EMI Filters

- Surface mount EMI filters
- Panel mount EMI filters
- Hermetic panel mount EMI filters
- EMI Power filters
- Special filters and assemblies
- Planar arrays
- Discoidal multilayer capacitors
- Varistor filters
- X2Y - Integrated Passive devices
- Filters for High-Rel applications

SYFER CMP
A DOVER COMPANY

Introduction to Syfer Technology

Syfer Technology Limited is a UK company dedicated to the manufacture of ceramic based electronic components. Syfer has been producing Multilayer Ceramic Capacitors for over 30 years and its employees are committed to providing customers with high quality products together with a fast, friendly and flexible service from a state-of-the-art facility.

Production process

At the core of Syfer's ceramic manufacturing technology is the 'Wet Process'. This fully integrated computer-controlled manufacturing operation is in a clean room environment, and offers unique advantages in the manufacture of filter products. This has resulted in Syfer being a world leader in the manufacture of EMI filters, discoidal capacitors and planar arrays. Our multilayer ceramic manufacturing facility and filter assembly facility holds a number of internationally recognised approvals including ISO 9001:2000, IS0 14001:2004 and OHSAS 18001:1999. Syfer is also an ESA (European Space Agency) and NASA approved source. Specific product approvals/qualifications include IECQ CECC, UL, TÜV and AEC-Q200.

Products

Syfer's excellence in ceramic materials technology, combined with EMI filter expertise, has enabled us to offer an unrivalled range of EMI filters products including:

- 3 terminal EMI chips
- Surface mount Pi filters
- X2Y - Integrated Passive Components
- Panel mount threaded filters
- Panel mount solder-in filters
- Hermetically sealed panel mount EMI filters
- EMI Power filters
- Custom filter assembly capability
- Varistor filters
- Discoidal capacitors
- Planar capacitor and planar varistor arrays

Benefits

Panel mount EMI filters

- Use of X7R and C0G/NP0 ceramics - no Z5U
- High capacitance values, high voltage
- Use of self-healing plastic film material

Surface mount EMI filters

- High capacitance, high voltage, high current Pi filters
- FlexiCap™ termination an option
- AEC-Q200 qualifications

X2Y

- Available with FlexiCap™ termination
- AEC-Q200 qualifications
- Available in surface mount, panel mount and planar array versions

Planar arrays

- Mechanical superiority, tighter mechanical tolerances
- High voltage capability, mixed capacitance values
- NASA approved
- Available in capacitor, varistor, inductor and X2Y formats

Discoidal capacitors

- Small sizes, high capacitance values, high voltage capability
- Custom sizes available
- Varistor discoidal options

Multiway filter assemblies

- Can use either discoidal capacitor elements or planar arrays
- Full custom design facility

Other Syfer products

- Multilayer ceramic chip capacitors
- High voltage MLCCs
- FlexiCap™ capacitors with flexible terminations
- Class 'X' and 'Y' SMD surge and safety capacitors
- Radial leaded capacitors
- AEC-Q200 qualified capacitors
- IECQ CECC approved capacitors and radials
- Capacitors for space applications

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THE QUEEN'S AWARDS FOR ENTERPRISE: INNOVATION 2008

Contents

Syfer - *The EMI Filter Specialist*

The need for 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 other international regulations such as FCC, 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 (Fig 1).

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 (Fig 2). 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.

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.

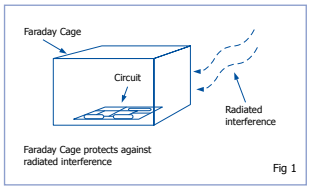
Filter location - panel mount filters

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 (Fig 3).

Filter location - surface mount filters

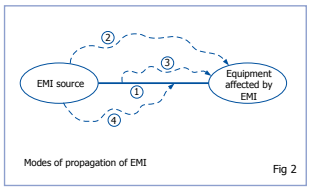
Where there is no suitable bulkhead for mounting the filters, pcb types can be used (Fig 4). While this can be an effective method of filtering, it should be noted that in general the insertion loss performance can be reduced at higher frequencies, unless additional screening measures are taken.

Good design practices such as short tracks, short connections, close proximity to input and good grounding will help improve insertion loss performance.



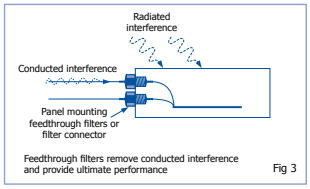
Faraday Cage protects against radiated interference

Fig 1



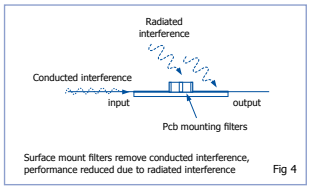
Modes of propagation of EMI

Fig 2



Feedthrough filters remove conducted interference and provide ultimate performance

Fig 3



Surface mount filters remove conducted interference, performance reduced due to radiated interference

Fig 4

Explanation of common terms

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.

Cut-off frequency/3dB point

The frequency at which filters start to become effective - is generally taken to be at 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.

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 dc to GHz frequencies and beyond. Sources of disturbance may include radar transmitters, motors, computer clocks, lightning, electrostatic discharge and many other phenomena.

Emissions

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

ESD

Electrostatic discharge, which can result in damage through excessive voltage spikes. We can offer assistance on whether our products can meet specific ESD test requirements.

Insertion loss

At a given frequency, the insertion loss of a feed though suppression capacitor or filter connected into a given transmission system is defined as the ratio of voltages appearing across the line immediately beyond the point of insertion, before and after insertion. As measured herein, insertion loss is represented as the ratio of input voltage required to obtain constant output voltage, with and without the component, in the specified 50Ω system. This ratio is expressed in decibels (dB) as follows:

$$\text{Insertion loss} = 20 \log \frac{E_1}{E_2}$$

Where:

E_1 = The output voltage of the signal generator with the component in the circuit.

E_2 = The output voltage of the signal generator with the component not in the circuit.

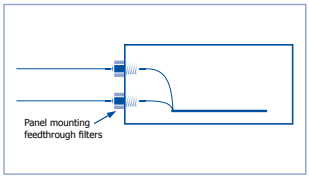
When testing is conducted with a network/spectrum analyzer, the equipment usually maintains a constant output voltage and can be set to record the output to input voltage ratio in decibels.

Low-pass filter

A filter that lets through dc and low frequency signals, while attenuating (unwanted) high frequency noise.

Panel mount 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.

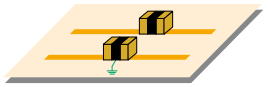


Radiated interference

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

Surface mount filter

A filter that is suitable for surface mounting on PCBs. It offers improved filtering compared to standard MLCCs, ease of assembly and savings on board space compared to a combination of descreet filter elements. Filter performance at higher frequencies is reduced compared to panel mount types, unless additional shielding measures are taken (see page 10).



Susceptibility

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

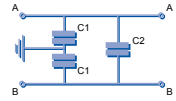
Working voltage

Continuous operating voltage. This can potentially be across the entire operating temperature range.

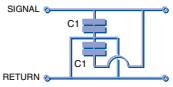
X2Y filter

Integrated passive component with extremely low self inductance for filtering and de-coupling.

For filtering applications:



For de-coupling applications:



Factors affecting insertion loss

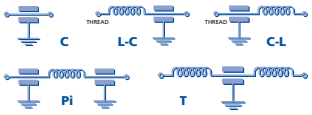
The insertion loss performance is used to aid filter selection by showing signal attenuation at any given frequency. However, it can only ever be a guide as actual performance in service will vary depending on the overall circuit characteristics.

Insertion loss is determined by:

- Electrical configuration
- Source/load impedances
- The load current (which can cause ferrite saturation)
- Ceramic dielectric materials. The capacitance change will be affected by applied voltage, temperature and the age of the part
- Earthing impedance
- Shielding integrity

Electrical configuration

A number of different electrical configurations are available in feedthrough filters, including the common types shown opposite. A single element filter (a capacitor or an inductor) theoretically provides an insertion loss characteristic of 20dB per decade, a dual element filter (capacitor/inductor) 40dB per decade whilst a triple element filter (Pi or T configuration) theoretically yields 60dB per decade. In practise, the insertion loss curves do not exactly match the predictions, and the data sheets should be consulted for the realistic figure. The choice of electrical configuration is made primarily on the source and load impedances and may also be influenced by the level of attenuation required at various frequencies.



C filter

This is a feedthrough capacitor with low self inductance. It shunts high frequency noise to ground and is suitable for use with a high impedance source and load.

L-C filter

This is a feedthrough filter with an inductive element in combination with a capacitor. It is commonly used in a circuit with a low impedance source and a high impedance load (or vice versa). The inductive element should face the low impedance.

Pi filter

This is a feedthrough filter with 2 capacitors and an inductive element between them. Ideally, it should be used where both source and load impedances are high.

T filter

This is a feedthrough filter with 2 series inductive elements separated by one feedthrough capacitor. It is suitable for use where both source and load impedances are low.

Source and load impedances

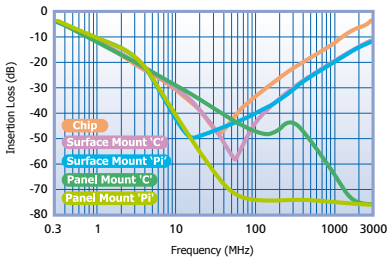
Insertion loss figures are normally published for a 50Ω source and 50Ω load circuit. In practise the impedance values will probably be very different, which could result in either an increase or decrease in insertion loss. The electrical configuration of the filter (the capacitor/inductor combination) should be chosen to optimise the filter performance for that particular source/load impedance situation. An estimate of insertion loss for source and load impedances other than 50Ω can be supplied. Please contact our Sales Office.

Load current

For filters which include ferrite inductors, the insertion loss under load current may be less than that with no load. This is because the ferrite material saturates with current. The reduction in insertion loss depends on the current and the characteristics of the particular ferrite material. In extreme cases the ferrite will become ineffective and insertion loss will appear to be the same as for a C filter. For further information contact the Sales Office.

Attenuation curve

A plot of insertion loss versus frequency on a logarithmic scale.



Choice of ceramic dielectric material

When choosing a filter, it is important to be aware of the different performance characteristics that may be available from different categories of ceramic materials employed in their capacitors. Generally, stability of dielectric constant (and therefore filter capacitance value), with respect to some operational and environmental parameters, deteriorates with increasing dielectric constant. Specific factors which affect dielectric constant are temperature, voltage, frequency and time (ageing).

The three main classifications of ceramic dielectric employed in the manufacture of EMI filters are generally referred to as ultra stable (C0G/NP0), stable (X7R) and general purpose (Z5U, Y5V or X7W).

C0G/NP0

Most parameters for materials in this dielectric classification remain unaffected by temperature, voltage, frequency or time. Stabilities are measured in terms of parts per million but dielectric constants are relatively low (10 to 100).

X7R

This is a classification for materials which are relatively stable with respect to temperature, voltage, frequency and time. Typical dielectric constants would be of the order 2,000 to 4,000, enabling the achievement of far higher capacitance values for a given size of capacitor than can be gained from C0G/NP0 materials.

If the voltage coefficient (VC) is critical, Syfer are also able to offer parts with BX (2X1) and BZ (2C1) VC characteristics. Refer to the factory for further details.

Z5U/Y5V/X7W

These are classifications for materials which are relatively unstable with respect to temperature, voltage, frequency and time. Whilst typical dielectric constants may be of the order 5,000 to 25,000, operating temperature ranges are severely restricted.

A summary of the specifications of these materials follows. Please note that Syfer uses only the higher performance C0G/NP0 and X7R in its standard ranges.

Summary of ceramic dielectric characteristics

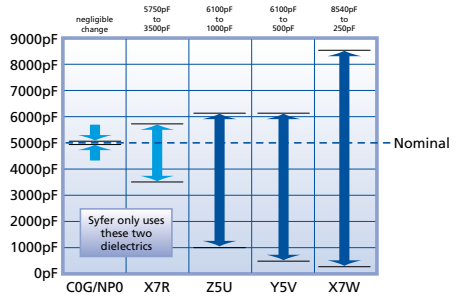
	C0G/NP0	X7R	Z5U	Y5V	X7W
EIA dielectric classification	Ultra stable	Stable	General purpose		
Rated temperature range	-55ºC to +125ºC	-55ºC to +125ºC	-10ºC to +85ºC	-30ºC to +85ºC	-55ºC to +125ºC
Maximum capacitance change over temperature range (no voltage applied)	0 ±30 ppm/°C	±15%	+22-56%	+22-56%	+40-90%
Ageing characteristics	Zero	1% per time decade	6% per time decade	6% per time decade	6% per time decade

Spread of capacitance values

The capacitance of a ceramic capacitor can change as a result of a change in temperature, applied voltage and age. Please note that this potential change can lead to a significant drop in filtering performance.

Example

Consider the typical performance of 5,000pF filter capacitors, offered in standard dielectric classifications, operating at a voltage of 100Vdc at 85ºC, at an age of 10,000 hours. The final capacitance value can fall within the range of values (see chart to the right), taking into account the ageing process and effects of temperature and voltage as shown in the chart above.



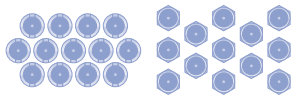
It is clear that the capacitance can change as a result of an increase (or decrease) in temperature, applied voltage and as a result of ageing. If the capacitance has reduced, so too will the insertion loss performance.

Thread size or head size? What's the crucial factor in spacing

The thread size has no relevance to the mounting pitch, but can influence cost. Very small threads are harder to work with, but offer little or no gain over larger thread sizes.

If close mounting pitch is important, change instead to a round body style. Mounted using modified screwdriver blades, this style of component removes the need to allow space for mounting sockets and allow components to be mounted almost touching each other.

Syfer offer a full range of round head filter types - SFNO, SFKB, SFKK, SFLM, SFMD and SFUM. Special requirements can also be considered.



Schematic showing the pitch improvement that can be gained with round head filters compared to traditional hexagon heads

Hermetic seals vs resin seals

Resin sealed filters have epoxy encapsulants injected into the cavities either side of the filter elements. The purpose of the resin is to 'ruggedise' the assembly, supporting the pins and sealing the ceramic to prevent reliability issues from such as moisture ingress. Poor encapsulants can be susceptible to cracking away from the metalwork due to temperature change. This can then allow moisture ingress which can result in reliability concerns. They can also exert a force on the ceramic which can result in cracking causing electrical failure. MIL or Space specifications generally do not demand resin sealed filters be tested for immersion or accelerated damp heat testing.

Syfer resin sealed filters use a very high purity, highly filled, epoxy encapsulant with a very low co-efficient of thermal expansion – very closely matched to the expansion co-efficient of the ceramic and other materials used in the construction. These characteristics enable Syfer filters to be thermally cycled with very little stress being applied to the ceramic elements, and with reduced risk of cracking allowing moisture ingress. Certain Syfer filters have successfully passed immersion and accelerated damp heat testing.

Screw mount 'hermetic' filters generally have glass to metal seals soldered into place instead of conventional resin seals. They are better than resin sealed filters in applications where outgassing is critical, or where the environment is particularly harsh. MIL or Space specifications generally do require hermetically sealed filters be tested for immersion or accelerated damp heat testing. Unless fitted with sealing rings, they will not normally provide a gas seal between either side of the mounting bulkhead – the seal is to protect the internal capacitor elements. Care must be taken when using the filters, as the exposed solder joints can reflow, compromising the seal effectiveness, if too high a temperature is applied to the end terminals.

Solder mount hermetic filters may create a gas seal between either side of the bulkhead, but this is more dependant on the sealing capabilities of the solder joint mounting the filter rather than the filter seal. Usually, solder mount filters only have a glass seal on one side of the filter body, with the other end resin sealed. Test plans are normally the same as those for resin sealed filters. Hermetically sealed solder mount filters are only normally required in applications where one end of the filter will be exposed to hash environments, or where outgassing is critical on one side of the panel.

Discoidal capacitor vs tubular capacitor

The original panel mount filters used single layer tubular capacitors. There is one major advantage of this type of capacitor - it lends itself to very easy Pi filter construction. For this reason, Pi filters have tended to be considered the optimum filter configuration.

As performance demands increased, higher capacitance values were required. High K, unstable (Z5U / Y5V see page 7) dielectrics and multilayer tubes began to be used. These use buried layer electrodes within the tube walls, but the reduced dielectric thickness resulted in lower voltage withstand capability. The unstable dielectrics result in poor performance over the voltage and temperature ranges.

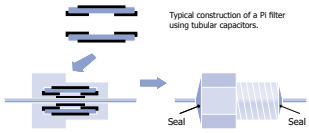
Tubular capacitors have one major flaw - the thin ceramic walls make them very prone to cracking causing electrical failures.

As MLCC chip capabilities developed, the discoidal capacitor appeared in filters. These devices use MLCC chip technology to produce a very low inductance (low ESL / low ESR) capacitor giving improved performance and higher capacitance and voltage ranges (higher capacitance per unit voltage). They are physically much stronger and robust than tubes.

Most Syfer panel mount filters use discoidal capacitors for optimum mechanical strength and high quality X7R or C0G/NP0 dielectric materials for optimum electrical performance. However, there are other dielectric materials used in the manufacture of filters.

