P1
L17D204182TX
Hadware Female Screw

P2
D-Sub 3pin POWER Connector
3003W3PXX42A10X_CONEC

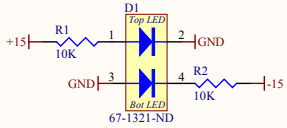
P3
Circuit Breaker Thrm 2A 250VAC 50vdc
302-1210-ND

P4
Contact Crimp Non-Gendered 18-24 AWG Gold
WM2305-ND

P5
3 Position Receptacle 0.156" (3.96mm)
WM2112-ND

P6
Quick Connect Female 18-22AWG Fully Insulated 0.250inch
A27817CT-ND

±15v POWER LEDS FRONT PANEL



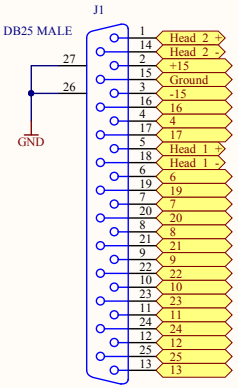
Circuit Board to extract a 3.125MHz signal from the existing OMC DCPDs

P7
TNC female Bulkhead Feedthru Isolated to SMA right angle male 7" Field Components

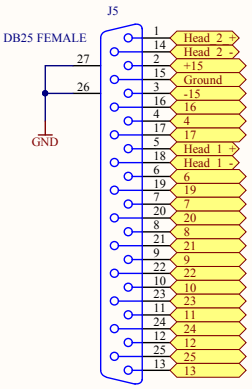
P9
TNC female Bulkhead Feedthru Isolated to SMA right angle male 7" Field Components

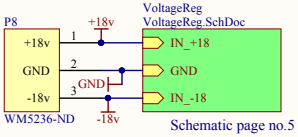
P10
TNC female Bulkhead Feedthru Isolated to SMA right angle male 7" Field Components

Input from OMC DCPD

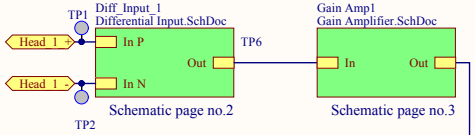


Output to ISC WHITENING

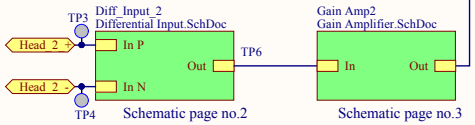


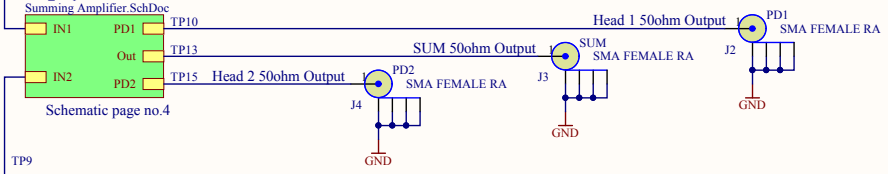


Head No. 1

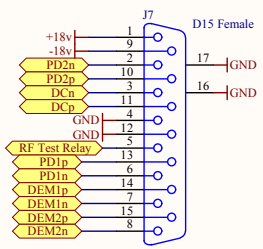


Head No.2



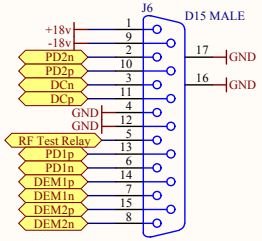


HOMODYNE DETECTOR INTERFACE



Front Panel

HOMODYNE DETECTOR INTERFACE



PCB Output

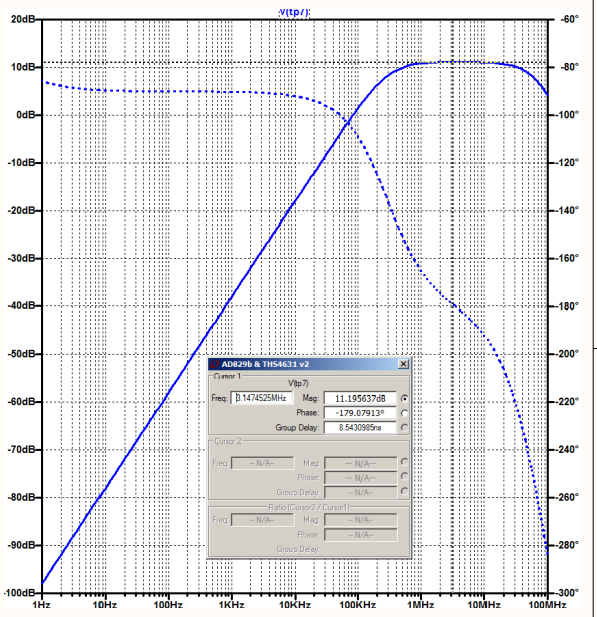
Revision and Modifications on Prototype design:

1. Initial Release.

Last Edited: 8/23/2017				
Title: SQUEEZER ANGLE CONTROL SCHEMATIC			LIGO Laboratory, California Institute of Technology, Massachusetts Institute of Technology	LIGO
Size: B	DCC Number: D1700376	Revision: 1	Engineer: L.Sanchez	Date: 8/24/2017
File: C:\Users\Public\Documents\Altium\Projects\SqueezerAngleControl\PCB_SqueezerAngleCtrl\SAC.SchDoc				Time: 9:08:44 AM
				Sheet 1 of 5

pole at 290KHz 8.22dB

C4,C10 are considered 1 pole

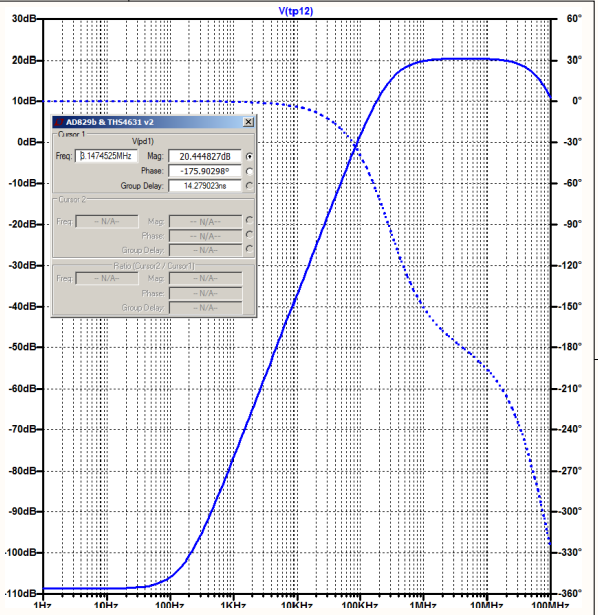


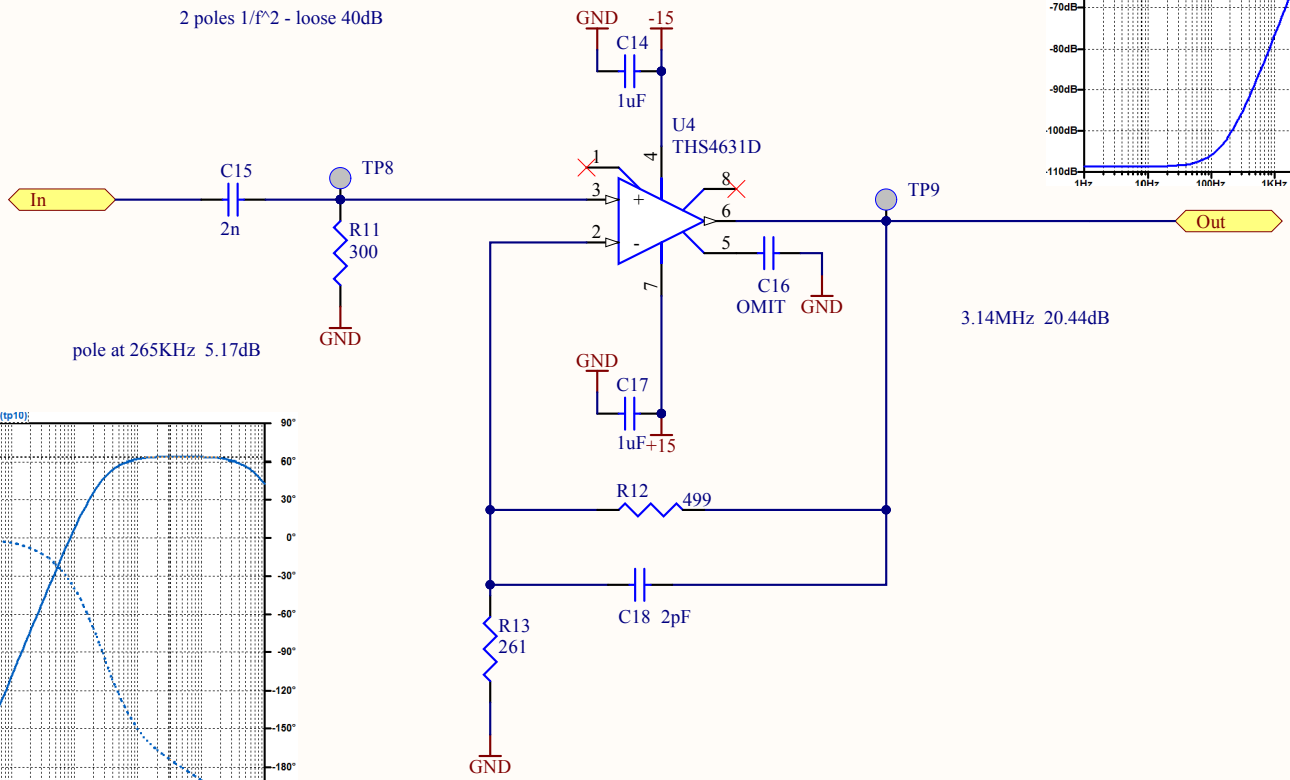
Title: *Differential Input*				*LIGO Laboratory* *California Institute of Technology* *Massachusetts Institute of Technology*	LIGO
Size: A	DCC Number: D1700376	Revision: 1	Engineer: *Luis Sanchez*	Last Edited: 8/23/2017	Date: 8/24/2017 Time: 9:08:44 AM
File: C:\Users\Public\Documents\Altium\Projects\SqueezerAngleControl\PCB_SqueezerAngleCtrl\Differential Input.SchDoc					Sheet 2 of 5

