Proto-Full

1 DESCRIPTION

The PTSolns *Proto-Full* v2.1 is a prototyping board to provide the user flexibility in realizing their circuit design. This full-sized board resembles a traditional breadboard; in that the breakout section is divided into rows of five. The board features two different power input options for conveniently connecting a battery or a benchtop power supply. Multiple power rail configurations can be used to support different voltage levels simultaneously. Silkscreen printing and component footprints exist on both sides of the board allowing the user to work on two layers.

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2 DOCUMENT REVISION HISTORY

Current document revision is Rev 0.

3 PRODUCT FEATURES

This section highlights notable features of the *Proto-Full* v2.1.

3.1 Power Input

The *Proto-Full* has the following power input options:

1) 2-Pin screw terminal (2.54 mm/0.1 in).
2) Female barrel jack (2.1 mm X 5.5 mm).

These power input options are shown in Figure 1.

Note that the positive terminal of Option 1 is electrically connected to the positive terminal of Option 2. Similarly, the negative terminal of Option 1 is electrically connected to the negative terminal of Option 2. **It is not recommended to use both power input options simultaneously.**

Both power input options can be soldered onto either the front or back of the PCB. For this reason, the footprint of the female barrel jack of option 2) is unconventional. An additional, electrically isolated, through-hole exists such that the female barrel jack can be connected on either side while keeping the barrel opening in the same direction (away from the PCB). An example can be found in Section 6.1

Figure 1: Two power input options for the Proto-Full.

3.2 Power Rails

The *Proto-Full* features ten rails, each consisting of 30 tie-point through-holes, as shown in Figure 2. The rails can be electrically connected in different configurations. By default, all rails are initially electrically disconnected. Four of the rails can be connected to the positive terminal. Similarly, four other rails can be connected to the negative terminal. The remaining two rails are suggested to be used in one of two ways:

1) Use the provided footprint connection to GND.
2) Use it for a data signal.

Connecting rails is suggested to be done in one of two methods:

1) Using a short wire to bridge the connection and soldering it in place. This is a permanent connection in which the user does not intent to change the configuration often.
2) Using male header pins connected with 2-Pin jumper caps. This is a temporary connection in which the user can easily disconnect the rail. This allows the jumper cap to act as an enable/disable for the rail and allows the rail to be reconfigured to transmit a different signal or voltage. An example can be found in Section 6.2.

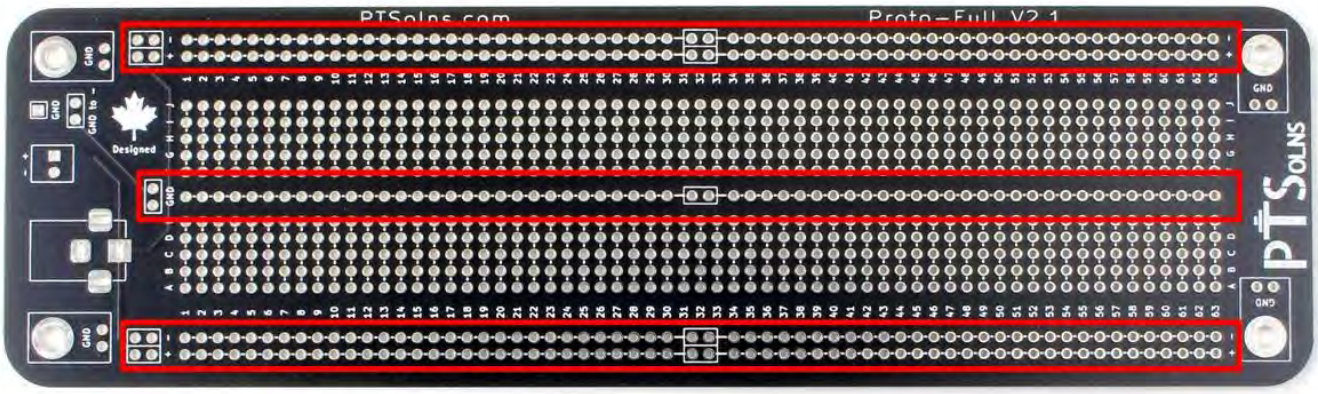

Figure 2: Ten rails of the Proto-Full.

