

Applying for Failure Analysis Service

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Release Note: Revision bars indicate significant changes to the previous edition.

1. Introduction

This document is aimed to specify the scope of TDK-Micronas' failure analysis and customer duty to achieve the requirements of the automotive sector.

As a world-class supplier of Automotive electronics, TDK-Micronas offers the service of failure analysis on delivered products. TDK-Micronas' analysis processes are qualified to offer best results in the identification of the failure cause.

The experienced team is able to identify artefacts from devices stripping processes. TDK-Micronas is continuously increasing its expertise level and know-how. Nevertheless, it does not mean that the success of each analysis is guaranteed.

To increase the success rate at project level, the cooperation and the involvement of the customer in the failure analysis process is primordial.

1.1. What is the Purpose of a Failure Analysis?

- Identify the failure root cause
 - Perform physical or process analysis
 - Decide of the necessity of further containment / product recall
 - Implement relevant corrective actions
- Determine the risk
 - Assess the risk
 - Hold all the available suspect devices
 - Decide of containment actions

2. Requirements for Risk Assessment

Without customer support, the risk cannot be assessed.

- Customer shall report the problem in quantifiable terms, recommended method is 5W2H approach. (Using 8D report or TDK-Micronas' FA Application Questionnaire Form available on request - extract see [Table 2-1](#)).
- Who (Customer name)
- What (Part name and number and TDK-Micronas' lot number or marking)
- When (Date, hours of use \ mileage)
- Where (In line, other facility or in field)
- Why (failure symptoms description "No Function" is not relevant)
- How (How did the failure appear, temperature or other conditions)
- How many (Number of claimed parts)
(with Customer 8D or TDK-Micronas' FA Application Questionnaire Form)

Table 2-1: Table extract from TDK-Micronas' FA Application Questionnaire Form

| | | |
|---------------------------------------|---------------------------------------------------|--|
| Applicant information Who? | Applicant Claim ID number | |
| | Applicant Company name: | |
| | Location: | |
| | Division | |
| | Supplier name (when not direct by TDK-Micronas) | |
| | Applicant contact Person: | |
| | Phone: | |
| | E-mail: | |
| | Date: | |
| | Expected date for reporting | |
| | Module Application name: | |
| What? | Type and version of the rejected Micronas device: | |
| | Device traceability (lot No, Date code etc....) | |
| When? | Failure date: | |
| Where? | Applicant production line: | |
| | Applicant product Qualification tests | |
| | Applicant life/reliability tests: | |
| | Applicant customer production line | |
| | Applicant customer product Qualification tests | |
| | Applicant customer life/reliability tests: | |
| | Car manufacturer facility | |
| | Field failures (warranty / milage / km): | |
| | Others | |

Table 2–1: Table extract from TDK-Micronas' FA Application Questionnaire Form

| | | |
|----------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|
| Why? | Description of failure mechanism on single device. Complete the "Electrical behavior" sheet. | |
| How? | Electrical conditions: (supply voltage, I/O-signals, etc) | |
| | Environmental conditions: (Cockpit, motor, other) (temperature range, time to failure, etc) | |
| | Failure mode: | |
| | Data sheet item(s) considered as violated | |
| | Name: | |
| | Page Number: | |
| | Impact on vehicle | |
| | Provide logistic flow Assembly / soldering/ test/ final assembly/ test etc | |
| | Does applicant implement Burn-in? Conditions? | |
| | Description of stripping down method used. In case of overmolded application provide the list of used chemicals | |
| | Was the program lock activated? | Yes / No |
| Provide the programmed parameters or Typical parameter for the application | | |
| How many? | Reject rate | |
| | Delivered quantity: | |
| | in the time frame (from/to) | |
| | Total number of rejects (or %) | |
| | Stock situation of subject Micronas product. (Mandatory in case of multiple occurrence.) | Complete the "Available TDK-Micronas Lots" sheet. With lots in finished goods stocks too. |

- The customer must provide the complete product inventory information related to the claimed device from TDK-Micronas
 - TDK-Micronas' lot numbers in stock (before production)
 - TDK-Micronas' lot numbers in process and in finished stock
- The provided information allows TDK-Micronas
 - to check the lot history and assess the status of suspect products.
 - to understand the device malfunction.
 - to confirm the malfunction of returned device.
 - to initiate relevant containment actions (referring to product inventory).
 - to report to customer accordingly.

