify button to check the errors. If compiling successfully, the message "Done compiling." will appear in the status bar.



After that, click the "Upload" button to upload the code. Wait a few seconds - you should see the RX and TX leds on the board flashing. If the upload is successful, the message "Done uploading." will appear in the status bar.



Step6| Open the Serial Monitor

After that, click the serial monitor button to open the serial monitor.

💿 sketch_jul30a   Arduino 1.5.6-r2	
File Edit Sketch Tools Help	
	Serial Monitor 😰
sketch_jul30a §	1
void setup()	·
{	
Serial.begin(9600);	
pinMode (ledpin, OUTPUT);	
}	
void loop ()	
val=Serial.read();	=
if(val=='R')	-
{	
digitalWrite(ledpin, HIGH);	
delay (500);	
digitalWrite(ledpin, LOW);	
delay (500);	
<pre>Serial.println("Hello World!");</pre>	
}	*
<	4

Then set the baud rate as 9600, enter an "R" and click Send, you should see the TX led on the board blink once, and then D13 led blink once, finally "Hello World!" is showed on the monitor, the RX led blink once.



Package Included:

- Keyestudio MEGA Advanced board \* 1pcs
- USB cable \* 1pcs



Other Links:

You might also want to look at:

the examples for using various sensors and actuators;

the reference for the Arduino language;

You can download the datasheet from the link:

https://drive.google.com/open?id=1EdtG7by2aCPR55Q5uYlwcwk\_e5cWnh2M

Software Download:

https://drive.google.com/open?id=12D-JkXdNm03Qt4dlPQr3RP6OmgXqpvHc

Troubleshooting:

If you have problems, please see the troubleshooting suggestions.

CHAPTER

NINE

# **KS0486 KEYESTUDIO PLUS DEVELOPMENT BOARD**





1.Description

Doing experiments with electronic products, we often program on the Arduino IDE development environment with Arduino series microcontrollers.

Keyestudio PLUS control board is fully compatible with Arduino IDE development environment. It is as same as the Arduino UNO R3 board. Moreover, some improvements we made highly strengthen its function(as shown below). In order to wire efficiently, we equip it with a 1m USB cable with type-c interface for you.



**Keyestudio PLUS** 

- 1. USB CP2102, stability and compatibility are better forto-turn chip
- 2. Working voltage can be selected 3.3 V or 5 V, can connect 3.3 V sensor
- 3. Two more IO mouth, A6,A7, the best

4. Extended serial communication and I2C

interface, can be easily connected to similar devices

5. Unique DC-DC power supply design, working voltage 5 V, the current of 2 A, can directly drive some high current load, such as steering gear and motor

6. Extension of 6 PWM ports and 6 analog port interfaces to connect sensors directly

7. Extended serial communication and I2C interface, can be easily connected to similar devices

- 8. Input voltage 6-15 V, wider voltage range, choose more
- 9. Choose the current more popular type-c interface, beautiful and generous, faster transmission speed



# Arduino UNO R3



- 1. USB turnstile chip is 16 U2, Some systems are not compatible
- 2. Only 5 V working voltage, no way to connect 3.3 V sensor



3. Design did not leave these 2 IO ports, defective



4. No expansion port, more complex connection required



- 5. Working voltage 5 V, the current only 1 A, can not drive the equipment with high current.
- 6. No expansion port, more complex connection required
- 7. No expansion port, more complex connection required
- 8. Input voltage 7-12 V, optional power supply mode is not
- 9. Adopt traditional square USB interface, more common

#### 2.Specification

MicrocontrollerATMEGA328P-AU USB to serial chip: CP2102 Working voltage: 5V or 3.3V (DIP switch control) External power: DC 6-15V (recommend 9V)

Digital I / O pins: 14 (D0-D13) PWM channel: 6 (D3 D5 D6 D9 D10 D11) Analog input channel (ADC): 8 (A0-A7) Each I / O Port of DC output capability : 20 mA Output capability of 3.3V port: 50 mA Flash Memory: 32 KB (of which 0.5 KB is used by the bootloader) SRAM: 2 KB (ATMEGA328P-AU) EEPROM: 1 KB (ATMEGA328P-AU) Clock speed: 16MHz

On-board LED pin: D13

**3.Interfaces** 



## 4.Specialized Functions of Some Pins:

Serial communication interface: D0 is RX, D1 is TX

PWM interface (pulse width modulation): D3 D5 D6 D9 D10 D11

External interrupt interface: D2 (interrupt 0) and D3 (interrupt 1)

SPI communication interface: D10 is SS, D11 is MOSI, D12 is MISO, D13 is SCK

IIC communication port: A4 is SDA, A5 is SCL

### 5. Install Arduino IDE and Driver

### 5.1 Download the Arduino IDE

When getting this control board, we need to install Arduino IDE.



Download the version you want and the latest one is available for downloading too.

# Download the Arduino IDE



#### ARDUINO 1.8.13

The open-source Arduino Software (IDE) makes it easy to write code and upload it to the board. It runs on Windows, Mac OS X, and Linux. The environment is written in Java and based on Processing and other opensource software. This software can be used with any Arduino board.

Refer to the Getting Started page for Installation instructions.

Windows Installer. for Windows 7 and up Windows ZIP file for non admin install

Windows app Requires Win 8.1 or 10

Mac OS X 10.10 or newer

Linux 32 bits Linux 64 bits Linux ARM 32 bits Linux ARM 64 bits

Release Notes Source Code Checksums (sha512

Alternatively, you could select previous release.

In this project, we use 1.8.12 version

# **Previous Releases**

Download the previous version of the current release the classic Arduino 1.0.x, or the Arduino 1.5.x Beta version.

All the Arduino OOxx versions are also available for download. The Arduino IDE can be used on Windows, Linux (both 32 and 64 bits), and Mac OS X.



# ARDUINO 1.8.12

Arduino IDE that can be used with any Arduino board, including the Arduino Yún and Arduino DUE. Refer to the Getting Started page for Installation instructions. See the release notes.

# Windows Installer

Windows ZIP file for non admin install

Mac OS X 10.8 Mountain Lion or newer

Linux 32 bits Linux 64 bits Linux ARM 32 Linux ARM 64

# Source

Click **Windows Installer** to download an installer of Arduino 1.8.12 versionwhich needs to be installed manually. When you tap **Windows ZIP file for non admin install** a zip file of Arduino 1.8.12 version will be directly downloaded, and you only need to unzip it to finish the installation.

# Contribute to the Arduino Software

Consider supporting the Arduino Software by contributing to its development. (US tax payers, please note this contribution is not tax deductible). Learn more on how your contribution will be used.





**CONTRIBUTE & DOWNLOAD** 

to download Arduino IDE.

# Click icon

# 5.2 Installing Driver

Let's install the driver of keyestudio PLUS control board. The USB-TTL chip on PLUS board adopts CP2102 serial chip. The driver program of CP2102 is included in Arduino 1.8 version and above, which is convenient to operate. Plugged in USB, the computer can recognize the hardware and automatically install the driver of CP2102.

Note: If the version of Arduino IDE you download is below 1.8, you need to download the driver of CP2102.

### Download the driver of CP2102:

### https://fs.keyestudio.com/CP2102-WIN

If install unsuccessfully, or you intend to install manually, open the device manager of computer. Right click Computer— Properties— Device Manager.

書 设备管理器	_	×
File Action View Help		
<ul> <li>XIAORONG</li> <li>Audio inputs and outputs</li> <li>Computer</li> <li>Disk drives</li> <li>Display adapters</li> <li>Display adapters</li> <li>IDE ATA/ATAPI controllers</li> <li>Keyboards</li> <li>Mice and other pointing devices</li> <li>Monitors</li> <li>Network adapters</li> </ul>		 
<ul> <li>Other devices</li> <li>CP2102 USB to UART Bridge Controller</li> <li>Protes (CONT &amp; LPT)</li> <li>Processors</li> <li>Processors</li> <li>Security devices</li> <li>Software devices</li> <li>Software devices</li> <li>Sotrage controllers</li> <li>System devices</li> <li>Universal Serial Bus controllers</li> </ul>		

There is a yellow exclamation mark on the page, which implies an unsuccessful installation of the driver of CP2102. Then please double click the hardware and update the driver.



Click "OK" to enter the following page, click "browse my computer for updated driver software", and find the installed or downloaded ARDUINO software. As shown below:

 $\times$ 



There is a DRIVERS folder in Arduino software installed package you can see the driver of CP210X series chips.

, open driver folder and

 $\times$ 

# 🔶 📱 Update Drivers - CP2102 USB to UART Bridge Controller

Browse for drivers on yo	ur computer		
Search for drivers in this location			- <b>F</b>
C:\Users\Administrator\Desktor	\arduino-1.8.12\drivers\CP210;	k_6.7 ∨	Browse
✓ Include subfolders			

→ Let me pick from a list of available drivers on my computer This list will show available drivers compatible with the device, and all drivers in the same category as the device.

Open device manager, we will find the yellow exclamation mark disappear. The driver of CP2102 is installed successfully.

Next

Cancel

 $\times$ 

Update Drivers - Silicon Labs CP210x USB to UART Bridge (COM4)

Windows has successfully updated your drivers

Windows has finished installing the drivers for this device:



Silicon Labs CP210x USB to UART Bridge

Close



### 5.3 Arduino IDE Setting





To avoid the errors when uploading the program to the board, you need to select the correct Arduino board that matches the board connected to your computer.

Then come back to the Arduino software, you should click Tools→Board, to select the board. (as shown below)

🥺 sketch jul17a	Arduino 1.8.12	_		×	
File Edit Sketch	Tools Help				
	Auto Format	Ctrl+	Т		
	Archive Sketch				
sketch_jul17a	Fix Encoding & Reload				Parada Managan
<pre>void setup() {</pre>	Manage Libraries	Ctrl+	Shift+I		Boards Manager
// put your	Serial Monitor	Ctrl+	Shift+M		Arduino AVR Boards
1	Serial Plotter	Ctrl+	Shift+L		Arduino Yún
1 I	WEIOI (WENINA E	- 11	L	٠	Arduino Uno
<pre>void loop() {</pre>	WIFITOT / WIFININA FIRMWare	e Opdater		_	Arduino Duemilanove or Diecimila
// put your	Board: "Arduino Uno"			2	Arduino Nano
1,	Port			;	Arduino Mega or Mega 2560
	Get Board Info				Arduino Mega ADK
					Arduino Leonardo
	Programmer: "AVRISP mkll"			1	Arduino Leonardo ETH
	Burn Bootloader			_	Arduino Micro
					Arduino Esplora
					Arduino Mini
					Arduino Ethernet
					Arduino Fio
					Arduino BT
					LilyPad Arduino USB
					LilyPad Arduino
Invalid library	found in C:\Users\Administra	ator\Desktop\#	Arduino	1	Arduino Pro or Pro Mini
					Arduino NG or older
<					Arduino Robot Control
5		Arduino U	no on COM	4	Arduino Robot Motor

Then select the correct COM port (you can see the corresponding COM port after the driver is successfully installed)





Before uploading the program to the board, let's demonstrate the function of each symbol in the Arduino IDE toolbar.

🥺 sketch_apr03a   Arduino 1.8.12	_		×
File Edit Sketch Tools Help			
			Ø
ketch_apr0.e			-
voli setu () {			^
A B C D E	F		
<pre>void loop() {     // put your main code here, to run repeatedly:</pre>			
}			
			~
1	Arduino	Uno on C	OM7

- A- Used to verify whether there is any compiling mistakes or not.
- B- Used to upload the sketch to your Arduino board.
- C- Used to create shortcut window of a new sketch.
- D- Used to directly open an example sketch.
- E- Used to save the sketch.
- F- Used to send the serial data received from board to the serial monitor.

## 5.4 Start First Program

Open the file to select Example, and choose BLINK from BASIC, as shown below:

<b></b>	sketch_jul17a	Arduino 1.8.12		∆ Built-in Examples	-	) X	
File	Edit Sketch	Tools Help	F	01 Basics	,	Analog	ReadSerial
	New	Ctrl+N		02 Digital		BareM	inimum
	Open	Ctrl+O		02.Digital		Blink	
	Open Recent	: >		03.Analog	1	Digital	ReadSerial
	Sketchbook	2		05 Control	1	Eade	teausenar
	Examples	3		06 Sensors	1	ReadA	nalogVoltage
	Close	Ctrl+W		07 Display	1	ReadA	laiogvoitage
	Save	Ctrl+S		08 Strings	Ś		
	Save As	Ctrl+Shift+S		00.1158	Ś		
	Dage Setup	Ctrl+Shift+D		10 StarterKit BasicKit	Ś		
	Print	Ctrl+D		11 ArduinoISD	Ś		
	FILL	Curr		ThArdumorse	_		
	Preferences	Ctrl+Comma		Examples for any board			
	Ouit	Ctrl+O		Adafruit Circuit Playground	>		
				Bridge	>		
				Esplora	>		
				Ethernet	>		
				Firmata	>		
				GSM	>		
				LiquidCrystal	>	~	
				LiquidCrystal I2C	>		
Inva	lid librarv	found in C:\		MCP23017-Arduino-Library	>	uino ID 🗸	
Inva	lid library	found in C:\		Robot Control	>	luino ID	
				Robot Motor	>	~	
<				SD	>	>	
5				Servo	>	on COM7	



Set board and COM port, the corresponding board and COM port are shown on the lower right of IDE.



Click to start compiling the program, check errors.



Click to upload the program, upload successfully.

🥺 Blink   Arduino 1.8.12		_		×
File Edit Sketch Tools Help				
				Ø
Blink				
This example code is in the public	domain.			
http://www.arduino.cc/en/Tutorial/ */	<u>'Blink</u>			
<pre>// the setup function runs once when void setup() { // initialize digital pin LED_BUII</pre>	n you press res TIN as an outp	et or ut.	power	the
<pre>pinMode(LED_BUILTIN, OUTPUT); }</pre>				
<pre>// the loop function runs over and o void loop() {</pre>	over again fore	ver		
<pre>digitalWrite(LED_BUILTIN, HIGH); delay(1000);</pre>	<pre>// turn the L // wait for a</pre>	ED on secor	(HIGH nd	is t
<pre>digitalWrite(LED_BUILTIN, LOW); dalar(1000);</pre>	// turn the L	ED off	by ma	akinç
deray(1000);	// Walt for a	secor	a	~
<				>
Done uploading.				
Invalid library found in C:\Users\Ad	ministrator\Des	ktop\/	Arduin	
Invalid library lound in C:\Users\Ad	ainistrator\Des	ikcop\/	arauin	, 10 V
<				>
1		Arduino	Uno on C	OM7

Upload the program successfully, the onboard LED lights on for 1s, lights off for 1s. Congratulation, you finish the first program.

- 6. MAC System
- 6.1 Install Arduino IDE on MAC System

The installation instruction is as same as the chapter 5.1, as shown below:
## ARDUINO 1.8.12

Arduino IDE that can be used with any Arduino board, including the Arduino Yún and Arduino DUE. Refer to the Getting Started page for Installation instructions. See the release notes.

Windows Installer Windows ZIP file for non admin install

Mac OS X 10.8 Mountain Lion or newer

Linux 32 bits Linux 64 bits Linux ARM 32 Linux ARM 64

### Source

6.2 Download the Driver of CP2102

https://fs.keyestudio.com/CP2102-MAC

6.3 How to Install the Driver of CP2102

The following link is for your reference:

https://wiki.keyestudio.com/How\_to\_Install\_the\_Driver\_of\_CP2102\_on\_MAC\_System

6.4 Arduino IDE Setting

The setting method is as same as that in the chapter 5.3 except from COM port, as shown below.

### **Board for Arduino**



#### **Resource:**

https://fs.keyestudio.com/KS0486

### CHAPTER

TEN

## KS0497 KEYESTUDIO V4.0 DEVELOPMENT BOARD



### Description

The processor core of Keyestudio V4.0 development board is ATMEGA328P-PU , fully compatible with ARDUINO UNO REV3.

It has 14 digital input/output pins(of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button.

What's more, you can burn the firmware for ATMEGA328P-PU through the built-in ICSP port. The firmware of this chip is burnt well before delivery. Therefore, you don't need to burn the firmware.

The power can be supplied through USB wire, DC head and Vin GND pins.

### Specification

Microcontroller: ATMEGA328P-PU USB to serial chipCP2102 Operating Voltage: 5V Input Voltage (recommended):DC 7-12V Digital I/O Pins: 14 (D0-13) PWM Digital I/O Pins6 (D3 D5 D6 D9 D10 D11) Analog Input Pins: 6(A0-A5) DC Current per I/O Pin: 20 mA DC Current for 3.3V Pin: 50 mA Flash Memory: 32 KB (ATMEGA328P-PU) of which 0.5 KB used by bootloader SRAM:2 KB (ATMEGA328P-PU) EEPROM: 1 KB (ATMEGA328P-PU) Clock Speed:16 MHz LED\_BUILTIN:D13

**Pins and Parts Introduction** 



1	ICSP (In-	the AVR, an Arduino micro-program header consisting of MOSI, MISO, SCK, RESET,
	Circuit	VCC, and GND. It is often called the SPI (serial peripheral interface) and can be
	Serial Pro-	considered an "extension" of the output. In fact, slave the output devices to the SPI
	gramming)	bus host. When connecting to PC, program the firmware to ATMEGA328P-PU.
	Header	
2	Power LED	Powering the Arduino, LED on means that your circuit board is correctly powered on. If LED
	Indicator	is off, connection is wrong.
3	Digital I/O	Arduino MEGA has 14 digital input/output pins (of which 6 can be used as PWM out-
		puts). These pins can be configured as digital input pin to read the logic value (0 or 1). Or
		used as digital output pin to drive different modules like LED, relay, etc. Using pinMode(),
		digitalWrite(), and digitalRead() functions.
4	GND	GND
5	AREF	Reference voltage (0-5V) for analog inputs. Used with analogReference(). Configures the
		reference voltage used for analog input (i.e. the value used as the top of the input range).
6	SDA	IIC communication pin
/	SCL	IIC communication pin
8	RESET	You can reset your Arduino board,
0	D12 LED	There is a built in LED driven by digital nin 12. When the nin is IIICII value, the LED is an
9	DISLED	when the pin is I OW it's off
10	USB Con-	Arduino board can be powered via USB connector. All you needed to do is connecting the
10	nection	USB port to PC using a USB cable
11	CP2102	USB serial chip translate the USB signal of computer into serial signal
12	TX LED	Onboard you can find the label: TX (transmit) When Arduino board communicates via serial
12		port, send the message. TX led flashes.
13	RX LED	Onboard you can find the label: RX(receive ) When Arduino board communicates via serial
		port, receive the message, RX led flashes.
14	Crystal Os-	How does Arduino calculate time? by using a crystal oscillator. The number printed on the
	cillator	top of the Arduino crystal is 16.000H9H. It tells us that the frequency is 16,000,000 Hertz or
		16MHz.
15	Voltage	To control the voltage provided to the Arduino board, as well as to stabilize the DC voltage
	Regulator	used by the processor and other components. Convert an external input DC7-12V voltage into
		DC 5V, then switch DC 5V to the processor and other components.
16	DC Power	Arduino board can be supplied with an external power DC7-12V from the DC power jack.
	Jack	
17	Microcon-	Each Arduino board has its own microcontroller. You can regard it as the brain of your board.
	troller	The main IC (integrated circuit) on the Arduino is slightly different from the panel pair. Mi-
		crocontrollers are usually from ATMEL. Before you load a new program on the Arduno IDE,
10	IODEE	you must know what IC is on your board. This information can be checked at the top of IC.
18	IOKEF	I his pin on the board provides the voltage reference with which the interocontroller operates.
		A property configured smeld can read the TOKEF pin voltage and select the appropriate power source or enable voltage translators on the outputs for working with the 5V or 3 3V
10	DESET	Connect an external button to reset the board. The function is the same as reset button
17	Header	connect an external button to reset the board. The function is the same as reset button.
20	Power Pin	A 3.3 volt supply generated by the on-board regulator. Maximum current draw is 50 mA.
	3V3	
21	Power Pin	Provides 5V output voltage
	5V	
22	Vin	You can supply an external power input DC7-12V through this pin to Arduino board.
23	Analog Pins	Onboard has 6 analog inputs, labeled A0 to A5.