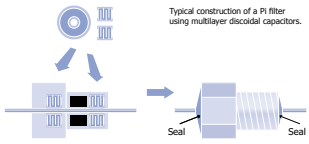
	Advantages	Disadvantages
Tube based filters	Cheap. Suited to Pi filter manufacture.	Low capacitance only, not robust – easily cracked multilayer tubes = higher capacitance but low voltage.
Disc based filters	Robust. High capacitance. C, L-C, & T circuits easy. Very high capacitance Pi filters possible. Tight tolerance possible. Vc characteristics possible.	Low capacitance Pi filters, relatively expensive.

Tubular capacitor



Typical construction of a Pi filter using tubular capacitors.

Multilayer discoidal capacitor

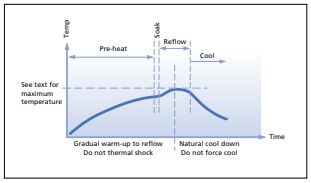


Typical construction of a Pi filter using multilayer discoidal capacitors.

Surface mount and panel mount solder-in filters

Solder pad layouts are included with the detailed information for each part.

Recommended soldering profile



Soldering of filters

The soldering process should be controlled such that the filter does not experience any thermal shocks which may induce thermal cracks in the ceramic dielectric.

The pre-heat temperature rise of the filter should be kept to around 2°C per second. In practice successful temperature rises tend to be in the region of 1.5°C to 4°C per second dependent upon substrate and components.

The introduction of a soak after pre-heat can be useful as it allows temperature uniformity to be established across the substrate thus preventing substrate warping. The magnitude or direction of any warping may change on cooling imposing damaging stresses upon the filter.

E01, E03, E07 SBSP ranges are compatible with all standard solder types including lead-free, maximum temperature 260°C. For SBSG, SBSM and SFSS ranges, solder time should be minimised, and the temperature controlled to a maximum of 220°C. For SFSR, SFST and SFSU ranges the maximum temperature is 250°C.

Cooling to ambient temperature should be allowed to occur naturally. Natural cooling allows a gradual relaxation of thermal mismatch stresses in the solder joints. Draughts should be avoided. Forced air cooling can induce thermal breakage, and cleaning with cold fluids immediately after a soldering process may result in cracked filters.

Note: The use of FlexiCap™ terminations is strongly recommended to reduce the risk of mechanical cracking.

Soldering to axial wire leads

Soldering temperature

The tip temperature of the iron should not exceed 300°C.

Dwell time

Dwell time should be 3-5 seconds maximum to minimise the risk of cracking the capacitor due to thermal shock.

Heat sink

Where possible, a heat sink should be used between the solder joint and the body, especially if longer dwell times are required.

Bending or cropping of wire leads

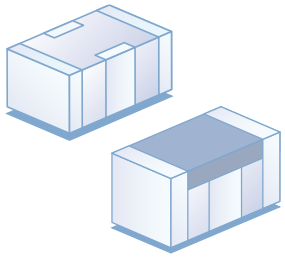
Bending or cropping of the filter terminations should not be carried out within 4mm (0.157") of the epoxy encapsulation, the wire should be supported when cropping.

A more comprehensive application note covering installation of all Syfer products is available on the Syfer website.

Termination types available surface mount filters

Termination	E01	E03	E07	SBSP	SBSG	SBSM
F: Silver Palladium					❍	❍
J: Silver base with nickel barrier (100% matte tin plating)	●	●	●		❍	❍
A: Silver base with nickel barrier (tin/lead plating with min 10% lead)	●	●	●		❍	❍
Y: FlexiCap™ with nickel barrier (100% matte tin plating)	●	●	●	●	❍	❍
H: FlexiCap™ with nickel barrier (tin/lead plating with min 10% lead)	●	●	●		❍	❍

❍ See page 14 for termination type.



Resin filled screw mounted EMI filters

General
The ceramic capacitor, which is the heart of the filter, can be damaged by thermal and mechanical shock, as well as by over-voltage. Care should be taken to minimise the risk of stress when mounting the filter to a panel and when soldering wire to the filter terminations.

Mounting to chassis
Mounting torque
It is important to mount the filter to the bulkhead or panel using the recommended mounting torque, otherwise damage may be caused to the capacitor due to distortion of the case. When a threaded hole is to be utilised, the maximum mounting torque should be 50% of the specified figure which relates to unthreaded holes. For details of torque figures for each filter range, please see below.

	Torque (max.)	
Thread	With nut	Into tapped hole
M2.5 & 4-40 UNC	-	0.15Nm (1.32lbf in)
M3	0.25Nm (2.21lbf in)	0.15Nm (1.32lbf in)
6-32 UNC	0.3Nm (2.65lbf in)	0.15Nm (1.32lbf in)
M3.5	0.35Nm (3.09lbf in)	0.18Nm (1.59lbf in)
M4 & 8-32 UNC	0.5Nm (4.42lbf in)	0.25Nm (2.21lbf in)
M5, 12-32 UNEF & 2BA	0.6Nm (5.31lbf in)	0.3Nm (2.65lbf in)
M6 & 1/4-28 UNF	0.9Nm (7.97lbf in)	-

Tools
Hexagonal devices should be assembled using a suitable socket. Round bodied filters may be fitted to the panel in one of two ways (and should not be fitted using pliers or other similar tools which may damage them):

- Round bodies with slotted tops are designed to be screwed in using a simple purpose-designed tool.
- Round bodies without slotted tops are intended to be inserted into slotted holes and retained with a nut.

Grounding
To ensure the proper operation of the filters, the filter body should be adequately grounded to the panel to allow an effective path for the interference. The use of locking adhesives is not recommended, but if used should be applied after the filter has been fitted.

Minimum plate thickness
Users should be aware that the majority of these filters have an undercut between the thread and the mounting flange of the body, equal to 1.5 x the pitch of the thread. Mounting into a panel thinner than this undercut length may result in problems with thread mating and filter position. It is recommended that a panel thicker than this undercut length be used wherever possible.

Maximum plate thickness
This is specified for each filter in order that the nut can be fully engaged even when using a washer.

Soldering to axial wire leads
Soldering temperature
The tip temperature of the iron should not exceed 300°C.

Dwell time
Dwell time should be 3-5 seconds maximum to minimise the risk of cracking the capacitor due to thermal shock.

Heat sink
Where possible, a heat sink should be used between the solder joint and the body, especially if longer dwell times are required.

Bending or cropping of wire leads
Bending or cropping of the filter terminations should not be carried out within 4mm (0.157") of the epoxy encapsulation, the wire should be supported when cropping.

RoHS compliance
All surface mount filters, resin sealed panel mount filters and power filters are fully RoHS compliant through material exemption, although care must be taken not to exceed the maximum soldering temperatures of surface mount parts.

Standard hermetic sealed panel mount filters use SnPb solders as part of their assembly, and are intended for exempt applications such as aerospace or military. Substitution of the SnPb solder with Pb free solders is possible to create a RoHS compliant part – please contact factory for further details.

Hermetic panel mount EMI filters

General
The ceramic capacitor, which is the heart of the filter, can be damaged by thermal and mechanical shock, as well as by over-voltage. Care should be taken to minimise the risk of stress when mounting the filter to a panel and when soldering wire to the filter terminations.

Mounting to chassis
Mounting torque
It is important to mount the filter to the bulkhead or panel using the recommended mounting torque, otherwise damage may be caused to the capacitor due to distortion of the case.

Case style	Thread	Max Torque
SLA	M5 x 0.5 - 6g	0.6Nm (5.31 lbf in)
SLR	¼ - 28 UNF - 2A	0.9Nm (7.97 lbf in)
SLS	¼ - 28 UNF - 2A	0.9Nm (7.97 lbf in)
SLT	¼ - 24 UNF - 2A	0.9Nm (7.97 lbf in)
SLO	¼ - 28 UNF - 2A	0.9Nm (7.97 lbf in)
SLP	¼ - 28 UNF - 2A	0.9Nm (7.97 lbf in)

Tools
All these devices should be mounted into appropriate shaped mounting holes. Use of the correct mounting hole will lock the filter body from turning. Pliers or similar tools must not be used as these will cause damage to the body and risk damage to the hermetic seal or ceramic discoidal.

All filters are supplied with appropriate nuts and washers. The nuts should be tightened using a suitable socket set to, or below, the maximum tightening torque as above.

Thread design and mounting hole details
All the hermetic filters incorporate thread run-outs which may need to be allowed for in panel design.

Grounding
To ensure the proper operation of the filters, the filter body should be adequately grounded to the panel to allow an effective path for the interference. The use of locking adhesives is not recommended, but if used should be applied after the filter has been fitted.

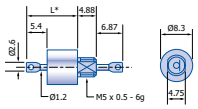
Soldering to axial wire leads
Soldering temperature
The tip temperature of the iron should not exceed 300°C.

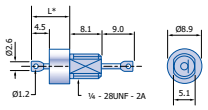
Dwell time
Dwell time should be 3-5 seconds maximum to minimise the risk of cracking the capacitor or seal due to thermal shock.

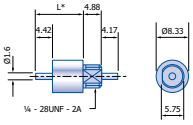
Heat sink
Where possible, a heat sink should be used between the solder joint and the body, especially if longer dwell times are required.

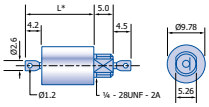
Bending or cropping of wire leads
Bending or cropping of the filter terminations should not be carried out as this is likely to result in damage to the glass seal.

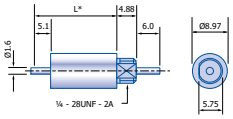
Case styles

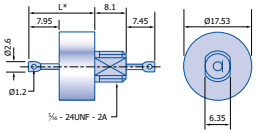
SLA


SLR


SLO


SLS


SLP


SLT


Dimensions - mm. * For L dimensions, see individual product range tables.
¼ - 28UNF - 2A thread variants are also available with a M6 x 0.8 - 6g thread option.
Please refer to factory for details on how to specify this.

C

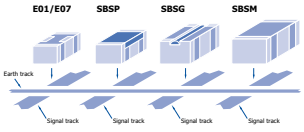
Type		E01			E07			SBSGC	SBSMC
Chip Size		0805	1206	1806	0805	1206	1806	1812	2220
Max Current		300mA	300mA	300mA	1A	2A	2A	10A	20A
Rated Voltage	Dielectric	Minimum and maximum capacitance values							
50Vdc	C0G/NP0	680pF-820pF	-	-	-	-	-	-	-
	X7R	22nF-47nF	22nF-100nF	100nF-200nF	22nF-47nF	33nF-100nF	82nF-200nF	220nF	470nF
100Vdc	C0G/NP0	22pF-560pF	22pF-1nF	22pF-2.2nF	-	-	-	-	-
	X7R	1nF-15nF	1.5nF-15nF	2.2nF-68nF	1nF-15nF	10nF-22nF	22nF-68nF	100nF-150nF	220nF-330nF
200Vdc	C0G/NP0	-	-	-	-	-	-	-	-
	X7R	-	-	-	-	-	-	68nF	100nF-150nF
500Vdc	C0G/NP0	-	-	-	-	-	-	-	-
	X7R	-	-	-	-	-	-	1nF-47nF	1nF-68nF

Notes: 1) For dimensions and pad sizes see page 14.
2) For ordering information see page 15.
3) Ranges in red available as qualified AEC-Q200.

Effects of mounting method on insertion loss

C and Pi filters are mounted to PCBs and soldered in identical manner to chip capacitors. Solder connections made to each end (signal lines) and each side band (earth track).

Whilst SBSG, SBSM and SBSP filters can be mounted conventionally on PCBs, they are also suitable for mounting in a wall or partition on a board. This greatly improves the screening between filter input and output, thereby enhancing the high frequency response.



The following insertion loss curves (for SBSP, SBSG, SBSM Pi filters), based on actual measurements, show the effect. It can be seen that the filters conventionally mounted (Fig. 1) exhibit a drop in attenuation at higher frequencies. Improved shielding methods (Fig. 2), maintain excellent suppression characteristics to 1GHz and above. See below for application example.

Figure 1. Filters mounted on open pcb

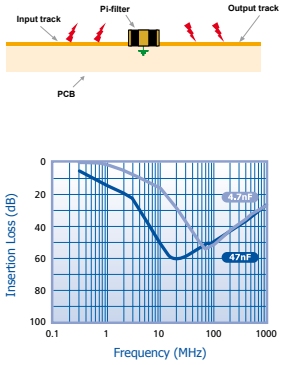
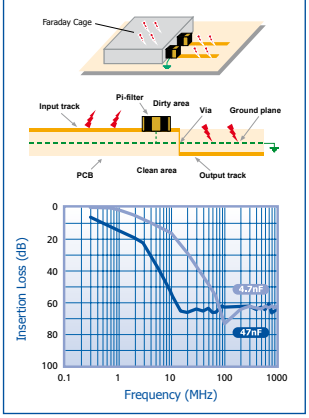


Figure 2. Improved shielding



Pi

Type		SBSPP	SBSGP	SBSMP
Chip Size		1206	1812	2220
Max Current		1A	5A	10A
Rated Voltage	Dielectric	Minimum and maximum capacitance values		
25Vdc	C0G/NP0	-	-	-
	X7R	100nF-150nF	-	-
50Vdc	C0G/NP0	-	-	-
	X7R	22nF-68nF	220nF	470nF
100Vdc	C0G/NP0	22pF-470pF	-	-
	X7R	1nF-15nF	100nF-150nF	220nF-330nF
200Vdc	C0G/NP0	-	-	-
	X7R	-	68nF	100nF-150nF
500Vdc	C0G/NP0	-	-	-
	X7R	-	1nF-47nF	1nF-68nF

Notes: 1) For dimensions and pad sizes see page 14.
2) For ordering information see page 15.

Insertion loss tables for surface mount EMI filters - C filter

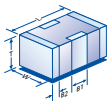
	Open Board Performance						Feedthrough or Shielded Performance				
Capacitance	0.1MHz	1MHz	10MHz	100MHz	1GHz	Resonance Freq (MHz) approx.	0.1MHz	1MHz	10MHz	100MHz	1GHz
22pF	0	0	0	0	28	1100	0	0	0	0	10
33pF	0	0	0	1	24	790	0	0	0	0	12
47pF	0	0	0	2	20	640	0	0	0	1	15
68pF	0	0	0	4	17	500	0	0	0	2	18
100pF	0	0	0	5	15	405	0	0	0	4	22
150pF	0	0	0	8	14	330	0	0	0	7	25
220pF	0	0	1	12	13	260	0	0	0	10	29
330pF	0	0	1	13	13	200	0	0	0	13	33
470pF	0	0	2	19	12	160	0	0	1	16	35
560pF	0	0	3	21	12	150	0	0	1	17	37
680pF	0	0	4	24	12	130	0	0	2	19	39
820pF	0	0	5	25	12	120	0	0	3	21	40
1nF	0	0	6	28	12	100	0	0	4	23	41
1.5nF	0	0	8	35	12	80	0	0	7	26	45
2.2nF	0	0	12	47	12	60	0	0	10	30	50
3.3nF	0	1	15	43	12	50	0	0	13	33	52
4.7nF	0	2	18	39	12	40	0	1	16	36	55
6.8nF	0	4	21	37	12	32	0	2	19	39	57
10nF	0	5	25	35	12	25	0	4	22	41	60+
15nF	0	8	28	34	12	20	0	7	25	44	60+
22nF	0	12	31	34	12	15	0	10	29	46	60+
33nF	1	15	35	33	12	12	0	13	33	48	60+
47nF	2	18	39	32	12	10	1	16	35	50	60+
68nF	3	21	43	32	12	8.5	2	19	39	54	60+
100nF	6	24	49	32	12	7	4	22	41	57	60+
150nF	8	27	55	32	12	5.5	7	25	45	60+	60+
220nF	11	31	65	32	12	4.2	10	29	49	60+	60+
330nF	14	34	60	32	12	3.5	13	33	52	60+	60+
470nF	17	37	60	32	12	2.8	16	35	55	60+	60+

Insertion loss tables for surface mount EMI filters - Pi filter

	Open Board Performance						Feedthrough or Shielded Performance				
Capacitance	0.1MHz	1MHz	10MHz	100MHz	1GHz	Resonance Freq (MHz) approx.	0.1MHz	1MHz	10MHz	100MHz	1GHz
22pF	0	0	0	2	22	1100	0	0	0	1	12
47pF	0	0	0	3	15	640	0	0	0	3	21
100pF	0	0	0	7	14	405	0	0	0	7	32
220pF	0	0	1	14	12	260	0	0	1	13	45
470pF	0	0	3	23	12	160	0	0	2	22	58
1nF	0	0	6	31	12	100	0	0	5	33	60+
1.5nF	0	0	8	32	12	80	0	0	9	40	60+
2.2nF	0	0	12	32	12	60	0	0	11	47	60+
3.3nF	0	1	15	32	12	50	0	0	14	54	60+
4.7nF	0	2	19	32	12	40	0	1	19	57	60+
6.8nF	0	4	24	32	12	32	0	2	24	60+	60+
10nF	0	5	29	32	12	25	0	5	29	60+	60+
15nF	0	8	35	32	12	20	0	7	36	60+	60+
22nF	0	11	41	32	12	15	0	11	42	60+	60+
33nF	1	13	46	32	12	12	0	14	51	60+	60+
47nF	2	15	49	32	12	10	1	16	57	60+	60+
68nF	3	18	51	32	12	8.5	3	19	60+	60+	60+
100nF	6	19	52	32	12	7.5	5	21	60+	60+	60+
150nF	8	20	52	32	12	5.5	8	23	60+	60+	60+
220nF	11	25	52	32	12	4.2	11	27	60+	60+	60+
330nF	14	34	52	32	12	3.5	14	35	60+	60+	60+
470nF	17	41	52	32	12	2.8	17	41	60+	60+	60+

Notes: 1) All dimensions mm (inches).
2) Pad widths less than chip width gives improved mechanical performance.
3) Insulating the earth track underneath the filters is acceptable and can help avoid displacement of filter during soldering.

