Flash EEPROM Emulation

(How to measure the duration of Fee_Init)

for TraveoII series

Automotive Software div.

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Revision History

Revision Date	Comment
2020-08-04	Initial version

Fee_Init

What is the duration of Fee_init?

API	Internal Operation	Execution Count
Fee_Init	Initialize internal variables.	1
Fee_Mainfunction	Read Config	1
	Check physical sector status	(Total sector size / 2048) × 3
	Check logical sector status	(Total sector size / logical sector size(*1)) × 5 (*1)Logical sector size = ROUNDUP((total block size(*2)×2 + 40)/4096,0) × 4096 (*2)total block size Total size of blocks(block info.(16byte)+ data size) defined in Config
	※ If it is brand new chip, - erase all sectors - set sector flag => END [depend on hardware (erase time)]	HW erase time is dominant. e.g. BE2M, 128K => 5,120 ms(typ) / 10,240 ms(worst) which is dependent on HW spec.
	Search data on FLASH and create index of block information on RAM.	The number of Blocks existed in valid logical sector on Flash
	※ If corrupt data is detected, do recycle. => END	Refer to next page (Recycle)
	Re-write valid flag to each blocks. (Fail Safe function)	The number of Block ID existed in valid logical sector on Flash

What is the duration of Fee_init?

- Recycle

API	Internal Operation	Execution Count
Fee_Mainfunction	Pre-processing of recycle.	2
	Erase all garbage sectors (or non-erased). [depend on hardware(erase)]	HW erase time is dominant. Garbage sector size = Used logical sector size e.g. Used logical sector size = 4K 160 ms(typ) / 320 ms(worst) which is dependent on HW spec.
	Change sector Info. [depend on hardware(write)]	(Typ) 4
	If block data is on FLASH (old sector), write valid block(block info + data) to new sector. [depend on hardware(write)]	HW write time is dominant. e.g. The number of valid block on Flash = 50 => Block Info requires 16 bytes for each block. The total data size of valid block = 600 byte 10.5 ms(typ) / 21 ms(worst) which is dependent on HW spec.
	Change sector info. [depend on hardware(write)]	(Typ) 4

What is the duration of Fee_init?

【In case of the first initialization (all sectors erased)】

[Estimation Formula]

-Production spec:

Fee_Init : Initialize internal variables(**1cycle**)

Fee_MainFunction : Read Config(**1cycle**) + Check physical sector status (**(Total sector size/2048)×3**) + Check logical sector status (**(Total sector size/logical sector size)×5**)

-Hardware spec

HW erase time of all sectors

[DateSeet Spec]

		(typ)	(worst)
4 byte write	=	30 us	60 us
2048 byte erase	=	80 ms	160 ms

[Examlpe for estimation]

- Total sector size = 128 Kbtyte (BE2M)
- Total size of blocks(block info.(16byte)+ data size) defined in Config = 720 [the number of block ID = 15 the data size of each block = 32 bytes]
- logical sector size = 4 Kbyte (ROUNDUP((720×2 + 40)/4096,0) * 4096)
- 1 cycle = 57 us (actual average value)

[Typical initialization]

-Product spec : 354 cycle × 57 us = 20.178 (ms)

[1+1+((128K/2K)×3)+((128K/4K)×5) = 354 cycle]

-Hardware spec : 5,120 (ms)) (*)

[erase : 128K/2K×80ms = 5,120 ms]

Estimation ≒ 5,140 (ms)

[Worst initialization]

-Product spec : 354 cycle × 57 us = 20.178 (ms)

[1+1+((128K/2K)×3)+((128K/4K)×5) = 354 cycle]

-Hardware spec : 10,240 (ms)

[erase : 128K/2K×160ms = 10,240 ms]

Estimation ≒ 10,260 (ms)

(*) Data sheet value is very pessimistic. According to our experiences , actual runtime is 1/3 ~ 1/5(1000ms~2000ms).

What is the duration of Fee_init?

