TESLA K10 GPU ACCELERATOR

BD-06280-001_v09 | October 2014

Board Specification

DOCUMENT CHANGE HISTORY

BD-06280-001_v09

Version	Date	Authors	Description of Change
01	April 10, 2012	GG, SM	Preliminary Information (Information contained within this board specification is subject to change)
02	April 11, 2012	GG, SM	•Updated board length •Updated "Overview" section •Updated Table 4
03	May 14, 2012	GG, SM	•Removed "Preliminary Information" statement as this board specification is no longer considered preliminary •Updated title to *Tesla K10 GPU Accelerator Board Specification* •Updated number of core processors •Updated Figure 2 and Figure 3
04	May 21, 2012	GG, SM	Removed NDA and confidential statements from document
05	June 22, 2012	GG, SM	Updated the "Standard I/O Connector Placement" section with steps on removing the bracket
06	September 18, 2012	GG, SM	•Added note to "Overview" section •Added peak memory bandwidth to "Key Features" section •Updated Table 1
07	November 7, 2012	GG, SM	Added MTBF information (Table 1)
08	August 5, 2014	TY, SM	Updated MTBF information (Table 1)
09	October 15, 2014	GG, SM	Updated Figure 2

TABLE OF CONTENTS

Overview 1
Key Features 1
Tesla K10 Block Diagram 3
Configuration 4
Mechanical Specifications 5
PCI Express System 5
Standard I/O Connector Placement 6
Internal Connectors and Headers 8
External PCI Express Power Connectors 8
Power Specifications 12
Support Information 13
Certificates and Agencies 13
Agencies 13
Languages 14

LIST OF FIGURES

Figure 1. Tesla K10 Block Diagram 3
Figure 2. Tesla K10 GPU Accelerator 5
Figure 3. Tesla K10 Bracket 6
Figure 4. Tesla K10 with Bracket 7
Figure 5. Tesla K10 without Bracket 7
Figure 6. 6-Pin PCI Express Power Connector 9
Figure 7. 8-Pin PCI Express Power Connector 10

LIST OF TABLES

Table 1. Board Configurations 4
Table 2. 6-Pin PCI Express Power Connector Pinout 11
Table 3. 8-Pin PCI Express Power Connector Pinout 11
Table 4. Configuration with External PCI Express Connectors 12
Table 5. Languages Supported 14

OVERVIEW

The NVIDIA® Tesla® K10 graphics processing unit (GPU) accelerator is a PCI Express, dual-slot, full height (4.376 inches by 10.5 inches by 1.52 inches) form factor computing module comprising two NVIDIA GK104 GPUs. The Tesla K10 offers a total of 8 GB of GDDR5 on-board memory (4 GB per GPU) and supports PCI Express Gen3.

The Tesla K10 can be configured by the OEM or by the end user to enable or disable ECC or error correcting codes that can fix single-bit errors and detect double-bit errors. Enabling ECC will cause some of the memory to be used for the ECC bits, so the user available memory will decrease by 10%. On the Tesla K10 the ECC protection is for DRAM only.

Note: The Tesla K10 can be installed and works in a PCI Express Gen2 system as well. In such configurations the Tesla K10 will run at PCI Express Gen2 speeds.

KEY FEATURES

GPU

The Tesla K10 GPU accelerator has two GK104 GPUs. Characteristics for both GPUs are as follows:

- Number of processor cores: 1536 per GPU
- Processor core clock: 745 MHz
- Package size: 40 mm × 40 mm 1745-pin ball grid array (BGA)

Board

- PCI Express Gen3 ×16 system interface
- Physical dimensions: 4.376 inches × 10.5 inches, dual-slot
- Board power: 225 W

External Connectors

- None

Internal Connectors and Headers

- One 6-pin PCI Express power connector
- One 8-pin PCI Express power connector

Memory

- Memory clock: 2.5 GHz
- Peak memory bandwidth: Cumulative 320 GB/s (160 GB/s per GPU)
- Interface: 256-bit
  - Total board memory: 8 GB (4 GB per GPU)
  - 32 pieces of 128M × 16 GDDR5, SDRAM (per GPU)

BIOS

- 2Mbit Serial ROM

TESLA K10 BLOCK DIAGRAM

Figure 1 is the block diagram for Tesla K10 GPU accelerator. It comprises two identical GK104 GPUs, each with 4 GB of GDDR5 memory. The GPUs are connected via a PCI Express switch. The board supports PCI Express Gen3.

