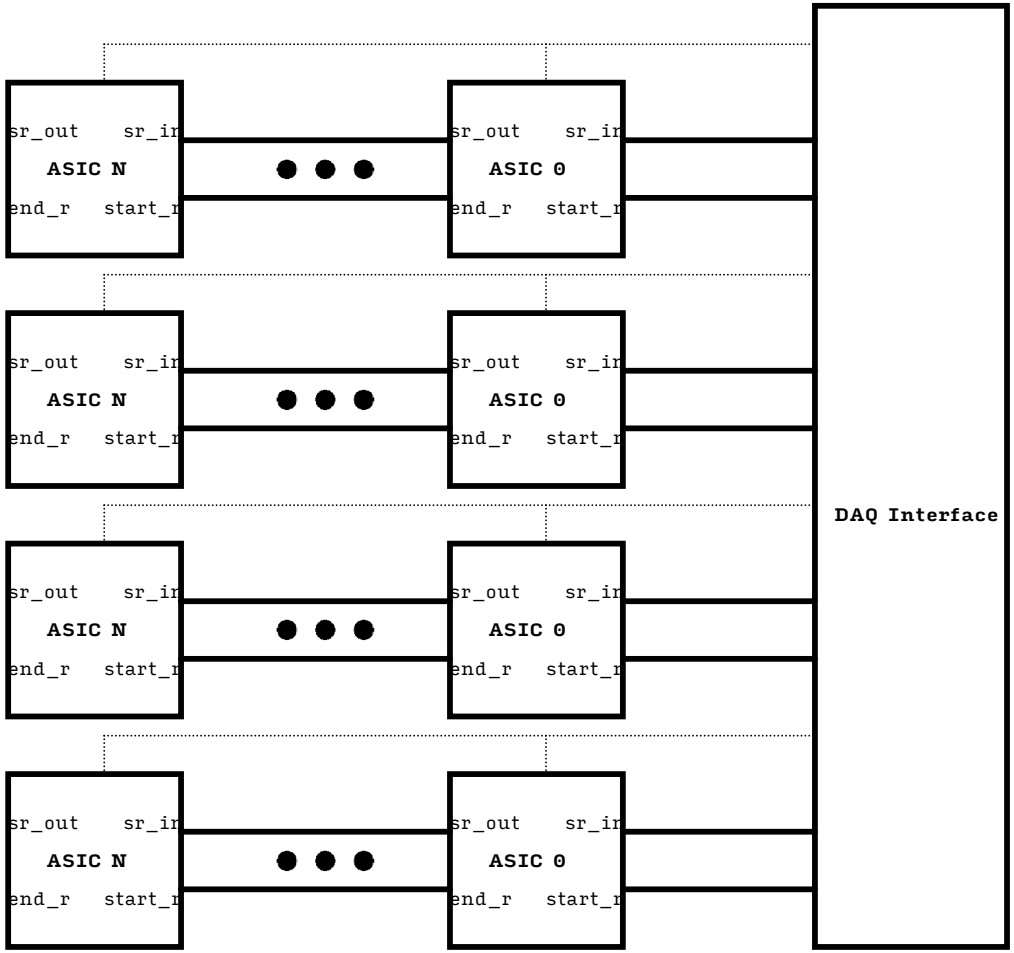
MICROROC is dedicated chip for GEM/MICROMEGAS. MICROROC(pin pin compatible with HR2b) is based on HR2b same back-end, same readout format, same pinout, only the preamplifier is changing
Dynamic range 1fC~500fC

The GEM detector is designed as 37cm*37cm, and its effictive area is 30cm*30cm.
Each Microroc ASIC has 64 readout channels. That is to say some of Microrocs cannot be full used and the unused pin should be left float to reduce the input capacitor.
The ESD protection is necessary as there might be spark in the GEM.



There are 3 kinds of control signals
1. Daisy chain signals: sr_in, sr_out, start_readout, end_readout
2. Independent signal for each chain: Dout1b, Dout2b, TransmitOn1b, TransmitOn2b, ChipSatb, TrigExt, StartAcq, StartReadout1, StartReadout2, sr_rstb, sr_ck, sr_in, EndReadout1, EndReadout2, sr_out
3. Common signals for all chains: 4 LVDS signals, power on signals, reset_b, rst_counterb, select, hold, out_trigger0~2b

FPGA LVDS driver can handle directly many ASICs (6-10) for sure.
But if there is more ASICs, you should use more than 1 dedicated LVDS drivers.
In this design, M-LVDS buffer is used

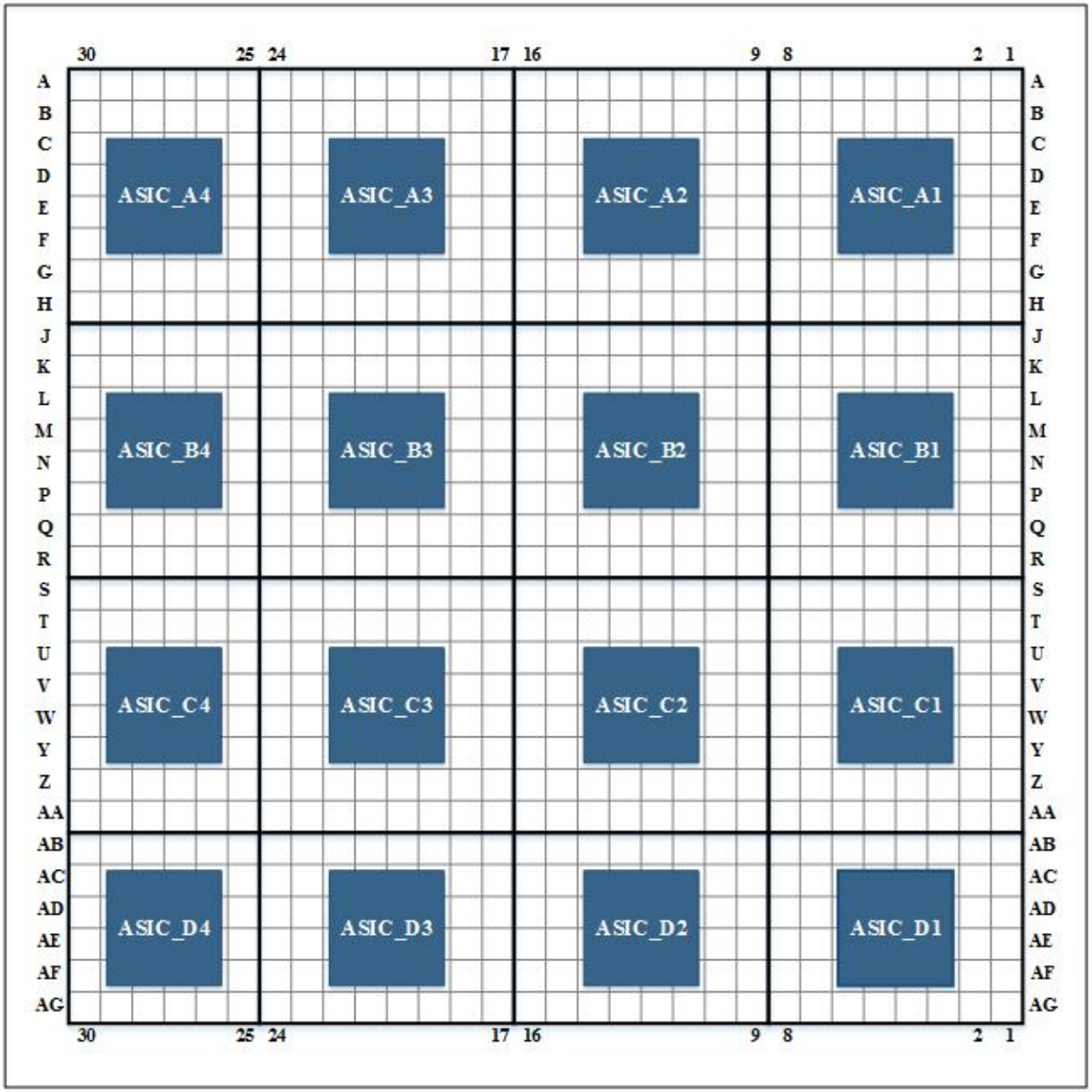
SDHCal FEB

SDHCal FEB
Version: 1.0
Design Tools: Cadence 16.6
Finish Date: 2018/01/29
Engineer: Yu Wang
Company: USTC

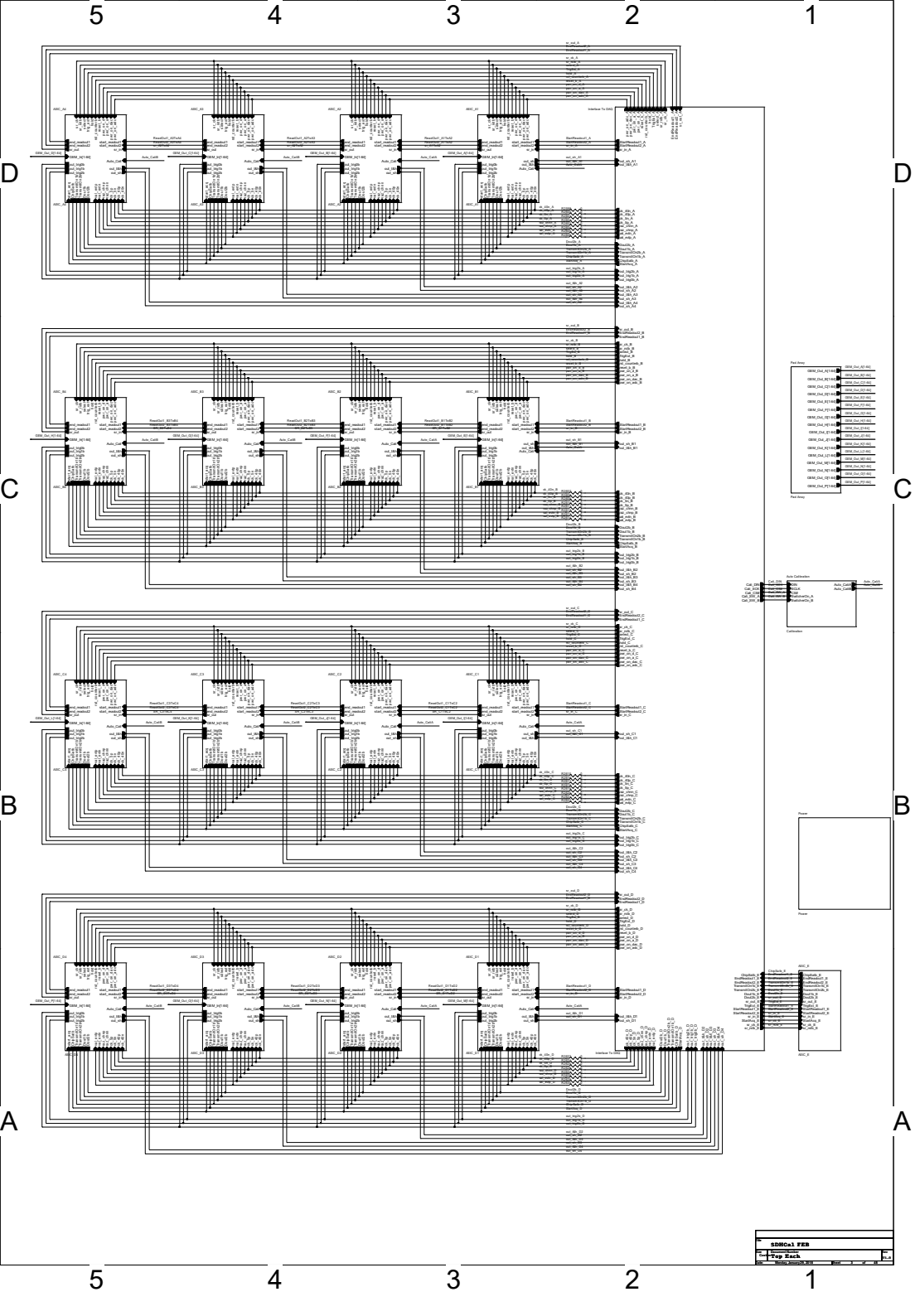
Tips: If there is gibberish, please install the 'Input' font, 'Romantic' font and 'Celestina' font.

Note:All the Title and Document Number is Input, blod, size 10.Rev is Input, size 6.
All the comments is Input, blue size 6
Note: All the unsolder package should value x(Not X)
Capacitor: F(Not f)

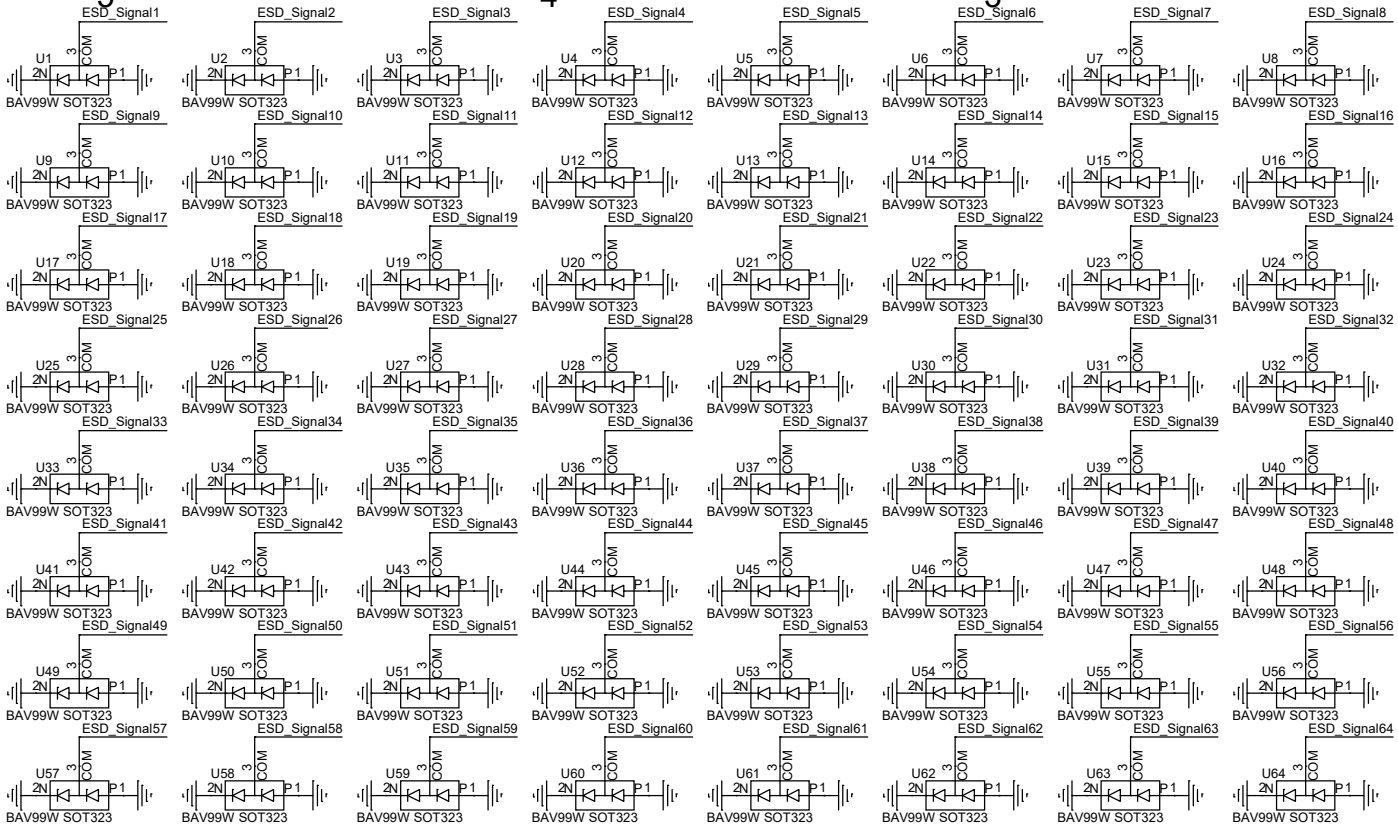
Title: SDHCal FEB		
Size: A4	Document Number: Design Info	Rev: v1.0
Date: Monday, January 29, 2018	Sheet 1 of 48	

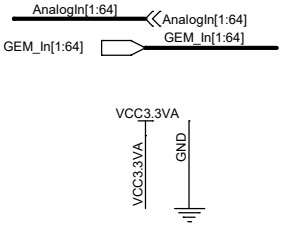


Title	SDHCal FEB	
Size A4	Document Number Design Structure	Rev v1.0
Date: Monday, January 29, 2018	Sheet 2 of 48	

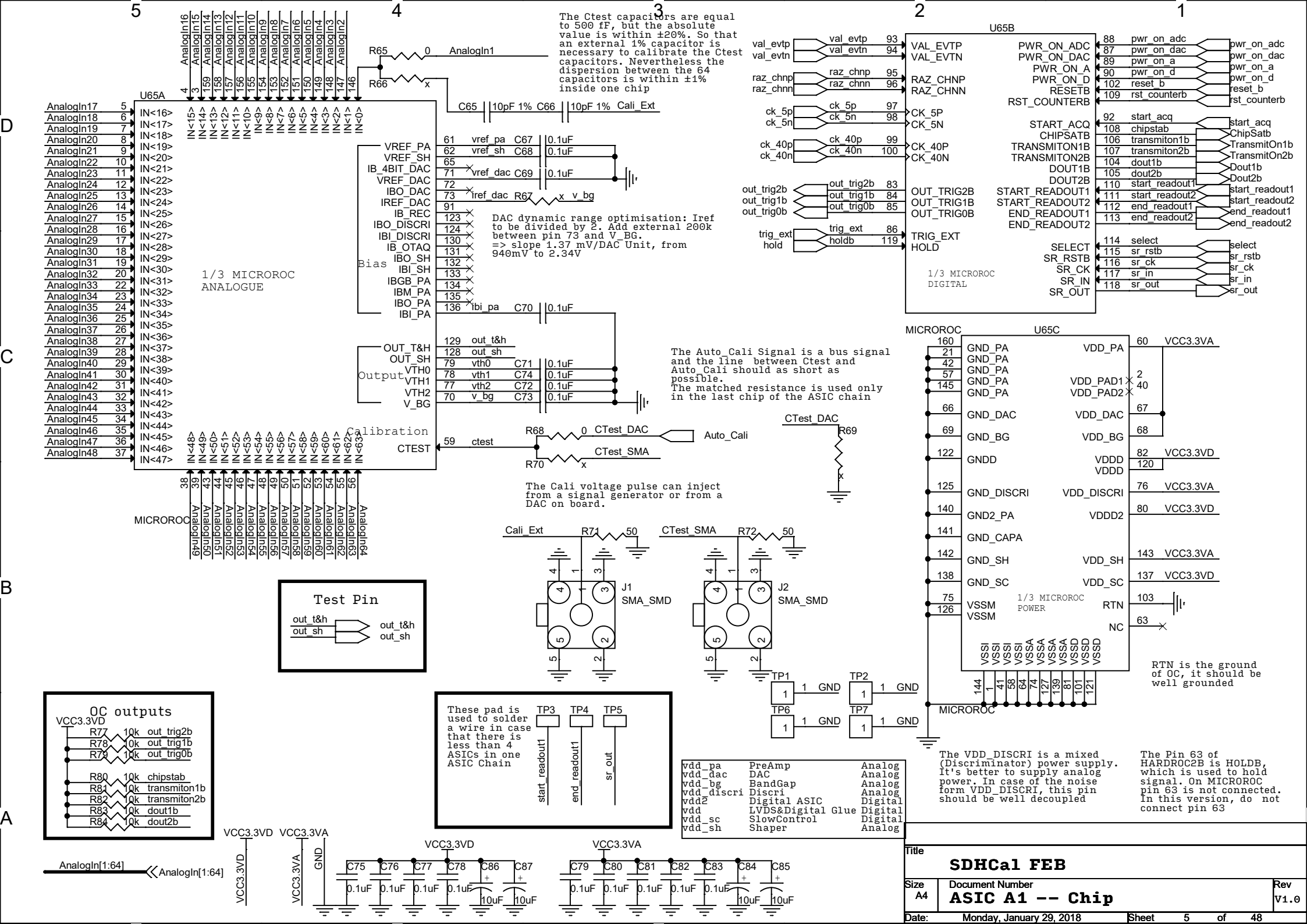

5
4
3
2
1
D
C
B
A
SDHCn1 FEB
Top Each

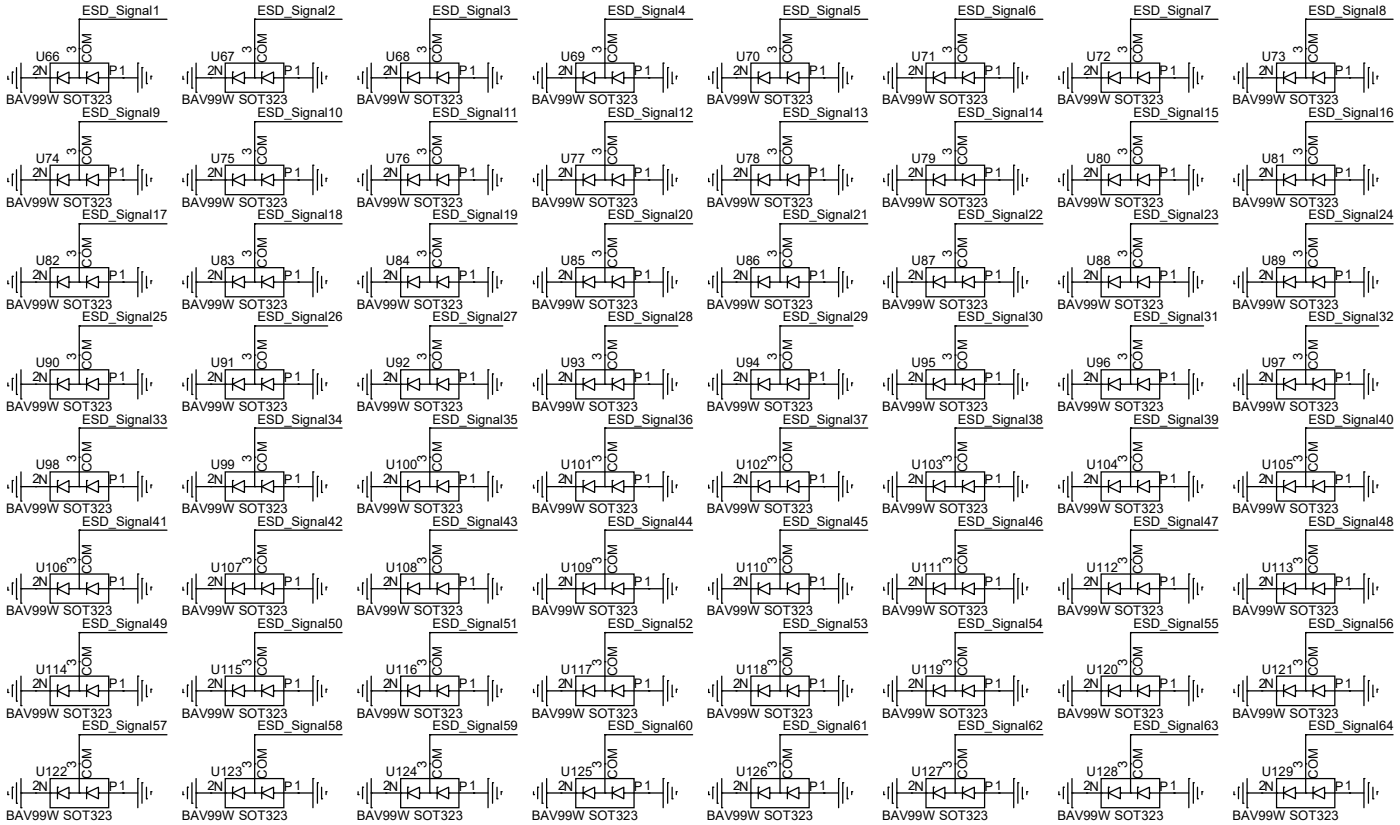
Although the each channel of MICROROC has a spark protection network, it's recommanded to add external protection circuit. BAV99W is a choise but may not be the best!

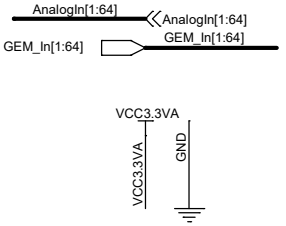


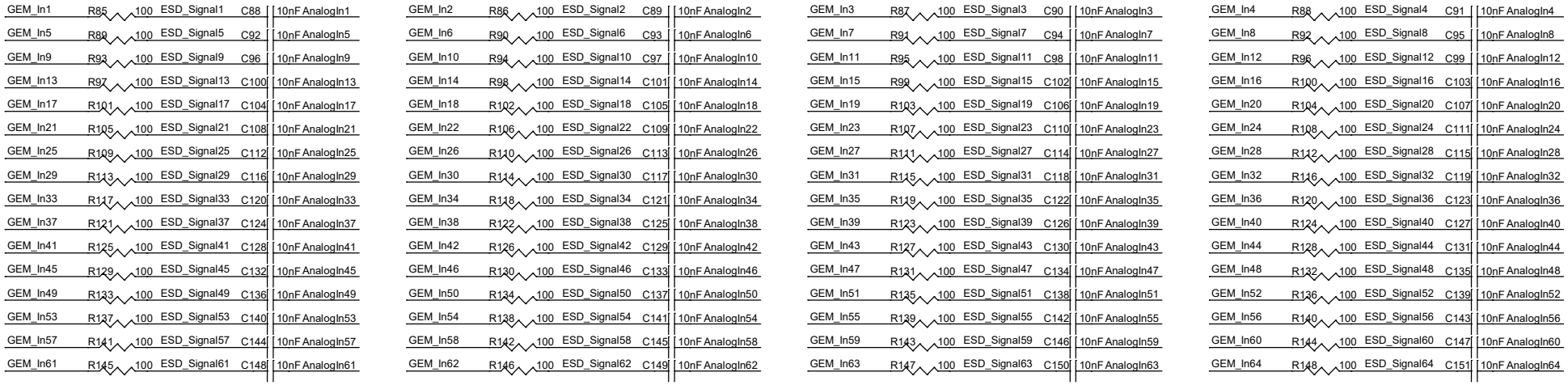


Title	SDHCal FEB	
Size: Custom	Document Number: ASIC A1 -- Analog In	Rev: V1.0
Date: Monday, January 29, 2018	Sheet 4 of 48	

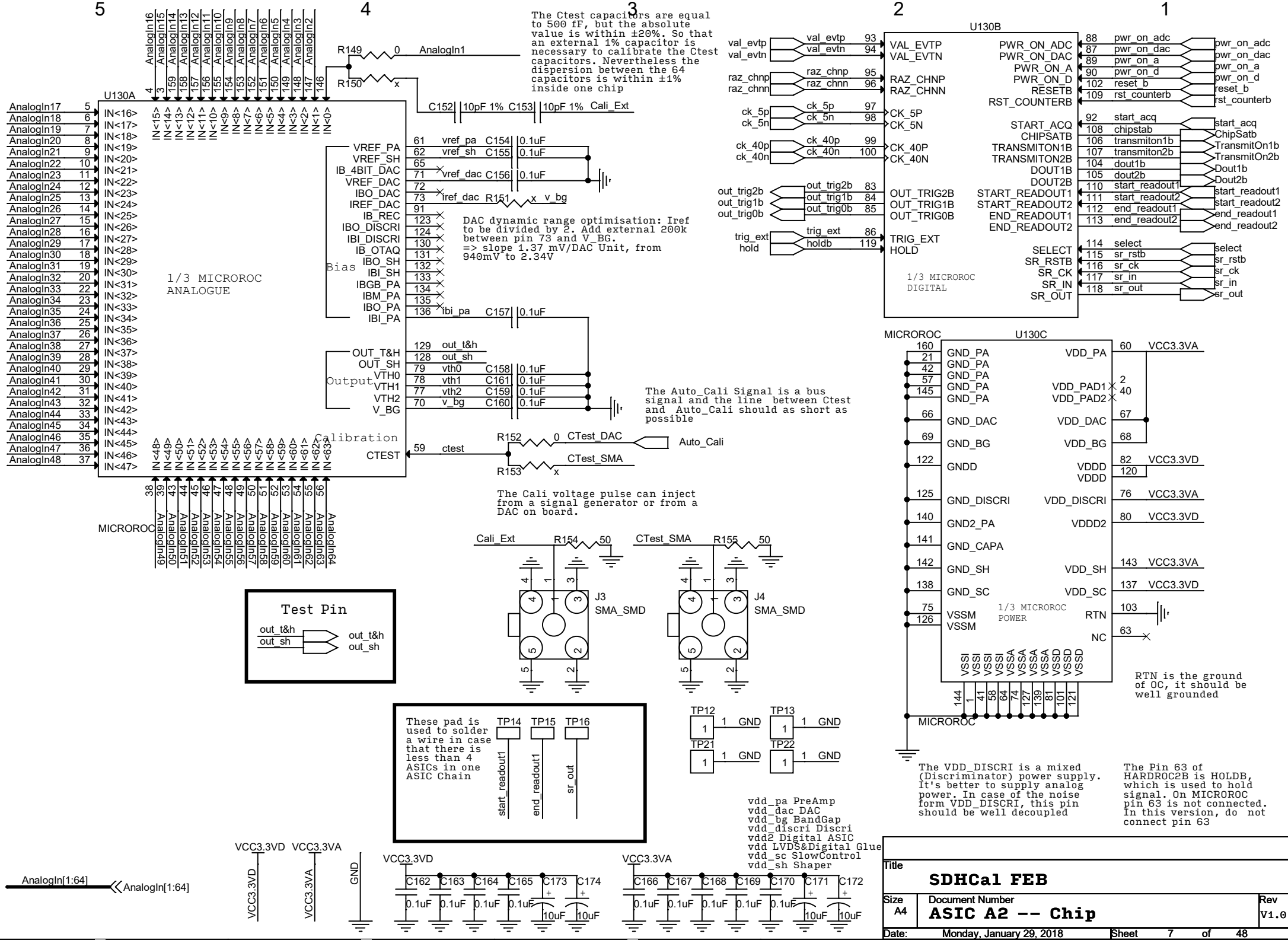

The Ctest capacitors are equal to 500 fF, but the absolute value is within ±20%. So that an external 1% capacitor is necessary to calibrate the Ctest capacitors. Nevertheless the dispersion between the 64 capacitors is within ±1% inside one chip
U65A
1/3 MICROROC ANALOGUE
DAC dynamic range optimisation: Iref to be divided by 2. Add external 200k between pin 73 and V_BG. => slope 1.37 mV/DAC Unit, from 940mV to 2.34V
The Auto_Cali Signal is a bus signal and the line between Ctest and Auto_Cali should as short as possible. The matched resistance is used only in the last chip of the ASIC chain
The Cali voltage pulse can inject from a signal generator or from a DAC on board.
U65B
1/3 MICROROC DIGITAL
U65C
MICROROC
1/3 MICROROC POWER
RTN is the ground of OC, it should be well grounded
Test Pin
OC outputs
These pad is used to solder a wire in case that there is less than 4 ASICs in one ASIC Chain
The VDD_DISCRI is a mixed (Discriminator) power supply. It's better to supply analog power. In case of the noise form VDD_DISCRI, this pin should be well decoupled
The Pin 63 of HARDROC2B is HOLDB, which is used to hold signal. On MICROROC pin 63 is not connected. In this version, do not connect pin 63
SDHCal FEB
ASIC A1 -- Chip
Monday, January 29, 2018

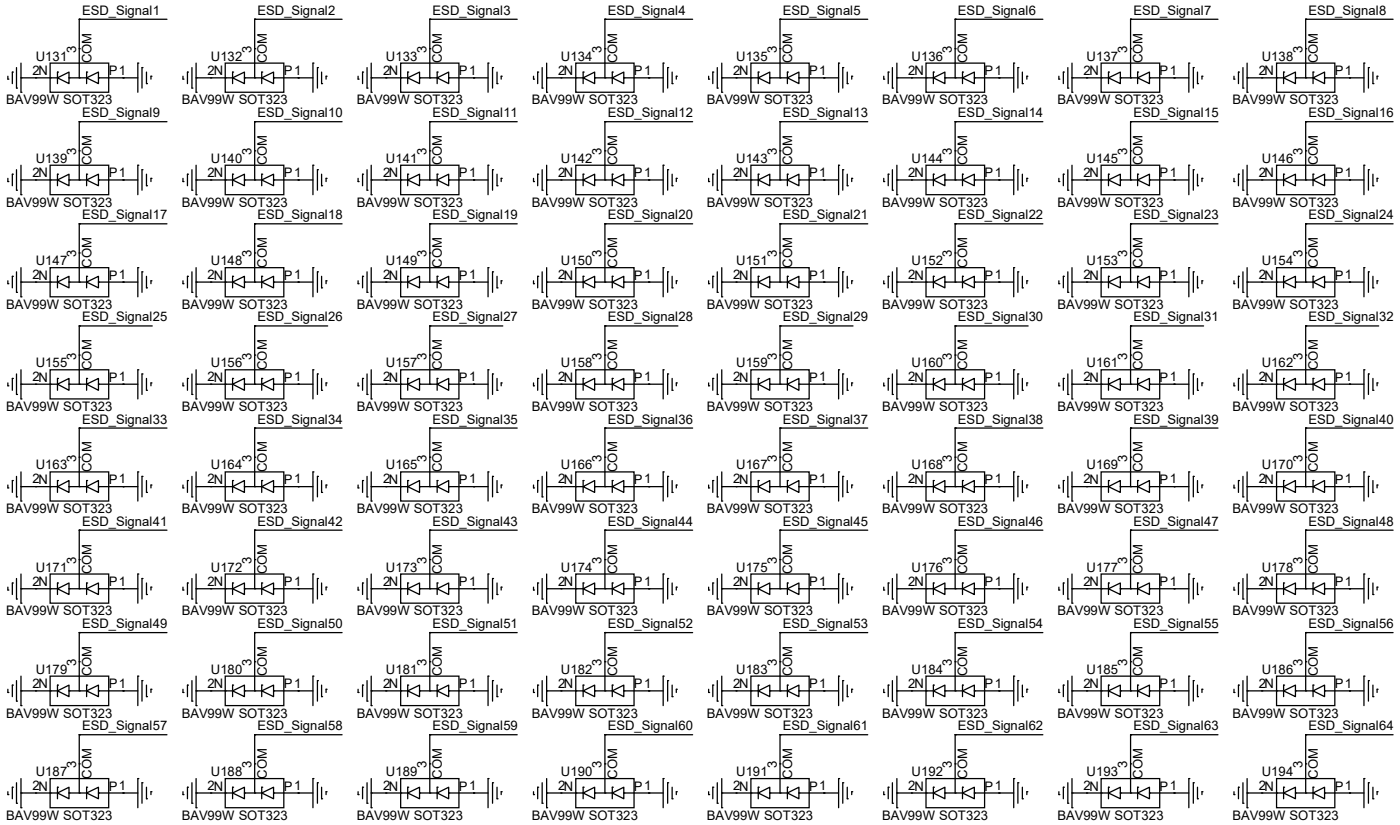


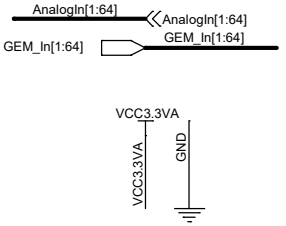




Title	SDHCal FEB	
Size: Custom	Document Number: ASIC A2 -- Analog In	Rev: V1.0
Date: Monday, January 29, 2018	Sheet 6 of 48	


