



Hardware Element Evaluation Assessment Report

Project:

Y31M LPDDR5 SDRAM

Customer:

Micron Technology, Inc.

Boise (ID), USA

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Management Summary

Micron Technology, Inc. has performed a hardware element evaluation for the Y31M LPDDR5 SDRAM memory device in accordance with ISO 26262-8, clause 13. Y31M is a standard memory product, that was not developed according to ISO 26262, but is planned to be used in safety related systems and applications with allocated safety requirements up to ASIL D.

Micron, the developer and manufacturer of the Y31M LPDDR5 SDRAM, has decided to perform the main part of the hardware element evaluation by itself, even though such an evaluation is usually done by the system integrator using the hardware element. However, the intimate understanding of the Y31M design and manufacturing process puts Micron in the best position to perform the in-depth analyses and exhaustive tests that are required for the hardware evaluation. Micron subsequently requests its customer (i.e. the system integrator) to complete the evaluation by validating the assumptions and results of the hardware element evaluation against the actual requirements, conditions and stresses of the intended system and application. This combined effort enables a complete hardware evaluation without any gaps due to missing information or lack of understanding on hardware element, system and application level.

Micron has specified a set of assumed requirements (incl. safety requirements, functional and performance requirements, environmental conditions, etc.), against which the Y31M LPDDR5 SDRAM has been evaluated using a combination of analysis, verification and testing methods. The assumed requirements are also documented and communicated to the customer and system integrator for verification against the actual requirements in the target system and application.

Micron has performed various safety analyses (incl. CFMEA, DFMEA and DFA) to determine and analyze high-level and detailed failure modes, their root causes and effects, and to define counter measures for any critical failure modes with a high risk-level. In addition, Micron has also performed a quantitative analysis of random hardware faults (FMEDA) to analyze the effect of permanent and transient faults on the application. The Y31M LPDDR5 SDRAM FMEDA results show that metric targets (SPFM, LFM, PMHF budget) up to ASIL D can be achieved.

Micron has done extensive design analyses, verification and testing for the Y31M LPDDR5 SDRAM (incl. pre-silicon simulation, design analyses and reviews, post-silicon validation and analyses on engineering samples, electrical characterization, automotive qualification, system integration testing, etc.), which constitutes the overall Y31M verification plan and represents industry state-of-the-art for SDRAM verification. The analysis and verification results provide strong evidence that the Y31M LPDDR5 SDRAM fulfill its (assumed) requirements and that the risk from systematic failure is low.

exida has performed a functional safety assessment for the Y31M LPDDR5 SDRAM hardware evaluation against the objectives and requirements of ISO 26262-8, clause 13 and other relevant clauses from ISO 26262, as well as the current state-of-the-art in the semiconductor and DRAM industry. The processes applied by Micron are found to be appropriate for the Y31M hardware evaluation and in compliance with the relevant ISO 26262 requirements. The results and evidence produced by Micron confirm that the Y31M LPDDR5 SDRAM can be integrated and used in safety related systems and applications with allocated safety requirements up to ASIL D, if:

- the system integrator and user evaluates and confirms the suitability of the Y31M LPDDR5 SDRAM and the validity of the evaluation results by verifying the requirements, conditions and stresses assumed by Micron against the actual requirements, conditions and stresses in the intended system and application; and
- the system integrator and user fulfills all other requirements, constraints and assumptions specified by Micron in the Y31M Hardware Evaluation Report [D1], Safety Application Note [D2] and Safety Analysis Report [D18], considering the targeted application and ASIL.

Table of Contents

Management Summary	1
1 Purpose and Scope	3
2 Project Management	4
2.1 <i>exida</i>	4
2.2 Project Phases	4
2.3 Roles of the Parties Involved	4
2.4 Reference Documents.....	4
2.5 Assessment Approach.....	6
3 Product Description	7
3.1 Overview of the Hardware Element	7
3.2 Automotive Use Case Description	9
3.3 Hardware Revisions	10
3.4 Product Modifications	10
4 Evaluation of a Hardware Element.....	11
4.1 Scope and Applicability	11
4.2 Evaluation by the Developer or Integrator of a Hardware Element	11
5 Functional Safety Assessment Results	13
5.1 Objectives and Goals	13
5.2 Assessment.....	13
5.3 Conclusion	15
6 Terms and Definitions.....	16
7 Status of the Document	18
7.1 Liability.....	18
7.2 Version History	18
7.3 Release Signatures	18
Annex A: Confirmation Reviews	19
A.1 Legend.....	19
A.2 Confirmation Review Results for the Evaluation of a Hardware Element	19

7 Status of the Document

7.1 Liability

exida prepares reports based on methods advocated in international standards. Failure rates are obtained from a collection of industrial databases. *exida* accepts no liability whatsoever for the use of these numbers or for the correctness of the standards on which the general calculation methods are based.

7.2 Version History

Versions:	V0, R1	15-Feb-2021	Initial version
	V0, R2	16-Feb-2021	Update based on exida review comments Management summary added
	V1, R0	26-Feb-2021	Update based on Micron review comments First released version

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Review: V0, R1 P. Mueller (exida)
V0, R2 Review by Micron

Status: V1, R0 Released

7.3 Release Signatures

A handwritten signature in blue ink, appearing to read "A. Griessing".

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