# SAMD21 Arduino Bootloader Uploading

Various development boards like Arduino Zero, Sparkfun SAMD21, and Adafruit METRO use the ATSAMD21 microcontroller. These development boards can be programmed using Arduino IDE through a USB connection. But for a raw ATSAMD21 chip, it is necessary to upload the compactable Arduino bootloader to the microcontroller before uploading the code through Arduino IDE. For this, a bootloader uploader PCB is designed, which includes a 48-pin TQFP IC holder (*Fig. 1*). The ATSAMD21 microcontroller can be easily attached to the IC holder without soldering. Segger J-Link EDU programmer and Microchip studio are used to upload the  samd21_sam_ba_sparkfun bootloader using the SWD interface. After this step, the code can be uploaded to the ATSAMD21 microcontroller through a USB interface.
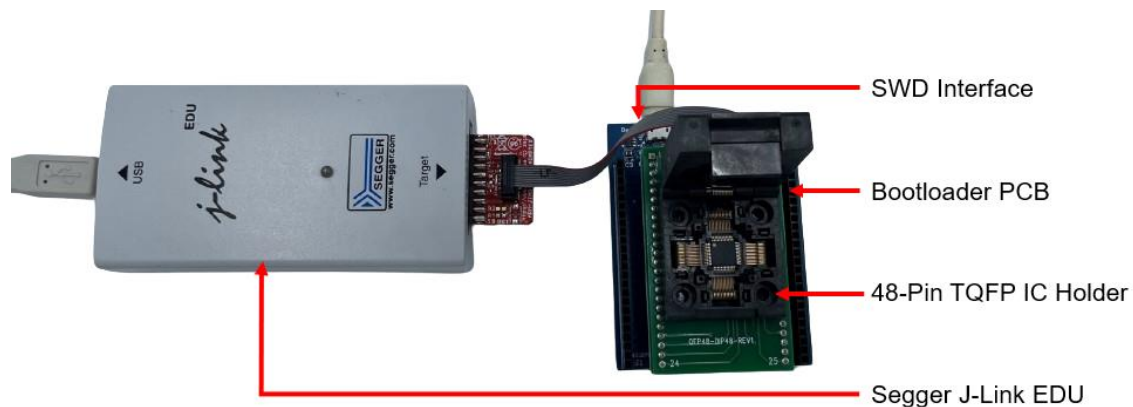


*Fig. 1. ATSAMD21 bootloader uploading setup.*

Step: 1

Our custom-made bootloader uploader PCB comes with two parallel female headers where we can attach the 48-pin TQFP IC holder module without soldering. Then, the ATSAMD21 IC must be placed inside the TQFP IC holder, where PIN NO 1 of the IC should be at PIN NO 1 of the TQFP module.

Step: 2

The micro-USB cable should be connected before the Segger J-Link EDU programmer connection, and the USB cable should power the board.

Step: 3

We used Segger J-Link EDU programmer to upload the bootloader. Our PCB has an SWD connector, so a JTAG adapter is required. We used the OLIMEX JTAG ADAPTER FOR ARM-USB-TINY-H. The ribbon cable of the adapter has a red marking, which should be connected towards the 3.3 V pin in the SWD connector (For our board, it is at the switch side)

Step: 4

Install the necessary software,

1. Download the J-Link software from segger.com and install it as they recommended.
   https://www.segger.com/downloads/jlink/

2. Download Microchip Studio from microchip.com and follow their procedure for installation.
   https://www.microchip.com/en-us/tools-resources/develop/microchip-studio

3. Install Arduino IDE from the below link.
   https://www.arduino.cc/en/software

Step: 5

Connect the Segger J-Link EDU programmer to the computer (Windows is used here). Open Microchip Studio and go to Tools – Device Programming.
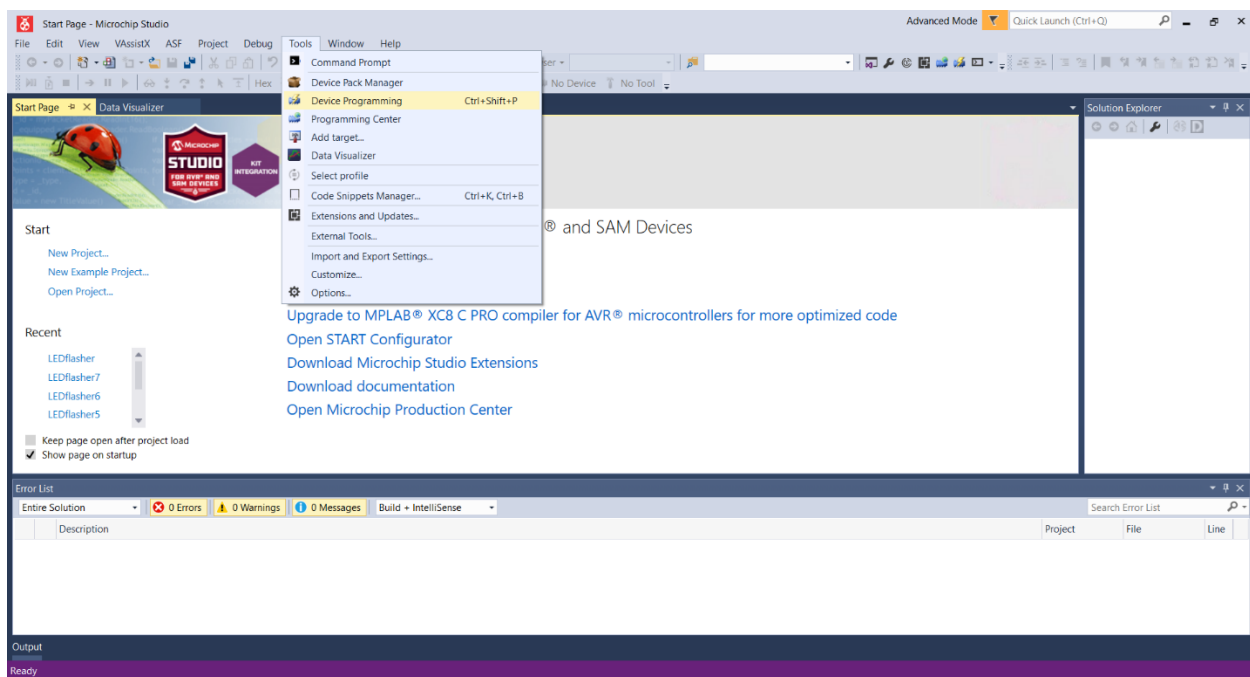