3.3 Ground (GND)

The ground (GND) of the PCB can be electrically connected to an external GND using the GND out pin. By default, this GND out pin is not connected to any other part of the PCB. Each of the four mounting holes can be connected to the GND of the PCB separately by closing the corresponding 2-Pin connections (one in each corner of the PCB). Additionally, the central rail can be connected to the GND of the PCB in a similar fashion.

The ground and negative terminal are by default electrically disconnected. To connect GND to the negative terminal the corresponding 2-Pin connection (marked as "GND to –") must be electrically bridged. All GND connection options are shown in Figure 3. See Figure 8 for the electrical schematic.

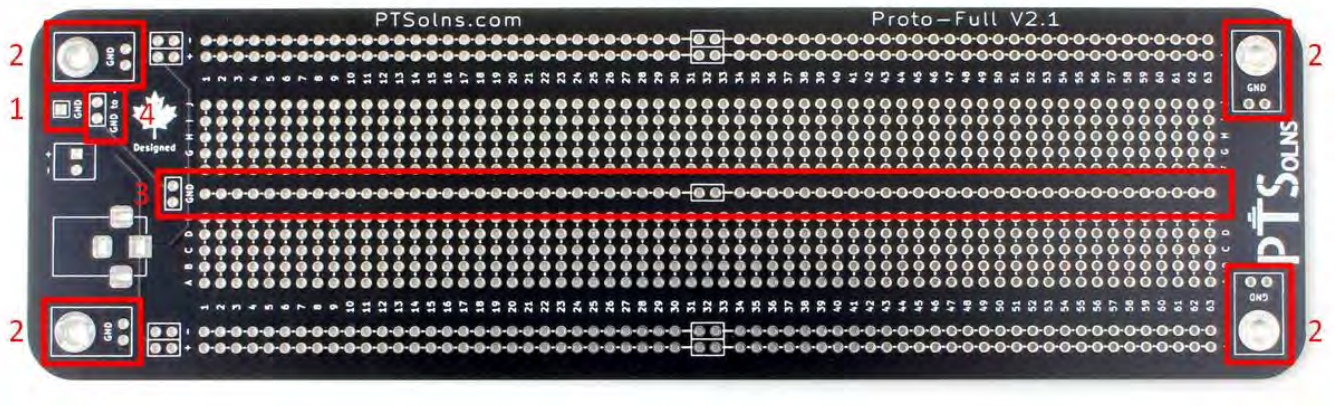

Figure 3: Various GND connection options of the Proto-Full. 1) GND out pin, 2) GND of each of the four mounting holes, 3) GND of the central rail, 4) GND to negative terminal connection.

3.4 Silkscreen Printing

The breakout section of the *Proto-Full* is fully labelled along the rows and columns. For ease of use, the silkscreen printing exists on both sides of the board. White dashed silkscreen lines between tie-points indicate an existing hardwired electrical connection. All components can be soldered on either side of the board, including asymmetrical components such as the female barrel jack.

3.5 Mounting

There are four 3.2 mm diameter mounting holes on the PCB as shown in Figure 4. These mounting holes are intended for hardware such as standoffs, of size M3. Each mounting hole has a 6.4 mm diameter copper pad and can be connected to the main ground (GND) of the PCB separately by bridging the respective 2-Pin jumper. Figure 7 shows the dimensions of the mounting holes.

