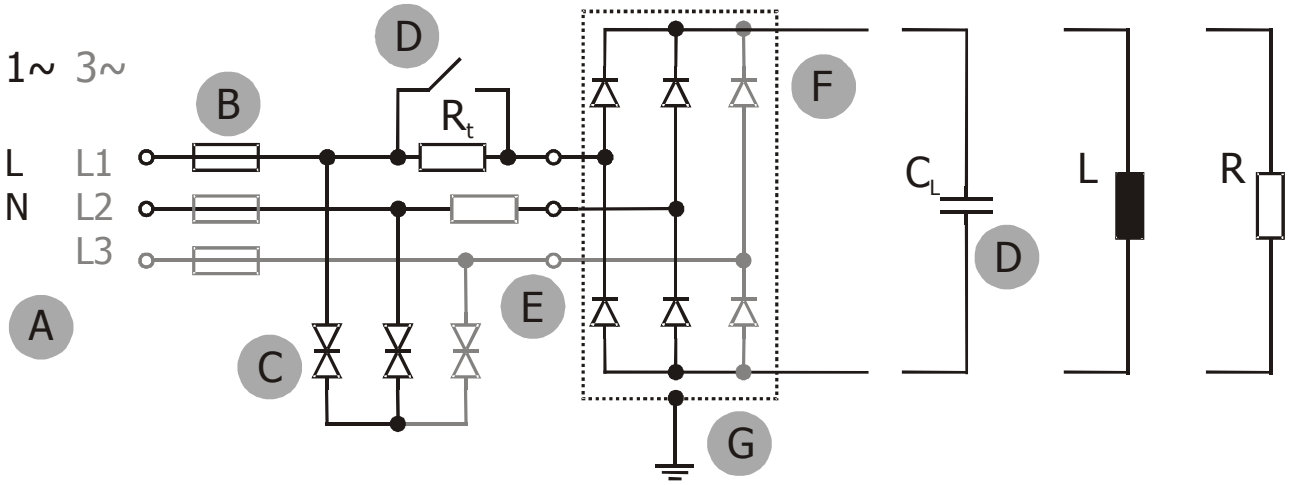
Bridge Rectifier Fundamentals
or
Why to use Diotec Products for Input Rectification

The input rectifier is one of the key elements of a power supply, providing the AC to DC rectification from the mains towards the connected load. This note describes some fundamental items for designers of power supplies, no matter if they are just for few Watts or even several kiloWatts. In picture below, black coloured is the circuit of a single phase bridge. Including the grey coloured items, we have a three phase version.



A Input Voltages V_{VRMS} and V_{RRM}

A detailed description of these parameters can be found in Diotec's technical information [1]). It is the common industry standard to test (=guarantee) V_{RRM}, and to define V_{VRMS} by calculation. Theoretically, V_{VRMS} equals to V_{RRM} divided by √2. Practically, it is recommended to keep a safety margin of at least 100% between √2xV_{VRMS} (peak value of the mains) and V_{RRM}, in order to prevent the circuit from being damaged by short voltage spikes from disturbed mains or the switching stage following the bridge.

The Diotec advantage

Diotec offers single phase bridges with V_{RRM} up to **1600V** and three phase bridges with up to **1800V**!

B Rating for Fusing, i²t

A description of this parameter can be found in Diotec's technical information [1]). Fuses protect the complete circuit in cases of a malfunctions of any device. Though the mains itself has got fuse protection, an additional fuse inside the device avoids completely mains shut-down.

C Overvoltage Protection

Even in case there is sufficient safety margin on input voltage, occasionally very short yet very high voltage spikes may occur. Varistors are often used at this stage; they provide protection against high power surges, but are relatively slow. TVS (suppressor) diodes are protective elements against fast transients with low to medium power.

The Diotec advantage

Diotec offers a wide range of TVS diodes with breakdown voltage up to **550V**.

D Inrush Current Limitation, R_t, C_L, I_{FSM}

A description of this parameters can be found in Diotec's technical information [1]), as well as in the data sheet of the MiniDIL series. Inrush happens only at capacitive load, so only in this case a limitation is required. It is a good practice to limit the maximum inrush current to about 50% of the rated I_{FSM} value. Often an NTC (thermistor) is used as a simple solution to limit the inrush current. If however during operation (NTC low resistive) the mains drops and comes back, there is the risk of excessive inrush current.

1 http://diotec.com/tl_files/diotec/files/pdf/products/generalinformation/6_technik.pdf

E Contacting the Terminals

Bridge rectifiers are available for cable and solder assembly. Fast-on connectors are preferably used for cable contacting. In case they should be soldered to a printed circuit board (PCB), care has to be taken to follow the solder instructions given by common standards. These are mentioned in the according device data sheets as well as in Diotec's solder instructions [1]).

The Diotec advantage

Diotec offers dedicated devices for being soldered to PCBs such as the "W" series of KBPC bridges or the DBI series of three phase bridges.

F Dedicated Devices for Input Rectification, I_{FAV}

Input rectifiers can be built by discrete devices or by complete assembled bridges. The decision for the right device depends upon various factors, such as board space, application itself, automatic or manual assembly and much more.

Reliability is an important item for power supplies. Bridge rectifier will get hot during operation; heatsink assembly and a low forward voltage drop V_F is good for reliable operation. I_{FAV} is the rated output of the bridge, and is always connected with ambient or case (= heatsink) temperature. Derating diagrams in the data sheet show maximum admissible currents at other temperatures than the rated ones. Especially when devices are hot, their leakage current should not reach too high values, in order to avoid thermal runaway. This is an issue mainly for high power devices using big chip sizes.

The Diotec advantage

Diotec offers a wide range of both discrete and bridge devices. The MYS series measuring only 3 by 3 mm², but offering anyway up to 0.5A/800V. Discrete Melf types or parts in SMA, SMB and SMC with up to 2000V. The S250K and GBUK8G are so called Protectifiers® providing superior V_F and I_{FSM} ratings.

Heatsink assembly can be done for various packages. The DBI25-18A, an 1800V three phase bridge, is designed for easy PCB and heatsink assembly.

Diotec's high power bridges, such as KBPC, DB and DBI series, undergo a 100% hot leakage current testing.

G Heat Sink Assembly, V_{iso}

Considerations about correct heat sink mounting are given in Diotec's assembly instructions [1]). Since the heat sink itself is mostly connected to earth ground for safety reasons, the life parts of the bridge has to be isolated against its package. An instruction how to repeat an isolation voltage test is given in our technical information [2]). The admissible mounting torque for screwing up the parts is provided in the according data sheets.

The Diotec advantage

Diotec's bridges for heat sink assembly are 100% tested for the rated isolation voltage V_{iso}. This includes the assembly hole, allowing for the usage of metal screws.

1 http://diotec.com/tl_files/diotec/files/pdf/products/generalinformation/4_solder-assembly.pdf
2 http://diotec.com/tl_files/diotec/files/pdf/products/generalinformation/6_technik.pdf