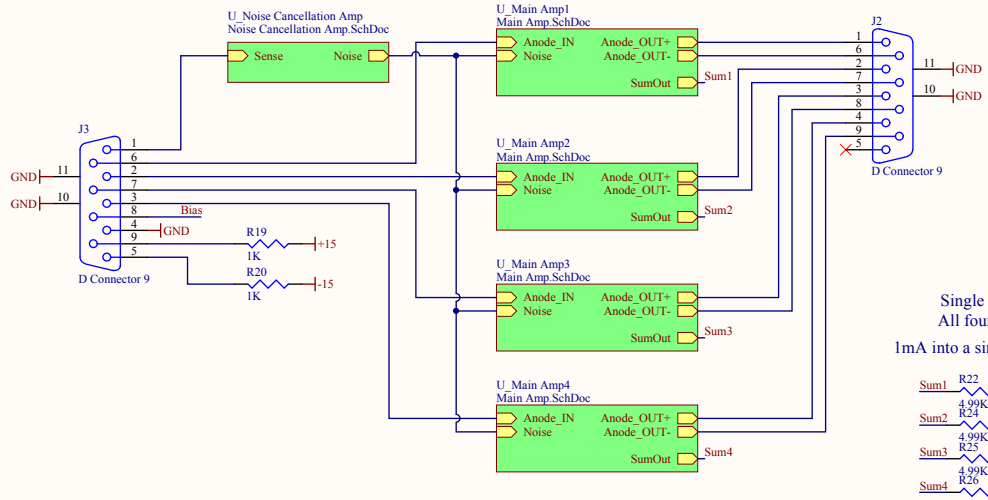
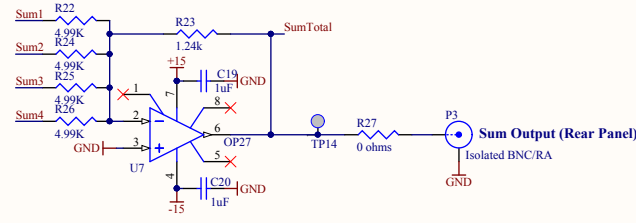
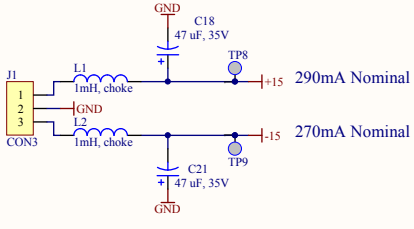
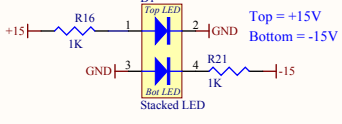


Single input gain = 0.2485
All four input gain = 0.994

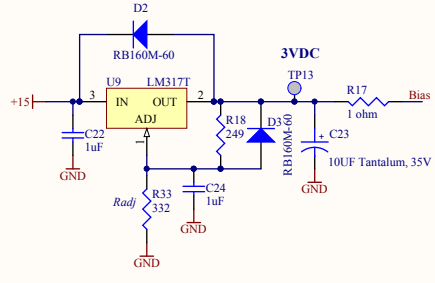
1mA into a single anode input should produce 2.845VDC at TP14







Heatsink Part Number: AE10852-ND



Change History
Version. 1 - Initial Release
Version. 2 notes:
(1). R18 = 240, R17 = 336 for 3V DC on LM317. A formal decision on the bias voltage
(2). DS1, DS2 are dual type LED's for convenience and lower parts count
(3). Add R15 = 0 ohms resistor in series with the noise cancellation output. This is a backup incase we don't like the noise amp any more
(4). JP1 is added to the input of the Noise Cancellation Amp. This is for testing purposes
(5). J2, J3 DB9 connectors shells are grounded to improve cable shielding
Change History - V3 Schematic Only and the PCB Boards are in V2

Version. 3 notes:
(1). Capacitor C15 is removed
(2). Resistor R15 attributes have been changed correctly to 0 ohms.
(3). PCB Board physical layout is the board generated in version 2 still