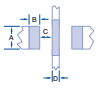
E01
300mA



Refer to page 15 for termination options.

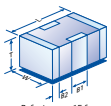
	0805	1206	1806
L	2.0 ± 0.3 (0.079 ± 0.012)	3.2 ± 0.3 (0.126 ± 0.012)	4.5 ± 0.35 (0.177 ± 0.014)
W	1.25 ± 0.2 (0.049 ± 0.008)	1.6 ± 0.2 (0.063 ± 0.008)	1.6 ± 0.2 (0.063 ± 0.008)
T	1.0 ± 0.15 (0.039 ± 0.006)	1.1 ± 0.2 (0.043 ± 0.008)	1.1 ± 0.2 (0.043 ± 0.008)
B1	0.60 ± 0.2 (0.024 ± 0.008)	0.95 ± 0.3 (0.037 ± 0.012)	1.4 ± 0.3 (0.055 ± 0.012)
B2	0.3 ± 0.15 (0.012 ± 0.006)	0.5 ± 0.25 (0.02 ± 0.01)	0.5 ± 0.25 (0.02 ± 0.01)

Recommended solder lands



	0805	1206	1806
A	0.95 (0.037)	1.2 (0.047)	1.2 (0.047)
B	0.9 (0.035)	0.9 (0.035)	1.4 (0.055)
C	0.3 (0.012)	0.6 (0.024)	0.8 (0.03)
D	0.4 (0.016)	0.8 (0.03)	1.4 (0.055)

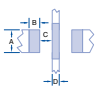
E07
1Amp / 2Amp



Refer to page 15 for termination options.

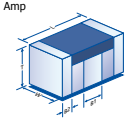
	0805	1206	1806
L	2.0 ± 0.3 (0.079 ± 0.012)	3.2 ± 0.3 (0.126 ± 0.012)	4.5 ± 0.35 (0.177 ± 0.014)
W	1.25 ± 0.2 (0.049 ± 0.008)	1.6 ± 0.2 (0.063 ± 0.008)	1.6 ± 0.2 (0.063 ± 0.008)
T	1.0 ± 0.15 (0.039 ± 0.006)	1.1 ± 0.2 (0.043 ± 0.008)	1.1 ± 0.2 (0.043 ± 0.008)
B1	0.60 ± 0.2 (0.024 ± 0.008)	0.95 ± 0.3 (0.037 ± 0.012)	1.4 ± 0.3 (0.055 ± 0.012)
B2	0.3 ± 0.15 (0.012 ± 0.006)	0.5 ± 0.25 (0.02 ± 0.01)	0.5 ± 0.25 (0.02 ± 0.01)

Recommended solder lands



	0805	1206	1806
A	0.95 (0.037)	1.2 (0.047)	1.2 (0.047)
B	0.9 (0.035)	0.9 (0.035)	1.4 (0.055)
C	0.3 (0.012)	0.6 (0.024)	0.8 (0.03)
D	0.4 (0.016)	0.8 (0.03)	1.4 (0.055)

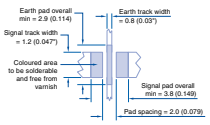
SBSP
1 Amp



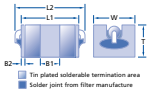
Y = FlexiCap™

	1206
L	3.2 ± 0.3 (0.126 ± 0.012)
W	1.6 ± 0.3 (0.063 ± 0.012)
T	1.6 ± 0.2 (0.063 ± 0.008)
B1	0.95 ± 0.3 (0.037 ± 0.012)
B2	0.5 ± 0.25 (0.02 ± 0.01)

Recommended pad/track details

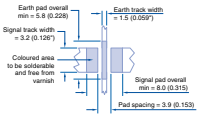


SBSG
5Amp / 10Amp

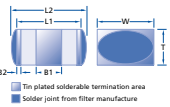


	C	Pi
L1	4.55 ± 0.25 (0.179 ± 0.010)	4.55 ± 0.25 (0.179 ± 0.010)
L2	4.70 ± 0.4 (0.185 ± 0.015)	5.25 ± 0.4 (0.207 ± 0.015)
W	3.20 ± 0.2 (0.126 ± 0.008)	3.20 ± 0.2 (0.126 ± 0.008)
T	2.50 ± 0.15 (0.098 ± 0.006)	2.50 ± 0.15 (0.098 ± 0.006)
B1	1.50 ± 0.4 (0.059 ± 0.015)	1.50 ± 0.4 (0.059 ± 0.015)
B2	0.30 ± 0.25 (0.012 ± 0.010)	0.30 ± 0.25 (0.012 ± 0.010)

Recommended pad/track details



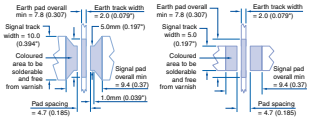
SBSM
10Amp / 20Amp



	2220
L1	5.7 ± 0.4 (0.224 ± 0.015)
L2	6.6 ± 0.4 (0.260 ± 0.015)
W	5.0 ± 0.4 (0.197 ± 0.015)
T	3.18 ± 0.2 (0.125 ± 0.008)
B1	2.25 ± 0.4 (0.088 ± 0.015)
B2	0.30 ± 0.25 (0.012 ± 0.010)

Recommended pad/track details

C Filter *Pi filter*



Note: Earth track can be split into 2 separate pads by adding resist to centre if required. This can help with preventing the part floating on solder underneath the filter.

Ordering Information

1206	Y	100	0222	M	X	T	E01
Chip Size	Termination	Voltage	Capacitance in picofarads (pF)	Tolerance	Dielectric	Packaging	Type
0805 1206 1806	J = Nickel Barrier (Tin) Y = FlexiCap™ (Tin) A = (Tin/Lead) H = FlexiCap™ (Tin/Lead)	050 = 50Vdc 100 = 100Vdc	First digit is 0. Second and third digits are significant figures of capacitance code. The fourth digit is number of zeros following Example: 0222=2200pF.	M = ±20%	A = C0G/NP0 AEC-Q200 C = C0G/NP0 E = X7R AEC-Q200 X = X7R	T = 178mm (7") reel R = 330mm (13") reel B = Bulk	

Reeled quantities	178mm (7") reel	0805	1206	1806	330mm (13") reel	0805	1206	1806
		3000	2500	2500		12000	10000	10000

For available range details see page 12.

Ordering Information

1206	Y	100	0103	M	X	T	E07
Chip Size	Termination	Voltage	Capacitance in picofarads (pF)	Tolerance	Dielectric	Packaging	Type
0805 1206 1806	J = Nickel Barrier (Tin) Y = FlexiCap™ (Tin) A = (Tin/Lead) H = FlexiCap™ (Tin/Lead)	050 = 50Vdc 100 = 100Vdc	First digit is 0. Second and third digits are significant figures of capacitance code. The fourth digit is number of zeros following Example: 0103=10nF.	M = ±20%	X = X7R	T = 178mm (7") reel R = 330mm (13") reel B = Bulk	

Reeled quantities	178mm (7") reel	0805	1206	1806	330mm (13") reel	0805	1206	1806
		3000	2500	2500		12000	10000	10000

For available range details see page 12.

Ordering Information

SBS	P	P	100	0153	M	X	T
Type	Size	Configuration	Voltage	Capacitance in picofarads (pF)	Tolerance	Dielectric	Packaging
Surface mount board filter	P = 1206	P = Pi Section	025 = 25Vdc 050 = 50Vdc 100 = 100Vdc	First digit is 0. Second and third digits are significant figures of capacitance code. The fourth digit is number of zeros following Example: 0153=15nF.	M = ±20%	C=C0G/NP0 X=X7R	T=178mm (7") reel R=330mm (13") reel B = Bulk

Reeled quantities	178mm (7") reel	1206	330mm (13") reel	1206
		1500		6000

For available range details see page 13.

Ordering Information

SBS	G	P	500	0473	M	X	T
Type	Size	Configuration	Voltage	Capacitance in picofarads (pF)	Tolerance	Dielectric	Packaging
Surface mount board filter	G = 1812	C = C Section P = Pi Section	050 = 50Vdc 100 = 100Vdc 200 = 200Vdc 500 = 500Vdc	First digit is 0. Second and third digits are significant figures of capacitance code. The fourth digit is number of zeros following Example: 0473=47nF.	M = ±20%	X=X7R	T=178mm (7") reel R=330mm (13") reel B = Bulk

Reeled quantities	178mm (7") reel	1812	330mm (13") reel	1812
		500		2000

For available range details see pages 12 & 13.

Ordering Information

SBS	M	P	050	0474	M	X	T
Type	Size	Configuration	Voltage	Capacitance in picofarads (pF)	Tolerance	Dielectric	Packaging
Surface mount board filter	M = 2220	C = C Section P = Pi Section	050 = 50Vdc 100 = 100Vdc 200 = 200Vdc 500 = 500Vdc	First digit is 0. Second and third digits are significant figures of capacitance code. The fourth digit is number of zeros following Example: 0474=470nF.	M = ±20%	X=X7R	T=178mm (7") reel R=330mm (13") reel B = Bulk

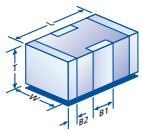
Reeled quantities	178mm (7") reel	2220	330mm (13") reel	2220
		500		2000

For available range details see pages 12 & 13.

X2Y

Type		E03					
Chip size		0603	0805	1206	1410	1812	2220
Rated voltage	Dielectric	Minimum and maximum capacitance values					
16Vdc	C0G/NP0	150pF	-	-	-	-	-
	X7R	15nF	-	-	-	-	-
25Vdc	C0G/NP0	120pF	560pF - 820pF	1.8nF - 3.3nF	6.8nF - 8.2nF	12nF - 15nF	22nF - 33nF
	X7R	12nF	56nF - 68nF	-	470nF	820nF	1.2µF
50Vdc	C0G/NP0	10pF - 100pF	390pF - 470pF	1.2nF - 1.5nF	4.7nF - 5.6nF	8.2nF - 10nF	18nF
	X7R	150pF - 10nF	18nF - 47nF	56nF - 220nF	180nF - 400nF	390nF - 680nF	560nF - 1.0µF
100Vdc	C0G/NP0	-	10pF - 330pF	22pF - 1.0nF	100pF - 3.9nF	820pF - 6.8nF	1.0nF - 15nF
	X7R	-	470pF - 15nF	1.5nF - 47nF	4.7nF - 150nF	8.2nF - 330nF	10nF - 470nF
200Vdc	C0G/NP0	-	-	22pF - 1.0nF	100pF - 3.3nF	820pF - 5.6nF	1.0nF - 15nF
	X7R	-	-	820pF - 33nF	1.2nF - 120nF	2.7nF - 180nF	4.7nF - 470nF
500Vdc	C0G/NP0	-	-	-	-	820pF - 3.9nF	1.0nF - 10nF
	X7R	-	-	-	-	2.7nF - 100nF	4.7nF - 180nF

Note: For some lower capacitance parts, higher voltage rated parts may be supplied.
For ordering information see page 17.



	0603	0805	1206	1410	1812	2220
L	1.6±0.2 (0.063±0.008)	2.0±0.3 (0.08±0.012)	3.2±0.3 (0.126±0.012)	3.6±0.3 (0.14±0.012)	4.5±0.35 (0.18±0.014)	5.7±0.4 (0.22±0.016)
W	0.8±0.2 (0.03±0.008)	1.25±0.2 (0.05±0.008)	1.60±0.2 (0.063±0.008)	2.5±0.3 (0.1±0.012)	3.2±0.3 (0.126±0.012)	5.0±0.4 (0.2±0.016)
T	0.5±0.15 (0.02±0.006)	1.0±0.15 (0.04±0.006)	1.1±0.2 (0.043±0.008)	2 max. (0.08 max.)	2 max. (0.08 max.)	2.5 max. (0.1 max.)
B1	0.4±0.15 (0.016±0.006)	0.5±0.25 (0.02±0.01)	0.95±0.3 (0.037±0.012)	1.20±0.3 (0.047±0.012)	1.4±0.35 (0.06±0.014)	2.25±0.4 (0.09±0.016)
B2	0.25±0.15 (0.010±0.006)	0.3±0.15 (0.012±0.006)	0.5±0.25 (0.02±0.01)	0.5±0.25 (0.02±0.01)	0.75±0.25 (0.03±0.01)	0.75±0.25 (0.03±0.01)

Note 1: All dimensions mm (inches).
Note 2: Pad widths less than chip width gives improved mechanical performance.
Note 3: Insulating the earth track underneath the filters is acceptable and can help avoid displacement of filter during soldering.

The Syfer X2Y Integrated Passive Component is a 3 terminal EMI chip device.

When used in balanced line applications, the revolutionary design provides simultaneous line-to-line and line-to-ground filtering, using a single ceramic chip. In this way, differential and common mode filtering are provided in one device.

For unbalanced applications, it provides ultra low ESL (equivalent series inductance). Capable of replacing 2 or more conventional devices, it is ideal for balanced and unbalanced lines, twisted pairs and dc motors, in automotive, audio, sensor and other applications.

Available in sizes from 0603 to 2220, these filters can prove invaluable in meeting stringent EMC demands.

Manufactured in the UK by Syfer Technology Limited under licence from X2Y attenuators LLC.

Advantages

- Replaces 2 or 3 capacitors with one device
- Ultra low inductance due to cancellation effect
- For balanced lines: Matched capacitance line to ground on both lines
- Differential and common mode attenuation
- Effects of temperature and voltage variation eliminated
- Effect of ageing equal on both lines
- High current capability

Applications

- Single ended/unbalanced lines
- Balanced lines and twisted pairs
- EMI Suppression on dc motors
- Sensor/transducer applications
- Wireless communications
- Audio amplifiers
- CANBUS systems

Dielectric
X7R or C0G/NP0

Electrical configuration
Multiple capacitance

Capacitance measurement
At 1000hr point

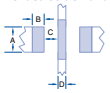
Typical capacitance matching
Better than 5%

Temperature rating
-55°C to 125°C

Dielectric withstand voltage
2.5 x Rated Volts for 5 secs. Charging current limited to 50mA Max.

Insulation resistance
100Gohms or 1000s (whichever is the less)

Recommended solder lands



	0603	0805	1206	1410	1812	2220
A	0.6 (0.024)	0.95 (0.037)	1.2 (0.047)	2.05 (0.08)	2.65 (0.104)	4.15 (0.163)
B	0.6 (0.024)	0.9 (0.035)	0.9 (0.035)	1.0 (0.04)	1.4 (0.055)	1.4 (0.055)
C	0.4 (0.016)	0.3 (0.012)	0.6 (0.024)	0.7 (0.028)	0.8 (0.03)	1.2 (0.047)
D	0.2 (0.008)	0.4 (0.016)	0.8 (0.03)	0.9 (0.035)	1.4 (0.055)	1.8 (0.071)

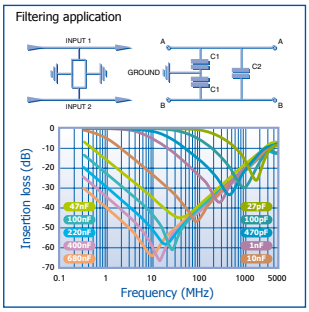
Note: Earth track can be split into 2 separate pads by adding resist to centre if required. This can help with preventing the part floating on solder underneath the filter.

