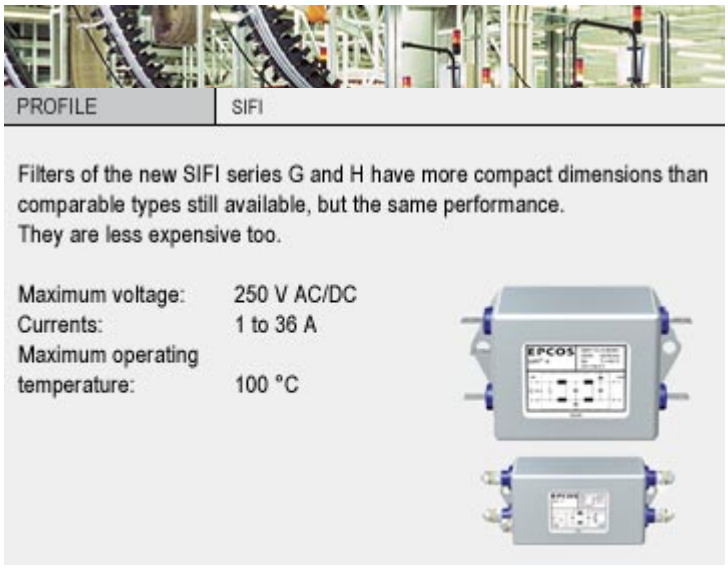
EMC filters

October 2005

Compact SIFIs pack a punch



Two-line filters suppress electromagnetic interference and ensure high system availability. At the same time, they do much to minimize electromagnetic emissions.

The SIFI-G and SIFI-H types are the latest additions to EPCOS' successful SIFI® range. They are manufactured with new components, and their internal design has been radically modified. The results speak for themselves. SIFI modules are now available for currents up to 36 A, and the new filters can also be used over a wider temperature range up to 100 °C as specified by IEC 60068-1. EPCOS has managed to make the new SIFI filters with more compact overall dimensions without compromising performance. What's more, the new SIFI G and H types cost less than the B and C types.

One world market, one solution

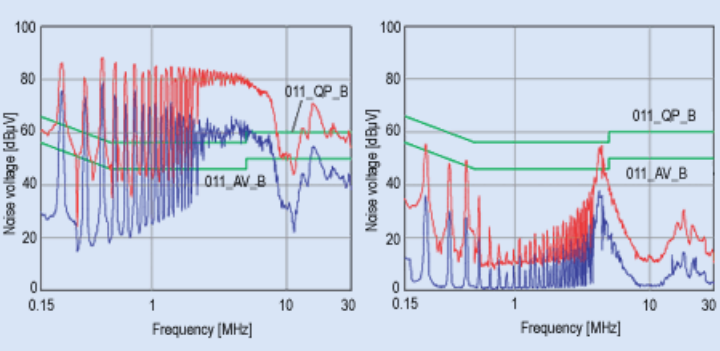
Companies that manufacture for the world market face a variety of statutory regulations on interference suppression in electrical equipment in the various countries that they serve. Yet the same laws of physics apply worldwide. To avoid EMC problems in the vicinity of other electrical equipment, equipment manufacturers are increasingly orienting product design toward the toughest EMC legislation or the harshest ambient conditions. They then comply with the EMC limits defined in this way in all their products supplied worldwide - even if the standards adopted surpass local statutory requirements by far in some countries.

As well as satisfied customers, simplified logistics results from this approach because only a single EMI suppression variant is needed for the entire world market. In addition, machinery and equipment are often relocated after a short time to another region where EMC regulations are even tougher. For this reason, there is a growing tendency to integrate as comprehensive as possible a filter solution into equipment to prevent any unpleasant surprises in the future.

Customized solutions

Typical applications of SIFI filters include switch-mode power supplies in switch cabinets, professional IT equipment such as servers, hubs and routers, industrial electronics (such as spot welding equipment), inverters in solar technology and high-end domestic appliances. A typical example is an industrial electronics customer looking for an interference suppression solution for a switch-mode power supply that failed to satisfy the requirements of EN 55011, Class B. As space was at a premium in the power supply, which has to handle up to 3 A, the company opted for an

external solution with a two-line SIFI-G filter of type B84112-G-B30. The measurement curves in → 1 show to what extent this filter from the SIFI-G series eliminates noise voltages.



All SIFI filters of series A to E plus G and H have been approved for AC and DC voltages up to 250 V. Even at currents of 36 A, the maximum leakage current in the SIFI-G types is a mere 0.5 mA, a value that also applies to the SIFI-H types designed for up to 16 A. With maximum leakage currents of only 3.5 mA at rated currents of 20, 25 or 36 A, these SIFI-H modules achieve really impressive values. The new types are equipped with 6.3 mm faston connectors for rated currents from 3 to 16 A and with M5 screw terminals for rated currents from 20 to 36 A → 2.

2 EMC Filters for general applications

Type	Nominal current [A]	Leakage current [mA]	Connections				
			Faston	Screw	IEC	Litz	Print
SIFI G	3 / 6 / 10 / 16 / 20 / 25 / 36	<0.5	•	•			
SIFI H	3 / 6 / 10 / 16 20 / 25 / 36	<0.5	•	•			
SIFI A	1 / 2 / 3 / 6 / 10 / 20	<0.5	•		•	•	
SIFI B	1 / 2 / 3 / 6 / 10 / 20	<0.5	•		•	•	•
SIFI C	3 / 6 / 10	<0.5	•		•	•	
SIFI D	1 / 2 / 3 / 6 / 10	<0.5	•		•	•	
SIFI E	3 / 6 / 10	<0.5	•		•		

series are still being manufactured. In terms of attenuation, the SIFI-G corresponds approximately to the SIFI-B, and the SIFI-H has more or less the same filter characteristic as the SIFI-C. All SIFI models have UL, CSA/cUL and ENEC approval.

Design and manufacture

For the new SIFI modules, EPCOS uses a selective soldering process in conjunction with a proprietary fixing or mounting technique instead of wave soldering. The configuration of the components also affects the attenuation characteristics. The various elements must therefore be exactly positioned, fixed and soldered in the module case. The SIFI filters are subsequently encapsulated with a polyurethane compound certified to UL 94 V-0.

EPCOS has developed special design and manufacturing techniques for the filters. This ensures that the new filters have the same RF properties and comply with the same specifications as their predecessors despite their lack of circuit board. Thanks to a permanently reproducible manufacturing process, the new filters from EPCOS feature a cost advantage with undiminished product quality, which very few suppliers can match. This successful combination makes the significantly less expensive SIFI modules with their more compact dimensions veritable blue chips in the filter market.

What's more, the new SIFI modules can now operate at temperatures up to 100 °C (previously 85 °C) in climate category 25/100/21 to IEC 60068-1. This higher temperature ceiling has been made possible because the SIFI modules no longer need a circuit board and the lead-free soldering technique uses solder suitable for higher

Applications & Cases

temperatures. Both new SIFI types were designed as RoHS-compatible from the outset.

EPCOS will keep focusing on miniaturization of SIFI filters and offer even smaller products. More compact types with a restricted voltage range, e.g. for DC voltages of 24, 48 or 150 V, as well as for currents below 3 A are also being planned. But EPCOS will also offer more rugged SIFI filters designed for currents up to 100 A.