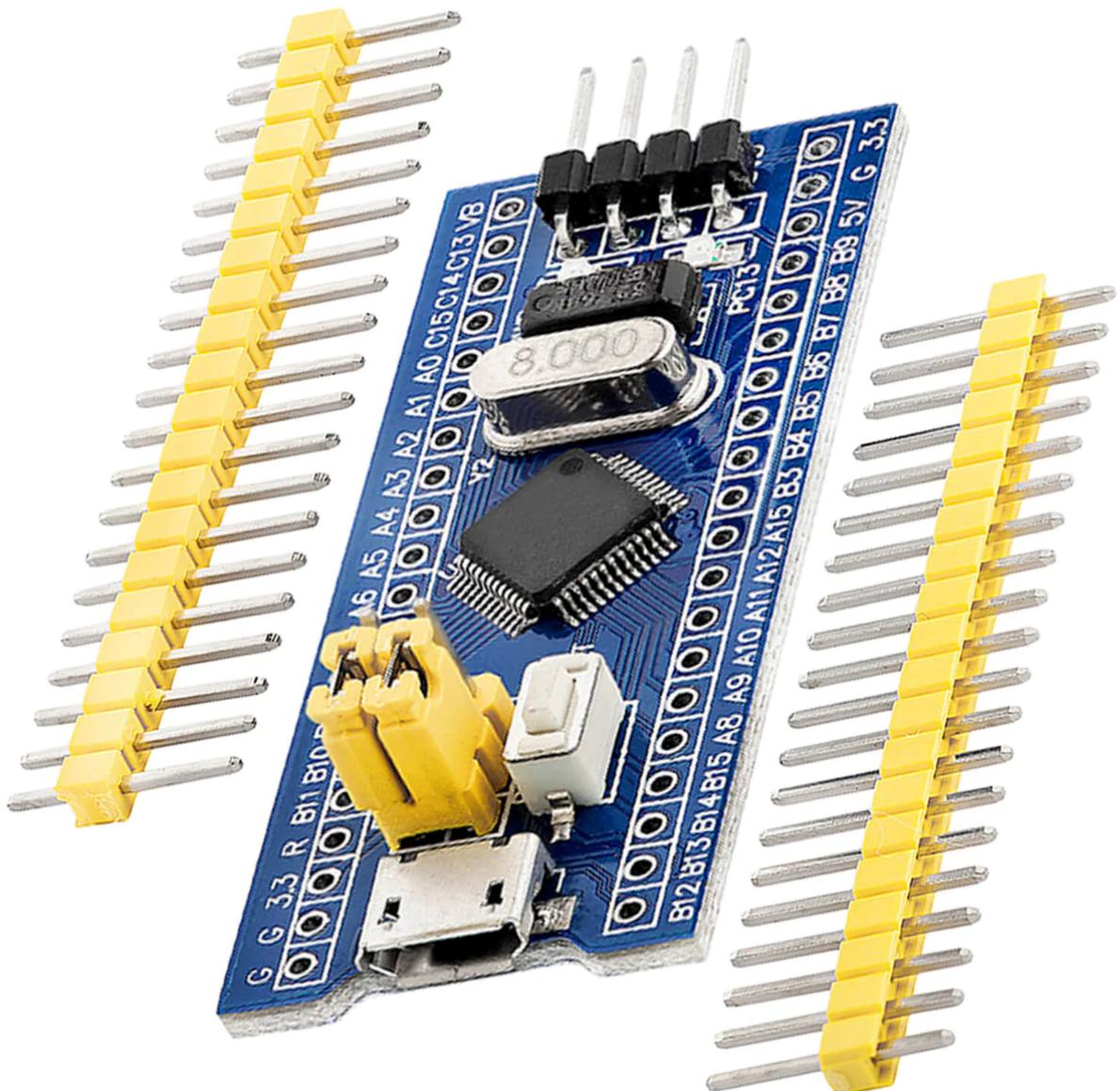


Quick-Start

The STM32 Blue Pill



Areas of application

Education and teaching: Use in schools, universities and training institutions to teach the basics of electronics, programming and embedded systems. Research and development: Use in research and development projects to create prototypes and experiments in the fields of electronics and computer science. Prototype development: Use in the development and testing of new electronic circuits and devices. Hobby and Maker Projects: Used by electronics enthusiasts and hobbyists to develop and implement DIY projects.

Required knowledge and skills

Basic understanding of electronics and electrical engineering. Knowledge of programming, especially in the C/C++ programming language. Ability to read schematics and design simple circuits. Experience working with electronic components and soldering.

Operating conditions

The product may only be operated with the voltages specified in the data sheet to avoid damage. A stabilized DC power source is required for operation. When connecting to other electronic components and circuits, the maximum current and voltage limits must be observed to avoid overloads and damage.

Environmental conditions

The product should be used in a clean, dry environment to avoid damage caused by moisture or dust. Protect the product from direct sunlight (UV)

Intended Use

The product is designed for use in educational, research and development environments. It is used to develop, program and prototype electronic projects and applications. The Sensor product is not intended as a finished consumer product, but rather as a tool for technically savvy users, including engineers, developers, researchers and students.

Improper foreseeable use

The product is not suitable for industrial use or safety-relevant applications. Use of the product in medical devices or for aviation and space travel purposes is not permitted

disposal

Do not discard with household waste! Your product is according to the European one Directive on waste electrical and electronic equipment to be disposed of in an environmentally friendly manner. The valuable raw materials contained therein can be recycled become. The application of this directive contributes to environmental and health protection. Use the collection point set up by your municipality to return and Recycling of old electrical and electronic devices. WEEE Reg. No.: DE 62624346

electrostatic discharge

Attention: Electrostatic discharges can damage the product. Note: Ground yourself before touching the product, such as by wearing an anti-static wrist strap or touching a grounded metal surface.

