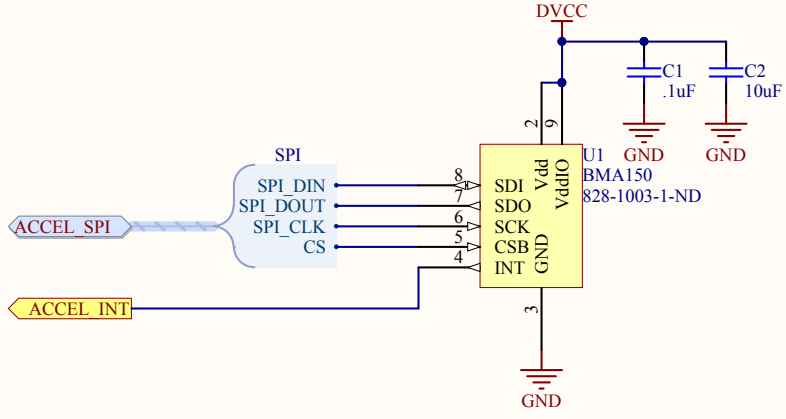
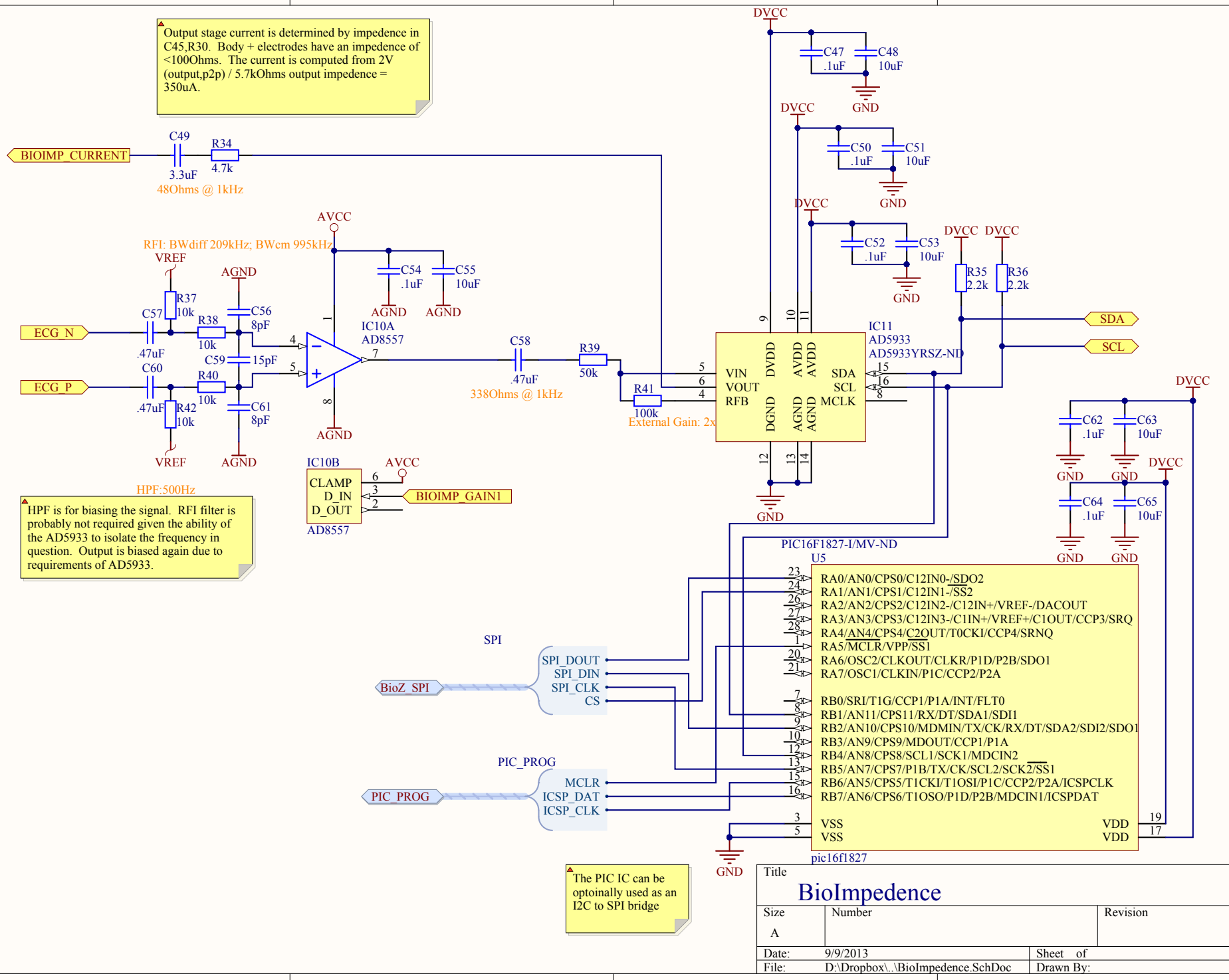
