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FDA-1B DAC Manual

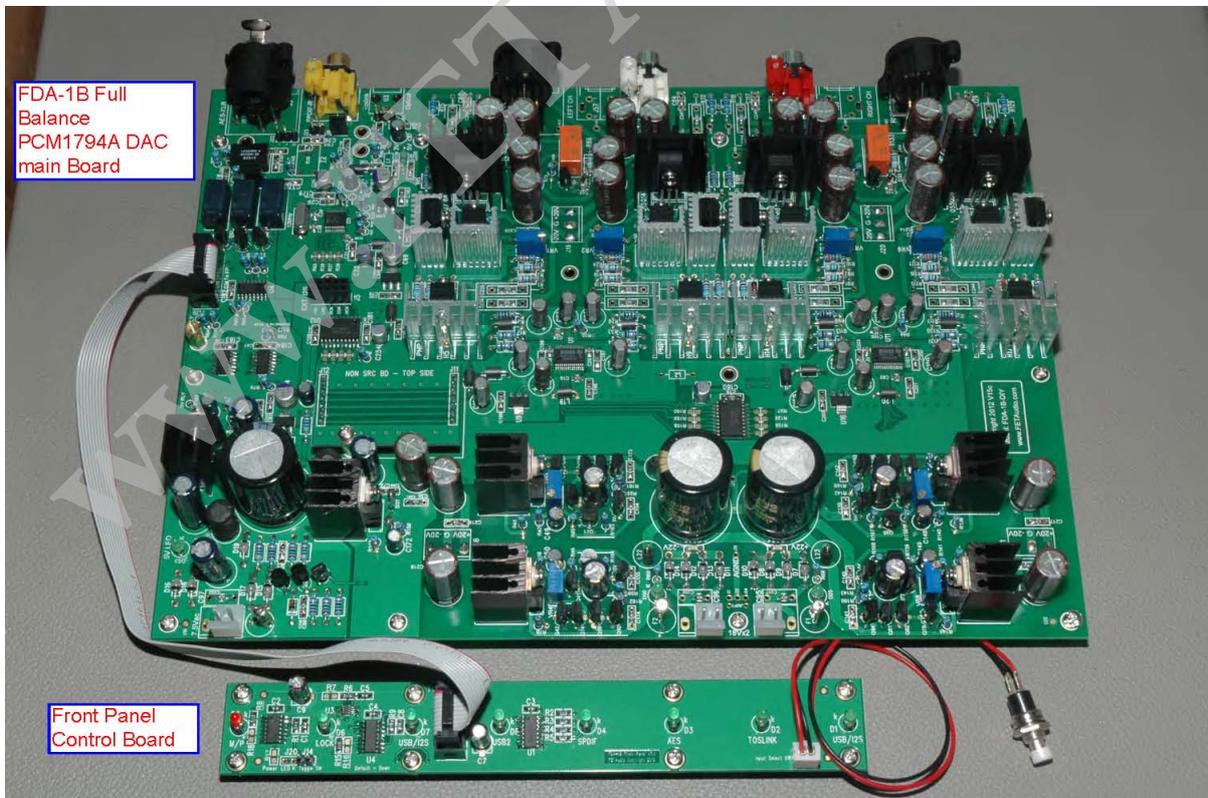
PCM1794A Full Balance DAC

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

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Designed By Spencer Cheung of FETAudio.com
Email: spencer@fetaudio.com or skcheung68@hotmail.com



A. Introduction:

This FDA-1B PCM1794A DAC is an upgraded version of the obsolete FDA-1 Single Ended DAC. FDA-1B has been developing for 1.5 years since FDA-1 was selling. More than 7 version PCBs have been tested before launching to DIYers. It has improved all the weaknesses of FDA-1 and added additional features and functions to enhance the sonic performance and flexibility of the design. Thus it is a more complete and mature design with separate Front Panel control board, I2S input via RJ45 socket and optional ASRC function via daughter board plug-in!

Since it is a DIY DAC and thus most of the parts are selected to be through-hole parts except the ICs and some film capacitors. In fact most of the film capacitors pad are designed with both SMT (Surface Mount Technology) and TH (Through Hole) pads/holes and thus user can make a change in case better parts is available on hand. In the I/V section, all TH resistors and some filter capacitors are also provided with a SMT pads in case people want to try the SMT parts. For the digital section TH resistor pads can also be soldered with a 0805 SMT resistor due to its pitch is 2.54mm. **Thus this PCB design is really remarkable and flexible for DIYers to experiment with different types of part for sound tuning!**

For the Front Panel control board, it is mainly SMT parts with TH for LEDs and sockets. Thus it provides a good basic training for all DIYers for SMT soldering. In fact, SMT parts (with size 0603 and above) are more easy and faster to hand solder than TH parts after managing the skills. What you need is just a 5x magnify glass with stand, small head tweezers, 0.4mm to 0.5mm diameter solder wire and your two stable hands.

Major differences between FDA-1 and FDA-1B-DIY DAC are:

1. Change single end design to full balance design in a single board with both balance and single end analogy output.
2. Change digital receiver chip from CS8416 to WM8804 which is the best receiver chip with lowest jitter performance and excellence sonic performance.
3. All mirror image PCB layout for analogy regulators, DAC and IV sections to gain maximum sonic performance in 3D sound stage.
4. Improve PCB layout in all sections to achieve lowest noise level and super accurate timing for on board digital signal paths.
5. A separate front control board is provided for the digital input select control and LED indication of input and working status. Memory is provided for the input selection even after power off.
6. Add two daughter board options: One for the 4th digital I2S input via RJ45 socket and the other ASRC options using AD1896 or SRC4192 chips. CS8421 has been tested but rejected due to its harsh sonic performance.
7. Future expansion to USB input using new chipset like XMOS solution is possible via the input daughter board using the 4th I2S digital input. In fact, the XMOS reference design has been tested successfully via the I2S input at J5.

Major sonic improvement:

1. More “Beef” in the sound.
2. Improve overall resolution and details.
3. Quieter music background.
4. Much refine sound stage, and super 3D position.
5. More relax and musical sound.

With the above improvements, it is hardly can find a branded or DIY DAC that can produce music close to FDA-1B no matter what the price is.

Component choices:

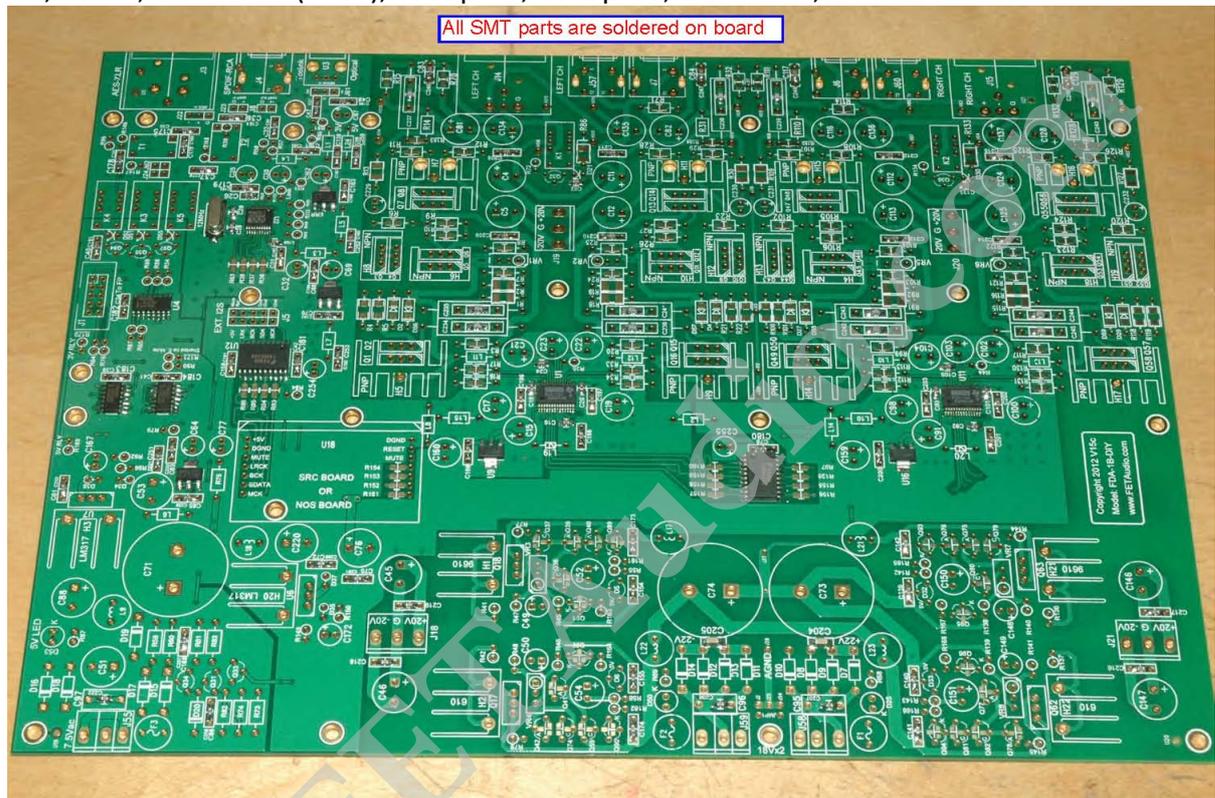
1. Many Toshiba obsolete parts are eliminated and better parts are selected from various sources to ensure continue supply. Many Fairchild transistors are used for the better specifications and easily available from Mouser or Digikey.
2. Use 50ppm/K through-hole resistors rather than the 100ppm dale resistor. Thus Vishay MRS25 and Xicon 50ppm 1% resistors are widely used.
3. Maintain the use of Elna Silmic II capacitors in the analogy sections for its best sonic performance.
4. Use more SMT capacitors (both E-cap and MLCC) in the digital section as they perform better and with lower ESR. Example is OS-con SVP or Panasonic FK series. The 6800p and 1500p low pass filter capacitors have changed to SMT type for more accurate and stable performance.
5. ROHS compliance is the first choice for all components.

B. Specifications:

1. DAC chips: Texas Instruments PCM1794A x 2 pieces 24bit/192k best in class DAC operating in mono mode for best dynamic performance – up to 132 db.
2. Digital Receiver: Wolfson WM8804 24bit/192k digital receiver. Best sound receiver chip ever made.
3. I/V and Analogy Filter: Discrete power transistor I/V (current steering) operating in pure Class A mode with NO global feedback. Aka Pass D1 I/V topology.
4. Digital Input: SPDIF, AES, Toslink and I2S Bus (RCA, XLR female, Toslink and 5x2-pin header – daughter board is required for I2S input via RJ45 socket).
5. Bit/Sampling Frequency: Up to 24bit/192k.
6. ASRC options are provided with additional cost: Two choices – AD1896 or SRC4192 can be provided. AD1896 will be at max 96k Fs and SRC4192 can be at max 192k Fs.
7. Analogy Output: Stereo Channels Single End @ 1.5Vrms and Full Balance at 3Vrms via RCA and XLR male connectors.
8. Output Impedance: 150 ohm Single End mode; 300 ohm Full Balance mode
9. Output auto muting using relays.
10. Power supply: AC 18V x 2, 1A and AC 8~9V x 1, 1A; total consumption around 250mA per AC input or around 14W/Board.
11. Display LEDs: Power/Mute, Lock, and Digital Input Selection.
12. Distortion: Maximum 0.02%, 1kHz at 0dbFS, 20kHz @ 3Vrms. Typically at 0.002% or below at -10dbFS input level.
13. Board: 11 x 8 inches double sided 1.6mm gold plated FR4; 12 x M3 supporting holes; max height part 35mm. Total board height is 37mm.

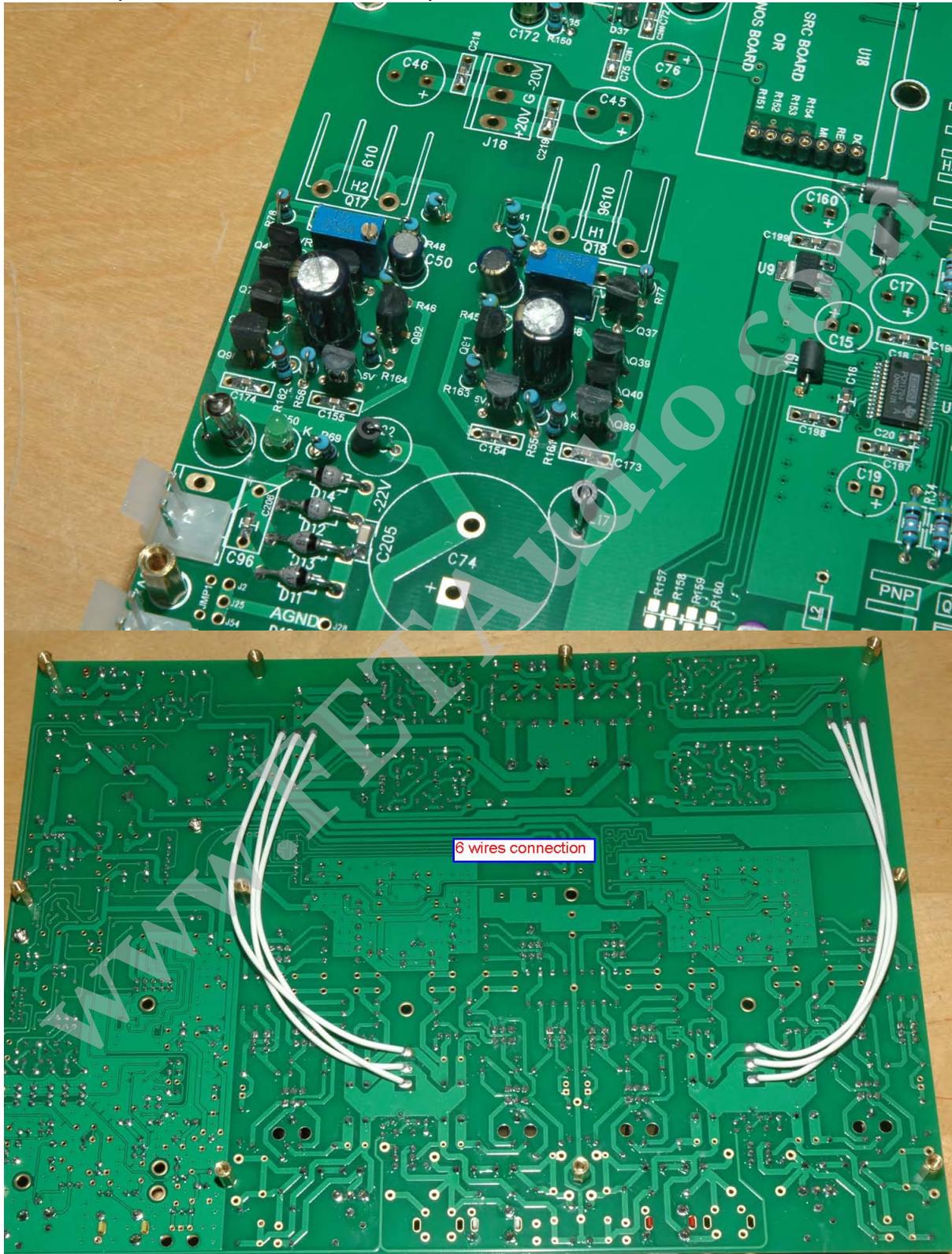
C. Assembly Instruction

1. Please take necessary ESD precautions, as all the parts are ESD sensitive!
2. Solder all SMD IC: PCM1794A, 74VHC244, WM8804, AMS1117-3v3, 74HC00D, 74HC02D and 74HC238D etc... Align the markings of the IC with the text on the PCB screen-printing.
3. Solder all SMD chip capacitors provided as per below sequence. They are 15pF x 2, 470p x 2, 1u x 1, 0.047u x 2 (1206), 1500p x 4, 6800p x 8, 0.01u x 14, 0.1u x 63.



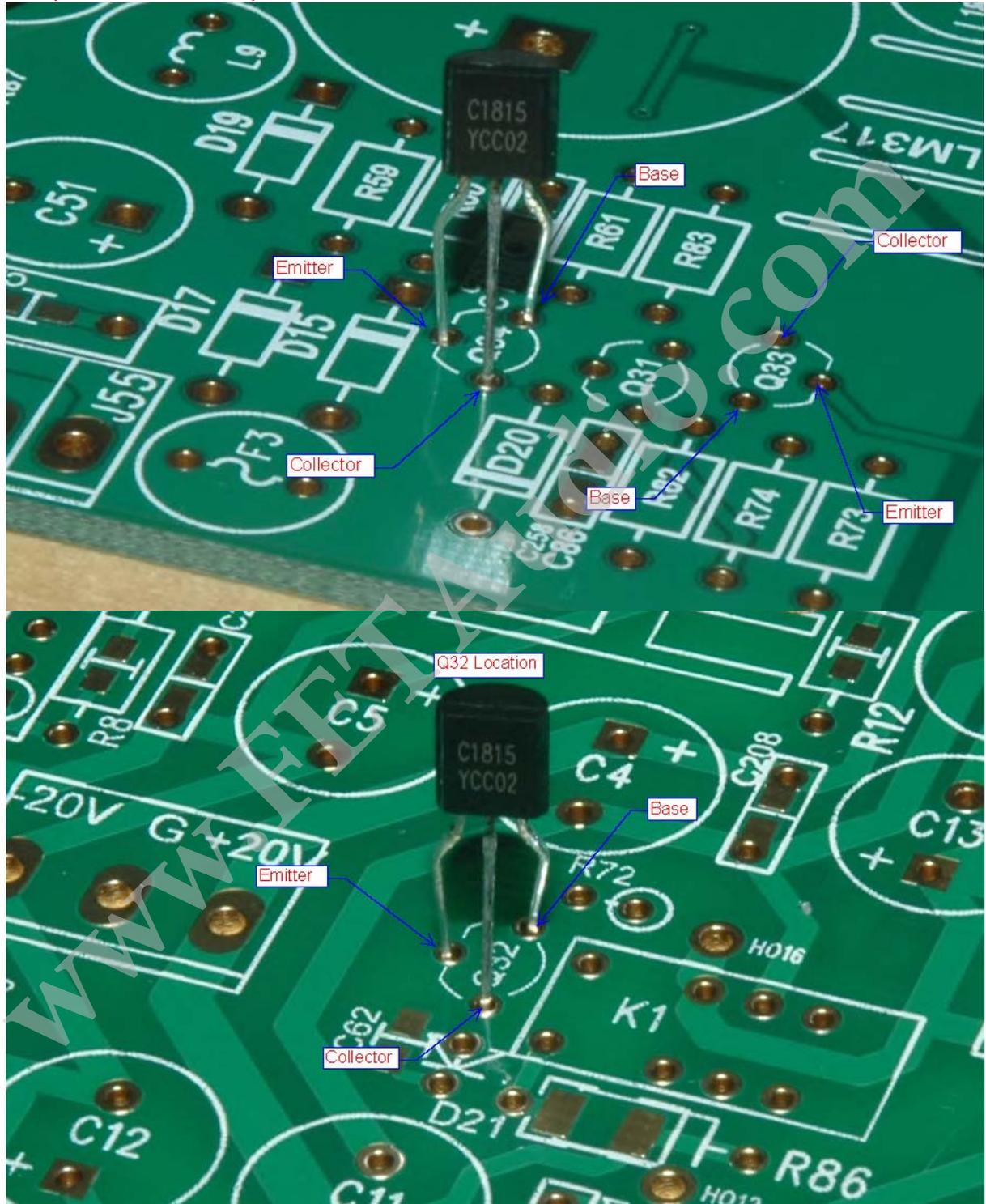
- 4.
5. After that wash the PCB to remove all the flux with Isopropyl Alcohol. Use a tooth brush to clean the gap of the ICs leads. After that rinse the PCB with distill water and dry it properly.
6. Use a multi meter to check all the leads of PCM1794A and WM8804 connections. Ensure no adjacent leads are shorted together unless it is designed to be shorted.

