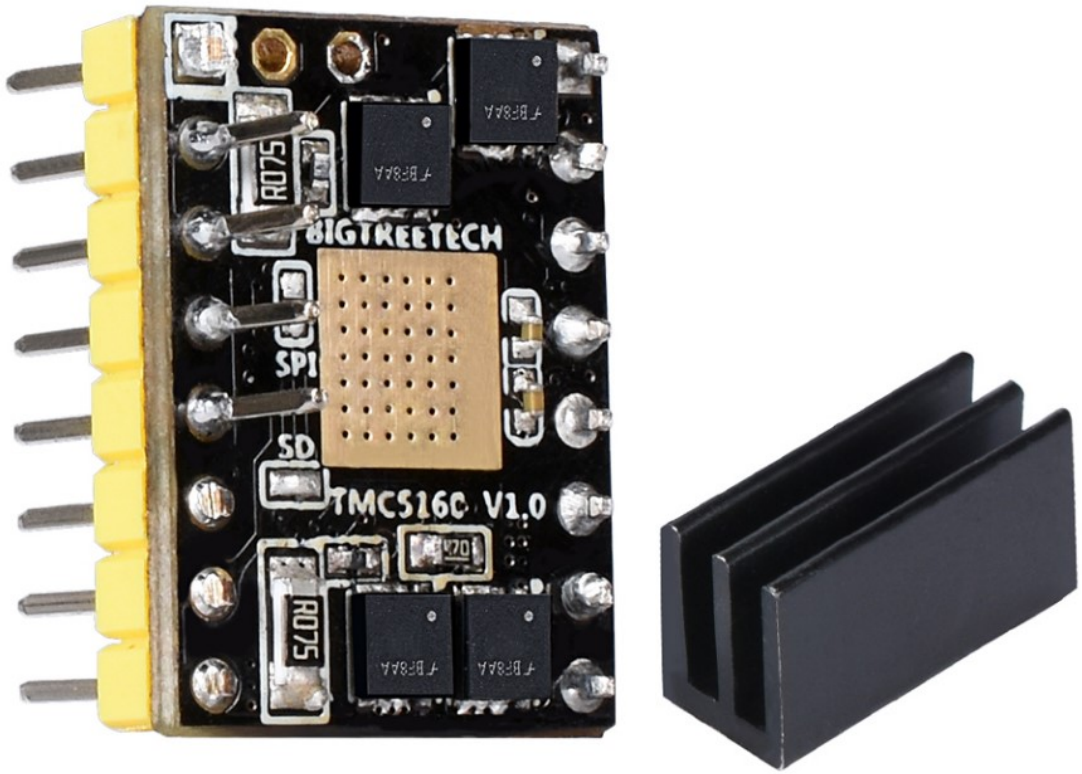
TMC5160



Product Profile

TMC5160 is a high-power stepper motor driving control chip, which has externally expanded power MOS tube, the maximum current can reach 20A, low heat when working.

Supporting TRINAMICS unique stealthChop2 mode eliminates motor noise by reducing resonance and achieves a silent effect.StallGuard2 ™ blocking rotation detection is a safe stop to detect the motor and replaces a mechanical stop switch.It can achieve stepping motor torque control or sensorless back to the origin.

dcStep ™ can let the motor run near its limit load and speed limit, can be achieved in the absence of any step 10 times or more dynamic range.

spreadCycle ™ chopper algorithm has high precision, used for high dynamic motor sports and current wave absolutely clean. Low noise, low resonance and low vibration chopper.

coolStep ™ current control function, optimize the drive performance, balance the speed and motor torque and optimize energy efficiency, drive smoothly and no noise, energy consumption can be reduced by 75%.

TMC5160 is an expansion of the TMC2100, TMC2130 and

TMC5130 series to higher voltages and higher motor currents.

Product Link: BIGTREETECH Official Website

Features Highlights

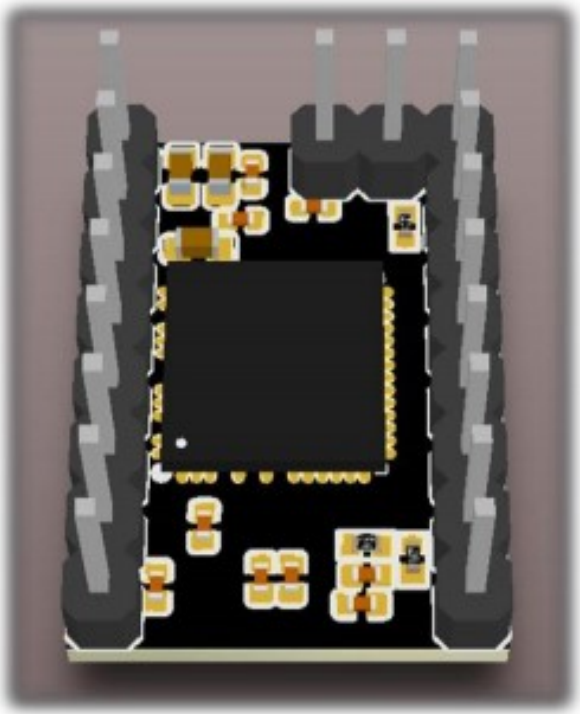
- External power MOS tube can support larger current, the maximum current can reach 20A (because the module is limited by area, the current cannot exceed)
- Super-mute mode
- Low calorific value
- can prevent motor shake(5)not easy to lose step
- can drive 57 stepper motor

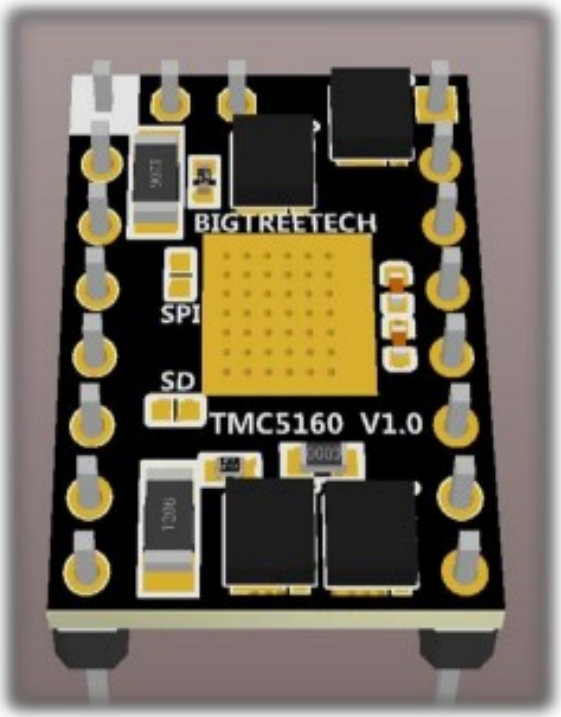
Specifications

Driver chip	**TMC5160T V1.0**

Driver chip	TMC5160T V1.0
Product size	15.3mm*20.4mm
Power supply voltage (VM)	8V-- -40V
Maximum current	4.4A (the sense resistor determines the maximum current)
Maximum subdivision	256
Working mode	SPI mode