Version 4 (R. Abbott)
1. Added jumper (P1) to board to disconnect the noise amp
2. Added explanatory text to PCB in case future boards are ordered
3. Changed all front end transimpedance amplifiers from AD8675 to OP-27 due to fragile input structure on AD8675

Version 5 (R. Abbott) PCB Revision is now Version 5 too
1. Added sum output via BNC on rear of board
2. Added jumpers to allow choice of whitened or unwhitened outputs for each channel
3. Upgraded bias regulator due to part obselesence
4. Cleaned and groomed the BOM plus the PCB layout

Version 6 (R. Abbott)
1. Changed value of R23 from 20k to 1.24k to avoid saturation if all four quadrants are at 10VDC. Version 5 PCB is still current

Last Edited: 9/16/2014				
Title: ISC QPD Transimpedance Amplifier		* California Institute of Technology LIGO Project		LIGO
Size: B	DCC Number: D1001974	Revision: v6	Engineer: Mohana/R. Abbott	Date: 9/16/2014 Time: 9:30:11 AM Sheet 1 of 3
File: C:\Rich's Files\Mycadfiles\ISC\aLIGO Quadpd amp\D1001974-v5\QPD.SchDoc				

SumOut

Whitening Select

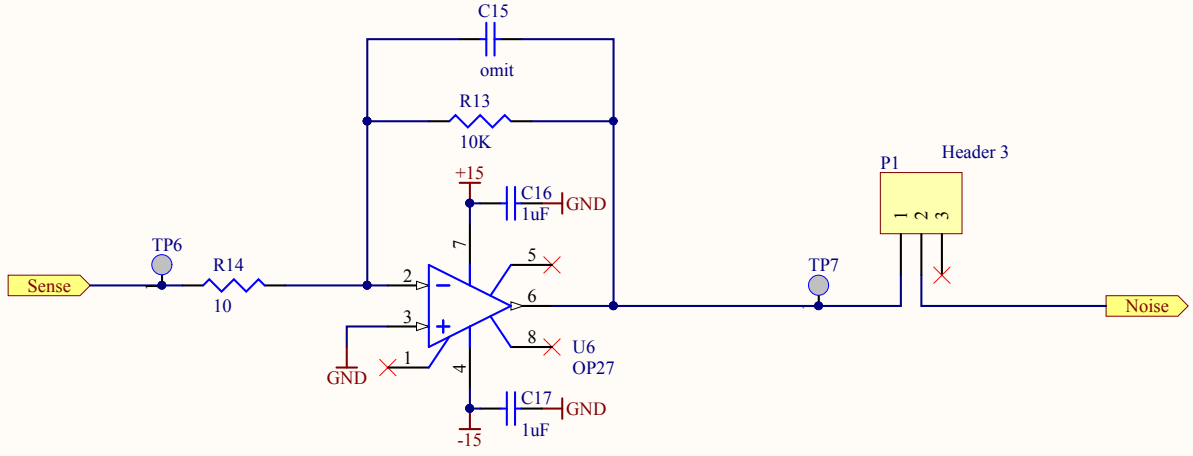
P2
3
2
1
Header 3

2-881545-2-ND for Jumper

GND
C1
20 uF
Zero = 0.39Hz
Pole = 39.8Hz
Pole = 79.6kHz
R1
200
C2
100pF
TP1
R3
20K
TP3
C3
5.1pF
R4
1K
Noise
R6
10K
C5
100pF
+15
C8
1uF
GND
TP4
Anode_IN
R8
10
GND
U4
OP27
C11
-15
1uF
GND
R9
1
U2
V1+
V2+
NC
NC
V1-
V2-
HA5002
C6
GND
1uF
+15
GND
C12
1uF
-15
+15
C7
1uF
GND
6 U3
OP27
C10
1uF
GND
-15
R5
4.99K
R2
4.99K
+15
C4
1uF
GND
6 U1
OP27
R7
0 ohms
Anode_OUT+
C9
1uF
GND
-15
TP2
R12
4.99K
R10
4.99K
+15
C13
1uF
GND
6 U5
OP27
R11
0 ohms
Anode_OUT-
C14
1uF
GND
-15
TP5
GND

