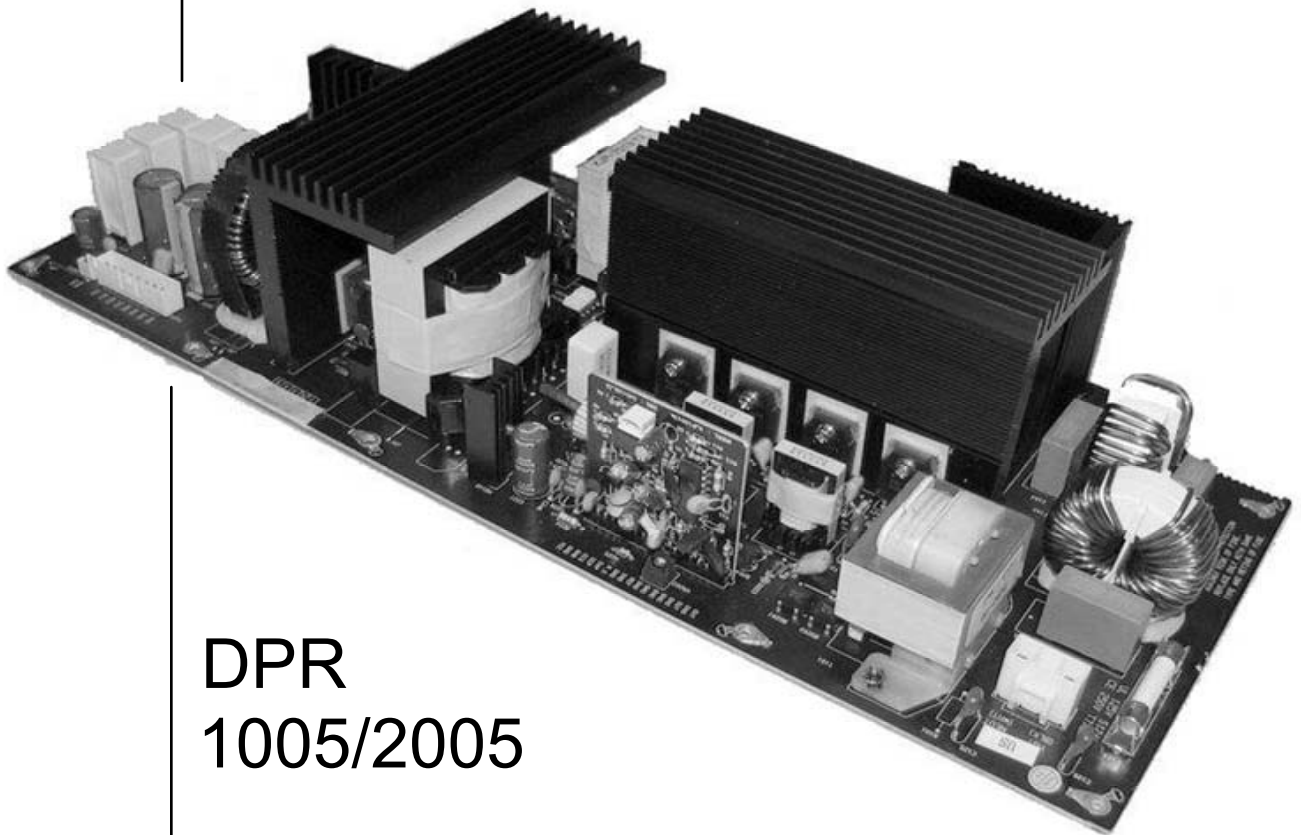


harman consumer group

SMPS



DPR
1005/2005

Theory of operation and
Service information

By Andy Andersen

DPR 1005 / 2005 Block Diagram

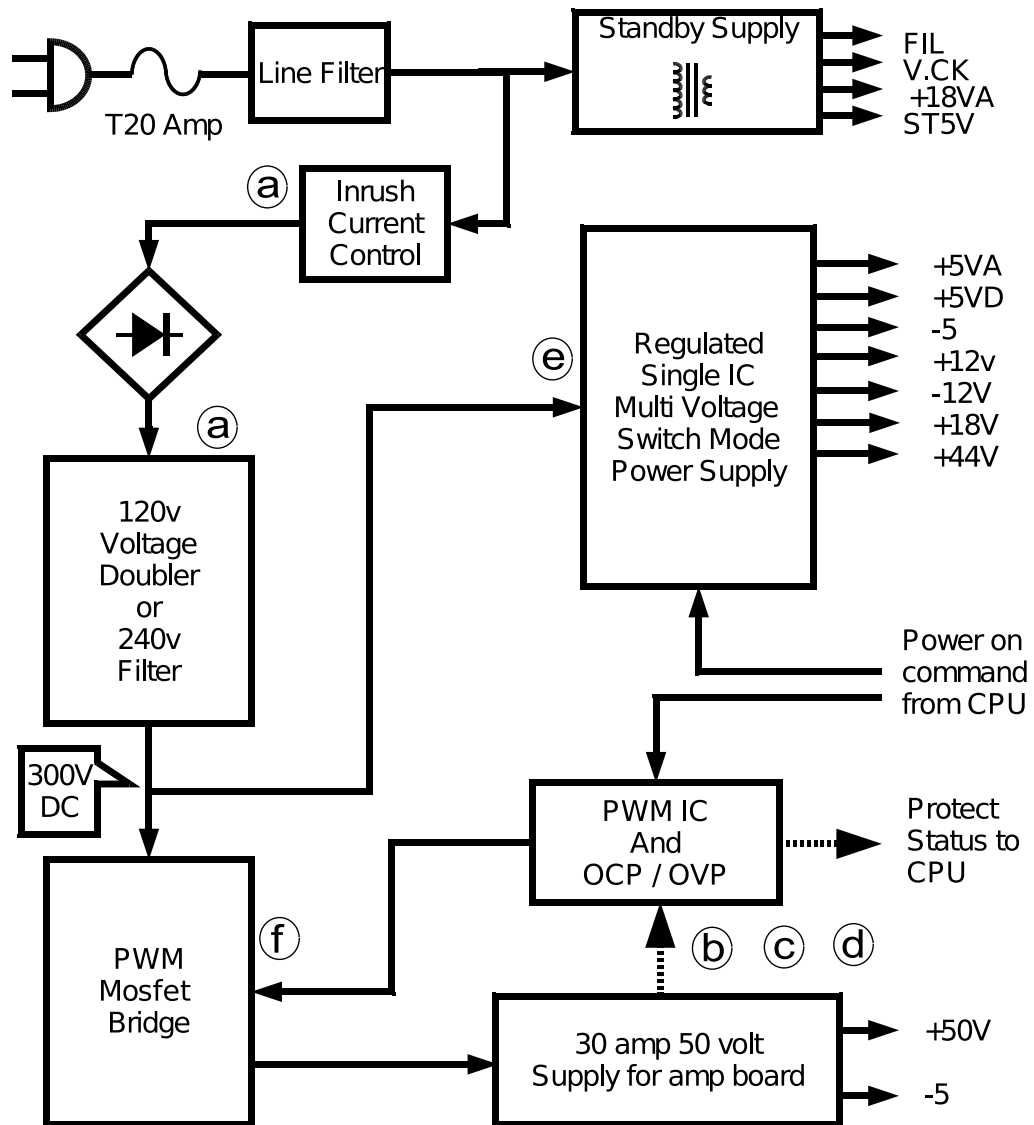


Figure 1

A: Voltage Doubler and inrush
 B: Over Voltage protect
 C: Over Current protect
 D: Over Current / Voltage protect

E: Multi Voltage SMPS
 F: Mosfet Bridge

Operation summary

Applied AC line voltage for stand by.

