Application Advisory

Title	Optimization of eFuse Programming for ESP32 / ESP32-C3 / ESP32-S2 / ESP32-S3 Series of Chips
Issue date	2022/09/22
Advisory Number	AR2022-006
Serial Number	NA
Version	v1.0

Issue Summary

If secure boot v1, secure boot v2, and/or flash encryption are used, and there are no corresponding keys burned in eFuse, the bootloader will generate the key and burn it to the corresponding eFuse BLOCK. It was identified that there is a very small probability of failure in some cases where eFuse bits might not be burned from 0 to 1.

For secure boot v1 and secure boot v2, if the eFuse key is not correct, the verification of bootloader will fail, and the system will not be started up normally. For the IDF versions older than v4.4.2, v4.3.3, v4.2.4, there is no eFuse data validation after burning in bootloader.

The issue has been investigated. Due to the use of different programming environments, the following possible causes have been identified of eFuse bits not being flashed correctly:

1. The power-up and power-down time of eFuse time settings is not configured appropriately.

2. Some eFuse bits are not easily fused by a single program action.

In order to decrease the failure rate, the following updates have been introduced in ESP-IDF:

1. Updated the eFuse time settings configuration for power-up and power-down.

2. Introduced the option to validate the eFuse data after burning and re-burning.

Fixed/Patched Versions for ESP-IDF

The above-mentioned updates have been included in the ESP-IDF v5.0-beta1, v4.4.2, v4.3.3, v4.2.4 releases and will be present in the newer versions.

The detailed commits in the ESP-IDF branches are as follows:

Release/V4.2: b85c0ec35210c2f15d69b6ec79b662df9ba75392

Release/V4.3: 9bbe2fc041c5e0bb7ecaf8d1b5e782d0ac2e4649

Release/V4.4: 6382b51bfbaf6a17a709601dbe3b8f9c6ea4f0dc

Release/V5.0: 2ce6c78af44e5fbeede7eb5e74c55e4958d81dc3

Recommendations for Espressif Users

If your application uses secure boot v1, secure boot v2 or flash encryption as well as uses the bootloader to generate the key and burn it to the corresponding eFuse BLOCK, it is recommended that you update to the latest stable IDF release version that includes the above-mentioned updates.

Although, very few reports regarding the issue in question have been received from ESP32 ECO, V3 customers, it is still recommended that you use the latest stable IDF release version with other ESP32 series of chips, e.g. ESP32-C3, ESP32-S2 and ESP32-S3.