PERSISTOR
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Data Acquisition and Storage Solutions for Industry and Science

Sandisk Industrial Grade CompactFlash EOL Notice
Technical Notes for CF1 and CF2 Users

Sandisk Industrial Grade CompactFlash Discontinued

Sandisk has entirely discontinued their industrial grade CompactFlash. Industrial grade cards were distributed through the OEM channels and are recognized by their black label. Persistor has recommended, tested and certified Sandisk Industrial grade cards for use in Persistor Products. These part numbers are now discontinued, where xxx represents the memory size in MB.

Persistor Part #	Equivalent Sandisk Part #
PCF xxx MBC-OEM	SDCFB-xxx-201-80
PCF xxx MBI	SDCFBI-xxx-201-80

Sandisk initially offered a last time order deadline of April 29th but then imposed minimum quantities on the OEM distribution chain and made orders subject to approval. Persistor will attempt to process last time purchases for customers but due to these circumstances the orders will be non-cancelable and non-returnable, subject to approval, without commitment and subject to unpredictable multi week delivery delays.

Persistor Recommends Silicon Systems SiliconDrive

Persistor has reviewed replacement options and has qualified and recommends Silicon Systems SiliconDrive cards for Persistor products. SiliconSystems was founded to cater exclusively the high performance and high reliability Enterprise System OEM market. This product's features are equal to, or in some cases superior to SanDisk's Industrial Grade. That combined with their commitment to multi-year product life-cycles make them the clear choice for mission-critical use in Persistor products. The SiliconDrive is available in CompactFlash and PC card format.

- Capacity Range: 128MB to 4GB
- Less than 1 Error in 1014 Bits Read
- Advanced Wear Leveling
- 6 bit ECC
- High Shock & Vibration Tolerance
- MTBF > 4,000,000 Hours @ 25C
- Endurance > 2,000,000 write/erase cycles
- Binary NAND Flash

Persistor will be offering the SiliconDrive CompactFlash using part numbers SSCFxxxMBI and SSCFxxxGBI, where xxxB or xxxG represents the memory size in MB or GB. These cards are rated for -40 to +85C operation.

Choose SiliconDrive CompactFlash under these circumstances

- Maximum data storage reliability is of primary concern.
- The application requires operation above 70C or below 0C.
- The system may experience power loss or card removal during file operations.
- The system requires repeatable behavior with different cards installed.
- The system builds will span several years and require repeatable behavior.

Current Drain Issues with SiliconDrive

The SiliconSystems CompactFlash cards will work with all Persistors and all versions of PicoDOS, but CF2s and CF1s sold (approximately) before April 2005 will not allow sub-milliamp LPSTOP without a hardware modification to the data-line pull-up resistors, and without either an upgrade to PicoDOS 4.00r1 or a one-line code addition to the LPSTOP statements in your application code. These changes are described in detail ahead.

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Hardware Change Details

The original CF1/CF2 design incorporates 1Mohm pull-up resistors on all sixteen data lines to prevent floating CMOS input current drain when the signals are tri-stated. SanDisk cards have never used data line pull-up or pull-down resistors so they have no effect on power. Some brands of cards use strong pull-down resistors on the data lines and these interfere with 68332 reset processing and so will not work at all with a CF1 or CF2.

The SiliconSystems cards have weak pull-downs (1Mohm typ, 220Kohm min), and with the typical pull-down value matching the CF1/CF2 pull-up, they form sixteen voltage dividers, which then apply 1/2Vcc to the data line inputs when tri-stated. With the data lines tri-stated in LPSTOP with 1/2Vcc we see about 1.6mA instead of the normal 200uA, but could see as much as 5mA with the variation in pull-down values.

To eliminate this effect, we are changing the 1Mohm pull-ups on the CF2 to 68Kohms. This value will guarantee a high enough threshold to eliminate excess current drain at even the lowest value of the cards internal pull-downs. An additional 500uA of run-time current drain is only downside to the 68Kohm pull-ups. This amounts to about a 1% power increase at the standard 16MHz, but as much as 10% when running at 640kHz.

