Board Specification

NVIDIA Tesla C870 GPU Computing Board

January 29, 2008 | BD-03399-001_v03

Document Change History

Version	Date	Reason for Change
01	July 24, 2007	Preliminary Release
02	August 1, 2007	Clarified language support for Linux (Table 9)
03	January 29, 2008	Removed confidential statement Updated look and feel to meet current standards

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NVIDIA Tesla C870 Overview

The NVIDIA® Tesla™ C870 GPU computing board is a PCI Express full-height (4.376 inches by 12.283 inches) form factor computing add-in card based on the NVIDIA Tesla C870 graphics processing unit (GPU), and is targeted as a high performance computing (HPC) solution for PCI Express systems.

The Tesla C870 computing board offers 1536 MB of 136-pin ball grid array (BGA) GDDR3 memory.

Key Features

GPU

- Core clock: 600 MHz
- Voltage: 1.3 V ± 130 mV
- Package size: 42.5 mm × 42.5 mm 1449-pin flip-chip ball grid array (FCBGA)

Board

- Twelve layers printed circuit board (PCB)
- PCI Express ×16 system interface
- Physical dimensions: 4.376 inches × 12.283 inches, dual slot
- Power: 170.9 W

External Connectors

- None

Internal Connectors and Headers

- Two 6-pin PCI Express power connectors
- 4-pin fan connector

Memory

- Memory clock: 800 MHz
- Interface: 384-bit
- Frame buffer: 1536 MB
  - Twenty-four pieces 16M × 32 GDDR3 136-pin BGA SDRAM

Display Support

- Direct display output is not supported
- Graphics remoting is supported

BIOS

- Serial ROM, 128 K × 8

GPU Description

The Tesla C870 GPU computing board is based on the 8-Series GPU from NVIDIA.

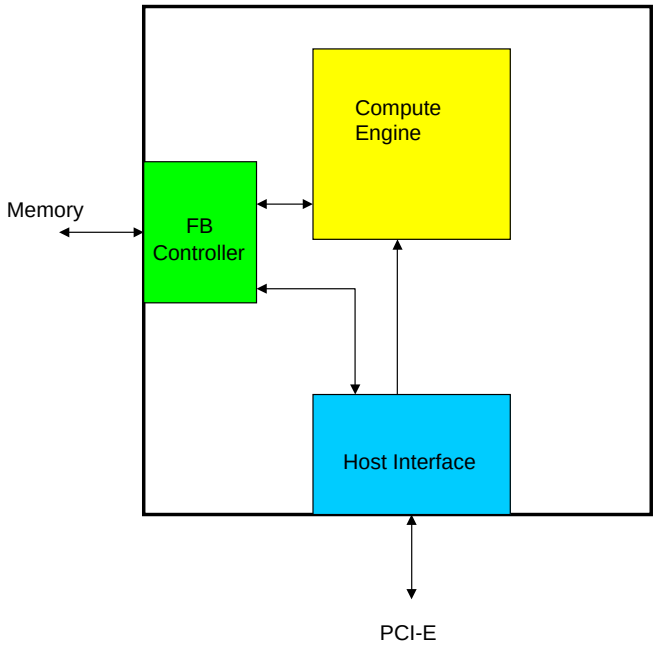


Figure 1. Tesla C870 GPU

Configuration

There is one configuration available (Table 1) for the NVIDIA Tesla C870 graphics board.

Table 1. Board Configuration

Specification	Description
SKU reference	900-20357-0000-000
Chip	Tesla C870 GPU
Package size: GPU	42.5 mm × 42.5 mm
Core clock	600 MHz
Memory clock	800 MHz
Frame buffer	1536 MB
Memory I/O	384-bit
Memory configuration	24 pcs 16M × 32 GDDR3 SDRAM
Connectors	N/A
Internal connectors and headers	Two 6-pin PCI Express power connectors 4-pin fan connector Two SLI 26-pin edge connectors are present but not used for Tesla C870
Total board power	170.9 W
HDCP supported	N/A

PCI Express System

The NVIDIA Tesla C870 board (Figure 2) conforms to the PCI Express full height (4.376 inches by 12.283 inches) form factor.

Figure 2. PCI Express Board

Placement of Standard I/O Connectors

The Tesla C870 does not include any external I/O connectors.

