THE SIMPLE P2++ HARDWARE MANUAL

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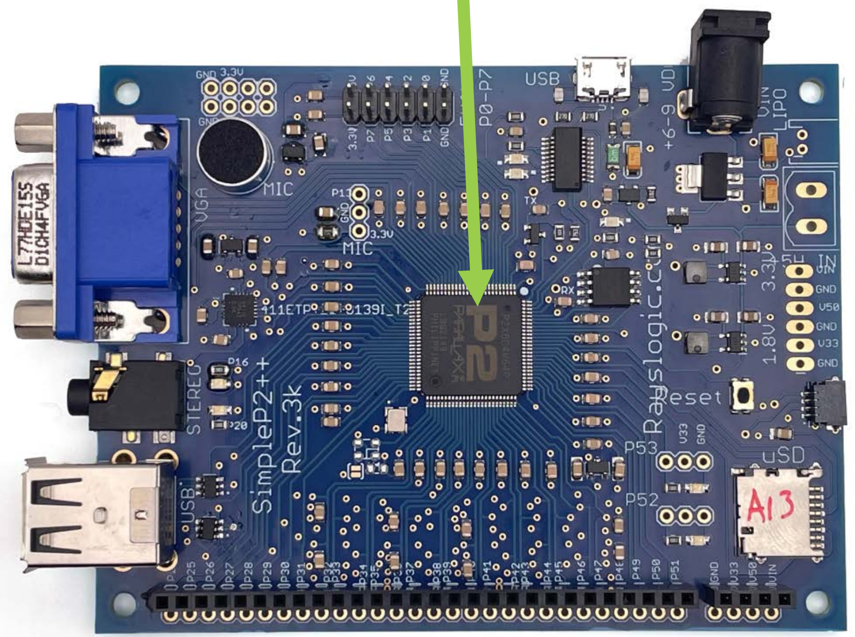
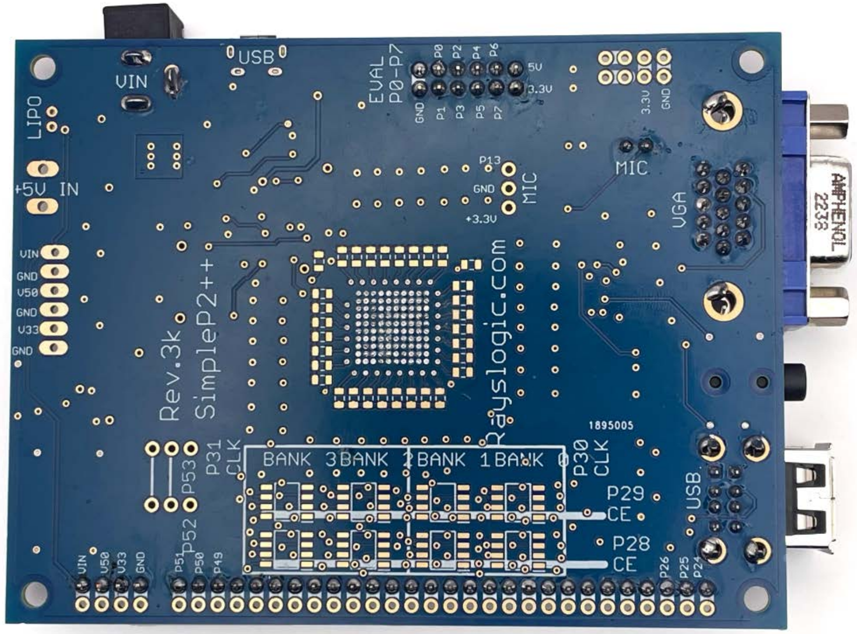
THE SIMPLE P2++ BOARD FEATURES THE PARALLAX PROPELLER II MICROCONTROLLER

