

HULA for Voron

HULA anti-vibration feet on Voron 2.4R2, Trident & Switchwire

Supplementary User Guide

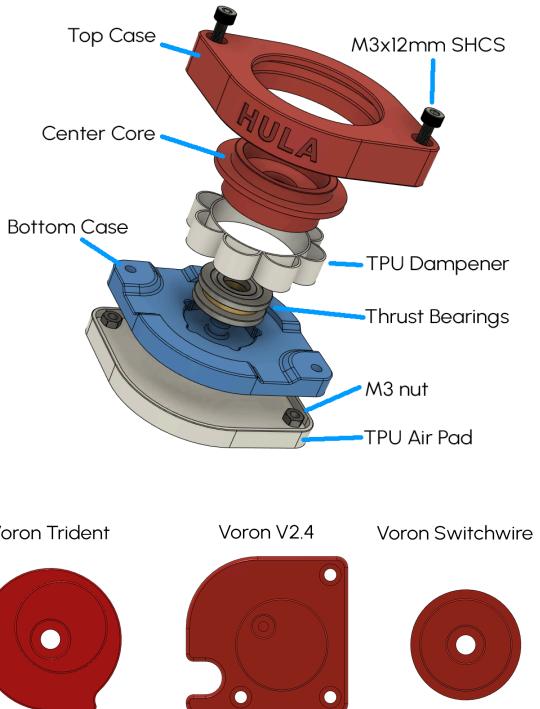
Version: 20240626



Concept & Design by ThrutheFrame

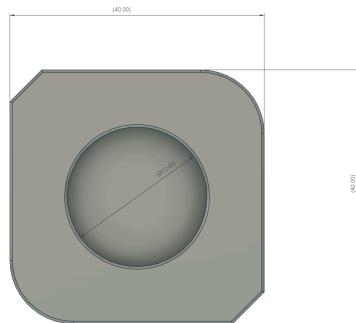
BOM

1. Top Case x4
2. Bottom Case x4
3. Center Core x4
4. Feet adapters
 - a. Voron Trident
 - b. Voron 2.4
 - c. Switchwire
5. F8-22 Thrust Bearings x4
6. TPU Dampener_06mm x4
7. TPU Air Pad x4
8. Air Pad Insoles
9. M3x12mm SHCS x8
10. M3 Nut x8



FILAMENTS for HULA

It is recommended to print the (1)Top Case, (2)Bottom Case, (3)Universal Center Core and (4)Feet adapters in PET-g. The (5)TPU Dampener and (6)TPU Feet Cover are printed in 95A TPU. This is because PET-g is less brittle and has negligible shrinkage. If you are printing HULA in ABS or ASA, please use the "HULA Dimension Test Rig" to calculate the compensation ratio required.



HARDWARE KIT

Sourcing for the right hardware can be tedious and not everyone wants to buy a 1kg spool of TPU for this project. Hence, I have partnered with regional vendors to provide a Hardware Kit for the HULA build. The Kit includes the required bearings, screws, nuts and printed TPU parts for the project. HULA for Voron is designed using the HULA centre core (designed for the Creality K1) and fitted with specific feet adaptors for the different Voron printers.

