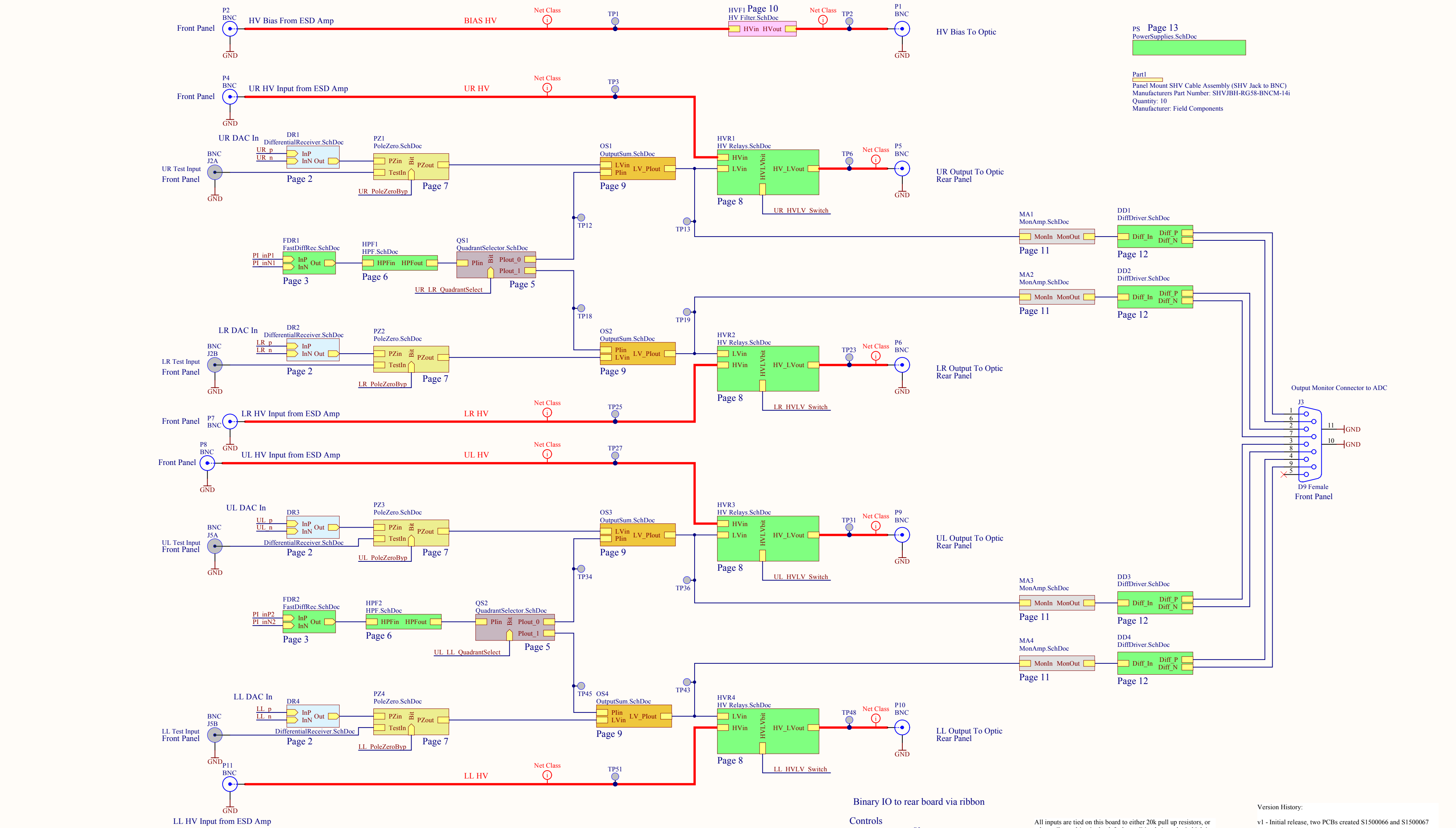
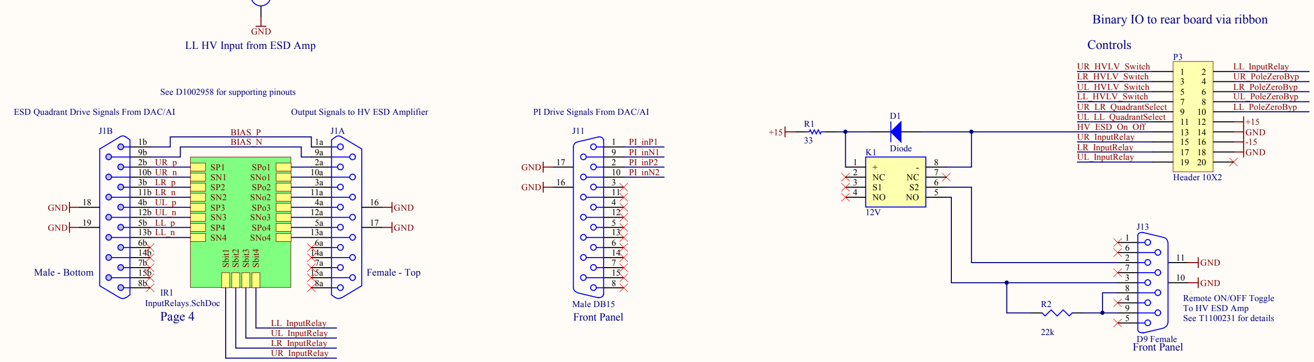




All inputs are tied on this board to either 20k pull up resistors, or relay coils resulting in the default condition being a logic high in the absence of a logic input from an external control source.

HVLV Switch - If actively pulled low will result in the LV path being open, and the HV path being closed.

QuadrantSelect - If actively pulled low will select the PI_out1 connection corresponding to either LL or LR

HV ESD On/Off - This is a toggle function. If this input is actively pulled low for > 2seconds, the state will toggle between on and off.

Input Relay - If actively pulled low will connect DAC input to HV ESD amplifier

Pole Zero Bypass - If actively pulled low, the pole-zero are engaged

Version History:

v1 - Initial release, two PCBs created S1500066 and S1500067

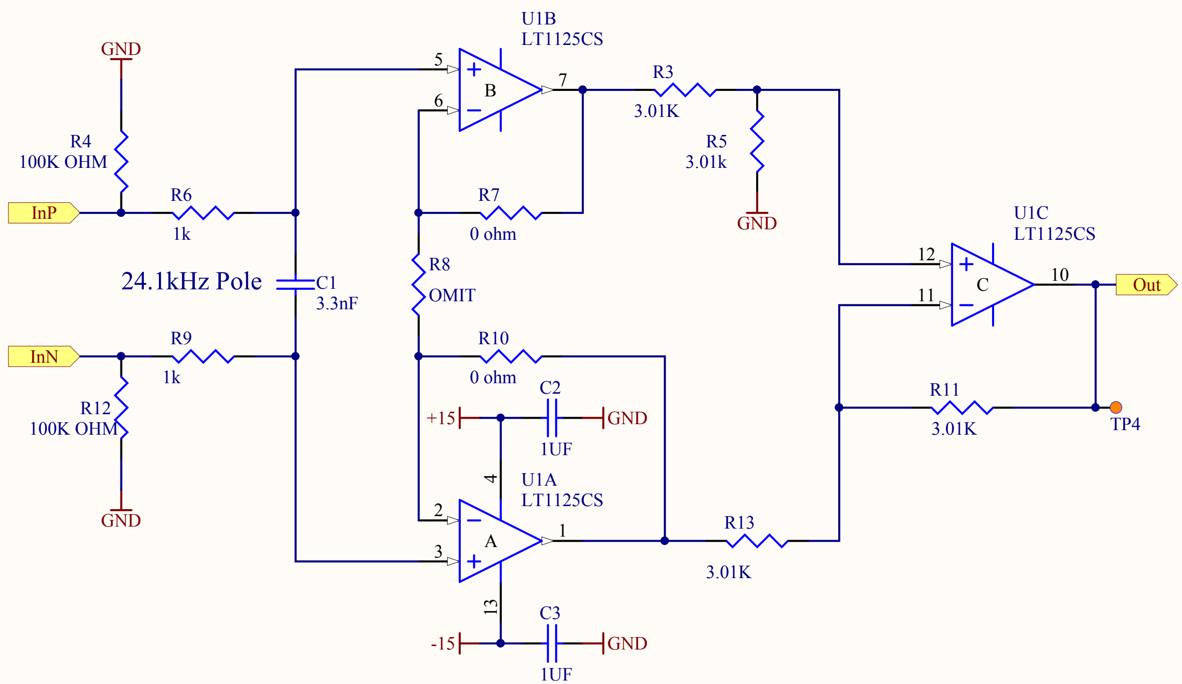
v2 - New PCB release. Changes are:
1. Rearranged the bits serving the input relays for better mapping.
2. Changed opamps in High Pass Filter from OP27 to AD829 for higher slew rate. Added 68pF compensation capacitors for AD829
3. Changed the Quadrant Selector relay, K8, to be able to terminate unused channels in short to avoid inconsistent loading of unused PI input to quadrant drive.
4. Added page numbering to top sheet for ease of browsing