3. Traceability

3.1. Information

On box label

All information is readable by bar code system.

Several labels types are available. Please refer to “Sensors and Controllers: Ordering Codes, Packaging, Handling” or relevant PPAP for details.

On devices

Micronas products are marked on the package body with information allowing the identification of the product name, with additional information like date code, trace code or lot number. Please refer to “Sensors and Controllers: Ordering Codes, Packaging, Handling” or relevant PPAP for details.

“Sensors and Controllers: Ordering Codes, Packaging, Handling” is available on the TDK-Micronas website (<http://www.micronas.tdk.com/en/service-center/downloads>).

3.2. Date Code (DC)

- Depending on the product technology, production flow and lot merging, DC on label can be different as DC on devices package
- The DC code is the same for all devices or box labels passing the marking process on the particular DC day.
 - Several lots of the same product may be processed at the same day within single or different TDK-Micronas facility
 - The quantity of suspect devices is not limited to one lot and to one production

3.3. Trace Code

- Usually it is a 4 digits code using 0 to 9 and A to Z characters
- Each code is corresponding to a unique assembly lot number

3.4. Lot Number

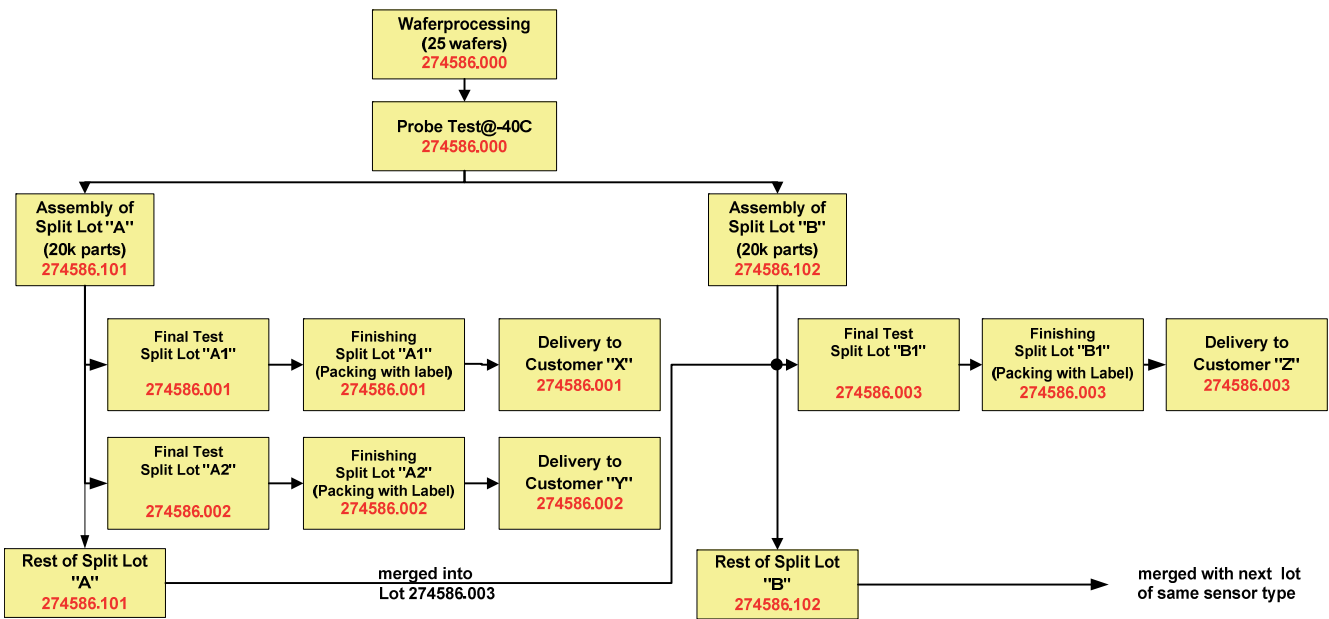
– Lot number structure: **6 digits. 3 digits: Batch.Split**

Example: 274586.002

- 274586 is the lot number generated by the system when the lot started
- 002 is identifying a split of the lot.

