Another helping of chips

Gordon Laing digs deep and uncovers the Coppermine process then lives life to the DVD MAX.

In a packed *Hands On Hardware* this month we've got details on performance and compatibility issues with Intel's new raft of Pentium III chips, news of a software DVD player that can generate SPDIF output to Dolby Digital decoders and, by popular demand, updates on my dual over-clocked Celeron PC.

But first those new chips. In late October 1999, Intel announced no fewer than 15 new Pentium III processors, ranging from 500MHz to 733MHz. Many are made with Intel's 0.18micron manufacturing process, codenamed Coppermine. This finer manufacturing method boasts several advantages compared with the previous 0.25micron 'Katmai' process, thanks to what happens when transistors are placed closer together. There are four advantages:

- It takes less power to make them work
- They generate less heat
- You can make them go at faster speeds
- Closer transistors means physically smaller chips – hence more squeezed onto a single wafer and greater yields.

Changing manufacturing processes is no small task, so for some time Intel will be selling Pentium IIIs made with both its 0.25 and 0.18micron processes. Additionally, some Pentium IIIs are designed for a 100MHz front-side bus (FSB), while others are designed to run at 133MHz FSB. This could be confusing, so a chip labelled with an E suffix refers to the Enhanced 0.18micron process, while the B suffix mean it's designed for a 133MHz FSB. Intel's new range includes four 600MHz Pentium IIIs, labelled 600, 600B, 600E and 600EB. At the time of writing, the 600 and 600B were priced at £295 and £309, while the Coppermine 600E and 600EB parts weighed in at £305 each.

The finer Coppermine process has allowed Intel to incorporate 256KB of Level 2 cache directly onto the die. This not only saves physical space and cost, but it also drives the cache at the core processor speed.

YOU'RE MY BIGGEST FAN! THE COOLTIUM, LEFT, COMPARED TO INTEL'S STANDARD S370 CELERON FAN, RIGHT

Previous Katmai Pentium IIIs drove their Level 2 cache at half the core speed, but featured 512KB of the stuff.

So which is better: 256KB running at full speed, or 512KB running at half speed? Intel explains the Katmai's 512KB L2 cache is two-way set associative, compared to the Coppermine's 256KB L2 cache being eight-way set associative. The direct-mapped cache efficiency is calculated as its size multiplied by its set associativity. Coppermine boasts 256 x 8, which equals 2MB, compared to Katmai's 512 x 2, which equals 1MB.

Intel claims that this higher efficiency, along with running at double the speed, boasts an overall L2 cache performance increase of up to three times. But how does this impact general applications?

New buyers should definitely be choosing Coppermine chips over Katmai models

One of the first tests was run by Tom's Hardware (www.tomshardware.com), which reckoned the Coppermine chips were about 10 per cent faster than Katmai chips of the same clock speed across general office applications and games. Since the new chips are actually cheaper and the finer process has potential over-clocking benefits too, new buyers should be choosing Coppermine chips over older Katmai models where both are available. These Pentium IIIs come in the 500, 533, 550 and 600MHz speeds, so ask for the new E versions! The 650MHz chips upwards are all Coppermine, and don't need an E label to differentiate them.

More power, but less voltage

All but two of the new desktop Pentium III processors are SECC-2 cartridge designs, but can you simply drop one of these into your existing Slot-1 motherboard? Perhaps unsurprisingly, there are differences. The B-suffixed chips, which include 533, 600, 667 and 733MHz speeds, are designed to run on 133MHz FSB. This requires using a motherboard containing one of Intel's new official chipsets, or a Taiwanese solution which uses a VIA or tweakable BX chipset. Anyone wanting to play safe on an existing BX motherboard should check out the 500, 550, 600, 650, and 700MHz Pentium IIIs, which are designed to run at 100MHz FSB. My aging Asus P2B motherboard, for example, supports 100MHz FSB and clock multipliers up to eight times, in half-step intervals.

Interestingly, a 133MHz FSB does not necessarily result in memory running at the same speed. Intel chipsets do not (and are unlikely ever to) support 133MHz SDRAM, with the chip giant preferring to stick with PC100 memory until the RAMBUS situation is resolved.