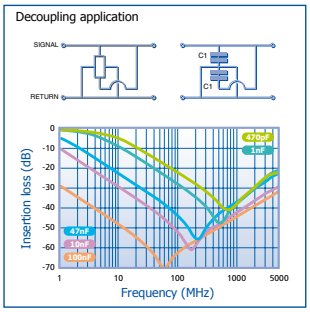
Surface mount EMI filters - X2Y Integrated Passive Components

AEC-Q200 range - (E03)

Chip size		0805	1206	1410	1812
Rated voltage	Dielectric	Capacitance values			
50Vdc	C0G/NP0	390pF - 470pF	1.2nF - 1.5nF	4.7nF - 5.6nF	8.2nF - 10nF
	X7R	18nF - 33nF	56nF - 150nF	180nF - 330nF	390nF- 560nF
100Vdc	C0G/NP0	10pF - 330pF	22pF - 1.0nF	100pF - 3.9nF	820pF - 6.8nF
	X7R	470pF - 15nF	1.5nF - 47nF	4.7nF - 150nF	8.2nF - 330nF

Component	Advantages	Disadvantages	Applications
Chip capacitor	Industry standard	Requires 1 per line High inductance Capacitance matching problems	By-pass Low frequency
3 terminal feedthrough	Feedthrough Lower inductance	Current limited	Feedthrough Unbalanced lines High frequency
Syfer X2Y Integrated Passive Component	Very low inductance Replaces 2 (or 3) components Negates the effects of temperature, voltage and ageing Provides both common mode and differential mode attenuation Can be used on balanced & unbalanced lines	Care must be taken to optimise circuit design	By-pass Balanced lines High frequency dc electric motors Unbalanced lines Audio amplifiers CANBUS





Ordering information

1812	Y	100	0334	M	X	T	E03
Chip Size	**Termination**	**Voltage**	**Capacitance in picofarads (pF) C_1**	**Tolerance**	**Dielectric**	**Packaging**	**Type**
0603 0805 1206 1410 1812 2220	J = Nickel barrier Y = FlexiCap™ A = (Tin/lead) H = FlexiCap™ (Tin/lead)	016 = 16Vdc 025 = 25Vdc 050 = 50Vdc 100 = 100Vdc 200 = 200Vdc 500 = 500Vdc	First digit is 0. Second and third digits are significant figures of capacitance code. The fourth digit is number of zeros following Example: 0334=330nF. Note: $C_1 = 2C_2$	M = ±20%	A = C0G/NP0 AEC-Q200 C = C0G/NP0 E = X7R AEC-Q200 X = X7R	T = 178mm (7") reel R = 330mm (13") reel B = Bulk	Syfer X2Y Integrated Passive Component

Reeled quantities

178mm (7") reel	0603	0805	1206	1410	1812	2220
	4000	3000	2500	2000	1000	1000

330mm (13") reel	0603	0805	1206	1410	1812	2220
	16000	12000	10000	8000	4000	4000

For available range details see page 16.

filtsmx2y.ver8

Solder-in panel mount EMI filters

Case styles	Rated voltage dc	Min. - Max. capacitance		Circuit configuration	Max current
		C0G/NP0	X7R		
SFSSC 2.3mm Ø discoidal Lead Ø 0.7mm	50	-	47nF	C	10A
	100	-	22nF		
	200	-	10nF		
	500	10pF - 220pF	470pF - 4.7nF		
SFSSC 2.8mm Ø discoidal Lead Ø 0.7mm	50	-	100nF	C	10A
	100	-	68nF		
	200	-	47nF		
	300	-	33nF		
	500	10pF - 680pF	1nF - 22nF		
SFSSC 3.0mm Ø discoidal Lead Ø 0.7mm	50	-	150nF	C	10A
	100	-	100nF		
	200	-	47nF - 68nF		
	500	10pF - 680pF	1nF - 33nF		
SFSSC 5.0mm Ø discoidal Lead Ø 0.7mm	50	-	680nF	C	10A
	100	-	330nF - 470nF		
	200	-	220nF		
	500	-	47nF - 150nF		
SFSSC 8.75mm Ø discoidal Lead Ø 1.0mm	50	-	3.3µF	C	15A
	100	-	1.5µF - 2.2µF		
	200	-	1µF		
	300	-	680nF		
	500	-	100nF - 470nF		
	1000	-	15nF - 68nF		
	2000	330pF - 1nF	1.5nF - 10nF		
	3000	100pF - 220pF	-		
SFSRC 2.8mm body Ø Lead Ø 0.7mm	50	-	47nF	C	10A
	100	-	22nF		
	200	-	10nF		
	500	10pF - 220pF	470pF - 4.7nF		
SFSTC 3.25mm body Ø Lead Ø 0.7mm	50	-	100nF	C	10A
	100	-	68nF		
	200	-	47nF		
	300	-	33nF		
	500	10pF - 680pF	1nF - 22nF		
SFSUC 5.6mm body Ø Lead Ø 0.7mm	50	-	680nF	C	10A
	100	-	330nF - 470nF		
	200	-	220nF		
	500	10pF - 680pF	1nF - 150nF		

Notes:
1) For insertion loss information see p21
2) For ordering information see p22
3) For assembly and soldering information see p9

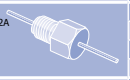
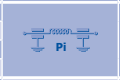
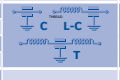
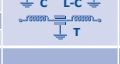
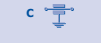
filtsmx2y.ver7

Resin filled screw mounted EMI filters

Case styles	Rated voltage dc	Min. - Max. capacitance		Circuit configuration	Max current
		C0G/NP0	X7R		
SFNOC M2.5 x 0.45 - 6g Head Ø 3.5mm Lead Ø 0.7mm	50	-	47nF	C	10A
	100	10pF - 220pF	470pF - 22nF		
SFAA 4-40 UNC Class 2A Head 4.0mm A/F Lead Ø 0.7mm	50	-	150nF	C	10A
	100	-	100nF		
	200	-	47nF - 68nF		
	500	10pF - 680pF	1nF - 33nF		
SFAJ M3 x 0.5 - 6g Head 4.0mm A/F Lead Ø 0.7mm	50	-	150nF	C L-C	10A
	100	-	100nF		
	200	-	47nF - 68nF		
	500	10pF - 680pF	1nF - 33nF		
SFAB 6-32 UNC Class 2A Head 4.0mm A/F Lead Ø 0.7mm	50	-	150nF	C L-C	10A
	100	-	100nF		
	200	-	47nF - 68nF		
	500	10pF - 680pF	1nF - 33nF		
SFKB 6-32 UNC Class 2A Head Ø 4.4mm Lead Ø 0.7mm	50	-	150nF	C L-C	10A
	100	-	100nF		
	200	-	47nF - 68nF		
	500	10pF - 680pF	1nF - 33nF		
SFAK M3.5 x 0.6 - 6g Head 4.0mm A/F Lead Ø 0.7mm	50	-	150nF	C L-C T	10A
	100	-	100nF		
	200	-	47nF - 68nF		
	500	10pF - 680pF	1nF - 33nF		
SFKK M3.5 x 0.6 - 6g Head Ø 4.4mm Lead Ø 0.7mm	50	-	150nF	C L-C T	10A
	100	-	100nF		
	200	-	47nF - 68nF		
	500	10pF - 680pF	1nF - 33nF		
SFBC 8-32 UNC Class 2A Head 4.75mm A/F Lead Ø 0.7mm	50	-	150nF	C L-C	10A
	100	-	100nF		
	200	-	47nF - 68nF		
	500	10pF - 680pF	1nF - 33nF		
SFBC 8-32 UNC Class 2A Head 4.75mm A/F Lead Ø 0.7mm	50	-	94nF	Pi	10A
	100	-	44nF		
	200	-	20nF		
	500	20pF - 440pF	940pF - 9.4nF		
SFBL M4 x 0.7 - 6g Head 4.75mm A/F Lead Ø 0.7mm	50	-	150nF	C L-C	10A
	100	-	100nF		
	200	-	47nF - 68nF		
	500	10pF - 680pF	1nF - 33nF		
SFBL M4 x 0.7 - 6g Head 4.75mm A/F Lead Ø 0.7mm	50	-	94nF	Pi	10A
	100	-	44nF		
	200	-	20nF		
	500	20pF - 440pF	940pF - 9.4nF		
SFBD 12-32 UNEF Class 2A Head 4.75mm A/F Flange Ø 6.35mm Lead Ø 0.7mm	50	-	150nF	C L-C T	10A
	100	-	100nF		
	200	-	47nF - 68nF		
	500	10pF - 680pF	1nF - 33nF		
SFBD 12-32 UNEF Class 2A Head 4.75mm A/F Flange Ø 6.35mm Lead Ø 0.7mm	50	-	300nF	Pi	10A
	100	-	200nF		
	200	-	94nF - 136nF		
	500	20pF - 1.36nF	2nF - 66nF		
SFCD 12-32 UNEF Class 2A Head 6.35mm A/F Lead Ø 0.7mm	50	-	680nF	C L-C	10A
	100	-	330nF - 470nF		
	200	-	220nF		
	500	10pF - 680pF	1nF - 150nF		

Notes:
1) For insertion loss information see p21
2) For ordering information see p22
3) For assembly and soldering information see p9

Resin filled screw mounted EMI filters

Case styles	Rated voltage dc	Min. - Max. capacitance C0G/NP0	Min. - Max. capacitance X7R	Circuit configuration	Max current
SFCD 12-32 UNEF Class 2A Head 6.35mm A/F Lead Ø 0.7mm 	50	-	300nF	 Pi	10A
	100	-	200nF		
	200	-	94nF - 136nF		
	500	20pF - 1.36nF	2nF - 66nF		
SFCI 2BA Head 6.35mm A/F Lead Ø 0.7mm 	50	-	680nF	 C L-C	10A
	100	-	330nF - 470nF		
	200	-	220nF		
	500	10pF - 680pF	1nF - 150nF		
SFBM M5 x 0.8 - 6g Head 4.75mm A/F Flange Ø 6.35mm Lead Ø 0.7mm 	50	-	150nF	 C L-C T	10A
	100	-	100nF		
	200	-	47nF - 68nF		
	500	10pF - 680pF	1nF - 33nF		
SFBM M5 x 0.8 - 6g Head 4.75mm A/F Flange Ø 6.35mm Lead Ø 0.7mm 	50	-	300nF	 Pi	10A
	100	-	200nF		
	200	-	94nF - 136nF		
	500	20pF - 1.36nF	2nF - 66nF		
SFCM M5 x 0.8 - 6g Head 6.35mm A/F Lead Ø 0.7mm 	50	-	680nF	 C L-C	10A
	100	-	330nF - 470nF		
	200	-	220nF		
	500	10pF - 680pF	1nF - 150nF		
SFLM M5 x 0.8 - 6g Head Ø 6.0mm Lead Ø 0.7mm 	50	-	150nF	 C L-C T	10A
	100	-	100nF		
	200	-	47nF - 68nF		
	500	10pF - 680pF	1nF - 33nF		
SFLM M5 x 0.8 - 6g Head Ø 6.0mm Lead Ø 0.7mm 	50	-	300nF	 Pi	10A
	100	-	200nF		
	200	-	94nF - 136nF		
	500	20pF - 1.36nF	2nF - 66nF		
SFTM low profile M5 x 0.8 - 6g Head 6.35mm A/F Lead Ø 0.7mm 	50	-	150nF	 C	10A
	100	-	100nF		
	200	-	47nF - 68nF		
	500	10pF - 680pF	1nF - 33nF		
SFUM low profile M5 x 0.8 - 6g Head Ø 6.0mm Lead Ø 0.7mm 	50	-	150nF	 C	10A
	100	-	100nF		
	200	-	47nF - 68nF		
	500	10pF - 680pF	1nF - 33nF		
SFJE ¼-28 UNF Class 2A Head Ø 9.8mm  Lead Ø 1.0mm	50	-	3.3µF	 C L-C	15A
	100	-	2.2µF		
	200	-	1µF		
	300	-	680nF		
	500	-	100nF - 470nF		
	1000	-	15nF - 68nF		
	2000	330pF - 1nF	1.5nF - 10nF		
	3000	100pF - 220pF	-		
SFJN M6 x 0.75 - 6g Head Ø 9.8mm  Lead Ø 1.0mm	50	-	3.3µF	 C L-C	15A
	100	-	2.2µF		
	200	-	1µF		
	300	-	680nF		
	500	-	100nF - 470nF		
	1000	-	15nF - 68nF		
	2000	330pF - 1nF	1.5nF - 10nF		
	3000	100pF - 220pF	-		

Notes:
1) For insertion loss information see p21
2) For ordering information see p22
3) For assembly and soldering information see p9

Resin filled panel mount EMI filters

Typical insertion loss (dB) for panel mount EMI filters. No load. 50Ω system

C - section filters

SFAAC	SFABC	SFAJC	SFAKC	SFBCC	SFBDC	SFBLC	SFBMC
SFCDC	SFCIC	SFCMC	SFJEB	SFJEC	SFJNC	SFKBC	SFKKC
SFLMC	SFNOC	SFSRC	SFSSC	SFSTC	SFSUC	SFTMC	SFUMC

Capacitance	0.01MHz	0.1MHz	1MHz	10MHz	100MHz	1GHz
10pF						4
15pF						7
22pF						10
33pF						12
47pF					1	15
68pF					2	18
100pF					4	22
150pF					7	25
220pF					10	29
330pF					13	33
470pF				1	16	35
680pF				2	19	39
1nF				4	23	41
1.5nF				7	26	45
2.2nF				10	30	50
3.3nF				13	33	52
4.7nF			1	16	36	55
6.8nF			2	19	39	57
10nF			4	22	41	60
15nF			7	25	44	62
22nF			10	29	46	65
33nF			13	33	48	68
47nF		1	16	35	50	70
68nF		2	19	39	54	70
100nF		4	22	41	57	70
150nF		7	25	45	60	70
220nF		10	29	49	62	70
330nF		13	33	52	66	70
470nF	1	16	35	55	68	70
680nF	2	19	38	58	70	70
1µF	4	22	41	61	70	70
1.5µF	7	25	45	64	70	70
2.2µF	10	29	48	66	70	70
3.3µF	14	34	52	70	70	70

L-C - section filters

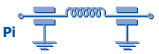
SFABL	SFAJL	SFAKL	SFBCL	SFBDL	SFBLL	SFBML	SFCDL
SFCIL	SFCML	SFJEL	SFJNL	SFKBL	SFKKL	SFLML	

Capacitance	0.01MHz	0.1MHz	1MHz	10MHz	100MHz	1GHz
10pF						6
15pF						9
22pF						12
33pF					1	15
47pF					2	19
68pF					4	20
100pF					7	24
150pF					10	27
220pF					12	30
330pF				1	16	34
470pF				2	19	38
680pF				3	22	41
1nF				6	25	44
1.5nF				9	29	48
2.2nF				12	31	51
3.3nF				15	35	54
4.7nF			1	18	39	57
6.8nF			2	21	41	60
10nF			4	23	43	63
15nF			7	27	46	66
22nF			10	30	48	68
33nF			13	34	50	70
47nF		1	17	37	51	70
68nF		2	20	40	55	70
100nF		4	22	44	60	70
150nF		7	25	47	62	70
220nF		10	29	49	66	70
330nF		13	33	53	68	70
470nF	1	16	35	56	70	70
680nF	2	19	38	58	70	70
1µF	4	22	41	61	70	70
1.5µF	7	25	45	64	70	70
2.2µF	10	29	49	66	70	70
3.3µF	14	34	53	70	70	70

T - section filters

SFBDT	SFBMT	SFLMT	SFAKT	SFKKT

Capacitance	0.1MHz	1MHz	10MHz	100MHz	1GHz
10pF					9
15pF					11
22pF				1	14
33pF				2	18
47pF				4	20
68pF				6	23
100pF				9	27
150pF				12	30
220pF				15	33
330pF			1	19	36
470pF			2	21	40
680pF			4	24	43
1nF			7	28	47
1.5nF			10	30	50
2.2nF			13	34	53
3.3nF			17	38	57
4.7nF			19	40	59
6.8nF		1	23	43	63
10nF		4	26	45	66
15nF		7	29	47	68
22nF		10	33	49	70
33nF		14	36	50	70
47nF	1	17	39	52	70
68nF	2	20	42	57	70
100nF	4	22	46	62	70
150nF	7	25	49	68	70



Pi - section filters

SFBCP	SFBDP	SFBLP	SFBMP	SFCDP	SFLMP

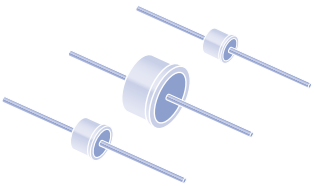
Capacitance	0.1MHz	1MHz	10MHz	100MHz	1GHz
20pF				1	11
30pF				2	15
44pF				3	19
66pF				4	23
94pF				6	29
136pF				8	35
200pF				11	41
300pF			1	15	50
440pF			2	20	57
660pF			3	25	65
940pF			5	31	68
1.36nF			7	37	70
2nF			10	44	70
3nF			13	51	70
4.4nF		1	17	59	70
6.6nF		2	21	64	70
9.4nF		4	27	68	70
13.6nF		6	34	70	70
20nF		9	40	70	70
30nF		12	48	70	70
44nF	1	14	54	70	70
66nF	2	17	63	70	70
94nF	4	18	68	70	70
136nF	8	25	70	70	70
200nF	10	27	70	70	70
300nF	13	30	70	70	70

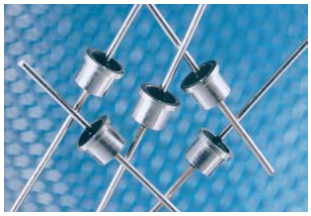
Ordering information

Solder-in types *Note: Ordering code can have up to 4 additional digits on the end to denote special requirements.*

SFS	T	C	500	0223	M	X	0
Type	**Case dia.**	**Electrical configuration**	**Voltage**	**Capacitance in picofarads (pF)**	**Capacitance tolerance**	**Dielectric**	**Nuts & washers**
Solder-in panel mount filter	S = Special (no case) Contact Sales Office for full part number R = 2.8mm T = 3.25mm U = 5.6mm	C = C section	050 = 50Vdc 100 = 100Vdc 200 = 200Vdc 300 = 300Vdc 500 = 500Vdc 1K0 = 1kVdc 2K0 = 2kVdc 3K0 = 3kVdc	First digit is 0. Second and third digits are significant figures of capacitance code. The fourth digit is number of zeros following Example: 0223=22nF	M = ±20% (Standard) P = -0 +100% S = -20%+50% Z = -20%+80%	C = C0G/NP0 X = X7R	0 = Without

For available range details see page 18.