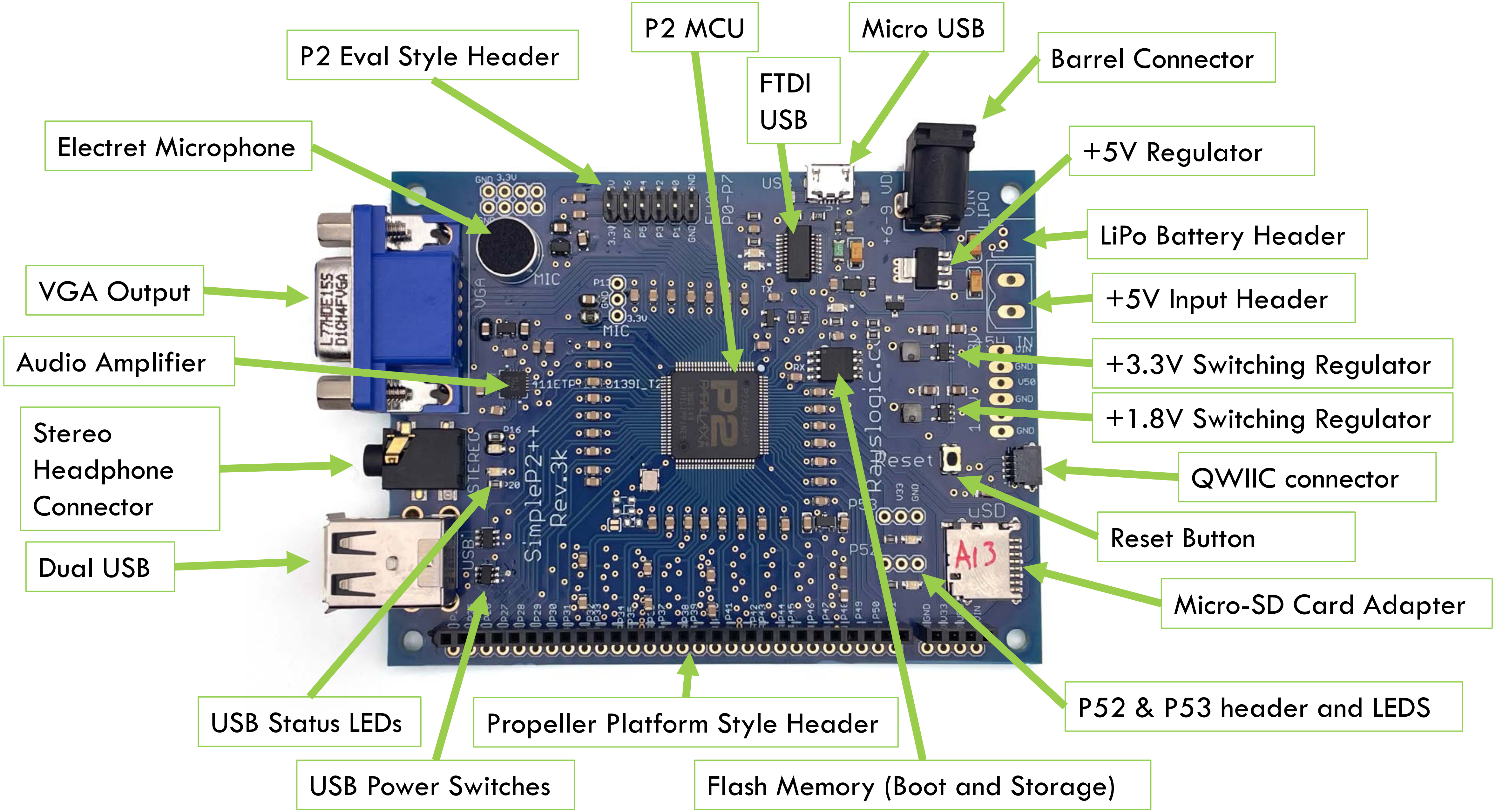


Front View



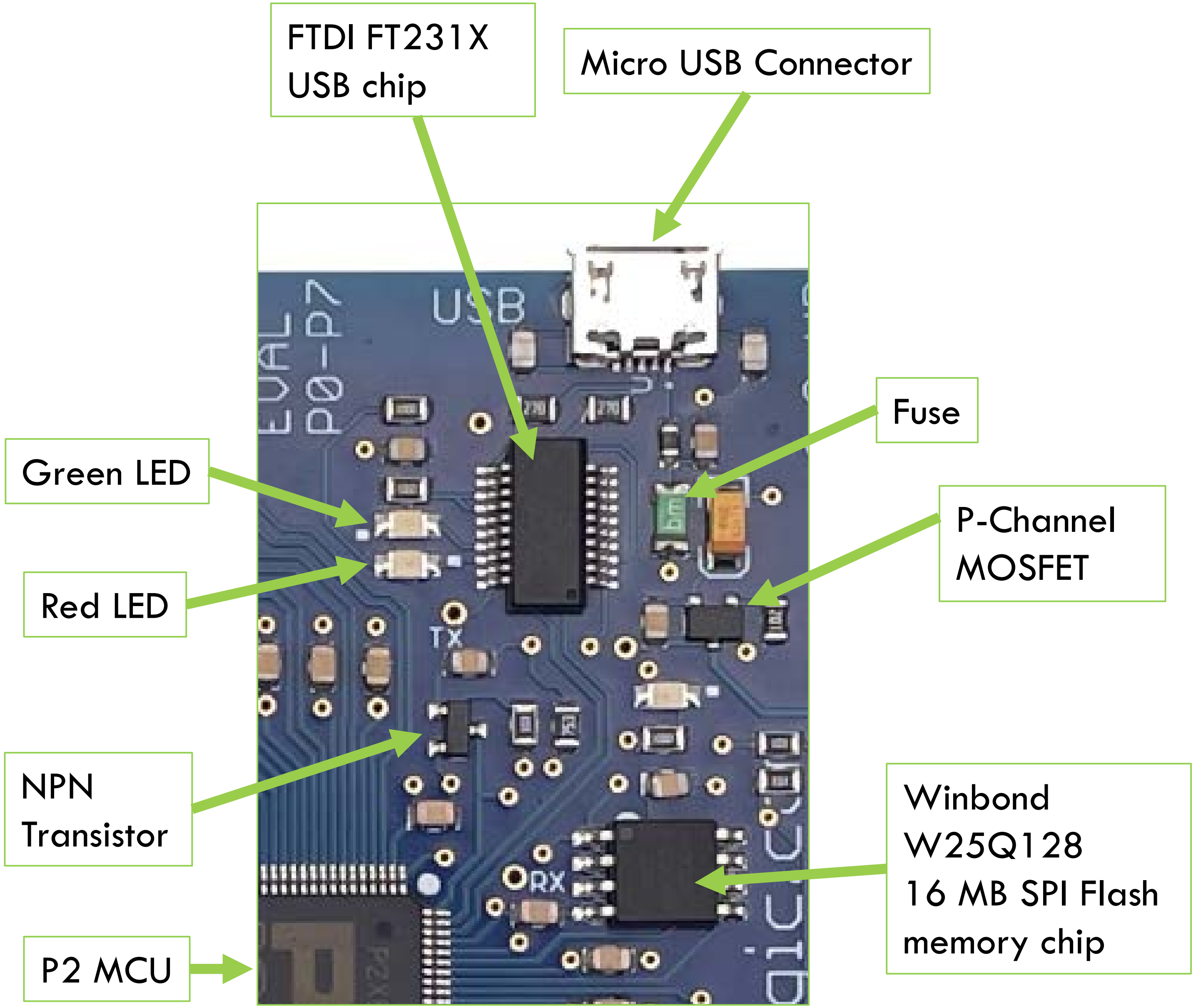
Back View

SIMPLE P2++ HARDWARE OVERVIEW



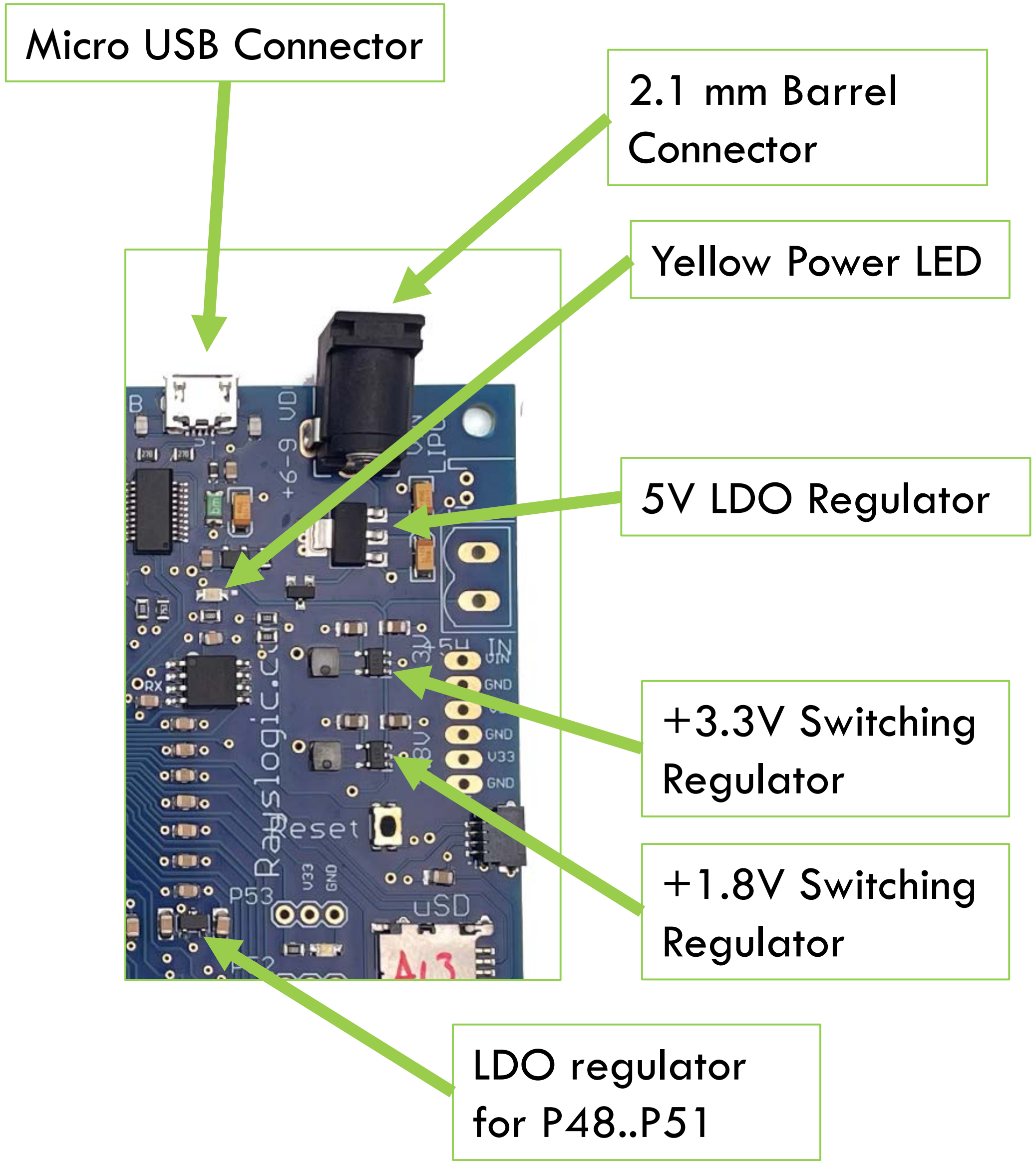
SIMPLE P2++ USB SERIAL INTERFACE AND FLASH OVERVIEW

- The FTDI FT231X chip converts USB signals into 3.3 V serial TTL logic signals for communication with P2 chip
  - Allows for programming of P2 RAM and also programming of Flash chip for booting
  - The Red LED lights when data is being sent from P2 to Computer
  - The Green LED lights when data is being sent from Computer to P2
  - A 500 mA self-resetting poly fuse protects the Computer USB port from overcurrent
  - A P-Channel MOSFET is gated by the FTDI chip to enable power from Computer, once USB communications are established
  - The NPN Transistor is enabled by the DTR serial control signal from the FTDI chip to reset the P2 chip and begin the programming sequence
- The Winbond W25Q128 is a 16 MB SPI Flash memory chip
  - The first 512 kB holds the boot code for the P2 and Simple P2++ board is configured to boot from flash at power up, unless an serial connection to a computer is established first
  - The remaining ~15 MB of flash memory can be used like a flash hard drive for file storage



