Tode-SIOST

Hardware Development

Tode Side-IO Screw Terminals [#SIOST]

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

Build Version: 21C9 / Last Updated: 2021-12-09

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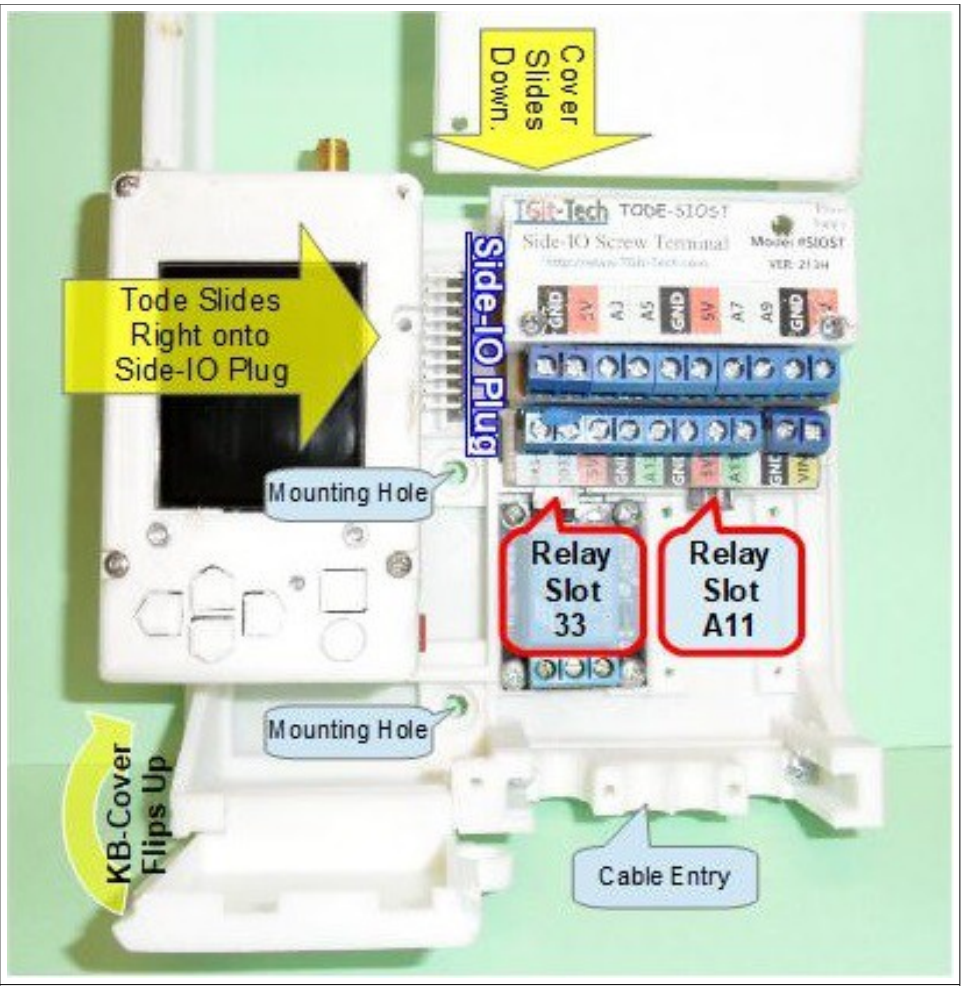
1. Introduction



- ✔ 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 https://github.com/TGit-Tech/Tode-RC
#COVER	A Cover Only	*Not available at this time*

