
Using SEC K8A2815ETC & Spansion WS128N Compatibility For NOR Flash Application Note

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Preliminary

Samsung Electronics

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Purpose

This application note will guide you to distinguish SEC-NOR feature from Spansion-NOR feature. It describes difference about command set, configuration register and block size etc. between SEC and Spansion NOR Flash. Especially this application note is focused on Comparison about SEC(128Mb C-die K8A2815ETC) and Spansion(WS128N) . This is helpful for mobile system hardware and software engineers.

Definitions and Acronyms

Definitions and Acronyms	Description
/AVD	Address Input Valid
Mux	Multiplexed

References

- Samsung NOR Flash Databook
- Spansion NOR Flash Databook
- Mobile Planning Group Materials

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1. SEC(128Mb C-die) vs Spansion(WS128_N) Comparison

Between Samsung NOR flash and Spansion, there are differences in Cell Type, Block Size, Block Protection, Boot block, Read access time, Burst read mode, word program time and write buffer/word program. Figure 1 indicates that overall features between Samsung and Spansion.

	Samsung(128Mb K8A2815ET(B)C)	Spansion (128Mb WS128N)
Cell Type	<u>SLC</u>	<u>Mirror Bit</u>
Power	1.7~1.95V	1.7~1.95V
Organization	8M * 16	8M * 16
I/O	De-muxed	De-muxed
Bank	16	16
Block size	<u>Boot : 4KW, Main : 32KW</u>	<u>Boot : 16KW, Main : 64KW</u>
Block protection	<u>Normal protection</u> <u>Advanced block protection(option)</u>	<u>Advanced block protection</u>
OTP block	256 Word	256 Word
Boot block	<u>Top or Bottom</u>	<u>Top and Bottom</u>
Remark	Async page(8-word), Sync burst, RWW	Sync Burst, RWW
Read access time	<u>70ns</u>	<u>80ns</u>
Page access time	20ns	Not support
Max. Frequency	108Mhz	80Mhz
Sync read	Start by C.R set	Start by C.R set
Burst read mode	<u>Continuous Read, 8/16 Word Wrap</u>	<u>Continuous Read, 8/16/32 Word Wrap or no Wrap</u>
Word program time	<u>11.5us / word</u>	<u>40us / word</u>
Write Buffer program	<u>Not Support</u>	<u>32word write buffer</u>
Accel. Word Program	<u>Quad word PGM</u>	<u>Accel. Buffer PGM</u>

Figure 1 Overall Features Comparison

1.1 Command set

Basic command (Read, Program, Erase etc.) is same. But MID, DID, OTP Block command and Buffer/Quad PGM is different. Refer to below contents.

- Manufacture ID, Device ID
(Samsung: 00ECh, 2402h:BB, 2403:TB) (Spansion : 0001h, 227Eh)
- OTP Block Command (Samsung) : CMD -> 70h

- Write buffer program (Spansion Only) : CMD -> 25h
- Quad word program (Samsung Only) : CMD -> A5h

1.2 Block Size

- **Samsung** : Main block + Boot block (Top or Bottom)

Main block size : 32KW, Boot block size : 4KW

- **Spansion** : Main block + Boot block (Top and Bottom)

