

# Samsung' s ATA Flash Controllers

## Reference Design Manual

### CompactFlash / PC Card / IDE Disk

#### HELP DESK

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Samsung Electronics Co.,LTD

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## Revision History

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This attached guide reference is prepared and approved by SAMSUNG Electronics CO.,LTD.

SAMSUNG Electronics CO., LTD. reserve the right to change the specifications.

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# Chapter 1

## Introduction

## 1.1 Overview

This document describes application information required to assemble PC-ATA, CompactFlash card and True-IDE hard disk with Samsung's "NAND Flash memory" and "NAND Flash controllers". Samsung manufactures both the "NAND Flash memory" and "NAND Flash controllers". Until now, the NAND Flash of density ranging 4Mb to 1Gb is available. For more detailed features and specifications for NAND Flash memory, please refer to the current data sheets and technical note parts. (<http://www.intl.samsungsemi.com/Memory/Flash/datasheets.html>). The NAND Flash controllers support 32Mb, 64Mb, 128Mb, 256Mb, 512Mb and 1Gb NAND Flash memory made by Samsung. S3C49F9X and S3CI910X are under mass production. (X means a version number for firmware and hardware revision)

## 1.2 NAND Flash Components & Controllers

### 1.2.1 NAND Flash Components

Density (Under M/P)	Power Supply	Features	Access Time	Program / Erase Time	Package
1Gb (K9D1G08U0M-YCB0)	2.7V~3.6V	512B/Page 16KB/Block	10us/50ns Serial	200us(Per Page) / 2ms(Per Block)	48 TSOP I
512Mb (K9D1208U0A-YCB0 & K9F1208U0M-YCB0)					
256Mb (K9F5608U0A-YCB0)					
128Mb (K9F2808U0B-YCB0)					
64Mb (K9F6408U0B-YCB0)				44(40) TSOP II	
32Mb (K9F3208U0B-YCB0)	250us(Per Page) / 2ms(Per Block)				

### 1.2.2 NAND Flash Controllers

Part Number	Flash Component Supported	Write Performance	Densities Supported (Min. / Max.)	Package
S3C49F9X	Max.10ea	> 1MB/s	4MB / 896MB	100 Pin TQFP
S3CI910X	Max.16ea	> 1.5MB/s	4MB / 256MB	100 Pin TQFP

## 1.3 S3C49F9X Controller Features

### 1.3.1 Features

- PC Card-ATA / True IDE / CompactFlash compatible host interface.
- 1-bit ECC function
- Operating voltage: 3.3V to 5.0V
- System Clock 20MHz
- Efficient and powerful ARM7TDMI CPU core
- The minimum and maximum card capacity is as follows.

NAND Flash Density	Min / Max. Capacity (Number of Flash)
32Mb, 64Mb, 128Mb, 256Mb and 512Mb	4MB / 512MB (Up to 10ea)
1Gb	128MB / 896MB (Up to 7ea)

## 1.4. S3CI910X Controller Features

### 1.4.1 Features

- PC Card-ATA / True IDE / CompactFlash compatible host interface.
- Embedded Intel 80C32 Microprocessor
- On-The-Fly EDC and ECC parity bytes encode
- Embedded 40K SRAM partitioned into 3 sections : 32KB for Data Buffer, 7KB for Firmware Micro code and 1KB for Defect Mapping Table
- Operating voltage : 3.0V to 5.0V    - System Clock 24MHz
- 2-Way Interleave Read/Write capability to reduce Flash access latency
- The minimum and maximum card capacity is as follows

NAND Flash Density	Non-Interleave Mode	
	Min. / Max.Cap. (Number of Flash)	Interleave Mode Min. / Max.Cap. (Number of Flash)
32Mb, 64Mb, 128Mb	4MB / 128MB (Up to 8ea)	4MB / 256MB (Up to 16ea)
256Mb	32MB / 128MB (Up to 4ea)	32MB / 256MB (Up to 8ea)
512Mb	64MB / 128MB (Up to 2ea)	64MB / 256MB (Up to 4ea)
1Gb	128MB (Up to 1ea)	128MB / 256MB (Up to 2ea)

Note: SEC has a plan to increase the maximum card capacity up to 1GB for S3CI910X on September 2001

## 1.5 Design Guide for Card Assembly

The following lists are application information required to assemble cards. Samsung supports items described below in order to help with card assembly.

- Board Schematics and PCB Gerber file : Compact Flash Card, True-IDE Disk
- Data Sheet : S3C49F9X, S3CI910X
- Initialization Utility Program
- Vendor Unique Command Description & CIS/IDI Information
- Compatibility Test Results ( Digital Still Camera, Desk-Top/Handheld PC, Card Reader etc.)

