



Clocking off

Gordon Laing's got his overclocking head on and **even Coppermine standards won't get in the way.**

I've finally got my hands on a socketed Flip Chip Coppermine Pentium III processor, and as many of us hoped, it could end up being the overclocker's dream.

Better than that, I've been shopping and got some neat accessories that no overclocker should be without, and finally, I've got news of a test that reveals which chipset gives the best memory performance! But first, when is a socket not a socket? When it's a slot.

Slot it in

After producing socketed CPUs since day one, Intel launched its Pentium II processor in a package where the CPU and Level 2

cache chips were mounted on a card with a Single Edge Connector or Contact, and the whole shebang was housed in a cartridge. Also known as a SECC, these packages fitted into so-called Slot 1 motherboards.

The first Celeron processors also used the slot design, albeit naked without the surrounding cartridge. However, later Celeron CPUs returned to the traditional socketed form factor – the package was known as a plastic pin grid array, PPGA, while the motherboard socket which

cache of recent Pentium III CPUs onto the processor die, making the Slot 1 package physically redundant. Indeed, it's Intel's long-term plan to dump Slot 1 and return to a socketed solution for its PIIIs. While the fastest PIIIs at the time of writing were still debuting in Slot 1 format, Intel additionally offered 500-750MHz Pentium III CPUs in its new

looked like the FC-PGA CPUs didn't want to play with older systems.

To use an FC-PGA chip, Intel officially says you'll need to find a modern motherboard with a socket that directly supports it. Well, we've looked around and at the time of writing, there weren't all that many available, and those that were used a limited choice of chipsets.

Fortunately, we can thank

the cunning Taiwanese once again for producing a solution to our woes: the Slot 1 to socketed CPU convertor, or Slocket for short.

Slockets are essentially just a board with a socket for a CPU and an edge connector that fits into a normal

Slot 1 motherboard. They've been available for some time to let socketed PPGA Celerons be fitted into Slot 1 motherboards, but the latest breed are also FC-PGA savvy. They don't care about alternative wiring or nasty reset pins. No, your humble Slocket usually just has a single jumper which sets it to work with either PPGA or FC-PGA CPUs. Better than that, most Slockets also feature an array of CPU core voltage settings, which may be able to override a conservative 'legacy' motherboard.

Typically costing around £25 to £35, an FC-PGA compatible Slocket could end up being the Slot 1 motherboard owners' best friend. While in Japan recently (see box on final page), I managed to pick up a pair of Iwill's top of the range Slocket IIs for the princely sum of 6,258 Yen or about £20 each. See www.iwill.net for more details.

Overclocking Coppermine

I'd long looked forward to overclocking a modest Coppermine Pentium III CPU using the same trick that worked with the old Celerons – namely getting around the



Slocket to me: The Iwill Slocket II lets you use socketed CPUs in a Slot 1 motherboard. The picture shows an Intel 600MHz Pentium III FC-PGA – note the tiny CPU die in the middle

socketed Flip Chip Pin Grid Array, FC-PGA package.

The FC-PGA physically looks just like a PPGA Celeron, except that the actual silicon faces upwards rather than downwards – but this flipped design does give the silicon beneficial direct

contact with a heatsink. However, just to be annoying, Intel played around with the pins, and made the FC-PGA incompatible with existing Socket 370 motherboards. Coupled with the fact the Coppermine process also runs on a lower voltage that existing 'legacy' Socket 370 motherboards weren't aware of, it

housed them was known as Socket 370. By this time the Celeron's Level 2 cache was integrated onto the actual CPU die itself, so there was no physical need for the larger Slot 1 package.

Regular readers know that Intel's latest 0.18micron Coppermine process also allows it to integrate the Level 2

An FC-PGA compatible Slocket could be the best friend of the Slot 1 motherboard owner



locked clock multiplier by instead increasing the speed of the front-side bus (FSB). With older Celerons designed for a 66MHz FSB, overclocking it to 100MHz effectively increases the CPU's speed by 50 per cent. You must subsequently set your PCI bus-divider to 1/3 to keep it running at 33MHz and be certain that your memory can handle being driven at 100MHz, but so long as these conditions are met, as well as ensuring you don't push the chip beyond its manufacturing process, you may be in luck.

The same theory applies to the Pentium III, which operates with an external FSB of either 100MHz or 133MHz. Since the clock multiplier is locked on production Intel CPUs, the only way to overclock them is to increase the FSB. Hence the models to go for are the ones designed for an FSB of 100MHz, as you then have the option of increasing the FSB to 133MHz, thereby achieving a 33 per cent performance boost (note that PIII CPUs designed for 133MHz FSB are often labelled with a B for Bus).

