

EPI-Hi Bias Supply Status

Peer Review – 9/23/2013

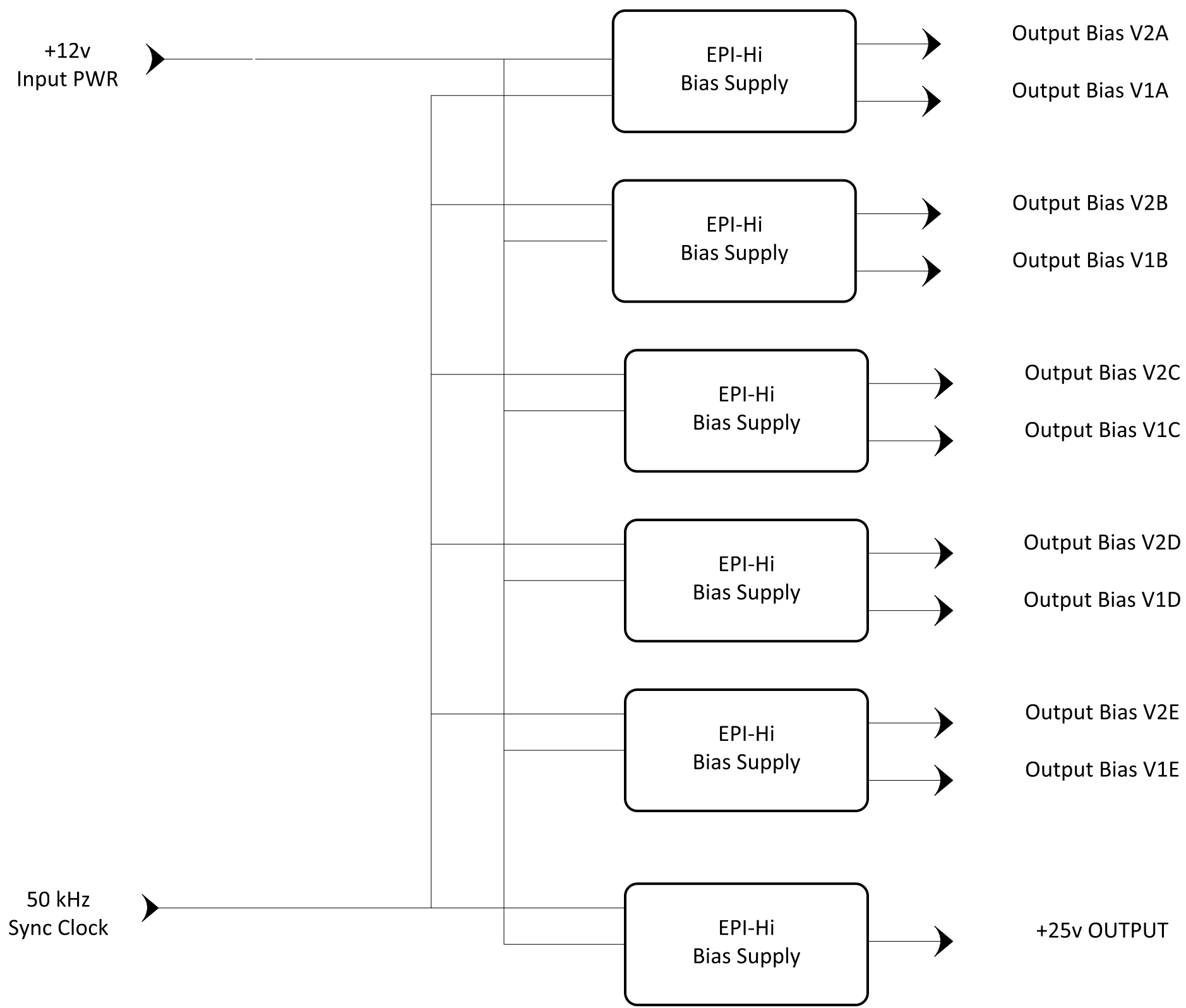
Board	Schematic	Fit Check	Outline/ Keep Outs	Layout	Parts Stress Analysis	Thermal Analysis
Prototype	Yes	N/A	N/A	Yes	N/A	N/A
EM	Yes	Yes	Yes	In progress	No	No

The EM board will have five identical HV supplies and one 25V supply.

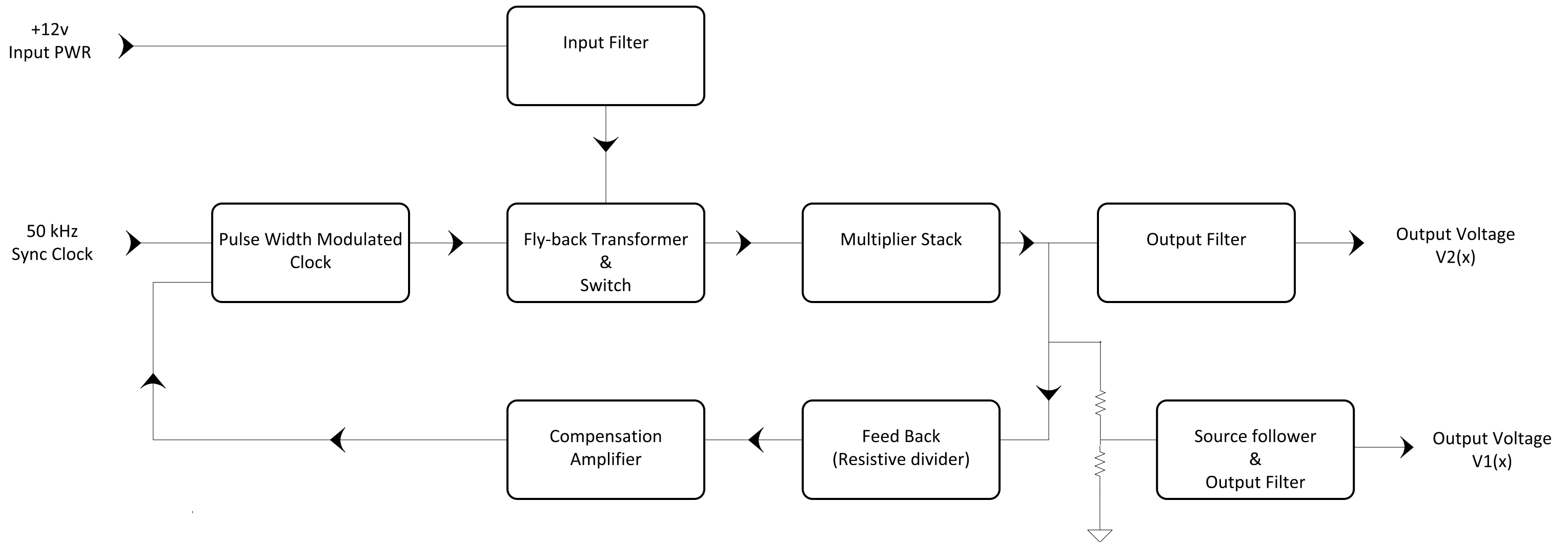
The Prototype board has one HV supply copy and one 25V supply copy.
It has been fabricated as a single-sided rigid PCB and partially assembled.
Waiting for some more parts to arrive, will start testing soon.

Bias Supply - Main Features

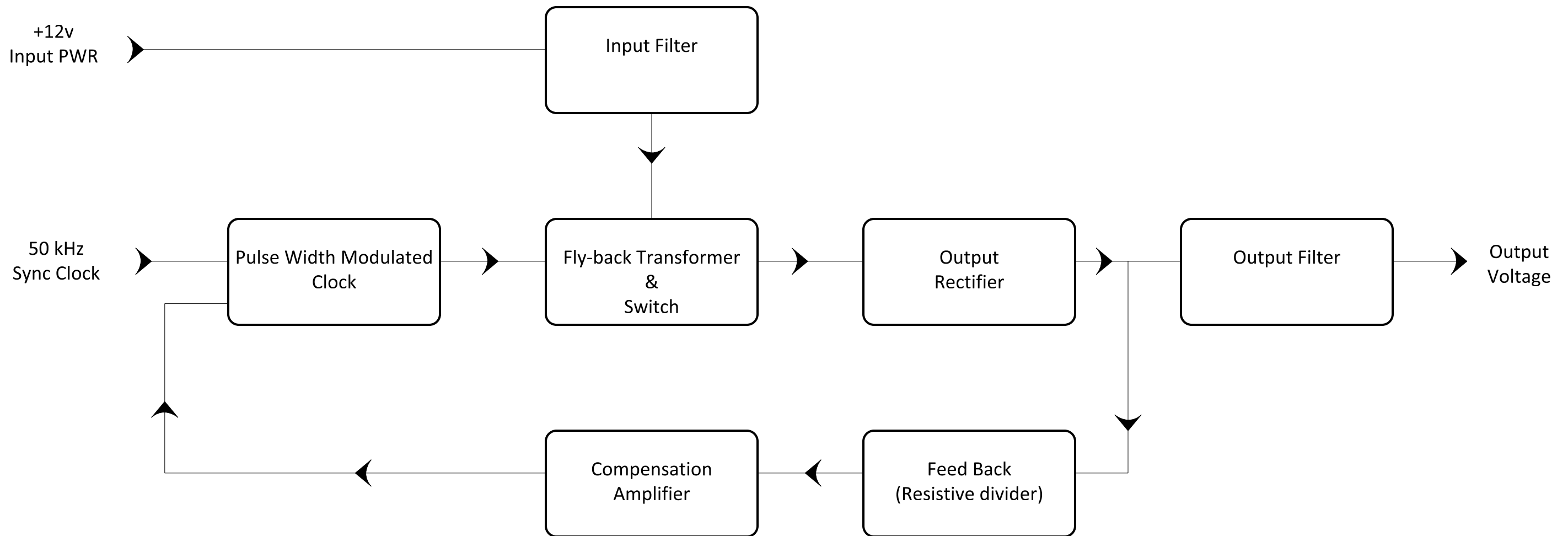
- Provides adjustable dual HV bias to 3 telescopes (40-80V and 160-260V) for the thick Si detectors
- Supplies 25V to LET1 & LET2 boards for local LV bias generation (2-20V and 4-20V) for the thin Si detectors
- Dedicated HV supply for each telescope end (5 total)
- Control and input power come from DPU board
- Double-sided rigid-flex design
- Blind and buried vias with a middle ground plane



