OBC (800V/22kW) Using Wide-Bandgap Semiconductors

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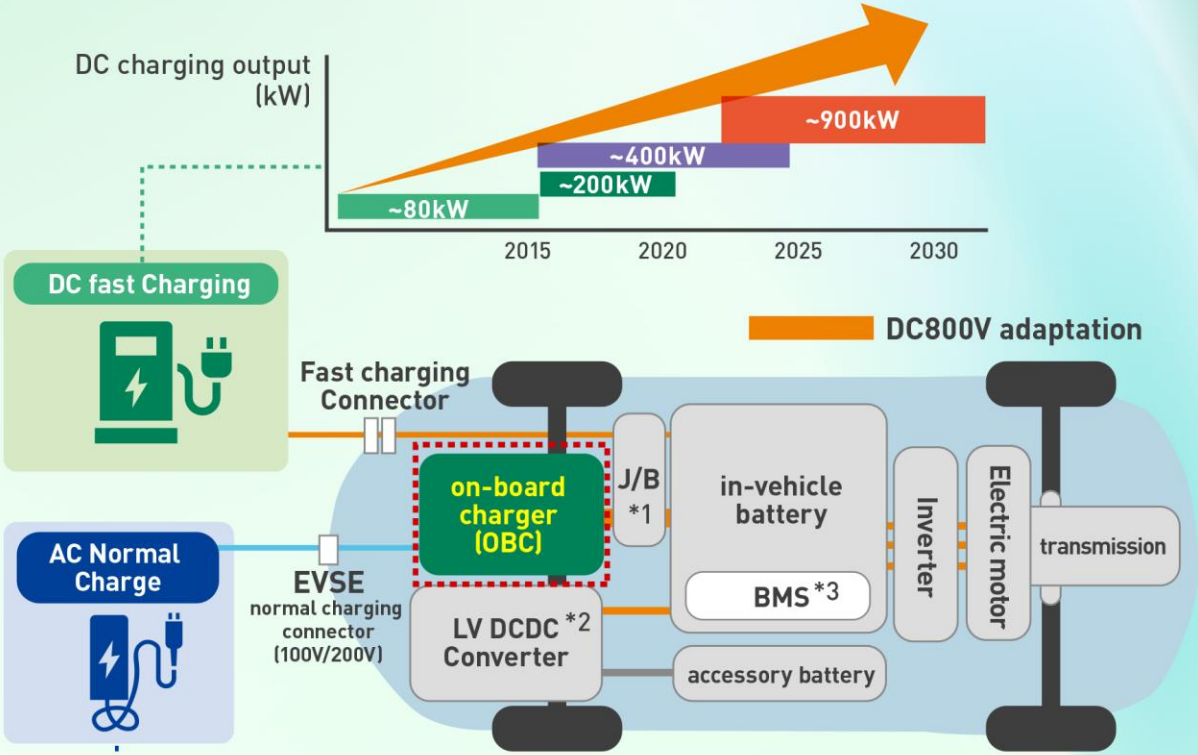
Benefits

Customer satisfaction improvement by 800V system and 22kW OBC introduction.

- AC/DC Charging time reduction
- DC conduction loss reduction
- Power consumption reduction
- Weight reduction



22kW OBC : already in market.
(Exhibited at ITSWC 2022)

*1 : Junction box
*2 : Low Voltage DCDC converter
*3 : Battery Management System

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Technical Advantages

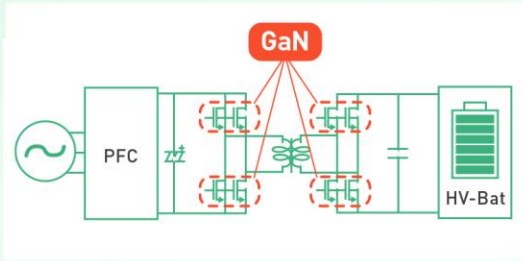
High Efficiency over wide output voltage/ current range

DAB with phase/frequency multi control algorithm by Employing Multimode Control Strategy DAB is used to extend operating time because use case is changed by bi-directional function. (V2L: x1.6 times, V2G: x10.6 times the operating time required against uni-directional OBC)

1200V GaN device

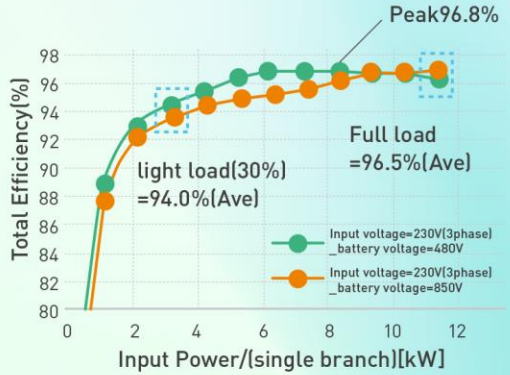
- High power/High voltage
  Realize "800V/22kW" circuit technology
- High power density
  2.2kW/L by 500kHz switching with GaN device
- High efficiency
  96.5% by SiC→98% by Gan device (PFC+DCDC)
  GaN device spec. : voltage/current : 1200V/40A
  On-resistance : 15.5mΩ (target)

DAB*4 topology (11kW/Branch)



*4 : Dual Active Bridge

Total Efficiency (SiC)



Comparison Si vs SiC vs GaN

	Si - MOSFET	SiC - MOSFET	GaN HEMT (on GaN)
Bandgap [eV]	1.1	3.3	3.4
Frequency	~1MHz	~200kHz	~1MHz
Voltage	~1kV	~several kV	~1200
Performance index [εμEc3]	1	440	1130

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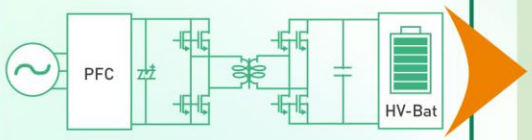
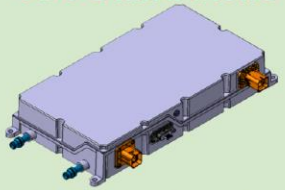
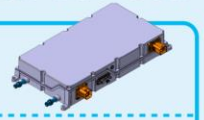
Applications

Small size and High Efficiency Solution



Application	Explanation	Benefit
OBC Stand alone  Spec. of displayed sample as target AC 240V/22kW input, DC 800V output, Efficiency 98%, Power density: 2.2kW/L, Bi-directional operation	A rapidly and significantly evolving component among integrated components	**•Flexible position in the vehicle based on OEM design. (ex. BEV)** •OBC easy adaptability to the regulation and norm in global market
OBC integrated into One-box J/B + BMS  LV DCDC	Technical trend for expansion of EV adoption to produce EV with low cost, low weight	**•Further weight and space reduction opportunity by integrating sub-components** •Reduced weight, cost, space •Reduced vehicle interface (harness, cooling system)

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