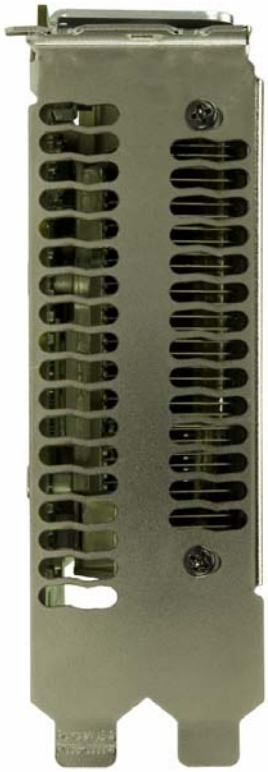


Figure 3. Bracket

Internal Connector and Headers

The NVIDIA Tesla C870 graphics board supports the following internal connectors and headers.

- Two 6-pin PCI Express power connectors
- 4-pin fan connector

PCI Express Power Connector

The NVIDIA Tesla C870 graphics board is a high powered board and utilizes power from two 6-pin PCI Express connectors (Figure 4) and external power. Table 5 lists the pin description for the 6-pin power connector.

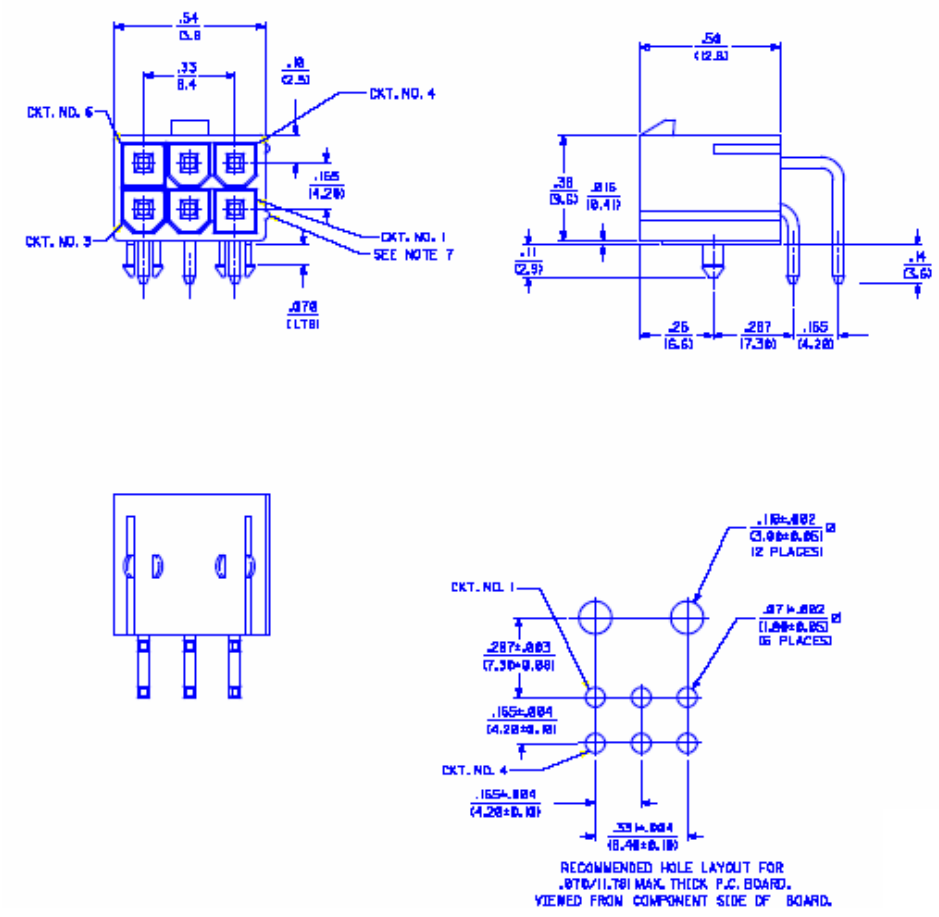


Figure 4. 6-Pin PCI Express Power Connector

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

4-Pin Fan Connector

The NVIDIA Tesla C870 graphics board uses a 4-pin fan connector (Figure 5) to connect the fan to the PCB for fan control by the Tesla C870 product.