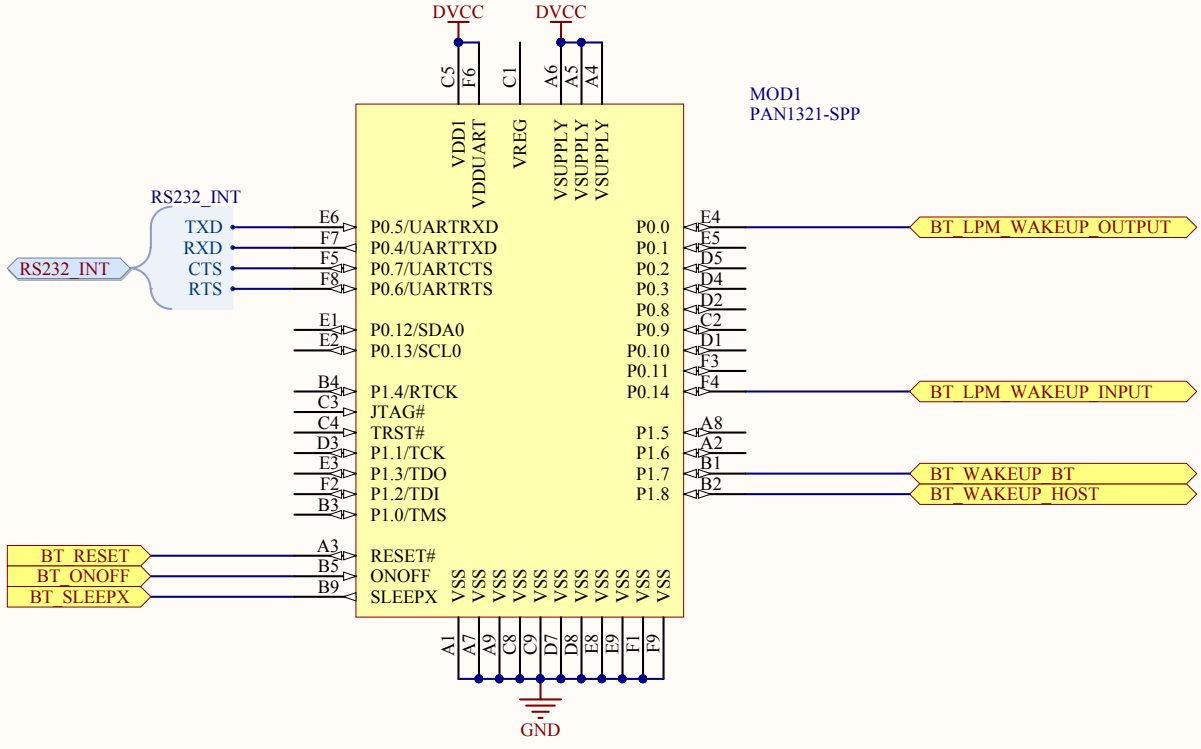
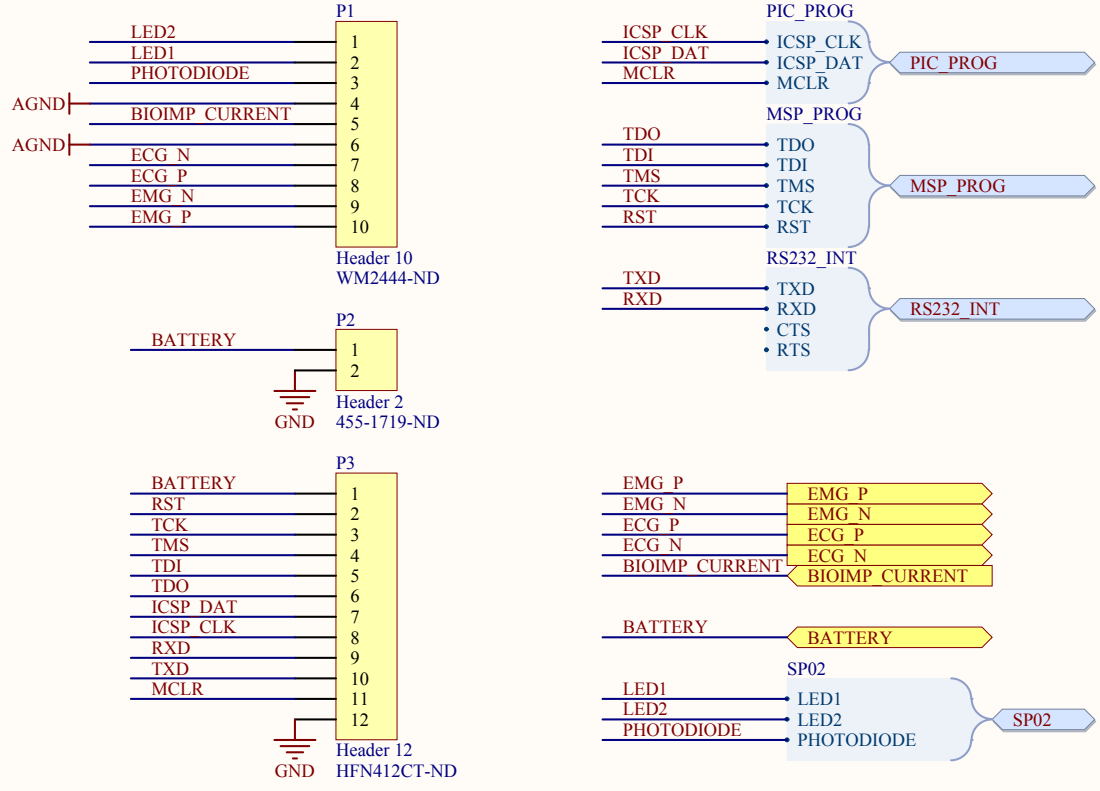



