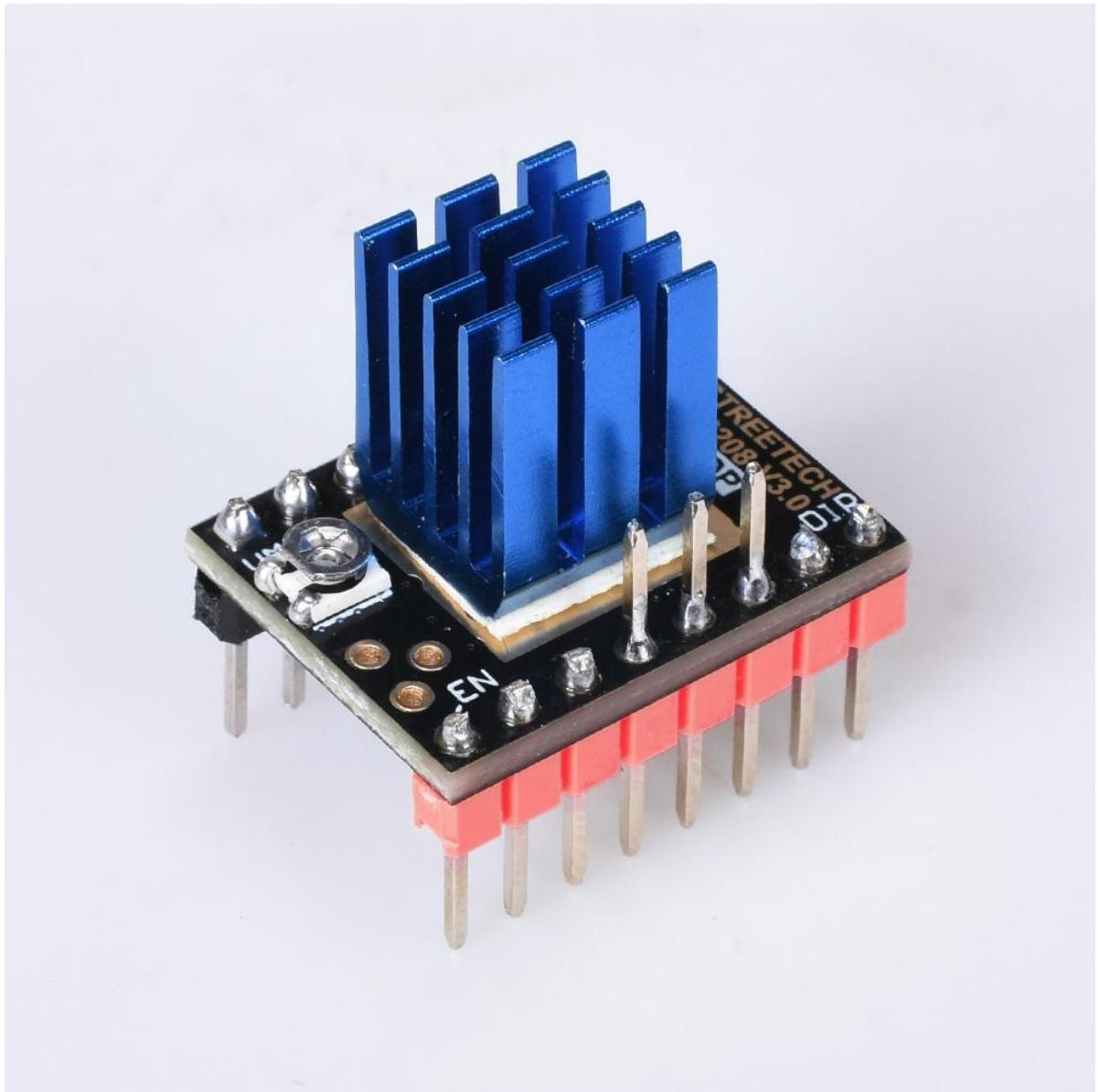
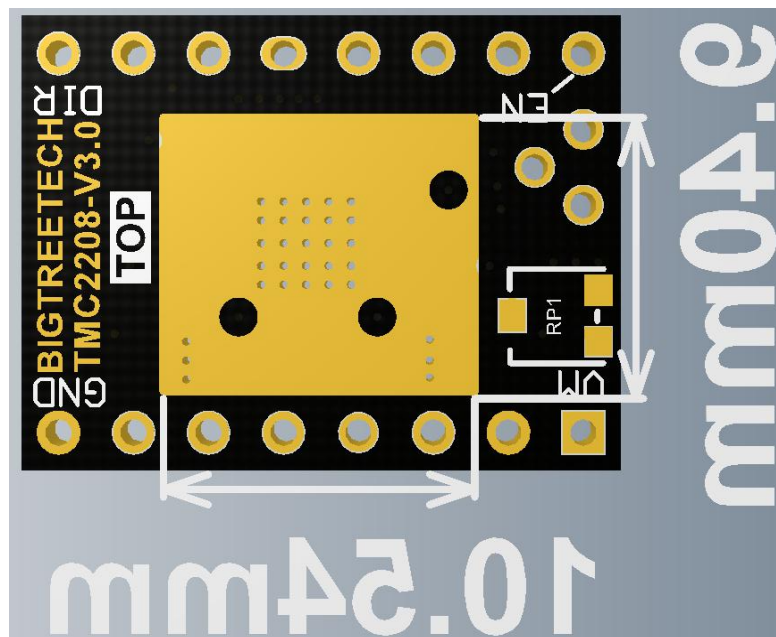