AC line voltage from the relay board goes to connector CN101 and supplies the voltage for transformer (T101). T101 supplies standby and run voltages +18VAB, ST5V H8.4V (AC for display). These are the source voltages for the micro (IC62) for stand by operation.

The applied AC flows through inrush resistors R105 and R104 then rectified by BD101 to charge C106 and C107. BD101 with C106 and C107 are configured as voltage doublers for 120 operation. Jumper J102 is removed for 240 volt operation. In either 120 or 240 volt operation 300 volts is developed for secondary transformer T102.

Stand by to power on

When a High signal is received to connector P-S/W (from micro on main board) Q201 turns on. Q201 controls optoisolator PC102. PC102 controls U101 at pin 3. U101 is the driver IC for the SMPS that supplies run voltages +5VA, +5vd, +12V, -12V, +18V, +24V, +44V for the main board.

Other activities at power on

When voltage is developed at D101 and C108 (off T102 of the SMPS) RL101 closes (Pins 3, 4 make contact) A short is produced across the in rush resistors R105 and R104 (5W 15Ω) Current now flows through RL101 and not the inrush resistors.

At the same time voltage is applied to relay SK41 (located on the Outlet Board (rear relay board)). Its contacts are wired across the main power switch and is used to prevent all the receivers current from flowing through the main power switch (the switch is rated for 8amps, relay for 20 amps).

Power on

Once the secondary voltages are developed from T102 (smmps), the micro sends a signal to power on (4volt high) the high current SMPS used for the D2 audio module (cn201 pin 11 P-CON, CN2 pin 1 PWR CNTR-2). IC U1 (PWM KA3525) pin 10 goes low, and a PWM signal is developed to pins 11,14 (out A/B) to two driver Transformers (T201, T202), then to a Mosfet Bridge to drive T103.

Details

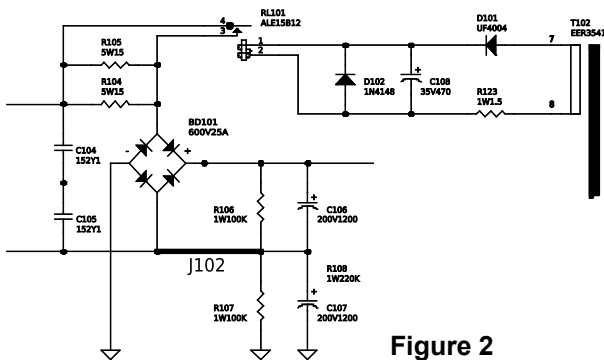


Figure 2

When AC is applied to the SMPS, R104 and R105 are used to protect the inrush to capacitor C106 and C107. After the voltages are developed from the SMPS of T102, Relay RL101 closes across the inrush resistors.

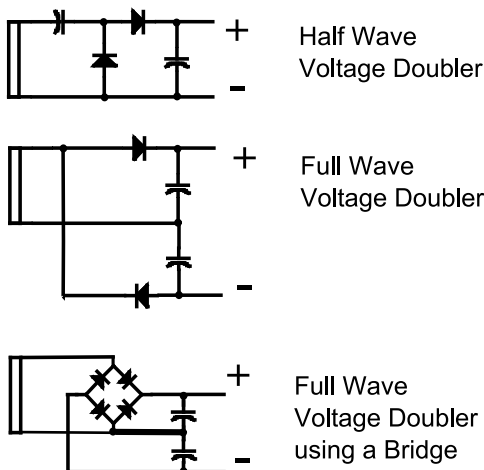


Figure 3

For the 120 volt version to develop the 300 volts need to drive the two switch mode power supplies a bridge diode assembly is used for the full wave voltage doubler. For the 230/240 volt SMPS a voltage doubler is not necessary. To change from 120 to 240 volt operation, remove jumper J102 for the SMPS part of the power supply. Please note the standby transformer is specific for each AC voltage.