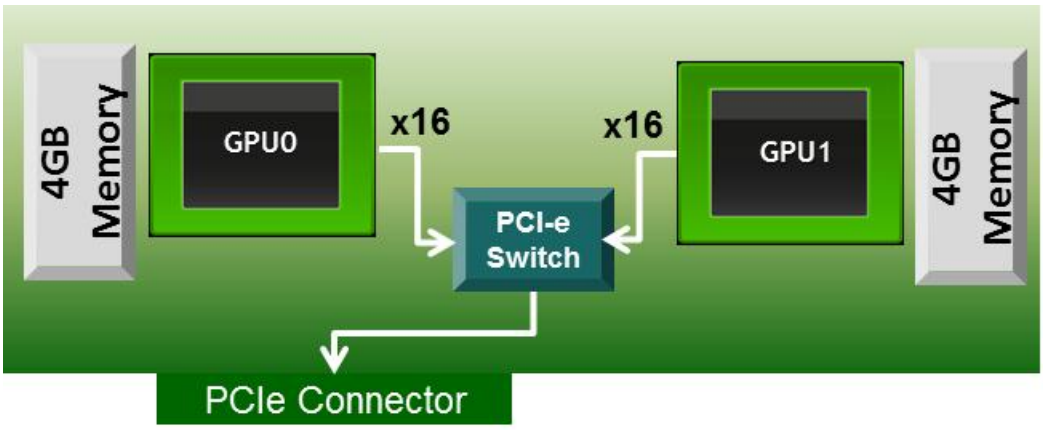

Figure 1. Tesla K10 Block Diagram

CONFIGURATION

The Tesla K10 boards are available in the following configurations (Table 1) based on the orientation of the airflow inside the system.

Table 1. Board Configurations

Specifications	Tesla K10
Generic SKU reference	•900-22055-0010-000: Airflow left to right •900-22055-0020-000: Airflow right to left
Chip	2× GK104
Package size GPU	42.5 mm × 42.5 mm 1981-pin ball grid array (BGA)
Processor clock	745 MHz
Memory clock	2.5 GHz
Memory size	4 GB per GPU (8 GB per board)
Memory I/O	256-bit GDDR5
Memory configuration	32 pieces of 128M × 16 GDDR5 SDRAM
External connectors	None
Internal connectors and headers	•8-pin PCI Express power connector •6-pin PCI Express power connector
Board power	225 W
Meantime between failures (MTBF)[1]	•Controlled environment: 516941.5627 hours at 35 °C •Uncontrolled environment: 386442.93 hours at 35 °C

Note: [1]The MTBF was calculated using Telcordia SR-332, Issue 3

MECHANICAL SPECIFICATIONS

PCI EXPRESS SYSTEM

The Tesla K10 boards (Figure 2) conform to the PCI Express full height (4.376 inches by 10.5 inches) form factor. Figure 2 is shown without the bracket.

