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## **2012 Product Reliability**

The manufacture of HolyStone ceramic capacitors is carried out in its modern high tech facility in Taiwan. This facility uses modern, state-of-the-art equipment, with each process stage and materials carefully controlled. Statistical Process Control (SPC) is used at all process critical stages, to reduce manufacturing and product variations.

Every manufacturing lot is subject to Destructive Physical Analysis (DPA) and Scanning Acoustic Microscopy (SAM). Sample testing (AQL) is also carried out for Solderability, Resistance to Solder Heat, Humidity, Temperature Cycling, Flexure of Substrate and Vibration.

100% electrical testing is carried out for Capacitance, Dissipation Factor, Voltage proof and Insulation Resistance. In addition to this electrical testing HolyStone conducts an ongoing program of Endurance testing to provide customers with reliability data applicable to actual applications.

Samples from a cross section of product types are placed onto High Temperature Endurance Test, enabling reliability or F.I.T. (Failures In Time) data to be calculated.

Notes:

- 1) 1 F.I.T. = 1 component failure in  $10^9$  component hours
- 2) M.T.B.F. (Hours) =  $10^9$ /FITS

### **High Temperature Test Conditions**

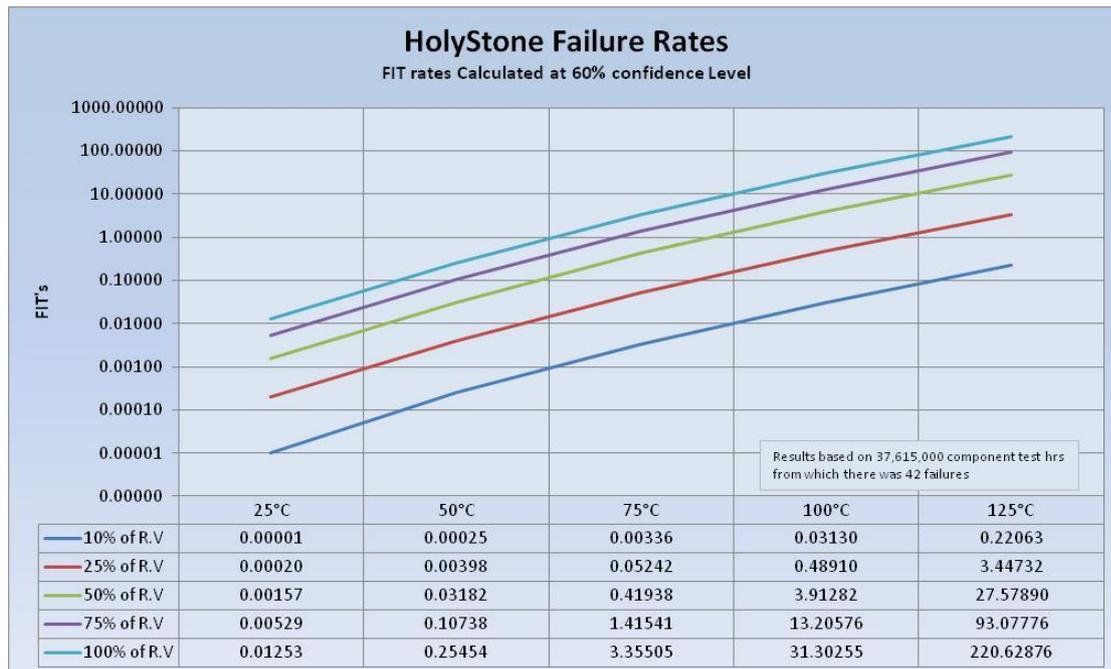
Test Voltage = 1.2 to 2 times rated voltage (depending on component rated voltage)