Interface Diagram

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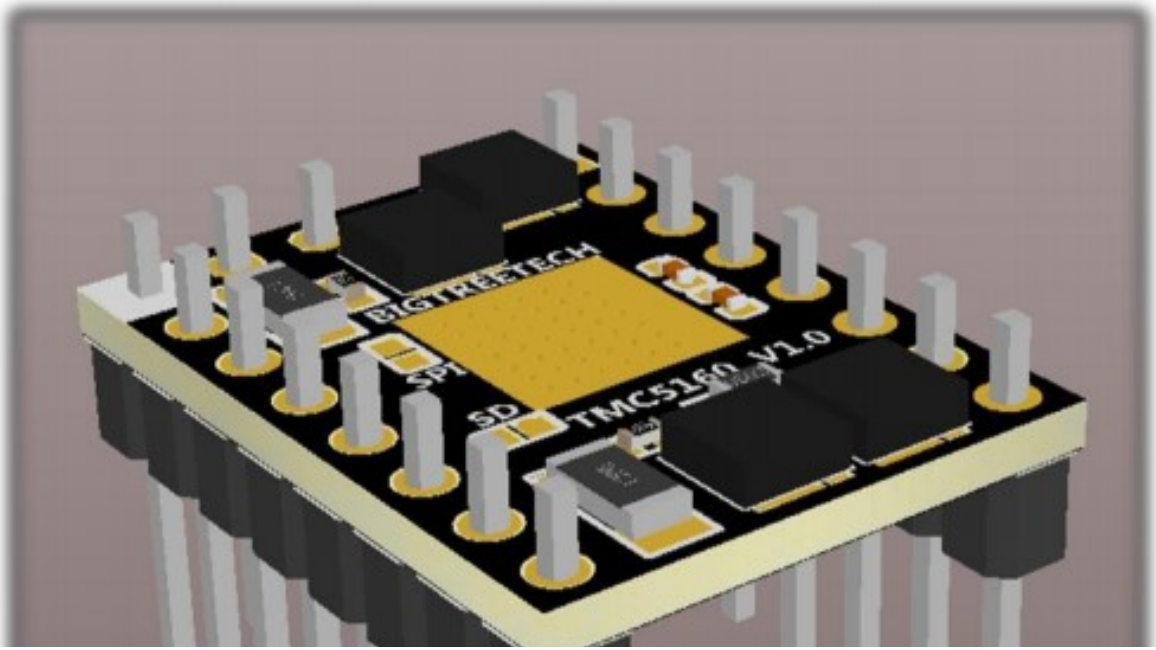
SPI
SD
TMC5160 V1.0


BIGTREETECH
SPI
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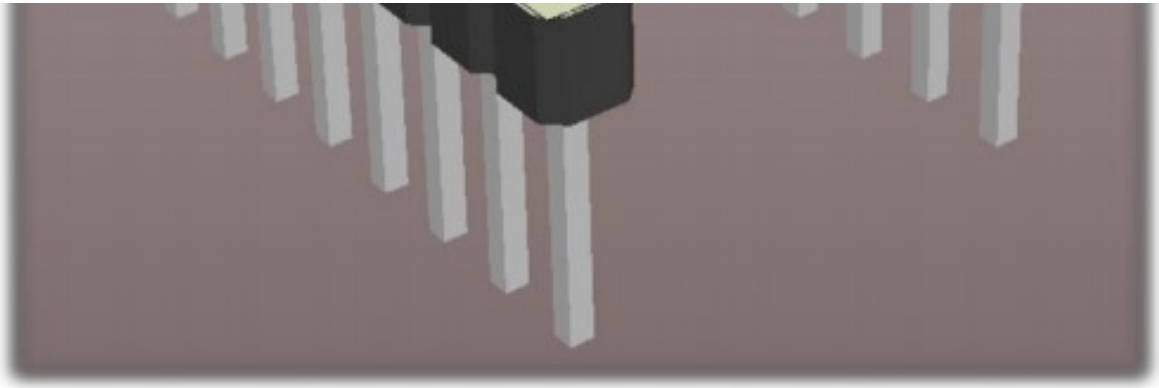
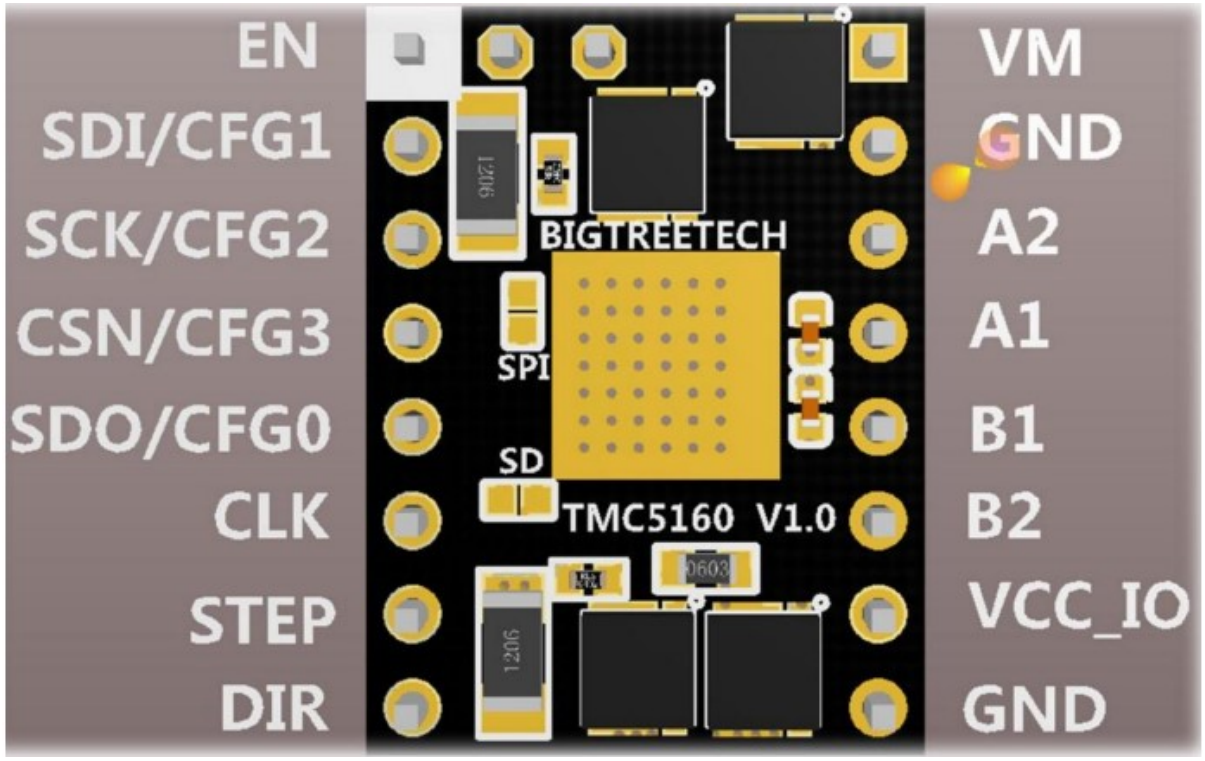
TMC5160 V1.0



Pinout/Function



J1	Function	J2	Function
1	(EN) Enable	1	(VM) Motor Supply Voltage
2	(SDI/CFG1) data	2	(GND) Grounding
3	(SCK/CFG2) Clock	3	（A2）
4	(CSN/CFG3) (Chip Selection)	4	（A1）
5	(SDO/CFG0) data	5	（B1）
6	（CLK）	6	（B2）
7	(STEP) Pulse Input	7	(VCC_IO) Logical Voltage
8	DIR Directional Input	8	(GND) Grounding

Hardware Configuration

Driver Current Description

The range of driver current depends on the value of the sense resistor.

