

FlexReg Dual Rail Power Supply Build Notes

The idea for this PCB is to provide a flexible dual-rail general purpose regulated power supply for low power audio projects (e.g. preamps, crossovers, etc.). The design goals for the board and power supply included:

- Compact with PCB mount transformer & optional connections for an external transformer
 - o 15 or 25VA Transformer Options
- Dual Rail Regulated DC power supply (Positive & Negative)
- Flexibility for using standard 78xx/79xx family of fixed regulators OR 317/337 adjustable regulators
- Able to fit in an off-the-shelf Hammond chassis OR into the 10x10 grid of a Modushop / DIYAudio chassis
- CRCRC pre filtering before regulators
- Include ground break rectifier on the PCB
- Include A/C cap on the PCB
- Flexibility for 120/240 mains
- Optional items for users to populate or not:
 - o LEDs on PCB (for rail voltage indication and front panel indicator) – optional to populate
 - o Snubber circuitry

Thank you to Jim “6L6” for the inspiration, brainstorming, and encouragement on this project!

Project Difficulty: **NOVICE** **INTERMEDIATE** **EXPERT**



Questions?

You're probably not alone!

Post your question(s) on the DIYAudio forums.



This project uses line/mains voltages and has a power supply capacitors. The voltages in this board can kill – even at miniscule current. If you are not competent / confident with working with these voltages, please seek advice from either a qualified electrician, or an audio DIYer who is competent and experienced in this area. Always work safe and work smart!

The PCBs for this project are offered without any warranty, guarantee provided, or liability taken.

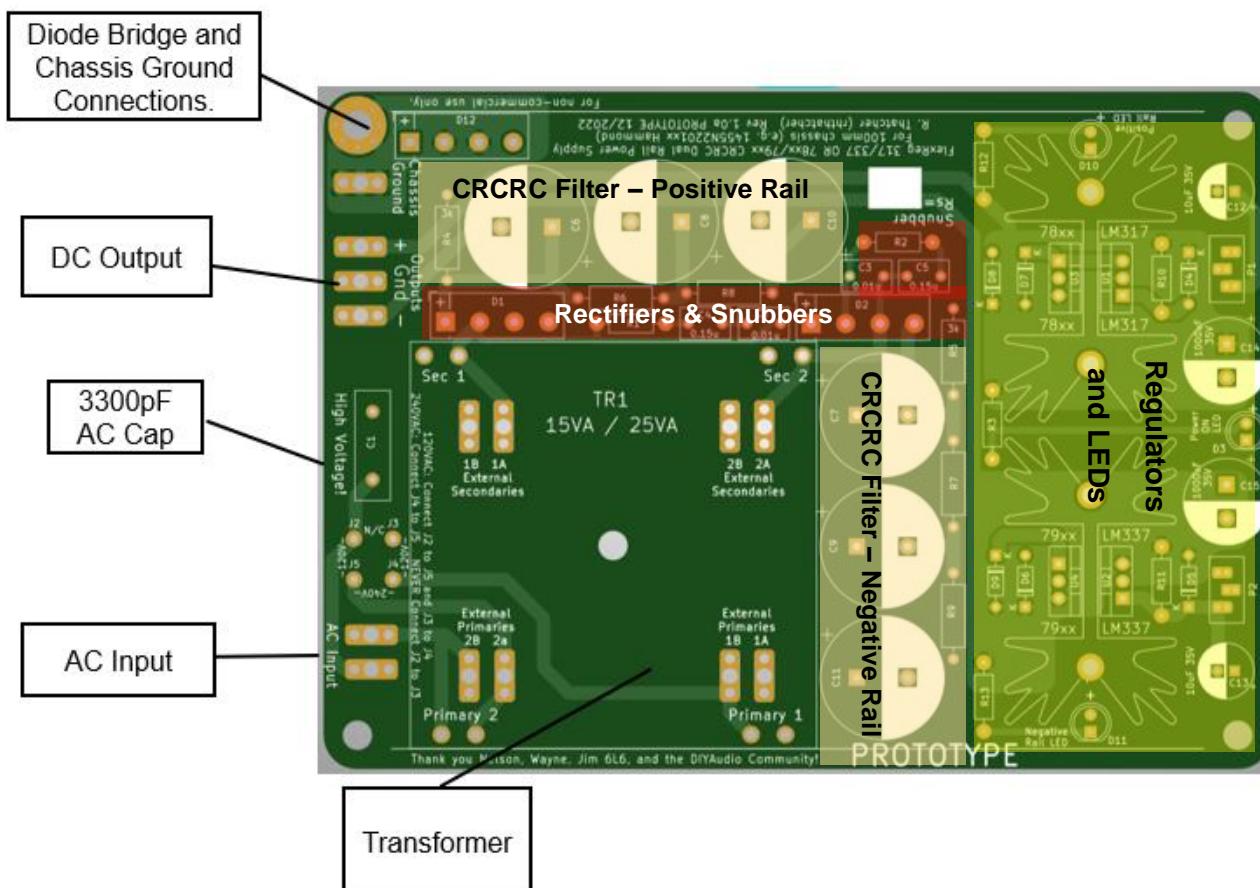
Version / Date		Revision History
V1.0a	03 January 2023	DRAFT
V1.0b	03 March 2023	Original Release
V1.0c	17 April 2023	Corrected numbering error in BOM – Thank you comiccc!r

