Electric Vehicle Charger for Plug-In Hybrid Electric Vehicles

FUNCTIONAL DESCRIPTION AND COMPLETE SYSTEM BLOCK DIAGRAM

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INTRODUCTION

The goal of the plug-in hybrid electric vehicle project is to design a system that will function as an electric vehicle charger. A Digital Signal Processor based power electronics converter will be designed such that the system can convert 120 volt AC grid power to the required 48[V] DC value to charge an electric vehicle battery of less than 1 KW power. The system consists of a boost converter and a bi-directional converter for discharging and charging of the energy storage elements such as batteries or ultra-capacitors under load variation.

GOALS

Develop the control algorithm of this system based on the TMS320F2812 DSP board.
Calculate values for all circuit elements.
Select specific devices and circuit elements that fit within the values previously calculated to use in our system.
Design and test circuitry subsystems, then combine into the completed system.

SYSTEM BLOCK DIAGRAM

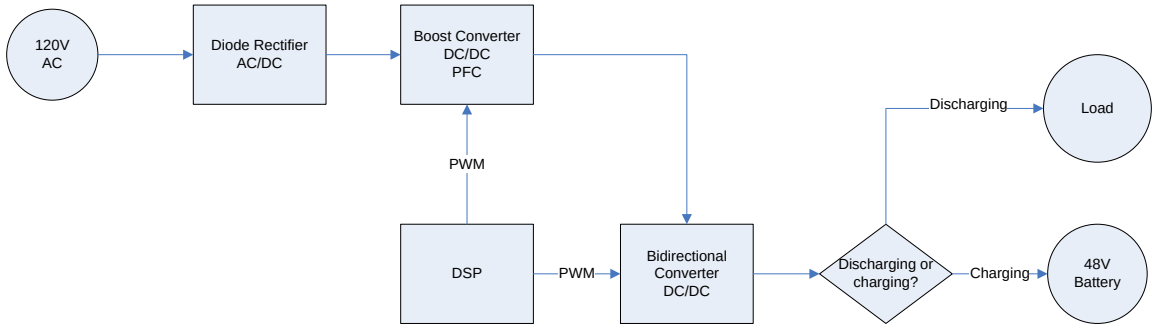

Figure 1. High Level System Block Diagram

SUBSYSTEMS

Diode Rectifier:
Will be used to convert 120 Vrms AC grid power to DC. This DC voltage will later be manipulated by the other circuitry to safely charge the battery.

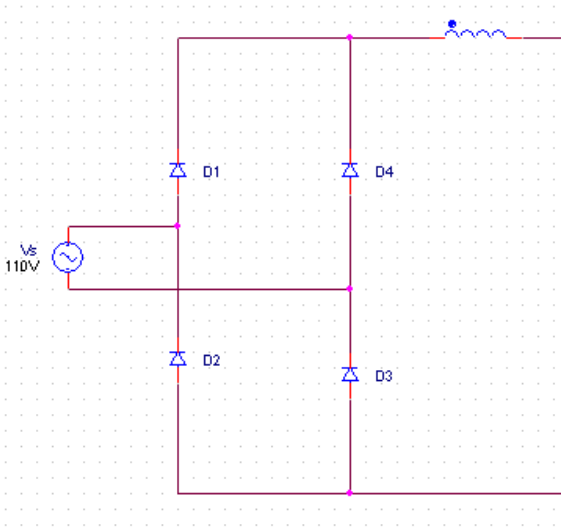

Figure 2. Diode Rectifier Circuit

Boost Converter:
The DC voltage output will be regulated through the DSP based boost converter considering a Power Factor Correction.

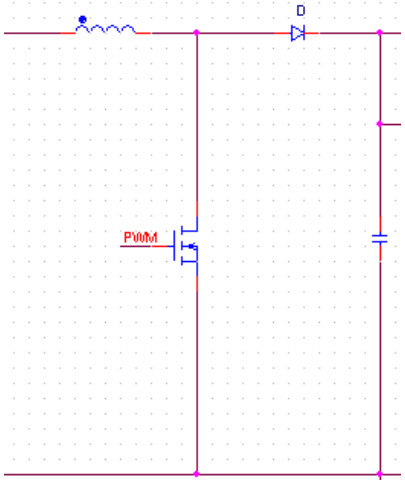

Figure 3. Boost Converter Circuit

Bidirectional converter:

The bidirectional converter will give us the option to use it as a buck converter for lowering the DC voltage to the required level for charging the battery, or a boost converter for raising the voltage to 240 Volts to cope with the varying electric loads; such as, a motor and inverter. The necessary duty cycles will be determined by the DSP and it will output the PWM to the switches.

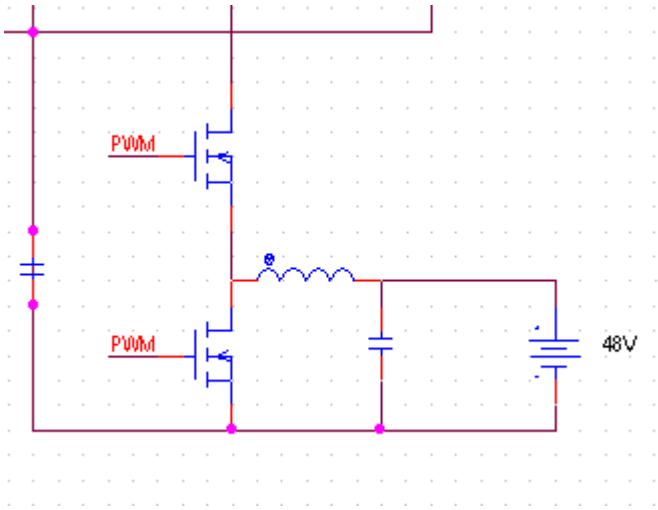

Figure 4. Bidirectional Converter Circuit

Microprocessor Control

The DSP will control and monitor the system for charging and discharging of the battery while performing the power factor correction and protecting the system from the high voltage and current.

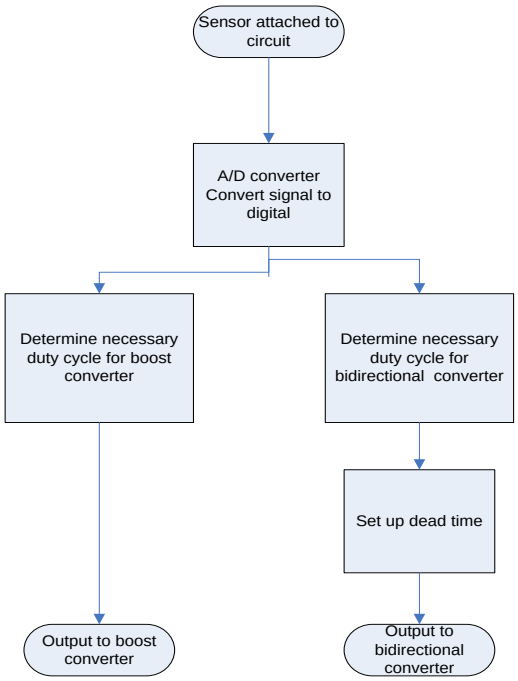

Figure 5. Microprocessor Flow Chart

Appendix A

References

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