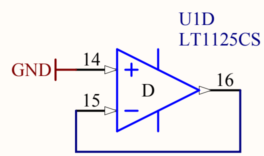
v3 - Component value changes per ECR E1500341
1. Changed C32 in monitoring amplifier from 1uF to 10nF to put the pole frequency at the intended 1kHz
2. Changed C36 in the summing node from 1uF to 0.047uF to increase the dynamic range of the normal quadrant path such that inspiral waveforms may be adequately injected at higher frequencies
3. Corrected typo on DAC noise spectrum from 800uV to 800nV

+380mA, -190mA Measured Quiescent +/- 18V Current Draw

Last Edited:	11/18/2015
Title	**Top Level ETM Low Voltage ESD Driver**
LIGO Laboratory, California Institute of Technology, Massachusetts Institute of Technology	LIGO
Size: C	DCC Number: D1500016
SCH / PCB Revision: V3	Engineer: R. Abbott
Date: 11/18/2015	Time: 3:30:10 PM
File: C:\Rich's Files\Mycadfiles\Suspensions\ETM LVLN Driver\ETM LVLN DriverTopSheet.SchDoc	Sheet 1 of 15

Overall Gain = 1from InP-InN to Out
Ex. 10V battery across input = 10V from Out to GND





The 24.1kHz RC filter is there to cut high frequency noise to prevent slew rate limiting. Overall gain is 1 such that 10 volts peak from DAC yields 10v wrt ground at output

Checked All

Last Edited: 9/16/2015

Title
Differential Receiver

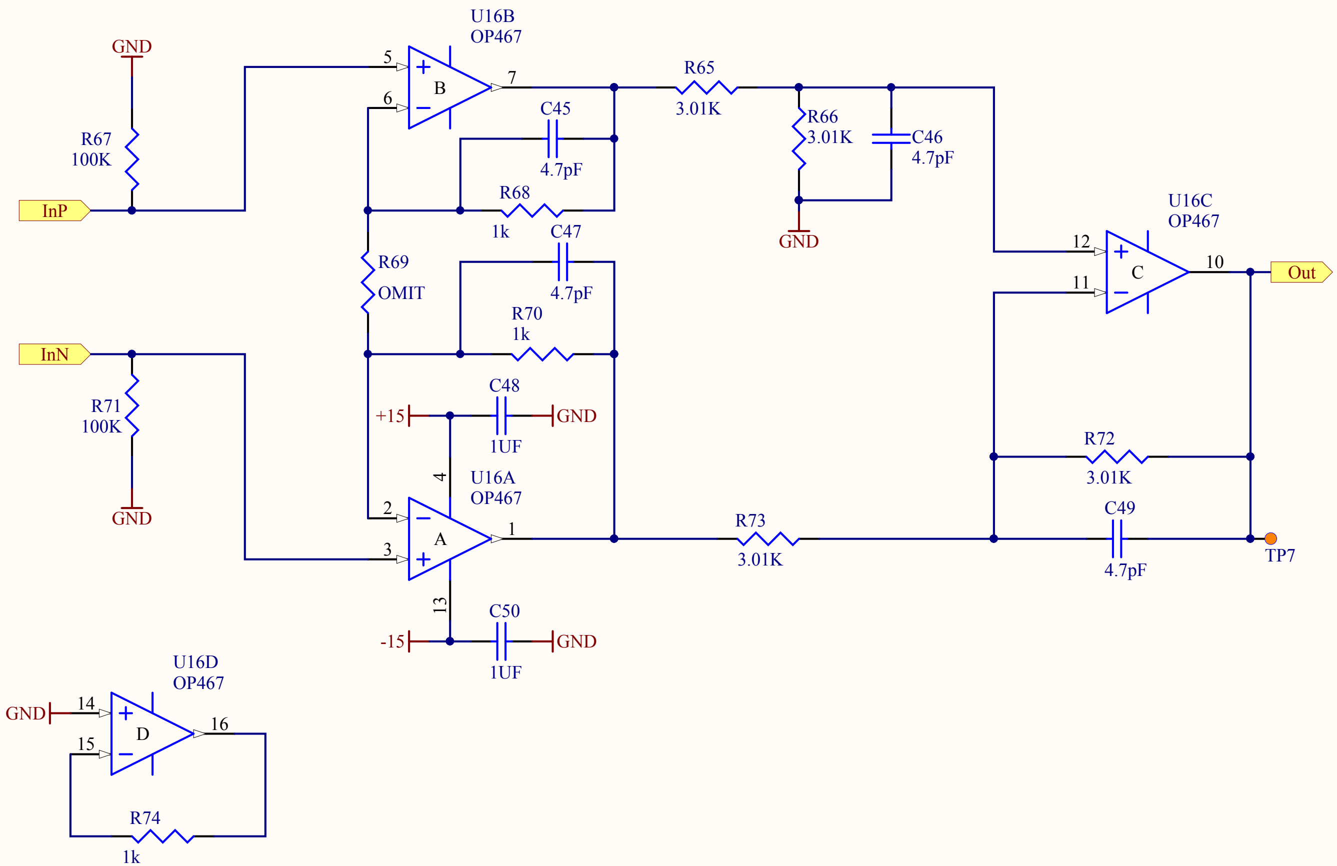
LIGO Laboratory
California Institute of Technology
Massachusetts Institute of Technology

LIGO

Size: A
DCC Number: D1500016
Revision: V3
Engineer: R. Abbott
Date: 11/18/2015
Time: 3:30:10 PM
Sheet 2 of 15

File: C:\Rich's Files\Mycadfiles\Suspensions\ETM LVLN Driver\DifferentialReceiver.SchDoc

Overall Gain = 1from InP-InN to Out
Ex. 10V battery across input = 10V from Out to GND



Checked All

Last Edited: 9/16/2015

Title
Fast Differential Receiver

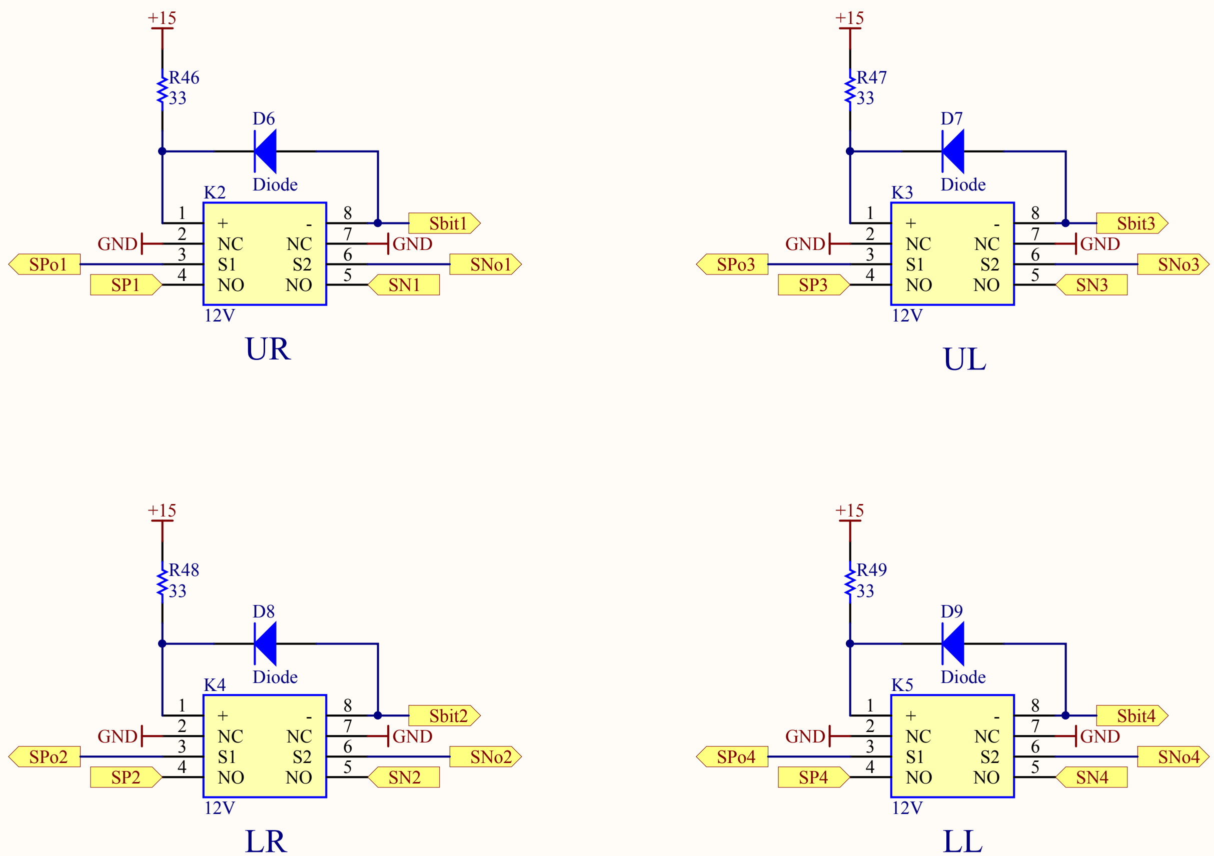
LIGO Laboratory
California Institute of Technology
Massachusetts Institute of Technology

