XSPC Full Cover Waterblock and Backplate for the NVidia GTX780 GPU

A Comprehensive Review and Recommendation

David Young

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The XSPC Waterblock and Backplate are aftermarket components used to watercool the Nvidia GTX780 reference graphics card. This formal report serves to review the physical attributes of the XSPC components as well as analyze their performance in thermal, acoustic and performance testing.

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Background

Graphical Processing Units

Any modern enthusiast or gaming PC contains both a CPU (Central Processing Unit) and a GPU (Graphical Processing Unit). The CPU handles the computer's simple logic based operations with a single or relatively few (<12) powerful and fast cores. Graphical processing entails calculating the vertices of three dimensional objects in a virtual space for the purposes of rendering reflected light. Given this enormous quantity of very simplistic calculations, graphical work often requires parallel processing. This means a single powerful core (like the one found in a CPU) is not as efficient as a large quantity of less powerful cores. Because of this, discrete graphical processing units (GPUs) containing thousands of weaker cores have been developed to be used in combination with a CPU. Such GPUs will handle the graphical processing work involved in 3D rendering, video encoding, physics or fluid modelling and PC gaming.

GPUs are manufactured by two major companies: AMD and NVidia. The GPUs themselves are silicon chips. To make the chips compatible as drop in components for PC builders, they are housed in what are called "Graphics Cards." A graphics card is a consumer part composed of a GPU, a printed circuit board (PCB), a cooler and fans. The PCB provides the necessary circuitry to power the GPU and a means of interfacing with the rest of the components in the computer. The cooler and fans provide dissipation of the heat produced by the GPU. For most PC enthusiasts, installing a stock graphics card, handles their performance needs. However, there will always be performance hungry enthusiasts who seek more for their dollar. In this spirit, the few and the brave turn to alternate methods for cooling their GPU.

Watercooling

Watercooling is the process of cooling PC components with water. This can include the CPU, the GPU, the motherboard, and even the memory. This review will focus primarily on how watercooling relates to cooling a GPU. Certain components in a computer produce significant amounts of heat while functioning. Generally heat is dissipated by a passive cooler comprised of a large metal heatsink, or a heatsink cooled by fans. Although this works for the majority of users, water has a significantly higher heat capacity than air. In a watercooled PC, heat produced by the GPU is absorbed by water before being dissipated via radiators. To make this a perpetual cooling system, a mechanical pump circulates water through a loop that connects the hot components to radiators. This is very similar to the way a car engine is cooled by water. In a car, a

water pump circulates water through a loop that includes a radiator and channels cut into the engine block. The heat produced by combustion transfers from the engine block to the flowing water, before being dissipated via the radiator. The same logic holds in watercooling a PC, where the heat production occurs via a GPU instead of combustion.

Waterblocks and Backplates

Because GPUs and other computer components are circuit based, and therefore quite hydrophobic, one cannot simply allow water to come in direct contact with the GPU. Waterblocks are used to transfer heat from the hot components to the flowing water. A waterblock is a block of metal (typically copper) with channels cut through its interior for the passage of water. The block is mated to the surface of the GPU in place of the stock cooler on the face of the graphics card. Similar to how heat from a stove top transfers to a metal pot before transferring to the water inside, heat from a GPU will transfer to a metal waterblock before transferring to the water inside. Without a waterblock, watercooling would not be a viable option.

A backplate on the other hand is an optional component, yet it serves some very important functions. A backplate is a thin piece of plastic that covers the back of the naked PCB on a graphics card. Whether or not a graphics card is watercooled, it is always a good idea to use a backplate. A backplate will protect the PCB from ambient heat inside the computer case, as well as protect against short circuits in the event the PCB is pressed against anything metal.

Introduction

Nvidia GTX780 Reference Graphics Card

In May, 2013, NVidia released the GTX780 enthusiast graphics card. The GTX780 marked the launch of the Geforce 700 series family of graphics cards, and filled the top slot as NVidia's flagship performance gaming card. The card used a Kepler GK110 28nm GPU and sported a newly designed reference cooler (an air cooler provided by the manufacturer). The reference cooler on the GTX780 is collectively known as the best reference cooler provided by a manufacturer to date. Not only is the cooler aesthetically pleasing and well built, it also provides extremely efficient air cooling at very quiet noise levels. The card did not come without a price premium however, with a launch price of $649.99.

GPU Boost 2.0 & Voltage Dependent Overclocking

New with Kepler based GPUs is "GPU Boost 2.0", a dynamic clocking technology designed to increase performance and card longevity. Essentially cards that utilize this technology (such as the GTX780) dynamically increase or decrease their core clock speeds to maintain stability with a supplied voltage. This means that, provided a given voltage supply, the card will adjust its clock speed to provide the most performance in any situation while staying within user defined temperature and fan speed boundaries. It also means that the card does not run at maximum speed regardless of load. At idle the card will down clock to a crawl, so as the increase the life of the circuitry and decrease required fan noise.

Physical Overview of the XSPC Waterblock and Backplate

Technical Specifications

Waterblock	
MSRP:	$119.99
Base Material:	CNC Machined Copper
Top Material:	Stainless Steel
Faceplate:	Brushed Aluminum
Dimensions:	266.7 x 124.4 x 25mm
Ports:	SLI compatible with 7x G1/4" ports
Boxed Supplies:	Twin 3mm LED, mountain kit, G1/4" plugs, thermal pads and thermal paste
Support:	GTX Titan and GTX780 cards (Reference PCB Design ONLY)

BackPlate	
MSRP:	$19.99
Dimensions:	266.7 x 87.3 x 4mm
Material:	Anodised Aluminium
Boxed Supplies:	Allen Key, Thermal Pads, Red Washers, Screws, Foam Pad

Build Quality and Aesthetics

Build quality of the XSPC components is absolutely stunning. The CNC copper base of the waterblock is mirror smooth, the joining of surfaces is tight and stout, and the components are sturdy. The materials used are of the highest quality and the packaging is noteworthy. The only complaint is weight. The GTX780 is already a heavy card, and with the addition a large copper block some added stress will be placed on the connecting joint between the card and the motherboard. It is recommended the installer ensures a proper fastener is used near the I/O port on the backside of the card where it meets the case.

Aesthetics are ultimately subjective, but I feel the card is elegant and simplistic. It is subtle enough to find a home in any color themed build.

Installation Overview

Installing the XSPC Waterblock and Backplate went smoothly without any hiccups. The manufacturer included instructions were adequate but brief. A detailed documentation of my own procedure has been included in the Appendix. The installation requires only simple hand tools, about 2 hours of time and a bit of patience. An unexperienced individual, following the instructions included in the Appendix, should be able to complete the installation. No special knowledge or training is required.

Testing Procedure

Tests

To identify the benefits and shortcomings of the XSPC waterblock and backplate, the reference card will be compared to the watercooled card in thermal, acoustic and performance tests. The tests will include four card setups as follows: the reference card with stock clock speed and overclocked clock speed, and the watercooled card with stock clock speed and overclocked clock speed.

The majority of the testing will be composed of benchmarks. A benchmark is a short repeatable graphical task. This can include a synthetic benchmark, where software runs an identical rendering each and every test or a gaming benchmark, where the user controls the inputs during a PC gaming scenario in a repeatable fashion. Synthetic benchmarks often have a tallied score based off a combined set of performance criteria, and gaming benchmarks are typically compared by the number of frames a GPU can render and buffer during the benchmark (normalized to frames per second, or FPS). Although synthetic benchmarks are identical in all instances, it is easy for GPU manufacturers to optimize their hardware for specific benchmarks, potentially distorting the relative performance of the GPU in a real word usage scenario. Because of this, gaming benchmarks are commonly accepted as a better indication of the relative performance between GPUs.