Getting to know the PCB

The PCB size is 100x140mm.

The PCB is designed to fit into a Hammond Chassis (1455N2201xx Series) with room for IEC and Switch.

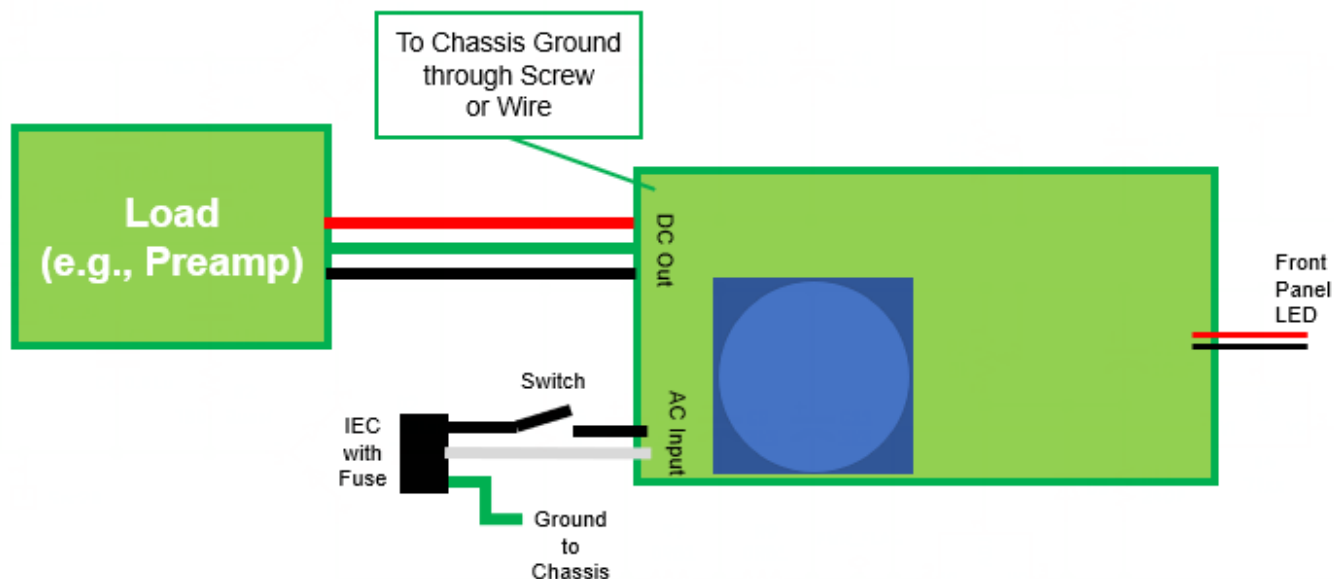
The mounting holes are also compatible with the DIYAudio / Modushop 10x10mm grid.