safety instructions

Although our product complies with the requirements of the RoHS Directive (2011/65/EU) and does not contain any hazardous substances in quantities above the permitted limits, residues may still be present. Observe the following safety instructions to avoid chemical hazards: Caution: Soldering can produce fumes that can be harmful to health. Note: Use a solder fume extractor or work in a well-ventilated area. If necessary, wear a respirator mask. Caution: Some people may be sensitive to certain materials or chemicals contained in the product. Note: If skin irritation or allergic reactions occur, stop use and, if necessary, consult a doctor. Caution: Keep the product out of the reach of children and pets to avoid accidental contact and swallowing of small parts. Note: Store the product in a safe, closed container when not in use. Attention: Avoid contact of the product with food and drinks. Note: Do not store or use the product near food to prevent contamination. Although our product complies with the requirements of the RoHS Directive (2011/65/EU) and does not contain any hazardous substances in quantities above the permitted limits, residues may still be present. Observe the following safety instructions to avoid chemical hazards: Caution: Soldering can produce fumes that can be harmful to health. Note: Use a solder fume extractor or work in a well-ventilated area. If necessary, wear a respirator mask. Caution: Some people may be sensitive to certain materials or chemicals contained in the product. Note: If skin irritation or allergic reactions occur, stop use and, if necessary,

consult a doctor. Caution: Keep the product out of the reach of children and pets to avoid accidental contact and swallowing of small parts. Note: Store the product in a safe, closed container when not in use. Attention: Avoid contact of the product with food and drinks. Note: Do not store or use the product near food to prevent contamination. The product contains sensitive electronic components and sharp edges. Improper handling or assembly can result in injury or damage. Observe the following safety instructions to avoid mechanical hazards: Attention: The product's circuit board and connectors may have sharp edges. Use caution to avoid cuts. Note: Wear appropriate protective gloves when handling and assembling the product. Caution: Avoid excessive pressure or mechanical stress on the board and components. Note: Only mount the product on stable and flat surfaces. Use appropriate spacers and housings to minimize mechanical stress. Attention: Make sure the product is securely fastened to prevent accidental slipping or falling. Note: Use appropriate support or secure mounting in enclosures or on mounting plates. Caution: Make sure all cable connections are connected securely and correctly to avoid strain and accidental unplugging. Note: Route cables so that they are not under tension and do not pose a tripping hazard. The product operates with electrical voltages and currents that, if used improperly, can result in electric shocks, short circuits or other hazards. Observe the following safety instructions to avoid electrical hazards: Attention: Use the product only with the specified voltages. Note: The performance limits of the product can be found in the associated data sheet Caution: Avoid short circuits between the connectors and components of the product Note: Make sure that no conductive objects touch or bridge the circuit board. Use insulated tools and pay attention to the arrangement of connections. Caution: Do not perform any work on the product when it is connected to a power source. Note: Disconnect the product from power before making any circuit changes or connecting or removing components. Caution: Do not exceed the specified current ratings for the product's inputs and outputs. Note: The performance limits of the product can be found in the technical specifications or in the data sheet Attention: Make sure that the power sources used are stable and correctly sized. Note: Only use tested and suitable power supplies to avoid voltage fluctuations and overloads. Attention: Maintain sufficient distance from live parts to avoid accidental contact. Note: Ensure that the cabling is arranged safely and clearly according to the voltage used. Caution: Use insulating housings or protective covers to protect the product from direct contact. Note: Place the product in a non-conductive case to avoid accidental touching and short circuits. The product and the components on it may become warm during operation. Improper handling or overloading the product can result in burns, damage or fire. Observe the following safety instructions to avoid thermal hazards: Caution: Make sure the product is used within recommended operating temperatures. Note: The recommended operating temperature range is typically between -40°C and +85°C. Check the specific information in the product data sheet. Attention: Do not place the product near external heat sources such as radiators or direct sunlight. Note: Ensure that the product is operated in a cool and well-ventilated area. Attention: Make sure the product is well ventilated to avoid overheating. Note: Use fans or heat sinks when operating the product in a closed enclosure or in an environment with limited air circulation. Attention: Mount the product on heat-resistant surfaces and in heat-resistant housings. Note: Use enclosure materials that can withstand high temperatures to avoid damage or fire hazard. Caution: Implement temperature monitoring when using an enclosure and, if necessary, protection mechanisms that shut down the product if it overheats. Note: Note: Use temperature sensors and appropriate software to monitor the temperature of the product and shut down the system if necessary. Caution: Avoid overloads that can cause excessive heating of components. Note: To prevent overheating, do not exceed the specified current and voltage limits. Caution: Short circuits can generate significant heat and cause fires. Note: Make sure that all connections are correct and secure and that no conductive objects can accidentally cause short circuits.

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Introduction

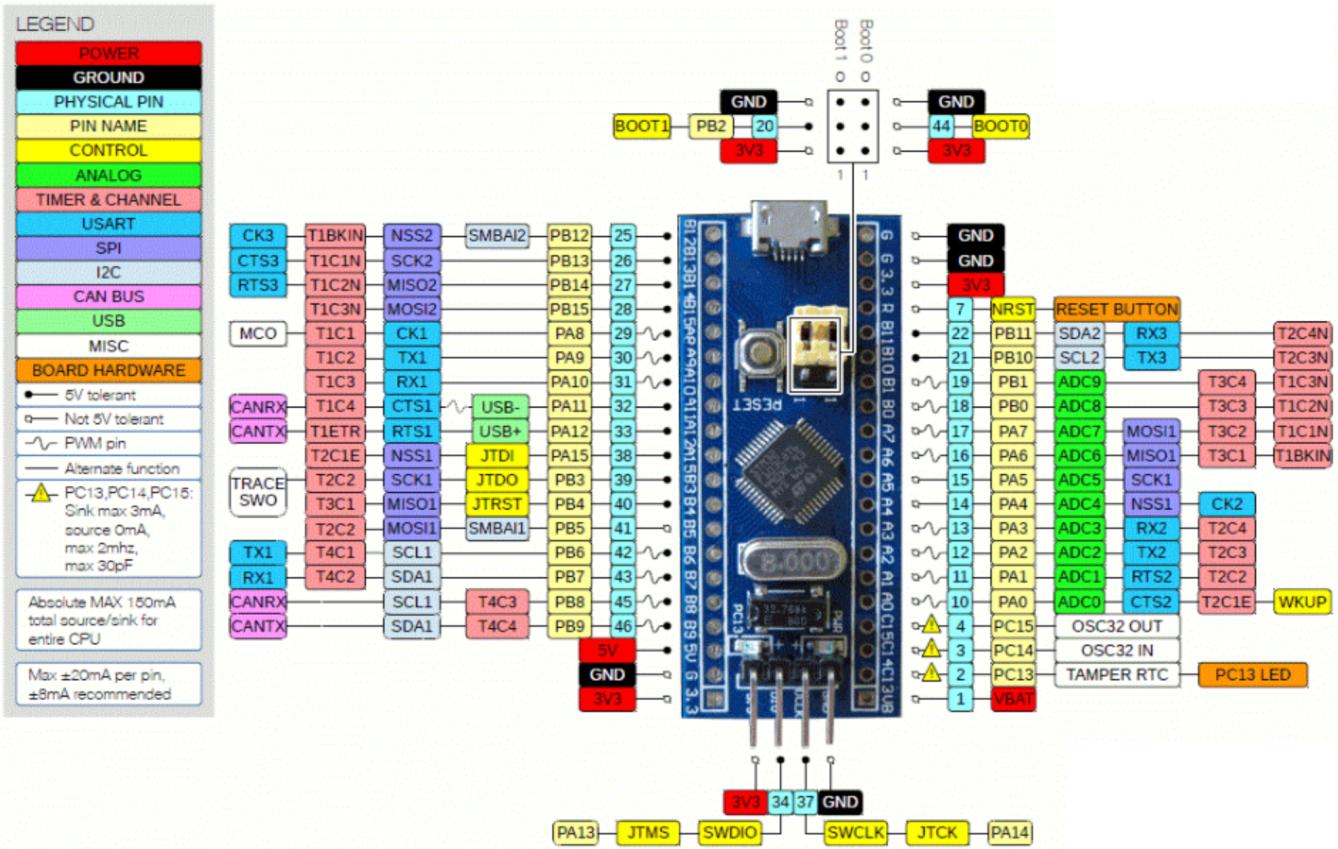
The STM32 Blue Pill is a development board based on the STM32F103C8T6 microcontroller, which belongs to the STM32F1 series. It is a compact and cost-effective board that offers a wide range of features and capabilities. The Blue Pill board has gained popularity mainly due to its low price, Arduino compatibility, and wide community support. It comes in a small form factor with a 32-bit ARM Cortex-M3 core, running at a clock speed of up to 72 MHz. The microcontroller offers 64 KB of Flash memory, 20 KB of SRAM, and numerous peripherals, making it suitable for various applications.

