
Erase Time Window For NOR Flash Application Note

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Preliminary

Samsung Electronics

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Purpose

This application note will guide you to use Erase-suspend operation of NOR Flash in the right direction. It describes how to keep Erase time-window and how to use another command during the Internal Erase operation. This application note is focused on using the Erase Suspend Command and Erase time-out window area. This is helpful for mobile system software engineers.

Definitions and Acronyms

Definitions and Acronyms	Description
Time Window	Erase Time out Window

References

- Samsung NOR Flash Databook

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1. NOR Flash Guideline of Using Erase Operation

1.1 Erase Time-out Window Definition

An aspect of Nor Flash, to Erase a block is to write 1 into the desired memory block by executing the Internal Erase Routine. The below contents that shows Erase Sequence and time window definition.

The Block Erase requires six bus cycles to write the command sequence. After the first two unlock cycles, the erase setup command (80H) is written at the third cycle. Then there are two more unlock cycles followed by the Block Erase command. The Internal Erase Routine automatically pre-programs and verifies the entire memory prior to erasing it. The block address is latched on the rising edge of AVD, while the Block Erase command is latched on the rising edge of WE. Multiple blocks can be erased sequentially by writing the sixth bus-cycle. Upon completion of the last cycle for the Block Erase, additional block address and the Block Erase command (30H) can be written to perform the Multi-Block Erase. For the Multi-Block Erase, only sixth cycle(block address and 30H) is needed.

An 50us (typical) time window is required between the Block Erase command writes. The Block Erase command must be written within the 50us time window, otherwise the Block Erase command will be ignored. The 50us time window is reset when the falling edge of the /WE occurs within the 50us of time window to latch the Block Erase command. During the 50us of time window, any command other than the Block Erase or the Erase Suspend command written to the device will reset the device to read mode. After the 50us of time window, the Block Erase command will initiate the Internal Erase Routine to erase the selected blocks. Any Block Erase address and command following the exceeded time window may or may not be accepted. No other commands will be recognized except the Erase Suspend command during Block Erase Operation.

1.2 Erase Internal Operation to use another CMD guideline

During the Erase operation using another CMD must adhere to the following guidelines:

Erase Command Entry(30h) -> Erase Status Check (using the DQ3 bit: High Detect) or Delay for 50us -> Suspend Entry(B0h) -> Suspend Status Check -> Any Command Entry

Figure 1 shows Erase suspend sequence and is followed by specific instructions regarding the keep the time window spec.

