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D1V2 + Zen I/V Manual

PCM63 x 4, SM5842, WM8804, Zen I/V (Nelson Pass)

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Classic B2B DAC full balance design
Digital to Analogue Converter

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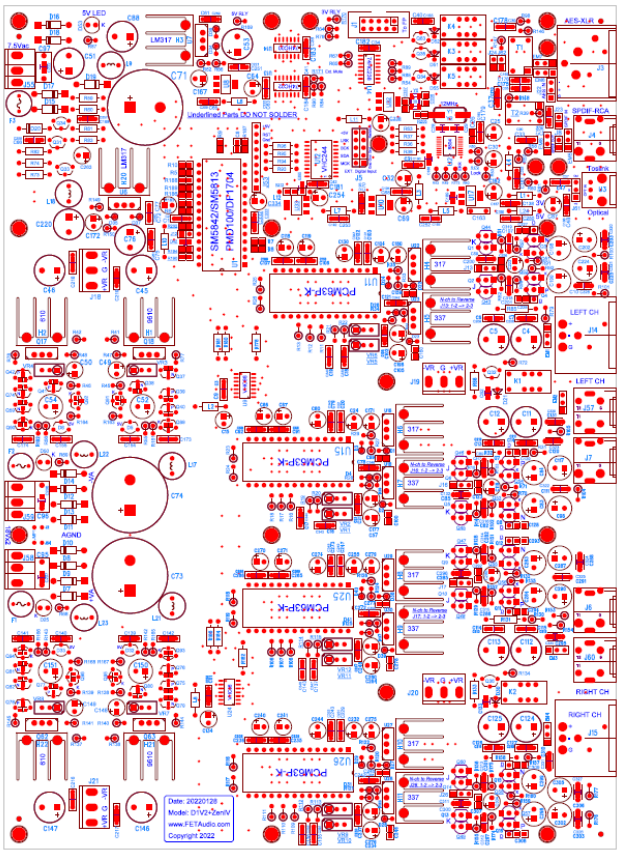


A. Introduction:

Nelson Pass has designed a "Classic D1 DAC" using 4 pcs PCM63 R2R DAC chips with full balance back in 1997. I have done a so call D1 clone circuit board back in 2012. Nelson had also issued a Zen I/V article since 2010 but I did not take a serious look due to my day-time work commitment. Some people have been posted many derivates of the Zen I/V since then in http://www.diyaudio.com forum. Mr. Pass had laid down the foundation of Zen I/V with many hinds for Diyer to explorer further. Of course, there are still many people interest to build old R2R DACs as the sound is typical analogy style!

Finally in 2022, I decided to make a new PCB of D1 clone (name it D1V2 Zen I/V). My purpose is to see how good the Zen I/V is compared to the past design of my jfets I/V which has quite a high distortion level of about 0.3% per channel! I started with a daughter board Zen I/V and mounted on my old D1V3.3 version board for experiment. The result is promising with distortion at about 0.005% levels. As far as I know the D1V3.3 still has many weaknesses and thus I am going to address them one by one whatever I can in the new PCB.

Here are the key features of the D1V2 Zen I/V PCB:

1. WM8804 receiver chip is used (one of the lowest jitter receiver chip available) with relay switching for 3 digital inputs (AES/ SPDIF/ Optical). The selection still uses the FDA-1B front panel to control the selection of input digital source. WM8804 clock - XTI input is also provided with an option of XO or TCXO (5x3.2 or 3.2x2.5mm size) besides standard 12MHz Crystal. User can search the more accurate frequency and lower jitter XO/TCXO to experiment.
2. Keep the form factor of the FDA-1B circuit board with all the M3 mounting holes, input, and output sockets for easy fitting into existing casing. I can cut short much time to design the digital part and power supply sections. In fact the time is spend on fine tune the layout of the digital section.
3. Digital Bus signal buffer chip 74VHC244 can select to use either 5V or 3.3V supply. If use 5V, it is acting like a level shifting buffer from 3V3 to 5V CMOS levels. At 3V3 supply, it is used for digital filter DF1706 to match the input levels.
4. Digital filter is designed for SM5842 by default, but SM5813/DF1700, PMD100, SM5843, DF1704 and DF1706 can also be used. The last two DF chips need a SSOP28 to DIP28 converter board for mounting. All the hardware mode selections are done using 0805 size SMD resistors on top or bottom side of the board. A "**Digital Filter Assignment Table**" (section E, item 8-9) is provided for setting but it is not a quick switching using jumpers or dip switches due to possibility of damaging the chip if connected wrongly on the power supply.
5. Since DF1706 use 3.3V supply, a regulator is added on the bottom of board.
6. J53 connector pins (2.54mm pitch) are added next to the DF chip. It is used for future daughter board when SM5803 is used (some code loading is needed during power up to set the attenuation of the chip to Zero and I know many diyers are better than me on software coding).
7. After the DF, phase convertor chip 74HC86 DIP is changed to 74VHC86 SOIC. Reason is availability issue and faster speed for better jitter performance.

8. PCM63 design is keeping the distortion tuning option by trimming pots. With the lower distortion of Zen I/V, I expect the turning is workable with proper setup and very low distortion measurement equipment.
9. Other DAC chips PCM1702U / PCM1702 DIP / PCM1704U can be used as new converter boards for each of them is available. Of course, the I/V resistor should be adjusted for higher output levels. Due to supply rails limitation, the output levels will be a bit lower, but distortion is also lower at full digital scale.
10. The power supply of Zen I/V is adopted from FDA-1B analogy low noise regulators. Each PCM63 +/-5V power supply is regulated by two IC (LM317/LM337) and the input voltage is from the +/-20V low noise regulator. Digital supply of PCM63 is derived from the analogy +/-5V supply with RC filtering. The digital and analogy ground is connected at the middle of the DAC chip by the ground plane. In summary, the Yamaha DA8X PCB layout for the power supply and grounding is used as the DA8X supply and layout is well designed to ensure low noise and low distortion performance.
11. Resistors are mostly Through Hole except the mode setting resistors of digital filter are 100% 0805 style. In fact, the TH resistors pitch is 100mil (2.5mm) and thus 0805 resistor is okay to use. At the IV side, TH resistors is 3.5mm pitch and thus 1206 size SMD resistor should be use. Power rating there for the IV resistor is HIGH! For capacitor, both through hole 5mm pitch OR 0805 pads are provided for flexibility.
12. Zen I/V is adapted Mr. Nelson Pass's design with an added transistor emitter follower by default. The input can use a complementary K170/J74 pair or two K369 jfets. I duplicate the input FET pads so that people can put max two K170/J74 pairs or 4 pcs K369 jfets as input section. For output buffer, it can use one pair of NPN/PNP transistor as emitter follower or K170/J74 as source follower (I added one "**D**" hole so that jfets can be mounted easily as source follower). I also added two more DGS pads for K170/K170, K363/K363 or K369/K369 buffer when use it in single end buffer when input is using only K/K jfets. Thus, there are many combinations diyer can explorer. Finally, if there is new better IV design, a daughter board can also be mounted on top like what I did on the D1V3.3 board.
13. Added EMI filters (LCL) pads at all AES/SPDIF/Analogy outputs as some user may have EMI issue complaints. If not use, just short the pad with a wire!
14. I like single board DAC design because the supply is there, layout is there and all the wirings issues has been addressed in the PCB design stages to get better performance. This is the main reason I make a full DAC PCB design as I want diyers to have consistent result when building a DAC with some good topology.
15. With limited time, my main purpose is to share the DAC PCB. Not to sell kit but I still can provide some of the components if I have extra in my stock. Note that most of the part can be found in distributors like RS components, Element14, Mouser and Digikey etc…

B. Specifications:

1. Power supply: 18V x 2 and 9V x 1 transformer of total about 60VA of equal share.
2. Digital Input: RCA/SPDIF, XLR female/AES and Toslink/Optical input. Control by front panel using tact switch or push button. Selection by two pins with 00/01/10/11.
3. Analogy Output: Two male XLR on board sockets for balance output, two single RCA and two dual RCA pads is also provided for single end output.
4. Zen I/V rail: use +/-20V with default I/V resistors values. User can adjust the rails and I/V resistors as they like.
5. Output levels: With PCM63 DAC, it is about 1.5Vrms in SE mode or 3Vrms for balance mode.
6. Output distortion is around 0.008% for using PCM63 in single end mode with Jfets NP pair input and transistors NP pair buffer. That is one pair of K170/J74 (8~9mA Idss) and one pair of transistors KSC1845/KSA992 for each I/V.
7. Output capacitors from emitter follower is using two Electrolytic capacitors. Big film capacitors space is not provided but they can be connected on top or bottom of the PCB.
8. Digital Receiver chip: WM8804. 4 Digital output formats are able to be set on board by 4 resistors (only solder two at one time).
9. Digital Filter: SM5842, SM5843, SM5813, DF1700, PMD100, DF1704 & DF1706. Last two DF chips need a SSOP28 to DIP28 converter board. SMD bypass film capacitor should be added on the convert boards for the power supply and ground pins of the DF chip.
10. SM5803AP may be able to use as a connector "**J53**" is reserved for putting a daughter board to transfer preset codes into the internal registers during power up or reset cycles.
11. Buffer and Inverter: 74VHC244 and 74VHC86 fast CMOS logic IC.
12. DAC: PCM63 DIP28, PCM1702 (DIP and SOIC), & PCM1704 SOIC. Note that converter board is needed for 1702 / 1704 DAC chips.
13. Zen I/V: Use Nelson Pass basic design with some modification of added output buffer and different I/V resistor values and rail voltages. Distortion level as measured is very close or equal to Nelson Pass's figures.

C. Assembly Procedures:

**** For manual soldering, the rule is to solder part from small to big size and from short to tall parts ****

1. Refer to the BOM, solder all the SMD small part first – resistors and capacitors as per BOM.
2. Solder all the SOICs – U2, U4, U9, U12, U13, U14, U24, & Y5 (XO). Solder all the 3V3 SMD SOT223 regulators. For WM8804, use a multimeter to check if there is any short solder between adjacent pins and the connectivity to the pad and trace.
3. Solder all the Diodes, Beads, and inductors and small through hole components.
4. Solder all small pins, jumpers and DIP28 IC sockets. That is the SMALL J parts.
5. Solder the through hole resistors vertically placed including the VRs.
6. Solder the relays.
7. Solder all Through Hole transistors and Jfets.
8. Solder all the heatsink together with the IRFs and LM317/LM337 parts. Make sure there is a mounting kit for all these parts with a mica or thermal pad between the TO-220 body and the heatsink surface. Verify the insulation of the part body to the heatsink pins by a multimeter after soldering.
9. Solder the rest of through hole capacitors.
10. Solder all the power connector and input and output sockets – BIG J parts.
11. Check if any missing components and solder them all to complete the assembly process.

Use of Other DF filter chips: SM5843, SM5813, DF1700, PMD100, DF1704, DF1706

1. Follow the "**Digital Filter Pin Cross Reference**" table to determine what component is needed if another digital filter chip is used other than SM5842. All the part designations are layout either on top or bottom nearby the U1 - DF location. For SM5842 (default DF), all the parts required are placed on the Top of the PCB. Any part with "Underlined Designation like C334" is not required on top side. For other digital filter chips, follow the cross-reference table to put in the components on either top or bottom of the PCB **carefully**.
2. For PMD100, there is two power supply pins and thus additional supply through two resistors R195 and R196 to pin 7 is needed, they are all 0R jumper resistors on the bottom side of PCB. C334 and C332/C333 are providing additional filter and bypass for pin 7. R194, D42 are for HDCD LED on board. If off board is needed for the LED, do not solder D42 and use J12 to connect the LED off the board.
3. For DF1704 and DF1706, they are required to be mounted on a SSOP28 to DIP28 converter board first. Addition SMD 0.1u MLCC capacitors is needed to solder on the converter boards to improve power supply bypass.
4. For DF1706, it is a 3.3V parts thus two 3.3V regulators are needed to ensure it is working properly. One is for the supply of DF1706 at the bottom U31. Other components needed is R203, and C335. **Make sure L10 is remove for the 5V supply to pin 22**! Besides, U33 is also needed for 74VHC244's power supply at 3V3 due to DF1706 input levels at 3V3 range. Other parts for the U33 regulator are R212, and C355. **When using U33, make sure L12 is disconnected also!**

D. Adjustment and Testing Procedures:

DO NOT PLUG IN ANY DIGITAL FILTER CHIPS AND DAC CHIPS FOR BELOW ADJUSTMENT AND TESTING!

1. **Digital power supply**:
    a. Connect an AC voltage about 7-9V to J55, check the DC voltage at the D19 anode for about 9 to 12V dc. Note down the DC voltage as standard.
    b. Check the regulator U6 and U7 for a 5V regulated voltages at their TO-220 heatsink body (not the big heatsink which is grounded).
    c. Then verify all the 3V3 regulators output is correct by touching the pin 4 (heatsink) of each unit to ground. That is U8, U10 and U17. If other SOT223 regulator is used, check them also for U32, U33 and U31 – bottom at U1 pin 22 (for using DF1706 only).
    d. By default, if SM5842 is used, pin 22 of U1 is at 5Vdc.
    e. If PMD100 is used, pin 7 of U1 should also be at 5V. that is R195 and R196 is shorted. DO NOT SHORT THESE TWO RESISTORS FOR OTHER DIGITAL FILTER CHIPS OR ELSE DAMAGE MAY HAPPEN!
    f. Once all the regulators voltage is correct, most likely the digital section is working! Remove the AC at J55 and continue the testing below.
2. **Analogy power supply**:
    a. Connect AC 18V x 2 to J58 and J59. Verify the output near D7 (+VA) marking for about +24V dc. Also check at D14 (-VA) marking for about -24V dc.
    b. Then connect the meter to two -VR (one by one) and ground and adjust VR4 and VR8 (two regulators) for an output voltage of -20Vdc.
    c. Also connect the meter to two +VR (one by one) and ground and adjust VR3 and VR7 (two regulators) for an output voltage of +20Vdc.
    d. The voltages should be very easy to adjust to be within +/-0.1V as the VR is a 10 turns type.
    e. Then connect 6 wires from J18 to J19 and J20 to J21. Make sure the +VL, GL & -VL AND +VR, GR & -VR are connected together respectively.
    f. Power on the 18V x 2 again and then check the +/-20V supply voltages at the other I/V side of the socket. Trouble shoot if the supply drop by more than 0.5V.
    g. Verify the regulators voltage for EACH PCM63 location as below:
        i. Pin 2 and Pin13 should be about +5V +/- 0.1V
        ii. Pin 28 and Pin 11 should be about -5V +/- 0.1V
    h. Repeat the checking for all the 8 regulators for PCM63: That is for U11, U15, U25 and U26. Total 4 x 4 points.
    i. In case the voltage is wrong, verify the two resistors value for the regulators.
    j. Next verify the I/V resistors (R51 & R52 for the first I/V) voltage at the drain of input Jfets Q1 and Q2. They should be about + ?V +/-0.5V and - ?V +/-0.5V respectively.
    k. Check the input dc offset voltage at pin 6 of PCM63 to be below 3mV dc. A good match jfet pair will give even lower dc offset readings about 1mV or below.

l. Check the emitter resistor at the emitter of each transistor Q3 & Q4 and they should be about 0.5V below the voltages at the drain of each jfets Q1 & Q2. That is about +?V +/-0.5V and -?V +/- 0.5V readings.
m. Repeat step j to l for the other 3 Zen I/V.
n. If all the voltages in the analogy section is correct, then power it off again.
o. Plug in the digital filter chips and the DAC chips.