In an official Intel 133FSB solution, only the communication between the chipset and the CPU is running at 133MHz. This could explain why early

tests show little overall performance benefits for a 133MHz FSB over 100MHz. Taiwanese motherboards are, however, likely to drive the memory at the same speed as the FSB, so any 133MHz wannabees had better make sure they've fitted PC133 SDRAM memory.

Coppermine groupies had better watch the voltage being supplied to their brand spanking new chips. While Katmai was happy with a voltage range of around 1.93-2.07v, the new Coppermine ones operate in the range of 1.52-1.69v – nominally that's about 2v compared to 1.65v, so anyone popping one of these into their motherboard must ensure they've suitably adjusted the supply. Sometimes this is automatic, while at other times you'll need to adjust it manually. My advice is to check your motherboard manufacturer's website for Coppermine processor compatibility issues – it may involve a BIOS update.

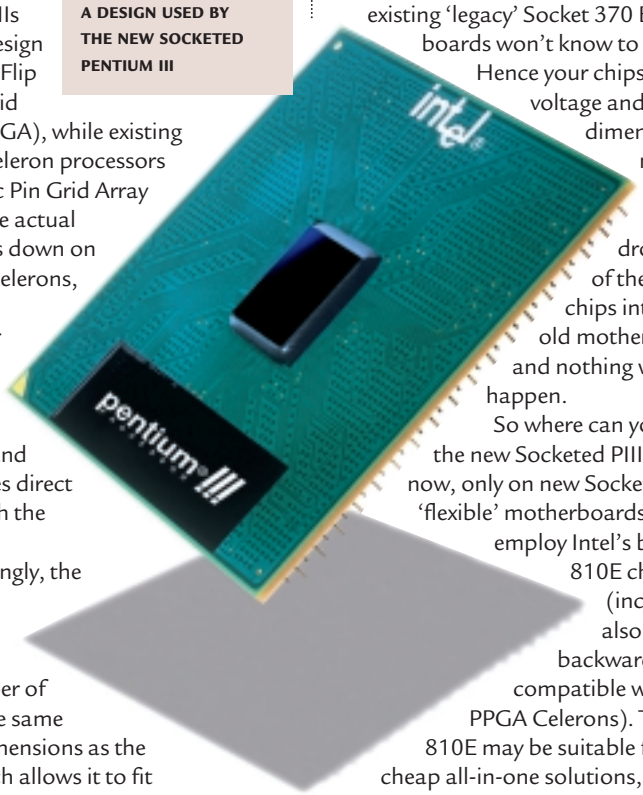
Size does matter

Of course if the L2 cache is on-die, there's no need for that big, nasty SECC-2 cartridge any more, and indeed Intel's announcement included two new Coppermine Pentium IIIs featuring a socket interface. They run at 500 and 550MHz, and both employ a 100MHz FSB.

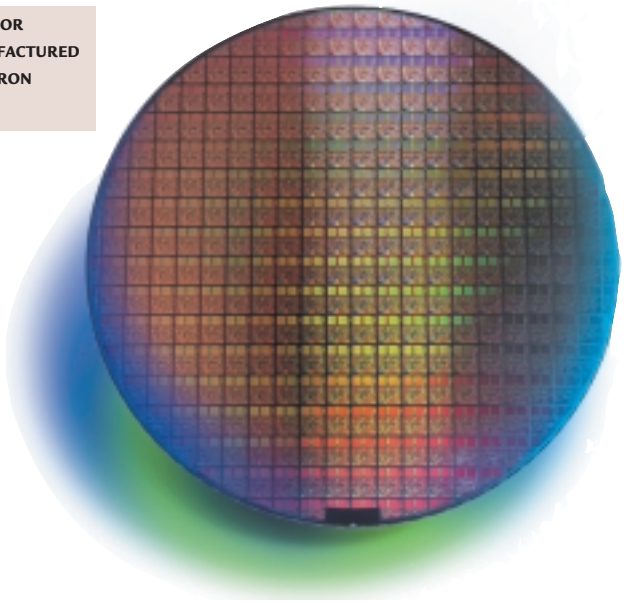
These new socketed PIIIs employ a design known as a Flip Chip Pin Grid Array (FC-PGA), while existing socketed Celeron processors use a Plastic Pin Grid Array (PPGA). The actual silicon faces down on the PPGA Celerons, whereas it's flipped over to face upwards on the FC-PGA PIIIs, and hence makes direct contact with the heatsink.