PCB Revisions

PCB	Version / Date	Revision History
FlexReg Dual Rail	V1.0a – 12/2022	Prototype
FlexReg Dual Rail	V1.0b – 1/2023	Initial Release

FlexReg Dual Rail Wiring Concept



Parts Selection

- Determine your desired output voltage and current, then select the appropriate transformer and filter caps (C6-11) and filter resistors. Refer to below and BOM.
- Determine if you want fixed or adjustable output voltage
 - o Fixed: follow 78xx/79xx Schematic and BOM
 - o Adjustable: follow 317/337 Schematic and BOM

There are columns in the BOM highlighting "Yes/No" for each configuration

Depending on output voltage, the PCB's power output is limited by transformer VA rating or regulator current rating. Plan accordingly.

Transformers

- Size: 60x60mm
- 15 or 25 VA Rating
- Digikey stocks Amgis and Talema transformers for this application. BOM shows Amgis option. Either will work great.
- OPTIONAL: use external transformer and wire to PCB.

Power Supply Output	Transformer Secondary Voltage
5-7 VDC	2x 7VAC
7-10 VDC	2x 9VAC
10-13 VDC	2x 12VAC
13-18 VDC	2x 15VAC
18-22 VDC	2x 18VAC
22-28 VDC	2x 22VAC

Connections to PCB

You have several options for wire connections to the board including Quick Disconnect Spades, bare wire, or Euroblock type 5mm / 5.08 mm connectors.

Setting Mains Voltage to 120 or 240V

For 120V Mains connect J2 & J5 and connect J3 & J4 with jumper wires (e.g. old resistor leads)

For 240V Mains connect J4 & J5 with jumper wires

NEVER CONNECT J2 & J3

Fuse

You **MUST** use a fuse. Options include a fused IEC or standalone fuse holder. Suggested fuse values are in the BOM.

Grounding

Always ground IEC earth ground pin to Chassis!

Connect "Chassis Ground" point on the PCB to chassis

- Option 1: connect a ground wire from the PCB connection point to the Chassis
- Option 2: connect via metal screw between chassis and PCB. Use Lock / Star Washers.

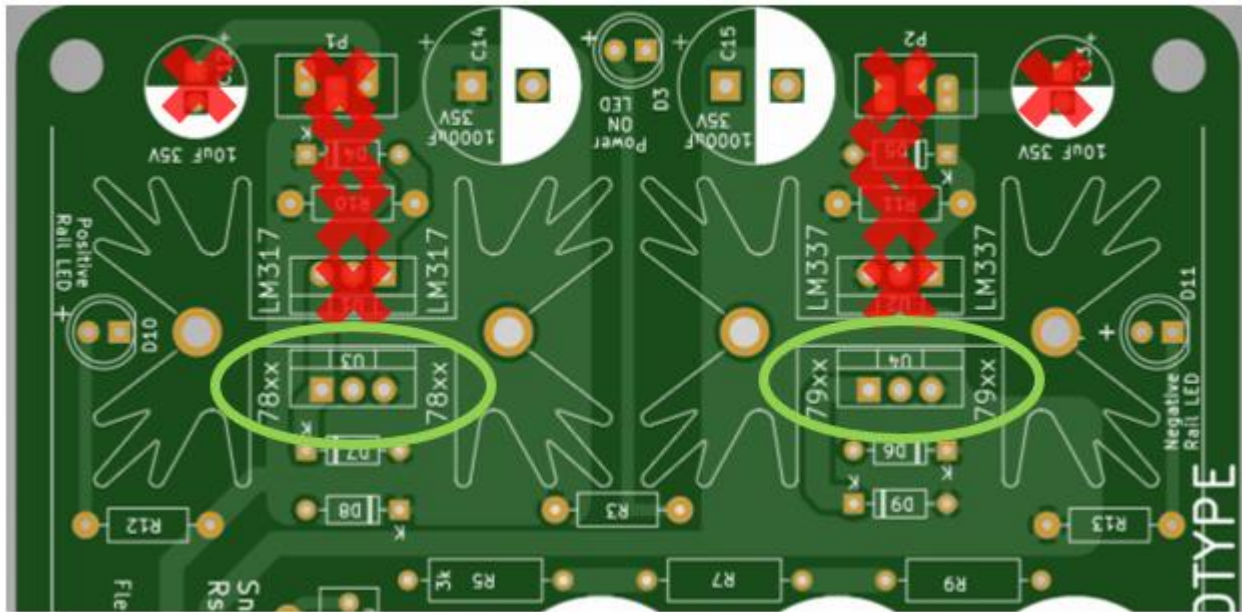
Snubbers (Optional)

The snubber circuit is used to damp ringing between the transformer and the rectifiers. The theory and application is well described by Mark Johnson in his paper including on post #1 of the DIYAudio thread entitled "Simple, no-math transformer snubber using Quasimodo test-jig". Using a Quasimodo test jig one can determine the Snubber Resistor value required.

