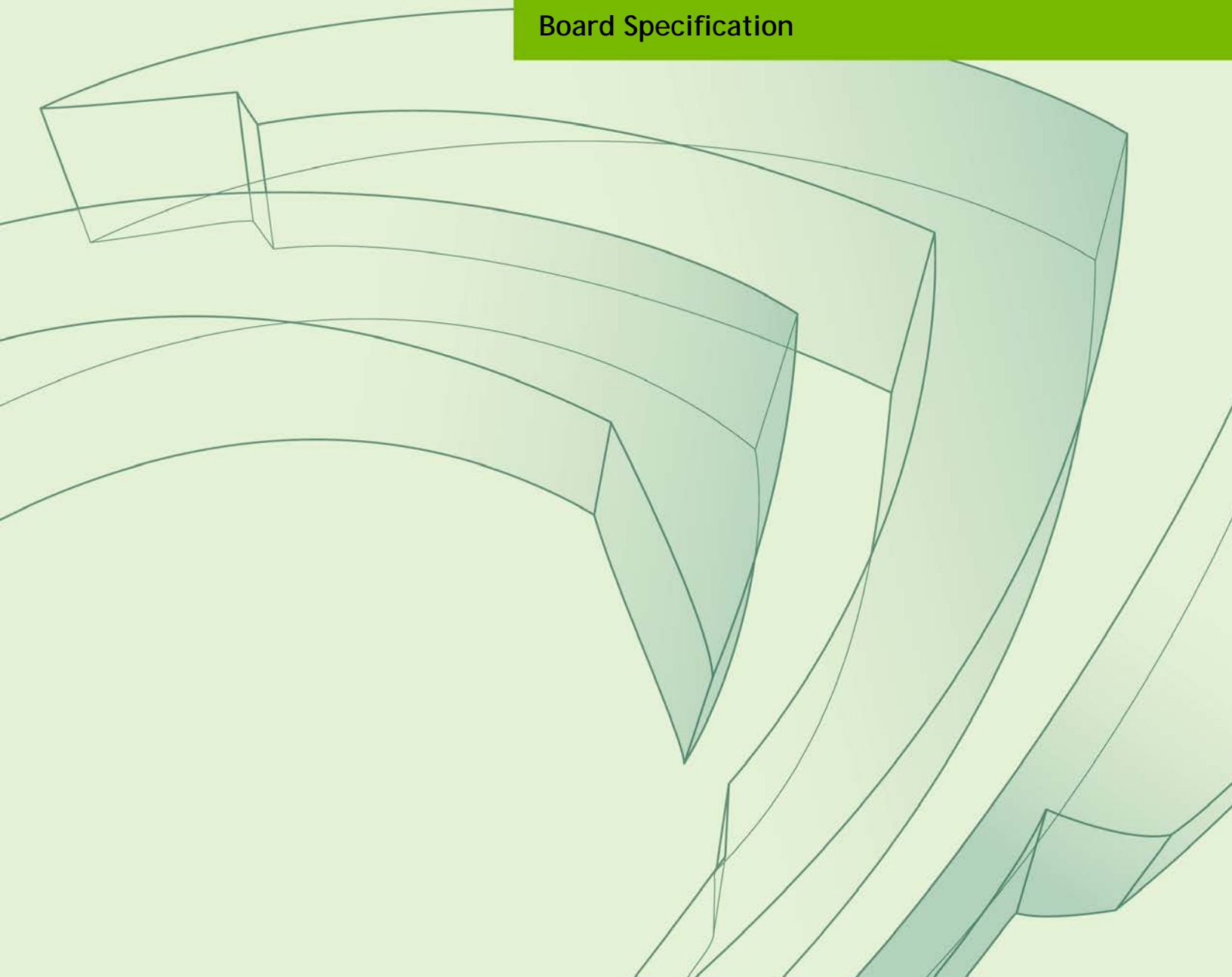




# QUADRO K620 GRAPHICS BOARD (P2012 SKU 504)

BD-07249-001\_v02 | August 2014

## Board Specification



## DOCUMENT CHANGE HISTORY

BD-07249-001\_v02

| Version | Date            | Authors | Description of Change                                    |
|---------|-----------------|---------|----------------------------------------------------------|
| 01      | May 16, 2014    | CM, SM  | Initial Release                                          |
| 02      | August 15, 2014 | TY, SM  | Removed all confidentiality as product has been released |

