

IT'S OUR BIRTHDAY! TEN GLORIOUS YEARS OF CPC

# CUSTOM PC

THE BEST-SELLING MAG FOR PC HARDWARE, OVERCLOCKING, GAMING & MODDING

## BUILD A TINY GAMING PC

**£999**  
INC VAT

### SHRINK YOUR DESKTOP

➤ Full expert building guide

➤ Plays the latest games at 2,560 x 1,600



**PLUS**

**GEFORCE GTX 760 GROUP TEST**

**MINI-ITX MOTHERBOARD GROUP TEST**

**RASPBERRY Pi-LITE: LIGHTS ALIVE!**



ISSUE 121 ★ OCT 2013 ★ £4.50



# PERFORM IN STYLE



CM 690 II Advanced raises the bar again with improvements over the top-selling CM 690. The spacious mid-tower will keep enthusiasts happy with room for up to 3 VGA cards, high-end CPU coolers, top or bottom mount water cooling radiator and 1.8"/2.5" drive adapter. It also features much improved airflow with oversized mesh and enough space for up to 10 fans. Maintenance will be a breeze with the tool-free drive bays, new cable management and CPU cooler retention hole.



Up to 10 fans



Top and bottom radiator



Oversized mesh



HDD dock



VGA card holder

**CCL Price Only £59.99 - SAVE £30.00**

[www.coolermaster.com](http://www.coolermaster.com)



[www.cclonline.com](http://www.cclonline.com)  
Call us on 08000 50 10 10

Prices correct at time of going to publishing (29th July 2013).  
Images are for illustrative purposes only.





# CUSTOM PC

## Welcome to Issue 121

### Editorial EDITOR

Ben Hardwidge  
editor@custompcmag.org.uk

### TECHNICAL EDITOR Harry Butler

### GAMES EDITOR Rick Lane

### ART EDITOR Bill Bagnall

### PRODUCTION EDITOR Julie Birrell

### Publishing & Marketing GROUP PUBLISHER

Paul Rayner  
paul\_rayner@dennis.co.uk

### LICENSING MANAGER

Carlotta Serantoni  
Carlotta\_Serantoni@dennis.co.uk  
+44 (0)20 7907 6550

### LICENSING AND SYNDICATION ASSISTANT

Nicole Adams  
Nicole\_Adams@dennis.co.uk  
+44 (0)20 7907 6134

### SYNDICATION SENIOR MANAGER

Anjum Dosaj  
+44 (0)20 7907 6132



### Dennis Publishing Limited

Tel: 020 7907 6000 fax 020 7907 6193

### DIRECTOR OF ADVERTISING

Julian Lloyd Evans

### MANAGING DIRECTOR DENNIS TECHNOLOGY

John Garewal

### CEO

Ian Westwood

### NEWSTRADE DIRECTOR

David Barker

### FINANCE DIRECTOR

Brett Reynolds

### GROUP FINANCE DIRECTOR

Ian Leggett

### CHIEF EXECUTIVE

James Tye

### CHAIRMAN

Felix Dennis

### SUBSCRIPTIONS

You can manage your existing subscription through [www.subsinfo.co.uk](http://www.subsinfo.co.uk) - this should be your first port of call if you have any queries about your subscription. Email: [custompc@servicehelpline.co.uk](mailto:custompc@servicehelpline.co.uk)

Annual subs: UK £39.99

UK subs: 0844 844 0032

Overseas subs: Europe £60,

ROW £80 Overseas subs: +44 (0)1795 592 906

### LICENSING, REPRINTS, EPRINTS

Wright's Media

0800-051-8327 (Toll Free)

Printed by BGP

Distributed by Seymour Distribution

Tel: 020 7429 4001



When you have finished with this magazine please recycle it

The paper used within this magazine is produced from sustainable fibre, manufactured by mills with a valid chain of custody.

### DON'T TRY THIS AT HOME

The advice and information provided in this magazine is given in good faith.

Dennis Publishing Limited cannot accept any responsibility for any loss, disruption or damage to your data or your computer system which may occur as a result of following or attempting to follow advice given in the magazine or on its website. If things do go wrong, take a break. The world tends to seem better after a cup of tea.

Custom PC is published monthly by Dennis Publishing Ltd, 30 Cleveland Street, London W1T 4JD, a company registered in England number 1138891.

Entire contents © Dennis Publishing Ltd licensed by Felden.

© Copyright Dennis Publishing Limited. Custom PC is a trademark of Felix Dennis.

October 2013 ■ 3



# contents

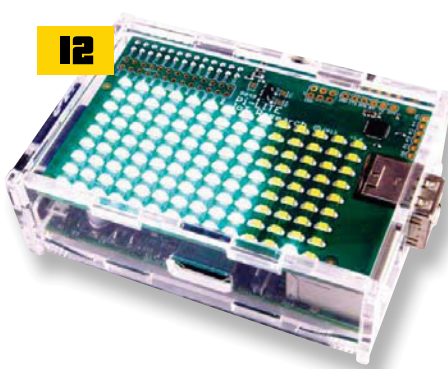
## COVER STORY

### BUILD A TINY GAMING PC

92

Your average desktop PC takes up lots of space, it's a pain to carry to LAN parties and, as so few of us use more than two PCI-E slots now, for many people, there seems little point in having a full-sized desktop. Thankfully, there's a very easy way to build a small PC without compromising on performance.

Mini-ITX motherboards are now just as overclockable as their full-sized counterparts, and include many of the same features, such as PCI-E graphics slots, SATA 6Gbps ports, USB 3 ports and headers and even on-board WiFi and Bluetooth – just check out the Labs on p40 for proof. Here, we take a look at all the gear you need to build a £999 mini-ITX gaming system, as well as how to build it.



## highlights

11

### BRAIN TRAINING

A remedy for EMF? That's unbelievable, says Tracy King.

12

### HOBBY TECH

Gareth checks out the Raspberry Pi Wireless Inventors Kit and shows you how to make an LED CPU activity meter with the Pi-Lite.

20

### ASUS MAXIMUS VIGENE

We check out Asus' latest micro-ATX board for enthusiasts.

28

### SAMSUNG SSD 840 EVO

Get 1TB of solid state storage for just over £500.

40

### Z87 MINI-ITX MOTHERBOARD LABS

Everyone wants a piece of the enthusiast shoebox market now - we investigate mini Z87 motherboards from all the big players.

50

### GEFORCE GTX 760 GRAPHICS CARD LABS

Nvidia's GeForce GTX 760 blew us away last

20

month, but which one should you buy? We put five cards through their paces to find out.

86

### ENGINE ROOM

Rick Lane investigates the 4A engine – the foundation for both Metro: 2033 and Last Light.

90

### THE PORN WALL

David Cameron wants us to sleepwalk into censorship via 'default on' filtering, argues Jim Killock from the Open Rights Group.





102



98



98

### HAPPY BIRTHDAY CPC!

We've been going for ten years. Join us, as we look back to where it all began.

106

### HOW TO FIT HEAT DUCTING

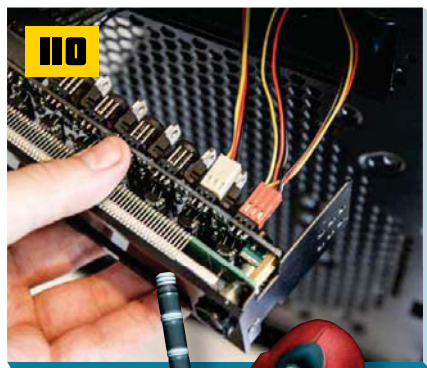
Antony Leather shows you how to direct cool air from your intake fan directly onto your CPU cooler.

110

### HOW TO AUTOMATE YOUR COOLING SYSTEM

Set your own temperature thresholds and fan speeds for your cooling system.

110



78



## Regulars

- 8 From the editor
- 11 Tracy King
- 12 Hobby tech
- 16 Incoming
- 36 How we test
- 64 CPC Elite products
- 76 Cynical hit
- 86 The engine room
- 88 Dev perspective
- 90 Digital rights
- 120 Retro tech
- 122 James Gorbald

## Community

- 102 Readers' drives
- 106 How to fit heat ducting
- 110 How to automate your cooling system
- 112 Letters
- 117 Folder of the month
- 118 Your folding milestones

## Reviewed this month

### Hardware

#### MOTHERBOARD

- 20 Asus Maximus VI Gene

#### CASE

- 22 Cubitek Mini Cube
- 24 Corsair Carbide 530 Air

#### SSD

- 28 Samsung SSD 840 EVO 120GB, 500GB, 750GB and 1TB

#### KEYBOARD

- 30 SteelSeries Apex

#### MOUSE

- 32 Corsair Raptor M30

### Custom kit

- 38 Dobble
- 38 Seal Shield Pup Glow 2
- 38 QDOS QBOPZ
- 39 Razer Goliathus – League of Legends Edition
- 39 Antec AMP SP1
- 39 i-box Bass Addicts

### Z87 mini-ITX motherboard Labs test

- 43 Asus Maximus VI Impact
- 44 Asus Z87i-Pro
- 45 ASRock Z87E-ITX
- 46 Gigabyte GA-Z87N-WiFi
- 48 MSI Z87i

### GeForce GTX760 graphics card Labs test

- 50 EVGA GeForce GTX 760 SC ACX 2GB
- 52 MSI GeForce GTX 760 Twin Frozr OC Gaming 2GB
- 54 KFA? GeForce GTX 760 EX OC 2GB
- 56 PNY GeForce GTX 760 XLR8 2GB
- 58 Zotac GeForce GTX 760 AMP! Edition 2GB

### Games

- 78 Deadpool
- 80 Dark
- 81 Joe Danger Bundle
- 82 Magrunner: Dark Pulse
- 84 Reus

30  
PRODUCTS  
REVIEWED





Cyberpower recommends Windows 8

# CYBERPOWER

Create the PC of Your Dreams



To Custom Build Your Ideal Desktop or Laptop, Visit :

**www.cyberpowersystem.co.uk**  
**0844 371 2727**



## Infinity Hercules GT

Extreme Performance Gaming Station  
Intel® Core™ i7-4770K Processor @ 3.5Ghz!

### Windows 8

Asus® P8Z87-K MB with SATA III, USB 3  
16GB Kingston® Hyper X Blu 1600Mhz Memory  
120GB Kingston HyperX 3K SSD  
2TB 7200rpm SATA III 6.0Gb/s 64MB Cache HDD  
2GB Nvidia® GeForce® GTX 770 Graphic Card  
CoolerMaster Dominator 2 CM-692 Black

**CoolerMaster Seidon 120mm Water Cooling System**

LCD monitor is not included but optional

From **£1199** Inc VAT and Del

Intel® Core™ i7 Processor  
4770K 3.5Ghz £ 1355  
4770 3.4Ghz £ 1325

Intel® Core™ i5 Processor  
4670K 3.4Ghz £ 1255  
4670 3.4Ghz £ 1239  
4570 3.2Ghz £ 1199



## Infinity Hercules

A Media Dream for Photo/Video Editing  
4th Generation Intel® Core™ Processor

### Windows 8

GIGABYTE® Z87-HD3 MB with SATA III, USB 3  
8GB Kingston® Hyper X DDR3 Blu 1600Mhz Memory  
2TB 7200rpm SATA III 6.0Gb/s HDD  
2GB Nvidia® GTX 760 Graphic Card  
NZXT Phantom 410 Mid Tower White

**CoolerMaster Seidon 120mm Water Cooling System**

LCD monitor is not included but optional

From **£919** Inc VAT and Del

Intel® Core™ i7 Processor  
4770K 3.5Ghz £ 1059  
4770 3.4Ghz £ 1029

Intel® Core™ i5 Processor  
4670K 3.4Ghz £ 965  
4670 3.4Ghz £ 949  
4570 3.2Ghz £ 919



- Free UK delivery\*
- All desktops come with 3 year warranty\*\*
- Flexible finance available and secure online payment

\*UK mainland only, see our website for detail

\*\*See our website for detail





## Infinity Fusion TITAN

Extreme CPU & VGA Water Cooling Gaming Monster  
Intel® Core™ Processor i7-3970X

### Windows 8

Asus® P9X79 PRO DDR3 with SATA III, USB3  
16GB Kingston® Hyper X DDR3 Blu 1600Mhz Memory  
240GB (2x 120GB in Raid 0) Kingston 3K SATAIII SSD  
2TB 7200rpm SATA III 6.0Gb/s 64MB Cache HDD  
6GB Nvidia® GTX TITAN Graphic Card  
15x Pioneer BluRay BDR-208DBK Writer Black  
CoolerMaster HAF X Gaming Tower Case w/Side-Panel Window  
**Cyberpower Advance Water Cooling system with both CPU and Graphic Card**  
with reservoir and pump

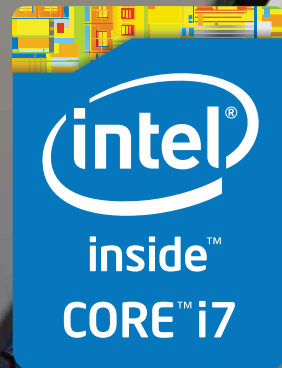
LCD monitor is not included but optional



### Intel® Core™ i7 Processor Extreme Edition

3970X 3.50Ghz 15MB	£ 3175
3930K 3.20Ghz 12MB	£ 2725
3820 3.60Ghz 10MB	£ 2399

From **£2399**  
Inc VAT and Del



# UNLEASH THE POWER



## Infinity Hercules SE

Great Value for Money Home PC with Water Cooling  
Intel® Core™ i5 Processor

### Windows 8

B85M HD3 MB  
8GB DDR3 Kingston® HyperX Blu 1600mhz Memory  
1TB 7200rpm SATA III 3.0Gb/s 32MB HDD  
1GB AMD® Radeon™ 7770 Graphic Card  
CoolerMaster Elite 430 Mid-Tower Case with Side Panel Window  
**CoolerMaster Seidon 120mm Water Cooling System**  
LCD monitor is not included but optional

From **£669** Inc VAT and Del

Intel® Core™ i7 Processor  
4770K 3.5Ghz £ 809  
4770 3.4Ghz £ 779

Intel® Core™ i5 Processor  
4670K 3.4Ghz £ 715  
4670 3.4Ghz £ 699  
4570 3.2Ghz £ 669



## Infinity Level 10

High Performance All-Rounder  
Intel® 3rd Generation Core™ Processor

### Windows 8

ASUS® P9X79 LE  
16GB Kingston® HyperX DDR3 Blu 1600Mhz Memory  
2TB 7200rpm SATA III 6.0Gb/s 64MB Cache HDD  
2GB Nvidia® GTX 780 Graphic Card  
15X Pioneer BluRay BDR-208DBK Writer Black  
Thermaltake Level 10GT Full Tower w/ Side-Panel Window  
**CoolerMaster Seidon 120mm Water Cooling System**  
LCD monitor is not included but optional

From **£1719** Inc VAT and Del

Intel® Core™ i7 Processor  
Extreme Edition  
3970X 3.5Ghz £ 2459  
3930K 3.2Ghz £ 2015  
3820 3.6Ghz £ 1719



## Infinity Xplorer X6-6800

Gaming Laptop with 4th Generation  
Intel® Core™ Processor i7 4900MQ  
Intel® HM87 Chipset  
WiFi Link 802.11 A/B/G/N

### Windows 8

8GB DDR3-1600 SODIMM Corsair Vengeance  
750GB SATA II HDD  
15.6" Full HD 1920 x 1080 Display  
2GB Built-in Nvidia® GeForce® GTX 765M PCIe Video  
GIGABYTE® LAN & Wireless N Network Card  
Built-in 2 Mega Pixels HD Webcam

From **£879** Inc VAT and Del

Intel® Core™ i7 Processor  
Extreme Edition  
4900MQ £ 1129  
4800MQ £ 969  
4700MQ £ 879



## FANGBOOK EVO HX7-200

Gaming Laptop with 4th Generation  
Intel® Core™ Processor i7-4930MX

Intel® HM87 Chipset  
WiFi Link 802.11 A/B/G/N

### Windows 8

16GB DDR3-1600 SODIMM Corsair Vengeance  
750GB 7200RPM HDD  
64GB Crucial M4 Series Gaming MLC  
17.3" Full HD 1920 x 1080 Display  
3GB Built-in Nvidia® GeForce® GTX 770M Graphics  
Built-in 2MP HD Webcam

From **£1379** Inc VAT and Del

Intel® Core™ i7 Processor  
Extreme Edition  
4930MX £ 2109  
4900MQ £ 1655  
4800MQ £ 1489  
4700MQ £ 1379





FROM THE EDITOR

# HAPPY BIRTHDAY TO US!



Ben Hardwidge reflects on why the desktop PC is still special to enthusiasts after ten years

**Y**ou're launching a print magazine now? A technical one about computer hotrods? Are you feeling okay? You know everyone can just get all that stuff on the Web, don't you? That was the general attitude among many people including, believe it or not, myself, when Gareth Ogden announced that he was working on a new magazine project for PC enthusiasts at Dennis, although I shut up when he decided to give me a job. Ten years later, the naysayers have been proved completely and utterly wrong.

Competitors have come and gone, and the traditional desktop PC has largely disappeared from the shelves of PC World, yet **Custom PC** has stood strong for a whole decade. I look at **Custom PC** as being a little like Iron Maiden in that respect. Mainstream computing trends change, just like mainstream music, yet a heavy metal band that's been around for over 30 years, and hasn't changed its style, still sells out arenas and festivals.

The stage shows are full of over-the-top sets, props and costume changes, which are technically superfluous, but actually make the show massively more enjoyable. Most importantly, Iron Maiden has fans like no other band. They're loyal to the point of obsession; they don't care about the latest fads, they just love the feeling of euphoria as Bruce Dickinson belts out the opening lines of Aces High.

Likewise, for many people, a desktop PC is over the top, which is why they've largely been replaced by laptops and tablets in the average home. But we're different. We're the people who love knowing that we have the best gaming hardware on earth by a country mile; we're the people who want to overclock our hardware as far as it will go, just for the fun of it; we're the people who make a working synthesiser out of a Commodore 64 chip (see p14).

We still love new technology, of course. We still buy smartphones and tablets, and play around with flexible new computers such as the Raspberry Pi, but we also know that there's simply no replacement for a desktop. Whether it's a full-sized ATX beast or a mini-ITX baby, you still have your own choice of storage, CPU, graphics card, memory and cooling.

I love my Nexus 7 for general mucking about on the Net from the sofa, and for controlling my HTPC, but I also love my desktop. You might be able to play the same games on consoles, but they won't look anywhere near as good. Plus, with the PlayStation 4 and Xbox One set to be based on AMD APU's, top-end PCs are still going to provide the best graphical gaming hardware for years to come.

PC enthusiasm is undoubtedly a niche, but it's a niche that's filled with people who really love PCs; people who will always come back to their PC, no matter what else happens because, like Iron Maiden, nothing

else provides that experience.

So thank you, all you lovely PC hobbyists, for continuing to strive to get the most out of your hardware, and for buying **Custom PC** throughout its first ten years. It turns out that not only are people still very interested in PC enthusiasm, but that they also want to read a print magazine about it, despite what the naysayers predicted. We wouldn't be here without you, and we hope we'll continue to inform and entertain you in the years to come.

**They just love the feeling of euphoria as Bruce Dickinson belts out the opening lines of Aces High**

Ben Hardwidge is the editor of **Custom PC**. He likes PCs, real ale and Warhammer 40,000.

✉ [EDITOR@CUSTOMPCMAG.ORG.UK](mailto:EDITOR@CUSTOMPCMAG.ORG.UK) @MANSHARK



ASUS recommends Windows 8.



\*Apps from Windows Store; vary by market.



## ASUS ALL-IN-ONE PC FOR ALL OF US IN SEARCH OF INCREDIBLE ET2300 INSPIRED BY INTEL

Powered by an Intel® 3rd gen Core™ i7 desktop processor, discrete graphics, and a 10-point Full HD IPS touchscreen for intuitive Windows 8 experiences, the ET2300 provides top of the line audio and video performance with exclusive ASUS SonicMaster technology, the first array speaker on any AiO PC, and a dedicated subwoofer. For greater comfort, it offers a 180-degree foldable design.

Prepare to be entertained at [insearchofincredible.com](http://insearchofincredible.com)



[amazon.co.uk](http://amazon.co.uk)

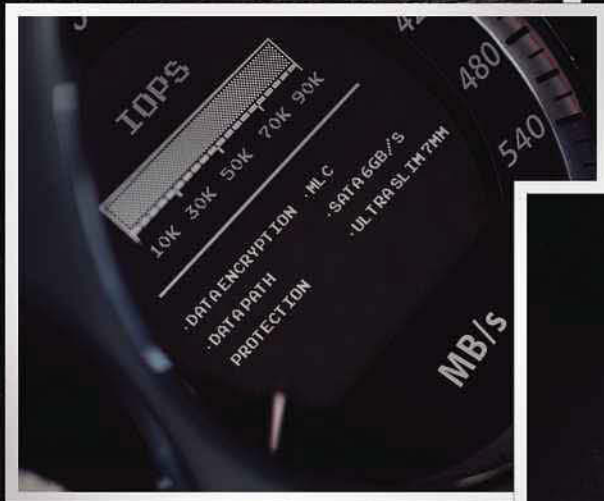
Currys PC World

Beautiful, fast, fluid

Windows 8



Finally, the **drive** you've been waiting for...



### Vertex 450 Solid State Drives

Here's your ticket to a faster system. The Vertex 450 Series dramatically accelerates your gaming, content creation, and multimedia applications, all while driving an improved overall computing experience. Get ready for hard-drive humiliating performance that is ideal for today's high-end consumers and client applications.



**TRACY KING**

# ALTERNATIVE MEDICINE FOR PCs



Be wary of pseudoscience when it comes to EMF remedies, says Tracy King

**Y**ou know what they call alternative medicine that's been proven to work? Medicine. So says Tim Minchin to the alternative-lifestyle advocate 'Storm' in his comedy poem of the same name. Funny, true and completely unrelated to a magazine about technology. Until today. For today, I'm amused and horrified to present to you: alternative medicine for your laptop, router or phone.

That's right, for only £25 you can now purchase a little round blob called an EnergyDot that 'harmonises electromagnetic frequencies (EMFs) from the electronic equipment you use'.

The maker claims that 'the principle is similar to that used in homeopathic medicine or other vibrational remedies, where an energy signature is stored in a solid substance'. That might stand a chance of being reasonable if that was remotely how homeopathic medicine works, but it isn't. If, like most people, you don't know the magic theory behind homeopathy, perhaps thinking it's some sort of herb, you're in for a fun read. Homeopathy is just water, nothing more. Practitioners claim that it 'stores a memory' of the original cure to which it was first introduced millions of dilutions ago, but it doesn't, because that's Harry Potter talk. I wish I was joking.

So, EnergyDots work on the same principle, according to the manufacturer, which is handy for me as an investigator of such claims because it makes it easy to say 'this doesn't and can't work as described' without reading ten contradictory studies. Not, I note, that the good folks at EnergyDots have provided any reputable scientific studies to back up their claims. They do provide several hilarious ones, carried out by Biofield Sciences, an Indian alternative medicine centre. The website says they use 'an open-minded scientific approach'. As many smarter people than I have quipped, it's good to be open-minded, but not so open-minded that your brain falls out.

**It's the sort of pseudoscience you might find in a psychic's pamphlet**

The main research document provided starts badly, by assuming that the EnergyDot works as described. The rest of it is largely pseudoscience, the sort you might find on a ghost-hunter's website or psychic's pamphlet. The most telling sentence, however, is 'participants were informed of the nature of the study'. There you have it. The 60 people in the study knew what they were testing and were allowed to ask questions beforehand. That's how you get bias and how you confuse placebo effect with actual efficacy.

EnergyDot provides a nice quote from a doctor though. 'I use an electroDOT and a bioDOT and recommend them to clients without hesitation,' says Dr Stephen Hopwood. I had already heard of him but he's worth a Google if you're wondering why EnergyDot would choose to put his name on its site. Dr Hopwood is a former GP turned holistic practitioner who advocates treating cancer with baking soda, something that landed his clinic in hot water with Trading Standards last year when his conference on the subject was deemed illegal. Not exactly a ringing endorsement, EnergyDot.

I don't think assessing whether the dot works as described is even the issue here. Way before we get to that, we have the small issue of it claiming to solve a problem that doesn't exist, that of allegedly harmful EMF, which sufferers claim causes a host of symptoms from headaches to death. I've covered EMF in this column before, and the evidence hasn't changed since. So to reiterate, there is no decent proof that 'electro-smog' is the cause of reported symptoms. Full stop, or if you prefer, dot.

**Gamer and science enthusiast Tracy King dissects the evidence and statistics behind some of the popular media stories surrounding tech and gaming** [@TKINGDOLL](#)



# GARETH HALFACREE'S HOBBY tech

The latest tips, tricks and news in the world of computer hobbyism, from Raspberry Pi and Android to retro computing

## RASPBERRY Pi WIRELESS INVENTOR'S KIT

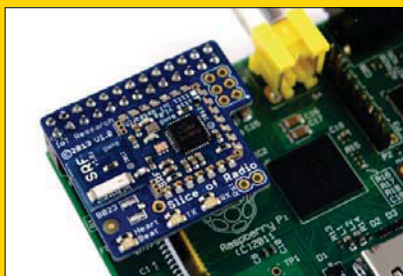
Get ready for some serious RF tinkering

This month, I've been spending a lot of time with an early prototype of the Raspberry Pi Wireless Inventors Kit, or RasWIK, again from Ciseco. The company has jumped at the low-cost Raspberry Pi, and this latest kit is the culmination of its efforts in the field of the Internet of Things (IoT).

Combining two of its existing products – the Arduino-compatible XinoRF and the Slice of Radio accessory for the Raspberry Pi – with extra components, the RasWIK is designed for those taking their first tentative steps into the IoT. Supplied with software pre-installed on an SD card – just insert it into the Pi to get started – the guys at Ciseco have worked hard on creating realistic beginners' projects using the LEDs, switches, buzzer, thermistor and light-dependent resistor (LDR) included in the package.

For those who have played with an Arduino starter kit, the components will be familiar, right down to the miniature breadboard. Where it gets clever is in the wireless spectrum: the XinoRF is an Arduino-compatible microcontroller – an Uno clone, in fact – with an integrated software-defined radio preset to use the licence-free 868MHz spectrum. Combined with the Slice of Radio accessory – the same radio chip, but housed on a break-out board that connects it to the Raspberry Pi's GPIO header – it allows for some very clever wireless tinkering.

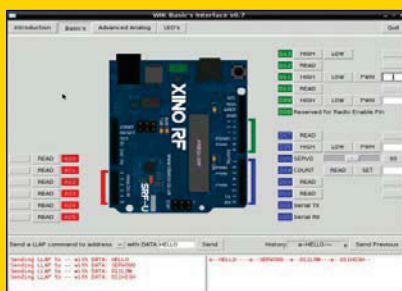
The bundled software gets you started: connect the XinoRF and the Slice of Radio-equipped Pi to power, load the Python program – still under development at the time of writing – and start clicking. A drawing of the XinoRF provides visual feedback of what's going on, and allows you to read from pins,



The Slice of Radio add-on provides the Pi with a wireless connection



The other end of the connection, the Xino RF, is a fully Arduino-compatible microcontroller



Although it's in the early stages of development, the RasWIK software shows considerable promise

switch other pins on and off, or even control a servo – not supplied in the basic kit – without connecting the two devices with a wire.

It all becomes really clever when you investigate the Lightweight Local Automation Protocol, or LLAP, on which the demonstration runs. Using a series of fixed-length text messages, prefixed with a device identifier, it's possible to control individual devices on a larger network. Buying additional radio-enabled parts – such as the tiny Arduino-compatible RFu 328, £15.74 – and giving them unique identifiers means you can have as many remote devices hanging off your Pi as your heart desires.

That gives the Pi considerable power; as the brains of the system, it could offer remote monitoring of the temperature of every room in your house, with live data being uploaded to a remote server. Alternatively, it could serve a web page that enables you to turn electrical equipment on and off – a simple job that requires only a relay and a modicum of care – just by clicking an icon. You can even easily weatherproof your design, as no external wires are required – you could even add an outdoor sensor to tell you the temperature, or whether your gate is open.


That isn't to say the RasWIK is perfect, of course. While the £49.99 inc VAT cost – which, at the time of writing, had yet to be confirmed as the final price – is low enough,

the selection of components is basic. The Slice of Radio also precludes the use of the Pi's GPIO port for anything else, despite only using the UART and power pins. Still, I've had a blast playing with it – and it's given me more than a few ideas for future projects.



# PI LITE

## How to set up this LED grid as a CPU activity monitor

 This symbol means the command should all be on one line

I was recently sent a bright white version of the Pi Lite accessory from Internet of Things (IoT) specialist Ciseco. Funded via Kickstarter, the Pi Lite adds a grid of 126 LEDs in a 14 x 9 layout to the top of the Raspberry Pi. An Arduino-compatible microcontroller drives them, while power and data are provided through the Pi's GPIO port.

While the Pi Lite's primary purpose is scrolling text across the display, I had a different idea in mind: a scrolling bar graph that displays CPU activity. When the Pi is maxed out, I'll know at a glance; and when the display goes dark, I'll know that it's finished working. If you have a Pi Lite – £19.99 from <http://shop.ciseco.co.uk> – you can do the same, following the simple steps below.

### 01 CONFIGURE THE PI

The Pi needs adjustment to use the UART portion of the GPIO header, so that it can communicate with the Pi Lite. You just need to remove some settings from the /etc/inittab

and /boot/cmdline.txt files as detailed on Cisco's webpage at <http://tinyurl.com/cisecosetup>. When finished, power off the Pi ready for installation with the command:

```
sudo shutdown -h now
```

### 02 CONNECT THE PI LITE

Plug the Pi Lite into the Pi's GPIO header. Its design makes it compatible with most cases, excluding some designs with a hinged lid. Make sure the GPIO connector is centred, and press down gently but firmly before powering up your Pi.

### 03 INSTALL THE PYTHON LIBRARIES

To read CPU information easily, install the psutil and serial Python libraries with the following command at the Pi console or terminal:

```
sudo apt-get update &&
sudo apt-get install
python-psutil python-serial
```

### 04 GRAB THE PYTHON PROGRAM

As the program is a little long for this column, grab the file with the following command and, if you want to know more, just open it with a text editor to see what's going on inside.

```
wget -O cpugraph.py
http://tinyurl.com/picpugraph
```

### 05 RUN PYTHON IN THE BACKGROUND

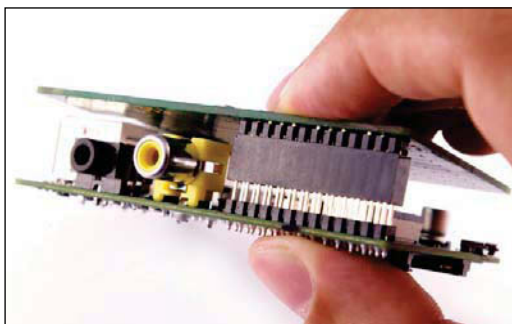
To run the program in the background, first make it executable with the following command:

```
chmod +x cpugraph.py
```

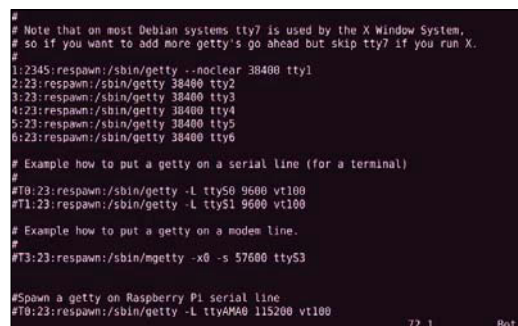
Then execute it with an ampersand at the end of the command:

```
./cpugraph.py &
```

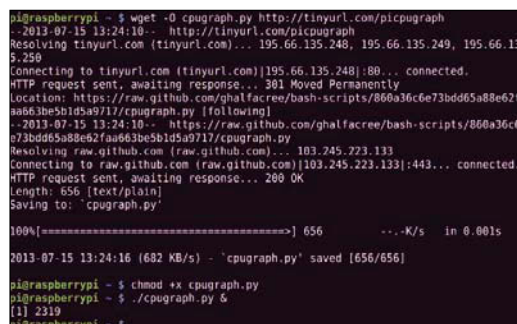
Now all CPU activity will be mapped to the Pi Lite as a scrolling graph. Each column represents one second, and each LED just over 10 per cent (actually 11.1 recurring, as there are nine LEDs per column) of activity.



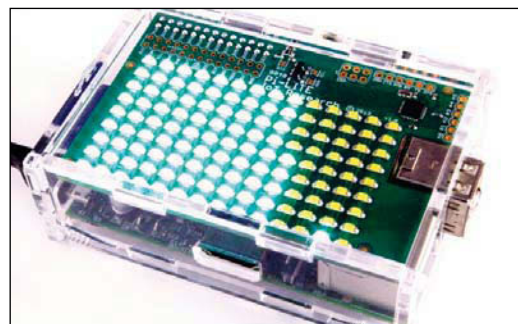
Yes, I took a picture of the 'gently squeeze' process. It took ages too, you ingrates



To get the Pi ready for the Pi Lite, you'll need to edit a couple of files



An ampersand at the end of a command runs it in the background



The finished project, displaying heavy CPU activity associated with a recently finished ImageMagick conversion



# CHARLOTTE GORE'S SIDI PROJECT

We take a look inside this Arduino-based synthesiser, which uses the Commodore 64's SID sound chip

As a tech journalist, I often have the pleasure of talking to people undertaking exciting projects in their fields.

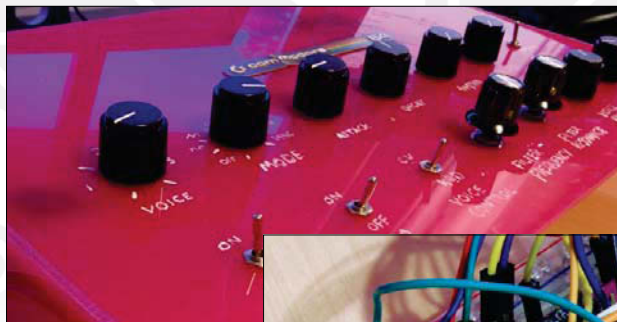
This was the case with Charlotte Gore, a talented polymath, musician and coder who is branching out into the world of electronics with an interesting creation, and in doing so, hoping to bring one of my favourite integrated circuits, the MOS 6581 SID (sound interface device), to a wider audience.

Developed to add multi-channel audio to the Commodore 64, a device that would become the single best-selling computer in history, to say the SID chip was ahead of its time was an understatement. 'The guy who designed the SID chip, Bob Yannes, felt that those rival computer sound chips were obviously designed by people who knew nothing about music,' Gore explains, clearly warming to her topic as she demonstrates her creation, in classic 1980s micro style, in a bedroom converted into a storage area and workshop.

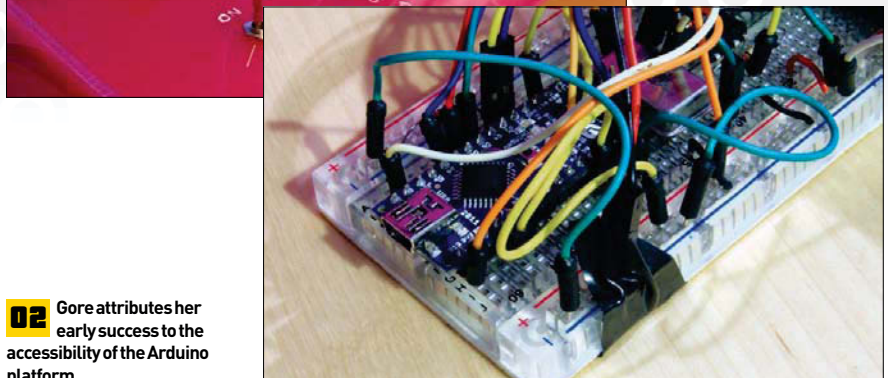
'He designed a powerful and versatile synthesiser on a single chip – so have different kinds of waveforms; you have square and triangle, plus ramp, noise, and ring modulation, which are really advanced features, and you can synchronise these various voices with each other.

'It has an analogue filter in it, which is something that Moog [synthesisers], proper analogue synthesisers have, and it's what gives them their characteristic sound. He added one, which is ridiculous because it's an 8-bit computer – people were perfectly happy with just noises and beeps and stuff like that, and he just said, "Oh, I'm going to put in an actual analogue synthesiser inside the Commodore 64."

Despite cutting some corners that disappointed Yannes, his colleague Charles Winterble famously described the chip as 'ten times better than anything out



**01** The controls of the SID-to-MIDI control surface are designed to be familiar to musicians



**02** Gore attributes her early success to the accessibility of the Arduino platform

there, and 20 times better than it needs to be' – and there's a generation of musicians, Gore included, who agree.

'I bought my first Commodore 64, and I remember putting a game in and it just started playing music at me while it was loading,' Gore tells me, recalling her epiphany after migrating from the C64's biggest rival, the Sinclair ZX Spectrum. 'This music was obviously a full SID synth, with all the filter sweeps, pulse width modulation manipulation and all this weird stuff, and it was the most amazing sound I'd heard in my entire life. Ever since, I've always kind of thought of the Commodore 64 as very special.'

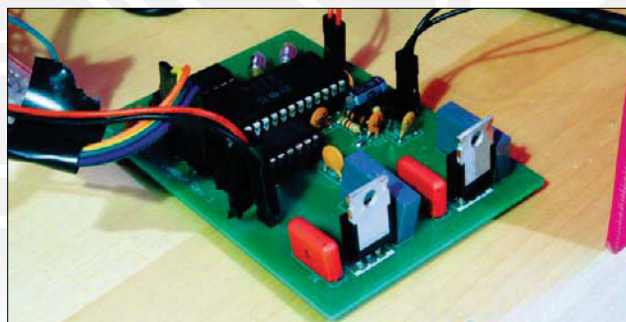
Even so, her original project wasn't necessarily designed with it in mind. 'It's only recently, when I was actually thinking about wanting to make a synth with an Arduino, I thought, maybe there's a single chip that I could get, and I could just program this chip and get sounds out of it. I started looking into what was out there, and I realised there was nothing like that. It didn't exist, and the only time that it did actually exist was back in the old Commodore 64 days with the SID chip.'

Through an add-on shield called the SIDaster, which was abandoned in favour of a from-scratch approach, with help from the MIDIbox SID project, Gore has developed a prototype of what could be the first SID-based synthesiser aimed at musicians, just as Yannes had intended for his creation.

The crunchy, iconic sound of the SID is greatly prized among musicians – from both the chiptune scene and mainstream music circles, but capturing it is difficult. There has never been another chip like the SID, and software emulation falls short of its distinctive sound.

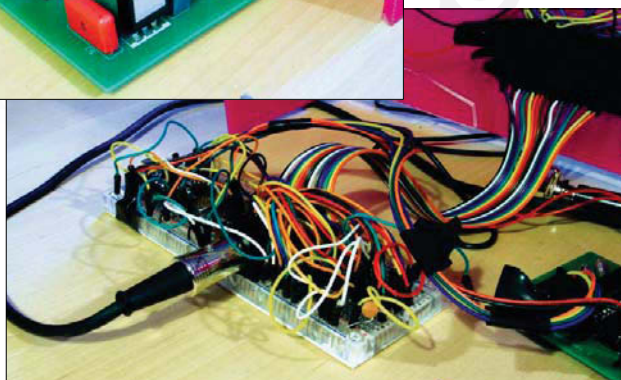
Creating music using an original C64 is also awkward for non-programmers, and even standalone devices such as the Elektron Sidstation fall short. 'It was rubbish for musicians,' Gore tells me, 'because it had a screen and a keypad. It was terrible.'

Gore's invention is rather different; using an Arduino, shift registers, a bunch of toggle switches and potentiometers, Gore has created something that most musicians could quickly grasp. Unlike the Sidstation, there's no need to know hexadecimal or how



**03** Custom-made PCBs are easy to have produced, but SID chips are in short supply

**04** The next step for Gore is to redesign the system to communicate via the I2C bus



the registers of the C64 were set up. Gore's device allows for full control of the SID's capabilities simply by twisting a few knobs. It's installed in a hot-pink chassis built at her local Hackspace, and you can play it using a MIDI keyboard too.

When Gore fires up the device, the effect is electric. Running her fingers over the keys in a simple melody, she quickly flicks between square, sine and sawtooth waveforms, and generates the memorable sound that anybody familiar with a Commodore 64 will recall.

Meanwhile, adjustment of other controls allows for voices to be linked through the ring modulator, creating a sound that puts an unmistakable grin on my face.

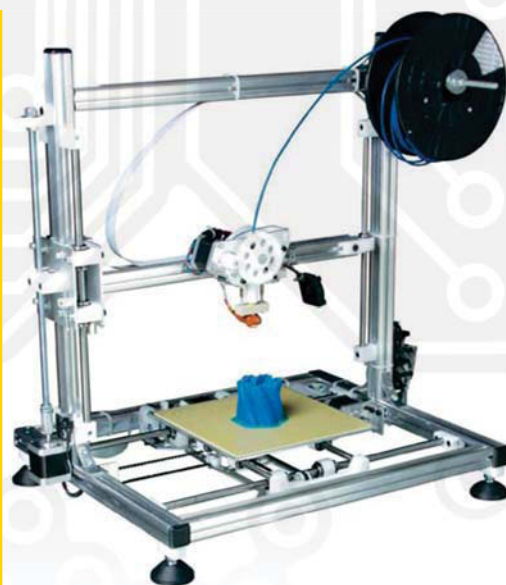
The project is far from finished though. Having started as an absolute beginner, Gore now has visions of creating multiple control surfaces that can communicate over the inter-integrated circuit (I2C) bus, and daisy-chaining multiple SIDs together for true polyphony. This could then be put together in a robust, stylish case with a view to selling them to other musicians.

'I want to put the SID in the hands of musicians in a form they understand,' Gore enthuses. 'Anybody who understands a Moog synthesiser should understand these controls, and I just think that's what it needs to do.'

The biggest issue is finding SIDs. The notoriously fragile chips are often one of the first components to go in a Commodore 64, and it's been several years since factories churned them out under the guidance of Commodore subsidiary MOS Technologies.

'My source for SIDs is eBay,' Gore laments, while donning an anti-static wrist strap before positioning one of the precious components under my camera lens. 'It means going on eBay and buying Commodore 64s – you tear off the case, and hope the SID isn't soldered down.'

All the schematics and source code for the project are available from <http://github.com/CharlotteGore>, while a sample of the amazing sounds it can create can be found on SoundCloud at <http://tinyurl.com/sidofsteel> **GPC**



## MAPLIN GETS INTO 3D PRINTING

Hot on the heels of Amazon's US arm, electronics giant Maplin has announced its own entry into the market. 'Until now, the cost of 3D printers limited their use to the professional market. However, the Velleman K8200 kit has enabled us to introduce 3D printing to the mass market,' said Maplin's commercial director Oliver Meakin. The DIY kit is on sale now, costing £699.99 inc VAT with bundled software and 5m of polylactic acid (PLA) printing material.

## SPACE SEEKS FUNDING FOR FAB LAB

Arts charity SPACE has turned to Kickstarter to fund the launch of a digital fabrication facility dubbed Fab Lab in London. If successful, Fab Lab will create a hackspace of sorts, including 3D printing, vinyl and laser-cutting equipment, and provide access to its production capabilities for just £20 a year.



**GARETH HALFACREE**

is the news reporter at [www.bit-tech.net](http://www.bit-tech.net), and a keen computer hobbyist

who likes to tinker with technology.



@ghalfacree





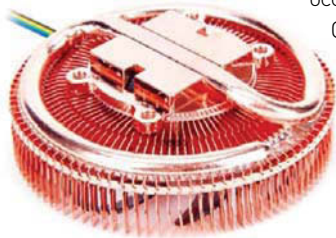
# incoming

We take a look at the latest newly announced products

## ZALMAN TARGETS MINI-ITX

The cooling aficionados over at Zalman have just announced another cooler based on Zalman's distinctive copper flower design, but there's a twist – this one is specifically built for low-profile mini-ITX systems. The all-copper cooler features a heatpipe that directly touches the CPU, and then curves all the way around the cooler in an S-bend.

More importantly, however, it also only measures 84 x 27mm, meaning it should happily sit on a CPU in a low-profile mini-ITX build without clashing with VRM heatsinks, DIMM slots or even the PCI-E slot; instead, it just occupies the usual space allocated to the CPU socket. According to Zalman, the CNPS2X is compatible with a variety of Intel and AMD sockets, including LGA1150 and FM2, and can cool CPUs with a TDP of up to 120W. The cooler is available for pre-order from [www.quietpc.com](http://www.quietpc.com) for £23.99 inc VAT now.



## ADATA RAM HITS 3,100MHz

Adata is the latest memory maker to win the continual willy-waving contest in the RAM business. The company's new XPG V2 DDR3 3100 modules feature eight-layer PCBs, are certified to run at 3,100MHz and will be available in 8GB (2 x 4GB) dual-channel kits. According to Adata, you just need to select the first XMP profile to reap the benefits of the extra bandwidth, which will give you 3,100MHz memory, albeit with 12-14-14-36 latency timings, with a voltage of 1.65V.



## PHANTEKS ON THE CASE

Previously better known for its CPU coolers, Dutch firm Phanteks has now decided to have a stab at the case market. Phanteks' new Enthoo Primo ATX case sports controllable LED lighting, and fasten and release tools behind the motherboard tray to aid with cable routing. Amazingly, the case also has room for two PSUs, and features no fewer than 16 120/140mm fan mounts, with five Phanteks premium 140mm fans included as standard.

The company also claims that radiators can be installed in five locations inside, and that the case will feature specific radiator mounting brackets in the bottom and side, as well as a rear reservoir mount. There's also a cable cover with pre-drilled holes for reservoirs and a universal pump bracket, complete with vibration dampening. The Enthoo Primo is available for £199.99 inc VAT from [www.overclockers.co.uk](http://www.overclockers.co.uk) now.

## NVIDIA TEGRA 5 BEATS GEFORCE 8800 GTX

Nvidia has just given us a teaser of what's to come from its forthcoming Tegra 5 mobile GPU, which the company claims is based on the same Kepler GPU architecture used in its desktop GPUs. In a presentation at Siggraph, Nvidia showed off a slide showing that the chip's graphics performance wouldn't just overtake the iPad 4, but could also be quicker than Nvidia's GeForce 8800 GTX desktop GPU.



Okay, so that's an old GPU, but it's also a full-spec DirectX 10 chip – it offers faster performance and vastly superior graphics to any current tablet or console. A couple of demo videos have also been released, including a realistically expressive human head called Ira, which can be seen at <http://tinyurl.com/LoganHead>.

Codenamed Project Logan, Tegra 5 supports DirectX 11 and is scheduled to be launched next year.

# NEW OPPORTUNITIES WITH NEW DOMAINS

Create your perfect web address with **over 500 new top-level domains** from 1&1! Short, memorable domains like *fashion.blog* and *kitchens.online* are ideal for getting your website found easily. Pre-order your preferred domain for **free, with no obligation!** With regular updates from 1&1, you'll stay fully informed and be in the best position to register your domain with new domain extensions! Find out more at **1and1.co.uk**

**PRE-ORDER  
FREE**  
WITH NO OBLIGATION!\*



DOMAINS | E-MAIL | WEB HOSTING | eCOMMERCE | SERVERS

**1and1.co.uk**

\* Pre-ordering a domain name is not a guarantee that the domain will be registered. If your requested domain has already been pre-ordered, you will be added to a waiting list for that domain.