### 4. Specialized Functions of Some Pins:

Serial Communication: D0 (RX) and D1 (TX)

PWM Pins (Pulse-Width Modulation): D3 D5 D6 D9 D10 D11

External Interrupts: D2 (interrupt 0), D3 (interrupt 1)

SPI communication: D10 (SS), D13 (SCK), D11 (MOSI), D12 (MISO).

These pins support SPI communication using the SPI library. The SPI pins are also broken out on the ICSP header, which is physically compatible with the Arduino Uno.

IIC communication: A4 (SDA); A5 (SCL).

5. Windows System

### 5.1 Download the Arduino IDE

When getting this control board, we need to install Arduino IDE



You can select the latest version—1.8.13. Alternatively, the previous release is your another choice.

# Download the Arduino IDE



ARDUINO 1.8.13

The open-source Arduino Software (IDE) makes it easy to write code and upload it to the board. It runs on Windows, Mac OS X, and Linux. The environment is written in Java and based on Processing and other opensource software. This software can be used with any Arduino board. Refer to the <u>Getting Started</u> page for Installation instructions. Windows Installer. for Windows 7 and up Windows ZIP file for non admin install

Windows app Requires Win 8.1 or 10

Mac OS X 10.10 or newer

Linux 32 bits Linux 64 bits Linux ARM 32 bits Linux ARM 64 bits

Release Notes Source Code Checksums (sha512

### In this project, we use 1.8.12 version

## **Previous Releases**

Download the previous version of the current release the classic Arduino 1.0.x, or the Arduino 1.5.x Beta version.

All the Arduino OOxx versions are also available for download. The Arduino IDE can be used on Windows, Linux (both 32 and 64 bits), and Mac OS X.

# Click: previous version of the current release to view the below page

## ARDUINO 1.8.12

Arduino IDE that can be used with any Arduino board, including the Arduino Yún and Arduino DUE. Refer to the Getting Started page for Installation instructions. See the release notes.

Windows Installer Windows ZIP file for non admin install

Mac OS X 10.8 Mountain Lion or newer

Linux 32 bits Linux 64 bits Linux ARM 32 Linux ARM 64

Source

The **Windows installer** needs installing manually. Yet, the **Windows zip file for non admin install**a zip file of Arduino 1.8.12 version, can be directly downloaded and installed.

# Contribute to the Arduino Software

Consider supporting the Arduino Software by contributing to its development. (US tax payers, please note this contribution is not tax deductible). Learn more on how your contribution will be used.



### **5.2 Installing Driver**

Let's install the driver of Keyestudio V4.0 development board. The USB-TTL chip on V4.0 development board adopts CP2102 serial chip.

Its driver files are included in the Arduino 1.8 version and above. Therefore, when the board is attached to the computer, the computer can recognize the driver of CP2102 automatically.

### Note: If the version of Arduino IDE you download is below 1.8, you need to download the driver of CP2102.

### Download the driver of CP2102:

### https://fs.keyestudio.com/CP2102-WIN

If it is installed unsuccessfully, you need to install it manually.

Click Computer— Properties— Device Manager, as shown below:

<b>書 设备管理器</b>	_	×
File Action View Help		
V 📇 XIAORONG		
> 🗸 Audio inputs and outputs		
> 💻 Computer		
> 👝 Disk drives		
> 🙀 Display adapters		
> 🗛 Human Interface Devices		
> 📷 IDE ATA/ATAPI controllers		
> 🔤 Keyboards		
> 🖉 Mice and other pointing devices		
> 💻 Monitors		
> 🚽 Network adapters		
✓ <u>Other devices</u>		
📓 CP2102 USB to UART Bridge Controller		
> Print queues		
> Processors		
> W Security devices		
Software devices		
Sound, video and game controllers		
> 🙀 Storage controllers		
Leisystem devices		

There is a yellow exclamation mark on the page, which implies the installation of the driver of CP2102 has failed.



Click "OK" to enter the following page and click "browse my computer for updated driver software".

~	Update Drivers - CP2102 USB to UART Bridge Controller	
	How do you want to search for drivers?	
	→ Search automatically for updated driver software Windows will search your computer and the Internet for the latest driver software for your device, unless you've disabled this feature in your device installation settings.	
	→ Browse my computer for driver software Locate and install driver software manually.	
		Cancel
Click "	Browse", then search the driver of CP2102 and click "Next",	

There is a DRIVERS folder in Arduino software installed package check the driver of CP210X series chips.

arduino-1.8.12

, open driver folder and

### Update Drivers - CP2102 USB to UART Bridge Controller

Browse for drivers on yo			
Search for drivers in this location		•	
C:\Users\Administrator\Desktor	\arduino-1.8.12\drivers\CP210	x_6.7 ∨	Browse
✓ Include subfolders			

→ Let me pick from a list of available drivers on my computer This list will show available drivers compatible with the device, and all drivers in the same category as the device.

When opening the device manager, we will find the yellow exclamation mark disappear. The driver of CP2102 is installed successfully.

Next

Cancel

Update Drivers - Silicon Labs CP210x USB to UART Bridge (COM4)

Windows has successfully updated your drivers

Windows has finished installing the drivers for this device:



Silicon Labs CP210x USB to UART Bridge

Close



### **5.3Arduino IDE Setting**





When downloading the sketch to the board, you must select the correct name of Arduino board that matches the board connected to your computer. As shown below;

🥺 sketch_jul17a	Arduino 1.8.12	_		×	
File Edit Sketch	Tools Help				
	Auto Format	Ctrl+	Т		
	Archive Sketch				
sketch_jul17a	Fix Encoding & Reload				D   M
<pre>void setup() {</pre>	Manage Libraries	Ctrl+	Shift+I		Boards Manager
// put your	Serial Monitor	Ctrl+	Shift+M		Arduino AVR Boards
3	Serial Plotter	Ctrl+	Shift+L		Arduino Yún
l'		Undatas	L	•	Arduino Uno
<pre>void loop() {</pre>	WIFITOT / WIFININA FIRMware	opdater		_	Arduino Duemilanove or Diecimila
// put your	Board: "Arduino Uno"			>	Arduino Nano
3	Port	,		;	Arduino Mega or Mega 2560
· /	Get Board Info				Arduino Mega ADK
					Arduino Leonardo
	Programmer: "AVRISP mkll"			1	Arduino Leonardo ETH
L	Burn Bootloader			_	Arduino Micro
					Arduino Esplora
					Arduino Mini
					Arduino Ethernet
					Arduino Fio
					Arduino BT
					LilyPad Arduino USB
					LilyPad Arduino
Invalid library	found in C:\Users\Administrat	tor\Desktop\A	Arduino	1	Arduino Pro or Pro Mini
					Arduino NG or older
<					Arduino Robot Control
5		Arduino U	no on COM	4	Arduino Robot Motor

Then select the correct COM port (you can see the corresponding COM port after the driver is successfully installed)







- A- Used to verify whether there is any compiling mistakes or not.
- B- Used to upload the sketch to your Arduino board.
- C- Used to create shortcut window of a new sketch.
- D- Used to directly open an example sketch.
- E- Used to save the sketch.
- F- Used to send the serial data received from board to the serial monitor.

### 5.4 Start first program

Open the file to select **Example**, and click **BASIC>BLINK**, as shown below:

<b></b>	sketch_jul17a	Arduino 1.8.12		∆ Built-in Examples	-	) X	
File	Edit Sketch	Tools Help	F	01 Basics	,	Analog	ReadSerial
	New	Ctrl+N		02 Digital		BareM	inimum
	Open	Ctrl+O		02.Digital		Blink	
	Open Recent	: >		03.Analog	1	Digital	ReadSerial
	Sketchbook	2		05 Control	1	Eade	teausenar
	Examples	3		06 Sensors	1	ReadA	nalogVoltage
	Close	Ctrl+W		07 Display	1	ReadA	laiogvoitage
	Save	Ctrl+S		08 Strings	Ś		
	Save As	Ctrl+Shift+S		00.1158	Ś		
	Dage Setup	Ctrl+Shift+D		10 StarterKit BasicKit	Ś		
	Print	Ctrl+D		11 ArduinoISD	Ś		
	FILL	Curr		ThArdumorse	_		
	Preferences	Ctrl+Comma		Examples for any board			
	Ouit	Ctrl+O		Adafruit Circuit Playground	>		
				Bridge	>		
				Esplora	>		
				Ethernet	>		
				Firmata	>		
				GSM	>		
				LiquidCrystal	>	~	
				LiquidCrystal I2C	>		
Inva	lid librarv	found in C:\		MCP23017-Arduino-Library	>	uino ID 🗸	
Inva	lid library	found in C:\		Robot Control	>	luino ID	
				Robot Motor	>	~	
<				SD	>	>	
5				Servo	>	on COM7	



Set board and COM port, the corresponding board and COM port are shown on the lower right of IDE.



Click to start compiling the program, check errors.



Click to upload the program.

🥺 Blink   Arduino 1.8.12		_		×
File Edit Sketch Tools Help				
				ø
Blink				
This example code is in the public	c domain.			
http://www.arduino.cc/en/Tutorial/ */	<u>/Blink</u>			
<pre>// the setup function runs once when void setup() {    // initialize digital pin LED_BUII</pre>	n you press res TIN as an outp	set or	power	the
<pre>pinMode(LED_BUILTIN, OUTPUT); }</pre>				
<pre>// the loop function runs over and o void loop() {</pre>	over again fore	ver		
<pre>digitalWrite(LED_BUILTIN, HIGH);</pre>	// turn the I	ED on	(HIGH	is t
delay(1000); digitalWrite(LED_BUILTIN_LOW).	<pre>// wait for a // turn the I</pre>	secor FD off	1d Ebv.m	aking
delay(1000);	// wait for a	secor	nd 1	ANTIN'
}				~
<				>
Done uploading.				
Invalid library found in C:\Users\Ad	ministrator\Des	sktop\i	Arduin	
Invalid library found in C:\Users\Add	ministrator\Dea	sktop/	Arauin	~ III
<				>
1		Arduino	Uno on (	сом7

After the code is uploaded, the onboard LED will blink. Congratulation, you have finished the first program.

6.MAC System 6.1 Install Arduino IDE on MAC System

The installation instruction is as same as the chapter 5.1, as shown below:

## ARDUINO 1.8.12

Arduino IDE that can be used with any Arduino board, including the Arduino Yún and Arduino DUE. Refer to the Getting Started page for Installation instructions. See the release notes.

Windows Installer Windows ZIP file for non admin install

Mac OS X 10.8 Mountain Lion or newer

Linux 32 bits Linux 64 bits Linux ARM 32 Linux ARM 64

### Source

6.2 Download the Driver of CP2102

https://fs.keyestudio.com/CP2102-MAC

6.3 How to Install the Driver of CP2102

The following link is for your reference:

https://wiki.keyestudio.com/How\_to\_Install\_the\_Driver\_of\_CP2102\_on\_MAC\_System

6.4 Arduino IDE Setting

The setting method is as same as the chapter 5.3 except from COM port, as shown below.

### **Board for Arduino**



Resources:

https://fs.keyestudio.com/KS0497

### CHAPTER

## **ELEVEN**

## KS0498 KEYESTUDIO MEGA 2560 DEVELOPMENT BOARD



### 1. Description

The processor core of Keyestudio MEGA R3 development board is the ATMEGA2560-16AU , fully compatible with ARDUINO MEGA R3.

It has 54 digital input/output pins (of which 15 can be used as PWM outputs), 16 analog inputs, 4 UARTs (hardware serial ports), a 16 MHz crystal oscillator, a USB connection, a power jack, 1 ICSP header, and a reset button. What's more, you can burn the firmware for ATMEGA2560-16AU through the built-in ICSP port. The firmware of this chip is burnt well before delivery. Therefore, you don't need to burn the firmware.

The power can be supplied through USB wire, DC head and Vin GND pins.

2.Specification Microcontroller: ATMEGA2560-16AU USB serial chipCP2102 Operating Voltage: 5V Input Voltage (recommended):DC 7-12V Digital I/O Pins: 54 (D0-D53) PWM Digital I/O Pins15(D2-D13 D44-D46) Analog Input Pins: 16(A0-A15) DC Current per I/O Pin: 20 mA DC Current for 3.3V Pin: 50 mA Flash Memory: 256 KB of which 8 KB used by bootloader SRAM: 8 KB EEPROM: 4 KB Clock Speed: 16 MHz LED\_BUILTIN:D13

**3.Pins and Parts Introduction:** 



1	Digital I/O	Arduino MEGA has 54 digital input/output pins (of which 15 can be used as PWM
		outputs). These pins can be configured as digital input pin to read the logic value
		(0 or 1). Or used as digital output pin to drive different modules like LED, relay, etc.
		Using pinMode(), digitalWrite(), and digitalRead() functions.
2	GND	GND
3	AREF	Reference voltage (0-5V) for analog inputs. Used with analogReference(). Configures the
		reference voltage used for analog input (i.e. the value used as the top of the input range).
4	SDA	IIC communication pin
5	SCL	IIC communication pin
6	RESET	You can reset your Arduino board,
	Button	
7	USB Con-	Arduino board can be powered via USB connector. All you needed to do is connecting the
	nection	USB port to PC using a USB cable.
8	D13 LED	There is a built-in LED driven by digital pin 13. When the pin is HIGH value, the LED is on,
		when the pin is LOW, it's off.
9	CP2102	USB serial chip, translate the USB signal of computer into serial signal
10	TX LED	Onboard you can find the label: TX (transmit) When Arduino board communicates via serial
		port, send the message, TX led flashes.
11	RX LED	Onboard you can find the label: RX(receive) When Arduino board communicates via serial
10	0 1 0	port, receive the message, RX led flashes.
12	Crystal Os-	How does Arduino calculate time? by using a crystal oscillator. The number printed on the
	cillator	top of the Arduino crystal is 16.000H9H. It tells us that the frequency is 16,000,000 Hertz or
12	Voltago	10MHZ.
15	Voltage	to control the voltage provided to the Arduino board, as well as to stabilize the DC voltage used by the processor and other components. Convert on external input DC7 12V voltage into
	Regulator	used by the processor and other components. Convert an external input $DC_{7-12}v$ voltage into $DC_{7-12}v$ voltage into
14	DC Power	Arduino board can be supplied with an external power DC7 12V from the DC power jack
17	Je Tower Iack	Ardunio board can be supplied with an external power De 7-12 v from the De power jack.
15	IOREF	This pin on the board provides the voltage reference with which the microcontroller operates.
10	Ionei	A properly configured shield can read the IOREF pin voltage and select the appropriate power
		source or enable voltage translators on the outputs for working with the 5V or 3.3V.
16	RESET	Connect an external button to reset the board. The function is the same as reset button.
	Header	
17	Power Pin	A 3.3 volt supply generated by the on-board regulator. Maximum current draw is 50 mA.
	3V3	
18	Power Pin	Provides 5V output voltage
	5V	
19	Vin	You can supply an external power input DC7-12V through this pin to Arduino board.
20	Analog	Onboard has 16 analog inputs, labeled A0 to A15.
	Pins	
21	ICSP (In-	the AVR, an Arduino micro-program header consisting of MOSI, MISO, SCK, RESET, VCC,
	Circuit	and GND. It is often called the SPI (serial peripheral interface) and can be considered an "ex-
	Serial Pro-	tension" of the output. In fact, slave the output devices to the SPI bus host. When connecting
	gramming)	to PC, program the firmware to ATMEGA2560-16AU.
- 22	Header	
22	Microcon-	Each Arduino board has its own microcontroller. You can regard it as the brain of your board.
	troner	The main IC (integrated circuit) on the Arduino is slightly different from the panel pair. Mi-
		you must know what IC is on your board. This information can be abacked at the top of IC
22	Power I FD	you must know what it is on your board. This information can be checked at the top of IC. Powering the Arduino, I ED on means that your circuit board is correctly powered on If I ED.
23	Indicator	is off connection is wrong
	mulcator	is on, connection is wrong.

### **4.Specialized Functions of Some Pins:**

• Serial Communication: D0 (RX0) and D1 (TX1); Serial 1: D19 (RX1) and D18 (TX1); Serial 2: D17 (RX2) and D16 (TX2); Serial 3: D15 (RX3) and D14 (TX3).

Used to receive (RX) and transmit (TX) TTL serial data. Pins 0 and 1 are also connected to the corresponding pins of the CP2102 USB-to-TTL Serial chip.

• PWM Pins (Pulse-Width Modulation): D2 to D13, and D44 to D46.

Provide 8-bit PWM output with the analogWrite() function.

• External Interrupts: D2 (interrupt 0), D3 (interrupt 1), D18 (interrupt 5), D19 (interrupt 4), D20 (interrupt 3), and D21 (interrupt 2).

These pins can be configured to trigger an interrupt on a low level, a rising or falling edge, or a change in level. See the attachInterrupt() function for details.

• SPI communication: D53 (SS), D52 (SCK), D51 (MOSI), D50 (MISO).

These pins support SPI communication using the SPI library. The SPI pins are also broken out on the ICSP header, which is physically compatible with the Arduino Uno.

• IIC communication: D20 (SDA); D21 (SCL). Support TWI communication using the Wire library.

### 4. Windows System

4.1 Download Arduino IDE

When getting this control board, we need to install Arduino IDE



You can select the latest version—1.8.13. Alternatively, the previous release is your another choice.

# Download the Arduino IDE



ARDUINO 1.8.13

The open-source Arduino Software (IDE) makes it easy to write code and upload it to the board. It runs on Windows, Mac OS X, and Linux. The environment is written in Java and based on Processing and other opensource software. This software can be used with any Arduino board. Refer to the <u>Getting Started</u> page for Installation instructions. Windows Installer. for Windows 7 and up Windows ZIP file for non admin install

Windows app Requires Win 8.1 or 10

Mac OS X 10.10 or newer

Linux 32 bits Linux 64 bits Linux ARM 32 bits Linux ARM 64 bits

Release Notes Source Code Checksums (sha512

### In this project, we use 1.8.12 version

## **Previous Releases**

Download the previous version of the current release the classic Arduino 1.0.x, or the Arduino 1.5.x Beta version.

All the Arduino OOxx versions are also available for download. The Arduino IDE can be used on Windows, Linux (both 32 and 64 bits), and Mac OS X.

Click: previous version of the current release to view the below page

## ARDUINO 1.8.12

Arduino IDE that can be used with any Arduino board, including the Arduino Yún and Arduino DUE. Refer to the Getting Started page for Installation instructions. See the release notes.

Windows Installer Windows ZIP file for non admin install

Mac OS X 10.8 Mountain Lion or newer

Linux 32 bits Linux 64 bits Linux ARM 32 Linux ARM 64

Source

The **Windows installer** needs installing manually. Yet, the **Windows zip file for non admin install**a zip file of Arduino 1.8.12 version, can be directly downloaded and installed.

# Contribute to the Arduino Software

Consider supporting the Arduino Software by contributing to its development. (US tax payers, please note this contribution is not tax deductible). Learn more on how your contribution will be used.



Click icon

### 4.2 Installing Driver

Let's install the driver of MEGA R3 Development Board. The USB-TTL chip of 2560 R3 board adopts CP2102 serial chip.

Its driver files are included in the Arduino 1.8 version and above.

When the board is attached to the computer, the computer can recognize the driver of CP2102 automatically.

### Note: If the version of Arduino IDE you download is below 1.8, you need to download the driver of CP2102.

### Download the driver of CP2102:

### https://fs.keyestudio.com/CP2102-WIN

If it is installed unsuccessfully, you need to install it manually.

Click Computer-Properties-Device Manager, as shown below:

書 设备管理器	_	×
File Action View Help		
V 🗄 XIAORONG		 
> III Audio inputs and outputs		
> Computer		
> Disk arives		
> 🙀 Display adapters		
S I Keyboards		
Mice and other pointing devices		
Monitors		
> P Network adapters		
V 10 Other devices		
🕼 CP2102 USB to UART Bridge Controller		
> 🚍 Print queues		
> Processors		
> 🛐 Security devices		
> Software devices		
> 🕡 Sound, video and game controllers		
> 🍇 Storage controllers		
> 🏣 System devices		
> 🏺 Universal Serial Bus controllers		

There is a yellow exclamation mark on the page, which implies the failed installation of the driver of CP2102.



Click "OK" to enter the following page and click "browse my computer for updated driver software".

