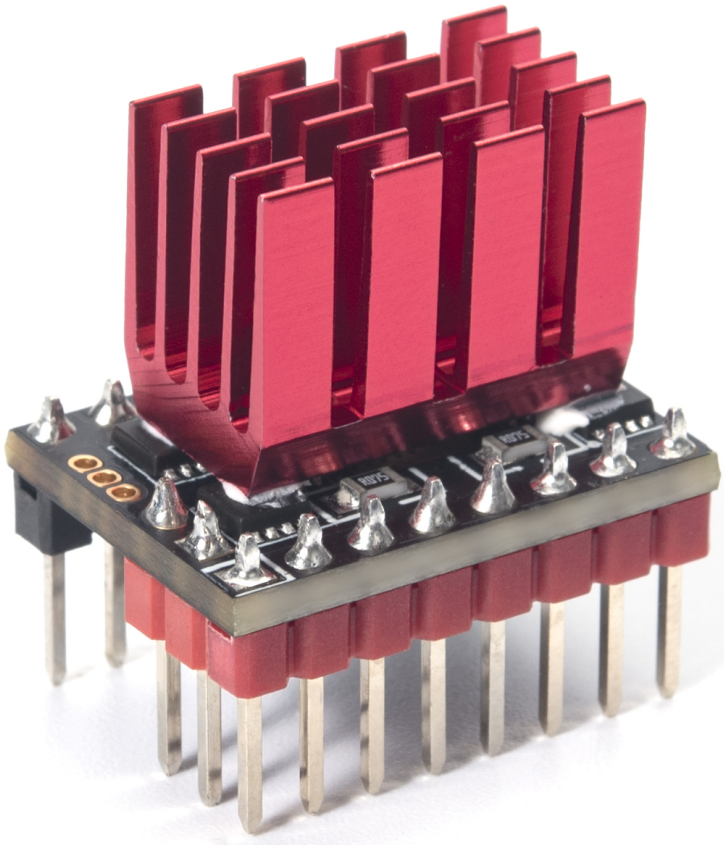
BIGTREETECH

TMC5160T Pro V1.0

User Manual



Revision Log

Version	Date	Revisions
v1.00	October 18th, 2024	Initial Version

Table of Contents

1. Product Profile

The TMC5160 is a high-power stepper motor driver control chip that uses external power MOSFETs. It can operate at voltages up to 56V, supporting a wider range of stepper motors and offering higher adaptability.

1.1. Feature Highlights

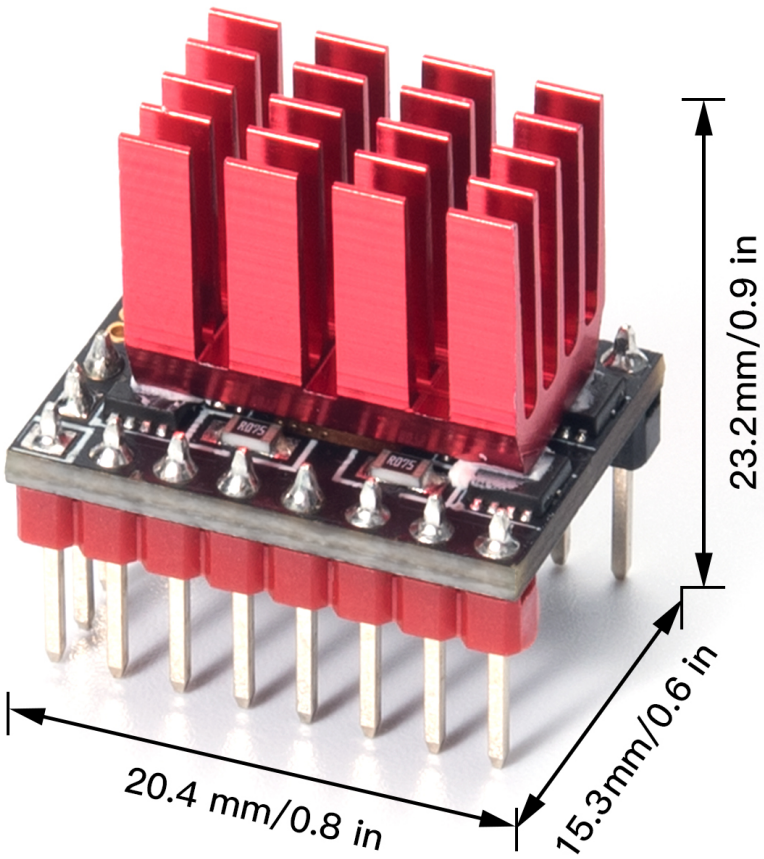
- Utilizes external power MOSFETs to support higher voltages and larger currents.
- Generates significantly less heat compared to drivers such as the 2209 and 2130.
- Delivers greater torque to prevent motor-jitter, reducing the likelihood of missing steps.
- Capable of driving 57 stepper motors.
- Adopts a universal driver board design for higher compatibility across various applications.
- Features a heatsink with enhanced fin design for improved cooling.
- Includes expansion interfaces for DIY enhancements.

