WHITEPAPER

Understanding the Importance of Power System Reliability Modelings

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1 Power System Reliability is a complex topic that hides its importance quite well

A proverb says, “A chain is only as strong as its weakest link”. Almost every business relies on IT infrastructure for smooth operation; for some businesses, the infrastructure is even the core of their business operations, like data centers for AI. Often, they rely so much on it that a single unscheduled downtime event has the potential to significantly impact the profitability and, in extreme cases, the viability of a company. It is, therefore, **essential to ensure that a critical part of an IT infrastructure, the Power Supply Units (PSUs), are as reliable as possible**. Understanding the importance of these mission-critical components and their reliability is thus vital throughout a company up to the management level.

Yet, the capital costs of equipment acquisition are the dominant driver in the purchasing process, and a nuanced and interconnected discipline such as reliability is often neglected. This is especially true since **reliability causes overhead in cost and effort in the short term and only shows its value in the long run through difficult to obtain metrics such as the Total Cost of Ownership (TCO).**

Given the unique challenges that power supplies in high-reliability environments face, **Infineon decided to investigate Power System Reliability Modeling (PSRM)** and develop innovative solutions to overcome those challenges. This whitepaper will serve as an introduction to this topic and pave the way into this new and innovative field.

2 Scope of this paper

Reliability means that, for example, a power supply fulfills its desired system function over the specified time with the defined mission profile. The mission profile is the operating conditions, such as electrical load, temperature, humidity, etc., under which the whole system is expected to operate.

Therefore, reliability is, more than other disciplines within the design cycle, a very interconnected topic, as many aspects influence the reliability of a system. Even within a company, multiple disciplines might be needed to design a reliable system, like the component-, system-, layout-, manufacturing-, thermal-, testing- and reliability engineers. This can become even more complicated as suppliers and customers undoubtedly have their own reliability standards to be incorporated.

Collaborating between those different disciplines with a clear understanding of reliability and failures to create a thoughtful design and selecting high quality components allows the successful operation of the power supply. But successful collaboration between the companies of the value chain particularly the component vendors, the power supply manufacturers, and the power supply operators, is as essential as the company’s internal communication. However, in some instances, this communication can be difficult as component vendors look at the reliability of their components while power supply manufacturers look at the reliability of a whole system comprising of many different components while eventually power supply operators are interested in the operation and management of multiple power supplies in parallel.

This paper gives a brief overview of how those companies approach seemingly the same aspects of reliability and describes the tools and methods they use to create a common understanding of reliability and enable more efficient designs and communication.

However, even the most reliable designs fail at some point. Therefore, the new innovative field of Power System Reliability Modeling is discussed. This field looks into **enabling reliability modeling and feedback for a power supply in the field, allowing advanced data analytics schemes, and potentially improving a system’s overall TCO**. Moreover, an analysis of a data center’s TCO is provided to emphasize the importance of proper maintenance, error prevention, and reliability management overall.

It is important to note that the description of the Infineon Reliability and Qualification process is out of this paper’s scope. If you are interested, please visit this website www.infineon.com/cms/en/about-infineon/company/quality/. Out of scope is also a detailed description of how to design reliable power supplies.

3 Understanding the reliability and failures of components and systems

3.1 General introduction

Everything wears out or fails eventually. The longer this takes, the more reliable it is perceived to be. The classic way to explain this is using the bathtub curve, which shows how the failure rate of a population of devices varies over time.

The **failure rate λ (also Failures In Time (FIT)** is described as one failure in 10^9 hours. Here, it is important to note that this is a statistical parameter, meaning that based on the failure rate, it is not feasible to say when a failure is happening but rather the likelihood of a failure happening in a defined time interval.

The inverse of the FIT rate is the **Mean Time Between Failure (MTBF)** or Mean Time To Failure (MTTF). The MTBF describes the average time that passes between (repeating) failures of a repairable system, while the MTTF describes the average time to a failure event of a non-repairable system. For the remainder of the document, we focus on the term MTBF, but the principles hold true for MTTF as well.

Those values are related to the population of equal devices that a simplified MTBF calculation looks like:

$$\text{MTBF} = \frac{\textbf{Observed Failures}}{\textbf{Accumulated operating time of the population}}$$

Those parameters can be equally applied to individual components or a complete system such as a PSU, though the methodologies and calculations differ.