## 1.6 Compliance Test of Cards Assembled with Samsung's Controller

TESTMETRIX has been selected as the official provider of Certification Compliance Testers for the Compact Flash Association. CFA Members can either purchase the compliance tester, or receive an upgrade for an existing tester if already purchased. Samsung's ATA / Compact Flash Production Test Library has been already completed by TESTMETRIX. Manufacturers have to purchase the Production Test Library at TESTMETRIX. (<http://www.testmetrix.com>)

A general compliance test program is offered for registered customer by TESTMETRIX. If customer has no user name and password, please contact with us. Customer has to use the latest compliance test program updated by TESTMETRIX.

# **Chapter 2**

## **For S3C49F9X Flash Controller**

## 2. ATA Card Utility Program

### 2.1 Overview

This utility program is the Flash initialization program provided by Samsung. In order to process the initialization program, manufacturer should use batch file of each density made by Samsung. The batch file consists of ATA and Vendor Unique Command. Samsung provides the following files to manufacturer.

Note : If customer wants to test assembled card, please test it under Native-DOS with SMARTDRV,

### 2.2 Schematics and Manual Files

49CARD\_00.pdf : CF card schematic  
(00 means that version number for CompactFlash card)  
49IDE\_00.pdf : IDE disk schematic  
(00 means that version number for IDE interface like HDD)  
49DATA\_00.pdf : Data sheet for S3C49F9X  
(00 means that version number for firmware revision)  
SAMSUNG.def : CIS/IDI information summary  
49VENDOR.pdf : Described vendor unique commands

### 2.3 Utility Program Files

Users should create a new directory and copy all the files to this new directory.

Cmdlog.c	: Cmdlog source file
Setcmd.c	: Setcmd source file
Longsec.c	: Longsec source file
seata.h	: Header file
Cmdlog.exe	: Cmdlog execution file
Setcmd.exe	: Setcmd execution file
Longsec.exe	: Longsec execution file
Initcard.bat	: This batch program performs initialization of CF card, which controlled by S3C49F9X
Initclr.bat	: This batch program performs initialization of CF card, which controlled by S3C49F9X It must be used carefully. This batch file erases all flash chips clearly. Furthermore, it erases also bitmap information in the flash chips.
samsung.def	: This file contains CIS/IDI information of CF card which controlled by S3C49F9X

## 2.4 Setup I/O Range for System

1. First of all, customer should search I/O range used on customer system. In case of using the cardsoft program made by SystemSoft co., customer can check I/O range using "cardinfo" command under DOS environment.
2. If customer finds your system I/O range, for example, 0x380-0x38F, change header file as follows:
 

```
#define      EVEN_DATA    0x380
#define      ERROR        0x381
#define      FEATURE      0x381
#define      SEC_COUNT    0x382
#define      SEC_NUM      0x383
#define      CYL_LOW      0x384
#define      CYL_HIGH     0x385
#define      DRIVE_HEAD   0x386
#define      STATUS       0x387
```
3. Recompile the source file each by each by using Turbo-c or Borland-c compiler. And then customer will get setcmd.exe, cmdlog.exe and longsec.exe.

To distinguish used I/O range address in the batch file, rename execution files as follows:

```
setcmd.exe ==> set380.exe
cmdlog.exe ==> cmd380.exe
longsec.exe ==> long380.exe
```

If I/O range was 0x270, customer can rename the execution files as follows:

```
setcmd.exe ==> set270.exe
cmdlog.exe ==> cmd270.exe
longsec.exe ==> long270.exe
```

setcmd function : setcmd execution file performs the ATA commands and vendor unique commands.

cmdlog function : cmdlog file executes thereafter read data from controller's buffer save to the host as file of which default file name is "dat.log".

longsec function : longsec execution file performed the same functions of setcmd file except long byte(528bytes) access.

3. Now, customer can use these commands as shown in the following format: (refer to chapter 2.5.3)

<pre>Command &lt;Feature&gt;&lt;Sec Cnt&gt;&lt;Sec Num&gt;&lt;Cyl Low&gt;           &lt;Cyl High&gt;&lt;C/D/H&gt;&lt;Command&gt;[definition file]</pre>
---

\* Command ~ setcmd or cmdlog or longsec

\* [definition file] ~ This is Option.

Ex)

Case1: To read sector

```
C:> cmd380 00 01 01 00 00 00 20
```

Sector's data were stored in host as "dat.log"

You can see "dat.log" file on your current directory.

Case2: To write Sector

```
C:> cmd380 00 01 01 00 00 00 30 CIS_SMP.def
```

Case3: To execute Initial Drive Parameter command

```
C:> set380 00 20 00 00 00 02 91
```

Case4: To write Sector as all "FF"

```
C:> set380 00 01 01 00 00 00 30 FF
```

Case5: To read physical sector from 3rd chip, 0 block, 1 page

```
C:> long380 f0 c0 02 01 00 00 ef
```

## 2.5 How to Use Utility Program

### 2.5.1 Batch File Features

The Compact Flash card and IDE disk need initialization before they are used for the first time. This process requires the several special information. Customer should set the appropriate parameters in the batch file for different density and the number of chips

For example, the initialization of the Compact Flash card consists of following process.