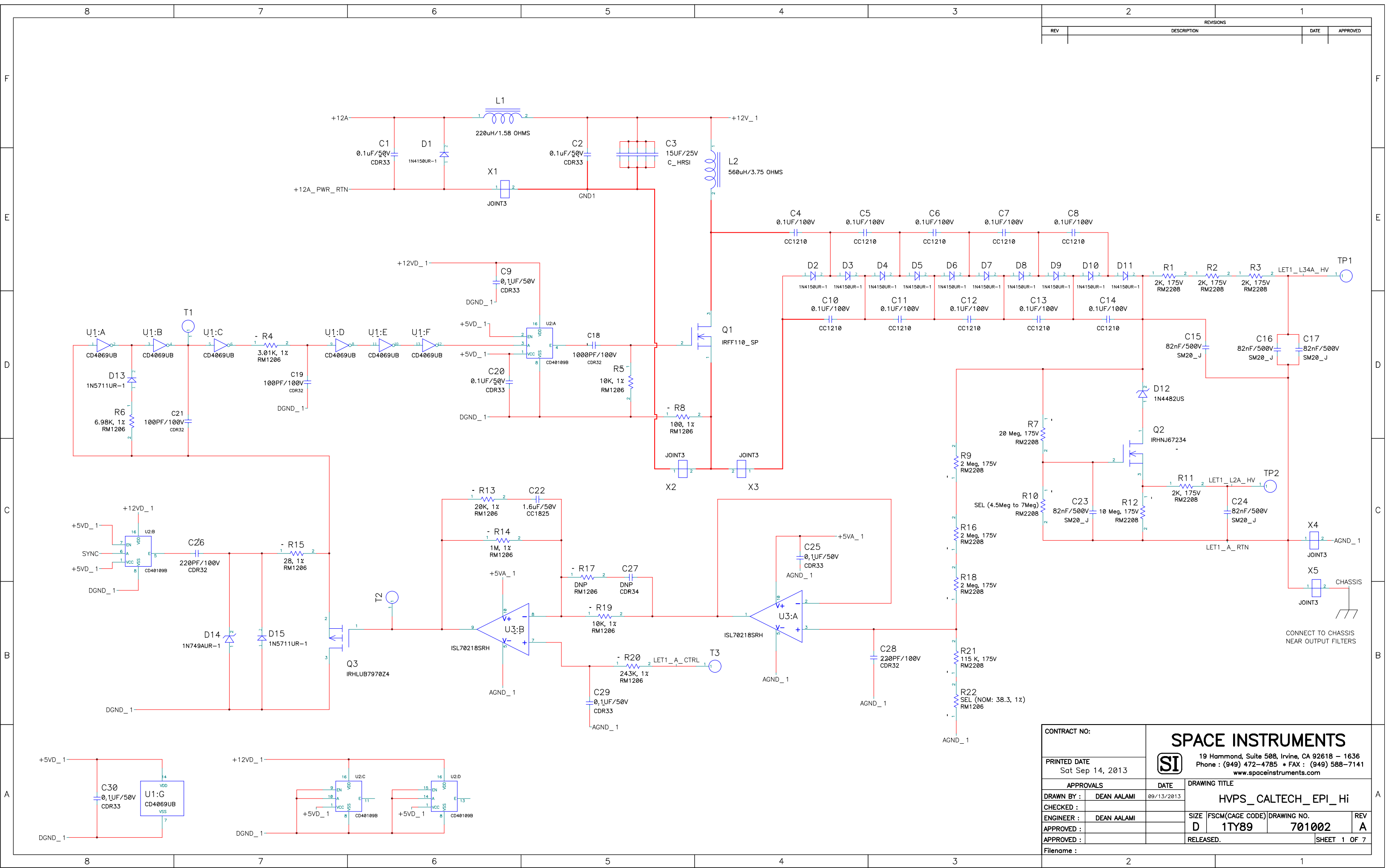
Block Diagram
EPI-Hi Bias Supply Board
6/27/2013



Block Diagram
EPI-Hi Bias Supply
(One of 5 identical supplies)
07/02/2013



Block Diagram
EPI-Hi +25v Supply
07/02/2013



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REVISIONS			
DESCRIPTION	DATE	APPROVED	

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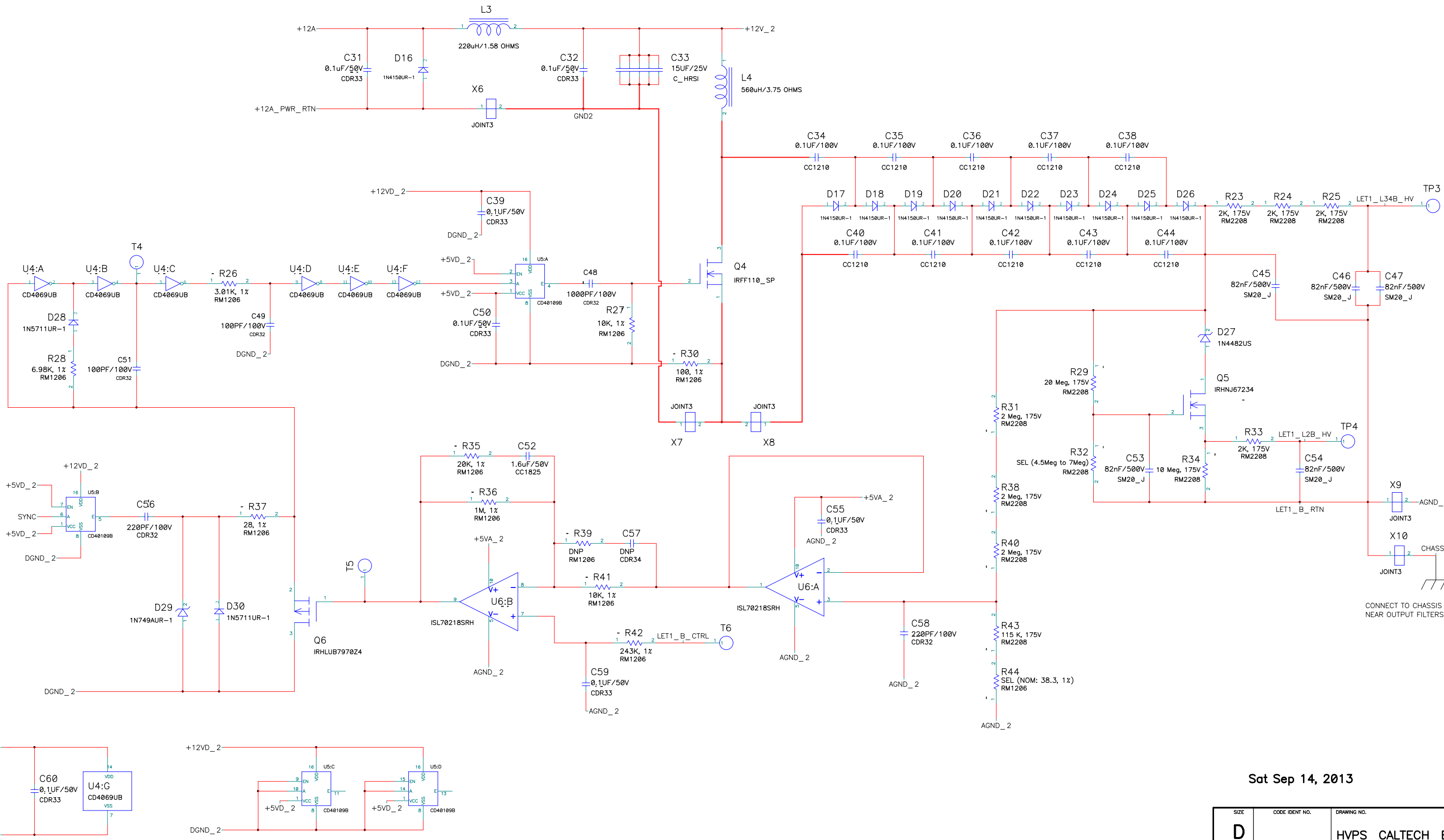
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Sat Sep 14, 2013

SIZE	CODE IDENT NO.	DRAWING NO.
D		HVPS_CALTECH_EPI_Hi
SCALE	SHEET	OF
	2	7

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REVISIONS			
DESCRIPTION	DATE	APPROVED	

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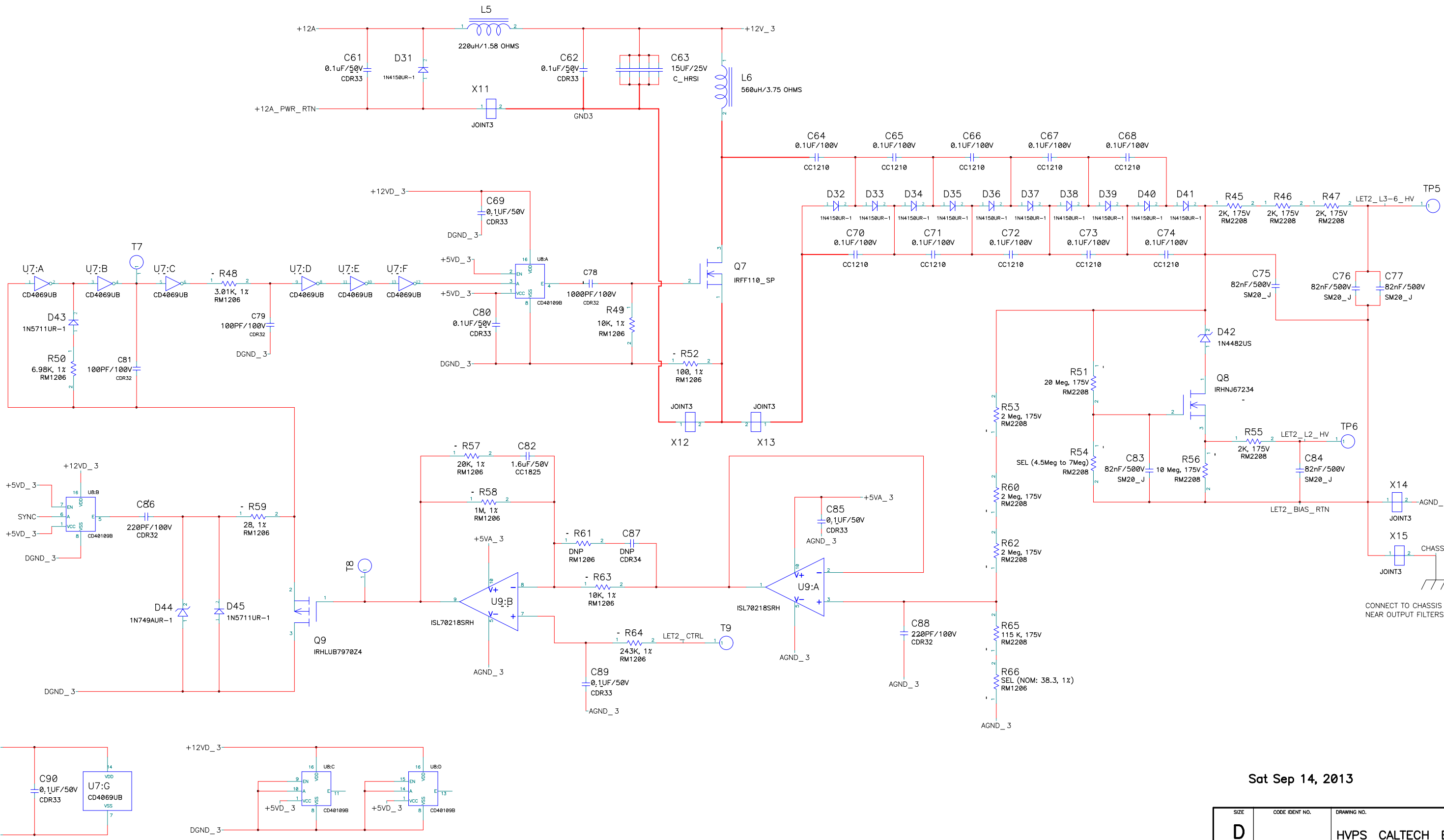
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Sat Sep 14, 2013