U130A
1/3 MICROROC ANALOGUE
Bias
Output
Calibration
MICROROC
U130B
1/3 MICROROC DIGITAL
U130C
MICROROC
1/3 MICROROC POWER
The Ctest capacitors are equal to 500 fF, but the absolute value is within ±20%. So that an external 1% capacitor is necessary to calibrate the Ctest capacitors. Nevertheless the dispersion between the 64 capacitors is within ±1% inside one chip
DAC dynamic range optimisation: Iref to be divided by 2. Add external 200k between pin 73 and V_BG. => slope 1.37 mV/DAC Unit, from 940mV to 2.34V
The Auto_Cali Signal is a bus signal and the line between Ctest and Auto_Cali should as short as possible
The Cali voltage pulse can inject from a signal generator or from a DAC on board.
Test Pin
These pad is used to solder a wire in case that there is less than 4 ASICs in one ASIC Chain
RTN is the ground of OC, it should be well grounded
The VDD_DISCRI is a mixed (Discriminator) power supply. It's better to supply analog power. In case of the noise form VDD_DISCRI, this pin should be well decoupled
The Pin 63 of HARDROC2B is HOLDB, which is used to hold signal. On MICROROC pin 63 is not connected. In this version, do not connect pin 63
vdd_pa PreAmp
vdd_dac DAC
vdd_bg BandGap
vdd_discri Discri
vdd2 Digital ASIC
vdd LVDS&Digital Glue
vdd_sc SlowControl
vdd_sh Shaper
Title
SDHCal FEB
Size A4
Document Number ASIC A2 -- Chip
Rev V1.0
Date: Monday, January 29, 2018
Sheet 7 of 48





GEM_In1	R168	100	ESD_Signal1	C175	10nF AnalogIn1	GEM_In2	R169	100	ESD_Signal2	C176	10nF AnalogIn2	GEM_In3	R170	100	ESD_Signal3	C177	10nF AnalogIn3	GEM_In4	R171	100	ESD_Signal4	C178	10nF AnalogIn4
GEM_In5	R172	100	ESD_Signal5	C179	10nF AnalogIn5	GEM_In6	R173	100	ESD_Signal6	C180	10nF AnalogIn6	GEM_In7	R174	100	ESD_Signal7	C181	10nF AnalogIn7	GEM_In8	R175	100	ESD_Signal8	C182	10nF AnalogIn8
GEM_In9	R176	100	ESD_Signal9	C183	10nF AnalogIn9	GEM_In10	R177	100	ESD_Signal10	C184	10nF AnalogIn10	GEM_In11	R178	100	ESD_Signal11	C185	10nF AnalogIn11	GEM_In12	R179	100	ESD_Signal12	C186	10nF AnalogIn12
GEM_In13	R180	100	ESD_Signal13	C187	10nF AnalogIn13	GEM_In14	R181	100	ESD_Signal14	C188	10nF AnalogIn14	GEM_In15	R182	100	ESD_Signal15	C189	10nF AnalogIn15	GEM_In16	R183	100	ESD_Signal16	C190	10nF AnalogIn16
GEM_In17	R184	100	ESD_Signal17	C191	10nF AnalogIn17	GEM_In18	R185	100	ESD_Signal18	C192	10nF AnalogIn18	GEM_In19	R186	100	ESD_Signal19	C193	10nF AnalogIn19	GEM_In20	R187	100	ESD_Signal20	C194	10nF AnalogIn20
GEM_In21	R188	100	ESD_Signal21	C195	10nF AnalogIn21	GEM_In22	R189	100	ESD_Signal22	C196	10nF AnalogIn22	GEM_In23	R190	100	ESD_Signal23	C197	10nF AnalogIn23	GEM_In24	R191	100	ESD_Signal24	C198	10nF AnalogIn24
GEM_In25	R192	100	ESD_Signal25	C199	10nF AnalogIn25	GEM_In26	R193	100	ESD_Signal26	C200	10nF AnalogIn26	GEM_In27	R194	100	ESD_Signal27	C201	10nF AnalogIn27	GEM_In28	R195	100	ESD_Signal28	C202	10nF AnalogIn28
GEM_In29	R196	100	ESD_Signal29	C203	10nF AnalogIn29	GEM_In30	R197	100	ESD_Signal30	C204	10nF AnalogIn30	GEM_In31	R198	100	ESD_Signal31	C205	10nF AnalogIn31	GEM_In32	R199	100	ESD_Signal32	C206	10nF AnalogIn32
GEM_In33	R200	100	ESD_Signal33	C207	10nF AnalogIn33	GEM_In34	R201	100	ESD_Signal34	C208	10nF AnalogIn34	GEM_In35	R202	100	ESD_Signal35	C209	10nF AnalogIn35	GEM_In36	R203	100	ESD_Signal36	C210	10nF AnalogIn36
GEM_In37	R204	100	ESD_Signal37	C211	10nF AnalogIn37	GEM_In38	R205	100	ESD_Signal38	C212	10nF AnalogIn38	GEM_In39	R206	100	ESD_Signal39	C213	10nF AnalogIn39	GEM_In40	R207	100	ESD_Signal40	C214	10nF AnalogIn40
GEM_In41	R208	100	ESD_Signal41	C215	10nF AnalogIn41	GEM_In42	R209	100	ESD_Signal42	C216	10nF AnalogIn42	GEM_In43	R210	100	ESD_Signal43	C217	10nF AnalogIn43	GEM_In44	R211	100	ESD_Signal44	C218	10nF AnalogIn44
GEM_In45	R212	100	ESD_Signal45	C219	10nF AnalogIn45	GEM_In46	R213	100	ESD_Signal46	C220	10nF AnalogIn46	GEM_In47	R214	100	ESD_Signal47	C221	10nF AnalogIn47	GEM_In48	R215	100	ESD_Signal48	C222	10nF AnalogIn48
GEM_In49	R216	100	ESD_Signal49	C223	10nF AnalogIn49	GEM_In50	R217	100	ESD_Signal50	C224	10nF AnalogIn50	GEM_In51	R218	100	ESD_Signal51	C225	10nF AnalogIn51	GEM_In52	R219	100	ESD_Signal52	C226	10nF AnalogIn52
GEM_In53	R220	100	ESD_Signal53	C227	10nF AnalogIn53	GEM_In54	R221	100	ESD_Signal54	C228	10nF AnalogIn54	GEM_In55	R222	100	ESD_Signal55	C229	10nF AnalogIn55	GEM_In56	R223	100	ESD_Signal56	C230	10nF AnalogIn56
GEM_In57	R224	100	ESD_Signal57	C231	10nF AnalogIn57	GEM_In58	R225	100	ESD_Signal58	C232	10nF AnalogIn58	GEM_In59	R226	100	ESD_Signal59	C233	10nF AnalogIn59	GEM_In60	R227	100	ESD_Signal60	C234	10nF AnalogIn60
GEM_In61	R228	100	ESD_Signal61	C235	10nF AnalogIn61	GEM_In62	R229	100	ESD_Signal62	C236	10nF AnalogIn62	GEM_In63	R230	100	ESD_Signal63	C237	10nF AnalogIn63	GEM_In64	R231	100	ESD_Signal64	C238	10nF AnalogIn64

Title	SDHCal FEB		
Size: Custom	Document Number: ASIC A3 -- Analog In		Rev: V1.0
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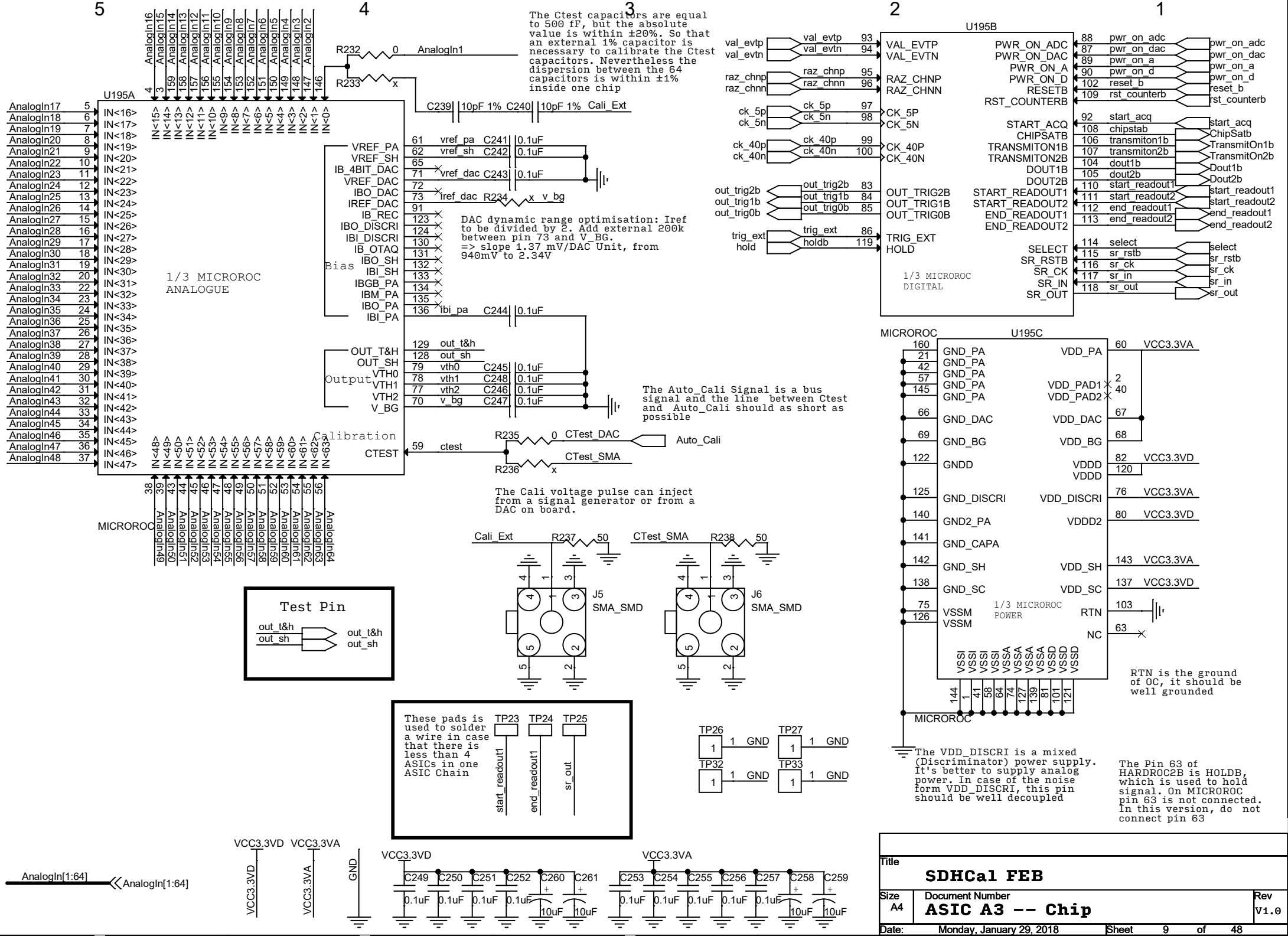
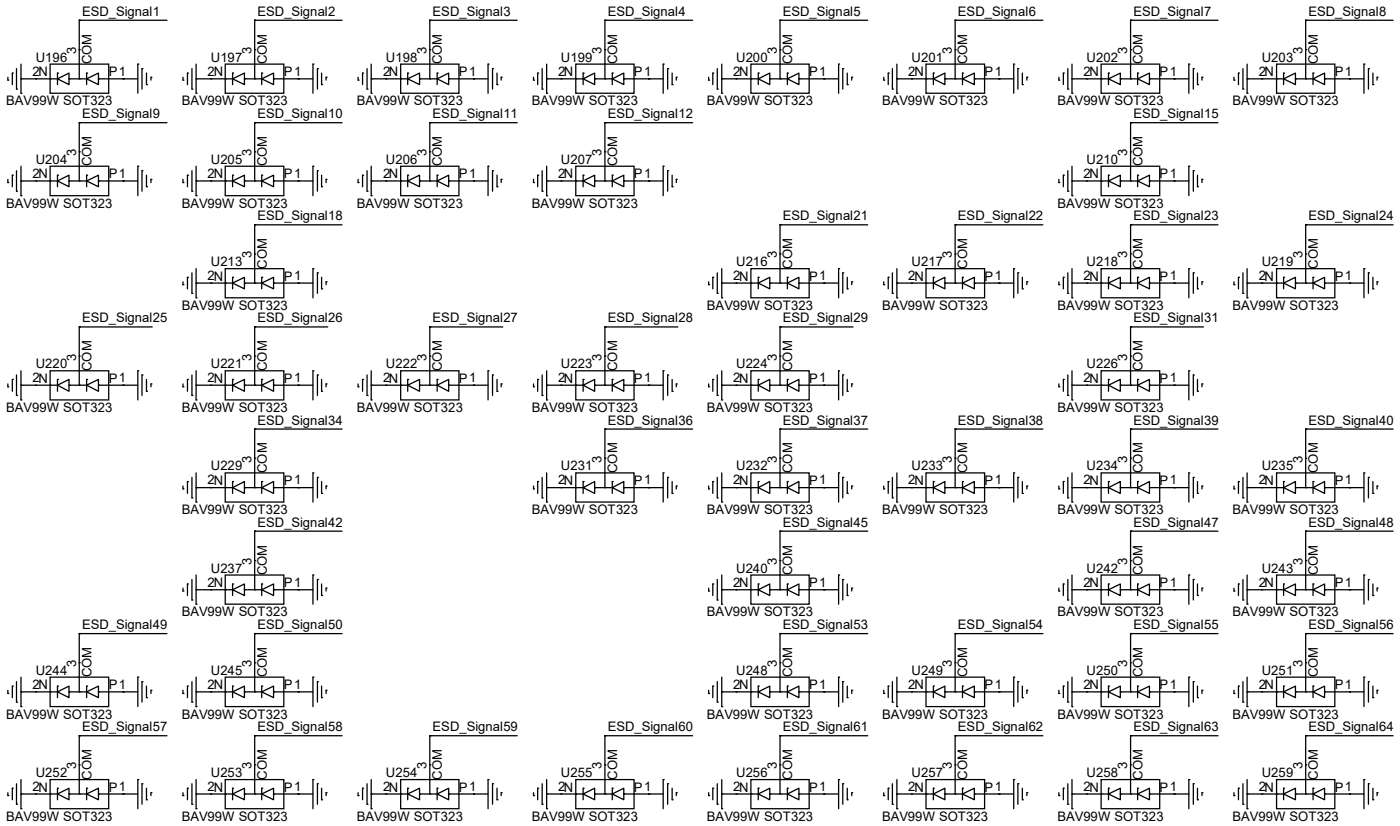
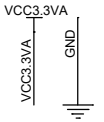
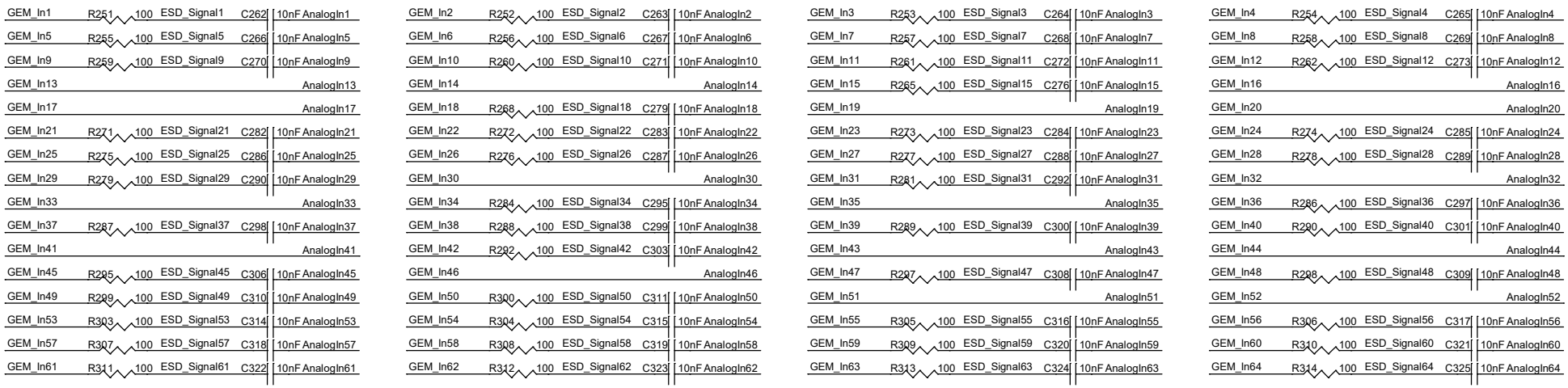
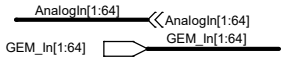

U195A
1/3 MICROROC ANALOGUE
Bias
Output
Calibration
MICROROC
U195B
1/3 MICROROC DIGITAL
U195C
1/3 MICROROC POWER
The Ctest capacitors are equal to 500 fF, but the absolute value is within ±20%. So that an external 1% capacitor is necessary to calibrate the Ctest capacitors. Nevertheless the dispersion between the 64 capacitors is within ±1% inside one chip
DAC dynamic range optimisation: Iref to be divided by 2. Add external 200k between pin 73 and V_BG. => slope 1.37 mV/DAC Unit, from 940mV to 2.34V
The Auto_Cali Signal is a bus signal and the line between Ctest and Auto_Cali should as short as possible
The Cali voltage pulse can inject from a signal generator or from a DAC on board.
Test Pin
These pads is used to solder a wire in case that there is less than 4 ASICs in one ASIC Chain
RTN is the ground of OC, it should be well grounded
The VDD_DISCRI is a mixed (Discriminator) power supply. It's better to supply analog power. In case of the noise form VDD_DISCRI, this pin should be well decoupled
The Pin 63 of HARDROC2B is HOLDB, which is used to hold signal. On MICROROC pin 63 is not connected. In this version, do not connect pin 63
SDHCal FEB
ASIC A3 -- Chip
Monday, January 29, 2018

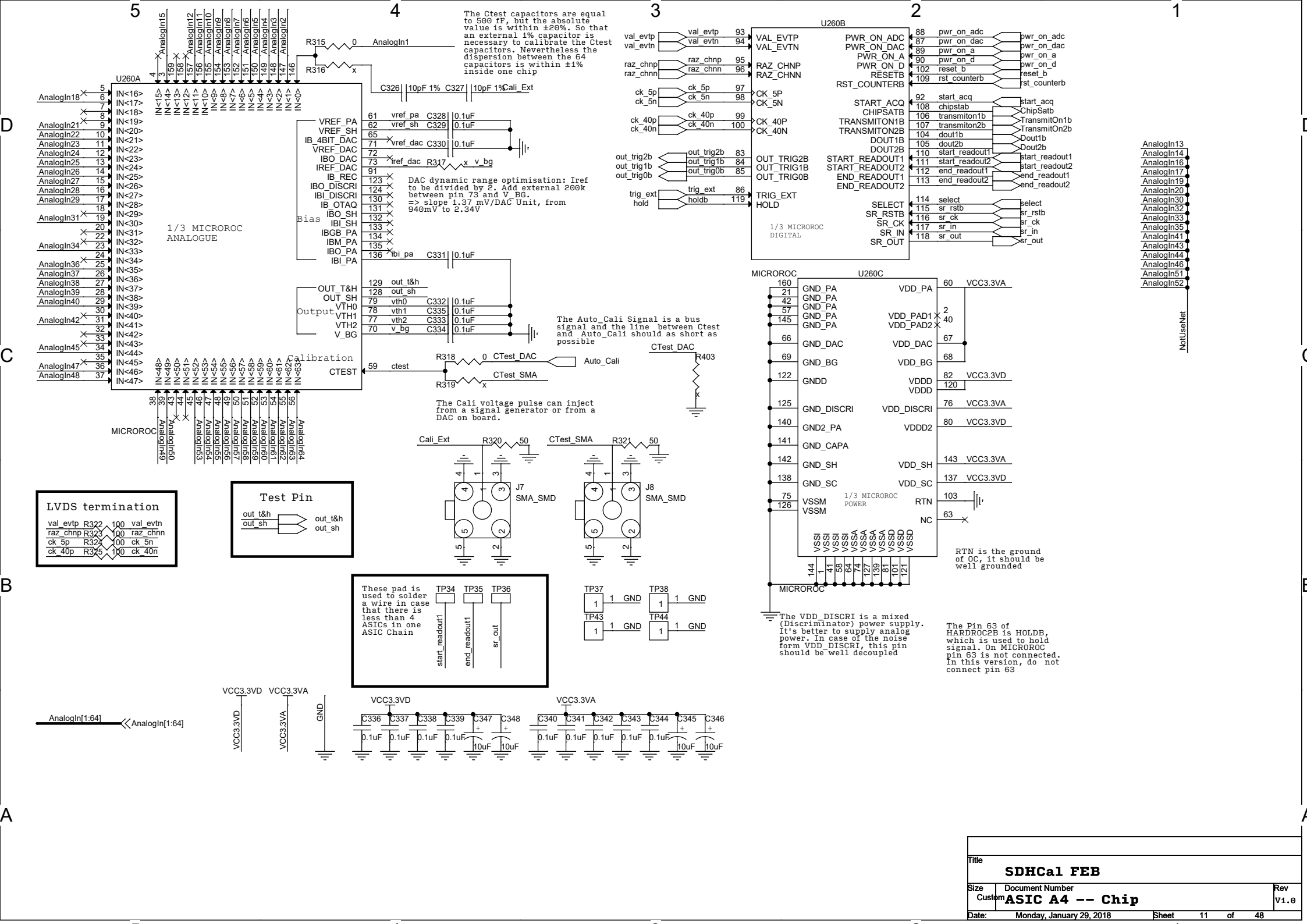


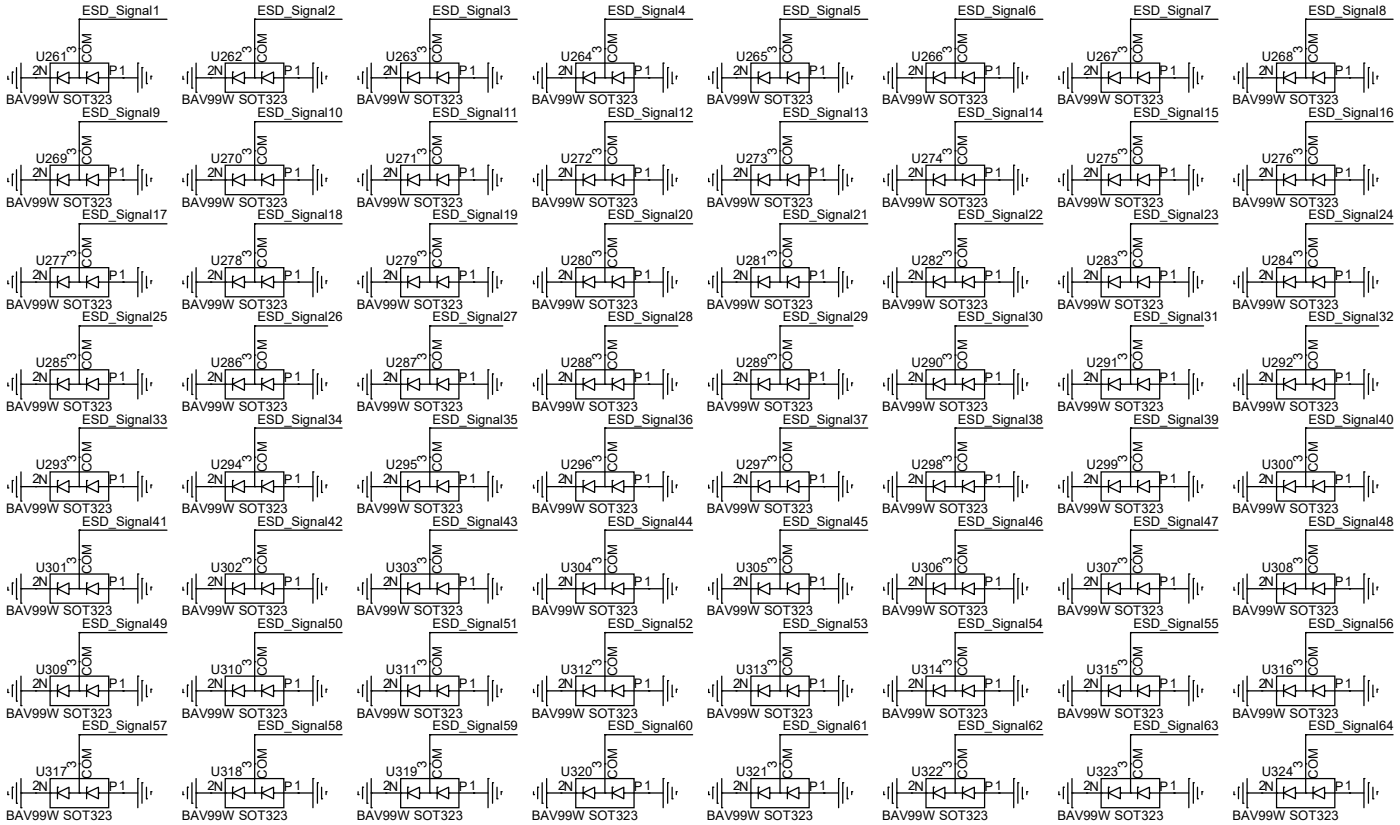






Title	SDHCal FEB	
Size: Custom	Document Number: ASIC A4 -- Analog In	Rev: V1.0
Date: Monday, January 29, 2018	Sheet 10 of 48	


U260A
1/3 MICROROC ANALOGUE
Bias
Output
Calibration
MICROROC
U260B
1/3 MICROROC DIGITAL
U260C
1/3 MICROROC POWER
The Ctest capacitors are equal to 500 fF, but the absolute value is within ±20%. So that an external 1% capacitor is necessary to calibrate the Ctest capacitors. Nevertheless the dispersion between the 64 capacitors is within ±1% inside one chip
DAC dynamic range optimisation: Iref to be divided by 2. Add external 200k between pin 73 and V_BG. => slope 1.37 mV/DAC Unit, from 940mV to 2.34V
The Auto_Cali Signal is a bus signal and the line between Ctest and Auto_Cali should as short as possible
The Cali voltage pulse can inject from a signal generator or from a DAC on board.
LVDS termination
Test Pin
These pad is used to solder a wire in case that there is less than 4 ASICs in one ASIC Chain
RTN is the ground of OC, it should be well grounded
The VDD_DISCRI is a mixed (Discriminator) power supply. It's better to supply analog power. In case of the noise form VDD_DISCRI, this pin should be well decoupled
The Pin 63 of HARDROC2B is HOLDB, which is used to hold signal. On MICROROC pin 63 is not connected. In this version, do not connect pin 63
Title
SDHCal FEB
Size
Custom
Document Number
ASIC A4 -- Chip
Rev
V1.0
Date: Monday, January 29, 2018
Sheet 11 of 48



AnalogIn[1:64] AnalogIn[1:64]

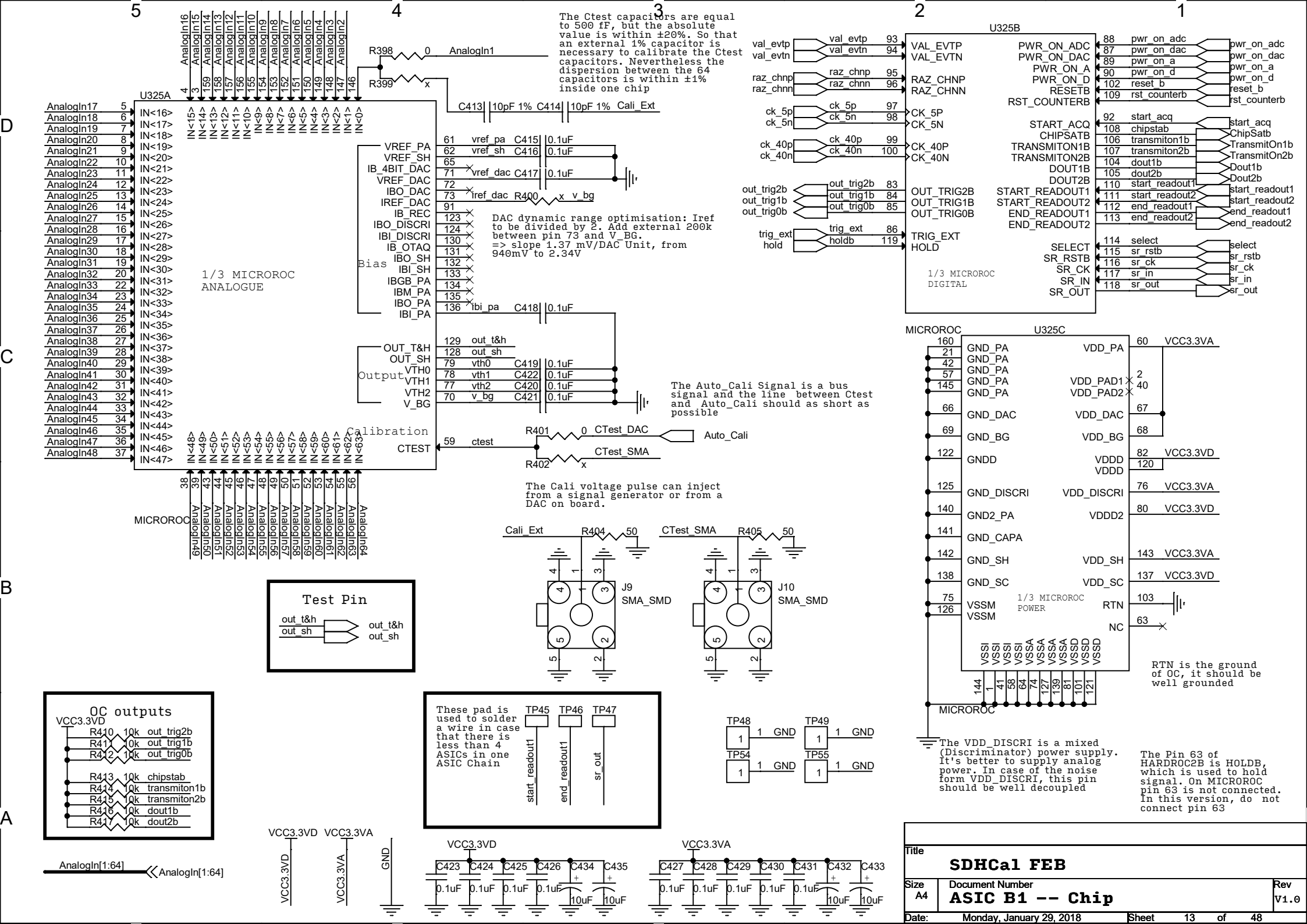
GEM_In[1:64] GEM_In[1:64]

