Mean Time Between Failures (MTBF)

White Paper

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1. Overview

Providing products of higher reliability than competitors is always one of the key factors for success. To obtain high product reliability, thorough thinking of reliability issues should be integrated from the very beginning of the design phase. This leads to the concept of *reliability prediction*. In the past, this term was referred to the process of applying mathematical models and component data for the purpose of estimating the field reliability of a system before failure data are available for the system. However, the objective of reliability prediction is not limited to predicting whether reliability goals, such as MTBF, can be reached. It can also be used for:

- Evaluating the feasibility of a design
- Clarifying potential design weaknesses
- Comparing different designs and life-cycle costs
- Giving models for system reliability/availability analysis
- Establishing goals for reliability tests
- Helping business decisions such as budget allocation and scheduling

Once the prototype of a product is available, lab tests can be utilized to obtain more accurate reliability predictions. Accurate reliability prediction of electronic products requires knowledge of design, components, manufacturing process and the expected operating conditions. Several different approaches have been developed to achieve the reliability prediction of electronic systems and components.

In the following chapter, the Bellcore predictive method adopted by Apacer will be elaborately introduced.

2. Method Descriptions

Apacer's MTBF prediction adopts and complies with Bellcore analysis Method I, which assumes that device failure rate can be generated by the sum of failure rates in each component. The equation for the steady-state failure rate and the factors involved that may influence the result of MTBF prediction will be given in the below section.

Bellcore Predictive Method

Bellcore was a telecommunications research and development company that provided joint R&D and standards setting for AT&T and its co-owners. Because of dissatisfaction with military handbook methods for their commercial products, Bellcore designed its own reliability prediction standard, which assumes a serial model for electronic parts and it addresses failure rates at the infant mortality stage and at the steady-state stage with Methods I, II and III. Apacer adopts Method I which is similar to the MIL-HDBK-217F parts count and part stress methods. The standard provides the generic failure rates and part stress factors as below:

$$\lambda_{ss} = \pi_E \sum_{i=1}^{m} (Ni\lambda_{SSi})$$

m: number of component types
λ_{SS}: device failure rate at steady state
Ni: quantity of i type component
λ_{SSi}: failure rate for i type component at steady state
π_E: device environment factor

Procedure of MTBF Calculation

The procedure of Apacer's MTBF calculation comprises the following steps:

I. Collect characteristic information of the product.

II. Prepare bill of material (BOM) and component specifications.

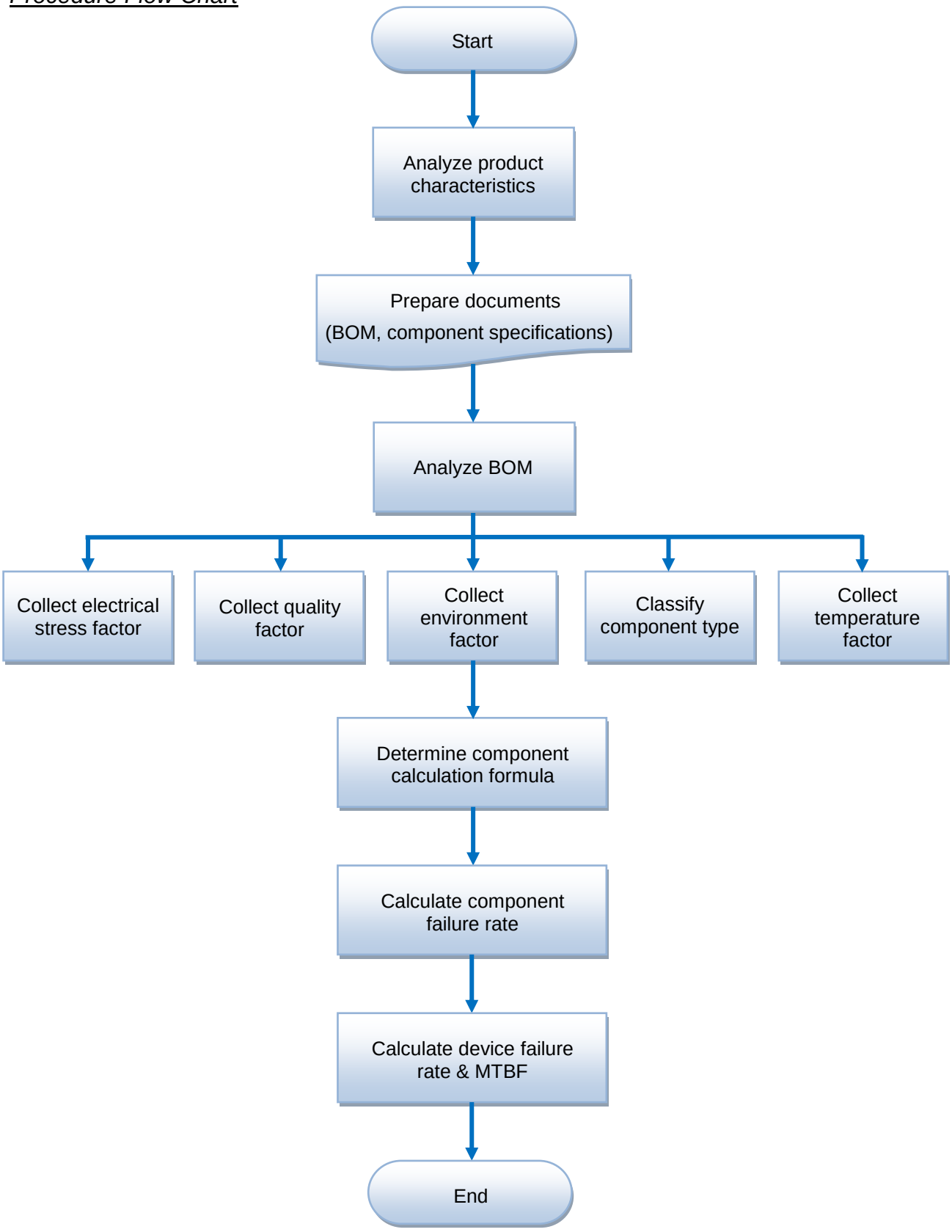
III. Analyze BOM and produce component parameters.

IV. Determine calculation equation for every component.

V. Calculate failure rates of each component.

VI. Generate product failure rate and MTBF.

Procedure Flow Chart



3. Conclusion

This white paper discusses the approach adopted by Apacer to the reliability prediction of electronic products. Having been used for many years, the Bellcore predictive method can be considered an ideal solution to be applied in the design stage as it not only exhibits convenience to use, but also provides an approximate prediction results of product reliability, which can be used to evaluate the lifecycle of new products in the early stage.

Revision History

Revision	Date	Description	Remark
1.0	2/20/2009	Official release	
1.1	6/29/2016	Consolidated the white paper	

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