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# OVERVIEW

The NVIDIA Quadro® K620 graphics board (GM107 / P2012 SKU 504) is a PCI Express low profile form factor graphics add-in card based on the NVIDIA® Maxwell™ architecture graphics processing unit (GPU). The Quadro® K620 graphics board is targeted for professional CAD, DCC and Scientific Visualization applications.

The Quadro K620 graphics board offers 2 GB of DDR3 memory and supports up to four digital displays and one CRT.

## KEY FEATURES

### GPU

- ▶ Maximum core clock: 1059 MHz
- ▶ Supports NVIDIA GPU Boost™ to maximize performance
- ▶ NVIDIA® CUDA® cores: 384
- ▶ VESA® DisplayPort™ 1.2
- ▶ 10-bit internal display processing, including hardware support for 10-bit scan-out
- ▶ Full Microsoft DirectX 11.1 Shader Model 5.0 support
- ▶ Full OpenGL 4.4 support
- ▶ Programming support for CUDA C, CUDA C++, DirectCompute 5.0, OpenCL™, Python, Fortran

### Board

- ▶ PCI Express 2.0 ×16 system interface
- ▶ Physical dimensions: 2.713 inches × 6.3 inches, single-slot
- ▶ Board power: 45 W

## Display Connectors

- ▶ One dual-link DVI-I connector
- ▶ One DisplayPort output connector

## Memory

- ▶ Maximum memory clock: 900 MHz
- ▶ Memory I/O interface: 128-bit
- ▶ Total board memory: 2 GB
  - 8 pieces 128M ×16 DDR3
- ▶ Memory bandwidth: 29 GB/s

## Display Support

- ▶ 400 MHz integrated RAMDAC
  - Maximum resolution over VGA (through DVI to VGA cable): 2048 × 1536 × 32 bpp at 85 Hz
- ▶ Dual-link internal TMDS (DVI 1.0)
  - Maximum resolution over digital port (single GPU): 2560 × 1600 × 32 bpp at 60 Hz (reduced blanking)
- ▶ Single-link internal TMDS (DVI 1.0)
  - Maximum resolution over digital port (single GPU): 1920 × 1200 × 32 bpp at 60 Hz (reduced blanking)
- ▶ DisplayPort 1.2
  - Maximum resolution 4096 × 2160 × 30 bpp at 60 Hz

## BIOS

- ▶ 2Mbit serial ROM
- ▶ UEFI supported

# GRAPHICS CARD DESCRIPTION

The Quadro K620 graphics card is NVIDIA's next generation entry graphics board. It delivers OpenGL 4.4, Microsoft DirectX 11.1 and Shader Model 5.0 hardware acceleration.

## CONFIGURATION

Table 1 lists the configuration for the Quadro K620 graphics board.

Table 1. Board Configuration

| Specification                     | SKU 500 Description                                                                                                                                                                            |
|-----------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Generic SKU reference             | 699-52012-0504-7xx                                                                                                                                                                             |
| Chip                              | GM107                                                                                                                                                                                          |
| Package size GPU                  | 29 mm × 29 mm                                                                                                                                                                                  |
| Core clock                        | 1059 MHz                                                                                                                                                                                       |
| Memory clock                      | 900 MHz                                                                                                                                                                                        |
| CUDA cores                        | 384                                                                                                                                                                                            |
| Frame buffer                      | 2 GB                                                                                                                                                                                           |
| Memory I/O                        | 128-bit                                                                                                                                                                                        |
| Memory configuration              | 8 pcs 256M × 16 DDR3                                                                                                                                                                           |
| Memory bandwidth                  | 29 GB/s                                                                                                                                                                                        |
| BAR1 size                         | 256 MB                                                                                                                                                                                         |
| Display connectors                | <ul style="list-style-type: none"> <li>•One dual-link DVI-I connector</li> <li>•One DisplayPort connector</li> </ul>                                                                           |
| Total board power                 | 45 W                                                                                                                                                                                           |
| HDCP supported                    | Yes                                                                                                                                                                                            |
| Weight                            | 133 grams                                                                                                                                                                                      |
| Thermal cooling solution          | Active fan sink                                                                                                                                                                                |
| Mean time between failures (MTBF) | <ul style="list-style-type: none"> <li>•Uncontrolled environment: 2878720.2273 hours at 35 °C<sup>1</sup></li> <li>•Controlled environment: 4266678.9495 hours at 35 °C<sup>1</sup></li> </ul> |