| | | |
|---|---|---|
| Title: Accelerometer | | |
| Size: A | Number: | Revision: |
| Date: 9/9/2013 | | Sheet of |
| File: D:\Dropbox\..\Accel.SchDoc | | Drawn By: |

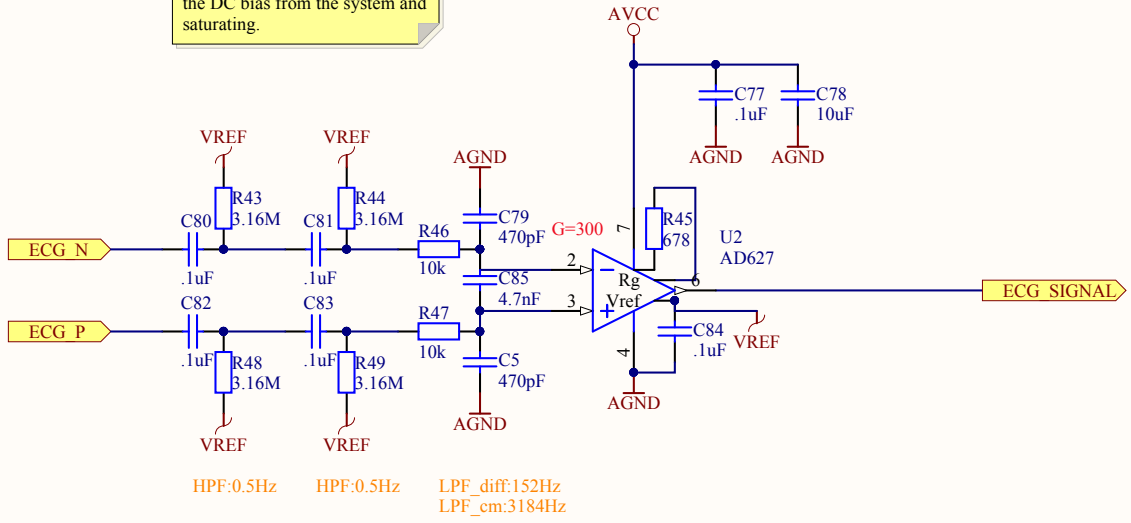

Output stage current is determined by impedence in C45,R30. Body + electrodes have an impedence of <100Ohms. The current is computed from 2V (output,p2p) / 5.7kOhms output impedence = 350uA.
BIOIMP_CURRENT
C49
3.3uF
R34
4.7k
48Ohms @ 1kHz
RFI: BWdiff 209kHz; BWcm 995kHz
VREF
AGND
AVCC
ECG_N
ECG_P
C57
.47uF
C60
.47uF
R37
10k
R38
10k
R40
10k
R42
10k
C56
8pF
C59
15pF
C61
8pF
C54
.1uF
C55
10uF
IC10A
AD8557
C58
.47uF
338Ohms @ 1kHz
R39
50k
R41
100k
External Gain: 2x
HPF:500Hz
HPF is for biasing the signal. RFI filter is probably not required given the ability of the AD5933 to isolate the frequency in question. Output is biased again due to requirements of AD5933.
IC10B
CLAMP
D_IN
D_OUT
AD8557
BIOIMP_GAIN1
DVCC
C47
.1uF
C48
10uF
C50
.1uF
C51
10uF
C52
.1uF
C53
10uF
R35
2.2k
R36
2.2k
SDA
SCL
IC11
AD5933
AD5933YRSZ-ND
VIN
VOUT
RFB
DVDD
DGND
AVDD
AGND
SDA
SCL
MCLK
C62
.1uF
C63
10uF
C64
.1uF
C65
10uF
GND
PIC16F1827-I/MV-ND
U5
RA0/AN0/CPS0/C12IN0-/SDO2
RA1/AN1/CPS1/C12IN1-/SS2
RA2/AN2/CPS2/C12IN2-/C12IN+/VREF-/DACOUT
RA3/AN3/CPS3/C12IN3-/C1IN+/VREF+/C1OUT/CCP3/SRQ
RA4/AN4/CPS4/C2OUT/T0CKI/CCP4/SRNQ
RA5/MCLR/VPP/SS1
RA6/OSC2/CLKOUT/CLKR/P1D/P2B/SDO1
RA7/OSC1/CLKIN/P1C/CCP2/P2A
RB0/SRI/T1G/CCP1/P1A/INT/FLT0
RB1/AN11/CPS11/RX/DT/SDA1/SDI1
RB2/AN10/CPS10/MDMIN/TX/CK/RX/DT/SDA2/SDI2/SDO1
RB3/AN9/CPS9/MDOUT/CCP1/P1A
RB4/AN8/CPS8/SCL1/SCK1/MDCIN2
RB5/AN7/CPS7/P1B/TX/CK/SCL2/SCK2/SS1
RB6/AN5/CPS5/T1CKI/T1OSI/P1C/CCP2/P2A/ICSPCLK
RB7/AN6/CPS6/T1OSO/P1D/P2B/MDCIN1/ICSPDAT
VSS
VDD
pic16f1827
SPI
SPI_DOUT
SPI_DIN
SPI_CLK
CS
BioZ_SPI
PIC_PROG
MCLR
ICSP_DAT
ICSP_CLK
PIC_PROG
The PIC IC can be optoinally used as an I2C to SPI bridge
Title
BioImpedence
Size
A
Number
Revision
Date: 9/9/2013
Sheet of
File: D:\Dropbox\..\BioImpedence.SchDoc
Drawn By:




| | | |
|---|---|---|
| Title | Bluetooth | |
| Size: A | Number: | Revision: |
| Date: 9/9/2013 | Sheet of | |
| File: D:\Dropbox\..\Bluetooth Module - Pansonic.SchDoc | Drawn By: | |

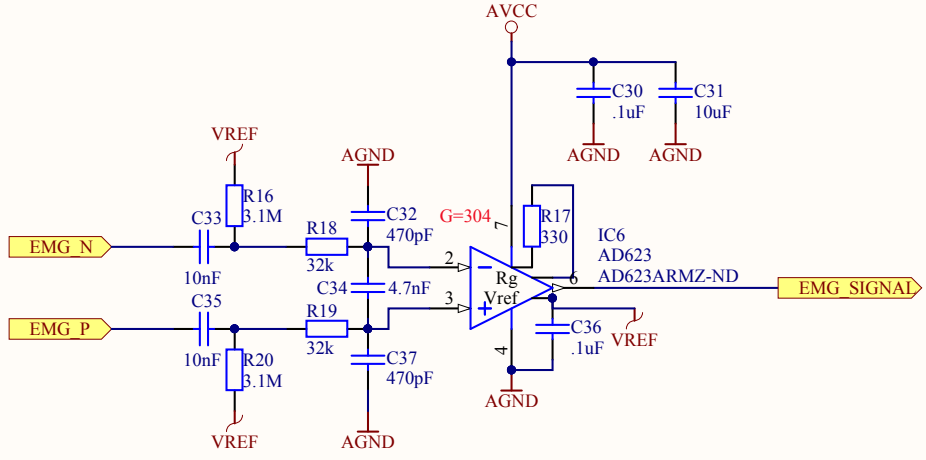



| | | |
|---|---|---|
| Title | Connectors | |
| Size: A | Number: | Revision: |
| Date: 9/9/2013 | | Sheet of |
| File: D:\Dropbox\..\Connectors.SchDoc | | Drawn By: |