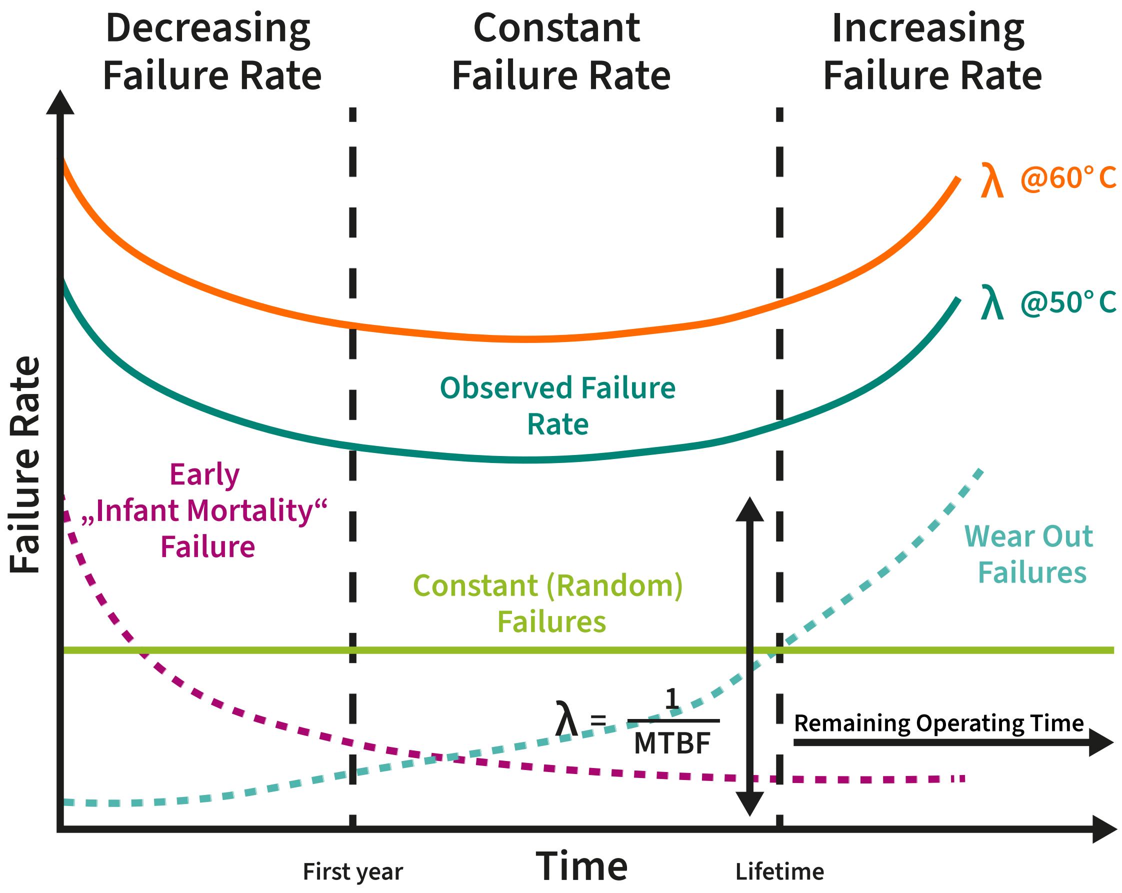


Figure 1 Bathtub curve of failure rate versus time

The graph shows the three most important stages of a product's failure rate for a product batch.

The initial life cycle phase, also called the **Infant Mortality Phase**, has a high failure rate that rapidly decreases. This is caused by faulty devices coming out of production that fail immediately under test or quite soon during operation.

The second phase is the **Normal Life or Random Failure Phase**, with a relatively constant failure rate. Here, most of the pre-damaged devices have already failed, but wear-out effects are not yet a dominating factor.

The third phase is the **Wear-out Phase**, where the product fails due to age and wear mechanisms, and the failure rate rapidly increases. Between the normal life and the wear-out phase is the lifetime. In general, it is intended to design a system that does not experience wear-out effects during its manufacturer-defined lifetime.

3.2 Modeling failure rates – Weibull distribution

The bathtub curve can be modelled by the Weibull distribution, as it allows to model a variable likelihood of failure throughout the life cycle of the electrical system.

The Weibull distribution is a versatile mathematical function for reliability modeling that can be used to calculate the failure rates of every phase based on field or test failure data. This has a huge benefit, as important parameters such as the lifetime or maintenance schemes can be determined based on the calculated failure rates. However, calculating the failure rate based on Weibull analysis is quite cumbersome since extended tests to failure are expensive, and high-quality field data is not easy to obtain.

The failure probabilities are usually modeled by a Weibull distribution with **two parameters η** (scale factor that represents the time when 63.2% of the total population is failed) and **β** (shape factor that controls the type of failure, i.e. infant mortality phase, wear-out phase, or random failure phase).