- 1) **Flash Memory Initialization**
- 2) **CIS/IDI Information Amendment**
- 3) **CIS/IDI Read**
- 4) **MBR/PBR Write**
- 5) **Logical Formatting**

For example, the initialization of the IDE disk consists of following process.

- 1) **Flash Memory Initialization**
- 2) **CIS/IDI Information Amendment**
- 3) **CIS/IDI Read**
- 4) **After rebooting on your PC, try to execute FDISK**
- 5) **Logical Formatting**

A batch file is used for the consecutive execution of the above process. This batch file consists of several command according to the above 1) ~ 5) sequences. The main commands used in a batch file, are 'SETCMD', 'LONGSEC', 'CMDLOG', 'ATAINIT' and 'FORMAT'.

'SETCMD', 'LONGSEC' and 'CMDLOG' commands are the utility commands which supported by SAMSUNG Electronics. When customer wants to use these commands, the modifications of the command arguments and the definition file are required.

'ATAINIT' is the special command that is given by PC card reader (PCMCIA type) maker. And 'FORMAT' is DOS command.

## 2.5.2 The Details of Commands

The main commands need to parameters input. The commands require 7 parameters input except 'CMDLOG' (CMDLOG requires 8 parameters. It needs to input the file name of the definition file additionally.) The description of this command is found in Vendor.pdf.

Following source is a batch file to initialize 128MB(256Mb x 4EA) CF card.

```
setcmd f0 c4 00 04 00 a0 ef ← 1) Flash Memory Initialization
longsec f0 c0 00 00 00 a0 ef ← 2) CIS/IDI Information Amendment
cmdlog f0 c5 00 f0 00 a0 ef samsung.def
longsec f0 c0 00 00 00 a0 ef ← 3) Read the written CIS/IDI
longsec f0 c0 00 01 00 a0 ef
c:\cardsoft\atainit.exe d: /v ← 4) Write the MBR/PBR
format d: ← 5) Logical DOS format
:end
```

Following source is a batch file for the initialize for 128MB(256Mb x 4EA) IDE disk.

```
setcmd f0 c4 00 04 00 a0 ef ← 1) Flash Memory Initialization
longsec f0 c0 00 00 00 a0 ef ← 2) CIS/IDI Information Amendment
cmdlog f0 c5 00 f0 00 a0 ef samsung.def
longsec f0 c0 00 00 00 a0 ef ← 3) Read the written CIS/IDI
longsec f0 c0 00 01 00 a0 ef
:end
```

CAUTION :

To initialize an IDE disk based on these platforms, customer should remove two lines (" c:\cardsoft\atainit.exe d: /v" and " format d:") from the batch file of compact Flash card above. That is, customer should not use CardSoft program made by SystemSoft co.. An initialization method for IDE disk is as follows.

1. Setting of hardware :
  - Connect to primary master or slave
  - Use DOS diskette for IDE drive system booting
  - Try to store source, execution and batch files into DOS diskette
2. Execute power-off or software reset (ctrl+alt+delete)
3. Execute an appropriate batch file according to the disk capacity
4. After rebooting on PC, try to execute FDISK and logical DOS Format

Customer has to change the value according to number of mounted Flash memory. Line "setcmd f0 c4 00 #1 (Number of mounted Flash memory) 00 a0 ef "of batch file should be modified as following examples. For example, 04 means that four Flash memory are mounted on card.

Line "cmdlog f0 c5 00 f0 00 a0 ef samsung.def " : Writes CIS/DID information into Flash memory.

- After Completion of Initialization for Flash

c:\cardsoft\atainit.exe d: /v	← Create the boot sector
format d:	← DOS Logical format

ATAINIT is a to create a DOS partition on the Flash Disk card.  
This program is the utility program which is given by SytemSoft Corp..

### 2.5.3 Command Form

[FORM] SETCMD <feature> <sec\_cnt> <sec\_num> <cyl\_low> <cyl\_high> <C/D/H> <command>

[FORM] LONGSEC <feature> <sec\_cnt> <sec\_num> <cyl\_low> <cyl\_high> <C/D/H> <command>

[FORM] CMDLOG <feature> <sec\_cnt> <sec\_num> <cyl\_low> <cyl\_high> <C/D/H> <command> <definition file >

<feature> : **Feature register set value.**

Used when the host sets a particular function to the card. Available only for writing data and not for reading.

<sec\_cnt> : **Sector count register set value.**

The host sets the number of sectors to transfer in this register. The default setting is "01H" . The number of sectors are 256 when "00H" is set.

<sec\_num> : **Sector number register set value.**

Sets the number of the sector where transfer start.

<cyl\_low> : **Cylinder low register set value.**

Sets the lower 8bits of the number of the cylinder where the sector transfer starts.