$\leftarrow$	Update Drivers - CP2102 USB to UART Bridge Controller	
	How do you want to search for drivers?	
	→ Search automatically for updated driver software Windows will search your computer and the Internet for the latest driver software for your device, unless you've disabled this feature in your device installation settings.	
[	→ Browse my computer for driver software Locate and install driver software manually.	
-		
		Cancel
Click "B	Browse", then search the driver of CP2102 and click "Next",	
Thora is	a DRIVERS folder in Arduino software installed peakage	an driver folder en

There is a DRIVERS folder in Arduino software installed package check the driver of CP210X series chips.

. Open driver folder and

### Update Drivers - CP2102 USB to UART Bridge Controller

Browse for drivers on yo	our computer		
Search for drivers in this location	1:		<b>A</b>
C:\Users\Administrator\Desktop	\arduino-1.8.12\drivers\CP210	k_6.7 ∨	Browse
✓ Include subfolders			

→ Let me pick from a list of available drivers on my computer This list will show available drivers compatible with the device, and all drivers in the same category as the device.



When opening the device manager, we will find the yellow exclamation mark disappear. The driver of CP2102 is installed successfully.
$\times$ 

Update Drivers - Silicon Labs CP210x USB to UART Bridge (COM4)

Windows has successfully updated your drivers

Windows has finished installing the drivers for this device:



Silicon Labs CP210x USB to UART Bridge

Close



# 4.3 Arduino IDE Setting





When downloading the sketch to the board, you must select the correct name of Arduino board that matches the board connected to your computer. As shown below;

🥯 sketch_jul15a   Arduino 1.8.12 — □ ×						
File Edit Sketch To	ols Help					
	Auto Format	Ctrl+T				
	Archive Sketch					
sketch_jul15a	Fix Encoding & Reload			Boards Manager		
<pre>void setup() {</pre>	Manage Libraries	Ctrl+Shift	+1	Arduino AVR Boards		
// put your	Serial Monitor	Ctrl+Shift	+M	Arduino Yún		
}	Serial Plotter	Ctrl+Shift	+L	Arduino Uno		
	WiFi101 / WiFiNINA Firmware Updater			Arduino Duemilanove or Diecimila		
void loop() {		_		Arduino Nano		
// pao your	Board: "Arduino Mega or Mega 2560"		- 2	<ul> <li>Arduino Mega or Mega 2560</li> </ul>		
}	Processor: "ATmega2560 (Mega 2560)"			Arduino Mega ADK		
	Port			Arduino Leonardo		
	Get Board Info			Arduino Leonardo ETH		
	Programmer: "AVRISP mkII"		>	Arduino Micro		
	Burn Bootloader			Arduino Esplora		
				Arduino Mini		
				Arduino Ethernet		
				Arduino Fio		
				Arduino BT		
			_	LilyPad Arduino USB		
				LilyPad Arduino		
				Arduino Pro or Pro Mini		
				Arduino NG or older		
				Arduino Robot Control		
1 Arduino Mega or Mega 2560, ATmega2560 (Mega 2560						

Then select the correct COM port (you can see the corresponding COM port after the driver is successfully installed)







- A- Used to verify whether there is any compiling mistakes or not.
- B- Used to upload the sketch to your Arduino board.
- C- Used to create shortcut window of a new sketch.
- D- Used to directly open an example sketch.
- E- Used to save the sketch.
- F- Used to send the serial data received from board to the serial monitor.

# 4.4 Start a Program

Open the file to select **Example**, and click **BASIC>BLINK**, as shown below:

$\odot$	💿 sketch jul15a   Arduino 1.8.12 — 🗆 🗙							
File	Edit Sketch	Tools Help		Δ				
	New	Ctrl+N		Built-in Examples			0	
	Open	Ctrl+O		01.Basics		2	Analogi	ReadSerial
	Open Recent	>		02.Digital			BareMi	nimum
	Sketchbook	>		03.Analog			Blink	
	Examples	3		04.Communication		1	DigitalR	eadSerial
- I	Close	Ctrl+W		05.Control			Fade	
	Save	Ctrl+S		06.Sensors			ReadAn	alogVoltage
	Save As	Ctrl+Shift+S		07.Display		>		
L 1	Page Setup	Ctrl+Shift+P		08.Strings		>		
	Print	Ctrl+P		09.USB		>		
		carri		10.StarterKit_BasicKit		>		
	Preferences	Ctrl+Comma		11.ArduinoISP		>		
	Quit	Ctrl+Q		Examples for any board				
				Adafruit Circuit Playgroun	d	>		
				Bridge		>		
				Esplora		>		
				Ethernet		>		
				Firmata		>		
				GSM		>	•	
				LiquidCrystal		>		
Inva	alid library	found in C:\		LiquidCrystal I2C		> iui	no ID ^	
Inva	alid library	found in C:\		MCP23017-Arduino-Libra	ry	>	no ID	
<				Robot Control		>	>	
1				Robot Motor		>) or	COM7	
				SD		>		



Set board and COM port, the corresponding board and COM port are shown on the lower right of IDE.



Click to start compiling the program, and check errors.



Click to upload the program

💿 Blink   Arduino 1.8.12		_		×
File Edit Sketch Tools Help				
				ø
Blink				
This example code is in the public	c domain.			
http://www.arduino.cc/en/Tutorial, */	/Blink			
<pre>// the setup function runs once when void setup() { // initialize digital pin LED_BUID</pre>	n you press res LTIN as an outp	set or	power	the
<pre>pinMode(LED_BUILTIN, OUTPUT); }</pre>				
<pre>// the loop function runs over and ( void loop() {</pre>	over again fore	ever		
<pre>digitalWrite(LED_BUILTIN, HIGH);</pre>	// turn the I	ED on	(HIGH	is t
deray(1000); digitalWrite(LED BUILTIN, LOW);	// wait for a // turn the I	ED off	ia Ebyma	aking
delay(1000);	// wait for a	a secor	nd	
1		_		× *
				,
Done uploading.				
Invalid library found in C:\Users\Ad	ministrator\De:	sktop\i	Arduin	
Invalid library found in C:\Users\Ad	ministrator\De:	sktop\.	Arduin	0 10
<				>
24	Arduino Mega o	r Mega 2	560 on (	ом7

After the code is uploaded, the onboard LED will blink.

# MAC System

5.1 Install Arduino IDE on MAC System

The installation instruction is as same as that in the chapter 4.1, as shown below:

# ARDUINO 1.8.12

Arduino IDE that can be used with any Arduino board, including the Arduino Yún and Arduino DUE. Refer to the Getting Started page for Installation instructions. See the release notes.

Windows Installer Windows ZIP file for non admin install

Mac OS X 10.8 Mountain Lion or newer

Linux 32 bits Linux 64 bits Linux ARM 32 Linux ARM 64

# Source

5.2 Download the Driver of CP2102

https://fs.keyestudio.com/CP2102-MAC

5.3 How to Install the Driver of CP2102

https://wiki.keyestudio.com/How\_to\_Install\_the\_Driver\_of\_CP2102\_on\_MAC\_System

5.4 Arduino IDE Setting

The setting method is as same as the chapter 4.3 except from COM port, as shown below.

# **Board for Arduino**



Resources

https://fs.keyestudio.com/KS0498

## KS0499 Keyestudio Mega Plus development board

## 1. Description

KEYESTUIDO Mega plus Board, whose processor core is ATMEGA2560-16AU, is fully compatible with ARDUINO Mega REV3.

USB to TTL chip adopts more economic and stable CP2012.

This plus board consists of 54-channel digital input and output ports, of which 15 pins are served as PWM output, 16 analog inputs, 4 serial communication ports, one 16MHz crystal oscillator, 1 USB port, 1 power socket, 1 ICSP interface and 1 reset button.

- 1. Specification
- Microcontroller: ATMEGA2560-16AU
- USB to TTL chipCP2102
- Operating Voltage: 5V
- Input Voltage (recommended):DC 7-12V
- Digital I/O Pins: 54 (D0-D53)
- PWM Digital I/O Pins15(D2-D13 D44-D46)
- Analog Input Pins: 16(A0-A15)
- DC Current per I/O Pin: 20 mA
- DC Current for 3.3V Pin: 50 mA
- Flash Memory: 256 KB of which 8 KB used by bootloader
- SRAM: 8 KB
- EEPROM: 4 KB

- Clock Speed: 16 MHz
- LED\_BUILTIN:D13

Interfaces Description



Special Interfaces Description

Serial communication interface(4 channel): SerialD0 =RX0, D1 =TX0, Serial1D19 is RX1, D18 is TX1)

Serial2 D17 is RX2, D16 equals to TX2, Serial3D15 is RX3, D14 is TX3), D0 and D1 are connected to ATMEGA16U2-MU

PWM portPulse width modulation): D2-D13 and D44-D46

External interrupt pinsD2interrupt 0), D3(interrupt 1), D21interrupt 2), D20 (interrupt 3), D19(interrupt 4and D18interrupt 5

SPI communication interfaceD53 stands for SS, D51 is MOSI, D50 is MISO, D52 equals to SCK

IIC communication interfaceD20 represents SDA, D21 is SCL

Install Arduino IDE and Driver

5.1 Installing Arduino IDE

We firstly navigate the ARDUINO official website: https://www.arduino.cc/, click "SOFTWARE"—-"DOWNLOADS", we'll see the following page.



There are many versions for Arduino software but you only need to download the version suitable for your system. Here, we take WINDOWS system as an example to introduce how to download and install Arduino IDE.

# Download the Arduino IDE



There are two versions for your choice, one is an installer which can be directly downloaded in computer and the other is zip file which requires you to unzip and install it.

Consider supporting the Arduino Software by contributing to its development. (US tax payers, please note this contribution is not tax deductible). Learn more on how your contribution will be used.



Just click"JUST DOWNLOAD".

# 5.2 Installing Driver

The downloading process is finished. Now, let's install the driver of KEYESTUDIO PLUS control board. Its chip is CP2102 serial chip. In general, the driver of CP2102 serial chip is included in ARDUINO version 1.8 and above. The driver will be recognized and installed as long as you connect board to computer with USB.

Some system can't install automatically driver but you could install it by hand. Open the device manager of computer and you will see a yellow exclamation mark which means the driver of CP2102 isn't installed successfully.

Double-click the "Cp2102 USB to UART Bridge Controller" and a window pops up, click "update driver", as shown below:

書 设备管理器	- □ X					
File Action View Help						
V 🛃 XIAORONG						
> III Audio inputs and outputs						
Disk drives						
> La Display adapters						
> m Human Interface Devices						
> The Alay Alapi controllers						
Mice and other pointing devices						
Monitorr						
Network adapters						
V III Other devices						
CP2102 USB to UART Bridge Controller						
> 🛱 Print queues						
> Processors						
> P Security devices						
> Software devices						
> 👖 Sound, video and game controllers						
> 🎥 Storage controllers						
> 🏣 System devices						
> 🏺 Universal Serial Bus controllers						

Ⅰ 设备管理器	_	$\times$
File Action View Help		
CP2102 USB to UART Bridge Controller Properties		
V       Image: Constraint of the second		
CP2102 USB to UART   Ports (COM & LPT)   Print queues   Processors   Processors   Software devices   Sound, video and game   Stratege controllers		
System devices     Universal Serial Bus con     OK Cancel		

Click"Browse my computer for driver software" to find out the ARDUINO software to be installed.



There is a **DRIVERS** folder inside, enter it and the driver of CP210X series chip is shown.

 $\times$ 

# Update Drivers - CP2102 USB to UART Bridge Controller Browse for drivers on your computer Search for drivers in this location: C:\Users\Administrator\Desktor\arduino-1.8.12\drivers\CP210x\_6.7 Browse... Include subfolders Let me pick from a list of available drivers on my computer This list will show available drivers compatible with the device, and all drivers in the same category as the device. Next Cancel

Choose the folder to be installed, click"Next", the driver of CP2010 is installed successfully.

Update Drivers - Silicon Labs CP210x USB to UART Bridge (COM7)

Windows has successfully updated your drivers

Windows has finished installing the drivers for this device:



Silicon Labs CP210x USB to UART Bridge

Close

 $\times$ 

Up to now. Then you can right click"Computer"->"Properties"

-->"Device manager", you will see the device as the figure shown below.

The driver is installed successfully and the yellow exclamation mark is gone.

Chapter 11. KS0498 Keyestudio MEGA 2560 development board



## 5.3 Arduino IDE Setting





To avoid the errors when uploading the program to the board, you need to select the correct Arduino board that matches the board connected to your computer.

Then come back to the Arduino software, you should click Tools→Board, select the board. (as shown below)

💿 sketch_nov10a   /	Arduino 1.8.12 -	- 🗆 >	<	
File Edit Sketch To	ols Help			
	Auto Format	Ctrl+T		
	Archive Sketch			
sketch_nov10a	Fix Encoding & Reload			Boards Manager
<pre>void setup() {</pre>	Manage Libraries	Ctrl+Shift+I		Arduino AVR Boards
// put your	Serial Monitor	Ctrl+Shift+M		Arduino Yún
1	Serial Plotter	Ctrl+Shift+L		Arduino Uno
1	METOL AMENUNA Commenciation			Arduino Duemilanove or Diecimila
<pre>void loop() {</pre>	WIFITOT / WIFININA Firmware Updater			Arduino Nano
// put your	Board: "Arduino Mega or Mega 2560"	3	•	Arduino Mega or Mega 2560
}	Processor: "ATmega2560 (Mega 2560)"	>		Arduino Mega ADK
	Port	>		Arduino Leonardo
	Get Board Info			Arduino Leonardo ETH
	Des services in MAX/DECD services			Arduino Micro
		1		Arduino Esplora
	Burn Bootloader			Arduino Mini
				Arduino Ethernet
				Arduino Fio
				Arduino BT
				LilyPad Arduino USB
				LilyPad Arduino
				Arduino Pro or Pro Mini
				Arduino NG or older
				Arduino Robot Control
				Arduino Robot Motor
1	Arduino	Mega or Mega 2560		Arduino Gemma

Then select the correct COM port (you can see the corresponding COM port after the driver is successfully installed)





Before uploading the program to the board, let's demonstrate the function of each symbol in the Arduino IDE toolbar.



- 1. Used to verify whether there is any compiling mistakes or not.
  - B- Used to upload the sketch to your Arduino board.
  - C- Used to create shortcut window of a new sketch.
  - D- Used to directly open an example sketch.
  - E- Used to save the sketch.
  - F- Used to send the serial data received from board to the serial monitor.

5.4 Start Your First Program

Open file to choose Examples->BASIC->BLINK

💿 s	ketch_nov10a	Arduino 1.8.1	Δ	F	]	×	
File E	Edit Sketch 1	Tools Help	Built-in Examples				
	New	Ctrl+N	01.Basics	2	Α	nalogF	ReadSerial
	Open	Ctrl+O	02.Digital	2	В	areMir	nimum
	Open Recent	>	03.Analog	>	В	link	
	Sketchbook	2	04.Communication	2	D	igitalR	eadSerial
	Examples	3	05.Control	2	Fa	ade	
	Close	Ctrl+W	06.Sensors	2	R	eadAn	alogVoltage
	Save	Ctrl+S	07.Display	>			
	Save As	Ctrl+Shift+S	08.Strings	>			
			09.USB	>			
	Page Setup	Ctrl+Shift+P	10.StarterKit_BasicKit	>			
	Print	Ctrl+P	11.ArduinoISP	>			
	Preferences	Ctrl+Comma	Examples for any board				
	Quit	Ctrl+Q	Adafruit BMP280 Library	>			
			Adafruit Circuit Playground	>			
			Adafruit TiCoServo	>			
			Adafruit_NeoPixel_master	>			
			Adafruit_TFTLCD3-2	>			
			Bridge	>			
			CCS811	>		~	
			DFRobot_ST7687S-master	>			
			Esplora	>			
			EtherCard	>			
			Ethernet	>			
1			Firmata	>	an 00	M7	
_			GSM	>	on oc	/////	

🥺 Blink   Arduino 1.8.12		_		×
File Edit Sketch Tools Help				
				ø
This example code is in the public	c domain.			
http://www.arduino.cc/en/Tutorial, */	/Blink			
<pre>// the setup function runs once when void setup() { // initialize digital pin LED_BUI pinMode(LED_BUILTIN, OUTPUT); }</pre>	n you press res LTIN as an outy	set or	power	the
<pre>// the loop function runs over and ( void loop() {</pre>	over again fore	ever		
<pre>digitalWrite(LED_BUILTIN, HIGH); delay(1000); digitalWrite(LED_BUILTIN, LOW); delay(1000);</pre>	<pre>// turn the I // wait for a // turn the I // curit for</pre>	LED on a secon LED of:	(HIGH nd f by ma	is t akinç
delay(1000); }	// Walt for a	a secoi	na	~
<		_		>
1 Arduino Mega or Mega	2560, ATmega2560	(Mega 2	560) on (	COM7

Set board and COM port, the bottom right corner of the IDE displays the corresponding board and COM port.



Click icon to start compiling the program, and check errors.



Click icon to start upload the program, upload successfully.



The program is uploaded successfully, LED of board lights on for 1s, and lights off for 1s.

# KS0500 Keyestudio Max Development Board



# 1.Introduction:

Keyestudio Max development board is an Arduino uno-compatible board, which isbased on ATmega328P MCU, and with a cp2102 Chip as a UART-to-USB converter.MAX development board integrates three LEDs, two 6812RGB LEDs, two button switches, a buzzer, a microphone sensor, a light sensor, and an 8\*16 dot matrix.

Using the onboard hardware, you can start 20 project courses. If you are a beginner, a MAX board is enough!

MAX can also be connected to all arduino sensors and modules, and it is also compatible with all Arduino shield boards.

Now, use MAX to enter the magical world of ARDUINO!

# 2.Max development board Pinout

Max has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, 2 ICSP headers and a reset button.



It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it via an external DC power jack (DC 7-12V) or via female headers Vin/ GND(DC 7-12V) to get started.

Microcontroller	ATmega328P-PU
Operating Voltage	5V
Input Voltage (recommended)	DC7-12V
Digital I/O Pins	14 (D0-D13) (of which 6 provide PWM output)
PWM Digital I/O Pins	6 (D3, D5, D6, D9, D10, D11)
Analog Input Pins	6 (A0-A5)
DC Current per I/O Pin	20 mA
DC Current for 3.3V Pin	50 mA
Flash Memory	32 KB (ATmega328P-PU) of which 0.5 KB used by bootloader
SRAM	2 KB (ATmega328P-PU)
EEPROM	1 KB (ATmega328P-PU)
Clock Speed	16 MHz
LED_BUILTIN	D13

3.Max development board onboard interface



red LED: D8

yellow LED: D10

green LED: D13

6812 RGB LED: D4

two button switches: D2, D3

buzzer: D9

microphone sensor: A7

light sensor: A6

8\*16 dot matrixA4,A5 (I2C interface)

4-digit DIP switch: on right, D2, D3, A4, A5, these onboard components interface is connected. on left, these interface is disconnected,

They are connected to the corresponding interface on the max board pin header.

# 4. Install Arduino software and Driver
## **1Installing Arduino IDE**

When we get max control board, we need to download Arduino IDE and driver firstly. You could download Arduino IDE from the official website:

https://www.arduino.cc/, click the **SOFTWARE** on the browse bar, click "DOWNLOADS" to enter download page, as shown below:



There are various versions Of IDE for Arduino, just download a version that compatible with your system, here we will show you how to download and install the windows version Arduino IDE.



There are two versions of IDE for WINDOWS system. You can choose between the Installer (.exe) and the Zip packages. We suggest you use the first one that installs directly everything you need to use the Arduino Software (IDE), including the drivers. With the Zip package you need to install the drivers manually. The Zip file is also useful if you want to create a portable installation.

Consider supporting the Arduino Software by contributing to its development. (US tax payers, please note this contribution is not tax deductible). Learn more on how your contribution will be used.



You just need to click JUST DOWNLOAD.

### (2) Installing Max board Driver

Let's install the driver of Keyestudio Max board. The USB-TTL chip on Max board adopts CP2102 serial chip. The driver program of this chip is included in Arduino 1.8 version and above, which is convenient.

When you attach USB port to computer, the driver of CP2102 can be installed.

If the driver is installed unsuccessfully, you need to install it manually.

Open the device manager of computer. Right click Computer-Properties-Device Manager.