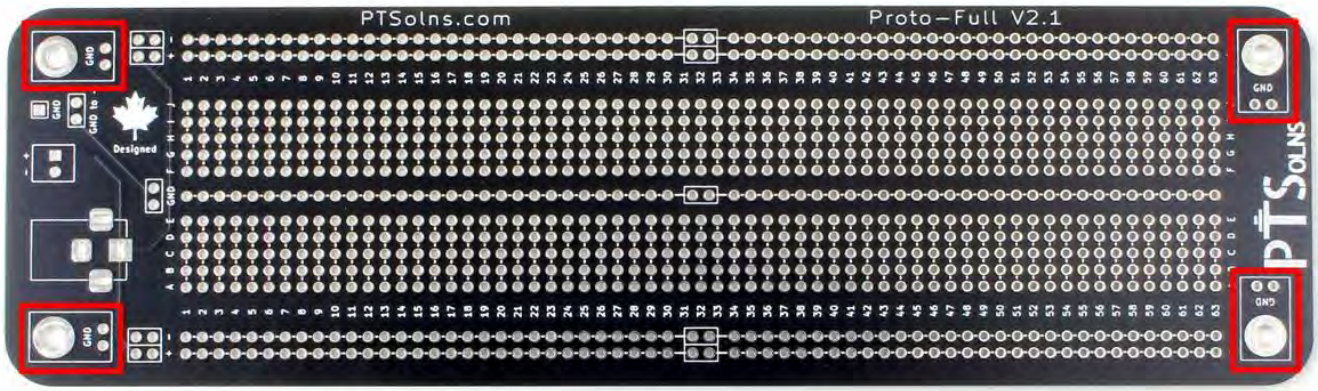

Figure 4: Four mounting holes of the Proto-Full.

3.6 Mark of Authenticity

Authentic PTSolns PCBs have a black solder mask color and are marked with the “PTSolns” logo in white silkscreen printing. The “Canadian Designed” symbol, consisting of the Canadian Maple Leaf with the word “Designed” underneath, can also be found on the PCB in white silkscreen printing. The “PTSolns” trademark and the “Canadian Designed” symbols are shown in Figure 5.

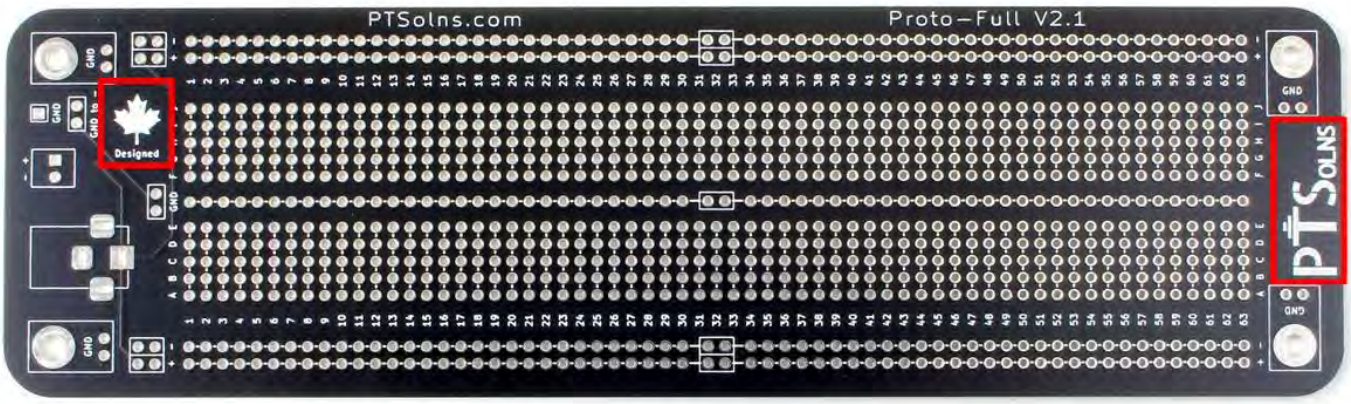

Figure 5: The "Canadian Designed" symbol found on authentic PTSolns PCBs.

4 PHYSICAL PROPERTIES

The physical properties of the *Proto-Full* are outlined in Table 1.

Table 1: Physical Properties.

	Quantity	Value	Reference
PCB	Length	200.7 mm	Figure 6
	Width	58.4 mm	Figure 6
	Thickness	1.6 mm	Figure 6
	Corner radius	7.6 mm	Figure 6
	Weight	36 g	--
	Color	Black	--
	Silkscreen	White	--
Tie-point	Number of tie-points	930	Figure 6
	Tie point spacing	2.54 mm/0.1 in	Figure 6
	Tie-point hole diameter	1.0 mm	Figure 7
	Tie-point copper pad diameter	1.7 mm	Figure 7
Mounting	Hole diameter	3.2 mm	Figure 7
	Copper pad diameter	6.4 mm	Figure 7
	Center-to-center distance along length	185.4 mm	Figure 6
	Center-to-center distance along width	43.2 mm	Figure 6
Material	Lead free HASL-RoHS surface finish		--
	FR-4 base		--