Board is suitable for learners that want to learn the STM32 microcontroller with ARM Cortex-M3 32-bit core.

Specifications

Model	STM32F103C8T6
Operating voltage	2.0-3.6V
Core	ARM 32 Cortex-M3 CPU
CPU frequency	72 MHz
Number of GPIO pins	37
Number of PWM pins	12
Analog input pins	10 (12 bit resolution)
Communication	I2C, SPI, UART, CAN, USB
USART Peripherals	3
I2C Peripherals	2
SPI Peripherals	2
Can 2.0 Peripheral	1
Flash Memory	64kB
RAM	20kB
Dimensions	22.86mm x 253.34mm

Overview



Pinout

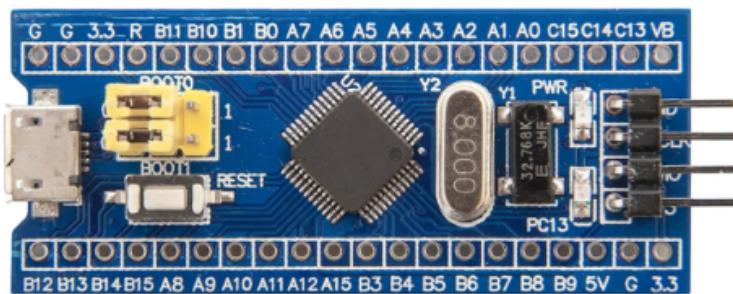
Analog pins	PA0-PA7, PB0-PB1
Serial	TX1, RX1 ,TX2, RX2, TX3, RX3 (UARTpins)
External interrupts	PA0-PA15, PB0-PB15, PC13-PC15
PWM	PA0-PA3, PA6-PA10, PB0-PB1,PB6-PB9
SPI	MISO0, MISI0, SCK0, CS0, MISO1, MISI1, SCK1,CS1
I2C	SCL1, SDA1,SCL2, SDA2
CAN	CAN0TX, CAN0RX

Setting up Arduino environment

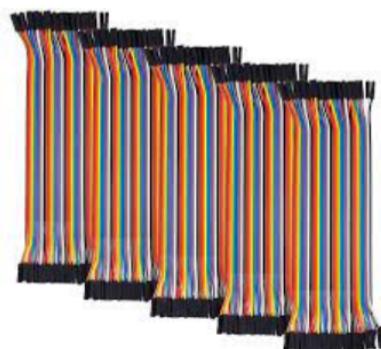
The uses of this product are very simple. In this section of this article, we will discuss how to blink LED using an STM32 microcontroller with the ST-Link V2 Mini and Arduino IDE , so first of all we need a setup which described below:

Setup for Development environment, we need :

-The STM32 Blue Pill



-Jumper Wire



-ST-Link



Installation of the Arduino IDE

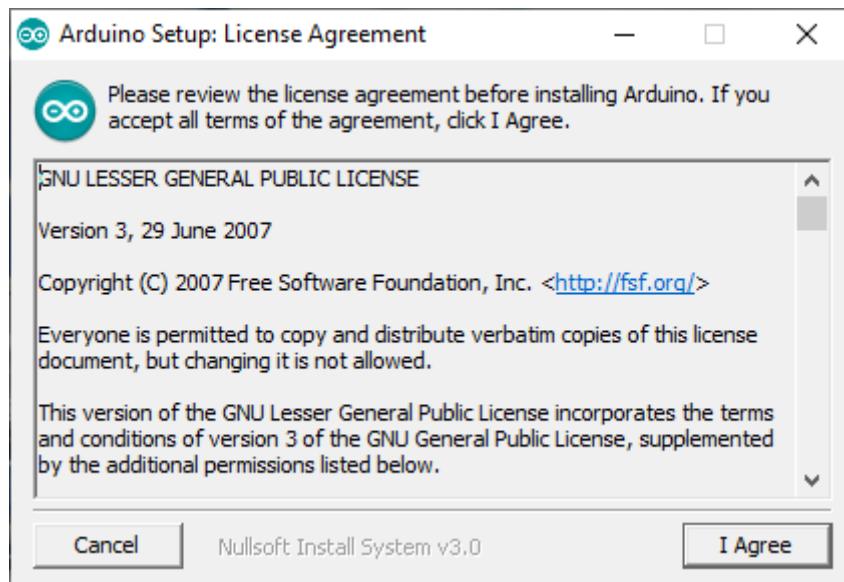
You can download the free Arduino IDE development environment from the following link: <https://www.arduino.cc/en/Main/Software>

Windows users should definitely use one of the first two download options for the Arduino IDE. The "Windows App" version from the Windows Store will cause connection problems especially when using third party board definitions.