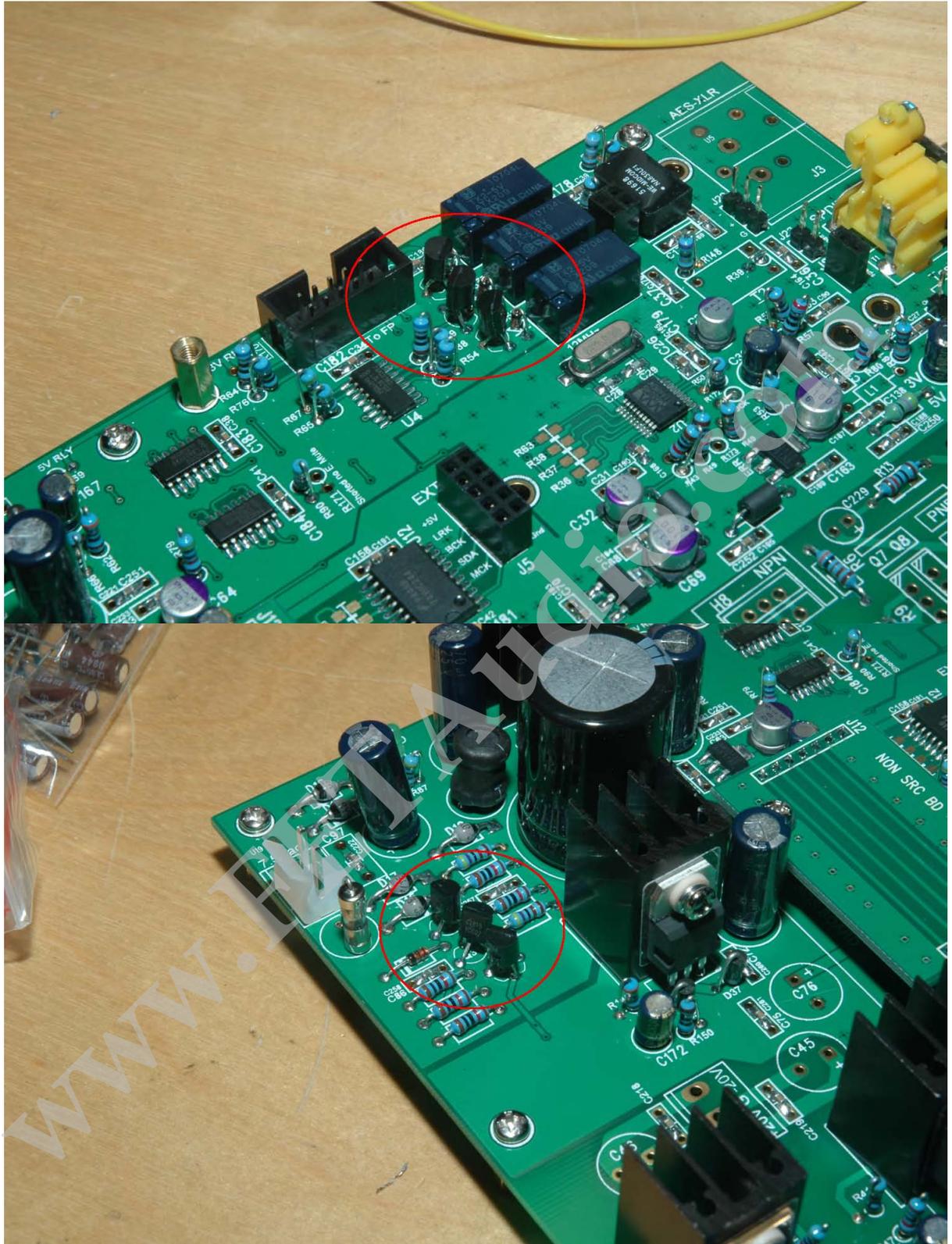
7. Solder the rest of the parts starting from the smallest parts first, preferably also by component type. For example, resistors, chokes, beads, diodes, E-caps etc... For SMD E-capacitors (OS-con), pull the leads straight and insert into the PCB holes before soldering. Do not pull the lead too hard as it may break.

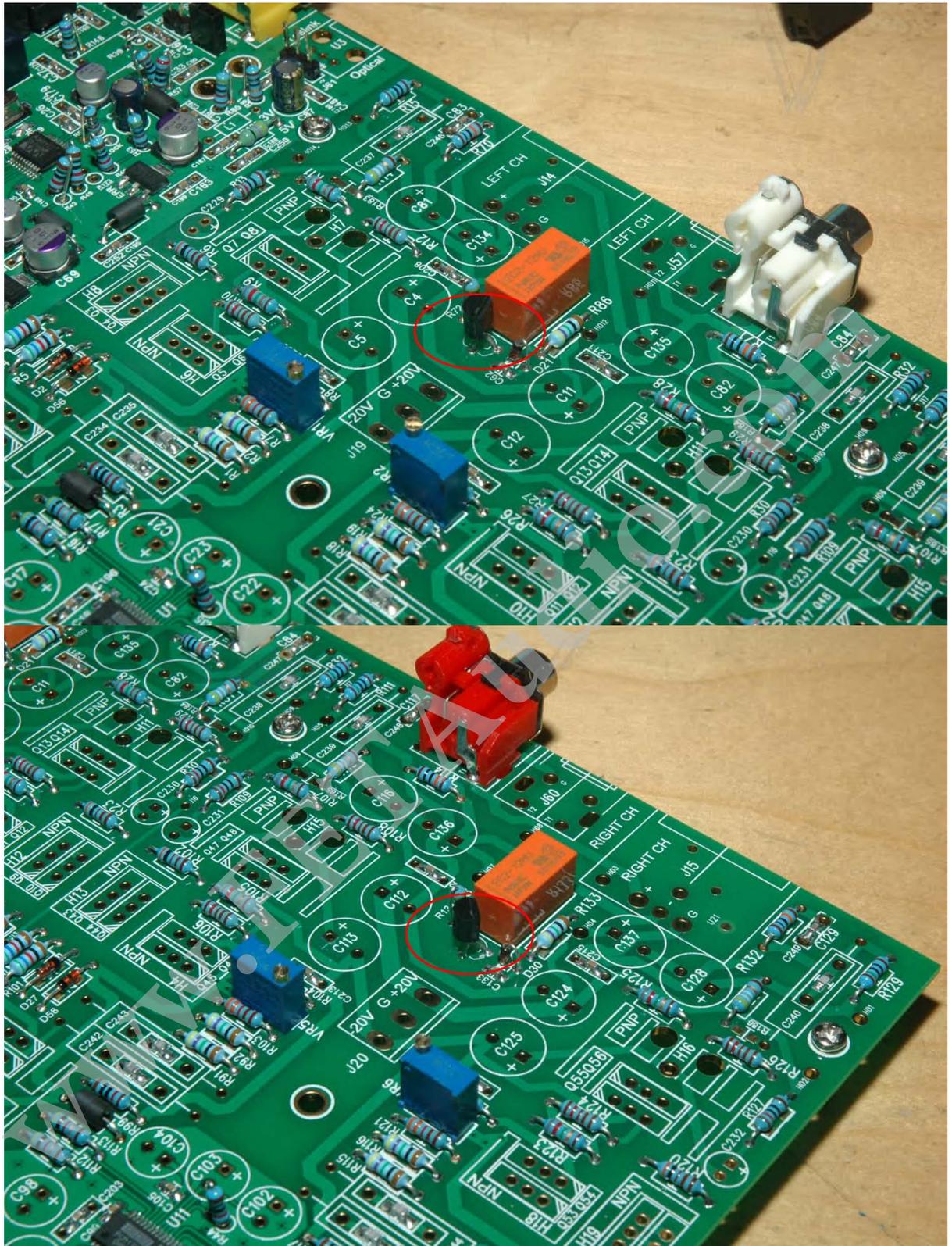


8. There are some parts that need special attentions during assembly:

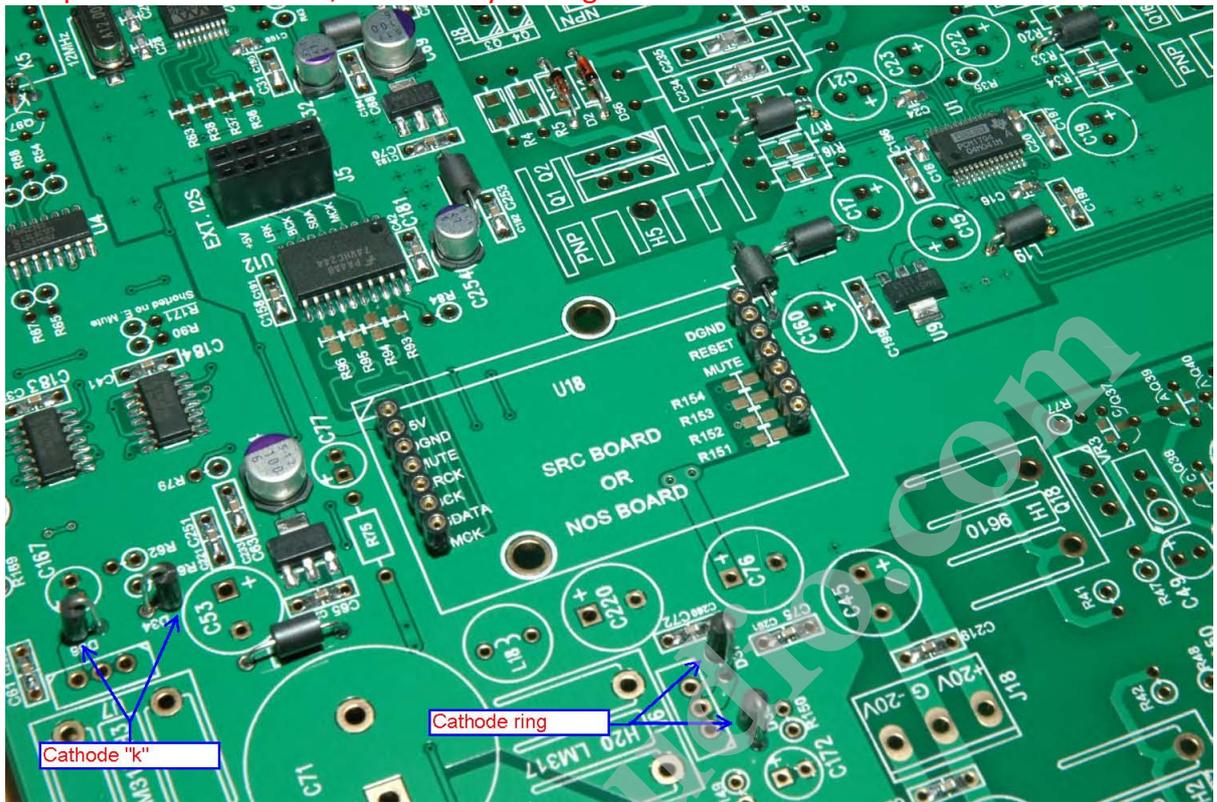
8.1. Transistors C1815 x 8 pcs - **Q31, Q32, Q33, Q34, Q35, Q36, Q84, & Q97**: The pads are not properly designed and thus these parts must be inserted as per the photos below. The orientation should not follow the marking on the PCB. See below photos of all the 8 pieces C1815 transistor orientation.



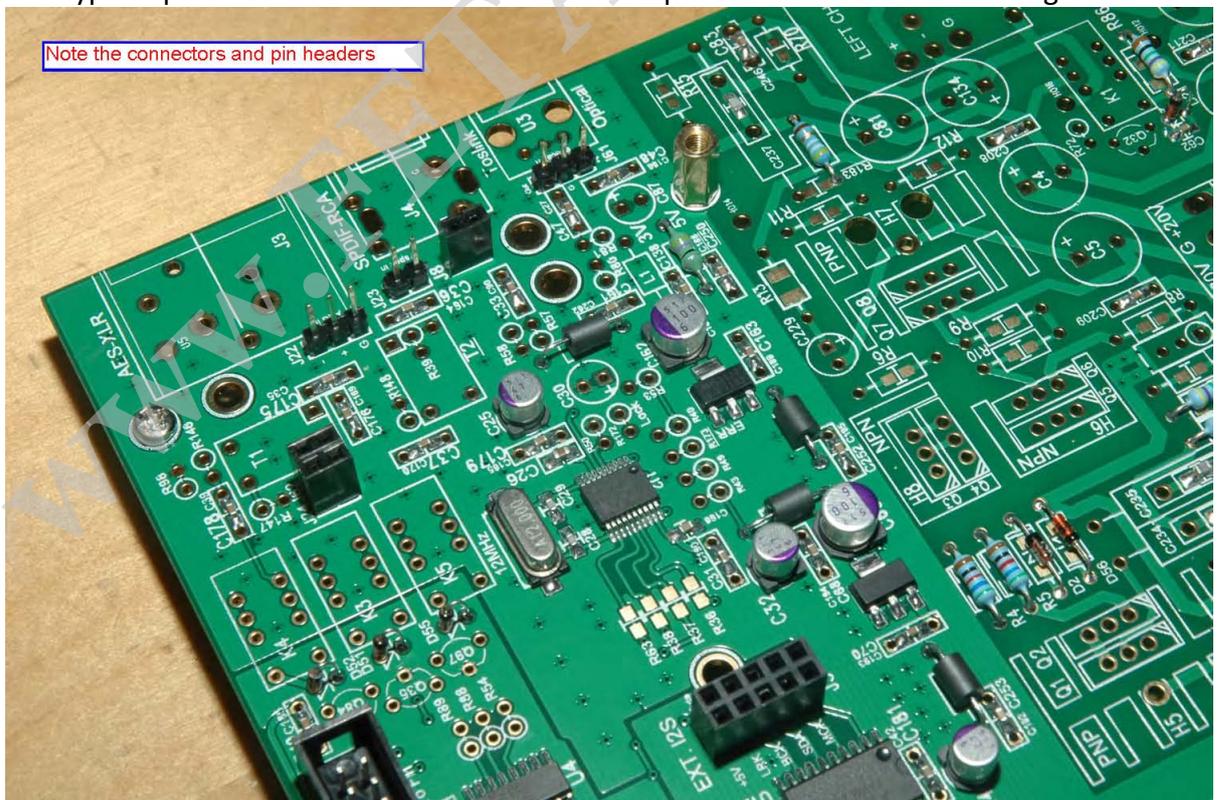




8.2. Diodes 1N4007 x 4 pcs – D34, D35, D36, & D37: The cathode mark (strip or K) is not provided on the PCB, it is actually the big white circle on the PCB.



8.3. Connectors J22, J23, J8, J61, J24, J62, J5, J1, J55, J59, & J58 – refer to photo for the type of pin header or socket in case the description on the BOM is confusing.



8.4. Do not connect the 6 wires at J18, J19, J20 and J21. Refer to the tuning procedure for details.

8.5. IRF9610 x 2, IRF610 x 2, and LM317T x 2, PNP and NPN Transistors are installed on all heatsink with their marking all facing upward as shown below. Note that there is a mica insulation sheet between the body of TO-220 parts and the heat sink only. The transistors do not need a mica sheet for insulation.



8.6. R39, R169 and R172 are jumpers and not provided. Use an excess component lead to short solder the two pads.

D. Tuning Procedures:

1. With all the parts in place except the 6 wires provided.
2. Connect AC 8V (or a regulated power supply with current limit set to 300mA at 12Vdc) to J55 (do not connect J58 and J59 to AC 18V), check the voltages at U6 and U7 (LM317T) body heat-sink (not the big heat-sink that it attached to) relative to ground (DGND at U18 daughter board position or AGND at the middle of the two 5600u big filter capacitors). The voltage should be at about 5V +/- 0.15Vdc. If the voltage is much more than 5V (6V or above), cut off the power immediately to prevent damage to the expensive PCM1794A chips.
3. Then check the voltage at U8, U9, U10, U16, & U17 (AMS1117-3.3). The voltage at the little heat-sink of the regulators should be 3.3V +/- 0.1Vdc.
4. Plug in the Remote Control Board via J1 on both PCBs. D1 (USB/I2S) and D5 should be "ON". Press the toggle switch (at J2 or J14) to see if the LEDs D1 to D4 is "ON" one by one. The sequence is from D1 → D4 → D3 → D2 → D1 → D4 ... and repeat. Also hear if the relays K3, K4 and K5 have clicking sounds when pressing the toggle switch.
5. Inject a digital SPDIF signal to J4 RCA socket, the LOCK LED (D6) should be "ON" if SPDIF (D4) is selected. This shows that the digital section is working properly.
6. Then remove the power at J55.
7. Connect AC18V (or a regulated power supply with current limit set to 300mA at 24Vdc) to J59, check for voltage at J18 and J21 for -20V to G points. The initial voltage should be around -15.5V. Adjust VR4 and VR8 until the voltage is -20V +/- 0.02Vdc. Remove the power applied to J59.
8. Connect AC18V (or a regulated power supply with current limit set to 300mA at 24Vdc) to J58, check at J18 and J21 for +20V to G points. The initial voltage should be around 15.5V. Adjust VR3 and VR7 until the voltage is +20V +/- 0.02Vdc. Remove the power applied to J58.
9. Solder the 6 wires provided from J18 to J19 and J21 to J20. Make sure that the wires are connected from -20V to -20V, G to G and +20V to +20V points. Note that there is cross-over of wires on one side.
10. Connect power to all J55, J59 and J58.
11. Check the +20V and -20V are still at about the same voltages as before. If not, the IV section is shorted somewhere.
12. Output DC offset adjustment:
13. Check the offset voltage at C246 (C83) inner hole relative to G of J57. It should be around 0.45Vdc. Adjust VR1 until this voltage to below 1mV. Repeat at C247 (C84) and adjust VR2 to nearest 0V offset.
14. Check the offset voltage at C248 (117) inner hole relative to G or J60. It should be around 0.45Vdc. Adjust VR5 until this voltage to below 1mV. Repeat at C249 (C129) and adjust VR6 to nearest 0V offset.
15. After warm up for 30 minutes, repeat above two steps to ensure the offset is below 1mV by adjustment again if necessary. For normal use, the offset of +/-5mV is ok as all output has couple capacitor to block any DC from going to the next stage.
16. If all the DC adjustment is done, proceed to AC measurement.
17. Connect a 1kHz digital signal to the SPDIF input (RCA socket). A test CD recorded with 1kHz can be used with a CD player with SPDIF output.

18. Check the output levels for 0dBFS input signal is at about 1.5Vrms at RCA and 3Vrms at XLR output sockets. Left and right channel should not be more than 0.25dB differences in levels.
19. Check that the distortion of the output 1KHz signal is below 0.02% for both channels.
20. Burn-in the DAC for about ½ hour to stabilize the parts.

