OPEN SOURCE | FLIGHT CONTROLLER | BLADE INDUCTRIX | TINY WHOOP

ALIENWHOOP
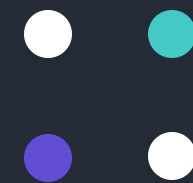
STMicro F4 or F7

MPU 9250 or 6500

ALIENWHOOP
...Take Me To Your Leader-Board...

DIY ALIENWHOOP ASSEMBLY

REFERENCE MANUAL

#1

BILL OF MATERIALS

CHECK YOUR CART
SEVERAL TIMES BEFORE BUYING

01 TAKE THE TIME TO CAREFULLY CREATE YOUR SHOPPING CART

02 PAST DIY HAVE HAD SUCCESS WITH MOUSER, DIGI-KEY, FARNELL, AND EVEN EBAY OR HARVESTING COMPONENTS FROM OLD CIRCUIT BOARDS

03 BUY EXTRA SMALL PARTS SUCH AS CAPACITORS, RESISTORS, AND LEDS. THEY'RE EASY TO LOSE

04 DON'T FORGET TO ORDER SOLDER PASTE, FLUX, ESD , ETC (SEE APPENDIX A)

**05** FEEL FREE TO ASK QUESTIONS VIA FACEBOOK MESSENGER FB.ME/ALIENWHOOP

Bill of Materials

	Value	Device	Package	Parts/Silkscreen Label	Description	MF	MPN
1	Value	Device	Package	Parts/Silkscreen Label	Description	MF	MPN
2	.01uF	Capacitor 0.01 uF	0603	C3	CAPACITOR	Murata	GRM188R71C103KA01D
3	.1uF	Capacitor 0.10 uF	0603	C2, C5, C6, C8, C9, C11, C12, C14	CAPACITOR	Murata	GRM188R71C104KA01D
4	10uF	Capacitor 10.0 uF	0805	C1, C4	CAPACITOR	Taiyo Yuden	JMK212AB7106KG-T
5	1uF	Capacitor 1.00 uF	0603	C13	CAPACITOR	Murata	GRM188R71C105KA12D
6	4.7uF	Capacitor 4.70 uF	0603	C7, C10	CAPACITOR	Murata	GRJ188C70J475KE11D
7	4.7uF	Capacitor 4.70 uF	0603	C15	CAPACITOR	Murata	GRJ188C70J475KE11D
8	FDMA410NZ	MOSFET	UMLP-6	Q2, Q3, Q4, Q5	MOSFET 20V Single N-Ch 1.5V (9.5 amp continuous, 23 amp pulsed)	Fairchild	FDMA410NZ
9	1S (3.8V)	Connector JST PH 2.0	S2B-PH-K-S	BAT	1S LIPO connector to make PowerWhoop 2.0 pigtail w/24AWG wire and heatshrir	JST	S2B-PH-K-S
10	SBUS	Connector 3-pin Receiver	S3B-ZR	RX	3 Pin Receiver (optional.. Used if not directly soldering satellite rx to through hol	JST	S3B-ZR
11	105133-0011	Vertical USB Port	1051330011-SD	USB	Molex USB Connectors uUSB B Rec Vertical TH 2.30	MOLEX	105133-0011
12	IRLML6402	MOSFET-P	SOT-23	Q1	P-Channel MOSFET	IR	IRLML6402
13	MPU-6500	MPU-6500 Gyro/Acc	QFN24_PAD	U2	Invensense MPU-6500 6-axis motion processor gyro accelerometer NO COMPASS	INVENSENSE	MPU-6500
14	MPU-9250	MPU-9250 Gyro/Acc/Mag	QFN24_PAD	U2	Invensense MPU-9250 9-axis motion processor gyro accelerometer compass	INVENSENSE	MPU-9250
15	2.2uH	Inductor 2.2 uH	TFM201610ALMA	L1	Thin Film Metal Inductor substituted for Taiyo Yuden	Taiyo Yuden	TFM201610ALMA2R2MTAA
16	53047-0210	Connector Brushed Motor	PICO-53047-02	M1, M2, M3, M4	Motor Connector	MOLEX	53047-0210
17	0R	Resistor 0.00 Ohms	0603	C15	RESISTOR used as Jumper	Yageo	RC0603FR-070RL
18	0R	Resistor 0.00 Ohms	0603	C7, C10	RESISTOR used as Jumper	Yageo	RC0603FR-070RL
19	10K	Resistor 10K Ohms	0603	R1, R2, R3, R4, R5	RESISTOR	Vishay	CRCW060310K0FKEAHP
20	8mhz	Resonator 8 MHz	RESONATOR_8	Y1	SMD Ceramic Resonators	Murata	CSTCE8M00G55-R0
21	BLUE	LED (blue as spec'd only!)	0805	LED0, LED1, PWR	SMD CHIP LED	Kingbright	APHCM2012QBC/D-F01
22	STM32F4/F7	STM32F405RGT	LQFP64	IC1	ARM 32-bit Cortex™-M3 168 MHz CPU		STM32F405RGT6
23	STM32F4/F7	STM32F722RET	LQFP64	IC1	ARM 32-bit Cortex™-M4 216 MHz CPU		STM32F722RET6
24	TPS63001	TPS630XX-TPS63001	VSON-N10	U1	Buck/Boost Converter	TI	TPS63001DRCR
25	AW-F4-BR-V2-PCB	AW-F4-BR-V2-PCB	PCB	PCB	PCB 0.8mm thick 2oz copper	OSH Park	AlienWhoop F7 DIY MIX
26							
27	* Yellow highlighted rows are for F4 builds or in case of MPU-9250 optional upgrade for compass/mag						
28	** LED circuits lack current limiting resistor so only specified blue LED can be used for LED0 and LED1						