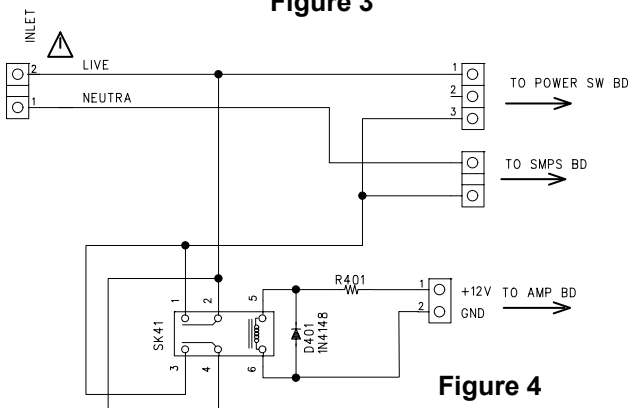


Figure 4

The main power switch cannot handle the current the DPR can draw. A relay (SK41) was added to shunt the power switch at turn on. When the main switch is turned on and after voltage is developed in the stand by supply (from T101) the relay will close. At this point the main A/C portion of the power switch assembly cannot turn off the

DPR. For power down the D/C portion of the power switch sends a command to the micro to sequence the power supply down, the last step is to release the power relay.

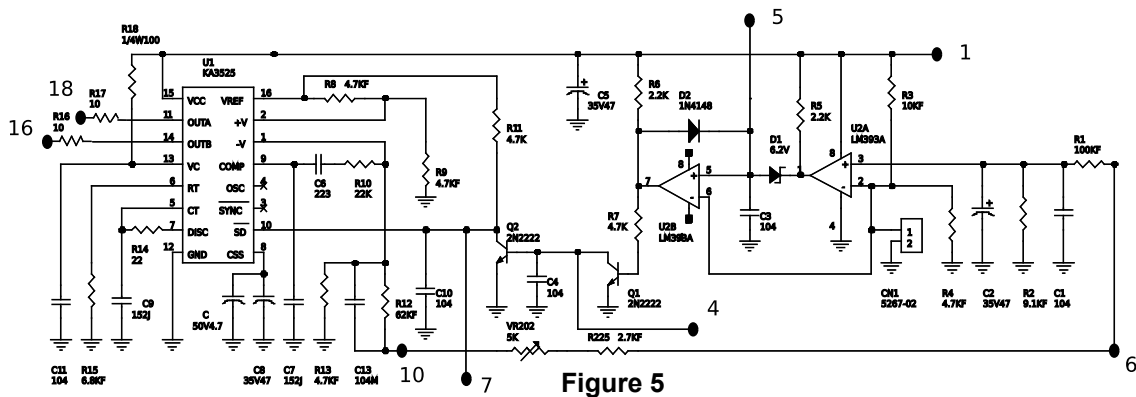


Figure 5

A group of small transistors, the protection latch and the PWM IC with its related components are located on a small upright daughterboard at the rear of the main SMPS board. When servicing this board, be aware of differences from the schematic and the actual PCB for CN1 (the schematic is correct but the PCB is wrong).

U1, KA3525 is a common PWM IC. In servicing the PWM check for VCC pin 15, and VC, VCC should be 15 volts. Power on SD pin 10 has to be low for the PWM to work. If not low check the signal from the CPU (CN201 pin 11) for a high. If the power on from the CPU is high check for a protect event trigger (could be a bad Mosfet or an over voltage problem and protect has triggered and latched).

