Diotec Products for Power LED Lamps – Halogen and CFL Retrofits

GU10 Power LED

High current LEDs are considered the light source of the future. They offer a much higher efficiency than halogen lamps and this is where most of the initial products are positioned. Long term, they will also replace incandescent lightbulbs, compact fluorescent lamps (CFL) and even fluorescent lamps in tubes. At the moment there is still a cost premium associated with LED lamps and not all technical aspects about the colours are 100% resolved.

When replacing halogen light sources, the issues are straightforward. A 4/8W LED lamp has a similar light output as a 30/50W halogen lamp. They are also advertised as having a much longer life time – up to 50'000 hours – which compares very favourable with halogen light bulbs. There are two popular variations – with GU10 or MR16 (GU5.3) connections – depending whether they are operated on the mains or not. LED products used in lighting sources are typically 350mA or 700mA at the moment – in the future they may go up to 1A.

MR16/GU5.3 Power LED

The preferred topology for driving Power LEDs at 110/230V_{AC} mains at the low power levels is the Flyback converter. At 12V_{AC} input a non-isolated topology such as a buck (step-down) converter can be used. The switching stage is nowadays available in various integrated versions; main active components to be added are further an input bridge, an output or free-wheeling rectifier and sometimes a snubber network. Those parts are introduced in this application note.

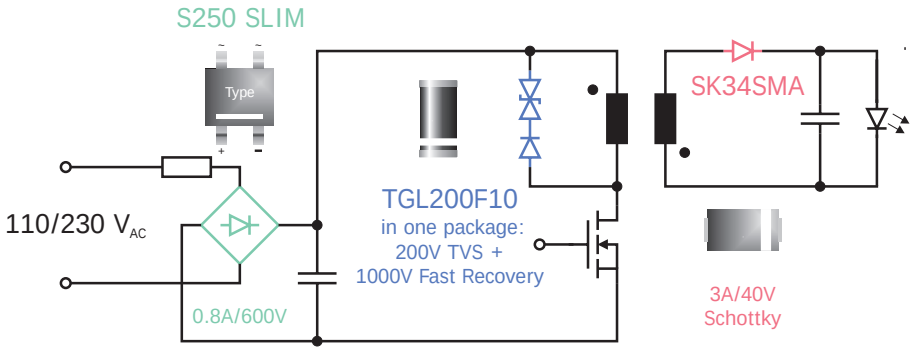


Fig. 1: Flyback converter for driving LEDs directly at 110/230V_{AC} mains

Input Bridge Rectifiers

When looking at a typical GU10 design (Fig. 1), the input bridge rectifier demands can be easily met from a technical perspective. Space however is always an issue. The S250 SMD input bridge is the optimal component. If your lamps are sold in countries where the AC mains is not very well regulated, you may consider the 1000V version called S500 for extra safety. The proprietary Plasma EPOS process of Diotec allows production of these small bridges up to 1000V as a standard.

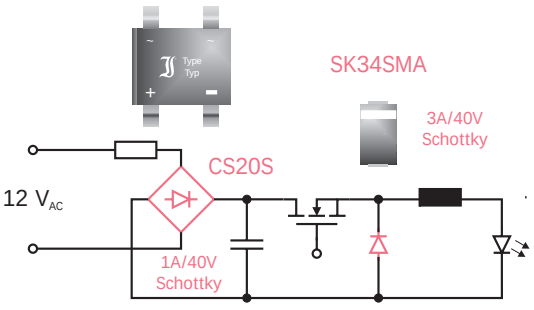
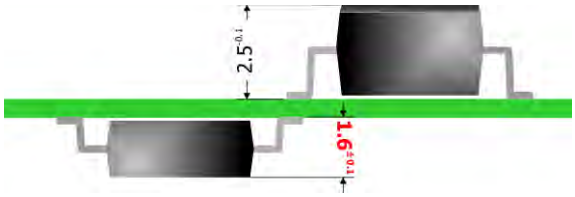


Fig. 2: Buck (step-down) converter for 12V_{AC} operation of LEDs

At MR16 designs (Fig. 2), the bridge can be made out of Schottky rectifiers, giving lower power losses at the (here) higher input currents. It can be made by using four discrete devices such as the SGL1-40 or SK14 (1A/40V), or even the SK34SMA (3A/40V). The SMD Schottky bridge CS20S by Diotec has an advantage in terms of PCB space savings.

Diotec reduced the height of its MiniDIL series of SMD bridges to 1.6mm, the so called “SLIM” version of S40 through S500. This allows the device to be placed on the bottom side of the PCB – offering even further space savings.



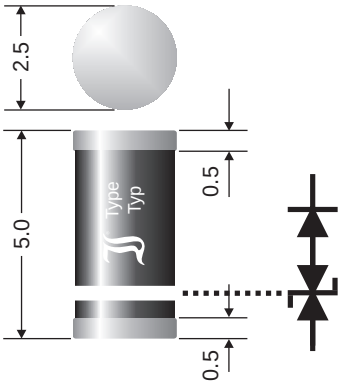
S250 SLIM series by Diotec – SMD input bridge with reduced height for easy bottom side assembly

Output Schottky Rectifiers

Normally a 1A Schottky would be sufficient. However the need for a lifetime of up to 50'000 hours necessitates a lower junction temperature in the semiconductors to get a better MTBF. This makes the SK34SMA series the ideal component for this application. The device offers a 3A/40V rating in the small SMA package. By using them at 350mA or 700mA, designers will increase the lifetime of their design.

Snubber Network

Depending on the transistor used for switching, RC, RCD or active snubbers are needed. Diotec has a wide range of products also in this area. In the case of active snubbers and low power, we can integrate the Diode and the TVS into one package, further reducing size. An existing device is the TGL200F10, a series connection of a 200V TVS and a 1000V Fast Recovery diode in a single Melf package. On request, even other combinations of TVS and rectifier are possible – contact Diotec for your product selection.



TGL200F10 integrated snubber device

