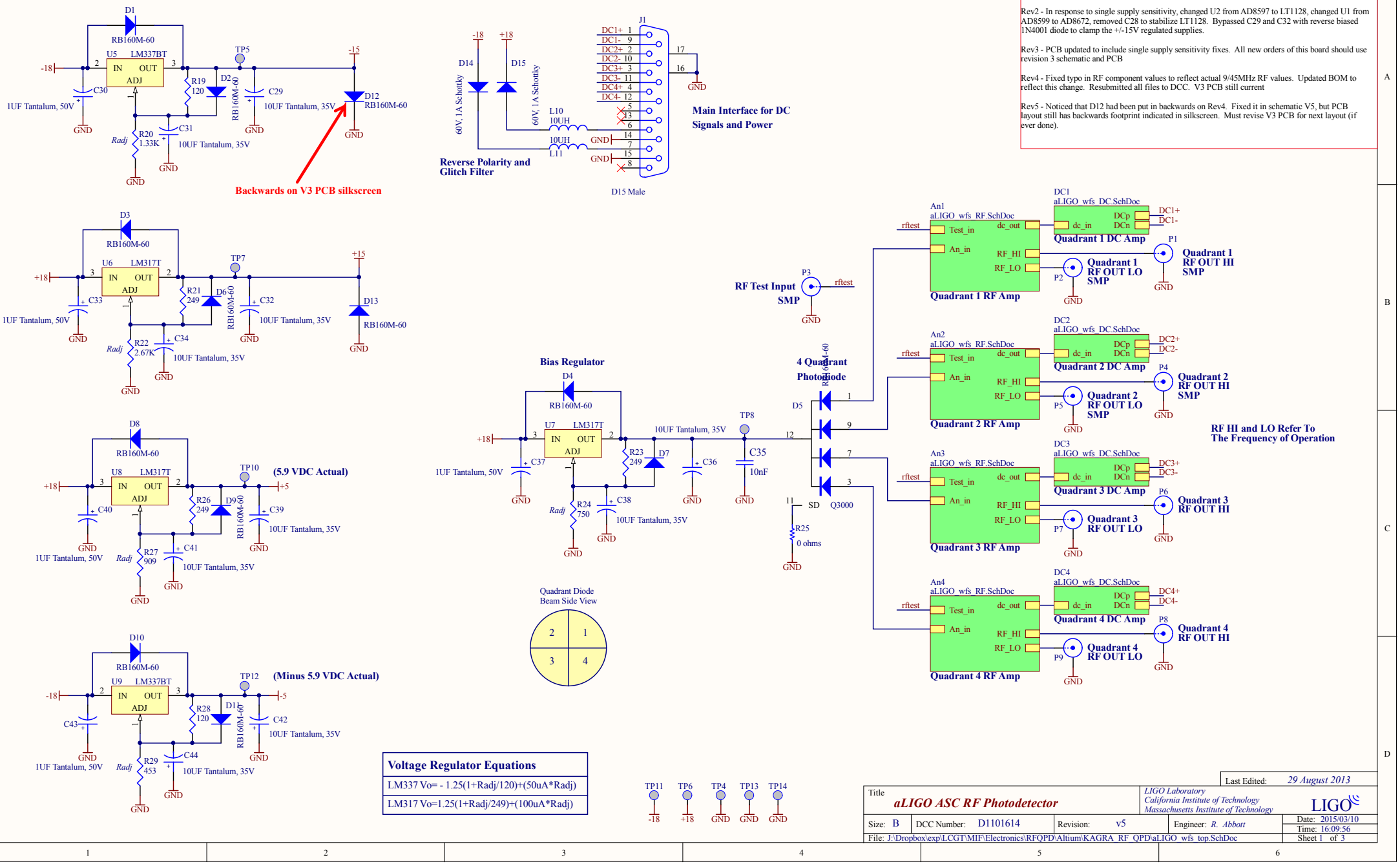
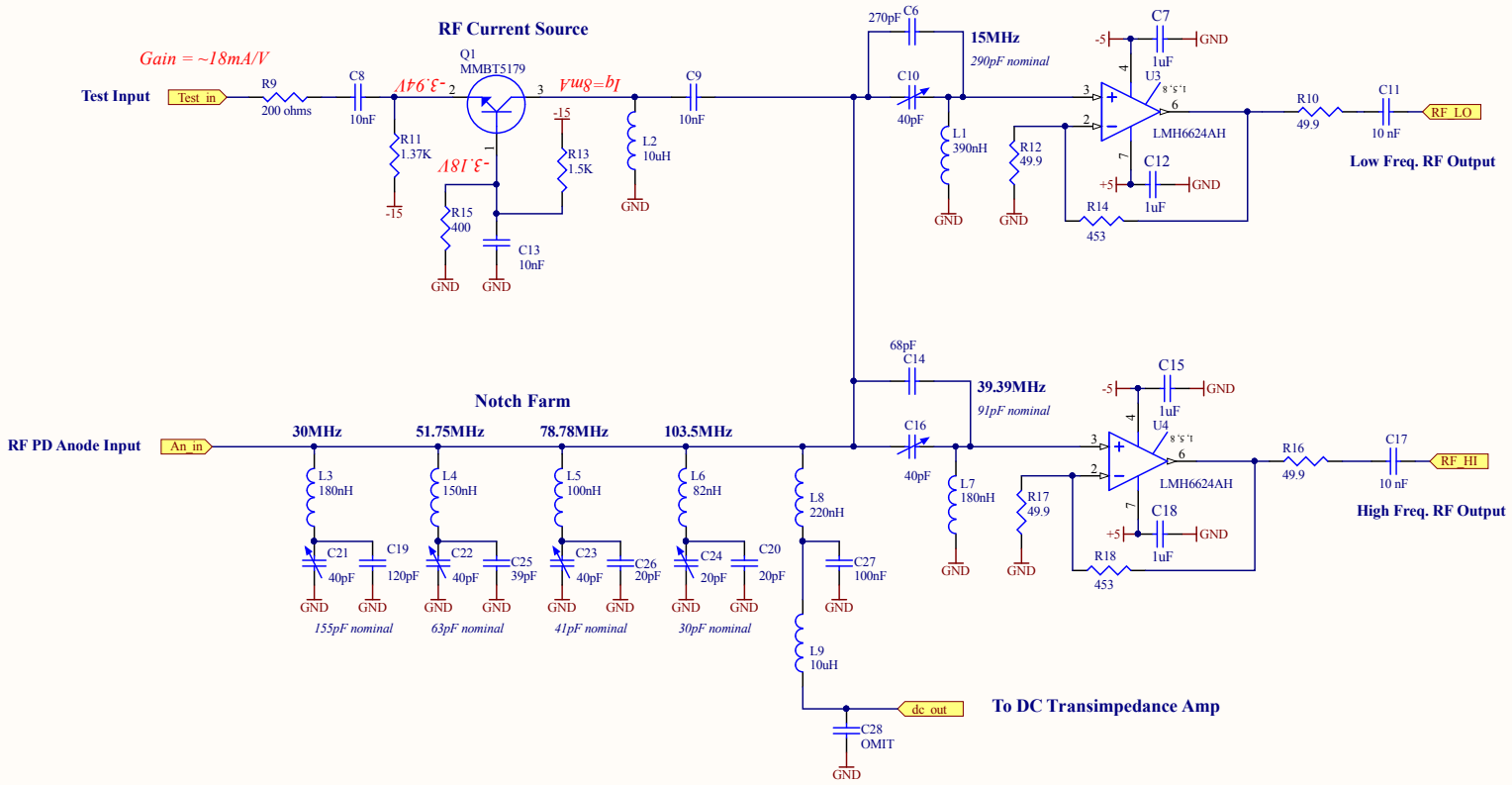

Revision History:
Rev1 - Initial release
Rev2 - In response to single supply sensitivity, changed U2 from AD8597 to LT1128, changed U1 from AD8599 to AD8672, removed C28 to stabilize LT1128. Bypassed C29 and C32 with reverse biased 1N4001 diode to clamp the +/-15V regulated supplies.
