Power Magnetics Roundup: EMI Filters

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This column frequently focuses on the application of magnetic components in switched-mode power supply (SMPS) circuits where inductors, transformers and coupled inductors play a critical role in power processing. However, magnetics also serve another purpose in SMPSs within the EMI filters installed on power supply inputs. By attenuating the switching noise produced by the power supply, EMI filters enable compliance with conducted EMI standards.

While some of the previous Power Magnetics Roundups have identified new choke components that may be used in the design of EMI filters, this article offers news about complete EMI filter modules introduced over the course of this year. These products are listed roughly in the reverse chronological order of when they were announced.

Products highlighted in this feature include:

- EMI Filters Offer Wide Temperature Range, Many Options (XP Power)
- Three-Phase Book Style EMC Filters Are Compact (Schaffner)
- Three-Phase Mains Filters Target Industrial Machines (Schurter)
- Compact Power Entry Module Integrates Filter (Schurter)
- DIN Rail Mounted EMI Filter Series Eases Installation (API Technologies)
- High-performance Three-Line EMC Filters Meet EN 61800−3:2004+A1:2011 (TDK)
- EMC Filters With High Frequency Stability Are Compact And Quiet (SMP Sintermetalle Prometheus)
- Filtered Power Entry Modules Meet IEC IEC62368-1 (Schaffner)
- Common-Mode Line Filters Replace Discontinued Components (Premier Magnetics)

EMI Filters Offer Wide Temperature Range, Many Options

XP Power has introduced a range of chassis mount and IEC inlet EMI filters that satisfy the requirement for equipment to conform to the latest EMC emissions and immunity standards. The filters are suitable for any electrical or electronic equipment that is powered from a single-phase ac supply.

Chiefly aimed at medical and IT equipment manufacturers, types FASA/M, FCSS, FDMM, FFSA, FGSM are IEC power entry inlets with integral line filters; and types FHSA/M and FIHA/M are chassis-mount filters. Exhibiting versatility, FFSA and FGSM units also feature input switches. The range includes many variations to cater to a wide variety of end user needs and contribute greatly to OEM customers' time saving when incorporating the units into host equipment.

XP Power's EMI filters feature a wide operating temperature range of -40°C to 110°C, with full power operation to +50°C. This operating range permits operation in warmer ambient temperatures than competitors' products, which according to XP Power, derate from +40°C.

The filters' shielded metal body prevents radiated emissions within the equipment and a medical version features an earth leakage figure of just 5 µA at 250 Vac for stringent medical applications. The range embraces current ratings from 1 A to 20 A. Dual-stage, chassis-mount versions are also available that provide greater attenuation levels than standard.

Saving on customer manufacturing costs, compact combined versions with single or dual fuse holder or fuse holder and switch reduce the amount of wiring and panel cutouts required. All models feature a bleed resistor and Faston terminals. XP Power's IEC inlet EMI filters come with a three-year warranty. The series is priced at $4.30 each in quantities of 500. For more information, see the vendor website.

Three-Phase Book Style EMC Filters Are Compact

Schaffner describes its FN 3287 and FN 3288 series EMC filters as the most compact and most modern solution on the market today. Designed for motor drives, power drive systems and many other power converter applications, these filters are optimized to serve the requirements of machine tool and machinery equipment.

According to the vendor, this next-generation product is based on the newest component technology within optimized packaging. The filters employ a new design structure resulting in a significant footprint reduction and allowing them to integrate the connection terminals within the filter cubical.

The FN 3287 and FN 3288 series are available with 11 current ratings from 10 A to 160 A. Both series are available for 480 Vac and the FN 3288 series is also offered for 690-Vac and IT network applications. These filters meet high-attenuation and low leakage current requirements.

All models are CE, UL and ENEC approved and RoHS compliant. For further information, visit the company website.

Three-Phase Mains Filters Target Industrial Machines

Schurter's FMAC NEO single-stage filter family offers compact size and high performance. The series is well suited for use in portable industrial machines designed to occupy less space in manufacturing plants. Example applications include frequency converters, stepper motor drives, UPSs and inverters. A voltage rating of 520 Vac enables world wide acceptance. Current ratings range from 16 to 230 A.

Features include terminals for three phases and ground, very high attenuation and industrial or low-leakage-current versions as well as wide operating temperature range and light weight design. For more information, see the product page or datasheet.

Compact Power Entry Module Integrates Filter

Schurter has extended its DD12 power entry module series with the addition of new flange variants for screw and snap mounting. New versions are also available with additional ground choke for suppressing high frequency interference on the ground conductor. These panel mount modules integrate four functions: an appliance inlet protection class I, a line switch 2-pole; a fuseholder for fuse-links 5 x 20 mm, 1 or 2 pole; and a line filter in standard and medical versions. They also feature a V-Lock notch standard and 6.3- x 0.8-mm quick-connect terminals.

