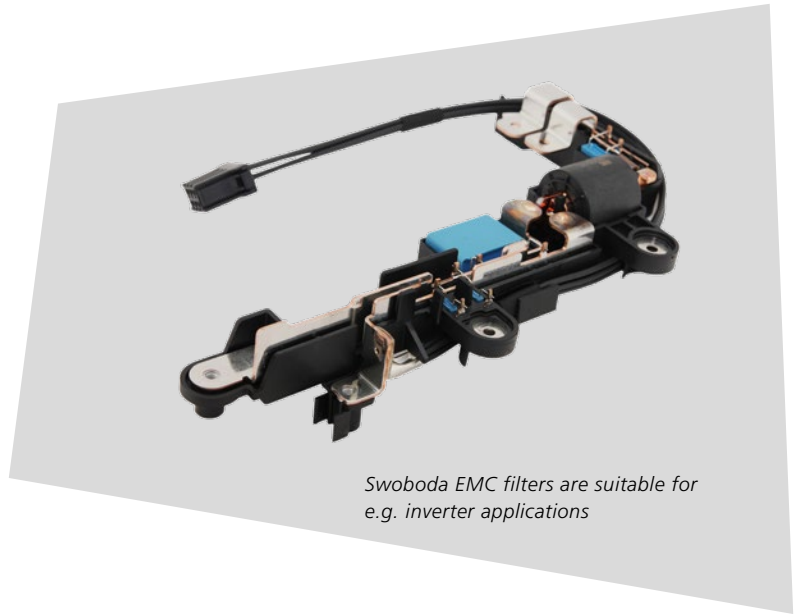


SWOBODA EMC FILTERS FOR AUTOMOTIVE APPLICATIONS



Swoboda EMC filters are suitable for e.g. inverter applications

INTRODUCTION

EMC filters are used in a wide variety of commercial, industrial and automotive applications. They help to prevent the propagation of electromagnetic energy which may cause unwanted effects such as electromagnetic interference or even physical damage.

The Swoboda EMC filters are suitable for a wide range of automotive inverter and other applications. Our development expertise guarantees tailored filtering solutions according to our customer requirements, whereas our manufacturing experience enables compact assembly of capacitive and inductive filtering components.

FEATURES & BENEFITS

- Design and dimensioning of filters components with inhouse capabilities for simulation & frequency response measurements
- Mechanical design upon customer requirements
- Temperature simulation to prevent components from overheating
- Creepage & clearance analysis to fulfil standard norms as DIN EN IEC 60664 or customer specific norms
- Functional safety (ISO 26262): QM, fit rate calculation possible
- Maximum current I_{max} : up to 700 A (DC)
- Operating voltage U_{op} : 48V to 960 V (DC)
- Typical wired noise bandwidth f_{wire} : 150 kHz to 108 MHz
- Ambient temperature range T_{amb} : - 40°C to + 85 °C
- EMC design qualification & testing according to CISPR-25
- Fully automotive qualified

ADVANTAGES

- Filtering of common & differential mode emissions
- Compact design upon customer engineering space
- Low self-heating
- Calculation & simulation of component altering effects
- Manufacturing specialist in stamping & injection molding components

APPLICATION AREAS

- Automotive main inverter
- Electric motor drives
- Externally excited synchronous motors (EESM)

Any questions about this product?

Please contact us:

Sales Department

Swoboda Schorndorf KG

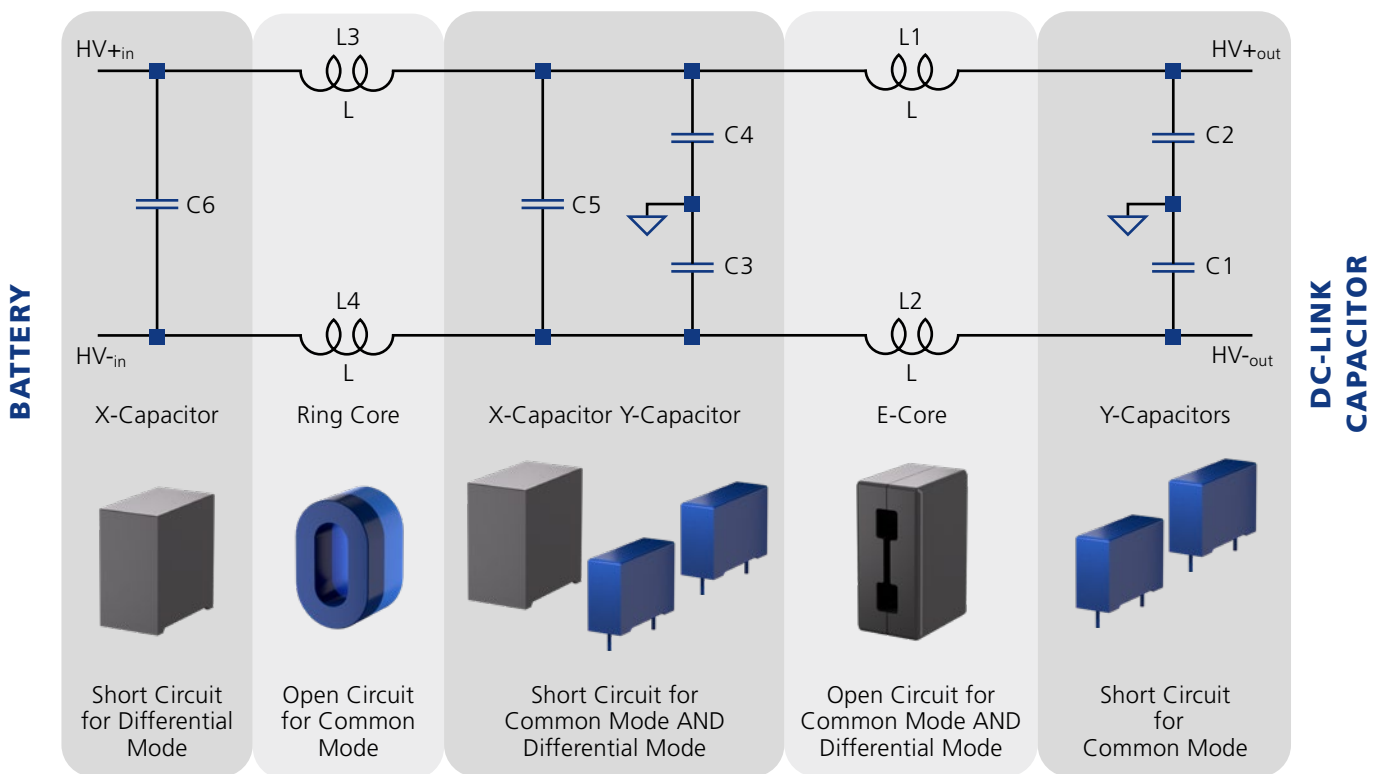
Telephone: **+49 (0) 7181 7003-0**

► sales.schorndorf@swoboda.com

PRINCIPLE OF OPERATION

Swoboda EMC filters prevent the propagation of electromagnetic energy which may cause unwanted effects such as electromagnetic interference or even physical damage. They can filter common and/or differential mode interferences over a defined wired frequency bandwidth. These interference modes have different requirements on the behaviour of the filter & the damping properties of the filter components like e.g. capacitors, e-cores or toroid cores.

TYPICAL APPLICATION EXAMPLE – INVERTER FOR E-DRIVES



Schematic of a two-stage EMC filter for inverter application

In a typical HV inverter application an EMC filter is used to reduce the PWM switching noise generated by the power modules and prevent the battery from getting damaged by those high frequency interferences.

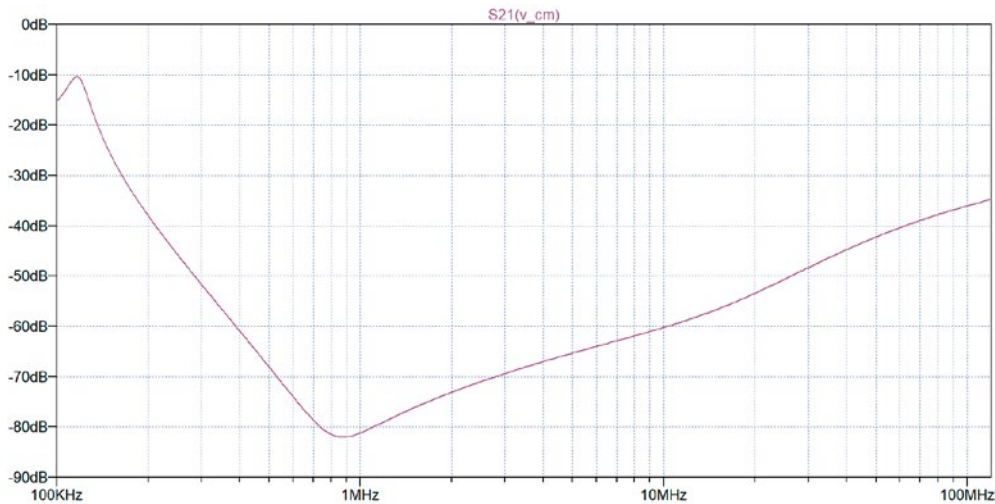
Typical operating characteristics are shown in the table below.

