

CFast Card (SLC) Datasheet

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Revision History

Rev.	Date	History
0.1	2010/7/23	1. 1 st draft
0.2	2010/8/4	1. Add P/N List
1.0	2011/1/25	1. Update Emb'Core Logo & PN List
1.1	2011/1/26	1. Correct Temperature Spec. 2. Detailed Performance Spec.

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1. Overview

Advantech SQFlash CFast card combines the advantages of Flash Disk technology with the Serial ATA II interface, which electrically complies with the Serial ATA International Organization standard. Given the features of the low power consumption, small form factor, and high shock-resistance, CFast cards are deemed to be widely adopted as the next mainstream storage for embedded solutions. CFast is a newly defined standard by CompactFlash Association, and due to performance enhancement, CFast will be a more attractive solution to replace the conventional (PATA) interfaced CF card in industrial applications or markets where performance is a major concern.

The connector of a CFast card consists of a SATA-based 7-pin standard interface for data segment and 17-pin for power and controller segment, designed to operate at a maximum operating frequency of 150MHz with 30MHz external crystal. Its capacity could provide a wide range from 2GB to up to 16GB. Also, CFast can reach the read and write performance of 100MB/s and 50MB/s, respectively based on SLC flash.

2. Features

■ Standard SATA interface

- Support SATA 1.5 Gbps and 3.0 Gbps interface
- SATA Revision 2.6 compliant
- Power management supported

■ Compact Design

- Build-in VCC Power pin (pin 7)

■ Capacities

- SLC type : 2GB , 4GB , 8GB , 16GB

■ Transfer Mode

- PIO Mode: 0~4
- Multiword DMA: 0~2
- Ultra DMA: 0~6

■ Performance

- 4-CH SLC
 - Sustain Read Speed up to 95 MB/s
 - Sustain Write Speed up to 50 MB/s
- 2-CH SLC
 - Sustain Read Speed up to 45 MB/s
 - Sustain Write Speed up to 25 MB/s

■ Access time : 0.3ms

■ Error Correction Function

- Built-in ECC corrects up to 8-bit per 512-Byte

■ Temperature Ranges

- Commercial Temperature
 - 0°C to 70°C for operating
 - -55°C to 95°C for storage
- Industrial Temperature
 - -40°C to 85°C for operating
 - -55°C to 95°C for storage

■ Mechanical Specification

- Shock : 1,500G / 0.5ms
- Vibration : 20G / 7~2,000Hz

■ Humidity

- Relative Humidity : 10-95%, non-condensing

■ Data Retention

- 10 years

■ Acquired RoHS 、 CE 、 FCC Certificate

■ Acoustic : 0 dB

■ Dimension : 36.4 mm (L) x 42.8 mm (W) x 3.6 mm (H) (CFAST type I)

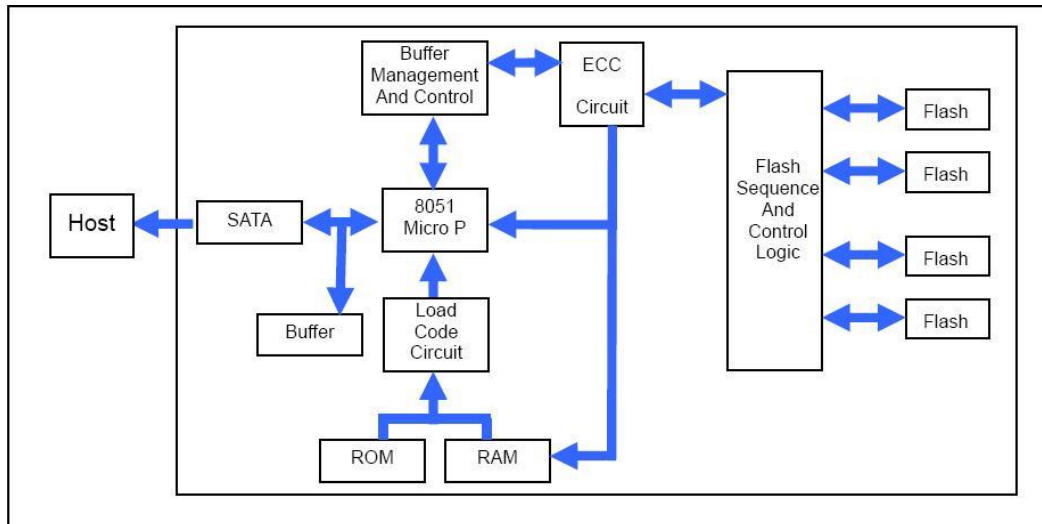
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- Weight : 10g ± 2g

3. Theory of operation

■ Overview

Below Figure shows the operation of SQFlash CFast card from the system level, including the major hardware blocks. As the diagram shown, SATA II controller communicates with SATA II host interface directly. Also SATA II controller supports one flash IC.



■ SATA II Controller

The SATA II controller is 3.0Gbps, and supports hot-plug. This SATA II controller support four flash IC and communicates with host interface, this SATA II controller can support the flash ICs both for 2kbyte and 4kbyte per page.

■ Error Detection and Correction

Highly sophisticated Error Correction Code algorithms are implemented. The ECC unit consists of the Parity Unit (parity-byte generation) and the Syndrome Unit (syndrome-byte computation). This unit implements an algorithm that can correct 8 bits per 512 bytes in an ECC block. Code-byte generation during write operations, as well as error detection during read operation, is implemented on the fly without any speed penalties.