*Fig. 2. Device programming Microchip studio.*

Step: 6

In the pop-up window, select

- Tools- J-Link

- Device- the exact model of the SAMD21 microcontroller (The one used here is ATSAMD21G18A)
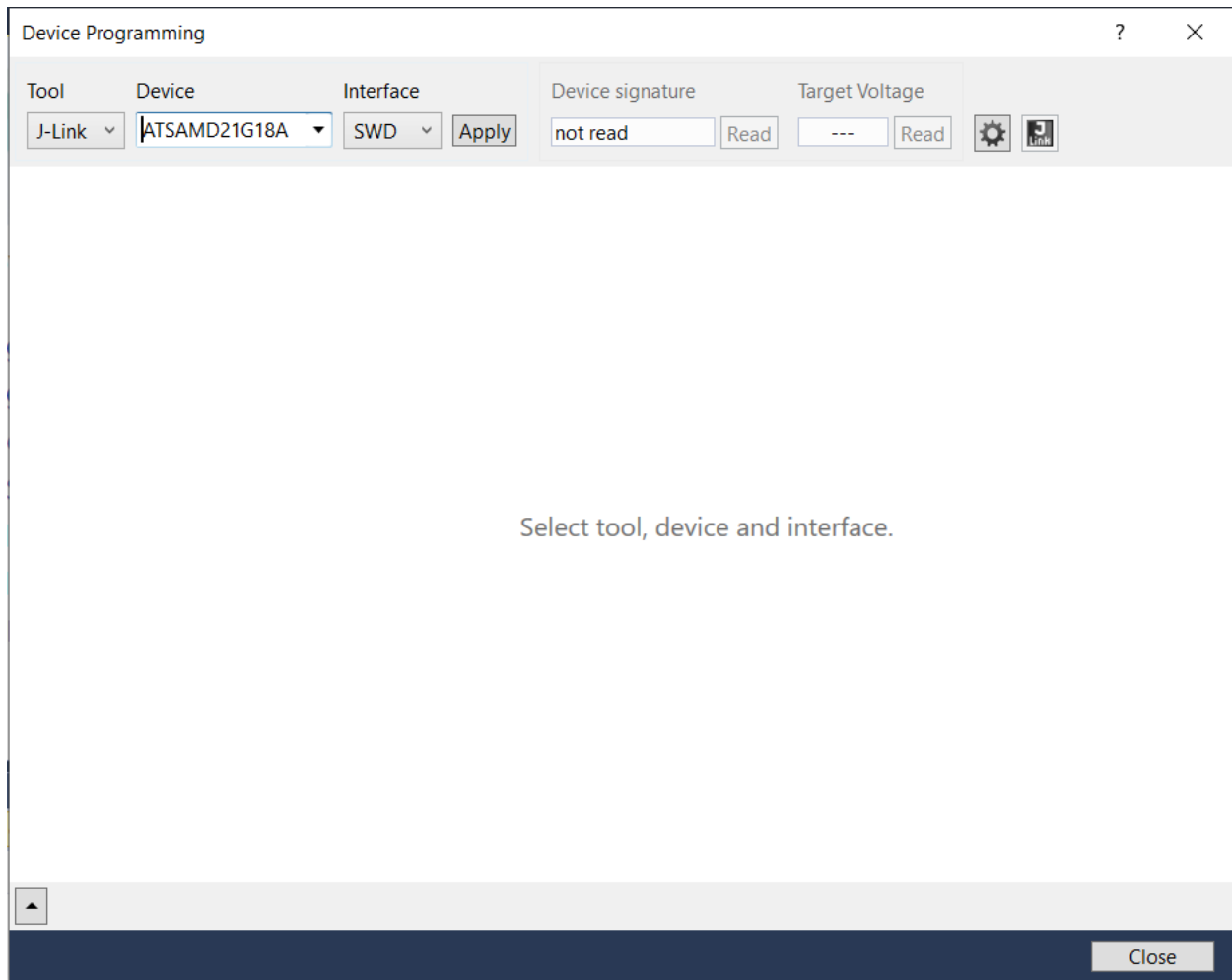- Interface- SWD
- Then click apply to get the details.



