Video Nouveau

David Spencer looks at what s in store video-wise for the next generation of computers from Acorn.

The last few months have seen countless rumours emerging about a new range of computers that Acorn are set to launch, and whilst no firm details are available, it is a safe bet that a main feature of the new systems will be improved video capabilities. Such enhancements are made possible by the new VIDC20 video controller recently launched by ARM Ltd., and the purpose of this article is to look at the most important features offered by this chip, and hence almost certainly by any new machines.

The new VIDC20 video controller from ARM Ltd.

A BIT OF HISTORY

To date, all Archimedes systems have used essentially the same video controller - the VIDC1, which was designed over six years ago. At the time when the A310 was first launched in 1987, the facilities offered by VIDC1 were more than adequate, and even now, it is far from being totally outdated. However, in the last six years, the video systems on other computers haven t stood still, and PC owners can now enjoy vastly superior graphics systems compared to those on the Arc.

There are three main areas where VIDC1 falls down badly. Firstly its range of colours is limited to only 256 on screen at any one time, and because of constraints on the original design, there are further restrictions on what these colours can be in 256-colour modes. Secondly, the maximum rate of the so-called dot clock (see later) is relatively low (at most 36MHz) and this limits the maximum resolution available whilst still retaining a flicker-free display. Finally, VIDC1 has to compete with the ARM processor for memory accesses, which leads to ridiculous speed reductions in high-resolution modes (try using mode 21 on a non-ARM3 computer). Another weak area not directly related to video, but provided by VIDC1, is the Archimedes sound system.

A WARM WELCOME TO VIDC20

As already mentioned, VIDC20 is the new video controller from ARM Ltd., and supersedes VIDC1, addressing all the above issues. The remainder of this article is a brief summary of some of the new and extended features offered by VIDC20.

COLOURS

As you probably know, VIDC1 supports 2, 4, 16 and 256-colour screen modes, and as already said the 256-colour modes are not as flexible as they could be. Additionally, the palette which maps colour numbers onto real colours only supports 4 bits per primary colour (red, green and blue), giving a total number of possible colours of 2^(4+4+4) = 4096.

VIDC20 retains all these existing modes, but with two major extensions. Firstly, in 256-colour modes, all restrictions about the range of colours that can be used have been removed, and secondly, 8 bits of data can be used for each primary colour, giving a total range of colours of 2^(8+8+8), which is in excess of 16 million.

Of much more importance, though, is the fact that VIDC20 supports new 16 and 32-bit per pixel modes. This in effect gives 65536 and 16 million colour modes - ideal for displaying digitised pictures. Anyone who hasn t seen a 16 million colour display will probably not appreciate the sheer quality, but when you think

that this range of colours is better than that provided by broadcast TV, you can begin to get the picture.

Another nice feature of VIDC20 is that 4 bits of extra information can be added to each colour, these being output separately by the chip. This feature could be used by external hardware to achieve effects such as overlaying of video signals and fancy fading between the two.

SCREEN RESOLUTIONS

The limits on maximum screen resolution depend on a number of factors, not least the capabilities of your monitor. However, from VIDC's point of view it is the so-called dot clock that imposes the ultimate limit. This dot clock is a master timing signal that is divided several times to select the horizontal and vertical resolutions, the sync rate and the refresh rate. Early Arcs used a single dot clock of 24MHz. This has been extended on newer machines to include 25.175 and 36MHz clocks as well. The former is needed to support VGA modes properly, and the latter allows the Super VGA resolution of 800 x 600 to be displayed without flicker.

VIDC20 provides a much more flexible arrangement for the dot clock. Firstly, several different fixed clocks can be connected with no extra hardware, and these can be up to 100MHz (as opposed to about 36MHz for VIDC1). This will allow much higher resolution modes, including the XGA 1024 by 768 standard and beyond. Secondly, VIDC20 includes a circuit called a Phase Locked Loop which allows the dot clock to be synthesized by multiplying up a lower frequency clock. This allows a wide range of dot clock frequencies to be generated from just a single clock input. The upshot of this is that when designing screen modes, the dot clock frequency best suited to that mode can be chosen, rather than having to put up with the closest frequency available. This opens up all sorts of possibilities, such as having sets of screen modes tailored to particular models of monitor.

VIDEO RAM

One major feature of VIDC20 is its support for so-called video RAM (VRAM). This differs from the normal RAM found in a computer in that two different locations can be accessed at the same time. The idea is that the processor can read or write locations in a random order as normal, whilst the video system can read locations in a sequential fashion totally oblivious to the processor's actions (or vice-versa). The beauty of this arrangement is that VIDC20 can go about its business of accessing the display data from the VRAM, without ever holding up the processor, or tying up the system data bus, as is the case in existing systems. This solves in one hit all the problems of the machine's speed being crippled in high-resolution modes.

For use without VRAM, VIDC20 can support dual banks of RAM with 64-bits of data being moved around at a time, rather than the 32 used currently. This will also reduce the load on the system bus, because moving one set of 64-bits is considerably quicker than moving two sets of 32-bits.

SOUND

VIDC20 retains the basic sound system of VIDC1, albeit extended to allow a clock source separate to that used for the video system. This gets around the problem found on current machines where the sound system is out of tune in VGA display modes. However, a new approach to sound generation is also provided, in which the built-in 8-bit digital to analogue converters (DACs) are replaced by two external 16-bit DACs of the type used in CD players. As you may expect, this gives true CD-quality sound output.

OTHER FEATURES

For portable applications, VIDC20 contains the functionality of the custom-designed LCD ASIC chip used in the A4 portable. This allows VIDC20 to drive various types of LCD displays as well as normal monitors. Limited features are also included for connecting to colour LCD display panels.

Interlaced display operation has also been improved over that offered by VIDC1 in that it is now usable! In fact, this change owes more to a new memory controller, MEMC20, which goes with VIDC20, but that is beyond the scope of this article. The principle of an interlaced display is that instead of displaying all the lines of the image on each frame, one of each pair of lines can be shown on one frame, and the alternate lines on the second frame, interleaved with the first ones. This effectively offers a doubling of vertical resolution, albeit with a slight increase in flicker. For example, this could be put to good use to emulate VGA modes on TV-standard monitors.

CONCLUSION