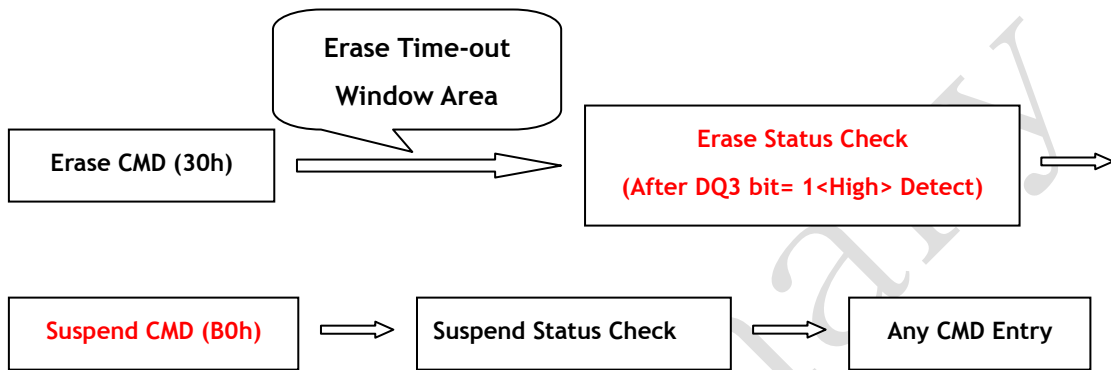


Figure 1 NOR Erase Suspend Operation Guide

1.3. NOR Flash Block Erase Operation Flow Chart

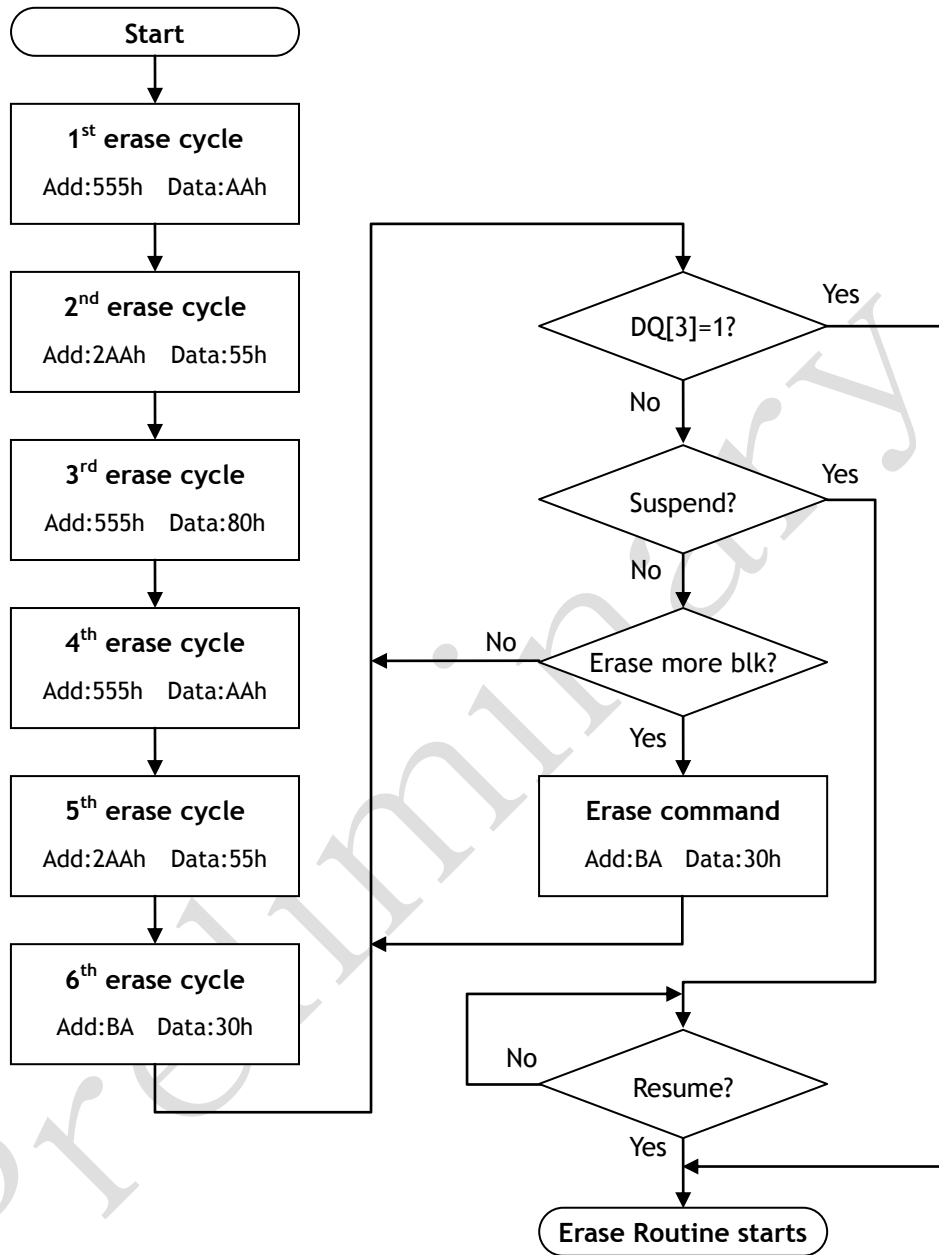


Figure 2 NOR Erase command operation flow chart

1.4 Acceptable Command during Block Erase Operation

Erase CMD Invoke period	Erase CMD Seq.	Check six cycle of erase command sequence
	Invalid CMD	Reset the device to read mode
Erase time Window period	6 th Erase CMD	Latch Block address for Multi-block erase Restart time window
	Suspend CMD	Suspend Erase operation, terminate time window Internal erase routine starts after resume
	Invalid CMD	Reset the device to read mode
Internal erase Routine period	6 th Erase CMD	Ignore command, keep internal erase routine
	Suspend CMD	Suspend Erase operation
	Invalid CMD	Ignore command, keep internal erase routine