The sense resistor sets the upper current which can be set by software settings *IRUN*, *IHOLD* and *GLOBALSCALER*. Choose the sense resistor value so that the maximum desired current (or slightly more) flows at the maximum current setting (*GLOBALSCALER* = 0 and *IRUN* = 31).

The relationship between the effective value and maximum value of the driver current and the magnitude of the sense-resistor, please see the following picture:

9 Selecting Sense Resistors

The TMC5160 provides several means to set the motor current: Sense resistors, *GLOBALSCALER* and currentscale *CS*. To adapt a drive to the motor, choose a sense-resistor value fitting or slightly exceeding the maximum desired current at 100% settings of the scalers. Fine-tune the current to the specific motor via the 8 bit *GLOBALSCALER*. Situation specific motor current adaptation is done by 5 bit scalers (actual scale can be read via *CS*), controlled by coolStep, run- and hold current (*IRUN*, *IHOLD*). This makes the *CS* control compatible to other TRINAMIC ICs.

Set the desired maximum motor current by selecting an appropriate value for the sense resistor. The following table shows the RMS current values which are reached using standard resistors.

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

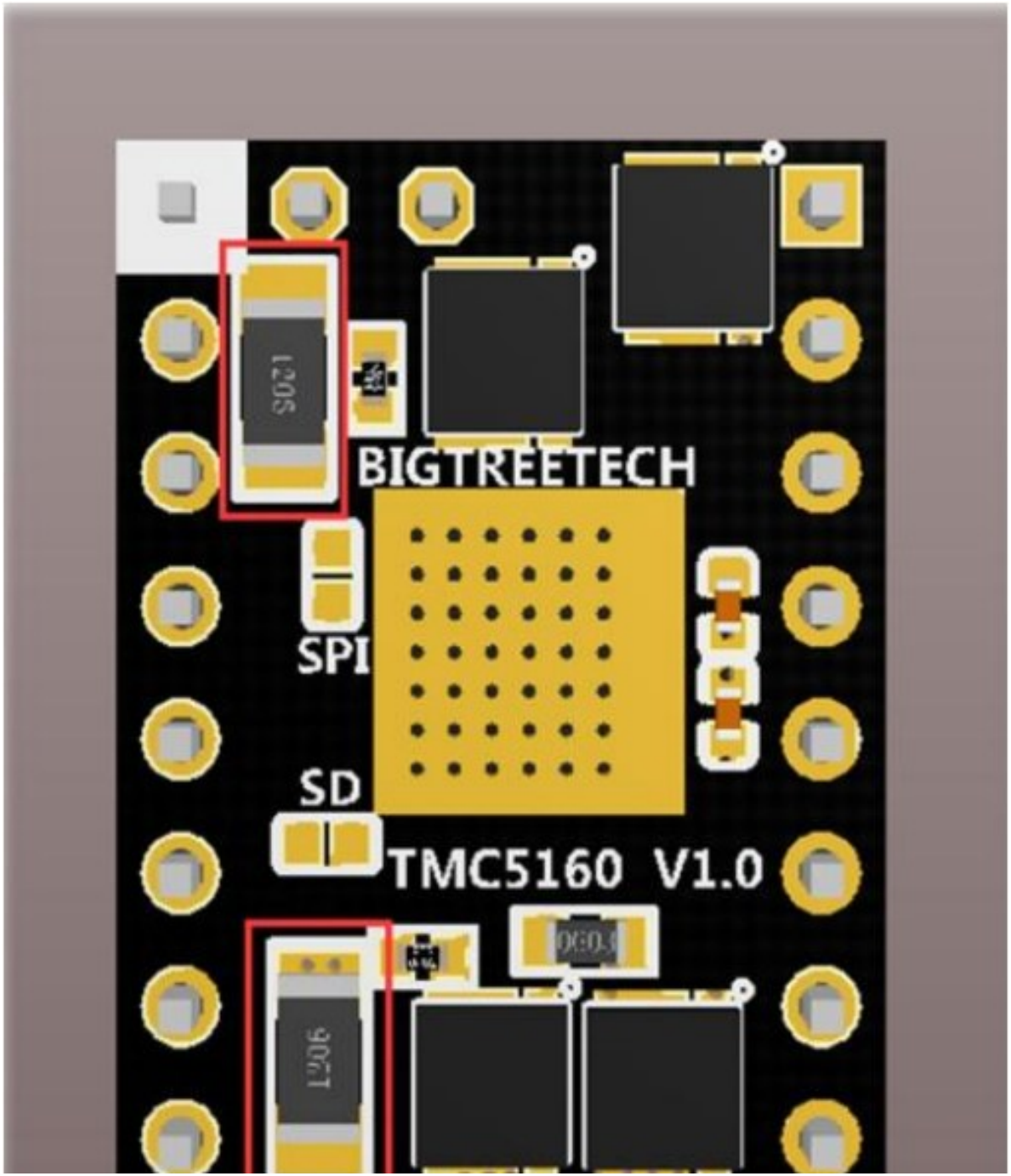
Sense resistors should be carefully selected. The full motor current flows through the sense resistors. Due to chopper operation the sense resistors see pulsed current from the MOSFET bridges. Therefore, a low-inductance type such as film or composition resistors is required to prevent voltage spikes causing ringing on the sense voltage inputs leading to unstable measurement results. Also, a low-inductance, low-resistance PCB layout is essential. A massive ground plane is best. Please also refer to layout considerations in chapter 29.

The sense resistors used in the TMC5160-V1.0 is 0.075R, so the effective value of the driver current of this driver is 3.1A, and the maximum current is 4.4A.

If you need to use a larger current, you need to replace the value of the sense resistor yourself (you need to prepare the components and soldering yourself).

Replace the resistor not less than 0.05R (subject to module size limit).

