Halogen-free & RoHS Recast Compliant

CompactFlash Series 6

Industrial CompactFlash Card Specifications

June 23, 2015

Version 1.1

Apacer Technology Inc.
1F, No.32, Zhongcheng Rd., Tucheng Dist., New Taipei City, Taiwan, R.O.C
Tel: +886-2-2267-8000 Fax: +886-2-2267-2261
www.apacer.com

Features:

- **CompactFlash Association Specification Revision 6.0 Standard Interface**
  - ATA command set compatible
  - ATA transfer mode supports:
    PIO Mode 6
    Multiword DMA Mode 4
    Ultra DMA Mode 7
    PCMCIA UDMA Mode 7
- **Capacities**
  - 512 MB
  - 1, 2, 4, 8, 16, 32, 64 GB
- **Performance***
  - Sustained read: Up to 110 MB/sec
  - Sustained write: Up to 80 MB/sec
- **Intelligent ATA/IDE module**
  - Wear-leveling algorithms to substantially increase longevity of flash media
  - Built-in BCH ECC capable of correcting up to 72 bits in 1KB data
  - Supports S.M.A.R.T commands
- **NAND Flash Type: SLC**
- **Temperature ranges**
  - Operating:
    Standard: 0°C to 70°C
    Extended: -40°C to +85°C
  - Storage: -40°C to +100°C
- **Operating voltage for read and write**
  - 3.3 V
  - 5.0 V
- **Power consumption (typical)***
  - Active mode: 310 mA
  - Standby mode: 5 mA
- **Connector Type**
  - 50 pins female
- **Physical Dimensions**
  - 36.4mm x 42.8mm x 3.3mm
- **Halogen free**
- **RoHS Recast Compliant**
  - Complies with 2011/65/EU

*Performance and power consumption may vary depending on capacities, flash configuration or host system settings.

© 2015 Apacer Technology Inc.

Table of Contents

1. GENERAL DESCRIPTION 3

1.1 INTELLIGENT ENDURANCE DESIGN 3
1.1.1 Error Correction Code (ECC) 3
1.1.2 Wear-leveling algorithms 3
1.1.3 S.M.A.R.T. Technology 3
1.1.4 Flash Block Management 4

2. FUNCTIONAL BLOCK 5

3. PIN ASSIGNMENTS 6

4. PRODUCT SPECIFICATION 8

4.1 CAPACITY 8
4.2 PERFORMANCE 8
4.3 ENVIRONMENTAL SPECIFICATIONS 9
4.4 MEAN TIME BETWEEN FAILURES(MTBF) 9
4.4 CERTIFICATION & COMPLIANCE 9

5. SOFTWARE INTERFACE 10

5.1 CF-ATA COMMAND SET 10

6. OPERATING CONDITIONS 12

7. PHYSICAL CHARACTERISTICS 13

7.1 DIMENSION 13

8. PRODUCT ORDERING INFORMATION 14

8.1 PRODUCT CODE DESIGNATIONS 14

© 2015 Apacer Technology Inc.

1. General Description

Apacer's value-added Industrial CompactFlash Card offers high performance, high reliability and power-efficient storage. Regarding standard compliance, this CompactFlash Card complies with CompactFlash specification revision 6.0, supporting transfer modes up to Programmed Input Output (PIO) Mode 6, Multi-word Direct Memory Access (DMA) Mode 4, Ultra DMA Mode 7, and PCMCIA Ultra DMA Mode 7.

Apacer's value-added CFC provides complete PCMCIA – ATA functionality and compatibility. Apacer 's CompactFlash technology is designed for applications in Point of Sale (POS) terminals, telecom, IP-STB, medical instruments, surveillance systems, industrial PCs and handheld applications such as the new generation of Digital Single Lens Reflex (DSLR) cameras.

1.1 Intelligent Endurance Design

1.1.1 Error Correction Code (ECC)

The CompactFlash card is programmed with BCH Error Detection Code (EDC) and Error Correction Code (ECC) algorithms capable of correcting up to 72 random bits in 1KB bytes data.

High performance is achieved through hardware-based error detection and correction.

