

Spring 2018: Solar Array Maximum Power Point Tracker

Sponsor: Michigan State University Solar Car Racing Team

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The Michigan State University Solar Car Racing Team is a student run organization that designs, builds, and races solar powered vehicles. The team participates in a track race called the Formula Sun Grand Prix (FSGP) every summer, and a road race called the American Solar Challenge (ASC) every other summer. The only source of power for propulsion of the car is the solar array, so efficiency is the most important factor.

A maximum power point tracker (MPPT) is an electronic circuit that is the link between the solar array (power generation) and the battery (power storage). It consists of a DC-DC boost converter to take the lower voltage of the solar array and match the higher voltage of the battery, and a microprocessor controlled tracking algorithm to find the maximum power point by adjusting the voltage slightly. Figure 1 shows a typical IV curve for a solar panel under different illumination levels, and figure 2 shows the basic schematic of a boost converter. As the illumination changes, so does the voltage at which the maximum power point occurs. An MPPT can produce the maximum output power possible regardless of illumination level or temperature.

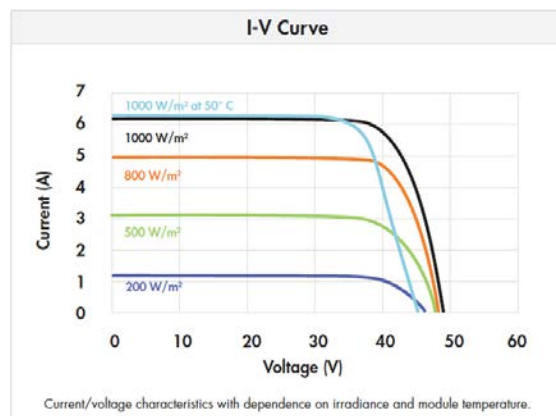


Figure 1: 240W Solar Panel (Source: Sunpower)

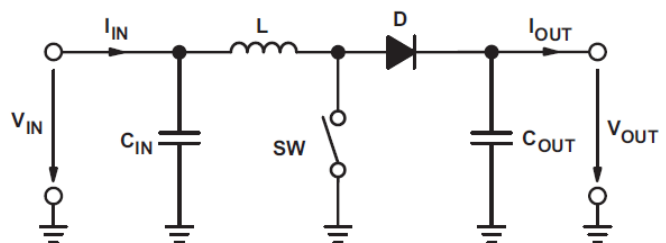


Figure 2: Boost Converter (Source: TI slva372c)

This project will be divided into three stages:

Stage 1: Prototype a DC-DC boost converter (20-60V, 6A input, ~100V output).

Stage 2: Program a microcontroller (TI MSP430) to track and adjust the powerpoint.

Stage 3: Create a PCB combining these two components that meets the design requirements

Design Requirements:

Efficient (Greater than 95%)

Small (Size of a credit card or less)

Lightweight (less than 100g)