

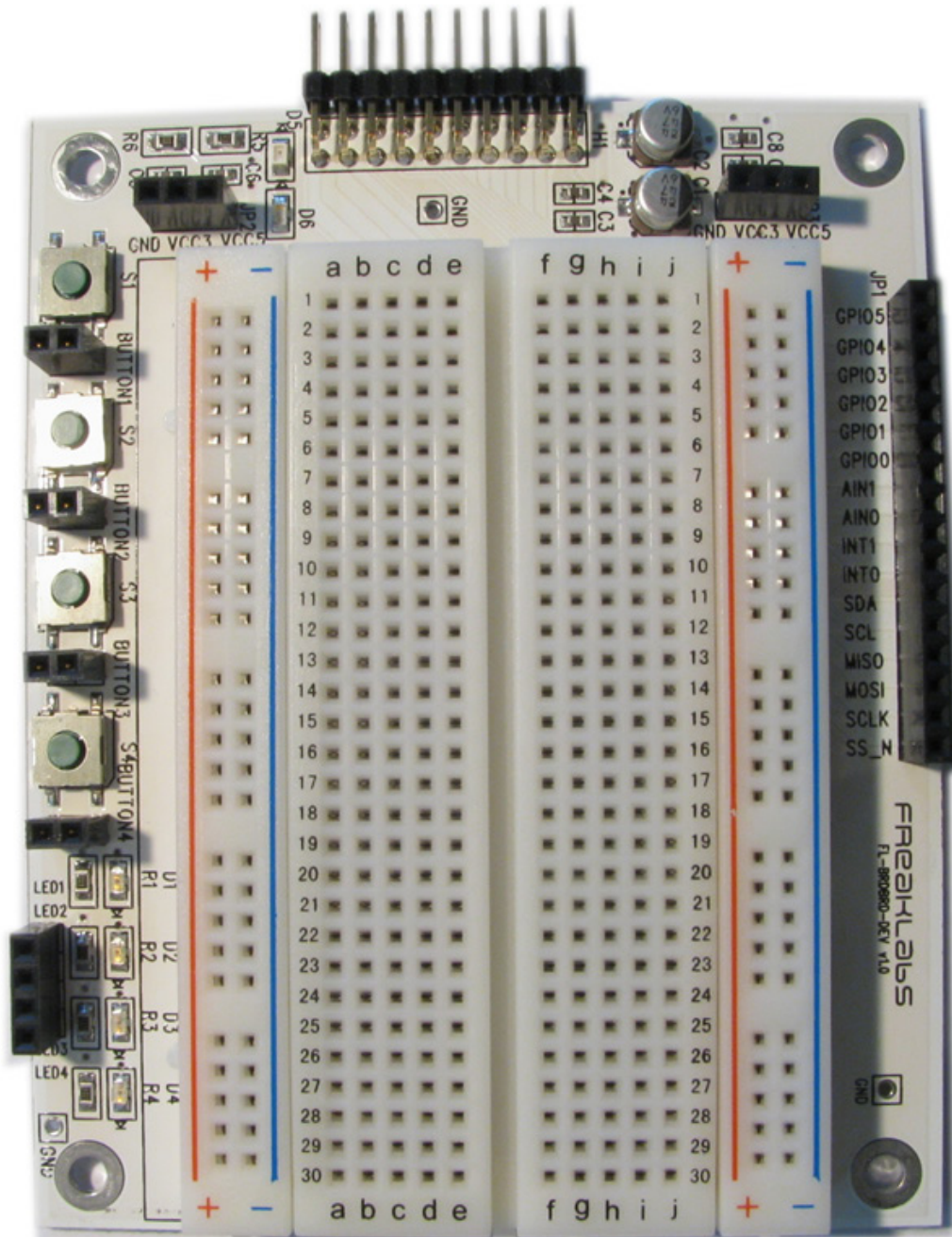
# FREELABS

Rapid Prototyping Platform

Breadboard Peripheral

FL-BRDBRD-DEV v1.0

User Guide v1.0A



## Document Revision History

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<i>Date</i>	<i>Description</i>
2010-04-05	User Guide v1.0A Document creation

## Specifications

The FreakLabs breadboard peripheral is designed to quickly prototype circuits to check for feasibility and also become familiar with how the circuit will actually behave.