This review will include four synthetic benchmarks, a pair from each of two different software companies. From 3D Mark, the benchmarks Vantage and Firestrike will be used, and from Unigine, the benchmarks Heaven and Valley will be used. A total of 4 gaming benchmarks will be run, including Crysis 3, Far Cry 3, Battlefield 3 and Bioshock Infinite. These are some of the most demanding “AAA” titles out right now and should indicate the most demanding graphical gaming loads available today. All testing will be run at a

resolution of 2560x1440p, as this is the resolution demographic the GTX780 is aiming for. For resolutions as small as 1080p, the GTX780 wouldn't be pushed to full load in any of the tests being run.

For thermal testing, the temperature of the cores under idle and load conditions will be compared. To replicate the conditions a GPU faces under maximum load, a specifically taxing benchmark (Crysis 3) will be run on continuous loop. Running Crysis 3 at 2560 x 1440p calls for 100% GPU usage, essentially demonstrating the heaviest load the graphics card could ever face. Acoustic testing will be limited to subjective comparison by ear, since no dB meter was available for use during testing. For the acoustic comparisons, the same benchmark as the thermal testing will be run and video footage will be recorded for each trial and compared back to back.

Test-Bed & Environment

To ensure external factors cannot create an advantage for any single card configuration, the testing bed for the card will be kept constant throughout all trials. The test-bed computer of choice was assembled with complementary components and cooling to ensure that no other component was bottlenecking the performance of the GPU. The specifications of the test-bed have been supplied so that a reader at home can qualify results obtained in their own benchmarks using a different PC.

Component	Part
CPU	Intel 3770K @4.8GHz
Motherboard	Asus Maximus V Gene
Memory	16GB of Corsair Vengeance @1800Mhz
SSD	Samsung 840 Pro 256GB
PSU	Seasonic X-860 Gold
Case	Corsair 350D
Pump	Swiftech MCP-655
Pump Top/Reservoir	EK CSQ 140ml Res/Top Combo
Radiators	XSPC AX240mm, Alphacool Nexxos ST30 240mm
Fans	4x Noctua NF-F12
Tubing	Primochill ½ " ID ¾ " OD
Fittings	BitzPower Compression Fittings

Competition

The primary objective of this review is to compare the performance of the GTX780 before and after the installation of the XSPC Waterblock & Backplate and the implementation of water cooling. However it may be worth noting performance improvements over some of NVidia's competition. The primary competitor to the NVidia GTX780 is AMD's 7970 GHz Edition. At the time of this review, the 7970 is AMD's flagship gaming graphics card. It was released with a launch price of $549, and until the release of the GTX780 the 7970 held the single GPU performance crown. Since a 7970 was not accessible for this review, results in common benchmarks for the AMD card will be averaged from a range of reputable reviewers including LinusTechTips, Anandtech.com and Overclock3d.net.

Overclocking

Overclocking is the process of modifying parameters of a PC component to increase its operational clock frequency compared to stock (as specified by the manufacturer). This often includes increasing voltages, increasing power consumption and increasing heat production, all of which must be dealt with efficiently to keep the part operational.

Methods

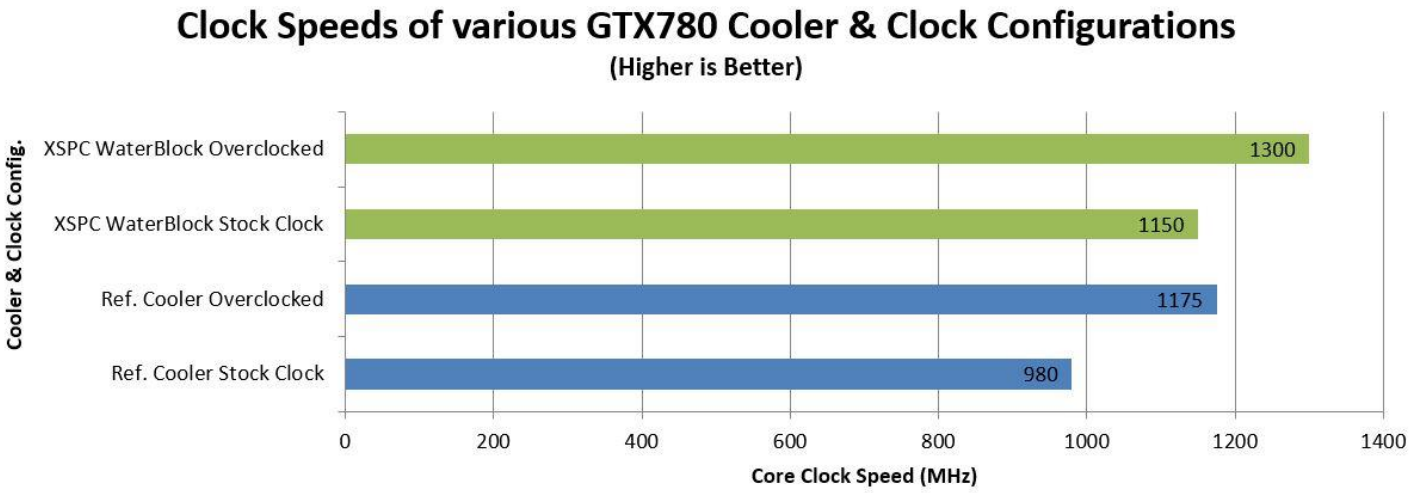
Overclocking a card with GPU Boost 2.0 is a breeze. Because the chip dynamically alters its clock speed to find stability, all one has to do is set the desired thermal and acoustic boundaries for the cards operation. Beyond that, a user can increase voltage supplied to the core. For anyone who has overclocked an older GPU or a current CPU, where the incremental trial and error method is still in effect, the overclocking the GTX780 will be a breath of fresh air.

EVGA Precision X software was used to overclock the card with the following software settings.

Software Setting	Setting Used
Preference:	Power Preferred
Temp Target Slider	Maximum
Power Target Slider	Maximum
Over-Voltage	Checked
Voltage Slider	+38mV
Core Clock Speed Slider	+190
Memory Clock Speed Slider	+250

Overclocking Results

The settings above resulted in a sizeable overclock of 1300Mhz for the watercooled card. The clock speeds of different cooler and clock configurations are shown on the following page. “Overclocked” indicates an overclocked card and “Stock Clock” indicates a card with stock manufacturer clock settings. “Ref. Cooler” indicates a card with the stock reference cooler supplied by the manufacturer, and “XSPC WaterBlock” indicates a watercooled card using the XSPC waterblock and backplate.



