

# Tode-RC .BD241S

## Hardware Development

Arduino-Mega UI + Ebyte T20/30db RF

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

Tode-RC Model# BD241S / Last Updated: 2025-12-28

### Model #BD241S

Backside IO Access

Ebyte Radio T20D/T30D



Access to 46-IO pins.

(16) Analog-In

..or.. Digital-In/Out [A0-A15]

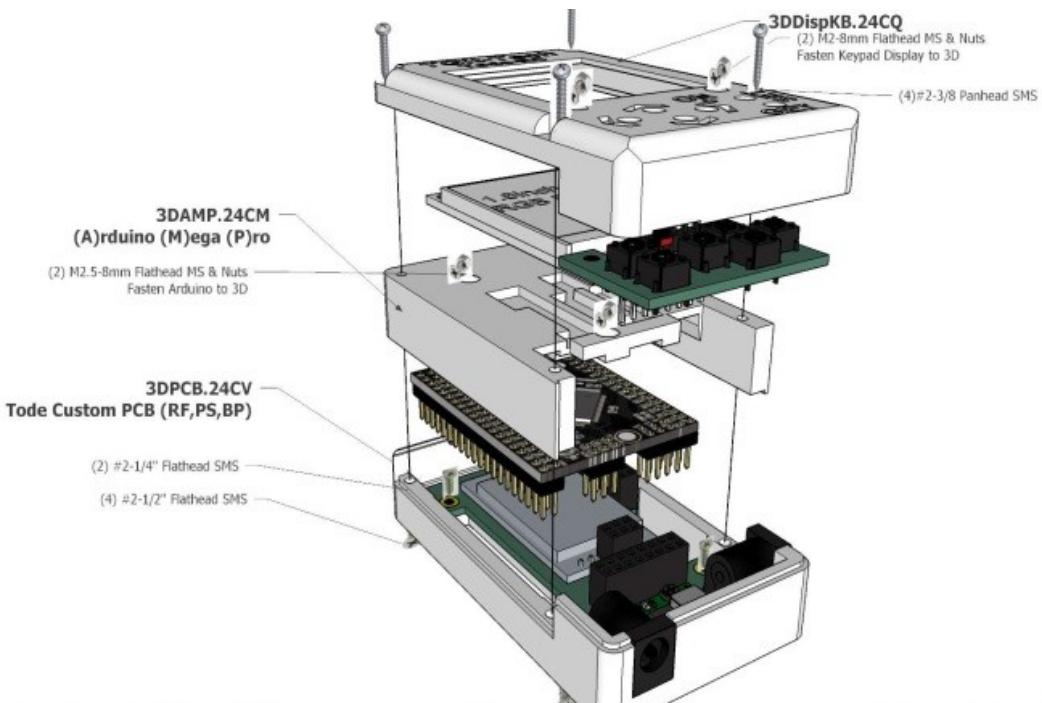
(30) Digital-In/Out [18-47]

Special Purpose pins

(1) Serial Data [18,19]

(3) Analog-Out PWM [44,45,46]

(4) HDW Interrupts [18-21]



Assembly	QTY	UNIT	NAME	DETAILS	EACH	PRICE
3DDispKB	15 grams	3D Print		(@ \$0.02/gPLA,@ \$0.01/g3D,\$0.01/gKWH)	\$0.04	\$0.60
	\$5.21	1 pcs	TFT Display	1.8" TFT LCD ST7735 RGB	\$3.00	\$3.00
	1 pcs		PCB	6-Key Keypad Custom version 231Q	\$0.25	\$0.25
	1 pcs		Pin Header Male	1x8P 2.54mm pitch	\$0.01	\$0.08
	1 pcs		Resistor	47KΩ 0805 SMT	\$0.01	\$0.01
	6 pcs		Push Buttons	6x6-7mm DIP-4 Through-hole Tactile	\$0.15	\$0.90
	1 pcs		LED	3mm Green	\$0.05	\$0.05
	2 pairs		Machine Screws & Nuts	M2x0.4-8mm Flathead Phillips	\$0.08	\$0.32
3DAMP	17 grams	3D Print		(@ \$0.02/gPLA,@ \$0.01/g3D,\$0.01/gKWH)	\$0.04	\$0.68
	\$13.05	1 pcs	Arduino Mega Pro	AtMega-2560	\$12.05	\$12.05
	2 pairs		Machine Screws & Nuts	M2.5x0.45-8mm Flathead Phillips	\$0.08	\$0.32
3DPCB	16 grams	PLA 3D Printed Plastic		(@ \$0.02/gPLA,@ \$0.01/g3D,\$0.01/gKWH)	\$0.04	\$0.64
	\$13.69	1 pcs	RF Radio	Ebyte E22-900T30D	\$10.77	\$10.77
	1 pcs		Power Supply Module	CN3903 DCDC Buck Step-Down 5V @ 3A	\$0.80	\$0.80
	1 pcs		PCB	Tode Custom version 2415	\$0.61	\$0.61
	2 pcs		Barrel Jacks	5.5x2.1mm DC PCB Mount	\$0.08	\$0.16
	1 pcs		Pin Header Female	2x7P Short Leg 2.54mm pitch (IO to RF,DispKB)	\$0.18	\$0.18
	1 pcs		Pin Header Female	2x8P Long Leg 2.54mm pitch (DispKB to PCB)	\$0.15	\$0.15
	1 pcs		Pin Header Female	2x4P Short Leg 2.54mm pitch (PWR)	\$0.17	\$0.17
	1 pcs		Pin Header Female	2x3P Short Leg 2.54mm pitch (ICSP)	\$0.12	\$0.12
	4 pcs		Pin Header Male	1x1P 2.54mm pitch (CN3903)	\$0.01	\$0.04
	2 pcs		Resistor	0-10Ω 0805 SMT (Jumpers)	\$0.01	\$0.02
	1 pcs		Resistor	2.2KΩ 0805 SMT (D13 Pull-Up)	\$0.01	\$0.01
	2 pcs		Resistor	4.7KΩ 0805 SMT (RxTx)	\$0.01	\$0.02
OTHER					<b>TODE SUBTOTAL</b>	<b>\$31.95</b>
	1 pcs		Antenna	SMA Omni-folding	\$2.26	\$2.26
	1 pcs		Battery Tray	See 9V Battery for Breakdown	\$3.00	\$3.00
	1 pcs		Fees	Listing & Transaction Fees	\$2.79	\$2.79
	5 hr		Labor	Building Labor	\$2.00	\$10.00
					<b>TOTAL</b>	<b>\$50.00</b>

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# 1. Tode-RC \$47.46

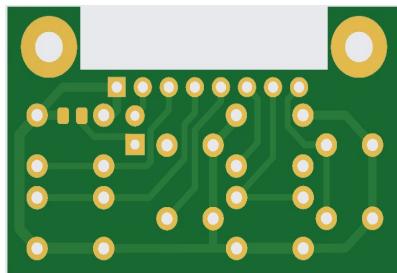
## 1.1 Keypad Assembly PCB.231Q \$7.99

### 1.1.1 Materials \$5.41

#### A. Parts \$3.45



- 1.8 or 1.77 -Inch TFT LCD Display
  - Power-In: 5Vdc
  - Resolutions: 128 x 160dpi ST7735 RGB
  - Dimensions: 35mm x 56mm
  - Temp: -20C to 70C
  - (8)Pin-Order: GND,VCC,SCL,SDA,RES,DC,CS,BL
  - Pricing: \$3.20/each