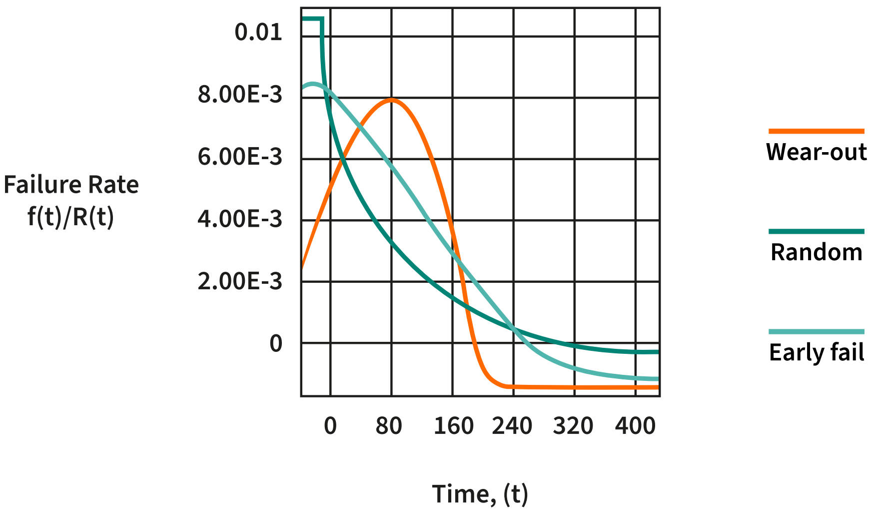


Figure 2 The Weibull distribution

Eventually, the survival function (that gives the probability that a device does not fail before a specific point in time) is for the two-parameter function:

$$R(t) = 1 - F(t) = \begin{cases} \mathrm{e}^{-\left(\frac{t}{\eta}\right)^{\beta}} & \text{for } t \geq 0, \\ 1 & \text{else.} \end{cases}$$

4 Setting failures into context

As mentioned, the general phases of the life cycle and parameters like service life, MTBF, or FIT can be applied on a component and system level. However, for some of those phases, the methods and tools component vendors and power OEMs use are very different. Understanding those differences is very important to reliably design systems as component reliability and design decisions influence the overarching reliability in the same way. A more detailed description of the methods is provided in the following section.

4.1 Avoid Infant Mortality Failures with proper screening

At the start of the lifecycle, there are ‘Infant Mortality Failures’ where brand-new devices or components fail.
This happens for several reasons, the main being a fault during manufacturing, or a defective subcomponent being used. Manufacturing faults can include lousy solder joints, incorrect or missing bump placement on the chip, and dust or other contaminants in a critical location during manufacturing.

In this phase, component vendors and power OEMs refer to the same countermeasure: Appropriate screening methods (e.g., burn-in or other stress tests) are applied to identify the latent defects. During burn-in testing, the device is powered up and taken through a test cycle designed according to the customer’s reliability requirements. For example, being powered up for a certain amount of time at an elevated temperature accelerates failure mechanisms so that faulty devices fail and can be eliminated leaving ‘healthy’ components that have not been overstressed or degraded. The failure rate is relatively high compared to the stage of weeding out the good from the bad. The bathtub shows that it then drops off quickly because the obviously faulty parts have been removed. However, some will not have been picked up, so there continue to be some early mortality failures, but the frequency of these continues to drop off over time – usually well within the first year. Not all failures are detected during the burn-in testing because there is always a trade-off between the cost of a failure and the higher costs of longer test periods.

4.2 Modeling the random failures

For the middle section, the „Random Failure Phase“, it is important to remember that this phase covers most of the device’s working life, i.e., after the brief early mortality phase and before the wear-out phase.

The random failures happen seemingly without any indication or warning, making them very hard to predict. But how do random failures happen? Random could mean that an overstress of a component happens that was not foreseen (e.g., Electrostatic Discharge or ESD), bad design choices that have not been discovered during development overstress the component constantly and causes a randomly appearing error (remember this testing is expensive), or it could be some completely random effect happening (e.g., almost damaged structures within the component which barely passed the burn-in testing).

Their randomness means that they cannot be predicted. Still, by using the established parameter – Failures in Time (FIT), the expected number of failures within a defined time period can be understood.

This FIT rate is usually calculated differently for components and power supplies due to the complexity of the systems and the associated cost of running widespread tests.

4.3 Determining component failure rate through accelerated lifetime tests

The FIT parameter for components such as semiconductors is calculated based on the number of observed failures during qualification tests and adjusted with an upper confidence level to account for the uncertainty and variability of the sample data. The upper confidence level provides a confidence interval describing the chance that the calculated failure rate is underestimating the real one. One more direct example: An 80% upper confidence level describes that only with a 20% probability, the predicted calculated failure rate underestimates the observable real failure rate.
This is important because overestimating the reliability of your components can cause too many unforeseen errors.

Modern semiconductors are very reliable, and only a few or no failures happen during testing. This is why lifetime acceleration tests are used, which speed up the aging time by applying higher temperatures or other stresses.

