NXP Semiconductors
Application Note

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i.MX 6ULZ Product Usage Lifetime Estimates

1. Introduction

This document describes the estimated product lifetimes for the i.MX 6ULZ applications processors, based on the criteria used in the qualification process.

The product lifetimes described in this document are estimates and do not represent the guaranteed lifetime of a particular product. The i.MX 6 series consists of an extensive number of processors that deliver a wide range of processing and multimedia capabilities across various qualification levels.

This document provides guidance on interpreting the i.MX 6ULZ qualification levels in terms of the target operating frequency of the device, the maximum supported junction temperature of the processor (Tj), and how this relates to the lifetime of a device.

Contents

The qualification level supported (commercial) defines the number of Power-on Hours (PoH) available to the processor under a given set of conditions, such as:

- The target frequency of the application (consumer).
  - The target frequency is determined by the input voltage of the processor's core complex (VDD_SOC_IN).
  - The use of the LDO-enabled or LDO-bypassed modes.
    - When using the LDO-bypassed mode, do not set the target voltage to the minimum specified in the datasheet. All power-management ICs have allowable tolerances. Set the target voltage higher than the minimum specified voltage to account for the tolerance of the PMIC.
    - The LDO-enabled mode uses the regulators on the i.MX 6ULZ. These regulators are well-characterized and you may set them to output an exact minimum specified voltage. To achieve a higher PoH, use the LDO-enabled mode.
    - 900 MHz can only be achieved in the LDO-enabled mode.
- The percentage of the active use compared to the standby.
  - The active use means that the processor is running in the active performance mode.
    - The performance modes are 528 MHz and 900 MHz.
    - In the stand-by/DSM mode, the datasheet defines the lower operating conditions for the VDD_SOC_IN, reducing the power consumption and the junction temperature. 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.
- The junction temperature of the processor (Tj).
  - The maximum junction temperature of the device is 95 °C This maximum temperature is guaranteed by the final test.
  - Ensure that your device is appropriately thermally managed and the maximum junction temperature is not exceeded.

NOTE

All data provided within this document are estimates of the PoH, based on extensive qualification experience and testing with the i.MX 6 series. Do not view these statistically-derived estimates as a limit to the individual device's lifetime, nor construe them a warranty for the actual lifetime of a device. The sales and warranty terms and conditions still apply.

2. Device qualification level and available PoH definitions

2.1. Commercial qualification

This table provides the number of PoH for the typical use conditions of the extended commercial devices:

Table 1. Commercial qualification lifetime estimates

—	ARM® core frequency (MHz)	PoH (hours)	ARM core operating voltage (V)	Junction temperatue [Tj] (°C)
Case C1: LDO enabled	528	21,900	1.15	95
Case C2: LDO bypassed	528	16,300	1.18	95
Case C3: LDO enabled	900	21,900	1.25	95

The following figures provide guidelines for estimating the PoH as a function of the CPU frequency and the junction temperature. Read the PoH directly from the charts below to determine the trade-offs to be made to the CPU frequency and the junction temperature to increase the estimated PoH of the device.