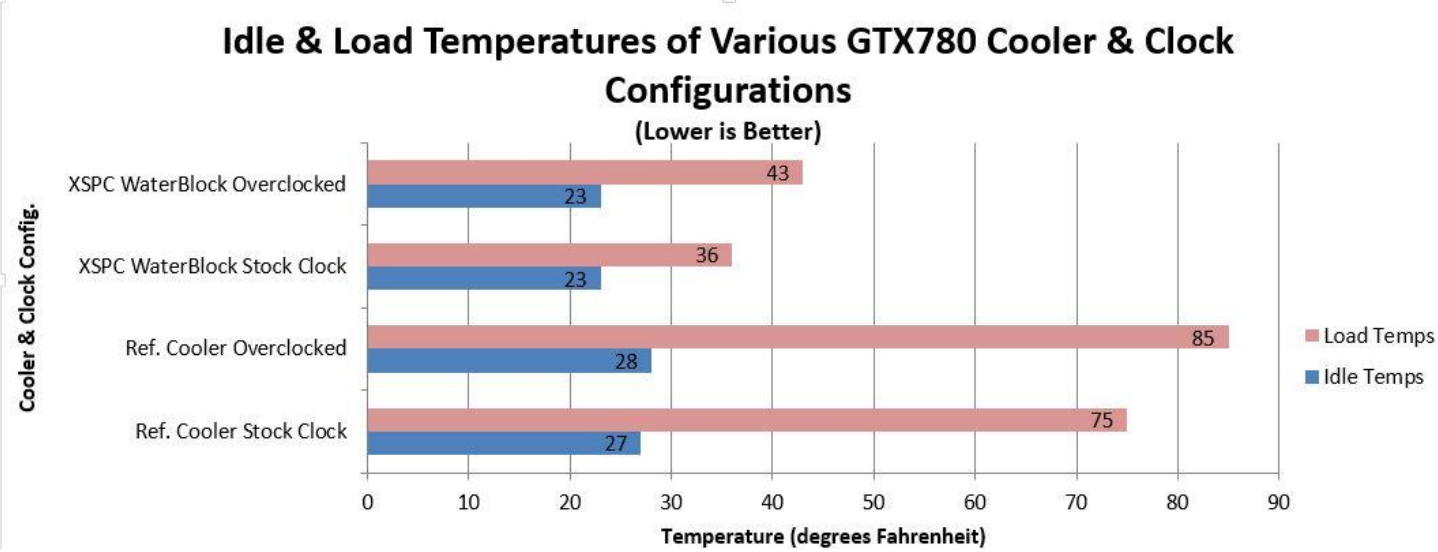
Without manually modifying the operational parameters of the GTX780, the clock speed of the watercooled card increased by over 17%. When EVGA Precision X was used to modify operational parameters, the clock speed rose by almost 33%. This is a tremendous overclock.

Thermal Headroom with GPU Boost 2.0 & Silicon Lottery

As the results show, the limiting factor in overclocking the reference GTX780 was heat. With watercooling eliminating heat as a dominant factor, the attainable overclock rose by 11%. As thermal results will show, even with the maximum overclock on the watercooled card, the temperatures still never rose above 43 degrees Fahrenheit. Therefore, the stability of any overclock above 1300Mhz was limited more by voltage supply to the core, than by temperature. With the stock BIOS, NVidia caps the additional voltage available to the core at 38mV. An aftermarket or hacked BIOS would provide the ability to increase voltage beyond that limit. However this would decrease the reliability and life expectancy of the GPU, and definitely void the manufacturer warranty. Because of this, aftermarket BIOS' or voltage increases above 38mV were not tested in this review.

When considering overclocks above the manufacturer guaranteed stock frequencies, it is important to note the element of chance. This element of chance has been coined the "Silicon Lottery," because GPUs and CPUs are made of silicon and their maximum attainable overclocks vary on an individual component basis. No two components are identical. It is entirely possible to obtain a GPU from the same manufacturer that will not overclock at all. On the alternate side, it is possible to receive a GPU that is capable of stable overclocks beyond that which was achieved in this review.

Thermal Results

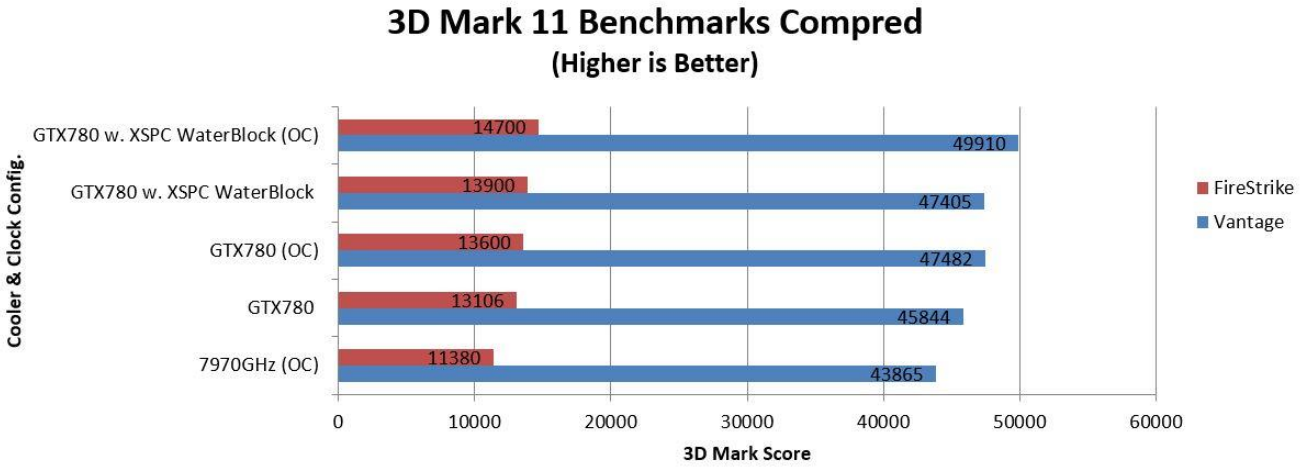


When looking at thermal test results, the important data to observe is the load temperatures. Idle temperatures indicate little about the performance differences between coolers. This is because any differences will present themselves at the boundaries of GPU performance.

Looking at the load temperatures, the XSPC components managed to keep the card 32 degrees, or 71%, colder than the reference cooler. Keep in mind this is comparing an overclocked watercooled card to a stock clocked reference card. That means even with elevated clock speeds, the watercooled card ran cooler than the slower running card equipped with the reference cooler. The XSPC component's ability to keep the GTX780 running so cold is the reason a 1300Mhz overclock was attainable.

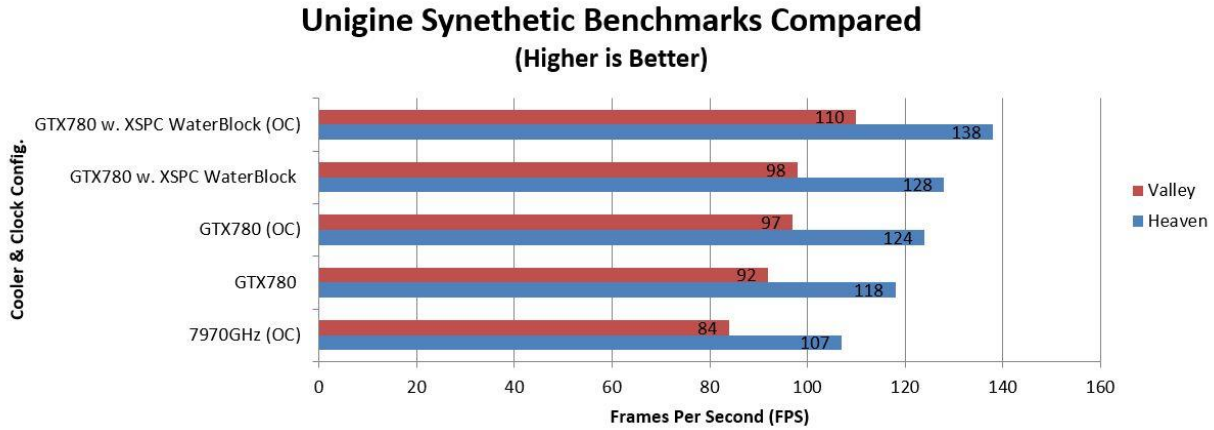
Performance Results (Synthetic)

3D Mark Vantage & Firestrike



3D Mark 11 is known widely as one of the most punishing synthetic benchmarks. The stock GTX780 performs admirably and the numbers only get more impressive with the addition of watercooling. The overclocked watercooled card scored 9% higher than the reference card at stock clock speeds, while the FireStrike score rose by over 12%.