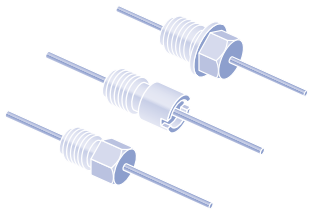




Threaded types *Note: Ordering code can have up to 4 additional digits on the end to denote special requirements.*

SF	J	E	L	050	0335	M	X	1
Type	**Case style** ** = Low Profile*	**Thread**	**Electrical configuration**	**Voltage** *or varistor maximum continuous working voltage*	**Capacitance in picofarads (pF)**	**Capacitance tolerance**	**Dielectric**	**Nuts & washers**
Screw mount filter	A = 4mm A/F B = 4.75mm A/F C = 6.35mm A/F D = 10mm A/F J = 9.8mm O.D. K = 4.4mm O.D. L = 6mm O.D. M = 6.35mm O.D. N = 3.5mm O.D. T = 6.35mm A/F * U = 6mm O.D. *	A = 4-40 UNC B = 6-32 UNC C = 8-32 UNC D = 12-32 UNEF E = 1/4-28 UNF I = 2BA J = M3 K = M3.5 L = M4 M = M5 N = M6 O = M2.5 P = M8	C = C section L = L-C section P = Pi section T = T section B = Balanced line filter V = Varistor EMI filter	050 = 50Vdc 100 = 100Vdc 200 = 200Vdc 300 = 300Vdc 500 = 500Vdc 1K0 = 1kVdc 2K0 = 2kVdc 3K0 = 3kVdc	First digit is 0. Second and third digits are significant figures of capacitance code. The fourth digit is number of zeros following Example: 0335=3.3µF 13N6=13.6nF	M = ±20% (Standard) P = -0 +100% S = -20%+50% Z = -20%+80%	C = C0G/NP0 X = X7R M = MOV (varistor material)	0 = Without 1 = With

For available range details see pages 19, 20, 36 & 37.



Hermetically sealed panel mount EMI filters

The SL range of ceramic based filters represents an extension to our exciting SF range of filters with the added features of hermetic construction, wound coil inductors and iron powder cores for improved high current performance.

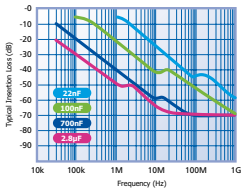
Additionally, the range also includes a selection of filters designed and tested to meet the requirements of WE772 / DEF-STAN. 59-45/90/013.

These miniature feedthrough suppression capacitors are intended for general applications and are suitable for filtering data, signal and power lines at all voltages up to their maximum ratings.

Various case and terminal styles are featured in this range to suit a wide variety of mounting and connection requirements.

All types are hermetically sealed.

Typical performance in a 50Ω system



Product range

Case style	L mm (inches)	Rated Current A	Rated Voltage Vdc	Cap Min.	Series Resist Max. Ω	I.R. Min. MΩ	Typical No Load Insertion Loss (dB) (as BS 6299) 30KHz	150KHz	300KHz	1MHz	10MHz	100MHz	1GHz	Circuit Configuration
SLS	13.5	15	80	2.8µF	0.002	200	20	34	40	50	65	-	70	C
	10.1	15	80	1.4µF	0.002	350	15	28	34	45	60	-	70	
	13.5	15	100	1.5µF	0.002	350	16	29	35	46	60	-	70	
	10.1	15	100	750nF	0.002	500	10	24	30	40	52	-	60	
	13.5	15	150	660nF	0.002	500	8	22	28	38	50	-	60	
	10.1	15	150	330nF	0.002	500	4	17	22	32	50	-	60	
	13.5	15	200	400nF	0.002	500	5	18	24	34	50	-	60	
	10.1	15	200	200nF	0.002	500	-	13	18	28	46	-	60	
	13.5	15	300	200nF	0.002	500	-	13	18	28	46	-	60	
	10.1	15	300	100nF	0.002	500	-	8	12	21	40	-	60	
	13.5	15	450	44nF	0.002	500	-	-	5	12	32	38	50	
	10.1	15	450	22nF	0.002	500	-	-	-	8	27	35	50	
SLT	17.1	15	300	350nF	0.002	100	-	15	20	30	50	70	70	
		15	300	700nF	0.002	100	10	24	30	40	60	70	70	
SLR	12.3	15	50	400nF	0.001	100	-	15	20	30	50	70	70	
		15	100	600nF	0.001	100	-	20	25	40	60	70	70	
		15	300	200nF	0.001	100	-	10	15	25	45	65	70	
SLO	12.25	15	100	600nF	0.002	100	-	20	25	40	60	70	70	
		15	300	200nF	0.002	100	-	10	15	25	45	65	70	
SLA	13.0	15	100	600nF	0.002	1000	-	20	25	40	60	70	70	
		15	300	200nF	0.002	1000	-	10	15	25	45	65	70	

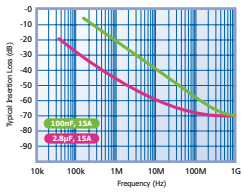
Notes: 1) For ordering information see page 27.
2) For mounting details see page 10.
3) For case dimensions see page 11.

L-C, C-L

This range of feedthrough suppression filters is suitable for power lines and signal lines. These filters feature an identical case diameter across a series of current and voltage ratings.

The L-C or C-L circuit configuration of these filters will give optimum performance where the capacitor faces a high impedance and the inductor faces a low impedance.

Typical performance in a 50Ω system



All types are hermetically sealed and have spade terminations for easy connection.

Product range

Case style	L mm (inches)	Rated Current A	Rated Voltage Vdc	Cap Min	Series Resist Max Ω	I.R. Min MΩ	Typical No Load Insertion Loss (dB) (as BS 6299) 30KHz	100KHz	150KHz	300KHz	1MHz	10MHz	1GHz	Circuit Configuration
SLS	18.8	15	80	2.8µF	0.002	200	20	30	34	40	50	60	70	L-C / C-L
		0.5	80	1.4µF	0.6	350	17	35	42	54	70	70	70	
	18.8	1	80	1.4µF	0.25	350	15	28	34	45	65	70	70	
		3	80	1.4µF	0.06	350	15	26	29	35	51	70	70	
		5	80	1.4µF	0.015	350	15	25	28	34	45	70	70	
		10	80	1.4µF	0.005	350	15	25	28	34	44	65	70	
	13.5	15	80	1.4µF	0.002	350	15	25	28	34	44	60	70	
		0.5	100	750nF	0.6	500	13	29	37	48	66	70	70	
	18.8	1	100	750nF	0.25	500	10	22	29	39	56	70	70	
		3	100	750nF	0.06	500	10	20	24	30	45	70	70	
		5	100	750nF	0.015	500	10	20	23	29	39	68	70	
		10	100	750nF	0.005	500	10	19	23	28	38	58	70	
	13.5	15	100	750nF	0.002	500	10	19	23	28	38	50	70	
		0.5	150	600nF	0.6	500	12	29	36	48	65	70	70	
		1	150	600nF	0.25	500	10	23	28	38	59	70	70	
	18.8	3	150	600nF	0.06	500	9	20	24	30	45	70	70	
		5	150	600nF	0.015	500	8	15	21	27	39	67	70	
		10	150	600nF	0.005	500	6	12	18	22	33	54	70	
	13.5	15	150	600nF	0.002	500	6	12	18	22	33	52	70	
		0.5	150	330nF	0.6	500	6	24	30	42	62	70	70	
		1	150	330nF	0.25	500	4	16	22	32	52	70	70	
	18.8	3	150	330nF	0.06	500	-	13	17	22	38	68	70	
		5	150	330nF	0.015	500	-	13	16	20	33	62	70	
		10	150	330nF	0.005	500	-	12	16	20	31	51	70	
	13.5	15	150	330nF	0.002	500	-	12	16	20	31	50	70	
		0.5	200	200nF	0.6	500	-	18	25	38	58	70	70	
		1	200	200nF	0.25	500	-	12	19	29	48	70	70	
	18.8	3	200	200nF	0.06	500	-	9	13	17	33	65	70	
		5	200	200nF	0.015	500	-	9	13	17	28	61	70	
		10	200	200nF	0.005	500	-	9	13	17	27	48	70	
	13.5	15	200	200nF	0.002	500	-	9	13	17	27	45	70	
		0.5	300	100nF	0.6	500	-	12	20	32	52	70	70	
		1	300	100nF	0.25	500	-	6	11	22	42	70	70	
	18.8	3	300	100nF	0.06	500	-	5	7	14	30	65	70	
		5	300	100nF	0.015	500	-	4	7	12	24	56	70	
		10	300	100nF	0.005	500	-	-	7	12	22	45	70	
	15	15	300	100nF	0.002	500	-	-	7	12	21	40	70	

Notes: 1) For ordering information see page 27.
2) For mounting details see page 10.
3) For case dimensions see page 11.

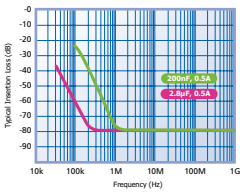
Pi

The range of Pi circuit feedthrough filters is suitable for power lines and signal lines. These filters feature a series of current and voltage ratings in each case style.

The Pi circuit configuration of these filters will give optimum performance where the threaded end (capacitor) and the unthreaded end each face a high impedance.

All types are hermetically sealed.

Typical performance in a 50Ω system



Product range

Case style	L mm (inches)	Rated Current A	Rated Voltage Vdc	Cap Min	Series Resist Max Ω	I.R. Min MΩ	Typical No Load Insertion Loss (dB) (as BS 6299) 30KHz	150KHz	300KHz	1MHz	10MHz	100MHz	1GHz	Circuit Configuration
SLS	20.4	0.5	80	2.8µF	0.6	200	34	78	80	80	80	80	80	Pi
		1	80	2.8µF	0.25	200	22	68	80	80	80	80	80	
		3	80	2.8µF	0.06	200	-	50	70	80	80	80	80	
		5	80	2.8µF	0.015	200	-	36	60	80	80	80	80	
		8	80	2.8µF	0.005	200	-	-	42	78	80	80	80	
		10	80	2.8µF	0.005	200	21	34	40	50	70	-	80	
		0.5	100	1.4µF	0.6	350	23	65	80	80	80	80	80	
		1	100	1.4µF	0.25	350	-	55	75	80	80	80	80	
		3	100	1.4µF	0.06	350	-	40	58	80	80	80	80	
		5	100	1.4µF	0.015	350	-	-	50	80	80	80	80	
		8	100	1.4µF	0.005	350	-	-	18	68	80	80	80	
		10	100	1.4µF	0.005	350	15	27	34	44	62	-	80	
		0.5	150	660nF	0.6	500	5	52	69	80	80	80	80	
		1	150	660nF	0.25	500	-	42	60	80	80	80	80	
		3	150	660nF	0.06	500	-	22	43	78	80	80	80	
		5	150	660nF	0.015	500	-	-	28	65	80	80	80	
		8	150	660nF	0.005	500	-	-	-	53	80	80	80	
		10	150	660nF	0.005	500	8	20	27	38	58	80	80	
		0.5	200	400nF	0.6	500	-	42	62	80	80	80	80	
		1	200	400nF	0.25	500	-	34	52	80	80	80	80	
		3	200	400nF	0.06	500	-	-	34	68	80	80	80	
		5	200	400nF	0.015	500	-	-	18	58	80	80	80	
		8	200	400nF	0.005	500	-	-	-	44	80	80	80	
		10	200	400nF	0.005	500	4	16	24	34	52	-	80	
		0.5	300	200nF	0.6	500	-	32	50	80	80	80	80	
		1	300	200nF	0.25	500	-	15	40	70	80	80	80	
		3	300	200nF	0.06	500	-	-	12	54	80	80	80	
		5	300	200nF	0.015	500	-	-	-	45	80	80	80	
		8	300	200nF	0.005	500	-	-	-	28	80	80	80	
		10	300	200nF	0.005	500	-	12	18	28	45	-	80	
		0.5	450	44nF	0.6	500	-	15	25	54	80	80	80	
		1	450	44nF	0.25	500	-	-	13	45	80	80	80	
		3	450	44nF	0.06	500	-	-	-	27	80	80	80	
		5	450	44nF	0.015	500	-	-	-	10	75	78	80	
		8	450	44nF	0.005	500	-	-	-	-	65	75	80	
		10	450	44nF	0.005	500	-	-	5	14	34	50	80	
SLO	18.8	1	350	20nF	0.4	1000	11	27	36	62	80	80	80	
		5	350	13nF	0.1	1000	4	9	16	39	80	80	80	
		15	200	40nF	0.001	1000	-	-	-	15	60	80	80	
SLT	30	2	100	400nF	0.25	750	16	58	76	80	80	80	80	
		4	100	400nF	0.15	750	4	49	68	80	80	80	80	
SLP	21.5	5	80	350nF	0.1	1000	11	58	76	80	80	80	80	
	22.0	10	80	800nF	0.01	500	-	15	25	60	80	80	80	
	21.6	10	350	20nF	0.05	1000	-	-	11	37	80	80	80	

Notes: 1) For ordering information see page 27.
2) For mounting details see page 10.
3) For case dimensions see page 11.

Introduction to WE772

Specification WE772 was originally prepared by the Royal Aircraft Establishment (RAE) and the Atomic Weapons Research Establishment (AWRE) to define a range of filters for use in aircraft equipment and missile applications.

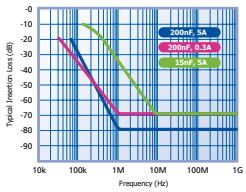
This specification is also known as DEF. STAN. 59-45 / 90 / 013. although never issued as such.

Although nominally obsolete, filters designed and tested to meet the requirements of this specification are included to fulfil market demands.

These filters are particularly designed to suit the exacting requirements for protection of military and aerospace equipment, such as explosive devices, missiles and flight control systems. They will also be suitable for other rigorous applications and may meet the requirements of other military and aerospace specifications.

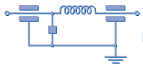
In line with the original requirements of the specification, these filters are also available with a 4.7MΩ shunt resistor fitted in parallel to the capacitive element to prevent static charge and to ensure safe discharge of the capacitor. See ordering details for information on how to specify this feature.

Typical performance in a 50Ω system



Circuit configurations

Shunt resistor (4.7MΩ) is optional



Shunt resistor (4.7MΩ) is optional

Pi, L-C

WE772 Product range

Case style	*L Max mm	Rated Current A	Rated Voltage Vdc	Cap Min	Series Resist Max Ω	I.R. Min MΩ	Minimum No Load Insertion Loss (dB) -55ºC to +125ºC (as BS 6299) 30KHz	150KHz	300KHz	1MHz	10MHz	100MHz	1GHz	Circuit Configuration
SLO	18.8	1	100	15nF	0.4	1000	10	26	35	55	70	70	70	L-C
		5	100	15nF	0.1	1000	-	10	18	39	70	70	70	
		1	100	100nF	0.4	1000	13	38	51	70	70	70	70	
		5	100	100nF	0.1	1000	-	24	36	57	70	70	70	
		1	100	20nF	0.4	100	11	27	37	57	70	70	70	
		0.3	100	200nF	5.2	100	17	46	56	70	70	70	70	
		0.45	100	200nF	2.5	1000	17	42	56	70	70	70	70	
		1	100	200nF	0.4	1000	15	40	55	70	70	70	70	
		5	100	200nF	0.1	100	-	25	40	60	70	70	70	
		0.3	100	40nF	5.2	1000	13	32	46	75	80	80	80	Pi
		0.45	100	40nF	2.5	1000	13	32	46	75	80	80	80	
		1	100	40nF	0.4	1000	11	30	44	74	80	80	80	
		0.3	100	200nF	5.2	1000	12	50	65	80	80	80	80	
		0.45	100	200nF	2.5	1000	12	50	65	80	80	80	80	
		1	100	200nF	0.4	1000	10	45	65	80	80	80	80	
		5	100	200nF	0.02	1000	-	20	40	70	80	80	80	
SLP	21.6	5	100	200nF	0.1	1000	-	34	52	80	80	80	80	
		10	100	400nF	0.015	1000	-	15	40	70	80	80	80	

Notes: 1) For ordering information see page 27.
2) For mounting details see page 10.
3) For case dimensions see page 11.

Construction

The hermetically sealed screw-in panel mount EMI SL range filters feature bright tin plated steel bodies and bright tin plated copper alloy conductors. In all cases the capacitive element is a low ESR high performance discoidal ceramic multilayer device.

All parts are hermetically sealed to provide environmental protection to the internal elements with zero outgassing. The filters are 100% tested for sealing performance during manufacture.

Filters with case style SLS and fitted with inductors (L-C, C-L, Pi or T configurations) are fitted with wound coil or iron powder core inductors dependant on current flow. These inductors offer maximum performance with minimal degradation of insertion loss due to through currents. All other filters incorporating inductors are fitted with conventional ferrite beads and are primarily intended for signal lines. They will carry current to the maximum rated value, but will provide reduced performance at maximum rated current.

Plating Finish

All the hermetically sealed EMI filters are plated with bright tin after assembly. The internal surfaces are copper plated to prevent whisker growth inside the filter assembly.

