Board Specification

NVIDIA Tesla C870 GPU Computing Processor Board

April 14, 2008 | BD-03399-001_v04

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
04	April 14, 2008	Updated terminology to be the same as used on web site and other documents

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NVIDIA Tesla C870 Overview

The NVIDIA® Tesla™ C870 GPU computing processor board is a PCI Express (Gen 1) 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 board offers 1536 MB of 136-pin ball grid array (BGA) GDDR3 memory.

Key Features

GPU

- Number of streaming processor cores: 128
- Processor core clock: 1.35 GHz
- 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 Generation 1 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 size: 1536 MB
  - Twenty-four pieces 16M × 32 GDDR3 136-pin BGA SDRAM
- Memory clock: 800 MHz
- Interface: 384-bit GDDR3

BIOS

- Serial ROM, 128 K × 8

GPU Description

The Tesla C870 is based on the G80 Tesla GPU from NVIDIA.

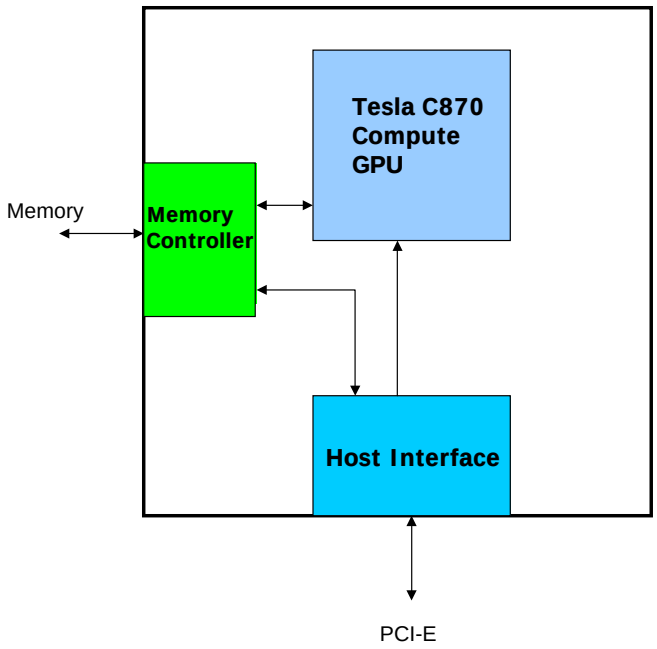


Figure 1. Tesla C870 GPU

Configuration

There is one configuration available (Table 1) for the NVIDIA Tesla C870 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
Processor clock	1.35 GHz
Memory size	1536 GHz
Memory clock	800 MH z
Memory I/O	384-bit GDDR3
Memory configuration	24 pcs 16M × 32 GDDR3 SDRAM
Display connectors	N/A
Board connector	PCI Express Gen 1 x16
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

PCI Express System

The 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 board does not include any external I/O connectors.

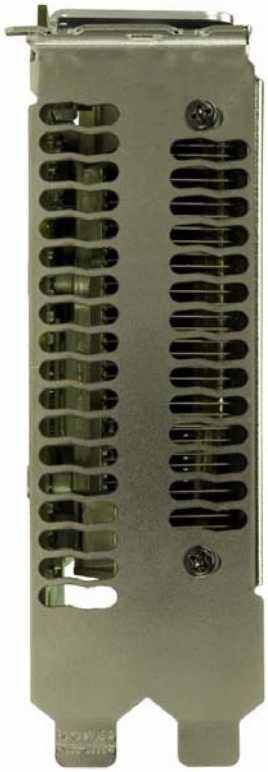


Figure 3. Blank Bracket

Internal Connector and Headers

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

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

PCI Express Power Connector

The Tesla C870 is a high performance-optimized, high-end 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.