Unigine Valley & Heaven



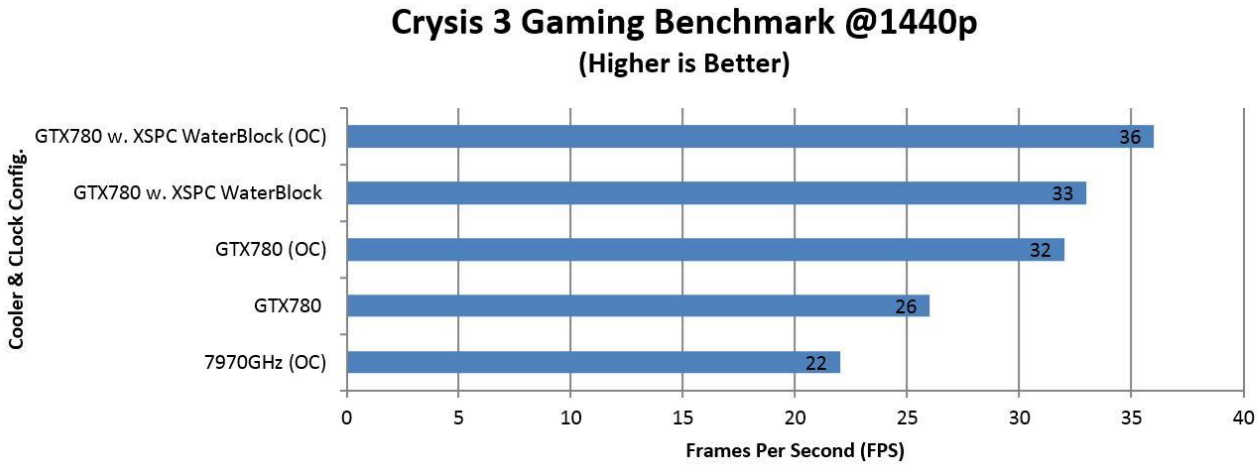
The scores for Unigine Heaven rose approximately 17% while the scores for Valley rose by over 19%.

Summary

Overall, performance in synthetic benchmark testing rose by an average of over 14%. This is a very respectable increase for an overclocked graphics card. It is however worth noting that synthetic benchmarks are prone to intentional GPU optimization by GPU manufacturers. Because of this the results in synthetic benchmarks may already be optimized on the GTX780's GK110 GPU and therefore less conducive to large performance gains as a result of increasing clock speed. Nevertheless, the addition of the XSPC components resulted in increased performance.

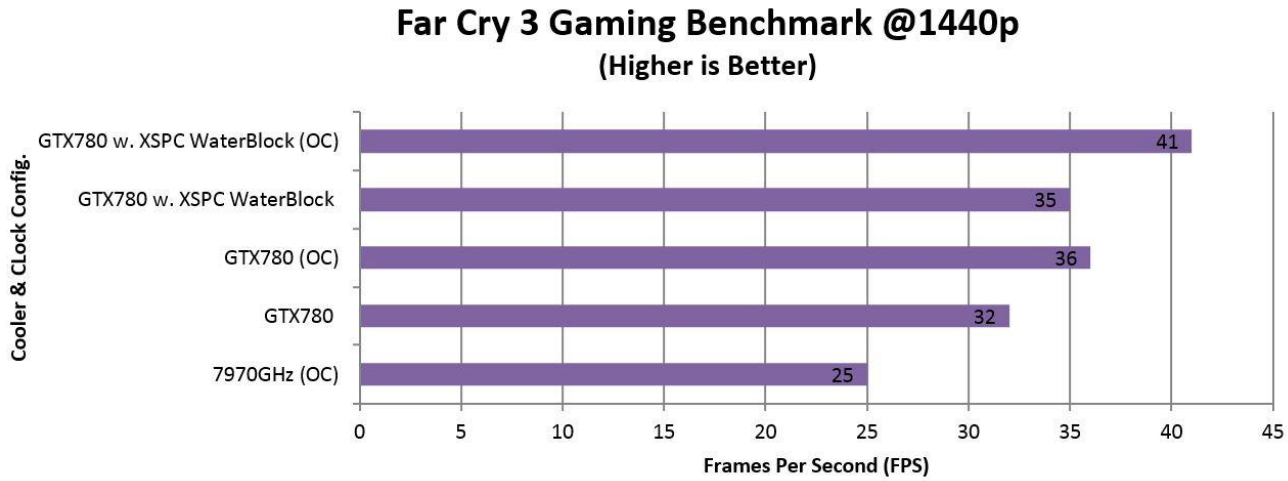
Performance Results (Gaming)

Crysis 3



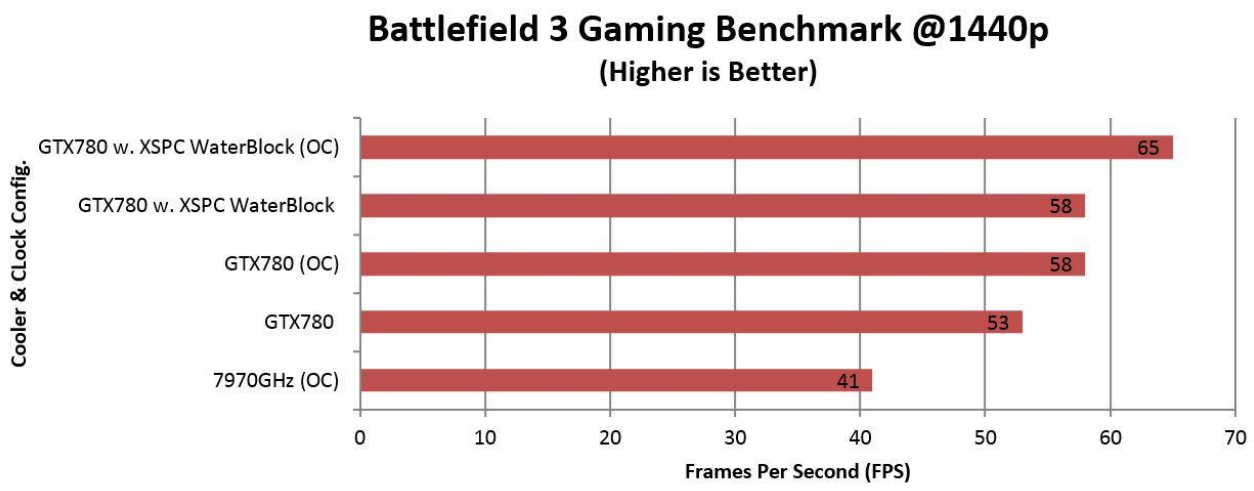
Crysis 3 remains the most graphically demanding PC game available on the market today. It is therefore an excellent tool to discern the performance differences between powerful card configurations. The watercooled GTX780 managed to increase frame rates by over 38%. This kind of performance increase permitted higher graphical in-game settings to be used at playable frame rates, meaning an improved gaming experience.