■ Mean Time between Failures (MTBF)

Below table summarizes the MTBF prediction results for various SQFlash CFast card configurations. The analysis is performed using a RAM Commander™ failure rate prediction.

- **Failure Rate:** The total number of failures within an item population, divided by the total number of life units expended by that population, during a particular measurement interval under stated condition.
- **Mean Time between Failures (MTBF):** A basic measure of reliability for repairable items: The mean number of life units during which all parts of the item perform within their specified limits, during a particular measurement interval under stated conditions.

Condition	MTBF (Hours)
Telcordia SR-332 GB, 25°C	> 3,000,000

■ Wear Leveling

Flash memory can be erased within a limited number of times. This number is called the erase cycle limit or write endurance limit and is defined by the flash array vendor. The erase cycle limit applies to each individual erase block in the flash device.

Advantech SQFlash CFast card uses a static wear-leveling algorithm to ensure that consecutive writes of a specific sector are not written physically to the same page and block in the flash. This spreads flash media usage evenly across all pages, thereby extending flash lifetime.

■ Bad Blocks Management

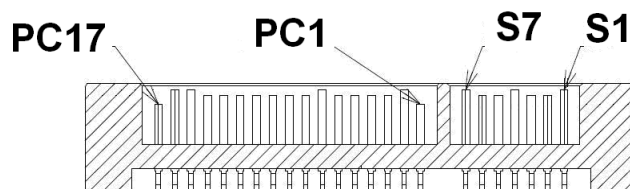
Bad Blocks are blocks that contain one or more invalid bits whose reliability are not guaranteed. The Bad Blocks may be presented while the SQFlash CFast card is shipped, or may develop during the life time of the SQFlash CFast card. The Bad Blocks will not exceed more than 6.25% of the total device volume. When the Bad Blocks is detected, it will be flagged, and not be used anymore. The SQFlash CFast card implements Bad Blocks management, Bad Block replacement, Error Correct Code to avoid data error occurred. The functions will be enabled automatically to transfer data from Bad Blocks to spare blocks, and correct error bit.

4. Pin Assignment and Description

4.1 CFast card Interface Pin Assignments (Signal and Power Segment)

Pin #	Segment	Name	Description	Mate Sequence
S1	SATA	SGND	Ground for signal integrity	1 st
S2	SATA	A+	Differential signal pair A	2 nd
S3	SATA	A-		2 nd
S4	SATA	SGND	Ground for signal integrity	1 st
S5	SATA	B-	Differential signal pair B	2 nd
S6	SATA	B+		2 nd
S7	SATA	SGND	Ground for signal integrity	1 st

Pin #	Segment	Name	Description	Mate Sequence
PC1	PWR/CTL	CDI	Card Detect In	3 rd
PC2	PWR/CTL	GND		1 st
PC3	PWR/CTL	TBD		2 nd
PC4	PWR/CTL	TBD		2 nd
PC5	PWR/CTL	TBD		2 nd
PC6	PWR/CTL	TBD		2 nd
PC7	PWR/CTL	GND		1 st
PC8	PWR/CTL	LED1	LED Output	2 nd
PC9	PWR/CTL	LED2	LED Output	2 nd
PC10	PWR/CTL	IO1	Reserved Input/Output	2 nd
PC11	PWR/CTL	IO2	Reserved Input/Output	2 nd
PC12	PWR/CTL	IO3	Reserved Input/Output	2 nd
PC13	PWR/CTL	PWR	Device Power (3.3V)	2 nd
PC14	PWR/CTL	PWR	Device Power (3.3V)	2 nd
PC15	PWR/CTL	PGND	Device Ground	1 st
PC16	PWR/CTL	PGND	Device Ground	1 st
PC17	PWR/CTL	CDO	Card Detect Out	3 rd



4.2 CFast card Interface Pin Description (Signal and Power Segment) Description of Signal Segment Pins

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Name	Type	Description
SGND	Signal Ground	These are intended to provide isolation for the high speed differential signals.
A+, A-, B+, B-	SATA Differential	The functionality and electrical characteristics of these pins are defined in the SATA reference

Description of PWR/CTL Segment Pins

Name	Type	Description
CDI	CMOS Input	This signal is driven by the CFast host, and shall be sampled by the CFast device. This pin shall be shorted on a CFast device to CDO. This signal and CDO provide a mechanism for a CFast host to detect that a CFast device has been fully inserted, and so that power can be applied safely. The host may drive, and the device may sample, this pin to provide signaling to enable CFast Power Management Sleep state.
CDO	CMOS Output	This pin shall be shorted on the CFast device to CDI. It is effectively driven by CDI.
LED1	LED Output	LED Output
LED2	LED Output	LED Output
IO1	CMOS Input/Output	Unassigned Input/Output pin
IO2	CMOS Input/Output	Unassigned Input/Output pin
IO3	CMOS Input/Output	Unassigned Input/Output pin

5. Identify Device Data

The Identify Device Data enables Host to receive parameter information from the device. The parameter words in the buffer have the arrangement and meanings defined in below table. All reserve bits or words are zero

