Customer complaint management — Details on return shipments for failure analysis request (FAR)

Application Note

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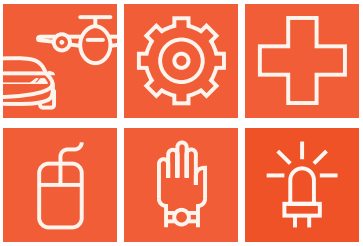
Customer complaint management — Details on return shipments for failure analysis request (FAR)

Application Note No. AN001



Valid for:
all products

Abstract

Our goal is to provide highest quality products and therefore we continuously strive to improve our products and processes. Despite their reliability and robustness, LEDs can experience faults and failures. For a fast and effective quality analysis it is essential to understand the problem. It is also important to ensure that in the case of a return the affected component is not damaged by handling and that the original source of the defect is not falsified. This document gives guidance on how parts meant for failure analysis are to be returned to ams-OSRAM AG to ensure a fast and reliable analysis.

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1 General information

Despite their reliability and robustness, LEDs can experience faults and failures caused for example by various manufacturing processes, by design or system factors when in use or as a result of interaction with other system components. For almost every root cause analysis it is therefore essential to perform a detailed and thorough failure analysis based on which the right conclusion can be drawn. This is independent on who is actually responsible for the failures.

Due to the large portfolio and the different complexity of the components, ams-OSRAM AG differentiates between two component groups, the Optoelectronic Semiconductors and the Optoelectronic multichip modules (OE-MCMs), as classified in the AEC-Q 102 Documents. This basically results in two different FAR processes, as described in chapter 4.1 "Optoelectronic semiconductors" and chapter 4.2 "Optoelectronic multichip modules".

2 Analysis methods

For the event of quality issues ams-OSRAM AG established a step-by-step process for components in our in-house analysis laboratory. Among others the following analysis methods are available:

- Electrical & optical characterization
- Light microscopy
- IR microscopy
- Photoemission microscopy (PEM)

- Energy dispersive X-ray analysis (EDX)
- Focused ion beam preparation (FIB)
- X-Ray photoelectron spectroscopy (XPS)
- Solderability testing
- X-ray & X-ray CT imaging

3 Communication of necessary information

For ams-OSRAM AG as supplier it is essential to have sufficient information available when a complaint is started. The information provided before shipping a part, can be helpful to speed up the root cause investigation, set-up robust containment actions and check production history in advance to have a conclusive and complete analysis.

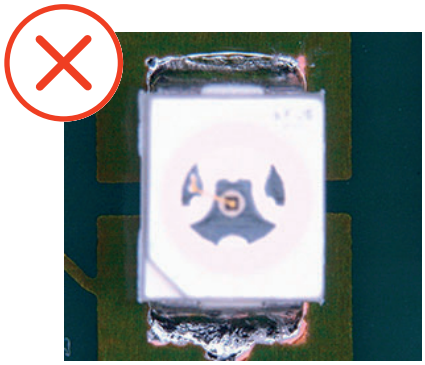
- Product (e.g. LED type)
- Failure location (incoming inspection, production, qualification, 0-km, field incl. km/hours) Clear failure/symptom description (optical, electrical, mechanical, etc.)
- Quantity (how many failures occurred)
- Application (e.g. headlamp, dashboard, backlighting, etc.)
- Date of occurrence
- Delivery note
- Operating conditions
- Application/ambient conditions
- Label Information
- Laser code (in case available on component - see Figure 1)
- Purchase Order No.
- Pictures of affected LED/application
- Failure rate
- Cross-swap evidence for OE-MCMs

To gather this information in advance, ams-OSRAM AG provides a Failure Analysis Request form (FAR form) which is available at regional sales and customer service departments. The contents of the FAR form are essential for a fast and reliable failure analysis and will help us to

handle your complaint fast and without time-consuming questions and answers. Please always provide a filled out FAR form when starting a complaint.