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E. Board Interface Specifications:

1. Power Supply Connectors:

Location	Description	Format
J58	18V to 20V AC, 1A, 20VA	3.96mm pitch
J59	18V to 20V AC, 1A, 20VA	3.96mm pitch
J55	8 to 9V AC, 1.5A, 20VA	3.96mm pitch
J2/J25/J54	Chassis Ground	Connect AGND to star ground point

2. J5: External Digital Connector: (5 x 2 Pin Header; pitch 2.54mm, CMOS 3V3 logic)

Symbol	Description	Pin	Marking on PCB
DGND	Digital Ground	1	GND
MCLK	System clock 256fs	2	MCLK
DGND	Digital Ground	3	GND
SDA	Serial Digital Data	4	SDA
DGND	Digital Ground	5	GND
BCLK	Bit clock 64fs	6	BCK
Reset	Power up reset	7	RST
LRCLK	Work clock fs	8	LRK
Mute	Output Mute (Hi = Mute)	9	Mute
+5V	+5V DC Supply for plugin	10	+5V

3. Digital Input Socket:

Location	Description	Spec	Format
J4	SPDIF input	75 ohm 24bit/192k	RCA (Yellow)
J3	AES input	110 ohm 24bit/192k	XLR female
U3	Optical input	Optical 24bit/192k	Toslink
J5	I2S, Mute & Reset	3.3V CMOS	5x2 pin header

4. Analogy Output Socket:

Location	Description	Format
J7	Left Single End Output	RCA (white)
J14	Left Balance Output	XLR Male
J6	Right Single End Output	RCA (red)
J15	Right Balance Output	XLR Male

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

Location	Description
J1	Connect to DAC main board J1 via a 10-pin flat cable
J2 & J14	Use a Push type "Toggle Switch without latch". Switch is normal open, Connect one of them for digital input selection
J20	Power LED – optional for additional Power display
R8	Connect +3v3 to D5 – Power indicator, then R18 must be opened
R18	Connect Mute to D5 – Input Mute indicator, then R8 must be opened
R15/R16	R15 short and R16 open – count down, R15 open and R16 short – count up – this will change the switching direction of the digital input selection

6. Front Panel Control Board LED Display:

Location	Description
D1	"ON" = Select I2S/USB input (J5)
D2	"ON" = Select Toslink (Optical)
D3	"ON" = Select AES (XLR female)
D4	"ON" = Select SPDIF (RCA)
D5	Mute or Power indication (R8 = Open & R18 = 0R → Mute; R8 = 0R & R18 = Open → Power)
D6	Lock ("ON" = WM8804 is locked to digital input signal)
D7	USB/I2S; either USB or I2S plug-in is activated
D8	USB2; reserve for USB lock indicator

7. Main PCB Options:

Location	Description
<u>R169/R170</u>	R169 short & R170 open → use 5V relay; R169 open & R170 short → use 3v3 relay for K3, K4 & K5; default is R169 short and use 5V relays.
<u>R171</u>	If short, then the I2S mute is not functioning, i.e. analog output NO-Mute; default is Mute.
<u>R172/R173</u>	If R172 short & R173 open → Mute is using LOCK signal; if R172 open & R173 short → Mute is using Gen Error signal. Default is LOCK signal
<u>L1</u>	If populated, use 3V3 Optical receiver but L24 must not be used (Default)
<u>L24</u>	If populated, use 5V Optical receiver but L1 must be removed
J22	Same as J3, AES input
J23	Same as J4, SPDIF input
J61	Same as U3, Toslink input
J8	SPDIF output for WM8804, need to connect to a external RCA socket
JMP1	If connected, the M3 hole next to it will be connected to analog ground
C95/C96/C97	Can be used to connect a MOV for surge suppression, not provided
H01 to H016	Output couple capacitor connection points for large film capacitor. Two groups of pads are provided. Example: H01 & H02 are the same points, and H03 & H04 are the same points. Thus connect a film capacitor from H01 to H03 and/or H02 to H04. Other connections are {H05 to H08, H06 to H07}; {H09 to H011, H010 to H012}; {H013 to H015, H014 to H016}.
C229 to C232	Optional filtering capacitors for IV, not provided
U18	A NOS daughter board will be provided as the default option. ASRC daughter board using AD1896 or SRC4192 can be purchased separately to plug into same location. The output sampling frequency from the ASRC BD is preset to either 96k for AD1896 or 192k for SRC4192.
<u>T2</u>	Not used and not provided
J57	Left Channel Analog Output: T1 = +ve, T2 = -ve, G = Ground. This is for external RCA and XLR socket connection.
J60	Right Channel Analog Output: T1 = +ve, T2 = -ve, G = Ground. This is for external RCA and XLR socket connection.

Attachments:

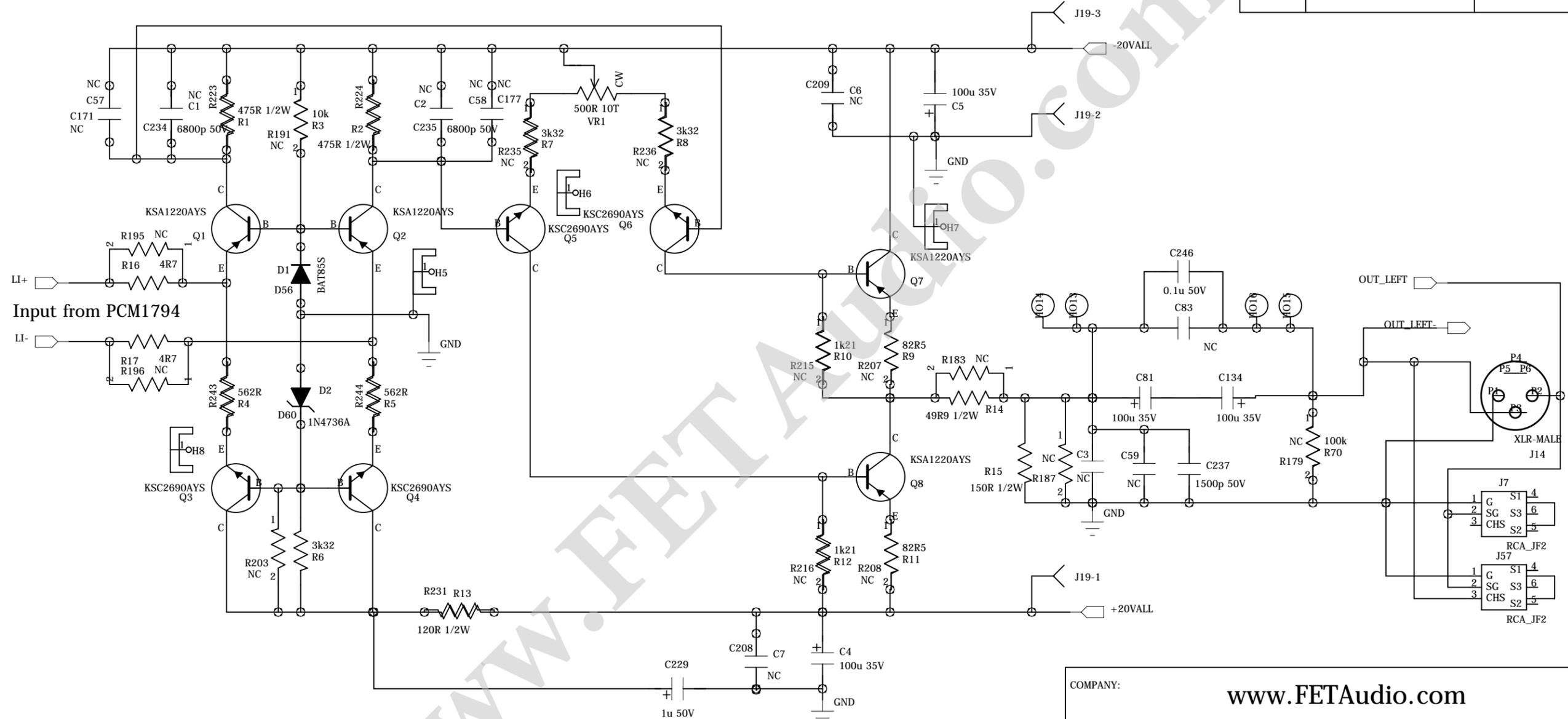
1. Circuit Diagram – 12 pages
2. FDA-1B DAC BOM – 2 pages
3. FFT measurement – 8 pages
4. PCBs mounting dimension – 5 pages

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Discrete IV Left -V

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TITLE: FDA-1B (PCM1794A DAC)

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| RELEASED:<br>Spencer Cheung | DATED:<br>2012-03-03     |

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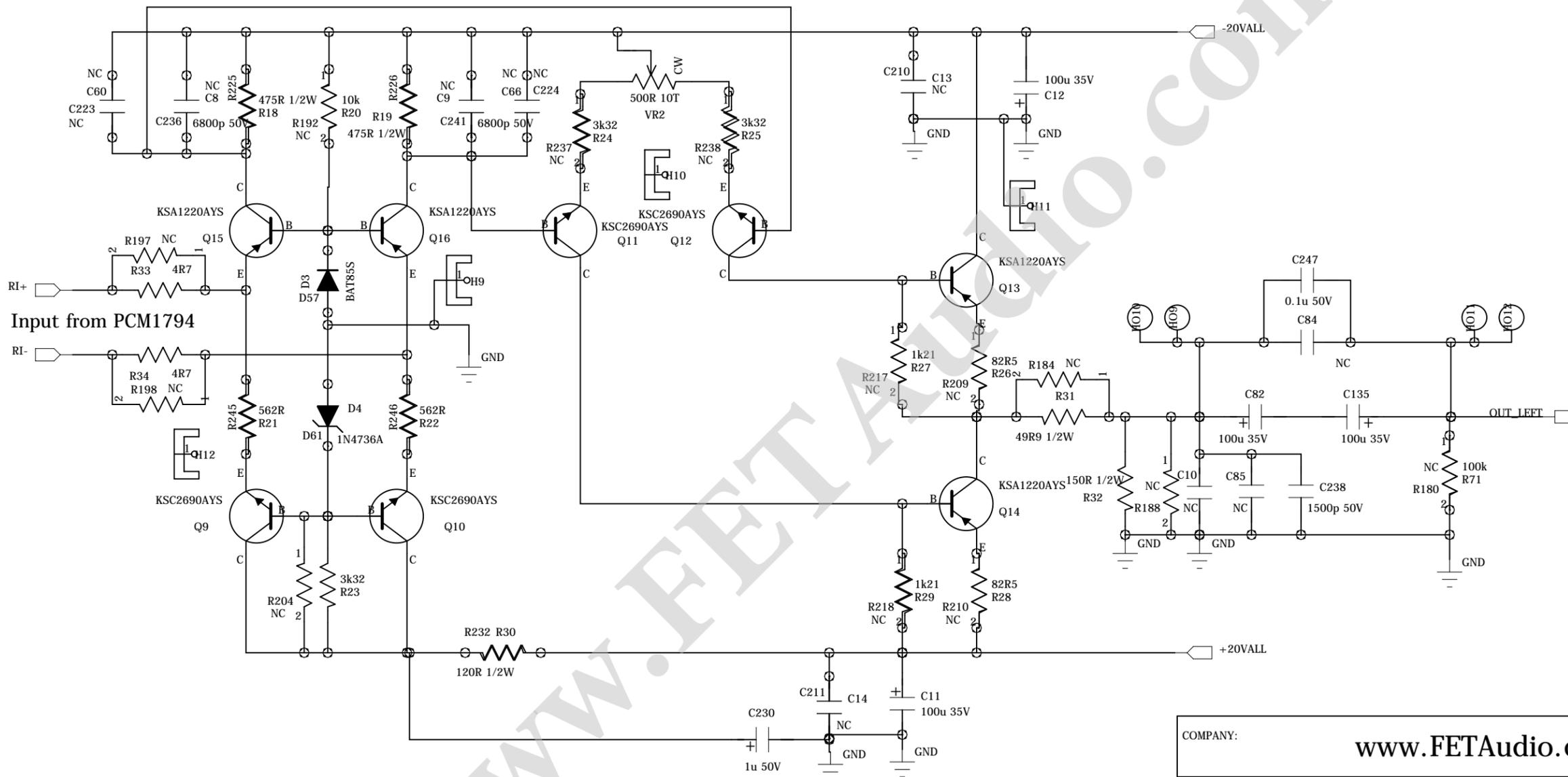
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### Discrete IV Left +V

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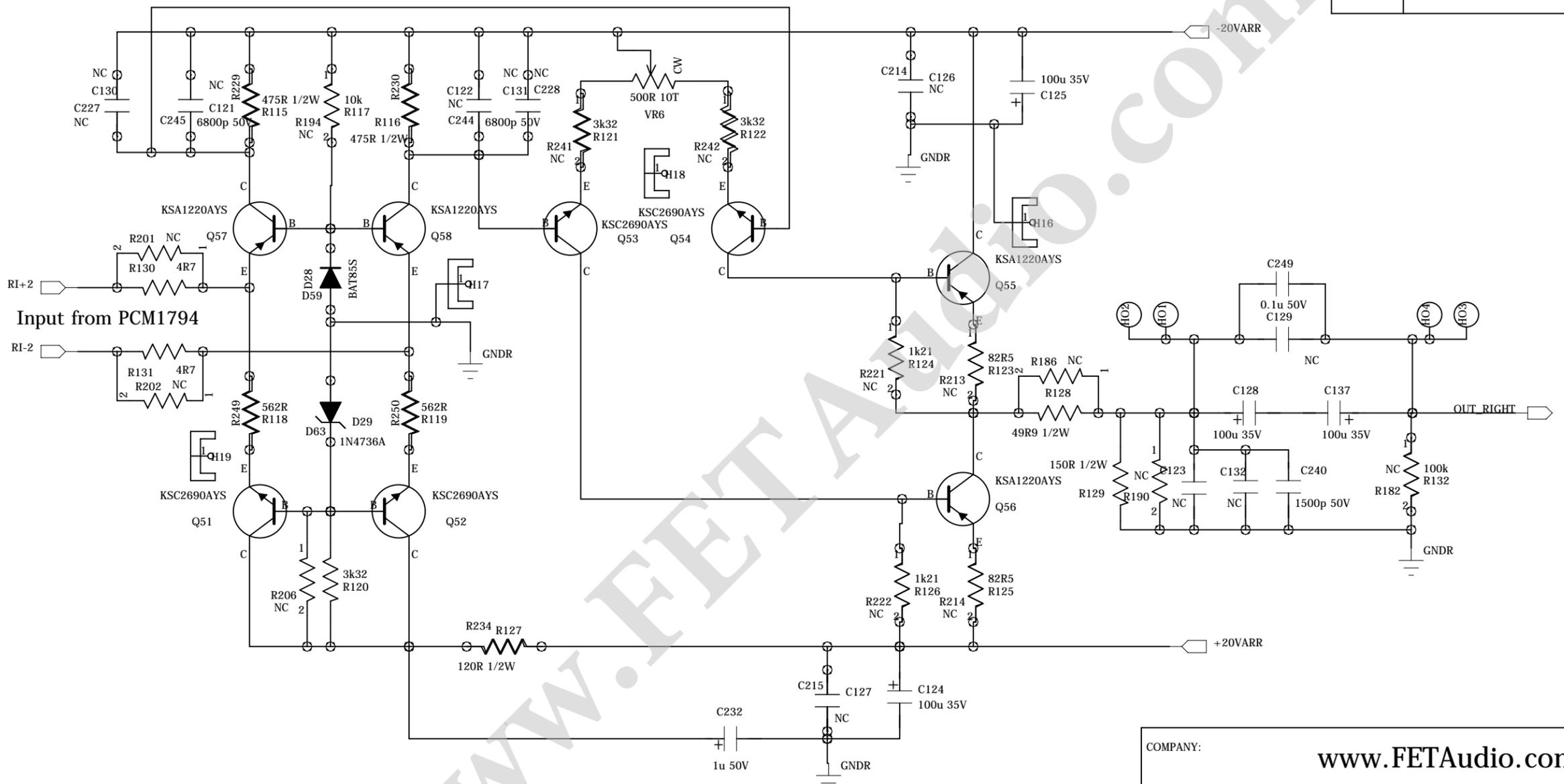
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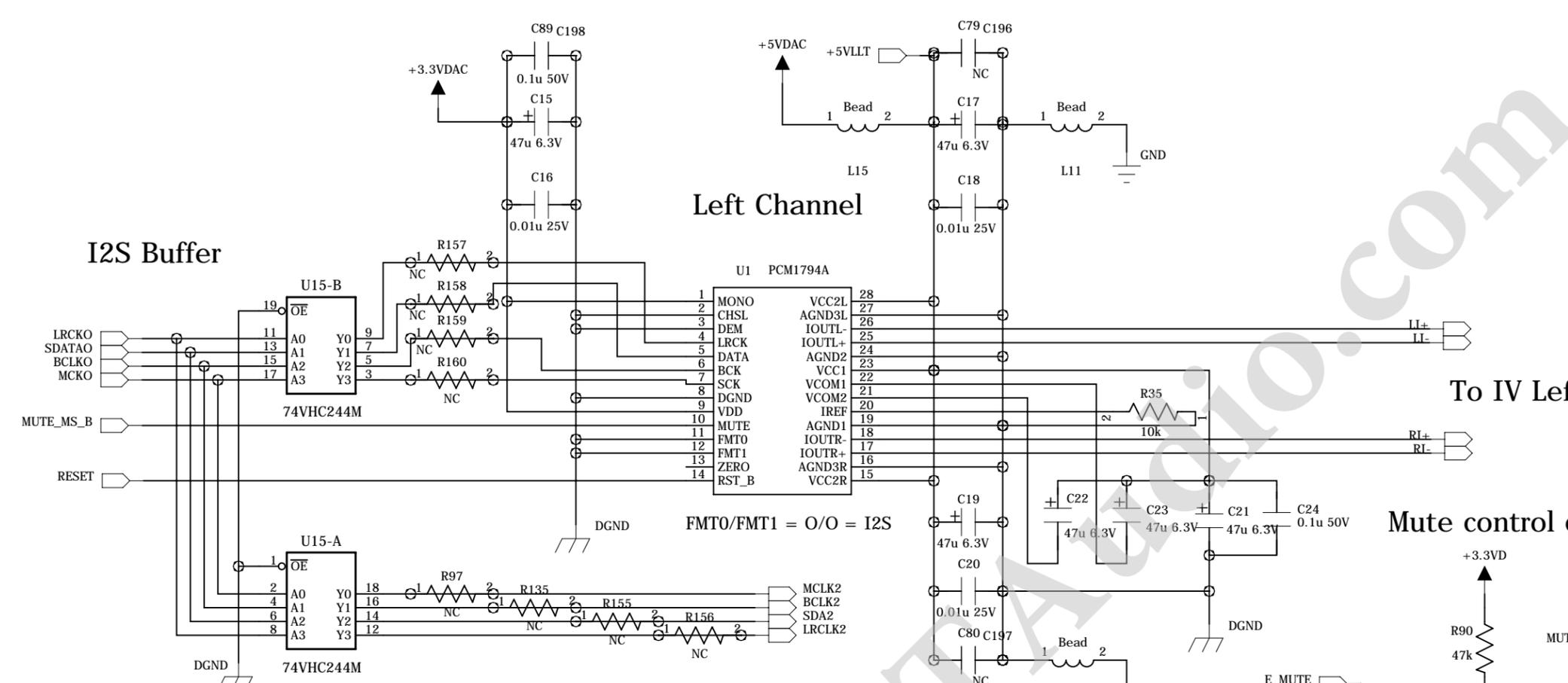
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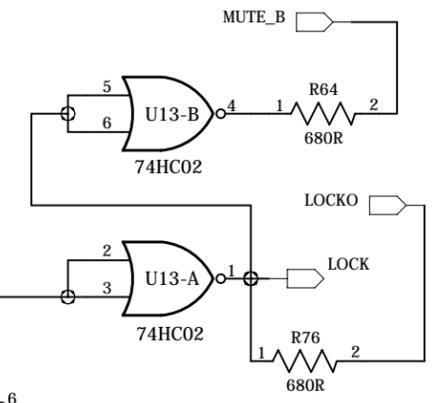
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To IV Left Ch

