WEMS ELECTRONICS
EMI FILTER GROUP

Glossary of EMI Filter Terms

ALUMINUM ELECTROLYTIC: A capacitor that uses a thin aluminum oxide layer on pure aluminum foil as a dielectric. An electrically active solution called electrolyte is part of the cathode of the capacitor.

ACTIVE FILTER: A filter made up of both active and passive components. It may provide amplification, as well as attenuation.

ATTENUATION: The ability of a filter to reduce interference on incoming or outgoing power lines. Expressed in dB (see Decibel).

BAND – ELIMINATION FILTER: A filter that rejects frequencies above and below a frequency, or frequencies, of interest.

BANDPASS FILTER: A filter that rejects frequencies above and below a frequency, or frequencies, of interest.

BASELINE: A document that establishes a procedure for controlling all changes to design sheets, outline drawing, cross sectional drawing, part procurement drawing, high reliability documentation and all procedures and processes, both assembly and test, used in conjunction with the manufacturing of parts to a customer's drawings.

BOLT STYLE FILTERS: Also referred to as Bushing Style Filters, Bolt Style Filters, and Screw Body Style Filters.

BUTTERWORTH: A filter specifically designed to have a maximally flat passband.

BUTTON FILTER: A cylindrical, or coaxial, style filter with a straight or nail head lead for a terminal. These filters are normally "C" or "L" circuits and are epoxy sealed on both ends.

CAPACITANCE REACTANCE: Opposition offered to the flow of alternating or pulsating current by capacitance, measured in ohms.

CAPACITANCE: The technically correct term for capacity. It is the measure of the amount of electrical charge stored in a capacitor expressed in farads. One farad is one coulomb of charge at one volt.

CHIP FILTER: A filter specifically designed for surface mount installation.

CHEBYSHEV: A filter design approach providing greater selectivity (for a given number of elements) than a Butterworth design by introducing some ripple in the passband.

CISPR: The international special committee for EMI/RFI suppression.

COMMON MODE INTERFERENCE: Interference which is present as a common potential between ground and all power lines, also referred to as asymmetric interference.

CONDUCTED EMI: Electromagnetic interference that exits or enters a piece of equipment via conduction on the power line.

CORNER FREQUENCY: The cutoff frequency.

CORONA: An undesirable electrical discharge resulting from lionization of gas within a capacitor. This is a particular problem with film capacitors in AC voltage conditions.

CUTOFF FREQUENCY: The frequency which determines the end of the passband, normally the 3 dB point.

CYLINDRICAL STYLE FILTERS: Also referred to as Coaxial Style Filters, Mini Filters, Sub-miniature Filters, Broadband Filters, Threaded Mount Style Filters, and Button Filters.

DECADE (FREQUENCY): An increase or decrease in frequency by a factor of 10. 1 kHz to 10 kHz is one decade.

DECIBEL (Db): Convenient method of expressing the ratio of signal levels i.e. input to output.

DIELECTRIC: The insulating material that separates the two plates of the capacitor. Common dielectric include mica, ceramic, plastic films, tantalum pentoxide, and aluminum oxide.

DIFFERENTIAL MODE INTERFERENCE: Interference which is present as a potential between individual power lines, also referred to as symmetric Interference.

DPA: Destructive Physical Analysis. A method of examining a filter or capacitor for defects, such as voids or de-laminations, by cross-sectioning.

ELLIPTIC FUNCTION: A design approach which yields maximum selectivity by introducing stopband and passband ripple.

EMC: Electromagnetic Compatibility

EMI: Electromagnetic Interference. Same as RFI.

EMISSION: the releasing or sending forth of either conducted or radiated EMI produced by some electronic device.

EMP: Electromagnetic Pulse. A high energy electromagnetic pulse resulting from a nuclear detonation in the stratosphere.

ED: Electrostatic discharge.

ESL: Equivalent series inductance. The extent to which the capacitor acts as though there were an inductor in series with the capacitor. ESL is generally undesirable especially at high frequencies.

ESR: Equivalent series resistance. The extent to which the capacitor acts as a resistor when charging and discharging in an electronic circuit expressed as a resistance in series with the capacitor.

FEED-THROUGH CAPACITOR: A three terminal capacitor where the third terminal is grounded. The capacity is between the line passing through the capacitor and ground.

FEED-THROUGH FILTER: A filter designed for bulkhead mounting. All signals must “feed-through” the bulkhead.

FILM CAPACITORS: Capacitors made out of any plastic, polyester, polypropylene, and polystyrene, being the most common.

FILTER: An electronic circuit that offers minimum opposition to the passage of certain signals, but offers maximum opposition to others.

GAIN: Ratio of output to input at a certain frequency. The filter both amplifies and attenuates if the gain is greater than one.

HERF: An acronym for High Energy Radiated Fields. This type of radiated susceptibility testing generates electric fields in excess of 1000 volts per meter to simulate close lightning strikes, normally applicable to aircraft testing.

HI-POT: High-potential test. A test for determining the breakdown point of insulating materials and spacing also referred to as dielectric withstanding voltage.

