

# Tode-SIOST

## Hardware Development

Tode Side-IO Screw Terminals [ #SIOST ]

by TGit-Tech [ <http://www.tgit-tech.com> ]

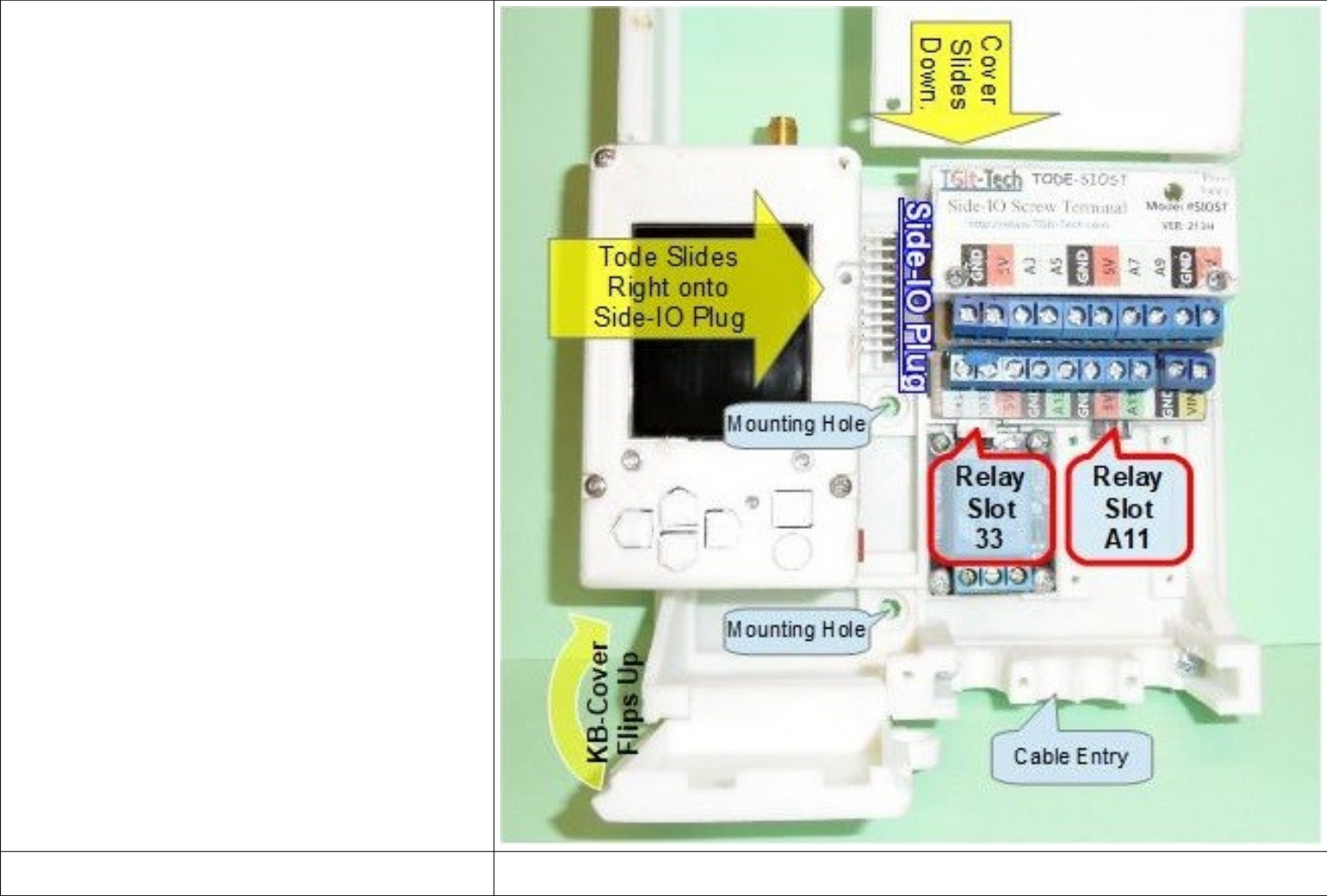
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1. Introduction



