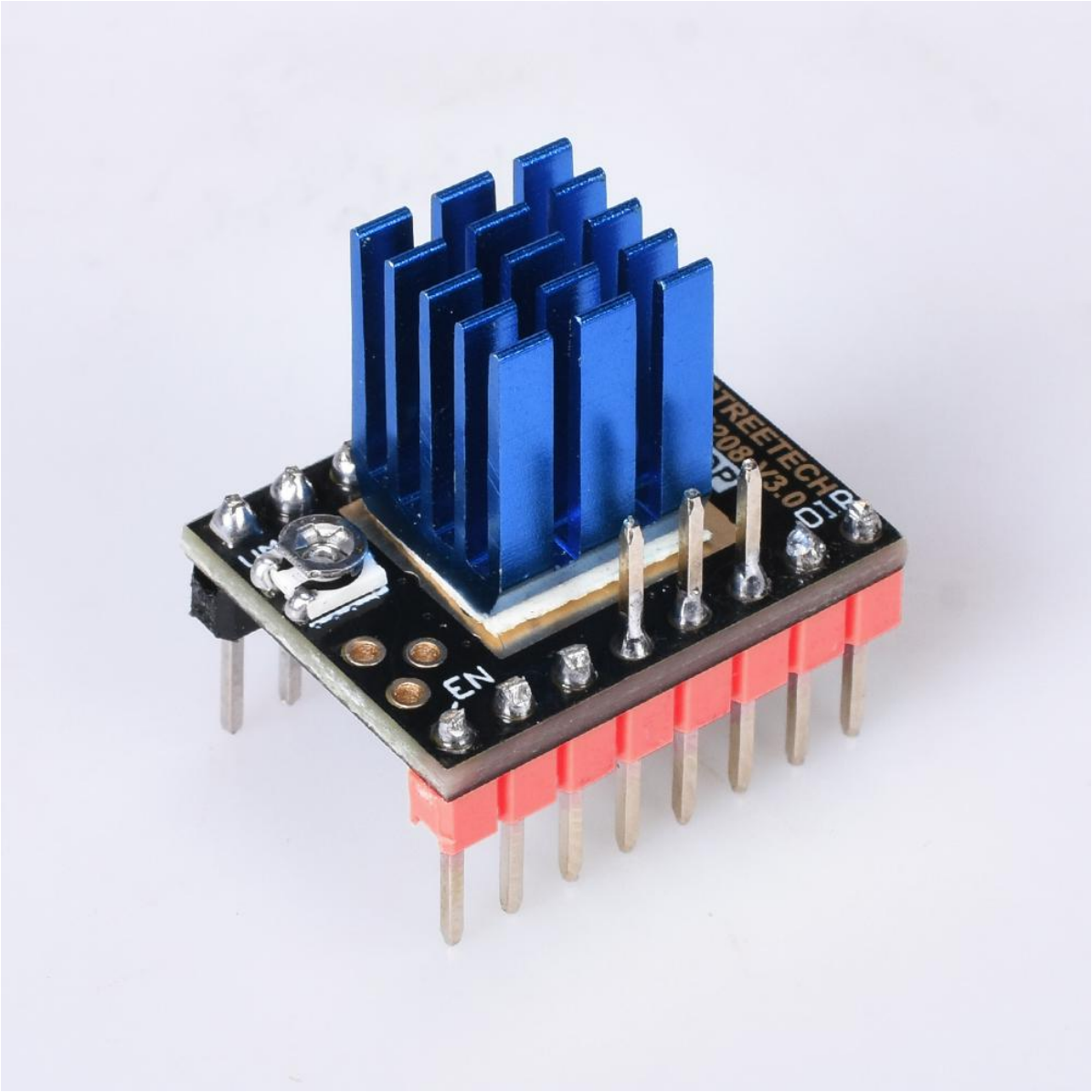
深圳市必趣科技有限公司

BIG TREE TECH

# BIGTREETECH

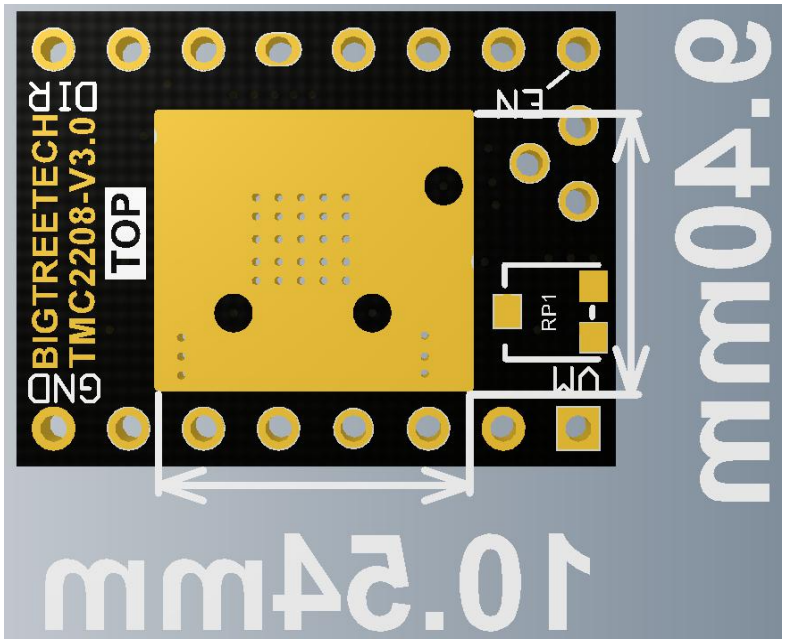
# TMC2208-V3.0

# Stepper motor driver



TMC2208 V3.0 single-axis stepper motor drive chip, power tube built-in drive current 1.4A peak current 2A, voltage range 4.75V-36V, 256 subdivision; with patented technology spreadCycle ™ high chopper frequency, dcStep ™, stallGuard2 ™ stall detection technology, CoolStep ™ current dynamic adjustment technology, can save 70% of the energy, StealthChop mute technology.Support Single Wire UART for advanced configuration options.Integrated Pulse Generator for standalone motion.