Note: It is not recommended to replace the resistor. If it must be replaced,the driver will be damaged during the replacement process is at your own risk.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SPI
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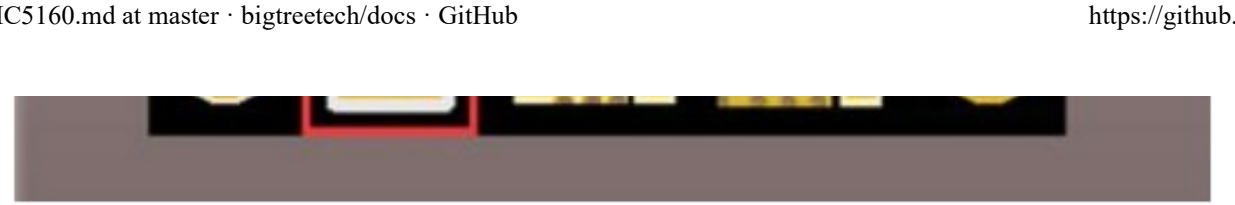
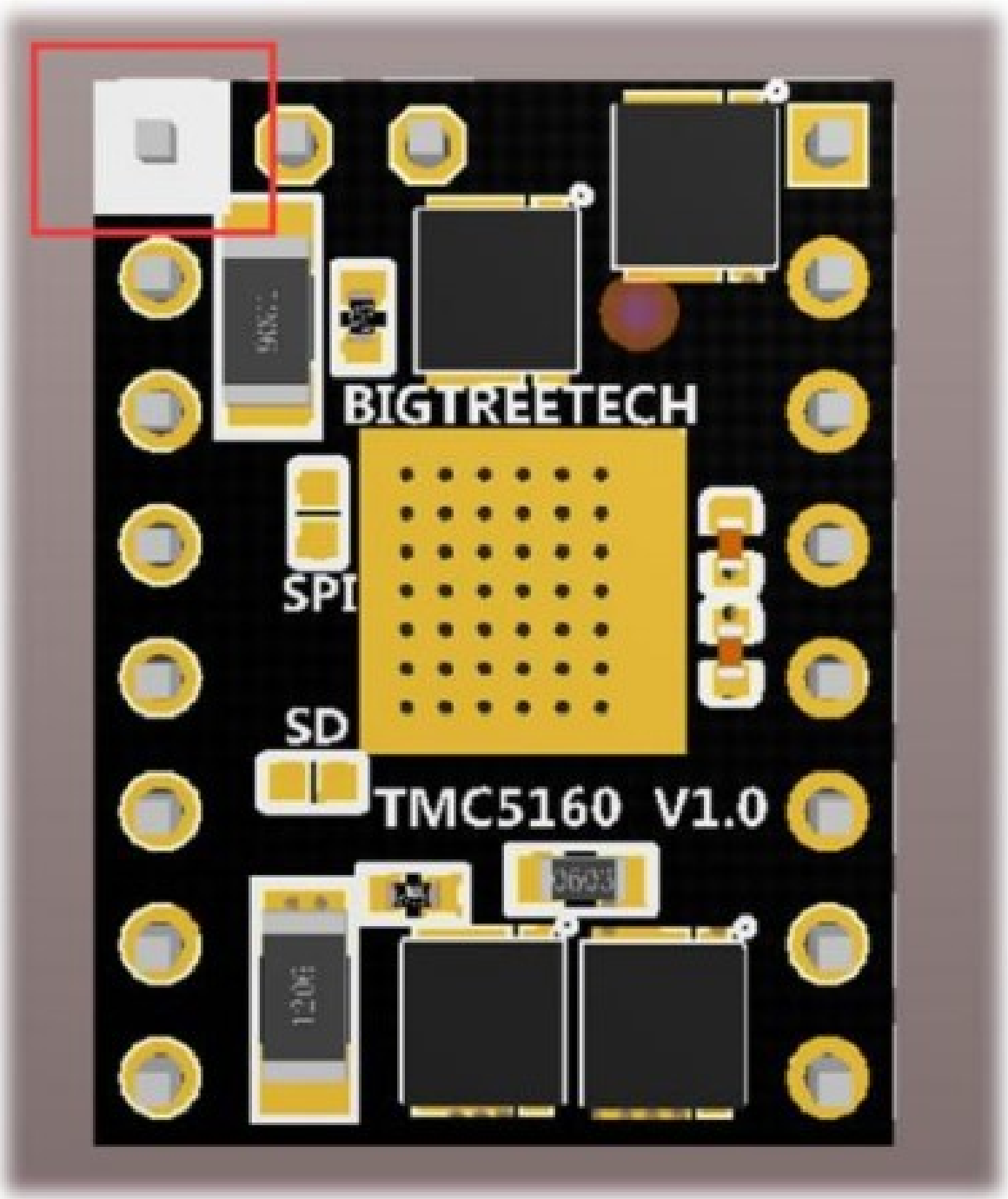
TMC5160 V1.0



Hardware Installation

The pins with white block diagram on the driver are enabled (EN) pins as shown in the red box below.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SPI
SD
TMC5160 V1.0

Software Configuration

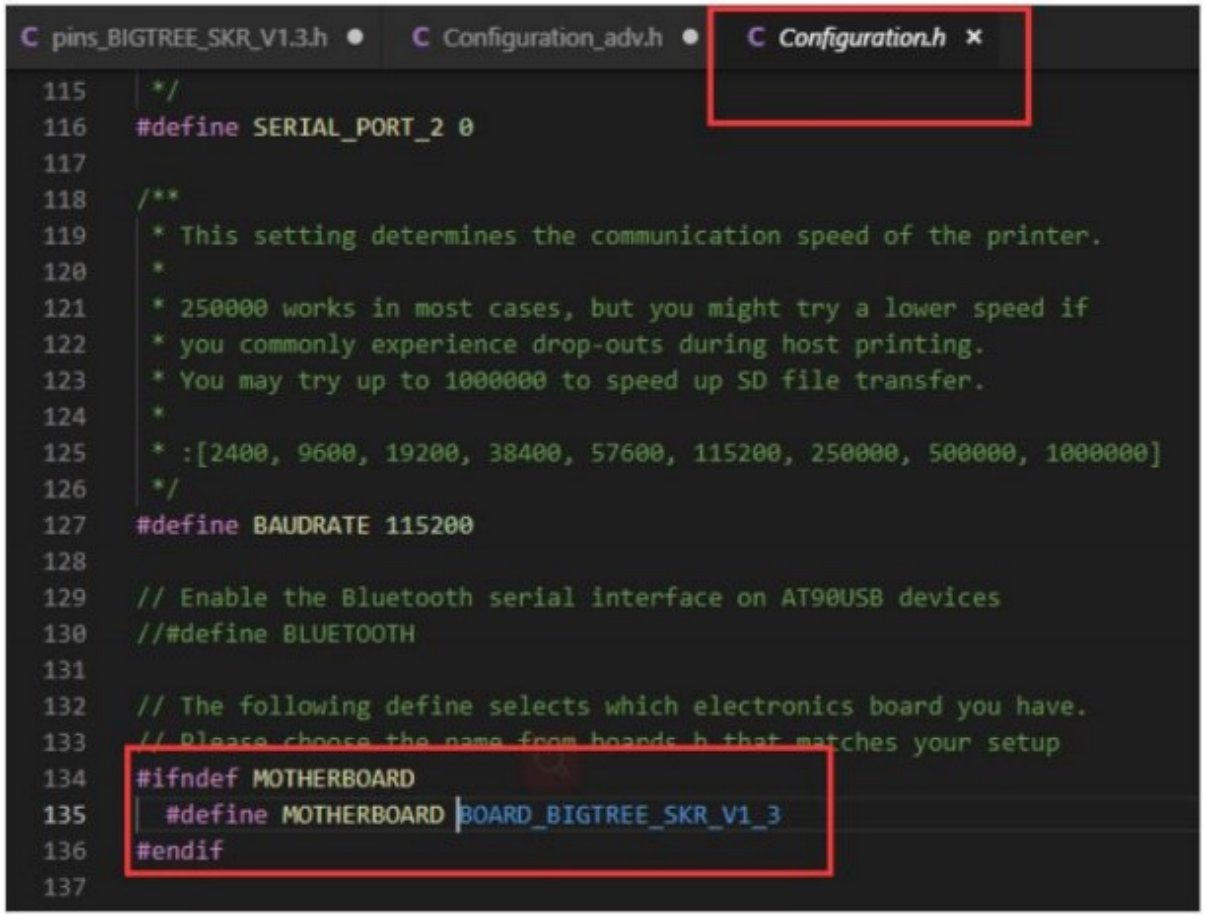
Klipper Config Example

```
[tmc5160 stepper_x]
cs_pin: PD2
spi_software_sclk_pin: PC6
spi_software_mosi_pin: PC8
spi_software_miso_pin: PC7
run_current: 0.80
sense_resistor: 0.075
interpolate: True
stealthchop_threshold: 0
diag1_pin: ^!PF3
driver_SGT: 0
```