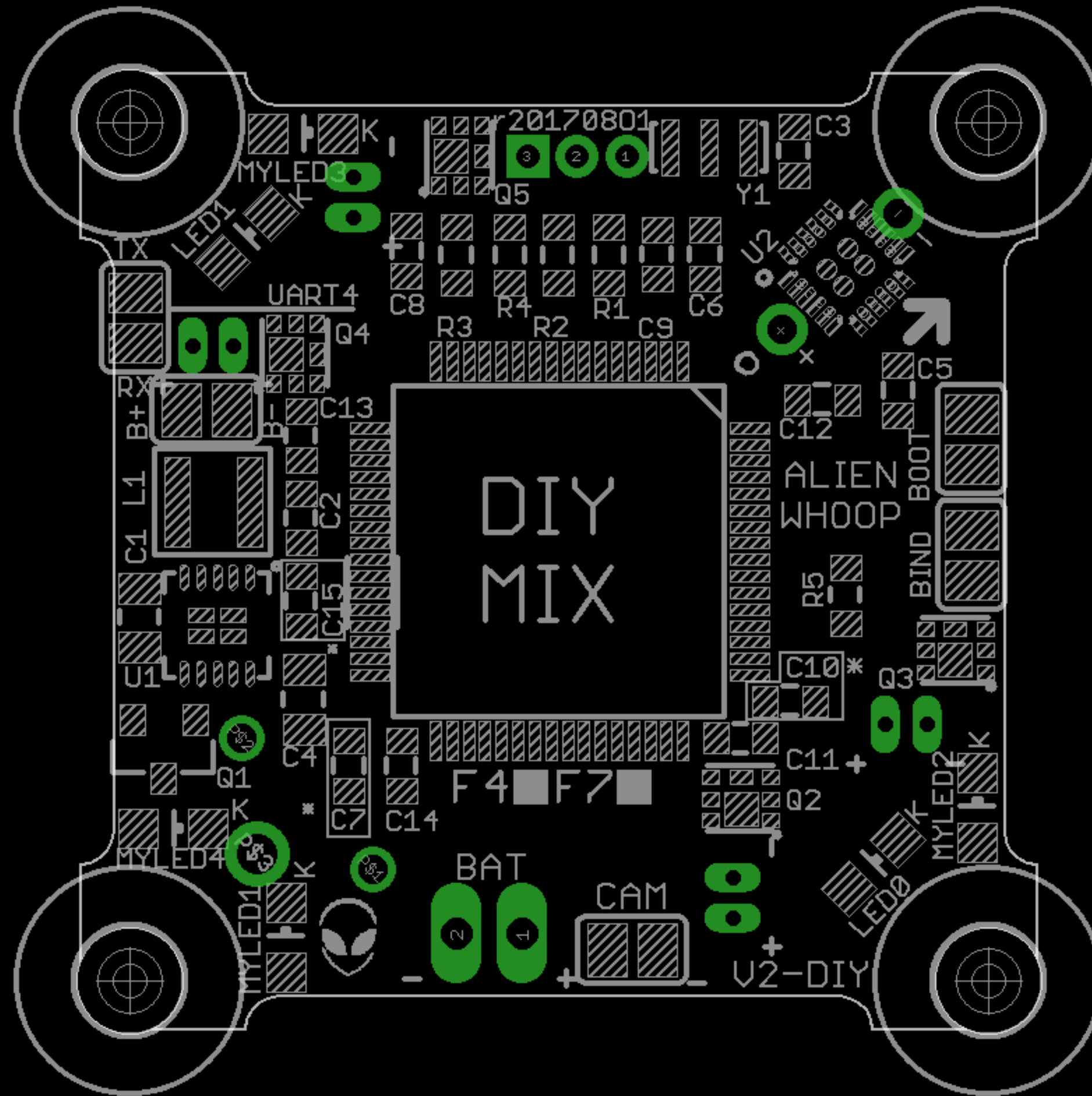* Yellow highlighted rows are for F4 builds or in the case of MPU-9250 optional upgrade for compass/mag