**Parameter description**




**Parameter description**

**256 microsteps** per fullstep

interpolation from lower input resolutions

**stealthChop2**™ - for quiet positioning

**spreadCycle**™ - for high speed and high dynamics

**Low RDSon** LS 280mΩ & HS 290mΩ (typ. at 25°C)

**Voltage Range** 4.75V/36VDC

**Single Wire UART** for advanced configuration options

**Integrated Pulse Generator** for standalone motion

Configuration:STEP/ DIR or UART

microsteps:  Up to 1/256

microPlyer:  1/256

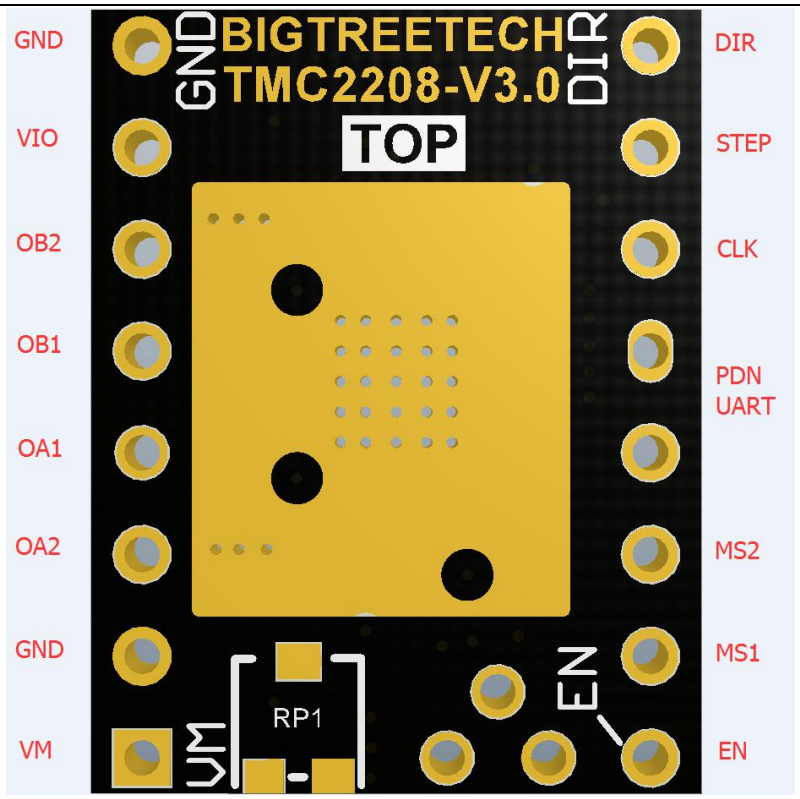
Logic Voltage VI0: 3.3-5V

Motor Voltage : 4.75-36V

Motor Phase Current: 1.2A RMS, 2.0A Peak

## I. Working mode and potentiometer description

**STEP/DIR mode ：**




Choice of working mode：MS1、MS2：

| MS1 | MS2 | Steps | Interpolation | ChopperMode |
|---|---|---|---|---|
| GND | GND | 8 | Yes to 256 | stealthChop2 |
| VIO | GND | 2 | Yes to 256 | stealthChop2 |
| GND | VIO | 4 | Yes to 256 | stealthChop2 |
| VIO | VIO | 16 | Yes to 256 | stealthChop2 |

To access all other modes (eg spreadCycle) you have to use the UART interface.