**BIGTREETECH**  
**TMC2208-V3.0**  
**Stepper motor driver**



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™ and CoolStep™ current dynamic adjustment technology. It can save 70% of the energy, StealthChop mute technology. It also support Single Wire UART for advanced configuration options and 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 V<sub>I0</sub>: 3.3-5V

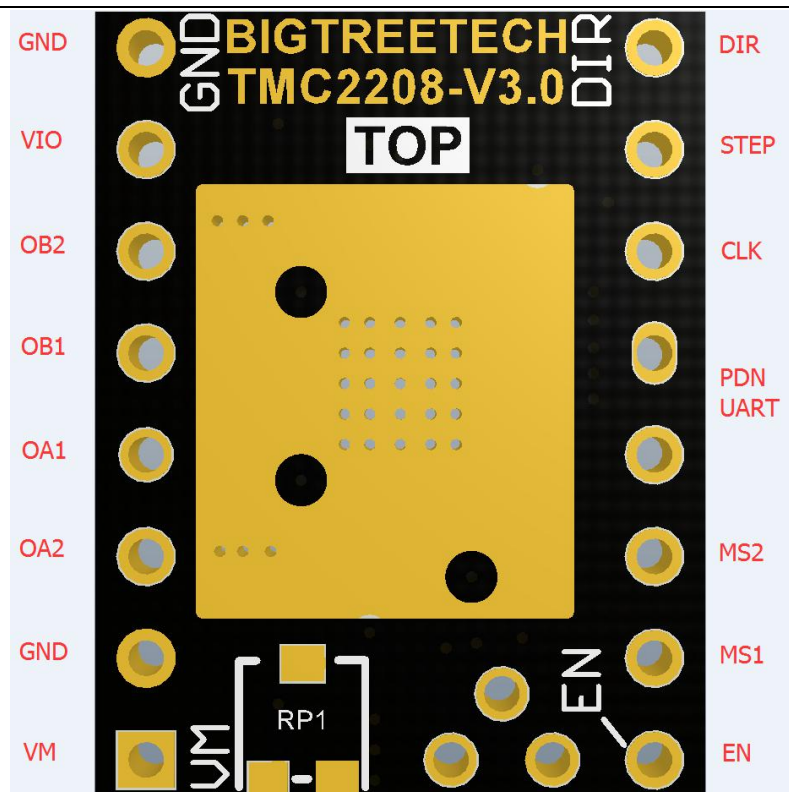
Motor Voltage : 4.75-36V

Motor Phase Current: 1.2A RMS, 2.0A Peak

## **I. Working mode and potentiometer description**

**STEP/DIR mode :**

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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.