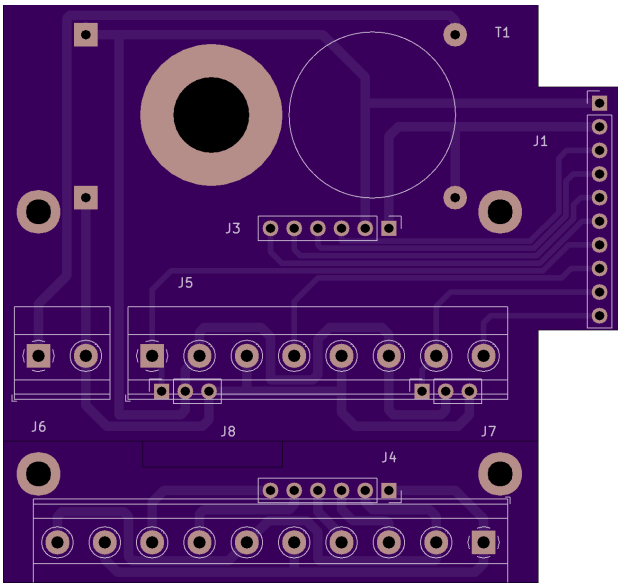
Tode Models *(post-fix RC=Remote/Radio Control equipped)*		
Model	**Components**	**Resources**
Tode #AMP	Arduino Mega Pro (AtMega2560)	*Not available at this time*
Tode-RC #AMPE32T30	Arduino Mega Pro (AtMega2560) Ebyte E32-433T30D Radio (1W/30dbm)	Design Files https://github.com/TGit-Tech/Tode-RC Firmware https://github.com/TGit-Tech/Tode-RC-Firmware
Tode-RC #AMPE32T20	Arduino Mega Pro (AtMega2560) Ebyte E32-433T20D Radio (250mW/20dbm)	*Not available at this time*
Tode-RC #AMPXBEE	Arduino Mega Pro (AtMega2560) Digi Xbee Radio	*Not available at this time*

SIO Stations (*Input/Output by Todes Side-IO [SIO] plug*)		
Model	**Components**	**Resources**
#SIOST	Screw Terminals	Design Files https://github.com/TGit-Tech/Tode-SIOST
#SIOAP	Aviation Plugs	*Not available at this time*

✔ See the "Tode General Hardware Development" document for required tools

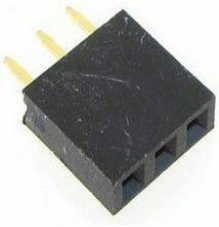
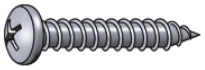
2. Bill of Materials (BOM) $14

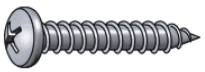
- ✔ LM2596 DC-DC Step Down Buck Power Supply Module
  - Power In: 3Vdc to 35Vdc
  - Power Out: 1.5Vdc to 35Vdc (adjustable)
  - Load Amps: 2A to 3A (10W)
  - Dimensions: 44mm x 22mm x 12mm (high)
  - Temp Range: -40C to 85C
  - Pricing: ~ $0.50/each
  - http://www.aliexpress.com/item/32668330319.html



