AN13274

i.MX 8QuadMax/8QuadPlus Product Lifetime Usage

Rev. 0 — May 25, 2021 Application Note

Contents

1 Introduction

This document describes the estimated product lifetimes for the i.MX 8QuadMax/QuadPlus application processors based on the criteria used in the qualification process.

The product lifetimes described here are estimates and do not represent a guaranteed life time for a product.

The i.MX 8QuadMax/QuadPlus series consist of several processors that deliver a wide range of processing and multimedia capabilities across various qualification levels. This document intends to provide you with guidance on how to interpret the different i.MX 8QuadMax/QuadPlus qualification levels in terms of the target operating frequency of the device, the maximum supported junction temperature (Tj) of the processor, and how it relates to the lifetime of the device.

2 Device qualification level and available PoH

Each qualification level supported (automotive and industrial) defines a number of Power-on Hours (PoH) available to the processor under a given set of conditions such as:

- Target voltage for the application (automotive and industrial)
  - The target frequency is determined by the input voltage to the processor's core complex (VDD_A72 and VDD_A53) .
- Percentage of active use vs. the Low power mode.
  - Active use means that the processor is running in an active performance mode.
    - For the automotive tier of 8QuadMax/QuadPlus, the maximum performance mode as Cortex-A72 is 1.6 GHz; Cortex-A53 is 1.2 GHz.
    - For the industrial tier of 8QuadMax/QuadPlus, the maximum performance mode as Cortex-A72 is 1.3 GHz and as Cortex-A53 is 1.0 GHz.
  - In the Low power(KS1) mode, the datasheet defines lower operating conditions for all core power supplies such as VDD_A72 and VDD_A53, reducing power consumption and junction temperature. For detailed information on KS1, refer to Datasheet for QualMax /QualPlus. In this mode, the voltage and temperature are set low enough so that the effect on the lifetime calculations is negligible and treated as if the device was powered off.
- Junction temperature of the processor (Tj)
  - The maximum junction temperature of the device is different for a given qualification level. For example, 125°C for the automotive tier and 105°C for the industrial tier. It is important to note that while the automotive device is guaranteed to operate at 125°C; operating the device at 125°C for an extended period of time will have negative consequences on the lifetime of the device.
  - Ensure that your device is appropriately thermally managed, such that the maximum junction temperature is not exceeded.

NOTE

All data provided within this document are estimates for PoH that are based on extensive qualification experience and testing with the i.MX 8QuadMax/QuadPlus series. These statistically derived estimates should not be viewed as a limit on an individual device lifetime, nor should they be construed as a guarantee by NXP as to the actual lifetime of the device. Sales and warranty terms and conditions still apply.

2.1 Automotive lifetime estimates

Table 1 provides the number of PoH for the typical use conditions for the automotive device.

Table 1. Automotive qualification lifetime estimates

Operating mode	Cortex®-A72 speed grade (MHz)	Cortex-A53 speed grade (MHz)	Power-on Hours [PoH] (Hrs)	Arm® Core Operating Voltage(V)	Junction Temperature [Tj] (°C)
Overdrive	1600	1200	13,132	1.1	105
Overdrive	1600	1200	4,462	1.1	125

Figure 1 establishes guidelines for estimating PoH as a function of junction temperature. PoH can be read directly from the curves below to determine the necessary trade-offs to the junction temperature at the maximum CPU frequency.

