VOLTAGE REGULATOR / DC-DC CONVERTER

LPRDS-CMS-2011 TECHNICAL MEMO

SUBJECT: VOLTAGE REGULATOR / DC-DC CONVERTER
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ABSTRACT
A voltage regulator must be selected for the OBPP and ESS boards. The boards will be powered by the 4-cell battery packs. This means that the supply voltage will range anywhere from 9-13 volts. The circuits require a steady 5 volt source. This memo will outline the power supplies tested, researched, and selected for our project.

TECHNICAL FINDINGS
Since the power supply varies with the amount of charge in the cells, a zener diode power supply was originally tested. The benefit of a zener diode is that once it is biased above its designated value, it produces a constant voltage drop across the diode. This simple circuit was verified with a resistor and zener diode in series with a 12 volts supply. Even when the power supply was adjusted from 9-15 volts, the drop across the diode remained relatively constant. It only varied a few hundred millivolts. This circuit can be improved by connecting the top of the diode to the gate of a bipolar transistor. This retains the voltage supply characteristics of the zener diode but increases the current driving capability of the supply. This circuit was verified and worked as desired. It is important to note the voltage drop of the bipolar transistor must be taken into account. Therefore, if a 5 volt supply is desired, a 5.6V zener diode in conjunction with a bipolar transistor would produce the desired result. The downside of this type of power supply is that is has a very high quiescent current which would drain the batteries even when the boards were using little power from the 5 volt supply. Professor Nadovich informed me the zener diode and bipolar transistor is common in linear regulators and that I should look for a component with a low quiescent current.

RECOMMENDATIONS AND DECISIONS
After researching various components, I recommend the LM 2936 Voltage Regulator for the OBPP and ESS boards. It can accept up to 60V input and produces a steady 5V supply. It also has an ultra-low quiescent current as low as 15uA. There were other supplies with less quiescent current but could not accept an input voltage as high as 13V.

ATTACHED DOCUMENTS
LM2936.pdf