Far Cry 3



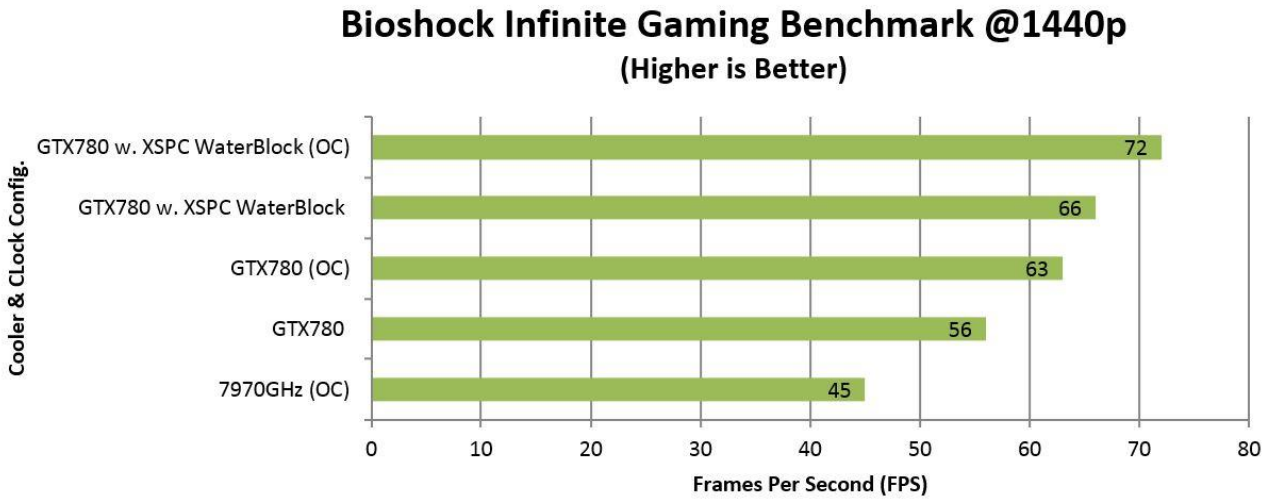
Performance in Far Cry 3 rose by over 28%. This increase also enabled higher graphical in-game settings, and therefore more favorable gameplay, at playable frame rates.

Battlefield 3



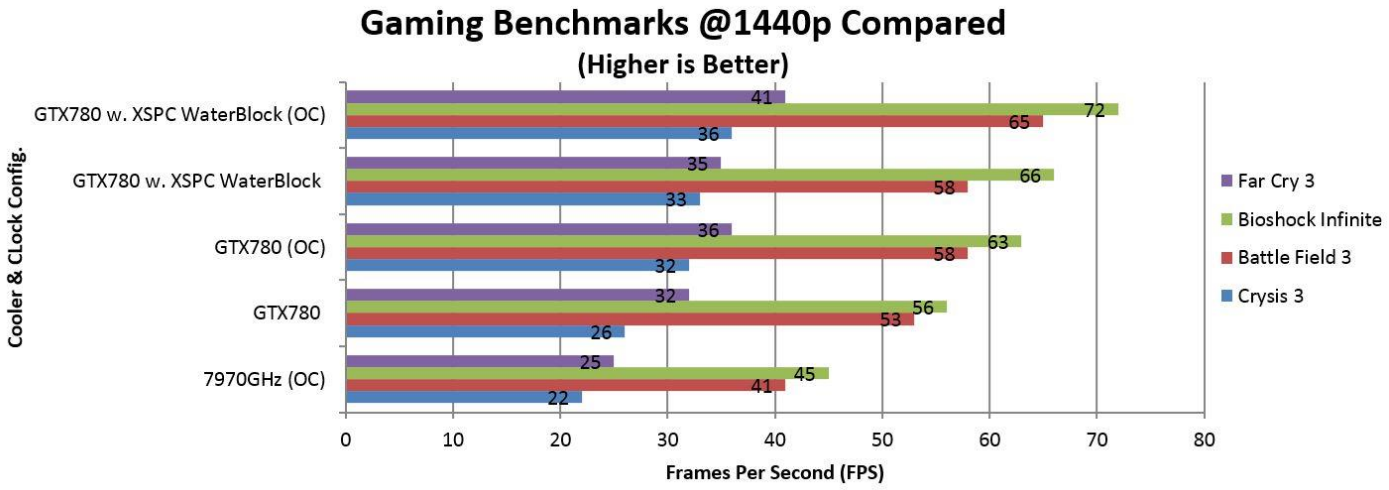
Frame rates in Battle Field 3 rose by almost 23%.

Bioshock Infinite



Frame rates in Bioshock Infinite rose by over 28%.

Summary



The gaming benchmarks presented in this review represent some of the most graphically demanding titles available today. The performance of the stock GTX780 already impressive, but the addition of the XSPC waterblock and backplate promoted that performance to outstanding. Overall, frame rates in gaming benchmarks rose by an average of over 29%. A performance increase of 10-15% is generally considered a sizeable and noteworthy improvement as the result of overclocking. In this tier of enthusiast class hardware, where components ship from the factory with near maximized performance, a 29% frame rate improvement is an extremely rare occurrence. If a consumer finds the price tag of the GTX780 worth the performance of a stock GTX780, then the price tag of the XSPC components will be the bargain of a century.

Acoustic Performance

It is difficult to attribute the enormous acoustic benefits of watercooling to the specific XSPC components reviewed here. Any properly designed watercooling loop will be nearly silent, given that the CPU cooler and graphics card cooler are out of the equation. A poorly chosen pump can produce some noticeable noise, but such noise would be constant as the pump runs at fixed speed rather than increasing with GPU load. Therefore the selection of a GPU waterblock plays very little role in how quiet a system will be. Because of this, acoustic results are irrelevant for the individual choosing between waterblocks from different manufacturers. For a PC enthusiast on the edge about watercooling, or an individual who needs a silent workstation, the acoustic benefits of watercooling (as a general process) are worth noting.

To reiterate, the stock cooler on the Nvidia GTX 780 is one of the finest reference coolers ever produced. It is efficient but also extremely quiet. However, despite being quiet during normal operation, when overclocking the card to the thermal limit, the fans on the reference cooler are spinning as fast as they can. Because of this the card is definitely audible, and most likely the loudest component in the computer. When watercooling, the pump becomes the loudest component with its faint whine.

Because a dB meter could not be obtained for this test, no quantifiable acoustic data is present in this review. Instead, a subjective acoustic analysis will have to suffice. I was only able to hear the pump humming when I pressed my ear up against the side panel of the case, whereas I could hear the reference cooler from the other side of the room. If I was using the reference cooler in a professional office setting, or in a gaming rig without headphones, I would have to dial back the overclock for acoustic reasons before thermal limitations kicked in. Such an acoustic limitation does not exist for a watercooled system. In summary, the reference cooler is quiet but a water cooled rig is silent.

Summarized Analysis & Conclusion

The build quality of the XSPC Waterblock and Backplate is second to none. The materials used are of the highest quality and the machine milled surface, that mates to the GPU, is glass smooth. The waterblock is heavier (as a full cover block) than most blocks which cover just the GPU chip itself, but this is of no concern when it comes to performance.

