SMART POWER SUPPLY V2.0

A Smart power supply using ATmega32A Microcontroller capable of just about anything.

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SPS V2.0 DETAILS:

1) 120W+ Linear Power Supply.
2) Has two charging ports, one for normal speeds (5W) and the other for high-speed charging (37W).
   - The 5W charging circuit will be current limited at 1A using the L7805 regulator.
   - The 37W charging circuit will be using the L7818 Regulator.
3) Has two output voltage modes,
   - ➔ The first is a positive only High ampere output capable of delivering full power (120W)
   - Using the LM338T voltage regulator
   - ➔ The second is a positive AND negative medium (1.5A) output capable of everyday electronic testing.
   - Using LM317T and LM337T for both positive and negative voltages respectively.
4) Has a charging port for 18650 batteries.
5) Has a charging port for Lithium-ion batteries using the TP4056 battery charging module.

All of this will be controlled using the ATmega32A microcontroller.

- ➔ All the outputs will be controlled via relays or high power MOSFETS, each output will be a function that YOU (The user) execute via a menu that appears on the LCD.
- ➔ Voltage reading will be via voltage dividers.
- ➔ Current reading will be using the ACS712 current sensor module (up to 20A).

There are currently 3 working modes in the SPS project but in the future, I want to add at least two more useful modes like a built in Function generator and a Frequency counter using Timer 1 peripheral.

I've also created a GitHub page that is still in the works that explains the project a bit more, over at the link below.

- ➔ https://github.com/RattleBrattle/SmartPSU.git

EXPLAINING EACH FUNCTION WITH DETAIL:

In this section, I will explain to you each function that the SPS (Smart Power Supply) V2.0 is capable of and providing circuit schematic and connection explanations.

1) THE MAIN TWO OUTPUTS OF THE SPS V2.0:

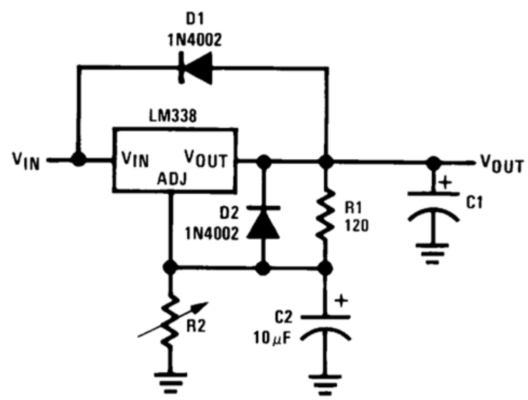
→In here I will explain the main two outputs.

THE FIRST BEING THE HIGH AMPERE OUTPUT WITH FULL POWER.

→I will be using the LM338T, which is an excellent voltage regulator capable of delivering a MAX 5A load with 32V which will be more than enough to power most DC motors and high-powered components.

- Using the ATmega32's PWM output (TMR0) as a driver for a MOSFET (NMOS) to efficiently and effectively control the output voltage.
- The MOSFET I am using is going to be IRLZ44N – NMOS, which for this use case is going to be more than sufficient in controlling the voltage output via PWM from the ATmega32A.

For the LM338T, we're going to connect it using the figure given in the datasheet and since stated in the datasheet for outputs more than 24V we need protections diodes, so we're going to use protection diodes.



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$V_{OUT} = 1.25V\left(1 + \frac{R2}{R1}\right) + I_{ADJ}R2$

Since I'm going to control the output voltage using the NMOSFET instead, so I am going to R2 to the highest value possible.

$34 = 1.25\left(1 + \frac{R_2}{220}\right)$ So then $R_2 = 5984 \approx 6k\Omega$.

So, for this configuration a resistor of 6K would do.

THE SECOND BEING THE LOW AMPERE OUTPUT WITH MINIMUM POWER.

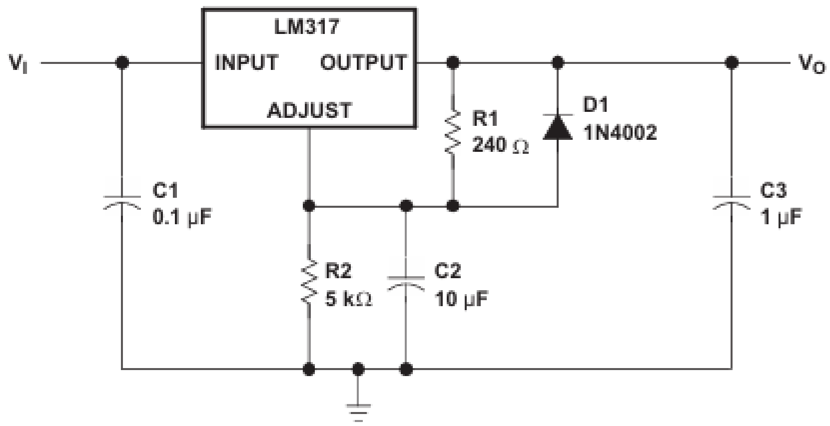
→In this mode, I will stick to the tried and true positive and negative voltage regulators.

- The LM317T and the LM337T.
- Both offer the same Ampere output and will do greatly at just about testing everyday electronic components that don't require much power unlike the LM338T.