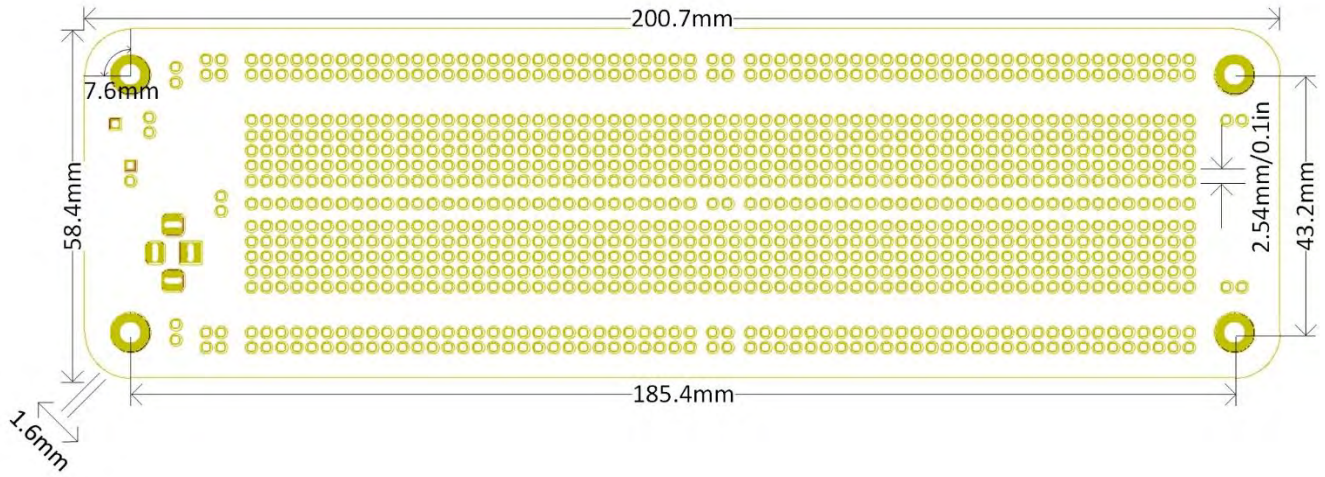

Figure 6: Dimensions of the Proto-Full PCB.

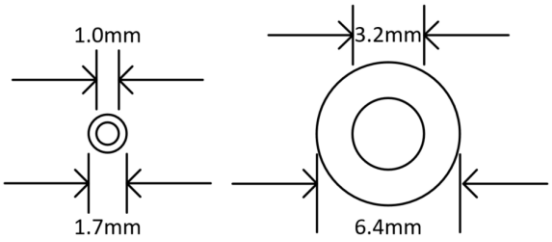

Figure 7: Dimensions of tie-point (left) and mounting hole (right).

5 ELECTRICAL PROPERTIES

The current ratings of the *Proto-Full* are outlined in Table 2. Electrical connections made by copper traces are shown in Figure 8. Copper traces have a weight of 1 oz/ft^2.

Table 2: Current rating for *Proto-Full*.

Type of trace	**Current rating**[1]
Positive power rails	1.5 A
Negative power rails	1.5 A
Central ground rails	1.5 A
Power input female barrel jack	1.5 A
Power input 2-Pin screw terminal	1.5 A
All GND connections	1.5 A
5-Pin breakout rows	1.0 A