SIZE	CODE IDENT NO.	DRAWING NO.
D		HVPS_CALTECH_EPI_Hi
SCALE	SHEET 3 OF 7	

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REVISIONS			
DESCRIPTION	DATE	APPROVED	

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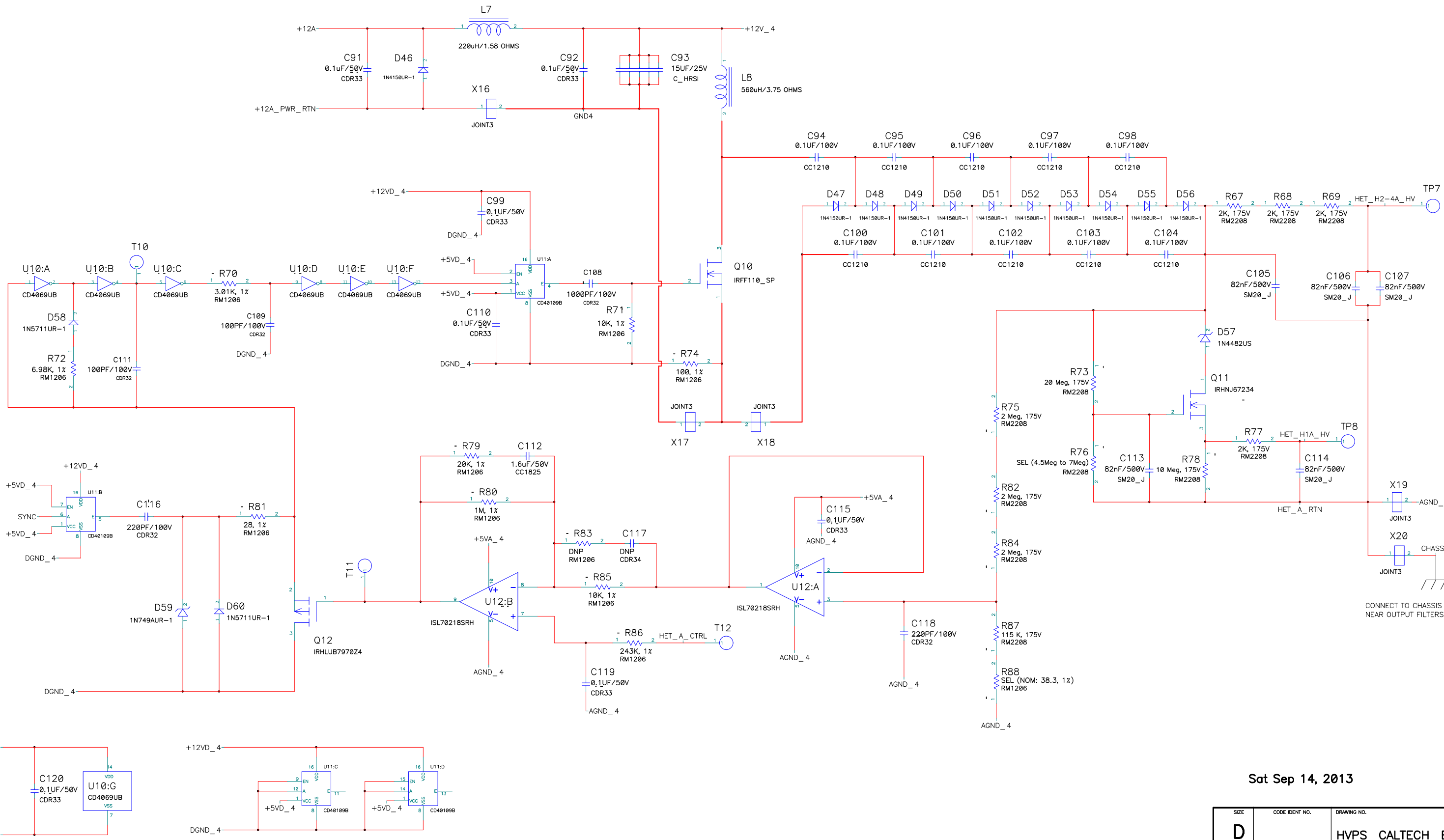
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Sat Sep 14, 2013

SIZE	CODE IDENT NO.	DRAWING NO.
D		HVPS_CALTECH_EPI_Hi
SCALE		SHEET 4 OF 7

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REVISIONS			
DESCRIPTION	DATE	APPROVED	

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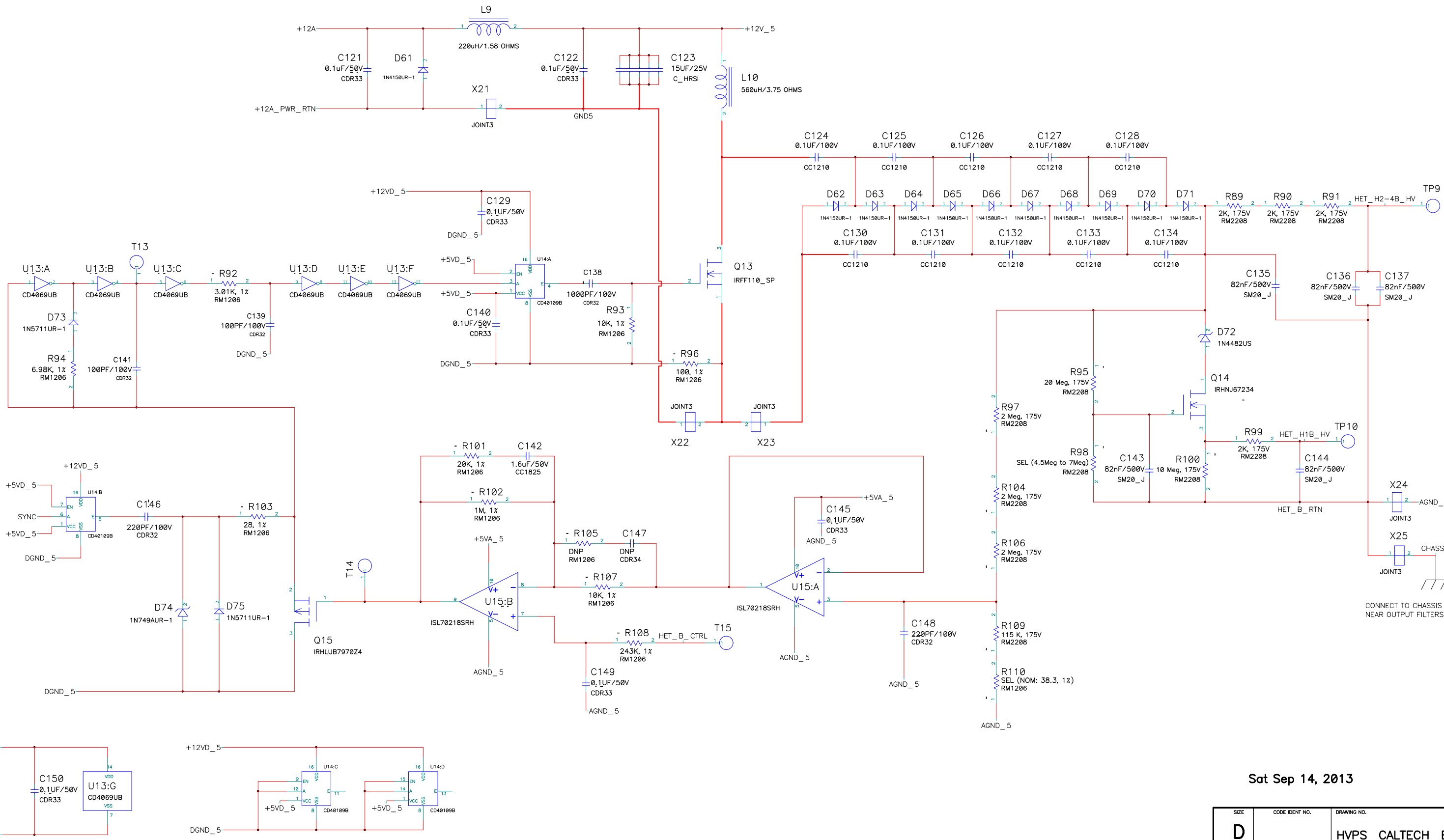
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Sat Sep 14, 2013