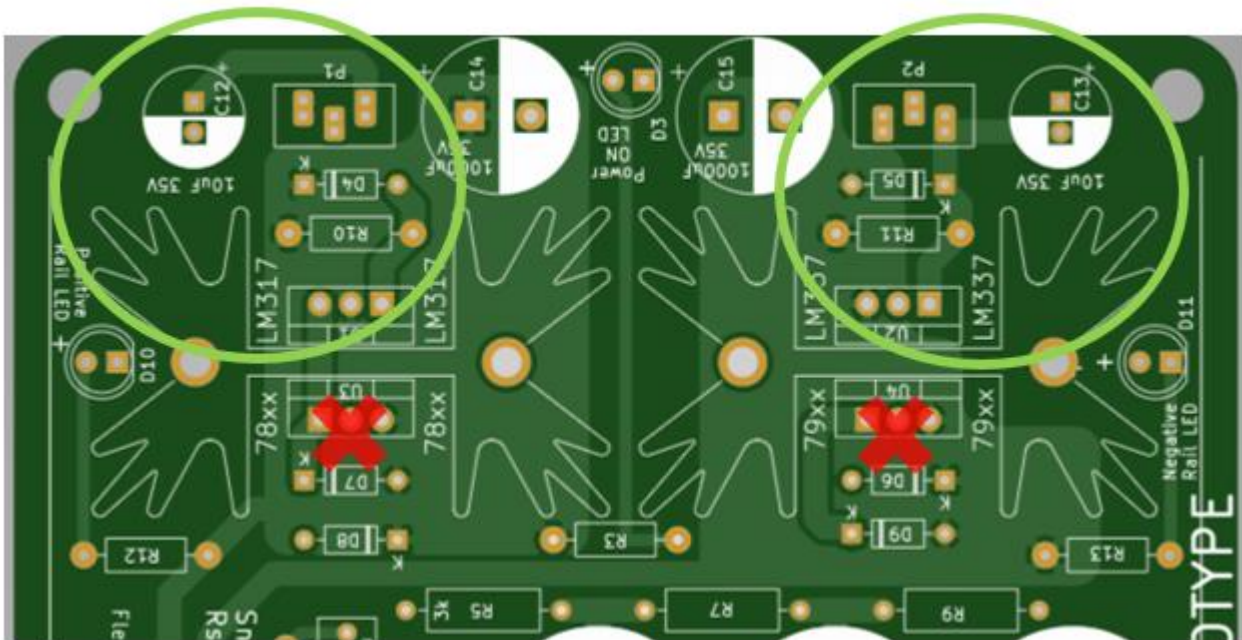
Regulators – Fixed 78xx/79xx Series vs. Adjustable 317/337 Series

Note which positions will be populated based on selection of 78xx/79xx vs. 317/337 regulators. Refer to Schematic and BOM for additional details.