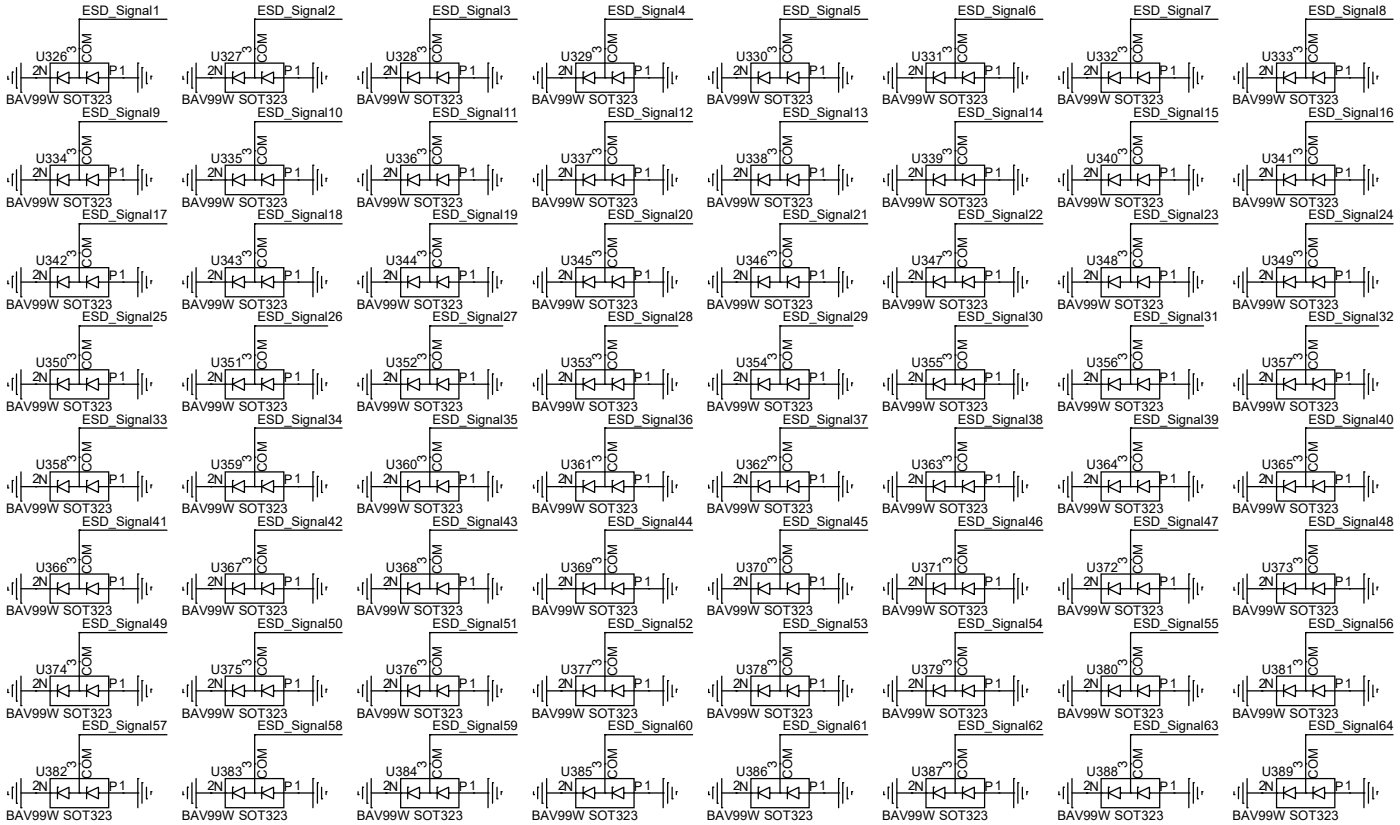
VCC3.3VA

VCC3.3VA GND

GEM_In1	R334	100	ESD_Signal1	C349	10nF AnalogIn1	GEM_In2	R335	100	ESD_Signal2	C350	10nF AnalogIn2	GEM_In3	R336	100	ESD_Signal3	C351	10nF AnalogIn3	GEM_In4	R337	100	ESD_Signal4	C352	10nF AnalogIn4
GEM_In5	R338	100	ESD_Signal5	C353	10nF AnalogIn5	GEM_In6	R339	100	ESD_Signal6	C354	10nF AnalogIn6	GEM_In7	R340	100	ESD_Signal7	C355	10nF AnalogIn7	GEM_In8	R341	100	ESD_Signal8	C356	10nF AnalogIn8
GEM_In9	R342	100	ESD_Signal9	C357	10nF AnalogIn9	GEM_In10	R343	100	ESD_Signal10	C358	10nF AnalogIn10	GEM_In11	R344	100	ESD_Signal11	C359	10nF AnalogIn11	GEM_In12	R345	100	ESD_Signal12	C360	10nF AnalogIn12
GEM_In13	R346	100	ESD_Signal13	C361	10nF AnalogIn13	GEM_In14	R347	100	ESD_Signal14	C362	10nF AnalogIn14	GEM_In15	R348	100	ESD_Signal15	C363	10nF AnalogIn15	GEM_In16	R349	100	ESD_Signal16	C364	10nF AnalogIn16
GEM_In17	R350	100	ESD_Signal17	C365	10nF AnalogIn17	GEM_In18	R351	100	ESD_Signal18	C366	10nF AnalogIn18	GEM_In19	R352	100	ESD_Signal19	C367	10nF AnalogIn19	GEM_In20	R353	100	ESD_Signal20	C368	10nF AnalogIn20
GEM_In21	R354	100	ESD_Signal21	C369	10nF AnalogIn21	GEM_In22	R355	100	ESD_Signal22	C370	10nF AnalogIn22	GEM_In23	R356	100	ESD_Signal23	C371	10nF AnalogIn23	GEM_In24	R357	100	ESD_Signal24	C372	10nF AnalogIn24
GEM_In25	R358	100	ESD_Signal25	C373	10nF AnalogIn25	GEM_In26	R359	100	ESD_Signal26	C374	10nF AnalogIn26	GEM_In27	R360	100	ESD_Signal27	C375	10nF AnalogIn27	GEM_In28	R361	100	ESD_Signal28	C376	10nF AnalogIn28
GEM_In29	R362	100	ESD_Signal29	C377	10nF AnalogIn29	GEM_In30	R363	100	ESD_Signal30	C378	10nF AnalogIn30	GEM_In31	R364	100	ESD_Signal31	C379	10nF AnalogIn31	GEM_In32	R365	100	ESD_Signal32	C380	10nF AnalogIn32
GEM_In33	R366	100	ESD_Signal33	C381	10nF AnalogIn33	GEM_In34	R367	100	ESD_Signal34	C382	10nF AnalogIn34	GEM_In35	R368	100	ESD_Signal35	C383	10nF AnalogIn35	GEM_In36	R369	100	ESD_Signal36	C384	10nF AnalogIn36
GEM_In37	R370	100	ESD_Signal37	C385	10nF AnalogIn37	GEM_In38	R371	100	ESD_Signal38	C386	10nF AnalogIn38	GEM_In39	R372	100	ESD_Signal39	C387	10nF AnalogIn39	GEM_In40	R373	100	ESD_Signal40	C388	10nF AnalogIn40
GEM_In41	R374	100	ESD_Signal41	C389	10nF AnalogIn41	GEM_In42	R375	100	ESD_Signal42	C390	10nF AnalogIn42	GEM_In43	R376	100	ESD_Signal43	C391	10nF AnalogIn43	GEM_In44	R377	100	ESD_Signal44	C392	10nF AnalogIn44
GEM_In45	R378	100	ESD_Signal45	C393	10nF AnalogIn45	GEM_In46	R379	100	ESD_Signal46	C394	10nF AnalogIn46	GEM_In47	R380	100	ESD_Signal47	C395	10nF AnalogIn47	GEM_In48	R381	100	ESD_Signal48	C396	10nF AnalogIn48
GEM_In49	R382	100	ESD_Signal49	C397	10nF AnalogIn49	GEM_In50	R383	100	ESD_Signal50	C398	10nF AnalogIn50	GEM_In51	R384	100	ESD_Signal51	C399	10nF AnalogIn51	GEM_In52	R385	100	ESD_Signal52	C400	10nF AnalogIn52
GEM_In53	R386	100	ESD_Signal53	C401	10nF AnalogIn53	GEM_In54	R387	100	ESD_Signal54	C402	10nF AnalogIn54	GEM_In55	R388	100	ESD_Signal55	C403	10nF AnalogIn55	GEM_In56	R389	100	ESD_Signal56	C404	10nF AnalogIn56
GEM_In57	R390	100	ESD_Signal57	C405	10nF AnalogIn57	GEM_In58	R391	100	ESD_Signal58	C406	10nF AnalogIn58	GEM_In59	R392	100	ESD_Signal59	C407	10nF AnalogIn59	GEM_In60	R393	100	ESD_Signal60	C408	10nF AnalogIn60
GEM_In61	R394	100	ESD_Signal61	C409	10nF AnalogIn61	GEM_In62	R395	100	ESD_Signal62	C410	10nF AnalogIn62	GEM_In63	R396	100	ESD_Signal63	C411	10nF AnalogIn63	GEM_In64	R397	100	ESD_Signal64	C412	10nF AnalogIn64

Title	SDHCal FEB		
Size: Custom	Document Number: ASIC B1 -- Analog In		Rev: V1.0
Date: Monday, January 29, 2018	Sheet 12 of 48		


U325A
1/3 MICROROC ANALOGUE
Bias
Output
Calibration
MICROROC
U325B
1/3 MICROROC DIGITAL
U325C
1/3 MICROROC POWER
The Ctest capacitors are equal to 500 fF, but the absolute value is within ±20%. So that an external 1% capacitor is necessary to calibrate the Ctest capacitors. Nevertheless the dispersion between the 64 capacitors is within ±1% inside one chip
DAC dynamic range optimisation: Iref to be divided by 2. Add external 200k between pin 73 and V_BG. => slope 1.37 mV/DAC Unit, from 940mV to 2.34V
The Auto_Cali Signal is a bus signal and the line between Ctest and Auto_Cali should as short as possible
The Cali voltage pulse can inject from a signal generator or from a DAC on board.
Test Pin
OC outputs
These pad is used to solder a wire in case that there is less than 4 ASICs in one ASIC Chain
RTN is the ground of OC, it should be well grounded
The VDD_DISCRI is a mixed (Discriminator) power supply. It's better to supply analog power. In case of the noise form VDD_DISCRI, this pin should be well decoupled
The Pin 63 of HARDROC2B is HOLDB, which is used to hold signal. On MICROROC pin 63 is not connected. In this version, do not connect pin 63
SDHCal FEB
ASIC B1 -- Chip
Monday, January 29, 2018



AnalogIn[1:64] AnalogIn[1:64]

GEM_In[1:64] GEM_In[1:64]

VCC3.3VA

VCC3.3VA GND

GEM_In1	R418 100	ESD_Signal1	C436	10nF	AnalogIn1		
GEM_In5	R422 100	ESD_Signal5	C440	10nF	AnalogIn5		
GEM_In9	R426 100	ESD_Signal9	C444	10nF	AnalogIn9		
GEM_In13	R430 100	ESD_Signal13	C448	10nF	AnalogIn13		
GEM_In17	R434 100	ESD_Signal17	C452	10nF	AnalogIn17		
GEM_In21	R438 100	ESD_Signal21	C456	10nF	AnalogIn21		
GEM_In25	R442 100	ESD_Signal25	C460	10nF	AnalogIn25		
GEM_In29	R446 100	ESD_Signal29	C464	10nF	AnalogIn29		
GEM_In33	R450 100	ESD_Signal33	C468	10nF	AnalogIn33		
GEM_In37	R454 100	ESD_Signal37	C472	10nF	AnalogIn37		
GEM_In41	R458 100	ESD_Signal41	C476	10nF	AnalogIn41		
GEM_In45	R462 100	ESD_Signal45	C480	10nF	AnalogIn45		
GEM_In49	R466 100	ESD_Signal49	C484	10nF	AnalogIn49		
GEM_In53	R470 100	ESD_Signal53	C488	10nF	AnalogIn53		
GEM_In57	R474 100	ESD_Signal57	C492	10nF	AnalogIn57		
GEM_In61	R478 100	ESD_Signal61	C496	10nF	AnalogIn61		

GEM_In2	R419 100	ESD_Signal2	C437	10nF	AnalogIn2		
GEM_In6	R423 100	ESD_Signal6	C441	10nF	AnalogIn6		
GEM_In10	R427 100	ESD_Signal10	C445	10nF	AnalogIn10		
GEM_In14	R431 100	ESD_Signal14	C449	10nF	AnalogIn14		
GEM_In18	R435 100	ESD_Signal18	C453	10nF	AnalogIn18		
GEM_In22	R439 100	ESD_Signal22	C457	10nF	AnalogIn22		
GEM_In26	R443 100	ESD_Signal26	C461	10nF	AnalogIn26		
GEM_In30	R447 100	ESD_Signal30	C465	10nF	AnalogIn30		
GEM_In34	R451 100	ESD_Signal34	C469	10nF	AnalogIn34		
GEM_In38	R455 100	ESD_Signal38	C473	10nF	AnalogIn38		
GEM_In42	R459 100	ESD_Signal42	C477	10nF	AnalogIn42		
GEM_In46	R463 100	ESD_Signal46	C481	10nF	AnalogIn46		
GEM_In50	R467 100	ESD_Signal50	C485	10nF	AnalogIn50		
GEM_In54	R471 100	ESD_Signal54	C489	10nF	AnalogIn54		
GEM_In58	R475 100	ESD_Signal58	C493	10nF	AnalogIn58		
GEM_In62	R479 100	ESD_Signal62	C497	10nF	AnalogIn62		

GEM_In3	R420 100	ESD_Signal3	C438	10nF	AnalogIn3		
GEM_In7	R424 100	ESD_Signal7	C442	10nF	AnalogIn7		
GEM_In11	R428 100	ESD_Signal11	C446	10nF	AnalogIn11		
GEM_In15	R432 100	ESD_Signal15	C450	10nF	AnalogIn15		
GEM_In19	R436 100	ESD_Signal19	C454	10nF	AnalogIn19		
GEM_In23	R440 100	ESD_Signal23	C458	10nF	AnalogIn23		
GEM_In27	R444 100	ESD_Signal27	C462	10nF	AnalogIn27		
GEM_In31	R448 100	ESD_Signal31	C466	10nF	AnalogIn31		
GEM_In35	R452 100	ESD_Signal35	C470	10nF	AnalogIn35		
GEM_In39	R456 100	ESD_Signal39	C474	10nF	AnalogIn39		
GEM_In43	R460 100	ESD_Signal43	C478	10nF	AnalogIn43		
GEM_In47	R464 100	ESD_Signal47	C482	10nF	AnalogIn47		
GEM_In51	R468 100	ESD_Signal51	C486	10nF	AnalogIn51		
GEM_In55	R472 100	ESD_Signal55	C490	10nF	AnalogIn55		
GEM_In59	R476 100	ESD_Signal59	C494	10nF	AnalogIn59		
GEM_In63	R480 100	ESD_Signal63	C498	10nF	AnalogIn63		

GEM_In4	R421 100	ESD_Signal4	C439	10nF	AnalogIn4		
GEM_In8	R425 100	ESD_Signal8	C443	10nF	AnalogIn8		
GEM_In12	R429 100	ESD_Signal12	C447	10nF	AnalogIn12		
GEM_In16	R433 100	ESD_Signal16	C451	10nF	AnalogIn16		
GEM_In20	R437 100	ESD_Signal20	C455	10nF	AnalogIn20		
GEM_In24	R441 100	ESD_Signal24	C459	10nF	AnalogIn24		
GEM_In28	R445 100	ESD_Signal28	C463	10nF	AnalogIn28		
GEM_In32	R449 100	ESD_Signal32	C467	10nF	AnalogIn32		
GEM_In36	R453 100	ESD_Signal36	C471	10nF	AnalogIn36		
GEM_In40	R457 100	ESD_Signal40	C475	10nF	AnalogIn40		
GEM_In44	R461 100	ESD_Signal44	C479	10nF	AnalogIn44		
GEM_In48	R465 100	ESD_Signal48	C483	10nF	AnalogIn48		
GEM_In52	R469 100	ESD_Signal52	C487	10nF	AnalogIn52		
GEM_In56	R473 100	ESD_Signal56	C491	10nF	AnalogIn56		
GEM_In60	R477 100	ESD_Signal60	C495	10nF	AnalogIn60		
GEM_In64	R481 100	ESD_Signal64	C499	10nF	AnalogIn64		

Title	SDHCal FEB		
Size	Document Number		Rev
Custom	ASIC B2 -- Analog In		V1.0
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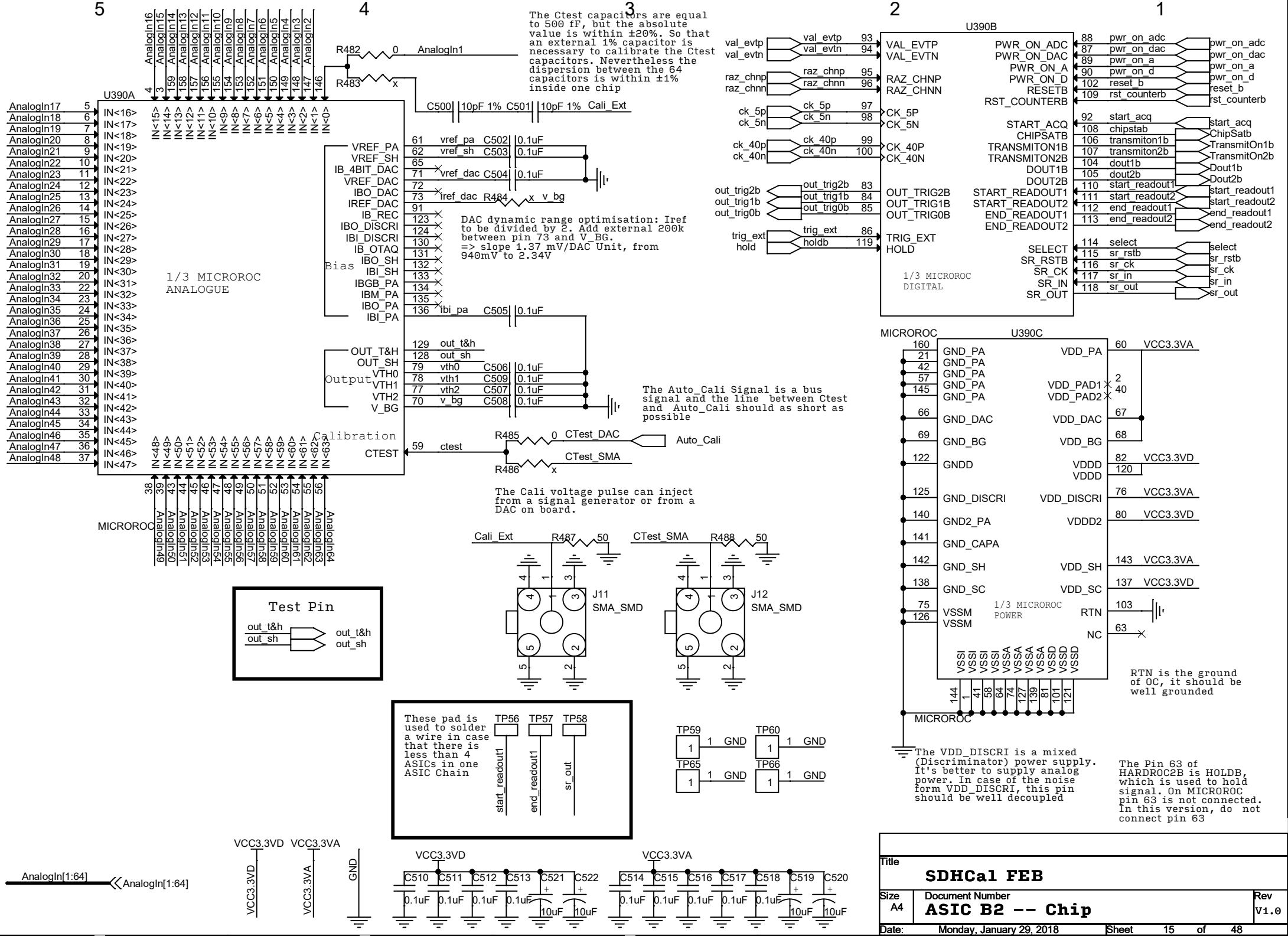
5
4
3
2
1
D
C
B
A
U390A
1/3 MICROROC
ANALOGUE
Bias
Output
Calibration
MICROROC
U390B
1/3 MICROROC
DIGITAL
U390C
1/3 MICROROC
POWER
MICROROC
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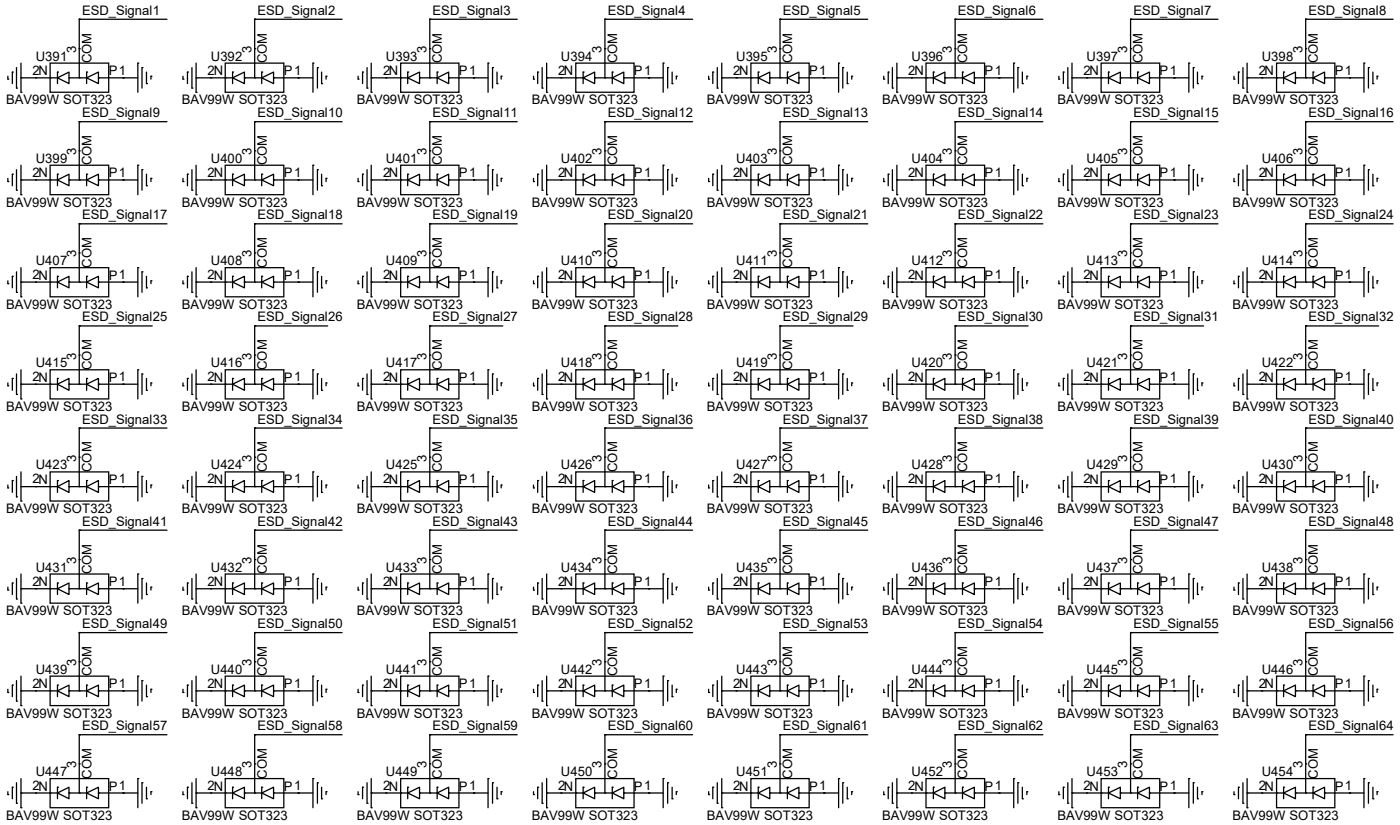
=> slope 1.37 mV/DAC Unit, from 940mV to 2.34V
The Auto_Cali Signal is a bus signal and the line between Ctest and Auto_Cali should as short as possible
The Cali voltage pulse can inject from a signal generator or from a DAC on board.
Test Pin
These pad is used to solder a wire in case that there is less than 4 ASICs in one ASIC Chain
RTN is the ground of OC, it should be well grounded
The VDD_DISCRI is a mixed (Discriminator) power supply. It's better to supply analog power. In case of the noise form VDD_DISCRI, this pin should be well decoupled
The Pin 63 of HARDROC2B is HOLDB, which is used to hold signal. On MICROROC pin 63 is not connected. In this version, do not connect pin 63
Title
SDHCal FEB
Size A4
Document Number
ASIC B2 -- Chip
Rev V1.0
Date: Monday, January 29, 2018
Sheet 15 of 48



AnalogIn[1:64] AnalogIn[1:64]

GEM_In[1:64] GEM_In[1:64]

VCC3.3VA

VCC3.3VA GND

GEM_In1	R501	100	ESD_Signal1	C523	10nF AnalogIn1	GEM_In2	R502	100	ESD_Signal2	C524	10nF AnalogIn2	GEM_In3	R503	100	ESD_Signal3	C525	10nF AnalogIn3	GEM_In4	R504	100	ESD_Signal4	C526	10nF AnalogIn4
GEM_In5	R505	100	ESD_Signal5	C527	10nF AnalogIn5	GEM_In6	R506	100	ESD_Signal6	C528	10nF AnalogIn6	GEM_In7	R507	100	ESD_Signal7	C529	10nF AnalogIn7	GEM_In8	R508	100	ESD_Signal8	C530	10nF AnalogIn8
GEM_In9	R509	100	ESD_Signal9	C531	10nF AnalogIn9	GEM_In10	R510	100	ESD_Signal10	C532	10nF AnalogIn10	GEM_In11	R511	100	ESD_Signal11	C533	10nF AnalogIn11	GEM_In12	R512	100	ESD_Signal12	C534	10nF AnalogIn12
GEM_In13	R513	100	ESD_Signal13	C535	10nF AnalogIn13	GEM_In14	R514	100	ESD_Signal14	C536	10nF AnalogIn14	GEM_In15	R515	100	ESD_Signal15	C537	10nF AnalogIn15	GEM_In16	R516	100	ESD_Signal16	C538	10nF AnalogIn16
GEM_In17	R517	100	ESD_Signal17	C539	10nF AnalogIn17	GEM_In18	R518	100	ESD_Signal18	C540	10nF AnalogIn18	GEM_In19	R519	100	ESD_Signal19	C541	10nF AnalogIn19	GEM_In20	R520	100	ESD_Signal20	C542	10nF AnalogIn20
GEM_In21	R521	100	ESD_Signal21	C543	10nF AnalogIn21	GEM_In22	R522	100	ESD_Signal22	C544	10nF AnalogIn22	GEM_In23	R523	100	ESD_Signal23	C545	10nF AnalogIn23	GEM_In24	R524	100	ESD_Signal24	C546	10nF AnalogIn24
GEM_In25	R525	100	ESD_Signal25	C547	10nF AnalogIn25	GEM_In26	R526	100	ESD_Signal26	C548	10nF AnalogIn26	GEM_In27	R527	100	ESD_Signal27	C549	10nF AnalogIn27	GEM_In28	R528	100	ESD_Signal28	C550	10nF AnalogIn28
GEM_In29	R529	100	ESD_Signal29	C551	10nF AnalogIn29	GEM_In30	R530	100	ESD_Signal30	C552	10nF AnalogIn30	GEM_In31	R531	100	ESD_Signal31	C553	10nF AnalogIn31	GEM_In32	R532	100	ESD_Signal32	C554	10nF AnalogIn32
GEM_In33	R533	100	ESD_Signal33	C555	10nF AnalogIn33	GEM_In34	R534	100	ESD_Signal34	C556	10nF AnalogIn34	GEM_In35	R535	100	ESD_Signal35	C557	10nF AnalogIn35	GEM_In36	R536	100	ESD_Signal36	C558	10nF AnalogIn36
GEM_In37	R537	100	ESD_Signal37	C559	10nF AnalogIn37	GEM_In38	R538	100	ESD_Signal38	C560	10nF AnalogIn38	GEM_In39	R539	100	ESD_Signal39	C561	10nF AnalogIn39	GEM_In40	R540	100	ESD_Signal40	C562	10nF AnalogIn40
GEM_In41	R541	100	ESD_Signal41	C563	10nF AnalogIn41	GEM_In42	R542	100	ESD_Signal42	C564	10nF AnalogIn42	GEM_In43	R543	100	ESD_Signal43	C565	10nF AnalogIn43	GEM_In44	R544	100	ESD_Signal44	C566	10nF AnalogIn44
GEM_In45	R545	100	ESD_Signal45	C567	10nF AnalogIn45	GEM_In46	R546	100	ESD_Signal46	C568	10nF AnalogIn46	GEM_In47	R547	100	ESD_Signal47	C569	10nF AnalogIn47	GEM_In48	R548	100	ESD_Signal48	C570	10nF AnalogIn48
GEM_In49	R549	100	ESD_Signal49	C571	10nF AnalogIn49	GEM_In50	R550	100	ESD_Signal50	C572	10nF AnalogIn50	GEM_In51	R551	100	ESD_Signal51	C573	10nF AnalogIn51	GEM_In52	R552	100	ESD_Signal52	C574	10nF AnalogIn52
GEM_In53	R553	100	ESD_Signal53	C575	10nF AnalogIn53	GEM_In54	R554	100	ESD_Signal54	C576	10nF AnalogIn54	GEM_In55	R555	100	ESD_Signal55	C577	10nF AnalogIn55	GEM_In56	R556	100	ESD_Signal56	C578	10nF AnalogIn56
GEM_In57	R557	100	ESD_Signal57	C579	10nF AnalogIn57	GEM_In58	R558	100	ESD_Signal58	C580	10nF AnalogIn58	GEM_In59	R559	100	ESD_Signal59	C581	10nF AnalogIn59	GEM_In60	R560	100	ESD_Signal60	C582	10nF AnalogIn60
GEM_In61	R561	100	ESD_Signal61	C583	10nF AnalogIn61	GEM_In62	R562	100	ESD_Signal62	C584	10nF AnalogIn62	GEM_In63	R563	100	ESD_Signal63	C585	10nF AnalogIn63	GEM_In64	R564	100	ESD_Signal64	C586	10nF AnalogIn64

Title	SDHCal FEB	
Size: Custom	Document Number: ASIC B3 -- Analog In	Rev: V1.0
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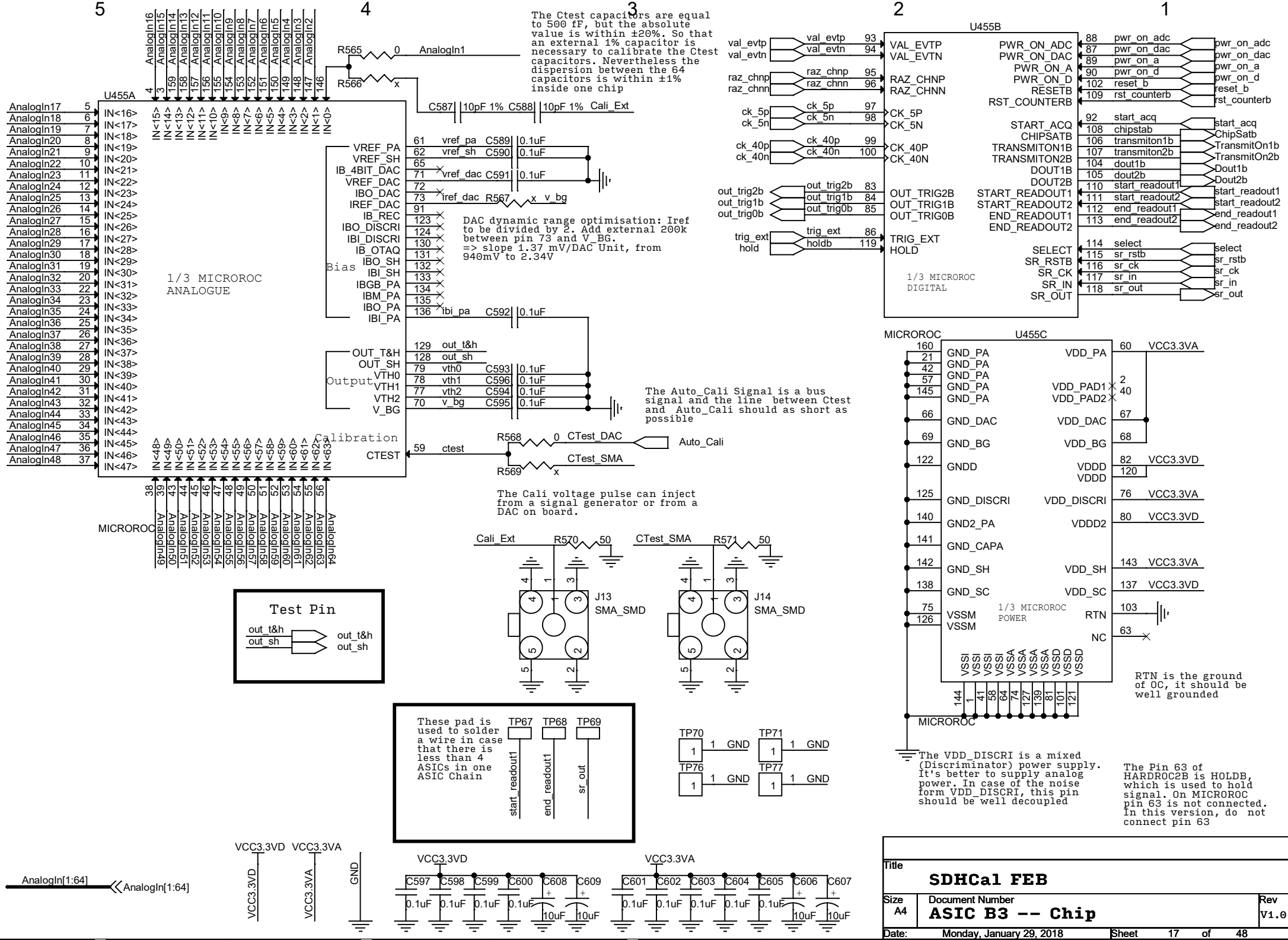
U455A
1/3 MICROROC ANALOGUE
Bias
Output
Calibration
MICROROC
U455B
1/3 MICROROC DIGITAL
U455C
1/3 MICROROC POWER
MICROROC
The Ctest capacitors are equal to 500 fF, but the absolute value is within ±20%. So that an external 1% capacitor is necessary to calibrate the Ctest capacitors. Nevertheless the dispersion between the 64 capacitors is within ±1% inside one chip
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Test Pin
These pad is used to solder a wire in case that there is less than 4 ASICs in one ASIC Chain
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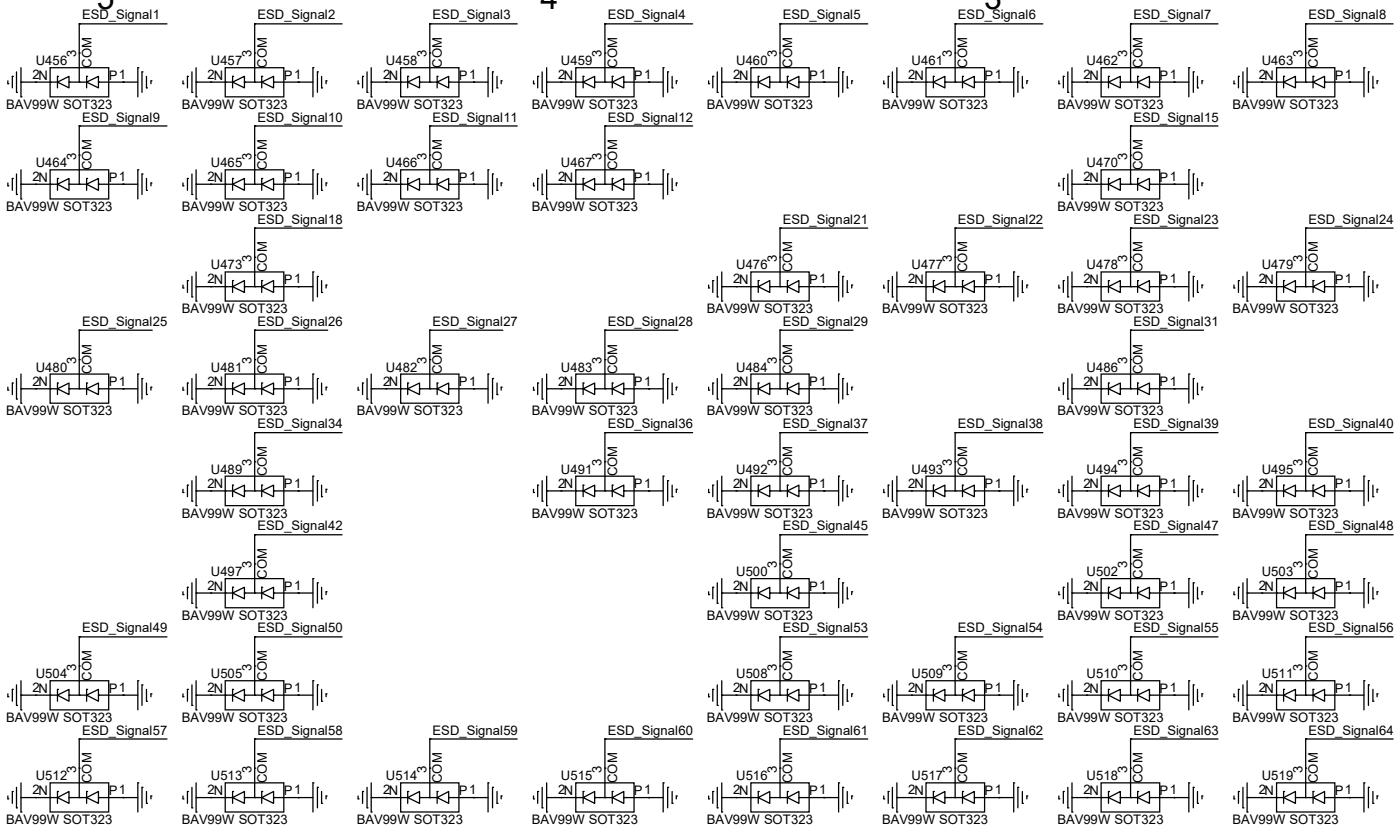
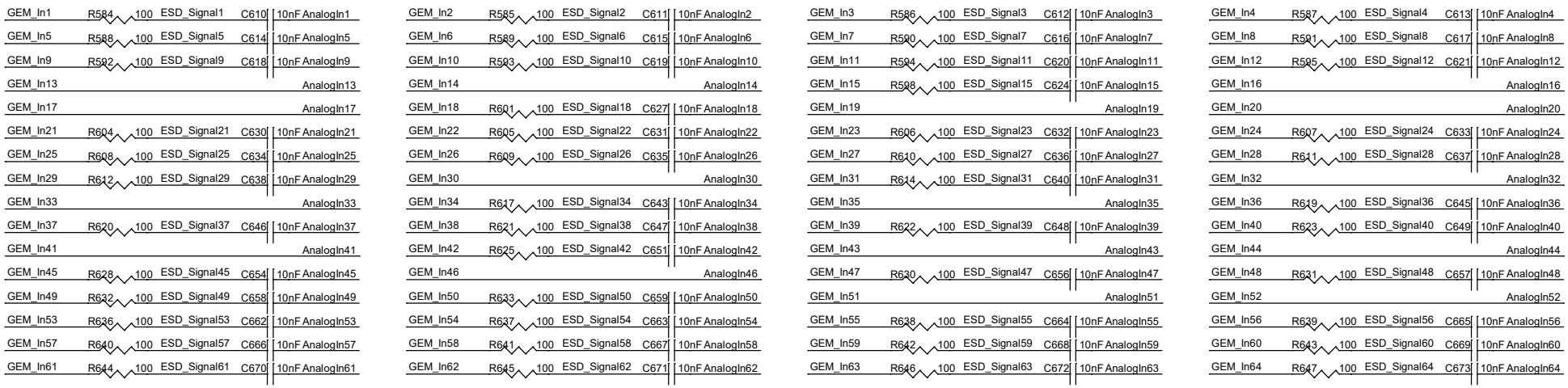
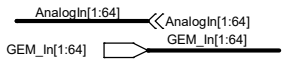
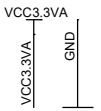
The Pin 63 of HARDROC2B is HOLDB, which is used to hold signal. On MICROROC pin 63 is not connected. In this version, do not connect pin 63
SDHCal FEB
ASIC B3 -- Chip
Monday, January 29, 2018

