Inductors

Quality and environment

Date: October 2008

Corporate goals

Our aim is to play a leading role among the world's most competitive companies in the sector of electronic components. This aim is shared by the EPCOS quality and environment management system:

1 EPCOS quality system

1.1 Extract from EPCOS quality policy

- The quality of our products and services represents a key constituent of our corporate strategy, whose principal aim is customer satisfaction.
- Our quality management system is continuously oriented to the international standards that stipulate the highest requirements.

1.2 Quality management system

The quality management system to ISO/TS 16949:2002 is applied throughout the company and is used to implement the EPCOS quality policy. The implications include:

As a rule, product and process developments follow the rules of APQP[1)],

Quality tools such as FMEA[2)], DoE[3)] and SPC[4)] minimize risks and ensure continuous improvements in conjunction with regular internal audits and QM reviews.

1.3 Certification

The EPCOS quality management system forms the basis for the company certification to ISO 9001:2000 and ISO/TS 16949:2002 that comprises the EPCOS plants and sales organizations. The company certificates are posted on the EPCOS Internet (www.epcos.com/quality).

1.4 Production sequence and quality assurance

The business units implement the corporate specifications for quality management in procedural and work instructions referred to products and processes.

1.5 Delivery quality

"Delivery quality" means compliance with the agreed data at the time of delivery.

1.6 Failure criteria

A component is defective if one of its features does not correspond to the specification of the data sheet or an agreed delivery specification.

1.7 Incoming goods inspection at the customer

We recommend the use of a random sampling plan to ISO 2859-1 (contents compliant with MIL STD 105 D and IEC 410) for the incoming inspection.

The test methods to be used are laid down in the relevant standards. Deviations must be agreed by the customer and the supplier.

1) APQP = Advanced Product Quality Planning
2) FMEA = Failure Modes and Effects Analysis
3) DoE = Design of Experiments
4) SPC = Statistical Process Control

1.8 Service life/reliability

The service life in terms of reliability is the time period during which random failures occur, i.e. the range in the product operating life in which the failure rate remains largely constant (early failures and end of operating life excepted). The value depends strongly on conditions of use.

The ambient temperature, direct current loads and the inherent heating caused by alternating current loads might have a decisive effect on the service life and usability of chokes and inductors.

1.9 Failure rate (long-term failure rate)

The failure rate is defined as the fraction failure divided by a specified operating period. The failure rate is expressed in fit (failures per 10^9 component test hours) or percentage failure in 1000 hours.

1 fit $= 1 \cdot 10^{-9}$ failures/h (**fit** = **f**ailure **i**n **t**ime)

Example of a failure rate λ_{test} determined by a service life test:

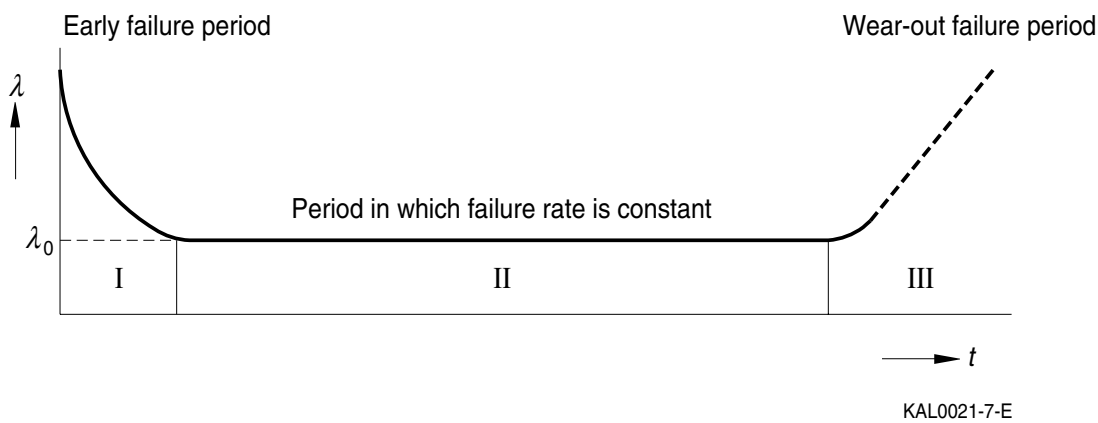
1) Number of components tested $N = 8\,000$
2) Operating hours (duration of test) $t_b = 25\,000$ h
3) Number of failures $n = 2$

$$\lambda_{test} = \frac{n}{N} \cdot \frac{1}{t_b} = \frac{2}{8000} \cdot \frac{1}{25000} = 10 \text{ fit} = 0,001\ \%/1000\text{h}.$$

When failure rate values are stated, the corresponding failure criteria and the operating and ambient conditions must also be given.

The failure rate of components, when plotted against time, shows the following characteristic curve with the three periods

I: early failure period,
II: service period,
III: wear-out failure period



Unless otherwise specified, the given failure rate refers to the service period (phase II).

During phase II, an approximately constant failure rate λ_0 can be assumed.

1.10 Traceability

At all stages of production, components are identified by papers accompanying each batch. The completion of manufacturing and testing steps are confirmed and documented in SAP R/3. This ensures the traceability of a batch. After shipment, traceability is ensured by a code on the packing.

1.11 AQL values

The AQL (AQL = acceptable qualitiy level) figures are based on a random sampling plan to DIN ISO 2859-1 (contents compliant with MIL STD 105D and IEC 60410).