SIZE	CODE IDENT NO.	DRAWING NO.
D		HVPS_CALTECH_EPI_Hi
SCALE	SHEET 5 OF 7	

D

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D

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B

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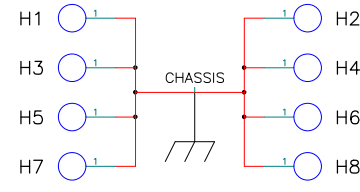
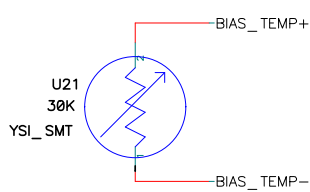
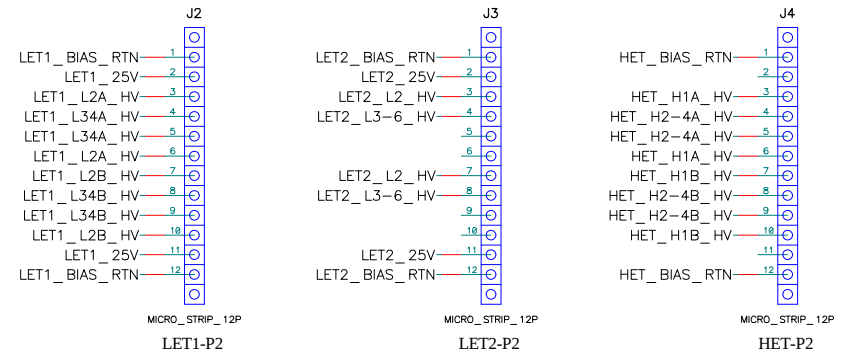
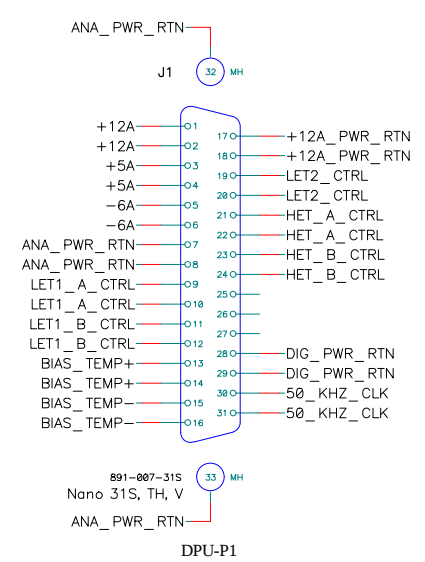
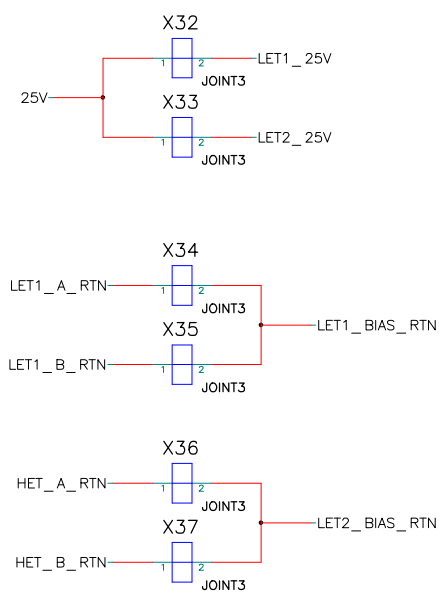
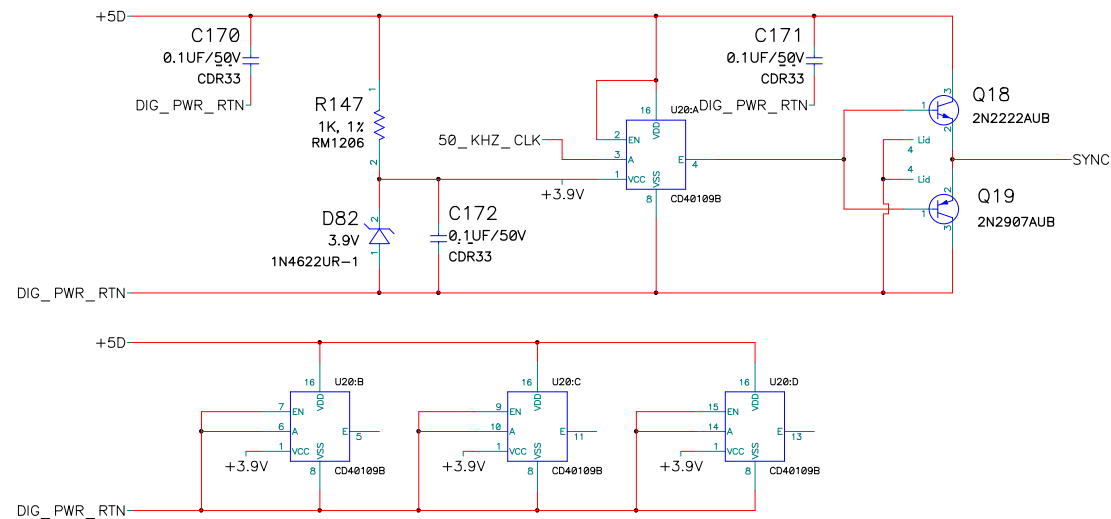
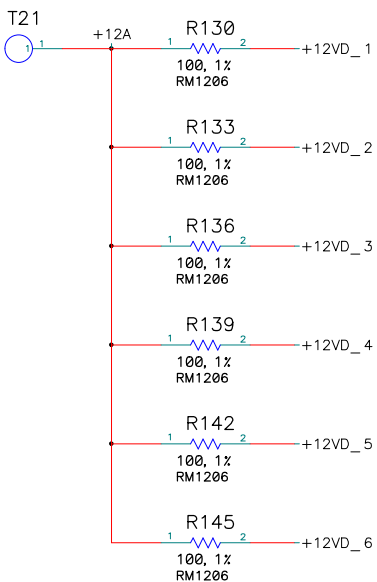
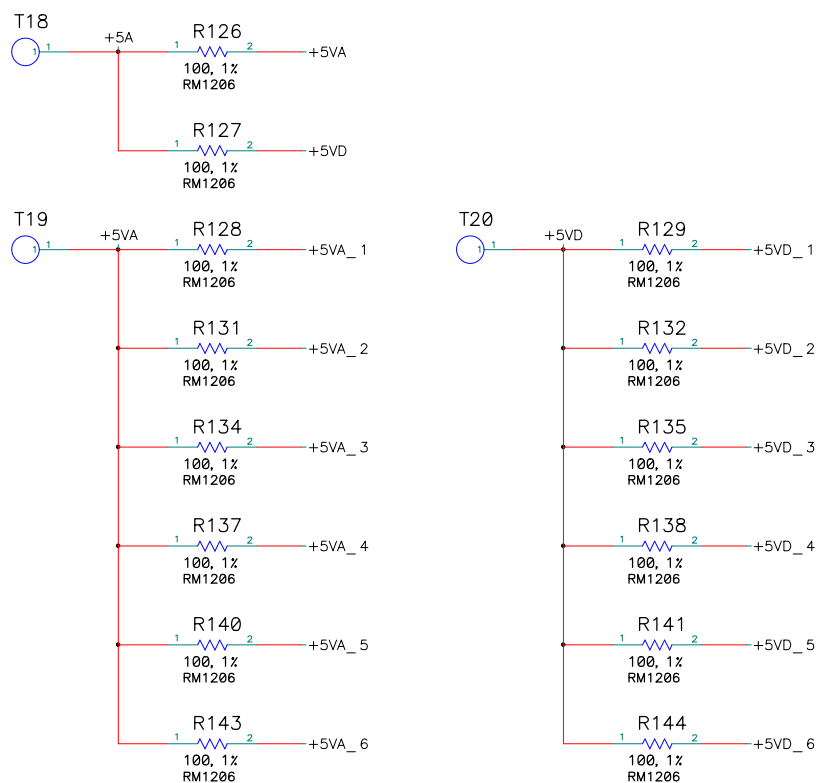
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REVISIONS			
DESCRIPTION	DATE	APPROVED	



Sat Sep 14, 2013

SIZE	CODE IDENT NO.	DRAWING NO.
D		HVPS_CALTECH_EPI_Hi
SCALE	SHEET	OF
	7	7

4

3

2

1

DATE: 06/01/2013

SPACE INSTRUMENTS
19 Hammond, Suite 508
Irvine, CA 92618-1636
Phone (949) 472-4785 Fax (949) 588-5887
Website : www.spaceinstruments.com
Email : dean@spaceinstruments.com

Parts List for 1 HVPS EPI_Hi CALTECH

Count	Part Number	ComponentName	Value	Manufacturer	RefDes	Note
1	JANTXV1N4482US	1N4482US		Microsemi	D12	
1	ISL70218 SRHMF	ISL70218SRH		Intersil	U3	
1	5962R9664501VXC	CD40109B		Intersil	U2	
1	SR1725X7R165K2NT95#M123	CC1825	1.6uF/50V	Presidio	C23	
10	SR1209X7R104K3NT95#M123	CC1210	0.1uF/100V	Presidio	C5 C6 C7 C8 C9 C11 C12 C13 C14 C15	
2	CDR32BP101BJUS	CDR32	100PF/100V	Kemet	C20 C22	
1	CDR32BP102BJUS	CDR32	1000PF/100V	Kemet	C19	
2	CDR32BP221BJUS	CDR32	220PF/100V	Kemet	C27 C29	
8	CDR33BX104AKUS	CDR33	0.1uF/50V	Kemet	C1 C2 C3 C10 C21 C26 C30 C31	
1		CDR34	DNP	Kemet	C28	DO NOT INSTALL
1	JANTX 1N749AUR-1	1N749AUR-1		Microsemi	D14	
11	JANTX 1N4150UR-1	1N4150UR-1		Microsemi	D1 D2 D3 D4 D5 D6 D7 D8 D9 D10 D11	
2	JANTXV 1N5711UR-1	1N5711UR-1		Microsemi	D13 D15	
1	CD4069UBKMSR	CD4069UB		Intersil	U1	
1	HRSI214X7R156M1J5	C HRSI	15uF/25V	Presidio	C4	
1	MIL4922-29L	MIL4922	220uH/1.58 OHMS	Delevan	L1	
1	MIL4922-34L	MIL4922	560uH/3.75 OHMS	Delevan	L2	
1	D55342H06B98E1TW	RM1206	6.98K, 1%	State of the Art	R10	
1	D55342H07B1F00TW	RM1206	1M, 1%	State of the Art	R16	
1	D55342H07B3E01TW	RM1206	3.01K, 1%	State of the Art	R8	
1		RM1206	DNP	State of the Art	R18	DO NOT INSTALL
1	D55342H07B10D0TW	RM1206	10, 1%	State of the Art	R2	
2	D55342H07B10E0TW	RM1206	10K, 1%	State of the Art	R9 R19	
1	D55342H07B20E0TW	RM1206	20K, 1%	State of the Art	R15	
1	D55342H07B28D0TW	RM1206	28, 1%	State of the Art	R17	
1	D55342H07B38D3TW	RM1206	SEL (NOM: 38.3, 1%)	State of the Art	R25	SEL (NOM: 38.3, 1%)
3	D55342H07B100D0TW	RM1206	100, 1%	State of the Art	R1 R3 R4	
1	D55342H07B243ETW	RM1206	243K, 1%	State of the Art	R23	
4	M55342K05B2E00TW	RM2208	2K, 175V	State of the Art	R5 R6 R7 R13	
1	M55342K05B2E00TW	RM2208	115 K, 175V	State of the Art	R24	
3	M55342K05B2F00TW	RM2208	2 Meg, 175V	State of the Art	R20 R21 R22	
1	M55342K05B10F0TW	RM2208	10 Meg, 175V	State of the Art	R14	
1	M55342K05B20F0TW	RM2208	20 Meg, 175V	State of the Art	R11	
1		RM2208	SEL (4.5Meg to 7Meg)	State of the Art	R12	SEL (4.5Meg to 7Meg)
5	SM20B823K501BM	SM20	82nF/500V	Kemet	C16	

					C17 C18 C24 C25	
1	IRHNJ67234	IRHNJ67234		International Rectifier	Q2	
1	JANTXV2N6782	IRFF110 SP		International Rectifier	Q1	
1	IRHLUB7970Z4	IRHLUB7970Z4		International Rectifier	Q3	