# Reviews

Our in-depth analysis of the latest PC hardware

## Reviewed this month



**22** CUBITEK MINI CUBE  
A mini-ITX case with room for almost everything



**24** CORSAIR CARBIDE AIR 540  
A cube-shaped case for enthusiasts



**28** SAMSUNG SSD 840 EVO  
Where 1TB of solid state storage costs just £509



**30** STEELSERIES APEX  
A membrane keyboard with premium aspirations



**32** CORSAIR RAPTOR M30  
Corsair has a stab at the £35 mouse market



**38** SEAL SHIELD PUP GLOW 2  
Built to go places other keyboards wouldn't dare



**39** ANTEC AMP SP1  
A Bluetooth speaker you'll be proud to take to the park



**39** i-BOX BASS ADDICTS  
Can you get quality bassy sound for just £11?



# Asus Maximus Gene VI

Striking the middle ground between mini-ITX and ATX, we check out Asus' new RoG micro-ATX board **20**



ASUS

## Maximus VI Gene



Another great Gene, but it's pricier than we expected

### + MAXIMUS

Great EFI; good overclocker; plenty of features; superb layout

### - QUINTUS

Comparatively expensive; smaller RoG motherboard now available

#### HOW MUCH?

Price £170 inc VAT

#### Supplier

[www.overclockers.co.uk](http://www.overclockers.co.uk)

#### Manufacturer

<http://uk.asus.com>

#### IN DETAIL

**Chipset** Intel Z87

**CPU support** LGA1150 Core i3, Core i5, Core i7, Pentium and Celeron

**Memory support** 4 x slots: max 32GB DDR3 (up to 3,000MHz)

**Expansion slots** 2 x 16x PCI-E (one at 16x, two at 8x), 1 x 4x PCI-E 2 slot, Sound ROG Supreme FX

**Networking** 1 x Killer E2205 Gigabit LAN

**Overclocking** Base clock 90-300MHz; CPU straps 1, 1.25, 1.67 and 2.5; CPU multiplier 8-80x; max voltages CPU 2.1V, RAM 2.44V

**Ports** 8 x SATA 6Gbps, 1 x mSATA 6Gbps [Z87], 8 x USB 2 [Z87], 8 x USB 3 [Z87], 1 x LAN, 4 x surround audio out, line in, mic, optical S/PDIF out, HDMI

**Dimensions (mm)** 244 x 244

# W

hile Asus' first RoG-branded mini-ITX motherboard is grabbing the limelight, it's easy to forget about the other, more affordable dinky RoG product – the Gene.

The Gene V sat on our Elite list for over a year, with its pocket-rocket demeanour and great price.

The Maximus VI Gene currently retails for £170, which isn't quite as wallet-friendly as you might expect, but when you account for inflation, and consider that you could buy a Maximus IV Gene for around £145 in 2011, this isn't quite heresy on Asus' part. It's still significantly cheaper than we expect the Maximus VI Formula to cost. That said, Asus does have one issue, which comes from its own line-up – the Maximus VI Hero. It costs the same as the Maximus VI Gene and has a very similar set of features.

While the Maximus VI Gene sports more USB 3 ports and a mini-PCI-E Combo II slot, the Maximus VI Hero offers a third 16x PCI-E slot, which is limited to four lanes, and while it lacks any kind of mini-PCI-E slot, it does have three 1x PCI-E slots compared to the Maximus VI Gene's single 4x PCI-E slot.

Otherwise, the differences are small. Both motherboards have eight SATA 6Gbps ports (two via the Intel Z87 chipset and a further two via an ASM1061 controller), an Intel Gigabit LAN port and a noise-isolated on-board 8-channel sound card.

In short, if you want a micro-ATX motherboard, or you're not planning on using two GPUs, the Maximus VI Gene should have enough ports to satisfy everyone, but if you're not bothered about having a mini PCI-E slot, and two more USB 3 ports, the Maximus VI Hero certainly gives you more PCI-E expansion room and PCB real-estate for your money.

Layout is excellent, as you would expect from a thoroughbred RoG motherboard. The power sockets are located right on the edge of the PCB, as is the USB 3 header, while the eight SATA 6Gbps ports are all right-angled for easy cable routing. Meanwhile, the 4x PCI-E slot is located in such a way that most multi-GPU setups will end up blocking it, which is a shame, especially if you prefer to use a discrete sound card. As

with the Maximus VI Hero, there are also power and reset buttons, and a CMOS clear switch on the rear I/O panel, while a POST LED readout is located in the top right corner, all of which make testing your hardware much easier. It also has a RoG extension header, which enables you to connect the Asus OC panel overclocking tool.

Asus has introduced several new software features under its RoG brand too. SSD Secure erase – useful for maintaining performance of SandForce-based SSDs – is integrated into the EFI, so you can perform a secure erase prior to installing Windows. Meanwhile, RoG RAMDisk enables you to use a part of your system RAM as a hard disk for super-speedy file access.

#### PERFORMANCE

We started by putting the SATA 6Gbps ports through their paces, and the read and write speeds of 542MB/sec and 520MB/sec respectively were right on the money compared to other Z87 motherboards we've seen. As usual, if you have a SATA 6Gbps SSD that can manage read and write speeds above 400MB/sec,

## LAYOUT IS EXCELLENT, AS YOU WOULD EXPECT FROM A THOROUGHbred REPUBLIC OF GAMERS MOTHERBOARD

you'll want to steer clear of the ports powered by the ASM1061 controller, which managed speeds of 396MB/sec and 384MB/sec respectively.

At stock speed in our Media Benchmarks, the Gene was a powerhouse, managing the fastest image editing and multi-tasking scores we've seen from a Z87 motherboard, at 2,115 and 1,739. It also came within a whisker of the best result in our video encoding test, at 3,720. Overall, though, the Gene managed to claim the top spot, with a score of 2,522; just ahead of the Maximus VI Hero. The game tests also saw it score well, matching the minimum frame rate of its sibling in Skyrim and bettering it with a minimum of 29fps in Total War: Shogun 2.

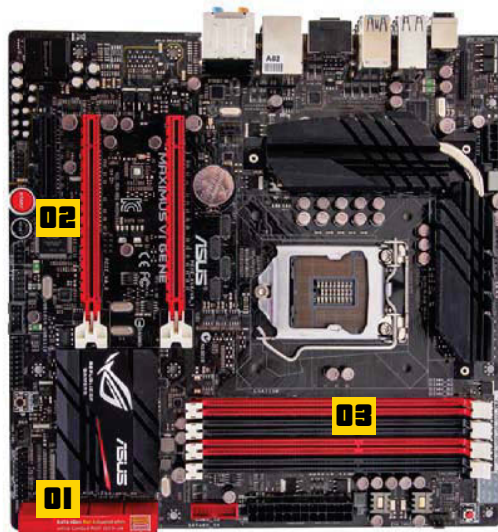


The EFI is the usual slick and well laid-out RoG affair with more options than you can shake a stick at too. We managed to get our CPU to its maximum speed of 4.7GHz using a multiplier of 47x, which is the highest we've managed from any Z87 motherboard so far. We booted into Windows using a vcore of 1.27V and managed to lower this to 1.225V, which is slightly lower than we needed with the Maximus VI Hero.

This saw the overall score in our Media Benchmarks rise to 2,904 – the fastest result we've seen (just), while The Elder Scrolls V: Skyrim and Total War: Shogun 2 saw boosts of 10fps and 7fps respectively. There was nothing nasty to report when it came to power consumption either, with stock and overclocked load figures of 127W and 178W, which are both in the usual mix we've seen.

## CONCLUSION

The Asus Maximus VI Gene has plenty of features, and it overclocks like a trooper. It's also just as fast, if not faster, than any other motherboard we've tested, both at stock speed and when overclocked. There's little to choose between it and the Maximus VI Hero, though, which may represent better value depending on your



**01** The eight SATA 6Gbps ports are all right-angled for easy cable routing

**02** There are no 1x PCI-E slots, but a 4x slot sits at the bottom of the board

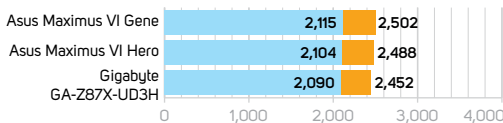
**03** Asus' RoG RAMDisk system enables you to use a part of your system RAM as a hard disk for super-speedy file access

needs. However, last month's Labs winner, Gigabyte's GA-Z87-UD3H, costs £20 less, overclocks just as well and has plenty of useful features. There's also the matter of Asus' Maximus VI Impact mini-ITX motherboard (see p42), which will enable you to build an even smaller system without sacrificing much.

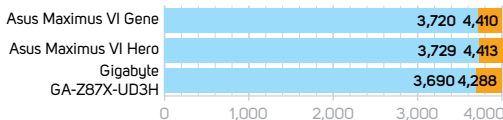
ANTONY LEATHER

## RESULTS

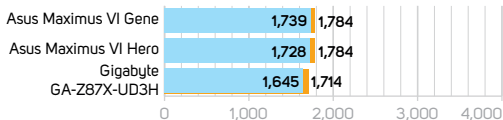
### GIMP IMAGE EDITING



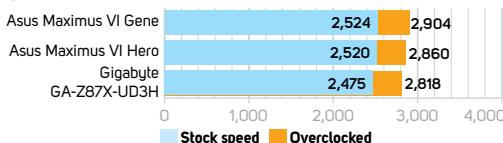
### HANDBRAKE H.264 VIDEO ENCODING



### MULTI-TASKING

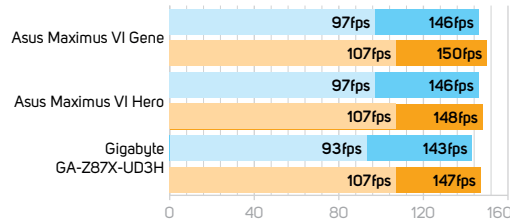


### OVERALL



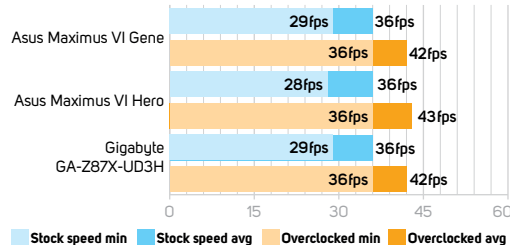
### THE ELDER SCROLLS: SKYRIM

1,920 x 1,080, 16x AF, 0x AA



### TOTAL WAR: SHOGUN 2 DX9 CPU TEST

Default settings, no AA or AF



## SCORES

SPEED 43/45

FEATURES 27/30

VALUE 17/25

**CUSTOM PC**  
**87**  
**OVERALL**

### TEST KIT

3.5GHz Intel Core i7-4770K CPU, 16GB Corsair Vengeance Pro 1,600MHz Corsair DDR3 memory, 128GB OCZ Vector SSD, Nvidia GeForce GTX 680 2GB graphics card, Corsair Pro Series Gold HX750 PSU, Windows 7 64-bit



# CUBITEK

## Mini cube



Great for air cooled systems but there's no room for water cooling

### + CUBED

Great GPU cooling; small size; elegant design; room for full-sized CPU cooler and PSU

### - HALVED

PSU will block some graphics cards; limited space for liquid cooling; no fans as standard

**T**he first thing that struck us about Cubitek's Mini Cube was that it looks exactly like a normal case inside. Unlike most ATX case designs, mini-ITX cases differ wildly in their internal layouts, as space is at a premium. Lian Li's mini-ITX cases often mount the motherboard in a tray at the back, with the PSU mounted over the top, limiting your CPU cooler choice. BitFenix's Prodigy, however, mounts the PSU in the normal way but has the motherboard mounted horizontally above it.

However, the PSU and motherboard mounts are both where you expect them in the Cubitek Mini Cube, yet the case is tiny – smaller in every dimension than the Prodigy, which we've always considered a little too large for a mini-ITX case. Despite the fact that it's smaller, though, the Mini Cube costs £10 more than the Prodigy. It also doesn't include any fans out of the box, but its construction is much more refined. It's made entirely out of aluminium, with a single curved piece stretching from the base, before going all the way around the front and over the top.

The aluminium construction also means it's significantly lighter than the steel Prodigy – just 2.3kg compared to 6.7kg. The side panels screw on from the sides, although some of the edges are a little sharp for comfort. Apart from the



lack of fans and occasional harsh edge, though, there's little else not to like. The build quality is superb inside and out, and there are two USB 3 and two USB 2 ports on the top, next to gold-plated mini-jacks.

The size does mean some restrictions, though, so you'll be limited to 150mm-tall CPU coolers, 150mm PSUs and 280mm-long graphics cards, although

**THE ALUMINIUM CONSTRUCTION MEANS IT'S SIGNIFICANTLY LIGHTER THAN THE STEEL PRODIGY – JUST 2.3KG COMPARED TO 6.7KG**

there's room for two expansion slots, meaning that you can install a dual-slot graphics card. The PSU also has a removable dust filter, but the 120mm intake fan mount is still likely to lead to regular cleaning sessions, while the eagle-eyed will already have noticed that there's no optical drive mount.

One of the best features of the Mini Cube, however, is the large section behind the motherboard tray. It's over 1in thick, and has space for three 3.5in hard disks or four 2.5in SSDs, with a further 2.5in mount in the main section. Of course, this is the perfect place for hiding cables too, which is just as well, as anything left in the main section is likely to get in the way. Our only concern is that hard disks don't receive any airflow, but the aluminium construction and the large area in which they're mounted means they don't get too hot.

There are also two fan mounts – a 120mm floor intake mount and a rear 80/92mm exhaust mount, which are both unoccupied out of the box, but we



### HOW MUCH?

Price £83 inc VAT

#### Supplier

[www.overclockers.co.uk](http://www.overclockers.co.uk)

#### Manufacturer

[www.cubitek.com](http://www.cubitek.com)

#### SKU number

CB-MNI-B004

### IN DETAIL

**Dimensions (mm)** 200 x 300 x 320 (W x D x H)

**Material** Aluminium

**Available colours** Black

**Weight** 2.3kg

**Front panel** Power, 2x USB 2, 2x USB 3

**Drive bays** 5x internal 2.5, 3x internal 3.5in

**Form factor(s)** Mini-ITX

**Cooling** 1 x 120mm fan mount (fan not included), 1 x 80/92mm fan mount (fan not included)

**Extras** None

highly recommend fitting good fans in both. The 120mm fan points directly at the graphics card; as we'll see later, this means that the graphics card runs fairly cool. However, the fan sits extremely close to the PSU, so fitting a radiator or all-in-one liquid cooler will be tricky unless you opt for an SFX PSU.

Dual-slot graphics cards sit barely 1cm away from the PSU too, but as long as your card's cooling fan sits at the far end of the PCB, it should poke over the end, and not get suffocated.

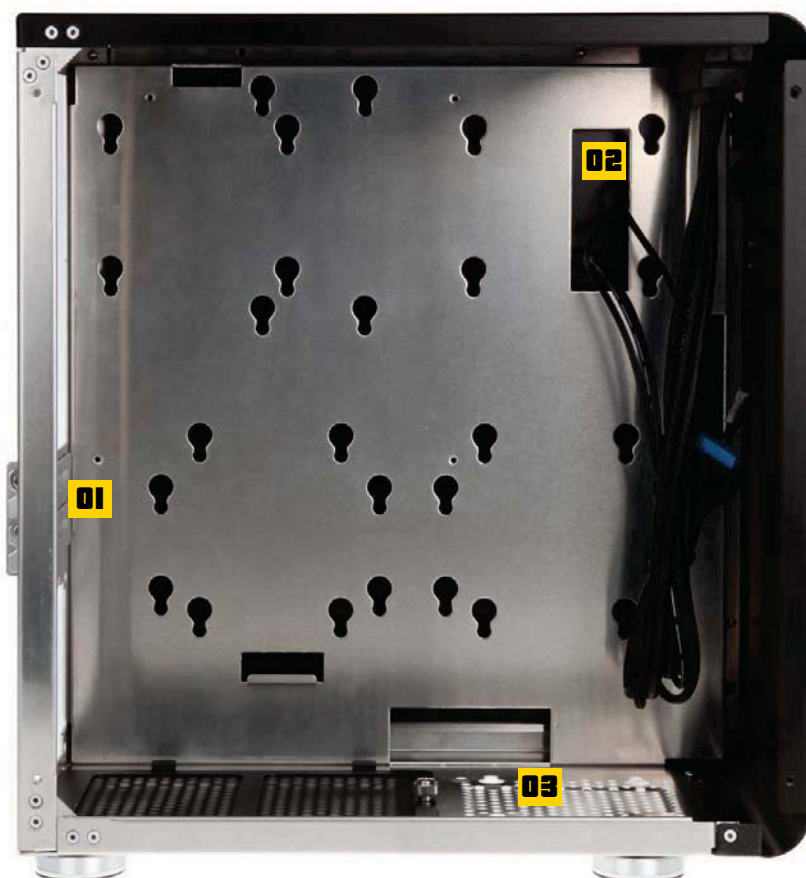
## PERFORMANCE

Since the Mini Cube doesn't include any fans, we had to fit them, as it would undoubtedly fail miserably otherwise. We used a BitFenix Spectre 120mm fan for the base – the same fan that's provided with the Prodigy – and a Noctua NF-A9x14. The latter is quite expensive compared to the Spectre, at around £11, but you'll want to use fans with strong good airflow, as it's the only exhaust fan, so it will dictate your CPU temperature.

With these fans in place, the Mini Cube managed to better the GPU delta T of the Prodigy by 10°C, most likely thanks to the 120mm fan blowing cool air directly into the GPU cooler. The CPU delta T was 4°C warmer, however, although this is far from a terrible result, especially when using our low-profile cooler.

## CONCLUSION

The Mini Cube is a delightful mini-ITX case that's small, light and attractive. Its cable routing – despite its size – is excellent, it can fit a half-decent-sized CPU



**01** There's room for two expansion slots, meaning that you can install a dual-slot graphics card

**02** The section behind the motherboard tray is 1in thick, providing space for hiding cables, as well as three 3.5in hard disks or four 2.5in SSDs

**03** A 120mm intake fan mount sits on the floor, along with the PSU mount

cooler, a 280mm-long dual slot graphics card, a standard-size PSU and plenty of hard disks and SSDs. It also has ample USB ports, which are easily accessible, and its cooling is good too, especially for graphics cards.

There are some caveats though. The graphics card sits right next to the PSU, meaning models with centre-mounted fans may find a part of their intake path blocked. Adding your own fans is also a must, as the CPU or GPU will suffer if either is absent. This obviously adds additional cost, and two good fans will bring the total price closer to £100.

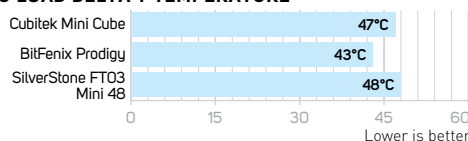
Installing water-cooling systems or all-in-one liquid coolers will also be an arduous task, with the PSU right up against the 120mm fan mount, and a radiator likely to have a major territory dispute with the PSU cables. The front panel is begging for an additional fan mount too, although modders will likely find mounting a dual 120mm-fan radiator here is possible if you don't mind voiding your warranty.

If you just want to build a mini air-cooled system, though, the Mini Cube is one of the best mini-ITX cases we've seen, as long as you choose your components carefully and don't mind investing in a couple of fans.

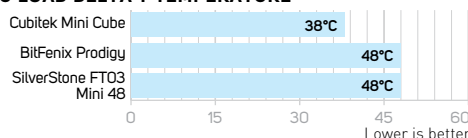
ANTONY LEATHER

## RESULTS

### CPU LOAD DELTA T TEMPERATURE



### GPU LOAD DELTA T TEMPERATURE



## SCORES

COOLING 28/30

FEATURES 17/20

DESIGN 26/30

VALUE 15/20

**CUSTOM PC**  
**86%**  
**OVERALL**



# CORSAIR

## Carbide Air 540



Unique, well-priced and great for tidy PC building

### + CUBE

Decent cooling;  
unique design;  
tidy interior; space  
for water cooling

### - SQUARE

Large; only  
room for two  
3.5in drives

#### HOW MUCH?

Price £117 inc VAT

#### Supplier

www.overclockers.co.uk

#### Manufacturer

www.corsair.com

#### SKU number

CC-9011030-WW

#### IN DETAIL

**Dimensions (mm)** 332 x 415 x 458 (W x D x H)

**Material** Steel, plastic

**Available colours** Black

**Weight** 8kg

**Front panel** Power, reset, 2 x USB 3, stereo, mic

**Drive bays** 2 x external 5.25in, 2 x internal 3.5in/2.5in, 4 x internal 2.5in

**Form factor(s)** E-ATX, ATX, micro-ATX

**Cooling** 2 x 140mm/3 x 120mm front fan mounts (2 x 140mm fans included), 1 x 140mm rear fan mount (fan included), 2 x 120mm/140mm top fan mounts (fan not included)

**CPU cooler clearance** 170mm

**Maximum graphics card length** 320mm

**Maximum PSU length** 200mm

**Extras** None

**L**arge cube-shaped cases have always been rare, as they're often very specialist, sacrificing looks in favour of niche features, such as support for multiple PSUs, or offering space for a seemingly silly number of hard drives. They're usually quite expensive too. As such, when we saw that Corsair's new Carbide Air 540 costs just over £100, and is one of the best-looking cube cases we've ever seen, we were understandably keen to take a look.

While its overall dimensions aren't huge – it's only 46cm tall and 42cm deep, the result of its shape is a large footprint, meaning you'll need plenty of desk or floor space for it. The advantage of all the space, however, is plenty of room for cooling, not just in terms of airflow space, but also fan mounts.

The front is dominated by a large removable grille that hides a filter and two 120/140mm fan mounts, which are currently occupied by two 140mm fans. Meanwhile, the roof is home to two 120/140mm fan mounts behind a second large removable grille, while a third 140mm exhaust fan is included at the rear. Both the front and roof fan mounts support dual 120/140mm-fan radiators too, with the front section stretching to a triple 120mm-fan radiator.

If you do want to use this case for water cooling, the lop-sided 5.25in bays may result in an odd appearance if you opt for a bay reservoir, but otherwise, there's plenty of space to mount pumps and reservoirs internally. Of course, Corsair is undoubtedly hoping that you'll kit out your Carbide Air 540 with one of its all-in-one liquid coolers, and the case has room for any of its current 120mm or 140mm models, including



the monstrous H100i and H110. Underneath these drive bays on the front panel, you'll also find the usual audio mini-jacks, power and reset buttons, and two USB 3 ports.

There's a stark contrast between this featureless side of the front panel, and the grille panel next to it, though, which hints at the case's unique interior layout. It's split into two sections, connected only by cable-routing holes. One side houses the 3.5in hard disks, motherboard and graphics card, while the other hides your other storage devices and PSU.

## ONE SIDE HOUSES YOUR 3.5IN HARD DISKS, MOTHERBOARD AND GRAPHICS CARD, WHILE THE OTHER HIDES YOUR OTHER DRIVES AND PSU

This has the effect of dramatically reducing cable clutter, with numerous cable-routing holes surrounding the motherboard. These provide handy paths to run cables from one side of the case to the other, without having to run them over your motherboard or up from your PSU, as in regular cases. This is just as well, as there's also a huge side-panel window that gives a great view of the surprisingly neat motherboard side of the case.



There's plenty of space for large PSUs on the other side too, and the four quick-release 2.5in mounts should provide enough space for even the most SSD-obsessed enthusiasts. However, despite its size, the Carbide Air 540 only has two 3.5in hard disk mounts, which are located beneath the motherboard.

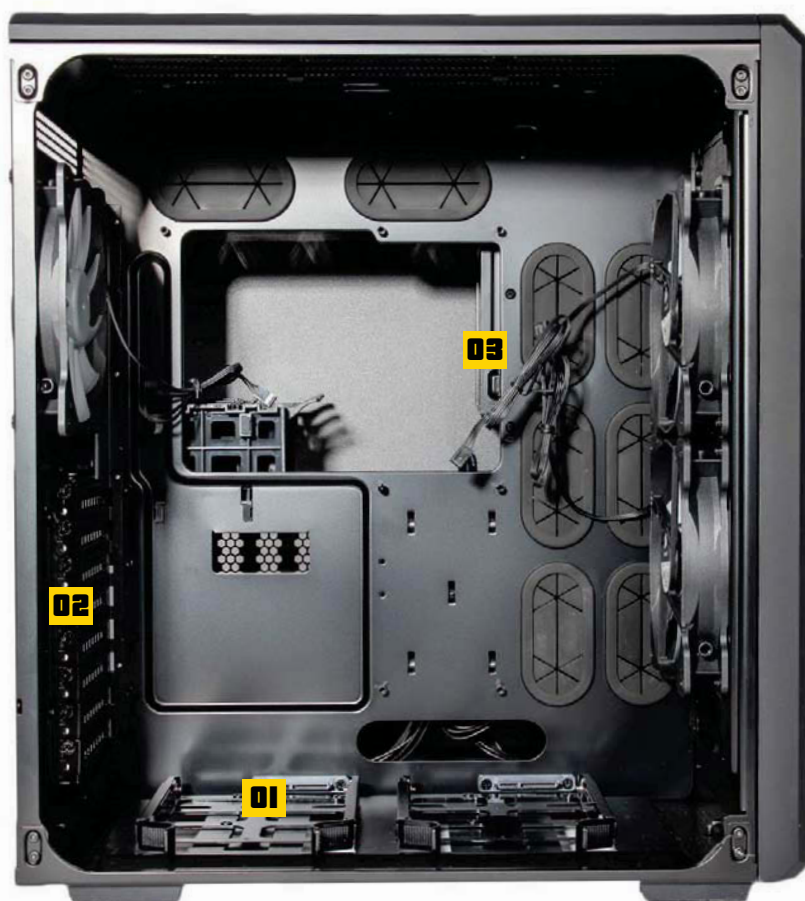
This is enough for most of us, but the case is clearly aimed at enthusiasts rather than server builders, unlike large cube-shaped cases we've seen before. That said, there's room for eight expansion slots, and the case can accommodate E-ATX motherboards and plenty of water-cooling hardware too, so there's definitely scope for building a monster PC.

The hard disk mounts also hide a small shortcoming of the Carbide Air 540, which are the small openings beneath them. This could potentially lead to dust being sucked in from the floor, as there are no filters here.

A fan controller would have been a good inclusion too, and they're usually included with other cases in this price range. However, overall, what you get for your money is a well-built, if slightly plastic-laden, case that looks very attractive on your desk with its huge side window.

## PERFORMANCE

With no fan controller, the three 140mm fans were left to their own devices, but they were quieter than our test hardware, with the cavernous interior clearly soaking up some of the noise. Cooling was well above average too, with a particularly good CPU delta of 48°C. The GPU delta T was a little less remarkable; at 47°C, it's over 10°C warmer than that of the



standard-shaped Cooler Master HAF X, but still better than many more expensive cases, such as the NZXT Phantom 630.

## CONCLUSION

The Carbide Air 540 may have a larger than average footprint and only two 3.5in mounts, but the list of likes is very long. It has a large side window, fantastic cable routing and the dual-chamber design means that even the most impatient enthusiast can build a tidy system. There's space for large PSUs, graphics cards and CPU coolers, and enough radiators to deal with all but the most extreme multi-GPU system as well.

We're still amazed by the price too; at less than £120, Corsair has really hit the nail on the head, pricing it lower or similarly to other racy-looking models from NZXT and BitFenix. For us, though, it's the Carbide Air 540's unique look that really sets it apart. Corsair has created something different that won't cook your hardware. The result is a chassis that will really stand out at LAN parties, while also cooling your hardware very well. If you have the room for it, and don't need more than two hard disk mounts, you won't find much better for less than £120.

ANTONY LEATHER

**01** Despite its size, the Carbide Air 540 only has two 3.5in hard disk mounts, which are located beneath the motherboard

**02** There's room for eight expansion slots, and the case can accommodate E-ATX motherboards too

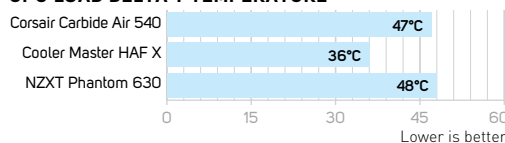
**03** The interior is split into two sections, with only cable-routing holes connecting them

## RESULTS

### CPU LOAD DELTA T TEMPERATURE



### GPU LOAD DELTA T TEMPERATURE



## SCORES

COOLING 23/30

FEATURES 17/20

DESIGN 28/30

VALUE 18/20

**CUSTOM PC**  
**86%**  
**OVERALL**



## Unleash the gamer within you...



### Fusion 650 Gaming PC

Game at the next level with the Fusion 650 PC. With AMD FX technology and AMD 7 Series Graphics, the Fusion 650 will breeze through any game.

- AMD FX 6200 CPU
- **Genuine Windows 8**
- 8GB Samsung DDR3 1333MHz RAM
- 1TB SATA III Hard Drive
- 1GB AMD Radeon HD7770
- 10x BluRay ROM Drive
- PCS Maelstrom Gaming Case
- 3 Year Silver Warranty

from  
**£649\***



### Vanquish X200 Gaming PC

"I really like what PC Specialist have done here and with exception of the case, I don't think I'd change a thing..."  
*Peter Donnell, eTeknix.com*

- 3rd Gen Intel® Core™ i5-3570K Processor
- **Genuine Windows 8**
- 8GB Kingston Hyper-X 1600MHz RAM
- 120GB Kingston V300 SSD
- 2GB AMD Radeon HD 7870
- Corsair 200R Gaming Case
- 3 Year Silver Warranty

from  
**£899\***



### Vanquish 300R Gaming PC

"A great selection of top-notch components and liquid cooling make this a great gaming PC..."  
*Kat Orphanides, Expert Reviews*

- 3rd Gen Intel® Core™ i5-3570K Processor
- **Genuine Windows 8**
- 8GB Kingston Hyper-X 2400MHz RAM
- 120GB Intel 330 SSD
- 1TB SATA III Hard Drive
- 2GB NVIDIA GTX 670 Graphics
- 3 Year Silver Warranty

from  
**£999\***



### Inferno V 3K Laptop

"You are not likely to find such a powerful, tiny laptop anywhere else right now at this price point..."  
*Zardon, KitGuru.net*

- 11.6" LED Display (1366 x 768)
- 3rd Gen Intel® Core™ i7-3630QM Processor
- **Genuine Windows 8**
- 8GB Kingston Hyper-X 1600MHz RAM
- 120GB Kingston V300 SSD
- 2GB nVidia GeForce GT650M
- 3 Year Silver Warranty

from  
**£649\***



New!  
Intel Haswell

### Optimus V Laptop - NEW!

Powered by a 4th Gen Intel CPU and NVIDIA 7 Series GPU, the Optimus IV provides you with an amazing experience where your working, playing or editing.

- 17.3" LED Display (1920 x 1080)
- 4th Gen Intel® Core™ i7-4700QM Processor
- **Genuine Windows 8**
- 8GB Kingston Hyper-X 1600MHz RAM
- 120GB Kingston 3K SSD
- 2GB nVidia GeForce GTX 765M
- 3 Year Silver Warranty

from  
**£899\***



New!  
Intel Haswell

### Vortex IV 17 Laptop - NEW!

Designed for high end gaming, the Vortex IV is an extremely powerful Haswell ready notebook which features NVIDIA 7 Series GPUs and SSD Technology!

- 17.3" LED Display (1920 x 1080)
- 4th Gen Intel® Core™ i7-4700QM Processor
- **Genuine Windows 8**
- 8GB Kingston Hyper-X 1600MHz RAM
- 120GB Kingston SSD
- 4GB nVidia GeForce GTX 780M
- 3 Year Silver Warranty

from  
**£1499\***





# AWARD-WINNING CUSTOM PCs & LAPTOPS FROM THE UK'S LEADING MANUFACTURER!



**New!**  
Intel Haswell

## Vanquish R4 Gaming PC

"PC Specialist clearly knows how to build a high performance rig - The Vanquish R4's tidy build quality is testament to that."  
*Parm Mann, HEXUS.net*

- 4th Gen Intel® Core™ i5-4670K Processor
- **Genuine Windows 8**
- 16GB Kingston Hyper-X 1600MHz RAM
- 120GB Kingston SSD
- 3GB AMD Radeon HD 7950
- Fractal R4 Silent Performance Case
- 3 Year Silver Warranty

**from  
£999\***

**PC ADVISOR**



**New!**  
Intel Haswell

## Vanquish 912 Gaming PC

"A good system, and you can't get much hotter - or should we now say cooler?"  
*Robin Morris, PC Advisor*

- 4th Gen Intel® Core™ i5-4670K Processor
- **Genuine Windows 8**
- 16GB Kingston Hyper-X 2400MHz RAM
- 120GB Kingston 3K SSD
- 2GB nVidia GeForce GTX 770
- CoolerMaster HAF 912
- 3 Year Silver Warranty

**from  
£1149\***



**New!**  
Intel Haswell

## Vanquish Enforcer PC

"A well built, well rounded gaming system with plenty of power on tap for 2560 x 1600 gaming, rendering & video editing..."  
*Zardon, KitGuru.net*

- 4th Gen Intel® Core™ i5-4670K Processor
- **Genuine Windows 8**
- 16GB Kingston Hyper-X 2400MHz RAM
- 120GB Kingston 3K SSD
- 3GB nVidia GeForce GTX 770
- CoolerMaster HAF 912 Case
- 3 Year Silver Warranty

**from  
£1499\***



## Vanquish Prodigy Mini PC

"...an overclocked Core i5 processor, 8GB of memory, a solid-state system drive and a GeForce GTX 660 Ti provide a near-perfect configuration for high-quality, full-HD gaming."

*Parm Mann, HEXUS.net*



- 3rd Gen Intel® Core i5-3570K
- **Genuine Windows 8**
- 8GB Kingston Hyper-X RAM
- 120GB Kingston HyperX SSD
- 1TB Serial ATA III Hard Drive
- 2GB nVidia GeForce GTX660Ti
- Corsair TX650 Power Supply
- Corsair Hydro H40 Cooler
- BitFenix Prodigy Case (Black)
- 3 Year Silver Warranty

**0844 499 4000**  
**www.pcspecialist.co.uk**

**SAVE £15**  
**on your order**  
**code: CPC35**



# SAMSUNG

## SSD 840 EVO

A great entry-level SSD that overcomes its TLC NAND limitations with ingenuity



### + RAPID

Improved write speeds over the SSD 840; RAPID mode astonishingly effective; 1TB drive offers great value for money

### - RAPID

120GB drive well behind the rest

**S**amsung's new SSD 840 EVO series directly replaces the SSD 840 range. This time, 750GB and 1TB models have also been added, with the latter costing just £509. However, the biggest changes can be found inside.

For starters, Samsung has shrunk the transistors of its Toggle 2 TLC NAND from 21nm to 19nm. Meanwhile, the drives' new TurboWrite feature, which is similar to SanDisk's nCache technology, runs a fixed portion of storage space as SLC NAND, dramatically improving write speeds. During idle times, the SLC buffer is flushed to the remaining TLC NAND, although write times will temporarily fall to speeds much closer to those of the SSD 840 if the buffer is filled before the SSD has enough idle time to flush it.

The number of bits per cell of the buffer has also been reduced from three to one; only a third of the allocated TLC space is usable for TurboWrite. Meanwhile, the triple-core ARM Cortex R4 controller has been carried over from the SSD 840, but runs 33 per cent faster at 400MHz, and the amount of cache has been doubled for each capacity too.

However, the star of the show is the new RAPID mode in Samsung's Magician software, which ships with all 840 EVO drives. This uses up to 1GB of system

memory as a cache to drastically increase read and write speeds. It's mainly designed to improve the performance of small file read/write operations at low-queue-depths, but algorithms that detect and cache commonly used 'hot data' can boost sequential performance too.

RAPID mode requires a single click to set up, and it also maintains cached hot data across reboots. However, it's limited to Samsung drives (the 840 Pro will also be supported) and Windows 7 or 8 only. Finally, it can only be used with one physical drive per system.

### PERFORMANCE

In our tests, sequential read speeds are close to those of the original 840 series, but thanks to TurboWrite, sequential write speeds in both CrystalDiskMark and AS-SSD are much faster. Random 4KB performance at a single-queue-depth is also improved, with both synthetic tests showing read speeds of around 40MB/sec – the fastest we've seen.

The gains are even clearer at high-queue-depths – the 1TB EVO produced the best result we've seen in a 64-queue-depth read test. The 64-queue-depth write results also held up very well against the competition, with the exception of the 120GB drive, which struggled.

#### HOW MUCH?

Price £86.99 inc VAT (120GB); £290 inc VAT (500GB); £416 inc VAT (750GB); £509 inc VAT (1TB)

#### Supplier

[www.overclockers.co.uk](http://www.overclockers.co.uk)

#### Manufacturer

[www.samsung.com/uk](http://www.samsung.com/uk)

#### IN DETAIL

Interface SATA 6Gbps

Nominal capacity 120GB, 500GB, 750GB and 1TB

Formatted capacity 111.79GB, 465.75GB, 698.64GB and 931.51GB

Controller Samsung MEX

Cache 256MB LPDDR2 (120GB); 512MB LPDDR2 (500GB); 1GB LPDDR2 (750GB and 1TB)

Memory 19nm Toggle 2.0 TLC NAND flash;

8x Samsung 16GB (120GB); 32x Samsung 16GB (500GB); 48x Samsung 16GB (750GB); 64x Samsung 16GB (1TB)

Warranty Three years

#### SCORES: SAMSUNG SSD 840 EVO 120GB

SPEED 39 / 50

£/GB 15 / 20

BANG/BUCK 19 / 30

CUSTOM PC  
**73**  
OVERALL

#### SCORES: SAMSUNG SSD 840 EVO 750GB

SPEED 44 / 50

£/GB 18 / 20

BANG/BUCK 26 / 30

CUSTOM PC  
**88**  
OVERALL

#### SCORES: SAMSUNG SSD 840 EVO 500GB

SPEED 44 / 50

£/GB 17 / 20

BANG/BUCK 26 / 30

CUSTOM PC  
**87**  
OVERALL

#### SCORES: SAMSUNG SSD 840 EVO 1TB

SPEED 46 / 50

£/GB 18 / 20

BANG/BUCK 28 / 30

CUSTOM PC  
**92**  
OVERALL

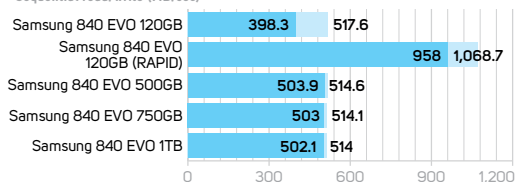
The EVO sadly faltered in our Windows boot test though; the 1TB drive was the slowest drive we've seen in this respect, but the difference is only a couple of seconds. The drives coped well with PCMark 7's app and gaming tests too.

The biggest show, however, came from the aptly named RAPID mode. When enabled on the 120GB drive, it consistently achieved incredible sequential speeds of over 900MB/sec. Huge leaps were made in random performance too, with single-queue-depth write speeds hitting 240.1MB/sec and 350.1MB/sec in AS-SSD and CrystalDiskMark respectively (more than double the speed of the next fastest drive for both). RAPID also enabled the drive to record the fastest-ever Windows boot time of just 7.3 seconds.

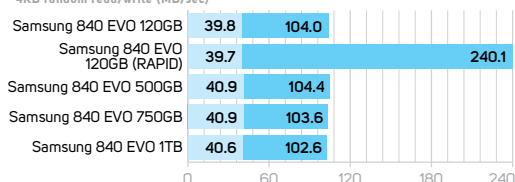
## RESULTS

### AS-SSD

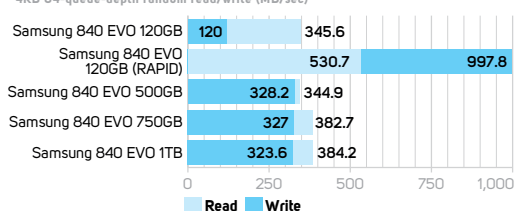
Sequential read/write (MB/sec)



4KB random read/write (MB/sec)

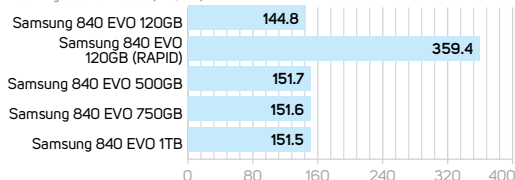


4KB 64-queue-depth random read/write (MB/sec)



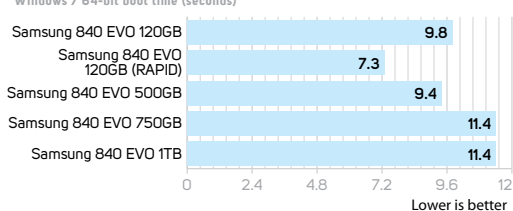
### PCMARK 7

Gaming test raw result (MB/sec)



### BOOTRACER

Windows 7 64-bit boot time (seconds)



## CONCLUSION

The SSD 840 EVO range justifies its price with speed.

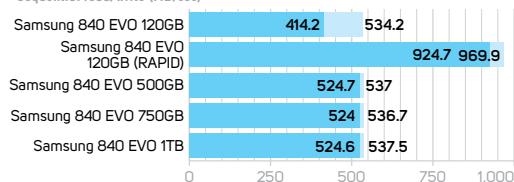
The smaller transistors, faster controller and larger DRAM cache play their parts, but TurboWrite and RAPID provide the clearest benefits. RAPID is heavily dependent on system resources, though, rather than just those of the drive. Our only criticism is that every drive came up with SMART errors during installation – a problem we hope will be fixed with future firmware.

The 120GB drive is notably slower than the others, and offers less for your money, but the 500GB, 750GB and particularly the 1TB drives all offer super-fast performance for reasonable money. If you want fast, good-value and high-capacity storage, look no further.

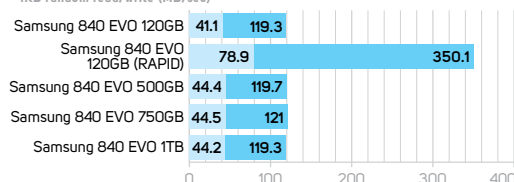
MATTHEW LAMBERT AND HARRY BUTLER

### CRYSTALDISKMARK

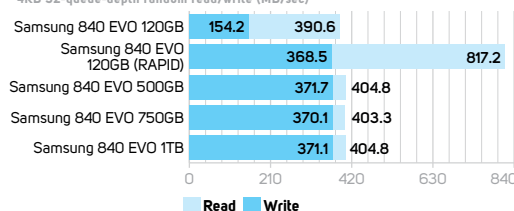
Sequential read/write (MB/sec)



4KB random read/write (MB/sec)

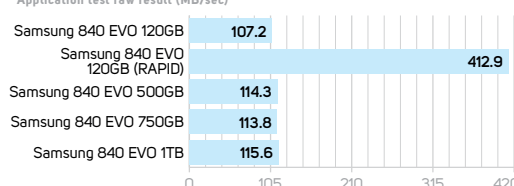


4KB 32-queue-depth random read/write (MB/sec)



### PCMARK 7

Application test raw result (MB/sec)



## TEST KIT

4.2GHz Intel Core i5-2500K CPU, Asus Maximus V Formula motherboard, 8GB Kingston 1,600MHz DDR3 memory, Nvidia GeForce GTS 250 512MB graphics card, PC Power and Cooling Silencer 750W PSU, Windows 7 Home Premium 64-bit, Intel Rapid Storage Technology driver (iaStor.sys)



# STEELSERIES

## Apex

A bold attempt at making a desirable membrane keyboard



### + SIGNAL

Large keys; can be made to look good; diagonal cursor keys

### - NOISE

Many features unnecessary; high price; shallow key action

**I**t doesn't take a statistician to see that the trend in gaming keyboards is heading towards mechanical models. You pay a premium for them, and their noisy clacking may grate on some people's nerves, but the quick, linear key action and direct feel they offer make them ideal for gaming. This trend has, by default, relegated membrane keyboards to the cheaper end of the market. Or at least, that's what we thought, right up until the point that the SteelSeries Apex strutted into our lab.

With a retail price of £99, the Apex sits squarely in mechanical keyboard territory – the excellent Gigabyte Osmium (see Issue 108, p70) can be had for £98, for example. What does it have up its sleeve to justify this price tag, then? Lots of features is the answer, some of which are worthwhile, and some of which border on the silly.

At the more farcical end is ActiveZone illumination, which allows different key groups (macro, Num pad, F keys and so on) to be backlit in different colours. We doubt that anyone has been particularly waiting for this feature, but it can certainly make the Apex look pretty.

Also over the top is the approach to macro keys – there are 22 of them. What's more, when combined with the four software profiles, up to 88 different macros can be bound to the keyboard. This is all well and good, but it's a case of diminishing returns. Is having 88 macro keys tangibly better than having 18? Would even a diehard RPG player use them all? We doubt it.

That said, the second set of macro keys, which run above the F keys, has been expertly placed. They're raised to make them easier to hit, and it's easier to reach for these keys than the bank of keys on the left. Another neat touch is the double-height space bar, which is reassuringly easy to hit. Likewise, the extra diagonal cursor keys make it easy to navigate around spreadsheets quickly.

The physical aspects of the keyboard are also good; it looks smart (with a sensible lighting scheme), and although its plastic body may creak a little when held up and twisted, it's reassuringly solid once planted on a desktop. The key action is unusually short for a desktop keyboard, however, and it takes a little while

## THE SECOND SET OF MACRO KEYS, WHICH RUN ABOVE THE F KEYS, HAS BEEN EXPERTLY PLACED

to get used to it after using a mechanical keyboard. SteelSeries flaunts the short action, calling the Apex a 'quick' keyboard and, while we agree, the action feels decidedly imprecise compared to the mechanical competition, with their Cherry switches.

### CONCLUSION

At £99, the Apex is expensive for a membrane keyboard, and it attempts to justify this price with an extended feature list. Unfortunately, while some of these features are genuinely useful, many are frivolous, making the Apex comparatively poor value for money. If you want to drop £100 on a keyboard, we recommend buying the Gigabyte Osmium instead.

PAUL GOODHEAD

### SCORES

DESIGN 26 / 40

FEATURES 30 / 35

VALUE 13 / 25

CUSTOM PC  
**69**%  
OVERALL



#### HOW MUCH?

Price £99 inc VAT

Supplier [www.ginger6.com](http://www.ginger6.com)

Manufacturer  
[www.steelseries.com](http://www.steelseries.com)

SKU number  
SS-64147-APEX

#### IN DETAIL

Connection Wired, USB

Cable 2m braided

Material Plastic

Extras Extra feet, USB hub

**OVERCLOCKERS UK**

www.overclockers.co.uk



Buy With Confidence



**NEW**



## EREBOSS

"Designed in Germany", Ereboss is manufactured to provide awesome performance at a great price.

- Nickel Copper Base, efficient 6mm Heat-pipes
- Ultra Large Dissipating Area
- Super Slim Type 14013 PWM Fan
- Low Noise, Outstanding Air Flow
- Multiple Mounting Kits
- Patent Designed Fins
- Dual Fans Installation Option

Stock Code: HS-000-RT

**£31.99**



SEARCH THE STOCK CODES ON  
OUR WEBSITE TO FIND THE PRODUCT



## AIDOS

- Non-Copper Base Design
- Solder-less Fin Assembly
- Less Junk Pollution
- Anti-Vibration Rubbers
- Easy Installation

Stock Code: HS-002-RT

**£14.99**



## THEMIS

- Non-Copper Base Design
- Solder-less Fin Assembly
- Less Junk Pollution
- Large Dissipating Area
- Elegant Design

Stock Code: HS-001-RT

**£21.95**



Overclockers UK | Unit 5 Lymedale Cross, Newcastle-under-Lyme, Staffordshire, ST5 9BT

**www.overclockers.co.uk ■ Tel: 0871 200 5052**

Prices correct at time of print but may change without prior notice. All items subject to availability. Discount codes are valid for two weeks after publication  
Core Inside, Intel, the Intel logo, Intel Core, Intel Inside, the Intel Inside logo are trademarks of Intel Corporation in the U.S. and/or other countries



# CORSAIR

## Raptor M30

A decent affordable gaming mouse, but it's up against some stiff competition



### + VELOCIRAPTOR

Simple; well made and priced; good scroll wheel

### - OVIRAPTOR

Thumb button placement; not ideal for finger-grip users

**D**espite still being a relative newbie in the world of gaming peripherals, Corsair has been expanding its range of mice and keyboards with confidence over the last few months. The main thrust of its expansion into the mouse market has been into the high-volume, sub-£50 end of the market; a move that has likely been driven by Corsair's acquisition of fellow peripheral manufacturer Raptor Gaming in late 2012. Indeed, the £35 Raptor M30 here is heavily based on a Raptor Gaming design.