- ✓ The Tode Project is a Universal Platform of...
  - Face - UI Options
  - Tode – Backplane with optional Radio & Arduino Micro-Controller
  - Extensions - IO Interfaces, Battery Trays

**Face Options ( User Interface )**

Model	Components	Resources
#TFT18KB6	1.8" TFT LCD Color Screen (6) Key keypad	Design Files <a href="https://github.com/TGit-Tech/Tode-RC">https://github.com/TGit-Tech/Tode-RC</a>
#COVER	A Cover Only	<i>Not available at this time</i>

**Tode Models (post-fix RC=Remote/Radio Control equipped)**

Model	Components	Resources
Tode #AMP	Arduino Mega Pro (AtMega2560)	<i>Not available at this time</i>
Tode-RC #AMPE32T30	Arduino Mega Pro (AtMega2560) Ebyte E32-433T30D Radio (1W/30dbm)	Design Files <a href="https://github.com/TGit-Tech/Tode-RC">https://github.com/TGit-Tech/Tode-RC</a> Firmware <a href="https://github.com/TGit-Tech/Tode-RC-Firmware">https://github.com/TGit-Tech/Tode-RC-Firmware</a>
Tode-RC #AMPE32T20	Arduino Mega Pro (AtMega2560) Ebyte E32-433T20D Radio (250mW/20dbm)	<i>Not available at this time</i>
Tode-RC #AMPXBEE	Arduino Mega Pro (AtMega2560) Digi Xbee Radio	<i>Not available at this time</i>

**SIO Stations ( Input/Output by Todes Side-IO [SIO] plug )**

Model	Components	Resources
#SIOST	Screw Terminals	Design Files <a href="https://github.com/TGit-Tech/Tode-SIOST">https://github.com/TGit-Tech/Tode-SIOST</a>
#SIOAP	Aviation Plugs	<i>Not available at this time</i>

The Tode System is licensed under the MIT License. It's hosted on Github.com at:

<https://github.com/TGit-Tech/Tode-RC>

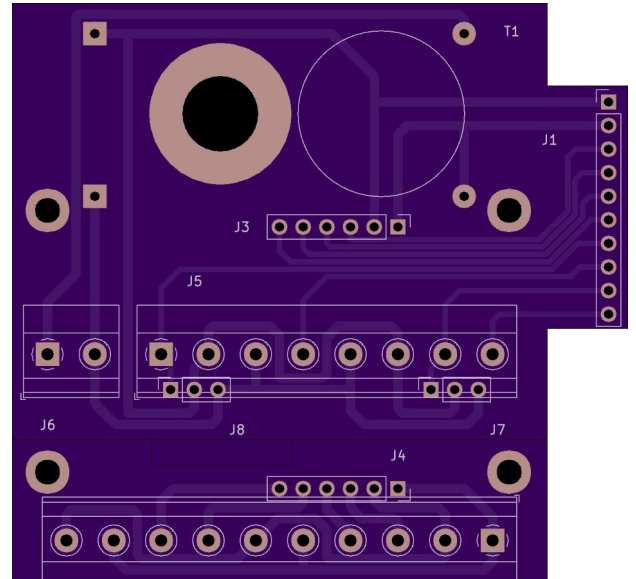
✓ [See the "Tode General Hardware Development" document for required tools](#)

## 2. Bill of Materials (BOM) \$16








- ✓ LM2596 DC-DC Step Down Buck Power Supply Module
  - Power In: 3Vdc to 35Vdc
  - Power Out: 1.5Vdc to 35Vdc (adjustable)
  - Load Amps: 2A to 3A (10W)
  - Dimensions: 44mm x 22mm x 12mm (high)
  - Temp Range: -40C to 85C
  - Pricing: ~ \$0.50/each
  - <http://www.aliexpress.com/item/32668330319.html>



- ✓ SideIO #SIOST PCB
  - Manufacturer: Oshpark.com
  - Pricing: \$6.38/ea
  - Batch Price: \$127.60 per 20

