

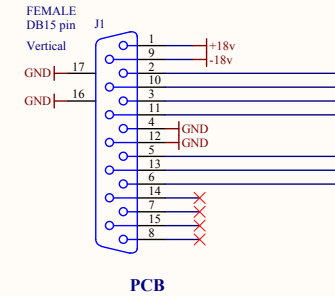
Power is coming from the 3.125MHz BPF. ±18v

Circuit Board to Whitening signals from Squeezer Homodyne Detector

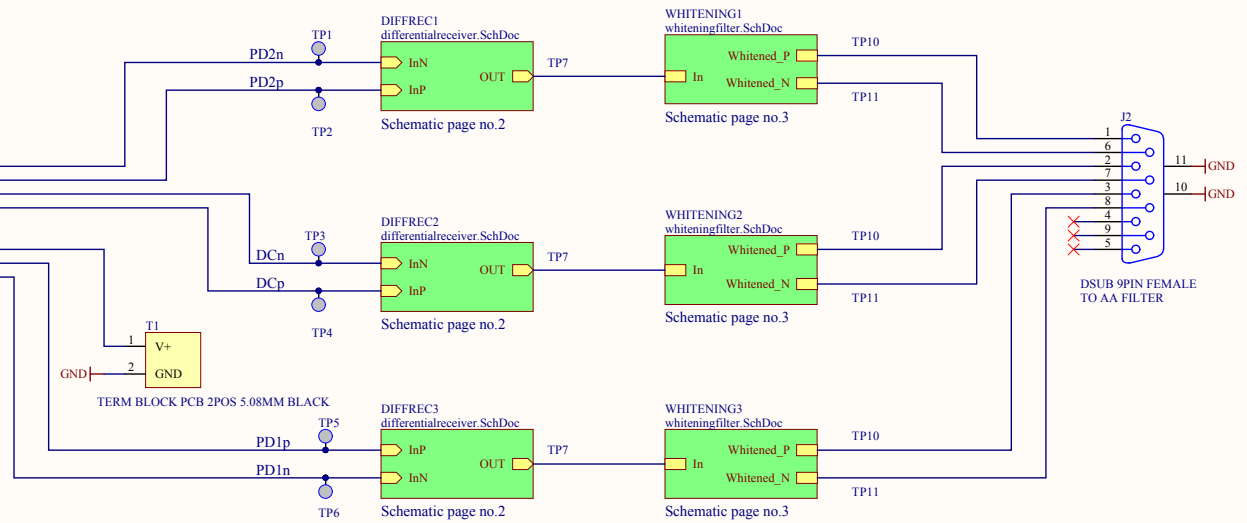
Revision and Modifications on Prototype design:

1. Initial Release.

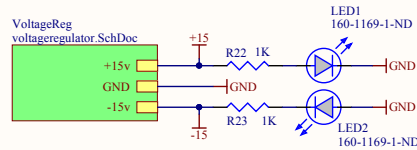
HOMODYNE DETECTOR INTERFACE



PCB



- P1 CONN D-SUB PLUG 15POS STR IDC AMR15B-ND
- P3 CONN D-SUB RCPT 15POS STR IDC 1175-1814-ND
- P5 CBL RIBN 15COND 0.050 GRAY 5' AE15G-5-ND
- P7 CONN SCREWLOCK FEMALE 4-40 .315" 626-1256-ND

