New Materials Solutions Deliver Miniaturization-Friendly, In-Package EMI Shielding Options

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The issue of electro-magnetic interference (EMI) has been well-understood by electronics specialists for decades. If not controlled, EMI -- which is a disturbance to an electrical circuit due to electromagnetic coupling from external sources -- can compromise or inhibit the function of a circuit and can lead to data degradation or loss. Traditionally, the most common way to protect against EMI is through EMI shielding caps – metal lids attached to grounding pads -- to prevent outside interference, minimize interference between components within a design and to prevent crosstalk of components on printed circuit boards (PCBs). This solution is effective, but market dynamics are forcing non-conventional approaches to EMI shielding.

The drive toward highly miniaturized designs, increased integration and greater functionality is driving package designers and materials specialists to innovate new approaches to EMI package shielding. Not only are device dimensions dictating smaller package profiles, which limit the use of traditional cans, but multiple parts that have higher and lower operating frequencies are now within the same package and can experience EMI. So now, not only is there package interference concern with other adjacent packages on the same board, but with parts within the same package. This is the case with today’s System-in-Package (SiP) designs and, in the longer-term, EMI will also have to be addressed for system-on-chip (SoC) devices.

Understanding material formulation complexities and in-field performance requirements, the materials specialists at Henkel have begun developing some novel solutions for EMI shielding. The three Henkel approaches address solutions for traditional package shielding, SiP compartment shielding and shielding in package and are promising strategies to manage current and future challenges.

First, Henkel is actively working on two different methods for cap shielding. While conventional metal cans provide good board level package shielding at comparatively low cost, the cans are not practical as designs become thinner and smaller. Some industry alternatives have already emerged and include plating and sputtering shielding material directly onto the package so as to lower the profile and deliver a thinner conformal shielding solution. While both of these methods are being used in production, they do have some drawbacks. Primarily, the challenge with plating and sputtering is the ability to cover the sides of the package at the strip level prior to singulation. Sputtering requires the individual parts to be singulated first, placed on a dicing tape, marked before coating and then coated: it’s a time-intensive and expensive process. The two alternatives Henkel is investing resource in are techniques that enable coating and part marking prior to singulation. The first method leverages the speed of stencil printing and has been successfully carried out at a well-known package subcontractor. The second approach is a unique spraying deposition method that can apply a very thin coating on the top of the package
and in the narrow pre-singulated molding lanes, delivering a streamlined and high UPH solution. Both conformal shielding methods are being developed in tandem, with early results very promising.

For SiP devices, where targeted die need to be separated from each other to avoid signal interference, Henkel has commercialized two gap filling materials that create two Faraday cages to separate the die from each other within the package. Once the part is molded, a groove is laser cut through the mold compound down to the package substrate and runs in conjunction with a series of ground pads that are in the printed circuit board (PCB). That gap then has to be filled, which is challenging. Filling the gap aspect ratio, which can be anywhere from 5:1 up to 10:1, involves not just depositing the material, but also displacing the air so that the gap is completely filled. Henkel’s LOCTITE® ABLESTIK® ABP 2820 and LOCTITE® ABLESTIK® ABP 2821 are currently the market’s only viable materials for this application. Both materials are high solids loading conductive epoxy/acylate systems that are jetted into the gap to effectively fill them while providing low shrinkage, good adhesion and low voiding. The materials create the fourth wall of the Faraday cage and deliver robust compartment shielding in a high UPH process. Following this process, the package is then coated with a conformal shield as described above.

Finally, Henkel’s innovative technologists have moved from the package to the chip and have applied for a patent for materials that provide shielding directly on the die in the package. Put simply, instead of the Faraday cage being formed on the outside of the package as in the SiP process, this takes the idea to the chip level. Using novel encapsulants, shielding materials and then final molding compound, a package within a package that already contains shielding functionality is formed. Indeed, it is a novel concept and one for which Henkel has already applied for patents on the enabling materials. Beta testing will soon be underway, moving the industry closer to a viable, user-friendly in-package shielding solution.

Package- and chip-level functionality will only continue to increase, driving the need for creative solutions for EMI shielding to protect device and product performance. With a forward-looking approach, Henkel has already developed innovative materials and processes for on-package and in-package shielding, offering manufacturers high UPH, cost-effective ways to achieve design and performance objectives. For more information on any of Henkel’s package shielding solutions, visit www.henkel.com/electronics or call +1-888-943-6535 in the Americas, +32 1457 5611 in Europe or +86 21 3898 4800 in Asia.

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