## 2.1 Supplies \$5

	<p>QTY: <b>(9-in<sup>2</sup>) Clear Craft Plastic</b>          Grafix Clear Craft Plastic 0.02" thick          For SIOST-Cover.stl Windows          8" x 8" (Pack of 4) = \$9.17 (\$0.036/in<sup>2</sup>)          @\$0.036/ in<sup>2</sup> = \$0.33</p>		<p>QTY: <b>(1/2-Sheet) Adhesive Shipping Label</b>          @0.04/sheet = \$0.02</p>
	<p>QTY: <b>(1) 1x10P 90° Male Pin Header</b>          Dupont 2.54mm-Pitch          For Side-IO Plug          @\$0.10/ea = \$0.10</p>		<p>QTY: <b>(0.1oz) Clear Adhesive Silicone</b>          GE-2708910 Clear Adhesive Silicone          2.8 oz Tube for \$6.61          For SIOST-Cover.stl Windows          @\$2.36/oz = \$0.24</p>
	<p>QTY: <b>(2) 1x3P Female Pin Headers</b>          Dupont 2.54mm-Pitch          For Relay Plug-In          @\$0.10/ea = \$0.20</p>		<p>QTY: <b>(10) Generic 1x2P Screw Terminals</b>          5.08mm Pitch          @\$0.10/ea = \$1.00          -- or --          QTY: (10) CUI TB007-508-02BE 1x2P Terminals          @\$0.30/ea = \$3.00</p>
	<p>QTY: <b>(2) #2 x 1/4" Sheet Metal Screws</b>          For SIOST-KBHood.stl          @\$0.05/ea = \$0.10</p>		<p>QTY: <b>(3) #2 x 5/8" Sheet Metal Screws</b>          For SIOST-KBCover.stl &amp; SIOST-Cover.stl          @\$0.05/ea = \$0.15</p>

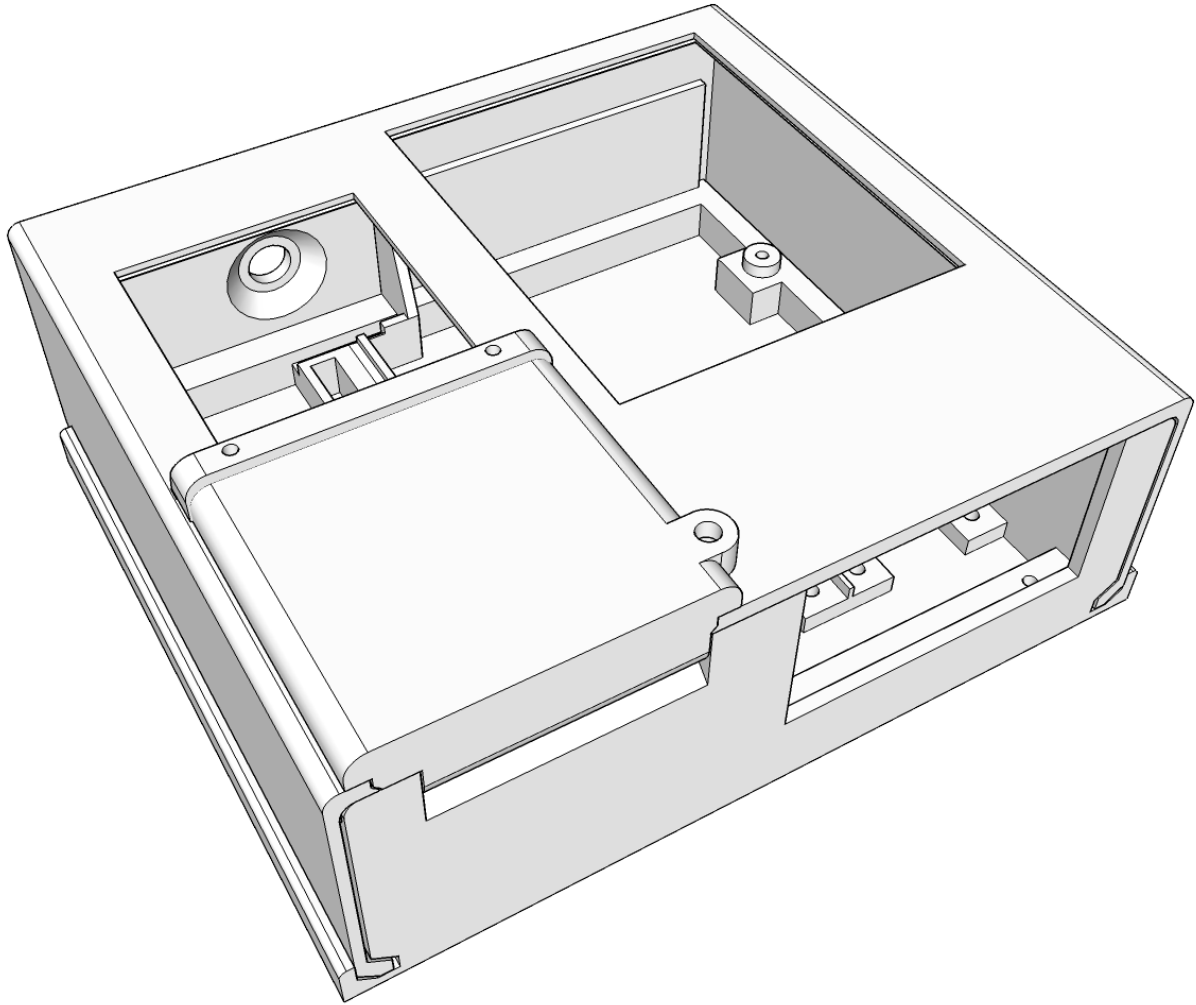
	QTY: <b>(2) #4 x 1/2" Sheet Metal Screws</b> For SIOST-CableEntry.stl @\$0.05/ea = \$0.10		QTY: <b>(2) #4 x 5/8" Sheet Metal Screws</b> For SIOST-CableEntry.stl @\$0.05/ea = \$0.10
	QTY: <b>(2) #2-56 x 7/8" Machine Screw</b> For SIOST-PSCover & Terminal Block @\$0.05/ea = \$0.10		