Figure 3 Acceptable Command during Block Erase Operation table

2. Erase Suspend Sequence Failure Example

2.1 No exist of Status Read Function and Suspend CMD

Figure 5 shows that OTP command comes after Erase command (30h) without either time window (min. 50us) delay or Erase Status check sequence/Suspend command. This can cause erase reset. Failure sequence is : **Erase Command Entry(30h)** -> (*Erase Status Check (using the DQ3 bit: High Detect) or Delay for 50us -> Suspend Entry(B0h) -> Suspend Status Check*) -> **Any Command Entry (OTP CMD: 70h)** Figure 4 shows that Erase suspend failure sequence.

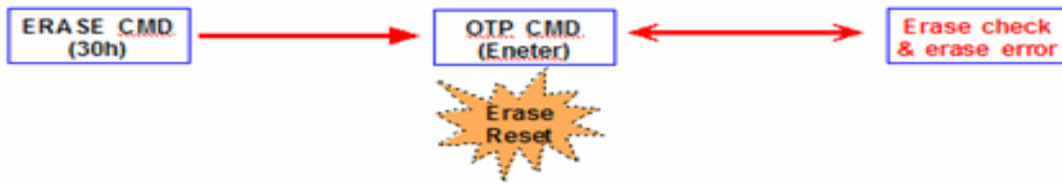


Figure 4 NOR Erase Suspend Failure Operation

NOR Erase Timing_Fall

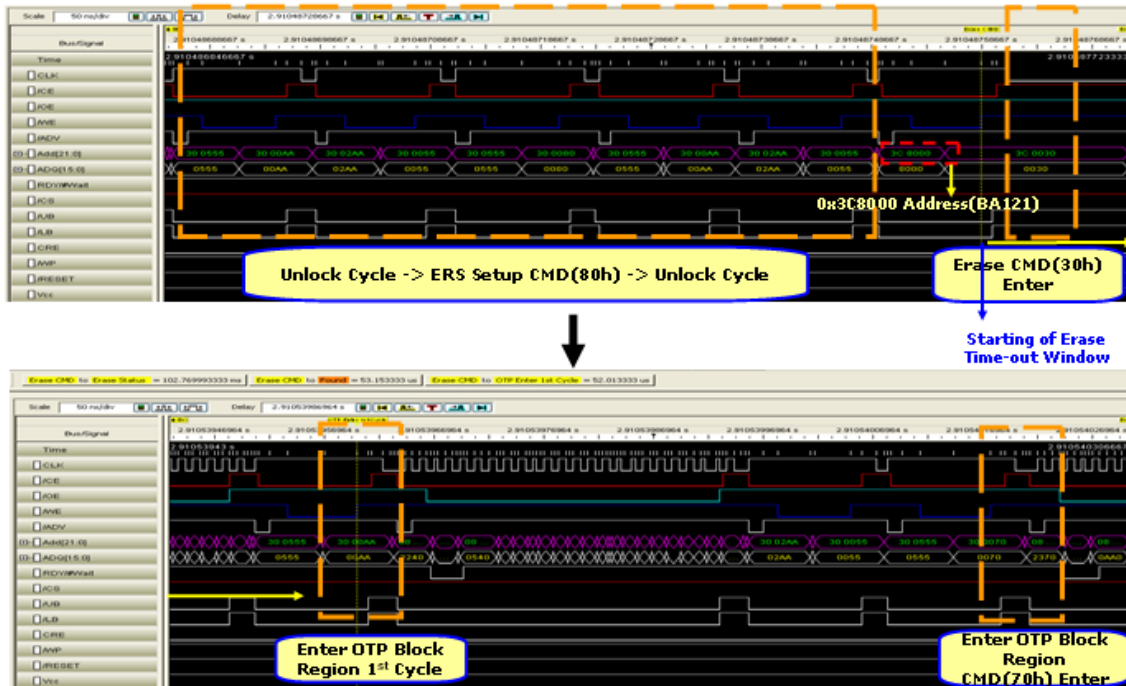


Figure 5 NOR Erase Failure Timing Example (1/3)

2.2 Status Read Failure (continue)

As we mentioned previous chapter, to use another function during the erase operation, command sequence should be involved Erase status check/Suspend command. If there is no this sequence, application system will be failed. Figure 6,7 displays that status failure timing.