**Note:** <sup>1</sup>Starting in January 2013, NVIDIA began using Telcordia (TelC3) SR-332, Issue 3 for all reliability calculations.

# MECHANICAL SPECIFICATIONS

## FORM FACTOR

The Quadro K620 graphics board is a low profile form factor (Figure 1).

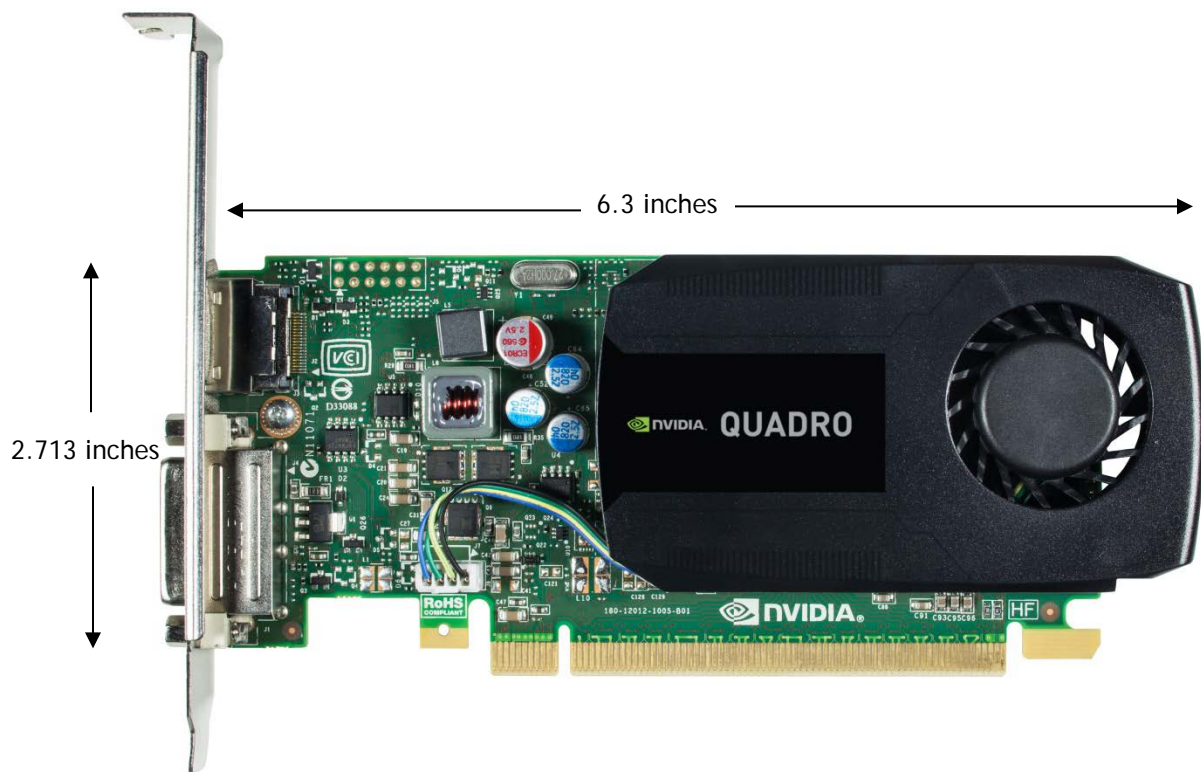


Figure 1. Quadro K620 Graphics Board



## PLACEMENT OF STANDARD I/O CONNECTORS

Figure 2 shows the standard placement of the connectors for the Quadro K620 graphics board.

