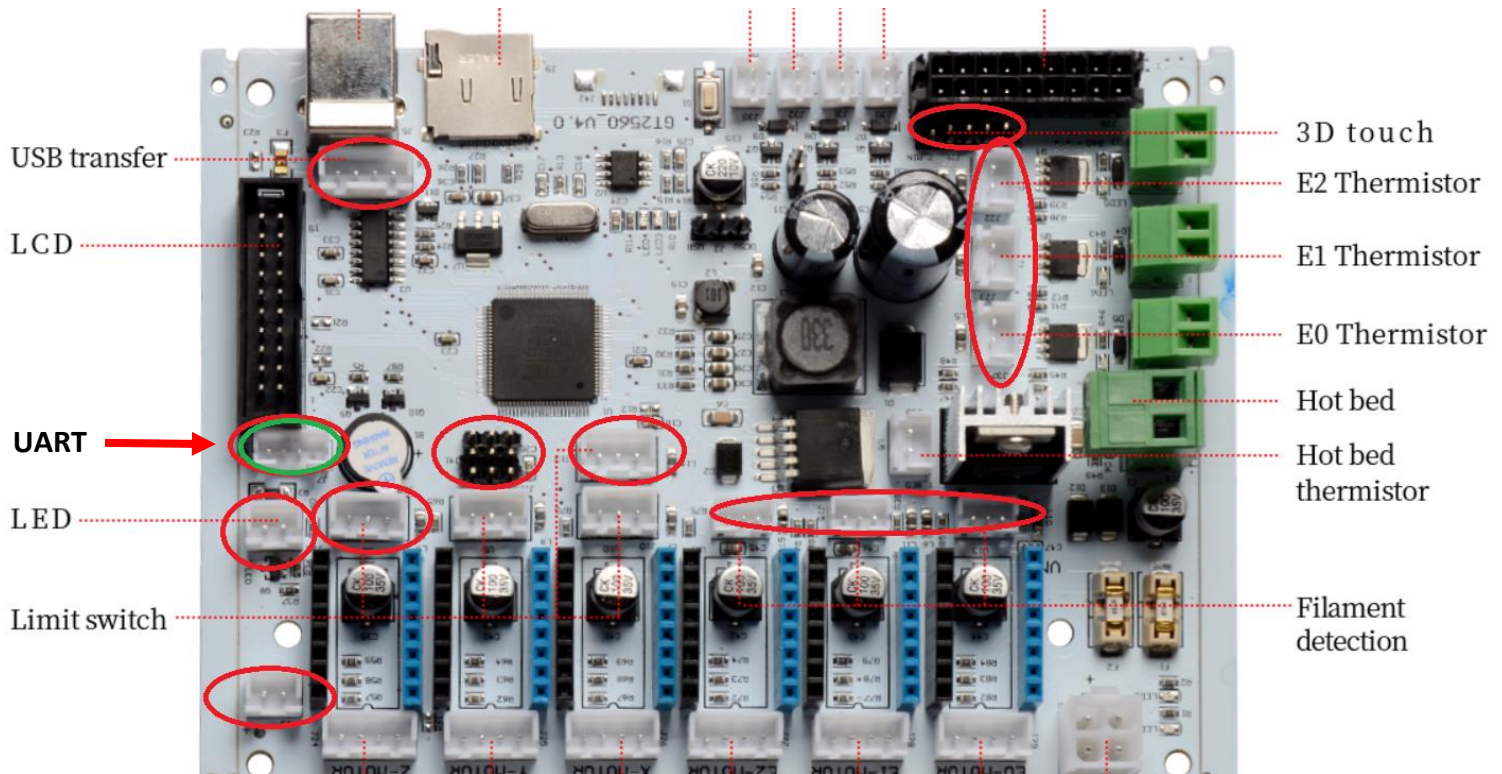


# CONFIGURING TRINAMICS TMC2209 IN UART MODE FOR GT2560

VCP – 03/09/2020

## GT2560 V4 HARDWARE:



T BED	87	PK2(ADC10/PCINT18)	(OC3B/INT4)PE4	6	PWM1
T1	88	PK1(ADC9/PCINT17)	(OC3A/AIN1)PE3	5	LCM_D6
T0	89	PK0(ADC8/PCINT16)	(XCK0/AIN0)PE2	4	
			(TXD0)PE1	3	TXD0
			(RXD0/PCIN8)PE0	2	RXD0
	79	PJ7	(ADC7/TDI)PF7	90	ADC7
	69	PJ6(PCINT15)	(ADC6/TDO)PF6	91	ADC6
	68	PJ5(PCINT14)	(ADC5/TMS)PF5	92	ADC5
	67	PJ4(PCINT13)	(ADC4/TCK)PF4	93	ADC4
	66	PJ3(PCINT12)	(ADC3)PF3	94	ADC3
	65	PJ2(XCK3/PCINT11)	(ADC2)PF2	95	ADC2
	64	PJ1(TXD3/PCINT10)	(ADC1)PF1	96	ADC1
	63	PJ0(RXD3/PCINT9)	(ADC0)PF0	97	ADC0
	27	PH7(T4)	(OC0B)PG5	1	PWM3
PWM8	18	PH6(OC2B)	(TOSC1)PG4	29	
PWM7	17	PH5(OC4C)	(TOSC2)PG3	28	
PWM6	16	PH4(OC4B)	(ALE)PG2	70	Z DIR
PWM5	15	PH3(OC4A)	(RD)PG1	52	EC1
	14	PH2(XCK2)	(WR)PG0	51	EX EN
TXD2	LCM_D4	PH1(TXD2)			
RXD2	LCM_EN	PH0(RXD2)			

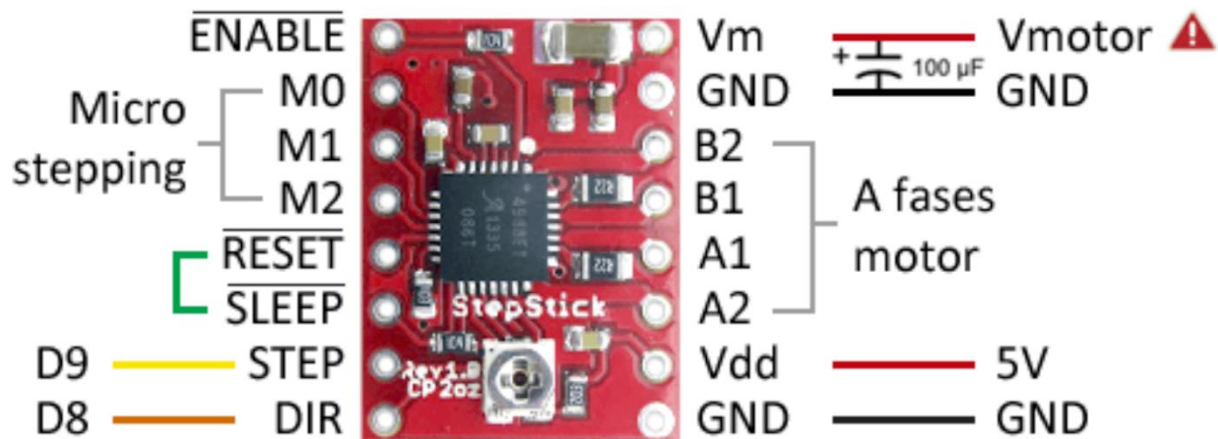
ATMEGA2560-16AU

The same case is seen in the GT2560 V3.0 and V3.1 but the pins are already labeled:

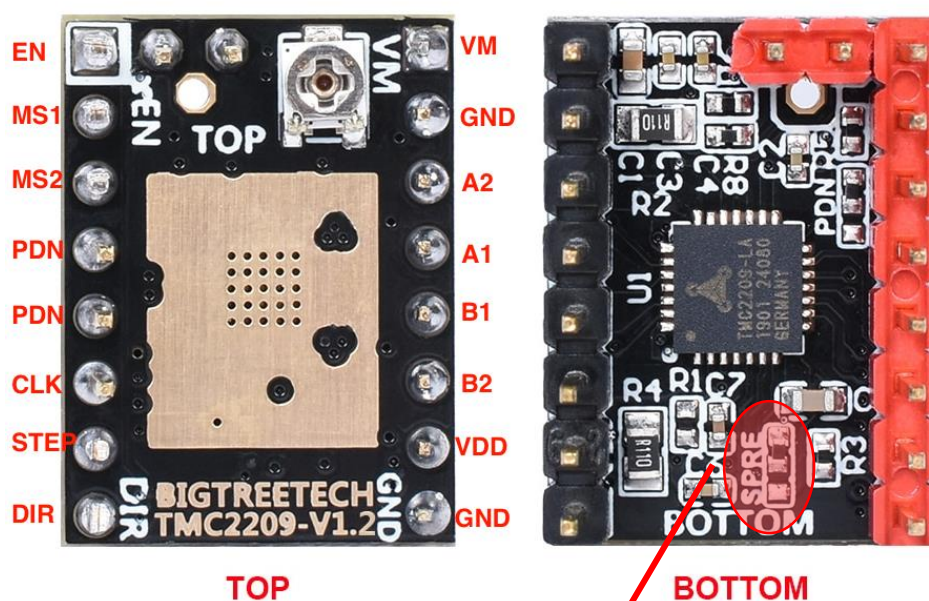


The hardware serial interface is connected to **TXD3 and RXD3**, which is defined as **Serial3** in Marlin.

ORIGINAL A4988 DRIVERS:

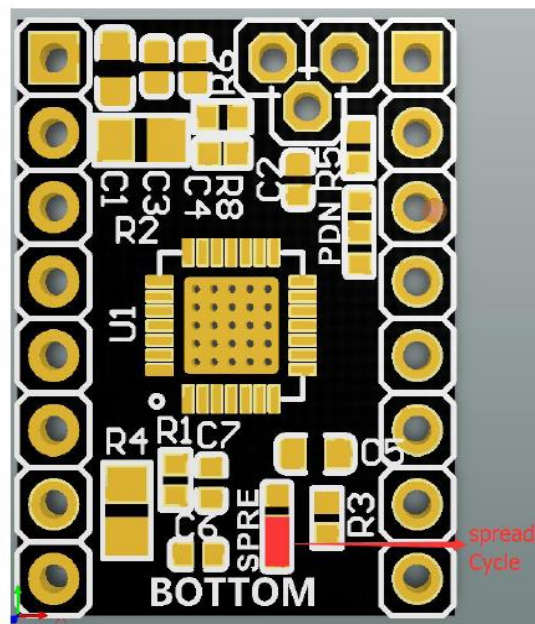
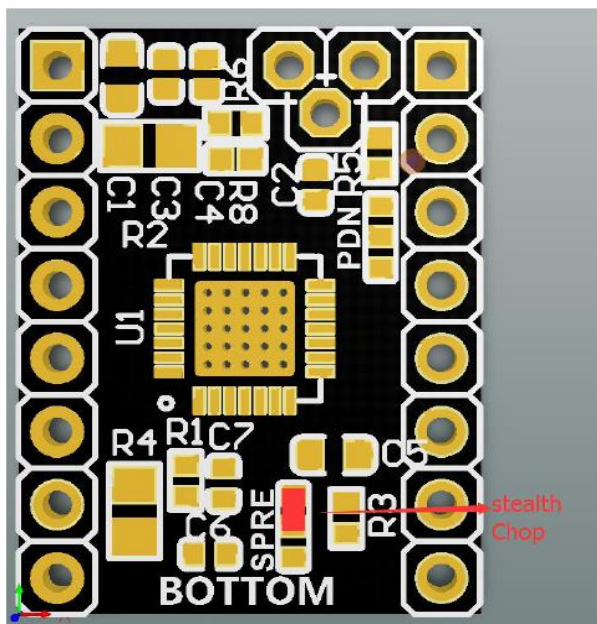


BIGTREETECH TMC2209 V1.2 DRIVERS:



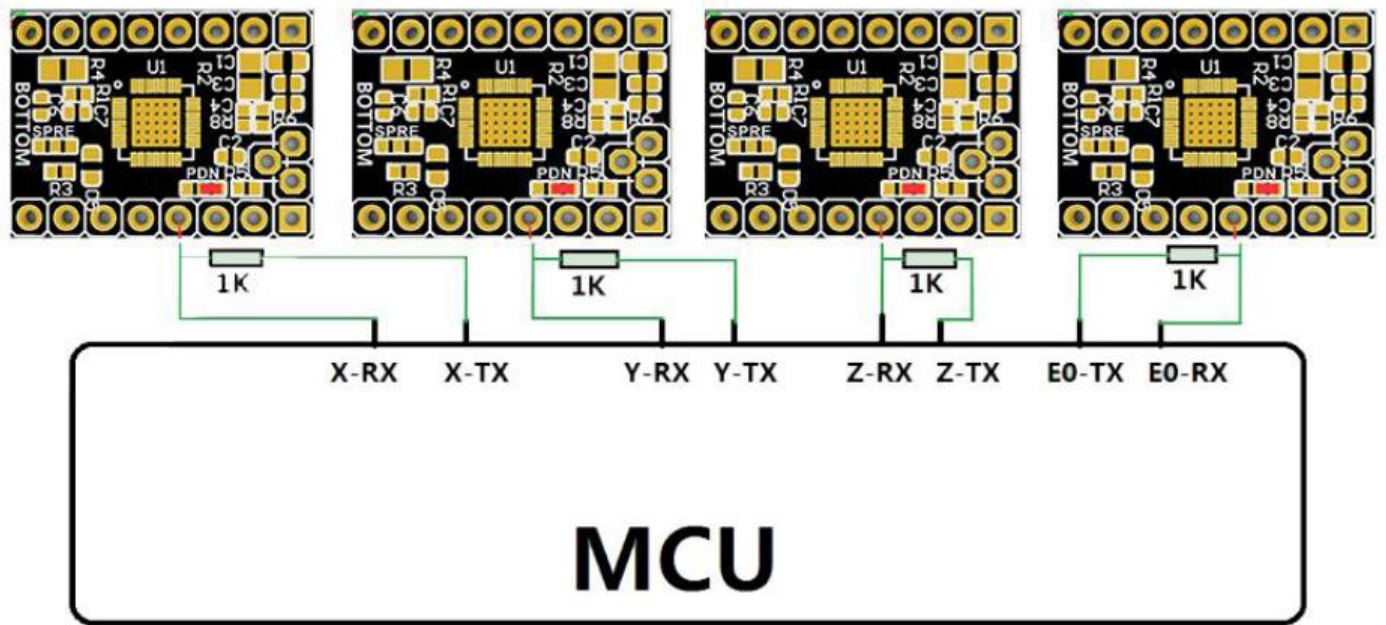
STEALTH CHOP = SILENT MODE

SPREADCYCLE = HIGH TORQUE MODE

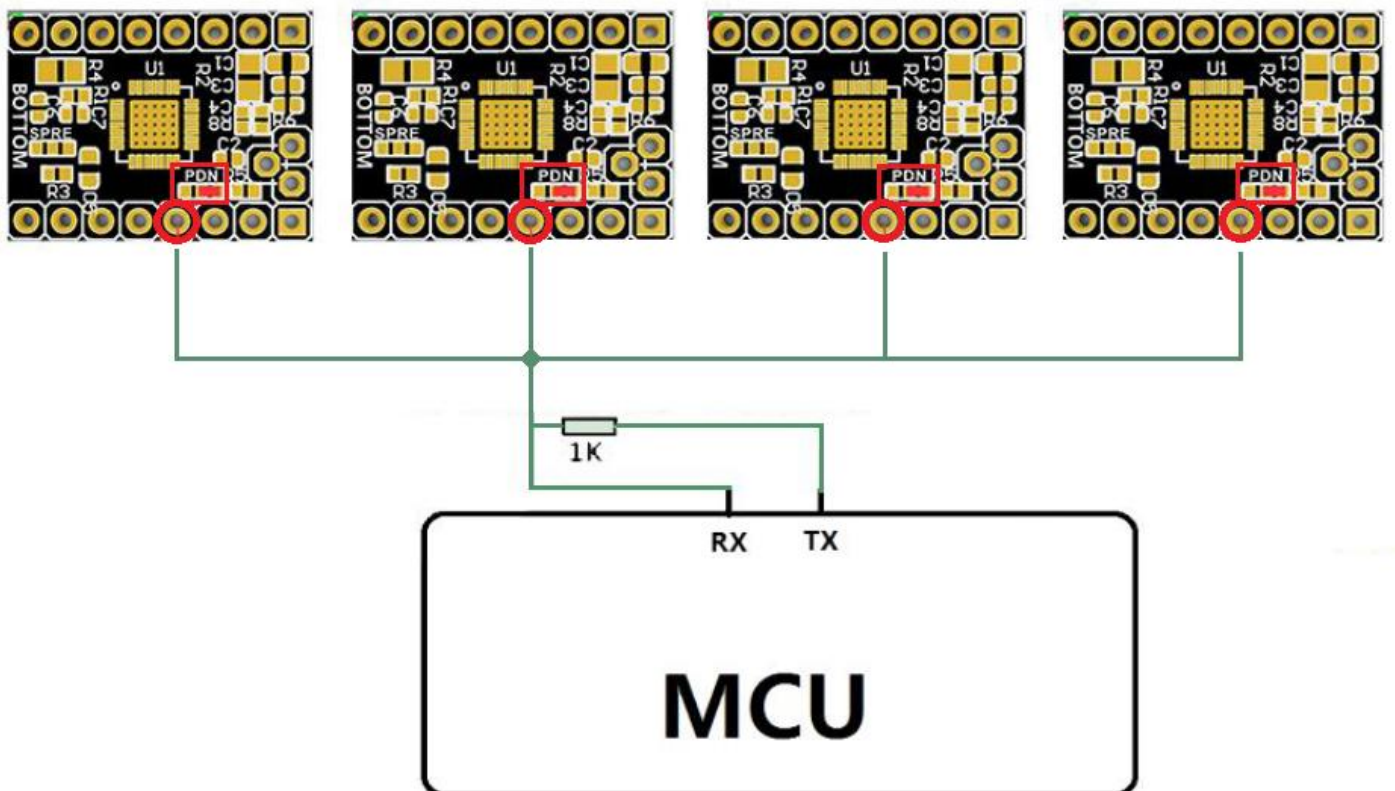




UART MODE - MULTIPLE DRIVERS IN MULTIPLE SERIAL PORTS:



UART MODE - MULTIPLE DRIVERS IN THE SAME SERIAL PORT (up to 4):



## UART MODE - MULTIPLE DRIVERS IN THE SAME SERIAL PORT (SLAVE ADDRESS CONFIG):

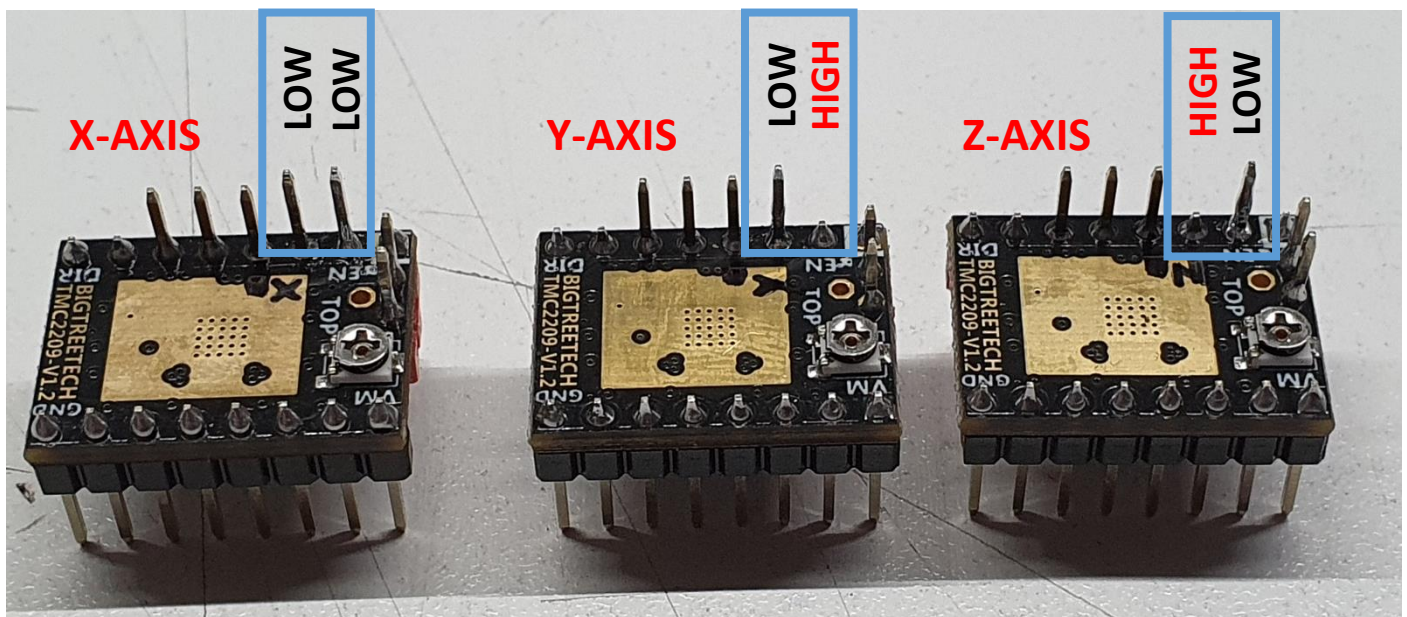
We need to connect MS1 and MS2 pins of each driver to VDD or GND depending on which slave address we assign to each one of them according to the following table:

ADDRESS	MS1	MS2
0	LOW	LOW
1	HIGH	LOW
2	LOW	HIGH
3	HIGH	HIGH

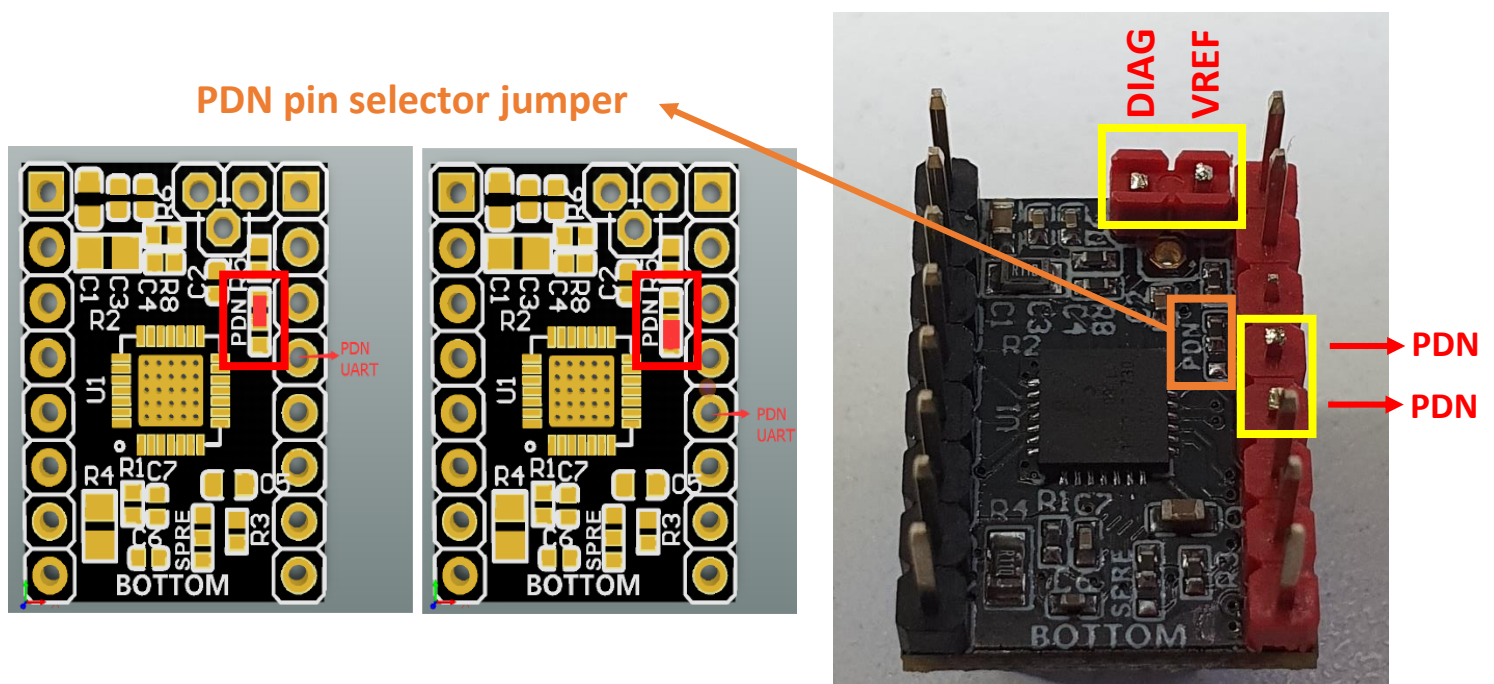
### CASE 1: GT2560 V4.0 (without jumpers below the drivers)

The drivers sockets in the GT2560 by default are tied to VDD so we need to remove, cut or solder to the top side of the board those pins we want to be GND so they won't be connected to the main board.

In my case I decided to use Address 0 for X-Axis, Address 1 for Y-Axis and Address 2 for Z-Axis, this leads to:



We also need to remove some useless pins for our board and the PDN pin

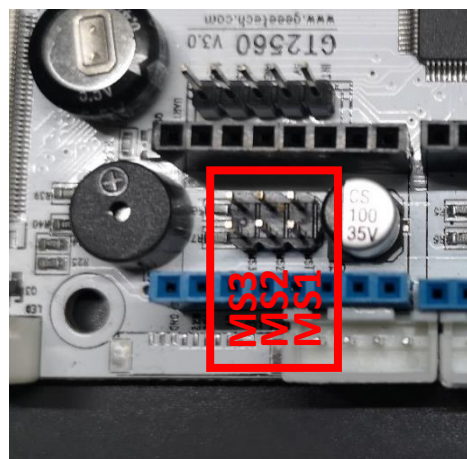
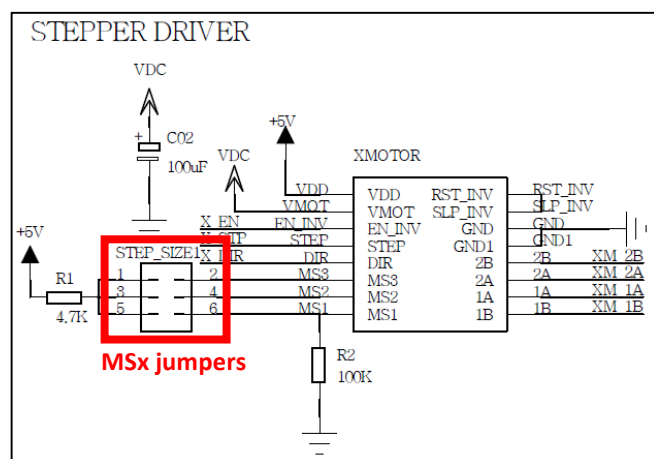


Both PDN pins must be removed from the BOT side, but the selected one should be soldered to the TOP because it will be wired to the GT2560



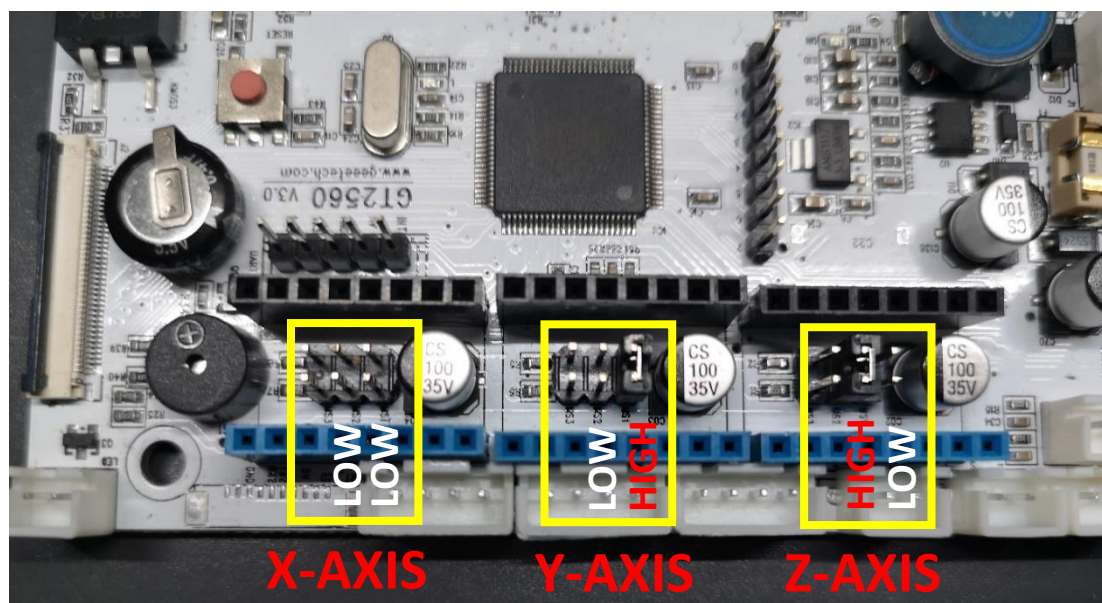
### CASE 2: GT2560 V3.0 and V3.1 (with jumpers below the drivers)

In this case, these boards have jumpers to select MS1, MS2 and MS3 below the drivers so cutting/unsolder those pins is not needed.