As an example, during a High-Temperature Operation Life (HTOL) test in which the device is operated at a temperature of T_{HTOL}=150°C compared to its mission profile of T_{MP}=65°C and an activation energy of E_a=0.7 eV the Arrhenius equation can be used to calculate the acceleration factor AF (with the Boltzmann constant k_B).

$$AF = e^{\frac{E_a}{k_B}\left(\frac{1}{T_{MP}} - \frac{1}{T_{HTOL}}\right)}$$

This way, a 1000-hour HTOL test would artificially age the component by 124,940 hours. The tests that are done especially for silicon semiconductor devices can be found in the JEDEC Publication JEP122H, “Failure Mechanisms and Models for Silicon Semiconductor Devices.”

The constant failure rate is described by the exponential probability distribution. Hence, the chi-squared distribution (X^2) can be used to calculate the FIT rate dependent on the confidence interval.

$$\lambda_{\text{1-sided}} = \frac{\chi^2\,(a,\, 2r + 2)}{2nt}\, 10^9$$

The calculation considers the observed failures (r) in the normalized (acceleration factor considered) period of testing time (nt). As failures are always statistical and the FIT rate λ can only be defined with a certain confidence level (α), the chi-square distribution (X^2) is used to model it.

5 Random failures for power supplies

For systems consisting of many components, it is more complex to actually determine the failure rate as there are many interdependencies between the components, but mechanical components also play a big role. Therefore, there are three different approaches available:

- Accelerated lifetime tests
- Field failure analysis
- Reliability handbooks

5.1 Accelerated lifetime tests

The FIT calculation method behind accelerated lifetime tests is similar to the component methodology. Via Accelerated Life Tests (ALT) and statistical means (such as chi-square), the FIT rate is calculated based on the failures during the test, the normalized deployment time, and the confidence level. However, this requires a significant monetary commitment and effort by the power supply manufacturer as many power supplies must be manufactured and tested extensively (especially for reliable power supplies).

5.2 Field failure analysis

The seemingly straightforward approach, which would also have the best result, is to analyze the field failures of the power supplies to refine the FIT rate while they are deployed. However, this only works easily in theory, as, for an objective assessment, the operating time and real operation conditions of the failed power supply must be available to normalize the deployment time under the load and temperature-dependent acceleration factors. Additionally, in most cases, the power OEMs are not operating the power supplies themselves and will have minimal and limited access to the operational profiles of their power supplies in the field.

5.3 Reliability handbooks

Power supply manufacturers use the standard approach to calculate the FIT values through reliability handbooks. Those reliability handbooks provide reference FIT rates and acceleration factors (e.g., temperature, environmental, and electrical stress) for different components of an electrical system. Those models are based on a statistical analysis of a huge amount of lifetime and failure data (so basically the second approach) collected by the creators of the handbooks. Some often-used handbooks are the

- MIL-HDBK-217 created by the US. Navy for consumer/military applications
- Telcordia SR-332 created/maintained by Ericson for telecommunication and the
- SN-29500 created by Siemens for industrial applications.

The huge benefit of those handbooks is their simplicity as they define a ‘parts count method’, which is particularly valuable in the reliability assessment during the early stages of development. Essentially, each component of the BOM is associated with a basic failure rate and via mission profile assumptions, the acceleration factor for those components can be determined and the resulting FIT rate $\lambda_{\text{Component}}$ for the component can be calculated.

The handbooks usually assume that one component failure causes a full system failure, which means that one sums up the resulting FIT rates to obtain the overall system FIT rate $\lambda_{\text{System}} \sim \Sigma\lambda_{\text{Component}}$.

Those reliability handbooks get their fair share of criticism as the databases used for the FIT rates are quite old, and newer components are not represented. The resulting FIT rate of the standards can be easily manipulated by applying them for different mission profiles, or combining different handbooks can create an artificial improvement of the FIT rates. Therefore, comparing the FIT/MTBF values in the datasheet can be misleading, and viewing the FIT/MTBF as absolute values is not necessarily recommended. However, when the standard is consistently applied, it is a very nice tool to compare the reliability of designs with each other, not on the absolute value but on a relative comparison (e.g., design A 2.0 is 1.6x times more reliable than design A 1.0).

5.4 Wear-out failures limit the lifetime

While the FIT parameter determines the baseline of failures in a specific amount of time, the ‘wear-out failures’ define the absolute lifetime. Wear-out failure comes from the aging of either electrical or mechanical components. After certain stress has accumulated within the device/system, certain substructures have experienced so much wear that the component fails. This is called a failure mechanism. Each component, solder joints, or copper traces have one or many thermal, mechanical, chemical, or electrical load-dependent failure mechanisms.

Now, the question is, which components’ failure mechanism limits the lifetime of a power supply? It is often stated that the weak point of any power supply is electrolyte capacitors, as they dry out quite consistently (failure mechanism). However, statistically, they account only for 30% of the failures.

