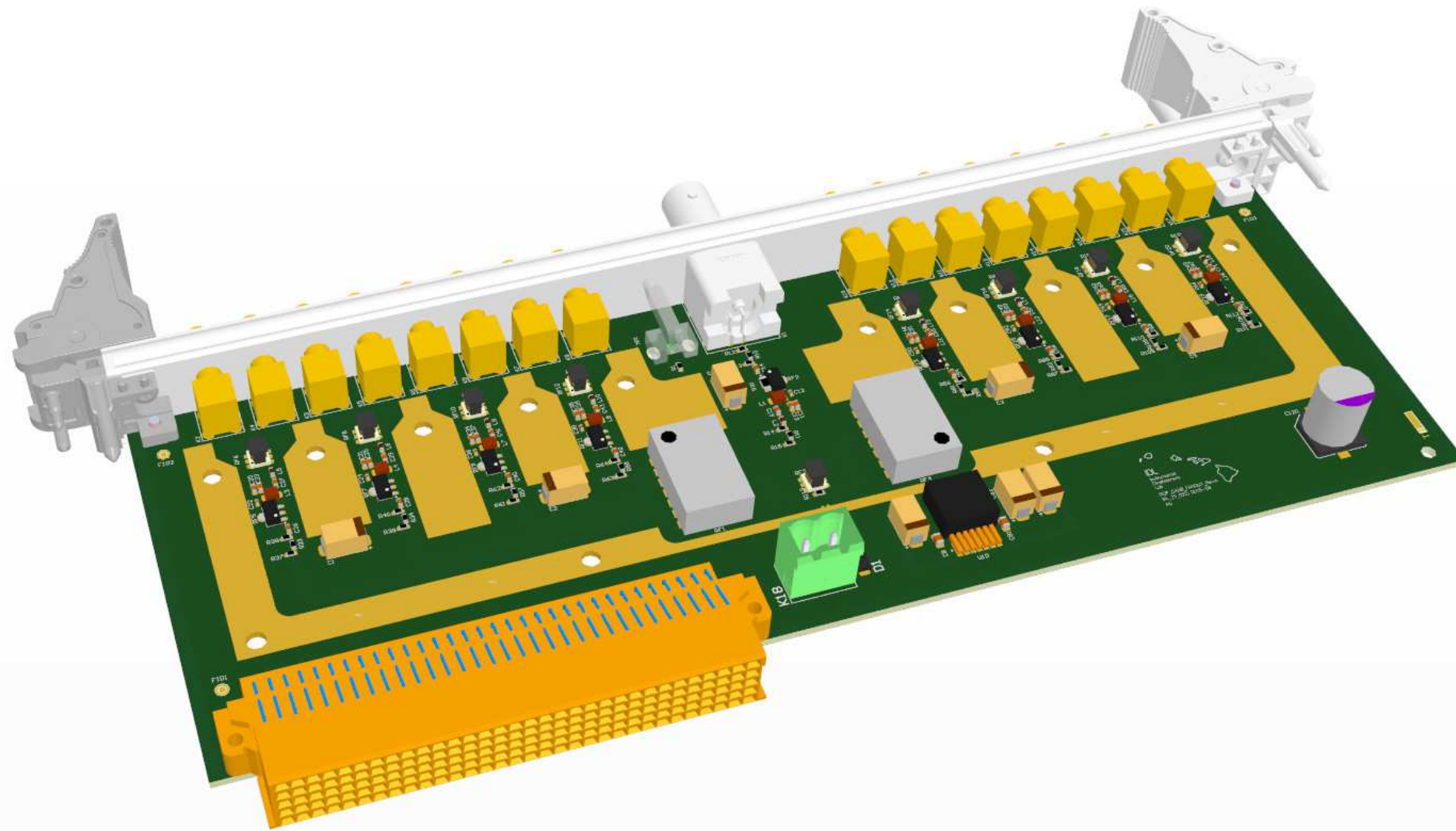




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Instrumentation Development Laboratory
2505 Correa Road, Honolulu, HI 96822



Production Documentation for:

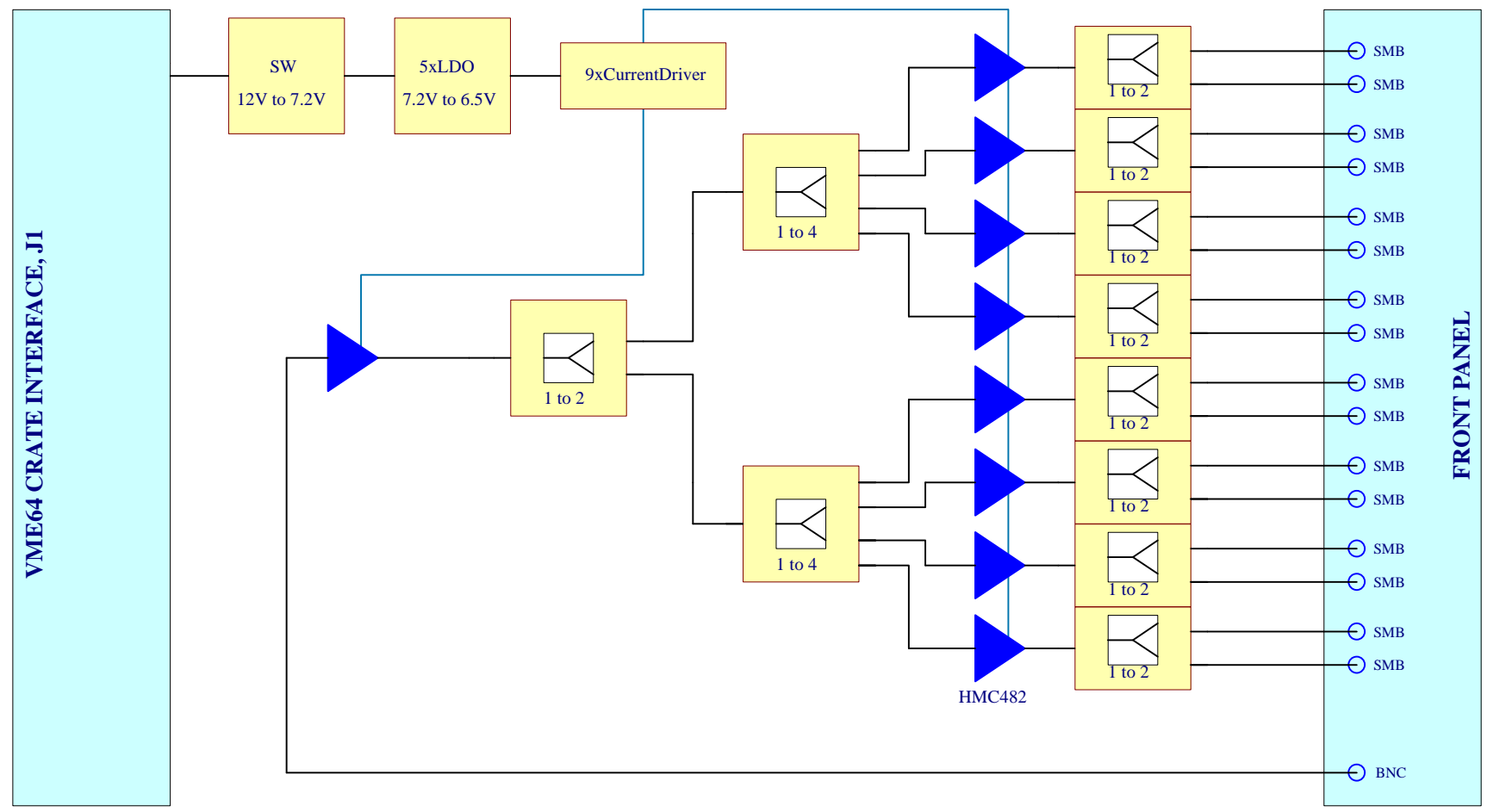
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Board Name: ITOP_CALIB_FN1
IDL num: IDL_15_22
Revision: A
Variant: Master

Designer: Peter Orel
Drawn by: Peter Orel
Approved by: Gary S. Varner

High Energy Physics Group, Instrumentation Development Lab	Designer: Peter Orel	IDLAB design #: IDL_15_22
Project name: ITOP	Drawn By: Peter Orel	Revision: A
Board name: ITOP_CALIB_FN1	Approved By: Gary S. Varner	Variant: Master
	Modif. Date: 1. okt 2015	
	Sheet 1 of 4	