REGIONAL VENDORS

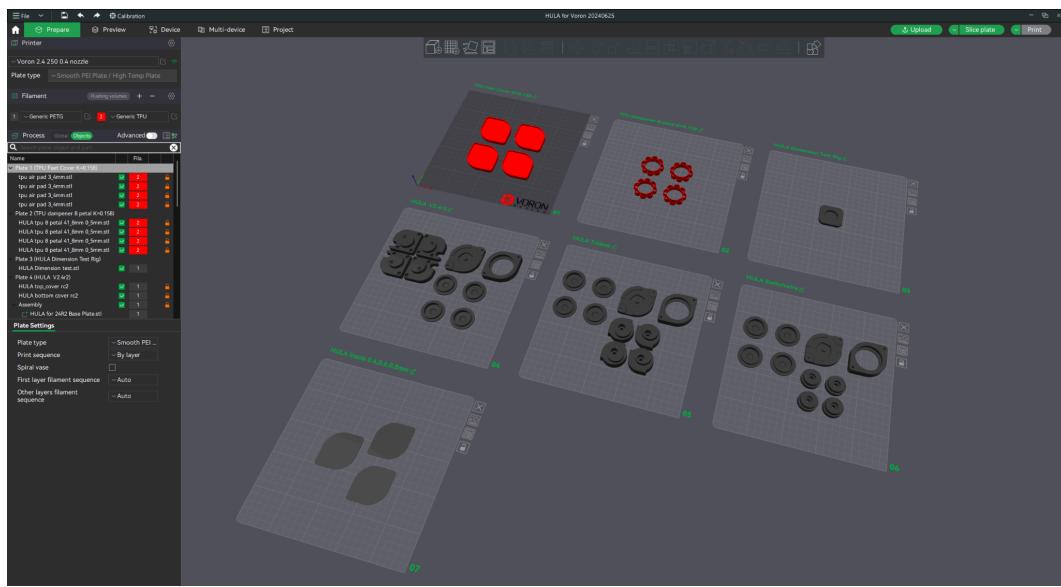
US & CA	A collaboration between ThrutheFrame and Voxelpla offers pre-assembled and hardware kits (printed in Voxelpetg+ and 95A TPU filaments). VOXELPLA Store . In addition, Voxelpla offers free shipping when you purchase HULA preassembled/hardware kit along with 3 spools of Voxel filaments . On shipping to Canada, please contact Voxelpla directly.
EU	A partnership between ThrutheFrame and Veetec3D offers pre-assembled and hardware kits printed in Prusament Black PET-g and Esun White 95A TPU. For more information please visit VEETEC3D Store
AUS & NZ	The pre-assembled and hardware kits of HULA are available for sale on JC-3D. For more information please visit JC-3D Store

For the most updated link to the vendors, please visit the project page on MakerWorld to contact the vendors. <https://makerworld.com/en/models/417509#profileId-319901>

PRINTING HULA for Voron

Introduction

The STLs for HULA are prepared in Bambu Slicer and saved as a 3mf file. The hotend nozzle size is 0.4mm. You need to calibrate Filament Flow Dynamic (Pressure Advance) for your filament to get proper prints. This is especially important for TPU printing. My PA value for TPU is K=0.158, a ballpark figure you can use as a starting point. Do not enable the scarf joint setting. Do not use fibre-filled filaments ie PET-g CF, PET-g GF, ABS-CF, or ASA-CF as it may create tolerance issues.



Print Settings

Build Plate 01 - TPU Air Pad

TPU Air pad is item (7) in the BOM. I recommend tuning your printer settings and printing one piece to test the fitting. I used the stock settings of Bambu Lab TPU 95A with a Flow Dynamics value of K=0.158. You will need to print 4 pcs.

- Wall generator = Arachne
- Wall loops/perimeter = 3
- Top layers = 3
- Top shell thickness = 0.8mm
- Bottom layers = 2
- Infill = Gyroid @12%

Build Plate 02 - TPU Dampener

TPU Dampener is item (6) in the BOM. I recommend tuning your printer settings and printing one to test the fitting. I used the stock settings of Bambu Lab TPU 95A with a Flow Dynamics value of K=0.158. You will need to print 4 pcs.

- Wall generator = Arachne
- Wall loops/perimeter = 1
- Detect thin wall enabled

Build Plates 03 - HULA Dimension Test Rig

If you print your parts in ASA or ABS, please use the "HULA Dimension Test Rig" to calculate the required compensation ratio.

Build Plate 04, 05, 06 - Parts for Voron 2.4, Trident & Switchwire

This build plate consists of printed parts (items 1-4) for the Voron 2.4, Trident & Switchwire. You will need to print 4 sets of top and bottom cases.

