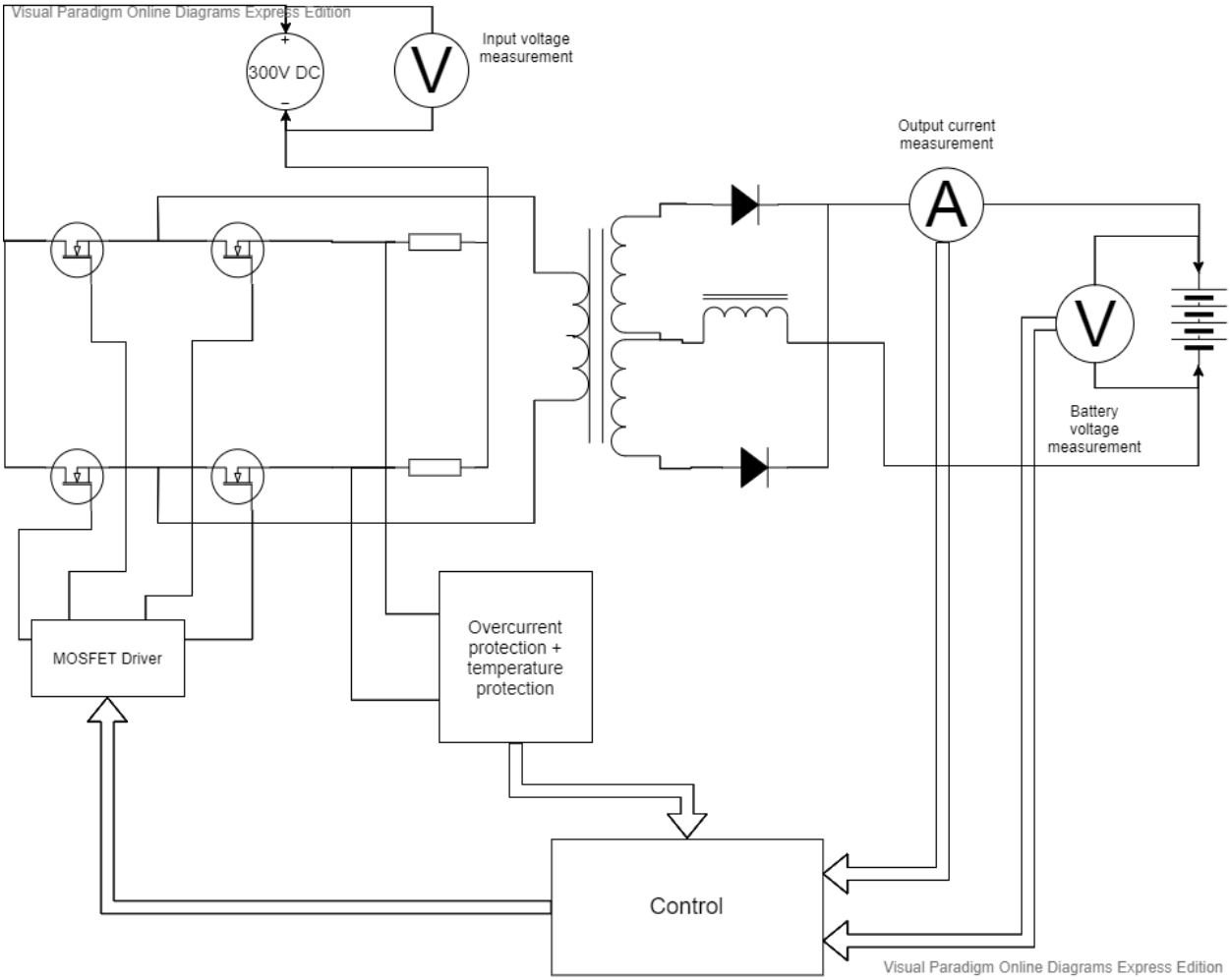
Battery charger description



The charger is powered by the single phase 220V source and after rectification and filtering the DC voltage is approximately 300V. The filter capacitors need not to be large, since some pulsation is tolerable when charging batteries.

The switching type is full bridge, using phase shift technique. Both parts of the bridge are fed with fixed 50% duty cycle pulse train. The phase shift between the half bridges controls the output current. The MOSFET drive signals, current feedback and the UART control are managed by dsPIC33FJ16GS502 microcontroller. It is a special purpose PIC series for implementing in DC-DC conversions up to 400кHz.

Switching circuit

The switching transistors are SPW17N80C3 in TO247 package. The maximum ratings are 17A drain current and 800V drain-source voltage. During the switching off phase It is highly possible to have 600V DC voltage at the transistors.