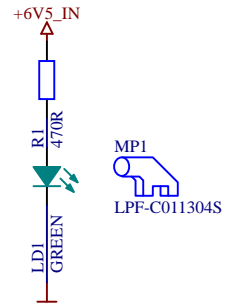
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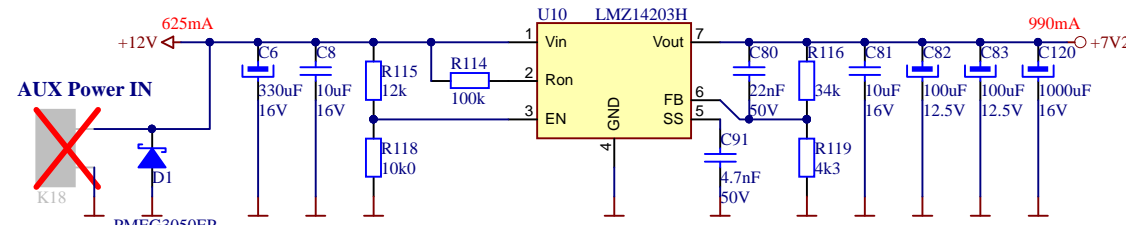
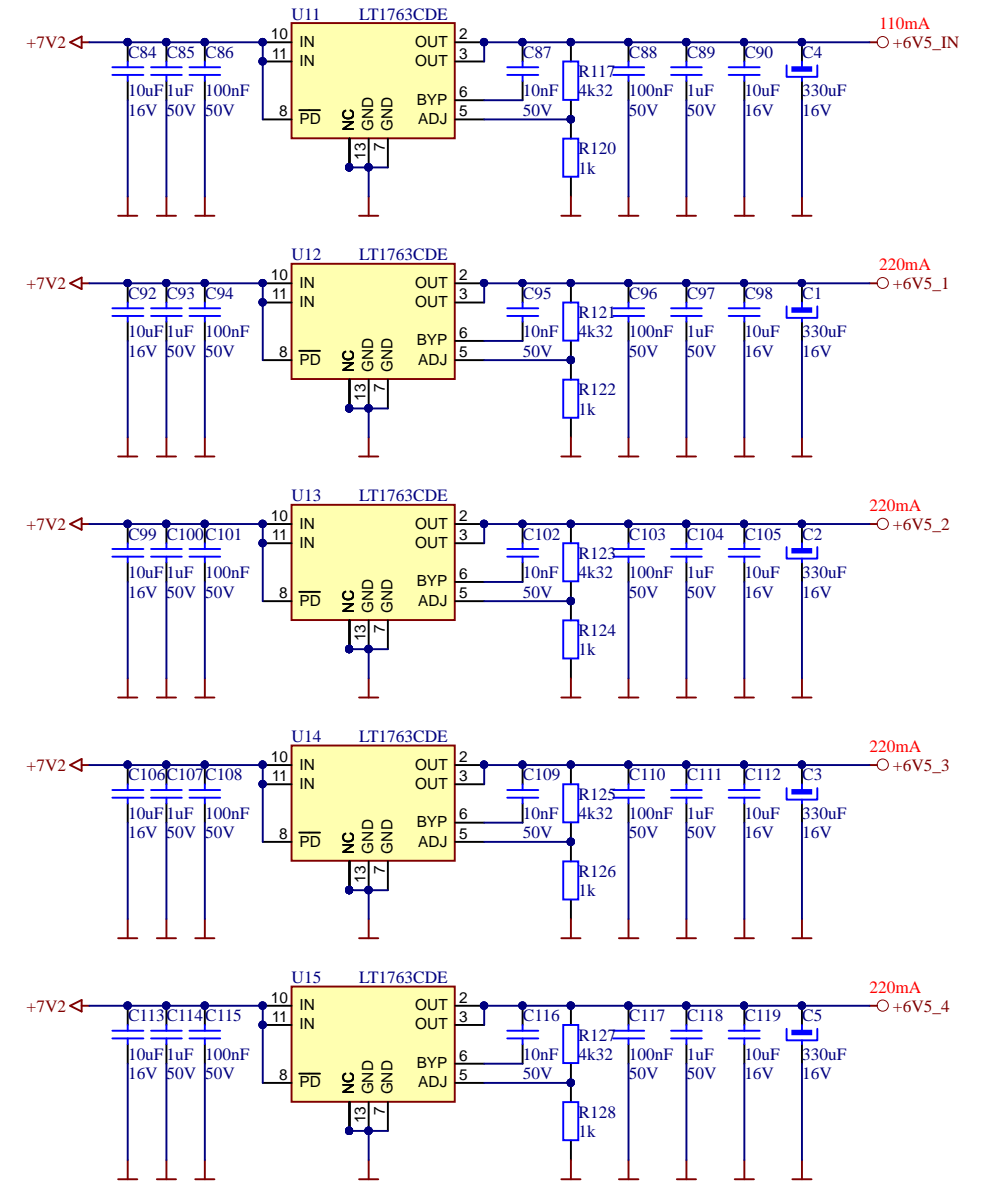
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Board:	ITOP_CALIB_FN1	Designer: Peter Orel
Sheet Title:	Functional Block Schematic	Drawn By: Peter Orel
		Approved By: Gary S. Varner
		IDLAB design #: IDL_15_22
		Revision: A
		Variant: Master
		Modif. Date: 1. okt 2015
		Sheet 2 of 4