### 3. 3D-Prints \$3

- ✓ 3D Print the Following Files in Folder /3DPrints/stl

- Priced @ \$20/per 1KG Roll

QTY	File Name	Grams	Cost \$0.02/g	Time HH:MM	Power & Use \$0.01/hr	Total Cost
1	SIOST-Base.stl	60-grams	\$1.14	10h:59m	\$0.04	\$1.25
1	SIOST-Standoff.stl	5-grams	\$0.10	00h:54m	\$0.01	\$0.12
1	SIOST-PSCover.stl	4-grams	\$0.08	00h:40m	\$0.01	\$0.10
1	SIOST-KBCover.stl	8-grams	\$0.12	01h:21m	\$0.01	\$0.14
1	SIOST-KBHood.stl	2-grams	\$0.04	00h:20m	\$0.01	\$0.05
1	SIOST-Cover.stl	40-grams	\$0.82	05h:35m	\$0.03	\$0.90
1	SIOST-CableEntry.stl	12-grams	\$0.24	01h:30m	\$0.01	\$0.26
4	SIOST-CablePlug.stl	1-gram	\$0.08	00h:06m	\$0.01	\$0.09



## 4. PCB Assembly

Printed Circuit Boards can be either ordered from a Custom PCB Manufacturer or created with a CNC Router.

### ✓ Custom Manufactured PCB

- Benefits - Custom PCB manufacturing is by far the better approach.

- Copper through holes provide better connection
- A Silk Screen for better corrosion resistance
- Far easier to solder

- Common Custom Manufacturing Businesses

- <https://oshpark.com/>
- <https://jlcpcb.com/>
- <https://www.pcbway.com/orderonline.aspx>
- <https://www.customcircuitboards.com/>
- <https://custompcb.com/>

### ✓ CNC Routed PCB

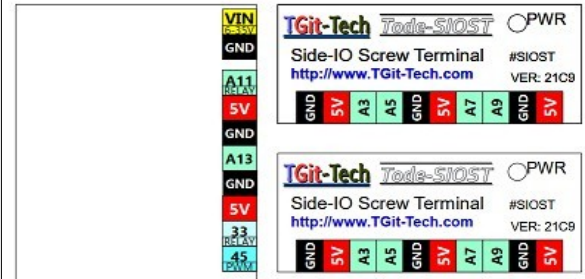
- Benefits

- Generally cheaper by a couple dollars
- Instant product (No shipping/manufacturing wait time)
- Good for designing phases; not good for finished design production.