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

2.1 Supplies $3

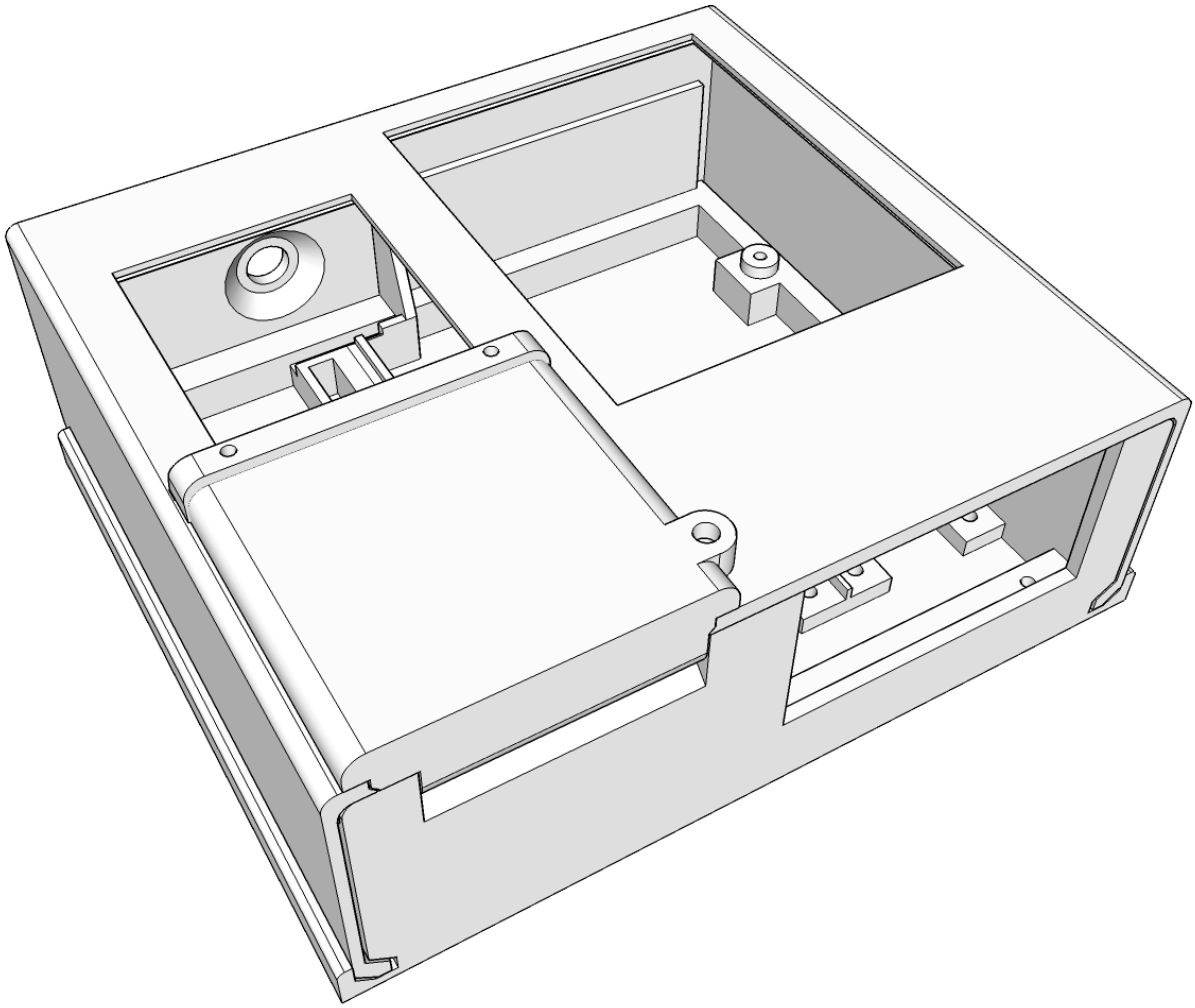
	QTY: **(9-in^2) Clear Craft Plastic** Grafix Clear Craft Plastic 0.02" thick For SIOST-Cover.stl Windows 8" x 8" (Pack of 4) = $9.17 ($0.036/in^2) @$0.036/ in^2 = $0.33		QTY: **(1/2-Sheet) Adhesive Shipping Label** @0.04/sheet = $0.02
	QTY: **(1) 1x10P 90° Male Pin Header** Dupont 2.54mm-Pitch For Side-IO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

	QTY: **(2) #4 x 1/2" Sheet Metal Screws** For SIOST-CableEntry.stl @$0.05/ea = $0.10		QTY: **(2) #4 x 5/8" Sheet Metal Screws** For SIOST-CableEntry.stl @$0.05/ea = $0.10
	QTY: **(2) #2-56 x 7/8" Machine Screw** 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

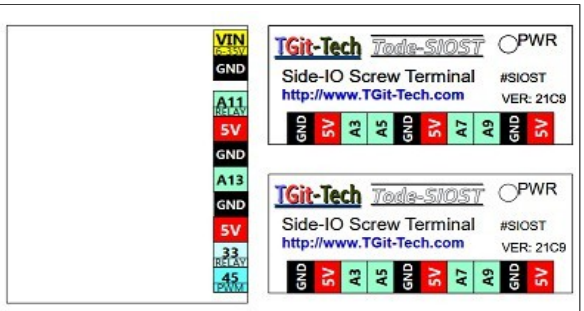
Printed Circuit Boards can be either ordered from a Custom PCB Manufacturer or created with a CNC Router.

