AN13984

i.MX RT1180 Product Lifetime Usage Estimates

Rev. 2.0 — 31 October 2025 Application note

Document information

Information	Content
Keywords	AN13984, RT1180, Lifetime
Abstract	This document describes the estimated product lifetimes for the i.MX RT1180 applications processor based on the criteria used in the qualification process.

1 Introduction

This document describes the estimated product lifetimes for the i.MX RT1180 applications processor based on the criteria used in the qualification process.

Note: *The product lifetimes described here are estimates and do not represent a guaranteed lifetime for a particular product.*

The i.MX RT series consists of an extensive number of processors that deliver a wide range of processing and multimedia capabilities across various qualification levels.

This document guides users how to interpret the different i.MX RT1180 qualification levels in terms of the target operating frequency of the device, the maximum supported junction temperature (Tj) of the processor, and how this Tj relates to the lifetime of the device.

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

- The target frequency for the application.
  - The target frequency is determined by the input voltage to the core complex (`VDD_SOC_IN`) of the processor.
  - The use of DCDC-enabled or DCDC-bypass mode.
    - When using DCDC-enabled mode or DCDC-bypass mode, the target voltage must not be set to the minimum specified in the data sheet. The on-chip DCDC module and all power management ICs have allowable tolerances. The target voltage must be set higher than the minimum specified voltage to account for the tolerance of the DCDC or PMIC. The tolerance assumed in the calculations in this document is +/-25 mV.
- The percentage of active use vs. standby.
  - Active use means that the processor is running at an active performance mode.
    There are three available performance modes:
    - Overdrive mode: CM7 at 800 MHz and CM33 at 300 MHz.
    - Normal mode: CM7 at 600 MHz and CM33 at 240 MHz.
    - Underdrive mode: CM7 at 360 MHz and CM33 at 100 MHz.
  - In the STANDBY mode, the data sheet defines lower operating conditions for `VDD_SOC_IN`, reducing power consumption and 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 were powered off.
- The junction temperature (Tj) of the processor.
  - The maximum junction temperature of the device is 105^{o}C for industrial and 125 ^{o}C for extend industrial. This maximum temperature is guaranteed by final test.
  - Users must ensure that their 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 RT series. These statistically derived estimates cannot be viewed as a limit on the lifetime of an individual device. They cannot be construed as a guarantee by NXP as to the actual lifetime of the device. Sales and warranty terms and conditions still apply.*

2 Device qualification level and available PoH

2.1 Industrial qualification

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

Table 1. Industrial qualification lifetime estimates

	Arm core speed CM7/ CM33 (MHz)	Arm core speed CM7/ CM33 (MHz)	Power-on Hours [PoH] (Hrs)	Arm core operating voltage (V)	Junction Temperature [Tj] (°C)
Case C1: Over Drive Mode	800	300	26,267	1.125	105
Case C2: Normal Mode	600	240	116,486	1.025	105
Case C3: Under Drive Mode	360	100	601,988	0.925	105

Figure 1 establish guidelines for estimating PoH as a function of CPU frequency and junction temperature. To determine the necessary trade-offs for CPU frequency and junction temperature to increase the estimated PoH of the device, you can read PoH directly off the charts.

