

EMC filters

2-line filters
for PCB mounting

Series/Type: **B84110A**

Date: January 2015

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Power line filters for 1-phase systems
Rated voltage V_R : 250 V AC/DC
Rated current I_R : 0.5 A to 6 A

Construction

- 2-line filters
- Plastic case

Features

- High insertion loss
- For PCB mounting
- Cost-effective EMC solution
- ENEC, UL and cUL approval (0.5 A to 4 A)


Typical applications

- Low and medium switch-mode power supplies
- Data systems, gambling machines, small-size equipment, industrial electronics
- DC applications

Terminals

- Pins fitting standard grid

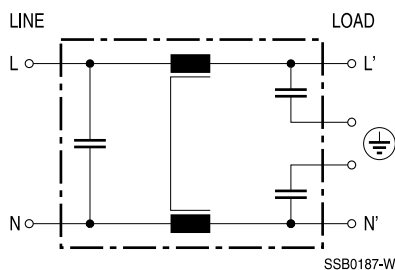
Marking

Marking on component:

Manufacturer's logo, ordering code, rated voltage, rated current, date code, approvals

Minimum data on packaging:

Manufacturer's logo, ordering code, quantity, date code

Circuit diagram


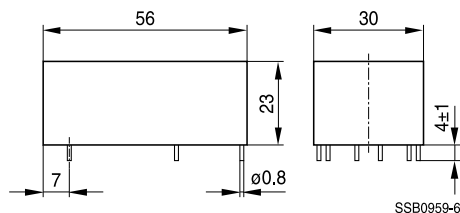
Technical data and measuring conditions

Rated voltage V_R	250 V AC (50/60 Hz) / 250 V DC
Rated current I_R	Referred to 40 °C rated temperature
Test voltage V_{test}	1414 V DC, 2 s (line/line) 2700 V DC, 2 s (lines/case)
Leakage current I_{LK}	At V_R and 50 Hz
Climatic category (IEC 60068-1)	25/100/21 (-25 °C/+100 °C/21 days damp heat test)
Weight	Approx. 53 g
Approvals	IEC 60939, UL 1283, CSA C22.2 No.8 (0.5 A to 4 A)

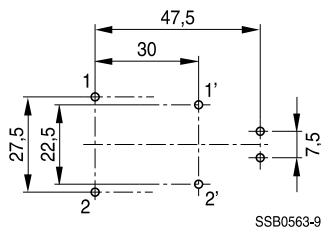
Characteristics and ordering codes

I_R	C_R X2 μ F	C_R Y2 pF	L_R mH	I_{LK} mA	Ordering code	Approvals		
A								
$V_R = 250$ V AC/DC								
0.5	0.22	2 × 4700	2 × 39	0.369	B84110A0000A005	×	×	×
1	0.22	2 × 4700	2 × 10	0.369	B84110A0000A010	×	×	×
2	0.22	2 × 4700	2 × 5.6	0.369	B84110A0000A020	×	×	×
4	0.22	2 × 4700	2 × 2.7	0.369	B84110A0000A040	×	×	×
6	0.22	2 × 4700	2 × 1.9	0.369	B84110A0000A060	×	–	–