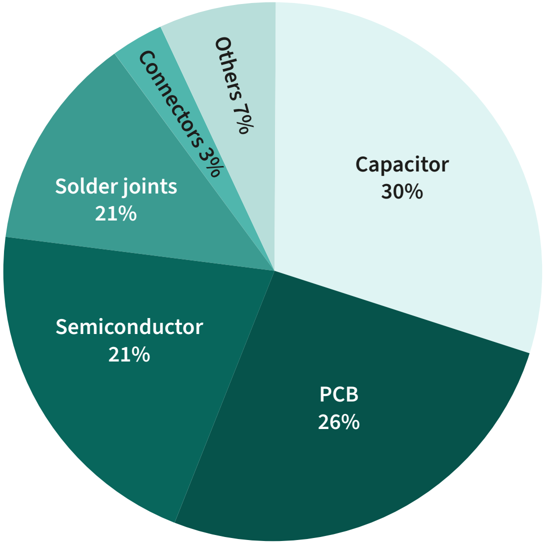


Figure 3 Components’ failure mechanism limits the power supply lifetime

Which component limits the lifetime depending on the operating conditions? For a low ambient temperature, the electrolyte dry-out can set in much later, as this is the big accelerating factor for this particular failure mechanism. But, if the system has large temperature changes at a MOSFET due to big load jumps, a bond-wire lift-off could happen. The gold material of the bond wire has a different thermal coefficient than the aluminum. Thus, during temperature cycling, the three materials expand differently, creating a mechanical sheering force between the bond wire and the pad, which results in cracks. After millions of thermal cycles, the bond wire detaches from the pad, causing the component to fail as an open connection.

An often-repeated view is that the weakest component in the system gives the boundaries for the lifetime of the system. However, as outlined before, those failure mechanisms are highly dependent on the operating conditions, and it is fairly difficult to determine which failure mechanism will be dominant. Thus, the power system designer is doing a lot of simulations and thermal calculations to mitigate the start of the wear-out phase and find the weakest link.

However, having information about the failure mechanisms of the different components can be very challenging. Therefore, component manufacturers with great knowledge about their high-quality products' underlying failure mechanisms are the key enablers in developing truly reliable systems. Additionally, third-party tools incorporate lifetime models, which can be used to analyze the physics of failure of different parts of the design, like solder joints, copper tracks, or even mechanical systems, in dependence on different stresses.

This in-depth knowledge about reliability and a good knowledge of operation conditions allows power supply designers to optimize their designs for reliability requirements. By using high-quality components, the base rate of failures can be reduced, and, by extensive analysis of the underlying failure mechanism in the power supply, a quite precise End-of-Life (EOL) can be defined. With this knowledge, a device can be precisely engineered for a defined lifetime.

6 Importance of the mission profile

As reliability is often one of the fundamental goals during the development of systems, the power system designer wants to keep the failure rate during the lifetime as low as possible and wants the wear-out of the components to start after the required lifetime. As those two parameters are highly dependent on the mission profile, the power designers need to understand the system's operation condition well. The difficult part is knowing what mission profiles to use to qualify the base failure rate and the wear-out's failure rate.

Ideally, those profiles can be derived from field data. However, to get the real operation conditions is difficult as:

- Power OEMs are not the end user of their product and get no access to the operating environments
- Additional sensors are needed to actually measure the operating conditions with the appropriate resolution
- System infrastructure to measure, communicate and store this data is not available.

To compensate for the missing field data, mission profile assumptions for an application are done. This allows us to define the test cases and qualify for an expected mission profile but also for a worst-case mission profile. However, worst case analysis can lead to a drastically overengineering of the design, increased cost and a competitive disadvantage due to too pessimistic reliability parameters.

The following graph visualizes the accumulated failure probability (shown on the Y-axis) over time (x-axis) for a system and relates it to the customer reliability requirements (Box).