Rev3 - PCB updated to include single supply sensitivity fixes. All new orders of this board should use revision 3 schematic and PCB
Rev4 - Fixed typo in RF component values to reflect actual 9/45MHz RF values. Updated BOM to reflect this change. Resubmitted all files to DCC. V3 PCB still current
Rev5 - Noticed that D12 had been put in backwards on Rev4. Fixed it in schematic V5, but PCB layout still has backwards footprint indicated in silkscreen. Must revise V3 PCB for next layout (if ever done).
Backwards on V3 PCB silkscreen
Reverse Polarity and Glitch Filter
Main Interface for DC Signals and Power
D15 Male
Bias Regulator
4 Quadrant Photodiode
RF Test Input SMP
Quadrant Diode Beam Side View
(5.9 VDC Actual)
(Minus 5.9 VDC Actual)
RF HI and LO Refer To The Frequency of Operation
Quadrant 1 RF Amp
Quadrant 2 RF Amp
Quadrant 3 RF Amp
Quadrant 4 RF Amp
Quadrant 1 DC Amp
Quadrant 2 DC Amp
Quadrant 3 DC Amp
Quadrant 4 DC Amp
Quadrant 1 RF OUT HI SMP
Quadrant 1 RF OUT LO SMP
Quadrant 2 RF OUT HI SMP
Quadrant 2 RF OUT LO SMP
Quadrant 3 RF OUT HI
Quadrant 3 RF OUT LO
Quadrant 4 RF OUT HI
Quadrant 4 RF OUT LO
Voltage Regulator Equations
LM337 Vo= - 1.25(1+Radj/120)+(50uA*Radj)
LM317 Vo=1.25(1+Radj/249)+(100uA*Radj)
Title
aLIGO ASC RF Photodetector
LIGO Laboratory
California Institute of Technology
Massachusetts Institute of Technology
Last Edited: 29 August 2013
Size: B
DCC Number: D1101614
Revision: v5
Engineer: R. Abbott
Date: 2015/03/10
Time: 16:09:56
Sheet 1 of 3
File: J:\Dropbox\exp\LCGT\MIF\Electronics\RFQPD\Altium\KAGRA_RF_QPD\aLIGO_wfs_top.SchDoc