1.2. Specifications

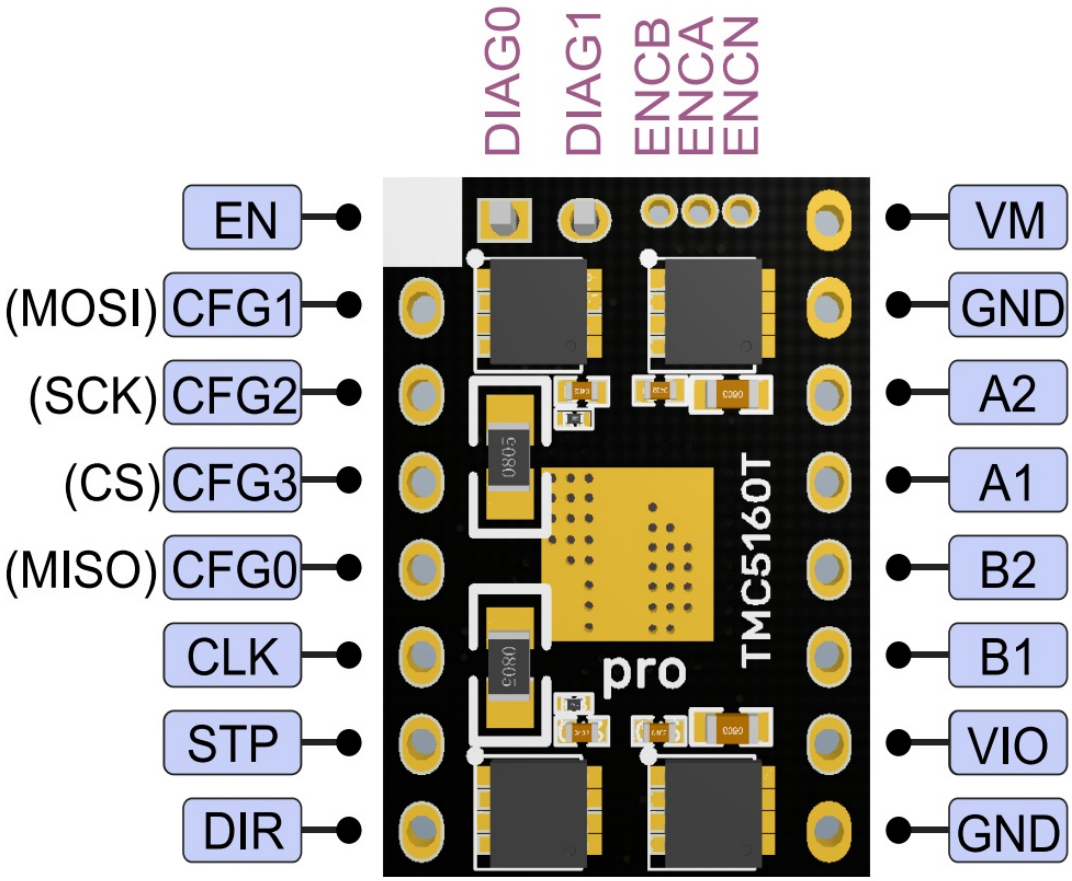
- Dimensions: 20.4mm x 15.3mm x 23.2mm
- Driver Chip: TMC5160-TA
- Input Voltage (VM): 8V-56V (TMC5160T Pro), 8V-24V (TMC5160T)
- Maximum Current: RMS 3.1A, Peak 4.4A (base capacity of 3A maximum)
- Maximum Microstepping: 256 steps
- Operating Mode: SPI