Figure 1: Picture of a LED with laser code

Clear picture with readable laser code



Insufficient picture of affected part with no readable laser code

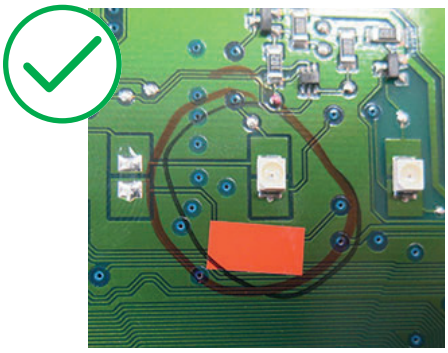
4 How to return parts for analysis

The following section describes the different ways of sending components for failure analysis. A clear differentiation is made between optoelectronic semiconductors and optoelectronic multichip modules. However, the shipping and handling instructions in chapter 4.3 "Shipping parts for FAR" are equally valid for all of them.

4.1 Optoelectronic semiconductors

Affected parts should be provided for failure analysis in the actual failure condition, i.e. in the condition they were in when the fault or failure occurred. Most likely the affected component is mounted on a custom board when the error occurs. Then it is best to send the complete board for analysis. Figure 2 shows how a LED should be returned and a bad exampled of a de-soldered part with different types of stress.

Figure 2: How to return a LED for FAR

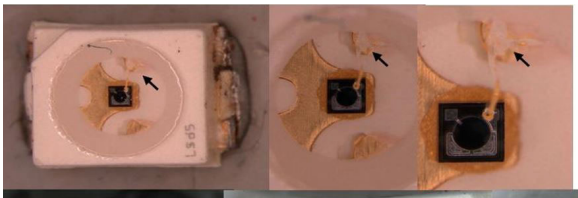


Return parts clearly marked in actual failure condition

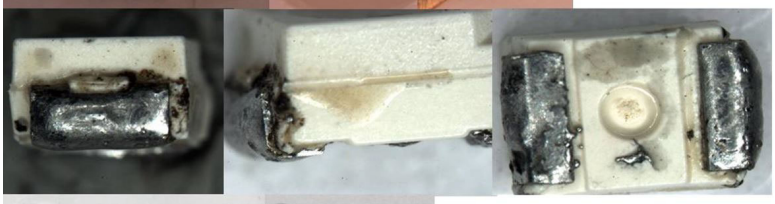
Do not return parts that have been desoldered and subjected to various stresses.

As a general rule, optoelectronic semiconductors should not be detached or de-soldered from the circuit board. This avoids any further damage or degradation to the LED, which may mask or even eliminate the original fault (Figure 3). Additionally, a potential influence of the circuit or other design factors can also be investigated and possibly excluded.

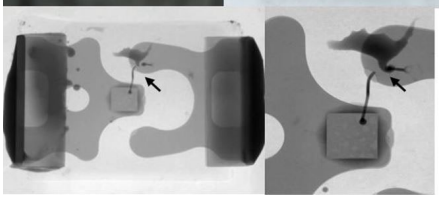
Figure 3: Problem with de-soldered devices: impact on device may mask or eliminate original failure



Pictures of returned unit/ internal assembly: problem at stitch probably caused during desoldering



Side view of package: thermal damage of package material due to desoldering

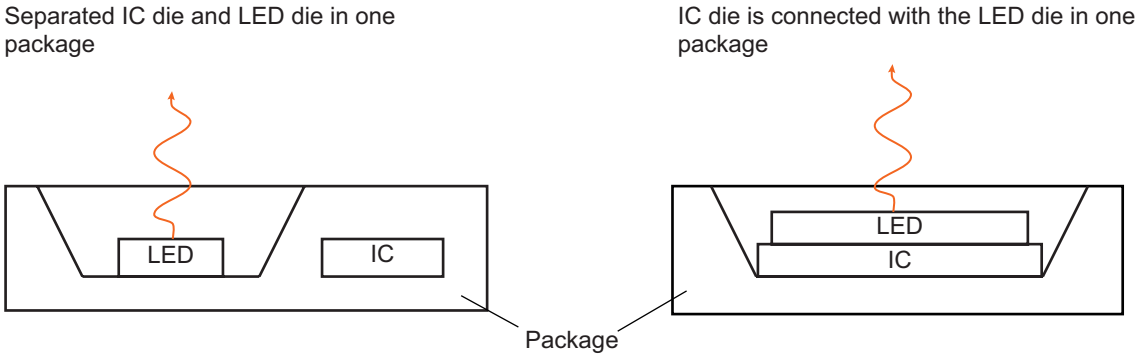


X-ray analysis: hints for broken wire

4.2 Optoelectronic multichip modules

Optoelectronic multichip modules (OE-MCMs), sketched in the principal design-setup in Figure 4, are more complex and therefore the analysis methods are different here.