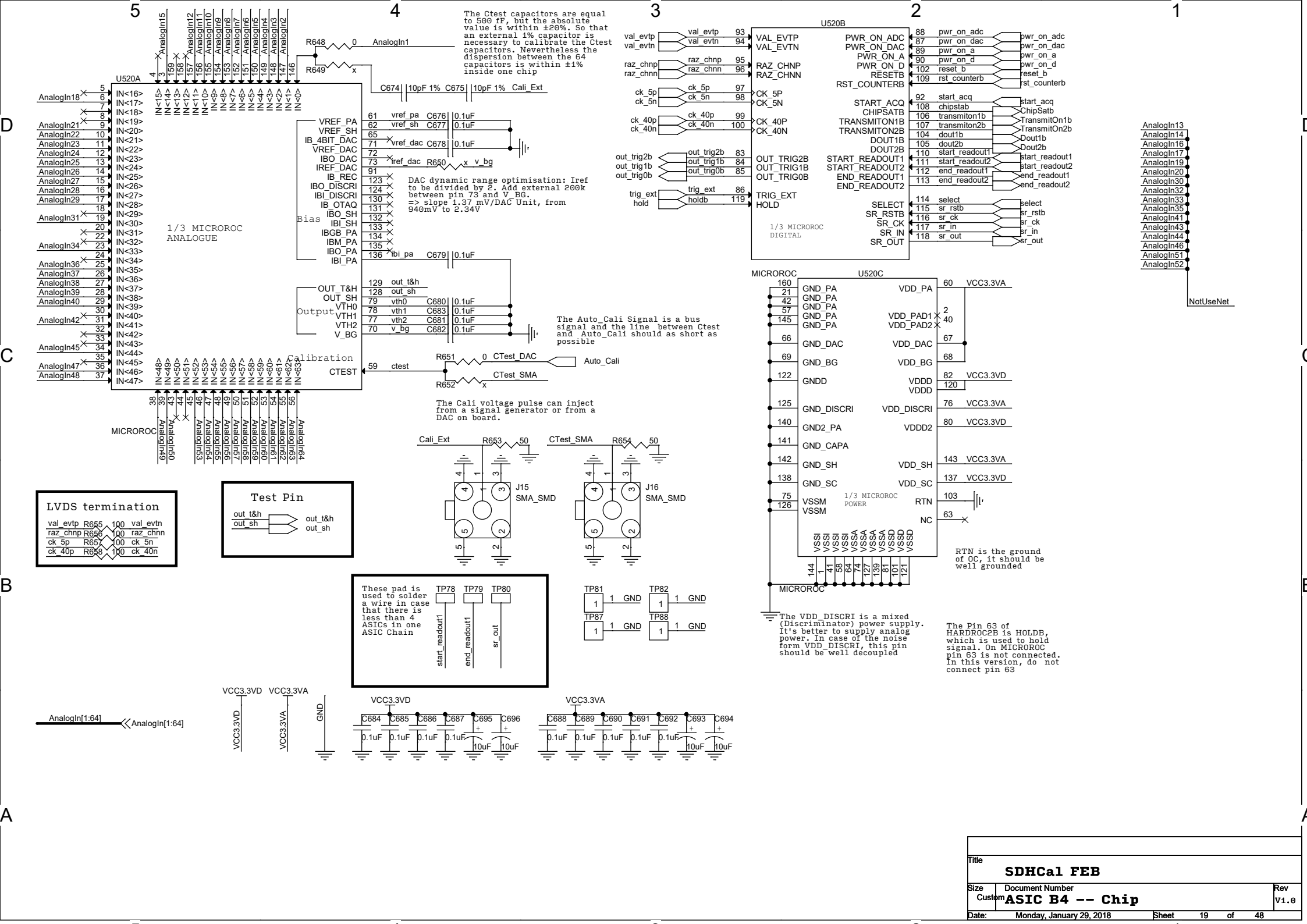








Title	SDHCal FEB	
Size: Custom	Document Number: ASIC B4 -- Analog In	Rev: V1.0
Date: Monday, January 29, 2018	Sheet 18 of 48	


U520A
1/3 MICROROC ANALOGUE
U520B
1/3 MICROROC DIGITAL
U520C
MICROROC
1/3 MICROROC POWER
Bias
Output
Calibration
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The Auto_Cali Signal is a bus signal and the line between Ctest and Auto_Cali should as short as possible
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LVDS termination
Test Pin
These pad is used to solder a wire in case that there is less than 4 ASICs in one ASIC Chain
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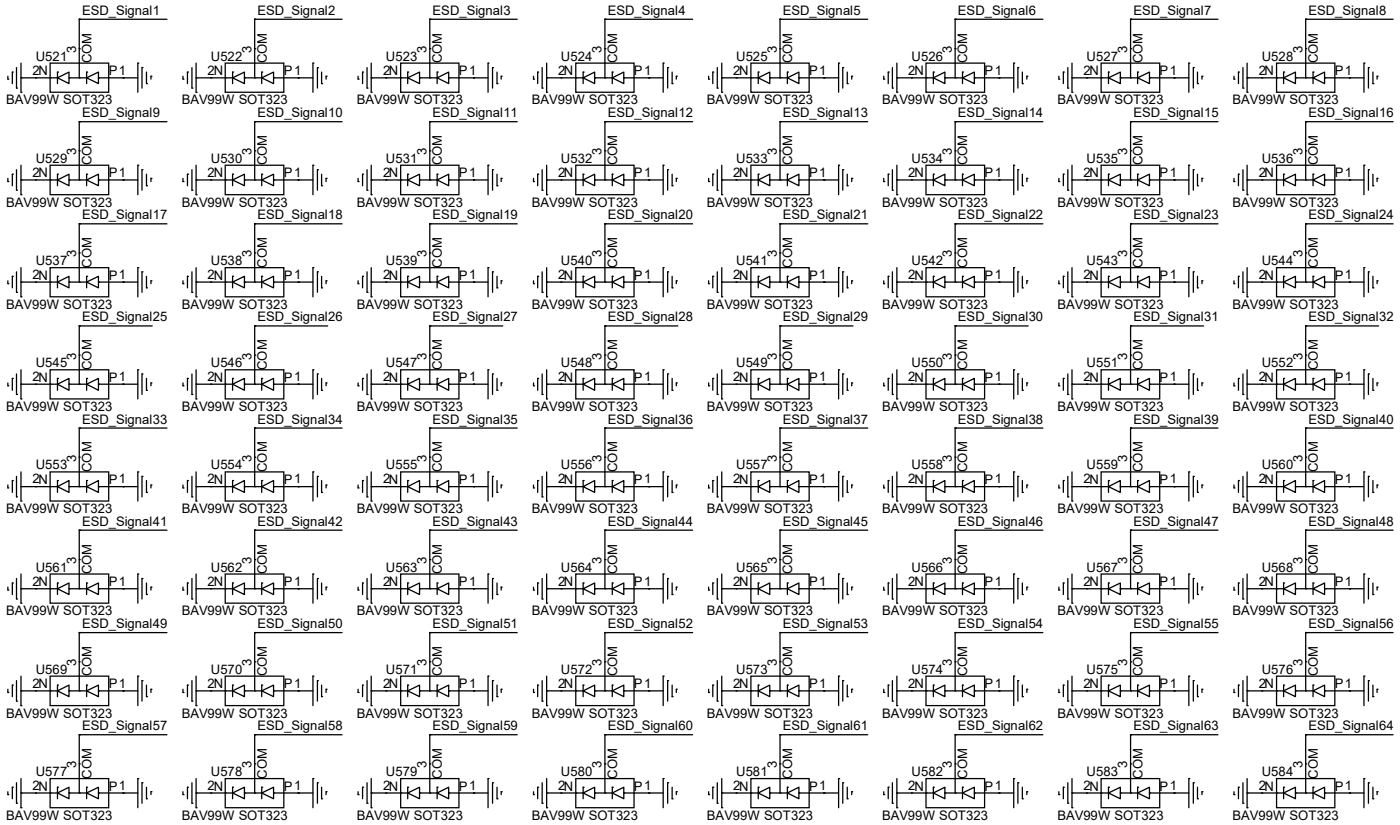
The VDD_DISCRI is a mixed (Discriminator) power supply. It's better to supply analog power. In case of the noise form VDD_DISCRI, this pin should be well decoupled
The Pin 63 of HARDROC2B is HOLDB, which is used to hold signal. On MICROROC pin 63 is not connected. In this version, do not connect pin 63
NotUseNet
SMA_SMD
Title
SDHCal FEB
Size
Custom
Document Number
ASIC B4 -- Chip
Rev
V1.0
Date:
Monday, January 29, 2018
Sheet
19
of
48



AnalogIn[1:64] AnalogIn[1:64]
GEM_In[1:64] GEM_In[1:64]

VCC3.3VA
VCC3.3VA GND

GEM_In1	R667	100	ESD_Signal1	C697	10nF AnalogIn1	GEM_In2	R668	100	ESD_Signal2	C698	10nF AnalogIn2	GEM_In3	R669	100	ESD_Signal3	C699	10nF AnalogIn3	GEM_In4	R670	100	ESD_Signal4	C700	10nF AnalogIn4
GEM_In5	R671	100	ESD_Signal5	C701	10nF AnalogIn5	GEM_In6	R672	100	ESD_Signal6	C702	10nF AnalogIn6	GEM_In7	R673	100	ESD_Signal7	C703	10nF AnalogIn7	GEM_In8	R674	100	ESD_Signal8	C704	10nF AnalogIn8
GEM_In9	R675	100	ESD_Signal9	C705	10nF AnalogIn9	GEM_In10	R676	100	ESD_Signal10	C706	10nF AnalogIn10	GEM_In11	R677	100	ESD_Signal11	C707	10nF AnalogIn11	GEM_In12	R678	100	ESD_Signal12	C708	10nF AnalogIn12
GEM_In13	R679	100	ESD_Signal13	C709	10nF AnalogIn13	GEM_In14	R680	100	ESD_Signal14	C710	10nF AnalogIn14	GEM_In15	R681	100	ESD_Signal15	C711	10nF AnalogIn15	GEM_In16	R682	100	ESD_Signal16	C712	10nF AnalogIn16
GEM_In17	R683	100	ESD_Signal17	C713	10nF AnalogIn17	GEM_In18	R684	100	ESD_Signal18	C714	10nF AnalogIn18	GEM_In19	R685	100	ESD_Signal19	C715	10nF AnalogIn19	GEM_In20	R686	100	ESD_Signal20	C716	10nF AnalogIn20
GEM_In21	R687	100	ESD_Signal21	C717	10nF AnalogIn21	GEM_In22	R688	100	ESD_Signal22	C718	10nF AnalogIn22	GEM_In23	R689	100	ESD_Signal23	C719	10nF AnalogIn23	GEM_In24	R690	100	ESD_Signal24	C720	10nF AnalogIn24
GEM_In25	R691	100	ESD_Signal25	C721	10nF AnalogIn25	GEM_In26	R692	100	ESD_Signal26	C722	10nF AnalogIn26	GEM_In27	R693	100	ESD_Signal27	C723	10nF AnalogIn27	GEM_In28	R694	100	ESD_Signal28	C724	10nF AnalogIn28
GEM_In29	R695	100	ESD_Signal29	C725	10nF AnalogIn29	GEM_In30	R696	100	ESD_Signal30	C726	10nF AnalogIn30	GEM_In31	R697	100	ESD_Signal31	C727	10nF AnalogIn31	GEM_In32	R698	100	ESD_Signal32	C728	10nF AnalogIn32
GEM_In33	R699	100	ESD_Signal33	C729	10nF AnalogIn33	GEM_In34	R700	100	ESD_Signal34	C730	10nF AnalogIn34	GEM_In35	R701	100	ESD_Signal35	C731	10nF AnalogIn35	GEM_In36	R702	100	ESD_Signal36	C732	10nF AnalogIn36
GEM_In37	R703	100	ESD_Signal37	C733	10nF AnalogIn37	GEM_In38	R704	100	ESD_Signal38	C734	10nF AnalogIn38	GEM_In39	R705	100	ESD_Signal39	C735	10nF AnalogIn39	GEM_In40	R706	100	ESD_Signal40	C736	10nF AnalogIn40
GEM_In41	R707	100	ESD_Signal41	C737	10nF AnalogIn41	GEM_In42	R708	100	ESD_Signal42	C738	10nF AnalogIn42	GEM_In43	R709	100	ESD_Signal43	C739	10nF AnalogIn43	GEM_In44	R710	100	ESD_Signal44	C740	10nF AnalogIn44
GEM_In45	R711	100	ESD_Signal45	C741	10nF AnalogIn45	GEM_In46	R712	100	ESD_Signal46	C742	10nF AnalogIn46	GEM_In47	R713	100	ESD_Signal47	C743	10nF AnalogIn47	GEM_In48	R714	100	ESD_Signal48	C744	10nF AnalogIn48
GEM_In49	R715	100	ESD_Signal49	C745	10nF AnalogIn49	GEM_In50	R716	100	ESD_Signal50	C746	10nF AnalogIn50	GEM_In51	R717	100	ESD_Signal51	C747	10nF AnalogIn51	GEM_In52	R718	100	ESD_Signal52	C748	10nF AnalogIn52
GEM_In53	R719	100	ESD_Signal53	C749	10nF AnalogIn53	GEM_In54	R720	100	ESD_Signal54	C750	10nF AnalogIn54	GEM_In55	R721	100	ESD_Signal55	C751	10nF AnalogIn55	GEM_In56	R722	100	ESD_Signal56	C752	10nF AnalogIn56
GEM_In57	R723	100	ESD_Signal57	C753	10nF AnalogIn57	GEM_In58	R724	100	ESD_Signal58	C754	10nF AnalogIn58	GEM_In59	R725	100	ESD_Signal59	C755	10nF AnalogIn59	GEM_In60	R726	100	ESD_Signal60	C756	10nF AnalogIn60
GEM_In61	R727	100	ESD_Signal61	C757	10nF AnalogIn61	GEM_In62	R728	100	ESD_Signal62	C758	10nF AnalogIn62	GEM_In63	R729	100	ESD_Signal63	C759	10nF AnalogIn63	GEM_In64	R730	100	ESD_Signal64	C760	10nF AnalogIn64

Title	SDHCal FEB	
Size: Custom	Document Number: ASIC C1 -- Analog In	Rev: V1.0
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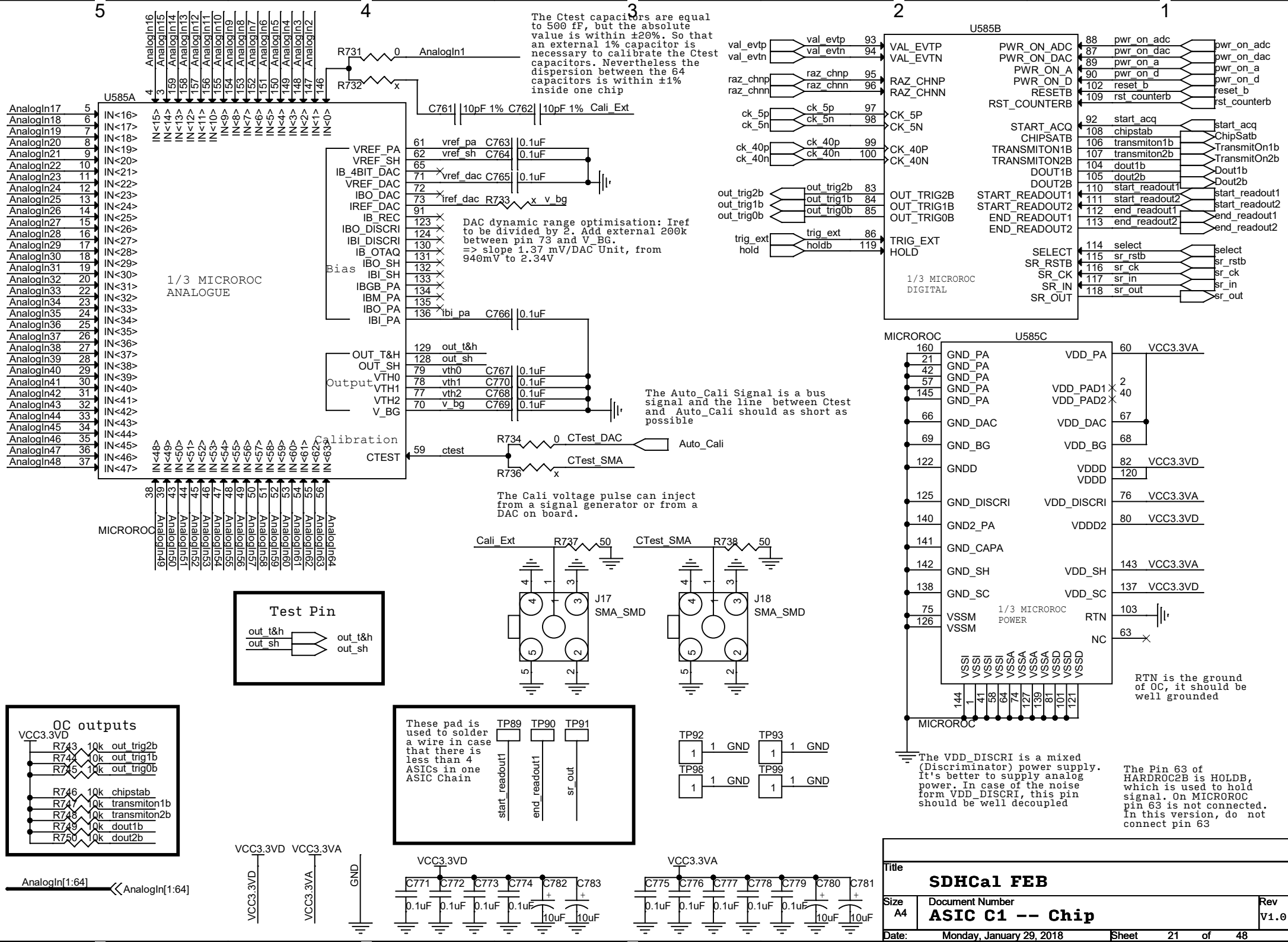
U585A
1/3 MICROROC ANALOGUE
Bias
Output
Calibration
MICROROC
The Ctest capacitors are equal to 500 fF, but the absolute value is within ±20%. So that an external 1% capacitor is necessary to calibrate the Ctest capacitors. Nevertheless the dispersion between the 64 capacitors is within ±1% inside one chip
DAC dynamic range optimisation: Iref to be divided by 2. Add external 200k between pin 73 and V_BG. => slope 1.37 mV/DAC Unit, from 940mV to 2.34V
The Auto_Cali Signal is a bus signal and the line between Ctest and Auto_Cali should as short as possible
The Cali voltage pulse can inject from a signal generator or from a DAC on board.
U585B
1/3 MICROROC DIGITAL
U585C
MICROROC
1/3 MICROROC POWER
RTN is the ground of OC, it should be well grounded
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Test Pin
OC outputs
These pad is used to solder a wire in case that there is less than 4 ASICs in one ASIC Chain
Title
SDHCal FEB
Size A4
Document Number
ASIC C1 -- Chip
Rev V1.0
Date: Monday, January 29, 2018
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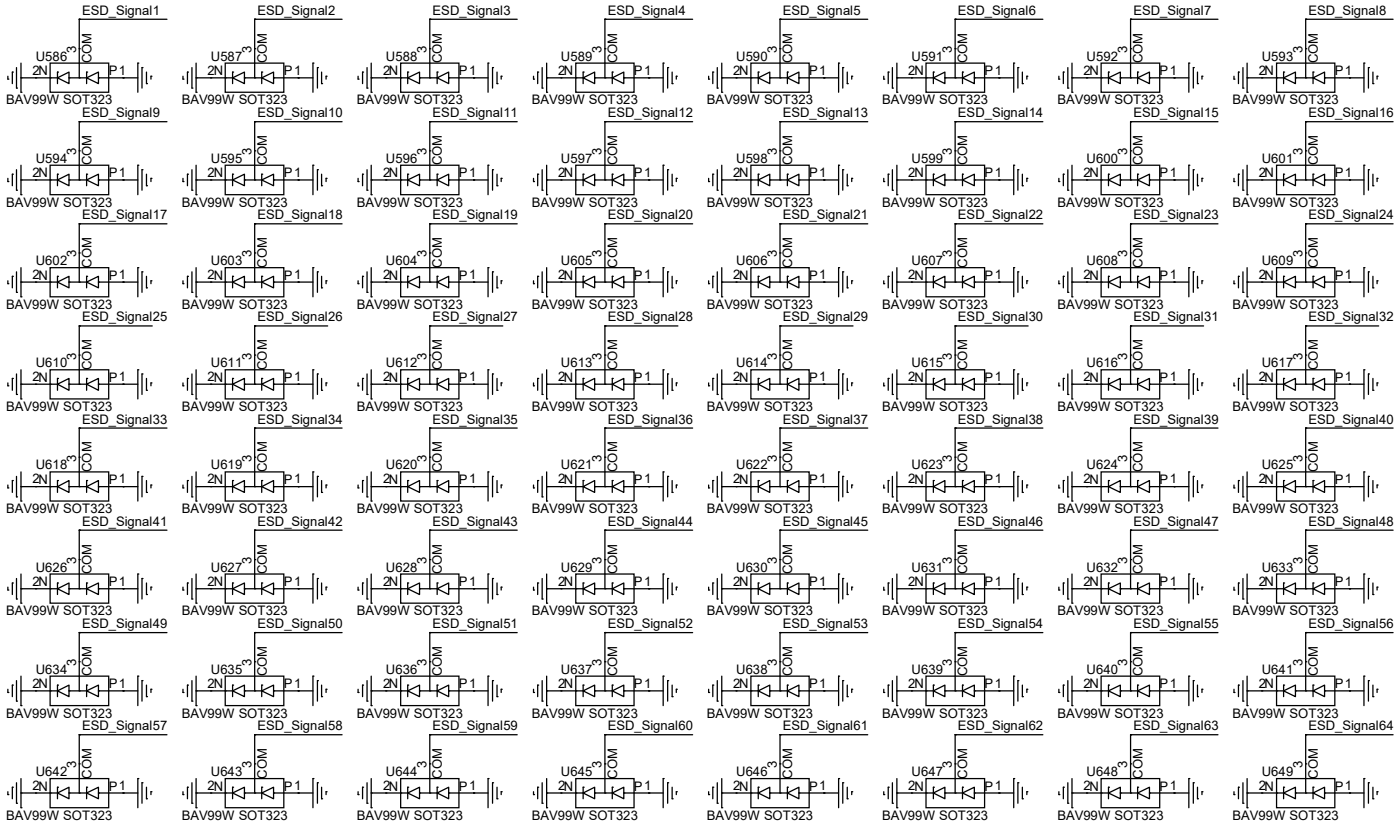

AnalogIn[1:64] AnalogIn[1:64]
GEM_In[1:64] GEM_In[1:64]

VCC3.3VA
VCC3.3VA GND

GEM_In1	R751	100	ESD_Signal1	C784	10nF AnalogIn1	GEM_In2	R752	100	ESD_Signal2	C785	10nF AnalogIn2	GEM_In3	R753	100	ESD_Signal3	C786	10nF AnalogIn3	GEM_In4	R754	100	ESD_Signal4	C787	10nF AnalogIn4
GEM_In5	R755	100	ESD_Signal5	C788	10nF AnalogIn5	GEM_In6	R756	100	ESD_Signal6	C789	10nF AnalogIn6	GEM_In7	R757	100	ESD_Signal7	C790	10nF AnalogIn7	GEM_In8	R758	100	ESD_Signal8	C791	10nF AnalogIn8
GEM_In9	R759	100	ESD_Signal9	C792	10nF AnalogIn9	GEM_In10	R760	100	ESD_Signal10	C793	10nF AnalogIn10	GEM_In11	R761	100	ESD_Signal11	C794	10nF AnalogIn11	GEM_In12	R762	100	ESD_Signal12	C795	10nF AnalogIn12
GEM_In13	R763	100	ESD_Signal13	C796	10nF AnalogIn13	GEM_In14	R764	100	ESD_Signal14	C797	10nF AnalogIn14	GEM_In15	R765	100	ESD_Signal15	C798	10nF AnalogIn15	GEM_In16	R766	100	ESD_Signal16	C799	10nF AnalogIn16
GEM_In17	R767	100	ESD_Signal17	C800	10nF AnalogIn17	GEM_In18	R768	100	ESD_Signal18	C801	10nF AnalogIn18	GEM_In19	R769	100	ESD_Signal19	C802	10nF AnalogIn19	GEM_In20	R770	100	ESD_Signal20	C803	10nF AnalogIn20
GEM_In21	R771	100	ESD_Signal21	C804	10nF AnalogIn21	GEM_In22	R772	100	ESD_Signal22	C805	10nF AnalogIn22	GEM_In23	R773	100	ESD_Signal23	C806	10nF AnalogIn23	GEM_In24	R774	100	ESD_Signal24	C807	10nF AnalogIn24
GEM_In25	R775	100	ESD_Signal25	C808	10nF AnalogIn25	GEM_In26	R776	100	ESD_Signal26	C809	10nF AnalogIn26	GEM_In27	R777	100	ESD_Signal27	C810	10nF AnalogIn27	GEM_In28	R778	100	ESD_Signal28	C811	10nF AnalogIn28
GEM_In29	R779	100	ESD_Signal29	C812	10nF AnalogIn29	GEM_In30	R780	100	ESD_Signal30	C813	10nF AnalogIn30	GEM_In31	R781	100	ESD_Signal31	C814	10nF AnalogIn31	GEM_In32	R782	100	ESD_Signal32	C815	10nF AnalogIn32
GEM_In33	R783	100	ESD_Signal33	C816	10nF AnalogIn33	GEM_In34	R784	100	ESD_Signal34	C817	10nF AnalogIn34	GEM_In35	R785	100	ESD_Signal35	C818	10nF AnalogIn35	GEM_In36	R786	100	ESD_Signal36	C819	10nF AnalogIn36
GEM_In37	R787	100	ESD_Signal37	C820	10nF AnalogIn37	GEM_In38	R788	100	ESD_Signal38	C821	10nF AnalogIn38	GEM_In39	R789	100	ESD_Signal39	C822	10nF AnalogIn39	GEM_In40	R790	100	ESD_Signal40	C823	10nF AnalogIn40
GEM_In41	R791	100	ESD_Signal41	C824	10nF AnalogIn41	GEM_In42	R792	100	ESD_Signal42	C825	10nF AnalogIn42	GEM_In43	R793	100	ESD_Signal43	C826	10nF AnalogIn43	GEM_In44	R794	100	ESD_Signal44	C827	10nF AnalogIn44
GEM_In45	R795	100	ESD_Signal45	C828	10nF AnalogIn45	GEM_In46	R796	100	ESD_Signal46	C829	10nF AnalogIn46	GEM_In47	R797	100	ESD_Signal47	C830	10nF AnalogIn47	GEM_In48	R798	100	ESD_Signal48	C831	10nF AnalogIn48
GEM_In49	R799	100	ESD_Signal49	C832	10nF AnalogIn49	GEM_In50	R800	100	ESD_Signal50	C833	10nF AnalogIn50	GEM_In51	R801	100	ESD_Signal51	C834	10nF AnalogIn51	GEM_In52	R802	100	ESD_Signal52	C835	10nF AnalogIn52
GEM_In53	R803	100	ESD_Signal53	C836	10nF AnalogIn53	GEM_In54	R804	100	ESD_Signal54	C837	10nF AnalogIn54	GEM_In55	R805	100	ESD_Signal55	C838	10nF AnalogIn55	GEM_In56	R806	100	ESD_Signal56	C839	10nF AnalogIn56
GEM_In57	R807	100	ESD_Signal57	C840	10nF AnalogIn57	GEM_In58	R808	100	ESD_Signal58	C841	10nF AnalogIn58	GEM_In59	R809	100	ESD_Signal59	C842	10nF AnalogIn59	GEM_In60	R810	100	ESD_Signal60	C843	10nF AnalogIn60
GEM_In61	R811	100	ESD_Signal61	C844	10nF AnalogIn61	GEM_In62	R812	100	ESD_Signal62	C845	10nF AnalogIn62	GEM_In63	R813	100	ESD_Signal63	C846	10nF AnalogIn63	GEM_In64	R814	100	ESD_Signal64	C847	10nF AnalogIn64