DATE: 06/01/2013

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Count	Part Number	ComponentName	Value	Manufacturer	RefDes	Note
1	ISL70218 SRHMF	ISL70218SRH		Intersil	U6	
1	5962R9664501VXC	CD40109B		Intersil	U5	
1	SR1725X7R165K2NT95#M123	CC1825	1.6uF/50V	Presidio	C43	
3	SR1725X7R185K2NT95#M123	CC1825	1.8uF/50V	Presidio	C37 C38 C48	
2	CDR32BP101BJUS	CDR32	100PF/100V	Kemet	C40 C42	
1	CDR32BP102BJUS	CDR32	1000PF/100V	Kemet	C39	
2	CDR32BP221BJUS	CDR32	220PF/100V	Kemet	C45 C47	
8	CDR33BX104AKUS	CDR33	0.1uF/50V	Kemet	C32 C33 C34 C36 C41 C44 C49 C50	
1		CDR34	DNP	Kemet	C46	
1	JANTX 1N749AUR-1	1N749AUR-1		Microsemi	D20	
3	JANTX 1N4150UR-1	1N4150UR-1		Microsemi	D16 D17 D18	
2	JANTXV 1N5711UR-1	1N5711UR-1		Microsemi	D19 D21	
1	CD4069UBKMSR	CD4069UB		Intersil	U4	
1	HRSI214X7R156M1J5	C HRSI	15uF/25V	Presidio	C35	
1	MIL4922-29L	MIL4922	220uH/1.58 OHMS	Delevan	L3	
1	MIL4922-34L	MIL4922	560uH/3.75 OHMS	Delevan	L4	
1	D55342H06B98E1TW	RM1206	6.98K, 1%	State of the Art	R32	
1	D55342H07B3E01TW	RM1206	3.01K, 1%	State of the Art	R30	
1		RM1206	DNP	State of the Art	R38	
1	D55342H07B6E34TW	RM1206	6.34K, 1%	State of the Art	R42	
2	D55342H07B10E0TW	RM1206	10K, 1%	State of the Art	R31 R33	
1	D55342H07B10F0TW	RM1206	10M, 1%	State of the Art	R35	
2	D55342H07B24E9TW	RM1206	24.9K, 1%	State of the Art	R40 R41	
1	D55342H07B28D0TW	RM1206	28, 1%	State of the Art	R36	
1	D55342H07B80E6TW	RM1206	80.6K, 1%	State of the Art	R39	
4	D55342H07B100DTW	RM1206	100, 1%	State of the Art	R26 R27 R28 R29	
2	D55342H07B100ETW	RM1206	100K, 1%	State of the Art	R34 R37	
1	ISYE-1009RH-Q	ISYE-1009RH		Intersil	U7	
1	JANTXV2N6782	IRFF110 SP		International Rectifier	Q4	
1	IRHLUB7970Z4	IRHLUB7970Z4		International Rectifier	Q5	

8/5/13 17:00	Add min power mode when all PHASIC channels disabled, re-estimate Iq for +5V LDO, Is for +5Vref, HKchip consumption (BK)
7/16/13 11:00	Set LVPS outputs to the target values (BK)
6/27/13 16:00	Updated PHASIC consumption (12mW/ch) (BK)
5/1/13 14:00	Added redundant S/C I/F driver/receiver, and set LVPS outputs to 0.1V above nominal value (BK)
1/25/13 17:00	Updated Bias Supply consumption, added 3 op-heater control switches and the combined op-heater power for all 3 telescopes (BK)
11/15/12 11:00	Reverted rad-hard clock oscillator power to 15mA @ 3.3V with load (in MISC/OSC/SRAM contribution), corrected sourcing of +25V which is from Bias Supply, not LVPS (BK)
11/2/12 19:30	Updated PHASIC consump (11mW/ch) & individual MISC contrib, added rad-hard clock oscillator delta & Hot Case, deleted references to high rates, corrected some equations (BK)
8/1/12 10:06	Fixed regulator power, new op-amps added (JAB)

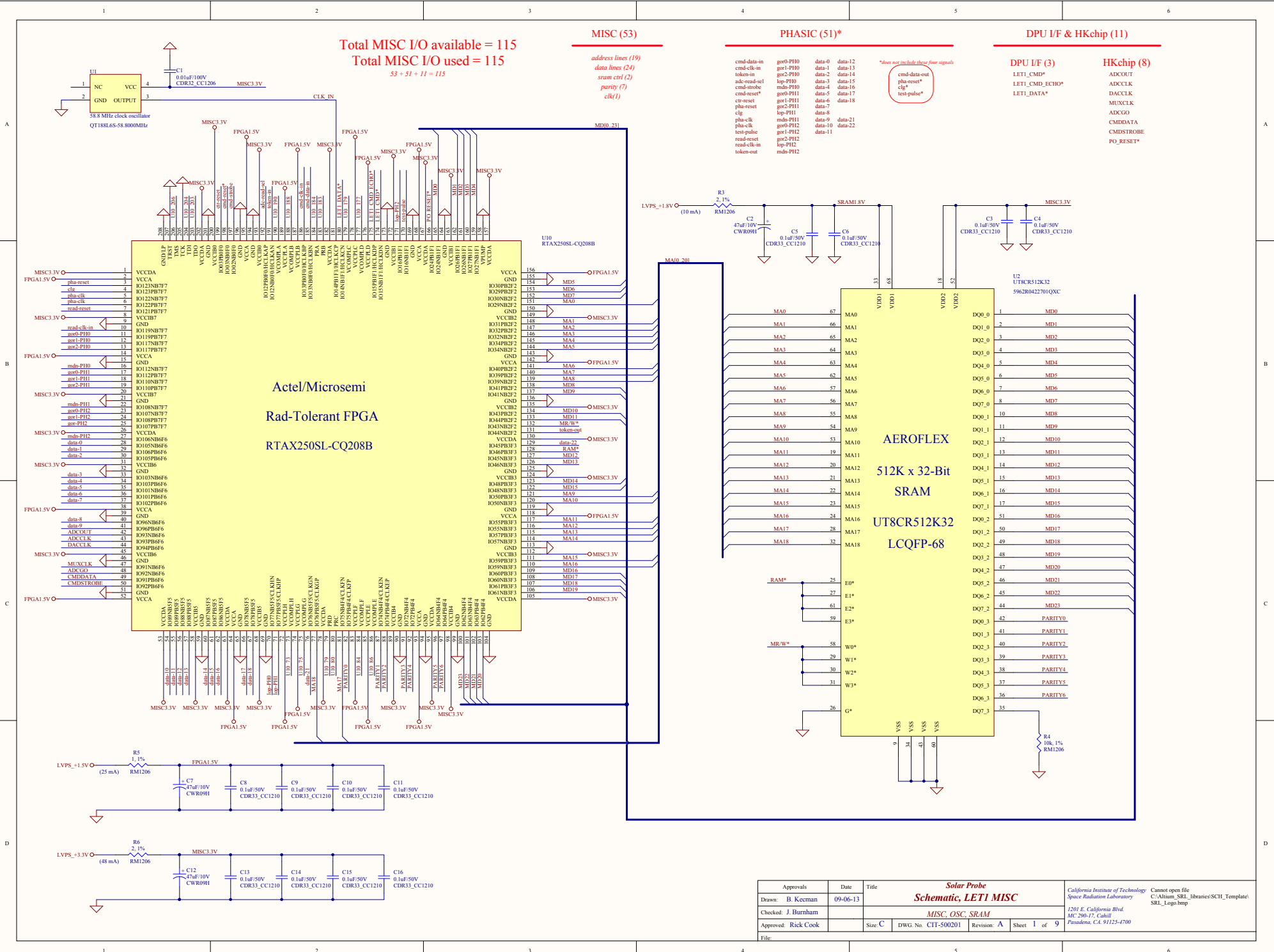
LVPS nominal outputs	Boards ->	HET	LET1	LET2	DPU	BIAS		LVPS		TOTALS:	BOL Current (mA)	BOL Power (mW)	EOL Current (mA)	EOL Power (mW)
						BOL	EOL	BOL	EOL					
		# PHASICs	3	3	2									
		# channels	36	40	24									
		mA	mA	mA	mA	mA	mA	mA	mA					
+6VA	PHASIC +5VR	101.40	111.00	67.60						6	338.2	2029.0	338.2	2029.0
	P5V post-regulator (Iq)	12.50	13.00	11.00	4.00									
	N5V post-regulator	0.85	0.85	0.85										
	HK chip	1.03	5.03	3.03	6.03									
-6VA	PHASIC N5V	3.30	3.30	2.20						-6	12.6	75.3	12.6	75.3
	N5V post-regulator	0.85	0.85	0.85										
	LV bias (<20V)					0.20	0.20							
	HV bias (40 - 260V)					1.00	1.00							
+12VA	5V precision reference (Is)	1.20	1.20	1.20	1.20					12	16.0	192.4	63.0	756.4
	LV bias (<20V)					1.01	1.01							
	HV bias (40 - 260V)					8.00	55.00							
+3.3VD	MISC/OSC/SRAM	48.00	48.00	48.00	95.00					3.41	287.0	978.7	287.0	978.7
	Interface				30.00									
	MRAM				0.00									
	Op-heater control (3 switches, 50% duty-cycle)				18.00									
+1.5VD	MISC	25.00	25.00	25.00	25.00					1.53	100.0	153.0	100.0	153.0
+1.8VD	SRAM	10.00	10.00	10.00	10.00					1.82	40.0	72.8	40.0	72.8
	+25V from Bias Supply for LV bias		0.71	0.36										
											Min Pwr	Nom Pwr		Peak Pwr
	Secondary power by board (mW)	954.11	1056.46	756.59	618.66	115.38	679.38				1944.2	3501.2		4065.2
	Primary power losses in LVPS (mW)										1500.51	1742.22		
											Primary (mW)	2777.4	5001.7	5807.4
	Combined op-heater power for all 3 EPI-Hi telescopes per thermal analysis of 11/13/2012 (Trade 12) (mW)										330.0	330.0		330.0
	EPI-Hi total power w/ op-heaters (mW)										3107.4	5331.7		6137.4
	Min Pwr Mode on telescope boards (mW)	396.71	438.46	374.99										
	All PHASIC channels disabled, LDO reg. Iq 5-6 mA													
	Primary power losses in LVPS in Min Pwr Mode (mW)										833.22			

EPI-Hi resources: Mass [g]		4/27/11	6/1/12	2/12/13	4/5/13	8/14/13	8/27/13	Uncertainty
<u>Component</u>		<u>Baseline</u>	<u>Past</u>	<u>Past</u>	<u>Intermed.</u>	<u>Intermed.</u>	<u>Present</u>	
LET1 det. & housing		225	225	225	225	225	225	20%
LET1 electronics		257	238	221	240	258	258	20%
-----		-----	-----	-----	-----	-----	-----	
LET1 subtotal:		482	463	446	465	483	483	20%
LET2 det. & housing		145	145	145	145	145	145	20%
LET2 electronics		235	209	190	214	233	233	20%
-----		-----	-----	-----	-----	-----	-----	
LET2 subtotal:		380	354	335	359	378	378	20%
HET det. & housing		120	120	120	120	120	120	20%
HET electronics		235	238	221	231	250	250	20%
-----		-----	-----	-----	-----	-----	-----	
HET subtotal:		355	358	341	351	370	370	20%
Elec. box & hardware		1091	1000	1050	1100	1335	1335	20%
Shielding		0	0	0	0	0	100	20%
DPU board		279	247	198	197	197	197	20%
Bias Supply		228	228	228	286	354	354	20%
LVPS		292	292	260	260	260	260	20%
-----		-----	-----	-----	-----	-----	-----	
Central elec. subtotal:		1890	1767	1736	1843	2146	2246	20%
-----		-----	-----	-----	-----	-----	-----	
EPI-Hi subtotal:		3107	2942	2859	3019	3377	3477	20%
Thermal hardware		0	0	50	50	50	50	20%
Thermal blankets		34	34	100	100	100	100	C
-----		-----	-----	-----	-----	-----	-----	
EPI-Hi total:		3141	2976	3009	3169	3527	3627	20%

