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QUALITY REPORT
FAILURE RATE AND MTBF DATA
0201 MULTI LAYER CERAMIC CHIP CAPACITORS
(COG, X7R, X5R & Y5V)

Tested Products: – COG: C0201COG250-101JNE
 – X7R: C0201X7R100-103KNE
 – X5R: C0201X5R6R3-223KNE
 – Y5V: C0201Y5V100-103ZNE



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Accelerated Life Test

MTBF (mean time between failure) after the Accelerated Life Test is transformed to that of rated condition (operating condition) by using the following Acceleration factor, and assurance time in normal condition can be predicted.

1. Acceleration factor

$$A_F = L_1/L_2 = f(V) \cdot f(T) \cdot f(RH)$$
$$= \{V_2/V_1\}^n \cdot \exp[Ea/k\{1/T_1 - 1/T_2\}] \cdot \exp[H\{1/RH_1 - 1/RH_2\}]$$

- A_F : Acceleration factor
- L : Average life span
- T : Absolute temperature (273+ °C)
- H : Relative humidity
- V : Voltage
- k : BOLTZMANN constant (8.67 x 10⁻⁵ eV/°K)
- n : Voltage acceleration coefficient
- Ea : Activation energy
- 1 : Real condition
- 2 : Test condition

Table1. Acceleration factor

	n (Voltage)	Ea (Temperature)
COG	5.34	0.98
X7R	3.11	1.14
X5R		
Y5V	2.56	1.21

Failure Rate: FIT (Failure in Time)

2. FIT in High Temperature Bias Test

* Test Condition

Characteristics	Temperature	Voltage	Time
COG, X7R	125 ±3°C	2 x Vr	1000 hr
X5R, Y5V	85 ±3°C	2 x Vr	1000 hr

* FIT (Failure in Time). Vr = Rated Voltage

$$FIT = (Number_of_Failures / Total_Test_Time \times AF) \times 10^9, MTTF = (1 / FIT) \times 10^9 \text{ hr}$$

Characteristics	FIT	Test Condition	Accelerated Condition
COG	0.75	50 °C/1 Vr	125 ±3°C/2 Vr/1000 hr
X7R	1.18		125 ±3°C/2 Vr/1000 hr
X5R	48.58		85 ±3°C/2 Vr/1000 hr
Y5V	55.62		85 ±3°C/2 Vr/1000 hr

** Sample size: 40 pcs.

** Inferred Failures in No. Failures = 0.92 (60% Confidence Level)