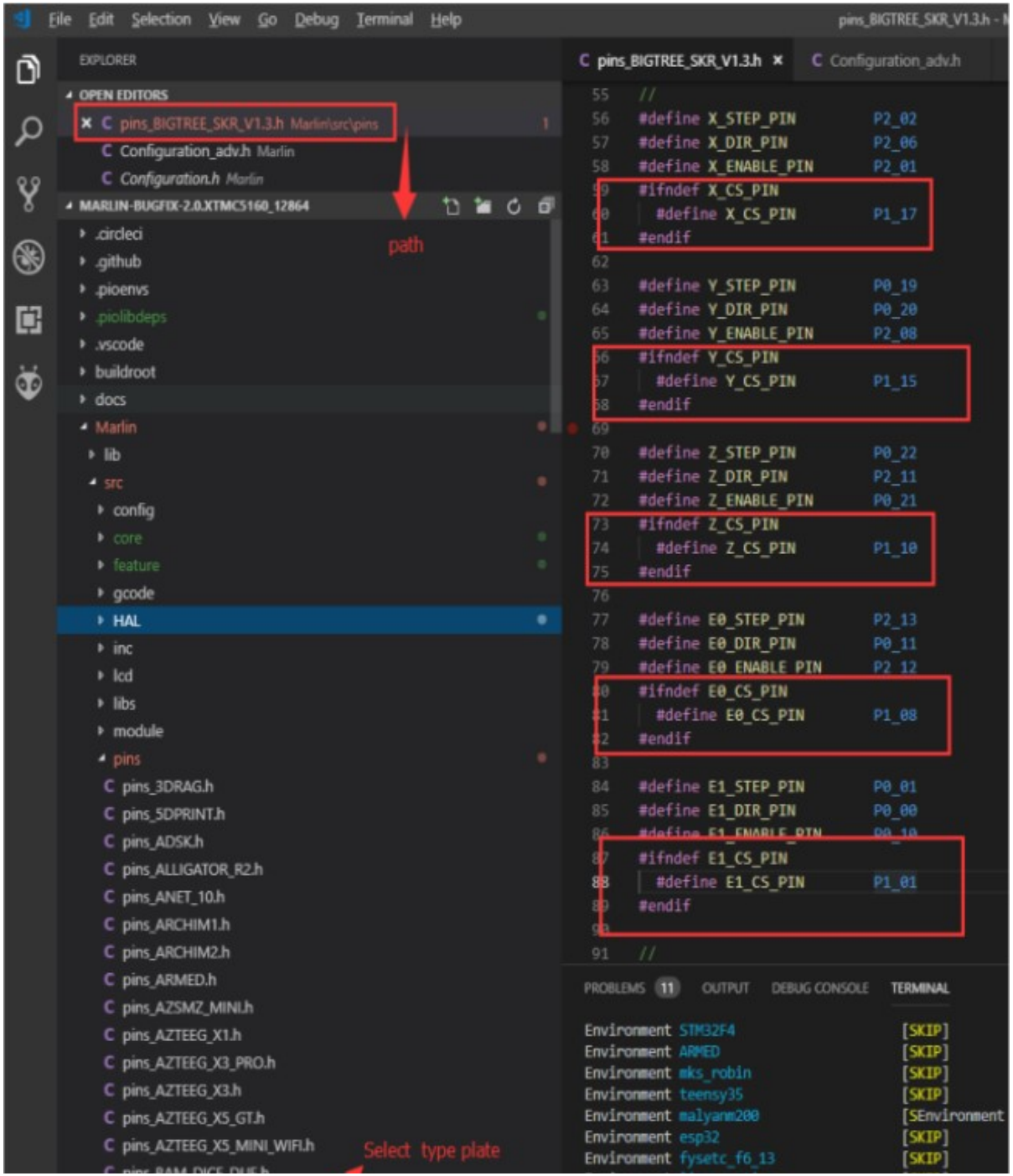
Marlin Config

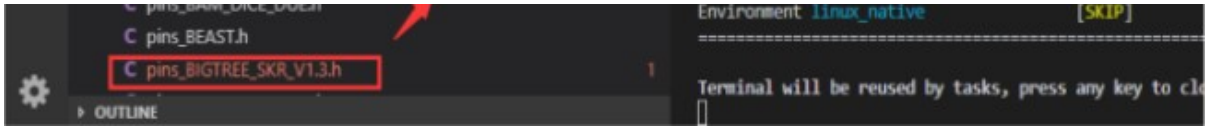
!!! note "Marlin version" Currently only firmware of Marlin 2.0 and above supports the SPI mode of TMC5160.

Find and open `Configuration.h` in Marlin 2.0 firmware File, and then find `# define MOTHERBOARD XXXXXX` and `XXXXX` Represents the type of board used. Confirm the motherboard you use.

