

Automotive Electronics Council

Component Technical Committee



AEC-Q102 (& AEC-Q102-003)

Optoelectronic (& Optoelectronic Multichip Modules)

Task Group Status Update

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Status AEC-Q102 Task Group

Discussion for revision update ongoing

- Actual Q102 rev. A published Apr. 2020 (Q102-003 rev.: Aug. 2022)
- Discussion for revision update started Oct. 2024 (appr. 160 change requests)
- Q102: 95% ready for ballot (Q102-003: 10% ready for ballot)

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Status AEC-Q102 Task Group

Several major changes – example I

1 Scope:

- Bare die used e.g. for mini-LED-displays (not covered by Q105 first revision)
- Bare die qualification should follow AEC-Q102 whenever possible

Qualification of bare dies should follow AEC-Q102 testing by using appropriate surrogate packages. The supplier shall provide constructional details of these surrogate packages to the user upon request. Note, bare die testing target die related issues therefore, some failure mechanisms associated with package integrity are not adequately addressed here. The following tests, described in Table 2, are mandatory for bare die qualification:

- HTOL (HTRB)
- LTOL
- PLT
- HBM.

Supplier and user should mutually agree about the implementation of additional testing, the handling of test failures and the use of appropriate surrogate packages. For testing to cover appropriate package and application related failure mechanisms, these mutually agreed testing, handling and surrogates should consider soldering, wire bonding, as well as other connections of the bare dies to any carrier. Note, the user is responsible to fulfill his customer's requirements.

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Several major changes – example II

1 Scope:

Use of old vs. new revision for re-qualification, family qualification and PCN

(following AEC-Q200 rev. E)

In using this document, the following shall apply:

- New qualifications, including additions to a qualified family (as stated in Section 2.2), shall use this new revision. See also note 1)
- For re-qualification of components the same revision as for qualification is allowed to be used.
- On-going qualifications to previous revision, at the time of release of this new revision, may continue under previous revision.
- Any changes to an already qualified component (to any previous revisions) must meet the applicable tests (found in Change Tables) of this new revision. See also note 2)
- Components qualified to any previous revisions remain qualified.
- In all cases, the Supplier must clearly indicate which revision of this document a qualification was performed against in all relevant AEC-Q102 data and reports.

Note 1) If the new revision is not capable, the part remains AEC-Q102 qualified acc. to previous revision after passing the tests according to the previous revision.

Note 2) If the new revision is not capable, the part remains AEC-Q102 qualified acc. to previous revision after passing the relevant tests of the change matrix within the previous revision.

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Several major changes – example III

4 Qualification Tests – Humidity testing:

Discussion of purpose for several variants of humidity testing

- WHTOL1 and WHTOL2 remain unchanged
- H³TRB (used for PD and PT) not to add for LEDs (used in special application)
- Remove DEW
- Add WHTSL for color converting LEDs/laser

A2d	<u>Wet High Temperature Storage Life</u>	<u>WHTSL</u>	<u>D. G. X.</u> <u>Y</u>	<u>26</u>	<u>3</u>	<u>0 Fails</u>	<u>JEDEC JESD22-A101</u>	<u>Only for LEDs and laser components with color conversion.</u> <u>Duration 1000 h at T_{ambient} = 85 °C / 85% RH with no drive current. Generic data allowed if same phosphor type (chemical composition) and same embedding material (e.g.: silicone, glass) is used. Generic data can only be used for parts with smaller or equal light emitting area.</u> <u>TEST before and after WHTSL.</u>
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Several major changes – example IV

4 Qualification Tests - TC:

- Allow TSK as alternative for TC

A4	Temperature shock	TSK	D_G	26	3	0 fails	JEDEC JESD22-A106	Alternative for test A4 Temperature Cycling PC before TSK Duration 1000 cycles liquid/liquid. Minimum and maximum temperature as specified in part specification: min. T_{storage} and max. T_{solder}. Transfer time <20s. The minimum dwell time shall not be less than the total time required for the load to achieve the required temperature and the load shall reach the specified temperature within the dwell time. TSK condition shall be mentioned in the test report. TEST before and after TSK. DPA after TSK. Additionally, for hermetic packages only: HER after TSK.
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Several major changes – example V

