

KEMET® *T E C H T O P I C S*

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Bulk Cassette Packaging

by Jim Bergenthal

Introduction:

The surface mount industry is at last ready to successfully introduce the bulk cassette package. For those of you who don't know about this technology, bulk cassette packaging allows chip components (ceramic capacitors and resistors) to be provided in a small plastic box (see figure), replacing the bulkier tape and reel package.



Key innovations have contributed to the success of this packaging technique. Greater usage is only waiting for the OEM's and subcontractors to introduce bulk cassettes in their process. KEMET is already providing 0603 and 0402 ceramic chip capacitors in bulk cassettes, with much success.

HISTORY

The Beginning:

The early innovators of surface mount technology had to answer an important question: How would parts be provided to the placement machine? Industry experience in feeding loose parts (bowl or linear feeder) was not very good. The dimensions of the parts to be fed were inconsistent from any one supplier, let alone from different suppliers. Redesign of the chips to make them uniform and consistent was found to be very difficult and impractical. To legislate it through, specification was not likely to succeed without limiting the number of suppliers. (The predominant size at the time was 1206.)

The innovators also quickly discovered that the place-

ment machine was very dependent on the parts being consistently supplied to the machine. The machine was going to be very expensive. The placement machines had many feed stations and thus many opportunities for mis-feeding and stopping. As an example, a machine with 100 stations (feeding 100 part types) might be capable of a feed error rate of 1 every 10,000 parts (a very good rate for bowl feeders feeding non-uniform parts). The machine could then stop on the average of once per 100 parts — not a very good efficiency for an automatic machine. This had to be overcome.

The tape and reel packaging method we have come to know as a standard was conceived at this time. The tape and reel packaging specification (EIA-481) standardized and tightly controlled the interface with the placement machine. The locations of the sprocket holes, the pitches, and center of the pocket relative to the sprockets were critical. The amount of movement of the part in the pocket was also important. The design of the pocket was left to the supplier of the part. This allowed him to account for the size variation of his particular parts, as long as the pocket and chip could be matched to prevent the chip from moving excessively in the pocket. The SMT innovators were directly involved in structuring of this specification, which has been fine tuned over time, and has worked wonders. The cycle times and the continuous running times of modern placement machines are truly amazing.

As the chip sizes continued to shrink to 0603 and 0402, the clearances in the tape became more of a problem. This has challenged suppliers to provide better-than-standard tolerances for these parts. The high-speed placement machines demanded this, even for tape and reel packaging.

One of the placement machine innovators veered from the tape and reel standard early in the process. His concept was to provide parts in bulk cassettes and feed them in tubes to the placement surface. Cylindrical parts were preferred for this application. This was the beginning of the bulk cassette system. One of the rectangular chip suppliers began to see the potential advantages of the bulk cassette package. For at least 10 years, two companies have presented this concept to the industry, with little success.

The Breakthroughs:

Recently, a number of items have come together to make the bulk cassette a very attractive option in parts feeding.

The small size chips (0603 and 0402) required very tight dimensional controls to allow them to be tape fed in high speed placement machines. In addition, the manufac-

turers of these parts were retooling equipment to improve the efficiency in manufacturing these parts. A few suppliers (including KEMET) were savvy enough to make sure these parts were capable of being fed on the loose chip feeders associated with bulk cassette placement machines. Parts are designed to be on metric nominal dimensions with very tight manufacturing tolerances. This makes all parts consistent and more easily fed in a loose configuration.

International standards for the cassette have been developed (IEC 286-6 and EIAJ 7201).

New high-speed placement machines were challenged by the dimensional stack-ups of the small parts, tape and reel, and machine-related tolerances. This was a capability, not a quality or performance, issue. In addition, they felt some pressure from their customers to provide bulk feeders. The success of a few of the placement machine suppliers has driven the industry to provide this feature on most new machines. In addition, some of the older machines are convertible to bulk cassette with the addition of new part feeders.

The users of the placement machines became aware that volume of tape and reel packaging material was much greater than that of the smaller parts themselves. The inventory necessary to keep the high speed machines supplied took up a lot of room on the manufacturing floor. Recycling or disposal of the packaging material was also becoming a higher priority.

The Pioneers:

All changes in the industry need those who can provide the tools and a pioneer to show the industry that they do in fact work. One of the largest users of surface mount chips has introduced the bulk cassette in high-volume production, and the industry is now off and running.

IS BULK CASSETTE FOR YOU?

Why "Bulk Cassette" ?

The advantages to bulk cassette packaging are many, and can have quite an impact on the "total cost" of manufacturing products.

- There are more parts in a bulk cassette package (15,000 0603's & 50,000 0402's), and with a little experience they can be easily changed while the placement machine continues to operate. This can greatly improve the running time of the equipment, and decrease the need for more machines.
- The cassette is merely placed on the machine. No time to feed tape and attach cover tape is required.
- Inventory space associated with bulk cassettes is much less than tape and reel. This can result in more floor space devoted to production processes and less to inventory of parts for the process. Of course, stock room space can also be reduced.
- Bulk cassettes are less subject to damage from improper stacking in inventory.
- Bulk cassettes do not contribute secondary dust to the process. Tape and reel (especially paper tape) can contribute dust that clogs the pipettes.

- Static Voltages (ESD), such as that involved with cover tape peel back, are not involved with bulk cassettes (the cassette is static dissipative).

Things to watch out for:

Bulk cassette packaging is still in "pioneer" status. It is important to watch out for a few features. Unfortunately, all these are not well known and bad experiences can cloud an otherwise good project.

The placement equipment suppliers are first introducing the interim feeders necessary to feed the loose parts from the bulk cassette to the pipettes of the placement machines. It is difficult to find literature on these feeders. Most of the sales team for the feeders do not yet know that tight tolerances for the parts are necessary, and these are not listed in much of the literature available. The dimensions and tolerances for good feeding have been established by the early leaders. The 0603 (1608) and 0402 (1005) parts must have metric nominal dimensions. Thickness and height must be the same. The tolerances for length, width and height dimensions are tight (for 0603, +/- 0.07 mm, and for 0402, +/- 0.05 mm).

Some placement equipment suppliers are suggesting that larger sizes of chips can also be bulk fed. Remember the part dimensions play a critical role. Ask your part suppliers if they have parts that meet the critical dimensions. Some industry experience exists that indicates bulk feeding chips in 0805 sizes and larger may result in poorer performance than tape and reel. It is suggested that you move slowly in this direction.

Not much experience is available for the interim feeders. Ask your placement machine supplier for capability data, or involve your parts suppliers in early trials. This is especially true for larger part types.

Some of the interim feeders are very difficult to purge (clean out all parts). This might make them a "part number" feeder, requiring interim feeders for all part numbers. Investigate this early in your program as the cost of feeders is not insignificant.

Consider carefully which of your part numbers you wish to convert to bulk cassette. Tape and reel and bulk cassette live together on your placement machines without problems. Since the bulk cassette has so many more parts than the tape and reel, and since you may need a cassette for each location on each machine, it may be more advantageous to use tape and reel for lower usage part numbers and bulk cassette for higher usage part numbers. Inventory cost of the parts is an item to be considered.

Some parts suppliers are proposing "non-standard" bulk cassettes. As with all non-standard items, this serves only to cloud the picture. Be very careful as all part suppliers may not be able to provide parts in these non-standard cassettes.

BULK CASSETTE OUTLOOK

The "bulk cassette" package has arrived. We at KEMET believe it has a very bright future, and look forward to its evolution.