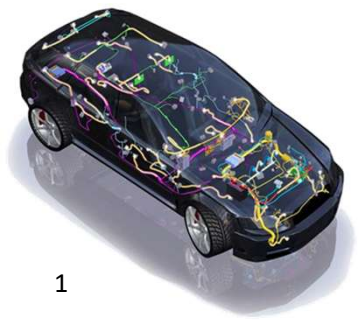


AEC-Q102: Task Group Status Update

Uwe Berger – Forvia Hella

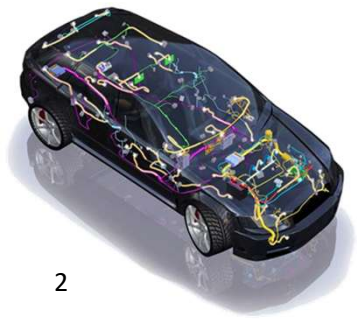
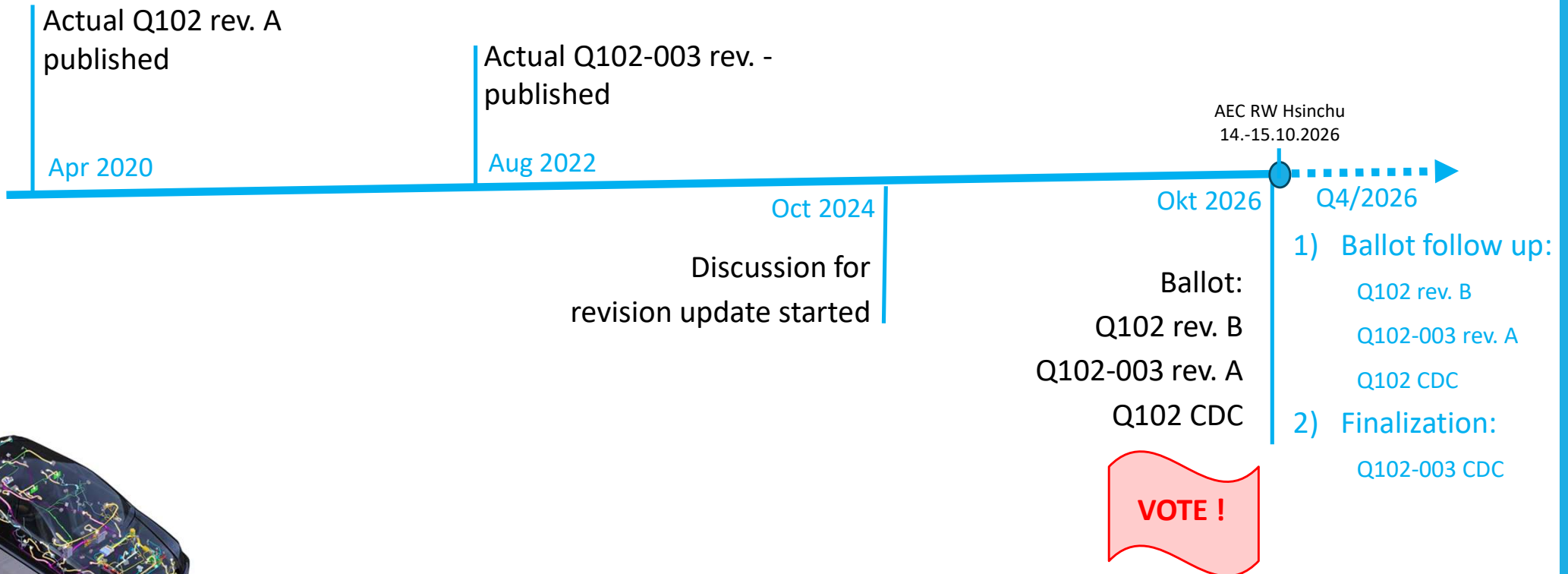
AEC RW Hsinchu – October 14 & 15, 2026



Automotive Electronics Council
Component Technical Committee

AEC-Q102: Task Group Status Update

Overview - Timeline



AEC-Q102: Task Group Status Update

The Team

amul OSRAM

AUMOVIO

DOMINANT
Opto Technologies
Innovating Illumination

EVERLIGHT

FORVIA
HELLA

IST
INTEGRATED
SERVICE
TECHNOLOGY

LUMILEDS

LUMINAR

M
MARELLI



NICHIA

OUSTER



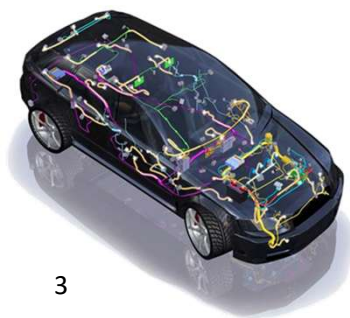
VISHAY

WE
WÜRTH
ELEKTRONIK

AEC Q102 Sub-Committee Members:

Manfred Bittner	AMS Osram
Christian Jung	AMS Osram
Jennifer Rieder	AMS Osram
Markus Ritzer	AMS Osram
Stefan Tuebel	AMS Osram
Marcus Rühl	Aumovio
Hartmut Wettengl	Dominant
Herane Norico	Everlight
Uwe Berger [Q102 Team Leader]	Forvia Hella
Udo Fornahl	Forvia Hella
Matthias Ogonda	Forvia Hella
Dam Lee	IST
Christian Kalkschmidt	Lumileds
Norbert Lesch	Lumileds
Doug Lesser	Lumileds
Richmond Hicks	Luminar
Bastian Kopp	Marelli
Luisa Scarcione	Marelli
Zulia Zulkiffli	Marelli
David Lee Simpson	Missile Defense Agency
Saori Mitsuhashi	Nichia
Melinda Schnoes	Ouster
Song Yang	UL LLC
Morris Wilson	Vishay
Zhelio Andreev	Würth Elektronik

Automotive Electronics Council
Component Technical Committee



AEC-Q102: Task Group Status Update

Several major changes for Q102 rev B – example I

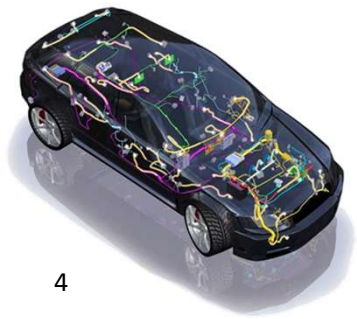
Scope:

- 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 the requirements of his user.



AEC-Q102: Task Group Status Update

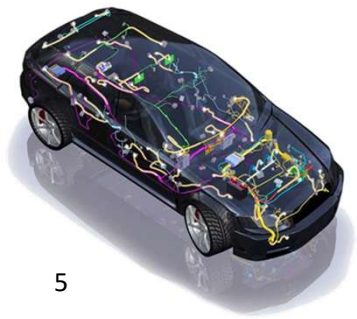
Several major changes for Q102 rev B – example II

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, 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>PC before WHTSL</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.</u> <u>TEST before and after WHTSL.</u>
-----	--	--------------	-------------------	-----------	----------	----------------	--------------------------	---



AEC-Q102: Task Group Status Update

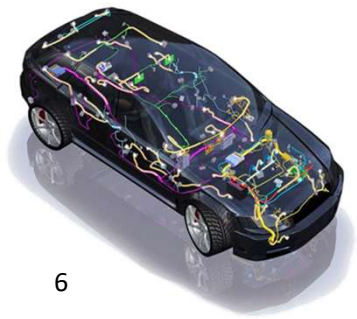
Several major changes for Q102 rev B – example III

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.



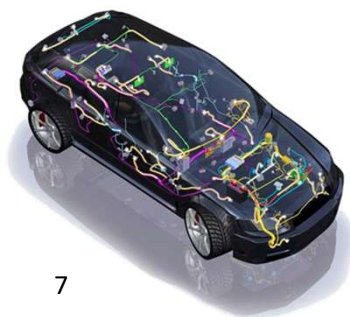
AEC-Q102: Task Group Status Update

Several major changes for Q102 rev B – example IV

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	IEC 60068-2-43 IEC 60747-5-13	<u>For SMD parts only: perform as many reflow cycles before H2S as maximum allowed according to part specification.</u> <u>Combined gas test (H₂S and NO₂):</u> (including hygroscopic treatment acc. to 6.2.in IEC 60747-5-13) Duration 48 h at 40 °C ± 2 °C; and 75 % RH ± 5 % RH H₂S concentration: 2 × 10⁻⁶ vol/vol; NO₂ concentration: 4 × 10⁻⁶ vol/vol Rate of ventilations: 3 - 10 cycles/hour Corrosion class A: (preferred) Duration 336 h at 40 °C and 90% RH. H₂S concentration: 15ppm Corrosion class B: (acceptable for some application) Duration 500 h at 25 °C and 75% RH. H₂S concentration: 10ppm The corrosion class has to be mentioned clearly in the test report.
-----	-------------------	-----	------	----	---	---------	--	---

