NP D1 Clone Ver 3 Assmebly Manual

Marking on board (next to U15):
BAL PCM63 DAC
2007-10 DIY FUN
NP D1 Clone V3

Major differences from Pass D1 DAC:

1. No PLL, no uP, no remote.
2. Use CS8412, CS8414 (require 8414 to 8412 converter board) or DIR9001 receiver (require a separate DIR9001 to 8412 converter board).
3. Double series regulator for Digital section and analogy sections.
4. Use LM317/LM337 regulators instead of 78/79 series regulators. Thus LT1085/LT1033 regulators are also can be used.
5. Change the Pass mosfet IV to Jfet IV and add a buffer (source follower) at output stage to reduce the output impedance.
6. Jfet IV supply from a low noise regulator base on Borbely Erno concept.
7. Output path add a relay mute for power on/off pop noise and power on delay – NP design.
8. DAC Output signal level fine adjust at IV stage to ensure fully balance mode operation.

Major Features:

1. Two SPDIF digital inputs: - 1) RCA and 2) XLR via separate coupling pulse transformer.
2. Required two transformers 18Vx2 30VA and 9Vx2 30VA to work.
3. Output is Single Ended or XLR balance output.
4. Digital inputs are selected by two relays with a 5V supply on a jumper. The jumper select can be extended to a front panel select switch for digital input select.
5. Input receiver IC CS8412/8414 can be set to 16 or 18 bit output mode (D1 original design is 18 bit output mode) by jumpers J28 & J29.
6. SM5842 can be set to 16 or 18 bit input signal mode by jumper J22.
7. Keep the functions Polarity, Jitter and Dither mode of the SM5842 by jumpers J5, J6 and J7 respectively.
8. The input clock for SM5842 can be selected by a jumper from either 8412/14 (receiver chip) or on board XO by J9. The XO clock can also be output to external transport via connection J20.
9. The SM5842 output bit mode is fixed at 20 bits for PCM63.
10. J21 will set the De-emphasis function when different receiver chip is used.
11. SM5842 data output will be muted when the error LED is ON.
12. Add a Lock LED which is in reverse logic of the Error LED to indicate signal is locked.
13. In EACH Jfet IV module, there are 3 pots need to be adjusted:
    a. Input dc level to 0V point B1~4 on pcb: R2 for B1, R11 for B2, R22 for B3 and R32 for B4.
    b. Output dc level at half of +ve supply voltage at point A: R1 for A1, R10 for A2, R21 for A3 and R31 for A4. Since the point As are covered by the 2700p silver mica, use the points at the C4, C15, C25 & C35 (big 10uf) at the DAC side.

Example if supply voltage is +18V, the point A should be at +9Vdc to provide max swing of output signal.

c. Output level of AC signal: require a Test CD of 1kHz or other freq and a AC voltmeter. All the AC output level need to be adjusted to same value at the output socket (+/-out points for left and right).

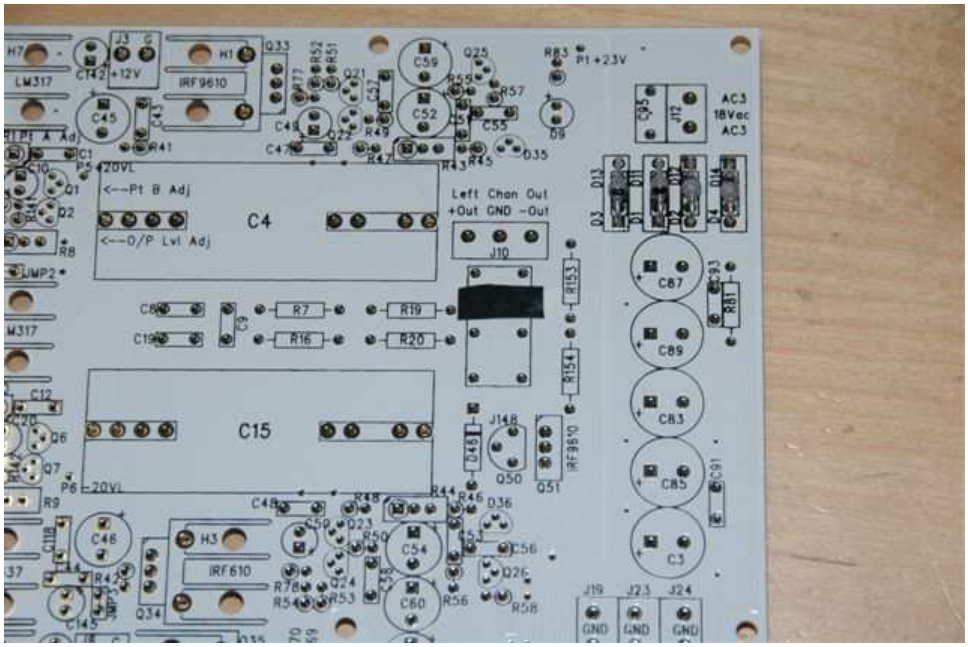
Stuffing and Adjustment Procedures:

The approach for successful assembly:

1. Main supply +/-23V is working
2. Main supply +/-12V is working
3. +/-18VL & +/-18VR Low noise regulators are working (P3, P4, P5 & P6 marked +/-20V on PCB)
4. +/-5V regulators for PCM63 are working
5. Digital section +8V regulator is working
6. All 5V regulators LT1117-5 are working in digital section.
7. Verify the input relay is functioning
8. Verify the output relay is functioning
9. Pre adjust Point As and Bs at target dc voltages
10. Plug in the IC one by one to see if the supply voltage is still at normal and no smoke come out in digital section.
11. Check for any oscillation on the Jfet IV.
12. Plug in PCM63 for final adjustment of point As and Bs.
13. Warm up for 1 hrs and do final adjustment and measurement.

Steps:

1. Solder LT1117 regulators on the digital section.
2. Solder resistors, LED and rectifier/diodes, note the polarity.
3. Solder all jumper pins, do not short the pins.
4. Solder film capacitors, Silver mica 2700pf after POTs.
5. Solder IC sockets
6. Solder bead, inductors
7. Solder Pulse transformer
8. Solder input/output connectors if used
9. Solder all pots (VR) – For R2, R8, R9, R11, R17, R22, R18 and R32, you may want to reverse the position so as the 2700 mica cap will not block you from adjustment later.
10. Solder small E-caps (22uF to 330uF); note the polarity Square pad is +ve, Round is -ve – Note that C60 and C77 do not have enough space on the layout.
11. Solder the low noise Regulator +/-18V section Jfet / Transistors C2240/A970 / LM336 etc.. (do not solder jfet IV fets)
12. Solder all relays – Note that K3 and K4 has two leads pre-cut and two pins on the pcb has to be cover by insulation tape to prevent the two pins from grounded. White color tape will be used as the black tape is just for visual demo purpose.

13. 

14. Solder big E-caps (1000uF(; note the polarity Square pad is +ve, Round is –ve.
15. With a transformer of 18Vx2, the P1 and P2 should be at +23 and -23Vdc, max +/-25Vdc, respectively. Check LEDs D9/D10 and let the voltage discharge first before going further.
16. Solder IRF610/9610 with heat sink and insulation sheet. Note that the heatsink is grounded and thus the mosfet must be insulated from it.
17. Power up again. Verify the +/- 18V regulators (at P3, P4, P5 and P6) are working and adjust the output voltage to +/-18V dc within 0.05V. Power off.
18. Then solder the Jfet IV FETs section.
19. Power up again and adjust Pot R1 until Point A to 9Vdc, Adjust Pot R2 until Point B is 0Vdc.
20. Repeat to solder other Jfet IV section and adjust voltages as above. You need to look for the related position or parts for measurement / adjustment!!
21. Then solder the heatsink and regulators as below:
22. Solder the LM317 and LM337 (U2/U3, U5/U6, U9/U10, U12/U13) with heat sink in pairs.
23. **THIS IS THE MOST DIFFICULT PART OF ASSEMBLY**
24. **There are two way that U2/U3 and U10/U11 is powered: Either from +/-12V raw digital supply or from +/-18V analogy regulator. This section involves solder of jumper wire (0.8 to 1mm dia single core copper or silver wire) at the bottom of the pcb (no marking) and thus the wiring must be very very careful!**
25. **Don's ask me which way is better sound and use your ears!!**
26. **Blue is powered from +/-12V digital supply:**
    a. **When J3 (+12V pin) is power with +12V (via a wire from J25), U2 is powered.**
    b. **When J4 (-12V pin) is power with -12V (via a wire from J1), U3 is powered.**
    c. **When J8 (+12V pin) is powered with +12V (via a wire from J25), U9 is powered.**
    d. **When J27 (-12V pin) is power with -12V (via a wire from J1), U10 is powered.**
    e. **Connect also 4 ground wires from J17/J26 to the "G" hole of J3/J4/J8/J27.**