4 Qualification Tests - HBM & CDM:

ESD: consider family approach under special circumstances

~~The following tests must be performed on the specific part (i.e., family data is not allowed for these tests):~~

- a. Electrostatic Discharge Characterization (Table 2, Test E3 & E4) - Family approach may be possible, in case the evidence can be provided (on request) that there are no ESD relevant differences of affected products. The corners of a family approach (see also Appendix 1) must be covered within the three qualification lots.
- b. Parametric Verification (Table 2, Test E2) - The supplier must demonstrate that the part is capable of meeting parametric limits detailed in the ~~individual user~~ part specification. The test must be performed on the specific part (i.e., family data is not allowed for these tests). The use of 100% final testing data (= electrical and photometrical test as per figure 4) from production is possible, in case the part specification relevant parameters are covered.

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Several major changes – example VI

4 Qualification Tests - H2S & FMG:

- **FMG:** removed because no failures seen in the past
- **H2S:** class A & B: changed to 2-gas-test (H₂S & NO₂) acc. to IEC 60747

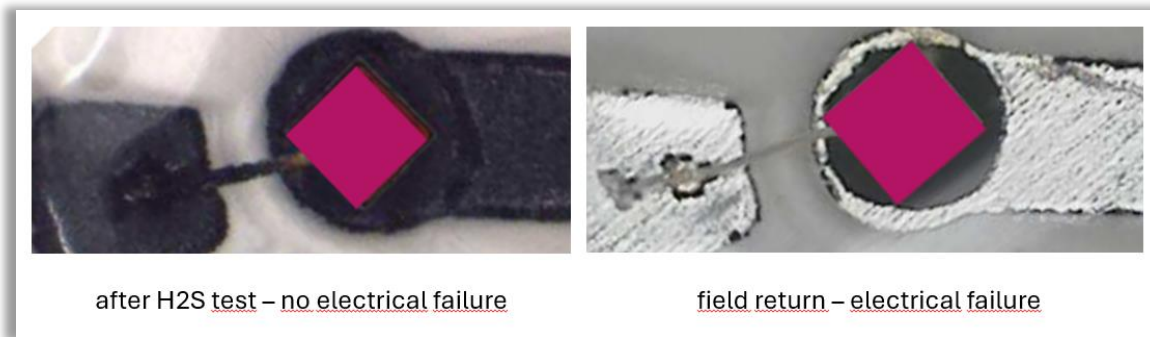
C12	Hydrogen Sulphide	H2S	D, G	26	3	0 Fails	<p>IEC 60068 2-43 IEC 60747-5-13</p> <p><u>For SMD parts only: perform as many reflow cycles before H2S as maximum allowed according to part specification.</u></p> <p><u>Combined gas test (H₂S and NO₂), duration 48h</u></p> <p><u>Corrosion class A: (preferred)</u> <u>Duration 336 h at 40 °C and 90% RH.</u> <u>H₂S concentration: 15ppm</u></p> <p><u>Corrosion class B: (acceptable for some application)</u> <u>Duration 500 h at 25 °C and 75% RH.</u> <u>H₂S concentration: 10ppm</u></p> <p><u>The corrosion class has to be mentioned clearly in the test report.</u></p> <p><u>Compliance of electrical and optical parameter after testing is not sufficient to pass the test. Consider also Appendix A6.4.</u> <u>No corrosion allowed. If the supplier can show by means of additional testing or analysis that the corrosion has no impact on product reliability and lifetime, the device may be considered as passed. Nevertheless, the corrosion has to be mentioned within the test report. Details of additional testing or analysis have to be provided to the user if requested.</u> TEST before and after H2S. DPA after H2S.</p>
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Several major changes – example VI

Background of change to 2-gas-test (H₂S & NO₂) acc. to IEC 60747

Note: H₂S is a robustness test with only very limited correlation to field behavior.



Compliance of electrical and optical parameter after testing is not sufficient to pass the test. Any corrosion is an indicator for a risk, which has to be evaluated. If the supplier can show by means of additional testing or analysis that the corrosion has no impact on product reliability and lifetime, the part may be considered as passed.