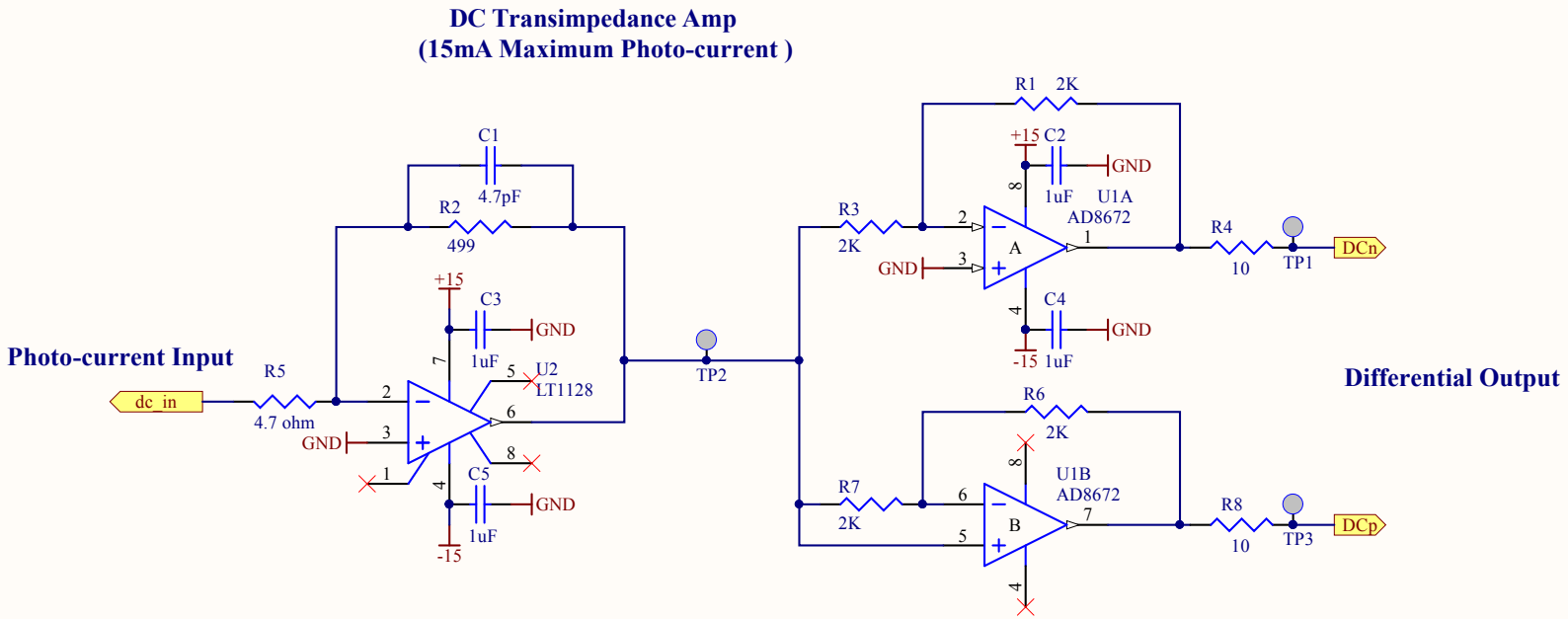
Values shown for 9/45 MHz. For component variations at different operating frequencies, see T1300199




**9/45 Design Corresponds to: C:\Rich's Files\LT Spice\PhotodiodeAnalysis\lsc_rfpds\aLIGO_ASC_2011\9_45_ASC_v3.asc**

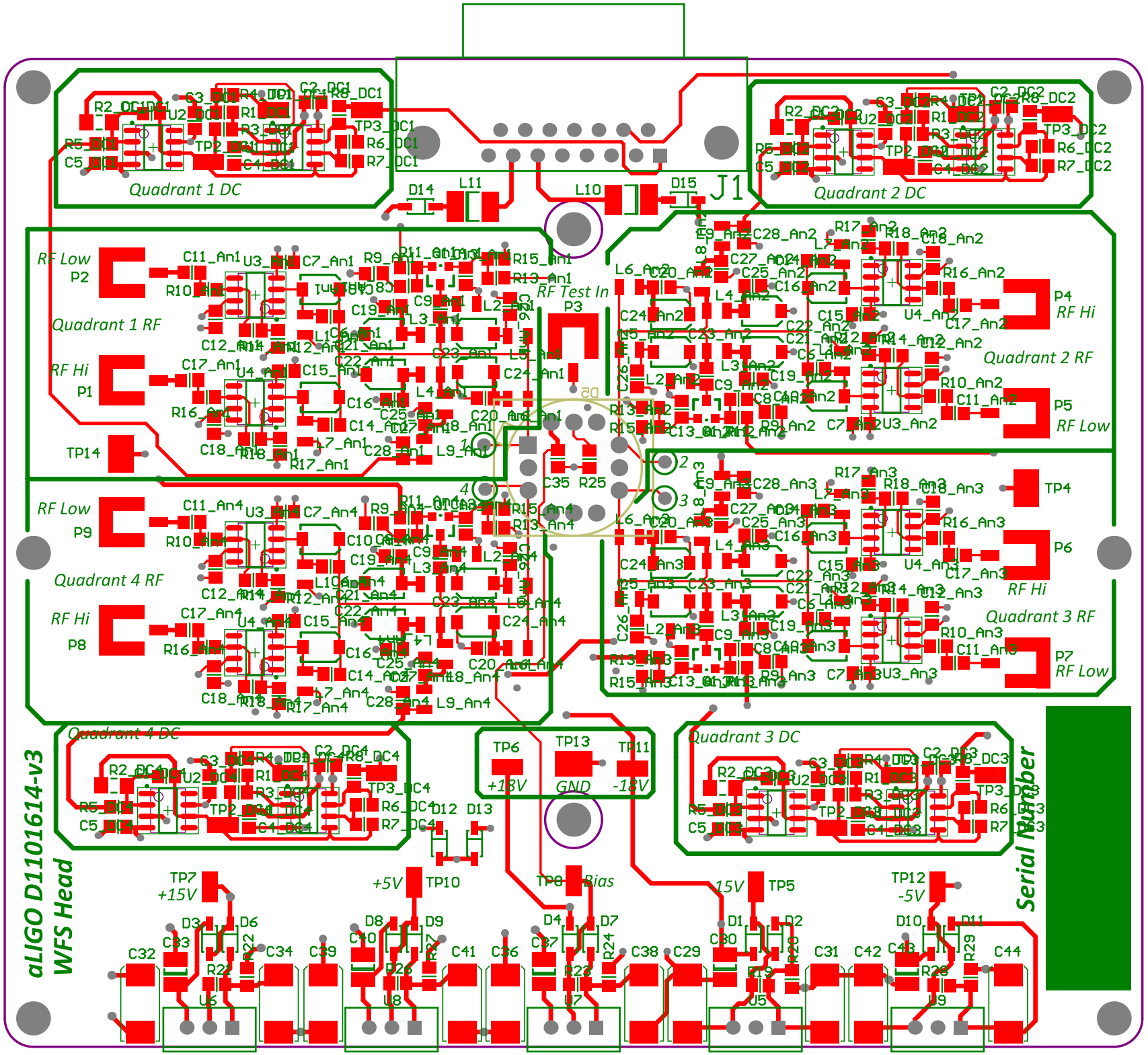
Last Edited: *29 August 2013*

| | | | | |
|---|---|---|---|---|
| Title: ***RF Section*** | | | *LIGO Laboratory*<br>*California Institute of Technology*<br>*Massachusetts Institute of Technology* | LIGO |
| Size: B | DCC Number: D1101614 | Revision: v5 | Engineer: *R. Abbott* | Date: 2015/03/10<br>Time: 16:09:56 |
| File: J:\Dropbox\exp\LCGT\MIF\Electronics\RFQPD\Altium\KAGRA_RF_QPD\aLIGO_wfs_RF.SchDoc | | | | Sheet 2 of 3 |




Last Edited: *29 August 2013*

| | | | | |
|---|---|---|---|---|
| Title: ***DC Section*** | | | *LIGO Laboratory*<br>*California Institute of Technology*<br>*Massachusetts Institute of Technology* | LIGO |
| Size: A | DCC Number: D1101614 | Revision: v5 | Engineer: *R. Abbott* | Date: 2015/03/10<br>Time: 16:09:56 |
| File: J:\Dropbox\exp\LCGT\MIF\Electronics\RFQPD\Altium\KAGRA_RF_QPD\aLIGO_wfs_DC.SchDoc | | | | Sheet 3 of 3 |


aLIGO D1101614-v3
WFS Head
Serial Number
Quadrant 1 DC
Quadrant 2 DC
Quadrant 3 DC
Quadrant 4 DC
Quadrant 1 RF
Quadrant 2 RF
Quadrant 3 RF
Quadrant 4 RF
RF Low
RF Hi
RF Test In
J1
P1
P2
P3
P4
P5
P6
P7
P8
P9
TP4
TP5
TP6
TP7
TP8
TP9
TP10
TP11
TP12
TP13
TP14
+18V
GND
-18V
+15V
-15V
+5V
Bias

| Designator | Comment | Digikey Part Number | Manufacturer Part Number | Quantity |
|---|---|---|---|---|