Temperature = +125°C

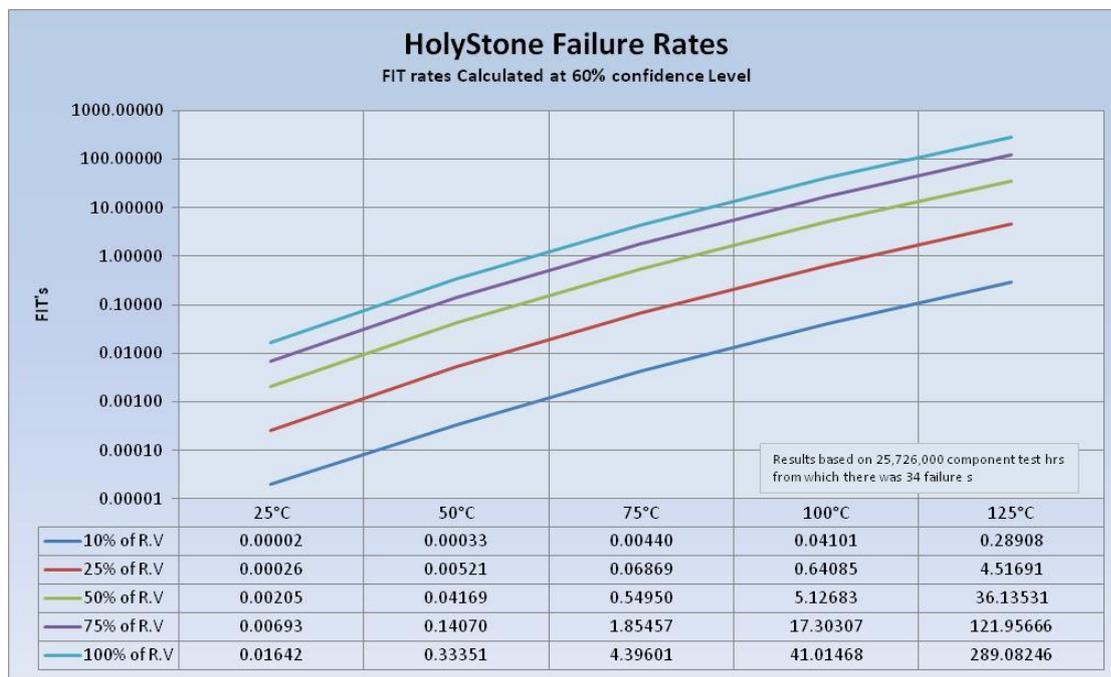
Duration = 1000 hours

The results of this endurance testing are shown below in the General Failure Rates. In addition this has been broken down to show the individual failure rates by dielectric for COG/NPO and X7R.