LIGO

Size: A | DCC Number: D1500016 | Revision: V3 | Engineer: *R. Abbott*

Date: 11/18/2015
Time: 3:30:10 PM

File: C:\Rich's Files\Mycadfiles\Suspensions\ETM LVLN Driver\FastDiffRec.SchDoc



These relays are used to disconnect the applied differential DAC signals from the high voltage ESD amplifier after transition to low voltage control.

Checked All

Last Edited: 9/16/2015

Title *Input Relays*

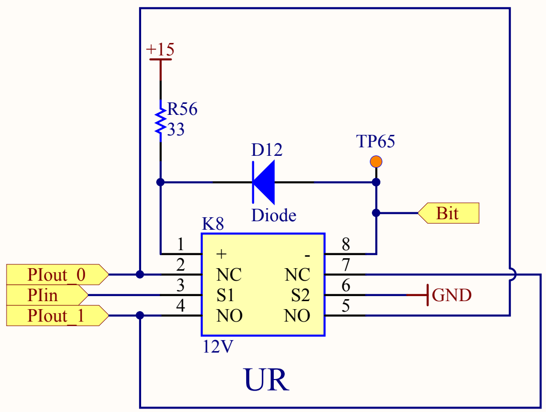
LIGO Laboratory
California Institute of Technology
Massachusetts Institute of Technology

LIGO

Size: A | DCC Number: D1500016 | Revision: V3 | Engineer: *R. Abbott*

Date: 11/18/2015
Time: 3:30:10 PM

File: C:\Rich's Files\Mycadfiles\Suspensions\ETM LVLN Driver\InputRelays.SchDoc



Only a total of 2 ADC channels were available within the existing SUS topology for the PI input. This switch allows the user to select which two quadrants of a test mass will receive the PI correction signals.

The grounded pin on S2 terminates the unused leg of the PI output path to mimic the voltage source that would have been connected. Failure to do this would result in a change in the transfer function of the passive summing network.

Bit control input pulling low will select the PIout_1 path and vice versa

Last Edited: 9/16/2015

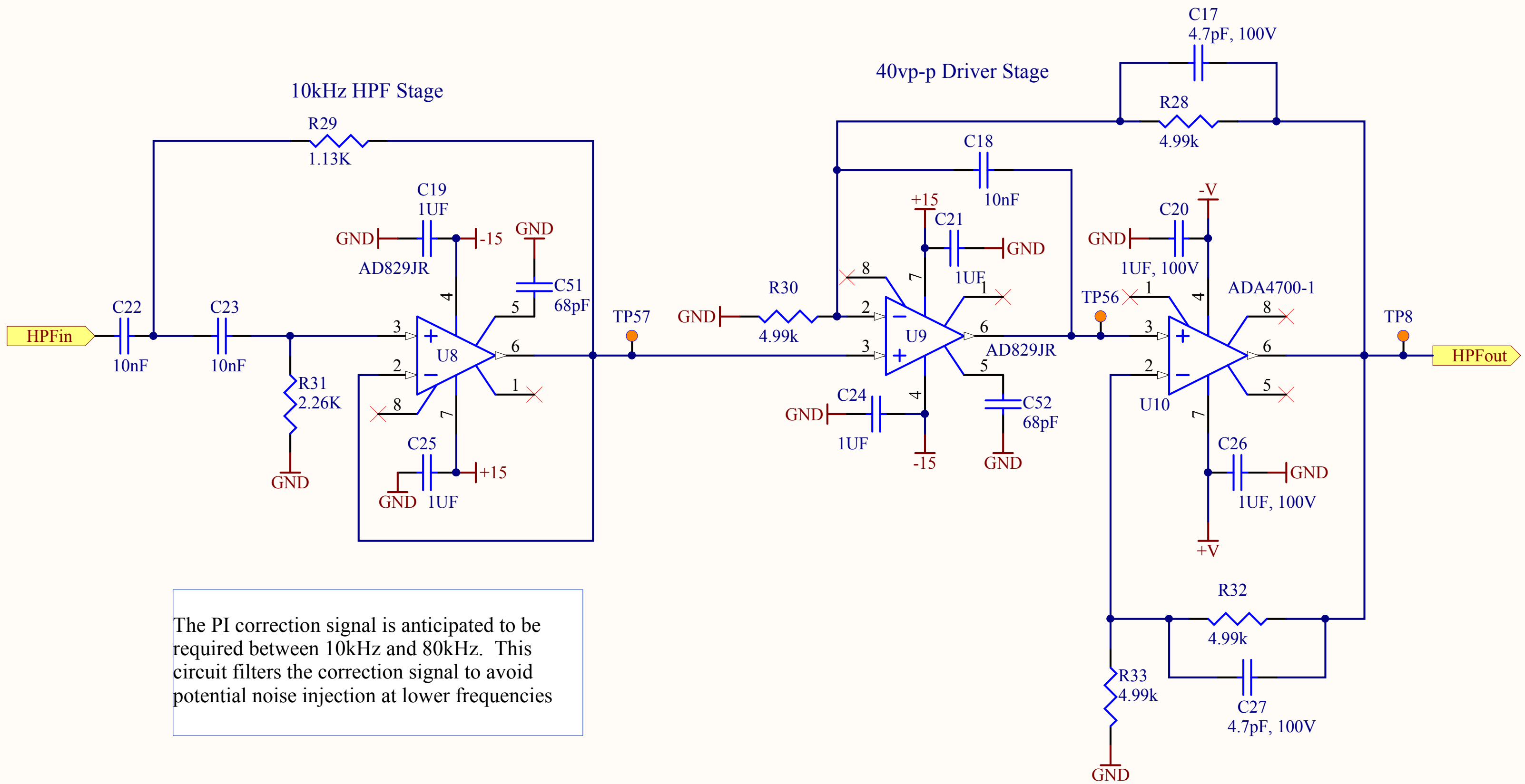
Title: **Quadrant Selector**

LIGO Laboratory
California Institute of Technology
Massachusetts Institute of Technology

LIGO

Size: A	DCC Number: D1500016	Revision: V3	Engineer: R. Abbott	Date: 11/18/2015 Time: 3:30:10 PM

File: C:\Rich's Files\Mycadfiles\Suspensions\ETM LVLN Driver\QuadrantSelector.SchDoc