## 4.1 Preparation

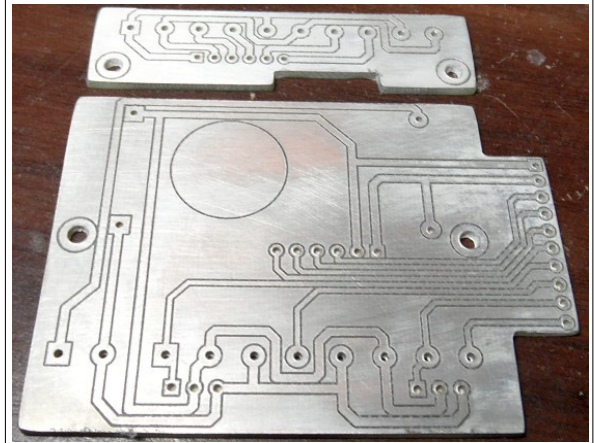
### 4.1.1 Print Stickers on Self-Adhesive Shipping Labels

- ✓ Printer – Color Laser
- ✓ Media – Self-Adhesive Shipping Label Paper
- ✓ File - /docs/Tode-SIOST Stickers.pdf



### 4.1.2 Obtain SIOST PCB(s)

- ✓ Purchase or Make the PCB Design File at:
  - /Tode-SIOST/kicad/SIOST/SIOST/output/
  - File contains (2) PCB(s) as shown in picture



## 4.2 Assembly

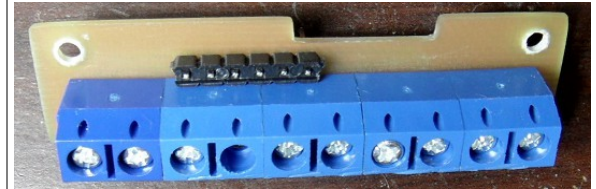


**4.2.1 Bottom-PCB Label, Terminals & Power**

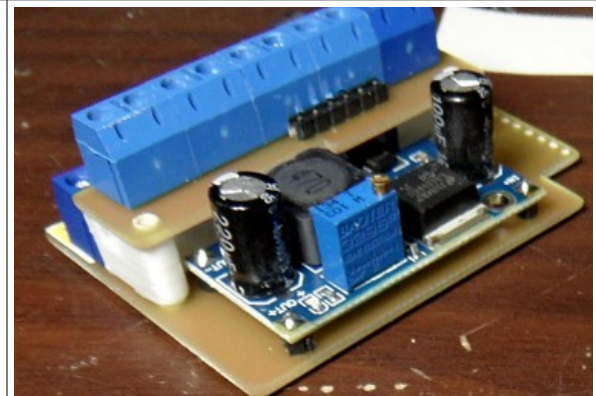
1. Cut & Stick Terminal Label from printer sticker sheet
2. Install and Solder the Left-8 and Right-2 Screw Terminals
  - a) NOTE: The right-2 screw terminals are separated.
3. Install and Solder the LM2596 DC-DC Power Module
  - a) Use (4) Individual 1P Male Header sections and solder both ends.

**4.2.2 Top-PCB Terminals & Pin-Header**

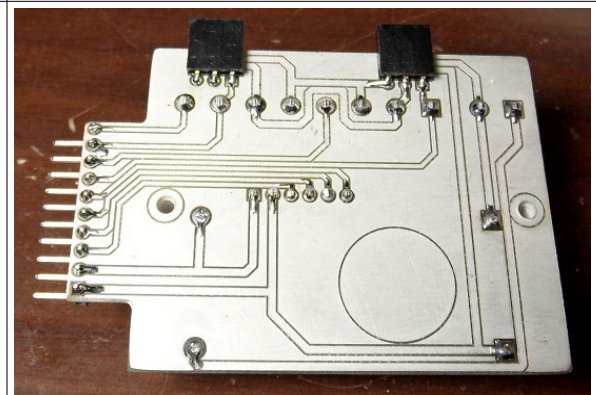
4. Solder on a 6P Male Header from the back-side of PCB pushing pins down flush on the top as shown.
  - a) NOTE: If using CUI Screw Terminals Remove Black after Solder
5. Install & Solder 10-Merged Screw Terminals to PCB

