Power (off PCB)

#CB1 MRCB_187080F-03-1
#BT1 Battery
#U1 WattMeter
VIN+ VOUT+
VIN− VOUT−
#SW1 ESTOP
#SW2 REMOTE
#SW3 POWER
#U3 DC100D100CH
#U4 DC100D100CH
+BATT
+BATT_MOTORS
PWR_FLAG
GNDPWR

#CB2 MRCB_187080F-03-1
#BT2 MotorBattery
#U2 WattMeter
VIN+ VOUT+
VIN− VOUT−

#MES1 Voltmeter
#MES2 Voltmeter
GNDPWR

U11 PDQ15-Q24-S12-D
24V Vin+ Vout+ 12V
Vin− Trim
15W Vout−
C9 1000u
L1 15u
C11 C13 C15
100u 1u 10n
+12V
10k RV4
C20 10n
GNDA

U12 PDQ30-Q24-S5-D
24V Vin+ Vout+ 5V
Vin− Trim
30W Vout−
L2 15u
C12 C14 C16
100u 1u 10n
+5V
10k RV5
C21 10n
GNDD

U1 TinkerBoard
VCC3.3V_IO
GP8A4_I2C1_SDA
GP8A5_I2C1_SCL
GP7C1_I2C4_SDA
GP7C2_I2C4_SCL
GP5B1_UART1TX
GP5B0_UART1RX
GP5B2_UART1CTSN
GP5B3_UART1RTSN
GP7C7_UART2TX_PWM3
GP7C6_UART2RX_PWM2
GP7A7_UART3RX
GP7B0_UART3TX
GP0C1_CLKOUT
GP5C3
GP6A0_PCM/I2S_CLK
GP6A1_PCM/I2S_FS
GP6A3_PCM/I2S_SDI
GP6A4_PCM/I2S_SDO
GP5B4_SPI0CLK_UART4CTSN
GP5B6_SPI0_TXD_UART4TX
GP5B7_SPI0_RXD_UART4RX
GP5B5_SPI0CSN0_UART4RTSN
GP5C0_SPI0CSN1
GP8B1_SPI2TXD
GP8B0_SPI2RXD
GP8A6_SPI2CLK
GP8A7_SPI2CSN0
GP8A3_SPI2CSN1
GND

VCC5V_SYS
+5V
+3.3V
SDA SCL
Sheet: IMU
File: MP6050.sch
VCC VIO SDA SCL INT GND

ENC_A ENC_B
MOSI MISO SCLK SS

C1 1u C2 10n
GNDD

R12 10k 10k 10k
Only if more pull-ups needed
SCL SDA

MountingHole
H1 H2 H3 H4
G1 G2 G3 G4
^ hack for misc. board footprints

U2 Sabertooth2x60
B+ M1+
B− M1−
S1 M2+
S2 M2−
5V 0V
M1+ 25m R1 M1− #M1 Motor_DC
M2+ 25m R2 M2− #M2 Motor_DC

U3 Sabertooth2x60
M3+ 25m R3 M3− #M3 Motor_DC
M4+ 25m R4 M4− #M4 Motor_DC

U4 Sabertooth2x60
M5+ 25m R5 M5− #M5 Digger_Motor
M6+ 25m R6 M6− #M6 Lin_Actuator

U5 Sabertooth2x60
M7+ 25m R7 M7− #M7 Lin_Actuator
M8+ 25m R8 M8− #M8 Lin_Actuator

SW1 LIMIT_1
SW2 LIMIT_2
TestPoint TP1
+3.3V +BATT_MOTORS GNDPWR GNDD

gain is about 100x at 24kHz PWM
U7 INA4181
M5+4 REF1 VS
M5−3 IN−1 REF2
M6+6 IN+2 REF3
M6−7 IN−2 REF4
M7+15 IN+3 OUT1
M7−14 IN−3 OUT2
M8+17 IN+4 OUT3
M8−18 IN−4 OUT4
GND
+3.3VADC +1.65V C5 100n
GNDREF
TP2 TestPoint
R10A R10B R10C R10D 100k
C7A C7B C7C C7D 10n
GNDREF

U6 INA4181
M2+4 REF1 VS
M2−3 IN−1 REF2
M1+6 IN+2 REF3
M1−7 IN−2 REF4
M3+15 IN+3 OUT1
M3−14 IN−3 OUT2
M4+17 IN+4 OUT3
M4−18 IN−4 OUT4
GND
+3.3VADC 1.65V C4 100n
GNDREF
≈160Hz cut-off freq
R9A R9B R9C R9D 100k
C6A C6B C6C C6D 10n
GNDREF

TP3 TestPoint

U10 REF2033
EN VIN VBIAS
GND VREF
+5V +1.65V
+3.3VADC
C10 100n
GNDREF

U9 MCP3008
CH0 CH1 CH2 CH3 CH4 CH5 CH6 CH7
Vref Vdd
MUX ADC CNTRL
CLK Dout Din CS/SHDN
AGND DGND
SCLK MISO MOSI SS
+3.3VADC +3.3V
+3.3V C17 100n
GNDREF GNDREF GNDREF

U13 Hokuyo_UST-10LX
Vin+ Vin−
+12V GNDA
C18 470u
U14 Hokuyo_UST-10LX
Vin+ Vin−
Ethernet→TinkerBoard not shown
LIDAR