Consequently, the design of the M30 is a marked departure from Corsair's previous mice. Gone is the aggressive supercar-esque styling and flashy exposed metal chassis, replaced by smoother lines and a simpler appearance.

The shape, too, is significantly different to the tall, rear-weighted, hand-filling shape that has recently been Corsair's signature style. Instead, the M30 has a much lower profile and is significantly slimmer. When you add this profile to the scooped styling of the two primary mouse buttons, the M30 ends up resembling a Razer DeathAdder that's been crash-dieting for a month.

In the hand, the M30 initially feels comfortable and natural, but we stumbled the first time we reached for the thumb buttons, as they're located quite far from the rear of the mouse, and unusually high up on the chassis. For us, this made them difficult to find, as they're located above where our thumb naturally wanted to reside.

As a result, finding them in the heat of battle was tricky, especially as they aren't marked in a way that can be easily distinguished by touch alone. A groove or trough under the buttons, such as the one on the SteelSeries Kana (see Issue 108, p66) would help the situation massively.

The distance of the thumb buttons from the rear of the mouse also means that the M30 demands the use of a palm or claw-style grip. If you're used to gripping a mouse with just your fingertips while the heel of your hand rests on the mouse mat (a finger-grip), anyone with less than Hulk-sized hands will find their thumb

lies behind the thumb buttons, making it even more awkward to use them.

However, that's enough complaining about the positioning of the thumb buttons. The other main feature you notice about this mouse is its light-up scroll wheel. The M30 cleverly uses the brightness of the light behind the large scroll wheel to indicate which DPI setting is currently in use, and these settings can be changed on the fly too.

A brighter light means a higher DPI. Annoyingly, though, the M30 forgets which DPI setting you were using whenever it loses power, meaning that you'll need to flick to your preferred setting each time you boot your PC.

**THE BRIGHTNESS OF THE LIGHT BEHIND THE LARGE SCROLL WHEEL INDICATES WHICH DPI SETTING IS CURRENTLY IN USE**

### CONCLUSION

The Raptor M30 has little in terms of bells and whistles, but this made it easy to set up and its price reflects this simplicity. Its thumb buttons are awkwardly placed, however, and while this is a small flaw, there's a lot of choice in the peripherals market at the moment. Those looking for a small, affordable mouse would be better served by the SteelSeries Kana or the Mionix Naos 3200 (see Issue 108, p60).

PAUL GOODHEAD

### SCORES

DESIGN 32 / 40

FEATURES 20 / 35

VALUE 21 / 25

**CUSTOM PC**  
**73** %  
**OVERALL**

#### HOW MUCH?

Price £35 inc VAT  
Supplier [www.scan.co.uk](http://www.scan.co.uk)  
Manufacturer  
[www.corsair.com](http://www.corsair.com)  
SKU number  
CH-9000042-EU

#### IN DETAIL

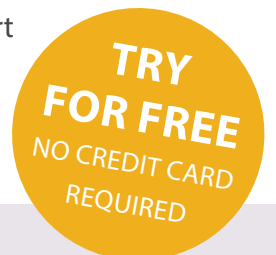
Connection Wired, USB  
Cable 1.5m braided  
Material Plastic  
Extras None

# Backup & Sync Everything



## Your files, wherever you are

- A massive 5,000GB Cloud Drive
- Unlimited Backup for 5 computers
- Access your files anywhere
- Stream to your mobile device
- Military Grade Encryption
- UK based Customer Support



[www.livedrive.com/custompc](http://www.livedrive.com/custompc)

***livedrive***™

Cloud Storage for Everyone



# www.aria.co.uk

e: sales@aria.co.uk

t: 0844 999 2499

## TECHNOLOGY FOR CHAMPIONS!

### £25 WORTH OF M&S VOUCHERS FOR EVERY BUSINESS PC BOUGHT

**Dell Optiplex 780 Core 2 Duo**  
Windows 7 Professional Refurbished PC



Offer valid from 25/07/2013.

Quick Code #56253

**£226.<sup>80</sup>**  
incl. VAT

**HP DC7900 Core 2 Duo**  
Windows 7 Professional Refurbished SFF PC



Offer valid from 25/07/2013.

Quick Code #56249

**£230.<sup>40</sup>**  
incl. VAT



**CALL**  
0844 999 2499  
Mon - Fri 9am - 5:30pm



**CLICK**  
www.aria.co.uk  
Order online 24/7



**VISIT**  
Manchester  
6 days a week





# Be the best and win in game with Award-Winning PCs.

Aria Recommends Windows® Software



## GLADIATOR Diablo GTX 770

4.40GHz Overclocked 4670K Gaming PC

- 2GB NVIDIA GTX 770 Graphics Card
- Core i5-4670K OC to 4.40GHz CPU
- 8GB DDR3 RAM
- 250GB SSD / 2TB HDD
- Microsoft Windows 8

Windows 8

Microsoft



powered by

**GIGABYTE™**

Save **£300** ~~WAS £1299.95~~  
**£999.98** incl. VAT

Quick Code #56029

## GLADIATOR FX Predator

650Ti Boost FX-6300 4.10GHz Gaming PC



Windows 8

Microsoft



Save **£100**

Quick Code #55341

**£599.99** incl. VAT

## GLADIATOR Punisher 7870 LE

Intel i5-3570K 4.30GHz LAN OC Gaming PC



Windows 8

Microsoft



Save **£100**

Quick Code #55342

**£999.95** incl. VAT

**ARIA**  
SUPER SPECIALS

[www.aria.co.uk](http://www.aria.co.uk)

Give us a call on: 0844 999 2499  
or visit us today in Manchester

**aria**PC  
TECHNOLOGY



# how we test

Thorough testing and research is the key to evaluating whether a product is worth buying, and deciding whether or not there's a better alternative

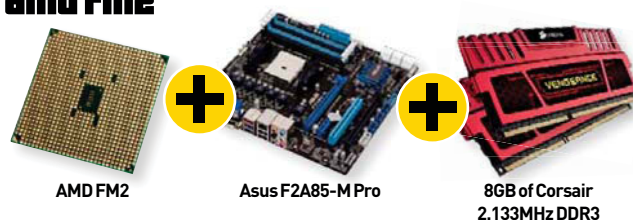
## PROCESSORS

We judge CPUs on whether they offer sufficient speed for the price. Part of a CPU's speed score comes from how overclockable it is. Every type of CPU is tested in the same PC, so all results are directly comparable.

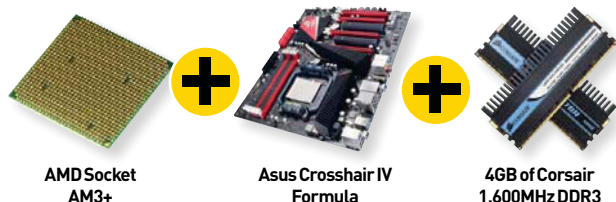
### Intel LGA1150



### amd fm2



### amd socket am3+



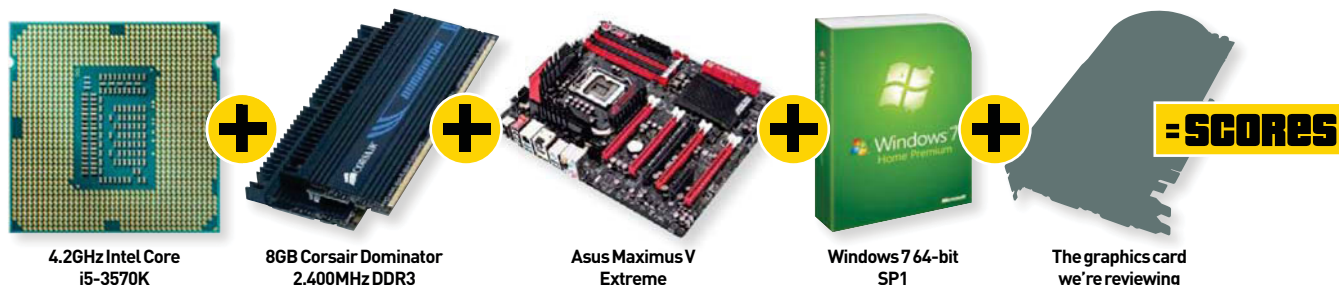
### COMMON COMPONENTS



**TESTS:** We use the Custom PC Media Benchmarks, Cinebench R11.5, and Total War: Shogun. We also test the resultant power draw of the test PC with the CPU installed. These tests reveal a broad range of performance characteristics for the CPU, from image editing to gaming and video encoding to 3D rendering. We run all the tests with the CPU at stock speed and again when overclocked to its highest frequency.

## graphics cards

Graphics cards are mainly evaluated on how fast they are for their price. However, we also consider the efficacy and quietness of the cooler. Every graphics card is tested in the same PC, so all results are directly comparable.





## custom PC media benchmarks



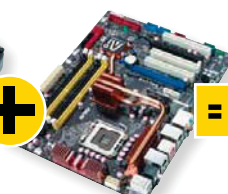
2.66GHz Intel Core 2  
Duo E6750



2GB of Corsair  
1,066MHz DDR2



250GB Samsung  
SpinPoint P120S



Asus P5K Deluxe  
WiFi-AP

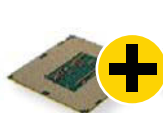
**= 1,000**

Our benchmark suite simulates how people really use PCs, and a higher score is better. You can download the suite from [www.tinyurl.com/benchies](http://www.tinyurl.com/benchies)

## motherboards

Motherboards are evaluated on everything from layout and features to overclockability and value for money. Every motherboard is tested with the same components, so all results are directly comparable.

### intel LGA1150



Intel Core  
i7-4770K



Motherboard  
on test



16GB of Corsair  
Vengeance Pro Silver  
1,600MHz DDR3

### amd fm2



AMD A10-5800K

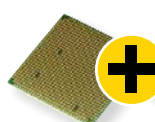


Motherboard  
on test



8GB of Corsair  
2,133MHz DDR3

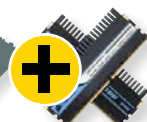
### amd socket am3+



AMD Phenom  
II X6 1100T BE



Motherboard  
on test



4GB of Corsair  
1,600MHz DDR3

### common components



Nvidia GeForce  
GTX 680 2GB\*



120GB OCZ Vector



Windows 7  
64-bit

**TESTS:** We use the Custom PC Media Benchmarks and several games, and also test the speeds of the board's SATA ports. We try to overclock every motherboard we review by testing for a maximum QPI, base clock or HTT as well as overclocking the CPU to its maximum air-cooled level. We run our tests at stock speed and with the CPU overclocked.

\*Please note: We test AMD FM2 motherboards using the on-board graphics, not the Nvidia GeForce GTX 680 2GB 3GB

**TESTS:** By using the fast PC detailed on the left, we can be sure that any limitations we see are due to the graphics card on test. We test the four games (right) at their maximum detail settings, in their highest DirectX mode, and at three resolutions. High-end cards should be able to sustain playable frame rates at 2,560 x 1,600, while 1,920 x 1,080 is more important for mid-range cards; we also now test at 5,760 x 1,080 for three-screen setups. As well as this, we try to overclock every graphics card we test to see what difference this makes to the card's performance.



## the awards



Some products are gloriously over the top. These items of excellent overkill earn our Extreme Ultra award.



Premium Grade products are utterly desirable – we'd eat nothing but beans until we could afford them.



Products worthy of the Professional award make you and your business appear even more awesome.



Approved products are those that do a great job for the money; they're the canny purchase for a great PC.



For those gadgets and gizmos that really impress us, or that we can't live without, there's the Custom Kit award.



# Custom Kit

Written by Paul Goodhead  
Seen something worthy of  
appearing in Custom Kit?  
Send suggestions to  
paul\_goodhead@dennis.co.uk

We check out the latest gadgets, gizmos and geek toys

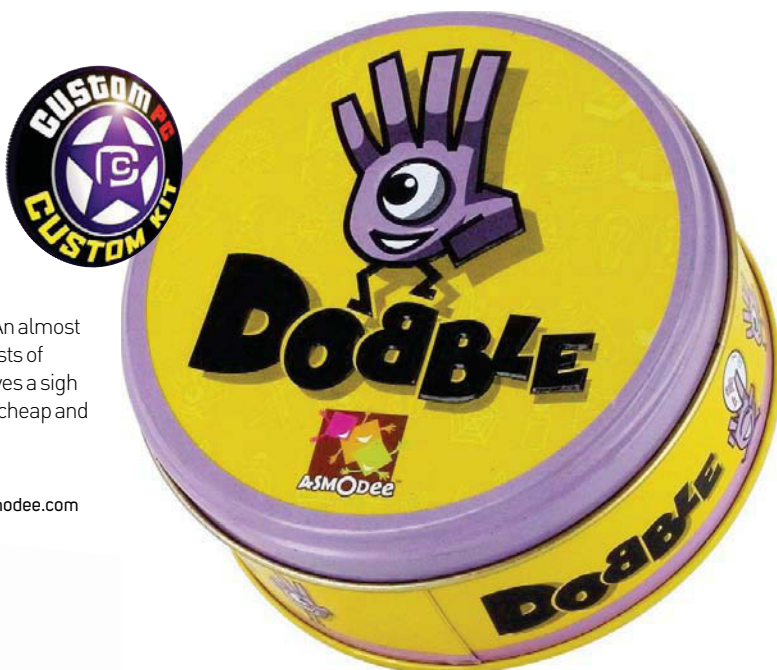
## CARD GAME

### DOBBLE

**01** If you were being simplistic, you could say that Dobble is merely a spruced-up version of Snap. It involves competitively matching symbols on cards, after all. Of course, you could also say that Battlefield 3 is simply Doom with better graphics; there's a grain of logic, but it's hidden in a beach of ignorance. Dobble boasts five impressively varied game types, and all create a fantastically tight, nervous atmosphere as up to eight players strain to pick out matches. An almost trance-like state falls over games, punctuated by sporadic bursts of movement, with the tension only released when everyone heaves a sigh of relief as the game ends. It's fantastic, and the fact that it's so cheap and very easy to pick up only adds to the appeal. **PG**

**PADAWAN** ●●●●● **MASTER**

Price £10 inc VAT Supplier [www.gameslore.com](http://www.gameslore.com) Manufacturer [www.asmodee.com](http://www.asmodee.com)



## KEYBOARD

### SEAL SHIELD PUP GLOW 2

**02** While most keyboards are robust enough to stand up to the odd rage-quit, most would wilt in the face of a seriously hostile environment, such as a playschool or kitchen. Enter the Pup Glow 2, a rubber-enscenced keyboard with backlit keys and a built-in track pad – it's built to go to places other keyboards wouldn't dare. The Pup's thick waterproof exterior means it's entirely dishwasher-safe, and it's even impregnated with antimicrobial and anti-fungal agents. Unfortunately, its compact size and rubber exterior don't make for a pleasant typing experience, and that's a problem for a keyboard with a £99 asking price. You'd have to be absolutely certain that a normal keyboard wouldn't suffice to make the Pup a worthwhile investment. **PG**

**PUP** ●●●○○ **DIREWOLF**

Price £99 inc VAT Supplier [www.keyboardco.com](http://www.keyboardco.com)  
Manufacturer [www.sealshield.com](http://www.sealshield.com)

## BLUETOOTH SPEAKER

### QDOS Q-BOPZ

**03** As with the Antec SP1 (see opposite), the tennis ball-sized Q-BOPZ faces competition from myriad other Bluetooth speakers, so it needs to stand out to succeed, preferably in a more tangible way than just having an ugly, childish-sounding name. Fortunately, it has a trick: a large suction cup on its back allows it to be stuck to the rear of a phone or tablet and function as both a speaker and stand. Alternatively, it can also be stuck to any shiny surface, such as metal or glass. Sound quality isn't stellar (especially when facing away from you (its default position when used to prop up a tablet or phone), but then neither is the £30 price tag. Audiophiles should steer clear, but it still works well as a convenient, flexible travel speaker. **PG**



**SPELIN** ●●●●● **SPELLING**

Price £30 inc VAT Supplier [www.qdosound.com](http://www.qdosound.com)  
Manufacturer [www.qdosound.com](http://www.qdosound.com)



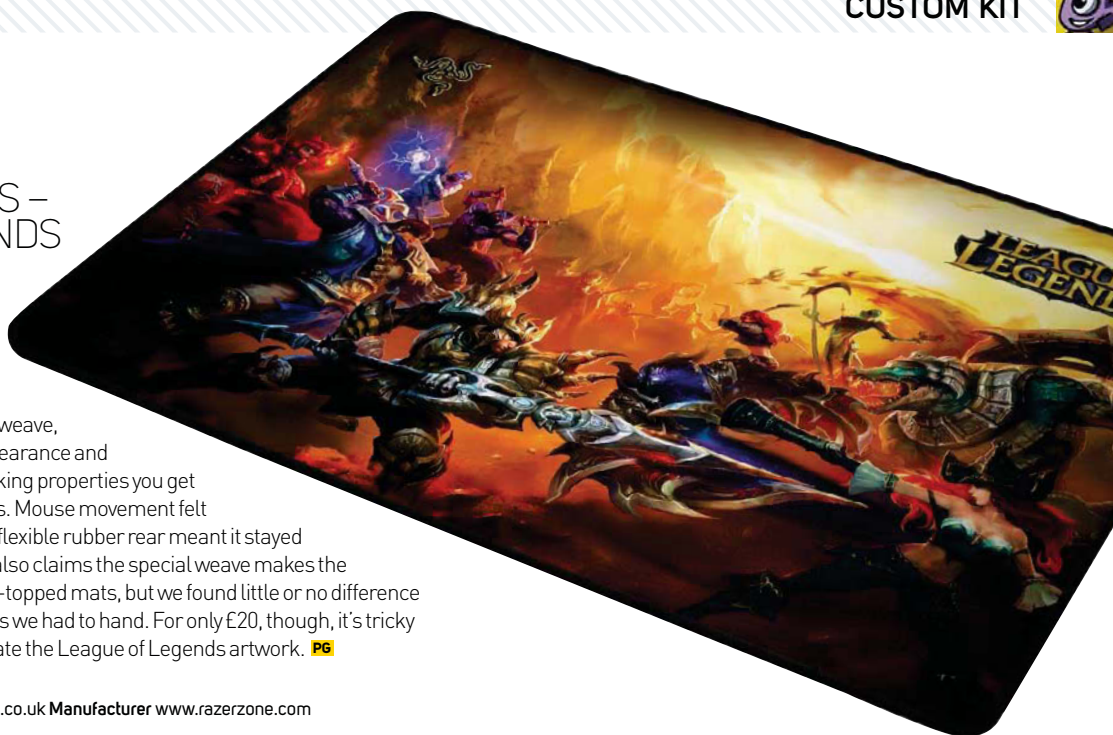
## MOUSE MAT

# RAZER GOLIATHUS – LEAGUE OF LEGENDS EDITION

**04** It's a rare day that we get excited about weaving technology, but the material from which the Goliathus is made is intriguing. It has an extremely tight weave, which gives it an almost plastic appearance and feel, but it retains the excellent tracking properties you get from the texture of most fabric mats. Mouse movement felt precise and smooth, and the mat's flexible rubber rear meant it stayed planted throughout testing. Razer also claims the special weave makes the Goliathus quicker than other fabric-topped mats, but we found little or no difference when comparing it to the other mats we had to hand. For only £20, though, it's tricky to go wrong, as long as you appreciate the League of Legends artwork. **PG**

**GOLIATH** ●●●●● **DAVID**

Price £20 inc VAT Supplier [www.pcworld.co.uk](http://www.pcworld.co.uk) Manufacturer [www.razerzone.com](http://www.razerzone.com)



## BLUETOOTH SPEAKER

# ANTEC AMP SP1

**06** Bluetooth speakers are clearly the bandwagon du jour right now, as announcements of new models are tumbling into our inbox with absurd frequency. Antec's effort – the SP1 – sets itself apart by looking lovely; the brightly coloured rubber exterior and sharp, stylish lines radiate confidence, and the build quality is excellent. You'd be proud to chuck down the SP1 in front of your mates at the beach or park. Audio quality follows suit and; it's first-rate and matches the £180 Damson Oyster of two issues ago in all but volume. Our only qualm is that, at £75, you may get a good deal for the quality on offer, but it still isn't cheap, meaning that some people may be reticent to let the SP1 lead the boisterous, outdoor party lifestyle that it so clearly desires. **PG**

**PENNY** ●●●●● **POUND**

Price £75 inc VAT Supplier [www.overclockers.co.uk](http://www.overclockers.co.uk) Manufacturer [www.antec.com](http://www.antec.com)



## EARPHONES

# i-BOX BASS ADDICTS

**05** Despite costing a measly £11, the Bass Addicts earphones have a pleasingly robust feel, thanks to their metal construction. It's a premium theme that continues through its swanky flattened cable, as well as the included host of different shapes and sizes of silicon earbuds. It's one that ends when the music starts, however; audio is messy and far too bass-focused, turning even tracks that would usually revel in a bass heavy mix into sloppy parodies of their original recording. What's more, the metal construction of the earphones makes them heavy, meaning they fell from our ears with only the slightest twitch of the cable. **PG**

**BASS ADDICTS** ●●●○○○ **UPGRADE ADDICTS**

Price £11 inc VAT Supplier [www.amazon.co.uk](http://www.amazon.co.uk)

Manufacturer [www.iboxstyle.com](http://www.iboxstyle.com)





## Mini motherboards and **GREAT GRAPHICS CARDS**

This month we assemble several Z87 mini-ITX motherboards and GeForce GTX 760s to find the best parts for a mini gaming rig

**H**ere at **CPC** towers, we've long been fans of mini-ITX PC builds, cramming full-sized parts into pint-sized cases. When it all comes together, you're left with a system that's just as powerful as a full-sized ATX version, in a fraction of the space. Finally, it seems that the PC industry at large has taken note, with the new Intel Z87 chipset seeing every motherboard manufacturer get in on the miniature form factor, and there's now even a mini-ITX Asus RoG board. We've put every Z87 mini-ITX board currently on sale in the UK through its paces to find the best board for a miniature build.

A mini gaming rig also needs a quality graphics card and, as we found out last month (see Issue 120, p20), the new £200 GeForce GTX 760 2GB is a superb all-round card that doesn't eat power supplies for lunch. There's a baffling array of choice out there when it comes to custom coolers and factory overlocks, though, so we've grabbed five GTX 760 partner cards for this month's Labs test. We've also overclocked them to frankly outrageous levels of performance, enabling them to perform on a par with cards that are more than £100 more expensive.

The end result? A perfect mini-ITX combo ready to fit into even diminutive cases, while still providing prodigious amounts of performance.

HARRY BUTLER AND MIKE JENNINGS

### contents

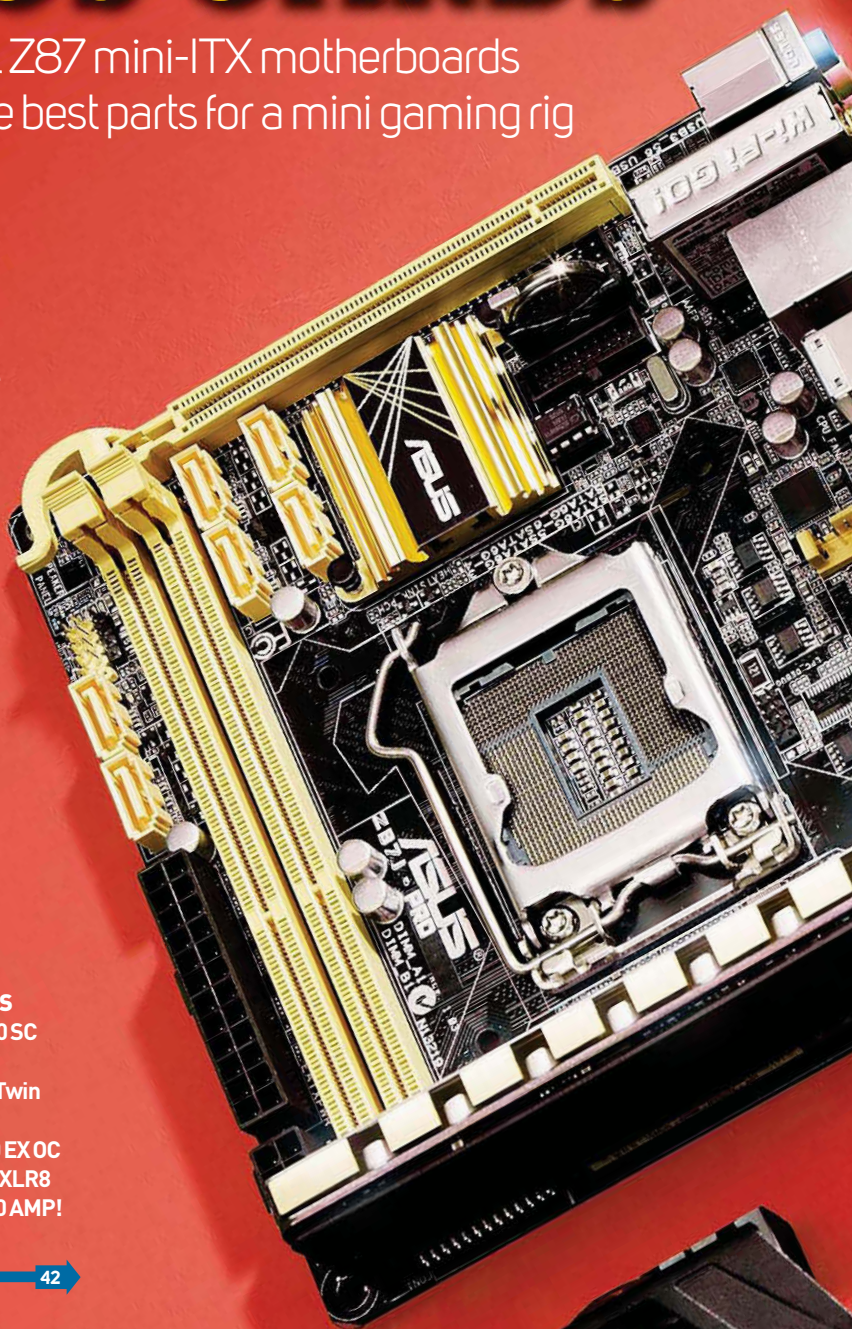
**42** How we test  
**50** Graphs

#### MINI-ITX Z87 MOTHERBOARDS

**43** Asus Maximus VI Impact  
**44** Asus Z87i-Pro  
**45** ASRock Z87E-ITX  
**46** Gigabyte GA-Z87N-WiFi  
**48** MSI Z87i

#### GEFORCE GTX 760 CARDS

**50** EVGA GeForce GTX 760 SC ACX 2GB  
**52** MSI GeForce GTX 760 Twin Frozr OC Gaming 2GB  
**54** KFA<sup>2</sup> GeForce GTX 760 EX OC  
**56** PNY GeForce GTX 760 XLR8  
**58** Zotac GeForce GTX 760 AMP! Edition 2GB









## how we test

This month's Labs combined our GPU and motherboard test systems, for a heady amount of testing during the hottest weather in years, making the art of overclocking thermally sensitive parts such as CPUs and GPUs particularly tricky. If these GPUs and motherboards could overclock here, they could overclock anywhere.

### Z87 MINI-ITX MOTHERBOARDS

The motherboards were tested using an Intel Core i7-4770K, 16GB (2 x 8GB) of Corsair Vengeance 1,600MHz memory, a GeForce GTX 680 2GB graphics card and a 256GB OCZ Vector SSD. Cooling was provided by a Corsair H80i for the CPU, with another single cooling fan running at full speed throughout.

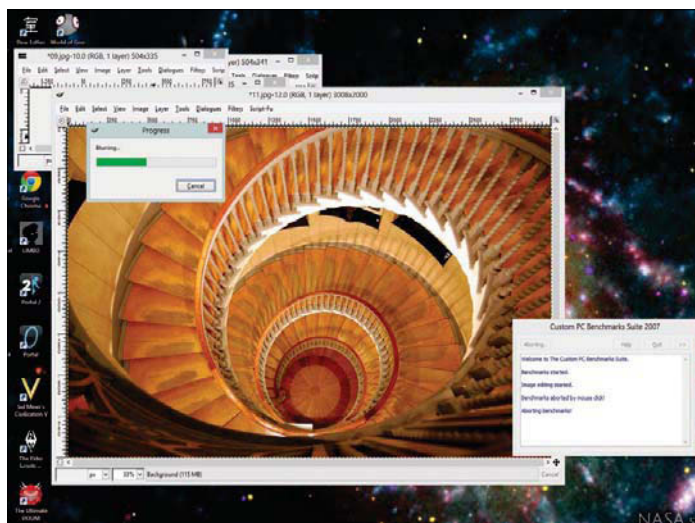
We used our own suite of Media Benchmarks (freely available from <http://tinyurl.com/benchies>) to test each board's performance, which tested image editing in Gimp, H.264 video encoding using Handbrake and multi-tasking performance.

For 3D performance, we used a 60-second sequence from Shogun 2: Total War's built-in DX9 CPU benchmark, and a 60-second manual Skyrim play-through. Performance is tested at fail-safe defaults (with the RAM set to 1,600MHz), and again at the board's peak stable overclock. Power consumption numbers are recorded at idle and under full load via Prime 95's smallfft test.

Scores are calculated by comparing the boards on test to each other, rather than the market at large, enabling us to produce a score based on a particular niche or sub-category, rather than comparing a budget mini-ITX board to a super premium ATX model. Performance is calculated by the board's average performance against those also on test right across our benchmarks, at both stock and overclocked settings. The Features score is calculated via a checklist of desirable features, while the Value score is a combination of these two scores divided by the price.

### GEFORCE GTX 760 CARDS

Our GPU test rig is based on an Asus Maximus V Extreme LGA 1155 motherboard. The CPU is an Intel Core i5-3570K running at



We used our own suite of Media Benchmarks, which is freely available from <http://tinyurl.com/benchies>, to test each board's performance

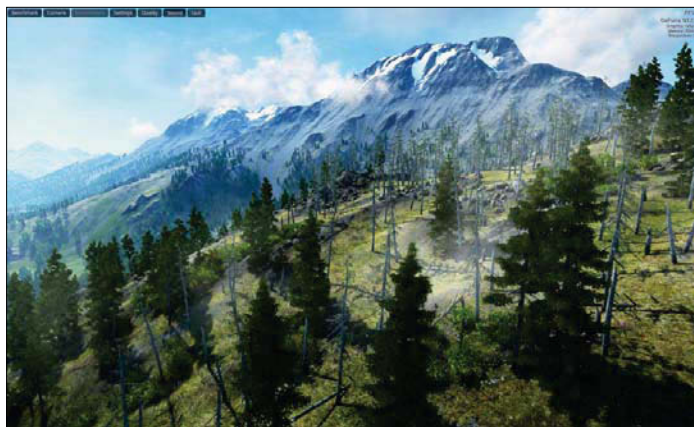
4.2GHz, with 8GB of Corsair Dominator 2,400MHz DDR3 memory and a 256GB Samsung SSD 840 Pro SSD. Powered by a humungous LEPA G1600 1,600W PSU and housed in a fan-filled NZXT Switch 810, our GPU test rig is big and powerful enough to power even four GTX Titans.

We test each card in Battlefield 3 (a 90-second sequence from Going Hunting), Crysis 3 (a 45-second sequence from Red Star Rising), The Elder Scrolls V: Skyrim (a 60-second sequence outside Whiterun) and BioShock Infinite (a 40-second sequence from the built-in benchmark). Each game is tested three times at its maximum detail and quality settings, and the final results are the average of the three separate tests. We also test using Unigine's Valley benchmark, for a points-based comparison to give you an idea of future performance.

We also leave Unigine's Valley benchmark looping when overclocking, as we increase the core and RAM clocks to find their maximum stable settings. We then retest Crysis, Battlefield 3 and Unigine Valley to gauge peak overclocked speed.

As GPUs are more die-dependent when it comes to overclocking than motherboards, GPU performance is based on stock speed compared to the other cards on test. As such, these results aren't directly comparable to our usual GPU reviews, which assess a card's position in the market as a whole.

The Features score is based on cooling, power consumption, PCB size and fan noise. Meanwhile, the Overclocking score is based on the increases we were able to gain over a stock GTX 760 2GB's clock speeds. Finally, the Value score is a combination of these three scores, divided by the price.



We leave Unigine's Valley benchmark looping when overclocking, as we increase the core and memory frequencies to their stable maximum settings

# ASUS Maximus VI Impact

A fast board with loads of features, but it's also expensive

Price £206 inc VAT Supplier [www.overclockers.co.uk](http://www.overclockers.co.uk) Manufacturer [www.asus.com](http://www.asus.com)

**+** **MAXIMUS** High-end features; excellent EFI; quick performance

**-** **MINIMUS** Some layout issues; extremely high price

The Maximus VI Impact sports several features that cheaper boards just can't match. Its rear I/O panel, for instance, sports the only error code readout display in this month's Labs, doubling as a motherboard temperature display. There's also a clear-CMOS switch, a MemOK button to help diagnose memory issues and a button to boot directly to the EFI – useful for overclocking.

The Impact is also the only board on test to have on-board power and reset buttons, with a dedicated VRM daughterboard and accompanying heatsink making other ITX offerings look puny in comparison. There's also a SupremeFX sound daughterboard. Fitted with interference shielding and high-quality capacitors, it bridges the gap between on-board and discrete sound, meaning you won't need an external sound card.

The board's layout, meanwhile, is mostly sensible, with the board's 24-pin and 8-pin EPS 12V power connectors aligned along the right-hand edge rather than awkwardly crammed in the middle of the PCB.

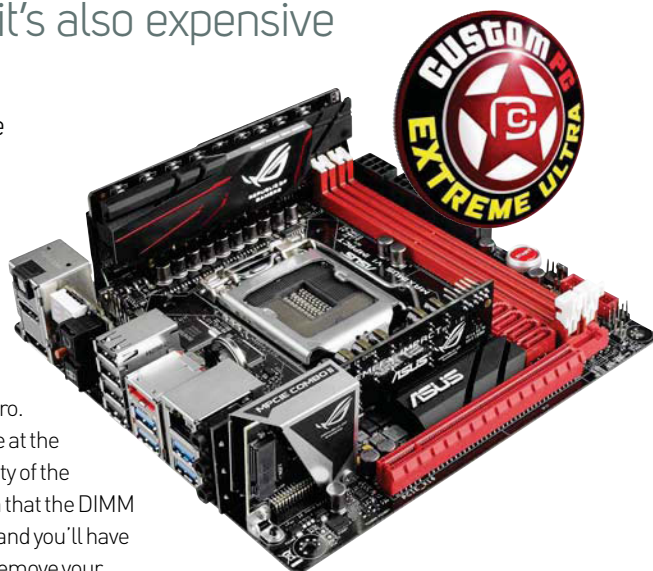
The same edge also houses the chunky USB 3 header and one of the board's four 4-pin fan headers. The placement of the four SATA 6Gbps connectors could be better, though, as they're sandwiched between the DRAM and PCI-E slots, making maintenance

tricky in a system you've already built.

This rest of the board isn't without fault either, with many of the same issues that afflicted Asus' cheaper Z87i-Pro. The large VRM cooling module at the top of the PCB and the proximity of the PCI-E slot at the bottom mean that the DIMM slots are extremely cramped, and you'll have to be dexterous if you want to remove your RAM or graphics card without taking all the components out of the machine. The Impact is also the only board in this test to not include an on-board Wi-Fi module. The biggest issue, though, is price. At £206, this is the most expensive motherboard on test; it's almost twice the price MSI Z87i. This is an awful lot of money, even with the enthusiast features.

The Maximus delivered a dominant performance in our Media Benchmarks. When running at stock speed, it was the best performer in every test, with an overall score of 2,536 points. The Impact also topped the stock speed tables in Skyrim and Shogun 2, and snuck ahead of the cheaper Asus board in SATA tests.

With its RoG pedigree, the Impact also delivered when it came to overclocking, being one of only two boards on test to take our Core i7-4770K to 4.7GHz, and doing so with just a 1.23V vcore. The EFI layout is also easy to navigate and responsive. When overclocked, the Impact



proved the best board on test in both the image editing and multi-tasking tests, and only the ASRock board proved quicker in our video encoding benchmark. It all adds up to a good score – the Asus' overclocked overall score of 2,917 is this month's best.

There wasn't much to choose between the five boards in our overclocked gaming benchmarks though. The Asus' 109fps minimum in Skyrim was just 1fps behind the ASRock, and its 35fps Shogun 2 result was equalled by three other boards.

## CONCLUSION

The Asus Maximus VI Impact proved to be an excellent performer in our benchmarks and it's filled with high-end features that not only make overclocking easy, but negate some of the limitations of a mini-ITX build. It's an undeniably attractive component, but at £206, its price is a steep premium over the likes of the MSI Z87i, which perform to within a few per cent of the Impact's results for half the price. As such, it's the essence of an Extreme Ultra product, offering loads of features and a lightning turn of speed, but for a hefty premium. MJ



SPEED 43/45

FEATURES 28/30

VALUE 14/25

**CUSTOM PC**  
**85%**  
**OVERALL**

44



# ASUS Z87i-Pro

A bold PCB design, a good EFI and nippy performance

Price £145 inc VAT Supplier [www.scan.co.uk](http://www.scan.co.uk) Manufacturer [www.asus.com](http://www.asus.com)

- +** **PROFESSIONAL** Eye-catching design; intuitive EFI; fast
- **AMATEUR** Components too close together; comparatively pricey

It might be the cheaper of the two Asus boards on test, but the Z87i-Pro will still alleviate your wallet of £145. It stands out for more reasons than its price tag, though, thanks to Asus' bold design. The PCI-E slot, RAM slots and SATA connectors are golden-yellow, in contrast to the black PCB.

The Z87i-Pro also packs in several features that draw the eye. It has more VRM cooling than the competition, thanks to a chunky heatsink fitted to a daughterboard. It's basically the same dramatic system seen on the Asus Maximus VI Impact, but with a different colour scheme. This effectively leaves more room to tweak the board layout, so both the power connectors are aligned along one edge of the board, with two SATA 6Gbps ports also installed along an outer edge for easy access.

It isn't all good news in terms of layout though. The two DIMM slots suffer are very close to the VRM heatsink board, and almost touch the PCI-E slot too. We had to be very careful when accessing the memory and graphics card – removing one or the other,

or both, is advisable. Four SATA 6Gbps ports also sit very close to these slots, and several front-panel connectors are hidden away behind the rear I/O panel too. Thankfully, that rear I/O is packed with six USB 3 ports (more than any other board on test), along with dedicated CMOS and EFI flashback buttons, making EFI maintenance and updates easy.

The Z87i-Pro can store two BIOS files, and its EFI is the best on test. Its home screen serves up more information than any other board in the Labs, its range of tweaking settings are easily accessible and it's responsive. Another neat touch is that, when you tap the F10 key to save and exit the BIOS, a pop-up window details your changes.

The Z87i-Pro stormed ahead in our stock speed benchmarks, producing some of this test's best scores. Its image editing result of 2,107 is equal to that of the Maximus VI Impact, and its overall score 2,525 puts it 166 points ahead of any non-Asus board too. It excelled in our gaming tests and storage benchmarks too.

We couldn't get the Asus to boot with our CPU overclocked to 4.7GHz, but we did get it running at 4.6GHz thanks to the EFI's precise settings. The ability to adjust the vcore to three decimal places saw us running a low 1.175V through the processor, and we set the load line calibration level to three – the same figure as on the ASRock board.

Overclocked performance was understandably less spectacular than its stock performance, but the Z87i-

Pro still performed well. Its image editing and video encoding results dropped to second and third in our results table, although its multi-tasking result led the field.

An overall score of 2,864 places it third overall, making it the fastest of the boards that peaked at 4.6GHz.

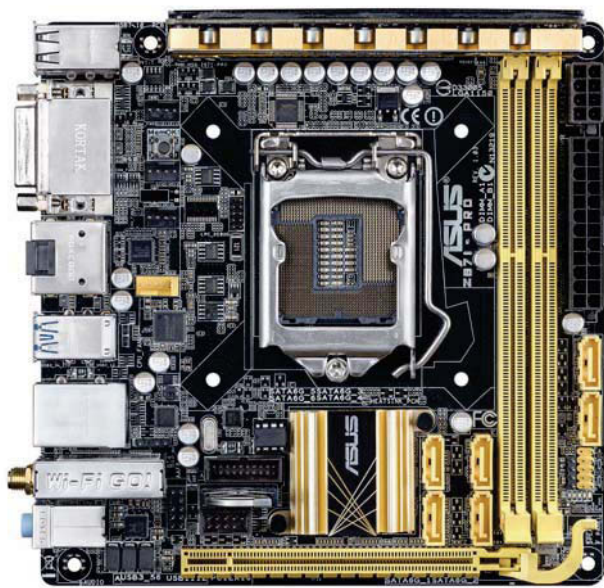
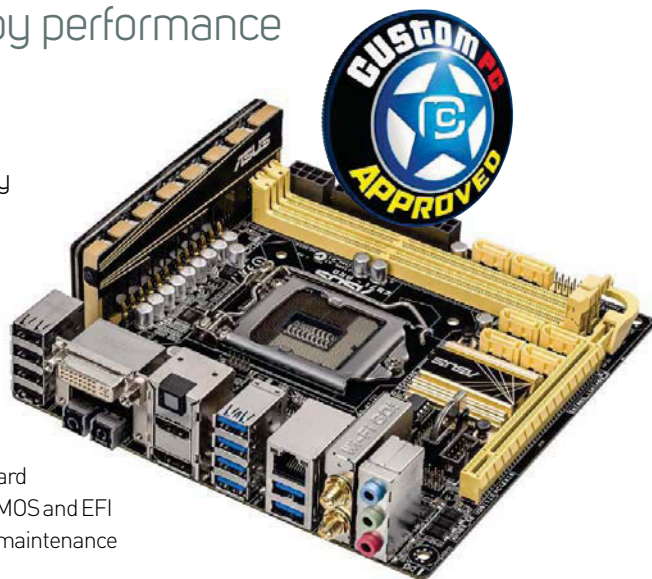
Performance in games again saw the Z87i-Pro pipped by the pair of 4.7GHz capable boards, but the margins remained small. Minimum frame rates of 108fps in Skyrim and 35fps in Shogun 2 are still great results, being just a couple of frames per second behind the quickest.

## CONCLUSION

The Asus Z87i-Pro isn't as consistent as the award-winning MSI board thanks to its slightly crowded layout, but it has plenty to recommend it: a visually exciting design, the best EFI of any board on test and great stock speed performance. However, MSI's Z87i is £40 cheaper, overclocks equally well and offers a tidier layout, making it the better board. If the Z87i-Pro's extended set of features fit your needs better, though, it remains a great choice. **MJ**

**SPEED 42/45**  
**FEATURES 24/30**  
**VALUE 18/25**

**CUSTOM PC**  
**84%**  
**OVERALL**



# ASROCK Z87E-ITX

Next-gen Wi-Fi and great overclocking, but layout could be better

Price £132 inc VAT **Supplier** [www.ebuyer.com](http://www.ebuyer.com) **Manufacturer** [www.asrock.com](http://www.asrock.com)

**+** **ROCKY** Full-sized mSATA slot; network EFI updates; excellent overclocking; 802.11ac Wi-Fi

**-** **HORROR** Awkward board layout

**A**SRock's Z87E-ITX sits in the middle of the pricing field, but it has some features that you still don't find on more expensive products. For starters, it's the only board on test with a full-sized mSATA slot, rather than a half-height version. This means that the tiny dual-band Wi-Fi card can be removed and replaced with an mSATA SSD; you could completely dispense with a SATA drive and make a super-tidy build. The Wi-Fi card is also notable for being the only one on test that's compatible with the faster 802.11ac standard.

The Z87E-ITX also boasts a feature we wish we saw more often: the ability to connect to the Internet and download firmware updates from within the EFI, thanks to built-in network drivers. It came in handy during our testing, and worked perfectly with our connection – it's definitely an advantage over the USB-based methods used on other boards.

It has an attractive black PCB too; like last month's ASRock Z87-Extreme3, this is dotted with gold capacitors. Many of the major components are sensibly laid out, with the CPU socket and PCI-E slot positioned far

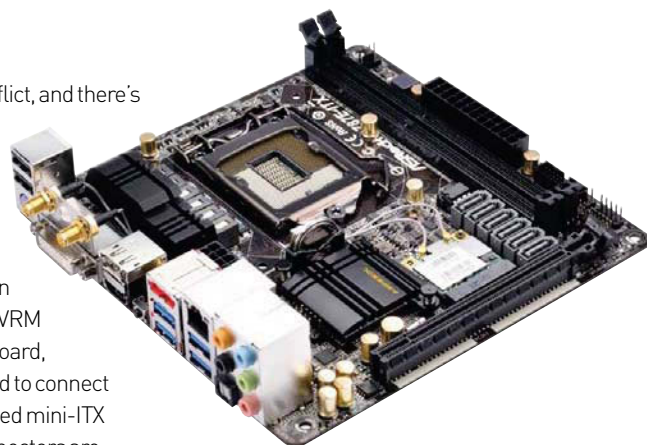
enough apart to avoid any conflict, and there's a small VRM heatsink.

In other areas, though, ASRock's design seems short-sighted. The 8-pin EPS 12V power connector is awkwardly positioned between Wi-Fi antenna cables and the VRM heatsink in the middle of the board, making it particularly awkward to connect within the confines of a cramped mini-ITX case. Several front-panel connectors are also jammed behind the rear I/O, and the six SATA 6Gbps ports sit in the middle, and are arranged in a tight line between the PCI-E and DIMM slots. At least the 24-pin ATX power socket, front panel plugs and USB 3 connectors are gathered along one edge.

Looking to the rear I/O, there are HDMI, DisplayPort and DVI outputs, alongside the standard four chipset-based USB 3 ports. The addition of an eSATA port is of note, though, as is the clear-CMOS button – handy if you run into overclocking problems and need to reset the board without taking the system apart.

The Z87E-ITX proved an inconsistent performer in our Media Benchmarks though. Its image editing result of 2,031 was the second best on test, but it was second worst in the multi-tasking test and ended up sitting mid-table overall. It proved middling in the Skyrim and Shogun 2 games tests too, with a minimum frame rate of 87fps in Skyrim – 9fps below the Maximus V Impact.

Meanwhile, the EFI is more functional than fashionable, with dated-looking graphics. At least



the settings are grouped into sensible blocks, with all the frequency and voltage settings found in the OC Tweaker menu.

The Z87E-ITX was one of just two boards on test to stably overclock to 4.7GHz (47 x 100) too. We managed to hit this magic number by tweaking the vcore to 1.25V and changing the load line calibration to level three.