Alternative plating finishes (eg nickel / silver / gold / SnPb) are available - please contact the factory to discuss your requirements.

Voltage Rating

The quoted voltage rating is the maximum dc voltage up to 125ºC. Voltage spikes can have a significant effect on the reliability of the filter, and must be taken into account if anticipated. If in doubt, please contact the factory.

As a general guide, dc rated ceramic filters are suitable for ac operation subject to a voltage derating ratio of 4:1 - ie a 400Vdc rated filters is suitable for operation at 100Vac. However, heating effect and power dissipation (frequency and capacitance dependant) must also be taken into account - please contact the factory to discuss any specific application.

Current Rating

All current ratings quoted are maximum continuous operating currents for temperatures up to 105ºC. Between 105ºC and 125ºC the current rating must be de-rated linearly from 100% quoted maximum to 60% quoted maximum.

Allowance must be made for any anticipated surge currents.

Filter Circuits

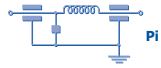
C, L-C, C-L and Pi filter configurations are available as standard. T filter and multi-element (eg L-C-L-C-L) configurations are available upon request. Please contact the factory for more information.

Resistor

Certain filters are also available with a 4.7MΩ shunt resistor fitted in parallel to the capacitive element to prevent static charge and to ensure safe discharge of the capacitor. Please contact the factory to discuss your requirements.

Typical circuit configurations

Shunt resistor (4.7MΩ) is optional



Shunt resistor (4.7MΩ) is optional

Dielectric Material

All filters in the hermetically sealed range utilise stable X7R dielectric to achieve the optimum balance of stability and high capacitance. Low capacitance ultra stable C0G/NP0 parts are also available.

Also available are variants incorporating MOV dielectric materials to provide the dual role of filtering and bi-directional clamping. This material is available in all variants, but is especially suited to Pi filter configuration, where it can be combined with a conventional high capacitance ceramic disc to provide improved filtering performance. As a general guideline, Syfer can supply varistor filters to a maximum clamping voltage of 100V.

Custom Specials

In line with our existing business, Syfer welcomes enquiries for custom design filters. We are happy to consider modifications both electrical and mechanical. Please contact the factory with your specific requirement.

Safety

Care should be taken not to exceed the maximum rated voltage and current for the filter.

All the filters in this catalogue are designed to operate at high currents / high voltages and may be fitted with high capacitances resulting in a potential electric shock hazard. Electrical energy may be stored for some time after switch off – do not handle filters without first discharging and / or checking that the stored voltage is at a low level.

Ordering information

SLA	J	C	300	0204	P	X	1
Case style	Rated Current (A)	Electrical configuration	Voltage	Capacitance in picofarads (pF)	Capacitance tolerance	Dielectric	Class
SLA SLO SLP SLR SLS SLT	A = 0.3 B = 0.45 C = 0.5 D = 1 E = 3 F = 5 G = 8 H = 10 J = 15 K = 20 L = 32 M = 63 N = 100 P = 2 Q = 4	C = C section L = L-C section H = C-L section P = Pi section	080 = 80Vdc 100 = 100Vdc 150 = 150Vdc 200 = 200Vdc 300 = 300Vdc 450 = 450Vdc	First digit is 0. Second and third digits are significant figures of capacitance code. The fourth digit is number of zeros following Examples: 0153 = 15nF 0204 = 200nF 0285 = 2.8µF	P = -0 +100% (Standard) *Other tolerances may be available. Please refer to factory.*	C = C0G/NP0 X = X7R	1 = STD W = WE772 R = 4M7 resistor L = WE772 + 4M7 resisitor M = Metric thread

Notes: Ordering code can have up to 4 additional digits on the end to denote special requirements.
All supplied with nuts and washers.
See page 11 for case styles.
For more information on WE772 specification filters see page 26.
For more information on 4M7 resistor option see technical notes above.
For available range details see pages 23-26.

EMI Power Filters - 10A - SLQ & SLU Range

Description

A range of miniature dc and ac feedthrough capacitors rated at 10A. Capacitance values from 1.3nF to 1.5µF. Rated voltages from 30Vdc to 600Vdc and 250Vac. RoHS compliant.

Ratings and characteristics

Rated Current, I_R	[1]10A @ 50ºC
Insulation Resistance	>100MΩ
dc Resistance	<2mΩ
Operating Temperature Range	-55ºC to +85ºC

[1]Current derating between 50ºC and 85ºC
For temperature θ, $I_R = I_R \sqrt{(85-\theta)/35}$

EMI Power filters introduction

EMI Power filters are designed for applications where currents up to several hundred amps are required.

Utilising plastic film technology the range includes high ac and dc working voltage options along with parts designed and tested to meet the rigorous demands of EN132400/EN60950 safety specifications.

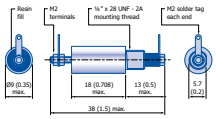
Typical applications include: IT servers, telecoms base stations, MRI room equipment, power supplies, radar and military vehicles. Filters designed and tested to meet EN132400/EN60950 class Y2 and Y4 requirements are intended for use on mains supply systems or lower voltage lines where safety is important.

Product range

Case style	Capacitance Value (±20%)	Rated Voltage Vdc	Test Voltage Vdc	Max. Leakage Current (mA) @ 250V 50Hz	Typical Insertion Loss (dB) in 50 Ω system: 10 kHz	30 kHz	100 kHz	300 kHz	1 MHz	10 MHz	30 MHz	100 MHz	300 MHz	1 GHz	Circuit Configuration
SLQ & SLU	1.3nF	[2]600	2250	0.12	-	-	-	-	-	7	16	26	36	46	C
	3.3nF	[2]600	2250	0.31	-	-	-	-	-	14	24	34	44	54	
	4.7nF	[2]600	2250	0.45	-	-	-	-	-	17	27	37	47	57	
	100nF	400	800	-	-	1	5	14	24	44	-	70	-	84	
	200nF	250	500	-	-	3	10	20	30	50	-	74	-	90	
	300nF	160	320	-	-	5	14	24	34	50	-	74	-	90	
	600nF	100	200	-	3	10	20	30	40	50	-	80	-	90	
	900nF	63	126	-	5	13	23	33	43	51	-	83	-	90	
	1.5µF	30	60	-	8	17	27	37	47	55	-	87	-	90	

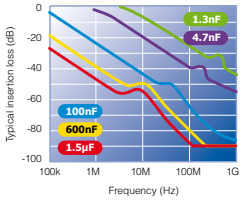
[2]600Vdc are dual rated at 250Vac. Order as a 600Vdc part.

Case style - Dimensions - mm (inches)



SLQ - Thread ¼" x 28 UNF - 2A
SLU - Thread M6x 75 - 6g

Insertion Loss



Notes: 1) Please refer to page 34 for ordering information and mounting details.
2) This range available as multiway assemblies for cost and space saving. Please refer to page 35.

Mechanical details

Mounting hardware	8 A/F fixing nut and crinkle washer
Terminals & Case	Nickel plated brass
Weight	5g
Maximum torque:	Terminals - 0.2Nm (1.77lbf in) (use 2 spanners) Mounting thread - 1Nm (8.85lbf in)

EMI Power Filters - 20A - SLE Range

Description

A range of miniature dc feedthrough capacitors rated at 20A. Capacitance values from 5nF to 12µF. Rated voltages from 30Vdc to 600Vdc and 250Vac. RoHS compliant.

Ratings and characteristics

Rated Current, I_R	[1]20A @ 50ºC
Insulation Resistance	>100MΩ
dc Resistance	<1mΩ
Temperature Range	-55ºC to +85ºC

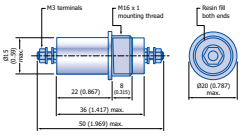
[1]Current derating between 50ºC and 85ºC
For temperature θ, $I_R = I_R \sqrt{(85-\theta)/35}$

Product range

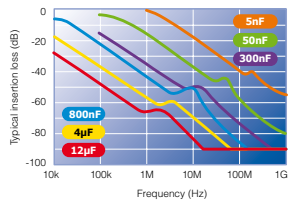
Case style	Capacitance Value (±20%)	Rated Voltage Vdc	Test Voltage Vdc	Max. Leakage Current (mA) @ 250V 50Hz	Typical Insertion Loss (dB) in 50 Ω system: 10 kHz	30 kHz	100 kHz	300 kHz	1 MHz	10 MHz	100 MHz	300 MHz	1 GHz	Circuit Configuration
SLE	5nF	[2]600	2250	0.5	-	-	-	-	2	17	37	47	57	C
	10nF	[2]600	2250	1	-	-	-	1	6	24	44	54	64	
	20nF	[2]600	2250	1.9	-	-	-	3	10	30	46	60	70	
	50nF	[2]600	2250	4.7	-	-	-	8	18	38	58	68	78	
	80nF	[2]600	2250	7.5	-	-	-	12	22	42	62	72	82	
	100nF	[2]600	1250	9.4	-	-	-	14	24	44	70	74	84	
	200nF	[2]600	1250	19	-	-	-	20	30	50	74	80	90	
	300nF	[2]600	1250	28	-	-	-	24	34	50	74	84	90	
	800nF	400	800	-	4	12	22	32	42	51	82	-	90	
	1µF	250	500	-	5	14	24	34	44	52	84	-	90	
	2µF	160	320	-	10	20	30	40	50	58	90	90	90	
	4µF	100	200	-	16	26	36	46	56	70	90	90	90	
	5µF	80	160	-	18	28	38	48	58	74	90	90	90	
	7µF	63	126	-	21	31	41	51	60	79	90	90	90	
	12µF	30	60	-	26	36	46	56	62	86	90	90	90	

[2]600Vdc are dual rated at 250Vac. Order as a 600Vdc part.

Case style SLE - Dimensions - mm (inches)



Insertion Loss



Notes: 1) Please refer to page 34 for ordering information and mounting details.
2) This range available as multiway assemblies for cost and space saving. Please refer to page 35.

Mechanical details

Mounting hardware	19 A/F fixing nut and crinkle washer
Terminals & Case	Nickel plated brass
Weight	25g
Maximum torque:	Terminals - 0.5Nm (4.42lbf in) (use 2 spanners) Mounting thread - 7Nm (61.96lbf in)

Description

A range of dc and ac feedthrough capacitors rated at 100A. Capacitance values from 0.1µF to 12µF. Rated voltages from 30Vdc to 600Vdc and 250Vac. RoHS compliant.

Ratings and characteristics

Rated Current, I_R	[1]100A @ 50ºC
Insulation Resistance	>100MΩ
dc Resistance	<0.5mΩ
Temperature Range	-55ºC to +85ºC

[1]Current derating between 50ºC and 85ºC

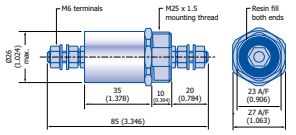
For temperature θ, $I_\theta = I_R\sqrt{(85-\theta)/35}$

Product range

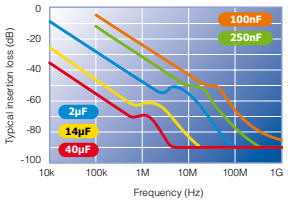
Case style	Capacitance Value (±20%)	Rated Voltage Vdc	Test Voltage Vdc	Max. Leakage Current (mA) @ 250V 50Hz	Typical Insertion Loss (dB) in 50 Ω system with load: 10 kHz	30 kHz	100 kHz	300 kHz	1 MHz	10 MHz	100 MHz	1 GHz	Circuit Configuration
SLM	100nF	[2]600	2250	9.4	-	-	5	14	24	44	70	84	C
	200nF	[2]600	2250	19	-	-	10	20	30	50	74	90	
	250nF	[2]600	2250	24	-	-	12	22	32	50	74	90	
	500nF	[2]600	1250	47	-	-	18	28	38	50	78	90	
	1µF	[2]600	1250	94	-	-	24	34	44	52	84	90	
	2µF	400	800	-	10	20	30	40	50	58	90	90	
	4µF	250	500	-	16	26	36	46	56	70	90	90	
	6µF	160	320	-	20	30	40	50	60	77	90	90	
	14µF	100	200	-	27	37	47	57	63	87	90	90	
	18µF	80	160	-	29	39	49	59	66	90	90	90	
	25µF	63	126	-	32	42	52	62	66	90	90	90	
	40µF	30	60	-	36	46	56	66	66	90	90	90	

[2]600Vdc are dual rated at 250Vac. Order as a 600Vdc part.

Case style SLM - Dimensions - mm (inches)



Insertion Loss



Mechanical details

Mounting hardware	30 A/F fixing nut and crinkle washer
Terminals & Case	Nickel plated brass
Weight	120g
Maximum torque:	Terminals - 2.5Nm (22.13lbf in) use 2 spanners Mounting thread - 14Nm (123.9lbf in)

Notes: 1) Please refer to page 34 for ordering information and mounting details.

2) This range available as multiway assemblies for cost and space saving. Please refer to page 35.

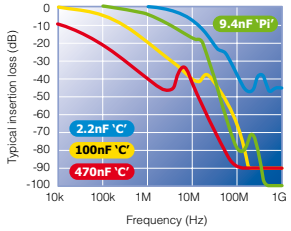
Class Y2 and Y4 introduction

The class Y2 and Y4 high current feedthrough filters are designed and tested to meet or exceed the stringent test requirements of EN132400 and EN60950 including the 5000V DWV and 5000V peak pulse testing (Y2) or 2500V DWV and 2500V peak pulse testing (Y4).

This makes these filters particularly suitable for all high performance applications demanding high reliability coupled with very good high frequency insertion loss performance, such as servers, IT switches and telecoms base stations. This range is fully RoHS compliant and available in 'C' and 'Pi' configuration as standard, with other configurations available on request.

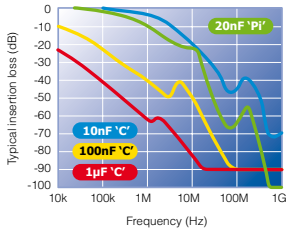
Y2 Ratings and characteristics

Rated voltage	250Vac 50/60 Hz
Test voltage	5000Vdc 2 seconds
Capacitor class (EN132400)	Y2
Rated current	10A to 100A
Pulse test (EN132400)	5000V peak
Insulation resistance: (within 1 minute)	C < 0.33µF, R > 15000MΩ C > 0.33µF, RC > 5000s (MΩµF)
dc resistance	≤ 6mΩ
Temperature range	-40ºC to +85ºC
Insulating materials flammability rating	UL94 V-0



Y4 Ratings and characteristics

Rated voltage	130Vac 50/60 Hz (Also 130Vdc)
Test voltage	2500Vdc 2 seconds
Capacitor class (EN132400)	Y4
Rated current	10A to 100A
Pulse test (EN132400)	2500V peak
Insulation resistance: (within 1 minute)	C < 0.33µF, R > 15000MΩ C > 0.33µF, RC > 5000s (MΩµF)
dc resistance	≤ 6mΩ
Temperature range	-40ºC to +85ºC
Insulating materials flammability rating	UL94 V-0

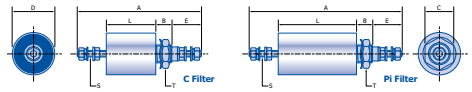


Mechanical details

Mounting hardware	Fixing nuts and crinkle washers supplied
Terminals & Case	Nickel plated brass
Maximum torque: (Mounting thread)	**M10** - 3Nm (26.55lbf in), **M12** - 4Nm (35.4lbf in), **M16** - 7Nm (61.69lbf in), **M20** - 10Nm (88.51lbf in), **M24** - 14Nm (123.9lbf in)
Maximum torque: (Terminals) *Use 2 spanners*	**M3** - 0.5Nm (4.43lbf in), **M4** - 1.2Nm (10.62lbf in), **M6** - 2.5Nm (22.13lbf in), **M8** - 5Nm (44.25lbf in)

Note: Please refer to page 34 for ordering information and mounting details.

