Overview of Component Specs for Military and Space Electronics

Instructors: **Lawrence Harzstark, Aerospace, lawrence.i.harzstark@aero.org**
Peter Majewicz, NASA Goddard, peter.majewicz@nasa.gov
Ron Demcko, KYOCERA AVX Components Corporation, ron.demcko@avx.com
Shri Agarwal, NASA Jet Propulsion Laboratory, shri.g.agarwal@jpl.nasa.gov
Benny Damron, Jacobs Engineering, benny.damron@nasa.gov

COURSE SUMMARY

This three-hour overview training class is intended to focus on the myriad of specs available to component engineers working the field of electronics. There are many legacy and emerging mil and commercial specifications to select from and they can be very confusing and overwhelming to the inexperienced user. Critical microelectronic devices such as: hybrids, microcircuits, discrete semiconductors, RF MMIC modules, optoelectronics, MEMS and packaged sensors, hermetic and non-hermetic devices of all types rely on DOD and in some cases commercial specifications to guide the qualification and manufacture of reliable hardware.

The course is intended for anyone interested in gaining better insight and understanding into the specifications that govern the quality and reliability of products intended for high reliability military and space environments.

Component Spec Overview

This opening session will provide a grand view of most of the common requisite specifications available to a component engineer. The history of part specifications date back prior to the Apollo program and QPL (Qualified Parts list) standards such as MIL-STD-38510 slash sheets. In the mid-nineties under Secretary Perry, many of these specs were rewritten and the focus shifted to performance specifications and the qualification of manufacturing lines and the generation of MIL-PRF-38535 and QML.

The overview will provide a historical perspective of how we started and where we are now and what we see for the future. The military, and especially the space community, were heavily involved in creating and then modifying requirements as time and issues evolved. Space grade product included many solutions to known and anticipated problems from wafer fab, assembly, test and qualification. Flows were developed for 100% screens, qualification and quality conformance inspection with application, reliability, radiation and cost in mind.

As we enter new and more complex devices and system requirements, it deserves new thinking as to what should be required and what is feasible. The microelectronics specifications will be defined and analyzed as to what they offer and why they are necessary.

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Active Component Specifications

The following Active Component Specifications and applicable subtopics will be discussed in greater detail:

- MIL-PRF-19500 SEMICONDUCTOR DEVICES, GENERAL SPECIFICATION FOR
- MIL-PRF-38534 HYBRID MICROCIRCUITS, GENERAL SPECIFICATION FOR
  - Definitions
  - Hermetic Classes (K, H…)
  - Non-Hermetic Classes ((L, F…)
  - Element Evaluations
  - Screening Tests
  - Qualification Tests (QML & PI)
  - Major & Minor Changes
  - Design Analyses
  - RHA
  - Process Control Monitor
- MIL-PRF-38535 INTEGRATED CIRCUITS (MICROCIRCUITS) MANUFACTURING, GENERAL SPECIFICATION FOR

BREAK

Passive Component Specs

This session will provide students with a high-level overview of Military, ESA, COTS and auto grade specifications applicable to capacitors, resistors, filters and inductors. The intent and details of key component specifications is given along with an abbreviated summary of significant differences between components governed by the different grades of specs (for example - Mil-PRF - xxxx vs. Auto grade AEC Q200). Component technology, ranges and failure modes are presented. Alternates grades of each component family are shown.

INSTRUCTOR BIOS

Larry Harzstark has over 35 years of experience in parts and component management-related engineering areas. He has been involved in all aspects of component engineering from the design of custom radiation-hardened devices to meet strategic missile requirements, to failure analysis, parts selection, design reviews, supplier audits, technology reviews and parts control boards. Recently, Larry has been involved in aspects of Commercial Off the Shelf (COTS), as well as Plastic Encapsulated Microcircuits (PEMs) and their utilization in military systems. He developed the guidelines for use of PEMs in an Army missile system and in space applications. His extensive expertise and knowledge in the field of microelectronics has earned him a reputation as a problem solver. Larry currently is an Aerospace Fellow responsible for technical aspects of new technology insertion, PMP management, evaluations of alternative technologies and problem resolution for programs. He earned his BSEE from the Polytechnic Institute of Brooklyn in 1969, and his MSEE from Clarkson College of Technology in 1970.

Ron Demcko graduated in 1982 from the Clarkson College of Technology BSEE. He is currently an AVX Fellow and manages TSG team at AVX Headquarters in Fountain Inn SC. This role centers on projects ranging from simulation models for passive components to product support / new product identification & applied development. Prior to that, Ron was the EMC lab Manager AVX Raleigh N.C. This lab concentrated on sub assembly testing and passive component fixes for harsh electrical and environmental. Before the EMC lab work, he held an Application Engineering position at AVX Product work included integrated passive components, EMI filters and Transient voltage suppression devices. Before joining AVX he worked as a Product Engineer and later Product Engineering Manager at Corning Glass Works electronics division. In this role he supported production, sale and development of Pulse Resistant Capacitors, High Temperature Capacitors and radiation resistant capacitors. He developed high frequency test methods and co-developed high temperature test systems.

Peter Majewicz received a B.S. in Computer Engineering from Old Dominion University, Norfolk, VA, in 1999, a M.S. in Electrical Engineer from the Naval Postgraduate School in Monterey, CA in 2005, and a Ph.D. in Systems Engineering from George Washington University, Washington D.C. in 2017. He has been with NASA since 2009, and currently is the Manager of the NASA Electronic Parts and Packaging (NEPP) Program. Prior to NASA, he retired from active duty, ending a 22-year career in the U.S. Navy.

Shri Agarwal currently works at the Jet Propulsion Laboratory and coordinates the NASA Electronic Parts Assurance Group (NEPAG). He has supported the NEPP/NEPAG Program as the Agency's point of contact for microcircuits and represents NASA on Defense Logistics Agency in the area of space microcircuits manufacturer audits, infusion of new technology into military standards, etc. Agarwal was instrumental in developing requirements for Class Y, a classification assigned to the advanced (system-on-a-chip complexity) ceramic-based non-hermetic microcircuits for space. He holds master's degrees from the University of Southern California, Los Angeles; the Indian Institute of Technology, New Delhi, India; and Agra University, Agra, India.

Benny Damron works for Jacobs Engineering on the Engineering Services and Science Capabilities Augmentation contract providing EEE Parts support to NASA Marshall Space Flight Center in Huntsville Alabama. Benny supports the MSFC EEE Parts and Analysis Team in developing parts control plans, screening requirements for inhouse programs such as ECLSS, Space Launch System, International Space Station, Human Landing System, and the agency wide NEPAG program. Benny reviews and provides comments on proposed changes to military and space specifications, test method and industry discrete semiconductor standards. In addition, Benny participates in Defense Logistics Agency Land and Maritime MIL-PRF-19500/MIL-STD-750 supplier audits for discrete semiconductor suppliers and test facilities. Benny Damron is co-chair of the JEDEC 19500 appendix J task group with Mr. Ronan Dillon of Microchip. Benny Damron is also the co-chair of the JEDEC 883 PIND task group with Mr. Joe Micelli of Anaren and co-chair of the Longer Shock Pulse Width PIND task group. Benny has been supporting the NASA MSFC EEE Parts group for over 20 years. Benny Damron has a Bachelor of Science in electrical and computer engineering from the University of Alabama in Huntsville.