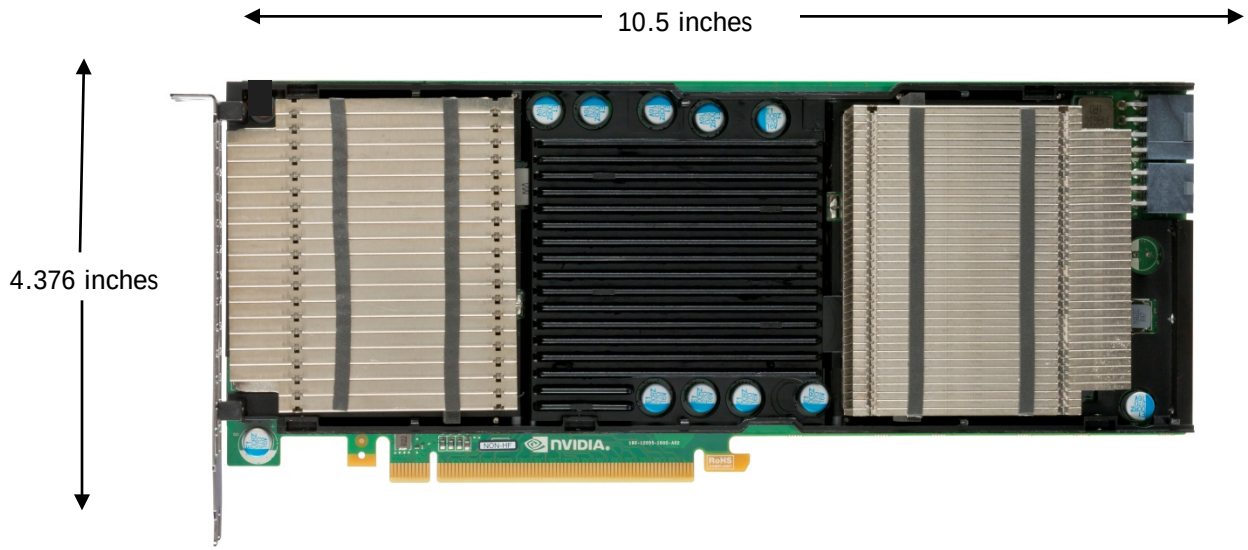

Figure 2. Tesla K10 GPU Accelerator

Note: The final product will ship with an 8 and 6-pin connector and shroud.

STANDARD I/O CONNECTOR PLACEMENT

As shown in Figure 3, the Tesla K10 includes a vented bracket. If you are an OEM who qualifies for bracket modifications, you have the option of receiving your modules with no bracket installed.

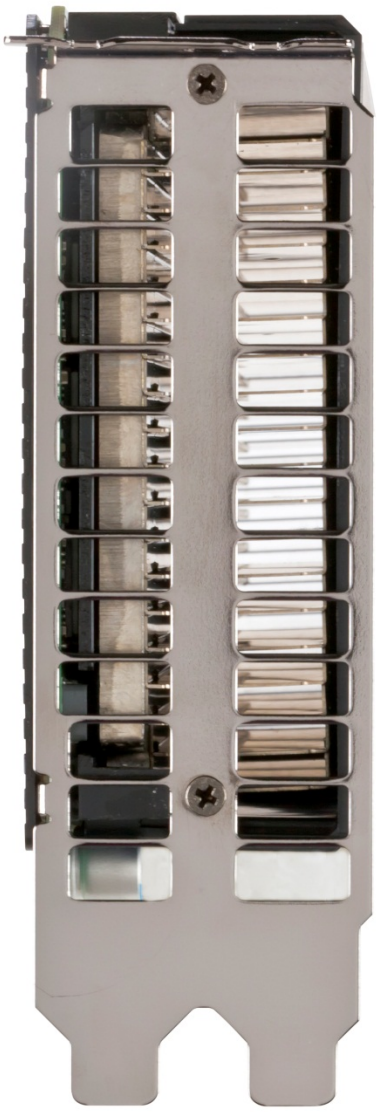

Figure 3. Tesla K10 Bracket

If you need to remove the standard bracket follow these simple steps:

1. Remove the two shoulder screws on the back side of the PCB.
2. Remove the two flat head screws on the bracket exhaust face.
3. Remove the bracket.
4. Slide the washer in between the PCB and the backplate to maintain clearance between the PCB and the backplate.
5. Attach the shoulder screws.

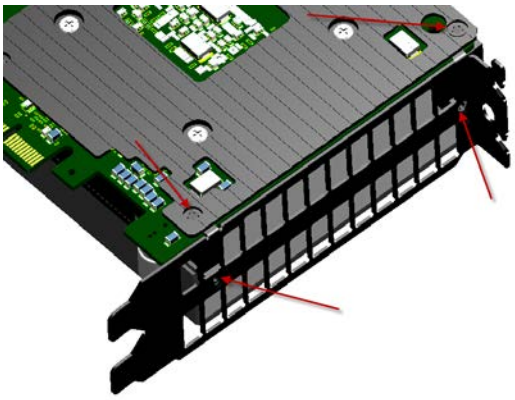

Figure 4. Tesla K10 with Bracket

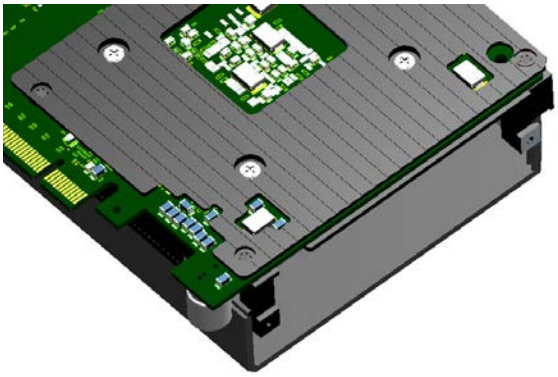

Figure 5. Tesla K10 without Bracket

INTERNAL CONNECTORS AND HEADERS

The Tesla K10 GPU accelerator supports the following internal connectors and headers.