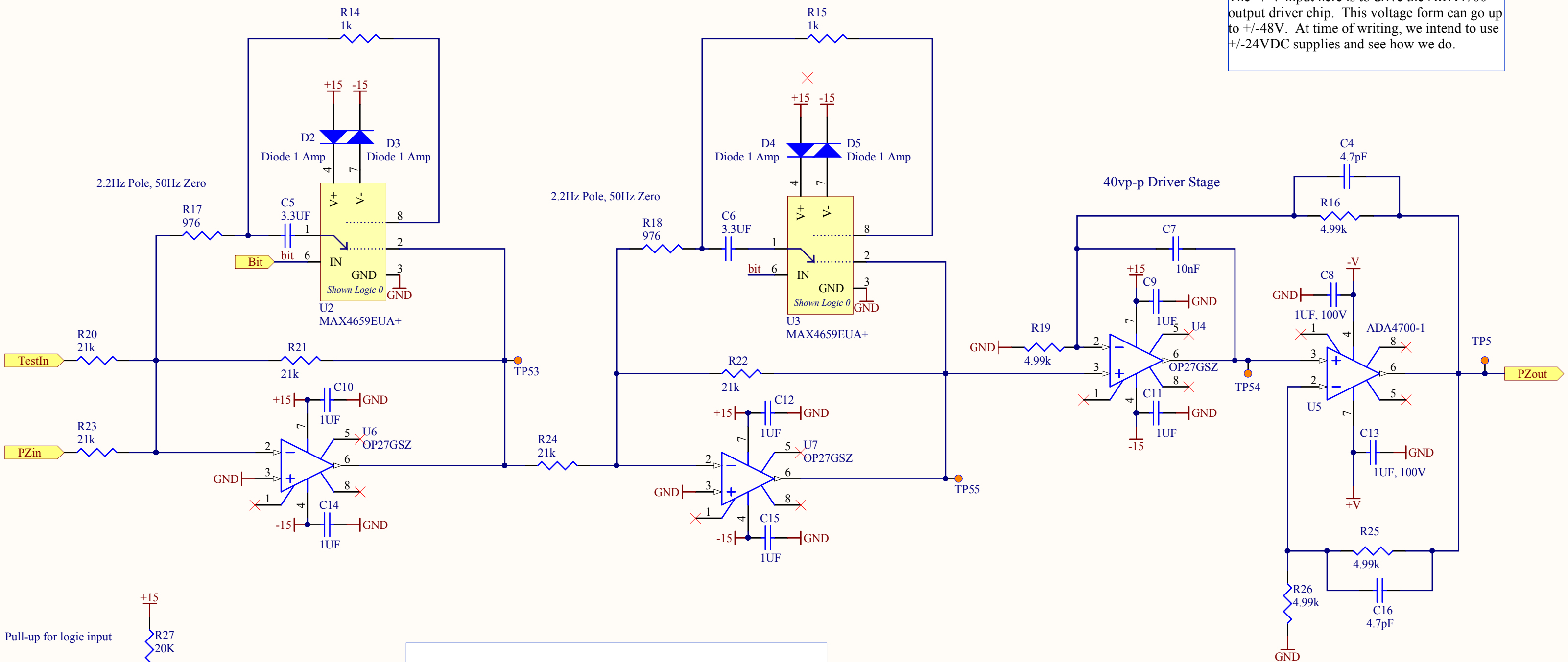


The +/-V input here is to drive the ADA4700 output driver chip. This voltage form can go up to +/-48V. At time of writing, we intend to use +/-24VDC supplies and see how we do.

The PI correction signal is anticipated to be required between 10kHz and 80kHz. This circuit filters the correction signal to avoid potential noise injection at lower frequencies

Title: *10kHz Sallen Key HPF*		*LIGO Laboratory, California Institute of Technology, Massachusetts Institute of Technology*	Last Edited: 9/16/2015
Size: A	DCC Number: D1500016	Revision: V3	Engineer: *R. Abbott*
File: C:\Rich's Files\Mycadfiles\Suspensions\ETM LVLN Driver\HPF.SchDoc		Date: 11/18/2015, Time: 3:30:10 PM	Sheet 6 of 15

The +/-V input here is to drive the ADA4700 output driver chip. This voltage form can go up to +/-48V. At time of writing, we intend to use +/-24VDC supplies and see how we do.



The design of this pole zero stage is motivated by the need to reduce the DAC noise at frequencies greater than 20Hz to a value less than 40nV/rtHz. The DAC noise is estimated (per G1401399-v2) to be 800nV/rtHz at 20 Hz. The choice of pole and zero frequency above results in a predicted circuit output noise of 28nV/rtHz at 20Hz in the presence of the anticipated DAC noise. The zero preserves some drive dynamic range at intermediate frequencies.

The ADA4700-1 stage provides the capability to increase the dynamic range to 40vp-p

Checked All

Last Edited: 9/16/2015

Title: *Pole-Zero and Driver*

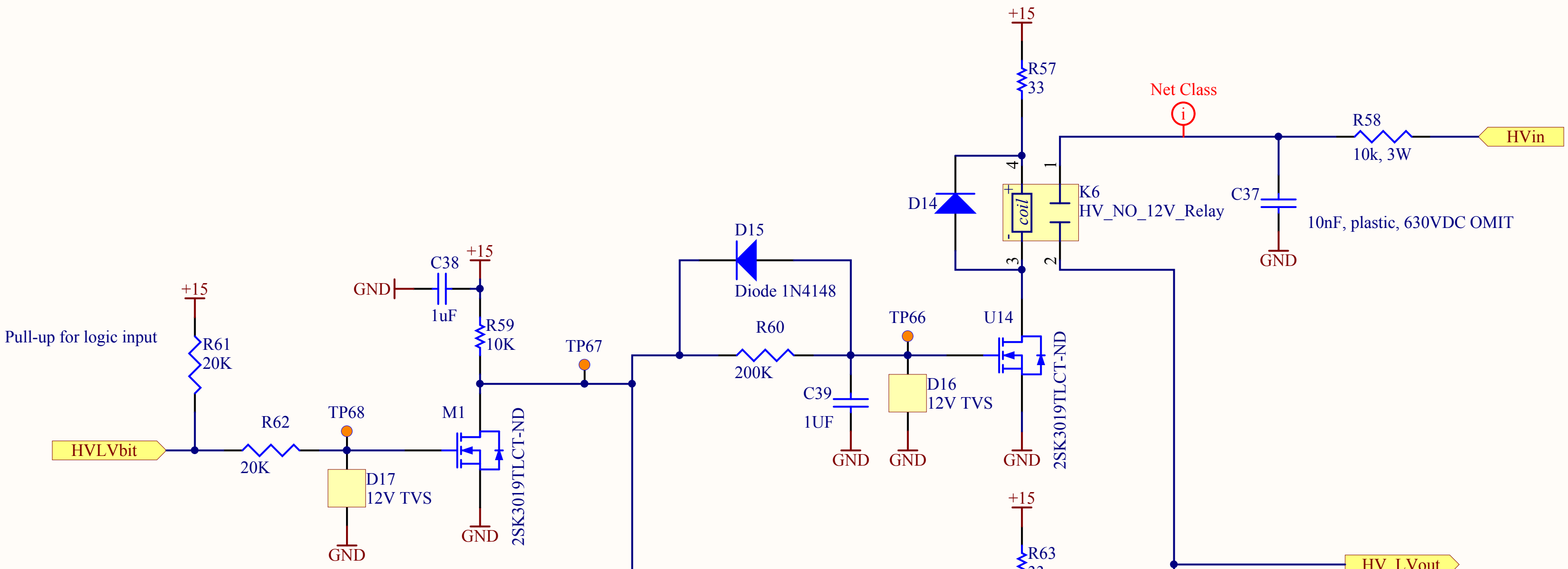
LIGO Laboratory
California Institute of Technology
Massachusetts Institute of Technology

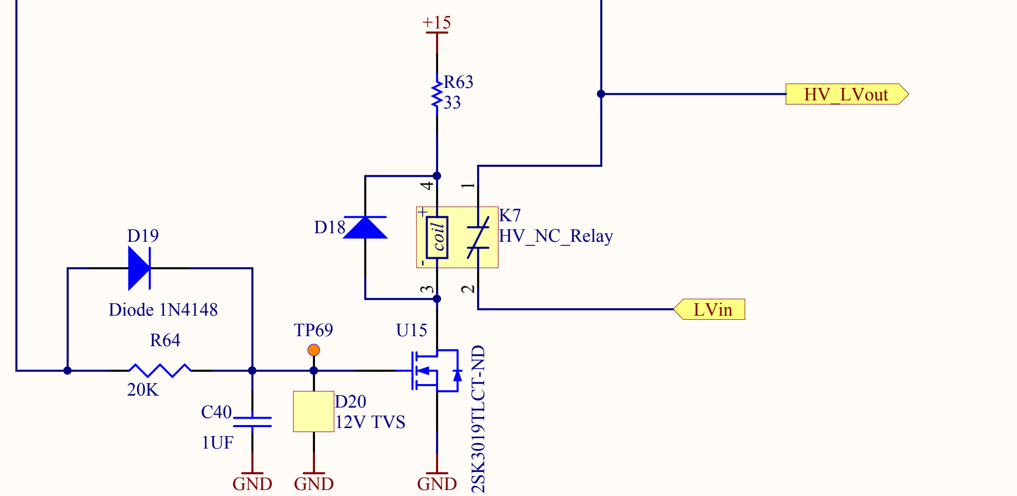
LIGO

Size: B | DCC Number: D1500016 | Revision: V3 | Engineer: *R. Abbott*

Date: 11/18/2015
Time: 3:30:10 PM

File: C:\Rich's Files\Mycadfiles\Suspensions\ETM LVLN Driver\PoleZero.SchDoc





Acceptable logic levels are as follows: The HVLVbit = logic high if the voltage is 5 to 20V. A logic low < 2V

Logic high on HVLVbit input will result in the LV path being closed, and the HV path being open and vice versa.

