

# PSL range with Termination

“The PSL range already provides a high quality component suitable for demanding applications such as power supplies, DC-DC converters and LED lighting. Thus with the addition of a termination material specifically designed to absorb greater levels of mechanical stress and the reduction of capacitor failures associated with mechanical cracking, the PSL range is enhanced”.

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## **PSL range with FlexiCap™ Introduction**

Syfer Technology Ltd introduced FlexiCap™ in 1999 and became the first multilayer capacitor manufacturer to offer a flexible termination to customers. This type of termination has proven to be very successful as customers realize the benefits and also as demonstrated by other capacitor manufacturers subsequently introducing flexible terminations, some with very similar names to FlexiCap™.

The PSL range with FlexiCap™ refers to a flexible termination material that is applied over a sintered termination. The FlexiCap™ material is a silver loaded epoxy polymer that is applied using conventional termination techniques and then cured at 180°C. Following the curing process, components are processed through the same manufacturing, test and inspection stages when compared with a standard PSL component.

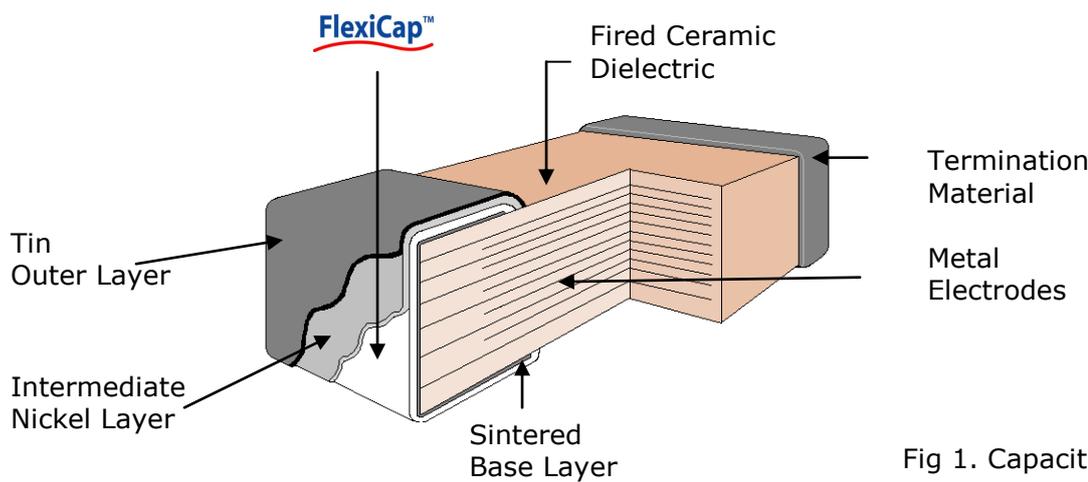
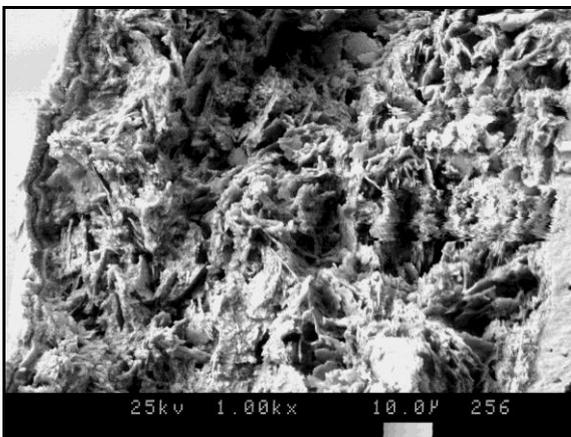


Fig 1. Capacitor Construction



Picture taken at 1000x magnification using a SEM showing a fracture section through a capacitor termination.

The picture demonstrates the fibrous nature of the FlexiCap™ termination that absorbs greater levels of mechanical stress when compared with standard sintered termination.

