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Damaging Power Supplies with Repetitive Peak Current Draws

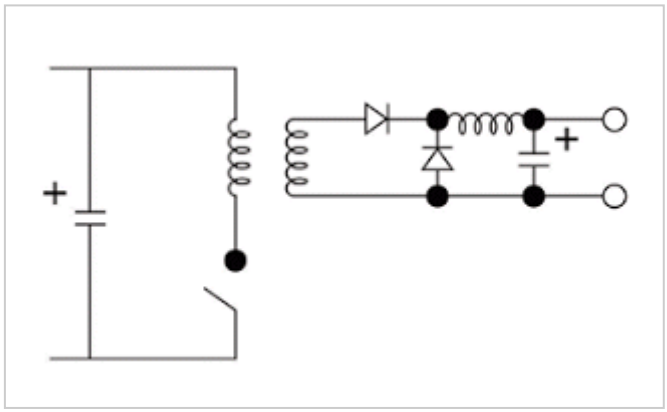
There are many devices that require peak currents when first turned on including print heads, motors, disk drives and pumps.

Many users often do not measure the actual peak current and rely on an empirical method whereby they try a power supply in the application to see if it will work. If the power supply cannot provide enough peak current, capacitors are added to the output. Those capacitors will act as temporary energy storage, enough to deliver load current for a few hundred micro seconds. If that works then the power system solution is deemed as working, and the Engineer moves on to the next phase of their project.

Many power supplies have the ability to supply high peak currents, even though the datasheet does not mention it. In fact some of the cheapest power supplies on the market can deliver very large currents for a short period of time because the output current limit is very crude, and is primarily there to protect the unit against a short circuit on the output.

In discussion with TDK-Lambda Engineering, I learned that this can lead to field failures. Let me explain further.

Below is a schematic of a forward converter, the power FET is shown as a switch for simplicity. That "switch" operates at a rate usually in the hundreds of kHz, energy is transferred from the secondary side to the output rectifiers and then is smoothed by the output LC filter.



When a pulsed (peak) load is applied to the power supply in excess of its rated current, the energy is first drawn from the output capacitor. This can add to the capacitor ripple current, raising the temperature and reducing the component's life. Heat, as I explained in earlier blogs, dries out the capacitor's electrolyte.

When the energy stored in the capacitor starts to deplete, the power supply will then try to continue to provide the peak current from the main switching circuit. This in turn leads to repetitive surge currents in both the output diodes which is then reflected by the transformer to the power FET. Often this peak current exceeds the maximum rating of the semiconductors leading to latent and erratic field failures.

Additional heating in the transformer, inductors and printed circuit board traces is also experienced because, although the average power drawn from the power supply is less than the continuous rating, we are dealing with the formula I2R and the peak current is now squared.

TDK-Lambda recommends using a power supply that has a specified peak power rating like our HWS-P series or working closely with the power supply manufacturer to determine if the product is suitable for the application

Posted by Power Guy