



Vincotech

DC FAST CHARGING SOLUTIONS

A photograph of a white electric car being charged at a station. The car is on the right side of the frame, with a charging cable plugged into its port. The background shows a paved road with white dashed lines, street lamps, and trees under a clear sky. The image is overlaid with a large black diagonal shape on the left side and a dark blue diagonal shape at the bottom.

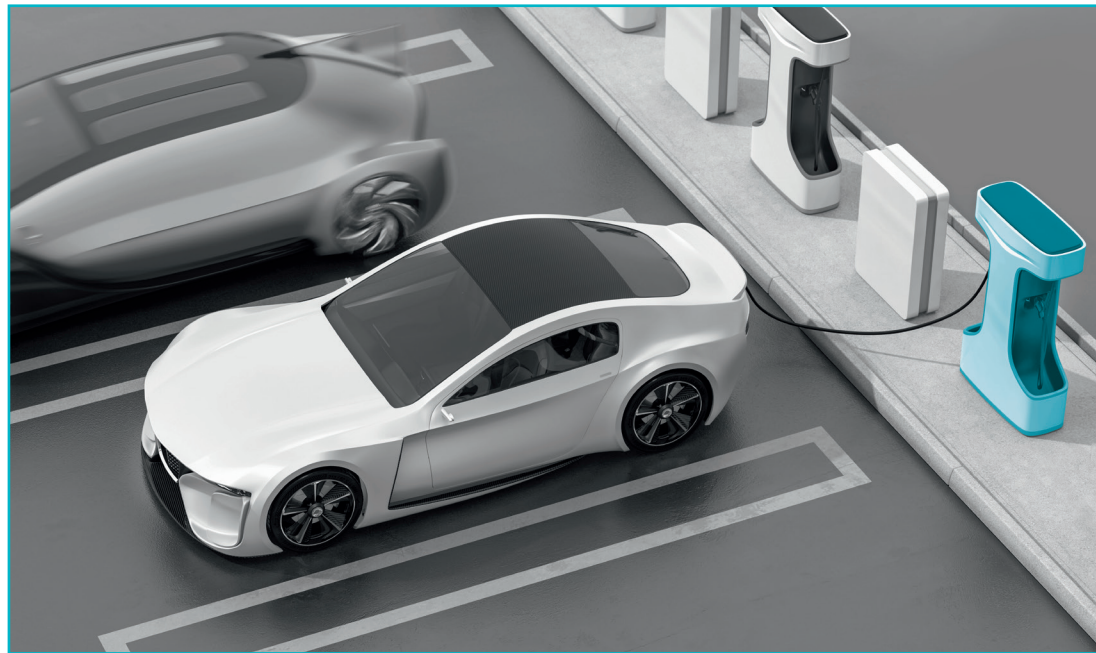
EMPOWERING YOUR IDEAS

CHARGING THE FUTURE

/ The market for electric vehicles (EVs) has entered a phase of fast growth, boosted by global challenges like CO₂ reduction and energy saving. Charging infrastructure is the backbone of this transition to e-mobility and the world is going to need a lot more of it in the near future.

/ But climate-friendly mobility is not just limited to passenger cars. Heavy-duty vehicles and also industrial vehicles have to be taken in consideration.

/ Vincotech with more than 25 years' experience in power modules offers a comprehensive product portfolio to cover all conversion stages, and power ranges, from as little as 5kW up to megawatt (MCS) in a DC fast charger system architecture.



Vincotech power modules are well established in many DC Charger applications from EV charger and Industrial charger key manufactures who benefit from:

- / Multi-sourced SiC-components for more freedom of choice and less supply chain risk
- / Factor >3 improved power cycling capability for higher lifetime
- / Integrated DC capacitors to mitigate voltage overshoot
- / High performance substrates for higher lifetime
- / Press-fit pins and pre-applied TIM to help reduce production cost