1.1.2 Wear-leveling algorithms

Flash memory devices differ from Hard Disk Drives (HDDs) in terms of how blocks are utilized. For HDDs, when a change is made to stored data, like erase or update, the controller mechanism on HDDs will perform overwrites on blocks. Unlike HDDs, flash blocks cannot be overwritten and each P/E cycle wears down the lifespan of blocks gradually. Repeatedly program/erase cycles performed on the same memory cells will eventually cause some blocks to age faster than others. This would bring flash storages to their end of service term sooner. Wear leveling is an important mechanism that level out the wearing of blocks so that the wearing-down of blocks can be almost evenly distributed. This will increase the lifespan of SSDs. Commonly used wear leveling types are Static and Dynamic.

1.1.3 S.M.A.R.T. Technology

S.M.A.R.T. is an acronym for Self-Monitoring, Analysis and Reporting Technology, an open standard allowing disk drives to automatically monitor their own health and report potential problems. It protects the user from unscheduled downtime by monitoring and storing critical drive performance and calibration parameters. Ideally, this should allow taking proactive actions to prevent impending drive failure. Apacer SMART feature adopts the standard SMART command B0h to read data from the drive. When the Apacer SMART Utility running on the host, it analyzes and reports the disk status to the host before the device is in critical condition.

© 2015 Apacer Technology Inc.

1.1.4 Flash Block Management

Current production technology is unable to guarantee total reliability of NAND flash memory array. When a flash memory device leaves factory, it comes with a minimal number of initial bad blocks during production or out-of-factory as there is no currently known technology that produce flash chips free of bad blocks. In addition, bad blocks may develop during program/erase cycles. When host performs program/erase command on a block, bad block may appear in Status Register. Since bad blocks are inevitable, the solution is to keep them in control. Apacer flash devices are programmed with ECC, block mapping technique and S.M.A.R.T to reduce invalidity or error. Once bad blocks are detected, data in those blocks will be transferred to free blocks and error will be corrected by designated algorithms.

© 2015 Apacer Technology Inc.

2. Functional Block

The CompactFlash Card (CFC) includes a controller and flash media, as well as the CompactFlash standard interface. Figure 2-1 shows the functional block diagram.

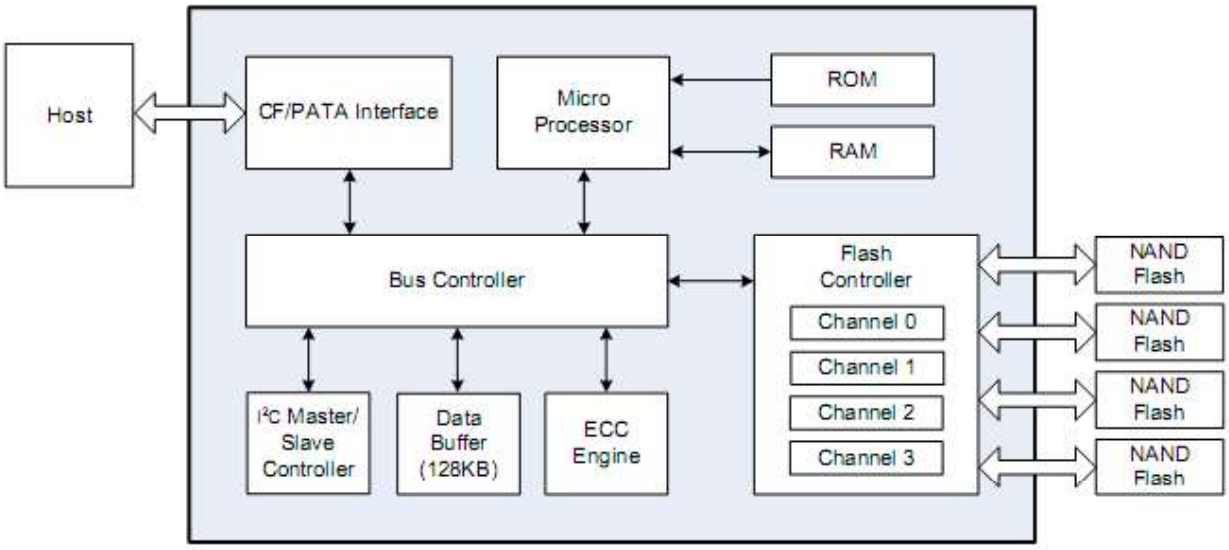


Figure 2-1: Functional block diagram

© 2015 Apacer Technology Inc.

