

TURN 992 GT3R Guide

Introduction

This wheel is designed to be 3D printed via FDM (Filament Deposit Material) or MJF (Multi Jet Fusion) technology. With a 3mm aluminum or carbon core as a mounting base. Handles are offered as printed, upholstered or urethane molded options.

We recommend the final carbon finish to be achieved via hydro dipping or vinyl wrapping. But sky's the limit 😊

Supported until

This project is supported until 1 December 2023.

Functions of the wheel

The Wheel have the following Features:

- 15 - Buttons - (Including the two blinker and brake bias shifters on the back)
- 1 - Button for backlighting control powered via USB
- 2 - Shifters
- 2 - Extra Brake Bias Shifters
- 2 - Encoders
- 3 - 12 Position Rotary Switch*
- 1 - 6 Position Rotary Switch*

*It is **important** to state that the 12 & 6 Position Rotary Switch functions as 42 individual buttons, and some games don't support that feature unlike Encoders that just give up or down button presses.

Tool and skills

Soldering - Some parts need to be soldered to the PCB like the Transistor and JST connectors.

FDM 3D-printer - Some parts are too small to be printed via big scale MJF service, like the silhouette template for the Rotors. so there you have to order a FDM print or print it yourself.

Gluing - The Acrylic sheet needs to be glued into the main front plate.
If you go for the Small printer option (225x225mm) you need to glue the main shell.

3D Printing Service

We recommend that the majority of parts shall be printed at a 3D Printing Service. Where the Main Shell can be printed in Black HP PA-12 Nylon. All the other parts like Button Guards, Rotor Knobs and Thumb Rotor holder can be printed in resin to keep the details.

Here is a Guide for JLC PCB:[How to Place a 3D Printing Order at JLCPCB - YouTube](#)

Under The Folder 3D printing/3D Printing Service are the parts separated by Material.

With the PCB holder and Silhouette in separate folders as they are best suited for PLA.

And here follow the number of parts you need:

Main Shell	1	MJF	Black PA-12
Front Lid	1	MJF	Black PA-12
Front Handle R	1	MJF	Black PA-12
Front Handle L	1	MJF	Black PA-12
Back Grip Mid	1	MJF	Black PA-12
Front Grip Mid	1	MJF	Black PA-12
6P Rotary Knob	1	Resin	Black Resin
12p Rotary Knob	3	Resin	Black Resin
Button Guard R	1	Resin	Black Resin
Button Guard L	1	Resin	Black Resin
Thumb Enc Holder R	1	Resin	Black Resin
Thumb Enc Holder L	1	Resin	Black Resin
Thumb Rotor	2	Resin	Black Resin
Button Cap 12mm	12	Resin	Clear or white Resin (R9000)
PCB Holder L	1	PLA	N/A
PCB Holder R	1	PLA	N/A
Silhouette	1	PLA	Black

Shifters are not covered here.

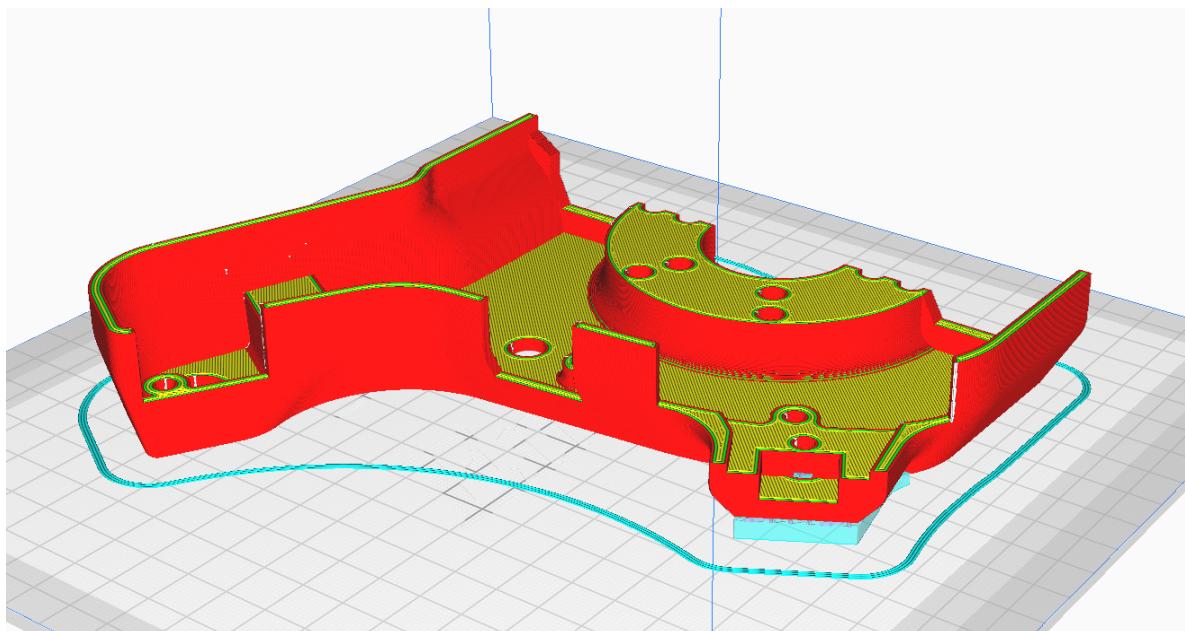
Grips moldes are to be printed in white resin (R9000).