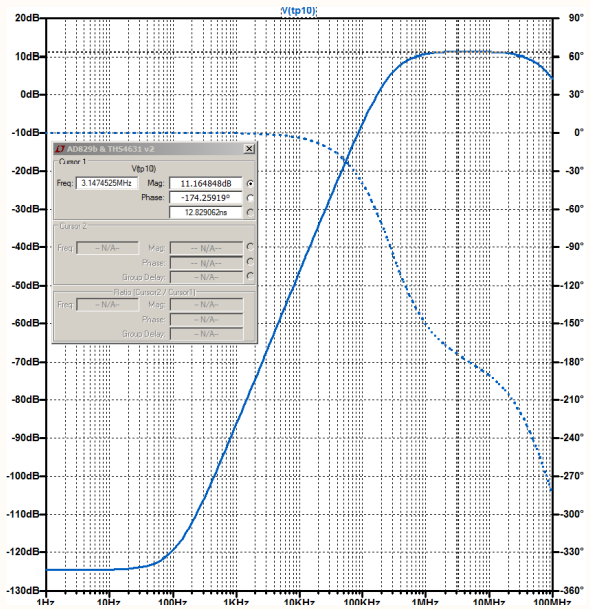
C4,C10 are considered 1 pole

C14 1 pole

2 poles 1/f^2 - loose 40dB

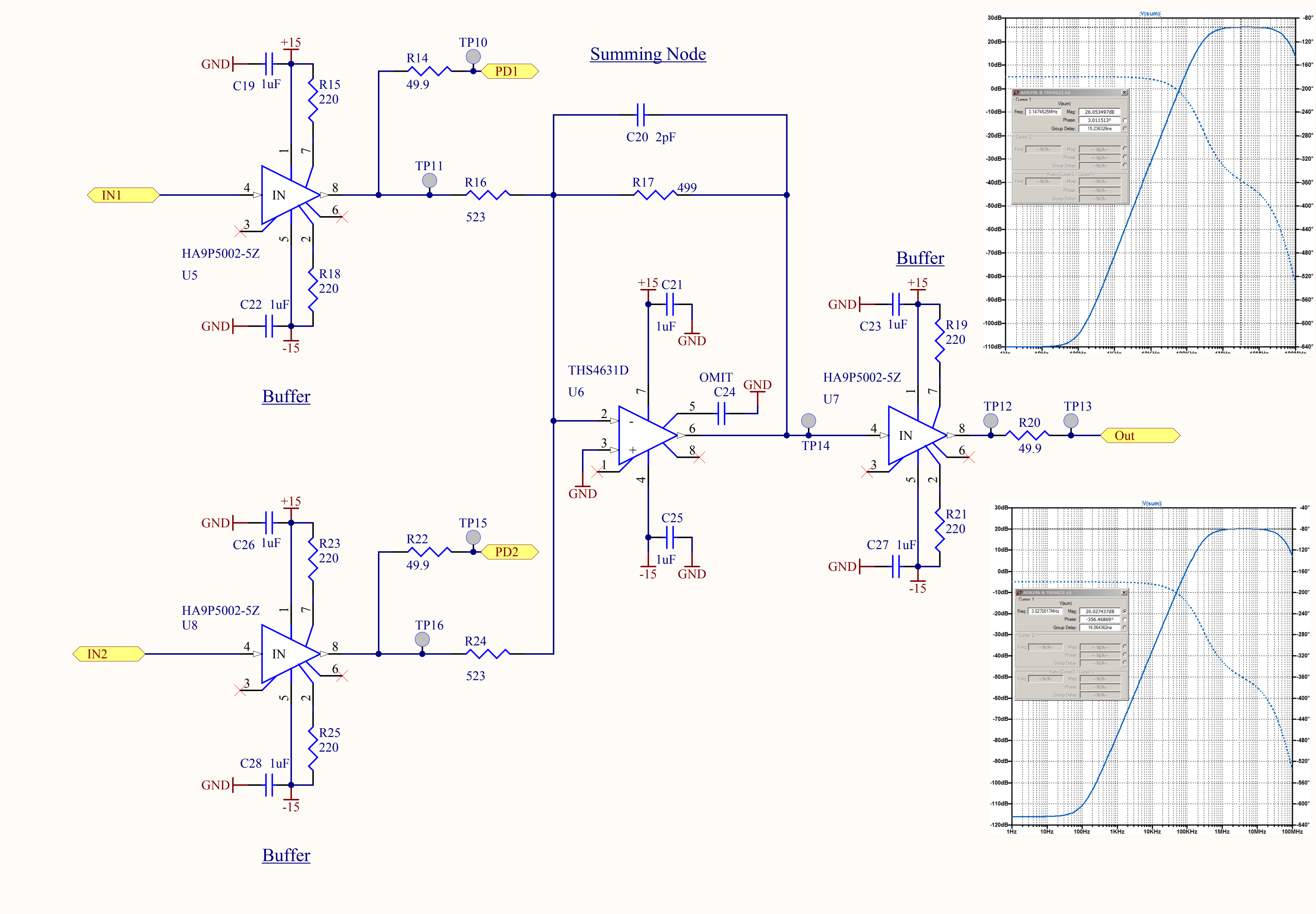






Title: *Filter & Gain Amplifier*				*LIGO Laboratory* *California Institute of Technology* *Massachusetts Institute of Technology*
Size: A	DCC Number: D1700376	Revision: 1	Engineer: *Luis Sanchez*	Date: 8/24/2017 Time: 9:08:44 AM
File: C:\Users\Public\Documents\Altium\Projects\SqueezerAngleControl\PCB_SqueezerAngleCtrl\Gain Amplifier.SchDoc				Sheet 3 of 5

Last Edited: 8/23/2017



Last Edited: 8/23/2017

Title **Summing Amplifier**

LIGO Laboratory
California Institute of Technology