EMI Power Filters - Class Y2 - 250Vac (A25)



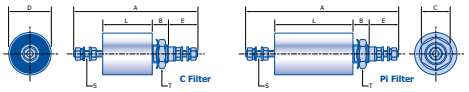
Product range

Case style	*Current Rating I_r (A) @60ºC	Capacitance Value (±20%)	Inductance (nH)	Max. Leakage Current (mA) @ 250V 50Hz	Typical Insertion Loss (dB) in 50Ω system 10 kHz	30 kHz	100 kHz	300 kHz	1 MHz	10 MHz	100 MHz	1 GHz	Dimensions	Circuit Configuration
SLB	10	2.2nF	-	0.21	-	-	-	-	-	8	38	45	A = 57mm B = 10mm C = 13mm D = 15mm E = 16mm L = 18mm S = M3 T = M10 x 1	C
		4.7nF	-	0.44	-	-	-	-	-	14	43	60		
SLC	10	9.4nF	70	0.9	-	-	-	-	4	18	80	100	A = 98mm B = 12mm C = 17mm D = 20mm E = 16mm L = 57mm S = M3 T = M12 x 1	Pi
SLD	32	4.7nF	-	0.44	-	-	-	-	-	14	43	60	A = 63 to 106mm B = 12mm C = 17mm D = 20mm E = 18mm L = 18 to 61mm S = M4 T = M12 x 1	C
		10nF	-	0.94	-	-	-	-	3	21	45	70		
		47nF	-	4.4	-	-	2	6	15	34	50	90		
		20nF	70	1.9	-	-	2	4	10	22	65	100		Pi
SLF	32	100nF	-	9.4	-	2	5	11	20	40	65	90	A = 77mm B = 14mm C = 22mm D = 25mm E = 18mm L = 30mm S = M4 T = M16 x 1	C
SLG	63	10nF	-	0.94	-	-	-	-	3	21	45	70	A = 96 to 160mm B = 14mm C = 22mm D = 25mm E = 26mm L = 30 to 94mm S = M6 T = M16 x 1	C
		47nF	-	4.4	-	-	2	6	15	34	50	90		
		100nF	-	9.4	-	2	5	11	20	40	65	90		
		94nF	80	8.9	-	-	6	11	21	50	85	100		Pi
SLK	100	47nF	-	4.4	-	-	2	6	15	34	50	90	A = 113 to 184mm B = 16mm C = 27mm D = 32mm E = 32mm L = 33 to 104mm S = M8 T = M20 x 1	C
		100nF	-	9.4	-	2	5	11	20	40	65	90		
		200nF	90	19	-	2	10	18	27	60	100	100		Pi
SLL	100	470nF	-	44	6	9	16	22	33	33	90	90	A = 133mm B = 19mm C = 27mm D = 38mm E = 32mm L = 50mm S = M8 T = M24 x 1	C

*Current derating between 60ºC and 85ºC:
For temperature θ, $I_\theta = I_r \sqrt{(85-\theta)/25}$

Note: Please refer to page 34 for ordering information and mounting details.

EMI Power Filters - Class Y4 - 130Vac/130Vdc (A13)



Product range

Type	*Current Rating I_r (A) @60ºC	Capacitance Value (±20%)	Inductance (nH)	Typical Insertion Loss (dB) in 50Ω system 10 kHz	30 kHz	100 kHz	300 kHz	1 MHz	10 MHz	100 MHz	1 GHz	Dimensions	Circuit Configuration
SLB	10	10nF	-	-	-	-	-	3	21	45	70	A = 57mm B = 10mm C = 13mm D = 15mm E = 16mm L = 18mm S = M3 T = M10 x 1	C
SLC	10	20nF	70	-	-	2	4	10	23	65	100	A = 90mm B = 12mm C = 17mm D = 20mm E = 16mm L = 49mm S = M3 T = M12 x 1	Pi
SLD	32	10nF	-	-	-	-	-	3	21	45	70	A = 63 to 98mm B = 12mm C = 17mm D = 20mm E = 18mm L = 18 to 53mm S = M4 T = M12 x 1	C
		47nF	-	-	-	2	6	15	34	50	90		
		100nF	-	-	2	5	11	20	40	65	90		
		20nF	70	-	-	2	4	10	23	65	100		Pi
SLG	63	10nF	-	-	-	-	-	3	21	45	70	A = 96 to 160mm B = 14mm C = 22mm D = 25mm E = 26mm L = 30 to 94mm S = M6 T = M16 x 1	C
		47nF	-	-	-	2	6	15	34	50	90		
		100nF	-	-	2	5	11	20	40	65	90		
		200nF	80	2	4	10	18	27	62	95	100		Pi
SLH	32	470nF	-	6	9	15	22	33	33	90	90	A = 82mm B = 16mm C = 27mm D = 32mm E = 18mm L = 33mm S = M4 T = M20 x 1	C
SLJ	63	470nF	-	6	9	15	22	33	33	90	90	A = 101mm B = 16mm C = 27mm D = 32mm E = 26mm L = 33mm S = M6 T = M20 x 1	C
SLK	100	47nF	-	-	-	2	6	15	34	50	90	A = 113 to 184mm B = 16mm C = 27mm D = 32mm E = 32mm L = 33 to 104mm S = M8 T = M20 x 1	C
		100nF	-	-	2	5	11	20	40	65	90		
		470nF	-	6	9	15	22	33	33	90	90		
		940nF	90	7	14	23	30	32	70	100	100		Pi
SLL	100	1µF	-	10	15	24	32	42	50	90	90	A = 133mm B = 19mm C = 27mm D = 38mm E = 32mm L = 50mm S = M8 T = M24 x 1	C

*Current derating between 60ºC and 85ºC:
For temperature θ, $I_\theta = I_r \sqrt{(85-\theta)/25}$

Note: Please refer to page 34 for ordering information and mounting details.

Background to Power Filters

Feedthrough filters offer high insertion loss performance from kHz to GHz and high feedthrough currents to 100A+.

Stable, self-healing plastic film capacitors offering very low series inductance and very high self resonant frequency and through bulkhead mounting gives them a defined performance advantage over board level or discrete component filtering with traditional 2 terminal capacitors.

'C' Circuit filters (also known as feedthrough capacitors) offer good general purpose performance at low cost. Improved performance and sharper cut-off curves are achieved with the use of Pi filters. Other package configurations (e.g. L-C or T filters) are also available for low or mismatched source and load impedances – please refer to the factory.

Typical applications include power input lines on IT servers and telephone base stations or high performance power supplies.

Construction

All Syfer power filters in this catalogue are manufactured using self-healing polyester film wound capacitors and incorporate a non-soldered construction for maximum reliability.

Plastic film capacitors are used as standard and offer the best mix of performance and temperature range, allowing high volumetric capacitance and operating temperatures up to 85°C (including self heating effect).

For specialist applications alternative plastic films can be used to offer low dielectric losses or higher operating temperatures. Please refer to the factory for further information.

Unlike some manufacturers, Syfer do not use oil impregnated paper film capacitors which can catch fire or explode in the case of failure.

Pi filters incorporate iron powder core inductors for maximum performance with minimal degradation of insertion loss due to high through currents. Declared performance is for full load.

Through conductors are copper alloy for maximum conductivity with minimum loss or heating effect. Bodies are brass or aluminium. All metal parts are nickel plated as standard to present good electrical conductivity and anti corrosion properties. All filters are resin sealed to protect against harsh environments.

Mounting

These EMI Power filters and capacitors are designed to be mounted in a bulkhead or partition wall to achieve maximum high frequency filtering performance through exploitation of the Faraday cage effect. Filtering performed using discrete components at board level will generally offer a lower level of filtering performance as high frequency signals radiate over and around the filter.

When mounting the filters, take care not exceed the maximum mounting torques quoted as this may cause damage to the metalwork or the internal components. All filters are supplied as standard with the requisite nuts and washers to successfully mount the part. When tightening conductor nuts, use two spanners to prevent twisting the internal conductor and risking damage to the resin seal.

Particular care must be taken to ensure good contact is made to the through conductor, as high currents can result in localised 'hot spots' through high resistive joints.

Safety

Care should be taken not to exceed the maximum rated voltage and current for the filter.

Standard feedthrough capacitors rated at 600Vdc / 250Vac are tested to either 1250V or 2250Vdc during manufacture which can make them suitable for use in mains 250Vac applications, but if operating safety is critical, or high transients are anticipated, then the Y2 and Y4 class filters are designed and tested to meet or exceed the test requirements of EN132400 and EN60950 including the 5000V DWV and 5000V peak pulse testing requirements (Y2) or 2500V DWV and 2500V peak pulse testing requirements (Y4).

All insulating materials are UL94 V-0 rated.

High currents will generate some heating effect, and particular care should be paid to the current derating calculation shown on each page. If current exceeds the maximum rating for the filter, change to a higher rated device or talk to the factory for possible alternatives.

All the EMI Power filters in this catalogue are designed to operate at high currents / high voltages and may be fitted with high capacitances resulting in a potential electric shock hazard. Electrical energy may be stored for some time after switch off – do not handle filters without first discharging and / or checking that the stored voltage is at a low level.

Failure mode

All these EMI Power filters utilise plastic film capacitors that will self-heal following break down due to excessive voltage. The initial fail would be detected by a brief short circuit transient followed by recovery to normal operation. If the part is repeatedly subjected to over voltage transients, then the capacitance will gradually decrease as the capacitor operating layer is effected.

If a part is repeatedly driven to failure, subjected to a severe over voltage condition or subjected to high ac voltages to drive high ac current through the capacitor then a significant heat build up can occur causing irreversible damage to the capacitor which may result in a permanent open or short circuit condition being generated.

RoHS compliance

All Power filters are RoHS compliant.

Ordering information

SLE	K	C	250	0105	M	1	1
Case style	Rated current (A)	Electrical configuration	Voltage	Capacitance in picofarads (pF)	Capacitance tolerance	Dielectric	Class
SLB SLC SLD SLE SLF SLG SLH SLJ SLK SLL SLM SLQ	A = 0.3 B = 0.45 C = 0.5 D = 1 E = 3 F = 5 G = 8 H = 10 J = 15 K = 20 L = 32 M = 63 N = 100	C = C section P = Pi section	030 = 30Vdc 063 = 63Vdc 100 = 100Vdc 160 = 160Vdc 250 = 250Vdc 400 = 400Vdc 600 = 600Vdc A13 = 130Vac A25 = 250Vac	First digit is 0. Second and third digits are significant figures of capacitance code. The fourth digit is number of zeros following Examples: 0132 = 1.3nF 0105 = 1.0µF 0406 = 40µF	M = ±20% (Standard)	1 = Plastic Film	1 = STD Y = Y4 (130Vac only) Y = Y2 (250Vac only)

Note: Ordering code can have up to 4 additional digits on the end to denote special requirements. All supplied with nuts and washers.

Example ordering information - Y2 Range

SLG	M	P	A25	0943	M	1	Y
Case style	Rated current (A)	Electrical configuration	Voltage	Capacitance in picofarads (pF)	Capacitance tolerance	Dielectric	Class
SLG	M = 63	P = Pi section	A25 = 250Vac	Example: 0943 = 94nF	M = ±20% (Standard)	1 = Plastic Film	Y = Y2 (250Vac only)

Example ordering information - Y4 Range

SLL	N	C	A13	0105	M	1	Y
Case style	Rated current (A)	Electrical configuration	Voltage	Capacitance in picofarads (pF)	Capacitance tolerance	Dielectric	Class
SLL	N = 100	C = C section	A13 = 130Vac	Example: 0105 = 1µF	M = ±20% (Standard)	1 = Plastic Film	Y = Y4 (130Vac only)

For available ranges see pages 28 - 33.

Custom Specials

The vast majority of filters manufactured are customised to meet the specific requirements of individual customers. Syfer offer the option to manufacture to a customer specification or to work together with the customer to develop a solution to the problem.

If standard designs have been used for prototypes or initial production, please talk to us about modifying the package to suit your requirements to improve cost and ease assembly. Prototypes can be arranged quickly and in small quantities to solve particular problems.

Typical customisations include:

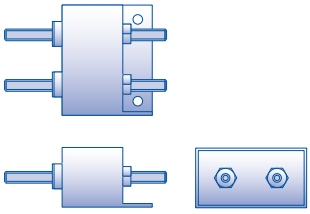
Multi-Way Assemblies

All the standard ranges of plastic film filters can also be supplied as multi-way assemblies to offer cost and space savings where several lines require filtering.

Utilising the same internal piece parts as the standard filters, multi-ways offer the same high electrical performance as the single line filters, but replacing the machined brass cases with a single formed magnetic stainless steel case reduces the cost per way even for low volumes. Additional cost savings are also made from reduced installation times and the use of standard mounting hardware. Thirdly, overall size is reduced, allowing for a more compact design.

If several filters of different types, values or circuits are required, it may be possible to incorporate these into a single multi-way housing. All assemblies are fully resin sealed (UL94-V0) and are designed to withstand harsh environments making them suitable for severe industrial and military applications.

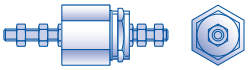
Standard assemblies include 2, 3, 4 and 8 ways, but any number can be incorporated. Please contact Syfer sales for further details.



Typical 2-way assembly

Different housing design

Special designs are available to suit any particular customer requirement. All standard filters are designed with round bodies and a single, large mounting nut as the optimum combination of cost and ease of mounting. Typical changes include full hexagonal bodies to enable fitting in tight spaces, or bodies with multiple mounting locations for critical vibration.



Centre mounting glands can be considered, although these are generally not preferred as the increase the required space for a particular filter. Note: 'P' and 'U' clamps are often requested - we can supply these, but advise against it as they can compromise the filtering performance by increasing the earth path resistance and inductance - for optimum performance all power filters should be mounted in a through bulkhead.

Subject to volumes, lower cost body materials can be used.

Multi-way assemblies can be supplied with custom shaped cases to fit specific locations or available area. Syfer can produce to design or from available envelope.

- Higher working voltages (to 1000Vdc typical) and higher current carrying capacities (to 500A typical) are available.

Varistor Filters

The Syfer range of varistor filters provides both transient voltage protection and EMI filtering in one device. The heart of this unique device is a multilayer varistor discoidal, which provides a dual function. The use of metal oxide based ceramic (MOV) provides the voltage protection, with bi-directional clamping, while the inherent capacitance, due to the multilayer construction, ensures effective lowpass EMI filtering up to at least 1GHz.

Maximum continuous dc working voltage

This is the maximum continuous dc working voltage which may be applied up to the maximum operating temperature of the varistor.

Nominal voltage

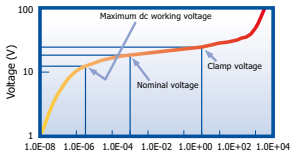
This is the voltage across the varistor when drawing a dc current of 1mA. It is this point that is notionally the start of the region of normal varistor operation.

Maximum clamping voltage

As a varistor is designed for handling transient voltages, all tests requiring currents in excess of 1mA are conducted as pulse tests.

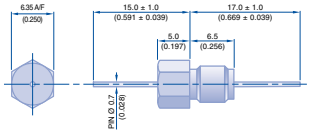
The clamping voltage of a varistor is the peak voltage appearing across the device when measured under the conditions of a specified pulse current and a specified waveform.

Varistor V-I characteristics



Current (A) typical varistor V-I curve

Circuit configuration



Electrical details	
Electrical configuration	See circuit configuration
Capacitance measurement	At 1000hr point at 1MHz
Temperature rating	-55°C to 125°C
Working voltages, Vdc	10, 14, 18, 26, 42
Capacitance range, nF	1, 2.2, 4.7, 10, *
Leakage current	100µA max @ 20°C
Maximum dc current	10A

*(Other values can be supplied, consult Sales Office for details).

Mechanical details	
Nut A/F	6mm (0.236")
Head diameter	6.35mm (0.25")
Washer diameter	9.1mm (0.358")
Mounting torque	0.6Nm (6.8lbf in) max. if using nut 0.3Nm (3.4lbf in) max. if into tapped hole
Mounting hole dia.	5.2mm ± 0.1 (0.205" ± 0.004")
Max panel thickness	3.4mm (0.134")
Weight	1.8g typical (0.06oz)
Finish	Silver plate on copper undercoat

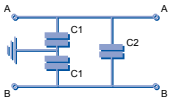
Type No.	Capacitance -20% +80% @1V, 1MHz	Typical insertion loss (dB) 50Ω system No load				Maximum continuous working voltage	Nominal voltage at 1mA dc		Max clamp voltage at 10A (8/20µs)	Maximum non-repetitive surge energy (10/1000µs)	Maximum non-repetitive surge current (8/20µs)
		1MHz	10MHz	100MHz	1GHz		Min.	Max.			
						V	V	V	V	J	A
SFCMV0260102ZM1	1000pF	0	4	23	41	26	30	40	60	1.5	300
SFCMV0420102ZM1						42	51	65	90	3	300
SFCMV0140222ZM1	2200pF	0	10	30	50	14	18.5	25.5	36	2	300
SFCMV0180222ZM1						18	22	28	40	2	300
SFCMV0260222ZM1						26	30	40	60	3	300
SFCMV0420222ZM1						42	51	65	90	3	300
SFCMV0010472ZM1	4700pF	1	16	36	55	10	13	20	30	1	300
SFCMV0140472ZM1						14	18.5	25.5	36	2	300
SFCMV0180472ZM1						18	22	28	40	2	300
SFCMV0260472ZM1						26	30	40	60	3	300
SFCMV0010103ZM1	10000pF	4	22	41	60	10	13	20	30	1	300
SFCMV0140103ZM1						14	18.5	25.5	36	2	300
SFCMV0180103ZM1						18	22	28	40	2	300

Note: For ordering information see page 22.

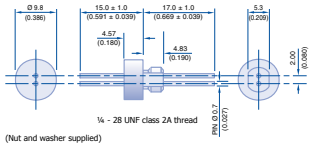
Panel mount EMI Filter - X2Y Integrated Passive Components

The Syfer balanced line filter is a 2-pin panel mounting device suitable for balanced lines and twisted pairs. It is ideal for passing lines through a bulkhead, and the feedthrough construction offers insertion loss performance up to 1GHz and above. The filter also incorporates capacitance line-to-line as well as line-to-ground, and therefore both differential and common mode filtering are offered in the same package. In this way one single device can replace three separate components.

