FETAudio FDA-1

'PCM1794A Single End DAC '
&
'PCM1794A Full Balance DAC

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*High Fidelity 24 bit*192kS/s*
Digital to Analogue Converter

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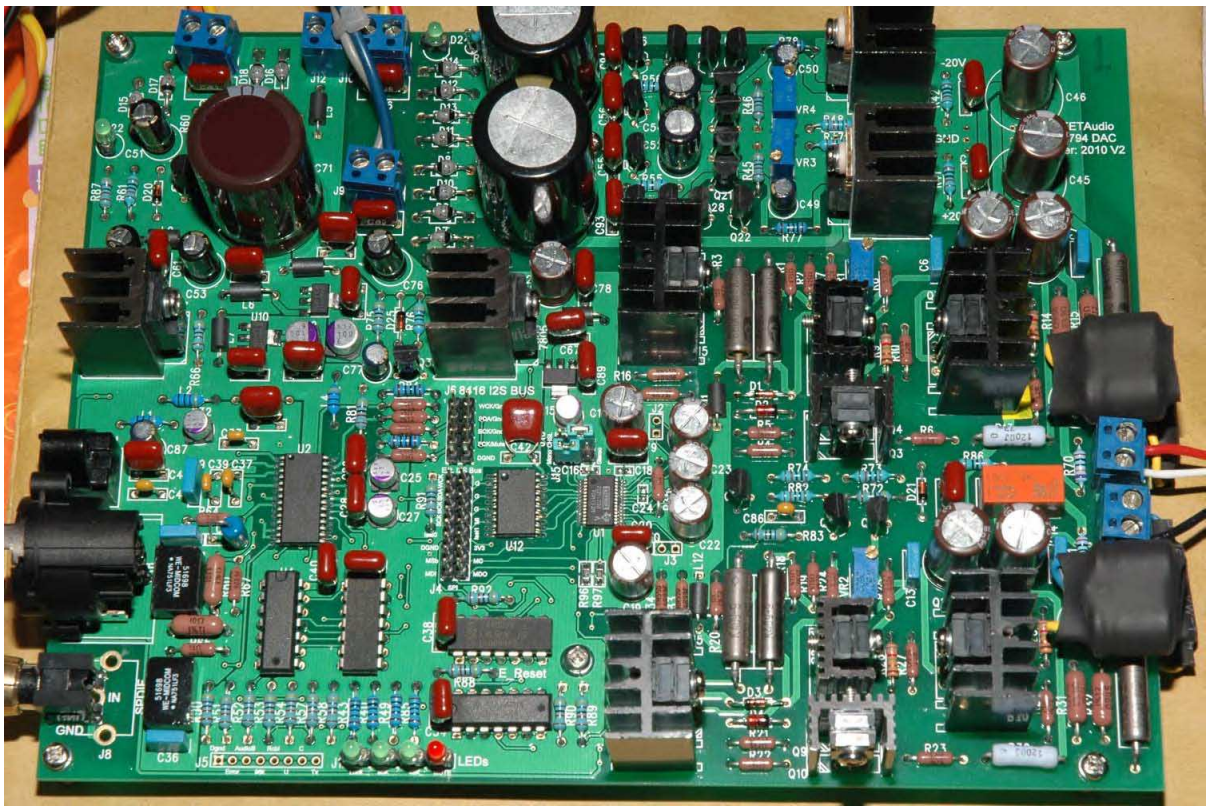


Manual

A. Introduction:

These DACs are designed for the serious audiophile. They utilize the best DAC chip - PCM1794A that is capable of producing a super dynamic range of 127dB in stereo mode and 132dB in mono mode!

The I/V and analogy sections are custom designed and use 100% discrete components. The I/V converter is a "Current Steering" topology and the analogy section is a pure 'Class A' non negative feedback driver and output buffer stages. With this combination, the sound will be musical, dynamic, accurate and real.

In Single End version, the DAC uses one circuit board with one PCM1794A DAC chip working in Stereo Mode. In Full Balance version, the DAC uses two circuit boards (one Master and the second Slave) and two PCM1794A DAC chips, each configured in mono mode (namely Mono L and Mono R) to deliver super dynamic range of 132dB.

Users can start with Single End version to see if the performance is up to the expectation of Hi-Fidelity. To protect your investment, a very clear and simple upgrade path is built into the design. Users of the Single End version can easily upgrade to the True Full Balance version anytime by adding a second slave DAC board! The sonic improvement of the Full Balance version brings new meaning to the word 'High-Fidelity'!

These 'serious audiophile' DACs are peppered with high quality audiophile grade components that are selected because of their complementary sonic signatures after many exhaustive hours of listening tests. Audio transistors, Paper-In-Oil capacitors, Silmic II capacitors and Dale resistors are widely used in the DACs.

However, the most important feature is that these DACs sounds musical, dynamic, open and warm with an unparalleled resolving power. These are truly remarkable DACs capable of holding themselves against any branded DAC costing many times more!

B. Specifications:

1. DAC chip: Texas Instruments PCM1794A 24bit/192k best in class DAC
2. Digital Receiver: Crystal CS8416 24bit/192k digital receiver
3. I/V and Analogy Filter: Discrete transistor I/V (current steering) operating in pure Class A mode with NO global feedback for the best sonic performance
4. Digital Input: SPDIF, AES, Toslink and I2S Bus (RCA, XLR female, Optical and 8x2-pin header)
5. Bit/Sampling Frequency: Up to 24bit/192k
6. Analogy Output: Stereo Channels (Single End) @ 1.5Vrms (expandable to Full Balance output by using two boards @ 3Vrms)
7. Output Impedance: 150 ohm Single End mode; 300 ohm Full Balance mode

8. Auto muting for noiseless operation when no audio/digital signal is detected or when a digital error occurs (e.g. AC-3 signal) or when powering up or down
9. Power supply: AC 17~18V x 2, 0.5A and AC 8~9V x 1, 0.5A; total consumption 7W/board
10. Display LEDs: PLL Lock, 48k, 96k and Mute (for CS8416 input only)
11. Distortion: Typically at or less than 0.02% 1kHz at FS, 20kBW Single Ended @ 1.5Vrms. At full bandwidth typically no more than 0.04%.
12. Board: 6 x 8 inches double sided 1.6mm gold plated FR4; 6 x M3 supporting holes; max height part 35mm.

C. Circuit Description:

1. Digital Receiver:

The Crystal Digital Receiver Chip CS8416 is operated in hardware mode set by R81 thus providing a maximum of 4 digital inputs. In this board, only 3 of the 4 inputs are used (RXP1 to 3) for SPDIF (RCA), AES (XLR female) and Toslink (Optical). The forth RXP0 input is not used.

The output of CS8416 is preset to the I2S format and the external I2S input signal from J4 8x2-pin header (pin 1 to pin 8). The 74VHC244 is used to select the I2S signal either directly from the CS8416 or externally via J4. The selection of the input by pins 9-10 of J4 is as below:

ISEL0 (J4 pin 9)	**ISEL1 (J4 pin 10)**	**Description**
0 (GND)	0 (GND)	I2S via J4 (External I2S signal selected)
0 (GND)	1 (+3v3)	SPDIF RCA selected (**default**)
1 (+3v3)	0 (GND)	AES XLR selected
1 (+3v3)	1 (+3v3)	Toslink Optical selected

Note that if there is no signal on pin 9 and 10 of J4, the default input is set to RCA – SPDIF input by onboard resistors.

Full Balance Output (Two Boards Required):

In addition to the output signal from J4, there is another custom designed pin header J6 (5 x 2 pin). J6 is the I2S bus output for the CS8416 that will drive a second slave board via the second board's J4 connection. When the master board is set to "Mono L" mode and the slave board is set to "Mono R" mode by onboard jumpers J15 and J16, the result will be a true Full Balance DAC using two boards. To achieve the lowest possible jitter performance, the I2S connector cable should be as short as possible or not longer than 25cm.

D. PCM1794A DAC

The input data format for the PCM1794A is set to the I2S format via R96 and R97 to ground. J15 and J16 is the logic selector for Mono via pin 1 and CHSL via pin 2 of PCM1794A respectively. Pin selections for stereo and mono modes are:

Mono (J15)	CHSL (J16)	PCM1794A output Mode
0 (short pin 2-3)	0 (short pin 2-3)	Stereo
1 (short pin 1-2)	0 (short pin 2-3)	Mono L channel
1 (short pin 1-2)	1 (short pin 1-2)	Mono R channel

Thus when two boards are used with one set to Mono L and the other to Mono R, we have a true full balance output version of DAC. The connection of the J6 & J4 of the two boards will be as below (assuming Board 1 is the digital source master and board 2 is slave board):

Board 1 J6 pin	Board 1 J6 pin	Board 2 J4 pin	Board 2 J4 pin
1 WCK	2 DGND	1 WCK	2 DGND
3 SDA	4 DGND	3 SDA	4 DGND
5 BCK	6 DGND	5 BCK	6 DGND
7 SCK	8 8416 Mute Out	7 SCK	8 MUTE In
9 DGND	10 DGND	9 ISEL0	10 ISEL1

Then pins 9 & 10 of J4 on Board 2 will be forced to Ground to select the external I2S input. A 5x2 pin header to 8x2 pin header cable should be used to connect the boards together in this full balance mode operation.

E. I/V Section

The I/V converter uses the "current steering" method and two common base transistors as the current pass through device. The input common base transistors Q1 and Q2 are biased at about 10mA by a current source from another two transistors Q3 and Q4 from the positive supply. Since the PCM1794A output (sink) about 6.2mA to ground (or the negative supply), this current will superimpose with the bias current. Therefore, when no signal is detected, the input transistor bias will be at about 16.2mA. Since the PCM1794A swing current is 7.8mA peak-to-peak, the minimum and maximum current at Q1 and Q2 will be 12.3mA and 20.1mA respectively. Thus a medium powered transistor with a heat sink is selected to handle this current and voltage ratings.

The input signal current of 7.8mA p-p will then pass through R1 and R2 (I/V resistors), which convert the current into voltage. The signal voltage at Full Scale across R1 and R2 is about 2.6Vrms. C1 and C2 are the I/V capacitors that will create a single pole low pass filter roll off at frequency about 50kHz.

Diode (D1) should be a low forward voltage Schottky diode to prevent the PCM1794A's current output pins from being driven to negative voltages (below ground). If this happens, it will increase harmonic distortions tremendously at peak levels.

Q5, Q6, Q7 and Q8 form a pure "Class A" driver and output buffer stage. As Q7 and Q8 are biased to between 20mA to 22mA, a heat sink is required. Q5 and Q6 are biased at about 2mA.

Please note that the transistors are thermally coupled in pairs to reduce thermal drift. If the transistors are matched from same batch (date code), the output DC offset can be kept to a minimum.

VR1 adjusts the output DC offset, which should be adjusted to as close to 0Vdc as possible (at point A). R15 and C3 will remove unwanted high frequency noise further. C81 and C82 will block any potentially damaging DC voltage from flowing into the first stage of the pre-amplifier. Bi-Polar and/or film capacitors are recommended at C83 & C84. Besides BP capacitor, other capacitors including Paper-In-Oil (PIO) and Polypropylene can be used too. The hole-sizes of C83 & C84 are enlarged for easy connection of bigger external capacitors.

The output decoupling capacitors C81 and C82 may be removed and shorted with a wire for sonic comparison. In this way, the DAC is Output Capacitor Less (OCL) mode.

****** NOTE: TRY OCL MODE AT YOUR OWN RISK AS ANY DC DRIFT OR SURGE MAY DAMAGE THE PRE-AMP, POWER AMP AND EVEN SPEAKERS DESPITE THE OUTPUT PROTECTION /MUTING CIRCUITARY. ******

F. Power Supply and Regulators

There is nothing unique about the power supply design except that the PCB layout is designed with particular focus on a proper "star" ground return path. Chokes and beads are used to reduce cross-noise interference. Normal speed regulators are selected for their musical sound and audio grade capacitors are selected for best overall sonic signature.

1. Digital Section:
A separate 9Vac supply is used for all the digital sections of the CS8416, logic circuits and the PCM1794A. There are two 5V LM7805 type regulators and three 3.3V sub-level regulators in this section. For best noise and sonic performance, one 5V and one 3.3V regulator are dedicated for the PCM1794A DAC.

2. I/V Section:
The transistor I/V section is powered by 18V x 2 AC sources that are then filtered and regulated by a super low noise and low drop out regulator to +/-20Vdc. VR3 and VR4 adjust their output voltages.

3. Importance of Layout & Grounding:
With so many regulators working simultaneously in the digital, DAC and I/V sections, the board layout and grounding path designs are critical in achieving a low ground noise floor. Various grounding techniques are employed here resulting is a very low ground noise floor of below –135dbV (SE mode), which is confirmed by the FFT measurements taken. In fact, the noise floor is lower than what the equipment can measure!

4. Distortion:
There are basically 4 harmonics distortions in the FFT chart that are mainly due to the non-linearity of the transistor I/V converter. With the clean noise floor and minimum harmonic

spikes, the background of the sound will be very quiet and smooth! This is the main reason why this DAC pleases the ears more easily than normal op-amp base DAC even where the distortion levels are 10 or 100 times less.

A low noise transformer is also required for such low noise floor and low hum level results. Thus a R-core transformer or low noise type transformer is highly recommended.

G. Component choices

1. Digital Receiver: The DIR9001 was evaluated during the initial hardwire version. However, after many hours of listening tests comparing it to the CS8416, it was decided not to use the DIR9001. Our listening tests concluded that the CS8416's sonic performance was superior to that of the DIR9001 in this platform.
2. PCM1794A: This is currently the best DAC chip available on earth with a 127db dynamic range for stereo mode and 132 db for mono mode. Many other DAC chips are 24/192k (some claim they are even 32 bits) capable but their dynamic ranges are usually no better than 120db.
3. I/V transistors: The high-speed medium power driver stage transistors (2SC3421Y & 2SA1358Y) by Toshiba are used. Their high Ft will prevent any signal roll-off at high audio frequencies. Their high current rating can easily cope with the demanding current output of the PCM1794A. Their bigger size also helps dissipate the power/heat generated in pure Class A operation.
4. Capacitors: Power supply filtering capacitors for both the I/V stage and PCM1794A are Elna Silmic II audio grade for best sonic performance. I/V LPF filtering is Russian PIO K40Y-9 or equivalent for best dynamics, transparency and smoothness in sound. The output decoupling capacitor should be good bi-polar capacitors (Elna RBD, Panasonic SU, Nichicon Muse ES or Black Gate N depending on sonic preference) or Russian PIO MBGO, KGB or better. In the digital section, Sanyo OS-Con is used due to their low ESR and high reliability. With these capacitors, the DAC will be transformed from good to excellent! See the Bill of Materials for capacitor selection.
5. Resistors: Although the impact on the performance of the DAC may not be as significant as with changes in capacitors, Dale resistors are widely used throughout the signal path circuit from digital input to analogy output for its low noise and low temperature drift properties. See the Bill of Materials for various selection of resistor.
6. Rectifiers: High-speed fast recovery Philips/Vishay BYV27 series is selected for their outstanding sonic performance and accuracy.

H. Sonic Performance & D1V33 comparison

Many DIYers have listened to the D1V3 or D1V33 DAC using the PCM63 DAC chip. So how does the new PCM1794A DAC compare in listening tests?

In my opinion, I still believe the PCM63 is the best 20-bit R2R DAC ever made. It has a very good output current driver stage, which is necessary for achieving hi fidelity, especially in a well-designed DAC, like the D1. The PCM63 has a very open, smooth and involving sound.

The bass, which is deep and extended, is its strength. This helps create depth and thickness (harmonics) in the music.

With the PCM1794A, its 'killer' feature is its resolving power. The PCM1794A trumps the PCM63 as it is capable of 24bit/192k format playback, which the PCM63 cannot. Therefore, if listeners want to enjoy the world of 24bit/192k hi resolution playback, the PCM63 is not an option.

In my opinion, the sonic signature of this PCM1794A DAC in single ended mode is better than that of the PCM63; smooth, open and musical but with the added advantage of a much higher dynamic range, resolving power and accuracy. This adds to the dynamism of the music. The soundstage is transparent, open and deep.

With the addition of a second slave board, the DAC is transformed into a true Full Balance mode operation. In this configuration, it will easily outperform the D1 in every aspect. The music is more open, smooth and involving. If the D1 is sweet, then in balanced-mode, the PCM1794A can be characterize as 'natural honey sweet'; its music is very life-like, detailed, accurate, dynamic and musical. At the same time, the resolving power and dynamic range performance of the PCM1794A is maximized. In mono-mode, the dynamic range increases to 132 dB! This improves and extends the soundstage beyond the physical boundaries of the speakers whilst at the same time, increasing the tonal 'accuracy' and 3D placements of the music. It gives the feeling of 'just like being there'.

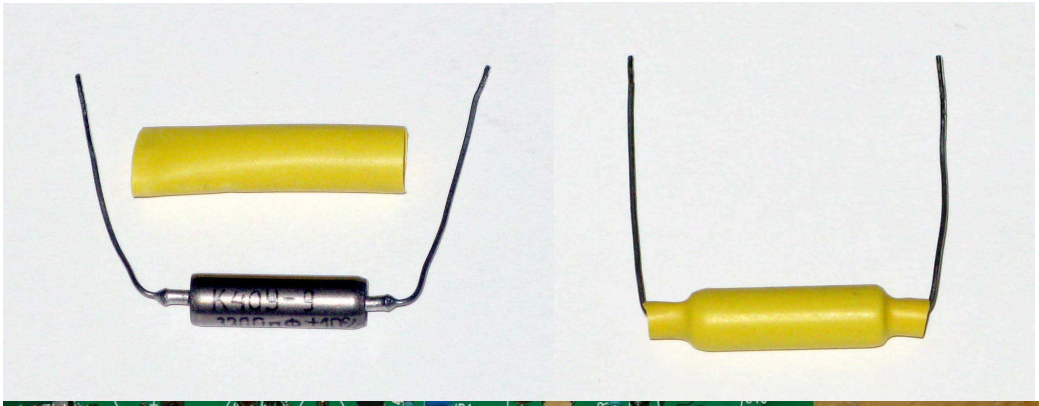
It is our belief that for the PCM1794A Single End mode and Full Balance mode to excel, they need to be partnered with equally competent transports and other components down the chain.

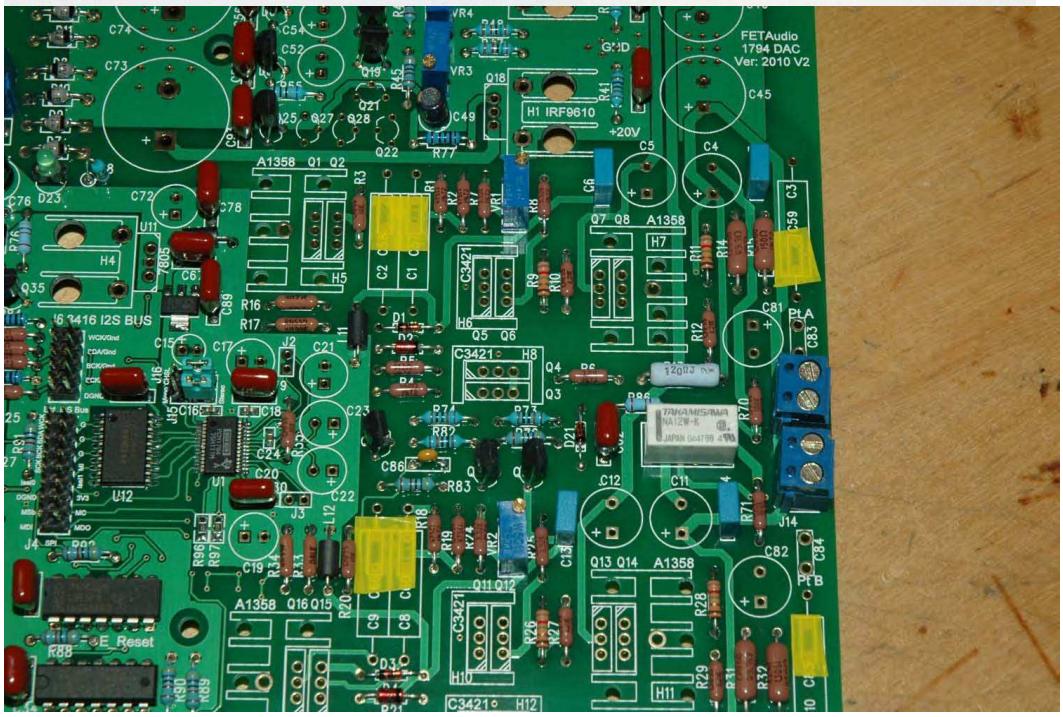
Overall the PCM1794A SE and FB DACs are very well balanced DACs. Furthermore, as it is capable of playing the new 24bit/192k high-resolution format music files, it is a sure winner!

