any one time, the more memory there is, the more switching of banks there will need to be, and that will subsequently reduce efficiency.

What this amounts to on the Commodore 64 is that if you want to run a program in BASIC, the ROMs containing the BASIC interpreter will need to be switched in, and this will reduce the amount of available RAM to 40 Kbytes (and system variables and screen RAM will still need to come out of this allocation).

Though bank switching has been added to quite a few home computers by way of a modification, it is achieved on the Commodore 64 by using a special microprocessor. The 6510 is very similar to the 6502 that has proved so popular in home computer design. The instruction set is identical, and it features an eight-bit data bus, 16-bit address bus, and various control signals. However, it also sports an eight-bit programmable input/output port. This means that there are eight additional pins on the chip, each of which can be set to 1 or 0, or can be used to read values placed onto them by an external device. Normally such ports are implemented by means of a special chip (called a PIO, PIA or VIA depending on the manufacturer), and a typical home computer will include several of these to handle the keyboard and peripheral ports.

The port appears as the lowest two memory locations in the map ($0000 and $0001). The former is for reading and writing the individual bits, while the latter location indicates whether each bit is set as an input or an output. Having this port built into the microprocessor means that the 6510 would be ideal for incorporation into numerous domestic devices — from dishwashers to programmable toys. On the Commodore 64, it is used to select between the banks of memory (see panel). You could do this with BASIC POKE statements, but there is a distinct possibility of 'crashing' the system, forcing you to reset the computer. Most memory switches are therefore

IAN McKINNELL

COMMODORE 64

PRICE
Approx £200

DIMENSIONS
404×216×75mm

CPU
6510

MEMORY
64K RAM, of which 39K is available for BASIC programs. 20K of ROM including the character generator

SCREEN
25 rows of 40 columns. In low resolution, 16 colours are available from the keyboard for characters, border and background. Maximum high resolution is 320×200 pixels. Up to eight sprites can be defined and used

INTERFACES
Joysticks (2) plus light pen, RS232 (adaptor needed), 8-bit parallel, cassette, serial (for disk and printer), composite monitor, audio input and output, TV, cartridges

LANGUAGES AVAILABLE
BASIC, FORTH, LOGO, 6502 Assembly language

KEYBOARD
Typewriter-style, with cursor keys and four programmable function keys

DOCUMENTATION
The computer comes with an adequate instruction manual, but to take full advantage of the functions, you should purchase the Programmer's Reference Guide, or one of the many independently published guides to the Commodore 64

STRENGTHS
Large standard memory. Sprite graphics. Sophisticated sound control. Quality keyboard. Good range of peripherals. More business software available than for most home computers

WEAKNESSES
Requires manufacturer's cassette unit. BASIC weak on useful commands (unless you purchase a cartridge add-on). Limited choice of graphics modes and resolutions. Disk unit slow

Business Mileage

A large proportion of the Commodore 64's software base can be said to have been inherited from its predecessors, the PET and Vic-20. The BASIC interpreter is more or less identical on all three machines, and there is much common ground in the disk operating systems, too. Because the business software developed for the PET range could only be used on Commodore's machines, it is hardly surprising that the software developers were so quick to take advantage of the potential new market opened up by the 64.

For business application, there is a wide choice of word processing packages, several of which have spelling checkers. Two of the most popular examples are EasyWrite/EasySpell from Commodore, and VizaWrite/VizaSpell. Two other popular packages, but without the spelling option, are Paperclip 64 and Wordcraft 40. The latter is different from most word processors, in that the screen displays the text in the format in which it will finally be printed, whilst most others display 'embedded controls' — single character symbols to signify a carriage return, or that a heading is to be centred on the page.

Spreadsheets are available starting from just a few pounds. One package, however, is worth special mention. At over £100 CalcResult is more expensive than most spreadsheets for low-cost micros, but it works in full colour, includes a facility for

displaying barcharts of the figures in any column on the spreadsheet, and works three dimensionally. That is to say, several pages of memory can be held in memory at once, and it is possible to add together figures from all these sheets .

Magpie, too, is a fairly outstanding piece of software — falling into the category of applications generators. An application is defined by drawing the layouts for screen records and printed forms on the screen, and then specifying the relationships between the fields within those documents: VAT=TOTAL*15%, for example

IAN McKINNELL