#2
SOLDERING COMPONENTS
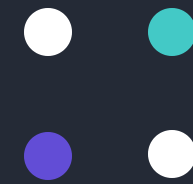
A GOOD METHOD FOR DIY IS TO FIRST PLACE THE F7 MCU AND ENSURE NO SOLDER BRIDGES BEFORE MOVING ON TO GYRO AND BUCK BOOST AND FINALLY PASSIVES AND THROUGH HOLE AT THE VERY END

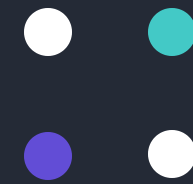Do the top side first; then the bottom

DO THE TOP SIDE FIRST SKIPPING THROUGH HOLE COMPONENTS. THEN DO THE BOTTOM SMD FIRST LIKE THE POWER LED. THEN DO THE USB. THEN TEST THE BOARD FOR POWER AND FLASH BOOTLOADER
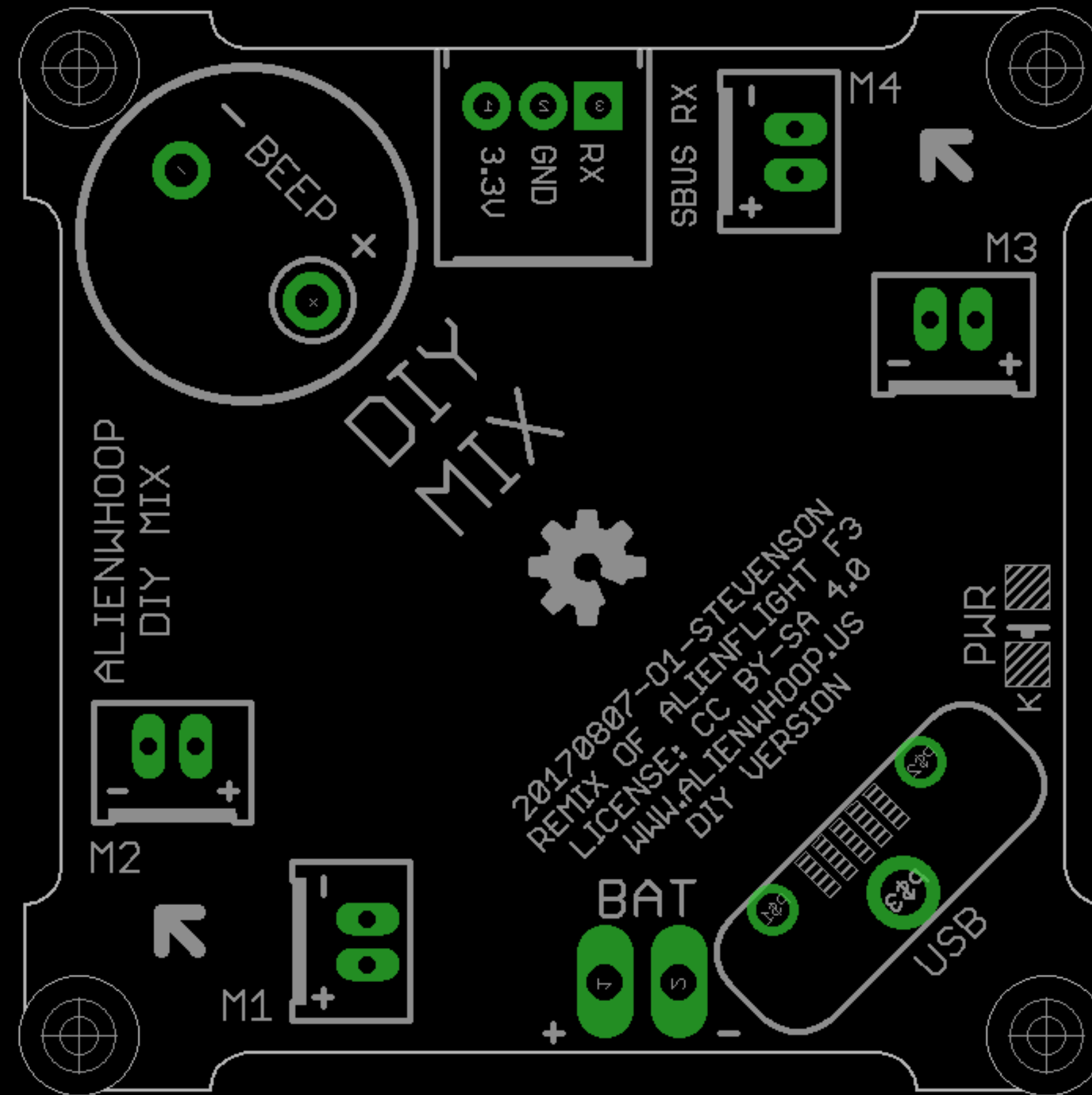
Save plugs and beeper until after flashing