For products manufactured within TDK-Micronas facilities, lot numbers are recorded and tracked at each production step. It is possible to trace back each lot and to know when, on which equipment and at which TDK-Micronas location a device was processed.

3.5. Typical Lots and Splits Flow



3.6. Limitations

- For effective containment actions, adequate traceability at the customer is recommended
- Device Date Code is not ensuring the tracing back to one single batch when full traceability is required for customer project (see [Section 3.2](#)).
- In case Micronas device is embedded into resin or other compound, for application purpose, it is customer responsibility to make sure that traceability is ensured by:
 - Appropriate stripping down method to allow marking readability
 - System record e.g.: database linking module serial number to TDK-Micronas' lot number.

N.B.: Even when some Micronas devices have traceability information recorded in memory, it could be not readable in case of failure affecting the memory block.

- Missing traceability is leading to:
 - No possibility of containment action.
 - No possibility to identify the related process or equipment failure.

4. Failure Symptoms

4.1. Causality

- The causality of failure has to be secured by correlating the symptom at each analysis stage.
 - It is important to make sure that the analysis process is leading to the failure root cause.
 - It is important to avoid damages related to handling in the claim return management or analysis process (ESD, mechanical or electrical over-stress).
 - Customer shall reproduce and confirm electrical failure of the suspect device free of overmolding material and out of the sensor module.
 - TDK-Micronas expertise is limited to failure analysis at device level. After the confirmation of electrical failure in our lab, physical analysis is proceeding based on the observation.
 - For 0 km and field failure, when Micronas failure analysis (3D status) results are not correlating with customer failure description and are showing without doubt no failure, TDK-Micronas will not perform destructive preparation without final customer (OEM) written agreement. It will be considered as non-justified complaint (refer to [Section 9.5](#)).

4.2. Description

- Failure symptom description has to be duly reported.
 - Device data sheet is the reference. Violations have to be identified and reported when relevant.
 - Detailed analysis of electrical failure symptoms observed on the single device has to be reported with all the relevant details.
 - Electrical circuit diagram
 - Output signal oscillogram, curves V_{out} vs. magnetic field, frequency, etc.
 - Environmental conditions (temperature, humidity, etc.)
 - “No function” or “No signal” are not an acceptable description to confirm the failure symptoms causality or correlation in a qualified engineering environment.
- Failure correlation at each step is essential for the reporting to final customer

5. Request Announcement:

- Make sure that all the failure description is clear, symptoms identified and completed (as above describe).
- Make sure that all the relevant information (5W2H etc.) are available. (Refer [Section 2](#))
- Customer has to confirm in writing that return sample is free of any hazardous or other substances requiring specific handling cares and personal precaution to avoid workers injury, skin or eyes irritation or other possible trouble.
 - In case of possible trace of hazardous substances, the list and safety data sheet has to be submitted to TDK-Micronas prior sample shipment and may lead to the denial of failure analysis.

Name and complete address of the issuer:

Hereby we declare that sample(s) returned for failure analysis reference : _____
is(are) free of any radioactive, biological and/or chemical contamination and is(are) safe to be handled without specific cares or personal precaution for TDK-Micronas GmbH employees.

Date and place:

Name and position:

Signature:

Fig. 5–1: Example of declaration (Available in MS-Excel with FA Application questionnaire form)

- Send an E-mail to: [Mic-rejects@tdk.com](mailto:mic-rejects@tdk.com) with all the required information.
 - Traceability data and stock situation are mandatory in case of multiple occurrences.
- Failure analysis request will be accepted, but it does not mean that TDK-Micronas is accepting the claim (refer to [Section 9.1](#))

6. Samples Preparation

- Device has to be stripped down from the application
 - Considering the wide range of customers and applications, TDK-Micronas has no qualified process to remove embedded devices from each customer application.
 - The part has to be returned as single device, free of resin, glue or other moulding material. Lead length of returned device shall be 5 mm or more but at least 3 mm for TO92 packages. SMD devices lead length have to be the original length.
 - When it is considered necessary to analyze the part with customer's PCB for package cracks, solderability, etc. (PCB assembly related concern), please consult TDK-Micronas' Quality or a local office before requesting its analysis.
- Each device has to be identified in the parcel
 - Please attach customer name and customer claim ID to each device for appropriate identification.
- It has to be packed in mechanical and ESD protective material.

