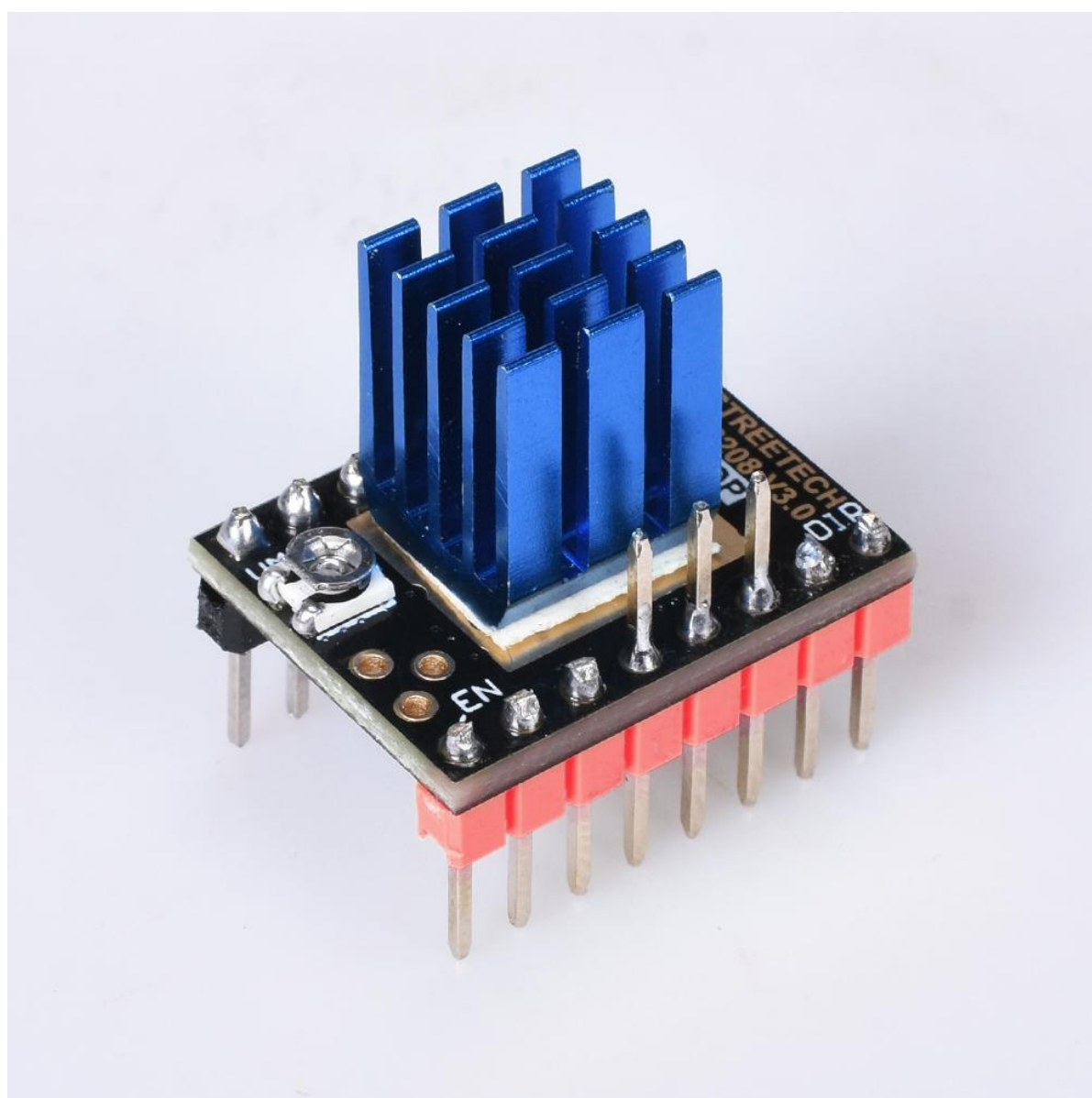


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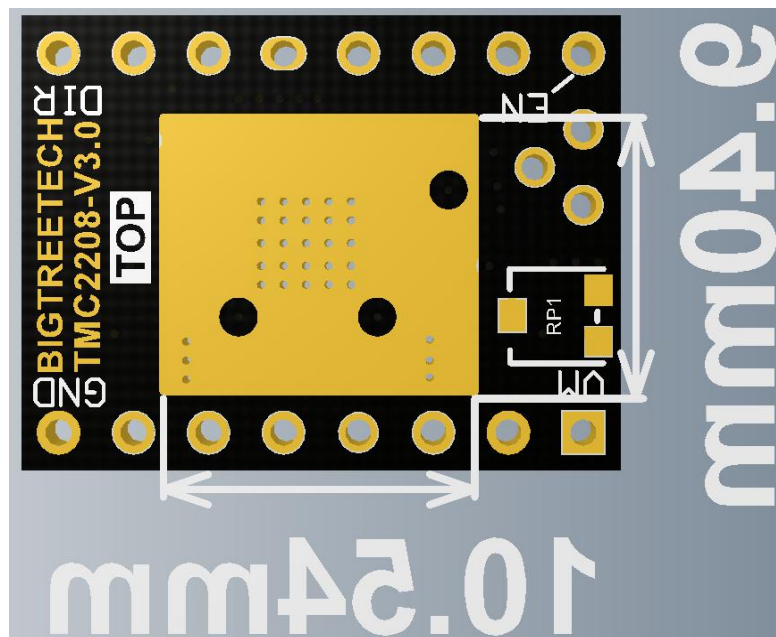
BIGTREETECH
TMC2208-V3.0
Stepper motor driver



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