Tode-RC

Hardware Development

Tode Side-IO Screw Terminals [#SIOST]

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

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Table of Contents

1. Introduction

The Tode System

- Tode-RC = Handheld Remote Control Models
  - Model #AMP Arduino Mega Pro (No RF Module)
  - Model #AMPE32T30 Arduino Mega Pro + Ebyte E32-433T30D (1W/30dbm) RF module
  - Model #AMPE32T20 Arduino Mega Pro + Ebyte E32-433T20D (250mW/20dbm) RF module
  - Model #AMPXBEE Arduino Mega Pro + Digi XBee RF Module

- Tode SideIO = Input/Output Stations
  - Model #SIOST Tode SideIO with Screw Terminals
  - Model #SIOAP Tode SideIO with Aviation Plugs

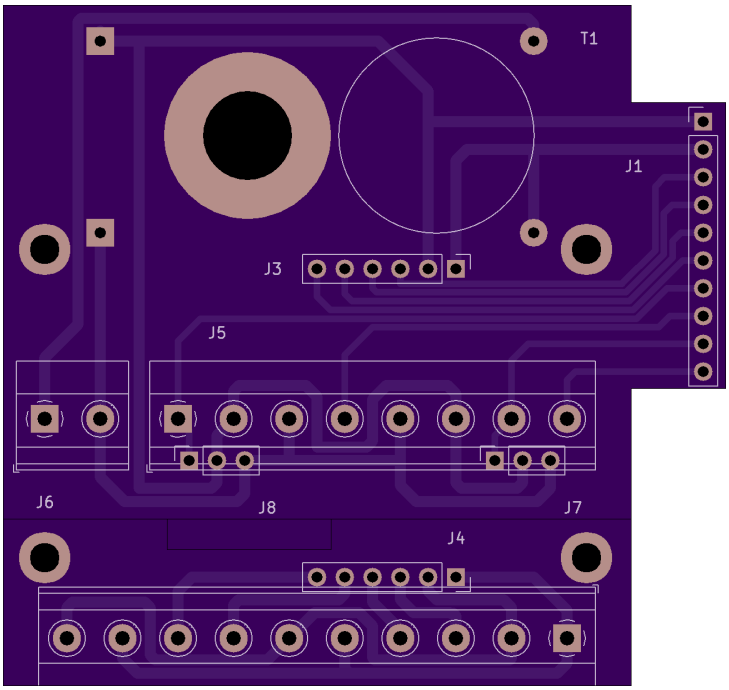
Manuals

- User Manual Operator Instructions including Setup and Wiring
- Hardware Development How to build the hardware including detailed circuit diagrams
- Firmware Development How to adjust and create firmware for the Tode

2. Bill of Materials (BOM) $12

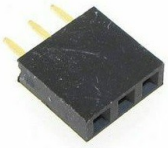
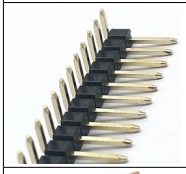
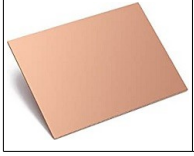
2.1 Parts $7

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



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

2.2 Supplies $2

	QTY: 2 @ $0.10/ea = $0.20 1x3P Female Dupont 2.54mm-Pitch Used in Step#3 as a Relay Plug-in		QTY: 10 @ $0.10/ea = $1.00 1x2P Screw Terminal 5.08mm Pitch Step #4 and #5
	QTY: 1 @ $0.10/ea = $0.10 1x10P Male 90-degree Dupont 2.54mm-pitch Used in Step #3 as Tode-IO Plug-in		QTY: 1/2 @ $0.02 = $0.02 1/2-Sheet Adhesive Shipping Label
	QTY: 1 @ $0.50/ea = $0.50 4" x 3" Single Sided Cu Clad PCB		$0.05/ea