These compact modules also feature an aluminum case that provides good shielding and are considered suitable for applications with high transient loads. They are also deemed suitable for use in equipment according to IEC/UL 60950 and for use in medical equipment according to IEC/UL 60601-1. For more details, see the datasheet.

DIN Rail Mounted EMI Filter Series Eases Installation

API Technologies' API's 62-STB series of DIN-rail-mounted EMI filters for medical to metrology grade applications reduce installation complexity. These single-phase power EMI filters eliminate both differential-mode and common-mode EMI and meet stringent EMC specifications.

In addition to their applications in low- and high-voltage power supplies, the filters are well suited for reducing unwanted interference for industrial applications and high-power office/medical equipment and instruments. Specific uses include test and measurement instruments, medical X-ray machines, medical bone mineral densitometry devices, electrical installation control panels, textile machinery, powered exercise equipment (treadmills and etc.), electrical boilers and HVAC equipment, refrigeration units and printers.

The DIN-rail-mounted EMI filters are easily integrated, installed and connected externally or internally to existing equipment, control panels and the power line. They also can be easily replaced, retrofit or serviced and mount to any DIN rail system. Several models include chassis mounting features for greater customization and utility.

The filters feature 50/60-Hz rated voltage operation to 250 Vac; max current ratings ranging from 6 A to 30 A and very low maximum leakage current, typically 0.5 mA at 250 VAC, with models available that reach a maximum of 0.1 mA. The EMI filters' low maximum voltage drop is less than 1.0 V.

API's DIN-rail-mounted noise filters demonstrate high insulated resistance of 300 MΩ at 500 Vdc between the power line and ground. Moreover, these EMI filters are built to survive industrial temperatures, with an operating temperature range from -25°C to +85°C, including a maximum temperature rise of 45℃. They can be made with enhanced high pulse and high noise attenuation features to meet a wider range of operational requirements.

API's DIN-rail-mounted EMI filters are safety agency approved, ruggedly manufactured with epoxy-molded housing, RoHS compliant, and designed to meet all applicable industrial standards. For more information, see the DIN Rail Mounted Filters page.

High-performance Three-Line EMC filters Meet EN 61800−3:2004+A1:2011

TDK has expanded its B84243 series of EPCOS 3-line EMC filters to include 10 new types for currents of up to 280 A. All 18 types in the series are designed for a rated voltage of 530 Vac. The performance of this series of filters has been optimized for adherence to limit values in accordance with EN 61800−3:2004+A1:2011 for motor cable lengths of up to either 25 m (C1) or 50 m (C2).

The metal cases of the filters are designed with IP20 protection and, depending on the type, have compact dimensions between 190 x 40 x 95 mm and 450 x 170 x 230 mm. Thanks to the highly saturation resistant chokes, parasitic asymmetric currents can be reliably controlled even in the case of longer motor cables.

A further advantage of the new B84243 series is the low leakage current that also permits operation in a 30-mA RCD environment. For smaller, hand-operated equipment the leakage current must be below 3.5 mA. For this reason, the 3-A version (B84243A8003U000) has been designed for a leakage current of 1.9 mA at 400 V ac. One important safety aspect is the short discharge time to <60 V within one second for the types rated at up to 44 A.

Typical applications for the new filters are frequency converters for the drives of elevators, pumps, conveyor systems, and HVAC systems. Further information can be found on the company's website.

EMC Filters With High-Frequency Stability Are Compact And Quiet

SMP Sintermetalle Prometheus (SMP) has introduced a series of EMC filters with high-frequency stability for power electronic applications. The materials have been developed by SMP especially for this application and are now effective for frequencies up to the gigahertz range.

EMC filters reduce interference currents in power converter systems which are generated by parasitic effects and cyclic elements of the system. The material plays an important part in this: the target is to achieve stable inductance over the entire frequency spectrum in order to maximize interference suppression. Compared with standard technologies which use materials such as ferrite, electrical steel sheets and nanocrystalline metal sheets, interference levels with the new EMC filters from SMP are as much as 40 dBµV lower, according to the vendor.

The SMP filters are also described as compact, up to 30% lighter, and noiseless because they are made from magnetostriction-free materials. The overall efficiency of the system is improved due to very low losses through the materials. Moreover, fewer filter components are needed, says the vendor, so volume is reduced and the cost effectiveness of the power electronic system as a whole is increased substantially. The filters can be manufactured with single or magnetically coupled chokes, and so offer a choice for reducing common-mode and differential-mode interference.

SMP specializes in customer-specific development and manufacture of filter systems and inductive components. The component portfolio is designed for currents of up to 2000 A, up to 3000 A for special applications, and for frequencies up to the gigahertz range. The materials have been developed and manufactured by SMP specifically for this purpose and have a high saturation induction of up to 2 Tesla.