Word	Description	Value
0	General Configuration Bit 15 0=ATA device Bit 14:8 Retired Bit 7:6 Obsolete Bit 5:3 Retired Bit 2 Response incomplete Bit 1 Retired Bit 0 reserved	045Ah
1	Number of logical cylinders	XXXXh
2	Specific configuration	0000h
3	Number of logical heads	16
4-5	Retired	0000h
6	Number of logical sectors per logical track	63
7-8	Number of sectors per card	XXXXh
9	Retired	0000h
10-19	Serial number in 20 ASCII	aaa
20-21	Retired	0002h 0002h
22	Obsolete	0004h
23-26	Firmware revision in 8 ASCII	aaaa
27-46	Model number in 40 ASCII	aaaa
47	15-8: 80 7-0: 00h Reserved 01h-FFh: Maximum number of sectors that shall be transferred per DRQ data block on READ/WRITE Multiple commands	8002h
48	Trusted Computing feature set options 15 shall be cleared to zero 14 shall be set to one 13:1 Reserved for the Trusted Computing Group 0 0 = Trusted Computing feature set is not supported	0000h
49	Capabilities 15-14: Reserved for the IDENTIFY PACKET DEVICE command. 13: 1=Standby timer values as specified in this standard are supported 0:Standby timer values shall be managed by the device 12: Reserved for the IDENTIFY PACKET DEVICE command 11: 1=IORDY supported 0=IORDY may be disabled 10 1: IORDY may be disabled 9 1=LBA supported 8 1=DMA supported. 7-0 Retired	0F00h
50	Capabilities 15: Shall be cleared to zero 14: Shall be set to one 13:2 Reserved 1 Obsolete 0 0	0000h
51	PIO data transfer cycle timing mode	0200h

52	Obsolete	0000h
53	15 Free-fall control Sensitivity 00h: Vendor's recommended setting 7:3 Reserved 2: 1=the fields reported in word 88 are valid 1: 1=the fields reported in words (70:64) are valid 0: Obsolete	0007h
54	Number of current logical cylinders	XXXXh
55	Number of current logical heads	XXXXh
56	Number of current logical sectors per logical track	XXXXh
57-58	Current capacity in sectors	XXXXh
59	15:9 Reserved 8 0:Multiple sector setting is invalid 7:0 Current setting for number of logical sectors that shall be transferred per DRQ data block on READ/WRITE Multi commands	0102h
60-61	Total number of user address sectors(DWord)	XXXXXXXXh
62	Obsolete	0000h
63	Multi-word DMA transfer(Not support)	0007h
64	15-8 Reserved 7-0 PIO modes supported	0003h
65	Minimum Multiword DMA transfer cycle time per word 15-0 Cycle time in nanoseconds	0078h
66	Manufacturer's recommended Multiword DMA transfer cycle time per word 15-0 Cycle time in nanoseconds	0078h
67	Minimum PIO transfer cycle time without flow control 15-0 Cycle time in nanoseconds	0078h
68	Minimum PIO transfer cycle time with IORDY flow control 15-0 Cycle time in nanoseconds	0078h
69-74	Reserved	0000h
75	No DMA QUEUED command supports	0000h
76	Serial ATA Capabilities 15:11 Reserved for Serial ATA 10 1= Supports Phy Event Counters 9 1= Supports receipt of host initiated power management Requests 8 0= No Support native Command Queuing 7:3 Reserved for future SATA signaling speed grades 2 1=Supports SATA Gen2 Signaling Speed (3.0Gb/s) 1 1=Support SATA Gen1 Signaling Speed (1.5Gb/s) 0 Shall be cleared to zero	0000h
77	Reserved for Serial ATA	0000h
78	Serial ATA features supported 15:7 Reserved for Serial ATA 6 0=Device not supports Software Settings Preservation 5 Reserved for Serial ATA 4 0= Device not supports in-order data delivery 3 0= Device not supports initiating power management 2 0= Device not supports DMA Setup auto-activation 1 0= Device not supports non-zero buffer offsets 0 Shall be cleared to zero	0000h
79	Serial ATA feature enabled 15:7 Reserved for Serial ATA 6 0=Software Settings Preservation not enabled 5 0=Reserved for Serial ATA 4 0= In-order data delivery not enabled	0000h

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	<p>3 0= Device initiated power management not enabled 2 0= DMA setup auto-activation not enabled 1 0= Non-zero buffer offsets not enabled 0 Shall be cleared to zero</p>	
80-81	ATA Version support (ATA8-ACS)	0020 0000h
82	<p>Command and feature sets supported 15 0 = Obsolete 14 0 = NOP Command not supported 13 0 = READ BUFFER Command not supported 12 0 = WRITE BUFFER Command not supported 11 0 = Obsolete 10 0 = Host Protected Area Feature Set not supported 9 0 = DEVICE RESET Command not supported 8 0 = SERVICE Interrupt not supported 7 0 = RELEASE Interrupt not supported 6 1 = Look-ahead supported 5 1 = Write Cache supported 4 0 = indicate that the PACKET feature set is not supported 3 1 = mandatory Power Management Feature Set supported 2 0 = Obsolete 1 0 = Security Mode Feature Set not supported 0 1 = SMART Feature Set supported</p>	700Ah
83	<p>Command and feature sets supported 15 Shall be cleared to zero 14 Shall be set to one 13 0 = FLUSH CACHE EXT Command not supported 12 1 = mandatory FLUSH CACHE Command supported 11 0 = Device Configuration Overlay feature set not supported 10 0 = 48-Bit Address feature set not supported 9 0 = Automatic Acoustic Management feature set not supported 8 0 = SET MAX security extension not supported 7 0 = See Address Offset Reserved Area Boot, INCITS TR27:2001 6 0 = SET FEATURES subcommand not required to spin-up after power-up 5 0 = Power-Up in Standby feature set supported 4 0 = Removable Media Status Notification feature set not supported 3 0 = Advanced Power Management feature set not supported 2 0 = CFA feature set not supported 1 0 = READ/WRITE DMA QUEUED not supported 0 1 = DOWNLOAD MICROCODE Command supported</p>	5004h
84	<p>Command Set/Feature Supported Extension 15 Shall be cleared to zero 14 Shall be set to one 13-6 Reserved 5 0 = General Purpose Logging feature set not supported 4 reserved 3 0 = Media Card Pass Through Command feature set not supported 2 0 = Media Serial Number not supported 1 0 = SMART self-test not supported 0 1 = SMART Error Logging not supported</p>	4000h
85	<p>Command and feature sets supported or enabled 15 0 = Obsolete 14 0 = NOP Command not enabled 13 0 = READ BUFFER Command not enabled 12 0 = WRITE BUFFER Command not enabled 11 Obsolete 10 0 = Host Protected Area feature set not enabled 9 0 = DEVICE RESET Command not enabled 8 0 = SERVICE Interrupt not enabled</p>	7008

