

Last Edited: 8/23/2017

Title
Differential Input

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\Differential Input.SchDoc

Sheet 2 of 5

A

B

C

D

A

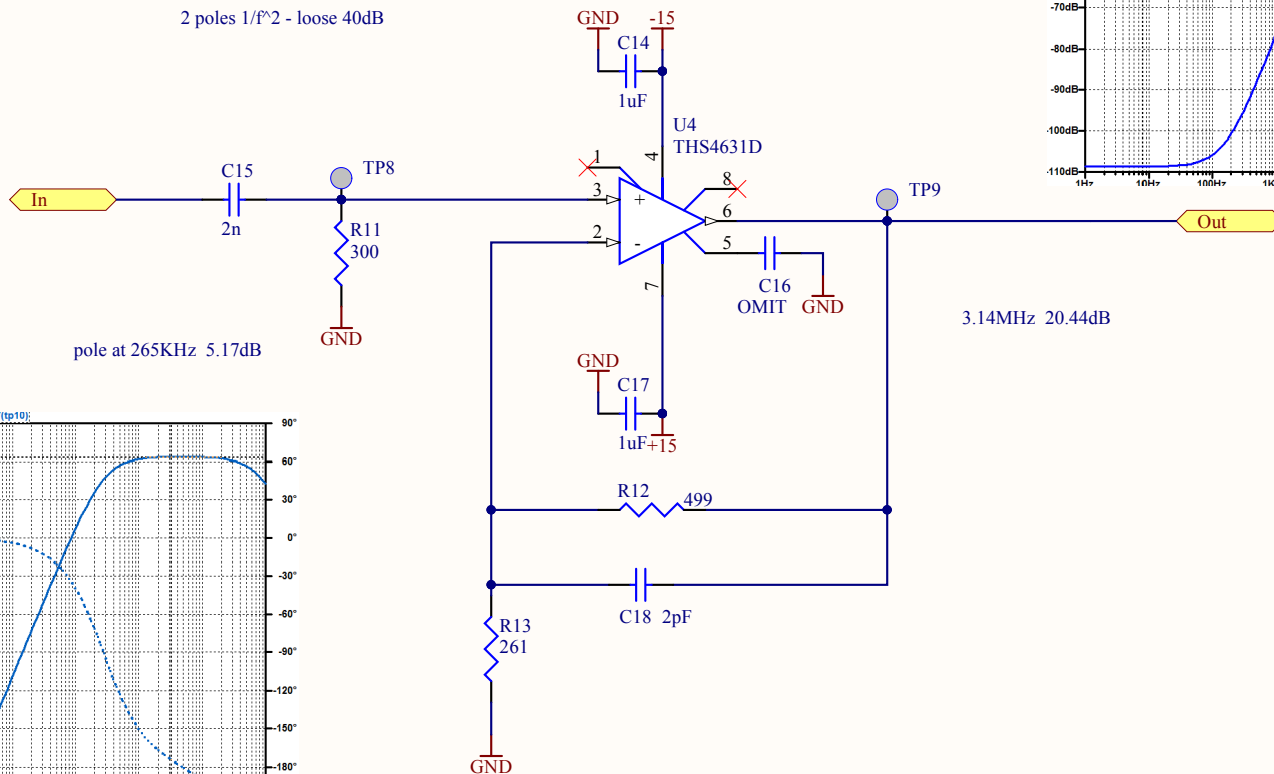
B

C

D

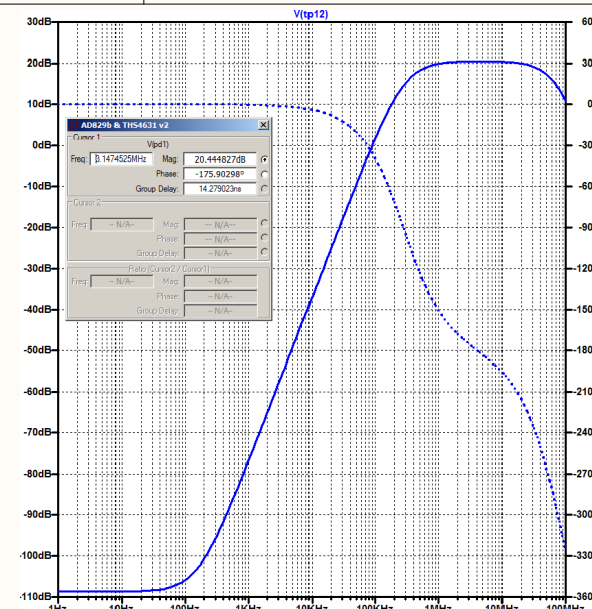
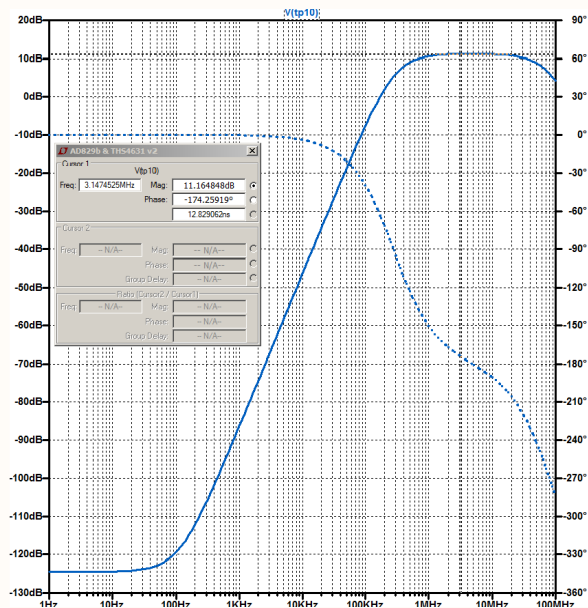
C4,C10 are considered 1 pole

C14 1 pole

2 poles 1/f² - loose 40dB

pole at 265KHz 5.17dB

3.14MHz 20.44dB



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Title
Filter & Gain Amplifier

LIGO Laboratory
California Institute of Technology
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LIGO

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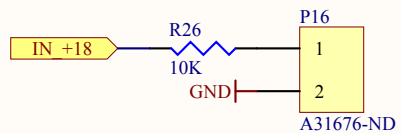
Sheet 3 of 5

File: C:\Users\Public\Documents\Altium\Projects\SqueezerAngleControl\PCB SqueezerAngleCtrl\Gain Amplifier.SchDoc

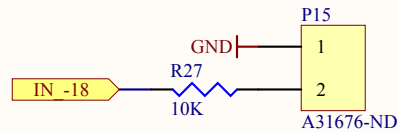
P12

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

±18v POWER LEDS REAR PANEL

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

P13

LED GREEN 1/4" HOLE PANEL MOUNT
L10005-NDP19
2 Position Receptacle 0.156" (3.96mm)
A24111-ND

GND



GND



GND



GND



GND



GND



GND

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-NDD7 protects against C40 (input shorts)
D8 protects against C42 (output shorts)