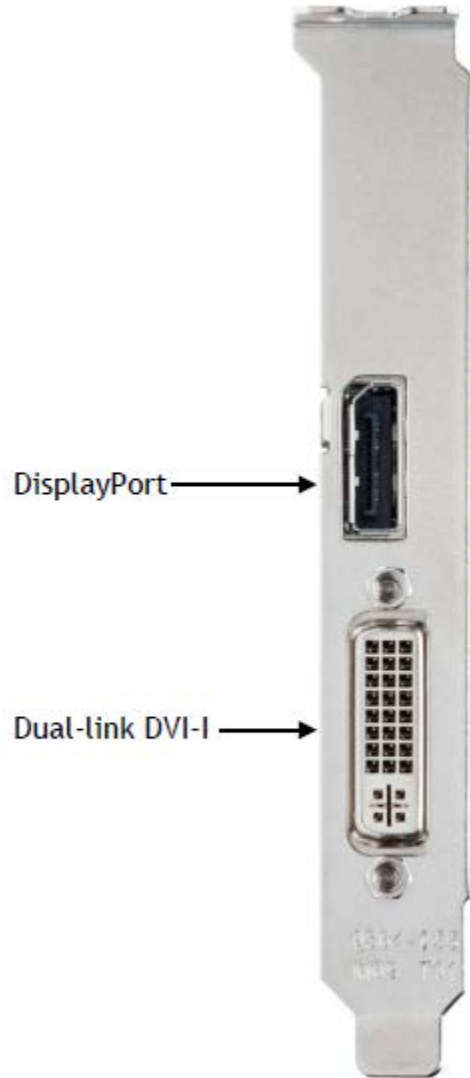


Figure 2. Standard Connector Placement

## DISPLAY CONNECTORS

The Quadro K620 graphics board supports the following connectors.

- ▶ One dual-link DVI-I connector
- ▶ One DisplayPort connector

### DVI

The Quadro K620 graphics board supports the DVI-I combined analog and digital interface connector (Figure 3). Table 2 lists the DVI-I connector pinout.