Key Trends and Drivers in DC Charger Engineering

High Power Charging Stations

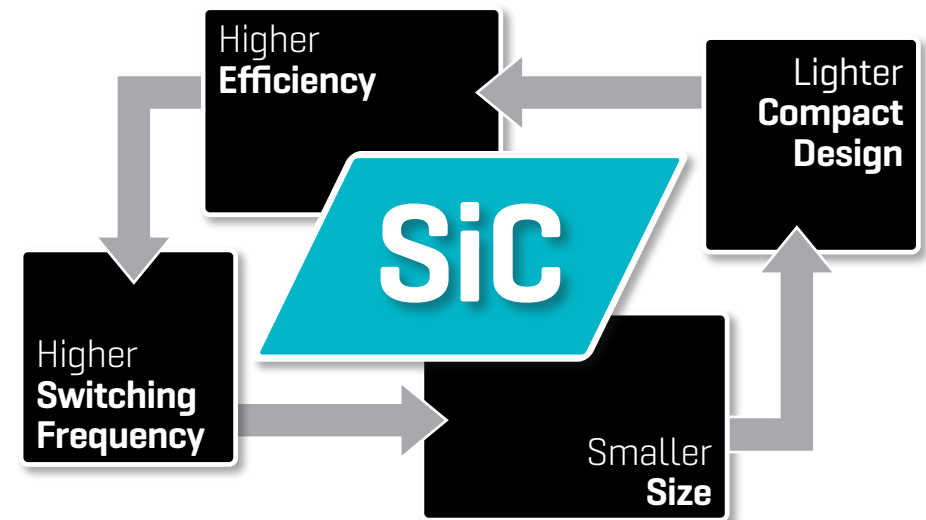
- Charging will shift towards public and workplace options, as more people without access to home charging start to buy EVs. There will be a growing need for DC fast chargers with nominal power beyond 22 kW in the next years
- For commercial vehicles like trucks and busses for long-haul trips on the move charging availability of 45min will be needed which will require >1 MW chargers

Battery Voltage 400V → 800V → 1000V

- Trend towards higher system voltage
- 500V → 1000V → 1500V

Bi-directional Charging

- V2L, V2G or V2H



Reliability

- More challenging mission profiles

Modular Design

- For >30kW the modular design is more dominant than the monolithic design approach, giving the benefits of high design flexibility
- Several 30 kW or 50-to-60 kW charger modules are connected in parallel to deliver the desired amount of power

Power Module Solution

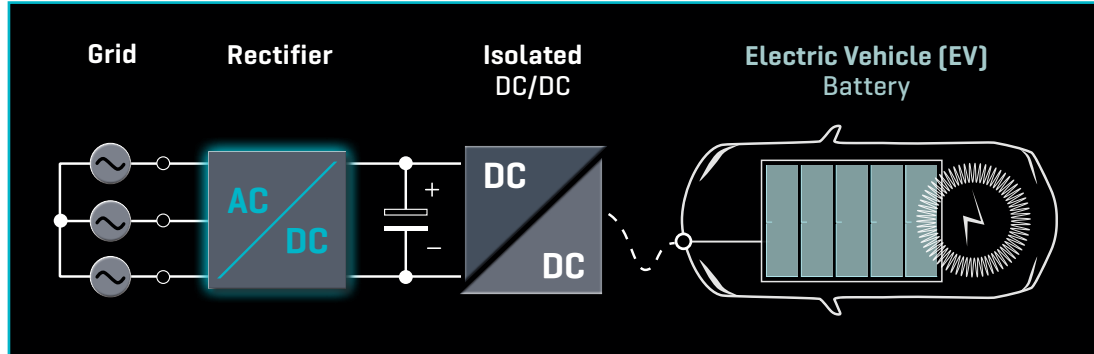
- For >30 kW the power module solution is more preferred than the discrete solution, thus benefiting from optimal thermal management, simplified mechanical assembly, and low parasitic inductance

Efficiency: from today 95% to 98%

- WBG components are playing a key role to achieve this goal
- 3% efficiency improvement will save 2,1 billions kWh electricity per year*

*30million electric vehicles by 2025 / 15000 km annual driven kilometers / average power consumption 15kWh