<cyl\_high> : **Cylinder high register set value.**

Sets the upper 8bits of the number of the cylinder where the sector transfer starts.

<C/D/H> : **Drive head register set value.**

Sets the LBA,DRV and head number . When LBA=0,the cylinder head sector(CHS) mode is selected. The DRV bit is used for selecting the master or slave configuration. The card can be accessed when the DRV# bit of the socket and copy register is equal to this bit. Bit3 to bit0 are used to set the number of the head where sector transfer starts.

<command> : **Command register set value.**

<define file name> : **Drive Information parameter definition filename**

The define file name mentioned above includes <cylinder>,<head>,<sector/track> , <total sector> information according to CF memory sizes. But you don' t have to modify it. Just input "samsung.def" as definition file-name. All parameters will be adjust automatically.

## 2.5.4 IDI Parameter Definition

<samsung.def> definition file contains drive information parameters for card initial. The Initial program checks the number of flash memory ICs and calculates card size.

And then, CIS/IDI parameters are modified automatically and suitably. Therefore, you need not handle these parameters in <samsung.def> definition file.

The following definition file' s contents are just reference.

[Figure 2.2] Definition File for 128MB(256Mbit \* 4EA) CF Card

CIS (Sample) (256Mbit \* 4) 128Mbytes Card:

000 : 01 04 df 4a 01 ff 1c 04 02 d9 01 ff 18 02 df 01

:

100 : 84 8a 03 c4 00 00 00 08 00 00 02 00 00 20 00 03

110 : c4 00 00 00 20 20 20 20 20 20 20 20 20 20 20 20

:

160 : 00 00 02 00 00 00 01 00 00 00 00 01 03 c4 00 08

170 : 00 20 00 03 c4 00 01 00 00 03 c4 00 00 00 00 00

:

- Cylinder
- Head
- Sector/Track
- Total Sector

### EX) For 128 Mbytes

Cylinder	0x03c4	(HEX)
Head	0x08	(HEX)
Sector/Track	0x20	(HEX)
Total Sector	0x03C400	(HEX)

[Table 1] Memory IC Select Table for Various CF-Card Size

CFSIZE [MBytes]	Number of Flash Memory IC (EA)				
	K9F6408 64Mbits	K9F2808 128Mbits	K9F5608 256Mbits	K9F5608 512Mbits	K9F1G08 1Gbits
4	-	-	-	-	-
8	1	-	-	-	-
16	2	1	-	-	-
24	3	-	-	-	-
32	4	2	1	-	-
40	5	-	-	-	-
48	6	3	-	-	-
56	7	-	-	-	-
64	8	4	2	1	-
72	9	-	-	-	-
80	10	5	-	-	-
96	-	6	3	-	-
112	-	7	-	-	-
128	-	8	4	2	1
144	-	9	-	-	-
160	-	10	5	-	-
192	-	-	6	3	-
224	-	-	7	-	-
256	-	-	8	4	2
288	-	-	9	-	-
320	-	-	10	5	-
384	-	-	-	6	3
448	-	-	-	7	-
512	-	-	-	8	4
576	-	-	-	9	-
640	-	-	-	10	5
768	-	-	-	-	6
896	-	-	-	-	7

## 2.5.5 The Example Code of an Initial Batch File

For your understanding, the example codes of the initial batch file and the definition file, are shown in [EXAMPLE 1] and [EXAMPLE 2]. When you have difficulty in modifying file, refer to following code.

[EXAMPLE 1] contents of the Initializing batch file <INITCARD.BAT>

```
echo *****
echo   Flash Memory Initialization
echo *****

setcmd f0 c4 00 04 00 a0 ef

pause

cls

echo *****
echo   Change the CIS/IDI Information
echo *****

longsec f0 c0 00 00 00 a0 ef

cmdlog f0 c5 00 f0 00 a0 ef samsung.def

pause

cls

echo *****
echo   Read the CIS/IDI Information
echo *****

longsec f0 c0 00 00 00 a0 ef

pause

cls

longsec f0 c0 00 01 00 a0 ef

pause

cls
```

```
echo *****  
echo      Write the MBR/PBR  
echo *****  
pause  
c:\cardsoft\atainit.exe d: /v  
pause  
cls
```

```
echo *****  
echo      Perform the Logical Format  
echo *****  
format d:  
:end
```