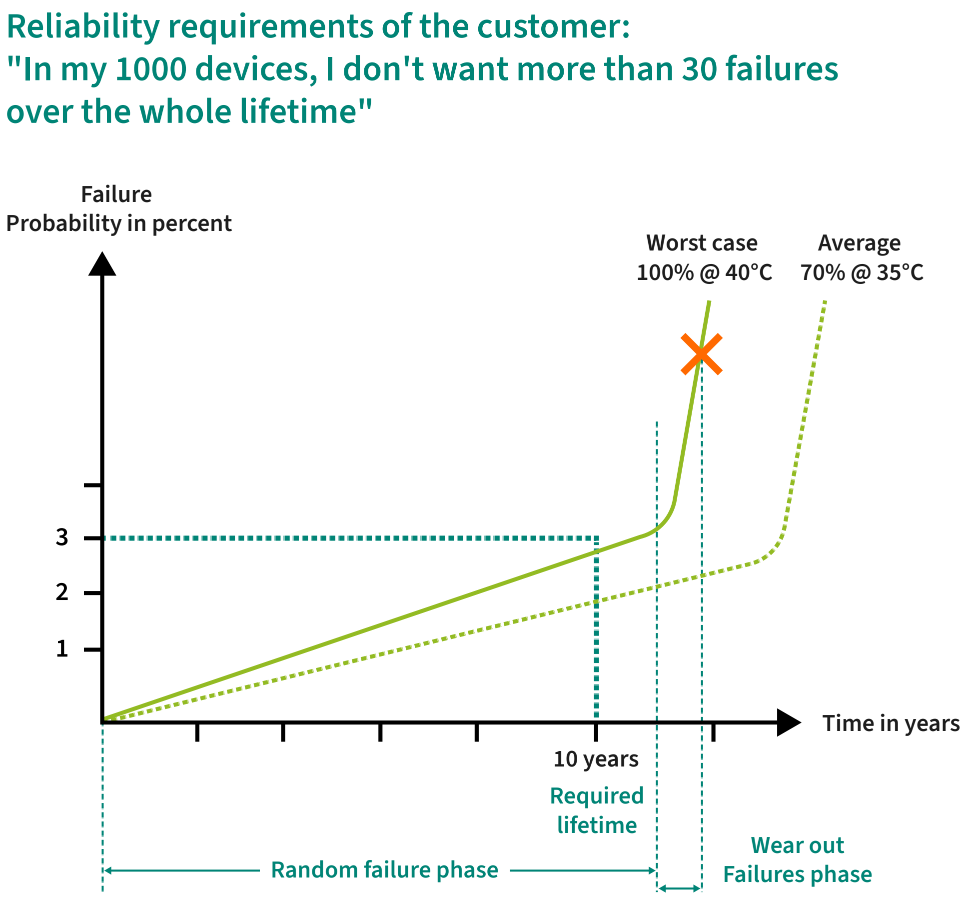


Figure 4 Reliability estimation based on mission profile assumptions

Those reliability requirements specify a maximum failure probability for a required lifetime. This example requires a maximum failure probability of 3%, meaning that in 1000 devices, 30 failures would be allowed. In a few applications, e.g., server and data centers' availability rates around 99.9999% are common, in which 3% would not meet the reliability requirements.

To qualify the system reliability, the power supply OEM does a worst-case analysis (solid line) to meet the customer reliability requirements. However, when analyzing the actual average operation conditions of the power supply, shown as the dotted line, it becomes clear that the power supply far exceeds the customer's reliability requirements. Therefore, the customer overspends his cost on the reliability of the power supply.

One can also turn it around. If the power supply is operated under worse operating conditions than expected, the failure probability and lifetime are reduced. As a rule of thumb, a ten-degree increase in temperature will half a device's lifetime.

7 The cost of downtime is greater than expected

Having investigated the importance of reliability and precisely understanding how to model failures, it's time to look into the impact of the discussed topics. An old saying is, "If you think you are too small to make a difference, try sleeping with a mosquito". Similarly, a failure of a PSU can have a substantial negative financial impact on the operation of a company because it can close down its entire IT infrastructure. So, when considering the system's TCO with smarter PSUs where the health state of each PSU is known, it is essential to factor into the calculations that the latter greatly reduces the likelihood of expensive, unexpected downtimes due to PSU failures.

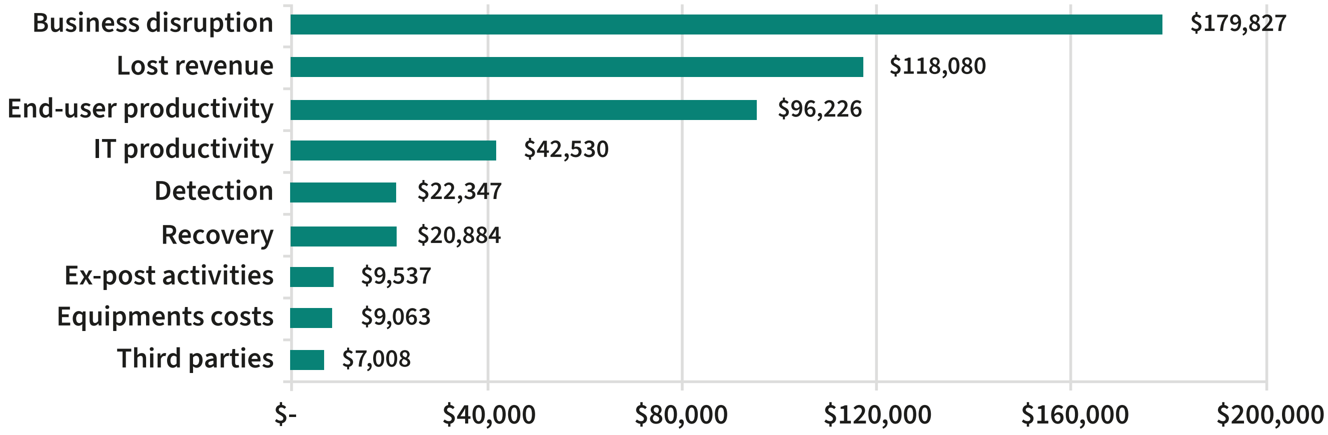
The figure below shows the average unplanned data center outage or downtime costs. The total financial impact is around fifty times greater than the basic cost of the equipment. Despite this, PSUs are invariably selected for being the least expensive. This is because there are costs that are not immediately thought of, with the focus on the evident, immediate business disruption and the costs of replacing equipment. In contrast, the total overall costs are enormous.