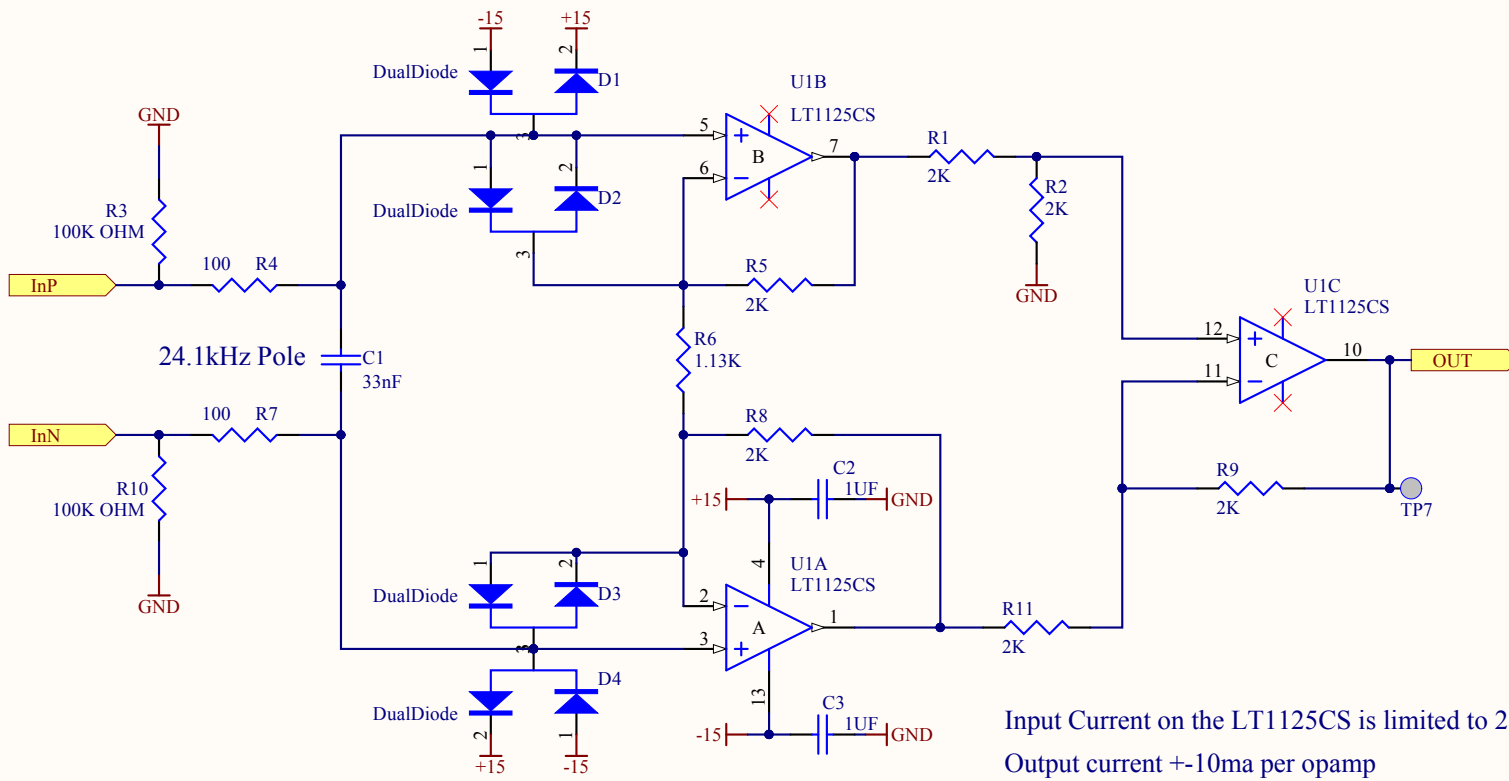


- P2 CONN D-SUB PLUG 9POS STR IDC AML09B-ND
- P4 CONN D-SUB RCPT 9POS STR IDC AFL09B-ND
- P6 CBL RIBN 15COND 0.050 GRAY 5' AE15G-5-ND
- P8 CONN SCREWLOCK FEMALE 4-40 .315" 626-1256-ND

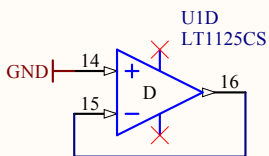
Title		Last Edited: 9/6/2017	
Whitening Differential Input		LIGO Laboratory California Institute of Technology Massachusetts Institute of Technology	
Size: B	DCC Number: D1700403	Revision: 1	Engineer: Luis Sanchez
File: C:\Users\Public\Documents\Altium\Projects\Squeezer Whitening\DiffRec\PCB Whitening DiffRec\Squeezer WhiteningFilter SchDoc		Date: 9/6/2017	Time: 9:10:43 AM
		Sheet 1 of 4	