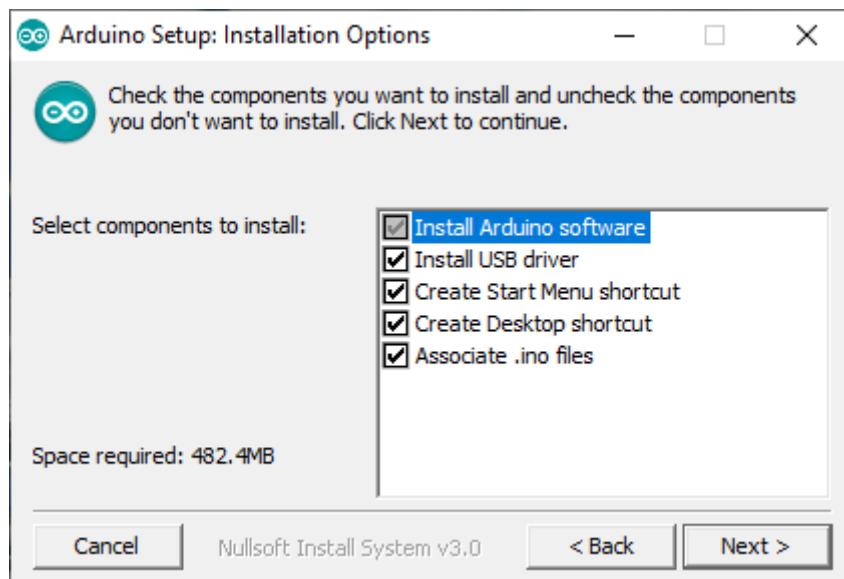
Download the Arduino IDE



After starting the Arduino IDE installation file "arduino-1.X.X-windows.exe" the license conditions of the software must be read and accepted:



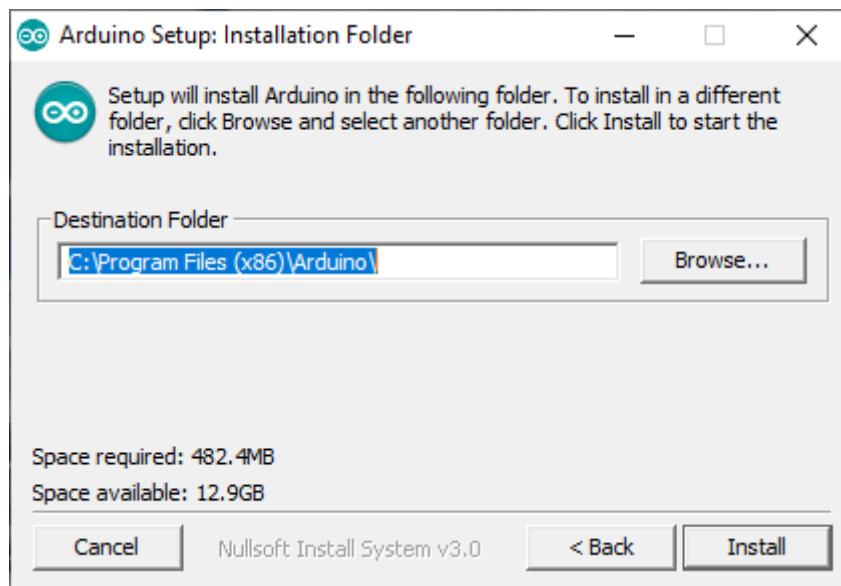
In the next step, different options can be selected for installation.



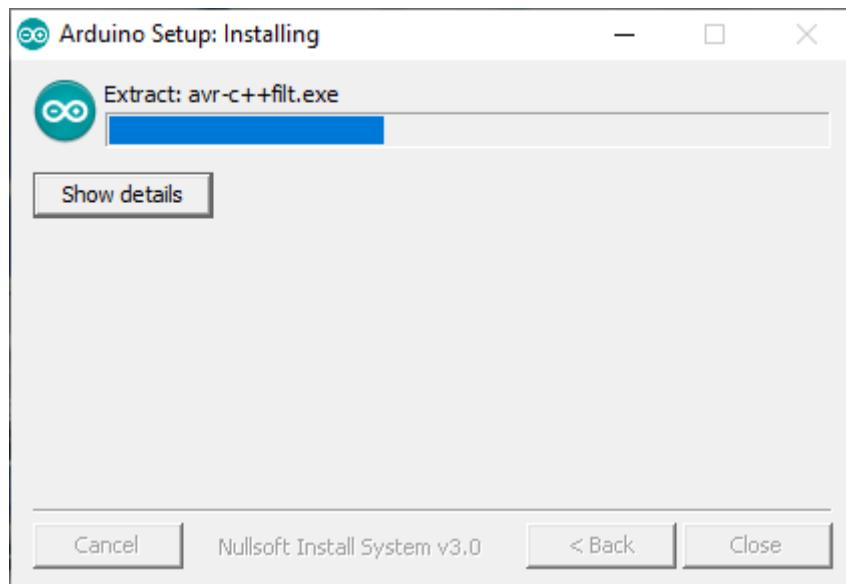
A brief overview of the different options follows, with a brief explanation of each option:

Option	Erklärung
Install Arduino Software	Installs the Arduino IDE - This option can not be deselected
Install USB Driver	Installs USB drivers for various other microcontrollers. These are not required to use the software with the D1 mini, but we strongly recommend installing them if you also use other microcontrollers
Create Start Menu shortcut	Creates a shortcut in the Windows Start menu (optional)
Create Desktop shortcut	Creates a shortcut on the workstation (Optional)
Associate .ino files	Creates a filename extension for files with the extension .ino and links it to the Arduino IDE

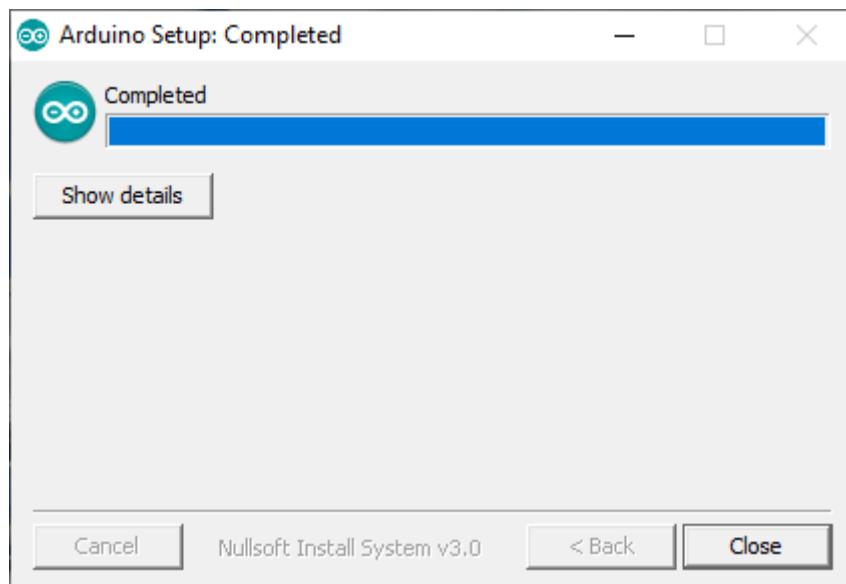
Finally, the destination folder must be specified. The installation requires about 500MB of free disk space.