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Size: Custom	Document Number: ASIC C2 -- Analog In	Rev: V1.0
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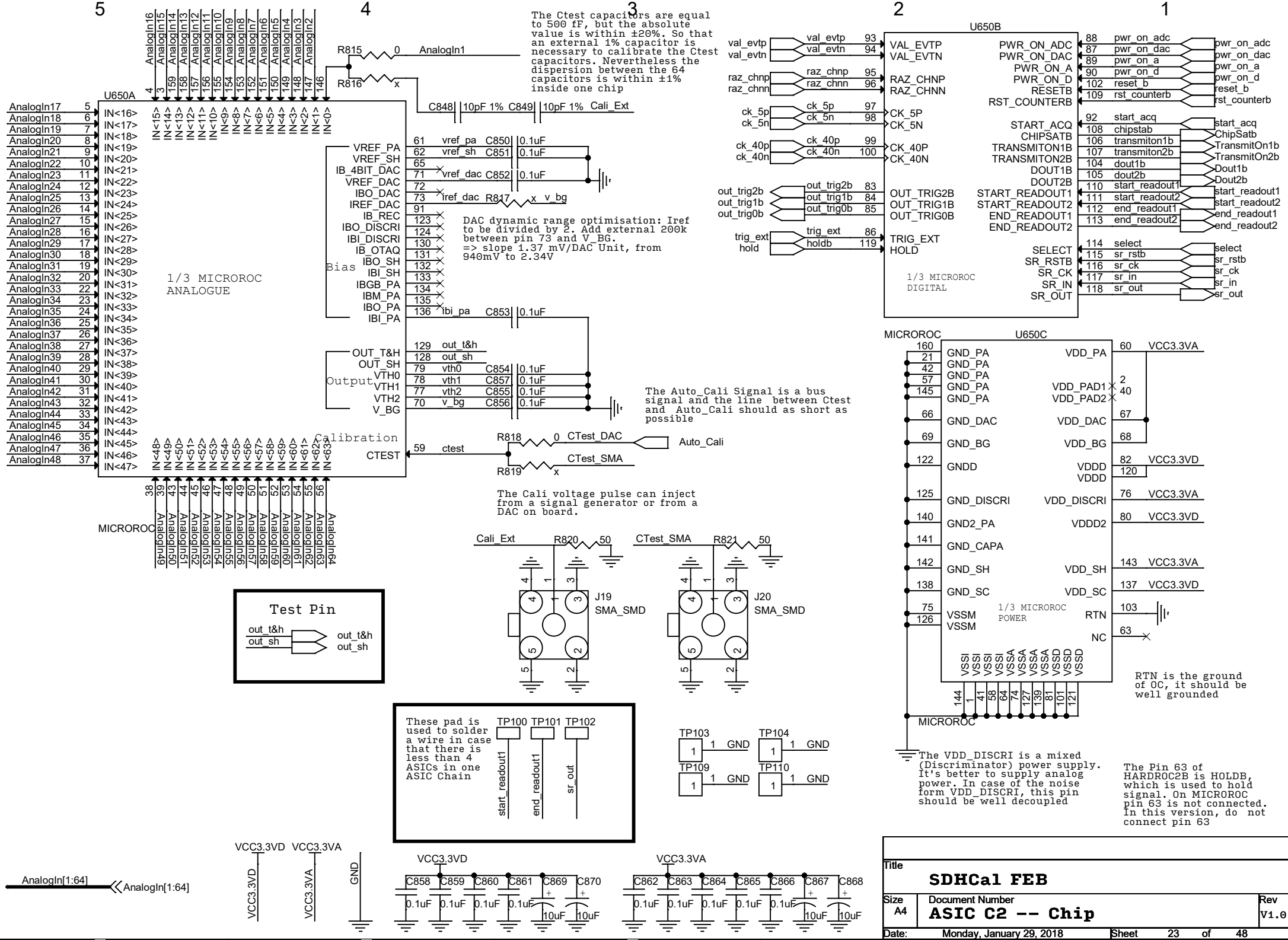
U650A
1/3 MICROROC ANALOGUE
Bias
Output
Calibration
MICROROC
U650B
1/3 MICROROC DIGITAL
U650C
1/3 MICROROC POWER
MICROROC
The Ctest capacitors are equal to 500 fF, but the absolute value is within ±20%. So that an external 1% capacitor is necessary to calibrate the Ctest capacitors. Nevertheless the dispersion between the 64 capacitors is within ±1% inside one chip
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The Cali voltage pulse can inject from a signal generator or from a DAC on board.
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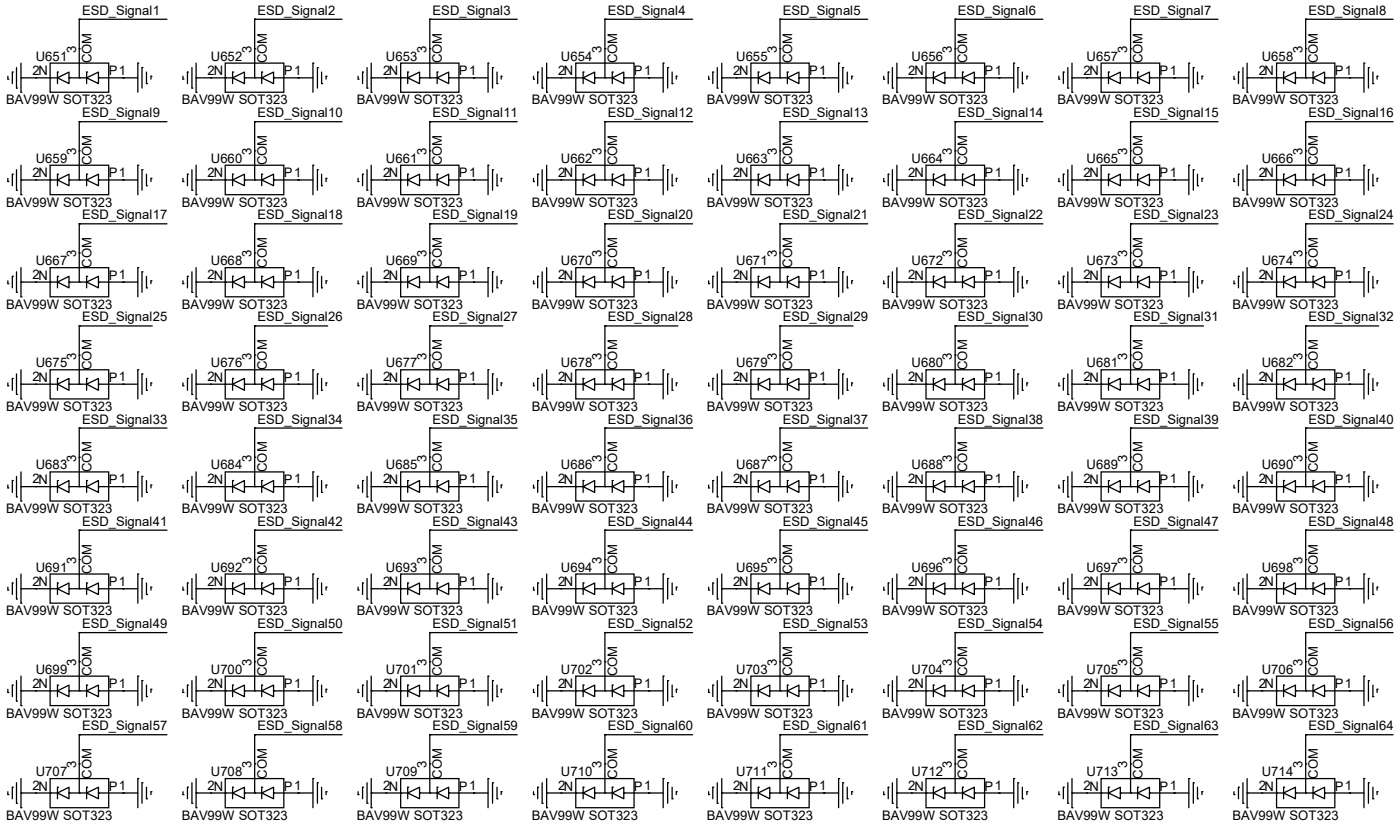
SDHCal FEB
ASIC C2 -- Chip
Monday, January 29, 2018



AnalogIn[1:64] AnalogIn[1:64]

GEM_In[1:64] GEM_In[1:64]

VCC3.3VA

VCC3.3VA GND

GEM_In1	R834 100	ESD_Signal1	C871	10nF	AnalogIn1		
GEM_In5	R838 100	ESD_Signal5	C875	10nF	AnalogIn5		
GEM_In9	R842 100	ESD_Signal9	C879	10nF	AnalogIn9		
GEM_In13	R846 100	ESD_Signal13	C883	10nF	AnalogIn13		
GEM_In17	R850 100	ESD_Signal17	C887	10nF	AnalogIn17		
GEM_In21	R854 100	ESD_Signal21	C891	10nF	AnalogIn21		
GEM_In25	R858 100	ESD_Signal25	C895	10nF	AnalogIn25		
GEM_In29	R862 100	ESD_Signal29	C899	10nF	AnalogIn29		
GEM_In33	R866 100	ESD_Signal33	C903	10nF	AnalogIn33		
GEM_In37	R870 100	ESD_Signal37	C907	10nF	AnalogIn37		
GEM_In41	R874 100	ESD_Signal41	C911	10nF	AnalogIn41		
GEM_In45	R878 100	ESD_Signal45	C915	10nF	AnalogIn45		
GEM_In49	R882 100	ESD_Signal49	C919	10nF	AnalogIn49		
GEM_In53	R886 100	ESD_Signal53	C923	10nF	AnalogIn53		
GEM_In57	R890 100	ESD_Signal57	C927	10nF	AnalogIn57		
GEM_In61	R894 100	ESD_Signal61	C931	10nF	AnalogIn61		

GEM_In2	R835 100	ESD_Signal2	C872	10nF	AnalogIn2		
GEM_In6	R839 100	ESD_Signal6	C876	10nF	AnalogIn6		
GEM_In10	R843 100	ESD_Signal10	C880	10nF	AnalogIn10		
GEM_In14	R847 100	ESD_Signal14	C884	10nF	AnalogIn14		
GEM_In18	R851 100	ESD_Signal18	C888	10nF	AnalogIn18		
GEM_In22	R855 100	ESD_Signal22	C892	10nF	AnalogIn22		
GEM_In26	R859 100	ESD_Signal26	C896	10nF	AnalogIn26		
GEM_In30	R863 100	ESD_Signal30	C900	10nF	AnalogIn30		
GEM_In34	R867 100	ESD_Signal34	C904	10nF	AnalogIn34		
GEM_In38	R871 100	ESD_Signal38	C908	10nF	AnalogIn38		
GEM_In42	R875 100	ESD_Signal42	C912	10nF	AnalogIn42		
GEM_In46	R879 100	ESD_Signal46	C916	10nF	AnalogIn46		
GEM_In50	R883 100	ESD_Signal50	C920	10nF	AnalogIn50		
GEM_In54	R887 100	ESD_Signal54	C924	10nF	AnalogIn54		
GEM_In58	R891 100	ESD_Signal58	C928	10nF	AnalogIn58		
GEM_In62	R895 100	ESD_Signal62	C932	10nF	AnalogIn62		

GEM_In3	R836 100	ESD_Signal3	C873	10nF	AnalogIn3		
GEM_In7	R840 100	ESD_Signal7	C877	10nF	AnalogIn7		
GEM_In11	R844 100	ESD_Signal11	C881	10nF	AnalogIn11		
GEM_In15	R848 100	ESD_Signal15	C885	10nF	AnalogIn15		
GEM_In19	R852 100	ESD_Signal19	C889	10nF	AnalogIn19		
GEM_In23	R856 100	ESD_Signal23	C893	10nF	AnalogIn23		
GEM_In27	R860 100	ESD_Signal27	C897	10nF	AnalogIn27		
GEM_In31	R864 100	ESD_Signal31	C901	10nF	AnalogIn31		
GEM_In35	R868 100	ESD_Signal35	C905	10nF	AnalogIn35		
GEM_In39	R872 100	ESD_Signal39	C909	10nF	AnalogIn39		
GEM_In43	R876 100	ESD_Signal43	C913	10nF	AnalogIn43		
GEM_In47	R880 100	ESD_Signal47	C917	10nF	AnalogIn47		
GEM_In51	R884 100	ESD_Signal51	C921	10nF	AnalogIn51		
GEM_In55	R888 100	ESD_Signal55	C925	10nF	AnalogIn55		
GEM_In59	R892 100	ESD_Signal59	C929	10nF	AnalogIn59		
GEM_In63	R896 100	ESD_Signal63	C933	10nF	AnalogIn63		

GEM_In4	R837 100	ESD_Signal4	C874	10nF	AnalogIn4		
GEM_In8	R841 100	ESD_Signal8	C878	10nF	AnalogIn8		
GEM_In12	R845 100	ESD_Signal12	C882	10nF	AnalogIn12		
GEM_In16	R849 100	ESD_Signal16	C886	10nF	AnalogIn16		
GEM_In20	R853 100	ESD_Signal20	C890	10nF	AnalogIn20		
GEM_In24	R857 100	ESD_Signal24	C894	10nF	AnalogIn24		
GEM_In28	R861 100	ESD_Signal28	C898	10nF	AnalogIn28		
GEM_In32	R865 100	ESD_Signal32	C902	10nF	AnalogIn32		
GEM_In36	R869 100	ESD_Signal36	C906	10nF	AnalogIn36		
GEM_In40	R873 100	ESD_Signal40	C910	10nF	AnalogIn40		
GEM_In44	R877 100	ESD_Signal44	C914	10nF	AnalogIn44		
GEM_In48	R881 100	ESD_Signal48	C918	10nF	AnalogIn48		
GEM_In52	R885 100	ESD_Signal52	C922	10nF	AnalogIn52		
GEM_In56	R889 100	ESD_Signal56	C926	10nF	AnalogIn56		
GEM_In60	R893 100	ESD_Signal60	C930	10nF	AnalogIn60		
GEM_In64	R897 100	ESD_Signal64	C934	10nF	AnalogIn64		

Title	SDHCal FEB		
Size: Custom	Document Number: ASIC C3 -- Analog In		Rev: V1.0
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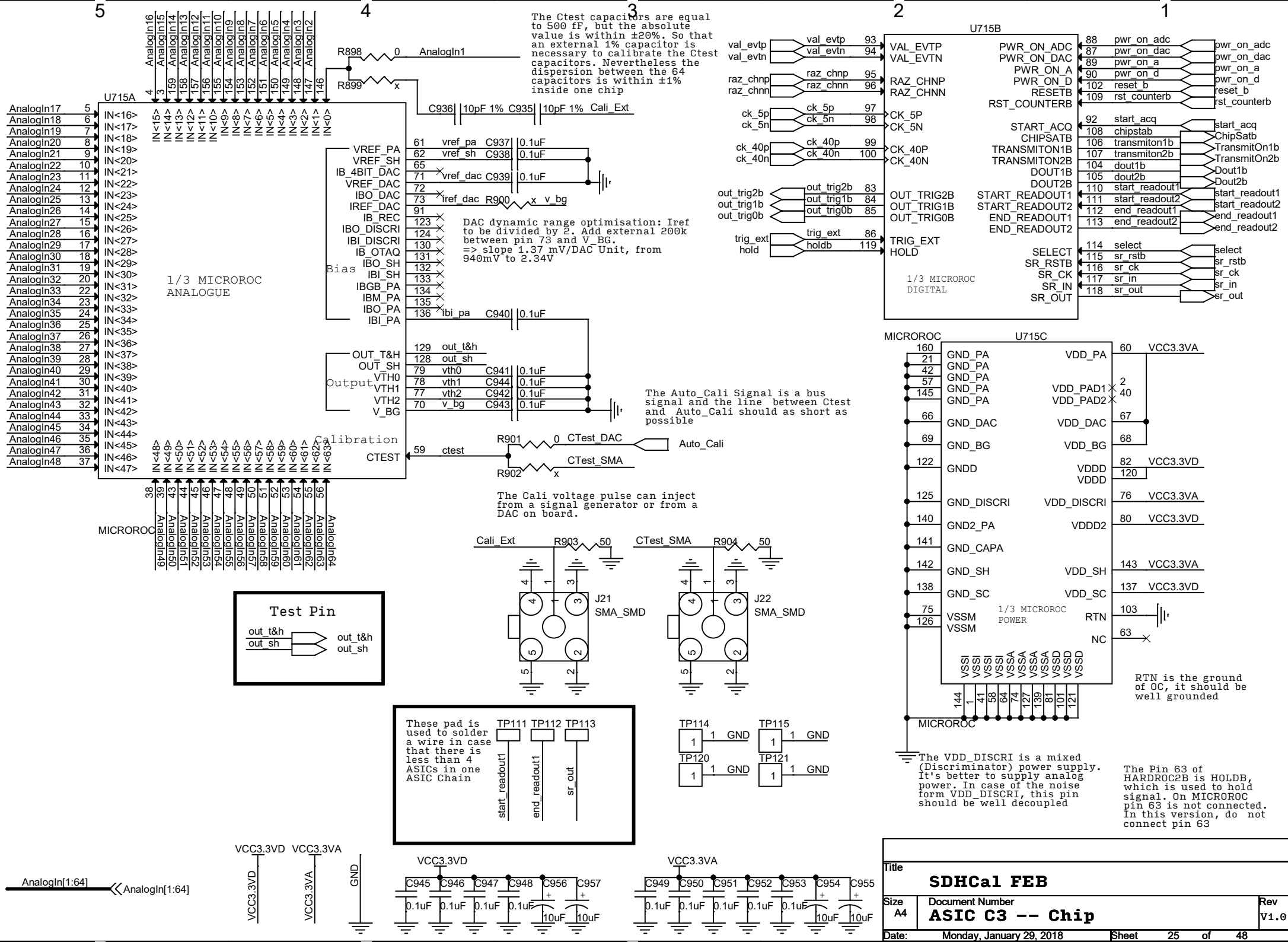
U715A
1/3 MICROROC ANALOGUE
Bias
Output
Calibration
MICROROC
U715B
1/3 MICROROC DIGITAL
U715C
1/3 MICROROC POWER
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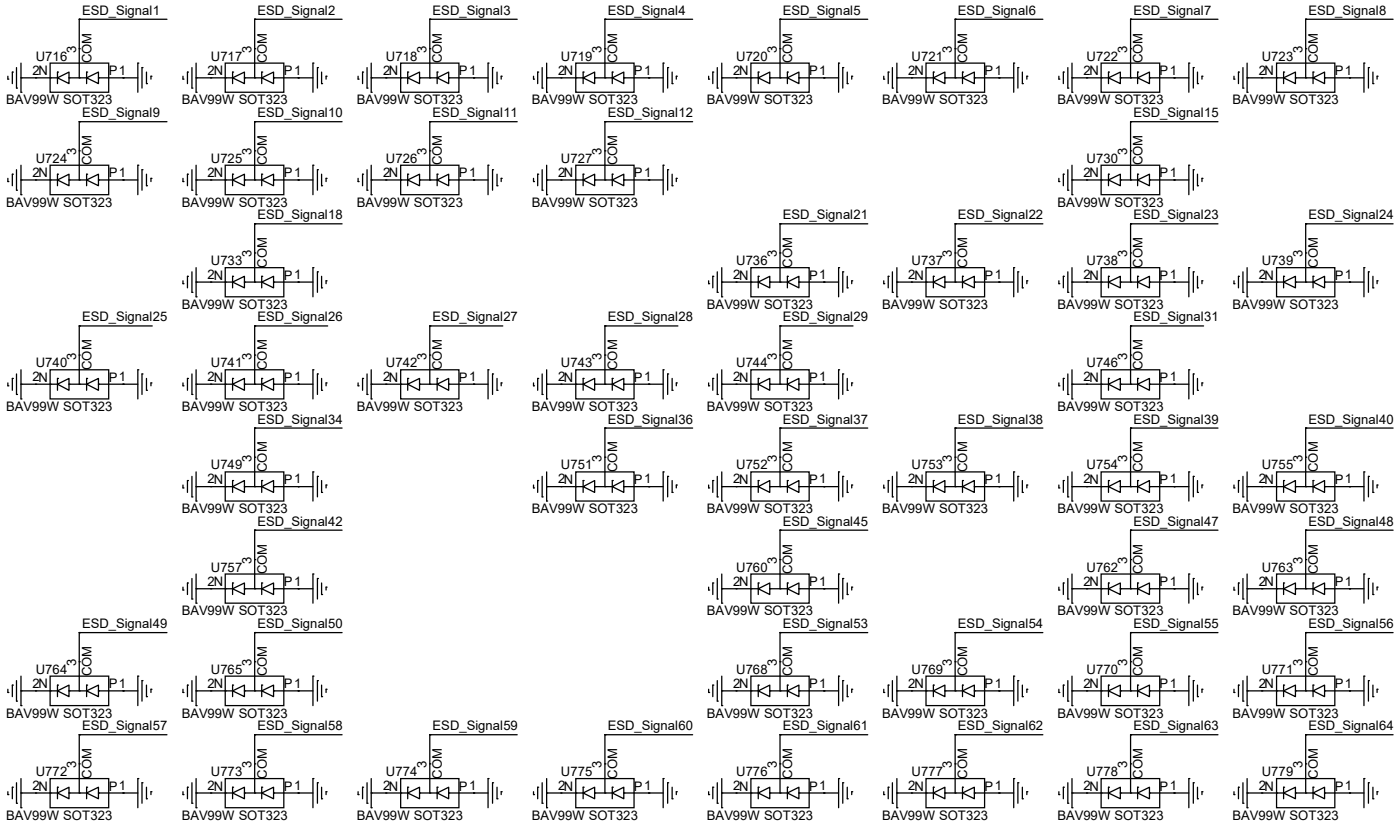
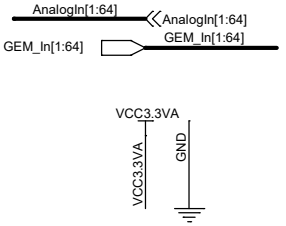
SDHCal FEB
ASIC C3 -- Chip
Monday, January 29, 2018





GEM_In1	R917	100	ESD_Signal1	C958	10nF	AnalogIn1	GEM_In2	R918	100	ESD_Signal2	C959	10nF	AnalogIn2	GEM_In3	R919	100	ESD_Signal3	C960	10nF	AnalogIn3	GEM_In4	R920	100	ESD_Signal4	C961	10nF	AnalogIn4
GEM_In5	R921	100	ESD_Signal5	C962	10nF	AnalogIn5	GEM_In6	R922	100	ESD_Signal6	C963	10nF	AnalogIn6	GEM_In7	R923	100	ESD_Signal7	C964	10nF	AnalogIn7	GEM_In8	R924	100	ESD_Signal8	C965	10nF	AnalogIn8
GEM_In9	R925	100	ESD_Signal9	C966	10nF	AnalogIn9	GEM_In10	R926	100	ESD_Signal10	C967	10nF	AnalogIn10	GEM_In11	R927	100	ESD_Signal11	C968	10nF	AnalogIn11	GEM_In12	R928	100	ESD_Signal12	C969	10nF	AnalogIn12
GEM_In13						AnalogIn13	GEM_In14						AnalogIn14	GEM_In15	R931	100	ESD_Signal15	C972	10nF	AnalogIn15	GEM_In16						AnalogIn16
GEM_In17						AnalogIn17	GEM_In18	R934	100	ESD_Signal18	C975	10nF	AnalogIn18	GEM_In19						AnalogIn19	GEM_In20						AnalogIn20
GEM_In21	R937	100	ESD_Signal21	C978	10nF	AnalogIn21	GEM_In22	R938	100	ESD_Signal22	C979	10nF	AnalogIn22	GEM_In23	R939	100	ESD_Signal23	C980	10nF	AnalogIn23	GEM_In24	R940	100	ESD_Signal24	C981	10nF	AnalogIn24
GEM_In25	R941	100	ESD_Signal25	C982	10nF	AnalogIn25	GEM_In26	R942	100	ESD_Signal26	C983	10nF	AnalogIn26	GEM_In27	R943	100	ESD_Signal27	C984	10nF	AnalogIn27	GEM_In28	R944	100	ESD_Signal28	C985	10nF	AnalogIn28
GEM_In29	R945	100	ESD_Signal29	C986	10nF	AnalogIn29	GEM_In30						AnalogIn30	GEM_In31	R947	100	ESD_Signal31	C988	10nF	AnalogIn31	GEM_In32						AnalogIn32
GEM_In33						AnalogIn33	GEM_In34	R950	100	ESD_Signal34	C991	10nF	AnalogIn34	GEM_In35						AnalogIn35	GEM_In36	R952	100	ESD_Signal36	C993	10nF	AnalogIn36
GEM_In37	R953	100	ESD_Signal37	C994	10nF	AnalogIn37	GEM_In38	R954	100	ESD_Signal38	C995	10nF	AnalogIn38	GEM_In39	R955	100	ESD_Signal39	C996	10nF	AnalogIn39	GEM_In40	R956	100	ESD_Signal40	C997	10nF	AnalogIn40
GEM_In41						AnalogIn41	GEM_In42	R958	100	ESD_Signal42	C999	10nF	AnalogIn42	GEM_In43						AnalogIn43	GEM_In44						AnalogIn44
GEM_In45	R961	100	ESD_Signal45	C1002	10nF	AnalogIn45	GEM_In46						AnalogIn46	GEM_In47	R963	100	ESD_Signal47	C1004	10nF	AnalogIn47	GEM_In48	R964	100	ESD_Signal48	C1005	10nF	AnalogIn48
GEM_In49	R965	100	ESD_Signal49	C1006	10nF	AnalogIn49	GEM_In50	R966	100	ESD_Signal50	C1007	10nF	AnalogIn50	GEM_In51						AnalogIn51	GEM_In52						AnalogIn52
GEM_In53	R969	100	ESD_Signal53	C1010	10nF	AnalogIn53	GEM_In54	R970	100	ESD_Signal54	C1011	10nF	AnalogIn54	GEM_In55	R971	100	ESD_Signal55	C1012	10nF	AnalogIn55	GEM_In56	R972	100	ESD_Signal56	C1013	10nF	AnalogIn56
GEM_In57	R973	100	ESD_Signal57	C1014	10nF	AnalogIn57	GEM_In58	R974	100	ESD_Signal58	C1015	10nF	AnalogIn58	GEM_In59	R975	100	ESD_Signal59	C1016	10nF	AnalogIn59	GEM_In60	R976	100	ESD_Signal60	C1017	10nF	AnalogIn60
GEM_In61	R977	100	ESD_Signal61	C1018	10nF	AnalogIn61	GEM_In62	R978	100	ESD_Signal62	C1019	10nF	AnalogIn62	GEM_In63	R979	100	ESD_Signal63	C1020	10nF	AnalogIn63	GEM_In64	R980	100	ESD_Signal64	C1021	10nF	AnalogIn64

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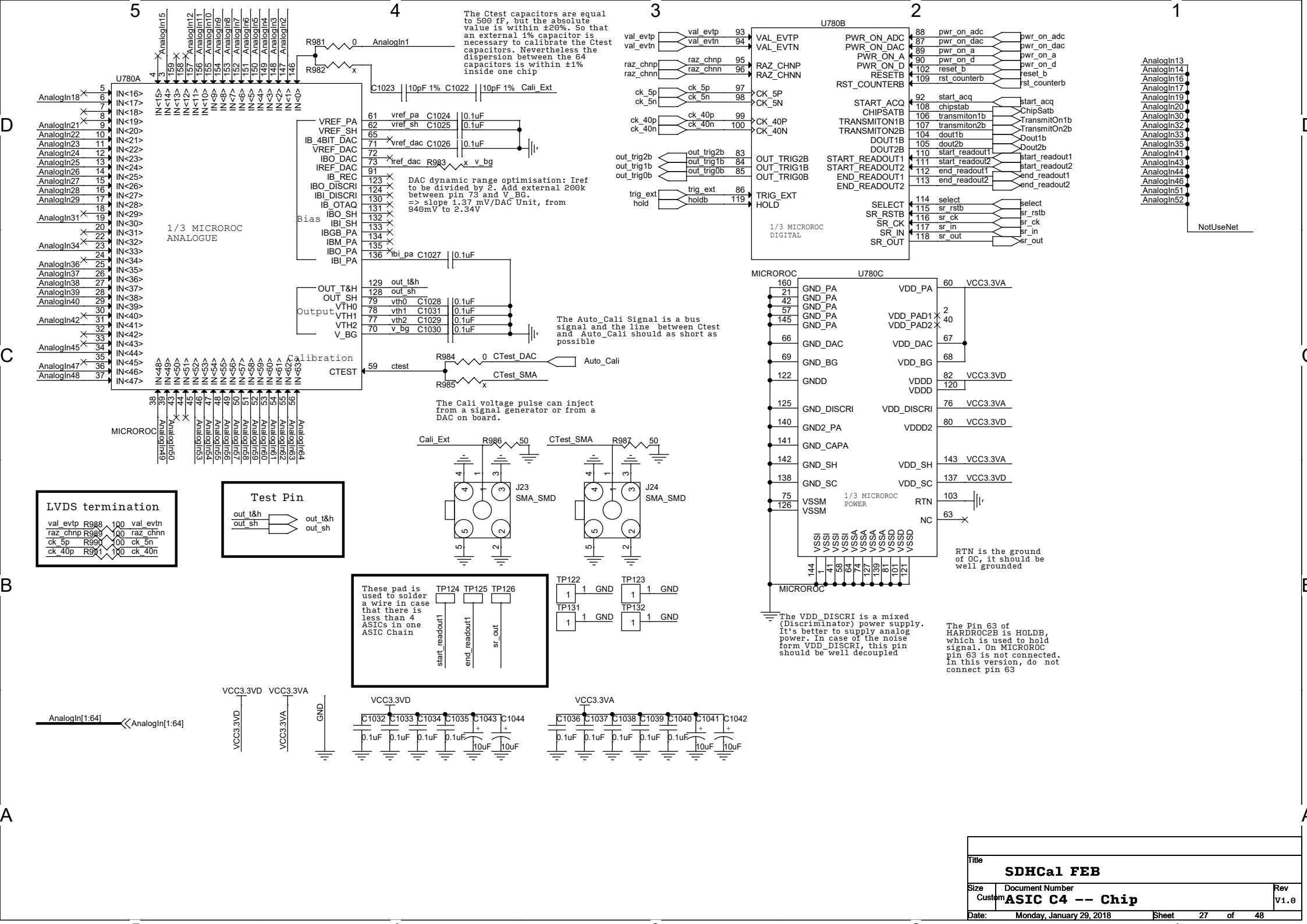

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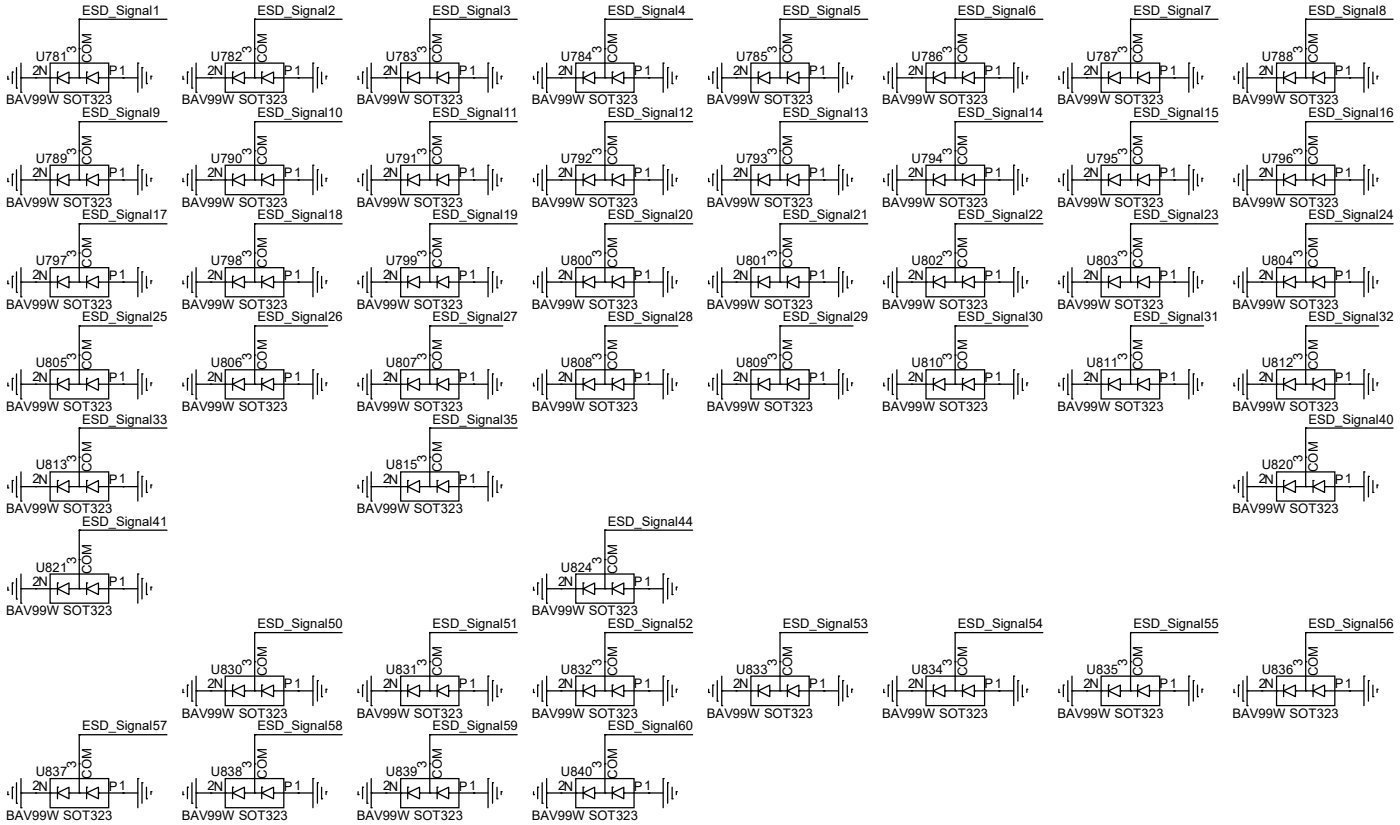