- ✔ Custom Manufactured PCB
  - Benefits - Custom PCB manufacturing is by far the better approach.
    - Copper through holes provide better connection
    - A Silk Sscreen 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

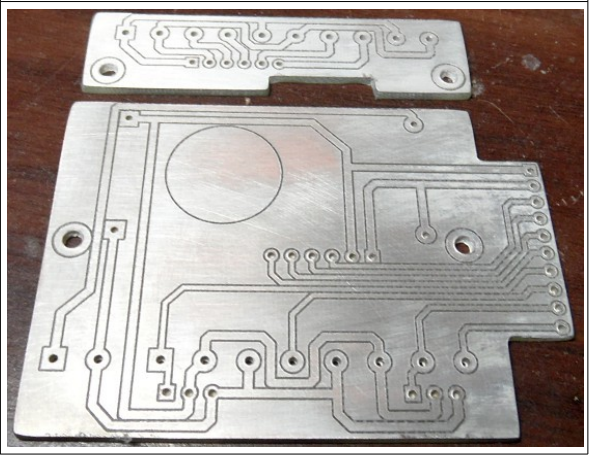
4.1.1 Print Stickers on Self-Adhesive Shipping Labels

- ✔ 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

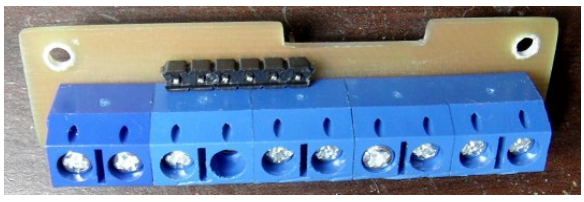
2. Install and Solder the Left-8 and Right-2 Screw Terminals
   a) NOTE: The right-2 screw terminals are separated.

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. Install & Solder 10-Merged Screw Terminals to PCB

5. Solder on a 6P Male Header from the back-side of PCB pushing pins down flush on the top as shown.



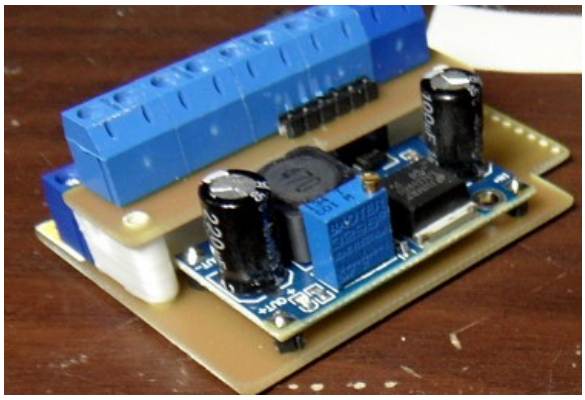
4.2.3 Top to Bottom PCB with 6P Female Header

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.

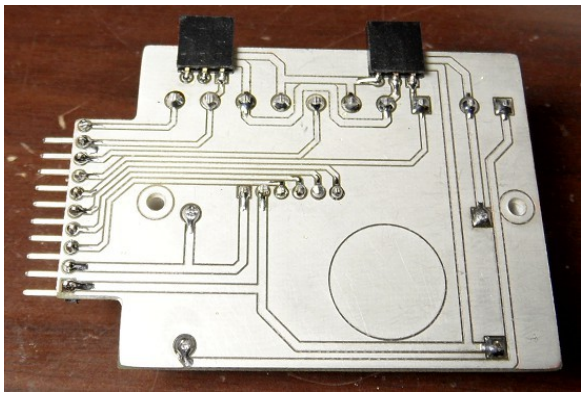
9. Solder the 6P Female Plug pins.