FDM 3D Printning

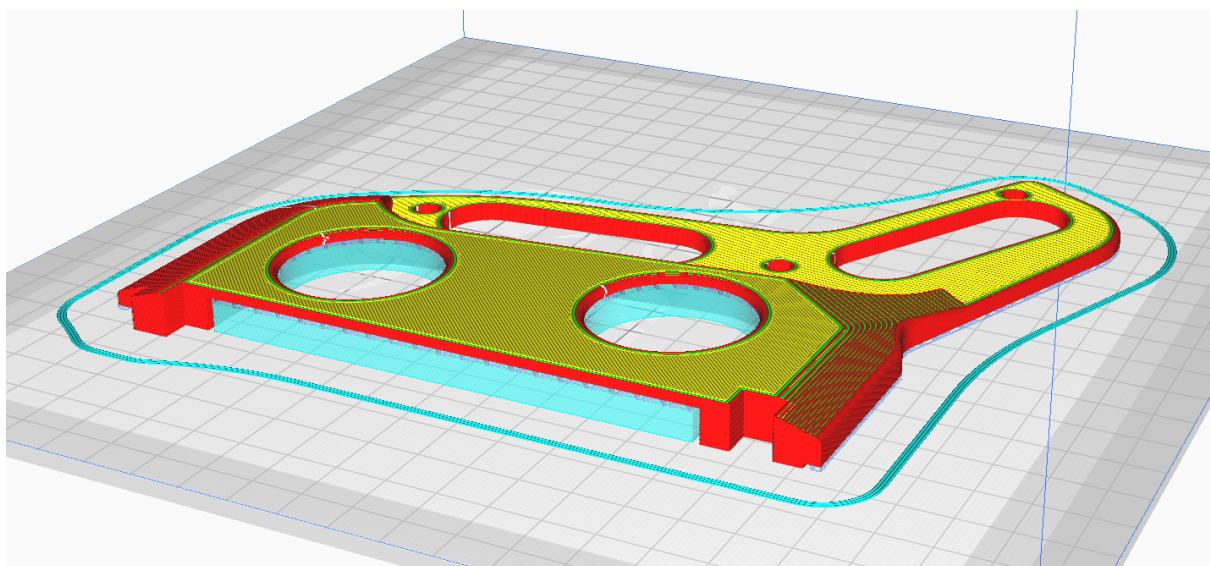
There are 2 options offered, one for printers that can print the entire shell and lid, and a second where the parts are split and can be glued together. The widest part of the main shell is about 280mm. but here follows the recommended printer orientations.

We recommend the outer wall to be 3 layers, so that the walls of the main shell are solid. Support from the main plate is needed. Other settings are up to you. Here follow some of the trickiest parts and how they work to print:

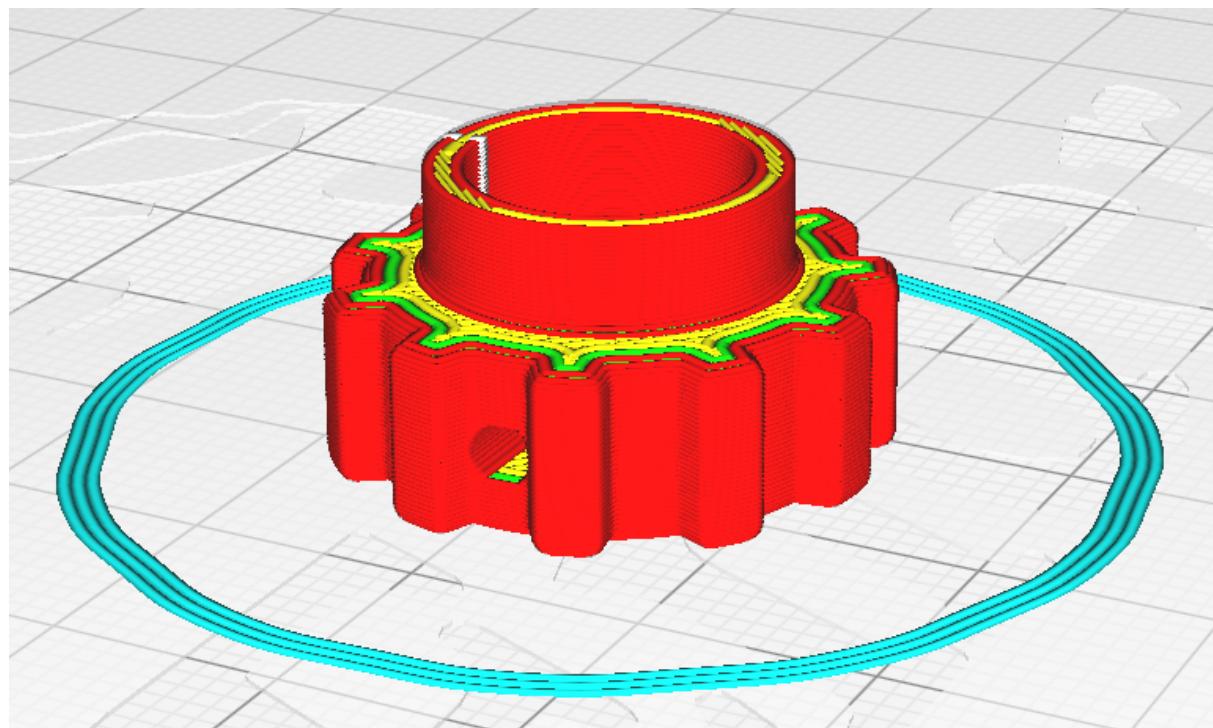
Main Shell:



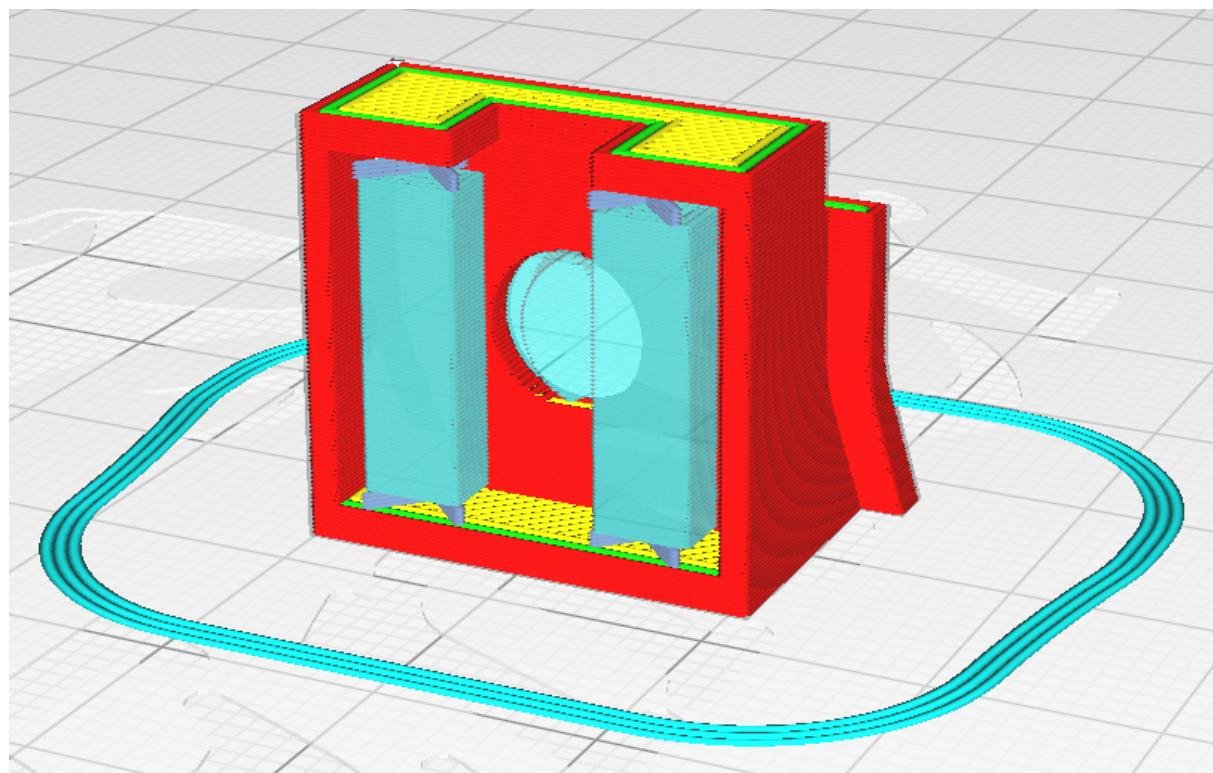
Main Front Lind:



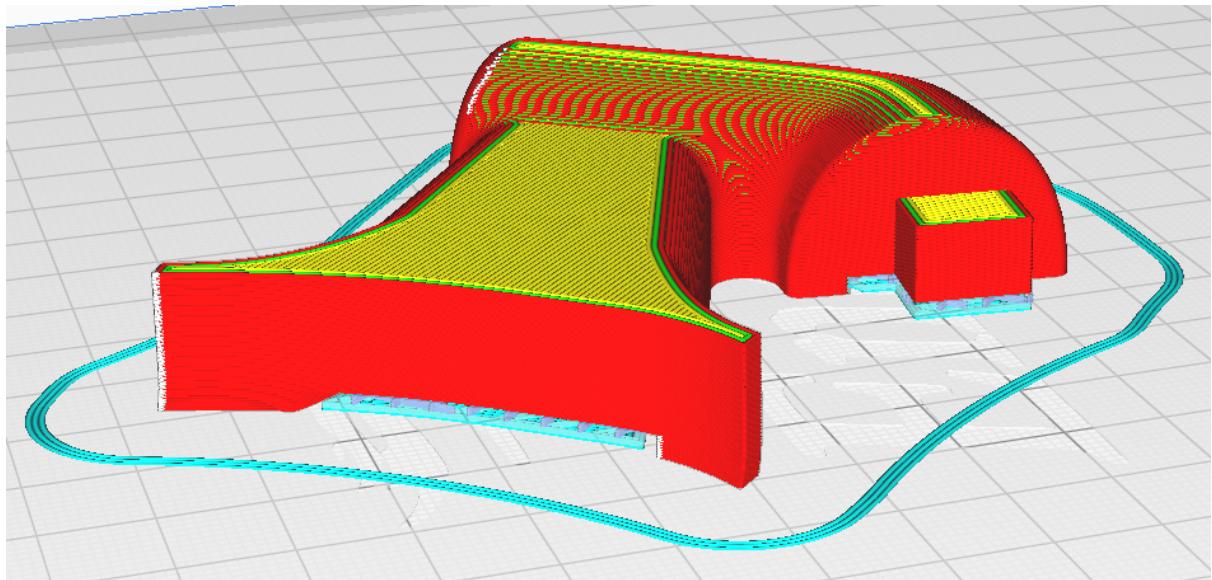
Thumb Rotary Knob:



Thumb Rotary Holder:

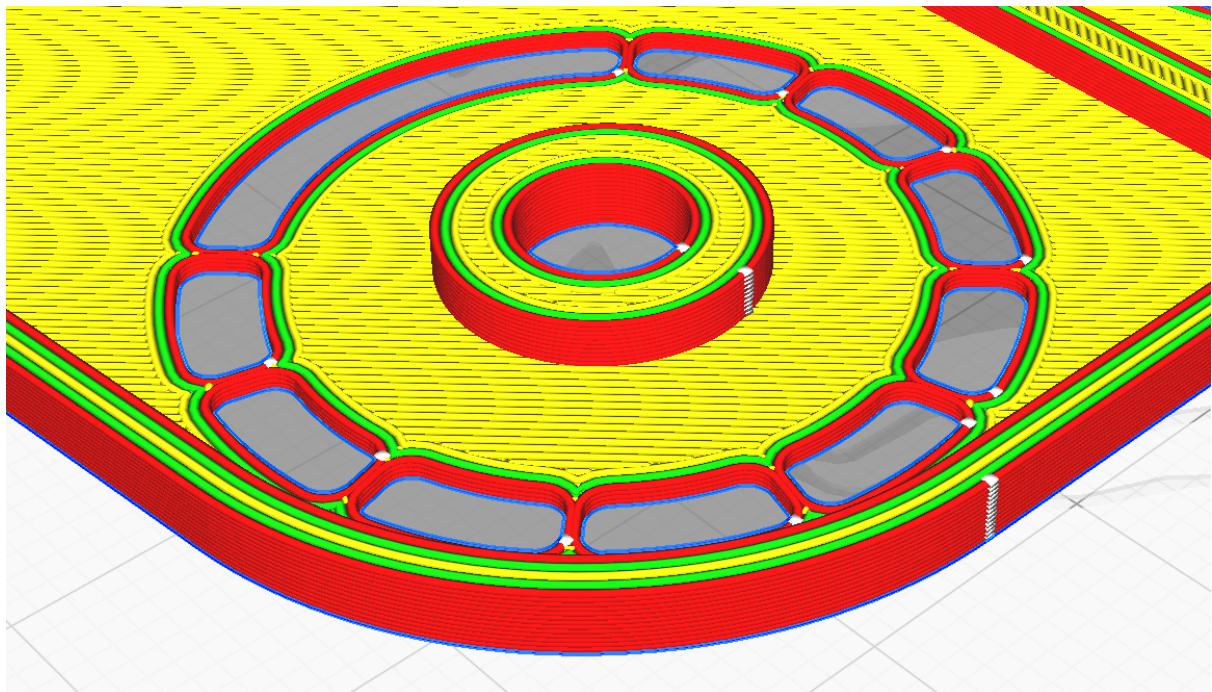


Grips and Handles



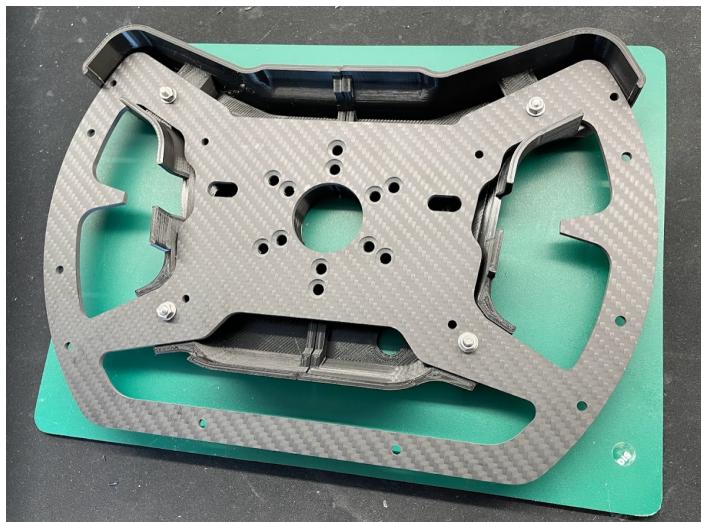
Silhouette (Special)

This part is a little tricky, in order to get the correct shadow on the Acrylic sheet this part needs to be printed with a 0,4mm nozzle or smaller. And it can not be printed in Resin or Nylon. So it's recommended to print this part at home or order the part in FDM print.



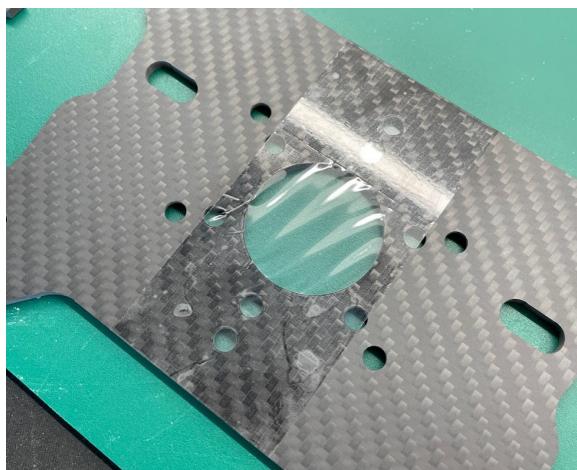
Gluing Recommendation

If you print the main shell and Main lid in two halves, it's important to ensure that the parts fit the core plate, so recommendations are to use the core plate as a jig to ensure a good fit for both the PCB, buttons and the acrylic sheet.