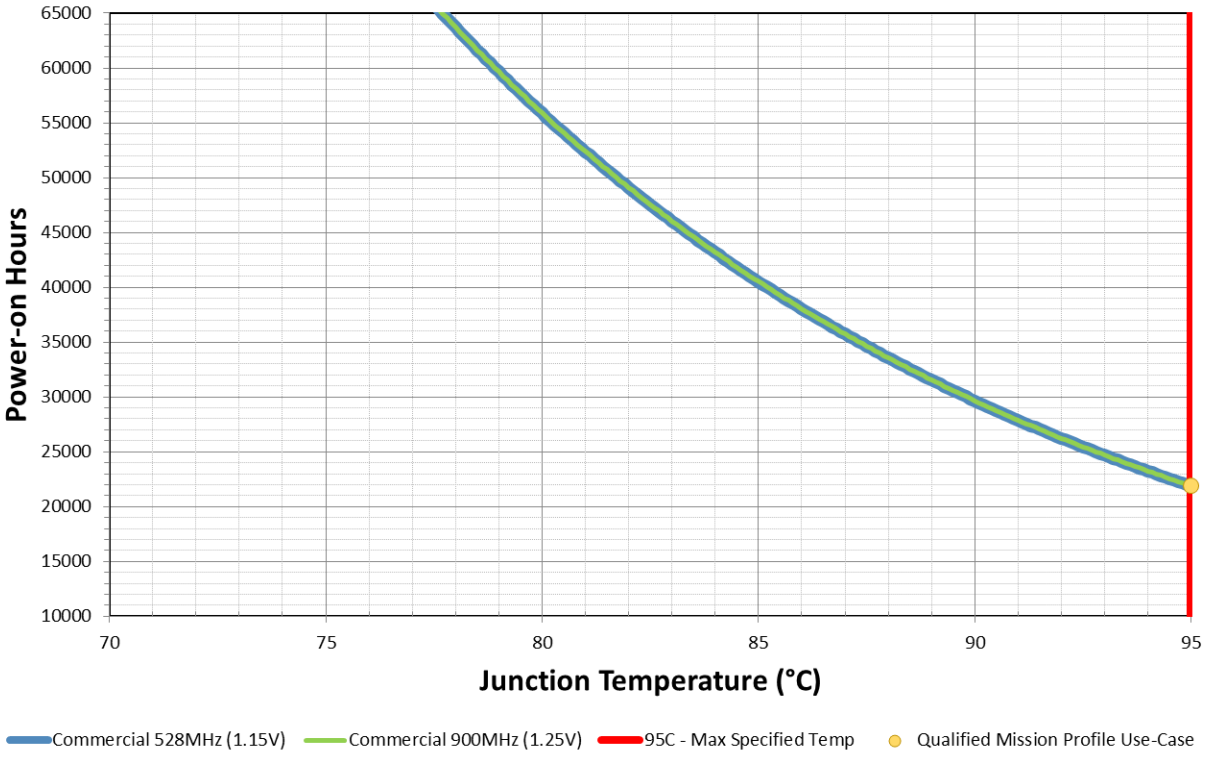

Figure 1. i.MX 6ULZ commercial lifetime estimates in LDO-enabled mode

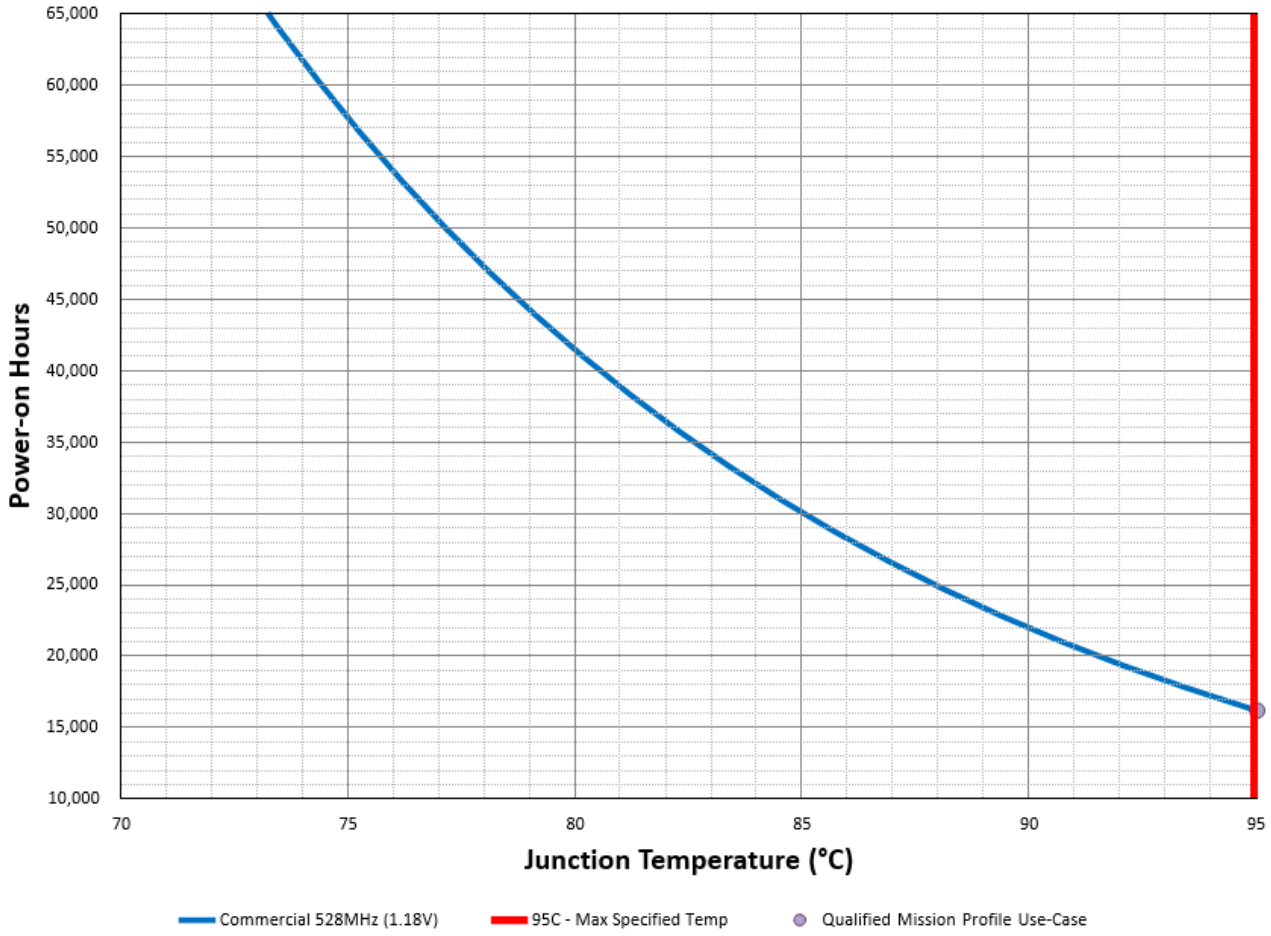

Figure 2. i.MX 6ULZ commercial lifetime estimates in LDO-bypassed mode

3. Combining use cases

In some applications, a constant operating use case cannot provide the target PoH. In this case, multiple operating conditions are used. This method provides some of the benefits of running at a lower performance, while keeping the system's ability to use the highest performance state required by the application.