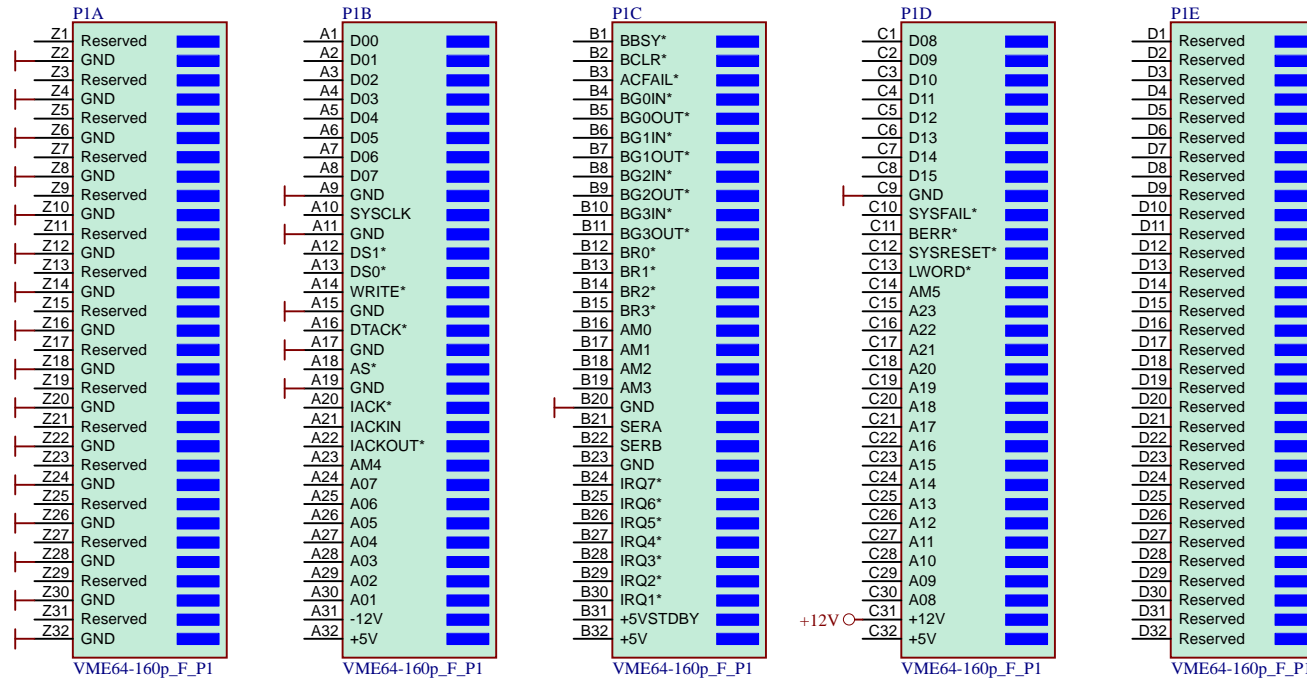
Power ON LED



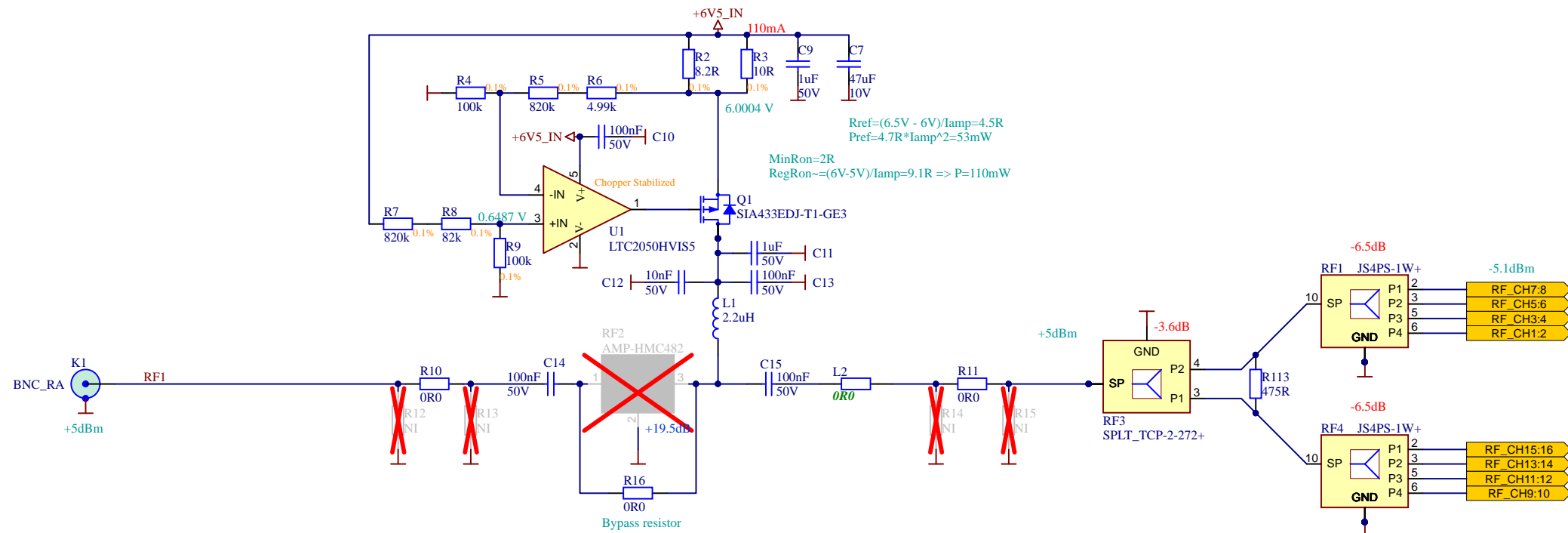
Amplifier Power Supply

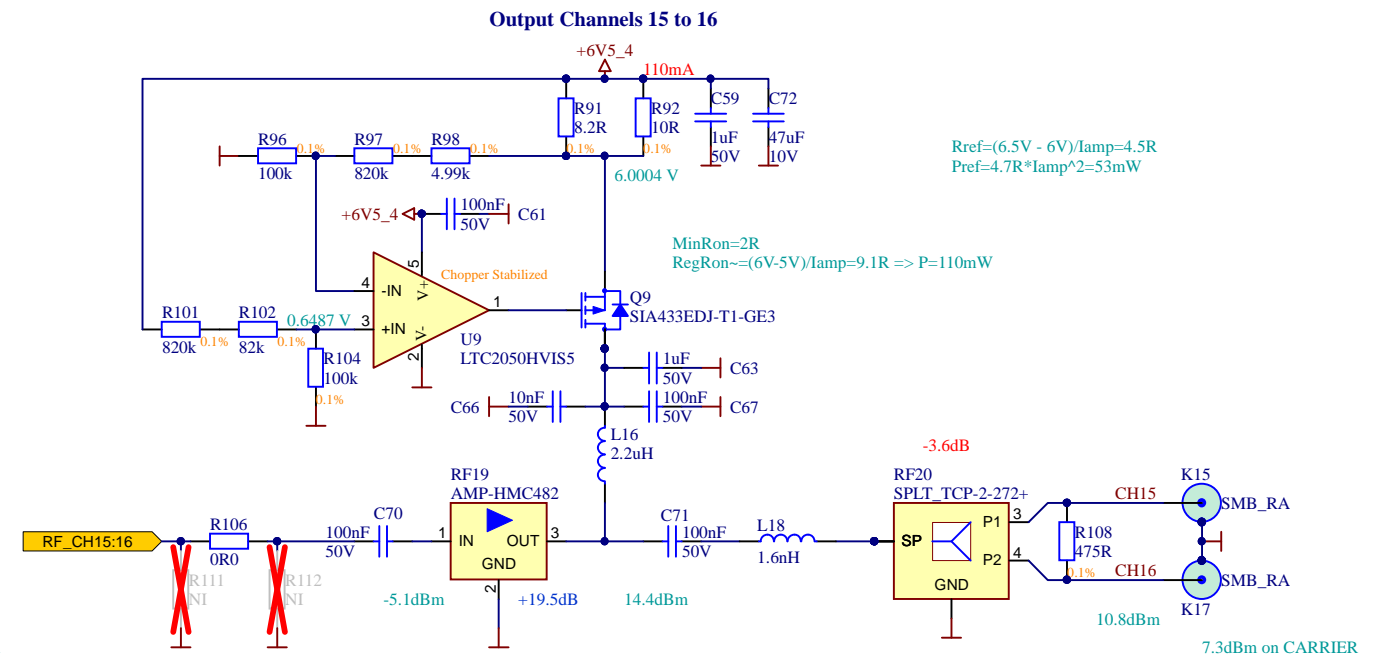
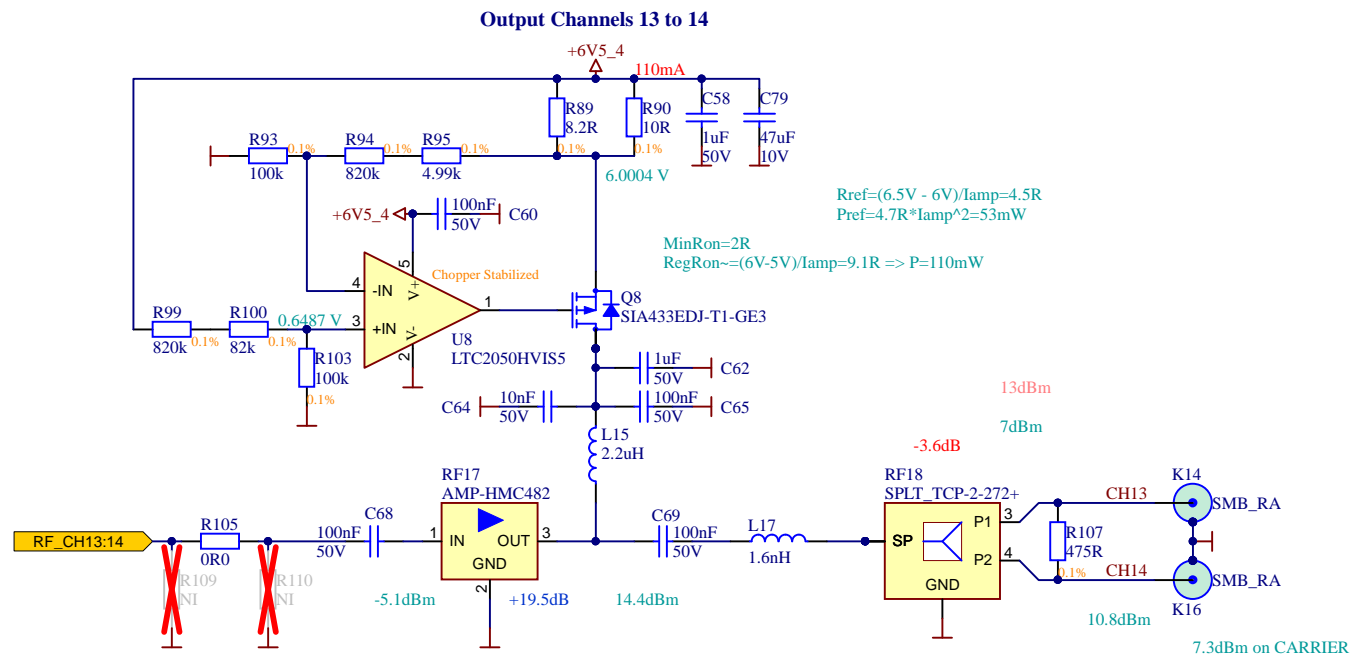
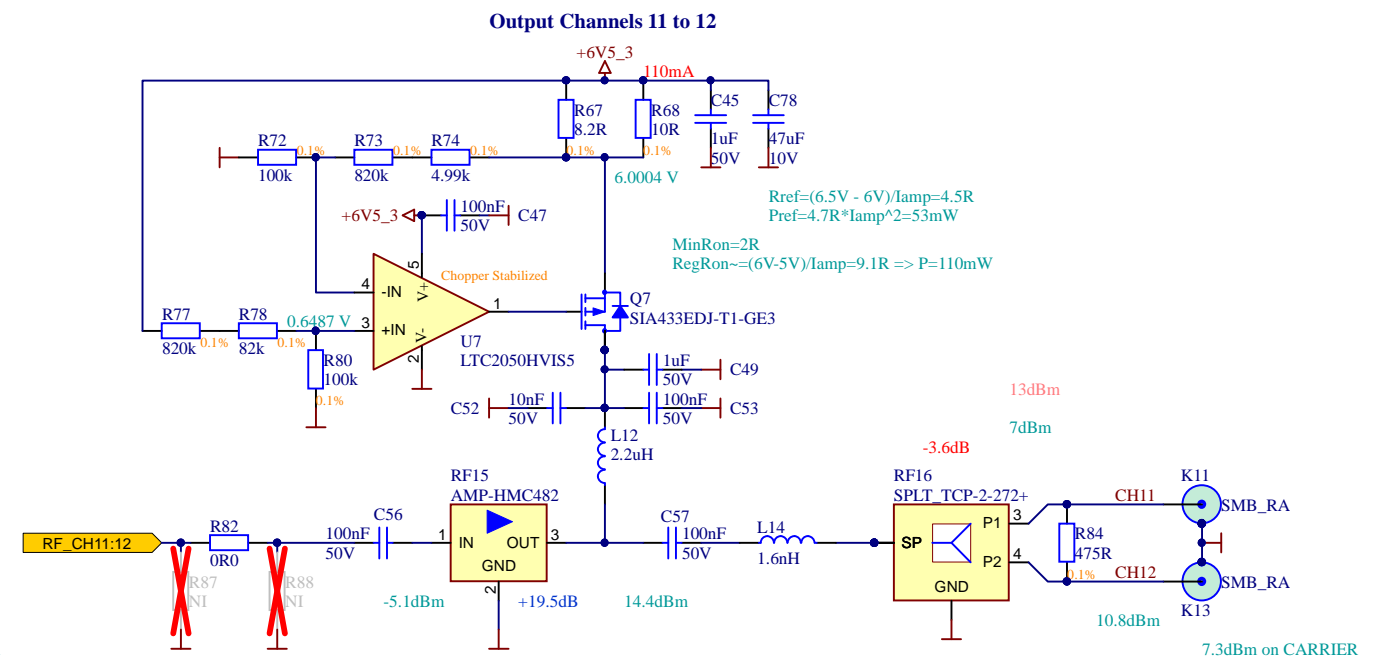
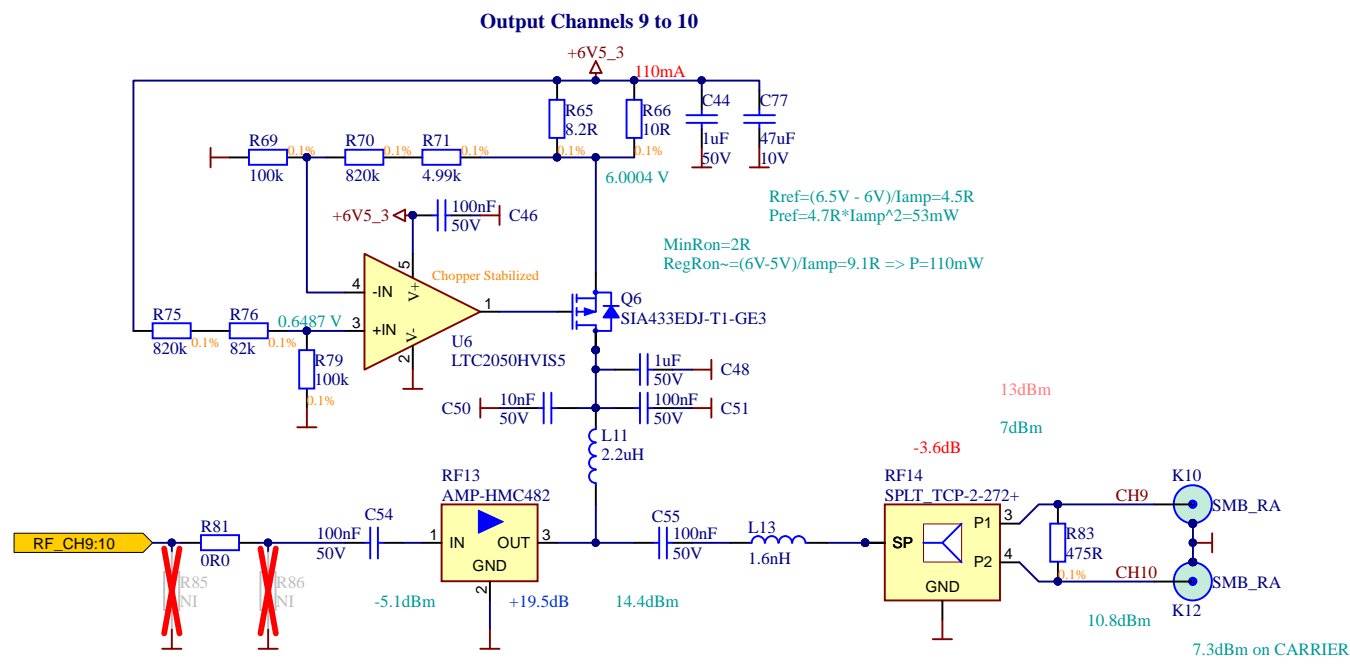


VME64, J1 Connector to Crate



Input RF Chain





Bill Of Material per Board ITOP

Source Data From: IDL_15_22_A.PrfPcb
 Project: ITOP_CALIB_FN1
 Revision: A
 Variant: Master
 IDLAB Design #: IDL_15_22