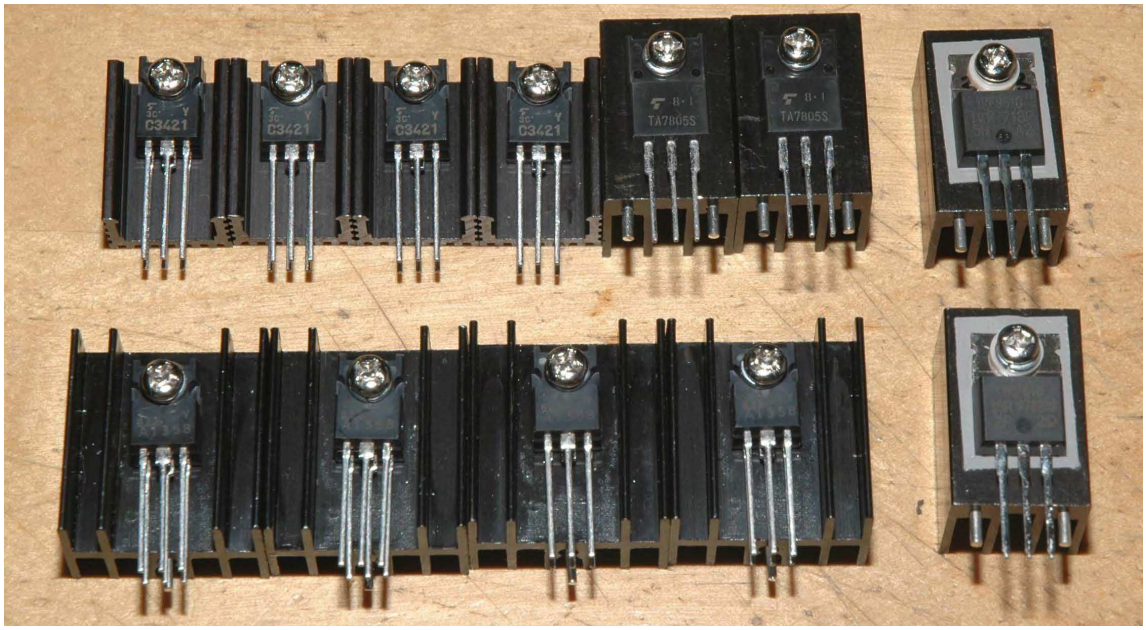
In simple terms, this PCM1794A DAC delivers the same or superior high audiophile performance of the PCM63 but with an even higher resolution plus support for today's high bit and high sample rate recording music sources.

I. Assembly & Adjustment Instruction

1. Please take necessary ESD precautions, as all the parts are ESD sensitive!
2. Solder all SMD IC: PCM1794A, 74VHC244 and CS8416CSZ. Align the markings of the IC with the text on the PCB screen-printing.
3. Solder all SMD resistors and chip capacitors – R96/97, C16, C18, C20, C24.
4. Wash the flux of all SMD parts by using flux-cleaning agent.
5. Solder all 3 SMD regulator U8 ~ U10 and Logic IC 74HC00/02. Align the markings of the IC with the text on the PCB screen-printing.
6. Solder the rest of the parts starting from the smallest parts first, preferably also by component type. For example, resistors, chokes, beads, diodes, PIO & film caps etc… For SANYO OS-CON SMD capacitors, pull the leads straight and insert into the PCB holes before soldering.
   ******Note:* Do not solder all the active parts with heat sinks – U7, U11, U17, U18, Q1/2, Q3/4, Q5/6, Q7/8, Q9/10, Q11/12, Q13/14, Q15/16 and Q17/Q18. *****
7. When soldering C1, C2, C3, C8, C9 & C10 (Russian PIO) capacitors, precaution has to be taken to prevent its body from shorting to the pad below. Two methods are suggested here: 1) use shrink wrap to insulate the body of all PIO capacitors or 2) use insulation tape to cover the pads of C57, C58, C59, C60, C66 & C86.

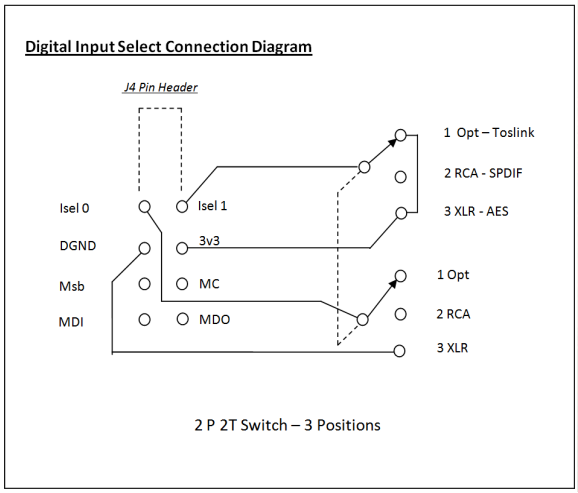


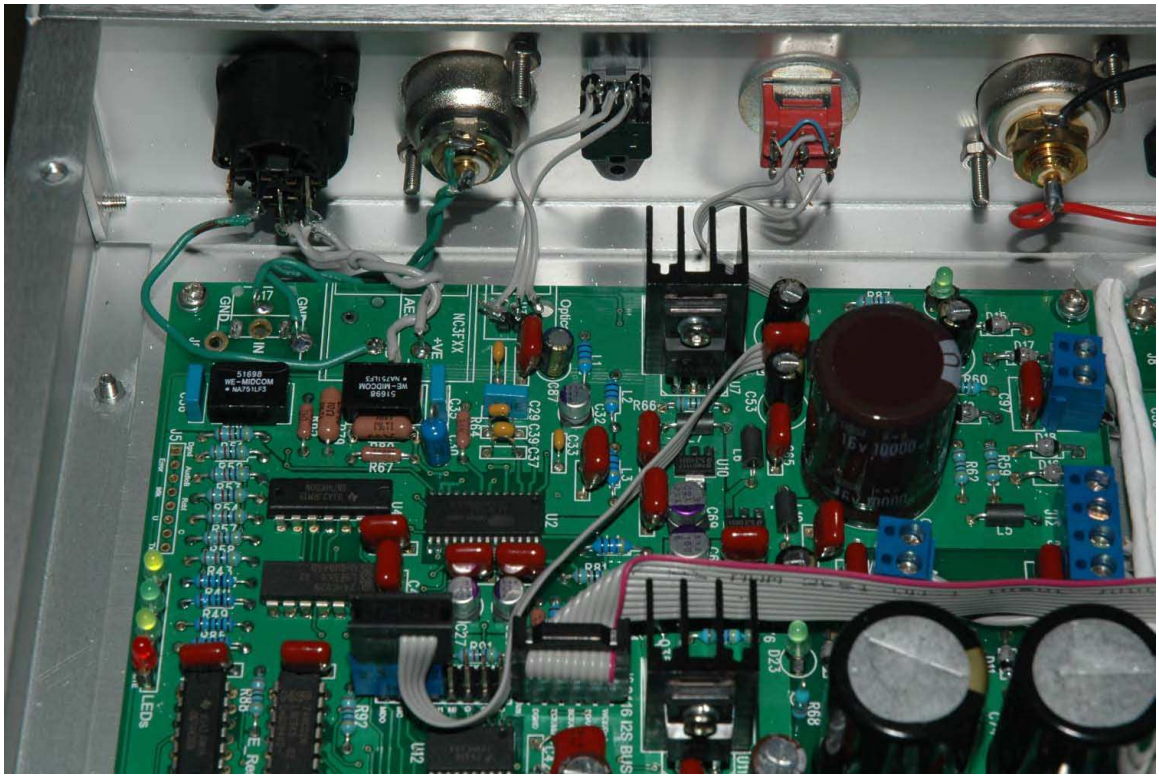
8. 

9. There is no need to solder J2, J3 and J5.
10. For J15 and J16, short pins 2 and 3 (square pad is pin 1) by jumpers provided for single-end stereo operation. Please refer to Section D on page 3 for mono settings for full balance mode operation.
11. **For DC measurement, the reference point should be J12 – Chassis ground.**
12. Prepare the parts with heat sink as shown in diagram with markings facing up. Note that two transistors of same type are mounted onto one heat sink. All transistors should be properly aligned one on top of the other with markings facing upwards. H7 and H11 is a taller heat sink of 30mm height for 2SA1358. ******Please do not over tighten the retaining screws as it may cause the transistors to fail or break!******
13. The two grey insulating pads together with the white holding washers should be used when mounting the IRF610 and IRF9610 to isolate its heat sink from ground. Failure to do so will short the regulators and possibly damage it and/or the board. For the transistor and regulator TA7805, this isolation is not necessary.
14. **Use a taller heatsink for H7 and H11.**
15. 

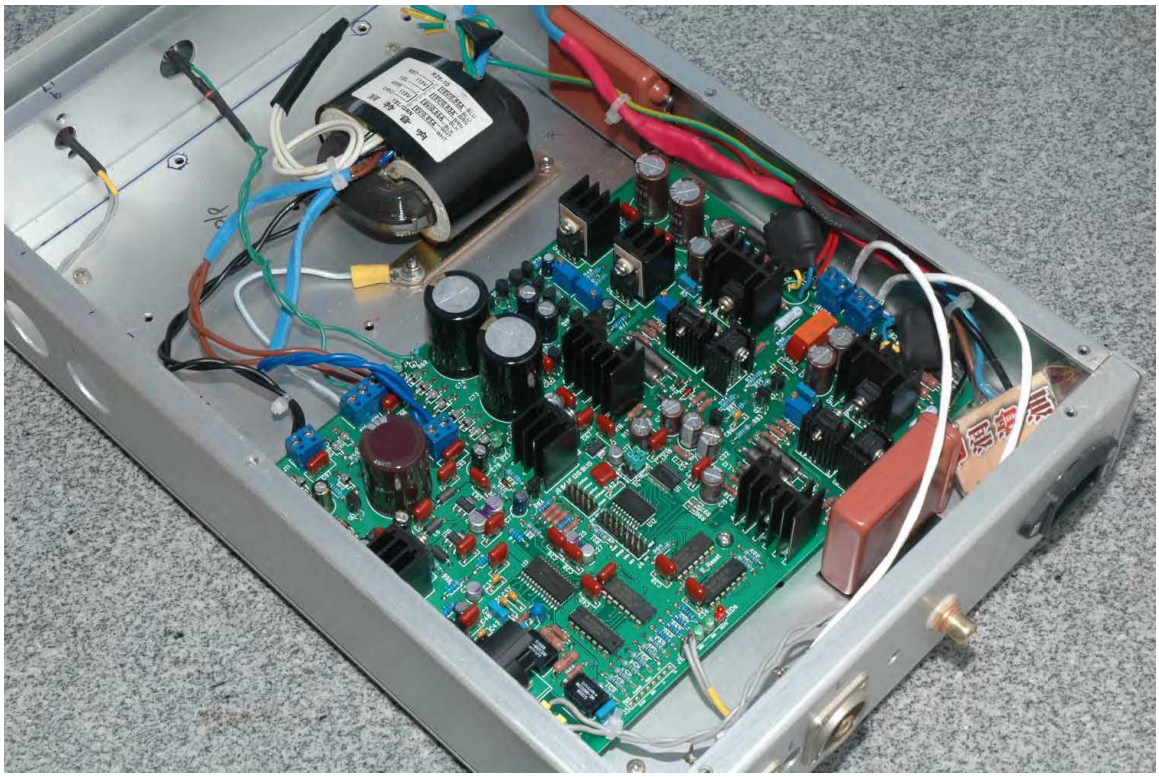
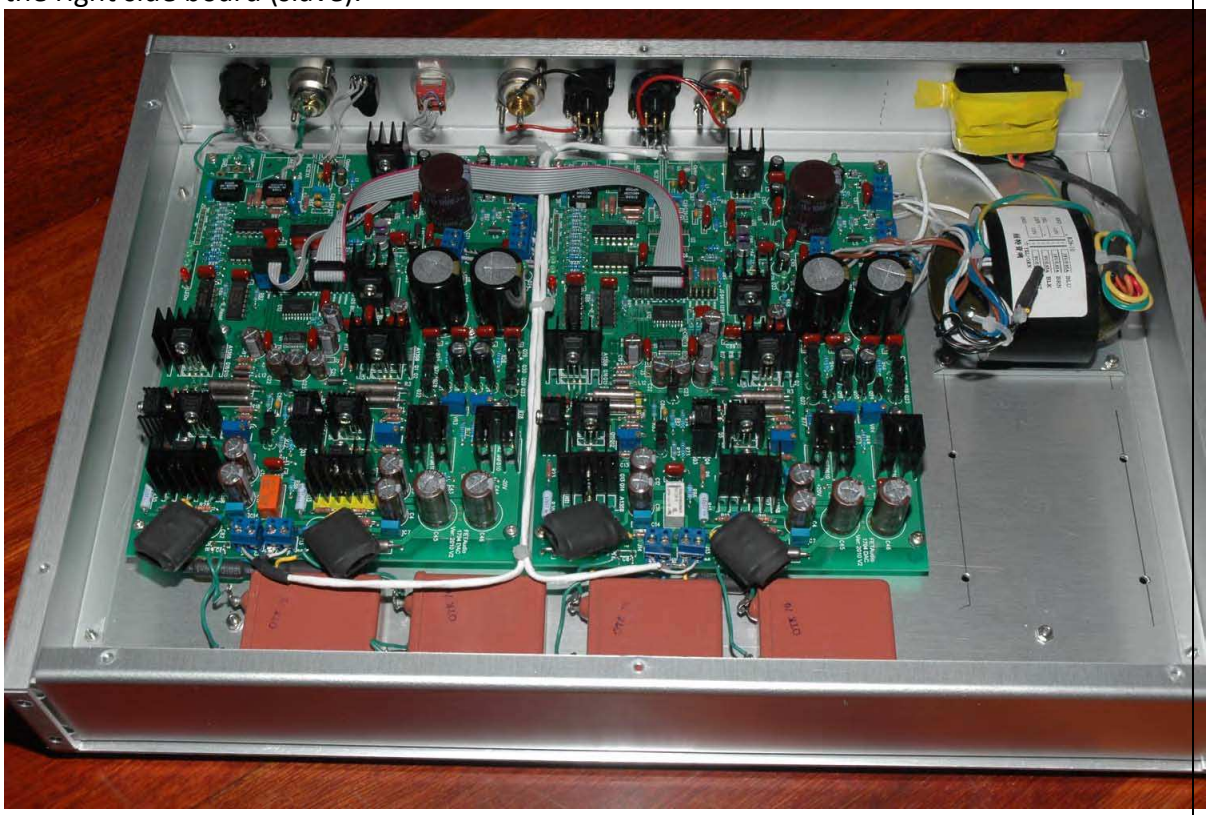
16. Solder one TA7805 regulator at U7 and then connect a 9Vac to J11. Immediately measure the DC voltages at the heat-sink of U8 and U10. They should be at 3.3V +/-0.1V. Check the voltage at L7. It should be at 5V+/-0.1V. Then check the voltage at L9. It should be at about 12.5Vdc. Disconnect the supply at J11.
17. Solder the second TA7805 regulator IC at U11 and then connect a 9Vac to J11 again. Immediately measure DC voltages at L8. It should be 5V+/-0.1V. Then measure the voltage at the heat sink of U8. It should be 3.3V +/-0.1V dc. Once completed, disconnect the 9Vac supply at J11 again.
18. *If the measurements at the regulators are not correct, cut the power immediately and check for soldering problems! Caution!! If voltages are too high, it may damage the expensive CS8416 and PCM1794A ICs!*
19. Solder Q17 – IRF610 and connect an 18Vac to J10. Measure the voltage at the Q17 heat sink and adjust VR4 until the voltage is at –20V+/-0.05V dc. Disconnect power at J10.
20. Solder Q18 – IRF9610 and connect an 18Vac to J9. Measure the voltage at the Q18 heat sink and adjust VR3 until the voltage is at 20V+/-0.5V dc. Disconnect power at J9.

21. Solder Q1 to Q8 on the PCB together with all their heat sinks. Connect all three power supplies; 9Vac to J9 and 18Vac to J10 and J11. Check that the regulated voltages at Q17 and Q18 are still at –20V and +20Vdc respectively. Then measure the DC voltage at point A (C83) and adjust VR1 until the voltage is below +/-1mVdc. *If near 0Vdc is not possible at Point A, then something is wrong with the board. Disconnect all power immediately and see if any parts are shorted or if there is an open solder.*
22. Now solder Q9 to Q16 on the PCB and repeat the previous step but with adjustment at VR2 and measurement at point B (C84).
23. Note that these DC voltages at point A and B will need to be adjusted again after about 30 minutes when the heat sinks reach stable operating temperature.
24. Now check the bias current by measuring DC voltage across resistor R9 and R26 (82.5 ohm), it should be about 1.70Vdc. Check DC voltage across resistor R11 and R28, it should be about 1.9Vdc.
25. Then check the DC voltage at J2 and J3 (PCM1794A 4x current output pins), it should be between 0.34Vdc to 0.37Vdc.
26. Connect a 1kHz digital signal to the SPDIF input socket. The PLL and either the 48k or 96k LED should be ON (depending on the sampling frequency of the input signal). You should hear the Relay click indicating that the board is un-muted and there should be 1kHz output signals at J13 and J14. Check output level using AC voltmeter, the output should be about 1.5Vrms at both channels. The channel imbalance of output level for left and right channel is due to the tolerance of PCM1794A output current. According to the PCM1794A data sheet, the maximum gain mismatch is 3% with a typical value of +/-0.5%. If the diyer wants to adjust the output level, two high resistance value resistor with same grade should be connected in parallel with the I/V resistors 475 ohm (R1/2 or R18/19 depending on where is the higher output level channel) at the bottom of the PCB. The value of the resistor should be determined by 'trial and error' starting from a minimum value of about 22k ohm.
27. Check that the distortion of the output 1KHz signal is about 0.02% for both channels.
28. Burn-in the DAC for about ½ hour to stabilize the old PIOs and other capacitors.
29. The digital input source is set by default to the RCA co-axial socket. However, to facilitate switching between the three digital input sources, a digital input selection switch is used. In the reference set, we have used a simple 2-pole 2-through 3-positions switch. The Digital Input Selection Circuit Diagram is below:

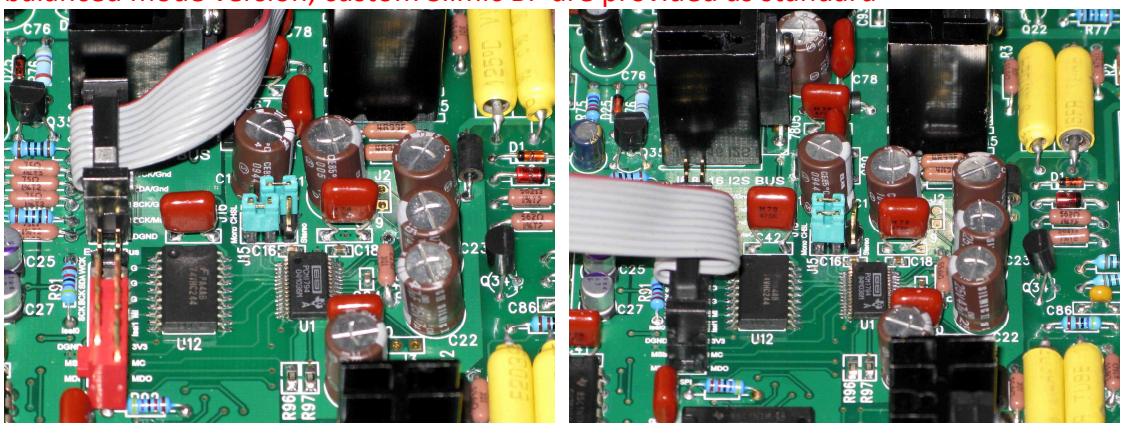


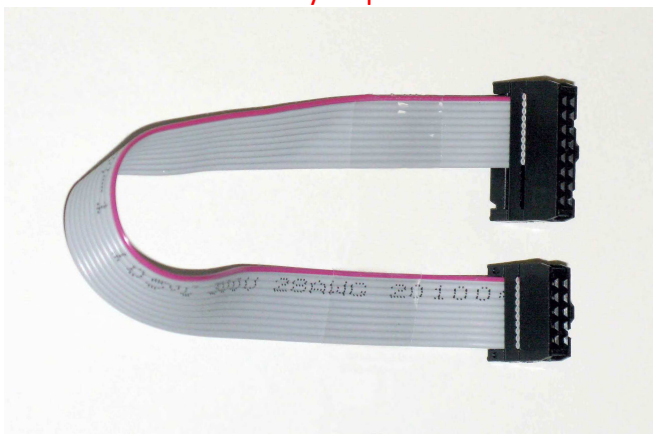
30. 

31. From left to right connectors: XLR (AES), RCA (SPDIF), and Optical (Toslink) above
32. 
33. Photo of a full balance version rear panel.

