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Open Mode Capacitors

Open mode capacitors have been designed using inset electrode margins specifically for use in applications where mechanical cracking is a severe problem. When combined with Syfer FlexiCap™ Termination, Syfer Open Mode Capacitors provide a robust component, with the assurance that if a part becomes cracked, the crack will be unlikely to result in short circuit failure.

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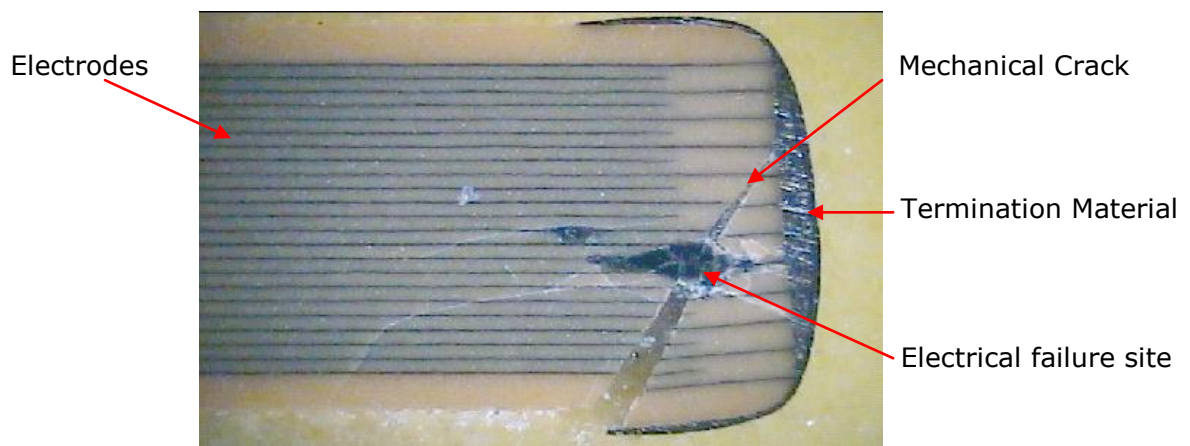
Introduction

Open mode Capacitors have been designed specifically for use in applications where mechanical cracking is a severe problem and short circuits due to cracking are unacceptable. Open mode capacitors use inset electrode margins, which prevent any mechanical cracks which may form during board assembly from connecting to the internal electrodes.

When combined with Syfer's FlexiCap™ Termination, Syfer open mode capacitors provide a robust component with the assurance that if a part becomes cracked, the crack will be unlikely to result in short circuit failure.

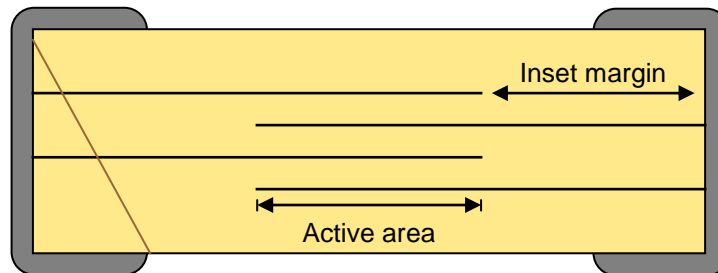
Background

One of the most common causes of failure with standard capacitors is directly attributable to bending of the printed circuit board (PCB) after solder attachment. Excessive bending will create mechanical crack(s) within the ceramic capacitor. Mechanical cracks, depending upon severity, may not cause capacitor failure during the final assembly test. Over time, moisture penetration into the crack can cause a reduction in insulation resistance and eventual dielectric breakdown leading to capacitor failure in service.



Mechanical cracking always initiates from the point of highest stress, which is at the junction of the ceramic body and the termination band.

Syfer open mode capacitors use an inset electrode design which prevents any mechanical crack from crossing the active area of the capacitor, therefore preventing a short circuit failure as shown below.



Important Notes

- Syfer open mode capacitors will only fail as open circuit (or low capacitance) if the failure is due to mechanical cracking. Any other cause of capacitor failure will almost certainly result in short circuit.
- Syfer strongly recommends the avoidance of any procedure that may generate mechanical cracking, as a cracked part may in time create degradation and failure. Open mode capacitors will minimise but cannot completely eliminate this risk.