The Z87E-ITX then redeemed itself with stellar overclocking results. It topped the table in the video encoding test, surpassing even the £200 Maximus VI Impact with a score of 4,384, and its overclocked overall score of 2,889 was second only to the Impact. Its overclocked pace also took it to the top of the table in the Skyrim benchmark, with a minimum frame rate of 109fps.

## CONCLUSION

ASRock's board totes some desirable high-end features and superb overclocking results, but it's hampered by a clumsy board layout. Unless you want to overclock to the max without forking out the premium for the Asus Maximus VI Impact, you'll be better off with the substantially cheaper MSI Z87i. **MJ**

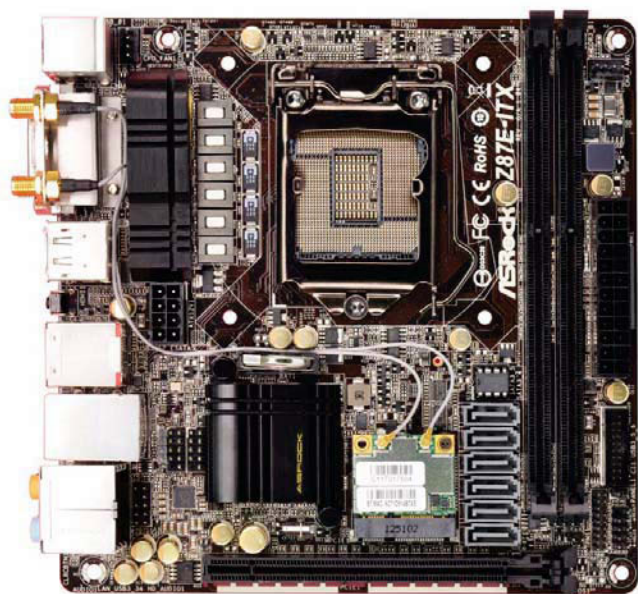
**SPEED 42/45**

**FEATURES 21/30**

**VALUE 19/25**

**CUSTOM PC**  
**82%**  
**OVERALL**

46





# GIGABYTE GA-Z87N-WiFi

A good price, but it's up against serious competition

Price £110 inc VAT Supplier [www.ebuyer.com](http://www.ebuyer.com) Manufacturer [www.gigabyte.com](http://www.gigabyte.com)

- + **GIGABYTE** Low price; some good layout choices
- **GIGA-BITTEN** Crowded layout; no VRM cooling; sluggish EFI

At £110, the Gigabyte GA-Z87N-WiFi is the second-cheapest board on test, so it's not surprising that it has a more utilitarian-looking PCB than the Asus boards. The design is a mixed bag, too. It's great that the 24-pin power connector, SATA 6Gbps ports and USB 3 header are arranged along the top edge, for example, as they'll all be easily accessible in a built system.

However, the CPU socket, memory slots and PCI-E slot are clustered very close together in one corner of the board. This makes component installation tricky, and it will be very difficult to install large heatsinks or water-cooling loops when building a system using this board. This is also the only board on test without a VRM heatsink, although there is a heatsink on top of the chipset. There's just a 4-pin EPS12V connector too; however, as we've seen in the past, this isn't necessarily a barrier to performance or overclocking.

There's little on the rear I/O panel to make the board stand out either. There are no enthusiast features, such as reset or clear-

CMOS buttons and, as with the MSI Z87i, the inclusion of dual Gigabit LAN remains baffling, as it's a feature few people need. Elsewhere, the GA-Z87N-WiFi firmly establishes its mid-range credentials. It has four SATA 6Gbps ports, rather than six, just two PWM-equipped fan connectors and an mSATA slot that's only half-height, and therefore can't be used for SSDs.

The GA-Z87N-WiFi didn't impress in our Media Benchmarks either. It was bottom of the table in three out of the four tests, with its overall score of 2,339 points sitting almost 200 behind the quickest board. It improved a little in games tests, with a 92fps minimum frame rate in Skyrim putting the GA-Z87N-WiFi in third place.

While the EFI has automatic overclocking options, they also proved largely useless thanks to pumping too much voltage through the processor and causing the PC to crash. In our tests, the CPU was only boosted to 4.2GHz but with a whopping 1.417V vcore, quickly causing thermal throttling.

Manual overclocking proved much more fruitful, even with the board's lack of VRM cooling and 4-pin EPS12V connector.

Delving into the EFI, we found an attractive, straightforward layout but soon hit problems. Many options are adjusted using fiddly sliding bars that don't work well with the laggy mouse control, and it isn't possible to hit F10 from anywhere. If you want to save your changes and exit, you need to head back to the main screen before exiting, otherwise any changes will be lost. The system also didn't stabilise with



manual overclocking at 4.7GHz so, as with most of the boards in this test, we had to drop down to 4.6GHz (46 x 100) with a 1.2V vcore.

The overclock didn't help the Gigabyte to leap up our performance tables, but it remained competitive, with the margins between the fastest and slowest boards remaining slim. It was bottom of the pile in the overclocked image editing and multi-tasking tests, and its overall overclocked result of 2,808 was the second lowest on test. Meanwhile, its overclocked minimum frame rates of 104fps in Skyrim and 35fps in Shogun 2 were just a couple of frames per second behind the quickest on test.

## CONCLUSION

The GA-Z87N-WiFi has a tempting price, but its tight budget is evident. Some of the connectors are clustered too closely together for comfort, and the EFI is sluggish and difficult to navigate.

Meanwhile, performance is fair but nothing to shout about, with the Gigabyte being eclipsed by both Asus boards but remaining competitive throughout. If you want a board on a budget, the award-winning MSI Z87i is cheaper and better-designed. **MJ**



**SPEED** 41/45  
**FEATURES** 18/30  
**VALUE** 21/25

**CUSTOM PC**  
**80**  
**OVERALL**

# msi®

MSI recommends Windows 8.



## GE60 GE70

**OFFER AVAILABLE WHILST STOCK LAST**

Promotion Period: **15th July~30th Sep**

Last online claim register date: **15th Oct**

\*Terms & Conditions Apply.

Further details on MSI cashback claim site

<http://ukcashback.msi.com/vga/>

**£100 CASHBACK**



**Where to buy:**

**SCAN**  
computers

**SAVE on  
LAPTOPS**

**amazon.com**

**laptops  
direct.co.uk**

**ebuyer.com**

NVIDIA  
**GEFORCE®  
GTX**





# MSI Z87i

Not the quickest, but it matches a great design with a low price

## + VICTORIOUS

Sensible layout; well-stocked I/O; intuitive EFI; excellent price

## - LABORIOUS

Comparatively slow; some components close together

**T**he MSI Z87i's price of £104 inc VAT makes it the cheapest board in this month's test, being almost half the price of the £206 Asus Maximum VI Impact. For that money, you'd be forgiven for thinking it falls behind its rivals, but this isn't the case.

We were immediately impressed by the MSI's layout. Its four SATA 6Gbps ports, 24-pin ATX power connector and USB 3 connector are all easily accessible along one side of the black PCB.

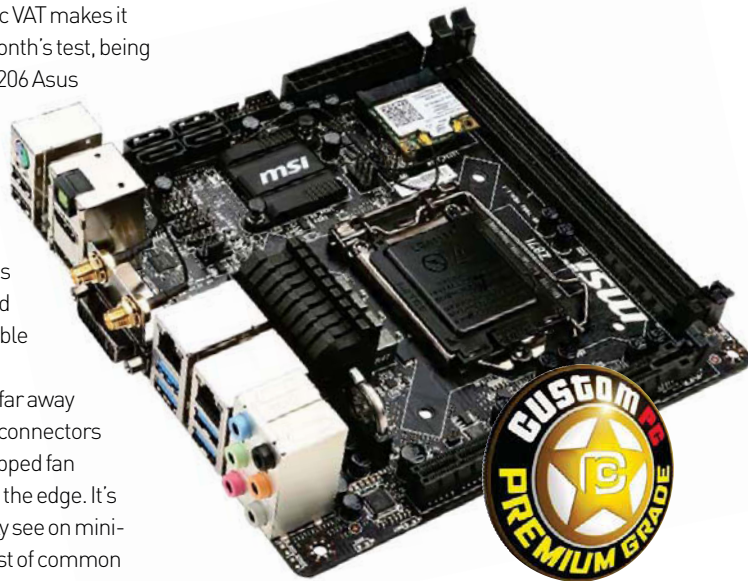
Other important connectors aren't far away either; the mini PCI-E slot, two USB 2 connectors and one of the board's two PWM-equipped fan connectors are all positioned towards the edge. It's a sensible level of design that we rarely see on mini-ITX motherboards, meaning that a host of common features is easy to reach rather than being buried in the middle of the board.

That packed edge isn't the only impressive aspect of the MSI's design either. Its VRM and chipset cooling is provided by a pair of heatsinks, with only the two Asus boards and their discrete cooling systems able to offer better. The PCI-E and memory slots aren't too close together either, unlike the slots on the two Asus boards, so there won't be any conflict when plugging in parts or troubleshooting them.

It's a good start, but the MSI's design isn't quite perfect. The CPU socket and 16x PCI-E slot are close together, which could cause problems with particular hardware; large graphics cards and CPU coolers could easily clash, and the angle will likely prove too steep to run water-cooling tubing between the CPU and the top edge of a graphics card.

There's also only a 4-pin EPS12V power connector, which is half the size of the sockets on several rivals and situated awkwardly in the middle of the board. As we've seen before, though, a 4-pin power connector is no barrier to overclocking and the slot is at least positioned above the VRM heatsink, unlike the same connector on the GA-Z87N-WiFi.

Meanwhile, the mini PCI-E slot houses a dual-band 802.11n Wi-Fi card but, unlike the ASRock board, it's half-height – so the connector can't be used for an mSATA SSD.



Elsewhere, the MSI Z87i board ticks many more boxes. Four SATA 6Gbps sockets will be enough for all but the most ardent file hoarders, and its count of two fan connectors is on a par with most of this month's boards.

The rear I/O panel is particularly impressive though. The addition of clear-CMOS and Go2BIOS buttons will please overclockers, but there are also four USB 3 ports, two USB 2 ports, a PS/2 connector, optical

## A HOST OF COMMON FEATURES IS EASY TO REACH, RATHER THAN BEING BURIED IN THE MIDDLE OF THE BOARD

S/PDIF and two wireless antenna connectors. Meanwhile, display outputs include DVI, HDMI and DisplayPort. There are also two Ethernet connectors.

There's only one EFI chip rather than two, but MSI's EFI software is excellent. Its main page has temperature, version and boot order information, and any changes made to motherboard settings are displayed at the top of the window – a handy inclusion. The menus themselves also follow patterns we're used to seeing on older BIOS systems, which is preferable to hunting around menus for options that have been needlessly moved.

### HOW MUCH?

Price £104 inc VAT

Supplier [www.scan.co.uk](http://www.scan.co.uk)

Manufacturer [www.msi.com](http://www.msi.com)



The only notable missing features are on-board power buttons, an LED POST-code display and a discrete audio card, but the only board in this test to fit these options is the Asus Maximus, which is virtually twice the price. Considering the Z87i is the cheapest board on test, it boasts a great array of features that easily match those of the more expensive opposition.

## PERFORMANCE

The MSI Z87i doesn't set its stall out as a high-end board, and that's reflected in its benchmark results. At stock speed, it recorded mediocre image editing and video encoding scores, and its overall result of 2,343 was 182 points behind the speedy Asus Z87i Pro.

The MSI didn't manage to close the gap in our stock speed gaming benchmarks either. Its 81fps minimum frame rate result in Skyrim was the slowest on test – 13fps behind the Asus – and it also propped up the bottom of the results table in Shogun 2, thanks to a 27fps minimum frame rate that's 2fps slower than the best boards in the Labs.

SATA performance wasn't anything to shout about either. While the MSI's read pace of 536MB/sec was the second-best on test, its write pace of 501MB/sec was at the bottom of the results table, being 19MB/sec behind the rapid Asus Z87i-Pro.

As with three other boards in the Labs, we were unable to overclock the MSI to 4.7GHz, as the system overheated when booted with a vcore of 1.27V and crashed when we dropped the voltage to 1.26V.

We dropped the multiplier to 46x and, after several attempts with lower voltages, the system became stable with the vcore at 1.2V. It took a little time, but MSI's well laid-out EFI made the job easy, providing information about multipliers and temperatures on the main menu, as well as a Hardware Monitor tool that's packed with more information.

The 4.6GHz overclock didn't help the MSI to climb our performance tables, but it was certainly able to compete. While its revised image editing result was second best in this test, it was still second from the bottom in the rest of the Media Benchmarks, and it came bottom of the pile in the overall test with a score of 2,779.

While this makes the MSI Z87i the only board on test not to record an overall score of at least 2,800 points, its overall result is still less than 5 per cent slower than the Asus Maximus VI Impact.

When overclocked, the MSI Z87i was still bottom of the table in our gaming tests too, but it closed the gap in both The Elder Scrolls V: Skyrim and Shogun 2: Total War. In the former benchmark, it was 9fps behind this month's quickest board, and just 1fps slower in Shogun 2.



## CONCLUSION

The MSI Z87i is one of the slowest boards on test, but the margins are slim and, when overclocked, it's only slightly slower than boards costing almost twice its price. It excels in other areas, though, making up for its lack of raw speed. Easy access to the majority of ports and connectors is aided by an excellent layout, and the rear I/O panel, which is stuffed with ports, as well as a couple of buttons that will appeal to enthusiasts.

The EFI is also responsive and easy to navigate, and proved just as overclockable as most of the other boards on test, having no problems maintaining a 4.6GHz overclock. It's an excellent all-rounder, and it's also the cheapest board on test. When a product this good is virtually half the price of some of the competition, we can't help but give the MSI Z87i a Premium Grade. **MJ**

**01** The four SATA 6Gbps ports, 24-pin ATX power connector and USB 3 connector are all easily accessible along one side of the black PCB

**02** The mini PCI-E slot, two USB 2 connectors and one of the board's two PWN-equipped fan connectors are all positioned towards the edge

**03** The PCI-E and memory slots aren't too close together either, so there won't be any conflict when plugging in parts or troubleshooting them

## SCORES

**SPEED 40 / 45**

**FEATURES 22 / 30**

**VALUE 24 / 25**

**CUSTOM PC**  
**86%**  
**OVERALL**



# EVGA GeForce GTX 760 SC ACX 2GB

The fastest card out of the box, but others overclock better

Price £219 inc VAT **Supplier** [www.ebuyer.co.uk](http://www.ebuyer.co.uk) **Manufacturer** [www.evga.com](http://www.evga.com)

**+ HEATPIPE** High factory overclock; maintains peak boost clock; quiet

**- PIPE DREAM** Third heatpipe doesn't contact GPU; limited overclocking

**E**VGA has three different GTX 760 SKUs, and the SC ACX is the top dog, sporting a triple-heatpipe custom cooler and a factory overclock. EVGA's ACX cooler is a whopper, with a large aluminium heatsink running almost the full length of the card, which is contained beneath a plastic shroud. Mounted on the shroud are two 90mm downdraft fans, blowing air onto the heatsink and PCB below. The heatsink's fins are arranged laterally along the card to guide airflow towards the rear I/O and side of the card, but a fair amount of heat will still be exhausted into your case.

Threaded through the heatsink are three direct-contact heatpipes, which sit directly on top of the GPU. Or at least, two of them sit there. The third heatpipe sits impotently away from the GPU contact area, so it's far less effective. This is a disappointing flaw that doesn't affect EVGA's other cards, thanks to their contact plates.

The SC ACX has a big factory overclock though. Its 1,072MHz base clock is almost 100MHz higher than a stock card, and the ACX cooler ensures that the card continually boosts to its peak 1,215MHz core frequency. Meanwhile, the memory remains at the stock speed of 6GHz. Under load, the GPU reached 74°C with an ambient temperature of 28°C, well away from the 81°C throttle threshold set by Nvidia. The pair of fans ran at 1,890rpm to maintain this temperature and, while audible, they were nowhere near as noisy as stock cards under the same circumstances.

With the highest effective overclock of any card on test, the SC ACX was able to demonstrate a small advantage over the other factory-overclocked cards. Its minimum frame rate of 82fps in Skyrim at 1,920 x 1,080 was 8fps quicker than the stock card, while a minimum frame rate of 56fps in BioShock Infinite was 4fps quicker. All the increases were minimal, though, and not enough to shift a result from unplayable to playable.



**WITH THE HIGHEST EFFECTIVE OVERCLOCK OF ANY CARD ON TEST, THE SC ACX WAS ABLE TO DEMONSTRATE A SMALL ADVANTAGE**

Using EVGA's excellent Precision overclocking software, we then raised the power threshold to 115 per cent and the temperature target to 95°C, before pushing the SC ACX as far as it would go, which turned out wasn't that far. Adding an extra 50MHz to the core frequency pushed the peak boost clock to 1,267MHz, just a few megahertz above the PNY stock card. We managed to push the memory up to 7GHz, but this is still 800MHz behind the most capable cards on test.

Hitting these clock speeds pushed the GPU's temperature to 81°C with a 28°C ambient temperature, but the card didn't throttle and its fans, while audible at 2,000rpm, were still quieter than the stock card under the same circumstances. The boosted clock speeds saw the minimum frame rate in Crysis 3 at 1,920 x 1,080 climb

from 41fps to 45fps, but the score of 1,702 in Unigine Valley was some 70 points lower than the best overclockers.

## CONCLUSION

EVGA's GTX 760 SC ACX 2GB is the fastest card on test at its default frequencies, boosting to its maximum frequency and staying there, even in high ambient temperatures. However, its redundant third heatpipe is bothersome and, while it's quieter than a stock card, it didn't overclock much higher. For the same price, the MSI Twin Frozr is cooler, quieter and a more capable overclocker. **HB**

## IN DETAIL

**Graphics processor** GeForce GTX 760  
**Clock speeds** 1,072MHz base clock, 1,215MHz guaranteed boost clock, 1,215MHz max boost clock  
**Pipeline** 1,152 stream processors, 6SMTs, 3/4GPCs  
**Memory** 2GB GDDR5, 6GHz effective  
**Bandwidth** 192GB/sec, 256-bit interface  
**Compatibility** DirectX 11.1, OpenGL 4.1  
**Outputs/inputs** 2 x DVI, 1 x DisplayPort, 1 x HDMI  
**Power connections** 1 x 6-pin, 1 x 8-pin top-mounted  
**Size** 240mm long, dual-slot

**SPEED** 29/30  
**FEATURES** 15/20  
**O/CING** 12/20  
**VALUE** 23/30

**CUSTOM PC**  
**79%**  
**OVERALL**

# GAMERS' CHOICE FOR NEXT GENERATION GAMING

## UP TO 1202 MHZ CLOCK SPEEDS WITH ZOTAC 700 SERIES AMP! EDITION

Embrace fast, smooth and quiet on a supercharged level with the finely-tuned ZOTAC GeForce GTX 760 AMP! Edition and GTX 770 AMP! Edition. These graphic cards boosts the engine and memory clocks far beyond the stock levels for an extra performance kick in the most demanding gaming situations.



**ZOTAC®**  
**GEFORCE® GTX 760 AMP!®**  
EDITION

- 2GB GDDR5 Memory
- Engine Clock: 1111 MHz (base), 1176 MHz (boost)
- Next Generation Gaming
- NVIDIA ShadowPlay ready
- ZOTAC FireStorm overclocking utility included
- ZOTAC Boost Premium software included



**ZOTAC®**  
**GEFORCE® GTX 770 AMP!®**  
EDITION

- 7 Gbps Memory Speed
- 2GB GDDR5 Memory
- Engine Clock: 1150 MHz (base), 1202 MHz (boost)
- Next Generation Gaming
- ZOTAC Dual Silencer cooling system
- Splinter Cell Compilation Game Bundle:  
Splinter Cell Double Agent, Splinter Cell Conviction,  
and the all new Splinter Cell Blacklist



AVAILABLE FROM:



ebuyer.com



**WWW.ZOTAC.COM**

© 2013 ZOTAC International (MCO) Limited. All Rights Reserved. All brand names and trademarks are property of their respective owners. Product features and specifications are subject to change without prior notice. © 2013 NVIDIA Corporation. All Rights Reserved. NVIDIA, NVIDIA logo, GeForce, GeForce GTX logo, SLI, PhysX, 3D Vision, 3D Vision Surround, and CUDA are registered trademarks and/or trademarks of NVIDIA Corporation in the United States and other countries.

**ZOTAC®**  
*It's Time to Play*



# MSI GeForce GTX 760 Twin Frozr OC Gaming 2GB

The best GTX 760 on test, with awesome cooling and overclocking

## + GAMING

Amazingly low noise and temperatures; phenomenal overclocking

## - WORKING

Large 260mm PCB

**M**

SI's Twin Frozr coolers have long been hailed in these hallowed pages, and the latest iteration, the Twin Frozr IV, sits on top of the GTX 760 Twin Frozr OC Gaming 2GB. The

hefty 260mm PCB means it's the largest card on test, but it remains a dual-slot card despite the humungous cooler, which rises slightly in height above the top edge of the PCB. Top mounted 8-pin and 6-pin PCI-E power connectors supply the juice, while there's the usual set of 2 x DVI, HDMI and DisplayPort outputs on the backplate.

The huge cooler is made up of very tightly stacked aluminium cooling fins arranged laterally along the length of the card. Four chunky nickel-plated heatpipes run through the fin stack, culminating in a nickel-plated copper contact plate to effectively distribute heat from the GPU between them. On top of the cooler sits a pair of 90mm low-profile cooling fans, blowing down air through the fins and over the PCB. The card isn't heavy on shrouding, so most of the card's heat will be dissipated into your PC's case rather than out of the rear backplate.

Beneath the imposing cooler sits an aluminium base plate to provide enhanced cooling to the VRMs and 1GB of GDDR5 memory fitted to the front side of the PCB. Sadly, the memory on the back isn't actively cooled though. Meanwhile, when it comes to power phases, the Twin Frozr boasts a pair for the memory and five for the GPU, for a KFA<sup>2</sup>-matching 7+1 phases overall.

As you'd imagine with such a heavily upgraded PCB and cooler, MSI has shipped the Twin Frozr with a factory overclock, but it's fairly small. The base clock has been boosted by 40MHz from 980MHz to 1,020MHz, with a guaranteed boost clock of 1,085MHz and a maximum boost clock of 1,150MHz. This means that the card maintains the +130MHz maximum boost curve of the stock card; elsewhere, the KFA<sup>2</sup> GTX 760 only boosts by a maximum of +91MHz above its apparently higher 1,059MHz base clock, while the Zotac only boosts by +39 above its 1,111MHz base clock due to thermal constraints. The result is that all three cards boost to



a maximum of 1,150MHz, despite having very different base clocks.

Bizarrely, despite actively cooling the memory, MSI has chosen to ship the Twin Frozr with a stock GDDR5 clock of 1.5GHz (6GHz effective). However, of the other cards on test, only the Zotac AMP! offers a memory overclock, so this isn't a significant disadvantage.

## PERFORMANCE

With such a hefty cooler, the Twin Frozr had no problem maintaining its peak 1,150MHz boost clock, even under extended load in very hot weather. The

## IT'S A DODDLE TO PUSH FREQUENCIES HIGHER WITH MSI'S AFTERBURNER SOFTWARE

GPU temperature reached a maximum of just 62°C in an ambient 24°C, with its pair of cooling fans spinning at a virtually inaudible 1,110rpm. This is by far the best cooling of any card on test, despite the fans running slower and quieter than any of the competition.

As with many of the GTX 760s on test, though, the Twin Frozr struggled to have an impact on in-game frame rates in comparison to the stock GTX 760, despite its 40MHz overclock. In Battlefield 3 at 1,920 x 1,080, its minimum frame rate of 61fps is identical to that of the stock card, as is its result of 40fps in Crysis 3

### HOW MUCH?

**Price** £221 inc VAT  
**Supplier** [www.scan.co.uk](http://www.scan.co.uk)  
**Manufacturer** <http://uk.msi.com>

### IN DETAIL

**Graphics processor**  
GeForce GTX 760

**Clock speeds** 1,020 MHz base clock, 1,085MHz guaranteed boost clock, 1,150MHz max boost clock

**Pipeline** 1,152 stream processors, 6SMs, 3/4GPCs

**Memory** 2GB GDDR5, 6GHz effective

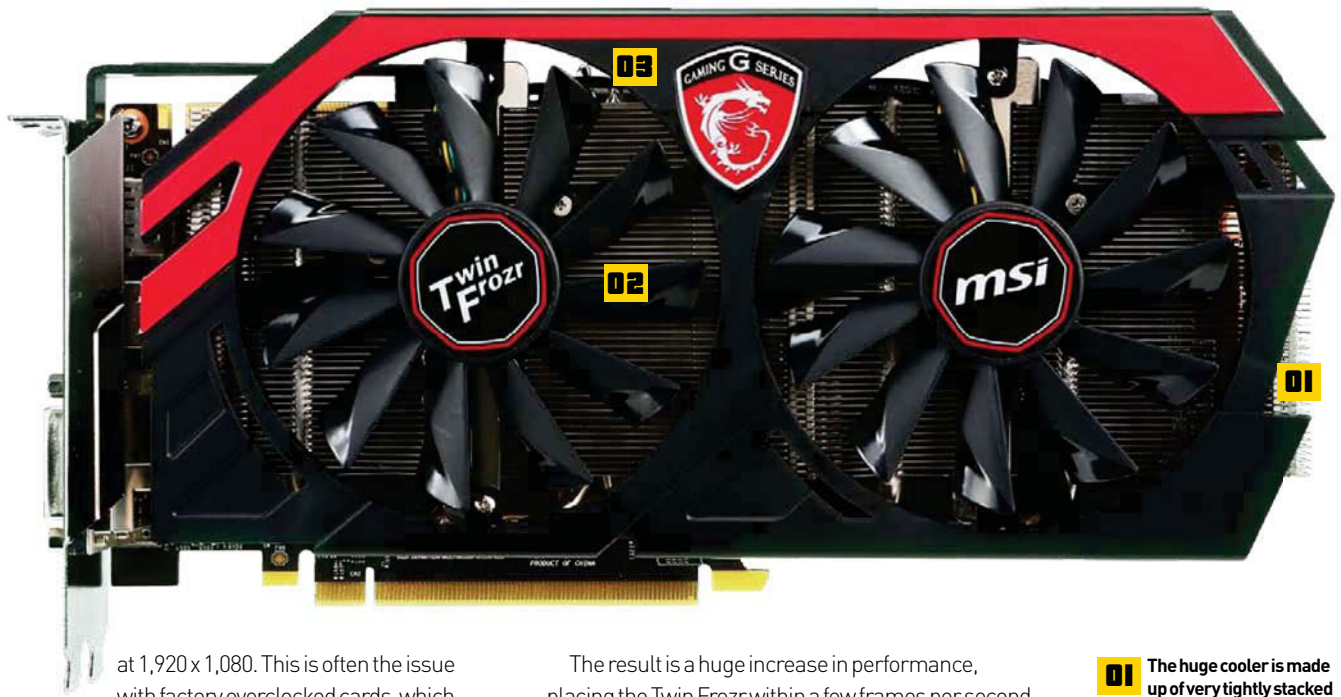
**Bandwidth** 192GB/sec, 256-bit interface

**Compatibility** DirectX 11.1, OpenGL 4.1

**Outputs/inputs** 2 x DVI, 1 x DisplayPort, 1 x HDMI

**Power connections** 1 x 6-pin 1x8-pin, top-mounted

**Size** 260mm long, dual-slot



**01** The huge cooler is made up of very tightly stacked aluminium cooling fins arranged laterally along the length of the card

**02** On top of the cooler sits a pair of 90mm low-profile cooling fans, blowing down air through the fins

**03** Four chunky nickel-plated heatpipes run through the fin stack, culminating in a nickel-plated copper contact plate to effectively distribute heat from the GPU between them

at 1,920 x 1,080. This is often the issue with factory overclocked cards, which carry a heavy premium but rarely boost performance enough out of the box to justify it.

An additional 4fps at 1,920 x 1,080 in Skyrim over the stock card is a more favourable result, but the Twin Frozr's default overclock certainly isn't enough to justify the partner-card premium on its own. Its Unigine Valley score of 1,536 was also just 44 points higher (3 per cent) than a stock card in the same test. The twin Frozr offered one benefit over the stock card, however – its peak power consumption of 286W was 9W lower than the stock PNY.

Of course, a major reason for buying a card with a custom cooler and PCB is to overclock it and that, happily, is where the Twin Frozr excels. Paired with MSI's legendary Afterburner overclocking software, it's a doddle to push frequencies higher, and there's a great deal of headroom too. With the full +145 per cent power threshold and 95°C temperature target, we were able to manage a base clock of 1,170MHz, boosting to a steady maximum of 1,293MHz.

This is a tasty 16 per cent higher than a stock card's maximum boost clock, but the Twin Frozr can maintain this frequency all day long. We observed just a 6°C increase in GPU temperature using our maximum overclock, with the pair of cooling fans spinning up to a muted 1,200rpm.

The 2GB of GDDR5 memory also proved very open to overclocking, and we were able to raise its frequency to a towering 1,950MHz (7.8GHz effective). These overclocks match those of the KFA² EX OC card, but the MSI accomplishes them with lower GPU temperatures and quieter fans.

The result is a huge increase in performance, placing the Twin Frozr within a few frames per second of the £350 GeForce GTX 770 2GB. In Battlefield 3 at 2,560 x 1,600, its overclocked minimum frame rate of 41fps was only 2fps behind a GTX 770 and 7fps faster than a stock GTX 760. In Crysis 3 at 1,920 x 1,080, the overclocked Twin Frozr achieved a minimum frame rate of 47fps, just 1fps behind the GTX 770 2GB and 7fps faster than a stock GTX 760 2GB. Its overall Unigine Valley score of 1,774 was still some way behind the 1,934 of a GTX 770 2GB, but this is still a phenomenal level of performance from a £221 card.

## CONCLUSION

Both the MSI and its KFA² competitor have amazed us with their overclocking headroom. Pushing a £200 GPU to performance just below that of a £350 card is fantastic and, while there's a degree of variability between GPUs, user feedback on forums is showing the clock speeds we've achieved aren't uncommon. What's more, the Twin Frozr achieved these frequencies without breaking a sweat, keeping its GPU delta T below 45°C even when overclocking. As such, despite its slightly higher £221 price tag, it just pips the KFA² to this month's premium grade; if you're looking for a GTX 760, this is the one to buy. **HB**

## SCORES

**SPEED** 28 / 30  
**FEATURES** 18 / 20  
**O/C'ING** 19 / 20  
**VALUE** 28 / 30

**CUSTOM PC**  
**93%**  
**OVERALL**





# KFA<sup>2</sup> GeForce GTX 760 EX OC 2GB

A brilliant card that's capable of amazing overlocks

Price £216 inc VAT Supplier [www.overclockers.co.uk](http://www.overclockers.co.uk) Manufacturer [www.kfa2.com](http://www.kfa2.com)

**+ EXTREME** Healthy overclock; quiet fans; awesome overclocking; good price

**- MUNDANE** Short boost curve means it's no faster than lower-clocked cards

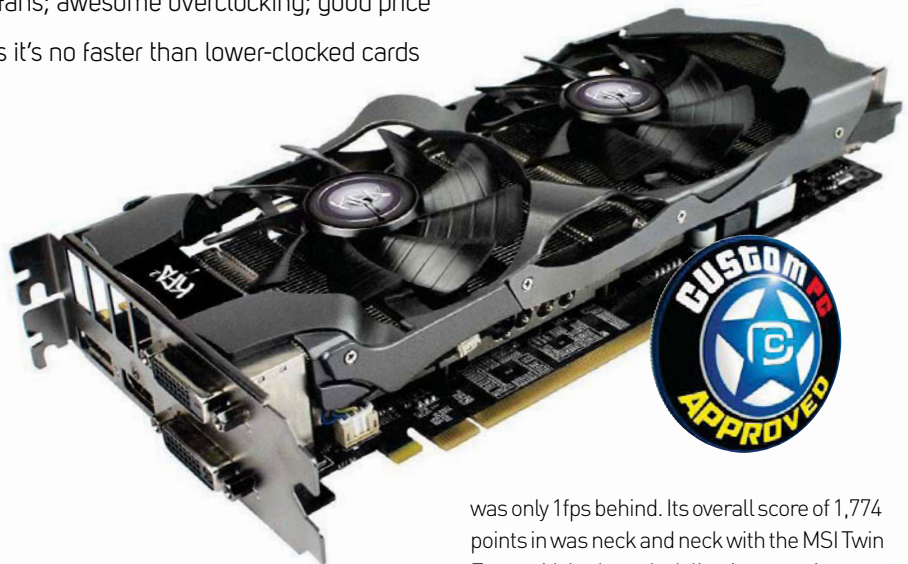
The KFA<sup>2</sup> GTX 760 EX OC 2GB is absolutely stuffed with top-spec power circuitry and cooling. A large aluminium heatsink runs laterally along the length of the card, through which four nickel-plated copper heatpipes run.

A pair of 80mm down-draft fans sit on top of the fin stack, mounted on the card's rather vicious-looking shroud. The shroud itself is quite minimal, in order to cut down on airflow interference, but this means that much of the card's heat will be dumped into your PC's case rather than out of the rear backplate. The fan shroud does have a neat extra though – it can be flipped vertically to allow easy access for cleaning.

Beneath the cooler are seven huge power phases, which are cooled by a separate aluminium heatsink, and all of the GDDR5 memory is fitted to the front side of the PCB, so it can be actively cooled by the fans.

The EX OC ships with a base clock of 1,059MHz and a guaranteed boost clock of 1,110MHz. However, its boost curve tops out at +91MHz instead of +130MHz, boosting to the same 1,150MHz maximum boost clock as the lower-clocked MSI Twin Frozr. Thankfully, unlike the Zotac AMP!, this isn't due to thermal throttling, with the EX OC running at a cool 71°C in a 26°C ambient temperature, and maintaining its peak boost with ease. What's more, the pair of fans ran at just 1,860rpm to maintain this temperature, making the EX OC very quiet, even when under full load.

The EX OC only offered a small performance advantage over a stock GTX 760, but this still made for a minimum frame rate of 78fps in Skyrim at 1,920 x 1,080 (4fps higher than stock) and 54fps in BioShock: Infinite at 1,920 x 1,080 (2fps higher than stock). A Unigine Valley score of 1,534 demonstrates the similarity in performance to that of the MSI Twin Frozr, with just two points separating them.



**WE COULD SCARCELY BELIEVE IT WHEN THE CARD RAN STABLY WITH AN EFFECTIVE GDDR5 MEMORY FREQUENCY OF 7.8GHZ**

The EX OC was also a delight to overclock. We eventually reached a base clock of 1,210MHz, with a maximum constant GPU Boost of 1,293MHz – the same as the MSI Twin Frozr. The memory proved even more open to overclocking, and we could scarcely believe it when the card ran stably with an effective memory frequency of 7.8GHz; that's an amazing 30 per cent increase, resulting in 249GB/sec of memory bandwidth. Even with these increases, the card's GPU temperatures only rose by 2°C, with the fans spinning up to an audible but unobtrusive 1,950rpm.

These increases enabled the card to reach levels of performance that were almost on a par with a GeForce GTX 770. Its minimum of 41fps in Battlefield 3 at 2,560 x 1,600 was just 2fps behind a GTX 770 2GB, while its minimum of 47fps in Crysis 3 at 1,920 x 1,080

was only 1fps behind. Its overall score of 1,774 points in was neck and neck with the MSI Twin Frozr, with both cards delivering amazing overclocking headroom.

## CONCLUSION

Simply put, the KFA<sup>2</sup> GeForce GTX 760 EX OC 2GB is a superb graphics card. While there are faster cards out of the box, few can compete in terms of overclocking headroom and cooling. It's a close competition between this card and the MSI; both are great cards, and while the KFA<sup>2</sup> is £5 cheaper, the MSI is both cooler and a little quieter, allowing it to just edge ahead. Either card is a fantastic choice though. **HB**

## IN DETAIL

**Graphics processor** GeForce GTX 760  
**Clock speeds** 1,059 MHz base clock, 1,110MHz guaranteed boost clock, 1,150MHz max boost clock  
**Pipeline** 1,152 stream processors, 6SMTs, 3/4 GPCs  
**Memory** 2GB GDDR5, 6GHz effective  
**Bandwidth** 192GB/sec, 256-bit interface  
**Compatibility** DirectX 11.1, OpenGL 4.1  
**Outputs/inputs** 2 x DVI, 1 x DisplayPort, 1 x HDMI  
**Power connections** 1 x 6-pin 1x8-pin, top-mounted  
**Size** 253mm long, dual-slot

**SPEED 28/30**  
**FEATURES 17/20**  
**O/CING 19/20**  
**VALUE 28/30**

**CUSTOM PC**  
**92%**  
**OVERALL**



# DON'T BLAME YOURSELF.



## IT'S TIME FOR YOUR PC TO EVOLVE, NOT YOU.

Whether for business or for everyday use, enjoy a faster, more reliable computing experience with Samsung SSD 840 EVO and 840 PRO. [www.ebuyer.com/samsung-840](http://www.ebuyer.com/samsung-840)

**ebuyer.com**

Don't forget you can order up to 11pm for  
**next day** delivery\*

\*Terms and conditions apply. See site for details.



[www.facebook.com/ebuyer](http://www.facebook.com/ebuyer)



[www.twitter.com/ebuyer](http://www.twitter.com/ebuyer)



[www.youtube.com/ebuyer](http://www.youtube.com/ebuyer)





# PNY GeForce GTX 760 XLR8 2GB

A great overclocker, but it can be noisy

Price £206 inc VAT Supplier [www.scan.co.uk](http://www.scan.co.uk) Manufacturer [www.pny.com](http://www.pny.com)

**+ STOCK** Low price; overclocks better than some custom-cooled opposition

**- OUT OF STOCK** Throttles max boost clock at stock speed; noisy and hot

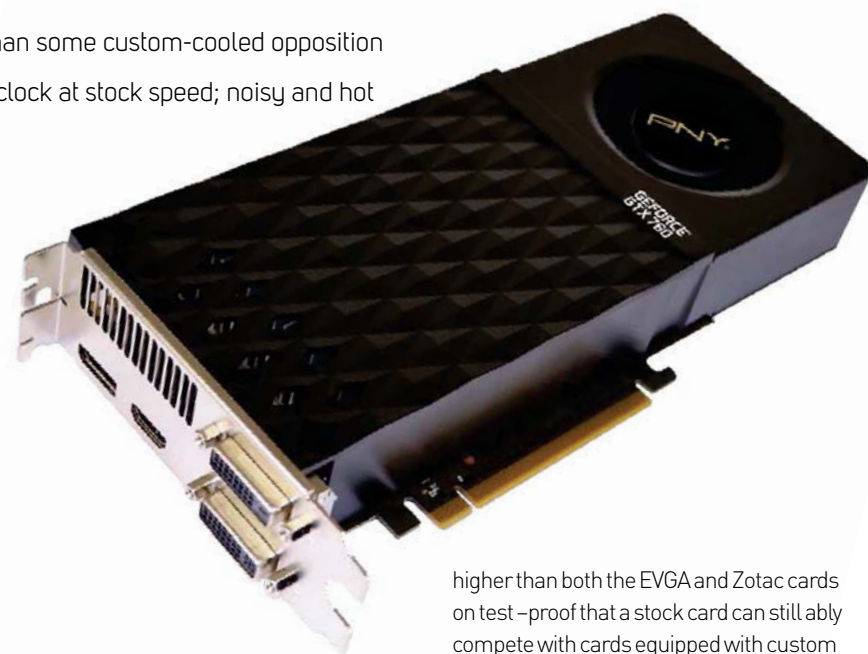
Despite its XLR8 moniker, PNY's take on the GeForce GTX 760 2GB is a stock version of the card. Measuring 240mm in length, its design uses a small 175mm PCB, with the extra 65mm taken up by the radial cooling fan and its shroud. Removing the shroud reveals a basic PCB, with the voltage regulation circuitry positioned towards the card's rear backplate. A separate aluminium heatsink sits on the VRMs, with a pair of power phases for the memory and four phases for the GPU, for a total of 6+1 phase power.

Cooling the GPU is a small vapour chamber cooler, on top of which sits a dense array of aluminium cooling fins. Air flows from the radial fan through these fins, through the VRM heatsink and out the rear backplate, ensuring that minimal heat from the GPU is deposited into your case. The small PCB does make for high thermal density, however, so the single fan has to work hard to keep the GPU cool.

As a stock card, the XLR8 has a base clock of 980MHz, a guaranteed boost clock of 1,032MHz and a peak boost clock of 1,110MHz. However, even at stock speeds in 24°C ambient temperatures, the card reached its 81°C throttle temperature when boosting to its maximum speed, and ran a few megahertz below its maximum. This situation is down to Nvidia, and all cards will throttle at this temperature at stock speed, with the focus on maintaining temperatures and fan noise, at a slight cost to performance.

As the stock baseline for this month's Labs test, the XLR8 is, not surprisingly, the slowest of the bunch out of the box. While this is less evident in Battlefield 3, where only the EVGA GTX 760 SC was quicker (by just 1fps), in both Skyrim and BioShock: Infinite, the factory-overclocked cards run 3-4fps faster.

With the thermal limit raised to 95°C, and the power limit raised to 115 per cent, the XLR8 proved a decent overclocker, and we were able to increase the base clock to



**A SMALL VAPOUR CHAMBER COOLS THE GPU, ON TOP OF WHICH SITS A DENSE ARRAY OF ALUMINIUM COOLING FINIS**

1,130MHz – a 15 per cent increase that saw the card continually GPU Boosting to 1,260MHz. The memory also proved open to overclocking, topping out at 1,702MHz (6.8GHz). This increased the card's memory bandwidth from 192GB/sec to 217.6GB/sec – a 13 per cent improvement. Of course, these overclocks degraded the thermal performance though; with the thermal controls disabled, the GPU delta T reached 58°C, with the cooling fans running at a very noisy 2,910rpm. Power consumption also rose to 322W.

With these boosted clock speeds, the minimum frame rate in Crysis 3 at 1,920 x 1,080 jumped from 40fps to 45fps, while the minimum in Battlefield 3 at 2,560 x 1,600 rose from 34fps to 39fps. Meanwhile, its overclocked Unigine score of 1,711 was

higher than both the EVGA and Zotac cards on test – proof that a stock card can still ably compete with cards equipped with custom PCBs and coolers.

## CONCLUSION

The PNY GeForce GTX 760 XLR8 2GB raises some eyebrows by overclocking further than both the EVGA and Zotac cards, but it does so at the cost of intrusively high fan speeds. This blow is softened by the low price of £206, but as it only costs an extra £10 for a quieter, faster and higher-overclocking card, your choice should lie with the KFA² or MSI cards. **HB**

## IN DETAIL

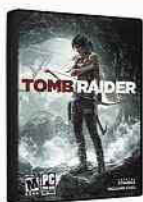
**Graphics processor** GeForce GTX 760  
**Clock speeds** 980MHz base clock, 1,032MHz guaranteed boost clock, 1,110MHz max boost clock  
**Pipeline** 1,152 stream processors, 6SMTs, 3/4GPCs  
**Memory** 2GB GDDR5, 6GHz effective  
**Bandwidth** 192GB/sec, 256-bit interface  
**Compatibility** DirectX 11.1, OpenGL 4.1  
**Outputs/inputs** 2 x DVI, 1 x DisplayPort, 1 x HDMI  
**Power connections** 2 x 6pin, top-mounted  
**Size** 240mm long, dual-slot

**SPEED** 27/30  
**FEATURES** 14/20  
**O/CING** 12/20  
**VALUE** 24/30

**CUSTOM PC**  
**76**  
**OVERALL**

# NEVER SETTLE: Reloaded

Beat the heat with the best games, on the best graphics



Buy **SAPPHIRE** HD 7000 series products  
and get the best games **FREE\***



#### **SAPPHIRE TOXIC HD 7970: Mad and Dangerous.**

It's a beast. Very, very special edition. By default, factory overclocked with 6GB of GDDR5. But it doesn't stop there. Dynamic Boost make things even faster. And if that's still not enough, our most extreme model offers a Lethal Boost Button, pushing your card to previously unimaginable limits.

*Get Crysis® 3 and BioShock® Infinite free with purchase.*

#### **SAPPHIRE HD 7870 DUAL-X: Keep it cool with Dual-X.**

Dual-X is a multi heatpipe cooling system coupled with two advanced fans that run slowly, efficiently and quietly – even under extreme load.

Other features include 2GB GDDR5 overclocked to 1200MHz.

*Get Tomb Raider™ and BioShock® Infinite free with purchase.  
In APAC region, get Devil May Cry™ and BioShock® Infinite.*



#### **SAPPHIRE HD 7770 Vapor-X: Exclusively from SAPPHIRE.**

High-end graphics cards use more power, which means they get hotter quicker. With the innovative Vapor-X, we were the very first to apply aerospace-industry vapor chamber technology to graphic cards.

*Get Far Cry™ free with purchase of a SAPPHIRE HD 7770 or get  
BioShock® Infinite free with purchase of a SAPPHIRE HD7790.*

From participating retailers and retailers.

Cards shown here are for illustration purposes only.  
Other HD 7000 series cards qualify for AMD's Never Settle Reloaded promotion.

\*Bundle options may vary.

**AMD**

**RADEON**  
GRAPHICS

Get **Radeon™** in your system.



**SAPPHIRE**  
www.sapphiretech.com

© 2013 Advanced Micro Devices, Inc. All rights reserved. AMD, the AMD logo, Radeon, and combinations thereof are trademarks of Advanced Micro Devices, Inc. All rights reserved. Images for Tomb Raider, Far Cry, Crysis, BioShock, BioShock Infinite, and Far Cry 3 are trademarks of Square Enix Ltd. The rating icon is a registered trademark of the Entertainment Software Association. All other trademarks are the property of their respective owners. All rights reserved.





# ZOTAC GeForce GTX 760 AMP! Edition 2GB

Too many megahertz for the cooler to handle

Price £240 inc VAT Supplier [www.Zotac.co.uk](http://www.Zotac.co.uk) Manufacturer [www.evga.com](http://www.evga.com)

**+ AMPLIFIER** Super-short PCB; quiet fans

**- AMPERSAND** Can't maintain max boost clock; poor overclocking

Zotac's AMP! Edition of the GTX 760 is, on paper, the fastest card on test. With a base clock of 1,111MHz, its base clock is 131MHz higher than that of a stock card, which should result in a guaranteed boost clock of 1,176MHz and a maximum boost clock of 1,240MHz. However, you'll no doubt have noticed that, alongside its highest clock speeds, the AMP! is also the smallest card on test, with its PCB measuring a diminutive 185mm and the metal shroud extending this length to 195mm. A pair of 75mm sculpted down-draft fans provide the cooling, with a trio of heatpipes running through a copper contact plate to direct heat into the small aluminium fin stack.

Being the fastest and shortest card on test may give the AMP! a huge advantage, but all is not as it seems. Despite a base clock of 1,111MHz, the AMP! quickly reached that critical 81°C thermal throttle temperature (set by Nvidia) with a 29°C ambient temperature, when under load, so it rapidly clocked down. We found that the card's boost clock bounced between 1,124MHz and 1,150MHz – no faster than the comparatively smaller overlocks of the MSI Twin Frozr and KFA² cards. This downclocking was apparent after just a few minutes under load, although the cooling fans were surprisingly quiet while spinning at 2,070rpm.

Thankfully, the AMP!'s memory frequency has also been given a boost, running 50MHz (200MHz) higher than a stock card for an effective memory frequency of 6.2GHz and a peak memory bandwidth of 198.4GB/sec.

With its unreliable overclock, the AMP! failed to deliver on its high clock speed promises, instead performing in line with cards overclocked to a lesser degree.