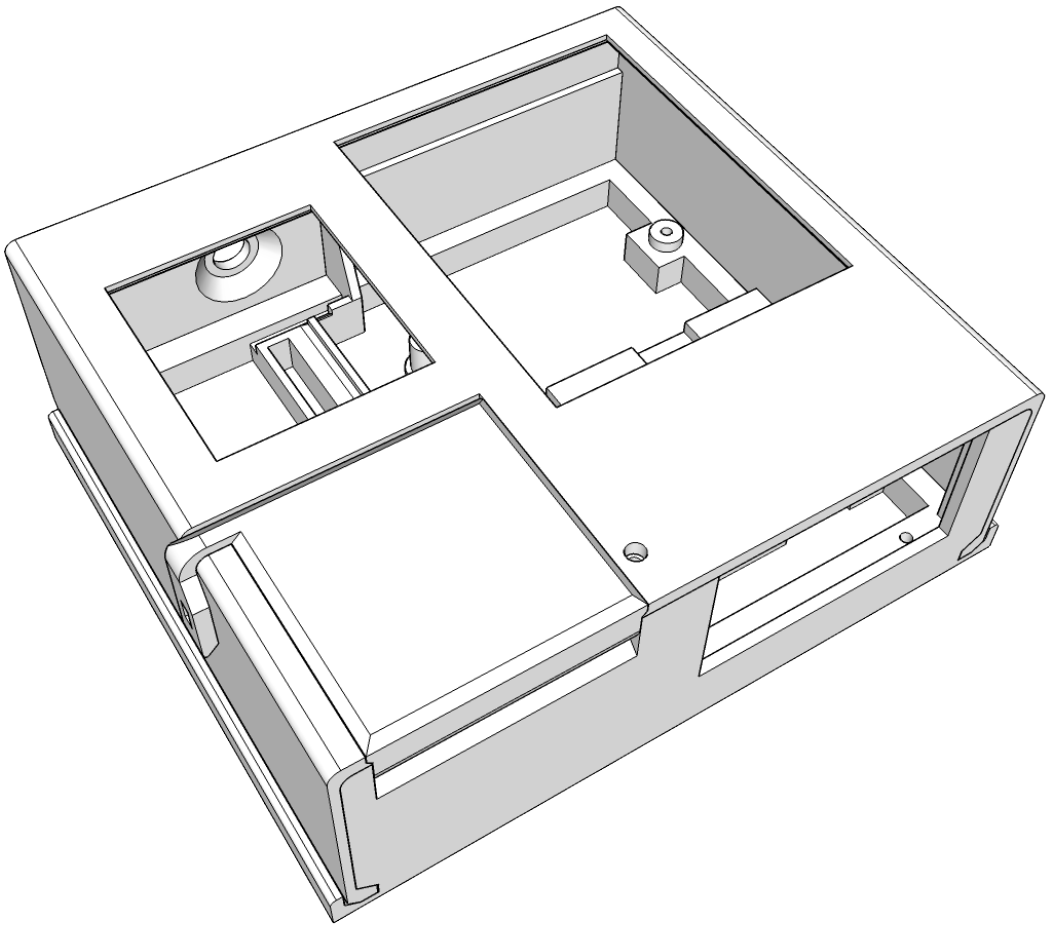
3. 3D-Prints $3

✔ 3D Print the Following Files in Folder: /3DPrints/SIOST/STL

File Name	Grams	Cost $0.01695/g	Time	Power $0.005/hr	Machine Use $0.0012/g	Total Cost
SIOST-Base.stl	57-grams	$0.97	7h 9m	$0.04	$0.07	$1.08
SIOST-Standoff.stl	5-grams	$0.09	36m	$0.01	$0.01	$0.11
SIOST-PSCover.stl	4-grams	$0.07	27m	$0.01	$0.01	$0.09
SIOST-KBCover.stl	6-grams	$0.11	46m	$0.01	$0.01	$0.13
SIOST-Cover.stl	40-grams	$0.68	4h 38m	$0.03	$0.05	$0.76
SIOST-CableEntry.stl	12-grams	$0.20	1h 30m	$0.01	$0.01	$0.22

✔ Pricing Determined by --
- (5)Kg Rolls of 3D Solutech White PLA
- Total Price with Tax & Shipping: $84.75 / 5000-grams = $0.01695/gram

Assembly Diagram



4. PCB Assembly

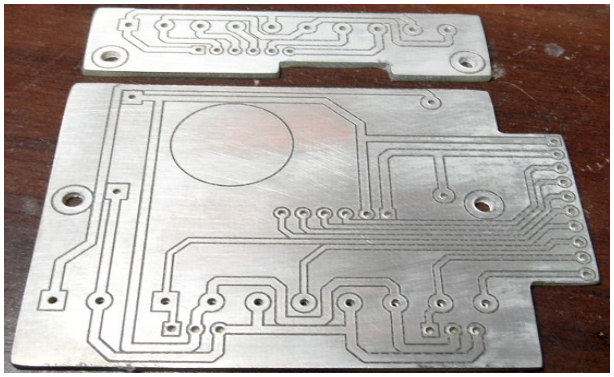
Printed Circuit Boards can be either ordered from a Custom PCB Manufacturer or created with a CNC Router.

