

Complete Grounding Inside Equipment for Combined ESD and EOS Protection

OnFILTER' miniature ground line filters GLE04-01 (Figure 1) block propagation of high-frequency noise via ground wires assuring equipotential ground throughout the tool and adding EMI-caused EOS protection to ESD grounding.

Background

If you look inside any equipment engaging in electronic manufacturing - semiconductor, LCD, electronic assembly and others - you most likely will see ground wires connecting its various parts (Figure 2). Equipment manufacturers do it in order to make sure that every conductive part of the tool, especially the ones coming into contact with sensitive devices, is grounded. Floating metal are problematic for ESD control causing unsafe ESD environment for sensitive devices. When the parts of the equipment are not just fastened together but are moving or are mounted on non-conductive or painted sections of the tool, the only way to positively assure their grounding is by dedicated wiring.

Properly done ESD ground indeed reduces ESD exposure during handling - it assures that all conductive parts in the tool have the same DC voltage. But what about EOS - **E**lectrical **O**ver**S**tress? According to Intel ([Intel® Manufacturing Enabling Guide](#), 2010, Section 3.2), "EOS is the number one cause of damage to IC components." Data from various semiconductor and PCBA manufacturers corroborate it.

Electrical overstress is caused not by static charge but by stray voltages and currents in the tool. Damaging levels of EOS are several magnitudes lower than that of ESD. IPC-A-610 standard that governs assembly of circuit boards worldwide recommends maximum 0.3V exposure to sensitive parts - significantly less than typical hundreds of volts for ESD. ITRS (International Technology Roadmap for Semiconductors - <http://www.ITRS.net>) specifies similar EMI-caused EOS limits. This is because EOS signals last much longer time and, unlike ESD events, are often repeatable. They are capable of providing significantly higher energy into the devices than ESD events and are much more likely to cause latent damage.

EOS Sources Inside Equipment

Any electrical equipment generates unwanted high-frequency voltages and currents in a course of its normal operation. This electrical noise is often called EMI - **E**lectro**M**agnetic **I**nterference. It resides on power lines and ground. Usual sources of EMI in equipment are servo motors and variable frequency drives (VFD), relays and solenoids, switched mode power supplies, UPS, LED and CFL lighting, incoming AC power and many other sources. Typical frequency spectrum of this type of noise is between ~40kHz and 10MHz. High frequency signals propagate quite differently from DC and 50/60Hz low frequencies. A regular grounding wire that provides near-zero resistance for DC, at high



Figure 1. EMI Ground Filter for In-Tool Applications GLE04-01

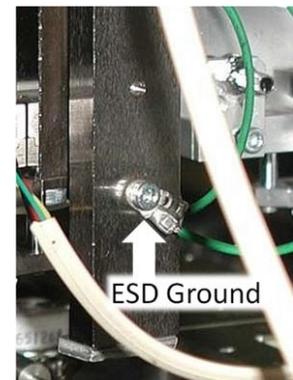


Figure 2. Typical ESD grounding inside the tool

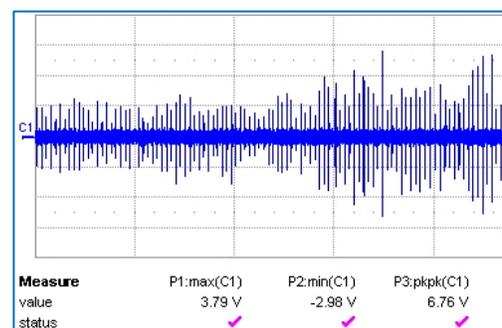


Figure 3. Ground voltage between robotic arm and test socket in the IC handler

frequencies is a high-impedance inductor which together with parasitic capacitance to other metal parts causes resonances. A combination of grounded metal parts and wires creates a practically undecipherable network of phase shifts, resonances and impedances. The end result is that high-frequency voltage in one spot of the tool may be quite different from any other place. Figure 3 shows voltage difference between the two parts of IC handler - robotic arm and test socket. Both parts are properly ESD-grounded. Yet, the voltage between them is almost 4V peak which is a magnitude higher than is specified in the standards.

As seen, ESD grounding is no guarantee of equipotential situation at high frequencies. It is realistically impossible to provide such equipotential situation at high frequencies given the complexity and the variety of all the parts and the noise sources that go into the tool.

Blocking Propagation of EMI in Equipment

The only practical way of assuring equipotential environment on ground at high frequencies is to block propagation of high-frequency currents in the tool. OnFILTER designed special miniature ground EMI filters GLE04-01 that connect in line with regular ESD grounding. They offer less than 0.2 Ohms resistance for ESD protection and are very effective in blocking high-frequency currents - see Figure 4. Together with regular ESD grounding GLE04-01 provides complete protection against ESD and EOS on tool's ground.

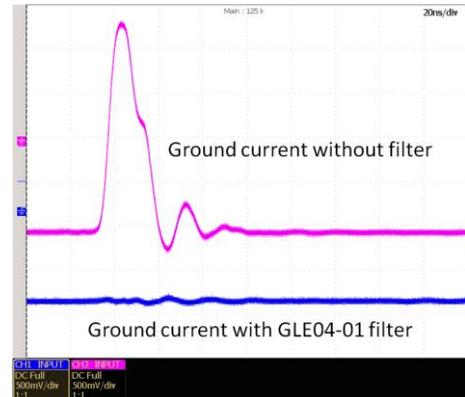


Figure 4. Ground filter GLE04-01 blocks EMI current

Installation

Ground filter GLE04-01 is designed for ease of installation. It is very small and can fit in tight spaces. GLE04-01 can be fastened using its mounting holes or simply using tie wrap or Velcro or event double-sticky tape.

OnFILTER can provide versions of GLE04-01 for extended temperature range as well as for different mounts - please contact us.

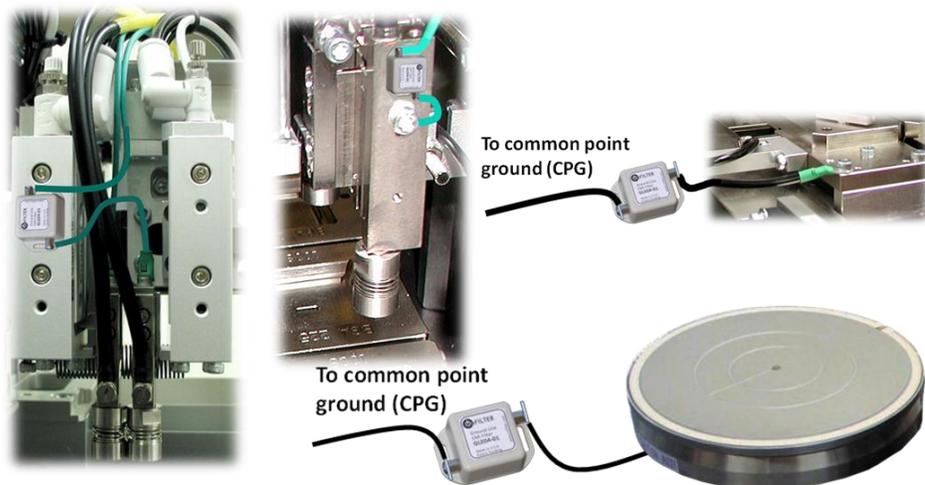


Figure 5. Examples of GLE-04-01 installation in equipment

Conclusion

OnFILTER' ground filters GLE04-01 installed in line with ESD ground in equipment provides complete safe environment for both ESD and EMI-caused electrical overstress. Please visit www.onfilter.com for more detailed information. Contact us at info@onfilter.com with any questions.