1.3. Peripheral Interface

1.3.1. Dimensions



1.3.2. Pin Description



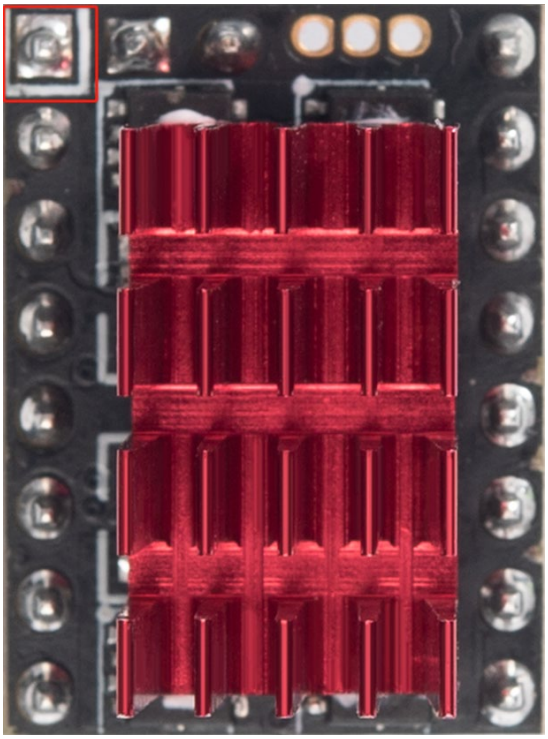
J1	Functions	J2	Functions
1	(EN) Enable	1	(VM) Motor Supply Voltage
2	(SDI/CFG1) Data	2	(GND) Ground
3	(SCK/CFG2) Clock	3	(A2) Phase A
4	(CSN/CFG3) Chip Select	4	(A1) Phase A
5	(SDO/CFG0) Data	5	(B2) Phase B
6	(CLK) External Clock Input	6	(B1) Phase B
7	(STEP) Pulse Input	7	(VIO) Logic Voltage
8	(DIR) Direction Input	8	(GND) Ground

ENCA_DCIN_CFG5	24	24	DI (pd)	Encoder A-channel input (when using internal ramp generator) or DcStep gating input for axis synchronization (SD_MODE=1, SPI_MODE=1) or Configuration input (SPI_MODE=0)
ENCN_DCO_CFG6	25	26	DIO	Encoder N-channel input (SD_MODE=0) or DcStep ready output (SD_MODE=1). With SD_MODE=0, pull to GND or VCC_IO, if the pin is not used for an encoder.
DIAG0_SWN	26	27	DIO (pu+ pd)	Diagnostics output DIAG0. Interrupt or STEP output for motion controller (SD_MODE=0, SPI_MODE=1). Use external pullup resistor with 47k or less in open drain mode. Single wire I/O (negative) (only with SD_MODE=0 and SPI_MODE=0)
DIAG1_SWP	27	28	DIO (pd)	Diagnostics output DIAG1. Position compare or DIR output for motion controller (SD_MODE=0, SPI_MODE=1). Use external pullup resistor with 47k or less in open drain mode. Single wire I/O (positive) (only with SD_MODE=0 and SPI_MODE=0)

2. Interface Introduction

2.1. Installation and Interface

The Enable (EN) pin is highlighted in red in the diagram and located inside the marked white box on the driver:

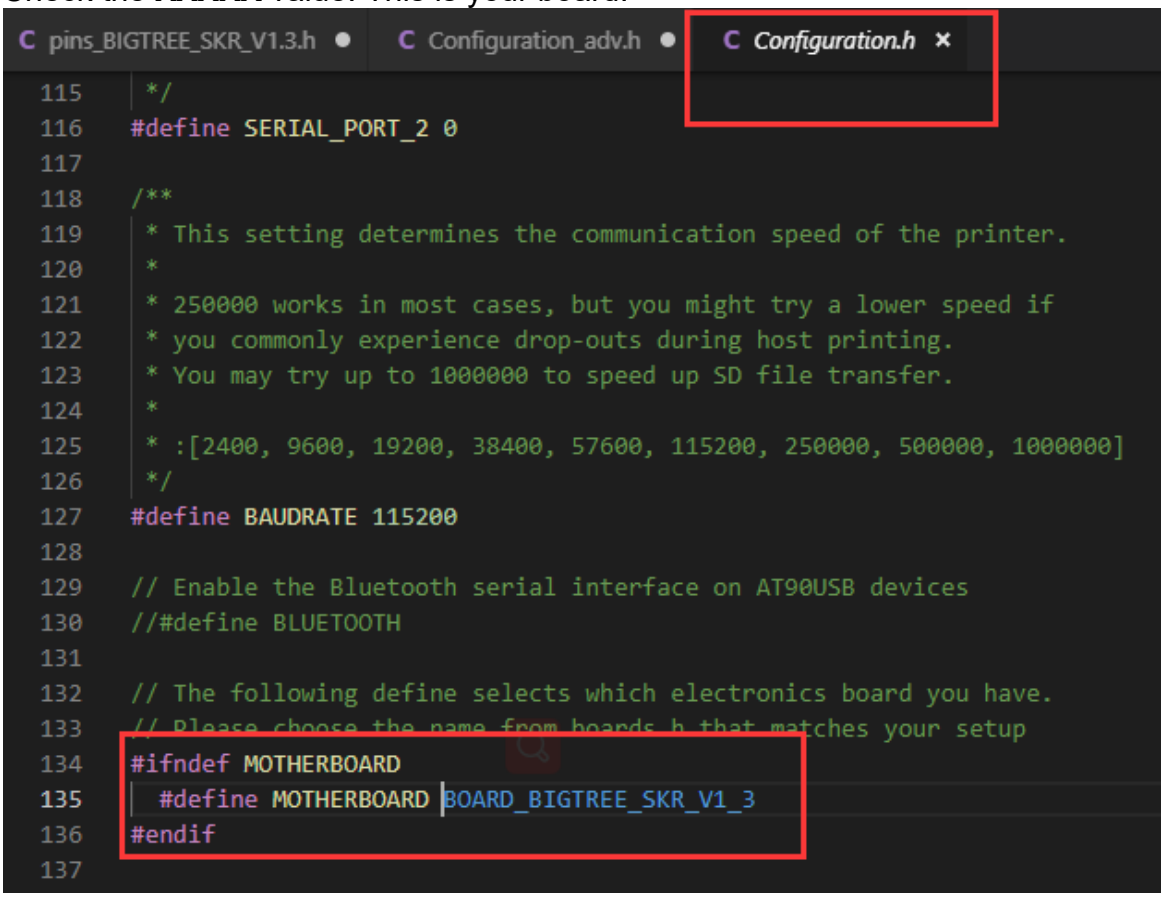


3. Firmware Settings

3.1. Marlin

Important: Marlin firmware version 2.0 or above is required for TMC5160's SPI mode.