#### 🗄 Device Manager $\times$ File Action View Help 🗢 🔿 🖬 🔚 🛛 🗗 💻 💺 🗙 📀 > 🐗 Audio inputs and outputs > 🧽 Batteries > 📃 Computer > 👝 Disk drives > 🌄 Display adapters > R DVD/CD-ROM drives 🗸 🐜 Human Interface Devices 🖓 USB Input Device > 📷 IDE ATA/ATAPI controllers > 🔤 Keyboards > 📗 Mice and other pointing devices > 📃 Monitors > 💻 Network adapters ✓ I<sup>™</sup> Other devices 🙀 CP2102 USB to UART Bridge Controller > 📇 Print queues > Processors > 📱 Software devices > 🍇 Storage controllers > 🍢 System devices > 🏺 Universal Serial Bus controllers

There is a yellow exclamation mark on the page, which implies the failure installation of the driver of CP2102.

Operate as follows

CP2102 U	ISB to UART Bridge Controller Properties	×											
General	Driver Details Events												
2	CP2102 USB to UART Bridge Controller												
	Device type: Other devices												
	Manufacturer: Unknown												
	Location: Port_#0002.Hub_#0001												
Devic	ce status												
The	drivers for this device are not installed. (Code 28)	^											
Ther	e are no compatible drivers for this device.												
To fi	nd a driver for this device, click Update Driver.												
✓													
	Update Driver												
	OK Car	cel											

Click "OK" to enter the following page and click "browse my computer for updated driver software".

	×
← Update Drivers - CP2102 USB to UART Bridge Controller	
How do you want to search for drivers?	
$\rightarrow$ Search automatically for updated driver software	
for your device, unless you've disabled this feature in your device installation settings.	2
-> Provise my computer for driver software	
Locate and install driver software manually.	
	Cancel

Click "Browse", then search the driver of CP2102 and click "Next",

There is a DRIVERS folder in Arduino software installed package check the driver of CP210X series chips.

arduino-1.8.12

, open driver folder and





### **3Arduino IDE Setting**



Click Arduino iconand open Arduino IDE.



When downloading the sketch to the board, you must select the correct name of Arduino board that matches the board connected to your computer. As shown below;

🥺 sketch_apr03a	Arduino 1.8.13	- 🗆	×	
File Edit Sketch	Tools Help			
	Auto Format	Ctrl+T		Boards Manager
	Archive Sketch			Δ
sketch_apr03a	Fix Encoding & Reload			Arduino AVR Boards
<pre>void setup() {</pre>	Manage Libraries	Ctrl+Shift+I		Arduino Yún
// put your	Serial Monitor	Ctrl+Shift+M	•	Arduino Uno
}	Serial Plotter	Ctrl+Shift+L		Arduino Duemilanove or Diecimila
	WiEi101 / WiEiNINA Eirmware Undate		-	Arduino Nano
<pre>void loop() {</pre>	winner / winner opdate		-	Arduino Mega or Mega 2560
// put your	Board: "Arduino Uno"	:	2	Arduino Mega ADK
}	Port	:	2	Arduino Leonardo
	Get Board Info			Arduino Leonardo ETH
	Programmer: "AVRISP mkII"		2	Arduino Micro
	Burn Bootloader			Arduino Esplora
			-	Arduino Mini
				Arduino Ethernet
				Arduino Fio
				Arduino BT
				LilyPad Arduino USB
				LilyPad Arduino
				Arduino Pro or Pro Mini
				Arduino NG or older
				Arduino Robot Control
				Arduino Robot Motor
				Arduino Gemma
				Adafruit Circuit Playground
2		Arduino U	•	Arduino Yún Mini

Then select the correct COM port (you can see the corresponding COM port after the driver is successfully installed)





- A- Used to verify whether there is any compiling mistakes or not.
- B- Used to upload the sketch to your Arduino board.
- C- Used to create shortcut window of a new sketch.
- D- Used to directly open an example sketch.
- E- Used to save the sketch.
- F- Used to send the serial data received from board to the serial monitor.

### **4Start First Program**

Open the file to select Example, choose BLINK from BASIC, as shown below:

00	sketch_apr03a	Arduino 1.8.1		∆ Built-in Examples		×
File	Edit Sketch	Tools Help	Г	01.Basics	,	AnalogReadSerial
	New Ctrl+N			02.Digital	,	BareMinimum
	Open	Ctrl+O		03.Analog	,	Blink
	Open Recent	;		04.Communication		DigitalReadSerial
	Sketchbook			05.Control	1	Fade
	Examples	, ,		06.Sensors	,	ReadAnalogVoltage
	Close	Ctrl+W		07.Display	>	
	Save	Ctrl+S		08.Strings	>	
	Save As	Ctrl+Shift+S		09.USB	>	
	Page Setup	Ctrl+Shift+P		10.StarterKit BasicKit	>	
	Print	Ctrl+P		11.ArduinoISP	>	
	Dreferences	Ctrl+Comma				
	Freierences	curreonina		Examples for any board		
	Quit	Ctrl+Q		Adatruit Circuit Playground	>	
				Bridge	>	
				Esplora	>	
				Ethernet	>	
				Firmata	>	
				GSM	>	
				LiquidCrystal	>	~
				Robot Control	>	
				Robot Motor	>	
				SD	>	
				Servo	>	
1				SpacebrewYun	>	n COM7
				Stepper	>	



Set board and COM port, the corresponding board and COM port are shown on the lower right of IDE.



Click to start compiling the program, and check errors.



Click to upload the program

💿 Blink   Arduino 1.8.13		_		×
File Edit Sketch Tools Help				
				Ø
Blink				
				^
This example code is in the public	domain.			
http://www.arduino.cc/en/Tutorial/ */	<u>/Blink</u>			
<pre>// the setup function runs once wher void setup() { // initialize digital pin LED_BUII pinMode(LED_BUILTIN, OUTPUT);</pre>	n you press re TIN as an out	set or put.	power	the
}				
<pre>// the loop function runs over and c void loop() {</pre>	over again for	ever		
<pre>digitalWrite(LED_BUILTIN, HIGH);</pre>	// turn the	LED on	(HIGH	is t
delay(1000);	// wait for	a secor	nd	
<pre>digitalWrite(LED_BUILTIN, LOW); delaw(1000);</pre>	// turn the	LED off	E by ma ad	akinç
deray(1000);	// Walt Ior	a secoi	ia	
·				>
Done uploading.		_		
Sketch uses 924 bytes (2%) of program	m storage spac	e. Max	imum i	s 32256
Global variables use 9 bytes (0%) of	dynamic memor	ry, lea	ving 2	039 byt
<				>
1		Arduino	Uno on (	сом7

Upload the program successfully, the onboard LED lights on for 1s, lights off for 1s. Congratulation, you finish the first program.

## 5. Max development board Project

# Project 1 : Hello world



## **Project instruction:**

As the beginning of all programming languages, Hello world occupies an unchangeable position, so the first project of our Arduino tutorial starts with hello world.

The "Hello, world" program refers to a computer program that outputs the string "Hello, world" on the computer screen.

In this project, the computer is the Max control board and the screen is the serial monitor. This project only needs one development board and one USB cable.

1. Tips:

After connecting the Max development board, open the Arduino IDE and ensure two points:

1. Select the correct development board version in Tools>Board (Max development board is compatible with Arduino UNO, so choose Arduino UNO for the board model in the software)

2. In Tools>Port, select the serial port where the Max development board is located.

#### 1. Project code:

/\*

keyestudio Max Development Board

Project 1

hello world

http://www.keyestudio.com

\*/

int val;//define variable val

void setup()

{

Serial.begin(9600);//Set the baud rate to 9600, which must be consistent with the software settings.

}

void loop()

{

val=Serial.read();//Read the instructions or characters sent by the PC to the Arduino and assign them to val

if(val=='h')//Judging whether the received command or character is "h".

{//If the received is "h"

Serial.println("Hello World!");//Display "Hello World!"

}}

### 1. Project results

Open the Arduino IDE, copy and paste the code in the IDE, click Verify to compile, and check the program for errors. At this time, the code has not been uploaded to the Max board.

Click upload, you can see the TX and RX LEDs on the Max board flash a few times, and the IDE prompts Done uploading.

Upload the code to the development board, when enter "h" in the Serial Monitor, it will display "Hello, world!".

COM7		(	_ 0 X	
h			Send	
Hello World!				٦
	r			
Autoscroll 🔲 Show timestamp	Newline 🔻	9600 baud 🔻	Clear outp	ut

**Project 2: LED blink** 



# 1. Project instruction

The next step is to start a very classic project-blink. This project is to light up an LED and control the delay time. It is an entry-level project for Arduino beginners.

In this example, the LED we use is an LED onboard MAX, As shown in the picture below, it is directly connected to the D13 pin.



# 1. Project Principle

LED is a type of semiconductor called "Light Emitting Diode "which is an electronic device made of semiconductor materials (silicon, selenium, germanium, etc.). It is dubbed indicator, digital and word display in circuit and device.

# 1. Project circuit



# 1. Project code

```
/*
```

keyestudio Max Development Board

Project 2

Blink

http://www.keyestudio.com

\*/

// the setup function runs once when you press reset or power the board

void setup() {

// initialize digital pin 13 as an output.

pinMode(13, OUTPUT);

}

// the loop function runs over and over again forever

void loop() {

digitalWrite(13, HIGH); // turn the LED on (HIGH is the voltage level)

delay(1000); // wait for a second

digitalWrite(13, LOW); // turn the LED off by making the voltage LOW

delay(1000); // wait for a second

When the upload is successful, it will prompt "Done uploading". After everything is successful, you can see the LED of D13 is on for one second and off for one second.

### 1. Code description

setup()function is the basic function of the Arduino program and must be included. It will only be executed once when the program is running. It is commonly used to define pins and declare variables.

loop(): loop function is also a necessary function of the Arduino program. Its function is to run after setup() is executed once, and it keeps repeating.

digitalWrite(13, HIGH) Set the output voltage of the pin to high or low. Here D13 is high level, so that the LED can light up.

delay(1000)The delay function is a delay function, the value here is 1000, the unit is milliseconds (ms), 1000ms is 1 second.

What if you want to make the LED flash faster? Yes, you only need to modify the delay. Decrease the value, it means that the waiting time is shorter, that is, the flashing is faster. or, the flash is slower.

## **Project 3: SOS light**



### 1. Project instruction

SOS is a Morse code distress signal (), used internationally, that was originally established for maritime use. In formal notation SOS is written with an overscore line, to indicate that the Morse code equivalents for the individual letters of "SOS" are transmitted as an unbroken sequence of three dots / three dashes / three dots, with no spaces between the letters.[1] In International Morse Code three dots form the letter "S" and three dashes make the letter "O", so "S O S" became a common way to remember the order of the dots and dashes. (IWB, VZE, 3B, and V7 form equivalent sequences, but traditionally SOS is the easiest to remember.)

### **Project Principle**

We could produce a letter through LED on and off state, long and short flash respectively represent dot and dash.

Through Morse code table, "S" is represented by three dots, therefore, we replace three dots with short flash, dash symbolizes letter "O", replace threw dashes with long flash.

## **Project circuit**



## **Project code**

	(continues on next page)
void setup() {	
int ledPin = 10;	
\*/	
http://www.keyestudio.com	
S 0 S	
Project 3	
keyestudio Max Development Board	
$\wedge$ *	

(continued from previous page)

```
pinMode(ledPin, OUTPUT);
}
void loop() {
// stand for" S"with three quick flash
for(int x=0;x<3;x++){
digitalWrite(ledPin,HIGH); //set LED on
delay(150); //delay in 150ms
digitalWrite(ledPin,LOW); //set LED off
delay(100); //delay 100ms
}
// time gap to produce next letter
delay(100);
//stand for" 0"with three short flash
for(int x=0;x <3;x++){
digitalWrite(ledPin,HIGH); //set LED on
delay(400); //delay in 400ms
digitalWrite(ledPin,LOW); //set LED off
delay(100); //delay in 100ms
}
// time gap to produce next letter
delay(100);
// stand for" S"with three quick flash
for(int x=0;x<3;x++){
digitalWrite(ledPin,HIGH); //set LED on
delay(150); //delay in 150ms
digitalWrite(ledPin,LOW); //set LED off
```

(continues on next page)

(continued from previous page)

```
delay(100); //delay in 100ms
}
// wait 5s before repeating S.0.S signal
delay(5000);
}
```

Upload code to Arduino, we will view LED flash S.O.S signal and wait for 5s and flash again. Plug external power in Arduino, and place them in a waterproof box, then S.O.S signal can be sent. S.O.S signal is usually applied in maritime use and mountain-climbing

# **Project 4: Breathing LED**

## **Project instruction**

We have learned how to control LED on and off, besides, the light intensity of LED can be controlled by program. The pins marked with"~"on Arduino board indicate they have PWM function. In this project, we will control LED brightness through PWM to simulate breathing effect.

## **Project Principle**

PWM is a means of controlling the analog output via digital means. Digital control is used to generate square waves with different duty cycles (a signal that constantly switches between high and low levels) to control the analog output. In general, the input voltage of port are 0V and 5V. What if the 3V is required? Or what if switch among 1V, 3V and 3.5V? We can't change resistor constantly. For this situation, we need to control by PWM.



In the above figure, the green line represents a period, and value of analogWrite() corresponds to a percentage which is called Duty Cycle as well. Duty cycle implies that high-level duration is divided by low-level duration in a cycle. From top to bottom, the duty cycle of first square wave is 0% and its corresponding value is 0. The LED brightness is

lowest, that is, turn off. The more time high level lasts, the brighter the LED. Therefore, the last duty cycle is 100%, which correspond to 255, LED is brightest. 25% means darker.

PWM mostly is used for adjusting the LED brightness or rotation speed of motor.

## **Project circuit**



# **Project code**

$\wedge^*$
keyestudio Max Development Board
Project 4
Breathing LED
http://www.keyestudio.com
$\setminus */$
<pre>int ledPin = 10;</pre>

(continues on next page)

(continued from previous page)

```
int value;
void setup() {
pinMode(ledPin,OUTPUT);
}
void loop()
{
for (value = 0; value \setminus 255; value=value+1)
{
analogWrite(ledPin, value);
delay(5);
}
for (value = 255; value \>0; value=value-1)
{
analogWrite(ledPin, value);
delay(5);
}
}
```

Upload test code successfully, LED gradually becomes brighter then darker, like human breath, rather than turn on and off imKS0500/mediately.

# **Code description**

Function analogWrite()

We know that digital port only has two state of 0 and 1. So how to send an analog value to a digital value? Here, this function is needed. Let's observe the Arduino board and find 6 pins marked "~"which can output PWM signals.

The formula as follows

analogWrite(pin,value)

analogWrite() is used to write an analog value from  $0\sim255$  for PWM port, so the value is in the range of  $0\sim255$ . Attention that you only write the digital pins with PWM function, such as pin 3, 5, 6, 9, 10, 11.

# **Project 5: Traffic light**



## 1. Project instruction

In the previous program, we have done the LED blinking experiment with one LED. Now, it's time to up the stakes to do a bit more complicated experiment-traffic light. Actually, these two experiments are similar. While in this traffic light experiment, we use three LEDs with different colors rather than an LED.



# 1. Project Principle

Max board imitates traffic light by controlling flashing time of LED through program.

1. Project circuit



```
1. Project code
```

```
/*
```

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Project 5

Traffic light

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```
*/
```

int redled =8; // initialize digital pin 8.

int greenled =10; // initialize digital pin 10.

```
int yellowled =13; // initialize digital pin 13.
```

void setup()

```
{
```

pinMode(redled, OUTPUT);// set the pin with red LED as"output"

pinMode(yellowled, OUTPUT); // set the pin with yellow LED as "output"

pinMode(greenled, OUTPUT); // set the pin with green LED as"output"

}

void loop()

## {

digitalWrite(greenled, HIGH);//// turn on green LED delay(5000);// wait 5 seconds digitalWrite(greenled, LOW); // turn off green LED for(int i=0;i<3;i++)// blinks for 3 times { delay(500);// wait 0.5 second digitalWrite(yellowled, HIGH);// turn on yellow LED delay(500);// wait 0.5 second digitalWrite(yellowled, LOW);// turn off yellow LED } delay(500);// wait 0.5 second digitalWrite(redled, HIGH);// turn on red LED delay(5000);// wait 5 second digitalWrite(redled, LOW);// turn off red LED

# }

## **Project 6: LED Chasing Effect**



## 1. Project instruction

Flow light is commonly viewed in our daily life, such as on building, advertisement board and so on. We will show you how to make a flow light in this part.

### 1. Project circuit



# 1. Project code

/\*

Project 6 LED Chasing Effect http://www.keyestudio.com \*/

keyestudio Max Development Board

int redled = 8;

int greenled = 10;

```
int yellowled =13;
```

void setup(){

pinMode(redled, OUTPUT);

pinMode(greenled, OUTPUT);

pinMode(yellowled, OUTPUT);

}

```
void loop()
```

{

digitalWrite(redled, HIGH);//turn on red light delay(100);//delay in 0.1s digitalWrite(redled, LOW); //turn off red light delay(100);//delay in 1s digitalWrite(greenled, HIGH);//turn on green light delay(100);//delay in 0.1s digitalWrite(greenled, LOW);//turn off green light delay(100);//delay in 0.1s digitalWrite(yellowled, HIGH);//turn on yellow light delay(100);//delay in 0.1s digitalWrite(yellowled, LOW);//turn off yellow light delay(100);//delay in 0.1s } Project 7: Play Music



# 1. project instruction

We can use Arduino to make many interactive works. The most commonly used one is acoustic-optic display. All the previous experiment has something to do with LED. However, the circuit in this experiment can produce sound. Normally, the experiment is done with a buzzer but not a speaker while buzzer is more simpler and easier to use.

The buzzer we introduced here is a passive buzzer. It cannot be actuated by itself, but by external pulse frequencies. Different frequency produces different sound. We can use Arduino to code the melody of a song, which is quite fun and simple.

### 1. Project Principle

Passive buzzer is an integrated electronic buzzer without vibration source inside. It must be driven by 2K-5K square wave instead of direct current signals. There is little difference between the two buzzers, but when the pins of the two buzzers are placed up, the passive buzzer comes with green circuit board, and the one sealed with vinyl is an active buzzer.

# 1. Project circuit



### 1. Project code

```
/*
```

keyestudio Max Development Board

Project 7

Play Music

http://www.keyestudio.com

\*/

int tonepin=9;// set pin9 connecting buzzer

void setup()

{

