



Syfer Technology Limited, Old Stoke Road,  
Arminghall, Norwich, Norfolk, NR14 8SQ,  
United Kingdom

Tel: +44 (0) 1603 723300.

Tel. (Sales): 01603 723310

Fax: +44 (0) 1603 723301

Email: [sales@syfer.co.uk](mailto:sales@syfer.co.uk)

Web: [www.syfer.com](http://www.syfer.com)

# QUALITY & RELIABILITY DATA

Issue 6



## QUALITY & RELIABILITY DATA

# CONTENTS

- 1 ..... [Introduction](#)
- 2 ..... [Endurance & 85/85 Test Conditions](#)
- 3 ..... [F.I.T. Rate Data](#)



## Section 1

### Introduction

The major influence, within Syfer Technology Limited, is to provide its Customers with 'World Class' capacitors.

Syfer has developed its own unique 'Wet Process' for the manufacture of Multilayer Ceramic Chip Capacitors. This has been in operation for some 20 years, significantly increasing the reliability levels obtained today, over those that were the expectation then.

Syfer's 'Wet Process' is based upon the principle of Screen Printing, both ceramic and electrode layers, in a single operation. This gives a more consistent deposition and greater accuracy of electrode alignment. In contrast to parts made by 'Tape Methods', it reduces stresses within the components.

At all manufacturing stages, well defined controls are in place. Statistical Process Control (SPC) techniques are used extensively to monitor and to reduce process variability.


Microsections are prepared from each batch of product built. Destructive Physical Analysis (DPA) is conducted on each microsection to verify structural integrity and the absence of voids, delaminations or other defects.

After the fabrication cycle, 100% testing is conducted for:

- (1) Capacitance
- (2) Dissipation Factor
- (3) Insulation Resistance
- (4) Voltage Proof

Syfer's Quality Control Function audits each process stage and the outgoing products, to ensure strict conformity to internal, customer, national and international specifications.

Syfer holds IECQ-CECC, TUV, UL, ISO9001, ISO14001 and OHSAS18001 approvals.

 The logo for Syfer CMP, a Dover Company. It features a stylized 'S' inside a blue circle with 'CMP' written below it. To the right, the word 'SYFER' is written in a bold, blue, sans-serif font, with 'A DOVER COMPANY' in smaller text underneath.	Application Note Reference No. AN0004 – Rel & Qual Issue 6	Page 4 of 8
--	--	-------------

In addition to its advanced construction methods, and sophisticated Quality Controls, Syfer carries out regular long term accelerated tests on its products to prove their reliability.

The Capacitor Industry accepts that no single test, in isolation, is an effective measure of total reliability and, therefore, accelerated testing, directed at selected capacitor performance factors, is conducted, by Syfer, on a regular basis. This includes:

- (1) 125°C Endurance Testing  
at 1.5 times rated voltage
- (2) 85°C/85% Relative Humidity Testing  
at stress voltages of 1.5, 5 and 50 vdc

Syfer maintains its rigorous test regime, to give its customers useful and detailed data on the reliability of its products. There is a continuing trend toward higher value capacitors in all major dielectric categories as circuit designers have demanded even greater volumetric capacity. This has prompted an increase in the number of 'high' value lots tested; now approximately 20% of such parts are tested compared with 10% for standard product. The results presented here reflect this change in product mix.

Each section of this document describes the methodology of test and includes a summary of the results obtained. F.I.T. Rate Data is shown, based upon Endurance Test results.

The aim of this document is to confirm that Syfer continues to maintain its reputation for the manufacture of products that meet, and exceed, customer's expectations of reliability.

Syfer's Quality and Technical personnel are available to discuss this information, on request.



## Section 2

### ENDURANCE TEST CONDITIONS

<b>Duration</b>	<b>1000 Hours</b>
<b>Intermediate Check Time</b>	<b>168 Hours</b>
<b>Voltage</b>	<b>1.5 x Rated Voltage</b>
<b>Current Limitation</b>	<b>Each component stressed via a 100K<math>\Omega</math> resistor</b>
<b>Temperature</b>	<b>C0G 125°C X7R 125°C</b>
<b>Post Test Limits</b>	
<b>Insulation Resistance</b>	<b>C0G <math>\geq 4000M\Omega</math> or 40s X7R <math>\geq 2000M\Omega</math> or 50s (whichever is the less)</b>