3. **Functional test section**:
   a. Feed a digital signal with 1kHz data at the RCA/SPDIF input (default) without front panel control board connection.
   b. Power on the digital and analogy supply together (J55, J58 and J59).
   c. You should hear the output mute relay to click after a while. That means the output is un-muted.
   d. Then measure the AC analogy output signal at C10 with the PCM63 DAC chips. The reading should be about 1.5Vrms at 1kHz if the digital signal is a 100% full scale signal.
   e. If no digital signal is available, music CD can be used.
   f. Repeat to plug in other PCM63 after power off one by one until all the 4 channels are working with almost same output analogy AC signal levels at C10, C131, C295 & C310. The variations of out levels should not be more than 0.5dB.
   g. After that can verify all the regulators voltage again to be at either 5V or 3v3 again carefully and not to short the probe to any traces other than measurement points. For +5V, LM317 heatsink can be used as the output voltage. For LM337, the pins at the 1uf capacitor pad at C107, C106, C103 and C102 should be measured.
   h. If the voltages are still accurate, then proceed to do output level, distortion test and frequency response tests!
   i. Finally Listen test can be started!

E. Board Interface Specifications:

1. Power Supply Connectors:

Location	Description	Format
J58	18V to 20V AC, 0.8A, 14VA	3.96mm pitch (5mm also provided)
J59	18V to 20V AC, 0.8A, 14VA	3.96mm pitch (5mm also provided)
J55	8 to 9V AC, 1.2A, 12VA	3.96mm pitch (5mm also provided)
J2/J54/JMP1	Chassis Ground	Connect AGND to star ground point

2. External digital Connector J5: (5 x 2 female Pin Header; pitch 2.54mm, CMOS 5V logic; 3V3 when used U33/R212/C355 and remove L12 to power up U12 VHC244)

Pin	Description	Marking on PCB
1	Digital Ground	GND
2	System clock 256fs	MCLK
3	USB2 LED drive (with current limit R120)	GND
4	Serial Digital Data	SDA
5	USB LED drive (with current limit R121)	GND
6	Bit clock 64fs	BCK
7	Power up reset (Low = Reset)	RST
8	Work clock fs	LRK
9	Output Mute (Hi = Mute)	Mute
10	+5V DC Supply for plugin	+5V

3. Digital Input / Output Socket:

Location	Description	Spec	Format
J4 / J23	SPDIF input	75 ohm 24bit/192k	RCA (Single deck)
J3 / J22	AES input	110 ohm 24bit/192k	XLR female
U3 / J61	Optical input	Optical 24bit/192k	Toslink - TORX147
J5	See item 2 above	5V (default) or 3.3V CMOS levels	5x2 pin header
J8	Digital SPDIF output	75 ohm 24bit/ 192k	2.54mm Pin header

Note: For 192k operation, an ASRC daughter must be used at U18 location.

4. Analogy Output Socket:

Location	Description	Format
J14	Left Ch balance output	XLR male
J15	Right Ch balance output	XLR male
J7	Left Single Ended Output	RCA (white)
J57	Left channel +V and -V output	RCA (vertical double deck) not provided
J6	Right Single Ended Output	RCA (red)

5. J1 – Front Panel connector (for hardware mode only):

Pin	Description	Marking on PCB
1	Digital input Select Binary bit 0 (0, A)	Default A = 1
2	Digital input Select Binary bit 1 (B, 0)	Default B = 1
3	GND	GND
4	USB2 LED drive from pin 1 of J62 (no current limit) AND pin 3 of J5 (with resistor R120=680R current limit).	USB2
5	DGND	GND
6	USB LED drive from pin 1 of J24 (no current limit) AND pin 5 of J5 (with resistor R121=680R current limit).	USB
7	+3V3 Supply from U8	+3v3
8	Lock LED drive (with resistor 680R current limit)	High = Lock
9	+3V3 Supply from U8	+3v3
10	Mute LED drive (with resistor 680R current limit)	High = Mute

6. Digital Input Select (Pin 1 and 2 of J1):

No	Description	Marking on PCB
1	Pin 2, Pin 1 = 0, 0	J5 ext digital input
2	Pin 2, Pin 1 = 0, 1	Toslink
3	Pin 2, Pin 1 = 1, 0	AES
4	Pin 2, Pin 1 = 1, 1	RCA - default

7. JUMPERS, RESISTOR AND PIN HEADER DESCRIPTION:

Location	Description
R90	Short one of these resistors; R90 = External Digital Mute at J5 pin 9 is active High. Default is R90 short (active high).
R171	If shorted, then the I2S Mute pin 9 is shorted to ground, thus the Mute conditions will depend on the setting of R53 and R88. Default is R171 open.
L1/L24	L1 and L24 are for 3V3 and 5V optical receiver at U3 respectively. Only one of the inductors should be connected per the spec of the Toslink.
R39	Should be shorted for SPDIF/RCA IN to work without T2.
JMP1	If connected, the M3 hole near to it will be connected to analogy ground
C95/C96/C97	Can be used to connect a MOV for surge suppression, not provided
R169/R170	R169 is 0R and R170 is open for 5V relays - K3, K4 & K5. For 3V3 relays, short R170 and open R169.
VR1, VR2, VR5, VR6, VR9, VR10, VR11, VR12	All 100k 10 turns pots to adjust distortion of PCM63 when needed. Use together with Resistors R19 to 22 and R112 to R115. This must refer to PCM63 data sheet for the adjustment method.
WM8804 **R43/R214** R43/R49 R215/R49 R215/R214	Digital output format setting: (Connect only two 10k resistors) 16-bit Right Justified (**Default** for PCM63/PCM1702/PCM1704 DAC) 24-bit I2S 16-bit I2S 24-bit Left justified

8. Digital Filter Pin tables:

Pin #	SM5842	SM5813 / DF1700	DF1704E	DF1706-3.3V	PMD100	SM5803	SM5843
1	DI / INF2N	DIN	DIN	DIN	DIN	DIN	DI / INF2N
2	BCKI	BCKI	BCKIN	BCKIN	BCKI	BCKI	BCKI
3	CKSLN	CKSL_	I2S	I2S	XTIM	CKSL_	CKSLN
3							
4	INF1N	CKDV_	IW0	IW0	DITH	CKDV_	INF1N
4							
5	IW1N / DIL	NC	IW1	IW1	GAIN	8X_	IW1N / DIL
5							
6	XTI	XTI	XTI	XTI	XTI	XTI	XTI
7	XTO	XTO	XTO	XTO	VDD1	XTO	XTO
7							
8	VSS	VSS1	VSS	VSS	VSS1	VSS1	VSS
9	CKO	CKO	CLKO	CLKO	PROG	CKO	CKO
10	IW2N / DIR	SYN_	MODE	MODE	OSIZ0	MS1	IW2N / DIR
10							
11	OW1N	NC	MD / CKO	MD /CKO	OSIZ1	MS2	MDT
11							
12	OW2N	NC	MC / LRIP	MC /LRIP	COB_	MS3	MDK
12							
13	SYNCN	NC	ML /RESV	ML /RSV	JUST	MDT	MLEN
13							
14	RSTN	RST_	RST	RST_	BCPL	MEN_	RSTN
14							
15	DEMPR	COB_	MUTE	MUTE_	SMUTE	MUTE	MUTE
15							
15							
15							
16	DEMPL	OW20_	DEM	DEM	DEEMPH	DIEM	DEMP
16							
17	FSEL1	OW18_	SF0	SF0	HMUTE	FSEL1	FSEL1
17							
18	FSEL2	NC	SF1	SF1	FSEL	FSEL2	FSEL2
18							
19	MUTER	NC	OW0	OW0	SCAL	DGR	OW20N
19							
19							
20	MUTEL	DG	OW1	OW1	DG	DGL	SYNCN
20							
20							
21	DITHN	VSS2	NC	X4	VSS2	VSS2	TMOD1
22	VDD	VDD	VDD	VDD	VDD2	VDD	VDD
23	DOR	DOR	DOR	DOR	DOR	DOR	DOR
24	DOL	DOL	DOL	DOL	DOL	DOL	DOL
25	WCKO	WCKO	WCKO	WCKO	WCKO	WCKO	WCKO
26	BCKO	BCKO	BCKO	BCKO	BCKO	BCKO	BCKO
27	DG	FSCO	SRO	SRO	HDCD	FSCO	TMOD2
27							
27							
28	LRCI	LRCI	LRCIN	LRCIN	LRCI	LRCI	LRCI

9. Digital Filter assignment tables:

NOTE: NC = NO CONNECTION

Pin #	RESISTOR	SM5842	SM5813 / DF1700	DF1704E	DF1706-3.3V	PMD100	SM5803	SM5843	Value
1									
2									
3	R8	0R	0R	0R	0R	0R	0R	0R	0R
3	R206	NC	NC	NC	NC	NC	NC	NC	10K
4	R7	0R	NC	0R	0R	NC	NC	0R	0R
4	R204	NC	NC	NC	NC	10K	NC	NC	10K
5	R2	NC	NC	0R	0R	NC	0R	NC	0R
5	R207	NC	NC	NC	NC	NC	NC	NC	10K
6									
7	R195	NC	NC	NC	NC	0R	NC	NC	0R
7	R196	NC	NC	NC	NC	0R	NC	NC	0R
8									
9	R193	NC	NC	NC	NC	0R	NC	NC	0R
10	R3	NC	NC	0R	0R	0R	J53-1	NC	0R
10	R208	NC	NC	NC	NC	NC	MS1	NC	10K
11	R9	0R	NC	NC	NC	NC	J53-2	NC	0R
11	R199	NC	NC	NC	NC	10K	MS2	NC	10K
12	R1	NC	NC	0R	0R	NC	J53-3	NC	0R
12	R198	NC	NC	NC	NC	10K	MS3	NC	10K
13	R4	NC	NC	NC	NC	NC	J53-4	NC	0R
13	R197	NC	NC	NC	NC	10K	MDT	NC	10K
14	C8	330pF	100pF	330pF	330pF	0R	J53-5	330pF	SEE left
14	R187	0R	0R	0R	0R	NC	MEN_	0R	0R
15	R10	0R	NC	NC	NC	NC	NC	NC	0R
15	R179	NC	NC	NC	NC	0R	0R	0R	0R
15	R213	NC	NC	0R	0R	NC	NC	NC	0R
15	R75	NC	NC	NC	NC	NC	NC	NC	10K
16	R5	0R	0R	0R	0R	0R	0R	0R	0R
16	R211	NC	NC	NC	NC	NC	NC	NC	10K
17	R188	0R	NC	0R	0R	0R	0R	0R	0R
17	R210	NC	NC	NC	NC	NC	NC	NC	10K
18	R189	0R	NC	0R	0R	0R	0R	0R	0R
18	R209	NC	NC	NC	NC	NC	NC	NC	10K
19	R191	NC	NC	0R	0R	0R	NC	0R	0R
19	R186	0R	NC	NC	NC	NC	NC	NC	0R
19	R201	NC	NC	NC	NC	NC	NC	NC	10K
20	R192	NC	NC	NC	NC	NC	NC	NC	0R
20	R183	0R	NC	NC	NC	NC	NC	NC	0R
20	R200	NC	NC	10K	10K	NC	NC	NC	10K
21	R6	0R	0R	NC	0R	0R	0R	0R	0R
22									
23									
24									
25									
26									
27	R190	NC	NC	NC	NC	NC	NC	NC	0R
27	R194	NC	NC	NC	NC	680R	NC	NC	680R
27	R202	NC	NC	NC	10K	NC	NC	NC	10k
28									
PMD100	C332/C333	NC	NC	NC	NC	**0.1uF**	NC	NC	0.1u
	C334	NC	NC	NC	NC	**10uF 25V**	NC	NC	10u
	R194	NC	NC	NC	680R	**680R**	NC	NC	680R
	D42 (LED)	NC	NC	NC	NC	**0805 LED**	NC	NC	0805 LED
	J12 (LED Con)	NC	NC	NC	NC	**2.54mm pin**	NC	NC	2.54mm PIN
DF1706	C335	NC	NC	NC	**0.1u 0805**	NC	NC	NC	0.1u 0805
	R203	NC	NC	NC	**0R**	NC	NC	NC	0R
	L10	Bead	Bead	Bead	**NC**	Bead	Bead	Bead	Bead
	U31	NC	NC	NC	**AMS1117-3.3V**	NC	NC	NC	SOT223 3,3V
	L12	Bead	Bead	Bead	**NC**	Bead	Bead	Bead	Bead
	R212	NC	NC	NC	**0R**	NC	NC	NC	0R
	C355	NC	NC	NC	**0.1u 0805**	NC	NC	NC	0.1u 0805
	U33	NC	NC	NC	**AMS1117-3.3V**	NC	NC	NC	SOT223 3,3V
	On Bottom side								
	On TOP side								

Note: For SM5803 digital filter, a small program board is required to write the codes into it during power up to set the attenuator to 0 dB via J53 on next page.

10. Digital Filter connector J53:

This connector is reserved for future control of SM5803 software mode digital filters. A counter and ROM with preset data is required to send the code to the DF chip during power up. The work clock can be used to clock the codes into the DF chips. Pin assignment is in below table:

No	DF chip Pin	Description:
1	10	See table 8 for SM5803 – MS1
2	11	See table 8 for SM5803 – MS2
3	12	See table 8 for SM5803 – MS3
4	13	See table 8 for SM5803 – MDT
5	14	See table 8 for SM5803 – MEN_
6	LRCLK	Work clock of the digital signal. Can be used for clocking of code into the DF chip.
7	GND	
8	Reset	Reset signal from the DAC
9	+5V	

11. Zen I/V configurations table: (Use "Zen I/V Left -V" circuit as illustration example)

Transistor/ Jfet Reference Designation	Part Name	Zen I/V + transistor NP buffer (Default)	Zen I/V + Jfet K/J buffer (full Jfets)	Zen I/V K/K + Jfet K/K buffer	Zen I/V KK/KK + K/K buffer
Q1	K170 / K363 / K369	Y	Y	Y	Y
Q44	K170 / K363 / K369				Y
Q2	J74	Y	Y	Y -K170 REVERSE	Y -K170 REVERSE
Q43	J74				Y -K170 REVERSE
Q3	KSC1845	Y	Y – K170 USE PAD D		
Q4	KSA992	Y	Y – J74 USE PAD D		
Q51	K170 / K363 / K369			Y	Y
Q52	K170 / K363 / K369			Y	Y
C318/C201	2n2 to 4n7 filter	Y	Y		
R99	100R	Y	Y		
R92	1k5	Y	Y		
C224/225	100u / 0.1u	Y	Y		
C223/C226	33u / 0.1u	Y	Y		
J13 jumper	Short 1-2 or 2-3	1-2	1-2	2-3	2-3

Note: Diyers can also think of other options to try out in the layout. For fast conversion without de-soldering and soldering again, IC pin sockets can be soldered on the pads so that transistors can be unplugged for replacement!

F. Front Panel Control Board (V7.1):

The front panel control board Version 7.1 will control the counting of two digits, that is choice of 4 inputs. In FDA-2A, it can be set to use either 4 digital input (2 x SPDIF, AES & Optical) or 3 digital input (SPDIF, AES, & Optical) and one external digital bus input (J5). Note that the front panel control will remember the last selection after power off as there is a static memory chips FM1106 on board. Short R107 and open R106 when this board is used for FDA-2A.

1. J1: Connect back to DAC main board via 10-pin flex cable.
2. J2 and J14 are the same toggle switch to select the digital input – SPDIF, AES, Toslink, and USB/I2S (J5 – not use as this moment).
3. J20 can be connected to an external Power LED. Brightness can be adjusted by changing the value of R17.
4. R18: D5 will indicate Mute if connected. R8 should not be connected in this mode.
5. R8: D5 will be power LED indicator if connected. R18 should not be connected in this mode.
6. The front panel can be mounted to the front plate when the LEDs are populated at the bottom of the PCB.

