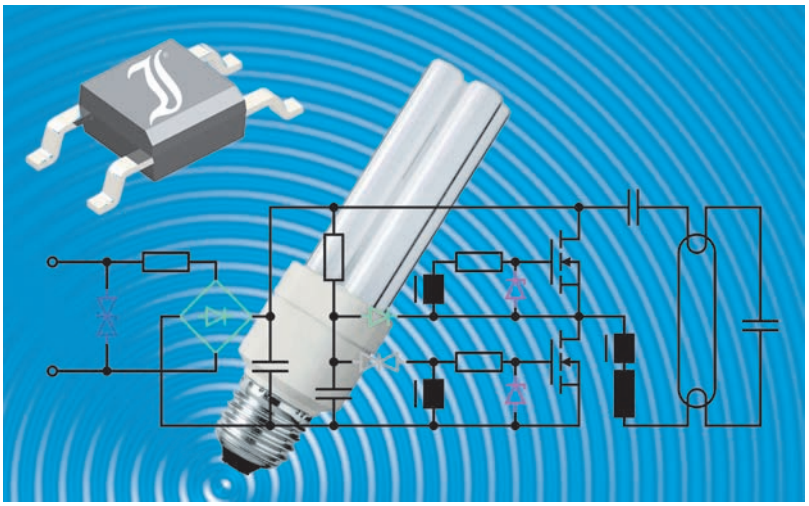
High Power ***in small packages***

Rectifiers in Lighting Products

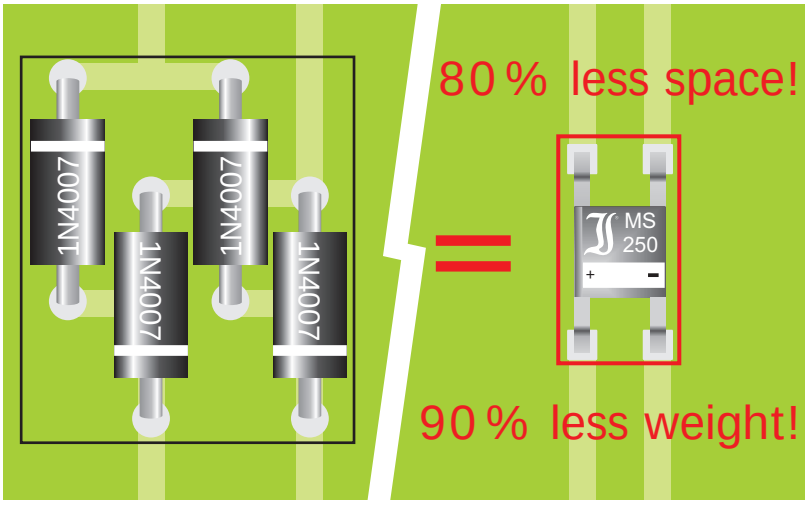
The most common rectifier used in lighting applications is the 1N4007 series. This 1A / 1000V Rectifier is still the workhorse of the power semiconductor industry and it is not really a new product. Billions of them are manufactured, mainly in China by now. Their cost has been driven so far down that increases in raw materials such as the Cu price for the leads drives up the end price to the customer. The silicon used in these rectifiers competes with silicon used in photovoltaic products / solar cells and as such has been under price pressure since 2006.



Rectifiers and diodes are key components in lighting circuits

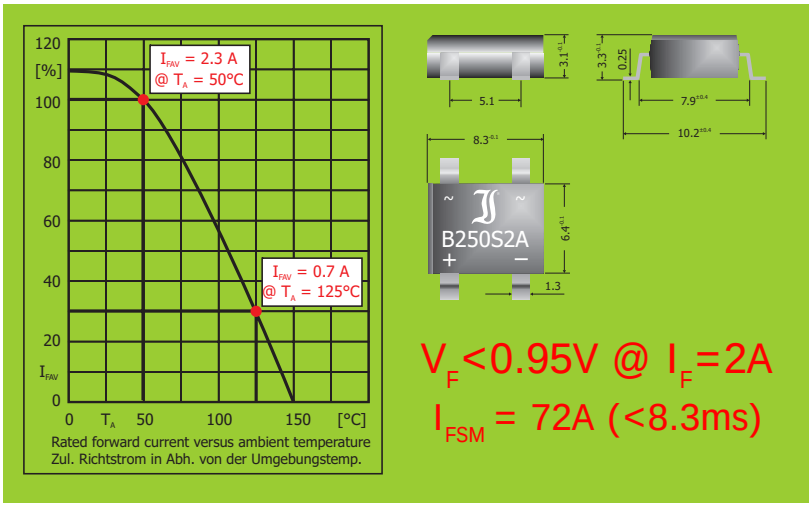
It is easy to predict that by the middle of this century billions of the 1N4007 will still be manufactured. The product cycle time of the product will then be 100 years. In a semiconductor world characterized by short product cycle times and relentless innovation this is a completely different story. This does not mean that no further evolution is possible on rectifiers for lighting. This article will propose three new Diotec Semiconductor products suitable for lighting systems. The way these products came into being will help the reader get some insight in what drives the 2 billion $ plus rectifier market – which has been growing at about the same rate as the rest of the semiconductor industry for the last 15 years.

