

Countermeasure for Power Supply Line Harmonics (noise)

Electro Magnetic Interference / Electro Magnetic Compatibility Countermeasure

**POWERFILTER (KHLC series)**

EMI / EMC problem occurs when memory or logic circuit ICs are composed of several logic circuits on the board, but each ICs has no problem during action of single substance. Harmonics that each ICs of a single mounted occurs into the logic circuit, combines and propagates on the bias current circuit when mounted by several pieces of IC. The harmonics produced by the other IC’s harmonic coming from the bias current line is the cause to distribute complex broad harmonics. By inserting the **POWERFILTER (KHLC series)** in the power supply line (BIAS Circuit), it will prevent the entry and leaking of harmonics into IC.

The Fundamental EMI / EMC Countermeasure That Eliminates the Unnecessary Radio Waves (noises) of Electronic Circuits

At present, the EMI / EMC countermeasure practiced by most electronic equipment manufacturers are to add conventional EMI / EMC countermeasure parts in order to remove the unnecessary noises from the circuit board. However, with the GHz speed up of digital signals is considered, this method is becoming feasible.

Presently, most countermeasure parts firms are in a process where temporary expedient is taken by improving only the parts that have stopped functioning each time there is advancement in speed up of parts being used. The KRFM’s **POWERFILTER** for power supply is the most newest concept to stop fundamentally the EMI / EMC.

Harmonics Easily Superpositioned On DC Power Supply Voltage

All ICs acts by DC (Direct Current) supply. Unlike AC (Alternating Current), DC electric potential doesn't move and is fixed. Therefore, DC easily combines with AC signal (harmonic is the same, too), which is an alternating electric potential.

There was no problem during the stage when clock of digital electric equipment was moving slowly. But, high-speed transmission was put to practical use at present, and a GHz clock signal became natural.

The EMI / EMC countermeasure of the digital circuit is difficult all the more in the method of used bypass capacitor. And present countermeasure parts of passive elements cannot correspond anymore to the speeding up of semiconductor.

Harmonic is easily superpositioned into DC power supply line because it is stable.
Harmonic Countermeasure of DC Power Supply Line Which Has Been Overlooked

Even if the harmonic distribution (component) included in the clock pulse is observed with the use of an Oscilloscope (time domain), the harmonic superpositioned in the signal and power is not observable.

In the field of digital technologies, the superpositioning of the harmonic is difficult to be understood because usually spectrum analyzer is not used in measuring the frequency domain.

Therefore, it is in the present situation of speed up corresponding products being developed one after another as required without the fundamental solution against harmonic superpositioned on the power supply line.

The Ultimate Cause of EMI/EMC Problem In The Harmonics Superpositioned In The DC Power Supply Line

To propagate (transmit) a digital signal (rectangular wave) correctly and at high speed, the harmonic waves whose bandwidth is extended to over ten times the fundamental frequency (7th, 11th...order) must be propagated through the signal transmission line. The more the digital clock speeds up, the more rapidly the harmonic bandwidth expands.

However, these harmonics are unnecessary and deleterious in places other than the signal transmission line. Because, discharging of such harmonic to the power line and to the other ICs through the power supply line are the ultimate causes of the EMI/EMC problem.

Example: Radiation spectrum for EMI/EMC problem
Harmonics That Extends Over A WideBand Cannot Be Suppressed Even By Use of Several Bypass Capacitors

The presently used bypass capacitors have specific bands to each product, and they can bypass only a very narrow range as compared with the harmonic bandwidth. With such, method making it correspond to the wideband was adopted by using several products that could correspond to different bands.

However, at present day when small size, multifunction, and high efficiency products are being demanded, suppression of the harmonic that has extended to the microwave band is only possible by combining not only the capacitor but several parts, including the inductor. Design and mounting have become difficult because multiple parts must be used.

Furthermore, it is not realistic since DC resistance value is increased and voltage sag is caused when multiple parts are mounted. What is more, there is no existing product capable of suppressing until the microwave band.

POWERFILTER Eliminating the Harmonics Over a Wideband

KRFM’s POWERFILTER is a hybrid type band elimination filter combined with our original filters of different specified band of frequency. Harmonics (noise) from the power supply line can be eliminated over the wideband from a little over 10 kHz even to the microwave band which the conventional components could not respond.
< In case of using conventional Bypass Capacitors >

+ D.C.Power line

IC₁  IC₂  IC₃

Signal Line  Signal Line  Signal Line

Vcc

- D.C.Power line

< In case of using POWERFILTER (KHLC) >

+ D.C.Power line

KHLC  KHLC  KHLC

Signal Line  Signal Line  Signal Line

Vcc

- D.C.Power line

All unnecessary harmonics that could not be suppressed by the Bypass Capacitors are superpositioned to the power line.

COMPLETLEY CUTS OFF the unnecessary harmonics.