All of the I/O from the universal serial connector as well as power and ground is broken out to a separate headers on the sides of the breadboard for easy access via jumper wires. This minimizes the amount of circuit that needs to be prototyped since GPIO, interrupts, ADC, PWMs, frequency counters, and power are already available.

Along with the I/O breakouts, there are four tactile pushbuttons and four LEDs to provide input stimulus and an output display to the circuit. Each pushbutton has a 2-input connector next to it and when the button is pushed, those inputs are connected. Each LED is already connected to a current limiting resistor so only a signal wire needs to be connected to it. With the addition of manual input stimulus, visual output display, power, and an integrated interface to the MCU, the breadboard peripheral is a very powerful prototyping tool that can get you from idea to working prototype very quickly.

### QUICK SPECS

**Breadboard:** 300 hole terminal strip, 100 hole power distribution strip

**Connectors:** 1 USC Peripheral, I/O breakout, power breakout

**Peripherals:** , 4 buttons, 4 LEDs

## Peripherals

The board comes with a 400 hole, 55 x 85 mm breadboard with power rails on both sides and prototyping area in the middle. Surrounding the breadboard is an I/O header that contains the signal pins from the universal serial connector. The I/O header has connections for the SPI bus, I2C bus, interrupts, ADC inputs, timer/capture input, PWM output and GPIO. Any unused pins can also be converter to GPIO.

There is also a power header on both sides of the breadboard near the power rails. A jumper wire needs to be connected from the power header to the breadboard in order to supply power to it. The power header contains both a 3.3V and 5V (if available) power supply as well as GND reference.

There are four SPST tactile pushbuttons with a 2-pin header next to each of them. One wire should be connected to the button input and one should be connected to the button output. When the button is pressed, the two connections will be shorted and when released, the connections will be open.

There are four LEDs on the board as well. The LEDs already contain a current limiting resistor and a signal wire just needs to connect to them. When the signal is high, the LED should turn on as long as the signal is higher than the forward voltage of the LED. Red LEDs were used because they have a relatively low forward voltage, hence making them compatible with most signals.

There are also two power indicators on the breadboard to show when 3.3V and 5V is available. The green LED is the 3.3V indicator and the red LED is the 5V indicator. If the red LED does

not light when the breadboard is attached to the MCU board, that means that 5V will not be available as a power source. This is usually the case if the MCU board is powered by batteries rather than the external DC connector or the USB.

## Connectors

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The universal serial connector (USC) interface is standard for all of the FreakLabs development boards. The FL-BRDBRD-DEV board contains a peripheral-side universal serial connector.

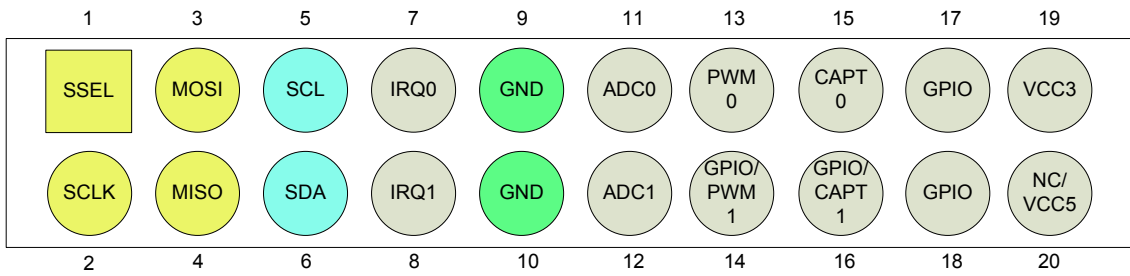
### **Universal Serial Connector Pinouts**

The FL-BRDBRD-DEV radio board supports the Universal Serial Connector (USC) v1.1. The connector supports an SPI bus, I2C bus, 2 interrupts, 2 analog inputs, 1 PWM output, 1 timer/capture input, 6 GPIOs, 3.3V supply, and optional 5V supply. All pins except power pins can also be used as GPIO if there is no need for the principal function. In the case of the radio board, only the SPI bus, 1 interrupt, and a few GPIO pins are used.