*Fig. 3. Providing chip and interface information.*

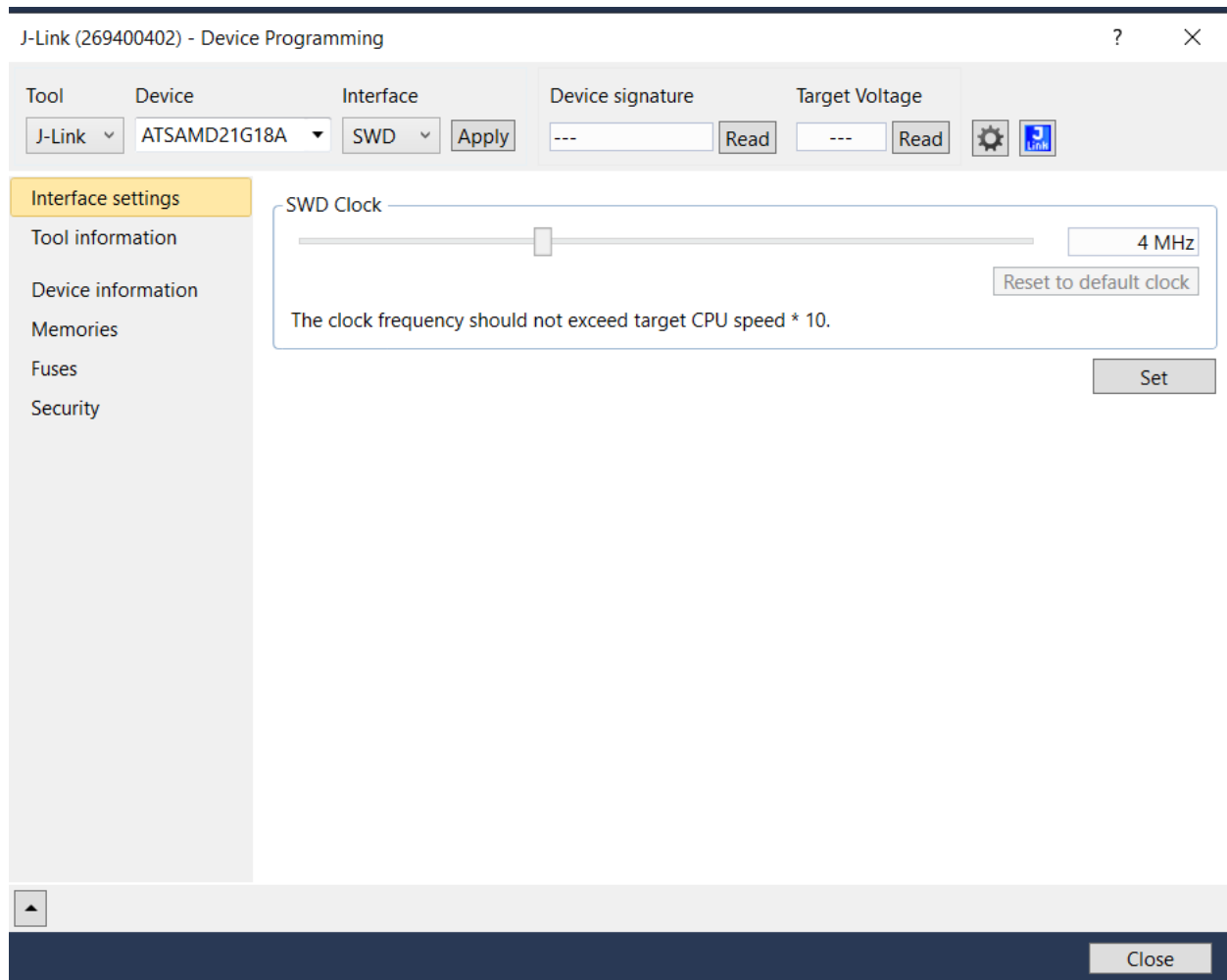The window will look like below.

*Fig. 4. If the data given is correct for the previous step.*

Step: 6

Click Read.

