SD NAND 存储功能描述（18）命令类 e

SD 存储卡的两种状态信息

SD 存储卡支持以下两种状态字段:—“Card Status”:已执行命令的错误和状态信息，在响应中显示- 'SD Status':扩展状态字段 512 位，支持 SD 存储卡的特殊功能和未来的特定应用功能。

卡状态响应

格式 R1 包含一个名为 card status 的 32 位字段。该字段旨在将卡的状态信息(可以存储在本地状态寄存器中)传输到主机。如果没有另行指定，则状态项总是与先前发出的命令相关。未使用的保留位设置为 0。表格中的 type 和 clear condition 字段缩写如下:

类型:

E:错误位。

S:状态位。

R:检测并设置为实际命令响应。

X:在执行命令时检测并设置。

主机可以通过发出带有 R1 响应的命令来获取状态。

明确的条件:

A:根据卡片当前状态。

B:总是和之前的命令有关。接收到有效的命令将清除它(延迟一个命令)。

C:通过读取清除。

Bits	Identifier	Type	Value	Description	Clear Condition
31	OUT_OF_RANGE	E R X	'0'= no error '1'= error	The command's argument was out of the allowed range for this card.	C
30	ADDRESS_ERROR	E R X	'0'= no error '1'= error	A misaligned address which did not match the block length was used in the command.	C
29	BLOCK_LEN_ERROR	E R X	'0'= no error '1'= error	The transferred block length is not allowed for this card, or the number of transferred bytes does not match the block length.	C
28	ERASE_SEQ_ERROR	E R	'0'= no error '1'= error	An error in the sequence of erase commands occurred.	C
27	ERASE_PARAM	E R X	'0'= no error '1'= error	An invalid selection of write-blocks for erase occurred.	C
26	WP_VIOLATION	E R X	'0'= not protected '1'= protected	Set when the host attempts to write to a protected block or to the temporary or permanent write protected card.	C
25	CARD_IS_LOCKED	S X	'0' = card unlocked '1' = card locked	When set, signals that the card is locked by the host	A
24	LOCK_UNLOCK_FAILED	E R X	'0' = no error '1' = error	Set when a sequence or password error has been detected in lock/unlock card command.	C
23	COM_CRC_ERROR	E R	'0'= no error '1'= error	The CRC check of the previous command failed.	B
22	ILLEGAL_COMMAND	E R	'0'= no error '1'= error	Command not legal for the card state	B
21	CARD_ECC_FAILED	E R X	'0'= success '1'= failure	Card internal ECC was applied but failed to correct the data.	C
20	CC_ERROR	E R X	'0'= no error '1'= error	Internal card controller error	C
19	ERROR	E R X	'0'= no error '1'= error	A general or an unknown error occurred during the operation.	C
18	reserved				
17	reserved for DEFERRED_RESPONSE (Refer to eSD Addendum)				

Bits	Identifier	Type	Value	Description	Clear Condition
16	CSD_OVERWRITE	E R X	'0'= no error '1'= error	Can be either one of the following errors: - The read only section of the CSD does not match the card content. - An attempt to reverse the copy (set as original) or permanent WP (unprotected) bits was made.	C
15	WP_ERASE_SKIP	E R X	'0'= not protected '1'= protected	*Set when only partial address space was erased due to existing write protected blocks or the temporary or permanent write protected card was erased.	C
14	CARD_ECC_DISABLED	S X	'0'= enabled '1'= disabled	The command has been executed without using the internal ECC.	A
13	ERASE_RESET	S R	'0'= cleared '1'= set	An erase sequence was cleared before executing because an out of erase sequence command was received	C
12:9	CURRENT_STATE	S X	0 = idle 1 = ready 2 = ident 3 = stby 4 = tran 5 = data 6 = rcv 7 = prg 8 = dis 9-14 = reserved 15 = reserved for I/O mode	The state of the card when receiving the command. If the command execution causes a state change, it will be visible to the host in the response to the next command. The four bits are interpreted as a binary coded number between 0 and 15.	B
8	READY_FOR_DATA	S X	'0'= not ready '1'= ready	Corresponds to buffer empty signaling on the bus	A
7:6					
5	APP_CMD	S R	'0' = Disabled '1' = Enabled	The card will expect ACMD, or an indication that the command has been interpreted as ACMD	C
4	reserved for SD I/O Card				
3	AKE_SEQ_ERROR (SD Memory Card app. spec.)	E R	'0' = no error '1' = error	Error in the sequence of the authentication process	C
2	reserved for application specific commands				
1, 0	reserved for manufacturer test mode				