3. Pin Assignments

Table 3-1 lists the pin assignments with respective signal names for the 50-pin configuration. A "#" suffix indicates the active low signal. The pin type can be input, output or input/output.

Table 3-1: Pin assignments (1 of 2)

Pin No.	Memory card mode		I/O card mode		True IDE mode	
	Signal name	Pin I/O type	Signal name	Pin I/O type	Signal name	Pin I/O type
1	GND	-	GND	-	GND	-
2	D3	I/O	D3	I/O	D3	I/O
3	D4	I/O	D4	I/O	D4	I/O
4	D5	I/O	D5	I/O	D5	I/O
5	D6	I/O	D6	I/O	D6	I/O
6	D7	I/O	D7	I/O	D7	I/O
7	#CE1	I	#CE1	I	#CS0	I
8	A10	I	A10	I	A10[1]	I
9	#OE	I	#OE	I	#ATA SEL	I
10	A9	I	A9	I	A9[1]	I
11	A8	I	A8	I	A8[1]	I
12	A7	I	A7	I	A7[1]	I
13	VCC	-	VCC	-	VCC	-
14	A6	I	A6	I	A6[1]	I
15	A5	I	A5	I	A5[1]	I
16	A4	I	A4	I	A4[1]	I
17	A3	I	A3	I	A3[1]	I
18	A2	I	A2	I	A2	I
19	A1	I	A1	I	A1	I
20	A0	I	A0	I	A0	I
21	D0	I/O	D0	I/O	D0	I/O
22	D1	I/O	D1	I/O	D1	I/O
23	D2	I/O	D2	I/O	D2	I/O
24	WP	O	#IOIS16	O	#IOCS16	O
25	#CD2	O	#CD2	O	#CD2	O
26	#CD1	O	#CD1	O	#CD1	O
27	D11	I/O	D11	I/O	D11	I/O
28	D12	I/O	D12	I/O	D12	I/O
29	D13	I/O	D13	I/O	D13	I/O
30	D14	I/O	D14	I/O	D14	I/O
31	D15	I/O	D15	I/O	D15	I/O
32	#CE2	I	#CE2	I	#CS1	I
33	#VS1	O	#VS1	O	#VS1	O
34	#IORD	I	#IORD	I	#IORD	I
35	#IOWR	I	#IOWR	I	#IOWR	I
36	#WE	I	#WE	I	#WE	I
37	RDY/-BSY	O	#IREQ	O	INTRQ	O
38	VCC	-	VCC	-	VCC	-
39	#CSEL	I	#CSEL	I	#CSEL	I
40	#VS2	O	#VS2	O	#VS2	O
41	RESET	I	RESET	I	#RESET	I

© 2015 Apacer Technology Inc.

Table 3-1: Pin assignments (2 of 2)

Pin No.	Memory card mode		I/O card mode		True IDE mode	
	Signal name	Pin I/O type	Signal name	Pin I/O type	Signal name	Pin I/O type
42	#WAIT	O	#WAIT	O	IORDY	O
43	#INPACK	O	#INPACK	O	DMARQ[2]	O
44	#REG	I	#REG	I	DMACK[2]	I
45	BVD2	O	#SPKR	O	#DASP	I/O
46	BVD1	O	#STSCHG	O	#PDIAG	I/O
47	D8	I/O	D8	I/O	D8	I/O
48	D9	I/O	D9	I/O	D9	I/O
49	D10	I/O	D10	I/O	D10	I/O
50	GND	-	GND	-	GND	-

1. The signal should be grounded by the host.
2. Connection required when UDMA is in use.

© 2015 Apacer Technology Inc.

4. Product Specification

4.1 Capacity

Capacity specification of the Compact Flash Card series (CFC) is available as shown in Table 4-1. It lists the specific capacity and the default numbers of heads, sectors and cylinders for each product line.

