Specials, Custom Assemblies and Planar Capabilities

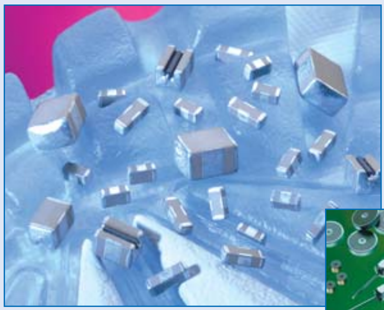
CATALOGUE FILTER RANGES

Range

The Syfer range of EMI filters is extensive, covering threaded and solder-in panel mounting versions, and an ever-expanding range of surface mount types.

Benefits

At the heart of every Syfer filter is a multilayer ceramic element, manufactured using our unique 'Wet Process'. Dielectric materials used include the ultra stable C0G and stable X7R types - Z5U/Y5V is not used. This ensures excellent insertion loss performance is provided up to full rated voltage and to the extremes of rated temperature.
Capacitance values up to 2.2µF are offered, with working voltages up to 3kVdc.



SPECIAL FILTERS / CUSTOM MULTIWAY ASSEMBLIES

Special EMI Filters

Syfer's design and manufacturing capabilities are well suited to providing special products. We are always pleased to consider modifications to standard devices, or fully custom products.
Special filters can be offered to suit specific applications - meeting a wide range of mechanical and electrical requirements.

- Lead lengths to suit
- Modified bodies
- Fully custom - either to customer drawings, or designed by Syfer

[Example - Battery terminal filter]

Multiway Filter Assemblies

Multiway assemblies can be offered using any of the filters in the Syfer range, either solder-in or screw-in. Our planar capacitor arrays can also be utilised, which allows closer pin pitching.
Specially manufactured chassis or plates can be provided, or alternatively filters can be assembled to customers free-issue plates. We would be pleased to discuss specific applications and propose designs.

- Flexible design - plates to suit the application
- Faster assembly for the customer - reduced risk of damage to the filters through soldering
- Reliability - 100% tested
- Filtering options - wide range of values
- Ground lines and unfiltered lines
- Planar arrays can be supplied with compliant spring clips for solderless assembly

- Higher test voltages than standard
- d.c. or a.c.
- alternative capacitance values or tolerances

[Example - high voltage filter]

[Examples - multiway filter assemblies]

notes

Please contact our Sales Office to discuss any interest in any of the above. We would be pleased to provide a technical and commercial proposal.

SYFER
SYFER TECHNOLOGY LIMITED
A DOVER Company

Technical Summary

EXPLANATION OF COMMON TERMS

EMC
ElectroMagnetic Compatibility. A situation wherein two pieces of electrical or electronic equipment are able to function in the same environment without adversely affecting, or being affected by, each other.

EMI
ElectroMagnetic Interference. A broad term covering a wide range of electrical disturbances, natural and man-made, from d.c. to GHz frequencies and beyond. Sources of disturbance may include radar transmitters, motors, computer clocks, lightning, electrostatic discharge and many other phenomena.

ESD
Electrostatic discharge.

Emissions
Signals, unwanted (interference) or otherwise from a piece of equipment.

Susceptibility
The extent to which a piece of equipment is vulnerable to interference emitted from another piece of equipment.

Radiated interference
Interference transmitted in free air. Protection is provided by shielding.

Conducted interference
Interference transmitted along a conductor/cable.
Protection is provided by a series component. If a feedthrough filter is used to remove conducted interference, and mounted in the wall of a shielded compartment, it provides effective filtering while maintaining the screening integrity. It should be noted that the filter will reduce both emissions and susceptibility.

Low-pass Filter
A filter that lets through d.c. and low frequency signals, while attenuating (unwanted) high frequency noise.

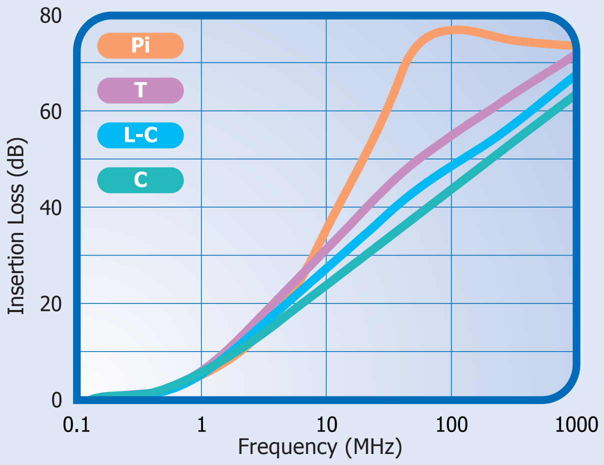
Feedthrough Filter
A panel mounted filter that will pass the signal from one side of the wall of a shielded box (or 'Faraday cage') to the other (it feeds the signal through the panel). For effective operation, the filter input and output should be screened from each other, ie there should ideally be no apertures in the panel.

Insertion loss
Is a measure of how effective a filter is at reducing unwanted interference at a specified frequency, i.e. how much it attenuates the interference at that frequency.
Expressed in decibels (dB), it is the ratio of voltages immediately beyond the point of insertion, before (E1) and after (E2) insertion of the filter under test. Insertion loss (I.L.) in a 50Ω system is defined as:

$$I.L.(dB) = 20\log\left(\frac{E1}{E2}\right)$$

A voltage ratio of 1:10 would yield an Insertion Loss figure of 20dB, 1:100 40dB and so on.

Attenuation Curve
A plot of Insertion Loss versus Frequency on a logarithmic scale. See example curves below.



Insertion Loss Characteristic
Expressed in dB per decade of frequency, this is the slope of the attenuation curve over the attenuated frequencies.

