

The highest quality capacitor in the world is not very useful if it cannot be reliably and precisely transferred to the customer's circuit. To ensure product integrity and ease of application, packaging has become an increasing important part of component technology. This edition of Tech Topics describes the subject with an article by Dave Penny, a packaging engineer in KEMET's Engineering department.

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Component Packaging

by David L. Penny

Introduction

KEMET's commitment to providing world-class products and services includes attention to the method and materials used to pack ceramic and tantalum capacitors. Although packaging appears to add little value, it significantly impacts the customer's identification of and access to the product. To be effective for the customer's operation, packaging must consistently feed the components smoothly to the pick-up head, maintain the position of the part, and allow easy removal. As suppliers, we must meet these requirements while keeping costs low. As capacitor size and price decrease, effective packaging becomes increasingly important to the total cost of the product.

This article describes KEMET's position on surface-mount packaging. The packaging of components involves three basic operations: placing the product in carrier tape, sealing the carrier tape with cover tape, and winding the tape onto a reel.

Packaging Materials

Carrier Tape

Most carrier tape on the market today is made of either cardboard or embossed plastic (both conductive and insulative).

Cardboard carrier tape is a laminated construction with a punched pocket. The bottom of the carrier is sealed, usually with rice paper, creating a cavity. KEMET uses cardboard carrier tape; although cost-effective, the material has the drawbacks of limited thickness and paper dust created during the slitting and punching operations.

Embossed plastic is the most popular carrier tape material. KEMET uses both plastic and plastic laminated aluminum (for ceramic product only).

The plastic carrier is a homogeneous construction of Polycarbonate (for 8mm product) and Polyester (for

12mm). Manufactured through a hot forming process, both plastics are very durable, dimensionally stable, and capable of forming a large range of pocket dimensions. Advantages for the customer include easy access for inspection of components in the tape, and adaptability to the feeders of pick-and-place equipment. The major disadvantage of plastic carrier tape is cost.

Developed as an alternative to the plastic material, the aluminum carrier is a laminate with a base of aluminum, a bottom layer of Polyimide, and a top - or seal - layer of PVC. The pocket is formed in a cold form, punch, and die operation. The aluminum carrier offers excellent dimensional stability and seal consistency (peel force) at a lower cost than the plastic carrier with a pocket depth suitable for components up to 1.4mm thick. However, some customers do not prefer aluminum because it is not widely used in industry and, due to its ductility, can cause cutter problems on pick-and-place feeders that cut waste carrier tape into small sections for disposal.

Cover Tape

Cover tape is designed to hold the component in the carrier tape pocket securely during shipment, storage, and production. It is a laminate, usually comprised of a top layer of Polyester (PETG), a center layer of adhesive used to hold the top and bottom layers together, and a bottom layer of sealant. The sealant is often a polystyrene resin that acts as a hot melt bonding layer to secure the cover to the carrier tape during the heat-sealing operation performed on the taping machine.

KEMET uses both insulative (for tantalum product) and static dissipative (for ceramic) cover tape. Cover tape should maintain a consistent peel force. Control of the variation from the target force is an important factor in achieving trouble-free placement.

Cover tape can present several problems to pick-and-place equipment. The following chart outlines the most frequent causes, and summarizes KEMET's strategies for minimizing these issues.

Reels

KEMET chip reels are dissipative white Polystyrene (PS) or High Impact Polystyrene (HIPS). They are available in four sizes: 178/180 x 8mm or 12mm, and 330 x 8mm or 12mm, and meet the requirements of EIA-481-1.

Problem	Potential Causes	Preventative Measures
Cover Tape Tearing	Misaligned seal shoe or cover-to-carrier tape, which creates sealing too close to the edge of the cover tape.	Cover tape / seal shoe alignment operation closely controlled
	Defective or nicked cover tape.	Tape purchased only from approved suppliers with demonstrated control of critical performance characteristics.
Cover Tape Delamination	Seal shoe misalignment.	Alignment operation controlled.
	Defective cover tape.	Tape purchased only from approved suppliers with demonstrated control of critical performance characteristics.
Electrostatic Charge (small ceramic components)	Excessive charge potential between carrier and cover tape during peel-back.	Peel force is closely monitored. Static dissipative cover tape is used.*

KEMET components are not susceptible to electrostatic discharge (ESD) from a functional standpoint. KEMET uses static dissipative cover tape to prevent ceramic product from sticking to the cover tape and to reduce the electrostatic charge generated during cover tape peel-back.

Environmental Issues

Recyclable packaging materials and eliminating large volumes of waste are of growing concern today. Both reels and plastic carrier tape are recyclable. Recycling the reels is a logical first step. KEMET is in the early stages of a pilot program that focuses on 13-inch reels.

New Developments

Two new methods for packaging product at significantly reduced cost and increased pick-and-place efficiency are available upon customer request: cassette bulk packaging and 2mm pitch carrier tape.

Cassette Bulk Packaging

Under this approach, non-polar components (1206 and smaller) are loaded into cartridges for shipping and storage. The customer then transfers the components from the cartridge into a cassette that orients and presents them to the machine pick-up location.

Cassette bulk packaging requires less shipping and storage volume, minimizes materials waste, and reduces costs. The 110 x 36 x 12mm cassettes hold 10,000 0805 chips (the same as a 13-inch reel). The cassettes are reusable, and the cost of carrier/cover tapes and reels is eliminated.

Cassette bulk packaging is not without disadvantages for the customer. Pick-and-place equipment must be modified to accept the new feeder, which in turn is more susceptible to jamming than tape and reel. Customers using chips from more than one manufacturer may find that variations in chip thickness cause feeder problems. There is also a greater potential for damage and for the mixing of components.

2mm Pitch Carrier Tape

Currently KEMET supplies 4mm-pitch carrier tape for 0603 chips. By using 2mm tape for 0603 and the future 0402 chips, we can double the number of components per unit length of carrier tape. This will reduce material and packaging cost, and improve the efficiency of customer equipment by reducing the frequency of reel changing.

Conclusion

KEMET is constantly striving to provide the highest quality packaging to meet or exceed customer requirements. We are dedicated to working with our customers to develop new alternatives for packaging our product, recycling packaging materials, and reducing the cost of shipment, storage, and application.

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