Overall Gain = 5 from InP-InN to Out
 Ex. 1V battery across input = 4.54V from Out to GND
 13.14dB at the Output pin TP7



Input Current on the LT1125CS is limited to 25mA
 Output current +/-10ma per opamp
 with 10v into 2K||2K the drive current is @ 10mA



Input Protection

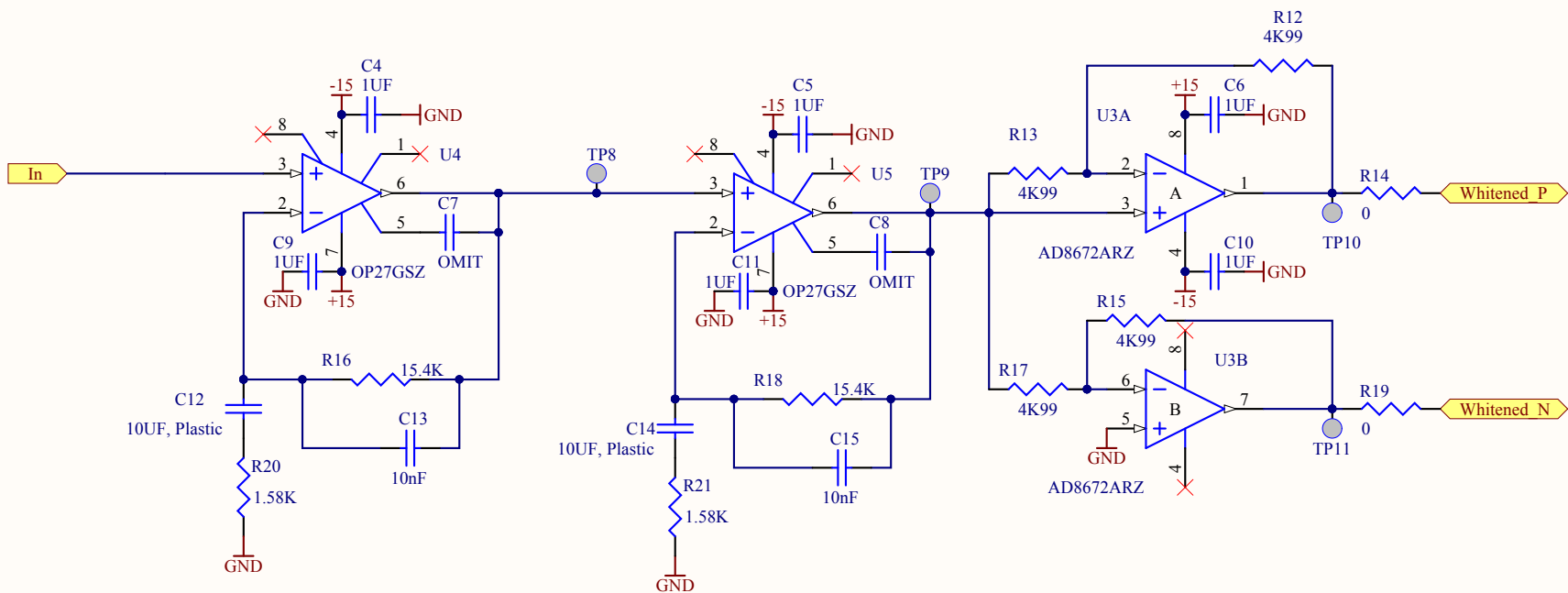
The 24.1kHz RC filter is there to cut high frequency noise to prevent slew rate limiting.
 Overall gain is 5 such that 1 volts peak from DAC yields 5v wrt ground at output

Last Edited: 9/5/2017

Title Differential Input		LIGO Laboratory California Institute of Technology Massachusetts Institute of Technology		Date: 9/6/2017 Time: 9:10:43 AM Sheet 2 of 4
Size: A	DCC Number: D1700403	Revision: 1	Engineer: Luis Sanchez	