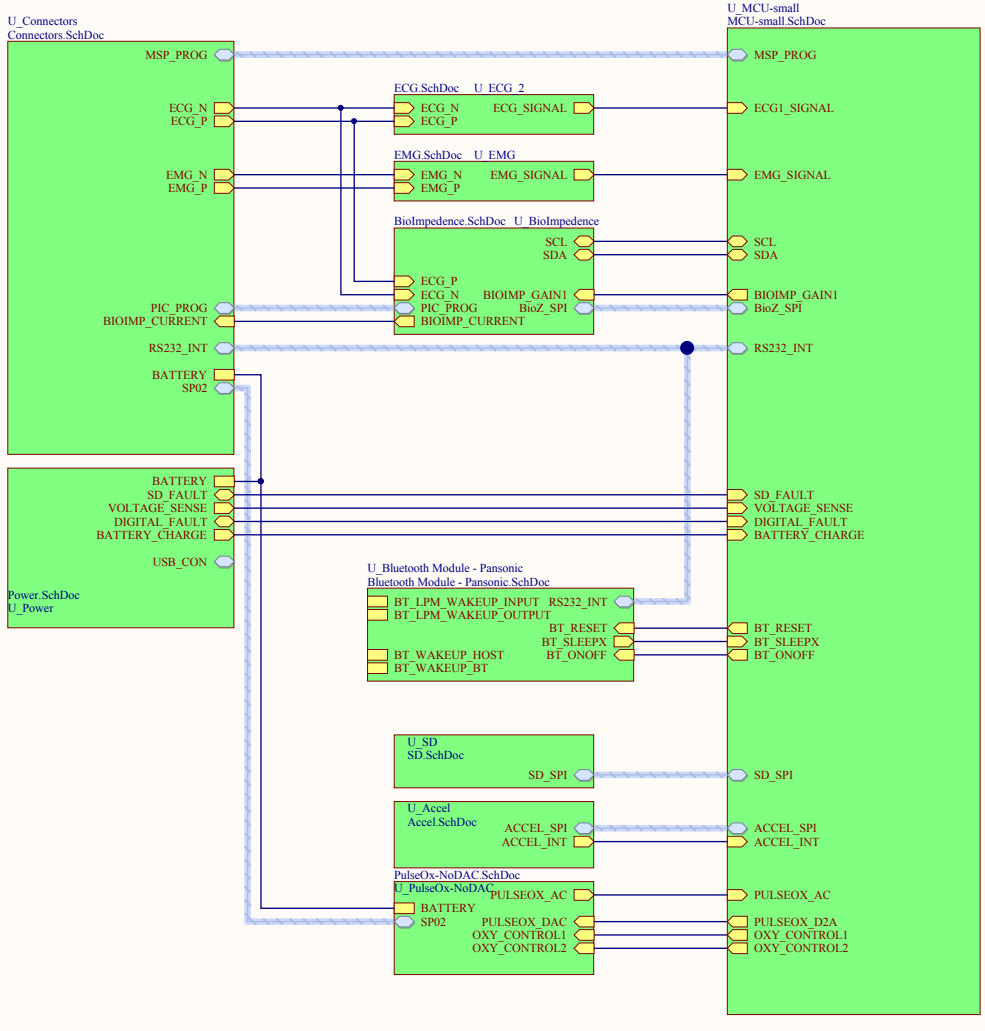



| | | |
|---|---|---|
| Title: ECG | | |
| Size: A | Number: | Revision: |
| Date: 9/9/2013 | | Sheet of |
| File: D:\Dropbox\..\ECG.SchDoc | | Drawn By: |

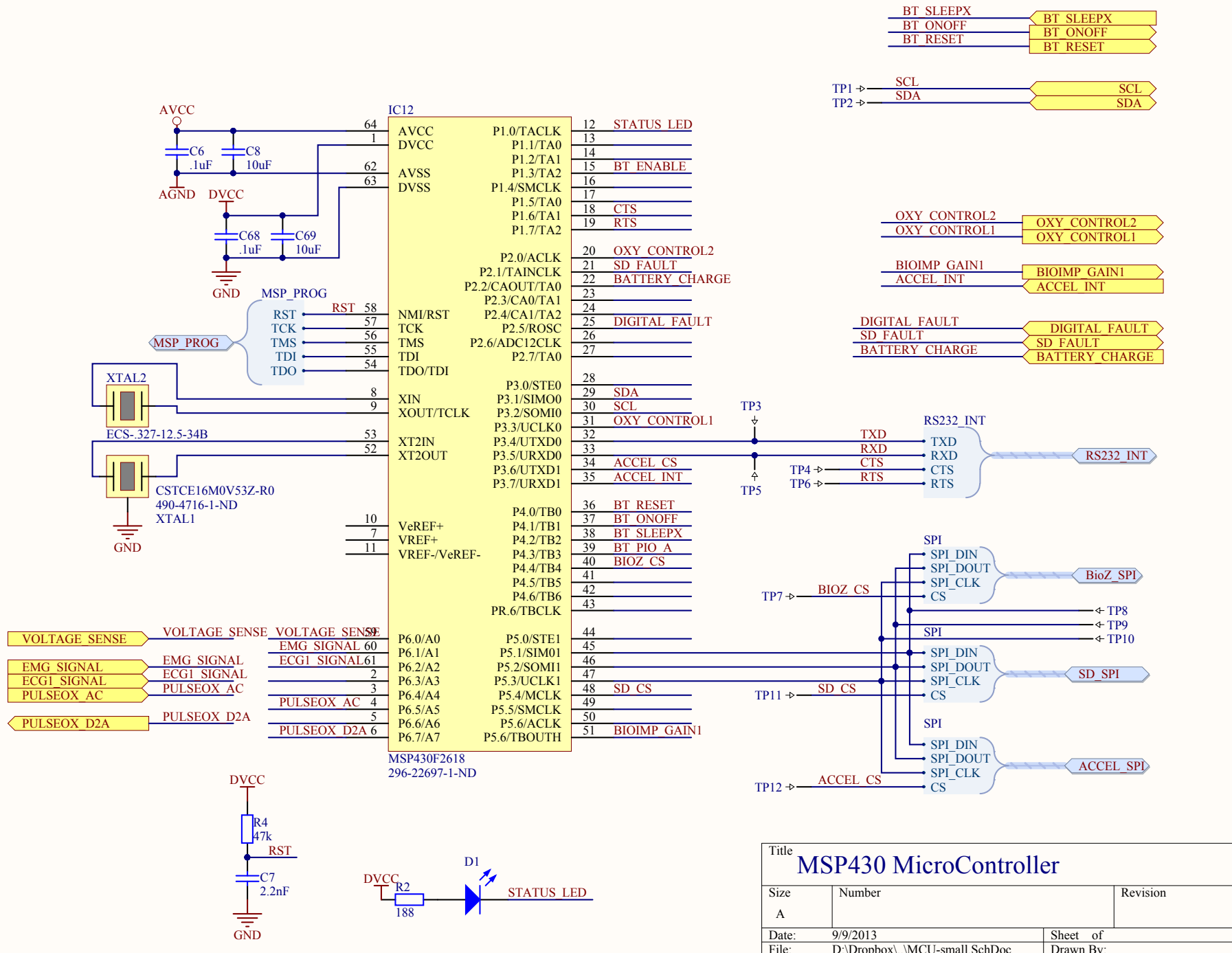
EMG can either be sampled at 1ksps or rectified & LPF'ed and sampled at a lower rate. This configuration is designed for a sampling rate of 1kSPS. The input has a HPF which biases the voltages around Vref, a LPF to set the bandwidth to 500Hz, an RFI filter followed by an instrumenation amplifier with a built-in bandwidth of 2kHz at G=200, thus requires the LPF to avoid aliasing (which is provided by the RFI filter).



