

# EMC Details and Fixes



Electromagnetic Compatibility is a major concern for designers due to fast system clocks, complex miniature systems and interaction of systems in networks. AVX offers a free EMC Solutions Course, which includes an EMI “fix it”, kit of samples.

## **Signal Termination Mismatches**

In an ideal world the respective load into which the signal is intended for would consume all of the signal energy. No energy would be reflected back and available for radiation. This is not the case in the real world.

In the real world, signal drivers are not terminated into loads equal to the drive impedance. Though this is the case for RF designs (50 ohms impedance is maintained in the system) digital designs do not follow this rule. Since constant impedances are not maintained, designers must identify noise sources one by one, classify them in terms of frequency and energy content, and then take action to attenuate the noise.

Once identified, noise sources may then be “modified” to reduce their EMC content- e.g. slow the rise time on a clock, drop the duty cycle or they must be dealt with through additional methods. Typical reduction methods are the introduction of shielding, filtering (capacitors, inductors) and impedance matching (resistors).

## **Simplified Noise Sources**

### **System Clock**

The system clock is typically a major source of noise. Typically the noise content of a clock occurs in the first three harmonics of the fundamental frequency (there are variations of this due to differing duty cycles of the clock). System clock noise can be minimized through the use of FeedThru filters and isolating the clock Vcc from digital Vcc (a 33ohm/100 mhz ferrite can work well). Attachment 1 describes AVX LC T type FeedThru filters.

### **Functional Circuits**

Transistors, ICs, Diodes and subsystem modules all switch, amplify and attenuate signals. ICs typically are the largest contributor of noise in this group. When an IC is idle, all outputs are at a steady state - typically zero. The DC load of the IC is constant. As the IC turns on and starts functioning the DC load to the power supply varies greatly and unpredictably over time. Large, more complex ICs exponentially add to this problem. Typically, IC manufacturers add more power and ground pins to the most complex ICs in an effort to reduce voltage drop during complex worst-case operations. Low inductance filter capacitors are placed at each Vcc pin to further minimize the DC load variation on the supply. See attachment 2 for an example of low inductance capacitor options.

Further, bulk capacitors exhibiting low inductance should be considered. Tantalum, Niobium Oxide and high C/V ceramic capacitors are good options for bulk capacitance.

## **AVX Fixes**

AVX has a variety of components to reduce EMC problems in systems and sub assemblies.

### **LICC, IDC, LICA**

AVX Low Inductance Capacitors can be used for effective decoupling across all levels of Vcc bus requirements. Additionally, Low Inductance Capacitors can be used at the output of regulators for effective broadband decoupling.

### **OxiCap & Tantalum Capacitors**

These devices are ideal on the output of the regulators to reduce ripple voltage to the load. Additionally they can be used as bulk capacitors around the PCB.

### **FeedThru Filters**

AVX offers both high current (2amp to 5 amp) FeedThru Filters (W2H series). These are ideal for broadband EMI attenuation on LDO and power circuitry. Low current FeedThru Filters in discrete and array configuration are available. These are ideal for LCD display filtering (arrays) as well as mixed signal interfaces. If the PCB should have poor ground planes AVX offers the KNH, KNF, KNA series. The non-symmetrical filters are ideal for poor ground PCBs.

Additionally AVX offers bulk head mountable (bolt in and solder in) C, LC and Pi filters.

Please contact your AVX sales representative for this seminar or to receive the EMI ‘fix it’ kit.

For further reading refer to the AVX Applications Guide to EMI, RFI, ESD solutions or to the AVX EMI designer's seminar notes.