The targeted voltage and device signature will display if the chip is reading correctly. A message at the bottom will say, " Reding OK, ID OK".
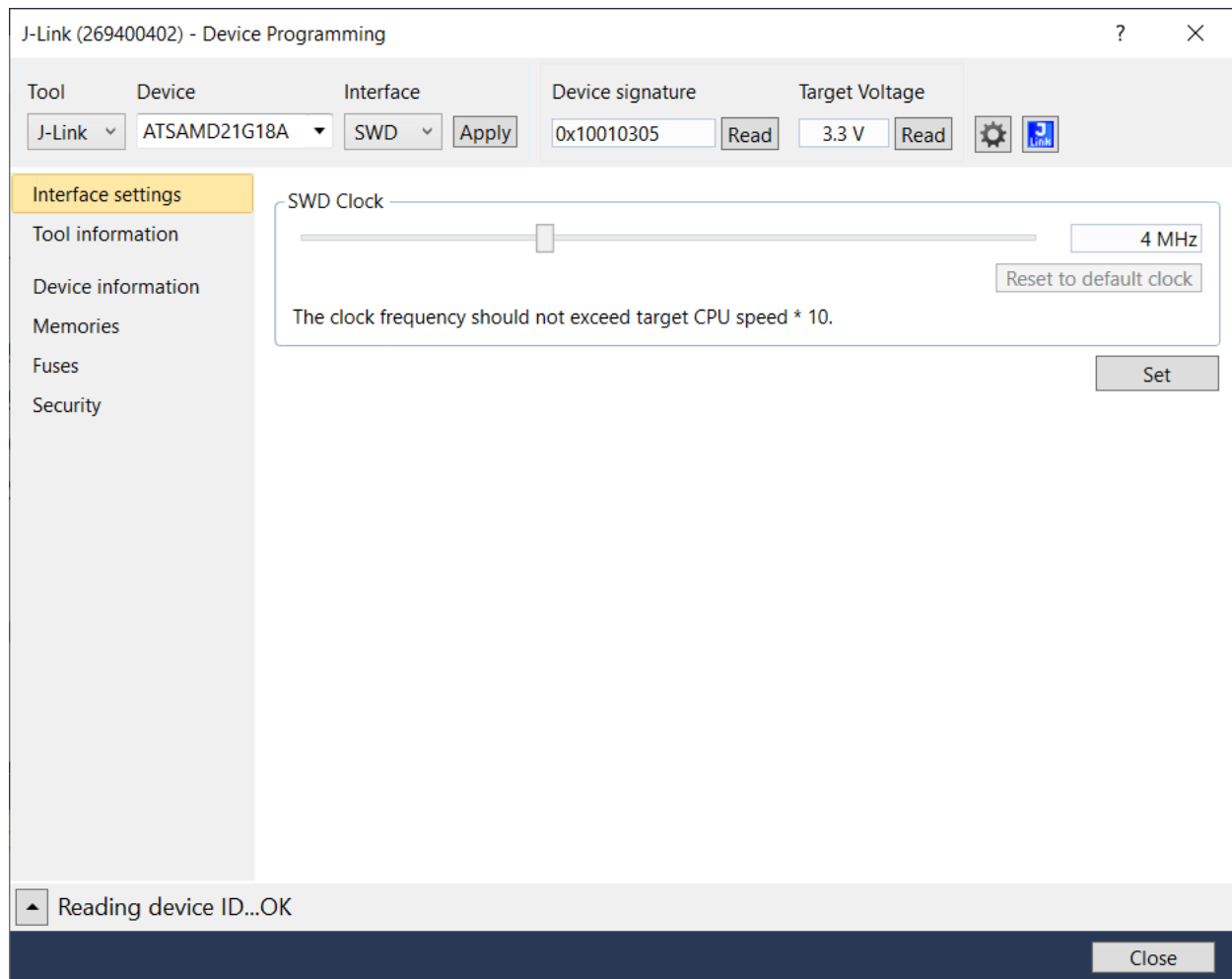
*Fig. 5. Successfully read the chip.*

Step: 8

Download the SAMD21_Dev_Breakout-master from the below GitHub repository. Unzip the folder.