Due to the action of the RC filters on the FET gates, a delay (30mSec minimum) is introduced ensuring the HV path will never be closed while the LV path is closed. Failure to do this would connect the HV circuit to the LV which would be bad.

The uncommanded state results in the HV being OFF and the LV being ON

The 10nF HV capacitor on the output can be optionally utilized to lower the source impedance in the event that is useful.

Last Edited: 9/16/2015

Title: ***High & Low Voltage Transition Relays***

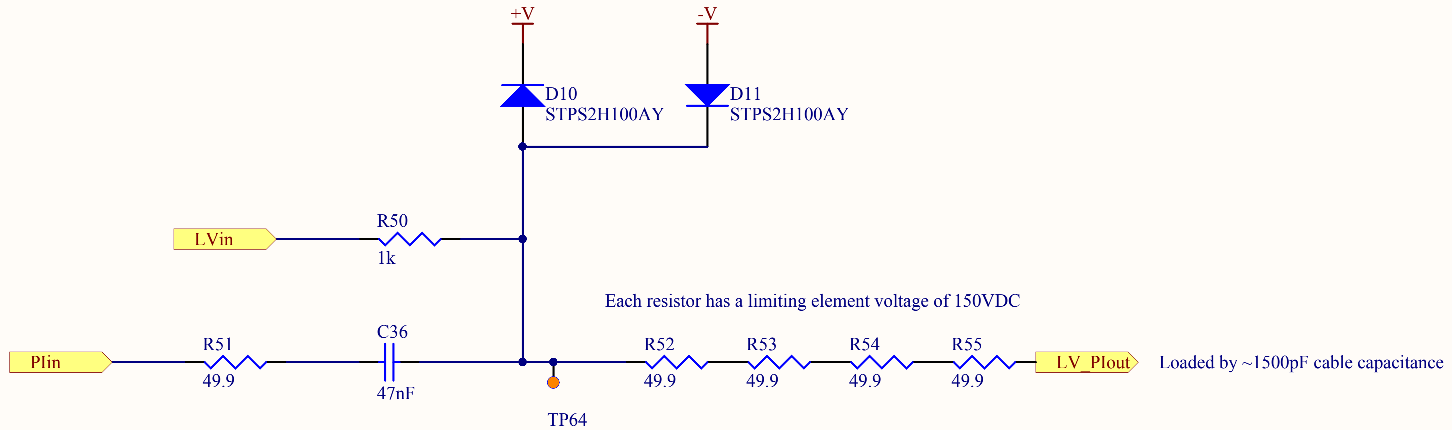
LIGO Laboratory
California Institute of Technology
Massachusetts Institute of Technology

LIGO

Size: A | DCC Number: D1500016 | Revision: V3 | Engineer: *R. Abbott*

Date: 11/18/2015
Time: 3:30:10 PM

File: C:\Rich's Files\Mycadfiles\Suspensions\ETM LVLN Driver\HV Relays.SchDoc



This summing node combines the low frequency DC coupled signals present in the normal feedback path to each quadrant with the parametric instability correction signal. The summing was done passively to allow greater dynamic range than that afforded by an active summing stage. The STPS2H100AY diodes and output 200 ohm resistor string dissipate the potential stored charge present on the output cable leading to the vacuum system and limit the instantaneous current to be less than 2 amperes assuming worst case cable charge of 400VDC and 1500pF cable capacity.

Checked All

Last Edited: 9/16/2015

Title: ***Output Summing Node***

LIGO Laboratory
California Institute of Technology
Massachusetts Institute of Technology

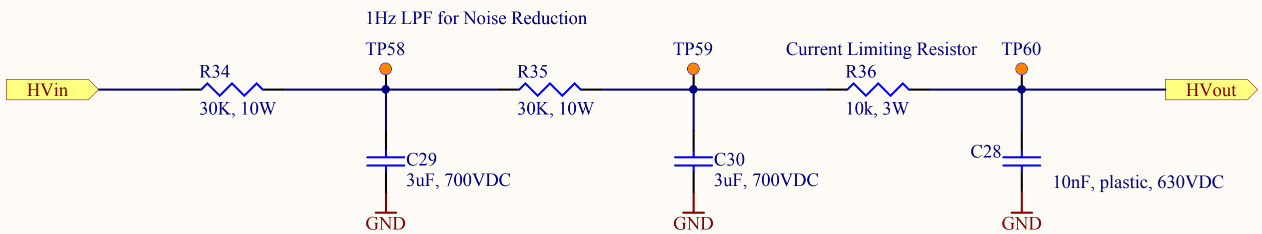
LIGO

Size: A | DCC Number: D1500016 | Revision: V3 | Engineer: *R. Abbott*

Date: 11/18/2015
Time: 3:30:11 PM

File: C:\Rich's Files\Mycadfiles\Suspensions\ETM LVLN Driver\OutputSum.SchDoc

This filter can store charge. Assume the capacitors are charged until positively discharged and measured.

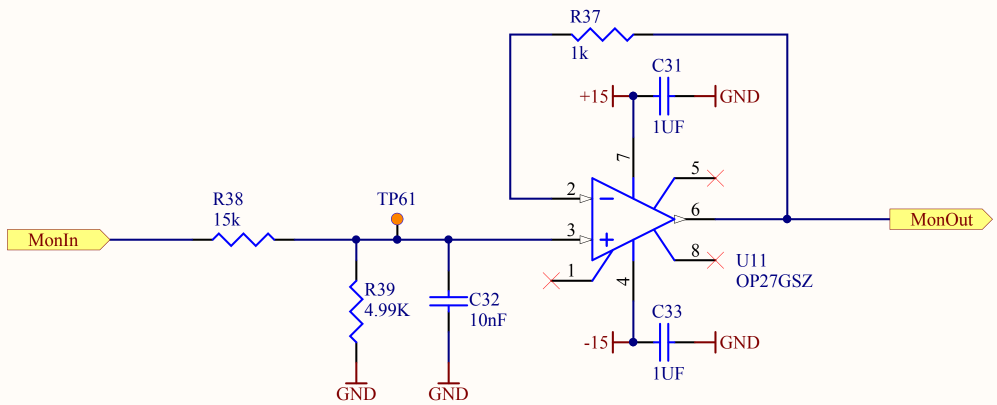


From T1400406 by Rai Weiss, this filter lowers the voltage noise on the bias path. This path has no requirement for fast frequency response beyond the ability to set the bias voltage on a human timescale.

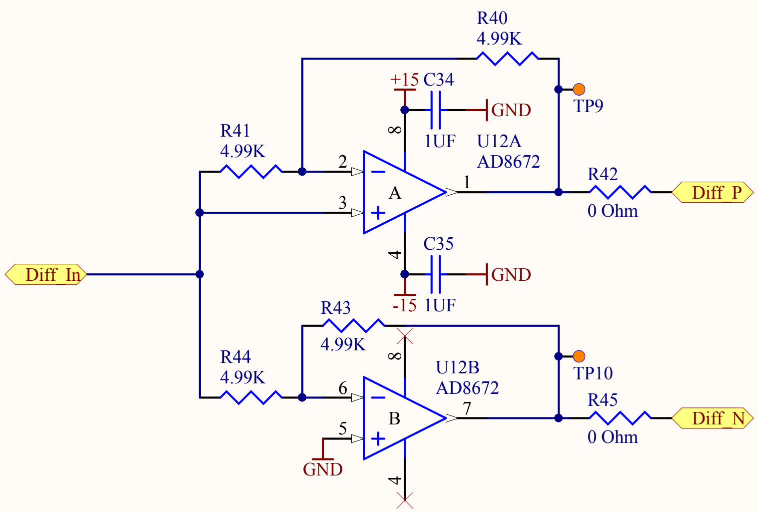
An additional 10k series resistor is conservatively included as a hedge against an in-vacuum discharge event. The 10nF HV capacitor on the output can be optionally utilized to lower the source impedance to the bias electrode in the event that is useful.