The graph on the left shows the other costs that should be included when calculating the total costs of an outage for a business – for example, the costs of detecting the cause of the outage, i.e., which unit failed. With intelligent loggers, it is much easier to debug and understand the failure mechanism of the outage, reduce the total downtime, and optimize the cost in cases of failures. Moreover, the costs of losing productivity or prior work must also be factored in. Customers and users dependent on the proper operation of the data center are impacted by downtime, leading to lower productivity and, eventually, costs on this side. Considering the loss of prior work, we can think about a data center running calculations for several weeks or sometimes even months, like training an AI model. Even with regular backups and redundant systems that cause a fair amount of cost and pre-investment into those systems, an unplanned downtime still bears the risk of losing prior work respectively training time in our example. This cost must be factored into the considerations as well, not only from the point in time onwards when the downtime occurs costs are generated, but there can also be costs generated because work is getting lost, eventually causing re-work or even restart of the whole process. Hence, having efficient and reliable power supplies, especially in the context of powering AI infrastructure, also plays a crucial role.

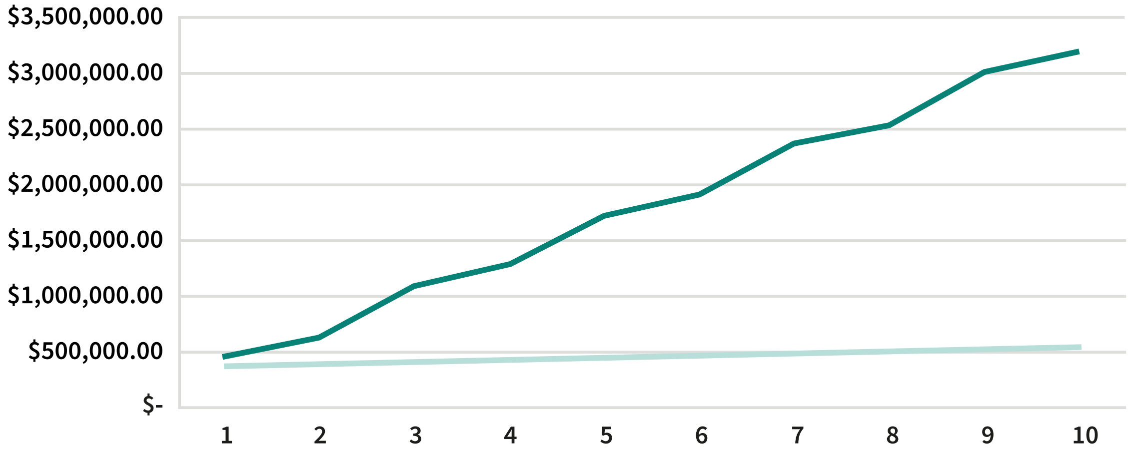
Reducing the possibility of failures is paramount to reducing the TCO and improving operations' smooth running. This is illustrated in the right-hand graph that shows as an orange line the potential rising costs of downtime as an accumulating sum over a ten-year period that exceeds three million dollars. The black line shows the accumulating cost of a service optimization program for the power infrastructure over the same ten-year period which is about a sixth. The adage that prevention is better than cure is particularly appropriate.

There is also the incredibly important aspect that needs to be factored in: The company's brand image is compromised as unreliable if outages are so frequent that customers will move their business to rivals who are seen to be more reliable. Thus, investing in a solution with smart PSUs that results in a much more reliable system makes long-term economic sense as it creates and reinforces end-customer loyalty.

Unprecedented reliance on IT systems has forged a stronger connection between data center availability and TCO. A single downtime event now has the potential to significantly impact an enterprise's profitability (and, in extreme cases, the viability).



Service optimization for power infrastructure can reduce total downtime costs, leading to significant improvement of the TCO.



Year	1	2	3	4	5
Total Downtime Cost (Potential)	$451,000	$631,400	$1,082,400	$1,262,800	$1,713,800
Total Optimization Investment	$368,000	$388,000	$408,000	$428,000	$448,000

Year	6	7	8	9	10
Total Downtime Cost (Potential)	$1,894,200	$2,345,200	$2,525,600	$2,976,600	$3,157,000
Total Optimization Investment	$468,000	$488,000	$508,000	$528,000	$548,000

Figure 5 The first one: The average costs of unplanned data center outages for nine categories. The second one: Potential downtime costs (orange) compared to CAPEX and ongoing service investments for power and cooling infrastructure optimization (dark gray). [1]

In summary, unexpected PSU failures are extremely costly when all associated costs are considered. To avoid these, early warning systems are needed that monitor the real-time health of each PSU so that failures can be avoided as much as possible.