MS3 is not used in the TMC2209s and the header pin for it is coincident with one of the PDN pins. So, to avoid any issues it is recommended to remove both PDN pins from the bottom side of the board and just solder the selected one to the top side (selected by the soldered PDN Selector jumper in the TMC driver board). This is the PDN that will be wired to the serial interface of the GT2560 so we need it available on the top.

In the figure below you can see the jumper configurations for this board.



## MARLIN CONFIGURATION:

Next, we need to modify both *Configuration.h* and *Configuration\_adv.h* according to the following images:

```
Configuration.h X
Marlin > Configuration.h > ...
656 /**
657  * Stepper Drivers
658  *
659  * These settings allow Marlin to tune stepper driver timing and enable advanced options for
660  * stepper drivers that support them. You may also override timing options in Configuration_adv.h.
661  *
662  * A4988 is assumed for unspecified drivers.
663  *
664  * Options: A4988, A5984, DRV8825, LV8729, L6470, L6474, POWERSTEP01,
665  *           TB6560, TB6600, TMC2100,
666  *           TMC2130, TMC2130_STANDALONE, TMC2160, TMC2160_STANDALONE,
667  *           TMC2208, TMC2208_STANDALONE, TMC2209, TMC2209_STANDALONE,
668  *           TMC26X, TMC26X_STANDALONE, TMC2660, TMC2660_STANDALONE,
669  *           TMC5130, TMC5130_STANDALONE, TMC5160, TMC5160_STANDALONE
670  * :['A4988', 'A5984', 'DRV8825', 'LV8729', 'L6470', 'L6474', 'POWERSTEP01', 'TB6560', 'TB6600', 'TMC
671  */
672
673 #define X_HARDWARE_SERIAL Serial3
674 #define Y_HARDWARE_SERIAL Serial3
675 #define Z_HARDWARE_SERIAL Serial3
676
677 #define X_DRIVER_TYPE  TMC2209
678 #define Y_DRIVER_TYPE  TMC2209
679 #define Z_DRIVER_TYPE  TMC2209
680 // #define X2_DRIVER_TYPE  A4988
681 // #define Y2_DRIVER_TYPE  A4988
682 // #define Z2_DRIVER_TYPE  A4988
```

```
Configuration_adv.h X
Marlin > Configuration_adv.h > E5_SLAVE_ADDRESS
2390 /**
2391  * Four TMC2209 drivers can use the same HW/SW serial port with hardware configured addresses.
2392  * Set the address using jumpers on pins MS1 and MS2.
2393  * Address | MS1 | MS2
2394  *         0 | LOW | LOW
2395  *         1 | HIGH | LOW
2396  *         2 | LOW | HIGH
2397  *         3 | HIGH | HIGH
2398  *
2399  * Set *_SERIAL_TX_PIN and *_SERIAL_RX_PIN to match for all drivers
2400  * on the same serial port, either here or in your board's pins file.
2401  */
2402 #define X_SLAVE_ADDRESS 0
2403 #define Y_SLAVE_ADDRESS 1
2404 #define Z_SLAVE_ADDRESS 2
2405 #define X2_SLAVE_ADDRESS 0
2406 #define Y2_SLAVE_ADDRESS 0
```

This is for my setup, change them accordingly to your selected slave address for each axis

```
Configuration.h X
Marlin > Configuration.h > INVERT_X_DIR
1085 // Invert the stepper direction. Change (or reverse the motor connector) if an axis goes the wrong way.
1086 #define INVERT_X_DIR false // Orig=true
1087 #define INVERT_Y_DIR false // Orig=true
1088 #define INVERT_Z_DIR true // Orig=false
1089
```

TMCs directions must be inverted from the original values for A4988 drivers

Also, you may want to enable the TMC\_DEBUG option to get detailed information about the drivers

```
Configuration_adv.h X
Marlin > Configuration_adv.h > ...
2554
2555 /**
2556  * Enable M122 debugging command for TMC stepper drivers.
2557  * M122 S0/1 will enable continous reporting.
2558  */
2559 #define TMC_DEBUG
2560
2561 /**
```