**4.2.3 Top to Bottom PCB with 6P Female Header**

6. Plug a 6P Female Plug onto the Top-PCB male pins.
7. Place the SIOST-Standoff.stl in front of the Power Module
  - a) File Location: /Tode-SIOST/3DPrints/stl/SIOST-Standoff.stl
8. Place Top-PCB on Standoff & align 6P Header to Bottom-PCB holes.
9. Solder the 6P Female Plug pins.

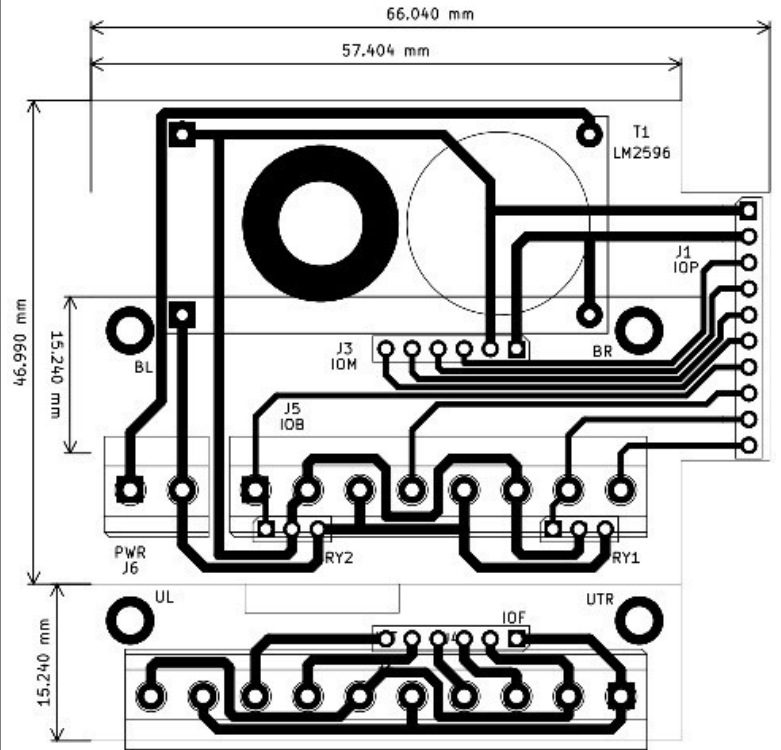
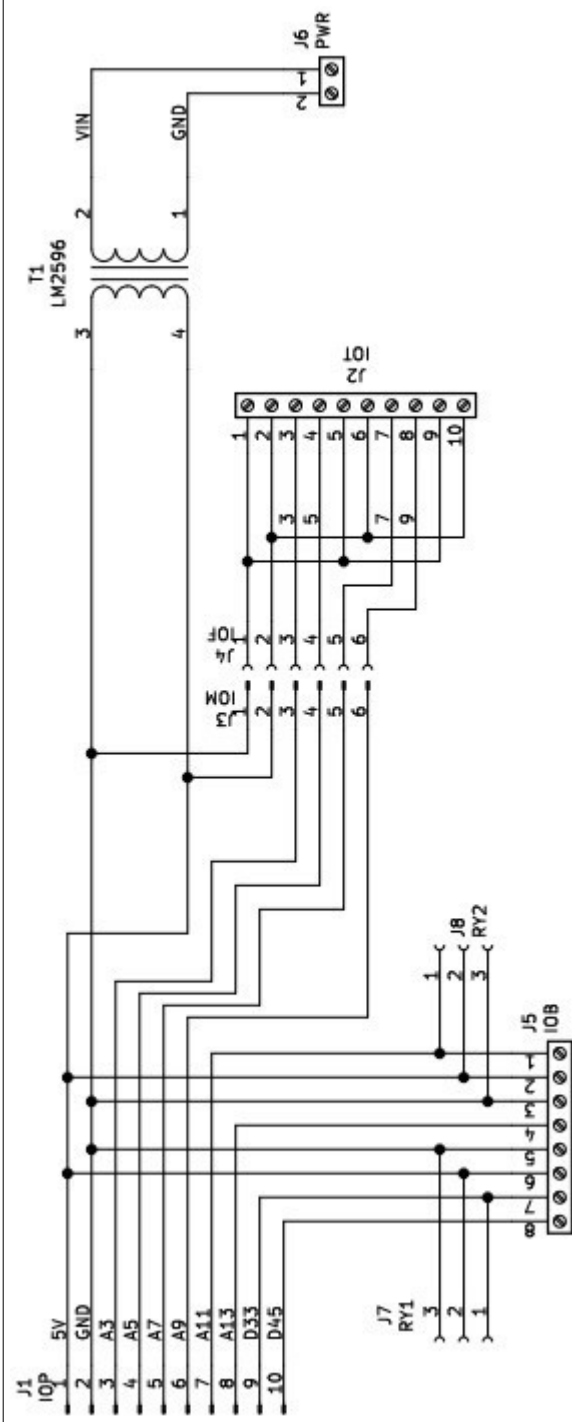
**4.2.4 Side-IO Header & (2) Relay 3P Female Headers**