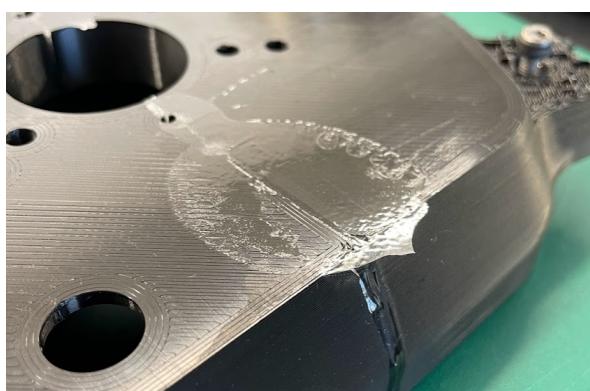


Bolting the core plate and the main shell together.

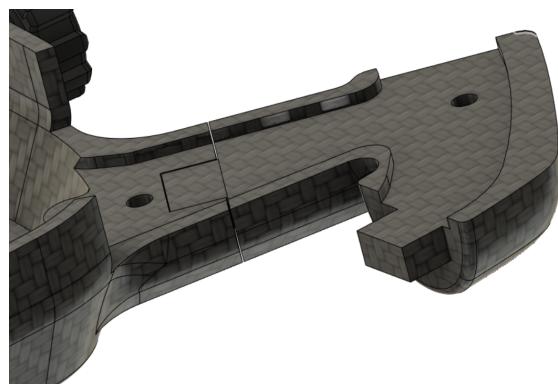
On a flat non-stick surface.



Recommendation is to use 5 min epoxy and have packing tape as non stick protection on the carbon core and flat surface.



Let the epoxy set but peel the tape before the glue has fully hardened (10min ->2h), and remove any overflow until the glue is fully hardent.



You can glue the two back handle segments too.

PCB ordering

In the PCB manufacturing folder you will find 3 different folders, one for every PCB you need. In each folder you will find the production files for JLC PCB in a zipped gerber file and the BOM and SOP files are required to place the needed components on the PCBs.

You can drop the zipped file in the JLC instant quote tool directly.

JLC have some good how to guides on the site: [PCB Prototype & PCB Fabrication Manufacturer - JLCPBCB](#)

Here is a Screenshot of a recommended order and a high res picture in the PCB manufacturing folder :

The SMT Assembly takes place on the front side on all 3 boards.

The screenshot shows the JLC PCB ordering interface. At the top, there are four tabs: Standard PCB/PCBA (selected), Advanced PCB/PCBA, SMT-Stencil, and 3D Printing. Below the tabs, two green PCB designs are shown. A message indicates "Detected 2 layer board of 159.26x262.19mm(6.27x10.32 inches)." A "Gerber Viewer" link is also present.

Base Material: FR-4 (selected), Aluminum, Copper Core.

Layers: 1, 2, 4, High Precision PCB, 6, 8, 10, 12, 14, 16, 18, 20.

Dimensions: 262.19, 159.26 mm.

PCB Qty: 5.

Product Type: Industrial/Consumer electronics (selected), Aerospace, Medical.

PCB Specifications:

- Different Design: 1, 2, 3, 4.
- Delivery Format: Single PCB, Panel by Customer, Panel by JLCPBCB.
- PCB Thickness: 0.4, 0.6, 0.8, 1.0, 1.2, 1.6 (selected), 2.0.
- PCB Color: Green (selected), Purple, Red, Yellow, Blue, White, Black.
- Silkscreen: White.
- Surface Finish: HASL(with lead) (selected), LeadFree HASL, ENIG.

High-spec Options:

- Outer Copper Weight: 1 oz, 2 oz.
- Via Covering: Tented, Untented, Plugged, Epoxy Filled & Capped, Copper paste Filled & Capped.
- Confirm Production file: No, Yes.
- Remove Order Number: No, Yes, Specify a location.
- Flying Probe Test: Fully Test, Not Test.
- Gold Fingers: No, Yes.
- Castellated Holes: No, Yes.

Advanced Options:

- PCB Remark:

PCB Assembly:

PCB Assembly: Free Assembly for your PCB order

Assemble top side

PCBA Type: Economic (selected), Standard, What's the difference?

Assembly Side: Top Side (selected), Bottom Side, Both Sides.

Assembly Side: Top Side (selected), Bottom Side, Both Sides.

PCBA Qty: 5, 2.

Tooling holes: Added by JLCPBCB, Added by Customer.

Confirm Parts Placement: No, Yes.

I agree to the Terms and Conditions of JLCPBCB SMT Service.