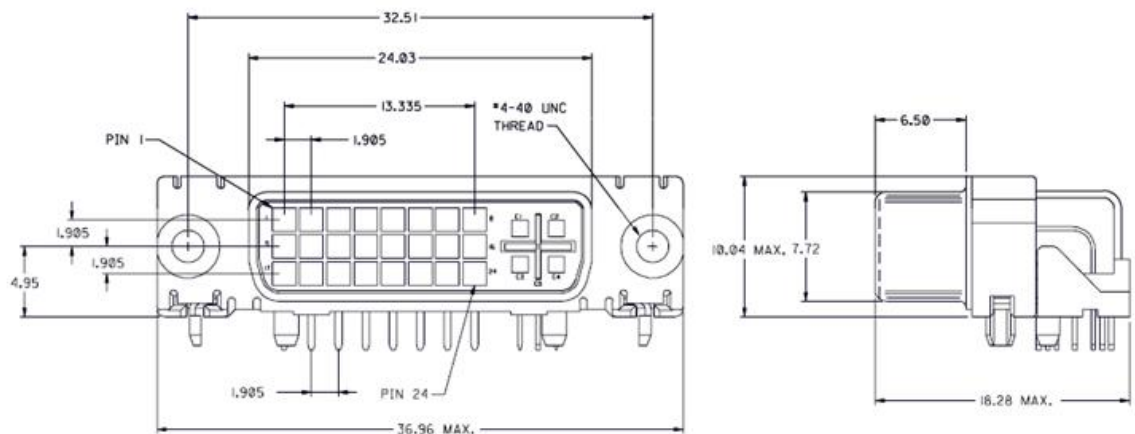


Figure 3. DVI-I Connector

Table 2. DVI-I Connector Pinout

| Pin | Signal               | Pin | Signal                        |
|-----|----------------------|-----|-------------------------------|
| 1   | TMDS data 2-         | 13  | TMDS data 3+                  |
| 2   | TMDS data 2+         | 14  | +5VDC power                   |
| 3   | TMDS data 2/4 shield | 15  | Ground (Return for +5)        |
| 4   | TMDS data 4-         | 16  | Hot plug detected             |
| 5   | TMDS data 4+         | 17  | TMDS data 0-                  |
| 6   | DDC clock            | 18  | TMDS data 0+                  |
| 7   | DDC data             | 19  | TMDS data 0/5 shield          |
| 8   | Analog vertical sync | 20  | TMDS data 5-                  |
| 9   | TMDS data 1-         | 21  | TMDS data 5+                  |
| 10  | TMDS data 1+         | 22  | TMDS clock shield             |
| 11  | TMDS data 1/3 shield | 23  | TMDS clock+                   |
| 12  | TMDS data 3-         | 24  | TMDS clock-                   |
| C1  | Analog red           | C4  | Analog horizontal sync        |
| C2  | Analog green         | C5  | Analog ground<br>(RGB return) |
| C3  | Analog blue          |     |                               |

## DisplayPort

The Quadro K620 graphics board supports the use of a VESA standard 20-pin DisplayPort connector (Figure 4) that supports DisplayPort 1.2 functionality. The graphics board is configured with two VESA standard DisplayPort connector interfaces between your system and your display. Table 3 provides the connector pinout.