G. Attachments:

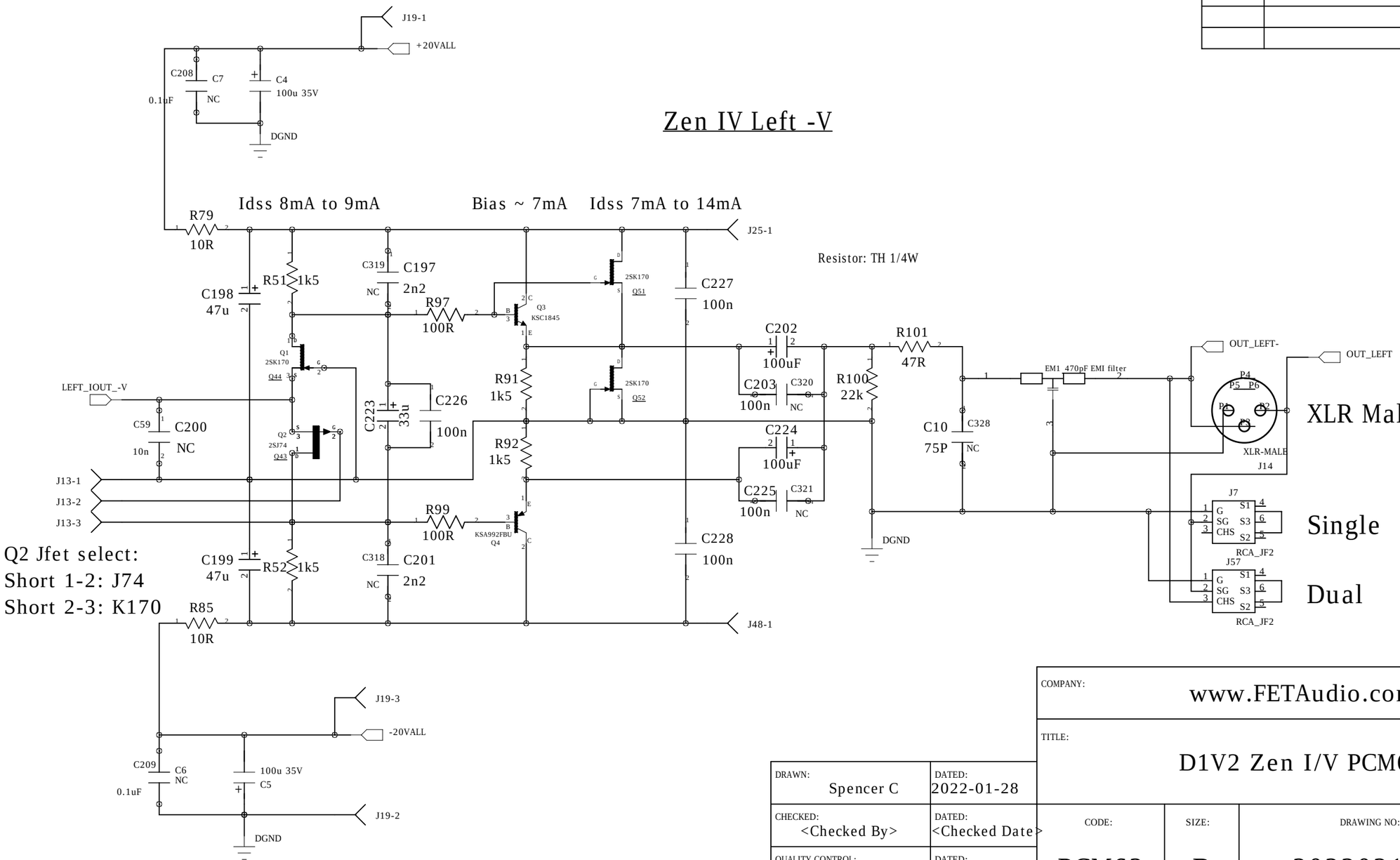
1. Circuit Diagram – 11 pages
2. BOM (Bill of Material) – 3 pages
3. PCBs silk screen, dimension & mounting – 3 pages
4. Front Panel Control Board – 3 pages
5. Photos - ? pages

*** E N D ***

Attachment 1: Circuit Diagram 11 pages

REVISION RECORD			
LTR	ECO NO:	APPROVED:	DATE:

Zen IV Left -V



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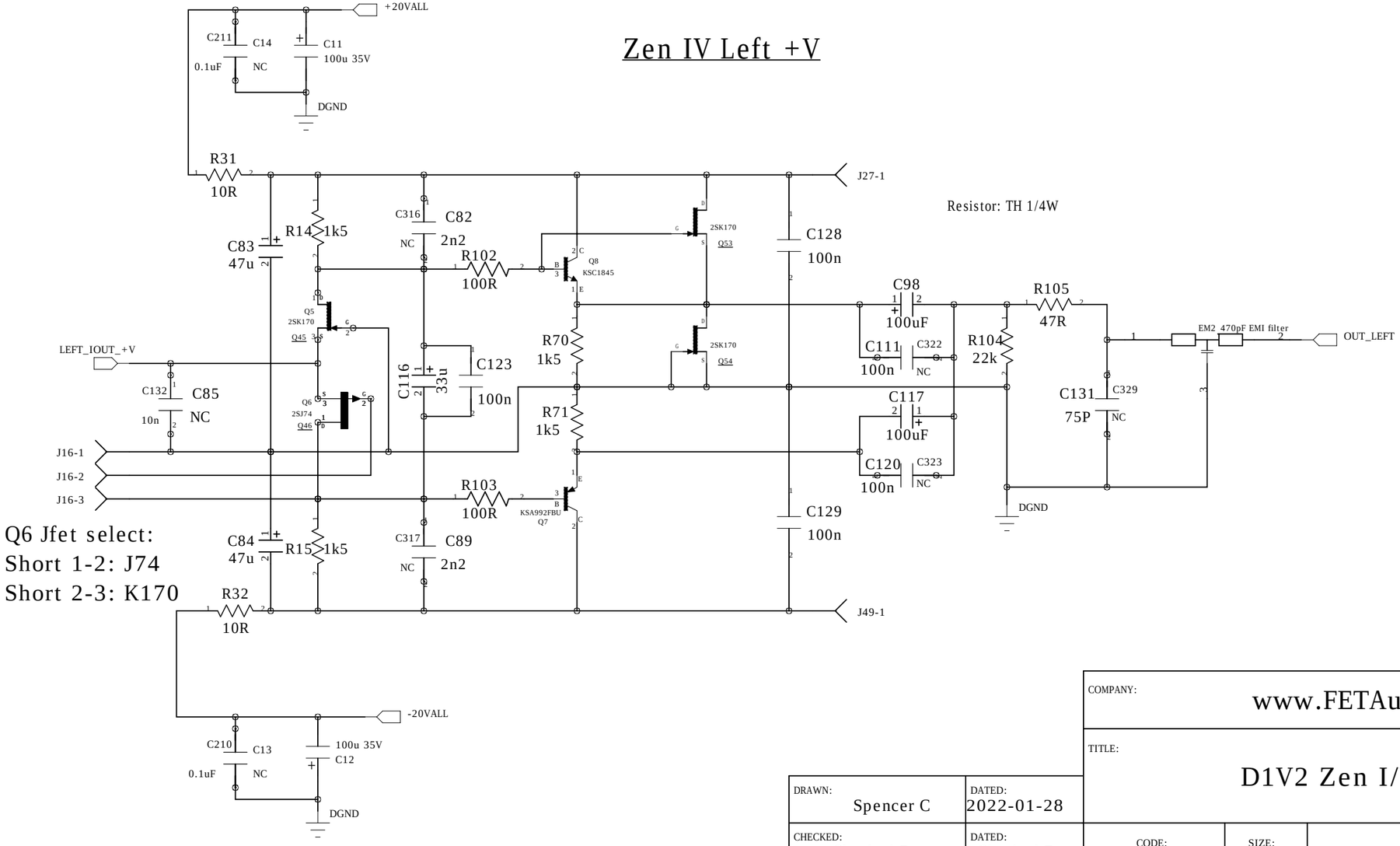
QUALITY CONTROL: <QC By>	DATED: <QC Date>	CODE: PCM63	SIZE: B	DRAWING NO: 20220213	REV: 1
RELEASED: Spencer Cheung	DATED: 2020 Feb	SCALE: 1:1		SHEET: 1 OF 11	

REVISION RECORD			
LTR	ECO NO:	APPROVED:	DATE:

Zen IV Left +V



Resistor: TH 1/4W

DRAWN: Spencer C	DATED: 2022-01-28	COMPANY: www.FETAudio.com	
CHECKED: <Checked By>	DATED: <Checked Date>	TITLE: D1V2 Zen I/V PCM63 x 4	
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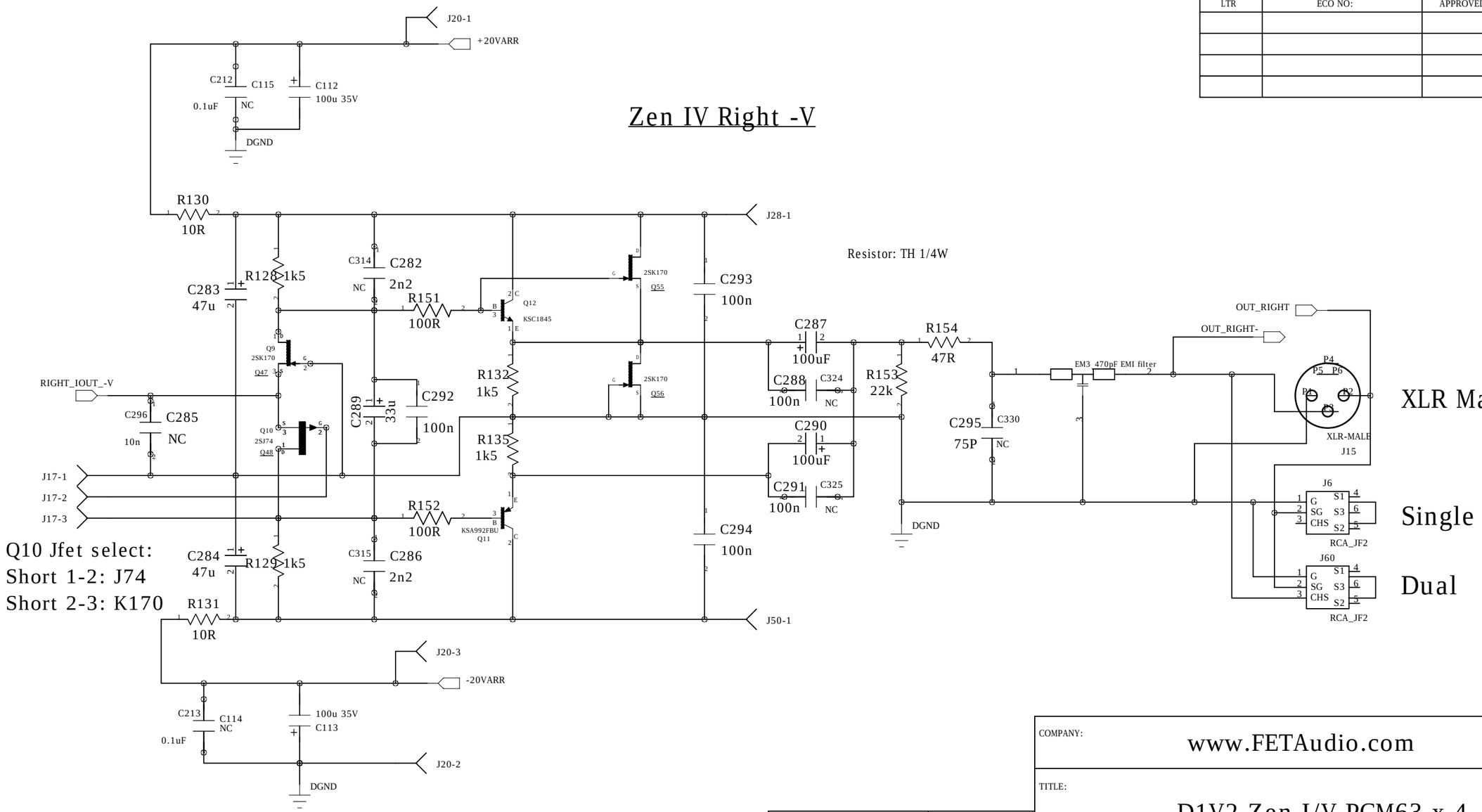
REVISION RECORD			
LTR	ECO NO:	APPROVED:	DATE:

Zen IV Right -V



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REVISION RECORD			
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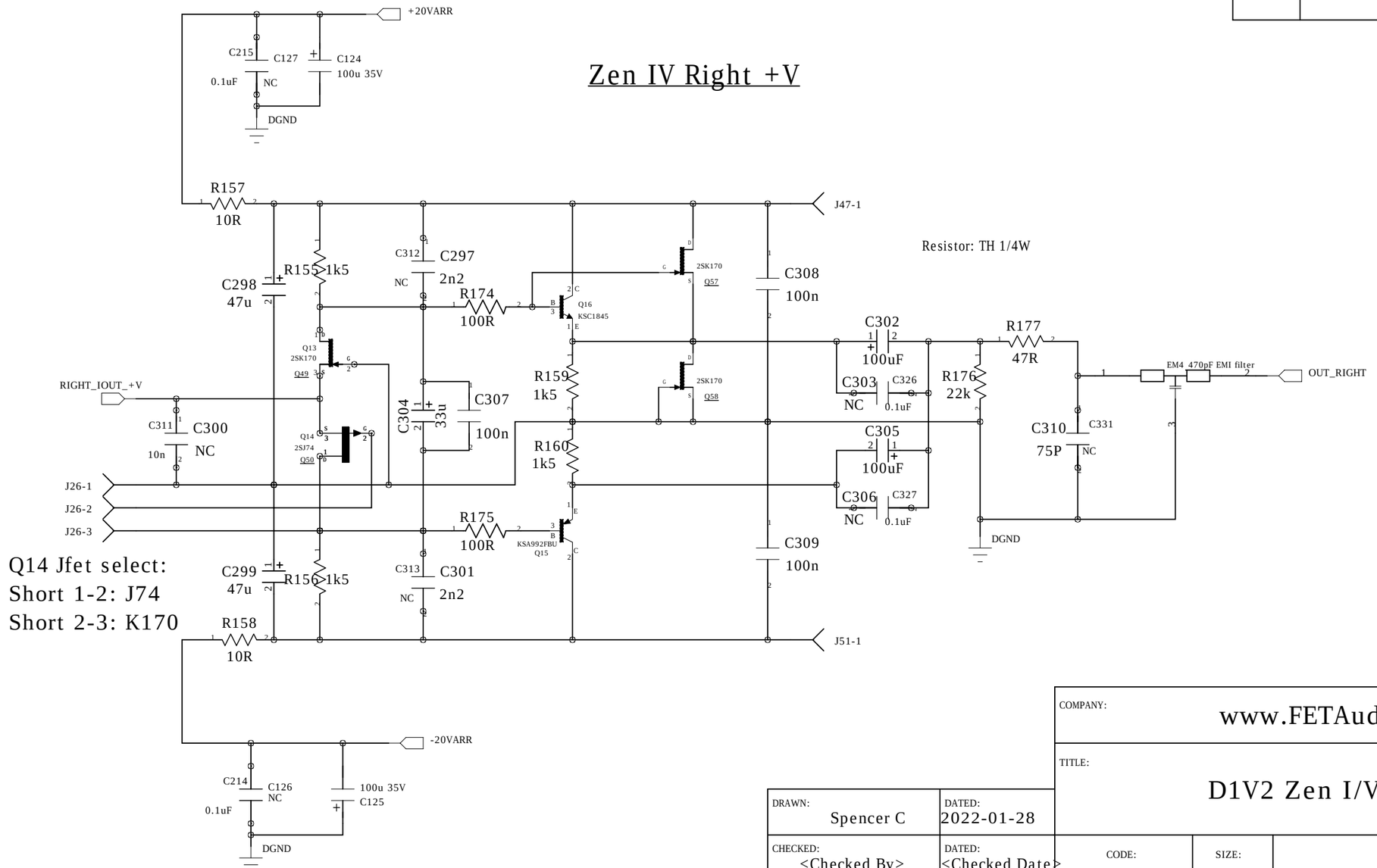
Zen IV Right +V