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 VIO: 3.3-5V

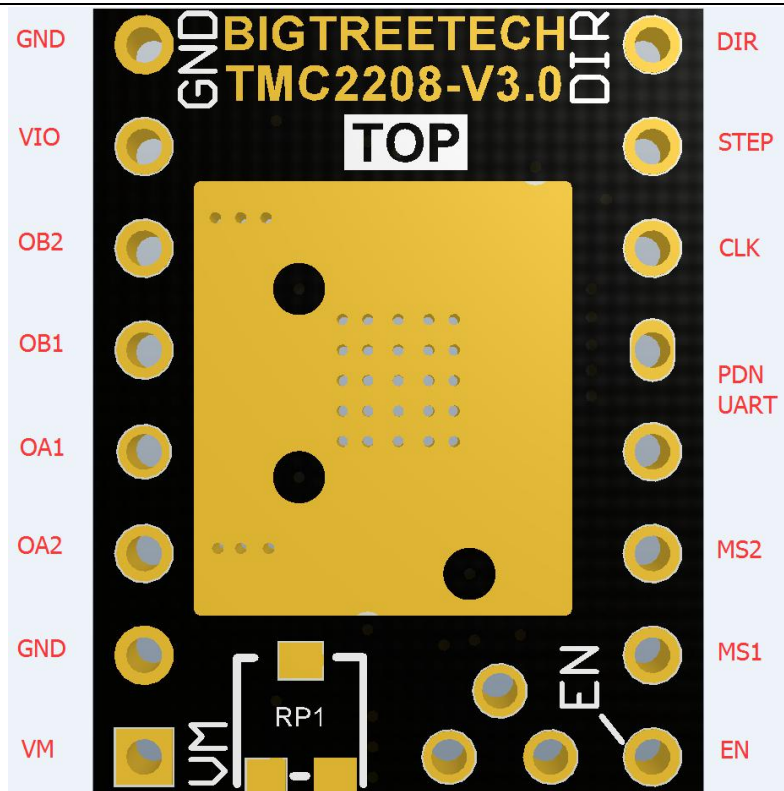
Motor Voltage : 4.75-36V

Motor Phase Current: 1.2A RMS, 2.0A Peak

I. Working mode and potentiometer description

STEP/DIR mode :