Working Current Reference:

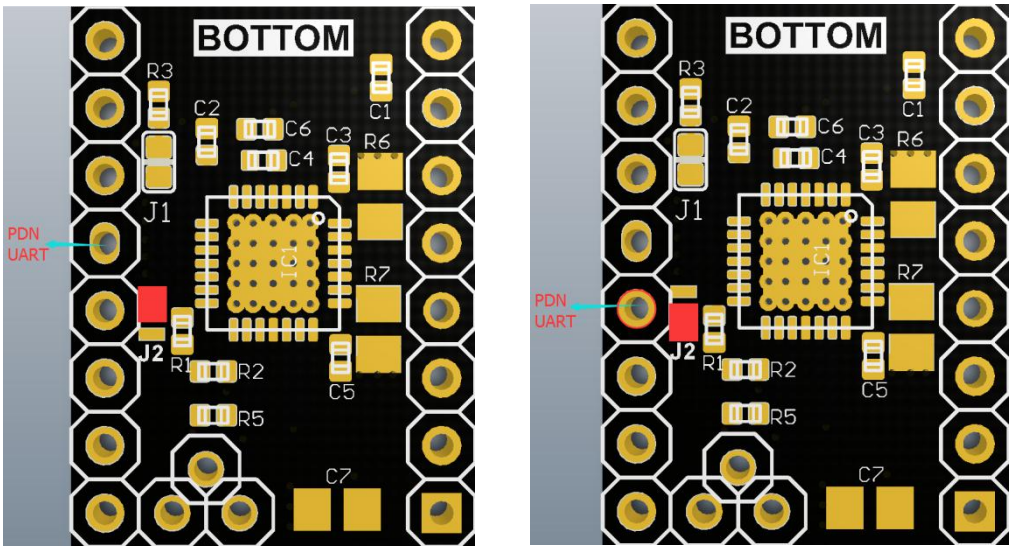
```
VRef 0...2.5V (0.11 Ohm  sense resistor)
>=2.50V    100% - 1.77A RMS
  1.25V     50% - 0.88A RMS
  0.50V     20% - 0.35A RMS

EN (with pull-up)
GND        driver enabled
VCC        driver disabled

PDN/UART (with pull-down)
GND        automatic standstill current reduction
VCC        automatic standstill power down disable
optional   UART interface

CLK (with pull-down)
GND        internal clock
optional   supply external clock
```

## 2.2 UART working mode

**Note:** the factory tmc2208-v3.0 has two modes of STEP/DIR and UART, customers can choose according to their needs.

Users who purchase the STEP/DIR mode driver need to perform the following hardware operations on the driver module before wiring (the user who purchases the UART mode driver does not need to perform any soldering operation):

1.Weld J2 as shown in the purple area, and put the driver in UART working mode.




**The benefits of UART mode:**

1.Motor current can be set arbitrarily by firmware.