Mute control circuit

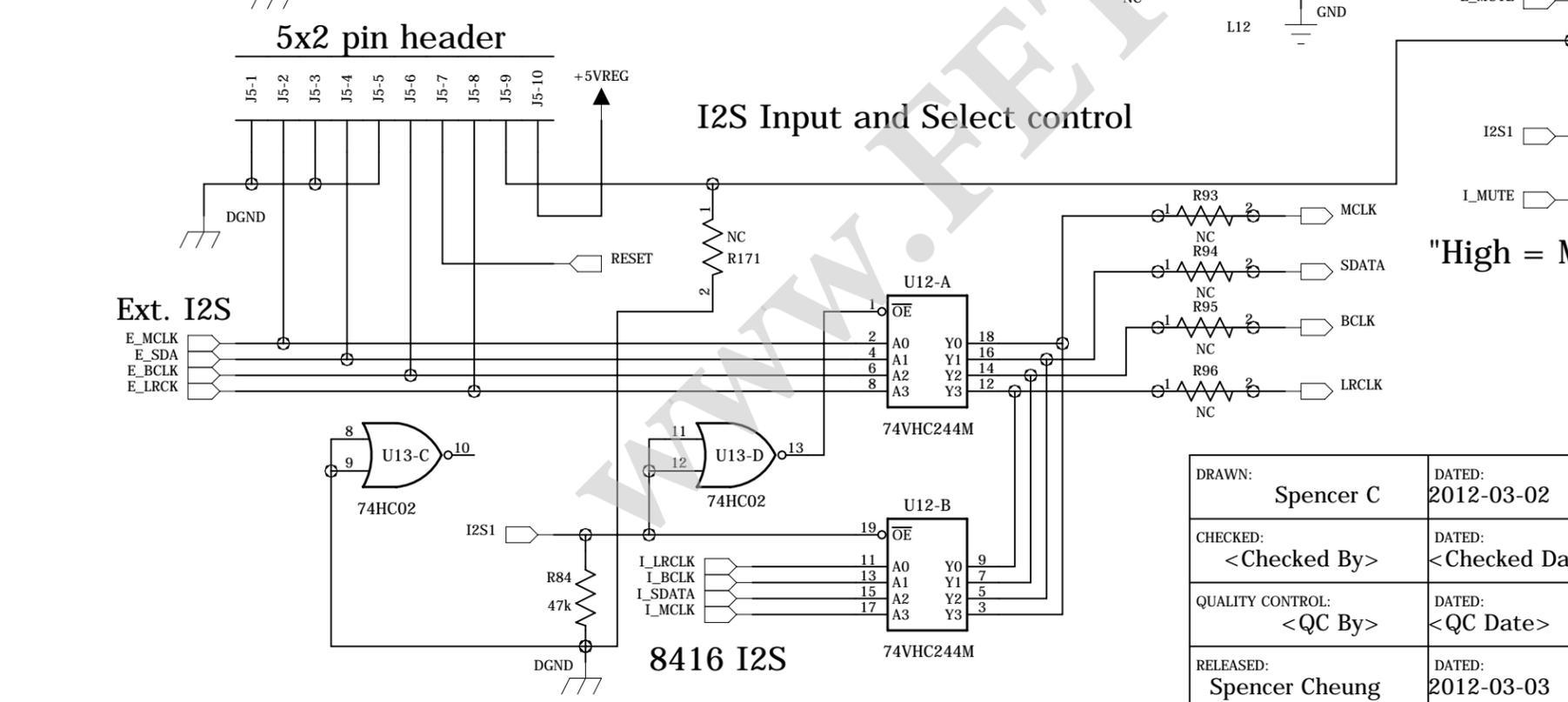


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"High = Mute"

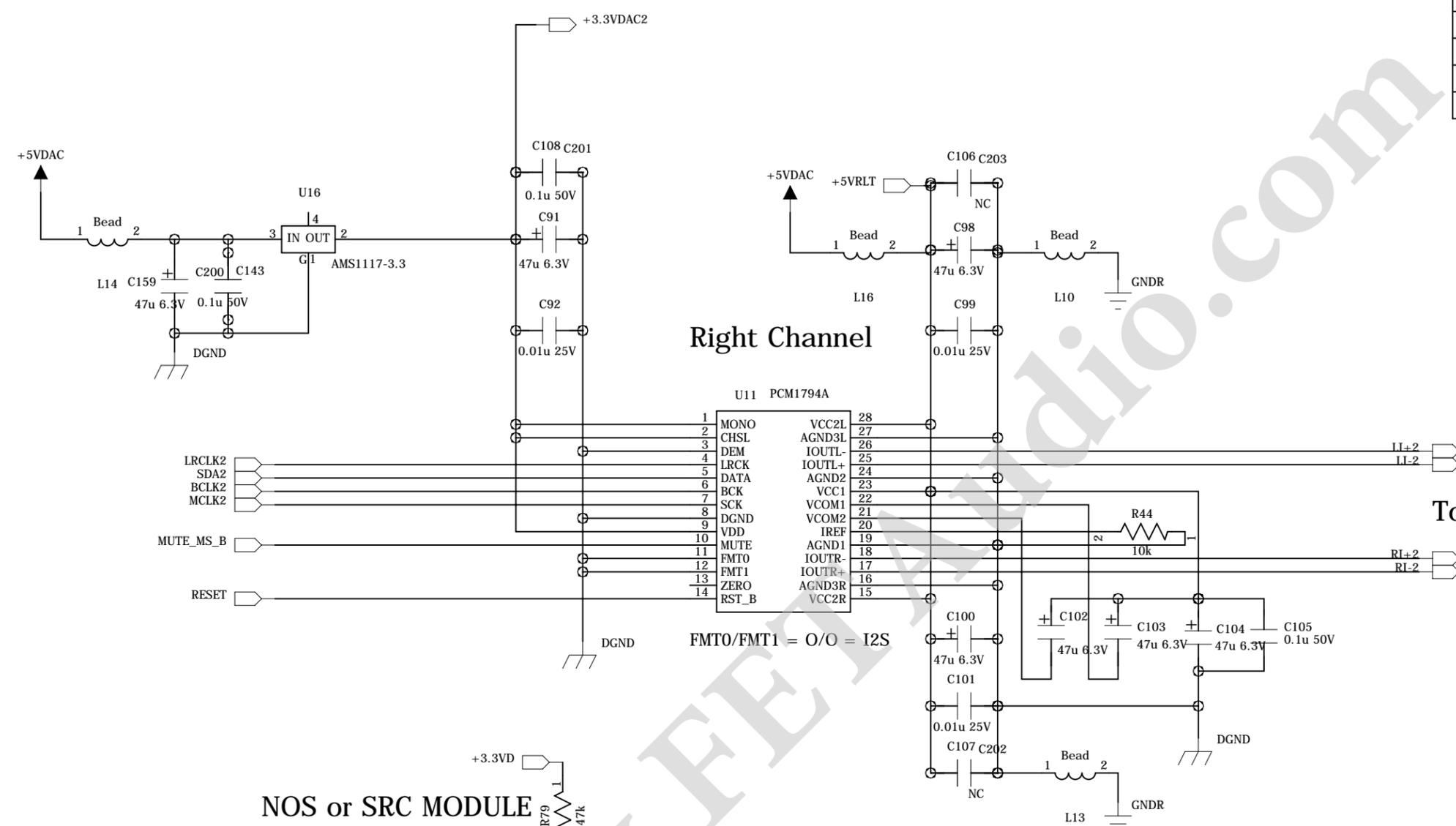
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To IV Right Ch

NOS or SRC MODULE

FMT0/FMT1 = O/O = I2S

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| COMPANY:       |                |                  |                | www.FETAudio.com      |      |                |    |
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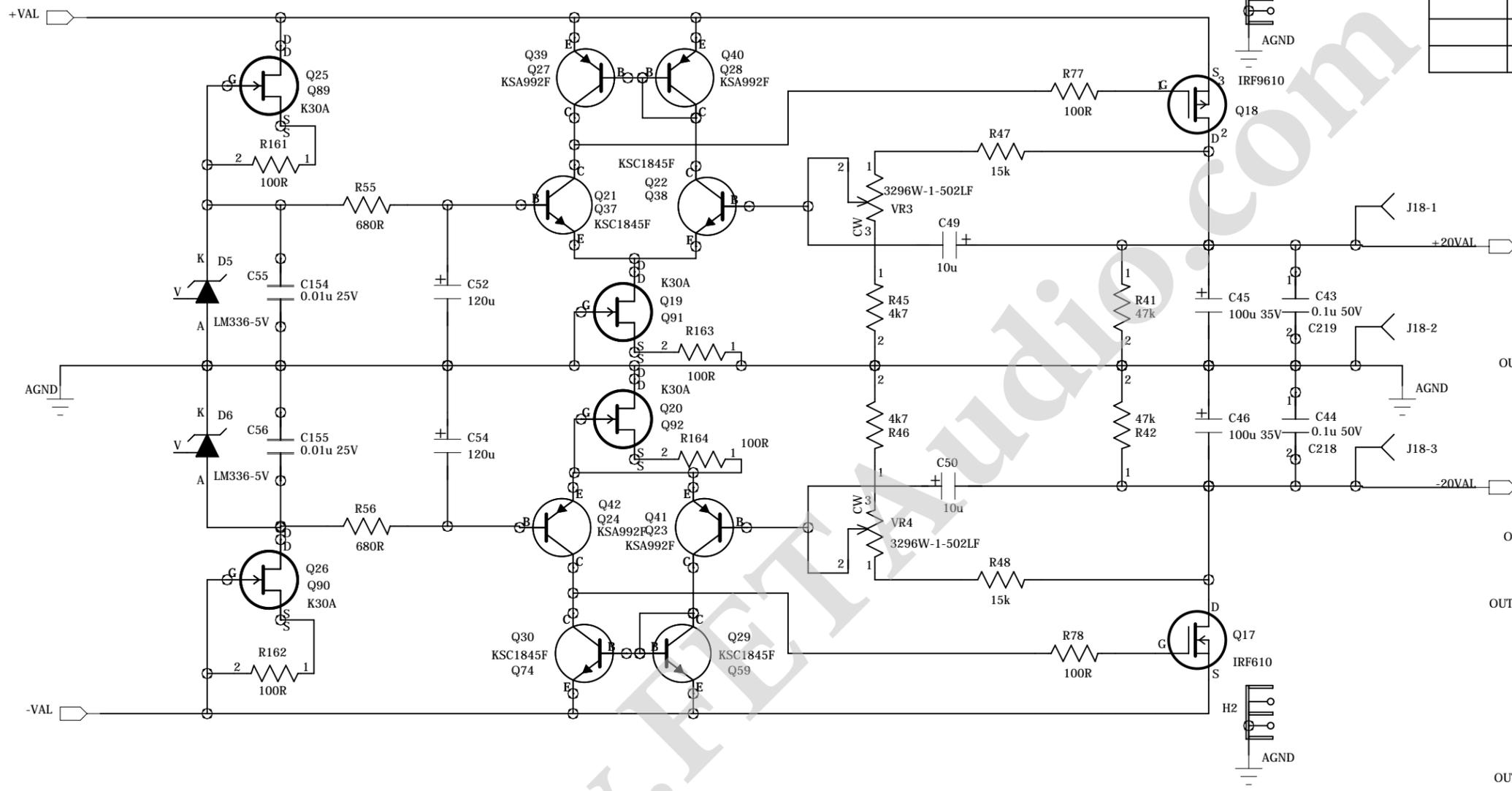
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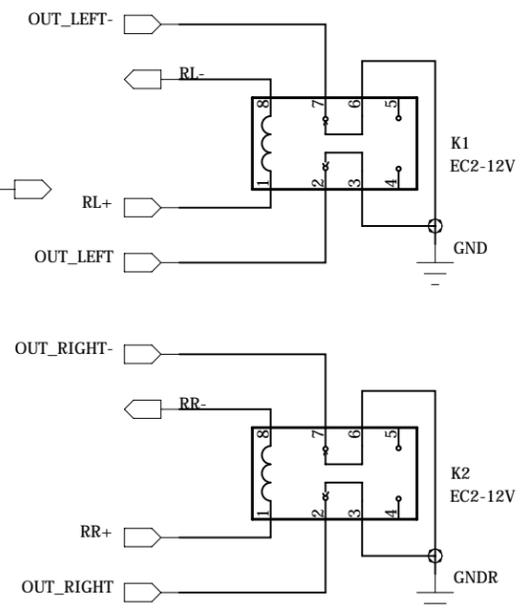
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### Low Noise Super Regulator - Left

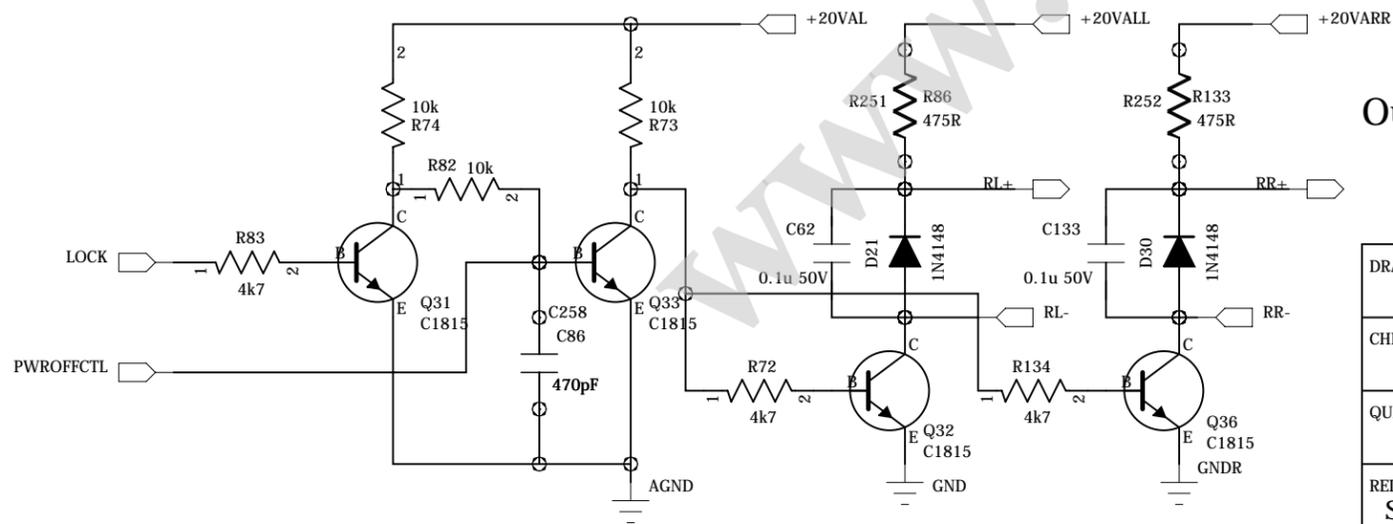


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| LTR             | ECO NO: | APPROVED: | DATE: |
|                 |         |           |       |
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### Mute Relays



### Output Muting Ckt



|                             |                          |
|-----------------------------|--------------------------|
| DRAWN:<br>Spencer C         | DATED:<br>2012-03-02     |
| CHECKED:<br><Checked By>    | DATED:<br><Checked Date> |
| QUALITY CONTROL:<br><QC By> | DATED:<br><QC Date>      |
| RELEASED:<br>Spencer Cheung | DATED:<br>2012-03-03     |

|                                 |            |                          |               |
|---------------------------------|------------|--------------------------|---------------|
| COMPANY:<br>www.FETAudio.com    |            |                          |               |
| TITLE:<br>FDA-1B (PCM1794A DAC) |            |                          |               |
| CODE:<br>WM15                   | SIZE:<br>B | DRAWING NO:<br>FDA-1B-15 | REV:<br>15    |
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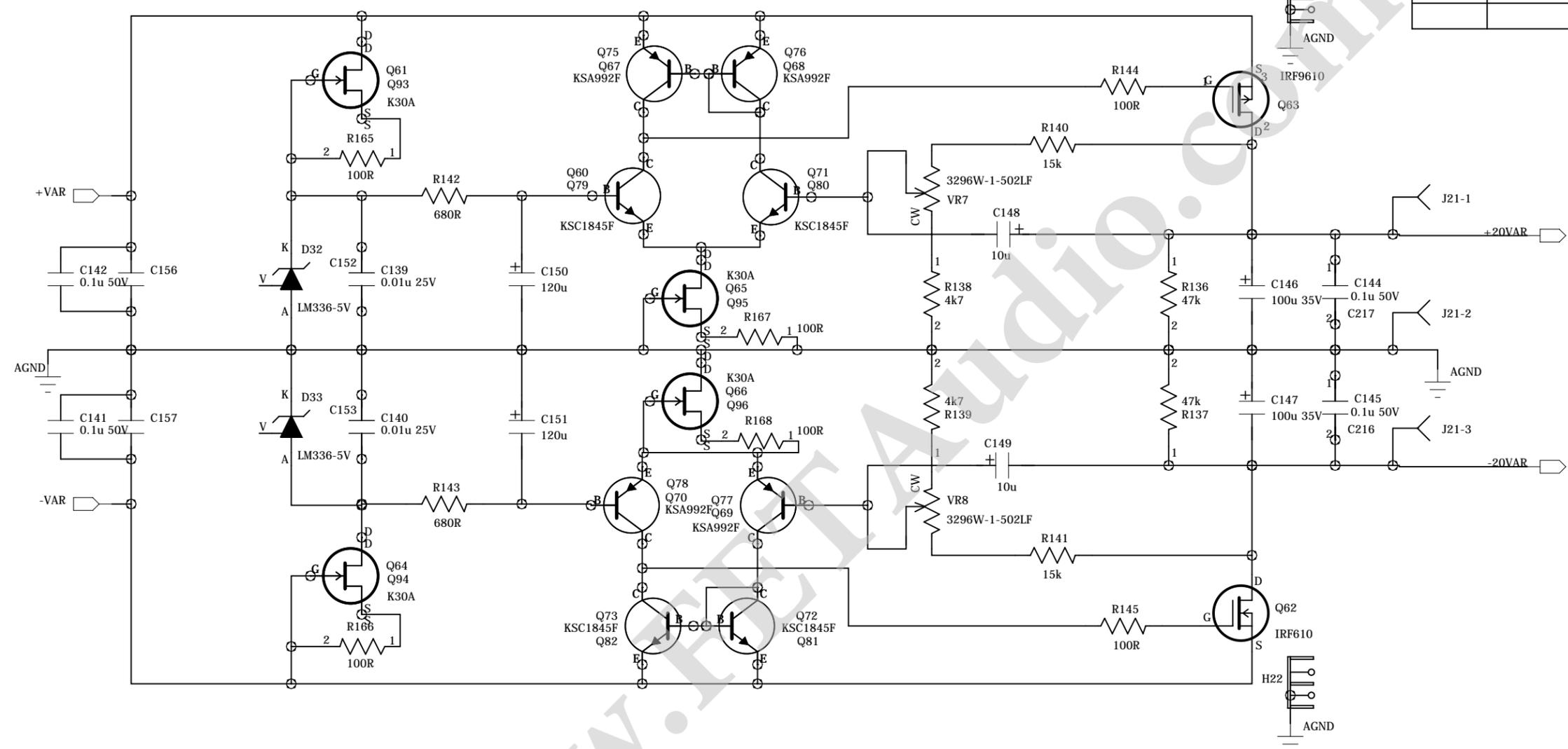
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| REVISION RECORD |         |           |       |
|-----------------|---------|-----------|-------|
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### Low Noise Super Regulator - Right