Similarly, I am going to be using a PWM control signal to efficiently and effectively create a drive signal for the NMOS connected to the Low output.

Circuit for LM317T:

In this circuit, we have improved ripple rejection (increase signal output stability) by adding the capacitors at the input and C2 at the ADJ pin, similarly Diode D1 exists as protection in case the output is shorted to ground.



- The LM317T follows the same formula as the LM338T so the circuit values are going to be the same as above.

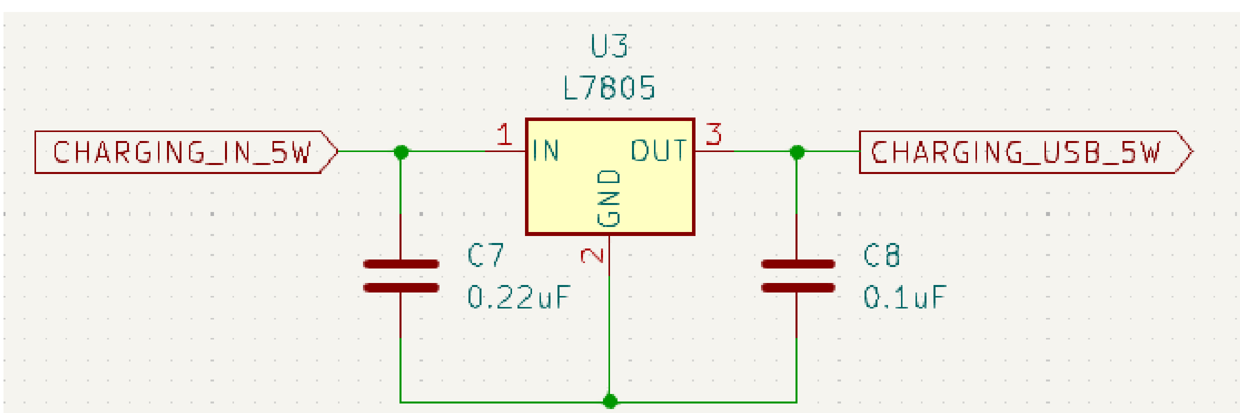
2) CHARGING CIRCUITS:

→The charging circuits for the USB output ports are simple enough to charge most phones and power most USB powered electronic devices.

To enable the Charging circuit outputs, the user chooses mode 3 in the LCD screen menu which sends a signal via the ATmega32A to the Relay controlling the Charging circuits and also sends power to the Lithium Battery Charger and 18650 Battery charger.

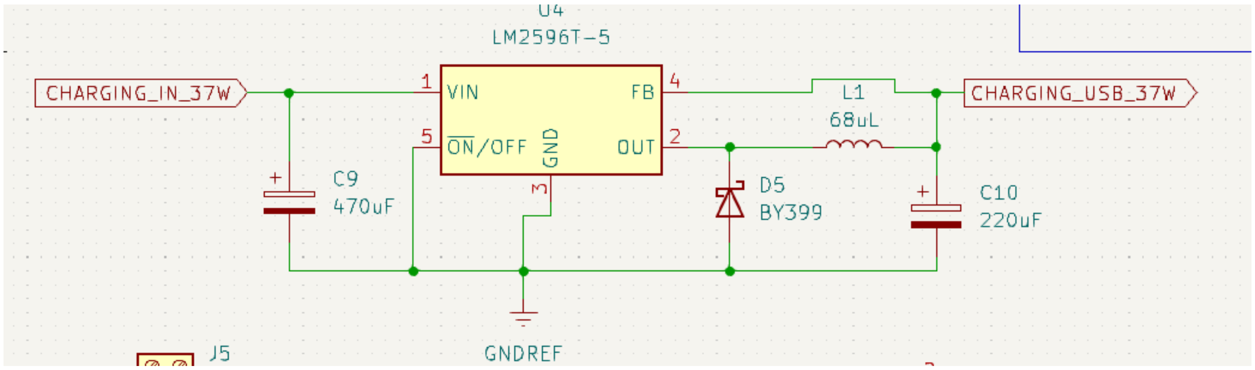
5W CHARGING CIRCUIT:

- ➔ The 5W-7.5W circuit is meant to be used to power low power electronics via USB output or charge old phones, and smartwatches.
- ➔ The Circuit is going to be built using the simple regulator L7805, where 5V is the target output voltage.



15W CHARGING CIRCUIT:

- ➔ This circuit is going to use the LM2596 – 5V regulator.



All the values are chosen according to the datasheet to provide the highest stable output voltage with low voltage ripple.

TP4056 LITHIUM BATTERY CHARGER:

→There is another output charging signal that is sent by the ATmega32A controller when the user chooses Charging mode, that activates the Lithium Battery Charger and the 18650 battery charging.

1) TP4056 module.
2) Using a 15W battery bank charger module to charge the 18650 batteries.

3) FREQUENCY COUNTER:

→WIP!

4)FUNCTION GENERATOR:

→Using the inbuilt PWM signal for Timer 2 peripheral and op-amps.

→WIP!

SMART POWER SUPPLY CASE DESIGN:

→WIP!