Table 4-1: Capacity specifications

Capacity	Total bytes[1]	Cylinders	Heads	Sectors	Max LBA
512 MB	512,483,328	993	16	63	1,000,944
1 GB	1,024,966,656	1,986	16	63	2,001,888
2 GB	2,048,901,120	3,970	16	83	4,001,760
4 GB	4,110,188,544	7,964	16	63	8,027,712
8 GB	8,195,604,480	15,880	16	83	16,007,040
16 GB	16,391,340,032	16,383	16	63	32,014,336
32 GB	32,019,316,736	16,383	16	63	62,537,728
64 GB	64,030,244,864	16,383	16	63	125,059,072

Notes:
Display of total bytes varies from operating systems.
Cylinders, heads or sectors are not applicable for these capacities. Only LBA addressing applies
Notes: 1 GB = 1,000,000,000 bytes; 1 sector = 512 bytes.
LBA count addressed in the table above indicates total user storage capacity and will remain the same throughout the lifespan of the device. However, the total usable capacity of the SSD is most likely to be less than the total physical capacity because a small portion of the capacity is reserved for device maintenance usages.

4.2 Performance

Performances of the CF cards are listed in Table 4-2

Table 4-2: Performance specifications

Capacity / Performance	512 MB	1 GB	2 GB	4 GB	8 GB	16 GB	32 GB	64 GB
Sustained read (MB/s)	85	85	105	110	110	110	110	110
Sustained write (MB/s)	20	40	70	70	75	75	80	80

Notes: performance may vary depending on flash configurations or host system settings.

© 2015 Apacer Technology Inc.

4.3 Environmental Specifications

Environmental specification of the Compact Flash Card series (CFC) which follows the MIL-STD-810F standards is available as shown in Table 4-3.

Table 4-3: Environmental specifications

Environment		Specification
Temperature	Operation	0°C to 70°C; -40°C to 85°C (Extended Temperature)
	Storage	-40°C to 100°C
Humidity		5% to 95% RH (Non-condensing)
Vibration (Non-Operating)		Sine wave : 10~2000Hz, 15G (X, Y, Z axes)
Shock (Non-Operating)		Half sine wave 1,500G (X, Y, Z ; All 6 axes)

4.4 Mean Time Between Failures(MTBF)

MTBF, an acronym for Mean Time Between Failures, is a measure of a device's reliability. Its value represents the average time between a repair and the next failure. The measure is typically in units of hours. The higher the MTBF value, the higher the reliability of the device. The predicted result of this mSATA device is higher than 1.99×10^6 hours.

4.4 Certification & Compliance

The CompactFlash card complies with the following global standards:

- CE
- FCC
- Halogen-free
- EMC
- RoHS Recast (2011/65/EU)

© 2015 Apacer Technology Inc.

5. Software Interface

5.1 CF-ATA Command Set

Table 5-1 summarizes the CF-ATA command set with the paragraphs that follow describing the individual commands and the task file for each.

Table 5-1: CFC-ATA command set

Command Set	Command	Code	Protocol
CFA Feature Set	Request Sense	03h	Non-data
	Write Sectors Without Erase	38h	PIO data-out
	Erase Sectors	C0h	Non-data
	Write Multiple Without Erase	CDh	PIO data-out
	Translate Sector	87h	PIO data-in
	Set Features Enable/Disable 8-bit Transfer	EFh	Non-data
General Feature Set	Execute Drive Diagnostic	90h	Device diagnostic
	Flush Cache	E7h	Non-data
	Identify Device	ECh	PIO data-in
	Read DMA	C8h	DMA
	Read Multiple	C4h	PIO data-in
	Read Sector(s)	20h or 21h	PIO data-in
	Read Verify Sector(s)	40h or 41h	Non-data
	Set Feature	EFh	Non-data
	Set Multiple Mode	C6h	Non-data
	Write DMA	CAh	DMA
	Write Multiple	C5h	PIO data-out
	Write Sector(s)	30h or 31h	PIO data-out
	NOP	00h	Non-data
	Read Buffer	E4h	PIO data-in
	Write Buffer	E8h	PIO data-out
	Set Feature	EFh	Non-data
Power Management Feature Set	Check Power Mode	E5h or 98h	Non-data
	Idle	E3h or 97h	Non-data
	Idle Immediate	E1h or 95h	Non-data
	Sleep	E6h or 99h	Non-data
	Standby	E2h or 96h	Non-data
	Standby Immediate	E0h or 94h	Non-data

© 2015 Apacer Technology Inc.

