

Multilayer Ceramic Components

Product Safety Information and Related Documents

Product Safety Information



This should be read in conjunction with the product data. Failure to observe the ratings and the information on this sheet may result in a safety hazard.

1. Material Content

The electronic components described in this catalogue are not considered to be substances or preparations within the meaning of the Chemicals Hazard Information and Packaging for Supply Regulations, and therefore there is no regulatory requirement to supply safety data sheets or hazard warning labels. However the following descriptions of the materials used may be useful when considering safety precautions and waste disposal methods. All Syfer chip capacitors, EMI chips and 1206 Pi filters fully comply with the WEEE (Waste Electrical and Electronic Equipment) and RoHS (Restriction of Hazardous Substances) Directives. Please see our application note on the Syfer.com website for further information.

- a. Ceramics:** these are blends of oxides of Barium or Magnesium and Titanium, with smaller additions of oxides of Aluminium, Boron, Bismuth, Calcium, Cobalt, Manganese, Niobium, Neodymium, Lead, Silicon, Tin, Zinc and Zirconium which are fired at high temperatures to give an insoluble reacted mass.
- b. Internal electrodes:** these are combinations of precious metals, mainly Palladium and Silver, which are relatively inert.
- c. Terminations:** these are combinations of precious metals, again mainly Palladium and Silver, which are fused to the ceramic body by a small amount of glass. The FlexiCap termination contains Silver and Polymer and is totally lead free. The terminations may also be covered with electroplated layers of Nickel and Tin or Tin/Lead.
- d. Leaded Product:** Tinned copper or steel wires are attached to the capacitor terminations using Tin/Lead or Tin/Silver solder alloys. The parts are encapsulated with a cured epoxy resin which contains Antimony trioxide as a fire retardant.
- e. Filter Product:** The ceramic elements are soldered to copper based current carrying axial leads using solders of different alloys dependent on particular filter type. These solders are formed from the elements Tin, Silver, Indium, Lead and Copper in varying proportions dependent on alloy used. If a filter body is present it will be manufactured from steel or copper alloy and soldered to the ceramic element using the same solder alloys as described above. All metal parts are electroplated with Nickel, Silver or Gold over a Copper or Nickel undercoat. Ferrite beads consisting of Manganese Zinc Ferric Oxide and Nickel Zinc Ferric Oxide are used to increase inductance in L-C and PI type filters. Encapsulants, are high purity epoxy resins with a synthetic fused silica filler. Conductive epoxies containing silver particles may be used to form electrical connections.
- f. Stacked chip capacitors:** These are joined using high temperature Tin/Lead/Silver solders or conductive epoxies containing silver particles. Lead frames, where used are copper alloy, electroplated with Silver over a Copper or Nickel undercoat.

2. Failure Mode

The normal failure mode of the component is to become short circuit. If there is then sufficient electrical power available the component will become extremely hot. Although the ceramic and metallic components of the capacitors are non-combustible, there is therefore a danger of ignition of neighbouring combustible materials and the encapsulation (if present). The component materials of the capacitor may also be vaporized, and give off toxic fumes. In the case of MLCC the component voltage ratings must not be exceeded and it is advisable to include current limiting in the circuit design. Circuits should be designed to fail safe under normal modes of failure.

3. Handling and Storage

The components represent no health hazard when handled normally. However, during testing or circuit operation capacitors can become charged to high voltages, and may retain this charge even after the equipment is switched off. Components must be discharged before being handled.

Care should be taken when handling components not to damage either the capacitor or any encapsulation so that the risk of failure is increased. Ideally long term storage conditions should be temperature controlled between -5°C and +40°C, and humidity controlled between 40 and 60% RH. The solderability of the component may be degraded by storage in contaminated atmospheres.

4. Disposal

It may be worthwhile refining scrap components to recover their precious metal content if there is a sufficient quantity available. In general the disposal of electronic equipment is covered by the EU directive on Waste Electrical and Electronic Equipment which lays down measures which aim to prevent waste electronic equipment and promote re-use, re-cycling and recovery.

5. Environmental Considerations

Syfer has eliminated the use of substances that are implicated in stratospheric ozone depletion as defined in the Montreal Protocol. In addition the use of VOCs, which can lead to ozone formation in the troposphere, is reviewed with the object of minimizing any emissions and eliminating the most harmful.

Other elements of the company's activities are assessed to determine which areas should be given priority in order to minimize any environmental impacts. Syfer is approved to ISO14001.

Capacitor Related Documents

BS EN 60384-1

Generic Specification : fixed capacitors.

CECC 32 100

Sectional Specification : fixed multilayer ceramic chip capacitors.

BS CECC 30 600

Sectional Specification : fixed ceramic capacitors, type 1.

BS CECC 30 700

Sectional Specification : fixed ceramic capacitors, type 2.

BS EN 60286-2

Packaging of components for automatic handling.

BS EN 60286-3

Packaging of components for automatic handling.