TYPICAL OPERATING CHARACTERISTICS

SIGNAL DESCRIPTION	UNITS	MIN.	NOM.	MAX.	REMARKS
Typical current I_{DD}	[A]	0	-	+700	can be adapted on customer needs
Operating voltage U_{op}	[V]	48	-	960	DC voltage
Ambient temperature T_{amb}	[°C]	-40	-	85	
Typical wired noise bandwidth f_{wire} [Hz]		150k	-	108M	customizable bandwidth

COMMON MODE

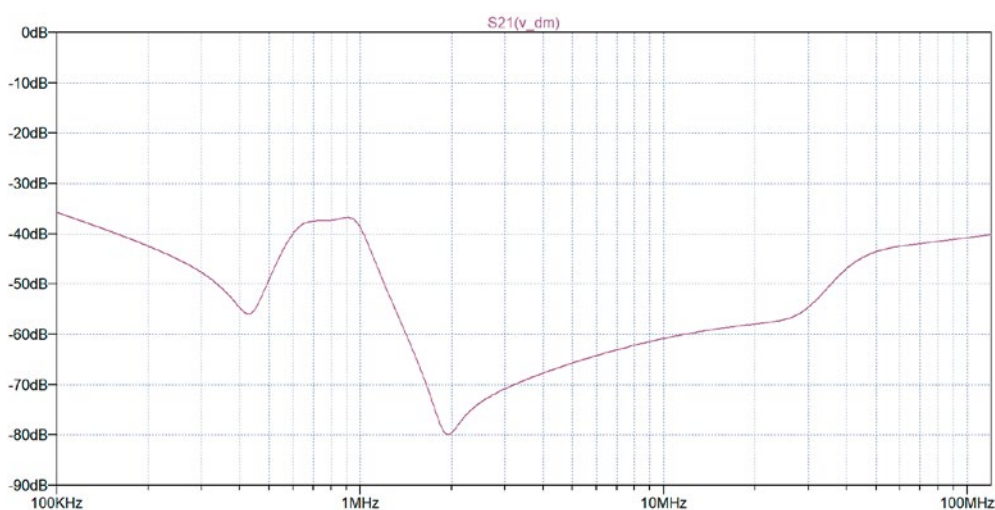
The common mode filtering is damping the interferences having the same influence on HV+ & HV- related to chassis GND. Typically, a LC combination of a toroid core (L) and y-capacitors (C) is necessary. The toroid core is mounted around both HV terminals, whereas the y-capacitors are mounted between both HV terminals and the chassis of the vehicle. In the figure below a typical common mode damping curve is shown.



Common mode filtering curve

DIFFERENTIAL MODE

The differential mode filtering is damping the interferences coming from HV+ and flowing back to HV-. In this case, a LC combination of an e-core (L) and x-capacitors is typically necessary. The e-core is mounted around both HV-terminals and the x-capacitors are mounted between HV+ and HV-. In the figure below a typical differential mode damping curve is shown.



Differential mode filtering curve

AVAILABLE PRODUCTS

Swoboda EMC filters are customer-specific products and optimized for the customer application. The scalability of Swoboda EMC filters allows to adapt all the used components upon customer requirements, e.g. maximum operating current & operating voltage, temperature behaviour, filtering profile over the complete wired noise frequency bandwidth, etc..

Swoboda reserves the right to apply changes to its products without prior notice.

Swoboda Schorndorf KG

Vogtswiesen 69
D-73614 Schorndorf

Telephone: **+49 (0) 7181 7003-0**

► sales.schorndorf@swoboda.com