### 85°C / 85%RH TEST CONDITIONS

<b>Duration</b>	<b>168 Hours</b>
<b>Voltage Bias</b>	<b>Rated voltage up to a maximum of 50 volts dc, however, when specified, 1.5VDC or 5VDC may be required</b>
<b>Current Limitation</b>	<b>Each component stressed via a 100K<math>\Omega</math> resistor</b>
<b>Temperature</b>	<b>85°C</b>
<b>Relative Humidity</b>	<b>85%</b>
<b>Post Test Limits</b>	
<b>Insulation Resistance</b>	<b>C0G <math>\geq 4000M\Omega</math> or 40s X7R <math>\geq 2000M\Omega</math> or 50s (Whichever is the less)</b>



### Section 3

## F.I.T. RATE DATA

### ACCELERATION FACTOR CALCULATIONS

$$\text{Acceleration Factor (AF)} = AF_{\text{voltage}} \times AF_{\text{temperature}}$$

where

$$\text{Acceleration Factor}_{\text{voltage}} = \left[ \frac{V_{\text{stress}}}{V_{\text{use}}} \right]^{2.7}$$

and

$$\text{Acceleration Factor}_{\text{temperature}} = e^{\frac{E_a}{k} \left[ \frac{1}{T_{\text{use}}} - \frac{1}{T_{\text{stress}}} \right]}$$

where  $E_a$  = Activation energy (1.0 eV for M.L.C's)  
 $K$  = Boltzmann' Constant ( $8.617 \times 10^{-5} \text{eV/}^\circ\text{K}$ )  
 $T$  = Temperature in  $^\circ\text{K}$  ( $273 + \text{Temperature in } ^\circ\text{C}$ )

Failure Rates at the Specified Confidence Level (60%) are derived from:-

$$FR = \frac{X^2}{2} \times \frac{1}{AF \times H}$$

where  $FR$  = Estimated Failure Rate at Use Stress  
 $X^2$  = Chi Square calculated for number of rejects at test stress  
 $H$  = Component test hours

#### Conversion Factors

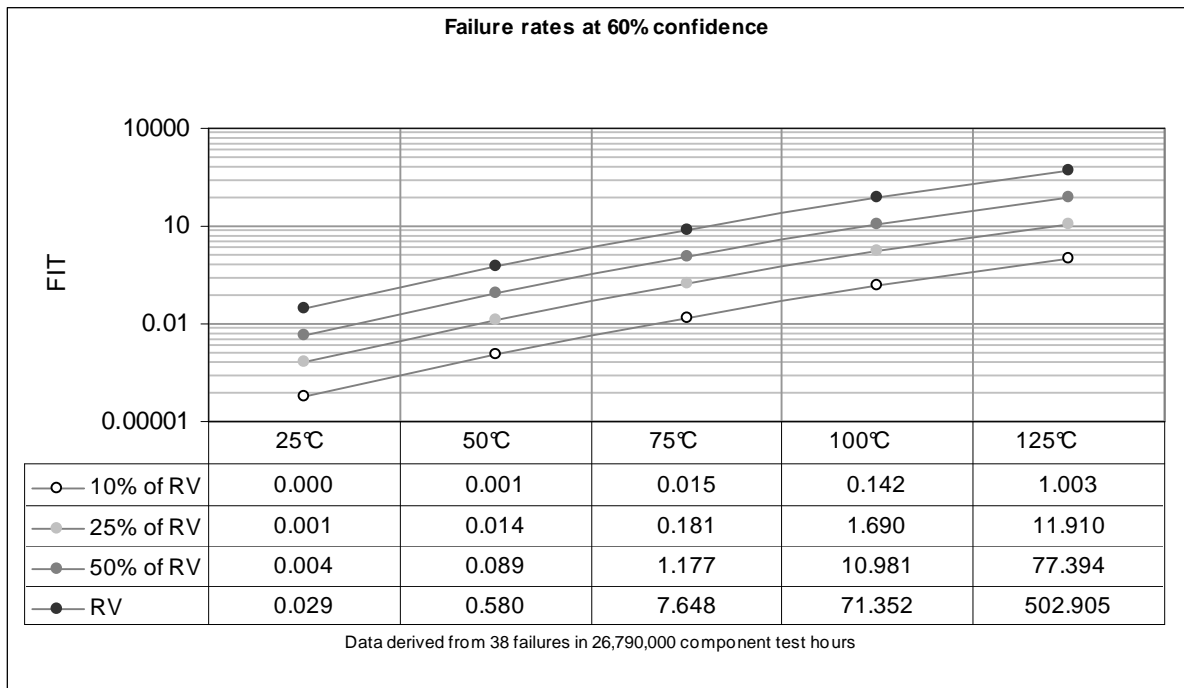
From	To	Operation
FITS	MTBF (Hours)	$10^9 \div \text{FITS}$
FITS	MTBF (Years)	$10^9 \div (\text{FITS} \times 8760)$



## C0G Capacitor Reliability Data

Product type: C0G capacitors.  
 Time period analyzed: 1<sup>st</sup> November 2007 to 1<sup>st</sup> November 2008.  
 Test laboratory: Syfer Technology Reliability Test Department.  
 Number of components tested: 26790  
 Endurance test conditions: 1000 hours with 1.5x rated voltage applied at 125°C.  
 Results: 38 failures in 26,790,000 component test hours.