2.Micro-steps can be set arbitrarily by firmware (up to 256 actual micro-steps);

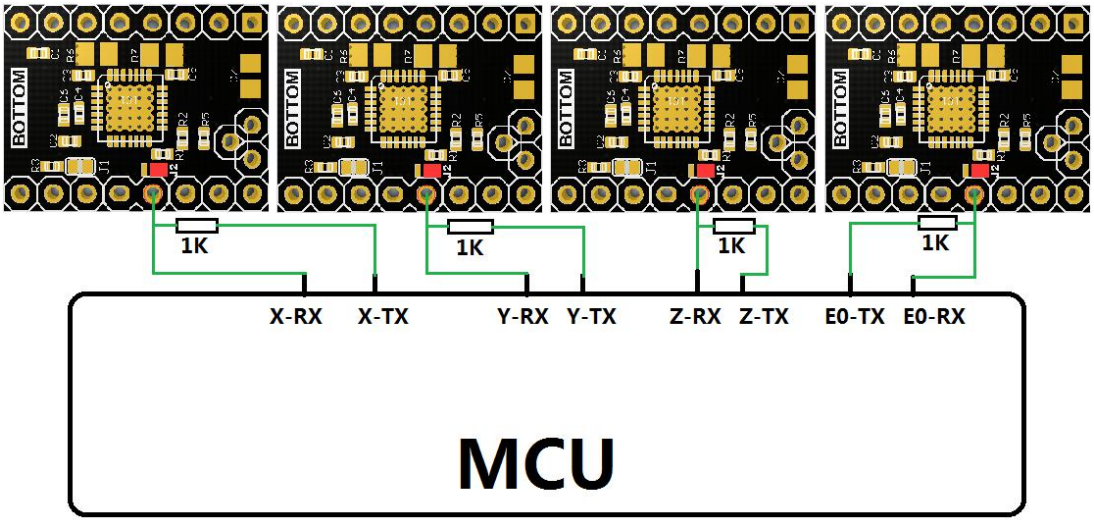
3.The actual and interpolated microsteps can be combined to achieve maximum torque.

Firmware can dynamically switch stepper motors between stealthChop2 and spreadCycle modes through UART.

When the motor is not moving, the standby current of the motor can be reduced dynamically (through UART).

**The wiring diagram is as follows:**

**Note: TMC2208-V3.0 is available in STEP/DIR and UART modes. Customers can choose according to their own needs.**



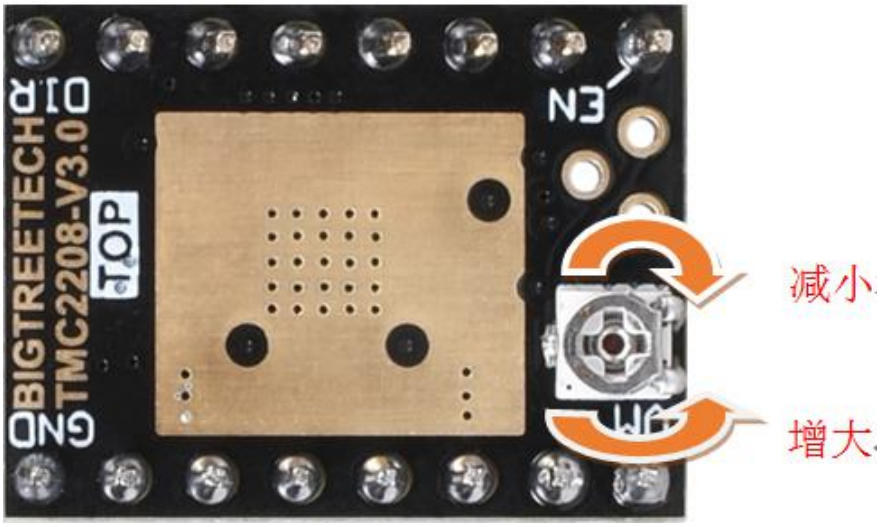

**3.Potentiometer regulation instructions:**

Clockwise Rotating Potentiometer - Reduces Vref, thereby reducing drive current;

Counterclockwise rotating potentiometer - Increase Vref, thereby increasing the driving current.