FlexReg Dual Rail using 78xx/79xx Regulators

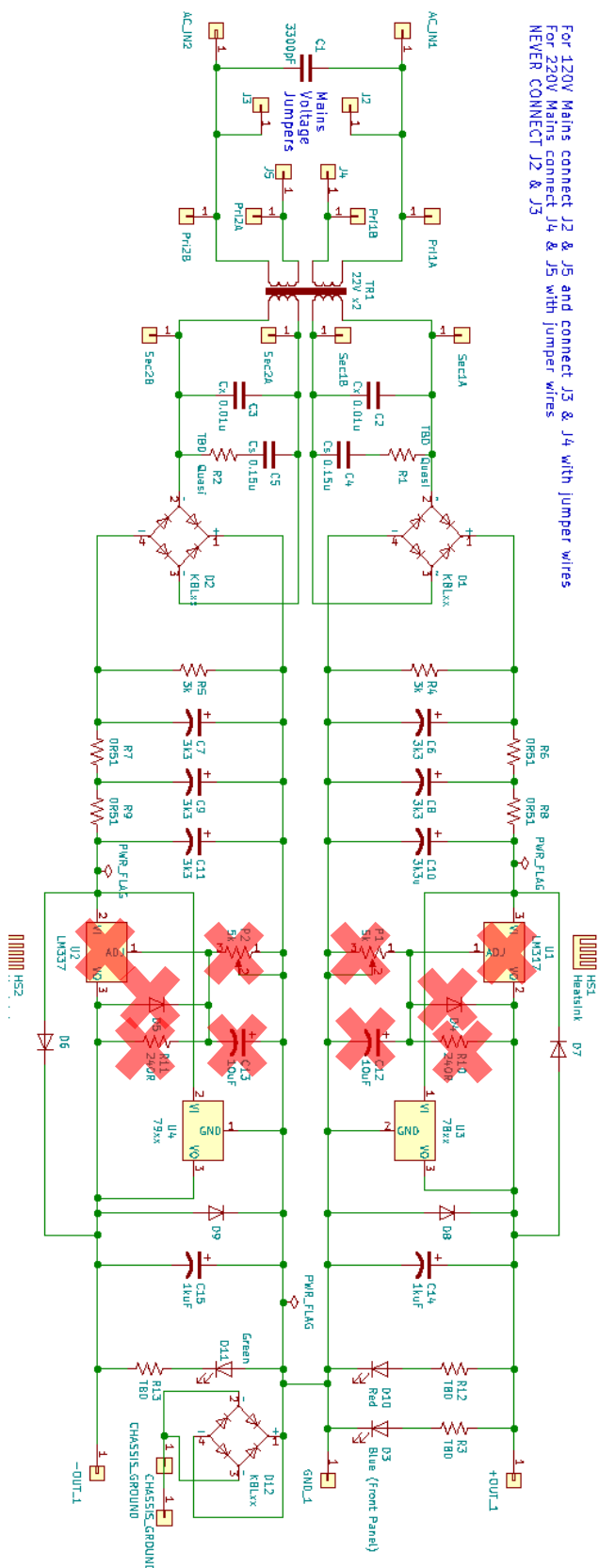


FlexReg Dual Rail using 317/337 Regulators



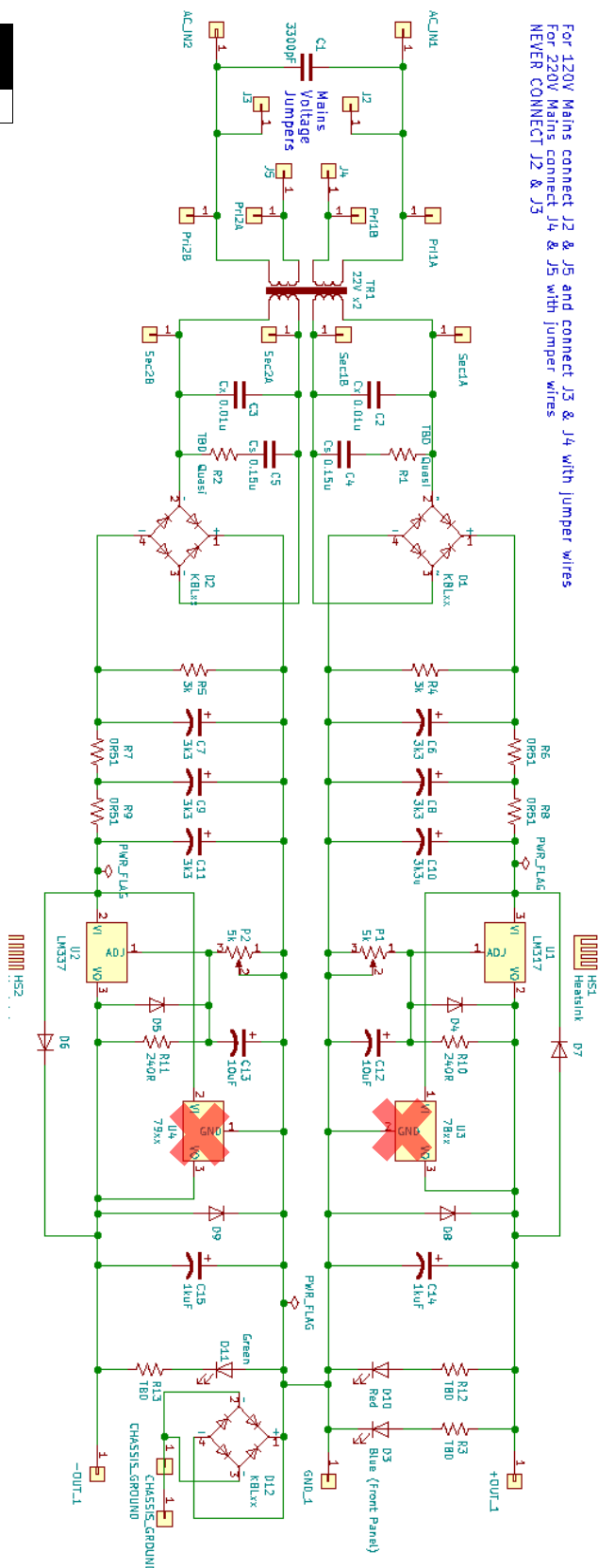
PCB Schematic – for use with 78xx/79xx Series RegulatorsDo not populate items with **Red X** (these are related to 317/337 regulators)