Confirm

Stencil: Order together with PCB

PCB Assembly

Resistor Ladder Soldering and Placement

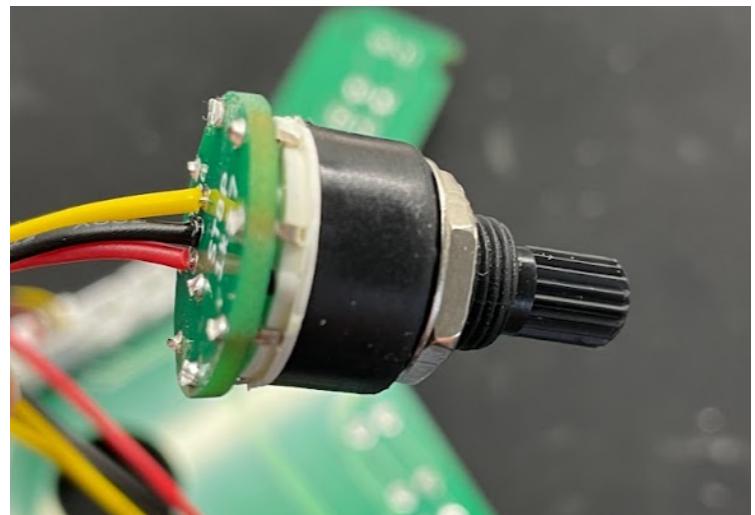
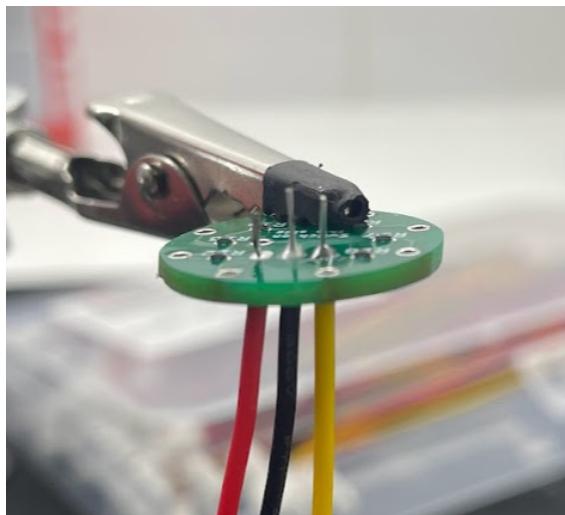
The 3 cables shall be solder to the board first, and then the resistor ladder shall be solder on the rotary switches.

Note that the small Resistors are facing the Rotary switch.

The excess wires from both the switch and cable shall be sniped off.

The Square pin hole on the resistor ladder PCB is Pin1.

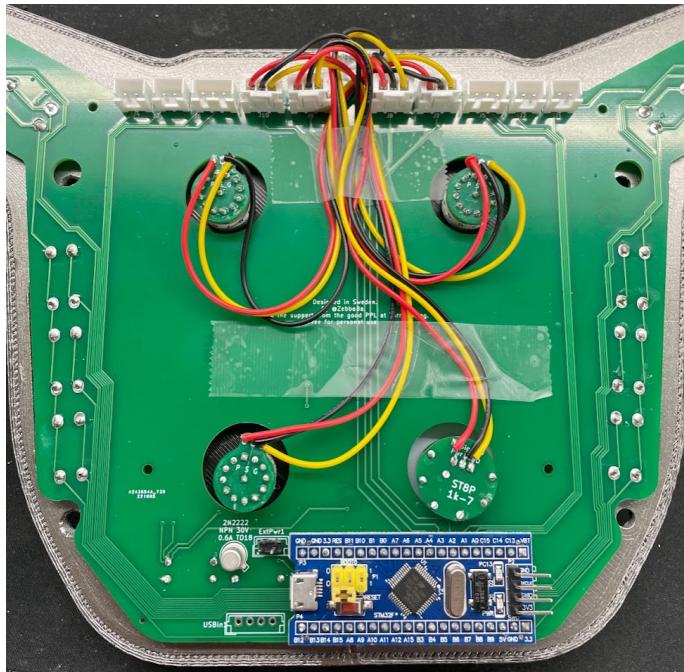
Be careful handling the switches and resistor ladders during the assembly, the cables can easily break off.



Cable routing.

The space between the core plate and the PCB is limited, therefore this is the recommended cable routing to ensure a good fit.

Don't use tape like shown in the picture, as that may result in EMI problems.



JST connectors

The Board is designed with JST-EH 2,5mm pin spacing soldering pads. We recommend you get the JST-EH pre mounted kits.

You can also use JST-XH but then the spacing on the top mounted connector needs to Flipped 180 degrees.

Another option is to buy pre-made cables with a connector in the middle of the cable and solder the cable ends to the PCB.



Resistor options and backlight brightness.

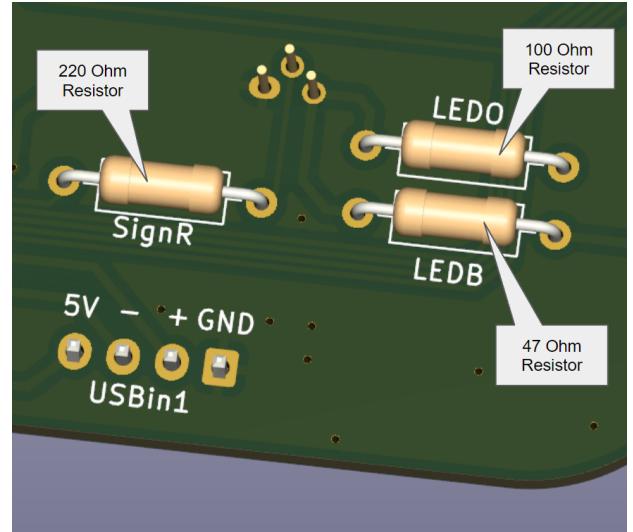
If you go for resin printed buttons the recommended resistor option are:

- 220 Ohm for the LED Signal Resistor - SignR
- 100 Ohm for the Rotor Graphics backlight -. LEDO
- 47 Ohm for the Button backlight. - LEDB

Both the LEDO and the LEDB can be changed to higher or lower resistance to adjust the brightness of the lights. but we don't recommend going lower than 22ohm.