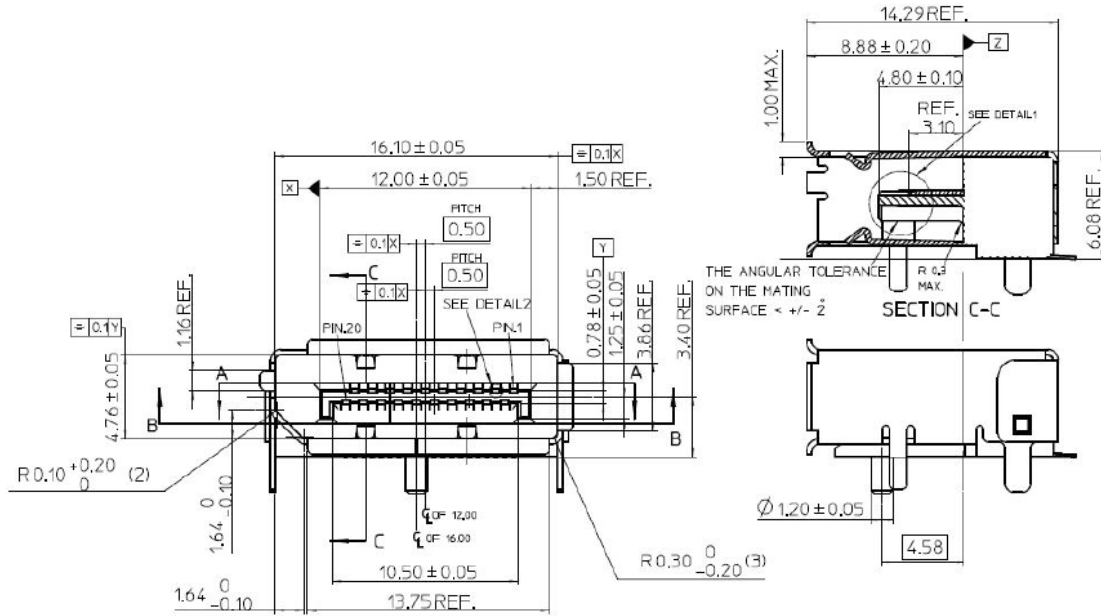


Figure 4. DisplayPort Connector

Table 3. DisplayPort Connector Pinout

| Pin | Signal Name     | Description |
|-----|-----------------|-------------|
| 1   | ML_Lane 0 (p)   | Out         |
| 2   | GND             | Ground      |
| 3   | ML_Lane 0 (n)   | Out         |
| 4   | ML_Lane 1 (p)   | Out         |
| 5   | GND             | Ground      |
| 6   | ML_Lane 1 (n)   | Out         |
| 7   | ML_Lane 2 (p)   | Out         |
| 8   | GND             | Ground      |
| 9   | ML_Lane 2 (n)   | Out         |
| 10  | ML_Lane 3 (p)   | Out         |
| 11  | GND             | Ground      |
| 12  | ML_Lane 3 (n)   | Out         |
| 13  | CONFIG1         | CONFIG      |
| 14  | CONFIG2         | CONFIG      |
| 15  | AUX CH (p)      | I/O         |
| 16  | GND             | Ground      |
| 17  | AUX CH (n)      | I/O         |
| 18  | Hot Plug Detect | In          |
| 19  | Return          | RTN         |
| 20  | DP_PWR          | Power Out   |

## HDCP SUPPORT

Support for high definition content protection (HDCP) comes integrated in the GPU used on the Quadro K620 graphics board.

The full HDCP specification is available upon request

# POWER SPECIFICATIONS

The Quadro K620 graphics board is a power optimized board solution. Power is taken from the PCI Express host bus.

## POWER BY RAIL

Table 4 lists the power by rail numbers for the Quadro K620 graphics board.

Table 4. Power by Rail

| TDP Application | PEX12V | PEX3V3 | Total Board Power |
|-----------------|--------|--------|-------------------|
| 3DMark11        | 41 W   | 4 W    | 45 W              |

## ENERGY STAR REPORT

Table 5 lists the energy star report for the Quadro K620 graphics board.

Table 5. Energy Star Report

| Specification           | Description                                                                                     |
|-------------------------|-------------------------------------------------------------------------------------------------|
| Brand                   | Quadro K620                                                                                     |
| GPU                     | GM107                                                                                           |
| Board                   | P2012                                                                                           |
| SKU                     | 504                                                                                             |
| Clocks                  | <ul style="list-style-type: none"> <li>• 1059 MHz (core)</li> <li>• 900 MHz (memory)</li> </ul> |
| Frame buffer            | 128-bit                                                                                         |
| Memory                  | 2 GB DDR3 SDRAM                                                                                 |
| PCI Express             | ×16                                                                                             |
| ASPM OFF ratio          | 7 : 1                                                                                           |
| Maximum power: ASPM OFF | 45 W                                                                                            |
| Idle power: ASPM OFF    | 6.3 W                                                                                           |

# THERMAL SPECIFICATIONS

## THERMAL QUALIFICATION SUMMARY

The information contained in this summary report is intended to provide users of the Quadro K620 graphics processor with thermal information necessary to assist in thermal management efforts. This information is not intended to provide a specific thermal management solution. However, it does show an approach that results in the reliable operation of the Quadro K620 GPU.

The product and cooling solutions used are:

- ▶ Device product: Quadro K620 graphics board.
- ▶ Cooling solution: Active fan sink solution (designed by NVIDIA, supplied by Cooler Master), NVIDIA P/N: 680-52012-0504-000. The cooling solution assembly includes a heat sink, fan, thermal grease interface material and screws.
- ▶ Result: Under the operating conditions described in the following tables, the Quadro K620 passed thermal qualification.



Table 6. Test Setup and Configuration

| System Part         | Description                                                                                     |
|---------------------|-------------------------------------------------------------------------------------------------|
| CPU                 | Intel Core i7-965, 3.2 GHz                                                                      |
| Motherboard         | Z77 / 287                                                                                       |
| DRAM                | 6 GB, DDR3, 1600 MHz                                                                            |
| PC operating system | Windows 7 64-bit                                                                                |
| Graphics board      | P2012 SKU 504                                                                                   |
| BIOS                | 82.07.39.00.01                                                                                  |
| Display driver      | 335.14                                                                                          |
| GPU                 | GM107-850                                                                                       |
| Clock speeds        | <ul style="list-style-type: none"> <li>● 1059 MHz (core)</li> <li>● 900 MHz (memory)</li> </ul> |

Table 7. Sample Thermal Results and Specification

| Test Application (3DMark11)                     | Temperature (°C)* |
|-------------------------------------------------|-------------------|
| GPU Junction temperature ( $T_j$ ) at the TDP** | 91                |
| GPU Slowdown temperature (maximum $T_j$ )       | 96                |
| GPU Shutdown temperature ( $T_j$ )              | 101               |
| Maximum fan inlet temperature                   | 55                |

**Notes:**

\* Junction temperature is reported by NVIDIA thermal sensor

\*\* TDP - Thermal design power.