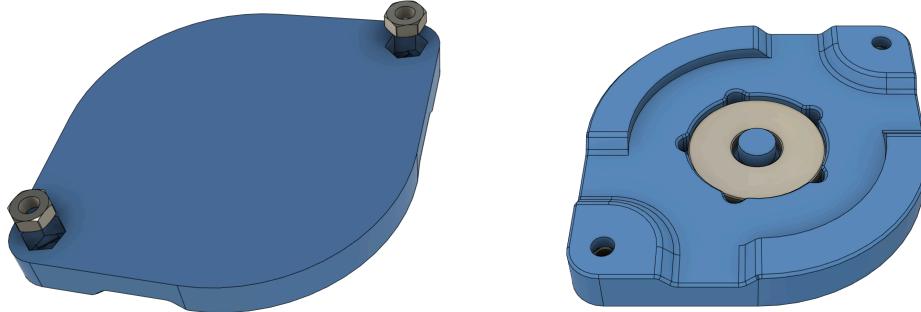
- Wall loops/perimeter = 4
- Top layers = 4
- Bottom layers = 2
- Infill = 3D Honeycomb @12% & 15%
- Support enabled to print Center Core.

Build Plate 06 - Insoles

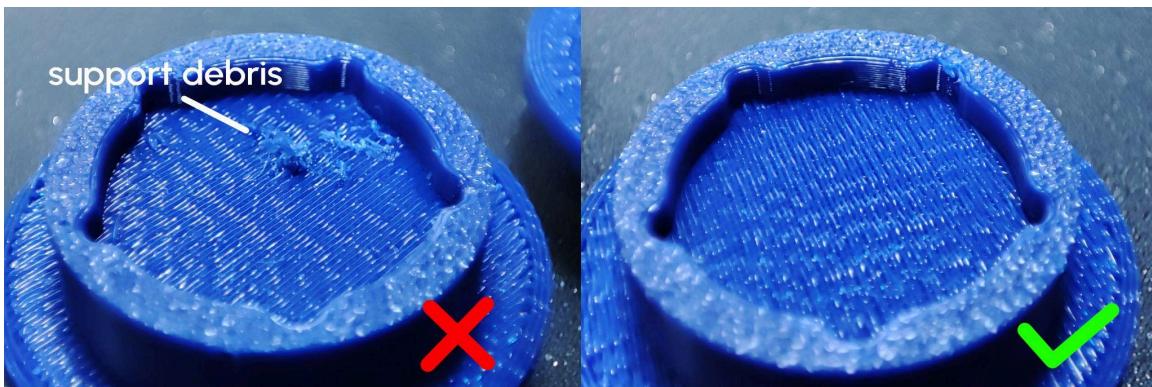
Insoles for air pads. 0.4mm, 0.6m & 0.8mm to compensate for the difference in height and weight distribution to the table surface.

PUTTING HULA TOGETHER

- Install both M3 nuts into the Bottom Case.
- They should fit snugly into the holes
- Install one of the thrust bearing's washer onto the Bottom Case.
- Bearing washers have to be installed with the smooth side facing the bearings.



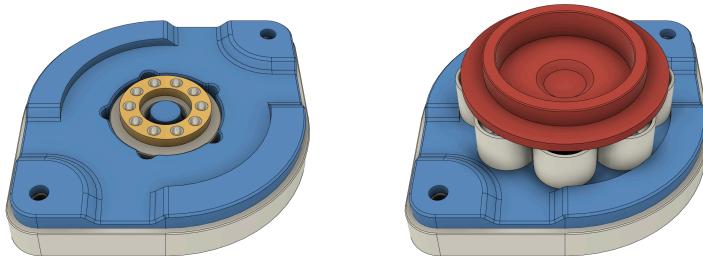
- Remove all supports from the Center Core.
- Ensure the area where the washer sits is cleared of all support debris (**very important**)



- Install the second thrust bearing washer onto the Center Core.
- Ensure the smooth side of the washer is facing up.
- Install the TPU dampener onto the Center Core.



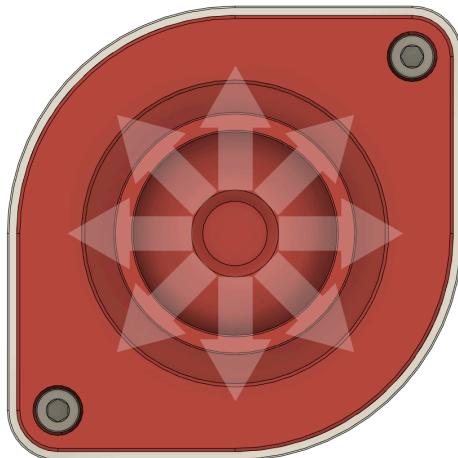
- Place the thrust bearing's ball ring onto the Bottom Case as seen in the image
- Place the Center Core onto the Bottom Case. You should be able to rotate it freely.