× = Approval granted

Dimensional drawing


General tolerances according to ISO 2768–cL
Dimensions in mm

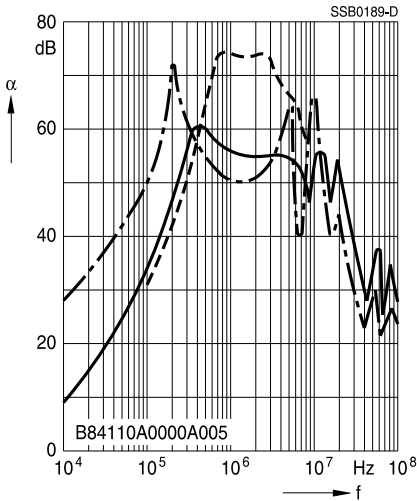
Pin layout


General tolerances according to ISO 2768–cL
Dimensions in mm

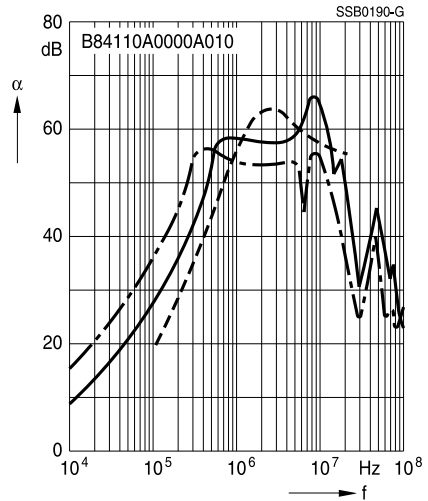
Insertion loss (typical values at $Z = 50 \Omega$)

- unsymmetrical, adjacent branches terminated
- - - - - common mode, all branches in parallel (asymmetrical)
- - - - - differential mode (symmetrical)

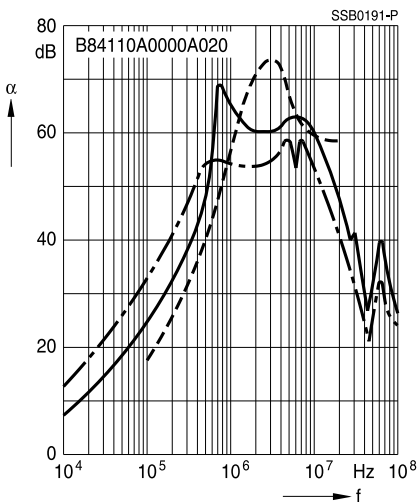
Filters for 0.5 A



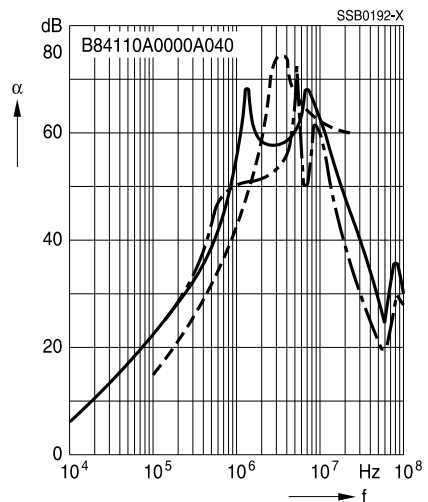
Filters for 1 A



Filters for 2 A



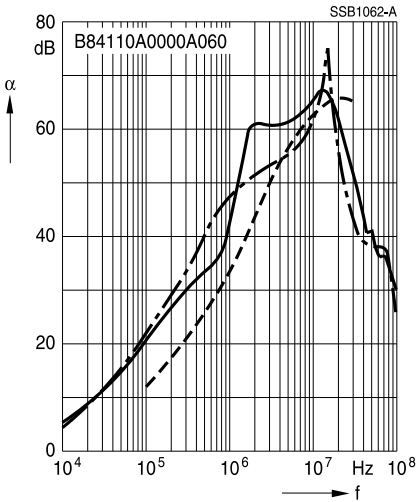
Filters for 4 A




Insertion loss (typical values at $Z = 50 \Omega$)

- unsymmetrical, adjacent branches terminated
- - - - - common mode, all branches in parallel (asymmetrical)
- - - - - differential mode (symmetrical)

Filters for 6 A



Cautions and warnings

Please read all safety and warning notes carefully before installing the EMC filter and putting it into operation (see ). The same applies to the warning signs on the filter. Please ensure that the signs are not removed nor their legibility impaired by external influences.

Death, serious bodily injury and substantial material damage to equipment may occur if the appropriate safety measures are not carried out or the warnings in the text are not observed.

Using according to the terms

The EMC filters may be used only for their intended application within the specified values in low-voltage networks in compliance with the instructions given in the data sheets and the data book. The conditions at the place of application must comply with all specifications for the filter used.