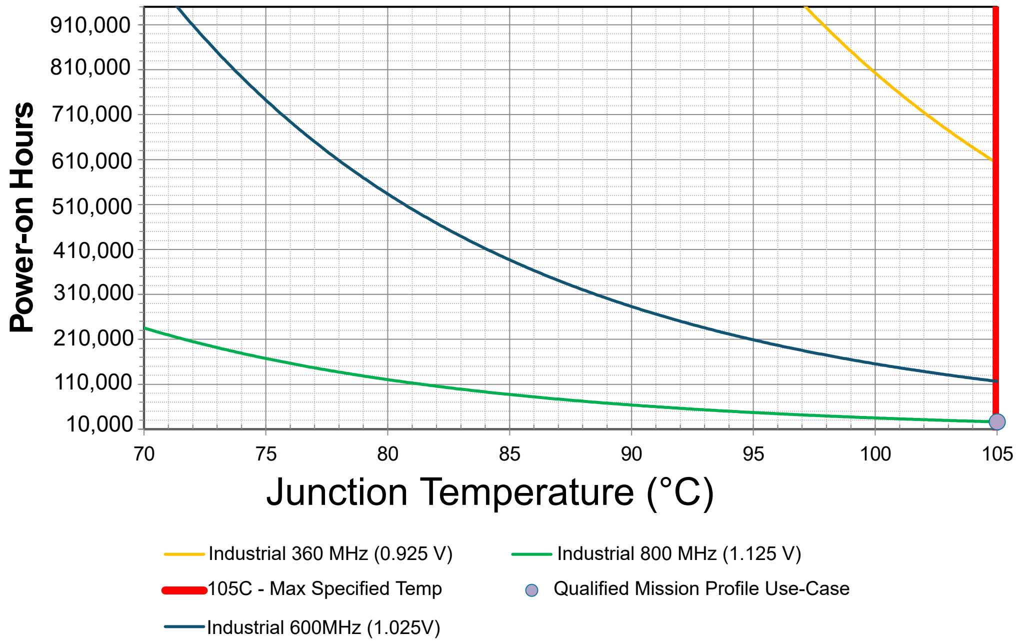

Figure 1. i.MX RT1180 industrial lifetime estimates

2.2 Extend Industrial qualification

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

Table 2. Extend industrial qualification lifetime estimates

	Arm core speed CM7/ CM33 (MHz)	Arm core speed CM7/ CM33 (MHz)	Power-on Hours [PoH] (Hrs)	Arm core operating voltage (V)	Junction Temperature [Tj] (°C)
Case C1: Over Drive Mode	800	300	21,278	1.125	125
Case C2: Normal Mode	600	240	94,360	1.025	125

Table 2. Extend industrial qualification lifetime estimates*...continued*

	Arm core speed CM7/ CM33 (MHz)	Arm core speed CM7/ CM33 (MHz)	Power-on Hours [PoH] (Hrs)	Arm core operating voltage (V)	Junction Temperature [Tj] (°C)
Case C3: Under Drive Mode	360	100	487,641	0.925	125

Figure 2 establishes guidelines for estimating PoH as a function of CPU frequency and junction temperature. PoH can be read directly off of the charts below to determine the necessary trade-offs to be made to CPU frequency and junction temperature to increase the estimated PoH of the device.

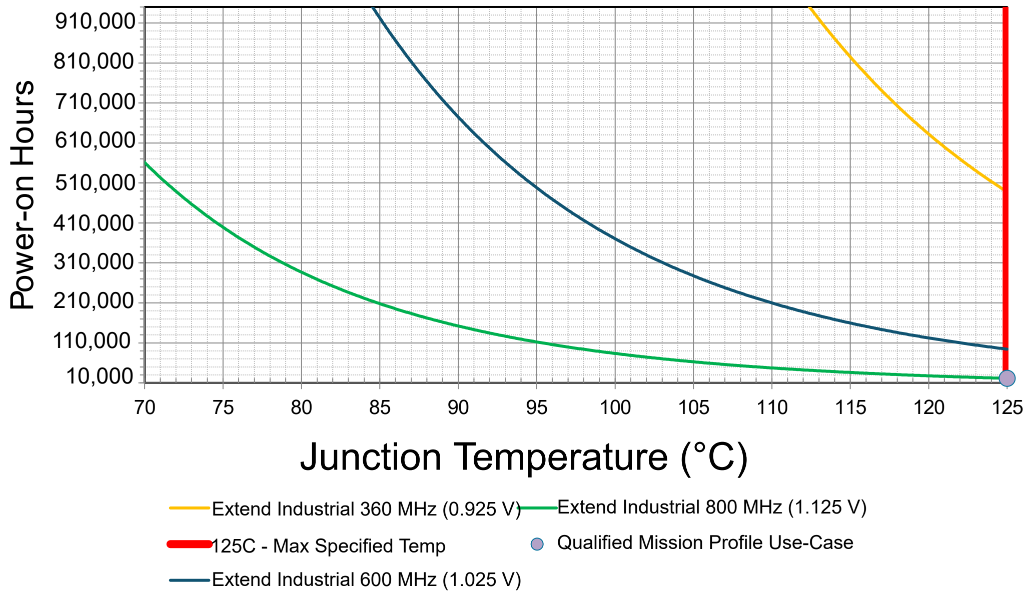

Figure 2. i.MXRT1180 extend industrial lifetime estimates

3 Combining use cases

In some applications, a constant operating use case cannot deliver the target PoH. In this case, it is advantageous to use multiple operating conditions. This method provides some of the lifetime benefits of running at a lower performance use case. Besides, this method keeps the ability of the system to use the highest performance state dictated by the demands of application.