Open mode and FlexiCap™ - Product Qualification

Syfer have built an excellent reputation throughout the industry using FlexiCap™ termination. FlexiCap™ is proven to prevent failures due to mechanical cracking during the board assembly process. By combining Open mode Capacitors and FlexiCap™, a range of capacitors has been introduced which offers all the benefits of FlexiCap™, plus the advantage of an inset electrode design.

Although it is extremely unlikely that a Syfer Capacitor with FlexiCap™ would suffer from mechanical cracking, under extreme handling conditions, a crack may be formed.

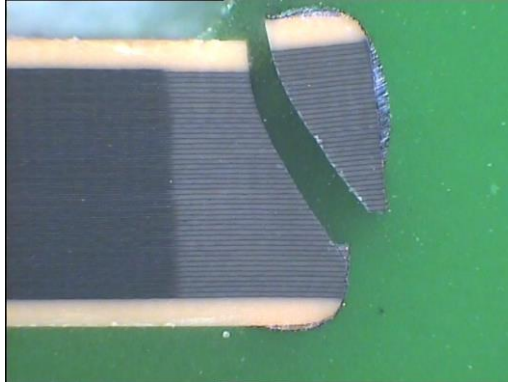
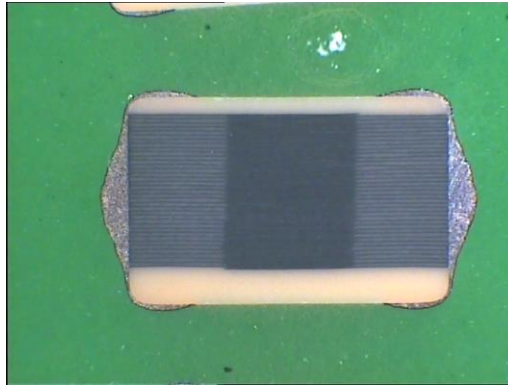
In order to simulate customer use of a cracked component, Open mode Capacitors were manufactured with Syfer FlexiCap™ termination. Samples were submitted for bend testing in accordance with AECQ-200 Rev C, in order to crack the components prior to Endurance and 8585 testing of the cracked parts.

It should be noted that in most cases, the FlexiCap™ parts were found to be unbreakable using a single bend test (up to 10mm of bend), and it was necessary to undertake multiple bend tests, or to terminate parts using an alternative material in order to break the components.

Following 1000 hour endurance and 8585 testing, the cracked components were electrically tested, and then removed from the test boards and micro sectioned. Some of the components had lower capacitance post test, capacitance loss was between zero and 70%, depending on the position of the cracks. There were no failures due to short circuit detected.

Examples of Open Mode Capacitors pre and post test

Open Mode Capacitor
Untested



Open Mode Capacitor
post bend and
85°C/85%RH test.
Capacitance loss
approximately 70%.

NB – Capacitor still
functioning

Product Range

The Open mode capacitor range is offered in low to high range capacitance values in X7R dielectric. It is recommended only with FlexiCap™ termination, but other termination materials may be available upon request.

Note – use of non FlexiCap™ termination will increase the risk of cracks caused by mechanical or thermal cycling stress.

Max capacitance in nF (X7R only)

| Chip size | 16V | 25V | 50/63V | 100V | 200/250V |
|-----------|------|------|--------|------|----------|
| 0603 | 39 | 33 | 22 | 6.8 | 2.7 |
| 0805 | 150 | 120 | 100 | 27 | 15 |
| 1206 | 470 | 330 | 220 | 100 | 68 |
| 1210 | 680 | 560 | 470 | 220 | 100 |
| 1812 | 1500 | 1200 | 1000 | 680 | 330 |
| 2220 | 3300 | 2200 | 1500 | 1000 | 680 |
| 2225 | 4700 | 3900 | 2700 | 1800 | 1000 |