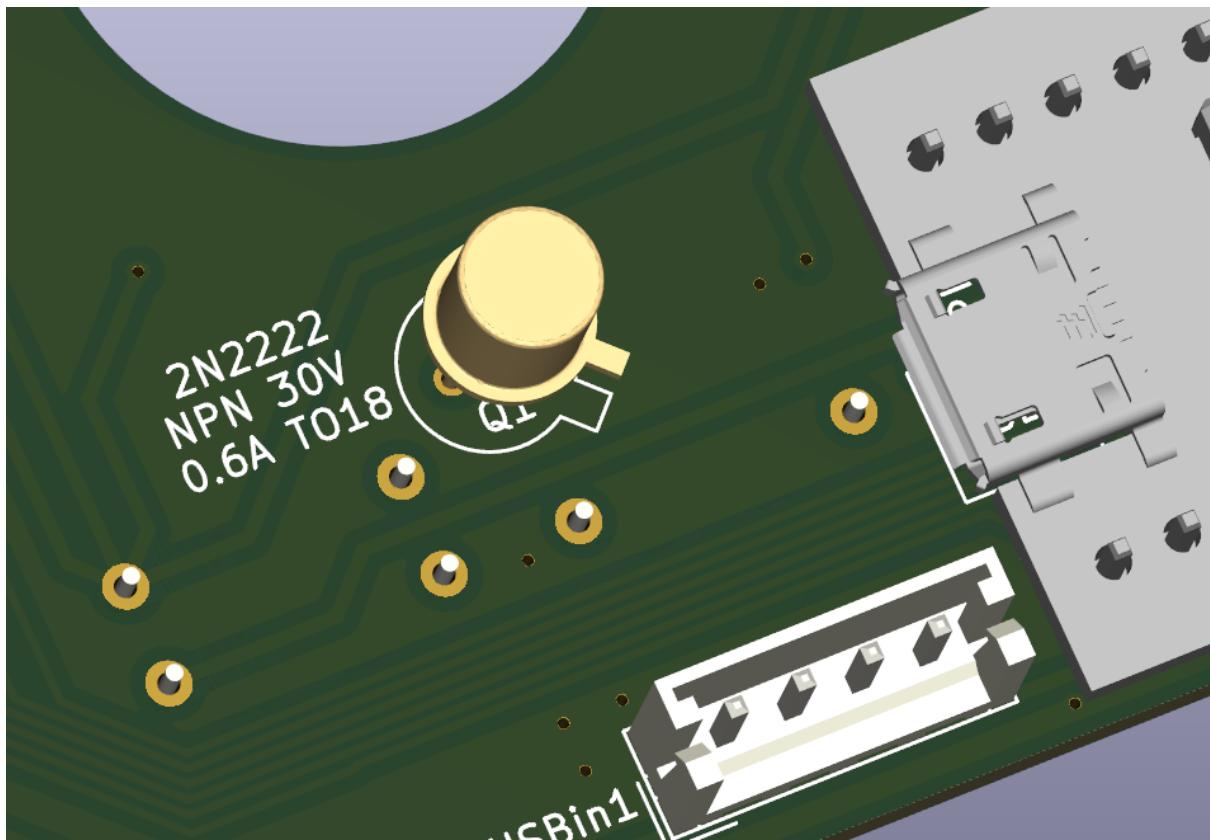
SignR shall not be changed.

resistors are non directional and can be mounted in any direction.