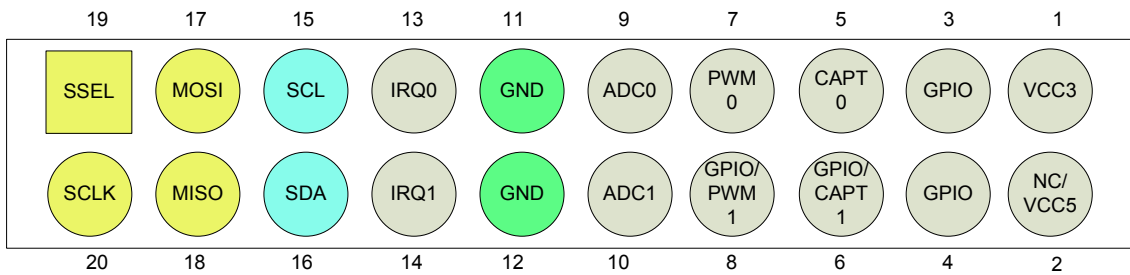
The connector consists of a host side which is a 20-pin, female, right-angle header and a peripheral side which is a 20-pin, male, right-angle header. The host side connector will always be on MCU boards and the peripheral connector will be found on peripheral boards that interface to the MCU boards.

The reason right angle connectors were chosen was so that the complete system can be level. This makes it easier to access individual signals and pins, as well as make modifications to the circuit. The following diagram shows the pinouts of the connectors:

### Universal Serial Connector v1.1 – Host (MCU) side



### Universal Serial Connector v1.1 – Peripheral side



The specific pinout of the universal serial peripheral connector of the FL-BRDBRD-DEV board can be found below:

<b>USC Peripheral Connector (H1)</b>			
<i>Pin</i>	<i>Description</i>	<i>Pin</i>	<i>Description</i>
1	VCC3	2	VCC5
3	GPIO4	4	GPIO5
5	GPIO2	6	GPIO3
7	GPIO0	8	GPIO1
9	ADC0	10	ADC1
11	GND	12	GND
13	INT0	14	INT1
15	SCL	16	SDA
17	MOSI	18	MISO
19	SS_n (SPI Select)	20	SCLK

<b>I/O Breakout Connector (JP1)</b>			
<i>Pin</i>	<i>Description</i>	<i>Pin</i>	<i>Description</i>
1	GPIO5	2	GPIO4

### ***I/O Breakout Connector (JP1)***

<i>Pin</i>	<i>Description</i>	<i>Pin</i>	<i>Description</i>
3	GPIO3	4	GPIO2
5	GPIO1	6	GPIO0
7	ADC1	8	ADC0
9	INT1	10	INT0
11	SDA	12	SCL
13	MISO	14	MOSI
15	SCLK	16	SPI SELECT_n