- 8-pin PCI Express power connector (can be used with a 6-pin power cable)
- 6-pin PCI Express power connector

External PCI Express Power Connectors

The Tesla K10 GPU accelerator is a performance optimized, high-end product and uses power from the PCI Express connector as well as external power connectors. The board can be used in two different ways.

- One 8-pin PCI Express power connector or
- Two 6-pin PCI Express power connectors

Figure 6 and Figure 7 show the specifications and Table 2 and Table 3 show the pinouts for the 6-pin and 8-pin PCI Express power connectors.

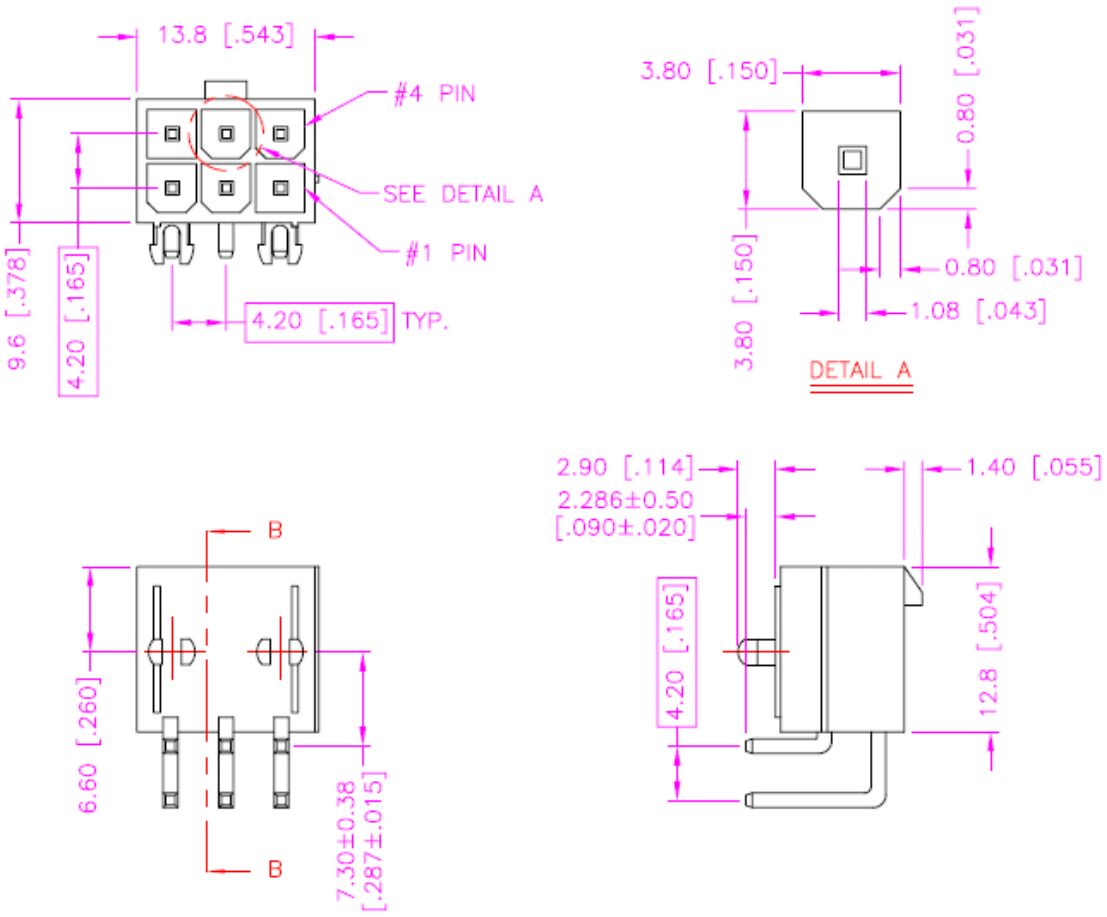

Figure 6. 6-Pin PCI Express Power Connector

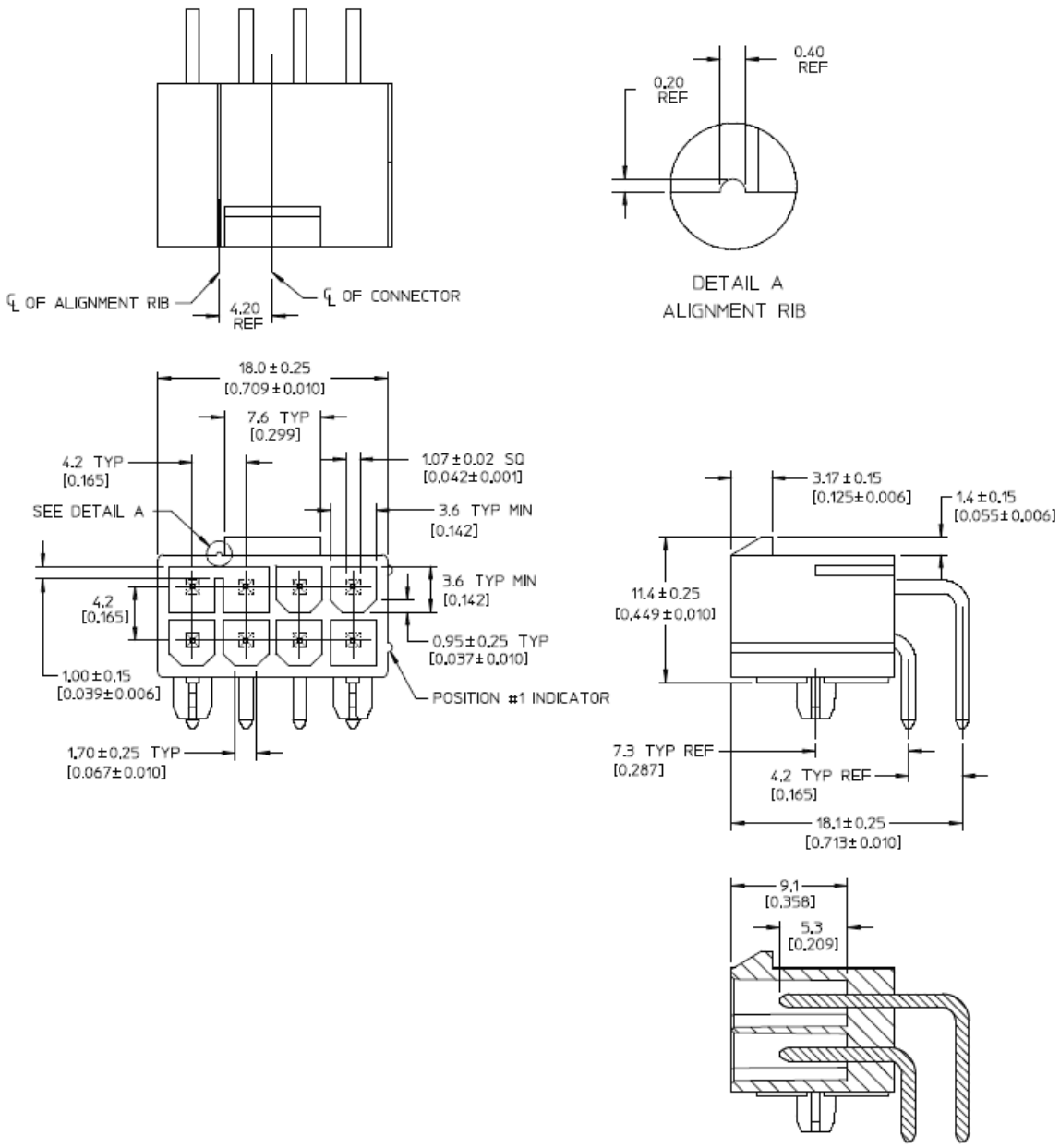

Figure 7. 8-Pin PCI Express Power Connector

Table 2. 6-Pin PCI Express Power Connector Pinout

Pin Number	Description
1	+12 V
2	+12 V
3	+12 V
4	GND
5	Sense
6	GND

Table 3. 8-Pin PCI Express Power Connector Pinout

Pin Number	Description
1	+12 V
2	+12 V
3	+12 V
4	Sense1
5	GND
6	Sense0
7	GND
8	GND

POWER SPECIFICATIONS

The Tesla K10 GPU accelerator requires power from the PCI Express connector as well as one or two auxiliary power connectors.

Table 4. Configuration with External PCI Express Connectors

Connector Type	6-Pin Power Connector	Supported	Notes
8-pin connected	6-pin connected	Yes	
8-pin connected	No cable installed	Yes	8-pin cable must supply 175 W
6-pin connected	N/A	No	6-pin cable in the 8-pin connector is not supported.
Not installed	N/A	No	8-pin connector should always be connected.