Last Edited: 9/16/2015			
Title: **High Voltage Bias Filter**		*LIGO Laboratory* *California Institute of Technology* *Massachusetts Institute of Technology*	LIGO
Size: A	DCC Number: D1500016	Revision: V3	Engineer: *R. Abbott*
File: C:\Rich's Files\Mycadfiles\Suspensions\ETM LVLN Driver\HV Filter.SchDoc			Date: 11/18/2015 Time: 3:30:11 PM Sheet 10 of 15

The large dynamic range of the output drivers (40vp-p) requires this monitor to attenuate the input signal. A pole at 1kHz is included for further attenuation of the PI band.

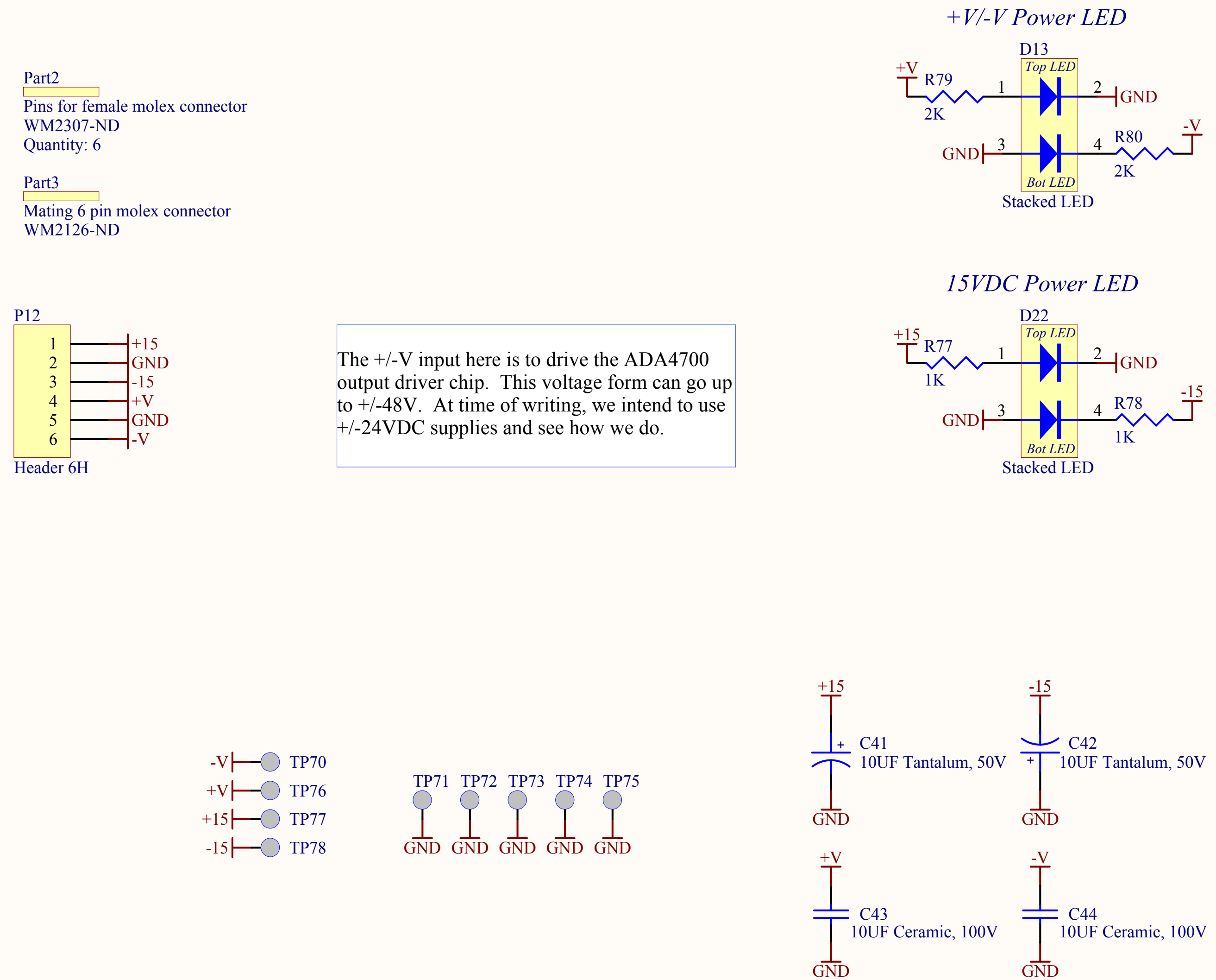


Title: *Monitoring Amplifier*		*LIGO Laboratory* *California Institute of Technology* *Massachusetts Institute of Technology*	Last Edited: 11/18/2015 LIGO
Size: A	DCC Number: D1500016	Revision: V3	Engineer: *R. Abbott*
File: C:\Rich's Files\Mycadfiles\Suspensions\ETM LVLN Driver\MonAmp.SchDoc			Date: 11/18/2015 Time: 3:30:11 PM Sheet 11 of 15



Typical LIGO differential driver circuit for the monitor signals.

Last Edited: 9/16/2015			
Title: ***Differential Driver***		*LIGO Laboratory* *California Institute of Technology* *Massachusetts Institute of Technology*	LIGO
Size: A	DCC Number: D1500016	Revision: V3	Engineer: *R. Abbott*
			Date: 11/18/2015 Time: 3:30:11 PM
File: C:\Rich's Files\Mycadfiles\Suspensions\ETM LVLN Driver\DiffDriver.SchDoc			Sheet 12 of 15



Last Edited: 9/16/2015

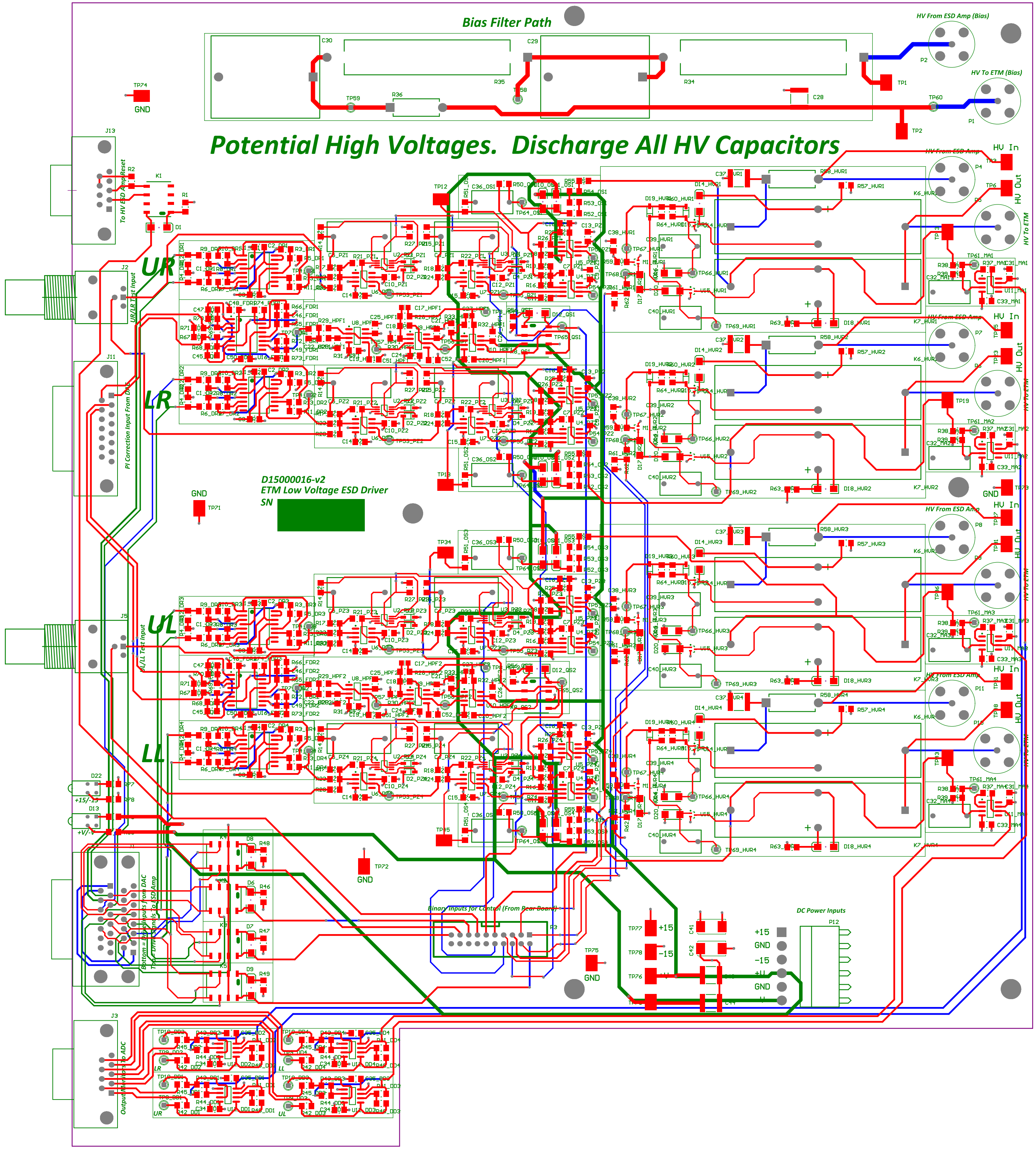
Title
Power Supplies

LIGO Laboratory
California Institute of Technology
Massachusetts Institute of Technology