#3

## BEFORE YOU POWER UP FOR THE FIRST TIME

CHECK FOR SOLDER BRIDGES AND MISALIGNMENT

01 LOOK CLOSELY WITH A LOUPE AND VISUALLY INSPECT PINS AND COMPONENTS FOR PERFECTION

02 USE A MULTIMETER IF IN DOUBT TO ENSURE NO SHORT CIRCUITS BETWEEN POWER AND GROUND

03 CLEAN WELL ISOPROPYL ALCOHOL AND OLD TOOTHBRUSH

04 COMPARE YOUR BOARD WITH REFERENCE PHOTOS ON FB.ME/ALIENWHOOP OR GITHUB WIKI

#4

INSTALL
SOFTWARE
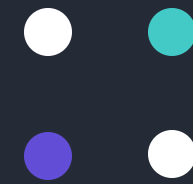
SETUP YOUR COMPUTER

ENSURE YOUR COMPUTER IS SETUP WITH
THE APPROPRIATE DRIVERS FOR
FLASHING CLEANFLIGHT OR BETAFLIGHT.
AT THE MOMENT ONLY BETAFLIGHT 3.2
IS OFFICIALLY SUPPORTED

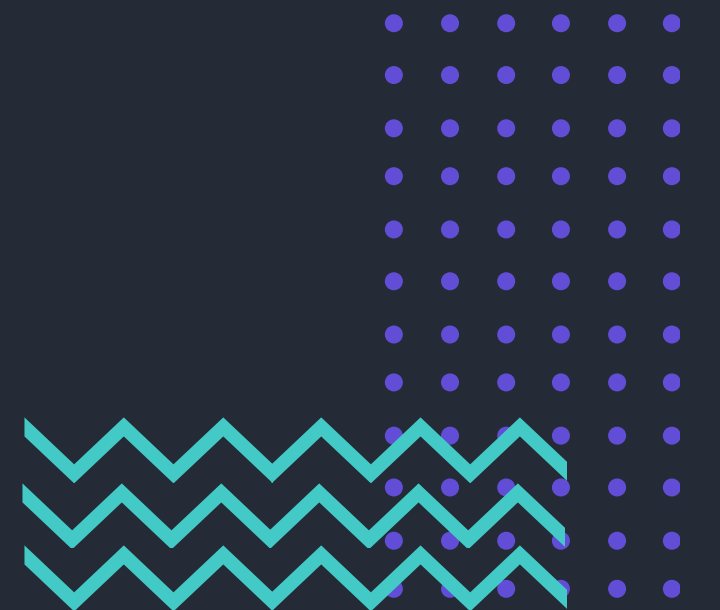https://github.com/betaflight/betaflight/wiki/Installing-Betaflight
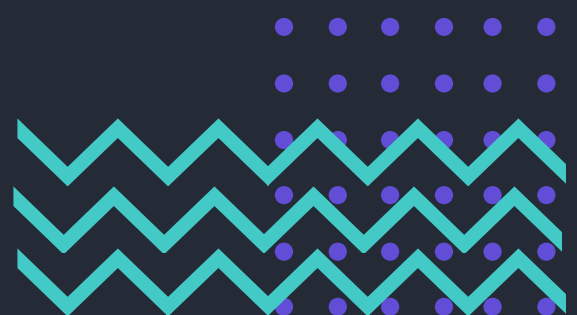
#5

CONNECT USB CABLE

GOT BLUE LIGHT?