The accurate voltage of Vref can only be measured when the main board is supplied with 12V or 24V voltage.

The range of Vref value: default value: 1V (+0.2); MAX: 2V; MIN: 0V; Rotating potentiometer must not use too much force to prevent irreversible damage to the potentiometer; when the counter-clockwise rotation reaches the maximum, if it continues to rotate, it will become the minimum; similarly, when the clockwise rotation reaches the minimum, if it continues to rotate, it will become the maximum

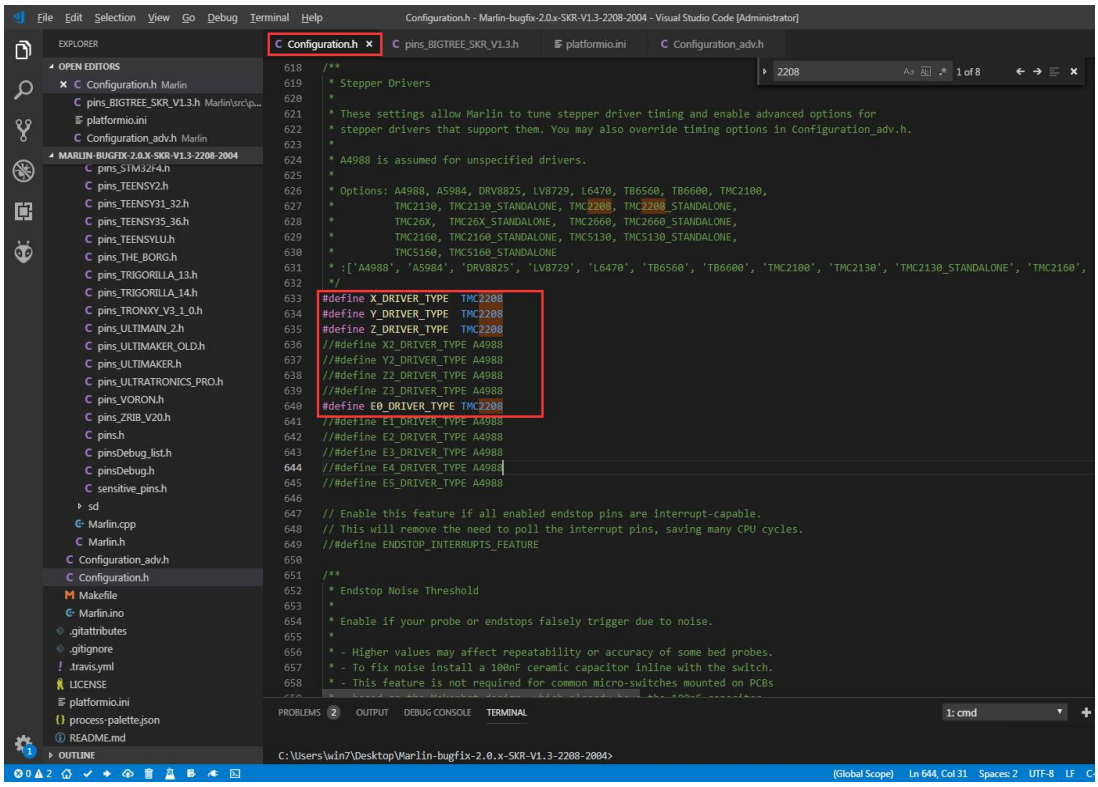



**4.firmware change instructions:**

Firmware (marlin-bugfix-2.0)