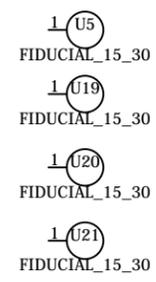
### M3 Screw Holes x 17



### Heatsink air holes



### smt pts



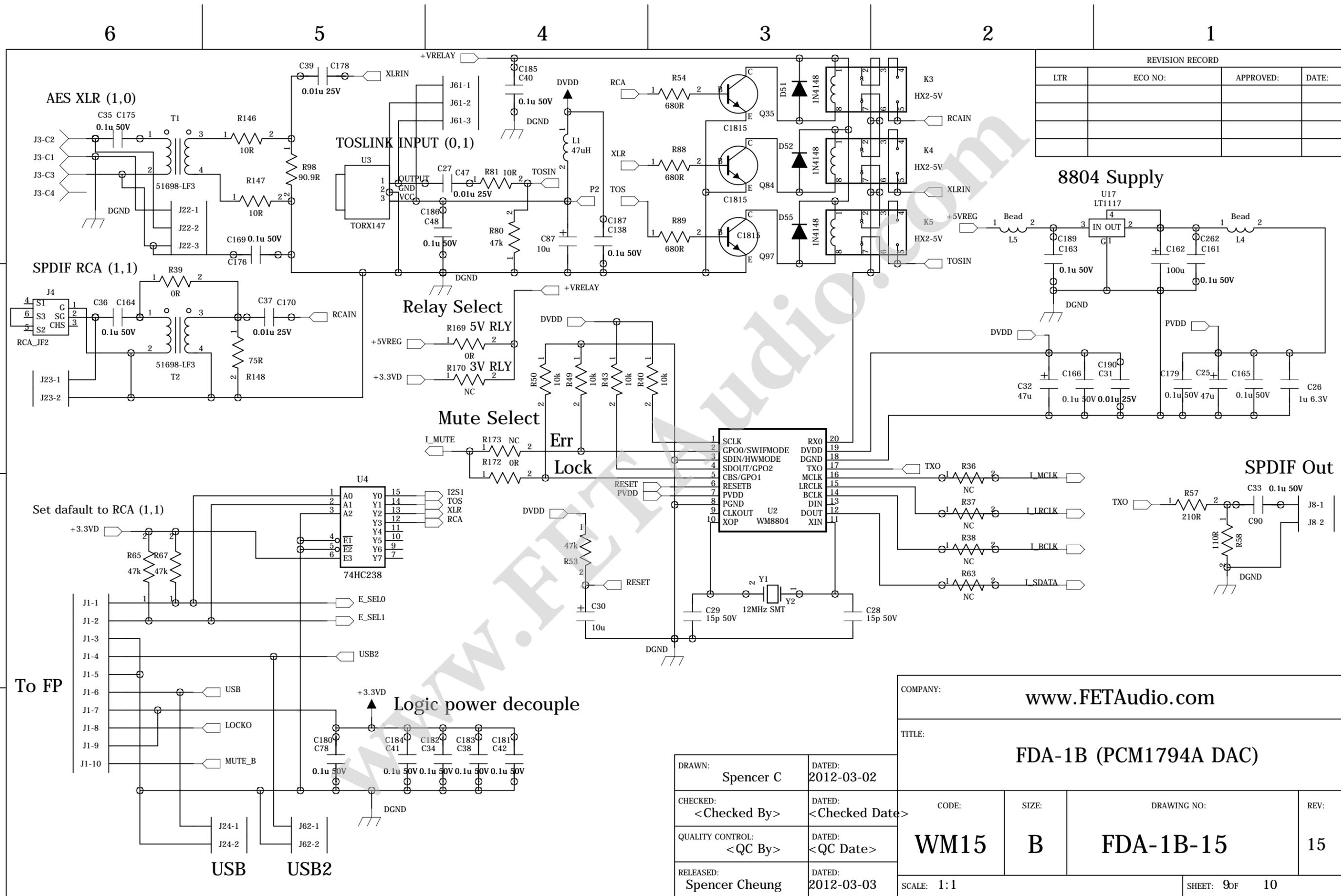
COMPANY: [www.FETAudio.com](http://www.FETAudio.com)

TITLE: **FDA-1B (PCM1794A DAC)**

|                             |                          |
|-----------------------------|--------------------------|
| DRAWN:<br>Spencer C         | DATED:<br>2012-03-02     |
| CHECKED:<br><Checked By>    | DATED:<br><Checked Date> |
| QUALITY CONTROL:<br><QC By> | DATED:<br><QC Date>      |
| RELEASED:<br>Spencer Cheung | DATED:<br>2012-03-03     |

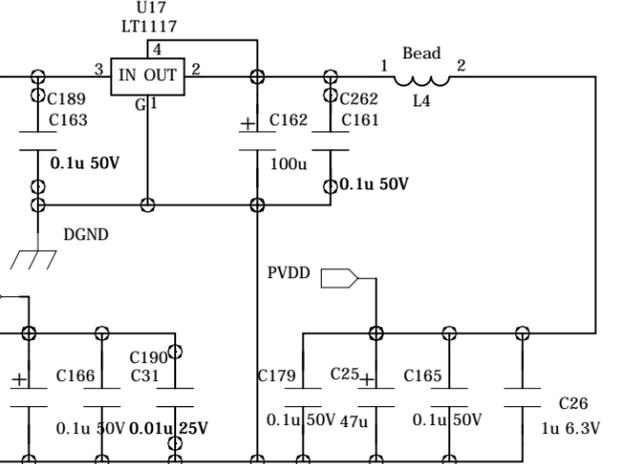
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SCALE: 1:1 SHEET: 8 OF 10

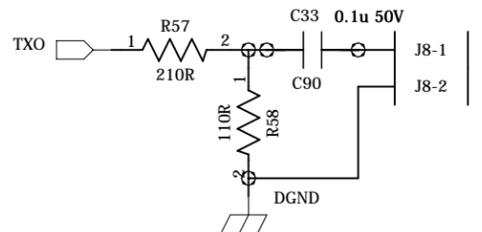


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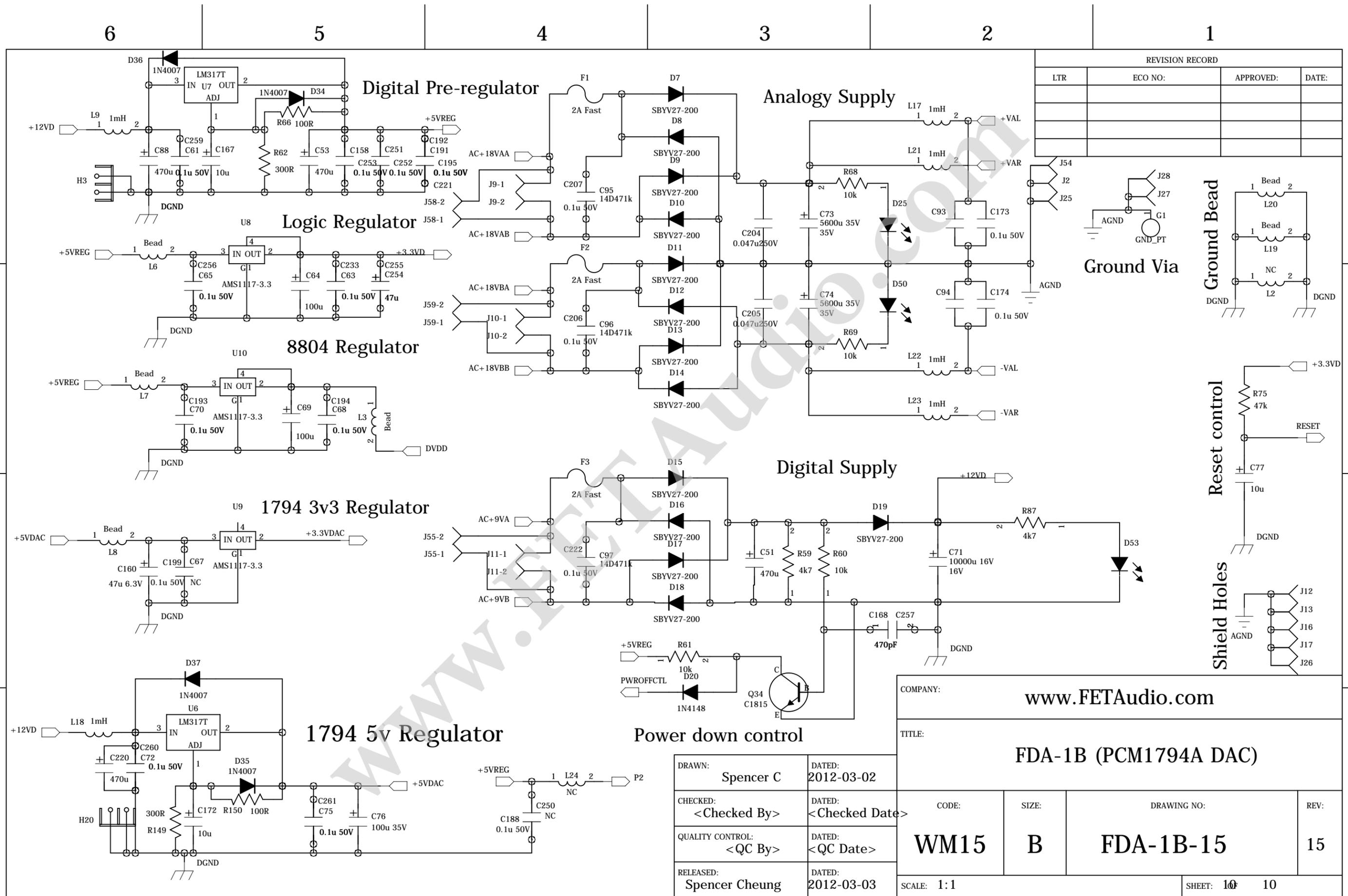
**8804 Supply**



**SPDIF Out**



|                |            |                  |                |                       |                |           |    |
|----------------|------------|------------------|----------------|-----------------------|----------------|-----------|----|
| COMPANY:       |            |                  |                | www.FETAudio.com      |                |           |    |
| TITLE:         |            |                  |                | FDA-1B (PCM1794A DAC) |                |           |    |
| DRAWN:         | DATED:     | CODE:            | SIZE:          | DRAWING NO:           | REV:           |           |    |
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| CHECKED:       | DATED:     | QUALITY CONTROL: | DATED:         | SCALE: 1:1            | SHEET: 9 of 10 |           |    |
| <QC By>        | <QC Date>  | <QC By>          | <QC Date>      |                       |                |           |    |
| RELEASED:      | DATED:     |                  |                |                       |                |           |    |
| Spencer Cheung | 2012-03-03 |                  |                |                       |                |           |    |



| REVISION RECORD |         |           |       |
|-----------------|---------|-----------|-------|
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|              |                |                  |           |                       |            |  |  |
|--------------|----------------|------------------|-----------|-----------------------|------------|--|--|
| COMPANY:     |                |                  |           | www.FETAudio.com      |            |  |  |
| TITLE:       |                |                  |           | FDA-1B (PCM1794A DAC) |            |  |  |
| DRAWN:       | DATED:         | CODE:            | SIZE:     | DRAWING NO:           | REV:       |  |  |
| Spencer C    | 2012-03-02     | WM15             | B         | FDA-1B-15             | 15         |  |  |
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| <Checked By> | <Checked Date> | <QC By>          | <QC Date> | Spencer Cheung        | 2012-03-03 |  |  |
| SCALE: 1:1   |                |                  |           | SHEET: 10 10          |            |  |  |

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| REVISION RECORD |         |           |       |
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| LTR             | ECO NO: | APPROVED: | DATE: |
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D

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C

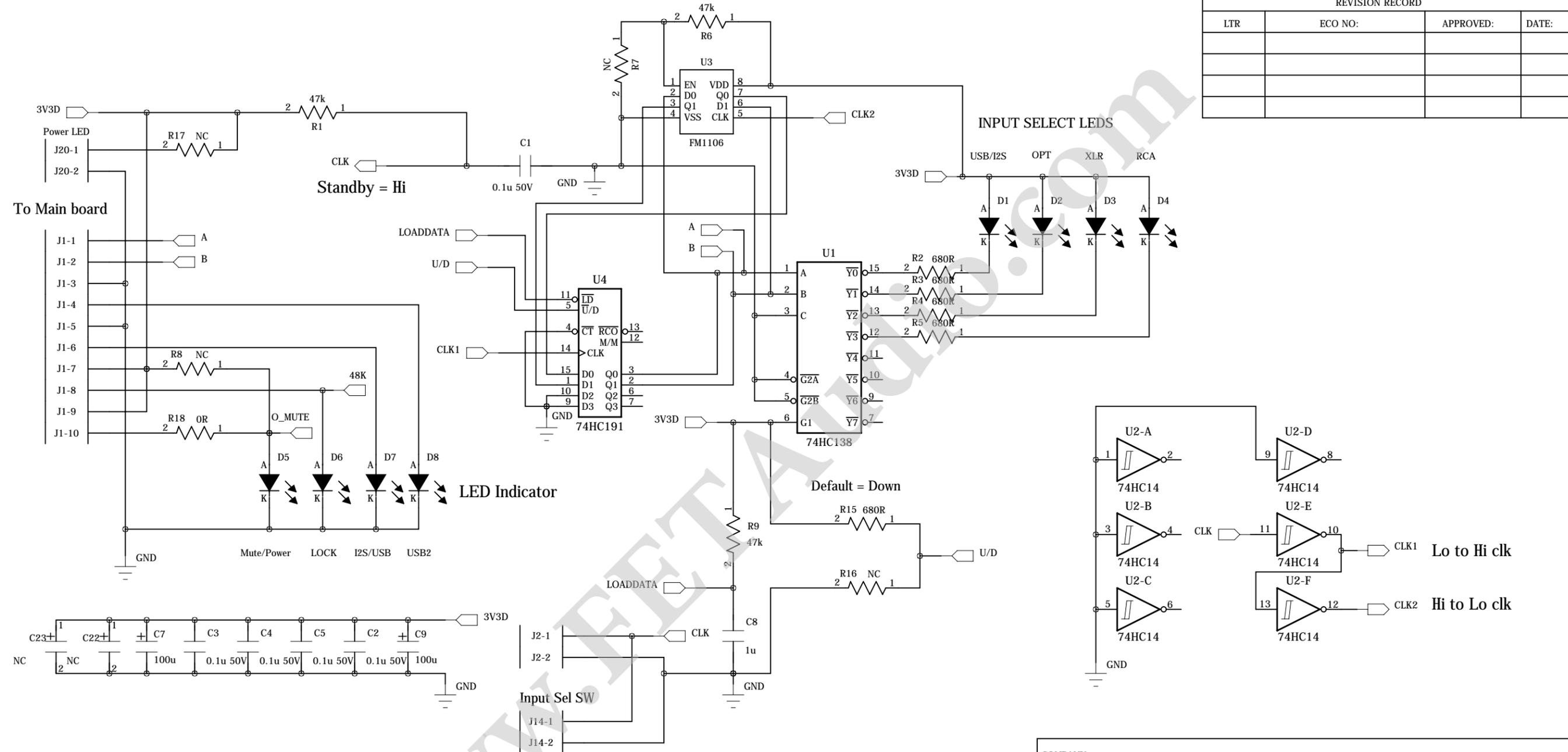
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B

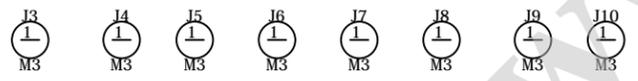
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A

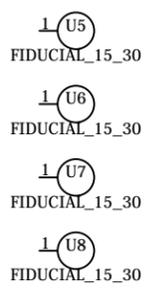
A



M3 Holes x 8



SMT Mark



COMPANY: [www.fetaudio.com](http://www.fetaudio.com)

TITLE: PDA-1B Front Panel, SRC & NOS

|                             |                          |
|-----------------------------|--------------------------|
| DRAWN:<br>Spencer C         | DATED:<br>3-Feb-2012     |
| CHECKED:<br><Checked By>    | DATED:<br><Checked Date> |
| QUALITY CONTROL:<br><QC By> | DATED:<br><QC Date>      |
| RELEASED:<br><Released By>  | DATED:<br><Release Date> |

|                       |                   |                               |                  |
|-----------------------|-------------------|-------------------------------|------------------|
| CODE:<br><b>1794A</b> | SIZE:<br><b>B</b> | DRAWING NO:<br><b>1794-FP</b> | REV:<br><b>6</b> |
| SCALE: <Scale>        |                   |                               | SHEET: 1 of 3    |

6

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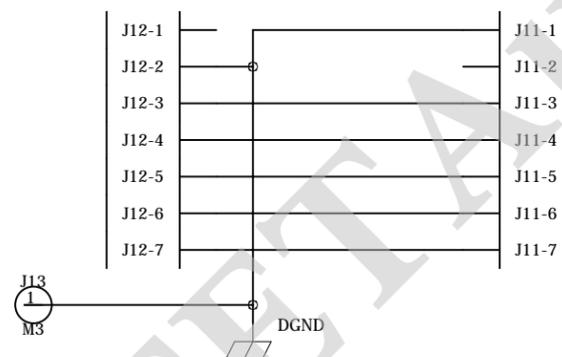
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| REVISION RECORD |         |           |       |
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| LTR             | ECO NO: | APPROVED: | DATE: |
|                 |         |           |       |
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### NOS Board

Pin Header 7 x 1



|                  |               |        |                |                               |       |               |      |
|------------------|---------------|--------|----------------|-------------------------------|-------|---------------|------|
| COMPANY:         |               |        |                | www.fetaudio.com              |       |               |      |
| TITLE:           |               |        |                | PDA-1B Front Panel, SRC & NOS |       |               |      |
| DRAWN:           | Spencer C     | DATED: | 3-Feb-2012     | CODE:                         | SIZE: | DRAWING NO:   | REV: |
| CHECKED:         | <Checked By>  | DATED: | <Checked Date> | 1794A                         | B     | 1794-FP       | 6    |
| QUALITY CONTROL: | <QC By>       | DATED: | <QC Date>      | SCALE: <Scale>                |       | SHEET: 2 of 3 |      |
| RELEASED:        | <Released By> | DATED: | <Release Date> |                               |       |               |      |