The individual components can be produced with dimensions from 19 mm to 300 mm and weights from 0.05 kg to 130 kg. The temperature class H (up to 180 °C) insulation system is UL certified. Depending on the application, protection ratings up to IP66 are available. HL classes according to EN 45545 can be specified according to requirements.

The filter systems and inductive components are used in industrial applications in the power electronics, automation and signal processing sectors, in drive applications for railway engineering, electromobility and marine engineering among others. These components also find application in medical technology, renewable energy and power supplies, and in the aerospace industry. For more details, see the website.

Filtered Power Entry Modules Meet IEC IEC62368-1

Schaffner has had their FN 9280 and FN 9290 families of filtered, high-end IEC power entry modules (PEMs) approved to IEC62368-1t. This certification enables customers manufacturing "Audio/Video, Information and Communications Technology equipment" to comply more easily with the requirements of the new technology-independent "hazard-based" standards approach. The additional approval will be beneficial to development design times of products for these markets, increasing the benefits of using Schaffner IEC PEMs in new equipment designs.

The FN 9280/90 product line offers the rapid availability of a standard filter associated with the necessary safety acceptances and a high attenuation performance. For higher attenuation performance the FN 9290 family with its dual-stage filter and identical panel cut-out can be used.

Key features of these modules include a removable front flange which offers 4D (front, back, horizontal and vertical) assembly, snap-in mounting and various performance versions including single or dual stage and reduced leakage current levels. For further information, see the FN 9280 datasheet and the FN 9290 datasheet.

Common-Mode Line Filters Replace Discontinued Components

Premier Magnetics has announced the in-stock availability of its PMCU series of common-mode line filters designed for switching power supply applications. Offered in both standard winding (for higher efficiency) and sectional winding (for improved high-frequency performance), the PMCU line models provide a direct cross for over three dozen PLA10ANxxx and PLA10ASxxx EMIFIL series components recently discontinued by Murata Manufacturing.

The PMCU line consists of low-profile, vertical coil inductors with wide operating temperature (-40°C to 80°C) and high insulation resistance (>100 MΩ at 500 Vdc). The standard winding models feature 3750-Vrms isolation and the sectional winding models, 2000 Vrms. The devices are offered with current ratings from 0.3 A to 2.0 A with rated voltage of 250 Vac, 50/60 Hz. Substitute parts are listed below in the table.

Table. The PMCU series common-mode line filters offer direct replacements for over three dozen the PLA10ANxxx and PLA10ASxxx EMIFIL series components discontinued by Murata.

Premier Magnetics	Murata Part Number	
PMCU-6003	PLA10AN 4330R3R2B	PLA10AS 4330R3R2B
PMCU-6007	PLA10AN 3030R4R2B	PLA10AS 3030R4R2B
PMCU-6011	PLA10AN 2030R5R2B	PLA10AS 2030R5R2B
PMCU-6013	PLA10AN 1230R6R2B	PLA10AS 1230R6R2B
PMCU-6017	PLA10AN 1030R7R2B	PLA10AS 1030R7R2B
PMCU-6019	PLA10AN 7420R8R2B	PLA10AS 7420R8R2B
PMCU-6023	PLA10AN 5521R0R2B	PLA10AS 5521R0R2B
PMCU-6025	PLA10AN 3521R2R2B	PLA10AS 3521R2R2B
PMCU-6029	PLA10AN 3021R3R2B	PLA10AS 3021R3R2B
PMCU-6033	PLA10AN 2221R5R2B	PLA10AS 2221R5R2B
PMCU-6037	PLA10AN 1821R7R2B	PLA10AS 1821R7R2B
PMCU-6041	PLA10AN 1522R0R2B	PLA10AS 1522R0R2B
PMCU-7001	PLA10AN 3630R3D2B	PLA10AS 3630R3D2B
PMCU-7005	PLA10AN 2230R4D2B	PLA10AS 2230R4D2B
PMCU-7009	PLA10AN 1330R5D2B	PLA10AS 1330R5D2B
PMCU-7015	PLA10AN 7720R7D2B	PLA10AS 7720R7D2B
PMCU-7021	PLA10AN 3621R0D2B	PLA10AS 3621R0D2B
PMCU-7027	PLA10AN 2021R3D2B	PLA10AS 2021R3D2B
PMCU-7031	PLA10AN 1821R5D2B	PLA10AS 1821R5D2B
PMCU-7035	PLA10AN 1321R7D2B	PLA10AS 1321R7D2B
PMCU-7039	PLA10AN 9012R0D2B	PLA10AS 9012R0D

To request a sample kit, see the vendor website and submit the request form.

A short list of EMI filter suppliers.

- Api Technologies
- Astrodyne TDI (formerly Radius Power)
- BetaDyne
- Premier Magnetics
- Schaffner
- Schurter
- SMP Sintermetalle Prometheus
- Taiyo Yuden
- TE connectivity Corcom
- TDK
- VPT
- XP Power