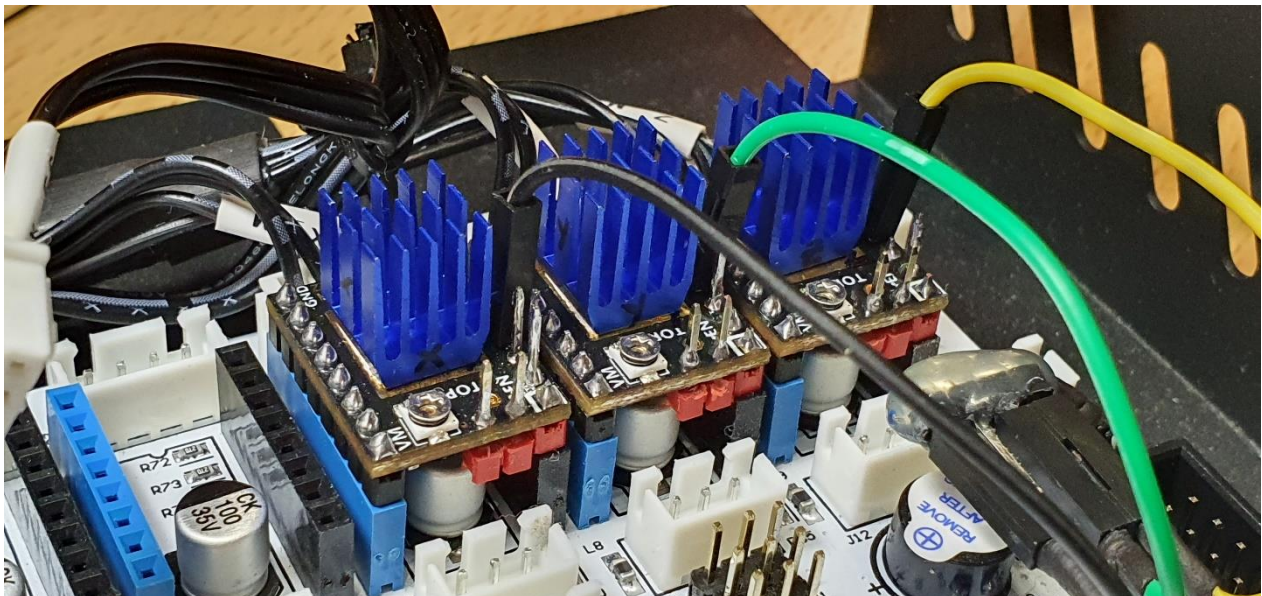
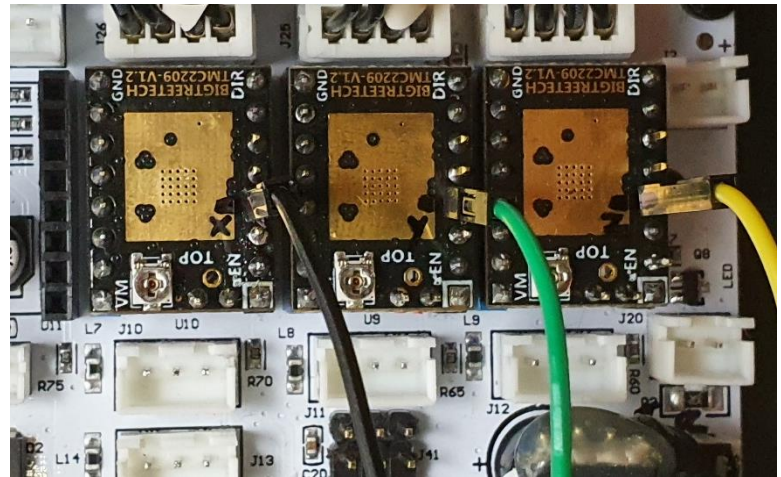
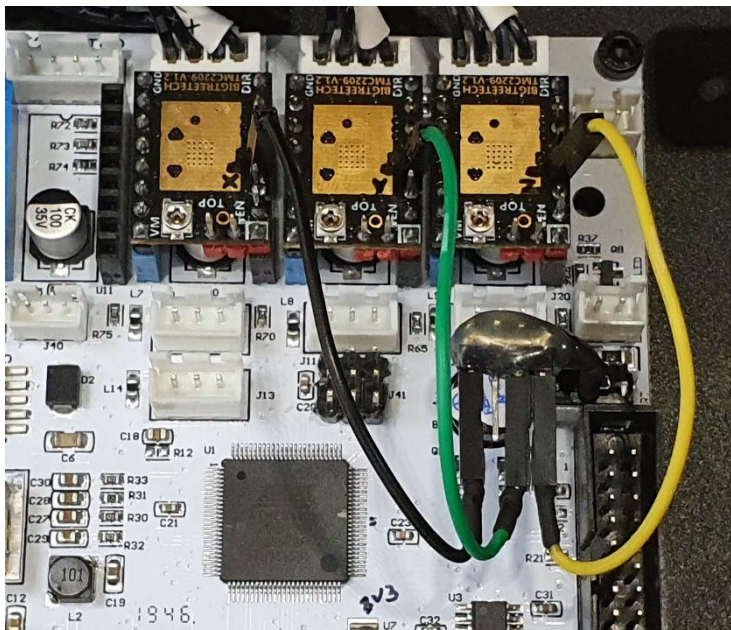
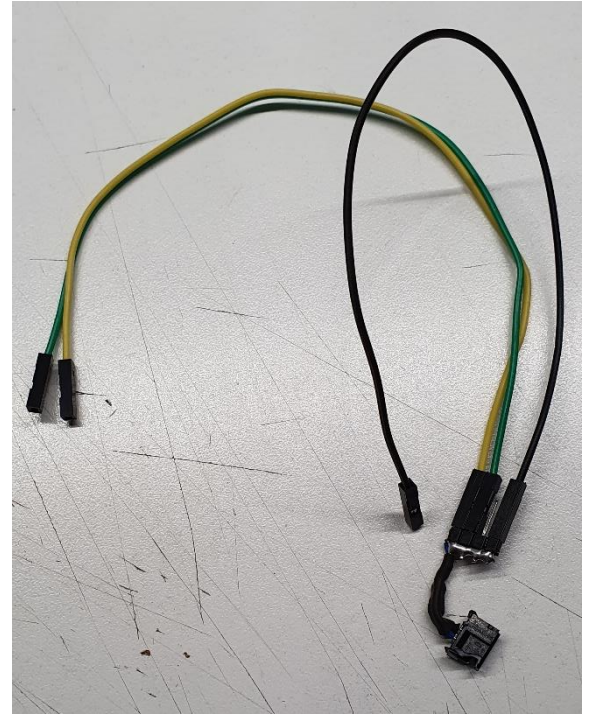
And the real-time driver's status monitor with:

```
Configuration_adv.h ●
Marlin > Configuration_adv.h > ...
2453 /**
2454  * Monitor Trinamic drivers
2455  * for error conditions like overtemperature and short to ground.
2456  * To manage over-temp Marlin can decrease the driver current until the error condition clears.
2457  * Other detected conditions can be used to stop the current print.
2458  * Relevant G-codes:
2459  * M906 - Set or get motor current in milliamps using axis codes X, Y, Z, E. Report values if no axis codes given.
2460  * M911 - Report stepper driver overtemperature pre-warn condition.
2461  * M912 - Clear stepper driver overtemperature pre-warn condition flag.
2462  * M122 - Report driver parameters (Requires TMC_DEBUG)
2463  */
2464 #define MONITOR_DRIVER_STATUS
2465
2466 #if ENABLED(MONITOR_DRIVER_STATUS)
2467   #define CURRENT_STEP_DOWN    50  // [mA]
2468   #define REPORT_CURRENT_CHANGE
2469   #define STOP_ON_ERROR
2470 #endif
2471
```

