

Press Release

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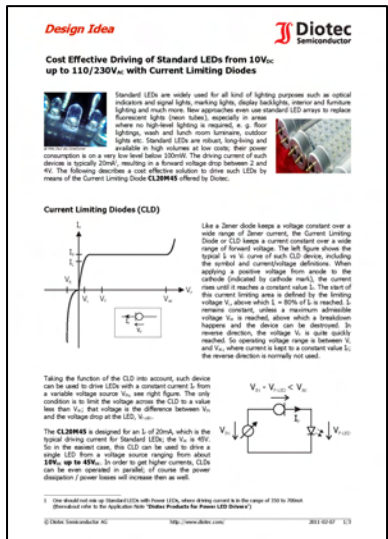
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Design Idea and Application Note for Driving LED Circuits

Cost and Space Saving Solutions for Standard and High Power LEDs

Diode Semiconductor AG proudly presents a new Design Idea and an Application Note about LED driving circuits. The Design Idea is intended for Standard LEDs where the driving currents are typically around 20 milliAmps. The Application Note deals with High Power LEDs, which are more and more replacing halogen and compact fluorescent lamps in the market place. These LEDs require a much higher driving current in the range of 350 to 700 milliAmps.



Design Idea
Cost Effective Driving of Standard LEDs from 110V/230V with Current Limiting Diodes

Standard LEDs are widely used for all kind of lighting purposes such as optical indicators and signal lights, marking lights, display backlights, signage and furniture lighting and much more. New approaches even use standard LED arrays to replace fluorescent lamps (linear tubes), especially in areas where no high-level lighting is required, e.g. floor lighting, wash and wash room sanitary, outdoor lights etc. Standard LEDs are robust, long-life and available in high volume at low costs. Their power consumption is on a very low level below 200mW. The driving current of such devices is typically 20mA, resulting in a forward voltage drop between 2 and 4V. The following describes a cost-effective solution to drive such LEDs by means of the Current Limiting Diode **CL20M45** offered by Diode.

Current Limiting Diodes (CLD)

Like a Zener diode keeps a voltage constant over a wide range of Zener current, the Current Limiting Diode or CLD keeps a current constant over a wide range of forward voltage. The left figure shows the typical $I \rightarrow V$ curve of such CLD device, including the normal and complementary definitions. When applying a positive voltage from anode to the cathode (indicated by cathode mark), the current rises until it reaches a constant value I . The start of the current limiting area is defined by the limiting voltage V_L , above which $I = 80\%$ of I_L is reached. I_L remains constant, unless a maximum admissible voltage V_M is reached, above which a breakdown happens and the device can be destroyed. In reverse direction, the voltage V_R is quite quickly reached. Its operating voltage range is between V_L and V_R , where current is kept to a constant value I ; the reverse direction is normally not used.

Taking the function of the CLD into account, such device can be used to drive LEDs with a constant current I from a variable voltage source V_{in} , see right figure. The only condition is to limit the voltage across the CLD to a value less than V_M , that voltage is the difference between V_{in} and the voltage drop at the LED, V_{LED} .

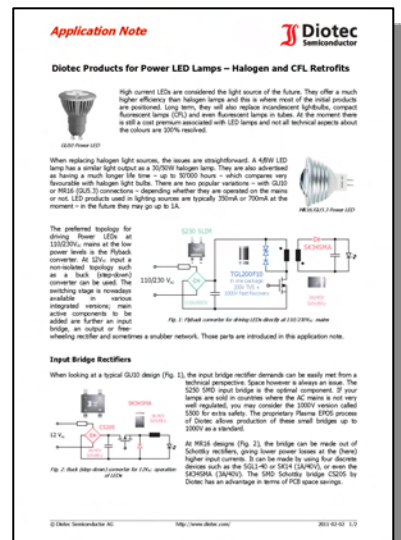
The **CL20M45** is designed for an I_L of 20mA, which is the typical driving current for standard LEDs, the V_M is 40V. So in the normal case, the CLD can be used to drive a single LED from a voltage source ranging from about 38V, up to 48V. In order to get higher currents, CLDs can be even connected in parallel, of course the power dissipation / power losses will increase then as well.

1. One should not mix up standard LEDs with those LEDs, whose driving current is in the range of 350 to 700mA (mentioned only in the Application Note "White Products for Power LED Drivers")

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Standard LEDs are mainly used for indication purposes, but new designs also show LED array solutions for replacement of neon light tubes. For all these applications, Diode introduces a so called "Current Limiting Diode" or CLD, which can be used to drive standard LEDs, with only few additional components, directly from the 110 Volts / 230 Volts mains. The Design Idea is now available for download at

<http://www.diode.com/service/files/cost-effective-led-driving.pdf>.



Application Note
Diode Products for Power LED Lamps - Halogen and CFL Retrofits

High current LEDs are considered the last source of the future. They offer a much higher efficiency than halogen lamps and this is where most of the initial products are directed. Long term, they will also replace fluorescent lamps, 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 40W LED lamp has a similar light output as a 200W 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 CFL or MR16 (GU5.3) connectors - 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.

The preferred topology for driving these LEDs at 110/230V, many at the low power levels is the Flyback converter. At 12V, 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, from active components to be added on further on input bridge, on output or full-bridge rectifier and sometimes a smaller network. These parts are produced in the application note.

Input Bridge Rectifiers

When looking at a typical GU24 design (Fig. 1), the input bridge rectifier demands can be easily met from a technical perspective. Space however is always an issue. The GU24 input bridge is the central component. If your lamps are sold in countries where the AC mains is not very well regulated, you may consider the 200V version called 500V for extra safety. The proprietary Plasma EPD process of Diode allows production of these small bridges up to 2500V as a standard.

In MR16 designs (Fig. 2), the bridge can be made out of Schottky rectifiers, giving lower power losses at the Diode's higher input currents. It can be made to carry four diode devices such as the SCL-M5 or SCL4 (S4N5), or even the SCHWAB (S4N5). The SCL-rectifier bridge (SCL5) by Diode has an advantage in terms of PCB space savings.

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Power LEDs are driven usually by means of a flyback converter. Halogen and compact fluorescent lamp retrofits are very space critical, therefore the converter board must be as small as possible to help obtain the necessary compact size. Diode offers three key components for such circuits, all of which help the designer to save a lot of board space. The Application Note is available for download at <http://www.diode.com/service/files/products-for-power-led-driving.pdf>.

< Text file (.txt) and high resolution picture see <http://www.diode.com/service/presse/> >

Diode Semiconductor AG, with headquarters in Germany and four worldwide factories, produces and sells Semiconductors such as Diodes, Rectifiers, Diacs and Transistors and has more than 30 years of experience.

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