```
pinMode(tonepin,OUTPUT);//set IO port to output
}
void loop()
{
unsigned char i,j;
while(1)
{
for(i=0;i<80;i++)//output a sound with frequency
{
digitalWrite(tonepin,HIGH);//emit a sound
delay(1);//delay in 1ms
digitalWrite(tonepin,LOW);//don't emit a sound
delay(1);//delay 1 ms
}
for(i=0;i<100;i++)// output another sound with frequency, 100 controls frequency and can be adjusted also by yourselves
{
digitalWrite(tonepin,HIGH);
delay(2);
digitalWrite(tonepin,LOW);
```

delay(2);

} } }

Seen from the above code, 80 and 100 in the for statement effects frequency, and delay controls time, alike beats in music.

# Project 8: WS2812 RGB LED

# 1. project instruction

In this project, we will take a look at an interesting product called the WS2812B Addressable LEDs. They are individually addressable RGB LEDs and are also called by different names like NeoPixel by Adafruit, for example. In this tutorial, we will learn about the WS2812B LEDs, its internal structure and construction and also how to control individually addressable LEDs using Arduino.

# 1. Project Principle

The WS2812B Addressable LED Strip is an intelligent light source that contains a control IC and an RGB LED in a same package, usually in SMD 5050 form factor. The following image shows a strip of WS2812B LEDs.



At first glance, it looks like a regular LED strip. But upon a closer inspection, you can find the WS2812B LED Control IC integrated into the SMD 5050 RGB LED Package. The following blown up image shows the same.



Individual WS2812B LED Block has four pins namely VDD, VSS (GND), DIN and simple function description of the pins.

Pin	Function
VDD	Power Supply for LED
VSS	Ground
DIN	Control Data Signal Input
DOUT	Control Data Signal Output

The power supply for the WS2812B IC is also supplied through the VDD Pin.

DOUT. The functions of these pins are very simple and the following table gives a

### WS2812B LED Application Circuit

To understand how the WS2812B LEDs can be individually controlled, the following application circuit will be useful. All the WS2812B LEDs are connected in a cascade manner where the DO of the first LED is connected to the DIN of the second LED and so on.

But the first LED has to receive data through its DIN pin from a Microcontroller like Arduino. The following image shows the typical application circuit block diagram.



The data transfer protocol used by the WS2812B LEDs is NRZ Mode. The first DIN Port of the WS2812B LED array receives data from the microcontroller. The data for individual pixel is of 24-bit that consists of individual Red, Green and Blue LED control data of 8-bits each. The order of data must be GRB and the composition of the 24-bit data is shown below. Note that HIGH bit data is sent first.

G7	G6	G5	<b>G4</b>	G3	G2	G1	<b>G0</b>	R7	R6	R5	R4	R3	R2	R1	R0	B7	B6	B5	B4	B3	B2	<b>B1</b>	B0	
----	----	----	-----------	----	----	----	-----------	----	----	----	----	----	----	----	----	----	----	----	----	----	----	-----------	----	--

Once the first WS2812B Block receives the first 24-bit data, the data is sent to its internal latch for further decoding. The remaining data is reshaped by its signal reshaping and amplification circuit and is passed to the next pixel in the cascade through the DO pin.

## 1. Project circuit



### 1. Project code

/\*

keyestudio Max Development Board Project 8

WS2812 RGB LED

http://www.keyestudio.com

\*/

#include <Adafruit\_NeoPixel.h>

#ifdef \_AVR\_

#include <avr/power.h>

#endif

#define PIN 4
// Parameter 1 = number of pixels in strip // Parameter 2 = Arduino pin number (most are valid) // Parameter 3 = pixel type flags, add together as needed: // NEO\_KHZ800 800 KHz bitstream (most NeoPixel products w/WS2812 LEDs) // NEO KHZ400 400 KHz (classic 'v1' (not v2) FLORA pixels, WS2811 drivers) // NEO GRB Pixels are wired for GRB bitstream (most NeoPixel products) // NEO\_RGB Pixels are wired for RGB bitstream (v1 FLORA pixels, not v2) Adafruit\_NeoPixel strip = Adafruit\_NeoPixel(2, PIN, NEO\_GRB + NEO\_KHZ800); // IMPORTANT: To reduce NeoPixel burnout risk, add 1000 uF capacitor across // pixel power leads, add 300 - 500 Ohm resistor on first pixel's data input // and minimize distance between Arduino and first pixel. Avoid connecting // on a live circuit... if you must, connect GND first. void setup() { // This is for Trinket 5V 16MHz, you can remove these three lines if you are not using a Trinket #if defined (AVR ATtiny85) if (F CPU == 16000000) clock prescale set(clock div 1); #endif // End of trinket special code strip.begin(); strip.show(); // Initialize all pixels to 'off' } void loop() { // Some example procedures showing how to display to the pixels: colorWipe(strip.Color(255, 0, 0), 50); // Red colorWipe(strip.Color(0, 255, 0), 50); // Green colorWipe(strip.Color(0, 0, 255), 50); // Blue // Send a theater pixel chase in... theaterChase(strip.Color(127, 127, 127), 50); // White theaterChase(strip.Color(127, 0, 0), 50); // Red theaterChase(strip.Color(0, 0, 127), 50); // Blue rainbow(20); rainbowCycle(20); theaterChaseRainbow(50); } // Fill the dots one after the other with a color void colorWipe(uint32\_t c, uint8\_t wait) {

```
for(uint16_t i=0; i<strip.numPixels(); i++) {</pre>
strip.setPixelColor(i, c);
strip.show();
delay(wait);
}
}
void rainbow(uint8_t wait) {
uint16_t i, j;
for(j=0; j<256; j++) {
for(i=0; i<strip.numPixels(); i++) {</pre>
strip.setPixelColor(i, Wheel((i+j) & 255));
}
strip.show();
delay(wait);
}
}
// Slightly different, this makes the rainbow equally distributed throughout
void rainbowCycle(uint8_t wait) {
uint16_t i, j;
for(j=0; j<256*5; j++) { // 5 cycles of all colors on wheel
for(i=0; i< strip.numPixels(); i++) {</pre>
strip.setPixelColor(i, Wheel(((i * 256 / strip.numPixels()) + j) & 255));
}
strip.show();
delay(wait);
}
}
//Theatre-style crawling lights.
void theaterChase(uint32_t c, uint8_t wait) {
for (int j=0; j<10; j++) { //do 10 cycles of chasing
for (int q=0; q < 3; q++) {
for (int i=0; i < strip.numPixels(); i=i+3) {</pre>
strip.setPixelColor(i+q, c); //turn every third pixel on
}
strip.show();
delay(wait);
```

```
for (int i=0; i < strip.numPixels(); i=i+3) {</pre>
strip.setPixelColor(i+q, 0); //turn every third pixel off
}
}
}
//Theatre-style crawling lights with rainbow effect
void theaterChaseRainbow(uint8_t wait) {
for (int j=0; j < 256; j++) { // cycle all 256 colors in the wheel
for (int q=0; q < 3; q++) {
for (int i=0; i < strip.numPixels(); i=i+3) {</pre>
strip.setPixelColor(i+q, Wheel( (i+j) % 255)); //turn every third pixel on
}
strip.show();
delay(wait);
for (int i=0; i < strip.numPixels(); i=i+3) {
strip.setPixelColor(i+q, 0); //turn every third pixel off
}
}
}
// Input a value 0 to 255 to get a color value.
// The colours are a transition r - g - b - back to r.
uint32_t Wheel(byte WheelPos) {
WheelPos = 255 - WheelPos;
if(WheelPos < 85) {
return strip.Color(255 - WheelPos * 3, 0, WheelPos * 3);
}
if(WheelPos < 170) {
WheelPos -= 85;
return strip.Color(0, WheelPos * 3, 255 - WheelPos * 3);
}
WheelPos -= 170;
return strip.Color(WheelPos * 3, 255 - WheelPos * 3, 0);
}
Project 9: To make a lamp
```

## 1. Project instruction

In previous lessons, we have known the output function of Arduino. In this experiment, we will make you have better understanding of I/O function through an LED experiment.

## 1. Project principle

The push button switch is usually used to turn on and off the control circuit, and it is a kind of control switch appliance that is widely used.

The push button switch can complete basic controls such as start, stop, forward and reverse rotation, speed change and interlock. Usually each push button switch has two pairs of contacts. Each pair of contacts consists of a NO contact and a NC contact. When the button is pressed, the two pairs of contacts act simultaneously, the NC contact is disconnected, and the NO contact is closed.

## 1. Project circuit



## 1. Project code

/\*

keyestudio Max Development Board

Project 9

To make a lamp

http://www.keyestudio.com

```
*/
```

```
int ledpin1=13;//define digital 13
int ledpin2=10;////define digital 10
int buttonpin1=2;//define digital 2
int buttonpin2=3;//define digital 3
int val1;//define variable val1
int val2;//define variable val2
void setup()
```

```
{
```

```
pinMode(ledpin1,OUTPUT);//define LED pin1 to output
pinMode(ledpin2,OUTPUT);//define LED pin2 to output
pinMode(buttonpin1,INPUT);//define button pin1 to input
pinMode(buttonpin2,INPUT);//define button pin2 to input
}
void loop()
{
val1=digitalRead(buttonpin1);//read the level of digital 2 and set to val
val2=digitalRead(buttonpin2);//read the level of digital 3 and set to val
if(val1==HIGH)//detect if the button is pressed, LED on when pressed
{
digitalWrite(ledpin1,LOW);
}
else
{
digitalWrite(ledpin1,HIGH);
}
if(val2==HIGH)//detect if the button is pressed, LED on when pressed
{
digitalWrite(ledpin2,LOW);
}
else
{
digitalWrite(ledpin2,HIGH);}
}
5. Project results:
```

This principle is applied widely in all kinds of circuit and household appliances, such as push switch and indicator.

## Project 10: To make a night light



#### 1. Project instruction

A photoresistor, relies on light to work. In the dark environment, it has high resistance. The stronger the light intensity is, the smaller its value is, thereby, we could check the light intensity through reading its resistance value.

We will make a photo-sensitive light which will adjust its light intensity with the ambient environment.

#### 1. Project Principle

Photoresistor, a kind of special electronic component, can transfer light signals into electronic signals. It contains special light-conductive material and is sealed with plastic and glass packaging. As the light is irradiated on this kind of photo-conductive material, its the resistance value will get small rapidly.

The photoresistor has a very high resistance in a dark environment. The stronger the light, the lower the resistance value. As the resistance value at both ends decreases, the Vout voltage increases (the value read from the analog port also increases, and the value of the analog port  $0\sim1023$  corresponds to the voltage value of  $0\sim5V$ ).

Why does the voltage decrease? Then we need to explain through physics knowledge-the principle of partial pressure. Let us look at a typical voltage divider circuit and see how it works.



Input voltage Vin(5V) connected to two resistors, only measures the voltage of Vout on resistor R1. Its voltage is less than input voltage,

The formula of the voltage of Vout is as follows

$$V_{out} = \frac{RI}{RI + Rz} \times V_{in}$$

R1 represents 10k resistor, R2 is photoresistor. When R2 is in the dark environment, its value gets larger but Vout's value is close to 0v. Once there is light, the value of R2 will get smaller and the value of Vout increases instead.

Judged from the above formula, R1 should be in 1k~10k, otherwise, the value of Vout is not apparent.

1. Project circuit



# 1. Project code

/\*

keyestudio Max Development Board

Project10

```
To make a night light
http://www.keyestudio.com
*/
int LED = 13; // set LED to pin 13
int val = 0; //set analog pin 0 to read the voltage value of photosensitive diode
void setup(){
pinMode(LED,OUTPUT); // set LED to output
Serial.begin(9600); // set serial baud rate to 9600
}
void loop(){
val = analogRead(A6); // read the voltage value 0 \sim 1023
Serial.println(val); // check the change of voltage value in serial
if(val>300)
{ // once exceed the set value, LED will be off
digitalWrite(LED,LOW);
}else
{ // otherwise, LED is on
digitalWrite(LED,HIGH);
}
delay(10); //delay in 10ms
```

}

## 1. Project results:

After wiring up hardware, open Arduino IDE to input code and LED will be on.

Turn on flashlight and point at photoresistor, LED is off. Once you move flashlight away, LED will be on again.

Project expansion:

For the test code, we read analog value of photoresistive diode through analog port.

Once the light is irradiated, the analog value read decreases. As the analog value is more than 300, LED will be off, on the contrary, the analog is less than and equivalent to 300, LED on

## **Project 11: Voice-activated**

1. Project instruction

Akin to a microphone, sound sensor can receive sound waves and show the vibration image of sound but not to measure the intensity of noise.

It has a built-in condenser electret microphone that is sensitive to sound.

The sound waves vibrate the electret film in the microphone, which causes the change of capacitance, and generates a correspondingly changed tiny voltage. This voltage is then converted into a 0-5V voltage, received by the data collector after A/D conversion, and sent to Arduino UNO.

1. Project Principle

- Use 5v DC power supply (working voltage 3.3V-5V)
- With analog output AO, real-time microphone voltage signal output
- High sensitivity, electret condenser microphone (ECM) sensor
- Can detect the sound intensity of ambient environment.

Note: This sensor can only identify the presence or absence of sound (according to the principle of vibration) and cannot identify the size of the sound or the sound of a specific frequency.

1. Project circuit



1. Project code

/\*

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Project11

Voice-activated

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```
*/
const int SOUND_PIN = A7;
const int LED_PIN = 13;
void setup() {
pinMode(LED_PIN, OUTPUT);
Serial.begin(9600);
}
void loop() {
// read A7 analog signal
int value = analogRead(SOUND_PIN);
// output signal value
Serial.println(value);
if(value > 5){
// more than threshold, pin 13 is high level and LED on digitalWrite(LED_PIN, HIGH);
delay(100);
}else{
// less than threshold, pin 13 is low level and LED off
digitalWrite(LED_PIN, LOW);
delay(100);
}
}
```

Project 12: 8\*16 dot matrix-turn on a led



1. Project instruction

The 8\*16 dot matrix integrated on the MAX board uses I2C communication. As long as 2 signal pins, up to 128 LEDs can be controlled, and interesting displays such as numbers, characters, and graphics can be displayed.

The 8\*16 dot matrix is also great for making scrolling displays or small video displays. In our example, we set it up so words flow from one matrix to the other. Can be used for advertising display.

The 8\*16 dot matrix uses a HT16K33 driver chip that does all the heavy lifting for you. This chip has a built in clock so they multiplex the display. Through a simple I2C interface, you can control the chip work and drive 8\*16 Dot matrix screen.

Now we are about to start many 8\*16 dot matrix projects, let's first turn on a light on the dot matrix.

## 1. Project circuit





#### 1. Project Principle

http://www.google.com/about

The display principle of 8\*16 dot matrix is very simple. The single-chip microcomputer can drive 8\*16 dot matrix

through HT16K33 chip according to above circuit diagram. The arrangement of the dot matrix is as follows: 8 LED lights in the horizontal direction and 16 LED lights in the vertical direction. The total number of lights is 128. In order to quickly find the position of the light, we number the horizontal lights from 0-7, and the vertical lights from 0-15.



How to turn on a LED on dot matrix?



According to above picture, the coordinate of red point is2,3, and we put coordinate value in the following code.



## 1. Project code

/\*

keyestudio Max Development Board

Project 12

8\*16 dot matrix-turn on a led

http://www.keyestudio.com

\*/

#include <Wire.h>

#include "Keyestudio\_LEDBackpack.h"

#include "Keyestudio\_GFX.h"

Keyestudio\_8x16matrix matrix = Keyestudio\_8x16matrix();

void setup()

{

matrix.begin(0x70); // pass in the address

# }

void loop()

# {

matrix.clear(); // clear display

matrix.drawPixel(2, 3, LED\_ON);

matrix.writeDisplay(); // write the changes we just made to the display

}

# Project 13: 8\*16 dot matrix-turn on one line

# 1. project instruction

In previous program, we light up a coordinate point.

In this project, we will light up a row of LEDs.

# 1. Project Principle



To light a row of LEDs, we need to make use of function matrix.drawLine.

Lighting up the start and terminal point on a row of LEDs indicates all LEDs on this row are on, therefore, we need to decide the start and terminal point of this row of LEDs



Seeing from the above picture, the start point locates (5,0) and the end one is5,15). Next, we place the value in the below code

1. Project circuit



## 1. Project code

```
/*
keyestudio Max Development Board
Project 13
8*16 dot matrix-turn on one line
http://www.keyestudio.com
*/
#include <Wire.h>
#include "Keyestudio_LEDBackpack.h"
#include "Keyestudio_GFX.h"
Keyestudio_8x16matrix matrix = Keyestudio_8x16matrix();
void setup()
{
matrix.begin(0x70); // pass in the address
}
void loop()
{
matrix.clear();
matrix.drawLine(5,0, 5,15, LED_ON);
matrix.writeDisplay(); // write the changes we just made to the display
}
```

# Project 14: 8\*16 dot matrix-draw a rectangle

# 1. Project instruction

I believe that you get more interested in our programs. In this part, we will display a rectangle on 8\*16 dot matrix.

## 1. Project Principle



So, how to show a rectangle? We need use a function matrix.fillRect, which implies that you have to make sure a point on dot matrix so as to draw a square or rectangle, as shown below:



For example, we will draw a rectangle 4 in width and length in 12 from the point2.2). What we need to do is put the value of width and length behind the point2.2). Therefore, we get the code224,12).

If display a square with 4 in width and length, its code are supposed to be (22 4,4.

1. Project circuit



## 1. Project code

/\*

keyestudio Max Development Board

Project 14

8\*16 dot matrix-turn on a rectangle

http://www.keyestudio.com

```
*/
```

#include <Wire.h>

#include "Keyestudio\_LEDBackpack.h"

#include "Keyestudio\_GFX.h"

Keyestudio\_8x16matrix matrix = Keyestudio\_8x16matrix();

void setup()

{

matrix.begin(0x70); // pass in the address

# }

void loop()

{

matrix.clear();

matrix.fillRect(2,2, 4,12, LED\_ON);

matrix.writeDisplay(); // write the changes we just made to the display

}

# Project 15: 8\*16 dot matrix-produce a circle

# 1. Project instruction

In this program, we will generate a circle on 8\*16 dot matrix.

# 1. Project Principle



To show a circle with a radius of 3, we could use a function matrix.drawCircle. Select a central point to decide its coordinate and check radius value, as shown below:



The coordinate of center point of circle is3,8), its radius is 3. We could put value3,8, 3, in the following code. If we want to draw a circle with a constant center point and a radius of 2, we just need to change the value behind coordinate of center point into 2.

1. Project circuit



## 1. Project code

/\*

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Project 15

8\*16 dot matrix-turn on a circle

http://www.keyestudio.com

\*/

#include <Wire.h>

#include "Keyestudio\_LEDBackpack.h"

#include "Keyestudio\_GFX.h"

Keyestudio\_8x16matrix matrix = Keyestudio\_8x16matrix();

void setup()

{

matrix.begin(0x70); // pass in the address

# }

void loop() {

matrix.clear();

matrix.drawCircle(3,8, 3, LED\_ON);

matrix.writeDisplay(); // write the changes we just made to the display

delay(500);

# }

# Project 16: 8\*16 dot matrix-display text and

## numbers

# 1. Project instruction

In this project, we will make 8\*16 dot matrix produce some numbers and texts, like advertisement board at bus station.

# 1. Project Principle

This program is pretty easy. We only need to confirm the coordinate of texts and numbers. Let's conduct an experiment to illustrate.

We set the display area to start from number 3 on horizontal coordinate and number zero on vertical coordinate, as shown below



We add the texts to be shown in the code matrix.print after getting the coordinate of text. Note: numbers can be shown directly, but texts need adding double quotes.



## 1. Project code

/\*

keyestudio Max Development Board

Project 16

8\*16 dot matrix-display text and numbers

http://www.keyestudio.com

\*/

#include <Wire.h>

#include "Keyestudio\_LEDBackpack.h"

#include "Keyestudio\_GFX.h"

Keyestudio\_8x16matrix matrix = Keyestudio\_8x16matrix();

void setup()

{

matrix.begin(0x70); // pass in the address

## }

void loop() {
matrix.setTextSize(1);// set size of text
matrix.setTextWrap(false); // we dont want text to wrap so it scrolls nicely
matrix.setTextColor(LED\_ON);
matrix.setRotation(1);// show rotation
matrix.clear();
matrix.setCursor(3,0);//set the coordinate of text
matrix.print("OK"); //show OK
matrix.writeDisplay();
delay(1000);
}

## Project 17: 8\*16 dot matrix-display images

## 1. Project instruction

A large number of display devices, like cellphone, computer screen and advertisement board, are made of tiny lightemitting unit. The 8\*16 dot matrix aren't able to show exquisite and high pixel pictures but some cute and customized heart-shape picture, smiley face and so on, even though consisting of 128 pcs light-emitting units.

## 2. Project Principle

Introduction for Modulus Tool

The online version of dot matrix modulus tool:

http://dotmatrixtool.com/#



The dot matrix is 8\*16 in this project, thereby, set the height to 8, width to 16, as shown below.







As same as dot matrix on Max board

Click Byte order to select "column major"



Tap endian to set little endian(lsb)

																_	
Generate Clear																	
	Width 🕶 Height 🕶 Byte Order 🕶										<b>-</b>	E	End:	an 👻			
	16px by 8px, column major, little e													e	Big Lit	Endian (MS tle Endian	B) (LSB)

Then we draw the pattern we need.

Click generate to get hexadecimal code.



0x00, 0x04, 0x02, 0x02, 0x04, 0x20, 0x40, 0x40, 0x40, 0x40, 0x40, 0x20, 0x04, 0x02, 0x02, 0x04, 0x00};

Move the above hexadecimal code into the code of the below program.