Choice of working mode: MS1、MS2:

Working Current Reference:

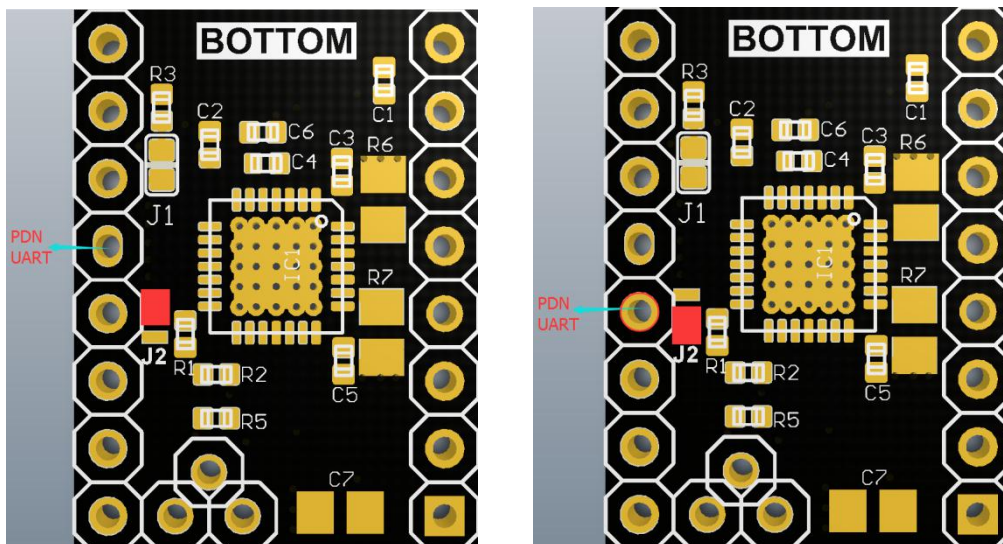
---

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

Before wiring, it is necessary to select the working mode of the driver module.

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.

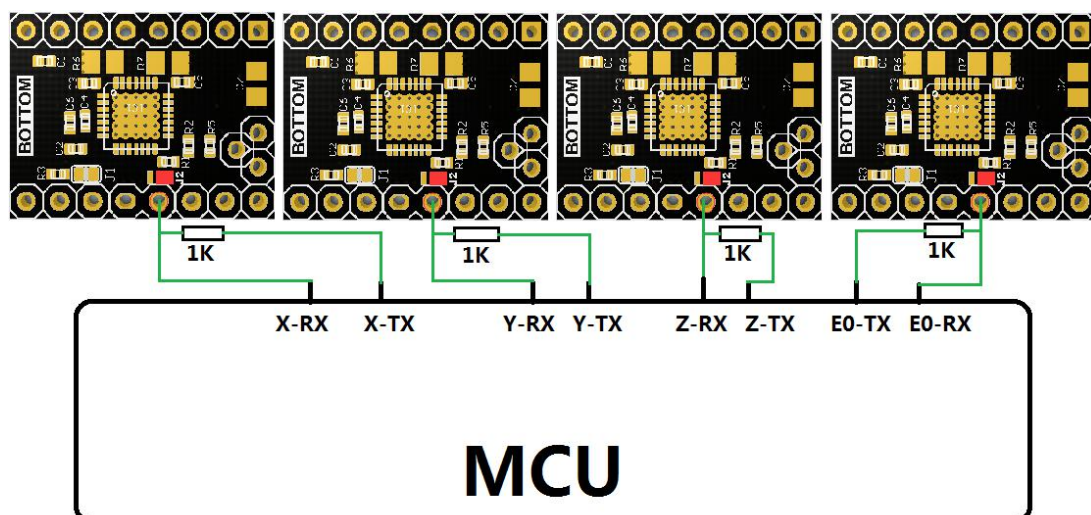
Firmware can dynamically switch stepper motors between stealthChop2 and spreadCycle modes through UART.