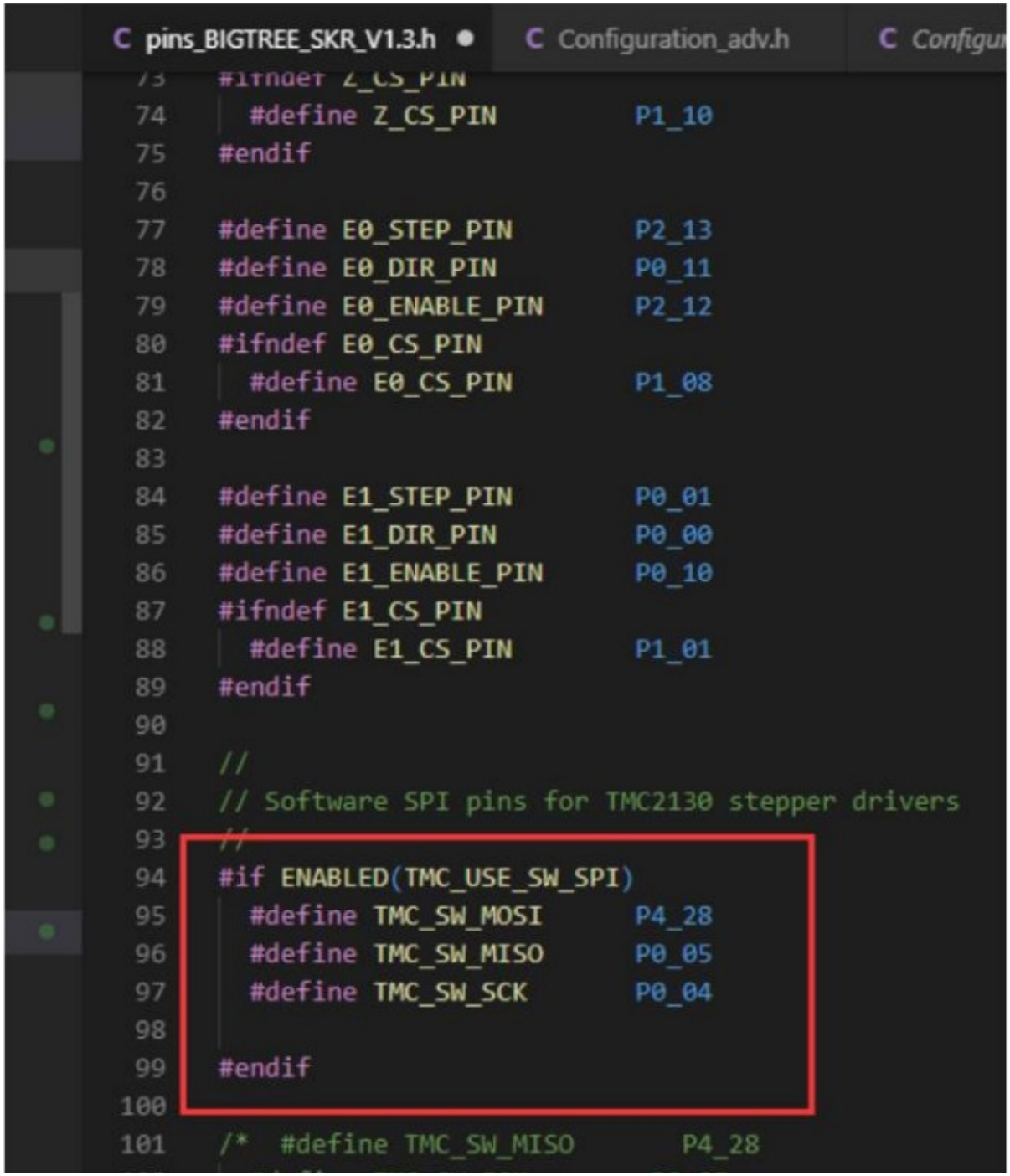


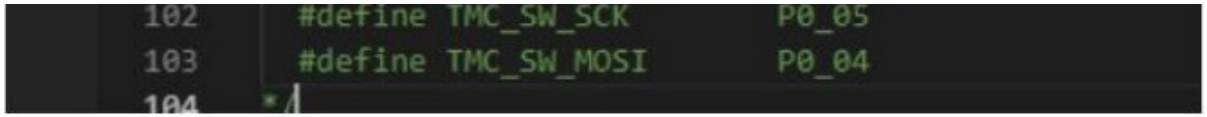
Find the `pins_xxxxxx.h` file (xxxx represents the model of the board) in the Marlin `./src/pins` directory, and then find `X_CS_PIN`, `Y_CS_PIN`, `Z_CS_PIN`, `E0_CS_PIN` under the file.Finally modify the following pin name to the pin you use.


File Edit Selection View Go Debug Terminal Help
pins_BIGTREE_SKR_V1.3.h - M
EXPLORER
OPEN EDITORS
pins_BIGTREE_SKR_V1.3.h Marlin\src\pins
Configuration_adv.h Marlin
Configuration.h Marlin
MARLIN-BUGFIX-2.0.XTMC5160_12864
path
.circleci
.github
.pioenvs
.piolibdeps
.vscode
buildroot
docs
Marlin
lib
src
config
core
feature
gcode
HAL
inc
lcd
libs
module
pins
pins_3DRAG.h
pins_5DPRINT.h
pins_ADSK.h
pins_ALLIGATOR_R2.h
pins_ANET_10.h
pins_ARCHIM1.h
pins_ARCHIM2.h
pins_ARMED.h
pins_AZSMZ_MINI.h
pins_AZTEEG_X1.h
pins_AZTEEG_X3_PRO.h
pins_AZTEEG_X3.h
pins_AZTEEG_X5_GT.h
pins_AZTEEG_X5_MINI_WIFI.h
Select type plate
pins_BIGTREE_SKR_V1.3.h
Configuration_adv.h
55 //
56 #define X_STEP_PIN P2_02
57 #define X_DIR_PIN P2_06
58 #define X_ENABLE_PIN P2_01
#ifndef X_CS_PIN
#define X_CS_PIN P1_17
#endif
63 #define Y_STEP_PIN P0_19
64 #define Y_DIR_PIN P0_20
65 #define Y_ENABLE_PIN P2_08
#ifndef Y_CS_PIN
#define Y_CS_PIN P1_15
#endif
70 #define Z_STEP_PIN P0_22
71 #define Z_DIR_PIN P2_11
72 #define Z_ENABLE_PIN P0_21
#ifndef Z_CS_PIN
#define Z_CS_PIN P1_10
#endif
77 #define E0_STEP_PIN P2_13
78 #define E0_DIR_PIN P0_11
79 #define E0_ENABLE_PIN P2_12
#ifndef E0_CS_PIN
#define E0_CS_PIN P1_08
#endif
84 #define E1_STEP_PIN P0_01
85 #define E1_DIR_PIN P0_00
#ifndef E1_CS_PIN
#define E1_CS_PIN P1_01
#endif
91 //
PROBLEMS 11 OUTPUT DEBUG CONSOLE TERMINAL
Environment STM32F4 [SKIP]
Environment ARMED [SKIP]
Environment mks_robin [SKIP]
Environment teensy35 [SKIP]
Environment malyanm200 [SEnvironment
Environment esp32 [SKIP]
Environment fysetc_f6_13 [SKIP]