- Digital Keypad PCB version 231Q
  - Manufacturer: jlpcb.com
  - Batch Price: \$20.93 per 100
  - Zip Folder: JLPCB-231Q-output
  - Pricing Each: \$0.25/each

#### B. Supplies \$1.61



**(1) 1x8P Male Pin Header**  
PCB-J1, Dupont 2.54mm-Pitch  
Cut from 40-Pin Male Pin Header  
\$0.01/pin = \$0.08



**(1) 47K 0805 SMT Resistors**  
PCB-R7  
\$0.01/ea = \$0.01



**(2) M2x0.4-8 Flat Phillips Machine Screw & Nut**  
Display & Keypad to Cover  
\$0.10/pair = \$0.20



**(6) 6x6-7mm Push Buttons**  
PCB-SW(1-6)  
DIP-4 Tactile Through-Hole  
\$0.15/ea = \$0.90



**(1) 3mm Green LED**  
PCB-D1  
\$0.05/ea = \$0.05



**(1) M2x0.04-20mm Machine Screw**  
Used as *Heating stem ONLY*  
\$0.10/ea = \$0.10

#### Optional (Face-Decals)

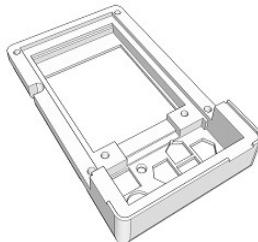


**(1) Half-Sheet Shipping Label**  
</docs/Cricut-Decal-Stickers.odg>  
\$9.25/200shts = \$0.02 Label



**(6) inches x 1ft Clear Laminate**  
</docs/Cricut-Decal-Laminate.jpg>  
\$1.27/foot roll = \$0.64/6in  
\$0.64/3-per-6in = \$0.25/ea

### C. 3D-Prints \$0.35

**Tode-DispKB-3DShell.stl**

Folder: .\Tode-RC\BD241S\3DPrints\stl\BD241S.3DDispKB.24CM.stl

Layer Height: 0.2mm

Infill Density: 100%

Supports: OFF

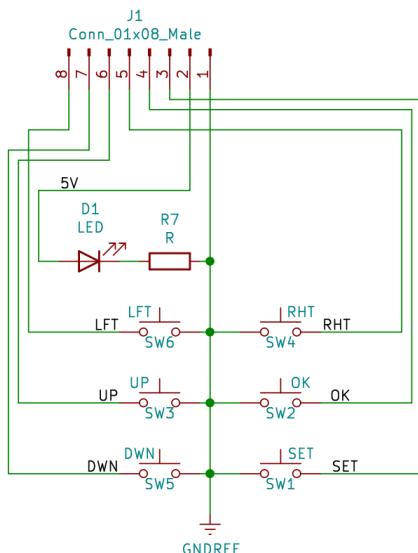
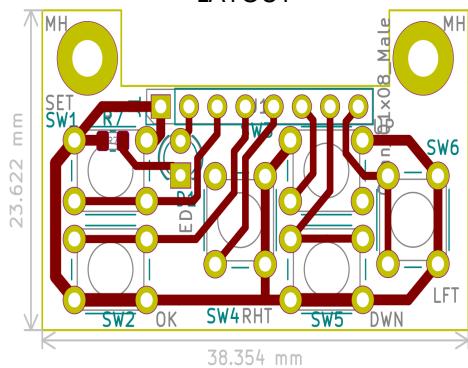
Plastic: 15-grams @ \$0.02/g = \$0.30

Printer-use: @ \$0.0015/g = \$0.0225

Power: 2h 29m @ \$0.01/hr = \$0.0248

TOTAL COST: \$0.35

### 1.1.2 Schematic & Layout

**SCHEMATIC****LAYOUT**

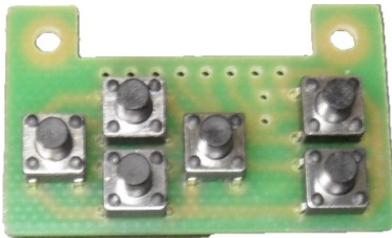
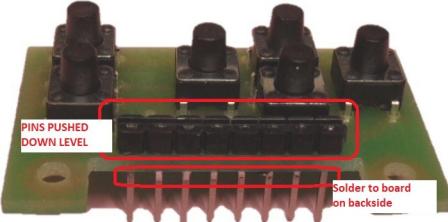
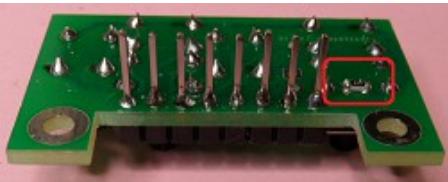
D1 = 3mm Round Green LED

R7 = 47Kohm 0805 SMT Resistor

-  $5V/47K = 0.1mA$  LED current.

SW(1-6) = 6x6x7mm Tactical Switches

### 1.1.3 PCB Assembly

<p><b>A. Push buttons</b></p> <ul style="list-style-type: none"> <li>Push (6) 6x6x7mm Tactile Push buttons into PCB.</li> <li>Solder the push buttons to the PCB</li> </ul>	
<p><b>B. Pin Header</b></p> <ul style="list-style-type: none"> <li>Cut and Insert a 8P male header</li> <li>Push pins down flush with top</li> <li>Solder back-side of pins</li> </ul>	
<p><b>C. LED</b></p> <ul style="list-style-type: none"> <li>Solder a 47K-ohm 0805 SMT resistor</li> <li>Insert a 3mm Green LED (do not solder yet)             <ul style="list-style-type: none"> <li>Short-lead in square-pad hole (GND)</li> </ul> </li> </ul>	

## 1.1.4 Keypad Case

<p><b>A. Heated Nuts Insert</b></p> <ol style="list-style-type: none"> <li>Thread a M2 nut onto just the very end of a long M2 Machine Screw (i.e. M2x0.04-20mm).</li> <li>Heat the Nut with a heat gun.</li> <li>Press the heated nut into the plastic as shown aligning the nuts shape with the shape in the casing.</li> <li>Using a screwdriver, press and drive the screw in, to clear excess plastic out the back-side then unscrew completely.</li> <li>Repeat for both nut locations under display opening</li> </ol>	
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## B. Face Decals (Optional)

- This step requires a cutting machine and special materials and design files.
- Contact Tgit-Tech if you'd like to purchase face stickers.
- DIY hobbyists can skip this step to create a unit without custom face stickers.

## C. Fasten

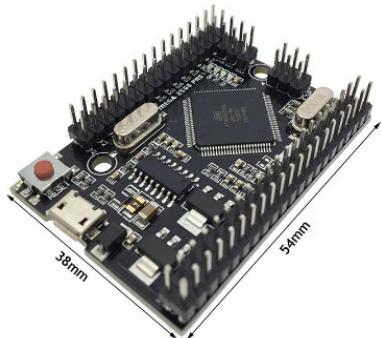
1. Place TFT display face-down on case first.
2. Place Keypad with Buttons over the top and align holes.
3. Fasten with **(2) M2x0.4 – 8mm** machine screws.
4. Align LED with hole in casing.
5. Solder the LED pins and clip excess off.