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:

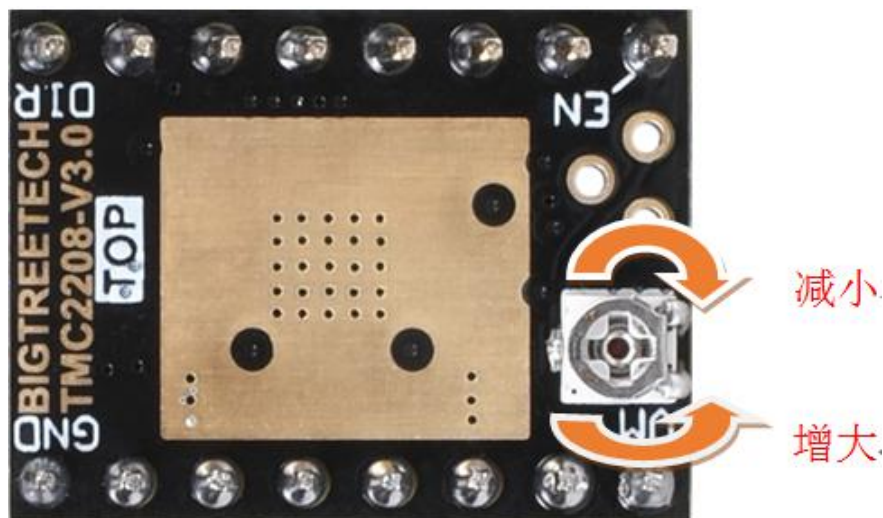


Clockwise Rotating Potentiometer - Reduces Vref, thereby reducing drive current;