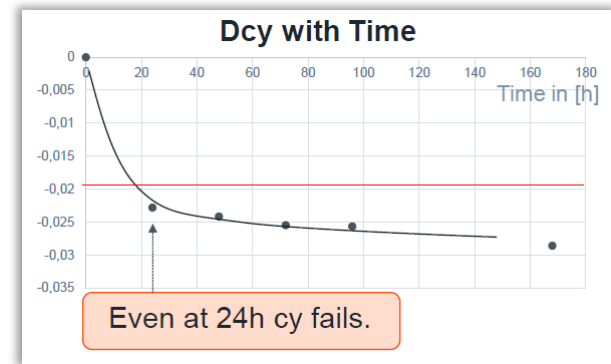
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Several major changes – example VI

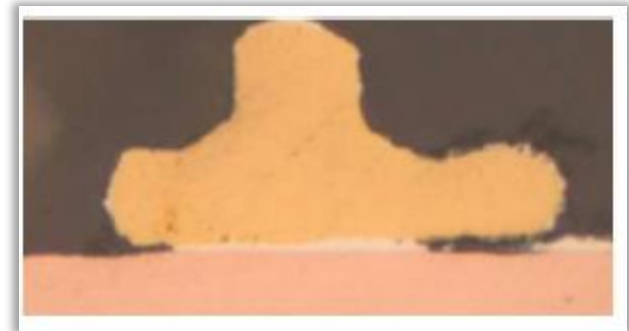
Background of change to 2-gas-test (H₂S & NO₂) acc. to IEC 60747

- Logarithmic behaviour of color degradation (indicator for critical leadframe corrosion)
=> test duration 48h has sufficient margin

- Even if no complete lifted balls are seen after 2-gas test (same as for old H₂S tests), the weakened ball connection is visible



Source: ams OSRAM group



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Several major changes – example VI

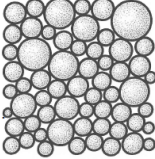
Background of change to 2-gas-test (H₂S & NO₂) acc. to IEC 60747

- Corrosion crystal morphology more similar to field observation


From AECQ102 expert discussion:

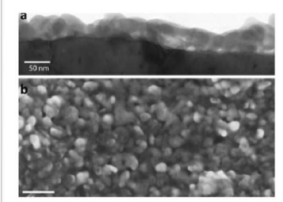
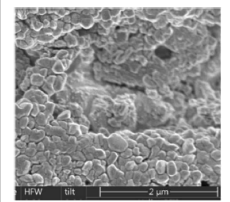
For H₂S & NO₂:

- Granular crystals
- Comparable to natural environmental conditions
- Stable sulfidation



H₂S only: - Filamentous crystals.



✓ *Literature check [2] confirms statement*

✓ *amsOSRAM test confirms statement*

Ag₂S crystal structure in real world environment is granular, as can be seen from the reaction of H₂S&NO₂

Source [2]: Keast, V. J. (2022). Atmospheric corrosion of silver and silver nanoparticles. Corrosion and Materials Degradation, <https://www.mdpi.com/2624-5558/3/2/13>

Source: ams OSRAM group

- Lower dependency of corrosion rate by humidity
- Comparison of 2-gas test (48h) with old H₂S class A (336h) shows similar results (failure criteria: Vf, color, corrosion visible)
- Highly accelerated test because NO₂ reacts as oxidation agent

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Many more items

- **Sample size:** limited sample size for special condition possible (following AEC-Q102-003)
- **H2S:** perform reflow cycles before H2S
- **PTC:** change procedure to determine the test parameter „*temperature*“ and „*current*“
- **TEST:** modification of some failure criteria
- **Process change guideline:** alignment with upcoming ZVEI DeQuMa revision
- **Data presentation:** ensure not to perform Q102 on „A-sample“ only
- ...

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Outlook

Major items need to be discuss:

- Q102 CDCQ (following Q100 approach)
- Q102-003
 - Superset to be aligned with all Q10x changes

Target for ballot: Q3 / 2026

Further remarks and change proposals welcome!



Thank you