Zero @ 1Hz, 10.07KHz, Pole @ 10Hz, 1.033kHz

Zero @ 1Hz, 10.07KHz, Pole @ 10Hz, 1.033kHz

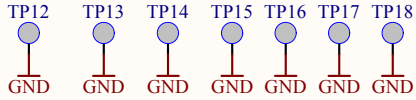


$f_z = 1/(2 * \pi * (R20 + R16) * C12) = 0.937\text{Hz}$
 $f_p = 1/(2 * \pi * R20 * C12) = 10\text{Hz}$
 $f_p = 1/(2 * \pi * R16 * C13) = 1.033\text{KHz}$

10Hz 48.40dB
 100Hz 54.238dB

Last Edited: 9/6/2017

Title Whitening		LIGO Laboratory California Institute of Technology Massachusetts Institute of Technology		LIGO	
Size: A	DCC Number: D1700403	Revision: 1	Engineer: Luis Sanchez	Date: 9/6/2017	
File: C:\Users\Public\Documents\Altium\Projects\Squeezer_WhiteningDiffRec\PCB_Whitening_DiffRec\whiteningfilter.SchDoc				Time: 9:10:43 AM	Sheet 3 of 4



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

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

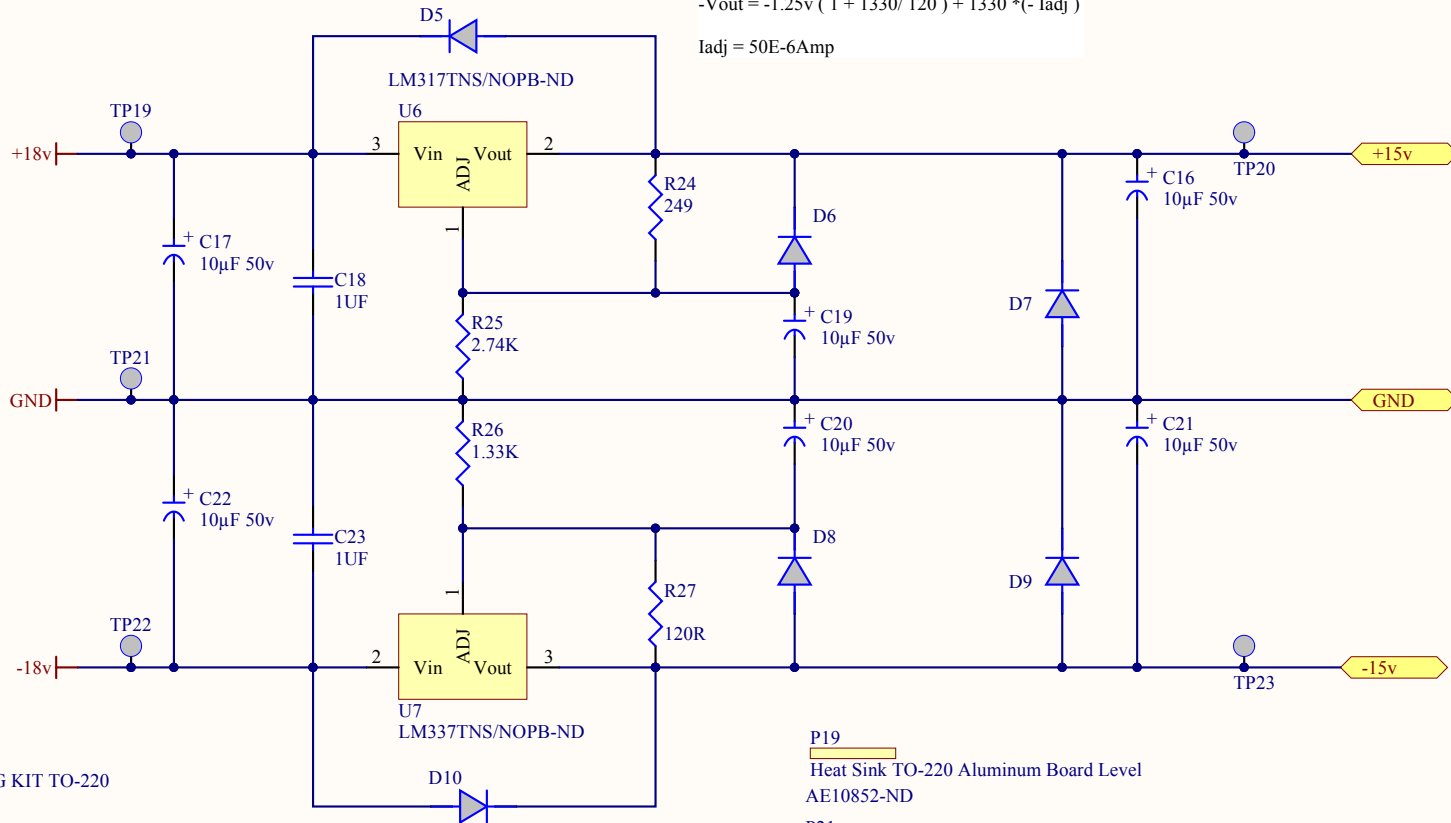
$$V_{out} = 1.25v (1 + R_{46} / R_{45}) + R_{46} * I_{adj}$$