7. Claim Shipping

– Sent the claim to:

TDK-Micronas GmbH
Quality Engineering Department
--- Rejects ---
Hans-Bunte-Strasse 19
D-79108 Freiburg, Germany

- Shipping costs and method are the responsibility of our customers.
- Do not address the parcel to one person of the team.
- Send the parcel tracking information via E-mail to: [Mic-rejects@tdk.com](mailto:mic-rejects@tdk.com)
- Parcel tracking number shall not be used as claim ID number.

8. Failure Analysis Denial

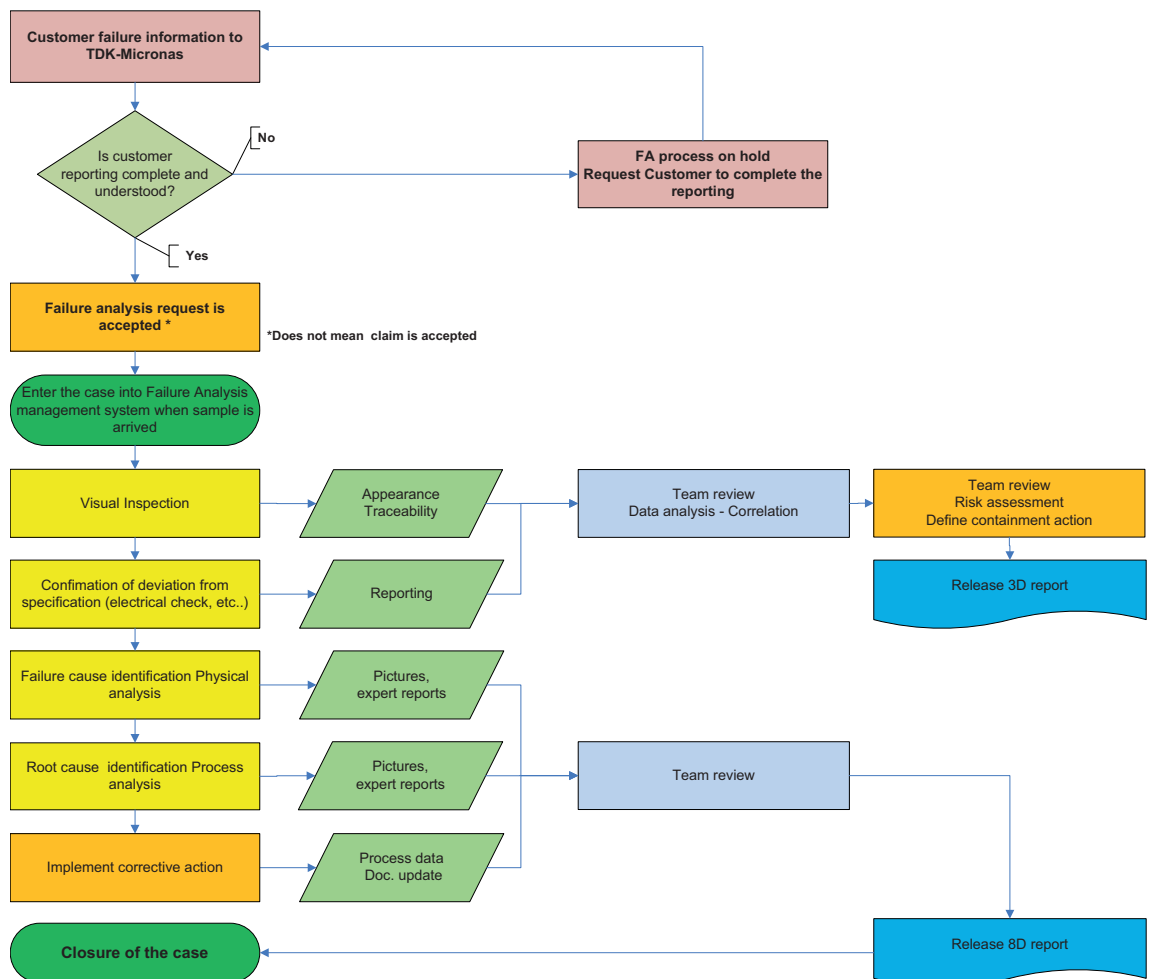
- Device returned by customer with “No trouble found” as failure description
- Device returned without hazardous contamination declaration (see [Section 5](#)).
- Devices will be returned to customer without processing in case of:
 - Devices with overmolding or on application without prior agreement.
 - Claims left 10 working days without proper failure description after request.
 - Devices not duly packed for shipment (ESD and Mechanical protection)
- Devices will be discarded after 10 working days in case of:
 - Devices arrived without information within these working 10 days.
 - No letter attached to the device in the parcel, no E-mail, customer or contact person not clear, no possibility of direct contact with applicant.