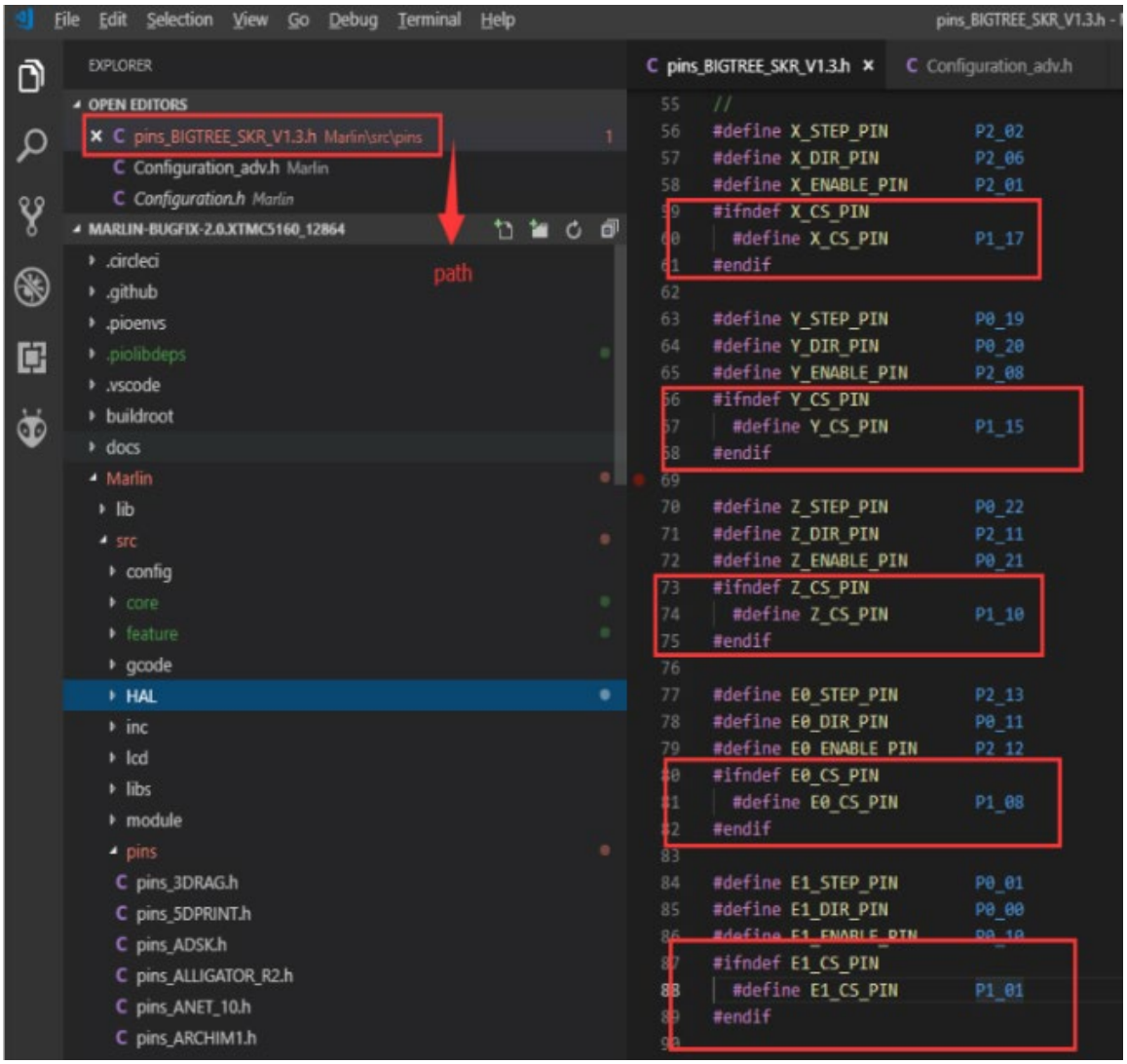
Step 1:
Open **Configuration.h** in your Marlin 2.0 firmware.
Find **#define MOTHERBOARD XXXXXX.**
Check the **XXXXX** value. This is your board.



Step 2:
Go to the **Marlin\src\pins** directory.
Open the **pins_xxxxxx.h** file that matches your board. (Remember, xxxxxx is your board model from Step 1).
Find these lines:

- **X_CS_PIN**
- **Y_CS_PIN**
- **Z_CS_PIN**
- **E0_CS_PIN**

Change the pin numbers to the ones which you are using.



Step 3:

Stay in that same **pins_xxxxxx.h** file. (The one from Step 2).

Find these lines:

#define TMC_SW_MOSI XXX

#define TMC_SW_MISO XXX

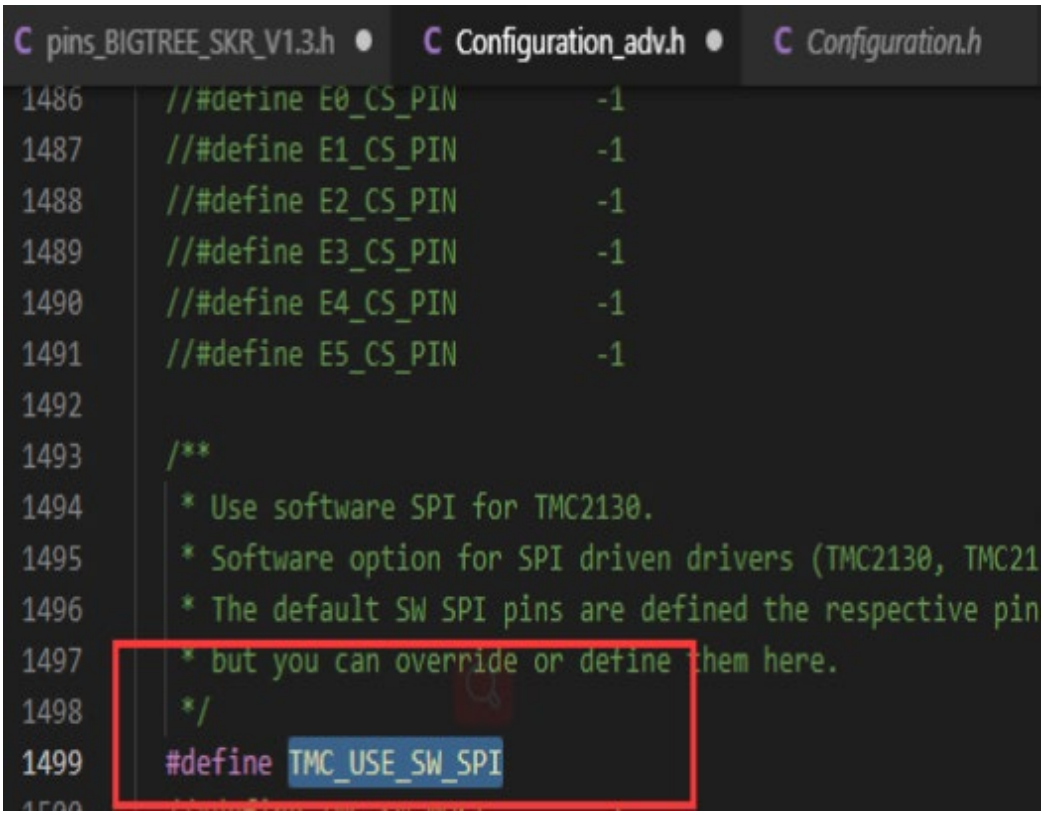
#define TMC_SW_SCK XXX

Replace those XXX placeholders with the correct pin numbers for your setup.

```
91   //
92   // Software SPI pins for TMC2130 stepper drivers
93   //
94   #if ENABLED(TMC_USE_SW_SPI)
95     #define TMC_SW_MOSI      P4_28
96     #define TMC_SW_MISO      P0_05
97     #define TMC_SW_SCK       P0_04
98
99   #endif
100
101  /*  #define TMC_SW_MISO       P4_28
102    #define TMC_SW_SCK        P0_05
103    #define TMC_SW_MOSI       P0_04
```

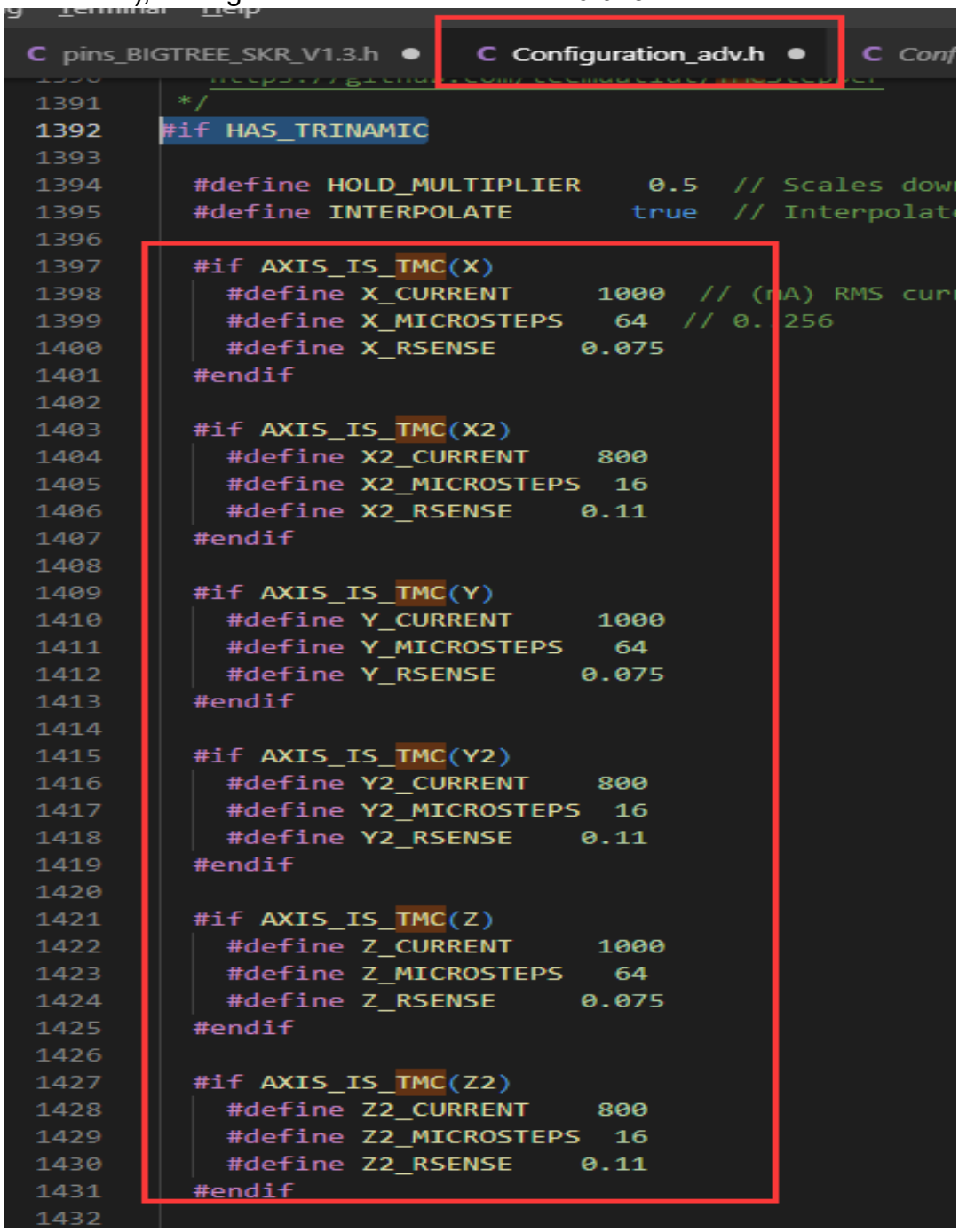
Step 4:

Open the **Configuration_adv.h** file. Find the line **#define TMC_USE_SW_SPI**. Remove the *//* at the beginning of the line.



Step 5:

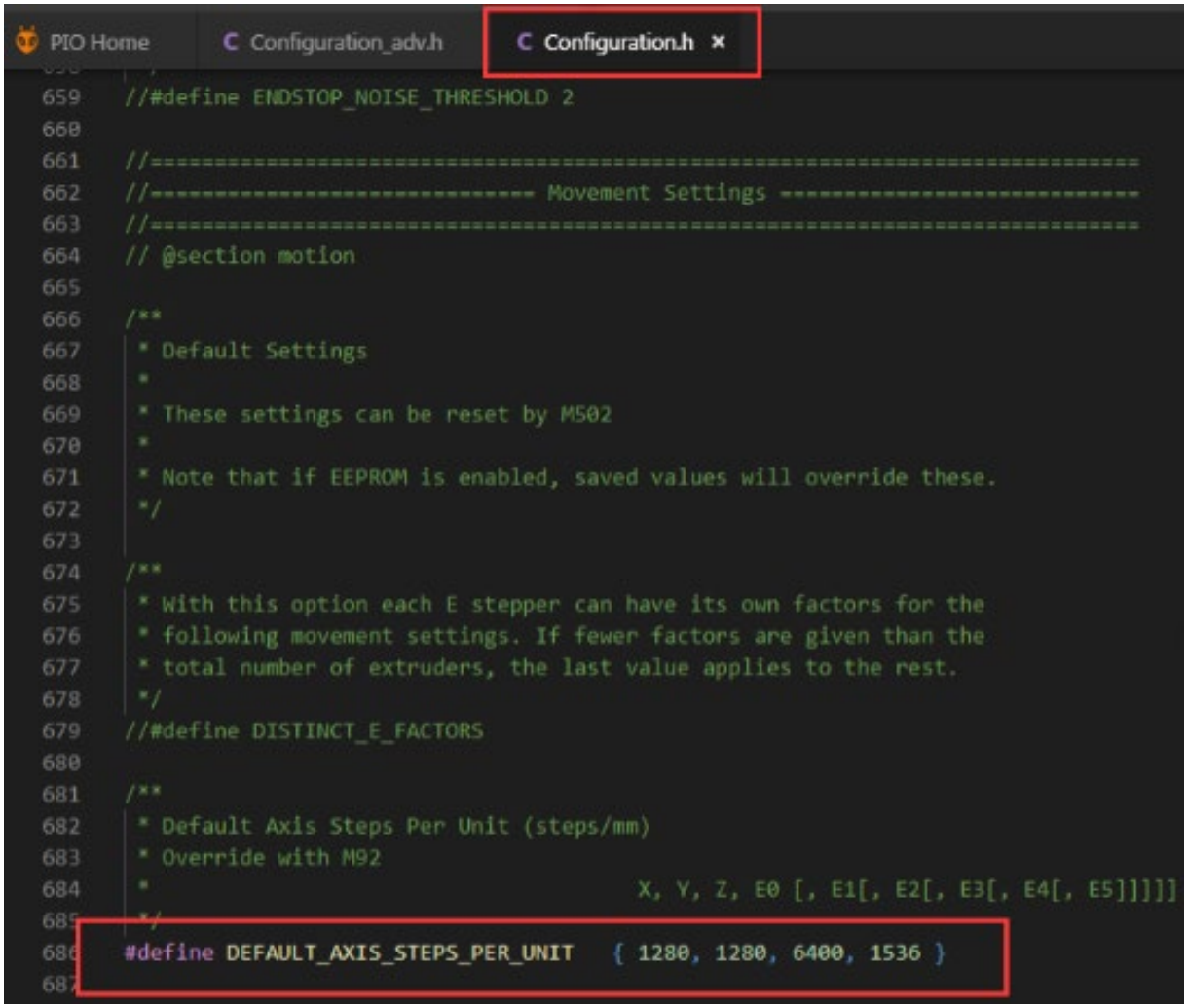
In **Configuration_adv.h**, find **#define X_CURRENT**, **#define X_MICROSTEPS**, **#define X_RSENSE** and modify the parameters (modifications are needed for all axes used), setting RSENSE for each axis to **0.075**.