The Coppermine process (labelled with an E where older Katmai versions are also available) should last Intel well into the realms above 1GHz. So, in theory, with a little extra juice and sufficient cooling, a 550MHz (5.5 times 100MHz) Coppermine CPU should overclock to 733MHz (5.5 times 133MHz), while a 750MHz (7.5 times 100MHz) may even push itself to the magic 1,000MHz (7.5 times 133MHz).

So far so good, but wouldn't you need a new motherboard that's aware of the lower Coppermine core CPU voltages, not to mention memory that can run at 133MHz and a 1/4 PCI bus-divider? In theory yes, and I'll be testing this out on a new Intel 840 chipset motherboard next month, but in the meantime, the Slocket convertor ended up breathing a surprising amount of new life into an older system of mine.

In previous issues I've mentioned my Asus P2B Slot 1 motherboard which

Warning and disclaimer

Overclocking pushes PC components beyond the range they were designed for. At best you'll lose any guarantee, and at worst you could permanently damage your system. Proceed with caution and remember that overclocking is done for the fun of seeing

how far you can push a PC, and should under no circumstances be used on a mission- or business-critical system.

An overclocked system is for experimental testing only and we cannot take any responsibility for damage to hardware or data.

offers a wide variety of FSB speeds, but with a minimum PCI divider of only 1/3, is pretty much limited to FSBs running no faster than 100MHz. The CPU multiplier is set using jumpers on the motherboard in half-step increments up to eight-times, so in theory you should be able to fire up an 800MHz CPU. Sadly my revision of the board is unaware of lower Coppermine core CPU voltages, which means it's limited to the fastest Katmai process Pentium III, which ran at 600MHz.

However, the 1.3 to 3.5v CPU core voltage adjustment on the Iwill Slocket II got me thinking. I borrowed a 600MHz FC-PGA Coppermine Pentium III, popped it in the Slocket, and popped that in my motherboard Slot. To keep things cool, I clipped on my new and, it has to be said,

rather fetching Titan TTC-M1AB Majesty heatsink and fan, which I also picked up in Japan for a bargain £18 – this 2in tall golden beauty shifts 20.83 cubic feet of air per minute, and is available online at www.titan-cd.com/news.htm.

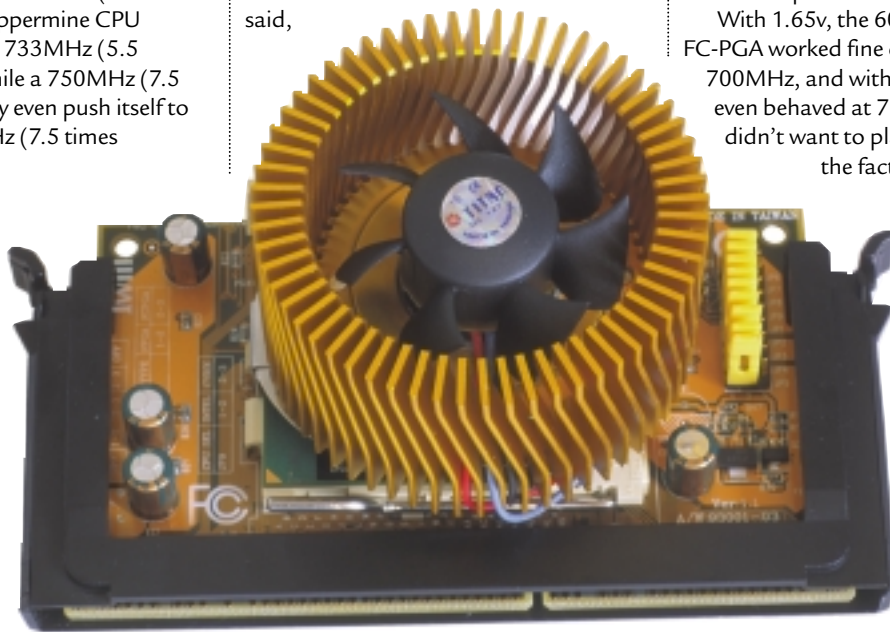
Ensuring the core voltage on the Slocket was set to the Coppermine-friendly 1.65v and that the motherboard was set to an FSB of 100MHz with a six-times multiplier, I fired up the system, and bingo, it actually worked! More exciting still was the fact that this Intel FC-PGA was a special test chip without a fixed clock multiplier. Without a one-quarter PCI bus-divider on my motherboard, I may not have been able to reliably overclock the CPU by increasing the FSB to 133MHz, but I could now at least try out different clock multipliers.