Main block size : 64KW, Boot block size : 16KW

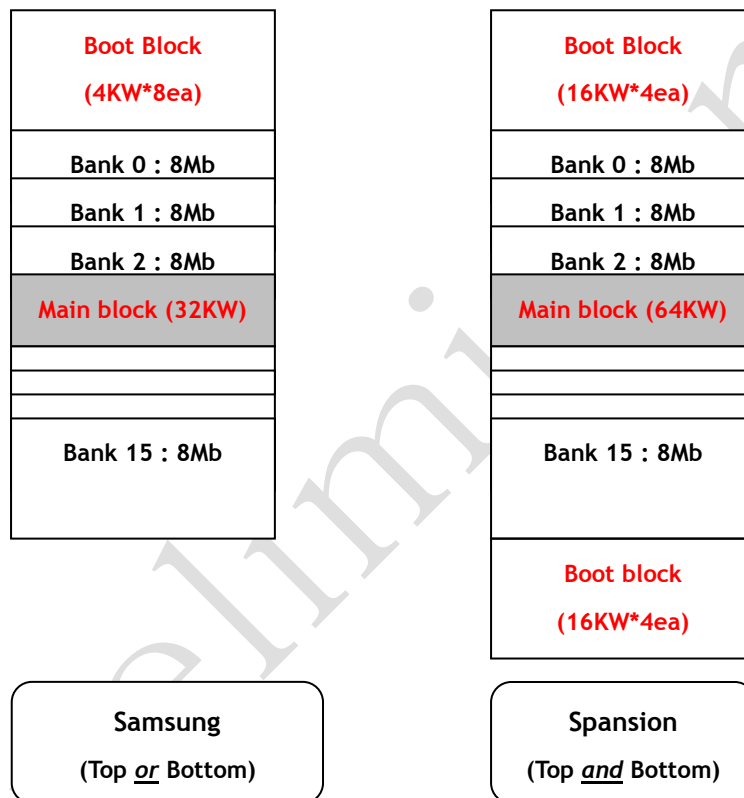


Figure 2 Different Factor in Bank & Block Structure

1.3 Configuration Register Set

Spansion is using 16bits and has RDY polarity, 32 word linear burst but the other items are the same. This table is captured by SEC and Spansion Spec. Refer to enclosed picture file.

- **Samsung** : Using 9 bits
- **Spansion** : Using 16bits, RDY Polarity Changeable, Burst Length (32-word Linear burst available)

Table 7.10 Configuration Register

CR Bit	Function				Settings (Binary)	
CR15	Set Device Read Mode				0 = Synchronous Read (Burst Mode) Enabled 1 = Asynchronous Read Mode (default) Enabled	
CR14	Reserved				1 = S29WS256N at 6 or 7 Wait State setting 0 = All others	
			54 MHz	66 MHz	80 MHz	
CR13	Programmable Wait State	S29WS128N	0	1	1	011 = Data valid on 5th active CLK edge after addresses latched 100 = Data valid on 6th active CLK edge after addresses latched 101 = Data valid on 7th active CLK edge after addresses latched (default) 110 = Reserved 111 = Reserved Inserts wait states before initial data is available. Setting greater number of wait states before initial data reduces latency after initial data. (Notes 1, 2)
		S29WS256N	0	1	1	
CR12		S29WS128N	1	0	0	
		S29WS256N	1	0	0	
CR11		S29WS128N	1	0	1	
		S29WS256N	1	0	1	
CR10	RDY Polarity				0 = RDY signal active low 1 = RDY signal active high (default)	
CR9	Reserved				1 = default	
CR8	RDY				0 = RDY active one clock cycle before data 1 = RDY active with data (default) When CR13-CR11 are set to 000, RDY is active with data regardless of CR8 setting.	
CR7	Reserved				1 = default	
CR6	Reserved				1 = default	
CR5	Reserved				0 = default	
CR4	Reserved				0 = default	
CR3	Burst Wrap Around				0 = No Wrap Around Burst 1 = Wrap Around Burst (default) Ignored if in continuous mode	
CR2 CR1 CR0	Burst Length				000 = Continuous (default) 010 = 8-Word Linear Burst 011 = 16-Word Linear Burst 100 = 32-Word Linear Burst (All other bit settings are reserved)	

Figure 3 Spansion_ Configuration Register comparison

Table 8: Burst Mode Configuration Register Table

Address Bit	Function	Settings(Binary)
A20	Output Driver Control	00 = Driver Multiplier : 1/3 01 = Driver Multiplier : 1/2 10 = Driver Multiplier : 1 (Default) 11 = Driver Multiplier : 1.5
A19		
A18	RDY Active	1 = RDY active one clock cycle before data 0 = RDY active with data(default)
A17	Burst Read Mode	000 = Continuous(default) 001 = 8-word linear with wrap 010 = 16-word linear with wrap 011 ~ 111 = Reserve
A16		
A15		
A14	Programmable Wait State	000 = Data is valid on the 4th active CLK edge after AVD transition to VIH (50/54Mhz) 001 = Data is valid on the 5th active CLK edge after AVD transition to VIH (60/66/70Mhz) 010 = Data is valid on the 6th active CLK edge after AVD transition to VIH (80/83Mhz) 011 = Data is valid on the 7th active CLK edge after AVD transition to VIH (90/100Mhz) 100 = Data is valid on the 8th active CLK edge after AVD transition to VIH (108Mhz,default) 101 = Reserve 110 = Reserve 111 = Reserve
A13		
A12		

Figure 4 Samsung_ Configuration Register comparison

1.4 Write Operation Status

Almost write operation status is similar. But Status data of Erase Suspend & Program Suspend for busy block are different. Refer to Figure 5 that shows status check table between Samsung

and Spansion.

