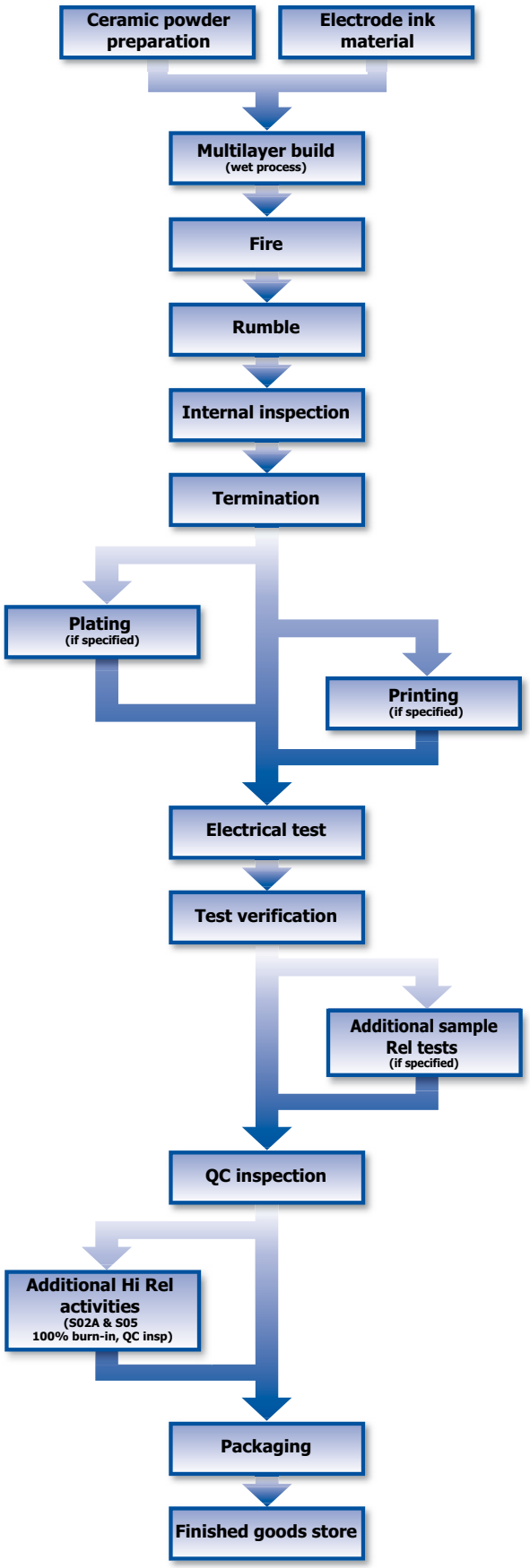
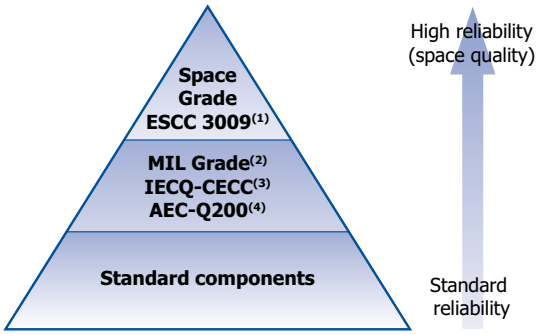
1.1 - Production process flowchart



1.2 - Syfer reliability grades



Notes:

(1) Space grade tested in accordance with ESCC 3009. Refer to Syfer specification S02A 0100.

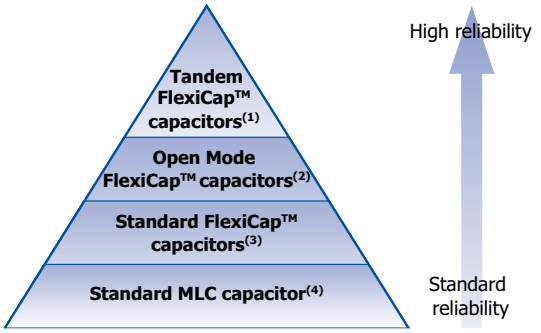
(2) MIL Grade. Released in accordance with US standards available on request.

(3) IECQ-CECC. The International Electrotechnical Commission (IEC) Quality Assessment System for Electronic Components. This is an internationally recognised product quality certification which provides customers with assurance that the product supplied meets high quality standards.

View Syfer's IECQ-CECC approvals at http://www.iecq.org or at www.syfer.com

(4) AEC-Q200. Automotive Electronics Council Stress Test Qualification For Passive Components. Refer to Syfer application note reference AN0009.

1.3 - Syfer reliability surface mount product groups



Notes:

(1) "Tandem" construction capacitors, ie internally having the equivalent of 2 series capacitors. If one of these should fail short-circuit, there is still capacitance end to end and the chip will still function as a capacitor, although capacitance maybe affected. Refer to application note AN0021. Also available qualified to AEC-Q200.

(2) "Open Mode" capacitors with FlexiCap™ termination also reduce the possibility of a short circuit by utilising inset electrode margins. Refer to application note AN0022. Also available qualified to AEC-Q200.

(3) Multilayer capacitors with Syfer FlexiCap™ termination. By using FlexiCap™ termination, there is a reduced possibility of the mechanical cracking occurring.

(4) "Standard" capacitors includes MLCCs with tin finish over nickel, but no FlexiCap™.

1.4 - FlexiCap™ termination

MLCCs are widely used in electronic circuit design for a multitude of applications. Their small package size, technical performance and suitability for automated assembly makes them the component of choice for the specifier.

However, despite the technical benefits, ceramic components are brittle and need careful handling on the production floor. In some circumstances they may be prone to mechanical stress damage if not used in an appropriate manner. Board flexing, depanelisation, mounting through hole components, poor storage and automatic testing may all result in cracking.

Careful process control is important at all stages of circuit board assembly and transportation - from component placement to test and packaging. Any significant board flexing may result in stress fractures in ceramic devices that may not always be evident during the board assembly process. Sometimes it may be the end customer who finds out - when equipment fails!

Syfer has the solution - FlexiCap™

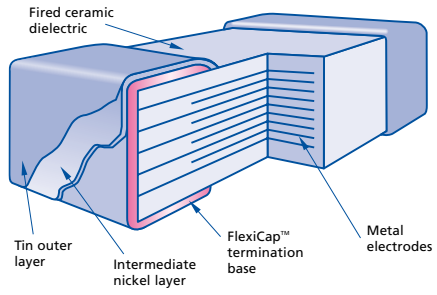
FlexiCap™ has been developed as a result of listening to customers' experiences of stress damage to MLCCs from many manufacturers, often caused by variations in production processes.

Our answer is a proprietary flexible epoxy polymer termination material, that is applied to the device under the usual nickel barrier finish. FlexiCap™ will accommodate a greater degree of board bending than conventional capacitors.

Syfer FlexiCap™ termination

All ranges are available with FlexiCap™ termination material offering increased reliability and superior mechanical performance (board flex and temperature cycling) when compared with standard termination materials. Refer to Syfer application note reference AN0001. FlexiCap™ capacitors enable the board to be bent almost twice as much before mechanical cracking occurs. Refer to application note AN0002.

FlexiCap™ is also suitable for Space applications having passed thermal vacuum outgassing tests. Refer to Syfer application note reference AN0026.



FlexiCap™ MLCC cross section

FlexiCap™ benefits

With traditional termination materials and assembly, the chain of materials from bare PCB to soldered termination, provides no flexibility. In circumstances where excessive stress is applied - the weakest link fails. This means the ceramic itself, which may fail short circuit.

The benefit to the user is to facilitate a wider process window - giving a greater safety margin and substantially reducing the typical root causes of mechanical stress cracking.

FlexiCap™ may be soldered using your traditional wave or reflow solder techniques and needs no adjustment to equipment or current processes.

Syfer has delivered millions of FlexiCap™ components and during that time has collected substantial test and reliability data, working in partnership with customers world wide, to eliminate mechanical cracking.

An additional benefit of FlexiCap™ is that MLCCs can withstand temperature cycling -55ºC to 125ºC in excess of 1,000 times without cracking.

● Picture taken at 1,000x magnification using a SEM to demonstrate the fibrous nature of the FlexiCap™ termination that absorbs increased levels of mechanical stress.

Available on the following ranges:

- All High Reliability ranges
- Standard and High Voltage chips
- Surge Protection and Safety capacitor chips
- 3 terminal EMI chips
- X2Y Integrated Passive Components
- X8R High Temperature capacitors

Summary of PCB bend test results

The bend tests conducted on X7R have proven that the FlexiCap™ termination withstands a greater level of mechanical stress before mechanical cracking occurs.

The AEC-Q200 test for X7R requires a bend level of 2mm minimum and a cap change of less than 10%.

Product X7R	Typical bend performance under AEC-Q200 test conditions
Standard termination	2mm to 3mm
FlexiCap™	Typically 8mm to 10mm

Application notes

FlexiCap™ may be handled, stored and transported in the same manner as standard terminated capacitors. The requirements for mounting and soldering FlexiCap™ are the same as for standard SMD capacitors.

For customers currently using standard terminated capacitors there should be no requirement to change the assembly process when converting to FlexiCap™.

Based upon board bend tests in accordance with IEC 60384-1 the amount of board bending required to mechanically crack a FlexiCap™ terminated capacitor is significantly increased compared with standard terminated capacitors.

It must be stressed however, that capacitor users must not assume that the use of FlexiCap™ terminated capacitors will totally eliminate mechanical cracking. Good process controls are still required for this objective to be achieved.

FlexiCap™

1.5 - Tests conducted during batch manufacture

	Syfer reliability SM product group					
	Standard SM capacitors	IECQ-CECC	AEC-Q200	MIL - PRF 55681[1]	S (space grade) High Rel	
					S05	S02A [3]
Solderability	●	●	●	●	●	●
Resistance to soldering heat	●	●	●	●	●	●
Plating thickness verification (if plated)	●	●	●	●	●	●
Destructive Physical Analysis (DPA)	●	●	●	●	●	●
Voltage proof test (DWV / Flash)	●	●	●	●	●	●
Insulation Resistance	●	●	●	●	●	●
Capacitance test	●	●	●	●	●	●
Dissipation Factor test	●	●	●	●	●	●
100% visual inspection	❍	❍	●	❍	●	●
100% burn-in[2]. (2xRV @125ºC for 100 hours)	❍	❍	❍	●	-	-
100% burn-in[2]. (2xRV @125ºC for 168 hours)	❍	❍	❍	-	●	●
Load sample test @ 125ºC. (Life at elevated temperature test).	❍	❍	❍	❍	❍	LAT1 & LAT2 (1000 hours)
Humidity sample test. 85ºC/85%RH	❍	❍	❍	❍	❍	240 hours
Hot IR sample test	❍	❍	❍	●	❍	❍
Axial pull sample test (MIL-STD-123)	❍	❍	❍	❍	❍	❍
Breakdown voltage sample test	❍	❍	❍	❍	❍	❍
Deflection (bend) sample test	❍	❍	❍	❍	❍	❍
SAM (Scanning Acoustic Microscopy)	❍	❍	❍	❍	❍	❍
LAT1 (4 x adhesion, 8 x rapid temp change + LAT2 and LAT3)	-	-	-	-	-	❍
LAT2 (20 x 1000 hour life test + LAT3)	-	-	-	-	-	❍
LAT3 (6 x TC and 4 x solderability)	-	-	-	-	-	❍

● Test conducted as standard.
❍ Optional test. Please discuss with Syfer Sales.

Notes:
1) In accordance with MIL-PRF-55681 group A. Additional optional tests available.
2) Burn-in also referred to as Voltage conditioning.
3) In accordance with ESCC 3009.

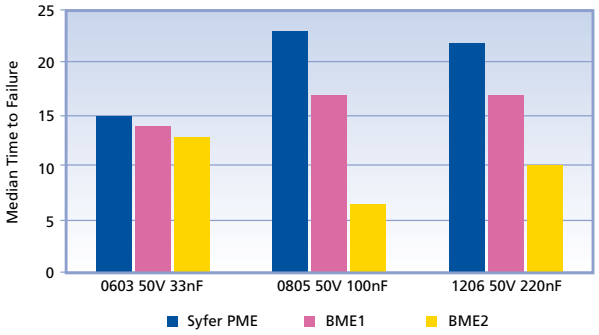
1.6 - Precious Metal Electrodes Vs. Base Metal Electrodes

Multilayer ceramic capacitors typically require sintering temperatures in excess of 1000ºC, which presents no problems to capacitors that employ a Precious Metal Electrode (PME) system. However, for Base Metal Electrode (BME) systems additional processes are required, including the use of a reducing atmosphere to prevent oxidation of the electrodes.

Despite the manufacturing problems, BME multilayer ceramic capacitors have proven to be a good choice for commercial products as they have reasonable electrical properties and life expectancy and can be used for some high reliability applications when properly qualified and screened.

At Syfer Technology we have been developing PME systems for over thirty years and use them exclusively for all our product lines. It produces capacitors to the highest reliability that can be used in all applications including the very demanding space requirements.

A recent Highly Accelerated Life Test (HALT) programme was undertaken to compare Syfer PME with equivalent BME capacitors. Capacitors rated at 50 volts were tested at 400 volts and at a temperature of 180ºC. The programme used three capacitor types from Syfer and two BME manufacturers.



In all cases the Syfer PME parts out-performed the BME capacitors suggesting that the long term reliability of PME systems is superior to BME, and PME parts should be regarded as the component of choice for high reliability applications.

1.7 - RoHS compliance

All Syfer surface mount capacitors (excluding Sn/Pb plated) are compliant with the EU RoHS directive. Breakdown of materials content is available on request.

1.8 - Release documentation

	Syfer reliability SM product group				
	Standard SM capacitors	IECQ-CECC	AEC-Q200 MIL grade	S (space grade) High Rel	
				S05	S02A
Certificate of conformance	●	-	●	●	●
IECQ-CECC Release certificate of conformity	-	●	-	-	-
Batch electrical test report	❍	❍	❍	Included in data pack	Included in data pack
S (space grade) data documentation package	-	-	-	●	●

● Release documentation supplied as standard.
❍ Original documentation.

1.9 - Technical summary

	C0G/NP0			X7R		
Dielectric characteristics	Ultra stable			Stable		
IECQ-CECC	1B/CG			2C1	2R1	2X1
EIA		C0G/NP0			X7R	
MIL			CG(BP)	BZ		BX
Rated temperature range	-55ºC to +125ºC			-55ºC to +125ºC		
Maximum capacitance change over temperature range No DC voltage applied	0 ± 30 ppm/ºC			± 20%	± 15%	± 15%
Rated DC voltage applied	-			+20-30%	-	+15-25%
Syfer dielectric ordering code	C			R	X	B
Tangent of loss angle (tan δ)	Cr > 50pF ≤ 0.0015 Cr ≤ 50pF = 0.0015 ($\frac{15}{Cr}$ + 0.7)					

The table above highlights the difference in coding for IECQ-CECC, EIA and MIL standards when defining the temperature coeffiecient and the voltage coefficient.

1.10 - Periodic tests conducted and reliability data availability

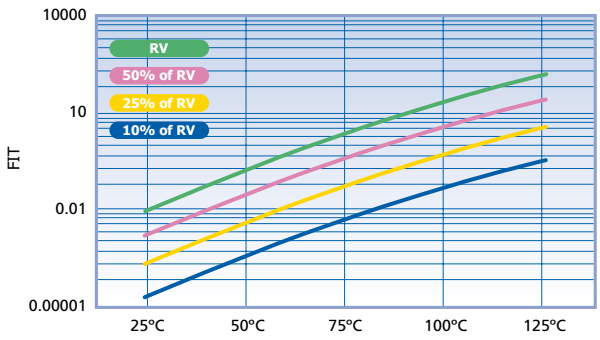
Standard Surface Mount Capacitors

Components are randomly selected on a sample basis and the following routine tests are conducted:

- Load Test. 1000 hours @125ºC. Applied voltage depends on components tested.
- Humidity Test. 168 hours @ 85ºC/85%RH.
- Board Deflection (bend test).

Test results are available on request.

Example of FIT (Failure In Time) data available:



Component type: 0805 (C0G/NP0 and X7R).
Testing location: Syfer reliability test department.
Results based on: 14,942,000 component test hours.

Conversion factors:

From	To	Operation
FITS	MTBF (hours)	10^9 ÷ FITS
FITS	MTBF (years)	10^9 ÷ (FITS x 8760)

FITS = Failures in 10^9 hours.
MTBF = Mean time between failures.

1.10 - Periodic tests conducted for IECQ-CECC and AEC-Q200

Test ref	Test	Termination type	D or ND	Additional requirements	Sample acceptance			Reference
					P	n	c	
P1	High temperature exposure (storage)	All types	D	Un-powered. 1000 hours @ T=150ºC. Measurement at 24 ± 2 hours after test conclusion	12	77	0	MIL-STD-202 Method 108
P2	Temperature cycling	C0G/NP0: All types X7R: Y and H only	D	1000 cycles -55ºC to +125ºC Measurement at 24 ± 2 hours after test conclusion	12	77	0	JESD22 Method JA-104
P3	Moisture resistance	All types	D	T = 24 hours/cycle. Note: Steps 7a and 7b not required. Un-powered. Measurement at 24 ± 2 hours after test conclusion	12	77	0	MIL-STD-202 Method 106
P4	Biased humidity	All types	D	1000 hours 85ºC/85%RH. Rated voltage or 50V whichever is the least and 1.5V. Measurement at 24 ± 2 hours after test conclusion	12	77	0	MIL-STD-202 Method 103
P5	Operational life	All types	D	Condition D steady state TA=125ºC at full rated. Measurement at 24 ± 2 hours after test conclusion	12	77	0	MIL-STD-202 Method 108
P6	Resistance to solvents	All types	D	Note: Add aqueous wash chemical. Do not use banned solvents	12	5	0	MIL-STD-202 Method 215
P7	Mechanical shock	C0G/NP0: All types X7R: Y and H only	D	Figure 1 of Method 213. Condition F	12	30	0	MIL-STD-202 Method 213
P8	Vibration	C0G/NP0: All types X7R: Y and H only	D	5g for 20 minutes, 12 cycles each of 3 orientations. Note: Use 8" x 5" PCB 0.031" thick 7 secure points on one long side and 2 secure points at corners of opposite sides. Parts mounted within 2" from any secure point. Test from 10-2000Hz	12	30	0	MIL-STD-202 Method 204
P9	Resistance to soldering heat	All types	D	Condition B, no pre-heat of samples: Single wave solder - Procedure 2	3	12	0	MIL-STD-202 Method 210
P10	Thermal shock	C0G/NP0: All types X7R: Y and H only	D	-55ºC/+125ºC. Number of cycles 300. Maximum transfer time - 20 seconds, Dwell time - 15 minutes. Air-Air	12	30	0	MIL-STD-202 Method 107
P11	Adhesion, rapid temp change and climatic sequence	X7R: A, F and J only	D	5N force applied for 10s, -55ºC/ +125ºC for 5 cycles, damp heat cycles	12	27	0	BS EN132100 Clause 4.8, 4.12 and 4.13
P12	Board flex	C0G/NP0: All types X7R: Y and H only	D	3mm deflection Class I 2mm deflection Class II	12	30	0	AEC-Q200-005
P13		X7R: A, F and J only	D	1mm deflection.	12	12	0	BS EN132100 Clause 4.9
P14	Terminal strength	All types	D	Force of 1.8kg for 60 seconds	12	30	0	AEC-Q200-006
P15	Beam load test	All types	D	-	12	30	0	AEC-Q200-003
P16	Damp heat steady state	All types	D	56 days, 40°C/93%RH, 15 x no volts, 15 x 5Vdc, 15 x rated voltage or 50V whichever is the less	12	45	0	BS EN132100 Clause 4.14

Test results are available on request.

1.11 - Standard product ranges - 10V to 6kV ranges

Capacitance values F.

= X5R Range

		0603	0805	1206	1210	1808	1812	1825	2220	2225	3640	5550	8060
10V	C0G/NP0	0.47p-3.9n	1.0p-15n	1.0p-47n	3.9p-100n	4.7p-100n	10p-220n	10p-470n	10p-470n	10p-560n	n/a	n/a	n/a
	X7R	100p-100n	100p-330n	100p-1.0µ	330n-1.5µ	100p-1.5µ	150n-3.3µ	220n-4.7µ	220n-5.6µ	330n-6.8µ	n/a	n/a	n/a
	X5R	120n-150n	390n-680n	100p-1.5µ	330p-3.3µ	100p-2.7µ	150p-10µ	220p-15µ	220p-18µ	330p-22µ	n/a	n/a	n/a
16V	C0G/NP0	0.47p-2.7n	1.0p-12n	1.0p-33n	3.9p-68n	4.7p-68n	10p-180n	10p-330n	10p-330n	10p-470n	n/a	n/a	n/a
	X7R	100p-100n	100p-330n	100p-1.0µ	330p-1.5µ	100p-1.5µ	150p-3.3µ	220p-4.7µ	220p-5.6µ	330p-6.8µ	n/a	n/a	n/a
	X5R	100p-120n	100p-470n	100p-1.2µ	330p-2.7µ	100p-2.2µ	150p-6.8µ	220p-12µ	220p-12µ	330p-15µ	n/a	n/a	n/a
25V	C0G/NP0	0.47p-2.2n	1.0p-10n	1.0p-27n	3.9p-56n	4.7p-47n	10p-150n	10p-220n	10p-220n	10p-330n	n/a	n/a	n/a
	X7R	100p-100n	100p-220n	100p-820n	330p-1.2µ	100p-1.2µ	150p-2.2µ	220p-3.9µ	220p-4.7µ	330p-5.6µ	n/a	n/a	n/a
	X5R	100p-100n	100p-390n	100p-1.0µ	330p-2.2µ	100p-1.5µ	150p-4.7µ	220p-10µ	220p-10µ	330p-12µ	n/a	n/a	n/a
50/63V	C0G/NP0	0.47p-1.5n	1.0p-5.6n	1.0p-22n	3.9p-33n	4.7p-33n	10p-100n	10p-150n	10p-150n	10p-220n	10p-330n	390p-680n	680p-1.0µ
	X7R	100p-47n	100p-220n	100p-470n	330p-1.0µ	100p-680n	150p-2.2µ	220p-1.8µ	220p-3.3µ	330p-3.3µ	470p-10µ	1.0n-15µ	2.2n-22µ
	X5R	100p-68n	100p-330n	100p-680n	330p-1.5µ	100p-1.0µ	150p-3.3µ	220p-6.8µ	220p-6.8µ	330p-10µ	n/a	n/a	n/a
100V	C0G/NP0	0.47p-470p	1.0p-2.2n	1.0p-8.2n	3.9p-18n	4.7p-18n	10p-47n	10p-68n	10p-68n	10p-82n	10p-270n	390p-470n	680p-680n
	X7R	100p-33n	100p-100n	100p-330n	330p-680n	100p-560n	150p-1.5µ	220p-1.5µ	220p-2.2µ	330p-2.7µ	470p-5.6µ	1n-10µ	2.2n-15µ
200/250V	C0G/NP0	0.47p-150p	1.0p-820p	1.0p-2.7n	3.9p-6.8n	4.7p-6.8n	10p-15n	10p-27n	10p-27n	10p-39n	10p-100n	390p-220n	680p-330n
	X7R	100p-10n	100p-56n	100p-150n	330p-330n	100p-270n	150p-680n	220p-1.0µ	220p-1.0µ	330p-1.5µ	470p-3.3µ	1.0n-5.6µ	2.2n-10µ
500V	C0G/NP0	0.47p-68p*	1.0p-390p	1.0p-1.5n	3.9p-4.7n	4.7p-3.9n	10p-10n	10p-18n	10p-15n	10p-22n	10p-68n	390p-150n	680p-220n
	X7R	100p-1.5n*	100p-10n	100p-47n	330p-120n	100p-120n	150p-330n	220p-560n	220p-560n	330p-820n	470p-1.0µ	1.0n-1.8µ	2.2n-3.3µ
630V	C0G/NP0	n/a	1.0p-180p	1.0p-1.0n	3.9p-1.8n	4.7p-2.2n	10p-5.6n	10p-10n	10p-10n	10p-15n	10p-39n	390p-68n	680p-150n
	X7R	n/a	100p-6.8n	100p-33n	330p-47n	100p-68n	150p-180n	220p-180n	220p-330n	330p-390n	470p-680n	1.0n-1.2µ	2.2n-2.2µ
1kV	C0G/NP0	n/a	1.0p-100p	1.0p-470p	3.9p-1.2n	4.7p-1.2n	10p-3.3n	10p-6.8n	10p-8.2n	10p-10n	10p-22n	390p-39n	680p-68n
	X7R	n/a	100p-4.7n	100p-27n	330p-33n	100p-47n	150p-100n	220p-120n	220p-120n	330p-150n	470p-180n	1.0n-390n	2.2n-1.0µ
1.2kV	C0G/NP0	n/a	n/a	1.0p-220p	3.9p-680p	4.7p-1.0n	10p-2.2n	10p-3.9n	10p-4.7n	10p-6.8n	10p-18n	390p-33n	680p-47n
	X7R	n/a	n/a	100p-15n	330p-10n	100p-10n	150p-33n	220p-68n	220p-82n	330p-100n	470p-150n	1.0n-220n	2.2n-470n
1.5kV	C0G/NP0	n/a	n/a	1.0p-180p	3.9p-470p	4.7p-680p	10p-1.5n	10p-2.7n	10p-3.3n	10p-4.7n	10p-12n	390p-22n	680p-33n
	X7R	n/a	n/a	100p-10n	330p-6.8n	100p-6.8n	150p-22n	220p-47n	220p-47n	330p-68n	470p-100n	1.0n-150n	2.2n-330n
2kV	C0G/NP0	n/a	n/a	1.0p-150p	3.9p-220p	4.7p-270p	10p-820p	10p-1.2n	10p-1.8n	10p-2.2n	10p-5.6n	390p-10n	680p-18n
	X7R	n/a	n/a	100p-2.2n	330p-4.7n	100p-4.7n	150p-10n	220p-10n	220p-27n	330p-33n	470p-47n	1.0n-82n	2.2n-150n
2.5kV	C0G/NP0	n/a	n/a	n/a	n/a	4.7p-220p	10p-680p	10p-1.0n	10p-1.5n	10p-1.8n	10p-4.7n	390p-6.8n	680p-12n
	X7R	n/a	n/a	n/a	n/a	100p-1.5n	150p-3.3n	220p-6.8n	220p-8.2n	330p-12n	470p-33n	1.0n-68n	2.2n-100n
3kV	C0G/NP0	n/a	n/a	n/a	n/a	4.7p-180p	10p-470p	10p-820p	10p-1.2n	10p-1.5n	10p-3.3n	390p-6.8n	680p-10n
	X7R	n/a	n/a	n/a	n/a	100p-1.2n	150p-2.7n	220p-3.9n	220p-6.8n	330p-8.2n	470p-22n	1.0n-47n	2.2n-82n
4kV	C0G/NP0	n/a	n/a	n/a	n/a	4.7p-150p*	10p-390p*	10p-680p*	10p-1.0n*	10p-1.2n*	10p-1.5n	390p-4.7n	680p-6.8n
	X7R	n/a	n/a	n/a	n/a	100p-1.0n*	150p-2.2n*	220p-2.2n*	220p-4.7n*	330p-5.6n*	470p-6.8n	1.0n-15n	2.2n-33n
5kV	C0G/NP0	n/a	n/a	n/a	n/a	4.7p-82p*	10p-270p*	10p-470p*	10p-680p*	10p-820p*	10p-1.0n	390p-2.2n	680p-3.9n
	X7R	n/a	n/a	n/a	n/a	100p-680p*	150p-1.2n*	220p-1.8n*	220p-3.9n*	330p-4.7n*	n/a	1.0n-10n	2.2n-22n
6kV	C0G/NP0	n/a	n/a	n/a	n/a	4.7p-56p*	10p-220p*	10p-330p*	10p-470p*	10p-560p*	n/a	n/a	n/a
	X7R	n/a	n/a	n/a	n/a	100p-390p*	150p-1.0n*	220p-1.5n*	220p-2.2n*	330p-2.7n*	n/a	n/a	n/a
		0603	0805	1206	1210	1808	1812	1825	2220	2225	3640	5550	8060

Note: * Indicates components that require conformal coating post soldering.

1.11 - IECQ-CECC

Maximum capacitance values.

		0603	0805	1206	1210	1808	1812	2220	2225
16V	C0G/NP0	1.5nF	6.8nF	22nF	33nF	33nF	100nF	150nF	220nF
	X7R	100nF	330nF	1.0µF	1.5µF	1.5µF	3.3µF	5.6µF	6.8µF
25V	C0G/NP0	1.0nF	4.7nF	15nF	22nF	27nF	68nF	100nF	150nF
	X7R	56nF	220nF	820nF	1.2µF	1.2µF	2.2µF	4.7µF	5.6µF
50/63V	C0G/NP0	470pF	2.7nF	10nF	18nF	18nF	33nF	68nF	100nF
	X7R	47nF	220nF	470nF	1.0µF	680nF	1.5µF	2.2µF	3.3µF
100V	C0G/NP0	330pF	1.8nF	6.8nF	12nF	12nF	27nF	47nF	68nF
	X7R	10nF	47nF	150nF	470nF	330nF	1.0µF	1.5µF	1.5µF
200V	C0G/NP0	100pF	680pF	2.2nF	4.7nF	4.7nF	12nF	22nF	27nF
	X7R	5.6nF	27nF	100nF	220nF	180nF	470nF	1.0µF	1.0µF
500V	C0G/NP0	n/a	330pF	1.5nF	3.3nF	3.3nF	10nF	15nF	22nF
	X7R	n/a	8.2nF	33nF	100nF	100nF	270nF	560nF	820nF
1kV	C0G/NP0	n/a	n/a	470pF	1.0nF	1.2nF	3.3nF	8.2nF	10nF
	X7R	n/a	n/a	4.7nF	15nF	18nF	56nF	120nF	150nF

1.11 - S05, S02A(1) Space Grade and MIL-PRF-55681(2) ranges

Maximum capacitance values.

		0603	0805	1206	1210	1812	2220	2225
16V	C0G/NP0	390pF - 1.5nF	1pF - 6.8nF	1pF - 22nF	10pF - 33nF	220pF - 100nF	470pF - 150nF	560pF - 220nF
	X7R	330pF - 100nF	100pF - 330nF	680pF - 1.0µF	1.0nF - 1.5µF	3.9nF - 3.3µF	10nF - 5.6µF	18nF - 6.8µF
25V	C0G/NP0	390pF - 1.0nF	1pF - 4.7nF	1pF - 15nF	10pF - 22nF	220pF - 68nF	470pF - 100nF	560pF - 150nF
	X7R	330pF - 56nF	100pF - 220nF	680pF - 820nF	1.0nF - 1.2µF	3.9nF - 2.2µF	10nF - 4.7µF	18nF - 5.6µF
50/63V	C0G/NP0	0.5pF - 470pF	1pF - 2.7nF	1pF - 10nF	10pF - 18nF	220pF - 39nF	470pF - 68nF	560pF - 100nF
	X7R	330pF - 47nF	100pF - 220nF	680pF - 470nF	1.0nF - 1.0µF	3.9nF - 2.2µF	10nF - 3.3µF	18nF - 3.3µF
100V	C0G/NP0	1pF - 330pF	1pF - 1.8nF	1pF - 6.8nF	10pF - 12nF	220pF - 27nF	470pF - 47nF	560pF - 68nF
	X7R	100pF - 10nF	100pF - 47nF	100pF - 150nF	1.0nF - 470nF	3.9nF - 1.0µF	10nF - 1.5µF	18nF - 1.5µF
200V	C0G/NP0	1pF - 100pF	1pF - 680pF	1pF - 2.2nF	10pF - 4.7nF	220pF - 12nF	470pF - 22nF	560pF - 27nF
	X7R	100pF - 5.6nF	100pF - 27nF	100pF - 100nF	1.0nF - 220nF	3.9nF - 470nF	10nF - 1.0µF	18nF - 1.0µF

Notes:
1) In accordance with ESCC 3009.
2) In accordance with MIL-PRF-55681 Group A tests.

1.11 - AEC-Q200 Rev C ranges

Maximum capacitance values.

		0603	0805	1206	1210	1812
50/63V	C0G/NP0	470pF	2.7nF	10nF	18nF	39nF
	X7R	33nF	150nF	330nF	680nF	1.5µF
100V	C0G/NP0	330pF	1.8nF	6.8nF	12nF	27nF
	X7R	10nF	47nF	150nF	470nF	1µF
200V	C0G/NP0	100pF	680pF	2.2nF	4.7nF	12nF
	X7R	5.6nF	27nF	100nF	220nF	470nF
500V	C0G/NP0	n/a	330pF	1.5nF	3.9nF	10nF
	X7R	n/a	8.2nF	33nF	100nF	270nF
630V	C0G/NP0	n/a	n/a	1.0nF	1.8nF	5.6nF
	X7R	n/a	n/a	10nF	27nF	150nF
1kV	C0G/NP0	n/a	n/a	470pF	1nF	3.3nF
	X7R	n/a	n/a	4.7nF	15nF	56nF

1.12 - Termination types available

	Syfer reliability SM product group					
	Standard SM capacitors	IECQ-CECC	AEC-Q200	MIL-PRF 55681(1)	S (space grade) High Rel	
					S05	S02A
F = Silver Palladium. RoHS compliant.	■	■	-	■	■	■
J = Silver base with nickel barrier (100% matte tin plating). RoHS compliant.	■	■	C0G/NP0 dielectric only	■	❒	❒
A = Silver base with nickel barrier (Tin/lead plating with min. 10% lead).	■	■	-	■	■	■
Y = FlexiCap™ termination base with Ni barrier (100% matte tin plating). RoHS compliant.	■	■	■	■	❒	❒
H = FlexiCap™ termination base with Ni barrier (Tin/lead plating with min. 10% lead).	■	■	-	■	■	■

■ Termination available.
❒ Termination available but generally not requested for space grade components. Please discuss with Syfer Sales.

Notes:
1) In accordance with MIL-PRF-55681 group A. Additional optional tests available.

1.13 - Ordering information

Standard product code construction

1210	Y	100	0103	J	X	T	_ _ _
Chip size	**Termination**	**Voltage**	**Capacitance in picofarads (pF)**	**Capacitance tolerance**	**Dielectric Rel Release codes**	**Packaging**	**Suffix code**
	Y = FlexiCap™ termination base with Ni barrier (100% matte tin plating). RoHS compliant. **H** = FlexiCap™ termination base with Ni barrier (Tin/lead plating with min. 10% lead). **F** = Silver Palladium. RoHS compliant. **J** = Silver base with nickel barrier (100% matte tin plating). RoHS compliant. **A** = Silver base with nickel barrier (Tin/lead plating with min. 10% lead).	010 = 10V 016 = 16V 025 = 25V 050 = 50V 063 = 63V 100 = 100V 200 = 200V 250 = 250V 500 = 500V 630 = 630V 1K0 = 1kV 1K2 = 1.2kV 1K5 = 1.5kV 2K0 = 2kV 2K5 = 2.5kV 3K0 = 3kV 4K0 = 4kV 5K0 = 5kV 6K0 = 6kV	First digit is 0. Second and third digits are significant figures of capacitance code. The fourth digit is number of zeros following Example: 0103 = 10nF	<10pF B = ±0.1pF C = ±0.25pF D = ±0.5pF ≥ 10pF F = ±1% G = ±2% J = ±5% K = ±10% M = ±20%	**C** = C0G/NP0 (1B) **X** = X7R (2R1)	**T** = 178mm (7") reel **R** = 330mm (13") reel **B** = Bulk pack - tubs	Used for specific customer require-ments

1.13 - IECQ-CECC product code construction

1210	Y	100	0103	J	D	T	_ _ _
Chip size	Termination	Voltage	Capacitance in picofarads (pF)	Capacitance tolerance	Dielectric Release codes(1)	Packaging	Suffix code
	Y = FlexiCap™ termination base with Ni barrier (100% matte tin plating). RoHS compliant. **H** = FlexiCap™ termination base with Ni barrier (Tin/lead plating with min. 10% lead). **F** = Silver Palladium. RoHS compliant. **J** = Silver base with nickel barrier (100% matte tin plating). RoHS compliant. **A** = Silver base with nickel barrier (Tin/lead plating with min. 10% lead).	016 = 16V 025 = 25V 050 = 50V 063 = 63V 100 = 100V 200 = 200V 250 = 250V 500 = 500V 630 = 630V 1K0 = 1kV	First digit is 0. Second and third digits are significant figures of capacitance code. The fourth digit is number of zeros following Example: 0103 = 10nF	<10pF B = ±0.1pF C = ±0.25pF D = ±0.5pF ≥ 10pF F = ±1% G = ±2% J = ±5% K = ±10% M = ±20%	**D** = X7R (2R1) with IECQ-CECC release **F** = C0G/NP0 (1B/NP0) with IECQ-CECC release **B** = 2X1/ BX released in accordance with IECQ-CECC **R** = 2C1/ BZ released in accordance with IECQ-CECC	**T** = 178mm (7") reel **R** = 330mm (13") reel **B** = Bulk pack - tubs	Used for specific customer require-ments

1.13 - S05 and S02A product code construction

1210	A	100	0103	J	X	T	_ _ _
Chip size	Termination	Voltage	Capacitance in picofarads (pF)	Capacitance tolerance	Dielectric Rel Release codes	Packaging	Suffix code
	A = Silver base with nickel barrier (Tin/ lead plating with min. 10% lead). **F** = Silver Palladium. RoHS compliant. **H** = FlexiCap™ termination base with Ni barrier (Tin/ lead plating with min. 10% lead).	016 = 16V 025 = 25V 050 = 50V 063 = 63V 100 = 100V 200 = 200V	First digit is 0. Second and third digits are significant figures of capacitance code. The fourth digit is number of zeros following Example: 0103 = 10nF	<10pF B = ±0.1pF C = ±0.25pF D = ±0.5pF ≥ 10pF F = ±1% G = ±2% J = ±5% K = ±10% M = ±20%	**C** = C0G/NP0 (1B) **X** = X7R (2R1)	**T** = 178mm (7") reel **R** = 330mm (13") reel **B** = Bulk pack - tubs **Q** = Waffle pack	Used for specific customer requirements **S05** = S (Space Grade) High Rel **S02A** = (2)S (Space Grade) High Rel

1.13 - Ordering information

AEC-Q200 product code construction

1210	Y	100	0103	J	E	T	_ _ _
Chip size	Termination	Voltage	Capacitance in picofarads (pF)	Capacitance tolerance	Dielectric Rel Release codes	Packaging	Suffix code
	Y = FlexiCap™ termination base with Ni barrier (100% matte tin plating). RoHS compliant. **J** = Silver base with nickel barrier (100% matte tin plating). RoHS compliant. (J termination not available with X7R products).	050 = 50V 063 = 63V 100 = 100V 200 = 200V 250 = 250V 500 = 500V 630 = 630V 1K0 = 1kV	First digit is 0. Second and third digits are significant figures of capacitance code. The fourth digit is number of zeros following Example: 0103 = 10nF	<10pF B = ±0.1pF C = ±0.25pF D = ±0.5pF ≥ 10pF F = ±1% G = ±2% J = ±5% K = ±10% M = ±20%	**A** = C0G/NP0 (1B) **E** = X7R (2R1)	**T** = 178mm (7") reel **R** = 330mm (13") reel **B** = Bulk pack - tubs	Used for specific customer requirements

Notes:

1) A & F approved for Space applications. If another termination type is required then contact Syfer Sales.

2) Please include Lot Acceptance Test requirement (LAT1, LAT2 or LAT3) on purchase order against each line item. Tests conducted after 100% Burn-In (2xRV @125ºC for 168 hours):
   LAT1: 4 x adhesion, 8 x rapid temp change + LAT2 and LAT3.
   LAT2: 20 x 1000 hour life test + LAT3.
   LAT3: 6 x TC and 4 x solderability.

Mouser Electronics

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Knowles:

2220Y5000105KXTWS2 0805Y1000103MET 0603Y0500103KET 0603Y0500471KET 0603Y0500102KET 0603Y0250104KETFB6 0603Y0500104KETFB6 0603Y0500473KET 0603Y1000223KET 0603Y1000473KET 0805Y0500103KST 0805Y1000103KST 0805Y1000223KST 1206Y1000224KET 1210J6300682JKTAG1 0805Y1000104KST 0805Y1K00102KST 0805Y1K00472KST 1206Y2K00222KST 1812Y2K00103KST 1812Y2K00222KST 1812Y2K00472KST 0805Y1000104KET 2220Y4K00222KET 1812Y4K00222KET 0805Y0500150KAT 2220JA250221KXTB16 0603Y0500104KET 060330160104JXT 0603J0503P30DAT 0603J0630271JAT 0603J0630560JAT 0603J0634P70DAT 0603Y0500271JAT 0603Y0500471KAT 0603Y0630120JAT 0603Y2000182KET 0805Y0630470KAT 0805Y2001P20CAT 0805Y5000151KET 1206J0630150JAT 1206J0631P20CAT 1206J2000220JAT 1206Y0500390JAT 1206Y0500561KAT 1206Y0630102JAT 1206Y0630274JET 1206Y0630681MET 1206Y0638P20BAT 1206Y2000333JET 1206Y5000560JAT 1206Y6300121KET 1210J0500153GAT 1210J0630102FAT 1210J0630102KAT 1210J0630153KAT 1210J1000181JAT 1210J1K00680JAT 1210J2000152JAT 1210J2000272FAT 1210J6300122KAT 1210J6300470KAT 1210Y0500822KET 1210Y0630120KAT 1210Y0630181GAT 1210Y1000122MET 1210Y1000471GAT 1210Y2000122MET 1210Y2000333JET 1210Y5000103JET 1210Y5000471JET 1210Y5000821MET 1210Y6300681KAT 1812J0630103GAT 1812J0630392FAT 1812J0630472KAT 1812J1K00152GAT 1812J1K00821JAT 1812J5000180KAT 1812J5000560KAT 1812J6300122GAT 1812Y0500125MET 1812Y0500471GAT 1812Y0630563KET 1812Y1K00183JET 1812Y1K00561KAT 1812Y2000184JET 1812Y5000104KET 1812Y5000562MET 1812Y6300122JET 1812Y6300271JAT 1812Y6300473KET 0805Y0500151KAT 0603J1000121GAT 0603J1000271GAT 0603J2000270KAT 0603Y0630330GAT 0603Y1006P80CAT 0805J0630330JAT 0805J2006P80DAT