Size: A | DCC Number: D1500016 | Revision: V3 | Engineer: R. Abbott

Date: 11/18/2015
Time: 3:30:11 PM

File: C:\Rich's Files\Mycadfiles\Suspensions\ETM LVLN Driver\PowerSupplies.SchDoc


Bias Filter Path
HV From ESD Amp (Bias)
HV To ETM (Bias)
Potential High Voltages. Discharge All HV Capacitors
UR
LR
UL
LL
D15000016-v2
ETM Low Voltage ESD Driver
SN
GND
HV In
HV Out
HV From ESD Amp
Binary Inputs for Control (From Rear Board)
DC Power Inputs
+15
-15

LIGO Bill of Materials

Source Data From:	**ETM LVLN Driver_v3.PrjPCB**
Board Designed By:	**R. Abbott**
Board D-number	**D1500016**
Board Revision	**V3**
Variant:	**None**

Creation Date:	11/18/2015	3:30:20 PM
Print Date:	18-Nov-15	3:30:28 PM

Designator	Comment	Description	Digikey Part Number	Manufacturers Part Number	Quantity
C1_DR1, C1_DR2, C1_DR3, C1_DR4	3.3nF	CAP 3.3nF 50V PPS 1206	PCF1302CT-ND		4
C2_DR1, C2_DR2, C2_DR3, C2_DR4, C3_DR1, C3_DR2, C3_DR3, C3_DR4, C19_HPF1, C19_HPF2, C21_HPF1, C21_HPF2, C24_HPF1, C24_HPF2, C25_HPF1, C25_HPF2, C34_DD1, C34_DD2, C34_DD3, C34_DD4, C35_DD1, C35_DD2, C35_DD3, C35_DD4, C48_FDR1, C48_FDR2, C50_FDR1, C50_FDR2	1UF	CAP 1.0UF 50V CERAMIC F 1206	478-1580-1-ND		28
C4_PZ1, C4_PZ2, C4_PZ3, C4_PZ4, C16_PZ1, C16_PZ2, C16_PZ3, C16_PZ4, C45_FDR1, C45_FDR2, C46_FDR1, C46_FDR2, C47_FDR1, C47_FDR2, C49_FDR1, C49_FDR2	4.7pF		478-1464-1-ND		16
C5_PZ1, C5_PZ2, C5_PZ3, C5_PZ4, C6_PZ1, C6_PZ2, C6_PZ3, C6_PZ4	3.3UF		EF1335-ND		8
C7_PZ1, C7_PZ2, C7_PZ3, C7_PZ4, C18_HPF1, C18_HPF2, C22_HPF1, C22_HPF2, C23_HPF1, C23_HPF2	10nF		PCF1340CT-ND		10
C8_PZ1, C8_PZ2, C8_PZ3, C8_PZ4, C13_PZ1, C13_PZ2, C13_PZ3, C13_PZ4, C20_HPF1, C20_HPF2, C26_HPF1, C26_HPF2	1UF, 100V	1uF, 100V, 1206 Capacitor	587-1777-1-ND		12
C9_PZ1, C9_PZ2, C9_PZ3, C9_PZ4, C10_PZ1, C10_PZ2, C10_PZ3, C10_PZ4, C11_PZ1, C11_PZ2, C11_PZ3, C11_PZ4, C12_PZ1, C12_PZ2, C12_PZ3, C12_PZ4, C14_PZ1, C14_PZ2, C14_PZ3, C14_PZ4, C15_PZ1, C15_PZ2, C15_PZ3, C15_PZ4, C31_MA1, C31_MA2, C31_MA3, C31_MA4, C33_MA1, C33_MA2, C33_MA3, C33_MA4, C38_HVR1, C38_HVR2, C38_HVR3, C38_HVR4	1UF	Capacitor	399-8147-1-ND		36
C17_HPF1, C17_HPF2, C27_HPF1, C27_HPF2	4.7pF, 100V		399-9251-1-ND		4
C28	10nF, plastic, 630VDC		399-5482-1-ND		1
C29, C30	3uF, 700VDC	10uF, 700VDC Capacitor	BC2786-ND	MKP1848S53070JK2A	2
C32_MA1, C32_MA2, C32_MA3, C32_MA4	10nF	10nF Plastic Cap	EF2103-ND		4
C36_OS1, C36_OS2, C36_OS3, C36_OS4	47nF		P14612-ND		4
C37_HVR1, C37_HVR2, C37_HVR3, C37_HVR4	10nF, plastic, 630VDC OMIT	An optional capacitor not stuffed initially	399-5482-1-ND OMIT from BOM		4
C39_HVR1, C39_HVR2, C39_HVR3, C39_HVR4, C40_HVR1, C40_HVR2, C40_HVR3, C40_HVR4	1UF		EF1105-ND		8
C41, C42	10UF Tantalum, 50V	Tantalum Capacitor	478-2380-1-ND		2
C43, C44	10UF Ceramic, 100V		445-13408-1-ND		2
C51_HPF1, C51_HPF2, C52_HPF1, C52_HPF2	68pF		399-1204-1-ND		4
D1, D6, D7, D8, D9, D12_QS1, D12_QS2, D14_HVR1, D14_HVR2, D14_HVR3, D14_HVR4, D18_HVR1, D18_HVR2, D18_HVR3, D18_HVR4	Diode	Default Diode	SE20AFJ-M3/6AGICT-ND		15
D2_PZ1, D2_PZ2, D2_PZ3, D2_PZ4, D3_PZ1, D3_PZ2, D3_PZ3, D3_PZ4, D4_PZ1, D4_PZ2, D4_PZ3, D4_PZ4, D5_PZ1, D5_PZ2, D5_PZ3, D5_PZ4	60V, 1A Schottky	Diode 1 Amp	RB160M-60CT-ND	RB160M-60TR	16
D10_OS1, D10_OS2, D10_OS3, D10_OS4, D11_OS1, D11_OS2, D11_OS3, D11_OS4	STPS2H100AY	Schottky Diode	497-11102-1-ND		8
D13, D22	Stacked LED	Dual Green LED	67-1321-ND		2
D15_HVR1, D15_HVR2, D15_HVR3, D15_HVR4, D19_HVR1, D19_HVR2, D19_HVR3, D19_HVR4	Diode 1N4148	High Conductance Fast Diode	1N4148WTPMSCT-ND		8
D16_HVR1, D16_HVR2, D16_HVR3, D16_HVR4, D17_HVR1, D17_HVR2, D17_HVR3, D17_HVR4, D20_HVR1, D20_HVR2, D20_HVR3, D20_HVR4	12V TVS	12V Bi-directional Transient Voltage Suppressor	SMAJ12CALFCT-ND		12
J1	D15 Female Top, Male Bottom	Stacked D-15 Female Top, Male Bottom, Norcomp 178 Series	1115FME-ND		1
J2, J5	BNC	Stacked Dual BNC	991-1023-ND		2
J3, J13	D9 Female	Receptacle Assembly, 9 Position, Right Angle	A32117-ND		2
J11	Male DB15	Receptacle Assembly, 15 Position, Right Angle	6E17C-015P-AJ-121-ND		1
K1, K2, K3, K4, K5, K8_QS1, K8_QS2	12V	12V DPDT Omron Relay	Z113CT-ND		7
K6_HVR1, K6_HVR2, K6_HVR3, K6_HVR4	HV_NO_12V_Relay		725-1047-ND	DAR71210	4
K7_HVR1, K7_HVR2, K7_HVR3, K7_HVR4	HV_NC_Relay		725-1049-ND	DBR71210	4
M1_HVR1, M1_HVR2, M1_HVR3, M1_HVR4, U14_HVR1, U14_HVR2, U14_HVR3, U14_HVR4, U15_HVR1, U15_HVR2, U15_HVR3, U15_HVR4	NMOS	ROHM N-Channel MOSFET	2SK3019TLCT-ND		12