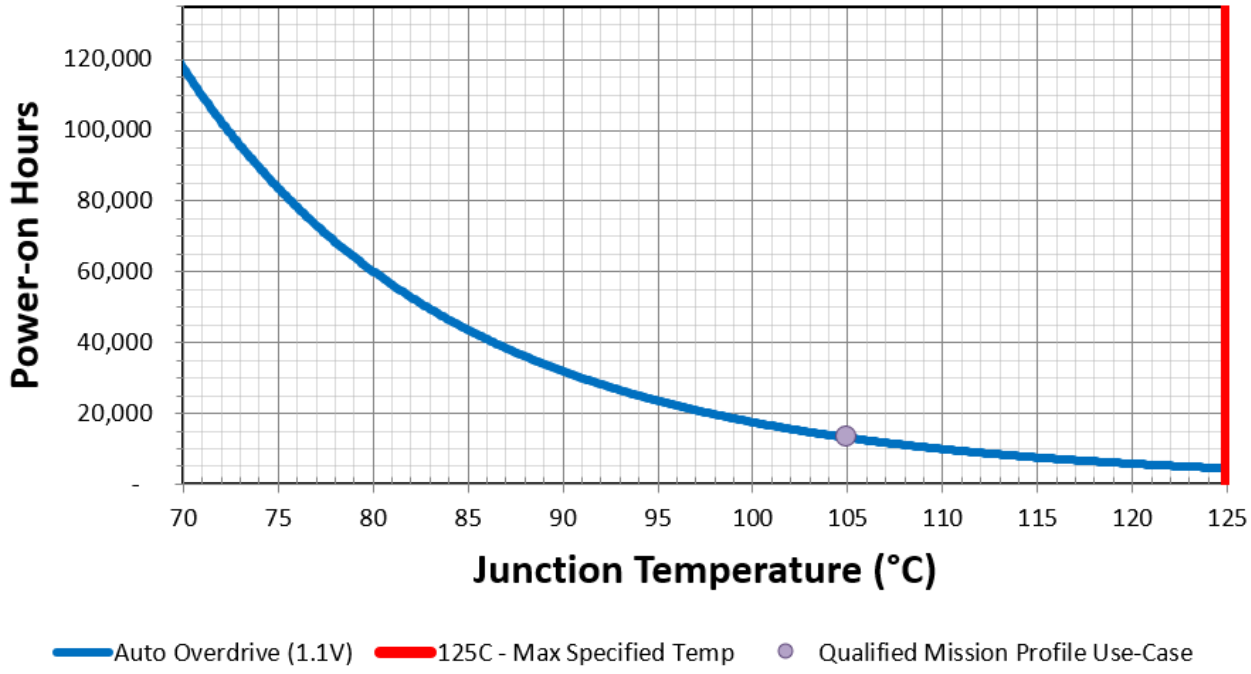

Figure 1. i.MX 8QuadMax /QuadPlus automotive lifetime estimates overdrive mode

2.2 Industrial qualification

Table 2 provides the number of PoH for the typical use conditions for the industrial device.

Table 2. Industrial qualification lifetime estimate

Operating mode	Cortex-A72 speed grade (MHz)	Cortex-A53 Speed Grade (MHz)	Power-on hours [PoH] (Hrs)	Arm Core Operating Voltage(V)	Junction temperature [Tj] (°C)
Overdrive	1300	1000	87,669	1.0	105

Figure 2 establishes guidelines for estimating PoH as a function of junction temperature. PoH can be read directly from the curves below to determine the necessary trade-offs to the junction temperature at the maximum CPU frequency.

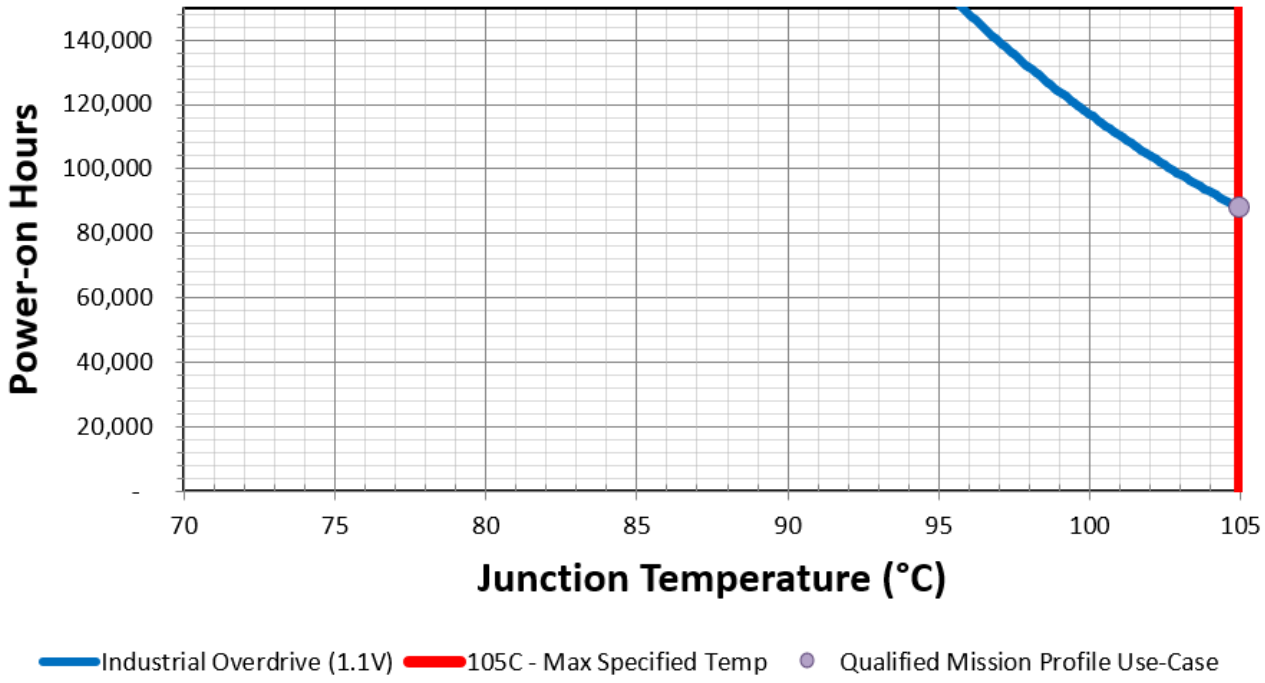

Figure 2. i.MX 8QuadMax /QuadPlus industrial lifetime estimates overdrive mode

3 Conclusion

Selecting the optimal operating performance point and thermal envelope is paramount to meet the application lifetime targets. Trade-offs between the target operating voltage/frequency of the device and the operating junction temperature (Tj) of the processor can greatly improve the lifetime of the device.

Lowering the operating junction temperature in the application is the most effective means to increase the lifetime of the device without affecting the performance of the device. This can be accomplished by increasing the thermal dissipation capacity in the application. In cases where the thermal properties cannot be altered, a lower operating voltage can be used to increase the lifetime of the device. Lowering the voltage may result in lowered performance and the operating frequency may have to be adjusted lower to match the voltage specified in the datasheet.

The data and examples provided in this application note help you to determine the estimated lifetime for your particular application.

4 Revision history

Rev.	Date	Substantive changes
0	25 May, 2021	Initial release

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Date of release: May 25, 2021

Document identifier: AN13274

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