EIA-469-C

Destructive physical analysis of ceramic capacitors.

Filter Related Documents

MIL-F-15733G

General specification for RFI filters and capacitors.

MIL-F-28861B

General specification for electromagnetic interference suppression filters and capacitors.

MIL-STD-220A

Method of insertion loss measurement.

MIL-STD-202F

Test methods for electronic and electrical component parts.

BS 9120:1988

Radio interference suppression filters of assessed quality: Generic data and methods of test.

BS 9125:1988

Capability approval of manufacturers of passive radio interference suppression filter units of assessed quality generic data.

BS 6299:1982

Measurement of the suppression characteristics of passive radio interference filters and suppression components.

CISPR 17:1981

Measurement of the suppression characteristics of passive radio interference filters and suppression components.

BS 2011:-

Environmental testing.

BS EN 60068:-

Environmental testing.

BS 2816:1989

Electroplated coatings of silver.

BS 3382

Electroplated coatings of threaded components.

Multilayer Ceramic Capacitors

Quality Requirements

Quality Requirements

Full details of the Qualification and Testing to Specification requirements are contained in the appropriate IEC/CECC specifications. Below are listed the major test parameters applicable to all our multilayer ceramic products. Under "Requirements Limits", where applicable, typical results of our products are listed.

Rating	Test procedures	Requirement Limits
Capacitance	At 20°C ± 1°C (Ref tests)	
Class 1B/CG	≤1000pF ≤1 volt rms at 1 MHz > 1000pF ≤1 volt rms at 1kHz	E24 Series of values available, see size and capacitance tables
Class 2C1 2R1 2X1	Preconditioning 1 hour at upper category temperature, followed by 24 hours at standard atmospheric conditions 1.0V rms at 1kHz for chip product. 0.5V rms at 1kHz for radial leaded product.	After correcting to allow for 1000 hour ageing E12 series of values available, see size and capacitance tables
Capacitance Tolerance		
Class 1B/CG	as for capacitance	Cr < 10pF ± 0.10pF (B) ± 0.25pF (C) ± 0.50pF (D) ± 1.00pF (F) Cr ≥ 10pF ± 1% (F) ± 2% (G) ± 5% (J) ± 10% (K)
Class 2C1 2R1 2X1	as for capacitance	± 5% (J) ± 10% (K) ± 20% (M)
Tangent of loss angle (Tan δ)		
Class 1B/C	as for capacitance	Cr > 50pF: tan δ ≤ 15 × 10 ⁻⁴ Cr ≤ 50pF: tan δ = 0.015(15/Cr+0.7) Typical results: 0.0005 to 0.0008
Class 2C1 2R1 2X1	as for capacitance	tan δ ≤ 250 × 10 ⁻⁴ Typical results 2C1 - 0.015 to 0.020

Rating	Test procedures	Requirement Limits
Climatic sequence test		
1. Dry heat	15 hours at upper category temperature	No visible damage (Test Ba IEC 60068-2-2)
2. Damp heat cycle	1 cycle of 24 hours at 55°C ± 2°C Relative humidity 95-100% no voltage applied	(Test Db IEC 60068-2-30)
3. Cold cycle	Lower category temperature for 2 hours	(Test Aa IEC 60068-2-1)
4. Damp heat	Class 1B/CG and Class 2C1, 2R1, 2X1 4 cycles as 2 above: after a recovery period	No visible damage Markings remain legible (Test Db IEC 60068-2-30) Capacitance change Class 1B/CG ± 2% or 2pF whichever is greater. Typical results:- negligible change. Class 2C1, 2R1, 2X1 ± 10% Typical results:- chips <0.5%, leaded caps. 1-2% (Test Db IEC 60068-2-30) Tangent of loss angle (tan δ) Class 1B/CG - 2 times initial value Typical results:- no change Class 2C1, 2R1, 2X1 - 0.05 Typical results:- no change (Test Db IEC 60068-2-30) Insulation resistance Class 1B/CG - 2500MΩ or 25s whichever is less. Typical results:- >20GΩ Class 2C1, 2R1, 2X1, ≥1000MΩ or 25s whichever is less. Typical results:- >20GΩ (Test Db IEC 60068-2-30)
Endurance	1000 hours at 1.5 times rated voltage and at upper category temperatures 1B/CG and 2C1, 2R1, 2X1 at 125°C. Recovery (class 2 only) 24 hours at standard atmospheric conditions.	No visible damage. Markings remain legible Capacitance change Class 1B/CG ± 2% or 1pF whichever is greater. Typical results:- negligible change. Class 2C1, 2R1, 2X1 ± 10% Typical results:- ± 2 to 5% Tan δ change Less than 1.5 times initial value. Typical results:- No change IR change Less than 0.25 times initial value. Typical results:- >20GΩ (Test Ba IEC 60068-2-2)