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	<p>7 0 = RELEASE Interrupt not enabled 6 0 = Look-ahead not enabled 5 0 = Write Cache not enabled 4 Shall be cleared to zero to indicate that the PACKET Command feature set is not supported. 3 1 = Power Management Feature Set enabled 2 0 = Removable Media feature set not enabled 1 0 = Security Mode Feature Set not enabled 0 0 = SMART Feature Set not enabled</p>	
86	<p>Command set/feature enabled 15-14 0 = Reserved 13 0 = FLUSH CACHE EXT Command not supported 12 1 = FLUSH CACHE Command supported 11 0 = Device Configuration Overlay not supported 10 0 = 48-Bit Address features set not supported 9 0 = Automatic Acoustic Management feature set not enabled 8 0 = SET MAX security extension not enabled by SET MAX SETPASSWORD 7 0 = Reserved 6 0 = SET FEATURES subcommand required to spin-up after power-up not enabled 5 0 = Power-Up in Standby feature set not enabled 4 0 = Obsolete 3 1 = Advanced Power Management feature set enabled 2 0 = CFA feature set not supported 1 0 = READ/WRITE DMA QUEUED Command not supported 0 1 = DOWNLOAD MICROCODE Command supported</p>	1004h
87	<p>Command and feature sets supported or enabled 15 Shall be cleared to zero 14 Shall be set to one 13 1 = IDLE IMMEDIATE with UNLOAD FEATURE supported 12 0 = Reserved for Technical Report, INCITS TR-37-2004 11 0 = Reserved for Technical Report, INCITS TR-37-2004 10:9 0 = Obsolete 8 0 = 64-Bit World Wide Name not supported 7 0 = WRITE DMA QUEUED FUA EXT Command not supported 6 0 = WRITE DMA FUA EXT and WRITE MULTIPLE FUA EXT commands not supported 5 0 = General Purpose Logging feature set not supported 4 0 = Obsolete 3 0 = Media Card Pass Through Command feature set not supported 2 0 = Media Serial Number is not valid 1 0 = SMART Self-Test not supported 0 0 = SMART Error-Logging not supported</p>	4000h
88	<p>Ultra DMA modes 15 Reserved 14 0 = Ultra DMA mode 6 is not supported 13 1= Ultra DMA mode 5 is selected 0= Ultra DMA mode 5 is not selected 12 1= Ultra DMA mode 4 is selected 0= Ultra DMA mode 4 is not selected 11 1= Ultra DMA mode 3 is selected 0= Ultra DMA mode 3 is not selected 10 1= Ultra DMA mode 2 is selected 0= Ultra DMA mode 2 is not selected 9 1= Ultra DMA mode 1 is selected 0= Ultra DMA mode 1 is not selected 8 1= Ultra DMA mode 0 is selected</p>	X01Fh

	0= Ultra DMA mode 0 is not selected 7 Reserved 6 0= Ultra DMA mode 6 is not supported 5 1= Ultra DMA mode 5 and below are supported 4 1= Ultra DMA mode 4 and below are supported 3 1= Ultra DMA mode 3 and below are supported 2 1= Ultra DMA mode 2 and below are supported 1 1= Ultra DMA mode 1 and below are supported 0 1= Ultra DMA mode 0 is supported	
89	Time required for Normal Erase mode SECURITY ERASE UNIT command	0000h
90	Time required for Enhanced erase mode SECURITY ERASE UNIT command	0000h
91	Current advanced power management level value	0000h
92	Master Password Identifier	0000h
93	Hardware reset result	XXXXh
94	Current automatic acoustic management value 15:8 Vendor's recommended acoustic management value. 7:0 Current automatic acoustic management value.	0000h
95-126	Reserved	0000h
127	Obsolete	0000h
128	Security Status 15:9 Reserved 8 Security level 0 = high, 1 = Maximum 7:6 Reserved 5 1= Enhanced security erase supported 4 1= Security count expired 3 0= Security frozen. 2 0 = Security not locked 1 0= Security not enabled 0 0= Security not supported	0000h
129-159	Vendor specific	0000h
160	CFA power mode 1	0000h
161-175	Reserved	0000h
176-205	Current media serial number	0000h
206-254	Reserved	0000h
255	Integrity word 15:8 Check Sum 7:0 Signature	XXXXh

6. ATA Command Set

[Command Set List]