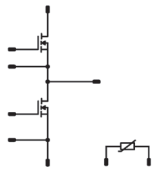
DC FAST CHARGER, AC/DC Stage



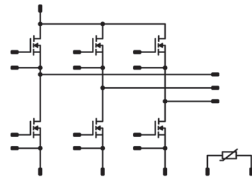
There are several three-phase PFC topologies available which can be addressed with multiple 3L and 2L topologies with pros and cons in terms of efficiency, costs and design complexity. Each of these topologies will influence:

- / the blocking voltage rating of the semiconductors, e.g. 650 V or 1200 V and as a result, the switching losses and the efficiency
- / the total system costs, e.g. PFC inductor size and costs
- / the thermal management, e.g. heat sink size
- / the design, e.g. uni- or bi-directional. For bi-directional charging the 3L SPFC and NPFC are suitable by replacing the boost diodes with switches, and the 2L 6pack per se

2L Topologies

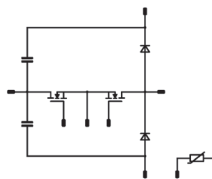


Product Line **flowDUAL SiC**

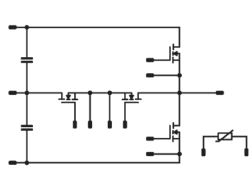


Product Line **flowPACK SiC**

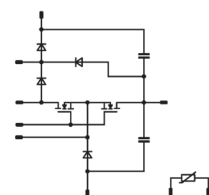
3L Topologies



Product Line **flowNPFC SiC / flowMNPC SiC**



Product Line **flowANPFC SiC**



Product Line **flowSPFC SiC**

Comprehensive 2L and 3L PFC Portfolio for the AC/DC Stage

Housing	NPFC/MNPC	ANPFC	SPFC
flow 0	-650V/75A, 100A IGBT H5, with 1200V fast Si Diode or SiC SBD -650V/45m0hm SiC MOSFET -Up to 30kW application power	-650V/100A IGBT fast, with 1200V fast Si Diode or SiC SBD -Up to 30kW application power	-650V/50A, 75A, 100A IGBT H5/S5, with 1200V fast Si Diode -Up to 22kW application power
flow 1	-650V/100A IGBT S5, with 1200V SiC SBD -650V/15m0hm SiC MOSFET -Up to 60kW application power	-650V/100A IGBT fast/S5 with 1200V SiC SBD -650V/15m0hm SiC MOSFET* -Up to 50kW application power	-650V/15m0hm SiC MOSFET* -Up to 50kW application power
flow E2	-650V/15m0hm SiC MOSFET -1200V/11m0hm SiC MOSFET -Up to 60kW application power		
flow E3	-3xNPFC/MNPC 650V/15m0hm* -Up to 50kW application power		

Housing	Half-bridge	6PACK
flow 1		-1200V/75m0hm-16m0hm SiC MOSFET -Up to 30kW application power
flow S3	-1200V/3m0hm, SiC MOSFET* -Up to 120kW application power	
flow E1	-1200V/32m0hm, 21m0hm, 18m0hm, 16m0hm SiC MOSFET -Up to 40kW application power	-1200V/75m0hm, 32m0hm SiC MOSFET -Up to 20kW application power
flow E2	-1200V/8m0hm, 5m0hm SiC MOSFET -Up to 75kW application power	-1200V/20m0hm, 11m0hm SiC MOSFET -Up to 35kW application power
flow E3	-1200V/2m0hm SiC MOSFET -Up to 150kW application power	



flow 0/1

- / Baseplate-less housing
- / Convex shaped substrate for superior thermal contact
- / Flexible pin arrangement for optimal and low inductive design
- / Optional features like integrated DC link capacitors for overvoltage mitigation
- / Solder pin or Press-fit pins for solder less connection to PCB
- / Pre-applied PC-TIM rated for 150°C



flow S3

- / Compact baseplate-less housing
- / VINcoPress technology aimed for superior thermal performance with improved reliability
- / Flexible pin arrangement for optimal and low inductive design
- / Optional features like integrated DC link capacitors for overvoltage mitigation
- / Solder pin or Press-fit pins for solder less connection to PCB
- / Pre-applied PC-TIM rated for 150°C



