Power Supplies with a "cool" design

For low power power supplies commonly flyback topologies are employed.

These topologies however, are quite inefficient and dissipate the high power loss as heat. As a result of this dissipation, the components of the power supply get very hot, and consequently the lifetime, or MTBF value of the power supply, is greatly reduced. The TOP-100 power supplies prevents this problem from occurring, by the use of a high efficient half-bridge converter circuitry. Due to this innovative topology, the TOP-100 power supplies generate much less heat and allow a higher power density.

Modern mains power supplies are extremely compact, but dissipate a substantial amount of power as heat, while operating. This very often leads to overheating of internal components, which in turn has an adverse effect on reliability and lifetime of the power supply. Normally the heat dissipation is so high, that in order to keep the power supply components at a safe operating temperature level, the design engineer has no other choice but too use a fan in his application. The relatively low reliability of mechanical fans, in addition to irritating fan noise, represents a technically unsatisfactory solution.

The TOP-100 series power supply in the standard 2"x 4"format from TRACOPOWER, has an output power rating of 100 Watts with an overall efficiency of greater than 90% under all operation conditions. The high level of efficiency implies low power dissipation within the power supply, which means lower component temperatures. As a consequence, the reliability of the power supply is significantly improved. The power supply can therefore be used at higher operating temperatures, without the necessity of power de-rating or additional forced cooling by external fans.



TRACOPOWER TOP-100 series Power Supply in 2" x 4" x 1.2" format rated for 100W output power with natural convection cooling

An economical converter concept - with significant handicaps .

The most used topology for switch-mode power supplies is the flyback converter. This topology is cost efficient, but it incorporates serious disadvantages e.g. high peak and RMS currents in power semiconductors, transformer and capacitors. This in turn leads to high temperatures in all circuit components, including the printed circuit board. The power losses resulting in poor energy conversion efficiency, causes high temperature stress to the electronic components, leading to a significantly higher failure rate of the power supplies. These failures are not evident during the initial testing and performance verification of the power supply within the application, but become very marked, in field use, over time.

Thermal pictures where taken of a typical 60 Watt flyback power supply from a leading manufacturer, and compared with the TOP-100 from TracoPower (see Fig. 1 and Fig. 2). Both models have the same dimensions of $2 \times 4 \times 1.2$ inch. The temperature distribution can very clearly be seen on the images captured with a thermal imaging camera and displayed as colour graduations according to temperature.



60W power supply with flyback topology



TOP-100 power supply





60W power supply with flyback topology







In the upper image in Fig.1, it can be seen that large areas on the component side are very hot. In particular semiconductors mounted on heat sinks near the mains input side and on the output side, appear white on the image, indicating that they have already reached around +100°C at ambient room temperature. It is easy to imagine what will happen if such a power supply unit were used in an application with little installation space and low air circulation. The components would inevitably become overheated.

In the upper image in Fig. 2, areas with extremely high operating temperatures are also visible, particularly in the area around the transformer. This PCB area is intensely heated by the surrounding semiconductor devices, and the printed circuit board is nearly +100°C at ambient room temperature. In the region around the output diodes, the temperature on the PCB is also very high.

On both, the component side and on the solder side, the 60W flyback power supply unit is considerably hotter than the TOP-100 unit under same load condition. The TracoPower power supply remains not only significantly cooler at 60W output power, but can even deliver 100W output power in the same 2"x 4" format without any overheated components. This power supply has a design based on half-bridge converter topology.

Calculated MTBF value in accordance with IEC 61709, taking account of the stress factors for voltage, current and temperature, for a flyback convertert power supply is approximately 200,000 hours. In marked contrast, the power supply unit with a half-bridge converter, with the same physical volume and the same load conditions, reaches a 10 times better MTBF.

Better concept - higher efficiency - lower power losses

The TOP-100 power supply unit is based on a resonant pulsed half-bridge circuit, this circuit achieves considerably larger current flow angles and consequently, significantly lower resistance losses in the transformer, choke and semiconductors. A further improvement of efficiency is achieved by replacing the secondary diodes with FETs with very low *on*-resistance. While state-of-the-art, off-line, flyback converter power supplies of this type achieve an efficiency of just 76% - 84% at 5V output, the TOP100 achieves 92% in the higher output load range. The power dissipation, and the heat generated in the TOP-100 is approximately 50% lower than in comparative models available on the market. The calculated MTBf figures for this power supply are 5 to 10 times better than for a fly back converter under same load conditions. The half-bridge uses converter more components then the flyback converter, which makes it slightly more expensive, but with the benefits of this topology the extra cost is well invested.

TOP-100 Power Supply Series

These 100W open-frame power supplies in the standard 2"x 4" format feature highest power density and low power dissipation. They feature 90 to 264VAC input voltage range with safety class I (safety ground) and class II (isolated) operation mode. The available standard output voltages are 3.3, 5,12, 24 and 48 VDC. The power supply units meet the requirements of all relevant standards, in terms of safety, radio interference protection and interference suppression, including power factor correction. No additional external mains filters or fuses are necessary. The circuit concept, the integrated temperature management, and the use of exclusively industrial-rated components, achieves an extremely high level of reliability. The TOP100 series offer an economic solution for applications with restricted installation space, high operating temperatures or when high reliability is required.

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