## COOLING SOLUTION

NVIDIA has designed an active fan sink (Figure 5) to cool the GPU, memories and power components. For fan specifications refer to Table 8 and for board environmental conditions refer to Table 9.

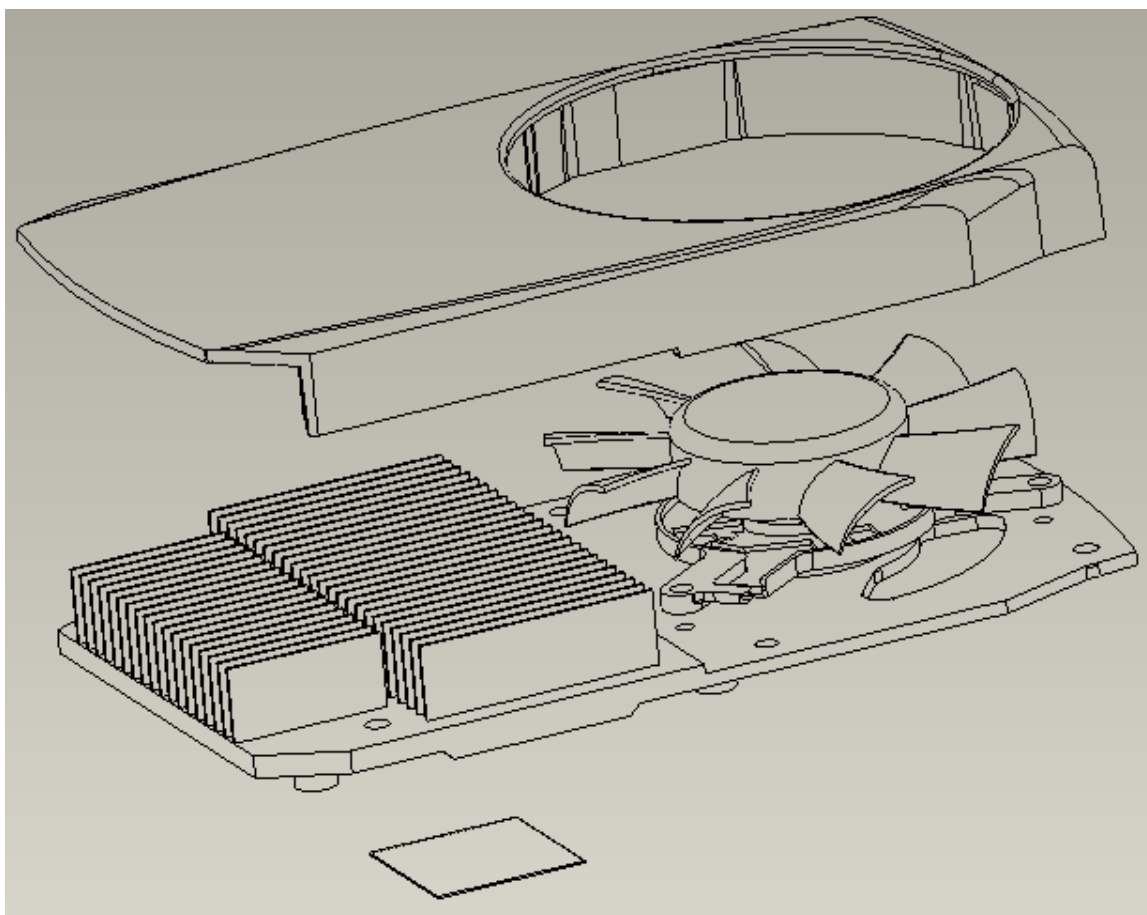


Figure 5. Active Fan Sink

Table 8. Fan Environmental Specifications

| Specifications      | Conditions                                                              |
|---------------------|-------------------------------------------------------------------------|
| Rated voltage       | 12 V                                                                    |
| Operating voltage   | 7 - 13.8 V DC                                                           |
| Rated current       | 0.24 Amp                                                                |
| Rated power         | 2.28 W                                                                  |
| Speed               | 6000 RPM +/- 10%                                                        |
| Fan life expectance | 50,000 hours continuous operation at 55 °C with 5-90% relative humidity |

Table 9. Board Environmental Conditions

| Specifications        | Conditions                  |
|-----------------------|-----------------------------|
| Operating temperature | 0 °C to 55 °C               |
| Storage temperature   | -40 °C to 75 °C             |
| Operating humidity    | 5% to 90% relative humidity |
| Storage humidity      | 5% to 95% relative humidity |

# SUPPORT INFORMATION

## CERTIFICATES AND AGENCIES

### Certifications

- ▶ Windows Hardware Quality Lab (WHQL):
  - Certified Windows 7 and Windows 8
- ▶ Ergonomic requirements for office work W/VDTs (ISO 9241)
- ▶ EU Reduction of Hazardous Substances (EU RoHS)
- ▶ Joint Industry guide (J-STD) / Registration, Evaluation, Authorization, and Restriction of Chemical Substance (EU) – (JIG / Reach)
- ▶ Halogen Free(HF)
- ▶ EU Waste Electrical and Electronic Equipment (WEEE)

### Agencies

- ▶ Australian Communications Authority and Radio Spectrum Management Group of New Zealand (C-Tick)
- ▶ Bureau of Standards, Metrology, and Inspection (BSMI)
- ▶ Conformité Européenne (CE)
- ▶ Federal Communications Commission (FCC)
- ▶ Industry Canada - Interference-Causing Equipment Standard (ICES)
- ▶ Imaging Science Foundation (ISF)