## 1.2 Arduino Assembly \$13.99

### 1.2.1 Materials \$12.96

#### A. Parts \$12.37



#### Arduino Mega Pro Mini [ATmega2560]

- Size: 38Wx55Lmm
- Power In: 6Vdc to 9Vdc ( Peak 18Vdc )
- Power Out: 5Vdc @ 800mA + 3Vdc @ 800mA
- Load Amps: 5Vdc @ 220mA
- IO-Pins: 54-Digital, 16-Analog
- Memory: 256kb RAM, 4kb EEPROM
- Temp Rng: -40C to 85C
- 24CM-Pricing: \$12.05/each
- Web @ <https://robotdyn.com/mega-2560-pro-embed-ch340g-atmega2560-16au.html>

#### B. Supplies \$0.20



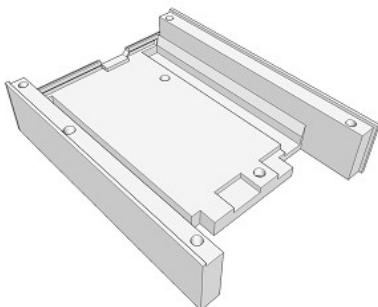
#### (2) M2.5x0.45 x 8mm Phillips-Flat Machine Screws & Nuts \$0.32

Attaches Arduino Mega Pro Mini to 3D Casing

24CM-Pricing: (2) Screws @ \$0.08/ea

24CM-Pricing: (2) Nuts @ \$0.08/ea

#### C. 3D Prints \$0.39



#### ALL-AMPCenter.stl

Folder: \All-3DPrints\stl

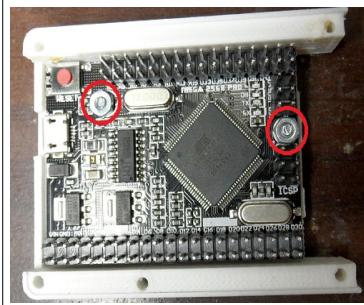
PLA Filament: 17g @ \$0.02/g = \$0.34

Printer-use: 17g @ \$0.0015/g = \$0.0255

Power: 2h 23m @ \$0.01/hr = \$0.025

TOTAL COST: \$0.39

## 1.2.2 Arduino Shell



### A. Arduino Mega-Pro in Plastic Shell

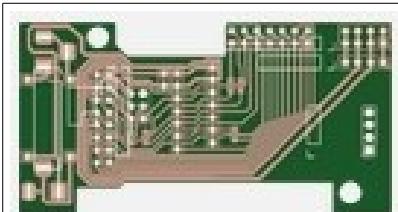
Fasten the Arduino Mega Pro Mini with Male Pin Headers into the 3D Printed case using **(2) M2.5x0.45 – 8mm** flat-head machine screws with nuts on Arduino side.

Be sure not to damage components next to the top nut while tightening.

## 1.3 Ebyte-RF Assembly PCB.BD241S \$22.99

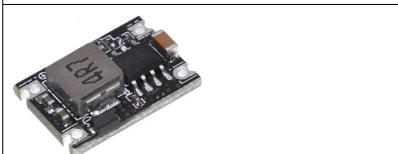
### 1.3.1 Materials \$19.83

#### A. Parts \$18.40



##### (1) BD241S PCB (Back-plane)

- File Location: \Tode-RC\BD241S\kicad\BD241S-Backplane\Final\_JLCPCB-241S.zip
- Manufacturer: jlcpcb.com
- Batch Price: \$46.11 per 75
- Pricing: \$0.61/ea = \$0.61



##### (1) CN3903 DC-DC Buck Step-Down Board 5V@3A

- Voltage: 5Vdc to 30Vdc Input to 5Vdc Output
- Size: 17.5mm x 12mm x 4.3mm (LWH)
- Max Output: 3A
- 24CM-Pricing: (10pcs) \$7.99 = \$0.80



##### (1) Ebyte Radio (Various T20D/T30D Options)

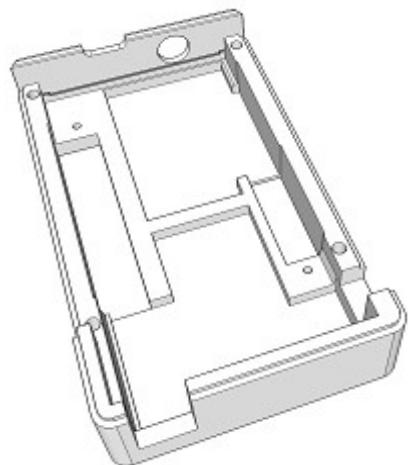
- E22-900T30D Pricing: \$14.73/ea
- E22-400T30D Pricing: \$7.94/ea
- E220-400T30D Pricing: \$10.07/ea
- E32-433T30D Pricing: \$9.06/ea
- E32-433T20D Pricing: \$6.44/ea
- Website: <https://www.cdebyte.com/Module-Lora>

	<b>(1) SMA Aerial Antenna (Various Options)</b> <ul style="list-style-type: none"> <li>■ Omni 6cm 2dbi: \$1.09/ea</li> <li>■ Omni-folding 11cm 3dbi: \$1.04/ea</li> <li>■ Omni-folding 19cm 6dbi: \$2.26/ea</li> </ul> <p>Estimated Price \$2.26/ea</p>
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## B. Supplies \$1.06

	<b>(1) 2x7P Pin Socket</b> Dupont 2.54mm-Pitch Backplane PCB \$0.18/ea = \$0.13		<b>(1) 2x8P LONG-Lead Socket</b> Dupont 2.54mm-Pitch Keypad & Display Connect \$0.15/ea = \$0.15
	<b>(1) 2x4P Pin Socket</b> Dupont 2.54mm-Pitch Radio, Buttons & IO \$0.17/ea = \$0.17		<b>(1) 1x4P Pin Header</b> Dupont 2.54mm-Pitch Radio Ground Stubs \$0.01/pin (from 40-pin cut) = \$0.04
	<b>(1) 2x3P Pin Socket</b> Dupont 2.54mm Pitch ICSP and Power \$0.10/ea = \$0.12		<b>(4) 1x1P Pin Header</b> Dupont 2.54mm-Pitch Radio Ground Stubs \$0.01/pin (from 40-pin cut) = \$0.04
	<b>(2) #2-1/4" Screw</b> PCB to Casing Phillips-Flat Sheet Metal Screw \$0.10/each = \$0.20		<b>(2) 5.5x2.1-9mm DC Barrel Jack PCB</b> Female PCB Mount 3-Terminal, 9mm Connector Depth. \$0.08/ea = \$0.16
	<b>(1) 2.2KΩ 0805 SMT Resistor</b> PCB-R3 \$0.01/ea = \$0.01		<b>(2) 4.7KΩ 0805 SMT Resistors</b> PCB-R1 & R2 \$0.01/ea = \$0.02
	<b>(2) 10Ω 0805 SMT Resistors</b> PCB-R4 & R5 \$0.01/ea = \$0.02		