Warning

- It shall be ensured that only qualified persons (electricity specialists) are engaged on work such as planning, assembly, installation, operation, repair and maintenance. They must be provided with the corresponding documentation.
- Danger of electric shock. EMC filters contain components that store an electric charge. Dangerous voltages can continue to exist at the filter terminals for longer than five minutes even after the power has been switched off.
- The protective earth connections shall be the first to be made when the EMC filter is installed and the last to be disconnected. Depending on the magnitude of the leakage currents, the particular specifications for making the protective-earth connection must be observed.
- Impermissible overloading of the EMC filter or filter, such as with circuits able to cause resonances, impermissible voltages at higher frequencies etc. can lead to bodily injury and death as well as cause substantial material damages (e.g. destruction of the filter housing).
- EMC filters and filters must be protected in the application against impermissible exceeding of the rated currents by overcurrent protective circuitry.
- In case of leakage currents >3.5 mA you shall mount the PE conductor stationary with the required cross section before beginning of operation and save it against disconnecting. For leakage currents $I_L^{(1)} \leq 10$ mA the PE conductor must have a KU value²⁾ of 4.5 A³⁾; for leakage currents $I_L > 10$ mA the PE conductor must have a KU value of 6⁴⁾.
- Output chokes and output filters must be protected in the application against impermissible exceeding of the component temperature.
- The converter output frequency must be within the specified range to avoid resonances and uncontrolled warming of the output chokes and output filters.

1) I_L = leakage current let-go

2) The KU value (symbol KU) is a classification parameter of safety-referred failure types designed to ensure protection against hazardous body currents and excessive heating.

3) A value of KU = 4.5 with respect to interruptions is attained with: a) permanently connected protective earth circuit ≥ 1.5 mm² and b) a protective conductor connection ≥ 2.5 mm² via connectors for industrial equipment (IEC 60309–2)

4) KU = 6 with respect to interruptions is achieved for fixed-connection lines ≥ 10 mm² where the type of connection and line layout correspond to the requirements for PEN conductors as specified in relevant standards.

The table below summarizes the safety instructions that must be observed without fail. A detailed description can be found in the relevant chapters of the databook.

Topic	Instructions	Reference chapter (data book), paragraph
Selecting a filter	When selecting a filter, it is mandatory to observe the rated data of the equipment (such as its rated input current, rated voltage, harmonic content etc.) as well as the derating instructions in Chapters 9 and 10.	Selection guide for converter filters
Rated voltage	When power distribution systems deviating from the symmetric TN-S system it is to check the suitability of the EMC filters and the allowed voltages including the fault cases.	Power distribution systems, 7
Protection from residual voltages Discharge resistors	Active parts must be discharged within 5 s to a voltage of less than 60 V (or 50 μ C). If this limit cannot be observed due to the operating mode, the hazardous point must be permanently marked in a clearly visible way. Filters which are not permanently connected (e.g. when the test voltage is applied to the filter at the incoming goods inspection) must be discharged after the voltage has been switched off.	Safety regulations, 6.1 Safety regulations, 6.2
Installing and removing of EMC filters Installation	When installing and removing our EMC filters, a voltage-free state must be set up and secured with observance of the five safety rules described in EN 50110-1.	Safety regulations, 6.4
Use in IT systems	The special features of the IT system ("first fault case" and other fault cases) shall be observed.	Power distribution system (network types), 7.6
Safety notes on leakage currents	The filter leakage currents specified in the data book are intended for user information only. The maximum leakage current of the entire electrical equipment or appliance has to be limited for safety reasons. Please obtain the applicable limits for your application from the relevant regulations, provisions and standards.	Leakage current, 8.4 Leakage current, 8.6
Voltage derating Hazards caused by overloading the filters	If the permissible limits for the higher-frequency voltages at the filter are exceeded, the filter may be damaged or destroyed.	Voltage derating, 9.8
Current derating at elevated ambient temperatures	Non-observance of the current derating may lead to overheating and consequently represents a fire hazard.	Current derating, 10.1