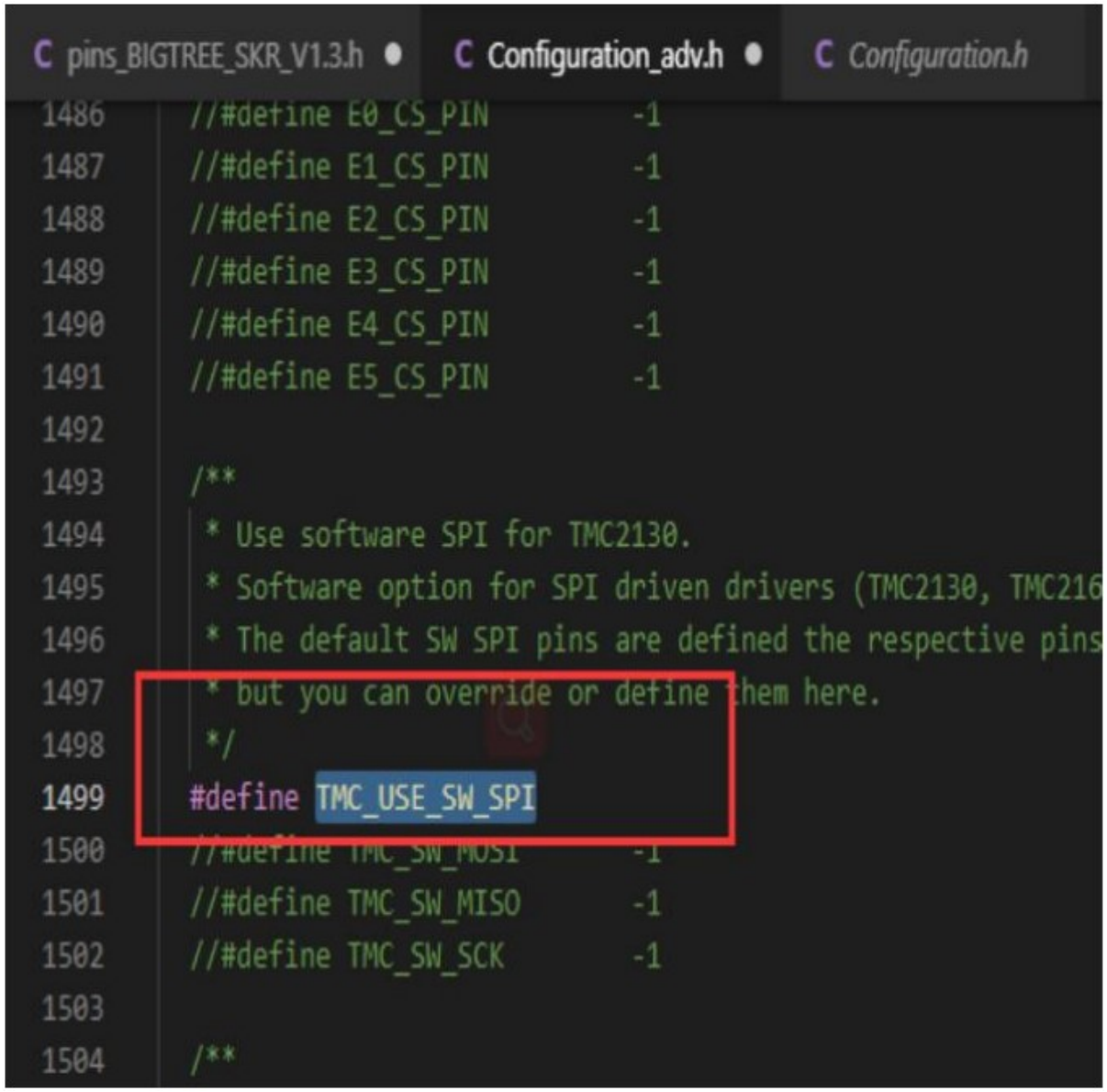


Find `#define TMC_SW_MOSI XXX`, `#define TMC_SW_MISO XXX`, `#define TMC_SW_SCK XXX` under the file in Step 2. Modify `XXX` to the pin you want to use.

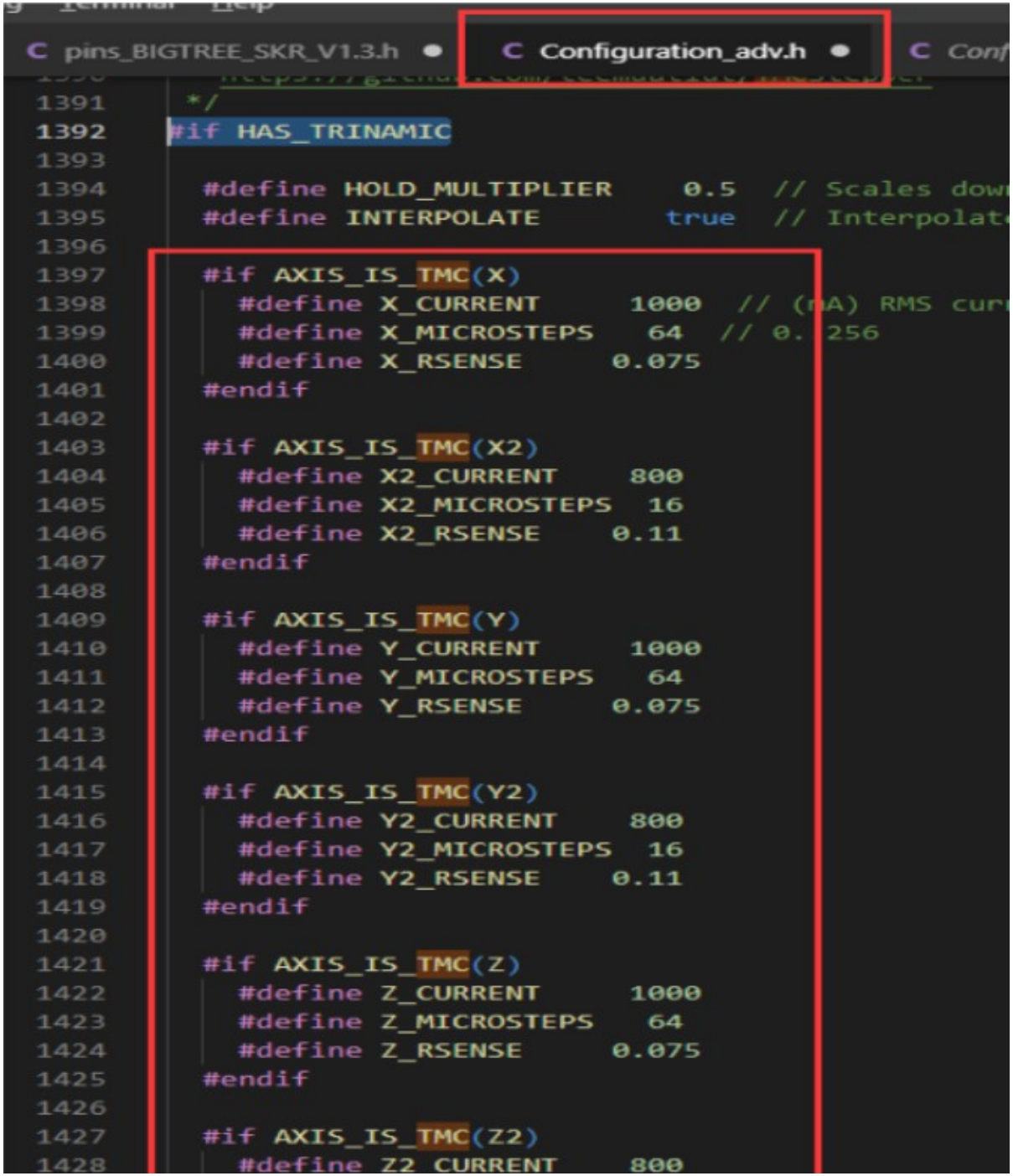

pins_BIGTREE_SKR_V1.3.h
Configuration_adv.h
#ifndef Z_CS_PIN
#define Z_CS_PIN P1_10
#endif
#define E0_STEP_PIN P2_13
#define E0_DIR_PIN P0_11
#define E0_ENABLE_PIN P2_12
#ifndef E0_CS_PIN
#define E0_CS_PIN P1_08
#endif
#define E1_STEP_PIN P0_01
#define E1_DIR_PIN P0_00
#define E1_ENABLE_PIN P0_10
#ifndef E1_CS_PIN
#define E1_CS_PIN P1_01
#endif
//
// Software SPI pins for TMC2130 stepper drivers
//
#if ENABLED(TMC_USE_SW_SPI)
#define TMC_SW_MOSI P4_28
#define TMC_SW_MISO P0_05
#define TMC_SW_SCK P0_04
#endif
/* #define TMC_SW_MISO P4_28



Find and open `Configuration_adv.h` and then find `#define TMC_USE_SW_SPI` to remove the comment `//` to enable.