### C. 3D-Prints \$0.37

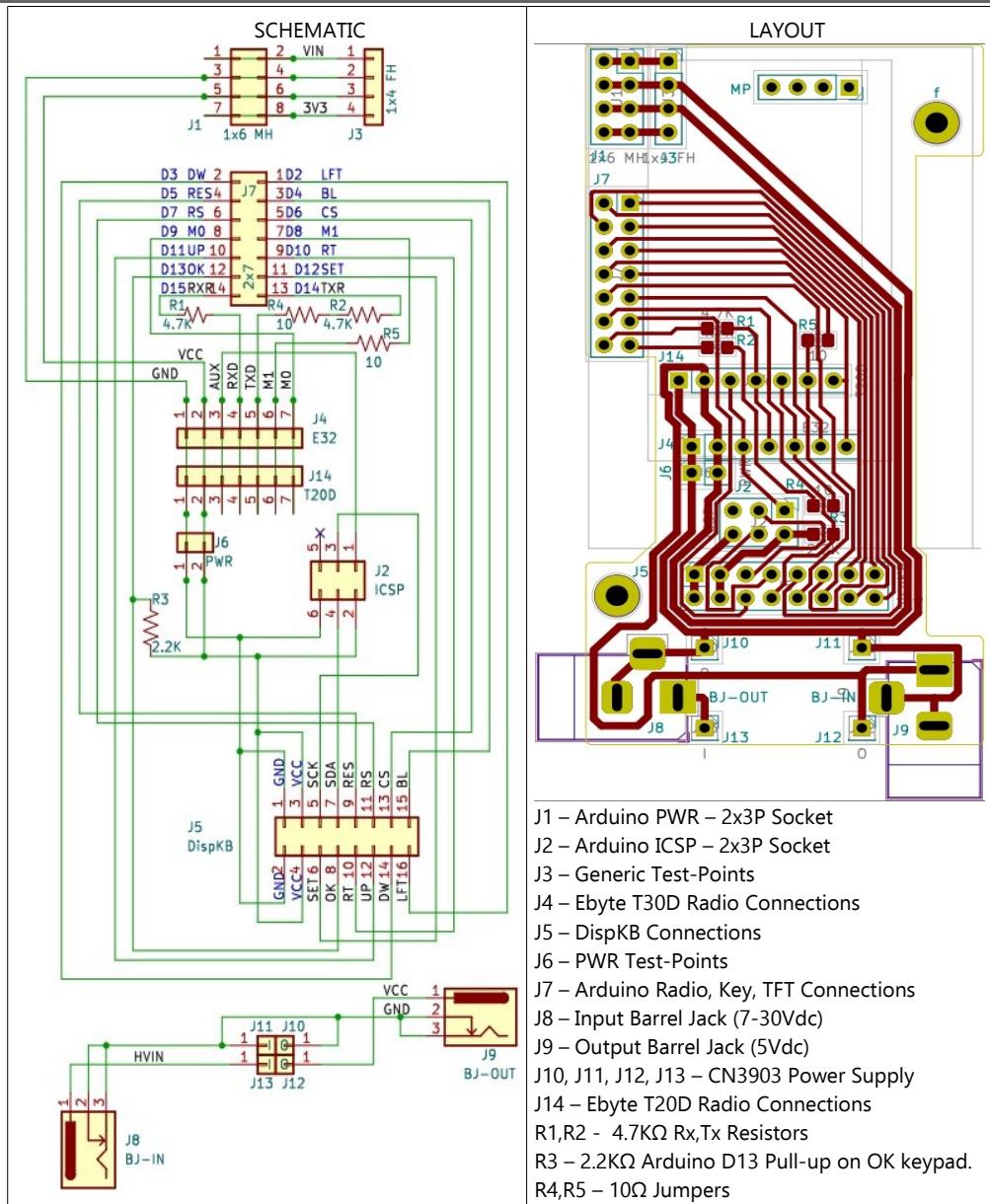


**BD241S-Backplane.24CM.stl**  
Folder: \BD241S\3DPrints\stl

PLA Filament: 16g @ \$0.02/g = \$0.32  
Printer Use: 16g @ \$0.0015/g = \$0.024  
Power: 2h 36m @ \$0.01/hr = \$0.025

**TOTAL COST: \$0.37**

## 1.3.2 Schematic & Layout



### 1.3.3 Radio-PCB Assembly

#### A. Resistors

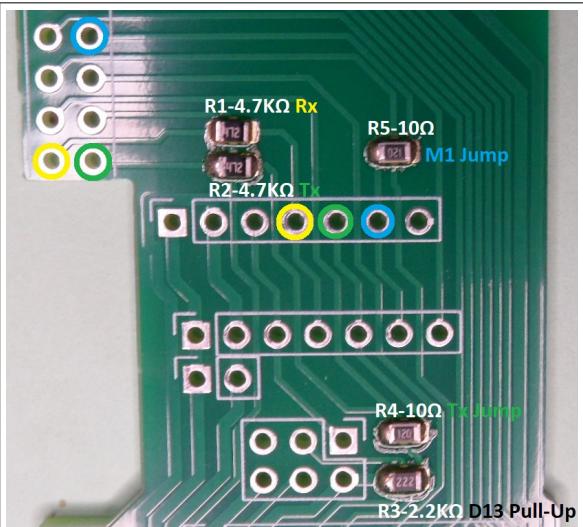
Solder Resistors on PCB

- R1 = 4.7KΩ above Ebyte-J14
- R2 = 4.7KΩ above Ebyte-J14
- R3 = 2.2KΩ side of ICSP Bottom
- R4 = 10Ω side of ICSP Top
- R5 = 10Ω above Ebyte-J14, Right-side

**TEST** – using Ω-meter test

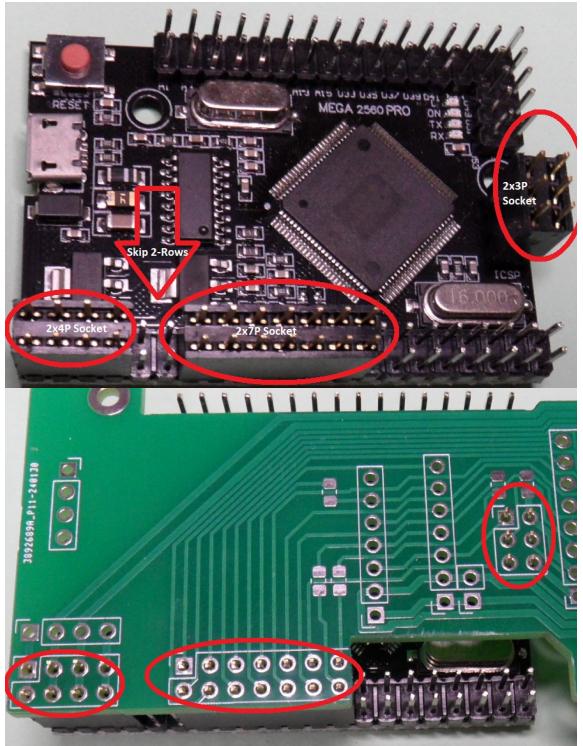
- (Rx) YELLOW to YELLOW = 4.7KΩ
- (Tx) GREEN to GREEN = 4.7KΩ
- (M1) BLUE to BLUE = 10Ω
- YELLOW to GREEN = No-Connection

Refer to Schematic & Layout for specifics.



## B. Arduino Sockets

1. Attach Dupont Sockets to Arduino
  - J1 = (1) 2x4P Left-Top Arduino
  - J7 = (1) 2x7P Left & 7-Rows down
  - J2 = (1) 2x3P on Arduino ICSP Header
2. Place BD241S PCB on Socket Pins.
3. Solder Dupont Sockets to PCB.
4. Unplug the PCB from Arduino.