- ▶ Consumer Video Quality Certification (ISV)
- ▶ Korean Communications Commission (KCC)
- ▶ Underwriters Laboratories (cUL, UL)
- ▶ Voluntary Control Council for Interference (VCCI)

## LANGUAGES

Table 10. Languages Supported

|                               | Windows 7 | Windows 8 | Linux |
|-------------------------------|-----------|-----------|-------|
| English (US)                  | Yes       | Yes       | Yes   |
| English (UK)                  | Yes       | Yes       | Yes   |
| Arabic                        | Yes       | Yes       |       |
| Chinese, Simplified           | Yes       | Yes       |       |
| Chinese, Traditional          | Yes       | Yes       |       |
| Czech                         | Yes       | Yes       |       |
| Danish                        | Yes       | Yes       |       |
| Dutch                         | Yes       | Yes       |       |
| Finnish                       | Yes       | Yes       |       |
| French                        | Yes       | Yes       |       |
| German                        | Yes       | Yes       |       |
| Greek                         | Yes       | Yes       |       |
| Hebrew                        | Yes       | Yes       |       |
| Hungarian                     | Yes       | Yes       |       |
| Italian                       | Yes       | Yes       |       |
| Japanese                      | Yes       | Yes       |       |
| Korean                        | Yes       | Yes       |       |
| Norwegian                     | Yes       | Yes       |       |
| Polish                        | Yes       | Yes       |       |
| Portuguese (Brazil)           | Yes       | Yes       |       |
| Portuguese (European/Iberian) | Yes       | Yes       |       |
| Russian                       | Yes       | Yes       |       |
| Slovak                        | Yes       | Yes       |       |
| Slovenian                     | Yes       | Yes       |       |
| Spanish                       | Yes       | Yes       |       |
| Spanish (Latin America)       | Yes       | Yes       |       |
| Swedish                       | Yes       | Yes       |       |
| Thai                          | Yes       | Yes       |       |
| Turkish                       | Yes       | Yes       |       |

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