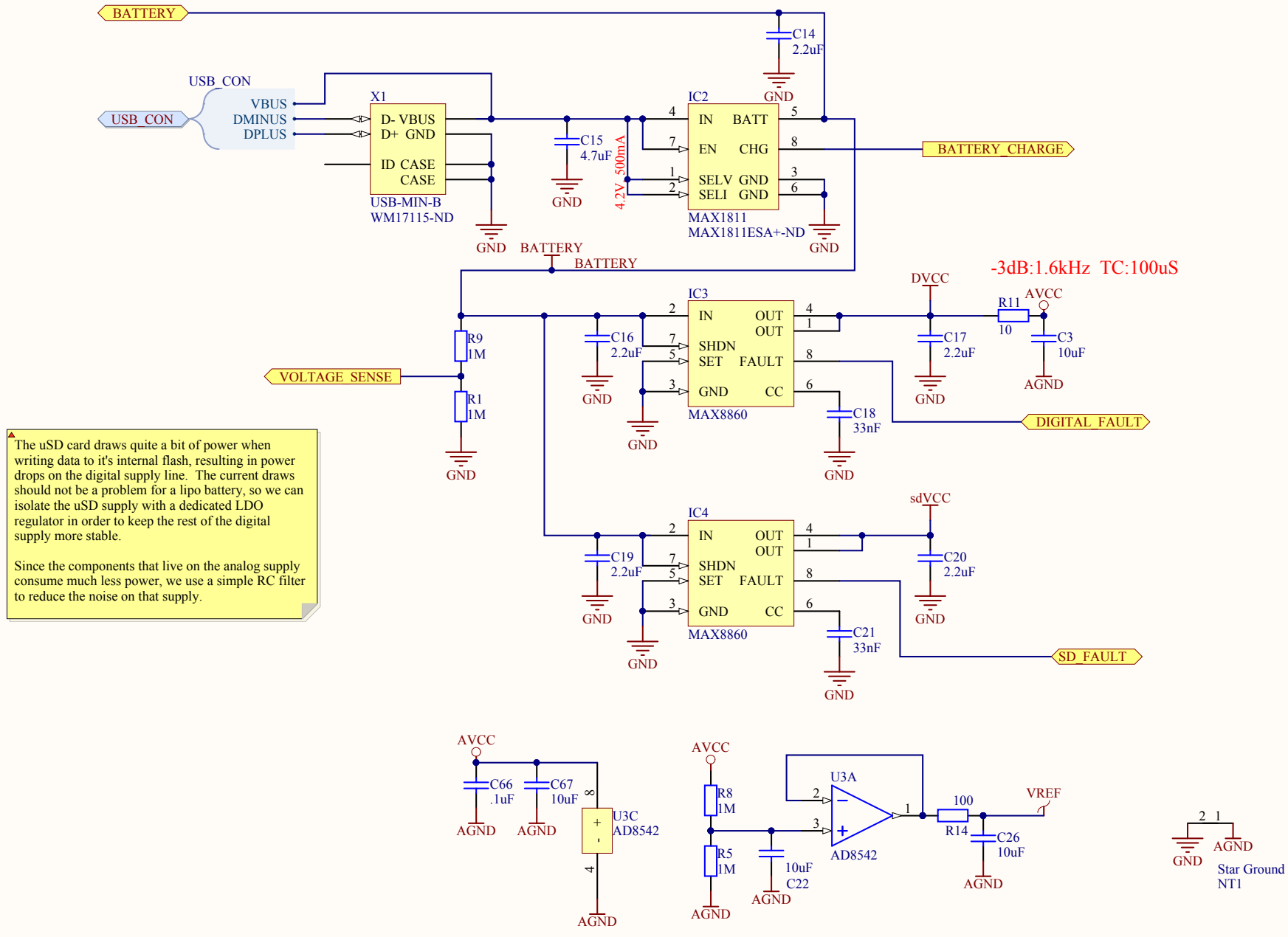

| | | |
|---|---|---|
| Title: EMG | | |
| Size: A | Number: | Revision: |
| Date: 9/9/2013 | | Sheet of |
| File: D:\Dropbox\..\EMG.SchDoc | | Drawn By: |