Massachusetts Institute of Technology

LIGO

Size: A | DCC Number: D1700376 | Revision: 1 | Engineer: *Luis Sanchez*

Date: 8/24/2017
Time: 9:08:44 AM

File: C:\Users\Public\Documents\Altium\Projects\SqueezerAngleControl\PCB_SqueezerAngleCtrl\Summing Amplifier.SchDoc

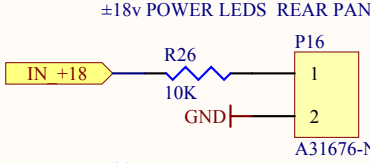
P12
LED GREEN 1/4" HOLE PANEL MOUNT
L10005-ND

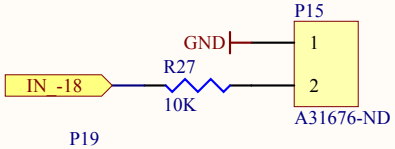
±18v POWER LEDS REAR PANEL

P13
LED GREEN 1/4" HOLE PANEL MOUNT
L10005-ND

P11
CONN SOCKET 18-24AWG SL156 GOLD
A24208CT-ND
P14
CONN SOCKET 18-24AWG SL156 GOLD
A24208CT-ND
P17
CONN SOCKET 18-24AWG SL156 GOLD
A24208CT-ND
P18
CONN SOCKET 18-24AWG SL156 GOLD
A24208CT-ND