With 1.65v, the 600MHz-rated FC-PGA worked fine clocked at 650 and 700MHz, and with a little more juice even behaved at 750MHz. Sadly, it didn't want to play at 800MHz, but the fact remained that I

was effectively running a 750MHz Coppermine Pentium III CPU in an old Slot 1 BX chipset motherboard. This is a chipset and motherboard that is unaware of the lower voltages necessary to stop Coppermine CPUs from frying, and even the

latest revision of the board is not certified for anything faster than 600MHz.

Thanks to the manual core CPU voltage adjustment on the Slocket, I could run FC-PGA Coppermine Pentium IIIs in my Slot 1 BX motherboard. I wouldn't even need to risk overclocking



Life in the old chipset: Intel's 600MHz socketed FC-PGA Pentium III processor cooled by the magnificent Titan Majesty heatsink, both sitting on an Iwill Slocket II converter, and ready to fire up almost any Slot 1 system!

Akiharbra – hardware heaven

On a recent trip to Japan I couldn't help but nose around Tokyo's amazing Akiharbra district. Anyone familiar with *Bladerunner* will have no difficulty picturing the scene: huge department stores covered in neon lighting rise into the sky, while tightly-packed market stores bustle for business at street level. But you won't find the usual mix of clothes or furniture here, as Akiharbra sells consumer electronics and computer goods only.

Spurning the big department stores in favour of the side-street market areas, PCW deputy editor Nik Rawlinson, fellow *Hands On* contributor Roger Gann and myself discovered a bewildering array of new and old systems, gadgets, cables, adaptors and sneaky work-arounds that were quite literally heaven for any PC

hardware enthusiast. Credit goes to Roger for spotting the magnificent Titan Majesty heatsink/fan combo which later found itself in the Laing shopping basket. This was the same one that is attached to an Intel FC-PGA in this very column!

There was a wealth of Slocket convertors which allow you to fit socketed PPGA Celerons or FC-PGA Pentium IIIs into Slot 1 motherboards (see main text), and small riser boards which fitted into RAMBUS memory slots, but took SDRAM DIMMs with the help of Intel's Memory Translator Hub (MTH) chip.

While it's obviously a long way to go for a hardware fix, I'd recommend any enthusiasts who find themselves in a big Japanese city to seek out the electronics district – Tottenham Court Road will never feel the same again.



Akiharbra: The off-world colonies – a chance to begin again in a golden land of opportunity and adventure. Ridley Scott, eat your heart out

the FSB either, as Intel now sells a 750MHz (7.5 times 100MHz) FC-PGA Pentium III processor, and an 800MHz FC-PGA version is sure to follow. In theory, I should be able to sit these in the Slocket, set the core voltage to 1.65v, and slot it into my Asus motherboard with the CPU multiplier set to 7.5 or eight-

Memory speed

In earlier issues we've discovered that it's not just the CPU that dictates your system performance – your graphics card, hard disk and even sound card also play big parts. However, the RAMBUS versus SDRAM memory battles that have been going on over recent

The RAMBUS versus SDRAM battles have brought memory performance into the public eye

times as appropriate. Leaving the FSB at 100MHz, my memory, PCI and AGP buses are not placed under undue stress, and behave impeccably.

As always, it's vital to remember that this is not a guaranteed solution. It may not work on your system, or worse, could damage your components. But if you're feeling brave, give the Slocket/FC-PGA combo a shot, and prove that your old BX system can keep up with the best of today's solutions.

months have brought memory performance under different chipsets into the public eye.

After speaking with several system integrators, I discovered that many were using a benchmark called Stream, developed by John McCalpin while on the faculty of the University of Delaware. After three years at SGI, John is now at IBM and over the years has built up a huge number of results using Stream on a vast range of systems.

Next month I'll be revealing the results of memory tests on a wide variety of chipsets – just how bad is SDRAM under Intel's 820 and 840 chipsets, and does RAMBUS really make a difference? Just to whet your appetite, I'll let you know that VIA's Apollo Pro 133A with 133MHz SDRAM is a contender, and that the humble BX has nothing to be ashamed of.

In the meantime, head over to www.cs.virginia.edu/stream, download the recent binary for NT in the PC-compatible section (also works on Windows 98) and give it a shot. The Wstream executable should be run from the command prompt with the speed of your CPU and number of iterations, (c:\wstream 550 10).

CONTACTS

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