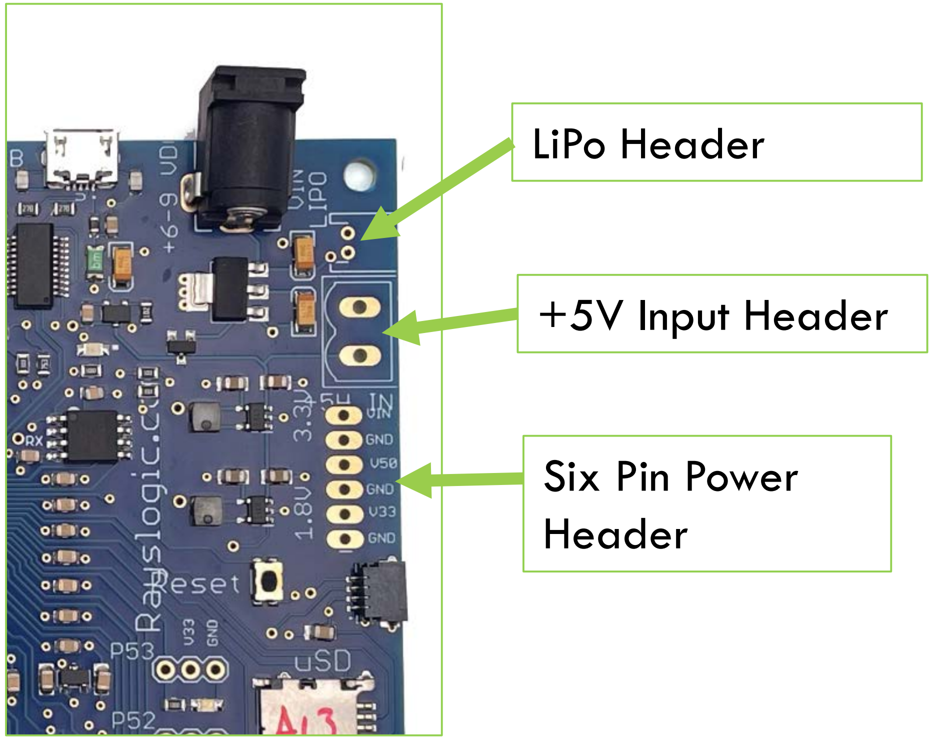
SIMPLE P2++ POWER SUPPLY OVERVIEW

- The Micro USB connector is the usual power source during development and testing
  - Note that you cannot use a USB charger to provide power this way because the FTDI USB chip only allows power when communications with a computer is established
  - Provides up to 500 mA of power, limited by poly fuse
- The Power Barrel Connector Jack (2.10mm ID, 5.50mm OD) provides a way to provide field use power or additional power, regulated by a 5V LDO regulator
  - There are USB to barrel connector cables that can be used with a USB charger to power the board as the LDO will pass on 5V
  - This power input goes to a +5V LDO regular, AZ1117IH, rated for 1 A
  - Input should be in the range of 6 to 9 VDC
  - Power from USB and here are isolated by a Schottky diode
- The main power for most I/O pins is provided by the +3.3V switching regulator and the main power for the P2 logic is provided by the +1.8V switching regulator
  - A Yellow LED is lit when +3.3V power is provided by the switching regulator
- There are three 3.3V LDO regulators to provide better analog performance for VGA, microphone, stereo audio, and also P48...P51 (shown here)



SIMPLE P2++ POWER HEADERS

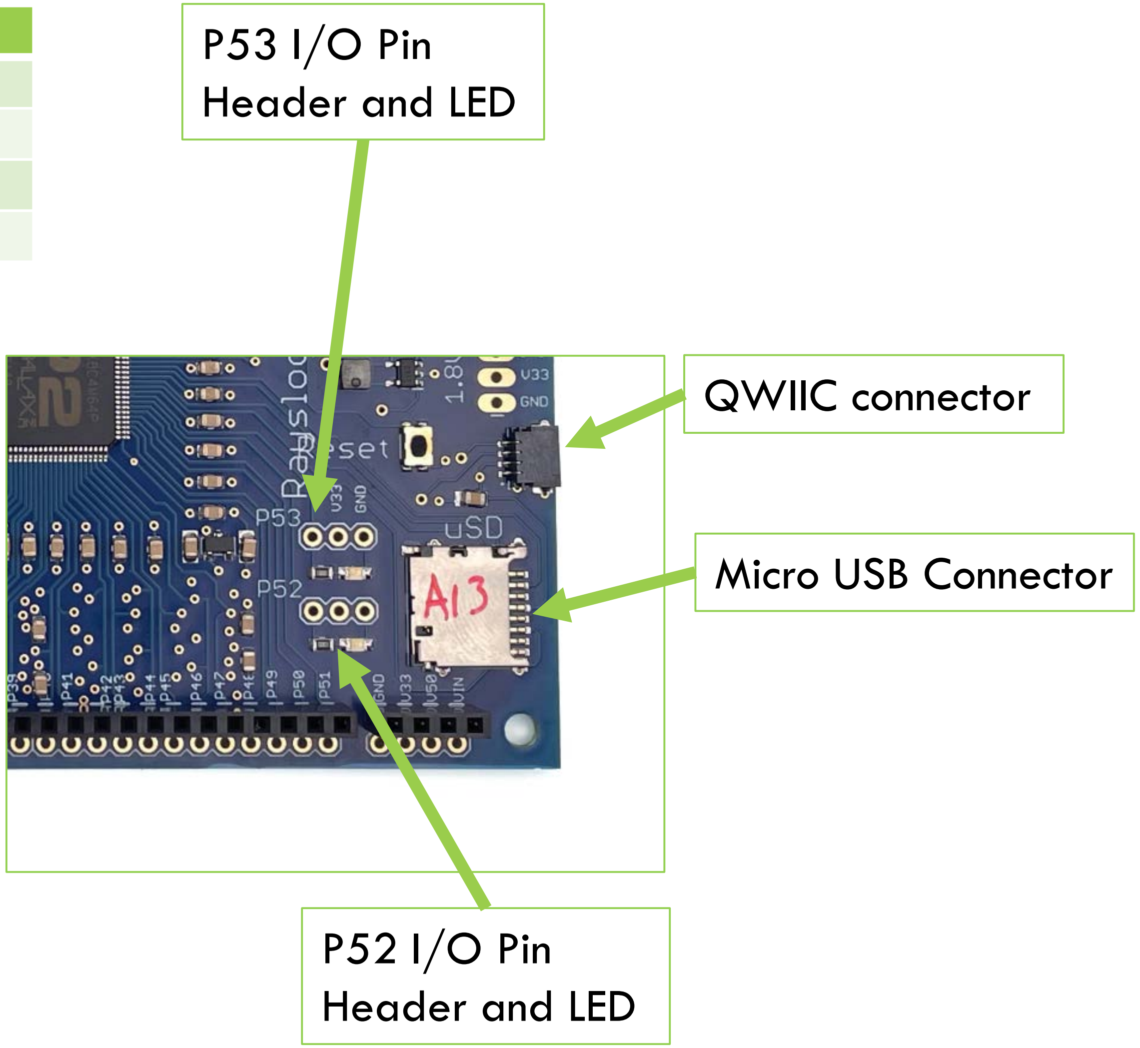
- A six-pin power header is provided for access to VIN, +5V, +3.3V, and GND
  - The six-pin header has 0.1” pin spacing
- Unpopulated LiPo and 5V headers are provide as additional ways to provide regulated power
  - These are wired in parallel and not meant to be used together
  - The 5V header has 5 mm spacing between pins
  - Input voltage should be in the range from 4.3 to 5.5 VDC
  - LiPo header is compatible with Sparkfun LiPo [JST battery connectors]



SIMPLE P2++ MICRO-SD AND P52..P53 OVERVIEW

- The Micro USB connector is provided for an easy way to add mass storage for input and output
  - Note that the pin used are different than used on other boards. Boards like the Parallax P2 Eval board share I/O pins for uSD with the flash chip. But with SimpleP2, the uSD gets it's own pins. This makes it possible to transfer files between uSD and onboard Flash chip.
  - Like most MCU boards, the uSD is accessed in SPI mode using the open MMC protocol
  - Cards up to 32 MB in size can be fully accessed in MMC mode. Larger size cards can be used, but need to be formatted as 32 MB FAT32
- I/O Pins P52 and P53 have onboard blue LEDs with series 100 Ohm resistors
  - Can be used as general purpose indicators for things like debugging
  - A three pin header is also provided for other usage
  - Drive these I/O pins high to light the LED
  - These pins are also used for I2C connectivity using the QWIIC connector. Sparkfun and Adafruit sell accessories that can be easily connected here. SeeedStudio has a similar system with a larger connector that can be used with adapter cables.