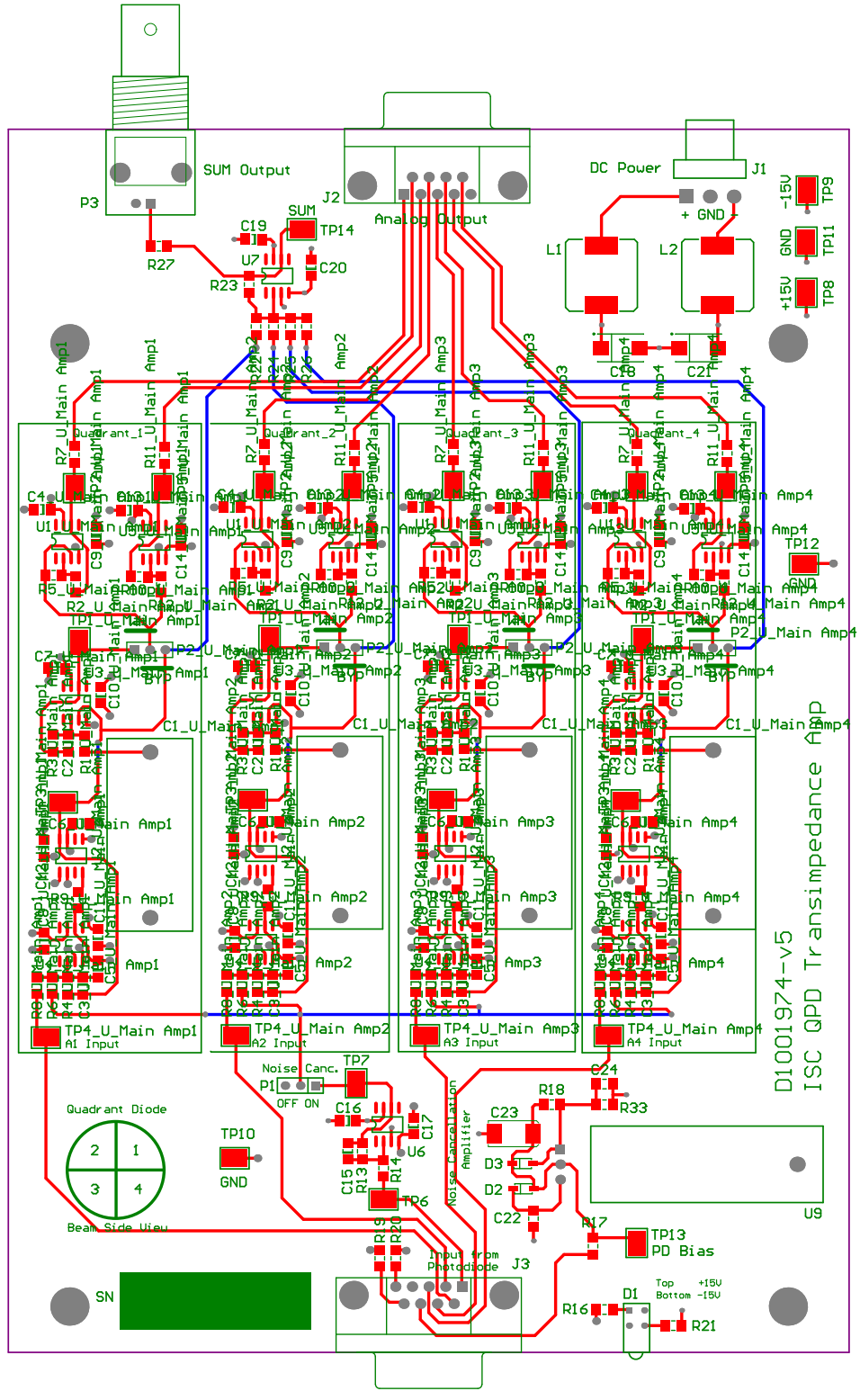
Last Edited: 17 July 2013

Title: *Transimpedance and Whitening Amplifier*			* California Institue of Technology LIGO Project	LIGO
Size: A	DCC Number: D1001974	Revision: v6	Engineer: *Mohana/R. Abbott*	Date: 9/16/2014 Time: 9:30:12 AM
File: C:\Rich's Files\Mycadfiles\ISC\aLIGO Quadpd amp\D1001974-v5\Main Amp.SchDoc				Sheet 2 of 3