AFTER PLUGGING IN THE USB CABLE YOU SHOULD SEE THE LED LABELED PWR ON THE BOTTOM OF THE BOARD ILLUMINATE. YOUR COMPUTER MIGHT PLAY A SOUND OR DISPLAY A NOTIFICATION THAT A DEVICE HAS CONNECTED.

FLASHING BETAFLIGHT RELEASE CANDIDATE

01   BEND A STAPLE OR APPLY A BLOB OF SOLDER TO BRIDGE THE BOOT PADS ON THE FLIGHT CONTROLLER

02   RECONNECT THE USB AND THE FLIGHT CONTROLLER SHOULD BE AVAILABLE TO FIRMWARE FLASHER

03   SHOW UNSTABLE RELEASES AND FULL CHIP ERASE

04   CHOOSE ALIENWHOOPF7 (OR F4 IF YOU USED F4 CHIP)

05   LOAD FIRMWARE (ONLINE) AND FLASH FIRMWARE

BETAFLIGHT
CONFIGURATOR 3.2.1

DFU

Auto-Connect

Connect

2017-08-07 @ 23:45:28 -- Using cached release information.

Show Log

- Welcome
- Documentation & Support
- **Firmware Flasher**

ALIENWHOOPF7 ▼   1

Select your board to see available online firmware releases - Select the correct firmware appropriate for your board.

3.2.0-RC3 - ALIENWHOOPF7 - 31-07-2017 17:26 ▼

Select firmware version for your board.

No reboot sequence   2

Enable if your FC is in boot mode. i.e. if you powered on your FC with the bootloader pins jumped or whilst holding your FC's BOOT button.

Full chip erase ✓

Wipes all configuration data currently stored on the board.

Manual baud rate   256000 ▼   3

Manual selection of baud rate for boards that don't support the default speed or for flashing via bluetooth.
Note: Not used when flashing via USB DFU

Show unstable releases

Show Release-Candidates and Development Releases.

Release info

Target: ALIENWHOOPF7
Name/Version: 3.2.0-RC3
Binary: betaflight_3.2.0_ALIENWHOOPF7-52-981df1d54.hex
Date: 31-07-2017 17:26
State: release-candidate
Release notes:

  ## Betaflight 3.2.0 RC3

  Please read the [Instructions for Upgrading](https://github.com/betaflight/betaflight/wiki/BetaFlight-3.2#instructions-for-upgrading).

  ### New:
  - Full F7 support (@sambas @blckmn)
  - [SITL](http://ardupilot.org/dev/docs/sitl-simulator-software-in-the-loop.html) simulator support (@cs8425)
  - Added crosshairs to CMS (@lostcontrol)
  - Improved ITerm windup handling for tricopter (@martinbudden)
  - Added SP RACING F3 OSD/PDB suport (@hydra)
  - Added horizon_tilt_effect command (@ethomas997)
  - Improved scheduler efficiency (@lilcw)
  - Increased motor output resolution (@borisbstyle)
  - Improved pwm timer precision (@blckmn)
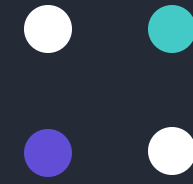 - Added new motor protocol Proshot1000 (@TonyBazz)

5   4

Flash Firmware   Load Firmware [Online]   Load Firmware [Local]

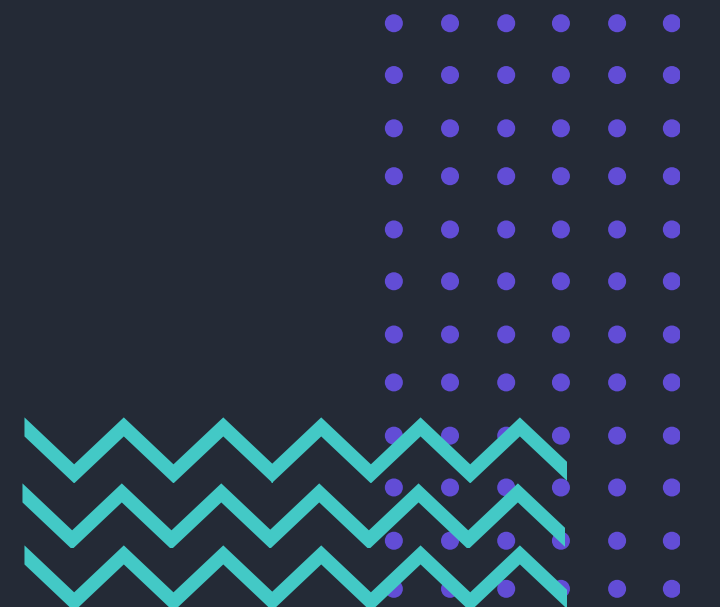Port utilization: D: 0% U: 0%   Packet error: 0   I2C error: 0   Cycle Time: 0   3.2.1