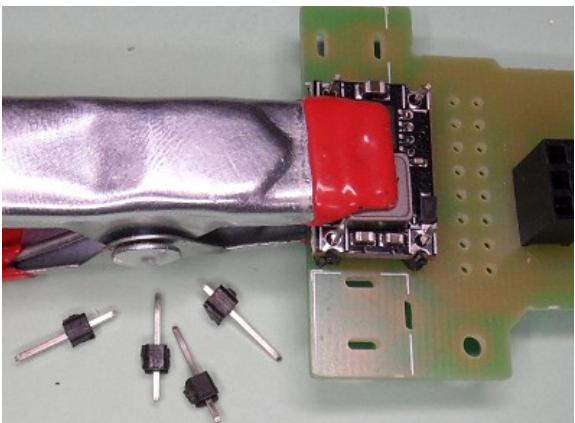
## C. Radio

1. Place Pin Header into Top of PCB.
  - 1.2. For T20D radios use 1x3P Header
  - 1.3. For T30D radios use 1x4P Header
2. Place Radio onto PCB.
3. Solder Radios 7-Pins to PCB.
4. Solder the 1x3P or 1x4P Pins to PCB.
5. Trim excess Pin Length from back PCB.



#### D. CN3903 Power Supply

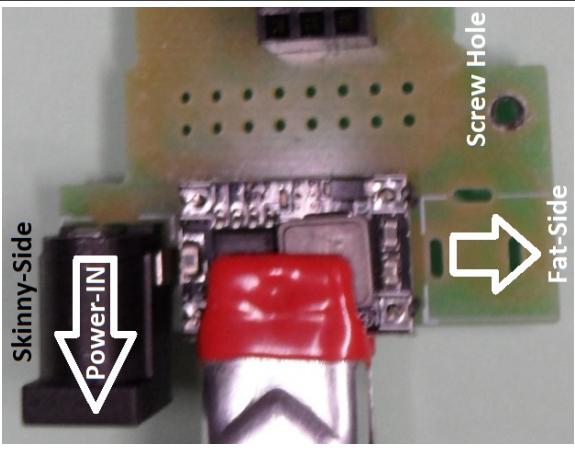
1. (4) 1x1P Headers into Bottom of PCB.
2. Place CN3903 Power Supply Module as pictured with its coil-block facing the PCB screw-hole (fatter-side).
3. Solder Pins to PCB and Power Supply.



#### E. DC Barrel Jacks

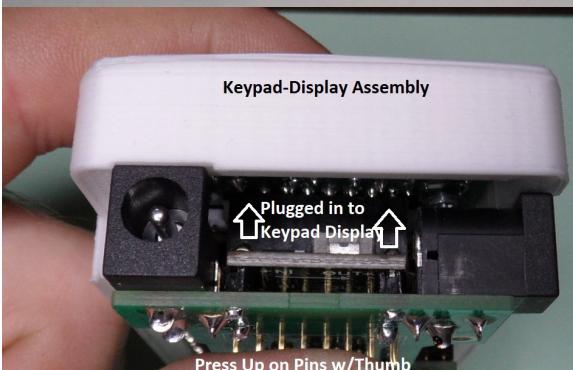
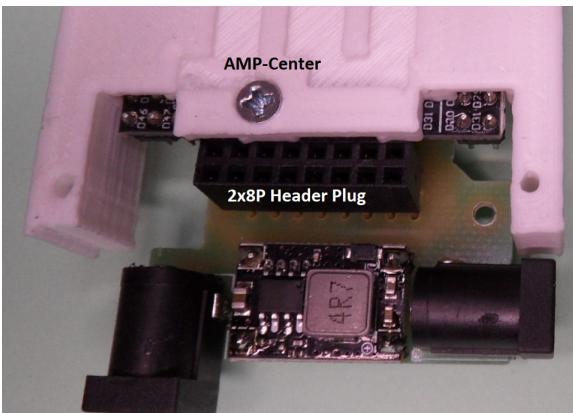
1. Solder (1) Barrel Jack (Power-IN) pointing **down** on **skinny-side**.
2. Solder (1) Barrel Jack (IO-Power) pointing to the PCB **edge** on the fat-side/ **screw-hole-side** of the PCB.

Component white footprint on PCB can help verify barrel jack direction.



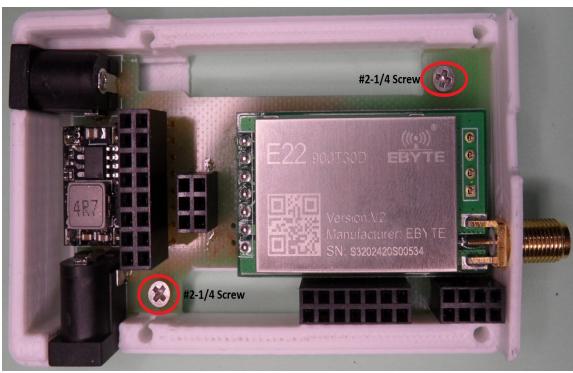
#### F. Keypad-Display Plug

1. Plug the AMP-Center into PCB.
2. Insert 2x8P Long-Leg Female Header into PCB.
3. Place and align pins of the Keypad-Display to plug into the 2x8P Back-plane Plug.
4. Use Pinch method and Thumb to press the 2x8P plug into the Keypad-Display.
5. Align the Assemblies then **solder** the 2x8P plug to the PCB. Consider screwing the Keypad top-screws to the AMP-Center to help align.
6. Trim excess lead length from back of PCB.



#### 1.3.4 Radio Casing

1. Unplug PCB and insert into casing putting the radio antenna through the hole first.
2. Make sure PCB is pressed down against Back-plane casing completely then use (2) #2-1/4 screws to secure.



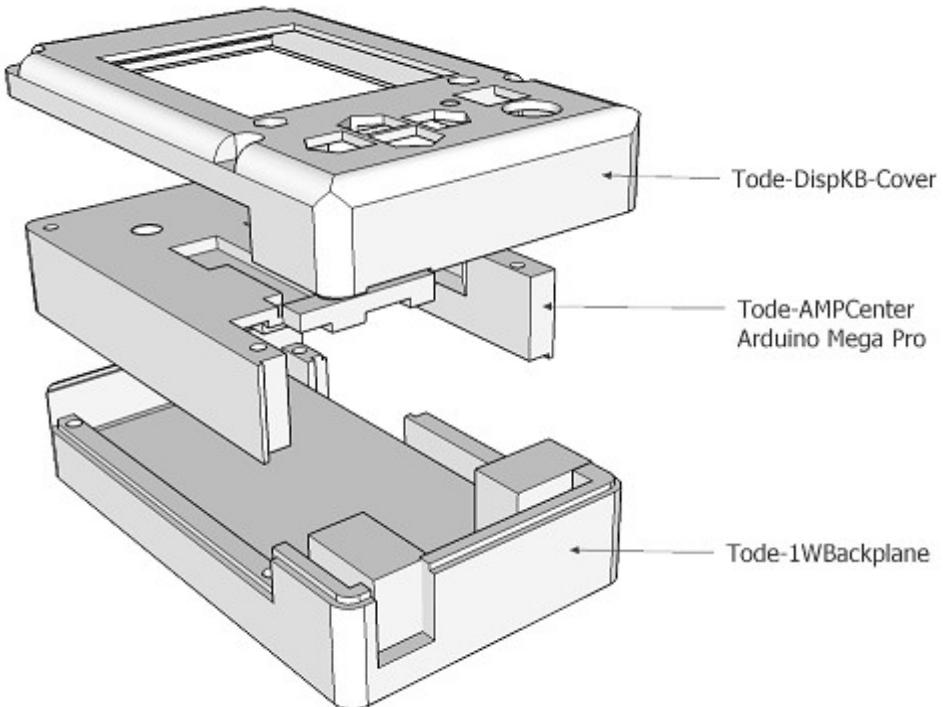
## 1.4 Final Assembly \$2.49

### 1.4.1 Materials \$1.23

#### A. Supplies \$1.23

	<p><b>(4) #2 x 3/8" Screws</b>            Display to Center            Phillips-Pan Sheet Metal Screw  <math>\\$0.10/\text{ea} = \\$0.40</math></p> <p><b>(4) #2 x 1/2" Screw</b>            Backplane to Center            Phillips-Flat Sheet Metal Screw            Sheet Metal Screw            Price <math>\\$0.06/\text{ea} = \\$0.24</math></p>		Aluminum Foil Approximately 1/2sqft $\$0.06/\text{sqft} = \$0.03$ <p><b>2-Inch Clear Packing Tape</b>            Aluminum Foil Insulation</p>
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### 1.4.2 Diagram