https://github.com/sparkfun/SAMD21_Dev_Breakout

Step: 9

Go to Memories and select the "samd21_sam_ba_sparkfun bootloader" file location in the Flash section. This file can be in the Firmware section of the SAMD21_Dev_Breakout-master folder. Make sure to choose All Files to view the file in Microchip Studio.
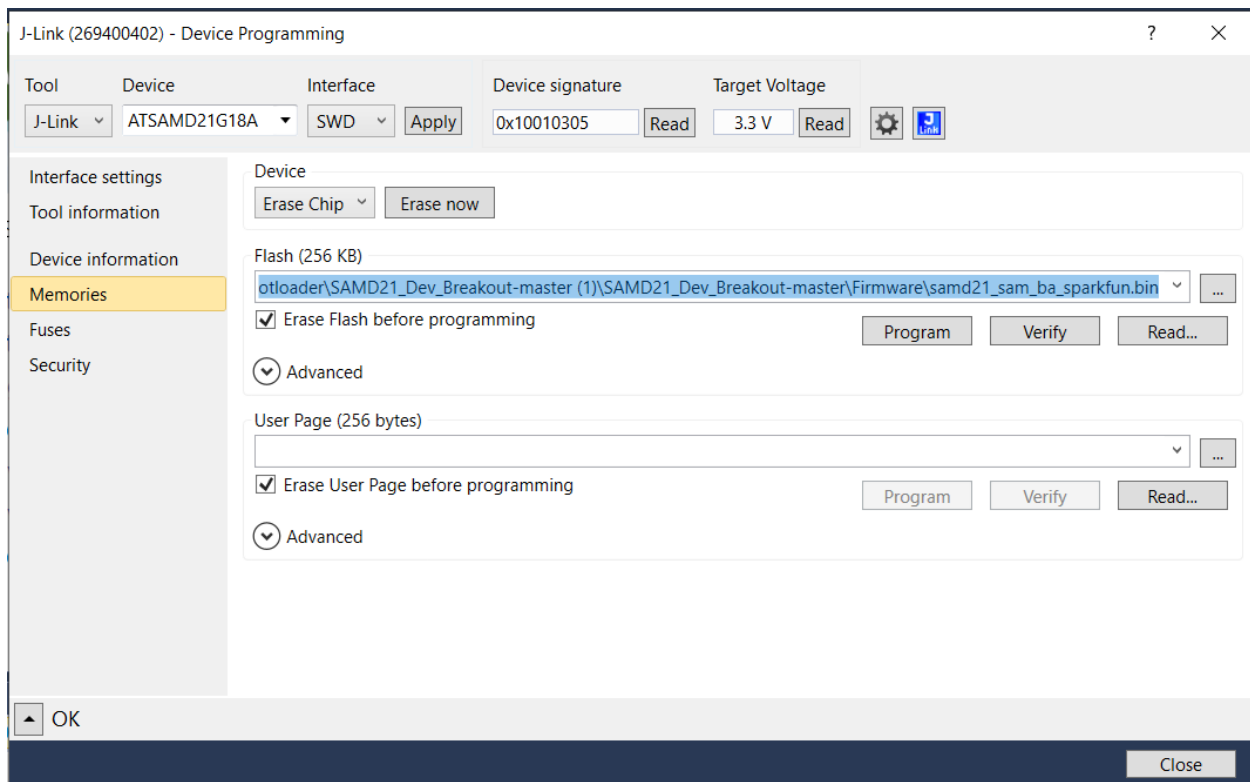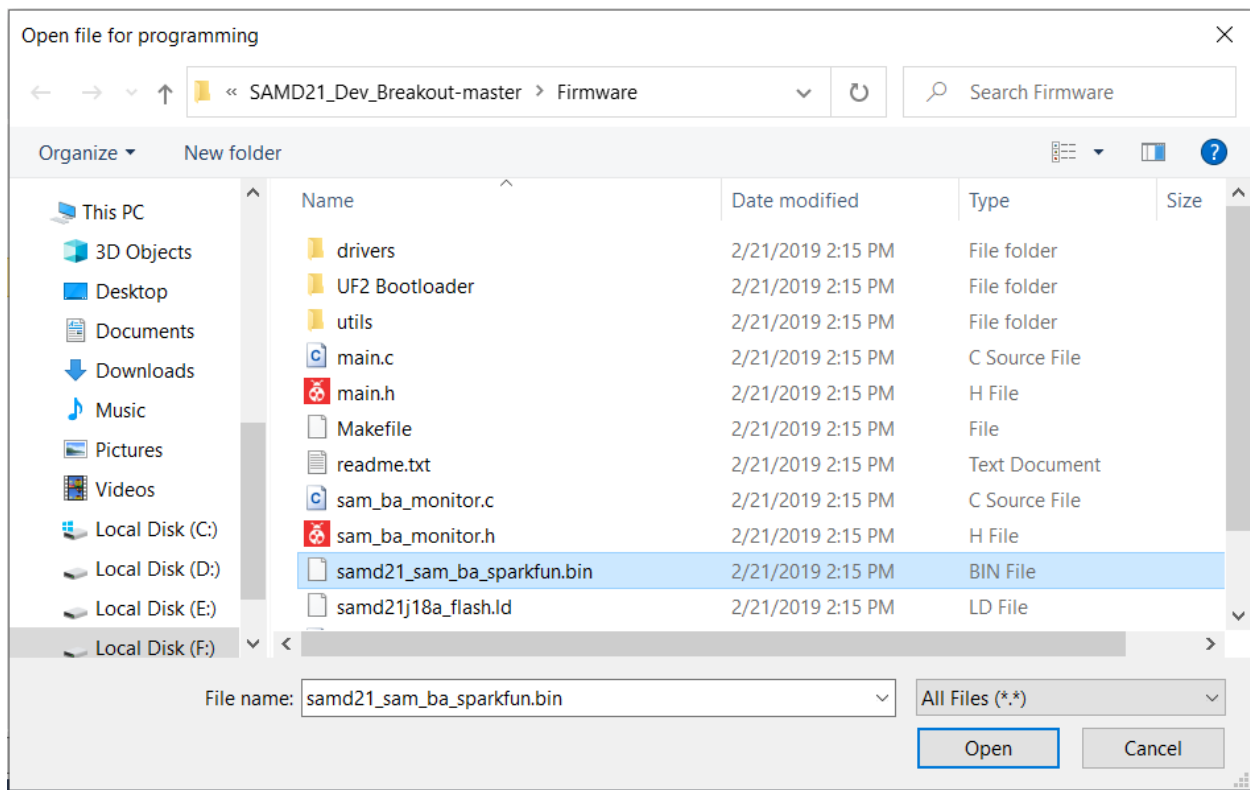
Fig. 6. Bootloader Flashing.



Fig. 7. Flashing file selection.

Step: 10

Click Erase and then click Program to upload the bootloader to the SAMD21 chip. After successfully uploading the bootloader, a "Verifying Flash OK" message will appear at the bottom. This means the Arduino bootloader is uploaded to the SAMD21 IC and can be programmed using Arduino IDE through USB.
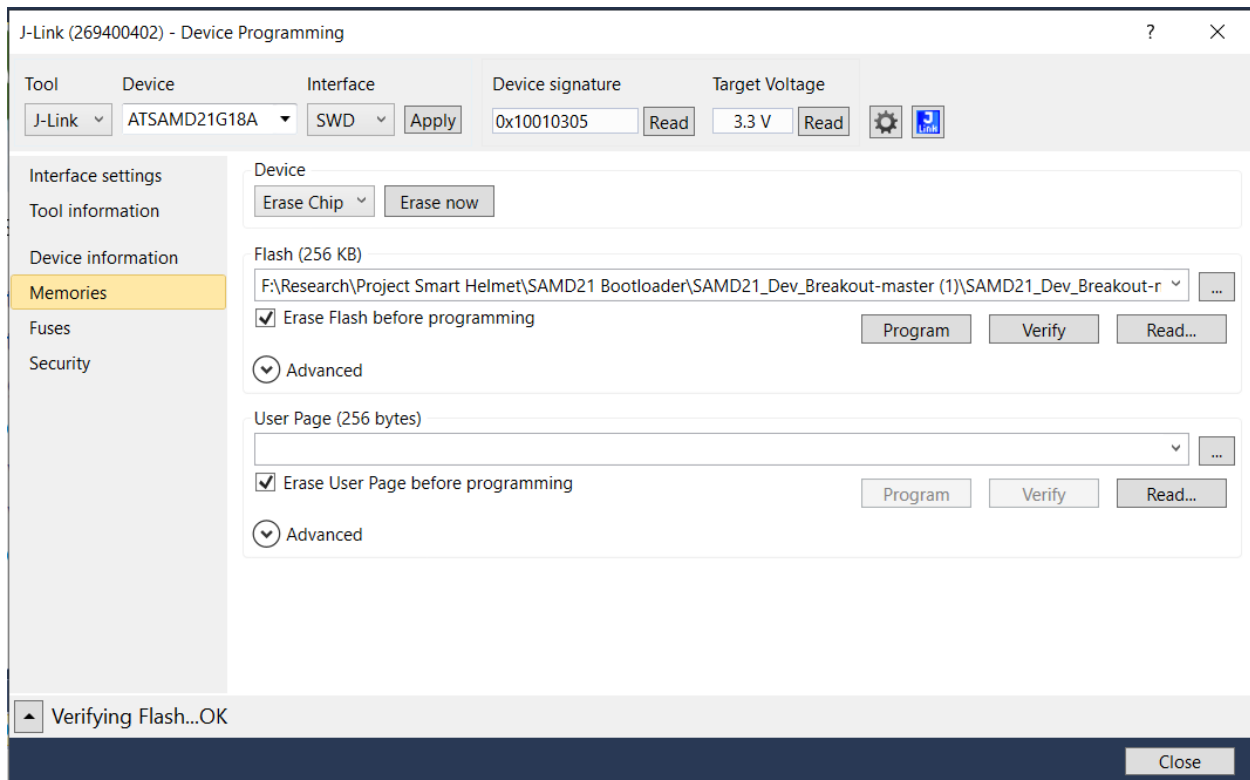