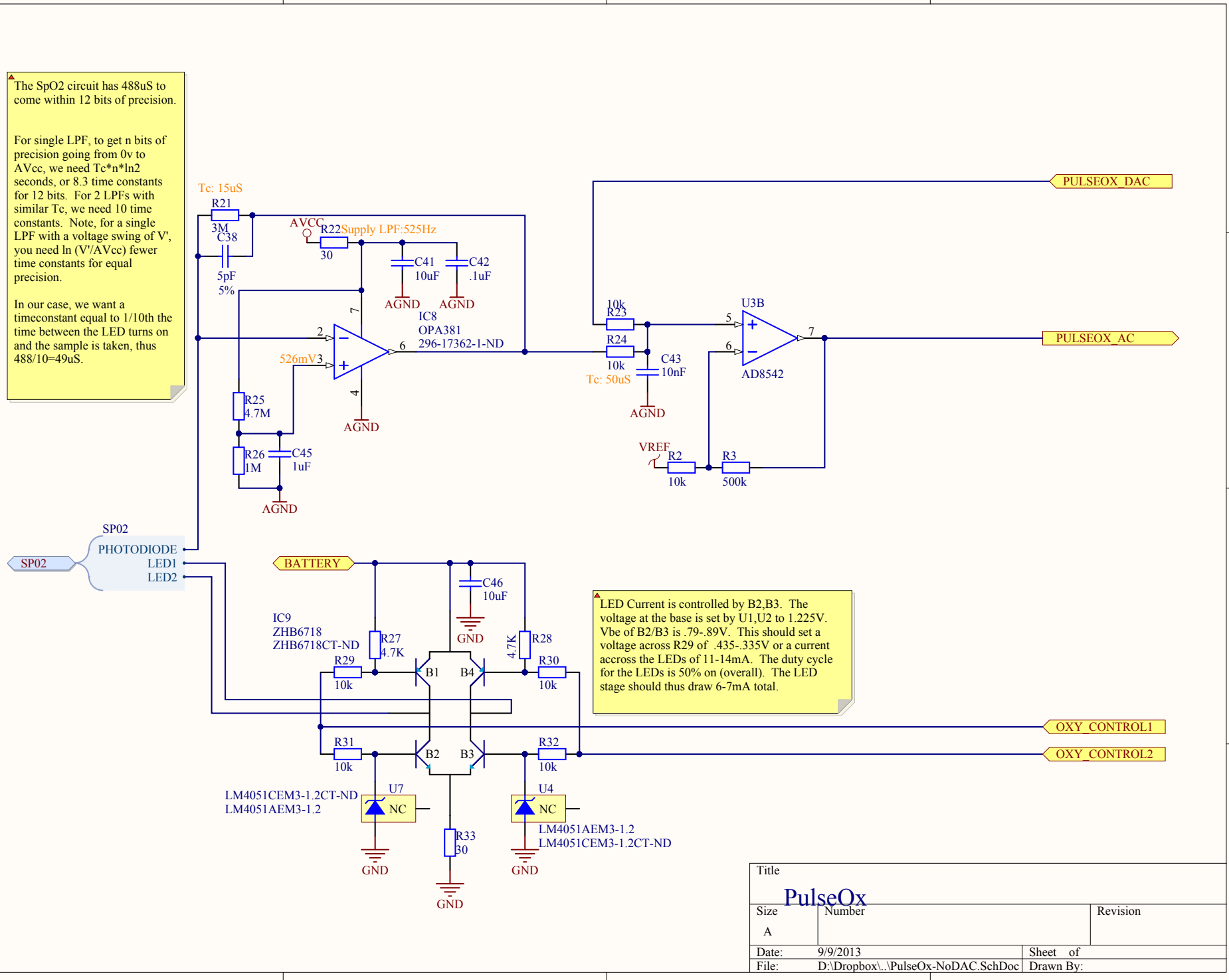


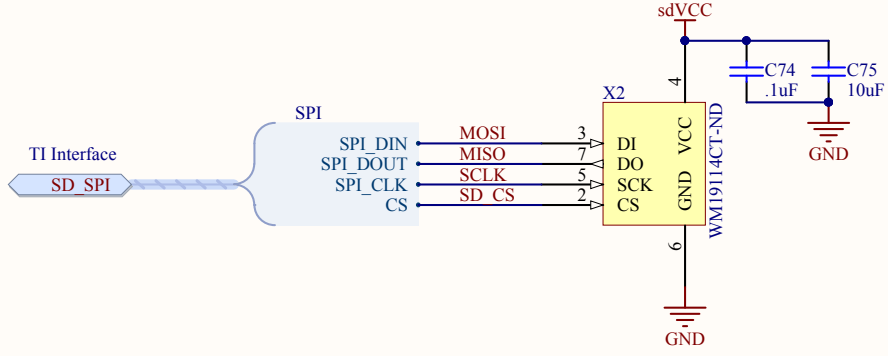

| | | | |
|---|---|---|---|
| Title | Master Layout | | |
| Size: B | Number: | | Revision: |
| Date: 9/9/2013 | | Sheet of | |
| File: D:\Dropbox\..\Master.SchDoc | | Drawn By: | |




| | | |
|---|---|---|
| Title | MSP430 MicroController | |
| Size: A | Number: | Revision: |
| Date: 9/9/2013 | Sheet of | |
| File: D:\Dropbox\..\MCU-small.SchDoc | Drawn By: | |


BATTERY
C14
2.2uF
GND
USB_CON
VBUS
DMINUS
DPLUS
USB_CON
X1
D- VBUS
D+ GND
ID CASE
CASE
USB-MIN-B
WM17115-ND
GND
C15
4.7uF
GND
4.2V_500mA
IC2
IN BATT
EN CHG
SELV GND
SELI GND
MAX1811
MAX1811ESA+-ND
GND
BATTERY_CHARGE
BATTERY
BATTERY
-3dB:1.6kHz TC:100uS
DVCC
AVCC
R11
10
C3
10uF
AGND
C17
2.2uF
GND
IC3
IN OUT
OUT
SHDN
SET FAULT
GND CC
MAX8860
C16
2.2uF
GND
C18
33nF
GND
DIGITAL_FAULT
R9
1M
VOLTAGE_SENSE
R1
1M
GND
The uSD card draws quite a bit of power when writing data to it's internal flash, resulting in power drops on the digital supply line. The current draws should not be a problem for a lipo battery, so we can isolate the uSD supply with a dedicated LDO regulator in order to keep the rest of the digital supply more stable.
Since the components that live on the analog supply consume much less power, we use a simple RC filter to reduce the noise on that supply.
sdVCC
IC4
IN OUT
OUT
SHDN
SET FAULT
GND CC
MAX8860
C19
2.2uF
GND
C20
2.2uF
GND
C21
33nF
GND
SD_FAULT
AVCC
C66
.1uF
AGND
C67
10uF
AGND
U3C
AD8542
AGND
AVCC
R8
1M
R5
1M
AGND
U3A
AD8542
10uF
C22
AGND
100
R14
VREF
C26
10uF
AGND
GND
AGND
Star Ground
NT1
Title
Power Supply, Battery ReCharge, Voltage Ref
Size
A
Number
Revision
Date: 9/9/2013
Sheet of
File: D:\Dropbox\..\Power.SchDoc
Drawn By:


The SpO2 circuit has 488uS to come within 12 bits of precision.
For single LPF, to get n bits of precision going from 0v to AVcc, we need Tc*n*ln2 seconds, or 8.3 time constants for 12 bits. For 2 LPFs with similar Tc, we need 10 time constants. Note, for a single LPF with a voltage swing of V', you need ln (V'/AVcc) fewer time constants for equal precision.
In our case, we want a timeconstant equal to 1/10th the time between the LED turns on and the sample is taken, thus 488/10=49uS.
Tc: 15uS
R21
3M
C38
5pF
5%
AVCC
R22
30
Supply LPF:525Hz
C41
10uF
C42
.1uF
AGND
IC8
OPA381
296-17362-1-ND
526mV
R25
4.7M
R26
1M
C45
1uF
PULSEOX_DAC
10k
R23
R24
10k
C43
10nF
Tc: 50uS
U3B
AD8542
PULSEOX_AC
VREF
R2
10k
R3
500k
SP02
PHOTODIODE
LED1
LED2
BATTERY
C46
10uF
GND
IC9
ZHB6718
ZHB6718CT-ND
R27
4.7K
R28
4.7K
R29
10k
R30
10k
B1
B4
B2
B3
R31
10k
R32
10k
OXY_CONTROL1
OXY_CONTROL2
LED Current is controlled by B2,B3. The voltage at the base is set by U1,U2 to 1.225V. Vbe of B2/B3 is .79-.89V. This should set a voltage across R29 of .435-.335V or a current accross the LEDs of 11-14mA. The duty cycle for the LEDs is 50% on (overall). The LED stage should thus draw 6-7mA total.
LM4051CEM3-1.2CT-ND
LM4051AEM3-1.2
U7
NC
U4
R33
30
Title
PulseOx
Size
A
Number
Revision
Date: 9/9/2013
Sheet of
File: D:\Dropbox\..\PulseOx-NoDAC.SchDoc
Drawn By:




| Title | | |
|---|---|---|
| SD Interface | | |
| Size: A | Number: | Revision: |
| Date: 9/9/2013 | | Sheet of |
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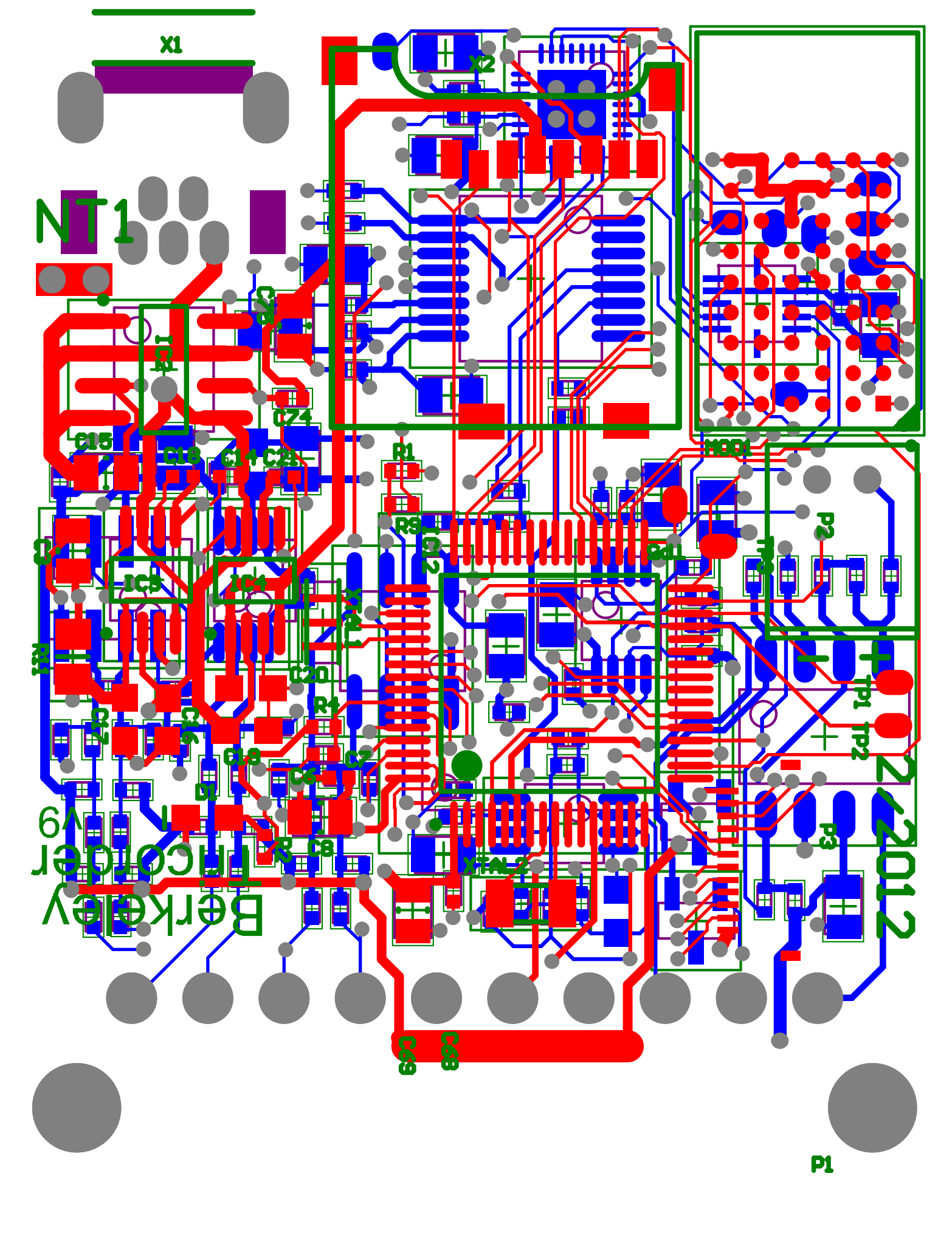
X1
X2
NT1
IC1
IC3
IC4
C1
C2
C3
C4
C5
C6
C7
C8
C9
C10
C11
C12
C13
C14
C15
C16
C17
C18
C19
C20
C21
R1
R2
R3
R4
R5
Q1
Q2
MOD1
P1
P2
P3
TP1
TP2
Berkeley
TFController
v9
2012