## 1.4.3 Casing Assembly

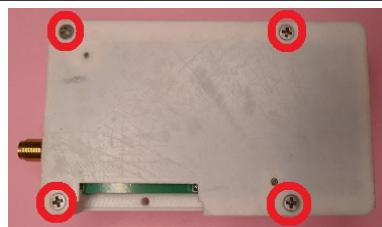
### A. Radio Foil

1. Cut a rectangle of **Aluminum Foil 27mm x 48mm**.
2. Cut a section of **2-Inch Clear Packing Tape** at least 100mm long.
3. Place the rectangle of Aluminum Foil on the sticky-side bottom end of the 2-Inch Packing Tape.
4. Wrap the tape completely around the Aluminum Foil
5. Cut/Trim the Tape edge a hair away from the Aluminum edge to prevent any aluminum exposure.
6. Place the tape-insulated aluminum foil over the Ebyte Radio as shown to prevent High-Power transmits from causing Arduino reboots.



### B. Back-side Fasteners

7. Plug the AMP (Arduino Mega Pro) Center to the 1W-Backplane assuring correct pin alignment.
8. Using **(4) #2-1/2" Phillips-Flat Screws** fasten the Backplane (back-side) to AMPCenter.



### C. Display Fasteners

9. Plug the DispKB into the (front-side) Backplane assuring correct pin alignment and casing alignment with Center.
10. Using **(4) #2-3/8 Phillips-Pan Screws** fasten the Display Casing to the Top.



### D. Antenna

Attach an antenna to the SMA-K connector.

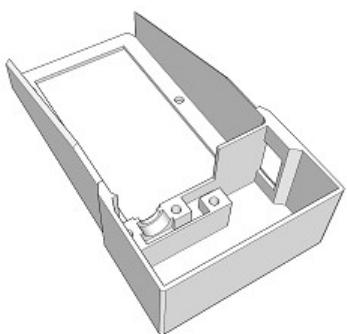
## 2. Battery-Tray Option \$3.00

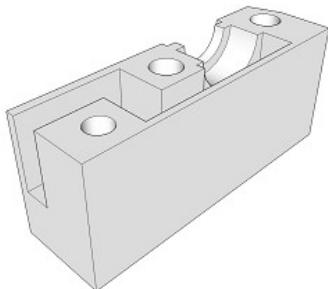
### 2.1 Materials

#### A. Supplies \$2.06

	<b>(1) 5.5x2.1mm Barrel Plug</b> 9mm Insert (!NO Longer!) \$0.11/ea = \$0.11		<b>(1) 9V Battery Clip</b> Hard Plastic Side-Exit Wires \$0.35/ea = \$0.35
	<b>(2) #4 x 3/4" Screws</b> Barrel Plug Clamp Phillips-Pan Sheet Metal Screw \$0.10/ea = \$0.20		<b>(1) KCD11 3A Rocker Switch</b> SPST 10x15mm \$0.10/ea = \$0.10
	<b>(1) #4 x 3/8" Screw</b> Battery Cover Phillips-Flat Sheet Metal Screw \$0.10/ea = \$0.10		<b>(Optional) Belt Clip</b> 55(2.6")x25(0.98")mm Metal 0.25" hole spacing (3mm dia) \$0.80/ea = \$0.80
	<b>(2) M2.5x0.45 - 5mm Flat</b> Belt Clamp Phillips-Pan Machine Screw \$0.20/ea = \$0.40		

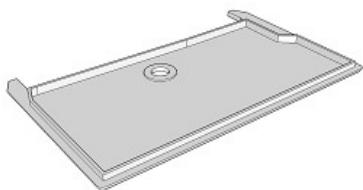
#### B. 3D-Prints \$0.94

	File: <b>9V1W.3DTray.24CV.stl</b> Folder: <b>.\Tode-9V-Batt\1W\3DPrints</b>
	Layer Height: 0.2mm Infill Density: 100% Supports: OFF
	Plastic: 32-grams @ \$0.02/g = \$0.64 Printer-use: @ \$0.0015/g = \$0.048 Power: 4h 48m @ \$0.01/hr = \$0.047 TOTAL COST: \$0.735



File: **9V1W.3DClamp.24CS.stl**  
Folder: \Tode-9V-Batt\1W\3DPrints

Layer Height: 0.2mm  
Infill Density: 100%  
Supports: OFF  
Plastic: 3-grams @ \$0.02/g = \$0.06  
Printer-use: @ \$0.0015/g = \$0.0045  
Power: 0h 42m @ \$0.01/hr = \$0.007  
TOTAL COST: \$0.0715



File: **9V1W.3DCover.24CS.stl**  
Folder: \Tode-9V-Batt\1W\3DPrints  
Layer Height: 0.2mm  
Infill Density: 100%  
Supports: OFF  
Plastic: 6-grams @ \$0.02/g = \$0.12  
Printer-use: @ \$0.0015/g = \$0.009  
Power: 0h 48m @ \$0.01/hr = \$0.008  
TOTAL COST: \$0.137

## 2.1.2 Assembly

Prepare 9V Battery Clip

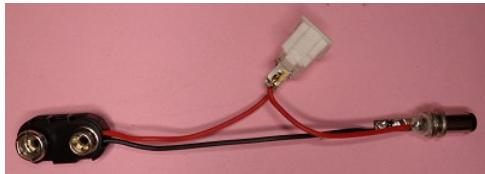
1. Cut Red wire 50mm long.
2. Cut Black wire 80mm long.
3. Cut a piece of Red wire 50mm long.



Strip, Clamp and Solder the black wire to the Barrel Plugs long lead.



Solder the Battery Clip Red wire to one of the rocker switches terminal.



Solder the piece of 50mm Red wire (3.) to the other switches terminal on one end and the Barrel plug short lead. to the other end. Putting the switch in the Red wires path as shown.

Route the Barrel Plug and Battery Clip through the switch hole and push the switch into the casing.



Put the barrel plug in the casing and route wires as shown.

Using **(2) #4 - 3/4" Phillips-Flat** Screws attach the Clamp to hold the Barrel Plug into place.