Last Edited: 17 July 2013

Title: *Noise Cancellation Amplifier*			* *California Institue of Technology* *LIGO Project*	LIGO
Size: A	DCC Number: D1001974	Revision: v6	Engineer: *Mohana/R. Abbott*	Date: 9/16/2014 Time: 9:30:12 AM
File: C:\Rich's Files\Mycadfiles\ISC\aLIGO Quadpd amp\D1001974-v5\Noise Cancellation Amp.SchDoc				Sheet 3 of 3


SUM Output
P3
R27
SUM
TP14
C19
U7
C20
R23
J2
Analog Output
DC Power
J1
+ GND -
L1
L2
-15V
TP9
GND
TP11
+15V
TP8
C18
C21
Quadrant_1_U_Main Amp1
Quadrant_2_U_Main Amp2
Quadrant_3_U_Main Amp3
Quadrant_4_U_Main Amp4
TP12
GND
TP4_U_Main Amp1
A1 Input
TP4_U_Main Amp2
A2 Input
TP4_U_Main Amp3
A3 Input
TP4_U_Main Amp4
A4 Input
Noise Canc.
P1
OFF ON
TP7
C16
C17
U6
C15
R13
R14
TP6
TP10
GND
Quadrant Diode
2
1
3
4
Beam Side View
Noise Cancellation Amplifier
C24
R18
R33
C23
D3
D2
C22
U9
R17
TP13
PD Bias
Input from Photodiode
J3
SN
D1
Top +15V
Bottom -15V
R16
R21
D1001974-v5
ISC QPD Transimpedance Amp