*Fig. 8. After successfully flashing.*

**Programming SAMD21 Using Arduino IDE.**

Step: 1

Install and open Arduino IDE (Arduino IDE 1.8.19 is used in this example).

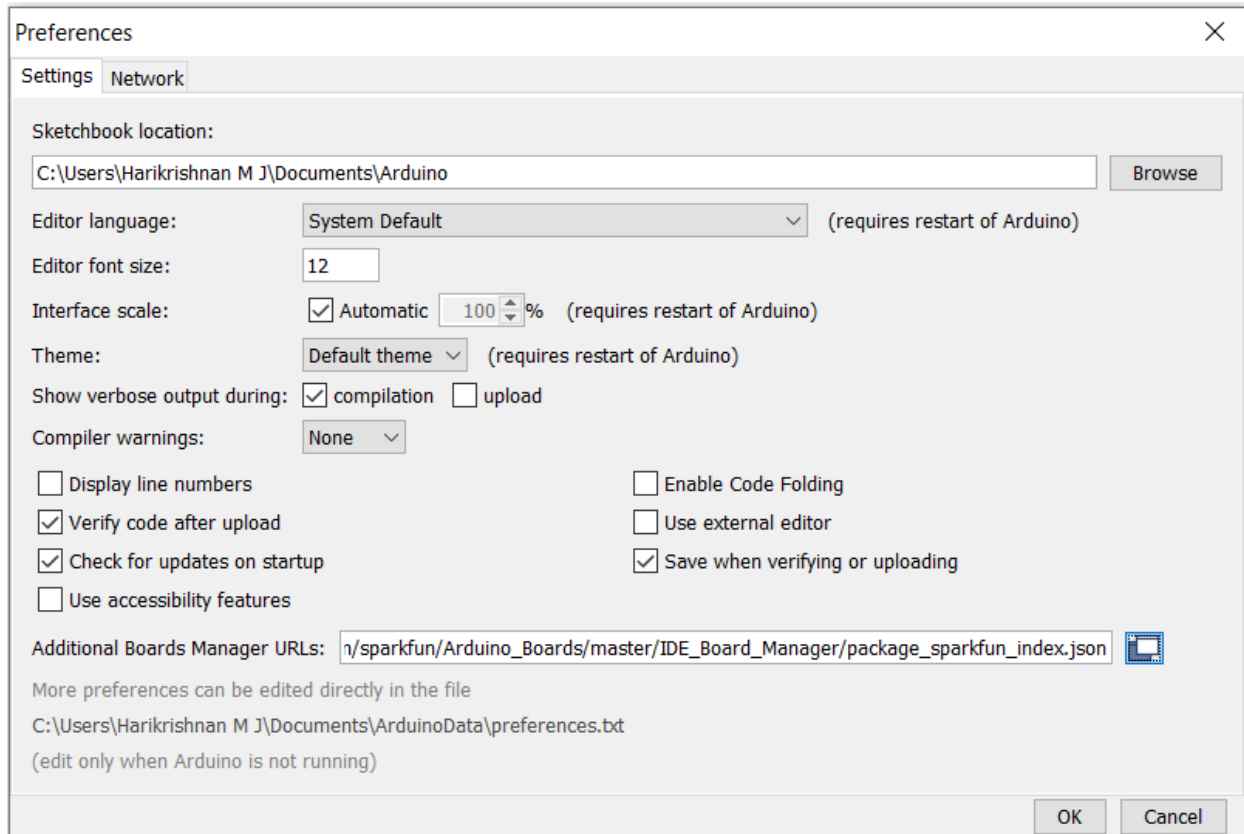Go to File- Preference. Then, this window will appear.