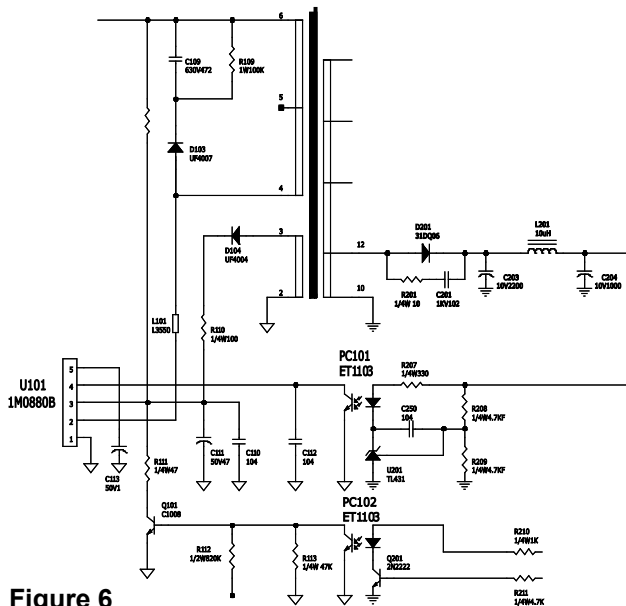
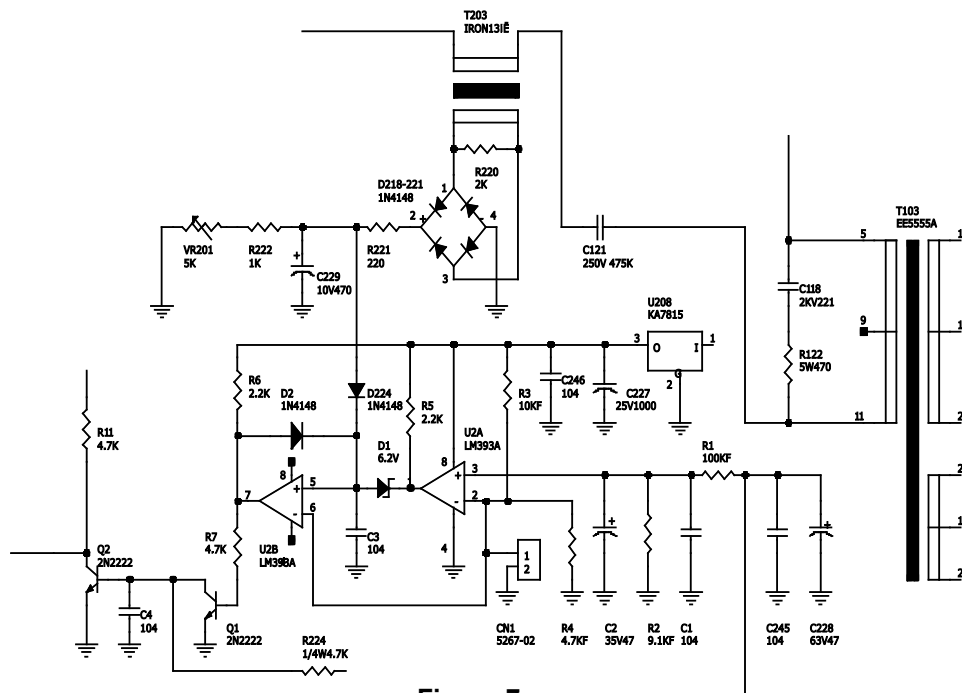


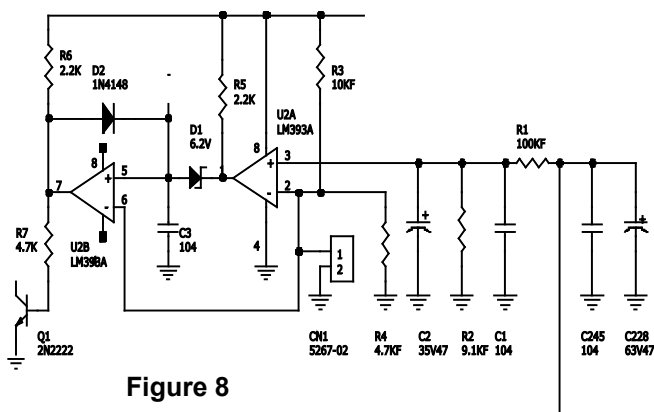
Figure 6

precision shunt regulators) controlling optical coupler PC101. Caution must be observed when working on this circuit. This is hot to the AC line voltage and is supplied by 300 volts from the main filter caps C106 and C107.