$$I_{adj} = 50E-6Amp$$

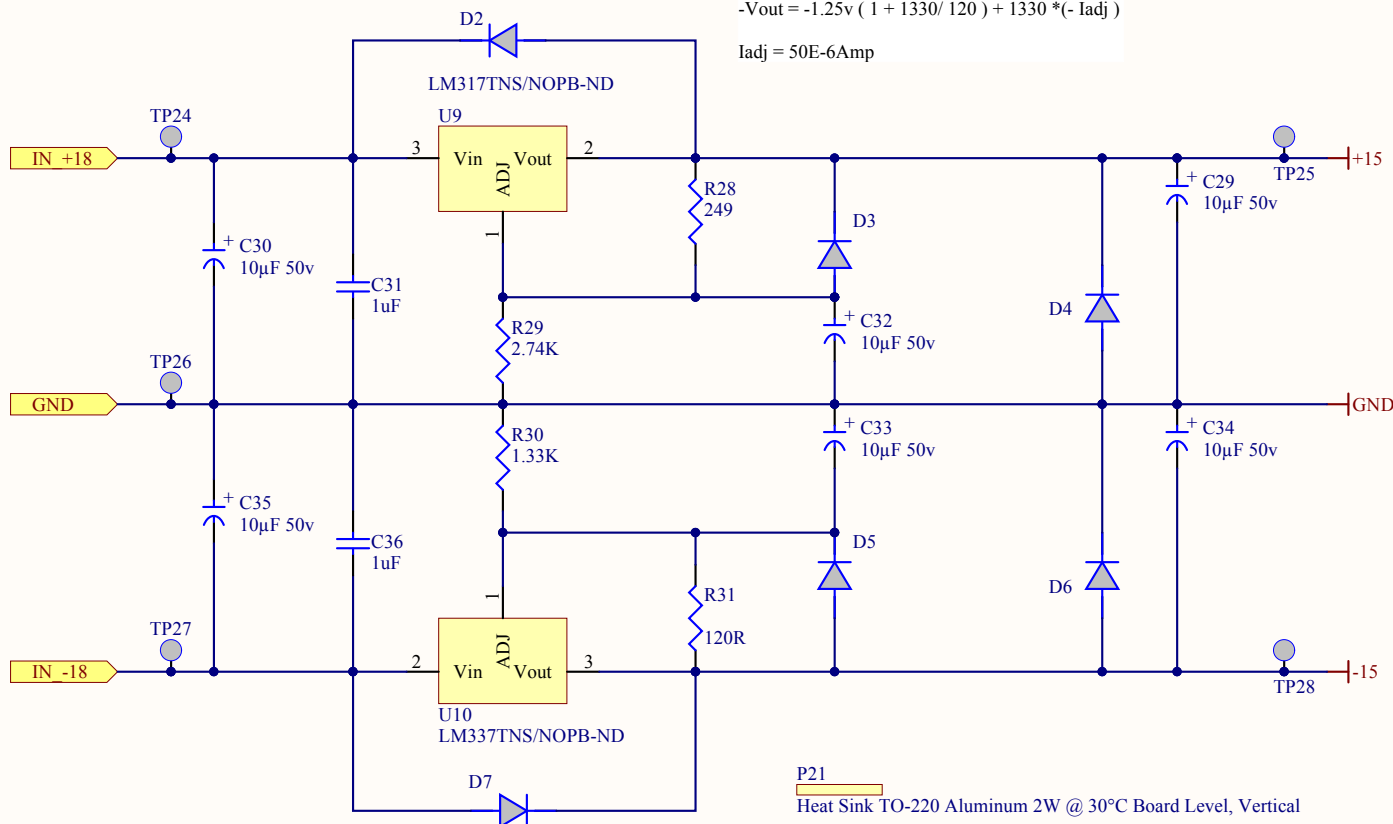
$$V_{out} = 1.25v (1 + R_{46} / R_{45}) + R_{46} * I_{adj}$$

$$V_{out} = 1.25v (1 + 2740 / 249) + (2740 * 50E-6) = 15.14v$$

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

$$-V_{out} = -1.25v (1 + 1330 / 120) + 1330 * (-I_{adj})$$

$$I_{adj} = 50E-6Amp$$



P22

MOUNTING KIT TO-220
HS417-ND

P24

MOUNTING KIT TO-220
HS417-ND

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

Title

Voltage RegulatorLIGO Laboratory
California Institute of Technology
Massachusetts Institute of Technology