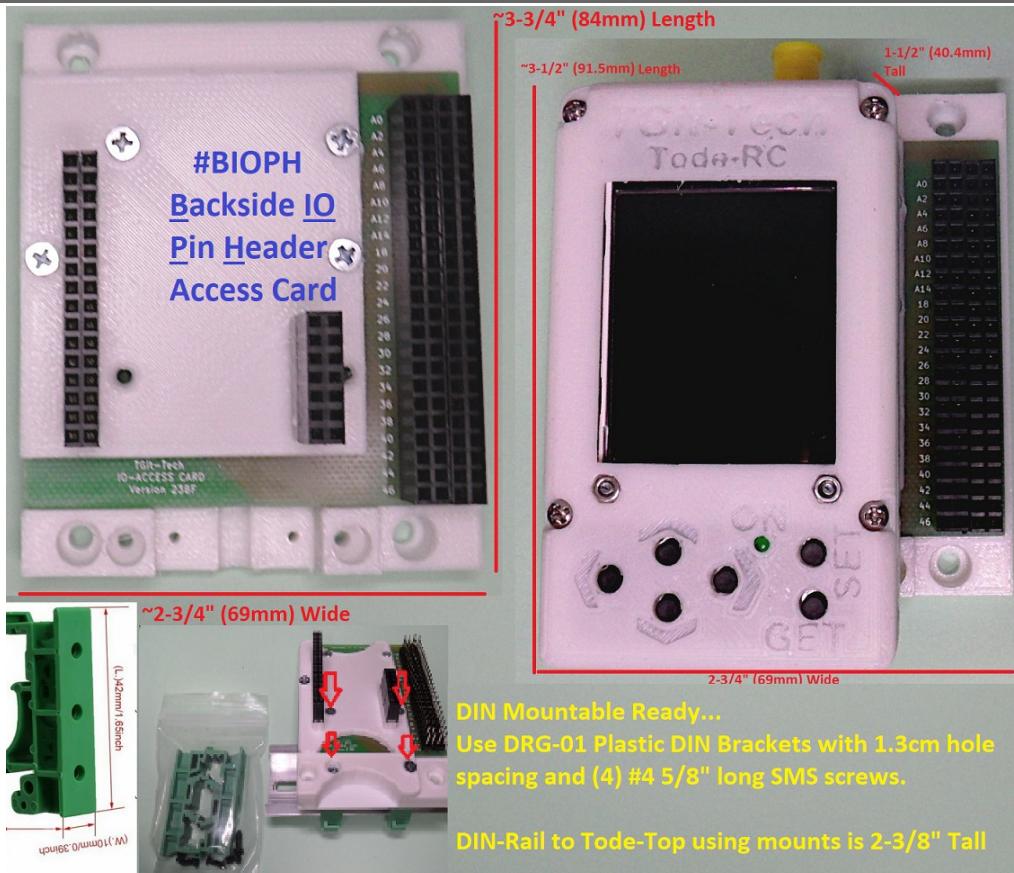
Clip on a battery and stuff the wires in the pocket over the switch.

Install the

Using **(1) #4 – 3/8" Phillips-Flat** Screw attach the Cover over the battery.

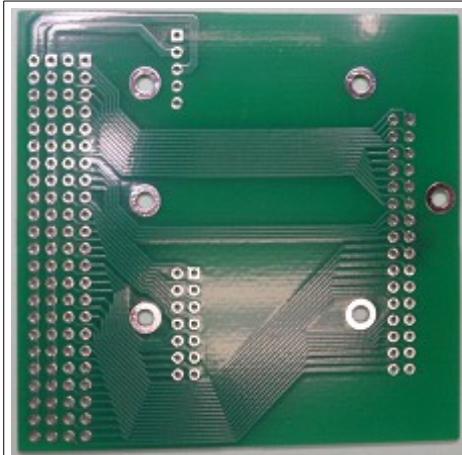


### 3. BIOPH Option \$4.99



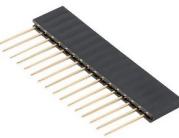
### 3.1.1 Materials \$3.58

#### A. Parts \$0.93

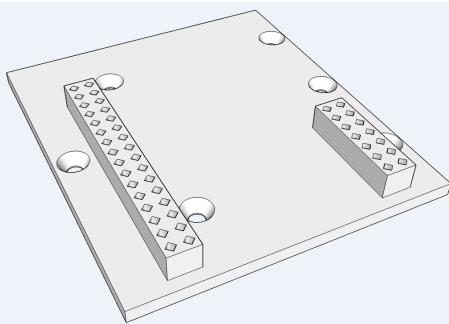


- IO-Access 23BF PCB
- Design Software: Kicad
- Folder: \Tode-IO\Tode-BIO\kicad\IO-ACCESS\SIOST
- Manufacturer: jlcpcb.com
- Batch Price: \$46.43 per 50
- Pricing: \$0.93/ea

#### B. Supplies \$1.92

 <p><b>(2) 2x23P Socket</b> Dupont 2.54mm-Pitch PCB Pin-Header Array @\$0.43/ea = <b>\$0.86</b></p>  <p><b>(1) 2x7P Long Leg Socket</b> Dupont 2.54mm-pitch PCB Digital-IO Tode-Side <b>RARE... Create with Leg Pins</b> <b>Created = \$0.30/ea</b></p>  <p><b>(4) #4 x 3/8"Phillips-Flat Screw</b> Front-Side to Back-Side \$0.03/ea = <b>\$0.12</b></p>	 <p><b>(2) 1x16P Long Leg Socket</b> Dupont 2.54mm-pitch PCB Analog-IO Tode-Side @\$0.17/ea = <b>\$0.34</b></p>  <p><b>(1) 14P+ Any Long Leg Socket</b> Dupont 2.54mm-pitch Use Pins to make 2x7P Long Leg @\$0.30/ea = <b>\$0.30</b></p>
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### C. 3D-Prints \$0.73