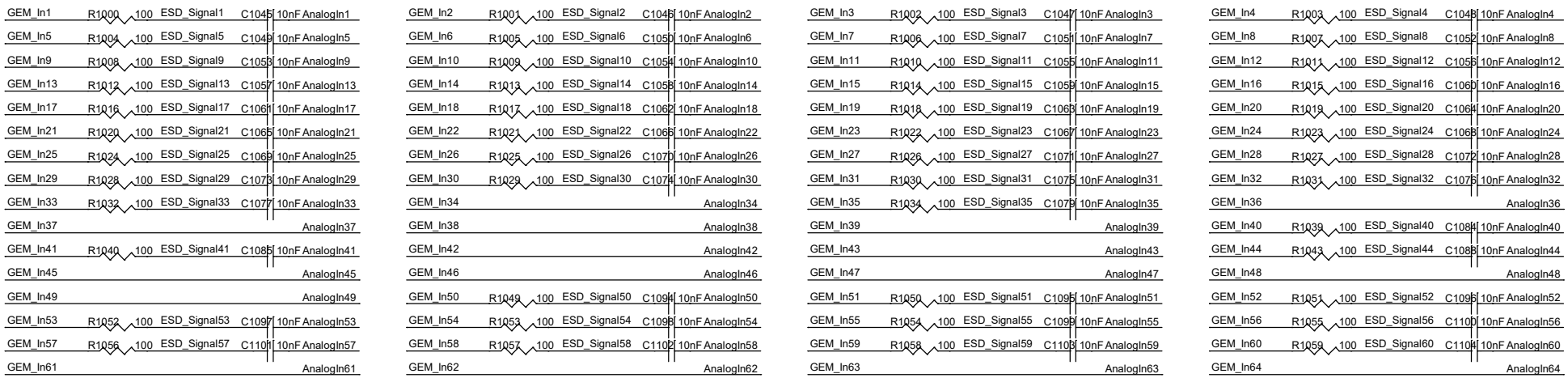

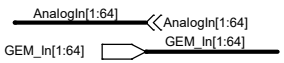

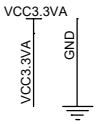

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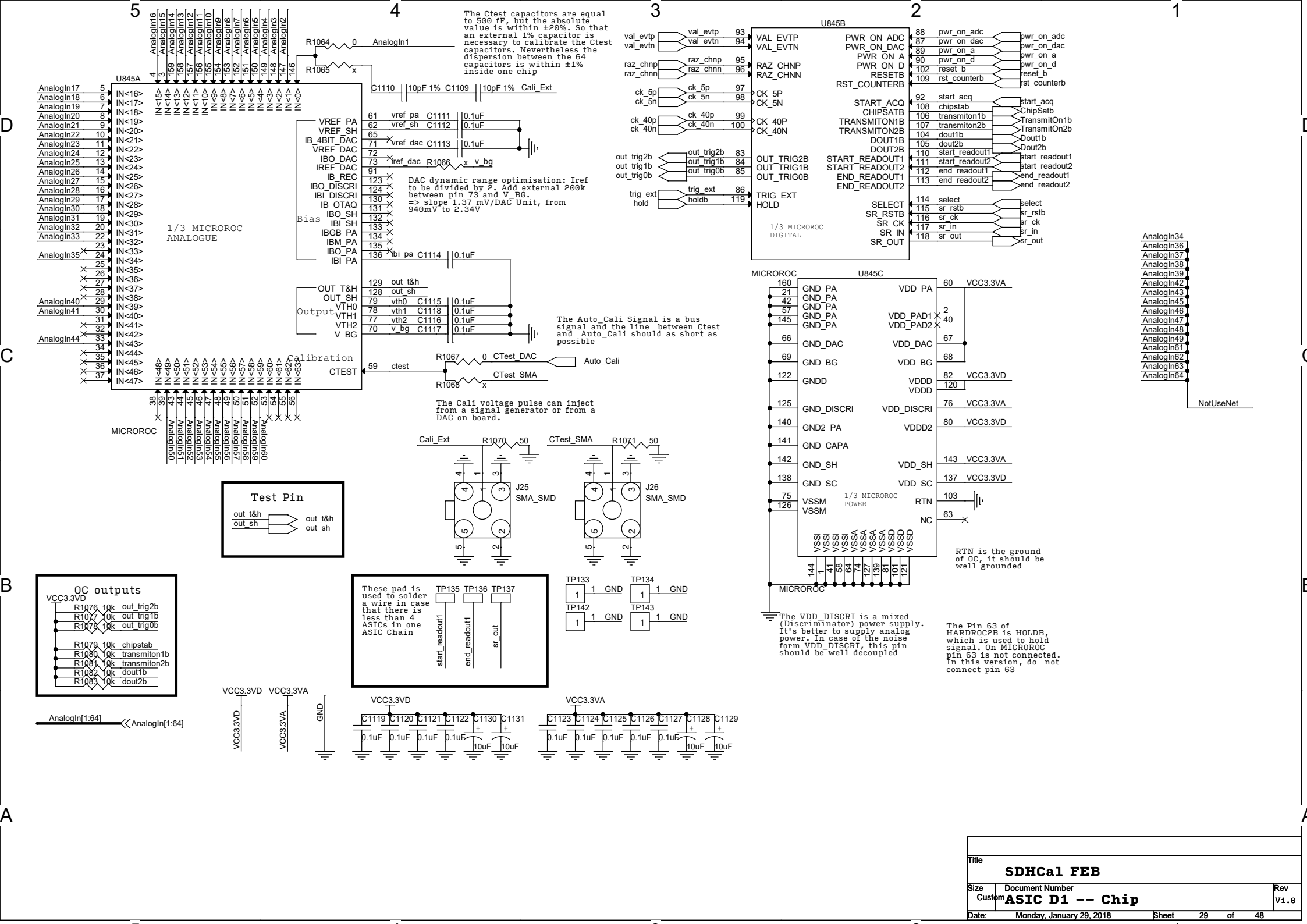
The Ctest capacitors are equal to 500 fF, but the absolute value is within ±20%. So that an external 1% capacitor is necessary to calibrate the Ctest capacitors. Nevertheless the dispersion between the 64 capacitors is within ±1% inside one chip
1/3 MICROROC ANALOGUE
DAC dynamic range optimisation: Iref to be divided by 2. Add external 200k between pin 73 and V_BG. => slope 1.37 mV/DAC Unit, from 940mV to 2.34V
The Auto_Cali Signal is a bus signal and the line between Ctest and Auto_Cali should as short as possible
The Cali voltage pulse can inject from a signal generator or from a DAC on board.
Test Pin
OC outputs
These pad is used to solder a wire in case that there is less than 4 ASICs in one ASIC Chain
1/3 MICROROC DIGITAL
1/3 MICROROC POWER
RTN is the ground of OC, it should be well grounded
The VDD_DISCRI is a mixed (Discriminator) power supply. It's better to supply analog power. In case of the noise form VDD_DISCRI, this pin should be well decoupled
The Pin 63 of HARDROC2B is HOLDB, which is used to hold signal. On MICROROC pin 63 is not connected. In this version, do not connect pin 63
NotUseNet
SDHCal FEB
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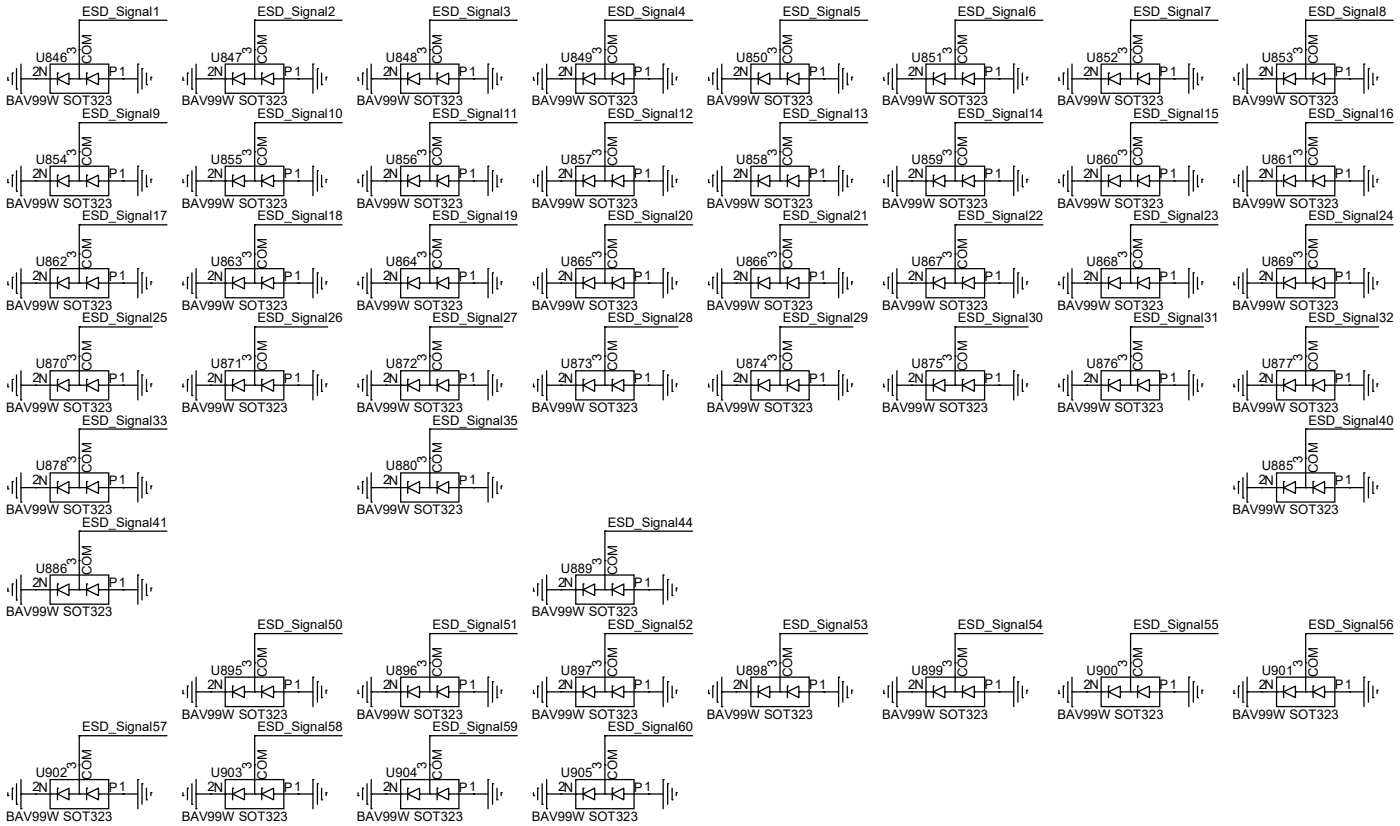

AnalogIn[1:64]
GEM_In[1:64]
AnalogIn[1:64]
GEM_In[1:64]

VCC3.3VA
VCC3.3VA
GND

GEM_In1	R1084 100	ESD_Signal1	C1132 10nF	AnalogIn1	GEM_In2	R1085 100	ESD_Signal2
GEM_In5	R1088 100	ESD_Signal5	C1136 10nF	AnalogIn5	GEM_In6	R1089 100	ESD_Signal6
GEM_In9	R1092 100	ESD_Signal9	C1140 10nF	AnalogIn9	GEM_In10	R1093 100	ESD_Signal10
GEM_In13	R1096 100	ESD_Signal13	C1144 10nF	AnalogIn13	GEM_In14	R1097 100	ESD_Signal14
GEM_In17	R1100 100	ESD_Signal17	C1148 10nF	AnalogIn17	GEM_In18	R1101 100	ESD_Signal18
GEM_In21	R1104 100	ESD_Signal21	C1152 10nF	AnalogIn21	GEM_In22	R1105 100	ESD_Signal22
GEM_In25	R1108 100	ESD_Signal25	C1156 10nF	AnalogIn25	GEM_In26	R1109 100	ESD_Signal26
GEM_In29	R1112 100	ESD_Signal29	C1160 10nF	AnalogIn29	GEM_In30	R1113 100	ESD_Signal30
GEM_In33	R1116 100	ESD_Signal33	C1164 10nF	AnalogIn33	GEM_In34		
GEM_In37				AnalogIn37	GEM_In38		
GEM_In41	R1124 100	ESD_Signal41	C1172 10nF	AnalogIn41	GEM_In42		
GEM_In45				AnalogIn45	GEM_In46		
GEM_In49				AnalogIn49	GEM_In50	R1133 100	ESD_Signal50
GEM_In53	R1136 100	ESD_Signal53	C1184 10nF	AnalogIn53	GEM_In54	R1137 100	ESD_Signal54
GEM_In57	R1140 100	ESD_Signal57	C1188 10nF	AnalogIn57	GEM_In58	R1141 100	ESD_Signal58
GEM_In61				AnalogIn61	GEM_In62		

GEM_In3	R1086 100	ESD_Signal3	C1134 10nF	AnalogIn3	GEM_In4	R1087 100	ESD_Signal4
GEM_In7	R1090 100	ESD_Signal7	C1138 10nF	AnalogIn7	GEM_In8	R1091 100	ESD_Signal8
GEM_In11	R1094 100	ESD_Signal11	C1142 10nF	AnalogIn11	GEM_In12	R1095 100	ESD_Signal12
GEM_In15	R1098 100	ESD_Signal15	C1146 10nF	AnalogIn15	GEM_In16	R1099 100	ESD_Signal16
GEM_In19	R1102 100	ESD_Signal19	C1150 10nF	AnalogIn19	GEM_In20	R1103 100	ESD_Signal20
GEM_In23	R1106 100	ESD_Signal23	C1154 10nF	AnalogIn23	GEM_In24	R1107 100	ESD_Signal24
GEM_In27	R1110 100	ESD_Signal27	C1158 10nF	AnalogIn27	GEM_In28	R1111 100	ESD_Signal28
GEM_In31	R1114 100	ESD_Signal31	C1162 10nF	AnalogIn31	GEM_In32	R1115 100	ESD_Signal32
GEM_In35	R1118 100	ESD_Signal35	C1166 10nF	AnalogIn35	GEM_In36		
GEM_In39				AnalogIn39	GEM_In40	R1123 100	ESD_Signal40
GEM_In43				AnalogIn43	GEM_In44	R1127 100	ESD_Signal44
GEM_In47				AnalogIn47	GEM_In48		
GEM_In51	R1134 100	ESD_Signal51	C1182 10nF	AnalogIn51	GEM_In52	R1135 100	ESD_Signal52
GEM_In55	R1138 100	ESD_Signal55	C1186 10nF	AnalogIn55	GEM_In56	R1139 100	ESD_Signal56
GEM_In59	R1142 100	ESD_Signal59	C1190 10nF	AnalogIn59	GEM_In60	R1143 100	ESD_Signal60
GEM_In63				AnalogIn63	GEM_In64		

GEM_In4	R1087 100	ESD_Signal4	C1135 10nF	AnalogIn4			
GEM_In8	R1091 100	ESD_Signal8	C1139 10nF	AnalogIn8			
GEM_In12	R1095 100	ESD_Signal12	C1143 10nF	AnalogIn12			
GEM_In16	R1099 100	ESD_Signal16	C1147 10nF	AnalogIn16			
GEM_In20	R1103 100	ESD_Signal20	C1151 10nF	AnalogIn20			
GEM_In24	R1107 100	ESD_Signal24	C1155 10nF	AnalogIn24			
GEM_In28	R1111 100	ESD_Signal28	C1159 10nF	AnalogIn28			
GEM_In32	R1115 100	ESD_Signal32	C1163 10nF	AnalogIn32			
GEM_In36				AnalogIn36			
GEM_In40	R1123 100	ESD_Signal40	C1171 10nF	AnalogIn40			
GEM_In44	R1127 100	ESD_Signal44	C1175 10nF	AnalogIn44			
GEM_In48				AnalogIn48			
GEM_In52	R1135 100	ESD_Signal52	C1183 10nF	AnalogIn52			
GEM_In56	R1139 100	ESD_Signal56	C1187 10nF	AnalogIn56			
GEM_In60	R1143 100	ESD_Signal60	C1191 10nF	AnalogIn60			
GEM_In64				AnalogIn64			

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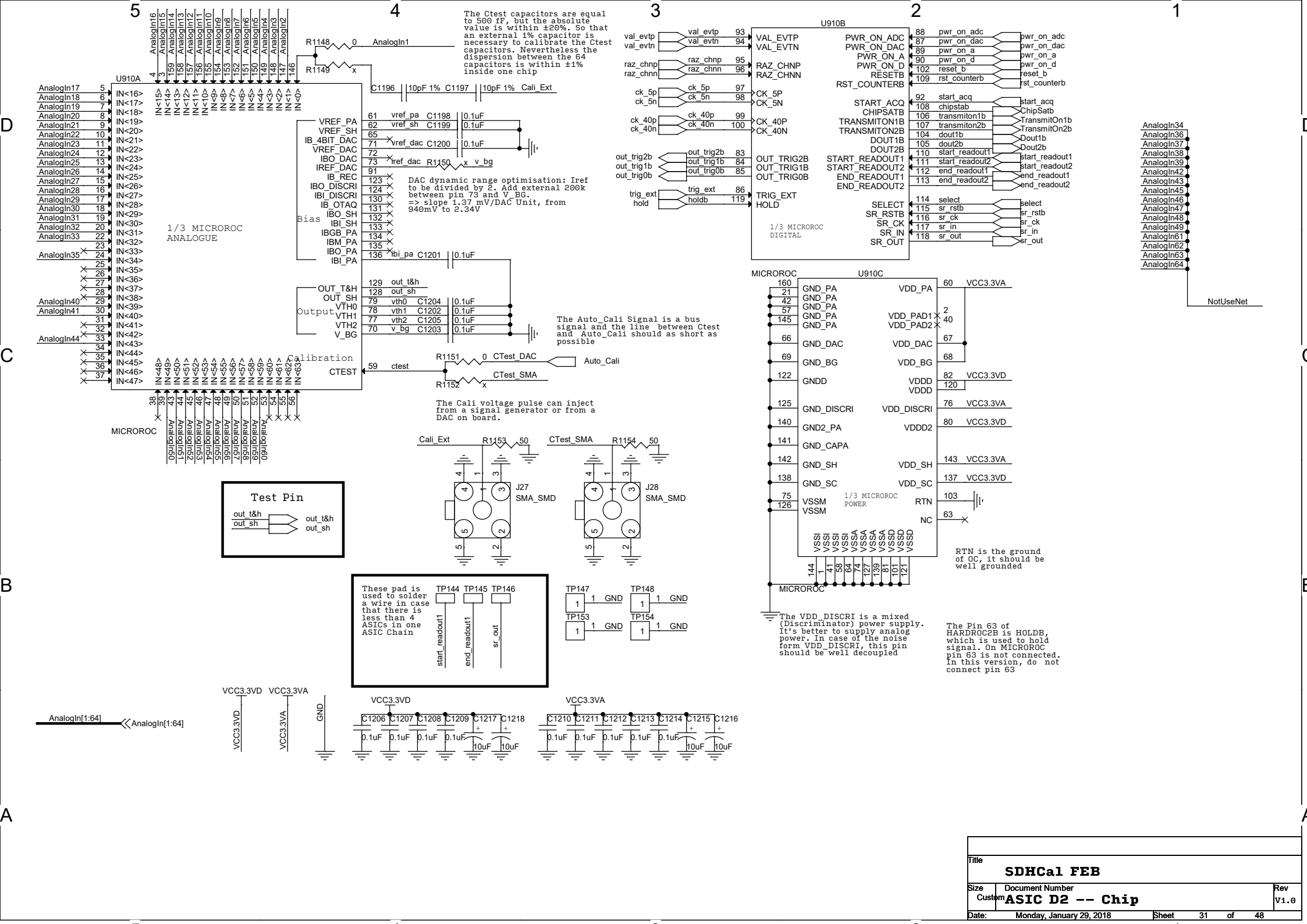
U910A
1/3 MICROROC
ANALOGUE
MICROROC
Bias
Output
Calibration
U910B
1/3 MICROROC
DIGITAL
U910C
1/3 MICROROC
POWER
MICROROC
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NotUseNet
SMA_SMD
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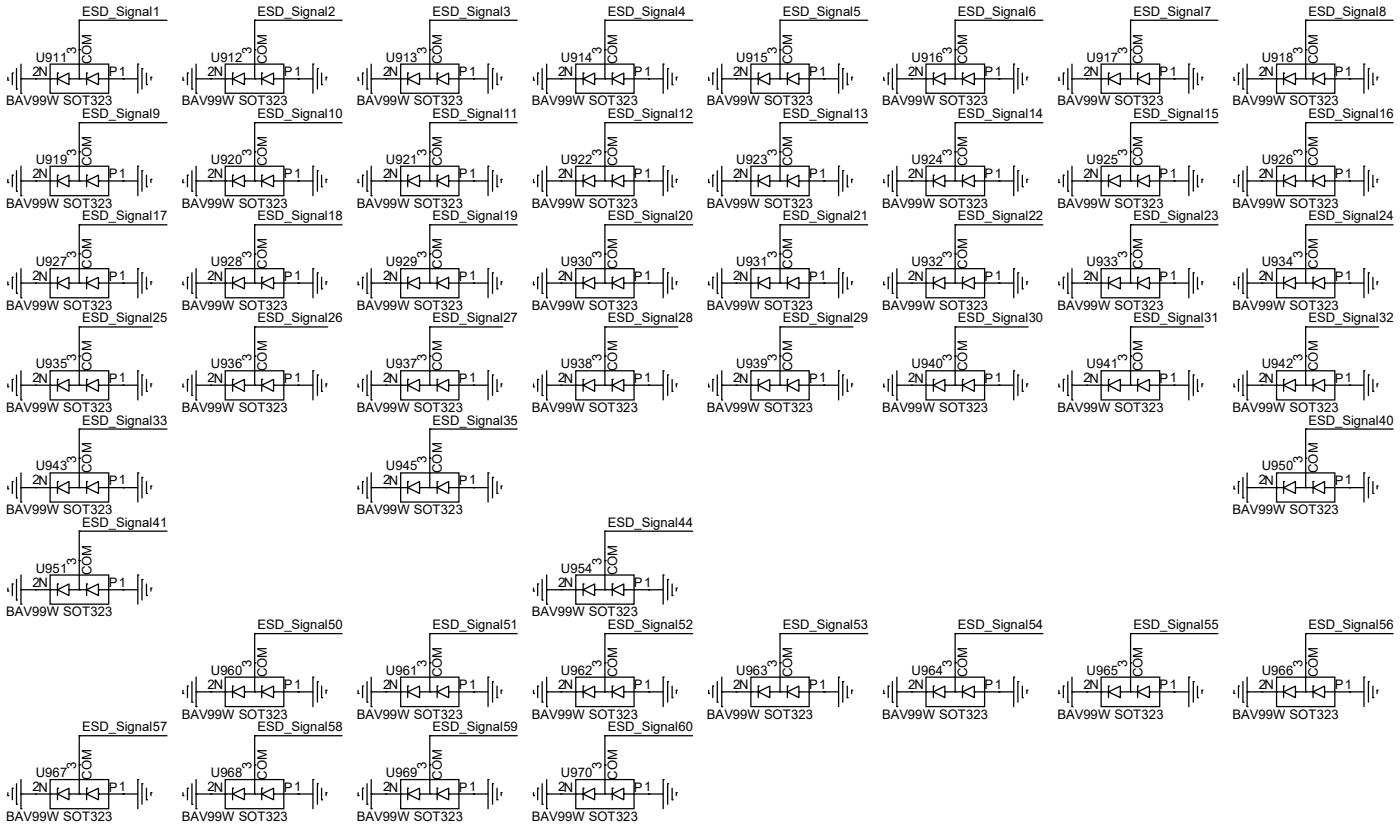

AnalogIn[1:64]
GEM_In[1:64]
AnalogIn[1:64]
GEM_In[1:64]

VCC3.3VA
VCC3.3VA
GND

GEM_In1 R1167 100 ESD_Signal1 C1219 10nF AnalogIn1
GEM_In5 R1171 100 ESD_Signal5 C1223 10nF AnalogIn5
GEM_In9 R1175 100 ESD_Signal9 C1227 10nF AnalogIn9
GEM_In13 R1179 100 ESD_Signal13 C1231 10nF AnalogIn13
GEM_In17 R1183 100 ESD_Signal17 C1235 10nF AnalogIn17
GEM_In21 R1187 100 ESD_Signal21 C1239 10nF AnalogIn21
GEM_In25 R1191 100 ESD_Signal25 C1243 10nF AnalogIn25
GEM_In29 R1195 100 ESD_Signal29 C1247 10nF AnalogIn29
GEM_In33 R1199 100 ESD_Signal33 C1251 10nF AnalogIn33
GEM_In37 AnalogIn37
GEM_In41 R1207 100 ESD_Signal41 C1259 10nF AnalogIn41
GEM_In45 AnalogIn45
GEM_In49 AnalogIn49
GEM_In53 R1219 100 ESD_Signal53 C1271 10nF AnalogIn53
GEM_In57 R1223 100 ESD_Signal57 C1275 10nF AnalogIn57
GEM_In61 AnalogIn61

GEM_In2 R1168 100 ESD_Signal2 C1220 10nF AnalogIn2
GEM_In6 R1172 100 ESD_Signal6 C1224 10nF AnalogIn6
GEM_In10 R1176 100 ESD_Signal10 C1228 10nF AnalogIn10
GEM_In14 R1180 100 ESD_Signal14 C1232 10nF AnalogIn14
GEM_In18 R1184 100 ESD_Signal18 C1236 10nF AnalogIn18
GEM_In22 R1188 100 ESD_Signal22 C1240 10nF AnalogIn22
GEM_In26 R1192 100 ESD_Signal26 C1244 10nF AnalogIn26
GEM_In30 R1196 100 ESD_Signal30 C1248 10nF AnalogIn30
GEM_In34 AnalogIn34
GEM_In38 AnalogIn38
GEM_In42 AnalogIn42
GEM_In46 AnalogIn46
GEM_In50 R1216 100 ESD_Signal50 C1268 10nF AnalogIn50
GEM_In54 R1220 100 ESD_Signal54 C1272 10nF AnalogIn54
GEM_In58 R1224 100 ESD_Signal58 C1276 10nF AnalogIn58
GEM_In62 AnalogIn62

GEM_In3 R1169 100 ESD_Signal3 C1221 10nF AnalogIn3
GEM_In7 R1173 100 ESD_Signal7 C1225 10nF AnalogIn7
GEM_In11 R1177 100 ESD_Signal11 C1229 10nF AnalogIn11
GEM_In15 R1181 100 ESD_Signal15 C1233 10nF AnalogIn15
GEM_In19 R1185 100 ESD_Signal19 C1237 10nF AnalogIn19
GEM_In23 R1189 100 ESD_Signal23 C1241 10nF AnalogIn23
GEM_In27 R1193 100 ESD_Signal27 C1245 10nF AnalogIn27
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GEM_In35 R1201 100 ESD_Signal35 C1253 10nF AnalogIn35
GEM_In39 AnalogIn39
GEM_In43 AnalogIn43
GEM_In47 AnalogIn47
GEM_In51 R1217 100 ESD_Signal51 C1269 10nF AnalogIn51
GEM_In55 R1221 100 ESD_Signal55 C1273 10nF AnalogIn55
GEM_In59 R1225 100 ESD_Signal59 C1277 10nF AnalogIn59
GEM_In63 AnalogIn63

GEM_In4 R1170 100 ESD_Signal4 C1222 10nF AnalogIn4
GEM_In8 R1174 100 ESD_Signal8 C1226 10nF AnalogIn8
GEM_In12 R1178 100 ESD_Signal12 C1230 10nF AnalogIn12
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GEM_In24 R1190 100 ESD_Signal24 C1242 10nF AnalogIn24
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GEM_In36 AnalogIn36
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GEM_In48 AnalogIn48
GEM_In52 R1218 100 ESD_Signal52 C1270 10nF AnalogIn52
GEM_In56 R1222 100 ESD_Signal56 C1274 10nF AnalogIn56
GEM_In60 R1226 100 ESD_Signal60 C1278 10nF AnalogIn60
GEM_In64 AnalogIn64

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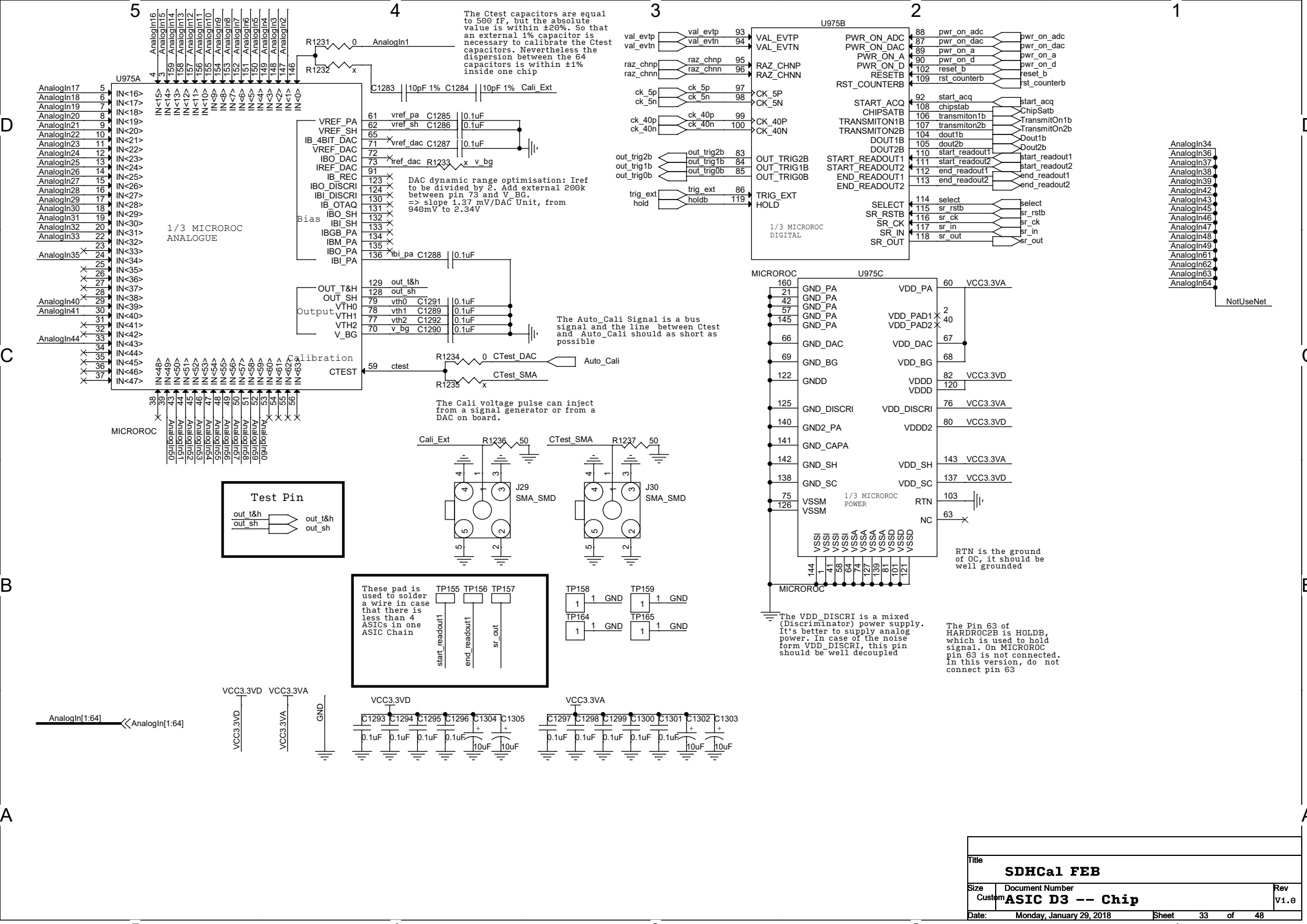