- Place the Top Case over the Bottom Case and secure it with 2 M3x12mm SHCS.
- Install the TPU Air Pad



- Congratulations. You have just put together a HULA for Voron. To check if you have installed it properly - rotate the Center Core as it should move freely within the HULA in omni-direction and as you push it towards the edge, the dampening resistance increases.

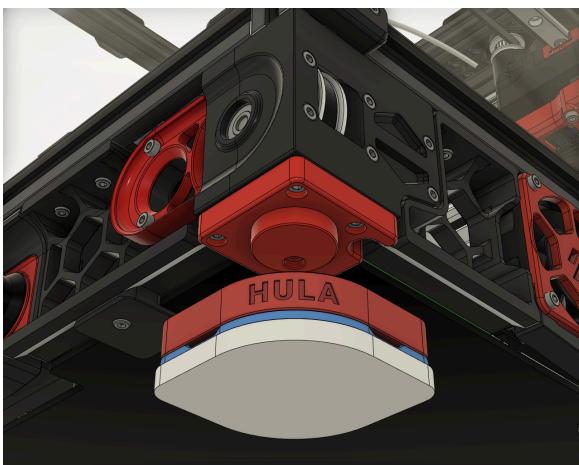
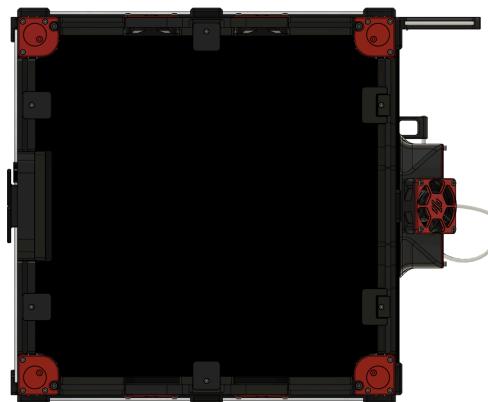
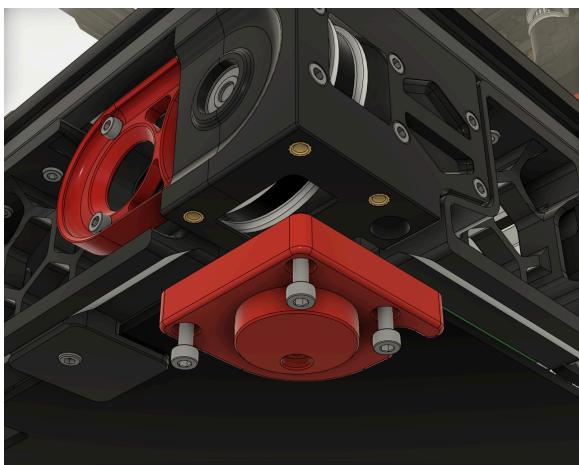


INSTALLING HULA onto a Voron Printer

While it might look funny when content creators make sparks fly, getting electrocuted by 110V/240V is not a pleasant experience. **ALWAYS PRACTICE ELECTRICAL SAFETY PROCEDURE.** Before starting any mod or installation, wait for the hotend to cool down, home the printer and turn it off.

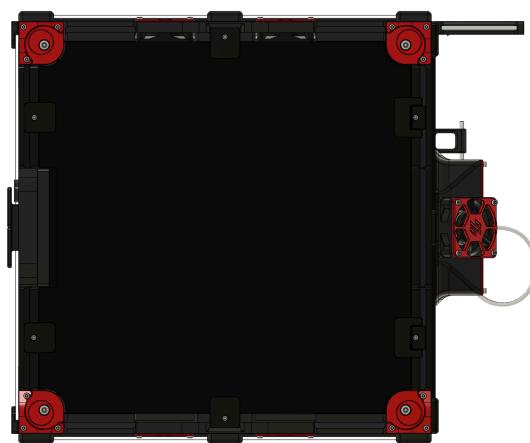
Voron 2.4

- Remove the stock rubber feet and feet accent. Use existing screws to secure the HULA feet adapter as seen in the image. Do this for all 4 corners as seen in the image below.
- Insert HULA to the feet adapter.