Interestingly, the FC-PGA package has the same number of pins and the same physical dimensions as the PPGA, which allows it to fit perfectly into existing S370 motherboards. However, before getting too excited about these implications, let us delve a little deeper.

THE FLIP CHIP PGA – A DESIGN USED BY THE NEW SOCKETED PENTIUM III



A PENTIUM III PROCESSOR WAFER WHICH IS MANUFACTURED USING INTEL'S 0.18MICRON PROCESS TECHNOLOGY



First you'll need a supporting chipset, but while Intel pushes its new 800 series, don't forget the old BX chipset has been working with the Pentium III for ages. And despite many cheaper ZX chipsets proliferating in the Celeron market, there are plenty of Socket 370 motherboards with BX chipsets. So surely if you reduced the supply from 2v down to around 1.6v, you'd be forgiven for thinking you've got a neat potential upgrade on your hands.

I'm afraid not. Intel's obviously thought about this, and has sneakily fitted two reset pins onto its socketed PIIIs and put them in a place where existing 'legacy' Socket 370 BX boards won't know to look. Hence your chipset, voltage and dimensions may be fine, but drop one of these new chips into your old motherboard and nothing will happen.

So where can you use the new Socketed PIIIs? For now, only on new Socket 370 'flexible' motherboards, which employ Intel's budget 810E chipset (incidentally also backward compatible with PPGA Celerons). The 810E may be suitable for cheap all-in-one solutions, but as all gamers know, its integrated i752 graphics processor just doesn't cut the high-end 3D mustard.

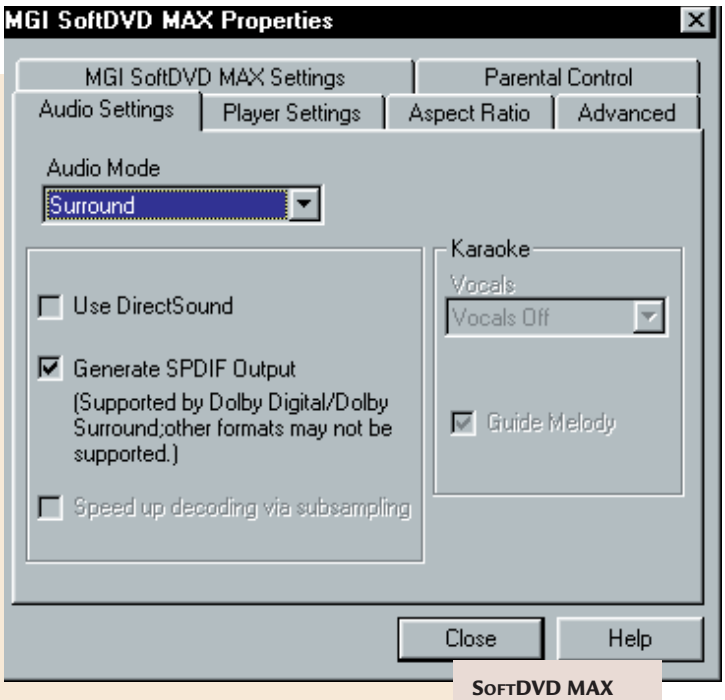
It's a huge shame that BX-board Celeron owners can't just lower the voltage and pop in a socketed PIII processor. It's even more infuriating when you consider the tweaking potential of the Coppermine process, which should eventually produce chips approaching the magic 1GHz. Imagine: the 550MHz FC-PGA Pentium III with fixed 5.5-times clock multiplier, may just be persuaded to operate at 733MHz when the FSB is over-clocked to 133MHz. Considering the FC-PGA 550MHz PIII costs £249 compared to £525 for the Slot-1 733MHz PIII, that's a potential bargain I'm desperate to try out.

