

Flash card adds functionality to mobile phones

David Guidry, product manager at SanDisk, explains how the thumbnail-sized miniSD card can bring high-capacity removable storage to form factor-constrained mobile phones.

As multimedia applications are requiring capacities that go well beyond existing onboard embedded storage, the miniSD flash storage card promises to provide a much-needed mechanism for exchanging data with other platforms. The card provides up to 64Mbyte of removable flash memory storage – 128 and 256Mbyte versions are planned by the end of the year. Furthermore, they are compatible with the standard SD card.

Trends in functionality

Mobile phone manufacturers have been attempting to accelerate the product replacement cycle by providing consumers with compelling reasons to upgrade beyond existing technology. As a result, 2.5G and 3G mobile phones are becoming Swiss Army knife-like with a multiplicity of features housed within the same sleek form factors as their voice-only predecessors. Among these are games, personal information management (pim) applications, mp3 players, mpeg-4 video capture, email, and digital cameras.

The ability to conveniently snap digital photographs and wirelessly share them via email and messaging is fuelling demand for these products. As a result, sales of these units have been brisk: over 18 million camera phones were shipped in 2002 and approximately 37 million more are expected to ship this year. And by 2005 it is anticipated that sales of these integrated camera phones will eclipse those of stand-alone digital cameras. Currently, the resolutions of the cameras built into these handsets are much less than can be achieved with existing digital cameras; however, advances are being made: 1.3-megapixel camera phones, such as models in the NTT DoCoMo 505i series, have been announced; and two megapixel units are expected by the year's end.

Accommodating such functionality within the available real-estate of a 100g mobile phone is a challenge that doesn't stop with the video aspects of the design: a flexible storage solution in particular, has been one of the biggest hurdles. Audio and video applications are capacity-hungry, yet space has not permitted a card slot for removable storage. Thus, early designs have been based on embedding flash memory chips directly within the units, which has meant capacities haven't been expandable and no mechanism has existed for physically moving data between platforms.

With 1.3-megapixel camera pictures each requiring about 0.5Mbytes (based on least compression jpeg format) and the typical MP3 song file consuming 3 to 5Mbytes, this limitation becomes all the more glaring. Measuring 21.5 by 20 by 1.4mm, the miniSD is said to require 40 percent less pcb area and 60 percent of the volume required to support the SD card in a portable device. Yet its internal workings and external interface are fully backward compatible.

Hardware interface

True to its SD card roots, miniSD sports the same simple, high performance serial interface. As with SD, four non-bused data lines support a transfer rate of up to 10Mbytes/s. And, going back yet another generation in compatibility, miniSD also supports the same 1-bit data path spi interface found in the

multimedia card. Those familiar with the SD card's 9-pin interface, however, will notice two additional pins (labelled here as NC). These are slated for future applications that may include intriguing applications such as e-commerce (imagine the convenience of pointing your phone at a tollbooth or vending machine and having payment occur automatically).

Although the pin count differs, the miniSD card can be used within SD card slots via a passive adapter. This provides interoperability, as SD is supported in over 900 pdas, digital cameras, audio players, and computer systems. Digital pictures, video clips, audio files, and application programs are easily shared across these platforms.

Internally, miniSD contains an SD flash memory controller technology that manages all aspects of the flash (including defect management and ECC), while furnishing disk-like, sector-oriented addressing. The card also contains SD's built-in encryption that supports digital rights management of copyrighted materials and the secure storage of confidential data.

Flash and wireless chipsets

Integrating miniSD into mobile phone designs has become a simple task thanks to increasingly integrated off-the-shelf wireless chipsets. The SD interface is directly supported along with just about every other imaginable mobile phone feature. This may be surprising, as not long ago, the number of specialised chips (not to mention the number of specialised engineering resources) required to handle the radio frequency interface, baseband with dsp, and application processing was relatively large. Today, chipsets from companies such as Intel, Qualcomm, and TI, integrate all of this functionality and directly support the SD interface, as well as many advanced multimedia functions. Reference designs based on these chipsets are essentially complete manufacturing-ready, miniSD-enabled, mobile phones – as a result, product development efforts have almost been reduced to an exercise in mechanical engineering.

Similar to a disk drive, miniSD requires a device driver to carry out read and write requests. And, at a layer further up in the storage subsystem, support for miniSD must also include a FAT file system for managing directories and files. Applications such as audio players and cameras make use of the operating system's application program interface (api) services which filter down into the file system, and then on to the device driver which communicates with the miniSD card.

Again, there is good news here for developers, as mobile phone software such as Symbian's operating system and Microsoft's Windows CE include all of this functionality. For platforms running proprietary operating systems or other specialised code, it's also still possible to get a pre-built solution.

SanDisk offers a software package that furnishes the api, FAT file system, and device driver required to fully support the miniSD card. The toolkit supplies complete asnsi c source code for all modules, including an abstraction layer that facilitates porting to any cpu environment.

Mobile phones based on 2.5G and 3G technology are poised for phenomenal growth as multimedia features such as integrated digital cameras and audio players are beginning to strike a how-did-we-ever-live-without-it chord among millions of consumers. The miniSD card should serve to further the success of these devices by providing an expandable and interoperable storage solution that melds minuscule size with high capacity.