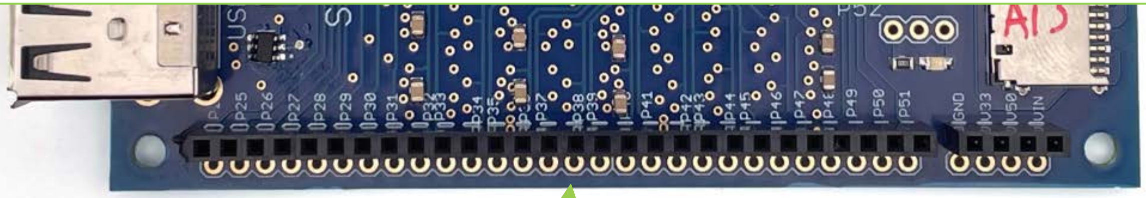
uSD Signal	I/O Pin
MISO	54
CLK	55
MOSI	56
CS	57



SIMPLE P2++ PROPELLER PLATFORM STYLE HEADER

- The SimpleP2 copies the I/O pin header style of the Propeller Platform board for the Parallax Propeller 1
  - There are two rows of I/O and power pins with 0.1" spacing that are connected together.
  - The top row is populated with a female header to allow easy usage without soldering
  - The bottom row is free for other use, can be populated by the user with a male header for connecting to a solderless breadboard
  - There are 28 I/O pins available on the header, P24…P51
    - Some of these I/O pins can optionally be used for PSRAM memory that can be soldered to the underside of the SimpleP2 board
    - P48…P51 are special in that their VIO power comes from an LDO regulator instead of the switching regular for less noise which is better for analog applications
- Note: +5V and VIN are present on the four pin power header. DO NOT connect these directly to any I/O pins as P2's I/O pins are not 5V tolerant and this will damage your P2 chip!!!

Example of a Propeller 1 Propeller Platform Board

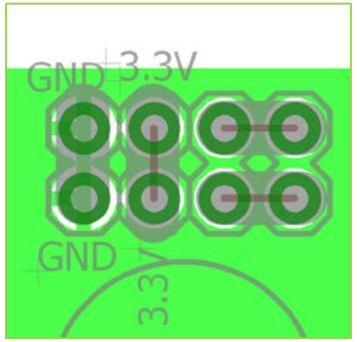


I/O Pin Header for P24..P51

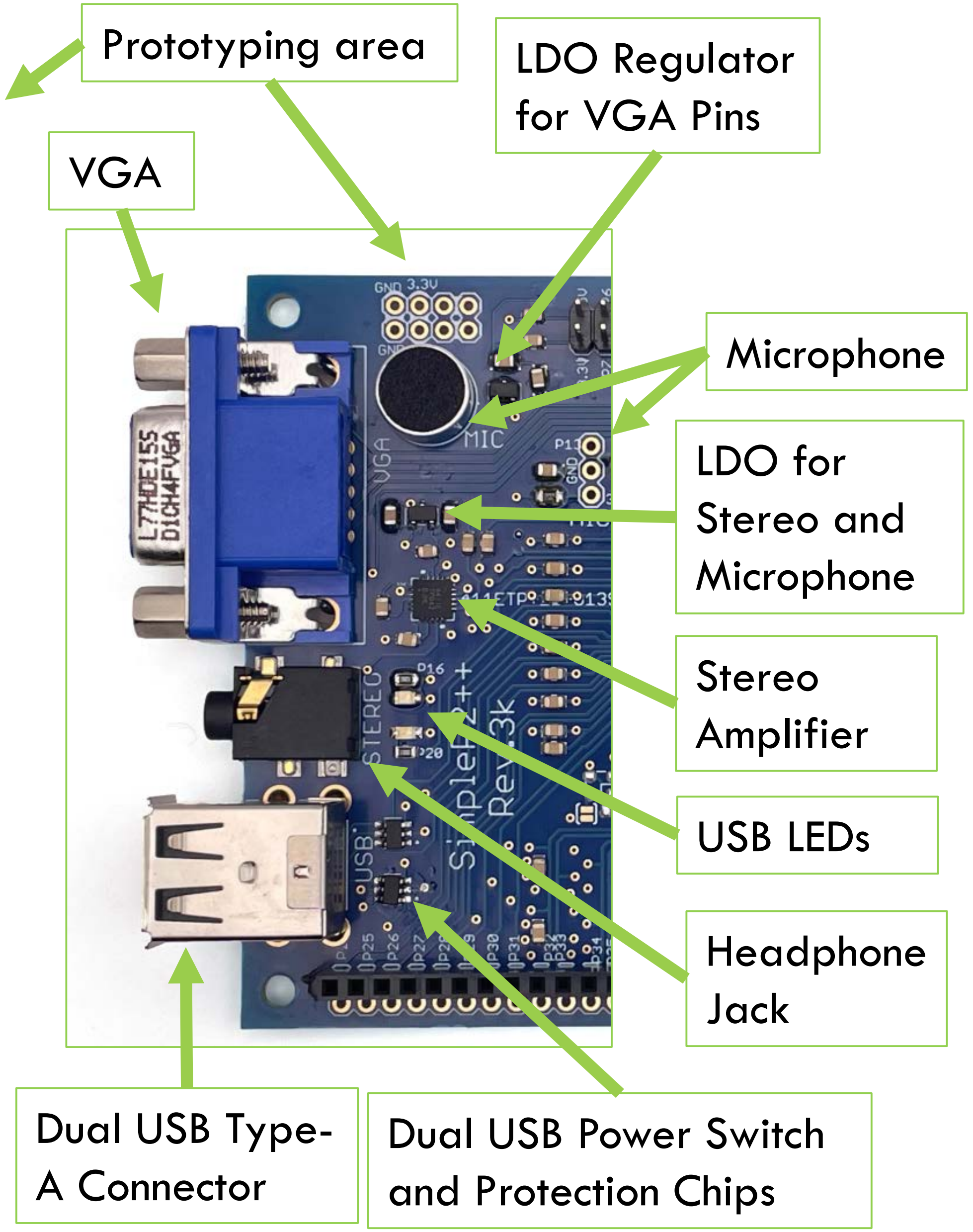
Power Header

SIMPLE P2++ VGA, STEREO, USB, AND MICROPHONE

- There are several versions of the SimpleP2 board that each have different things on the left edge for I/O Pins P8…P23
  - The SimpleP2++ variant uses these pins for VGA, stereo, USB, and microphone
  - There is also a very small prototyping area with two pins of GND, two pins of 3.3V, and two rows of two pins that are connected to each other
  - Giving the pins fast VGA signals their own LDO regulator provides a very clean analog video output free from interference from other I/O pins
  - Similarly, giving the stereo and microphone their own LDO regulator gives very low noise performance
- The P2 can display VGA resolutions of up to 1080p directly from P2 I/O pins P8…P12
- The Electret microphone can be used by P13 in ADC mode with 100X internal gain to record audio input and speech
  - A three pin header is also provided for other usage, such as with a powered microphone module from Sparkfun
- Stereo analog is amplified by a MAX4411 audio amplifier before going to headphone jack
- A Dual USB jack is provided with dual TPD3S014 power switch and protection chips