Class	Command	Code	FR	SC	SN	CY	DH	LBA
1	Check Power Mode	98H or E5H	-	-	-	-	D	-
1	Execute Device Diagnostic	90H	-	-	-	-	D	-
1	Erase Sector(s)	C0H	-	Y	Y	Y	Y	Y
2	Format Track	50H	-	Y	-	Y	Y	Y
1	Identify Device	ECH	-	-	-	-	D	-
1	NOP	00H	-	-	-	-	D	-
1	Read Buffer	E4H	-	-	-	-	D	-
1	Read Long Sector	22H or 23H	-	-	Y	Y	Y	Y
1	Read Verify Sector(s)	40H or 41H	-	Y	Y	Y	Y	Y
1	Recalibrate	1XH	-	-	-	-	D	-
1	Seek	7XH	-	-	Y	Y	Y	Y
1	Set Multiple Mode	C6H	-	Y	-	-	D	-
1	Set Sleep Mode	99H or E6H	-	-	-	-	D	-
1	Standby	96H or E2H	-	-	-	-	D	-
1	Standby Immediate	94H or E0H	-	-	-	-	D	-
2	Write Buffer	E8H	-	-	-	-	D	-

Note: FR: Feature Register
 SC: Sector Count Register
 SN: Sector Number Register
 CY: Cylinder Registers
 DH: Card/Device/Head Register
 LBA: LBA Block Address Mode Supported

[Command Set Descriptions]

1. CHECK POWER MODE (code: 98h or E5h);

Register	7	6	5	4	3	2	1	0
Command(7)	98h or E5h							
C/D/H(6)	X			Drive	X			
Cylinder High(5)	X							
Cylinder Low(4)	X							
Sector Number(3)	X							
Sector Count(2)	X							
Feature(1)	X							

This command checks the power mode. If the CompactFlash Storage is in, going to, or recovering from the sleep mode, the CFast card sets BSY, sets the Sector Count Register to 00h, clears BSY and generates an interrupt. If the CFast card is in idle mode, the CFast card sets BSY, sets the Sector Count Register to FFh, clears BSY and generates an interrupt.

2. Execute Device Diagnostic (code: 90h);

Register	7	6	5	4	3	2	1	0
Command(7)	90h							
C/D/H(6)	X			Drive	X			
Cylinder High(5)	X							
Cylinder Low(4)	X							
Sector Number(3)	X							
Sector Count(2)	X							
Feature(1)	X							

This command performs the internal diagnostic tests implemented by the CFast card. When the diagnostic command is issued in the True IDE Mode, the Drive bit is ignored and the diagnostic command is executed by both the Master and the Slave with the Master responding with status for both devices. Diagnostic Codes are returned in the Error Register at the end of the command.

Code	Error Type
01h	No Error Detected
02h	Formatter Device Error
03h	Sector Buffer Error
04h	ECC Circuitry Error
05h	Controller Microprocessor Error
8Xh	Slave Error in True IDE Mode

3. Erase Sector(s) (code: C0h);

Register	7	6	5	4	3	2	1	0
Command(7)	C0h							
C/D/H(6)	1	LBA	1	Drive	Head (LBA 27-24)			
Cylinder High(5)	Cylinder High (LBA 23-16)							
Cylinder Low(4)	Cylinder Low (LBA 15-8)							
Sector Number(3)	Sector Number (LBA 7-0)							
Sector Count(2)	Sector Count							
Feature(1)	X							

This command is used to pre-erase and condition data sectors in advance of a Write without Erase or Write Multiple without Erase command. There is no data transfer associated with this command but a Write Fault error status can occur.

4. Format Track (code: 50h);

Register	7	6	5	4	3	2	1	0
Command(7)	50h							
C/D/H(6)	1	LBA	1	Drive	Head (LBA 27-24)			
Cylinder High(5)	Cylinder High (LBA 23-16)							
Cylinder Low(4)	Cylinder Low (LBA 15-8)							
Sector Number(3)	X (LBA 7-0)							
Sector Count(2)	Count(LBA mode only)							
Feature(1)	X							

This command writes the desired head and cylinder of the selected drive with a vendor unique data pattern (typically FFh or 00h). To remain host backward compatible, the CFast card expects a sector buffer of data from the host to follow the command with the same protocol as the Write Sector(s) command although the information in the buffer is not used by the CFast card. If LBA=1 then the number of sectors to format is taken from the Sec Cnt register (0=256).

5. Identify Device (code: ECh);

Register	7	6	5	4	3	2	1	0
Command(7)	ECh							
C/D/H(6)	X	X	X	Drive	X			
Cylinder High(5)	X							
Cylinder Low(4)	X							
Sector Number(3)	X							
Sector Count(2)	X							
Feature(1)	X							

The Identify Device command enables the host to receive parameter information from the CFast card. This command has the same protocol as the Read Sector(s) command. All reserved bits or words are zero. Hosts should not depend in Obsolete words in Identify Device containing 0.

6. NOP (code: 00h);

Register	7	6	5	4	3	2	1	0
Command(7)	00h							
C/D/H(6)	X				Drive	X		
Cylinder High(5)	X							
Cylinder Low(4)	X							
Sector Number(3)	X							
Sector Count(2)	X							
Feature(1)	X							

This command always fails with the CFast card returning command aborted.

7. Read Buffer (code: E4h);

Register	7	6	5	4	3	2	1	0
Command(7)	E4h							
C/D/H(6)	X				Drive	X		
Cylinder High(5)	X							
Cylinder Low(4)	X							
Sector Number(3)	X							
Sector Count(2)	X							
Feature(1)	X							

The Read Buffer command enables the host to read the current contents of the CFast card sector buffer. This command has the same protocol as the Read Sector(s) command.

