

Improved Solderability for MLVs Using Nickel Plated Terminations

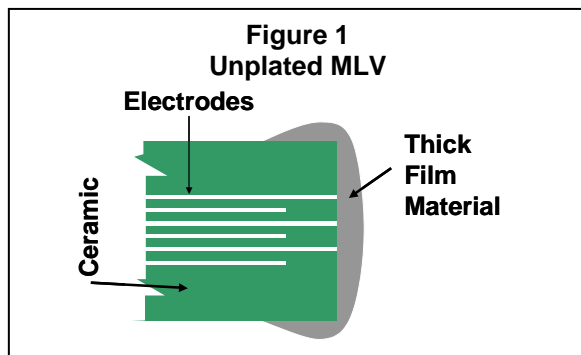
Varistor Solderability



Historically, the solderability of Multilayer Varistors (MLVs) has been a problem for the electronics manufacturer. He was faced with a device that either did not wet as well as other electronic components, or had its termination material leached away during the assembly process. However, by utilizing proprietary procedures, AVX Corporation provides the market with a MLV that has solderability comparable to that of other electronics components, and resists leaching during assembly.

Background

The basic construction of an unplated MLV is presented in Figure 1. The external termination

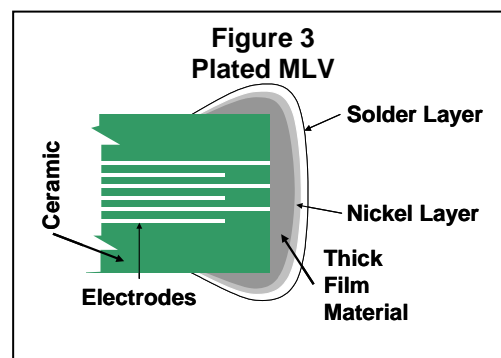
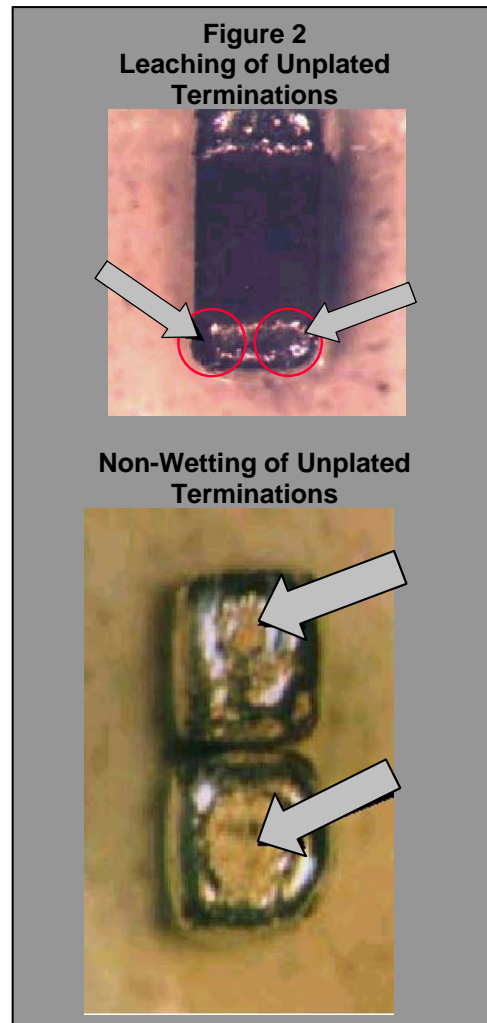


is a metal that connects the internal electrodes to the circuitry of the assembly using the MLV. The external electrode must accomplish two goals. First, it must be sufficiently solderable to allow the solder used in assembly to wet the end of the chip and make a reliable connection to the traces on the circuit board. Second, it must be robust enough to withstand the assembly process. This is particularly important if wave soldering is used. Unfortunately these two goals are competing. In order to achieve good solderability, an alloy high in silver content is chosen. However, this alloy is prone to leaching during assembly, so an additional metal is added to improve the leach resistance. While this improves the leach resistance, this addition makes the termination less solderable. The results are either terminations that leach away, or do not solder well (see the photographs in Figure 2)

Clearly, a plated termination system (as seen in Figure 3) is desired. This system, which is typical of other electronic components such as

capacitors and resistors, produces a much better assembled product.

In the plated termination, the base termination layer is still used (it provides contact from the



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electrodes to the circuitry). On top of the base termination is a layer of nickel. This is the surface to which the solder bonds during

assembly. It must be thick enough to stay intact during IR reflow or wave soldering so that the thick film material does not leach away. It must also be thick enough to prevent the inter-metallic layer between the thick film termination and the nickel layer from affecting the solderability.

In order to protect the nickel (i.e. maintain its solderability), a layer of solder is plated on top of the nickel. The solder preserves the solderability of the nickel layer. It must be thick and dense to keep oxygen and water from reaching the nickel layer.

The Challenge

Zinc oxide varistors are semi conductive in nature – that is what allows them to “turn on” and divert a damaging transient away from sensitive electronic circuitry and safely to ground. This semi-conduction poses a major problem for the manufacturer that wants to plate the terminations – the ceramic plates also! This condition, overplating, must be controlled, as it is cosmetically undesirable and could result in an unwanted path of conduction across the chip.

Early efforts in plating MLVs revolved around limiting the time that the chip was in the plating bath. This helped prevent overplating, but also produced chips with marginal solderability. The photographs in Figure 4 depict the problems that occur when the plated layers are not thick enough.

The Solution

AVX has developed a proprietary process that passivates the ceramic surface of the MLV. This allows us to plate the parts for a longer time without getting the overplate. This results in significantly thicker layers of nickel and alloy

plated onto the base termination. These thicker layers translate into bond strengths that are typically twice those of our competitors and solder fillets and parts that pass all measured of solderability (as seen in Figure 5).

AVX: The solution for MLV assembly problems.