8 Designing for reliability is a complex task along the value chain

Designing a device such as a PSU with a specific focus on reliability is a complex task as many stakeholders and experts are involved along the design cycle and value chain. This paragraph will explain the complexity when considering reliability as a primary design goal.

One crucial step is when the **System Architect** creates the system architecture for the PSU at the power supply manufacturer to meet the required specifications of their customers, e.g., of power efficiency, input and output voltages of their customers, e.g., the data center or telecom infrastructure operators. Using the reliability handbooks, the System Architect, in collaboration with the Design Engineer, can already feed the data of all the selected components into, e.g., a reliability modeling software to create an estimation for the lifetime of the PSU and the failure rate over the lifetime of the product. For example, 30 failures out of 1000 devices for the required lifetime of 10 years with a mission profile of 40 °C at 50% load.

At this stage, the **Design Engineer** can change the used components, e.g., switch to high-quality components with high reliability, and the model will change its predictions accordingly. Use higher quality components, and the predicted life increases, and conversely, the life decreases if lesser quality components are used. This is where there is a trade-off between cost per unit and the unit's reliability, both of which will have been specified by the customer.

However, even with components of the highest quality, there is still the risk of design errors like overseeing voltage overshoots or selecting components that are too weak to do the job. Moreover, as discussed earlier, the mission profile, i.e., how the system is operated, plays a crucial role as well on top of the quality of the selected components.

The **power supply manufacturer** would probably like to differentiate their product offering with innovation. As the whole chain starts to understand the cost benefits of reliability, this is the stage where reliability can now become a key issue. By requiring a higher level of reliability or advanced reliability prediction features, the power supply manufacturer can use this as a differentiating feature for its **customers like the data center or telecom infrastructure operators**. However, down the value chain, the customers of the power supply manufacturers must recognize the value of this innovation as, ultimately, they will be the ones who have to make use of this innovation.

The ability to monitor the health of each PSU is a major differentiator, especially if the value chain is ready for this innovation and it is requested by customers down the value chain. Demonstrably, more reliable devices and health monitoring differentiate the power supply supplier in the eyes of the customer as it means having the potential for fewer failures with all the reputational and cost implications that result. This pulls throughout the chain at every product specification point, i.e., there is a clear, value-added benefit to selecting enhanced reliability and monitoring as that will appeal to the next customer in the chain.

In the telecom infrastructure case, for example, the end customer wants to have completely reliable mobile phone service 24/7; otherwise, the customer will switch to another provider and be lost. The more unreliable the service, the more customers are lost, so the mobile network operators want to have the most reliable equipment possible while managing the cost-reliability tradeoff.

However, having features like health monitoring, data logging, or system reliability modeling being built into a power supply requires the whole value chain to work together as a feature being built into a building block like a power supply can only unfold its true potential if the infrastructure at the operator of the power supply is ready to make use of those features. Hence, the topic of **Power System Reliability Modeling** must be seen holistically and all players along the value chain, from the semiconductor component manufacturer like Infineon to the power supply manufacturer up to the data center and telecommunication infrastructure operators must collaborate to unfold its true potential.

9 Conclusion

Now that it is understood which types of failures occur within a device lifecycle and how dependent on the mission profile they are, an analysis of when a failure for an individual power supply device is happening would be the next logical step. Detecting an upcoming failure is a difficult task and is mainly thought about in academia, whereas industry adoption is pending.

Especially on a device level, component variations and statistical effects play a huge role for device’s reliability, meaning that the same two devices with the same mission profile can fail at vastly different times. This is why statistical parameters such as failure probability and confidence intervals can often be used to describe an upcoming failure. Therefore, a solution that models the system reliability measures the actual operation conditions which affect the system and calculates statistical probabilities of failures is already of great value.

Based on the outlined challenges and the importance of providing a solution to manage those power supply units, Infineon focuses on “Power System Reliability Modeling” and is working on innovative solutions within this domain. As a first innovation, Infineon enables statistical power system reliability modeling on system level based on the system’s dynamic operating parameters and individual component reliability.

Here is an interesting paper, if you want to read more.

Recommended next step: Visit our exploration tool and understand how mission profile and FIT rates influence a simple system’s reliability www.psrm.infineon.com.

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[1] Source: https://www.vertiv.com/globalassets/images/about-images/news-and-insights/articles/white-papers/understanding-the-cost-of-data-center/datacenter-downtime-wp-en-na-sl-24661_51225_1.pdf

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