Technofile: removable memory

Who says size matters? Portable storage devices may be tiny, but they pack plenty of megabytes.
Robin Morris finds out why flash memory looks set to get so big while remaining so small

The floppy disk has been a faithful medium for data storage and transfer to many a PC enthusiast over the past 20 years. But these days average file sizes routinely run to several megabytes and the humble 1.44MB floppy can no longer keep up. Fortunately, there's a whole world of alternative pocket-sized storage with plenty of capacity.

If you have a digital camera, PDA (personal digital assistant) or MP3 player, you almost certainly already have some of this so-called flash memory, but you've probably never considered using these tiny cards for general storage. Over the following pages, we'll introduce you to the most important formats, outline which features will keep your chosen variety at the top (or possibly the bottom) of the heap, and suggest some good devices for transferring data to and from your PC.

Flash memory has been with us for some time, but the latest USB breed are a brand-new departure. Drives that plug straight into the USB port are as portable and universal as it gets, but do they work in practice? We'll also test more traditional types of portable storage devices and explain what Iomega did to follow up on the success of its Zip drives.

Flash memory

Almost every digital camera, PDA, MP3 player and photo printer relies on the miracle of flash memory. And when you look at its advantages it's not hard to see why. The most obvious strength is its size. Many flash memory types are not much bigger than a postage stamp, which makes them the ideal storage medium in devices where space is at a premium. Digital cameras, for example, would be much

less appetising if the memory card was almost as large as the camera.

Flash memory is robust and reliable because it's a solid state memory, which means there are no moving parts. In contrast, non-solid state devices, such as hard drives, have intricate spinning platters used to store information and this makes them more prone to failure.

The sheer simplicity of flash memory also allows it to withstand huge temperature variations. Most types have an operating shock rating equivalent to a 10ft drop to the floor too, offering five to 10 times as much durability as a standard CD-ROM or hard drive.

Perhaps an even bigger feather in the cap for flash memory is that it's non-volatile, so it doesn't require battery power to retain its settings. Most desktop computers use volatile memory so, if the

power to your PC is suddenly cut, any unsaved information you were working on will be lost. With flash memory your data will be retained at all times.

CompactFlash

CompactFlash is the technology that put flash memory on the map. Released in 1994, the tiny 0.5oz CompactFlash Type I cards offered the PC industry a previously unseen level of portability. Energy consumption was modest as well, using just five percent of the power required by small disk drives. Combine these pros with an ability to move between 3.3V and 5V power inputs, and you have a memory medium that was born to make the gadget junkie happy. Indeed, a whole eight years after its creation, CompactFlash can be seen in a huge array of product types, ranging from digital cameras and photo printers to handheld PCs and MP3 players.

In some respects CompactFlash is now showing its age. The cards are not quite as small as SD (secure digital) and MMC (multimedia card) for instance, although some would argue that this is an advantage – CompactFlash is definitely easier to handle.

More worrying for the longevity of the card is its lack of security features, but it's still a first-class performer that

competes strongly with the cream of the field (only secure digital could keep up in our tests). And the huge range of cards (right up to an enormous 1GB) and dirt-cheap prices will keep CompactFlash near the top, even as more advanced memory types seize the initiative.

For even higher performance, Ultra CompactFlash is available for an extra £20-£30. With capacities of up to 512MB, this offers superb performance. It is hard to obtain, however, and it's more likely to be used as a high-end digital camera format rather than a general storage medium.

CompactFlash Type II

There's plenty of confusion surrounding CompactFlash Type II memory, particularly since its most famous exponent, the IBM Microdrive, isn't actually flash memory. Essentially, Type II is not dissimilar from Type I except that Type II cards are thicker (5mm as opposed to 3.3mm for Type I). In truth, IBM's Microdrive is the only Type II

card doing the rounds, although as it is a non-solid state device, it's not technically in the same class as the other cards here.