34. Photo of a completed set in Stereo Mode is below: pins 2-3 on both J15 & J16 are shorted.
35. 
36. Photo of the connecting flat cable and the DAC in Balanced Mode is below: 5x2 pin header J6 from left side board (source master) connected to 8x2 pin header J4 plug on the right side board (slave).
37. 
38. Output capacitors: 0.01u K40Y-9//Silmic BP – custom made//10u PIO MBGO.

** Note: The Russian Big Box 10uf PIO MBGO capacitor (brown boxes with the marking OTK) shown above is NOT part of the standard kit. For the single ended version, the standard output decoupling capacitors are Panasonic BP whereas for the fully balanced mode version, custom Silmic BP are provided as standard **

39. 

40. Left side board: J15 short pin 1-2 and J16 short pin 2-3 – Mono L mode.
41. Right side board: J15 short pin 1-2 and J16 short pin 1-2 – Mono R mode.
42. Balanced I2S cable: Only required for full balance version of DAC.
43. 
44. See last two attachments for power supply connections.
45. Change U11 7805 regulator to ST L4941BV. The different is the sonic of the sound – more dynamic and clean.
46. TA7805 is a more mellow sound with less clarity but it is still very good.
47. More details: http://www.fetaudio.com/archives/1140
48. http://www.fetaudio.com/archives/1094

Board Interface Specifications:

1. Power Supply Connectors:

Item	Description	Format
J9	17 to 18V ac, 0.5A	10mm
J10	17 to 18V ac, 0.5A	10mm
J11	8 to 9V ac, 0.5A	10mm
J12	Chassis Ground	10mm

2. J4: External Digital Connector: (8 x 2 Pin Header: 100mil)

Item	Description	Pin	Format
LRCK	Work clock fs	1	I2S
SDATA	Serial Digital Data	3	I2S
BCK	Bit clock 64fs	5	I2S
SCK	System clock 256fs	7	I2S
DGND	Digital Ground	2, 4, 6	Digital Ground
Mute In	Mute in for Output Signal	8	Active High
ISEL0	Input Select 0	9	See table 2
ISEL1	Input Select 1	10	See table 2
DGND	Digital ground	11	DGND
3V3	3v3 DC Supply	12	Max 50mA
SPI1 – MS_bar	**SPI Latch**	13	SPI for PCM1792
SPI2 - MC	**SPI Clock**	14	SPI for PCM1792
SPI3 - MDI	**SPI Input**	15	SPI for PCM1792
SPI4 - MDO	**SPI Output**	16	SPI for PCM1792

**** All logic signal level CMOS 3.3V.***

***** SPI should be at 3.3V levels for PCM1792 only***

3. Table 1: Sample Frequency Fs

Sampling Frequency fs	SCK Frequency 256fs (MHz)
32kHz	8.192
44.1kHz	11.2896
48kHz	12.288
96kHz	24.576
192kHz	49.152

4. Table 2: Digital Input Select

ISEL1	ISEL0	Description	On Board jumper J4
0 (GND)	0 (GND)	I2S via J4 (External I2S selected)	Short Pin 9-11 of J4
0 (GND)	1 (3V3)	SPDIF RCA selected (**default**)	All open (default)
1 (3V3)	0 (GND)	AES XLR selected	Short pin 9-11 and pin 10-12 of J4
1 (3V3)	1 (3V3)	Optical selected	Short pin 10-12 of J4

5. J6: CS8416 I2S Bus (5 x 2 pin header: 100mil)

Item	Description	Pin	I/O
LRCK	Work clock fs	1	From 8416
SDATA	Serial Data	3	From 8416
BCK	Bit clock 64fs	5	From 8416
SCK	System clock 256fs	7	From 8416
8416 Mute Out	Mute signal from 8416	8	8416 Mute out
DGND	Digital Ground	2, 4, 6, 9,10	DGND

6. Digital Input Socket:

Type	Description	Format
RCA – J8	SPDIF input	75 ohm 24bit/192k
XLR female - AES	AES input	110 ohm 24bit/192k
Toslink - Optical	Optical input	Optical 24bit/192k
Pin Header - J4	I2S and SPI control	3.3V CMOS

7. Analogy Output Socket: J13 & J14

Type	Description	Format – 10mm J13 & J14
RCA Left & Right	Analogy Output - Stereo	L–G (Left) and G–R (Right)
XLR - male	Balance Analogy Output	OUT+, G, OUT- (XLR)

***** For Mono L and R, set jumpers J15 and J16. XLR mode requires two boards.***

8. LED Display:

LEDs for 8416	Description
Lock	Digital signal is locked by 8416
96k	On when input signal is 96k to 192k Sampling Frequency
48k	On when input signal is 32k to 48k Sampling Frequency
Mute	Analogy signal muted by DAC and Relay - Error

Note that the LED is unable to tell Fs for external I2S input mode.

9. For PCM1792 connection (for evaluation only)

1. Remove R96 and R97 100R SMD resistors
2. Connect SPI 4 signals at J4 pin 13 to pin 16. Also DGND at Pin 11. Pin 12 is 3v3 dc supply if necessary.
3. 3v3 CMOS logic levels.

10. Transformer 40VA R-Core with shielding and safety approval: UL & CSA

- Primary:
- 115Vac x 2
- Secondary:
- 18Vac x 2, 0.5A
- 9Vac x 2, 0.5A (use one winding or two in parallel)

Attachments:

1. PCM1794A DAC BOM (Bill of Material for full kit and balance board) – 4 pages updated
2. Circuit Diagram – 6 pages
3. PCB file – 5 pages
4. FFT measurement – 7 pages (2 SE and 5 FB mode)
5. Power Supply Connection Diagrams – 3 pages

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SE Kit - US$175
PCM1794A Single End DAC Kit BOM

Rev 4

Item	Reference	Manufacturer	Part Name	Description	Qty	Supplier	Part No	PCB size
1	C64 C69	Sanyo OS-Con SVP	100u 6.3V SMD	ALUMINUM ELECTROLYTIC CAP.	2	SSP	6SVP100M	6x11x2.5mm
2	C15 C17 C19 C21	Elna Silmic II	47uf 25V	ALUMINUM ELECTROLYTIC CAP.	4	Digikey	604-1054-ND	8x11x3.5mm
3	C22 C23 C72	Elna Silmic II	47uf 25V	ALUMINUM ELECTROLYTIC CAP.	3	Digikey	604-1054-ND	8x11x3.5mm
4	C25 C27 C32	Sanyo OS-Con SVP	47uF 6.3V SMD	ALUMINUM ELECTROLYTIC CAP.	3	SSP	6SVP47M	5x11x2.5mm
5	C49 C50 C77 C87	Panasonic FC	12uf 35V	ALUMINUM ELECTROLYTIC CAP.	4	STV		5x6x2.5mm
6	C4-5 C11-12	Elna Silmic II	100uf 35V	ALUMINUM ELECTROLYTIC CAP.	4	Digikey	604-1065-ND	10x11x5mm
7	C45-46	Elna Silmic II	100uf 35V	ALUMINUM ELECTROLYTIC CAP.	2	Digikey	604-1065-ND	12.5x25x5mm
8	C51 C53 C76 C88	Panasonic FM	**100uf 25V; replaced by 470u 16V Panasonic FA**	ALUMINUM ELECTROLYTIC CAP.	4	Mouser Farnell	667-EEU-FM1E101 1219466	8x11x3.5mm
9	C52 C54	Panasonic FC	**120uf 50V**	ALUMINUM ELECTROLYTIC CAP.	2	Mouser	667-EEU-FC1V101	8x11x3.5mm
10	C71	Nippon Chemi-con KMH or Panasonic TS-UP	10,000uf 16V 22x30mm	ALUMINUM ELECTROLYTIC CAP.	1	Mouser STV	661-KMH16VN103MT2 or ECEC1CP103BA	22x30x10mm
11	C73-74	Panasonic Audio	5600uf 35V 22x35mm	ALUMINUM ELECTROLYTIC CAP.	2	STV		22x35x10mm
12	C81-82	Elna Silmic II BP	**100uf 35V x 2; two in series**	ALUMINUM ELECTROLYTIC CAP.	**4**	Digikey	604-1065-ND	10x11x5mm
13	C83-84	Russian PIO	K40Y-9 0.01uf,10% 200V	PIO K40Y-9 6x22mm Axial	2	ebay	PIO K40Y-9 6x22mm	2x5mm
14	C1-2 C8-9	Russian PIO	K40Y-9, 6800pF,10% 200V	PIO K40Y-9 5x22mm Axial	4	ebay	PIO K40Y-9 5x22mm	5x25mm
15	C3 C10	Russian PIO	K40Y-9, 1500pF,10% 200V	PIO K40Y-9 5x22mm Axial	2	ebay	PIO K40Y-9 5x22mm	5x25mm
16	C26 C28 C31 C34 C38 C40-44 C48 C55-56 C61-63 C65 C67 C68 C70 C75 C78-80 C89 C93-94	Panasonic ECQ-V or ECQ-U	0.047uf,10% 63V	RADIAL FILM CAPACITOR	27	Mouser	667-ECQ-V1J473JM	2x5mm
17	C29	Epcos B32529	22nf, 5% 63V	RADIAL FILM CAPACITOR	1	SSP		2x5mm
18	C30	Acrotronic or Philips	1nf, 5% 100V	RADIAL FILM CAPACITOR	1	SSP		2x5mm
19	C33 C37 C39 C47	MEPCO/Philips MLCC	0.01u, 20% 50V	RADIAL Ceramic CAPACITOR	4	SSP	K103M15Z5UF53H5	2x5mm
20	C35 C36	Epcos B32529	**0.1u, 63V; or use 0.22u**	RADIAL FILM CAPACITOR	2	SSP		2x5mm
21	C86	MEPCO/Philips MLCC	270pf, 20% 50V	RADIAL Ceramic CAPACITOR	1	SSP	K271J15COGFBAH5C	2x5mm
22	C95-97	Panasonic ECQ-V	0.33uf, 10% 50V	RADIAL FILM CAPACITOR	3	Mouser	667-ECQ-V1H334JL	2x5mm
23	C57-60 C66 C85	Russian or CDE Silver Mica	Film or Silver Mica to replace PIO capacitors	RADIAL FILM CAPACITOR	0	Not Use		2x5mm
24	C6-7 C13-14	Epcos B32529	0.47u, 63V	RADIAL FILM CAPACITOR	4	SSP		2x5mm
25	C16 C18 C20 C24	Epcos, TDK or Murata	0.1u, 10% 50V	SMD X7R 0603	4	Epcos	0603X7R104KC16P07	0603
26	D1 D3	Vishay or NXP	BAT85-T/R or BAT85S	Schottky Diode 30V 200mA	2	Farnell	1612329	2x10mm
27	D20-21 D25	Semtech	1N4148	100V 100mA diode	3	SZ	1N4148	2x10mm
28	D2 D4	Semtech	ZENER 6v8, 1W	Axial ZENER-DIODE	2	SZ	6.8V Zener	2x10mm
29	D22-24 & J1	China	LED,Green color x 6, Red x 1	LIGHT EMITTING DIODE	7	SZ	LED	pitch = 2.5mm
30	D5-6	Fairchild	LM336-5V,TO-92	PROGRAMMABLE PRECISION REFERENCE 5V	2	Mouser	512-LM336Z5	TO-92
31	D7-19	Philips / Vishay	BYV27-150 or BYV-200	DO-5 fast recovery	13	Mouser	78-BYV27-200	pitch = 10mm
32	H1-4	China	HEATSINK_SMALL, 630x600 mil 25mm	630 x 600 x 1000 mil (L x W x H) Heatsink	4	SZ		15x16mmx25H
33	H5 H9	China	HEATSINK_MINI,600 x 900 mil 25mm	Heatsink 600x900 mil	2	SZ	**20mm or 25mm tall**	15x23mmx25H
34	H7 H11	China	HEATSINK_MINI,600 x 900 mil 30mm	Heatsink 600x900 mil	2	SZ	**30mm tall**	15x23mmx30H
35	H6 H8 H10 H12	China	HEATSINK_MINI,400 x 600 mil 21mm	Heatsink 400 x 600 mil	4	SZ		10x15mmx21H
36	J1	China	IC socket single row 8 pins	PIN Socket .100 CENTERS	1	SZ		2.5mm pitch
37	J2 J3 J5	Not use	Not Use	Not Use	0	Not Use	Not Use	Not Use
38	J15-16	China	HEADER16, Dual Row 3x2	8x2 PIN HEADER; 100 MIL CENTERS	1	SSP		2.5mm pitch
39	J4	China	HEADER16, Dual Row 8x2	8x2 PIN HEADER; 100 MIL CENTERS	1	SSP		2.5mm pitch
40	J6	China	HEADER10,Dual Row 5x2	5x2 PIN HEADER; 100 MIL CENTERS	1	SSP		2.5mm pitch
41	J7	Neutrik	XLR FEMALE ,NC3FAA-H-2	XLR Female Socket PCB Horizontal	1	Mouser	568-NC3FAAH-2	NC3FAAH2
42	J8	China	RCA Socket Horzontal	RCA Socket PCB horizontal	1	SZ		10x10mm
43	J9-14	China	CON-SIP-2P-CHINA,Screw type 2 pin	GENERIC 2 PIN SIP HEADER .200 CENTERS (5MM)	6	SZ		5mm pitch
44	K1	NEC	RLY-NEC-EC2,12Vdc	Relay 2P2T 12V	1	Mouser	551-EC2-12SNJ	5x10mm
45	L1-4	Murata or others	IND-MOLDED,47uH	Radial inductors 100mA type	4	SZ	47uH	2.5x10mm
46	L5-12	China	IND-MOLDED,Bead	Radial inductors Bead type	8	SZ	Bead	2.5x10mm
47	Q1-2 Q7-8 Q13-16	TOSHIBA	2SA1358,Y grade	PNP Driver Transistor	8	SZG	2SA1358Y	2.5mm pitch
48	Q17	IR	IRF610,TO-220 type	MOSFET N CHANN POWER 200V 1.8A	1	WS	IRF610	TO-220
49	Q18	IR	IRF9610,TO-220 type	MOSFET P CHAN 200V 1.8A	1	WS	IRF9610	TO-220
50	Q19-20 Q25-26	TOSHIBA	2SK30A-Y,TO-92	N-CHANNEL, LOW NOISE JFET	4	SZ	2SK30A	TO-92
51	Q21-22 Q29-30	TOSHIBA	2SC2240,BL grade TO-92	LOW NOISE NPN TRANSISTOR	4	SZ	2SC2240BL	TO-92
52	Q23-24 Q27-28	TOSHIBA	2AS970,BL grade TO-92	LOW NOISE PNP TRANSISTOR	4	SZ	2SA970BL	TO-92
53	Q31-35	TOSHIBA	2SC1815-GR,TO-92	LOW NOISE NPN TRANSISTOR	5	SZ	2SC1815	TO-92
54	Q3-6 Q9-12	TOSHIBA	2SC3421,Y grade	NPN Driver TRANSISTOR	8	STV	2SC3421Y	2.5mm pitch
55	R10 R12 R27 R29	Vishay - Dale	RES-1/4W,1k21,1%	Leaded Resistor 1/4W	4	Mouser	71-CMF551K2100FHEK	2.5x10mm
56	R1-2 R18-19	Vishay - Dale	RES-1/4W,475R,1%	Leaded Resistor 1/4W	4	Mouser	71-CMF55475R00FHEK	2.5x10mm
57	R76 R86	Metal Film	RES-1/4W,470R,1%	Leaded Resistor 1/4W	2	Bell		2.5x10mm
58	R13 R30	Vishay - Dale	RES-2W,120 1W,5% CCF02120RJKR36	Leaded Resistor 2W	2	Mouser	71-CCF02-J-120	3.8x14mm
59	R14 R31	Vishay - Dale	RES-1/2W,49R9 1/2W 1/4W,1%	Leaded Resistor 1/2W or 1/4W	2	Mouser	71-CMF6049R900FKEK 71-CMF5549R900FHEK	3.8x14mm
60	R15 R32	Vishay - Dale	RES-1/2W,150R 1/2W,1%	Leaded Resistor 1/2W	2	Mouser	71-CMF60150R00FHEK	3.8x14mm
61	R16-17 R33-34	Vishay - Dale	RES-1/2W,4R99,1%	Leaded Resistor 1/4W	4	Mouser	71-RN55D-F-4.99	2.5x10mm
62	R3 R20 R35	Vishay - Dale	RES-1/4W,10k0,1%	Leaded Resistor 1/4W	3	Mouser	71-CMF5510K000FHEK	2.5x10mm
63	R41-42 R60-61 R68-69 R73-74 R82	Metal Film	RES-1/4W,10k,1%	Leaded Resistor 1/4W	9	Bell		2.5x10mm
64	R39 R40 R43 R49 R77-78 R84-85	Metal Film	RES-1/4W,100R,1%	Leaded Resistor 1/4W	**8**	SZ		2.5x10mm
65	R4-5 R21-22	Vishay - Dale	RES-1/4W,562,1%	Leaded Resistor 1/4W	4	Mouser	71-CMF55562R00FHEK	2.5x10mm
66	R45-46 R59 R62 R66 R72 R83 R87	Metal Film	RES-1/4W,4k7,1%	Leaded Resistor 1/4W	8	Bell		2.5x10mm
67	R47-48	Metal Film	RES-1/4W,15k,1%	Leaded Resistor 1/4W	2	Bell		2.5x10mm
68	R50-54 R57-58 R75 R81 R88-92	Metal Film	RES-1/4W,47k,1%	Leaded Resistor 1/4W	14	Bell		2.5x10mm
69	R55-56	Metal Film	RES-1/4W,680,1%	Leaded Resistor 1/4W	2	Bell		2.5x10mm

Item	Reference	Manufacturer	Part Name	Description	Qty	Supplier	Part No	PCB size
70	R6 R23 R64	Vishay - Dale	RES-1/4W,3k01,1%	Leaded Resistor 1/4W	3	Mouser	71-CMF553K0100FHEK	2.5x10mm
71	R36-38 R63 R65	Vishay - Dale	RES-1/4W,75R,1%	Leaded Resistor 1/4W	5	Mouser	71-CMF5575R000FHEK	2.5x10mm
72	R67	Vishay - Dale	RES-1/4W,90.9R,1%	Leaded Resistor 1/4W	1	Mouser	71-RN55D-F-90.9	2.5x10mm
73	R70-71	Vishay - Dale	RES-1/4W,100k,1%	Leaded Resistor 1/4W	2	Mouser	71-CMF55100K00FHEK	2.5x10mm
74	R7-8 R24-25	Vishay - Dale	RES-1/4W,3k32,1%	Leaded Resistor 1/4W	4	Mouser	71-CMF553K3200FHEK	2.5x10mm
75	R79-80	Vishay - Dale	RES-1/4W,10R,1%	Leaded Resistor 1/4W	2	Mouser	71-CMF6010R000FKEK 71-RN55D-F-10	2.5x10mm
76	R9 R11 R26 R28	Vishay - Dale	RES-1/4W,82.5,1%	Leaded Resistor 1/4W	4	Mouser	71-CCF55-82.5	2.5x10mm
77	R96-97	ASJ	RES-1/8W,100R,1%	SMD 0805	2	ASJ	CR21-1000-FL	0805
78	T1-2	MIDCOM	51698-LF3	MIDCOM 51698-LF3 SPDIF PULSE TRANSFORMER	2	Midcom	51698-LF3	5x10mm
79	U1	TEXAS INSTRUMENTS	PCM1794A,SSOP28	24 bit Digital to Analogy Converter	1	Mouser	595-PCM1794ADB	SSOP28
80	U12	Fairchild	74VHC244M,SOIC20	OCTAL BUFFER/LINE DRIVER 3 STATE OUTPUTS	1	Mouser	512-74VHC244M	SOIC20 wide
81	U2	Cirrus Logic Crystal	CS8416CSZ,SOIC28	Digital receiver192k	1	Avnet	CS8416-CSZ	SOIC28
82	U3	TOSHIBA	TORX147LF,T	OPTICAL RECEIVER 3.3V Cmos	1	Mouser	757-TORX147LFT	TORX147
83	U4 U14	NXP or Ti	74HC00N,DIP14	QUAD 2-INPUT POS-NAND GATE	2	WS	74HC00N	DIP14
84	U5 U13	NXP or Ti	74HC02N,DIP14	QUAD 2-INPUT POS-NOR GATE	2	WS	SN74HC02N	DIP14
85	U7 U11	Toshiba	TA7805S	5 VOLT, VOLTAGE REGULATOR	2	SZG	TA7805S	TO-220
86	U8-10	AMS	AMS1117-3.3,SOT-223	3.3V Regulator	3	WS	1117-3.3V	SOT223
87	VR1-2	China Sichun	VRES-TOP-ADJ,500	VARIABLE RESISTOR (TOP ADJUST TYPE)	2	SZ	Marking 501	2.5mm pitch
88	VR3-4	China Sichun	VRES-TOP-ADJ,5K	VARIABLE RESISTOR (TOP ADJUST TYPE)	2	SZ	Marking 502	2.5mm pitch
89	M_PCB	China	PCM1794V2PCB	PCB 1794 DAC FR4 double side 1.6mm; size 6 x 8 in	1	YML	PCM1794V2PCB	6x8 inches
90	M_Binder post	China	M3 threaded x 10mm	M3 threaded x 10mm	6	SZ		
91	M_Insulation To-220	China	Insulation sheet TO-220	Insulation sheet TO-220	2	SZ		
92	M_Plastic washer	China	Insulation plastice washer TO-220	Insulation plastice washer TO-220	2	SZ		
93	M_Screw	China	M3 x 10 or M3 x 12 mm	M3 x 10	8	SZ		
94	M_Screw	China	M3 x 6	M3 x 6	10	SZ		
95	M_Washer	China	M3 Spring washer	M3 Spring washer	18	SZ		
96	M_Screw	China	M3 x 12mm plastic screw	M3 x 12mm plastic screw	3	Bell	M3 x 12mm plastic screw	
97	P_Bubble Bag ESD	China	ESD bag	ESD bag	1	SZ		
98	P_Carton	China	Box	Box	1	SZ		
99	Input select cable	China	4-pin, 4-wire and 2P2T3P switch	4-pin, wire and 2P2T3P switch	1	Suntronics	Pins, Wires and SW	
				Part Count	**356**			