[EXAMPLE 2] Contents of the definition file <samsung.def>

```
000 : 01 04 df 4a 01 ff 1c 04 02 d9 01 ff 18 02 df 01  
010 : 20 04 07 c0 00 00 15 20 04 01 53 41 4d 53 55 4e  
020 : 47 20 20 20 20 20 00 53 43 46 43 2d 56 45 52  
030 : 31 2e 30 20 20 00 00 ff 21 02 04 01 22 02 01 01  
040 : 22 03 02 0c 0f 1a 05 01 03 00 02 0f 1b 08 c0 c0  
050 : a1 01 55 08 00 20 1b 06 00 01 21 b5 1e 4d 1b 0a  
060 : c1 41 99 01 55 64 f0 ff ff 20 1b 06 01 01 21 b5  
070 : 1e 4d 1b 0f c2 41 99 01 55 ea 61 f0 01 07 f6 03  
080 : 01 ee 20 1b 06 02 01 21 b5 1e 4d 1b 0f c3 41 99  
090 : 01 55 ea 61 70 01 07 76 03 01 ee 20 1b 06 03 01  
0a0 : 21 b5 1e 4d 14 00 ff ff 00 00 00 00 00 00 00  
0b0 : 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  
0c0 : 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  
0d0 : 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  
0e0 : 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
```

0f0 : 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  
100 : 84 8a 07 b0 00 00 00 04 00 00 02 00 00 20 00 03  
110 : d8 00 00 00 20 20 20 20 20 20 20 20 20 20 20  
120 : 20 20 20 20 20 20 20 20 00 02 00 02 00 04 52 65  
130 : 76 20 31 2e 30 31 53 41 4d 53 55 4e 47 20 43 46  
140 : 2f 41 54 41 20 20 20 20 20 20 20 20 20 20 20  
150 : 20 20 20 20 20 20 20 20 20 20 20 20 20 20 00 01  
160 : 00 00 02 00 00 00 01 00 00 00 00 01 07 b0 00 04  
170 : 00 20 d8 00 00 03 01 00 d8 00 00 03 00 00 00 00  
180 : 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  
190 : 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  
1a0 : 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  
1b0 : 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  
1c0 : 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  
1d0 : 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  
1e0 : 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  
1f0 : 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  
200 : 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00

## 2.5.6 Example of Running Utility

At this directory including the initial batch files and the definition files, type **initcard.bat** to evoke the utility program.

D : > initcard

The program' s main menu will look like this

```
*****
Initialization Start
*****
Press any key to continue ...
*****
Flash Memory Initialization
*****
Press any key to continue ...
<<< ATATEST : ATA Command TEST for SECF-KT>>>
Ver. X.X Date Copyright (C) Samsung Electronics Co.
Set ATA command BLOCK
[1] Set Feature      f0[Hex]
[2] SEC_COUNT      c4[Hex]
[3] SEC_NUM        00[Hex]
[4] Cyl_LOW        04[Hex]
[5] Cyl_HIGH       00[Hex]
[6] DRIVE_HEAD     a0[Hex]
[7] Status_REG     50[Hex]
[8] Set Command    ef[Hex]
Status (change DRDY?) | d0
Return Value Register
[1] Error REG      00[Hex]
[2] SEC_COUNT      c4[Hex]
```

[3] SEC\_NUM            00[Hex]  
[4] Cyl\_LOW            04[Hex]  
[5] Cyl\_HIGH           00[Hex]  
[6] DRIVE\_HEAD        a0[Hex]  
[7] Status\_REG        d0[Hex] \*\*\*\*\* Press any key to continue ...

\*\*\*\*\*

Change the CIS/IDI Information

\*\*\*\*\*

Press any key to continue ...

<<< ATATEST : ATA Command TEST for SECF-KT>>>

Ver. X.X Date Copyright (C) Samsung Electronics Co.

[1] Set Feature        f0[Hex]  
[2] SEC\_COUNT        c5[Hex]  
[3] SEC\_NUM           00[Hex]  
[4] Cyl\_LOW           f0[Hex]  
[5] Cyl\_HIGH          00[Hex]  
[6] DRIVE\_HEAD        a0[Hex]  
[7] Status\_REG        50[Hex]  
[8] Set Command       ef[Hex]

Start Data Transfer

Status (change DRDY?) | 50

Return Value Register

[1] Error REG        00[Hex]  
[2] SEC\_COUNT        c5[Hex]  
[3] SEC\_NUM           00[Hex]  
[4] Cyl\_LOW           f0[Hex]  
[5] Cyl\_HIGH          00[Hex]  
[6] DRIVE\_HEAD        a0[Hex]  
[7] Status\_REG        50[Hex] Press any key to continue ...

\*\*\*\*\*

Write the MBR/PBR

\*\*\*\*\*

Press any key to continue ...

General Configuration Word : 848A  
Fixed Cylinders ; 2034 <F1> - Help  
Removal Cylinders : 0 <ESC> - Quit  
Heads : 1  
Unformatted Bytes / track : 0  
Unformatted Bytes / sector : 512  
Physical Sectors / track : 32  
Minimum Inter-Sector Gap : 3  
Sync Bytes : 63744  
Minimum PLO Bytes : 0  
Serial Number :  
Controller Type : 2  
Controller Buffer : 1K of buffer  
Number of ECC Bytes : 4  
Firmware Rev : Rev. X.X  
Controller Mode 1 : SAMSUNG ATA CF  
Secors / interrupt : 1

Here is the drive info. Only cylinder, head and sector info are used. The rest are here to confirm the correct drive was found. Examine this carefully to insure it is correct.