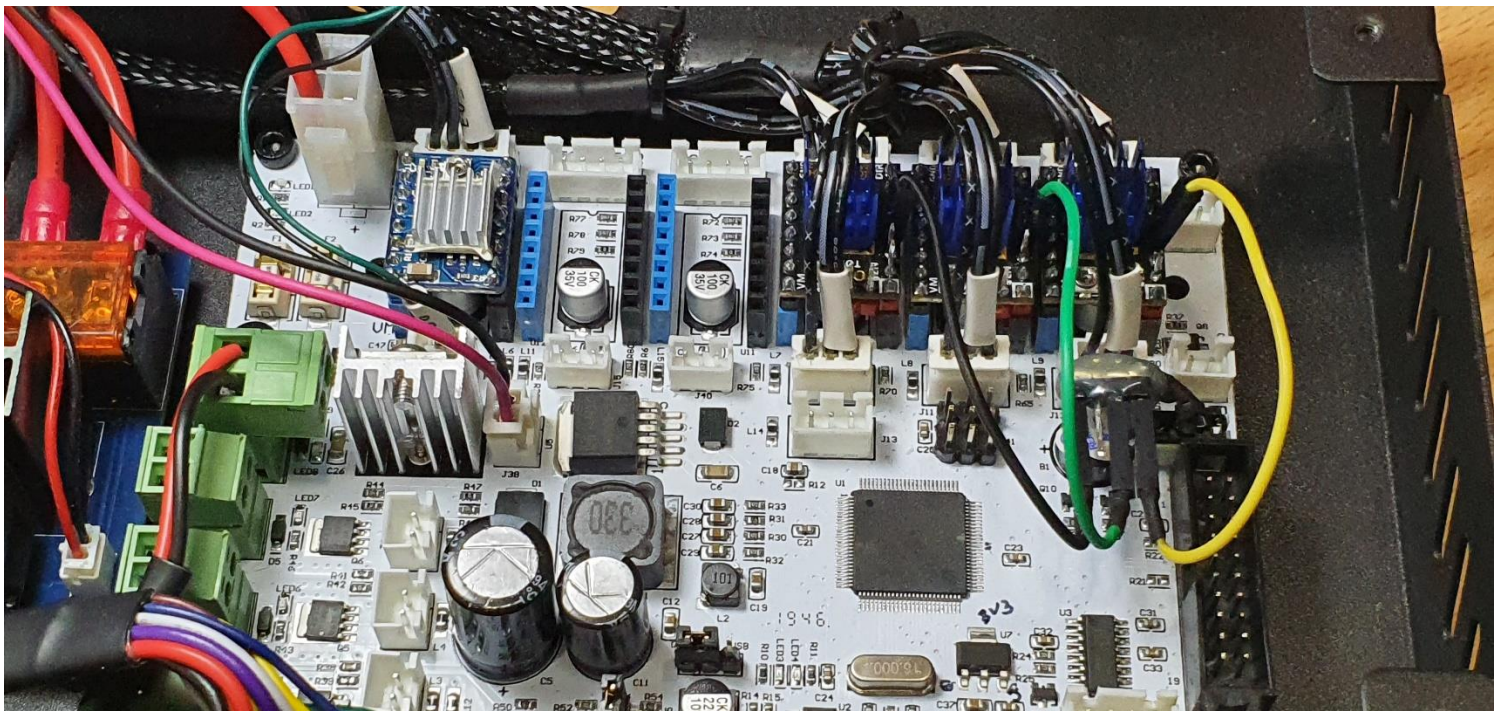
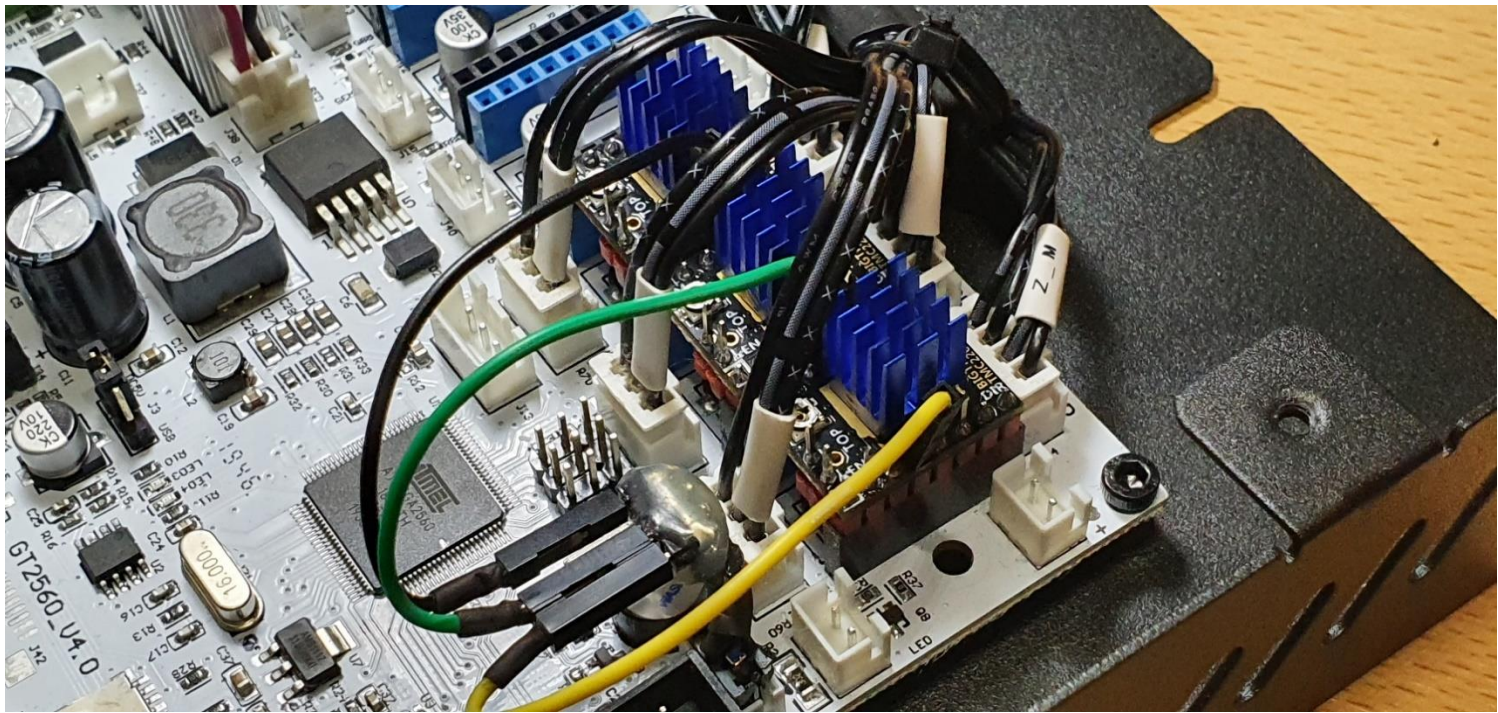


## WRAPPING ALL TOGETHER GT2560 V4.0:

### CONNECTOR AND RESISOR FOR PARALLEL CONNECT ALL THE DRIVERS

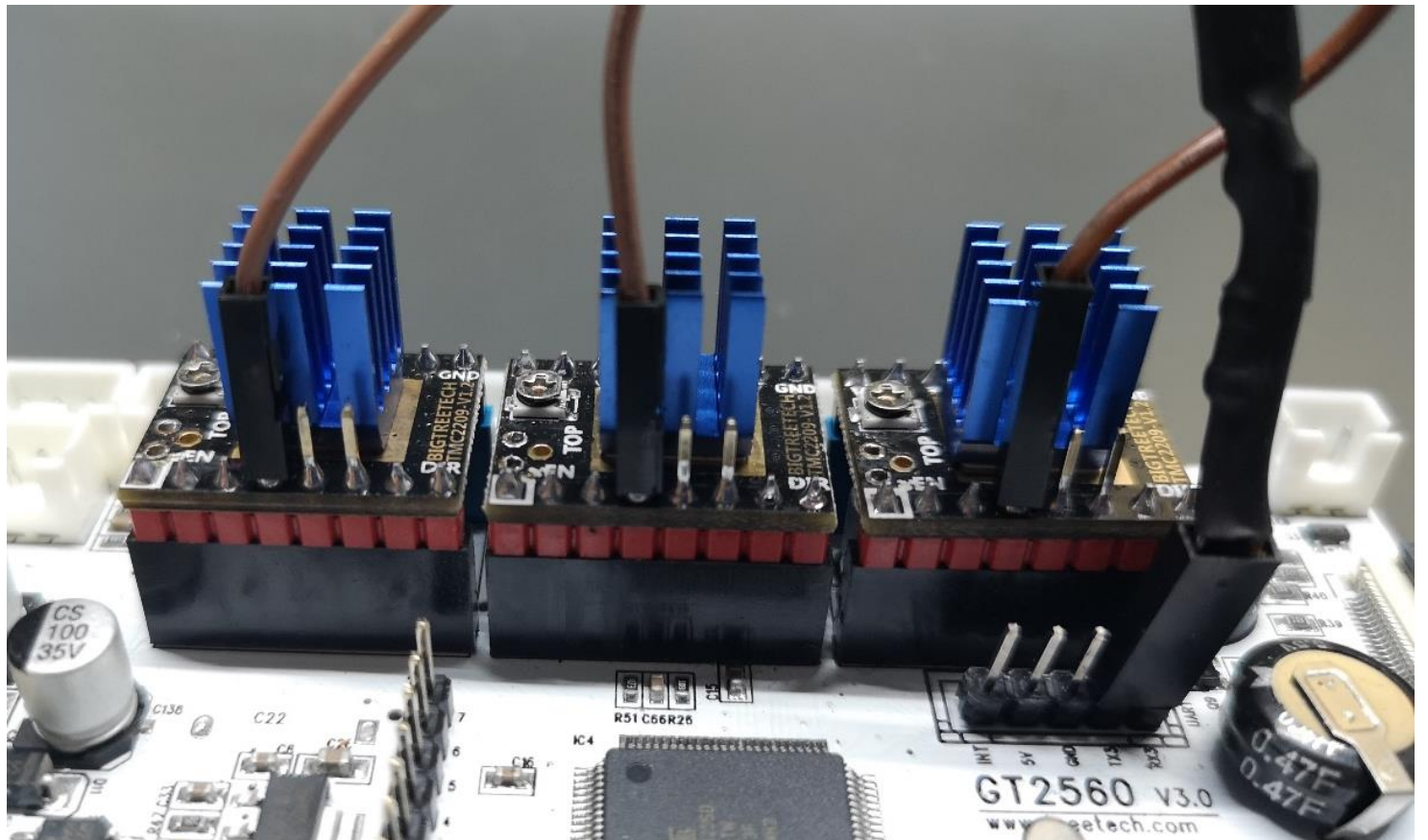
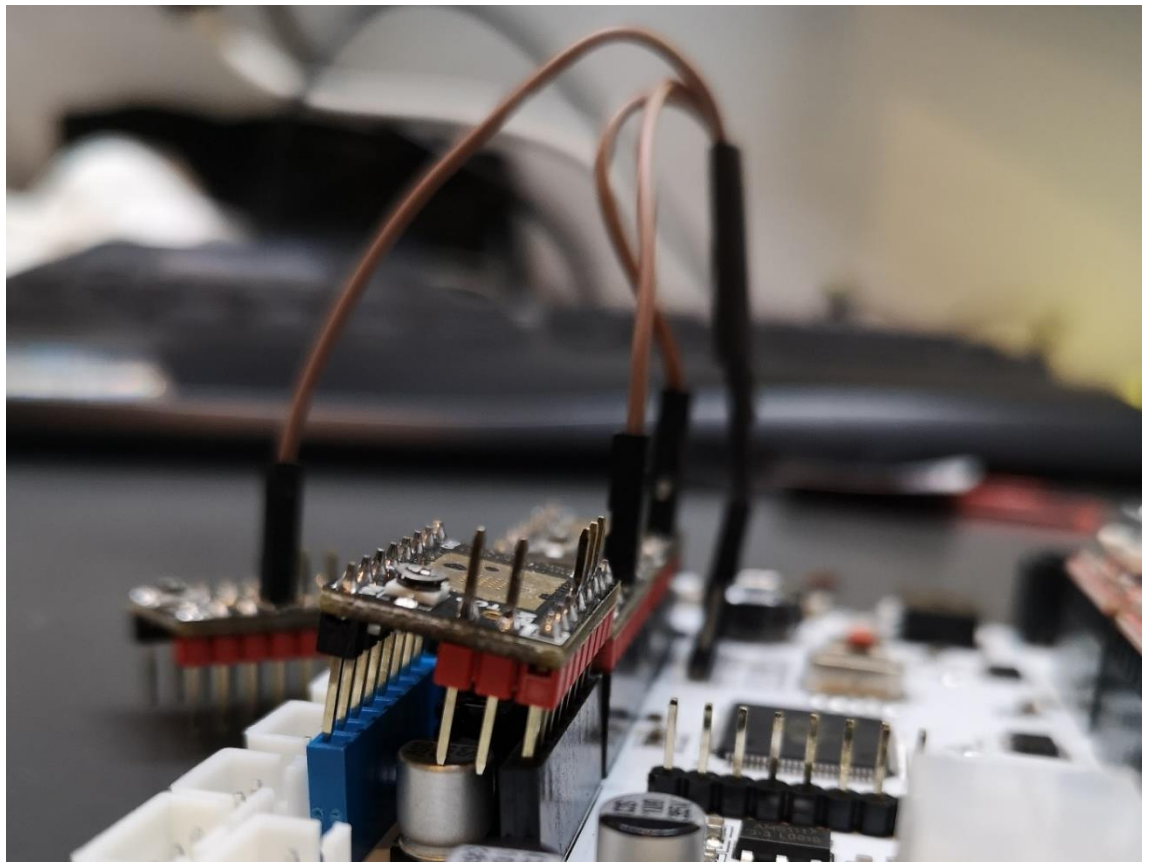