Dual thoughts

My original desire was to try out a pair of Socketed PIIIs in my Abit BP6 dual-S370 BX motherboard – until I found out about the reset pins. The sad answer is that the Abit BP6, like other legacy S370 motherboards, will not support FC-PGA Pentium IIIs. So saying, it's a fair bet the Taiwanese will come up with a decent (perhaps 840 chipset-based) dual-socket PIII solution in the near future, or perhaps they'll develop some kind of FC-PGA to PPGA convertor. In the meantime, I'm still getting plenty of mail from readers who've tried out the dual-Celeron system described in last month's *Hardware* column, so here's a quick update on how mine's getting on.

The biggest performance differences are still in Adobe Photoshop, which continues to fly along at all times.

Software DVD update



SoftDVD MAX can now generate SPDIF output to supply the full Dolby Digital 5.1 bitstream

Back in the October 1999 issue, this column discussed the pros and cons of DVD movie playback using a PC, covering hardware, software and hybrid solutions. As PC processors speed up and motion compensation becomes standard on all graphics cards, software decoding and playback is becoming an increasingly attractive option – after all, by eliminating the hardware, you literally eliminate most of the cost.

However, by getting rid of your dedicated hardware decoder card, you're also losing several useful outputs – first is the TV composite or S-Video socket, and next you'll be mourning the loss of the SPDIF digital audio output. The latter is vital to anyone wanting to hear full 5.1 channel digital surround sound, as you need this socket to connect to your external Dolby Digital AC-3 decoder and speaker system.

But anyone who has spent longer than is healthy behind their PC may have noticed that these outputs exist on other cards. Most video cards offer TV output, and many sound cards boast digital SPDIF output in either optical or electrical form. In October I commented that it was a shame existing software DVD players couldn't somehow redirect the Dolby Digital bitstream from the disc to an existing SPDIF output in your system.

Well, I was wrong because there are two available. The first is a bit pricey, costing £35. It's the Power DVD software from Cyberlink. But thanks go out to Colin Crawford of VideoLogic, who pointed me in the cheaper direction of the latest version of MGI's SoftDVD MAX.

This is often bundled with video cards, and is available as a download from MGI's website for only £14. Simply open the configuration panel, click on the audio settings and select Generate SPDIF output.

Now instead of the software decoding audio into plain analog stereo, which at best will only support Dolby ProLogic surround, SoftDVD MAX will squirt the Dolby Digital bitstream out of your SPDIF port. My Aureal Sonic Vortex sound card obeyed, and its optical connection with my Meridian 565 Surround processor promptly switched it into processing proper Dolby Digital 5.1.

It sounded absolutely great working under Windows 98, but failed to run under RC1 and 2 of Windows 2000.

Fans of DTS 5.1 digital surround sound will be disappointed – but not surprised – to learn that this version of SoftDVD MAX does not recognise and output the DTS bitstream on suitably authored titles.

There is a hardware decoding solution that does support DTS. It's employed on RKR Video's Titan and Cassini DVD players, which also boast scaled non-interlaced RGB output.

This is all down to the fact that they are essentially nothing more than PCs fitted with DVD-ROM drives and decent decoder cards – cunning stuff indeed.

www.mgisoft.com
www.rkrvideo.com

However, if the program runs out of RAM and has to go to the hard disk, the CPUs immediately become idle. So as I pointed out last month, a dual system (or indeed one with a single fast chip) will only make use of its processing muscle while data is constantly being supplied – and that means plenty of RAM and as fast a disk as you can find.

I've also found a source of hefty fans ideal for keeping over-clocked chips relatively chilled. The Cooltium from TopPC (www.toppc.co.uk) may have been designed for AMD K6 processors, but does a good job on a Socket 370 Celeron. It spins at 4,500rpm, so it can shift a lot of hot air away from the CPU, and costs a tenner. Crash-wise, my system still seems reasonably reliable when my 366s are over-clocked to 550MHz, although upgrading to Release Candidate 2 of Windows 2000 has increased the number of blue screens. Hopefully, this will be corrected in the final code due in February 2000, but tweakers should bear in mind my crashes so far are down to over-clocking and not the presence of two chips. I may not be able to pop in any socketed PIIIs, but I can always fit faster Celerons in the future and leave them clocked normally.

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