The sampling instructions of this standard are such that a delivered lot will be accepted with a probability of 90% if the percentage of non-conformancies does not exceed the stated AQL figure. As a rule, the percentage of non-conformancies in deliveries from EPCOS is significantly below the AQL figure. The acceptance value we apply to inoperatives, i.e. unusable components is c = 0.

1.12 Conditions of use

EPCOS products may only be used in line with the technical specifications and installation instructions and must comply with the state of the art. Non-observance of limits, operating conditions or handling guidelines can lead to disturbances in the circuit and other undesirable consequences such as a higher failure rate. In this connection, please note the “Important notes” on page 2.

Should you have any application-referred questions, please contact our experts, who will be pleased to advise you.

1.13 Customer complaints

If a fault occurs in a product despite careful manufacture and testing, please contact your local sales organization. They will register your complaint as an RMA[1)] process and forward it to the relevant technical departments for rapid handling.

EPCOS treats technical complaints according to the 8D methodology; i.e. with the use of interdisciplinary teams who aim to implement rapid countermeasures and sustained corrections and answer all complaints with an 8D report (8D = 8 disciplines).

In order to be able to deal quickly and smoothly with complaints, the following data are helpful:
- Number of components subject to complaint or returned
- Fault description
- How and when was the fault detected?
- Logistics data (date code, delivery note no.)
- Operating conditions
- Operating duration up to occurrence of the fault
- Measurement parameters in the case of divergent technical data

In the event of transport damage, we would ask you to describe this in more detail and if required to mark it so that it can be distinguished from any further damage sustained during the return shipment. The original package should also be checked and any damage to be described. In order to avoid further damage, the original packaging should also be used for the return shipment. In case of receiving a damaged delivery, please document this damage with a signature of the forwarding company on the delivery papers.

1) RMA = Return to Manufacturer Authorization

2 Environmental management system

2.1 Environmental policy

Our fundamental commitment to protect the environment is set down in the EPCOS environmental policy.

EPCOS defines the following guidelines for environmental protection:

- We work continuously to lighten the burden on the environment and to reduce consumption of energy and natural resources.
- We take all necessary precautions to avoid environmental hazards and damage.
- Environmental impacts are assessed and flow into product and process planning at the earliest possible stage.
- Our environmental management systems ensures that our environmental policy is effectively implemented. The technical and organizational procedures required are regularly monitored and constantly upgraded.
- Every employee is required to act in an environmentally conscious manner. Promoting of responsibility for the environment at all levels is a continuous management task.
- We seek to influence our business associates to follow environmental guidelines similar to ours. We supply our customers with information on environmentally compatible use of our products. We work in a spirit of cooperation with the relevant authorities.
- We inform the public of the environmental impact of our activities and the environmental achievements of our company.

2.2 Environmental management system

The EPCOS environmental management system for ISO 14001 that is applied across the company is used to implement the EPCOS environmental policy. It is posted on the EPCOS intranet and is thus accessible to all employees.

2.3 Certification

The EPCOS environmental management system forms the basis for the ISO 14001 company certification in which all the plants are being successively integrated.

The company certificate is posted on the Internet at www.epcos.com/environmental_management.

2.4 RoHS

In addition to superior technical characteristics and fulfillment of constantly increasing reliability requirements, the environmental impact of our inductive components is an important characteristics for EPCOS, meeting so the customers expectations.

Starting in the design phase EPCOS IN ensures that parts and processes satisfy the EPCOS BAD-SL (EPCOS Banned and Declarable - Substance List) and in particular RoHS (directive 2002/95/EC of the European Parliament and Council of January 2003 restricting the use of certain hazardous substances in electrical and electronic equipment).

RoHS analysis and reporting using the suppliers material data sheets ensure that there is no more than 0.1% concentration by weight of Pb, Hg, Cr6+, PBB and PBDE (Cd 0.01%) in homogeneous materials.

Today all inductive components and filters manufactured by EPCOS IN satisfy RoHS requirements – exception 7 allows the use of ferrite cores (magnetically active ceramic) and various components with high-temperature soldering (Pb > 80%).

For all EPCOS inductors MDS (material data sheet) and an analytical report are generated as verification of RoHS compliance (< 1 g weight of the product as *analysis of a homogeneous material* and > 1 g as the sum of the verification of the individual materials).

The term “RoHS-compatible” shall mean the following:

RoHS-compatible means that the products are in compatible with the requirements of Directive 2002/95/EC of the European Parliament and of the Council of 27 January 2003 on the restriction of the use of certain hazardous substances in electrical and electronic equipment (“Directive 2002/95/EC”), as amended by the Commission Decisions 2005/618/EC, 2005/717/EC; 2005/747/EC, 2006/310/EC, 2006/690/EC, 2006/691/EC and 2006/692/EC (“RoHS-Regulations”), and are compatible with the requirements of the provisions which will result from transformation of the RoHS-Regulations into national law to the extent such provisions reflect the RoHS-Regulations.

2.5 Material data sheets for product families

EPCOS posts material data sheets on the Internet (www.epcos.com/material) that show typical compositions of product groups by selected representatives. The materials are listed with their percentage weight distribution referred to the respective component.

As per IEC 61906 PAS, all materials with a weight percentage exceeding 0.1 are listed. All specifications are typical data and may vary slightly within a product group or production lot.

The material data sheets do not represent assured properties within the scope of the relevant legislation, but are merely given for purposes of information.

Please note in this connection the “Important notes“ on page 2.

2.6 Disposal

All inductors can be disposed off, reused or recycled.

However as disposal is regulated by national law, the respective national provisions have to be observed.