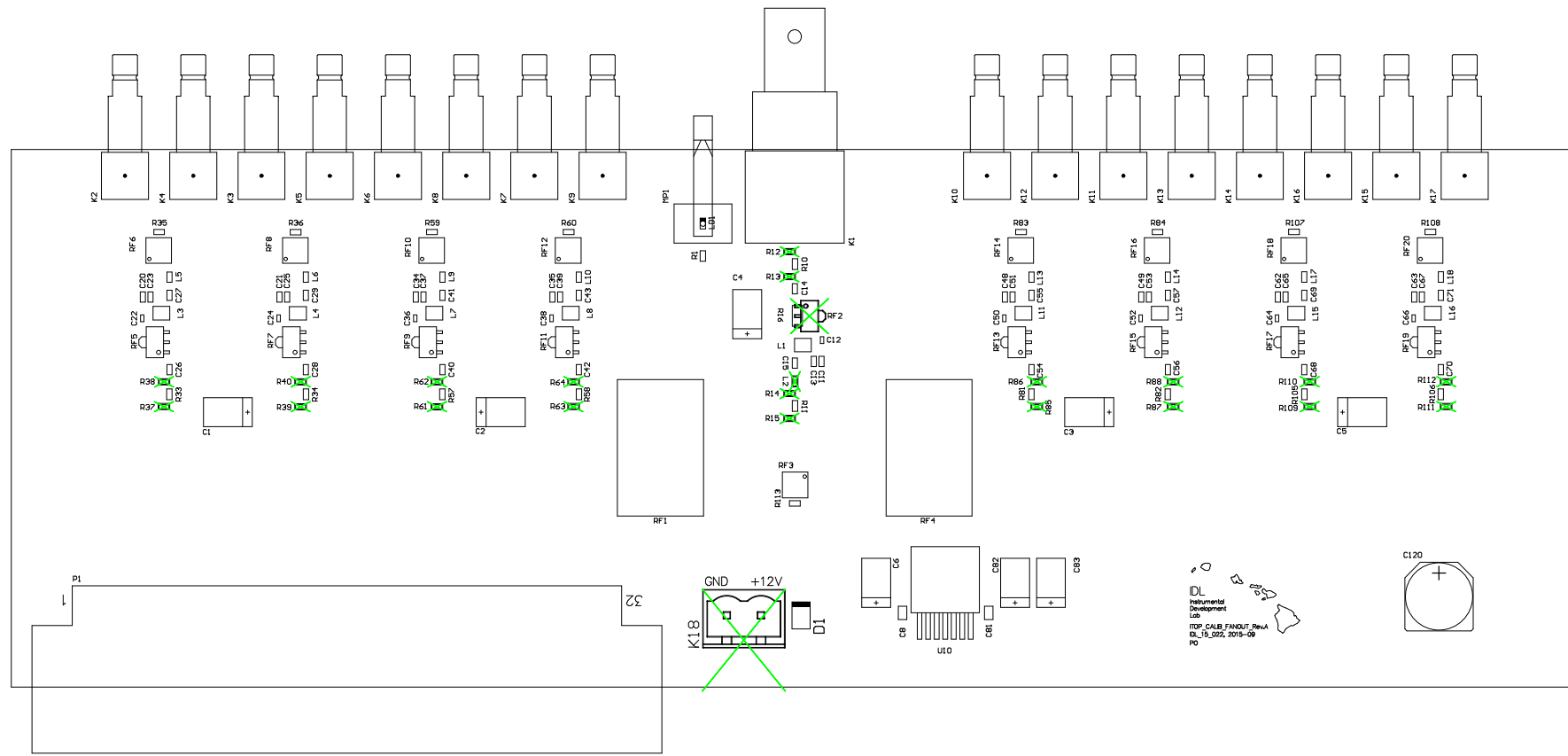
High Energy Physics Group
 Instrumentation Development Lab

Report Date: 11:18:33 1. okt 2015
 Print Date: 12:27 01.10.2015

Note: The components listed in this document can be purchased from different suppliers, following the original manufacturer's part number.
 Standard components (resistors and capacitors) can be produced by different manufacturers, however they must adhere to the quality requirements specified for the original components defined in this document.
 For all other components, the purchasing and assembly of alternatives, not specified in this document, must be authorized by the Instrumentation Development Laboratory

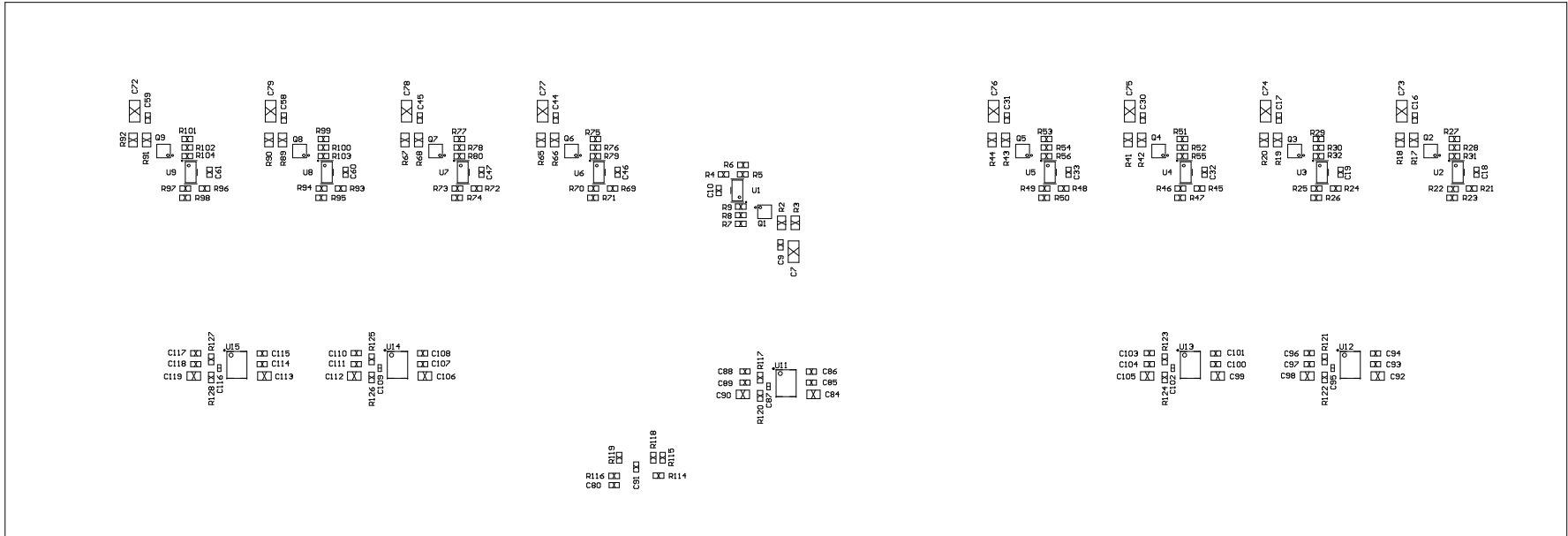
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1	FID1, FID2, FID3, PCB1	4	Fiducial top & bottom round open mask, Fiducial top & bottom round open mask, Fiducial top & bottom round open mask, Printed Circuit Board 4 layer FR4 1.6mm 35um Cu	PCB-FIDRTB, PCB-FIDRTB, PCB-FIDRTB, PCB_IDL_15_XX					0
2	C1, C2, C3, C4, C5, C6	6	Capacitor tantal smd 7343-43 16V 50mResr	330uF	Kemet	T521X337M016ATE050	Digi-Key	399-10365-1-ND	37,38
3	C7, C72, C73, C74, C75, C76, C77, C78, C79	9	Capacitor chip ceramic 1206 10V X5R	47uF	Murata	GRM31CR61A476ME15L	Digi-Key	490-5528-1-ND	6,93
4	C8, C81, C84, C90, C92, C98, C99, C105, C106, C112, C113, C119	12	Capacitor chip ceramic 0805 16V X7R	10uF	Murata	GRM21BR61C106KE15L	Digi-Key	490-3886-1-ND	1,632
5	C9, C11, C16, C17, C20, C21, C30, C31, C34, C35, C44, C45, C48, C49, C58, C59, C62, C63, C85, C89, C93, C97, C100, C104, C107, C111, C114, C118	28	Capacitor chip ceramic 0603 50V X7R	1uF	Murata	GRM188R71E105KA12D	Mouser	81-GRM188R71E105KA2D	5,61187
6	C10, C13, C14, C15, C18, C19, C23, C25, C26, C27, C28, C29, C32, C33, C37, C39, C40, C41, C42, C43, C46, C47, C51, C53, C54, C55, C56, C57, C60, C61, C65, C67, C68, C69, C70, C71, C86, C88, C94, C96, C101, C103, C108, C110, C115, C117	46	Capacitor chip ceramic 0603 50V X7R	100nF	Murata	GRM188R71H104KA93D	Digi-Key	490-1519-1-ND	1,84
7	C12, C22, C24, C36, C38, C50, C52, C64, C66, C87, C95, C102, C109, C116	14	Capacitor chip ceramic 0402 50V X7R	10nF	Murata	GRM155R71H103KA88D	Digi-Key	490-4516-1-ND	0,168
8	C80	1	Capacitor chip ceramic 0603 50V X7R	22nF	TDK	C1608X7R1H223K080AA	Digi-Key	445-1312-6-ND	0,1
9	C82, C83	2	Capacitor Aluminium Polymer, High Ripple, smd 7343-43 12.5V 12mResr	100uF	Murata	ECASD91B107M012K00	Digi-Key	490-5480-6-ND	7,84
10	C91	1	Capacitor chip ceramic 0603 50V X7R	4.7nF	Murata	GRM188R71H472KA01D	Digi-Key	490-1506-6-ND	0,1
11	C120	1	Capacitor electrolytic SMD 10x10x8mm 16V 80mR	1000uF	Panasonic	EEE-FT1C102AP	Digi-Key	P15087CT-ND	1,44
12	D1	1	Schottky diode 6A 30V 500ns 0.36Vf	PMEG3050EP	NXP	PMEG3050EP_115	Digi-Key	568-6753-6-ND	0,48
13	L1, L3, L4, L7, L8, L11, L12, L15, L16	9	Chip inductor 1008 0.28A 2.8R	2.2uH	Coilcraft	1008CS-222G_LB	Coilcraft	1008CS-222G_LB	9
14	L2, R10, R11, R33, R34, R57, R58, R81, R82, R105, R106	11	Chip Resistor 0603 100mW 1% 100ppm	0R0	Panasonic	ERJ-3GEY0R00V	Mouser	667-ERJ-3GEY0R00V	0,14646
15	L5, L6, L9, L10, L13, L14, L17, L18	8	Chip inductor 0603 0.70A 30mR	1.6nH	Coilcraft	0603CS-1N6XJEU	Coilcraft	0603CS-1N6XJEU	6,32
16	LD1	1	LED green HSMG vertical 2.6V 20mA 15mcd 52mW	GREEN	Avago	HSMG-C190	Mouser	630-HSMG-C190	0,3588
17	Q1, Q2, Q3, Q4, Q5, Q6, Q7, Q8, Q9	9	P-Channel MOSFET 20V 12A 0.06R	SIA433EDJ-T1-GE3	Vishay	SIA433EDJ-T1-GE3	Digi-Key	SIA433EDJ-T1-GE3CT-ND	6,3
18	R1	1	Chip Resistor 0603 100mW 1% 100ppm	470R	Panasonic	ERJ-3EKF4700V	Digi-Key	P470HDKR-ND	0,1
19	R2, R17, R19, R41, R43, R65, R67, R89, R91	9	Chip Resistor 0805 100mW 0.1% 25ppm	8.2R	TE Connectivity	1-1614884-5	Mouser	279-CPF0805BR2E1	2,11917
20	R3, R18, R20, R42, R44, R66, R68, R90, R92	9	Chip Resistor 0805 100mW 0.1% 25ppm	10R	TE Connectivity	2-1625868-7	Digi-Key	A110351CT-ND	2,16
21	R4, R9, R21, R24, R31, R32, R45, R48, R55, R56, R69, R72, R79, R80, R93, R96, R103, R104	18	Chip Resistor 0603 100mW 0.1% 25ppm	100k	Panasonic	ERA-3AEB104V	Mouser	667-ERA-3AEB104V	5,04563
22	R5, R7, R22, R25, R27, R29, R46, R49, R51, R53, R70, R73, R75, R77, R94, R97, R99, R101	18	Chip Resistor 0603 100mW 0.1% 25ppm	820k	TE Connectivity	CPF0603B820KE	Mouser	279-CPF0603B820KE1	4,23833
23	R6, R23, R26, R47, R50, R71, R74, R95, R98	9	Chip Resistor 0603 100mW 0.1% 25ppm	4.99k	Panasonic	ERA-3AEB4991V	Digi-Key	P4.99KDBCT-ND	5,67
24	R8, R28, R30, R52, R54, R76, R78, R100, R102	9	Chip Resistor 0603 100mW 0.1% 25ppm	82k	Panasonic	ERA-3AEB823V	Digi-Key	P82KDBCT-ND	5,67
25	R16	1	Chip Resistor 1206 250mW 1% 100ppm	0R0	Panasonic	ERJ-8GEY0R00V	Digi-Key	P0.0ECT-ND	0,1
26	R35, R36, R59, R60, R83, R84, R107, R108, R113	9	Chip Resistor 0603 100mW 0.1% 25ppm	475R	Panasonic	ERA-3AEB4750V	Digi-Key	P475DBCT-ND	5,67
27	R114	1	Chip Resistor 0603 100mW 1% 100ppm	100k	Panasonic	ERJ-3EKF1003V	Digi-Key	P100KHCT-ND	0,1
28	R115	1	Chip Resistor 0603 100mW 1% 100ppm	12k	Panasonic	ERJ-3EKF1202V	Digi-Key	P12.0KHCT-ND	0,1
29	R116	1	Chip Resistor 0603 100mW 1% 100ppm	34k	Panasonic	ERJ-3EKF3402V	Digi-Key	P34.0KHCR-ND	0,1
30	R117, R121, R123, R125, R127	5	Chip Resistor 0603 100mW 1% 100ppm	4k32	Yageo	RC0603FR-074K32L	Digi-Key	311-4.32KHRCT-ND	0,5
31	R118	1	Chip Resistor 0603 100mW 1% 100ppm	10k0	Panasonic	ERJ-3EKF1002V	Digi-Key	P10.0KHCT-ND	0,1
32	R119	1	Chip Resistor 0603 100mW 1% 100ppm	4k3	Yageo	RC0603FR-074K3L	Digi-Key	311-4.30KHRCT-ND	0,1
33	R120, R122, R124, R126, R128	5	Chip Resistor 0603 100mW 1% 100ppm	1k	Vishay	CRCW06031R00FKEA	Digi-Key	RMCF06031R00CT-ND	0,5
34	RF1, RF4	2	Power Splitter / Combiner 4-Way, 50R, 5 MHz to 1000 MHz	JS4PS-1W+	MiniCircuits	JS4PS-1W+	MiniCircuits	JS4PS-1W+	27,9
35	RF3, RF6, RF8, RF10, RF12, RF14, RF16, RF18, RF20	9	Power Splitter / Combiner 2-Way, 50R, 5 MHz to 2700 MHz	SPLT_TCP-2-272+	MiniCircuits	TCP-2-272+	MiniCircuits	TCP-2-272+	22,41
36	RF5, RF7, RF9, RF11, RF13, RF15, RF17, RF19	8	Monolithic Amplifier DC - 5GHz	AMP-HMC482	Analog Devices	HMC482ST89ETR	Digi-Key	1127-1421-1-ND	30,16
37	U1, U2, U3, U4, U5, U6, U7, U8, U9	9	Zero-Drift Operational Amplifier	LTC2050HV15S	Linear Technology	LTC2050HV15S#TRMPBF	Digi-Key	LTC2050HV15S#TRMPBFC-ND	34,92
38	U10	1	3A SIMPLE SWITCHER® Power Module for High Output Voltage	LMZ14203H	Texas Instruments	LMZ14203HTZ/NOPB	Digi-Key	LMZ14203HTZE/NOPB-ND	20,19