## **Disclaimer**

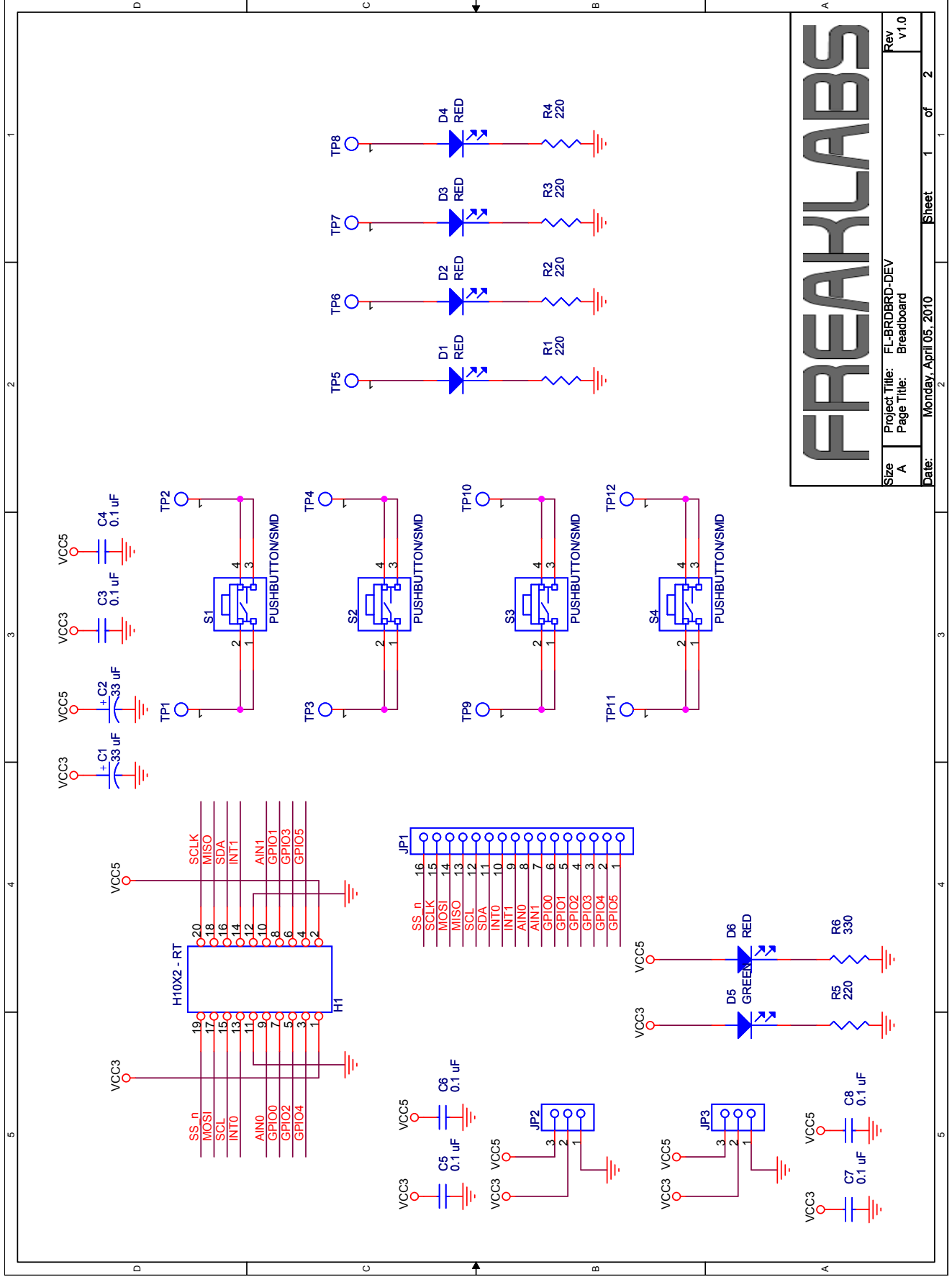
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The FL-BRDBRD-DEV board is NOT FCC approved. It is designed to comply with FCC Part 15 rules. However this board is not in a finished product form and is only intended for experimental and research/development purposes. If you wish to use this board in an actual product, you will need to attain certification with the appropriate local regulatory body for the complete system. Additionally, please use the wireless equipment in a responsible manner with regard for others and your surroundings.