- ✔ 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 Steps

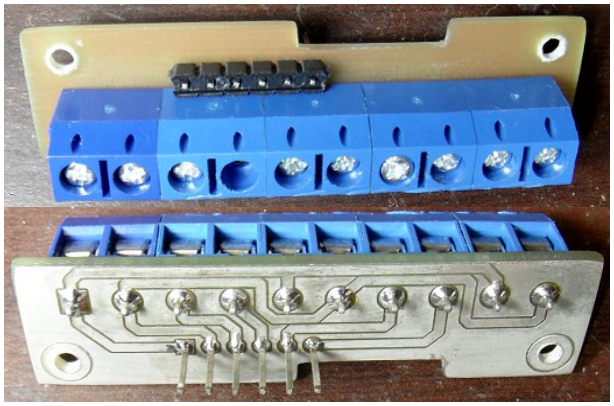
STEP #1 – Obtain (Purchase/Make) the SIOST – PCB(s)

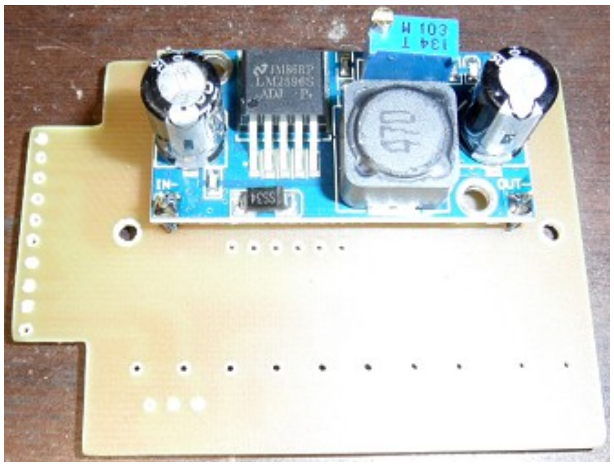
- ✔ Design File (2-pcs in one file)
  - FOLDER = /kicad/SIOST/SIOST/output/
  - GERBER FILE = SIOST-F_Cu.gbr
- ✔ CNC Routing
  - CNC File = SIOST-F_Cu.gbr.nc
  - CNC Settings: Z-Down: -0.045, Speed: 45mm/s
  - CNC Isolation Bit = Pyramid 0.2mm Tip 45-deg
  - Hole Sizes = 0.9mm, 1.0mm, 2.7mm (1.0 is plenty tight for ST)



STEP #2 – Attach Screw Terminals & 6P Male Pin Header to Top-PCB

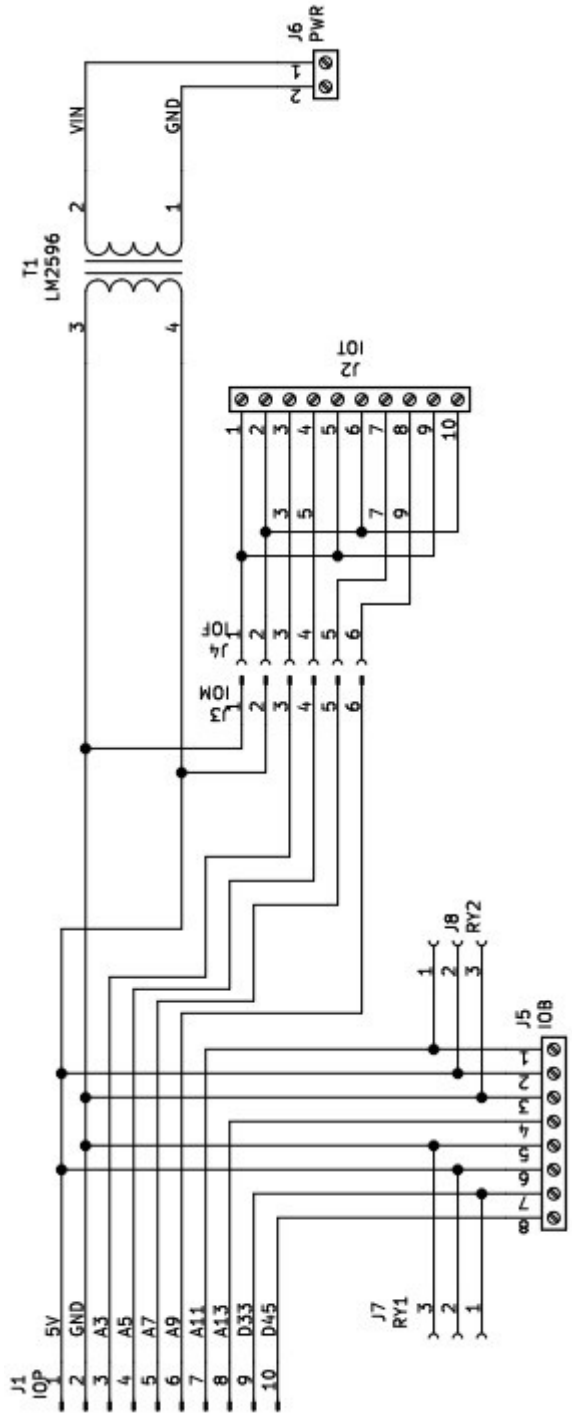
- ✔ Using Schematic & Layout Solder-Paste SMT Resistors
  - Push Male Pin headers flush with holder before soldering
  - All 5.08mm Pitch Screw Terminals should fit merged together