Security Mode Feature Set	Security Set Password	F1h	PIO data-out
	Security Unlock	F2h	PIO data-out
	Security Erase Prepare	F3h	Non-data
	Security Erase Unit	F4h	PIO data-out
	Security Freeze Lock	F5h	Non-data
	Security Disable Password	F6h	PIO data-out
SMART Feature Set	SMART Disable Operations	B0h	Non-data
	SMART Enable/Disable Autosave	B0h	Non-data
	SMART Enable Operations	B0h	Non-data
	SMART Return Status	B0h	Non-data
	SMART Execute Off-line Immediate	B0h	Non-data
	SMART Read Data	B0h	PIO data-in
Host Protected Area Feature Set	Read Native Max Address	F8h	Non-data
	Set Max Address	F9h	Non-data
	Set Max Set Password	F9h	PIO data-out
	Set Max Lock	F9h	Non-data
	Set Max Freeze Lock	F9h	Non-data
	Set Max Unlock	F9h	PIO data-out
Others	Format Track	50h	PIO data-out
	Initialize Drive Parameters	91h	Non-data
	Recalibrate	1Xh	Non-data
	Seek	7Xh	Non-data
	Wear Level	F5h	Non-data
	Write Verify	3Ch	PIO data-out
48-bit Address Feature Set	Read Sector Ext	24h	PIO data-in
	Read DMA Ext	25h	DMA
	Read Multiple Ext	29h	PIO data-in
	Write Sector Ext	34h	PIO data-out
	Write DMA Ext	35h	DMA
	Read Verify Sector Ext	42h	Non-data
	Write Multiple FUA Ext	CEh	PIO data-out
	Flush Cache Ext	EAh	Non-data

© 2015 Apacer Technology Inc.

6. Operating Conditions

Table 6-1: Operating range

Parameters	Range
Ambient temperature	0°C to 70°C
Extended temperature	-40°C to 85°C
Supply voltage at 3.3V	3.135 ~ 3.465 V
Supply voltage at 5V	4.75 ~ 5.25 V

Table 6-2: Power consumption (typical)

Mode \ Capacity	512 MB	1 GB	2 GB	4 GB	8 GB	16 GB	8 GB	16 GB
Active (mA)	220	220	260	260	260	290	290	310
Stand By (mA)	5	5	5	5	5	5	5	5

Note: Power consumptions may vary depending on settings and platforms

© 2015 Apacer Technology Inc.