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

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

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

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



P20
 MOUNTING KIT TO-220
 HS417-ND

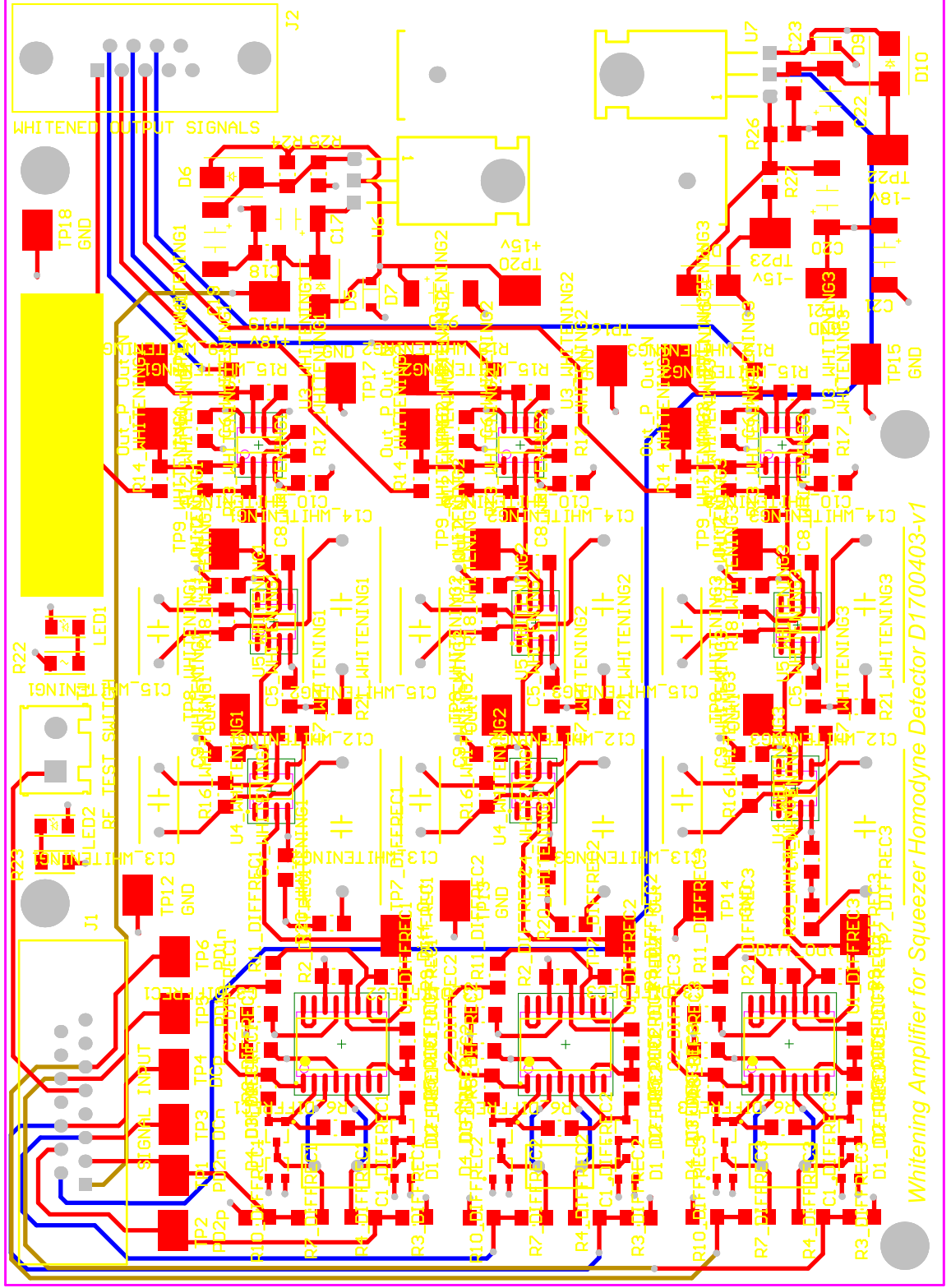
P22
 MOUNTING KIT TO-220
 HS417-ND

P19
 Heat Sink TO-220 Aluminum Board Level
 AE10852-ND

P21
 Heat Sink TO-220 Aluminum Board Level
 AE10852-ND

Last Edited: 9/5/2017

Title Voltage Regulator		LIGO Laboratory California Institute of Technology Massachusetts Institute of Technology		Date: 9/6/2017 Time: 9:10:43 AM Sheet 4 of 4
Size: A	DCC Number: D1700403	Revision: 1	Engineer: Luis Sanchez	



Whitening Amplifier for Squeezer Homodyne Detector D1700403-v1

4300 (mil)

5900 (mil)

LIGO Bill of Materials

Source Data From: PCB_Whitening_DiffRec.PjtPcb
 Board Designed By: Luis Sanchez
 Board D-number: D1700403
 Board Revision: 1
 Variant: None