TP17 TP18 TP19 TP20 TP21 TP22 TP23
GND GND GND GND GND GND GND





P20
2 Position Receptacle 0.156" (3.96mm)
A24111-ND

P19
2 Position Receptacle 0.156" (3.96mm)
A24111-ND

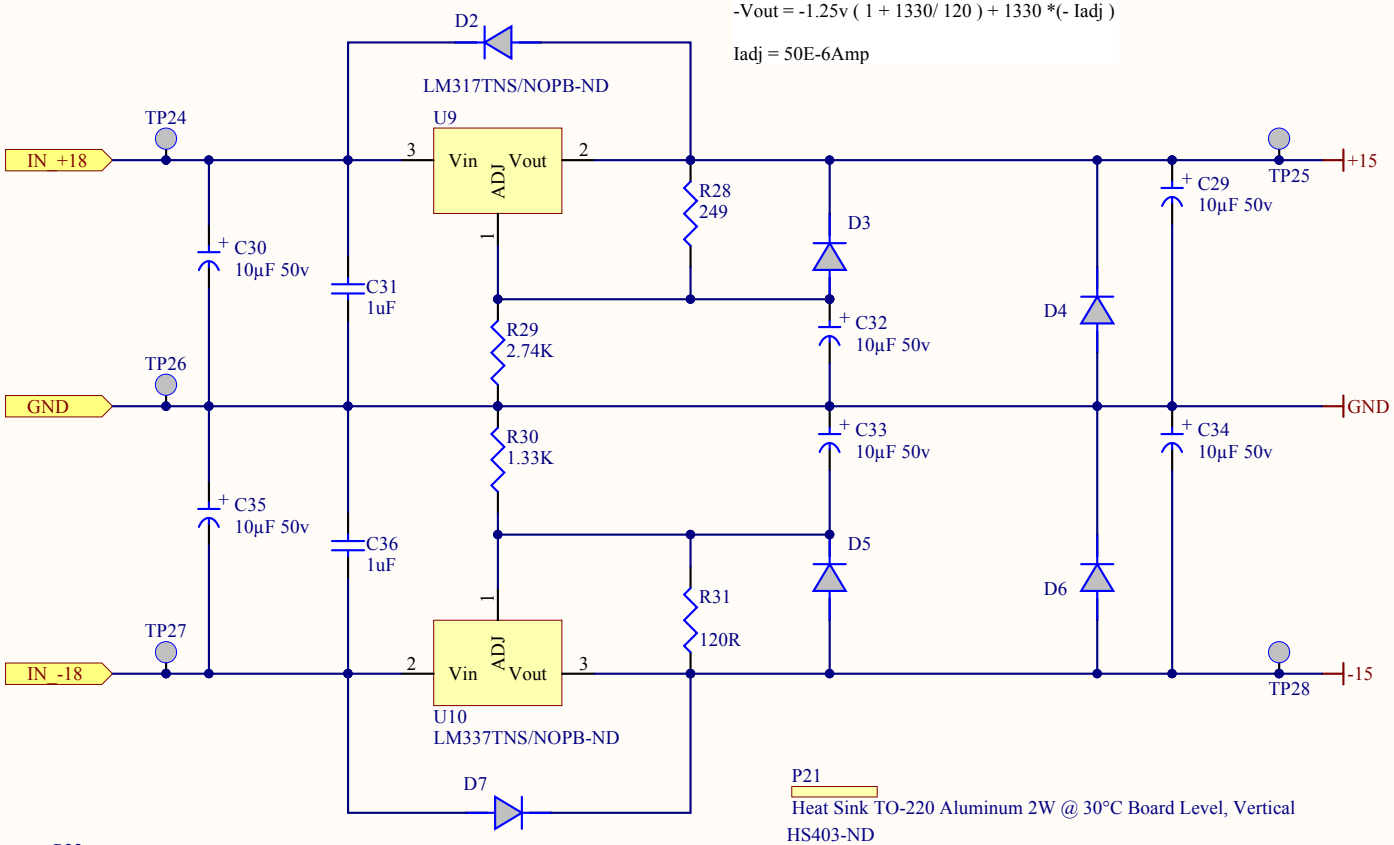
D7 protects againts C40 (input shorts)
D8 protects againts C42 (output shorts)

Iadj = 50E-6Amp
Vout = 1.25v (1 + R46 / R45) + R46 * Iadj
Vout= 1.25v (1 + 2740 / 249) + (2740 * 50E-6) = 15.14v

D10 protects againts C44 (input shorts)
D9 protects againts C43 (output shorts)

-Vout = -1.25v (1 + 1330/ 120) + 1330 *(- Iadj)

