

System Level Design Considerations with SST CompactFlash Card



Application Note
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INTRODUCTION:

The SST CompactFlash card offers a significant performance advantage over the existing CompactFlash solutions. The overall system performance can be greatly improved by optimizing the host design to take advantage of unique features of the SST CompactFlash card. These enhancements are in full compliance with the CompactFlash standards.

This application note describes various system level design considerations for SST CompactFlash card.

Detailed product specifications and timing diagrams are provided in the SST CompactFlash card data sheet. This application note assumes the reader has access to the data sheet. Please contact your local SST sales representative to obtain a copy. The SST datasheet can also be downloaded from SST Website at www.ssti.com or via SST Literature FaxBack at 1-888-221-1178.

SYSTEM LEVEL DESIGN CONSIDERATIONS

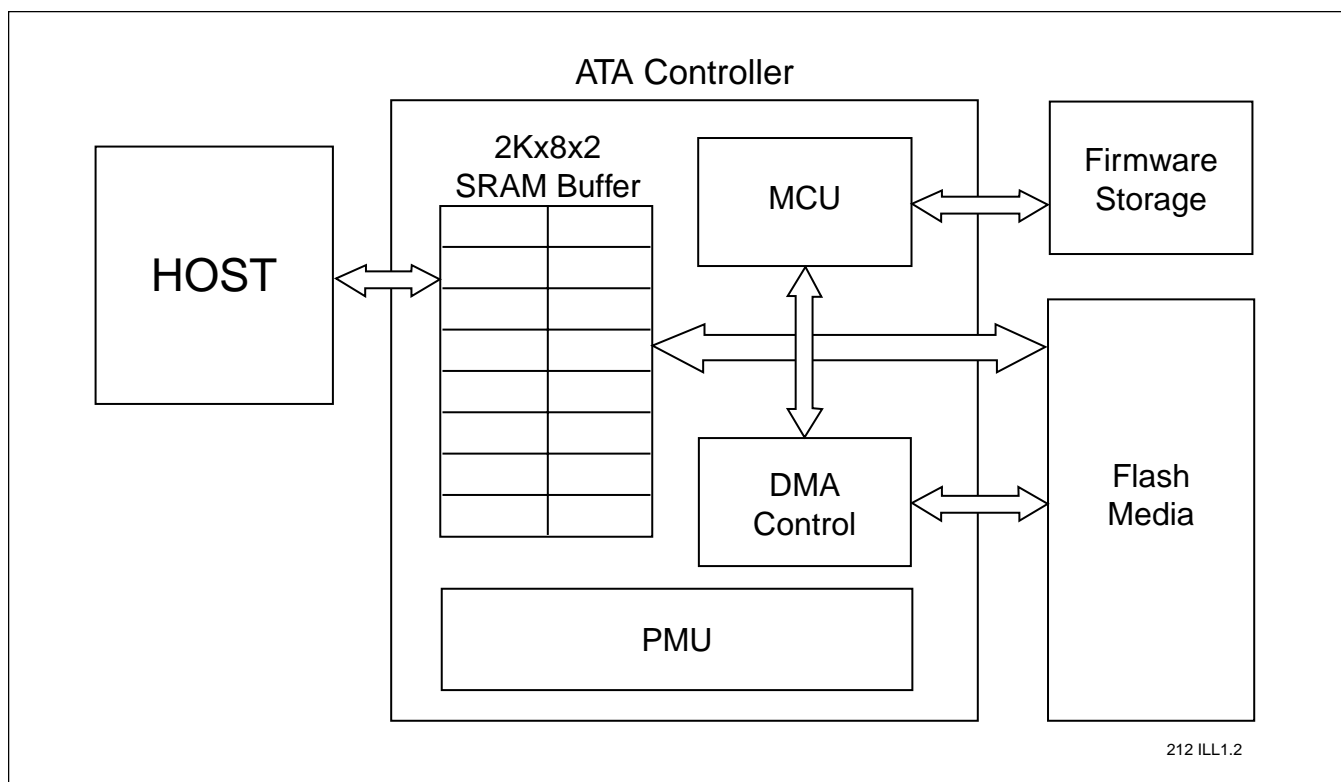
Dual port ATA Buffer

One of the significant contributors to the SST CompactFlash card performance is a 4 KByte (8 sectors) dual port ATA buffer. Refer to Figure 1 for SST CompactFlash card architecture. These 8 sectors could be independently accessed by both host system and on card DMA.