## **Queens Award for Innovation**

The Queen's Awards for Enterprise are the UK's most prestigious awards for business performance. The Awards are presented in three categories: International Trade, Innovation and Sustainable Development

The Awards are made each year by The Queen, on the advice of the Prime Minister, who is assisted by an Advisory Committee that includes representatives of UK Government, industry and commerce, and the trade unions.

The Queens Award for Innovation recognizes companies that have demonstrated commercial success through innovative products or services.

Her Majesty The Queen conferred the Queens Award for Innovation upon Syfer Technology Ltd in 2008 for recognition of outstanding achievements in Innovation with respect to FlexiCap™.

## **Benefits of Using FlexiCap™**

Sintered termination materials are fired onto the ceramic body of the component at approximately 800°C. The result is a very hard material that provides minimal protection to the ceramic body of the component with respect to mechanical strain when the component is situated on an assembly.

FlexiCap™ termination material is a silver loaded epoxy polymer that is flexible and absorbs some of the mechanical strain between the PCB and the ceramic component. Components terminated with FlexiCap™ withstand greater levels of mechanical strain when compared with sintered terminated components alone.

Types of mechanical strain where FlexiCap™ terminated capacitors offer enhanced protection include mechanical cracking (which is the largest cause for ceramic component failure) and also in applications where rapid temperature changes can occur. The PSL range is manufactured to exacting standards using our unique screen printing process. This provides a high quality component suitable for demanding applications and is suitable for extreme environments

### Mechanical Cracking

Due to its brittle nature, multilayer ceramic capacitors are more prone to excesses of mechanical stress than other components used in surface mounting. One of the most common causes of capacitor failures 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.

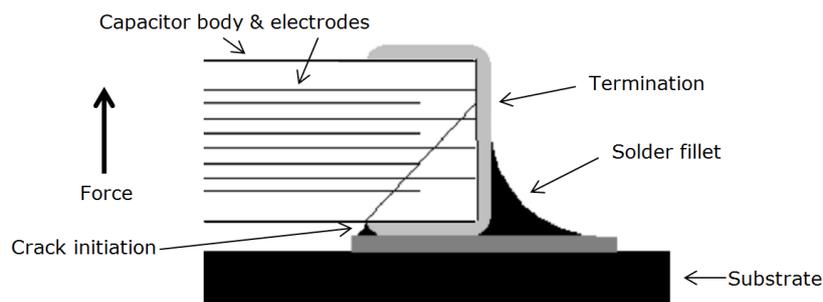


Fig 1. Mechanical Crack

Example of a capacitor issued by a customer to Syfer for failure investigation:



### **Customer Assembly Process Requirements**

Capacitors with FlexiCap™ termination should be handled, stored and transported in the same manner as capacitors with only sintered termination. The requirements for mounting and soldering capacitors with FlexiCap™ termination are the same as for capacitors with only sintered termination.

Components with FlexiCap™ are compatible with lead solder applications and lead-free solder applications with a maximum recommended reflow temperature of 270°C.

PSL with FlexiCap™ Moisture Sensitivity Level (MSL) = 1.

## **PSL with FlexiCap™ Test Summary**

PSL with FlexiCap™ has been rigorously tested and approved/ qualified to the following test requirements:

- Syfer qualification and ongoing routine tests.
- AEC-Q200 qualification.

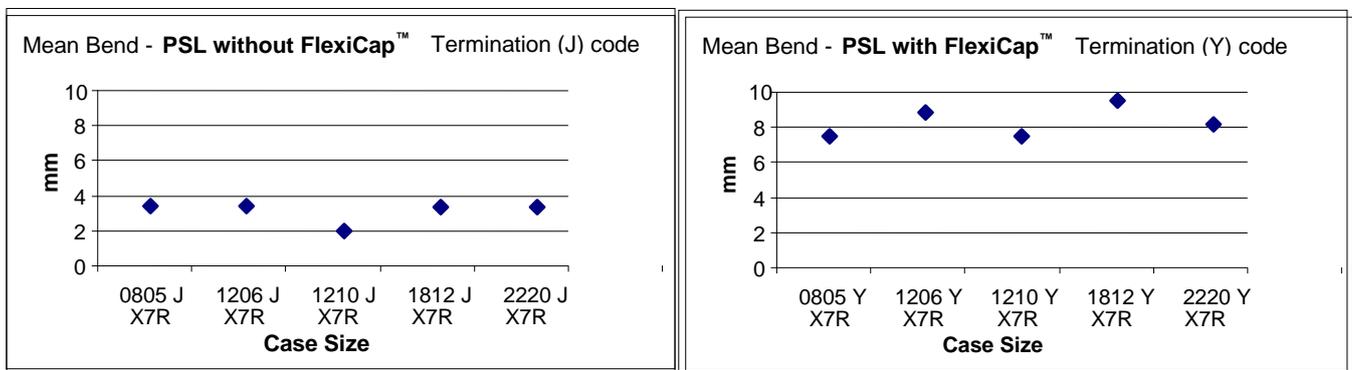
The key tests with respect to PSL with FlexiCap™ performance are as follows.

### ▪ **Bend Test (Board Flex).**

Method: Capacitor samples mounted onto a 100mm FR4 Test PCB and subjected to bend testing in accordance with IEC 60068-2-21. Environmental testing: Test U: Robustness of terminations and integral mounting devices or AEC-Q200-005.

(10mm maximum bend test equipment capability)

#### PSL performance with and without FlexiCap™



The bend test summary provides a comparison between component case sizes in the following groups:

- PSL X7R dielectric material without FlexiCap™ termination material.
- PSL X7R dielectric material with FlexiCap™ termination material.

The bend tests conducted confirm that with FlexiCap™ termination the PSL component withstands greater mechanical strain.

### ▪ **Temperature Cycling.**

#### Background on Temperature Cycling

Rapid temperature changes when components are mounted on a PCB can induce stress as a result of different material CTE (Coefficient of Thermal Expansion) rates. For example, a sintered terminated component will typically fail a temperature cycle test consisting of 1000 cycles (-55°C to 125°C). The difference in material (PCB, ceramic, solder) expansion rates can induce cracks within components that cause components to electrically fail.

The FlexiCap™ termination material absorbs some of the strain created during repeated rapid temperature changes and PSL components terminated with FlexiCap™ pass temperature cycle tests such as 1000 cycles (-55°C to 125°C). Reference JESD22-A104.

## Customer Qualification

The FlexiCap™ termination material has been used by customers since 1999 and the qualifications conducted by customers have been successful. The reaction to FlexiCap™ termination has been extremely favourable and the demand for FlexiCap™ terminated capacitors continues to increase as customers realize the advantages provided.

FlexiCap™ terminated capacitors are supplied to many blue chip companies, O.E.M's, E.M.S's and international component distributors. Applications include telecoms, military, aerospace, automotive, industrial and power supplies.

## PSL range

### Minimum/maximum capacitance values - PSL capacitors

Rated Voltage	Chip Size				
	0805	1206	1210	1812	2220
<b>50V/63V</b>	220pF - 100nF	470pF - 470nF	1nF - 1µF	N/A	N/A
<b>100V</b>	220pF - 47nF	470pF - 150nF	1nF - 330nF	1nF - 680nF	1nF - 1.5µF
<b>200V/250V</b>	220pF - 27nF	470pF - 100nF	1nF - 180nF	1nF - 470nF	1nF - 1µF
<b>500V</b>	220pF - 10nF	470pF - 56nF	1nF - 100nF	1nF - 220nF	1nF - 560nF
<b>630V</b>	220pF - 5.6nF	470pF - 47nF	1nF - 68nF	1nF - 150nF	1nF - 330nF
<b>1000V</b>	220pF - 3.3nF	470pF - 10nF	1nF - 22nF	1nF - 68nF	1nF - 100nF
				1nF - 330nF	1nF - 120nF
<b>2000V</b>	N/A	470pF - 1nF	1nF - 4.7nF	1nF - 10nF	N/A
		470pF - 2.2nF			

**Note:** Other capacitance values may become available, please contact our Sales Office if you need values other than those shown in the above table. For dimensions and soldering information, please go to our website ([www.syfer.com](http://www.syfer.com)).

 = AECQ200

**Ordering information - PSL capacitors**

1206	Y	1K0	0103	K	J	T
Chip size	Termination	Voltage	Capacitance in Pico farads (pF)	Capacitance tolerance	Dielectric	Packaging
<b>0805</b>	<b>J</b> = Nickel barrier with 100% matte tin plating. RoHS compliant.  <b>Y</b> =FlexiCap™ termination base with nickel barrier (100% matte tin plating). RoHS compliant. Lead free.	<b>050</b> = 50V	First digit is 0.	<b>K</b> = ±10%  <b>M</b> = ±20%	<b>J</b> = X7R  <b>S</b> = X7R AEC-Q200	<b>T</b> = 178mm
<b>1206</b>		<b>063</b> = 63V	Second and third digits are significant figures of capacitance code.			(7") reel
<b>1210</b>		<b>100</b> = 100V	The fourth digit is number of 0's following.	<b>R</b> = 330mm		
<b>1812</b>		<b>200</b> = 200V	Example: <b>0103</b> = 10000pF	(13") reel		
<b>2220</b>		<b>250</b> = 250V		<b>B</b> = Bulk		
		<b>500</b> = 500V		pack - tubs		
	<b>630</b> = 630V					
	<b>1K0</b> = 1kV					
	<b>2K0</b> = 2kV					

**Reeled quantities - PSL capacitors**

Chip Size	0805	1206	1210	1812	2220
<b>7" Reel</b>	3,000	2,500	2,000	500/1,000*	500/1,000*
<b>13" Reel</b>	12,000	10,000	8,000	2,000/4,000*	2,000/4,000*

\* Reel quantity depends on chip thickness. Please contact our sales office.

For quotations please contact Syfer Sales Department [sales@syfer.co.uk](mailto:sales@syfer.co.uk)

## **Additional Information**

Syfer has generated a comprehensive range of application notes (available at [www.knowlescapacitors.com/syfer/en/gn/technical-info/application-notes](http://www.knowlescapacitors.com/syfer/en/gn/technical-info/application-notes)) to provide additional information to customers.

Application notes that provide additional information with respect to FlexiCap™ :

<b>APPLICATION NOTE</b>	<b>CONTENTS</b>
AN0001	FlexCap™ Termination
AN0002 Bend Testing	Test methods for Capacitor bend testing, and the shape of typical cracks
AN0005 Mechanical Cracking	Potential causes of mechanical cracking, corrective actions and depanelisation methods
AN0006 Dielectric Ageing	Capacitor dielectric ageing
AN0009 AEC-Q200 Stress Test Qualification	Provides information on tests performed by Syfer in accordance with the AEC-Q200 specification
AN0010 Lead-free soldering and bend test performance	The effects of Lead-free soldering on bend testing through solder choice
AN0019 Tin Whiskers	Tin Whiskers mitigation and surface mount chip capacitors
AN0021 Tandem Capacitors	Tandem capacitors terminated with FlexiCap™ provide an ultra-robust and reliable component.
AN0022 Open Mode Capacitors	Open mode capacitors terminated with FlexiCap™ provide a robust component that fail in an open circuit mode.
AN0024 Moisture Sensitivity Level Classification for Syfer products	MSL classification IPC / JEDEC J-STD-020D for Syfer products.
AN0026 Outgassing test results for FlexiCap™ capacitors	Results for ECSS-Q-70-02A outgassing tests on FlexiCap™ capacitors.
AN0028 Soldering / Mounting Chip Capacitors, Radial Leaded Capacitors and EMI Filters	This gives guidance to engineers and board designers on mounting and soldering Syfer products.