Hit ENTER t accept and continue or <P> to prompt.

Do you wish a compact format ? Y

Here is the drive info. Only cylinder, head and sector info are used.

Partition table successfully written

PBR Boot sector successfully wiped

Processed with a DOS "FORMAT /U" command

Press any key to continue ...

\*\*\*\*\*

Perform the Logical Format

\*\*\*\*\*

Press any key to continue ...

WARNING : ALL DATA ON NON-REMOVABLE DISK

DRIVE D : WILL BE LOST !

Proceed with Format (Y/N) : Y

Checking existing disk format.

Existing format differs from that specified.

This disk cannot be unformatted.

Proceed with Format (Y/N) ? Y

Format complete

Formatting 127.06M

Volume label (11 characters, ENTER for none) ? SEC

132,956,160 bytes total disk space

132,956,160 bytes available on disk

2,048 bytes in each allocation unit

64,920 allocation units available on disk

Volume Serial Number is OA26-10E9.

This is the end of the initialization.

CAUTION :

If the cards fail the testing after initialization, they need to be re-initialized. Since, NAND Flash is already written data, most of blocks will be considered bad during re-initialization. To resolve this, a re-initialization based on the original bad block table (bit-map table) is necessary.

1. When valid bit-map exists in the cards

Firmware erases all blocks excluding the original bad block based on bit-map table automatically. For example, At this directory including the initial batch files and the definition files, type the same **initcard.bat**. That is, customer can use the same method as the initialization of the new CF card

D : > initcard

2. When valid bit-map does not exist in the cards

The firmware creates new bit-map table by erasing all blocks and running test patterns. The pattern erases and writes “AAh” and “55h” for each block to find bad blocks. Another pattern test with complement data is also executed. But customer has to change to “setcmd f0 c4 ff 04 00 a0 ef” in behalf of “setcmd f0 c4 00 04 00 a0 ef” in a batch file. For example, At this directory including the initial batch files and the definition files, type the same **initclr.bat** . That is, customer can use the same method as the initialization of the new CF card

D : > initclr

### 2.5.7 BOM(Bill Of Material)

This section lists the bill of material for the S3C49F9X controller. The BOM for CompactFlash cards will vary depending on the number of Flash memory used. Please refer to the CF card schematic recommended.

Table 2. Type 1 Samsung CompactFlash Parts Master List

Item	Reference Designator	Qty	Description
1	U3	1	Voltage Detector Part Number : <b>RN5VD26C</b> (Ricoh Product) - Need an external capacitor for setting output delay on pin 5(C <sub>D</sub> )  <i><b>This device is very important thing.</b></i> <i><b>You should check this part number !!!</b></i> ( <a href="http://www.ricoh.co.jp/LSI/english/spec/power/rn5vd/rn5vd-e.pdf">http://www.ricoh.co.jp/LSI/english/spec/power/rn5vd/rn5vd-e.pdf</a> )
2	U1	1	Voltage Regulator Part Number : AME8801AEEV(AME Product) - SEC guarantees for voltage regulator of 300mA output (3.3V).  ( <a href="http://ame.ame.com.tw/Datasheet/ame8801.pdf">http://ame.ame.com.tw/Datasheet/ame8801.pdf</a> )
3	CON1	1	50-Pin Connector
4	U2	1	Controller, 100TQFP
5	U4, U5, U6, U8	4	Flash Memory
6	U11	1	Crystal 20MHz
7	R1	1	Resistor 10K
8	R2	1	Resistor 1M
9	R3	1	Resistor 100K
10	C1,C3,C5,C6,C7, C8,C9,C10,C15,C16,C17,C18,	12	Capacitor 0.1uF
11	C2,C4	2	Capacitor 10uF
12	C12	1	Capacitor 1nF
13	C21	1	Capacitor 20nF
14	C13	1	Capacitor 0.47uF

## 2.5.8 Vendor Unique Command

S3C49F9X supports the eight vendor unique commands with standard ATA commands. Table 3 summarizes Vendor Unique Command set.

Table 3. Vendor unique command

Command Name	Description
Physical Read	Read from physical page in Flash memory
Physical Write	Write data to physical page in Flash memory
Physical Block Erase	Erase physical block in Flash memory
Flash Initialize	Executing Flash memory initializing
Change Information CIS/IDI	Changing data of CIS/IDI
Get Flash Information	Getting Flash memory information. (Structure of block number and page number)
Get Firmware Revision	Getting firmware revision
Get Flash ID Information	Getting Flash information of maker ID and device ID

# **Chapter 3**

## **For S3CI910X Controller**

## 3. ATA Card Utility Program

### 3.1 Overview

This utility is used to initialize the Compact Flash card (CF card ) after assembly. **This utility supports the True IDE interface mode only.** First this utility is used to write the firmware and its parameters into CF card. After that, the utility also provides the disk partition function and formatting. The CF card will be formatted with FAT12 or FAT16. Currently, this utility only runs under DOS systems. To use this utility to program un-programmed card, connect to this card after power-off. After booting PC, start initializing the card. In some Phoenix bios, an un-programmed card is not executed to this utility. However, this utility program runs both in AMI and AWARD bios.