SMD Parts presoldered

FB Upgrade Kit - US$150
PCM1794A Full Balance DAC Upgrade Kit BOM
(Full Balance DAC requires both the SE Kit and FB Upgrade Kit)

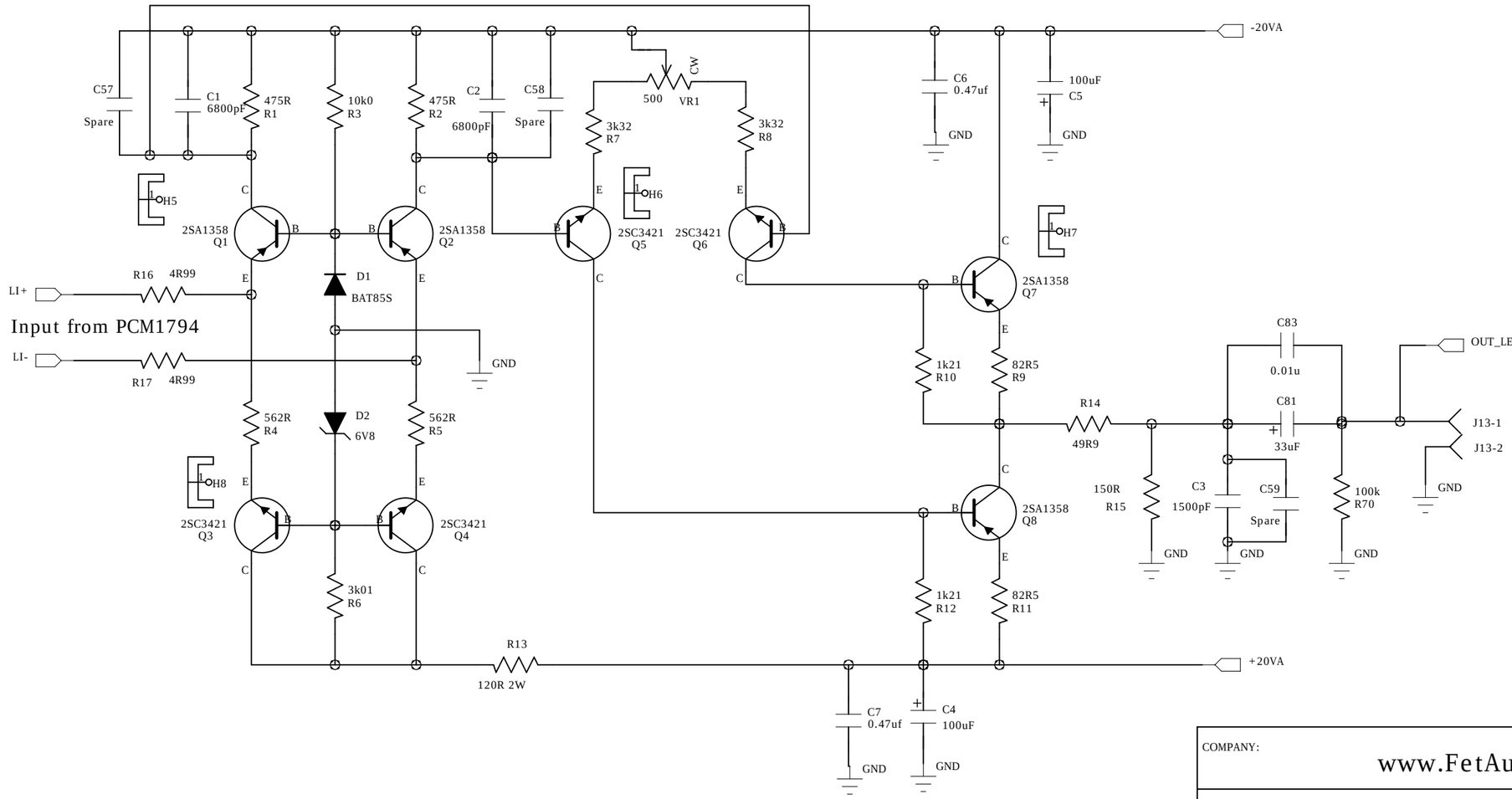
Rev 2

Item	Reference	Manufacturer	Part Name	Description	Qty	Supplier	Part No	PCB size
1	C64	Sanyo OS-Con SVP	100u 6.3V SMD	ALUMINUM ELECTROLYTIC CAP.	1	SSP	6SVP100M	6x11x2.5mm
2	C15 C17 C19 C21	Elna Silmic II	47uf 25V	ALUMINUM ELECTROLYTIC CAP.	4	Digikey	604-1054-ND	8x11x3.5mm
3	C22 C23 C72	Elna Silmic II	47uf 25V	ALUMINUM ELECTROLYTIC CAP.	3	Digikey	604-1054-ND	8x11x3.5mm
4	C49 C50 C77	Panasonic FC	12uf 35V	ALUMINUM ELECTROLYTIC CAP.	3	STV		5x6x2.5mm
5	C4-5 C11-12	Elna Silmic II	100uf 35V	ALUMINUM ELECTROLYTIC CAP.	4	Digikey	604-1065-ND	10x11x5mm
6	C45-46	Elna Silmic II	100uf 35V	ALUMINUM ELECTROLYTIC CAP.	2	Digikey	604-1065-ND	12.5x25x5mm
7	C51 C53 C76 C88	Panasonic FM	**100uf 25V; replaced by 470u 16V Panasonic FA**	ALUMINUM ELECTROLYTIC CAP.	4	Mouser Farnell	667-EEU-FM1E101 1219466	8x11x3.5mm
8	C52 C54	Panasonic FC	**120uf 50V**	ALUMINUM ELECTROLYTIC CAP.	2	Mouser	667-EEU-FC1V101	8x11x3.5mm
9	C71	Nippon Chemi-con KMH or Panasonic TS-UP	10,000uf 16V 22x30mm	ALUMINUM ELECTROLYTIC CAP.	1	Mouser STV	661-KMH16VN103MT2 or ECEC1CP103BA	22x30x10mm
10	C73-74	Panasonic Audio	5600uf 35V 22x35mm	ALUMINUM ELECTROLYTIC CAP.	2	STV		22x35x10mm
11	C81-82	Elna Silmic II BP	**100uf 35V x 2; two in series**	ALUMINUM ELECTROLYTIC CAP.	4	Mouser	604-1065-ND	10x11x5mm
12	C83-84	Russian PIO	K40Y-9 0.01uf,10% 200V	PIO K40Y-9 6x22mm Axial	2	ebay	PIO K40Y-9 6x22mm	2x5mm
13	C1-2 C8-9	Russian PIO	K40Y-9, 6800pF,10% 200V	PIO K40Y-9 5x22mm Axial	4	ebay	PIO K40Y-9 5x22mm	5x25mm
14	C3 C10	Russian PIO	K40Y-9, 1500pF,10% 200V	PIO K40Y-9 5x22mm Axial	2	ebay	PIO K40Y-9 5x22mm	5x25mm
15	C34 C38 C42-44 C55-56 C61-63 C65 C67 C75 C78-80 C89 C93-94	Panasonic ECQ-V	0.047uf,10% 63V	RADIAL FILM CAPACITOR	19	Mouser	667-ECQ-V1J473JM	2x5mm
16	C86	MEPCO/Philips MLCC	270pf, 20% 50V	RADIAL Ceramic CAPACITOR	1	SSP	K271J15COGFBAH5C	2x5mm
17	C95-97	Panasonic ECQ-V	0.33uf, 10% 50V	RADIAL FILM CAPACITOR	3	Mouser	667-ECQ-V1H334JL	2x5mm
18	C57-60 C66 C85	Russian or CDE Silver Mica	Film or Silver Mica to replace PIO capacitors	RADIAL FILM CAPACITOR	0	Not Use		2x5mm
19	C6-7 C13-14	Epcos B32529	0.47u, 63V	RADIAL FILM CAPACITOR	4	SSP		2x5mm
20	C16 C18 C20 C24	Epcos, TDK or Murata	0.1u, 10% 50V	SMD X7R 0603	4	Epcos	0603X7R104KC16P07	0603
21	D1 D3	Vishay or NXP	BAT85-T/R or BAT85S	Schottky Diode 30V 200mA	2	Farnell	1612329	2x10mm
22	D20-21 D25	Semtech	1N4148	100V 100mA diode	3	SZ	1N4148	2x10mm
23	D2 D4	Semtech	ZENER 6v8, 1W	Axial ZENER-DIODE	2	SZ	6.8V Zener	2x10mm
24	D22-24	China	LED,Green color x 3	LIGHT EMITTING DIODE	3	SZ	LED	pitch = 2.5mm
25	D5-6	Fairchild	LM336-5V,TO-92	PROGRAMMABLE PRECISION REFERENCE 5V	2	Mouser	512-LM336Z5	TO-92
26	D7-19	Philips / Vishay	BYV27-150 or BYV-200	DO-5 fast recovery	13	Mouser	78-BYV27-200	pitch = 10mm
27	H1-4	China	HEATSINK_SMALL, 630x600 mil 25mm	630 x 600 x 1000 mil (L x W x H) Heatsink	4	SZ		15x16mmx25H
28	H5 H9	China	HEATSINK_MINI,600 x 900 mil 25mm	Heatsink 600x900 mil	2	SZ	**20mm or 25mm tall**	15x23mmx25H
29	H7 H11	China	HEATSINK_MINI,600 x 900 mil 30mm	Heatsink 600x900 mil	2	SZ	**30mm tall**	15x23mmx30H
30	H6 H8 H10 H12	China	HEATSINK_MINI,400 x 600 mil 21mm	Heatsink 400 x 600 mil	4	SZ		10x15mmx21H
31	J2 J3 J5	Not use	Not Use	Not Use	0	Not Use	Not Use	Not Use
32	J15-16	China	HEADER16, Dual Row 3x2	8x2 PIN HEADER; 100 MIL CENTERS	1	SSP		2.5mm pitch
33	J4	China	HEADER16, Dual Row 8x2	8x2 PIN HEADER; 100 MIL CENTERS	1	SSP		2.5mm pitch
34	J9-14	China	CON-SIP-2P-CHINA,Screw type 2 pin	GENERIC 2 PIN SIP HEADER .200 CENTERS (5MM)	6	SZ		5mm pitch
35	K1	NEC	RLY-NEC-EC2,12Vdc	Relay 2P2T 12V	1	Mouser	551-EC2-12SNJ	5x10mm
36	L5 L6 L8-12	China	IND-MOLDED,Bead	Radial inductors Bead type	7	SZ	Bead	2.5x10mm
37	Q1-2 Q7-8 Q13-16	TOSHIBA	2SA1358,Y grade	PNP Driver Transistor	8	SZG	2SA1358Y	2.5mm pitch
38	Q17	IR	IRF610,TO-220 type	MOSFET N CHANN POWER 200V 1.8A	1	WS	IRF610	TO-220
39	Q18	IR	IRF9610,TO-220 type	MOSFET P CHAN 200V 1.8A	1	WS	IRF9610	TO-220
40	Q19-20 Q25-26	TOSHIBA	2SK30A,TO-92	N-CHANNEL, LOW NOISE JFET	4	SZ	2SK30A	TO-92
41	Q21-22 Q29-30	TOSHIBA	2SC2240,BL grade TO-92	LOW NOISE NPN TRANSISTOR	4	SZ	2SC2240BL	TO-92
42	Q23-24 Q27-28	TOSHIBA	2AS970,BL grade TO-92	LOW NOISE PNP TRANSISTOR	4	SZ	2SA970BL	TO-92
43	Q31-35	TOSHIBA	2SC1815,TO-92	LOW NOISE NPN TRANSISTOR	5	SZ	2SC1815	TO-92
44	Q3-6 Q9-12	TOSHIBA	2SC3421,Y grade	NPN Driver TRANSISTOR	8	STV	2SC3421Y	2.5mm pitch
45	R10 R12 R27 R29	Vishay - Dale	RES-1/4W,1k21,1%	Leaded Resistor 1/4W	4	Mouser	71-CMF551K2100FHEK	2.5x10mm
46	R1-2 R18-19	Vishay - Dale	RES-1/4W,475R,1%	Leaded Resistor 1/4W	4	Mouser	71-CMF55475R00FHEK	2.5x10mm
47	R76 R86	Metal Film	RES-1/4W,470R,1%	Leaded Resistor 1/4W	2	Bell		2.5x10mm
48	R13 R30	Vishay - Dale	RES-2W,120 1W,5% CCF02120RJKR36	Leaded Resistor 2W	2	Mouser	71-CCF02-J-120	3.8x14mm
49	R14 R31	Vishay - Dale	RES-1/2W,49R9 1/2W 1/4W,1%	Leaded Resistor 1/2W or 1/4W	2	Mouser	71-CMF6049R900FKEK 71-CMF5549R900FHEK	3.8x14mm
50	R15 R32	Vishay - Dale	RES-1/2W,150R 1/2W,1%	Leaded Resistor 1/2W	2	Mouser	71-CMF60150R00FHEK	3.8x14mm
51	R16-17 R33-34	Vishay - Dale	RES-1/2W,4R99,1%	Leaded Resistor 1/4W	4	Mouser	71-RN55D-F-4.99	2.5x10mm
52	R3 R20 R35	Vishay - Dale	RES-1/4W,10k0,1%	Leaded Resistor 1/4W	3	Mouser	71-CMF5510K000FHEK	2.5x10mm
53	R41-42 R60-61 R68-69 R73-74 R82	Metal Film	RES-1/4W,10k,1%	Leaded Resistor 1/4W	9	Bell		2.5x10mm
54	R77-78 R84	Metal Film	RES-1/4W,100R,1%	Leaded Resistor 1/4W	**3**	SZ		2.5x10mm
55	R4-5 R21-22	Vishay - Dale	RES-1/4W,562,1%	Leaded Resistor 1/4W	4	Mouser	71-CMF55562R00FHEK	2.5x10mm
56	R45-46 R59 R62 R66 R72 R83 R87	Metal Film	RES-1/4W,4k7,1%	Leaded Resistor 1/4W	8	Bell		2.5x10mm
57	R47-48	Metal Film	RES-1/4W,15k,1%	Leaded Resistor 1/4W	2	Bell		2.5x10mm
58	R75 R88-92	Metal Film	RES-1/4W,47k,1%	Leaded Resistor 1/4W	6	Bell		2.5x10mm
59	R55-56	Metal Film	RES-1/4W,680,1%	Leaded Resistor 1/4W	2	Bell		2.5x10mm
60	R6 R23	Vishay - Dale	RES-1/4W,3k01,1%	Leaded Resistor 1/4W	2	Mouser	71-CMF553K0100FHEK	2.5x10mm
61	R70-71	Vishay - Dale	RES-1/4W,100k,1%	Leaded Resistor 1/4W	2	Mouser	71-CMF55100K00FHEK	2.5x10mm
62	R7-8 R24-25	Vishay - Dale	RES-1/4W,3k32,1%	Leaded Resistor 1/4W	4	Mouser	71-CMF553K3200FHEK	2.5x10mm
63	R9 R11 R26 R28	Vishay - Dale	RES-1/4W,82.5,1%	Leaded Resistor 1/4W	4	Mouser	71-CCF55-82.5	2.5x10mm
64	R96-97	ASJ	RES-1/8W,100R,1%	SMD 0805	2	ASJ	CR21-1000-FL	0805
65	U1	TEXAS INSTRUMENTS	PCM1794A,SSOP28	24 bit Digital to Analogy Converter	1	Mouser	595-PCM1794ADB	SSOP28
66	U12	Fairchild	74VHC244M,SOIC20	OCTAL BUFFER/LINE DRIVER 3 STATE OUTPUTS	1	Mouser	512-74VHC244M	SOIC20 wide
68	U14	NXP or Ti	74HC00N,DIP14	QUAD 2-INPUT POS-NAND GATE	1	WS	74HC00N	DIP14
69	U13	NXP or Ti	74HC02N,DIP14	QUAD 2-INPUT POS-NOR GATE	1	WS	SN74HC02N	DIP14
70	U7 U11	Toshiba	TA7805S	5 VOLT, VOLTAGE REGULATOR	2	SZG	TA7805S	TO-220
71	U8-9	AMS	AMS1117-3.3,SOT-223	3.3V Regulator	2	WS	1117-3.3V	SOT223

Item	Reference	Manufacturer	Part Name	Description	Qty	Supplier	Part No	PCB size
72	VR1-2	China Sichun	VRES-TOP-ADJ,500	VARIABLE RESISTOR (TOP ADJUST TYPE)	2	SZ		2.5mm pitch
73	VR3-4	China Sichun	VRES-TOP-ADJ,5K	VARIABLE RESISTOR (TOP ADJUST TYPE)	2	SZ		2.5mm pitch
74	M_PCB	China	PCM1794V2PCB	PCB 1794 DAC FR4 double side 1.6mm; size 6 x 8 in	1	YML	PCM1794V2PCB	6x8 inches
75	M_Binder post	China	M3 threaded x 10mm	M3 threaded x 10mm	6	SZ		
76	M_Insulation To-220	China	Insulation sheet TO-220	Insulation sheet TO-220	2	SZ		
77	M_Plastic washer	China	Insulation plastice washer TO-220	Insulation plastice washer TO-220	2	SZ		
78	M_Screw	China	M3 x 10 or M3 x 12 mm	M3 x 10	8	SZ		
79	M_Screw	China	M3 x 6	M3 x 6	10	SZ		
80	M_Washer	China	M3 Spring washer	M3 Spring washer	18	SZ		
81	P_Bubble Bag ESD	China	ESD bag	ESD bag	1	SZ		
82	P_Carton	China	Box	Box	1	SZ		
83	I2S Connector	SGP China	Connector 5x2 to 8x2 flat cable	Connector 5x2 to 8x2 flat cable	1	Suntronics	10-wire flat cable + plugs	5x2+8x2 header plugs
				Part Count	**290**			

SMD Parts presoldered

REVISION RECORD			
LTR	ECO NO:	APPROVED:	DATE:



DRAWN:	DATED:
CHECKED:	DATED:
QUALITY CONTROL:	DATED:
RELEASED:	DATED:

COMPANY: www.FetAudio.com

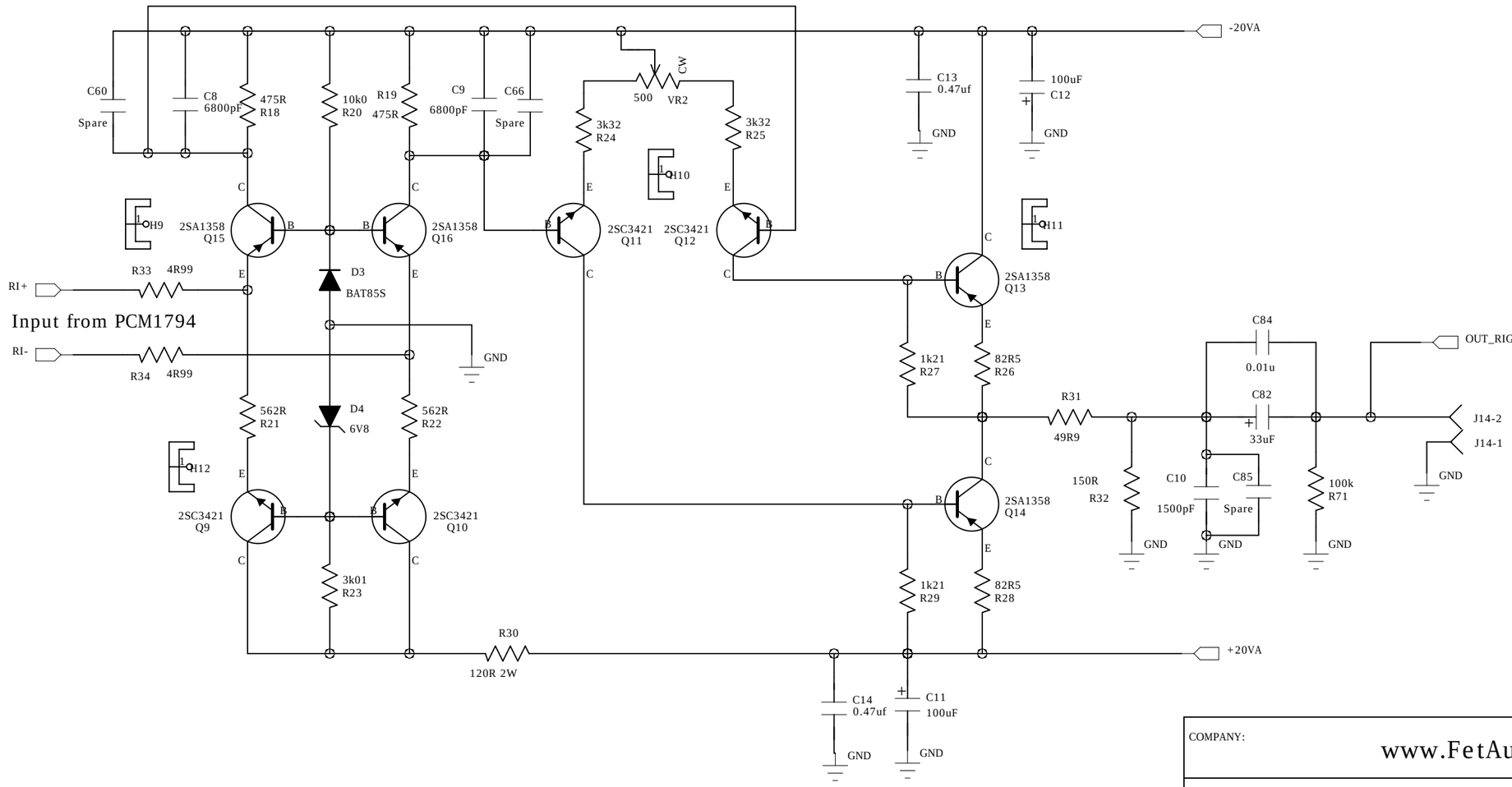
TITLE: Transistor IV and output buffer Left

CODE:	SIZE:	DRAWING NO:	REV:
	B		2

SCALE:

SHEET: 1 OF

REVISION RECORD			
LTR	ECO NO:	APPROVED:	DATE:



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CHECKED:	DATED:
QUALITY CONTROL:	DATED:
RELEASED:	DATED:

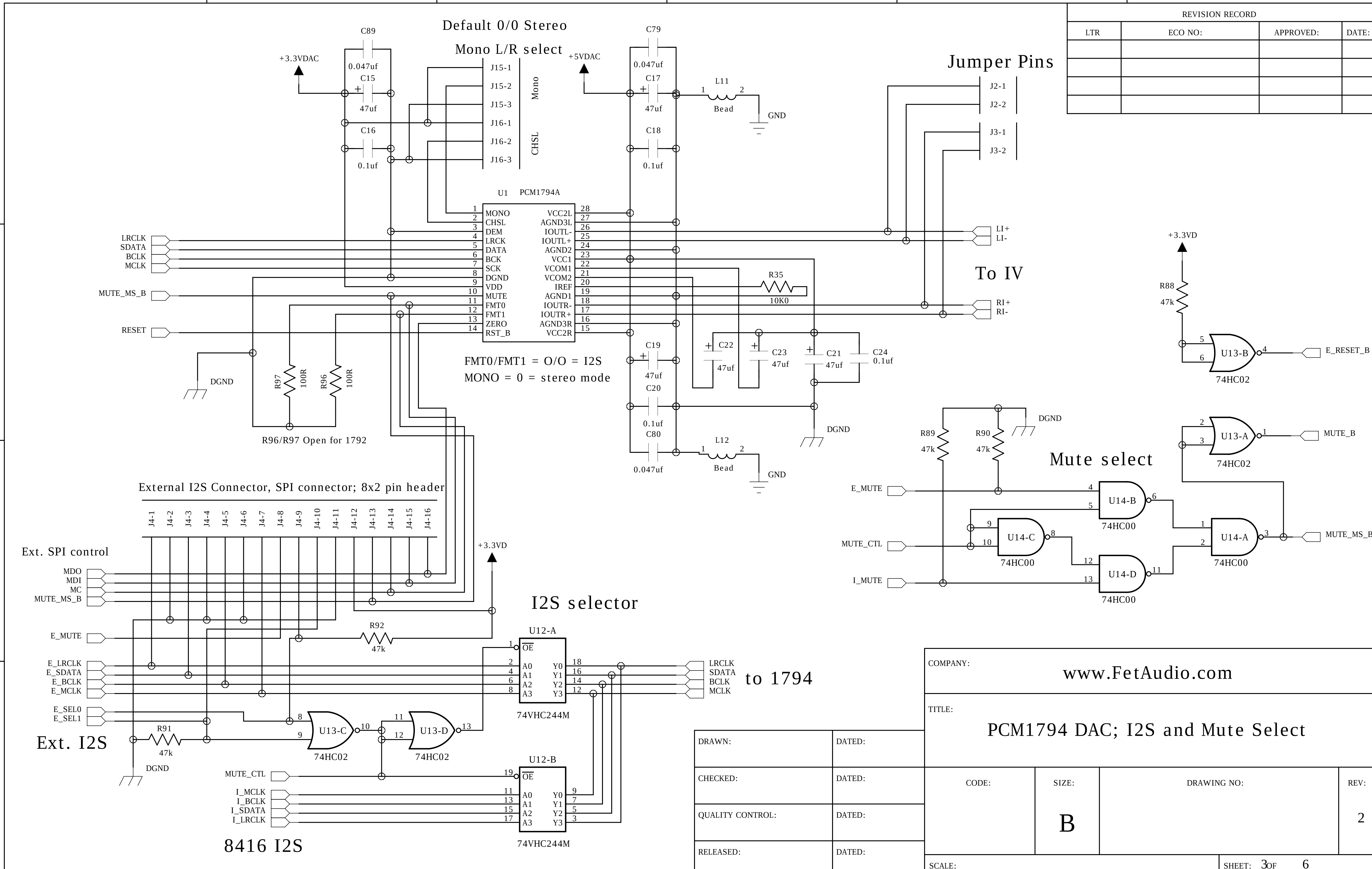
COMPANY: www.FetAudio.com

TITLE: Transistor IV and output buffer Right

CODE:	SIZE:	DRAWING NO:	REV:
	B		2

SCALE:

SHEET: 2 OF 6

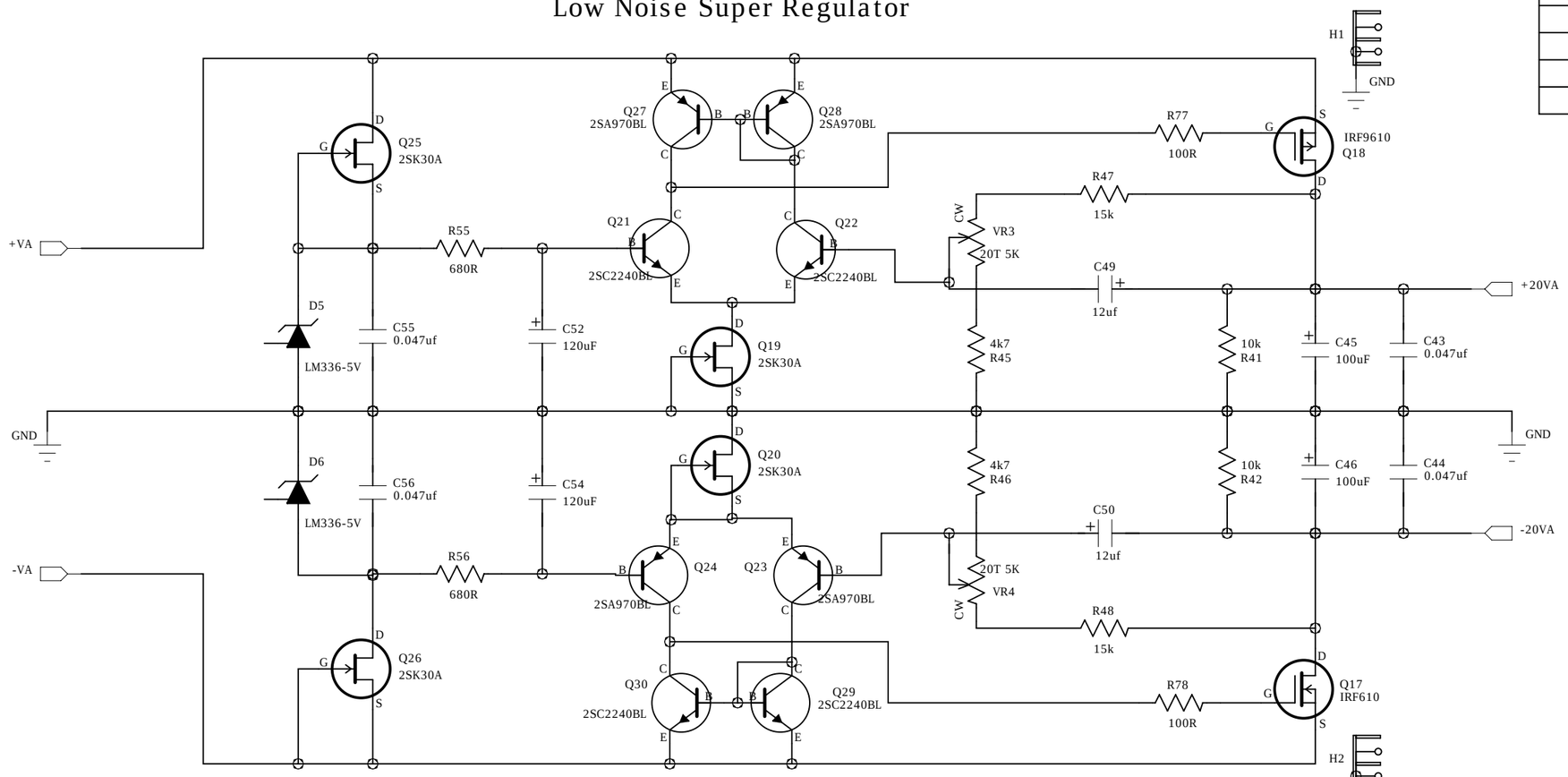


REVISION RECORD			
LTR	ECO NO:	APPROVED:	DATE:

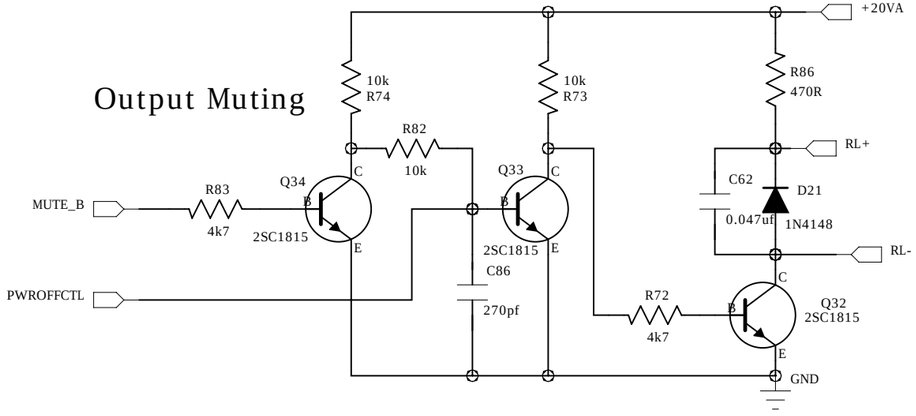
DRAWN:	DATED:	COMPANY: www.FetAudio.com		
CHECKED:	DATED:	TITLE: PCM1794 DAC; I2S and Mute Select		
QUALITY CONTROL:	DATED:	CODE:	SIZE: B	DRAWING NO:
RELEASED:	DATED:	SCALE:	SHEET: 3 OF 6	REV: 2

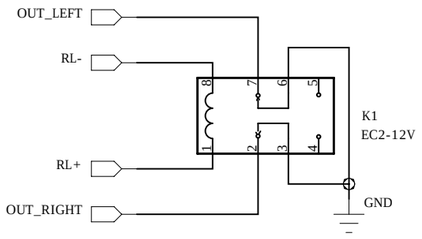
Low Noise Super Regulator

REVISION RECORD			
LTR	ECO NO:	APPROVED:	DATE:



Output Muting





DRAWN:	DATED:
CHECKED:	DATED:
QUALITY CONTROL:	DATED:
RELEASED:	DATED:

COMPANY: www.FetAudio.com

TITLE: Low Noise Regulator; Output Muting

CODE:	SIZE:	DRAWING NO:	REV:
	B		2

SCALE:

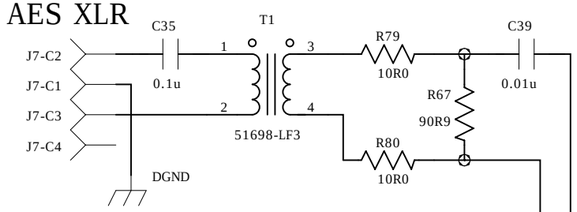
SHEET: 4 OF 6

6 5 4 3 2 1

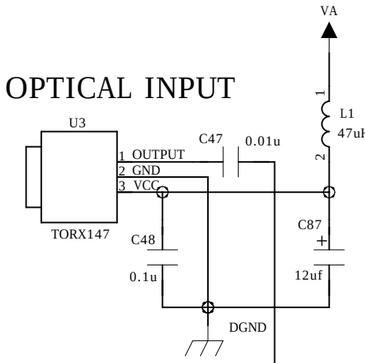
D C B A

REVISION RECORD			
LTR	ECO NO:	APPROVED:	DATE:

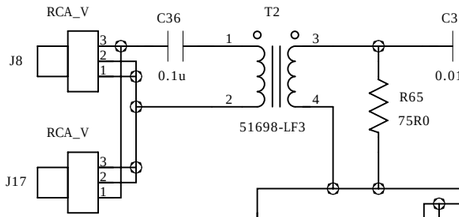
AES XLR



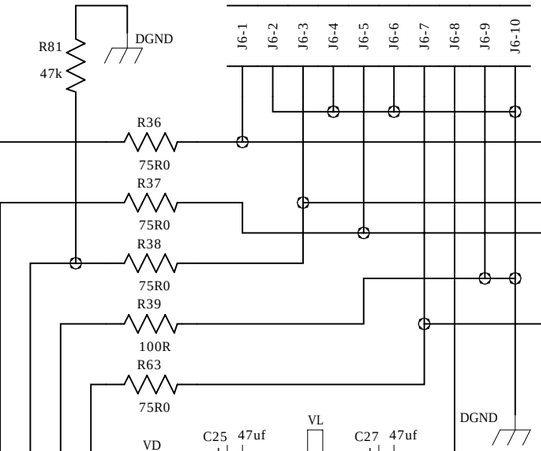
OPTICAL INPUT



SPDIF RCA

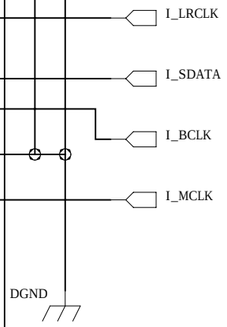


Hardware mode



I2S Bus Connector

5 x 2 pin header



WCK - Word Clock Fs

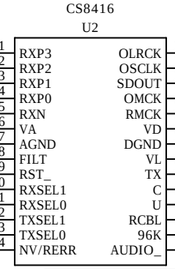
SDA - System Serial Data

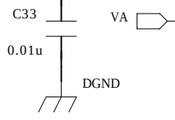
BCK - Bit Clock 64Fs

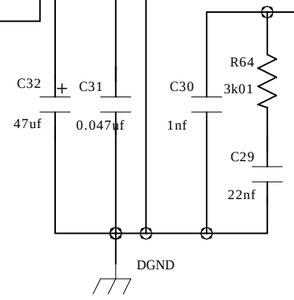
SCK - System CLOCK 256Fs

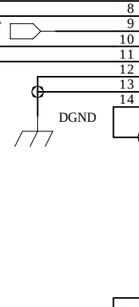
CS8416

U2

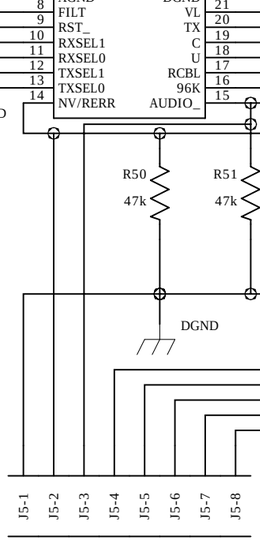






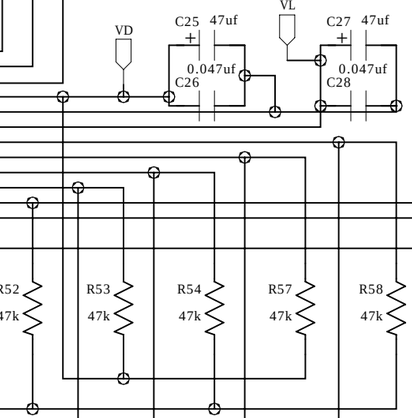


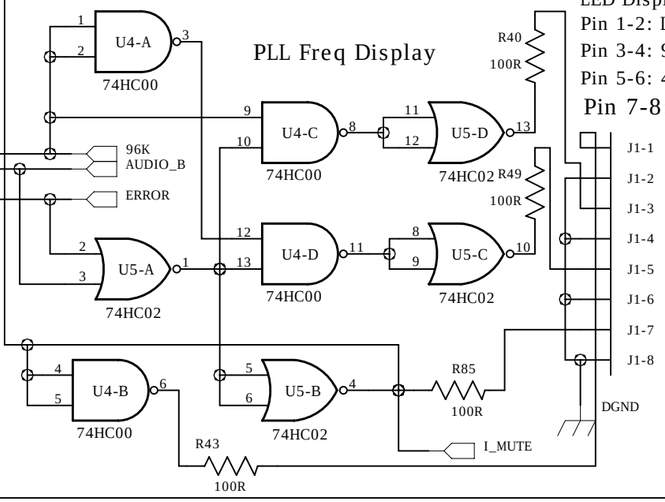
Digital Input Select



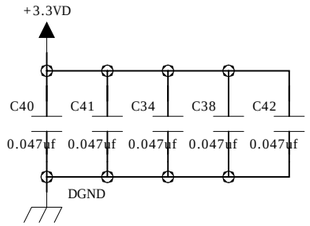
8416 MODE CONNECTOR

1. DGND
2. ERROR
3. AUDIO_BAR
4. 96K
5. RCBL
6. U
7. C
8. TX





LED Display:
Pin 1-2: Lock
Pin 3-4: 96k
Pin 5-6: 48k
Pin 7-8: Mute



Logic power decouple

DRAWN:	DATED:
CHECKED:	DATED:
QUALITY CONTROL:	DATED:
RELEASED:	DATED:

COMPANY: www.FetAudio.com

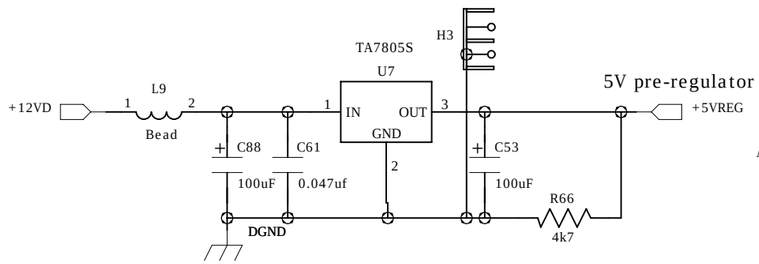
TITLE: CS8416 Receiver

CODE:	SIZE:	DRAWING NO:	REV:
	B		2

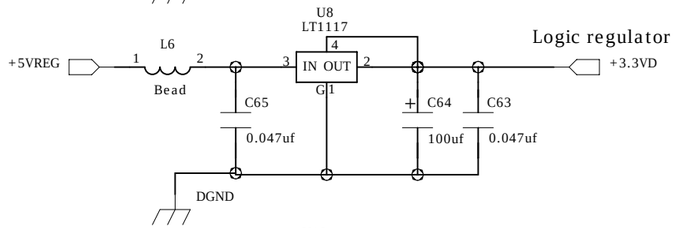
SCALE: SHEET: 5 OF 6

REVISION RECORD			
LTR	ECO NO:	APPROVED:	DATE:

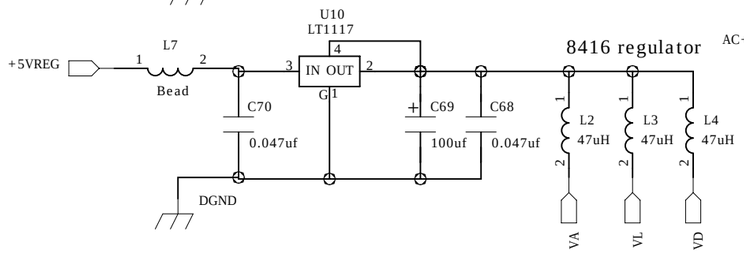
5V pre-regulator



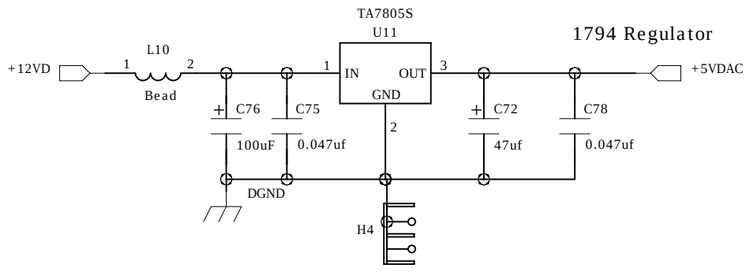
Logic regulator



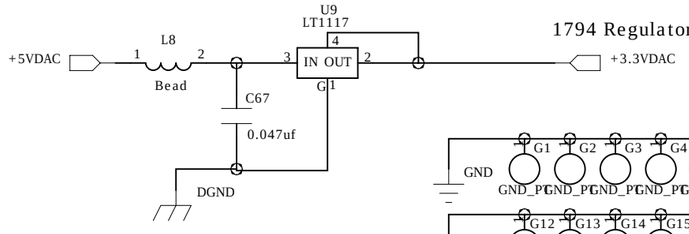
8416 regulator

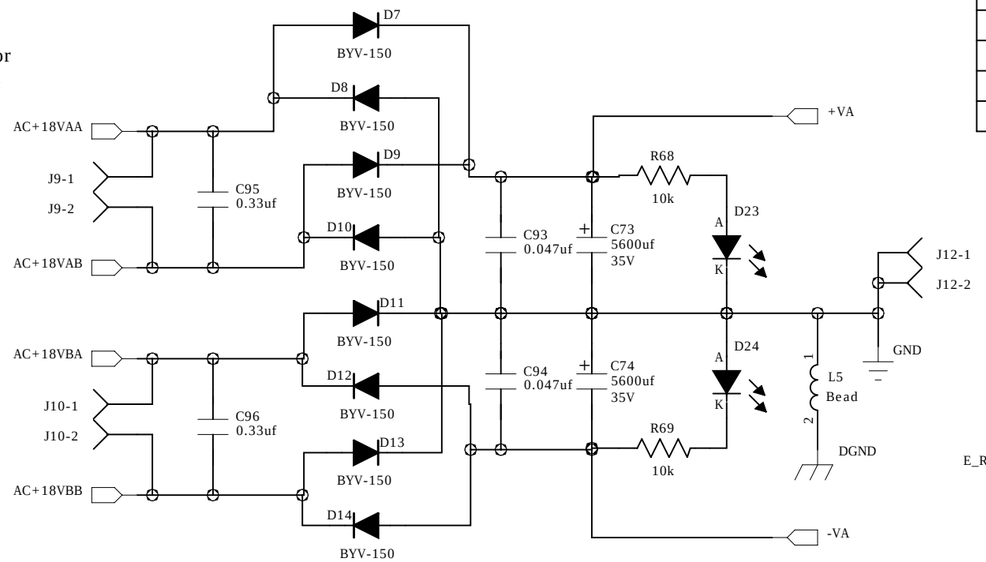


1794 Regulator

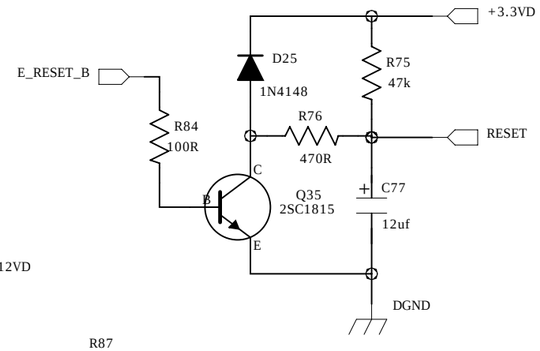


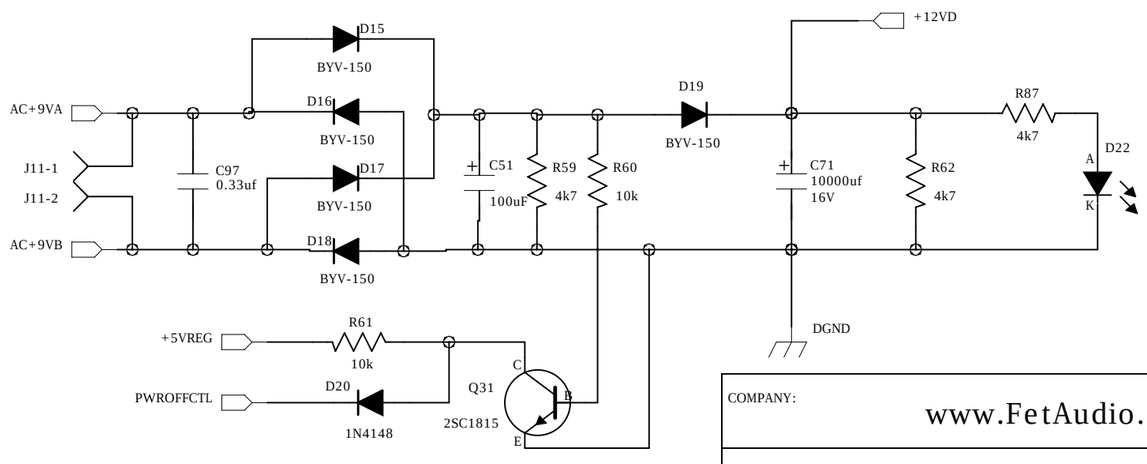
1794 Regulator

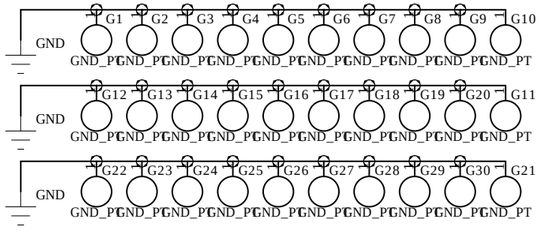




Reset







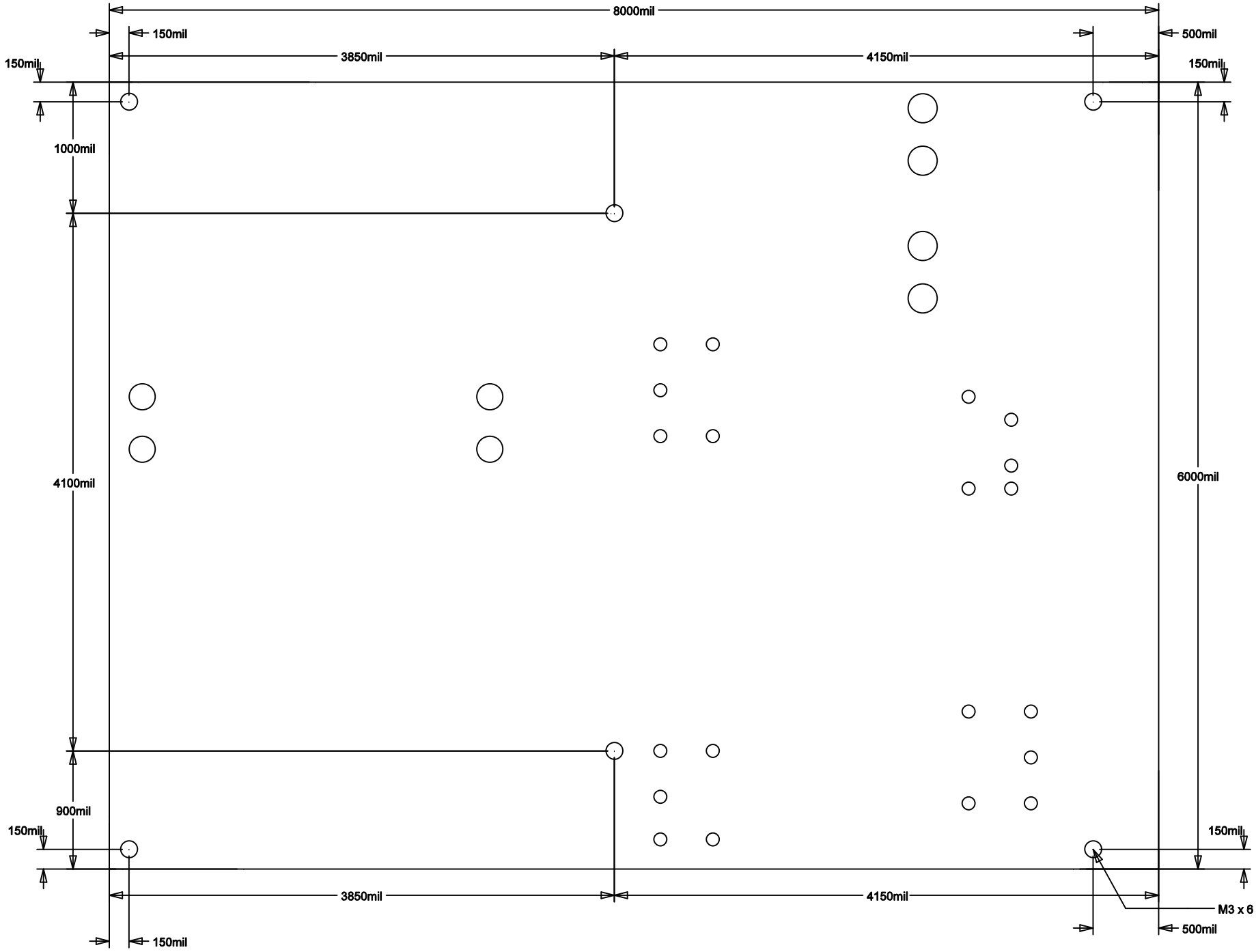
DRAWN:	DATED:
CHECKED:	DATED:
QUALITY CONTROL:	DATED:
RELEASED:	DATED:

COMPANY: www.FetAudio.com

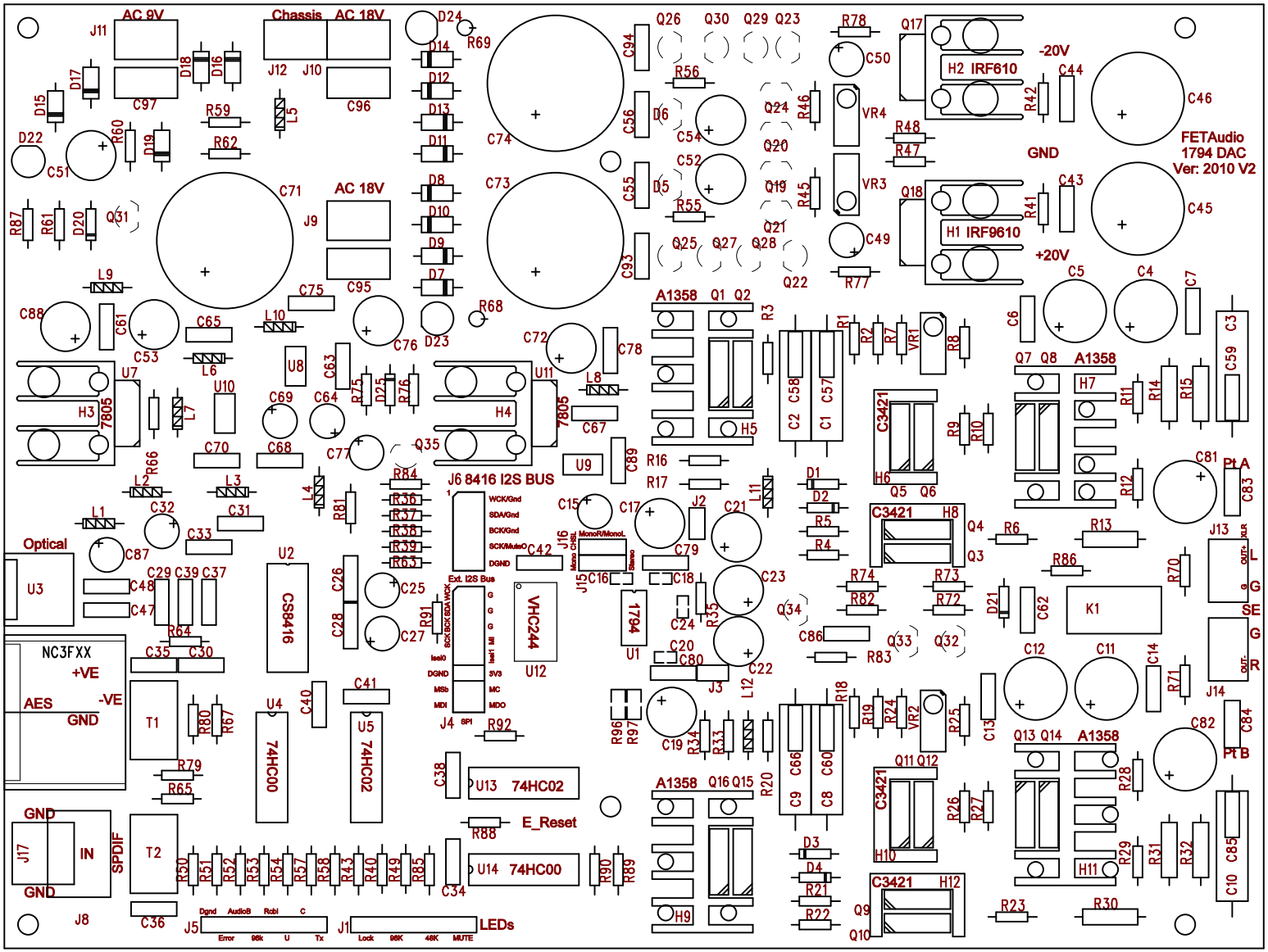
TITLE: Power Supply

CODE:	SIZE:	DRAWING NO:	REV:
	B		2

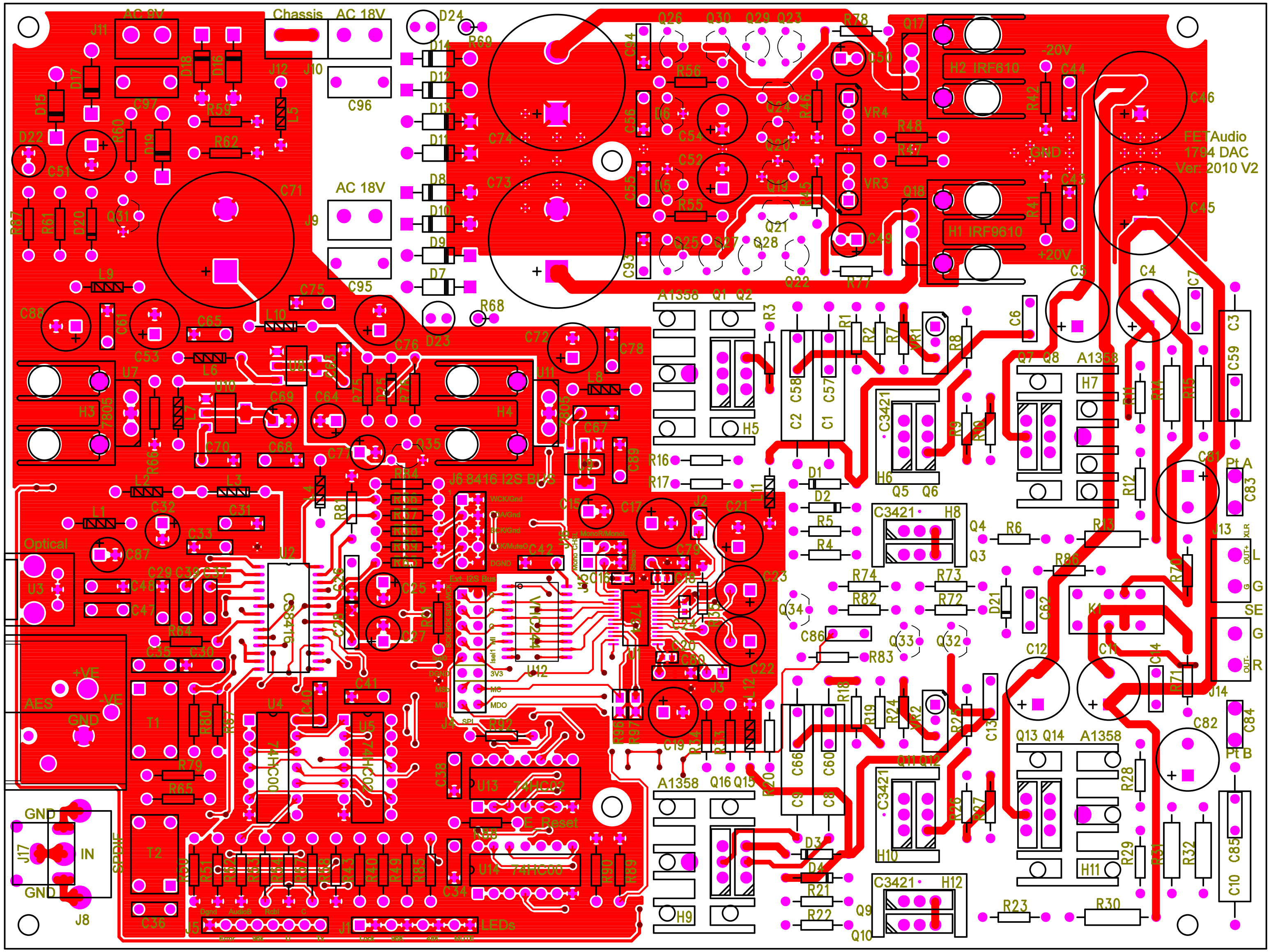
SCALE: SHEET: 6 OF 6

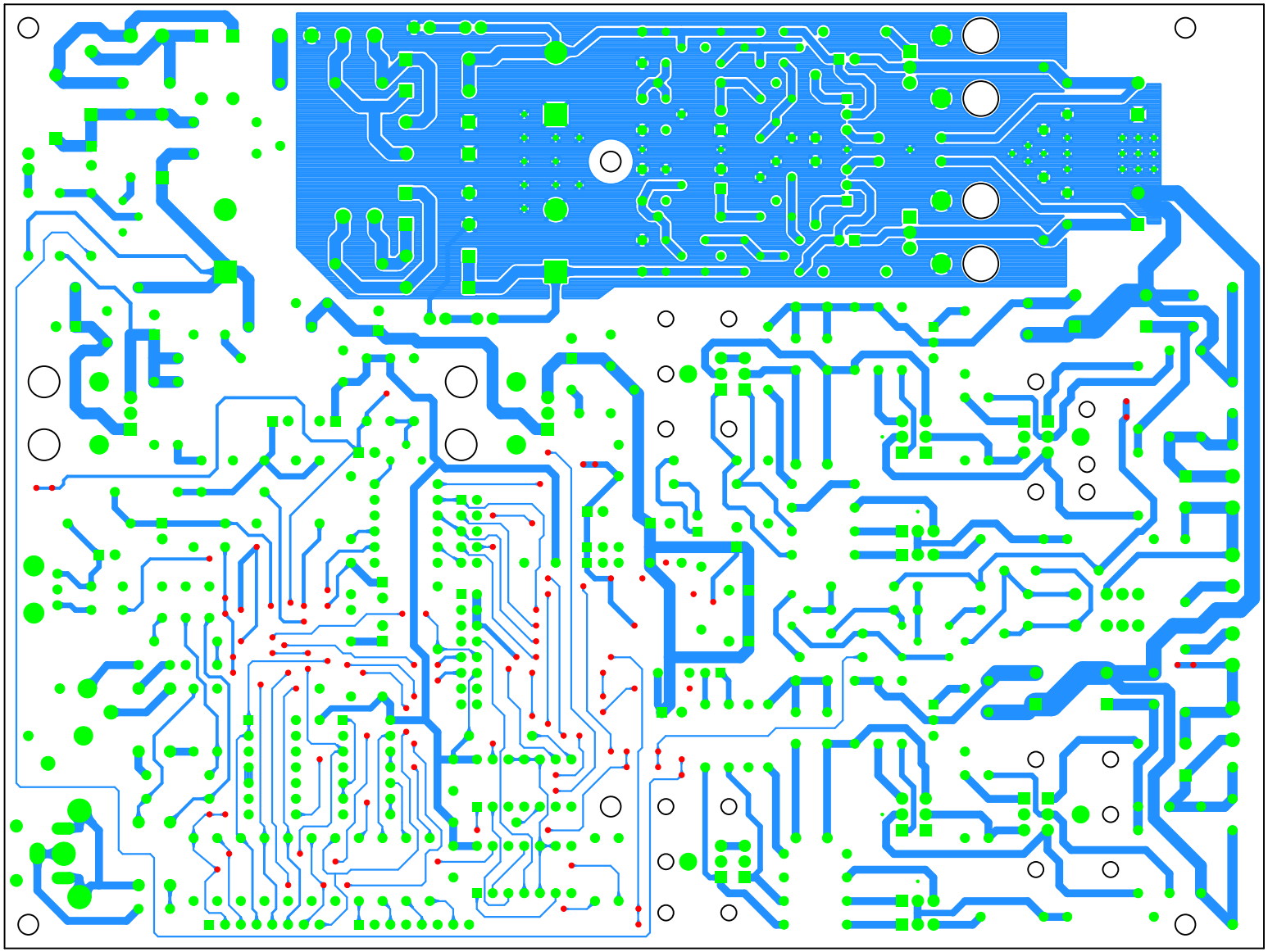

8000mil
150mil
500mil
3850mil
4150mil
150mil
150mil
1000mil
4100mil
6000mil
900mil
150mil
150mil
3850mil
4150mil
M3 x 6
500mil
150mil