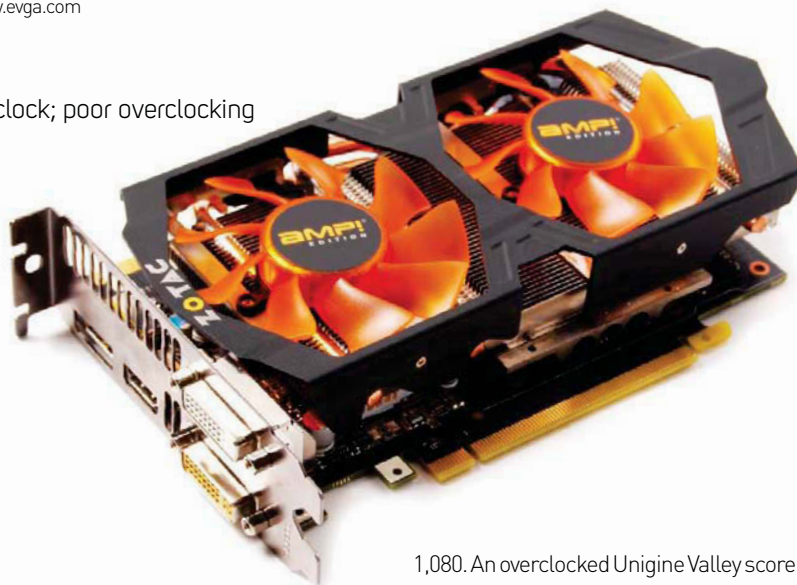
This gave it an advantage of just 1-2fps in most of our benchmarks, although its memory overclock enabled it to pick up a few extra frames per second here and there, as

## ALONGSIDE HAVING THE HIGHEST CLOCK SPEEDS, THE AMP! IS ALSO THE SMALLEST CARD ON TEST

well as a score of 1,544 in Unigine Valley, edging towards both the KFA² and MSI cards, but not by the margin you would expect from the overclock.

With thermal issues apparent from the outset, overclocking the AMP! further was a difficult experience. Even after raising Nvidia's 81°C target temperature to 95°C and increasing the power threshold to 115 per cent couldn't get the card to boost beyond 1,221MHz, with the core frequency instead capping at 1,189MHz. The memory also proved less open to overclocking than the rest of the cards on test. We managed to take it to 1,637MHz (6,550MHz effective) – a 350MHz effective improvement – but this pales in comparison to the 7.8GHz effective memory frequency we achieved with the KFA² card.

This disappointing overclock saw the AMP! delivering overclocked performance that was inferior to the stock PNY card, with a minimum frame rate of 38fps in Battlefield 3 at 2,560 x 1,600 and 46fps in Crysis 3 at 1,920 x



1,080. An overclocked Unigine Valley score of 1,628 points underlines the limited overclocking performance, being almost 150 points slower than the fastest cards on test.

### CONCLUSION

Thanks to its high base clock, the Zotac GeForce GTX 760 AMP! Edition 2GB is the most expensive card on test, with a price of £240. Sadly, it reaches beyond its means and its thermal throttling means it runs no faster than the cheaper and much more overclockable competition. Unless space is at an absolute premium, the MSI and KFA² cards are better choices. **HB**

### IN DETAIL

**Graphics processor** GeForce GTX 760  
**Clock speeds** 1,111MHz base clock, 1,176MHz guaranteed boost clock, 1,240MHz max boost clock  
**Pipeline** 1,152 stream processors, 6SAs, 3/4GPCs  
**Memory** 2GB GDDR5, 6.2GHz effective  
**Bandwidth** 198.2GB/sec, 256-bit interface  
**Compatibility** DirectX 11.1, OpenGL 4.1  
**Outputs/inputs** 2 x DVI, 1 x DisplayPort, 1 x HDMI  
**Power connections** 2 x 6pin, top-mounted  
**Size** 195mm long, dual-slot

**SPEED** 28/30  
**FEATURES** 15/20  
**O/CING** 8/20  
**VALUE** 19/30

**CUSTOM PC**  
**70**  
**OVERALL**  
**60**



Buy With Confidence

**OVERCLOCKERS UK**  
[www.overclockers.co.uk](http://www.overclockers.co.uk)

# **BitFenix**® CASES



## BitFenix Prodigy

Meticulously crafted and beautifully engineered, Prodigy redefines the Mini-ITX chassis. With tool-free convenience, USB 3.0 ports and filtered intakes, Prodigy is the compact case with no compromises.

Stock Code: CA-123-BX

**£69.95**

SEARCH THE STOCK CODES ON  
OUR WEBSITE TO FIND THE PRODUCT



**NEW**  
BitFenix Ronin  
Stock Code: CA-129-BX

**£69.95**



BitFenix Ghost  
Stock Code: CA-087-BX

**£77.95**



BitFenix Colossus  
Stock Code: CA-007-BX

**£119.99**



BitFenix Shinobi  
Stock Code: HS-022-PL

**£53.99**



BitFenix Merc  
Stock Code: HS-012-PL

**£32.99**



BitFenix Outlaw  
Stock Code: HS-023-PL

**£51.98**

Overclockers UK | Unit 5 Lymedale Cross, Newcastle-under-Lyme, Staffordshire, ST5 9BT

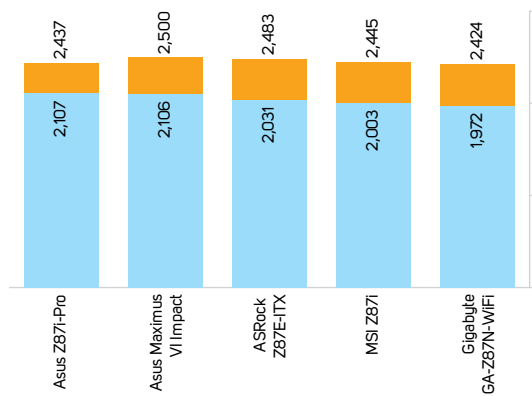
**[www.overclockers.co.uk](http://www.overclockers.co.uk) ■ Tel: 0871 200 5052**

Prices correct at time of print but may change without prior notice. All items subject to availability. Discount codes are valid for two weeks after publication. Core Inside, Intel, the Intel logo, Intel Core, Intel Inside, the Intel Inside logo are trademarks of Intel Corporation in the U.S. and/or other countries.

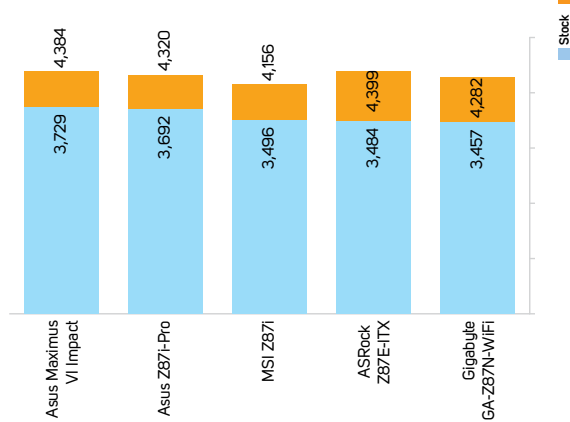


## MOTHERBOARD RESULTS

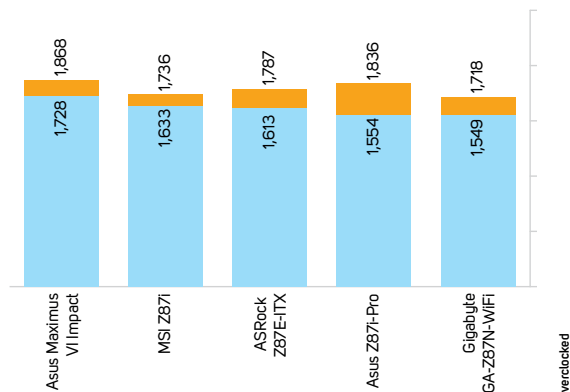
GIMP IMAGE EDITING



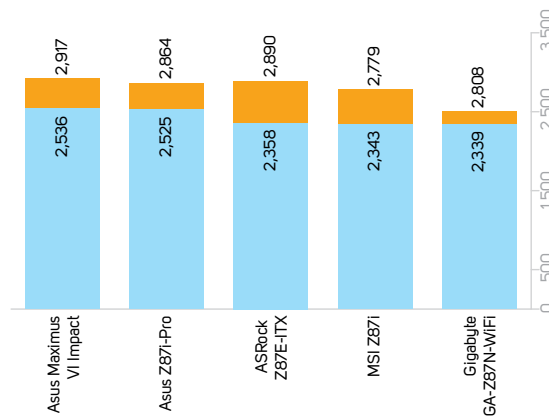
HANDBRAKE H.264 VIDEO ENCODING



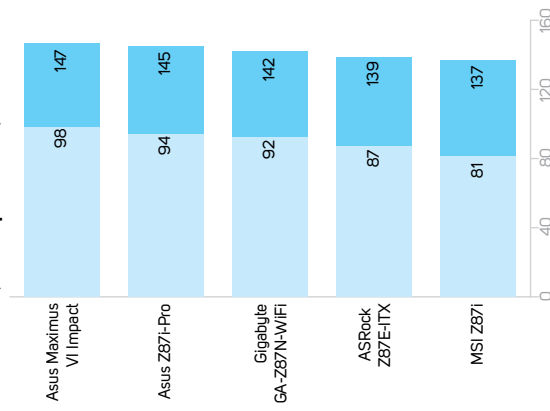
MULTI-TASKING



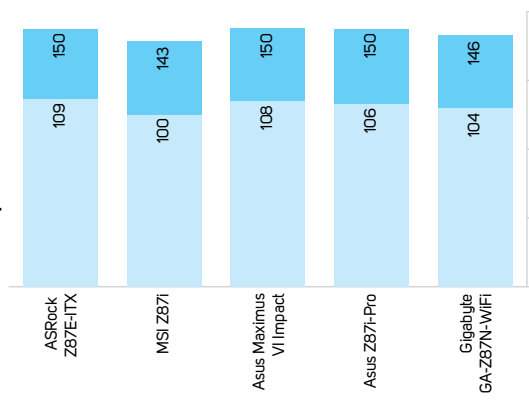
OVERALL



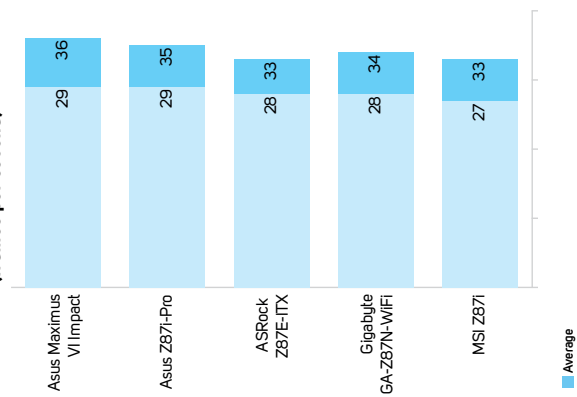
STOCK ELDER SCROLLS V: SKYRIM (frames per second)



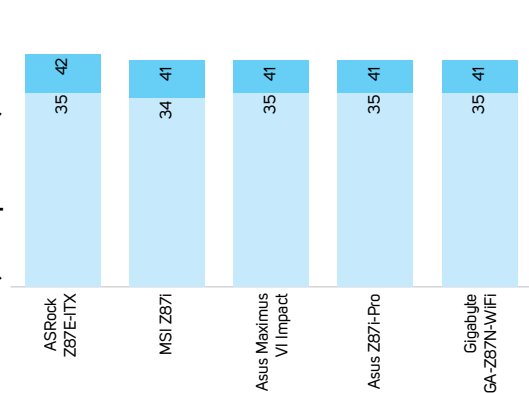
OVERCLOCKED ELDER SCROLLS V: SKYRIM (frames per second)



STOCK SHOGUN 2: TOTAL WAR (frames per second)

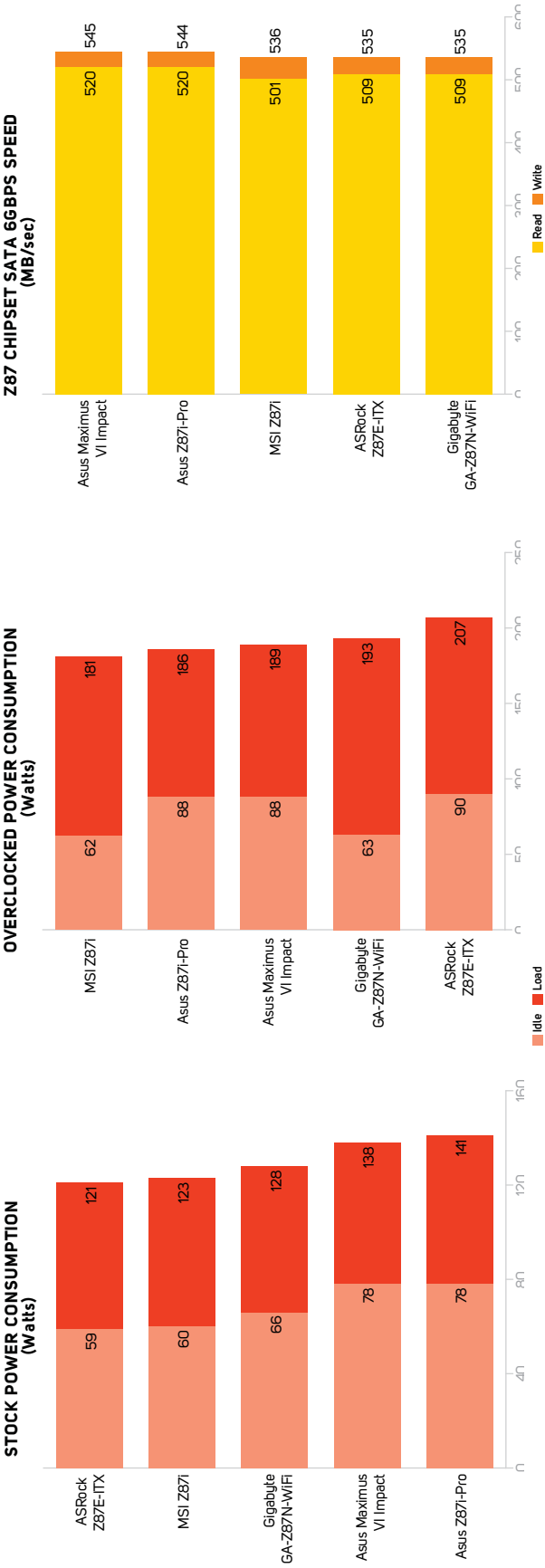


OVERCLOCKED SHOGUN 2: TOTAL WAR (frames per second)

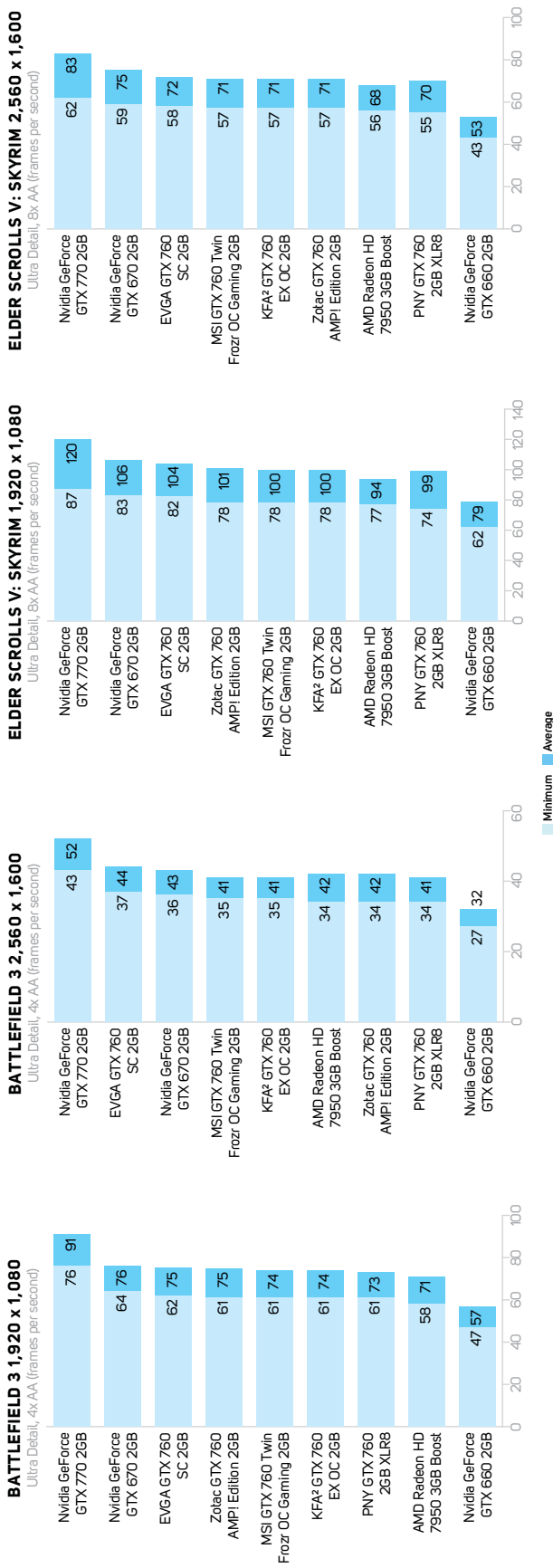




MOTHERBOARD RESULTS



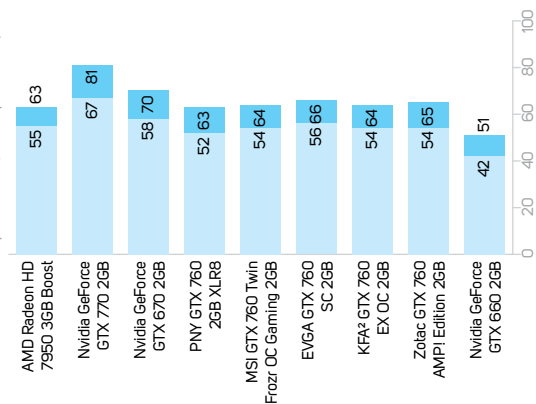
GRAPHIC CARDS RESULTS



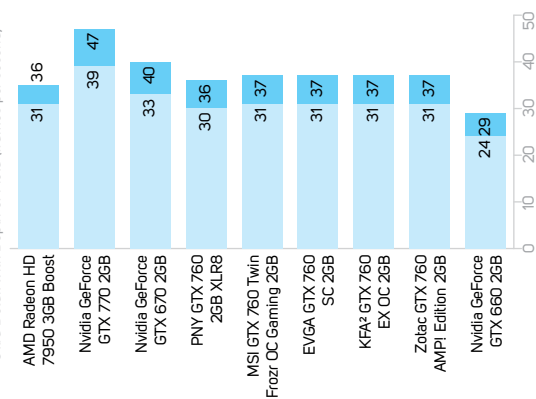


## GRAPHIC CARDS RESULTS

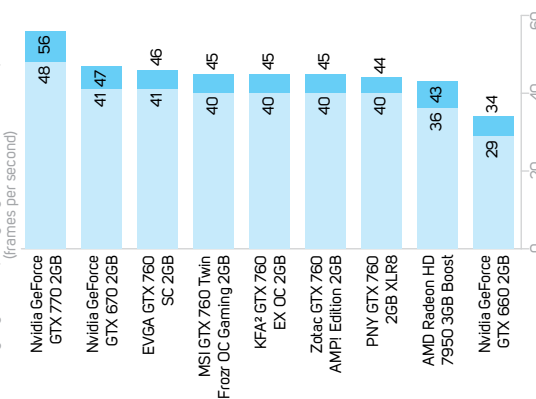
**BIOSHOCK INFINITE 1,920 x 1,080**  
Ultra Detail with Depth of Field (frames per second)



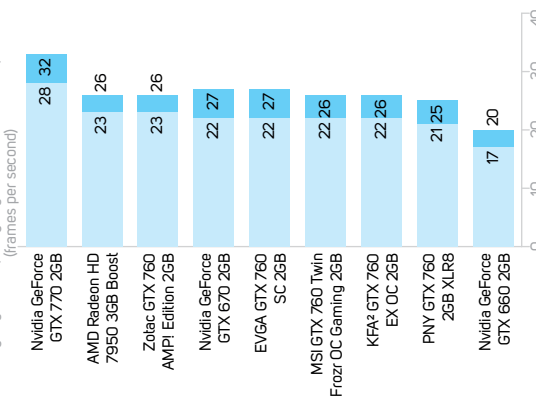
**BIOSHOCK INFINITE 2,560 x 1,600**  
Ultra Detail with Depth of Field (frames per second)



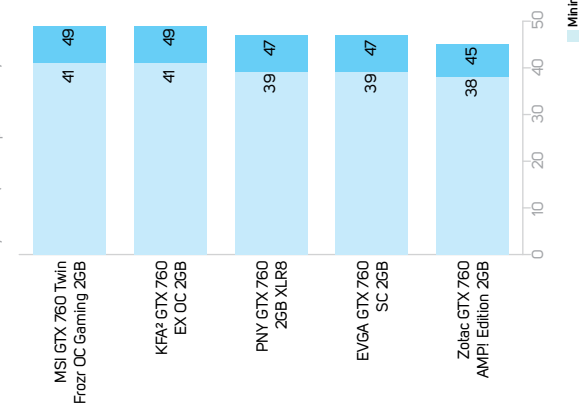
**CRYSIS 3 1,920 x 1,080**  
Very High Detail, Very High Texture Resolution, OX AA (frames per second)



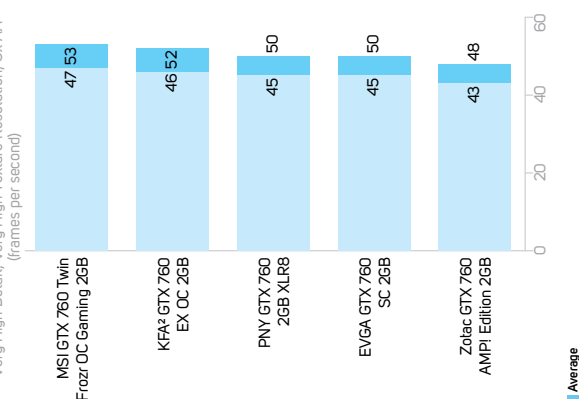
**CRYSIS 3 2,560 x 1,600**  
Very High Detail, Very High Texture Resolution, OX AA (frames per second)



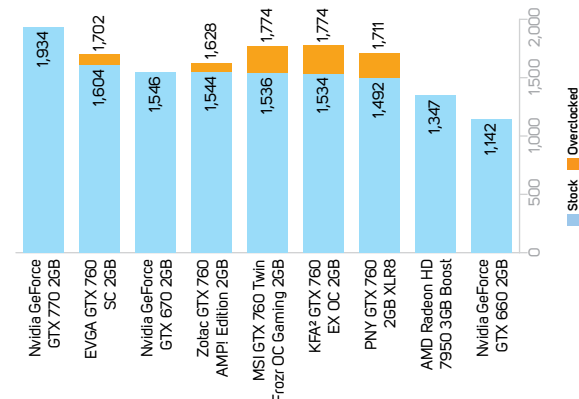
**OVERCLOCKED BATTLEFIELD 3 2,560 x 1,600**  
Ultra Detail, 4x AA (frames per second)



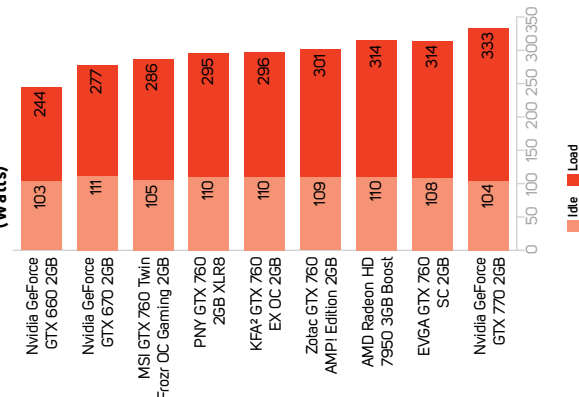
**OVERCLOCKED CRYSIS 3 1,920 x 1,080**  
Very High Detail, Very High Texture Resolution, OX AA (frames per second)



**UNIGINE VALLEY 2,560 x 1,600 (points)**



**POWER CONSUMPTION (Watts)**



# iiyama monitors - the winning formula



## ProLite G2773HS

## ProLite E2481HS

	Panel	27" LED-backlit	24" LED-backlit
	Resolution	Full HD 1920 x 1080 p	Full HD 1920 x 1080 p
	Response time	1 ms	2 ms
	Inputs	HDMI, DVI, VGA	HDMI, DVI, VGA
	Extra	120 Hz	Super slim bezel (7 mm)

iiyama monitors are available from the following reseller partners:



[www.iiyama.com](http://www.iiyama.com)

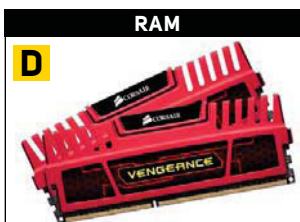
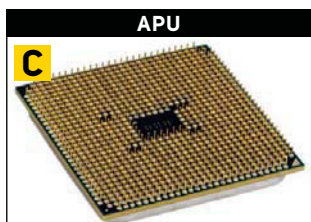
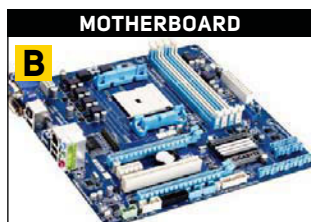
**iiyama**



Our choice of the best hardware available

## budget PC

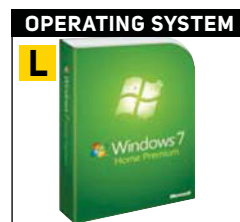
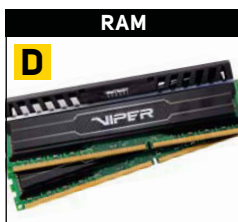
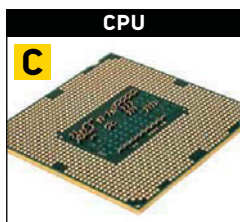
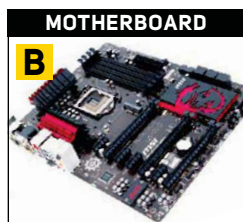
You don't have to spend an huge sum to get a decent PC. Our budget PC includes a superb AMD Richland APU, with a built-in Radeon HD 8670D GPU, plus 8GB of 2,133MHz RAM to boost the on-board graphics



	NAME	SUPPLIER	MANUFACTURER	REVIEWED	PRICE (inc VAT)
<b>A</b>	Xigamtek Midgard II	<a href="http://www.overclockers.co.uk">www.overclockers.co.uk</a>	<a href="http://www.xigmatek.com">www.xigmatek.com</a>	Issue 113, p74	£60
<b>B</b>	Gigabyte GA-F2A85XM-D3H	<a href="http://www.scan.co.uk">www.scan.co.uk</a>	<a href="http://www.gigabyte.com">www.gigabyte.com</a>	Issue 115, p90	£63
<b>C</b>	AMD A10-6800K	<a href="http://www.scan.co.uk">www.scan.co.uk</a>	<a href="http://www.amd.com">www.amd.com</a>	Issue 120, p20	£114
<b>D</b>	8GB Corsair Vengeance 2,133MHz CAS11	<a href="http://www.scan.co.uk">www.scan.co.uk</a>	<a href="http://www.corsair.com">www.corsair.com</a>	Issue 112, p60	£72
<b>E</b>	Gelid Tranquillo Rev 2	<a href="http://www.quietpc.com">www.quietpc.com</a>	<a href="http://www.gelidsolutions.com">www.gelidsolutions.com</a>	Issue 100, p86	£26
<b>F</b>	Be Quiet! Pure Power L8 530W	<a href="http://www.scan.co.uk">www.scan.co.uk</a>	<a href="http://www.bequiet.com">www.bequiet.com</a>	Issue 110, p55	£56
<b>G</b>	500GB Seagate Barracuda ST500DM002	<a href="http://www.scan.co.uk">www.scan.co.uk</a>	<a href="http://www.seagate.com">www.seagate.com</a>	Issue 104, p72	£40
<b>H</b>	Lite-On IHAS124-04	<a href="http://www.novatech.co.uk">www.novatech.co.uk</a>	<a href="http://www.liteonit.eu">www.liteonit.eu</a>	Issue 99, p108	£14
<b>I</b>	Microsoft Windows 7 Home Premium 64-bit	<a href="http://www.scan.co.uk">www.scan.co.uk</a>	<a href="http://www.microsoft.com">www.microsoft.com</a>	Issue 75, p46	£119
TOTAL SYSTEM PRICE					<b>£564</b>

# mid-price gaming PC

As Core i7 motherboards and high-end graphics cards command a premium price, here are some components for a Core i5 PC that offer great performance and won't break the bank



	NAME	SUPPLIER	MANUFACTURER	REVIEWED	PRICE (inc VAT)
<b>A</b>	SilverStone Raven RV03	<a href="http://www.scan.co.uk">www.scan.co.uk</a>	<a href="http://www.silverstonetek.com">www.silverstonetek.com</a>	Issue 103, p70	£95
<b>B</b>	MSI Z87-G45 Gaming	<a href="http://www.scan.co.uk">www.scan.co.uk</a>	<a href="http://www.msi-computer.com">www.msi-computer.com</a>	Issue 120, p58	£125
<b>C</b>	Intel Core i5-4670K	<a href="http://www.scan.co.uk">www.scan.co.uk</a>	<a href="http://www.intel.co.uk">www.intel.co.uk</a>	Issue 119, p38	£190
<b>D</b>	8GB Patriot Black Mamba 2,400MHz PV38G240C0K	<a href="http://www.overclockers.co.uk">www.overclockers.co.uk</a>	<a href="http://www.patriotmemory.com">www.patriotmemory.com</a>	Issue 120, p98	£74
<b>E</b>	Thermalright True Spirit 120M	<a href="http://www.overclockers.co.uk">www.overclockers.co.uk</a>	<a href="http://www.thermalright.com">www.thermalright.com</a>	Issue 116, p61	£25
<b>F</b>	MSI GeForce GTX 760 Twin Frozr OC Gaming 2GB	<a href="http://www.scan.co.uk">www.scan.co.uk</a>	<a href="http://www.msi.com">www.msi.com</a>	Issue 121, p52	£221
<b>G</b>	Be Quiet! Pure Power L8 530W	<a href="http://www.scan.co.uk">www.scan.co.uk</a>	<a href="http://www.bequiet.com">www.bequiet.com</a>	Issue 110, p55	£56
<b>H</b>	Seagate Barracuda 2TB ST2000DM001	<a href="http://www.scan.co.uk">www.scan.co.uk</a>	<a href="http://www.seagate.com">www.seagate.com</a>	Issue 104, p75	£69
<b>I</b>	Lite-On IHAS124-04	<a href="http://www.novatech.co.uk">www.novatech.co.uk</a>	<a href="http://www.liteonit.eu">www.liteonit.eu</a>	Issue 99, p108	£14
<b>J</b>	SanDisk Ultra Plus 256GB	<a href="http://www.ebuyer.com">www.ebuyer.com</a>	<a href="http://www.sandisk.com">www.sandisk.com</a>	Issue 117, p68	£125
<b>K</b>	Lite-On IHAS124-04	<a href="http://www.novatech.co.uk">www.novatech.co.uk</a>	<a href="http://www.liteonit.eu">www.liteonit.eu</a>	Issue 99, p108	£14
<b>L</b>	Microsoft Windows 7 Home Premium 64-bit	<a href="http://www.scan.co.uk">www.scan.co.uk</a>	<a href="http://www.microsoft.com">www.microsoft.com</a>	Issue 75, p46	£119

**TOTAL SYSTEM PRICE**

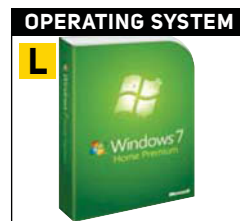
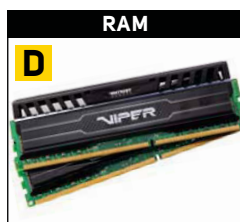
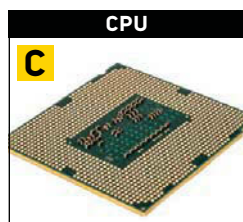
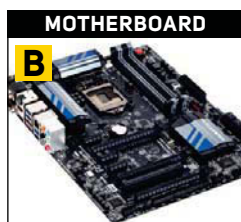
**£1,127**



Our choice of the best hardware available

## PERFORMANCE PC

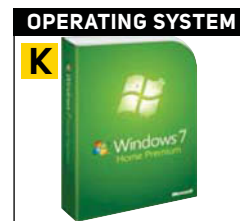
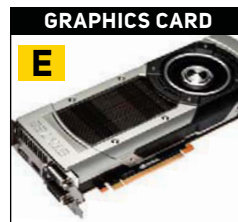
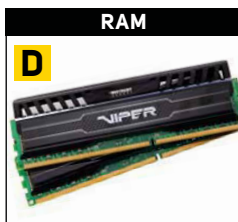
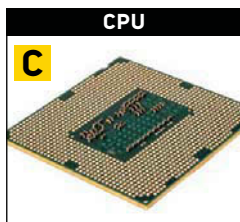
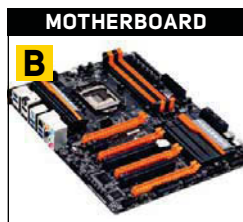
This PC has the potential to be the finest gaming machine you can find – as well as an excellent all-round computer for office work, digital photography, video production and media playback



	NAME	SUPPLIER	MANUFACTURER	REVIEWED	PRICE (inc VAT)
<b>A</b>	SilverStone Fortress FT02B-W USB 3.0	<a href="http://www.scan.co.uk">www.scan.co.uk</a>	<a href="http://www.silverstonetek.com">www.silverstonetek.com</a>	Issue 85, p88	£185
<b>B</b>	Gigabyte GA-Z87-UD3H	<a href="http://www.scan.co.uk">www.scan.co.uk</a>	<a href="http://uk.gigabyte.com">http://uk.gigabyte.com</a>	Issue 120, p52	£152
<b>C</b>	Intel Core i5-4670K	<a href="http://www.scan.co.uk">www.scan.co.uk</a>	<a href="http://www.intel.co.uk">www.intel.co.uk</a>	Issue 119, p38	£190
<b>D</b>	8GB Patriot Black Mamba 2,400MHz PV38G240C0K	<a href="http://www.overclockers.co.uk">www.overclockers.co.uk</a>	<a href="http://www.patriotmemory.com">www.patriotmemory.com</a>	Issue 120, p98	£74
<b>E</b>	Antec Kühler H20 920	<a href="http://www.scan.co.uk">www.scan.co.uk</a>	<a href="http://www.antec.com">www.antec.com</a>	Issue 116, p62	£82
<b>F</b>	Nvidia GeForce GTX 770 2GB	<a href="http://www.scan.co.uk">www.scan.co.uk</a>	<a href="http://www.nvidia.com">www.nvidia.com</a>	Issue 119, p72	£320
<b>G</b>	Corsair HX850	<a href="http://www.ebuyer.com">www.ebuyer.com</a>	<a href="http://www.corsair.com">www.corsair.com</a>	Issue 110, p68	£129
<b>H</b>	Seagate Barracuda 2TB ST2000DM001	<a href="http://www.scan.co.uk">www.scan.co.uk</a>	<a href="http://www.seagate.com">www.seagate.com</a>	Issue 104, p75	£69
<b>I</b>	Creative Sound Blaster Z	<a href="http://www.scan.co.uk">www.scan.co.uk</a>	<a href="http://www.creative.com">www.creative.com</a>	Issue 116, p42	£71
<b>J</b>	Plextor M5 Pro 256GB	<a href="http://www.scan.co.uk">www.scan.co.uk</a>	<a href="http://www.plextor.com">www.plextor.com</a>	Issue 117, p64	£173
<b>K</b>	Lite-On IHAS124-04	<a href="http://www.novatech.co.uk">www.novatech.co.uk</a>	<a href="http://www.liteonit.eu">www.liteonit.eu</a>	Issue 99, p108	£14
<b>L</b>	Microsoft Windows 7 Home Premium 64-bit	<a href="http://www.scan.co.uk">www.scan.co.uk</a>	<a href="http://www.microsoft.com">www.microsoft.com</a>	Issue 75, p46	£119
<b>TOTAL SYSTEM PRICE</b>					<b>£1,578</b>

# extreme ULTRA PC

The most awesome components around, before reaching workstation territory. We've included a dual 120mm liquid cooler kit as a base example, but the case has space for a variety of water-cooling setups



	NAME	SUPPLIER	MANUFACTURER	REVIEWED	PRICE (inc VAT)
<b>A</b>	SilverStone Temjin TJ07B-W	<a href="http://www.overclockers.co.uk">www.overclockers.co.uk</a>	<a href="http://www.silverstonetek.com">www.silverstonetek.com</a>	Issue 63, p87	£260
<b>B</b>	Gigabyte GA-Z87X-OC	<a href="http://www.ebuyer.com">www.ebuyer.com</a>	<a href="http://uk.gigabyte.com">http://uk.gigabyte.com</a>	Issue 120, p50	£158
<b>C</b>	Intel Core i7-4770K	<a href="http://www.scan.co.uk">www.scan.co.uk</a>	<a href="http://www.intel.co.uk">www.intel.co.uk</a>	Issue 119, p38	£269
<b>D</b>	8GB Patriot Black Mamba 2,400MHz PV38G240C0K	<a href="http://www.overclockers.co.uk">www.overclockers.co.uk</a>	<a href="http://www.patriotmemory.com">www.patriotmemory.com</a>	Issue 120, p98	£74
<b>E</b>	Nvidia GeForce GTX 780 3GB	<a href="http://www.scan.co.uk">www.scan.co.uk</a>	<a href="http://www.nvidia.com">www.nvidia.com</a>	Issue 119, p34	£515
<b>F</b>	Corsair H100i	<a href="http://www.scan.co.uk">www.scan.co.uk</a>	<a href="http://www.corsair.com">www.corsair.com</a>	Issue 116, p65	£91
<b>G</b>	Be Quiet! Dark Power Pro 10 850W	<a href="http://www.scan.co.uk">www.scan.co.uk</a>	<a href="http://www.bequiet.com">www.bequiet.com</a>	Issue 110, p64	£179
<b>H</b>	Samsung SSD 840 EVO 1TB	<a href="http://www.overclockers.co.uk">www.overclockers.co.uk</a>	<a href="http://www.samsung.com">www.samsung.com</a>	Issue 121, p28	£509
<b>I</b>	Creative Sound Blaster Z	<a href="http://www.scan.co.uk">www.scan.co.uk</a>	<a href="http://www.creative.com">www.creative.com</a>	Issue 116, p42	£71
<b>J</b>	Seagate Barracuda 2TB ST2000DM0001	<a href="http://www.scan.co.uk">www.scan.co.uk</a>	<a href="http://www.seagate.com">www.seagate.com</a>	Issue 104, p75	£69
<b>K</b>	Microsoft Windows 7 Home Premium 64-bit	<a href="http://www.scan.co.uk">www.scan.co.uk</a>	<a href="http://www.microsoft.com">www.microsoft.com</a>	Issue 75, p46	£119

**TOTAL SYSTEM PRICE**

**£2,314**

68



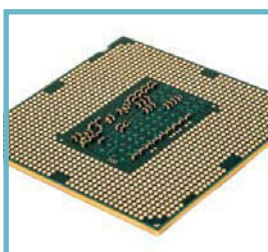
Our choice of the best hardware available

## graphics cards



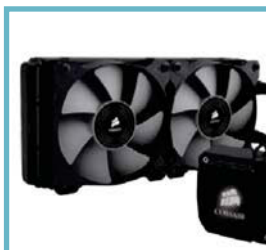
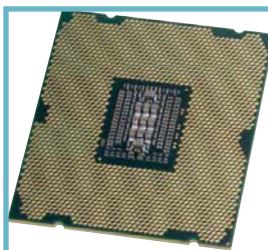
TYPE	GRAPHICS CARD	GRAPHICS CARD	GRAPHICS CARD	GRAPHICS CARD
NAME	Nvidia GeForce GTX 660 2GB	MSI GeForce GTX 760 Twin Frozr OC Gaming 2GB	Nvidia GeForce GTX 670 2GB	Nvidia GeForce GTX 770 2GB
SUPPLIER	<a href="http://www.scan.co.uk">www.scan.co.uk</a>	<a href="http://www.scan.co.uk">www.scan.co.uk</a>	<a href="http://www.overclockers.co.uk">www.overclockers.co.uk</a>	<a href="http://www.scan.co.uk">www.scan.co.uk</a>
MANUFACTURER	<a href="http://www.nvidia.com">www.nvidia.com</a>	<a href="http://www.msi.com">www.msi.com</a>	<a href="http://www.nvidia.com">www.nvidia.com</a>	<a href="http://www.nvidia.com">www.nvidia.com</a>
REVIEWED	Issue 119, p66	Issue 121, p52	Issue 119, p70	Issue 119, p72
PRICE (inc VAT)	£149	£221	£260	£320

## LG alliso components



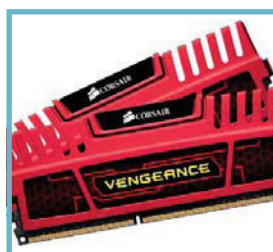
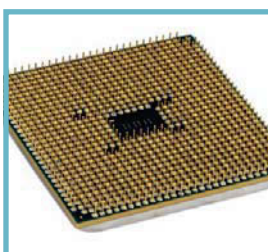
TYPE	CPU	MOTHERBOARD	COOLER	RAM
NAME	Intel Core i5-4670K	Gigabyte GA-Z87-UD3H	Thermalright True Spirit 120M	8GB Patriot Black Mamba 2,400MHz PV38G240C0K
SUPPLIER	<a href="http://www.scan.co.uk">www.scan.co.uk</a>	<a href="http://www.scan.co.uk">www.scan.co.uk</a>	<a href="http://www.overclockers.co.uk">www.overclockers.co.uk</a>	<a href="http://www.overclockers.co.uk">www.overclockers.co.uk</a>
MANUFACTURER	<a href="http://www.intel.co.uk">www.intel.co.uk</a>	<a href="http://uk.gigabyte.com">http://uk.gigabyte.com</a>	<a href="http://www.thermalright.com">www.thermalright.com</a>	<a href="http://www.patriotmemory.com">www.patriotmemory.com</a>
REVIEWED	Issue 119, p38	Issue 120, p52	Issue 116, p61	Issue 120, p98
PRICE (inc VAT)	£190	£152	£25	£74

# LG2011 components



TYPE	CPU	MOTHERBOARD	COOLER	RAM
NAME	Intel Core i7-3930K	Asus Sabertooth X79	Corsair H100i	16GB Corsair Vengeance 1,600MHz CAS9
SUPPLIER	<a href="http://www.novatech.co.uk">www.novatech.co.uk</a>	<a href="http://www.scan.co.uk">www.scan.co.uk</a>	<a href="http://www.scan.co.uk">www.scan.co.uk</a>	<a href="http://www.scan.co.uk">www.scan.co.uk</a>
MANUFACTURER	<a href="http://www.intel.co.uk">www.intel.co.uk</a>	<a href="http://uk.asus.com">http://uk.asus.com</a>	<a href="http://www.corsair.com">www.corsair.com</a>	<a href="http://www.corsair.com">www.corsair.com</a>
REVIEWED	Issue 101, p32	Issue 101, p70	Issue 116, p65	Issue 101, p40
PRICE (inc VAT)	£480	£267	£91	£119

# Socket FM2 components



TYPE	CPU	MOTHERBOARD	COOLER	RAM
NAME	AMD A10-6800K	Gigabyte GA-F2A85XM-D3H	Gelid Tranquillo Rev 2	8GB Corsair Vengeance 2,133MHz CAS11
SUPPLIER	<a href="http://www.scan.co.uk">www.scan.co.uk</a>	<a href="http://www.scan.co.uk">www.scan.co.uk</a>	<a href="http://www.quietpc.com">www.quietpc.com</a>	<a href="http://www.scan.co.uk">www.scan.co.uk</a>
MANUFACTURER	<a href="http://www.amd.com">www.amd.com</a>	<a href="http://www.gigabyte.com">www.gigabyte.com</a>	<a href="http://www.gelidsolutions.com">www.gelidsolutions.com</a>	<a href="http://www.corsair.com">www.corsair.com</a>
REVIEWED	Issue 120, p20	Issue 115, p90	Issue 100, p86	Issue 112, p60
PRICE (inc VAT)	£114	£63	£26	£72



Our choice of the best hardware available

## mini-itx and micro-atx



TYPE	MINI-ITX CASE	Z87 MINI-ITX MOTHERBOARD	MICRO-ATX CASE	Z87 MICRO-ATX MOTHERBOARD
NAME	BitFenix Prodigy	MSI Z87i	SilverStone TJ08-E	Asus Maximus VI Gene
SUPPLIER	<a href="http://www.overclockers.co.uk">www.overclockers.co.uk</a>	<a href="http://www.scan.co.uk">www.scan.co.uk</a>	<a href="http://www.scan.co.uk">www.scan.co.uk</a>	<a href="http://www.overclockers.co.uk">www.overclockers.co.uk</a>
MANUFACTURER	<a href="http://www.bitfenix.com">www.bitfenix.com</a>	<a href="http://www.msi.com">www.msi.com</a>	<a href="http://www.silverstonetek.com">www.silverstonetek.com</a>	<a href="http://uk.asus.com">http://uk.asus.com</a>
REVIEWED	Issue 109, p54	Issue 121 p48	Issue 98, p48	Issue 121, p20
PRICE (inc VAT)	£70	£104	£73	£170

## Cases



TYPE	BUDGET CASE	AIR-COOLING CASE	WATER-COOLING CASE
NAME	Xigmatek Midgard II	SilverStone Raven RV03	SilverStone Temjin TJ07B-W
SUPPLIER	<a href="http://www.overclockers.co.uk">www.overclockers.co.uk</a>	<a href="http://www.scan.co.uk">www.scan.co.uk</a>	<a href="http://www.overclockers.co.uk">www.overclockers.co.uk</a>
MANUFACTURER	<a href="http://www.xigmatek.com">www.xigmatek.com</a>	<a href="http://www.silverstonetek.com">www.silverstonetek.com</a>	<a href="http://www.silverstonetek.com">www.silverstonetek.com</a>
REVIEWED	Issue 113, p74	Issue 103, p70	Issue 63, p87
PRICE (inc VAT)	£60	£95	£260

# POWER SUPPLIES



TYPE	530W PSU	850W PSU	1.2kW PSU
NAME	Be Quiet! Pure Power L8 530W	Corsair HX850	Corsair AX1200i
SUPPLIER	<a href="http://www.scan.co.uk">www.scan.co.uk</a>	<a href="http://www.scan.co.uk">www.scan.co.uk</a>	<a href="http://www.scan.co.uk">www.scan.co.uk</a>
MANUFACTURER	<a href="http://www.bequiet.com">www.bequiet.com</a>	<a href="http://www.ebuyer.com">www.ebuyer.com</a>	<a href="http://www.corsair.com">www.corsair.com</a>
REVIEWED	Issue 110, p55	Issue 110, p68	Issue 111, p40
PRICE (inc VAT)	£56	£129	£250

# STORAGE



TYPE	HARD DISK	SSD	NAS BOX
NAME	Seagate Barracuda 2TB ST2000DM001	Plextor M5 Pro 256GB	Synology DiskStation DS213j
SUPPLIER	<a href="http://www.scan.co.uk">www.scan.co.uk</a>	<a href="http://www.scan.co.uk">www.scan.co.uk</a>	<a href="http://www.ebuyer.com">www.ebuyer.com</a>
MANUFACTURER	<a href="http://www.seagate.com">www.seagate.com</a>	<a href="http://www.plextor.com">www.plextor.com</a>	<a href="http://www.synology.com">www.synology.com</a>
REVIEWED	Issue 104, p75	Issue 117, p64	Issue 119, p50
PRICE (inc VAT)	£69	£173	£165



Our choice of the best hardware available

## monitors



TYPE	24IN MONITOR	27IN BUDGET MONITOR	29IN MONITOR	TRIPLE-MONITOR STAND
NAME	Dell U2412M	Digimate IPS-2701WPH	Dell U2913WM	XFX Triple Display Monitor Stand
SUPPLIER	<a href="http://www.scan.co.uk">www.scan.co.uk</a>	<a href="http://www.overclockers.co.uk">www.overclockers.co.uk</a>	<a href="http://www.overclockers.co.uk">www.overclockers.co.uk</a>	<a href="http://www.scan.co.uk">www.scan.co.uk</a>
MANUFACTURER	<a href="http://www.dell.com">www.dell.com</a>	<a href="http://www.digimate.com">www.digimate.com</a>	<a href="http://www.dell.com">www.dell.com</a>	<a href="http://www.xfxforce.com">www.xfxforce.com</a>
REVIEWED	Issue 105, p64	Issue 115, p62	Issue 115, p58	Issue 96, p58
PRICE (inc VAT)	£205	£420	£460	£306

## audio



TYPE	SOUND CARD	USB SOUND CARD	2.1 SPEAKERS	HEADSET
NAME	Creative Sound Blaster Z	Asus Xonar Essence One	Corsair SP2500	Qpad QH-90
SUPPLIER	<a href="http://www.scan.co.uk">www.scan.co.uk</a>	<a href="http://www.dabs.com">www.dabs.com</a>	<a href="http://www.scan.co.uk">www.scan.co.uk</a>	<a href="http://www.scan.co.uk">www.scan.co.uk</a>
MANUFACTURER	<a href="http://www.creative.com">www.creative.com</a>	<a href="http://www.asus.com">www.asus.com</a>	<a href="http://www.corsair.com">www.corsair.com</a>	<a href="http://www.qpad.com">www.qpad.com</a>
REVIEWED	Issue 116, p42	Issue 118, p44	Issue 118, p75	Issue 118, p69
PRICE (inc VAT)	£71	£348	£179	£73

# peripherals



TYPE	KEYBOARD	MOUSE
NAME	Gigabyte Osmium	Mionix Naos 3200
SUPPLIER	<a href="http://www.scan.co.uk">www.scan.co.uk</a>	<a href="http://www.ebuyer.com">www.ebuyer.com</a>
MANUFACTURER	<a href="http://www.gigabyte.com">www.gigabyte.com</a>	<a href="http://www.mionix.net">www.mionix.net</a>
REVIEWED	Issue 108, p70	Issue 108, p60
PRICE (inc VAT)	£98	£39

# games



TYPE	RPG	FPS	STRATEGY	UNDERDOG
NAME	Elder Scrolls V: Skyrim	BioShock Infinite	Frozen Synapse	Trine 2
DEVELOPER	<a href="http://www.bethsoft.com">www.bethsoft.com</a>	<a href="http://irrationalgames.com">http://irrationalgames.com</a>	<a href="http://www.mode7games.com">www.mode7games.com</a>	<a href="http://frozenbyte.com">http://frozenbyte.com</a>
PUBLISHER	<a href="http://www.bethsoft.com">www.bethsoft.com</a>	<a href="http://www.2kgames.com">www.2kgames.com</a>	<a href="http://www.mode7games.com">www.mode7games.com</a>	<a href="http://frozenbyte.com">http://frozenbyte.com</a>
REVIEWED	Issue 101, p100	Issue 118, p84	Issue 96, p92	Issue 102, p98
PRICE (inc VAT)	£18	£30	£19 for two	£12



## Watch Dogs

Watch Dogs' basic premise – 'What if smartphones were a bit smarter?' – might not sound particularly interesting, but it actually looks very intriguing. It's an open-world action game, in the vein of GTA, which is simultaneously fantastical and unnervingly close to reality. It casts the player as a vigilante in a near-future city who can hack into pretty much any electronic device, while using this ability for anything from stealing computer data to changing the colour of traffic lights to cause a pile-up. The game's success will ride on how far Ubisoft can spin this mechanic, and given its previous hit rate with open-world games, there's good reason to be excited.