From Standby to power on T102 develops the voltages for the secondary regulators. T102 and U101 are part of a single IC switch mode power supply. The micro sends an on command (pin6 CN201 P-S/W 5V) to optoisolator PC102. PC102 keeps Q101 off so a high can be developed on pin 3 of U101. The off state for U101 is pin 3 low. Pin 4 of U101 is the regulation control for the SMPS. Regulation is controlled by



Protection for the D2 audio module is accomplished by monitoring over voltage and over current of the supply voltages developed by T103. If a fault event is detected the output of U2 will be latched high to keep pin 10 of the PWM IC U1 high (power off).



Over voltage is detected by IC U2A. A reference voltage is set for pin 2 (about 4.8 volts) and if that reference is exceeded at pin 3, pin 1 will go high. When the rise of pin 1 exceeds 6.2 volts (Zener D1 prevents false trigger), a high will be sent to pin 5 of U2B.

The output pin 7 will now

send a high to shut the D2 audio module supply off. The high from pin 7 is also sent through diode D2 to latch pin 7 high. The output of the op amp can not go low until power is removed from the op amp. The protection state is monitored by the CPU (CN201 pin10 M.OCP), and if a fault is detected a command is sent to put the DPR in standby. There is no other indication of a protect shutdown for the power supply, but there are protect modes for the D2 module (as mentioned in the D2 audio info in the service manual) that would be displayed.

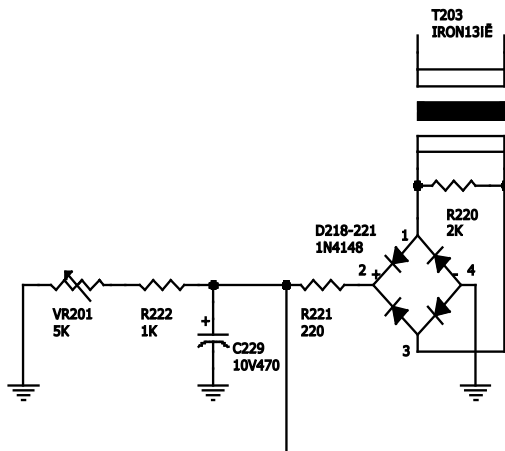


Figure 9



Figure 10

Current sense transformer T203 detects the AC current flow for the high current needed for the D2 module. The AC from T203 goes to a diode bridge, rectified and the dc is sent to the protection IC U2. When the voltage exceeds 5 volt reference, the protect will trigger and latch. Do not adjust the over current pot VR201. This is set at the factory for a protect trigger of 31.2 amps at the 50 volt output (1.6 load).