Click "Install" to start the installation.



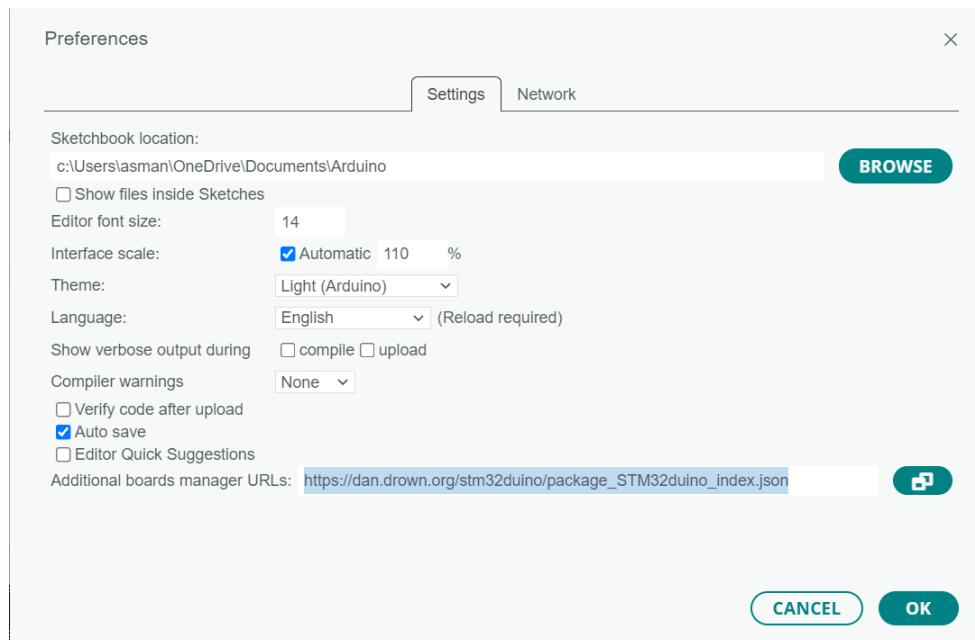
After successful installation, the installation program can be closed via the "Close" button:



Add STM32 Board to Arduino IDE

open the Arduino IDE and go to File -> Preferences. Then, select the option shown in the picture below. After selecting, In the last line, copy and paste the following link:

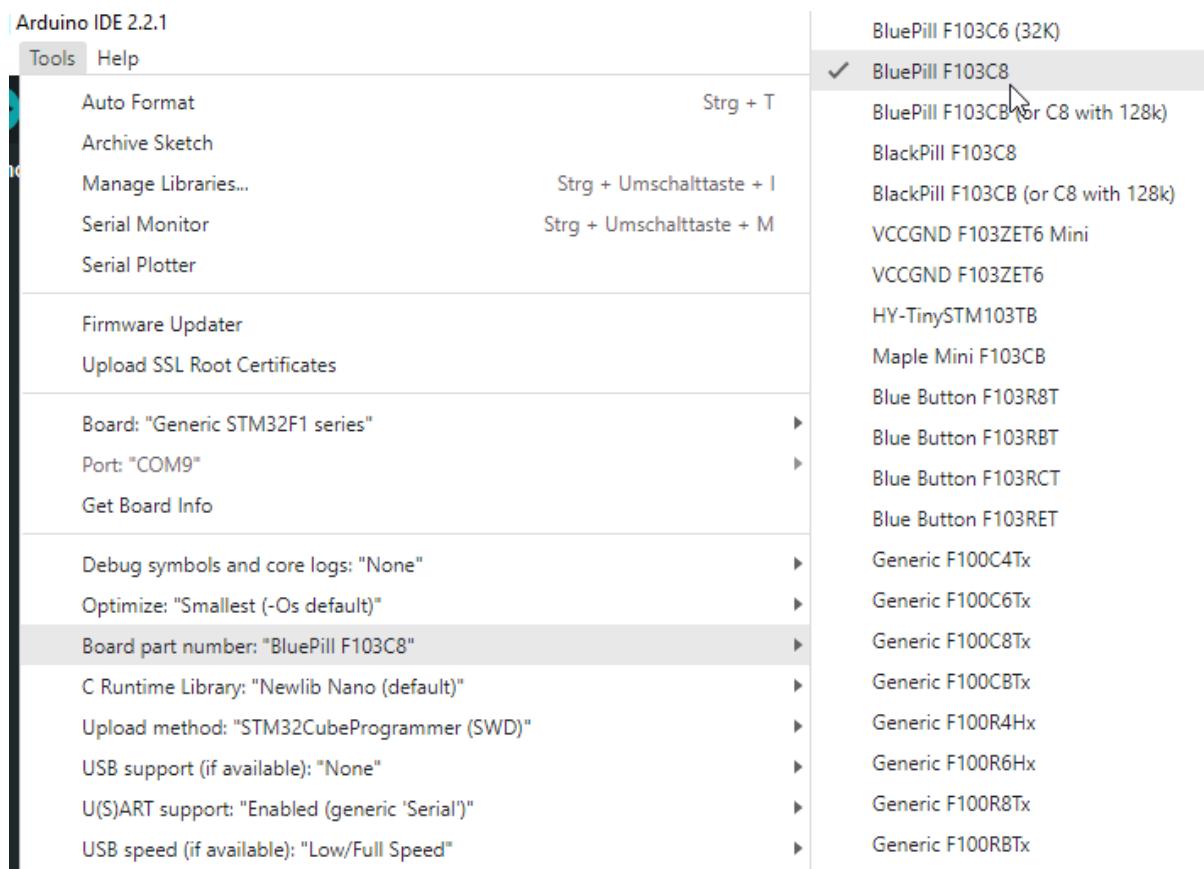
https://github.com/stm32duino/BoardManagerFiles/raw/main/package_stmicrelectronics_index.json



Finally, close both windows by pressing OK.

Select the Appropriate STM32 Board

You should also select Blue Pill F103C8 as the part number of the board.