**[CUSTOM PC  
EXCLUSIVE IMAGE]**



## this month

**76** **CYNICAL HIT**  
Chin up!

**78** **DEADPOOL**  
Comic asides

**80** **DARK**  
Fang to rights

**81** **JOE DANGER BUNDLE**  
Stunting season

**82** **MAGRUNNER:  
DARK PULSE**  
Opposites attract

**84** **REUS**  
Playing god

**86** **ENGINE ROOM**  
Inside the 4A engine

**88** **DEV PERSPECTIVE**  
Behind the booth

76

## Readers' Night

Wed, 28 August, 9 till late

**The place** Our Counter-Strike: Source server  
**What you need** An up-to-date Counter-Strike:  
Source installation

### GAME SERVER IP ADDRESSES

**32-player BC2** 85.236.101.22:16667

**32-player CS: Source** 85.236.101.24:37015

### FIND US ON STEAM

**Public group** <http://steamcommunity.com/groups/CustomPC>

**Modern Warfare 2** <http://steamcommunity.com/groups/CustomWarfare2>



**cynical hit**

# EVERYTHING IS LOVELY!

Don't be disheartened by DRM woes. Gamers' voices have never been louder, says **Richard Cobbett**



**S**omething made me angry this month, but I'm not going to tell you what. Suffice to say, it was the kind of corporate stupidity that makes you want to head into the garden, throw both hands up at the sky and scream 'Why? Why?!' until a publicly minded bird takes it upon itself to drop a silence bomb down the noise hole. While pouring the Listerine, though, I realised something – it probably won't end up being a big deal. Not really.

See, not much seems to be a big deal of late – I can't think of a time when companies have been more terrified of their customers, even if it's often obscured by a veil of corporate bravado. Mistakes are made on a regular basis, but rarely seem to stick, even in the face of profits.

By the logic of a couple of years ago, we should currently be paying for individual bullets in games, only getting half of the story without shelling out for DLC, and trapped in always-on gaming, bring monitored at all times in case our lives interfere with the precious Call of Duty servers.

Instead, everything is pretty damn good. DLC is increasingly being used for the right reasons, to sell additional content, with cases of paid-for epilogues and the like both rare and not sticking, even when it comes to companies that have tried them – Ubisoft, for instance, pulled it with Prince of Persia: The One Nobody Really Liked, while Assassin's Creed 3: Ditto got an alternate universe side-story.

If you want a free-to-play game that will take your money for the best gear, no problem – you'll find a probably Korean import that will do that. The industry as a whole, though, has proven that extras such as hats and virtual scratchcards (lockboxes) can fund games such as Guild Wars 2, with games such as Planetside 2 and Dota 2 raking it in via customer-friendly free-to-play mechanics.

**BY THE LOGIC OF A COUPLE OF YEARS AGO, WE SHOULD BE PAYING FOR INDIVIDUAL BULLETS IN GAMES**

You could say the same for controversies. Blizzard openly regrets implementing the Diablo 3 real-money Auction House, so don't expect that to be copied any time soon. Plus, far from ushering in a perpetually online world, even EA is looking at SimCity's Internet demands and spinning the idea of, maybe, adding an offline 'Classic' mode – after ditching its controversial 'Project Ten Dollar' assault on used games entirely. Meanwhile, Microsoft's handling of the Xbox One isn't so much a backtrack as a beeping retreat on features that probably aren't going to win or lose it the next console war, but certainly gave Sony cause to do the dance of joy at E3.

The list goes on. I'm certainly not saying everything is perfect, or that we always get what we want. Reselling PC games, for instance, remains a pipe dream, as does the fact that we'll lose a lot of games outright if services such as Steam are ever switched off. Increasingly, though, when mistakes are made, by even the biggest companies, they're

generally fixed or not repeated – which should still at least offer some optimism when complaining.

I'm not sitting back or letting them slide, of course. Without applying pressure, nothing will ever be done, especially if what's being done is profitable in at least the short term. When protesting, though, our voices have never been louder.

**Richard Cobbett is a writer, journalist and professional cynic, wishing everything could be as easily solved as an adventure game puzzle.**

 **@richardcobbett**

# SAPPHIRE

## SAPPHIRE EDGE VS8 MINI BAREBONE PC

### SPECIFICATIONS

AMD APU A8 1.6GHZ QUAD CORE  
2 X DDR3 SO-DIMM - NOT SUPPLIED UP TO 8GB  
SATA 2.5INCH HDD - NOT SUPPLIED  
AMD RADEON HD 7600G  
10/100/1000 MBPS BUILT-IN ETHERNET  
802.11B/G/N BUILT-IN WIRELESS NETWORK  
BUILT-IN BLUETOOTH 3.0  
1 X MINI DISPLAY PORT  
1 X HDMI PORT  
1 X RJ-45 GIGABIT LAN  
4 X USB 2.0 PORT  
1 X AUDIO-IN  
1 X LINE-OUT  
2 X USB 3.0 PORT  
1 X OPTICAL SPDIF  
1 X SD CARD READER

**£268.49** inc. vat

[www.ebuyer.com/sapphire-edge](http://www.ebuyer.com/sapphire-edge)

**ebuyer.com**

Don't forget you can order up to 11pm for  
**next day** delivery\*

\*Terms and conditions apply. See site for details.



[www.facebook.com/ebuyer](http://www.facebook.com/ebuyer)



[www.twitter.com/ebuyer](http://www.twitter.com/ebuyer)



[www.youtube.com/ebuyer](http://www.youtube.com/ebuyer)







# DEADPOOL

## Genius or madness?

### + DEADPOOL

Great character; often funny; metafiction!

### - DEAD END

Repetitive; some jokes misfire; outstays its welcome



#### THE KNOWLEDGE

Price £29.99 inc VAT  
Publisher Activision  
Developer High Moon Studios  
Website  
[www.deadpoolgame.com](http://www.deadpoolgame.com)

**D**eadpool is a contrary mixture of amusement and irritation. It manages to be entertaining and tedious, novel yet typical, intelligent and puerile all at the same time. In fact, it's difficult to reconcile Deadpool's two distinct faces into a definitive critical verdict, as it's simultaneously not very good yet absolutely worth playing.

Let's begin with a little background. Deadpool is a Marvel comics anti-hero who began life as a villain, but then proved popular enough to gain his own comic book series. He's known primarily for three facets: his ability to regenerate from almost any wound; being completely and utterly weird;; and for his tendency to break the fourth wall during his adventures. All three aspects of his character play significant parts in the game, but it's the last two that make Deadpool interesting.

Developer High Moon has done a largely excellent job of infusing its game with Deadpool's anarchic, self-referential character. For example, the game's plot revolves around Deadpool's demand that High Moon studios makes a big-budget game about him, which then turns into a contract to prevent the subtly named Doctor Sinister from taking over the world with his army of X-Men clones.

Veteran video-game voice-actor Nolan North gives a superb performance as the eponymous mercenary, and High Moon's script sits firm in the better half of game scripts. Best of all, though, is the way High Moon uses Deadpool's penchant for repeatedly bashing his head against the fourth wall as an excuse to mess around with the environment. In one instance, Deadpool rushes into a room that the designers have left unfinished due to budget constraints. The level grid is still visible, and character models float around the space, devoid of animations. After a little Deadpool-style persuasion, however, the game quickly gets back on track.

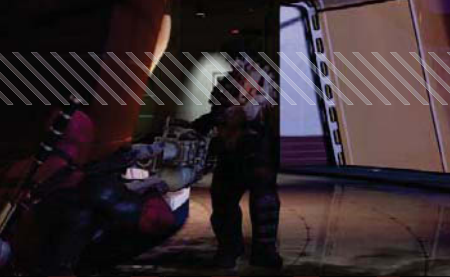
Deadpool also toys with your expectations, switching between perspectives and dipping into different game genres. When he isn't punching through your monitor into your living room, Deadpool is joking around, and in combat spews one-liners such as 'I aim because I care,' and 'Technology is your friend! Well, not YOUR friend!'

#### SCORE

CUSTOM PC

**65%**  
OVERALL





REVIEW

COMBO x8

COMBO x42

Sadly, there aren't enough one-liners to stretch through the game, so by the end, their repetition becomes more than a little grating. Also, while the script is generally funny, it occasionally drifts into childish territory. High Moon's Deadpool is zany even by Deadpool's standards, and he has a creepy obsession with breasts too.

While High Moon's characterisation of Deadpool is mostly successful, though, neither the humour nor the metafictional aspects can hide the fact that the game itself isn't particularly special. It's a standard third-person action game, which blends platforming with melee and ranged combat.

Of these, the melee combat is the most entertaining. With swords, daggers and hammers available in Deadpool's arsenal, a series of simple two-button combos will cause Deadpool to perform spectacular and messy manoeuvres. These are combined with special power attacks, which are unlocked as the game progresses, alongside a 'teleport' evasion move and counterattacks. Both of these are bound to the same key, though, which makes for some frustrating deaths. For example, you could be getting squashed by a hulking fire-monster, but Deadpool counters the attack of a nearby enemy cannon-fodder clone, rather than teleporting to safety.

The melee combat has other issues too. Foremost is that it's overused. Most of the clones from your enemy, Doctor Sinister, can take a fair amount of damage, and towards the end he throws waves of them at you. Typically, Deadpool jokes about this scenario, but the veneer of humour can't hide the lazy design.

This is the Deadpool experience in a nutshell – pockets of exuberance sprinkled

between stretched-out patches of repetitive gameplay. The environments illustrate this issue too. For every five minutes of fantastic ideas, there are 20 minutes of running through brown and grey corridors, whether they're sewers, catacombs or concrete fortresses. Deadpool keeps you going, but it's in spite of the game's design, rather than because of it. Little respite is found in the ranged combat either. Compared to using his melee weapons, firing Deadpool's guns feels as satisfying as eating dry Ryvita.

Furthermore, when fighting in ranged combat, Deadpool moves slowly and can't properly use cover, which can result in many restarts, given that the basic grunt clone can pack quite a punch if you're exposed to his gunfire. High Moon has also committed the cardinal game design sin of featuring floating enemies. Ever tried to catch a flying insect that got into your house through an open window? Now imagine the fly could fire lightning bolts at you. It's exactly that fun.

However, while Deadpool carries so many flaws throughout its seven hours, it still remains entertaining almost to the end. It's only in the last hour or so that its shortcomings finally overwhelm the strength of Deadpool's character and humour. This is partly

because the game's problems frequently blend with the game's tone. A good example is the hilariously dreadful roster of villains. Alongside Doctor \*snigger\* Sinister, are Arc Light, who fires electricity from her hands; Blockbuster, who is a really strong dude; and Vertigo, whose power is, in all seriousness, to make people feel slightly ill. But it makes sense that Deadpool's enemies are comically bad, and he freely admits it.

Deadpool isn't a great game. It's burdened by too many half-baked mechanics stretched out for too long. But it's by no means a terrible game either, Deadpool himself is excellent company, being far more interesting than the majority of game protagonists, and High Moon's light-hearted mockery of many gaming conventions raises a smile more often than not.

RICK LANE





## DARK

New Leap

## Show it you're cross

## + NOSFERATU

Pretty cel-shaded art style

## - TWILIGHT

Everything else

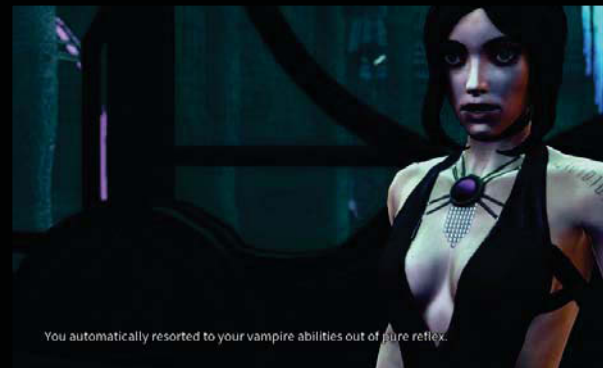
**D**ark is a stealth game that casts you as Eric Bane, a vampire whose bite marks are still fresh on his neck. So fresh, in fact, that Eric is unaware of what has occurred, and spends the first half-hour of the game wandering around a distinctly vampire-themed nightclub trying to figure out something the player already knows, which isn't exactly engaging.

Eventually someone points out to Eric that he is a vampire, although not completely. In order to become fully fledged, he needs to drink his absent creator's blood, otherwise he'll go mad or turn into a banana or something.

The terrible script doesn't make the plot gripping. Eric describes his first drink of blood as 'something else' and his first victim as a 'textbook sadist'. Presumably Eric read 'Sadists for Dummies' before beginning his search for his creator.

Stealth games normally involve hiding in darkness to evade enemy patrols, or using height and agility to clamber into places where you can't be seen, in order to locate alternate routes through a level. Eric doesn't have either of these options available to him. He has a few powers up his sleeve, despite only being a half-vampire, though, ranging from short-range teleportation to the ability to create supernatural distractions.

His main superpowers, however, are being able to crouch for inordinately long periods of time and hide behind big square objects. Environments consist of large rooms scattered with boxes,



crates, furniture and anything else that can be rendered in an oversized, rectangular fashion. Patrolling these areas are large groups of guards, gangsters and ghouls. Enemy patrols tend to be lengthy, and being spotted usually alerts everyone in the area, resulting in a quick death. To make matters worse, you have a strictly limited number of saves, and making any progress requires frequent bouts of trial and error, involving excessive periods of waiting.

The stealth element fluctuates between being either immensely frustrating or just plain dull, depending on how many powers you've unlocked. It's possible to adopt a more aggressive play style, although combat animations are poor and the controls are clumsy. Furthermore, hiding corpses

is difficult. Guards seem capable of spotting a finger poking out from behind a wall 100 yards away.

Dark might tempt you in with its pretty, cel-shaded visuals, but lurking behind that alluring exterior is a monster beyond redemption.

RICK LANE

## THE KNOWLEDGE

Price £29.99 inc VAT  
Publisher Kalypso Media  
Developer Realmforge studios  
Website  
[www.getintothedark.com](http://www.getintothedark.com)

## SCORE

CUSTOM PC  
**20**  
OVERALL

# JOE DANGER BUNDLE

## Live dangerously

### + STUNTMAN

Great concept; completely delightful; unique on PC

### - FALL GUY

Later stages are hard; first game lacks variety

**J**oe Danger is probably the happiest game ever. From the moment the start-line announcer yells 'JOOOOE DANGER!' as you launch your

motorbike onto the track, it's a cavalcade of vibrant colour, cheerful music and smiling anthropomorphic animals. Every stunt pulled, every challenge completed and every race won is accompanied by the rapturous applause of your audience.

The concept is devilishly simple. Initially, you just need to get Joe, the stuntman on his comeback tour after injury, from one side of the screen to the other without knocking him off his bike, simply by pressing the acceleration button on your gamepad (seriously, use a gamepad, this isn't a game for keyboards). You'll jump over a few obstacles, use the boost ability to fly up ramps, and have a merry (if simplistic) time doing so.

Then, gradually, the game adds layers of complexity based around the collection of gold stars, which are used to unlock more levels.

Collect all the blue stars in a level, and you'll earn a gold star. Beat a course under a certain amount of time, and you'll earn a gold star. Perform a string of stunts using a series of two-button combinations, while simultaneously performing a triple backflip and avoiding the paddling pool filled with sharks underneath you? That earns you a gold star too.

The real challenge arrives when you try to complete several objectives in a single run. Before you know it, your fingers are tap-dancing across the gamepad like Gene Kelly in a nightclub. Joe Danger's latter levels are particularly difficult. Fortunately, restarts are instantaneous, and longer stages have relatively well placed checkpoints, so failure only occasionally results in frustration.

The only substantial criticism that is that the first Joe Danger game doesn't add much variety to its formula throughout its length. Joe Danger 2, however, remedies this issue brilliantly. Using the premise of being a stuntman for the ultimate action movie, almost every stage of Joe Danger 2 brings something different. Alongside his traditional motorcycle, Joe rides Indiana Jones-style mine carts, jetpacks, skis, snowploughs and quad bikes. Meanwhile, the scenarios range from outrunning an avalanche to chasing



down a gang of robbers, dodging traffic and collecting the loot they drop along the way. This all has to be achieved while performing Joe's outlandish stunts, of course.

Add to that a level designer and Steam Workshop support for potentially infinite replay value, as well as the fact that there really isn't anything else like Joe Danger on the PC, and the result is the highlight of the summer.

RICK LANE

### THE KNOWLEDGE

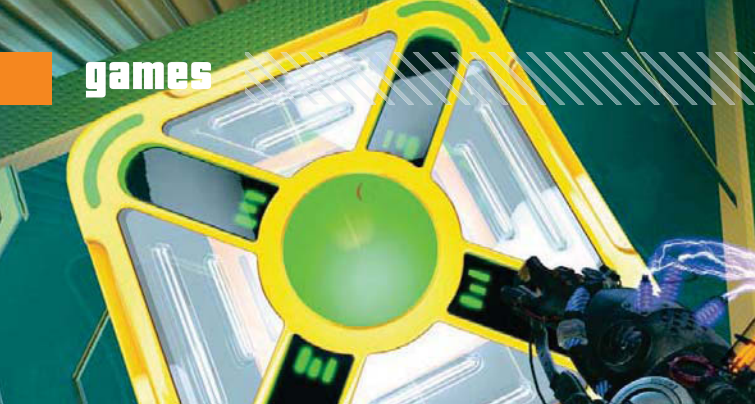
Price £16.99 inc VAT  
Publisher Hello Games  
Developer Hello Games  
Website  
[www.hellogames.org](http://www.hellogames.org)

SCORE

CUSTOM PC

91%  
OVERALL





# MAGRUNNER: DARK PULSE

## Fatal attraction

### + ATTRACTIVE

Fun concept;  
great puzzles;  
Cthulhu

### - REPULSIVE

Dull later  
environments;  
shaky script and  
voice acting;  
Cthulhu

**F**rogwares is apparently trying to be gaming's Heston Blumenthal; no other developer would consider combining cyberpunk sci-fi and the works of H.P. Lovecraft together. Fortunately, though, this virtual equivalent of Snail Porridge is rather pleasant.

Putting the presence of Lovecraft's most famous creation aside for one moment, mechanically, Magrunner is comparable to Valve's ingenious puzzler Portal. The action takes place in a series of test-chambers, ostensibly designed to find the most talented user of Magtech, the primary energy source designed for space exploration.

Needless to say, it doesn't quite go to plan once Cthulhu knocks his weighty fist onto the door of reality and the main character, Dax Ward, must instead use his magnetic talents to escape the facility rather than complete it. If this premise sounds familiar, that's because it is; the difference is that the malevolent AI of Portal is replaced by a malevolent god with an octopus for a face.

While Cthulhu may be the headline act, the puzzles are the stars of the show. Dax's MagGlove can reverse the polarity of a set number of objects in the world, represented by red and green lights. Magnetism in Magrunner works in an inverted sense, with alike colours attracting and opposing colours

repelling. This technique can be used to create makeshift elevators, projectiles and so on.

Magrunner spins this mechanic in ingenious ways. Some puzzles involve collecting enough objects from various corners of a chamber, and then giving them the same polarity to exert enough force to catapult an object across a chasm. Others require creating a chain reaction of magnetic effects, reversing polarities of several objects multiple times to create a makeshift bridge. It's well paced, too. Just when the game seems to run out of ideas, it gives you the ability to place your own magnetic objects, opening up a whole new avenue of puzzling possibilities.

Magrunner's only trouble is its lack of polish; both the script and voice acting vary dramatically in their quality. The game's bizarre antagonist is also so badly portrayed that it's actually quite amusing. Furthermore, the initially beautiful test-chambers make a sensible but disappointing drop in aesthetic quality after the first third of the game, and some of the later puzzles are downright fiddly.

Lastly, while we like Cthulhu, the game would have benefited from having more of an identity of its own, rather than this composite personality. It may have some great puzzles and blend some interesting ideas, but Magrunner's amalgamated novelty wears off by the end.

RICK LANE

### THE KNOWLEDGE

Price £14.99 inc VAT  
Publisher Focus Home  
Interactive  
Developer Frogwares  
Website [www.magrunner-thegame.com](http://www.magrunner-thegame.com)

### SCORE

CUSTOM PC

70%  
OVERALL

# A-STYLE

Your Lifestyle



COMPUTEX  
JUNE 4<sup>th</sup>-8<sup>th</sup>  
**ASRock**  
4F NANGANG HALL, M0311

- Supports 4<sup>th</sup> Gen Intel® Core Processor
- Waterproof by Conformal Coating
- Home Cloud
- WiFi 802.11ac
- Purity Sound™
- HDMI-In



Fatal1ty Z87 Professional Z87 Extreme9/ac Z87 OC Formula



## ASROCK

\* The specification is subject to change without notice. \* The brand and product names are trademarks of their respective companies. \* Any configuration other than original product specification is not guaranteed.

www.asrock.com



**ICY BOX®**  
www.icybox.de

## Big and fast!

4-bay JBOD system for 3.5" SATA I/II/III HDDs

The **ICY BOX IB-3640SU3** is a JBOD enclosure for a fast workflow with huge amounts of data. Video and music editing benefit from the fast connection speeds of USB 3.0 or eSATA which makes for a great performance on your MAC or PC.



- + Top price/performance
- + USB 3.0 & eSATA
- + Easy assembling by trayless design

**SUPER SPEED**  
**USB 3.0**



amazon.co.uk  
and you're done.



**ICY BOX®**  
www.icybox.de

## Extend your Computer

External aluminium enclosure for 3.5" SATA HDDs with USB 3.0 interface

**IB-366StU3+B** is an external aluminium enclosure for 3.5" SATA HDDs with USB 3.0 interface and chipset with UASP and SATA III 6Gbit/ HDDs support, so that the possible transfer speed is 3 to 4 times higher than normal USB 3.0 external cases. The Easy Swap® mechanism lets HDD changes be fast - no screws, just open the lid, pull out the HDD, push in the new HDD, close the lid. Ready.



- + Plug & Play and Hot Swap
- + Supports UASP function
- + USB 3.0 up to 5 Gbit/s
- + Low noise, fanless design



**SUPER SPEED**  
**USB 3.0**



amazon.co.uk  
and you're done.







# REUS

## Good gods

### + DIVINE

Charming, novel approach to god games

### - DEVILISH

Too many resources; not enough consequences

**T**here are few feelings in gaming as pure as the first few minutes of a god game – those initial moments when you're presented with an empty landscape and the loose, wet clay with which you'll sculpt your world. Reus pitches those first moments perfectly.

Beginning with a 2D, cross-sectional view of a barren planet, you wake four elemental giants – Rock, Ocean, Forest and Swamp – and set them to work in a frenzy of world-forging. Ocean batters the ground with his claws, the resulting hole swirling with rich, life-giving water, which moisturises the nearby landscape. Forest and Swamp then fertilise these moist lands with verdant flora, and Rock pulls mountains from the ground with his enormous stony fists.

God games are about mighty decisions and mighty consequences, and Reus' early stages perform this dance well. From there, however, the game changes course, and the result is a god game that doesn't feel quite as godly as you would expect.

Once the basic world is formed, you can access resources that encourage settlers to arrive. Soon they begin construction projects, such as schools or granaries, which require resources, such as food and gold. Space is limited, so you need to be creative by placing specific, symbiotic resources next to

each other, or using one of your giants' many powers to 'transmute' a resource, such as a blueberry bush, into something more bountiful, such as an apple tree.

This means that Reus is less about harnessing the power of the elements to forge a mighty world, and more about micromanaging plants, animals and minerals. For the most part, this is compelling enough in terms of play structure. Watching a settlement grow and flourish as you increase the resource density of the surrounding countryside is both fun and rewarding.

However, the only real consequence of unlocking resources and completing projects is, well, unlocking more resources. Settlements only have two end states; either they continue to flourish, or they become greedy and start warring with other settlements and attacking your giants, at which point you're forced to destroy them. There isn't nearly enough complexity in the behaviour of settlements to create unique worlds and scenarios. There are vast numbers of resources,

but the variety of feedback you receive from placing them is narrow.

Still, Reus certainly grows on you, and with such a dearth in God games at the moment, Reus' charming presentation and unanticipated depth still make it fun to play, despite its flaws.

RICK LANE

### THE KNOWLEDGE

Price £6.99 inc VAT

Publisher Abbey Games

Developer Abbey Games

Website

[www.reusgame.com](http://www.reusgame.com)

### SCORE

CUSTOM PC

72

OVERALL

%

# Obsidian Series® 350D

**MICRO ATX PC CASE**



## The Micro ATX case for high-performance system builds.

The Obsidian Series 350D Micro ATX PC case is designed for building compact high-performance systems with Micro ATX and Mini ITX motherboards. The compact size is ideal if your space is limited, but there's plenty of room inside for liquid CPU cooling, dual hard drives, dual SSDs, and dual full-length graphics cards.

Like all Obsidian cases, the 350D is designed for fast and neat builds, with tool-free access and drive installation. Smart features like a native 2.5" SSD cage make the most of its small size, and the cooling-focused interior has five fan mounting points, with room for two 240mm radiators.

Learn lots more at [corsair.com/350D](http://corsair.com/350D)



CHECK OUT THESE OTHER CORSAIR PRODUCTS DESIGNED TO MAKE YOUR PC THE BEST PC



MEMORY



POWER SUPPLIES



GAMING KEYBOARDS



SOLID-STATE DRIVES



MICE



HEADSETS



# the engine room

Rick Lane

## 4A

Rick Lane illuminates the tech behind Metro: Last Light – one of the year's best-looking games



The interiors in Last Light show the dramatic increase in colour

**D**espite only being developed by a handful of people, the eponymous 4A engine, created by Metro: 2033 and Last Light developer 4A Games,

rivals the very best that the heavyweights of graphics development have to offer. In fact, in certain areas, it could be argued to surpass them.

Oles Shishkovstov is the co-founder and lead engine programmer at 4A Games. Based in the Ukraine, both the company and the engine were formed in 2006 as a consequence of Shishkovstov and 4A's other founder, Oleksandr Maksymchuk, leaving GSC Game World, which developed STALKER: Shadow of Chernobyl.

After spending years struggling to program with GSC's atmospheric yet clunky X-Ray engine, Shishkovstov wanted to build an engine with which you could work quickly.

'Our goal was to iterate faster than others,' explains Shishkovstov. 'This means truly dynamic lighting, in-game editing and no map compilations or other processes that take more than a second to complete. We wanted to differentiate ourselves with something unique.'

As it turned out, the engine didn't become known for speedy iteration, but for its ability to produce intensely detailed environments. The 4A engine made an impressive debut in Metro: 2033. Its many features included an advanced lighting system, sporting

particularly beautiful spotlights, and support for several types of anti-aliasing, the highest settings of which will still challenge today's machines. It also implemented parallax mapping on all surfaces, giving its world of caves and subway tunnels a realistically rough and bumpy look, and volumetric fog to lend those tunnels an eerie atmosphere.

Creating the post-apocalyptic world of the Metro involved using the most advanced graphics technology available, but a few comparatively simple tricks also heightened

fragility of humanity's continued existence after Armageddon.

While Metro: 2033 looked incredibly advanced in certain areas, though, there were other aspects to the 4A engine that let it down. Character models and animations, particularly monster animations and human facial expressions, were a little unconvincing, and the game generally lacked colour. The sequel, Metro: Last Light, aimed to fix both these problems and improve the 4A engine in every other area besides.

'We spent a lot of time on optimisation.

We rewrote almost all the shaders; almost every effect was reimplemented in higher quality', says Shishkovstov 'What we tried to achieve this time was to improve the quality of every pixel, while still

## COMPELLING LIGHTING ISN'T JUST ABOUT THE LIGHTS; IT'S ALSO ABOUT UNDERSTANDING THE ILLUMINATED MATERIALS

the immersion. One of these involved the Metro series' most iconic feature – the gas mask. 'From a technical point of view, it was really easy,' says Shishkovstov. 'It's a kind of post-process shader that's affected by surrounding lights as well as the gameplay state.' Yet what effectively boils down to a screen overlay has a dramatic effect on how the player perceives the world. The mask mists up as the player struggles for breath in Moscow's poisoned air, and cracks when it receives damage, highlighting the

maintaining performance similar to the level of Metro: 2033.'

In the end, Last Light surpassed 2033 in terms of its performance. One of Last Light's biggest changes was a complete overhaul of the lighting model, which may seem a little odd given that Metro: 2033's lighting was one of its strongest assets. But creating compelling lighting isn't just about the lights themselves, it's also about understanding the materials that the light illuminates. Techniques that affect lighting of materials

include specular highlights (bright dots of lights) on smooth surfaces, and screen-space ambient occlusion (SSAO), which affects translucent surfaces such as skin.

'The material system was enhanced as well,' Shishkovstov points out. 'For example, specular power could now be controlled by both material properties and light, which is totally unrealistic from the physics standpoint, but gives more control to artists. The human skin got its own treatment. Screen-space reflections are far from being physics-based as well, but they greatly complement the lighting model.'

The idea of tweaking the engine so that it lends greater control to artists is a recurring theme in the changes between 2033 and Last Light. Shishkovstov particularly emphasises this effect on the subject of Last Light's weather, particularly the rainstorms, through which the player must battle in the latter half of the game. 'Give more controls to artists,' Shishkovstov states bluntly. 'In Metro: Last Light, we added gazillions of controls everywhere, and expanded the abilities of artists to do something exceptional that programmers never even imagined was possible.'

The artist's hand is also clearly perceptible in Last Light's use of colour. While 2033 tended towards the browns and greys that are all too common in the FPS genre, Last Light is much more liberal in its use of reds, greens and blues. Shishkovstov explains that balancing colour with realism is difficult, and requires a deft hand. 'Making the game grey or brown is an easy way to get into "believability" territory. Making it more colourful means much more work if you want to stay in that territory.'

The result is a game that's more realistic and more artistically interesting. But there's one area in which there has been no change – scale. For the most part with the Metro games, the 4A engine only needs to render corridors and enclosed spaces, so movement through larger environments tends to be strictly regulated.

On the subject of 4A's rendering capability, Shishkovstov states that 'our worlds are too detailed, but the scope and space is due to game design decisions, rather than a



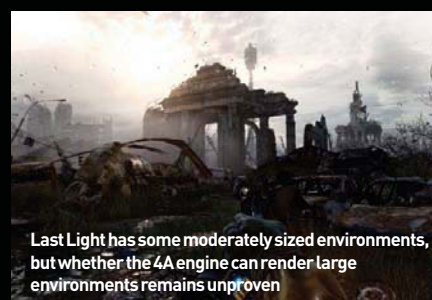
Ironically, it's at night that the 4A engine's lighting engine really shows itself off



The Nosalis Monster in 2033



The 4A Engine has some of the best-looking spotlights in gaming



Last Light has some moderately sized environments, but whether the 4A engine can render large environments remains unproven



The incredible storms in Last Light were the result of artistic freedom, rather than technical prowess

technical limitation'. Certainly the Metro games have so far opted for detail over scope, but whether the engine can bring that level of visual quality to an open-world game is yet to be proven.

However, Shishkovstov is very clear about the future of the 4A engine, which seems to involve further refining what the engine already does well. Alongside working on global illumination, 4A is also improving locomotion of AI agents and subsurface scattering – another technique for creating better interactions between light and

translucent surfaces. This could translate into more realistic-looking characters, suggesting the next 4A game will continue along the same storytelling rails.

'Basically, we're shifting from current-gen consoles to next-generation ones,' Shishkovstov says. Given how all 4A's games to date use the current generation of consoles as the lowest common denominator, and can still challenge even the most powerful hardware in their PC versions, this is very exciting news indeed. Prepare your eyeballs. **GPC**



# DEV PERSPECTIVE

Cliff Harris



## Behind the trade show booth

**F**or a long time, I've heard US-based developers extol the virtues of gaming and consumer tech trade shows such as GDC, E3 and PAX. They talk about how it's a fantastic way of getting feedback, talking to gamers, generating excitement about your game and attracting press coverage. The consensus always seemed to be that attending shows was a part of game development, and that anyone important has a booth at these shows. I've always been extremely sceptical about this view.

I recently exhibited at a show for the first time (I showed *Democracy 3* and *Redshirt* at Rezzed In Birmingham), so I eventually decided to try it, but let me talk you through my anti-show logic first.

Even indie game developers need to pay the bills. No, we aren't just in it for the money, but we have to pay back development costs, buy food and turn a profit if we're to carry on doing the job we love. The idea of going to a show and watching people play your game sounds cool, but does it really make any financial sense?

The answer depends on a few factors. The cost of a booth will vary dramatically, but you're talking about thousands, not hundreds, of pounds for a booth, and that's without any 'swag' that you might be giving away, such as badges, posters, t-shirts and so on. You also need to add the cost of a hotel for you and anyone else who'll be manning your booth, plus the cost of getting there – travelling to the USA is another huge cost for me. Suddenly the cost of attending a trade show can give you very little change out of £10,000.

Compared to the marketing budget of a big budget triple-A game, you might think 'is that all?', but this is a lot of money to an indie developer. If you attend three shows to promote the game, that's the cost of hiring a junior coder for a year. A whole year's work for someone means a lot of new features, or a shorter dev cycle. Can attending a few trade shows be a better investment? Maybe.

It really depends on why you do the show, and everyone has different motivations. For some, it's all about the press; they want the big

magazines and websites to notice their game. They know that those journalists will be walking past the booth at some point. The theory is that the huge audiences behind those sites will justify the show's expense, if the games get coverage they otherwise wouldn't receive.

For other developers, shows are about play testing. Nothing tells you more about the playability of your game than watching 100 total strangers try it in front of you. For some devs I spoke to, it's about morale – getting the team together with a big booth with some big screens showing the game is motivational. Personally, I think an all-expenses trip to the Bahamas might be better for morale, and possibly cheaper.

A few developers also cling to the idea that they'll actually sell copies of the game because a few thousand gamers saw it at the show. I love statistics, and I can tell you that this is possible, but extremely unlikely. Unless every single visitor buys your game (at full price), or recommends it to someone else,



you're unlikely to ever make a profit that way. Personally, I think the shows only make sense if you combine all those factors together.

So what was my experience? Firstly, it was nerve-wracking. I showed off two strategy games, one of which is billed as 'the most complex political strategy game ever made'. Would people play that at a games show? When there are big screens playing video of explosions, people dressed up as game characters and music blasting, is anyone going to sit there, contemplating taxes and interest rates?

Plus we had other concerns. What if the games crashed or hung? What if they just didn't run on the supplied PCs? What if attendance was really low? What if, rather than a morale-booster, this was a morale-crusher?

As it turned out, these worries were all unfounded. The games ran on the supplied PCs, and people did try the games – our concerns about people being disinterested were over within around two minutes of the doors opening. Feedback was very positive, the games didn't crash, and both myself and the Redshirt developer spent time talking to journalists, who expressed an interest in covering both games. It was pretty much a win for us, despite the costs.

However, there are also issues that no one ever warns you about. Firstly, there was nowhere for us to sit down. This isn't a big deal when you're 18, but I'm 43 now. I'm not used to standing for eight hours a day. It's tiring. Secondly, we were next to an annoying loud booth. It wasn't just loud, but like everything else at trade shows, it was also irritatingly

repetitive. If you sat and played Democracy 3 for 15 minutes, it would bug you. Imagine how we felt after eight hours a day for two days.

Thirdly, it turns out that people really love badges and leaflets. In fact, we ran out of both. I initially thought we might look silly because we had ordered too many. Wrong!

Issue number four – you don't get to see the show. You would imagine that with two days and eight hours a day, you would find time to see the show, but no. I knew the cafeteria pretty well, and I knew the booth I was manning very well, but I only managed to play

concepts, but everyone seemed to 'get' the games right away. Watching people play the games reassured me massively about the user-friendliness of the GUIs. My initial plan had been to stand there and film people playing them, for later review, but that became futile. There were too many people, the lights were too bright and we were talking to people too much. Lesson learned.

Surprisingly, it also turned out that most people were very happy to be interrupted while playing – for the developer to say 'you might want to click here, or try this function

and so on'. Gamers who attend shows are happy to be chatty to the developer, whereas I thought that saying who I was and why I was there might come across as showing off. I also learned that long-sleeved t-shirts are too hot.

Would I do a trade show again? I

think I would. It was a positive experience for me, especially as I can now go forewarned as to what I did wrong last time. To gamers, I'd say, please keep coming to these shows, please try our games, say hello (we're chatty people!) and, most of all, don't be surprised if we look tired. **GPC**

## IF YOU ATTEND THREE SHOWS TO PROMOTE A GAME, THAT'S THE SAME COST AS HIRING A JUNIOR CODER FOR A YEAR

just one other game (Surgeon Simulator, which I then bought the next day). That was the only time (the last part of the last day) that I got to see what all those thousands of gamers had come to see.

I learned an enormous amount from doing my first show. One lesson was that people need very little encouragement to come and play a game. A screen and an empty chair is all it takes. We probably had it about right with two games and four PCs – any more, and we'd be paying for empty seats. I also learned that people love badges, and that I'm not as young and fit as I used to be.

Most of all, though, I learned that the games were playable. I had worried massively that the tutorials needed to be more obvious, and that I'd need to walk people through the basic



**CLIFF HARRIS**

is the one-man coding wizard behind Positech Games ([www.positech.co.uk](http://www.positech.co.uk)), the developer of Gratuitous Tank Battles

[www.positech.co.uk](http://www.positech.co.uk)), the developer of Gratuitous Tank Battles

[@cliffski](https://twitter.com/cliffski)



# DIGITAL RIGHTS

Jim Killock

## The porn wall

Internet filters that are on by default could result in us sleep-walking into censorship, says Jim Killock

**D**avid Cameron has launched the UK towards what we might call 'nudge censorship', after a speech in which he announced new measures, which he claimed were aimed at protecting children. Should paedophiles be allowed to use Google to search for images that show crime scenes, asked Cameron? Companies must do more, he said. And, he added, children must be protected from accessing pornography. Additionally, possession of rape porn must be criminalised.

Why address these three issues in one speech? After all, he admits two of the problems 'are very distinct and very different', in relation to parental filters and child abuse images. He said, 'Both the challenges have something in common; they're about how our collective lack of action on the Internet has led to harmful and, in some cases, truly dreadful consequences for children.'

Perhaps the reason was to beef up his story, and to make people more open to the idea of clamping down to protect our children. Enter the mental frame of banning dangerous and appalling Internet material, and applying that idea to everyday inappropriate material seems so much more natural.

### SEARCH ENGINES AND CHILD ABUSE IMAGES

Cameron proposed to persuade search engines to ban the use of certain 'depraved' search terms. Unpublished evidence appears to suggest that 'casual' searching for paedophile material might be a point where paedophiles could be deterred from investigating and developing their predilection. Therefore, Cameron's supporters claim, stopping such searches from aiding people to find the images, and also warning them about what they're doing, could be an effective help.



Prime Minister David Cameron and Devises MP Claire Perry have pushed for 'default on' content filters, which will be implemented at the ISP level

There are counter-arguments, which note that the terms could be used for research, criminal investigations and even by people seeking help. On a practical level, nobody is sure how often such terms are really used and how much material is really available through searches. However, I think it's likely

### WHEN FACED WITH A LIST OF UNPLEASANT MATERIAL, MANY MAY SIMPLY THINK FILTERING SUCH WEBSITES IS A GOOD IDEA

to be very small, as it's removed when search engine companies become aware of it.

Many child protection experts are scathing about the plan. Jim Gamble, the former head of the Child Exploitation and Online Protection Unit (CEOP), rubbished it, reminding the media that most paedophiles lurked on darknets and peer-to-peer file-



Photo of Claire Perry by Anthony von Roretz

sharing networks. 'The balance is attack the root cause, invest with new money into child protection teams, victim support and policing on the ground. Let's create a real deterrent, not a pop-up that paedophiles will laugh at,' he told Radio 4's Today programme.

Tracy Edwards MBE, another former CEOP official, disputed claims from Cameron and Devises MP Claire Perry that CEOP is better staffed and resourced. In our sister publication PC Pro in July, she said: 'CEOP is haemorrhaging people at the moment ... People are just leaving because they are under-funded and under-supported. When you join CEOP, it's not just a job, there's a real sense of purpose. The job these people do is so horrendous that you have to know that what you're doing is actually leading to something. There are a lot of very unhappy people there at the moment.'

The consensus seems to be that policing UK criminals, tackling money laundering where criminal gangs are selling images, and persuading overseas governments to speed up site takedowns from days to hours, are the key measures for which we should be pressing. All of these are actions for the government, and were conspicuously absent from Cameron's speech.

## PARENTAL FILTERS

Cameron's speech also made no mention of the breadth of material to be blocked in his 'default on' parental filter proposal from the biggest four ISPs. He also didn't mention the implicit reversal of government policy he and Claire Perry have been making, apparently without telling anyone in the Cabinet. Last year, in December, the government decided to pursue 'whole home' filters for parents, but to avoid bringing adults who didn't need them into a 'censornet'. It said:

'The government is now asking all Internet service providers to actively encourage people to switch on parental controls if children are in the household and will be using the Internet. This approach should help parents make use of the available safety features without affecting Internet users aged 18 and over who can choose not to set up controls.'

'The government is urging providers to ... configure their systems to actively encourage parents, whether they are new or existing customers, to switch on parental controls. The government believes providers should automatically prompt parents to tailor filters to suit their child's needs e.g. by preventing access to harmful and inappropriate content.'

Cameron's speech changed the position, to enabling 'home network filters' during your broadband setup by default. 'We need good filters that are preselected to be on, pre-ticked unless an adult turns them off, and we need parents aware and engaged in the setting of those filters,' he said. 'By the end of this year, when someone sets up a new broadband account, the settings to install family-friendly filters will be automatically selected; if you just click next or enter, then the filters are automatically on.'

According to Cameron, the filters 'will cover any device connected to your home Internet account; no more hassle of downloading filters for every device, just one-click protection. One click to protect your whole home and to keep your children safe'.

Critical issues, including what information ISPs will record, which categories they propose blocking and what non-web services may be blocked, haven't been detailed by ISPs or the government. However, from conversations with ISPs and by looking at TalkTalk's system, we can construct the type of 'user journey' with which you'll be faced:

### 'Parental controls'

Do you want to install / enable parental controls?

- ☒ yes  
☐ no

[next]

[2] Screen two [if you have left the box ticked]

### 'Parental controls'

Do you want to block:

- ☒ pornography  
☒ violent material  
☒ extremist websites  
☒ anorexia and eating disorder websites  
☒ suicide-related websites  
☒ alcohol and drugs  
☒ smoking  
☒ web forums  
☒ social media  
☒ gaming  
☒ web blocking circumvention tools

You can opt back in at any time

Cameron and Perry seem to be hoping to sleepwalk people into censorship. If you follow the simplest journey, you'll enable blocking and, when faced with a list of unpleasant material, many may think that filtering such websites is actually a good idea.

In practice, we know that filters block much more than the bad stuff, and don't block all of the areas you might want to avoid. It's important that parents understand this issue as they enable filters. This process seems to suggest parents might not really engage with what they're doing.

If you sell jewellery (and maybe tobacco pipes), run a pub (alcohol), perhaps run a Nikon camera club (forums), a Linux coding site (circumvention tools) or an online games company (gaming), you should be worried about a large number of adults enabling filters without understanding why. Those people may not switch the filters off again, and you may find yourself losing market share. Even light swearing can potentially result in filters catching your website.

You may be worried about having conversations where you have to persuade your partner that disabling filters isn't the same as 'wanting porn'.