8. Read Long Sector (code: 22h or 23h);

Register	7	6	5	4	3	2	1	0
Command(7)	22h or 23h							
C/D/H(6)	1	LBA	1	Drive	Head (LBA 27-24)			
Cylinder High(5)	Cylinder High (LBA 23-16)							
Cylinder Low(4)	Cylinder Low (LBA 15-8)							
Sector Number(3)	Sector Number (LBA 7-0)							
Sector Count(2)	X							
Feature(1)	X							

The Read Long command performs similarly to the Read Sector(s) command except that it returns 516 bytes of data instead of 512 bytes. During a Read Long command, the CFast card does not check the ECC bytes to determine if there consists of 512 bytes of data transferred in word mode followed by 4 bytes of ECC data transferred in byte mode. This command has the same protocol as the Read Sector(s) command. Use of this command is not recommended.

9. Read Sector(s) (code: 20h or 21h);

Register	7	6	5	4	3	2	1	0
Command(7)	20h or 21h							
C/D/H(6)	1	LBA	1	Drive	Head (LBA 27-24)			
Cylinder High(5)	Cylinder High (LBA 23-16)							
Cylinder Low(4)	Cylinder Low (LBA 15-8)							
Sector Number(3)	Sector Number (LBA 7-0)							
Sector Count(2)	Sector Count							
Feature(1)	X							

This command reads from 1 to 256 sectors as specified in the Sector Count Register. A sector count of 0 requests 256 sectors. The transfer begins at the sector specified in the Sector Number Register. When this command is issued and after each sector of data (except the last one) has buffer, sets DRQ, clears BSY, and generates an interrupt. The host then reads the 512 bytes of data from the buffer.

At command completion, the Command Block Registers contain the cylinder, head and sector number of the last sector read. If an error occurs, the read terminates at the sector where the error occurred. The command Block Registers contain the cylinder head, and sector number of the sector where the error occurred. The flawed data is pending in the sector buffer.

10. Read Verify Sector(s) (code: 40h or 41h);

Register	7	6	5	4	3	2	1	0
Command(7)	40h or 41h							
C/D/H(6)	1	LBA	1	Drive	Head (LBA 27-24)			
Cylinder High(5)	Cylinder High (LBA 23-16)							
Cylinder Low(4)	Cylinder Low (LBA 15-8)							
Sector Number(3)	Sector Number (LBA 7-0)							
Sector Count(2)	Sector Count							
Feature(1)	X							

This command is identical to the Read Sectors command, except that DRQ is never set and no data is transferred to the host. When the command is accepted, the CFast card sets BSY. When the requested sectors have been verified, the CFast card clears BSY and generates an interrupt. Upon command completion, the Command Block Registers contain the cylinder, head, and sector number of the last sector verified. If an error occurs, the Read Verify Command terminates at the sector where the error occurs. The Command Block Registers contain the cylinder, head and sector number of the sector where the error occurred. The Sector Count Register contains the number of sectors not yet verified.

11. Recalibrate (code: 1Xh);

Register	7	6	5	4	3	2	1	0
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Command(7)	1Xh				
C/D/H(6)	1	LBA	1	Drive	X
Cylinder High(5)	X				
Cylinder Low(4)	X				
Sector Number(3)	X				
Sector Count(2)	X				
Feature(1)	X				

This command is effectively a NOP command to the CFast card and is provided for compatibility.

12. Seek (code: 7Xh);

Register	7	6	5	4	3	2	1	0
Command(7)	7Xh							
C/D/H(6)	1	LBA	1	Drive	Head (LBA 27-24)			
Cylinder High(5)	Cylinder High (LBA 23-16)							
Cylinder Low(4)	Cylinder Low (LBA 15-8)							
Sector Number(3)	X (LBA 7-0)							
Sector Count(2)	X							
Feature(1)	X							

This command is effectively a NOP command to the CFast card although it does perform a range check of cylinder and head or LBA address and returns an error if the address is out of range.

13. Set Multiple Mode (code: C6h);

Register	7	6	5	4	3	2	1	0
Command(7)	C6h							
C/D/H(6)	X			Drive	X			
Cylinder High(5)	X							
Cylinder Low(4)	X							
Sector Number(3)	X							
Sector Count(2)	Sector Count							
Feature(1)	X							

This command enables the CFast card to perform Read and Write Multiple operations and establishes the block count for these commands. The Sector Count Register is loaded with the number of sectors per block. Upon receipt of the command, the CFast card sets BSY to 1 and checks the Sector Count Register. If the Sector Count Register contains a valid value and the block count is supported, the value is loaded and execution is enabled for all subsequent Read Multiple and Write Multiple commands. If the Sector Count Register contains 0 when the command is issued, Read and Write Multiple commands are disabled. At power on, or after a hardware or (unless disabled by a Set Feature command) software reset, the default mode is Read and Write multiple disabled.

14. Set Sleep Mode (code: 99h or E6h);

Register	7	6	5	4	3	2	1	0
Command(7)	99h or E6h							

C/D/H(6)	X	Drive	X
Cylinder High(5)	X		
Cylinder Low(4)	X		
Sector Number(3)	X		
Sector Count(2)	X		
Feature(1)	X		

This command causes the CFast card to set BSY, enter the Sleep mode, clear BSY and generate an interrupt. Recovery from sleep mode is accomplished by simply issuing another command (a reset is permitted but not required). Sleep mode is also entered when internal timers expire so the host does not need to issue this command except when it wishes to enter Sleep mode immediately. The default value for the timer is 5 milliseconds.