**BIGTREETECH SKR V1.3 as example：**

**Configuration.h files**

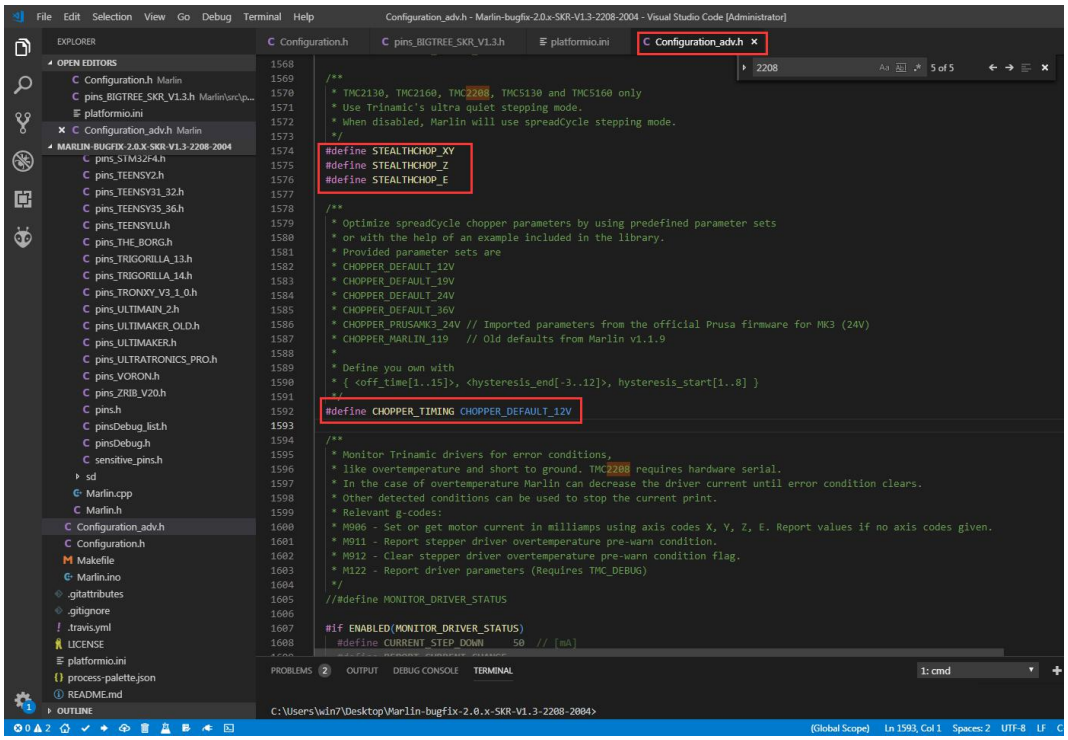



TMC2208 - means you want to control SilentStepStick through UART.

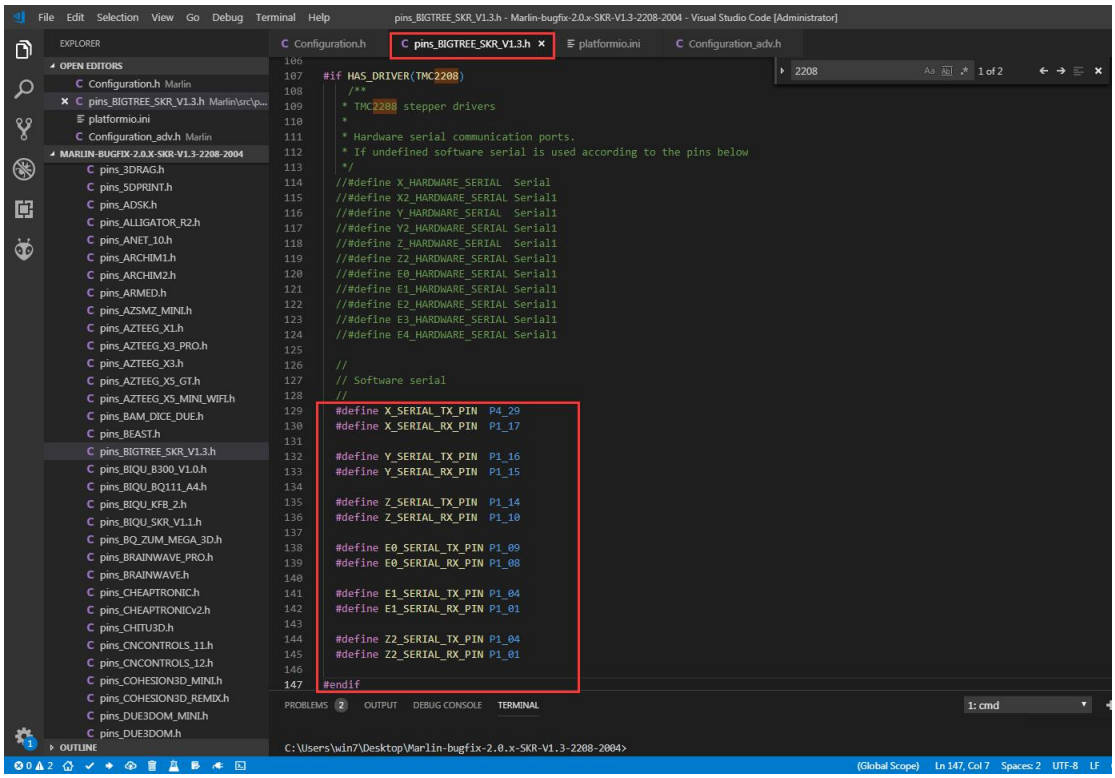
TMC2208_STANDALONE - does not use UART control but STEP/DIR .