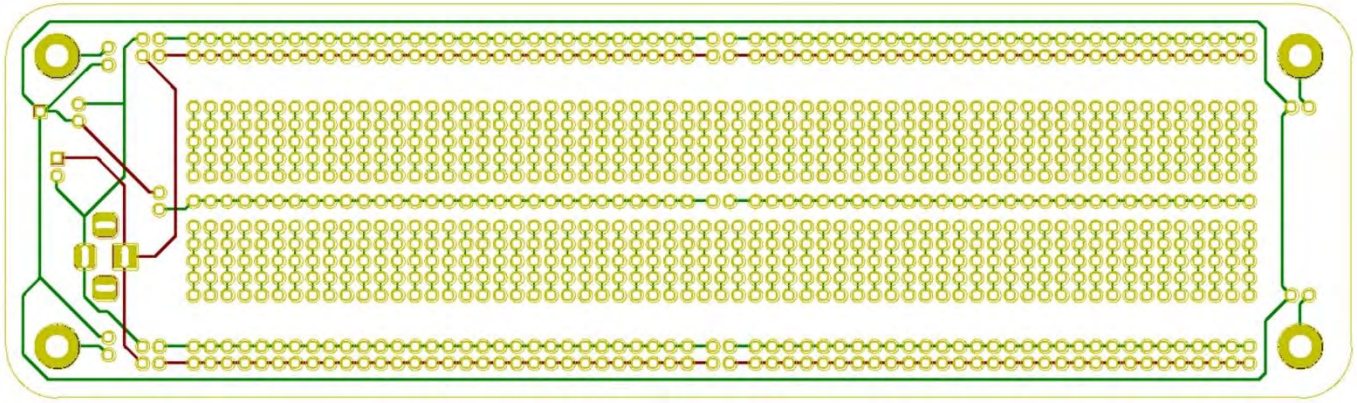

Figure 8: Electrical connections of the Proto-Full.

[1] Current ratings based on IPC-2221B and are in part determined assuming a maximum temperature rise of 20 ˚C.

6 USAGE AND APPLICATION

This section presents some usages and applications of the *Proto-Full*.

6.1 Power Input

This example shows two different options to power the *Proto-Full*. The image on the left in Figure 9 shows a green 2-Pin screw terminal and a black female barrel jack, both soldered onto the top side of the PCB. The image on the right in Figure 9 shows the same screw terminal on the top side, however, the female barrel jack is soldered onto the bottom side of the PCB. In both configurations stand-offs are used to lift the PCB up off the surface.

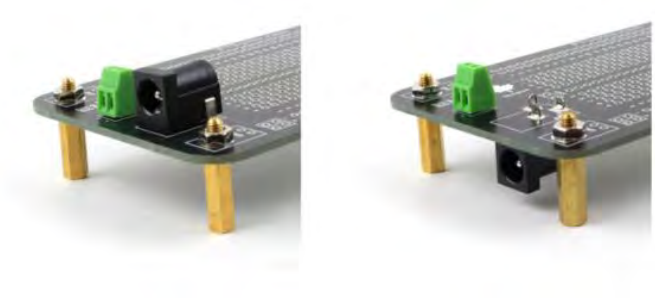

Figure 9: Power input configuration examples.

Both a screw terminal and a female barrel jack can be soldered into place simultaneously. This gives the user the ability to power the PCB with different connections, or easily switch between two different sources. Since these inputs are electrically connected in parallel, care should be taken to not power the PCB via both input methods at the same time.

6.2 Jumper Cap Connections

Rails and GND connections can be made by simply soldering across the respective 2-Pin gap. This is a permanent connection. A more temporary connection can be made by soldering male header pins across the 2-Pin gaps and using 2-Pin jumper caps, as shown in Figure 10.

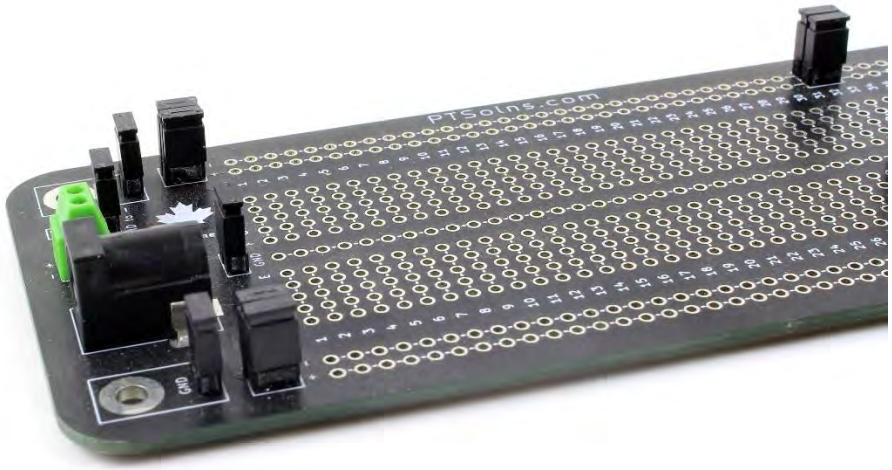

Figure 10: Connecting rails and GND using 2-Pin jumper caps.