15. Standby (code: 96h or E2h);

Register	7	6	5	4	3	2	1	0
Command(7)	96h or E2h							
C/D/H(6)	X			Drive	X			
Cylinder High(5)	X							
Cylinder Low(4)	X							
Sector Number(3)	X							
Sector Count(2)	X							
Feature(1)	X							

This command causes the CFast card to set BSY, enter the Sleep mode, clear BSY and return interrupt immediately. Recovery from sleep mode is accomplished by simply issuing another command (a reset is not required).

16. Standby Immediate (code: 94h or E0h);

Register	7	6	5	4	3	2	1	0
Command(7)	94h or E0h							
C/D/H(6)	X			Drive	X			
Cylinder High(5)	X							
Cylinder Low(4)	X							
Sector Number(3)	X							
Sector Count(2)	X							
Feature(1)	X							

This command causes the CFast card to set BSY, enter the Sleep mode, clear BSY and return the interrupt immediately. Recovery from sleep mode is accomplished by simply issuing another command (a reset is not required).

17. Write Buffer (code: E8h);

Register	7	6	5	4	3	2	1	0
Command(7)	E8h							
C/D/H(6)	X			Drive	X			

Cylinder High(5)	X
Cylinder Low(4)	X
Sector Number(3)	X
Sector Count(2)	X
Feature(1)	X

The Write Buffer command enables the host to overwrite contents of the CFast card sector buffer with any data pattern desired. This command has the same protocol as the Write Sector(s) command and transfer 512 bytes.

18. Security Set Password (code: F1h);

Register	7	6	5	4	3	2	1	0
Features	Na							
Sector Count	Na							
LBA Low	Na							
LBA Mid	Na							
LBA High	Na							
Device	obs	Na	obs	Na	Na			
Command	F1h							

This command transfer 512 byte of data from the host. The revision code field shall be returned in the IDENTIFY DEVICE word 92. The valid revision codes are 0001h through FFFEh. A value of 0000h or FFFFh indicates that the Master Password Revision Code is not supported.

19. Security Unlock (code: F2h);

Register	7	6	5	4	3	2	1	0
Features	Na							
Sector Count	Na							
LBA Low	Na							
LBA Mid	Na							
LBA High	Na							
Device	obs	Na	obs	Na	Na			
Command	F2h							

This command transfers 512 bytes of data from the host. If the Identifier bit is set to Master and the device is in high security level, then the password supplied shall be compared with the stored Master password. If the device is in maximum security level then the unlock shall be rejected.

If the Identifier bit is set to user then the device shall compare the supplied password with the stored User password. If the password compare fails then the device shall return command aborted to the host and decrements the unlock counter. This counter shall be initially set to five and shall decremented for each password mismatch when SECURITY UNLOCK and SECURITY ERASE UNIT commands shall be command aborted until a power-on reset or a hardware reset. SECURITY UNLOCK commands issued when the device is unlocked have no effect on the unlock counter.

20. Security Erase Prepare (code: F3h);

Register	7	6	5	4	3	2	1	0
Features	Na							
Sector Count	Na							
LBA Low	Na							

Specifications subject to change without notice, contact your sales representatives for the most update information.

LBA Mid	Na				
LBA High	Na				
Device	obs	Na	obs	Na	Na
Command	F3h				

The SECURITY ERASE PREPARE command shall be issued immediately before the SECURITY ERASE UNIT command to enable device erasing and unlocking. This command prevents accidental loss of data on the device.

21. Security Erase Unit (code: F4h);

Register	7	6	5	4	3	2	1	0
Features	Na							
Sector Count	Na							
LBA Low	Na							
LBA Mid	Na							
LBA High	Na							
Device	obs	Na	obs	Na	Na	Na	Na	Na
Command	F4h							

This command transfer 512 bytes of data from the host. If the password does not match the password previously saved by the device, the device shall reject the command with command aborted. The SECURITY ERASE PREPARE command shall be completed immediately prior to the SECURITY ERASE UNIT command. If the device receives a SECURITY ERASE UNIT command without an immediately prior SECURITY ERASE PREPARE command, the device shall command abort the SECURITY ERASE UNIT command. When Normal Erase mode is specified, the SECURITY ERASE UNIT command shall write binary zeroes to all user data areas. The Enhanced Erase mode is optional. When Enhanced Erase Mode is specified, the device shall write predetermined data patterns to all user areas. In Enhanced Erase mode, all previously written user data shall be overwritten, including sectors that are no longer in use due to reallocation. This command shall disable the device Lock mode, however, the Master password shall still be stored internally within the device and may be reactivated later a new User password is set.

22. Security Freeze Lock (code: F5h);

Register	7	6	5	4	3	2	1	0
Features	Na							
Sector Count	Na							
LBA Low	Na							
LBA Mid	Na							
LBA High	Na							
Device	Obs	Na	obs	Na	Na	Na	Na	Na
Command	F5h							

The SECURITY FREEZE LOCK command shall set the device to Frozen mode. After command completion any other commands that update the device Lock mode shall be command aborted. Frozen mode shall be disabled by power-off or hardware reset. If SECURITY FREEZE LOCK shall be issued when the device in Frozen mode, the command executes and the device shall remain in Frozen mode.

23. Security Disable Password (code: F6h);

Register	7	6	5	4	3	2	1	0
Features	Na							
Sector Count	Na							
LBA Low	Na							
LBA Mid	Na							

LBA High	Na							
Device	obs	Na	obs	Na	Na	Na	Na	Na
Command	F6h							

The SECURITY DISABLE PASSWORD command transfer 512 bytes of data from the host. If the password selected by word 0 matches the password previously saved by the device, the device shall disable the Lock mode. This command shall not change the Master password. The Master password shall be reactivated when a User password if set.