Step 6:

After completing step 5, open **Configuration.h** and locate **#define DEFAULT_AXIS_STEPS_PER_UNIT** and modify the parameters to set microstepping, ensuring it corresponds with the microstepping from step 5.

For microstepping calculation, "80,80,400,96" represents 16 microsteps, and if changed to 32 microsteps it becomes "80*(32/16), 80*(32/16), 400*(32/16), 96*(32/16)".



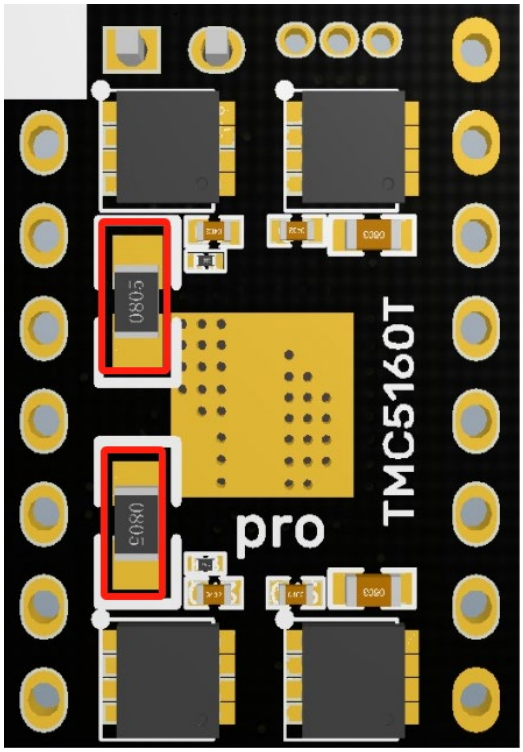
The TMC5160T Pro V1.0 uses a 0.075R current sensing resistor, which sets the maximum effective RMS current to 3.1A.

CHOICE OF R_{SENSE} AND RESULTING MAX. MOTOR CURRENT WITH *GLOBALSCALER*=255		
R_{SENSE} [Ω]	*RMS current [A] (CS=31)*	*Sine wave peak current [A] (CS=31)*
0.22	1.1	1.5
0.15	1.6	2.2
0.12	2.0	2.8
0.10	2.3	3.3
0.075	3.1	4.4
0.066	3.5	5.0
0.050	4.7	6.6
0.033	7.1	10.0
0.022	10.6	15.0

If you require higher currents, it is possible to replace the current sensing resistor with a new one. Please note that you will need to source and solder it yourself. Ensure that the replacement resistor is no less than 0.066R due to the size constraints of the module.

Note: Replacing the resistor is not recommended, but if you decide to go ahead, you'll need to take responsibility for any damage that might happen during the swap.

The location for the replacement resistor is indicated by the red box in the diagram below.



4. Cautions

Disconnect power before installing the driver to avoid damage.

Ensure proper orientation during installation to prevent malfunction.

Avoid hot-plugging the driver module to prevent damage.

If you need further resources for this product, you can find them at [GitHub](https://github.com/bigtreetech/). If you cannot find what you need, you may contact our after-sales support(service005@biqu3d.com).

If you encounter any other problems during use or have suggestions or feedback, please contact us. Thank you for choosing BIGTREETECH products.