



# TECHNICAL REPORT



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## Semiconductor devices – Scan based ageing level estimation for semiconductor devices

INTERNATIONAL  
ELECTROTECHNICAL  
COMMISSION

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## INTERNATIONAL ELECTROTECHNICAL COMMISSION

### SEMICONDUCTOR DEVICES –

### Scan based ageing level estimation for semiconductor devices

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Enquiry draft	Report on voting
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Full information on the voting for the approval of this technical report can be found in the report on voting indicated in the above table.

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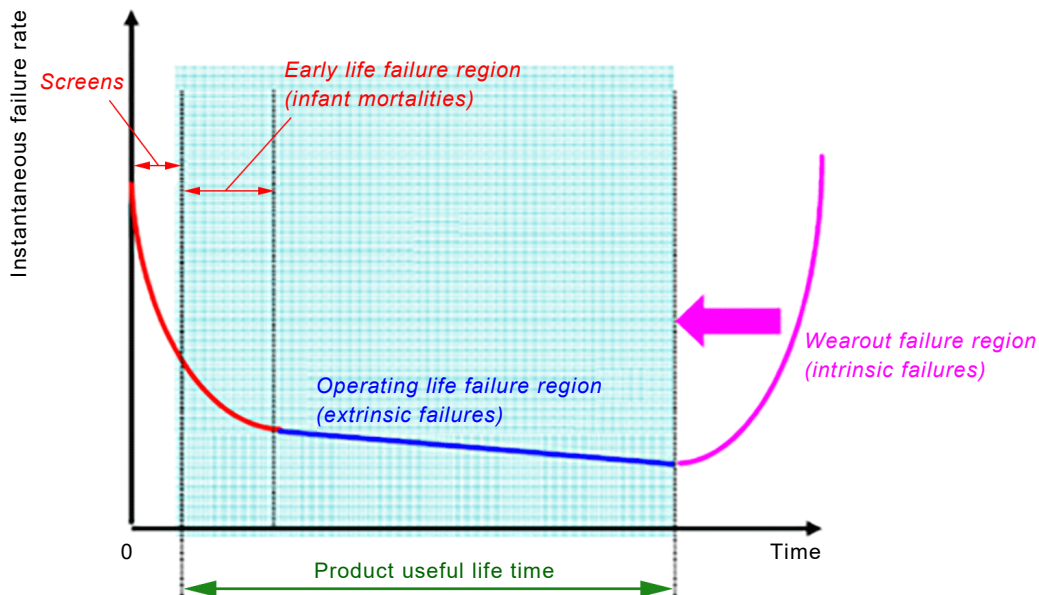
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## INTRODUCTION

A semiconductor device has an important role in reliability-critical applications, e.g., space, air and road vehicles, medical equipment. Although new technology has improved performance, power efficiency, cost efficiency etc., but the reliability becomes a serious threat [1]<sup>1</sup>. As can be seen in Figure 1, failure rate is decreases in early life, and low constant failure rate is preserved for a while, then wear out failure rate is increases significantly. Especially for reliability-critical applications, it is important to precisely monitor the ageing level to forewarn of any impending catastrophic failure. The semiconductor ageing is caused by negative/positive bias temperature instability, hot carrier injection, and time dependent dielectric breakdown, electro migration, and stress migration, etc. Path delay is known to be increased due to various ageing failures. Although a few ageing monitoring techniques have been developed [2 to 5], the ageing level has not been precisely diagnosed. For reliability-critical applications, the ageing level information can be utilized for taking adequate measures timely, e.g., device replacement, performance switching using dynamic voltage-frequency scaling. This document describes an efficient technique to monitor the ageing and characterize the ageing level.



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**Figure 1 – Reliability bathtub curve**

<sup>1</sup> Numbers in square brackets refer to the Bibliography.

## **SEMICONDUCTOR DEVICES –**

### **Scan based ageing level estimation for semiconductor devices**

#### **1 Scope**

This Technical Report specifies a design technique of performance estimation storage element, which can monitor semiconductor ageing and characterize ageing level. The estimated ageing level can be used to improve the reliability of system.

#### **2 Normative references**

There are no normative references in this document.