#	Designator	Quantity per Board	Description	Comment	Manufacturer	Manufacturer No	Supplier	Supplier Part Number	Supplier Subtotal
39	U11, U12, U13, U14, U15	5	500mA, Low Noise, LDO DFN	LT1763CDE	Linear Technology	LT1763CDE#PBF	Digi-Key	LT1763CDE#PBF-ND	20,75
40	MP1	1	Lightpipe, single round right angle	LPF-C011304S	Lumex	LPF-C011304S	Mouser	696-LPF-C011304S	0,91102
41	K1	1	BNC connector PCB Righth Angle, Female, 4GHz, Through hole, Low Profile	BNC_RA	TE Connectivity	5227161-7	Digi-Key	A32260-ND	3,35
42	K2, K3, K4, K5, K6, K7, K8, K9, K10, K11, K12, K13, K14, K15, K16, K17	16	SMB connector PCB Righth Angle, Female, 4GHz, Through hole	SMB_RA	Molex	73100-0097	Digi-Key	WM5276-ND	79,792
43	P1	1	VME64 Female standard 160pin DIN41612	VME64-160p F P1	Harting	02041601101	Digi-Key	1195-1030-ND	54,2
Approved		Total Quantity per Board	Notes:						Total Price
Total components:		314							412,50328

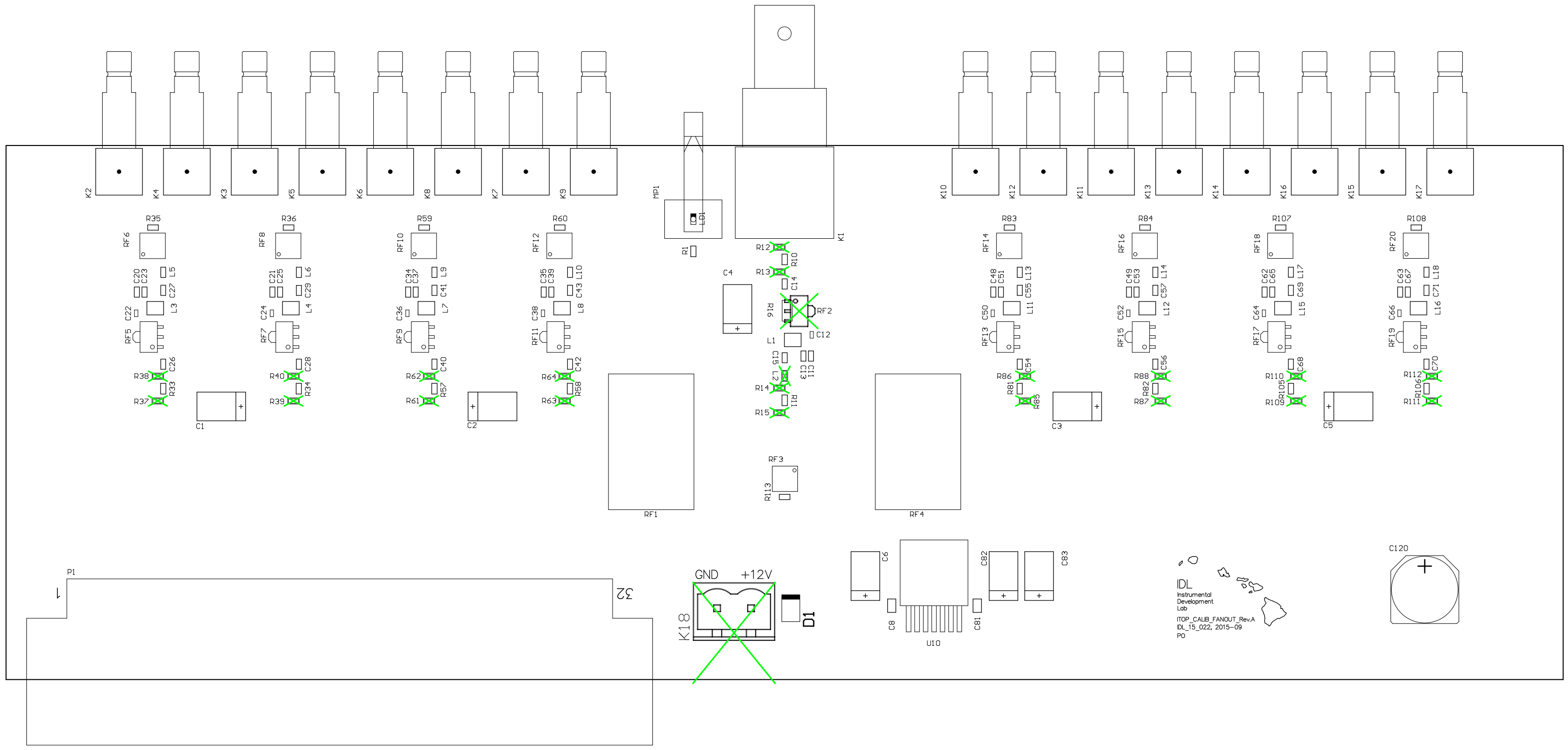


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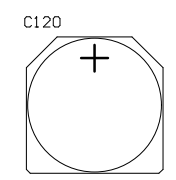
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Drawn By: Peter Orel	Modif. Date: Date	Variant: Master	ASSEMBLY	ID: ITOP_CALIB_FN1
Approved By: Gary S. Varner	Print Date: 1. okt 2015	Signature:	Size: A3 H	University of Hawaii at Manoa High Energy Physics Group Instrumentation Development Laboratory
Title: Top Assembly Drawing				