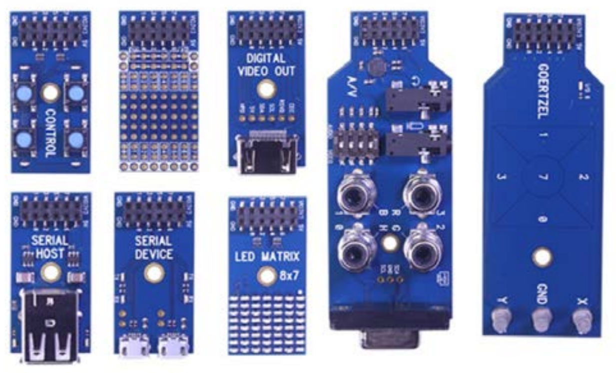


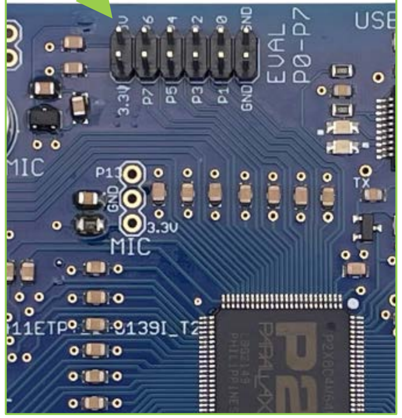
I/O Pin	Usage
8	VGA HSync
9	VGA Blue
10	VGA Green
11	VGA Red
12	VGA VSync
13	Microphone
14	Stereo Left
15	Stereo Right
16	Lower USB LED
17	Lower USB PWR Enable
18	Lower USB D-
19	Lower USB D+
20	Upper USB LED
21	Upper USB PWR Enable
22	Upper USB D-
23	Upper USB D+



SIMPLE P2++ EVAL STYLE HEADER

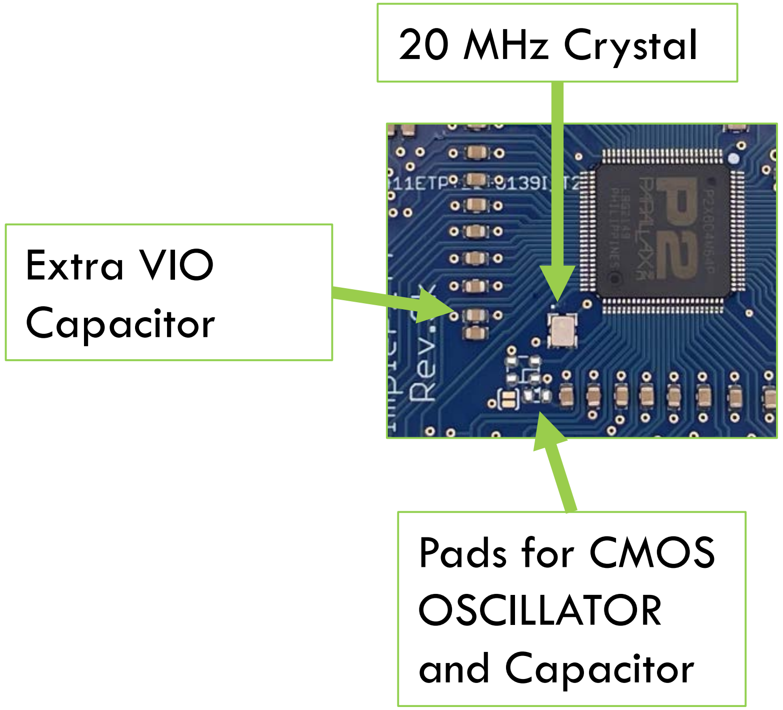
- The P2 I/O Pins P0…P7 are brought out to a 12-pin header in the style of the Parallax Propeller II Eval board
  - Allows for direct usage of several [Accessory Boards sold by Parallax]
  - There are also some third party boards for the Eval Style Header such as our own 24 MB PSRAM module
- Note: +5V is present on the Eval style header. DO NOT connect this directly to any I/O pins as P2's I/O pins are not 5V tolerant and this will damage your P2 chip!!!





SIMPLE P2++ CRYSTAL AND CLOCK CIRCUIT

- Like the P2 boards sold by Parallax, the SimpleP2++ board comes with a 20 MHz crystal that the P2 uses to generate the system clock
- Pads are provided in case one would like to remove the crystal and install a CMOS level oscillator instead, such as the [ECS-TXO-2520-33-200-AN-TR]
- Note that the crystal circuit is part of the P28…P31 pin group. Damaging these pins by connecting to >4 VDC can make the crystal circuit non-functional along with the whole pin group.

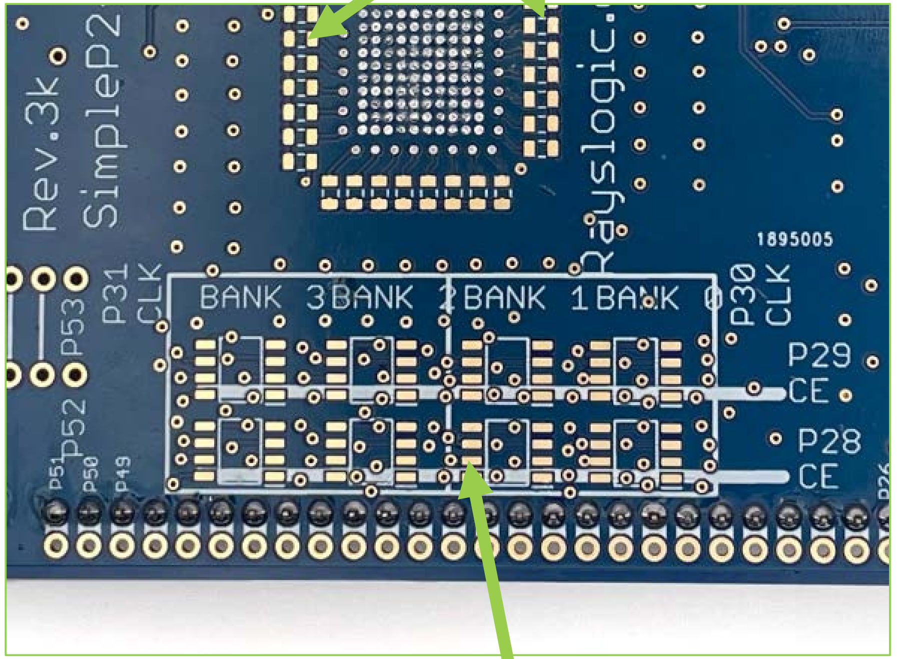


SIMPLE P2++ OPTIONAL EXPANDED MEMORY ON BOTTOM OF PCB

- On the bottom of the SimpleP2++ there are eight pads available for mounting APS6404L-3SQR-SN memory chips (available from Mouser).
  - Note that P2 pins used for this memory is shared with the Propeller Platform style header.
  - It is possible (but not exactly recommended) to share these P2 pins with other things as long as the P28 and/or P29 chip enable pins are controlled
  - These chips operate in SQI mode forming a fast, 4-bit, bus.
- A single memory chip is enough for many applications including VGA buffer and game emulator.
- The up to eight chips are arranged in four banks (Bank0…Bank3) and two rows.
  - The row closest to the P2 should probably be populated first, this row is enabled by P29 and the outer row by P28
  - The first bank should probably be populated first in order to keep the control pins contiguous
- There are many memory configurations one can consider
  - The basic would be a single chip on Bank 0, inner row
  - Next might be both rows on Bank 0 or Bank 0 and Bank 1 on inner row
  - It is possible to have two independent memories by populating, for example, Bank 0 and Bank 1 on the inner row and Bank 2 and Bank 3 on the outer row to form two independent 8-bit banks.
  - Of course, fully populating all 8 chips works as we as populating a single row.
- You may notice a ring of unpopulated pads surrounding the P2 chip on the bottom
  - These are for adding additional capacitors for all the VIO and VDD voltage pins of the P2

I/O Pin	Usage
28	Outer CE
29	Inner CE
30	Banks 0&1 CLK
31	Banks 2&3 CLK
32	Bank 0 DAT0
33	Bank 0 DAT1
34	Bank 0 DAT2
35	Bank 0 DAT3
36	Bank 1 DAT0
37	Bank 1 DAT1
38	Bank 1 DAT2
39	Bank 1 DAT3
40	Bank 2 DAT0
41	Bank 2 DAT1
42	Bank 2 DAT2
43	Bank 2 DAT3
44	Bank 3 DAT0
45	Bank 3 DAT1
46	Bank 3 DAT2
47	Bank 3 DAT3