WRAPPING ALL TOGETHER GT2560 V3.0 / V3.1:





After successful flashing the firmware you must see the TMC option in the LCD menu:

```
Info Screen      #
Motion           >
Temperature      >
>Configuration  >
```



```
Main            #
>Advanced Settings >
Runout Sensor:   On
Preheat PLA Conf >
```



```
Junction Dev: 0.060
Steps/mm      >
>TMC Drivers  >
Temperature    >
```



```
#Control        #
Driver Current  >
Stepping Mode   >
```



```
#TMC Drivers    #
X:              800
Y:              800
Z:              800
```



```
StealthChop Enabled
#TMC Drivers    #
X:              On
Y:              On
```

Also, you will see detailed information in the pronterface console (printer status report):

```
Connecting...
echo:start
External Reset
Marlin 2.0.6.1
echo: Last Updated: 2020-08-28 | Author: (VCP, MAGNA I V2, TMC2209-UART, noABL, BiLIN, LinADV, Rev05)
echo:Compiled: Sep 1 2020
echo: Free Memory: 2916 PlannerBufferBytes: 1408
//action:notification MAGNA I V2 Ready.
echo:V81 stored settings retrieved (697 bytes; crc 34971)
echo: G21 ; Units in mm (mm)
echo: M149 C ; Units in Celsius
echo;; Filament settings: Disabled
echo: M200 S0 D1.75
echo;; Steps per unit:
echo: M92 X80.00 Y80.00 Z400.00 E100.40
echo;; Maximum feedrates (units/s):
echo: M203 X500.00 Y500.00 Z20.00 E25.00
echo;; Maximum Acceleration (units/s2):
echo: M201 X1000.00 Y1000.00 Z50.00 E1000.00
echo;; Acceleration (units/s2): P<print_accel> R<retract_accel> T<travel_accel>
echo: M204 P2500.00 R2000.00 T1000.00
echo;; Advanced: B<min_segment_time_us> S<min_feedrate> T<min_travel_feedrate> J<junc_dev>
echo: M205 B20000.00 S0.00 T0.00 J0.06
echo;; Auto Bed Leveling:
echo: M420 S0 Z0.00
echo;; Material heatup parameters:
echo: M145 S0 H140 B60 F0
echo: M145 S1 H180 B60 F0
echo;; PID settings:
echo: M301 P22.56 I1.84 D69.29
echo: M304 P100.95 I14.50 D468.60
echo;; Stepper driver current:
echo: M906 X800 Y800 Z800
echo;; Driver stepping mode:
echo: M569 S1 X Y Z
echo;; Linear Advance:
echo: M900 K0.55
echo;; Filament load/unload lengths:
echo: M603 L200.00 U550.00
echo;; Filament runout sensor:
echo: M412 S1
//action:prompt_end
Testing X connection... OK
Testing Y connection... OK
Testing Z connection... OK
echo:SD card ok
Printer is now online.
```



And drivers status report:

```
>>> M122 S0
SENDING:M122 S0
      X      Y      Z
Address    0      1      2
Enabled    false  false  false
Set current 800    800    800
RMS current 795    795    795
MAX current 1121   1121   1121
Run current 25/31  25/31  25/31
Hold current 12/31 12/31  12/31
CS actual 12/31 12/31  12/31
PWM scale
vsense     1=, 18   1=, 18   1=, 18
stealthChop true    true    true
msteps     16      16      16
tstep      max     max     max
PWM thresh.
[mm/s]
OT prewarn false    false   false
triggered
OTP         false    false   false
pwm scale sum 14      14      14
pwm scale auto 0       0       0
pwm offset auto 36     36     36
pwm grad auto 14      14      14
off time 4    4       4       4
blank time 24    24     24
hysteresis
-end        2       2       2
-start      1       1       1
Stallguard thrs 0      0      0
uStep count 8       8       8
DRVSTATUS     X      Y      Z
sg_result 0    0       0
stst
olb
ola
s2gb
s2ga
otpw
ot
157C
150C
143C
120C
s2vsa
s2vsb
Driver registers:
      X      0xC0:0C:00:00
      Y      0xC0:0C:00:00
      Z      0xC0:0C:00:00
Testing X connection... OK
Testing Y connection... OK
Testing Z connection... OK
```