78xx/79xx Version Do Not Populate the following
U1 & U2
P1 & P2
D4 & D5
R10 & R11
C12 & C13



PCB Schematic – for use with 317/337 Series RegulatorsDo not populate items with **Red X** (these are related to 78xx/79xx regulators)

317/337 Version
Do Not Populate the following
U3 & U4



FlexReg Dual Rail BOM

BOM Version: v1.0a DRAFT

This table contains example part numbers and part recommendations. Any good quality similar parts will work with no detriment to the sound. Pay attention to notes on component sizing when making substitutions.

Qty	Reference	Value	Example Digikey Part Number	78xx/ 79xx	317/ 337	Notes
1	C1	3300pF, X1 Safety Rated	399-9501-1-ND	Yes	Yes	AC voltage must be rated above line voltage
2	C2, C3	FILM 10000pF / 10nF / .01uF	495-4975-1-ND	OPT	OPT	OPTIONAL: Snubber Cap
2	C4, C5	FILM 150nF / .15uF	495-77011-1-ND	OPT	OPT	OPTIONAL: Snubber Cap
6	C6-11	10000uF 16V	1189-1125-ND	Yes	Yes	5-7 VDC Output
		10000uF 16V	1189-1125-ND	Yes	Yes	7-10 VDC Output
		6800uF 25V	1189-1706-ND	Yes	Yes	10-13 VDC Output
		6800uF 25V	1189-1706-ND	Yes	Yes	13-18 VDC Output
		4700uF 35V	399-6595-ND	Yes	Yes	18-22 VDC Output
		4700uF 35V	399-6595-ND	Yes	Yes	22-28 VDC Output
		Electrolytic Cap up to 18mm Diameter, 7.5mm Lead Spacing, if using Hammond Enclosure: Max 40mm High				
2	C12, C13	10uF, 35V	493-11378-1-ND	NO	Yes	Up to 8mm diameter, 2.5mm Lead Spacing
2	C14, C15	1k uF, 35V	P19672CT-ND	Yes	Yes	Up to 12.5mm diameter, 5mm Lead Spacing
3	D1, D2, D12	Diode Bridge - KBL Package	641-2007-ND	Yes	Yes	KBL404, KBL406 or similar
3	D3, D10, D11	LEDs	Get an assortment pack on Amazon	Yes	Yes	3 or 5MM LED. All blue/cyan, or blue/cyan for "Power On" LED, red/green for rails.
2	D4 - D5	1N4002		NO	Yes	Get a 100 pack on Amazon
4	D6 - D9	1N4002		Yes	Yes	
2	HS1	Heatsink – 15VA	657-10ABPE	Yes	Yes	If using 15VA Transformer
		Heatsink – 25VA	345-1220-ND	Yes	Yes	If using 25VA Transformer
2	P1, P2	5k	3296W-502LF-ND	NO	Yes	Multi-turn pot - 5K
2	R1, R2	TBD Quasi	TBD	OPT	OPT	OPTIONAL: Snubber Resistor. Use Quasimodo
3	R3, R12, R13	TBD - LED Drop Resistors	TBD	Yes	Yes	LED Dropping Resistor. "Rule of Thumb" - 1k Ohm per PSU volt.
2	R4, R5	3k / 1W	PPC3.0KW-1CT-ND	Yes	Yes	Bleeder Resistors
4	R6 - R9	0R51 / 1W	A138242CT-ND	Yes	Yes	For applications <0.5A
		0R51 / 2W	A138376CT-ND	Yes	Yes	For applications >0.5A
/2	R10, R11	240R	13-MFR50SFTE52-240RCT-ND	NO	Yes	
1	TR1 – 15VA	2x 7VAC	TE2250-ND	Yes	Yes	15VA 5-7 VDC Output
		2x 9VAC	TE2251-ND	Yes	Yes	15VA 7-10 VDC Output
		2x 12VAC	TE2252-ND	Yes	Yes	15VA 10-13 VDC Output
		2x 15VAC	TE2253-ND	Yes	Yes	15VA 13-18 VDC Output
		2x 18VAC	TE2254-ND	Yes	Yes	15VA 18-22 VDC Output
		2x 22VAC	TE2255-ND	Yes	Yes	15VA 22-28 VDC Output
1	TR1 – 25VA	Transformer 25VA 2x 7VAC	TE2256-ND	Yes	Yes	25VA 5-7 VDC Output
		Transformer 25VA 2x 9VAC	TE2257-ND	Yes	Yes	25VA 7-10 VDC Output
		Transformer 25VA 2x 12VAC	TE2258-ND	Yes	Yes	25VA 10-13 VDC Output
		Transformer 25VA 2x 15VAC	TE2259-ND	Yes	Yes	25VA 13-18 VDC Output
		Transformer 25VA 2x 18VAC	TE2260-ND	Yes	Yes	25VA 18-22 VDC Output
		Transformer 25VA 2x 22VAC	TE2261-ND	Yes	Yes	25VA 22-28 VDC Output