flow E1/E2/E3

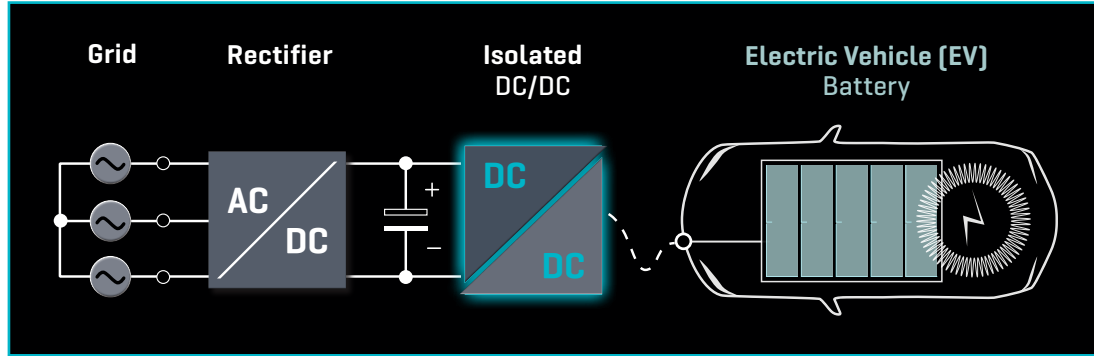
- / Baseplate-less standard industry housing
- / flow E1/E2 with convex shaped substrate for superior thermal contact
- / flow E3 with VINcoPress technology aimed for superior thermal performance with improved reliability
- / Optional features like integrated DC link capacitors for overvoltage mitigation
- / Solder pin or Press-fit pins for solder less connection to PCB
- / Pre-applied PC-TIM rated for 150°C

*in concept phase

Voltage and current R_{dson} are referred to the main device of the topology

Application power: Assuming a typical charging operation point: Vin 230V, Vdc 800V, fsw 40kHz, T_{hs} 80°C

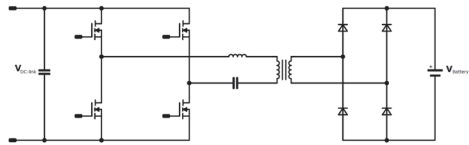
DC FAST CHARGER, DC/DC Stage



For the DC-DC power conversion stage mainly isolated topologies are employed like the full-bridge or three-phase LLC resonant converter, and the full-bridge phase-shift DAB. The first one is a pure frequency modulated configuration and the second operates with PWM.

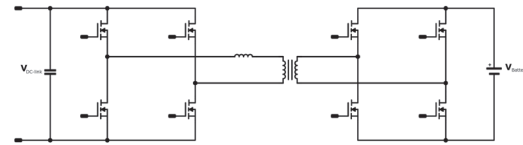
In this stage, SiC MOSFET chip technology is essential to meeting switching frequency [>100 kHz] and peak efficiency [$>98.5\%$] requirements. A 1200 V SiC MOSFET streamlines the topology by transitioning from a two cascaded interleaved LLC with 650V Si components to a single full-bridge LLC.