LIGO

Size: A

DCC Number: D1700376

Revision: 1

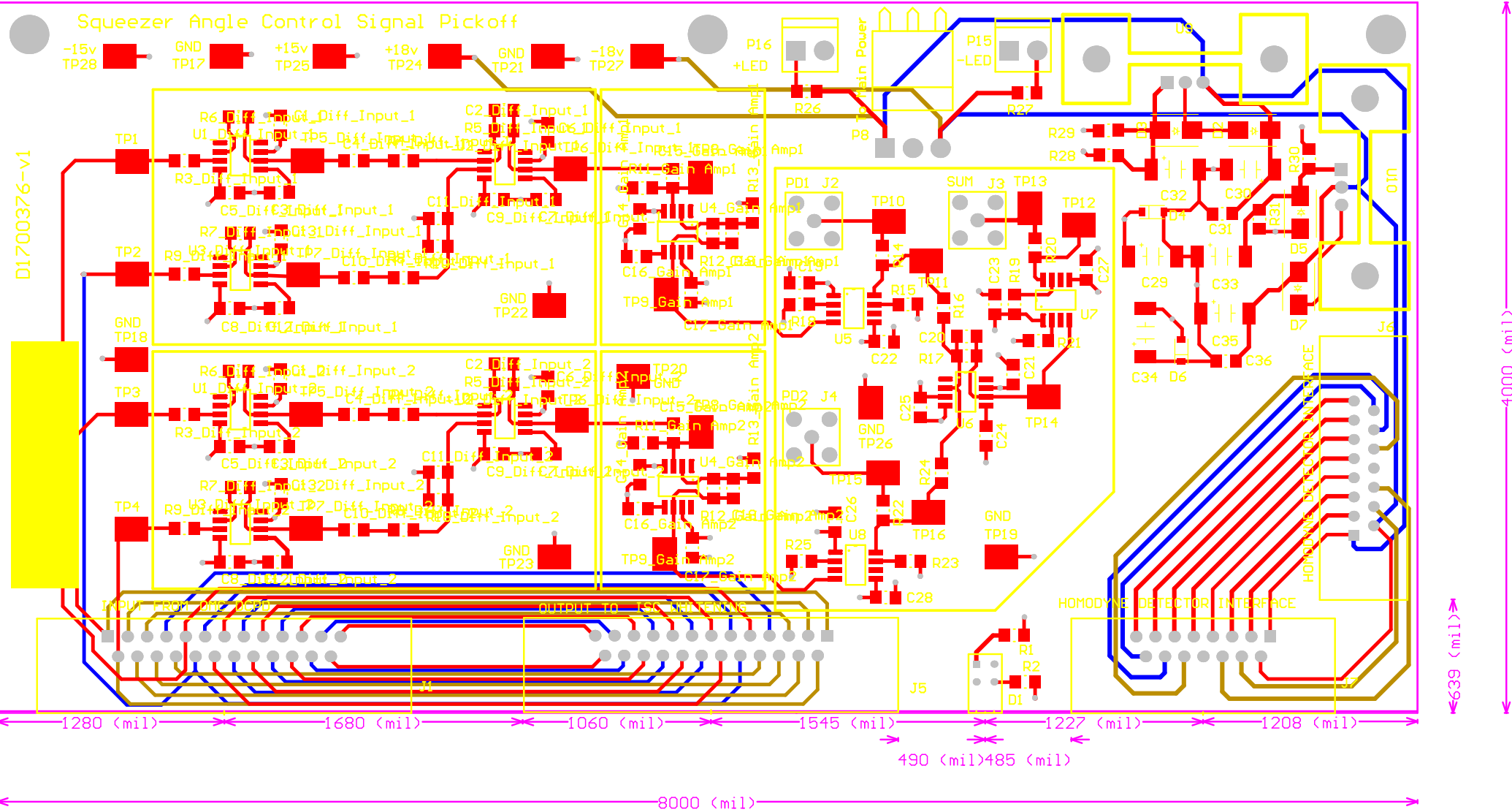
Engineer: Luis Sanchez

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File: C:\Users\Public\Documents\Altium\Projects\SqueezerAngleControl\PCB SqueezerAngleCtrl\VoltageReg.SchDoc