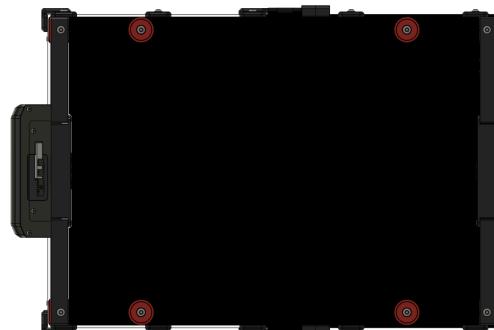
Voron Trident

- Remove the stock rubber feet and feet accent. Use existing screws to secure the HULA feet adapter as seen in the image. Do this for all 4 corners as seen in the image below.
- Insert HULA to the feet adapter.



Voron Switchwire

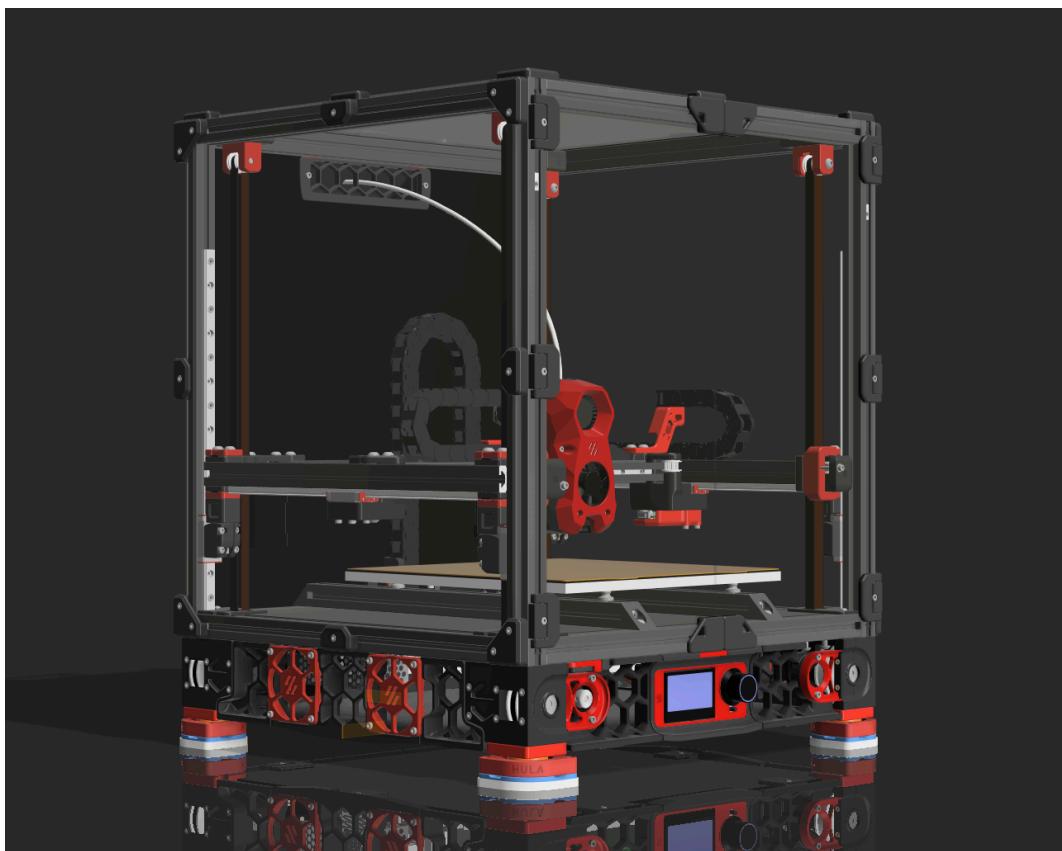
- Remove the stock rubber feet. Use existing screws to secure the HULA feet adapter as seen in the image. Do this for all 4 corners as seen in the image below.
- Insert HULA to the feet adapter.