Creation Date: 9/6/2017 9:10:48 AM
 Print Date: 06-Sep-17 9:10:53 AM

Designator	Comment	Description	Digkey Part Number	Manufacturers Part Number	Quantity
C1_DIFFREC1, C1_DIFFREC2, C1_DIFFREC3	CAP FILM 0.033UF 5% 100VDC RAD	CAP FILM 0.033UF 5% 100VDC RAD	495-1141-ND	B3252C133J000	3
C2_DIFFREC1, C2_DIFFREC2, C2_DIFFREC3, C3_DIFFREC1, C3_DIFFREC2, C3_DIFFREC3, C4_WHITENING1, C4_WHITENING2, C4_WHITENING3, C5_WHITENING1, C5_WHITENING2, C5_WHITENING3, C6_WHITENING1, C6_WHITENING2, C6_WHITENING3, C7_WHITENING1, C7_WHITENING2, C7_WHITENING3, C8_WHITENING1, C8_WHITENING2, C8_WHITENING3, C9_WHITENING1, C9_WHITENING2, C9_WHITENING3, C10_WHITENING1, C10_WHITENING2, C10_WHITENING3, C11_WHITENING1, C11_WHITENING2, C11_WHITENING3, C16, C23	CAP CER 1UF 50V Y5V 1206	CAP CER 1UF 50V Y5V 1206	1276-1204-1-ND	CL31F105ZBFNNE	26
C7_WHITENING1, C7_WHITENING2, C7_WHITENING3, C8_WHITENING1, C8_WHITENING2, C8_WHITENING3, C12_WHITENING1, C12_WHITENING2, C12_WHITENING3, C14_WHITENING1, C14_WHITENING2, C14_WHITENING3, C15_WHITENING1, C15_WHITENING2, C15_WHITENING3, C16, C17, C19, C20, C21, C22	OMIT	OMIT	OMIT	OMIT	6
C12_WHITENING1, C12_WHITENING2, C12_WHITENING3, C14_WHITENING1, C14_WHITENING2, C14_WHITENING3, C15_WHITENING1, C15_WHITENING2, C15_WHITENING3, C16, C17, C19, C20, C21, C22	10UF, Plastic	CAP FILM 10UF 10% 100VDC RADIAL	495-4942-1-ND	B3222C109K189	6
C16, C17, C19, C20, C21, C22	CAP FILM 10000PF 10% 400VDC RAD	CAP FILM 10000PF 10% 400VDC RAD	EF4103-ND	ECO-E4103KF, ECO-E4103KF, ECO-E4103KF, ECO-E4103KF, TCJD109M50R0120	6
D1_DIFFREC1, D1_DIFFREC2, D1_DIFFREC3, D2_DIFFREC1, D2_DIFFREC2, D2_DIFFREC3, D3_DIFFREC1, D3_DIFFREC2, D3_DIFFREC3, D4_DIFFREC1, D4_DIFFREC2, D4_DIFFREC3, D5, D6, D8, D10	SMD Cap Tantalum Poly 10uF 50v2917	SMD Cap Tantalum Poly 10uF 50v2917	R78-6492-2-ND	6	6
D1, D2, D3, D4, D5, D6, D8, D10	DualDiode	DUAL SERIES DIODE.	BA570-04L1TG05CT-ND	BA570-04L1TG	12