## 3. Project circuit



# 4. Project code

/\*

keyestudio Max Development Board

Project 17

8\*16 dot matrix-display images

http://www.keyestudio.com

\*/

#include <Wire.h>

#include "Keyestudio\_LEDBackpack.h"

#include "Keyestudio\_GFX.h"

Keyestudio\_8x16matrix matrix = Keyestudio\_8x16matrix();

void setup()

{

matrix.begin(0x70); // pass in the address

}

static const uint8\_t PROGMEM

smile\_bmp[] =

{ 0x00, 0x04, 0x02, 0x02, 0x04, 0x20, 0x40, 0x40, 0x40, 0x40, 0x20, 0x04, 0x02, 0x02, 0x04, 0x00};

void loop() {

//matrix.setRotation(1);

matrix.clear();

matrix.drawBitmap(0, 0, smile\_bmp, 8, 16, LED\_ON);

matrix.writeDisplay();

delay(1000);

}

## Project 18: 8\*16 dot matrix-knob control

## 1. Project instruction

There are on-board button switches on Max board, we will combine button switch and 8\*16 dot matrix to make an interactive display.

# 1. Project principle

The signal pins of two buttons are connected to D2 and D3. Press left button, 8\*16 dot matrix shows"L"; press right button, 8\*16 dot matrix shows"R".

## 1. Project circuit



# 1. Project code

/\*

keyestudio Max Development Board
Project 18
8\*16 dot matrix-knob control
http://www.keyestudio.com
\*/
#include <Wire.h>
#include «Keyestudio\_LEDBackpack.h"
#include "Keyestudio\_GFX.h"
Keyestudio\_8x16matrix matrix = Keyestudio\_8x16matrix();
int K1=3;
int K2=2;
int x;
void setup()
{
matrix.begin(0x70); // pass in the address

```
pinMode(K1,INPUT);
pinMode(K2,INPUT);
matrix.drawCircle(3,8, 3, LED_ON);
matrix.writeDisplay(); // write the changes we just made to the display
}
void loop()
{
int K1_level=digitalRead(K1);
int K2_level=digitalRead(K2);
if(K1\_level==0)
{
matrix.setTextSize(1);
matrix.setTextWrap(false); // we dont want text to wrap so it scrolls nicely
matrix.setTextColor(LED_ON);
matrix.setRotation(1);
matrix.clear();
matrix.setCursor(2,0);
matrix.print("L");
matrix.writeDisplay();
}
if(K2\_level==0)
{
matrix.setTextSize(1);
matrix.setTextWrap(false); // we dont want text to wrap so it scrolls nicely
matrix.setTextColor(LED_ON);
matrix.setRotation(1);
matrix.clear();
matrix.setCursor(9,0);
matrix.print("R");
matrix.writeDisplay();
}}
Project 19: 8*16 dot matrix-light control
```

## 1. project instruction

The light sensor feature that resistance is inverse proportion to to light intensity. Based on this characteristics, we made a night light. In this chapter, we will show you light column on dot matrix.

## 1. Project Principle

The signal pin of light sensor is linked with A6 of MAX development board.

8\*16 dot matrix will show light column, the darker the light intensity is, the shorter the height of light column.

# 1. Project circuit



1. Project code

/\*

keyestudio Max Development Board

Project 19

8\*16 dot matrix-light control

http://www.keyestudio.com

\*/

#include <Wire.h>

#include "Keyestudio\_LEDBackpack.h"

#include "Keyestudio\_GFX.h"

int light = A6;

int Light\_val;

Keyestudio\_8x16matrix matrix = Keyestudio\_8x16matrix();

void setup() {
Serial.begin(9600);
Serial.println("16x8 LED Matrix Test");
pinMode(A6,INPUT);
matrix.begin(0x70); // pass in the address
}
void loop() {
Light\_val=analogRead(A6);
Light\_val=analogRead(A6);
Light\_val=map(Light\_val,0,1023,0,15);
matrix.clear();
matrix.drawLine(3,0, 3,Light\_val, LED\_ON);
matrix.writeDisplay(); // write the changes we just made to the display
delay(10);

}

## Project 20: 8\*16 dot matrix-sound control

## 1. Project instruction

In this lesson, we will create more fantastic programs with microphone sensor and 8\*16 dot matrix

## 1. Project Principle

The signal pin of microphone sensor is connected to A7 of Max development.

The circle on dot matrix will enlarge with the sound intensity. The stronger the sound intensity, the larger the circle gets.

## 1. Project circuit


### 1. Project code

/\*

keyestudio Max Development Board

Project 20

8\*16 dot matrix-sound control

http://www.keyestudio.com

\*/

#include <Wire.h>

#include "Keyestudio\_LEDBackpack.h"

#include "Keyestudio\_GFX.h"

int mic = A7;

Keyestudio\_8x16matrix matrix = Keyestudio\_8x16matrix();

int Mic\_val;

void setup() {

Serial.begin(9600);

Serial.println("16x8 LED Matrix Test");

pinMode(mic,INPUT);

matrix.begin(0x70); // pass in the address

}

void loop() {
Mic\_val=analogRead(mic);
Mic\_val=map(Mic\_val,0,1023,0,10);
matrix.clear();
matrix.drawCircle(3,8,Mic\_val, LED\_ON);
matrix.writeDisplay(); // write the changes we just made to the display
delay(10);

}

### Project 21: 8\*16 dot matrix-game project

### 1. Project instruction

We could play games through Max development board. Can you imagine that?

Let's get started.

### 1. Project Principle

Game 1: gluttonous snake

Press two buttons on max board, the gluttonous snake moves clockwise and anticlockwise.

Note: 1.8.12 version Wire library is not compatible with code when testing code of game 2, you need change library in arduino-1.8.12\hardware\arduino\avr\libraries

Game 2: Break the bricks

Press buttons simultaneously to start.

### 1. Project circuit



### 1. Project code1

/\*

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Project 21

8\*16 dot matrix-gluttonous snake

http://www.keyestudio.com

\*/

#include <Wire.h>

#include <Keyestudio\_GFX.h>

#include <Keyestudio\_LEDBackpack.h>

// Button pin

const int buttonRightPin = 2;

const int buttonLeftPin = 3;

int\* buttonPin;

int\* buttonState;

// Game constants

// buttons const int RIGHTBUTTON = 0; const int LEFTBUTTON = 1; // direction const int TOP = 0; const int RIGHT = 1; const int BOTTOM = 2; const int LEFT = 3; // Snake const int MAX\_SNAKE\_LENGTH = 100; // Variables //Keyestudio\_8x8matrix matrix = Keyestudio\_8x8matrix(); // Display Keyestudio\_8x16matrix matrix = Keyestudio\_8x16matrix(); int direction = TOP; // direction of movement int snakeX[MAX\_SNAKE\_LENGTH]; // X-coordinates of snake int snakeY[MAX\_SNAKE\_LENGTH]; // Y-coordinates of snake int snakeLength = 1; // nr of parts of snake boolean buttonRead = false; // is button already read in this loop unsigned long prevTime = 0; // for gamedelay (ms) unsigned long delayTime = 500; // Game step in ms int fruitX, fruitY; unsigned long fruitPrevTime = 0; unsigned long fruitBlinkTime = 1000/250; int fruitLed = LED ON; void setup(){ Serial.begin(9600); Serial.println("Snake is started"); randomSeed(analogRead(0)); // Init led matrix matrix.begin(0x70); // init buttons int buttonpins[] = {buttonRightPin, buttonLeftPin}; initButtons(buttonpins, 2); // init snake snakeX[0] = 4;snakeY[0] = 7;

```
for(int i=1; i<MAX_SNAKE_LENGTH; i++){</pre>
snakeX[i] = snakeY[i] = -1;
}
makeFruit();
}
void loop(){
checkButtons();
unsigned long currentTime = millis();
if(currentTime - prevTime >= delayTime){
nextstep();
buttonRead = false;
prevTime = currentTime;
}
draw();
}
void initButtons(int pinNumbers[], int length){
Serial.println("initButtons");
// Copy PIN numbers
buttonPin = new int[length];
for(int i=0; i<length; i++){</pre>
buttonPin[i] = pinNumbers[i];
}
// Initialize button state
buttonState = new int[length];
for(int i=0; i<length; i++){</pre>
buttonState[i] = LOW;
}
for(int i=0; i<length; i++)</pre>
{
Serial.print(buttonPin[i]);
Serial.print(buttonState[i]);
}
}
boolean buttonClicked(int index){
// current state
int state = digitalRead(buttonPin[index]);
```

```
boolean buttonClick = false;
// button has pressed
if(buttonState[index] == HIGH){
if(state == LOW){
buttonClick = true;
}
}
buttonState[index] = state;
return buttonClick;
}
void checkButtons(){
if(!buttonRead){
int currentDirection = direction;
if(buttonClicked(LEFTBUTTON)){
direction-;
if(direction < 0)
direction = LEFT;
}
}
else if(buttonClicked(RIGHTBUTTON)){
direction++;
if(direction > 3){
direction = TOP;
}
}
buttonRead = (currentDirection != direction);
}
}
void draw(){
matrix.clear();
drawSnake();
drawFruit();
matrix.writeDisplay();
}
void drawSnake(){
for(int i=0; i<snakeLength; i++){</pre>
```

```
matrix.drawPixel(snakeX[i], snakeY[i], LED_ON);
}
}
void drawFruit(){
if(inPlayField(fruitX, fruitY)){
unsigned long currenttime = millis();
if(currenttime - fruitPrevTime >= fruitBlinkTime){
fruitLed = (fruitLed == LED_ON) ? LED_OFF : LED_ON;
fruitPrevTime = currenttime;
}
matrix.drawPixel(fruitX, fruitY, fruitLed);
}
}
boolean inPlayField(int x, int y){
return (x>=0) && (x<8) && (y>=0) && (y<16);
}
void nextstep(){
for(int i=snakeLength-1; i>0; i-){
snakeX[i] = snakeX[i-1];
snakeY[i] = snakeY[i-1];
}
switch(direction){
case TOP:
snakeY[0] = snakeY[0]-1;
break;
case RIGHT:
snakeX[0] = snakeX[0]+1;
break;
case BOTTOM:
snakeY[0] = snakeY[0]+1;
break;
case LEFT:
snakeX[0]=snakeX[0]-1;
break;
}
if((snakeX[0] == fruitX) \&\& (snakeY[0] == fruitY))
```

```
snakeLength++;
if(snakeLength < MAX_SNAKE_LENGTH){
makeFruit();
}
else {
fruitX = fruitY = -1;
}
}
}
void makeFruit(){
int x, y;
x = random(0, 7);
y = random(0, 15);
while(isPartOfSnake(x, y)){
x = random(0, 7);
y = random(0, 15);
}
fruitX = x;
fruitY = y;
}
boolean isPartOfSnake(int x, int y){
for(int i=0; i<snakeLength-1; i++){</pre>
if((x == snakeX[i]) \&\& (y == snakeY[i])){
return true;
}
}
return false;
1. Project code2
/*
keyestudio Max Development Board
Project 21
8*16 dot matrix-break the bricks
http://www.keyestudio.com
*/
```

#include <Wire.h> #include "Keyestudio\_LEDBackpack.h" #include "Keyestudio\_GFX.h" #include "Breakout.h" Keyestudio\_8x16matrix matrix = Keyestudio\_8x16matrix(); Breakout breakout; int count = 0; void setup() { Serial.begin(9600); Serial.println("8x16 LED Matrix Test"); pinMode(L\_PIN, INPUT); pinMode(R\_PIN, INPUT); matrix.begin(0x70); // pass in the address matrix.setBrightness(0); } void loop() { // action depends on game state - idealy the state should be a part of the Breakout class or a seperate logic class switch(state){ // setup game case SETUP: breakout.restart(); breakout.speed = START\_SPEED; state = START; break; case START: // ready to start the game, changed to PLAY if the action button is pushed. // Change here if paddle should be able to move before you shoot the first ball and start the game. checkActions(); if(actions == SEL)state = PLAY; } break; case LOST: // game lost breakout.lost(); reDraw();

```
blink(10, 100);
breakout.restart();
breakout.speed = START_SPEED;
state = START;
break;
case WON:
// game won
breakout.won();
reDraw();
blink(10, 100);
breakout.restart();
state = START;
break;
case PLAY:
// game in play
{
if(count > breakout.speed){
checkControls();
breakout.play(controls);
count = 0;
if(breakout.bricks == 128){
state = WON;
}
if(breakout.ball.y == 7)
state = LOST;
}
delay(20);
count++;
}
}
reDraw();
}
void reDraw(){
for(int i = 0; i < 8; i++){
for(int j = 0; j < 16; j++){ //change 8 into 16
if(breakout.level[i][16-j-1] != 'E'){
```

```
matrix.drawPixel(i,j,1);
}
else
matrix.drawPixel(i,j,0);
}
}
matrix.writeDisplay();
}
void checkActions(){
int count = 0;
while(count < 5 \ \&\& \ (!digitalRead(R_PIN))\&\&(!digitalRead(L_PIN))) \{
count++;
}
if(count > 4){
actions = SEL;
return;
}
actions = NO;
}
void checkControls(){
int count = 0;
while(count < 5 && (!digitalRead(L_PIN))){
count++;
}
if(count > 4){
controls = LEFT;
return;
}
count = 0;
while(count < 5 && (!digitalRead(R_PIN))){
count++;
}
if(count > 4){
controls = RIGHT;
return;
}
```

```
controls = NONE;
}
void blink(int times, int wait){
for(int i = 0; i < times; i++){
matrix.setBrightness(2);
matrix.writeDisplay();
delay(wait);
matrix.setBrightness(0);
matrix.writeDisplay();
delay(wait);
}
}</pre>
```

### 1. Resource:

https://fs.keyestudio.com/KS0500

## CHAPTER

# TWELVE

# **KS0502 KEYESTUDIO MEGA PRO DEVELOPMENT BOARD**



### Introduction

The MEGA control board, among the series of MCUs, is the most popular since it has numerous pins.

However, a substantial number of pins don't meet the space demand of DIY design. To tackle this issue, we roll out the Keyestudio MEGA PRO development board. In fact, its use method is as same as the official mega board, in addition to the different volume.

Its processor core is ATMEGA2560-16AU. In the meantime, it has 54 digital input/output pins (of which 15 can be used as PWM outputs), 16 analog inputs, 4 channel serial communication ports, a USB connection, 1 ICSP header, and a reset button. And all ports are extended by pins with the interval of 2.54mm.

What's more, you can burn the firmware for ATMEGA2560-16AU through the built-in ICSP port. The firmware of this chip is burnt well before delivery, therefore, you don't need to burn the firmware.

The power can be supplied through USB cable, port 5V, GNDDC 5V, as well as Vin GND (DC 7-12V).

### Specification

Microcontroller: ATMEGA2560-16AU USB to serial chipCH340G Operating Voltage: 5V Input Voltage (recommended):DC 7-12V Digital I/O Pins: 54 (D0-D53) PWM Digital I/O Pins15(D2-D13 D44-D46) Analog Input Pins: 16(A0-A15) DC Current per I/O Pin: 20 mA DC Current for 3.3V Pin: 50 mA Flash Memory: 256 KB of which 8 KB used by bootloader SRAM: 8 KB EEPROM: 4 KB Clock Speed: 16 MHz LED\_BUILTIN:D13

**Pinout Diagram:** 



1	External Power	External input: DC 7-12V
	Ports	
2	Ground	GND
3	5V	DC 5V input/output voltagesupply power for control board when inputting 5V
4	3.3V	Provide DC 3.3V output voltage
5	AREF	Analog reference. Used to set the external reference voltage(0-5V)
6	Reset	Can be connected to press button, as same as reset button
	Button	
	Port	
7	Serial	The default serial communication port RX responds to D0digital port), TX responds to D1digital
	commu-	port)
	nication	
	port	
8	Digital	Have 54 digital input/output pins (of which 15 can be used as PWM outputs). These pins can be
	Ports	configured as digital input pin to read the logic value (0 or 1). Or used as digital output pin to
		drive different modules like LED, relay, etc.
9	Analog	16 analog pins (A0-A15)
	Ports	
10	AT-	Each board has its own microcontroller,. The MCU of this board is ATMEGA2560-16AU.
	MEGA256	0
	Micro-	
	con-	
11	troller	
11	ICSP Pin	the AVR, an Arduino micro-program header consisting of MOSI, MISO, SCK, RESEI, VCC, and
		GND. It is often called the SPI (serial peripheral interface) and can be considered an "extension"
		of the output. In fact, slave the output devices to the SPI bus nost. when connecting to PC,
12	I Indiaa	When D12 is high level LED will be on when it is low level LED will be off
12	tor	when D15 is high level, LED will be on, when it is low level, LED will be on
13	ON Indi	LED is on when control board is plugged in power otherwise, it will be off
15	cator	LED is on when control board is plugged in power, other wise, it will be on
14	TX Indi-	When Arduino board communicates via serial port and sends the message TX led will flash
11	cator	when rited no bourd communicates the series port and series the message, fix fed with husin
15	RX Indi-	When Arduino board communicates via serial port and receive the message RX led will flash
	cator	
16	Reset	Reset your control board
	Button	
17	Micro	Supply power for control board and upload code
	USB	
18	USB to	CH340G, transform USB signals of computer to serial signals
	serial	
	chip	

### **Specialized Functions of Some Pins:**

Serial Communication Port(4-channel)SerialD0 corresponds to RX0, D1 is equivalent to TX0, Serial1D19 corresponds RX1, D18 is equivalent to TX1), Serial2 (D17 corresponds to RX2, D16 stands for TX2) and Serial3D15 stands for RX3, D14 corresponds to TX3.

RXD0and TXD1are connected to the USB to serial chip of CH340G

• Serial Communication: D0 (RX0) and D1 (TX1); Serial 1: D19 (RX1) and D18 (TX1); Serial 2: D17 (RX2) and D16 (TX2); Serial 3: D15 (RX3) and D14 (TX3).

- PWM Pins (Pulse-Width Modulation): D2 to D13, and D44 to D46.
- External Interrupts: D2 (interrupt 0), D3 (interrupt 1), D18 (interrupt 5), D19 (interrupt 4), D20 (interrupt 3), and D21 (interrupt 2).
- SPI communication: D53 (SS), D52 (SCK), D51 (MOSI), D50 (MISO).
- IIC communication: D20 (SDA); D21 (SCL).

#### 4. Windows System

#### 4.1 Download Arduino IDE

When getting this control board, we need to install Arduino IDE

ROFESSIONAL	EDUCATION	STORE		Q Search on Arduine
$\overline{\mathbf{OO}}$			HARDWARE SOFTWARE CLOUD DOCUMENTATION + C	COMMUNITY <del>-</del> Blog About
		Сос	PE ONLINE GETTING STARTED   C terring to the control of the contr	on a Ministra a tri infanta a tri
	[	Dow	nloads	
		Ø	O Arduino IDE 1.8.13	DOWNLOAD OPTIONS Windows Win 7 and newer Windows ZIP file
		The o and u Ardui Refer	pen-source Arduino Software (IDE) makes it easy to write code pload it to the board. This software can be used with any no board. to the <b>Getting Started</b> page for Installation instructions.	Windows app Win 8.1 or 10 Get Linux 32 bits Linux 64 bits Linux ARM 32 bits Linux ARM 64 bits
		sourc Active See th code they o	E CODE e development of the Arduino software is <b>hosted by GitHub</b> . ne instructions for <b>building the code</b> . Latest release source archives are available <b>here</b> . The archives are PGP-signed so can be verified using <b>this</b> gpg key.	Mac OS X 10.10 or newer Release Notes Checksums (sha512)

You can select the latest version—1.8.13. Alternatively, the previous release is your another choice.

In this project, we use 1.8.12 version.

# **Previous Releases**

Download the previous version of the current release, the classic 1.0.x, or old beta releases.

DOWNLOAD OPTIONS

Previous Release (1.8.12)

Arduino 1.0.x Arduino 1.5.x beta Arduino 1.9.x beta

# Previous Release (1.8.12) to enter the new page. As shown below; Click

The Windows installer needs installing manually. Yet, the Windows zip file for non admin installa zip file of Arduino 1.8.12 version, can be directly downloaded and installed.

# Previous IDE Releases

# ARDUINO 1.8.12

Arduino IDE that can be used with any Arduino board, including the Arduino Yún and Arduino DUE. Refer to the Getting Started page for Installation instructions. See the release notes.

Windows Installer Windows ZIP file for non admin install

Mac OS X 10.8 Mountain Lion or newer

Linux 32 bits Linux 64 bits Linux ARM 32 Linux ARM 64

### Source

### 4.2 Install Driver

For this part, we need to install the driver of Arduino IDE

First, let's attach USB cable to computer. The driver can be installed automatically if the PC system is Windows 10, however, you need to install the driver manually if the PC system is other version.