# Bill of Materials

<Parameter Title not found>

**Source Data From:** tricorder.PrjPcb
**Project:** tricorder.PrjPcb
**Variant:** None

Creation Date: 9/9/2013 1:54:42 PM
Print Date: 41526 41526.57974

| Footprint | Comment | LibRef | Designator | Description | Quantity |
|---|---|---|---|---|---|
| CAP_0402 | 0402 .1uF | Cap Semi | C1, C6, C36, C42, C47, C50, C52, C54, C62, C64, C66, C68, C74, C80, C81, C82, C83, C84 | Capacitor (Semiconductor SIM Model) | 18 |
| CAP_0805 | 0805 10uF | Cap Semi | C2, C3, C8, C22, C26, C31, C41, C46, C48, C51, C53, C55, C63, C65, C67, C69, C75, C78 | Capacitor (Semiconductor SIM Model) | 18 |
| CAP_0402 | 0402 470pF | Cap Semi | C5, C32, C37, C79 | Capacitor (Semiconductor SIM Model) | 4 |
| CAP_0402 | 0402 2.2nF | Cap Semi | C7 | Capacitor (Semiconductor SIM Model) | 1 |
| CAP_0402 | 0402 2.2uF | Cap Semi | C14 | Capacitor (Semiconductor SIM Model) | 1 |
| CAP_0805 | 0805 4.7uF | Cap Semi | C15 | Capacitor (Semiconductor SIM Model) | 1 |
| 3-0603 | 0603 2.2uF | Cap Semi | C16, C17, C19 | Capacitor (Semiconductor SIM Model) | 3 |
| CAP_0402 | 0402 33nF | Cap Semi | C18, C21 | Capacitor (Semiconductor SIM Model) | 2 |
| 1608[0603] | 0603 2.2uF | Cap Semi | C20 | Capacitor (Semiconductor SIM Model) | 1 |
| 3-0603 | 0603 .1uF | Cap Semi | C30, C77 | Capacitor (Semiconductor SIM Model) | 2 |
| CAP_0402 | 0402 10nF | Cap Semi | C33, C35, C43 | Capacitor (Semiconductor SIM Model) | 3 |
| CAP_0402 | 0402 4.7nF | Cap Semi | C34, C85 | Capacitor (Semiconductor SIM Model) | 2 |
| CAP_0402 | 0402 5pF | Cap Semi | C38 | Capacitor (Semiconductor SIM Model) | 1 |
| 3-0603 | 0603 1uF | Cap Semi | C45 | Capacitor (Semiconductor SIM Model) | 1 |
| CAP_0402 | 0402 3.3uF | Cap Semi | C49 | Capacitor (Semiconductor SIM Model) | 1 |
| CAP_0402 | 0402 8pF | Cap Semi | C56, C61 | Capacitor (Semiconductor SIM Model) | 2 |
| CAP_0402 | 0402 .47uF | Cap Semi | C57, C58, C60 | Capacitor (Semiconductor SIM Model) | 3 |
| CAP_0402 | 0402 15pF | Cap Semi | C59 | Capacitor (Semiconductor SIM Model) | 1 |
| 0603 | LED | LED3 | D1 | Typical BLUE SiC LED | 1 |
| SO-8_N | MAX1811 | MAX1811 | IC2 | | 1 |
| UMAX8_N | MAX8860 | MAX8860 | IC3, IC4 | | 2 |
| MSOP-8 | AD623 | AD623 | IC6 | Instrumentation Amp - High Speed | 1 |
| MSOP-8 | OPA381 | OPA381 | IC8 | Transimpedence Amp | 1 |
| SOT223-8 | ZHB6718 | ZHB6718 | IC9 | ZHB6718 | 1 |
| SO-8_N | AD8557 | AD8557 | IC10 | Programmable OPAMP | 1 |
| SOP65P780X200-16N | AD5933 | AD5933 | IC11 | 1MSPS 12Bit Impedence Converter Network Analyzer | 1 |
| LQFP64_N | MSP430F2618 | MSP430F2618 | IC12 | MSP430 Microcontroller | 1 |
| pan1321 lga | PAN1321-SPP | PAN1321-SPP | MOD1 | | 1 |
| 43650-1004 | Header 10 | Header 10 | P1 | Header, 10-Pin | 1 |
| S2B-PH-K-S(LF)(SN) | Header 2 | Header 2 | P2 | Header, 2-Pin | 1 |
| FH19C-12S-0.5SH(05) | Header 12 | Header 12 | P3 | Header, 12-Pin | 1 |
| RES_0402 | 0402 1M | Res2 | R1, R5, R8, R9, R26 | Resistor | 5 |
| RES_0402 | 0402 188 | Res2 | R2 | Resistor | 1 |
| RES_0402 | 0402 10k | Res2 | R2, R23, R24, R29, R30, R31, R32, R37, R38, R40, R42, R46, R47 | Resistor | 13 |
| RES_0402 | 0402 500k | Res2 | R3 | Resistor | 1 |
| RES_0402 | 0402 47k | Res2 | R4 | Resistor | 1 |
| 6-0805_N | 0805 10 | Res2 | R11 | Resistor | 1 |
| RES_0402 | 0402 100 | Res2 | R14 | Resistor | 1 |
| RES_0402 | 0402 3.1M | Res2 | R16, R20 | Resistor | 2 |
| RES_0402 | 0402 330 | Res2 | R17 | Resistor | 1 |
| RES_0402 | 0402 32k | Res2 | R18, R19 | Resistor | 2 |
| RES_0402 | 0402 3M | Res2 | R21 | Resistor | 1 |
| RES_0402 | 0402 30 | Res2 | R22, R33 | Resistor | 2 |
| RES_0402 | 0402 4.7M | Res2 | R25 | Resistor | 1 |
| RES_0402 | 0402 4.7K | Res2 | R27, R28, R34 | Resistor | 3 |
| RES_0402 | 0402 2.2k | Res2 | R35, R36 | Resistor | 2 |
| RES_0402 | 0402 50k | Res2 | R39 | Resistor | 1 |
| RES_0402 | 0402 100k | Res2 | R41 | Resistor | 1 |
| RES_0402 | 0402 3.16M | Res2 | R43, R44, R48, R49 | Resistor | 4 |
| RES_0402 | 0402 678 | Res2 | R45 | Resistor | 1 |
| 3mmx3mm LGA | BMA150 | BMA150 | U1 | Bosch Accelerometer | 1 |
| SO8 (R-8 Analog Device) (MS-012-A A) | AD627 | AD627 | U2 | Micropower Instrumentation Amplifier | 1 |
| MSOP-8 | AD8542 | AD8542 | U3 | | 1 |
| MF03A_N | LM4051AEM3-1.2 | LM4051AEM3-1.2 | U4, U7 | Precision Micropower Shunt Voltage Reference | 2 |
| UQFN-MV28_N | pic16f1827 | pic16f1827 | U5 | Flash Microcontroller with nano Watt XLP Technology, 4K (Words) Program memory, 384 Bytes SRAM, , Industrial Temperature | 1 |
| USB-molex-548190519 | USB-MIN-B | 548190519 | X1 | Molex Mini-B 548190519 | 1 |
| MOLEX-SD | SD Card | 5008730806 | X2 | Molex-SD | 1 |
| CSTCE_V | CSTCE16M0V53Z-R0 | CSTCE16M0V53Z-R0 | XTAL1 | 16Mhz Resonator | 1 |
| ECX-31B | ECS-.327-12.5-34B | ECS-.327-12.5-34B | XTAL2 | 32.768kHz Clock Oscillator | 1 |
| | | | | | 133 |

| Approved | Notes | |
|---|---|---|
| | | |