P1, P2, P4, P5, P6, P7, P8, P9, P10, P11	BNC	BNC Straight Away Connector	ARF1687-ND		10
P3	Header 10X2	Header, 10-Pin, Dual row	1175-1612-ND		1
P12	Header 6H	Header, 6-Pin, Right Angle	WM5236-ND		1
Part1, R8_DR1, R8_DR2, R8_DR3, R8_DR4, R69_FDR1, R69_FDR2	OMIT, Panel Mount SHV Cable Assembly (SHV Jack to BNC)	Panel Mount SHV Cable Assembly (SHV Jack to BNC), Resistor		SHVJBH-RG58-BNCM-14i	7
Part2	Pins for female molex connector	Pins for female molex connector	WM2307-ND		1
Part3	Mating 6 pin molex connector	Mating 6 pin molex connector	WM2126-ND		1
R1, R46, R47, R48, R49, R56_QS1, R56_QS2, R57_HVR1, R57_HVR2, R57_HVR3, R57_HVR4, R63_HVR1, R63_HVR2, R63_HVR3, R63_HVR4	33	Resistor	RHM33ICT-ND		15
R2		Resistor	P22KBCCT-ND		1
R3_DR1, R3_DR2, R3_DR3, R3_DR4, R5_DR1, R5_DR2, R5_DR3, R5_DR4, R11_DR1, R11_DR2, R11_DR3, R11_DR4, R13_DR1, R13_DR2, R13_DR3, R13_DR4, R65_FDR1, R65_FDR2, R66_FDR1, R66_FDR2, R72_FDR1, R72_FDR2, R73_FDR1, R73_FDR2	3.01K, 3.01K OHM	Resistor	P3.01KBCCT-ND		24
R4_DR1, R4_DR2, R4_DR3, R4_DR4, R12_DR1, R12_DR2, R12_DR3, R12_DR4, R67_FDR1, R67_FDR2, R71_FDR1, R71_FDR2	100K OHM	Resistor	P100KBCCT-ND		12
R6_DR1, R6_DR2, R6_DR3, R6_DR4, R9_DR1, R9_DR2, R9_DR3, R9_DR4, R14_PZ1, R14_PZ2, R14_PZ3, R14_PZ4, R15_PZ1, R15_PZ2, R15_PZ3, R15_PZ4, R37_MA1, R37_MA2, R37_MA3, R37_MA4, R50_OS1, R50_OS2, R50_OS3, R50_OS4, R68_FDR1, R68_FDR2, R70_FDR1, R70_FDR2, R74_FDR1, R74_FDR2	0 ohm, 1k	Resistor	P1.0KBCCT-ND		30
R7_DR1, R7_DR2, R7_DR3, R7_DR4, R10_DR1, R10_DR2, R10_DR3, R10_DR4, R42_DD1, R42_DD2, R42_DD3, R42_DD4, R45_DD1, R45_DD2, R45_DD3, R45_DD4	0 ohm	Resistor	P0.0ECT-ND		16
R16_PZ1, R16_PZ2, R16_PZ3, R16_PZ4, R19_PZ1, R19_PZ2, R19_PZ3, R19_PZ4, R25_PZ1, R25_PZ2, R25_PZ3, R25_PZ4, R26_PZ1, R26_PZ2, R26_PZ3, R26_PZ4	4.99k	Resistor	P4.99KBCCT-ND		16
R17_PZ1, R17_PZ2, R17_PZ3, R17_PZ4, R18_PZ1, R18_PZ2, R18_PZ3, R18_PZ4	976	Resistor	P976BCCT-ND		8
R20_PZ1, R20_PZ2, R20_PZ3, R20_PZ4, R21_PZ1, R21_PZ2, R21_PZ3, R21_PZ4, R22_PZ1, R22_PZ2, R22_PZ3, R22_PZ4, R23_PZ1, R23_PZ2, R23_PZ3, R23_PZ4, R24_PZ1, R24_PZ2, R24_PZ3, R24_PZ4	21k	Resistor	P21KBCCT-ND		20
R27_PZ1, R27_PZ2, R27_PZ3, R27_PZ4, R61_HVR1, R61_HVR2, R61_HVR3, R61_HVR4, R62_HVR1, R62_HVR2, R62_HVR3, R62_HVR4, R64_HVR1, R64_HVR2, R64_HVR3, R64_HVR4	20K	Resistor	P20.0KFCT-ND		16
R28_HPF1, R28_HPF2, R30_HPF1, R30_HPF2, R32_HPF1, R32_HPF2, R33_HPF1, R33_HPF2, R39_MA1, R39_MA2, R39_MA3, R39_MA4, R40_DD1, R40_DD2, R40_DD3, R40_DD4, R41_DD1, R41_DD2, R41_DD3, R41_DD4, R43_DD1, R43_DD2, R43_DD3, R43_DD4, R44_DD1, R44_DD2, R44_DD3, R44_DD4	4.99k	Resistor	TNP4.99KACCT-ND		28
R29_HPF1, R29_HPF2	1.13K		P1.13KBCCT-ND		2
R31_HPF1, R31_HPF2	2.26K		P2.26KBCCT-ND		2
R34, R35	30K, 10W		20J30KE-ND	20J30KE	2
R36, R58_HVR1, R58_HVR2, R58_HVR3, R58_HVR4	10k, 3W		ALSR3F-10.0K-ND		5
R38_MA1, R38_MA2, R38_MA3, R38_MA4	15k	Resistor	P15KBCCT-ND		4
R51_OS1, R51_OS2, R51_OS3, R51_OS4, R52_OS1, R52_OS2, R52_OS3, R52_OS4, R53_OS1, R53_OS2, R53_OS3, R53_OS4, R54_OS1, R54_OS2, R54_OS3, R54_OS4, R55_OS1, R55_OS2, R55_OS3, R55_OS4	49.9	Thin film resistor	P49.9BCCT-ND		20
R59_HVR1, R59_HVR2, R59_HVR3, R59_HVR4	10K	Resistor	P10.0KFCT-ND		4
R60_HVR1, R60_HVR2, R60_HVR3, R60_HVR4	200K	Resistor	P200KFCT-ND		4
R77, R78	1K	Resistor	TNP1.00KACCT-ND		2
R79, R80	2K	Resistor	RNCP1206FTD2K00CT-ND		2
TP1, TP2, TP3, TP6, TP12, TP13, TP18, TP19, TP23, TP25, TP27, TP31, TP34, TP36, TP43, TP45, TP48, TP51, TP70, TP71, TP72, TP73, TP74, TP75, TP76, TP77, TP78	TESTPT	PCB Testpoint	5016KCT-ND		27
U1_DR1, U1_DR2, U1_DR3, U1_DR4	LT1125CS	Quad Low Noise, High-Speed Precision Operational Amplifier	LT1125CSW#PBF-ND		4
U2_PZ1, U2_PZ2, U2_PZ3, U2_PZ4, U3_PZ1, U3_PZ2, U3_PZ3, U3_PZ4	MAX4659	SPDT CMOS Switch, 25 ohms Ron	MAX4659EUA+-ND	MAX4659EUA+	8
U4_PZ1, U4_PZ2, U4_PZ3, U4_PZ4, U6_PZ1, U6_PZ2, U6_PZ3, U6_PZ4, U7_PZ1, U7_PZ2, U7_PZ3, U7_PZ4, U11_MA1, U11_MA2, U11_MA3, U11_MA4	OP27GSZ	Ultra-Low Noise, Precision Operational Amplifier	OP27GSZ-ND		16
U5_PZ1, U5_PZ2, U5_PZ3, U5_PZ4, U10_HPF1, U10_HPF2	ADA4700-1	High Voltage Opamp	ADA4700-1ARDZ-ND		6
U8_HPF1, U8_HPF2, U9_HPF1, U9_HPF2	AD829JR	High-Speed, Low-Noise Video Operational Amplifier	AD829AR-ND		4
U12_DD1, U12_DD2, U12_DD3, U12_DD4	AD8672	High-Speed, Low-Power Dual Operational Amplifier	AD8672ARZ-ND		4
U16_FDR1, U16_FDR2	OP467	Quad Low Noise, High-Speed Precision Operational Amplifier	OP467GSZ-ND		2
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