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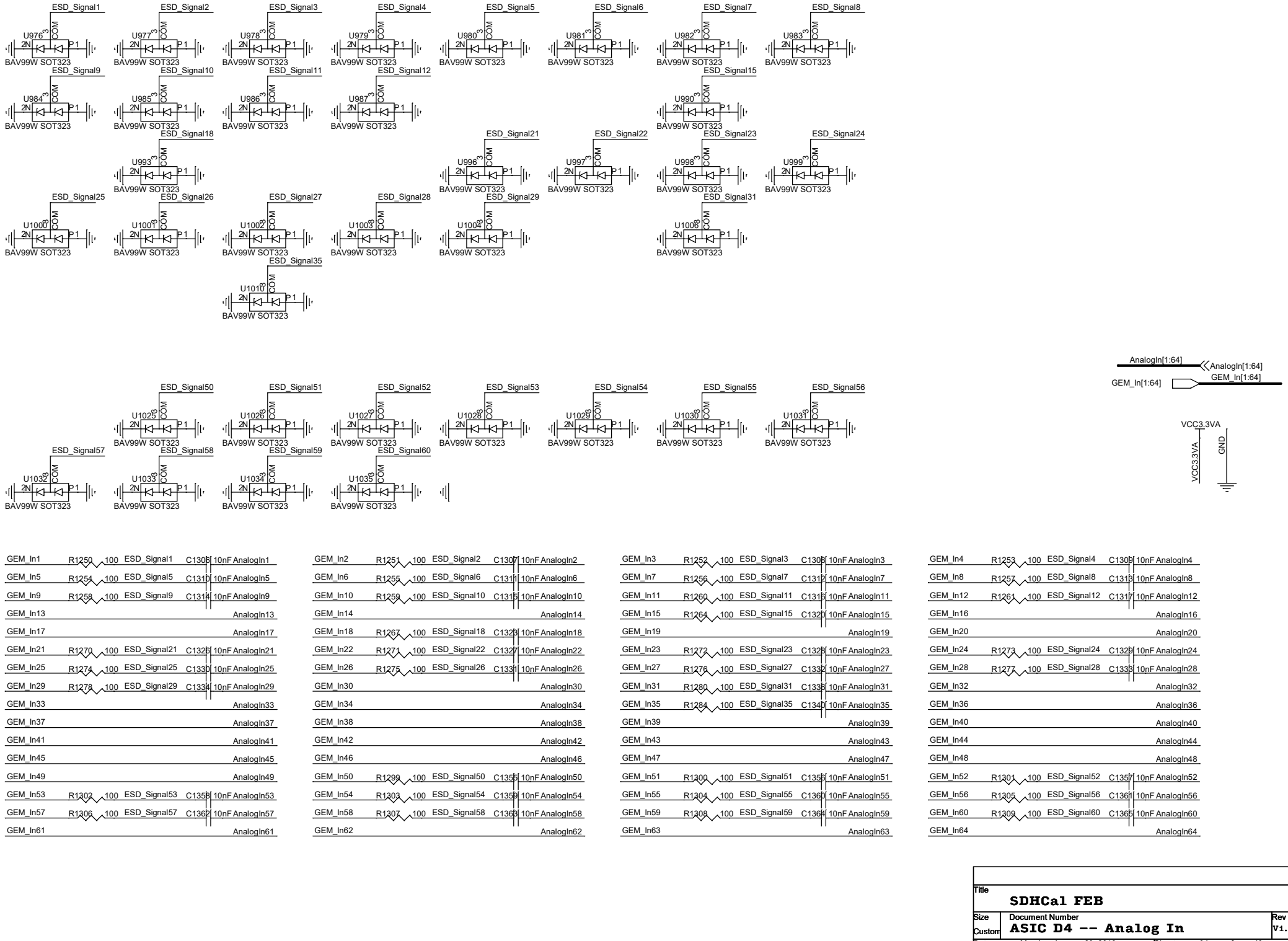
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ESD_Signal2 U977 BAV99W SOT323
ESD_Signal3 U978 BAV99W SOT323
ESD_Signal4 U979 BAV99W SOT323
ESD_Signal5 U980 BAV99W SOT323
ESD_Signal6 U981 BAV99W SOT323
ESD_Signal7 U982 BAV99W SOT323
ESD_Signal8 U983 BAV99W SOT323
ESD_Signal9 U984 BAV99W SOT323
ESD_Signal10 U985 BAV99W SOT323
ESD_Signal11 U986 BAV99W SOT323
ESD_Signal12 U987 BAV99W SOT323
ESD_Signal15 U990 BAV99W SOT323
ESD_Signal18 U993 BAV99W SOT323
ESD_Signal21 U996 BAV99W SOT323
ESD_Signal22 U997 BAV99W SOT323
ESD_Signal23 U998 BAV99W SOT323
ESD_Signal24 U999 BAV99W SOT323
ESD_Signal25 U1000 BAV99W SOT323
ESD_Signal26 U1001 BAV99W SOT323
ESD_Signal27 U1002 BAV99W SOT323
ESD_Signal28 U1003 BAV99W SOT323
ESD_Signal29 U1004 BAV99W SOT323
ESD_Signal31 U1006 BAV99W SOT323
ESD_Signal35 U1010 BAV99W SOT323
ESD_Signal50 U1025 BAV99W SOT323
ESD_Signal51 U1026 BAV99W SOT323
ESD_Signal52 U1027 BAV99W SOT323
ESD_Signal53 U1028 BAV99W SOT323
ESD_Signal54 U1029 BAV99W SOT323
ESD_Signal55 U1030 BAV99W SOT323
ESD_Signal56 U1031 BAV99W SOT323
ESD_Signal57 U1032 BAV99W SOT323
ESD_Signal58 U1033 BAV99W SOT323
ESD_Signal59 U1034 BAV99W SOT323
ESD_Signal60 U1035 BAV99W SOT323
AnalogIn[1:64]
AnalogIn[1:64]
GEM_In[1:64]
GEM_In[1:64]
VCC3.3VA
VCC3.3VA
GND
GEM_In1 R1250 100 ESD_Signal1 C1306 10nF AnalogIn1
GEM_In5 R1254 100 ESD_Signal5 C1310 10nF AnalogIn5
GEM_In9 R1258 100 ESD_Signal9 C1314 10nF AnalogIn9
GEM_In13 AnalogIn13
GEM_In17 AnalogIn17
GEM_In21 R1270 100 ESD_Signal21 C1326 10nF AnalogIn21
GEM_In25 R1274 100 ESD_Signal25 C1330 10nF AnalogIn25
GEM_In29 R1278 100 ESD_Signal29 C1334 10nF AnalogIn29
GEM_In33 AnalogIn33
GEM_In37 AnalogIn37
GEM_In41 AnalogIn41
GEM_In45 AnalogIn45
GEM_In49 AnalogIn49
GEM_In53 R1302 100 ESD_Signal53 C1358 10nF AnalogIn53
GEM_In57 R1306 100 ESD_Signal57 C1362 10nF AnalogIn57
GEM_In61 AnalogIn61
GEM_In2 R1251 100 ESD_Signal2 C1307 10nF AnalogIn2
GEM_In6 R1255 100 ESD_Signal6 C1311 10nF AnalogIn6
GEM_In10 R1259 100 ESD_Signal10 C1315 10nF AnalogIn10
GEM_In14 AnalogIn14
GEM_In18 R1267 100 ESD_Signal18 C1323 10nF AnalogIn18
GEM_In22 R1271 100 ESD_Signal22 C1327 10nF AnalogIn22
GEM_In26 R1275 100 ESD_Signal26 C1331 10nF AnalogIn26
GEM_In30 AnalogIn30
GEM_In34 AnalogIn34
GEM_In38 AnalogIn38
GEM_In42 AnalogIn42
GEM_In46 AnalogIn46
GEM_In50 R1299 100 ESD_Signal50 C1355 10nF AnalogIn50
GEM_In54 R1303 100 ESD_Signal54 C1359 10nF AnalogIn54
GEM_In58 R1307 100 ESD_Signal58 C1363 10nF AnalogIn58
GEM_In62 AnalogIn62
GEM_In3 R1252 100 ESD_Signal3 C1308 10nF AnalogIn3
GEM_In7 R1256 100 ESD_Signal7 C1312 10nF AnalogIn7
GEM_In11 R1260 100 ESD_Signal11 C1316 10nF AnalogIn11
GEM_In15 R1264 100 ESD_Signal15 C1320 10nF AnalogIn15
GEM_In19 AnalogIn19
GEM_In23 R1272 100 ESD_Signal23 C1328 10nF AnalogIn23
GEM_In27 R1276 100 ESD_Signal27 C1332 10nF AnalogIn27
GEM_In31 R1280 100 ESD_Signal31 C1336 10nF AnalogIn31
GEM_In35 R1284 100 ESD_Signal35 C1340 10nF AnalogIn35
GEM_In39 AnalogIn39
GEM_In43 AnalogIn43
GEM_In47 AnalogIn47
GEM_In51 R1300 100 ESD_Signal51 C1356 10nF AnalogIn51
GEM_In55 R1304 100 ESD_Signal55 C1360 10nF AnalogIn55
GEM_In59 R1308 100 ESD_Signal59 C1364 10nF AnalogIn59
GEM_In63 AnalogIn63
GEM_In4 R1253 100 ESD_Signal4 C1309 10nF AnalogIn4
GEM_In8 R1257 100 ESD_Signal8 C1313 10nF AnalogIn8
GEM_In12 R1261 100 ESD_Signal12 C1317 10nF AnalogIn12
GEM_In16 AnalogIn16
GEM_In20 AnalogIn20
GEM_In24 R1273 100 ESD_Signal24 C1329 10nF AnalogIn24
GEM_In28 R1277 100 ESD_Signal28 C1333 10nF AnalogIn28
GEM_In32 AnalogIn32
GEM_In36 AnalogIn36
GEM_In40 AnalogIn40
GEM_In44 AnalogIn44
GEM_In48 AnalogIn48
GEM_In52 R1301 100 ESD_Signal52 C1357 10nF AnalogIn52
GEM_In56 R1305 100 ESD_Signal56 C1361 10nF AnalogIn56
GEM_In60 R1309 100 ESD_Signal60 C1365 10nF AnalogIn60
GEM_In64 AnalogIn64
Title
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Custom
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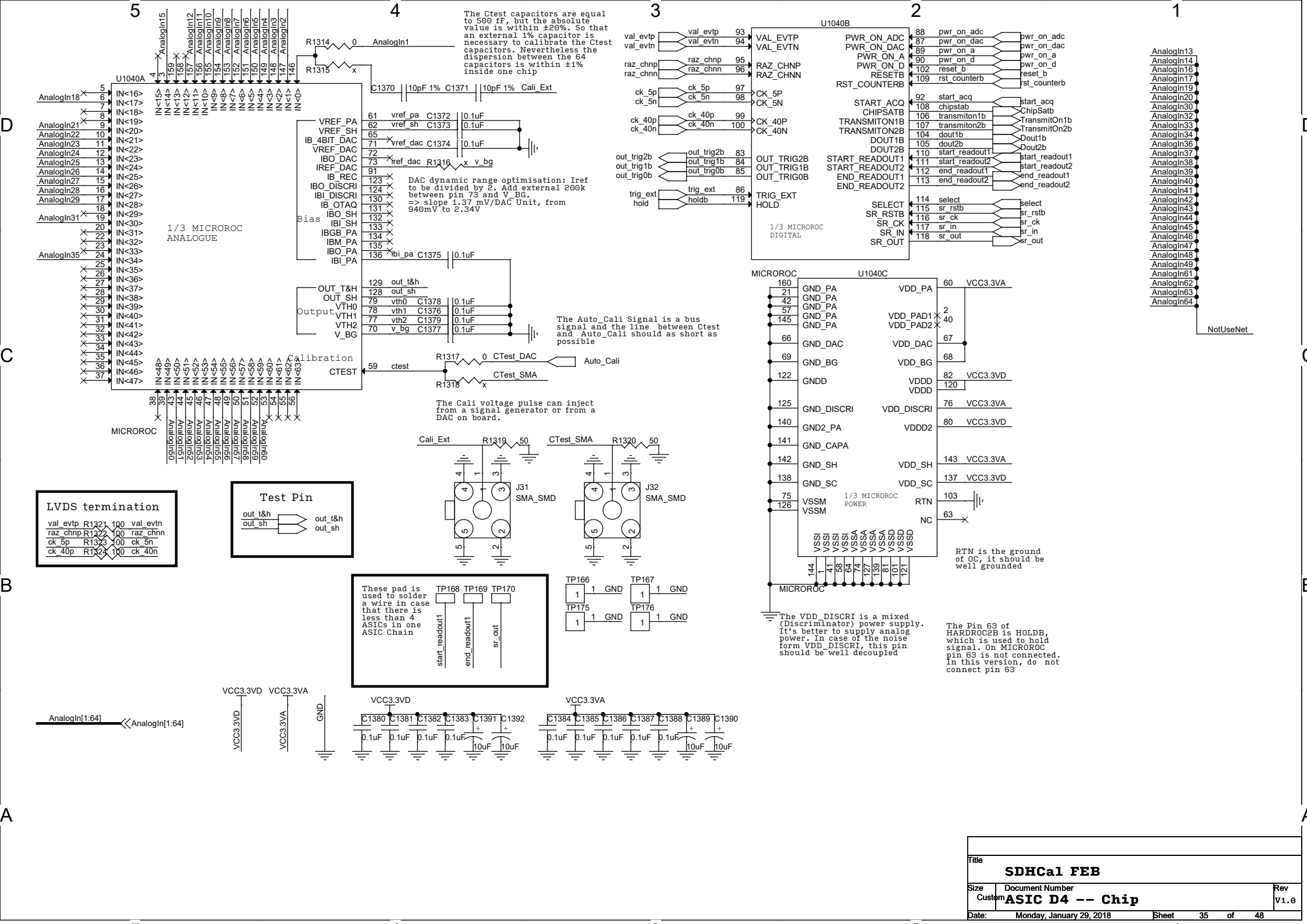
U1040A
1/3 MICROROC
ANALOGUE
MICROROC
Bias
Output
Calibration
CTEST
R1314 0 AnalogIn1
R1315 x
C1370 10pF 1% C1371 10pF 1% Cali_Ext
The Ctest capacitors are equal to 500 fF, but the absolute value is within ±20%. So that an external 1% capacitor is necessary to calibrate the Ctest capacitors. Nevertheless the dispersion between the 64 capacitors is within ±1% inside one chip
DAC dynamic range optimisation: Iref to be divided by 2. Add external 200k between pin 73 and V_BG.
=> slope 1.37 mV/DAC Unit, from 940mV to 2.34V
The Auto_Cali Signal is a bus signal and the line between Ctest and Auto_Cali should as short as possible
The Cali voltage pulse can inject from a signal generator or from a DAC on board.
R1317 0 CTest_DAC
R1318 x CTest_SMA
Auto_Cali
U1040B
1/3 MICROROC
DIGITAL
U1040C
1/3 MICROROC
POWER
RTN is the ground of OC, it should be well grounded
The VDD_DISCRI is a mixed (Discriminator) power supply. It's better to supply analog power. In case of the noise form VDD_DISCRI, this pin should be well decoupled
The Pin 63 of HARDROC2B is HOLDB, which is used to hold signal. On MICROROC pin 63 is not connected. In this version, do not connect pin 63
LVDS termination
Test Pin
These pad is used to solder a wire in case that there is less than 4 ASICs in one ASIC Chain
NotUseNet
SMA_SMD
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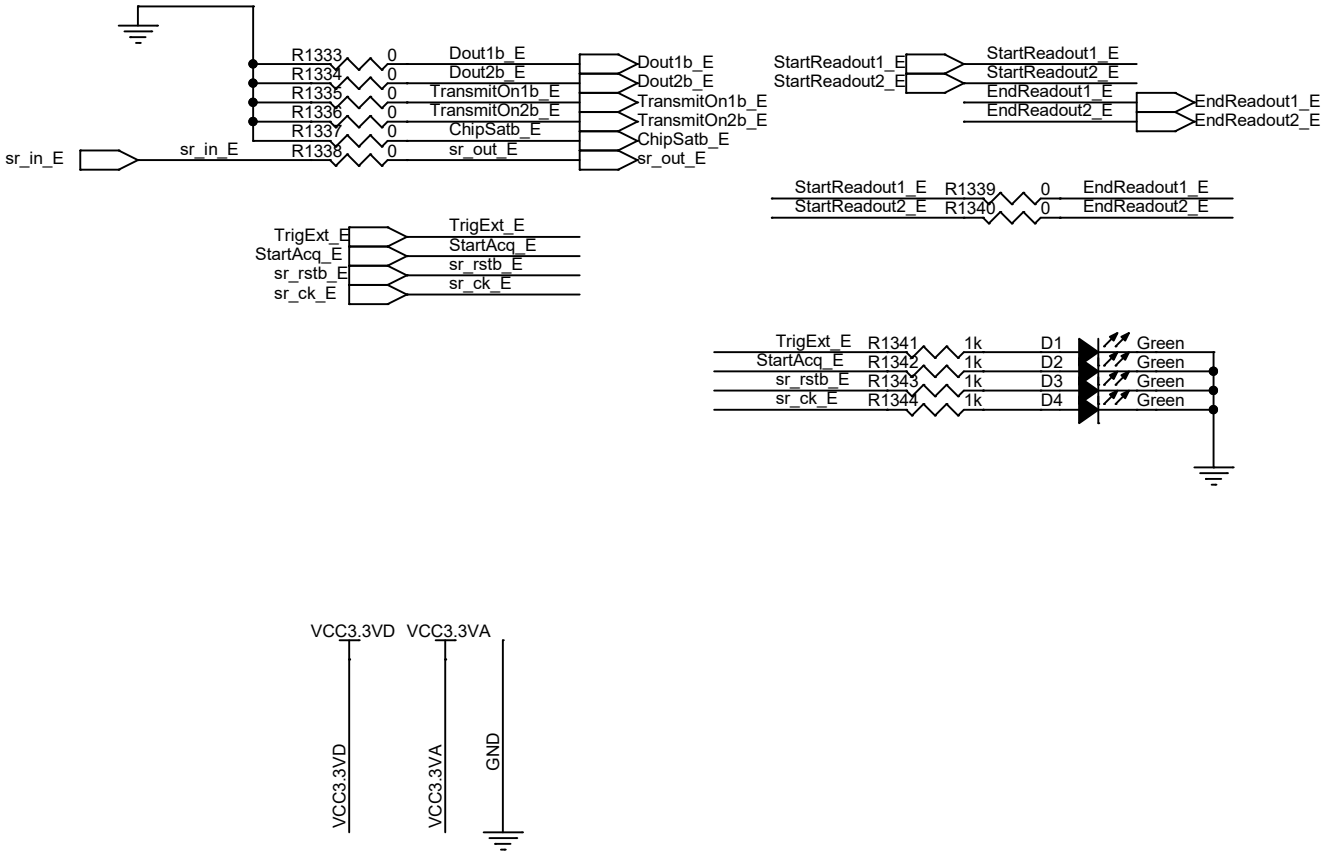

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The power supply of REF3212 is Vout + 0.05 ~5.5V

U1041
GND_F OUT_F
GND_S OUT_S
ENABLE IN
VCC3.3VA
C1395 0.47uF
REF3212
VREF1.25V
C1393 0.1uF
C1394 10uF

VCC3.3VA
U1044
VDD REF
DIN SCLK CS#
Control
DAC A OUTA
DAC B OUTB
AGND
TLV5618A SOIC
DAC_O1
DAC_O2
R1345 R1347 10k
R1348
R1349 0
R1350 0
R1351
R1352 10k
R1354
U1045
INA- INA+ INB+ INB-
OUTA OUTB
LM6142 SOIC

The reference voltage of TLV5618A is 0~VDD-1.5V

Cali_Signal_A
U1042
VCC3.3VA 2N P1
BAV99W SOT323
Do not solder

V+ is between -0.5V to 6.5V
V_NO and V_COM is -0.5~V+0.5V
r_on max is 1.4ohm
t_on is 2~10ns
t_off is 6.5~12 ns

VCC3.3VA
U1043
R1346 10k Cali_Signal_A
C1396 1nF
SwitcherOn_A
COM NO IN GND V+
TS5A3166

VCC3.3VA
U1046
R1353 10k Cali_Signal_B
C1397 1nF
SwitcherOn_B
COM NO IN GND V+
TS5A3166

Cali_Signal_B
U1047
VCC3.3VA 2N P1
BAV99W SOT323
Do not solder

The PCB should have a ground plane covering unused portions of the component side of the board to provide a low impedance path. Remove the ground plane near the package to reduce parasitic capacitance.

VCC3.3VA
C1398 0.1uF C1399 0.1uF C1400 0.1uF C1401 0.1uF C1402 0.1uF C1403 10uF C1404 10uF C1405 10uF C1406 10uF C1407 10uF

Locate the chip capacitor within 3 mm of each power pin

1k
R1355
R1356 1k
VCC3.3VA
U1048
IN1- IN1+ IN2+ IN2-
VOUT1 VOUT2
VS+ VS-
AD8062 MSOP
R1357
Cali_Signal_A R1358 0
Cali_Signal_B R1360 0
R1359 50 Auto_CaliA
R1361 50 Auto_CaliB
R1362
R1363 1k
R1364 1k

Auto_CaliA
Auto_CaliB

One Calibration Pusle is designed to drive 8 ASICs, which means this is a bus design. Each ASIC's Ctest pin should connect to the Auto_Cali signal as short as possible

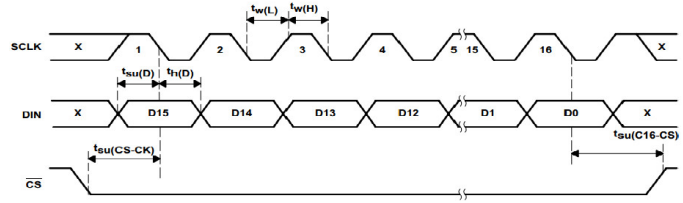
Locate the feedback resistor close to the inverting input pin. Use stripline design techniques for signal traces longer than 25 mm.

VCC3.3VD VCC3.3VA
VCC3.3VD VCC3.3VA GND

digital input timing requirements

			MIN	NOM	MAX	UNIT
$t_{su(CS-CK)}$	Setup time, $\overline{CS}$ low before first negative SCLK edge	C and I suffixes, V_{DD} = 5 V	5			ns
		C and I suffixes, V_{DD} = 3 V	10			ns
		Q and M suffixes	10			ns
$t_{su(C16-CS)}$	Setup time, 16th negative SCLK edge before $\overline{CS}$ rising edge		10			ns
$t_{w(H)}$	SCLK pulse width high		25			ns
$t_{w(L)}$	SCLK pulse width low		25			ns
$t_{su(D)}$	Setup time, data ready before SCLK falling edge	C and I suffixes, V_{DD} = 5 V	5			ns
		C and I suffixes, V_{DD} = 3 V	10			
		Q and M suffixes	8			
$t_{h(D)}$	Hold time, data held valid after SCLK falling edge	C and I suffixes, V_{DD} = 5 V	5			ns
		C and I suffixes, V_{DD} = 3 V	10			
		Q and M suffixes	10			
$t_{h(CSH)}$	Hold time, $\overline{CS}$ high between cycles	V_{DD} = 5 V	25			ns
		V_{DD} = 3 V	50			

timing requirements



data format

The 16-bit data word for the TLV5618A consists of two parts:

- Program bits (D15..D12)
- New data (D11..D0)

D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0
R1	SPD	PWR	R0	MSB	12 Data bits										LSB

SPD: Speed control bit 1 → fast mode 0 → slow mode
PWR: Power control bit 1 → power down 0 → normal operation
On power up, SPD and PWD are reset to 0 (slow mode and normal operation)

The following table lists all possible combinations of register-select bits:

register-select bits

R1	R0	REGISTER
0	0	Write data to DAC B and BUFFER
0	1	Write data to BUFFER
1	0	Write data to DAC A and update DAC B with BUFFER content
1	1	Reserved

The meaning of the 12 data bits depends on the register. If one of the DAC registers or the BUFFER is selected, then the 12 data bits determine the new DAC value:

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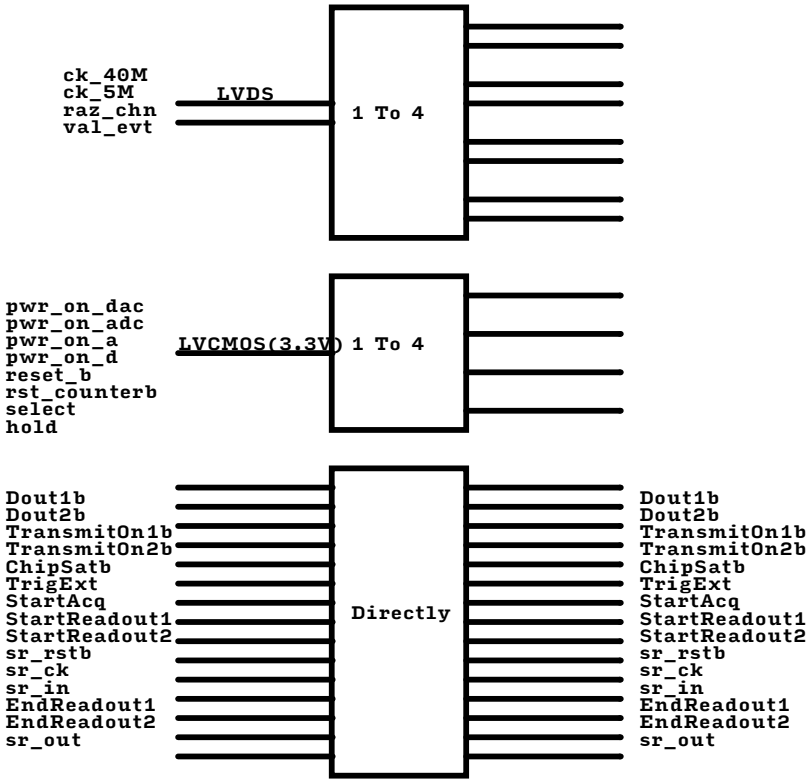
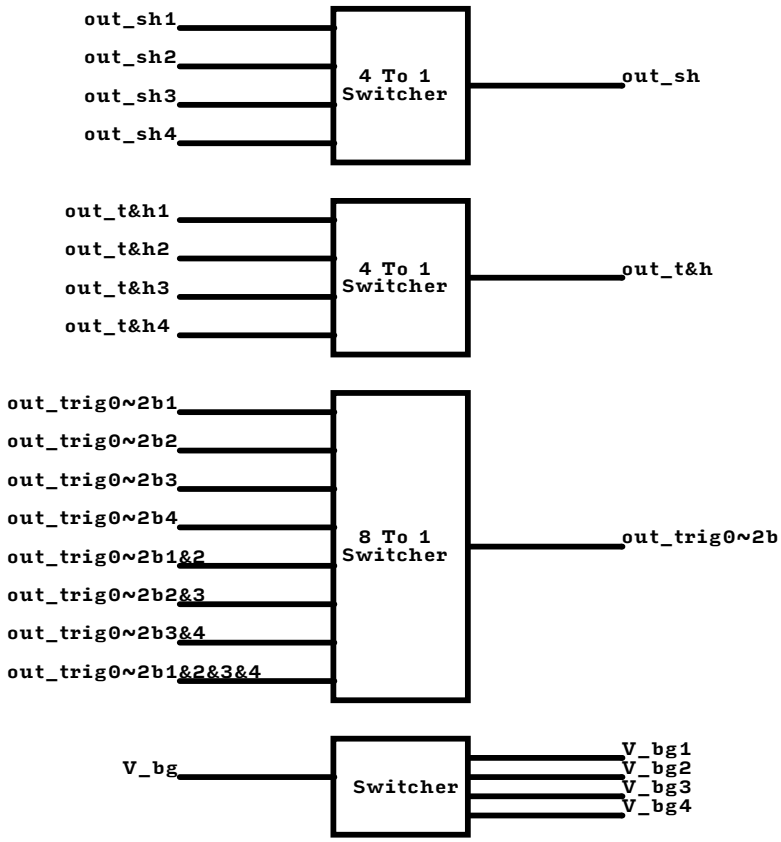
There are 4 kind of signal that need to be distributed.
LVDS signal, Single signal for each chain, Single signal every chain shared and test signal.
For LVDS signal, use LVDS buffer to drive the origin signal into 4 and connect to each chain.
Signal signal for each chain connect to each chain directly
Use logic buffer to drive the shared signal to every chain.
The test signal is switched by switches





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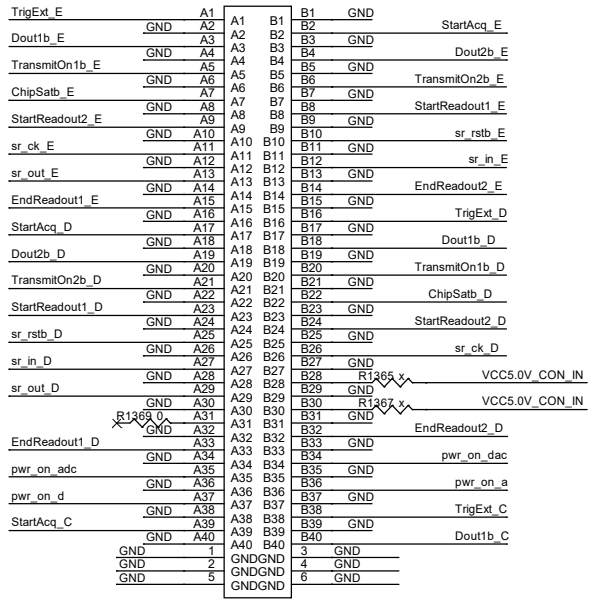
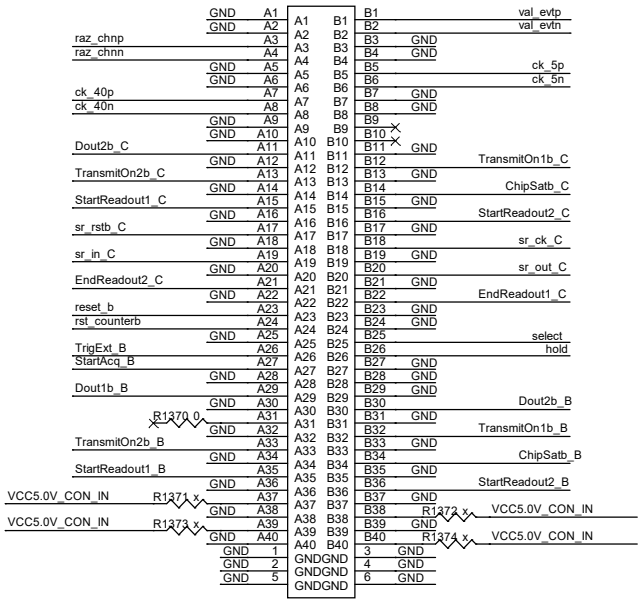
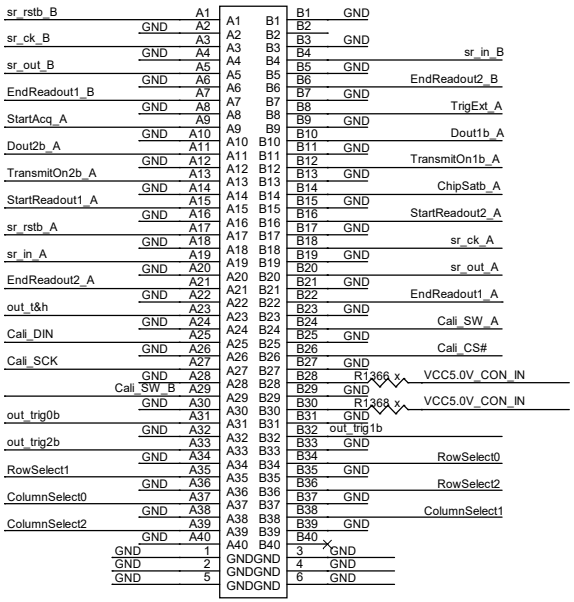
The B pins is forward to the innerside of board



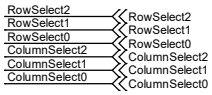




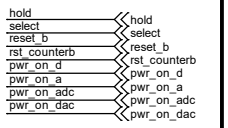
! ! ! **Warnning: The male connector and female connector has different footprint and package.**
The A1 pin of male connector is connected to the A1 pin of female connector, B1(male) connect to B1(female) ...
Note that this is different from ECal system but the signal connection is the same.

Female connector ERNI154744 on FEB
Male connector ERNI 154767 on DIF

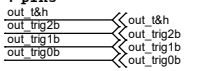
Row and Column select:
6 pins



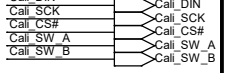
Common control signal:
8 pins



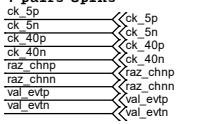
Test signal:
4 pins



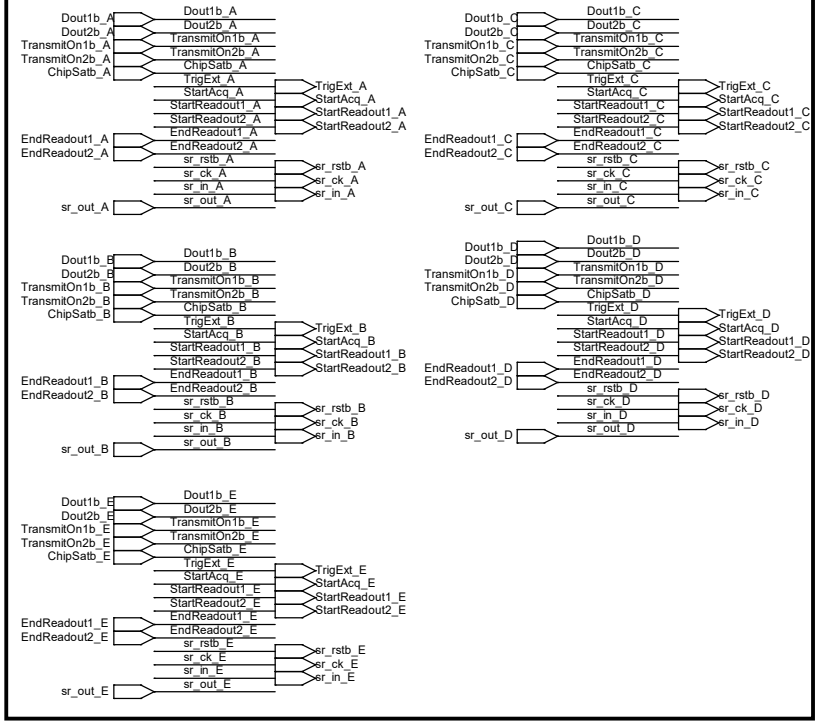
Calibration control:
5 pins

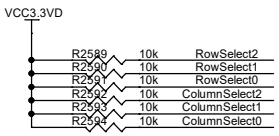


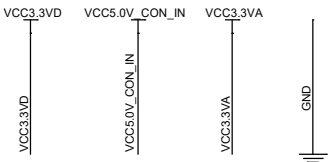
LVDS signals:
4 pairs 8pins



Independent control signals for each chain:
15*5 = 75 pins







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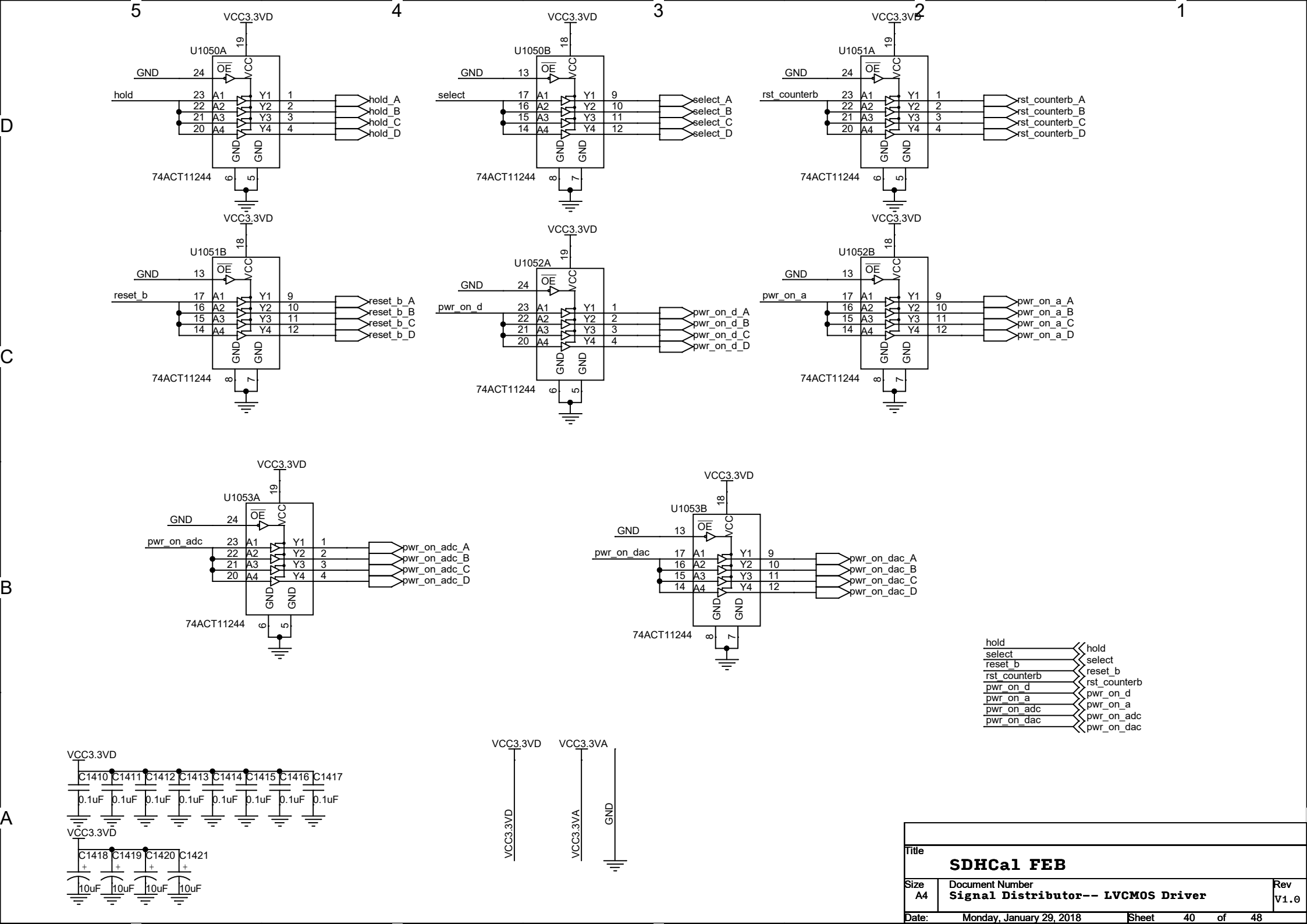
5
4
3
2
1
D
C
B
A
VCC3.3VD
U1050A
GND
hold
hold_A
hold_B
hold_C
hold_D
74ACT11244
U1050B
select
select_A
select_B
select_C
select_D
U1051A
rst_counterb
rst_counterb_A
rst_counterb_B
rst_counterb_C
rst_counterb_D
U1051B
reset_b
reset_b_A
reset_b_B
reset_b_C
reset_b_D
U1052A
pwr_on_d
pwr_on_d_A
pwr_on_d_B
pwr_on_d_C
pwr_on_d_D
U1052B
pwr_on_a
pwr_on_a_A
pwr_on_a_B
pwr_on_a_C
pwr_on_a_D
U1053A
pwr_on_adc
pwr_on_adc_A
pwr_on_adc_B
pwr_on_adc_C
pwr_on_adc_D
U1053B
pwr_on_dac
pwr_on_dac_A
pwr_on_dac_B
pwr_on_dac_C
pwr_on_dac_D
C1410 C1411 C1412 C1413 C1414 C1415 C1416 C1417
0.1uF
C1418 C1419 C1420 C1421
10uF
VCC3.3VA
GND
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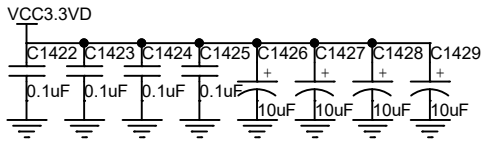
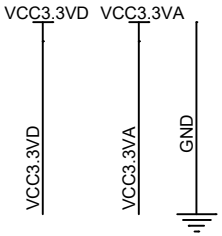
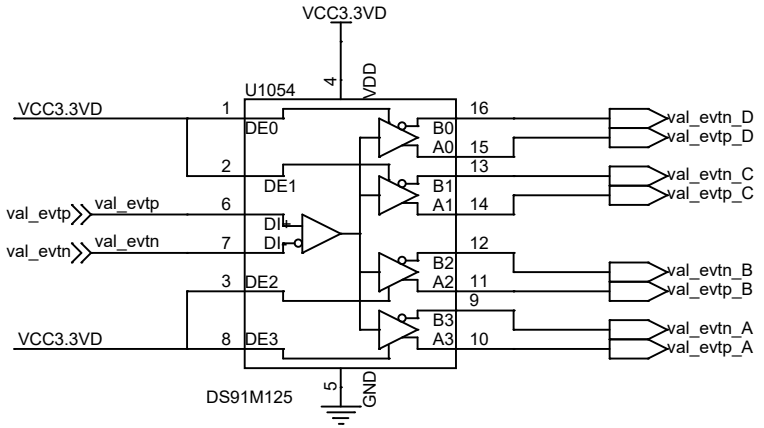
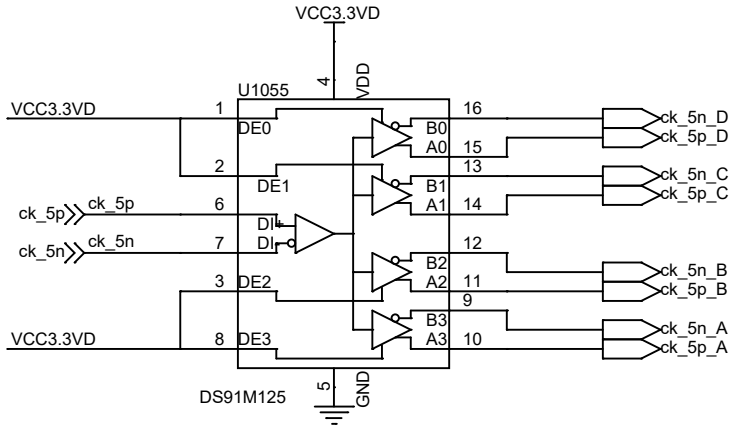
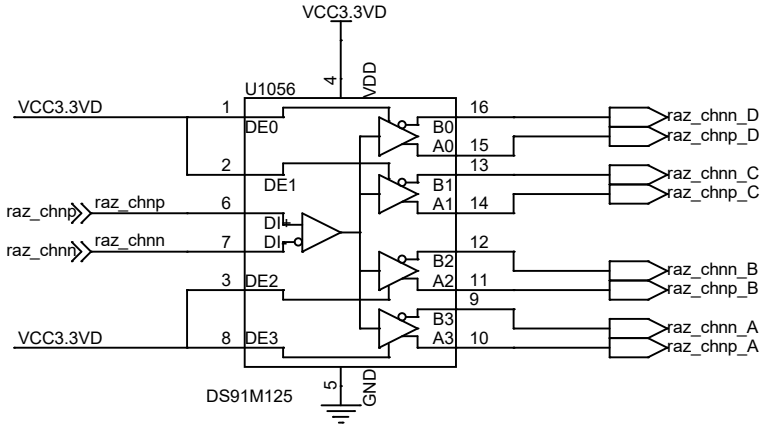
Driver enable pins:
When DE is low, the driver is disabled.
When DE is high, the driver is enabled.
There is a 300k ohm pulldown resistor on each pin.