When the reference cooler was replaced by the watercooling loop, the acoustic benefits were immediately apparent. The hard drive and pump were the only noticeably audible components in the whole system. The graphics card went from being quiet to silent.

The installment of the XSPC waterblock and backplate and the addition of watercooling permitted core temperatures to drop 71% under load. This translated to an overclock that was 33% faster than the stock clock speed on the GTX780. With a faster overclock came elevated benchmark and gaming performance. Graphical settings in games could be increased, and gameplay experience improved. Extrapolating to physical modelling, 3d rendering and video editing, runtime of workstation tasks could be dramatically reduced as well.

For any enthusiast uncertain about watercooling a GTX780, the performance results alone are well worth the transition. The additional acoustic benefits are icing on the cake. At the time of this review, the GTX780 is the single GPU performance king. Without an alternate and more powerful GPU available, extreme overclocking (made possible by the addition of watercooling) is the only way to increase performance of a single GPU gaming PC. For those in search of the ultimate performance, watercooling is the way to go. And for those already onboard, deciding between components for their watercooling loops, the XSPC Waterblock and Backplate are fantastic choices.

At $119.99 for the waterblock and $19.99 for the backplate, the XSPC components are not cheap. When one moves into the upper echelon of PC components, price to performance ratio will increase dramatically, with diminishing returns for additional expense. Given the GTX780 has a list price of $649.99, the additional XSPC components present a 29% increase in gaming performance for a 21% increase in price. This is a dramatic decrease in the price to performance ratio, something that rarely happens at this price point. Because of this the XSPC Waterblock and Backplate receive my highest recommendation.

Appendix

Glossary

Word	Definition
2560x1440p	A monitor resolution 2560 horizontal pixels by 1440 vertical pixels for a total count of 3,686,400 pixels to be rendered.
AAA Title	A lingo in the video game industry for games developed for major platforms with enormous marketing budgets.
AMD	(Advanced Micro Devices) A technology company and global provider of graphics and processors.
Backplate	A thin strip of plastic of covered metal that protects the back of PCB on a graphics card.
Benchmark	A standardized graphical test used to compare the performance of PC components. Can be Synthetic (automatically generated and run by software) or Gaming (conducted by a user in a consumer PC game).
BIOS	(Basic Input/Output System) A program a PC's CPU uses to get the computer system started when powered on.
Bottleneck	Phenomenon where the performance of a PC as an entire system is limited by the performance restrictions of a single component.
Clock Speed	The frequency at which a CPU or GPU runs.
CPU	(Central Processing Unit) A PC component that carries out the basic arithmetic, logic or input/output tasks associated with computer programs.
EVGA Precision-X	A GPU control software used to overclock and monitor GPUs.
FPS	(Frames Per Second) The rate at which frames in a continuous graphical display are being rendered. A typically accepted value for playable frame rates in computer games is around 45fps. Ideally 60+ fps.
GHz	(GigaHertz) 1 billion Hertz
GPU	(Graphical Processing Unit) A PC component that carries out graphical processing.
Graphics Card	A consumer product composed of a GPU, a cooler and a PCB.
I/O	Input/Output
MHz	(MegaHertz) 1 million Hertz.
Nvidia	A technology company and global provider of graphics and graphical processors.
Overclocking	The process of making a computer component operate at increased speed or capacity to increase system performance.
Parallel Processing	A computing process in which multiple calculations or computations are carried out simultaneously.
PCB	(Printed Circuit Board) A board that supports and electrically connects electrical components.
Radiator	A heat exchanger typically constructed from metal that dissipates the heat from coolant passing through its fins, into the surrounding air.
Silicon	An element used in the production of all microprocessors.

Stock Clock	The clock speed that a component is provided with stock as it ships from a manufacturer.
Test-Bed	The entirety of associated computer components that are used to test a single component.
Waterblock	A watercooling component made of thermally conductive metal that provides a path for heat transfer from a hot computer component to water.
Watercooling	The process of cooling hot PC components with water.

How to Install the XSPC Razor GTX Titan Full Cover Water Block and Back Plate

Warning! The XSPC Full Cover Water Block designed to increase the cooling performance of all GTX Titan and GTX 780 series graphics cards that use reference PCB layouts ONLY. If your video card is not a reference card, or if you are unsure as to whether your video card uses an alternative PCB layout, you should STOP HERE and contact XSPC for further options.

Warning! The XSPC Full Cover Water Block and associated components are designed for use in conjunction with a pre-existing water cooling system. The presence of water near electrical components presents the inherent risk of damage. Improper installation or use of the XSPC Full Cover Water Block could lead to damage of not only your video card, but other components inside your PC. If you are not competent to perform the installation, you should seek the service of a professional.

I, David Young, will not be held liable for any damaged components that may result from the installation of the XSPC Full Cover Water Block.

This guide will lead you through the following:

Unboxing the XSPC water block and back plate.
Dismantling the video card's reference cooler.
Installation the XSPC water block.
Installing the XSPC back plate.

Recommended Allotted Time and Skillset:

1. 1-2 Hours
2. Experience Dismantling Reference Coolers
3. Experience Installing GPU Water Blocks
4. Patience

Required Tools:

1. Anti-Static Mat
2. Anti-Static Wristband
3. Screw Driver
4. Rubbing Alcohol
5. Anti-Lint Cleaning Wipe
6. Small Phillips Head Screw Driver
7. Torx T6 Screw Driver

Recommended Tools:

1. Alternative Thermal Compound (I recommend Noctua NTH-1)
2. A Second Pair of Hands
3. Anti-Static Work Place (Do not work over carpet)
4. Compressed Air

Step 1: Ground Yourself and Establish a Safe Workplace

The first step before beginning anything is to ensure you will not accidently damage any components with electrostatic discharge.

To do this, ground yourself using an electrostatic wrist or ankle band. I like to grab a nearby power supply and ground myself to that, but whatever method is readily accessible will be fine.

Then provide a safe workplace by laying an anti-static mat down on a level work surface. This will serve as your work place and any electrical components should remain on the anti-static mat.

Step 2: Un-Box Components

The next step is to unbox all the components from their shipping boxes and lay all the parts out neatly on the antistatic mat. Before moving forward, verify that you are not missing any parts and that all pieces appear unblemished.

Water Block Box Contents:

- 1x GTX 780/Titan Water block
- 5x G1/4 Plugs
- 6x Thermal Pads 1mm
- 3x Thermal Pads 0.5mm
- 1x Thermal Paste
- 12x M3x6 Screws
- 12x Red Washer
- 1x M3 Nut
- 1x Twin 3mm Blue LED

Back Plate Box Contents:

- 1x Foam Pad
- 11x M3 10mm Screws
- 11x Red Washers
- 3x Thermal Pads
- 1 x Allen Key

Figures 1&2: Box Contents for both the water block and back plate.

If you are missing any components you should contact XSPC or the retailer from which you purchased the block before proceeding.

Step 3: Plug Unused Ports

a. Determine Port Configuration

Before installing the water block onto the graphics card, you should determine what entry and exit port configuration your loop and tube routing will necessitate. The XSPC Water Block works regardless of the direction of water flow.

b. Install Port Plugs and Fittings

It is now that you should take advantage of having the water block free to handle, without worry of damaging the PCB[1], to install the G1/4" plugs to block any unused ports in the XSPC Water Block. The loop will only require 1 entry and 1 exit port be left open. At this point you should also install any tube fittings you have chosen to use in connecting the inlet and output tubes to the water block.