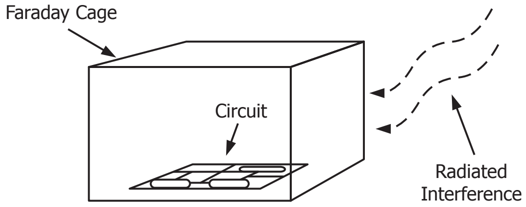
Cut-off frequency
The frequency at which the filter starts to become effective - generally taken to be the 3dB point of the attenuation curve. Anything on the line below this frequency will be unaffected. The higher the capacitance of the filter the lower the cut-off, and vice versa. It will also vary depending on source and load impedances.

THE NEED FOR FEEDTHROUGH EMI FILTERS

The use of electronic equipment is ever-increasing, with greater likelihood of interference from other pieces of equipment. Added to this, circuits with lower power levels that are more easily disturbed means that equipment is increasingly in need of protection from EMI (electromagnetic interference). To meet legislation such as the EU Directive on EMC, in addition to regulations such as American FCC and German VDE, EMI filtering is now an essential element of equipment design. Introducing screening measures, eg to the case or cables, may suffice in many instances, but some form of low-pass filtering will often be required.

'Faraday Cage'

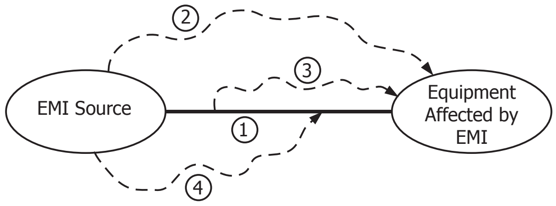
The ideal way of protecting a piece of equipment or circuit from EMI is to totally enclose it in a metal (or conductive) box. This screened enclosure is called a 'Faraday Cage'. Radiated interference is thus prevented from adversely affecting it. (Fig1)



Faraday Cage Protects against Radiated interference Fig1

Input/output Cabling

In reality however, most pieces of equipment require input and/or output connections, perhaps power cables or signal and control lines. The cables providing these connections can act as antennae, able to pick up interference and also to radiate it. (Fig2) Any cable or wire going in through the equipment case can introduce electrical noise, and also radiate it internally onto other wires and circuits. Similarly, it can provide a path to the outside from any noise generated internally, which can also then be radiated and may in turn adversely affect other equipment.

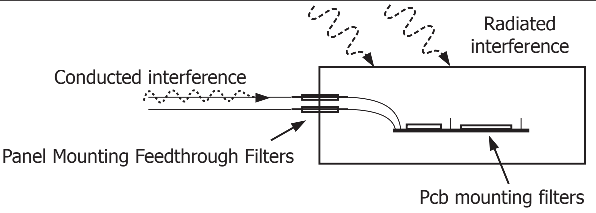


Modes of Propagation of EMI Fig2

1. Interference can enter a piece of equipment directly through the cabling (conducted interference)
2. Radiated interference can travel directly to the affected equipment
3. Interference can exit an EMI source via a cable, subsequently to be radiated from the cable and to the affected equipment
4. Interference can be radiated from an EMI source and then picked up by a cable entering the affected equipment

Feedthrough filters

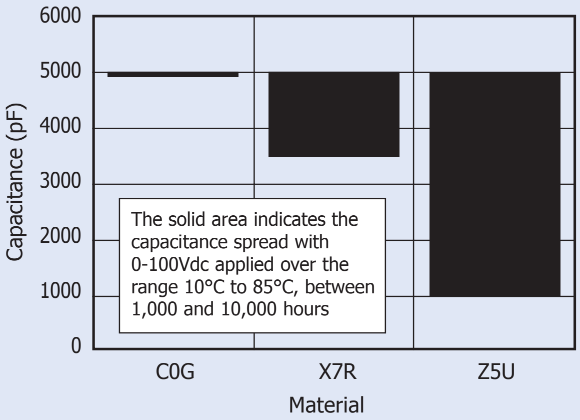
To prevent interference entering or leaving a piece of equipment, feedthrough EMI filters can be mounted in the wall of a shielded case. Any incoming or outgoing cables would then pass through the filters. Power or wanted signals pass through the filters unaffected, whilst higher frequency interference is removed. While the screened case protects against radiated interference, the feedthrough filters protect against conducted interference. The integrity of the equipment is thus assured. (Fig3)
Where there is no suitable bulkhead for mounting the filters, pcb types can be used. While this can be an effective method of filtering, it should be noted that in general the insertion loss performance can be reduced at higher frequencies, unless additional screening measures are taken. (See surface mount filter information for further details, in particular page 74).



Feedthrough Filters remove conducted interference Fig3

Spread of Capacitance Values

0-100Vdc, 10-85°C, 1,000-10,000 Hours



Example

The capacitance of a ceramic capacitor can change as a result of a change in temperature, applied voltage and age.
Consider the typical performance of 5,000pF filter capacitors, offered in standard dielectric classifications, operating at a voltage of 100Vd.c. at 85°C, at an age of 10,000 hours. The final capacitance value can fall within the range of values shown above, taking into account the ageing process and effects of temperature and voltage as shown in the charts on page 7.

It is clear that the capacitance can change as a result of an increase (or decrease) in temperature, applied voltage and as a result of ageing. If the capacitance has reduced, so too will the insertion loss performance.

Capacitance measurements

Due to the ageing process, it is necessary to state at what point on the ageing curve the capacitance shown on the datasheet is specified. All Syfer filters are specified at the 1,000 hour point, since for practical purposes there is relatively little further loss of capacitance after this time. All filters shipped will therefore be within tolerance at 1,000 hours after cooling through their Curie temperature. Other filter manufacturers may specify capacitance at 24 or 48 hours instead of 1,000 hours.