



# Therm-Alert: Solar Battery Charger with Thermal Imaging

## Hotspot Detector

John Hathaway & Mike Trutner

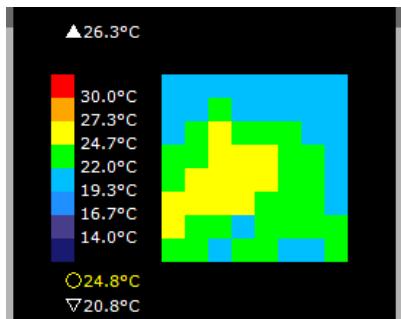


### Abstract

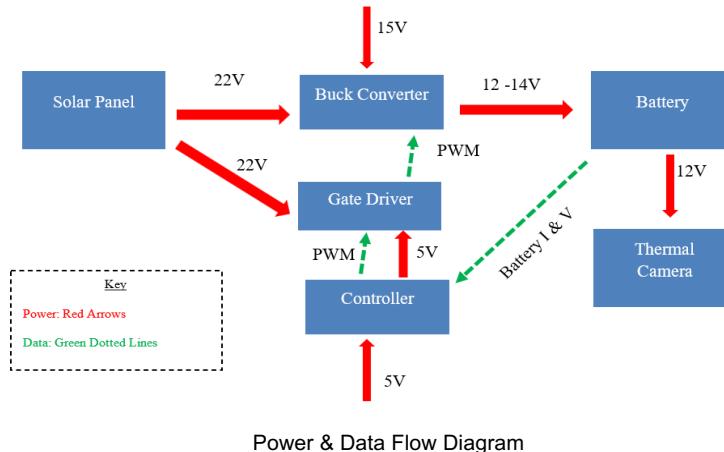
The project is a solar battery charging circuit that uses a 50W solar panel to charge a 12v battery. The charging is achieved using a buck converter circuit controlled by an Arduino Uno. The battery is then used to periodically power a thermal imaging camera that detects hotspots resulting from soiling on the solar panel. Hotspots are a common issue on solar panels and cause degradation of the panels over time. Hotspot detection is critical for increasing the lifespan of a solar panel.

### Background

- Solar panels operate optimally in direct sunlight
- Shading and soiling of photovoltaic panels is a natural occurrence but can cause current to build up in the shaded/soiled area.
- This build up of current causes the panel to heat up and over time this damages the panel.
- Thermal cameras are used to detect these hotspots early to prevent damage and address the issue.
- Most thermal cameras are handheld and only provide data periodically thus a fixed camera would allow for continuous data on the soiling/shading conditions of the panel.



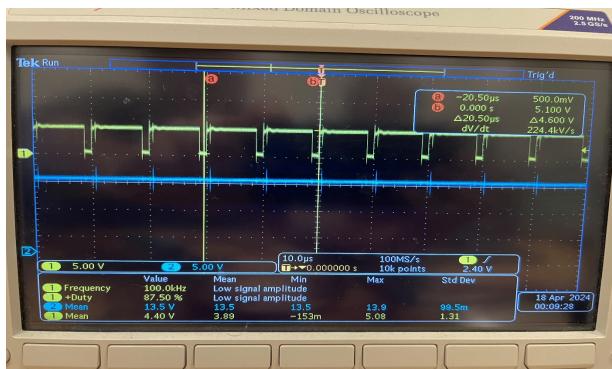
The thermal imaging camera shows the temperature variation across the solar panel.



### Methods and Materials

- The solar panel provides approximately 20 volts at the input of the circuit.
- The buck converter uses current control to modify the pulse width modulation signal into the buck converter that in turn regulates the current into the battery and charges it in a safe and optimal manner.
- The 12-volt 12 Ah lead acid battery is charged by the solar panel. When it is done charging the battery powers the thermal imaging camera.
- The thermal imaging camera is used to detect hotspots on the solar panel which prompts the observer to clean the panel.

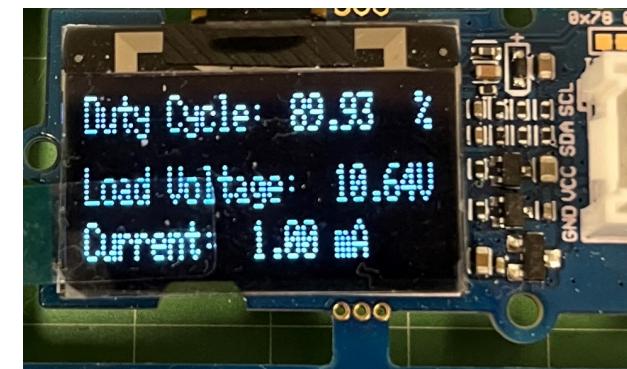
### Results



The output voltage in blue and the duty cycle in yellow. The duty cycle determines the output voltage relative to the input voltage.

### References

- [1] B. Sandeep, D. S. Reddy, A. R and R. Mahalakshmi, "Monitoring of PV Modules and Hotspot Detection using TensorFlow," 2022 International Conference on Electronics and Renewable Systems (ICEARS), Tuticorin, India, 2022, pp. 155-160, doi: 10.1109/ICEARS53579.2022.9752346.



The OLED display presents the output voltage and duty cycle measured in the circuit.

### Acknowledgements

We would like to thank Amr Radwan, Xichen Jiang, John Lund, and Reza Afshari for the guidance on many aspects of the project.