# EV Bi-Directional DC-DC

## Features


**200 kW Bidirectional DC-DC**

- **Seamless Bi-Directional Power Flow**
- **Modular Design**
- **100℃ Coolant Temperature**
- **Digitally Controlled**
- **High Power Density**
  - **>8 kW/L**
  - **>4 kW/kg**
- **Wide Battery and Bus Voltage Range**
- **Multi-Level Fault Protection**
- **Thermal Derating and Shutdown**
- **Voltage and Current Limiting**
- **High Efficiency**
  - **>97% efficiency above 15% load**
  - **>93% efficiency at 2.5% load**
- **CAN & USB Communication**
- **Programmable PID Controllers**
  - **Allows for better system integration by OEM**

## Description

The EV Bi-Directional DC-DC converter is a highly efficient modular bidirectional DC-DC converter system. The converter is composed of 50 kW modules that can be paralleled for up to 200 kW power, achieving a nearly flat efficiency curve. By allowing up to 100ºC coolant, the converter can operate on a single high temperature coolant loop in-line with an engine or motor drive electronics. The DC-DC converter system is a commercial-off-the-shelf (COTS) solution for electric vehicle manufacturers and designers. The system is highly redundant and robust, allowing it to continue to operate in non-ideal conditions. The system utilizes CAN communication to the vehicle controller which will allow for selection of proper operational modes, battery charging/discharging current levels, and voltage limits. Since the system is digitally controlled, the OEM of the vehicle can integrate their own PID controller values or use the default values already installed. The PC communication interface allows for easy in-system testing and customization through a USB connection. The converter is housed in a sealed aluminum enclosure, ready to be mounted to the vehicle chassis.

## Absolute Maximum Ratings

| | Parameter | Max. | Unit |
|---|---|---|---|
| $V_{bat}$ | Battery Voltage | 580 | V |
| $V_{bus}$ | Bus Voltage | 800 | V |
| $T_{cool}$ | Coolant Temp. | 100 | ℃ |
| $P_{out}$ | Output Power | 200 | kW |

## Recommended Operating Conditions

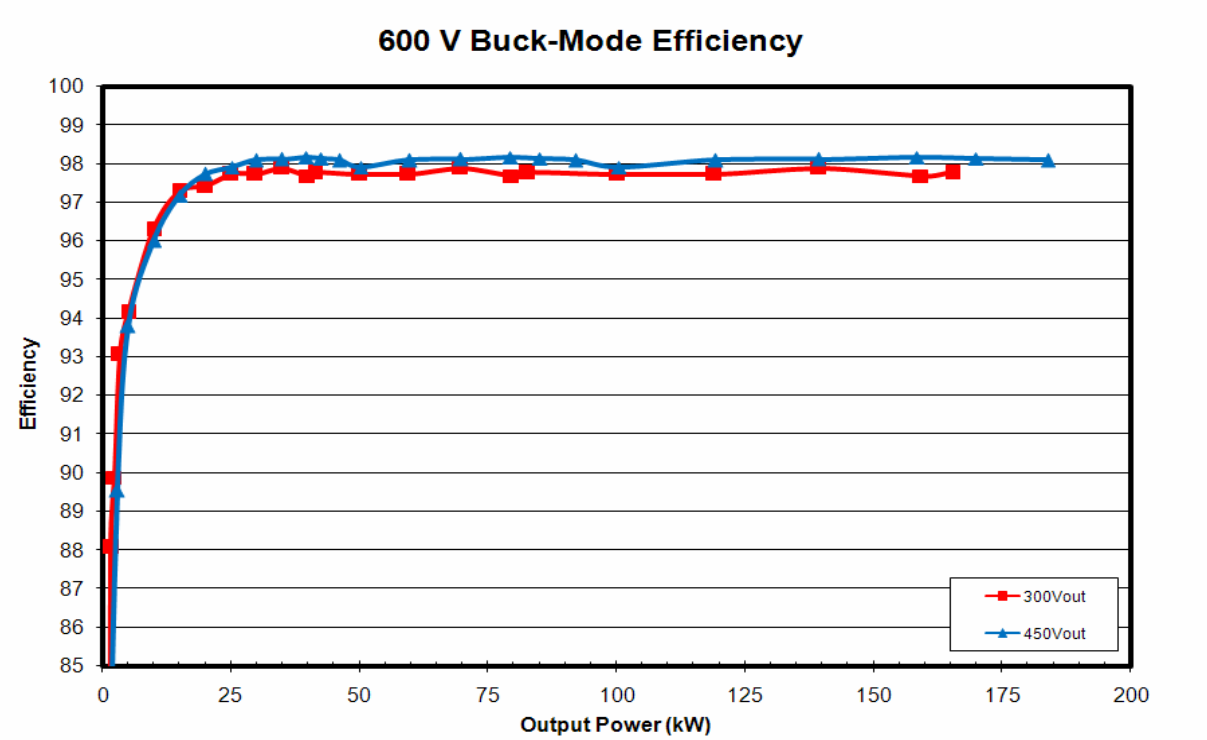
| | Parameter | Min. | Typ. | Max. | Unit | Conditions |
|---|---|---|---|---|---|---|
| $V_{bat}$ | Battery Voltage | 200 | - | 530 | V | |
| $V_{bus}$ | Bus Voltage | 580 | - | 800 | V | |
| $V_{supply}$ | Supply Voltage | 12 | - | 24 | V | |
| $I_{supply}$ | Supply Current | 1.8 | - | 3.6 | A | (1) |
| $P_{out}$ | Output Power | - | - | 200 | kW | |
| η | Converter Efficiency | 97 | - | - | % | (2) |
| | | 93 | - | - | % | (3) |
| $T_{cool}$ | Coolant Temperature | - | 100 | - | ℃ | |
| $P_{abs}$ | Absolute Coolant Pressure | - | - | 75 | PSI | |
| ΔP | Coolant Pressure Drop | - | 3 | - | PSI | (4) |
| Q | Coolant Flow Rate | - | 12.5 | - | L/min | |

**Notes:**
(1) 12V controller voltage
(2) Operation in Buck mode from 600V to 450V from 15% to full load
(3) Operation in Buck mode from 600V to 450V at 2.5% load
(4) At 12.5 L/min coolant flow rate

## Dimensions (200kW DC-DC)

| | Parameters | Typ. | Units |
|---|---|---|---|
| L | Length | 406 | mm |
| | | 16 | inch |
| W | Width | 343 | mm |
| | | 13.5 | inch |
| H | Height | 178 | mm |
| | | 7 | inch |
| W | Weight | 45 | kg |

## Typical Efficiency Characteristics




## CAN Commands and Setpoints

1. Converter Mode Select (Buck only, Boost only, Bidirectional, off)
2. Average Battery Charge Current Limit
3. Average Battery Discharge Current Limit
4. Peak Battery Charge Current Limit
5. Peak Battery Discharge Current Limit
6. Battery Current Limit Type (circuit-breaker, power limiting)
7. Battery Under-Voltage Limit
8. Battery Over-Voltage Limit
9. Bus Under-Voltage Limit
10. Bus Over-Voltage Limit
11. Bus Under-Voltage Fault Level
12. Bus Over-Voltage Fault Level
13. Fault Reset Level 1
14. Fault Reset Level 2

## CAN Feedback

1. Converter Mode
2. Battery Voltage
3. Bus Voltage
4. Battery Current
5. Converter Temp 1
6. Converter Temp 2
7. Converter Temp 3
8. Fault Codes