3.3 kW Isolated Bi-Directional AC to DC Converter

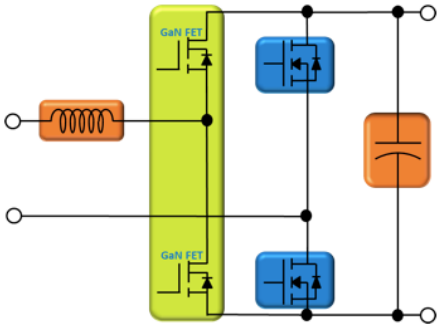
transphorm

Isolated AC to DC converters using Silicon MOSFETs have been around for many years—offering better performance versus the incumbent IGBTs. However, emerging applications are testing the MOSFETs' limits. For example, interest is rising in bi-directional applications that charge DC batteries, drive AC loads, or attach to AC power grids. These applications benefit hybrid solar systems where batteries and the AC grid both supply power to an end customer. They also benefit electric vehicles where high voltage batteries can be charged and used to power outside AC applications.

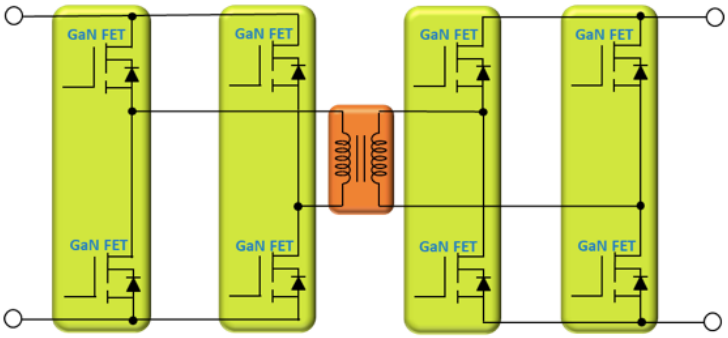
Replacing Silicon devices with Transphorm's GaN FETs currently in production will increase efficiency, shrink system size, and reduce overall cost. These advantages are made possible by the GaN's inherent faster switching speeds and bi-directional current flow as well as the reduction of power loss components.

The following example is based on actual design data from Transphorm's 3.3 kW reference design (TDTTP3300-RD) and 3.3 kW DC to DC bi-directional dual active full bridge (DAB) design guide (DG008). With a 230 Vac input voltage and a 350 Vdc output voltage, an overall efficiency of 97.7% at 1.6 kW or 96.7% at 3.3 kW is achieved.

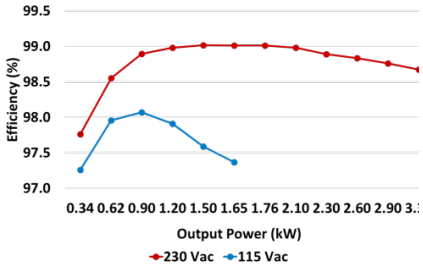
AC to DC Totem-Pole PFC



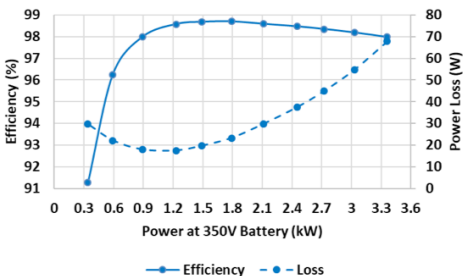
Isolated Bi-directional DC to DC Converter (DAB)



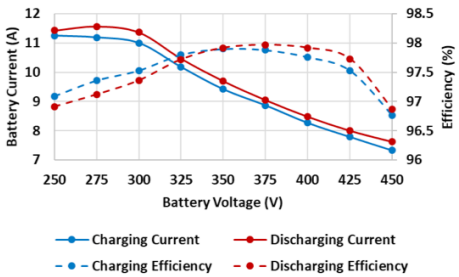
115 Vac and 230 Vac
Totem-Pole PFC



300 W to 3.3 kW
Power Range Charging 350 V Battery



250 V to 450 V Range
Charging/Discharging at 3.3 kW Power



input voltage: 230 V → 1.6 kW: 99.01%, 3.3 kW: 98.7% → 1.6 kW: 98.68%, 3.3 kW: 97.98% → output voltage: 350 Vdc → overall efficiency → 1.6 kW: 97.7%, 3.3 kW: 96.7%