### FIT (Failure In Time) Rate Graph



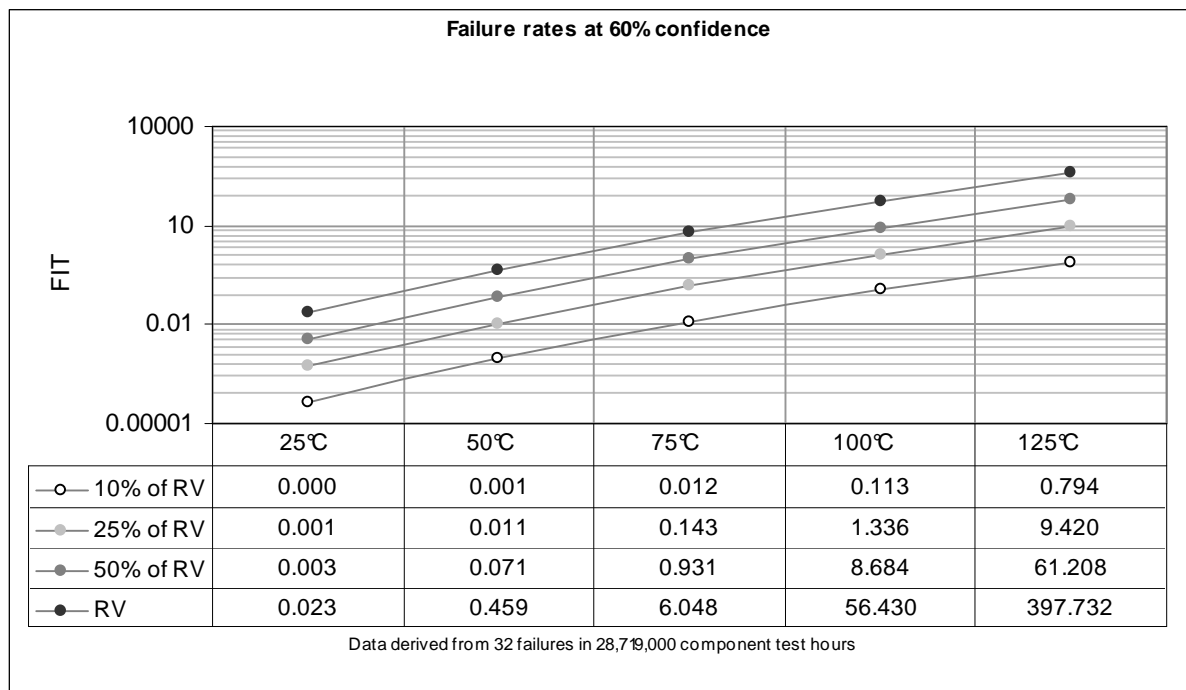
The FIT (Failure In Time) rate graph provides an indication of component reliability in relation to a customer's application with respect to temperature and voltage being applied. For example, at 25°C and 50%RV (Rated Voltage), the FIT rate graph indicates 0.004 FITs. As a comparison, an automotive customer specifies maximum of 0.1 FITs at 25°C and 50%RV (Rated Voltage).



## X7R Capacitor Reliability Data

Product type: X7R capacitors.  
 Time period analyzed: 1<sup>st</sup> November 2007 to 1<sup>st</sup> November 2008.  
 Test laboratory: Syfer Technology Reliability Test Department.  
 Number of components tested: 28719  
 Endurance test conditions: 1000 hours with 1.5x rated voltage applied at 125°C.  
 Results: 32 failures in 28,719,000 component test hours.

### FIT (Failure In Time) Rate Graph



The FIT (Failure In Time) rate graph provides an indication of component reliability in relation to a customer's application with respect to temperature and voltage being applied. For example, at 25°C and 50%RV (Rated Voltage), the FIT rate graph indicates 0.003 FITs. As a comparison, an automotive customer specifies maximum of 0.1 FITs at 25°C and 50%RV (Rated Voltage).