This is a major reason why groups such as Safer Media and Media Watch started pushing for 'default filters'. It looks as though they very much want filters to create social dissuasion from accessing pornography in general, which is a very different argument from helping children to avoid inappropriate material.

Of course, once categories and filtering are firmly established in the network, pressure may well come for stronger defaults, and widespread compulsory blocking. If this happens, they will find allies in the Daily Mail, no doubt, whose opposition to the Nanny State seems to stop when there is a possibility of demanding new controls on Internet filth. It still helps to sell papers, after all. **GPC**



**JIM KILLOCK**

is executive director of campaign organisation The Open Rights Group

([www.openrightsgroup.org](http://www.openrightsgroup.org))

@jimkillock





# BUILD A MINI GAMING PC FOR £999

Ever wished your PC was smaller? Antony Leather shows you how to build a pocket rocket that's just as fast as a full-sized PC

**W**e might have a fantastic choice of well-built enthusiast PC cases these days, but they're also often large and cumbersome. They take up lots of desk or floor space, they're a pain to carry to LAN parties and, since so few of us use more than two PCI-E slots now, for many people, there seems little point in having a full-sized desktop. Thankfully, there is a very easy way to build a small PC without compromising on performance.

Mini-ITX motherboards have been around for years, but have recently undergone a renaissance. They're now just as overclockable as their

full-sized counterparts, and include many of the same features too, such as overclocking capabilities, PCI-E graphics slots, SATA 6Gbps ports, USB 3 ports and headers, and even on-board WiFi and Bluetooth.

Historically, cases have been another stumbling point too, but there are now several available that have room not just for a high-end air-cooled system, but a water-cooled one too. In this article, we'll be taking a look at all the gear you need to build a budget-conscious mini-ITX gaming system, how to build it step by step and covering alternatives so that you can mix and match the components to suit your needs.

# WHAT'S INSIDE?

## THE CASE: BITFENIX PRODIGY

While the Prodigy is much larger than your typical mini-ITX case, it's incredibly versatile.

The key is to remove the internal middle hard disk enclosure.

If you're aiming for an air-cooled PC, the Prodigy then has room for large graphics cards, plenty of hard disks and SSDs, and practically any CPU cooler.

You can use a standard-sized PSU too, although we suggest sticking to 140mm-deep models.

Water-cooling enthusiasts have also snapped it up. You can fit a dual 120mm-fan radiator in the roof and, if you remove the second hard disk enclosure, you can even fit a 200mm-fan radiator in the front – more than enough to cool powerful hardware. Removing the bottom hard disk bay means that there's room for a pump here too. Out of the box, two 120mm fans are included, but there are plenty of additional fan mounts too, providing room for an all-in-one liquid cooler.

It's very customisable too. It's currently available in a variety of different colours, with the option to mix and match sections, and opt for mesh-fronted or solid colour-fronted front panels. There are also side window panels available for less than £10, and there are even foam silencing and fan filter kits too.

We've chosen the Passion Red model, which has a solid front, as we're using mid-range hardware and an all-in-one liquid cooler. However, if you're relying solely on air cooling, a mesh front panel will allow for much more airflow.

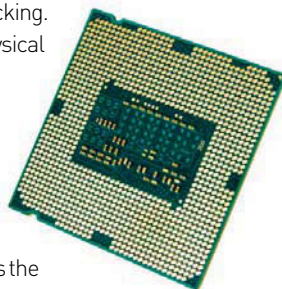


## THE CPU: INTEL CORE I5-4670K

Intel's new Haswell CPUs might not build on the overclocking headroom of their Ivy Bridge predecessors, but they're faster clock for clock and still offer great value for money. As our LGA1150 mini-ITX motherboard of choice sports an Intel Z87 chipset, it's a no-brainer choice to opt for a K-series model and dabble in some overclocking.

It sports four physical cores and a maximum Turbo Boosted frequency of 3.8GHz.

In our Media Benchmarks, it's the fastest non-hyper-threaded CPU we've tested, and it's also noticeably faster than the likes of the Core i5-2500K and Core i5-3570K in Cinebench R11.5. Our retail sample managed to overclock to 4.3GHz with no manual increase in voltage too, requiring just a multiplier hike to see a 500MHz boost in clock speed.



one stood out as striking the best balance between overclocking, features and price. MSI's Z87i has a great layout, with many of the important connectors located at the edge of the PCB. It also has on-board WiFi and a great EFI, which makes overclocking hassle-free.

We managed to overclock our Core i7-4770K to 4.6GHz with comparative ease using this board, and the inclusion of a clear-CMOS button will help with overzealous overlocks too.

Best of all is the price. It costs just £104 inc VAT, making it one of the cheapest enthusiast-orientated mini-ITX motherboards we've seen. This makes it £40 cheaper than Asus' Z87i-Pro and nearly £100 less than Asus' ROG model, the Maximus VI Impact.

## ALTERNATIVE

If you aren't fussed about overclocking and won't be opting for a K-series CPU, then you can save yourself some cash by buying a motherboard with an H87 or B85 chipset instead.

## ALTERNATIVE

If you do a lot of video editing, 3D rendering or other tasks that benefit from having as many CPU cores as possible, the Core i7-4770K will likely be worth the extra investment. Expect to pay a premium of around £100 for the privilege, though.



## THE MEMORY: 8GB 2,400MHz PATRIOT VIPER BLACK MAMBA

We've found that Haswell CPUs see some sizeable benefits from using fast memory – up to 20 per cent in some cases in the move from 1,600MHz to 2,400MHz.

Seeing as Patriot's 2,400MHz Viper Black Mamba 8GB kits only £65 now, which is barely any more than standard 1,600MHz memory, it makes sense to spend a little more for the extra performance.

## ALTERNATIVE

If you need more memory, opt for G.Skill's TridentX 16GB 2,400MHz kit, which offers great value at its price of £145.

## THE MOTHERBOARD: MSI Z87I

There are plenty of enthusiast mini-ITX motherboards around at the moment, as you can see from this month's Labs test. However,



## ALTERNATIVE

Cubitek's Mini Cube is a little more expensive than the Prodigy, and it has no fans as standard either. However, it's much smaller and still has enough room to house a standard PSU, 280mm-long graphics cards and 150mm-tall CPU coolers.





## THE GRAPHICS CARD: MSI GTX 760 TWIN FROZR OC

In order to impress us, a graphics card needs great performance out of the box, a quiet but effective cooler, a decent price and, preferably, some overclocking headroom. MSI's GTX 760 Twin Frozr OC ticks every box. As well as looking the business, it sports a 4 per cent factory overclock. However, the uprated circuitry meant we could apply a massive overclock, boosting the core frequency to 20 per cent and the memory by 27 per cent above standard GeForce GTX 760 2GB frequencies.

Here, it wasn't far short of matching a stock speed GeForce GTX 770 2GB, yet the cooler remained pleasantly quiet, while still keeping the GPU temperature well within its limits. The GTX 760 Twin Frozr OC might be the single most expensive item in our PC, but it's fast, copes with most games at 2,560 x 1,600 and it's quiet too.

### ALTERNATIVE

While it might be a last-generation graphics card, Nvidia's GeForce GTX 660 2GB can still handle all our game tests at 1,920 x 1,080. It costs less than £160 too – a saving of nearly £60 over the GTX 760 Twin Frozr OC.

## THE CPU COOLER: ANTEC KÜHLER H20 920

The reign of gargantuan air coolers has been waning for some time, almost entirely due to the invasion of all-in-one liquid coolers. The



reasons are clear; they offer fantastic performance, can often fit into small spaces and cost much less than a custom water-cooling kit. Many offer software fan control too, enabling you to customise fan speeds based on temperature, so you can enjoy blissful quiet if you aren't doing anything demanding. Most cases these days have rear or roof 120mm fan mounts too, so installing the coolers is usually straightforward.

You also have the benefit of being able to direct your CPU's waste heat directly out of the case via the radiator, instead of it splaying out into your case first. There are several very good all-in-one liquid coolers around at the moment. While Corsair's H80i offers fan control and excellent cooling, Antec's Kühler H20 920 just pips it to the post in terms of all-round value for money and performance. It uses a full-height single 120mm-fan radiator, and is equipped with two fans that work in unison to create substantial airflow, especially on the cooler's Extreme setting.

### ALTERNATIVE

Thermalright's True Spirit 120M costs just £25, and is still a great cooler if the Kühler H20 920's price tag is a little steep for your budget. If you're going all out, though, and want to make use of the Prodigy's dual 120mm fan mount in the roof, Corsair's H100i is an awesome choice, although it will set you back around £100.

## THE SSD: SANDISK ULTRA PLUS 256GB

For the budget-conscious enthusiast, a hard disk will still represent the best value for money and cost per gigabyte. However, an SSD boot drive will make a massive difference to Windows start-up times and system responsiveness. SSDs are silent too, and take up far less space than hard drives, making them the ideal choice for a mini-ITX system. For this job, we can highly recommend SanDisk's Ultra Plus 256GB. Despite offering a quarter of a terabyte of space, it retails for just £125, meaning that it sports a cost per gigabyte of just 52p.

However, it still manages to offer great performance, recording sequential read and write speeds of 498MB/sec and 440MB/sec respectively. This isn't quite as fast as the best SSDs available, but you'll be saving a packet in



### ALTERNATIVE

If you're after an SSD with even more speed, then Plextor's M5 Pro 256GB currently receives our vote. It managed sequential read and write speeds of 525MB/sec and 443MB/sec in our tests. It costs around £30 more, though, so if you're on a tight budget, this cash could be better spent elsewhere.

## SHOPPING LIST

Component	Model	Price (inc VAT)	Supplier
<b>CPU</b>	Intel Core i5-4670K	£187	www.ebuyer.com
<b>Motherboard</b>	MSI Z87i	£117	www.overclockers.co.uk
<b>Case</b>	BitFenix Prodigy	£70	www.overclockers.co.uk
<b>CPU cooler</b>	Antec Kühler H20 920	£84	www.specialtech.co.uk
<b>Memory</b>	8GB Patriot Viper Black Mamba 2,400MHz	£66	www.overclockers.co.uk
<b>Graphics card</b>	MSI GeForce GTX 760 Twin Frozr OC 2GB	£216	www.overclockers.co.uk
<b>SSD</b>	SanDisk Ultra Plus 256GB	£125	www.ebuyer.com
<b>Hard disk</b>	1TB Seagate ST1000DM003	£49	www.scan.co.uk
<b>PSU</b>	BeQuiet Pure Power L8 530W	£68	www.overclockers.co.uk
<b>Optical drive</b>	Asus DRW-24B5ST	£17	www.cclonline.com
		<b>TOTAL</b>	<b>£999</b>
<b>Optional</b>			
<b>Operating system</b>	Windows 7 64-bit OEM	£71	www.scan.co.uk
<b>Modding accessories</b>	Phobya LED lights	£7	www.aquatuning.co.uk
	BitFenix Alchemy cables	£15	www.overclockers.co.uk
		<b>TOTAL</b>	<b>£1,092</b>

the process. We find that 256GB hits the sweet spot in terms of capacity; you'll soon use up 128GB once you've installed Windows, some programs and a few games.

### THE HARD DISK: 1TB SEAGATE BARRACUDA ST1000DM003

Using a hard disk is entirely optional, especially as we're using a fairly sizeable SSD, and many people use network-attached storage (NAS) boxes now. However, if you have gigabytes of photos, videos and other archived data that you want to store in this PC, you'll probably need a little more space. As 1TB SSDs are still expensive, a hard disk is the way to go for large scale file storage.

Thankfully, hard disk prices have settled down after

the Thai floods that wreaked havoc in the storage industry a few years ago, seeing the

costs skyrocket. A 1TB Seagate Barracuda ST1000DM003 can now be yours for less than £50, so you don't need to worry about running out of space on your SSD.

### THE PSU: BEQUIET! PURE POWER L8530W

Most people don't need monstrous PSUs any more; you certainly shouldn't be eyeing up 1KW PSUs if you only have a single graphics card and an overclocked CPU. Even an overclocked system with a GeForce GTX Titan 6GB installed draws much less than 400W at load. Our system will be quite happy being powered by a 500W PSU, so we've opted for our current Elite list model, BeQuiet!'s Pure Power L8 530W. It costs £68 and doesn't have modular cables, but it offers stable power and decent efficiency. It's also the right size to fit snugly into the Prodigy's PSU mount.



### THE OPTICAL DRIVE: ASUS DRW-24B5ST

Sadly, it's still the case that Windows is supplied on an optical disc as standard, and if this is your only PC then you'll need an optical

## ALTERNATIVE

If you have access to another PC, you can create a bootable USB flash drive to install your operating system using Wintoflash ([www.wintoflash.com](http://www.wintoflash.com)). It's easy to use and will remove the need to install Windows using the DVD. If you can also grab the drivers for your motherboard from the manufacturer's website, you can fill the 5.25in bay with something more interesting, such as a fan controller.

drive to install Windows.

As such, for the sake of simplicity, we've selected a standard DVD writer to fill the Prodigy's single external 5.25in bay.



## THE MODDING GEAR

We've opted for a couple of extras to spruce up our PC. We've used BitFenix's Alchemy cable extensions, so we can hide the bare cables of our PSU. We've also opted for Phobya LED lights, which are powered by a 4-pin Molex connector, and they're also self-adhesive, so they can be placed anywhere in the case.



## ALTERNATIVE

You can, of course, probably get away without a hard disk if you're using a 256GB SSD, but if you need a lot more storage space then a 3TB Seagate drive can be bought for £90.

# HOW TO BUILD THE PC



### REMOVE THE HARD DISK CAGE

To use large graphics cards, you'll need to remove the Prodigy's middle hard disk cage. It's held in by two clips and it slides out easily.



### REMOVE THE TOP COVER

The removable grille at the top will allow you secure the CPU cooler. A simple latch holds it in place and will also enable you to line up the optical drive from behind too.



### INSTALL COOLER

We've opted to have the radiator exhausting air from the case, so we've mounted the fan underneath first before installing the radiator in the roof. Use the rear of the two fan mounts to make room for the optical drive.





#### 04 INSTALL COOLER MOUNT AND CABLES

Install the CPU and cooler, the memory and all the necessary cables to the motherboard outside of the case. Doing these jobs when the motherboard is installed can be fiddly due to the tight confines inside.



#### 05 MOUNT MOTHERBOARD

Take care with the CPU cooler tubes, and thread them into the case so they aren't under a lot of force. Don't forget to mount the I/O bracket, and route any cables through the cable-routing holes, before installing the motherboard.



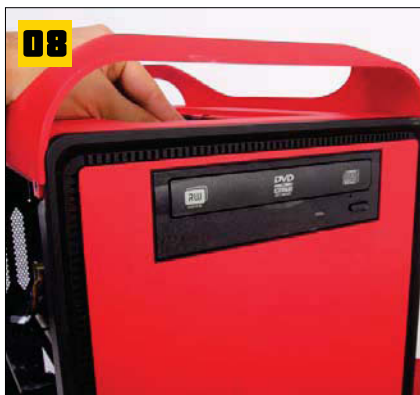
#### 06 INSTALL SSD

There's room for two SSDs in the side panel. They screw into place from underneath. When you replace the side panel, be sure to route the lower SATA and power cables through the PSU mount, or you might find the side panel won't close.



#### 07 REMOVE FRONT FASCIA

The case will have a blanking plate over the 5.25in bay out of the box, and you'll need to remove the front fascia to uninstall it. Four clips around the edge of the fascia will enable you to prise it off.



#### 08 INSTALL OPTICAL DRIVE

Replace the front fascia and slot the optical drive in place – it's a tight fit between the optical drive and CPU cooler. If your power and SATA cables can't be squeezed in to meet the drive, you can relocate the cooler's radiator to the rear fan mount.



#### 09 INSTALL HARD DISK

There are two free 3.5in mounts at the front, so install your hard disk in one of them, making sure the connectors point to the far side of the case to make the cabling look tidy.



#### 10 CONNECT CABLE EXTENSIONS

We've opted for 24-pin ATX, EPS 12V and 8-pin graphics card extension cables. Connect these to your PSU, then thread them through the relevant cable-routing holes.



#### 11 INSTALL PSU

Feed your PSU into the mount, taking care to thread the cables into the case so they don't block the way. The left-hand side provides a handy place to tie up any slack, of which there will be plenty if you use extension cables.



#### 12 MOUNT GRAPHICS CARD

There should now be ample for your graphics card, but make sure to fit the power cables first, as there isn't a lot of room above it.



#### 13 INSTALL LIGHTS

The final touch is to add your lights. We chose to mount them around the edge of the PSU cage, illuminating the graphics card, but as they're self-adhesive, you can mount them pretty much anywhere. **GPC**

# TURN YOUR IDEAS INTO CASH

ONLY  
**£9.99**

*step by step*

## How to set up an online 2013 business

### PLANNING

Start a business that plays to your strengths

### BUILDING

Create a website and master Google rankings

### MARKETING

Find customers and make them buy!

From the  
experts  
at PC Pro

**PC  
PRO**

### NEW!

How to build a  
shop for free  
Let Amazon ship  
your stock  
Build your  
own app

# ON SALE NOW

To order direct call **0844 844 0053** or visit **[www.magbooks.com](http://www.magbooks.com)**  
Magbooks cover a range of topics, from IT to Motoring and Fitness to Gardening

## FREE P&P

ON ALL UK  
DIRECT ORDERS



# ten GLORIOUS YEARS

**CUSTOM PC IS CELEBRATING ITS 10TH BIRTHDAY. JOIN US IN HAVING A LOOK AT WHERE IT ALL BEGAN**

**a** new craze was brewing. Tired of being limited by weedy CPU coolers, bored by unadventurous beige cases and fuelled by a genuine fascination of the inner workings of a computer, the PC enthusiast scene was now big enough to take seriously.

We'd been tinkering with computers for decades by this point, of course, but now

some little pockets of the PC industry were starting to take us seriously, launching new products, such as fan controllers and cold-cathode case lights, specifically aimed at us. We'd been sharing modding, tweaking and overclocking tips on forums for years, yet the PC magazines of the day were either aimed at computing noobs or IT managers. Where was our monthly slice of modding, gaming and overclocking goodies?

Spotting a gap in the magazine market for something aimed at this new breed of tech heads, PC Pro decided to rebrand its Gaming section (then edited by Gareth Ogden) as PC Pro Extreme. Taking

up just a few pages, it brought ideas such as volt-modding cooling fans and installing lights into the mainstream printed press – ideas that had previously only been found on niche (at the time) websites. A few months later, Gareth pitched the idea of a whole PC enthusiast magazine to the big names on the Dennis board of directors, and they liked it.

What then followed were several months of preparation. Market research was undertaken, focus groups were consulted, staff were hired and several ideas were born, considered and mauled into shape. Codenamed Project Hotrod in its early days, the new mag was eventually given the name of **Custom PC**, and the team started working on the branding. Several ideas were tried before the team eventually settled on the classic Custom PC font and basic cover structure.

Some of the alternative cover designs that were mocked up before launch











The next step was to produce a mock-up of the magazine with 20 pages, giving a sample of the sort of content it would contain. It had a couple of hardware and game reviews, a bit of news, an introductory column, a couple of ads and a PC-building guide. All the content was then repeated several times to bump it up to magazine size, and there was then a virtual issue of the mag that the team could take to trade shows and send to people to drum up interest. It's called Issue 0, and you occasionally find copies of it on eBay.

The rest of the team were then hired, a bunch of freelancers (including some of the current team) were drafted, and many nights were worked in the rush to get Issue 1 (or 'Issue 1' as it was mistakenly called on the spine) out the door.

It wasn't all plain sailing after then. Originally pitched as a lifestyle magazine in the same vein as Mac User, some of the first few issues used illustrations on the cover, rather than hardware photos. They sold abysmally. In fact, after Issue 3, which had a cover devoted to skinning Windows, the



First came Issue 0 – a prized collector's item if you can find it

Then came Issue 1 – complete with a mustard-coloured cover

future of the magazine was even brought into question. With Issue 4, we decided to try something different and put photos of PC hardware on the cover, which sold better. Then Issue 5 featured a full glory shot of

some DDR memory, and we realised we'd nailed it – people wanted PC hardware, and that, rather than arty illustrations and concepts, was what sold the magazine. We've never looked back since.

## where are they now?

We catch up with the team from the very first issue

A look through the list of contributors to Issue 1 reveals some familiar names, even if they weren't in the top jobs at that point. The list includes our current editor Ben Hardwidge, art editor Bill Bagnall, production editor Julie Birrell and photographer Danny Bird (the guy who shoots our fantastic-looking covers). However, we thought we'd catch up with the guys who ran the magazine back in the day to see what they're up to now.



### GARETH OGDEN

ASSOCIATE EDITOR

As the founding editor of Custom PC, I'm proud to see the mag still going strong ten years later. After editing CPC for almost five years, I moved into PR, working for Corsair and, very recently, I joined another famous tech company, Asus. As a lifelong PC enthusiast, the PC is still my hobby, and I'm still an avid PC gamer – although, with two little children, I don't get much game time these days. Happy birthday, Custom PC!



### ALEX WATSON

STAFF WRITER

I still remember Issue 1, unpacking the first few motherboards to test (and James blowing a hole in one unfortunate specimen), and it's great to see the mag is ten years old. After editing CPC for two years, I started working on some new ideas at Dennis, and that became a team creating apps. It's an Apple-dominated world, but I took the CPC approach with me. I still have a PC; it's in a lovely custom-painted mini Antec P180.





# HARDWARE OF THE DAY

A lot has changed in the past ten years since we started, and there are some notable differences between the hardware of that time and the hardware of today. A flick through the first issue reveals some of the notable changes. For a start, all the CPUs are single-core (this was even before Intel had told the world it had a dual-core CPU concept in the works), and they're also all 32-bit – this is the Pentium 4 and Athlon XP era. This even predates AMD's Athlon 64, and there was no such thing as Windows XP 64-bit either.

All desktop CPUs at this time also still used the Northbridge as the memory controller, and some of these memory controllers, such as the one on the Elite-listed EPoX EP-8KRA2+, were still single-channel. Notably, there was also no such thing as PCI-E at this point – all the graphics cards use the AGP interface, and motherboards had a bank of PCI slots.

Our top-rated GPU was ATI's Radeon 9800 Pro, which wouldn't run any of our current game benchmarks, even with a low frame rate, since it predates Shader Model 3. This is also well before the days of solid state storage, so our top storage choice was a 36GB Western Digital Raptor hard drive.

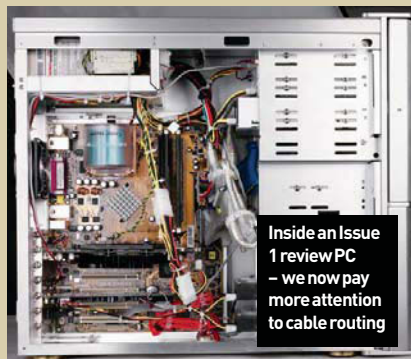
What's also striking is how the looks of core component hardware have changed. PC cases might have started to become

more interesting than the bland beige crates of yore, but all the motherboard PCBs sport the traditional green or yellow-brown hue.

The same also goes for the visibility of cables in the professionally-built review PCs. The cables are tied, but they look surprisingly messy for professional builds – this is before the days of cases with large spaces behind the motherboard tray, and when we still had to find space for huge IDE ribbon cables. Standards have clearly changed.

Below is our top-listed PC spec from the time:

**CPU** AMD Athlon XP 3000+  
**Motherboard** EPoX EP-8KRA2+  
**RAM** 1GB PC3700 DDR  
**Graphics card** Connect3D Radeon 9800 Pro  
**Case** Thermaltake Xaser III 2000+  
**Storage** 36GB Western Digital Raptor



## DANIEL EMERY

### GAME TESTS

I may have departed **Custom PC**, but the fun of customising PCs – and playing games – never departed me. When I'm not dismantling my system, or playing RTS, RPS and strategy games (mostly via Steam these days), I'm one of the BBC's technology reporters and a producer on the News Channel. However, I will always have fond memories of my time on **Custom PC**; it was loads of fun.



## JOSH BLODWELL

### STAFF WRITER

After leaving **Custom PC** in 2006, I relocated to the new and glorious Scottish Socialist Utopia.

It has been a busy time for all Scots, deciding how to spend that sweet oil money. The current vote is split between reinvigorating Clyde Shipbuilding, rapid fabrication or turning Loch Ness into a deep fat fryer. [Ed: I've missed you and your inimitable style, Josh!]



## JAMES GORBOLD

### TECHNICAL EDITOR

As one of members of the original launch team behind **Custom PC**, and a contributor to almost every issue since, I have lots of happy memories of seeing new kit, blowing it up and upsetting manufacturers along the way. Even though I now work at Scan, I still read **CPC** every month, as my passion for overclocking, tweaking and gaming is as strong as ever. Happy birthday **CPC**, long may you continue.





# community

Your chance to get involved in Custom PC

## PROJECT READERS DRIVES INVERTED

### meet thy maker

**Name** Martijn Laman

**Age** 35

**Occupation** IT Support

**Location** Bussum, The Netherlands

**Main uses for PC** Gaming, web surfing, movies and so on

**Likes** Modding, music and computer tech

**Dislikes** Sunday drivers and Fanta

Triggered by seeing Thermaltake's Level 10 GT case, Martijn Laman decided to build the unique inside-out PC design he'd had in his head for years



#### CPC: What is Project Inverted?

**Martijn:** It's a PC with the main hardware on the outside of the case or, as some people might say, an

inverted PC. While the idea for an inside-out build was in my head for a long time, the trigger to actually build it was seeing the Thermaltake Level 10 case. This was the closest to what I had in mind, and I decided it was time to build my own version of it. During the build, I drifted away from the boxy look of the Level 10, and decided to use diagonal bars to make it look original.

#### CPC: What's the PC's purpose?

**Martijn:** I wanted a PC that exactly fitted my personal preferences, and something original that would make people look twice. Now that the build is finished, I use it as my general PC, mostly for web surfing and gaming [Battlefield 3].

As the hardware is clearly visible on the outside, I wanted a motherboard with some

sort of wow factor, while also offering a little protection for its hardware. For this reason, I chose an Asus Z77 Sabertooth, since these boards have a full board cover and simply look stunning. The other specs were chosen according to their bang-per-buck ratio, which is why it has a 3570K instead of a 3770. Currently, the system does what I want, but in time, I'll most likely add another GPU so I that can run an SLI configuration.

#### CPC: What other mods have you built?

**Martijn:** I've been modding PCs for a very long time. Way back in the days of the first-generation Pentiums, I built a small PC in an Erres CD player, which I used as a music player connected to my stereo. I also built a car PC, using a VIA EPIA motherboard connected to a 7in touch-screen in my dashboard – I actually reused this screen on the right side of Project Inverted. One of the more recent builds is my HTPC, a Core i3 system build into a Harman/Kardon AVR355

receiver enclosure, which I uses as my XBMC media centre. You can read the project log at <http://tinyurl.com/HKHTPC>

#### CPC: What difficulties did you come across during the build process?

**Martijn:** When making the side panels, I ran into a big issue with the left panel. Once the motherboard was installed, the panel didn't fit between the motherboard and reservoir, so the case couldn't be opened. The solution was to add a hinge to the lower left panel.

Painting also was an issue, since I don't have a workshop, so I had to paint outside.

#### SYSTEM SPECS

**CPU** Intel Core i5-3570K

**GPU** Asus George GTX 670

**Storage** 128GB and 256GB Samsung 830 SSD

**Memory** 16GB 2,33MHz Corsair Dominator

**Motherboard** Asus Sabertooth Z77

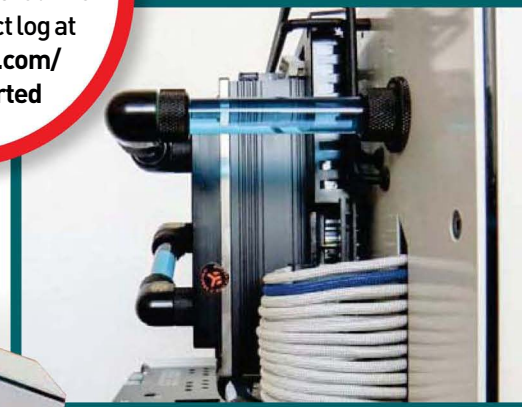
**PSU** Corsair AX750

**Cooling** 2 x EK Coolstream Rad XT 240, EK RAM Dominator X4 Acetal, EK Supreme HF Acetal, 5 x Corsair SP120 Fans and around 50 BitsPower Matt Black Fittings



## SEE MORE

of Martijn's inside-out PC  
in the full project log at  
<http://tinyurl.com/ProjectInverted>



I made a paint booth out of some huge cardboard boxes and took my time with the painting. In total, four layers of primer, and between four and six layers of paint were applied to all the parts. Of course, several small flies also decided to mess up my freshly painted surfaces on occasion.

### **CPC: How easy was it to integrate water cooling into the custom chassis?**

**Martijn:** Most of the integration went pretty smoothly, since the case was built around the water-cooling parts. The hardest part was aligning the tubes from the radiators into the diagonal panel underneath, and aligning the pump and reservoir combo so that it would sit in the middle of the hole in the panel.

Closing the case is tricky too; the top part of the case only has 2.5cm of clearance on the inside, and there are a lot of parts in the top (two SSDs, plus wiring for the 24-pin and

6-pin ATX power connectors, as well as the RGB controller). When the case is closed, I have to be careful not to squeeze the tubing too much, or it will restrict the flow around the water-cooling loop.

### **CPC: What tools and machinery did you use?**

**Martijn:** Unfortunately, I don't have a big workshop (I'd give up a kidney to have one!), so I performed most of the work on a small Black & Decker Workmate in my PC room. The most frequently used tools were my



cordless drill, a small hacksaw and a set of needle files. While I envy some of the guys that have access to laser cutters and CNC equipment, I think I've shown that, with dedication and a lot of time, you can achieve a high-quality finish with only basic tools.

**CPC: What materials did you use, and why?**

**Martijn:** For the frame I used 2.5 x 2.5cm aluminium tubes bolted together with 90-degree angles, while the top and sides are cut into 45-degree angles to give the case a distinct look. For the diagonal parts, I used the same 2.5 x 2.5cm tubes and sandwiched 2.5 x 0.5cm Plexiglas strips in between.

Meanwhile, the side panels are made from 2mm aluminium sheet, which I cut and bent to size, and the meshed parts on the back are made from small aluminium corner strips, hex-mesh and metal putty. Once I'd cut the angles to size, I stuck them to the hex-mesh using metal putty. After all the parts had been cut and filed to size, I started painting, all of which was performed using spray cans.

**CPC: What media interest has the project attracted?**

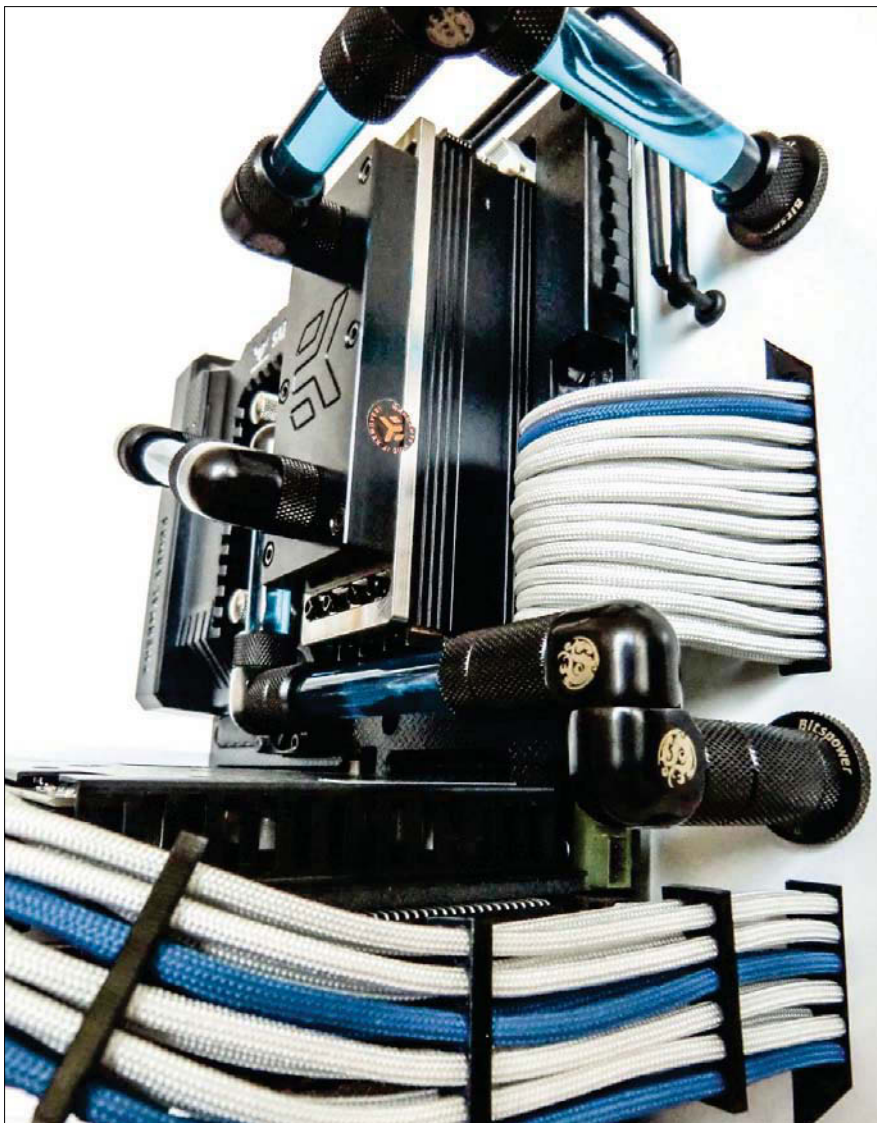
**Martijn:** It made it to Mod of the Month on bit-tech, and it's also been featured on Engadget and in a big article on the Asus RoG site. It also won a couple of small case mod competitions on Facebook, the most recent of which was the Highflow case mod competition at The Party11 – the biggest LAN in the Benelux (Belgium, The Netherlands and Luxembourg).

**CPC: How long did it take you to complete Project Inverted?**

**Martijn:** I started the build early in 2012, and finished it at the beginning of 2013. However, I haven't been working on it full-time; my son was born in April 2012, so I didn't do much modding at that time. Most of the work was performed at the weekends, so the project took me around eight months to finish.

**CPC: What have you learned from the build process?**

**Martijn:** I've learned a lot about water cooling in general, as I'd never experienced using it before. I'm still no expert, but I know most of the ins and outs about water-cooling setups now. I also learned that if you want your PC exactly the way you want it, you have to make it



yourself, otherwise you might not achieve the exact specs you want and may not be happy with the end result.

**CPC: Are you happy with the end result, and what would you do differently if you built it again?**

**Martijn:** I'm very happy with the result. Of course, there are parts I'd like to change or add, but that's just an ongoing process with all

of my builds. My first upgrade is going to be an additional GeForce GTX 670, and adding both GPUs to the water-cooling loop. Looking back, I think I would have also chosen a different pump and reservoir combo. The current pump (a Liang MCP355 and EK X-RES100) is quite loud; even louder than Project Inverted's air-cooled predecessor. Otherwise, though, I love the build and enjoy every minute I'm using it. **CPC**

**BE A WINNER!** To enter your machine for possible inclusion in Readers' Drives, your mod needs to be fully working and, ideally, finished based in the UK. Simply log on to [www.bit-tech.net](http://www.bit-tech.net) and head over to the forums. Once you're there, post a write-up of your mod, along with some pics, in the Project Logs forum. Make sure you read the relevant rules and advice sticky threads before you post. The best entrant each month will be featured here, where we'll print your photos of your project and also interview you about the build process. Fame isn't the only prize; you'll also get your hands on a fabulous selection of prizes – see the opposite page for details.

## Win all these prizes!

We've teamed up with some of the world's leading PC manufacturers and retailers to offer this great range of prizes to each lucky Readers' Drives winner. If your creation is featured in the magazine then you'll walk away with all of the prizes listed on this page, so get in your entries!

### CORSAIR CARBIDE SERIES 300R CASE AND 550W TX MODULAR POWER SUPPLY

Total value £142 inc VAT Manufacturer [www.corsair.com](http://www.corsair.com)

Corsair believes that a great PC starts with a great case. The Corsair Carbide Series 300R is a compact expression of this core philosophy. It packs in a remarkable number of features given its compact dimensions, provides builders with tonnes of room for expansion, and has amazing cooling potential. And, like all Corsair cases, it's built using the finest materials and finished to the highest standards, so it will withstand several years of upgrades.

Just as a quality case is essential to building a quality PC, a high-performance, high-quality power supply is also a vital ingredient. Based on the award-winning TX V2 Series, the new Enthusiast Series Modular PSUs add a modular cabling system for improved installation flexibility. TX Modular power supplies are built using quality components, and are rigorously tested and qualified at 100 per cent load at an ambient temperature of 50°C for unmatched reliability. They're designed to a superior standard so that they not only meet the ATX specification, but also exceed it. In addition to unmatched quality, TX Modular PSUs are also power-efficient, offering 85 per cent energy efficiency or higher at 50 per cent load.

With a Corsair Carbide Series 300R case and 550W TX Modular power supply at the heart of your build, you'll have the foundations for a truly awesome gaming machine.



### MAYHEMS COOLANT AND DYES

Value £50 inc VAT

Manufacturer [www.mayhems.co.uk](http://www.mayhems.co.uk)



Cooling performance is only one part of the equation when it comes to kitting out your rig with custom water-cooling gear. The other major bonus is that all those tubes and gleaming fittings just make your PC look damn sexy, and they look even better when they're pumped full of fancy coloured coolant. As such, we're particularly pleased to have the folks at Mayhems now on board with Readers' Drives; they're currently offering two 1-litre bottles of Mayhems' Pastel Ice White coolant, along with a selection of five dyes, so you can choose the colour that best complements your PC. Check out the blue coolant in our own mini PC mod on the cover of Issue 109 for an example of what's possible with some Mayhems coloured coolant.

### PHOBYA MODDING KIT

Value £50 inc VAT Manufacturer [www.phobyas.com](http://www.phobyas.com), [www.aqua-tuning.co.uk](http://www.aqua-tuning.co.uk)

The Phobya modding kit is designed with the modder in mind, offering great value for money and quality products. The kit includes Nano-G 12 Silent Waterproof 1,500rpm multi-option fans, which use an innovative fan-blade design. As standard, the fans include braided black cables to keep your case looking as neat as possible. The fans are also supplied with a special cable that lets you run the fan at 5V rather than 12V, reducing the noise emitted in order to help you to build a silent system.

The kit also includes the 60cm Phobya 3-pin Molex to 4x3-pin Molex Y-cable. This pre-

braided extension cable gives you extra routing options in your case, and it also enables you to run up to four fans from one compatible motherboard header. Meanwhile, the Phobya SATA3 cables included in the kit offer the same great quality braiding as the

rest of the Phobya range, while also securing your connection with latched connectors. As well as this, the kit includes the Phobya SlimGuide Controller, which gives you the option to vary the speed of other fans in your case, while the Phobya TwinLEDs let you shine a light on your mods.





# how to... Fit CPU heat ducting



Antony Leather shows you a cheap and easy way to lower your PC's temperatures

**T**here are many ways to improve your PC's temperatures. You can buy faster fans, a better CPU cooler or even water-cool your hardware. However, as the temperature rises in summer, even the best-cooled, overclocked PCs are pushed to their limits.

There's a frequently overlooked way to reduce your CPU temperature, though, which doesn't require buying new fans or heatsinks. Ducting can be used to channel cool air directly from outside the case to your CPU cooler. You can even use it to direct the warm exhaust air straight out of your case again.

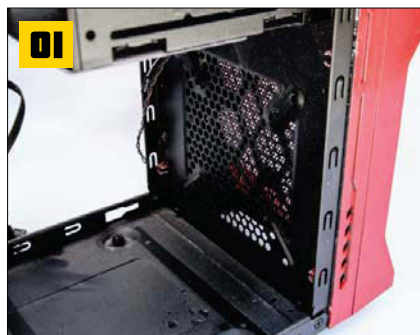
The ducting effectively means that your CPU heatsink receives much cooler air than usual, lowering your temperatures as a result. What's more, all the kit you need costs less than a decent CPU cooler, and the method works with many CPU coolers and even graphics cards.

## tools you'll need

■ **80mm aluminium flexible ducting**  
[www.ebay.co.uk](http://www.ebay.co.uk)

■ **Duct tape**  
Most hardware stores

■ **80mm and 120mm fan adaptors**  
[www.overclockers.co.uk](http://www.overclockers.co.uk)



### IDENTIFY DUCTING MOUNT POINTS

You'll need 80mm, 92mm or 120mm intake fan mounts with a clear path to your CPU cooler via one or two easy bends, so you'll want your duct to avoid graphics cards or hard disk cages. You'll also need a tower-type cooler with fans on one side – a top-down cooler will require too tight a bend with the ducting.



### PLAN YOUR DUCTING ROUTE

The ducting needs to run directly from an intake fan to the fan on your CPU cooler. Bear in mind that, while it's flexible, it still needs room to bend. A vacuum cleaner hose will give you a good idea of what you can expect from the ducting in terms of bending ability.



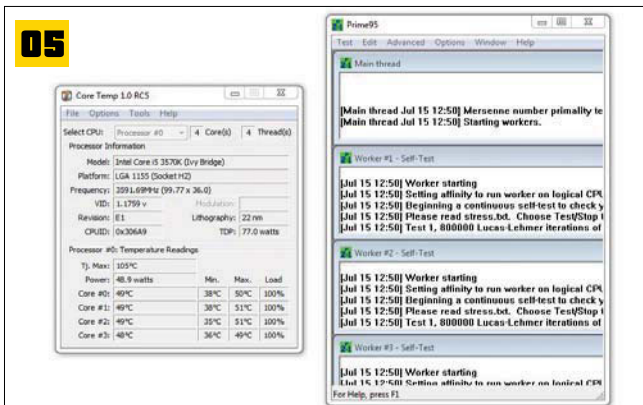
### CHOOSE COLOUR AND MATERIAL

You'll come across various colours and materials of ducting. Plastic ducting might seem attractive, both in terms of colour and the fact that it isn't conductive, but it's often very stiff – especially the ducting used in car ventilation systems. Aluminium ducting is the best option, as it's very flexible and relatively cheap.



### CHOOSE DUCTING SIZE

We've chosen 80mm ducting for our PC. If it were any smaller, it would restrict airflow, but any larger and it would become less able to bend tightly in the small confines of our case. This size of ducting is also easier to mount using standard fan adaptors, which we'll come to in a minute.



## CHECK TEMPERATURES

Record the ambient air temperature with a thermometer, and subtract the result from your CPU temperature in CoreTemp ([www.alcpu.com](http://www.alcpu.com)) to get the delta T. Then use Prime95 (<http://files.extremeoveryclocking.com>) to load your CPU for half an hour, recording the peak temperature.



## BEND DUCTING TO SHAPE

It's likely that the ducting will need to be moulded to your desired shape before you can insert it into the case. Take care not to overbend it, as it may kink, which will probably ruin it or at the very least, make it look unsightly. Practise bending it outside the case first so that you know its limits.



## TEST-FIT DUCTING

It's vital to test-fit the ducting prior to cutting it or fixing it to the fan mounts. You may find you need to remove an internal hard disk cage or other obstruction to make it fit. You also need to make sure it can bend easily, and with little force – we'll only be using tape to hold it onto the fan mounts.



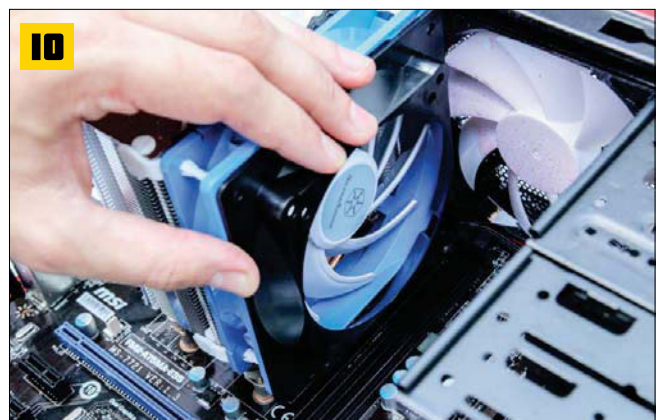
## CUT DUCTING TO SIZE

We've chosen thin aluminium ducting, as it's very flexible and easy to cut. Give yourself a little extra to play with, especially as you haven't fitted the fan adaptors yet. A pair of strong scissors should be able to cut through it.



## TEST-FIT CASE FAN ADAPTOR

Make sure the fan adaptor you're using to attach the ducting to your case fits – some case fans near drive cages have little room around them. You also need to ensure that your ducting fits neatly into the fan adaptor's vent hole. Don't worry if it's slightly too small or too big – duct tape can deal with small differences, but not if it's far too small.



## TEST-FIT CPU COOLER FAN ADAPTOR

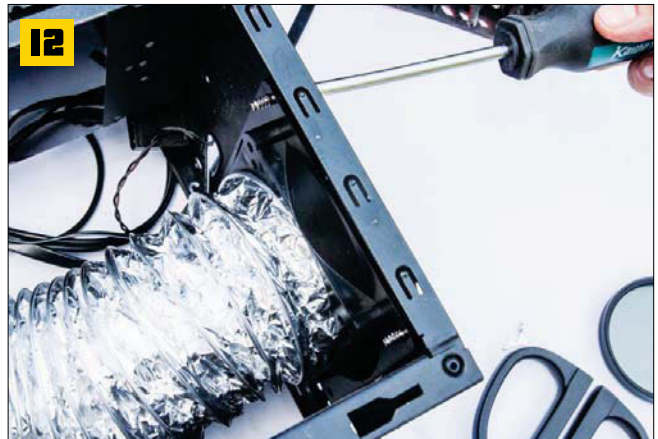
Attaching the ducting to your CPU cooler can be tricky, as all coolers are different. Our cooler uses clips at the rear of the fan to mount to the heatsink, leaving the front mounting holes free for our fan adaptor.





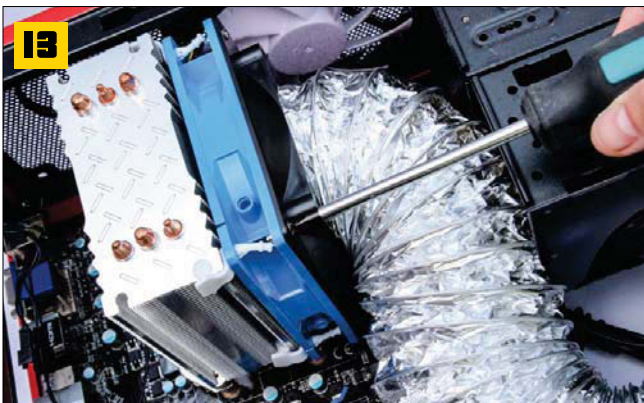
### 11 SECURE FAN ADAPTORS TO DUCTING

The fan adaptors enable you to use small-diameter ducting in your PC case. While cable ties or clips might look neat, the best way to ensure a good airtight seal is to use duct tape.



### 12 SECURE DUCTING TO FAN INTAKE

Secure the adaptors to your case's fans or mounts. We're attaching ours to a vacant fan mount in the front of the case, so the CPU fan can draw in air from outside the case. However, you can easily attach the fan adaptor to an existing fan and take advantage of the extra airflow too, although you'll then lose that airflow in the rest of your case.



### 13 SECURE DUCTING TO CPU COOLER

You may have to resort to using cable ties or smaller screws if your fan is secured using clips from the front. You can also try using rubber fan mounts, which cost a few quid. However, in our case, this job was a simple task of securing the fan adaptor to the fan on our CPU cooler using standard fan screws.