To optimize the overall system performance, it's recommended that host system data processing time overlap with the data storage time on the CompactFlash card.

For example, the host can process 2 KBytes of data and write it to the card ATA buffer, then process the next 2 KBytes of data. While host is processing the next 2 KBytes, the card can write the buffer data into flash media on the card.

This simultaneous write from host to ATA buffer and from buffer to Flash media will increase sustained write performance substantially.



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FIGURE 1: SST COMPACTFLASH CARD BLOCK DIAGRAM



Reduced access time without wait cycles

There are five different operation mode settings for a CompactFlash card. In the CompactFlash/PCMCIA specification for each mode there are five different grades of access time ranging from 100 ns to 600 ns (see PCMCIA electrical specification). The card's access time information is stored inside the CIS (Card Information Structure) for all CompactFlash cards. For any mode, if wait cycles are needed for a slower card, CF card can assert wait signals to extend a bus cycle. SST CompactFlash card is designed to respond with the fastest access time for all modes without any wait cycles. Table 1 indicates the access time at 5 Volts for SST CompactFlash card.

The SST CompactFlash card shows significant advantage in access time for the memory mode. *Host designer is encouraged to use CF/PCMCIA memory mode of operation to boost the system performance.* Memory mode is also more advantageous to implement since only a single move instruction is required to complete a whole sector memory transfer. And for a single command instruction the bulk of the execution time is with the memory access, where SST's CompactFlash card is vastly superior.

Using 16-bit data bus

SST CompactFlash card fully supports both 8-bit and 16-bit data transfer. By using 16-bit data bus instead of an 8-bit, the performance is doubled.

Erase Sector(s) (0xC0) command

Flash memory Write command consists of two mandatory operations: Erase and Program. To speed up the Write operation it is more advantageous to perform memory erase during platform inactive time, and perform memory program separately during time critical tasks.

For example, in digital camera designs, issue erase sector(s) command when deleting picture(s) or formatting a CF card.

When deleting a picture, not only modify FAT table and directory entries, but also issue erase sector(s) command to all the deleted sectors.

To format a card, don't just rebuild the FAT table and erase all directory entries, but also issue erase sector(s) command to all the data sectors. Once the sector is pre-erased, the Write command will only require a Program operation, considerably saving time. By doing Sector-Erase during the platform inactive time, the Write command can be made significantly faster.

The erase sector(s) command is a mandatory command for all CF cards. Using this command will not cause any backward or forward compatibility issues.

TABLE 1. SST COMPACTFLASH CARD ACCESS TIME

Configuration	Access time
CF/PCMCIA memory mode	100 ns max
CF/PCMCIA contiguous IO mode	165 ns max
CF/PCMCIA primary IO mode	165 ns max
CF/PCMCIA secondary IO mode	165 ns max
CF True IDE mode	165 ns max

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Read/Write Multiple command

SST CompactFlash card supports multiple sector transfer command. The block count is 4 as indicated in the Identify Drive Command information. By using this command, a block of 4 memory sector data will have only one interrupt instead of 4 interrupts in a single Write Sector command. The 4-sector memory transfer reduces the execution overhead associated with memory write verification.

Auto-sleep without overhead

SST CompactFlash card automatically switches into sleep mode within a few milliseconds when there are no more outstanding jobs that need to be done. SST CompactFlash card has very fast (<200ns) recovery time (sleep to read or write) allowing transition into and out of auto-sleep mode without overhead.

Since CompactFlash card is used in a variety of battery powered applications, this feature is critical to battery life.

SUMMARY

CompactFlash card is an optimal solution for many data storage applications such as solid state disks, digital voice recorders, digital cameras, and other portable mass storage applications.

The SST 48CFxxx CompactFlash card product family significantly improves performance within the CFA specification. By taking advantage of the unique design features of the SST CompactFlash card, a system designer can achieve significant improvement to the overall system performance. The SST CompactFlash card makes high performance solid state storage both easy and cost-effective.