The USB to serial chip of control board is CH340G, therefore, we will install its driver(usb\_ch341\_3.1.2009.06).

Click Computer-Properties-Device Manager, as shown below:

🗄 Device Manager — 🗆 >						
File Action View Help						
DESKTOP-PGHNBN7     Audio inputs and outputs						
> 🍃 Batteries						
> 💻 Computer						
> 🔜 Disk drives						
> 🏣 Display adapters						
> 🔗 DVD/CD-ROM drives						
> 🐺 Human Interface Devices						
> 📷 IDE ATA/ATAPI controllers						
> Keyboards						
Mice and other pointing devices						
> Monitors						
> 🚅 Network adapters						
USB2.0-Serial						
> 📑 Print queues						
> Processors						
Software devices						
Sound, video and game controllers						
Sustant devices						
Iniversal Serial Bus controllers						

Click **USB Serial** and "Update Driver Program"

🗂 Device Manager	_	$\times$
File Action View Help		
V 🗄 DESKTOP-PGHNBN7		
> III Audio inputs and outputs		
> Patteries		
> Computer		
> Disk drives		
> La Display adapters		
> a DVD/CD-ROM anves		
> mi Human Interface Devices		
> The Alay Alapi controllers		
Mice and other pointing devicer		
Network adapters		
V V Other devices		
W USB2.0-Serial		
> 🛱 Print queue Update driver		
> Processors Disable device		
Software de		
> I Sound, vide		
> 🍙 Storage cor 🛛 Scan for hardware changes		
> 🏣 System dev		
> Universal Se Properties		

Jump into the following page and select"Browse my computer for driver software".



Search the usb\_ch341\_3.1.2009.06 folder



After the driver is installed, you need to click Close.



Click Computer— Properties— Device Manager, as shown below

### 📇 Device Manager

File	Ac	tion View Help
•		
		Image: Sktop-PGHNBN7   Audio inputs and outputs   Batteries   Computer   Disk drives   Disk drives   Display adapters   DVD/CD-ROM drives   Human Interface Devices   IDE ATA/ATAPI controllers   Keyboards   Mice and other pointing devices   Monitors   Network adapters
		Processors Software devices Sound, video and game controllers Storage controllers System devices Universal Serial Bus controllers

### 4.3 Arduino IDE Setting





When downloading the sketch to the board, you must select the correct name of Arduino board that matches the board connected to your computer. As shown below;

🥺 sketch_jul15a	Arc	duino 1.8.12 -	_		×	
File Edit Sketch	Тоо	ls Help				
	4	Auto Format	Ctrl	+T		
		Archive Sketch				
sketch_jul15a		Fix Encoding & Reload				Boards Manager
<pre>void setup() {</pre>	1	Manage Libraries	Ctrl	+Shift+I		Arduino AVR Boards
// put your		Serial Monitor	Ctrl	+Shift+M	I	Arduino Yún
}		Serial Plotter	Ctrl	+Shift+L		Arduino Uno
		WiFi101 / WiFiNINA Firmware Updater				Arduino Duemilanove or Diecimila
<pre>void loop() {      // put your</pre>	_	······· , ····························			_	Arduino Nano
// put your		Board: "Arduino Mega or Mega 2560"			<b>)</b>	Arduino Mega or Mega 2560
}		Processor: "ATmega2560 (Mega 2560)"				Arduino Mega ADK
		Port				Arduino Leonardo
		Get Board Info				Arduino Leonardo ETH
		Programmer: "AVRISP mkII"			>	Arduino Micro
		Burn Bootloader				Arduino Esplora
l					-	Arduino Mini
						Arduino Ethernet
						Arduino Fio
						Arduino BT
						LilyPad Arduino USB
						LilyPad Arduino
						Arduino Pro or Pro Mini
						Arduino NG or older
						Arduino Robot Control
1		Arduino Mega or Mega 2560, ATmeg	a2560	) (Mega 25	80	Arduino Robot Motor

Then select the correct COM port (you can see the corresponding COM port after the driver is successfully installed).

### **Board for Arduino**

\_

 $\times$ 

### 📇 Device Manager

File	Act	tion View Help
<hr/>		
∨ ∄	DE	SKTOP-PGHNBN7
>	1	Audio inputs and outputs
>	\$	Batteries
>	-	Computer
>	-	Disk drives
>	-	Display adapters
>	_0	DVD/CD-ROM drives
>	M	Human Interface Devices
>	-	IDE ATA/ATAPI controllers
>		Keyboards
>	0	Mice and other pointing devices
>	1	Monitors
>	-	Network adapters
~	<b>P</b>	Ports (COM & LPT)
		USB-SERIAL CH340 (COM16)
>		Print queues
>	Ū	Processors
>		Software devices
>	1	Sound, video and game controllers
>	¥	Storage controllers
>	-	System devices
>	Ψ.	Universal Serial Bus controllers





- A- Used to verify whether there is any compiling mistakes or not.
- B- Used to upload the sketch to your Arduino board.
- C- Used to create shortcut window of a new sketch.
- D- Used to directly open an example sketch.
- E- Used to save the sketch.
- F- Used to send the serial data received from board to the serial monitor.

4.4 Start A Program

Open the file to select **Example**, and click **BASIC>BLINK**, as shown below:

				1	_	
0	sketch_apr15a	a   Arduino 1.8.1		Δ		
File	File Edit Sketch Tools Help			Built-in Examples		
	New	Ctrl+N		01.Basics	2	AnalogReadSerial
	Open	Ctrl+O		02.Digital	1	BareMinimum
	Open Recent			03.Analog	1	Blink
L _	Sketchbook			04.Communication		DigitalReadSerial
	Examples	3		05.Control	2	Fade
	Close	Ctrl+W		06.Sensors	>	ReadAnalogVoltage
L 1	Save	Ctrl+S		07.Display	>	
	Save As	Ctrl+Shift+S		08.Strings	>	
L 1				09.USB	>	
	Page Setup	Ctrl+Shift+P		10.StarterKit_BasicKit	>	
	Print	Ctrl+P		11.ArduinoISP	>	
	Preferences	Ctrl+Comma		Examples for any board		
L 1	Ouit	Ctrl+O		Adafruit BMP280 Library	>	
				Adafruit Circuit Playground	>	
				Adafruit TiCoServo	>	
				Adafruit NeoPixel master	>	
				Adafruit PWM Servo Driver Library master	>	
				Adafruit SSD1306	>	
				- Adafruit TFTLCD3-2	>	
				Bridge	>	
				CCS811	>	
				DFRobot ST7687S-master	>	
				Dht11	>	
				DS1302		
1		Arduino Meg				



Set the correct **COM port**, and the corresponding board and COM port are shown on the lower right of IDE.



Click to start compiling the program, and check errors.



Click to upload the program

💿 Blink   Arduino 1.8.12	- 🗆 X
File Edit Sketch Tools Help	
	<mark>⊅</mark>
Blink	
This example code is in the public	c domain.
http://www.arduino.cc/en/Tutorial/ */	<u>/Blink</u>
<pre>// the setup function runs once when void setup() { // initialize digital pin LED_BUII</pre>	n you press reset or power the CTIN as an output.
<pre>pinMode(LED_BUILTIN, OUTPUT); }</pre>	
<pre>// the loop function runs over and o void loop() {</pre>	over again forever
<pre>digitalWrite(LED_BUILTIN, HIGH);</pre>	// turn the LED on (HIGH is $\ensuremath{t}$
delay(1000);	// wait for a second
digitalwrite(LED_BOILIN, LOW);	// turn the LED off by making
}	// wait for a second
<	>
Done uploading.	
Sketch uses 1448 bytes (0%) of progr Global variables use 9 bytes (0%) of	am storage space. Maximum is 253 dynamic memory, leaving 8183 by
<	
23	Arduino Mega or Mega 2560 on COM16

After the program is uploaded successfully, the onboard LED blinks. Congratulation, you finish the first program.

- 5. MAC System
- 5.1 Install Arduino IDE on MAC System

The installation instruction is as same as the chapter 4.1, as shown below:

# ARDUINO 1.8.12

Arduino IDE that can be used with any Arduino board, including the Arduino Yún and Arduino DUE. Refer to the Getting Started page for Installation instructions. See the release notes.

Windows Installer Windows ZIP file for non admin install

Mac OS X 10.8 Mountain Lion or newer

Linux 32 bits Linux 64 bits Linux ARM 32 Linux ARM 64

# Source

5.2 Download the Driver of CH340

https://fs.keyestudio.com/CH340-MAC

5.3 How to Install the Driver of CH340

https://wiki.keyestudio.com/Download\_CH340\_Driver\_on\_MAC\_System

5.4 Arduino IDE Setting

The setting method is as same as the chapter 4.3 except from COM port, as shown below.

### **Board for Arduino**

🗯 Arduino File Edit Sketch	Tools Help				
sketch_nov19a	Auto Format Archive Sketch Fix Encoding & Reload Manage Libraries Serial Monitor				
<pre>// put your setup code here, to r } void loon() {</pre>	WiFi101 / WiFiNINA Firmware Updater ArduBlock				
// put your main code here, to run	Board: "Arduino Mega or Mega 2560" Processor: "ATmega2560 (Mega 2560) Port: "/dev/cu.SLAB_USBtoUART" Get Board Info Programmer: "AVRISP mkII" Burn Bootloader		Serial ports /dev/cu.AODUNA6-B-JL_HSP /dev/cu.Bluetooth-Incoming-Port ✓ /dev/cu.SLAB_USBtoUART /dev/cu.usbserial-0001		
0		scrat ze	cn top.zip		
Done uploading.					
#### CHAPTER

## THIRTEEN

## KS0546 KEYESTUDIO 328 PLUS DEVELOPMENT BOARD



#### 1.Description

Doing experiments with electronic products, we often program on the Arduino IDE development environment with Arduino series microcontrollers.

Keyestudio 328 PLUS control board is fully compatible with Arduino IDE development environment. It is as same as the Arduino UNO R3 board. Moreover, some improvements we made highly strengthen its function(as shown below). In order to wire efficiently, we equip it with a 1m USB cable with type-c interface for you.



#### Keyestudio 328 PLUS

- 1. USB CH340C, stability and compatibility are better forto-turn chip
- 2. Two more IO mouth, A6,A7, the best

3. Extended serial communication and I2C interface, can be easily connected to similar devices

4. Unique DC-DC power supply design, working

high current load, such as steering gear and motor

voltage 5 V, the current of 2 A, can directly drive some





#### Arduino UNO R3



1. USB turnstile chip is 16 U2, Some systems are not compatible



2. Design did not leave these 2 IO ports, defective



3. No expansion port, more complex connection required



4. Working voltage 5 V, the current only 1 A, can not drive the equipment with high current.



5. No expansion port, more complex connection required







7. Input voltage 7-12 V, optional power supply mode is not

8. Adopt traditional square USB interface, more common

6. Extended serial communication and I2C interface, can be easily connected to similar devices

5. Extension of 6 PWM ports and 6 analog

port interfaces to connect sensors directly

7. Input voltage 6-15 V, wider voltage range, choose more

8. Choose the current more popular type-c interface, beautiful and generous, faster transmission speed

#### 2.Specification

MicrocontrollerATMEGA328PB USB to serial chip: CH340C Working voltage: 5V External power: DC 6-15V (recommend 9V)

Digital I / O pins: 14 (D0-D13)

PWM channel: 6 (D3 D5 D6 D9 D10 D11)

Analog input channel (ADC): 8 (A0-A7)

Each I / O Port of DC output capability : 10 mA

Output capability of 3.3V port: MAX150 mA



Flash Memory: 32 KB (of which 0.5 KB is used by the bootloader) SRAM: 2 KB (ATMEGA328PB) EEPROM: 1 KB (ATMEGA328PB) Clock speed: 16MHz On-board LED pin: D13

3. Interfaces



4. Specialized Functions of Some Pins:



Serial communication interface: D0 is RX, D1 is TX

PWM interface (pulse width modulation): D3 D5 D6 D9 D10 D11

External interrupt interface: D2 (interrupt 0) and D3 (interrupt 1)

SPI communication interface: D10 is SS, D11 is MOSI, D12 is MISO, D13 is SCK

IIC communication port: A4 is SDA, A5 is SCL

5. Install Arduino IDE and Driver

#### 5.1 Download the Arduino IDE

When getting this control board, we need to install Arduino IDE.



Download the version you want and the latest one is available for downloading too.

## Download the Arduino IDE



ARDUINO 1.8.13

The open-source Arduino Software (IDE) makes it easy to write code and upload it to the board. It runs on Windows, Mac OS X, and Linux. The environment is written in Java and based on Processing and other open-source software. This software can be used with any Arduino board. Refer to the <u>Getting Started</u> page for Installation instructions.

Windows Installer. for Windows 7 and up Windows ZIP file for non admin install

Windows app Requires Win 8.1 or 10

Mac OS X 10.10 or newer

Linux 32 bits Linux 64 bits Linux ARM 32 bits Linux ARM 64 bits

Release Notes Source Code Checksums (sha512)

Alternatively, you could select previous release.

In this project, we use 1.8.12 version

#### **Previous Releases**

Download the previous version of the current release the classic Arduino 1.0.x, or the Arduino 1.5.x Beta version.

All the Arduino OOxx versions are also available for download. The Arduino IDE can be used on Windows, Linux (both 32 and 64 bits), and Mac OS X.

# Click previous version of the current release to view the below page

## ARDUINO 1.8.12

Arduino IDE that can be used with any Arduino board, including the Arduino Yún and Arduino DUE. Refer to the Getting Started page for Installation instructions. See the release notes.

Windows Installer Windows ZIP file for non admin install

Mac OS X 10.8 Mountain Lion or newer

Linux 32 bits Linux 64 bits Linux ARM 32 Linux ARM 64

Source

Click **Windows Installer** to download an installer of Arduino 1.8.12 versionwhich needs to be installed manually. When you tap **Windows ZIP file for non admin install** a zip file of Arduino 1.8.12 version will be directly downloaded, and you only need to unzip it to finish the installation.

# Contribute to the Arduino Software

Consider supporting the Arduino Software by contributing to its development. (US tax payers, please note this contribution is not tax deductible). Learn more on how your contribution will be used.



For different operating system, there may be slight difference in installation method. Below is an example in WIN 7.

When you connect Arduino Uno to your computer the first time, right click "Computer" —> "Properties"—> "Device manager", you can see "USB2.0-Serial".



Click "USB2.0-Serial", select "Update Driver software".

🚔 Device Manager			- • •
File Action View	Help		
(+ +) 🖬 🛐	2 🖬 🧔 🖹 🙀 🐻		
<ul> <li>keyess-PC</li> <li>Batteries</li> <li>Bluetooth R</li> <li>Computer</li> <li>Disk drives</li> <li>Disk drives</li> <li>Display ada</li> <li>Human Inte</li> <li>IDE ATA/AT</li> <li>The ATA/AT</li> <li>The ATA/AT</li> <li>The ATA/AT</li> <li>The ATA/AT</li> <li>Mice and of</li> <li>Monitors</li> <li>Network ada</li> <li>Other device</li> </ul>	Radios pters erface Devices FAPI controllers vices ther pointing devices lapters		
D - → → → → → → → → → →	Update Driver Software Disable & Uninstall Scan for hardware changes Properties		
Launches the Update D	river Software Wizard for the selecte	d device.	

In this page, click "Browse my computer for driver software".



Find the "usb\_ch341\_3.1.2009.06" file,Click "Next".



Installation completed; click "Close".



After driver is installed, go to "Device manager" again. Right click "Computer" —> "Properties"—> "Device manager", you can see CH340 device as below figure shows, also the Com port info.



#### 2.MAC system

Download CH340 driver

https://sparks.gogo.co.nz/ch340.html

1. Click V1.5 CH340 MaxOS Driver package

Gogo:Tronics Hobby Electronic Parts	Home	Electronic Components Online Shop	Tools, Docs, Downloads	Shipping & Payment Info	Contact O	Gogo:Tronic Hobby Electronic Pa
Older Windows Dri Download the Windows CH340 f Unzip the folder: If you are running a 64Bit Wind If you are running a 32Bit Wind If you don't know, try the 64 bit a In the Arduino IDE when the CH3 system:	Driver Driver dows: - rur dows: - rur nd if it does 340 is conn	THE SETUP_64.EXE installer. The SETUP_64.EXE installer. The SETUP_32.EXE installer. In twork, the 32 bit. Twork, the 32 bit. The second comport in the Tools		4 number for your device may	-vary-depending on y	Older Window • Download the Window • Unzip the folder: • If you are running a • If you are running a • If you don't know, try t • In the Arduino IDE wh system:
Macintosh						Macintosh
(Manufacturer's Chinese Info Lin	ik)					(Manufacturer's Chine
The following github has up to da	ay pkg files	for 1.3, 1.4 and 1.5 at time of writing, than	ks to Joshua Wallis for bringir	ng this to my attention		The following github h
https://github.com/ac	drianmi	halko/ch340g-ch34g-ch34	x-mac-os-x-driver			https://github.
Direct Download Links (from t	he github r	epo above):				Direct Download Lin
V1.5 CH340 MaxOS Driver Pkg						V1.5 CH340 MaxOS
V1.4 CH340 MacOS Driver Pkg						V1.4 CH340 MacOS
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See the github link above for inst	tallation inst	tructions if you need them.				See the github link ab
1. After the download	l, seen a	s below:				



1. click installation package and tap Continue



#### 1. Click Install



1. Input your user password and click Install Software

	🤗 Install CH34x_Install	
<ul> <li>Introduc</li> <li>Destinat</li> <li>Installat</li> <li>Installati</li> <li>Summar</li> </ul>	Installer is trying to install new software. Enter your password to allow this. Username: Angle Password:	oftware
	Cancel Install Software	
	Go Back	Install

1. Tap Continue Installation

		💝 Install CH34	x_Install		É
•	Introductic	When this software must restart your co you want to install t	finishes installing omputer. Are you s he software now?	, you sure	
•	Destinatio	Cancel	Continue Instal	lation	software
	Installatic	Curreer	Continue instan		
•					
•					
			(	Go Back	Install

1. Wait to install



1. Click Restart after the installation is finished

	🥪 Install CH34x_Install	
	The installation was completed successfully.	
<ul> <li>Introduction</li> <li>Destination Select</li> <li>Installation Type</li> <li>Installation</li> <li>Summary</li> </ul>	<b>The installation was successful.</b> The software was installed. Click Restart to begin installing the software.	
	Co Book	
	Go Back Restart	•

#### 5.3 Arduino IDE Setting





To avoid the errors when uploading the program to the board, you need to select the correct Arduino board that matches the board connected to your computer.

Then come back to the Arduino software, you should click Tools→Board, to select the board. (as shown below)

🥺 sketch_jul17a	Arduino 1.8.12	_		×	
File Edit Sketch	Tools Help				
	Auto Format	Ctrl+	Т		
	Archive Sketch				
sketch_jul17a	Fix Encoding & Reload				Danada Managan
<pre>void setup() {</pre>	Manage Libraries	Ctrl+	Shift+I		Boards Manager
// put your	Serial Monitor	Ctrl+	Shift+M		Arduino AVR Boards
}	Serial Plotter	Ctrl+	Shift+L		Arduino Yún
	WiEi101 / WiEiNINA Eirmware U	odatar	L	•	Arduino Uno
<pre>void loop() {</pre>	winter, wintered	puater		_	Arduino Duemilanove or Diecimila
// put your	Board: "Arduino Uno"			2	Arduino Nano
}	Port	1		2	Arduino Mega or Mega 2560
	Get Board Info				Arduino Mega ADK
	Programmer: "AV/RISD mkII"				Arduino Leonardo
	Purp Pootloader			1	Arduino Leonardo ETH
	Burn Boolloader			_	Arduino Micro
					Arduino Esplora
					Arduino Mini
					Arduino Ethernet
					Arduino Fio
					Arduino BT
					LilyPad Arduino USB
					LilyPad Arduino
Invalid library	found in C:\Users\Administrato	r\Desktop\A	rduino	1	Arduino Pro or Pro Mini
					Arduino NG or older
<					Arduino Robot Control
5		Arduino U	no on COM	4	Arduino Robot Motor

Then select the correct COM port (you can see the corresponding COM port after the driver is successfully installed)





Before uploading the program to the board, let's demonstrate the function of each symbol in the Arduino IDE toolbar.