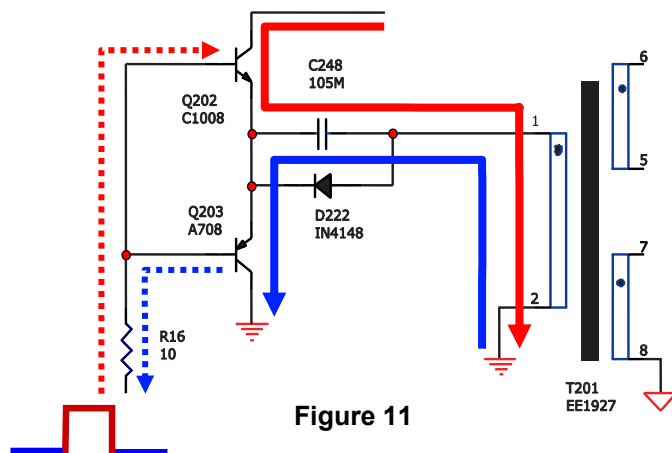
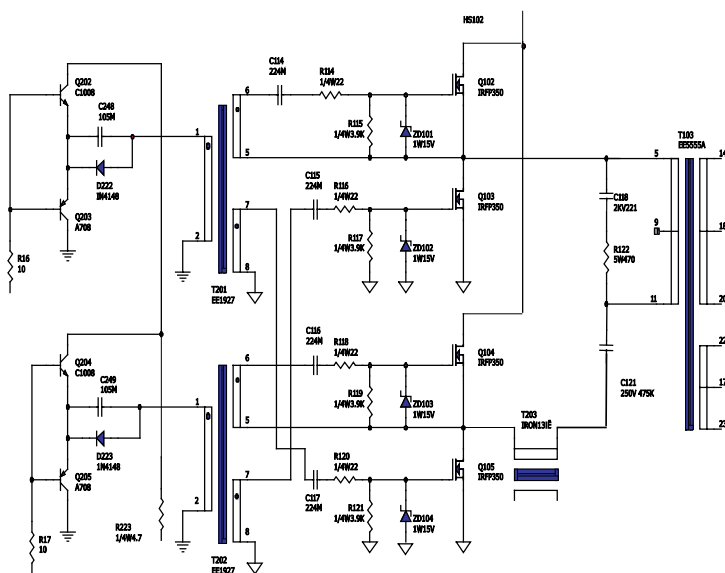


Figure 11

The output of the PWM IC (U1 KA3525 pins 11, 14) drives two driver transformers (T201, T202). Using T201 for the example, trigger high (5 Volts through R16) turns on Q202 and stores energy in T201 through C248. When the Trigger goes low the energy stored in T201 is replaced through D222 and Q203. The

result of using this dual transistor setup is almost perfect square wave at the output of T201. The result is no ringing or over shoot at the pulse transformer dual outputs.



300 volts DC supplies the mosfets Q102-Q104. The high current supply for the D2 module comes from T103. T103 is driven by 4 mosfets in a bridge mode to produce 600 volt PP for T103. Extreme caution is needed when working around the mosfets.

Figure 12

How to test and run the DPR with the D2 amp board removed from the receiver.

After removing PCB (T/F code : PBD04KAM20) loaded with D2Audio, and connecting wire as pictured, then you will be able to check the operation of processor PCB and the SMPS. You can also check the signal 2ch-out and 8ch-preout

(Remark): After checking, because of possible Semiconductdamage on Processor PCB, remove the connected wire first then load D2 AMP PCB.

[PCB CON3: schematic]

[PCB CON3: bottom view]

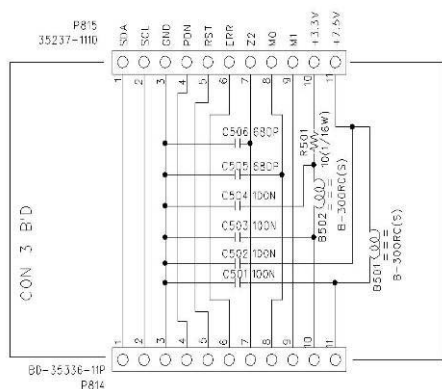


Figure 13

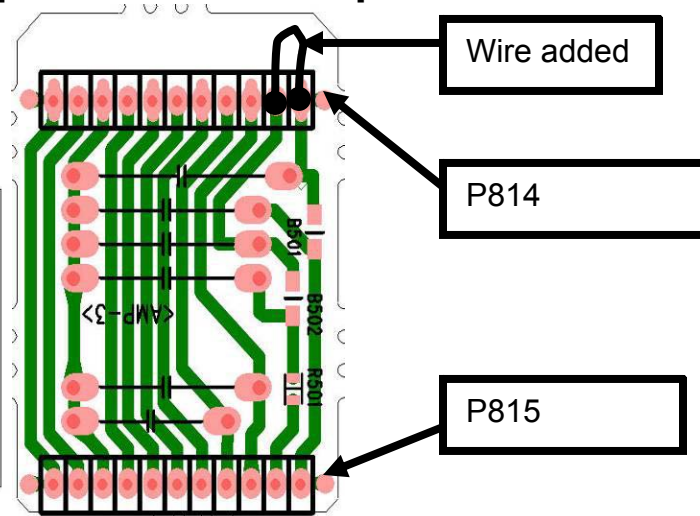


Figure 14

DPR1005/2005: Tech notes in no order

Protection check connector CN1 is hooked up in the print correctly but on the daughter board is hooked up to pin 5 of IC U2.