Prices are fairly good if you're looking for 512MB or more of storage space and, in terms of speed, the Microdrive is capable of keeping up with its smaller relative. However, for sheer versatility and availability, you're more likely to find your needs met by Type I CompactFlash.

SmartMedia

If the technology behind CompactFlash is simple, then SmartMedia is positively primitive. Based on a specification originated by Toshiba, SmartMedia cards consist of little besides the memory chips and do away with the specialist controller functions found in most flash memory.

So, while the cards themselves are undoubtedly cheap, the need for the host device (whether digital camera, handheld PC or photo printer) to house specialist controller functions makes them less appealing to manufacturers. Combine this with SmartMedia's inherent lack of speed (it finishes behind all the other flash

Card readers

If you're about to use flash memory as a storage device you'll need something that will allow your computer to read the memory cards. Card readers are an extremely convenient option. They plug directly into your computer and have slots for one or more different types of memory card. The reader will show up in Windows Explorer as an extra drive icon and you can drag and drop files to and from the cards as easily as you would with a floppy drive.

The interface is important. Most readers have basic USB 1.1 support. These will certainly be compatible with virtually all PCs and notebooks built in the past two years, but you may not be getting the best performance from your memory cards. If your computer has USB 2.0 or FireWire support, it's worth paying a little extra for a more advanced reader – for example, SanDisk's FireWire-ready Ultra Image Reader. This should allow you to cut read/write times in half.

If you're only going to be using one type of memory, save money by buying a memory-specific reader. For instance, buy separate Belkin (www.belkin.com) readers that can support either CompactFlash, SmartMedia or SD (secure digital)/MMC (multimedia card) memory, and it will cost you £25 a time. On the other hand, if you want access to every memory type available, Kingston's (www.kingston.com) £70 Six-in-1 Media Reader supports CompactFlash, SmartMedia, SD, MMC, Microdrive and Memory Stick.

For notebook users, a good alternative to a card reader is a PC Card adapter. Fit the memory card into the adapter and it can be pushed straight into your notebook's relevant slot. SanDisk offers a number of these, ranging in price from £15 for the CompactFlash version up to £50 for the SD/MMC version.

An even better solution is the SanDisk Cruzer. Incredibly portable, this USB card reader is compatible with SD cards. Prices start from around £50 for a 32MB version stretching up to £185 for the 256MB Cruzer.

memory cards in testing) and you have a format that's rapidly fading from the scene. SmartMedia is arguably the cheapest option, beating CompactFlash by a whisker, but if you're looking for a format for the future the smart money won't be backing this one.

Multimedia card

Less a significant product in its own right than a stepping stone to the new industry heavyweight that is SD memory, the MMC looks destined to fall by the wayside.

Only marginally bigger than a postage stamp, an MMC can reach spots other memory types can only dream about. Unfortunately, this could also prove its downfall, as all but the truly nimble fingered will find it hard not to lose their MMC cards. Adding to its woes is the fact that it has been heavily overshadowed by the superior SD cards. It falls behind both SD and CompactFlash on speed and fails to grab the initiative on price.

Significantly, the maximum capacity is stuck on an unimpressive 64MB and, although MMC's ability to fit any slot designed for SD will assure it a future supply of compatible hosts, MMC's golden age is surely behind it.

Secure digital

Licensed by Toshiba, Panasonic and SanDisk, SD takes MMC technology (the compact size) and bolsters it with strong performance – in our benchmark tests, the cards ran neck and neck with the zippy CompactFlash modules – and increased durability. Capacities are due to be expanded shortly, although 256MB versions are already available.