- If one of the HULA feet is not sitting firmly on the table, you will need to insert an insole in one of the TPU air pads. There is a range of 0.4-0.8mm thickness to choose from.



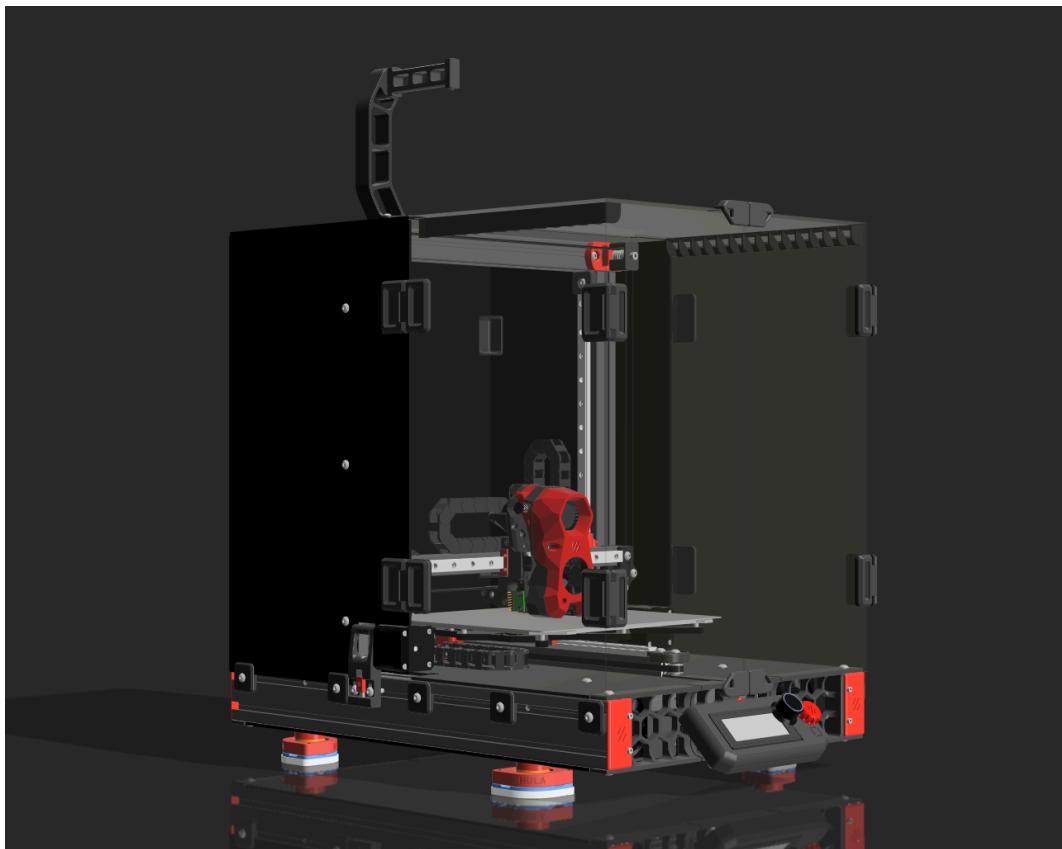
HULA for Voron 2.4



HULA for Voron Trident



HULA for Voron Trident



Pros & Cons of HULA

Pros

- Reduce the vibration translated to the table
- Easy to install and self-aligning
- Do not fold over itself (sprain ankle syndrome) unlike accordion-style feet

Cons

- The table or shelf the printer sits on has to be levelled.
- Not designed to work with crazy fast printing mode.
- Requires some hardware -
 - F8-22 thrust bearings, M3 nuts and screws

FINAL WORDS

HULA is a fun project that rethinks how we dampen a 3D printer. It is unconventional and may or may not work for your printer setup. As with all my designs, prototyping and testing were conducted to ensure printability and meet my expectations. Please read all instructions before you print and install them at your discretion. Finally, have fun HULA HULA.



HULA HULA