The pin outs for CN201 have a different description on the main board and the pin numbers are reversed.

The output mosfets on the DPR1005 are not IRFP3050 but SKH30N40.

The service manual shows only the 120 version. You must refer to the parts list for the correct value of the AC input components.

The grounds are common on the SMPS but note that current and digital will take a different path out of the connectors. If a complaint of noise is noted check the solder on the connectors.

The DPR series is not lead-free or ROHS compliant.

The standby transformer T101 will run warm. This is normal.

The Over Current pot can not be adjusted by the service centers. In the case of the DPR2005 the 50 volt output load current would have to be set at 31.2 amps (1.6Ω Load)

There are replacement components available except for the transformers.

The heat sink of U101 can be used has the hot ground (ground for IC 101 and the power mosfets). Do not hookup without adding a screw, the coating on the heat sink is an insulator.

!! Caution !! must be used around the primary side of T103.
There is a 600 volt PP AC signal around the components!

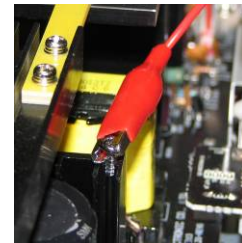
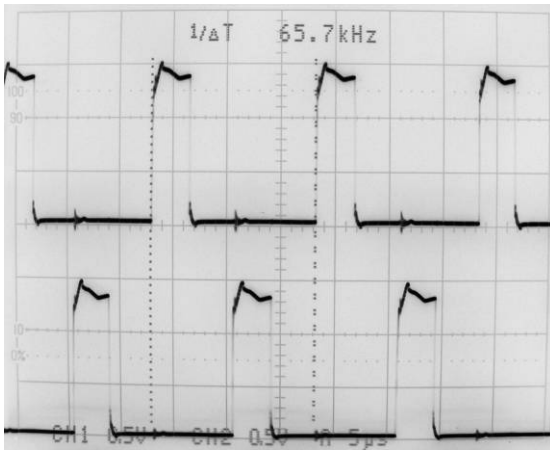


Figure 15

Power on Timing:

The regulator SMPS (using IC U101) will turn on about one second before the D2 supply voltage raises. CN201 pin 6 (P-S/W) will turn on before pin11 (P-CON). The voltage out of CN203 (50 volts for the DPR2005, 39 volts for the DPR1005) turns on with a slow rise of 20v / Second.



A

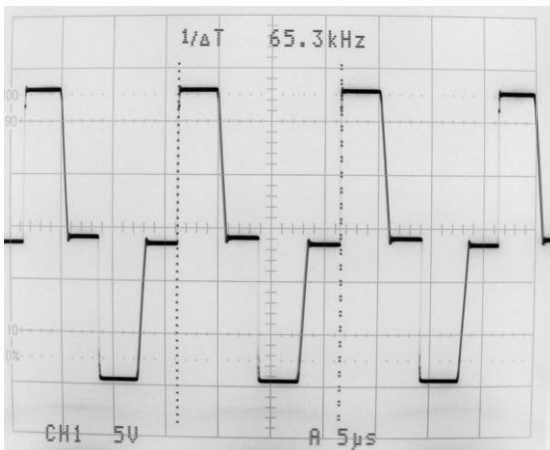
B

Pins 16, 18 on daughter board



C

Pin 1 of T202 off D223
5 volts per division



E

300 volts PP

One half BTL output. 50 volts per division



D