D

C

B

A

D

C

B

A

| Item                         | Reference                                                                                                                                   | Value                                  | Qty | PCB DECAL                |
|------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------|-----|--------------------------|
| <b>FDA-1B DAC main board</b> |                                                                                                                                             |                                        |     |                          |
| 2                            | Q1-2 Q7-8 Q13-16 Q47-50 Q55-58                                                                                                              | KSA1220AYS                             | 16  | TO-2-8H1A                |
| 4                            | Q3-6 Q9-12 Q43-46 Q51-54                                                                                                                    | KSC2690AYS                             | 16  | TO-2-8H1A                |
| 6                            | T1                                                                                                                                          | 51698-LF3 pulse trans                  | 1   | 51698-LF3                |
| 7                            | T2                                                                                                                                          | NC                                     | 1   | 51698-LF3                |
| 8                            | U14                                                                                                                                         | 74HC00D                                | 1   | SO14                     |
| 9                            | U13                                                                                                                                         | 74HC02D                                | 1   | SO14                     |
| 10                           | U4                                                                                                                                          | 74HC238D                               | 1   | SO16NB                   |
| 11                           | U12 U15                                                                                                                                     | 74VHC244M                              | 2   | SO20WB                   |
| 12                           | Q37-38 Q59 Q74 Q79-82                                                                                                                       | KSC1845F                               | 8   | TO-92D                   |
| 13                           | Q39-42 Q75-78                                                                                                                               | KSA992F                                | 8   | TO-92D                   |
| 14                           | D7-19                                                                                                                                       | BYV27-150                              | 13  | DO35                     |
| 15                           | C16 C18 C20 C27 C39 C92 C99 C101 C139-140 C154-155 C170 C190                                                                                | 0.01u 25V 0603                         | 14  | 0805S                    |
| 16                           | C37 C31 C178 C47                                                                                                                            | NC                                     | 4   | CK06                     |
| 17                           | C24 C34-35 C38 C41-42 C62 C78 C90 C105 C133 C141-142 C164-166 C169 C173-174 C185-189 C191-203 C206-219 C221-222 C233 C246-249 C256 C259-262 | 0.1u 50V 0603                          | 63  | 0805S                    |
| 18                           | C183-184 C33 C48 C61 C138 C40 C63 C158 C161 C163 C65 C68 C70 C72 C75 C36 C175 C251-253 C176 C179-182                                        | NC                                     | 26  | CK06                     |
| 19                           | C237-240                                                                                                                                    | 1500p 50V 0805                         | 4   | 0805S                    |
| 20                           | C28-29                                                                                                                                      | 15p 50V 0603                           | 2   | 0805S                    |
| 21                           | C26                                                                                                                                         | 1u 6.3V 0805                           | 1   | 0805                     |
| 22                           | C86 C168                                                                                                                                    | NC                                     | 2   | CK06                     |
| 23                           | C257-258                                                                                                                                    | 470pF 50V 0603                         | 2   | 0805S                    |
| 24                           | C234-236 C241-245                                                                                                                           | 6800p 50V 0805                         | 8   | 0805S                    |
| 25                           | C250                                                                                                                                        | NC                                     | 1   | CK06                     |
| 26                           | C204-205                                                                                                                                    | 0.047u250V 1206                        | 2   | 1206                     |
| 27                           | C171 C177 C223-228                                                                                                                          | NC                                     | 8   | 1206                     |
| 28                           | C71                                                                                                                                         | 10000u 16V SU                          | 1   | CX-P10X25MM              |
| 29                           | C64 C69 C162                                                                                                                                | 100u 6.3V OS-con                       | 3   | 279B-01                  |
| 30                           | C4-5 C11-12 C45-46 C76 C81-82 C112-113 C116 C124-125 C128 C134-137 C146-147                                                                 | 100u 35V Silmic II                     | 21  | ECAP-A-5X10MM            |
| 31                           | C30 C49-50 C77 C87 C148-149 C167 C172                                                                                                       | 12u 35V FC                             | 9   | 279B-01                  |
| 32                           | C52 C54 C150-151                                                                                                                            | 120u 25V FC                            | 4   | ECAP-3X8MM               |
| 33                           | C229-232                                                                                                                                    | NC                                     | 4   | 279B-01                  |
| 34                           | C51 C53 C88 C220                                                                                                                            | 470u 16V FA                            | 4   | ECAP-3X8MM               |
| 35                           | C25 C32 C254-255                                                                                                                            | 47u 6.3V OS-con                        | 4   | 279B-01                  |
| 36                           | C15 C17 C19 C21-23 C91 C98 C100 C102-104 C159-160                                                                                           | 47u 6.3V Silmic II                     | 14  | ECAP-3X8MM               |
| 37                           | C73-74                                                                                                                                      | 5600u 35V Audio                        | 2   | CX-P10X25MM              |
| 38                           | C95-97                                                                                                                                      | NC                                     | 3   | CFR04R-B1                |
| 48                           | J1                                                                                                                                          | 2x5 Male HD                            | 1   | HD-10V                   |
| 49                           | J8 J24 J62                                                                                                                                  | 2x1 female HD                          | 3   | SIP-2P                   |
| 50                           | J23                                                                                                                                         | 2x1 male HD                            | 1   | SIP-2P                   |
| 51                           | J55 J58-59                                                                                                                                  | 2x3 96mm male Connector                | 3   | CON_P2                   |
| 53                           | J22 J61                                                                                                                                     | 3x1 male HD                            | 2   | SIP-3P                   |
| 54                           | J18-21                                                                                                                                      | 6 x 150mm Con Wire                     | 6   | CON_P3_508               |
| 55                           | U18                                                                                                                                         | SRC Module board IC 7-pin socket M + F | 4   | CS8421_SRC               |
| 56                           | D34-37                                                                                                                                      | 1N4007                                 | 4   | R1/8WA                   |
| 57                           | D20                                                                                                                                         | 1N4148                                 | 1   | DO_MINI                  |
| 58                           | D21 D30 D51-52 D55                                                                                                                          | 1N4148                                 | 5   | DIODE_V                  |
| 60                           | D56-59                                                                                                                                      | BAT85S or BAS85                        | 4   | MLL34                    |
| 62                           | F1-3                                                                                                                                        | 2A T type                              | 3   | FUSE-5MM                 |
| 64                           | J5                                                                                                                                          | 2x5 female HD                          | 1   | HEADER10                 |
| 65                           | H4 H6 H8 H10 H12-13 H18-19                                                                                                                  | 10x15x21mm Heat sink                   | 8   | HEATSINK_MINI            |
| 66                           | H5 H9 H14 H17                                                                                                                               | 16x24x21mm Heat sink                   | 4   | HS_900_635MIL            |
| 67                           | H7 H11 H15-16                                                                                                                               | 16x24x30mm Black Heat sink             | 4   | HS_900_635MIL            |
| 68                           | H1-3 H20-22                                                                                                                                 | 16x16x25mm Black Heat sink             | 6   | HEATSINK_630X630X1000MIL |
| 70                           | L9 L18                                                                                                                                      | 1mH 500mA Inductor                     | 2   | IND-R-5MM                |
| 71                           | L1                                                                                                                                          | 47uH 100mA                             | 1   | IND-MOLDED_400MIL        |
| 72                           | L3-8 L10-17 L21-23                                                                                                                          | Bead                                   | 17  | IND-MOLDED_400MIL        |
| 73                           | L19-20                                                                                                                                      | Bead                                   | 2   | IND-MOLDED_300MIL        |
| 74                           | L2                                                                                                                                          | NC                                     | 1   | IND-MOLDED_400MIL        |
| 75                           | L24                                                                                                                                         | NC                                     | 1   | IND-MOLDED_400MIL        |
| 76                           | Q17 Q62                                                                                                                                     | IRF610                                 | 2   | IRF610-GDS               |
| 77                           | Q18 Q63                                                                                                                                     | IRF9610                                | 2   | IRF9610-GDS              |
| 78                           | Q89-96                                                                                                                                      | K30A-Y                                 | 8   | TO-92D                   |
| 79                           | D25 D50 D53                                                                                                                                 | LED TH Green                           | 3   | LED                      |
| 80                           | D5-6 D32-33                                                                                                                                 | LM336-5                                | 4   | TO-92D                   |
| 81                           | U6-7                                                                                                                                        | LM317T                                 | 2   | TO-220-UP                |
| 82                           | U8-10 U16-17                                                                                                                                | AMS1117-3.3V                           | 5   | SOT223                   |
| 84                           | Q31-36 Q84 Q97                                                                                                                              | KSC1815                                | 8   | TO-92D                   |
| 86                           | U1 U11                                                                                                                                      | PCM1794A                               | 2   | SSOP28                   |
| 88                           | J4 J6-7                                                                                                                                     | RCA H G/R/W color                      | 3   | RCA_JF2A                 |
| 89                           | R39 R169                                                                                                                                    | 0R - Jumper                            | 2   | R1/8W                    |
| 90                           | R172                                                                                                                                        | 0R - Jumper                            | 1   | R1/4WA                   |
| 91                           | R66 R77-78 R144-145 R150 R161-168                                                                                                           | 100R                                   | 14  | R1/4WA                   |
| 92                           | R81 R146-147                                                                                                                                | 10R                                    | 3   | R1/4WA                   |
| 93                           | R35 R44                                                                                                                                     | 10k                                    | 2   | R1/4WA                   |
| 94                           | R43 R40 R49-50 R68-69                                                                                                                       | 10k                                    | 6   | R1/4WA                   |
| 95                           | R60-61 R73-74 R82                                                                                                                           | 10k                                    | 5   | R1/8W                    |
| 96                           | R58                                                                                                                                         | 110R                                   | 1   | R1/4WA                   |
| 97                           | R47-48 R140-141                                                                                                                             | 15k                                    | 4   | R1/4WA                   |
| 98                           | R57                                                                                                                                         | 210R                                   | 1   | R1/4WA                   |
| 99                           | R62 R149                                                                                                                                    | 301R                                   | 2   | R1/4WA                   |
| 100                          | R41-42 R53 R65 R67 R79-80 R84 R90 R136-137                                                                                                  | 47k                                    | 11  | R1/4WA                   |
| 101                          | R75                                                                                                                                         | 47k                                    | 1   | R1/8W                    |
| 102                          | R45-46 R72 R87 R134 R138-139                                                                                                                | 4k7                                    | 7   | R1/4WA                   |
| 103                          | R59 R83                                                                                                                                     | 4k7                                    | 2   | R1/8W                    |
| 104                          | R54-56 R64 R76 R88-89 R142-143                                                                                                              | 680R                                   | 9   | R1/4WA                   |
| 105                          | R148                                                                                                                                        | 75R                                    | 1   | R1/8W                    |
| 106                          | R98                                                                                                                                         | 90.9R                                  | 1   | R1/4WA                   |
| 120                          | R70-71 R114 R132                                                                                                                            | 100k                                   | 4   | R1/8W                    |
| 121                          | R3 R20 R99 R117                                                                                                                             | 10k                                    | 4   | R1/8W                    |

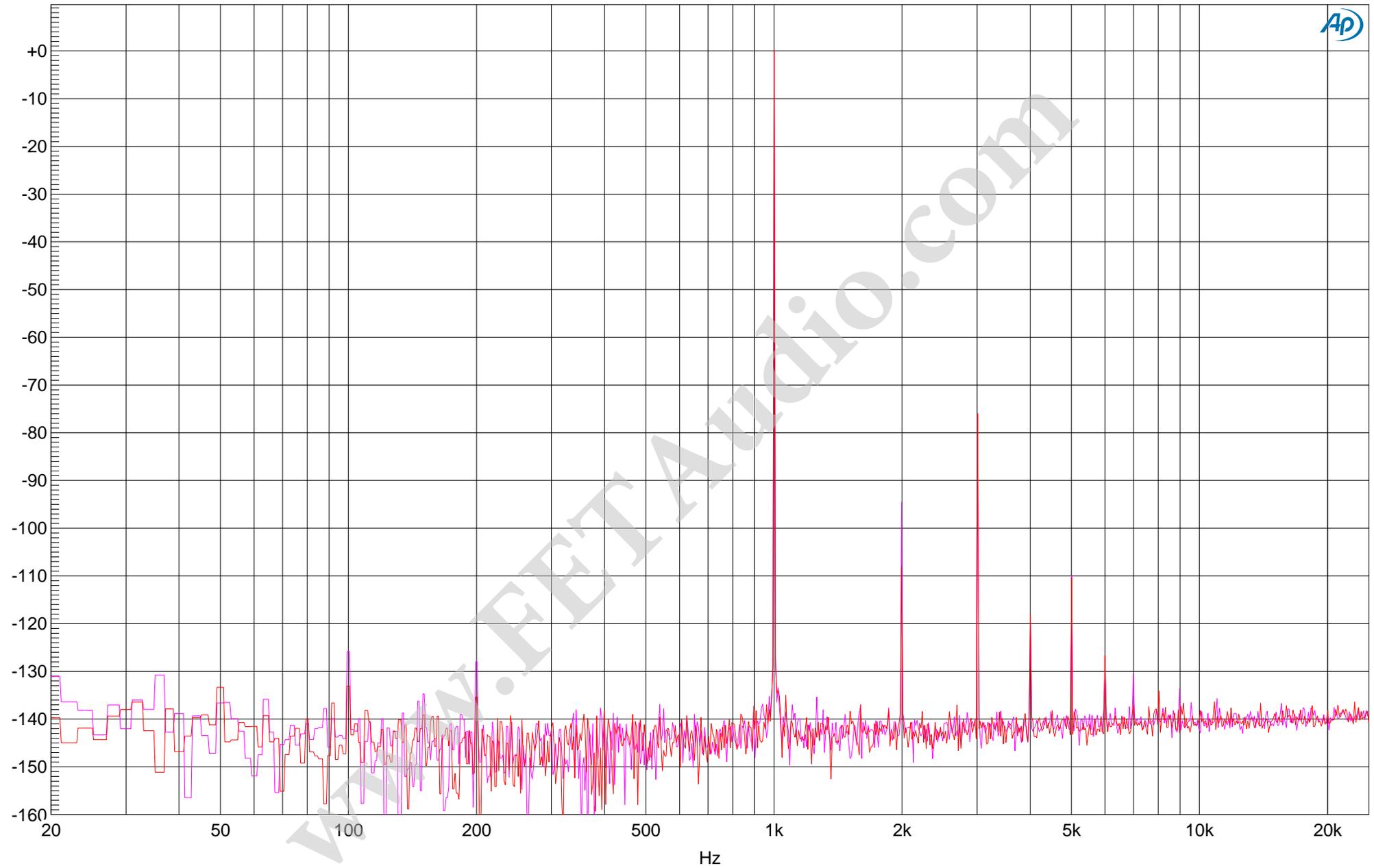
| Item                             | Reference                               | Value                    | Qty | PCB DECAL      |
|----------------------------------|-----------------------------------------|--------------------------|-----|----------------|
| 122                              | R13 R30 R109 R127                       | 120R                     | 4   | R1/8W          |
| 123                              | R15 R32 R111 R129                       | 150R                     | 4   | R1/8W          |
| 124                              | R10 R12 R27 R29 R106 R108 R124 R126     | 1k21                     | 8   | R1/8W          |
| 125                              | R7-8 R24-25 R103-104 R121-122           | 3k32                     | 8   | R1/8W          |
| 126                              | R6 R23 R102 R120                        | 3k01                     | 4   | R1/8W          |
| 127                              | R86 R133                                | 475R                     | 2   | R1/8W          |
| 128                              | R1-2 R18-19 R91-92 R115-116             | 475R                     | 8   | R1/8W          |
| 129                              | R14 R31 R110 R128                       | 49R9                     | 4   | R1/8W          |
| 130                              | R16-17 R33-34 R112-113 R130-131         | 4R02                     | 8   | R1/8W          |
| 131                              | R4-5 R21-22 R100-101 R118-119           | 562R                     | 8   | R1/8W          |
| 132                              | R9 R11 R26 R28 R105 R107 R123 R125      | 82R5                     | 8   | R1/8W          |
| 133                              | K1-2                                    | EC2-12V NED              | 2   | RLY-NEC-EC2    |
| 134                              | K3-5                                    | TX2-5V Panasonic         | 3   | RLY-NEC-EC2    |
| 135                              | U3                                      | TORX147L, or TORX177L    | 1   | TORX147_OK     |
| 136                              | VR1-2 VR5-6                             | VR 500R 10T 501          | 4   | VRES-TOP-ADJ   |
| 137                              | VR3-4 VR7-8                             | VR 5k 10T 502            | 4   | VRES-TOP-ADJ   |
| 138                              | U2                                      | WM8804                   | 1   | SSOP20-1       |
| 139                              | J14-15                                  | NC3MAA-H1 XLR male       | 2   | XLR-MALE       |
| 140                              | J3                                      | NC3FAA-H2 XLR female     | 1   | XLR_FEMALE_G   |
| 141                              | Y1                                      | 12MHz SMT                | 1   | XTAL_HC49SMT   |
| 143                              | D2 D4 D27 D29                           | 1N4736A 6V8 zener        | 4   | DO_MINIS       |
| 145                              | PCB Main Board                          | FDA-1B-DIY-V15c          | 1   | 8x11 in FR4    |
| 146                              | NOS pcb                                 | NOS BD PCB               | 1   | NOS pcb        |
| 147                              | NOS Pcb Mount                           | M3x5mm Screw             | 2   | NOS Mount      |
| 148                              | NOS Pcb Mount                           | M3 x 8mm spacer          | 1   | NOS Mount      |
| 149                              | H1 to H22                               | M3 x 10mm Screw          | 22  | Heatsink mount |
| 150                              | H1 to H22                               | M3 spring washer         | 24  | Heatsink mount |
| 151                              | H1-3 H20-22                             | M3-R insulation washer   | 6   | Heatsink mount |
| 152                              | H1-3 H20-22                             | Mica TO-220              | 6   | Heatsink mount |
| <b>FRONT PANEL CONTROL BOARD</b> |                                         |                          |     |                |
| 2                                | U2                                      | 74HC14D                  | 1   | SO14NB         |
| 3                                | U1                                      | 74HC138D                 | 1   | SO16NB         |
| 4                                | U4                                      | 74HC191D                 | 1   | SO16NB         |
| 6                                | C2-5                                    | 0.1u 50V 0603            | 4   | 0805           |
| 7                                | C1 C8                                   | 1u 0805                  | 2   | 0805           |
| 8                                | C7 C9                                   | 100u 10V or 16V          | 2   | 279B-01        |
| 12                               | J1                                      | 2x5 2.5mm male connector | 1   | HD-10V         |
| 13                               | J2                                      | 2.5mm male HD            | 1   | SIP-2P         |
| 17                               | U3                                      | FM1106                   | 1   | SOT-23         |
| 19                               | D1-4 D6-7                               | LED Green                | 7   | LED            |
| 20                               | D5                                      | LED Red                  | 1   | LED            |
| 26                               | R1 R6 R9                                | 47k                      | 3   | 0805           |
| 27                               | R2-5 R8 R15                             | 580k                     | 6   | 0805           |
| 31                               | FP V7.1 pcb                             | FP V7.1 pcb              | 1   | FP PCB         |
| 32                               | Mounting screws                         | Screw M3x5mm             | 8   |                |
| 33                               | Mounting Spacer                         | Spacer M3x8mm threaded   | 8   |                |
| 34                               | Flat cable 10 pin                       | 12 inches                | 1   |                |
| 35                               | 5x2 2.54mm plug for flat cable          | 5x2 header plug          | 2   |                |
| 36                               | Push Switch                             | Push SW                  | 1   |                |
| 37                               | Push SW wires with connector and socket | Wire 200mm               | 1   |                |
| 38                               | I2S daughter board                      | TBD                      | 0   |                |

SMD parts

FDA-1B FFT measurement  
FFT at 0dbFS, load 100k for all measurement



d  
B  
r  
A

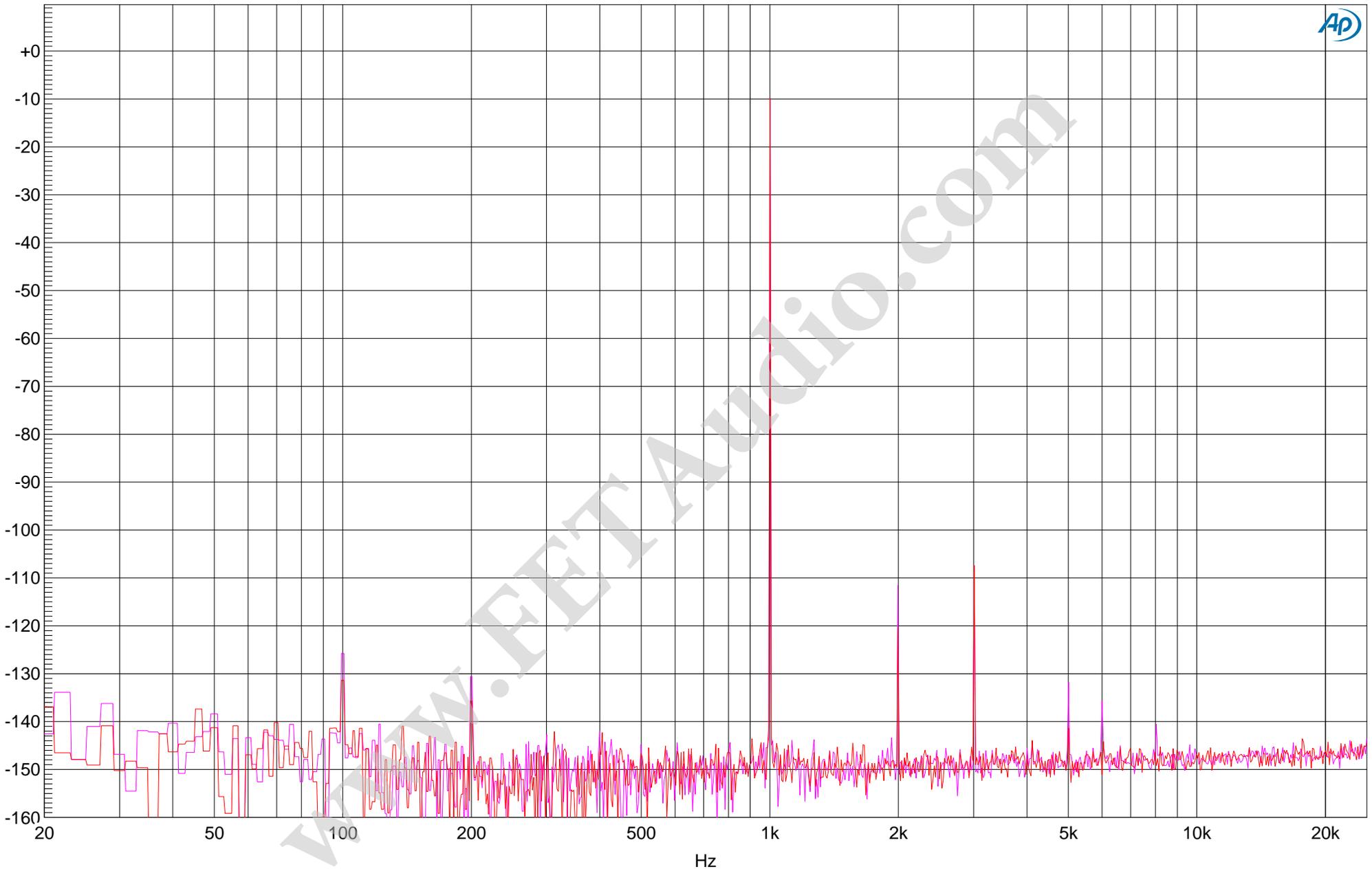


| Sweep | Trace | Color   | Line Style | Thick | Data          | Axis | Comment                      |
|-------|-------|---------|------------|-------|---------------|------|------------------------------|
| 1     | 1     | Red     | Solid      | 1     | Fft.Ch.1 Ampl | Left | FDA-1B @1kHz 0dBFS           |
| 1     | 2     | Magenta | Solid      | 1     | Fft.Ch.2 Ampl | Left | Distortion 0.016% @ 2.98Vrms |