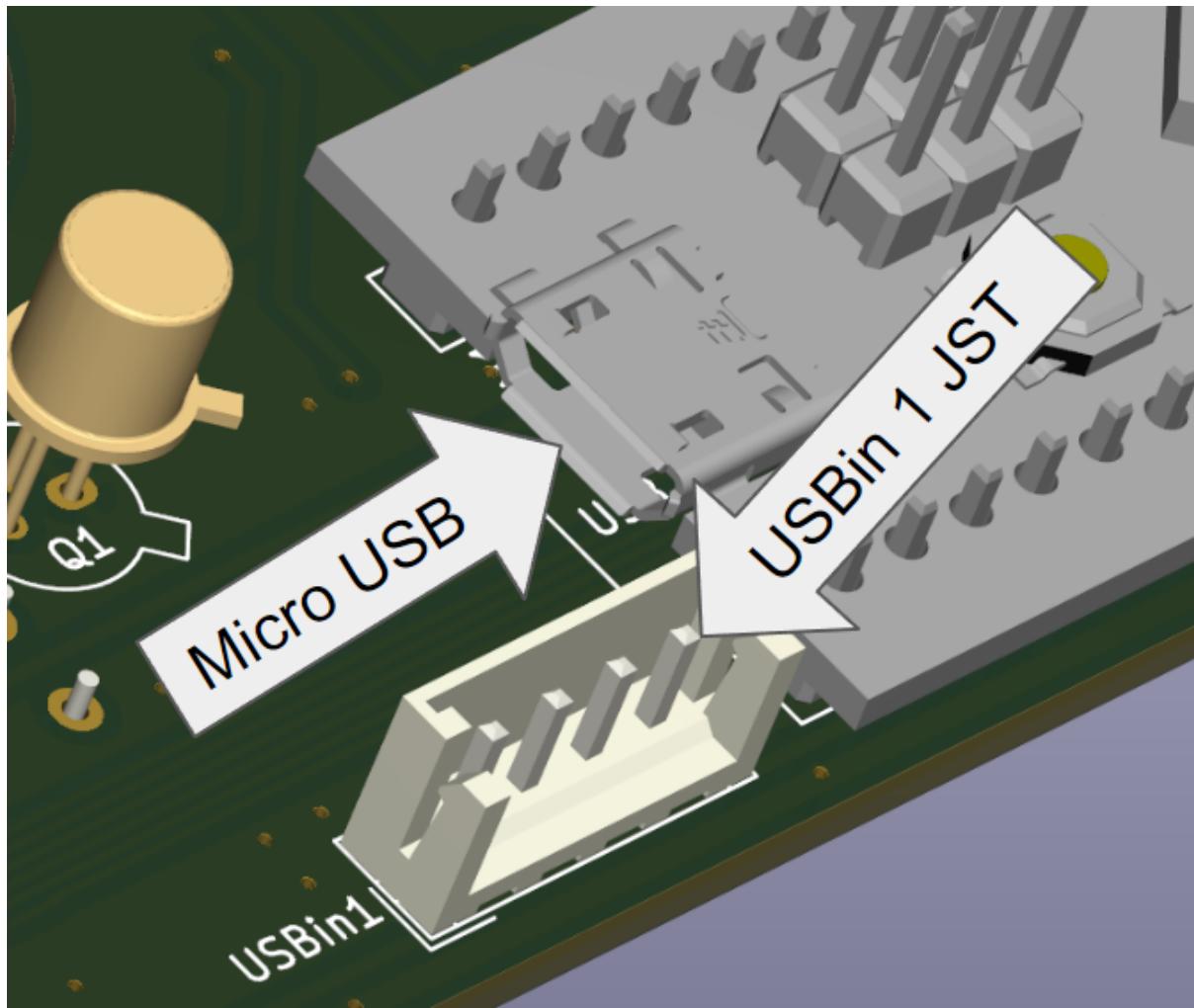


Transistor placement.

The Transistor (2N2222 NPN 0,6A TO18) shall be plated on the backside of the board.



PCB Power Option



Both the Micro USB port on the Bluepull microcontroller or the USBin1 JST on the main board can power and communicate to the main PCB.

We recommend using the Micro USB port.

It is important that you only use one of these two options, otherwise you may damage the STM32 microcontroller.

Button Caps

The files include button caps that can be printed in white or transparent resin. These buttons are 12mm in diameter on the top and are made to fit the 12 mm epoxy dome stickers.

You can use the multicolored button caps that are included in the adafruit button kit.
but then the black caps will not let any light through.



Stickers

Stickers are offered for both the resin printed buttons and for the injected molded button caps.

Epoxy dome Stickers - Resin Caps (recommended)

Resin 12mm stickers can be ordered as Epoxy dome stickers from AliExpress or your local print shop. and every printer is different. so moth the Illustrator or PDF files are included.

The Dome stickers shall be printed on white backing.

Injection molding caps and Clear Stickers

If you use the injection molded caps the stickers can be clear with just white and black text, and if you like you can add a clear 12 epoxy dome sticker, from Etsy or Aliexpress.

the black caps don't let light true, and the pink and blue buttons have to.



Acrylic sheet

The graphic for the 4 rotors shall be **printed on the front side** of the acrylic sheet with white backing. Both PDF, illustrator and .step files are recommended to send to the manufacturer.

The sheet shall be 2mm in thickness.

We recommend you look at the Turn Wiki page for vendors that we use in this case.

[Fabrication Services · turnracing/turnracing-diy Wiki \(github.com\)](#)

Be sure to tell the manufacturer what side you like the print to be on.

You can also get the acrylic sheet cut and make the graphics as a sticker. but that has not been tested.

Carbon / Alu Plates

Main core plate is not seen in the finished wheel, so you can pick whatever finish or material you like. Main core plate thickness is 3mm.

Shifters are designed to be 2mm and **3K Twill - Matte for all parts finish.**

And they are mirrored so they fit on both sides.

We recommend you look at the Turn Wiki page for vendors that we use in this case.

[Fabrication Services · turnracing/turnracing-diy Wiki \(github.com\)](#)

Grips

The Grips are offered in 3 main variants:

NO GAP - The Files with the - **NO GAP** - note are two part grips that are optimized for TPU or PLA printed grips, it does not have a gap to clasp the upholstered fabric between the grips halves.

Upholstery - The Files with the - **Upholstery** - note are grips that have a 0,75mm gap where the fabric or leather can be clamped.

Molded grips - Is a separate folder - **Grips And Molds** - where the molds and .step file assembly is available.



Molding Grips

If you like to mold your grips to the main core plate there is a dedicated instruction for that at the Turn racing Wiki: [Molded Grips · turnracing/turnracing-diy Wiki \(github.com\)](https://github.com/turnracing/turnracing-diy/wiki/Molded-Grips)

Lower Handle



We recommend the lower handle to be 3D printed and then painted with a Liquid Vinyl Permanent paint. we have used :
MTN PRO Liquid Vinyl Permanent Primer

MTN PRO MULTI-PURPOSE VINYL COATING black

The required molds will be included to make the grips from urethane, but that have not been tested, and a 3D printed core is recommended to keep weight down.

Shifters

Shifters are not covered in the 3D print segment, but can be printed in PLA via a FDM printer, CNC from metal or Printed in a SLM metal printer.

If you print the Shifters from plastic the plate and microswitch can be screwed into the plastic. But if you go for a metal option the threads need to be treads made beforehand. and M2 thread taps are hard to use.

Assembly

Main Assembly video is available using this Link:

<https://youtu.be/m3XovVu48KU>



Freejoy and Configuration

First you need to configure the Blue Pill to function as a Freejoy component, and then you can use the configuration file in the FreeJoy folder.

Here are the instructions for FreeJoy:[FreeJoy-Team/FreeJoyWiki: wiki for FreeJoy project \(github.com\)](https://FreeJoy-Team/FreeJoyWiki: wiki for FreeJoy project (github.com))

We recommend that you familiarize yourself with the Config ability of Freejay to get the most out of it and be able to customize the wheel.

The Configuration file is in the FreeJoy Config folder.