Inside Story

Paolo Baccanello pulls the lid off and peers inside

Weighing in at just over 3lb (excluding 2lb power supply), enclosed in an elegant black plastic shell measuring some 18" by 5", the QL hardly comes across as the heavyweight that it is cracked up to be.

Remove the ten screws that hold the casing together and the picture changes. To your right, modulator, microdrives and accompanying heat sink occupy all available space. Centre and left lies a packed PCB with the keyboard mechanism stacked on top.

Motorola 68008

On the far left of the PCB lies the Motorola 68008 Microprocessor. This is the driving force behind the QL. Making a break with the usual choice of '8 bit' CPU's (Z80 and 6502) Sinclair have gone directly to 3rd generation processors leapfrogging the plain 16 bit variety on their way.

The 68008 is one of a family of sophisticated '16/32 bit' processors. Introduced in 1979, these were designed with the programmer in mind. The series offers 16 32-bit general purpose registers, a 32-bit program counter, and a 16-bit status register. Five basic data types are supported, these are bits, BCD Digits (4-bits), bytes (8-bits), words (16-bits) and long words (32-bits). In addition there are 14 flexible addressing modes which include the capability to postincrement, predecrement, offset and index. Finally, the processor supports some 56 different instruction types of which several themselves include variations.

The CPU's highly regular structure makes assembly language programming both easier and more reliable. Operations on registers and memory are independent of the data. Separate special instructions that operate on byte, word and long word are not necessary. Where previously tens of operations were required, here a single operation will, in most cases, suffice. As a corollary, compilers on the 68000 are efficient and indeed, operating systems such as QDOS and Unix are for the most, written on such.

The 68000 also includes numerous features to aid in error correction. For example there are built-in hardware traps to detect certain common error conditions. There is even a TRACE facility that enables one to step through a program instruction-by-instruction.

Where the 68008 differs from its brothers the 68000 and 68010 is that its external databus is only 8 bits wide instead of 16. This slows the operation of the CPU because loading and storing of registers is done by halves. However, this has meant that the cost of memory chips has been kept down and even at reduced speed the 68008 is considerably faster than its competitors.

2nd Microprocessor

Because the 68008 works on interrupts making timing near impossible using the CPU's internal clock a further microprocessor has been incorporated. An Intel 8049, this is located on the far right on the PCB and controls keyboard, sound and RS232 receiver and leaves the main CPU free to run user programs.

The effect of the 2nd processor is quite noticeable if, for example, you type ahead while using the Quill. The slave processor continuously scans keyboard entry putting characters into a queue. Consequently nothing typed-in is ever lost.

QDOS

The QL's resident operating system began life on a collection of three 16K EPROMS (27128's). Two were on the PCB and a third plugged into the machine's ROM socket. Now, whittled down from 48K to 32K, final versions of QDOS (JM) occupy two masked ROM's to the rear of the PCB. Owners of earlier bug ridden systems (ie. versions FB, PM and KB) may send in their QL's to get an upgrade installed. To find out which version you have type PRINT VER$.

128K RAM and expansion ports

The QL comes with 128K of RAM which is contained within 16 identical chips occupying two rows at the front of the PCB. Of the 128K, 32K is devoted to the screen bit map.

As the 68008 is capable of addressing a maximum of 1 megabyte of memory, RAM extensions to make up this total should eventually be available. These along with such peripherals as disk drives will make use of the 64-way expansion port on the far left of the machine.

At the back of the QL a variety of ports have been incorporated. Moving left to right the first of these is a ROM cartridge socket providing up to 32K extension of ROM.

Next come two joystick ports. These use two BT 600 sockets which will probably be used with either games or to control the cursor (ie. with some sort of mouse device).

After the joystick ports come two RS232-C ports. One is wired for use with a modem (DCE) and the other, to drive a printer (DTE). Both are capable of full duplex transmit/receive at seven rates up to 9600 baud.

Unfortunately, as there is no provision to set differing baud rates for either port it is unlikely that users will be able to run both devices simultaneously.

Next comes a standard UHF socket and beyond that there is an 8 pin DIN type RGB socket. The latter supports displays of up to 85 columns and makes full use of the QL's 512 by 256 pixels resolution.

Finally, on the far right hand side are two network sockets. These are supposed to allow up to 64 QL's or Spectrums to be linked up. However, no network driver is as yet incorporated in QDOS so that these ports are little more than poorly implemented RS232's operating at 100K baud.

Microdrives

Without a cassette interface the QL is wholly dependent upon microdrives. Two of these are built into the QL. A further six may be connected in tandem via a concealed port on the far right.

For their storage medium the drives use a compact cartridge measuring some 450×350×5mm containing 200ft of tape in a continuous loop. Theoretically, this permits a storage capacity of some 255 sectors containing 512 bytes per sector. In practice, storage capacity varies from a minimum of 80K to a maximum of 100K.

The drives load at a rate of 15K bytes per second and take on average 3.5 seconds to locate data.

Sound

A Piezo – Electric Speaker is concealed under the microdrives. Sound quality, in many respects is similar to that found on the Spectrum and falls well short of that common to most home computers.

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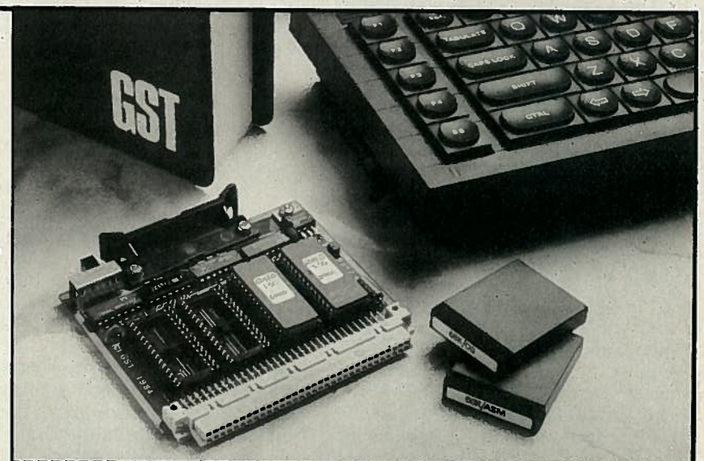

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