Iadj = 50E-6Amp



P21
Heat Sink TO-220 Aluminum 2W @ 30°C Board Level, Vertical
HS403-ND

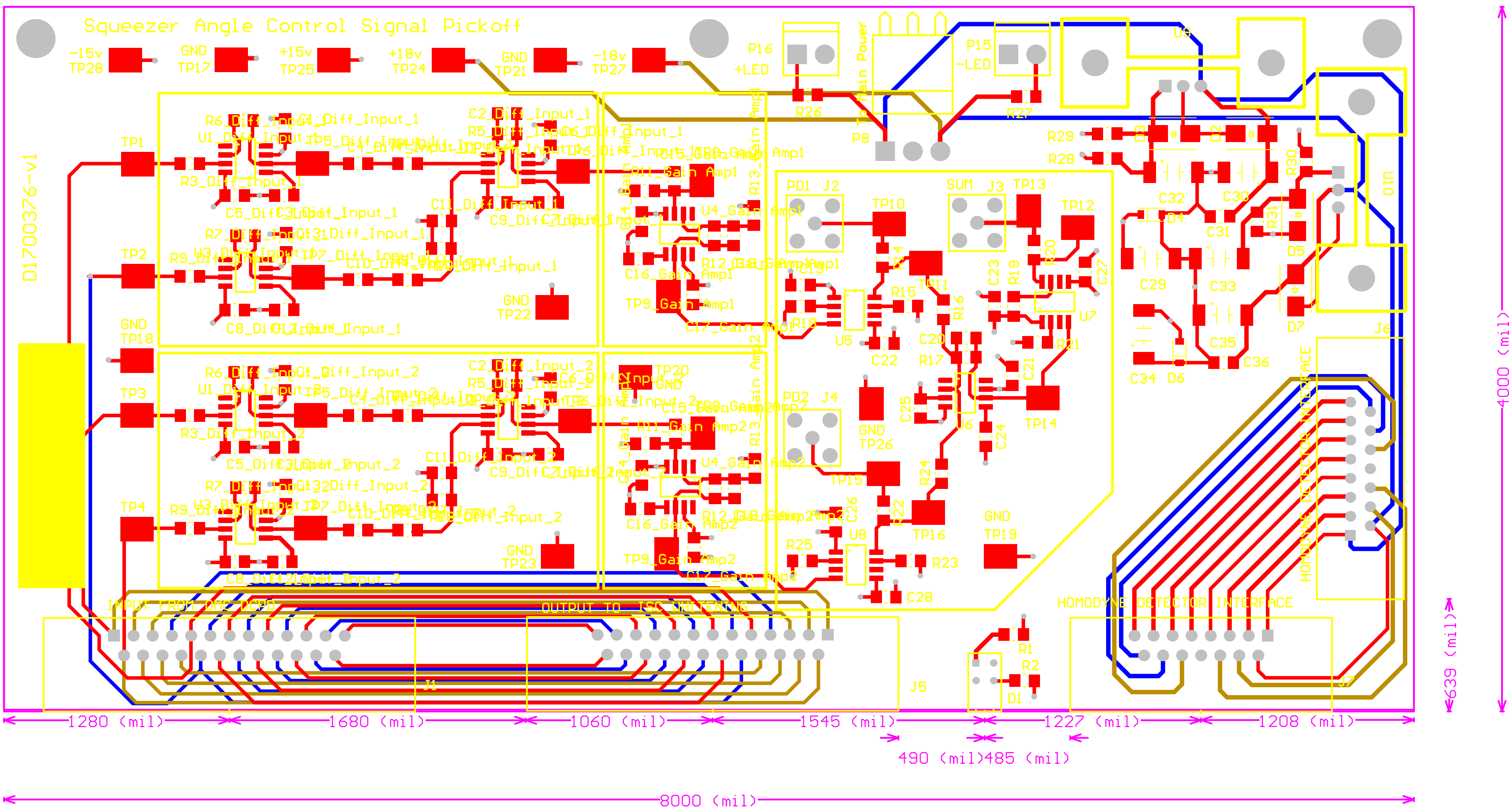
P23
Heat Sink TO-220 Aluminum 2W @ 30°C Board Level, Vertical
HS403-ND

P22
MOUNTING KIT TO-220
HS417-ND

P24
MOUNTING KIT TO-220
HS417-ND

Last Edited: 8/24/2017

Title: *Voltage Regulator*			*LIGO Laboratory* *California Institute of Technology* *Massachusetts Institute of Technology*	LIGO
Size: A	DCC Number: D1700376	Revision: 1	Engineer: *Luis Sanchez*	Date: 8/24/2017 Time: 9:08:44 AM
File: C:\Users\Public\Documents\Altium\Projects\SqueezerAngleControl\PCB_SqueezerAngleCtrl\VoltageReg.SchDoc				Sheet 5 of 5


Squeezer Angle Control Signal Pickoff
D1700376-v1
-15v TP28
GND TP17
+15v TP25
+18v TP24
GND TP21
-18v TP27
P16 +LED
P15 -LED
To Main Power
P8
R26
R27
PD1 J2
PD2 J4
SUM J3
INPUT FROM DARM DCPD
OUTPUT TO TCS INTERFACE
HOMODYNE DETECTOR INTERFACE
J1
J5
J6
J7
1280 (mil)
1680 (mil)
1060 (mil)
1545 (mil)
1227 (mil)
1208 (mil)
490 (mil)
485 (mil)
8000 (mil)
4000 (mil)
639 (mil)

LIGO Bill of Materials

Source Data From: PCB_SqueezerAngleCtrl.PrjPcb
Board Designed By: L.Sanchez
Board D-number D1700376
Board Revision 1
Variant: None