Install ST-Link Drivers

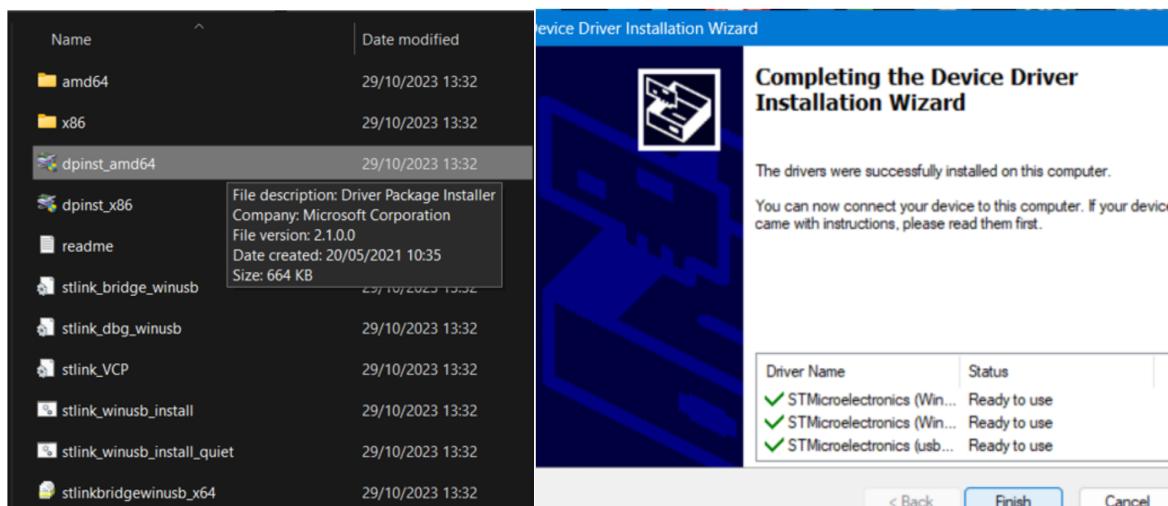
As you know, microcontrollers can't communicate with the computer directly. For this reason, you should always use a converter. We use ST-Link to connect STM32 boards to the computer and upload codes on them.

Installing ST-Link drivers for an STM32F103C8T6 microcontroller is important because these drivers allow your computer to communicate with and control the ST-Link debugger. So we have to install the driver as well.

You can download it from the ST official website :

<https://www.st.com/en/development-tools/stsw-link009.html>

extract and install.



Connection Diagram

Connect the ST-Link converter to the STM32 Blue Pill module as shown below.
 Connect the ST-Link to the computer's USB on the other side.



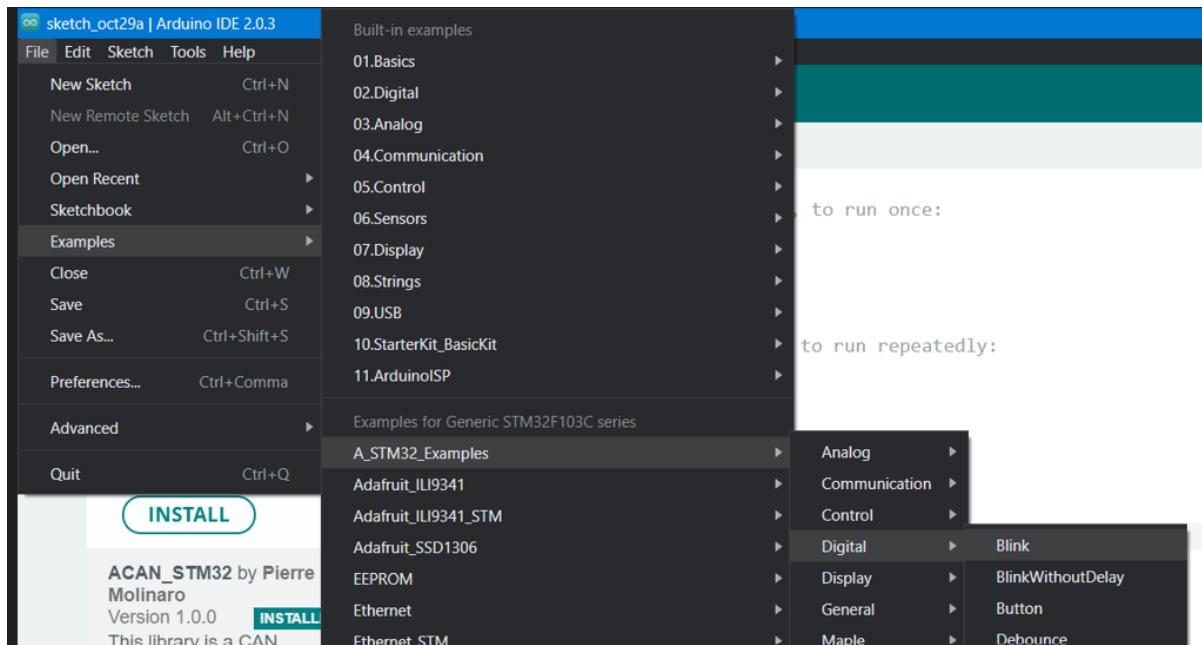
Connection

stm32	ST-Link
3.3V	3.3V
GND	GND
SWCLK	SWCLK
SWIO	SWDIO

Test example

Choose the example code :

Go to file -> Examples -> A_STM32_Examples→Digital→Blink



Test the Arduino Code:

```
void setup() {
    // put your setup code here, to run once:
    pinMode(PC13, OUTPUT);
}

void loop() {
    // put your main code here, to run repeatedly:
    digitalWrite(PC13,HIGH);
    delay(1000);
    digitalWrite(PC13,LOW);
    delay(1000);
}
```

Demonstration



Programming STM32F103C8 Board using USB Port

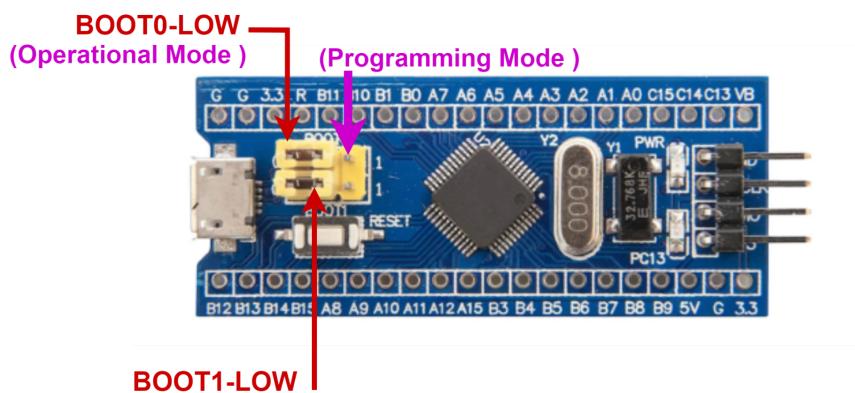
In the following section, we'll explore the process of installing a USB Bootloader on the STM32F103C8T6 Blue Pill board. With this STM32F103C8T6 USB Bootloader, you can effortlessly program the Blue Pill Board through the built-in USB port, eliminating the need for external hardware.

The connection between STM32 and ST LINK V2 for Uploading Bootloader

Connection Diagram



For the initial step, the BOOT0 pins are set to a HIGH state, effectively placing the board into Programming Mode.