7. Physical Characteristics

7.1 Dimension

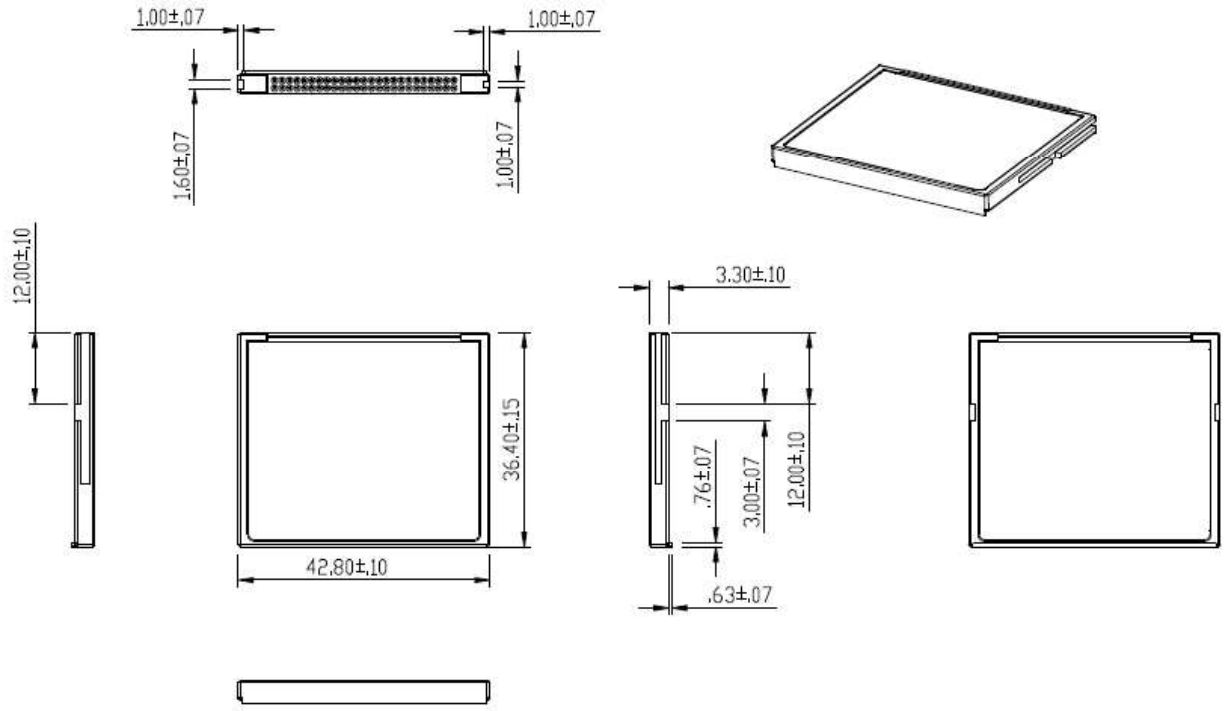


FIGURE 7-1: Physical dimension

Unit: mm

© 2015 Apacer Technology Inc.

8. Product Ordering Information

8.1 Product Code Designations

A P – CF x x x x R A N S – XXXXXX C

FW

Specification
- RM: Removable
- NR: Non-Removable
- ET: Extended Temperature
- NDRM: Non-DMA + Removable
- NDNR: Non-DMA + Non-Removable
- ETRM: Ext. Temp. + Removable
- ETNR: Ext. Temp. + Non-Removable
- ETNDRM: Ext. Temp + Non-DMA + Removable
- ETNDNR: Ext. Temp + Non-DMA + Non-Removable

Halogen Free Compliant

Configuration

CTL Type

CFC Type

Capacities:

512M	512MB
001G	1GB
002G	2GB
004G	4GB
008G	8GB
016G	16GB
032G	32GB
064G	64GB

Model Name

Apacer Product Code

© 2015 Apacer Technology Inc.

8.2 Valid Combinations

8.2.1 Standard Temperature

8.2.1.1 Non-Removable

Capacity	*AP/N*
512MB	AP-CF512MRANS-NRC
1GB	AP-CF001GRANS-NRC
2GB	AP-CF002GRANS-NRC
4GB	AP-CF004GRANS-NRC
8GB	AP-CF008GRANS-NRC
16GB	AP-CF016GRANS-NRC
32GB	AP-CF032GRANS-NRC
64GB	AP-CF064GRANS-NRC

8.2.1.2 Removable

Capacity	*AP/N*
512MB	AP-CF512MRANS-RMC
1GB	AP-CF001GRANS-RMC
2GB	AP-CF002GRANS-RMC
4GB	AP-CF004GRANS-RMC
8GB	AP-CF008GRANS-RMC
16GB	AP-CF016GRANS-RMC
32GB	AP-CF032GRANS-RMC
64GB	AP-CF064GRANS-RMC

Note: Valid combinations are those products in mass production or will be in mass production. Consult your Apacer sales representative to confirm availability of valid combinations and to determine availability of new combinations.

© 2015 Apacer Technology Inc.

8.2.1.3 Non-DMA + Removable

Capacity	*AP/N*
512MB	AP-CF512MRANS-NDNRC
1GB	AP-CF001GRANS-NDNRC
2GB	AP-CF002GRANS-NDNRC
4GB	AP-CF004GRANS-NDNRC
8GB	AP-CF008GRANS-NDNRC
16GB	AP-CF016GRANS-NDNRC
32GB	AP-CF032GRANS-NDNRC
64GB	AP-CF064GRANS-NDNRC

8.2.1.4 Non-DMA + Non-Removable

Capacity	*AP/N*
512MB	AP-CF512MRANS-NDRMC
1GB	AP-CF001GRANS-NDRMC
2GB	AP-CF002GRANS-NDRMC
4GB	AP-CF004GRANS-NDRMC
8GB	AP-CF008GRANS-NDRMC
16GB	AP-CF016GRANS-NDRMC
32GB	AP-CF032GRANS-NDRMC
64GB	AP-CF064GRANS-NDRMC

Note: Valid combinations are those products in mass production or will be in mass production. Consult your Apacer sales representative to confirm availability of valid combinations and to determine availability of new combinations.