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

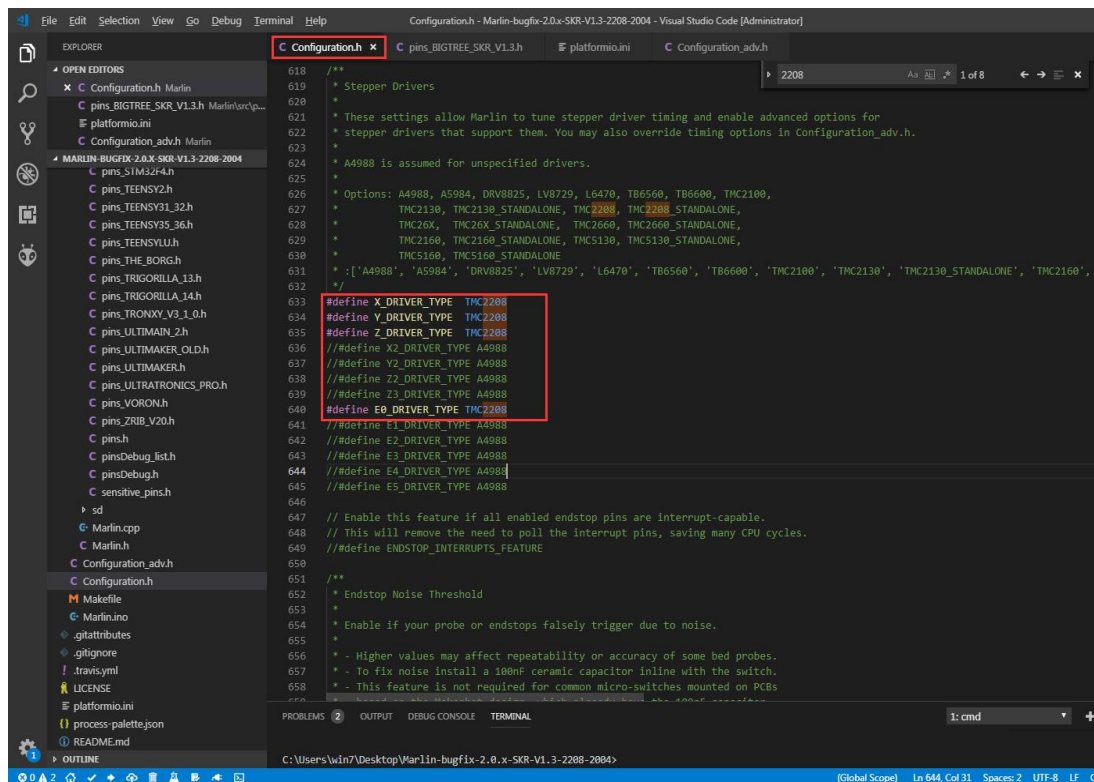


#### 4.firmware change instructions:

Firmware (marlin-bugfix-2.0)

**BIGTRETECH SKR V1.3 as example:**

**Configuration.h files**



```
618  /**
619   * Stepper Drivers
620   *
621   * These settings allow Marlin to tune stepper driver timing and enable advanced options for
622   * stepper drivers that support them. You may also override timing options in Configuration_adv.h.
623   *
624   * A4988 is assumed for unspecified drivers.
625   *
626   * Options: A4988, A5984, DRV8825, LV8729, L6470, TB6560, TB6600, TMC2100,
627   *           TMC2130, TMC2130_STANDALONE, TMC2208, TMC2208_STANDALONE,
628   *           TMC26X, TMC26X_STANDALONE, TMC2660, TMC2660_STANDALONE,
629   *           TMC2160, TMC2160_STANDALONE, TMC5130, TMC5130_STANDALONE,
630   *           TMC5160, TMC5160_STANDALONE
631   * :['A4988', 'A5984', 'DRV8825', 'LV8729', 'L6470', 'TB6560', 'TB6600', 'TMC2100', 'TMC2130', 'TMC2130_STANDALONE', 'TMC2160',
632   * ]
633   #define X_DRIVER_TYPE  TMC2208
634   #define Y_DRIVER_TYPE  TMC2208
635   #define Z_DRIVER_TYPE  TMC2208
636   // #define X2_DRIVER_TYPE A4988
637   // #define Y2_DRIVER_TYPE A4988
638   // #define Z2_DRIVER_TYPE A4988
639   // #define Z3_DRIVER_TYPE A4988
640   #define E0_DRIVER_TYPE TMC2208
641   // #define E1_DRIVER_TYPE A4988
642   // #define E2_DRIVER_TYPE A4988
643   // #define E3_DRIVER_TYPE A4988
644   // #define E4_DRIVER_TYPE A4988
645   // #define E5_DRIVER_TYPE A4988
646
647   // Enable this feature if all enabled endstop pins are interrupt-capable.
648   // This will remove the need to poll the interrupt pins, saving many CPU cycles.
649   // #define ENDSTOP_INTERRUPTS_FEATURE
650
651  /**
652   * Endstop Noise Threshold
653   *
654   * Enable if your probe or endstops falsely trigger due to noise.
655   *
656   * - Higher values may affect repeatability or accuracy of some bed probes.
657   * - To fix noise install a 100nF ceramic capacitor inline with the switch.
658   * - This feature is not required for common micro-switches mounted on PCBs
659   *   without exposed pins, as in the case of Proto-Panels.
660   */
661   #define ENDSTOP_NOISE_THRESHOLD 0
```