Transformer

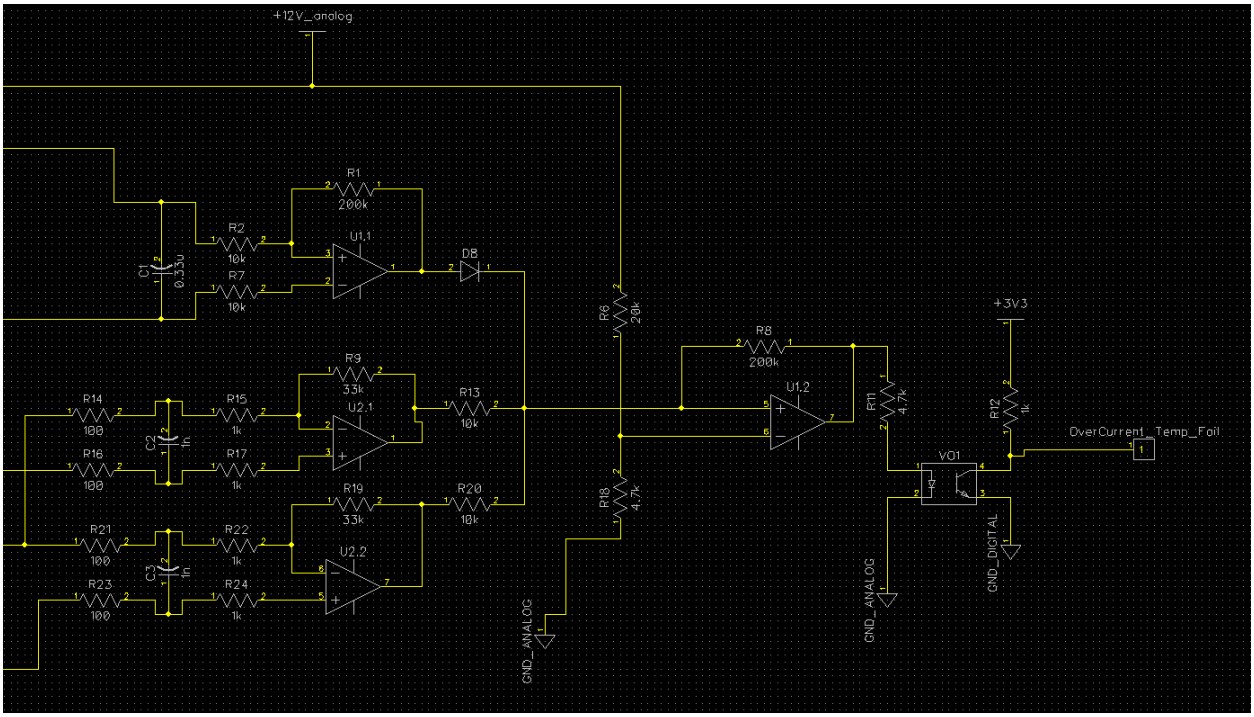
The transformer uses Epcos PM62/49 B65684A0000R027 ferrite N27 cores. The cores could be purchased with the matching coil former. The ratio is 12:10:10 windings with 3mm copper wire. The secondary winding is center tapped.
The transformer ratio could be changed in accordance with the battery voltage. In that case the output voltage control must be corrected in the software.

Rectifiers

The full wave rectifier uses 2 diodes of type DSEP29-12A It is Fast Diode, 1.2 kV, 30 A, 40 ns. Have in mind that the double voltage is applied over the reverse polarized diode in the full wave rectifier. That is why we should pick at least 1.2kV diode. It must be also soft recovery diode to decrease the switching spikes in the secondary circuit.

Filter inductor is used to limit the current in the output. I chose Epcos B66387G0000X187 ferrite with 70 wounds of 2mm wire. 1mm gap in the ferrite is required to prevent saturation at 10A charging current.

Overcurrent and temperature protection



The overcurrent protection is accomplished of 2 shunts R1 and R2, on each leg of the bridge. After filtering the current signal is applied to the differential amplifiers U2.1 and U2.2. Adding both amplified

signals goes to the comparator U1.2. In case the current via switching transistors increases above 8-9A, the overcurrent signal is triggered at pin AN2/RA2 of the PIC. The microcontroller fail-signal switches off the PWM generator. After the overcurrent condition subside, the PWM generator resumes it's function.

The thermo protection is accomplished by a thermistor TDK B59901D0060A040. It is not shown on the circuit diagram, but the thermistor is connected to pin J3-6 and is part of the resistor bridge R3-R4-R10. Tested at 60 deg the thermistor reaches 10kOm and triggers the comparator U1.1. Via the diode D8 the thermo protection is applied to the same fail pin of the PIC microcontroller.