Resistor: TH 1/4W

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RELEASED: Spencer Cheung	DATED: 2020 Feb	DRAWING NO: 20220213	REV: 1
		SCALE: 1:1	SHEET: 4 OF 11

Refer to table for DF select

Default: SM5842AP

SM5813/DF1700

PMD100

DF1704E

DF1706 - 3.3v

SM5803/SM5843 TBD

REVISION RECORD			
LTR	ECO NO:	APPROVED:	DATE:

PMD100 SUPPLY

Defalult for SM5842

U1 SM5842

HDCD LED

D42

DGND

J12-1

J12-2

CLK

LE

DOL

DOR

+5VDF1

Bead

L10

+5VDF

IMUTE

RESET

MCLK

LRCLK

SDATA

BCLK

+VR169

DGND

LRCLK

RESET

+5VREG

PMD100 SUPPLY

C8 330p

0.1uF C333

0.1uF C332

10u C334

0.1uF C335

10u C77

U31 AMS1117-3.3

+5VDF

+5VDF1

R203 NC

For SM5803 Program

DF1706 3.3v SUPPLY

+3.3VD

R90 47k

74HC02

U13-C

U13-B

U13-A

MUTE_B

LOCKO

LOCK

IMUTE

R64 680R

R76 680R

R213 NC

R183 0R

R186 0R

R179 NC

R75 NC

R201 NC

E_MUTE

I_MUTE

I2S1

74HC00

U14-A

U14-B

U14-C

U14-D

IMUTE

To Daughter Board - USB/I2S

+5VREG

RESET

DGND

Ext. Digital

E_MCLK

E_SDA

E_BCLK

E_LRCK

R171 NC

U12-A

74VHC244M

U12-B

74VHC244M

R93 56R

R94 56R

R95 56R

R96 56R

MCLK

SDATA

BCLK

LRCLK

U13-D

74HC02

I2S1

R84 47k

I_LRCLK

I_BCLK

I_SDATA

I_MCLK

8804 digital

Digital bus Select control

Mute control circuit

"High = Mute"

DRAWN: Spencer C	DATED: 2022-01-28	COMPANY: www.FETAudio.com	
CHECKED: <Checked By>	DATED: <Checked Date>	TITLE: D1V2 Zen I/V PCM63 x 4	
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PCM63 CKT LEFT

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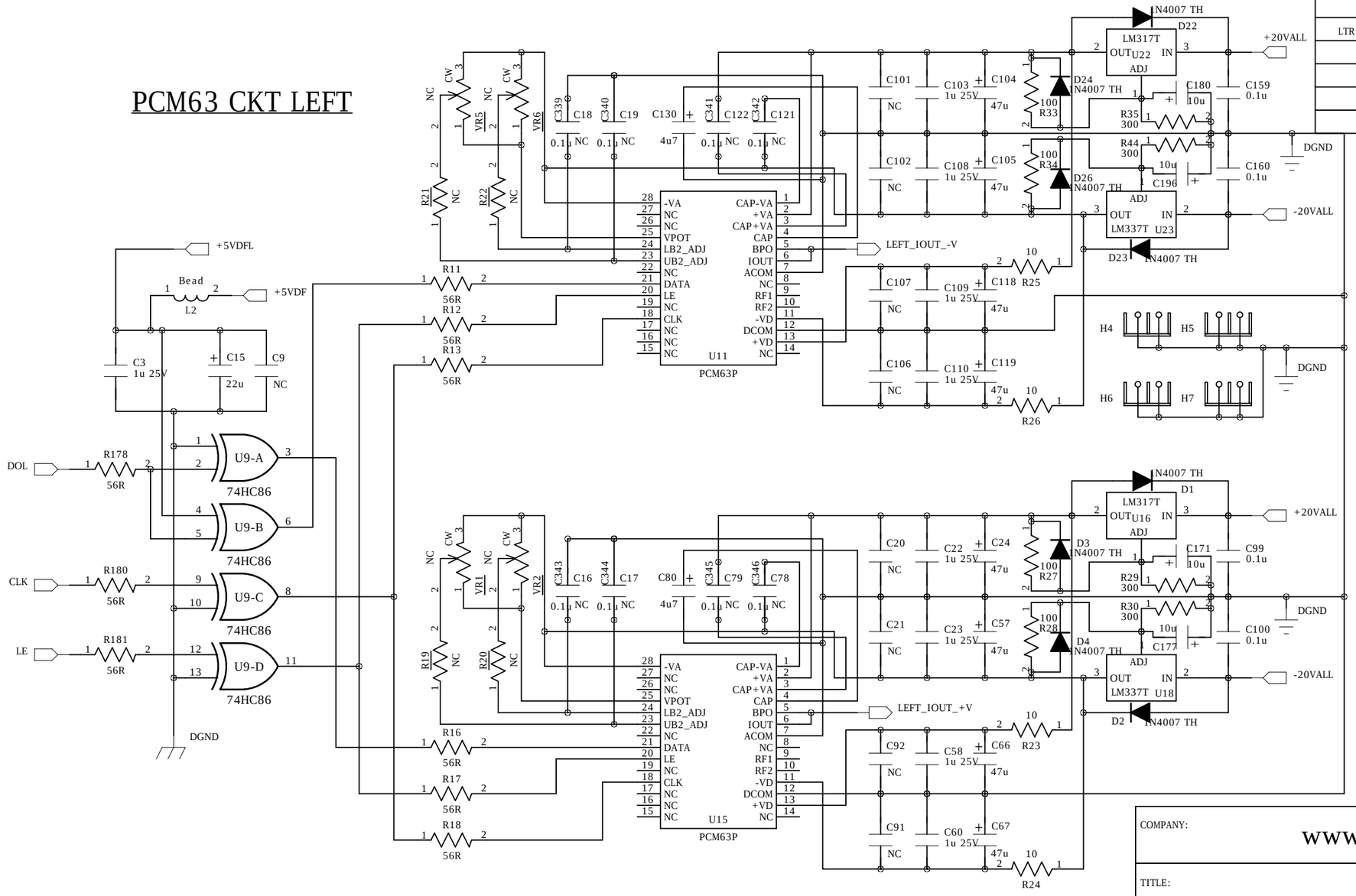

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		SCALE: 1:1	SHEET: 6 OF 11

PCM63 CKT RIGHT

REVISION RECORD			
LTR	ECO NO:	APPROVED:	DATE:

+5VDFR
Bead
+5VDF
L8
C281 1u 25V
C134 22u
C81 NC
U24-A 74HC86
U24-B 74HC86
U24-C 74HC86
U24-D 74HC86
DOR
CLK
LE
R182 56R
R184 56R
R185 56R
DGND
R106 56R
R107 56R
R108 56R
R109 56R
R110 56R
R111 56R
R114 NC
R115 NC
R112 NC
R113 NC
VR11
VR12
VR9
VR10
C347 0.1u NC
C348 0.1u NC
C137 NC
C143 NC
C274 4u7
C349 0.1u NC
C273 NC
C350 0.1u NC
C272 0.1u NC
C351 0.1u NC
C352 0.1u NC
C135 NC
C136 NC
C244 4u7
C353 0.1u NC
C243 NC
C354 0.1u NC
C242 0.1u NC
U25 PCM63P
U26 PCM63P
-VA
NC
VPOT
LB2_ADJ
UB2_ADJ
DATA
LE
CLK
CAP-VA
+VA
CAP+VA
CAP
BPO
IOUT
ACOM
RF1
RF2
-VD
DCOM
+VD
RIGHT_IOUT_-V
RIGHT_IOUT_+V
C247 NC
C249 1u 25V
C255 47u
C248 NC
C267 1u 25V
C264 47u
C266 NC
C268 1u 25V
C270 47u
C265 NC
C269 1u 25V
C271 47u
R124 100
R125 100
R118 10
R119 10
D40 N4007 TH
D41 N4007 TH
D38 N4007 TH
D39 N4007 TH
U29 LM317T ADJ
U30 LM337T ADJ
+20VARR
-20VARR
C279 10u
C277 0.1u
R126 300
R127 300
C280 10u
C278 0.1u
H8
H9
H10
H11
C229 NC
C231 1u 25V
C232 47u
C230 NC
C237 1u 25V
C234 47u
C236 NC
C238 1u 25V
C240 47u
C235 NC
C239 1u 25V
C241 47u
R120 100
R121 100
R116 10
R117 10
D29 N4007 TH
D31 N4007 TH
D27 N4007 TH
D28 N4007 TH
U27 LM317T ADJ
U28 LM337T ADJ
C275 10u
C245 0.1u
R122 300
R123 300
C276 10u
C246 0.1u

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		SCALE: 1:1	SHEET: 7 OF 11

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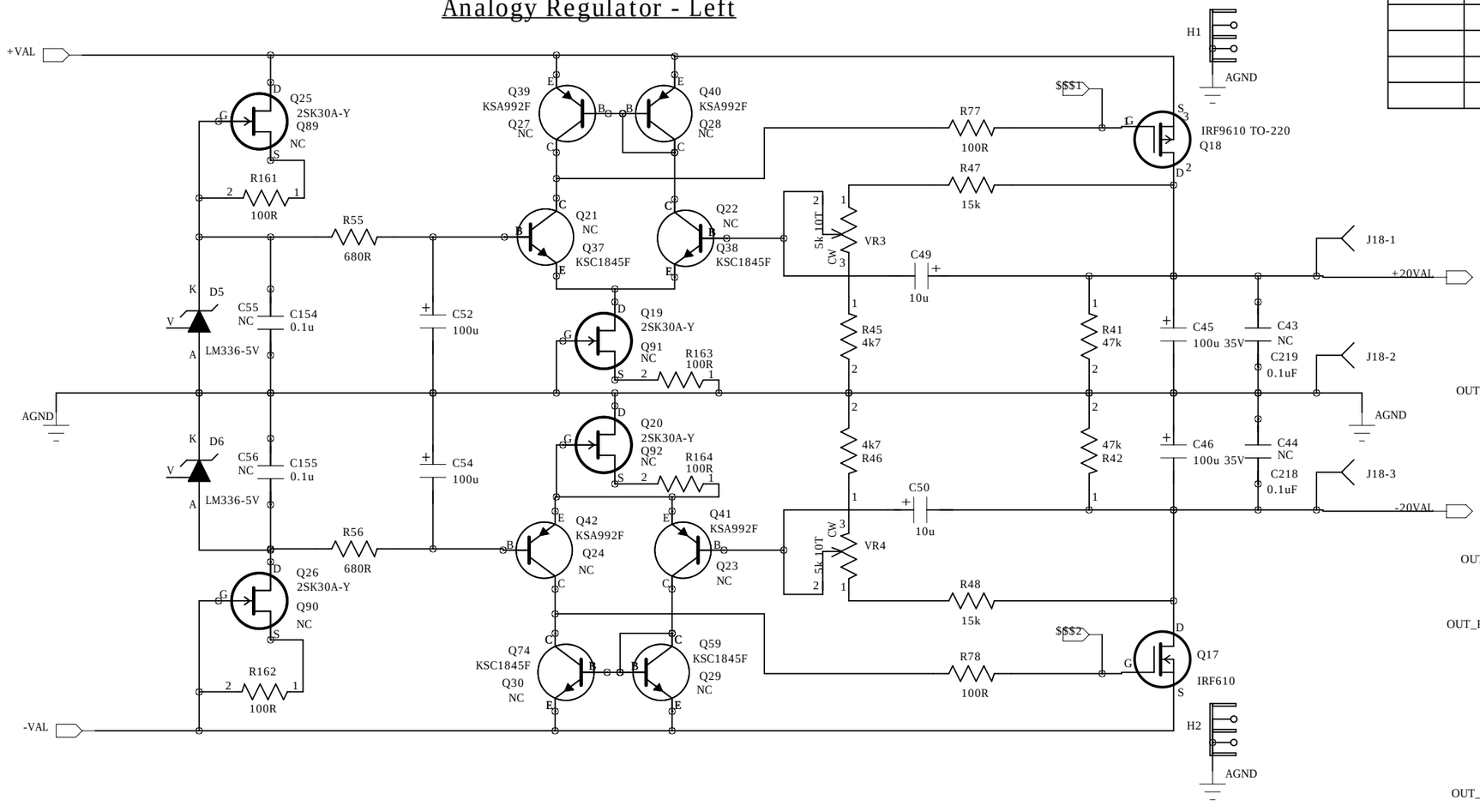
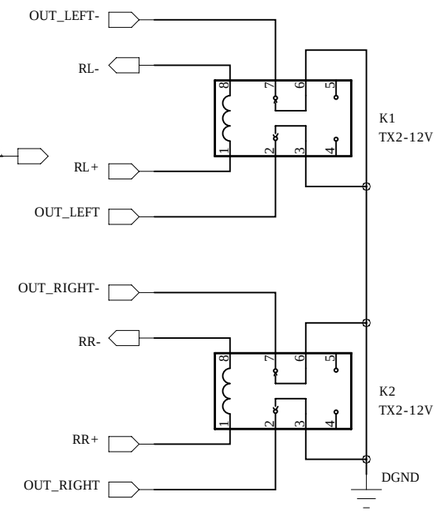
LTR	ECO NO:	APPROVED:	DATE:

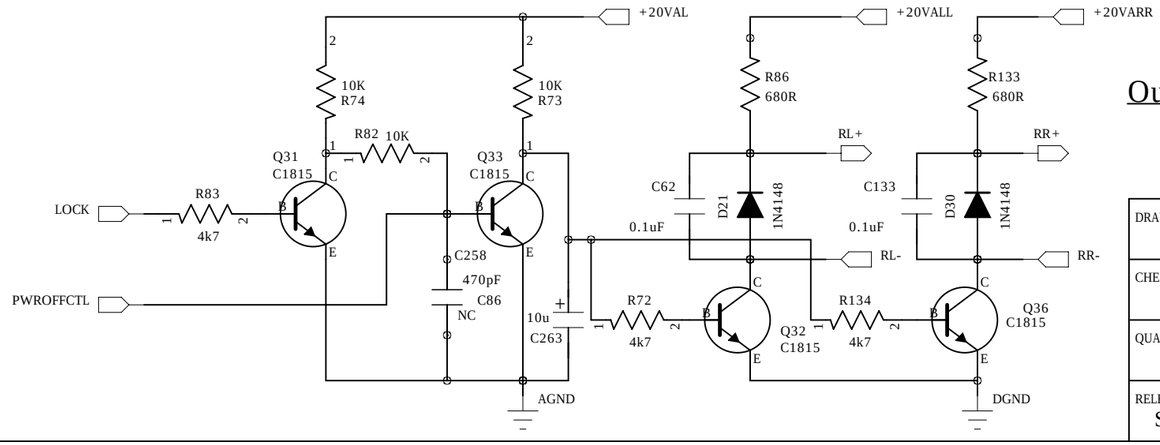
Analogy Regulator - Left



Mute Relays



Output Muting Ckt



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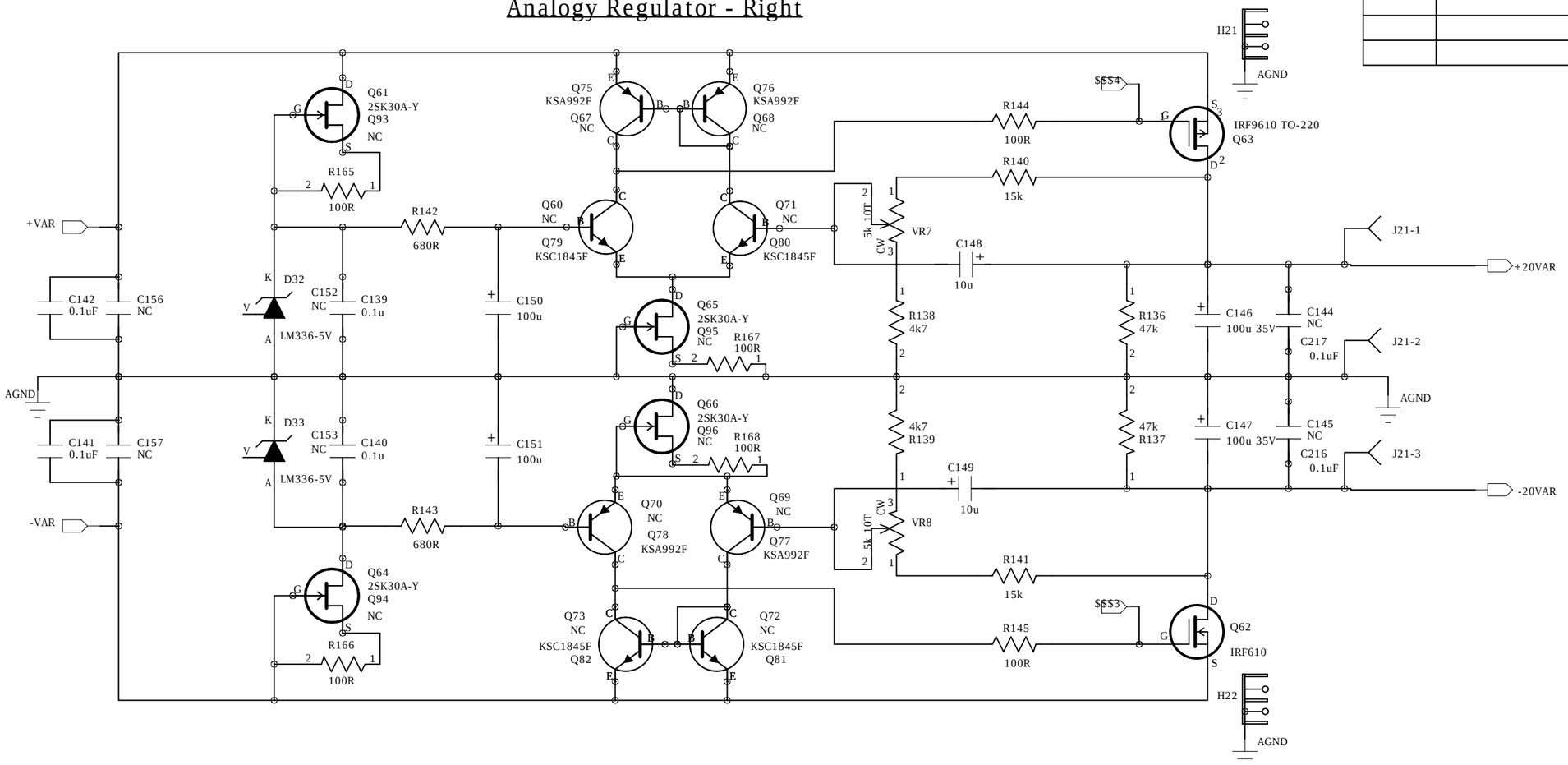
		SCALE: 1:1	SHEET: 8 OF 11

REVISION RECORD			
LTR	ECO NO:	APPROVED:	DATE:

Analogy Regulator - Right



smt pts

1 U5 FIDUCIAL_15_30

1 U19 FIDUCIAL_15_30

1 U20 FIDUCIAL_15_30

1 U21 FIDUCIAL_15_30

M3 Screw Holes

J29 J30 J31 J32 J33 J34 J35 J36 J37 J38 — M3

AGND

J39 J40 J41 J42 J43 J44 J45 J63 J64 — M3

DRAWN: Spencer C	DATED: 2022-01-28	COMPANY: www.FETAudio.com	
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RELEASED: Spencer Cheung	DATED: 2020 Feb	DRAWING NO: 20220213	REV: 1
		SCALE: 1:1	SHEET: 9 OF 11

6 5 4 3 2 1

D C B A

AES XLR (1,0)

EM7 470pF EMI filter
EM6 470pF EMI filter
C35 0.1u NC C175
T1 51698-LF3
J3-C2 J3-C1 J3-C3 J3-C4
R146 10R
R147 10R
R98 90.9R
J22-1 J22-2 J22-3
C169 0.1u C176 NC
DGND

SPDIF RCA (1,1)

J4 RCA_JF2
C36 NC C164 0.1u
R39 0R
C37 NC C170 0.01u
RCAIN
51698-LF3 T2
R148 75R
J23-1 J23-2
EM5 470pF EMI filter

TOSLINK INPUT (0,1)

C39 0.01u C178 NC XLRIN
J61-1 J61-2 J61-3
U3 TORX147
OUTPUT GND VCC
C27 0.01u NC C47
R81 10R TOSIN
P2
C186 0.1u C48 NC
R80 47k C87 10u
C187 0.1u C138 NC
DGND

+VRELAY
C185 0.1u C40 NC
DVDD
L1 47uH
DGND

RCA R54 680R Q35 C1815 D51 1N4148 K3 TX2-5V RCAIN
XLR R88 680R Q83 C1815 D52 1N4148 K4 TX2-5V XLRIN
TOS R89 680R Q84 C1815 D55 1N4148 K5 TX2-5V TOSIN

DGND
1N4148 D43 1N4148 D44 PVDD

Output Mode:

R43/R214: 16 bit R Justified
R43/R49: 24bit I2S
R215/R49: 16bit I2S
R215/R214: 24bit Left J.

DVDD
R50 10k R214 10k R49 10k R43 10k R215 10k R40 10k

Mute Select

I_MUTE R173 0R R172 NC
Err
Lock

U2 WM8804
SCLK GPO0/SWIFMODE SDIN/HWMODE SDOUT/GPO2 CBS/GPO1 RESETB PVDD PGND CLKOUT XOP
RX0 DVDD DGND TXO MCLK LRCLK BCLK DIN DOUT XIN

RESET PVDD
PVDL R53 47k RESET C30 10u
Y1 NC Y2 NC C29 NC C28 NC
DGND

TXO R38 56R I_MCLK
R37 56R I_LRCLK
R36 56R I_BCLK
R63 56R I_SDATA

+VXO R205 56R
C337 0.1u C336 0.1u
12MHz XO or TCXO
Y5 OUTPUT VDD GND TRI-STATE
Y6 NC

8804 Supply

+5VREG Bead L5
U17 LT1117 IN OUT G1
C189 0.1u C163 NC
PVDL Bead L4
C262 0.1u C162 100u C161 NC
DGND

DVDD C32 47u C166 0.1u C31 NC C190 0.01u
PVDD C179 NC C25 47u C165 0.1u C26 1u 6.3V

SPDIF Out

TXO R57 210R C33 NC C90 0.1uF
R58 110R
NC EM8
DGND
J8-2 J8-1

Set dafault to RCA (1,1)

U4 74HC238
A0 A1 A2 E1 E2 E3 Y0 Y1 Y2 Y3 Y4 Y5 Y6 Y7
I2S1 TOS XLR RCA
+3.3VD R65 47k R67 47k

To FP

J1-1 E_SEL0
J1-2 E_SEL1
J1-3
J1-4 USB2
J1-5
J1-6 USB
J1-7
J1-8 LOCKO
J1-9
J1-10 MUTE_B

Logic power decouple

+5VREG Bead L12
+3.3VD
C184 NC C182 NC C183 NC C181 NC C254 47u
C41 0.1u C34 0.1u C38 0.1u C42 0.1u
For Digital Filter IC +VU12
DGND

Relay Select

5V RLY +5VREG R169 0R +VRELAY
3V RLY +3.3VD R170 NC

J24-1 J24-2 USB
J62-1 J62-2 USB2

REVISION RECORD			
LTR	ECO NO:	APPROVED:	DATE:

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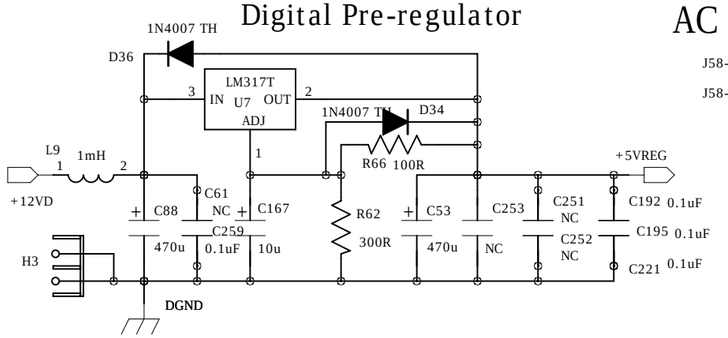
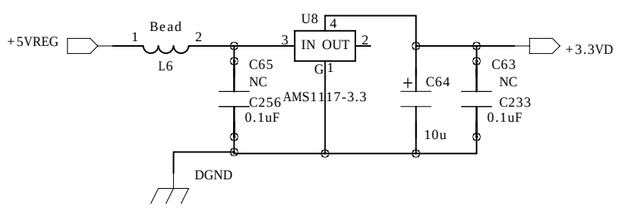
RELEASED: Spencer Cheung	DATED: 2020 Feb	DRAWING NO: 20220213	REV: 1
		SCALE: 1:1	SHEET: 10 OF 11

REVISION RECORD			
LTR	ECO NO:	APPROVED:	DATE:

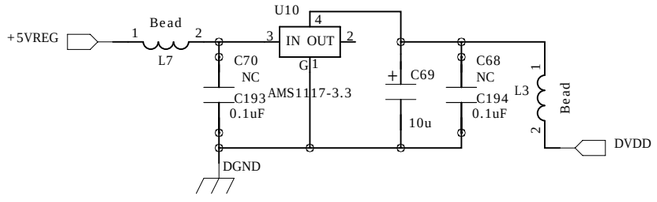
Digital Pre-regulator



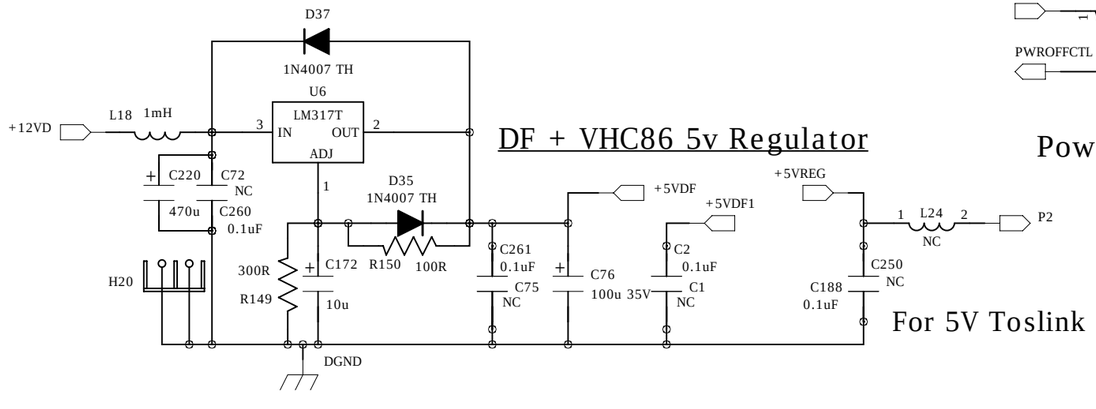
Logic Regulator



8804 Regulator



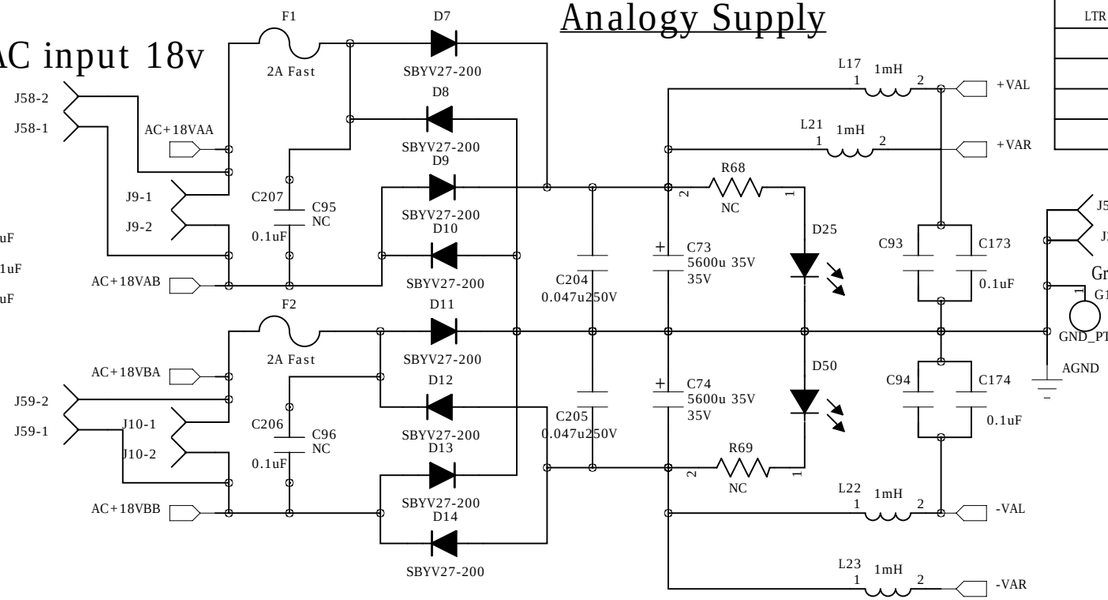
DF + VHC86 5v Regulator



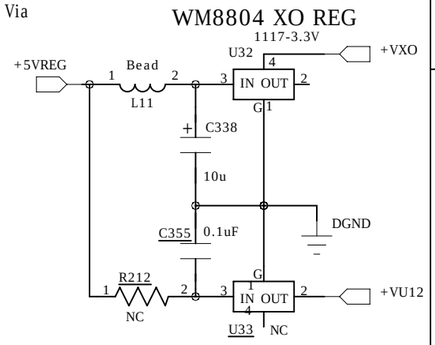
For 5V Toslink

Analogy Supply

AC input 18v



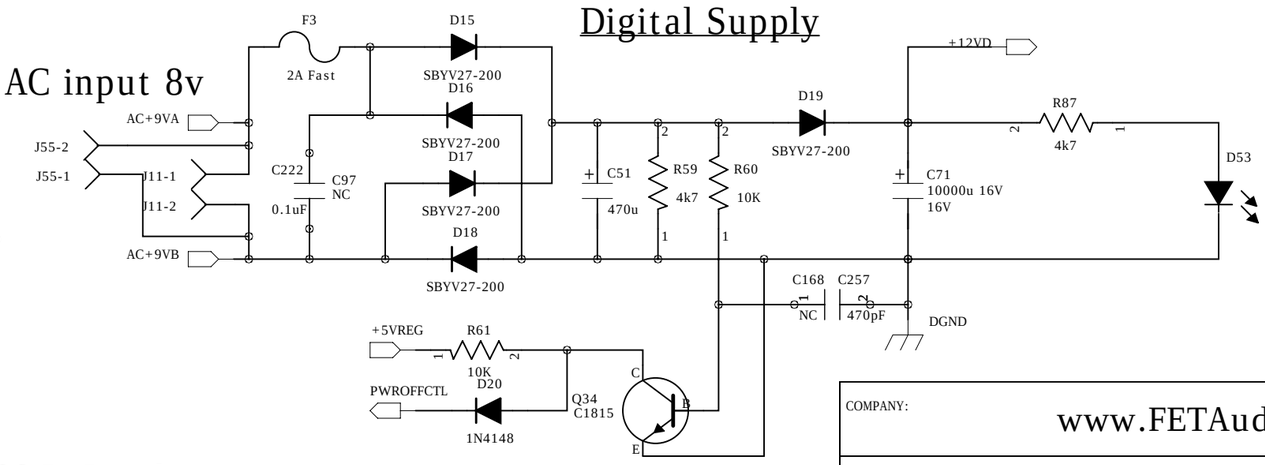
WM8804 XO REG



Regulator for VHC244 - for DF1706

Digital Supply

AC input 8v



Power down control

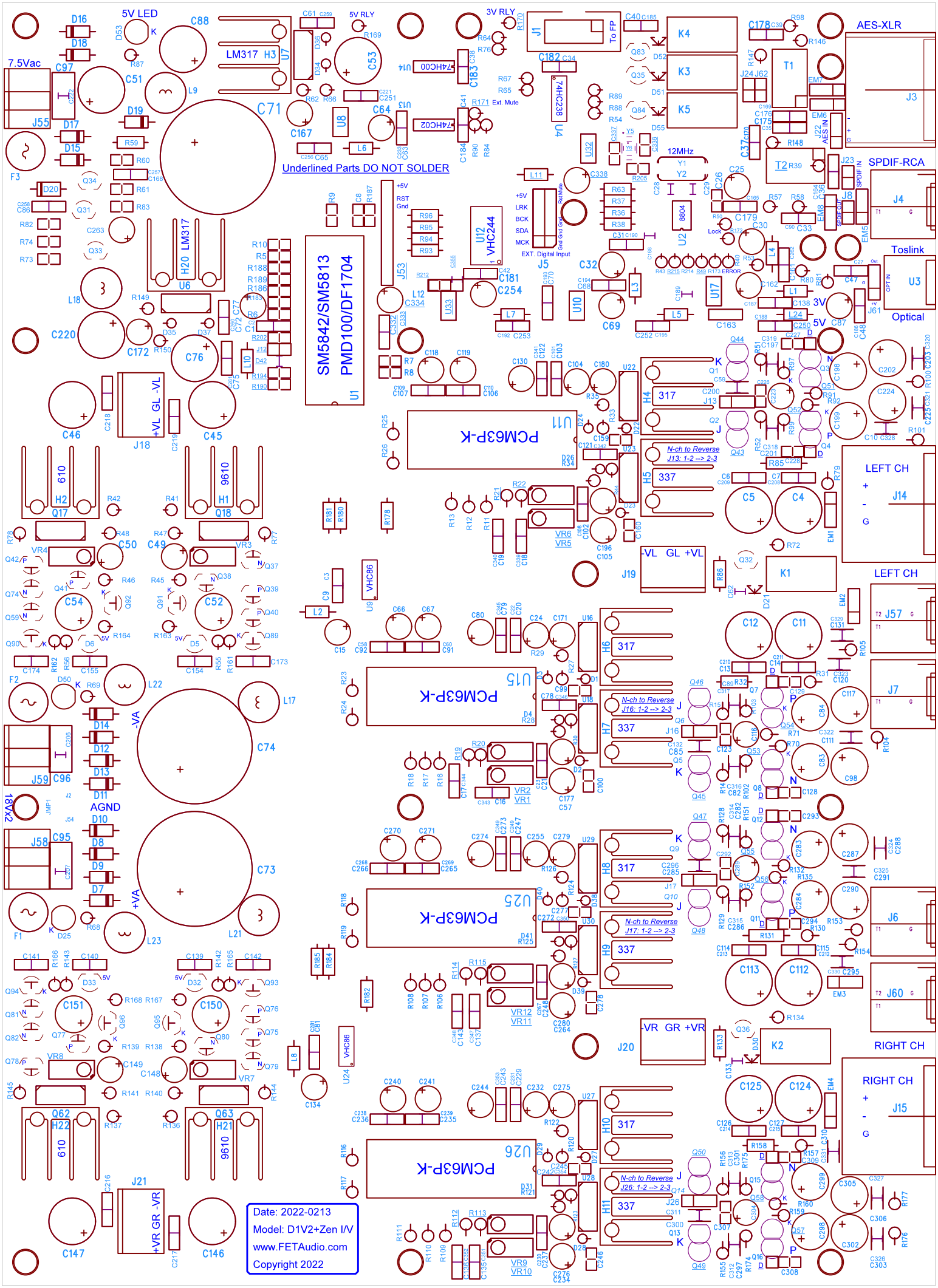
DRAWN: Spencer C	DATED: 2022-01-28	COMPANY: www.FETAudio.com	
CHECKED: <Checked By>	DATED: <Checked Date>	TITLE: D1V2 Zen I/V PCM63 x 4	
QUALITY CONTROL: <QC By>	DATED: <QC Date>	CODE: PCM63	SIZE: B
RELEASED: Spencer Cheung	DATED: 2020 Feb	DRAWING NO: 20220213	REV: 1
		SCALE: 1:1	SHEET: 11 OF 11

Attachment 2: BOM x 3 pages

S/N	USE Qty	Reference Designation	Manufacturer	Description	Part Number	Value / Alternative	PCB DECAL	Packaging	Section	Cost (est)	Total Cost
2	8	Q31-36 Q83-84	TOSHIBA or Fairchild	NPN TRANSISTOR	2SC1815 or KSC1815	C1815	TO-92D	TO-92		0.50	4.00
4	4	Q2 Q6 Q10 Q14	TOSHIBA	JFET_P-Channel_45V	2SJ74BL	2SJ74BL	TO92	TO-92	8-9mA idss	20.00	80.00
6	4	Q1 Q5 Q9 Q13	TOSHIBA	N-Channel_JFET D-G-S_pinout	2SK170 DGS	2SK369BL 2SK363BL	TO92	TO-92	8-9 mA idss	2.00	8.00
8	8	Q19-20 Q25-26 Q61 Q64-66	TOSHIBA	N-CHANNEL JFET Idss 0.6~1.4mA	2SK30A-Y	2SK30A-Y	TO-92D	TO-92	0.6 to 1.4mA	0.50	4.00
9	1	T1	MIDCOM	Transformer PULSE TRANSFORMER 1:1	51698-LF3	51698-LF3	51698-LF3	5x10mm		1.00	1.00
11	1	U14	NXP or TI	IC QUAD 2-INPUT POS-NAND GATE	74HC00D	74HC00D SOIC	SO14	SOIC14		1.00	1.00
12	1	U13	NXP or TI	IC QUAD 2-INPUT POS-NOR GATE	74HC02D	74HC02D SOIC	SO14	SOIC14		1.00	1.00
13	2	U9 U24	On Semi	QUADRUPLE 2-INPUT EXCLUSIVE-OR GATE	74VHC86M	74VHC86M SOIC	SO14NB	SOIC14		1.00	2.00
14	1	U4	NXP or Ti	3-LINE TO 8-LINE DECODER\DEMULTIPLEXER	74HC238M	74HC238D SOIC	SO16NB	SOIC16		1.00	1.00
15	1	U12	Fairchild or ST	IC OCTAL BUFFER/LINE DRIVER 3 STATE OUTPUTS	74VHC244M	74VHC244M WB	SO20WB	SO20WB		1.50	1.50
16	8	Q37-38 Q59 Q74 Q79-82	NXP, Fairchild, On Semi	GENERAL PURPOSE NPN SILICON TRANSISTOR	KSC1845F	KSC1845F	TO92	TO-92	hfe >150	0.50	4.00
17	8	Q39-42 Q75-78	NXP, Fairchild, On Semi	GENERAL PURPOSE PNP SILICON TRANSISTOR	KSA992F	KSA992F	TO92	TO-92	hfe >150	0.50	4.00
18	13	D7-19	Vishay/Phillips	Diode DO-5 fast recovery	SBYV27-200	BYV27-150	DO35	DO35		0.50	6.50
19	4	C27 C39 C170 C190	Murata or TDK	SURFACE MOUNT CAPACITOR 0.048 X 0.079 INCHES	0.01U COG 0805	0.01u	0805S	0805		0.10	0.40
20	14	C34-35 C38 C41-42 C164-166 C169 C185-187 C189 C262	Walsin or Samsung	SURFACE MOUNT CAPACITOR 0.048 X 0.079 INCHES	0.1u 0805 X7R	0.1uF	0805S	0805		0.05	0.70
21	8	C100 C159-160 C245-246 C99 C277-278	Walsin or Samsung	SURFACE MOUNT CAPACITOR 0.048 X 0.079 INCHES	0.1u 0805 X7R	0.1uF	0805	0805		0.05	0.40
22	4	C155 C139-140 C154	Walsin or Samsung	SURFACE MOUNT CAPACITOR 0.048 X 0.079 INCHES	0.1u 0805 X7R	0.1uF	0805S	0805		0.05	0.20
23	2	C336-337	Walsin or Samsung	SURFACE MOUNT CAPACITOR 0.048 X 0.079 INCHES	0.1u 0805 X7R	0.1uF	0805	0805		0.05	0.10
24	16	C339-354	Walsin or Samsung	SURFACE MOUNT CAPACITOR 0.048 X 0.079 INCHES	0.1u 0805 X7R	0.1uF	0805S	0805		0.05	0.80
25	14	C2 C62 C133 C192-195 C221 C233 C256 C259-261 C333	Walsin or Samsung	SURFACE MOUNT CAPACITOR 0.048 X 0.079 INCHES	0.1u 0805 X7R	0.1uF	0805S	0805		0.05	0.70
26	19	C207-219 C174 C222 C141-142 C173 C206	Walsin or Samsung	SURFACE MOUNT CAPACITOR 0.048 X 0.079 INCHES	0.1u 0805 X7R	0.1uF	0805S	0805		0.05	0.95
28	7	C90 C324-327 C188 C355	Walsin or Samsung	SURFACE MOUNT CAPACITOR 0.048 X 0.079 INCHES	0.1u 0805 X7R	0.1uF	0805S	0805		0.05	0.35
31	8	C111 C120 C203 C225 C291 C288 C303 C306	Walsin or Samsung	Through Hole film Capacitors 5mm pitch	0.1u film 5mm	100n 50/63V	CK05	TH 5mm		0.30	2.40
32	12	C129 C123 C128 C226-228 C292-294 C307-309	Walsin or Samsung	SURFACE MOUNT CAPACITOR 0.048 X 0.079 INCHES	0.1u 0805 X7R	0.1uF	0805	0805		0.05	0.60
33	4	C59 C132 C296 C311	Murata or TDK	SURFACE MOUNT CAPACITOR 0.048 X 0.079 INCHES	0.01U COG 0805	0.01u	0805S	0805	I/V	0.10	0.40
34	18	C3 C22-23 C58 C60 C103 C108-110 C231 C237-239 C249 C267-269 C281	Walsin or Samsung	SURFACE MOUNT CAPACITOR 0.048 X 0.079 INCHES	1u 0805 X7R	1u 25V	0805S	0805		0.10	1.80
35	1	C26	Walsin or Samsung	SURFACE MOUNT CAPACITOR 0.048 X 0.079 INCHES	1u 6.3V X7R	1u 6.3V	0805	0805		0.10	0.10
36	8	C82 C89 C197 C201 C282 C286 C297 C301	Murata or TDK	TH or 0805 SMD capacitors	2n2 0805 COG OR MICA	or 4n7 0805 OR MICA	CK05	TH 5mm	I/V	0.50	4.00
37	1	C8	Walsin or Samsung	SURFACE MOUNT CAPACITOR 0.048 X 0.079 INCHES	330p 0805 X7R	330p	0805	0805		0.05	0.05
38	2	C257-258	Walsin or Samsung	SURFACE MOUNT CAPACITOR 0.048 X 0.079 INCHES	470p 0805 X7R	470pF	0805S	0805		0.05	0.10
39	4	C10 C131 C295 C310		TH Mica 5mm pitch	75pF mica 5mm	75p to 150p MICA	CK05	TH 5mm	I/V	0.50	2.00
50	1	C71	NCC KMH or Panasonic SU 22-25mm	ALUMINUM ELECTROLYTIC CAP.	10000u 16V 22mm	10000u 16V P25mm	CX-P10X25MM	D25xP10		4.00	4.00
51	4	C52 C54 C150-151	Panasonic FC, FM, or FA; Sanyo OS-Con	ALUMINUM ELECTROLYTIC CAP.	100u 35V	100u P8mm	ECAP-3X8MM	D8xP3		0.30	1.20
52	1	C162	Panasonic FC, FM, or FA; Sanyo OS-Con	ALUMINUM ELECTROLYTIC CAP.	100u 10V	100u P5mm	TH 5X11MM	D5xP2		0.30	0.30
53	12	C4-5 C11-12 C45-46 C112-113 C124-125 C146-147	Elna Silmic-II or Nichicon UKA/UKT	ALUMINUM ELECTROLYTIC CAP.	100u 35V	100u 35V P10mm	ECAP-A-5X10MM	D10xP5	A supply	1.00	12.00
54	1	C76	Panasonic FC, FM, or FA; Sanyo OS-Con	ALUMINUM ELECTROLYTIC CAP.	100u 35V	100u 35V P10mm	ECAP-A-5X10MM	D10xP5		0.50	0.50
55	8	C171 C177 C180 C196 C275-276 C279-280	Panasonic FC, FM, or FA; Sanyo OS-Con	ALUMINUM ELECTROLYTIC CAP.	10u ~22u 35V	10u P5mm	TH 5X11MM	D5xP2		0.20	1.60
56	11	C30 C49-50 C77 C87 C148-149 C167 C172 C263 C334	Panasonic FC, FM, or FA; Sanyo OS-Con	ALUMINUM ELECTROLYTIC CAP.	10u 35V	10u P5mm	TH 5X11MM	D5xP2		0.20	2.20
57	2	C64 C69	Panasonic FC, FM, or FA; Sanyo OS-Con	ALUMINUM ELECTROLYTIC CAP.	10u 6.3V	10u P5mm	TH 5X11MM	D5xP2		0.20	0.40
58	1	C338	Panasonic FC, FM, or FA; Sanyo OS-Con	ALUMINUM ELECTROLYTIC CAP.	10u 35v	10u P5mm	TH 5X11MM	D5xP2		0.20	0.20
59	2	C15 C134	Panasonic FC, FM, or FA; Sanyo OS-Con	ALUMINUM ELECTROLYTIC CAP.	22u 25V	22uf P5mm	TH 5X11MM	D5xP2		0.20	0.40
60	4	C51 C53 C88 C220	Panasonic FC, FM, or FA; Sanyo OS-Con	ALUMINUM ELECTROLYTIC CAP.	**470u 25V**	470u P10mm	ECAP-A-5X10MM_B	D10xP5		0.30	1.20
61	16	C24 C57 C66-67 C104-105 C118-119 C232 C234 C240-241 C255 C264 C270-271	Nichicon UKA/UKT Audio cap	ALUMINUM ELECTROLYTIC CAP.	47u 35v	47u P5mm	TH 5X11MM	D5xP2	PCM63	0.74	11.84
62	3	C25 C32 C254	Panasonic FC, FM, or FA; Sanyo OS-Con	ALUMINUM ELECTROLYTIC CAP.	47u 6.3V	47u P5mm	TH 5X11MM	D5xP2	WM8804 / VHC244	0.74	2.22
63	4	C80 C130 C244 C274	Nichicon UKA/UKT Audio cap	ALUMINUM ELECTROLYTIC CAP.	4u7 35V	4u7 to 10u P5mm	TH 5X11MM	D5xP2	PCM63	0.74	2.96
64	2	C73-74	Panasonic Audio / SU 22-25mm	ALUMINUM ELECTROLYTIC CAP.	5600u 35V 22mm	5600u 35V P25mm	CX-P10X25MM	D25xP10		5.00	10.00
72	2	J2 J54			AGND	Connect Case	CON2				0.00
73	1	J1	China	RIBBON CABLE 10-PIN VERTICLE MALE NO LATCHES	2x5 2.5mm Male Header	2x5 Male HD	HD-10V	P2.5mm		0.10	0.10
81	4	J18-21	China	GENERIC 3 PIN SIP HEADER .100 CENTERS	3x5mm Con	3x5mm Con Wire	CON_P3_508	P5mm		2.00	8.00
84	20	D1-4 D22-24 D26-29 D31 D34-41	Toshiba M7	Diode 1000V 1A diode	1N4007 TH	1N4007 TH	R1/8WA	P2.5mm		0.10	2.00
85	1	D20	Semtech	Diode 100V 0.5A diode	LL4148	1N4148	DO_MINI	P2.5mm		0.10	0.10
86	5	D21 D30 D51-52 D55	Semtech	Diode 100V 0.5A diode	LL4148	1N4148	DIODE_V	P2.5mm		0.10	0.50

