Perihelion Proposed Power Protector

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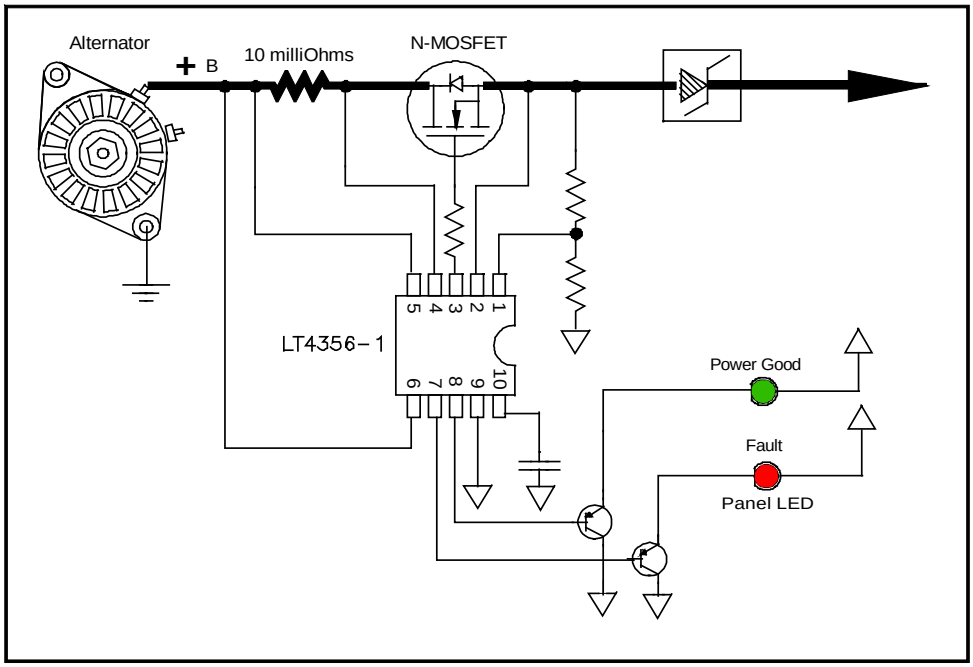
I have talked to many builders who are particularly concerned about frying their expensive avionics and glass panels. These parts are typically 1/3 of the airplane's cost.

Wiring a small aircraft involves installing systems to safeguard the busses against failure of the alternator. Either an internally regulated alternator or its more adaptable brother with an external regulator still has the potential problem of a runaway condition, as well as a short circuit of the main battery to alternator B-lead, and frequent load dump OV conditions.

A solution is herein proposed—

Linear Technology has introduced a clever device, the LT4356-1 Overvoltage Protection Regulator and Inrush Limiter to address all these worries. Not only that…they list "Automotive/Avionic Surge Protection" as one of its chief applications.

The LTC approach takes the high voltage from a load dump or failed alternator and REGULATES it while the situation is being tamed. The IC package is 3mm X 4mm and drives a big N-MOSFET that does the heavy work of regulating the voltage.



So what happens? Normally the alternator current is carried by the N-MOSFET. Assume the current is 50A, and the Rds(on) is 0.012 ohms. The dissipation would be only 30W. This is easy to handle with a medium-sized heat sink.

Assume the alternator and/or the regulator goes cuckoo. This could happen if the alternator field winding shorts to the B-lead output or the sense lead in the regulator opens, or other untoward goings-on. The alternator output goes into an upward voltage spiral. This voltage is not unlimited, especially if there is a load on it, but could be 80 VDC.

Now the LT4356-1 REGULATES the output via a big Mosfet on a heat sink. The aircraft busses never sees more than 14.5 Volts (or whatever is desired). This is true for the short time (500 mS) load dumps, and it will regulate a runaway alternator for a time determined by whatever the N-MOSFET and heat sink can dissipate.