### 14 CHECK FOR SHORT CIRCUITS

Unlike cloth and plastic ducting, aluminium ducting is conductive, so it's vital to check for any areas where the ducting could potentially move and touch your PC's hardware. The most likely culprits will be your graphics card and motherboard.



### 15 INSULATE DUCTING

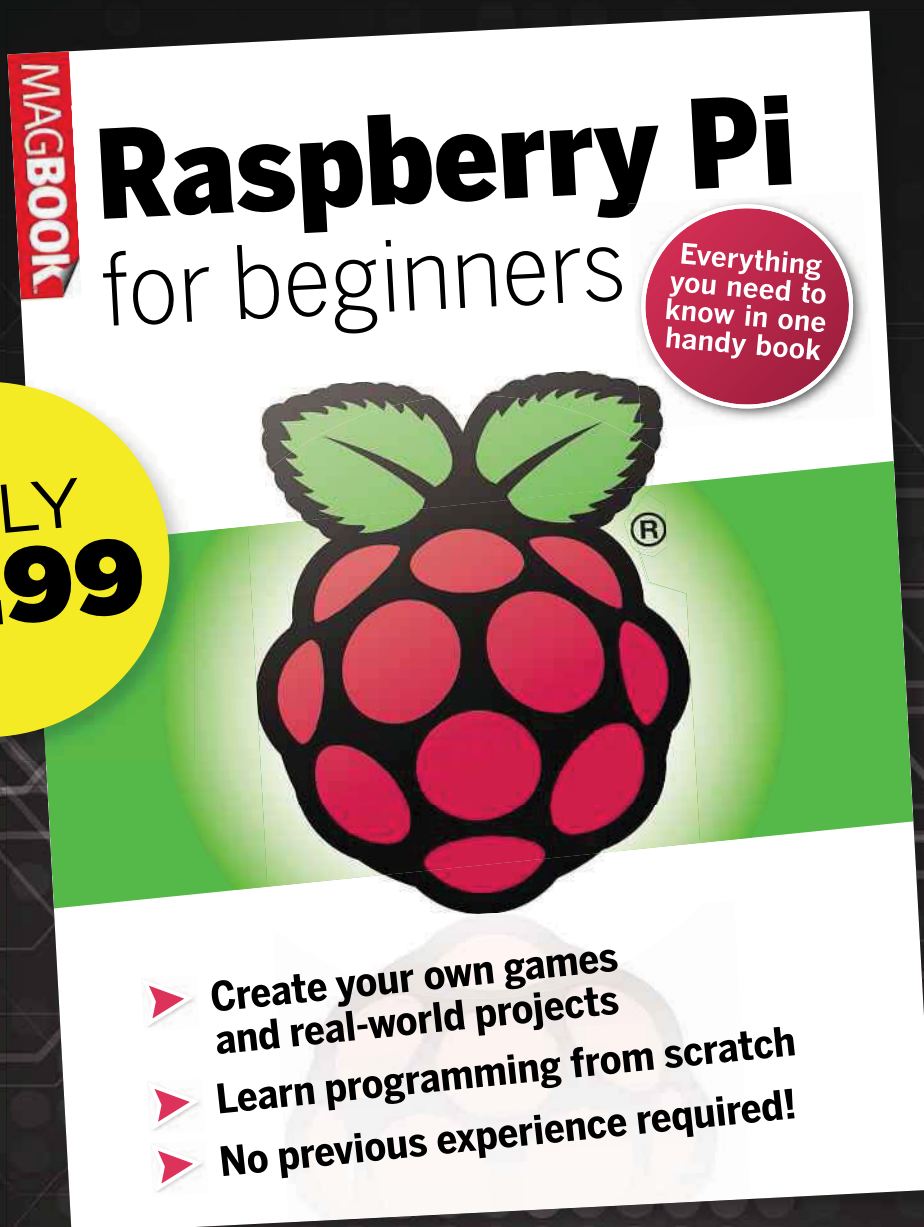
Once you've highlighted the problem areas, use duct tape or insulating tape to mask off the areas of concern. You can place insulation tape on the ducting but, for a less unsightly look, black insulating tape usually blends in well on PCBs and graphics card casings. You can also apply insulation tape to the far side of the ducting, out of sight.



### 16 CHECK TEMPERATURES

Perform a final check to make sure there are no short circuits. Finally, power on your system again, and run Prime95 and CoreTemp to see what difference the ducting has made to your temperatures. It's likely that you'll notice the biggest difference on warm days, and after your PC has been on for an hour or so. **CPC**

The **perfect guide** for  
anyone – from 8 to 88 – on  
learning to program with  
the Raspberry Pi



**ON SALE NOW**

To order direct call **0844 844 0053** or visit **www.magbooks.com**  
MagBooks cover a range of topics, from IT to Motoring and Fitness to Gardening

**FREE  
P&P**

**ON ALL UK  
DIRECT ORDERS**



# how to... automate YOUR cooling system

Whether your PC is water-cooled or air-cooled, automating your cooling system can make a big difference. Antony Leather shows you how

**M**otherboards are pretty good at controlling fans now. With 4-pin power connectors, we can set fan profiles in the BIOS

depending on our preferences and, when combined with thermal sensors, this enables your PC to automatically tune its fan speeds according to the current temperature. Meanwhile, manual fan control can achieve noise reduction too.

There's a better way to fine-tune your PC's cooling system and control more fans though. Automatic fan controllers enable you to set your own minimum and maximum temperatures for your components, while the controller adjusts the fan speeds. You can even hook up water-cooling pumps and flow meters. Here, we'll show you how to set up one, using temperature probes to monitor the coolant temperature in water-cooling systems to determine fan and pump speeds.

## tools you'll need

■ **Automatic fan controller**  
[www.kustompcs.co.uk](http://www.kustompcs.co.uk)

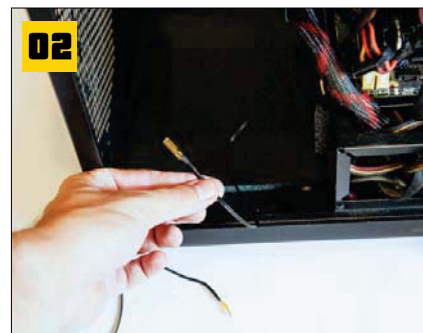
■ **G1/4in thermal probe**  
[www.specialtech.co.uk](http://www.specialtech.co.uk)

■ **Fan splitter cables**  
[www.specialtech.co.uk](http://www.specialtech.co.uk)



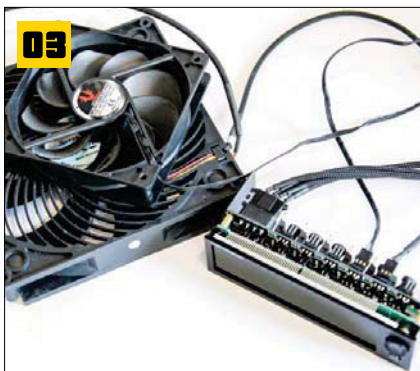
### 01 COUNT YOUR FANS AND PUMPS

To ascertain which fan controller you need, count the fans and pumps you want to control, so you know how many channels you need. Different controllers will have various power limits per channel, so you'll also want to add up the total wattage of all the devices you'll be connecting to each channel, especially pumps.



### 02 PLAN THERMAL PROBE LOCATIONS

There are two types of thermal probe – air-based, which need to be attached to your case or hardware, and coolant-based, which use a G1/4in plug to measure the coolant temperature in your water-cooling loop. Make sure the probes can reach back to the controller, but are still placed so they can function as necessary.



### 03 TEST FANS

You may want to turn off all or some of your fans when you're just typing or browsing the Web. However, some fans whine or fail to start properly if they're given voltages below 7V. Find the lower limits of your fans' voltage where they don't whine and also start spinning.



### 04 TEST PUMP

Some fan controllers can reduce the voltage supplied to your fans and pumps to 0V, effectively switching them off, which is handy for fans, but not recommended for pumps. We've set our pump's voltage manually at its lowest speed, which will have little impact on cooling, but will reduce noise and vibration considerably.



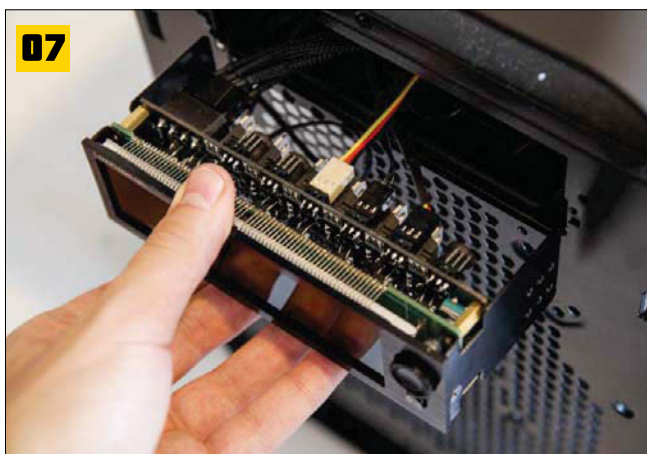
### STICK THERMAL PROBES TO CASE

In the event that your fan controller doesn't include adhesive strips, you can use double-sided mounting tape to secure them in place. You can mount them on hard disks to control fans nearby, or on the exhaust side of heatsinks to control CPU or radiator fans.



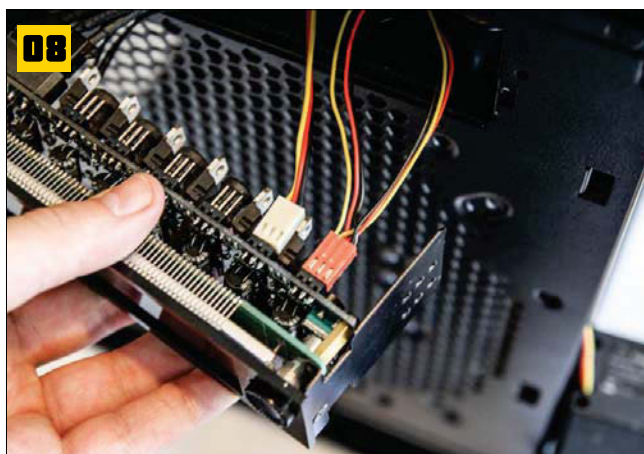
### INSERT FLOW METERS AND COOLANT PROBES

The coolant probes usually come pre-assembled, and simply need to be screwed into a free G1/4in hole. The coolant temperature tends to even out over the loop, so you can install them pretty much anywhere. Avoid placing them at the top of upright radiators or reservoirs, though, as the coolant may not reach them.



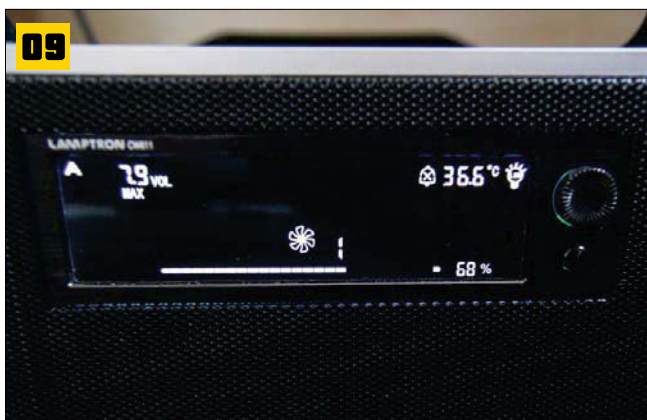
### CONNECT CABLES TO FAN CONTROLLER

Our fan controller has six thermal probe ports and six 3-pin fan headers. Each thermal probe port is linked to a particular fan header, so controlling the rear and roof fans with a single probe requires us to wire up both to the same connector. Connect all the cables before you secure the fan controller, using extension cables if necessary.



### USE FAN SPLITTER CABLES

If you plan to connect several pumps or radiators to a specific channel so that they can be controlled by a single thermal probe, you'll need a fan splitter cable. This might be necessary if you want the fans on a radiator and a pump to be controlled using a single coolant temperature probe, for example.



### PROGRAM CONTROLLER

Most automatic fan controllers have lower and upper voltage settings and a temperature target. Some also have fan profile curves, so the voltage responds to the temperature. With our Lampton CW611, we've set the minimum and maximum fan voltages to 4.5V and 10V respectively, and the target coolant temperature to 30°C.



### TEST SETTINGS

Once you've programmed your controller, run Prime95 and Unigine's Heaven benchmark (<http://unigine.com>) at the same time to put maximum stress on your system. Leave it running for 30 minutes, and record the temperatures of your CPU and GPU to see if your fan controller can deal with the extra heat. **CPG**



# Letters

Send your feedback and correspondence to  
[letters@custompcmag.org.uk](mailto:letters@custompcmag.org.uk)



## SOUND JUDGMENT

After reading Issue 120, and looking at all the lovely tech

you've reviewed, I happened to notice a few problems with your Elite list. I don't wish to sound like an Internet troll, sitting here full of rage and hate, feeling superior and smug, but a few minor compatibility issues have caught my attention.

Firstly, in your Mid-Price Gaming PC, you have an MSI Z87-G45 Gaming motherboard, which has lots of PCI-E slots. However, the sound card, an Asus Xonar DG, in that same list has a legacy PCI interface, and is therefore incompatible.

A second grey area is with your Extreme Ultra PC list. The motherboard is a Gigabyte GA-Z87X-OC and the sound card is a Creative Sound Blaster Z, which are both great-looking bits of kit. However, with the inclusion of a dual-slot GPU, the only PCI-E slot on the motherboard is obscured, so you can't fit a sound card at the same time.

**Michael Maher**

**Ben replies:** Argh, you're absolutely right about the PCI card. That's a horrendous mistake, and one that we'll rectify straight away by removing that card from the Mid-Price Gaming PC on the Elite list. Basically, we didn't finish the motherboard Labs test, and correct the Elite list, until the week we went to press last issue, due to various problems, and that was just a factor that didn't get considered.

You're right to say that the issue with Extreme Ultra PC is a grey area though. In case you don't know, you can put any PCI-E card, whether it has a 1x or 4x sized slot,



1x PCI-E devices such as the Sound Blaster Z will still work in a 16x PCI-E slot

into a 16x slot – it just won't use the rest of the slot. The PCI-E interface, and the slot design, is really clever like that. As such, the Sound Blaster Z will work just fine in any of the many 16x slots on that board.

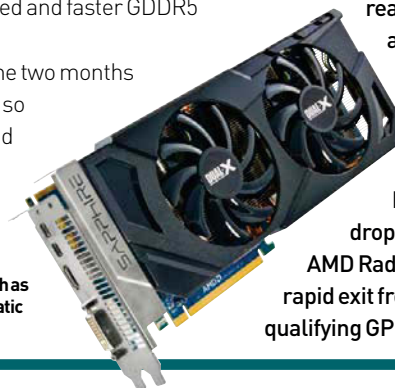
## MISSING GPU

I wanted to voice my disappointment with your graphics card super-test. You claimed to test 'every GPU,' and then left out the most powerful weapon in the AMD line-up – the 7870 Tahiti LE. It has the performance of a 7950 for the price of a 7870, so it would blow everything else away in terms of bang per buck.

It was another unfortunate naming misfire by AMD, letting its vendors choose a new name so they could sell off 7950 chips that had another four cores disabled. The misleading name belies the card's performance, though, as the 7900-series AMD cards use a different core chip to that of the 7800-series cards. The performance difference isn't even as large as the reduction from a 7970 to 7950, because the core clock is increased and faster GDDR5 memory is used.

I paid £169 for mine two months ago, from Novatech, so postage was free, and I got three free games in the AMD

The supply of cards based on the 'Tahiti LE' GPU, such as Sapphire's 7870 XT, is erratic and unpredictable



reloaded bundle – worth at least £50 (Crysis 3, BioShock Infinite, and Far Cry 3). Many other retailers have them too, including Aria, Overclockers, Dabs and Scan.

And today it's only £159. It's been around since February 2013 at least, so it isn't a surprise, nor limited in availability. It's perhaps the best-kept AMD secret, and I suspect it would have easily topped the super-test. Instead, you kept saying the Nvidia 660 was cheaper than a 7870, and while a 7970 challenged for the win of the next class up, it costs almost twice the price.

I haven't overclocked mine, but I've read that most folk can take their 975MHz cards straight to 1,100MHz with no problems, so losing the cores hasn't affected overclocking ability. The only downside is the increased power consumption, since it's basically a 7950. I was bitterly disappointed to see **Custom PC** miss it out, while claiming to be testing every GPU. If it were a no-hoper budget option then it's no big deal, but as a potential test winner, that's a big error indeed. Consider yourselves chastised.

**Alex Shaw**

**Harry replies:** You make a good point. However, while we're certainly aware of the 7870 XT's (or Tahiti LE) existence, we opted not to include it for a number of

reasons. The first is that it isn't an official AMD SKU, but a board-partner model using the Tahiti GPUs that didn't quite make the 7950 3GB grade. With no official backing, the SKU could be dropped at any time, as with the AMD Radeon 5830, which made a rapid exit from the market in 2010 once qualifying GPUs ran out.



## Twitter highlights

Follow us on Twitter at @custompcmag



**TheHarryButler** It is with a proper lump in my throat that I announce I'm leaving @CustomPCMag and @bittech Been the best five years of my life, Thank you!

**Ben:** For everyone who doesn't know, we're very sad to be saying goodbye to our loud, lively and shorts-clad technical editor Harry Butler this month, as he's gone and got himself another job. Farewell dude, we'll all miss you!



**frequentlyrare** Another great article by @CustomPCMag's @ghalfacree – my Nook Simple has just become a lot more interesting, thanks!

**stevefarnworth** Whoop, Kindle installed on the Nook. Thanks @CustomPCMag and all the devs!

**TobyJKing** Perfect, my mag arrived on the hottest day of the year so I'm just going to sit in the garden with a beer and read it :)

**JK95x** In Issue 119, p66, is this article about the Zotac GTX 660 or the GTX 660 in general?

**Ben:** It's about the GTX 660 in general – that Labs test was about the GPUs, as opposed to this month's test, for example, which is about specific cards.

**kamr32 @cliffski @CustomPCMag** 'Global Game Design' (119) was an awesome article – thanks a bunch for sharing. Convinced me to become a subscriber!

**Ben:** Excellent, thank you! We love having Cliff on board.

**smalltown2k** I'd hoped for a "Premium Grade" but I guess I can settle for an "Approved" for my beverage. ;-)



The second reason is stockists. While there may be some stock today at Novatech (and Overclockers), an exhaustive search during the writing of our GPU super-test revealed not one of the retailers you mentioned stocked Tahiti LE cards, which are only available in limited and erratic quantities. We have an editorial policy of only looking at products on sale in the UK, and the fact that we were unable to find a single SKU on sale, or a stockist accepting pre-orders, rang warning bells. After all, we don't want to recommend a card that no one can actually buy.

However, you're right that the 7870 XT is very competitive, especially at £160. At that price, it's easily a better bet than the GTX 660 2GB. Regarding AMD's Never Settle bundle, we've always approached software bundles as a bonus rather than adding extra value to a product. A potential buyer may have already purchased the games, or simply not want to play them. We similarly

ignored Nvidia's Free2play bundle, as well as any rebate programs or bundled games. These can change quickly, so they tend to muddy the value waters.

### TIPPING THE SCALES

I enjoy reading your magazine cover to cover every month. I find the review sections very informative, especially with the bar-graph comparisons showing games and app performance between stock and overclocked setups. However, I've noticed that in most of the frames-per-second charts the scaling stops at 100fps, while the results can exceed this result. For example, on p31 of Issue 120 Battlefield 3 has up to 107fps, but the graphic stops at 100fps.

While the figures are correct, this provides a misleading graphic, as the delta from stock to overclock frames isn't accurately represented. Also, in the motherboard group test in Issue 120, you rescaled the graphs from 0fps to 150fps, so

no maxing the graph occurs. If you could apply this new scaling to all tests that exceed 100fps, the problem would be solved. Thanks for a consistently good read.

**Henry Rawlinson**

**Ben replies:** Thanks for the feedback, Henry. We generally only increase the scale of the graphs when the results are significantly higher than the current scale. They start to look a little odd with scales that go up to 110fps, rather than a round number such as 100fps or 150fps. It was worth our while to enlarge the scale for the Skyrim graphs in the motherboard group test, as all the boards were hitting over 140fps. In general, though, I largely think that frame rates over 100fps are pretty meaningless unless you're vaguely looking at potential future-proofing – if a frame rate doesn't dip below 60fps then you're not going to see the difference, whether it's hitting 107fps or 100fps. **CPC**



CUSTOM PC

**SPECIAL  
CUSTOM PC  
BIRTHDAY  
OFFER**



# GET 50% OFF CUSTOM PC

To celebrate **Custom PC's 10th birthday** (and to apologise for ruining the cake), we're offering a **year's subscription for just £27** - that's a whopping **50% saving** over the newsstand price.

This is a **very special, limited-time offer** to say thank you to all our readers; without you we simply wouldn't be here.

So whether you're a Custom PC veteran, or just picking a copy up for the first time, we hope you'll choose to join us for the next 12 months. After all, with the challenge of next-gen consoles looming, the launch of DDR4 coming up and the Oculus Rift on the way, it looks like our 11th year will be anything but dull.

To claim this exclusive offer,  
quote code **D1310P** when you call

**0844 844 0032**

or visit [www.dennismags.co.uk/custompc](http://www.dennismags.co.uk/custompc)



FROM THE MAKERS OF **CUSTOM PC**



***bitGamer***

**www.bit-gamer.net**

**YOU'VE GOT THE HARDWARE,  
NOW FIND OUT HOW TO USE IT**



**XBOX 360 • PLAYSTATION 3 • PC • Handhelds**

# FOLDing@home

Join our folding team and help medical research

## WHAT IS FOLDING?

Folding@home uses the spare processing cycles from your PC's CPU and graphics cards for medical research. You can download the client from <http://folding.stanford.edu> and our team's ID is 35947. Once you pass a significant milestone, you'll get your name in the mag. You can also discuss folding with us and other readers on the [www.bit-tech.net](http://www.bit-tech.net) forums.

## FOLDER OF the month

We catch up with folder of the month: Scorpuk

**CPC:** So who is Scorpuk?

**Scorpuk:** My name is John Downie, and I'm a senior project engineer for EnerMech Ltd.

**CPC:** When did you start folding?

**Scorpuk:** It was an article in **Custom PC** magazine absolutely eons ago that got me started, but at the time I didn't have much in the way of processing power, so I eventually gave up. However, just over a year ago, I decided to have another attempt, as I had much more processing power – since then, I've been improving my folding performance when possible.

**CPC:** What excites you the most about folding?

**Scorpuk:** Checking the stats at <http://folding.extremeoverclocking.com> to see how close I am to other team members. There's also the fact that my otherwise idle processing cycles are contributing towards a goal that could help others, and possibly myself, in the future.

**CPC:** How many PCs do you have folding?

**Scorpuk:** I currently have three machines folding 24/7: a four-processor Opteron (6274) system with 64GB of RAM and 21TB of hard drive space; a Core i7-2600K with 8GB of RAM and a 150GB hard drive; and a Core 2 Quad Q9450 with 4GB of RAM, a GTX 460 and a 2TB hard drive. I also occasionally fold with my gaming rig, which has a Core i7-3930K

running at stock speeds, along with a GTX 580 and 16GB of memory.

**CPC:** What's your best piece of folding kit?

**Scorpuk:** My four-processor Opteron (4 x 6274), which is water-cooled using a nine-fan radiator. This is also my media server, which runs MythTV with a quad DVB-T2 tuner under Ubuntu 12.04.

**CPC:** What's your worst folding experience?

**Scorpuk:** Having to switch off my Opteron server during the summer months last year, as it became unbearable to sleep in my room.

**CPC:** And the best?

**Scorpuk:** Setting up the Opteron server and seeing the huge leap in points I achieved in the first week.

**CPC:** Do you intend to keep up your current production level?

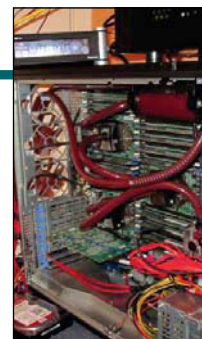
**Scorpuk:** I hopefully might be able to increase it at some time. I'm looking at Intel's new Haswell processor with interest, and possibly an AMD 8970.

**CPC:** What operating systems do you use?

**Scorpuk:** A mixture of Windows 7 64-bit with the v7 client, and Ubuntu 12.04 with the v6 client.

**CPC:** Any tips for fellow team members?

**Scorpuk:** If you have any problems, the



forums at <http://forums.bit-tech.net> are there to assist you. Everyone is willing to help, and there are no silly questions.

**CPC:** What do your friends and family think about your folding?

**Scorpuk:** My family are supportive, but my work colleagues think I'm strange!

**Team rank** 11

**World rank** 338

**Score** 118,956,457

**Work units** 6,236

**Daily points average** 455,453

### TOP FOLDERS

This month's shout-outs go to Dickie, Assassin8or and Slavcho. If you fold under any of these names, email [folding@custompcmag.org.uk](mailto:folding@custompcmag.org.uk)



## MILESTONES THIS MONTH

Username	Points milestone	Username	Points milestone	Username	Points milestone	Username	Points milestone
David	20000	jonathan thorpe	80000	Johnny2Bad	700000	ITHelpDirect	2000000
Liam266	20000	cal1902	100000	Lord_of_the_Nazgul	800000	maniyer	3000000
Maxwell_Bibby	30000	DJcarrot	100000	pipnina	800000	Dickie	4000000
Ollicle	30000	r4tch3t	100000	SkyTsar	900000	mikeyboy1973	6000000
Oscar_Unwin	30000	anadir	200000	SMauri	900000	rjcman	6000000
SuperLeon	30000	Chunky Brother	200000	Jon_Simmo	1000000	Laguna2012	8000000
Techie_Taylor	30000	pete	200000	mjperry	1000000	Tecnojedi	8000000
ericbau	40000	AtomicSpace	300000	Qazax	1000000	Looney	9000000
happysam10	50000	Pausanias828	400000	RDL_Mobile	1000000	luckybfocus	9000000
daza17	60000	SLOcaliGREEK	400000	biffa72	2000000	Witness	9000000
Sean_Fletcher	60000	ligmon	500000				
SniperPan	60000	bbnsol	600000				
Bob_D	80000	Froskoy	600000				
BP_Evil_Element	80000	gKitchen	600000				

World rank	Team name	Points	Daily points average	Time until overtake
7	Custom PC & bit-tech	7,516,626,259	5,538,534	0
10	Hardware.no	4,350,539,605	9,782,756	2 Years
18	Team MacOS X	3,263,596,149	7,680,485	5.4 Years
14	Hewlett Packard	3,502,115,215	6,662,614	9.8 Years
23	OcUK	2,188,385,938	6,809,496	11.5 Years
43	Team Board GameGeek	1,340,420,742	6,141,185	28.1 Years

Username	Points milestone
Desertbaker	10000000
Oatyflapjack	10000000
Assassin8or	20000000
johnim	60000000

## TOP 20 OVERALL

Rank	Username	Points	Work units
1	Dave_Goodchild	434,119,958	113,122
2	DocJonz	396,273,617	153,502
3	coolamasta	321,880,994	148,009
4	phoenicis	242,749,289	94,800
5	zz9pzza	211,014,628	15,794
6	Nelio	186,340,451	46,263
7	Christopher_N_Lewis	152,182,259	35,781
8	StreetSam	147,477,753	77,189
9	Wallace	144,932,909	5,933
10	Lizard	131,878,662	60,132
11	Scorpuk	116,944,038	6,180
12	Ben_Lamb	111,669,297	2,435
13	CustomBitChimps	101,613,749	47,983
14	Lordsoth	98,761,888	74,046
15	fir3x	88,636,155	15,137
16	The_M2B	84,023,080	44,722
17	BennieboyUK	78,482,604	4,832
18	PC_Rich	73,656,954	57,936
19	One_Box	68,432,279	7,416
20	johnim	62,494,929	69,403

## TOP 20 PRODUCERS

Rank	Username	Daily points average	Overall score
1	DocJonz	631,490	396,273,617
2	coolamasta	533,740	321,880,994
3	Nelio	503,577	186,340,451
4	Scorpuk	498,332	116,944,038
5	Ben_Lamb	255,704	111,669,297
6	Lordsoth	214,307	98,761,888
7	Wallace	146,899	144,932,909
8	BennieboyUK	142,138	78,482,604
9	piers_newbold	134,871	56,400,379
10	johnim	114,605	62,494,929
11	LordBadger	92,023	59,996,959
12	fir3x	85,858	88,636,155
13	Dickie	82,311	4,993,912
14	KevinWright	79,662	29,250,081
15	The_M2B	79,043	84,023,080
16	Dave_Goodchild	72,374	434,119,958
17	PC_Rich	69,663	73,656,954
18	Assassin8or	68,478	20,579,743
19	ITHelpDirect	67,661	2,150,590
20	Slavcho	58,791	36,210,196

# Coming next month in CUSTOM PC\*

## Power supplies

We can't emphasise the importance of buying a quality PSU enough, but which should you buy? We'll be pushing a pile of them to their limits to find out.



## Fibreglass

Antony Leather delves into the wonderful world of fibreglass, showing you what you need to use it, and how best to work with this material for modding purposes.



## Intel MinnowBoard

You know the maker scene has gone mainstream when Intel gets involved. Gareth Halfacree checks out the company's new open hardware development board.



## Saints Row IV

The ridiculously over-the-top open game world of Saints Row is subjected to an alien invasion. Is it genius, or is it gratuitous OTT pish for the sake of it? Rick Lane finds out.



# On sale 19 September, 2013

\*Please note that these articles are subject to product delays and time dedicated to nursing celebratory hangovers.

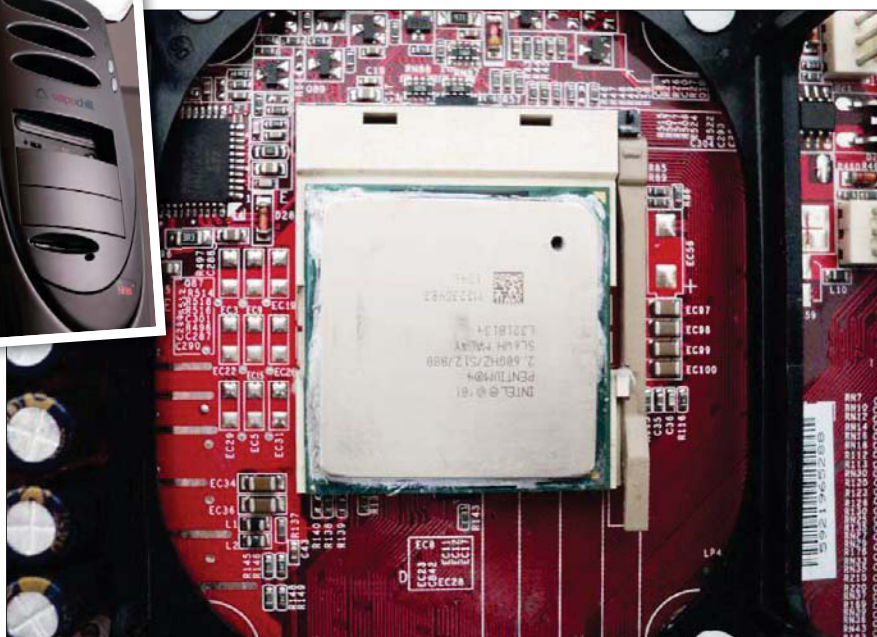




## Beat the office

Ben Hardwidge

benchmarks the CPU from Issue 1's Beat the Office PC to see how it fares now



**T**hrow it at the wall like a shuriken, suggested Erikir Dietrich. Blend it and keep the processor dust in a mini urn, said Dan Evans. Give it to me and I'll kill it with a hammer, proposed Michael Quinn. Blow it up, Mythbusters-style, advised Andrew Levick.

This is just a selection of the advice given on our social media channels when we posted a photo of the CPU from **Custom PC's** Beat the Office machine from Issue 1. We may even have a go at one, but first we wanted to try benchmarking it against the latest gear as a measure of progress. Was this 2.6GHz Pentium 4 really so useless that it deserved to be destroyed, or could it still be useful?

For those of you who aren't decrepit enough to remember Issue 1, we used to run a competition called Beat the Office. We got hold of a monstrously overclockable 2.6GHz Pentium 4 Northwood engineering sample, stuck it in a Vapochill phase change unit that brought the temperature down to -22.5°C, and clocked it up to 3.5GHz. The first reader to beat our benchmark scores won a prize – the Beat the Office machine itself.

Sadly, both the Vapochill unit and the highly clockable EPoX EP-4PDA2+ motherboard used in the machine had bitten the dust, but we managed to track down another Socket 478 motherboard and a compatible air cooler in the lab. We weren't able to replicate the monstrous overclock of Beat the Office. In

fact, the MSI 865GM3 motherboard we used wouldn't even take the CPU to 2.7GHz without spitting out its dummy. However, we decided to soldier on and benchmark the CPU at stock speed, just to get an idea of how far we've come in the past ten years. Clock speed isn't everything these days, after all.

What first struck us about using the system was just how long it took to boot Windows. For the sake of easily accessible drivers, we decided to use Windows XP, but the reliance on mechanical storage still meant it took a long time, and when it had booted, it lacked the instant responsiveness of Windows 7 or 8 on a top system today. Solid state storage has really transformed how we use our PCs in recent times.

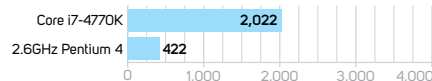
Even we weren't prepared for the colossal difference in benchmark performance, though. After all, our Media Benchmarks suite has been around since 2007 – a CPU from 2003 shouldn't be that much slower, should it? Boy, were we wrong. Watching the machine struggle through our benchmarks was a painful experience, just going to show the awful inefficiency of Intel's NetBurst architecture, and the difference made by having multi-core CPUs.

The 2.6GHz Pentium 4 had just one core with HyperThreading, so it really didn't like anything that relies on multiple threads, such as our multi-tasking and video encoding benchmarks. In particular, its result of 0.47

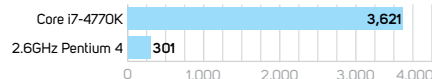
in Cinebench is pitiful. Not surprisingly, the test in which it performed best was our single-threaded Gimp image editing benchmark, but the inefficiency and poor IPC (instructions per clock) of the Pentium 4 was still very evident.

In short, CPUs have come a long way since Issue 1, especially when it comes to multi-threading. Now, where's that hammer? **GPC**

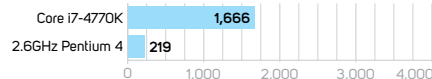
### GIMP IMAGE EDITING



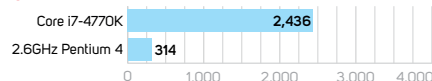
### HANDBRAKE H.264 VIDEO ENCODING



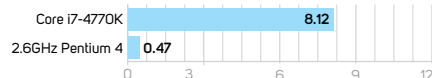
### MULTI-TASKING



### OVERALL



### CINEBENCH R11.5



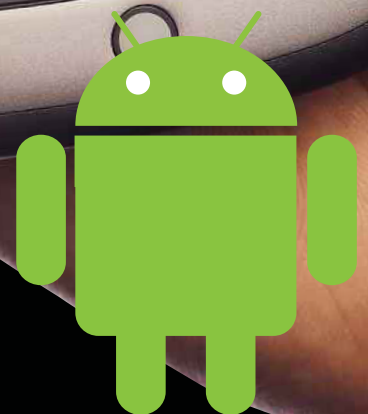
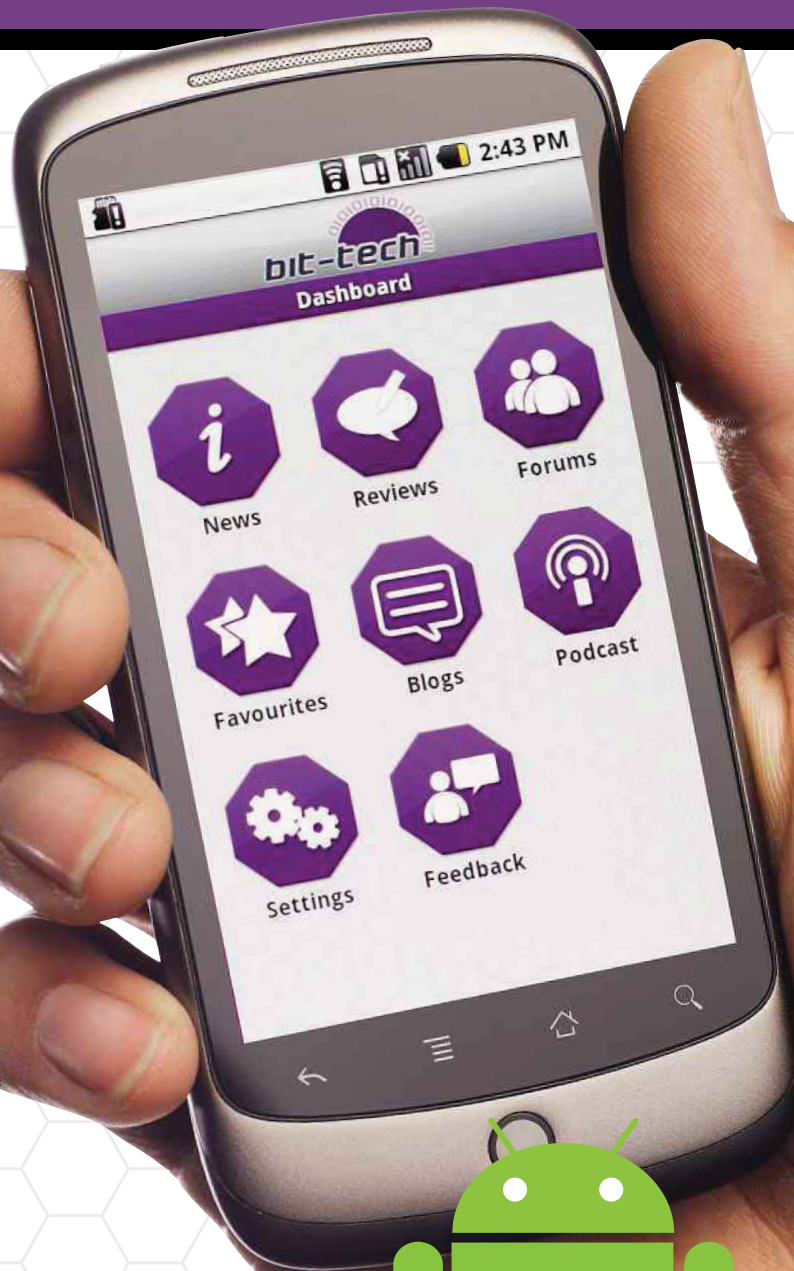
### TEST KIT

MSI 865GM3 motherboard, 2GB of Corsair PC3200 DDR memory, Arctic Cooling Freezer 4, Asus Radeon HD 3450 graphics card, 250GB Samsung SpinPoint hard drive, Windows XP Professional 32-bit.

# The best computing hardware and gaming reviews straight to your Android phone



- The very best in computer hardware reviews, modding, gaming and news direct from bit-tech.net
- Access and post to the forums straight from your phone
- Add sections to your favourite list and easily follow the news you're most interested in
- Play podcasts
- Share content on Facebook, Twitter and by email



Download now  
using this QR code

or Download now from <http://app.bit-tech.net/>



**JAMES GORBOLD**

# GRATUITOUS TOUCH-SCREENS

James Gorbold questions the latest fad of adding touch-screens to everything



**E**very few years, the tech industry becomes fixated on a new technology, or a new marketing term, and it then gets shoehorned into every device under the sun before you have time to say 'stereoscopic what?' The latest fad to sweep the industry is the touch-screen, with companies now desperately making every product touch-controllable.

Now don't get me wrong; touch-screens, when implemented properly, can offer great ways of controlling a device. Try switching back to a manual, button-only phone, or a stylus-controlled PDA, from your modern smartphone or tablet and you'll see what I mean. It isn't only that modern devices have high-resolution colour screens and are Internet-enabled; they're simply easier to use, thanks to the inherent easiness of using your fingers to manipulate a device that you're already holding in your hands.

Touch-screens also have a place in some static devices, such as interactive information displays in public transport stations and shops. After all, you wouldn't want to have a keyboard or mouse sitting next to such devices – they'd not only be unusable for some computer-illiterate people, but would also be either mashed into pieces or nicked before they could become cost-effective.

However, that doesn't mean touch-screens offer the best way to control every device. Where I personally draw the line is with my rule that any device I'll be using for long periods of time shouldn't have a touch-screen. Why? It's simple; I don't want to have to peer at the screen through a haze of dirty fingerprints and human grease. I'm happy to tolerate this experience on my smartphone, because I have plenty of other devices for my other computer activities, such as a TV and projector for watching films, a PC for work and play, and a Kindle for reading ebooks.

**I don't want to peer at the screen through a haze of fingerprints and human grease**

I think this is a common sense approach to readability, but the industry seems convinced that, in the future, all laptops should have touch-screens too. This is despite the fact that all laptops have a keyboard and pointing device already built in to them. If it doesn't, then it isn't a laptop – it's a tablet. This means we'll all be paying more for our laptops in the future, as it costs around \$80 to implement a touch-screen. What's particularly tragic is that the incoming swarm of touch-enabled laptops doesn't seem to be driven by consumer demand, but by the expectation that, since

Windows 8 supports touch-screens, touch-screens should be added to laptops too.

There's also a strong argument against using a vertically mounted gestural interface such as a touch-screen on a laptop for extended periods too. Known colloquially as 'gorilla arm' – since that's what your arm ends up looking like – the human arm simply

isn't designed to be held out in front of your face for long. After all, this is why the holster was invented – it's bloody knacker to hold a pistol out at arm's length all the time!

That's enough about my second favourite pastime though; I'd love to hear from you, and find out if I'm not alone in being fed up with touch-screens being implemented unnecessarily. Do you want to control your PC or laptop with a touch-screen, or is there no point when you can already use a keyboard and mouse? Feel free to let me know your thoughts at [jamesg@scan.co.uk](mailto:jamesg@scan.co.uk)

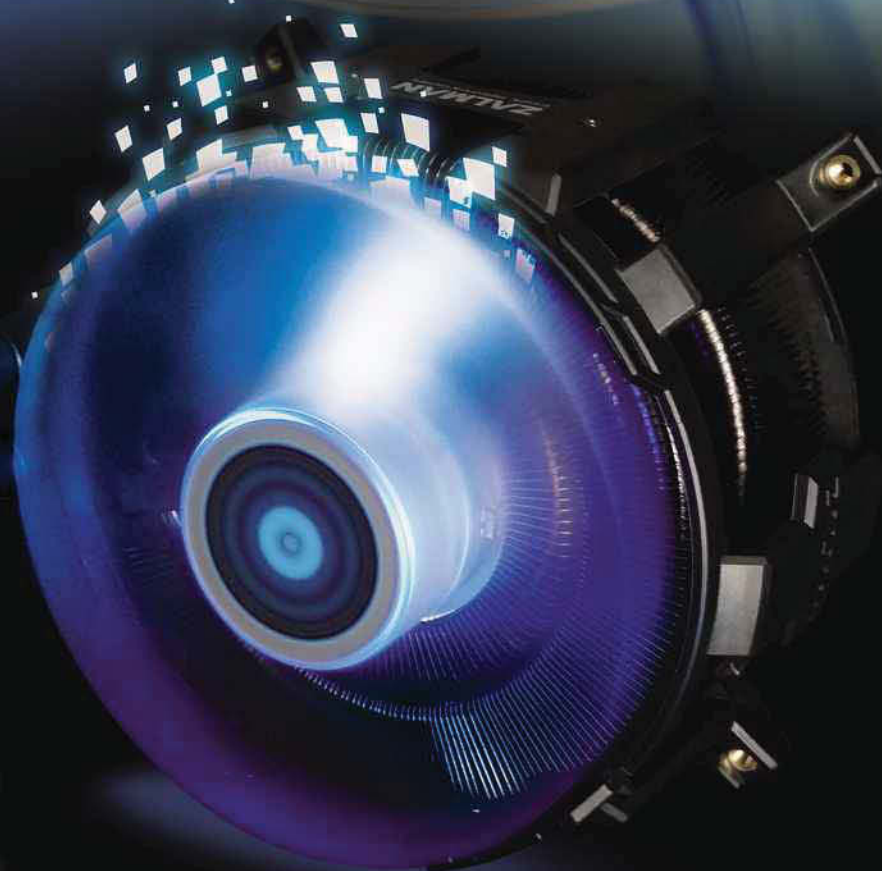
**James Gorbold fell in love with the original IBM PC in the early 1980s and has been building, tweaking and overclocking PCs ever since. He has written an article in almost every issue of Custom PC and now helps Scan Computers to develop new systems.**

**ZALMAN**  
COOL INNOVATIONS

# THE WORLD'S FIRST NANOFLUIDS LIQUID COOLER



CES 2013  
INNOVATION  
AWARD  
HONOREE



## ULTIMATE LIQUID CPU COOLER RESERATOR ③ MAX

Nanofluids helps to increase thermal conductivity dramatically  
Up to 400W ultra silent powerful cooling

- Dual radial radiator designed to maximize the air flow structure
- Dual-path radiator to optimize heat transfer and cooling performance
- High-performance built-in water pump to ensure maximum flow rate

120mm extra fan available for over-clockers

The above images are simulated images may differ from actual product.  
For more information visit [www.zalman.com](http://www.zalman.com)

**Quietpc.com**<sup>™</sup>  
*hear yourself think*

Tel : +44 1653 668000  
[www.quietpc.com](http://www.quietpc.com)



Sales Hotline +44 0871 622 7500  
[www.vip-computers.com/uk](http://www.vip-computers.com/uk)



# www.scan.co.uk

t: 0871-472-4747

SCAN COMPUTERS

## A 3XS PC is the definition of an award-winning system



GAMING  
LAPTOPS

GAMING PCs

OVERCLOCKED  
BUNDLES

## Built for enthusiasts



ALL - IN - ONES

PRO AUDIO

PRO GRAPHICS

PRO VIDEO

## By enthusiasts, for whatever your use...



3DArtist DEVELOP3D



### Scan Platinum Partners



#### NVIDIA GeForce® GTX760

GeForce® GTX 760 is the new weapon of choice for gamers—a powerful GPU that gives you the fast, smooth, quiet gaming you're looking for in all your favorite titles. It's packed with next gen features like NVIDIA GeForce Experience™ and GPU Boost 2.0



#### Corsair Raptor Gaming Peripherals

Your games. Your rig. Your tactics. Your style.

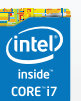
Corsair gaming mice and keyboards combine superior responsiveness, precise accuracy, and reliable controls to allow you to perform at your highest level.



#### Intel® 4th Gen Core Processor Family

Unlock the power within and take your experience to an incredible level with the New 4th gen Intel® Core™ i7 processor.

Remove the limits and see what happens.



Don't buy hardware without Scansure protection. 28 day installation damage insurance [www.scan.co.uk/scansure](http://www.scan.co.uk/scansure).



Scan Finance. Buy now, pay 10% deposit\* and spread the cost over 36 or 48 months when you spend £300 (inc vat) or more.

Prices correct at time of print. Classic credit options (36 or 48 months). Customers will initially only have to pay a 10% deposit, with the original loan amount payable over 36 or 48 months.  
\*Example: £1,000.00 Deposit: £100.00 Amount of loan: £900.00 Total charge for credit: £276.12 Total payable: £1276.12 Total 36 Monthly instalments of: £32.67 APR: 19.9%. Terms and Conditions Apply.