Resource history:	Mass [g]	4/27/11	6/1/12	2/12/13	4/5/13	8/14/13	8/27/13	
<u>Component</u>	<u>Baseline</u>	<u>Past</u>	<u>Past</u>	<u>Intermed.</u>	<u>Intermed.</u>	<u>Intermed.</u>	<u>Present</u>	Uncertainty
LET1 det. & housing	225	225	225	225	225	225	225	20%
Proposal MEL - Rounded up								
2/23/10 MEW memo	225	225	225	225	225	225	225	C
LET1 electronics	257	238	221	240	258		258	20%
6/18/13 BK update - the requested increase in LET1 board area has been approved by the Project								
5/1/13 BK update - requested 20% increase in LET1 board area for risk reduction (adding 9cm x 4cm extension; 0.51 g/cm2)						18	18	C
4/5/13 BK update - board area 85% populated; comp, staking, conf coat; 0.95 g/cm2					147	147	147	C
4/5/13 BK update - LET1 blank board 13.5cm x 13.5cm; 0.51 g/cm2					93	93	93	C
2/13/13 BK update - board area 80% populated; comp, staking, conf coat; 0.95 g/cm2								C
2/12/13 BK update - LET1 blank board 15cm x 13.5cm; 0.51 g/cm2								C
2/7/13 BK update - board area 90% populated; comp, staking, conf coat; 0.95 g/cm2				139				C
2/7/13 BK update - LET1 blank board 12cm x 13.5cm; 0.51 g/cm2				83				C
5/28/12 BK update w/ HKchip; board area 70% populated; comp, staking, conf coat; LET1 has 3 PHASIC hybrids as before		135						C
5/28/12 BK update - LET1 blank board 15cm x 15cm w/ corner cutout 9cm & 5cm; (		103						C
4/14/11 MEW memo	257							C
2/23/10 MEW memo								C
-----	-----	-----	-----	-----	-----	-----	-----	
LET1 subtotal:	482	463	446	465	483		483	20%
LET2 det. & housing	145	145	145	145	145	145	145	20%
Proposal MEL - Rounded up								
2/23/10 MEW memo	145	145	145	145	145	145	145	C
LET2 electronics	235	209	190	214	233		233	20%
6/18/13 BK update - the requested increase in LET2 board area has been approved by the Project								
5/1/13 BK update - requested 20% increase in LET2 board area for risk reduction (adding 9cm x 4cm extension; 0.51 g/cm2)						18	18	C
4/5/13 BK update - board area 70% populated; comp, staking, conf coat; 0.95 g/cm2					121	121	121	C
4/5/13 BK update - LET2 blank board 13.5cm x 13.5cm; 0.51 g/cm2					93	93	93	C
2/13/13 BK update - board area 60% populated; comp, staking, conf coat; 0.95 g/cm2								C
2/12/13 BK update - LET2 blank board 15cm x 13.5cm; 0.51 g/cm2								C
2/7/13 BK update - board area 70% populated; comp, staking, conf coat; 0.95 g/cm2				108				C
2/7/13 BK update - LET2 blank board 12cm x 13.5cm; 0.51 g/cm2				83				C
5/28/12 BK update w/ HKchip; board area 55% populated; comp, staking, conf coat; LET2 has 2 PHASIC hybrids as before		106						C
5/28/12 BK update - LET2 blank board 15cm x 15cm w/ corner cutout 9cm & 5cm; (		103						C
4/14/11 MEW memo	235							C
2/23/10 MEW memo								C
-----	-----	-----	-----	-----	-----	-----	-----	
LET2 subtotal:	380	354	335	359	378		378	20%

HET det. & housing	120	120	120	120	120	120	20%
2/23/10 MEW memo	120	120	120	120	120	120	C
HET electronics	235	238	221	231	250	250	20%
6/18/13 BK update - the requested increase in HET board area has been approved by the Project							
5/1/13 BK update - requested 20% increase in HET board area for risk reduction (adding 9cm x 4cm extension; 0.51 g/cm2)					18	18	C
4/5/13 BK update - board area 80% populated; comp, staking, conf coat; 0.95 g/cm2				139	139	139	C
4/5/13 BK update - HET blank board 13.5cm x 13.5cm; 0.51 g/cm2				93	93	93	C
2/13/13 BK update - board area 80% populated; comp, staking, conf coat; 0.95 g/cm2							C
2/12/13 BK update - HET blank board 15cm x 13.5cm; 0.51 g/cm2							C
2/7/13 BK update - board area 90% populated; comp, staking, conf coat; 0.95 g/cm2			139				C
2/7/13 BK update - HET blank board 12cm x 13.5cm; 0.51 g/cm2			83				C
5/28/12 BK update w/ HKchip; board area 70% populated; comp, staking, conf coat;		135					C
5/28/12 HET now has 3 PHASIC hybrids							C
5/28/12 BK update - HET blank board 15cm x 15cm w/ corner cutout 9cm & 5cm; 0.		103					C
4/14/11 MEW memo (HET has 2 PHASIC hybrids)	235						C
2/23/10 MEW memo (HET has 2 PHASICs)							C
-----	-----	-----	-----	-----	-----	-----	
HET subtotal:	355	358	341	351	370	370	20%
Elec. box & hardware	1091	1000	1050	1100	1335	1335	20%
6/18/13 BK update - the requested increases in E-box size and telescope bracket mass have been approved by the Project							
5/1/13 BK update - requested 100% increase in telescope bracket mass for risk reduction					80	80	C
5/1/13 BK update - requested 20% increase in board area for risk reduction (adding 9cm x 4cm extension) requires more hardware/spacers					30	30	C
5/1/13 BK update - requested 20% increase in board area for risk reduction (adding 9cm x 4cm extension) requires bigger box					125	125	C
4/5/13 BK update - Elec box 14cm x 14cm x 15cm				800	800	800	C
2/11/13 Sandy update - Hardware, spacers, connections			220	220	220	220	C
2/11/13 Sandy update - Telescope brackets			80	80	80	80	C
2/11/13 Sandy update - Elec box 13cm x 14cm x 15cm			750				C
6/1/11 Radiation shielding not needed since PHASIC will be rad-hard		0					C
4/14/11 MEW memo - Hardware	177	177					C
4/14/11 MEW memo - Radiation shielding	91						C
4/14/11 MEW memo - Telescope brackets	58	58					C
4/14/11 MEW memo - Elec box 16cm x 16cm x 10.4cm	765	765					C
Proposal & DPU/LVPS increments - Hardware							C
Proposal & DPU/LVPS increments - Elec box							C
2/23/10 MEW memo - Hardware							C
2/23/10 MEW memo - Elec box							C
2/23/10 MEW memo - Extra Board Area							C
Shielding	0	0	0	0	0	100	20%
8/27/13 Adopted from Project's mass allocation to ISIS						100	C
DPU board	279	247	198	197	197	197	20%
7/8/13 Sandy update - DPU board height reduced by 0.8cm to accommodate chamfer on the E-box; new board dims 13.5cm x 12.7cm							
4/5/13 BK update - board area 60% populated; comp, staking, conf coat; 0.95 g/cm2				104	104	104	C
4/5/13 BK update - DPU blank board 13.5cm x 13.5cm; 0.51 g/cm2				93	93	93	C
2/7/13 BK update - board area 75% populated; comp, staking, conf coat; 0.95 g/cm2			115				C
2/7/13 BK update - DPU blank board 12cm x 13.5cm; 0.51 g/cm2			83				C
5/28/12 BK update w/ HKchip; board area 65% populated; comp, staking, conf coat;		119					C

Component area now 4.9" x 3.5" w/ HKchip, which makes 25% reduction							C
DPU board has MDM connector and MCM SRAM		30					C
DPU board has flexi-strip cutouts of approximately 10cm2							C
5/28/12 BK update - DPU blank board 15cm x 15cm w/ corner cutout 9cm & 5cm; 0.		98					C
4/14/11 MEW memo (component area 4.9" x 4.7" per JAB I	279						C
Proposal DPU increment							C
2/23/10 MEW memo							
Bias Supply	228	228	228	286	354	354	20%
6/18/13 BK update - the requested increase in Bias Supply board area has been approved by the Project							
5/1/13 BK update - requested 20% increase in Bias Supply board area for risk reduction (adding 9cm x 4cm extension; 0.51 g/cm2)					18	18	C
5/1/13 BK update - if 20% increase approved, DPU and Bias Supply boards will be swapped in the stack; the latter will need an extra RF shield; both shields will be					130	130	C
5/1/13 Dean Aalami update for RF shield 0.030" thick					54	54	C
4/5/13 Dean Aalami update for board heavily populated; comp, staking, conf coat				127	127	127	C
4/5/13 Dean Aalami update for blank board area 13.5cm x 13.5cm (2.78 g/sq.in)				79	79	79	C
4/5/13 Dean Aalami update for RF shield 0.050" thick				80			C
2/12/13 BK update - Bias Supply blank board 15cm x 13.5cm; 0.51 g/cm2							C
4/14/11 MEW memo - Shield	82	82	82				C
4/14/11 MEW memo - Board	146	146	146				C
Proposal MEL - Board & Shield							C
2/23/10 MEW memo - Shield							C
2/23/10 MEW memo - Board							C
LVPS	292	292	260	260	260	260	20%
7/29/13 Sandy update - LVPS board height reduced by to accommodate chamfer on the E-box; new board dims 14cm x 10.8cm							
2/7/13 Reid Gurnee update - based on similar design and board size for another project			160	160	160	160	C
2/7/13 BK update - estimate for top RF shield			100	100	100	100	C
Proposal LVPS increment	292	292					
2/23/10 MEW memo							
-----	-----	-----	-----	-----	-----	-----	
Central elec. subtotal:	1890	1767	1736	1843	2146	2246	20%
-----	-----	-----	-----	-----	-----	-----	
EPI-Hi subtotal:	3107	2942	2859	3019	3377	3477	20%
-----	-----	-----	-----	-----	-----	-----	
Thermal hardware	0	0	50	50	50	50	20%
2/12/13 BK update - estimate for heaters, thermistors, thermal harness			50	50	50	50	C
Thermal blankets	34	34	100	100	100	100	20%
2/7/13 BK update - estimate for all blankets			100	100	100	100	C
4/14/11 MEW memo	34	34	34	34	34	34	C
2/23/10 MEW memo							
-----	-----	-----	-----	-----	-----	-----	
EPI-Hi total:	3141	2976	3009	3169	3527	3627	20%