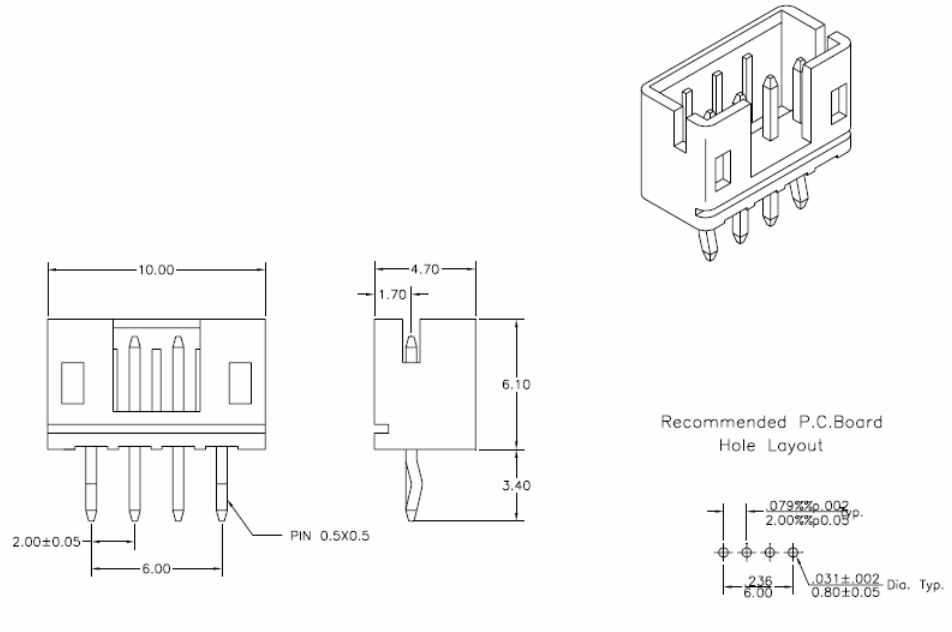


Figure 5. 4-Pin Fan Connector

Power Specifications

The Tesla C870 computing board is a performance optimized high-end board. Power is taken from the PCI Express host bus as well as two 6-pin PCI Express power connectors.

Without any auxiliary power provided to the Tesla C870, a buzzer on the board will beep and the graphics board will not boot.

Table 3. Configuration with Two 6-Pin Connectors

6-pin PCIe Power Connector (outside position – nearest corner of PCB)	6-pin PCIe Power Connector (Inside position)	Result
Connected	Connected	Full Power **
Connected	Not Connected	Graphics solution will perform at lower performance
Not Connected	Connected	Buzzer will sound – graphics board will not boot
Not Connected	Not Connected	Buzzer will sound – graphics board will not boot

**This is the recommended connection for this configuration in order to provide the necessary power into the graphics board to achieve full performance.

Power by Rail

Table 4 lists the power by rail numbers for the Tesla C870 computing board.

Table 4. Power By Rail

Input Rails		
12 V Voltage	Volts	12.69
12 V Current	Amps	2.86
12 V Power	Watts	36.29
3V3 Voltage	Volts	3.29
3V3 Current	Amps	1.14
3V3 Power	Watts	3.75
Input Rails Ext 12V		
12 V Voltage	Volts	12.14
12 V Current	Amps	5.08
12 V Power	Watts	61.67
Input Rails Ext 12V		
12 V Voltage	Volts	12.14
12 V Current	Amps	5.7
12 V Power	Watts	69.20
Total Power	Watts	170.9

Thermal Qualification Summary

The information contained in this summary report is intended to provide users of the Tesla C870 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 Tesla C870

The product and cooling solutions used are:

- Device Product: Tesla C870
- Cooling Solution: Fan sink solution, NV P/N 095-0041-020. The cooling solution assembly includes a heat sink, fan, thermal grease interface material, and screws. Full specification available.
- Result: Under the operating conditions described below, the Tesla C870 passed thermal qualification.

Table 5. Test Setup and Configuration

System Part	Configuration
PC:	Opened System in Closed Acrylic box in Oven 1
Power supply	850 W
CPU	Conroe 2.66 GHz
SDRAM	1 GB
PC operating system	Windows XP Professional
Graphics board	600-50357-0500-200-A / P357-A02-A-017
Bios	6.80.09.00.00
Display driver	100.09
GPU	L6094176 0637A2
GPU speed	600 MHz (Core) 800 MHz (MCLK)
Core graphics voltage:	1.3 V