1794DACv2.pcb - Fri Jul 16 09:05:28 2010

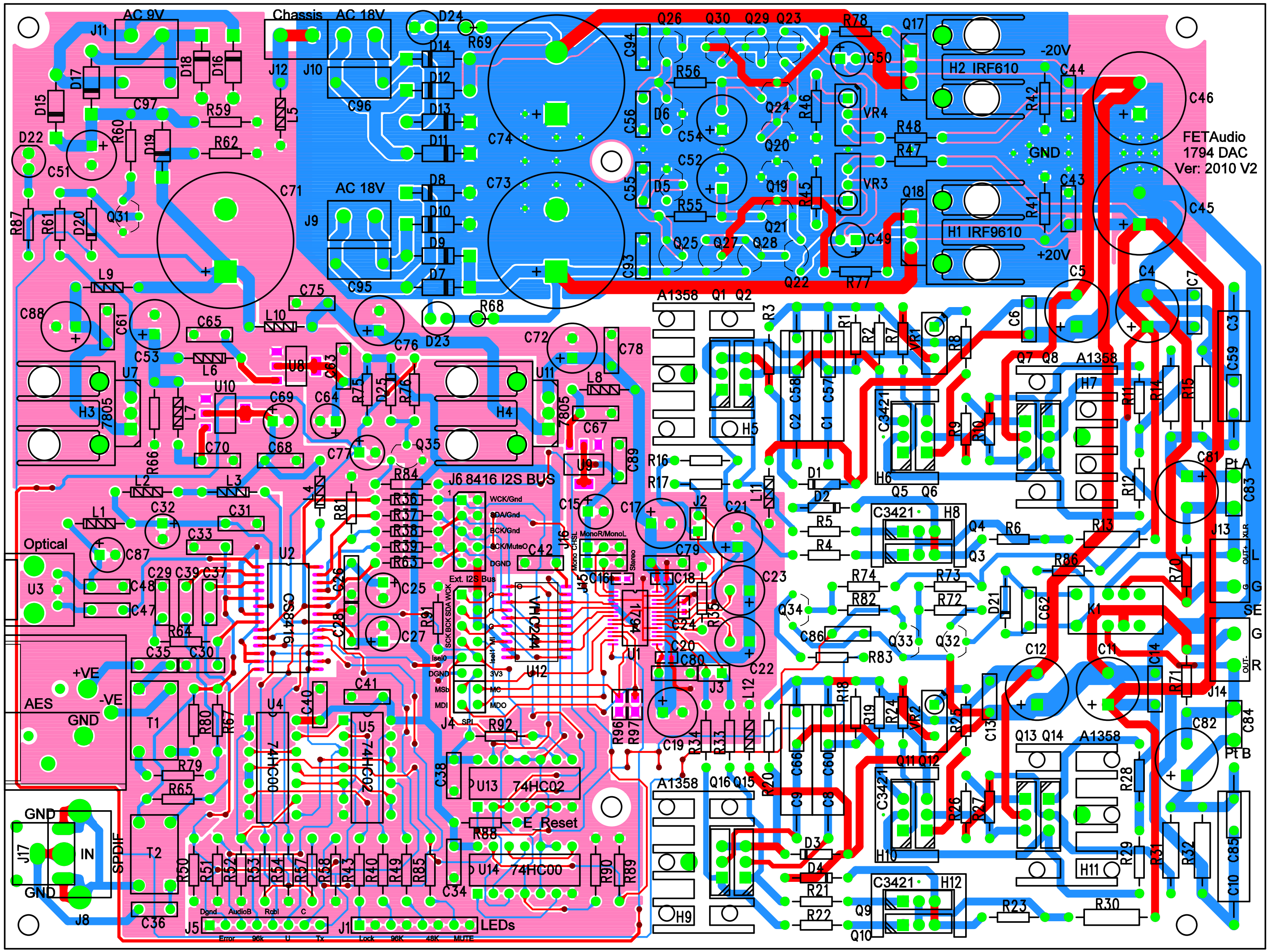


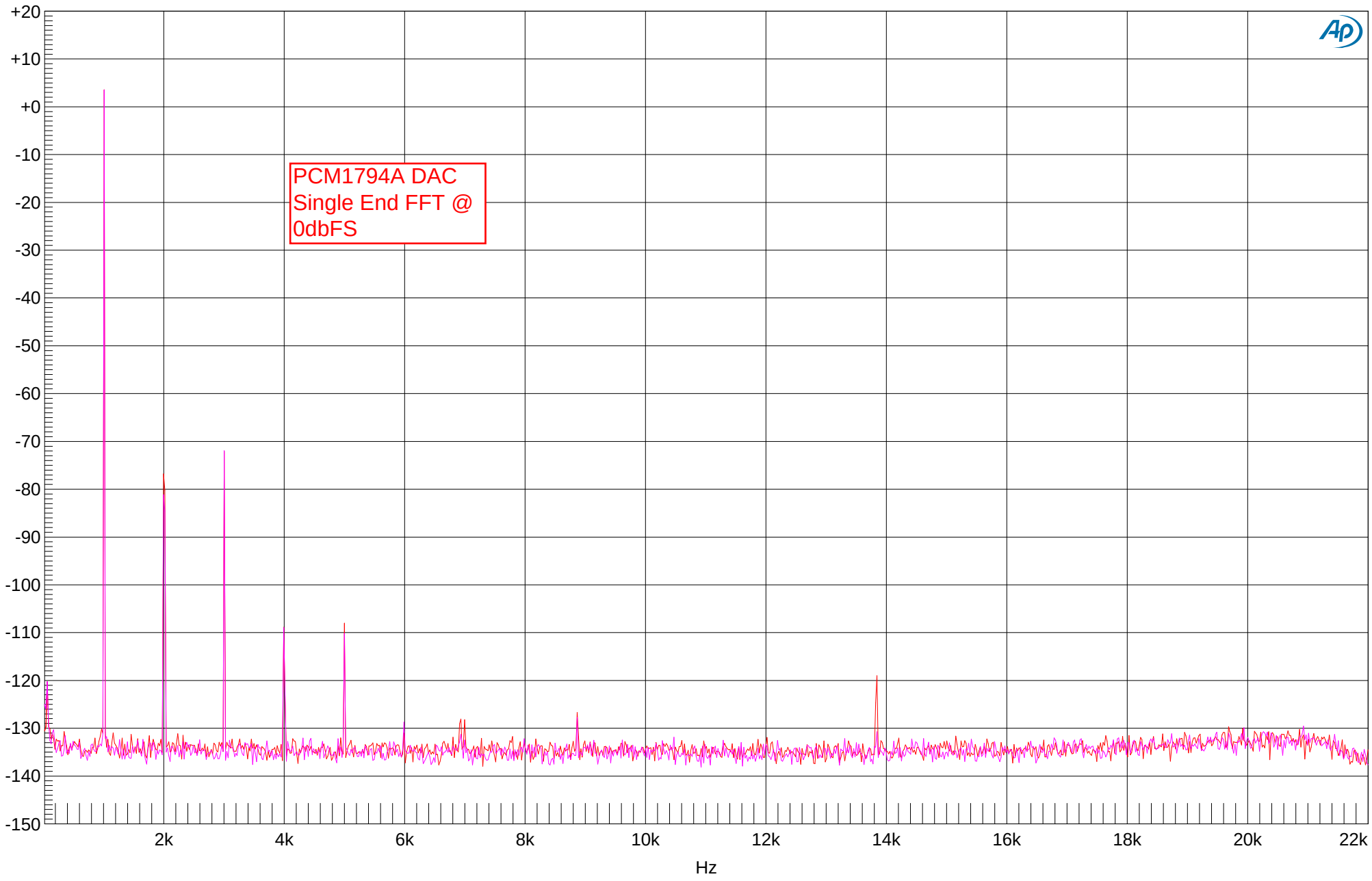
1794DACv2.pcb — Fri Jul 16 09:06:00 2010





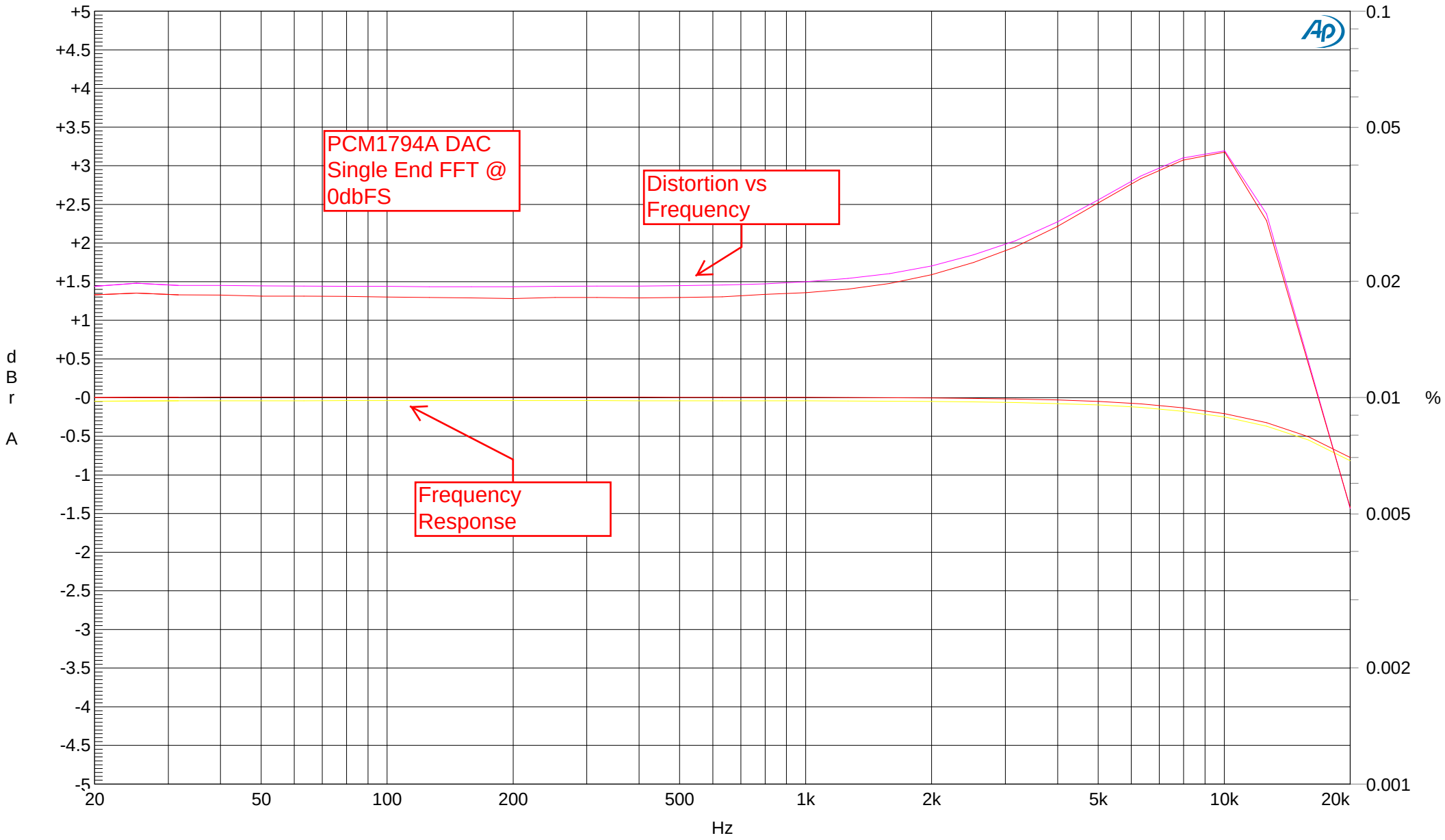
1794DACv2.pcb — Fri Jul 16 09:06:34 2010



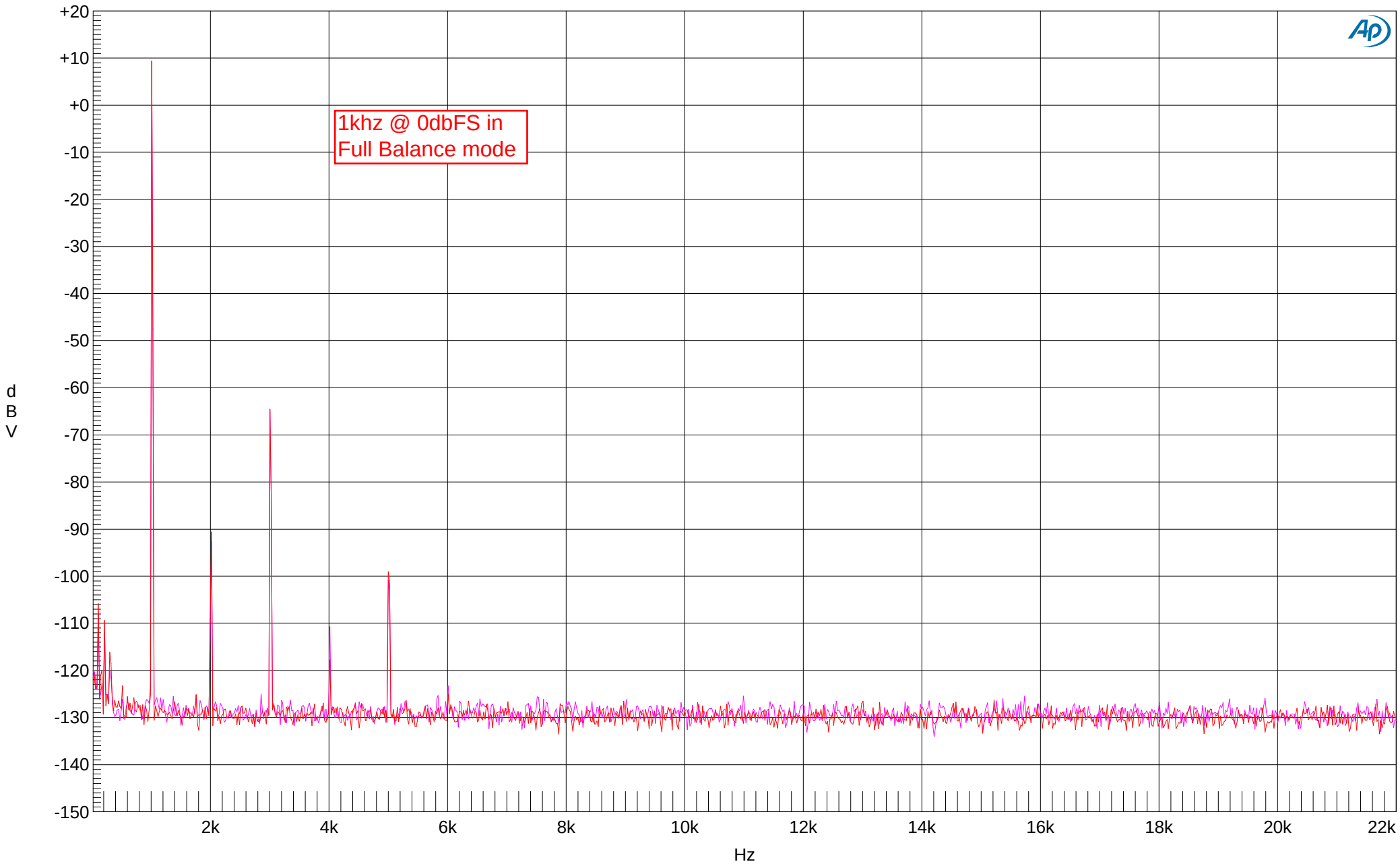


Sweep	Trace	Color	Line Style	Thick	Data	Axis	Comment
1	1	Red	Solid	1	Fft.Ch.1 Ampl	Left	
1	2	Magenta	Solid	1	Fft.Ch.2 Ampl	Left	

D-A FFT DAC 1794.at27



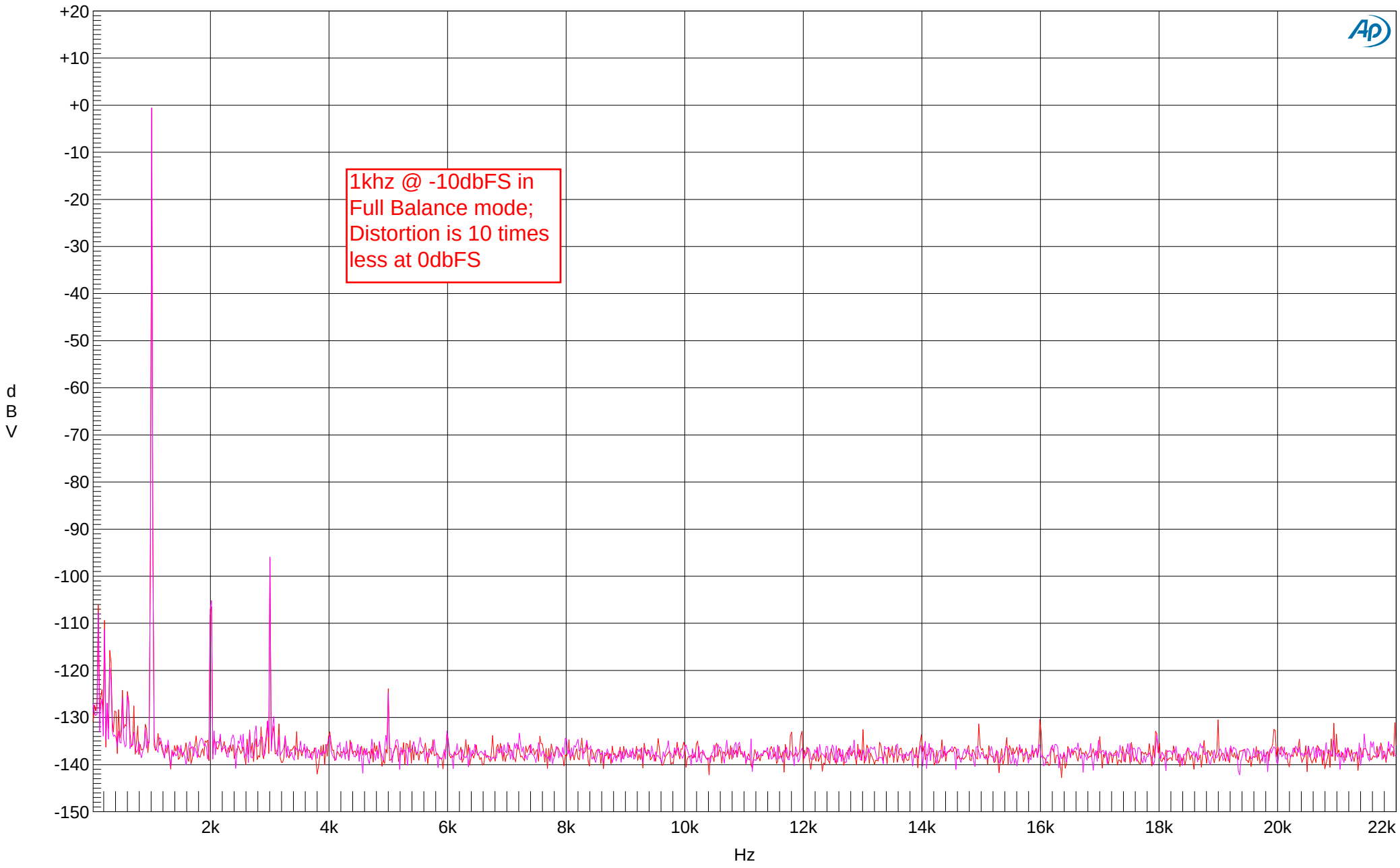
Sweep	Trace	Color	Line Style	Thick	Data	Axis	Comment
1	1	Red	Solid	1	Anlr.Level A	Left	
1	2	Magenta	Solid	1	Anlr.THD+N Ratio	Right	
1	3	Yellow	Solid	1	Anlr.Level B	Left	
1	4	Red	Solid	1	Anlr.THD+N Ratio	Right	



