

Application Note EV Charging

Safe, fast & reliable charging is the key driver for successful e-mobility. Equal if using AC or DC charging technology, core components like film capacitors has to be best in class for on- and off-board electronics.



EV Charging

Panasonic
INDUSTRY

PRODUCT

AEC-Q200 compliant metallized PP film capacitor ECQUA, ECWFG & EZPV series

PURPOSE

EV charging basically means a lot of power electronics. Current has to be converted from AC to DC, and DC / DC converters have to provide the right voltage level depending on the BMS system. Film caps with a high voltage range up to 1,100VDC and an integrated safety function are used in these circuits for EMI suppression and DC smoothing.

FEATURES

- High safety: patterned metallization with fuse function
- High humidity resistance
- High thermal shock resistance (ECQUA and ECWFG series only)
- AEC-Q200 compliant
- RoHS compliant



AC Charging

FACTS & FIGURES

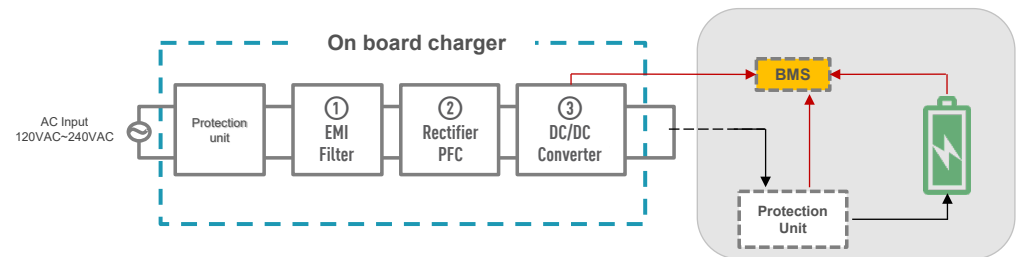
AC charging is the most common charging method for electric vehicles with a plug. Charging speed depends on the output power of the charge point as well as the converter's capabilities to convert the power to DC.

An on-board charger is the most essential part of AC charging. At the input side of AC/DC converter circuit of the OBC, class-X capacitors are placed to minimize the generation of EMI ①. Because of this direct connection to the AC power input, they may be subjected to overvoltage and therefore is required to handle high voltage impulses and protect users from harm due to electrical shock.

Thanks to Panasonic's in-house patterned metallization technology (also well known as „built-in fuse function“), its ECQUA series (safety class X2) offer overvoltage impact reduction to realize high safety with open failure mode. Both voltage values of 275VAC and 310VAC are available, and capacitance range is up to 10 μ F. Following power conversion from AC into DC, PFC circuit ② plays an important role to improve power efficiency. Here is where Panasonic ECWFG series come in as PFC film capacitor with its excellent DC smoothing performance.

Besides a wide DC voltage range of 600V up to 1,100V, this series provide high ripple current handling ability at high temperature, and feature high thermal shock resistance.

At the output side of DC/DC converting circuit ③, Panasonic ECWFG and EZPV series offer high voltage capacity up to 1,100VDC together with a wide capacitance range from 1 μ F to 110 μ F. High safety (thanks to built-in fuse function) and high ripple current capacity help these two series optimize the high power output performance of the circuit.



Application	① EMI Supression	② Smoothing	③ Smoothing
Voltage	275VAC, 310VAC	600VDC~1,100VDC	600VDC~1,100VDC
Product	ECQUA	ECWFG	ECWFG, EZPV