The 2-Pin gap for the various GND connections consists of two through-holes separated by 2.54 mm/0.1 in. Using the jumper cap method, the male headers required are 1 X 2 Pin with a pitch of 2.54 mm/0.1 in. The gap for the adjacent positive and negative power rails consists of four through-holes arranged in a 2 X 2 pattern, separated by 2.54 mm/0.1 in. In this situation, a 2 X 2 Pin male header is recommended using the jumper cap method. However, two 1 X 2 Pin male headers can also be used. **Note that when using jumper caps to connect negative to negative and positive to positive always ensure the jumper caps are not crossed the negative and positive terminal. Mind the direction the jumper caps are placed in the 2 X 2 configuration.**

6.3 Use of Voltage Regulator on Power Rails

This example shows an unconventional use of a voltage regulator. The Vin and Vout pins of the voltage regulator are soldered into the left and right positive voltage rails. This is done at the mid-section of the *Proto-Full* where the rails are disconnected by default. The GND pin of the voltage regulator is soldered into the negative voltage rail. This is done by slightly bending the GND pin backwards to reach the first through-hole of the negative rail. The left and right negative voltage rails have been bridged to make an electrical connection. Note that two smoothing capacitors are soldered across the positive and negative rails on either side of the Vin and Vout. This is not always necessary but recommended. Ratings for smoothing capacitors are project specific.

With this configuration there are two immediate advantages. The first advantage is that two voltage rails are at different levels. The left is at the supply voltage and the right at a lower down-regulated voltage. This is useful when working with different voltage levels simultaneously. The other advantage is that this configuration uses minimal space, as none of the 5-pin breakout rows are used.

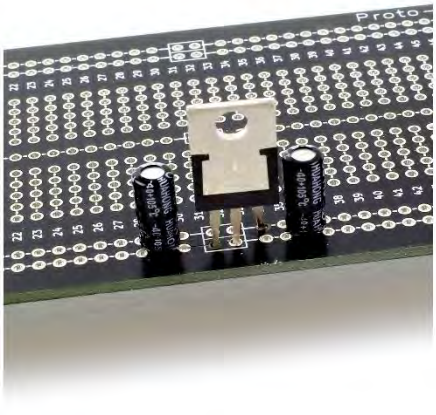

Figure 11: Voltage regulator across power rails.

7 RECOMMENDED ACCESSORIES

The following is a list of recommended components and accessories to help the user best utilize the *Proto-Full*.

- **Female barrel jack**. Size: 2.1 mm X 5.5 mm
  - Used as one of the power input options for positive and negative connections.
- **Female header**. Pins: 1 X 40 Pin; Pitch: 2.54 mm/0.1 in
  - The user can break the full row of pins into smaller sections as required.
- **Jumper cap**. Pins: 2; Pitch: 2.54 mm/0.1 in
  - Used to make temporary connection for power rails.
- **Male header**. Pins: 1 X 40 Pin; Pitch: 2.54 mm/0.1 in
  - The user can break the full row of pins into smaller sections as required.
- **Male header**. Pins: 2 X 40 Pin; Pitch: 2.54 mm/0.1 in
  - The user can break the full row of pins into smaller sections, such as 2 X 2 Pin, which can be used to connect the positive and negative power rails (with 2-Pin jumper caps)
- **Screw terminal**. Pins: 2; Pitch: 2.54 mm/0.1 in
  - Used as one of the power input options for positive and negative connections.
- **Stand-off set**. Size: M3; Length: various
  - Used in mounting holes to secure PCB.
- **Wire set**. A.W.G.: ≥19; Length: various; Type: preformed, DuPont, etc.
  - Used in any of the tie-point breakout sections.