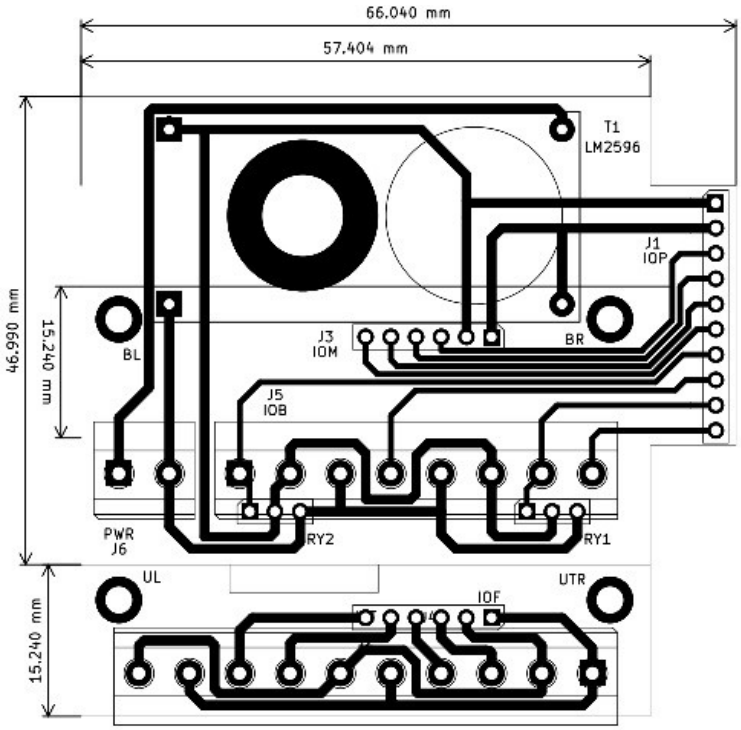
STEP #3 – Attach the LM Power supply with 1P Male Pin Headers ✔ Refer to Schematic & Layout to insert ○ J1 [PWR]	
STEP #4 – Attach 6P Female Pin Header for Top-PCB to Plug-into ✔ Using Schematic & Layout	
STEP #5 – Sticker, Terminals + 3P Relay Plugs ✔ Using Schematic & Layout	

4.1.1 Schematic & Layout

SCHEMATIC



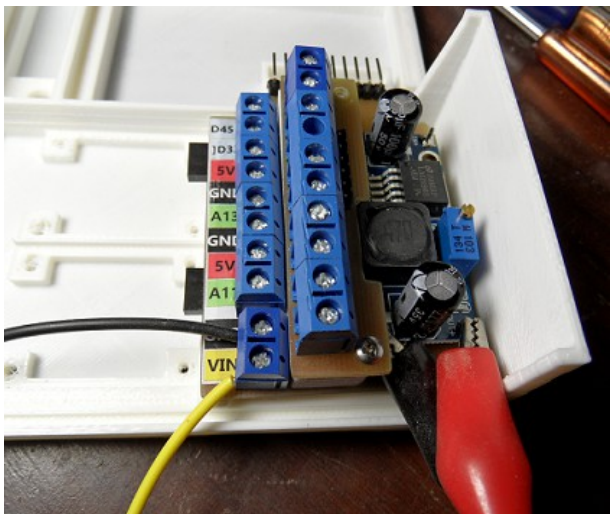
LAYOUT



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

5. Final Assembly

5.1.1 Steps

WARNING: Never Attach Tode until Power Supply is Set to 4.9Vdc **STEP #4** – Adjust the Power Supply ✔ Hook up a DMM Volt Meter to the Output Pins of the Power Supply ○ Wire up an adjustable DC Power Supply to VIN & GND Terminals ○ Input Voltage should be able to range from 7.5V to 30Vdc ○ Adjust the Blue-Pot till Voltage Out is always 4.9Vdc **STEP #5** –	

Step #6 – Upload Tode Firmware and Test Button Operation	Step #6 -
1. Fasten KEYS-PCB and LCD Display into Casing	Install 3mm Round LED into PCB Bit Size 3.58mm Drill out Buttons
Install 2mmx0.4mm x 10mm Screw to Pull Down nuts into plastic. Replace the 10mm long screws with 8mm screws for flush fit	Push LED up as far as possible and solder into place Clip leads Long Leg is Positive and goes to the Top Side
Step #7 – Cut out Clear Plastic Windows Tode Display Window Cut-Size 38mmW x 42mmL IO Display Window Cut-Size: 56.5mmW x 70mmL	
Tode Battery Screws = #2 x 3/8" long	