🥺 sketch_apr03a   Arduino 1.8.12	_		×
File Edit Sketch Tools Help			
			Ø
ketch_apr0.a			
<pre>voli setur() {     // put your setur code here, to run once:</pre>			^
ABCDE	F		
<pre>void loop() {     // put your main code here, to run repeatedly:</pre>			
}			
			~
1	Arduino	Uno on C	OM7

- A- Used to verify whether there is any compiling mistakes or not.
- B- Used to upload the sketch to your Arduino board.
- C- Used to create shortcut window of a new sketch.
- D- Used to directly open an example sketch.
- E- Used to save the sketch.
- F- Used to send the serial data received from board to the serial monitor.

#### **5.4Start First Program**

Open the file to select Example, and choose BLINK from BASIC, as shown below:

$\odot$	sketch_jul17a	Arduino 1.8.12		∆ Built-in Examples	-	) X	
File	Edit Sketch	Tools Help	F	01 Basics	,	Analog	ReadSerial
	New	Ctrl+N		02 Digital		BareMi	nimum
	Open	Ctrl+O		02.Digital		Blink	
	Open Recent	t >		03.Analog	1	Digital	PeadSerial
	Sketchbook	2		05 Control	1	Eada	teausenar
	Examples	3		06 Sensors	]	ReadAr	alogVoltage
	Close	Ctrl+W		07 Display		Reduki	lalogvoltage
	Save	Ctrl+S		08 Strings	Ś		
	Save As	Ctrl+Shift+S		09 LISB	Ś		
	Page Setup	Ctrl+Shift+P		10 StarterKit BasicKit	Ś		
	Print	Ctrl+P		11.ArduinoISP	>		
		curri			_		
	Preferences	Ctrl+Comma		Examples for any board			
	Quit	Ctrl+Q		Adafruit Circuit Playground	>		
				Bridge	>		
				Esplora	>		
				Ethernet	>		
				Firmata	>		
				GSM	>		
				LiquidCrystal	>	~	
				LiquidCrystal I2C	>		
Inva	lid library	found in C:\		MCP23017-Arduino-Library	>	uino ID 🔥	
Inva	alid library	found in C:\		Robot Control	>	luino ID	
				Robot Motor	>	~	
<				SD	>	>	
5				Servo	>	on COM7	



Set board and COM port, the corresponding board and COM port are shown on the lower right of IDE.



Click to start compiling the program, check errors.



Click to upload the program, upload successfully.

🥺 Blink   Arduino 1.8.12		_		×
File Edit Sketch Tools Help				
				ø
Blink				
This example code is in the public	c domain.			
http://www.arduino.cc/en/Tutorial/ */	/Blink			
<pre>// the setup function runs once when void setup() { // initialize digital pin LED_BUII i i i i i i i i i i i i i i i i i</pre>	n you press res LTIN as an outp	set or	power	the
<pre>pinMode(LED_BUILTIN, OUTPUT); }</pre>				
<pre>// the loop function runs over and o void loop() {</pre>	over again fore	ever		
<pre>digitalWrite(LED_BUILTIN, HIGH);</pre>	// turn the l	LED on	(HIGH	is t
delay(1000);	// wait for a	a secor	nd	
digitalwrite(LED_BOILIN, LOW); delaw(1000):	// turn the I	LED OII	t by ma bd	akinç
	// wait for a	1 30001	i ci	~
·				>
Done uploading.				
Invalid library found in C:\Users\Ad	ministrator\De	sktop\i	Arduin	
invarid library found in c. (05efs Ad	ministrator (De	arcob/		~
<				>
1		Arduino	Uno on C	COM7

Upload the program successfully, the onboard LED lights on for 1s, lights off for 1s. Congratulation, you finish the first program.

#### 6.Troubleshooting

1.If test code can't be uploaded, click



(verifying test code) doesn't work, there is something wrong with the test code or Arduino However, if clicking IDE.



2.If test code can be verified but not be uploaded, check the correct development board or COM port you choose.

3.If you can't select the correct COM port, just check if the driver of the development board is installed successfully.(refer to 5.2)



4. Since unstable power supply from USB, you can change different USB ports if the development board can't be recognized.

5. When uploading test code, TXRX of the development board is not allowed to be used(fail to upload test code).

If the Bluetooth module is used, upload test code then install the BT module

#### CHAPTER

### FOURTEEN

## **KS0547 KEYESTUDIO NANO PLUS DEVELOPMENT BOARD**



#### 1.Description

The processor core of Keyestudio NANO PLUS is ATMEGA328P-AU. It is as same as the official Arduino Nano in addition to driver file and USB to serial chip (CH340G).

It also has 14 digital input / output interfaces (6 of which can be used as PWM output), 8 analog input interfaces, 1 16MHz crystal oscillator, 1 mini USB port, 1 ICSP interface and a reset button.

The ICSP interface is used to program the Atmega328P-Au. We can supply power with a type-CUS cable or the port VIN GND (DC 7-12V)

#### 2.Specification

Microcontroller: ATMEGA328P-AU Operating Voltage: 5V Input Voltage (recommended): DC 7-12V Digital I/O Pins: 14 (D0-D13) PWM Digital I/O Pins6 (D3 D5 D6 D9 D10 D11) Analog Input Pins: 8(A0-A7) DC Current per I/O Pin: 40 mA Flash Memory: 32 KB of which 2 KB used by bootloader

#### SRAM:2 KB

EEPROM: 1 KB

Clock Speed:16 MHz

LED\_BUILTIN:D13

Pins





1	ICSP	ICSP (In-Circuit Serial Programming) Header ICSP is the AVR, an micro-program header
	Heade	r consisting of MOSI, MISO, SCK, RESET, VCC, and GND. It is often called the SPI (serial
		peripheral interface) and can be considered an "extension" of output. In fact, slave the
		output devices under the SPI bus host. When connecting to PC, program the firmware to
		ATMEGA328P-AU.
2	LED	Onboard you can find the label: RX(receive ) When control board communicates via serial port,
	indi-	receive the message, RX led flashes.
	cator	
	RX	
3	LED	Onboard you can find the label: TX (transmit) When control board communicates via serial port,
	indi-	send the message, TX led flashes.
	cator	
	TX	
4	LED	Power up the control board, LED on, otherwise LED off.
	ındı-	
	cator	
=	POW	There is a huilt in LED driven by disited air 12. When the size is IUCU value, the LED is an other
3	LED in di	There is a built-in LED driven by digital pin 13. when the pin is HIGH value, the LED is on, when
	indi-	the pin is LOW, it's off.
	cator T	
6	L	It has 14 digital input/output ning D0 D12 (of which 6 can be used as DW/M outputs). These ning
0	KAUDU TV1D1	on the sent formed as disited input ring to read the losis value (0 or 1). Or used as disited outputs in to
	1A1D1 D2	drive different modules like LED, relev. etc.
	D2- D13	drive different modules like LED, relay, etc.
7	RST	Reset pin: connect external button. The function is the same as RESET button
8	MEGA	Fach board has its own microcontroller. You can regard it as the brain of your board. Microcontrollers
Ŭ	328P	are usually from ATMEL. Before you load a new program on the Arduino IDE, you must know
	0201	what IC is on your board. This information can be checked at the top surface of IC. The board's
		microcontroller is ATMEGA328P-AU. More info. see the datasheet
9	MINI	The board can be powered via Mini-B USB connection. Also upload the program to the board via
	USB	USB port.
10	3V3	Provides 3.3V voltage output
	pin	
11	REF	Reference external voltage (0-5 volts) for the analog input pins. Used with analogReference().
12	A0-	The Nano has 8 Analog Pins, labeled A0 through A7.
	A7	
13	5V	Provides 5V voltage output
	pin	
14	GND	Ground pin
15	VIN	Input an external voltage DC7-12V to power the board.
16	Reset	Used to reset the control board
	But-	
	ton	
17	CH340	GUSB-to-serial port chip, converting the USB signal into Serial port signal.
18	AMS11	10 onvert the external voltage input DC7-12V into DC5V, then transfer it to the processor and other
		elements.

#### **3.**Specialized Functions of Some Pins

- Serial communication: 0 (RX) and 1 (TX). Used to receive (RX) and transmit (TX) TTL serial data.
- PWM (Pulse-Width Modulation): D3, D5, D6, D9, D10, D11

- External Interrupts: D2 (interrupt 0) and D3 (interrupt 1). These pins can be configured to trigger an interrupt on a low value, a rising or falling edge, or a change in value. See the attachInterrupt() function for details.
- SPI communication: D10 (SS), D11 (MOSI), D12 (MISO), D13 (SCK).
- IIC communication: A4 (SDA); A5(SCL)

#### 4.Windows System

4.1 Download the Arduino IDE

When getting this control board, we need to install Arduino IDE

Enter the wel	osite https://	www.arduino.cc/and click	OWNLOADS
PROFESSIONAL	EDUCATION	STORE	Q Search on Arduino.cc
ΘO		HARDWARE SOFTWARE CLOUD DOCUMENTATION -	COMMUNITY <del>v</del> blog about
		CODE ONLINE GETTING STARTED	4 CONTRACTOR CONT
	[	Downloads	
		Arduino IDE 1.8.13 The open-source Arduino Software (IDE) makes it easy to write co	DOWNLOAD OPTIONS Windows Win 7 and newer Windows ZIP file Windows app Win 8.1 or 10 Get
		and upload it to the board. This software can be used with any Arduino board. Refer to the <b>Getting Started</b> page for Installation instructions.	Linux 32 bits Linux 64 bits Linux ARM 32 bits Linux ARM 64 bits
		SOURCE CODE Active development of the Arduino software is <b>hosted by GitHub</b> See the instructions for <b>building the code</b> . Latest release source code archives are available <b>here</b> . The archives are PGP-signed so they can be verified using <b>this</b> gpg key.	Mac OS X 10.10 or newer Release Notes Checksums (sha512)

You can select the latest version—1.8.13. Alternatively, the previous release is your another choice.

In this project, we use 1.8.12 version.

## **Previous Releases**

Download the previous version of the current release, the classic 1.0.x, or old beta releases.

DOWNLOAD OPTIONS

Previous Release (1.8.12)

Arduino 1.0.x Arduino 1.5.x beta Arduino 1.9.x beta

## Previous Release (1.8.12) to enter the new page. As shown below; Click

The Windows installer needs installing manually. Yet, the Windows zip file for non admin installa zip file of Arduino 1.8.12 version, can be directly downloaded and installed.

# Previous IDE Releases

## ARDUINO 1.8.12

Arduino IDE that can be used with any Arduino board, including the Arduino Yún and Arduino DUE. Refer to the Getting Started page for Installation instructions. See the release notes.

Windows Installer Windows ZIP file for non admin install

Mac OS X 10.8 Mountain Lion or newer

Linux 32 bits Linux 64 bits Linux ARM 32 Linux ARM 64

Source

# Contribute to the Arduino Software

Consider supporting the Arduino Software by contributing to its development. (US tax payers, please note this contribution is not tax deductible). Learn more on how your contribution will be used.



JUST DOWNLOAD	CONTRIBUTE & DOWNLOAD	
Click icon		to download Arduino IDE.
4.2 Download Driver of CH340		
https://fs.keyestudio.com/CH340-WIN		
4.3 Install the Driver		

For this part, we need to install the driver of Arduino IDE

First, let's attach USB cable to computer. The driver can be installed automatically if the PC system is Windows 10, however, you need to install the driver manually if the PC system is other version.

The USB to serial chip of control board is CH340G, therefore, we will install its driver(usb\_ch341\_3.1.2009.06).

Click Computer-Properties-Device Manager, as shown below:

📇 Device Manager	_	×
File Action View Help		
DESKTOP-PGHNBN7		
> III Audio inputs and outputs		
> @ batteries		
> Computer		
> Disk drives		
> W DVD/CD POM driver		
Human Interface Devices		
> IDE ATA/ATAPI controllers		
Keyboards		
Mice and other pointing devices		
Monitors		
> 📮 Network adapters		
V Other devices		
USB2.0-Serial		
> 🖻 Print queues		
>  Processors		
> 📱 Software devices		
> 🐗 Sound, video and game controllers		
> 🍇 Storage controllers		
> 🏣 System devices		
> 🏺 Universal Serial Bus controllers		

Click **ISB Serial** and "Update Driver Program"
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Jump into the following page and select"Browse my computer for driver software".



Search the usb\_ch341\_3.1.2009.06 folder

		×
←	Update Drivers - USB2.0-Serial	
	Browse for drivers on your computer	
	Search for drivers in this location:	
	C:\Users\Administrator\Desktop\usb_ch341_3.1.2009.06 ~ Browse	
	Include subfolders	
	→ Let me pick from a list of available drivers on my computer This list will show available drivers compatible with the device, and all drivers in the same category as the device.	
	Next Cance	el

After the driver is installed, you need to click Close.

http://wiki.keyestudio.com/index.php/File:Driver\_6.png



Click Computer— Properties— Device Manager, as shown below.

## **Board for Arduino**

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## 🛔 Device Manager

File	Act	ion View Help
∨ ∄	DES	SKTOP-PGHNBN7
>	4	Audio inputs and outputs
>	\$	Batteries
>		Computer
>	_	Disk drives
>		Display adapters
>	0	DVD/CD-ROM drives
>	20	Human Interface Devices
>		IDE ATA/ATAPI controllers
>		Keyboards
>		Mice and other pointing devices
>		Monitors
>		Network adapters
~	÷.	Ports (COM & LPT)
		USB-SERIAL CH340 (COM3)
>		Print queues
>		Processors
>	-	Software devices
>	4	Sound, video and game controllers
>	<b>S</b>	Storage controllers
>		System devices
>	Ŷ	Universal Serial Bus controllers

### 4.4 Arduino IDE Setting





When downloading the sketch to the board, you must select the correct name of Arduino board that matches the board connected to your computer. As shown below;

፩ sketch_oct14b	Arduino 1.8.12	_		×		
File Edit Sketch 🚺	Tools Help					
	Auto Format	Ctrl	+T			
	Archive Sketch					
sketch_oct14b	Fix Encoding & Reload				Boards Manage	r
<pre>void setup()</pre>	Manage Libraries	Ctrl	+Shift+I		Arduino AVR Bo	ards
// put you	Serial Monitor	Ctrl	+Shift+M		Arduino Yún	
	Serial Plotter	Ctrl	+Shift+L		Arduino Uno	
}					Arduino Duemila	nove or Diecimila
	WIFITOT / WIFININA FIRMW	are Updater		٠	Arduino Nano	
<pre>void loop()</pre>	Board: "Arduino Nano"			4	Arduino Mega o	r Mega 2560
// put you	Processor: "ATmega328P"				Arduino Mega A	DK
1	Port: "COM16"				Arduino Leonard	lo
I	Get Board Info		/		Arduino Leonard	lo ETH
					Arduino Micro	
	Programmer: "AVRISP mkl	II			Arduino Esplora	
	Burn Bootloader				Arduino Mini	
					Arduino Etherne	t
					Arduino Fio	
					Arduino BT	
					LilyPad Arduino	USB
					LilyPad Arduino	
					Arduino Pro or F	Pro Mini
					Arduino NG or o	older
					Arduino Robot C	Control
					Arduino Robot M	Notor
1		Arduino N	ano on COM		Arduino Gemma	



Then select the correct COM port (you can see the corresponding COM port after the driver is successfully installed).





- A- Used to verify whether there is any compiling mistakes or not.
- B- Used to upload the sketch to your Arduino board.
- C- Used to create shortcut window of a new sketch.
- D- Used to directly open an example sketch.
- E- Used to save the sketch.
- F- Used to send the serial data received from board to the serial monitor.
- 4.5 Setting IDE for New Bootloader

Arduino Nano board could burn new and old bootloader. New bootloader is only compatible with 1.8.9 IDE and above. Yet the old one is compatible with all versions.



4.6 Select Your Serial Port

Select the serial device of the Arduino board from the **Tools | Serial Port menu**. **Note:** to avoid errors, the COM Port should keep the same as the Ports shown on Device Manager.

## 🛔 Device Manager

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File		Action	View	Help			
<b>(</b>	•	:4		? 🖬	<b>P</b>	<u>⊾</u> ×	۲
$\sim 1$	8	DESKT	OP-PGHI	NBN7			
	>	📢 Au	dio input	ts and o	utputs		
3	>	🍃 Bat	teries				
3	5 [	💭 Co	mputer				
	>	🕳 Dis	k drives				
	> [	👿 Dis	play ada	pters			
	>	🚊 DV	D/CD-RO	DM driv	es		
	>	Hu	man Inte	erface D	evices		
3	> 1	🖷 IDE	ATA/ATA	API cont	rollers		
3	> 1	Key	/boards				
3	>	🕛 Mi	ce and of	ther poi	nting d	evices	
	> [	📃 Mo	onitors				
;	> !	📄 Ne	twork ad	apters			
·	~	🛱 Po	rts (COM	& LPT)			
		Ē	USB-SEF	RIAL CH	340 (CC	DM3)	
	> 1	🖃 Pri	nt queue	s			4
3	>	🗖 Pro	ocessors				
3	>	Sof	ftware de	vices			
3	>	📢 Soi	und, vide	o and g	ame co	ontroller	5
3	> 1	🔄 Sto	rage cor	trollers			
3	>	🖿 Sys	tem dev	ices			
3	>	🏺 Un	iversal Se	erial Bus	contro	llers	



4.7 Hello World!

Copy the following code in the Arduino IDE.

```
int val;
int ledpin=13;
void setup()
{
Serial.begin(9600);
pinMode(ledpin,OUTPUT);
```

(continues on next page)

(continued from previous page)

```
}
void loop()
{
val=Serial.read();
if(val=='R')
{
digitalWrite(ledpin,HIGH);
delay(500);
digitalWrite(ledpin,LOW);
delay(500);
Serial.println("Hello World!");
}
}
```





Then click verify button to check the errors. If compiling successfully, the message "Done compiling." will appear in the status bar.



After that, click the "Upload" button to upload the code. If the upload is successful, the message "Done uploading." will appear in the status bar.

🥺 sketch_oct15a   Arduino 1.8.12	_		×
File Edit Sketch Tools Help			
			ø
sketch_octives			
void setup()			^
{			
<pre>Serial.begin(9600);</pre>			
<pre>pinMode(ledpin,OUTPUT);</pre>			
}			
<pre>void loop()</pre>			
(			
<pre>val=Serial.read();</pre>			
<pre>if(val=='R')</pre>			
£			
<pre>digitalWrite(ledpin, HIGH);</pre>			
delay(500);			
<pre>digitalWrite(ledpin,LOW);</pre>			
delay(500);			
<pre>Serial.println("Hello World!");</pre>			
}			
}			~
Unloading			
Oploading			
Sketch uses 1992 bytes (6%) of program store	age	space.	Maxi ^
Global variables use 200 bytes (9%) of dynam	nic 1	memory,	lea
			×
			>
19	Arduin	io Nano on	сомз



Then click **Local** to open serial monitor and set the baud rate to 9600, enter an "R" and click Send, that is, the computer will send the character R. When NANO board receives it, you should see the RX led on the board flash once, and then D13 led flash once; when keyestudio NANO board sends "Hello World!" to the computer, finally you should see the "Hello World!" is showed on the monitor, and TX led on the board flash once.

© COM3	-		×
R			Send
Hello World!			^
			~
Autoscroll Show timestamp 9600 baud	~ (	lear o	utput

#### 5.MAC System

5.1 Install Arduino IDE on MAC System

The installation instruction is as same as the chapter 4.1, as shown below:

# ARDUINO 1.8.12

Arduino IDE that can be used with any Arduino board, including the Arduino Yún and Arduino DUE. Refer to the Getting Started page for Installation instructions. See the release notes.

Windows Installer Windows ZIP file for non admin install

Mac OS X 10.8 Mountain Lion or newer

Linux 32 bits Linux 64 bits Linux ARM 32 Linux ARM 64

Source

### 5.2 Download Driver of CH340

https://fs.keyestudio.com/CH340-MAC

5.3 How to Install Driver of CH340

### Please refer to the following link:

 $https://wiki.keyestudio.com/Download\_CH340\_Driver\_on\_MAC\_System$ 

### 5.4 Setting Arduino IDE

The setting method is as same as the chapter 4.4 except from COM port, as shown below:



### 6.Shipping List

Keyestudio NANO PLUS\*1pcs

30cm Blue mini USB\*1pcs