Circuit configuration



Dimensions mm (inches)



(Nut and washer supplied)

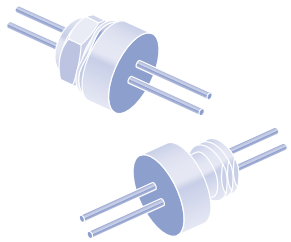
Electrical details		
Electrical configuration	See circuit configuration	
Capacitance measurement	At 1000hr point	
Temperature rating	-55°C to 125°C	
Dielectric withstand voltage	500Vdc	
Capacitance range, nF	Line to Ground (C1) 4.7, 10, 22, 47, 100	Line to Line (C2) 2.35, 5, 11, 23.5, 50

*(Other values can be supplied, consult Sales Office for details).

Mechanical details	
Nut A/F	7.92mm (5/16")
Head diameter	9.8mm (0.386")
Washer diameter	11.35mm (0.447")
Mounting torque	0.9Nm (10.2 lbf in) max.
Mounting hole dia.	 6.7mm O.D., 5.5mm A/F (0.264@ O.D., 0.217" A/F)
Max panel thickness	2.3mm (0.091")
Weight	3.0g typical (0.11oz)
Finish	Silver plate on copper undercoat

Type No.	Capacitance (C1) (±20%)	Dielectric code	Rated voltage (dc)	Current amps
SFJEB2000472MX1	4.7nF	X7R	200	10
SFJEB2000103MX1	10nF	X7R	200	10
SFJEB2000223MX1	22nF	X7R	200	10
SFJEB2000473MX1	47nF	X7R	200	10
SFJEB2000104MX1	100nF	X7R	200	10

Ceramic filter element manufactured in the UK by Syfer Technology Limited under licence from X2Y attenuators LLC.



Note: For ordering information see page 22.

The multilayer planar array is an application specific multi capacitor array designed for use in multiway EMI filter circuits. Derived from discoidal capacitor theory, it provides capacitance between the outside perimeter and the internal through holes.

The most common use of planar arrays is as the capacitor element in filter connectors, although they are also suitable in many other applications.

Syfer's core wet manufacturing process and ceramic handling expertise allows components to be produced with mechanical precision and electrical accuracy, enabling a filter assembly to withstand the most rigorous of electrical specifications. This has resulted in Syfer's position as the manufacturer of choice for the filter connector industry. To date, Syfer have delivered in excess of 3,000 different designs of planar array.

The quality and reliability of Syfer's planar arrays has been uniquely recognised by the approval of NASA for their use in the International Space Station.

Mechanical

With many years experience, Syfer have developed a comprehensive range of designs, including planform designs for the following connectors:

- Circular (MIL-C-38999, MIL-C-26482 and similar)
- Arinc 404 and 600
- 'D' sub
- High Density 'D' sub
- µD (MIL-C-83513)
- Nano 'D'

Special custom shapes and layouts can also be accommodated. Complex shapes including internal and external radii, multiple hole diameters and alignment guides can be considered.

As a guide, Syfer can manufacture planars to a maximum of 3.18mm (0.125") thick and to a maximum of 100mm (4.0") diameter or square.

Standard termination finish is gold plate over nickel for maximum electrical and mechanical performance. Options include conventional silver-palladium (AgPd) or silver-platinum (AgPt) fired terminations.

Solderless assembly/compliant spring clip

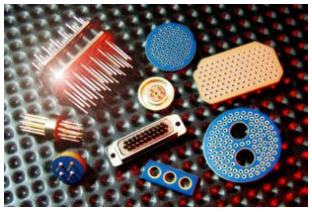
Solderless assembly of planars can be accommodated by the inclusion of compliant spring clips into the holes, allowing the array to be push fitted to through contact pins.

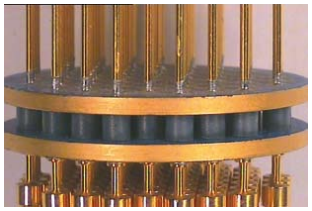
Syfer can supply a standard range of solder-in spring clips, or fit customer supplied compliant clips before shipping the finished array assembly.

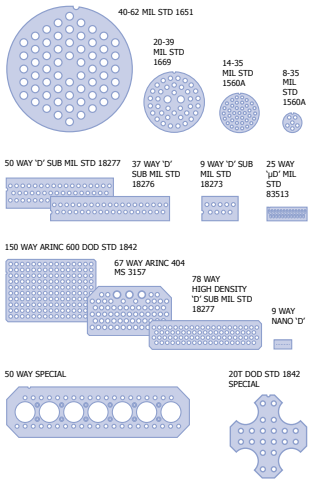
Contract assembly and technical back-up

Having an EMI filter assembly line alongside the ceramic manufacturing area allows Syfer to offer unprecedented technical back-up and advice to planar array and discoidal customers. This can include design and handling advice and forensic analysis assistance. Syfer personnel have many years experience in the use of planar arrays, having been involved directly in the development of the technology from its inception.

Syfer are also able to offer sub contract and prototype manufacturing services to planar customers and connector companies.







Electrical

- Only stable X7R and ultra stable C0G/NP0 dielectrics used
- Capacitance values from pF to µF
- High voltage capability - DWV (Dielectric Withstand Voltage) to 10kV
- Feedthrough low capacitance unterminated lines
- Grounded earth lines - maximum ground plane resistance specifications included
- Mix of capacitance values within planar – up to a ratio of 400:1 within individual planar possible
- Mixed capacitance lines / no cap feedthrough lines / grounded earth lines available within single planar

Quality

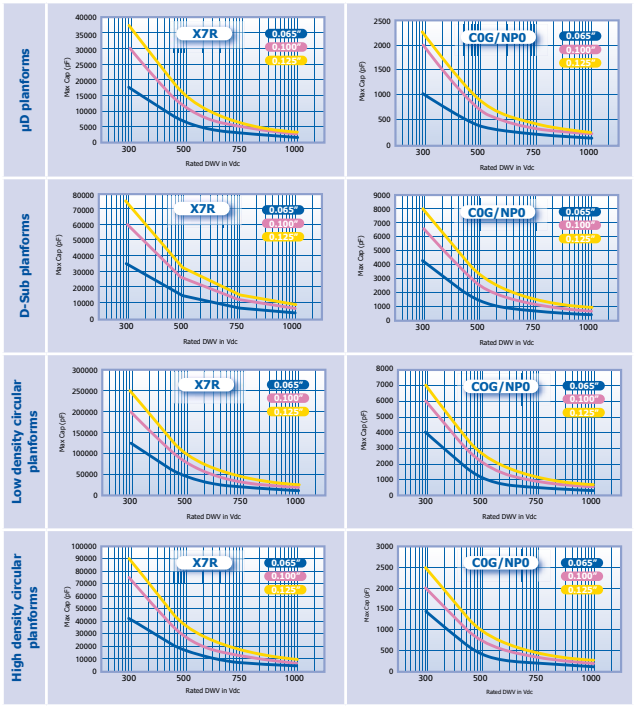
All planars are tested for the following:

- Capacitance
- Dissipation factor
- DWV (Dielectric Withstand Voltage)
- Insulation resistance
- Visual inspection
- Sample solderability and dimensional check

} 100%

100% SAM (Scanning Acoustic Microscopy) testing is offered as an option on all planars intended for more critical applications.

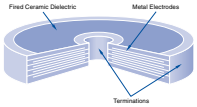
Graphs of typical maximum capacitance values against voltage for array thicknesses of 0.065" (1.65mm), 0.100" (2.54mm) and 0.125" (3.18mm).



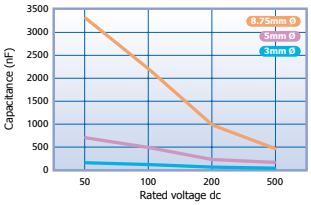
Discoidal multilayer capacitors

Discoidal capacitors are at the heart of many EMI filters. More robust and reliable than tubular capacitors, they offer higher capacitance options, with values up to several microfarads. In addition to standard configurations, Syfer is able to meet customers' specific drawings in terms of electrical performance and mechanical design.

Discoidal multilayer ceramic capacitors are of a configuration suitable for direct mounting into filters, onto bulkheads and hybrid circuits. Due to their geometry, they have excellent RF performance characteristics as well as very high self resonant frequencies. They are offered with a choice of C0G/NP0 or X7R ceramic, or in MOV (metal oxide varistor) material for voltage protection applications.

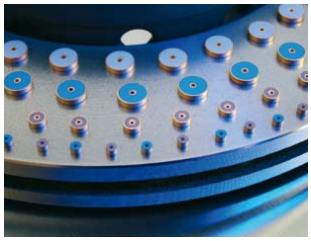


Typical capacitance vs disc size vs voltage
Based on typical hole diameter of 0.8mm, and X7R dielectric.



Varistor planar arrays and varistor discoidals

Varistor planar arrays and varistor discoidals provide a dual function. The use of metal oxide based ceramic (MOV) provides the voltage protection, with bi-directional clamping, while the inherent capacitance, due to the multilayer construction, ensures effective lowpass EMI filtering up to at least 1GHz.



General Specification

Dielectrics:
C0G/NP0, X7R, MOV

Mechanical:
Outer diameter 2.0mm minimum
Inner diameter 0.5mm minimum
Minimum wall thickness requirements apply
Refer to factory

Capacitance range:
pF to µF

Capacitance tolerance:
±5%, ±10%, ±20%, -0%+100%

Voltage:
50V to 3kVdc or higher

Operating temperature range:
C0G/NP0, X7R, MOV, -55°C to +125°C

Termination options:
Silver-palladium (AgPd), silver-platinum (AgPt), gold over nickel

To reflect the unique custom nature of discoidals and planar arrays, we do not list a standard range, but ask you to contact the sales office to discuss your specific requirement.

Special filters and assemblies

Manufacturing to customer designs or working together with the customer to develop a solution to a problem, Syfer offer the ability to modify standard filter designs or develop custom designs to suit your application.

Modifications to standard filters

Special mechanical outline

Typical examples:
- Lead lengths to suit
- Special thread options – e.g. M5 x 0.5 – 6g
- Special lead forms – e.g. headed pin / threaded contact
- Larger pin diameters
- Special body or pin finishes

Special electrical testing

Typical examples:
- Special test voltages – e.g. 500Vac 50Hz DWV test
- Special capacitance values
- 100% burn-in
- Higher current ratings possible

Special discrete filters to match your specific requirements

Manufactured to fit the customers specific requirements, electrical characteristics and space envelope. We can offer design solutions to meet your requirement or develop customer designs into production reality.

- **Example 1** -
  Battery terminal filter to meet precise environmental requirements and provide flat pin contact surface for connection to spring contacts on clip-on batteries. Designed to fit customers space envelope and meet specific electrical parameters.

- **Example 2** -
  Special SFSSC disc-on-pin decoupling stub filter for military application. Contact pin terminating inside discoidal and insulated from non pin side. Assembled with high melting point solder to allow customer to solder into panel.

Multiway filter assemblies

From a simple panel fitted with our single line discrete filters to a complex custom designed Pi filter assembly, we offer a full design and manufacture service. Assemblies can be based around discoidal capacitors for maximum flexibility or planar arrays for optimum space utilisation.
As an extension to our planar array range, we can offer soldered-in spring retaining clips for easy assembly into difficult applications such as hermetic sealed connectors and our extensive experience with filter connectors allows us to offer sub contract manufacturing to this industry sector.

- **Example 1** -
  4 way 22nF C section planar based filter assembly. DWV 2500Vdc, 100% tested. Supplied to sensor manufacturer for installation into commercial aerospace application.

- **Example 2** -
  85 way 1800pF L-C section planar based filter assembly, fitted into mounting plate for easy assembly. Designed to fit specific space envelope for military aerospace application

Please contact our sales office to discuss your specific filtering requirement. We would be pleased to provide a technical and commercial proposal.

Filters for Hi-Rel applications

Introduction
Syfer is experienced at providing products for the most demanding applications:

- Space - ESA and NASA projects
- Automotive - AEC-Q200 qualified
- Military and Civil aviation
- Motorsports - F1 and World Rally
- Oil / Downhole / Industrial
- Rail
- Medical

Syfer product qualifications include AEC-Q200, ESA vendor approval, and Space qualified planar arrays.

RoHS compliance
The full range of Syfer Resin filled and Plastic film filters are EU RoHS compliant to 2002/95/EC. Special finishes (eg. Sn/Pb) are available for exempt applications such as military and space. The hermetically sealed filter range is not RoHS compliant.

Surface mount
The surface mount C filter (E01, E07), Pi filter (SBSPP) and X2Y Integrated Passive Components (E03) are all available with Syfer FlexiCap™ (standard solderable proprietary flexible epoxy polymer termination material).

FlexiCap™ advantages
- Solves cracking problems caused by excessive mechanical stress
- The polymer allows greater degrees of Pcb deflection during de-panelisation, typically twice that of standard capacitors
- Permits more stress to be placed on components when using large through hole parts, eg. transformers, connectors, heatsinks
- More resistant to cracking due to temperature cycling
- No degradation in electrical performance
- Capacitors with tin-lead termination are also available with FlexiCap™ technology

The following are qualified to AEC-Q200:
- Surface mount C filter (E01 range)
- Integrated Passive Component (E03 range)

Ceramic based panel mount filters
Designed and manufactured to meet or exceed the requirements of MIL C 15733 and MIL C 28861. The test methods are in accordance with Mil Std 220 and Mil Std 202:

- Insertion loss
- Solderability
- Bump and vibration
- Temperature cycling
- Humidity
- Temperature rise under dc load

Special test requirements can be accommodated e.g. 100% burn-in.

Planar arrays and discoidals
Syfer were instrumental in delivering the standard for space approved planar arrays which includes Scanning Acoustic Microscopy (SAM) testing.

Plastic film filters
Plastic film filters are available/designed to meet the requirements of EN132400 and EN60950, Y2 or Y4 ratings. Please refer to specific catalogue pages for more details.

Additional Resources

Application notes

AN0001 - FlexiCap™ termination
Details of the FlexiCap™ termination, which helps prevent mechanical cracking of multilayer chip capacitors.

AN0011 - Solder alloy choice and stress release cracking in through hole ceramic capacitors
Solder alloy considerations when using through hole ceramic capacitors to minimise stress cracking.

AN0014 - X2Y Balanced Line EMI chip reliability and performance data
X2Y Component reliability and performance data.

AN0018 - Suppression for DC motors using X2Y
The application of X2Y chips for EMI Suppression in DC motors.

AN0028 - Soldering/mounting chip capacitors, Radial Leaded capacitors and EMI filters
This gives guidance to engineers and board designers on mounting and soldering Syfer products.

AN0031 - Metal Oxide Varistor planar array
Using MOV planar array technology for transient protection in filtered connectors.

Technical articles

Surface Mount filter article
An introduction to surface mount EMI filtering, and some of the filter components available.

Varistor planar article
Affordable transient protection, using multilayer planar varistor arrays in filtered connectors.

Advances in Surface Mount filtering technology
New integrated passive components for EMI suppression filtering.

Multilayer Varistor filters
Truly multi-functional passive components.

FlexiCap™ article
An introduction to FlexiCap™ and how it reduces mechanical cracking on PCB's.

Surface mount X2Y technology

The application of X2Y chips for EMI Suppression in stringent EMC demands, particularly in automotive applications.

Other related products

LTCC filters
New range of SMD filters for frequencies up to 6GHz using LTCC technology.

Available Sample Kits

A variety of sample kits are available from Syfer to help designers and EMC engineers to select the most suitable component for any particular application.

Surface Mount EMI Filters
Integrated Passive Components X2Y

syfer.com

Please see the Syfer website for further details, or contact the Sales Office directly.

SYFER
A DOVER COMPANY

BSC Filters Limited
Jorvik House, Outgang Lane, Osbaldwick, York YO19 5UP UK

Phone: +44 1904 438438
Fax: +44 1904 438123
Email: sales@bscfilters.com

Dielectric Laboratories, Inc
2777 Route 20 East, Cazenovia, NY 13035 USA

Phone: +1 315 655 8710
Fax: +1 315 655 0445
Email: sales@dilabs.com

Dow-Key Microwave
4822 McGrath Street, Ventura, CA 93003 USA

Phone: +1 805 650 0260
Fax: +1 805 650 1734
Email: askdk@dowkey.com

K&L Microwave
2250 Northwood Drive, Salisbury, MD 21801 USA

Phone: +1 410 749 2424
Fax: +1 443 260 2268
Email: sales@klmicrowave.com

Novacap
25111 Anza Drive, Valencia, CA 91355 USA

Phone: +1 661 295 5920
Fax: +1 661 295 5928
Email: info@novacap.com

Pole/Zero Corporation
5558 Union Centre Drive, West Chester, OH 45069 USA

Phone: +1 513 870 9060
Fax: +1 513 870 9064
Email: support@polezero.com

Syfer Technology Limited
Old Stoke Road, Arminghall, Norwich, NR14 8SQ UK

Phone: +44 1603 723300
Fax: +44 1603 723301
Email: sales@syfer.co.uk

Voltronics Corporation
100-10 Ford Road, Denville, NJ 07834 USA

Phone: +1 973 586 8585
Fax: +1 973 586 3404
Email: info@voltronicscorp.com

CERAMIC & MICROWAVE PRODUCTS
Electronic Components & Microwave Solutions
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www.dovercmp.com

Ceramic & Microwave Products (CMP) designs, manufactures and sells special electronic components and systems, including high-performance filters, switches, capacitors and EMI and cosite signal interference solutions. Our products are used in military, space, telecom infrastructure, medical and industrial applications where function and reliability are crucial.

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