SW3 SRX_Encoder .05" header
5V GND FLMT RLMT A B PWM
ENC_A ENC_B
GNDD

U8 ADS1015IDGS
VDD ALERT/RDY
AIN0 SCL
AIN1 SDA
AIN2 ADDR
AIN3 GND
+3.3V
R11 10k
SCL SDA
C8 100n
GNDD

RV1 10k RV2 10k RV3 10k
+3.3V

NT1 Net-Tie_2
GNDREF GNDD

Ports & Test Points
J1 Conn_02x03
MISO MOSI SCLK MISO SS MOSI
+3.3V GNDD

TP4 M1+ TestPoint
TP5 SDA TestPoint
TP6 SCL TestPoint
TP7 M1− TestPoint
TP8 +BATT TestPoint
TP9 TestPoint GNDPWR
TP10 +1.65V TestPoint
TP11 +12V TestPoint
TP12 TestPoint GNDA
TP13 +5V TestPoint
TP14 TestPoint GNDD
TP15 +3.3V TestPoint

F1 6A +BATT
J2 Conn_01x02 GNDPWR
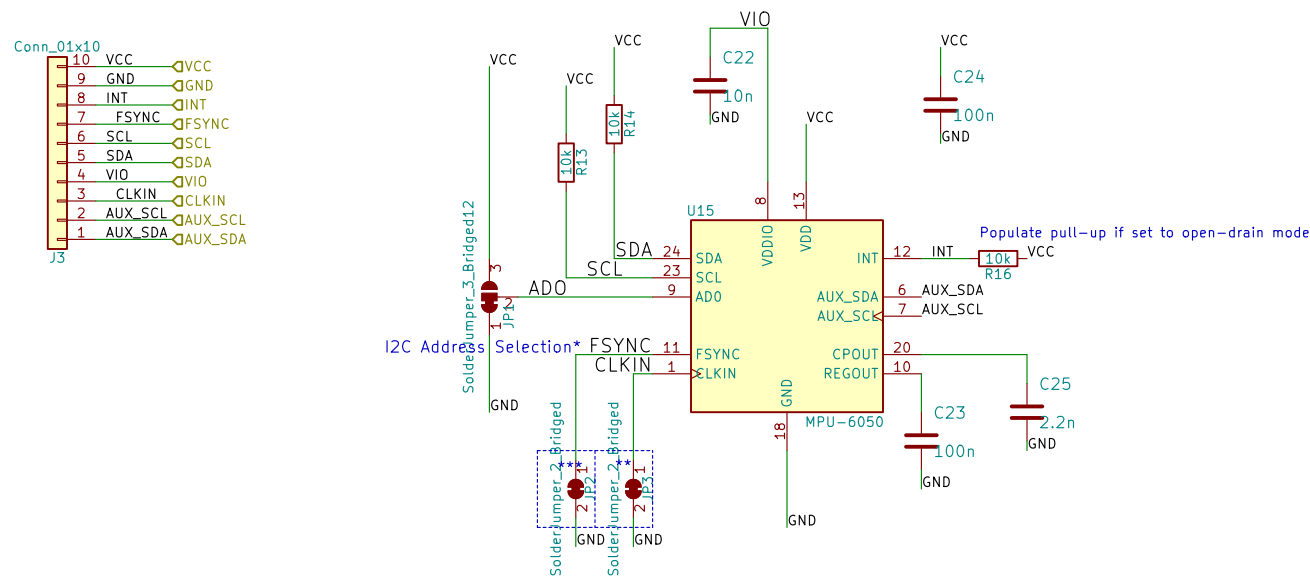
M1 Hopper_Servo
PWM POS
+5V Likely ≤1A stall
C3 470u
GNDD GNDD

Changes to V11
SCL and SDA were switched on V10, fixed on V11
Broke out VLOGIC line
C2 was mislabled as 10nF, should have been 2.2nF.
Added selectable jumpers to CLK, FSYNC and AD0
Minor layout changes
Played around with IC footprint.
Added 4 small tcream squares to middle pad.
Rounded and elongated pads.

BOM changes
YES
C2 is now 2.2nF instead of 10nF

New Stencil
YES

Changes to V12:

−0402 −−> 0603
−Changed Z−Axis symbol to reflect proper
 orientation from circle with x to circle with dot
−Changed NET labels in schematic to flags

Conn_01x10

10	VCC	▷VCC
9	GND	▷GND
8	INT	▷INT
7	FSYNC	▷FSYNC
6	SCL	▷SCL
5	SDA	▷SDA
4	VIO	▷VIO
3	CLKIN	▷CLKIN
2	AUX_SCL	▷AUX_SCL
1	AUX_SDA	▷AUX_SDA

J3

VIO

C22
10n
GND

VCC
C24
100n
GND

VCC

VCC
R14 10k

VCC
R13 10k

SolderJumper_3_Bridged12
JP1

U15

SDA	24	SDA
SCL	23	SCL
AD0	9	AD0
	8	VDDIO
	13	VDD
INT	12	INT
AUX_SDA	6	AUX_SDA
AUX_SCL	7	AUX_SCK
CPOUT	20	
REGOUT	10	
FSYNC	11	FSYNC
CLKIN	1	CLKIN
GND	18	

MPU−6050

Populate pull−up if set to open−drain mode
R16 10k VCC

C23
100n
GND

C25
2.2n
GND

I2C Address Selection*

GND

SolderJumper_2_Bridged
JP2
GND

SolderJumper_2_Bridged
JP3
GND

GND

* Two MPU−60X0s can be connected to the same I2C bus
The LSB bit of the 7 bit address is determined by the logic level on pin AD0.
Default Address = 0x68 (pin AD0 is logic low)
Alternative Address =0x69 (pin AD0 is logic high)

** Optional external reference clock input. Connected to GND by default.
Cut trace for external clock

*** Frame synchronization digital input. Connected to GND by default
Cut trace for external sync

Rewritten by Gabe
Sparkfun
Sheet: /IMU/
File: MP6050.sch
Title: MP6050 Breakout Board
Size: A | Date: | Rev:
KiCad E.D.A. kicad 5.1.4+dfsg1−1 | Id: 2/2