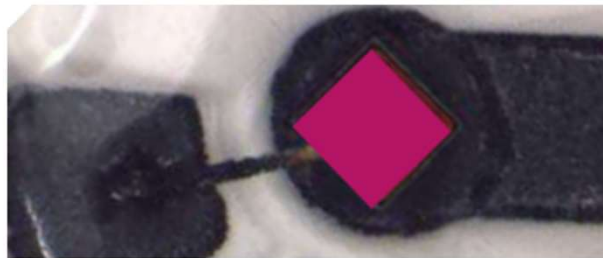


AEC-Q102: Task Group Status Update

Several major changes for Q102 rev B – example IV

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

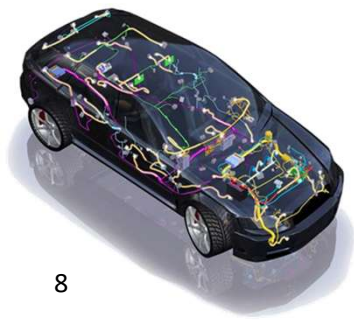
- H2S is a robustness test with only very limited correlation to field behavior.
- Compliance of electrical and optical parameter after testing is not sufficient to pass the test. Any corrosion is an indicator for a risk, which has to be evaluated. If the supplier can show by means of additional testing or analysis that the corrosion has no impact on product reliability and lifetime, the part may be considered as passed.



after H2S test – no electrical failure



field return – electrical failure



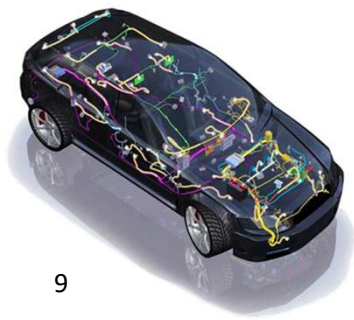
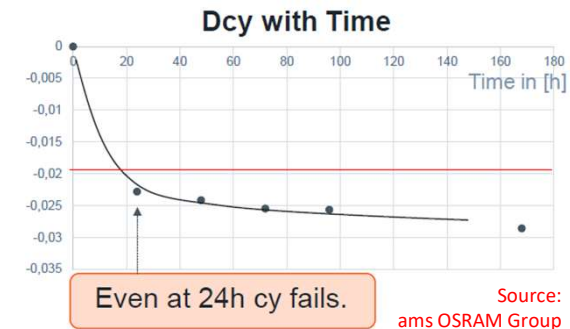
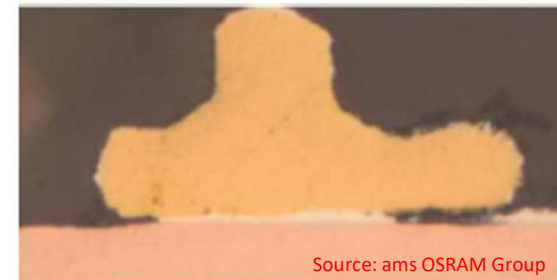
AEC-Q102: Task Group Status Update

Several major changes for Q102 rev B – example IV

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

- Even if no complete lifted balls are seen after 2-gas test (same as for old H₂S tests), the weakened ball connection is visible
- Logarithmic behaviour of color degradation (indicator for critical leadframe corrosion)
=> test duration 48h has sufficient margin

(Highly accelerated test because NO₂ reacts as oxidation agent)



AEC-Q102: Task Group Status Update

Several major changes for Q102 rev B – example IV

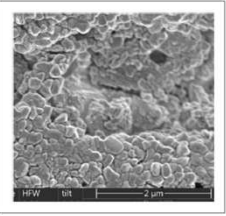
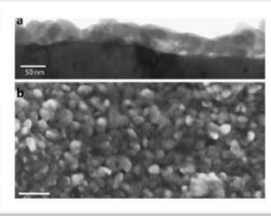
Background of change to 2-gas-test (H₂S & NO₂) acc. to IEC 60747

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

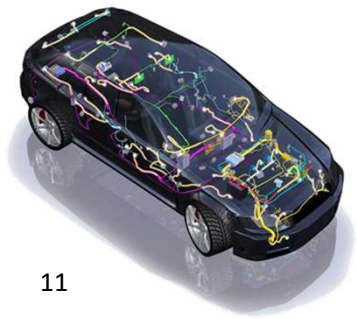
Source [2]: Keast, V. J. (2022). Atmospheric corrosion of silver and silver nanoparticles. Corrosion and Materials Degradation, <https://www.mdpi.com/2624-5558/3/2/13>