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**



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```
1568 /**  
1569  * TMC2130, TMC2160, TMC2208, TMC5130 and TMC5160 only  
1570  * Use Trinamic's ultra quiet stepping mode.  
1571  * When disabled, Marlin will use spreadCycle stepping mode.  
1572  */  
1573 #define STEALTHCHOP_XY  
1574 #define STEALTHCHOP_Z  
1575 #define STEALTHCHOP_E  
1576  
1577 /**  
1578  * Optimize spreadCycle chopper parameters by using predefined parameter sets  
1579  * or with the help of an example included in the library.  
1580  * Provided parameter sets are  
1581  * CHOPPER_DEFAULT_12V  
1582  * CHOPPER_DEFAULT_19V  
1583  * CHOPPER_DEFAULT_24V  
1584  * CHOPPER_DEFAULT_36V  
1585  * CHOPPER_PRUSAMK3_24V // Imported parameters from the official Prusa firmware for MK3 (24V)  
1586  * CHOPPER_MARLIN_119 // Old defaults from Marlin v1.19  
1587  *  
1588  * Define your own with  
1589  * ([<off_time[1..15]>, <hysteresis_end[-3..12]>, hysteresis_start[1..8] ]  
1590  */  
1591 #define CHOPPER_TIMING CHOPPER_DEFAULT_12V  
1592  
1593 /**  
1594  * Monitor Trinamic drivers for error conditions,  
1595  * like overtemperature and short to ground. TMC2208 requires hardware serial.  
1596  * In the case of overtemperature Marlin can decrease the driver current until error condition clears.  
1597  * Other detected conditions can be used to stop the current print.  
1598  * Relevant g-codes:  
1599  * M06 - Set or get motor current in milliamps using axis codes X, Y, Z, E. Report values if no axis codes given.  
1600  * M91 - Report stepper driver overtemperature pre-warn condition.  
1601  * M92 - Clear stepper driver overtemperature pre-warn condition flag.  
1602  * M122 - Report driver parameters (Requires TMC_DEBUG)  
1603  */  
1604 // #define MONITOR_DRIVER_STATUS  
1605  
1606 #if ENABLE(MONITOR_DRIVER_STATUS)  
1607 #define CURRENT_STEP_DOWN 50 // [mA]  
1608 #endif
```

### Pins\_BIGTREE\_SKR\_V1.3.h file

```
108 #if HAS_DRIVER(TMC2208)  
109 /**  
110  * TMC2208 stepper drivers  
111  * Hardware serial communication ports.  
112  * If undefined software serial is used according to the pins below  
113  */  
114 // #define X_HARDWARE_SERIAL Serial1  
115 // #define X2_HARDWARE_SERIAL Serial1  
116 // #define Y_HARDWARE_SERIAL Serial1  
117 // #define Y2_HARDWARE_SERIAL Serial1  
118 // #define Z_HARDWARE_SERIAL Serial1  
119 // #define Z2_HARDWARE_SERIAL Serial1  
120 // #define E0_HARDWARE_SERIAL Serial1  
121 // #define E1_HARDWARE_SERIAL Serial1  
122 // #define E2_HARDWARE_SERIAL Serial1  
123 // #define E3_HARDWARE_SERIAL Serial1  
124 // #define E4_HARDWARE_SERIAL Serial1  
125  
126 //  
127 // Software serial  
128 //  
129 #define X_SERIAL_TX_PIN P4_29  
130 #define X_SERIAL_RX_PIN P1_17  
131  
132 #define Y_SERIAL_TX_PIN P1_16  
133 #define Y_SERIAL_RX_PIN P1_15  
134  
135 #define Z_SERIAL_TX_PIN P1_14  
136 #define Z_SERIAL_RX_PIN P1_10  
137  
138 #define E0_SERIAL_TX_PIN P1_09  
139 #define E0_SERIAL_RX_PIN P1_08  
140  
141 #define E1_SERIAL_TX_PIN P1_04  
142 #define E1_SERIAL_RX_PIN P1_01  
143  
144 #define Z2_SERIAL_TX_PIN P1_04  
145 #define Z2_SERIAL_RX_PIN P1_01  
146  
147 #endif
```

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

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	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	
OI prewarn	false	false	false	false	
OI 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					
DRVSTAIUS	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!