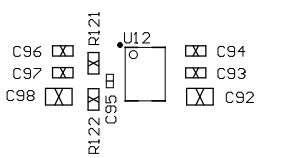
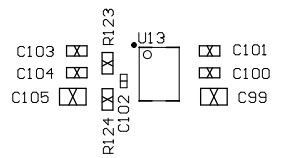
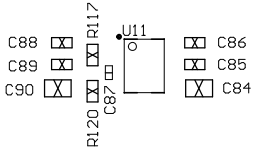
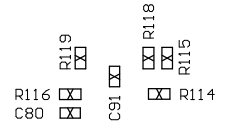
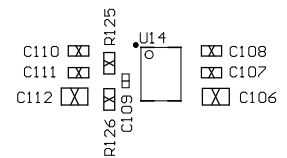
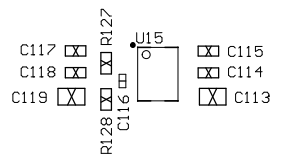
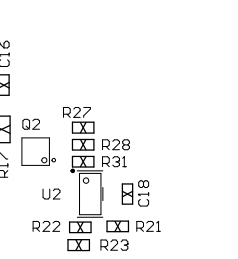
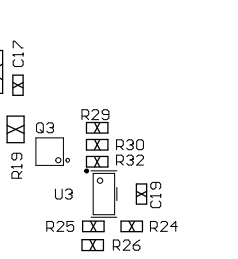
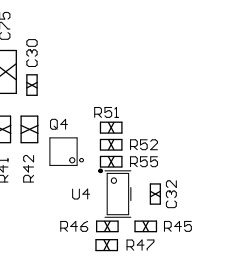
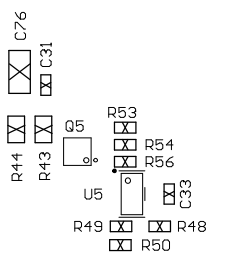
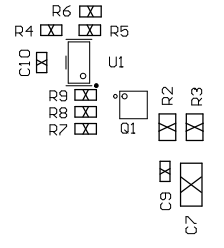
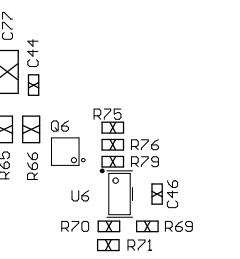
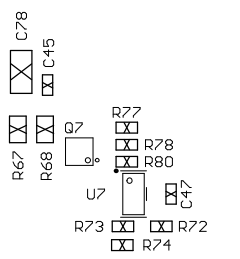
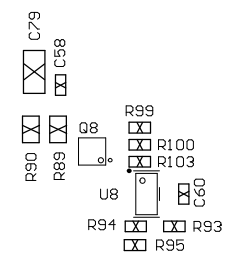
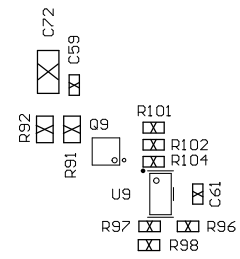


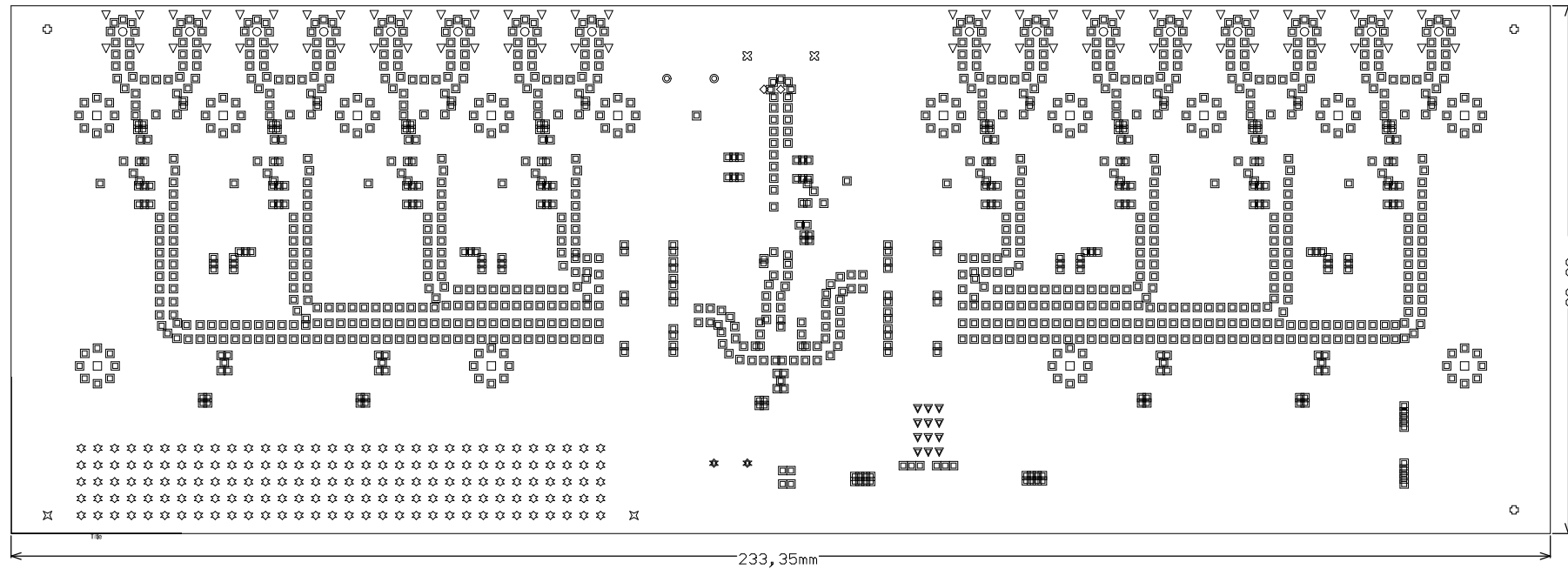
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Drawn By: Peter Orel	Modif. Date: Date	Variant: Master	ASSEMBLY	ID: ITOP_CALIB_FN1
Approved By: Gary S. Varner	Print Date: 1. okt 2015	Signature:	Size: A3 H	
Title: Bottom Assembly Drawing				University of Hawaii at Manoa High Energy Physics Group Instrumentation Development Laboratory



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 DL_15_022, 2015-09
 PO







Notes:

1. Board shall be fabricated - performance class II as per IPC-6011 and IPC6012
2. PCB manufacturer logo, P/N, revision and/or date code of manufacturing shall be printed in top solder mask (not over pcb traces, allowed over copper plane). The date code shall be in the format: "WWYY" where WW=week and YY= year, max height 0.15 inches
3. Silkscreen printed on both sides
4. Material: high temperature FR4 class epoxy glass rated UL94V-0. UL symbol and rating shall be marked farside
35um copper for external layers and 18um for all internal layers
Must be RoHS compliant and survive a lead-free assembly max reflow of 260 deg C (5 passes)
Td rating: >340 deg C
Tg = 150 deg C (min)
5. Solder mask: SMOBC per IPC-SM-840C, class T must be RoHS compliant, 0.001" max measured over bare copper plating, must clear all lands as indicated on gerber solder mask layers, color= GREEN
6. Finish: electro-less nickel immersion gold (ENIG), 0.05-0.125um Au over 3-6um Ni - over bare copper only
7. Solderability test: Category 2 of J-STD-003
8. Finished boards shall not have nicks, scratches, voids, exposed copper, poor plating or misdrilled holes
9. All holes sizes are after plating
10. PCB manufacturer may add copper thinning as needed to improve manufacturability, thinning to be 0.030" round pads at 0.050" spacing. Thinning will have a minimum of 0.100" clearance from existing copper and should not be placed under surface mounted devices
11. PCB manufacturer may use tear drops to improve annular rings as long as DRC rules are followed
12. All via connections to power and ground planes are solid
13. All unconnected pads on inner signal layers are removed
14. All finished boards are to be 100% electrically tested
15. Unless otherwise indicated, all linear tolerances shall be XX.X +/-0.2mm and XX.XX +/- 0.1mm
16. Gerber file GM1 shows board outline (milling line)
17. Table 1 shows Layer stack details

Additional notes:

- A1. Finished board thickness = 1.6mm +/- 10%; measured over top/bottom copper and solder mask

Table 2: NC Drill Details for IDL_15_22 Rev.A

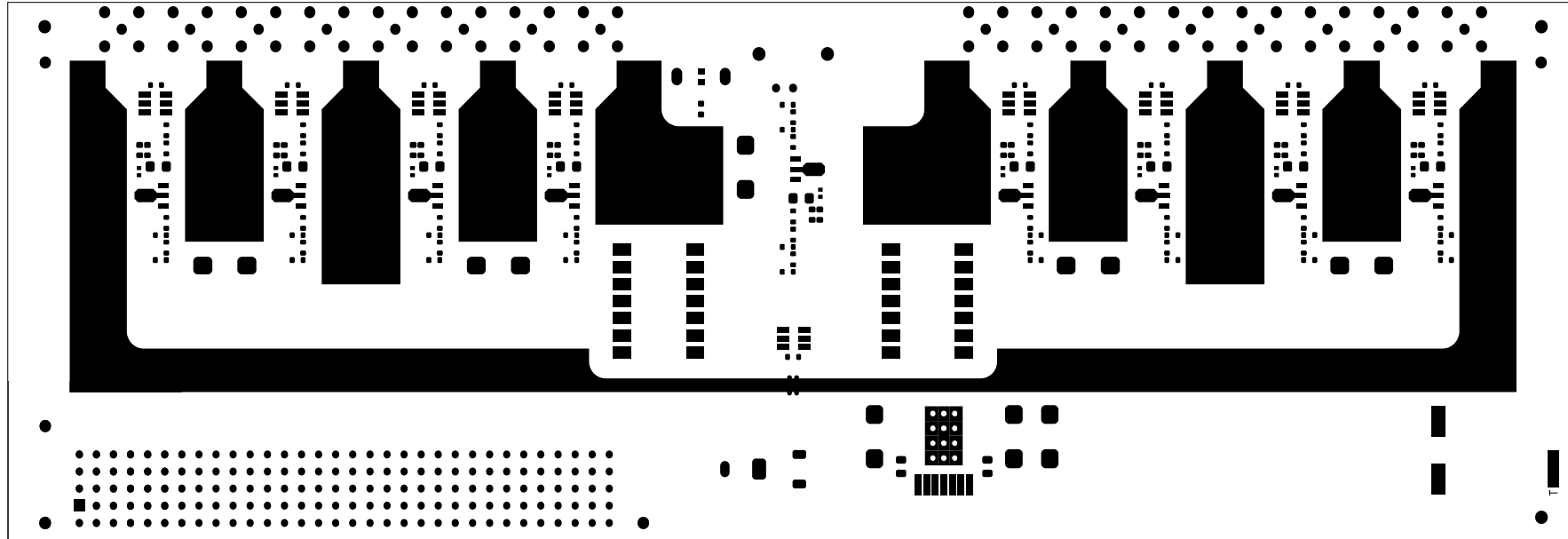
Symbol	Hit Count	Finished Hole Size	Plated	Hole Type
◇	2	0,900mm (35,43mil)	PTH	Round
★	2	1,400mm (55,12mil)	PTH	Round
⊗	2	2,000mm (78,74mil)	PTH	Round
⊙	2	2,000mm (78,74mil)	NPTH	Slot
⊗	2	2,800mm (110,24mil)	NPTH	Round
⊕	3	2,700mm (106,30mil)	NPTH	Round
▽	12	0,400mm (15,75mil)	PTH	Round
□	14	3,683mm (145,00mil)	PTH	Round
○	16	1,200mm (47,24mil)	PTH	Round
▽	64	1,600mm (62,99mil)	PTH	Round
☆	160	1,000mm (39,37mil)	PTH	Round
⊖	1241	0,300mm (11,81mil)	PTH	Round
	1520 Total			