Topic	Instructions	Reference chapter (data book), paragraph
Protective earth connection at operating currents >250 A	For operating currents greater than 250 A, we recommend the PE connection to be set up between the feed (filter: line) and output (filter: load) not via the PE terminal bolt in the filter housing.	Mounting instructions, point 2
Mounting position	Note the mounting position of the filters! It must always be ensured that natural convection is not impaired.	Mounting instructions, point 13
Long motor cables	Long motor cables cause parasitic currents in the installation. The cable lengths indicated for the output chokes and output filters serve for orientation. The user must check the technical parameters and especially the choke temperatures for the respective application.	Mounting instructions, point 15

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Symbols and terms

Symbol	English	German
α	Insertion loss	Einfügungs­dämpfung
C_R	Rated capacitance	Bemessungs­kapazität
C_X	Capacitance X capacitor	Kapazität X-Kondensator
C_Y	Capacitance Y capacitor	Kapazität Y-Kondensator
ΔV	Voltage drop (input to output)	Spannungsabfall im Filter
dv/dt	Rate of voltage rise	Spannungsan­stiegsgeschwindigkeit
f	Frequency	Frequenz
f_M	Converter output frequency	Motorfrequenz
f_P	Pulse frequency	Pulsfrequenz
f_R	Rated frequency	Bemessungs­frequenz
f_{res}	Resonant frequency	Resonanz­frequenz
I_C	Current through capacitor	Strom durch Kondensator
I_{LK}	Filter leakage current	Filter-Ableit­strom
I_{max}	Maximum current	Maximal­strom
I_N	Nominal current	Nenn­strom
I_{op}	Operating current (design current)	Betriebs­strom
I_{pk}	Rated peak withstand current	Bemessungs-Stoß­stromfestigkeit
I_q	Capacitive reactive current	Kapazitiver Blind­strom
I_R	Rated current	Bemessungs­strom
I_S	Interference current	Stör­strom
L	Inductance	Induktivität
L_R	Rated inductance	Bemessungs­induktivität
L_{stray}	Stray inductance	Streu­induktivität
P_L	Power loss	Verlust­leistung
R	Resistance	Wider­stand
R_{is}	Insulation resistance	Isolations­wider­stand
R_{typ}	DC resistance, typical value	Gleich­strom­wider­stand, Richtwert
T_A	Ambient temperature	Umgebung­temperatur
T_{max}	Upper category temperature	Obere Kategorietemperatur
T_{min}	Lower category temperature	Untere Kategorietemperatur
T_R	Rated temperature	Bemessungs­temperatur
u_k	Referred voltage drop in %	Bezogener Spannungsabfall in %
V_{eff}	RMS voltage	Effektiv­spannung
V_K	Voltage drop	Spannungsabfall
V_{LE}	Voltage line to earth; voltage line to ground	Spannung Phase zu Erdpotential
V_N	Nominal voltage	Nenn­spannung
V_R	Rated voltage	Bemessungs­spannung
V_{peak}	Peak voltage	Spitzen­spannung
V_{test}	Test voltage	Prüf­spannung
V_X	Voltage over X capacitor	Spannung über X-Kondensator
V_Y	Voltage over Y capacitor	Spannung über Y-Kondensator
X_L	Inductive reactance	Induktiver Blind­wider­stand
Z	Impedance	Schein­wider­stand
$ Z $	Impedance, absolute value	Schein­wider­stand (Betragswert)

Important notes

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1. Some parts of this publication contain **statements about the suitability of our products for certain areas of application**. These statements are based on our knowledge of typical requirements that are often placed on our products in the areas of application concerned. We nevertheless expressly point out **that such statements cannot be regarded as binding statements about the suitability of our products for a particular customer application**. As a rule, EPCOS is either unfamiliar with individual customer applications or less familiar with them than the customers themselves. For these reasons, it is always ultimately incumbent on the customer to check and decide whether an EPCOS product with the properties described in the product specification is suitable for use in a particular customer application.
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Important notes

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