FFT at -10dbFS

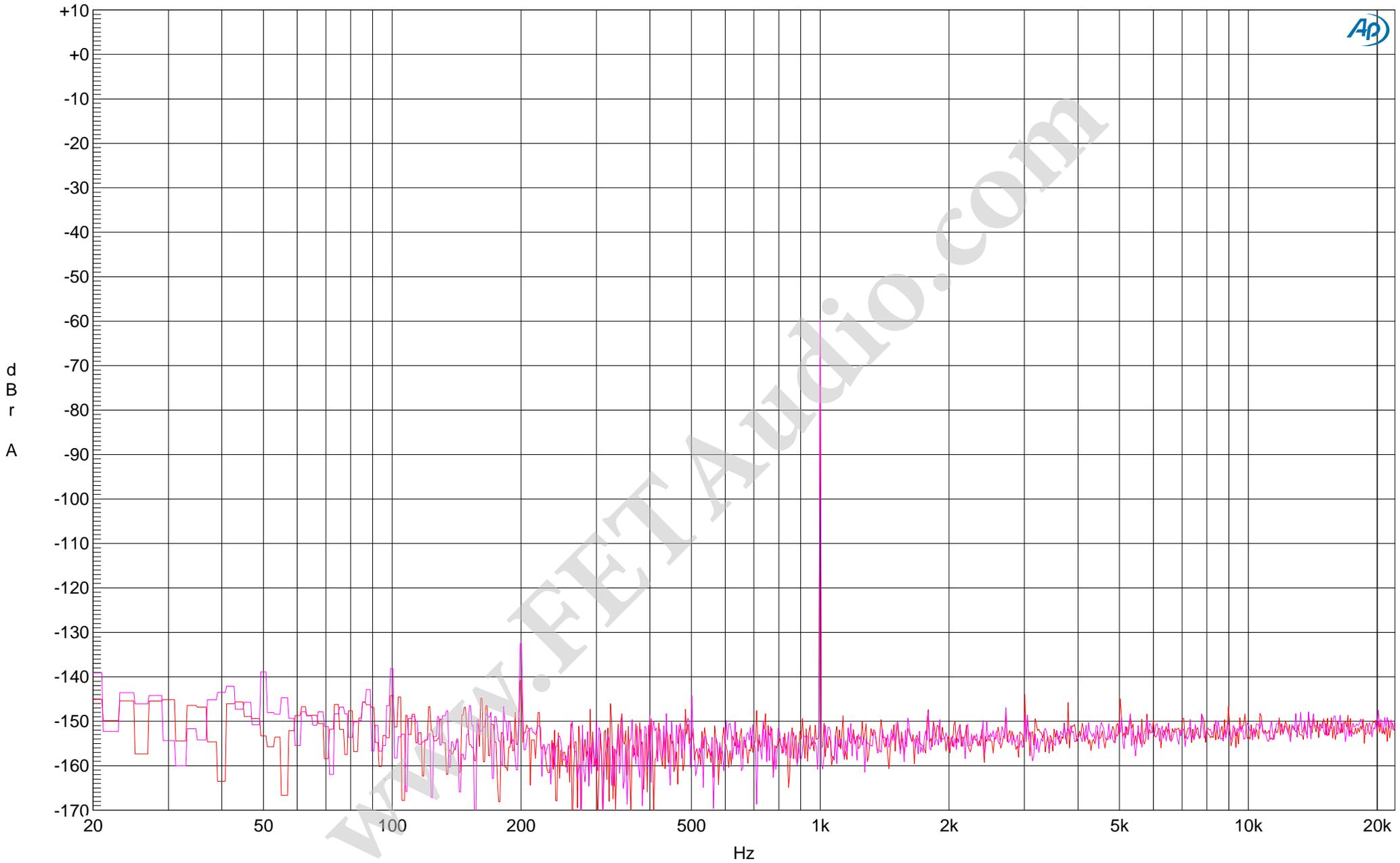


d  
B  
r  
A



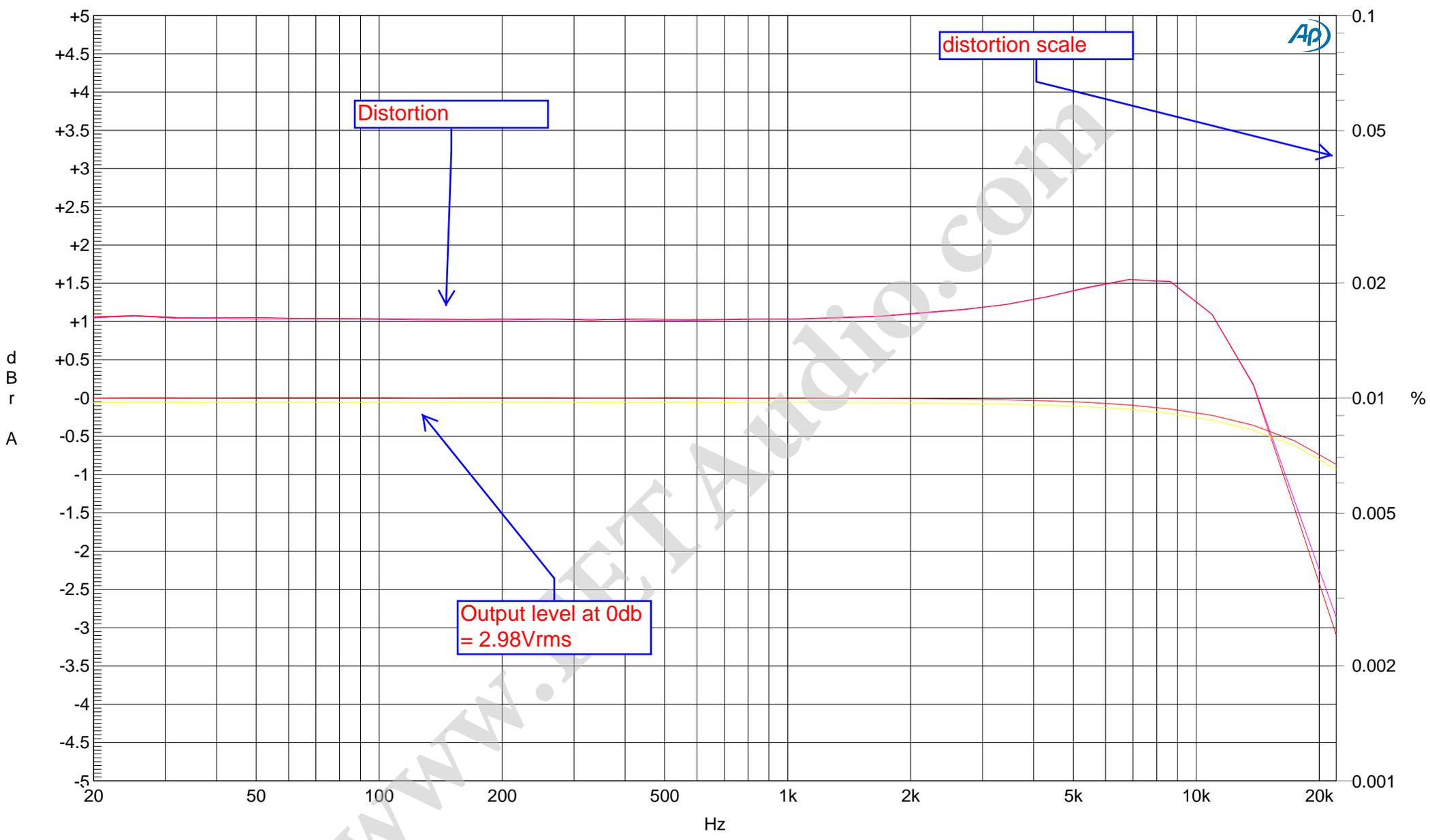
| Sweep | Trace | Color   | Line Style | Thick | Data          | Axis | Comment            |
|-------|-------|---------|------------|-------|---------------|------|--------------------|
| 1     | 1     | Red     | Solid      | 1     | Fft.Ch.1 Ampl | Left | input at -10dbFS   |
| 1     | 2     | Magenta | Solid      | 1     | Fft.Ch.2 Ampl | Left | distortion 0.0017% |

FFT at -60dbFS



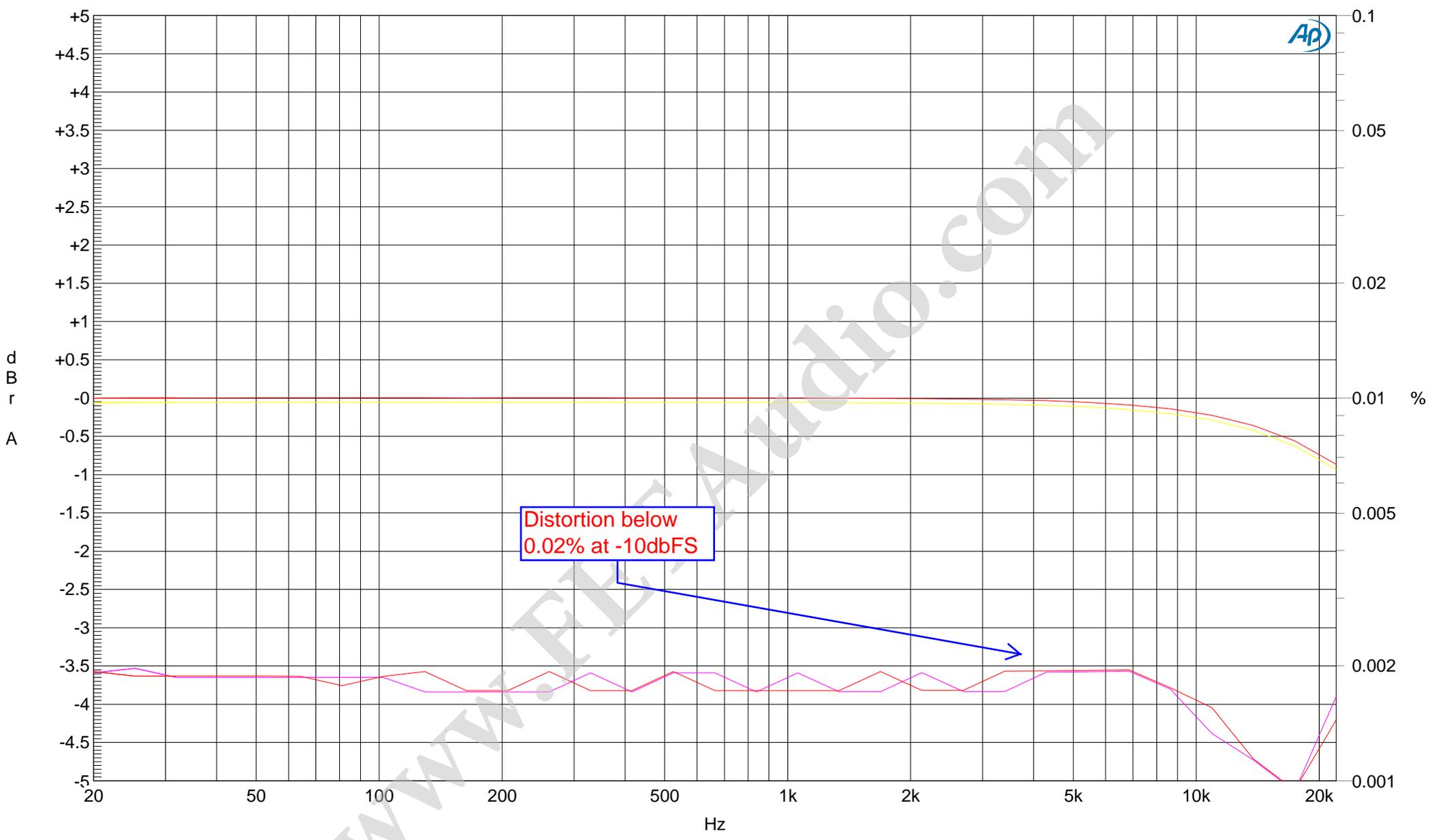
| Sweep | Trace | Color   | Line Style | Thick | Data          | Axis | Comment    |
|-------|-------|---------|------------|-------|---------------|------|------------|
| 1     | 1     | Red     | Solid      | 1     | Fft.Ch.1 Ampl | Left | at -60dBFS |
| 1     | 2     | Magenta | Solid      | 1   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

Frequency Response and Distortion 0dbFS



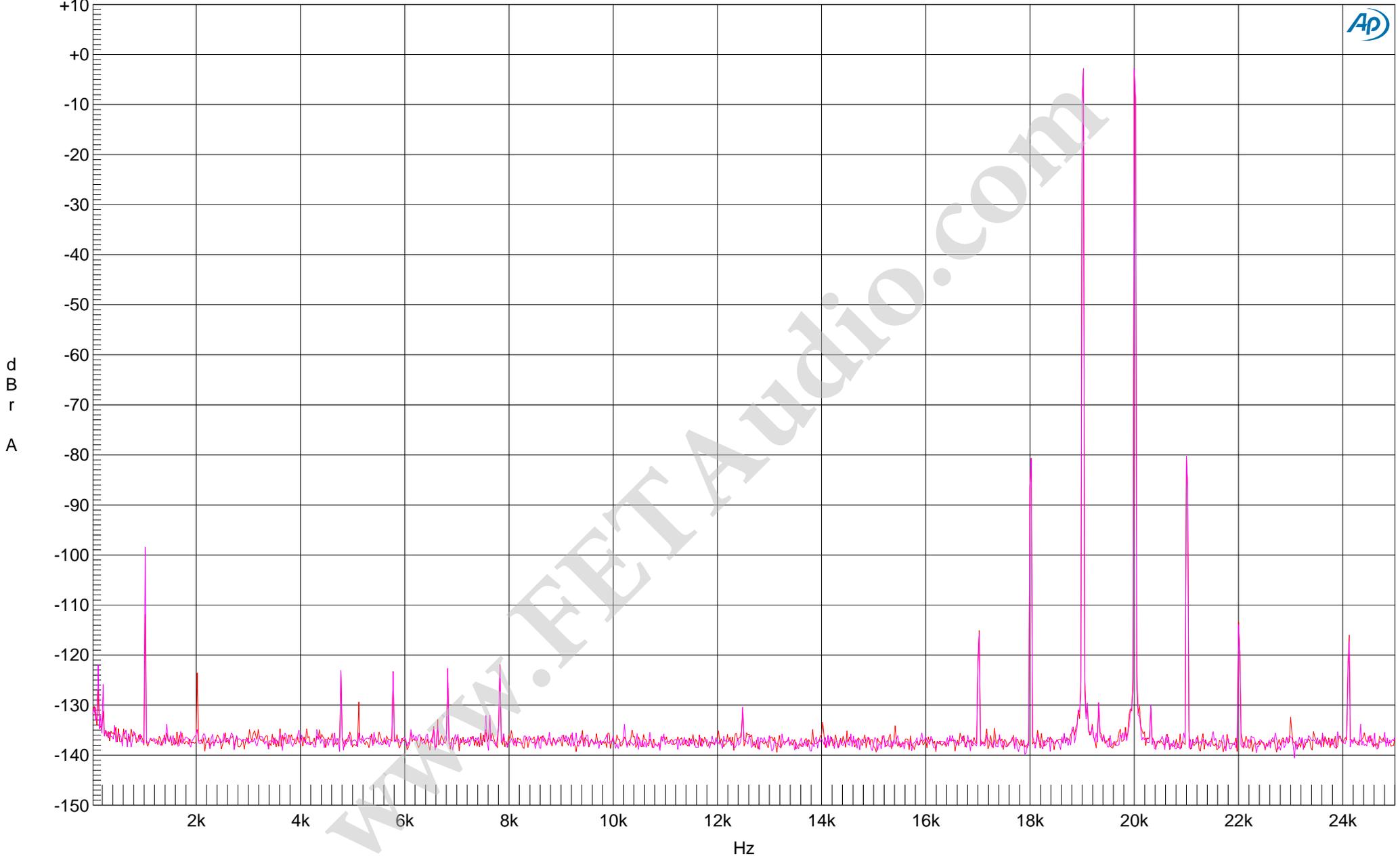
| Sweep | Trace | Color   | Line Style | Thick | Data             | Axis  | Comment             |
|-------|-------|---------|------------|-------|------------------|-------|---------------------|
| 1     | 1     | Red     | Solid      | 1     | Anlr.Level A     | Left  | 2.98Vrms            |
| 1     | 2     | Magenta | Solid      | 1     | Anlr.THd+N Ratio | Right | Distortion at 0dBFS |
| 1     | 3     | Yellow  | Solid      | 1     | Anlr.Level B     | Left  |                     |
| 1     | 4     | Red     | Solid      | 1     | Anlr.THd+N Ratio | Right |                     |

