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MULTIPURPOSE ACDC DCDC CONVERTER FOR ELECTRICAL VEHICLES

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MULTIPURPOSE ACDC DCDC CONVERTER FOR ELECTRICAL VEHICLES

Technical Task:

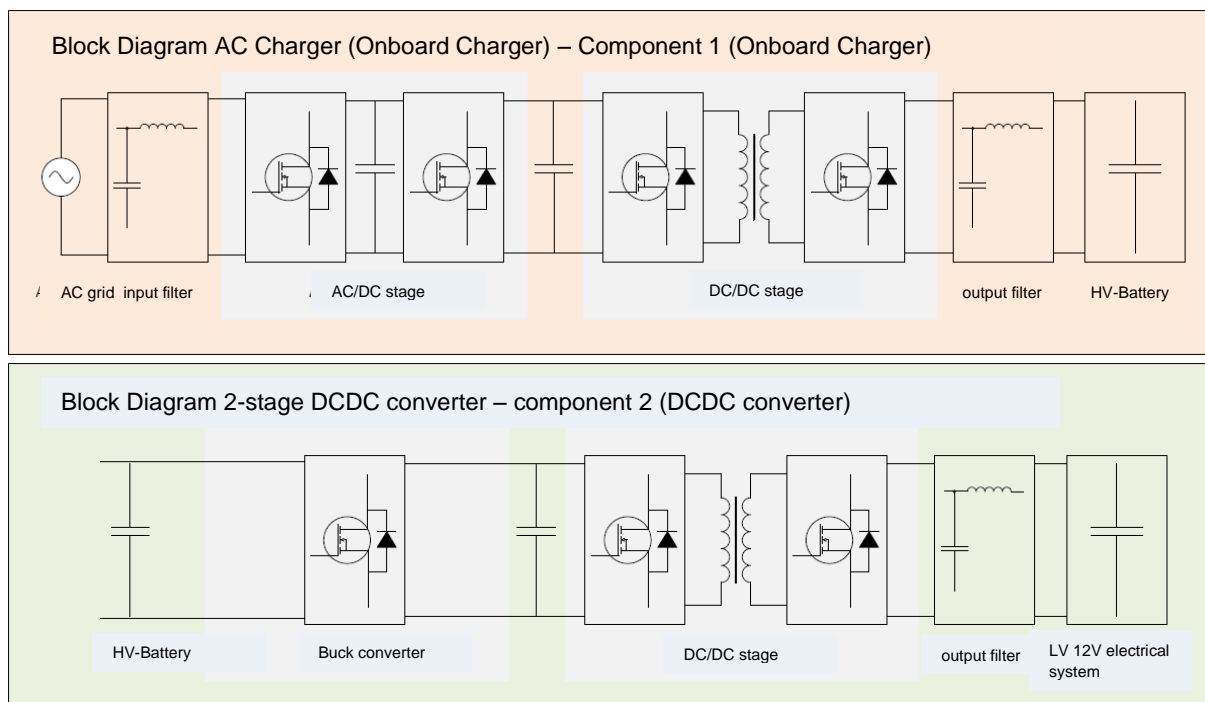
Current electric vehicles (BEVs) and hybrid vehicles (PHEV, HEV, etc.) have a vehicle architecture on the high-voltage side that includes two discrete components (AC charger and high-voltage DCDC converter). Depending on the operating point, both or only one of the components work. Driving mode: Here only the DCDC converter / charging mode works: the charger and the DCDC converter are connected in series (see figures 1-3).

Initial Situation:

The partitioning of the circuit parts into two separate components (AC charger, high-voltage DCDC converter) results in the overhead of an additional component and disadvantages in terms of cost, efficiency, weight, and error rate of the overall system.

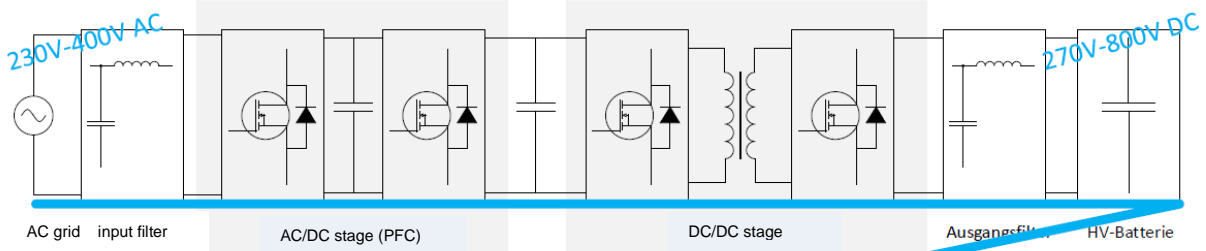
Solution:

The invention message includes the combination of the two components 1. AC charger and 2. high-voltage DCDC converter to a new component "Multipurpose DCDC converter" (see figures 4-7). The new circuit topology allows all functionalities of the previous components 1. Charger and 2 high-voltage DCDC converters in one component. For this purpose, the transformer is equipped with one (or more) additional secondary winding. The rectifier of the 1st AC charger is replaced by a bidirectional active rectifier. This makes it possible to feed energy from the high-voltage network (800V) in the direction of the transformer.

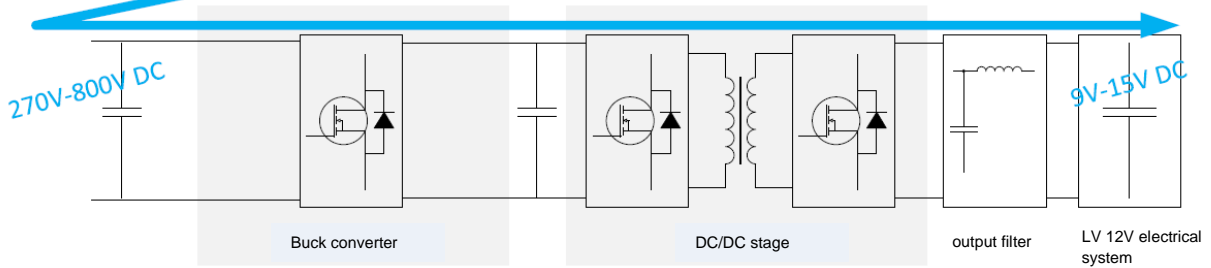


Energy flow in the AC charger

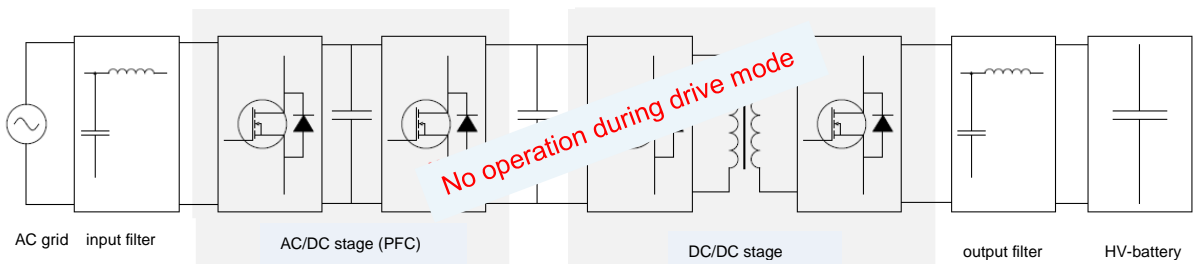
Block diagram AC charger (onboard charger)