9. Failure Analysis

9.1. Claim and analysis

- By accepting to perform failure analysis TDK-Micronas is not confessing a liability into the failure occurrence, but is aiming to support customer and the project by the understanding of the failure root cause.
- Claim will be accepted after the written confirmation by TDK-Micronas of a failure root caused by TDK-Micronas' process.
 - Compensation and return of material can be considered only after claim acceptance.
 - By requesting compensation, customer is accepting by implication all related improvement and changes (including PTN/PCN) proposed by TDK-Micronas.
 - Compensations have to be addressed to TDK-Micronas sales representative with reference to TDK-Micronas' failure analysis report number.

9.2. Typical Failure Analysis Flow



9.3. TDK-Micronas' Failure Analysis Standard

- 3D report target within 2 working days after arrival of the sample.
- 8D report targets are communicated directly with the customer. Analysis times vary depending on the product and failure origin:
 - 0 km or field failure
 - Customer line failure
 - Some products may require additional time for re-assembly.
- Release duration is depending from:
 - Effort requires to locate, visualize and assess the damage.
 - Time to identify and assess the root cause.
 - Time to release the corrective action.
- Devices are stored for a minimum of 1 year after end of analysis before they are scrapped.

9.4. Closure of Failure Analysis Process

- When the identified damage is correlating with the electrical failure.
- When the sample was irreparably damaged by TDK-Micronas' analysis process.
- When the team concludes that further investigation is not feasible.
- Considering the case of device without date code or lot number. The relation between the identified damage and real root cause cannot be confirmed. The observed failure and related damages will be considered for process FMEA, therefore nor root cause, neither corrective action will be reported in the final 8D.

9.5. Non-Justified Complaint and Analysis

- In case of analysis showing customer related root cause, or claim device showing no trouble, and in case of further request to complete customer understanding of the damage or technology, TDK-Micronas will reserve the right to invoice all expenses arising from the case.
- In case of No Trouble Found (NTF) additional tests to reproduce the failure mode could be mutually agreed on customer request. Prerequisite is a joint review of all previous results together with the initial failure mode conditions to identify the most useful and targeted measures.

10. Appendix

10.1. Definitions

- Field failure: Failure detected on the vehicle after it left OEM facility. (Guarantee)
- 0 km failure: Failure detected on the vehicle at OEM facility.
- Line failure: Failure detected on the line, prior the vehicle assembly line.

10.2. Field of Application

- The document has to be disclosed to the customer to ensure the right management and preparation of defect samples related to automotive requirements.
- In order to optimize the overall failure analysis process, it has to be known and disclosed to the customer as early as possible via:
 - Quality Department
 - Sales
 - Customer Service
 - Marketing
 - Sensor Application

10.3. Reference

- IATF 16949: 2016 10.2.6 Customer complaints and field failure test analysis

11. Document History

1. Applying for Failure Analysis Service, Oct. 25, 2012; GL000019_001EN.
First release of the document.
2. Applying for Failure Analysis Service, Feb. 8, 2016; GL000019_002EN.
Second release of the document.
3. Applying for Failure Analysis Service, Aug. 17, 2017; GL000019_003EN.
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4. Applying for Failure Analysis Service, Jan 24, 2019; GL000019_004EN.
Fourth release of the document.
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5. Applying for Failure Analysis Service, Feb. 1, 2019; GL000019_005EN.
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 - [Section 10.3](#) Reference changed
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