

Worth a patent: for higher efficiency The world's first DIN rail power supply unit with synchronous rectifier in combination with a flyback converter operating in discontinuous mode

Once again, Munich's PULS group, led by Bernhard Erdl, Chief developer and proprietor of PULS Power Supplies, has achieved a breakthrough in the development of switch mode power supplies. And efficiency of greater than 89% is being achieved, even for 12V devices, with a circuit for which patent applications may be filed.

The increased use of LEDs in lighting and beacon technology is one of the reasons for the increasing demand for more powerful 12 V power supplies. Adjustable output voltages are essential to compensate for losses in the supply lines which can, on occasion, be quite long. However the number of 12 V power supplies on the market in the power range from 100 W upwards is rather small. There are good reasons for this, because to construct an efficient 12 V power supply capable of a long service life it is necessary to overcome two problems at the very beginning. One of these is that internal back-voltages resulting, for instance, from negative overshoot in the transformer, cause much greater losses in relation to the lower output voltage than is the case in 24 V versions. The other is that twice as much current flows for any given power requirement. This applies not just to the loads, but also to the components in the power unit. The high voltage drop of simple rectifier diodes, between 0.7 and 0.9 V, makes them unsuitable for use in the output stage. In a 90 W power unit, this figure would correspond to a dissipation of more than 5 W in the secondary rectification alone.

A controlled, synchronous rectifier based on a MOSFET is a much more intelligent solution, because, if the silicon is properly dimensioned, only a few tenths of a volt potential drop will

occur. This is not, however, enough to achieve efficiencies similar to those of 24 V versions. To improve the efficiency yet further, a synchronous output rectification in combination with a flyback converter operating in discontinuous mode can also be employed. This avoids a large part of the switching losses through component-resonant switching. It is, however, very difficult to obtain the correctly timed signal for the synchronous output rectification in combination with a flyback converter

PULS MiniLine
ML100.102

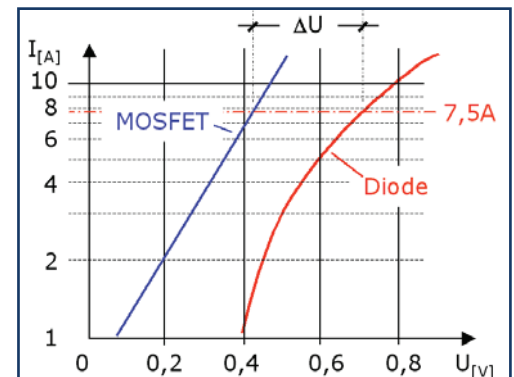


Figure 1: The power saving results from the difference between the voltage drop occurring at the diode and that occurring in the MOSFET at the required output current. When this difference is multiplied by the output current, the product is the additional power that the supply unit delivers to the load instead of dissipating as heat. With a difference of approx. 0.3V and with $I_{out} = 7.5A$, the difference is a 2.25W. An efficiency of 89% is achieved in the ML100.102 – this corresponds to a power loss of 9.9 W. An additional 2.25 W would comprise almost 25% additional loss.

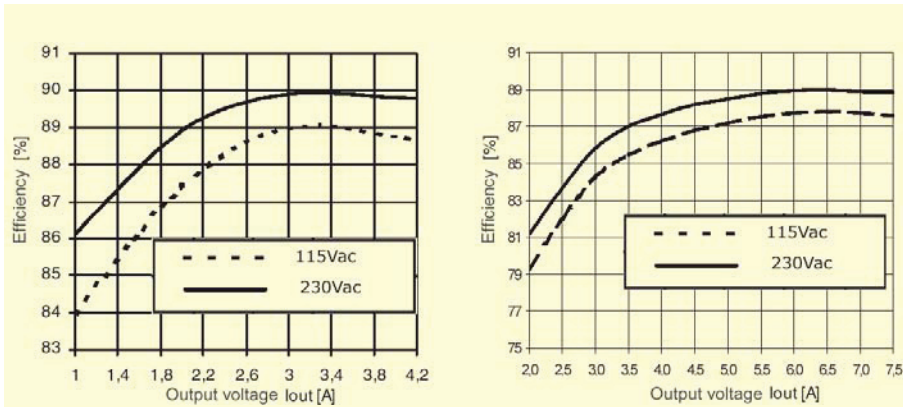


Figure 2: Efficiency of the 12 V device compared to that of the 24 V device

operating in discontinuous mode, and known circuit designs were until now unable to do this. A thing of the past: PULS has cut through this Gordian knot with a circuit design for which patent applications may be filed: the efficiency reached by, for instance, the 12-15V device, the ML100.102, at more than 89%, is almost the same as that of the 24 V version, the ML 100.100, and considerably better than other products on the market (see Fig. 2). Whereas other devices in this power class are usually specified with a rated power at an ambient temperature of 50°C, the rated power quoted by

PULS applies for the more usual (and higher) ambient temperature of 60°C. With a small power derating of 2W/K the ML100.102 can even be operated continuously at 70°C. Although these high ambient temperatures may not normally be present, this still indicates a high reserve, leading to an expectation of long service life and few failures (high MTBF).

With dimensions of only 73 x 75 x 103 millimetres (W x H x D), the convection-cooled DIN-rail power supply unit is significantly smaller than other units, and can be installed in various orientations.

The output voltage can be continuously varied between 12 and 15 V, and the rated output current is 7.5 A. The new ML100.102 offers all the benefits of the proven ML100 series, such as series and parallel connectivity, "auto select" wide-range inputs for mains voltages anywhere in the world, and the reliable and convenient spring-loaded terminals for connecting the secondary leads.

The device is protected against continuous short circuit, overload, idling, negative feed and transients in accordance with VDE 0160/W2 under any possible load. Buffer times of greater than 20 ms are guaranteed, and the MTBF according to the Siemens SN 29500 standard is more than 500,000 hours under full load. All relevant EMC standards, including those for power factor correction, are satisfied

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