Figures 3&4: G1/4 plugs and inlet/outlet fittings.

At this point the water block should be unpackaged, and all unused ports should be plugged. Fittings should be inserted into 2 of the ports on the water block (1 for entry, 1 for exit).

You can set the water block down now, while you work on removing the reference cooler.

Step 4: Remove the Stock Cooler from the Graphics Card

Before handling the graphics card, verify again that you are properly grounded.

a. Remove the Holding Screws

Place the Graphics card cooler side down on the anti-static mat, with the PCB facing upward. Using the torx driver, remove the 20 holding screws that fix the cooler to the PCB. The screws required for removal are highlighted in red in the following picture.

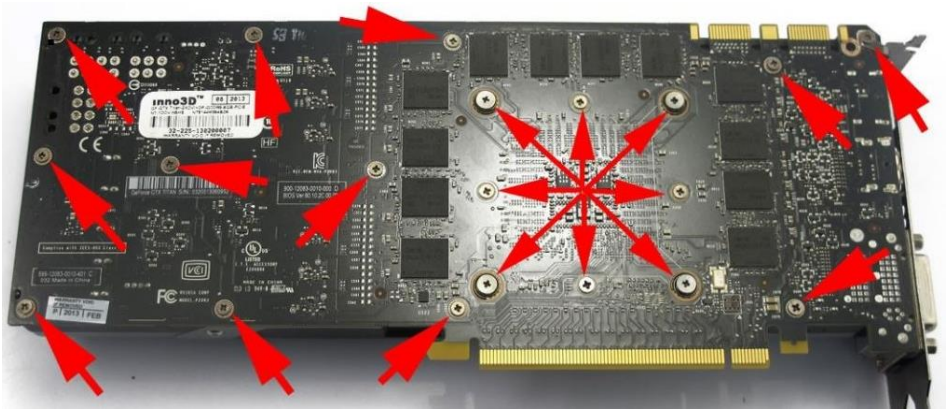


Figure 5: Back of PCB showing locations of cooler support screws

1: PCB Printed Circuit Board that supports and electrically connects components of the graphics card

b. Remove the Stock Cooler

Turn the card over once more and carefully lift the stock cooler off the PCB. Beware that the fan on the stock cooler is connected to the PCB by a power cable. Do not forget to unplug the cable before separating the PCB and the cooler more than an inch or so. Separating the two may require a bit of wiggling, as they are nested together fairly tight. Do not use excessive force.

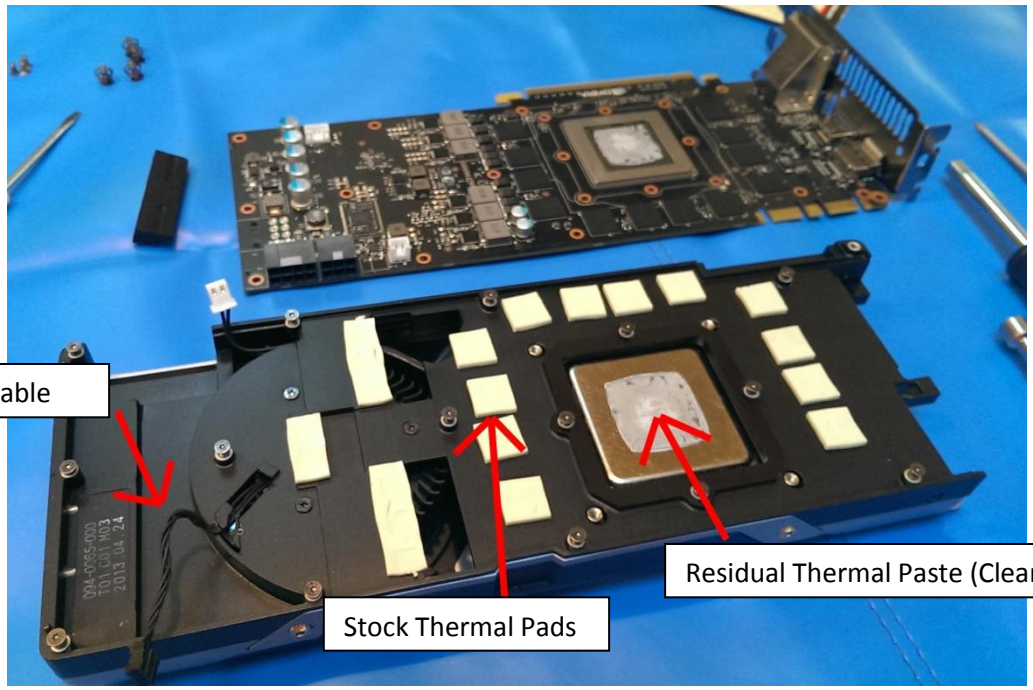


Figure 6: Removal of the stock cooler. Separation of cooler and PCB.

c. **Ensure all stock thermal pads remain on the stock cooler**

Make sure to remove any thermal pads sticking to the Vram on the PCB and place them in their corresponding location on the stock cooler.

d. Neatly Pack and Store the Stock Cooler

Clean the stock cooler of all residual thermal paste by rubbing it with an anti-lint wipe and rubbing alcohol. Make sure to place all the holding screws you removed in step a. back into their holes in the stock cooler. They will not be needed in installing the water block and this will ensure they do not get lost in the meantime. Set aside the cooler (I like to ensure that the thermal pads on the Vram extensions of the stock cooler do not fall off when storing the cooler. To do so, I wrap the cooler in plastic Saran wrap before storing it).

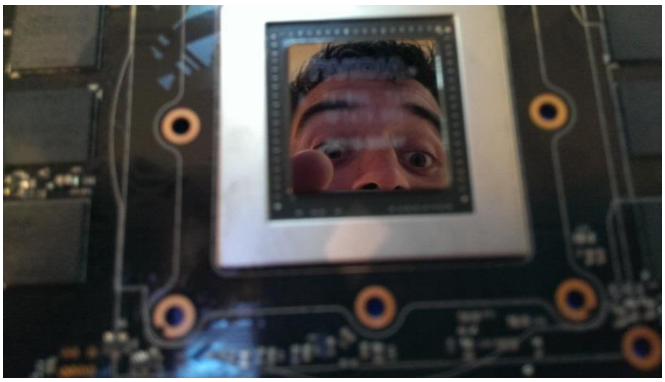
At this point you should have the PCB isolated with the reference card placed aside.

Step 5: Clean the GPU + Vram & Apply Thermal Compound

a. **Clean the GPU + Vram**

In order to ensure optimal contact between the water block and the GPU, you must remove the residual thermal paste left over from the stock cooler and ensure the GPU is spotless. To do this, dampen an anti-

lint wipe with rubbing alcohol and gently clean the surface until it reflects like a mirror. Similarly, clean the tops of all the Vram modules where residue from the previous thermal pads may remain.



Figures 7&8: Cleaning of the GPU face.

b. Apply Thermal Compound

To apply thermal compound, squeeze a very thin line (about the size of a grain of rice) onto the center of the GPU. If you cleaned the GPU surface properly, the compressive force between the water block and the GPU will squeeze the thermal compound evenly over the surface of the GPU. The included thermal compound from XSPC will work fine, however I prefer to use Noctua NT-H1.

