

ENGINEERING PRACTICE STUDY

TITLE: Use of Base Metal Electrode (BME) Capacitors in QML Hybrid Microcircuits.

September 26, 2012

STUDY PROJECT 5962-2012-007

FINAL REPORT

Study Conducted by DLA Land and Maritime-VAS

Prepared by:

Greg Cecil



I. OBJECTIVE: The purpose of this Engineering Practice (EP) Study is to obtain input from MIL-PRF-38534 Qualified Manufacturers Listing (QML) hybrid microcircuit manufacturers to determine if manufacturers are using Base Metal Electrode (BME) Capacitors, and what inspection, characterization, qualification, and screening tests are being performed if BME Capacitors are used.

II. BACKGROUND: Some MIL-PRF-38534 QML hybrid microcircuit manufacturers are using BME capacitors in their QML hybrid microcircuits. There is no military specification available that can be used to perform element evaluation on BME capacitors. Users of these QML hybrid products are concerned that these BME capacitors have not had the necessary characterization, qualification, or screening needed for parts used in high reliability hybrid microcircuits. Studies have shown that these BME capacitors could have failure modes such as ceramic voids, delaminations, micro cracks, inclusions, and metal migration. Some BME capacitors have been unable to pass voltage pre-conditioning and Highly Accelerated Life Test (HALT).

III. RESULTS: The EP Study project was opened and an initial draft was posted on the DLA Land and Maritime website and distributed to all JC-13.5 members on August 7, 2012. This EP study consisted of 6 questions related to the use of BME capacitors in hybrid QML microcircuits (see attachment). All comments received were evaluated by DLA land and Maritime. The EP Study was sent to 30 hybrid QML manufacturers, and there were three responses. Two hybrid QML manufacturers responded stating they do not use BME capacitors. The third company stated they do use BME capacitors, and have never had a failure. This company also stated that element evaluation was performed on the BME capacitors in accordance with the applicable requirements.

IV. CONCLUSIONS: The responses to this EP Study were evaluated by DLA Land and Maritime to aid in determining the use of BME capacitors in QML Hybrid Microcircuits. It was determined that there were not enough responses to this EP Study to draw any conclusions concerning the use of BME capacitors in QML hybrid microcircuits.

V. RECOMMENDATION: DLA Land and Maritime recommends that all manufacturers that use BME capacitors in their hybrid QML microcircuits review how these BME capacitors are being inspected, characterized, qualified, screened, and evaluated prior to assembly into the hybrid microcircuit.

ATTACHMENT

STUDY PROJECT 5962-2012-007

Company Name:

Point of Contact:

Please answer the following questions concerning Base Metal Electrode (BME) capacitors.

1. Does your company use BME capacitors in any of their MIL-PRF-38534 QML hybrid microcircuits (SMD, SCD, or Purchase order)?

2. If your company does use BME capacitors in QML hybrid devices, what kind of devices are they being used in?

3. What kind of element evaluation is being performed on BME Capacitors? Who is performing the element evaluation?

4. What types of inspection, characterization, qualification, and screening tests does your company perform to verify the BME capacitors will function in your QML hybrid devices?

5. What levels of testing were performed on the BME capacitors being used, since there is no current military specification available for evaluating BME capacitors?

6. Studies have shown that BME capacitors may exhibit the following failure modes:
 - A) Ceramic Voids
 - B) Delaminations
 - C) Micro cracks
 - D) Inclusions
 - E) Metal Migration

If your parts exhibited any of these failure modes, what corrective action was taken to ensure product sold to users did not fail?