### 3.2 Schematics and Manual Files

I9CARDNI\_00.pdf : CF card non-interleave schematic  
 (X means that version number for CF card schematic)  
 I9CARDI\_00.pdf : CF card interleave schematic  
 (X means that version number for CF card schematic)  
 I9DATA\_00.pdf : Data sheet for S3CI910X  
 (X means that version number for firmware revision)  
 I9CISIDI.pdf : Described CIS/IDI contents

### 3.3 Utility Program Files

Users should create a new directory and copy all the files to this new directory.

File names	File Descriptions
Diag.exe	Utility executable program
M8102.bin	Operation Firmware in binary format.
Initfw.bin	Initialization firmware in binary format.
Cis.bin	M8102 Card Information Structure in binary format. This file contains the needed parameters for the firmware.
Partitio.bin	Partition code, not executable.
Boot.bin	Bootable sector code, not executable.
id.bin	IDI data in binary format

### 3.4 The Hardware

It is necessary the IDE reader/writer between PC and the CF Card.

Hardware Names	Hardware Descriptions
IDE reader/writer	Customer should buy the IDE reader/writer
Compact Flash Adapter	This adapter is used to insert the CF Card.
CF card	The Compact Flash card with Compact Flash Controller.

### 3.5 How to Use Utility Program

At this directory, type **diag** to evoke the utility program. The program' s main menu will look like this

CF Initialization Main Menu, Rev. X.X

**0. True IDE Base IO address- 170h**

**1. Master/Slave Selection- Master**

**2. ID File Name- id.bin**

**3. CIS File Name- cis.bin**

**i. Initialization CF card**

**r. Re-initialization CF card**

**q. Exit**

Please Input Selection -----

**Item 0 : True IDE Interface Base IO Address Selection.(Default = 170h)**

Default is 170h. If customer enters 0 at the prompt, the 170h is changed as 1F0h

170h : Secondary Drive(Default)

1F0h : Primary Drive

**Item 1 : Master / Slave Disk Selection (Default = master)**

Default is master. If customer enters 1 at the prompt, the master is changed as slave.

**Item 2 : CF Card' s Identify Data file Selection (Default file name = id.bin)**

Default file is id.bin. Enter 2 at the prompt, At that time, if customer wants to change to the Identify Data file, which is altered by customer, it should write the file name at the sub menu.

**Item 3 : CF Card' s CIS file Selection(Default file name = cis.bin)**

Default file is cis.bin. Enter 3 at the prompt, At that time, if customer wants to change for CIS file, which is altered by customer, it should write the file name at the sub menu.

**Item i : Initialization of the Brand\_New Card**

For example : To start initializing the card, select item i.

A well-done message will appear on the screen after a successful downloading of a firmware and Flash Card Configuration Detection to check the configuration of the CF Card. The screen will show as follows.

```
C.F. Card current mode identification
C.F. Card downloading initialization firmware.....
Flash memory auto detection...
Chip number 0 group A-Block Size=32, total Size=1024
Chip number 0 group B-Not Found.
Chip number 1 group A-Not Found.
Chip number 1 group B-Not Found.
Chip number 2 group A-Not Found.
Chip number 2 group B-Not Found.
:
:
:
Chip number 7 group A-Not Found.
Chip number 7 group B-Not Found.
```

Is the list correct?            Y

In this configuration, there is only one flash chip installed in group A at chip 0 location. Depending on the location of the flash chip installed, flash memory auto detection will show a different chip number and group. The block size is 32 pages and the total number of blocks is 1024.

Total number of Blocks = 1024

1 Block Size = 32 Pages

1 Page = 528 Bytes (includes 512 bytes per sector and 16 bytes spare area)

1 Byte = 8 Bits

Capacity of Flash Chip = Total Size \* Block Size \* Page \* Bits  
= 1024 \* 32 \* 528 \* 8  
= 138,412,032 Bits  
= About 128Mb or 16MB

Capacity of Flash Card = Number of Flash Chips \* Capacity of Flash Chip

Enter Y for YES at the prompt if the configuration was correct. The program will then start the auto initialization. The following will be seen on the screen.

```
This is not an interleave Configuration!!!  
Mapping table initialization  
Parameters initialization  
Firmware initialization  
DOS system initialization has been finished.
```

This is the end of the initialization.

If you want to use card, take out the card from the CF adapter after power-off on PC and use in the Digital Camera or PC or etc.

**Item r : Re-Initialization of the used Card.**

For example : To start re-initializing the card, select item r.