To cost effectively replace the four 1N4007 rectifiers with a surface mount equivalent has long been an obsession of the (lighting) industry. The 600V MS250 from Diotec Semiconductor is the closest the industry has gotten so far. The rectifier bridge fits on existing 2.5mm Rectifier Bridge standard pad layouts in the industry. When designing the bridge, the consumption of materials was reduced as much as possible. The MS250 uses 0.016g of Cu, 4x 1N4007 uses 1.18g of Cu. The space needed on the PCB was reduced from 140mm square to 30mm square. The height of the MS250 is 1.6mm max allowing assembly flexibility. Furthermore all four internal dice are placed at



SMD bridges save space, weight and raw materials

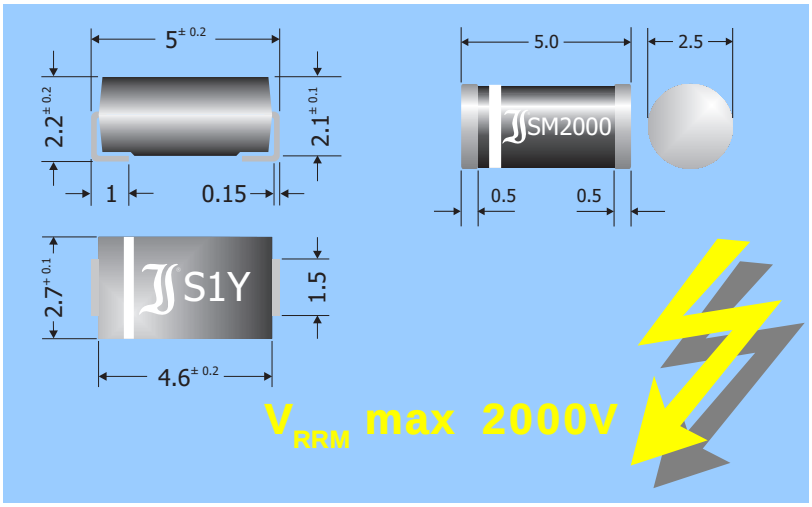
once using a unique assembly method called “QuattroChip”. This improves alignment of the die, improves thermal resistance and reduces failures caused by misaligned die and input current surges.



Bridges for high temperature applications

Most ballast designs do not draw a lot of current from the mains. As such the current rating requirements for the rectifiers are not very high. The common problem of lightning designs is the very high ambient temperature. The high ambient temperatures cause problems with current derating and in many cases surface mount bridges are avoided in high end ballasts. Designers prefer four discrete SMD or axial components. The B250S2A series solves this problem. This bridge rectifier is officially rated at 2.3A and still manages 0.7A at 125°C on a standard PCB. Furthermore it has a Vf specification of 0.95V @ 2A, which is 15-20% lower than competitors’ bridges. This gives you a small contribution towards improved efficiency of your design. The bridge is also manufactured using the unique “QuattroChip” die principle, where all 4 die are placed at once. This improves the surge performance.

Several applications exist in lighting applications for very high voltage rectifiers up to 2000V. These products are needed due to the high ignition voltages of certain lamp types. Die passivation techniques used in the industry make it difficult to manufacture these products in Surface Mount Packages. The “Plasma EPOS” of Diotec Semiconductor allows for wafer passivation technologies up to 2000V. The die produced using these processes can be assembled in MELF or flat packages. This resulted in the SM513 to SM2000 series, established Melf types having 1A current rating and blocking voltages of 1300 up to 2000V. Diotec recently introduced the new S1T to S1Y series – an expansion of the industry standard S1 series up to 2000V. Further available up to 2000V are 2A and 3A versions, the S2x and respectively S3x series.



High voltage Rectifiers in SMD

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