Regenerative powerdump circuit.

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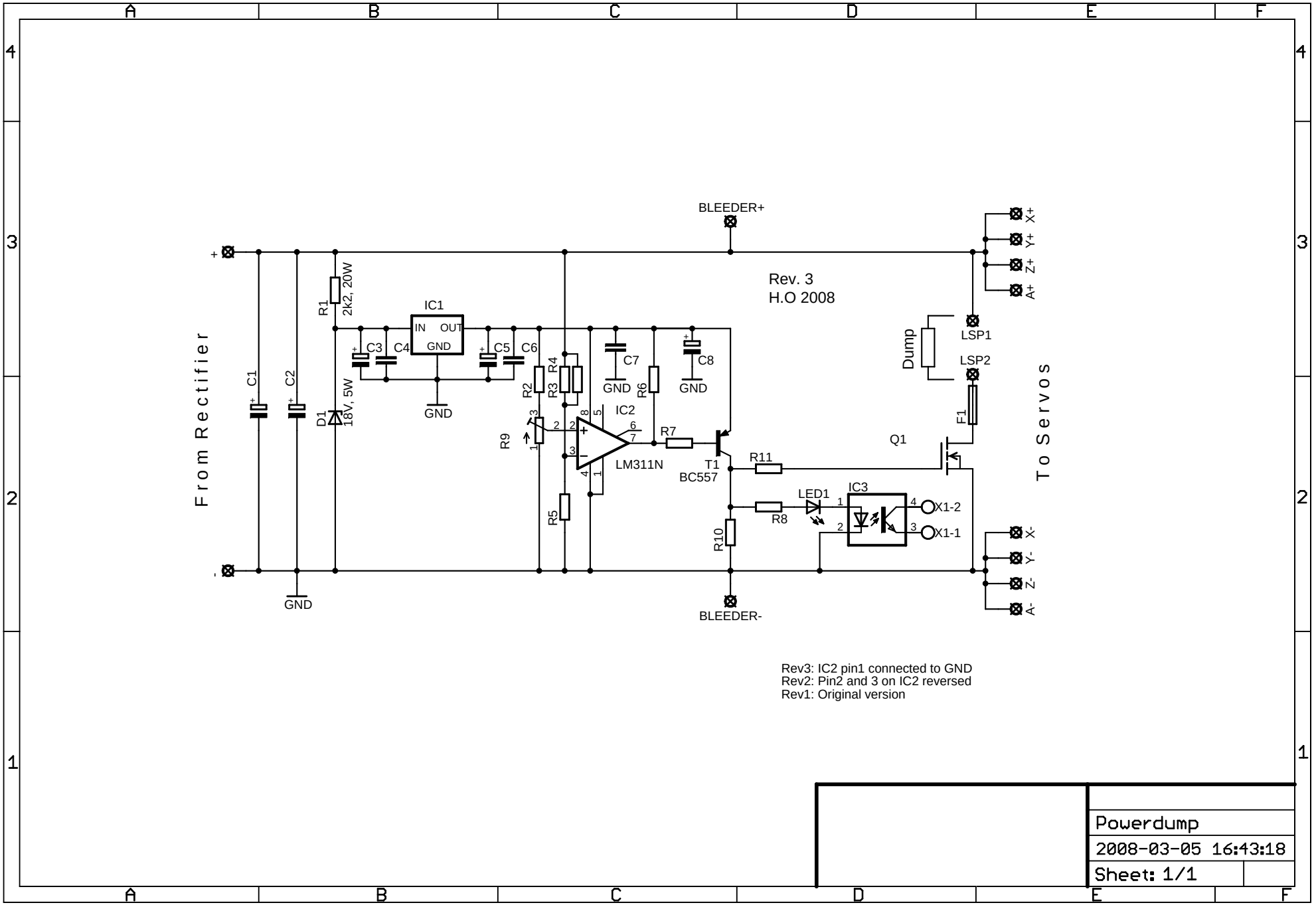
Disclaimer:

This circuit diagram has been checked to the best of my abilities but is supplied ”as is”. It is up to the end user to implement it properly. I can not be held responsible for any damage or injury caused by following this document.