Total MISC I/O available = 115
Total MISC I/O used = 115
53 + 51 + 11 = 115

MISC (53)

address lines (19)
data lines (24)
sram ctrl (2)
parity (7)
clk(1)

PHASIC (51)*

*does not include these four signals
cmd-data-out
cmd-data-in
cmd-strobe
cmd-reset

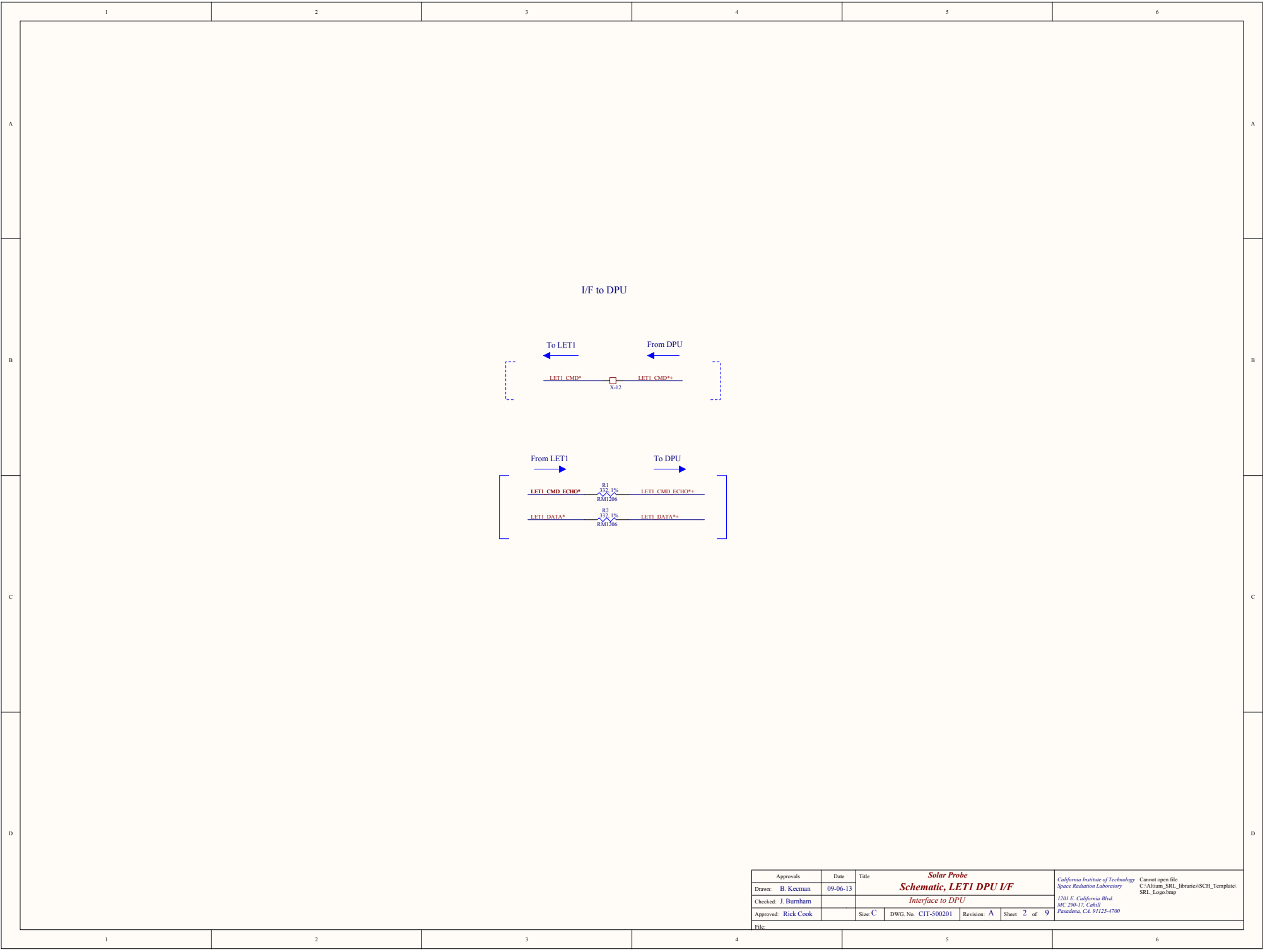
DPU I/F & HKchip (11)

DPU I/F (3)
LET1_CMD*
LET1_CMD_ECHO*
LET1_DATA*
HKchip (8)
ADCOUT
ADCCLK
DACCLK
MUXCLK
ADC00
CMD0DATA
CMDSTROBE
PO_RESET*

Approvals	Date	Title
Drawn: B. Kccman	09-06-13	Solar Probe Schematic, LET1 MISC
Checked: J. Burnham		MISC, OSC, SRAM
Approved: Rick Cook		Size: C DWG. No. CIT-500201 Revision: A Sheet 1 of 9
File:		

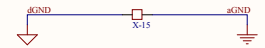
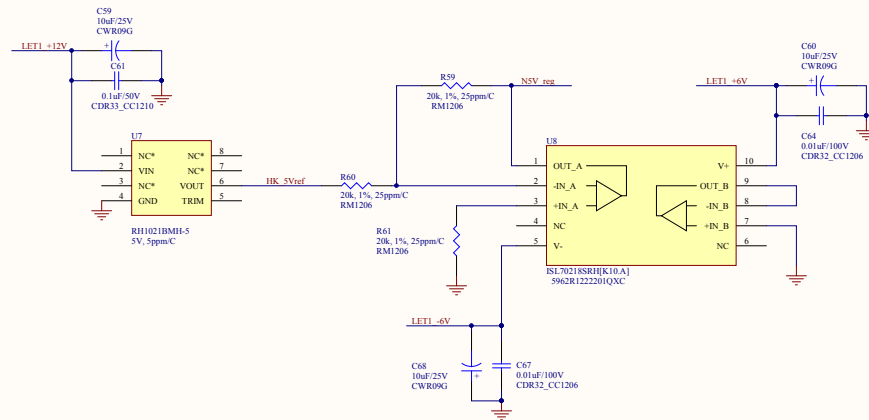
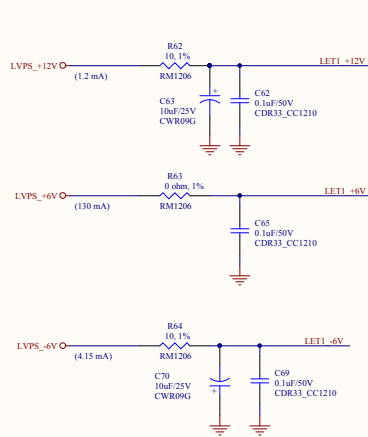
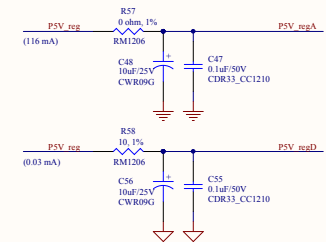
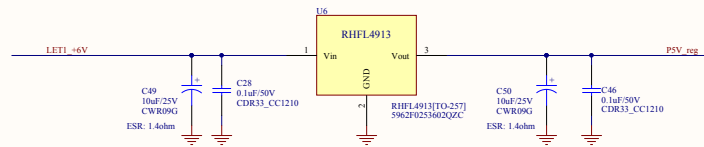
California Institute of Technology
Space Radiation Laboratory
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MC 290-17, Caltech
Pasadena, CA 91125-4700

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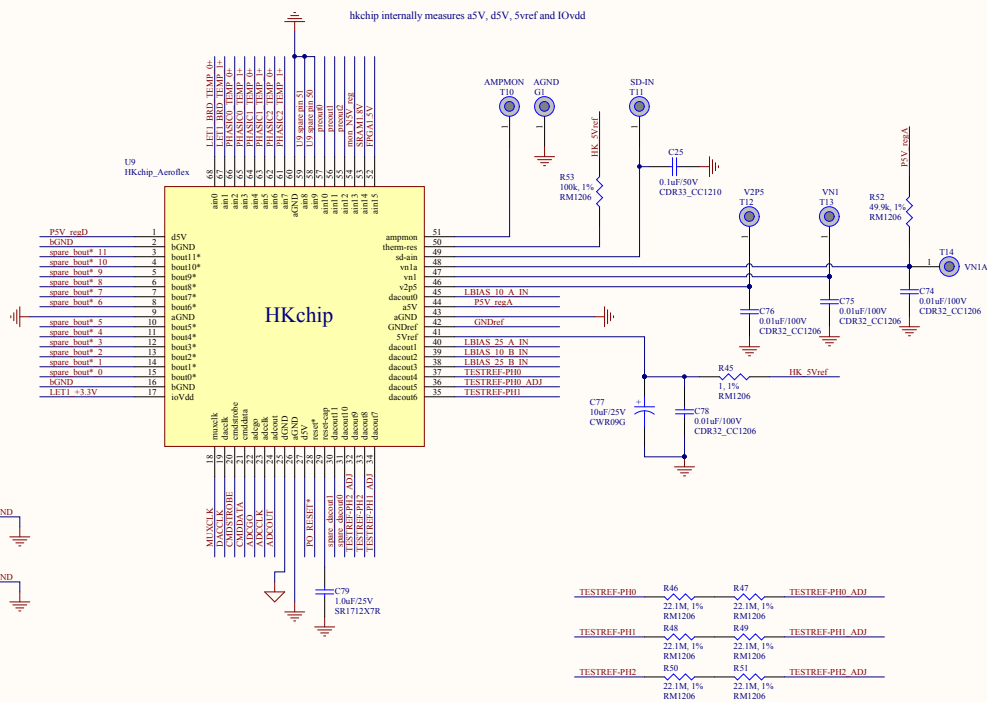
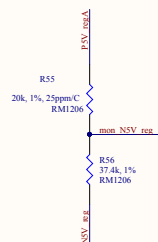
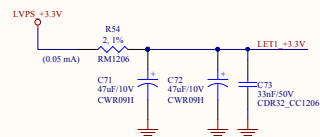


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Pasadena, CA 91125-4700

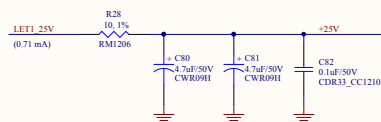


Approvals	Date	<i>Solar Probe</i>				<i>California Institute of Technology</i>	Cannot open file
Drawn: B. Kecman	09-06-13	<i>Schematic, LETI REG</i>				<i>Space Radiation Laboratory</i>	C:\Altium_SRL_library\SCH_Template\
Checked: J. Burnham		<i>Regulators</i>				<i>1201 E. California Blvd.</i>	SRL_Logo.bmp
Approved: Rick Cook		Size: C	DWG. No. CTI-500201	Revision: A	Sheet 3 of 9	<i>MC 290-17, Catal</i>	<i>Pasadena, CA 91125-4700</i>
File:							