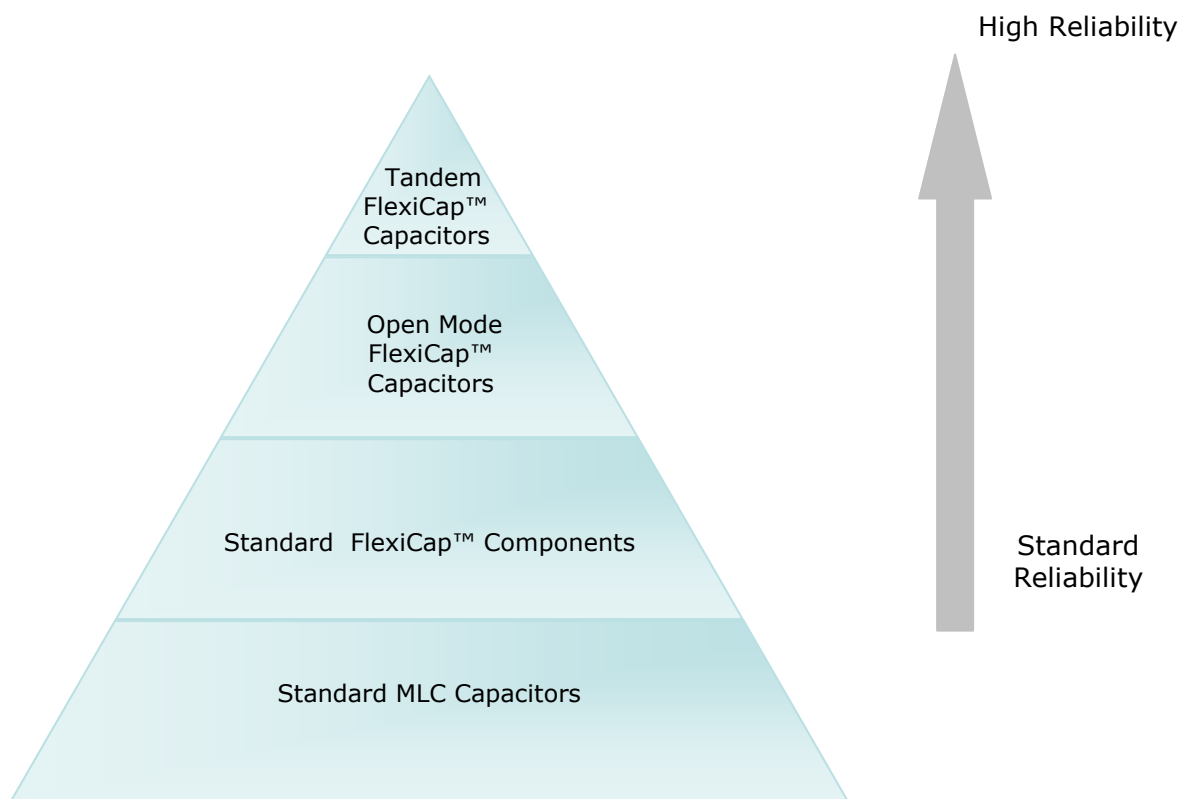
Other case sizes and voltages may be available on request.

Benefits

- Inset electrode design provides protection in case of mechanical cracking, with any crack formed likely to result in low capacitance or open circuit rather than short circuit failure.
- Syfer FlexiCap™ provides protection from mechanical cracking.
- Available in a wide range of chip sizes and voltage ratings

Mechanical Crack Prevention – Syfer Product Group

- The Open mode range is offered to compliment the Syfer standard FlexiCap™ range and the new Tandem capacitor range, to offer the best possible protection against mechanical cracking:



Ordering Information

The Open mode Capacitors can be ordered by using a standard Syfer product code with the suffix code M01.

Examples: 1206Y0500104KXT**M01**
1206Y0500104KET**M01**

1206 Case Size
Y Polymer Termination FlexiCap™
050 50V DC Rated
0104 100nF Capacitance Value
K 10% Capacitance Tolerance
X or E X - X7R Dielectric (standard)
E - X7R dielectric (AEC-Q200 product)
T Taped and Reeled

M01 Syfer Open mode Capacitor

All other specifications and properties are as Syfer standard product.

For further information or technical assistance please contact our Sales Department on +44 1603 723310 or by Email at sales@syfer.co.uk