| C1_DC1, C1_DC2, C1_DC3, C1_DC4 | 4.7pF | 478-1300-1-ND | | 4 |
| C2_DC1, C2_DC2, C2_DC3, C2_DC4, C3_DC1, C3_DC2, C3_DC3, C3_DC4, C4_DC1, C4_DC2, C4_DC3, C4_DC4, C5_DC1, C5_DC2, C5_DC3, C5_DC4, C7_An1, C7_An2, C7_An3, C7_An4, C12_An1, C12_An2, C12_An3, C12_An4, C15_An1, C15_An2, C15_An3, C15_An4, C18_An1, C18_An2, C18_An3, C18_An4 | 1uF | 478-1580-1-ND | | 32 |
| C6_An1, C6_An2, C6_An3, C6_An4 | 150pF | 445-13356-2-ND | | 4 |
| C8_An1, C8_An2, C8_An3, C8_An4, C9_An1, C9_An2, C9_An3, C9_An4, C11_An1, C11_An2, C11_An3, C11_An4, C13_An1, C13_An2, C13_An3, C13_An4, C17_An1, C17_An2, C17_An3, C17_An4, C35 | 10nF, 10nF, 10nF, 10nF, 10nF, 10nF, 10nF, 10nF, 10nF, 10 nF, 10 nF, 10 nF, 10 nF, 10nF, 10nF, 10nF, 10nF, 10 nF, 10 nF, 10 nF, 10nF | 399-1158-1-ND | | 21 |
| C10_An1, C10_An2, C10_An3, C10_An4, C16_An1, C16_An2, C16_An3, C16_An4, C21_An1, C21_An2, C21_An3, C21_An4, C22_An1, C22_An2, C22_An3, C22_An4, C23_An1, C23_An2, C23_An3, C23_An4, C24_An1, C24_An2, C24_An3, C24_An4, L1_An1, L1_An2, L1_An3, L1_An4, L3_An1, L3_An2, L3_An3, L3_An4, L4_An1, L4_An2, L4_An3, L4_An4, L5_An1, L5_An2, L5_An3, L5_An4, L6_An1, L6_An2, L6_An3, L6_An4, L7_An1, L7_An2, L7_An3, L7_An4 | 40 pF, 40 pF, 40 pF, 40 pF, 20 pF, 20 pF, 20 pF, 20 pF, 20 pF, 40 pF, 40 pF, 40 pF, 40 pF, 40 pF, 40 pF, 40 pF, 40pF, 40pF, 40pF, 20pF, 20pF, 20pF, 20pF, 390nH, 390nH, 390nH, 390nH, 180nH, 180nH, 180nH, 180nH, 150nH, 150nH, 150nH, 150nH, 100nH, 100nH, 100nH, 100nH, 82nH, 82nH, 82nH, 82nH, 180nH, 180nH, 180nH, 180nH | | | 48 |
| C14_An1, C14_An2, C14_An3, C14_An4 | 22pF | 490-3614-1-ND | | 4 |