The 68K pull-up resistors could be added externally on your RecipeCard or custom platform board.

PERCF11M serial number 51800 and above and PERCF21M serial number 4664 and above will be manufactured with 68K ohm pull-ups. The approximate date of change is April 1st 2005.

Software Change Details

CF1/CF2 systems operate the CompactFlash cards in TrueIDE mode as Card-1 devices when active and Card-0 devices when idle. This behavior has no effect with SanDisk cards, but helped keep early LexarMedia CF cards from locking up during non-power-up resets. However, the SiliconSystems cards respond to being setup as Card-0 by drawing an extra static 350uA. Since SiliconSystems is now the standard CF card and since LexarMedia has never been a recommended card for Persistors, PicoDOS 4.00r1 and later keep the CF cards as Card-1 devices and never switch them to Card-0.

PicoDOS 4.xx can run all applications built with older 2.2x versions of PicoDOS (but not 3.0x versions), so the software fix can be a simple as just upgrading PicoDOS and continuing to run your existing binary applications. However, current PicoDOS 3.0x users will need to rebuild their application before running them under 4.xx.

Customers unwilling to upgrade PicoDOS can eliminate the Card-1 current during LPSTOP by prefacing LPStopCSE calls with the following statement:

```
* (ushort *) 0xffffe00c = 0xF000;  // force CF card into Card-1 active mode
LPStopCSE(...
```

Summary of Current Drain Issues

Serial Number	**CF1 <51800 or CF2 <4664**		**CF1 =>51800 or CF2 =>4664**	
Type of CF card	**Sandisk**	**SiliconDrive**	**Sandisk**	**SiliconDrive**
Issue 1 **run time current** **due to pull ups**			68K pull ups cause additional 500uA. Accounts for 1% of current @ 16MHz. Accounts for 10% of current @ 640KHz	
Issue 2 **LPSTOP (no CF card)** **LPSTOP (w/CF card)**	(1M pull ups) 240uA typ 390 to 440uA typ	(1M pull ups) 1.6 to 5.0 mA 1.75 to 5.15 mA	(68K pull ups) 240uA typ 390 to 440uA typ	(68K pull ups) 240uA typ 415 to 465uA typ
Issue 3a **Due to Card-0/1** **If PicoDOS < 4.xx**		additional 350uA in all non-suspend modes		additional 350uA in all non-suspend modes
Issue 3b **If PicoDOS < 4.xx** **but force card-1**		eliminates 350uA only in LPSTOP		eliminates 350uA only in LPSTOP
Issue 3c **If PicoDOS = 4.xx**		no additional drain		no additional drain

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What Fixes Are Required to Use the SiliconDrive CompactFlash?

CF1 and CF2 purchased after April 1, 2005 You can use the SiliconDrive without making hardware or software changes and you will see only a slight increase (typically 50uA) in LPSTOP drain due to the SiliconDrive itself. Programs compiled for PicoDOS 3.xx will have to be recompiled for 4.xx. Programs compiled for PicoDOS 2.xx will run in PicoDOS 4.xx.

Using older CF1 or CF2 and don't care about the extra 1.5 to 5 mA LPSTOP current drain You can use the SiliconSystems cards without making hardware or software changes.

Using older CF1 or CF2 and can't tolerate the extra 1.5 to 5 mA LPSTOP current drain

A. You can return the boards to Persistor for rework at $100 each in small lots, $50 each for lots of 20 to 99, or $30 each for lots of 100 or more. Shipping costs will be added to the invoice.
B. You can add 68K pull ups to the 16 data line signals on your RecipeCard or custom platform board.

Unwilling or unable to make hardware or software upgrades

Review other card manufacturers that might meet your needs.