Frequency Response and Distortion -10dbFS



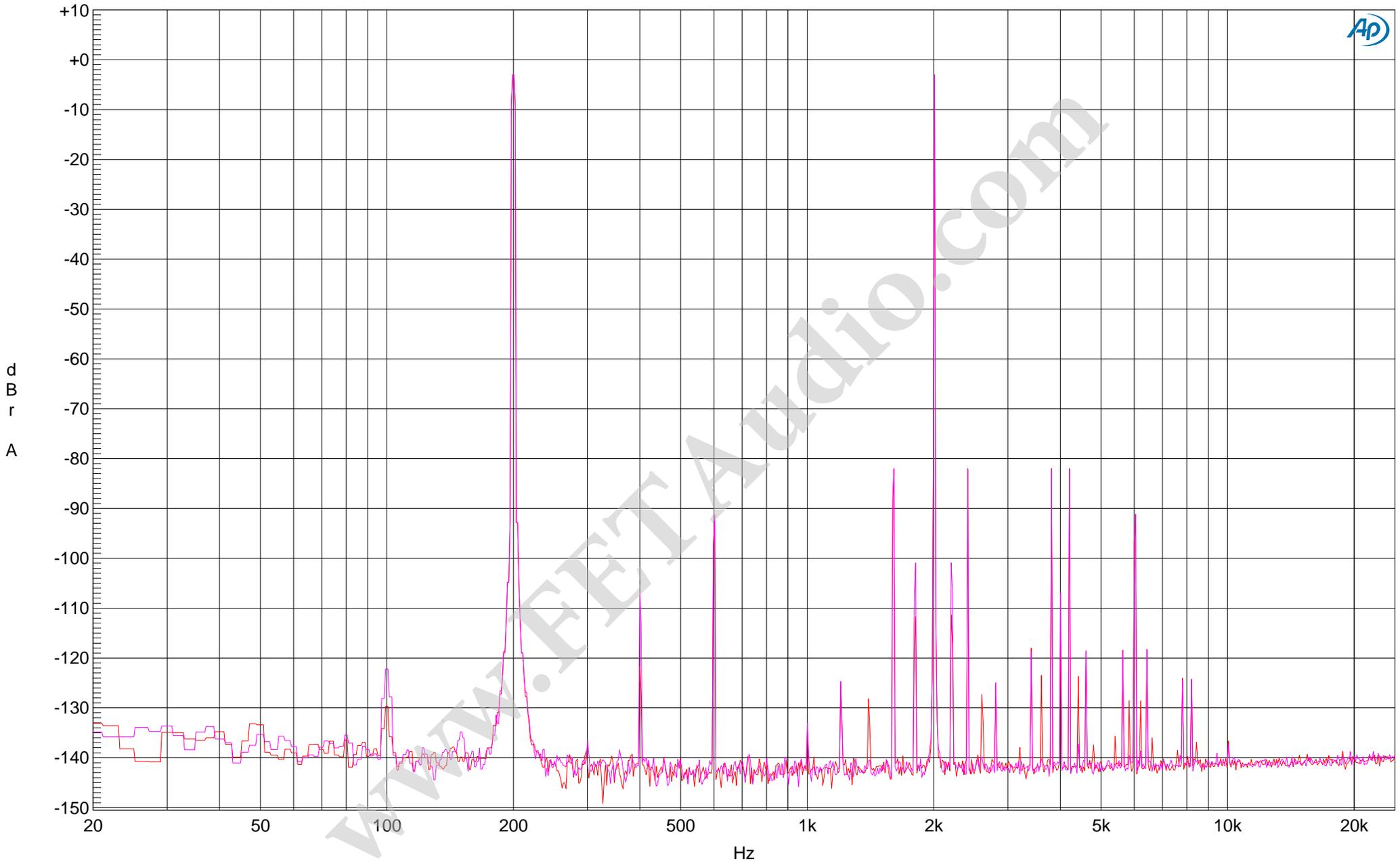
| Sweep | Trace | Color   | Line Style | Thick | Data              | Axis  | Comment                 |
|-------|-------|---------|------------|-------|-------------------|-------|-------------------------|
| 1     | 1     | Red     | Solid      | 1     | Anlr.Level A      | Left  | at -10dbFS              |
| 1     | 2     | Magenta | Solid      | 1     | Anlr.TH+D+N Ratio | Right | distortion below 0.002% |
| 1     | 3     | Yellow  | Solid      | 1     | Anlr.Level B      | Left  |                         |
| 1     | 4     | Red     | Solid      | 1     | Anlr.TH+D+N Ratio | Right |                         |

IMD distortion at  
19k and 20kHz



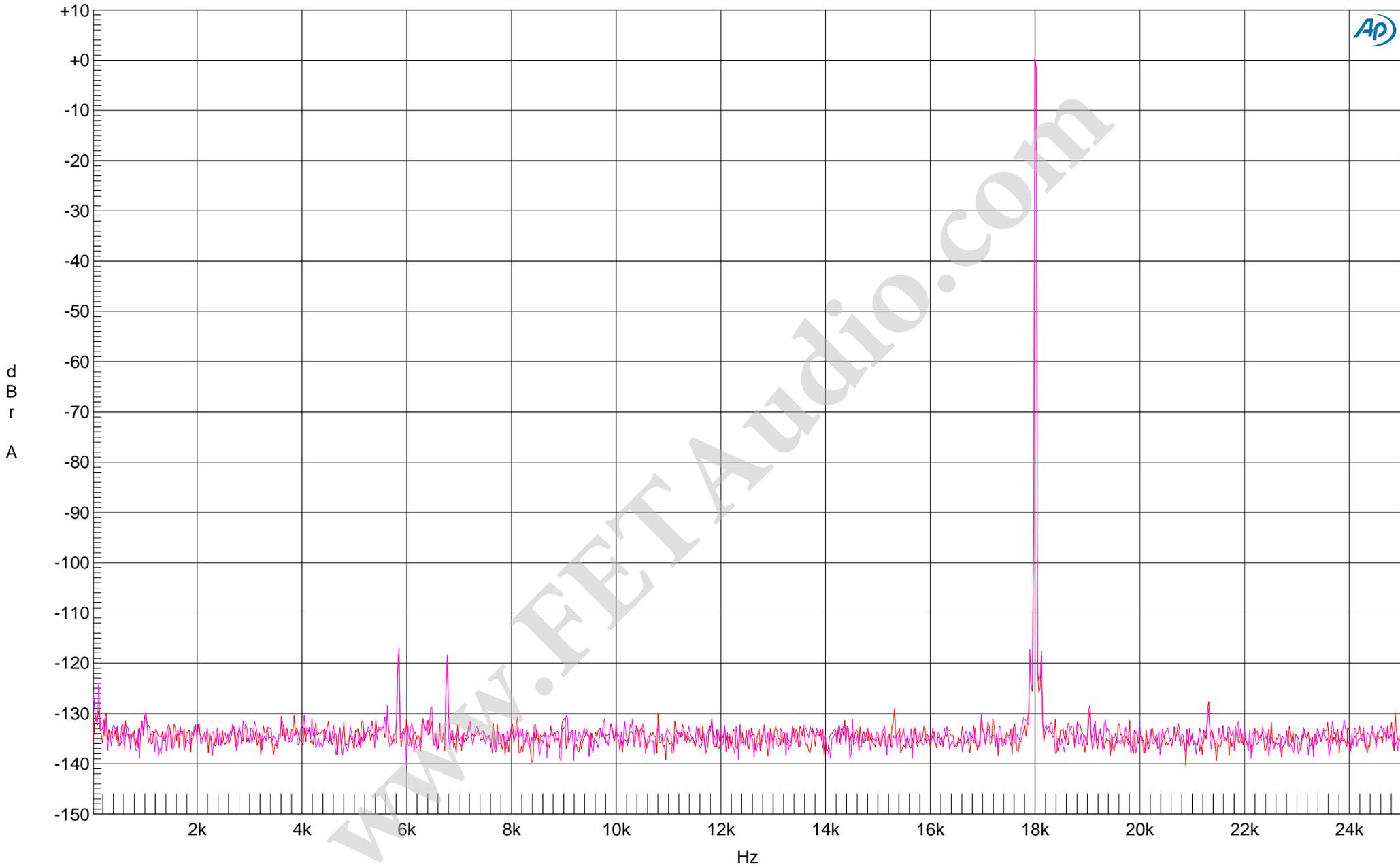
| Sweep | Trace | Color   | Line Style | Thick | Data          | Axis | Comment      |
|-------|-------|---------|------------|-------|---------------|------|--------------|
| 1     | 1     | Red     | Solid      | 1     | Fft.Ch.1 Ampl | Left | 19&20kHz IMD |
| 1     | 2     | Magenta | Solid      | 1     | Fft.Ch.2 Ampl | Left |              |

IMD at 200 and 2kHz



| Sweep | Trace | Color   | Line Style | Thick | Data          | Axis | Comment      |
|-------|-------|---------|------------|-------|---------------|------|--------------|
| 1     | 1     | Red     | Solid      | 1     | Fft.Ch.1 Ampl | Left | 200 & 2k IMD |
| 1     | 2     | Magenta | Solid      | 1     | Fft.Ch.2 Ampl | Left |              |

Jitter rejection at 10mUI 18k signal



| 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 |                 |

AES XLR input

SPDIF RCA input

Toslink input

On-board Left Channel Out - XLR & RCA

Output for external sockets via wires

On-board Right Channel Out - XLR & RCA

I2S socket J5

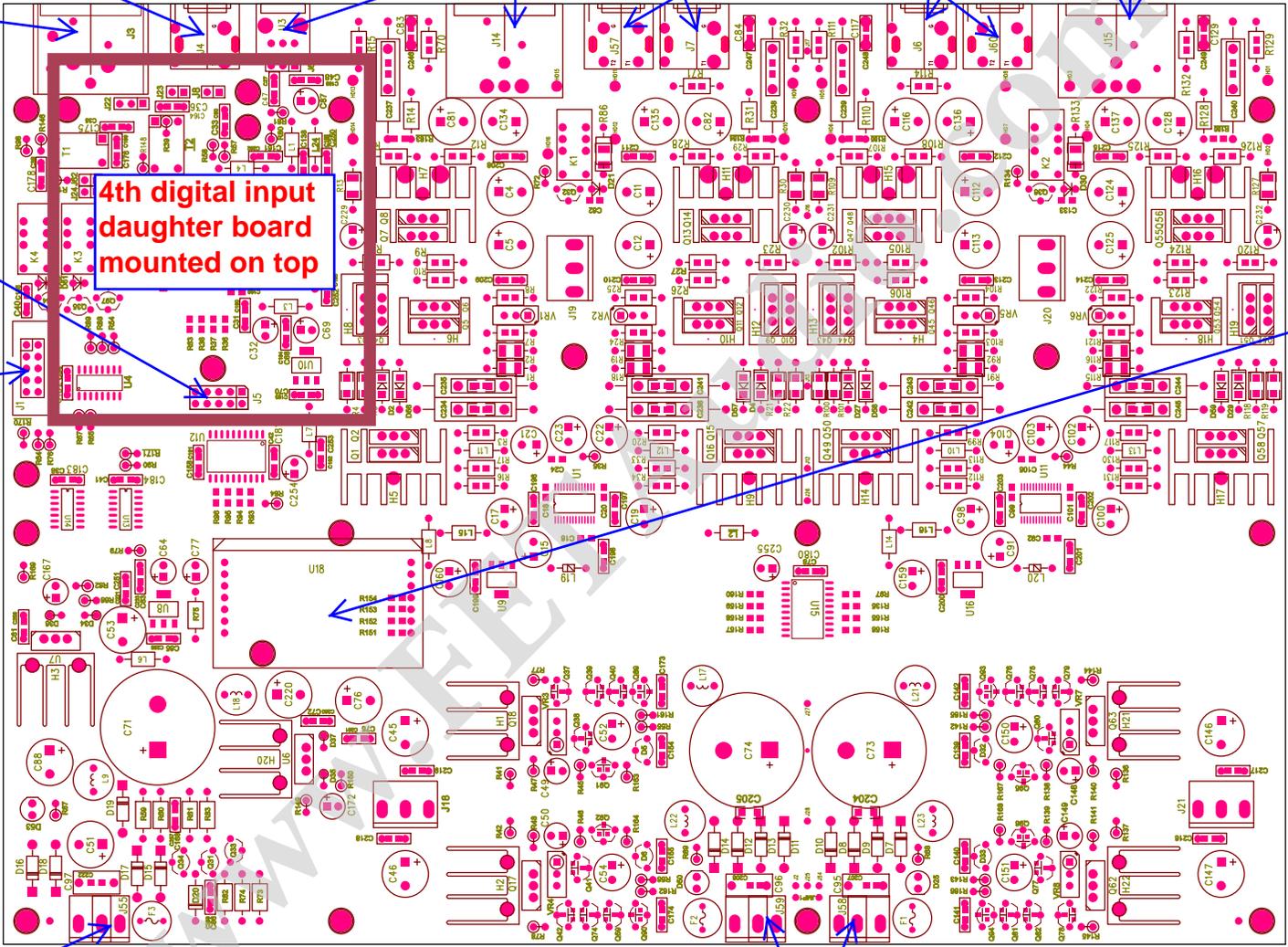
4th digital input daughter board mounted on top

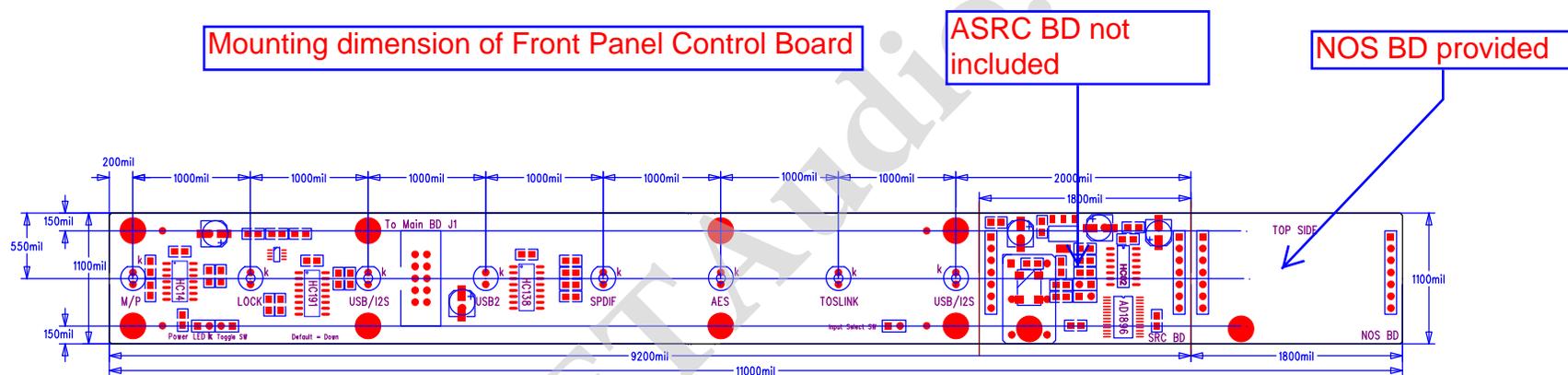
U18 NOS board or ASRC board

J1 to front panel control board

AC 8V input

18V AC x 2 input



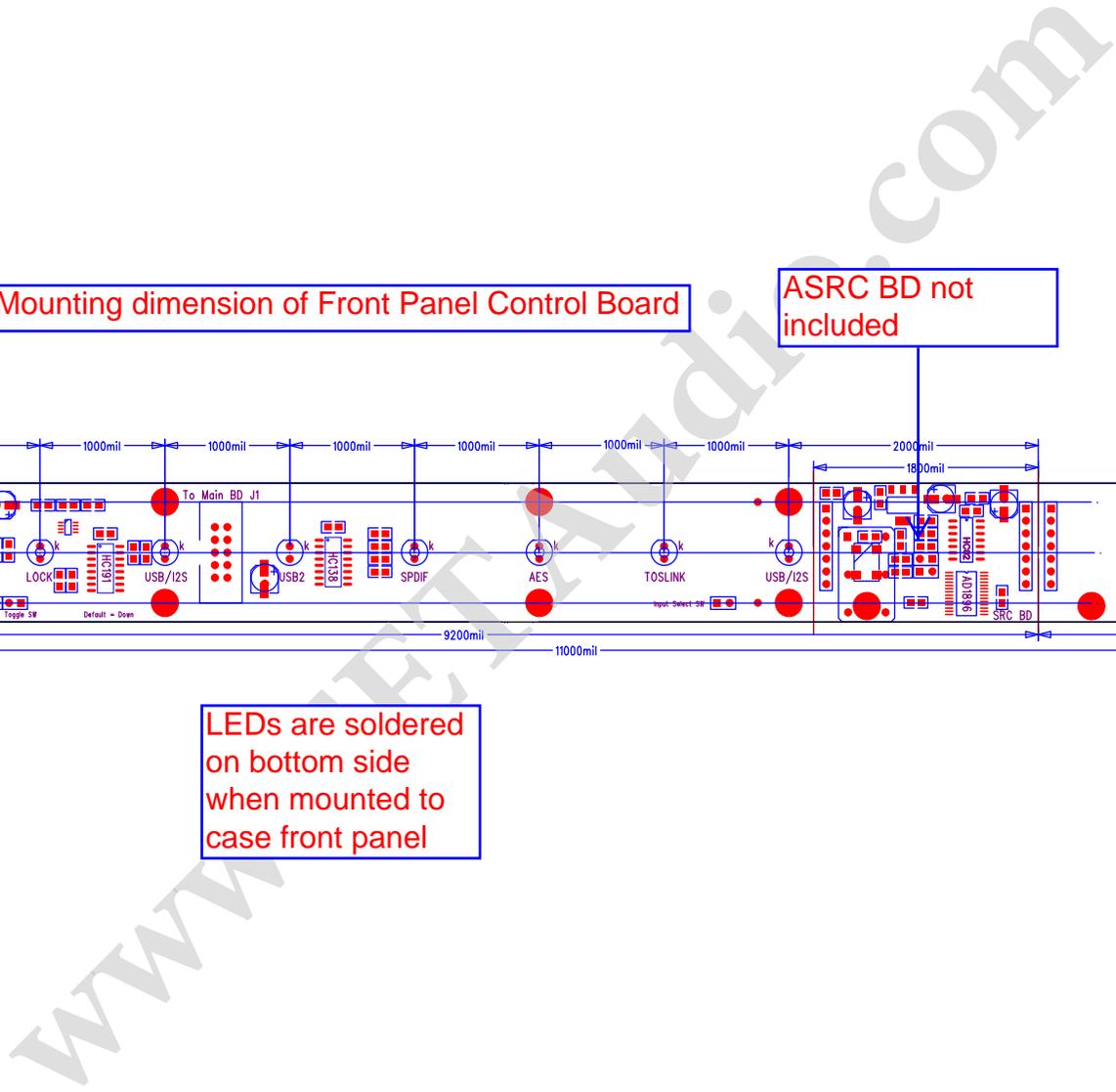


Mounting dimension of Front Panel Control Board

ASRC BD not included

NOS BD provided

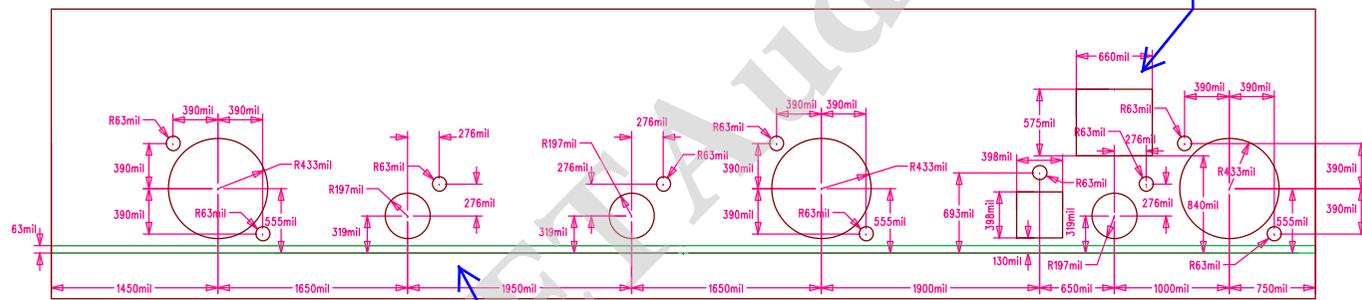
LEDs are soldered on bottom side when mounted to case front panel



View from rear side

All dimension in mil;  
1mil = 1/1000 inch  
1 inch = 25.4mm

For RJ45, I2S  
input; reserve for  
expansion



pcb in green color