7. System Power Consumption

7.1 DC Input Voltage

Parameter	Rating
Operating Voltage	3.3V +/- 10%

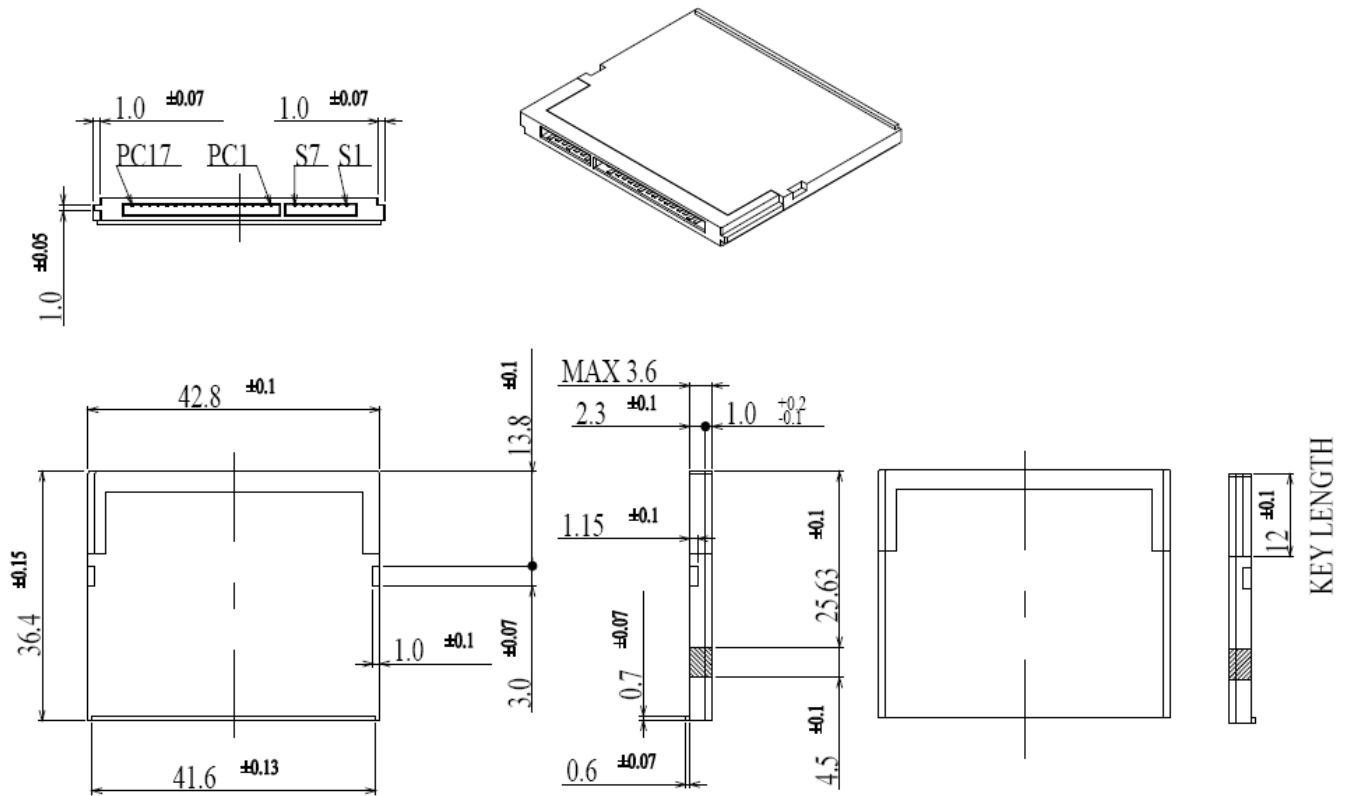
7.2 Power Consumption

Parameter	Value
Sustained Read	110 mA (max.)
Sustained Write	190 mA (max.)
IDLE	70 mA (max.)

8. Device Parameters

Capacity	Cylinders	Heads	Sectors	LBA
2GB	3,900	16	63	3,932,160
4GB	7,801	16	63	7,864,320
8GB	15,603	16	63	15,728,640
16GB	16,383	16	63	31,457,280

9. Physical Dimension
CFast card (Unit: mm)



Appendix: Part Number Table

Product	Advantech PN
Advantech SQFlash CFast Card 2GB SLC, 2-CH, DMA (0~70°C)	SQF-S10S2-2G-CTE
Advantech SQFlash CFast Card 4GB SLC, 4-CH, DMA (0~70°C)	SQF-S10S4-4G-CTE
Advantech SQFlash CFast Card 8GB SLC,4-CH, DMA (0~70°C)	SQF-S10S4-8G-CTE
Advantech SQFlash CFast Card 16GB SLC, 4-CH, DMA (0~70°C)	SQF-S10S4-16G-CTE
Advantech SQFlash CFast Card 2GB SLC, 2-CH, DMA (-40~85°C)	SQF-S10S2-2G-ETE
Advantech SQFlash CFast Card 4GB SLC, 4-CH, DMA (-40~85°C)	SQF-S10S4-4G-ETE
Advantech SQFlash CFast Card 8GB SLC,4-CH, DMA (-40~85°C)	SQF-S10S4-8G-ETE
Advantech SQFlash CFast Card 16GB SLC, 4-CH, DMA (-40~85°C)	SQF-S10S4-16G-ETE