TN1239
Technical note

How to change DCF STCU configuration

Introduction

The SPC58 family integrates a dedicated safety module to configure, control and execute self-test operations. This module is called Self-Test Control Unit (STCU2).

The user can configure the STCU2 in two ways. The first way uses the standard register access from user application. The second way exploits the Device Configuration Format (DCF) records.

This document explains the correct procedure to update a STCU configuration which has been already set by the specific DCF records in UTest memory. It focuses only on the second way to configure the STCU.

As a prerequisite the reader should be familiar with the functionality of STCU2, DCF, SSCM and UTest flash. For any details on these topics, refer to the reference manual.

Contents

1 Programming of STCU2

The normal flow to program STCU2 starts by providing the unlock keys and afterwards the rest of the configuration (left side of *Figure 1*).

Unlock keys are static keys. The user can find their values in the STCU chapter of the reference manual.

The STCU loads the configuration only if the user provides the correct unlock keys. If the unlock keys are not correct, the STCU ignores the following configuration.

The user passes these values to the STCU by writing them into the UTest sector of the Flash as DCF records as shown on the left side of *Figure 1*.

A problem occurs in case the user needs to change the STCU configuration. It means that the user has programmed at least a pair of unlock keys into UTest.

Given that the STCU2 considers only the first valid unlock keys and the following configuration, after the first acceptance of a configuration, STCU2 does not accept any other settings even if the provided unlock keys are correct. The SSCM reads the DCF incrementally from lower to higher addresses.

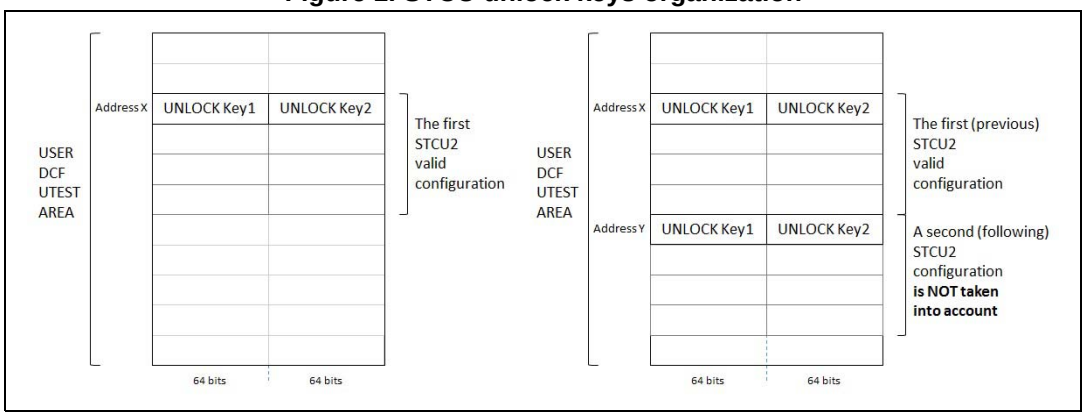
The right side of *Figure 1* shows two different configurations of the STCU. Both configurations start with the correct unlock keys:

1. First configuration starts at address X
2. Second configuration starts at address Y

Even if the second configuration starts with the correct unlock keys, the STCU ignores it. As a result, the STCU runs the L/MBIST accordingly with the configuration that starts at address X.

Next section explains how to instruct the STCU to load the second configuration and discard the first one.

Figure 1. STCU unlock keys organization



2 How STCU2 configuration can be updated

As explained in the previous chapter, simply writing a second STCU configuration at different location does not cause any change in the configuration that the STCU loads, such as the first one.