But it's not just performance and functionality that has brought the SD a warm reception. Besides a manual write-protection switch (so the erasing of card contents is temporarily disabled), SD cards comply with the SDMI (secure digital music initiative) standard, potentially giving companies far more control over what material they allow to be copied to and from memory cards. Although this standard is currently dormant, its significance could increase enormously in the coming years and its presence is

Flash memory

Manufacturer	Telephone	Website	Type of memory manufactured
Kingston Technology	01932 738 888	www.kingston.com	CompactFlash, SmartMedia, multimedia card, secure digital, card readers
Buffalo Technology	01753 555 000	www.buffalo-technology.com	CompactFlash, SmartMedia, multimedia card
Sony	020 7365 2947	www.sonystyle.co.uk	Memory Stick
IBM	01475 892 000	www.ibm.co.uk	IBM Microdrive
SanDisk	oemsales@sandisk.com	www.sandisk.co.uk	CompactFlash, Ultra CF, SmartMedia, secure digital, multimedia card, Memory Stick, card readers
Imation	01344 402 000	www.imationltd.co.uk	DataPlay
Belkin	01933 352 000	www.belkin.co.uk	card readers
Viking	sales@viking.ie	www.vikingcomponents.com Multimedia card, Secure Digital, card readers	CompactFlash, SmartMedia
Olympus	020 7253 2772	www.olympus.co.uk	xD-Picture
FujiFilm	recordingmedia@fuji.co.uk	www.fujifilm.co.uk	xD-Picture
PNY	01844 261 872	www.pny.co.uk	CompactFlash, SmartMedia, multimedia card, secure digital, card readers

← SmartMedia: the cheapest memory option but relies on the host device for specialist controller functions

one main reason for SD's popularity among the entertainment giants.

Another reason to expect SD to take off is that, potentially, the cards can do more than just store memory. With an appropriate SDIO (SD input-output) slot, it will be possible to plug in modules that can work as GPS (global positioning system) receivers or wireless LAN (local area network) cards, for instance. Look out for SDIO-equipped Pocket PCs and smartphones that explore the full potential of the SD standard.

While it's fast, modern and highly portable, SD memory is not be as cheap or, for the time being, offer quite the range of memory configurations as CompactFlash. In the long run, however, this is the flash memory type that will lay down the rules. Ignore it at your peril.

Memory Stick

Sony may have a habit of keeping its technology to itself, but when the product in question is this desirable, you can understand why it might be reluctant to share. A similar size to a stick of chewing gum, Sony's storage card is thin, lightweight but extremely easy to handle. Over its four-year history it has also been fairly prolific and, with the imminent release of a third take on the original concept, the Memory Stick family now has almost as many members as all other flash memory types put together.

The special MagicGate version allows for greater protection of copyright by assigning an ID number to each stick, while the brand new Duo is just one-third the size and should be a perfect match for mobile phones. Duo will come with an adapter that allows it to be plugged into standard memory stick slots.

Exclusivity generally isn't a good thing in the IT industry, though. Memory Stick may be faster than SmartMedia, but its inability to match CompactFlash's speed could count against it. Sony is pledging to make Memory Stick a universal format, but despite the presence of nice design features, like the write-protect tab, this remains a second or third choice.

Features comparison

Flash memory

Model	Dimensions (wxdxh)	Weight	Solid state	Advanced security	Available capacities	Sample prices ex VAT						
						16MB card	32MB card	64MB card	128MB card	256MB card	512MB card	1GB card
CompactFlash Type I	43x36x3mm	14.2g	yes	no	8MB-1GB	£15-£22	£18-£30	£30-£38	£50-£70	£105-£130	£230-£280	£550
IBM Microdrive	43x36x5mm	16g	no	no	340MB-1GB	n/a	n/a	n/a	n/a	n/a	£170-£200	£220-£250
SmartMedia	37x45x0.8mm	1.8g	yes	no	8-256MB	£13-£17	£15-£20	£30-£35	£50-£70	£125	n/a	n/a
Memory Stick	22x50x2mm	4g	yes	no	16-128MB	£19	£27	£35	£70	n/a	n/a	n/a
MagicGate Memory Stick	22x50x2mm	4g	yes	yes	32-128MB	n/a	£50	£60	£85	n/a	n/a	n/a
Multimedia card	24x32x1mm	1.5g	yes	no	8-64MB	£20-£25	£26-£30	£45-£55	n/a	n/a	n/a	n/a
Secure digital	24x32x2mm	1.5g	yes	yes	8-256MB	£30-£40	£40-£50	£50-£65	£95-£105	£140-£150	n/a	n/a