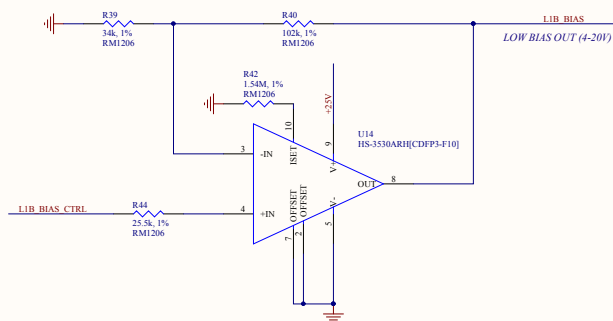
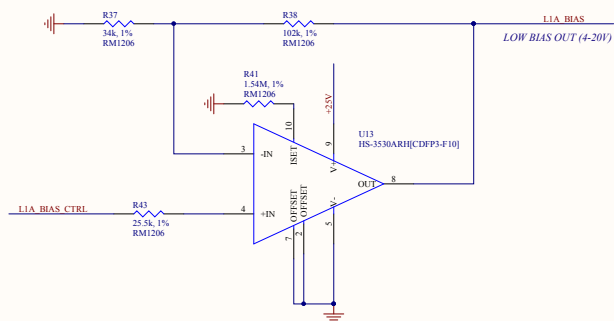
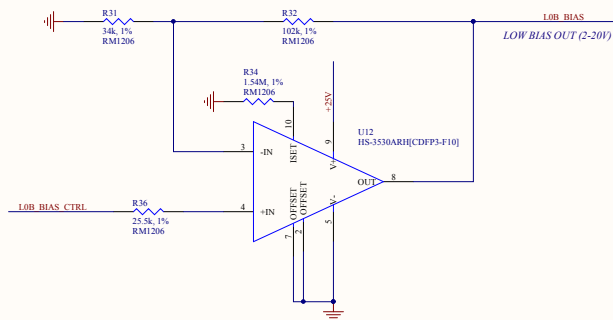
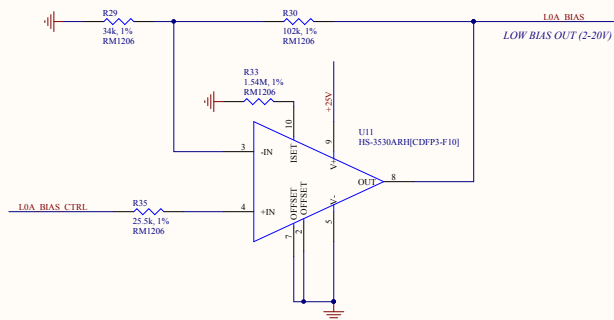


value TBD
tested with 39M
MIL SPEC claims RM1206 available up to 22M

Approvals	Date	<i>Solar Probe</i> <i>Schematic, LETI HKchip</i>				<i>California Institute of Technology</i> <i>Space Radiation Laboratory</i>	Cannot open file C:\Altium_SRL\libraries\SCH_Template\
Drawn: B. Keenan	09-06-13						SRL_Logo.bmp
Checked: J. Burnham		<i>Housekeeping ASIC</i>				1201 E. California Blvd. MC 296-17, Caltech Pasadena, CA 91125-4700	
Approved: Rick Cook		Size: C	DWG. No. CTI-500201	Revision: A	Sheet 4 of 9		
File:							



currently set all low bias for gain =4 i.e. 0-20V out



Approvals	Date	Title	California Institute of Technology Space Radiation Laboratory	
Drawn: B. Kechman	09-06-13	Solar Probe Plus / EPI-Hi / LETI Board Schematic, LETI Low Bias		Cannot open file C:\Altium_SRL_libraries\SCH_Template\ SRL_Logo.bmp
Checked: J. Burnham		Low Detector Bias Voltages		1201 E. California Blvd. MC 290-17, Caltech Pasadena, CA 91125-4700
Approved: Rick Cook		Size: C	DWG. No. CTT-500201	Revision: A
File:			Sheet 5 of 9	

A

B

C

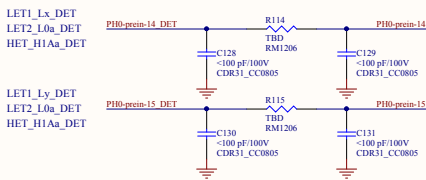
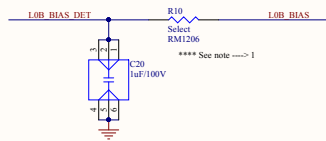
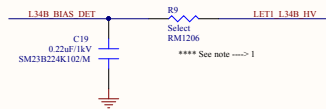
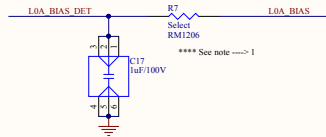
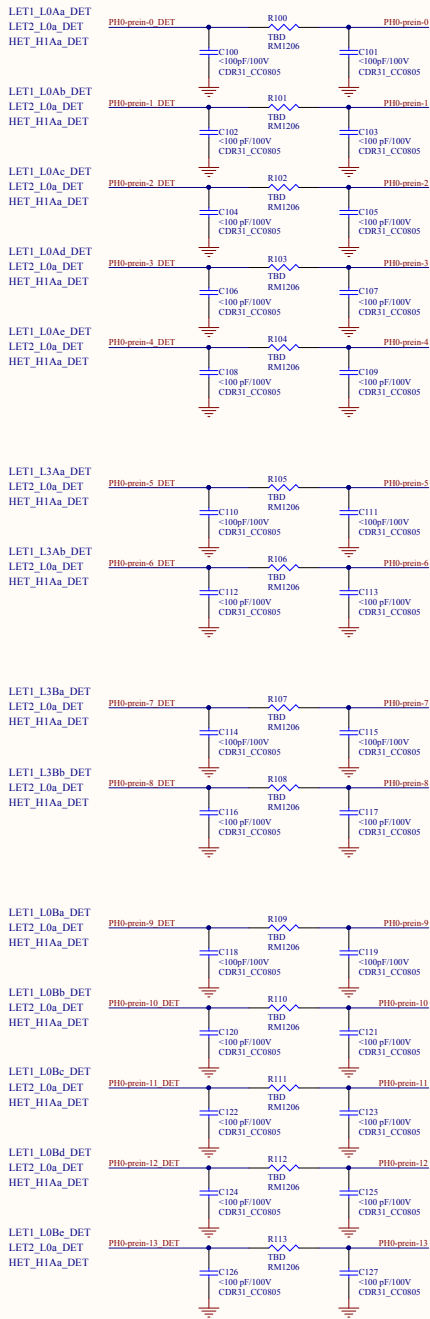
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A

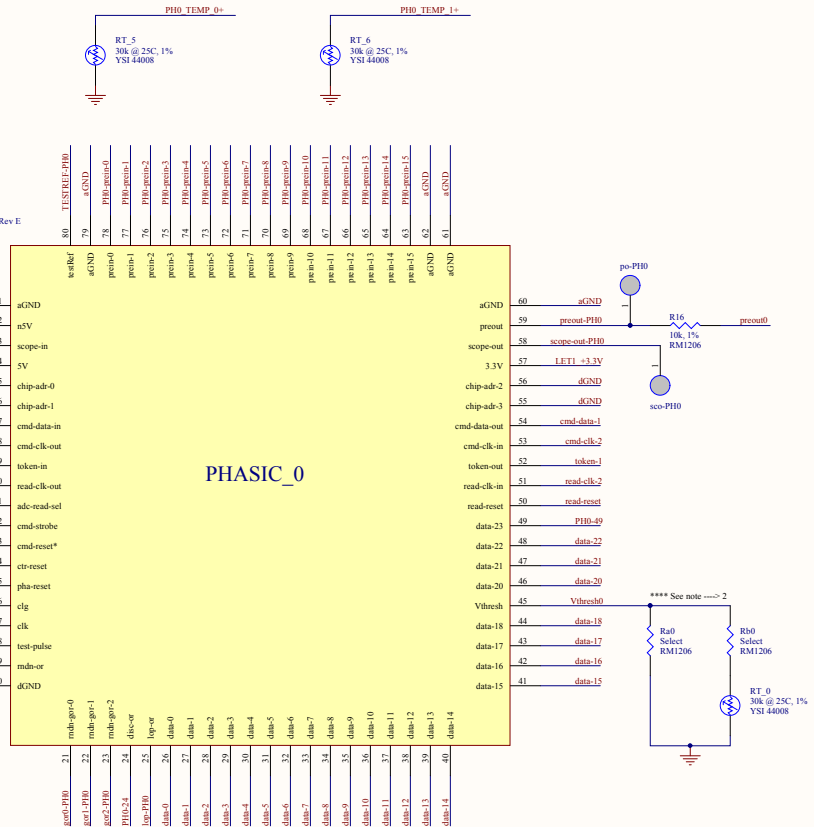
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C

D



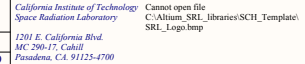
U3
1022945 Rev E

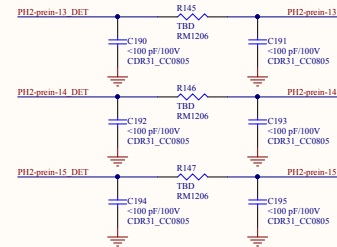
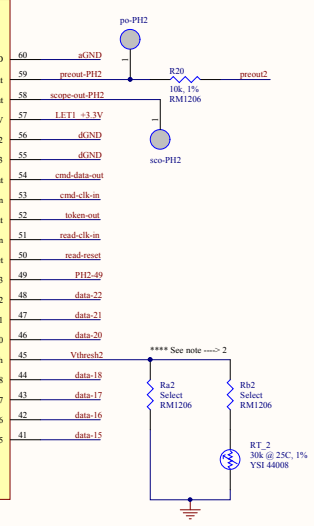
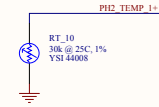


- NOTES:
- Select resistors for bias filters depending on the detector type.
 - Select resistors for each board depending on the PHASIC hybrid S/N.

BOARD S/N	HYBRID S/N	HYBRID REF. DES.	Ra	Rb
?	?	U7	194k	332k
?	?	U7	215k	357k

Approvals	Date	Title	California Institute of Technology Space Radiation Laboratory	
Drawn: B. Kecman	09-06-13	Solar Probe Plus / EPI-Hi / LET1 Board Schematic, LET1 PHASIC 0	1201 E. California Blvd. MC 290-17, Caltech Pasadena, CA 91125-4700	
Checked: J. Burnham		L0A, L3A, L3B, L0B	Cannot open file C:\Altium_SRI_libraries\SCH_Template\ SRI_Logo.bmp	
Approved: Rick Cook		Size: C	DWG. No: CIT-500201	Revision: A
File:			Sheet 6	of 9





BOARD S/N	HYBRID S/N	HYBRID REF. DES.	Ra	Rb
?	?	U?	196k	332k
?	?	U?	215k	357k

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