Creation Date: 8/24/2017 9:08:49 AM
Print Date: 24-Aug-17 9:08:54 AM

Designator	Comment	Description	Digikey Part Number	Manufacturers Part Number	Quantity
C1_Diff_Input_1, C1_Diff_Input_2, C5_Diff_Input_1, C5_Diff_Input_2, C6_Diff_Input_1, C6_Diff_Input_2, C8_Diff_Input_1, C8_Diff_Input_2, C9_Diff_Input_1, C9_Diff_Input_2, C13_Diff_Input_1, C13_Diff_Input_2, C14_Gain Amp1, C14_Gain Amp2, C17_Gain Amp1, C17_Gain Amp2, C19, C21, C22, C23, C25, C26, C27, C28, C31, C36	CAP CER 1UF 50V Y5V 1206	CAP CER 1UF 50V Y5V 1206	478-1580-1-ND	12065G105ZAT2A	26
C2_Diff_Input_1, C2_Diff_Input_2, C11_Diff_Input_1, C11_Diff_Input_2, C18_Gain Amp1, C18_Gain Amp2, C20	CAP CER 2PF 50V NP0 1206	CAP CER 2PF 50V NP0 1206	399-15091-1-ND	C1206C209D5GAC7800	7
C3_Diff_Input_1, C3_Diff_Input_2, C7_Diff_Input_1, C7_Diff_Input_2, C12_Diff_Input_1, C12_Diff_Input_2, C16_Gain Amp1, C16_Gain Amp2, C24	OMIT	CAP CER 5.1PF 50V C0G/NP0 1206	399-1186-1-ND	C1206C519C5GACTU	9
C4_Diff_Input_1, C4_Diff_Input_2, C10_Diff_Input_1, C10_Diff_Input_2, C15_Gain Amp1, C15_Gain Amp2	CAP CER 2000PF 100V C0G/NP0 1206	CAP CER 2000PF 100V C0G/NP0 1206	490-11605-1-ND	GRM3195C2A202JA01D	6
C29, C30, C32, C33, C34, C35	SMD Cap Tantalum Poly 10uF 50v 2917	SMD Cap Tantalum Poly 10uF 50v 2917	478-6492-2-ND	TCJD106M050R0120	6
D1	Stacked LED	Dual Green LED	67-1321-ND	SSF-LXH240GGD	1
D2, D3, D5, D7	Diode Standard 100V 1A Surface Mount SMB	Diode Standard 100V 1A Surface Mount SMB	S1BB-FDICT-ND	S1BB-13-F	4
D4, D6	Diode Schottky 60v 1A SMT PMDU SOD-123F	Diode Schottky 60v 1A SMT PMDU SOD-123F	RB162M-60CT-ND	RB162M-60TR	2
J1	DB25 MALE	CONN D-SUB PLUG 25POS R/A SOLDER	A32100-ND	5747842-4	1
J2, J3, J4	CONN SMA RCPT STR 50 OHM PCB Straight	CONN SMA RCPT STR 50 OHM PCB Straight	ARF1205-ND	901-144	3
J5	DB25 FEMALE	CONN D-SUB RCPT 25POS R/A SOLDER	A35111-ND	1734350-1	1
J6	D15 MALE	CONN D-SUB PLUG 15POS VERT SLDR	5750638-1-ND	5750638-1	1
J7	D15 Female	CONN D-SUB RCPT 15POS R/A SOLDER	182-15FE-ND	182-015-213R531	1
P1	10PACK FEMALE SCREW	10PACK FEMALE SCREW	L17D204182TX-ND	L17D204182TX	1
P2	D-Sub 3pin POWER Connector	D-Sub 3pin POWER Connector	3003W3PX042A10X_CONEC	3003W3PX042A10X	1
P3	Circuit Breaker Thrm 2A 250VAC 50vdc	Circuit Breaker Thrm 2A 250VAC 50vdc	302-1210-ND	3120-F321-P7T1-W02D-2A	1
P4	Contact Crimp Non-Gendered 18-24 AWG Gold	Contact Crimp Non-Gendered 18-24 AWG Gold	WM2305-ND	0008560106	1
P5	3 Position Receptacle 0.156" (3.96mm)	3 Position Receptacle 0.156" (3.96mm)	WM2112-ND	0009508033	1
P6	Quick Connect Female 18-22AWG Fully Insulated 0.250inch	Quick Connect Female 18-22AWG Fully Insulated 0.250inch	A27817CT-ND	2-520183-2	1
P7, P9, P10	TNC female Bulkhead Feedthru Isolated to SMA right angle male 7"	TNC female Bulkhead Feedthru Isolated to SMA right angle male 7"	Field Components	Field Components	3
P8	3 Pos Header 0.156inch	Molex 3p 0.156inch Through Hole Right Angle	WM5236-ND	0026615030	1
P11, P14, P17, P18	CONN SOCKET 18-24AWG SL156 GOLD	CONN SOCKET 18-24AWG SL156 GOLD	A24208CT-ND	770476-2	4
P12, P13	LED GREEN 1/4" HOLE PANEL MOUNT	LED GREEN 1/4" HOLE PANEL MOUNT	L10005-ND	5100H5	2