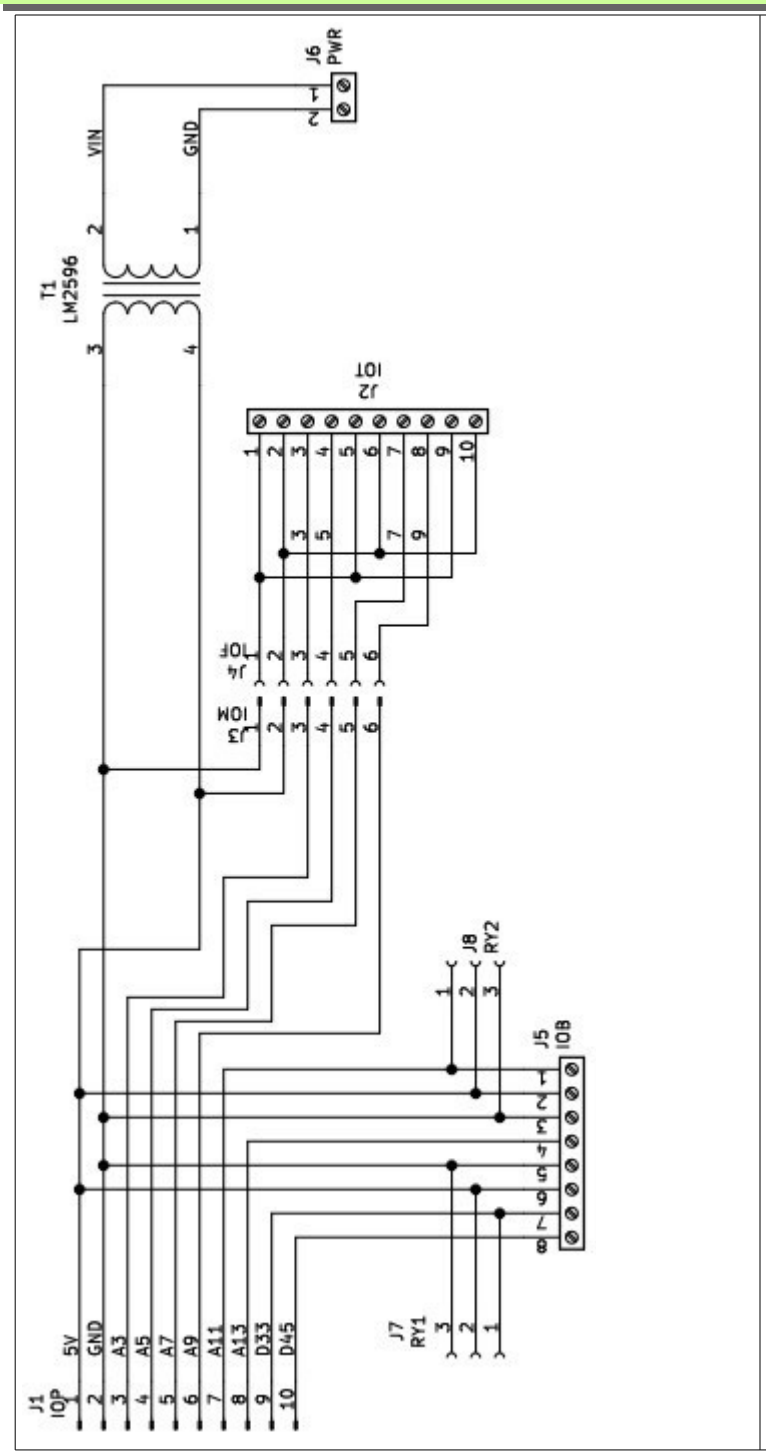
4.2.4 Side-IO Header & (2) Relay 3P Female Headers