Note: Detailed information about power draw by rail is available to authorized system partners in the *Tesla K10 Board System Design Guide* (DG-06105-001)

SUPPORT INFORMATION

CERTIFICATES AND AGENCIES

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)
- Korean Communications Commission (KCC)
- Underwriters Laboratories (cUL)
- Voluntary Control Council for Interference (VCCI)

LANGUAGES

Table 5. Languages Supported

	Windows Server 2008 and Windows Server 2008 R2	Linux
English (US)	X	X
English (UK)	X	
Arabic	X	
Chinese, Simplified	X	
Chinese, Traditional	X	
Danish	X	
Dutch	X	
Finnish	X	
French	X	
French (Canada)	X	
German	X	
Italian	X	
Japanese	X	
Korean	X	
Norwegian	x	
Portuguese (Brazil)	X	
Russian	X	
Spanish	X	
Spanish (Latin America)		
Swedish	X	
Thai	X	

Note: NVIDIA's CUDA™ software is only supported in English (U.S.)

Notice

The information provided in this specification is believed to be accurate and reliable as of the date provided. However, NVIDIA Corporation (“NVIDIA”) does not give any representations or warranties, expressed or implied, as to the accuracy or completeness of such information. NVIDIA shall have no liability for the consequences or use of such information or for any infringement of patents or other rights of third parties that may result from its use. This publication supersedes and replaces all other specifications for the product that may have been previously supplied.

NVIDIA reserves the right to make corrections, modifications, enhancements, improvements, and other changes to this specification, at any time and/or to discontinue any product or service without notice. Customer should obtain the latest relevant specification before placing orders and should verify that such information is current and complete.

NVIDIA products are sold subject to the NVIDIA standard terms and conditions of sale supplied at the time of order acknowledgement, unless otherwise agreed in an individual sales agreement signed by authorized representatives of NVIDIA and customer. NVIDIA hereby expressly objects to applying any customer general terms and conditions with regard to the purchase of the NVIDIA product referenced in this specification.

NVIDIA products are not designed, authorized or warranted to be suitable for use in medical, military, aircraft, space or life support equipment, nor in applications where failure or malfunction of the NVIDIA product can reasonably be expected to result in personal injury, death or property or environmental damage. NVIDIA accepts no liability for inclusion and/or use of NVIDIA products in such equipment or applications and therefore such inclusion and/or use is at customer’s own risk.

NVIDIA makes no representation or warranty that products based on these specifications will be suitable for any specified use without further testing or modification. Testing of all parameters of each product is not necessarily performed by NVIDIA. It is customer’s sole responsibility to ensure the product is suitable and fit for the application planned by customer and to do the necessary testing for the application in order to avoid a default of the application or the product. Weaknesses in customer’s product designs may affect the quality and reliability of the NVIDIA product and may result in additional or different conditions and/or requirements beyond those contained in this specification. NVIDIA does not accept any liability related to any default, damage, costs or problem which may be based on or attributable to: (i) the use of the NVIDIA product in any manner that is contrary to this specification, or (ii) customer product designs.

No license, either expressed or implied, is granted under any NVIDIA patent right, copyright, or other NVIDIA intellectual property right under this specification. Information published by NVIDIA regarding third-party products or services does not constitute a license from NVIDIA to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property rights of the third party, or a license from NVIDIA under the patents or other intellectual property rights of NVIDIA. Reproduction of information in this specification is permissible only if reproduction is approved by NVIDIA in writing, is reproduced without alteration, and is accompanied by all associated conditions, limitations, and notices.

ALL NVIDIA DESIGN SPECIFICATIONS, REFERENCE BOARDS, FILES, DRAWINGS, DIAGNOSTICS, LISTS, AND OTHER DOCUMENTS (TOGETHER AND SEPARATELY, “MATERIALS”) ARE BEING PROVIDED “AS IS.” NVIDIA MAKES NO WARRANTIES, EXPRESSED, IMPLIED, STATUTORY, OR OTHERWISE WITH RESPECT TO THE MATERIALS, AND EXPRESSLY DISCLAIMS ALL IMPLIED WARRANTIES OF NONINFRINGEMENT, MERCHANTABILITY, AND FITNESS FOR A PARTICULAR PURPOSE. Notwithstanding any damages that customer might incur for any reason whatsoever, NVIDIA’s aggregate and cumulative liability towards customer for the products described herein shall be limited in accordance with the NVIDIA terms and conditions of sale for the product.

Trademarks

NVIDIA, the NVIDIA logo, CUDA, Kepler, NVS, and Quadro are trademarks and/or registered trademarks of NVIDIA Corporation in the U.S. and other countries. Other company and product names may be trademarks of the respective companies with which they are associated.

Copyright

© 2012, 2014 NVIDIA Corporation. All rights reserved.