Multilayer Ceramic Capacitors

Quality Requirements

Quality Requirements/Factory and Product Approvals

Rating	Test procedures	Requirement Limits
Robustness of Terminations (Tensile (pull) test) Radial units only	For 0.5mm (0.02 inches) dia leads 10N (1Kg (2.2lbs)). For 0.6mm (0.025) dia leads 10N (1Kg (2.2lbs)).	No visible damage (Test Ua IEC 60068-2-21)
Bending test Radial units only	2 bends through 90° weight 5N (0.5Kg)	No visible damage (Test Ub IEC 60068-2-21)
Adhesion Chips only	Chip capacitor mounted on a substrate. A force of 5N (0.5Kg) is applied normally to the line joining the terminations and in a line parallel to the substrate. The force is applied progressively without shock for 10 ± 1 second.	No visible damage (Test U IEC 60068-2-21)
Solderability test Chips only	Flux Bath Temperature 20±2°C; solder bath temperature 230±10°C. immersed in flux bath for 5±1sec; immersed in solder bath for 2±0.5 sec. Recovery for 30-0+10 mins.	Termination area shall be at least 90% covered with smooth solder coating. No more than 10% termination to be leached or dewetted, with not more than 5% concentrated in one area. (Test Td IEC 60068-2-58)
Resistance to soldering heat Chips only	Immersed in flux bath for 2 sec; immersed in solder bath 260° +5°C for 10 ± 1 sec.	No capacitance change from initial value. Class 1B/CG - 0.5% or 0.5pF. Typical results:- negligible change. Class 2C1, 2R1, 2X1 - 5% + 10% Typical results:- <1% (Test Td IEC 60068-2-58)
Solderability Leaded capacitors	No preliminary drying or preconditioning. Temperature as for chip capacitors. Solder bath method, immersion of leads up to 2 + 0.5 - 0mm from the body of the capacitor for 3 seconds using a heat shield.	Good tinning (Test Ta IEC 60068-2-20)
Resistance to soldering heat Leaded capacitors	Temperature as for chip capacitors. Immersion of the capacitor leads to within 3.5 - 0 + 0.5mm from capacitor body.	No visible damage. Capacitance change from initial Class 1B/CG ≤ 0.5% or 0.5pF whichever is greater. Typical results:- negligible change Class 2C1, 2R1, 2X1 - ≤ 10% Typical results:- <1% (Test Tb IEC 60068-2-20)
Destructive Physical Analysis All chips for all product ranges	Sample every batch. Metallographic examination in a suitable resin. Half sample in transverse plane, remainder longitudinal plane. Examination under suitable magnification of X 100 to X 300.	As detailed in the relevant specification EIA-469
Accelerated Damp Heat Steady State Surface mount chip only	85°C, 85% RH, 500hrs Half - In series 100K ΩR 1.5 Vdc Half - In series 6.8K ΩR 50 Vdc	Recovery time 4-24 hours IR measurement including series R not less than 10% of initial measurement (Test Ca IEC 60068-2-3)

Factory Approvals

Factory manufacturing approval	Certificate number
CECC	M/0039/CECC/UK
ISO 9001:2000	FM 21663
ISO 14001	EMS 68436
OHSAS 18001	OHS 75225
TÜV	R2110618, R60001955
UL	E235189, E228790

A number of requirements must be achieved to obtain factory manufacturing approval under the above schemes. They are specified in the appropriate Quality Assurance manuals and concern the following:

1. Appointment and supervision of the factory inspection staff and facilities.
2. Control of the manufacturing process.
3. Operation of the test and calibration facilities.
4. Control of changes in the design and manufacture.
5. Stores procedures.
6. Maintenance of accurate records to enable batch traceability.

After an initial factory audit, the supervision of approvals is continuously monitored by an independent inspection authority.

Product Approval

Standard products are approved to the appropriate CECC specification. A complete listing of our product approvals is available upon request. The approvals give the equipment manufacturer the opportunity to purchase multilayer ceramic capacitors to commonly agreed and widely accepted specifications. Qualification approval of a product involves:

1. Specification of the product in an approved specification meeting the defined rules.
2. Qualification testing, including electrical, mechanical, environmental and life testing.
3. Supervision of testing and authentication of results.

Under these systems where product approval is held a formal certificate of conformity will accompany the components when they are despatched.

Certificate Test Record (CTR)

A periodical summary of certified test records (CTR's) obtained from specified tests for approved components to CECC specifications are available upon request.

Copies of qualification approval certificates are available.

Products approved to CECC specification generally comply with the appropriate MIL specification.

Quality Assurance and Burn-in

The establishment and maintenance of our ongoing quality programme under the 'Factory and Product Approval' schemes, together with the following tests and inspections on all products ensures the conformance of our product to customers' requirements.

1. 100% capacitance and tan δ testing.
2. 100% voltage proof testing.

We can also provide a service to supply 'burn-in or stress screened' product where required on a sample or 100% basis, test conditions subject to negotiation.