DC Charging

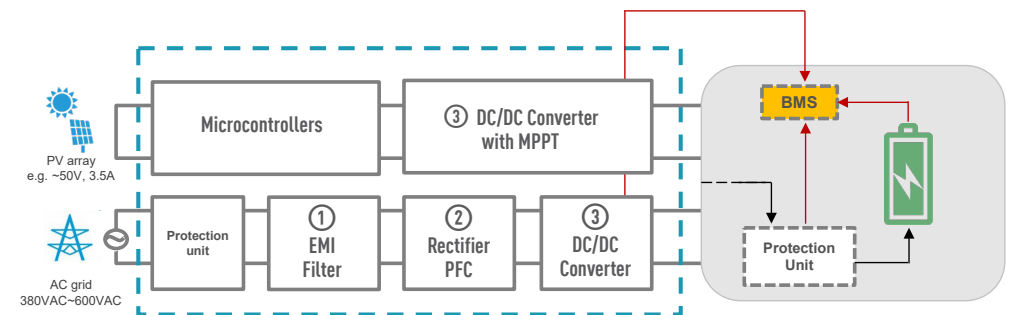
FACTS & FIGURES

Different from AC charging, the principle of DC charging is to convert the power before it enters the vehicle. After conversion, the DC power goes directly into the vehicle battery, bypassing the vehicle's converter. The required power for DC charging is normally considered to be within max. 36kWh and 90kWh range. It can also go up to a range of 120kWh and 350kW in terms of DC fast charging. To make the EV charging process faster and faster, DC charging technologies continue to evolve and improve aiming stable and high efficiency of energy output.

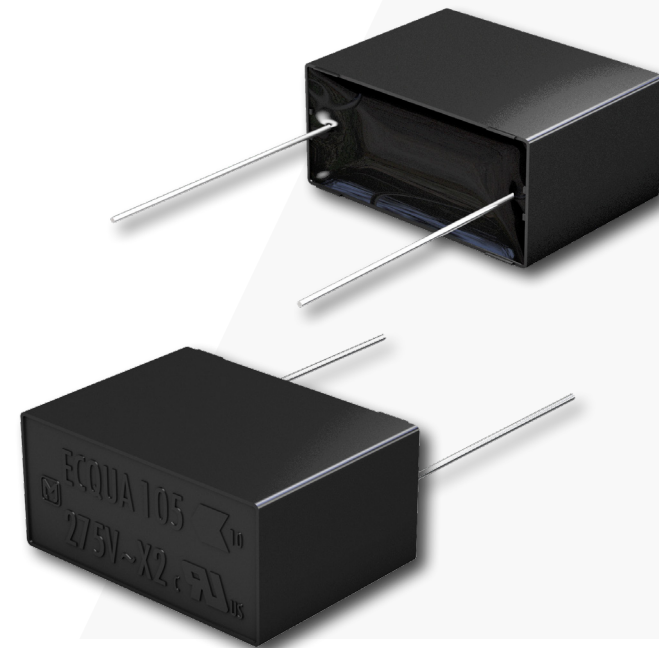
To meet this need, Panasonic provide its metallized PP film capacitor ECQUA (AC), ECWFG (DC), EZPV (DC) series featuring large current handling ability, high reliability and high safety, contributing to high-capability of input filtering, PFC circuit and DC/DC convert circuit. Typically the energy resource for a DC charging station comes from utility grid which is within 380VAC and 480VAC range. In the input side of AC/DC converting circuit, Panasonic ECQUA series (safety class X2) function as EMI suppression capacitors ① with high safety performance thanks to built-in fuse function.

Following power conversion from AC into DC, Panasonic ECWFG series optimizes PFC circuit ② with its wide voltage capability and excellent ripple handing ability at high frequency and high temperature. At the output side of DC/DC converting circuit ③, both ECWFG and EZPV series

offer high voltage capacity up to 1,100VDC, together with a wide capacitance range from 1μF to 110μF to enable high performance DC smoothing. Certainly it's also possible to skip the power conversion from AC into DC, by using off-grid energy resource such as solar panels (PV-grid). Maximum power from solar radiations is inherently non-uniform in nature and varies with temperature and time in a particular day. For that reason, the DC/DC converter ③ offers an interfacing between the PV panel and the battery to achieve maximum power transfer. To optimize this function of DC/DC converter, both ECWFG and EZPV series offer high voltage capacity up to 1,100VDC, meeting requirement for high capacitance, low ESR and high ripple current.



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Voltage	275VAC, 310VAC	600VDC~1,100VDC	600VDC~1,100VDC
Product	ECQUA	ECWFG	ECWFG, EZPV



Application Note - How to solve various tasks with film capacitors for on-board chargers

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Notes: Data and descriptions in this document are subject to change without notice.

Product renderings are for illustration purposes only and may differ from the real product appearance.