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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:

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```
URef 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
UCC          driver disabled

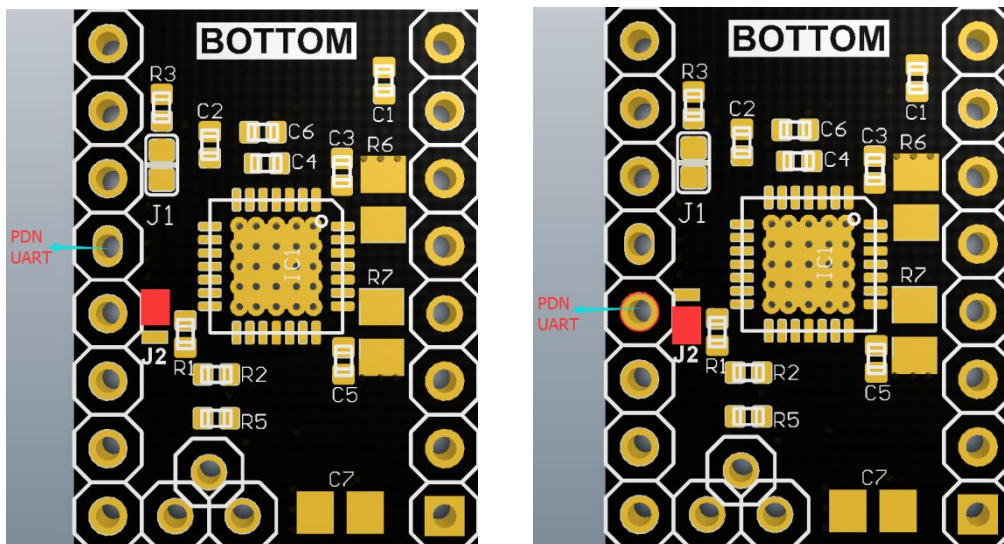
PDN/UART (with pull-down)
GND          automatic standstill current reduction
UCC          automatic standstill power down disable
optional    UART interface

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.

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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.

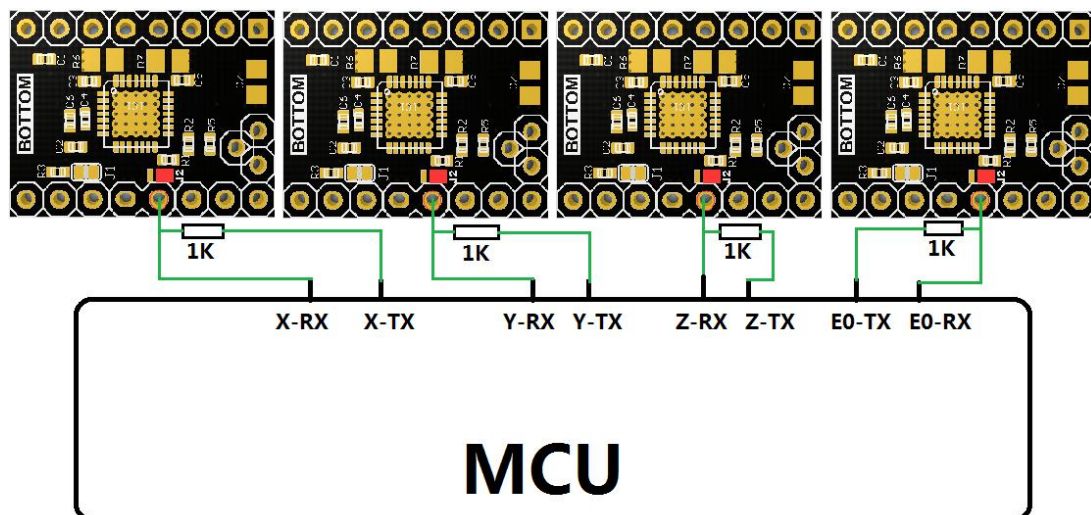
Firmware can dynamically switch stepper motors between stealthChop2 and spreadCycle modes through UART.