#6

FINISHING YOUR ALIENWHOOP

REMOVE BOOT JUMPER

REMOVE THE BOOT PAD JUMPER WIRES OR SOLDER BRIDGE AND RECONNECT THE USB CABLE. CONNECT AND VERIFY GYRO FUNCTION BY TWIRLING THE BOARD AROUND

FINISHING UP
COMPLETING YOUR BUILD

01 IF FUNCTIONING PROPERLY IN BETAFLIGHT GUI, ADD PLUGS, BEEPER, POWER PIGTAIL, CAMERA, ETC

02 BE MINDFUL OF POLARITY INDICATORS ON REFERENCE DIAGRAM AND SILKSCREEN

03 ADD RECEIVER & VERIFY FUNCTION (3.3V ONLY)

04 CUT OUT CROSS BRACES ON SOME FRAME MODELS TO FIT

05 INSTALL FLIGHT CONTROLLER AND ENJOY!

APPENDIX A
ADDITIONAL RESOURCES

01 FB.ME/ALIENWHOOP FACEBOOK MESSENGER FOR HELP

02 HTTP://GIT.ALIENWHOOP.COM FOR EAGLE CAD FILES

03 HTTPS://OSHPARK.COM/SHARED_PROJECTS/M61BC99QFOR PCB ORDERS

04 HTTPS://YOUTU.BE/5UIROWBKDFY PRO SOLDERING TECHNIQUES

05 HTTPS://GITHUB.COM/BETAFLIGHT/BETAFLIGHT/WIKI/BOARD---ALIENWHOOP

ALIENWHOOP F4/F7 FLIGHT CONTROLLER
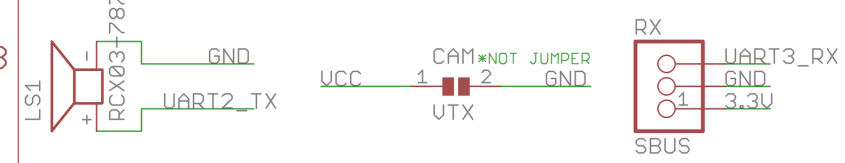
Remixed from AlienFlight F3 Brushed Quad http://f3-quad.alienwhoop.us/

by Charles K Stevenson with tremendous help from others … see GitHub for acknowledgements