HIGHPASS FILTER: A filter that passes frequencies above a specific frequency.

IMPEDANCE: A measure of the total opposition to current flow in an AC circuit.

INSERTION LOSS: The measured signal at a given point of the circuit at a specified frequency without a filter in the circuit. This is compared to the signal level obtained at the same point with the filter inserted into the circuit.

LEAKAGE CURRENT: The current that flows from the power line to ground potential when power is applied to the device in question. If the device becomes ungrounded, it could become a shock hazard.

LINEAR POWER SUPPLY: A power supply having an output voltage bearing a direct or linear relationship to the input voltage. Transformer power supplies with capacitive input filters are categorized as linear power supplies.

LOWPASS FILTER: A filter designed to pass frequencies below a specific frequency.

MIL-STD-202: A military specification delineating the electrical and environmental test methods for electronic parts. MIL-STD-202 is referenced in filter specifications MIL-PRF-15733 AND MIL-PRF-28861.

MIL-STD-220: A military specification delineating the test methods for measuring the insertion loss of a filter in a 50 ohm system. This document does not specify minimum limits and cannot be correlated to the requirements of MIL-STD-461.

MIL-STD-461 (462, 463): A joint service military specification that limits the level of conducted and radiated emissions (EMI) emanating from military subsystems and systems. This specification also establishes minimum levels of conducted and radiated susceptibility including EMP. EMI filters *do not* meet MIL-STD-461. EMI filters cause systems to comply with the requirements by reducing the conducted emissions.

MIL-PRF-15733: A general military specification for all types of radio frequency interference filters and capacitors.

MIL-PRF-28861: A general military specification specifically intended for EMI filters and capacitors that utilize ceramic dielectric capacitors. MIL-PRF-28861 is a more stringent specification than MIL-PRF-15733 and will eventually replace some of the filter slash sheets in MIL-PRF-15733.

MIL-STD-790: A military standard that defines the criteria for electronic parts reliability assurance programs which must be adhered to by manufacturers qualifying parts to specifications where established reliability is required.

MULTICIRCUIT FILTER: A custom engineered filter assembly whose main function is to provide filtering for primary input power lines (AC and DC) and, in some cases, the output or signal lines.

MULTILAYER CERAMIC (MLC): A ceramic capacitors manufactured by stacking many alternating layers of ceramic dielectric and conductive plates.

NOISE: A random or persistent electrical disturbance that can obscure or reduce the clarity of quality of an electrical signal or function.

NOTCH FILTER: A filter designed to reject a small band of frequencies, passing the low frequencies and the high frequencies.

OCTAVE (FREQUENCY): An increase or decrease in frequency by a factor of two. 6 MHz to 12 MHz is one octave.

The insertion loss of a filter increases at a rate of 6 dB per filter pole per octave in the reject band. The insertion loss of a Pi circuit filter will increase by 18 dB from 6 MHz to 12 MHz.

PASSBAND: The band of signal frequencies to which a filter offers minimum opposition.

PASSIVE FILTER: A filter comprised of only passive, reactive and resistive elements (resistors, capacitors, and inductors). The maximum gain of this type filter is less than one.

PASSIVE NETWORK: An electrical circuit comprised of passive components (resistors, capacitors, and inductors).

PDA: Percent Defective Allowed. The number of defective parts (failures) expressed as a percent of the lot, that are permitted for a given test or group of tests.

POWER LINE FILTER: A type of filter intended to prevent power line noise from entering electrical or electronic equipment. These filters also prevent digital signals from leaking out onto the power supply line.

REJECT BAND: See stop bend.

RFI: Radio Frequency Interference. Same as EMI.

SELECTIVITY: A term used to describe a filter's ability to distinguish between frequencies.

SOLDER-IN STYLE FILTERS: Also referred to as Eyelet Style Filters and Sleeve Mount Filters.

STOP BANK: The band of frequencies to which a filter offers maximum opposition.

SUSCEPTIBILITY: The ease with which an item of electronic equipment is affected by the influence of an outside RF signal source, which is being conducted or radiated in the equipment.

SWITCHING POWER SUPPLY: A power supply which uses transistors to switch a rectified and filtered DC voltage at 20 kHz or higher rate. This high frequency voltage is then applied to the primary winding of a transformer. An advantage of using this technique includes high efficiency in the power conversion process. Also, smaller transformers can be used, which results in a lightweight power supply.

TEMPEST: A general term for the protection and prevention of classified sensitive information being extracted electromagnetically. Electronic eavesdropping.

TRANSFER CHARACTERISTICS: Ratio of a filter's output to its input voltage as a function of frequency.

TRANSFER FUNCTION: A mathematical expression used in the synthesis of a filter design. Mathematically expressing the transfer characteristic.

TUBULAR CERAMIC CAPACITORS: A feed-through capacitor formed on large presses which extrude a mix of ceramic powders, organic binders and solvents. After firing, the tubes are cut to the desired length, .5 to 1.0 cm, using high speed a diamond saw. Electrodes are then applied to the OD and the ID of the tube.

TUNABLE FILTER: A filter having a corner, or center, frequency which can be adjusted or tuned.