Blockschaltbild 2-stufiger DC/DC Wandler

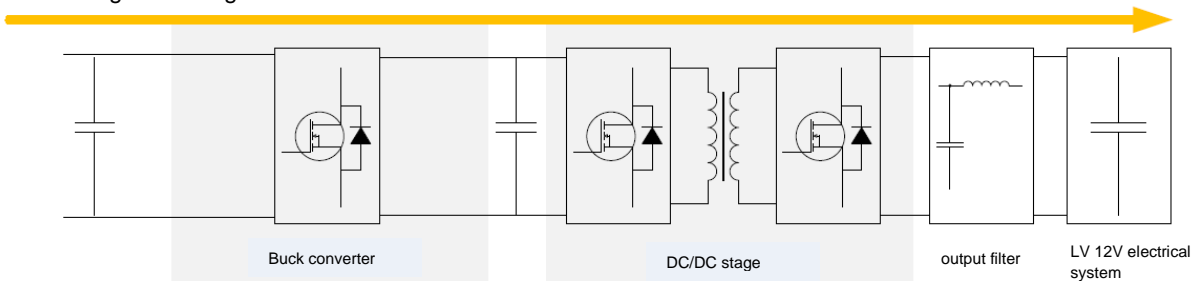


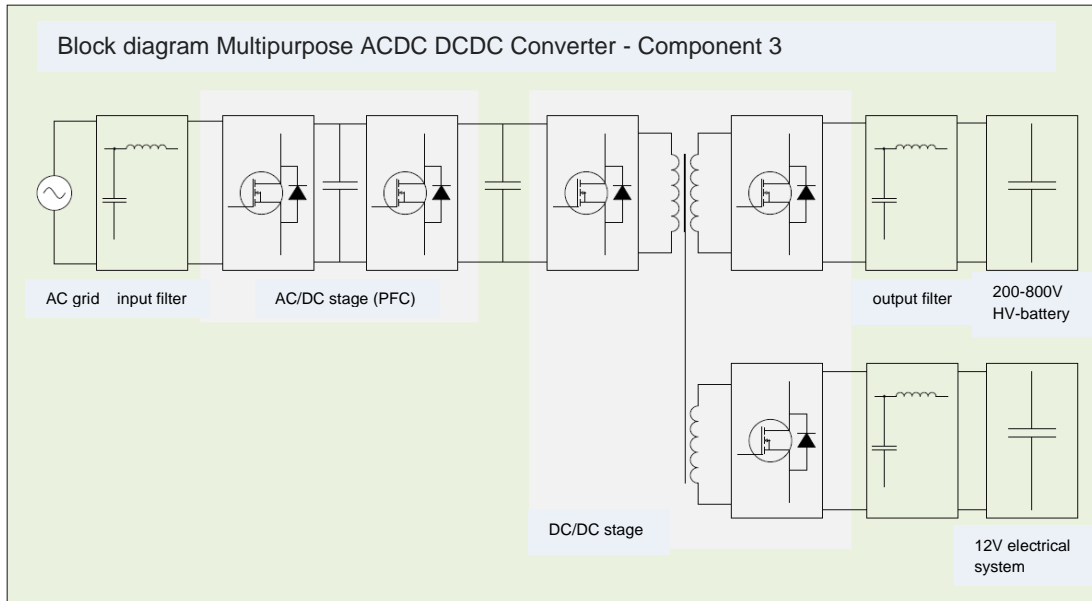
Block diagram AC charger (onboard charger)



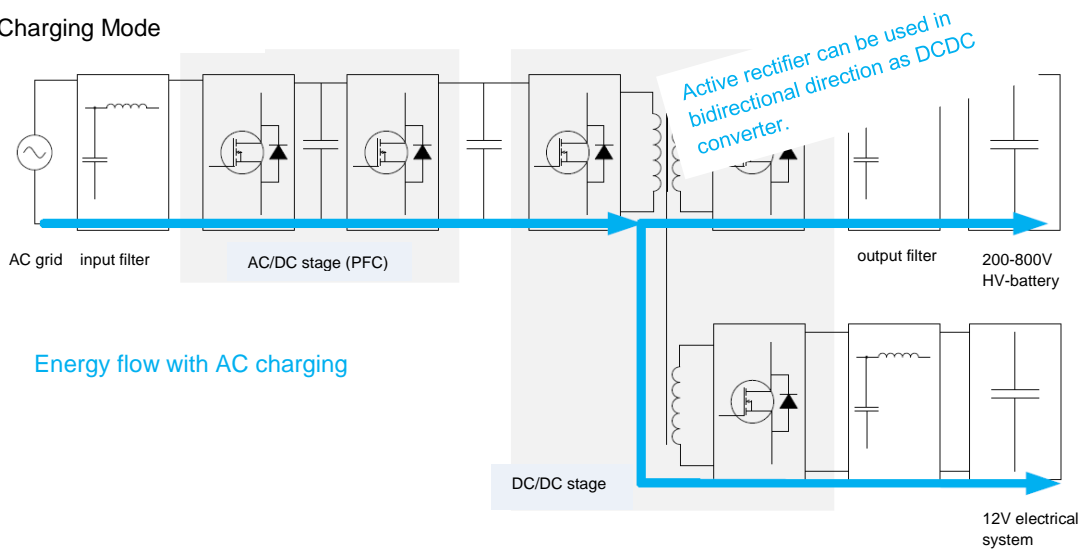
Energy flow while driving
DC/DC converter only