Removable hard drives

Model	Telephone	Website	Dimensions (wxdxh)	Weight	Interface	Available capacities	Cost of drive	Cost of replacement disks
Iomega HDD 20/40GB	020 7365 9527	www.iomega.co.uk	90x209x18mm	0.23kg	USB 1.1 and 2.0 (FireWire available)	20-40GB	20GB £120 40GB £170	n/a
Iomega HDD 80/120GB	020 7365 9527	www.iomega.co.uk	110x185x32mm	0.9kg	USB 1.1 and 2.0 (FireWire available)	80-120GB	80GB £150 120GB £200	n/a
Iomega Peerless 20GB	020 7365 9527	www.iomega.co.uk	241x267x124mm	1.13kg	USB 1.1 and 2.0 (FireWire available)	20GB	£250	£125
Iomega Zip 750MB USB 2.0	020 7365 9527	www.iomega.co.uk	107x167x20mm	0.18kg	USB 1.1 and 2.0	750MB	750MB £145	£30
La Cie PocketDrive	020 7872 8000	www.lacie.co.uk	87x143x27mm	0.36kg	USB 1.1 and 2.0 (FireWire available)	20-60GB	20GB £145 40GB £245 60GB £465	n/a

USB drives

Model	Telephone	Website	Dimensions (wxdxh)	Weight	Available capacities	Sample prices ex VAT		
						16MB 32MB drive	64MB 128MB drive	256MB 512MB drive
Disgo	020 8962 2406	www.mydisco.com	15x82x23mm	21g	16-256MB	£35 £53	£70 £120	£165 no
Freecom FM-1 USB Stick	info_uk@freecomtech.com	www.usbstick.com	22x73x10mm	20g	32-256MB	no £30	£45 £70	£120 no
Xtra Drive	01922 634 652	www.premierelect.com	26x84x17mm	25g	32-512MB	no £32	£32 £55	£110 £230
Asus Ai-Flash	0870 888 3021	www.asus.com.tw	26x84x17mm	25g	16-512MB	£26 £30	£59 £95	£150 no
USBee	01522 704 550	www.usbee.co.uk	20x70x10mm	13g	32-256MB	no £25	£42 £75	£126 no

USB drives

For high performance at a great price, flash memory can't be bettered as a portable storage medium. However, the drawback with flash memory is that accessing it requires there to be a card reader attached to the PC or notebook. This is fine if you just need to move files between your home and office computers or if you don't mind carrying a drive with you wherever you go. But what if you want access to your files at any time, any place and at any PC? Enter the USB drive.

A hard drive that plugs into the USB port, the USB drives are small enough to slip comfortably into your pocket or attach to a keyring. Almost every PC and notebook built in the past two to three years will be equipped with a USB slot, so there should be very few occasions when you can't access your files. And most of these products are driverless for Windows XP and Me users, which means that the PC can automatically detect and install the drive – Windows 98 users will need the driver CD with them if they're looking to use the USB drive on a new PC.

The fastest flash memory types (for example, CompactFlash or SD) will always outpace a USB drive, but you still get plenty of performance. Most drives have a write-protect switch to remove the risk of accidentally erasing your files, but some models provide more advanced features. The Disgo drives, for instance, offer password protected encryption,

← Faster than SmartMedia, the Memory Stick is no bigger than a stick of chewing gum

while Freecom's FM-1 range of drives can be used to access email or lock your PC.

In terms of price, a cheap model will cost you between £25 and £75 (16MB to 128MB), while the most sophisticated Disgo drive will set you back between £35 and £120. So buying a USB drive isn't the cheapest way of storing data, but neither is it prohibitively expensive. Considering the incredible portability and ease of use, these drives are a real bargain.

