CIRCUIT DESCRIPTION

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Power Section

There are two power inputs to this assembly J1 and J4. J1 is known as the power input header while J4 is the USB connector. Either input can be used and if power is present on both inputs, the primary input is via J1 the power input header.

Power Input

J1 has two poles, one is labeled "+" and one is labeled "-". This connection accepts 5V DC to 26V DC, though the recommended operating range is 6V DC to 15V DC. The input voltage is regulated to 5V DC (5V-VIN) by the Micrel MIC2920A-5.0 IC, which is in a SOT-223 package. This is a low drop out linear regulator. Micrel labels this part as being "bulletproof" because of its high tolerance for temperature variations and absurd behavior of the input voltage. The regulator has a current limit of 400mA. The circuit has a small capacitor on the input and a large capacitor on its output, per the recommendations in the data sheet. Each capacitor should be placed in close proximity to the IC.

J4 is a USB connection with both data and power. The ~5V USB (5V-USB) power is passed untouched to the next stage of the power path. It is assumed this power input is operating from a typical USB port with its current limits and voltage fluctuations per the USB spec. Ideally though, this port is providing a steady 5V DC at 100mA or more power.

Power OR'ing

Since there are two power inputs, 5V-VIN and 5V-USB, the assembly needs to select one or the other input as the feed for the remainder of the power section.

The circuit employes a Linear Technology LTC4415 as a prioritized, current limiting, "ideal diode" power selector. 5V-VIN is routed to IN1 and is the primary input. 5V-USB is routed to IN2. If both 5V-VIN and 5V-USB have a voltage present, 5V-VIN is selected. Both routes through the LTC4415 are current limited to 400mA. There is a single combined output of 5V-PRECAP.

Each input and the single output have medium bypass capacitors on them and they should be placed as close to the input/output of the IC as possible.

The EN1 and EN2 inputs are setup with a voltage divider such that IN1 is enabled when 5V-VIN is ~4.5V or higher. Should there be no 5V-VIN or it drops below ~4.5V, the IN2 or 5V-USB will be the path through the selector.

Power Storage for pulse load

The assembly's main components will have a pulse power demand, typical a current demand greater than either input path. To accommodate this, super capacitors are charged when there is low power demand and discharged when there is high power demand.

A Linear Technology LTC4425 is the IC of choice for current limiting of the supply for charging the super capacitors, and ensuring they are balanced. The input voltage to this IC, 5V-PRECAP, comes from the output of the Powering OR'ing section.

The output of LTC4425 charges the super capacitors and monitors the balance. Vout is approximately 5V (skewed towards just over 5V) but is dependent on VIN. The LTC4425 is current limited to charge based on the resistance on PROG input. This unit is set up for 100mA current limit.

Final regulation for assembly

After the power storage circuit are two low dropout regulators. One of for the digital portion of the assembly's circuit and one is for the pulsed, high load RF section. Each regulator takes the 5V-POSTCAP voltage and regulates it to 3.1V DC. This gives the maximum range for the super capacitors to discharge, while yet not going to the lower limit of 3.0V for the remainder of the circuit.

Micrel's MIC5219 is the IC of choice for both regulators. This IC has a limit of 500mA. The digital supply load will most likely be 50mA or less, while the RF section could be 350mA to 400mA and is to be determined during testing.

Modification for end assembly

LTC4425's EN input will be "wired" to be on, but through a jumper selector can be routed to a header for application specific control.

LTC4425's PROG input will be default to 100mA, but will have jumper selection for other resistor values allowing higher currents like 200mA, 300mA and 400mA.

The LDO of the 3.1V-RF will have its EN tied to the downstream circuit which will turn on this LDO when power is required.

The USB-Serial IC most likely will need to be powered by 5V-POSTCAP or later. This needs to be reviewed. This will allow for the current regulation for the whole assembly to be limited by LTC4425.