- **Scenario 1: Switching between two power states with different voltages**
  In this scenario, the system is using an 800 MHz full power state, and a 600 MHz reduced power state. It is assumed for these calculations that the temperature stays constant (at 105 °C) in either mode. If the system spends 50 % of its power-on-time at 800 MHz and 50 % of its power-on-time at 600 MHz, the two POH (read from Figure 3) can be combined with using those percentages: 277,755 × 0.5 + 62,633 × 0.5 = 170,194 PoH.

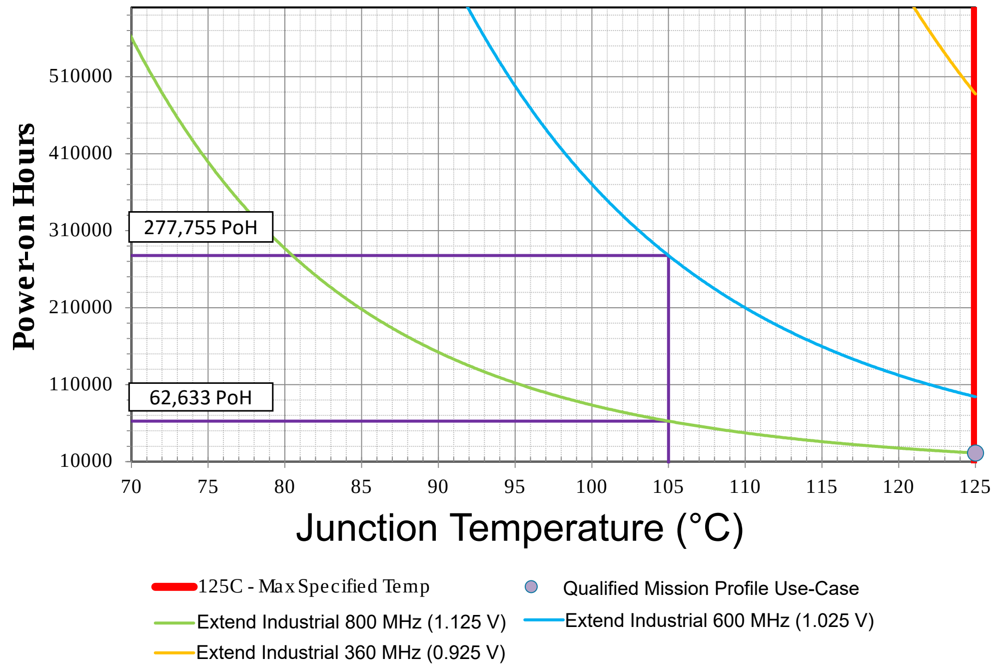

Figure 3. Multiple power state use cases

- **Scenario 2: Switching between two power states with different temperatures**
  This scenario assumes that the system can achieve a drop in temperature by throttling back in performance while still maintaining a constant voltage. To change this temperature, change the frequency or scale back the loading on the Arm cores or processing units. This use case is useful for customers who must take advantage of the full temperature range of the i.MX RT series. In this scenario, the system spends 50 % of its power-on-hours at 105 °C and 50 % of its power-on hours at 95 °C (as read off the chart in Figure 4). The two POH can be combined as such: 112,291 × 0.5 + 62,633 × 0.5 = 87,462 PoH.