Slot definitions : Rout Path Length = Calculated from tool start centre position to tool end centre position.
Hole Length = Rout Path Length + Tool Size = Slot length as defined in the PCB layout

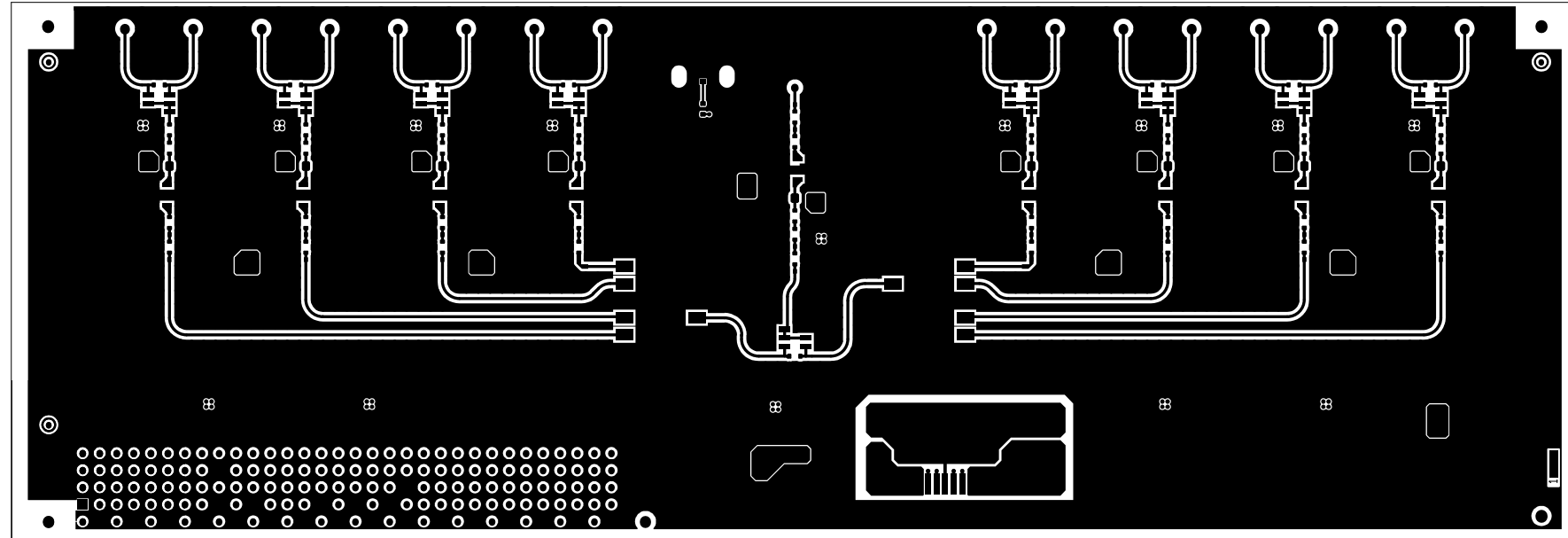
Table 1a: Layer Stack Details for IDL_15_22 Rev.A (Imperial Units)

Layer	Name	Material	Thickness	Constant	Board Layer Stack
1	Top Overlay				▨
2	Top Solder	Solder Resist	0.40mil	3.5	▨
3	Top Layer - SIG1	Copper	1.38mil		▨
4	Dielectric 1	FR-4	15,00mil	4.65	▨
5	Layer 2 - GND1	Copper	0.71mil		▨
6	Dielectric 3	FR-4	27,00mil	4.65	▨
7	Layer 3 - SIG2	Copper	0.71mil		▨
8	Dielectric 6	FR-4	15,00mil	4.65	▨
9	Bottom Layer - SIG4	Copper	1.38mil		▨
10	Bottom Solder	Solder Resist	0.40mil	3.5	▨
11	Bottom Overlay				▨

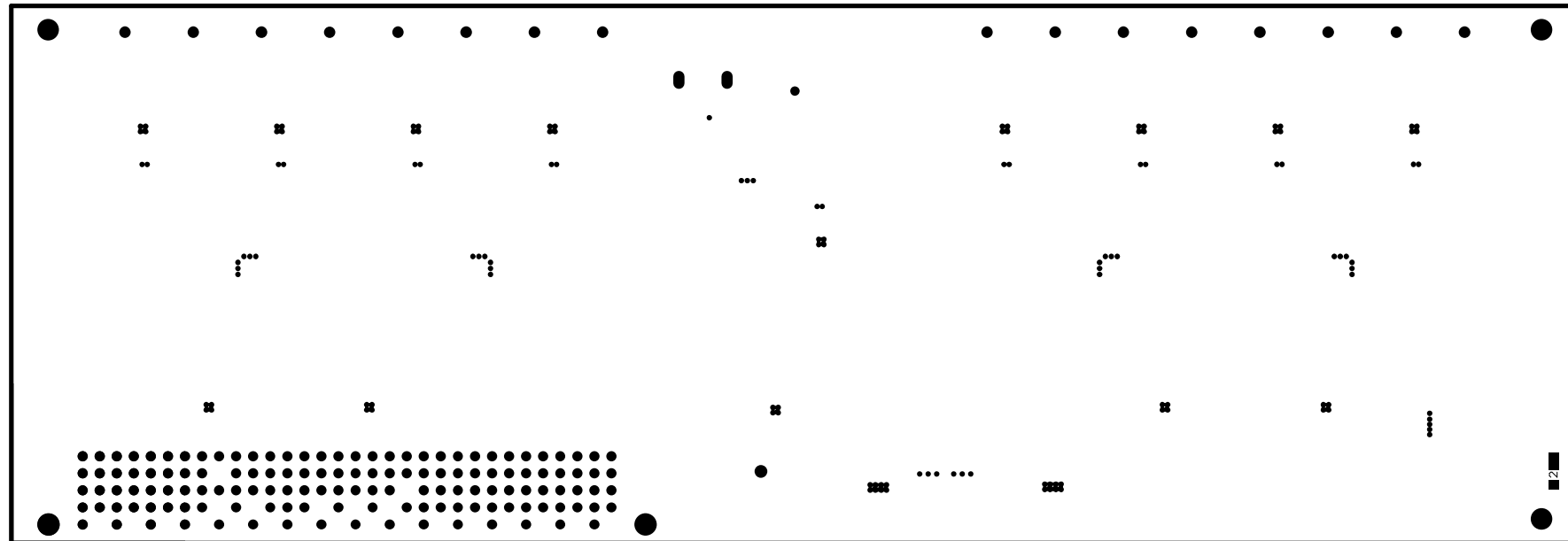
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Approved By: Gary S. Varner	Print Date: 1. okt 2015	Signature:	Size: A3 H	
Title: Drill Drawing and Dimensions (GD1)				University of Hawaii at Manoa High Energy Physics Group Instrumentation Development Laboratory



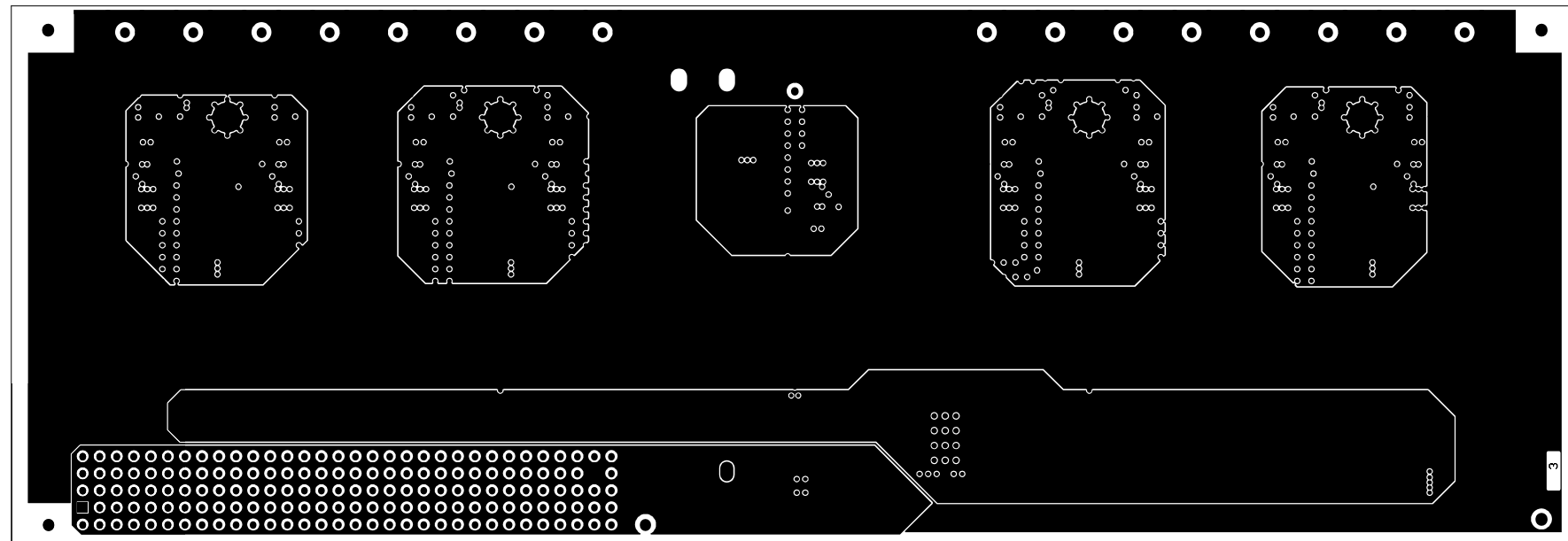
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Approved By: Gary S. Varner	Print Date: 1. okt 2015	Signature:	Size: A3 H	University of Hawaii at Manoa High Energy Physics Group Instrumentation Development Laboratory
Title: Top Solder Mask (GTS)				



