Automotive Electronics Council

Component Technical Committee

AEC-Q102 (& AEC-Q102-003)

Optoelectronic (& Optoelectronic Multichip Modules)

Task Group Status Update

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4th European Automotive Electronics Council Reliability Workshop

Bordeaux, 8th - 9th October 2025

Status AEC-Q102 Task Group

Discussion for revision update ongoing

- Actual Q102 rev. A published Apr. 2020
- Actual Q102-003 rev.- published Aug. 2022
- Discussion for revision update started Oct. 2024 (appr. 150 change requests)
- First ballot version ready before Detroit 2025 ?

Status AEC-Q102 Task Group

Several items already discussed – example I

Scope:

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

Qualification of bare dies should follow AEC-Q102 testing by using appropriate carriers or surrogate packages. If the supplier can show, that some test cannot be performed or do not make any sense, the deviation has to be discussed with the costumer. Any qualification of additional process steps for the connection of the bare dies to any carrier (e.g. by wire bonding or soldering) has to be agreed between supplier and customer.

Status AEC-Q102 Task Group

Several items already discussed – example II

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.

Status AEC-Q102 Task Group

Several items already discussed – example III

2.3.4 Sample Size Requirements:

Consider limited sample size under special circumstances

(following AEC-Q102-003)

Only for Laser components, which require additional electronic driver units to be operated mandatorily together in the stress chamber: the sample size for operating tests (HTOL, WHTOL, PTC, LTOL) may be reduced to a minimum 3 x 10pcs after mutual agreement between supplier and user. The sample size has to be clearly stated in the qualification report.

Status AEC-Q102 Task Group

Several items already discussed – example IV

4.2 Part Specific Tests:

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.

Status AEC-Q102 Task Group

Several items already discussed – example V

4 Qualification Tests – Humidity testing:

Discussion of purpose for several variants of humidity testing

- WHTOL1 and WHTOL2 remain unchanged
- HT³RTB (used for PD and PT) not to add for LEDs (used in special application)
- Remove DEW
- Add WHTSL for for color converting LEDs/laser

A2d	**Wet High Temperature Storage Life**	**WHTSL**	D, G, X, Y	26	3	0 Fails	JEDEC JESD22-A101	**Only for LEDs and laser components with color conversion.** 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. **TEST before and after WHTSL.**

Status AEC-Q102 Task Group

Several items already discussed – example VI

4 Qualification Tests - PTC:

- Request to perform PTC only for high power LEDs was rejected
- Change procedure to determine the test parameter „temperature“ and „current“

A3a	**Power Temperature Cycling**	**PTC**	D, G, X, Y	26	3	0 Fails	JEDEC JESD22-A105	**Only for LEDs and laser components.** **PC before PTC.** Duration 1000 temperature cycles, ~~with maximum drive current according to derating curve specified in part specification at maximum T_{solder}.~~ ~~For maximum temperature choose:~~ ~~PTC condition 1: *max* T_{solder} = 85 °C~~ ~~PTC condition 2: *max* T_{solder} = 105 °C~~ ~~PTC condition 3: *max* T_{solder} = 125 °C~~ ~~PTC condition should be chosen closest to the operating temperature range within the appropriate part specification.~~ Select temperature and drive current as follows: 1. Use the appropriate temperature parameter (T_{solder} or $T_{ambient}$) according to the part specification. 2. Choose the maximum drive current according to the derating curve in the part specification. 3. Determine the maximum corner temperature T_{corner} for maximum drive current according to the derating curve in the part specification. 4. Determine the appropriate chamber condition to target T_{corner} within a range of +/-10°C. If multiple chambers are used for the qualification, all test condition shall be the same within chamber setting tolerance. 5. In case that the determined chamber temperature is higher than T_{corner}, the drive current can be adjusted according to the derating curve in the part specification Minimum temperature (during power off) as specified in part specification. Operated with power cycle 5 min on / 5 min off. PTC condition shall be mentioned in the test report. Pulse operated laser components shall be operated at maximum stress condition (pulse current, pulse width & $T_{junction}$ ~~duty-cycle~~) according to part specification. The duty-cycle shall be chosen to achieve maximum $T_{junction}$ as rated in the appropriate part specification. LEDs and laser components using multiple emitters (e.g., RGB) must be operated with all emitters driven simultaneously. For use within special application; a longer test duration may be needed to ensure reliability over application lifetime. For details, see Appendix 7a ~~"Reliability Validation for LEDs"~~. **TEST before and after PTC. DPA after PTC.** **Additionally, for hermetic packages only: HER after PTC.**

Status AEC-Q102 Task Group

Several items already discussed – further examples

- Request to add Rth as criteria for TEST was rejected
- Allow TSK as alternative for TC

A4 Alt	**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.**

- Add PC before H2S

C12	**Hydrogen Sulphide**	**H2S**	D, G	26	3	0 Fails	IEC 60068-2-43	**PC before H2S** **Corrosion class A:** (preferred) Duration 336 h at 40 °C and 90% RH. H_2S concentration: 15ppm **Corrosion class B:** (acceptable for some application) Duration 500 h at 25 °C and 75% RH. H_2S concentration: 10ppm The corrosion class has to be mentioned clearly in the test report. No corrosion allowed. If the supplier can show by means of additional testing or analysis that the corrosion has no impact

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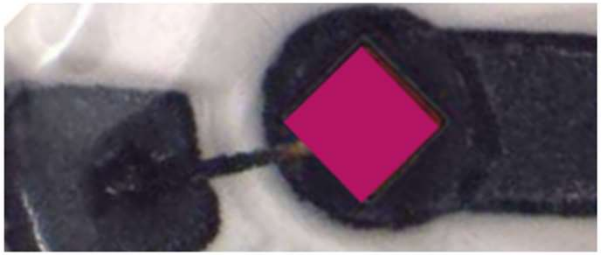
Items under actual discussion

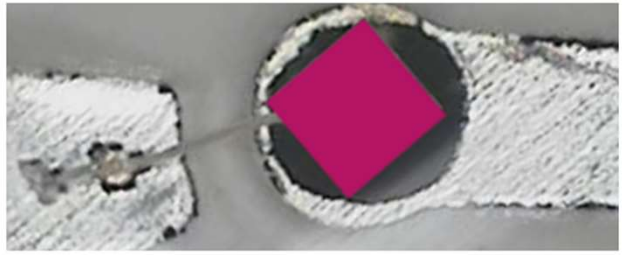
4 Qualification Tests - H2S:

- Proposal to change actual H2S test to 2-gas-test (H2S & NO2) acc. to IEC 60747
- See: „*Need for speed? A Comparative Study of H2S-Corrosion Tests*” in session 1

- 2-gas-test is faster and crystal formation seem to be more similar to field behavior
- Actual H2S is only a robustness test, only very limited correlation to field behavior



after H2S test – no electrical failure



field return – electrical failure

- Also no lifted stitches seen after 2-gas-test

Status AEC-Q102 Task Group

Many more items

- **H2S:** change test parameter for 15ppm H2S to have more margin regarding dew point
- **CDM:** how to deal with „small packages“
  - ESDA/JEDEC JTR 002-01-2025: *(<16mm²)*
  - ANSI/ESD/JEDEC JS-002-2025
- **TEST**: change of failure criteria for shift of flux/intensity/power, color and Vf
- **Process change guideline:** alignment with upcoming ZVEI DeQuMa revision
- **AEC-Q102-003 superset:** changes because of new AEC-Qxxx revisions
- …

Further remarks and change proposals welcome!

Thank you