TMC2208 SilentStepStick， In other words plug and play.

**Configuration_adv.h files**




## Pins_BIGTREE_SKR_V1.3.h file




After the firmware is changed, burned the firmware and check whether the driver is correctly installed is detected.

| | X | Y | Z | E0 | |
|---|---|---|---|---|---|
| Enabled | true | true | true | true | |
| Set current | 1000 | 1000 | 1000 | 1000 | |
| RMS current | 994 | 994 | 994 | 994 | |
| MAX current | 1402 | 1402 | 1402 | 1402 | |
| Run current | 17/31 | 17/31 | 17/31 | 17/31 | |
| Hold current | 11/31 | 11/31 | 11/31 | 11/31 | |
| CS actual | | 11/31 | 11/31 | 11/31 | 11/31 |
| PWM scale | | 13 | 13 | 13 | 13 |
| vsense | 0=.325 | 0=.325 | 0=.325 | 0=.325 | |
| stealthChop | true | true | false | true | |
| msteps | 4 | 4 | 4 | 4 | |
| tstep | 1048575 | 1048575 | 1048575 | 1048575 | |
| pwm | | | | | |
| threshold | | 24 | 24 | 16 | 13 |
| [mm/s] | 102.95 | 102.95 | 3.09 | 30.41 | |
| OT prewarn | false | false | false | false | |
| OT prewarn has | | | | | |
| been triggered | false | false | false | false | |
| off time | | 5 | 5 | 5 | 5 |
| blank time | 24 | 24 | 24 | 24 | |
| hysteresis | | | | | |
| -end | 2 | 2 | 2 | 2 | |
| -start | 3 | 3 | 3 | 3 | |
| Stallguard thrs | | | | | |
| DRVSTATUS | X | Y | Z | E0 | |
| stst | X | X | X | X | |
| olb | | | | | |
| ola | | | | | |
| s2gb | | | | | |
| s2ga | | | | | |
| otpw | | | | | |
| ot | | | | | |
| 157C | | | | | |
| 150C | | | | | |
| 143C | | | | | |
| 120C | | | | | |
| s2vsa | | | | | |
| s2vsb | | | | | |

Driver registers: X = 0xC0:0B:00:00
Y = 0xC0:0B:00:00
Z = 0xC0:0B:00:00
E0 = 0xC0:0B:00:00

**5.Attention ：**

1. When hardware chooses UART working mode, cautiously use soldering iron to prevent scalding hands. After treatment, carefully observe whether there is residual tin slag in the module. It must be cleaned up to prevent short circuit burning of the module.

2. Pay attention to the line sequence and IO port when wiring. If the wrong line is connected, the drive will not work.

3. When inserting drive into the main board, pay attention to see the direction of drive, can not insert backward, to prevent drive from burning.

4.Make sure to do a good job in heat dissipation (heat sink + heat dissipation fan) before driving to prevent abnormal operation of the drive.

If you encounter problems in use, welcome to contact us, we will be answer to you ASAP . If you have any good comments or suggestions on our products, please tell us , we will carefully consider your comments or Suggestions. Thank you for choosing BIGTREETECH products, thank you!