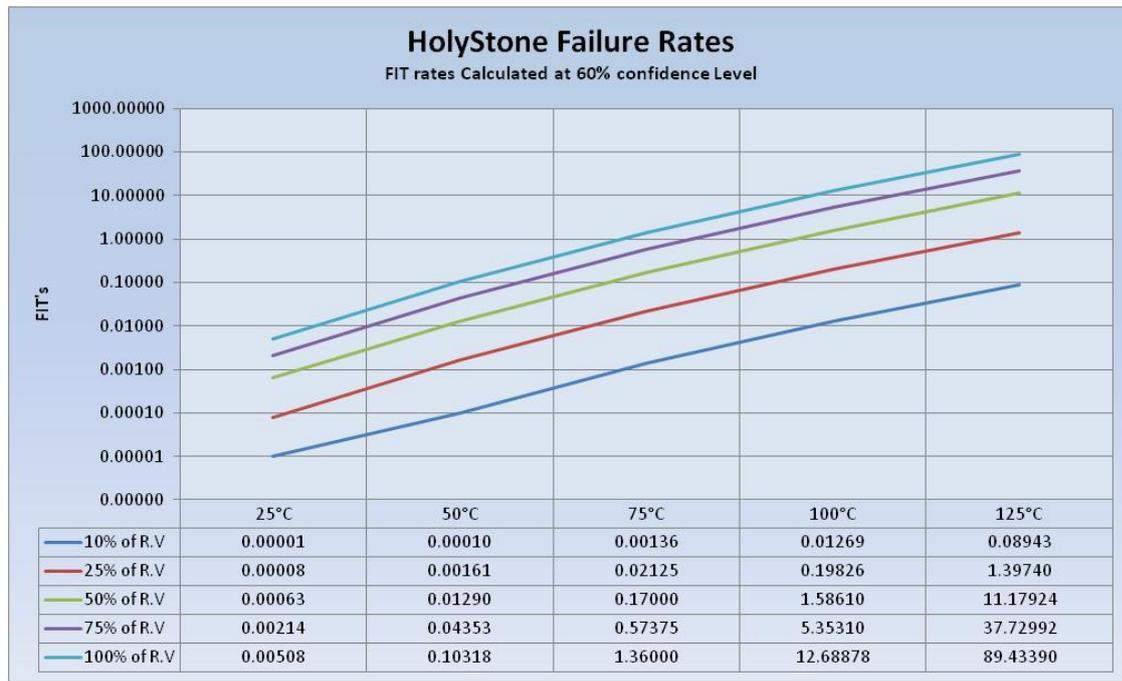
## General HolyStone Failure Rate



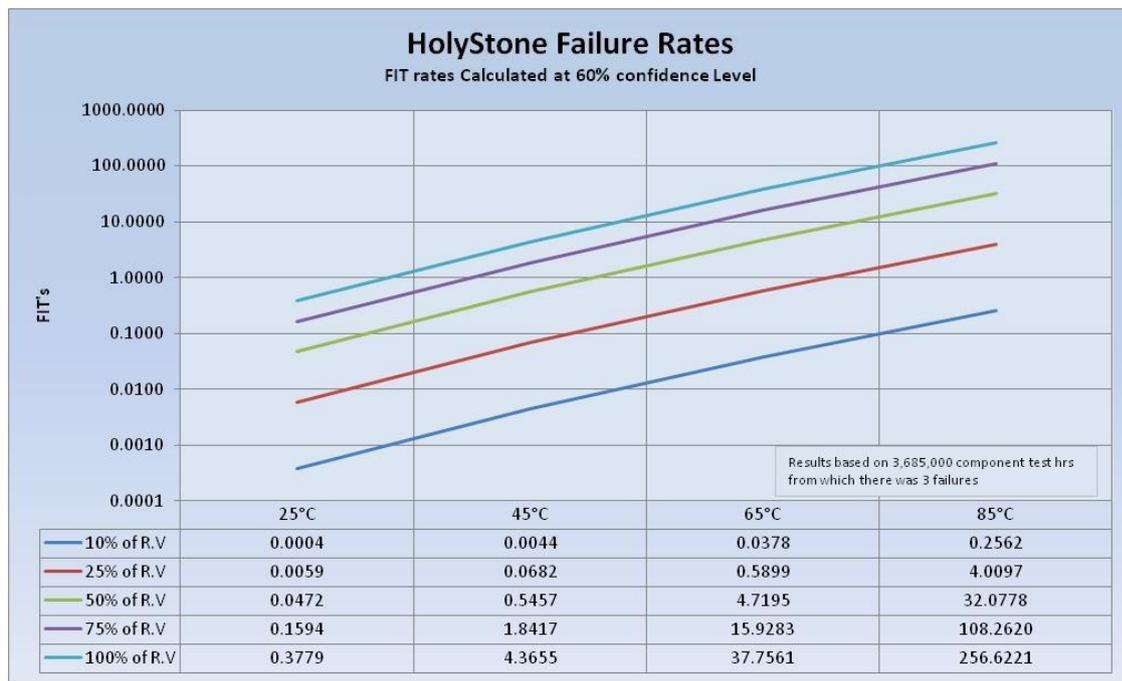
## X7R Failure Rate



## COG/NPO Failure Rate



## X5R Failure Rate



## Comments

The failure rate (or F.I.T. rate) of a component, in any specific application, will be largely dependant on the operating temperature and percentage of the maximum working voltage it is subjected to. Designers should take into account their expected 'system' failure rate when choosing a suitable component. This may require a higher voltage device, to reduce the expected F.I.T. rate, although the operating voltage is within the maximum working voltage of the device.