## **Schematics**

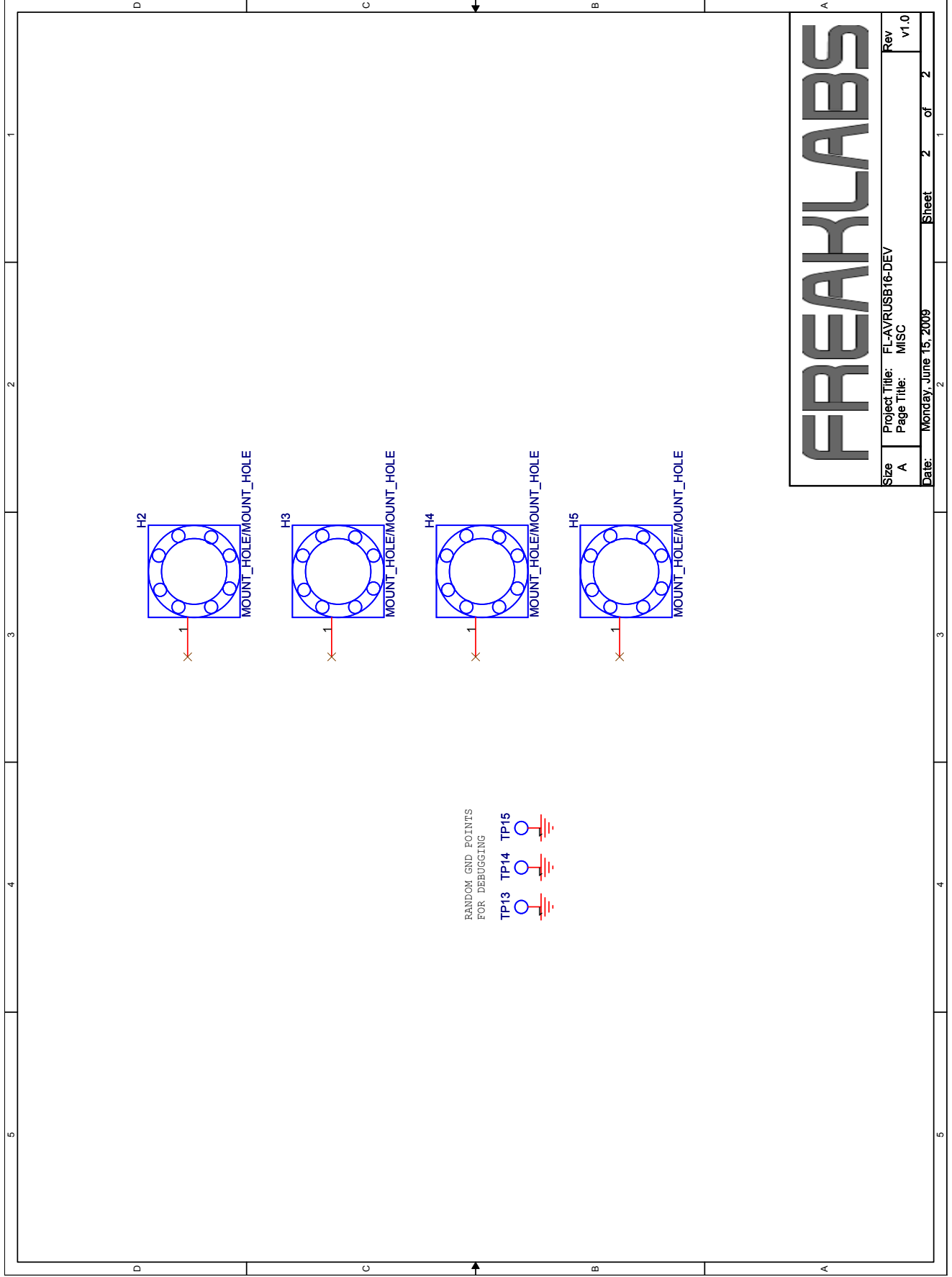
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Schematics can be found on the following page:



# FREAKLABS

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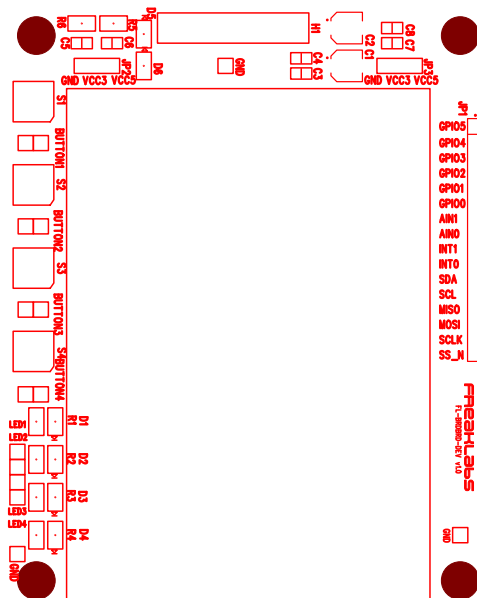
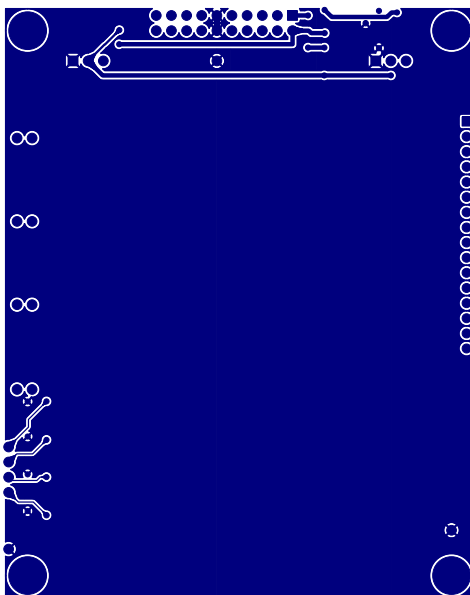
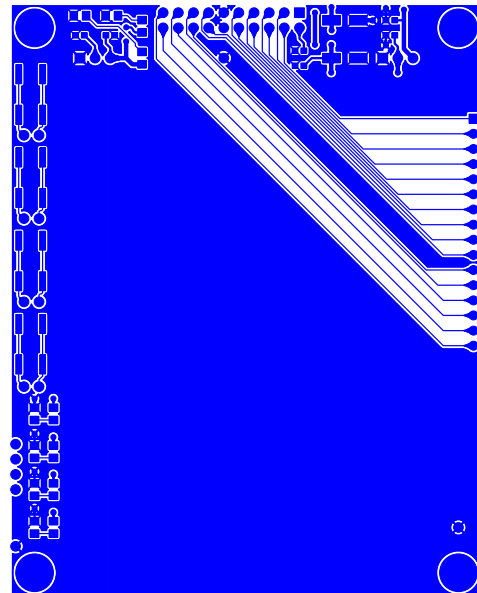
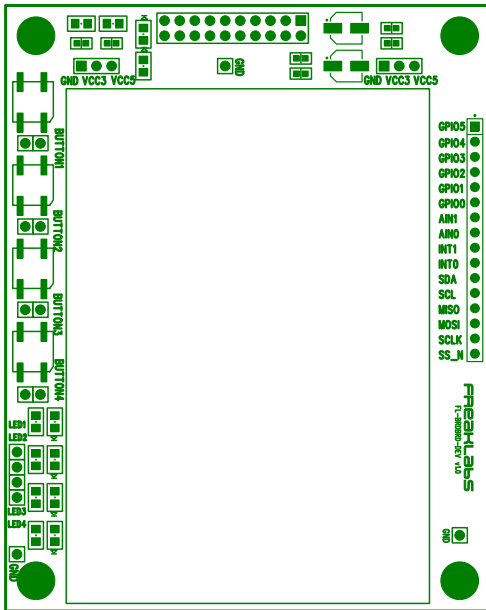
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# PCB Layout

PCB layout file order:

1. Assembly drawing
2. Top Layer
3. Bottom Layer
4. SilkscreenV



## Bill of Materials

<b>Quantity</b>	<b>Reference</b>	<b>Manufacturer</b>	<b>Part Number</b>	<b>Description</b>
2	C1 ,C2	Various		33uF/10V electrolytic capacitor
6	C3, C4, C5, C6, C7, C8	Various		0.1uF/50V, 0603
5	D1, D2, D3, D4, D6	Various		Red LED, 0805
1	D5	Various		Green LED, 0805
1	H1	Various		10x2 Right angle header, male, 0.100"
2	JP2, JP3	Various		3x1 Straight header, female, 0.100"
1	JP1	Various		16x1 Straight header, female, 0.100"
5	R1, R2, R3, R4, R5	Various		220 ohms, 0805
1	R6	Various		330 ohms, 0805
4	S1,S2,S3,S4	Various		SMD SPST Tactile Switch, Pushbutton
1	No Reference	EIC	EIC-801	Solderless Breadboard