Pads additional VIO and VDD capacitors



Pads for PSRAM expanded memory

SIMPLE P2++ OPEN SOURCE HARDWARE/SOFTWARE DESIGN

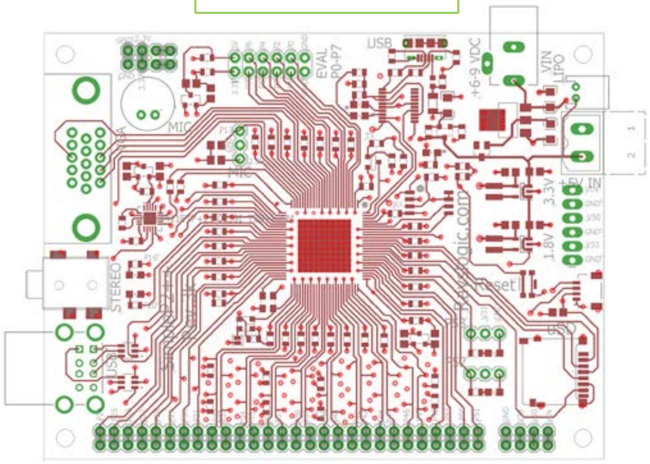
- The SimpleP2++ is an open source hardware design with Eagle 6.0 source files and gerbers provided free for commercial and non-commercial purposes
- All the source code examples for SimpleP2++ has a permissive, MIT license

open source
hardware

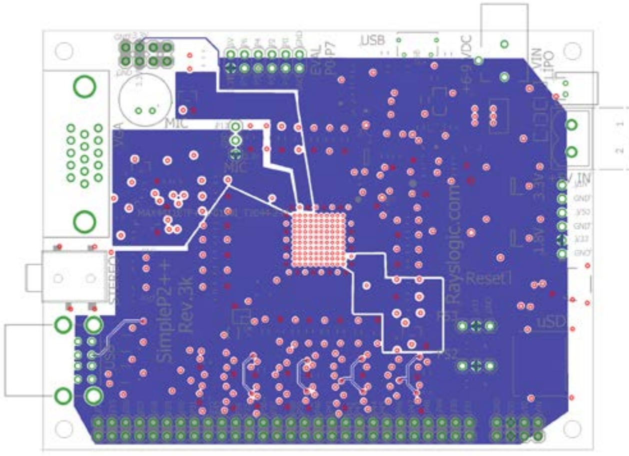
SIMPLE P2++ PCB LAYER IMAGES

- The SimpleP2++ is a four layer board with top layer mostly used for I/O wiring, middle layers for power, and bottom layer for ground

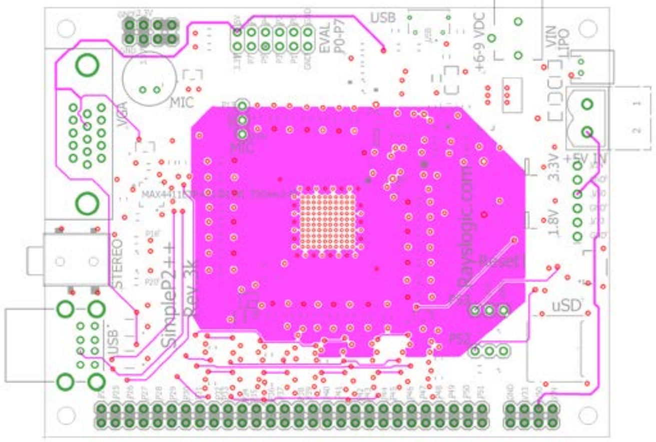
Top Layer



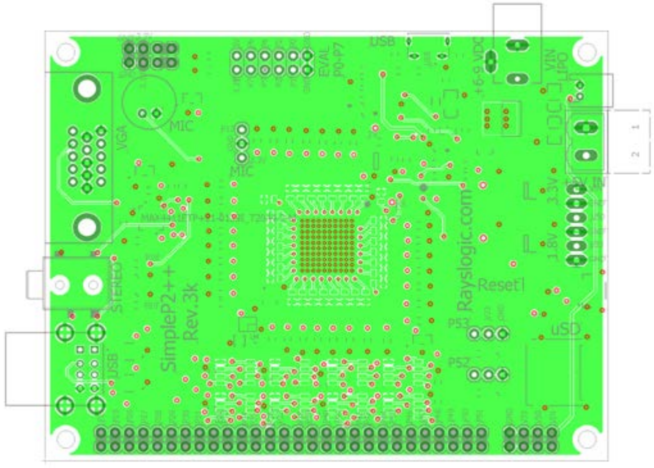
Layer 2 (mostly 3.3 V fill)



Layer 2 (mostly 1.8 V fill)

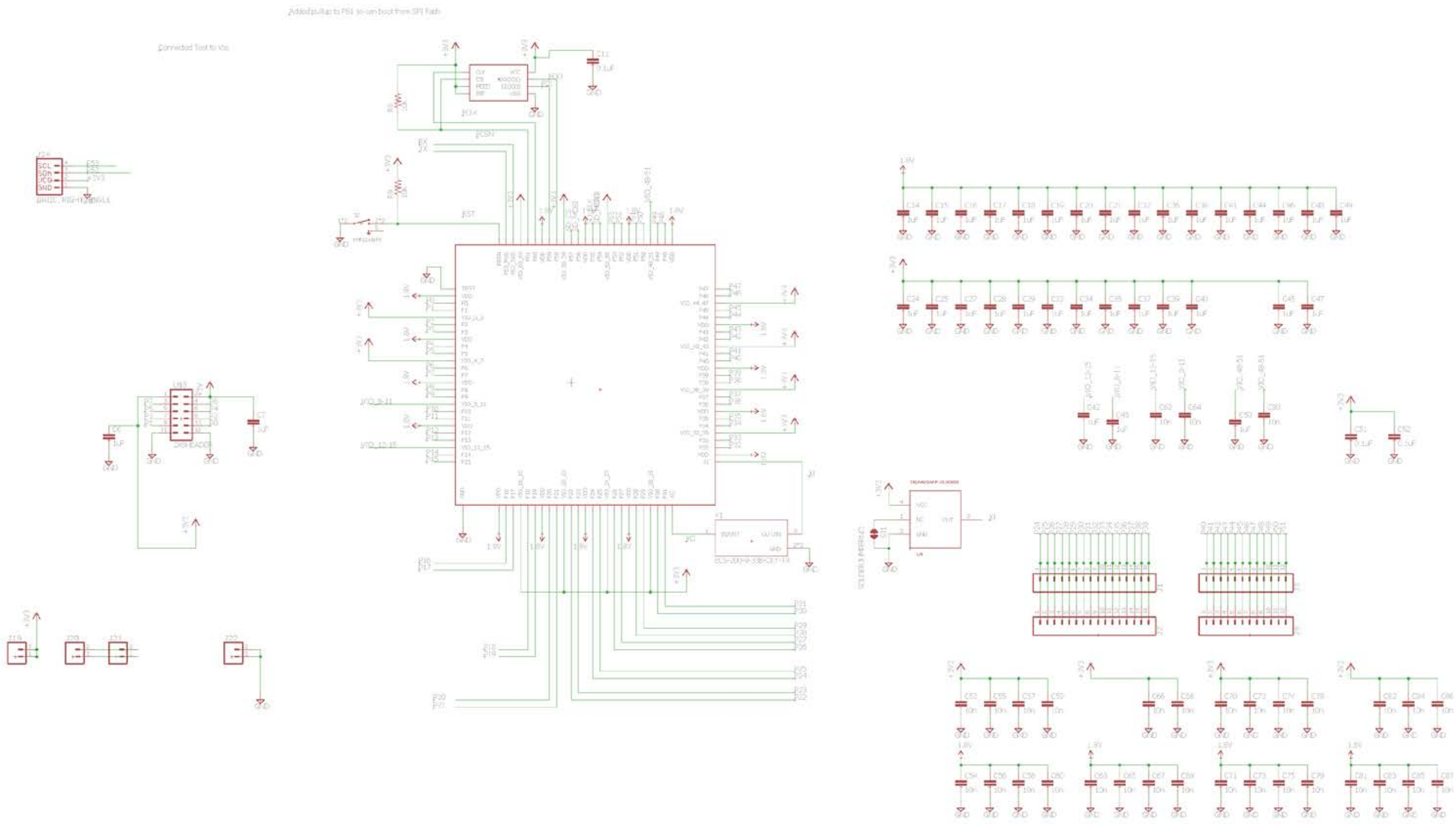


Bottom Layer (mostly GND fill)