P15, P16	2 Positions Header Connector 0.156" (3.96mm) Through Hole Gold	2 Positions Header Connector 0.156" (3.96mm) Through Hole Gold	A31676-ND	3-641208-2	2
P19, P20	2 Position Receptacle 0.156" (3.96mm)	2 Position Rectangular Housing Connector Receptacle Natural 0.156" (3.96mm)	A24111-ND	770849-2	2
P21, P23	Heat Sink TO-220 Aluminum 2W @ 30°C Board Level, Vertical	Heat Sink TO-220 Aluminum 2W @ 30°C Board Level, Vertical	HS403-ND	513002B02500G	2
P22, P24	MOUNTING KIT TO-220	MOUNTING KIT TO-220	HS417-ND	4880G	2
R1, R2, R26, R27	SMD Res 1206 10K 1% 0.25W	SMD Res 1206 10K 1% 0.25W	RNCP1206FTD10K0CT-ND	RNCP1206FTD10K0	4
R3_Diff_Input_1, R3_Diff_Input_2, R5_Diff_Input_1, R5_Diff_Input_2, R9_Diff_Input_1, R9_Diff_Input_2, R10_Diff_Input_1, R10_Diff_Input_2, R12_Gain Amp1, R12_Gain Amp2, R17	RES SMD 499 OHM 1% 1/2W 1206	RES SMD 499 OHM 1% 1/2W 1206	RNCP1206FTD499RCT-ND	RNCP1206FTD499R	11
R4_Diff_Input_1, R4_Diff_Input_2, R8_Diff_Input_1, R8_Diff_Input_2	RES SMD 274 OHM 0.1% 1/4W 1206	RES SMD 274 OHM 0.1% 1/4W 1206	P274BCDKR-ND	ERA-8AEB2740V	4
R6_Diff_Input_1, R6_Diff_Input_2, R7_Diff_Input_1, R7_Diff_Input_2	RES SMD 0.0 OHM JUMPER 1/4W 1206	RES SMD 0.0 OHM JUMPER 1/4W 1206	541-3033-1-ND	CRCW120600000ZEC	4
R11_Gain Amp1, R11_Gain Amp2	RES SMD 300 OHM 0.1% 1/4W 1206	RES SMD 300 OHM 0.1% 1/4W 1206	P300BCCT-ND	ERA-8AEB301V	2
R13_Gain Amp1, R13_Gain Amp2	RES SMD 261 OHM 0.1% 1/4W 1206	RES SMD 261 OHM 0.1% 1/4W 1206	P261BCCT-ND	ERA-8AEB2610V	2
R14, R20, R22	RES SMD 49.9 OHM 0.1% 0.4W 1206	RES SMD 49.9 OHM 0.1% 0.4W 1206	RTAN1206BKE49R9CT-ND	RTAN1206BKE49R9	3
R15, R18, R19, R21, R23, R25	RES SMD 220 OHM 0.1% 0.4W 1206	RES SMD 220 OHM 0.1% 0.4W 1206	RTAN1206BKE220RCT-ND	RTAN1206BKE220R	6
R16, R24	RES SMD 523 OHM 0.1% 1/4W 1206	RES SMD 523 OHM 0.1% 1/4W 1206	P523BCCT-ND	ERA-8AEB5230V	2
R28	RES SMD 249 OHM 1% 1/2W 1206	RES SMD 249 OHM 1% 1/2W 1206	RNCP1206FTD249RCT-ND	RNCP1206FTD249R	1
R29	RES SMD 2.74K OHM 0.1% 1/4W 1206	RES SMD 2.74K OHM 0.1% 1/4W 1206	P18633CT-ND	ERA-8ARB2741V	1
R30	SMD Res 1.33K 0.1% 0.25W 1206	SMD Res 1.33K 0.1% 0.25W 1206	P1.33KBCCT-ND	ERA-8AEB1331V	1
R31	SMD Res 120ohm 0.1% 0.25W 1206	SMD Res 120ohm 0.1% 0.25W 1206	P120BCCT-ND	ERA-8AEB121V	1
TP1, TP2, TP3, TP4, TP5_Diff_Input_1, TP5_Diff_Input_2, TP6_Diff_Input_1, TP6_Diff_Input_2, TP7_Diff_Input_1, TP7_Diff_Input_2, TP8_Gain Amp1, TP8_Gain Amp2, TP9_Gain Amp1, TP9_Gain Amp2, TP10, TP11, TP12, TP13, TP14, TP15, TP16, TP17, TP18, TP19, TP20, TP21, TP22, TP23, TP24, TP25, TP26, TP27, TP28	TESTPT	PCB Testpoint	36-5016CT-ND	5016	33
U1_Diff_Input_1, U1_Diff_Input_2, U3_Diff_Input_1, U3_Diff_Input_2	IC VIDEO OPAMP HS LN 8SOIC	IC VIDEO OPAMP HS LN 8SOIC	AD829ARZ-REEL7CT-ND	AD829ARZ-REEL7	4
U2_Diff_Input_1, U2_Diff_Input_2, U4_Gain Amp1, U4_Gain Amp2, U6	IC OPAMP GP 210MHZ 8SOIC	IC OPAMP GP 210MHZ 8SOIC	296-17626-5-ND	THS4631D	5
U5, U7, U8	IC OPAMP BUFFER 110MHZ 8SOIC	IC OPAMP BUFFER 110MHZ 8SOIC	HA9P5002-5Z-ND	HA9P5002-5Z	3
U9	Linear Voltage Reg + 1.25v to 37v 1.5A TO-220-3	Linear Voltage Reg + 1.25v to 37v 1.5A TO-220-3	LM317TNS/NOPB-ND	LM317T/NOPB	1
U10	Linear Voltage Reg -1.2v to -37v 1.5A TO-220-3	Linear Voltage Reg -1.2v to -37v 1.5A TO-220-3	LM337TNS/NOPB-ND	LM337TNS/NOPB	1
					181