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	1206SG1052AT2A	26
C2_Diff_Input_1, C2_Diff_Input_2, C11_Diff_Input_1, C11_Diff_Input_2, C18_Gain_Amp1, C18_Gain_Amp2, C20, 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	CAP CER 2PF 50V NP0 1206	CAP CER 2PF 50V NP0 1206	399-15091-1-ND	C1206C208D5GAC7800	7
C4_Diff_Input_1, C4_Diff_Input_2, C10_Diff_Input_1, C10_Diff_Input_2, C15_Gain_Amp1, C15_Gain_Amp2, C29, C30, C32, C33, C34, C35	OMIT	CAP CER 5.1PF 50V COGNP0 1206	399-1186-1-ND	C1206C519C5GACTU	9
D1	CAP CER 2000PF 100V COGNP0 1206	CAP CER 2000PF 100V COGNP0 1206	460-11605-1-ND	GRM3195C2A202JA01D	6
D2, D3, D5, D7	SMD Cap Tantalum Poly 10uF 50v 2917	SMD Cap Tantalum Poly 10uF 50v 2917	478-6492-2-ND	1CJD106M050R0120	6
D4, D6	Stacked LED	Dual Green LED	87-1321-ND	SSP-LX4240GGD	1
J1	Diode Standard 100V 1A	Diode Standard 100V 1A	S1B8-FDCT-ND	S1B8-13-F	4
J2, J3, J4	Surface Mount SMB	Surface Mount SMB	RB162M-60CT-ND	RB162M-60TR	2
J5	Diode Schottky 60v 1A SMT	Diode Schottky 60v 1A SMT	A32100-ND	5747842-4	1
J6	PMOSU 500-125F	CONN D-SUB PLUG 25POS	ARF1205-ND	901-144	3
J7	DB25 MALE	R/A SOLDER	A35111-ND	1734350-1	1
J8	CONN SMA RCPT STR 50 OHM PCB Straight	CONN SMA RCPT STR 50 OHM PCB Straight	5750638-1-ND	5750638-1	1
J9	DB25 FEMALE	CONN D-SUB PLUG 15POS	182-15FE-ND	182-015-213R531	1
P1	D15 MALE	CONN D-SUB RCPT 15POS	L17D204182TCK-ND	L17D204182TX	1
P2	10PACK FEMALE SCREW	R/A SOLDER	3003W3P0X42A10X_CODEC	3003W3P0X42A10X	1
P3	D-Sub 3pin POWER Connector	D-Sub 3pin POWER Connector	302-1210-ND	3120-F321-P771-W02D-2A	1
P4	Circuit Breaker Thrm 2A 250VAC 50mcs	Circuit Breaker Thrm 2A 250VAC 50mcs	WM2305-ND	0008660106	1
P5	Contact Crimp Non-Gendered 18-24 AWG Gold	Contact Crimp Non-Gendered 18-24 AWG Gold	WM2112-ND	0009508033	1
P6	3 Position Receptacle 0.156" (3.96mm)	3 Position Receptacle 0.156" (3.96mm)	A27817CT-ND	2-520183-2	1
P7, P9, P10	Quick Connect Female 18-22AWG Fully Insulated 0.250inch	Quick Connect Female 18-22AWG Fully Insulated 0.250inch	Field Components	Field Components	3
P8	TNC female Bulkhead Feedthru Isolated to SMA right angle male 7"	TNC female Bulkhead Feedthru Isolated to SMA right angle male 7"	WM5238-ND	0026615030	1
P11, P14, P17, P18	3 Pos Header 0.156inch	Molex 3p 0.156inch Through Hole Right Angle	A24208CT-ND	770476-2	4
P12, P13	CONN SOCKET 18-24AWG SIL156 GOLD	CONN SOCKET 18-24AWG SIL156 GOLD	L10005-ND	5100H5	2
P15, P16	LED GREEN 1/4" HOLE PANEL MOUNT	LED GREEN 1/4" HOLE PANEL MOUNT	A31676-ND	3-641208-2	2