LLC



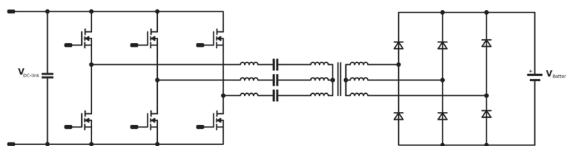
Product Line Full-bridge
fastPACK SiC

DAB



Product Line Full-bridge
fastPACK SiC

Three-Phase LLC

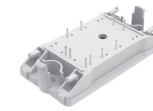


Product Line 6Pack
flowPACK SiC

New Product Line
Ultrafast Rectifier
flowCON SiC

fastPACK SiC and New flowCON SiC Product Line for the DC/DC Stage

Housing	H-Bridge	2ph Ultrafast Rectifier	3ph Ultrafast Rectifier
flow 0	-1200V/75m0hm,32m0hm SiC MOSFET Gen3 and Gen4 -950V/35m0hm,16m0hm SiC MOSFET Gen3 -650V-750V/45m0hm,20m0hm SiC* MOSFET Gen3 and Gen4	-650V/20A SiC SBD	
flow 1	-1200V/11m0hm SiC MOSFET Gen3* -650V-750V/11m0hm SiC* MOSFET Gen3 and Gen4	-1200V/60A,100A,120A Si fast diode and 60A,80A,100A SiC SBD -650V/160A Si fast diode and 60A,80A,100A SiC SBD	- 650V/70A Si fast diode
flow E1	-1200V/32m0hm,16m0hm SiC MOSFET Gen3 -650V/21m0hm,16m0hm SiC MOSFET Gen3	-1200V/10A,30A SiC SBD	
flow E2	-1200V/16m0hm,11m0hm SiC MOSFET Gen3 -750V/20m0hm SiC MOSFET Gen4	-1200V/80A SiC SBD*	- 1200V/40A SiC SBD
flow S3		-1200V/80A SiC SBD	



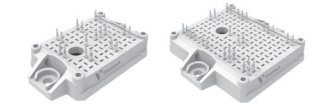
flow 0/1

- / Baseplate-less housing
- / Convex shaped substrate for superior thermal contact
- / Flexible pin arrangement for optimal and low inductive design
- / Optional features like integrated DC link capacitors for overvoltage mitigation
- / Solder pin or Press-fit pins for solder less connection to PCB
- / Pre-applied PC-TIM rated for 150°C



flow S3

- / Compact baseplate-less housing
- / VINcoPress technology aimed for superior thermal performance with improved reliability
- / Flexible pin arrangement for optimal and low inductive design
- / Optional features like integrated DC link capacitors for overvoltage mitigation
- / Solder pin or Press-fit pins for solder less connection to PCB
- / Pre-applied PC-TIM rated for 150°C



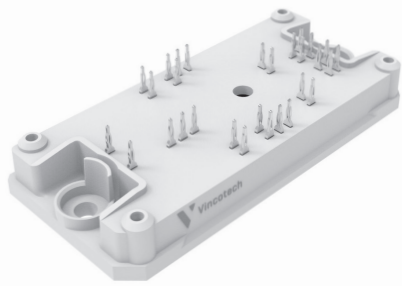
flow E1/E2

- / Baseplate-less standard industry housing
- / Convex shaped substrate for superior thermal contact
- / Optional features like integrated DC link capacitors for overvoltage mitigation
- / Solder pin or Press-fit pins for solder less connection to PCB
- / Pre-applied PC-TIM rated for 150°C

***in concept phase**

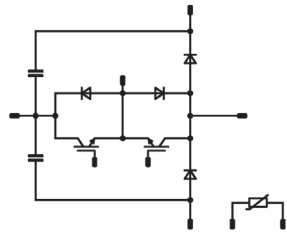
Voltage and current Rdson are referred to the main device of the topology

flowNPFC/MNPC 1 SiC Product Line for Application Power up to 60kW



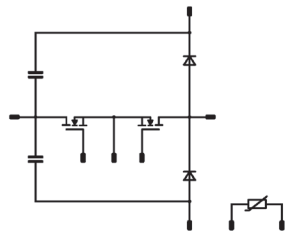
New Optimized Pin-out Features

- / Shorter DC+ to GND and DC- to GND distance
- / Lower stray inductance
- / Optimal commutation loops
- / Symmetrical and short commutation loops with balanced operation in pos and neg half period
- / Symmetrical gate commutation loops
- / Easy to add separated gate resistance



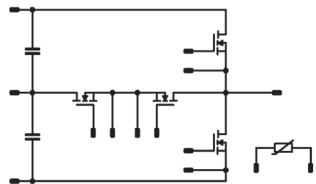
10-FY07LBA100S5-PG08J58T

- / For uni-directional charger
- / Cost efficient hybrid solution with 650V Trenchstop™ 5 IGBT and 1200V SiC boost diode