The LT4356-1 has a timer circuit to protect the N-MOSFET. If the time expires and the stress continues, the fault warning signals an impending power-down and the N-MOSFET shuts off the B-line.

Additionally, the LT4356-1 has a spare amplifier/comparator that can be used for any purpose. It operates from 4 to 80 VDC, and withstands –30V and up to 100V. A second Mosfet or a diode can be added to protect against a shorted alternator. The device has built-in protection again shorts between itself and the battery.

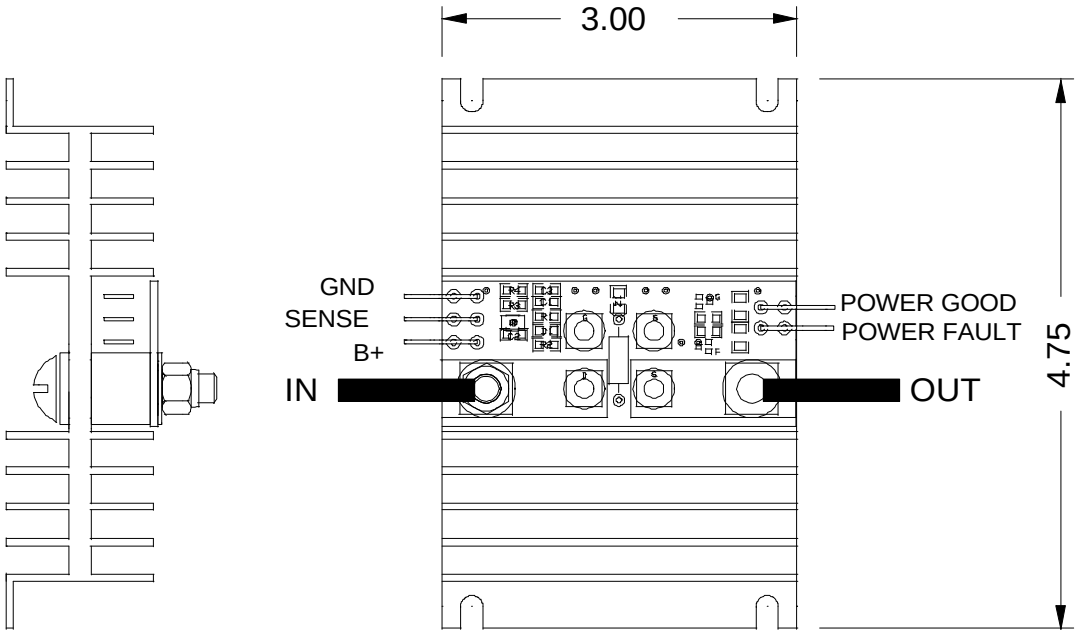
The drawing shows a basic form. Additional parts are necessary. However, consider the parts that wouldn’t be necessary:

- The B-Line contactor,
- OV monitor,
- Load Dump preventer,
- B-Line fuse,
- alternator switch.

And it allows the use of inexpensive and reliable internally regulated automotive alternators.

Here is the preliminary device package. The basic specifications—

Current 60A.
Output Voltage Limited to 16V (but normally it would be at whatever you set the alternator for.
Runaway Protection to 150V for an *indefinite* time….
Load Dump Protection
Overvolt Protection.
Power Good and Power Fault Indicators (Open collector)
Audio Warning and Panel Indicator Option.



Preliminary

So here's what happens from the pilot's seat:

You are flying along and everything is swell. (Funny how the other guys in the club are having avionics problems….) But suddenly the green Power Good indicator changes to the Power Fault flashing red. The alternator is still providing power because the Power Protector is regulating the voltage to 16V. But the alternator has gone into a "runaway". The pilot turns off high current loads and takes appropriate actions. Looks like that spare alternator or battery will come in handy….

But no fuss. The Power Protector has shut down the failed alternator and prevented high voltage from damaging any electronics.