10. Install & Solder the Side-IO(SIO) Plug using 90° 10P Male Header.
11. Bend (2) 3P Female Header pins to 90° and solder to back side of Bottom-PCB as shown.





### 4.3 Schematic & Layout



T1	LM2596 DC-DC Power	
J1	Side-IO Plug	1x10P 90° Male
J3	Top-PCB Plug-In	1x6P Female
J4	Top-PCB Plug-In	1x6P Male
J5	Screw Terminals	1x10 Screw Terminals
J6	1x2P Screw Terminal	
J7	Relay #1 Plug-In	1x3P Female PH
J8	Relay #2 Plug-In	1x3P Female PH

## 5. Final Assembly

## 5.1 Final Assembly Steps

### 5.1.1 Power Module Cover

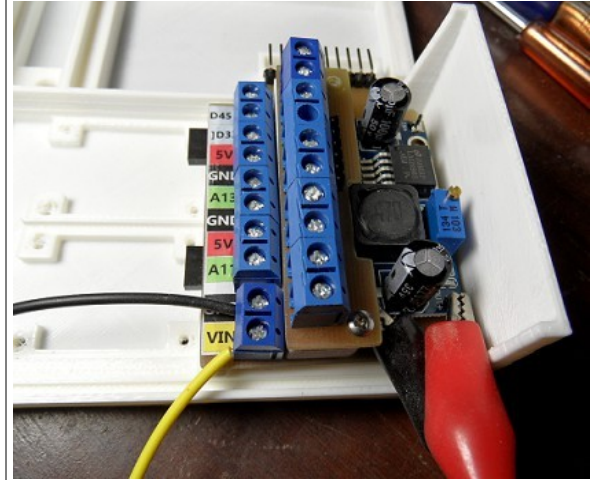
12. Cut & Stick PS Cover Label from printed stickers sheet
  - a) Stick it to /Tode-SIOST/3DPrints/stl/SIOST-PSCover.stl model.
13. Cut out Top-Right Hole by "PWR" text and screw holes as shown.