Status		DQ7	DQ6	DQ5	DQ3	DQ2	Samsung
In Progress	Programming	DQ7	Toggle	0	0	1	
	Block Erase or Chip Erase	0	Toggle	0	1	Toggle	
	Erase Suspend Read	Erase Suspended Block	1	1	0	0	Toggle (Note 1)
	Erase Suspend Read	Non-Erase-Suspended Block	Data	Data	Data	Data	Data
	Erase Suspend Program	Non-Erase-Suspended Block	DQ7	Toggle	0	0	1
	Program Suspend Read	Program Suspended Block	DQ7	1	0	0	Toggle (Note 1)
Exceeded Time Limits	Programming	DQ7	Toggle	1	0	No Toggle	
	Block Erase or Chip Erase	0	Toggle	1	1	(Note 2)	
	Erase Suspend Program	DQ7	Toggle	1	0	No Toggle	

Status		DQ7 (Note 2)	DQ6	DQ5 (Note 1)	DQ3	DQ2 (Note 2)	DQ1 (Note 4)	Spansion
Standard Mode	Embedded Program Algorithm	DQ7#	Toggle	0	N/A	No toggle	0	
	Embedded Erase Algorithm	0	Toggle	0	1	Toggle	N/A	
Program Suspend Mode (Note 3)	Reading within Program Suspended Sector	INVALID (Not Allowed)	INVALID (Not Allowed)	INVALID (Not Allowed)	INVALID (Not Allowed)	INVALID (Not Allowed)	INVALID (Not Allowed)	
	Reading within Non-Program Suspended Sector	Data	Data	Data	Data	Data	Data	
Erase Suspend Mode (Note 6)	Erase-Suspend-Read	Erase Suspended Sector	1	No toggle	0	N/A	Toggle	
	Erase-Suspend-Read	Non-Erase Suspended Sector	Data	Data	Data	Data	Data	
	Erase-Suspend-Program		DQ7#	Toggle	0	N/A	N/A	
Write to Buffer (Note 5)	BUSY State	DQ7#	Toggle	0	N/A	N/A	0	
	Exceeded Timing Limits	DQ7#	Toggle	1	N/A	N/A	0	
	ABORT State	DQ7#	Toggle	0	N/A	N/A	1	

Figure 5 Status check table between SEC and Spansion

2. Failure Example

2.1 Address Fetch Miss-Compatibility

Below example indicates that miss-compatibility between Samsung and Spansion. This application set is Smart Phone including RC12832CE(K5L2833ATA) memory and QSC6030 controller. Customer's 1st vendor was Spansion. When customer has selected to 2nd vendor, Samsung insists on that most of SEC feature are compatible with Spansion one. However between SEC and Spansion have difference about address fetch area. **In De-Muxed type address fetch of Samsung device didn't use /AVD, Spansion use /AVD Low active.** Samsung's address fetch point is /CE Low and transition of address. So PCB H/W was tied to Mux, it is caused Booting Fail in application level. Figure 6 display that timing of address fetch between SEC and Spansion.



Figure 6 Timing of Address Fetch between SEC and Spansion

2.2 Write Buffer Program

As we mentioned previous chapter, basic command (Read, Program, Erase etc.) is the similar. Only Spansion device has write buffer program function. To make Samsung device available, s/w code of write buffer program must change to the program command(A0h). Figure 7 indicate timing of write buffer program.

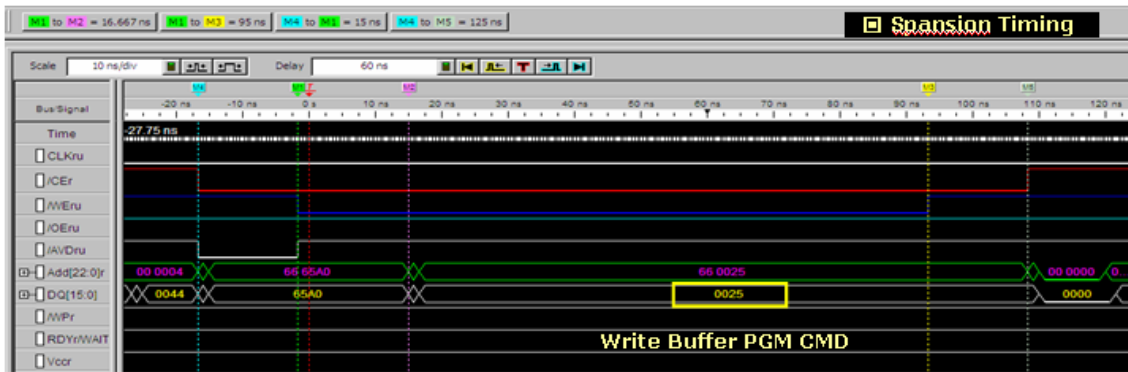


Figure 7 Timing of Write Buffer Program