f. **So total there are 8 wires at the bottom of PCB.**

27. **Green is powered from +/-18V analogy regulators:**
    a. **J3 +12V point connect to C45 + pin (square).**
    b. **J8 +12V point connect to C63 + pin (square).**
    c. **J4 -12V point connect to C46 – pin (round).**
    d. **J27 -12V point connect to C64 – pin (round).**
    e. **Note that this is quite difficult to locate the correct pin on the capacitors as there is no marking at the bottom of the pcb.**
    f. **Connect also 4 ground wire from J19/J23/J24 to all 4 "G" holes of J3/J4/J8/J27. You may be running out of holes at J19/J23/J24!**
28. **No matter you use method 26 or method 27, you must also connect L21 bead from digital to analogy ground together.**
29. **An optional ground wire can be connected from J24 to J26, ie the analogy and digital star ground points.**
30. **Analogy supplier jumpers:**
31. When JMP2 is shorted, U5 is powered by +18V regulator Q33.
32. When JMP3 is shorted, U6 is powered by -18V regulator Q34.
33. When JMP5 is shorted, U12 is powered by +18V regulator Q35.
34. When JMP6 is shorted, U13 is powered by -18V regulator Q36.
35. Verify all the 5V regulators output voltage at +/- 5V +/-0.03V at the PCM63 IC socket positions.
    a. Pin 2 = +5VA
    b. Pin 11 = -5VD
    c. Pin 13 = +5VD
    d. Pin 28 = -5VA
36. Verify the +18/-18V regulators are still at correct voltage. This voltage should not change more than 0.05V or else something may be wrong.
37. **Back to Digital section: When you power up digital section, you do not need to power up analogy section together!**
38. Solder the LM317 (U20) regulator with insulator & heatsink.
39. Short JMP1 and then the LT regulators are powered now.
40. Check all LT117 regulators are at +5V output at the heat sink (or middle pin).
41. Check the pin 22 of U16 is at +5V, it is too expensive to burn your SM5842 IC!
42. Check the pin 7 and Pin 22 of U15 are at +5V also, 8412 is also not cheap!
43. Before plug in any IC, set the jumper as below (NP default mode with 8412 or 8414 receiver):
    a. J2 D input Sel, short RCA side two pins
    b. J28 short
    c. J29 open
    d. J5 Pol Sel short pin1/2, NorPol side two pins
    e. J9 Clk Sel short 8412 side two pins
    f. J21 Dem Sel short 8412 side two pins
    g. J22 bit sel short 8412 side two pins – 18bit
    h. J6 jitter sel any side two pins short
    i. J7 Dither sel any side two pins short.
44. Check U15 pin 7 & 22 is at 5V, then Plug in the 8412 and check pin 7 and 22 still at +5V.

45. Check U16 pin 22 is at 5V, then Plug in 5842 chip and check pin 22 still at +5V.
46. Plug in all 74VHC86, check pin 14 at +5V. Note that polarity of IC!
47. See for following to verify the digital section is working:
48. Power up the digital section, the error LED should be ON and Lock LED should be off. Then inject a SPDIF signal to the RCA digital in socket, the Error LED should be OFF now and Lock LED should be ON. The DemLED should be OFF if the signal do not carry any De-emphasis signal.
49. Use a scope to check if there is pulsed at CLK, LE, DOL and DOR (150 ohm resistor R85/86/87, R92/93/94, R99/100/101, & R106/107/108. If don't have scope, use a DC voltmeter and check voltage is about 1.4 to 2.5Vdc.
50. **Power down and go back to DAC section.**
51. Plug in PCM63 first chip.
52. **POWER up both Digital and Analogy supply.**
53. Verify the Iout is at 0V dc (point B), if not, fine tune the R2 (R11/R22/R32 for other DAC). Note that this voltage should not change much after the first Pre-adjustment. Check point A still at about 9V, if not, adjust R1 (R10/R21/R31 for other DAC). Due to the variation of the sinking and driving idle current from PCM63, you will need to fine adjust the point A and B voltages. Moreover, for the point A and B voltage is more or less independent to each other.
54. Repeat for other PCM63 one by one.
55. Check the points A and B to see if the voltages are stable for power on and off.
56. Power down and Solder the 4 BIG film caps 10uF. **Here some good capacitor with shielding is recommended. Eg E-cap like black gate or film cap wrap by copper foils grounded to J19.**
57. Check the points A and B dc voltage again and it should be very close to the readings at step 53. **If the voltages is not same and point A is changed more than 1V and point B is more than 0.15 to 0.3V dc, then the big capacitor may cause some oscillation and go to next step to trouble shoot. Else skip next step.**
58. **Check for Jfet IV for any oscillation (using a scope of >100MHz), the symptom is that Point As and Bs dc voltage is not stable. Moreover the output sound will be distorted! The cause of the oscillation is due to the bulky 10uf film capacitor cross couple to each other for +/- signal swing. The only cure is to shield the bulky capacitors by using copper foil to wrap around the body and then ground the shield to star ground point J19. Note that the ground body of the cap cannot touch any pad of the C4/C15/C25/C36 or else the signal is shorted to ground! Position the capacitors by 90 deg will also help reducing the cross couple. Any shielded E-cap or oil cap with metal can is also good as there will be no leakage of signal.**
59. Shielding with big film capacitors below: