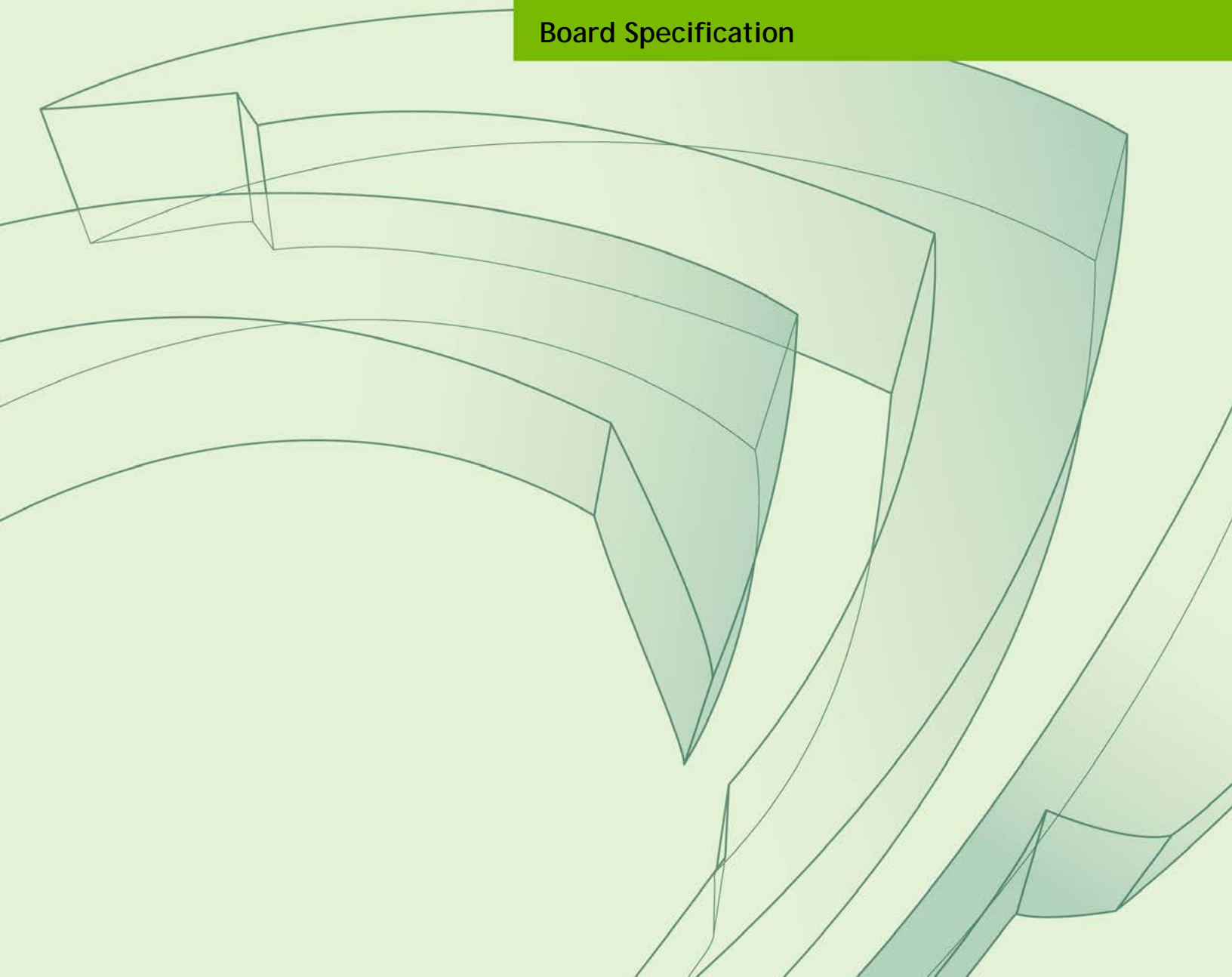




TESLA C2075 COMPUTING PROCESSOR BOARD

BD-05880-001_v02 | September 2011

Board Specification



DOCUMENT CHANGE HISTORY

BD-05880-001_v02

Version	Date	Authors	Description of Change
01	July 25, 2011	MC, SM	Initial Release
02	September 9, 2011	MC, SM	<ul style="list-style-type: none">•Updated “Thermal Qualification Summary” section•Updated Table 10 in the “Cooling Solution” Section

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OVERVIEW

The NVIDIA® Tesla™ C2075 computing processor board is a PCI Express 2.0 full-height (4.376 inches by 9.75 inches) form factor computing add-in card based on the NVIDIA Tesla T20A graphics processing unit (GPU). This board is targeted as high-performance computing (HPC) solution for PCI Express systems.

The Tesla C2075 is capable of running 515 GFLOPs per second of double precision processing performance. The Tesla C2075 and comes standard with 6 GB of GDDR5 memory.

The Tesla C2075 can be configured by the end user to enable or disable ECC or error correcting codes that can fix single-bit errors and report 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 to 5.25 GB.

KEY FEATURES

GPU

- ▶ Number of processor cores: 448
- ▶ Processor core clock: 1.15 GHz
- ▶ Voltage: 887.5 mV to 975 mV
- ▶ Package size: 42.5 mm × 42.5 mm 1981-pin ball grid array (BGA)

Board

- ▶ Twelve layers printed circuit board (PCB)
- ▶ PCI Express Gen2 ×16 system interface
- ▶ Physical dimensions: 4.376 inches × 9.75 inches, dual slot
- ▶ Board power dissipation: less than or equal to 215 W

External Connectors

- ▶ Single port, dual-link DVI-I

Internal Connectors and Headers

- ▶ One 6-pin PCI Express power connector
- ▶ One 8-pin PCI Express power connector
- ▶ 4-pin fan connector

Memory

- ▶ Memory clock: 1.50 GHz
- ▶ Interface: 384-bit
 - 6GB
 - 24 pieces 64M × 32 GDDR5 136-pin BGA, SDRAM

BIOS

- ▶ 2Mbit Serial ROM

COMPUTING PROCESSOR DESCRIPTION

Figure 1 is a block diagram of the Tesla C2075 computing processor.

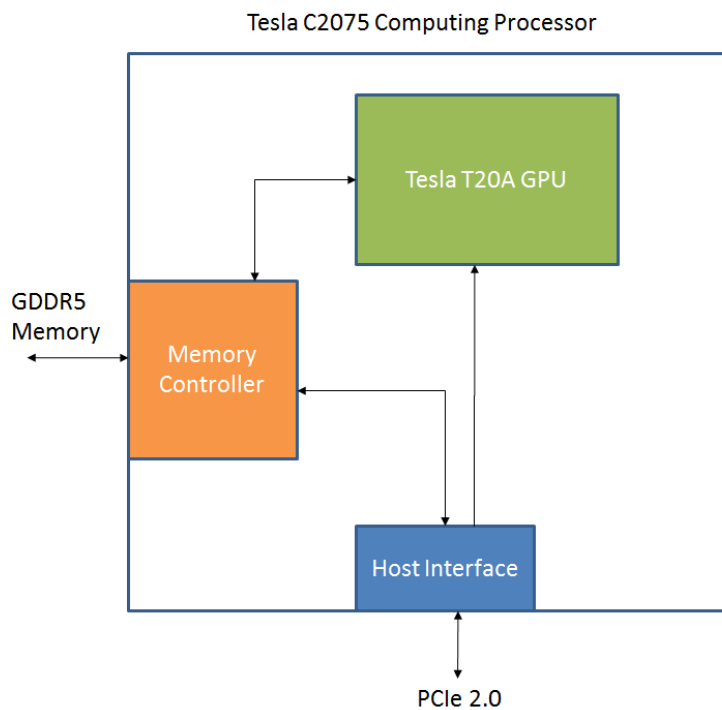


Figure 1. Tesla C2075 Block Diagram

CONFIGURATION

There is one configuration available (Table 1) for the Tesla C2075 board.

Table 1. Board Configuration

Specification	Description
Generic SKU reference	900-21030-0020-100
Chip	Tesla T20A GPU
Package size GPU	42.5 mm x 42.5 mm
Processor clock	1.15 GHz
Memory clock	1.50 GHz
Memory size	6 GB
Memory I/O	384-bit GDDR5
Memory configuration	24 pcs 64M × 32 GDDR5 SDRAM
External connectors	Single port, dual-link DVI-I
Internal connectors and headers	<ul style="list-style-type: none"> • 8-pin PCI Express power connector • 6-pin PCI Express power connector • 4-pin fan connector
Board power	< = 215 W
Thermal cooling solution	Custom active fan sink

MECHANICAL SPECIFICATIONS

PCI EXPRESS SYSTEM

The Tesla C2075 computing processor board (Figure 2) conforms to the PCI Express full height (4.376 inches by 9.75 inches) form factor.



Figure 2. Tesla C2075 Computing Processor Board

STANDARD I/O CONNECTOR PLACEMENT

As shown in Figure 3, the Tesla C2075 includes a single, dual-link DVI-I connector.

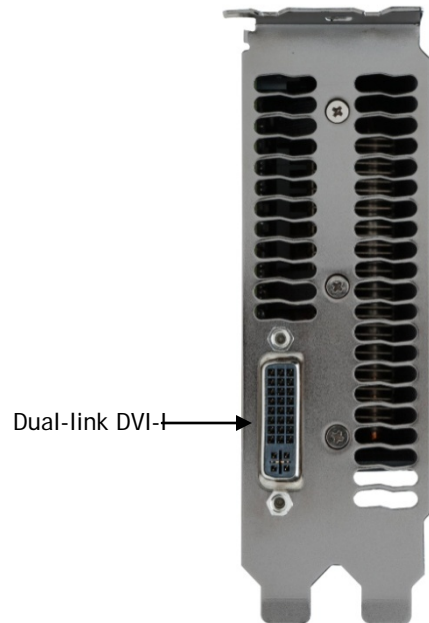


Figure 3. Tesla C2075 Bracket

DVI CONNECTOR

The Tesla C2075 computing processor board supports a dual-link DVI-I combined analog and digital interface described in Table 2.

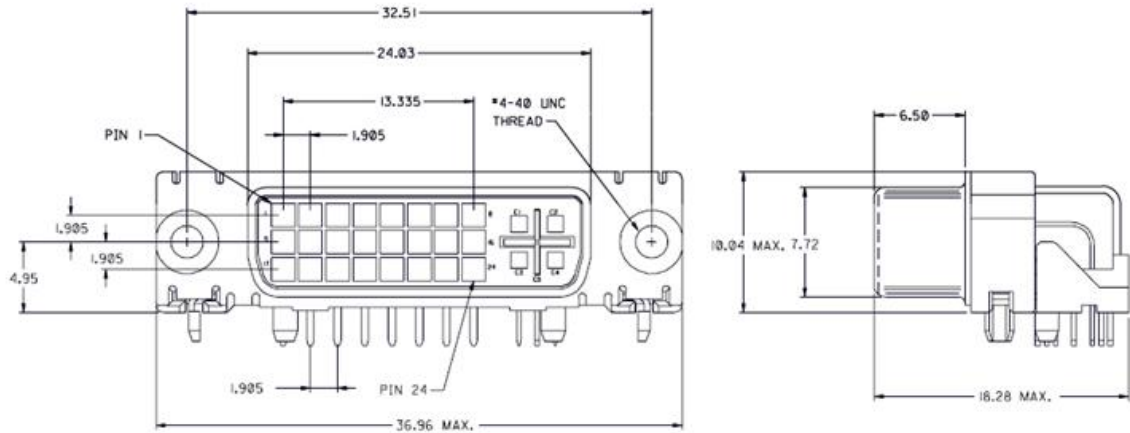


Figure 4. DVI-I Connector

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 (RGB return)
C3	Analog blue		

INTERNAL CONNECTORS AND HEADERS

The Tesla C2075 module supports the following internal connectors and headers.

- ▶ 8-pin PCI Express power connector
- ▶ 6-pin PCI Express power connectors
- ▶ 4-pin fan connector

External PCI Express Power Connectors

The Tesla C2075 computing processor board is a performance-optimized, high-end product and utilizes power from the PCI Express connector as well as external power connectors. The board can be used in two different ways.

- ▶ Dual 6-pin PCI Express power connectors
or
- ▶ One 8-pin PCI Express power connector

Figure 5 and Figure 6 show the specifications and Table 3 and Table 4 show the pinouts for the 6-pin and 8-pin PCI Express power connectors.

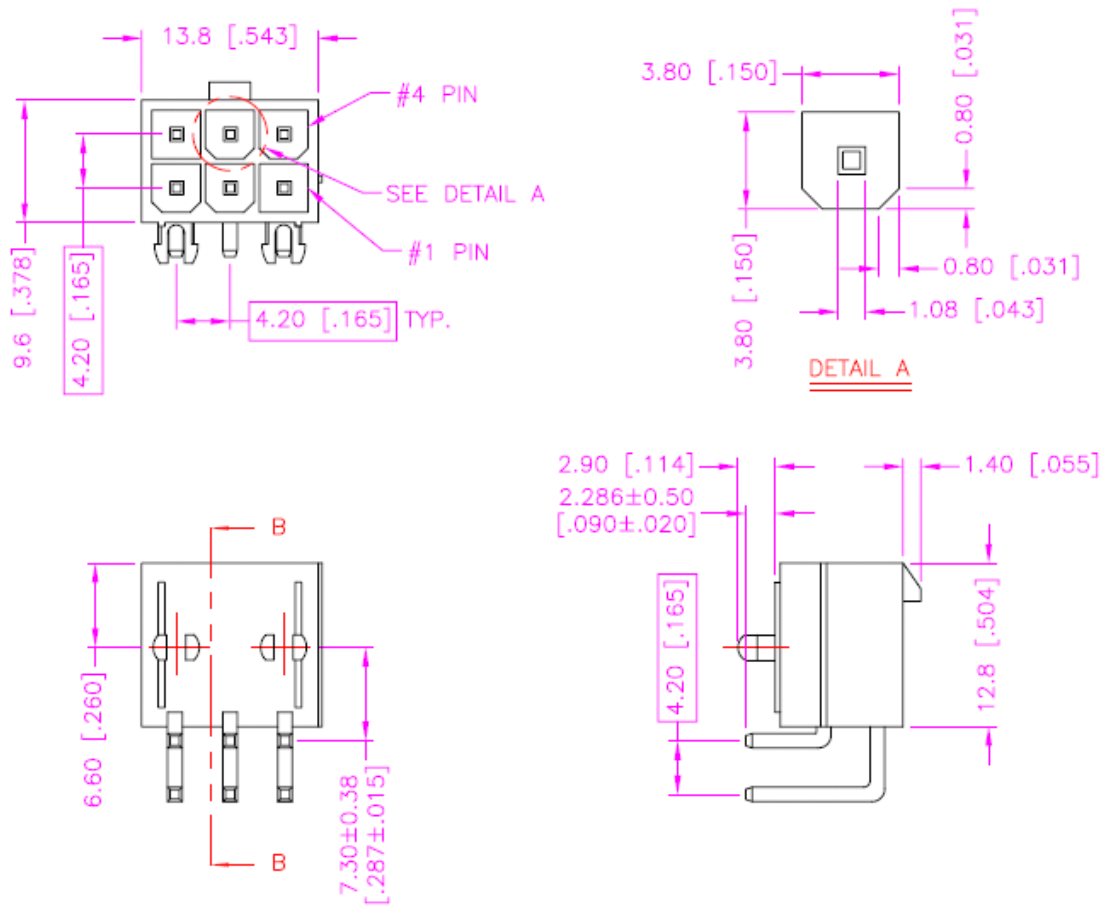


Figure 5. 6-Pin PCI Express Power Connector

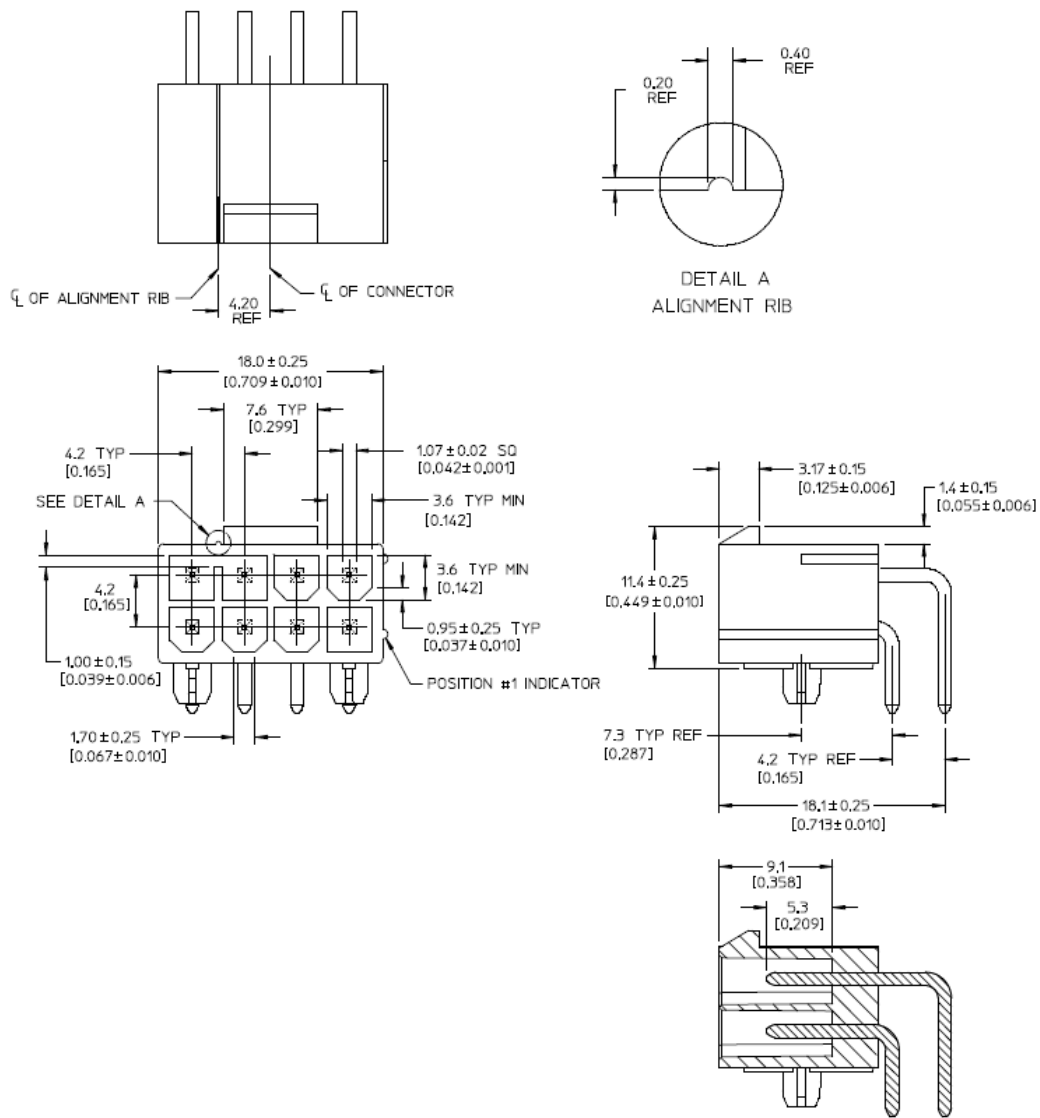


Figure 6. 8-Pin PCI Express Power Connector

Table 3. 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

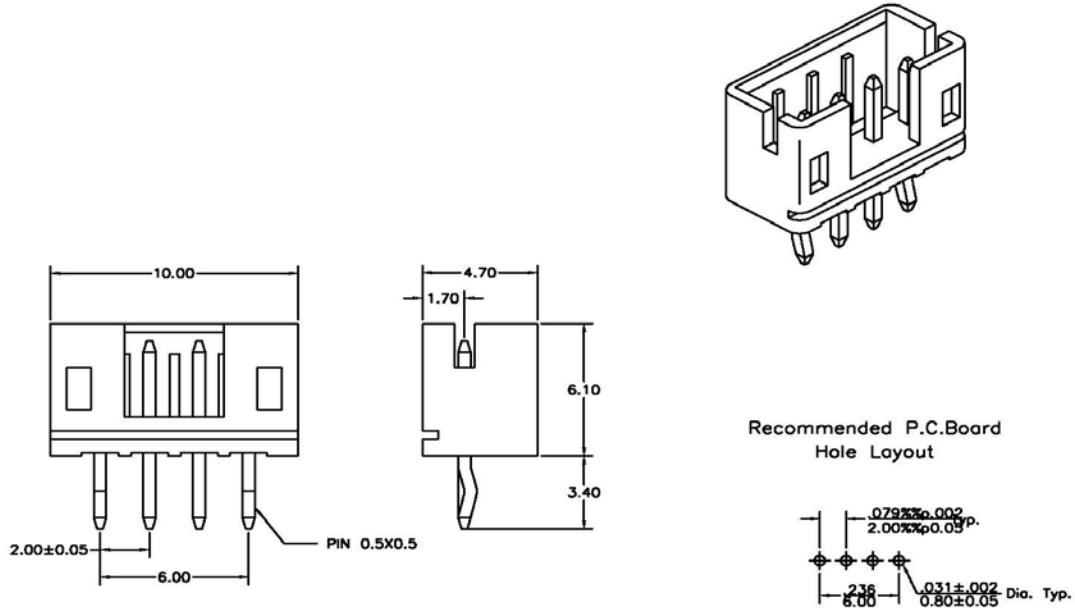
Table 4. 8-Pin PCI Express Power Connector Pinout

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

4-Pin Fan Connector

The Tesla C2075 computing processor board uses a 4-pin fan to control the fan speed of the thermal solution. The details of the connector (P/N: PH-T-4) are given in Figure 7. This part is a 2.0 mm (0.079") pitch disconnectable connector.

Table 5 lists the pin assignments for this connector.



Tolerance : ±0.25mm

Specifications:

- Current Rating : 2A AC, DC
- Voltage Rating : 250V AC, DC
- Temperature Range : -40°C to +105°C
- Contact Resistance : Initial Value/10 mΩ Max.
After Environmental Testing /20 mΩ Max.
- Insulation Resistance : 1000 MΩ Min.
- Withstand Voltage : 1500 VAC/Minute
- RoHS compliant.

Features:

- **Wafer**
- Model No. : PH-T-4
- Circuits : 4
- Material : Post : Brass Tin/Plated
Base : Nylon 66, UL94V-0
- P.C.Board Thickness : 1.6mm(.063")

Figure 7. 4-Pin Fan Connector

Table 5. 4 Wire Thermal Control Pinout

Pin Number	Description
1	+12 V
2	+12 V
3	+12 V
4	Sense1

POWER SPECIFICATIONS

The Tesla C2075 computing processor is a performance-optimized, high-end board solution. Power is taken from the PCI Express host bus as well as the 8-pin and the 6-pin PCI Express power connectors.

Without auxiliary power provided to the Tesla C2075 computing processor board, the board will boot at reduced power and functionality and LED lights on the board will light up as listed in Table 6. This table outlines the different possible scenarios as well as the resulting behaviors.

Table 6. Configuration with External PCI Express Connectors

8-Pin Power Connector	6-Pin Power Connector	Result
Connected (either 8-pin or 6-pin)	Connected	Full power - LED light on the bracket is GREEN by default
8-pin connected	Not connected	Full power - LED light on the bracket is GREEN by default
6-pin connected	Not connected	LED light is RED - board will display warning banner to the user
Not connected	Connected	LED light is RED - board will display warning banner to the user
Not connected	Not connected	LED light is RED - board will display warning banner to the user

POWER BY RAIL

Table 7 lists the power by rail numbers for the Tesla C2075 computing processor board. Power by rail measurements are worst case scenarios per rail while maximum TDP power is based on our worst case power application.

Table 7. Power by Rail

PEX12V	PEX3V3	EXT12V (6-Pin)	EXT12V (8-Pin)	Total Board Power
<= 36 W	< = 3 W	< = 78 W	< = 106 W	Less than or equal to 215 W

THERMAL SPECIFICATIONS

THERMAL QUALIFICATION SUMMARY

The information contained in this summary report is intended to provide users of the Tesla C2075 computing 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 result in the reliable operation of the Tesla C2075.



Note: The ambient air temperature around the inlet of the GPU fan should never exceed 45 °C.

The product and cooling solutions used are:

- ▶ Device product: Tesla C2075 computing processor board
- ▶ Thermal test application: DGEMM
- ▶ Result Under the operating described in the following tables, the Tesla C2075 passed thermal qualification.
- ▶ As previously reported, the Tesla C2075 draws a maximum of 215 W using DGEMM as the TDP application. In cases where an application draws more than 215 W, the Tesla C2075 will cap power usage at 225 W in all cases.

Table 8. Test Setup and Configuration

System Part	Configuration
PC	Motherboard attached to a chassis frame - entire unit placed in an acrylic box
Motherboard	GIGABYTE EX58-UD3R / Intel x58 SBIOS: F1
Power supply	SliverStone SST-ST1500 1500 W
CPU	Intel Core i7 965 at 3.20 GHZ
SDRAM	DDR3 1600 MHz 12 GB (3 x 4 GB)
PC operating system	Linux Cent operating system 64-bit
GPU computing processing board	Tesla C2075
BIOS	70.10.46.00.05
Display driver	270.41.26
GPU	Tesla T20A
Clock speed	1.15 GHz (core) 1500 MHz (mclk)

Table 9. Sample Thermal Results and Specifications

Test Application	T _{junction} (°C)*	T _A (°C)**
Test 1: Dgemm	93	44.9
GPU junction maximum temperature specification under any operating conditions	Thermal slowdown: 100	At any ambient temperature
	Thermal shutdown: 105	

* Junction temperature is reported by NVIDIA thermal sensor

** Ambient air temperature - average of 3 sensors positioned at the inlet to the GPU fan

COOLING SOLUTION

NVIDIA will utilize a Cooler Master active fan sink to cool the GPU, memories and power components. For environmental specifications refer to Table 10.

Table 10. Environmental Specifications and Conditions

Specifications	Conditions
Acoustic noise	25 to 37 dB A
Storage temperature	-40 °C to 75 °C
Storage humidity	5% to 95% RH

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 11. Languages Supported

	Windows XP	Windows Vista	Windows 7
English (US)	X	X	X
English (UK)	X	X	X
Arabic	X	X	X
Chinese, Simplified	X	X	X
Chinese, Traditional	X	X	X
Czech	X	X	X
Danish	X	X	X
Dutch	X	X	X
Finnish	X	X	X
French	X	X	X
French (Canada)	X	X	X
German	X	X	X
Greek	X	X	X
Hebrew	X	X	X
Hungarian	X	X	X
Italian	X	X	X
Japanese	X	X	X
Korean	X	X	X
Norwegian	x	x	x
Portuguese (Brazil)	X	X	X
Portuguese (European/Iberian)	X	X	X
Russian	X	X	X
Slovak	X	X	X
Slovenian	X	X	X
Spanish	X	X	X
Swedish	X	X	X
Thai	X	X	X
Turkish	X	X	X

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