D7, D9	Diode Standard 100V 1A Surface Mount SMB	Diode Standard 100V 1A Surface Mount SMB	S1BB-FDICT-ND	S1BB-13-F	4
J1	Diode Schottky 50v 1A SMT PMDU SOD-123F	Diode Schottky 50v 1A SMT PMDU SOD-123F	RB162M-60CT-ND	RB162M-60TR	2
J2	CONN D-SUB RCPT 15POSS VERT SLDR	CONN D-SUB RCPT 15POSS VERT SLDR	A34066-ND	5747299-2	1
LED1, LED2	CONN D-SUB RCPT 9POSS VERT SOLDER	CONN D-SUB RCPT 9POSS VERT SOLDER	A34075-ND	5747150-7	1
P1	SMD LED Green 589nm 2.1v 1206	SMD LED Green 589nm 2.1v 1206	180-1169-1-ND	LTST-C150GKT	2
P2	CONN D-SUB PLUG 15POSS STR IDC	CONN D-SUB PLUG 15POSS STR IDC	AMR15B-ND	1658613-3	1
P3	CONN D-SUB PLUG 9POSS STR IDC	CONN D-SUB PLUG 9POSS STR IDC	AML09B-ND	1658608-4	1
P4	CONN D-SUB RCPT 15POSS STR IDC	CONN D-SUB RCPT 15POSS STR IDC	1175-1814-ND	410F0-15-1-00	1
P5, P6	CONN D-SUB RCPT 9POSS STR IDC	CONN D-SUB RCPT 9POSS STR IDC	AFL09B-ND	1658610-4	1
P7, P8	CSL RBN 15COND 0.050 GRAY 5'	CSL RBN 15COND 0.050 GRAY 5'	AE15C-5-ND	AWG28-15/G/000	2
P19, P21	CONN SCREW LOCK FEMALE 4-40 315'	CONN SCREW LOCK FEMALE 4-40 315'	626-1256-ND	160X10359X	2
R20, R22	Heat Sink TO-220 Aluminum Board Level	Heat Sink TO-220 Aluminum Board Level	AE10852-ND	V8508F	2
R1, R2, R3, R4, R5, R6, R7, R8, R9, R10, R11, R12, R13, R14, R15, R16, R17, R18, R19, R20, R21, R22, R23	RES SMD 2K OHM 0.1% 1/4W 1206	RES SMD 2K OHM 0.1% 1/4W 1206	MSMT-ND	4880G	2
R1, R2, R3, R4, R5, R6, R7, R8, R9, R10, R11, R12, R13, R14, R15, R16, R17, R18, R19, R20, R21, R22, R23	RES SMD 2K OHM 0.1% 1/4W 1206	RES SMD 2K OHM 0.1% 1/4W 1206	P2.0KBCCT-ND	ERA-8AE8202V	18
R10, R11, R12, R13, R14, R15, R16, R17, R18, R19, R20, R21, R22, R23	100K OHM	Resistor	P100KBCCT-ND	ERA-8AEB104V	6
R10, R11, R12, R13, R14, R15, R16, R17, R18, R19, R20, R21, R22, R23	RES SMD 100 OHM 0.1% 1/4W 1206	RES SMD 100 OHM 0.1% 1/4W 1206	P100BCCT-ND	ERA-8AEB101V	6
R10, R11, R12, R13, R14, R15, R16, R17, R18, R19, R20, R21, R22, R23	RES SMD 1.13K OHM 0.1% 1/4W 1206	RES SMD 1.13K OHM 0.1% 1/4W 1206	P1.13KBCCT-ND	ERA-8AEB1131V	3