Please, always be careful when working with electricity in general and high voltage, high current powersupplies in specific.


BLEEDER+
BLEEDER-
From Rectifier
To Servos
Rev. 3
H.O 2008
R1 2k2, 20W
D1 18V, 5W
C1
C2
C3
C4
C5
C6
C7
C8
IC1
IN OUT GND
IC2
LM311N
R2
R3
R4
R5
R6
R7
R8
R9
R10
R11
T1 BC557
Q1
LED1
IC3
X1-2
X1-1
Dump
LSP1
LSP2
F1
X+
Y+
Z+
A+
X-
Y-
Z-
A-
GND
Rev3: IC2 pin1 connected to GND
Rev2: Pin2 and 3 on IC2 reversed
Rev1: Original version
Powerdump
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Parts list:

R1: 2k2, 20W (see note)
R2: 33k
R3: 220k 1%
R4: 180k 1%
R5: 1k
R6: 100k
R7: 1k
R8: 820ohm
R9: 10k, multiturn
R10: 100k
R11: 150ohm

C1: N/A (see note)
C2: N/A (see note)
C3: 100uF
C4: 100nF
C5: 100uF
C6: 100nF
C7: 100nF (see note)
C8: 100uF

T1: BC557
Q1: IRFP264 or IRFP264N
D1: 18V, 5W zenerdiode

IC1: 7812
IC2: LM311N
IC3: PC817

Notes:

- C1 and C2 are the main filter capacitors in the power supply and are shown here for illustration purposes only.
- C7 should be mounted as close to IC2 as possible.
- R3 and R4 should be 99k when connected in parallel.
- The value and power rating of resistor R1 depends on the nominal powersupply voltage. The table below shows the approximate values for various voltage ranges:

Power supply	R1 value	R1 power rating
50-80V	560ohm	14W
70-100V	820ohm	14W
90-120V	1200ohm	20W
110-140V	1500ohm	20W
130-170V	1800ohm	20W
160-200V	2200ohm	25W

I've already included a safety margin regarding the power rating sp the above value should be fine. Please note that this resistor will get very hot during operation.

Circuit description:

R1 and D1 brings down the powersupply voltage to around 18V which then feeds IC1. IC1 regulates the voltage further which insures a stable (enough) reference voltage for the comparator circuit.

R2 and the trimmer R9 forms an adjustable voltage divider which provides the comparators positive input with its reference. R3, R4 and R5 forms another voltage divider which provide the comparators negative input with a voltage that is 1% of the actual powersupply voltage. In other words, if the powersupply voltage is 125V there will be 1.25V at pin 3 of IC1.

In normal operating condition the voltage at the positive input of the comparator should be adjusted with R9 so that it is higher than 1% (plus some margin) of the voltage at which you want the circuit to activate. The comparators open collector output is then held high by R6 so that T1 is not conducting.

When the powersupply voltage, and therefore the voltage at pin3 is higher than the adjustable setpoint, the comparator switches its output to GND. This will turn on T1 which in turn will switch on the MOSFET Q1, connecting the dump resistor across the DC-bus. LED1 will turn on when dumping occurs and the optocoupler can be used as an interface to external circuits.

The IRFP264 is rated at 38A and the IRFP264N at 44A. The dump resistor needs to be selected so the current thru the MOSFET is well below those values. The fuse, F1 is there to prevent the PCB and wiring in case something goes horribly wrong.

Room for improvements:

The standard BC557 can only supply 100mA to the MOSFET gate therefore R11 needs to be 150ohm. A PNP transistor capable of higher current here can reduce the the switching time of the MOSFET. During testing though the BC557 has proven to work just fine.

Adding hysteresis to the comparator circuit is another thing I’ve thought about but don’t really know if the operation of the circuit will benefit from it.

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//Henrik Olsson.