

KOTEL 081: ACCELERATION OF AGING AND CORROSION TESTS FOR PCBA RELIABILITY (CORRE)

1. PROJECT DEFINITION

Project background and present state

Conformal coating is used in wide area of applications such as military, industrial and commercial that often need PCBA to be protected against environmental stresses. Various opinions and studies exist, but the outcome and real results are not clear due to the vast amount and combination of available fluxes, coating and wash/no wash alternatives. Subject is present-day, usefull and interesting for many companies in differents market areas.

2. PROJECT GOAL

The goal of this work is to find suitable combinations for PCBA flux, wash/no wash and conformal coation by aging and corrosion tests. Suggestions for combinations are also given based on available studies and theory.

3. PROJECT PHASES AND RESULTS

Project is divided into three phases. State of art, theory and tests. "*Italic*" text and "x" marks are to be discussed and decided together with participating companies in the official project meeting.

Project phases:

1. State of Art

- Know-how of flux, wash/no wash and conformal coating
- State of art results are used for more detailed test planning
- Suppliers expert network and studies are used to get information

2. Theory

- Theoretical background of corrosion protection against stresses (salt, moist, heat, etc.)
- Available standards
- No clean/clean components
- Pastes
- Fluxes
- Manual vs. automatic soldering/repair
- PCBA handling
- Washing solutions/no wash (water, other...)
- Conformal coating types and thickness

- General work process for conformal coating
- 3. Tests**
- What is possible/impossible, and difficult to verify with testing
 - Designing of PCBA design and layout and making of test samples: Electria
 - a. Company availability and limitations for choosing of flux, wash/no wash and conformal coating
 - b. Using also PCBA from participating companies
 - Test specification (Design of Experiment)
 - a. Test standard(s) to be used: *x*
 - b. PCBA should be: *powered (/not powered)*
 - c. Length of the test: *xxx* days and *xxxx* hours
 - d. *Notice, to be discussions needed in the official project meeting*
 - i. *How conformal coating works in moist environment?*
 - ii. *Is there need for test cycles with different stresses?*
 - iii. *Will there be a functional tester or are components only tested with simple independent tests before and after the tests?*
 - iv. *Should there also be tests outside test standards? Harder tests than in standards?*
 - v. *Flowing mixed gas tests: depends of participating companies and budget if this test is needed/possible*
 - vi.
 - e. Temperature level: *xx* Celsius
 - f. Moist level: *xx* %
 - g. Salt level: *xx xx*
 - h. Number of specially designed PCBA to be tested: e.g. *10?* (*amount depends of the sample sizes*)
 - i. Number of participant company PCBA to be tested: *x*, maximum amount of PCBA for each participant to use in the tests: *x*
 - j. Chosen components for PCBA: *transistor?, electrolytic capacitor?, FPGA?*
 - k. Size and weight of test samples: *xxxmm x xxxmm x xxxmm, xxxg*
 - l. No of layers in PCB: *x*
 - m. No of test samples approved by participating company: *x*
 - n. Type of tests: salt, moist, heat
 - Testing
 - a. Test place: VTT in Espoo, Finland
 - b. Test arrangements
 - c. Testing procedure
 - d. Reliability & interpretation of test results
 - Lessons learned
 - a. Was this type of study usefull for participating companies?

- b. Should the testing be considered to be used in other type of products too?
- c. What did/did not the testing reveal?
- d. Applicability for other products (flux, conformal coating, etc.)?
- e. Other points of view?

The handbook is an introduction of the theory and corrosion testing for PCBA reliability. Tests are used to demonstrate the acceleration and aging of corrosion of PCBA when using different flux, wash/no wash and conformal coating solutions. Size of the handbook will be kept short and readable.

4. UTILIZATION OF THE RESULTS

Conformal coating is already an essential solution used in various applications in an industry equipment. The development and adaptation of proper conformal coating combination will enable higher quality and reliability products. The benefits and possible utilization of the PCBA corrosion protection are clear.

Utilization from the point of view of work phases:

- State of Art
 - o Decision making: suitable flux, wash/no wash and conformal coating combinations
 - o What can be clarified and what is difficult/impossible with testing product development
- Theory
 - o Theory of the suitable combinations
- Tests
 - o How combinations work in accelerated/real life situations
- Handbook
 - o It can be used for training and practical design work. In addition, the handbook is helpful for communication for national and international co-operation needed in this field of technology.

Utilization from the point of view of short and long term planning:

- *In the short term* participants achieve immediate increase in their knowledge, improved work practices and co-operation and basis for product development improvement. In addition, the gained national visibility may be used for marketing and networked co-operation.
- *In the long term* the participants gain competitive edge with the use of flux, wash/no wash and conformal coating combinations. Knowledge of environmental protection of products is critical in the increasingly competitive global markets.
- *Future national and international research, development and standardization work* are natural follow up of the project. Flux, wash/no wash and conformal coating are used in wide area of applications and products.

5. RESOURCES AND ORGANISATION

KOTEL workgroups will participate in the project, Electria is responsible for the design, layout and manufacturing of PCBA with required PCB, components, flux, wash/no wash and conformal coating, VTT is responsible of PCBA testing and of the production of the short handbook.

A management group and a responsible leader are set for the project.

6. TIMETABLE

Project is implemented between *01.11.2009 – 31.09.2010*. More precise timetable will be written after the selection of the cases and updated project plan.

7. RISKS

The main risks of the project are seen to be the studied wide area of fluxes and conformal coating types, the available project resources and, thus, the management of the project activities. However, the risk of too wide research area and limited resources is reduced with the focus on participating company requirements. In addition, the research work is focused more during the project. Thus, efficient project management can be ensured by an active project board controlling the project progress.

With the numerous possibilities of application and the participant expectations of the results may be too high. Thus, the goals of the project should be kept in mind. The focus is to test and find out suitable combination for PCBA flux, wash/no wash and conformal coating and to get experiences of the tests. In addition, one should not underestimate the important learning process of the personnel involved to the project. It is seen, that even with the small resources important tests and knowhow for the PCBA heat, moist and salt environmental protection is created.