Follow @AlienWhoop on Facebook - Join the community
http://fb.me/alienwhoop/

AlienWhoop Build Guides, Store, and Latest News
http://git.alienwhoop.us/

open hardware

v20170807A

SMD Jumper Boot/Bind; OSD UART4

SJ1
3.3V 1 2 BOOT0
BOOT

UART*NOT JUMPER
UART4_RX 1 2 UART4_TX
RXTX

SJ2
BIND 1 2 GND
BIND

VBAT*NOT JUMPER
VCC 1 2 GND
VBAT

Beeper, Camera/VTX, and Sbus Rx

LS1 RCX03-787
GND
UART2_TX

CAM*NOT JUMPER
VCC 1 2 GND
VTX

RX
UART3_RX
GND
3.3V
SBUS

CUSTOM LED 3.3V PADS

3.3V MYLED1 GND   3.3V MYLED3 GND
CUSTOM   CUSTOM

3.3V MYLED2 GND   3.3V MYLED4 GND
CUSTOM   CUSTOM

STM32F4/F7 POWER

GND
64 3.3V VDD
63 VSS
19 VDD
18 VSS
48 VDD
32 VDD
C12 .1uF
C13 .1uF
C11 .1uF
C14 .1uF
GND
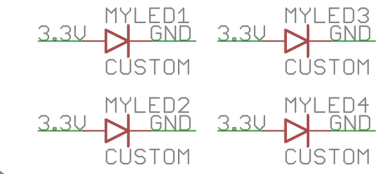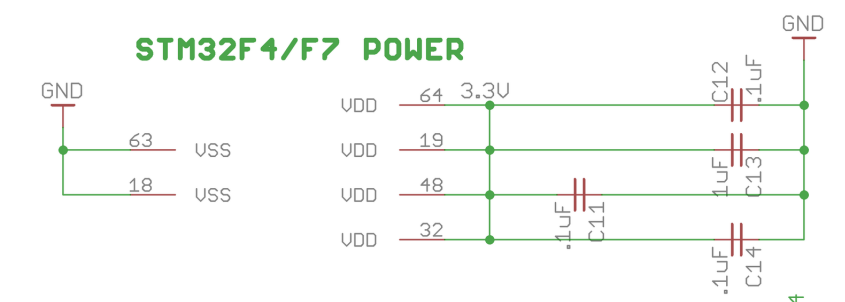
3.3V Filtered and Regulated Power

VCC
Q1 IRLML6402
GND
VCC-REG

L1 2.2uH
U1 TPS63001
L1 VIN VOUT L2
VINA
EN FB
PS/SYNC
GND PAD PGND
3.3V
BLUE PWR
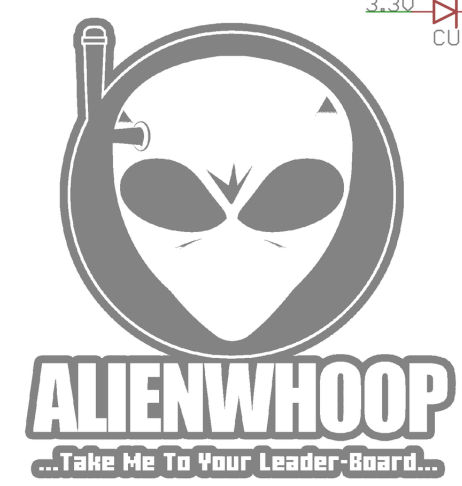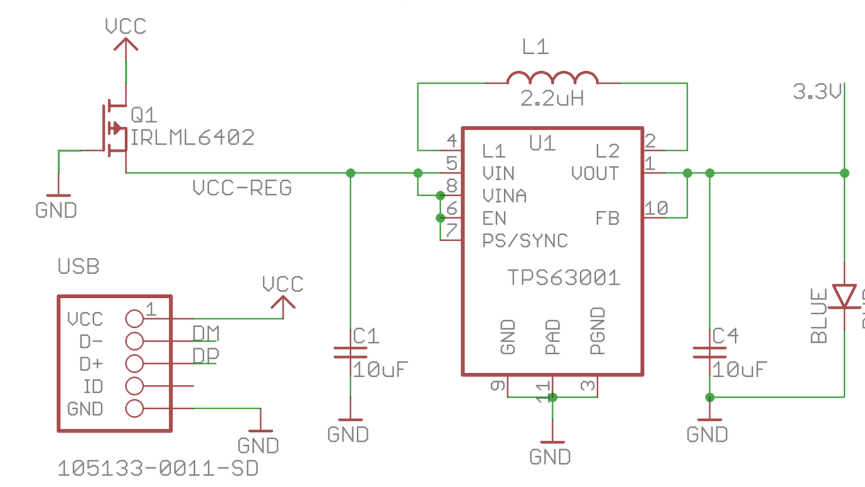
MCU 168 MHz STM32F405RGT or 216MHz STM32F722RET

IC1
SPI3_NSS 4 PC15   PB15 36 SPI2_MOSI
INT 3 PC14   PB14 35 SPI2_MISO
BIND 2 PC13   PB13 34 SPI2_SCK
LED0 53 PC12   PB12 33 SPI2_NSS
3.3V LED0 BLUE
UART3_RX 52 PC11 PB11 30 VCAP_1_F7
UART3_TX 51 PC10 PB10 29 F4F7_INCOMPAT_29
PWM1 40 PC9   PB9 62
PWM2 39 PC8   PB8 61
PWM3 38 PC7   PB7 59 I2C1_SDA
PWM4 37 PC6   PB6 58 I2C1_SCL
GND 25 PC5   PB5 57 SPI3_MOSI
24 PC4   PB4 56 SPI3_MISO
11 PC3   PB3 55 SPI3_SCK
10 PC2   PB2 28 F4F7_INCOMPAT_28
9 PC1   PB1 27 F4F7_INCOMPAT_27
8 PC0   PB0 26 F4F7_INCOMPAT_26