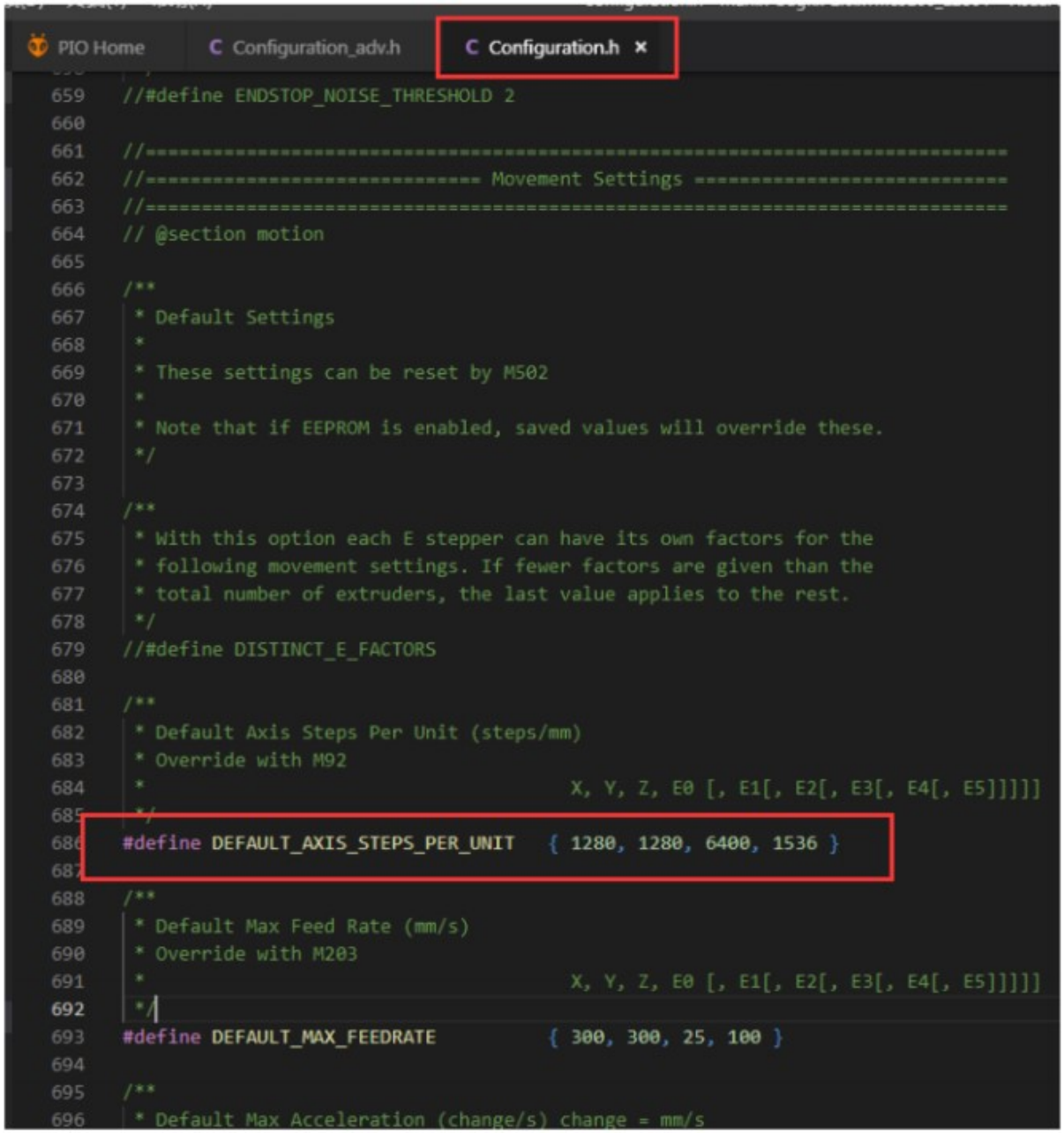
Under the `Configuration_adv.h` file, find `#define X_CURRENT`, `#define X_MICROSTEPS`, `#define X_RSENSE`. After modification of the parameters (the axes used need to be modified), the `RSENE` of the axes used should be changed to `0.075`


pins_BIGTREE_SKR_V1.3.h
Configuration_adv.h
*/
#if HAS_TRINAMIC
#define HOLD_MULTIPLIER 0.5 // Scales dow
#define INTERPOLATE true // Interpolat
#if AXIS_IS_TMC(X)
#define X_CURRENT 1000 // (mA) RMS cur
#define X_MICROSTEPS 64 // 0..256
#define X_RSENSE 0.075
#endif
#if AXIS_IS_TMC(X2)
#define X2_CURRENT 800
#define X2_MICROSTEPS 16
#define X2_RSENSE 0.11
#endif
#if AXIS_IS_TMC(Y)
#define Y_CURRENT 1000
#define Y_MICROSTEPS 64
#define Y_RSENSE 0.075
#endif
#if AXIS_IS_TMC(Y2)
#define Y2_CURRENT 800
#define Y2_MICROSTEPS 16
#define Y2_RSENSE 0.11
#endif
#if AXIS_IS_TMC(Z)
#define Z_CURRENT 1000
#define Z_MICROSTEPS 64
#define Z_RSENSE 0.075
#endif
#if AXIS_IS_TMC(Z2)
#define Z2_CURRENT 800



After the modification of Step 5 is completed, find and open `Configuration.h` and then find `#define DEFAULT_AXIS_STEPS_PER_UNIT` modifies the following parameters to set the subdivision, which must correspond to the subdivision of step 5.

Subdivision calculation method, `80, 80, 400, 96` represents 16 subdivisions. If modified to 32 subdivisions, it will be `80 * (32/16), 80 * (32/16), 400 * (32/16), 96 * (32/16)` .


PIO Home
Configuration_adv.h
Configuration.h
//#define ENDSTOP_NOISE_THRESHOLD 2
//========== Movement Settings ==========
// @section motion
/**
* Default Settings
*
* These settings can be reset by M502
*
* Note that if EEPROM is enabled, saved values will override these.
*/
/**
* With this option each E stepper can have its own factors for the
* following movement settings. If fewer factors are given than the
* total number of extruders, the last value applies to the rest.
*/
//#define DISTINCT_E_FACTORS
/**
* Default Axis Steps Per Unit (steps/mm)
* Override with M92
* X, Y, Z, E0 [, E1[, E2[, E3[, E4[, E5]]]]]
*/
#define DEFAULT_AXIS_STEPS_PER_UNIT { 1280, 1280, 6400, 1536 }
/**
* Default Max Feed Rate (mm/s)
* Override with M203
* X, Y, Z, E0 [, E1[, E2[, E3[, E4[, E5]]]]]
*/
#define DEFAULT_MAX_FEEDRATE { 300, 300, 25, 100 }
/**
* Default Max Acceleration (change/s) change = mm/s

Precautions

!!! warning Always disconnect the power supply before installing the driver to prevent the driver from burning.

```
Be sure to confirm the direction of the driver before installing the driver. Prevent the driver from burning due to reverse connection.

Please do not plug and unplug the driver module when power is on to avoid damage.

When installing the heat sink, please be careful not to contact the heat sink and the pin header to prevent short circuit.

The product is sensitive to static electricity, please handle it carefully when using, it is best to remove the package when using.
```