NOR Erase Timing_Fail

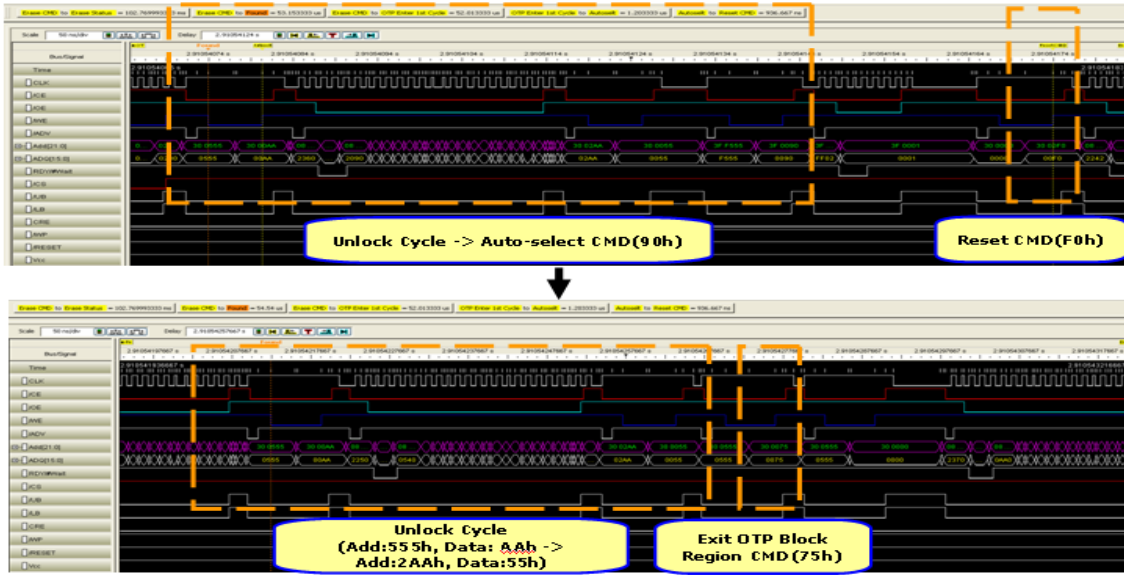


Figure 6 NOR Erase Failure Example (2/3)

NOR Erase Timing_Fail

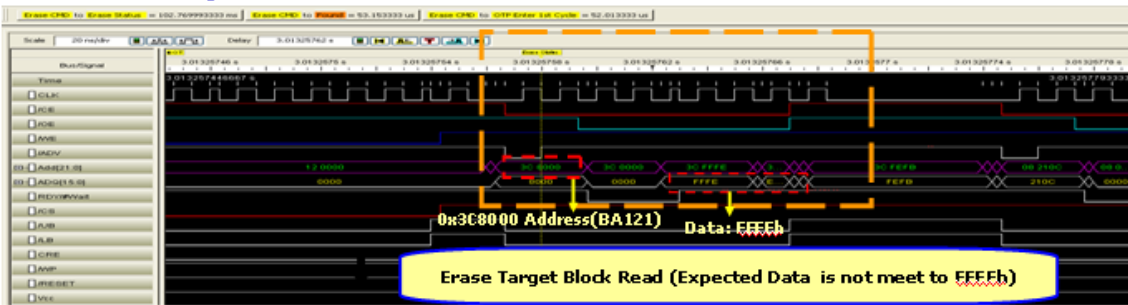


Figure 7 NOR Erase Failure Example (3/3)