*Fig. 9.SAMD21 board details adding to Arduino IDE.*

Step: 2

Go to Additional Boards Manager URLs and paste the below link there.

https://raw.githubusercontent.com/sparkfun/Arduino_Boards/master/IDE_Board_Manager/package_sparkfun_index.json

Step: 3

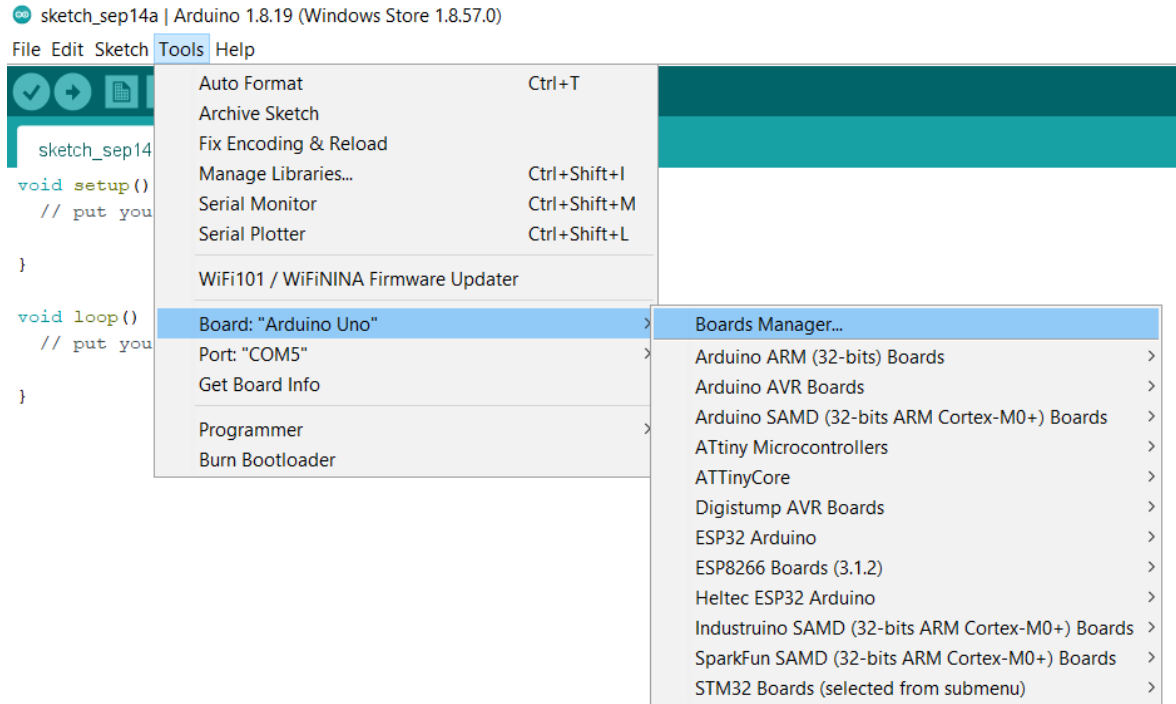Go to Tools- Board- Board Manager.

*Fig. 10. Installing SparkFun SAMD21 board- stage 1.*

Search SAMD21. Install SparkFun SAMD Boards (I have already installed it). Now we can upload the Program.
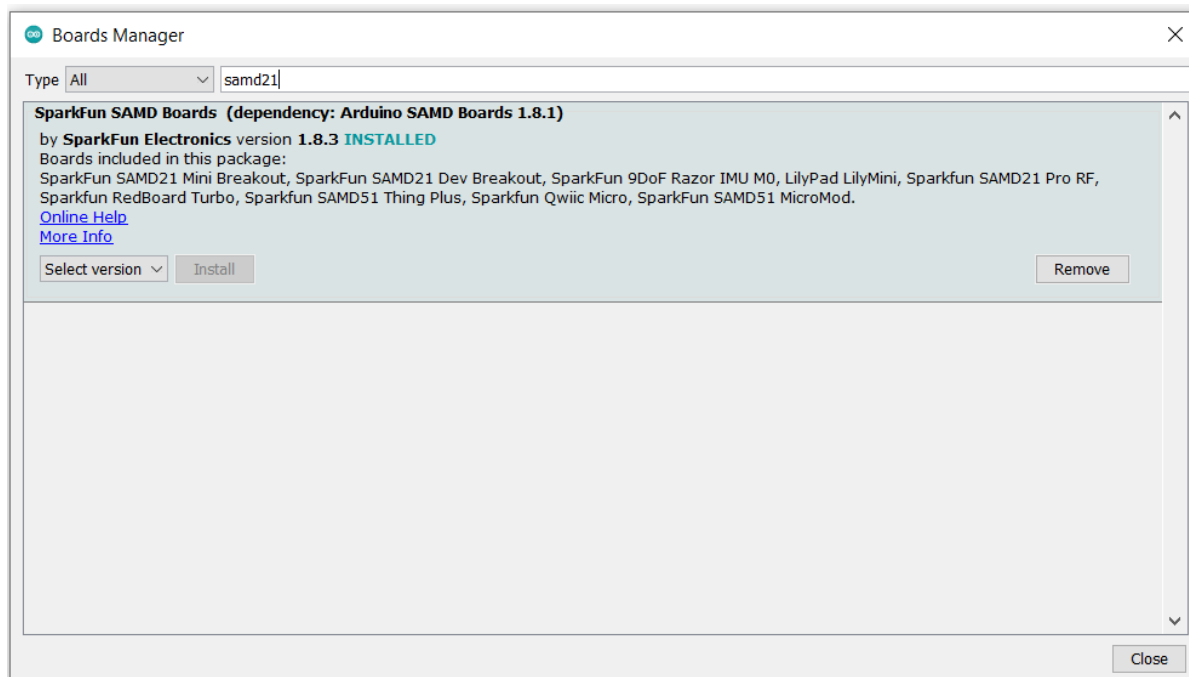