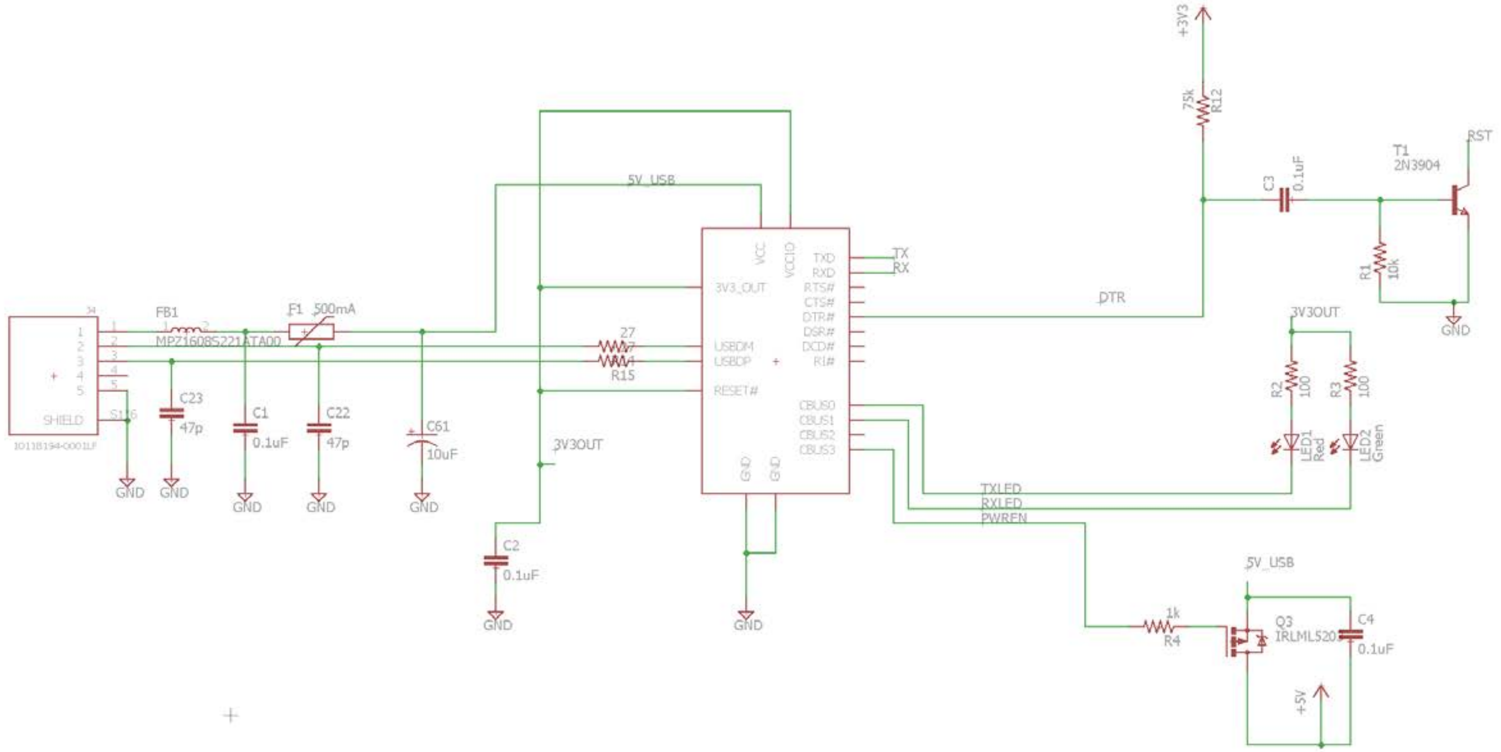
SIMPLE P2++ WIRING SCHEMATIC PAGE 1

- With P2 chip, flash chip, eval header, propeller platform style header, crystal, cmos oscillator, reset switch, and QWIIC connector



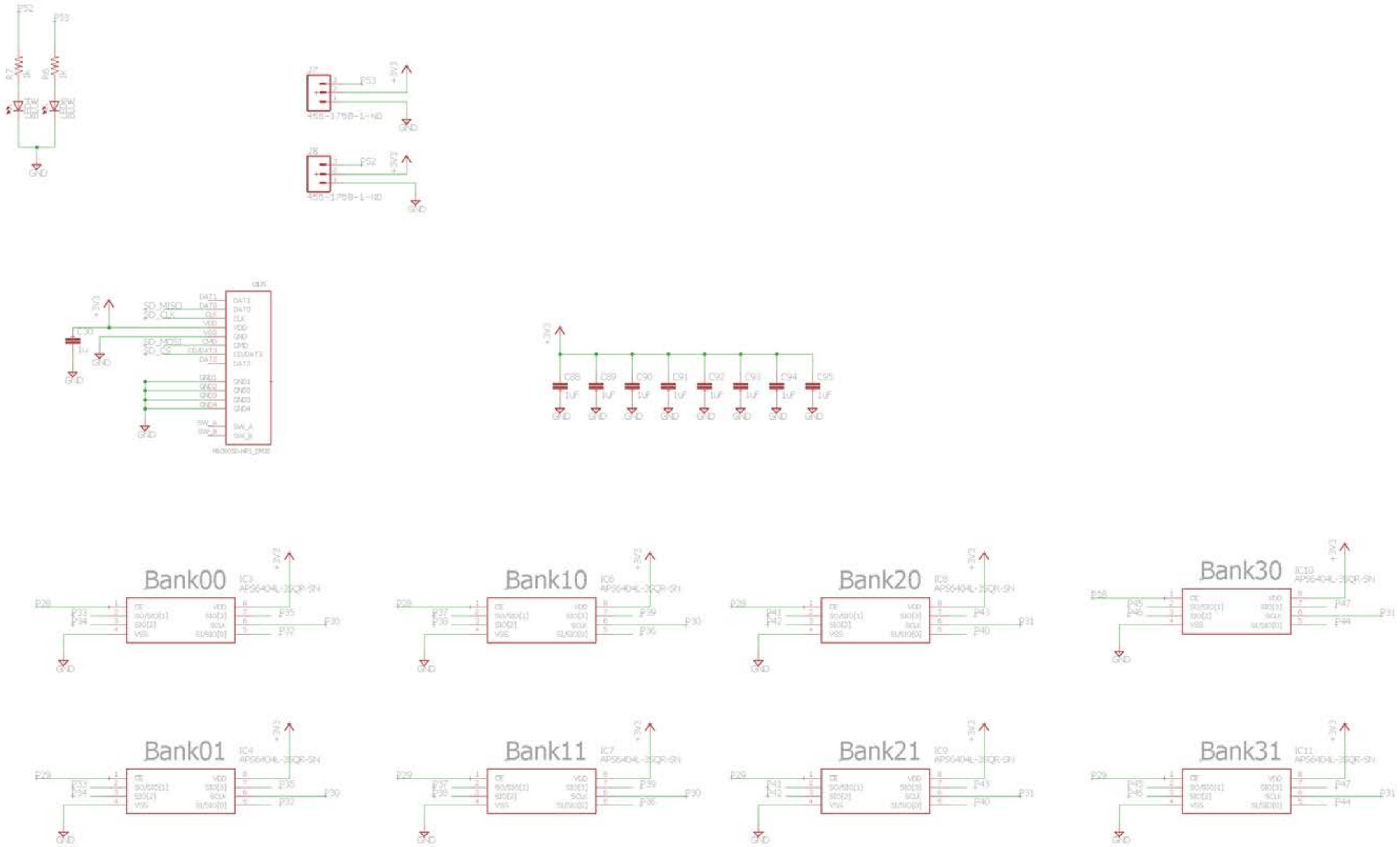
SIMPLE P2++ WIRING SCHEMATIC PAGE 2

- With FTDI USB Serial Chip, Micro-USB connector, reset circuit, and USB power circuit



