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QUALITY & RELIABILITY DATA

Issue 3

QUALITY & RELIABILITY DATA

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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 CECC, SEMKO, TUV, UL, Kitemark, ISO9001 and ISO14001 approvals.

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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

Duration	1000 Hours	
Intermediate Check Time	168 Hours	
Voltage	1.5 x Rated Voltage	
Current Limitation	Each component stressed via a 100KΩ resistor	
Temperature	C0G 125°C	
	X7R 125°C	
Post Test Limits		
Insulation Resistance	C0G	≥ 4000MΩ or 40s
	X7R	≥ 2000MΩ or 50s (whichever is the less)

Section 3

F.I.T. RATE DATA

ACCELERATION FACTOR CALCULATIONS

Acceleration Factor (AF) = AF_{voltage} x AF_{temperature}

where

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

and

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

where

- E_a** = Activation energy (1.0 eV for M.L.C's)
- K** = Boltzmann' Constant (8.617 x 10⁻⁵ eV/°K)
- T** = Temperature in °K (273 + Temperature in °C)

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

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

where

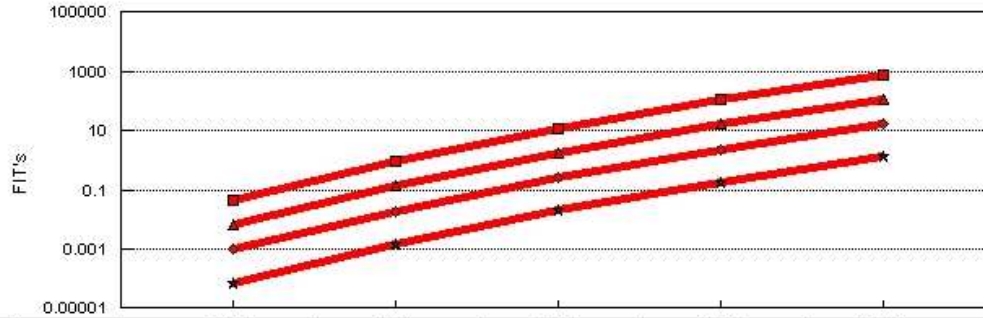
- FR** = Estimated Failure Rate at Use Stress
- X²** = Chi Square calculated for number of rejects at test stress
- H** = Component test hours

Conversion Factors

From	To	Operation
FITS	MTBF (Hours)	10 ⁹ ÷ FITS
FITS	MTBF (Years)	10 ⁹ ÷ (FITS × 8760)

C0G Failure Rate Data

FIT Rates Calculated at 60% Confidence Level

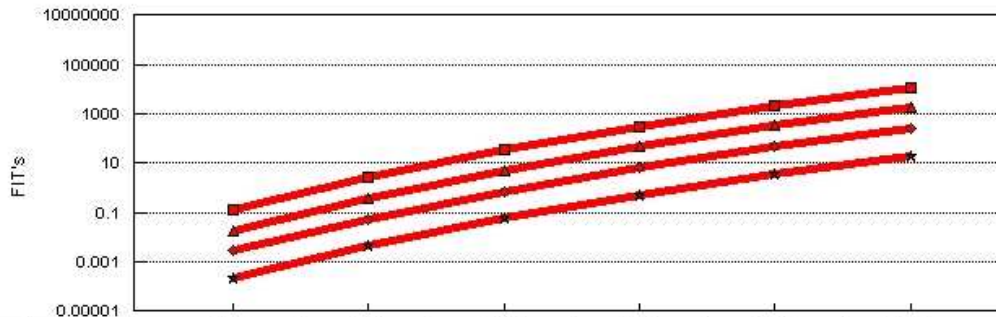


Temperature	25°C	50°C	75°C	100°C	125°C
10% of RV	0.000	0.001	0.020	0.184	1.302
25% of RV	0.001	0.018	0.234	2.189	15.455
50% of RV	0.006	0.115	1.522	14.227	100.428
RV	0.037	0.749	9.890	92.447	652.586

Data derived from 26,920,000 component test hours from which there were 50 failures

X7R Failure Rate Data

FIT Rates Calculated at 60% Confidence Level



Temperature	25°C	50°C	75°C	100°C	125°C	150°C
10% of RV	0.000	0.004	0.056	0.526	3.714	20.808
25% of RV	0.002	0.051	0.668	6.245	44.081	246.984
50% of RV	0.016	0.329	4.341	40.578	286.438	1604.906
RV	0.105	2.135	28.208	263.675	1861.280	10428.712

Data derived from 49,080,000 component test hours from which there were 271 failures

Note: X7R rating is -55°C to +125°C