Step 6: Prepare the PCB for the Water Block (Install Thermal Pads)

a. Install the Blue Thermal Pads

For each of the 6 blue thermal pads, remove the tape backing from both sides and carefully (without getting much oil from your fingers on the pads themselves) place the pads on in the locations marked 1 in the following picture.

b. Install the Grey Thermal Pads

Similarly install both grey thermal pads in the locations marked 2 in the picture below.

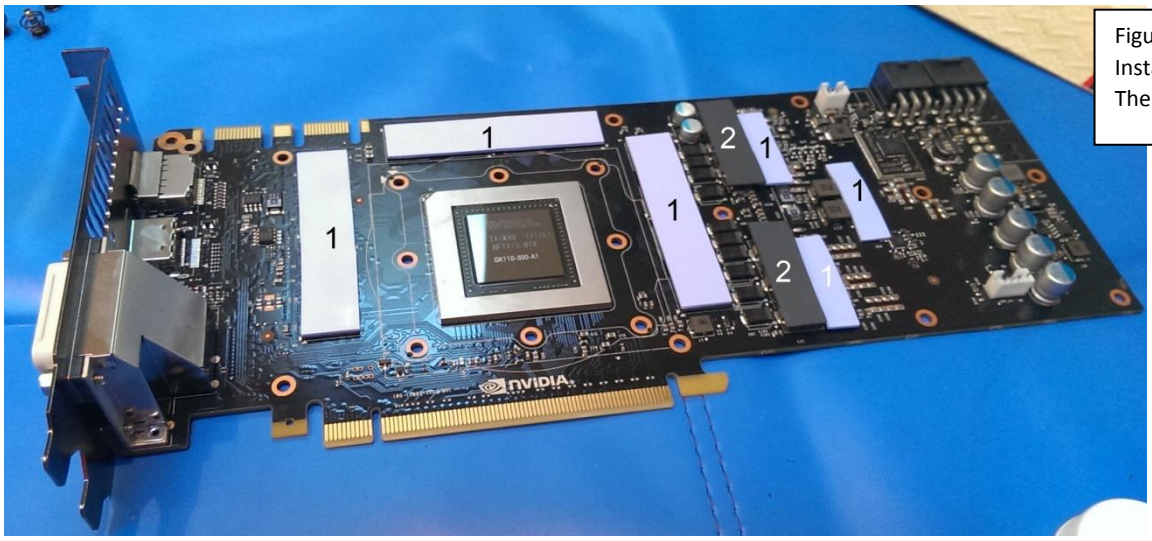


Figure 9: Installation of Thermal Pads.

Step 7: Prepare the Back Plate

a. **Remove the Protective Foam from the Back Plate**
   To remove the protective yellow foam backing from the back plate, simply peel it back and discard.
b. **Install Thermal Pad**
   Similar to the installation of the thermal pads on the PCB, place the included large thermal pad in the location indicated in the picture below by the 4 red arrows. And place the 3 blue thermal pads in the locations indicated in blue.

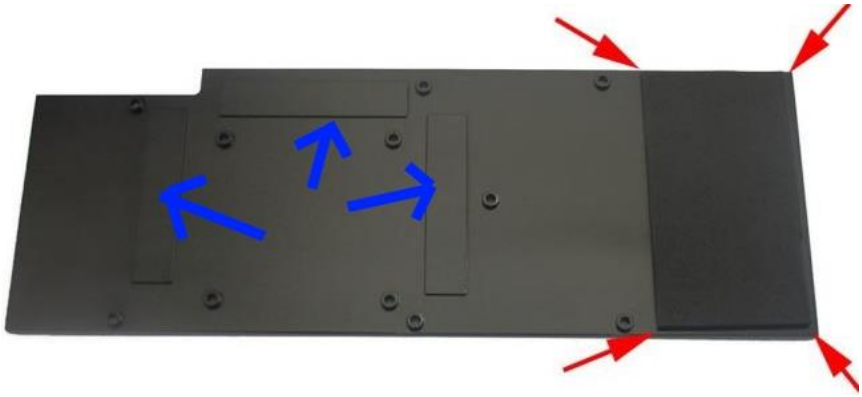


Figure 10: Installation of Thermal Pads to the Back Plate

Step 8: Install the Water Block & Back Plate

a. **Line Up the PCB with the Water Block**
   The first step in putting the 3 pieces together is to line up the PCB with the water block. The easiest way to accomplish this is to place the water block face down on the anti-static mat, and slowly place the PCB (GPU side down) onto the water block. As you lower the PCB onto the water block, be careful to line up the GPU with its corresponding location on the water block so as to evenly press and squeeze the thermal compound you applied earlier. I find it helpful to look at the screw holes and attempt to line them up evenly to the corresponding holes in the water block. This will help you gauge how tilted the PCB may be as you lower it down.
b. **Place The Washers**
   Take the included red washers (from either the back plate or the water block box) and place them in the locations shown in the picture below, around each of the screw holes.

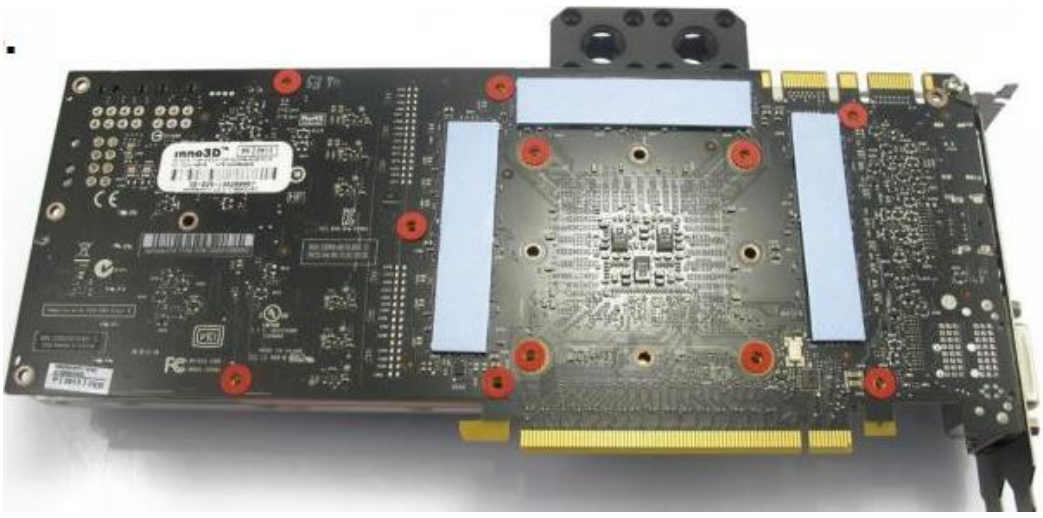


Figure 11: Placement of Washers

c. Align the Back Plate

Carefully lower the back plate (thermal pad side down, XSPC logo side up) down onto the PCB's backside above the washers you just laid out. This can be a frustrating process and any wiggle while placing the back plate down can cause a washer to shift underneath, requiring you to lift the back plate back up and reseat any washers that may have shifted. If all goes well, you should be able to see the screw holes in the PCB and water block through the screw holes in the back plate.

d. Install the Screws

Once the back plate is aligned, you can fix the water block, PCP and back plate together using the black M3 screws provided in the back plate box. The screw locations are highlighted in the photo below. Tighten the screws with the included Allen key, being careful not to over tighten.

Figure 12: Alignment of back plate and location of screws

The card is now ready for use. You may un-ground yourself and step back to enjoy the fruits of your work.

Figure 13: Result of finished installation (minus fittings and plugs)

List of Sources

Images

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