Block diagram 2-stage DC/DC converter

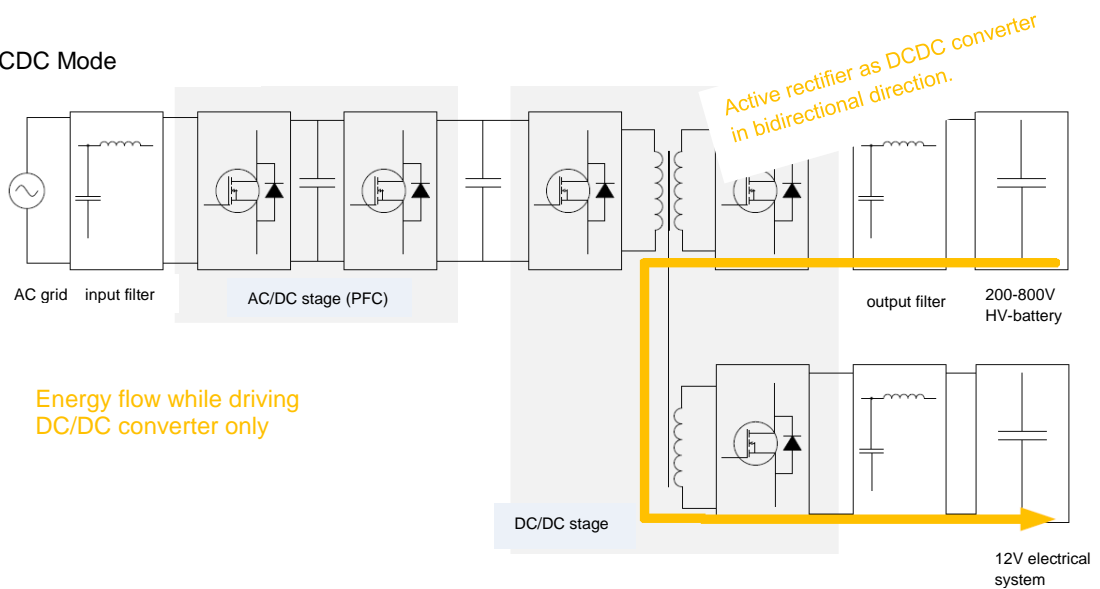




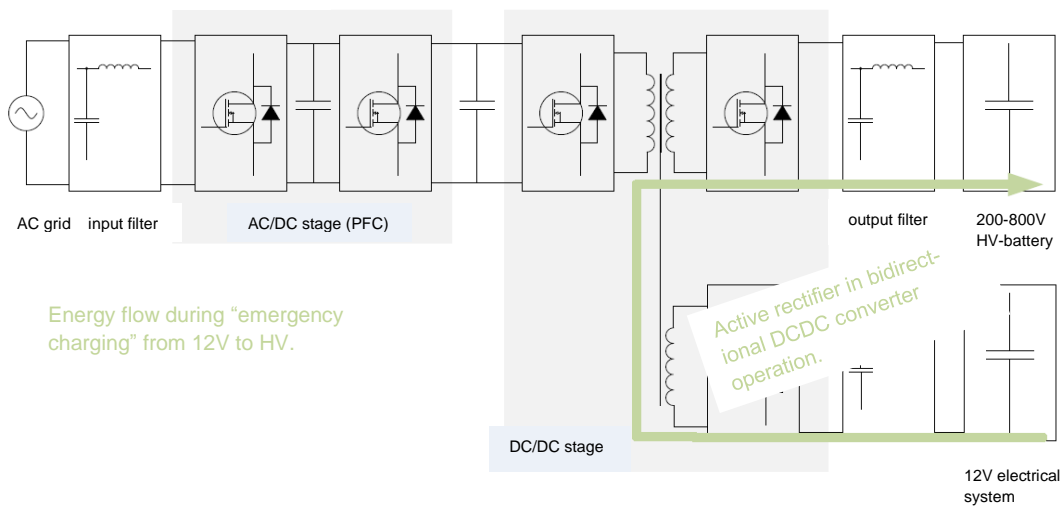
Charging Mode



DCDC Mode



DCDC mode [driving mode]



Advantages:

- Increase in efficiency (overall efficiency from AC grid to DC)
- Reduce weight (only one component)
- Reduction of manufacturing costs
- Reduce complexity and error proneness
- Additional functionality such as emergency loading - customer added value
- Enables energy transfer to all voltage levels
- Additionally expandable to bidirectional AC charging option
- Increase in efficiency (overall efficiency from AC grid to DC)

Possible Applications:

- Dead vehicles of an electric car because of completely discharged battery.
- The topology also makes it possible to have another secondary winding for e.g. 48V electrical system to provide.