10-PY07LBA015ME-PG08J68T

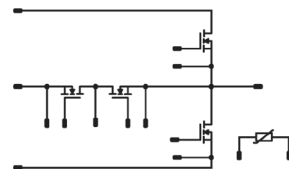
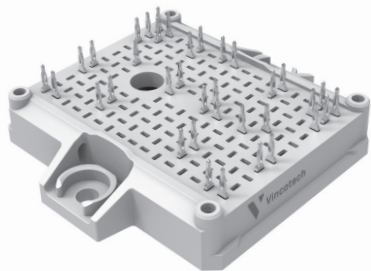
- / For uni-directional charger
- / High efficiency SiC solution with 650V SiC MOSFET and 1200V SiC boost diode



10-PY12NMD016ME-PG08F18T

- / For bi-directional charger
- / High efficiency solution with 650V/1200V SiC MOSFET

flowMNPC E2 SiC Product Line



10-EY12NMA016ME-LS28F16T 10-EY12NMA011ME30-LS28F18T

- / For bi-directional charger
- / High efficiency SiC solution with 650V SiC MOSFET and full 1200V SiC MOSFET

fastCSPFC Product Line for Application Power up to 35kW

New Current Synthesizing PFC (CSPFC) topology for highest efficiency at lowest total system costs through:

- / Reduced number of SiC devices
- / Reduced number and size of the PFC inductors
- / Elimination of large electrolytic DC-Link capacitors