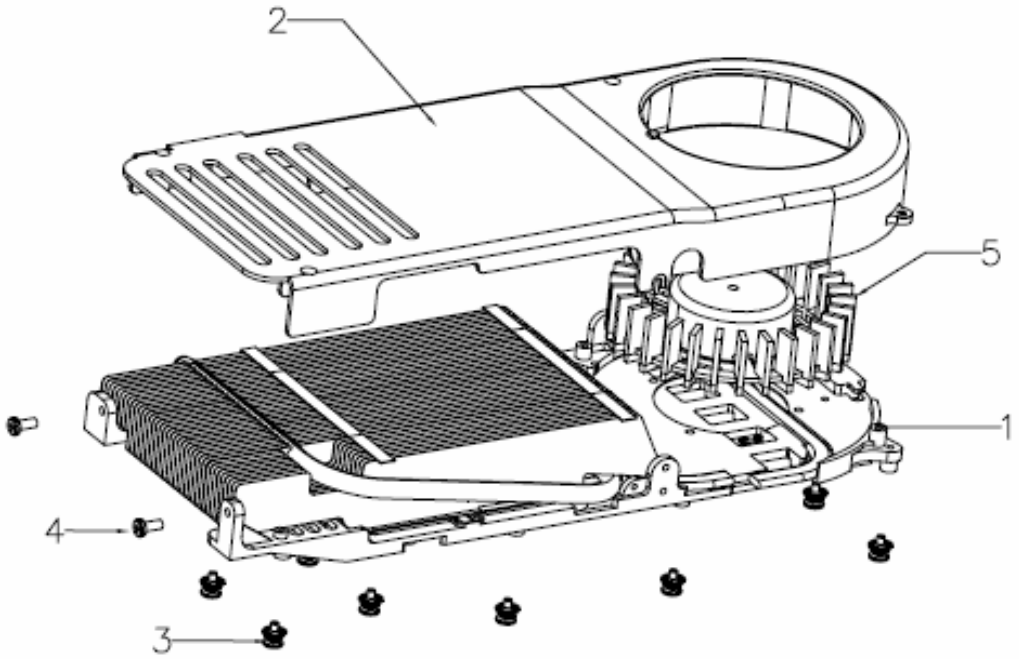
Table 6. Sample Thermal Results and Specification

Test Application	Tjunction(°C)*	TA(°C)**	Cooling Solution
Test 1: Q4	96	55	Fan-sink solution, NV P/N 095-0041-020
Test 2: 3DMark03 Nature	102		
GPU junction maximum temperature specification under any operating conditions.	105	At any ambient Temperature	

* Junction temperature as reported by NVIDIA thermal sensor.
** Ambient air temperature - average of 3 sensors positioned at the inlet to the GPU fan sink

Cooling Solution

NVIDIA will utilize a Cooler Master TM60 active fan sink (Figure 6) to cool the GPU. For fan and environmental specifications refer to Table 7 and Table 8.



No.	Description
1	Heat sink assembly
2	Cover
3	GPU screw
4	Screw
5	Fan

Figure 6. TM60 Active Fan Sink

Table 7. Fan Specifications and Conditions

Specifications	Conditions
Rated voltage	12 V
Operating voltage	5.0 – 12.6 V DC
Input current (fan only)	0.15 Amp (maximum 0.23 Amp)
Input power (fan only)	1.80 W (maximum 2.76 W)
Speed (fan only)	2500 RPM
Air flow	11.520 CFM (minimum 10.368 CFM)
Static air pressure	0.156" water (minimum 0.126” water)
Acoustic noise	31.5 dB-A (maximum 35.5 dB-A)
Life expectance	50,000 hours continuous operation at 40 °C

Table 8. Environmental Specifications and Conditions

Specifications	Conditions
Operating temperature	0 °C to 55 °C
Storage temperature	All function shall be normal after 500 hours at -40 °C to 75 °C at normal humidity with a 24 hours recovery period at room temperature
Operating humidity	5 to 90 % RH
Storage humidity	5 to 95 % RH

Languages

Table 9. Languages Supported

	WinXP	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)	x	
Swedish	x	
Thai	x	

Certificates and Agencies

Certifications

Windows Hardware Quality Lab (WHQL): Planned

Agencies

- Bureau of Standards, Metrology, and Inspection (BSMI)
- C-Tick
- Conformité Européenne (CE)
- Federal Communications Commission (FCC)
- Interference-Causing Equipment Standard (ICES)
- Ministry of Information and Communication (MIC)
- Underwriters Laboratories (UL)
- Voluntary Control Council for Interference (VCCI)

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