| C19_An1, C19_An2, C19_An3, C19_An4 | 120pF | 445-13352-1-ND | | 4 |
| C20_An1, C20_An2, C20_An3, C20_An4, C26_An1, C26_An2, C26_An3, C26_An4 | 20pF | 490-3607-1-ND | | 8 |
| C25_An1, C25_An2, C25_An3, C25_An4 | 39pF | 490-3611-1-ND | | 4 |
| C27_An1, C27_An2, C27_An3, C27_An4 | 100nF | 478-1316-1-ND | | 4 |
| C28_An1, C28_An2, C28_An3, C28_An4 | OMIT | OMIT | | 4 |
| C29, C31, C32, C34, C36, C38, C39, C41, C42, C44 | 10UF Tantalum, 35V | 478-1701-1-ND | | 10 |
| C30, C33, C37, C40, C43 | 1UF Tantalum, 50V | 478-3075-1-ND | | 5 |
| D1, D2, D3, D4, D6, D7, D8, D9, D10, D11, D12, D13, D14, D15 | RB160M-60, RB160M-60, RB160M-60, RB160M-60, RB160M-60, RB160M-60, RB160M-60, RB160M-60, RB160M-60, RB160M-60, RB160M-60, RB160M-60, RB160M-60, 60V, 1A Schottky, 60V, 1A Schottky | RB160M-60CT-ND | | 14 |
| D5 | Q3000 | Q3000 | | 1 |
| J1 | D15 Male | 6E17C-015P-AJ-121-ND | | 1 |
| L2_An1, L2_An2, L2_An3, L2_An4, L9_An1, L9_An2, L9_An3, L9_An4 | 10uH | | Coilcraft 1008LS-103XJLB | 8 |
| L8_An1, L8_An2, L8_An3, L8_An4 | 220nH | | Coilcraft 1008CS-221XGLB | 4 |
| L10, L11 | 10UH | 495-1754-1-ND | | 2 |
| P1, P2, P3, P4, P5, P6, P7, P8, P9 | SMP Surface Mount RF Connector | ARF1594-ND | | 9 |
| Q1_An1, Q1_An2, Q1_An3, Q1_An4 | MMBT5179 | MMBT5179CT-ND | | 4 |
| R1_DC1, R1_DC2, R1_DC3, R1_DC4, R3_DC1, R3_DC2, R3_DC3, R3_DC4, R6_DC1, R6_DC2, R6_DC3, R6_DC4, R7_DC1, R7_DC2, R7_DC3, R7_DC4 | 2K | P2.00KFCT-ND | | 16 |
| R2_DC1, R2_DC2, R2_DC3, R2_DC4 | 499 | RNCP0805FTD499RCT-ND | | 4 |
| R4_DC1, R4_DC2, R4_DC3, R4_DC4, R8_DC1, R8_DC2, R8_DC3, R8_DC4 | 10 | RNCP0805FTD10R0CT-ND | | 8 |