Sweep	Trace	Color	Line Style	Thick	Data	Axis	Comment
1	1	Red	Solid	1	Fft.Ch.1 Ampl	Left	0.02% at 0dbFS
1	2	Magenta	Solid	1	Fft.Ch.2 Ampl	Left	0.02% at 0dbFS

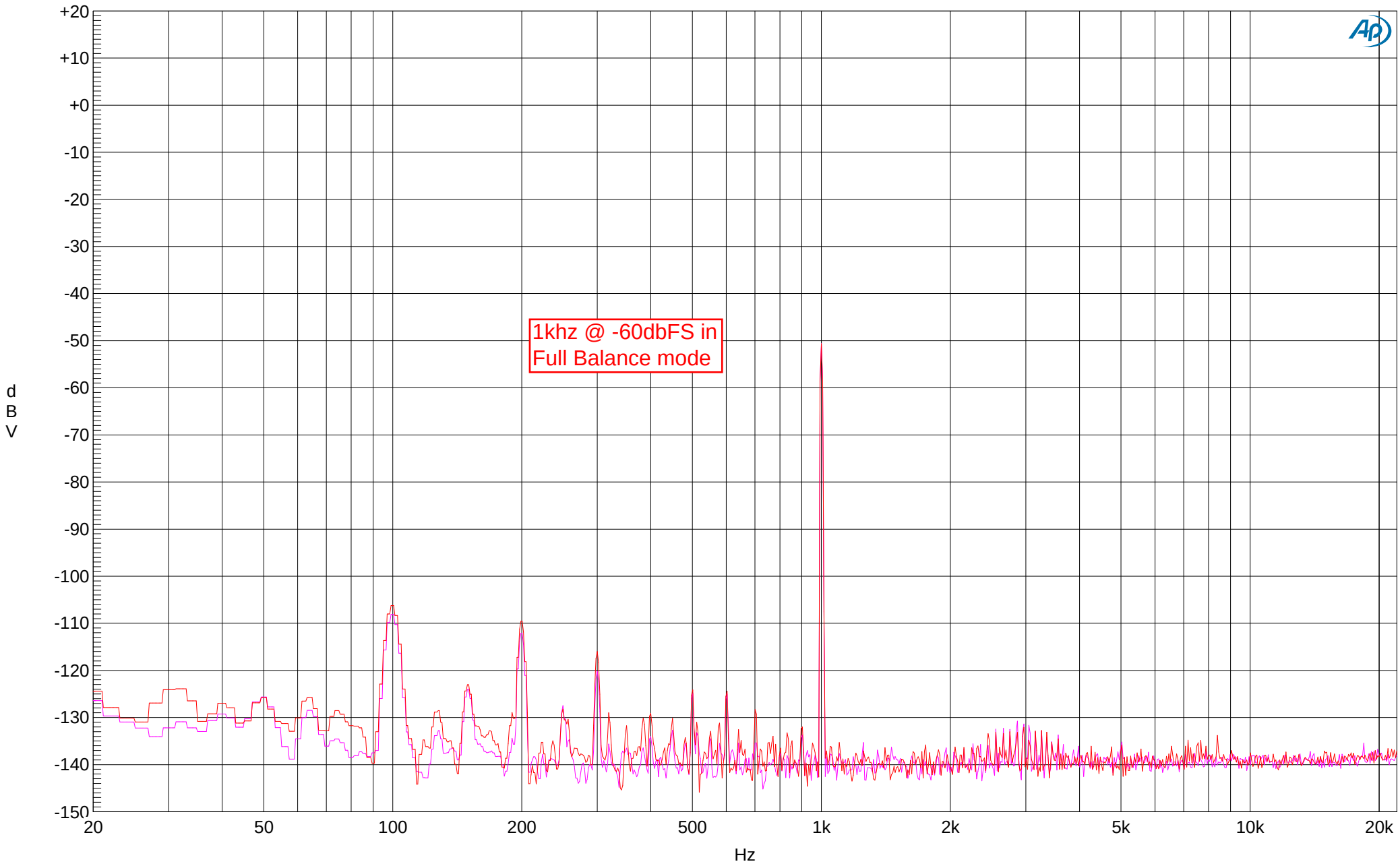
D-A FFT DAC 1794.at27

FET Audio 10/12/10 16:24:29



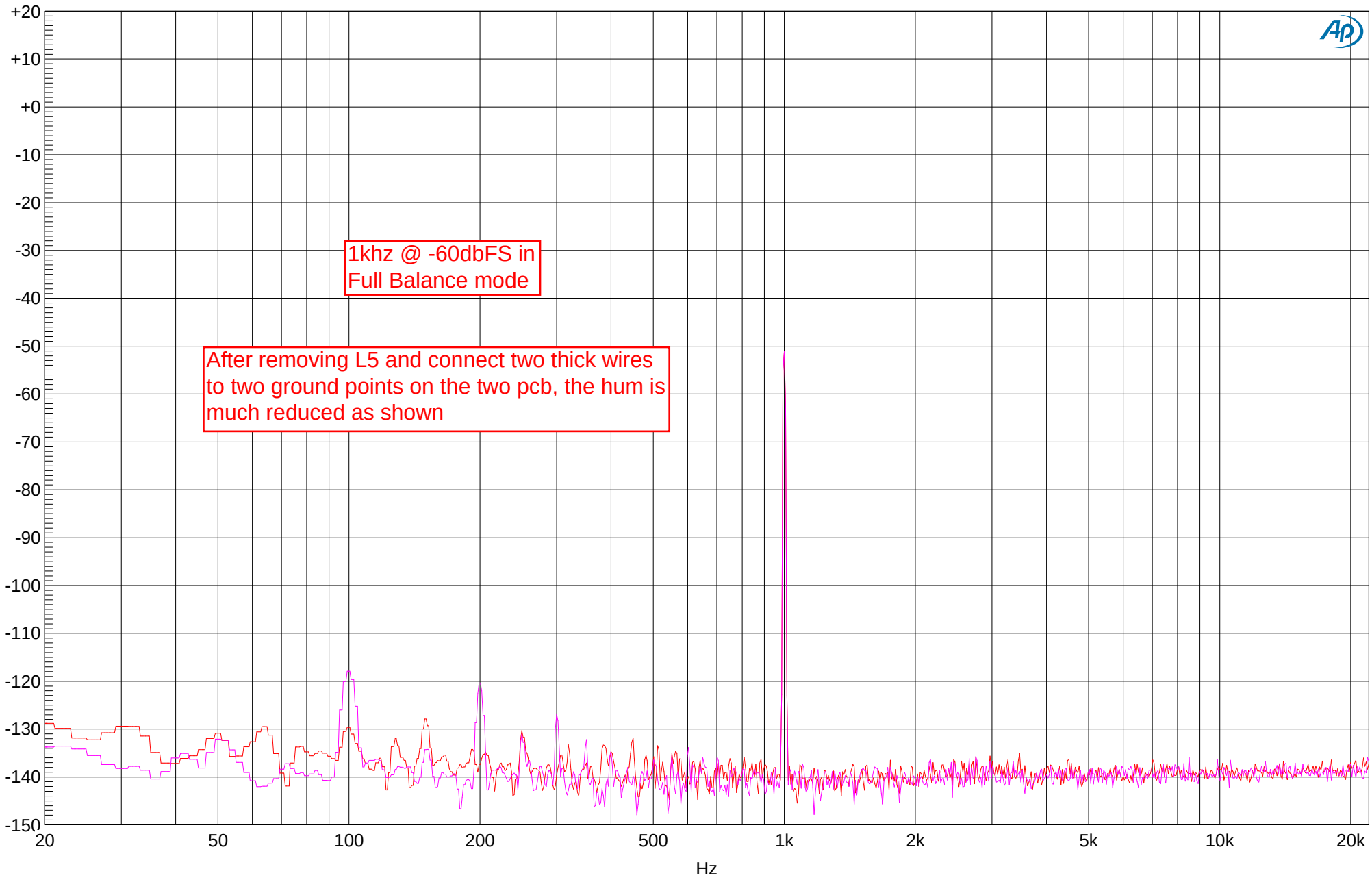
Sweep	Trace	Color	Line Style	Thick	Data	Axis	Comment
1	1	Red	Solid	1	Fft.Ch.1 Ampl	Left	0.0027% at -10dbFS
1	2	Magenta	Solid	1	Fft.Ch.2 Ampl	Left	0.0025% at -10dbFS

D-A FFT DAC 1794.at27



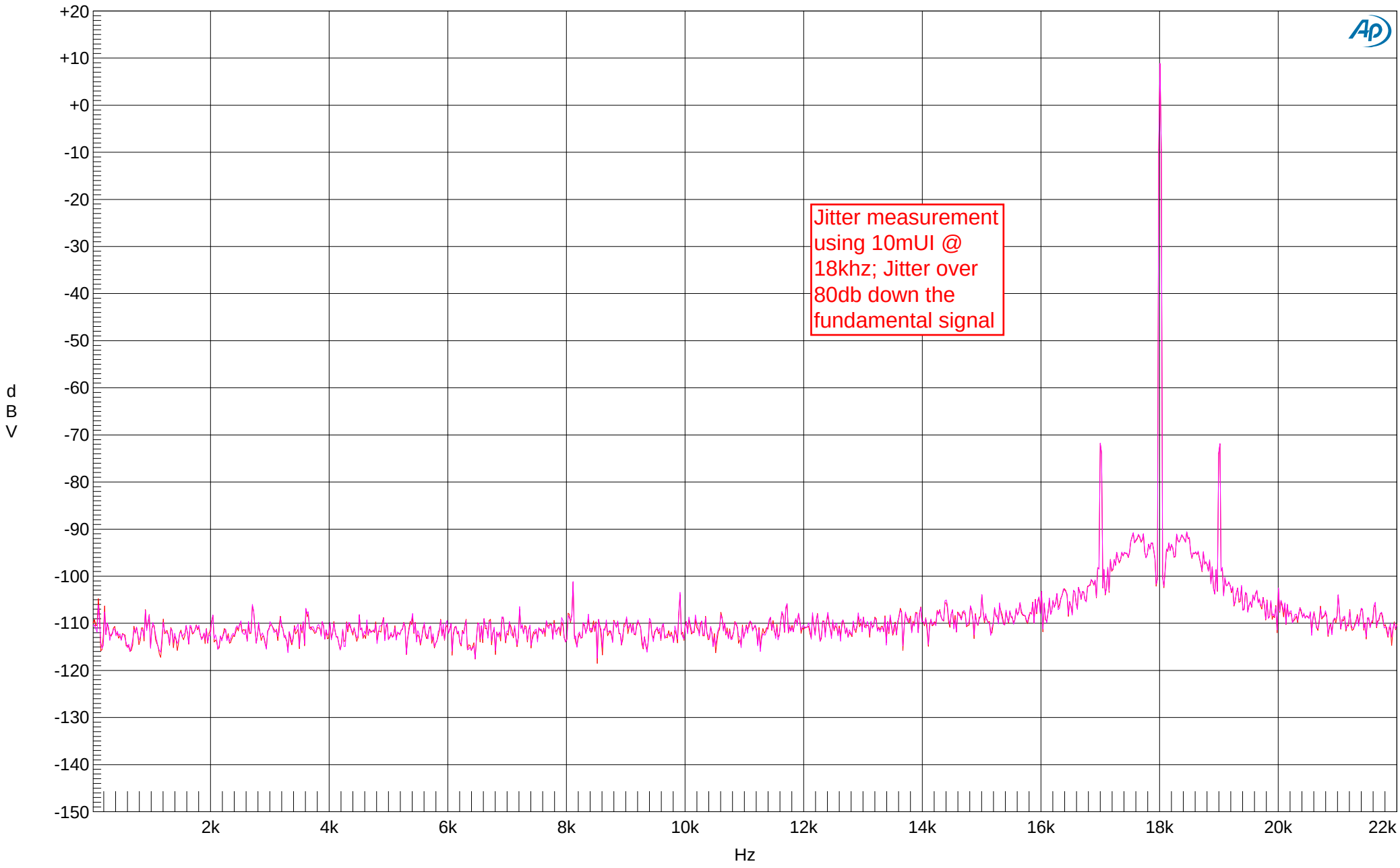
Sweep	Trace	Color	Line Style	Thick	Data	Axis	Comment
1	1	Red	Solid	1	Fft.Ch.1 Ampl	Left	at -60dbFS
1	2	Magenta	Solid	1	Fft.Ch.2 Ampl	Left	at -60dbFS

D-A FFT DAC 1794.at27



Sweep	Trace	Color	Line Style	Thick	Data	Axis	Comment
1	1	Red	Solid	1	Fft.Ch.1 Ampl	Left	
1	2	Magenta	Solid	1	Fft.Ch.2 Ampl	Left	

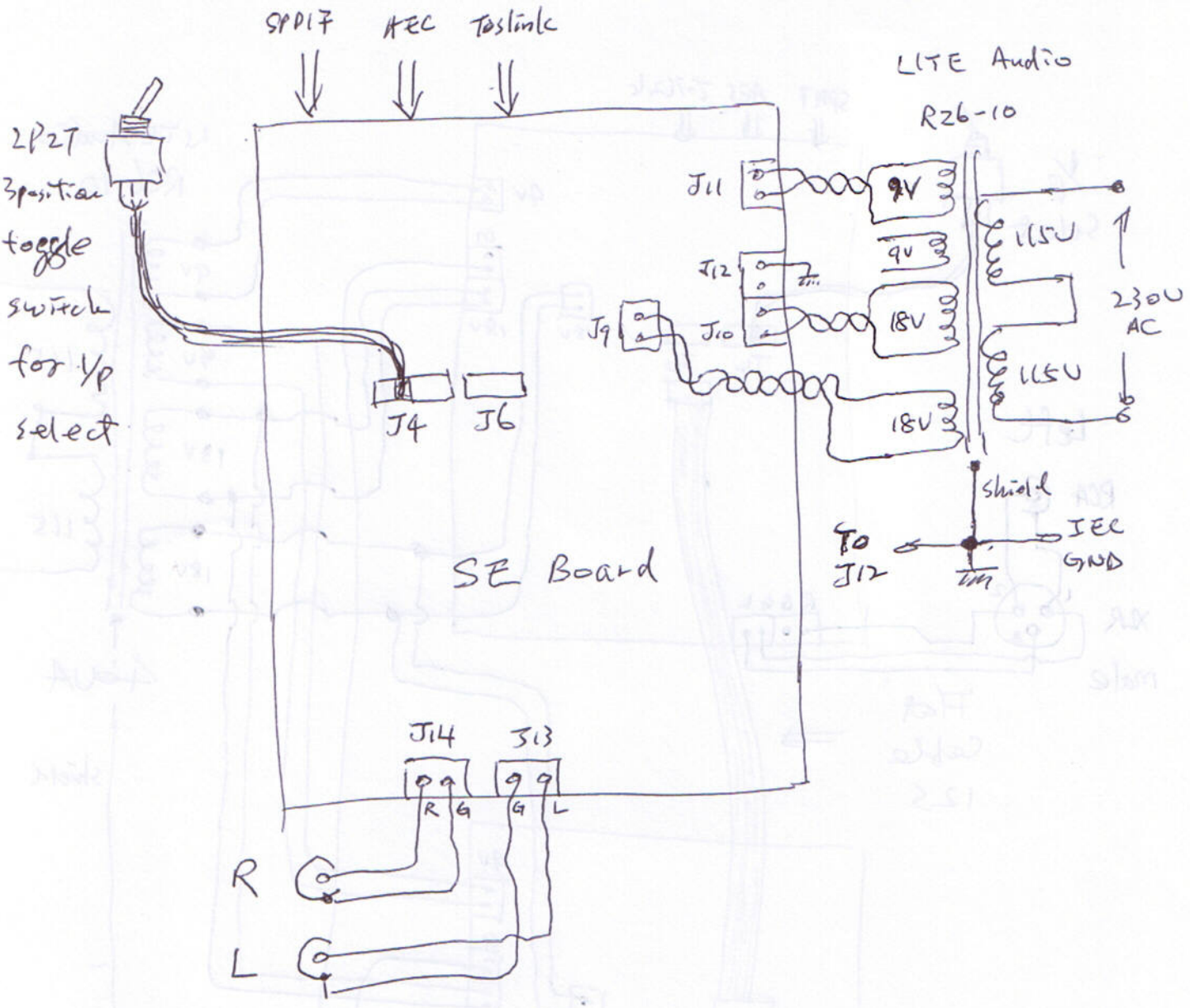
D-A FFT DAC 1794.at27



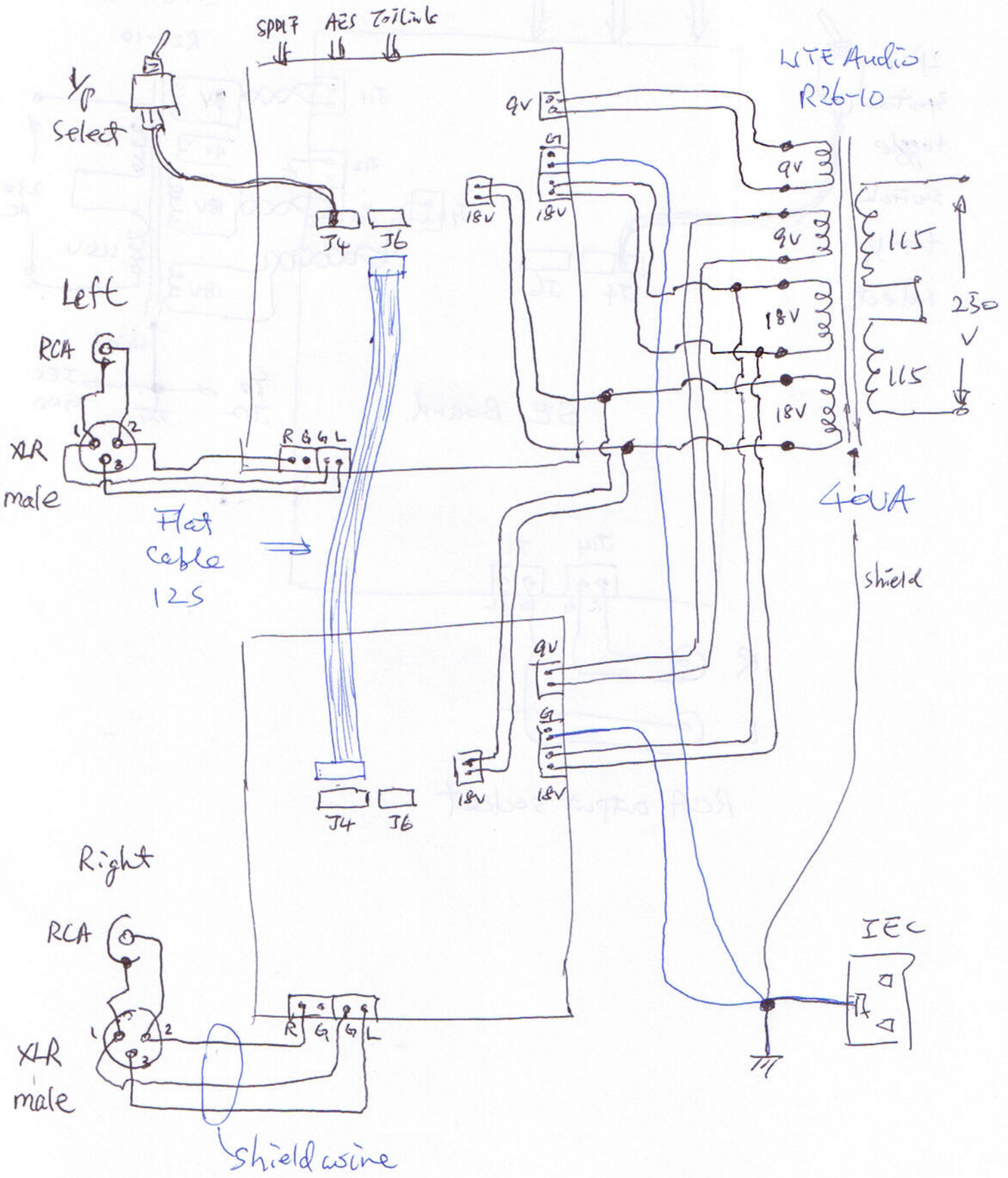
Sweep	Trace	Color	Line Style	Thick	Data	Axis	Comment
1	1	Red	Solid	1	Fft.Ch.1 Ampl	Left	jitter at 10mUI
1	2	Magenta	Solid	1	Fft.Ch.2 Ampl	Left	

D-A FFT DAC 1794 Jitter 10mUI.at27

Single End Connection Diagram



Full Balance Power Supply Connection



Full Balance Power Supply Connection

L5 is removed for both pcb
C51 change to 470 to 560uF
Add two ground wires 1 and 2 (RED) as shown in connection diagram
Use separate 9Vac windings for each pcb from R26-10 r-