P19, P20	2 Positions Header Connector 0.186" (3.96mm) Through Hole Gold	2 Positions Header Connector 0.186" (3.96mm) Through Hole Gold	A24111-ND	770849-2	2
P21, P23	2 Position Receptacle 0.156" (3.96mm)	2 Position Rectangular Housing Connector Receptacle Natural (0.156" (3.96mm))	HS403-ND	513002B02500G	2
P22, P24	Heat Sink TO-220 Aluminum 2W @ 30°C Board Level, Vertical	Heat Sink TO-220 Aluminum 2W @ 30°C Board Level, Vertical	HS417-ND	4880G	2
R1, R2, R26, R27	MOUNTING KIT TO-220 SMD Res 1206 10k 1% 0.25W	MOUNTING KIT TO-220 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, R6_Diff_Input_1, R6_Diff_Input_2, R8_Diff_Input_1, R8_Diff_Input_2, R7_Diff_Input_1, R7_Diff_Input_2, R11_Gain_Amp1, R11_Gain_Amp2	RES SMD 274 OHM 0.1% 1/4W 1206	RES SMD 274 OHM 0.1% 1/4W 1206	P274BCDKR-ND	ERA-8AEB2740V	4
R13_Gain_Amp1, R13_Gain_Amp2	RES SMD 0.0 OHM JUMPER 1/4W 1206	RES SMD 0.0 OHM JUMPER 1/4W 1206	541-3033-1-ND	CRCW1206000020DEC	2
R14, R20, R22	RES SMD 300 OHM 0.1% 1/4W 1206	RES SMD 300 OHM 0.1% 1/4W 1206	P300BCCT-ND	ERA-8AEB301V	4
R15, R18, R19, R21, R23, R25	RES SMD 261 OHM 0.1% 1/4W 1206	RES SMD 261 OHM 0.1% 1/4W 1206	P261BCCT-ND	ERA-8AEB2610V	2
R16, R24	RES SMD 49.9 OHM 0.1% 0.4W 1206	RES SMD 49.9 OHM 0.1% 0.4W 1206	RTAN1206BKE499RCT-ND	RTAN1206BKE499R	3
R28	RES SMD 220 OHM 0.1% 0.4W 1206	RES SMD 220 OHM 0.1% 0.4W 1206	RTAN1206BKE220RCT-ND	RTAN1206BKE220R	6
R29	RES SMD 523 OHM 0.1% 1/4W 1206	RES SMD 523 OHM 0.1% 1/4W 1206	P523BCCT-ND	ERA-8AEB5230V	2
R30	RES SMD 249 OHM 0.1% 1/2W 1206	RES SMD 249 OHM 0.1% 1/2W 1206	RNCP1206FTD249RCT-ND	RNCP1206FTD249R	1
R31	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
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	SMD Res 1.33K 0.1% 0.25W 1206	SMD Res 1.33K 0.1% 0.25W 1206	P133KBCT-ND	ERA-8AEB1331V	1
U1_Diff_Input_1, U1_Diff_Input_2, U3_Diff_Input_1, U3_Diff_Input_2, U2_Diff_Input_1, U2_Diff_Input_2, U4_Gain_Amp1, U4_Gain_Amp2, U9	SMD Res 120ohm 0.1% 0.25W 1206	SMD Res 120ohm 0.1% 0.25W 1206	P120BCCT-ND	ERA-8AEB121V	1
U5, U7, U8	TESTPT	PCB Testpoint	36-5016CT-ND	5016	33
U9	IC VIDEO OPAMP HS LN SSOIC	IC VIDEO OPAMP HS LN SSOIC	AD829ARZ-REEL7CT-ND	AD829ARZ-REEL7	4
U10	IC OPAMP GP 210MHZ 8SSOIC	IC OPAMP GP 210MHZ 8SSOIC	286-17626-5-ND	THS4631D	5
	IC OPAMP BUFFER 110MHZ SSOIC	IC OPAMP BUFFER 110MHZ SSOIC	HA9P5002-5Z-ND	HA9P5002-5Z	3
	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
	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