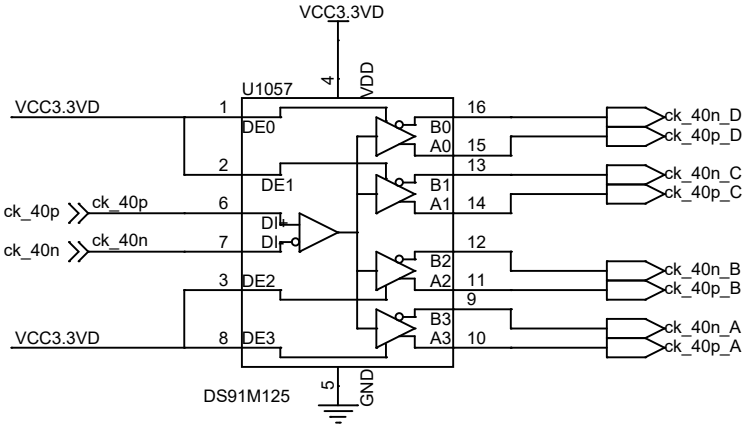












Title: **SDHCal FEB**		
Size: A4	Document Number: **Signal Distributor--LVDS Buffer**	Rev: V1.0
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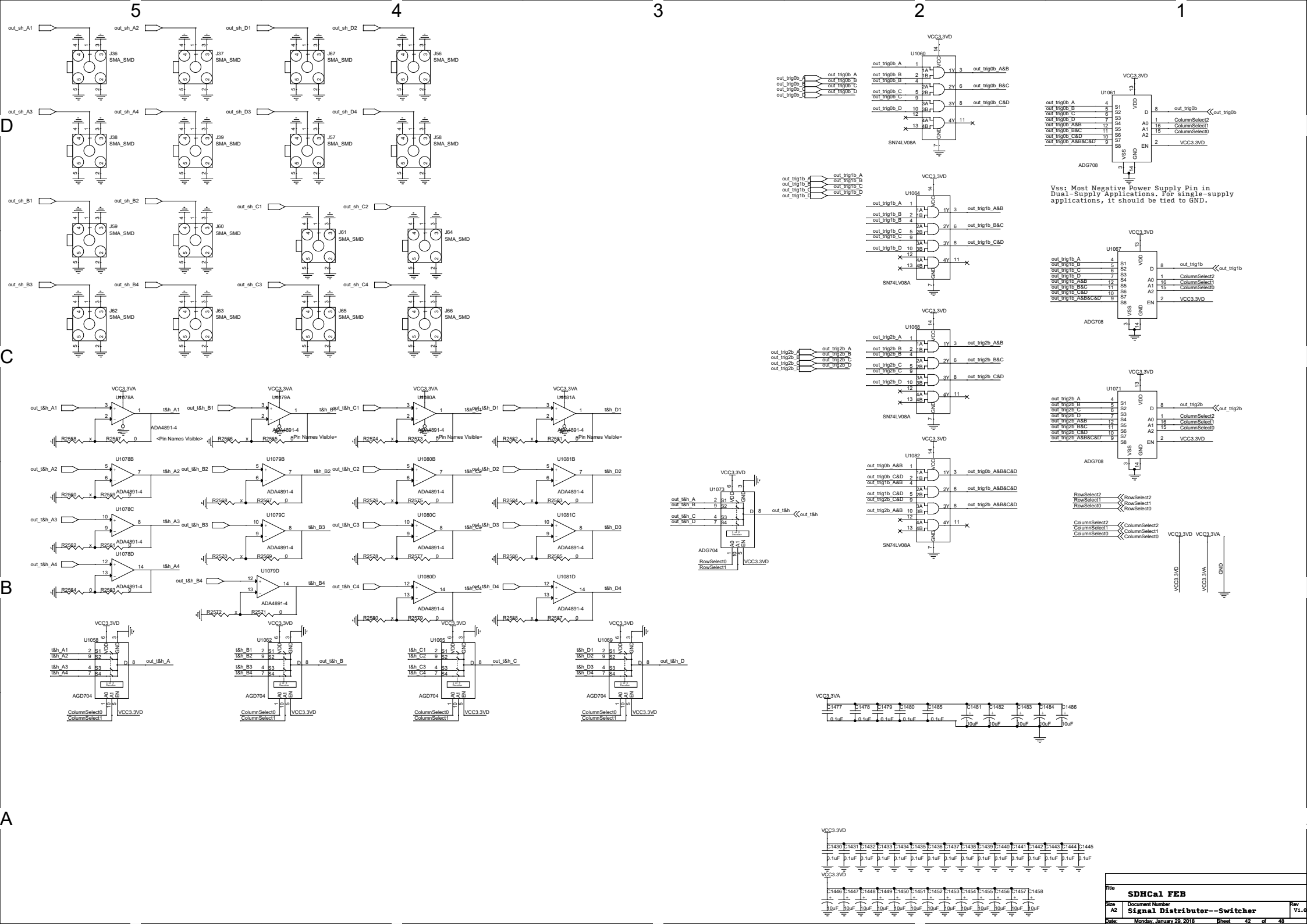
5
4
3
2
1
D
C
B
A
out_sh_A1
out_sh_A2
out_sh_D1
out_sh_D2
J36 SMA_SMD
J37 SMA_SMD
J67 SMA_SMD
J56 SMA_SMD
out_sh_A3
out_sh_A4
out_sh_D3
out_sh_D4
J38 SMA_SMD
J39 SMA_SMD
J57 SMA_SMD
J58 SMA_SMD
out_sh_B1
out_sh_B2
out_sh_C1
out_sh_C2
J59 SMA_SMD
J60 SMA_SMD
J61 SMA_SMD
J64 SMA_SMD
out_sh_B3
out_sh_B4
out_sh_C3
out_sh_C4
J62 SMA_SMD
J63 SMA_SMD
J65 SMA_SMD
J66 SMA_SMD
VCC3.3VA
U1078A
U1078B
U1078C
U1078D
U1079A
U1079B
U1079C
U1079D
U1080A
U1080B
U1080C
U1080D
U1081A
U1081B
U1081C
U1081D
ADA4891-4
out_t&h_A1
out_t&h_A2
out_t&h_A3
out_t&h_A4
out_t&h_B1
out_t&h_B2
out_t&h_B3
out_t&h_B4
out_t&h_C1
out_t&h_C2
out_t&h_C3
out_t&h_C4
out_t&h_D1
out_t&h_D2
out_t&h_D3
out_t&h_D4
t&h_A1
t&h_A2
t&h_A3
t&h_A4
t&h_B1
t&h_B2
t&h_B3
t&h_B4
t&h_C1
t&h_C2
t&h_C3
t&h_C4
t&h_D1
t&h_D2
t&h_D3
t&h_D4
<Pin Names Visible>
R2558
R2559
R2560
R2561
R2562
R2563
R2564
R2565
R2566
R2567
R2568
R2569
R2570
R2571
R2572
R2573
R2574
R2575
R2576
R2577
R2578
R2579
R2580
R2581
R2582
R2583
R2584
R2585
R2586
R2587
R2588
VCC3.3VD
U1058
U1062
U1065
U1069
AGD704
out_t&h_A
out_t&h_B
out_t&h_C
out_t&h_D
ColumnSelect0
ColumnSelect1
U1073
out_t&h
RowSelect0
RowSelect1
out_trig0b_A
out_trig0b_B
out_trig0b_C
out_trig0b_D
U1060
SN74LV08A
out_trig0b_A&B
out_trig0b_B&C
out_trig0b_C&D
U1061
ADG708
out_trig0b
ColumnSelect2
ColumnSelect1
ColumnSelect0
VCC3.3VD
Vss: Most Negative Power Supply Pin in Dual-Supply Applications. For single-supply applications, it should be tied to GND.
out_trig1b_A
out_trig1b_B
out_trig1b_C
out_trig1b_D
U1064
U1067
out_trig1b_A&B
out_trig1b_B&C
out_trig1b_C&D
out_trig1b
out_trig2b_A
out_trig2b_B
out_trig2b_C
out_trig2b_D
U1068
U1071
out_trig2b_A&B
out_trig2b_B&C
out_trig2b_C&D
out_trig2b
U1082
out_trig0b_A&B&C&D
out_trig1b_A&B&C&D
out_trig2b_A&B&C&D
RowSelect2
RowSelect1
RowSelect0
VCC3.3VA
GND
C1477
C1478
C1479
C1480
C1485
C1481
C1482
C1483
C1484
C1486
0.1uF
10uF
C1430
C1431
C1432
C1433
C1434
C1435
C1436
C1437
C1438
C1439
C1440
C1441
C1442
C1443
C1444
C1445
C1446
C1447
C1448
C1449
C1450
C1451
C1452
C1453
C1454
C1455
C1456
C1457
C1458
Title
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Size
A2
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This part is the readout array of GEM detector. The effective area of the GEM detector is 30cm*30cm, and the total size is 37.4*37.4. The detail structure of the Pad Readout Array is discribed in the Mechanical structure of Pad Readout Array.pdf

Title	SDHCal FEB	
Size: A4	Document Number: Pad Array Readme	Rev: v1.0
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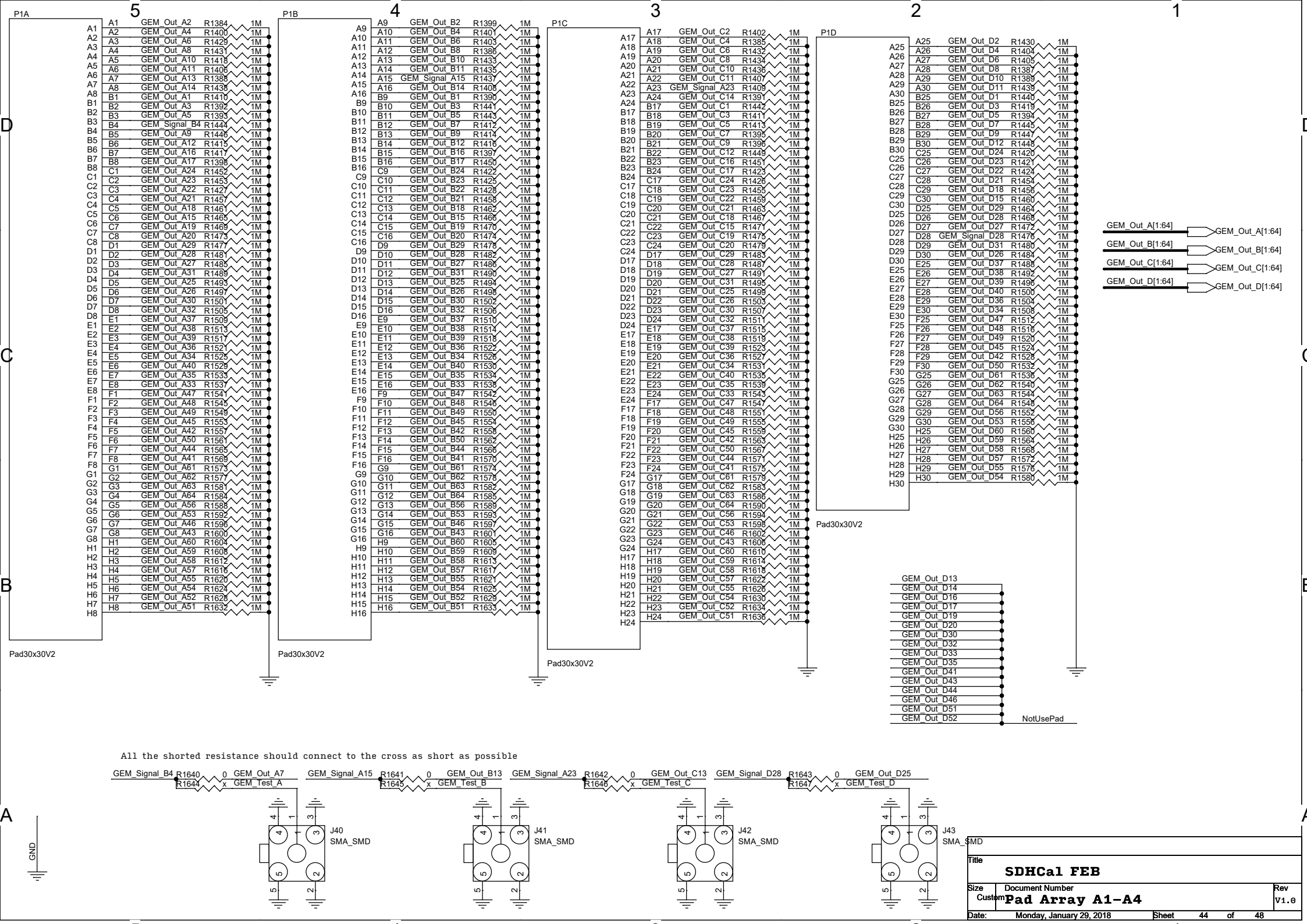

Title	SDHCal FEB
Size / Document Number	Custom / Pad Array A1-A4
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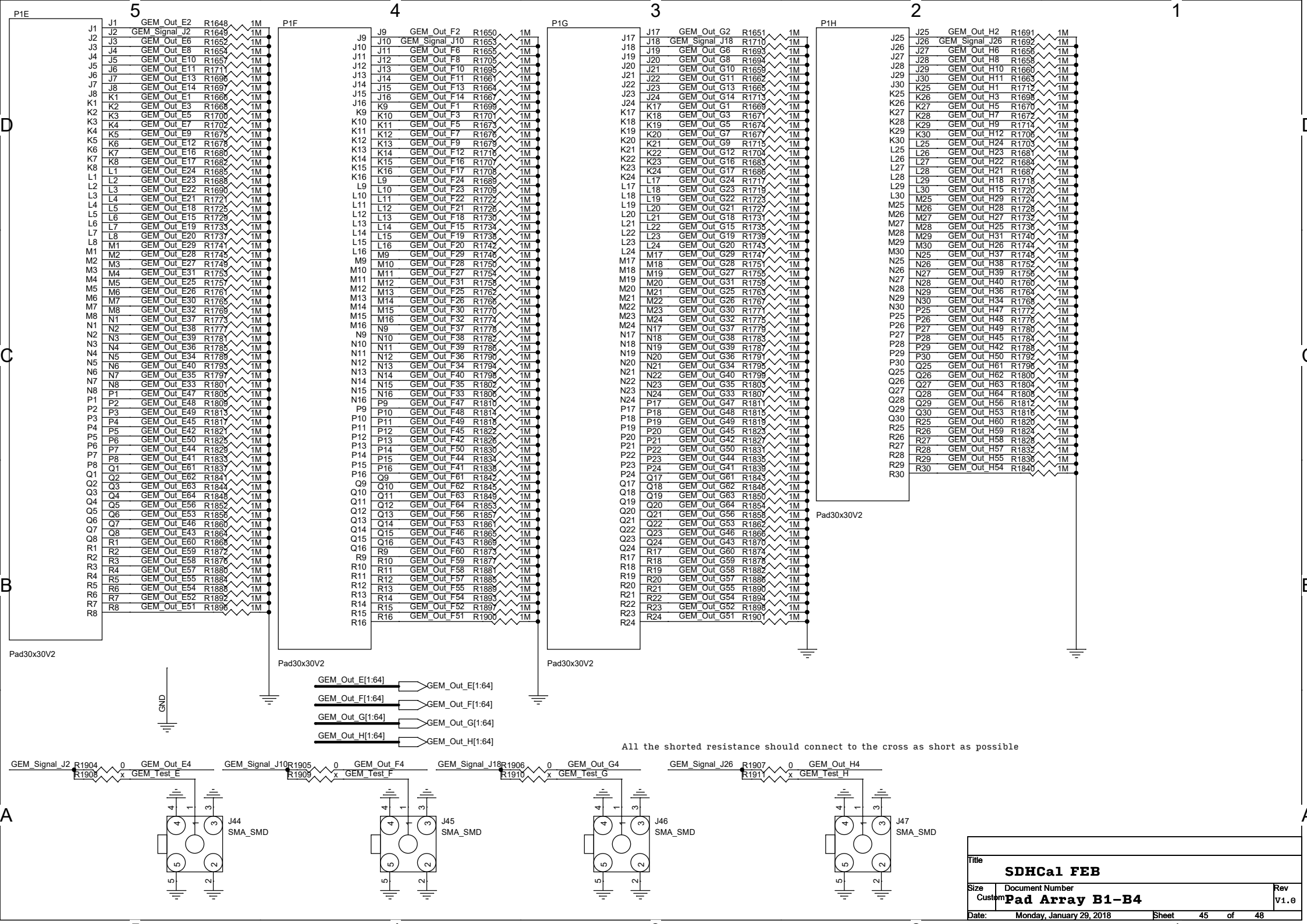
P1E
P1F
P1G
P1H
Pad30x30V2
GEM_Out_E[1:64]
GEM_Out_F[1:64]
GEM_Out_G[1:64]
GEM_Out_H[1:64]
GND
All the shorted resistance should connect to the cross as short as possible
GEM_Signal_J2
GEM_Signal_J10
GEM_Signal_J18
GEM_Signal_J26
GEM_Test_E
GEM_Test_F
GEM_Test_G
GEM_Test_H
J44
J45
J46
J47
SMA_SMD
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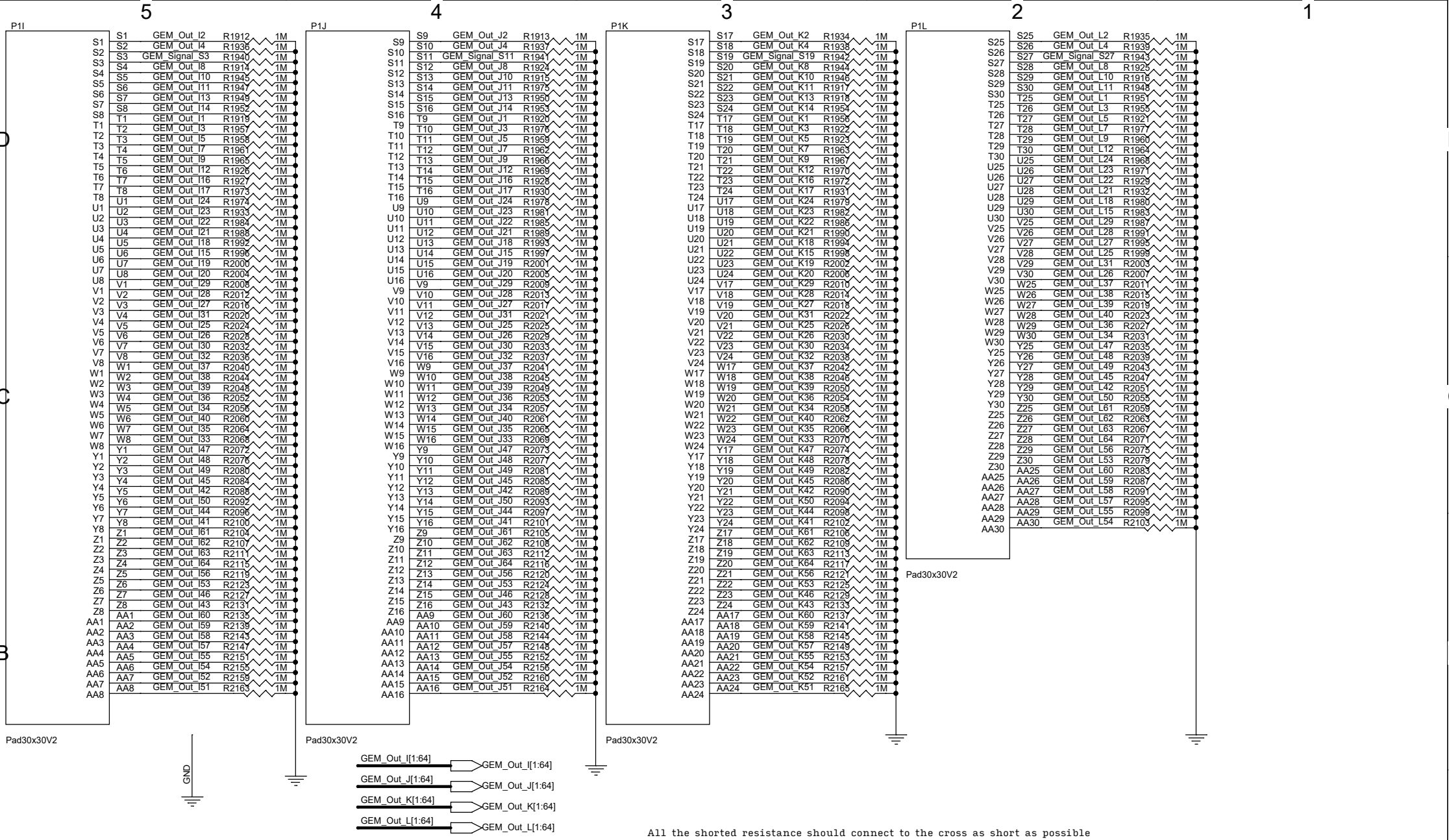

Title	SDHCal FEB
Size: Custom	Document Number: Pad Array C1-C4
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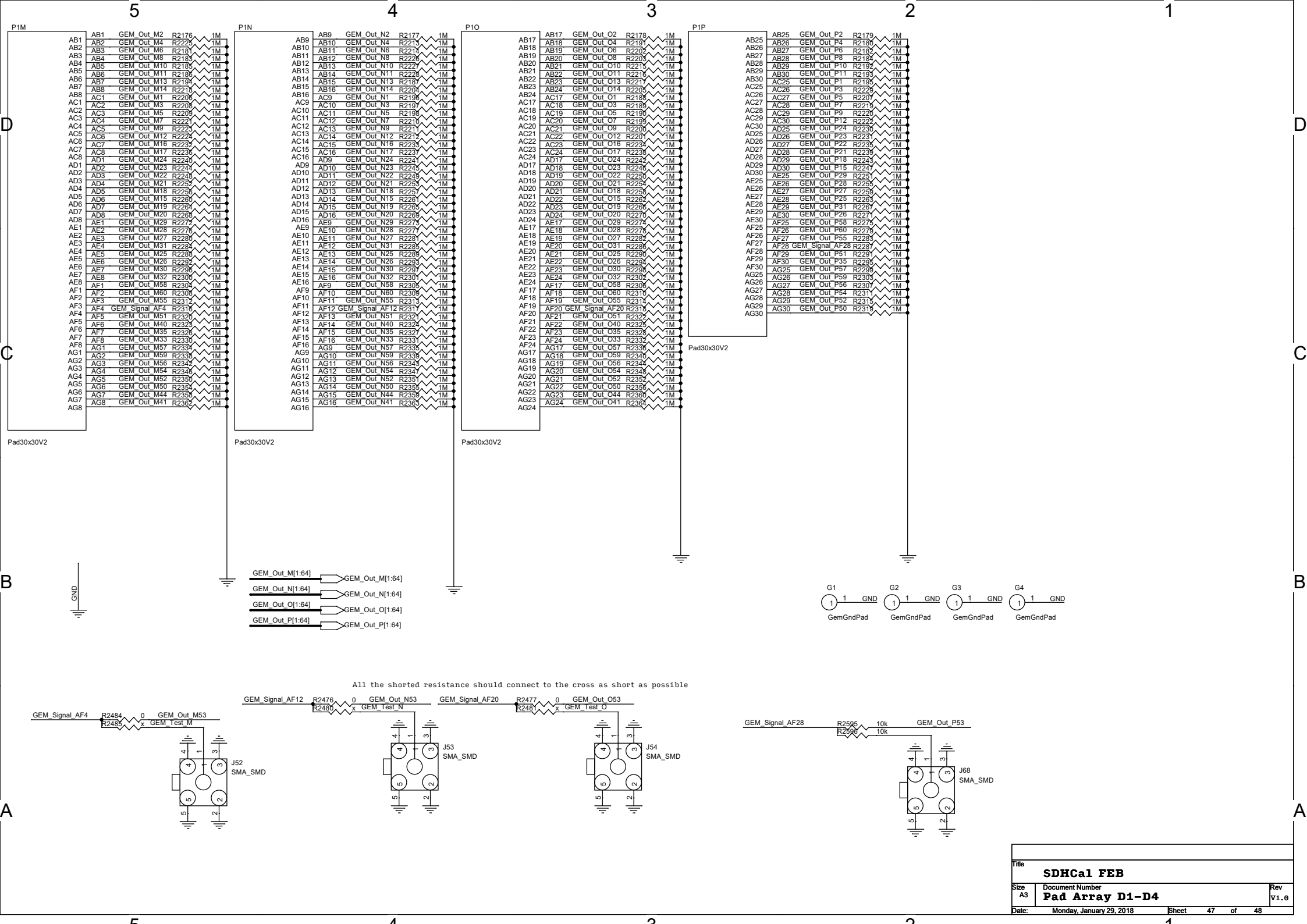

Title	SDHCal FEB	
Size A3	Document Number Pad Array D1–D4	Rev V1.0
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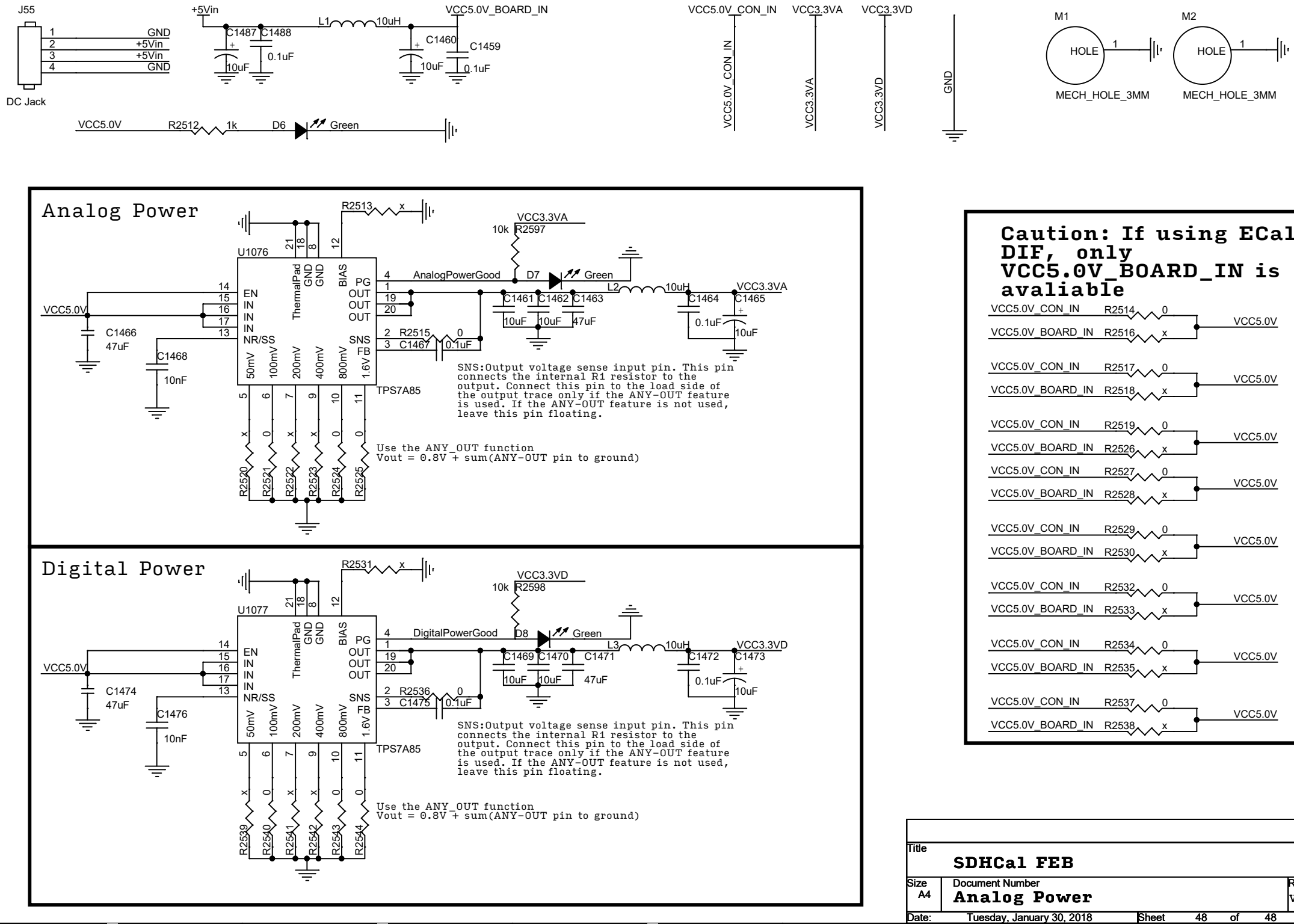
5
4
3
2
1
J55
DC Jack
+5Vin
VCC5.0V_BOARD_IN
L1
10uH
C1487
C1488
C1460
C1459
10uF
0.1uF
VCC5.0V_CON_IN
VCC3.3VA
VCC3.3VD
GND
M1
M2
HOLE
MECH_HOLE_3MM
VCC5.0V
R2512
1k
D6
Green
Analog Power
U1076
R2513
VCC3.3VA
10k R2597
AnalogPowerGood
D7
L2
C1461
C1462
C1463
C1464
C1465
C1466
47uF
C1468
10nF
R2515
C1467
TPS7A85
SNS:Output voltage sense input pin. This pin connects the internal R1 resistor to the output. Connect this pin to the load side of the output trace only if the ANY-OUT feature is used. If the ANY-OUT feature is not used, leave this pin floating.
Use the ANY_OUT function
Vout = 0.8V + sum(ANY-OUT pin to ground)
R2520
R2521
R2522
R2523
R2524
R2525
Digital Power
U1077
R2531
VCC3.3VD
10k R2598
DigitalPowerGood
D8
L3
C1469
C1470
C1471
C1472
C1473
C1474
47uF
C1476
10nF
R2536
C1475
SNS:Output voltage sense input pin. This pin connects the internal R1 resistor to the output. Connect this pin to the load side of the output trace only if the ANY-OUT feature is used. If the ANY-OUT feature is not used, leave this pin floating.
Use the ANY_OUT function
Vout = 0.8V + sum(ANY-OUT pin to ground)
R2539
R2540
R2541
R2542
R2543
R2544
Caution: If using ECal DIF, only VCC5.0V_BOARD_IN is avaliable
VCC5.0V_CON_IN
VCC5.0V_BOARD_IN
R2514
R2516
R2517
R2518
R2519
R2526
R2527
R2528
R2529
R2530
R2532
R2533
R2534
R2535
R2537
R2538
Title
SDHCal FEB
Size
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