Designator	Digikey Part Number	Heatsink Part Number	Jumper Part Number	Quantity
C1_U_Main Amp1, C1_U_Main Amp2, C1_U_Main Amp3, C1_U_Main Amp4	478-2592-ND			4
C2_U_Main Amp1, C2_U_Main Amp2, C2_U_Main Amp3, C2_U_Main Amp4, C5_U_Main Amp1, C5_U_Main Amp2, C5_U_Main Amp3, C5_U_Main Amp4	399-8127-1-ND			8
C3_U_Main Amp1, C3_U_Main Amp2, C3_U_Main Amp3, C3_U_Main Amp4	399-1186-1-ND			4
C4_U_Main Amp1, C4_U_Main Amp2, C4_U_Main Amp3, C4_U_Main Amp4, C6_U_Main Amp1, C6_U_Main Amp2, C6_U_Main Amp3, C6_U_Main Amp4, C7_U_Main Amp1, C7_U_Main Amp2, C7_U_Main Amp3, C7_U_Main Amp4, C8_U_Main Amp1, C8_U_Main Amp2, C8_U_Main Amp3, C8_U_Main Amp4, C9_U_Main Amp1, C9_U_Main Amp2, C9_U_Main Amp3, C9_U_Main Amp4, C10_U_Main Amp1, C10_U_Main Amp2, C10_U_Main Amp3, C10_U_Main Amp4, C11_U_Main Amp1, C11_U_Main Amp2, C11_U_Main Amp3, C11_U_Main Amp4, C12_U_Main Amp1, C12_U_Main Amp2, C12_U_Main Amp3, C12_U_Main Amp4, C13_U_Main Amp1, C13_U_Main Amp2, C13_U_Main Amp3, C13_U_Main Amp4, C14_U_Main Amp1, C14_U_Main Amp2, C14_U_Main Amp3, C14_U_Main Amp4, C16, C17, C19, C20, C22, C24	445-4044-1-ND			46
C15				1
C18, C21	399-5164-1-ND			2
C23	478-1722-1-ND			1
D1	67-1321-ND			1
D2, D3	RB160M-60CT-ND			2
J1	WM5236-ND			1
J2, J3	A32117-ND			2
L1, L2	308-1332-1-ND			2
P1, P2_U_Main Amp1, P2_U_Main Amp2, P2_U_Main Amp3, P2_U_Main Amp4	609-3468-ND		2-881545-2-ND	5
P3	A32244-ND			1
R1_U_Main Amp1, R1_U_Main Amp2, R1_U_Main Amp3, R1_U_Main Amp4	RG32P200BCT-ND			4
R2_U_Main Amp1, R2_U_Main Amp2, R2_U_Main Amp3, R2_U_Main Amp4, R5_U_Main Amp1, R5_U_Main Amp2, R5_U_Main Amp3, R5_U_Main Amp4, R10_U_Main Amp1, R10_U_Main Amp2, R10_U_Main Amp3, R10_U_Main Amp4, R12_U_Main Amp1, R12_U_Main Amp2, R12_U_Main Amp3, R12_U_Main Amp4, R22, R24, R25, R26	TNP4.99KACCT-ND			20
R3_U_Main Amp1, R3_U_Main Amp2, R3_U_Main Amp3, R3_U_Main Amp4	RG32P20.0KBCT-ND			4
R4_U_Main Amp1, R4_U_Main Amp2, R4_U_Main Amp3, R4_U_Main Amp4, R16, R19, R20, R21	RG32P1.0KBCT-ND			8
R6_U_Main Amp1, R6_U_Main Amp2, R6_U_Main Amp3, R6_U_Main Amp4, R13	RG32P10.0KBCT-ND			5
R7_U_Main Amp1, R7_U_Main Amp2, R7_U_Main Amp3, R7_U_Main Amp4, R11_U_Main Amp1, R11_U_Main Amp2, R11_U_Main Amp3, R11_U_Main Amp4, R27	P0.0ECT-ND			9
R8_U_Main Amp1, R8_U_Main Amp2, R8_U_Main Amp3, R8_U_Main Amp4, R14	CRT1206-BY-10R0ELFCT-ND			5
R9_U_Main Amp1, R9_U_Main Amp2, R9_U_Main Amp3, R9_U_Main Amp4	P1.0ECT-ND			4
R17	P1.0RCT-ND			1
R18	RNCP1206FTD249RCT-ND			1
R23	P1.24KBCCT-ND			1
R33	P332FCT-ND			1
TP1_U_Main Amp1, TP1_U_Main Amp2, TP1_U_Main Amp3, TP1_U_Main Amp4, TP2_U_Main Amp1, TP2_U_Main Amp2, TP2_U_Main Amp3, TP2_U_Main Amp4, TP3_U_Main Amp1, TP3_U_Main Amp2, TP3_U_Main Amp3, TP3_U_Main Amp4, TP4_U_Main Amp1, TP4_U_Main Amp2, TP4_U_Main Amp3, TP4_U_Main Amp4, TP5_U_Main Amp1, TP5_U_Main Amp2, TP5_U_Main Amp3, TP5_U_Main Amp4, TP6, TP7, TP8, TP9, TP10, TP11, TP12, TP13, TP14	5016KCT-ND			29
U1_U_Main Amp1, U1_U_Main Amp2, U1_U_Main Amp3, U1_U_Main Amp4, U3_U_Main Amp1, U3_U_Main Amp2, U3_U_Main Amp3, U3_U_Main Amp4, U4_U_Main Amp1, U4_U_Main Amp2, U4_U_Main Amp3, U4_U_Main Amp4, U5_U_Main Amp1, U5_U_Main Amp2, U5_U_Main Amp3, U5_U_Main Amp4, U6, U7	OP27GSZ-ND			18
U2_U_Main Amp1, U2_U_Main Amp2, U2_U_Main Amp3, U2_U_Main Amp4	HA9P5002-5Z-ND			4
U9	LM317TFS-ND	AE10852-ND		1