S/N	USE Qty	Reference Designation	Manufacturer	Description	Part Number	Value / Alternative	PCB DECAL	Packaging	Section	Cost (est)	Total Cost
88	8	C98 C117 C202 C224 C287 C290 C302 C305	Nichicon UKA/UKT	Leaded E capacitors Through Hole	100U 25V 8mm dia	100uF P8mm	ECAP-3X8MM	D8xP3	I/V	0.95	7.60
89	4	C116 C223 C289 C304	Nichicon UKA/UKT	Leaded E capacitors Through Hole	5mm ecap 22-33u 35V	22 to 47u P5mm	TH 5X11MM	D5xP2	I/V	0.74	2.96
90	8	C83-84 C198-199 C283-284 C298-299	Nichicon UKA/UKT	Leaded E capacitors Through Hole	100U 25V 8mm dia	100uF P8mm	ECAP-3X8MM	D8xP3	I/V	0.95	7.60
92	1	Y5	TXC	miniatue_SMD_HCMOS_TCXO_Oscillator.	7C-12.000MBA-T	12MHz XO or TCXO 3.3V CMOS 5x3.2mm	OSC_ECSTXO50 32120TR	5x3.2mm		2.49	2.49
94	3	F1-3	Bell or others	Fuse	2A Fast	2A Fast	FUSE-5MM	TH 5mm		0.50	1.50
96		J5	China	Generic PIN HEADER; 100 MIL CENTERS	2x5 2.5mm Female Header	2x5 female HD	HEADER10	P2.5mm		0.20	0.00
97	14	H1-11 H20-22	WAKEFIELD THERMAL / Muticomp / AAVID	Heatsink 634-10ABPE (0.64 x 0.64 x 1.0 in) / MC33261 / MC33262 / 6391BG	630 x 630 x 1000 mil	16x16x25mm	HEATSINK_630X 630X1000MIL	0.64x0.64x 1 inch		1.00	14.00
98	6	L9 L17-18 L21-23	Hualida	Radial inductors 1mH 1A	CH8010-1mH 1A	1mH 1A	IND-R-5MM	TH 5mm		0.50	3.00
99	1	L1	Hualida	Radial inductors 47uH 200mA	47uH 200mA	47uH 0.2A	IND-MOLDED_400MIL	TH 5mm		0.20	0.20
100	9	L2-8 L10-11	Hualida	Radial inductors 100mA Bead	Bead	Bead	IND-MOLDED_400MIL	TH 8mm		0.10	0.90
101	1	L12	Hualida	Radial inductors 100mA Bead	Bead	Bead	IND-MOLDED_400MIL_NS	TH 8mm		0.10	0.10
103	7	EM1-7	Murata	Pitch 2.54mm x 3 LCL filter	EM filter 470pF	470pF EMI filter	SIP-3P	P2.5x3mm		0.50	3.50
105	2	Q17 Q62	IR or Vishay	MOSFET N CHANN 200V 1.8A	IRF610 TO-220	IRF610	IRF610-GDS	TO-220		2.00	4.00
106	2	Q18 Q63	IR or Vishay	MOSFET P CHAN 200V 1.8A	IRF9610 TO-220	IRF9610	IRF9610-GDS	TO-220		2.00	4.00
108	4	Q4 Q7 Q11 Q15	On Semi Toshiba	KSA992_Series_120_V_50_mA_Through_Hole_PNP_Epitaxial_Silicon_Transistor_-TO-92-3	KSA992FBU	2SA1145 BC560C	TO92	TO-92		0.50	2.00
109	4	Q3 Q8 Q12 Q16	On Semi Toshiba	TO-92 Leaded Transistor	KSC1845	2SC2705 BC550C	TO92	TO-92		0.50	2.00
110	3	D25 D50 D53	China	Diode LIGHT EMITTING DIODE	Green LED 2.54mm TH	LED TH or 0805	LED	P2.5mm / 0805		0.20	0.60
112	4	D5-6 D32-33	NS or Fairchild	IC PRECISION VOLTAGE REFERENCE	LM336-5V	LM336-5	TO-92D	TO-92		0.30	1.20
113	6	U6-7 U16 U22 U27 U29	ST or Motorola	POSITIVE VOLTAGE REGULATOR; ADJUSTABLE	LM317T	LM317T	TO-220-UP	TO-220		1.50	9.00
114	4	U18 U23 U28 U30	ST or Motorola	NEGATIVE VOLTAGE REGULATOR;ADJUSTABLE	LM337T	LM337T	TO-220-UP	TO-220		1.50	6.00
115	4	U8 U10 U17 U32	AMS	IC 3.3V Regulator SOT-223	AMS1117-3.3	1117-3.3V	SOT223	SOT223		0.20	0.80
118	4	U11 U15 U25-26	Burr Brown	20bit Digital to Analogy Converter	PCM63P-K	PCM63P-K	DIP28-600	DIP28		**25.00**	100.00
120	3	J4 J6-7	JF	RCA H PCB with Screw	AV-8.4-8D	RCA H	RCA_JF2A	RCA		1.00	3.00
121	11	R5-10 R183 R186-189	ASJ, Walsin, or Royalohm	SURFACE MOUNT RESISTOR 0.048 X 0.079 INCHES	0R	0R	0805	P2.5mm / 0805		0.05	0.55
122	3	R173 R39 R169	ASJ, Walsin, or Royalohm	SURFACE MOUNT RESISTOR 0.048 X 0.079 INCHES	0R	0R	R1/4WA	P2.5mm / 0805		0.05	0.15
123	8	R23-26 R116-119	ASJ, Walsin, or Royalohm	THROUGH HOLE RESISTOR 1/4W	10R 1%	10R	R1/4WA3.5	P3.5mm / 1206		0.10	0.80
124	8	R27-28 R33-34 R120-121 R124-125	ASJ, Walsin, or Royalohm	SURFACE MOUNT RESISTOR 0.048 X 0.079 INCHES	100R 1%	100R	R1/4WA	P2.5mm / 0805		0.05	0.40
125	10	R66 R150 R161-168	ASJ, Walsin, or Royalohm	SURFACE MOUNT RESISTOR 0.048 X 0.079 INCHES	100R 1%	100R	R1/4WA	P2.5mm / 0805		0.05	0.50
126	8	R151-152 R97 R99 R102-103 R174-175	ASJ, Walsin, or Royalohm	THROUGH HOLE RESISTOR 1/4W	100R	100R	R1/4WA3.5	P3.5mm / 1206	I/V 1206	0.10	0.80
127	4	R145 R77-78 R144	ASJ, Walsin, or Royalohm	SURFACE MOUNT RESISTOR 0.048 X 0.079 INCHES	100R 1%	100R	R1/4WA	P2.5mm / 0805		0.05	0.20
128	5	R60-61 R73-74 R82	ASJ, Walsin, or Royalohm	SURFACE MOUNT RESISTOR 0.048 X 0.079 INCHES	10k 0805	10K	0805	0805		0.05	0.25
129	3	R81 R146-147	ASJ, Walsin, or Royalohm	SURFACE MOUNT RESISTOR 0.048 X 0.079 INCHES	10R 1%	10R	R1/4WA	P2.5mm / 0805		0.05	0.15
130	4	R40 R43 R50 R214	ASJ, Walsin, or Royalohm	SURFACE MOUNT RESISTOR 0.048 X 0.079 INCHES	10k	10k	R1/4WA	P2.5mm / 0805		0.05	0.20
131	1	R58	ASJ, Walsin, or Royalohm	SURFACE MOUNT RESISTOR 0.048 X 0.079 INCHES	110R 1%	110R	R1/4WA	P2.5mm / 0805		0.05	0.05
132	4	R47-48 R140-141	ASJ, Walsin, or Royalohm	SURFACE MOUNT RESISTOR 0.048 X 0.079 INCHES	15K 1%	15k	R1/4WA	P2.5mm / 0805		0.05	0.20
133	1	R57	ASJ, Walsin, or Royalohm	SURFACE MOUNT RESISTOR 0.048 X 0.079 INCHES	210R 1%	210R	R1/4WA	P2.5mm / 0805		0.05	0.05
134	8	R29-30 R35 R44 R122-123 R126-127	ASJ, Walsin, or Royalohm	SURFACE MOUNT RESISTOR 0.048 X 0.079 INCHES	1R 1%	300R	R1/4WA	P2.5mm / 0805		0.05	0.40
135	2	R62 R149	ASJ, Walsin, or Royalohm	SURFACE MOUNT RESISTOR 0.048 X 0.079 INCHES	300R 1%	300R	R1/4WA	P2.5mm / 0805		0.05	0.10
136	10	R41-42 R53 R65 R67 R80 R84 R90 R136-137	ASJ, Walsin, or Royalohm	SURFACE MOUNT RESISTOR 0.048 X 0.079 INCHES	47K 1%	47k	R1/4WA	P2.5mm / 0805		0.05	0.50
137	5	R45-46 R87 R138-139	ASJ, Walsin, or Royalohm	SURFACE MOUNT RESISTOR 0.048 X 0.079 INCHES	4K7 1%	4k7	R1/4WA	P2.5mm / 0805		0.05	0.25
138	1	R59	ASJ, Walsin, or Royalohm	TH 1/2W	4K7 1%	4k7	R1/8W	P8mm		0.05	0.05
139	2	R134 R72	ASJ, Walsin, or Royalohm	SURFACE MOUNT RESISTOR 0.048 X 0.079 INCHES	4K7 1% 0805	4k7	R1/4WA	P2.5mm / 0805		0.05	0.10
140	1	R83	ASJ, Walsin, or Royalohm	SURFACE MOUNT RESISTOR 0.048 X 0.079 INCHES	4K7 0805	4k7	0805	0805		0.05	0.05
141	1	R205	ASJ, Walsin, or Royalohm	SURFACE MOUNT RESISTOR 0.048 X 0.079 INCHES	56R 0805	56R	0805	0805		0.05	0.05
142	12	R11-13 R16-18 R106-111	Dale	THROUGH HOLE RESISTOR 1/4W	56R TH 1% OR 1206	56R	R1/4WA3.5	P3.5mm / 1206	PCM63 1206	0.10	1.20
143	10	R95-96 R93-94 R178 R180-182 R184-185	Dale	THROUGH HOLE RESISTOR 1/4W	56R TH 1%	56R	R1/8W	P8mm	D. Bus	0.10	1.00
144	9	R54-56 R64 R76 R88-89 R142-143	ASJ, Walsin, or Royalohm	SURFACE MOUNT RESISTOR 0.048 X 0.079 INCHES	680R 1%	680R	R1/4WA	P2.5mm / 0805		0.05	0.45
145	1	R148	ASJ, Walsin, or Royalohm	SURFACE MOUNT RESISTOR 0.048 X 0.079 INCHES	75R 1%	75R	R1/4WA	P2.5mm / 0805		0.05	0.05
146	1	R98	ASJ, Walsin, or Royalohm	SURFACE MOUNT RESISTOR 0.048 X 0.079 INCHES	90.9R 1%	90.9R	R1/4WA	P2.5mm / 0805		0.05	0.05

S/N	USE Qty	Reference Designation	Manufacturer	Description	Part Number	Value / Alternative	PCB DECAL	Packaging	Section	Cost (est)	Total Cost
154	4	R31 R79 R130 R157	Vishay BC Components MRS25	THROUGH HOLE RESISTOR 1/4W	TH 1% 1/4W resistor 10R	10R	R1/4WA3.5	P3.5mm / 1206	I/V 1206	0.10	0.40
155	2	R32 R158	Vishay BC Components MRS25	THROUGH HOLE RESISTOR 1/4W	TH 1% 1/4W resistor 10R	10R	R1/8W	P8mm		0.10	0.20
156	2	R85 R131	Vishay BC Components MRS25	THROUGH HOLE RESISTOR 1/4W	TH 1% 1/4W resistor 10R	10R	R1/4W	P8mm		0.10	0.20
157	16	R14-15 R51-52 R70-71 R91-92 R128-129 R132 R135 R155-156 R159-160	Vishay BC Components MRS25	THROUGH HOLE RESISTOR 1/4W	1k5	1k5	R1/4WA3.5	P3.5mm / 1206	I/V 1206	0.10	1.60
158	4	R100 R104 R153 R176	Vishay BC Components MRS25	THROUGH HOLE RESISTOR 1/4W	22k	22k	R1/4WA3.5	P3.5mm / 1206	I/V 1206	0.10	0.40
159	4	R101 R105 R154 R177	Vishay BC Components MRS25	THROUGH HOLE RESISTOR 1/4W	47R	47R	R1/4WA3.5	P3.5mm / 1206	I/V 1206	0.10	0.40
160	2	R86 R133	Vishay BC Components MRS25	Leaded Resistor 1/2W	MRS25 1% 680R	680R	R1/8W	P8mm		0.10	0.20
161	4	R36-38 R63	Vishay BC Components MRS25	THROUGH HOLE RESISTOR 1/4W	56R TH 1%	56R	R1/8W	P8mm		0.10	0.40
162	2	K1-2	Axicom FX2 Panasonic TX2	Relay 2P2T	TX2-12V	TX2-12V	RLY-NEC-EC2	10 x 5 mm		3.00	6.00
163	3	K3-5	Axicom FX2 Panasonic TX2	Relay 2P2T	TX2-5V	TX2-5V	RLY-NEC-EC2	10 x 5 mm		3.00	9.00
164	1	U1	NPC	High Performance Digital Filter	SM5842AP/APT	SM5813 / PMD100 / DF1704 / DF1706	DIP28-600	DIP28		30.00	30.00
165	1	U3	TOSHIBA	IC OPTICAL RECEIVER 3.3V	TORX147L	TORX147L	TORX147_OK			3.50	3.50
166	4	VR3-4 VR7-8	Bourns 3296	VARIABLE RESISTOR (TOP ADJUST TYPE)	3296W-1-502LF 5K	5k 10T	VRES-TOP-ADJ	2.54mmx3		1.00	4.00
168	1	U2	Wolfson	1:1 Digital Receiver	WM8804	WM8804	SSOP20-1	SSOP20-1		2.00	2.00
169	2	J14-15	Neutrik	XLR Male Socket PCB Horizontal	NC3MAA-H1	NC3MAA-H1	XLR-MALE	XLR		3.00	6.00
170	1	J3	Neutrik	XLR Female Socket PCB Horizontal	NC3FAA-H2	NC3FAA-H2	XLR_FEMALE_G	XLR		3.00	3.00
173	14	TO-220 Heatsink mouting kit		M3 screw x 8mm length, plastic ring, thermal pad, spring washer				M3		1.00	14.00
174	12	Standoff Board mounting		M3 screw x 8mm, spring wash and brass standoff 6~8mm				M3		1.00	12.00
175	1	D1V2 Zen I/V PCB	Fetaudio.com	Print circuit board for D1V2 + Zen I/V Marking: Date: 2022 0213	2022-0213		8 x 11 inches			55.00	55.00
Total	626									SGD$	$529.07