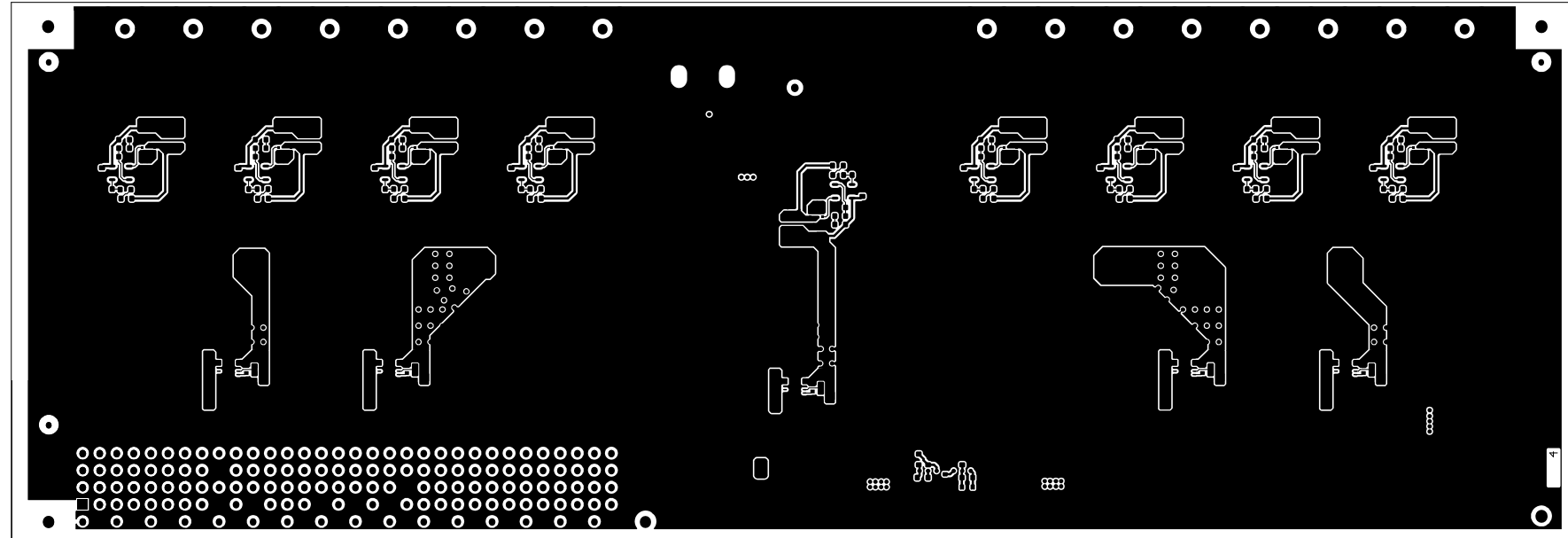
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Approved By: Gary S. Varner	Print Date: 1. okt 2015	Signature:	Size: A3 H	University of Hawaii at Manoa High Energy Physics Group Instrumentation Development Laboratory
Title: Top Layer- SIG1 (GTL)				



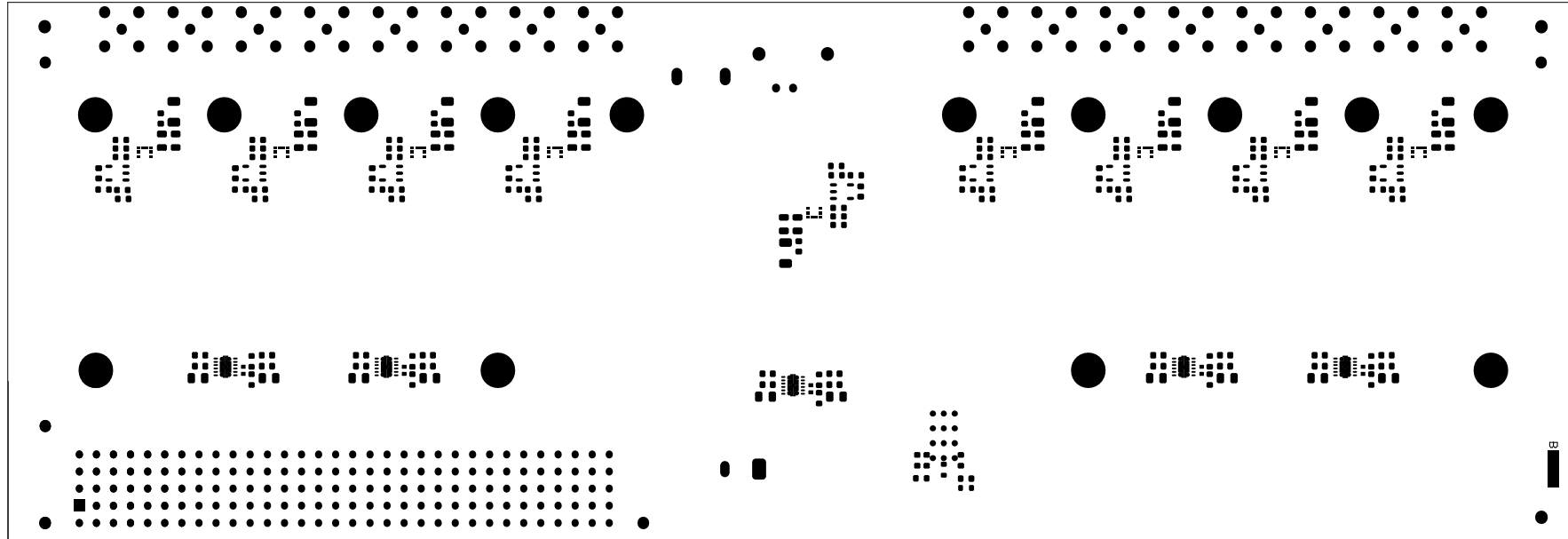
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Approved By: Gary S. Varner	Print Date: 1. okt 2015	Signature:	Size: A3 H	
Title: Layer 2 - GND1 (GP1)				University of Hawaii at Manoa High Energy Physics Group Instrumentation Development Laboratory



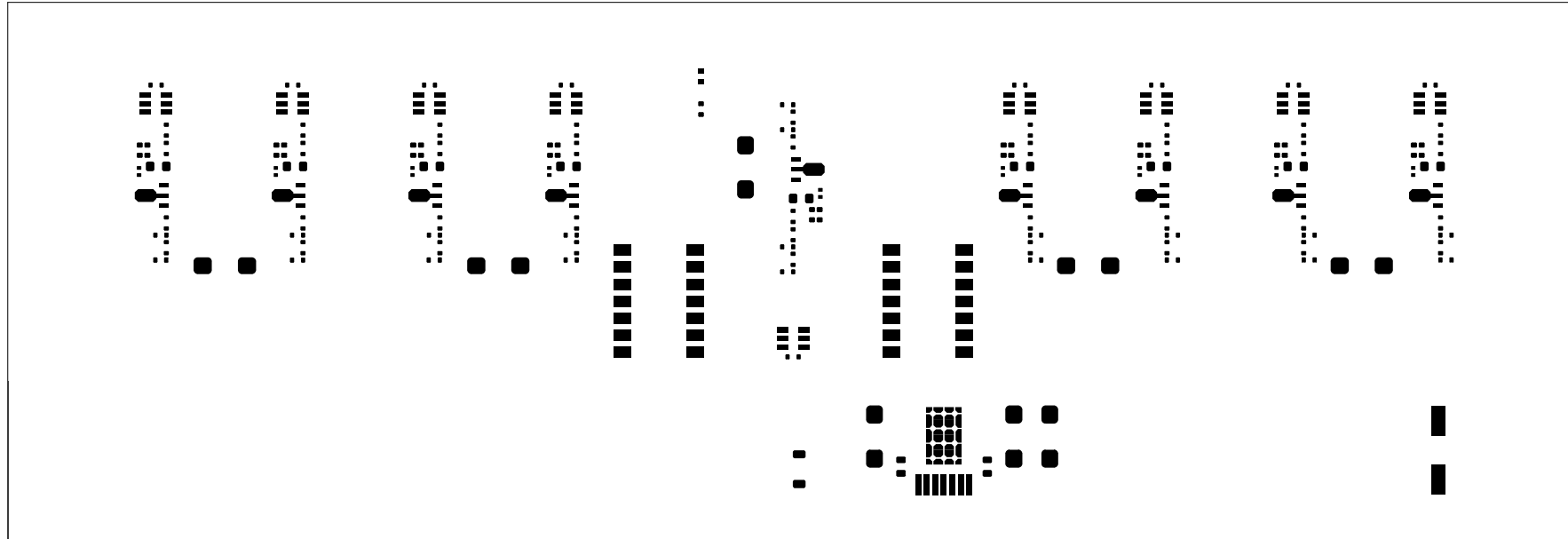
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Approved By: Gary S. Varner	Print Date: 1. okt 2015	Signature:	Size: A3 H	
Title: Layer 3 - SIG2 (G1)				University of Hawaii at Manoa High Energy Physics Group Instrumentation Development Laboratory



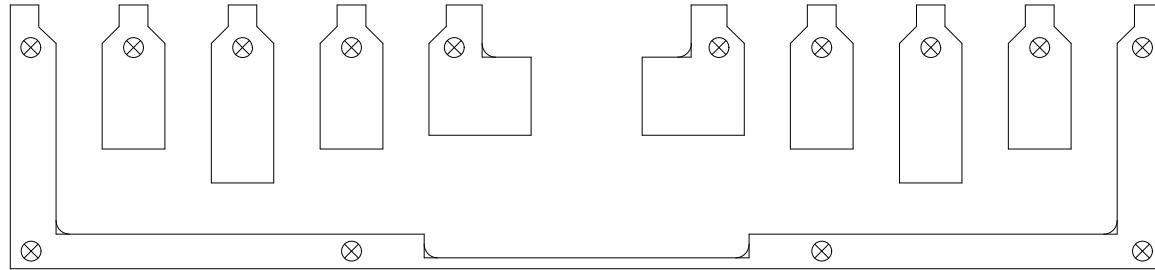
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Approved By: Gary S. Varner	Print Date: 1. okt 2015	Signature:	Size: A3 H	
Title: Bottom Layer - SIG3 (GBL)				University of Hawaii at Manoa High Energy Physics Group Instrumentation Development Laboratory



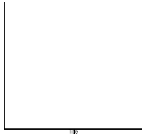
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Approved By: Gary S. Varner	Print Date: 1. okt 2015	Signature:	Size: A3 H	
Title: Bottom Solder Mask (GBS)				University of Hawaii at Manoa High Energy Physics Group Instrumentation Development Laboratory



Designer: Peter Orel	Revision: .Version	File: IDL_15_22_A.PcbDoc	Sheet 1 of 1	Code: IDL_15_22
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Approved By: Gary S. Varner	Print Date: 1. okt 2015	Signature:	Size: A3 H	
Title: Top Paste Mask Print GTP				University of Hawaii at Manoa High Energy Physics Group Instrumentation Development Laboratory



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Approved By: Gary S. Varner	Print Date: 1. okt 2015	Signature:	Size: A3 H	ID: ITOP_CALIB_FN1
Title: Mechanical Drawing (RF Shield Top)				University of Hawaii at Manoa High Energy Physics Group Instrumentation Development Laboratory



Designer: Peter Orel	Revision: .Version	File: IDL_15_22_A,PcbDoc	Sheet 1 of 1	Code: IDL_15_22
Drawn By: Peter Orel	Modif. Date: Date	Variant: Master	ASSEMBLY	
Approved By: Gary S. Varner	Print Date: 1. okt 2015	Signature:	Size: A3 H	ID: ITOP_CALIB_FN1
Title: Mechanical Drawing (RF Shield Bottom)				University of Hawaii at Manoa High Energy Physics Group Instrumentation Development Laboratory