Download STM32CubeProgrammer

Following the connection of the ST-Link to the STM32 Blue Pill module as depicted below, you should also connect the ST-Link to the computer's USB port on the opposite end.

To enable the program upload via the USB Port on the Blue Pill, it's essential to have a USB Bootloader already installed on the MCU. The subsequent step involves downloading the software from the website provided.

<https://www.st.com/en/development-tools/stm32cubeprog.html#get-software>

Next, download the USB bootloader from this github repository.

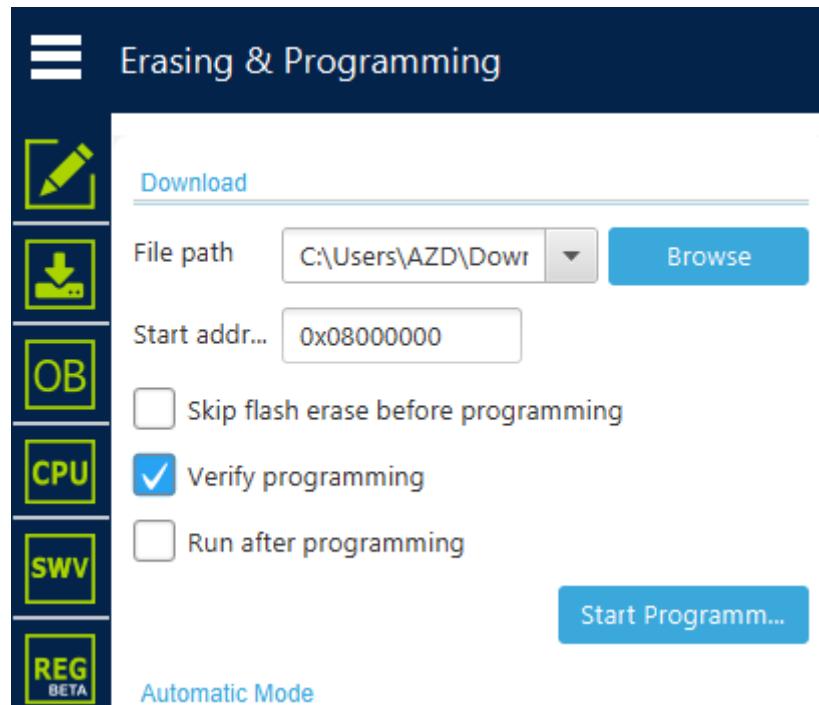
https://github.com/rogerclarkmelbourne/STM32duino-bootloader/blob/master/binaries/generic_boot20_pc13.bin

Run the STM32CubeProgrammer. Click on “Connect”



Go to “Erasing & Programming” section 

Go to “Browse” and choose the downloaded .bin file
Start programming via the “Start Programm...” button



When done you can close the STM32CubeProgrammer. You can change the BOOT jumper back to “Operational mode”

Download STM32 USB Mini Driver

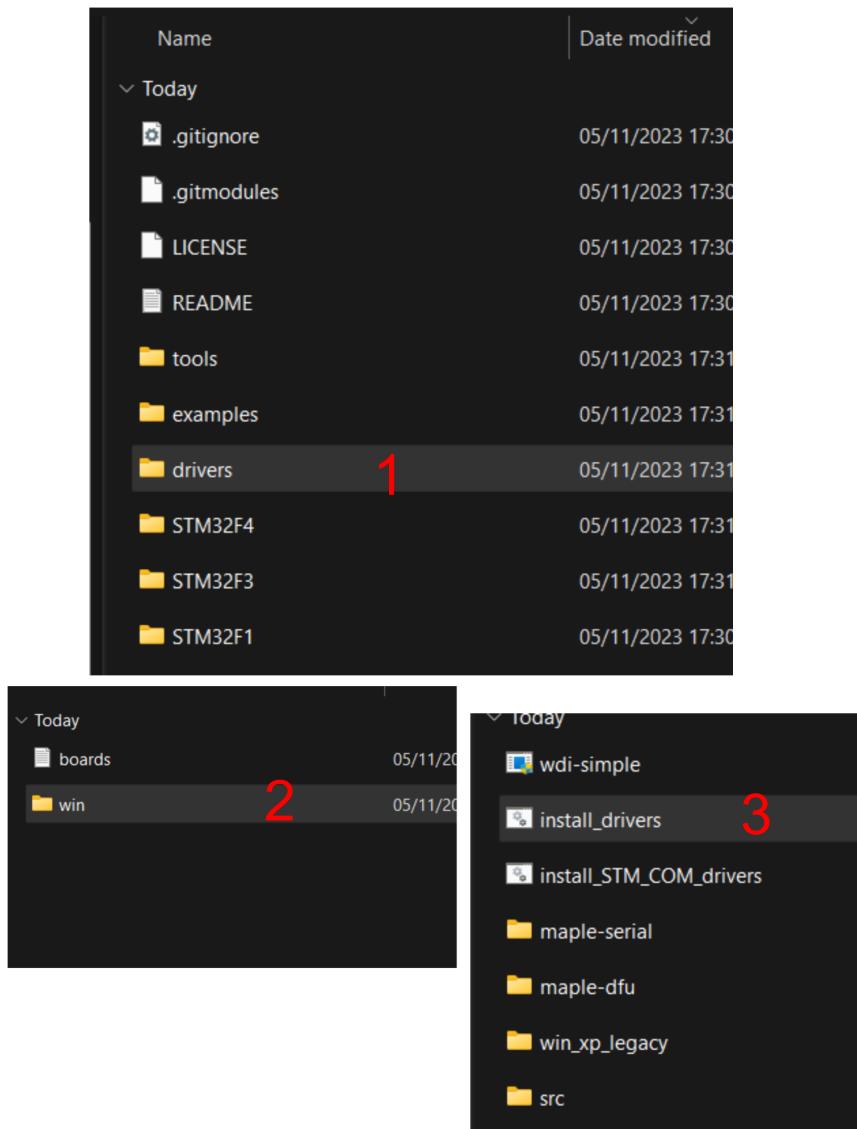
Now, disconnect the ST-Link. The USB drivers need to be installed.