Portable hard drives

Portability doesn't have to mean the product must be small enough to carry around in your pocket. Flash memory and USB drives are all very well, but once you go beyond 256MB the price of media accelerates rapidly. For the user who needs in excess of 10GB, the portable hard drive is the best option. Fast and on a cost-per-megabyte basis, these devices are still small enough to be unplugged and packed into a briefcase or bag. And with typical sizes of 20, 40 or 100 or more gigabytes, you're unlikely to run out of space or need replacement media. While these might be a bit much for transporting a few files, they are ideal for anyone needing to back up their hard drive or store huge amounts of data.

The best example is probably Iomega's HDD product. Light enough to be whisked from one PC to another, this offers blistering performance (thanks to USB 2.0 and optional FireWire support) that outclasses all flash memory cards.

It takes less than 10 seconds to copy a 30MB file and around three and a half minutes to transfer 1GB. Expect to pay £120 for a 20GB version and about £50 more for a 40GB version. If you don't mind sacrificing a little portability, 80GB and 120GB versions are available for £150 and £200, respectively. Considering that a mere 128MB CompactFlash card will cost you around £60, these drives are astonishingly cheap for copying huge volumes of data.

Another good choice is La Cie's PocketDrive. Again equipped with USB 2.0 and FireWire, these pocket-sized drives range in size from 20GB to 60GB although, with prices going from £150 to almost £500, they'll prove more expensive than the Iomega HDDs.

Other alternatives are less interesting. Iomega's Peerless product requires purchase of both a base station and additional 20GB disks and will prove its worth only if you copy huge amounts of data. The latest in the Zip range, the Zip 750, is particularly slow when it comes to copying multiple files, which would appear to make it a poor choice for backing up.

Which format?

For sheer convenience, you can't beat the USB drives. And if they cost a little more than flash memory, the small difference in

← HDD outstrips all other memory cards with its portability supported by FireWire and USB

price is easily compensated for by the unadulterated bliss of knowing that you can attach your favourite (or most important) files to your keyring and access them from almost any PC in the world. The Freecom FM-1 range is a particularly potent mix of price, portability and features.

Having said that, if you would prefer to build up a collection of memory cards, or need the increased speed or trimmed-down size, flash memory is still a great alternative. CompactFlash Type I offers exceptional value for money, with SD likely to become an ever-present force in the future especially if SDIO slots take off.

Finally, if you need to copy huge amounts of data (10GB or more) or want to keep a backup of your hard drives, Iomega's HDD is far and away your best bet. Capable of blistering USB 2.0 speed and incredibly cheap in light of the huge capacities available (from 20GB to 120GB), HDD is first class. ∎

Hot off the press

There's always something new happening in this market, so here are a couple of alternatives that should be hitting the streets by the time you read this. Groomed by FujiFilm and Olympus as the flash memory successor to SmartMedia, xD-Picture cards come with minimum control functions, allowing their price tags to potentially undercut even bargain-basement CompactFlash cards.

But regardless of price, the specifications are likely to astound. With dimensions of 20x25x2mm, these cards are even smaller than SD (secure digital) and MMC (multimedia card) and the manufacturers claim 8GB cards should be available in the future. Few card readers currently accept the format, so we predict it will be used as digital camera media rather than for general storage at first. If xD-Picture cards live up to the hype, they should add more interest to a burgeoning market.

Halfway between a CD-R and a flash memory card, DataPlay claims to offer the best of both worlds. On the face of it, the technology looks impressive. The tiny CD-shaped discs are about the same size as a 50p piece and can hold up to 500MB of data – enough to store up to 11 hours of MP3 tunes or over two hours of Mpeg-4 video.

There are a couple of flaws, though. Performance probably won't be on a par with the flash memory competition and DataPlay's optical technology (similar to a CD-R) only allows you to write data once. Media is well priced – you can expect to pay between £25 and £30 for a pack of three 500MB disks – and you should see Imation really pushing this in the coming months. But whether DataPlay's advantages will be enough to gain it a place in the competitive world of portable storage remains to be seen.