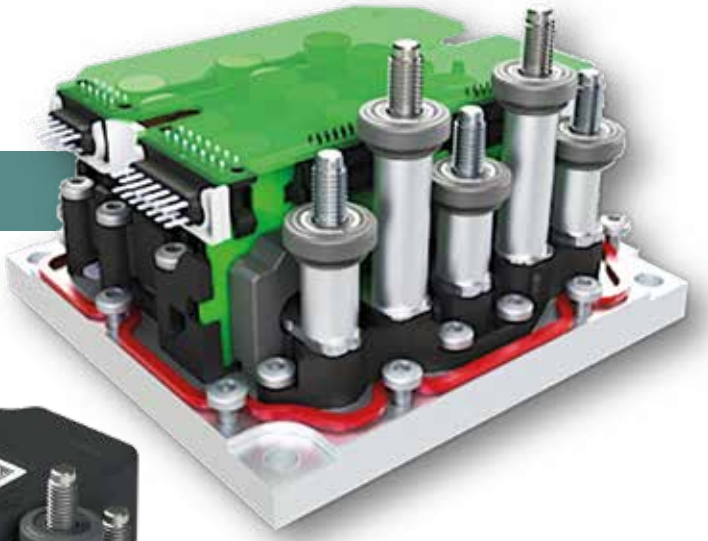
More than a module

The pre-integration of key-elements fills the gap of missing modules for LV power inverters



SKAI3 design-platform with user-controller (transparent green)

SKAI3 low-voltage inverter with standard cover

With the widespread electrification of vehicles and machines comes the need for new inverter solutions to comply with the requirements of various applications, but the necessary building blocks for new inverter designs are not always readily available.

For voltages of 300V to 900V, various high-voltage (HV) power modules exist to form the base of a power-inverter, however, this is not the case for 24V–144V low-voltage (LV) systems. This lack of modules has technical reasons but there is also a solution.

The reason for the missing low-voltage modules becomes clear when comparing the operating conditions of HV and LV inverters. HV inverters are able to deliver the higher power because of the high operating voltage, which is often 10-times higher than the voltage in their LV counterparts. However, high power also needs high current.

Here the situation is very different: current ratings of HV and LV inverters are quite comparable. These currents couple to parasitic inductances of the assembly resulting in inductively stored parasitic energies. These are independent from the voltage and therefore equal for HV and LV systems. These parasitic energies need to be handled and dissipated in the switching processes creating switching voltage-peaks.

In HV inverters, voltage-peaks of several hundred volts are often acceptable because of the high voltage rating of the semiconductor switches. In LV inverters, the voltage margins from the power semiconductors are about 10 times smaller, making it impossible to handle the same amount of parasitic energy. Parasitic inductances of inverters built from classical semiconductor modules combined with external capacitors are simply too high to make it work. This is the reason, why LV MOSFET modules are uncommon.

Due to the lack of ready-made and qualified modules, LV MOSFET inverters are built from individual components. The key-figure of the power-section of a LV inverter is the parasitic inductance, which is the inductance formed by the electrical connection between the DC-link capacitors and the individual MOSFET half-bridges.

To make it work, the MOSFET half-bridges and the DC-link capacitors must electrically be as close as possible – the smaller the better. Besides parasitic inductances, parasitic resistances, distribution resistances and balancing effects all benefit from miniaturization. Getting all these aspects reliably covered by a new inverter design is a complex task that is time and cost consuming.

The SKAI3 LV design helps to overcome this challenge for new inverter designs. It forms a pre-qualified and tested power-platform, which connects easily with a motor-control system, designed by the user. It provides a high-performance power section, complete with power-switches, DC-link capacitors, gate-driver, current- and temperature sensors, AC and DC power connectors and cooler. An IP66 rated cover is available for the design or alternatively it is open for customization if required. In this way, the SKAI3 LV supports a fast time-to-market for new inverter designs that are optimized to fit into a given system architecture without the need of designing and validating a complete new power-section.

With a power-density of more than 30 kVA/l and a total volume of less than 1.8l, the design fits into many applications with its standard case. The SKAI3 LV product family supports battery voltages with a wide range of input voltages, ranging from nominal 48V up to 144V DC and delivering peak currents of 600Arms covering all typical power-needs in industrial applications as well as most other vehicle applications.

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