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:

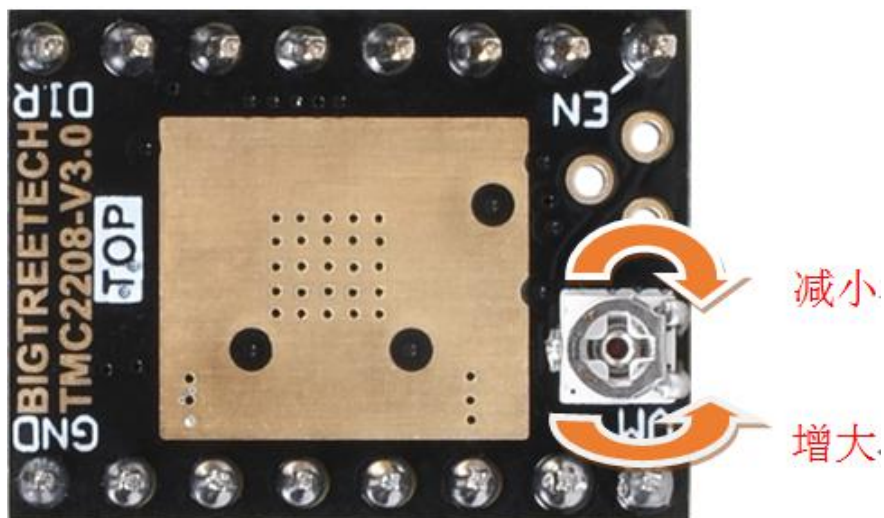
Clockwise Rotating Potentiometer - Reduces Vref, thereby reducing drive current;

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

```
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  */
634 #define X_DRIVER_TYPE TMC2208
635 #define Y_DRIVER_TYPE TMC2208
636 #define Z_DRIVER_TYPE TMC2208
637 // #define X2_DRIVER_TYPE A4988
638 // #define V2_DRIVER_TYPE A4988
639 // #define Z2_DRIVER_TYPE A4988
640 // #define Z3_DRIVER_TYPE A4988
641 #define EB_DRIVER_TYPE TMC2208
642 // #define E1_DRIVER_TYPE A4988
643 // #define E2_DRIVER_TYPE A4988
644 // #define E3_DRIVER_TYPE A4988
645 // #define E4_DRIVER_TYPE A4988
646 // #define E5_DRIVER_TYPE A4988
647
648 // Enable this feature if all enabled endstop pins are interrupt-capable.
649 // This will remove the need to poll the interrupt pins, saving many CPU cycles.
650 // #define ENDSTOP_INTERRUPTS_FEATURE
651
652 /**
653  * Endstop Noise Threshold
654  *
655  * Enable if your probe or endstops falsely trigger due to noise.
656  *
657  * - Higher values may affect repeatability or accuracy of some bed probes.
658  * - To fix noise install a 100nF ceramic capacitor inline with the switch.
659  * - This feature is not required for common micro-switches mounted on PCBs
660  *   with dedicated pins.
661  * #define ENDSTOP_NOISE_THRESHOLD 0
662  */
663 #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 v1.1.9  
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 * M906 - Set or get motor current in milliamps using axis codes X, Y, Z, E. Report values if no axis codes given.  
1600 * M911 - Report stepper driver overtemperature pre-warn condition.  
1601 * M912 - Clear stepper driver overtemperature pre-warn condition flag.  
1602 * M122 - Report driver parameters (Requires TMC_DEBUG)  
1603 */  
1604 // #define MONITOR_DRIVER_STATUS  
1605 #if ENABLE(MONITOR_DRIVER_STATUS)  
1606 #define CURRENT_STEP_DOWN 50 // [mA]  
1607 #endif  
1608
```

Pins_BIGTREE_SKR_V1.3.h file

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

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
DRVSTAT           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!