© 2015 Apacer Technology Inc.

8.2.2 Extended Temperature

8.2.2.1 Ext. Temp. + Non-Removable

Capacity	*AP/N*
512MB	AP-CF512MRANS-ETNRC
1GB	AP-CF001GRANS-ETNRC
2GB	AP-CF002GRANS-ETNRC
4GB	AP-CF004GRANS-ETNRC
8GB	AP-CF008GRANS-ETNRC
16GB	AP-CF016GRANS-ETNRC
32GB	AP-CF032GRANS-ETNRC
64GB	AP-CF064GRANS-ETNRC

8.2.2.2 Ext. Temp. + Removable

Capacity	*AP/N*
512MB	AP-CF512MRANS-ETRMC
1GB	AP-CF001GRANS-ETRMC
2GB	AP-CF002GRANS-ETRMC
4GB	AP-CF004GRANS-ETRMC
8GB	AP-CF008GRANS-ETRMC
16GB	AP-CF016GRANS-ETRMC
32GB	AP-CF032GRANS-ETRMC
64GB	AP-CF064GRANS-ETRMC

Note: Valid combinations are those products in mass production or will be in mass production. Consult your Apacer sales representative to confirm availability of valid combinations and to determine availability of new combinations.

© 2015 Apacer Technology Inc.

8.2.2.3 Non-DMA + Removable

Capacity	*AP/N*
512MB	AP-CF512MRANS-ETNDNRC
1GB	AP-CF001GRANS-ETNDNRC
2GB	AP-CF002GRANS-ETNDNRC
4GB	AP-CF004GRANS-ETNDNRC
8GB	AP-CF008GRANS-ETNDNRC
16GB	AP-CF016GRANS-ETNDNRC
32GB	AP-CF032GRANS-ETNDNRC
64GB	AP-CF064GRANS-ETNDNRC

8.2.2.4 Non-DMA + Non-Removable

Capacity	*AP/N*
512MB	AP-CF512MRANS-ETNDRMC
1GB	AP-CF001GRANS-ETNDRMC
2GB	AP-CF002GRANS-ETNDRMC
4GB	AP-CF004GRANS-ETNDRMC
8GB	AP-CF008GRANS-ETNDRMC
16GB	AP-CF016GRANS-ETNDRMC
32GB	AP-CF032GRANS-ETNDRMC
64GB	AP-CF064GRANS-ETNDRMC

Note: Valid combinations are those products in mass production or will be in mass production. Consult your Apacer sales representative to confirm availability of valid combinations and to determine availability of new combinations.

© 2015 Apacer Technology Inc.

Revision History

Revision	Date	Description	Remark
1.0	04/20/2015	First release	
1.1	06/23/2015	Added MTBF information	

© 2015 Apacer Technology Inc.

Global Presence

Taiwan (Headquarters)

Apacer Technology Inc.
1F., No.32, Zhongcheng Rd., Tucheng Dist.,
New Taipei City 236, Taiwan R.O.C.
Tel: 886-2-2267-8000
Fax: 886-2-2267-2261
amtsales@apacer.com

U.S.A.

Apacer Memory America, Inc.
386 Fairview Way, Suite102,
Milpitas, CA 95035
Tel: 1-408-518-8699
Fax: 1-408-935-9611
sa@apacerus.com

Japan

Apacer Technology Corp.
5F, Matsura Bldg., Shiba, Minato-Ku
Tokyo, 105-0014, Japan
Tel: 81-3-5419-2668
Fax: 81-3-5419-0018
jpservices@apacer.com

Europe

Apacer Technology B.V.
Science Park Eindhoven 5051 5692 EB Son,
The Netherlands
Tel: 31-40-267-0000
Fax: 31-40-267-0000#6199
sales@apacer.nl

China

Apacer Electronic (Shanghai) Co., Ltd
1301, No.251,Xiaomuqiao Road, Shanghai,
200032, China
Tel: 86-21-5529-0222
Fax: 86-21-5206-6939
sales@apacer.com.cn

India

Apacer Technologies Pvt. Ltd.
535, 1st Floor, 8th cross, JP Nagar 3rd Phase,
Bangalore – 560078, India
Tel: 91-80-4152-9061
sales_india@apacer.com

© 2015 Apacer Technology Inc.