A well-done message will appear on the screen after a successful downloading of a firmware and Flash Card Configuration Detection to check the configuration of the CF Card. The screen will show the following. (During re-initialization, test Flash memory to search bad block using AA and 55 pattern)

```
C.F. Card current mode identification  
C.F. Card firmware erasing .....  
.....  
C.F. Card downloading initialization firmware  
Flash memory auto detection....  
Chip number 0 group A-Block Size=32, total Size=1024  
Chip number 0 group B-Not Found.  
Chip number 1 group A-Not Found.  
Chip number 1 group B-Not Found.  
Chip number 2 group A-Not Found.  
Chip number 2 group B-Not Found.  
:  
:  
:  
Chip number 7 group A-Not Found.  
Chip number 7 group B-Not Found.
```

Is the list correct?            Y

This is not an interleave Configuration!!!

Start erasing .....

Whole Flash Memory Erased.

Flash memory auto detection....

Chip number 0 group A-Block Size=32, total Size=1024

Chip number 0 group B-Not Found.

Chip number 1 group A-Not Found.

Chip number 1 group B-Not Found.

Chip number 2 group A-Not Found.

Chip number 2 group B-Not Found.

:

:

:

Chip number 7 group A-Not Found.

Chip number 7 group B-Not Found.

Is the list correct?        Y

This is not an interleave Configuration!!!

Start erasing .....

Whole Flash Memory Erased.

Flash memory auto detection....

Chip number 0 group A-Block Size=32, total Size=1024

Chip number 0 group B-Not Found.

Chip number 1 group A-Not Found.

Chip number 1 group B-Not Found.

Chip number 2 group A-Not Found.

Chip number 2 group B-Not Found.

:

:

:

Chip number 7 group A-Not Found.

Chip number 7 group B-Not Found.

Is the list correct?        Y

This is not an interleave Configuration!!!

Start erasing .....

Whole Flash Memory Erased.

Mapping table initialization

Parameters initialization

Firmware initialization

DOS system initialization has been finished.

This is the end of the initialization.

If you want use card, take out the card from the CF adapter after power-off on PC and use in the Digital Camera or PC or etc.

### 3.6 BOM(Bill Of Material)

This section lists the bill of material for the S3Ci910X controller. The BOM for CompactFlash cards will vary depending on the number of Flash memory used. Please refer to the CF card schematic recommended.

Table 4. Type 1 Samsung CompactFlash Parts Master List(Non-Interleave mode)

Item	Reference Designator	Qty	Description
1	U4	1	Voltage Regulator Part Number : AME8801BEEV(AME Product) - SEC guarantees for voltage regulator of 300mA output (3.0V).  ( <a href="http://ame.ame.com.tw/Datasheet/ame8801.pdf">http://ame.ame.com.tw/Datasheet/ame8801.pdf</a> )
2	J1	1	50-Pin Connector(CF-CON50A)
3	U5	1	S3CI910X Controller, 100TQFP
4	U10,U11,U12,U13	4	Flash Memory
5	C1,C2,C3,C5,C8, C10	6	Capacitor 0.1uF
6	C4,C7,C9	3	Capacitor 10uF
7	C6	1	NC
8	R4	1	NC
9	R1	1	Resister 10K Ohm
10	R6	1	Resister 680 Ohm
11	R7	1	Resister 0 Ohm

Table 5. Type 1 Samsung CompactFlash Parts Master List(Interleave mode)

Item	Reference Designator	Qty	Description
1	U6	1	Voltage Regulator Part Number : AME8801BEEV(AME Product) - SEC guarantees for voltage regulator of 300mA output (3.0V).  ( <a href="http://ame.ame.com.tw/Datasheet/ame8801.pdf">http://ame.ame.com.tw/Datasheet/ame8801.pdf</a> )
2	J1	1	50-Pin Connector(CF-CON50A)
3	U5	1	S3CI910X Controller, 100TQFP
4	U1,U2,U3,U4	4	Flash Memory

5	C1,C2,C3,C4,C6, C8,C12,C13,C14, C15	10	Capacitor 0.1uF
6	C5,C7,C11	3	Capacitor 10uF
7	R1,R2	2	Resister 10K Ohm
8	R6	1	Resister 680 Ohm

### 3.7 The Interleave Method Using S3CI910X Controller

To use an interleave mode, use even numbers of Flash memory. Please refer to page 81 in data sheet. For example, to build a 64MB card with two 256Mb Flash memory, connect A-CE0 with one 256Mb Flash and B-CE0 with one 256Mb Flash. To build a 128MB card with four 256Mb Flash memory, connect A-CE0 with one 256Mb Flash, A-CE1 with one 256Mb Flash, B-CE0 with one 256Mb Flash, and B-CE1 with one 256Mb Flash. In case of using odd numbers of Flash memory, controller cannot support an interleave mode. Samsung provides customer with a non-interleave and interleave gerber files to assemble CF card