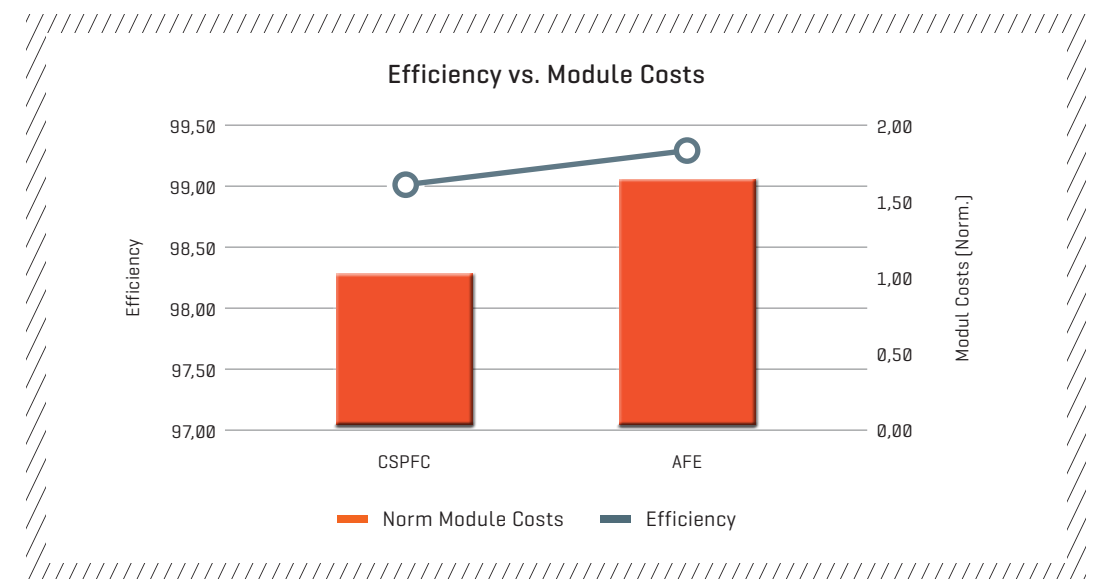
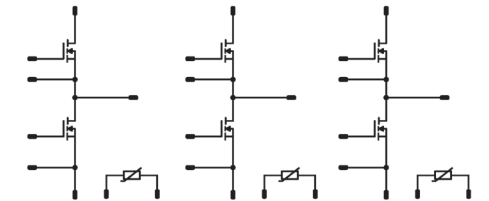
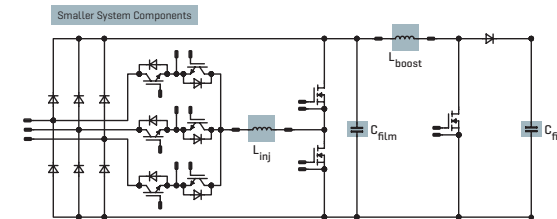
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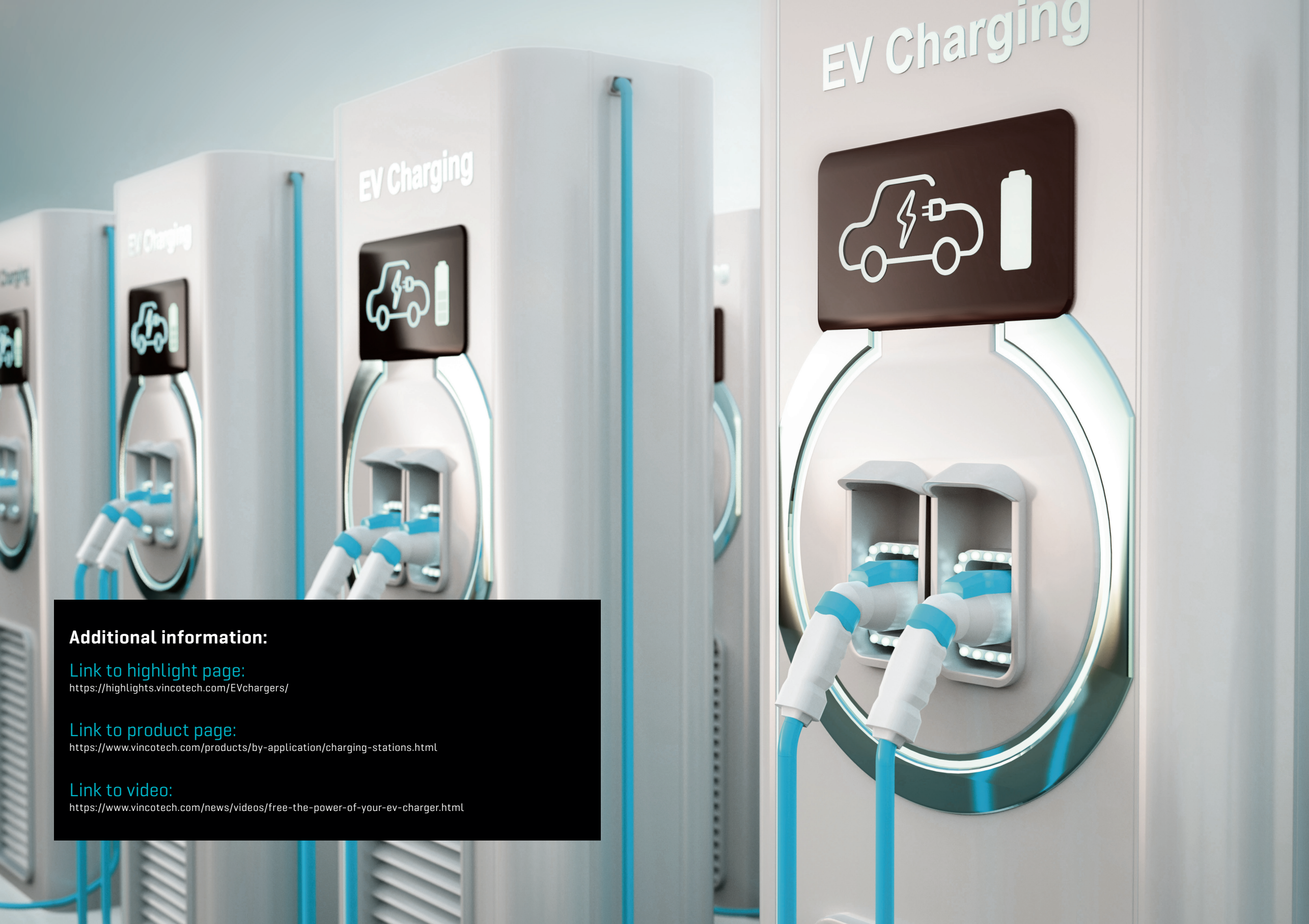


3x 10-EZ122PA016ME-LJ67F68T



VERSUS





Additional information:

Link to highlight page:

<https://highlights.vincotech.com/EVchargers/>

Link to product page:

<https://www.vincotech.com/products/by-application/charging-stations.html>

Link to video:

<https://www.vincotech.com/news/videos/free-the-power-of-your-ev-charger.html>



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