To do this, please visit the following link:

https://github.com/rogerclarkmelbourne/Arduino_STM32/tree/master

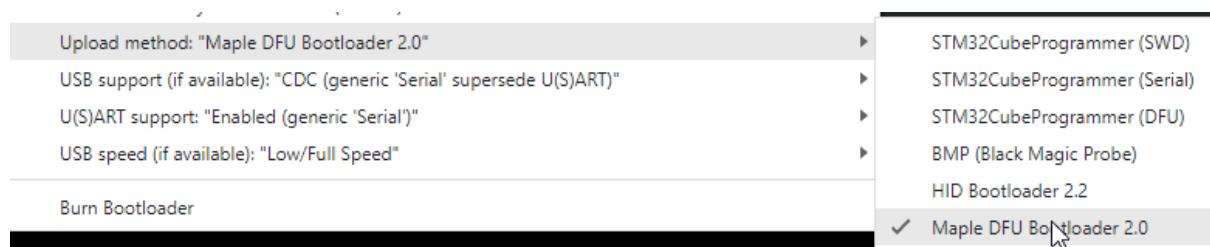
Then, download the "arduino-stm32" package by clicking on "Download ZIP."

Next go to the download folder and browse to driver folder and then execute file named **install_drivers.bat**



Configuring Arduino IDE

Once the installation is finished, open the Arduino IDE. Navigate to the "Tools" menu, and make the required adjustments in the board selector. Specifically, change the "Upload Method" option to "Maple DFU Bootloader 2.0"



Connect the Bluepill via USB cable and choose the COM-Port

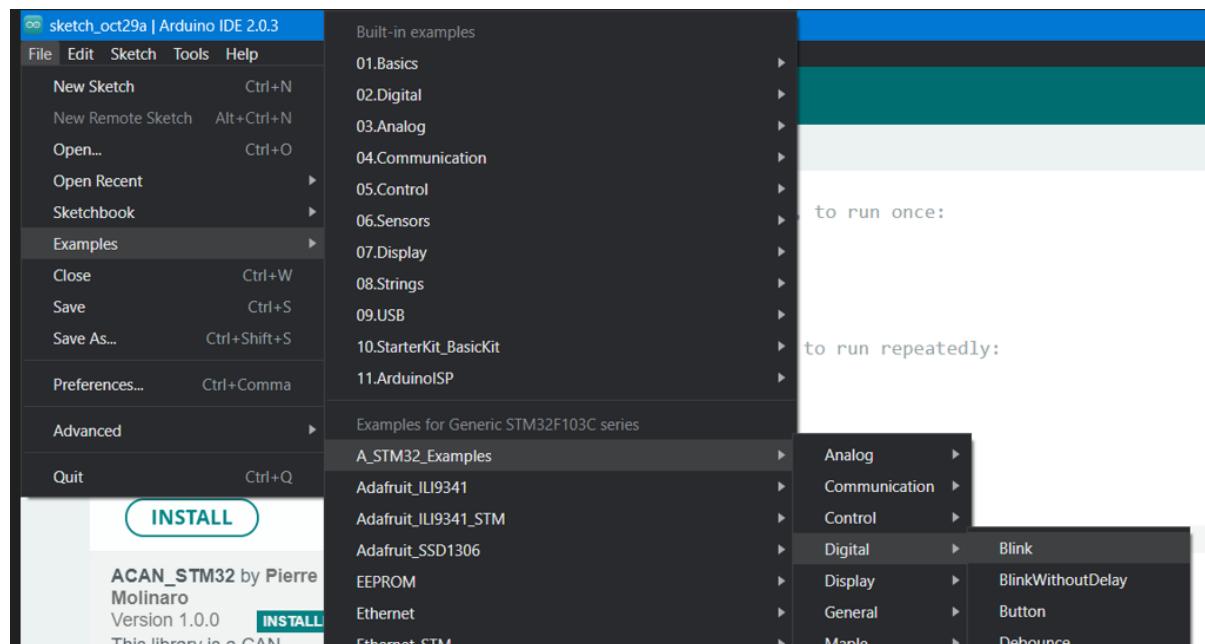


Uploading the Program

Choose the example code :

Go to file -> Examples -> A_STM32_Examples→Digital→Blink

Make sure that the LED is selected as PC13 and click on upload. The program will be uploaded through the USB port of the STM32 Board.

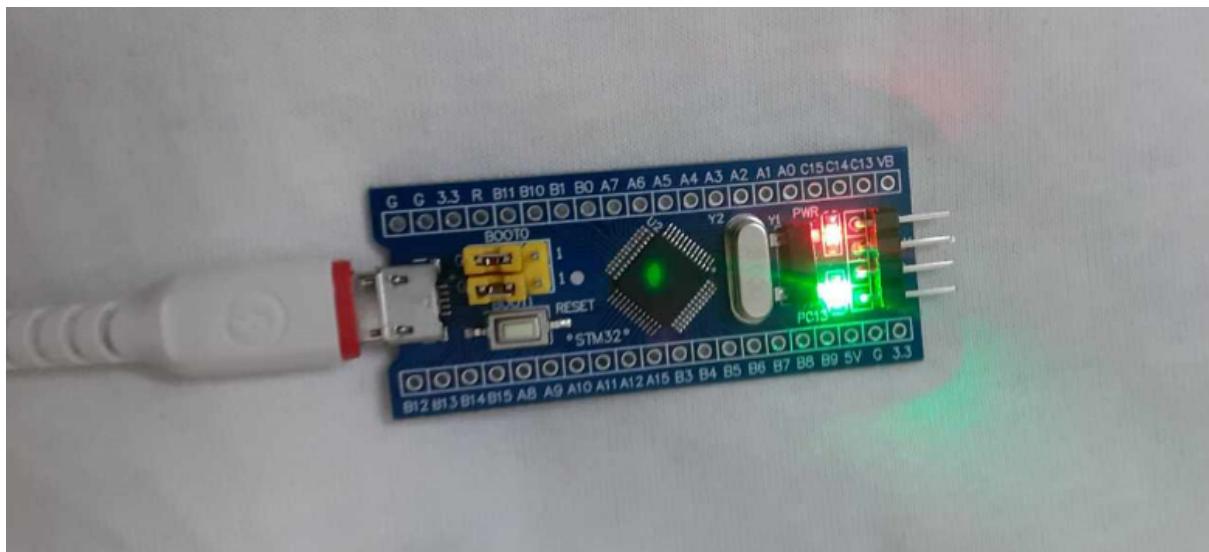


Test the Arduino Code:

```
void setup() {
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}
```

```
void loop() {  
    // put your main code here, to run repeatedly:  
    digitalWrite(PC13,HIGH);  
    delay(1000);  
    digitalWrite(PC13,LOW);  
    delay(1000);  
}
```

Demonstration



You've done it, you can now use your module for your projects :)

Now it is time to learn and make the Projects on your own. You can do that with the help of many example scripts and other tutorials, which you can find on the internet.

If you are looking for the high quality microelectronics and accessories, AZ-Delivery Vertriebs GmbH is the right company to get them from. You will be provided with numerous application examples, full installation guides, eBooks, libraries and assistance from our technical experts.

<https://az-delivery.de>

Have Fun!

Impressum

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