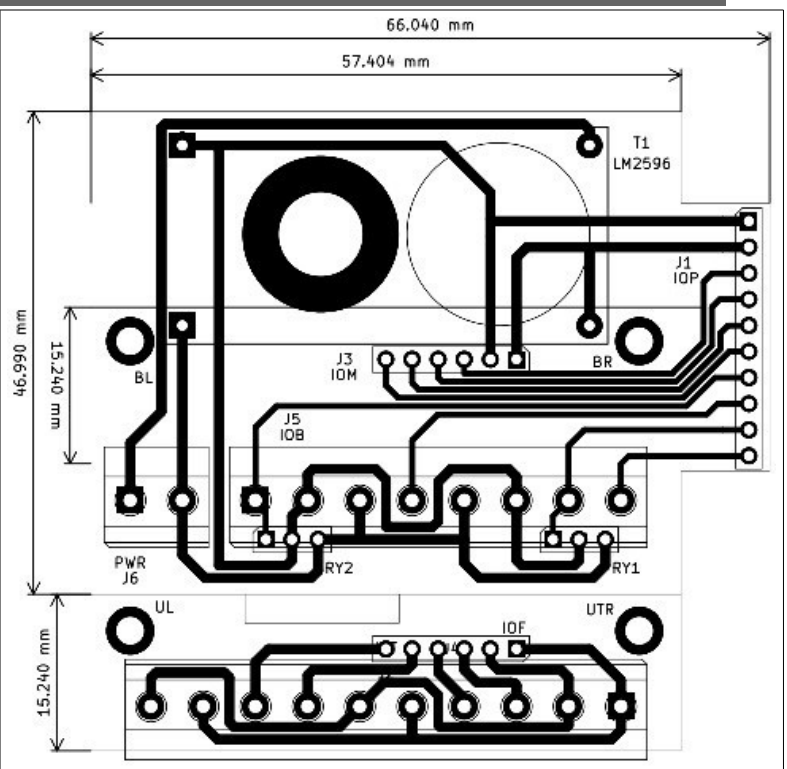
10. Install & Solder the Side-IO(SIO) Plug using 90° 10P Male Header.

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

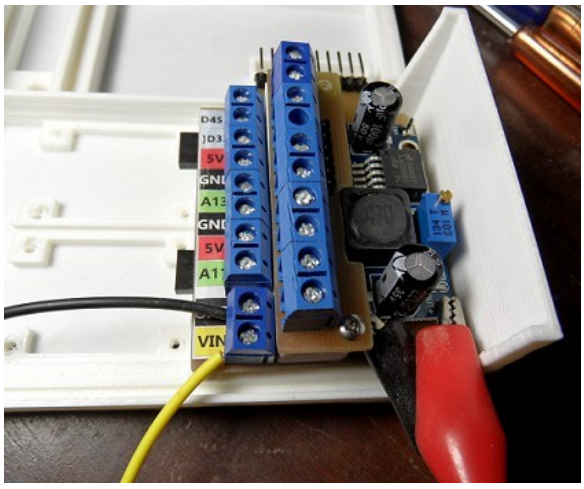
WARNING: Never Attach a Tode until Power Supply is Set to 5Vdc

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

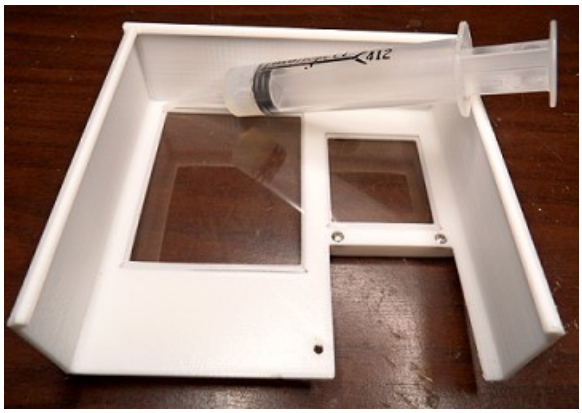
20. Cut (2) Clear Craft Plastic squares
    a) 38mm x 42mm for Tode-Display
    b) 56.5mm x 70mm for IO-Screw Terminals Window

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

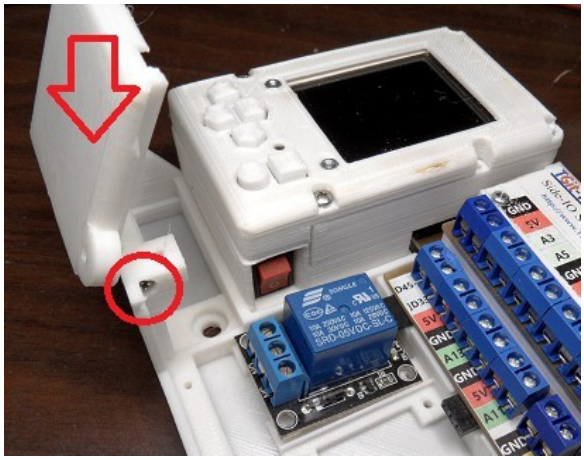


5.1.6 Install KBCover, Tode & Relays (Optional) in Base

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