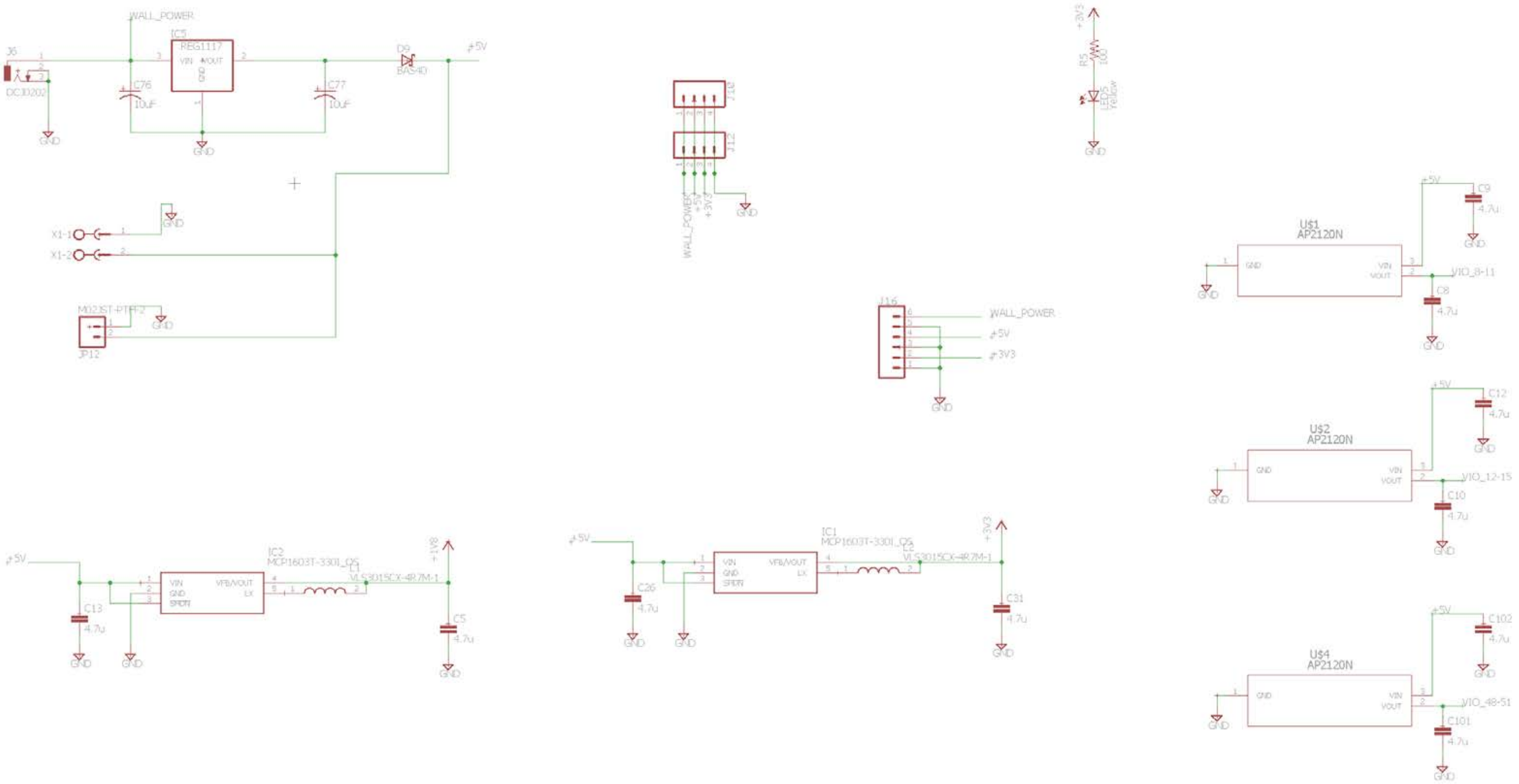
SIMPLE P2++ WIRING SCHEMATIC PAGE 3

- With uSD card circuit, PSRAM circuit, and P52/P53 LED and header circuits



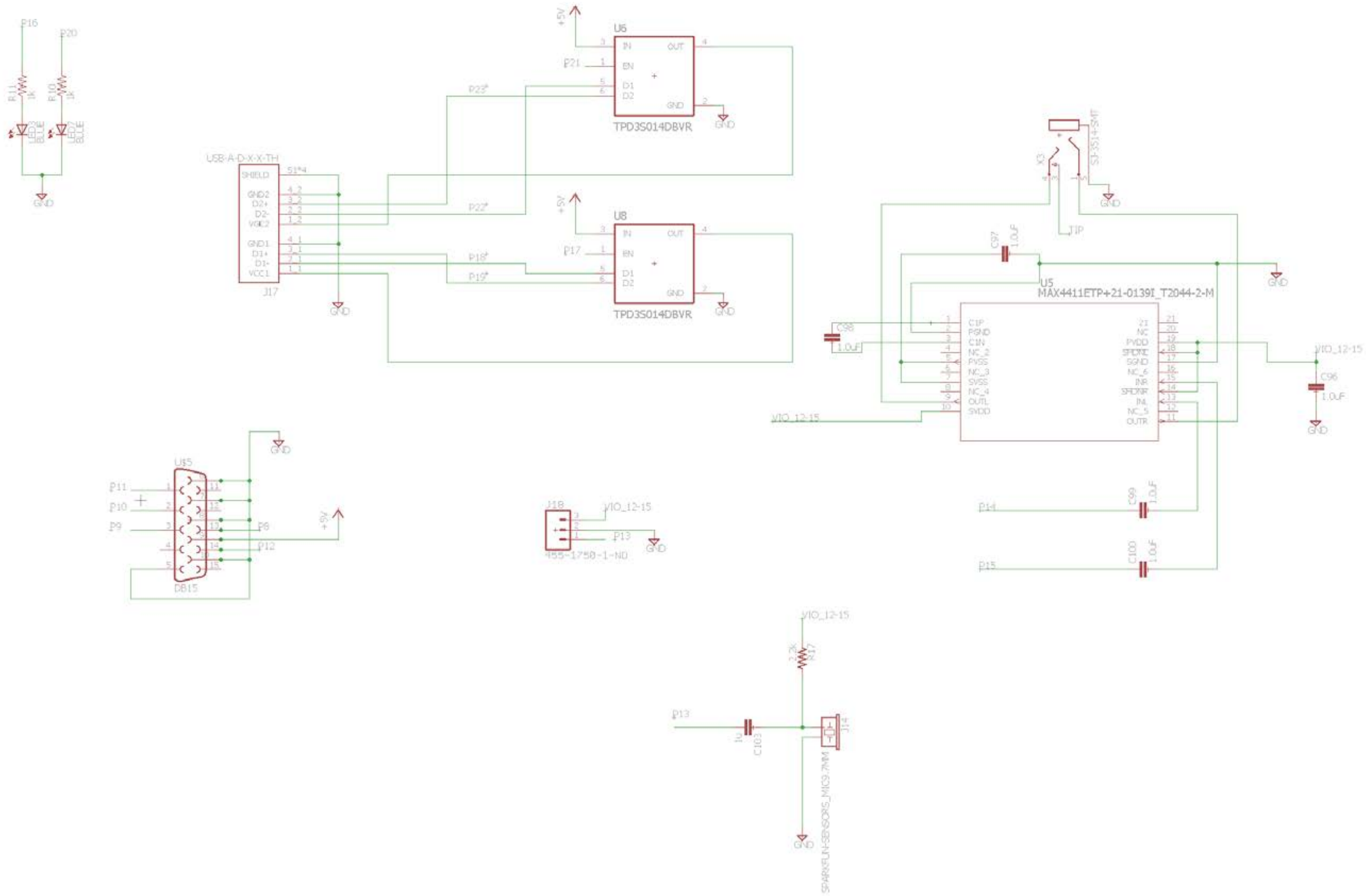
SIMPLE P2++ WIRING SCHEMATIC PAGE 4

- With 3.3V and 1.8 switching power supplies, power connectors, LDO supplies, and power LED



SIMPLE P2++ WIRING SCHEMATIC PAGE 5

- With dual USB host connector and power switches, audio amp, microphone, VGA, and USB activity LEDs



THANK YOU!

- Enjoy your SimpleP2++ board
- Visit the product page at rayslogic.com for more info and example code