### 5.1.2 Adjust Power Supply Module

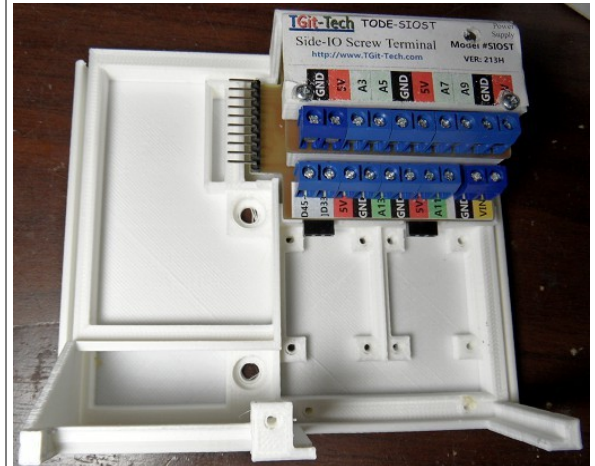
**WARNING: Never Attach a Tode until Power Supply is Set to 5Vdc**

14. Wire-Up an adjustable DC Power Supply to VIN & GND of Module
15. Attach a Volt Meter to VOUT+ and VOUT- of Module
16. Be sure DC Power Supply is under 35Vdc and Turn it on.
  - a) Adjust the Blue-Pot till **Voltage Out is ~4.98Vdc**
  - b) Check VOUT is ~5Vdc while VIN is adjusted 6V to 30V.
17. Apply Hot-Glue to the Blue Pot to keep static



### 5.1.3 Screw PCB-Assemblies to Base

18. Stack from Bottom to Top the following
  - a) Bottom-PCB
  - b) Standoff
  - c) Top-PCB
  - d) Power Supply Cover
19. Fasten the Stack to the Base using (2) #2-56 x 1" Machine Screws



### 5.1.4 Cover Windows in Cover

20. Cut (2) Clear Craft Plastic squares
  - a) 38mm x 42mm for Tode-Display
  - b) 56.5mm x 70mm for IO-Screw Terminals Window
21. Trim to Fit
  - a) Slide each into the SIOST-Cover.stl in appropriate spots
  - b) Trim with scissors for a precise fit
22. Seal Seams with Clear Adhesive Silicone
  - a) Apply to inner-seam conservatively (No finger spread)



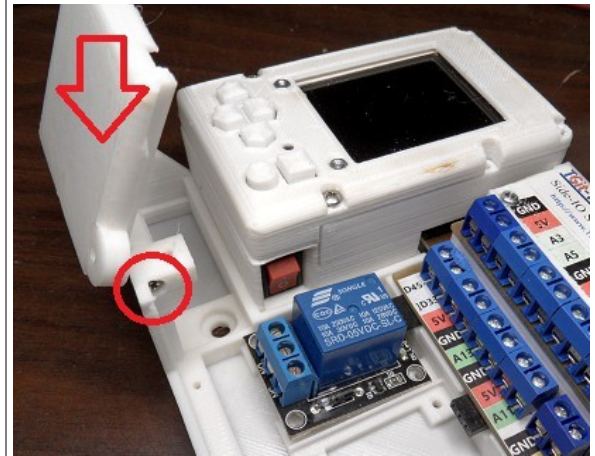
### 5.1.5 Install KBHood

23. Fasten /Tode-SIOST/3DPrints/stl/SIOST-KBHood.stl to Cover
  - a) Use **(2) #2 – 1/4"** Sheet Metal Screws
  - b) Check that grooves mesh together



### 5.1.6 Install KBCover, Tode & Relays (Optional) in Base

24. Fasten /Tode-SIOST/3DPrints/stl/SIOST-KBCover.stl as shown using **(2) #2 – 5/8"** Sheet Metal Screws
  - a) Leave screws loose enough for flipping cover action
25. Plug a Tode into the SIOST sliding right as shown.
26. Attach and fasten Relays as shown.



### 5.1.7 Attach Cover to SIOST-Base

27. Align Cover back edges with Base groove outer-edges and slide down the base.
28. Fasten in center of cover with **(1) #2 – 5/8"** Sheet Metal Screw
  - a) NOTE: This screw can also be fastened on the outside of the KB-Cover to secure manual operation.
29. Screw the Antenna to the Tode-RC
30. Include Cable Entry Brackets and Plugs with Assembly
  - a) **(2) #4 x 1/2"** Sheet Metal Screws for Back Cable Entry
  - b) **(2) #4 x 5/8"** Sheet Metal Screws for Top Cable Entry

Slide into a 6x8in Ziplock bag

