Prognostics for Avionics Power Supply Failures

Rolf F. Orsagh
Douglas Brown
Dr. Michael Roemer
Impact Technologies, LLC
200 Canal View Blvd
Rochester, NY 14623
(585) 424-1990

Carl S. Byington, P.E
carl.byington@impact-tek.com
814-861-6273

Prognostics and Health Management for Electronics Workshop
University of Maryland, August 24th, 2004
Power Supply Stress Conditions

**Electrical Stress**

**Mechanical Stress**

**Environmental Stress**

**Unintended Use**

**SMPS Operating Parameters**

Orsagh, Byington, Brown, Roemer
Phone: 585-424-1990
DC-DC Converter Basic Topologies

Buck Converter
- Step-down voltage
- Positive polarity

Boost Converter
- Step-up voltage
- Positive polarity

Buck-Boost Converter
- Step-up or Step-down voltage
- Negative polarity
Critical Component Identification

1. Transistors
2. Input Capacitors
3. Output Capacitors
4. Diodes
Capacitor Physics of Failure Model

Additional material not available for publication

Please contact authors for further details
MOSFET Physics of Failure Model

Additional material not available for publication

Please contact authors for further details
System Physics of Failure Model

Additional material not available for publication

Please contact authors for further details
Accelerated Failure Test Setup
Accelerated Failure Test Results and Incipient Fault Detection

Additional material not available for publication

Please contact authors for further details
Remaining Life Tracking

Remaining Transistor Life vs. Time

- Incipient Fault
- Progression Inflection
- Functional Failure
Conclusions

➢ Feature-based incipient fault detection
  - Temperature
  - PWM control signal
  - Input voltage & current
  - Efficiency

➢ Prognostic module evaluating fault to failure
  - MOSFET
  - Bipolar Transistors
  - Capacitors

➢ Accelerated failure testing (switching mode) power
  - Demonstrated diagnostic/prognostic features
  - Remaining useful life predictions

Support for this program from NAVAIR through the SBIR program with Thomas Dabney as program manager is gratefully acknowledged.