Qty	Reference	Value	Example Digikey Part Number	78xx/ 79xx	317/ 337	Notes
1	U1	LM317	497-1575-5-ND	NO	Yes	Adjustable Positive Voltage Regulator IC 1.5A TO-220
1	U2	LM337	497-1585-5-ND	NO	Yes	Adjustable Negative Voltage Regulator IC 1.5A TO-220
1	U3	78xx Fixed Voltage Positive Regulator	MC7805BTGOS-ND	Yes	NO	5V Fixed Output Positive
			497-1445-5-ND	Yes	NO	6V Fixed Output Positive
			MC7808CTGOS-ND	Yes	NO	8V Fixed Output Positive
			MC7812ACTGOS-ND	Yes	NO	12V Fixed Output Positive
			MC7815ACTGOS-ND	Yes	NO	15V Fixed Output Positive
			MC7818BTGOS-ND	Yes	NO	18V Fixed Output Positive
			MC7824ACTGOS-ND	Yes	NO	24V Fixed Output Positive
1	U4	79xx Fixed Voltage Negative Regulator	MC7905CTGOS-ND	Yes	NO	5V Fixed Output Negative
			MC7906CTGOS-ND	Yes	NO	6V Fixed Output Negative
			MC7908ACTGOS-ND	Yes	NO	8V Fixed Output Negative
			MC7912ACTGOS-ND	Yes	NO	12V Fixed Output Negative
			MC7915CTGOS-ND	Yes	NO	15V Fixed Output Negative
			MC7918CTGOS-ND	Yes	NO	18V Fixed Output Negative
			MC7924BTGOS-ND	Yes	NO	24V Fixed Output Negative
1	AC In Terminal Block	2 Position Terminal Block	277-1667-ND	OPT	OPT	
1	Output Terminal Block	3 Position Terminal Block	A98077-ND	OPT	OPT	
1	Fuse	200mA / 250V Slow Blow	507-1699-ND	Yes	Yes	15VA / 120V Mains
		315mA / 250V Slow Blow	507-1697-ND	Yes	Yes	25VA / 120V Mains
		100mA / 250V Slow Blow	507-1238-ND	Yes	Yes	15VA / 240V Mains
		160mA / 250V Slow Blow	507-1550-ND	Yes	Yes	25VA / 240V Mains