| R5_DC1, R5_DC2, R5_DC3, R5_DC4 | 4.7 ohm | RNCP0805FTD4R70CT-ND | | 4 |
| R9_An1, R9_An2, R9_An3, R9_An4, R12_An1, R12_An2, R12_An3, R12_An4, R17_An1, R17_An2, R17_An3, R17_An4 | 49.9 ohms | RNCP0805FTD49R9CT-ND | | 12 |
| R10_An1, R10_An2, R10_An3, R10_An4, R16_An1, R16_An2, R16_An3, R16_An4 | 30 ohms | 311-30BCT-ND | | 8 |
| R11_An1, R11_An2, R11_An3, R11_An4 | 1.37K | P1.37KDACT-ND | | 4 |
| R13_An1, R13_An2, R13_An3, R13_An4 | 1.5K | RNCP0805FTD1K50CT-ND | | 4 |
| R14_An1, R14_An2, R14_An3, R14_An4, R18_An1, R18_An2, R18_An3, R18_An4, R29 | 453 ohms, 453 ohms, 453 ohms, 453 ohms, 453 ohms, 453 ohms, 453 ohms, 453 ohms, 453 ohms | RG20P453BCT-ND | | 9 |
| R15_An1, R15_An2, R15_An3, R15_An4 | 402 ohms | 985-1294-1-ND | | 4 |
| R19, R28 | 120 | P120DACT-ND | | 2 |
| R20 | 1.33K | RG20P1.33KBCT-ND | | 1 |
| R21, R23, R26 | 249 | RNCP0805FTD249RCT-ND | | 3 |
| R22 | 2.67K | P2.67KDACT-ND | | 1 |
| R24 | 750 | RNCP0805FTD750RCT-ND | | 1 |
| R25 | 0 ohms | P0.0ACT-ND | | 1 |
| R27 | 909 | RNCP0805FTD909RCT-ND | | 1 |
| TP1_DC1, TP1_DC2, TP1_DC3, TP1_DC4, TP2_DC1, TP2_DC2, TP2_DC3, TP2_DC4, TP3_DC1, TP3_DC2, TP3_DC3, TP3_DC4, TP4, TP5, TP6, TP7, TP8, TP10, TP11, TP12, TP13, TP14 | TESTPT | 5016KCT-ND | | 22 |
| U1_DC1, U1_DC2, U1_DC3, U1_DC4 | ADB672 | ADB672ARZ-REEL7CT-ND | | 4 |
| U2_DC1, U2_DC2, U2_DC3, U2_DC4 | LT1128 | LT1128CS8#PBF-ND | | 4 |
| U3_An1, U3_An2, U3_An3, U3_An4, U4_An1, U4_An2, U4_An3, U4_An4 | LMH6624AH | 296-35334-1-ND | | 8 |
| U5, U9 | LM337BT | LM337BTGOS-ND | | 2 |
| U6, U7, U8 | LM317T | LM317BTGOS-ND | | 3 |