3.1. Switching between two power states with different temperatures

This scenario assumes that the system can achieve a drop in the temperature by throttling back the performance, while still maintaining a constant voltage. Achieve this temperature change by changing the frequency, or by simply scaling back the load on the ARM cores and processing units. This use case is particularly useful if you want to take advantage of the full commercial temperature range of the i.MX 6ULZ. In this scenario, the system spends 30 % of its PoH at 95 °C, 30 % of its PoH at 90 °C, and 40 % of its PoH at 85 °C (as shown in the following figure). Combine the three PoH values as:

$$21{,}900 \times 0.3 + 29{,}655 \times 0.3 + 40{,}529 \times 0.4 = 31{,}678 \text{ PoH} \quad \textit{Eq. 1}$$

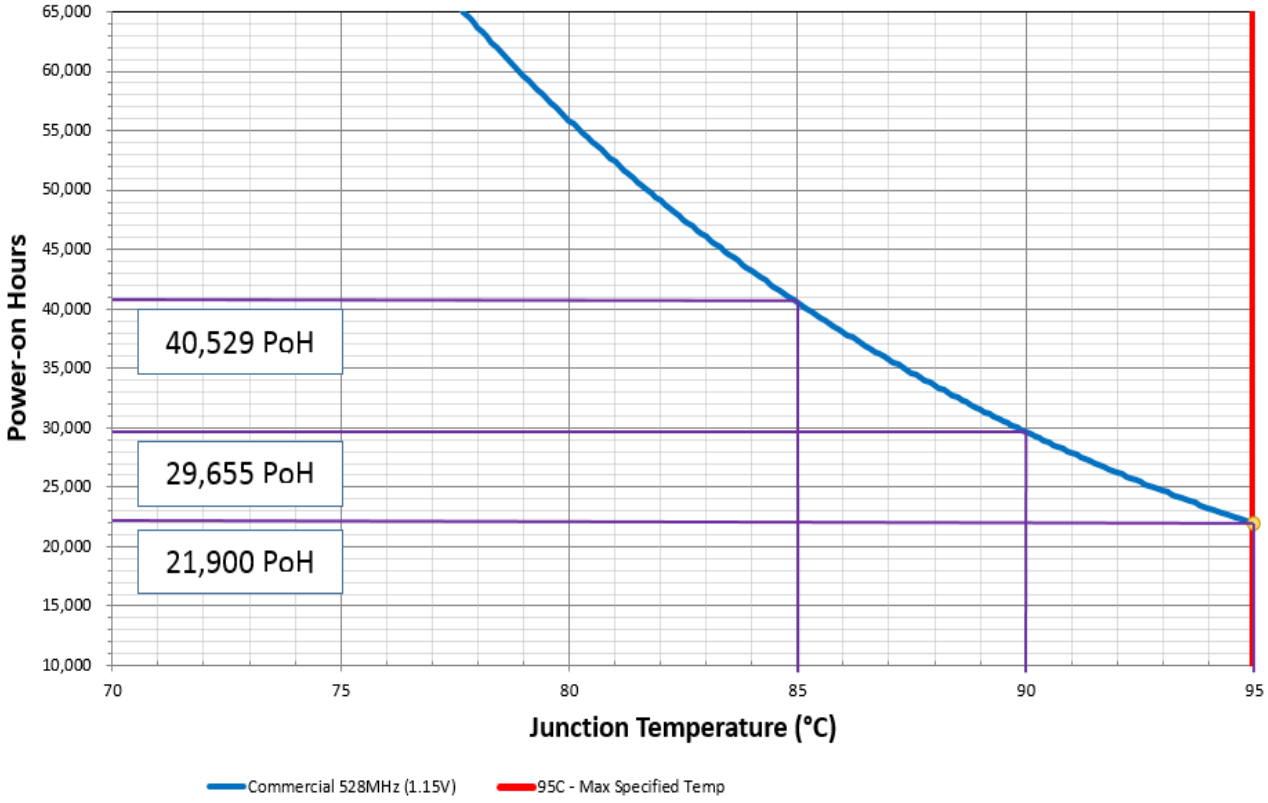

Figure 3. Multiple temperature use case

4. Revision history

This table summarizes the changes made to this document since the initial release:

Table 2. Revision history

Revision number	Date	Substantive changes
0	10/2018	Initial release.

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