

# NASA TECH BRIEF

*Lyndon B. Johnson Space Center*



NASA Tech Briefs announce new technology derived from the U.S. space program. They are issued to encourage commercial application. Tech Briefs are available on a subscription basis from the National Technical Information Service, Springfield, Virginia 22151. Requests for individual copies or questions relating to the Tech Brief program may be directed to the Technology Utilization Office, NASA, Code KT, Washington, D.C. 20546.

## Response of Tantalum Capacitors to Fast Transient Overvoltages

A study has been conducted to characterize the response of tantalum capacitors to fast transient overvoltages. The results have been published in a report (see note 1).

The report describes tests that were used to determine: (a) the absolute minimum time for the capacitors to fail due to overvoltage and (b) the maximum amount of overvoltage that the capacitors could sustain for 100  $\mu$ s without permanent damage. The tests were conducted by using a specialized commercially-available high-voltage tester, a 50-MHz oscilloscope with a camera, and a 50-Vdc power supply. Two groups of capacitors were tested: one group included 18- $\mu$ F, 50-V dry tantalum capacitors; the other included 6.8- $\mu$ F, 50-V wet tantalum capacitors. The test results were obtained by analyzing photographs of waveforms taken from the oscilloscope display.

The results show that when the dry tantalum capacitors are overstressed with forward voltage polarity, they fail at 190 percent of the rated voltage in 100  $\mu$ s. The reverse voltage limit and the time to failure are equal to 100 percent of the forward rated voltage and 100  $\mu$ s, respectively.

In contrast, the forward voltage tolerance of the wet tantalum capacitors is 300 percent of the rated voltage for approximately 140  $\mu$ s. The reverse voltage limits are 100 percent of the forward voltage ratings and occur in 250  $\mu$ s.

The shortest possible time to failure observed was 25  $\mu$ s. This was obtained by using a very high current generator output of 750 A at 56 V. Shorter failure times were not anticipated due to the kinetics of the failure mechanism within the capacitors.

### Notes:

1. Further information is available in the following report:

NASA TM-X-58152 (N75-14030), Tantalum Capacitor Behavior Under Fast Transient Overvoltages

Copies of this report may be obtained at cost from:

Technology Application Center  
University of New Mexico  
Albuquerque, New Mexico 87131  
Telephone: 505-277-3622  
Reference: B75-10274

2. Tantalum capacitors are also discussed in NASA Tech Brief B74-10294.

3. Specific technical questions may be directed to:

Technology Utilization Officer  
Johnson Space Center  
Code AT3  
Houston, Texas 77058  
Reference: B75-10274

### Patent status:

NASA has decided not to apply for a patent.

Source: J. A. Zill and K. D. Castle  
(MSC-14822)

380  
RM 1084  
VS

Category: 01 (Electronics - Components and Circuitry)