Card Status

对于 R1 响应的每个命令，下表定义了状态中受影响的位字段。“x”表示可以在相应命令的响应中设置错误/状态位。

(1)对 CMD3 的响应是 R6，其中仅包含卡状态中的 23、22、19 和 12:9 位
(2)此命令在 1.10 版本中定义

CMD Number	Response Format Card Status Bit Number																				
	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12:9	8	5
3[1]									x	x			x							x		
6[2]	x						x		x	x	x	x	x							x		
7					x	x	x	x	x	x	x	x	x			x	x	x	x	x	x	
11							x		x	x			x							x		
12	x	x				x	x		x	x	x	x	x					x		x		
13	x	x			x	x	x	x	x	x	x	x	x			x	x	x		x	x	
16			x		x	x	x	x	x	x	x	x	x			x	x	x	x	x		
17	x	x			x	x	x	x	x	x	x	x	x			x	x	x	x	x		
18	x	x			x	x	x	x	x	x	x	x	x			x	x	x	x	x		
19	x	x			x	x	x	x	x	x	x	x	x			x	x	x	x	x		
20	x	x	x		x	x	x	x	x	x	x	x	x			x	x	x	x	x	x	
23	x	x	x		x	x	x	x	x	x	x	x	x			x	x	x	x	x		
24	x	x	x		x	x	x	x	x	x	x	x	x			x	x	x	x	x	x	
25	x	x	x		x	x	x	x	x	x	x	x	x			x	x	x	x	x	x	
26					x	x	x	x	x	x	x	x	x			x	x	x	x	x		
27					x	x	x	x	x	x	x	x	x			x	x	x	x	x		
28	x				x	x	x	x	x	x	x	x	x			x	x	x	x	x		
29	x				x	x	x	x	x	x	x	x	x			x	x	x	x	x		
30	x				x	x	x	x	x	x	x	x	x			x	x	x	x	x		
32	x			x	x	x	x	x	x	x	x	x	x			x	x	x	x	x		
33	x			x	x	x	x	x	x	x	x	x	x			x	x	x	x	x		
38				x	x	x	x	x	x	x	x	x	x			x	x	x	x	x		
42					x	x	x	x	x	x	x	x	x			x	x	x	x	x		
55					x	x	x	x	x	x	x	x	x			x	x	x	x	x		x
56					x	x	x	x	x	x	x	x	x			x	x	x	x	x	x	x
ACMD6	x				x	x	x	x	x	x	x	x	x			x	x	x	x	x		x
ACMD13					x	x	x	x	x	x	x	x	x			x	x	x	x	x		x
ACMD22					x	x	x	x	x	x	x	x	x			x	x	x	x	x		x
ACMD23					x	x	x	x	x	x	x	x	x			x	x	x	x	x		x
ACMD42					x	x	x	x	x	x	x	x	x			x	x	x	x	x		x
ACMD51					x	x	x	x	x	x	x	x	x			x	x	x	x	x		x

Card Status Field/Command - Cross Reference

SD 状态

SD 状态包含与 SD 存储卡专有特性相关的状态位，并且可能用于未来特定应用程序的使用。SD Status 的大小为一个 512l 位的数据块。该寄存器的内容与 16 位 CRC 一起通过 DAT 总线传输到主机。

作为对 ACMD13 (CMD55 后接 CMD13)的响应，SD Status 通过 DAT 总线发送给主机。ACMD13 只能发送到“传输状态”的卡(卡被选中)。SD Status 结构描述如下。

未使用的保留位应设置为 0。“类型”和“明确条件”的缩写与上面的“卡片状态”相同。

Bits	Identifier	Type	Value	Description	Clear
511:510	DAT_BUS_WIDTH	S R	'00'= 1 (default) '01'= reserved '10'= 4 bit width '11'= reserved	Shows the currently defined data bus width that was defined by SET_BUS_WIDTH command	A
509	SECURED_MODE	S R	'0'= Not in the mode '1'= In Secured Mode	Card is in Secured Mode of operation (refer to the "Part 3 Security Specification").	A
508:502	Reserved for Security Functions (Refer to Part 3 Security Specification)				
501:496	reserved				
495:480	SD_CARD_TYPE	SR	'00xxh'= SD Memory Cards as defined in Physical Spec Ver1.01-3.00 ('x'=don't care). The following cards are currently defined: '0000h'= Regular SD RD/WR Card. '0001h'= SD ROM Card '0002h'=OTP	In the future, the 8 LSBs will be used to define different variations of an SD Memory Card (Each bit will define different SD Types). The 8 MSBs will be used to define SD Cards that do not comply with the Physical Layer Specification.	A
479:448	SIZE_OF_PROTECTED_AREA	SR	Size of protected area	(See below)	A
447:440	SPEED_CLASS	SR	Speed Class of the card	(See below)	A
439:432	PERFORMANCE_MOVE	SR	Performance of move indicated by 1 [MB/s] step.	(See below)	A
431:428	AU_SIZE	SR	Size of AU	(See below)	A
427:424	reserved				
423:408	ERASE_SIZE	SR	Number of AUs to be erased at a time	(See below)	A
407:402	ERASE_TIMEOUT	SR	Timeout value for erasing areas specified by UNIT_OF_ERASE_AU	(See below)	A
401:400	ERASE_OFFSET	SR	Fixed offset value added to erase time.	(See below)	A
399:396	UHS_SPEED_GRADE	SR	Speed Grade for UHS mode	(See below)	A
395:392	UHS_AU_SIZE	SR	Size of AU for UHS mode	(See below)	A
391:312	reserved				
311:0	reserved for manufacturer				

SD Status

SIZE_OF_PROTECTED_AREA

Setting this field differs between SDSC and SDHC/SDXC.
In case of SDSC Card, the capacity of protected area is calculated as follows:
Protected Area = SIZE_OF_PROTECTED_AREA_* MULT * BLOCK_LEN.
SIZE_OF_PROTECTED_AREA is specified by the unit in MULT*BLOCK_LEN.

In case of SDHC and SDXC Cards, the capacity of protected area is calculated as follows:
Protected Area = SIZE_OF_PROTECTED_AREA
SIZE_OF_PROTECTED_AREA is specified by the unit in byte.

SPEED_CLASS

这个 8 位字段表示速度类。低于此字段所指示的类也是有效的。
例如，第 10 类指示，主机应考虑第 2 至 6 类也有效。

SPEED_CLASS	Value Definition
00h	Class 0
01h	Class 2
02h	Class 4
03h	Class 6
04h	Class 10
05h – FFh	Reserved

Speed Class Code Field

注意事项:“SD Status”中的“Class”值(包括预留值)大于主机的“Class”值支持，主机应该读取任何类可以与卡一起使用。