*Fig. 11. Installing SparkFun SAMD21 board- stage 2.*

Step: 4

Upload the simple LED blinking. An SMD LED is connected to the D10 pin in our bootloader uploader board. Copy the below code and paste it into the Arduino IDE. Remove SWD connection from J-Link EDU. The code is uploaded through USB.

```
void setup() {
  // initialize digital pin LED_BUILTIN as an output.
  pinMode(10, OUTPUT);
}
//The loop function runs over and over again forever
void loop() {
  digitalWrite(10, HIGH);   // turn the LED on (HIGH is the voltage level)
  delay(1000);                    // wait for a second
  digitalWrite(10, LOW);    // turn the LED off by making the voltage LOW
  delay(1000);                    // wait for a second
}
```

Step: 5

Go to Tools- Board- SparkFun SAMD- SparkFun SAMD21 Dev Breakout.

Go to Tools- Port and select the SparkFun Port ( Check the device manager for more information about the port).

Upload the code, and the LED will blink. (It takes some time to upload the code- be patient).
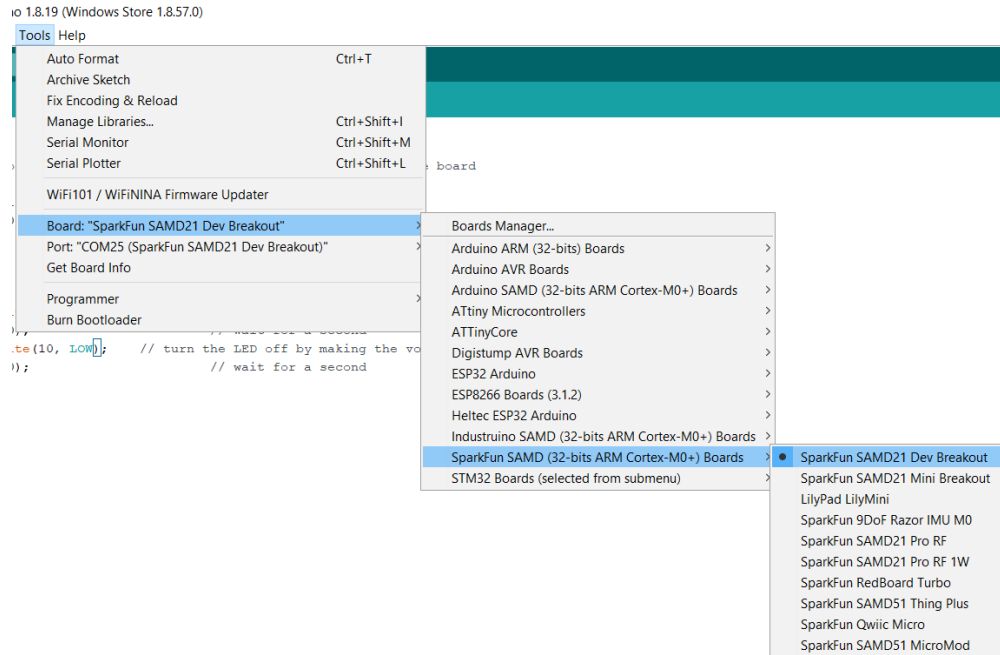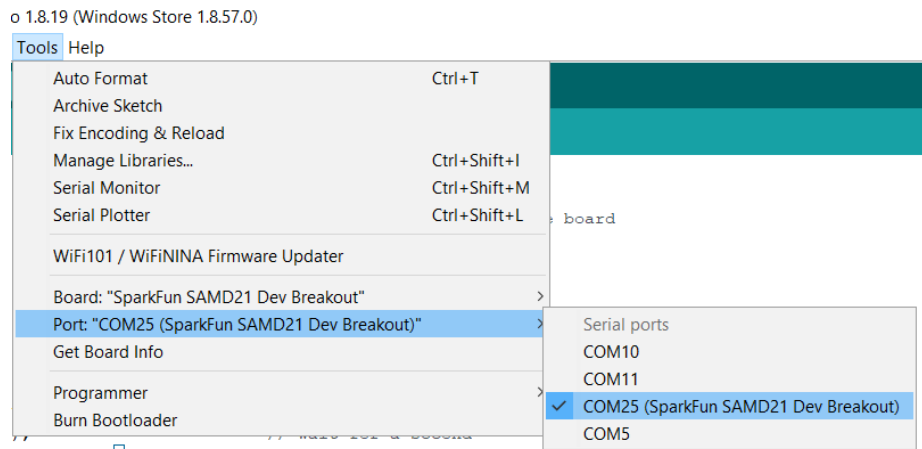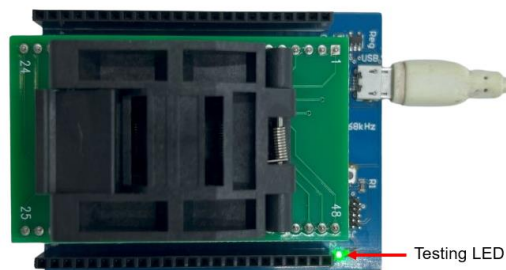
*Fig. 12. SparkFun SAMD21 board selection.*



*Fig. 13. SparkFun SAMD21 port selection.*



*Fig. 14. Testing LED Blinking.*