3.3V LED1 BLUE
LED1 54 PD2
C15 4.7uF
0R if F4
GND

PA15 50
PA14 49
PA13 46
PA12 45 DP
PA11 44 DM
PA10 43 UART1_RX
PA9 42 UART1_TX
PA8 41
PA7 23 SPI1_MOSI
PA6 22 SPI1_MISO
PA5 21 SPI1_SCK
PA4 20 SPI1_NSS
PA3 17 UART2_RX
PA2 16 UART2_TX
PA1 15 UART4_RX *ASYNC ONLY
PA0-WKUP 14 UART4_TX *ASYNC ONLY

Y1 8mHz
OSC_IN 5 OSC_IN
OSC_OUT 6 OSC_OUT

VBAT 1
VDDA 13
VSSA 12

R5 10K
NRST 7 NRST
BOOT0 60 BOOT0
VCAP1 31 VCAP1
VCAP2 47 VCAP2
VSS F7
0R if F7

STM32F4/F7
STM32F722RET6

USB

105133-0011-SD
VCC 1
DM D-
DP D+
ID
GND
VCC
C1 10uF
C4 10uF
GND

Vertical USB

VCC
BAT 1S (3.8V)
GND

PowerWhoop Pigtail

MPU-6500 6-Axis or MPU-9250 9-Axis
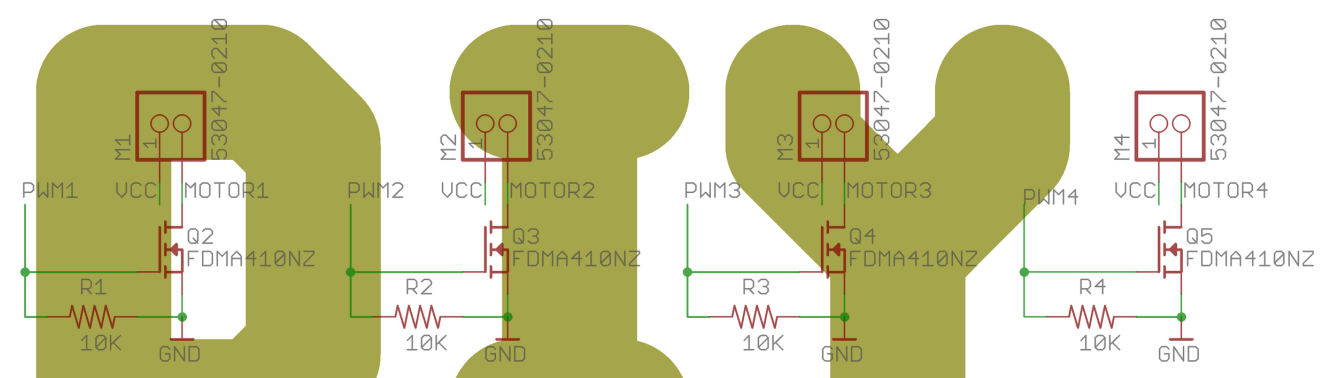
U2 MPU-9250
C2 .1uF
3.3V 13 VDD   AUX_CL 7
VDDIO 1 *2 VDDIO AUX_DA 21
C3 .01uF
INT 12 INT CS 22 SPI1_NSS
11 FSYNC SCL/SCLK 23 SPI1_SCK
10 REGOUT SDA/SDI 24 SPI1_MOSI
C5 .1uF
18 *3 GND AD0/SDO 9 SPI1_MISO
GND

3.3V
C6 .1uF C8 .1uF
C9 .1uF
C7 4.7uF C10 4.7uF
0R if F7
GND

Brushed Motor Power (9.5A Continuous 24A Pulsed FETs)

M1 53047-0210
PWM1 VCC MOTOR1
Q2 FDMA410NZ
R1 10K
GND

M2 53047-0210
PWM2 VCC MOTOR2
Q3 FDMA410NZ
R2 10K
GND

M3 53047-0210
PWM3 VCC MOTOR3
Q4 FDMA410NZ
R3 10K
GND

M4 53047-0210
PWM4 VCC MOTOR4
Q5 FDMA410NZ
R4 10K
GND

TITLE: AlienWhoopF7

ALIENWHOOP
...Take Me To Your Leader-Board...

ENJOY YOUR HOMEMADE ALIENWHOOP! FEEDBACK ON THIS BUILD GUIDE WELCOME VIA FB.ME/ALIENWHOOP

- ALIENWHOOP -