**File: BIOPH-FrontSide.249Q.stl**

Folder: ./BD241S/BIOPH/3DPrints/

Layer Height: 0.15mm

Infill Density: 100%

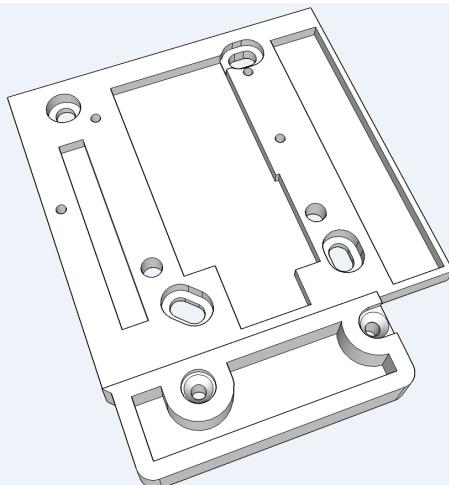
Supports: OFF

Plastic: 9-grams @ \$0.02/g = \$0.18

Printer-use: @ \$0.0015/g = \$0.0135

Power: 2h 08m @ \$0.01/hr = \$0.0213

**TOTAL COST: \$0.22**



**File: BIOPH-BackSide.261C.stl**

Folder: ./BD241S/BIOPH/3DPrints/

Layer Height: 0.15mm

Infill Density: 100%

Supports: OFF

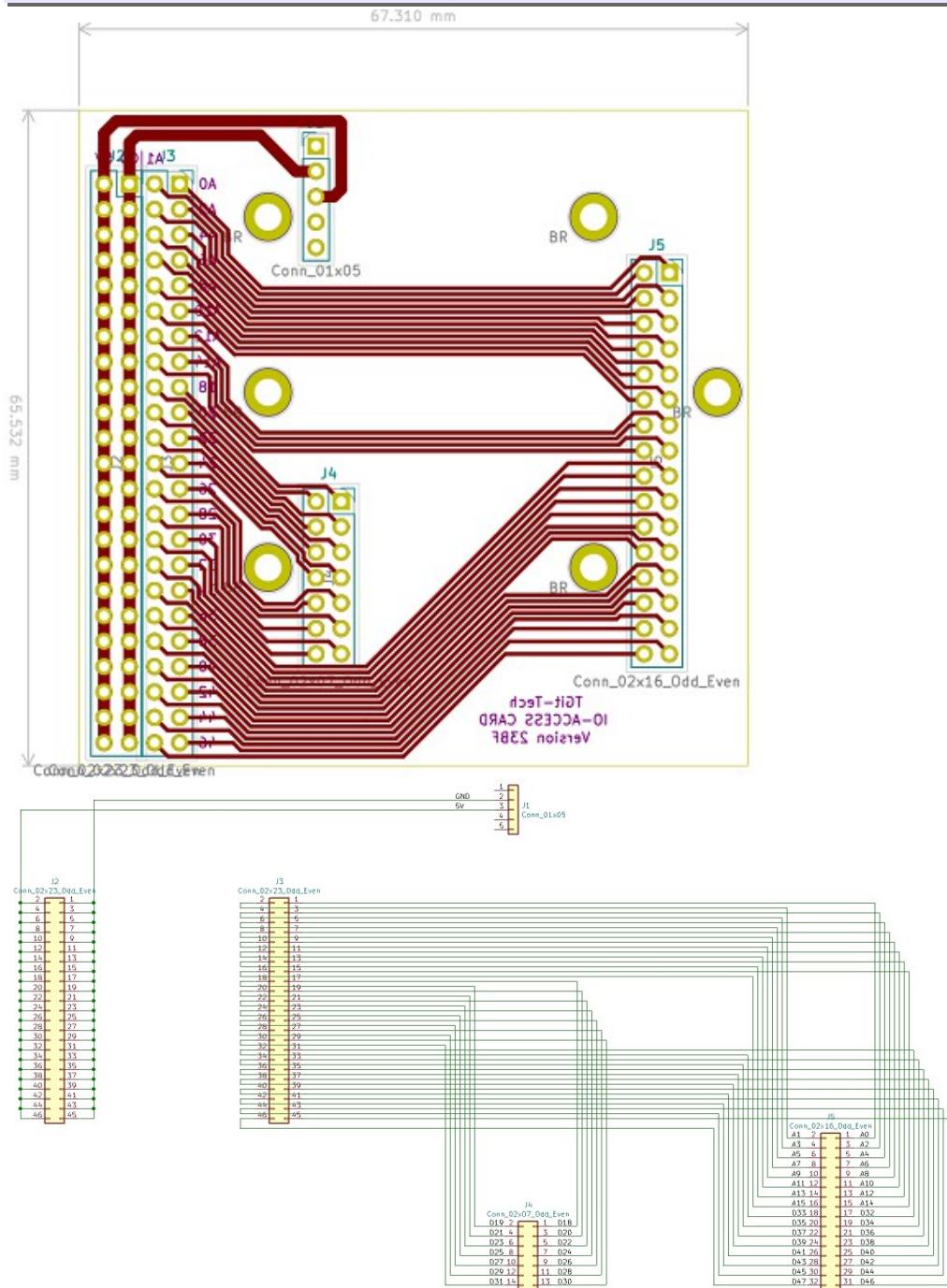
Plastic: 22-grams @ \$0.02/g = \$0.44

Printer-use: @ \$0.0015/g = \$0.033

Power: 3h 23m @ \$0.01/hr = \$0.0338

**TOTAL COST: \$0.51**

### 3.1.2 Diagram



### 3.1.3 Assembly lbr\$1.41

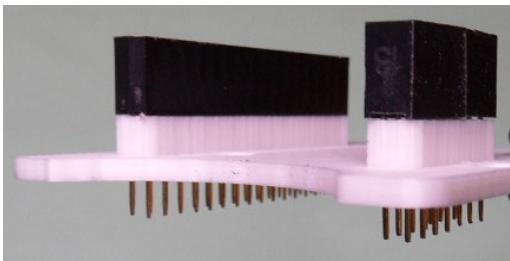
#### A. Make 2x7P Long Leg Socket

1. Pull Pins out of 2x7P Short Leg Dupont Socket and 14P from any Long Leg Socket..
2. Insert the 14P Long Leg Pins into the 2x7P Socket and tap lightly with hammer to seat.



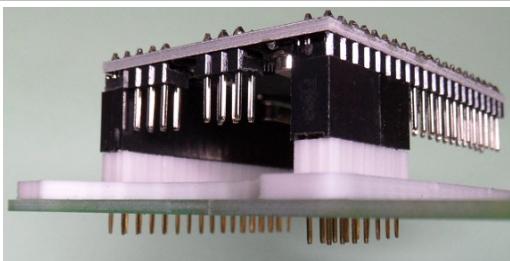
#### B. Sockets in Front-Side

3. Use a drill & 0.8mm drill bit to clean pin holes in Front-Side 3D-Print.
4. Press (2) 1x16P Long Leg Sockets into Front-Side 3DPrint.
5. Insert 2x7P Long Leg Dupont Socket made in the step above.



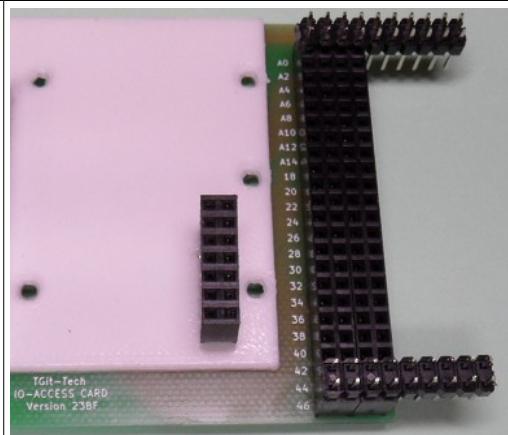
#### C. Front-Side on PCB

6. Press Front-Side with installed Pin Sockets into the PCB holes.
7. Plug in an Arduino Mega-Pro for correct plug alignment.
8. Solder the Sockets to the PCB.
9. Trim excess Pin Length



#### D. Install & Solder Access Array

10. Install the (2) 2x23P Sockets into the PCB.
11. Using a male pin header keep sockets aligned during the soldering process.
12. Solder all pins to PCB.  
**TIP:** Solder 4-Corners first then pinch sockets while reheating corners to ensure sockets are flush with PCB.



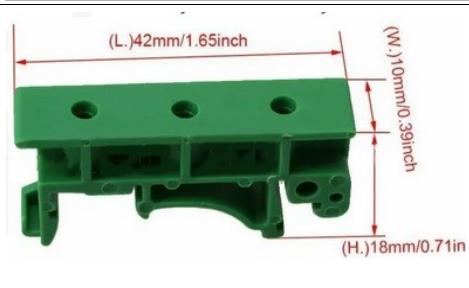
#### E. Attach Back-Side

13. Place Front-Side assembly on Back-side 3D Print as pictured.
14. Fasten with (4) #4 x 3/8in Flat-Head SMS screws.



## 3.2 DIN-Mount Materials +\$0.82

#### A. Parts \$0.66



(2) DIN Mount Brackets  
DRG-01 for 35 x 7.5mm DIN Rail  
Pricing: \$0.33/ea = \$0.66

**B. Supplies \$0.16**

	<b>(4) #4 x 5/8"Phillips-Flat Screw</b> Standoff-Label \$0.04/ea = <b>\$0.16</b>		
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**C. (OPTION) Screw on DIN Brackets**

1. Using (4) #4 x 5/8in Flat-Head SMS screws attach the DIN brackets with their pry-release tabs facing the bottom to the BIOPH Assembly.
2. Attach to desired DIN Rail.