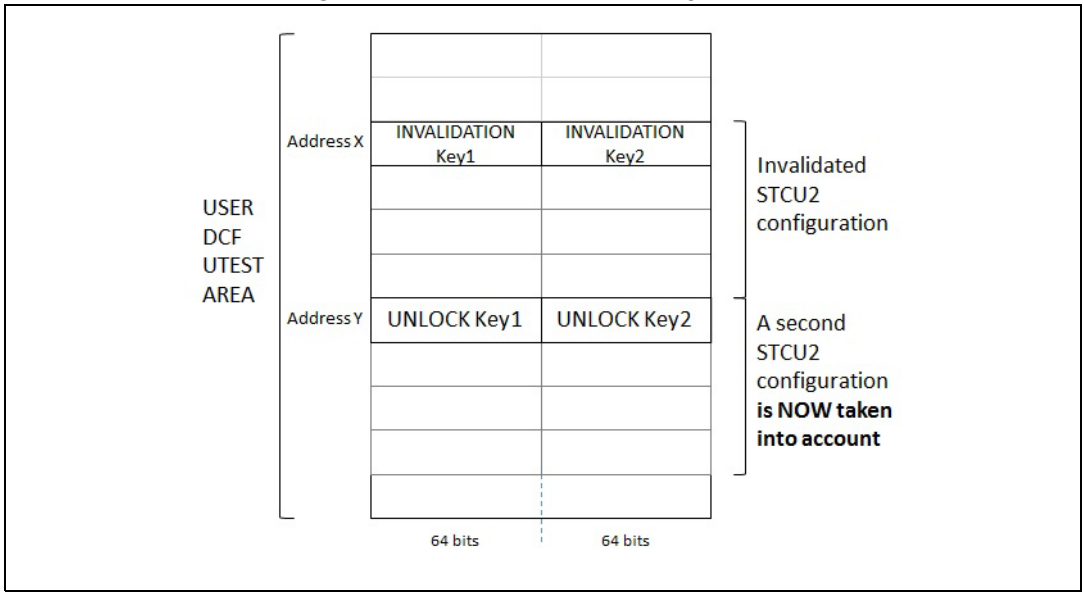
Since the UTest sector is not erasable, if the user wants to change the STCU configuration he must invalidate the first configuration. It means invalidating the first instance of the unlock keys.

As a consequence, STCU2 reads unlock keys that are not correct and ignores the following configuration.

With reference to *Figure 2*, if the user invalidates the unlock keys at address X the STCU ignores the first configuration and loads the second one.

If needed, the user can repeat the process by adding a third configuration and invalidating the unlock keys at address Y and so forth.

Figure 2. Make STCU unlock key invalid



Invalidating means overwriting the unlock keys with incorrect keys. The user, however, does this operation carefully due to the ECC/EDC.

The ECC/EDC protects the UTest content. It means that the UTest contains not only the data, but also some redundant bits. The hardware can correct or detect some errors by comparing the data and the redundant bits. This process is transparent from the standpoint of the user who cannot access the redundant bits.

For this reason, if the user overwrites the unlock keys with random data, there is a risk that the ECC/EDC logic detects one or more not correctable errors. In case of this event the sample does not start.

Under those circumstances, the user must adopt specific values that do not cause the ECC/EDC errors. These values are visible in *Table 1*.

Table 1. Physical values of unlock and invalidation keys

	Key 1	Key 2	Complete DCF key 1	Complete DCF key 2
Unlock	0xD3FEA98B	0x2C015674	0xD3FEA98B00080008	0x2C01567400080008
Invalidation	0xD3BCA98B	0x28011674	0xD3BCA98B00080008	0x2801167400080008

3 Limitation and prerequisites

These invalidation keys are effective only if unlock keys are aligned at 128 bits, otherwise the ECC must be computed explicitly for given data.

The user adopts the invalidation keys only in case valid unlock keys are saved in UTest and a new configuration is applied.

Invalidation keys must be written at exact positions of unlock keys which means overwrite the unlock keys.

4 Conclusion

The update of STCU2 configuration is possible even if there are strict rules which the user must consider.

If the user follows these rules this is no a risky operation. In addition, change of STCU2 configuration is an exceptional state which occurs mainly during developing phase and not in final application.

5 Reference documents

SPC58NE84C3, SPC58NE84E7, SPC58EG84C3 reference manuals, Rev2, Feb 2016

6 Acronyms

Table 2. Acronyms

Acronym	Name
STCU2	Self-test control unit
DCF	Device configuration format
SSCM	System status and configuration module

7 Revision history

Table 3. Document revision history

Date	Revision	Changes
26-Sept-2016	1	Initial release