Figure 4: Sketch of the principle design-setup of OE-MCMs



OE-MCMs must be returned in a de-soldered state for FAR. A cross-swap to exclude systematic external faults is an essential test before further analysis can be performed. A failure analysis is only possible if all other error factors can be excluded. Since the assembly of the modules on the board is also more complex, de-soldering is mandatory before returning the modules. It is important to note that components should never be de-soldered manually but always an appropriate rework station with controlled soldering temperature according to the JEDEC soldering profile should be used. If there are any uncertainties or questions regarding the procedure, information is available in the product-specific application note or by contacting ams-OSRAM.

4.3 Shipping parts for FAR

Handling in accordance with ESD protection guidelines is also essential for packing and shipping to avoid any further impact on the electronic assembly.

When sending a component for analysis, always select an appropriate shipping container. In addition, it should be ensured that the parts do not move or touch each other in the shipping container. The packaging must be dust-free and residue-free. Any kind of mechanical stress on the components has to be avoided. Further damage (scratching, shearing off of the lens, distortion of the bond wire, etc.) can conceal the original damage (lens defect, bond wire defect, etc.). Do not return several components as bulk material.

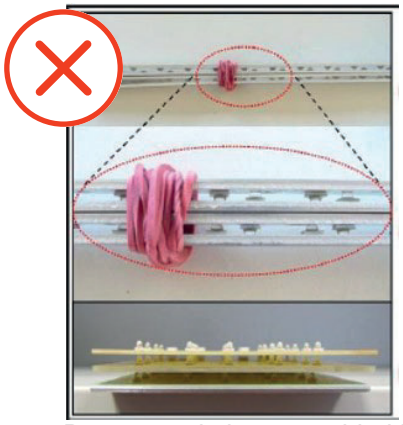
The returned components must be handled, packed and shipped properly. Please avoid contact with direct, indirect (electromagnetic pulse) or external electrostatic discharge (ESD) during transport. Therefore, packaging must be selected that not only protects the components from mechanical damage, but also in accordance with ESD standards. Do not use standard plastic bags or containers for shipping, as they may charge the parts inside. Figure 5 shows packaging examples for shipment.

Figure 5: Packaging examples for shipment

ESD packaging material
ESD cardboard box with foam inside to protrect parts against electrical and mechanical stress

Each part packed individually in a sealed ESD conformal bag

Do not use standard plastic bags
Do not ship bulk material



Do not stack the assembled boards
Insufficient protection of affected parts against electrical and mechanical stress

5 Conclusion

Failure analysis concerning the allocation of cause and effect can be a sensitive issue. In some cases it can even be controversial. Therefore, an accurate and well-structured proceeding is essential to prevent avoidable issues. Inside a concerted environment and on the basis of mutual trust, failure analysis provides a better understanding of the needs and expectations of both partners. Furthermore, a traceable and exact failure analysis initiates continuous learning and improvement of technologies, products, processes and services.

In any case, failure analysis is of mutual benefit and is a critical factor for success in terms of product quality and reliability.

The components should not be desoldered (except for Optoelectronic multichip modules) and should be returned in the condition in which the error occurs. With a detailed and comprehensive error description, the failure analysis will be more insightful.

For shipping parts a suitable packaging must be chosen, which includes:

- ESD protection
- Suitable shielding bags
- Protected against mechanical damage

ABOUT ams OSRAM Group (SIX: AMS)

The ams OSRAM Group (SIX: AMS) is a global leader in optical solutions. By adding intelligence to light and passion to innovation, we enrich people's lives. This is what we mean by Sensing is Life. With over 110 years of combined history, our core is defined by imagination, deep engineering expertise and the ability to provide global industrial capacity in sensor and light technologies. Our around 24,000 employees worldwide focus on innovation across sensing, illumination and visualization to make journeys safer, medical diagnosis more accurate and daily moments in communication a richer experience. Headquartered in Premstaetten/Graz (Austria) with a co-headquarters in Munich (Germany), the group achieved over EUR 5 billion revenues in 2021. Find out more about us on https://ams-osram.com

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