View metadata, citation and similar papers at core.ac.uk
brought to you by CORE
provided by Earth-prints Repository

Supervisor Circuit Decides When Solar Array Can Power A Load

Giovanni Romeo Istituto Nazionale di Geofosica a Vulcanologia, Rome, Italy

Sun powered electronic devices may suffer in twilight conditions. In particular microprocessors (widely used to perform solar power conditioning, such MPPTs) do not like unstable power or smooth edges on power on. The proposed circuit offers some nice supervision performance at the price of 3 transistors.
A solar power supervisor should connect the load (microprocessor) when the panel is able to power it and disconnect it in case of power lack. To do that it needs to load the power source with a dummy load greater than the real load itself, and switch to the real load when the solar array reaches an acceptable power condition. Fig. 1 shows the supervisor diagram.

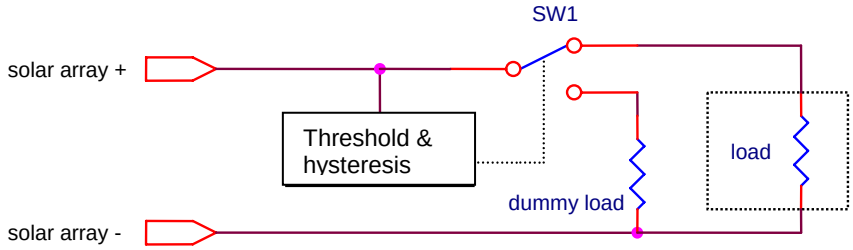

Fig. 1 The supervisor block diagram. The solar source is connected to a dummy load to allow the threshold and hysteresis block to make a useful measurement (an unloaded panel supplies high voltage even in poor light conditions). When the threshold is reached the power is switched to the load and vice versa. Figure 2 shows the designed to work supervisor.

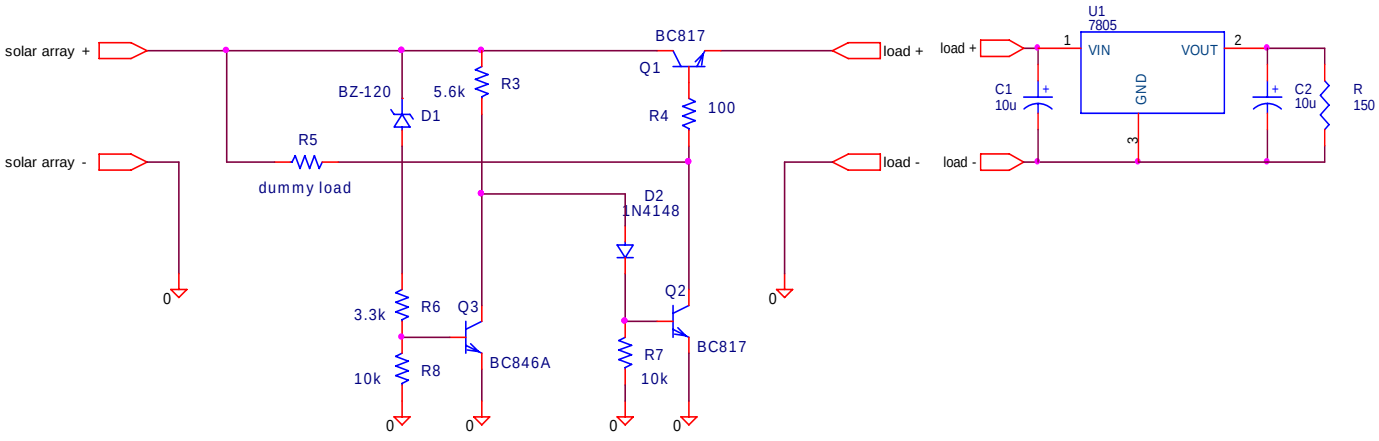

Fig. 2 the supervisor designed to work. The circuit threshold is defined by the zener diode D1.
The hysteresis is tied to the difference between the dummy load and the load (the dummy load must drain more current than the load). An expected load is a linear regulator used to power an MCU (on the right in the picture, loaded by a 150 Ohm resistor)

When the input voltage does not exceed the threshold (D1 zener voltage plus Q3 V_{be}) Q2 is ON and the panel is loaded by R5. When it does exceed the threshold, Q3 shuts off Q2 disconnecting the dummy and so rising the voltage on Q1 base, that supplies the power to the load. Since the load is lighter than the dummy load, the voltage on the solar array increases, the current on Q3 base too, and the circuit acts like a trigger, confirming the reached condition.
The diagram in fig. 3 shows the behavior of the circuit connected to a small solar array (0.5 A shorted, 19 V open) varying the light from 0% to 100% and again to 0%. A capacitor of 100uF has been placed at the input, and the output has been loaded with a 7805 with 10 uF capacitors (input and output)

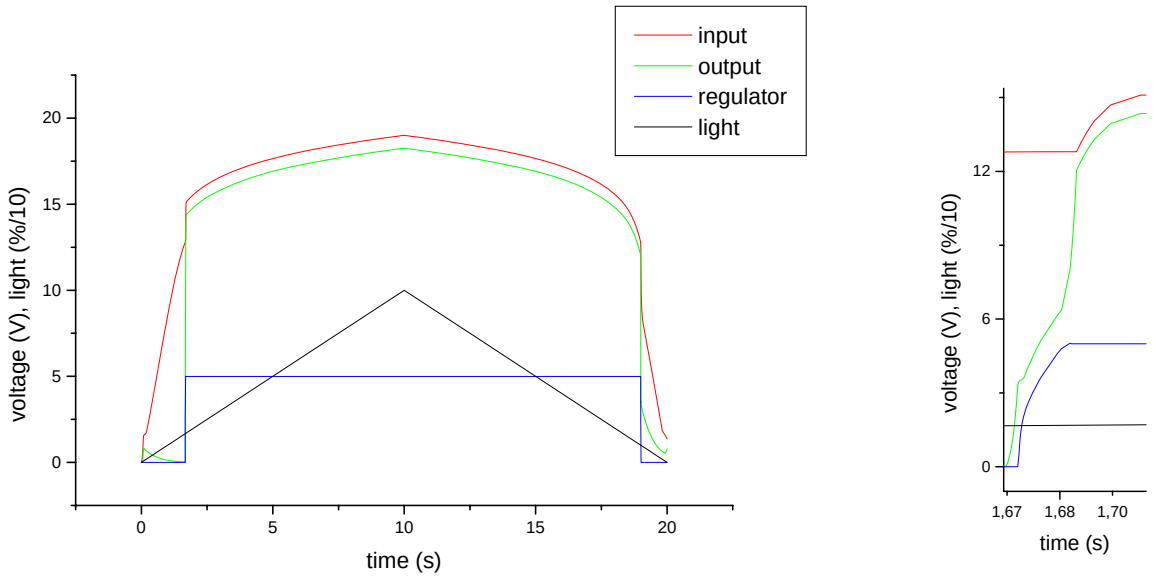

Fig.3 Behavior of the regulator powered by a 0.5 A 19 V solar panel. On the right, the rising edges zoom.

The circuit offers a 10ms rising edge (on 5 volt power, after the regulator) as visible on the right in fig. 3