Source: ams OSRAM Group

AEC-Q102: Task Group Status Update

Many more items for Q102 rev B

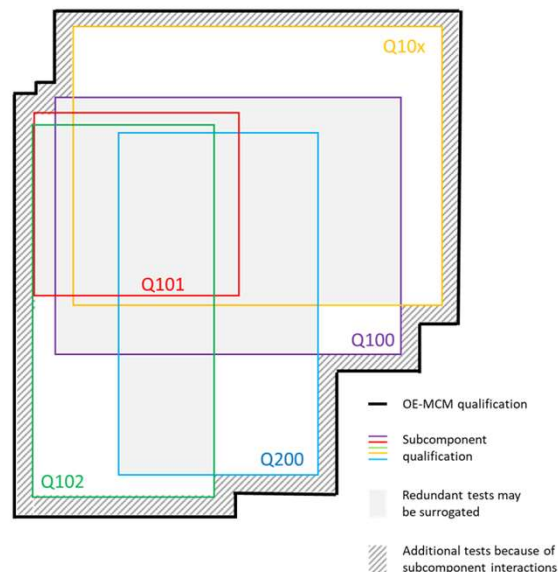
- **Scope:** define use of old vs. new revision for PCN, re- and family qual. (following AEC-Q200)
- **Sample size:** limited sample size for special condition possible (following AEC-Q102-003)
- **PTC:** change procedure to determine the test parameter „temperature“ and „current“
- **TC:** allow TSK as alternative test method
- **TEST:** modification of some failure criteria
- **Process change guideline:** alignment with upcoming ZVEI DeQuMa revision
- ...



AEC-Q102: Task Group Status Update

Main changes in Q102-003 rev A

- Update Process Change Guideline acc. to new Qxxx revisions
- Update Qualification Test Plan (Superset) acc. to new Qxxx revisions
- ...



Group	Subgroup	AEC-Qxxx test reference		Test	Test name	If tests are done on OE-MCM level: Substitution of test within subgroup possible?	Generic data from sub-component qualification (using different package) allowed? If no, only test on OE-MCM level allowed.	Additional remarks
C	C11	C11	Q102	C9	TR	Thermal Resistance	Yes	possible.
C	C12	C12	Q100	E12	LF	Lead (Pb) Free	Yes	Use of generic data from sub-component qualification (using different package) allowed? If no, only test on OE-MCM level allowed.
C		C12	Q101	C11	WG	Whisker Growth Evaluation		
C		C12	Q102	C11	WG	Whisker Growth		
C	C13	C13	Q402	C7	DEW	Dew-	No	No substitution because Q402 (e.g. by minimum current, as per JEDEC J-ESD-22-A1)
C	C14	C14	Q102	C12	H2S	Hydrogen Sulphide	No	No substitution because Q102
C	C15	C15	Q402	C13	FMG	Flowing Mixed Gas	No	No substitution because Q402
C	C16	C16	Q102	C14	BF	Board Flex	Yes	Not a gating test. Test is only required for MCMs
C		C16	Q200	21		Board Flex (SMD)		
C	C17	C17	Q100	C7	BST	Bump Shear Test	No	No substitution because Q102 Use of generic data from sub-component qualification (using different package) allowed? If no, only test on OE-MCM level allowed.
D	D1	D1	Q100	D1	EM	Electromigration	No	No substitution because Q102 Generic data are allowed.
					Time Dependent Dielectric			No substitution because Q102

AEC-Q102: Task Group Status Update

CDC Update

- Digitally readable CDC for Q102 (following Q100 approach) ready for ballot
- Digitally readable CDC for Q102-003 still need to be discussed in the team

#PKG-MAT-35	Primary wire bond type at lead/substrate/ceramic	
	Mold Compound Details	
#PKG-MAT-61	Mold compound type (PPA, SMC, EMC, etc.)	
	Encapsulation Compound Details	
#PKG-MAT-66	Encapsulation material	
#PKG-MAT-67	Tg (glass transition temperature °C)	
	Converter Compound Details	
#PKG-MAT-68	Converter base material	
#PKG-MAT-69	Converter material	
	Package Solder Attach Interface	
	External Attach Interface (Leadframe Plating Overview)	
#PKG-PCB-00	Pre-plate or post-plate?	
#PKG-PCB-01	Number of plating layers	
	External plating (solderable surface layer)	

> ...

Q102 - Die 1 Supplier 1 + Pkg

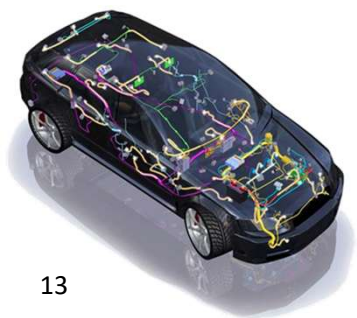
Q102 - Die 1 Supplier 2

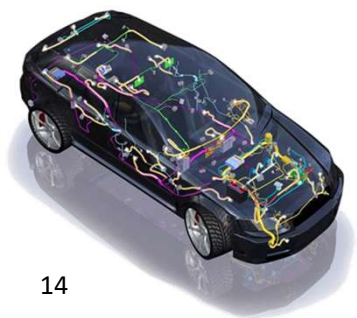
Q102 - Die 1 Supplier 3

Q102 - Die 2 Supplier 1

Q102 - Die 2 Supplier 2

Q





Thank you

Automotive Electronics Council
Component Technical Committee