R10, R11, R12, R13, R14, R15, R16, R17, R18, R19, R20, R21, R22, R23	RES SMD 4.99K OHM 0.1% 1/4W 1206	RES SMD 4.99K OHM 0.1% 1/4W 1206	TNP4.99KACCT-ND	TNP4.99KACCT-ND	12
R10, R11, R12, R13, R14, R15, R16, R17, R18, R19, R20, R21, R22, R23	RES SMD 0 OHM JUMPER 1/4W 1206	RES SMD 0 OHM JUMPER 1/4W 1206	RMCF1206Z0R00CT-ND	RMCF1206Z0R00	6
R10, R11, R12, R13, R14, R15, R16, R17, R18, R19, R20, R21, R22, R23	RES SMD 15.4K OHM 0.1% 1/4W 1206	RES SMD 15.4K OHM 0.1% 1/4W 1206	YAG5033CT-ND	RT1206BRD0715K4L	6
R10, R11, R12, R13, R14, R15, R16, R17, R18, R19, R20, R21, R22, R23	RES SMD 1.58K OHM 0.1% 1/4W 1206	RES SMD 1.58K OHM 0.1% 1/4W 1206	P1.58KBCCT-ND	ERA-8AEB1581V	6
R10, R11, R12, R13, R14, R15, R16, R17, R18, R19, R20, R21, R22, R23	Res SMD 1K 0.1% 0.25W 1206	Res SMD 1K 0.1% 0.25W 1206	P1KCSCT-ND	ERA-8ARB102V	2
R24	RES SMD 249 OHM 1% 1/2W 1206	RES SMD 249 OHM 1% 1/2W 1206	RNCP1206FTD249RCT-ND	RNCP1206FTD249R	1
R25	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
R26	SMD Res 1.33K 0.1% 0.25W 1206	SMD Res 1.33K 0.1% 0.25W 1206	P1.33KBCCT-ND	ERA-8AEB1331V	1
R27	SMD Res 120ohm 0.1% 0.25W 1206	SMD Res 120ohm 0.1% 0.25W 1206	P120BCCT-ND	ERA-8AEB121V	1
T1	TERM BLOCK PCB 2POS 5.08MM BLACK	TERM BLOCK PCB 2POS 5.08MM BLACK	281-1882-ND	1780510000	1
TP1, TP2, TP3, TP4, TP5, TP6, TP7, TP8, TP9, TP10, TP11, TP12, TP13, TP14, TP15, TP16, TP17, TP18, TP19, TP20, TP21, TP22, TP23	TESTPT	PCB Testpoint	36-5016CT-ND	5016	33
U1, U2, U3, U4, U5, U6, U7	LT1125CS	Quad Low Noise, High-Speed Precision Operational Amplifier	LT1125CSWPPF-ND	LT1125CSWPPF	3
U3, U4, U5, U6, U7	IC OPAMP GP 10MHZ 8SOIC	IC OPAMP GP 10MHZ 8SOIC	AD8672AR2-ND	AD8672ARZ	3
U3, U4, U5, U6, U7	IC OPAMP GP 8MHZ 8SOIC	IC OPAMP GP 8MHZ 8SOIC	OP27GSZ-REELCT-ND	OP27GSZ-REEL	6
U6	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	LM317TNS/NOPB	1
U7	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