【In case of corrupt data exists (recycle needed)】

[Estimation Formula]

-Production spec:

Fee_Init : Initialize internal variables(**1cycle**)

Fee_MainFunction : Read Config(**1cycle**) + Check physical sector status (**(Total sector size/2048)×3**) + Check logical sector status (**(Total sector size/logical sector size)×5**) + Search data on FLASH and create index of block information on RAM (**The number of Blocks existed in valid logical sector on Flash**)

Fee_MainFunction (Recycle) : Pre-processing of recycle (**2cycle**) + Change sector Info. (**4cycle**) + Change sector info. (**4cycle**)

-Hardware spec

HW erase time of garbage sector

HW time for writing valid data to new sector

[DateSeet Spec]		(typ)	(worst)
4 byte write	=	30 us	60 us
2048 byte erase	=	80 ms	160 ms

[Examlpe for estimation]

- Total sector size = 128 Kbtyte (BE2M)
- 10 block ID (date size of each block is 32 bytes) exists in valid sector on FLASH.
- 100 Block data exists in valid sector on FLASH
- Total size of blocks(block info.(16byte)+ data size) defined in Config = 720 [the number of block ID = 15 the data size of each block = 32 bytes]
- logical sector size = 4 Kbyte (ROUNDUP((720*2 + 40)/4096,0) * 4096)
- Garbage sector size = 4 Kbyte (logical sector size)
- 1 cycle = 57 us (actual average value)

[Typical initialization]

-Product spec : 464 cycle × 57 us = 26.448 (ms)

[1+1+((128K/2K)×3)+((128K/4K)×5)+100+2+4+4 = 464 cycle]

-Hardware spec : 163.6 (ms)

[erase : 4K/2K×80ms = 160 ms]

[write : ((10×16) + (10×32)) / 4byte ×30us = 3.6ms]

Estimation ≒ 190 (ms)

[Worst initialization]

-Product spec : 464 cycle × 57 us = 26.448 (ms)

[1+1+((128K/2K)×3)+((128K/4K)×5) +100+2+4+4 = 464 cycle]

-Hardware spec : 327.2 (ms)

[erase : 4K/2K×160ms = 320 ms]

[write : ((10×16) + (10×32)) / 4byte ×60us = 7.2ms]

Estimation ≒ 354 (ms)

What is the duration of Fee_init?

【In case of the other (not erased, recycle not needed)】

[Estimation Formula]

-Production spec:

Fee_Init : Initialize internal variables(**1cycle**)

Fee_MainFunction : Read Config(**1cycle**) + Check physical sector status (**(Total sector size/2048)×3**) + Check logical sector status (**(Total sector size/logical sector size)×5**)
+ Search data on FLASH and create index of block information on RAM (**The number of Blocks existed in valid logical sector on Flash**)
+ Re-write valid flag to each blocks. (Fail Safe function) (**The number of Block ID existed in valid logical sector on Flash**)

[DateSeet Spec]

		(typ)	(worst)
4 byte write	=	30 us	60 us
2048 byte erase	=	80 ms	160 ms

[Examlpe for estimation]

- Total sector size = 128 Kbtyte (BE2M)
- 10 block ID (date size of each block is 32 bytes) exists in valid sector on FLASH.
- 100 Block data exists in valid sector on FLASH
- Total size of blocks(block info.(16byte)+ data size) defined in Config = 720 [the number of block ID = 15 the data size of each block = 32 bytes]
- logical sector size = 4 Kbyte (ROUNDUP((720*2 + 40)/4096,0) * 4096)
- 1 cycle = 57 us (actual average value)

[Typical initialization]

-Product spec : 454 cycle × 57 us = 25.878 (ms)
[1+1+((128K/2K)×3)+((128K/4K)×5) +100 = 454 cycle]

-Hardware spec : 0.3ms
[write : (10×4byte)) / 4byte ×30us =0.3ms]

Estimation ≒ 26 (ms)

[Worst initialization]

-Product spec : 464 cycle × 57 us = 25.878 (ms)
[1+1+((128K/2K)×3)+((128K/4K)×5) +100+10 = 454 cycle]

-Hardware spec 0.3ms
[write : (10×4byte)) / 4byte ×60us =0.6ms]

Estimation ≒ 26(ms)

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