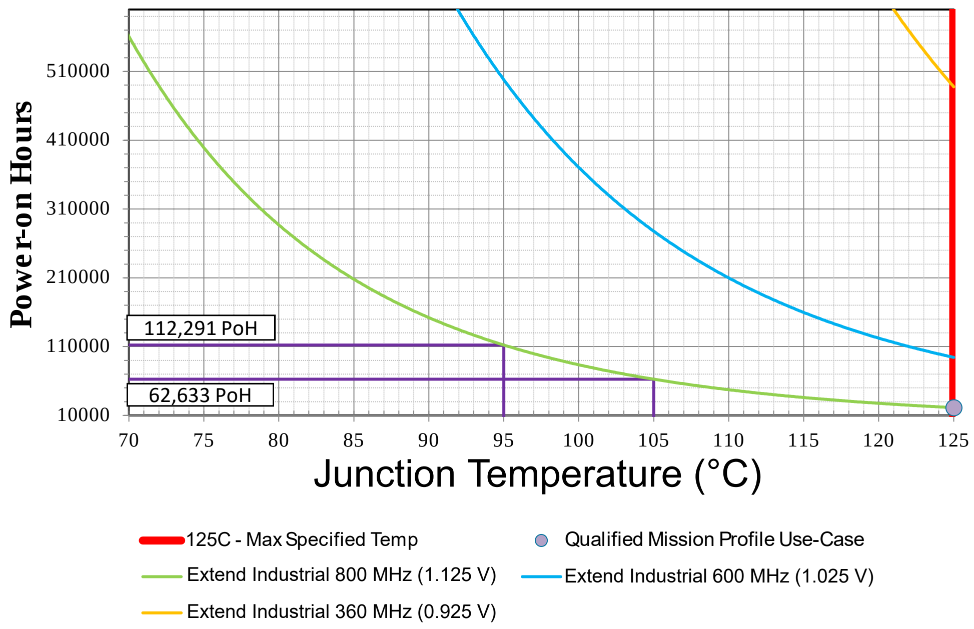

Figure 4. Multiple temperature use cases

- **Scenario 3: Using three or more power states**
  This scenario shows how this strategy can be extended to more than two power states. While this example only has three power states, there is no limit to the actual number of power states that can be combined. The power states that are being used in this scenario are 600 MHz (at 105 °C) and 800 MHz (at 105 °C and 95 °C). Each state is used equally one-third of the time. These power states can be combined as such: 277,755 × 0.34 + 112,291 × 0.33 + 62,633 × 0.33 = 152,161 PoH.

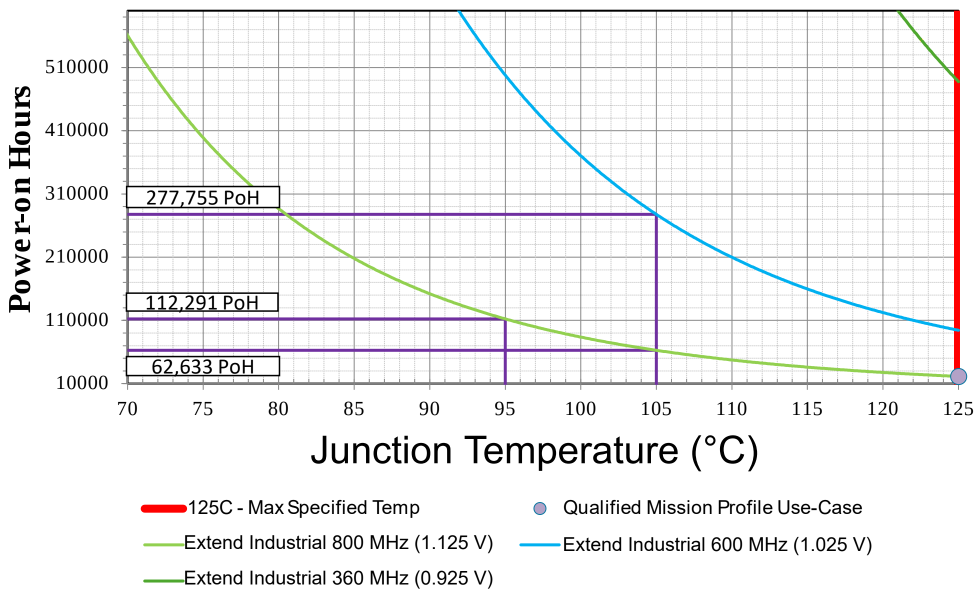

Figure 5. Various use cases

4 Revision history

Table 3 summarizes the revisions to this document.

Table 3. Revision history

Document ID	Release date	Description
AN13894 v.2.0	31 October 2025	Update for RevC0 Silicon and 125°C devices
AN13894 v.1.0	27 May 2024	Initial public release

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