



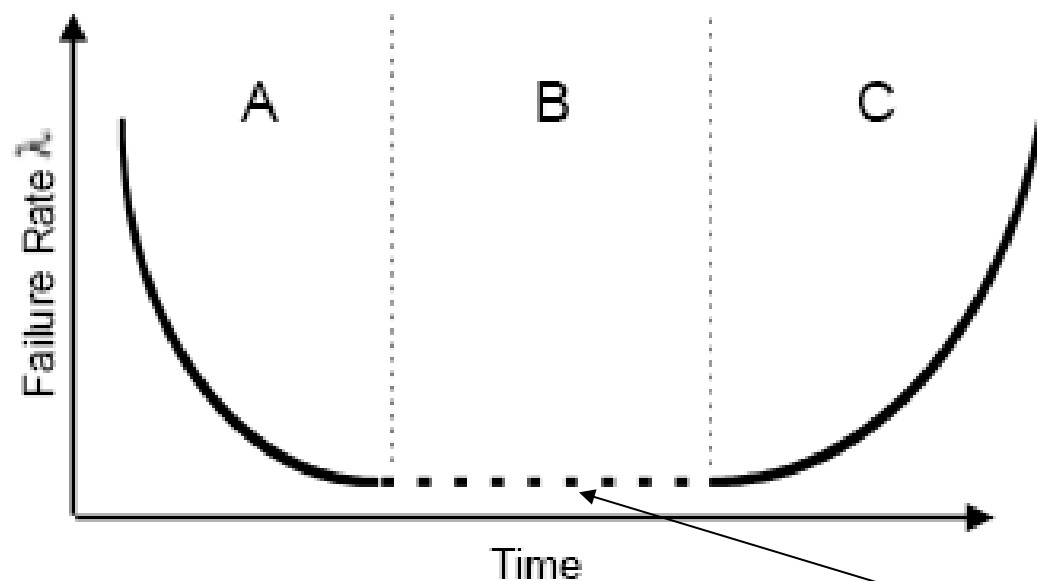
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MTBF Methods

Background



This curve has three regions:

- A Infant mortality.
- B Useful life.
- C Wear out

Figure 1. Failure Rate vs. Time

This the key region of interest.

MTBF Valid Only During the Product's "Useful" Life

Reliability Methods

Three main types:

1. **Calculated MTBF**
2. **Assessment or Demonstrated MTBF**
3. **Field observed MTBF**

Calculated MTBF Method

- Prediction method based on statistical failure rates of electronic components, requires a database
- Two popular Methods – MIL-HDBK-217F and BELLCORE/Telcordia (used by Telecom industry)
- Only really useful at the design stage when comparing one design iteration to another
- Often requested by customers

Things to note:

- MIL-217F is more pessimistic (i.e. 2-3x) than Bellcore/Telecordia
So an MTBF value calculated using MIL-217F will be worse e.g. up to 2-3x worse!
- Environmental conditions greatly matter
- Often times vendors will publish calculated MTBF values under “Ground Benign” environmental conditions at 25° C. This is essentially an air conditioned office compared to “Naval Sheltered” at 55° C there is 2.5-4x difference in results

Assessment or demonstrated MTBF Method

- Based on putting a sample number of units on “life test” or reliability demonstration test under greater than normal stress and then extrapolating for entire population based on failure rate during the test

E.g. Take 100 units and run them at elevated temperatures and electrical stress for a period of month. Assuming all units survived you would have a point MTBF value of:

$$100 \times 730 \text{ hours/month} = 73,000 \text{ hours.}$$

- Requires a “statistically significant” sample size to be useful (e.g. at least 40 units)
- Hard to distinguish between early failures and infant mortality

Field observed MTBF Method

- Based on large population size
- Based on actual observed failures in the field
- Final proof, no statistical methods required
- We currently have over 250,000 units in the field over a 11.5 year period.
- 1,000,000 hours MTBF = 114 year MTBF
- See Observed MTBF performance chart on following slide

Thank you for your attention!



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