5V LED
7.5Vac
LM317 H3
5V RLY
3V RLY
AES-XLR
SPDIF-RCA
Toslink
Optical
12MHz
Underlined Parts DO NOT SOLDER
SM5842/SM5813
PMD100/DF1704
VHC244
PCM63P-K
LEFT CH
RIGHT CH
N-ch to Reverse
J13: 1-2 --> 2-3
J16: 1-2 --> 2-3
J17: 1-2 --> 2-3
J26: 1-2 --> 2-3
Ext. Mute
EXT. Digital Input
-VL GL +VL
-VR GR +VR
AGND
Date: 2022-0213
Model: D1V2+Zen I/V
www.FETAudio.com
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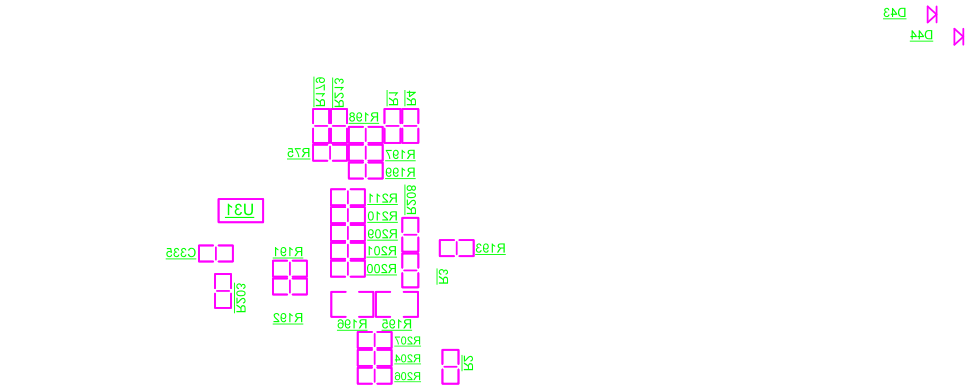
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D44
R198
R197
R199
R214
R210
R209
R201
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R207
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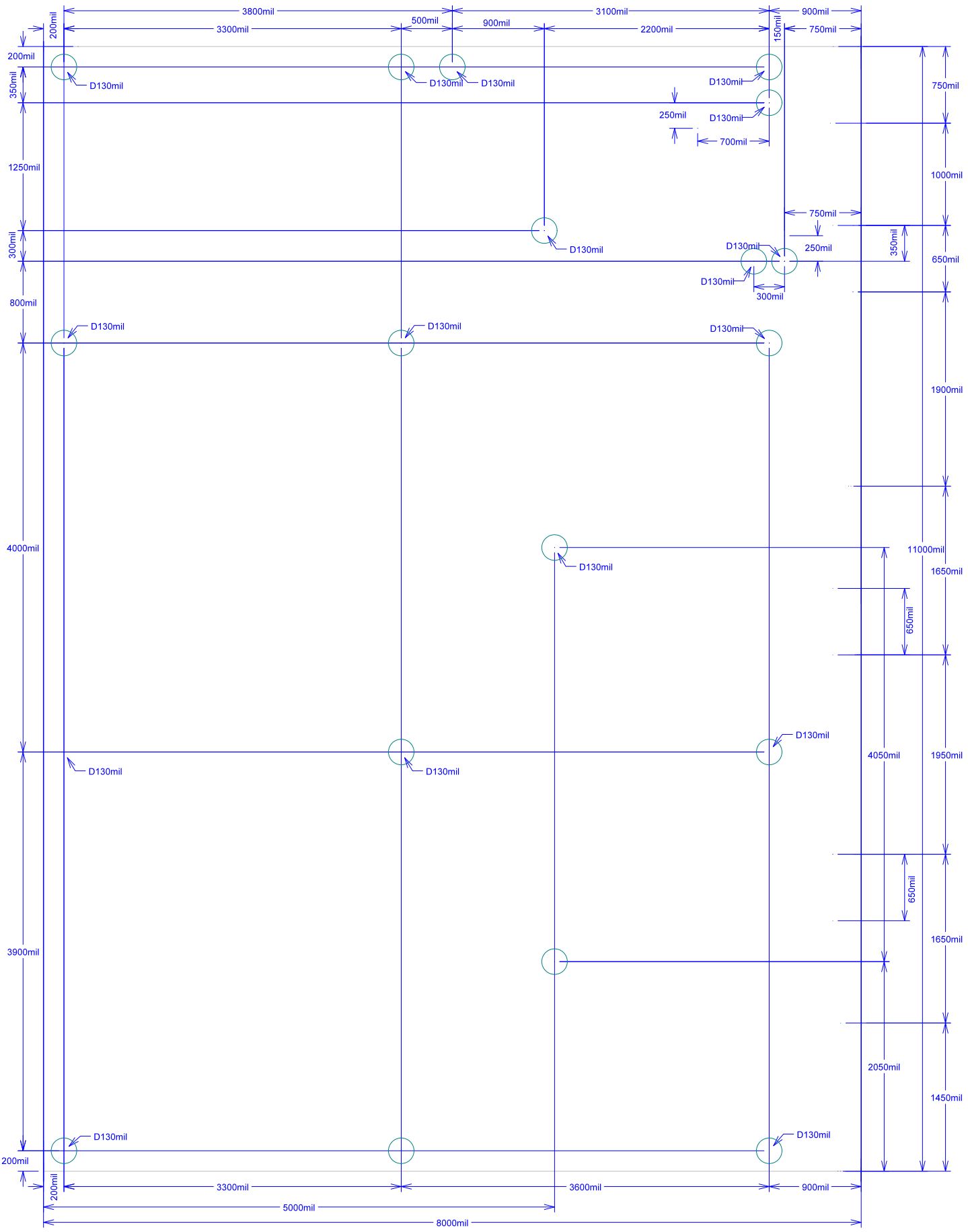
R193
R191
R192
U31
C235
C5
C4
C5
C5


3800mil
3100mil
900mil
200mil
3300mil
500mil
900mil
2200mil
150mil
750mil
200mil
350mil
D130mil
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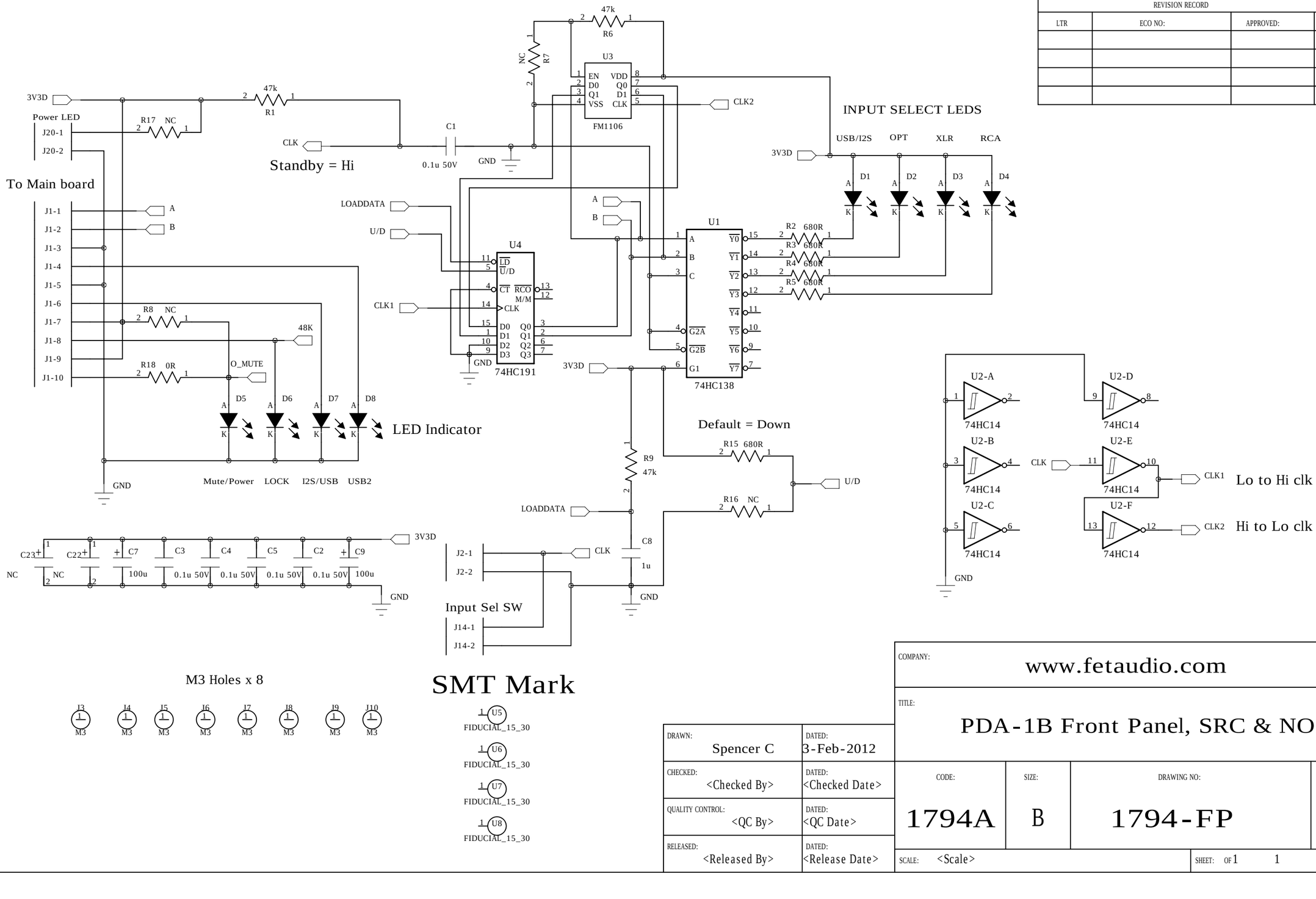
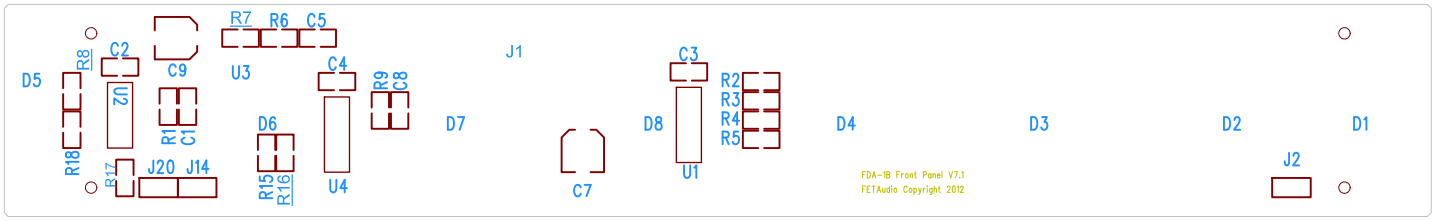
D130mil
D130mil
250mil
D130mil
700mil
750mil
1250mil
1000mil
750mil
300mil
D130mil
350mil
250mil
650mil
D130mil
300mil
800mil
D130mil
D130mil
D130mil
1900mil
4000mil
11000mil
D130mil
1650mil
650mil
D130mil
D130mil
D130mil
4050mil
1950mil
650mil
3900mil
1650mil
2050mil
1450mil
D130mil
D130mil
200mil
200mil
3300mil
3600mil
900mil
5000mil
8000mil

REVISION RECORD			
LTR	ECO NO:	APPROVED:	DATE:



DRAWN: Spencer C	DATED: 3-Feb-2012	COMPANY: www.fetaudio.com	
CHECKED: <Checked By>	DATED: <Checked Date>	TITLE: PDA-1B Front Panel, SRC & NOS	
QUALITY CONTROL: <QC By>	DATED: <QC Date>	CODE: 1794A	SIZE: B
RELEASED: <Released By>	DATED: <Release Date>	DRAWING NO: 1794-FP	REV: 6
		SCALE: <Scale>	SHEET: OF 1 1

Item	Qty	Reference	Part Name	Manufacturer	Description	PCB DECAL	Part Number	Value	Voltage Rating	PCB DECAL
1	1	U2	74HC14,74HC14D	TEXAS INSTRUMENTS or NXP	HEX SCHMITT-TRIGGER INV	SO14NB	74HC14D	74HC14D		SO14NB
2	1	U1	74HC138,74HC138D	TEXAS INSTRUMENTS or NXP	3-TO-8 LINE DECODER/DEMUX	SO16NB	74HC138D	74HC138D		SO16NB
3	1	U4	74HC191,74HC191D	TEXAS INSTRUMENTS or NXP	SYNCHRONOUS BINARY COUNTER 4 BIT	SO16NB	74HC191D	74HC191D		SO16NB
4	5	C1-5	CAP0805,0.1u 50V,10%	Walsin or Samsung	SMD X7R	0805	0.1u 50V	0.1u 50V	50V	0805
5	1	C8	CAP0805,1u	Walsin or Samsung	SURFACE MOUNT CAPACITOR 0.048 X 0.079 INCHES	0805	1u 10V	1u	10V	0805
6	2	C7 C9	CAP-AE5,100u,20%	Panasonic FC	ALUMINUM ELECTROLYTIC CAP.	279B-01	100u 10V	100u	10V	279B-01
7	0	C22-23	CAP-AE5,NC,20%	Panasonic FK or OS-con	ALUMINUM ELECTROLYTIC CAP.	C0505	47uF 6.3V	NC	6.3V	C0505
8	1	J1	CON-RIB10V,2x5 2.5mm male connector	China	RIBBON CABLE 10-PIN VERTICLE MALE NO LATCHES	HD-10V	RIB10V 2.5mm 2x5	2x5 2.5mm male connector		HD-10V
9	2	J2 J14	CON-SIP-2P,2.5mm male	China	GENERIC 2 PIN SIP HEADER .100 CENTERS	SIP-2P	2x1 Header	2.5mm male		SIP-2P
10	0	J20	CON-SIP-2P,NC	China	GENERIC 2 PIN SIP HEADER .100 CENTERS	SIP-2P	2x1 Header	NC		SIP-2P
11	0	U5-8	FIDUCIAL_15_30,NC		SMT Alignment Point	FIDUCIAL_15_30		NC		FIDUCIAL_15_30
12	1	U3	FM1106,FM1106	Ramtron	Nonvolatile 3V Dual State Saver	SOT-23	FM1106	FM1106		SOT-23
13	7	D1-4 D6-8	LED,2.5mm	China	Diode LIGHT EMITTING DIODE	LED	Green	2.5mm		LED
14	1	D5	LED,2.5mm	China	Diode LIGHT EMITTING DIODE	LED	RED	2.5mm		LED
15	0	J3-10	M3,NC	Nil	M3 screw hole	M3	M3 screw hole	NC		M3
16	1	R18	RES0805,0R,1%	Walsin or ASJ	SURFACE MOUNT RESISTOR 0.048 X 0.079 INCHES	0805	0R 1%	0R		0805
17	3	R1 R6 R9	RES0805,47k,1%	Walsin or ASJ	SURFACE MOUNT RESISTOR 0.048 X 0.079 INCHES	0805	47k 1%	47k		0805
18	5	R2-5 R15	RES0805,680R,1%	Walsin or ASJ	SURFACE MOUNT RESISTOR 0.048 X 0.079 INCHES	0805	680R 1%	680R		0805
19	0	R7-8 R16-17	RES0805,NC,1%	Walsin or ASJ	SURFACE MOUNT RESISTOR 0.048 X 0.079 INCHES	0805	680R 1%	NC		0805


R7
R6
C5
C2
C9
U3
C4
R9
C8
J1
C3
R2
R3
R4
R5
R8
D5
D6
D7
D8
D4
D3
D2
D1
U2
R1
C1
R18
R17
J20
J14
R15
R16
U4
C7
U1
J2
FDA-1B Front Panel V7.1
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