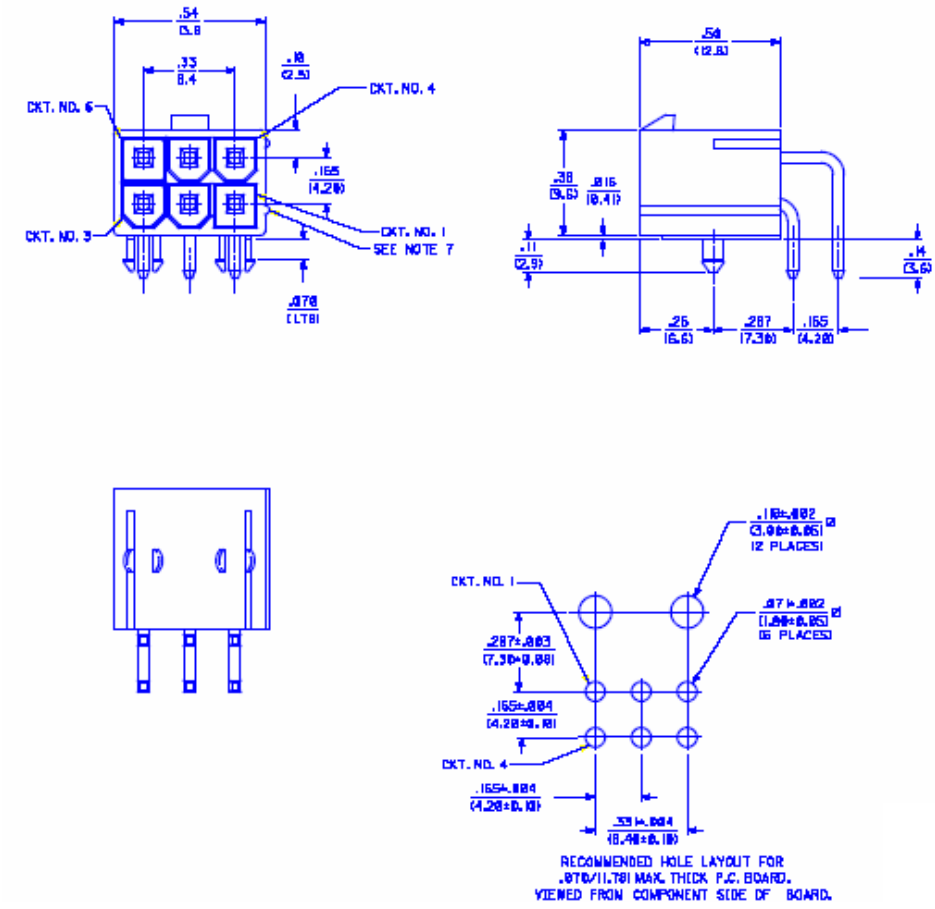


Figure 4. 6-Pin PCI Express Power Connector

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

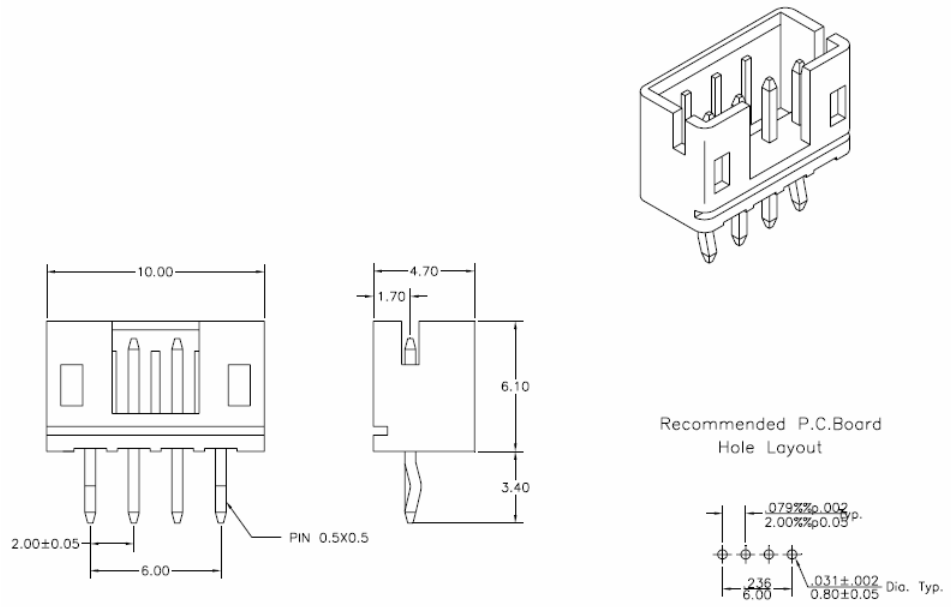


Figure 5. 4-Pin Fan Connector

Power Specifications

The Tesla C870 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 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	Board will perform at lower performance
Not Connected	Connected	Buzzer will sound – board will not boot
Not Connected	Not Connected	Buzzer will sound – board will not boot

**This is the recommended connection for this configuration in order to provide the necessary power into the Tesla C870 board to achieve full performance.

Power by Rail

Table 4 lists the power by rail numbers for the Tesla C870 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
System DRAM	1 GB
PC operating system	Windows XP Professional
GPU computing processor	Tesla C870
Bios	6.80.09.00.00
Cuda driver	100.09
GPU	L6094176 0637A2
GPU speed	1.35 GHz (processor core) 800 MHz (memory clock)
Core voltage:	1.3 V

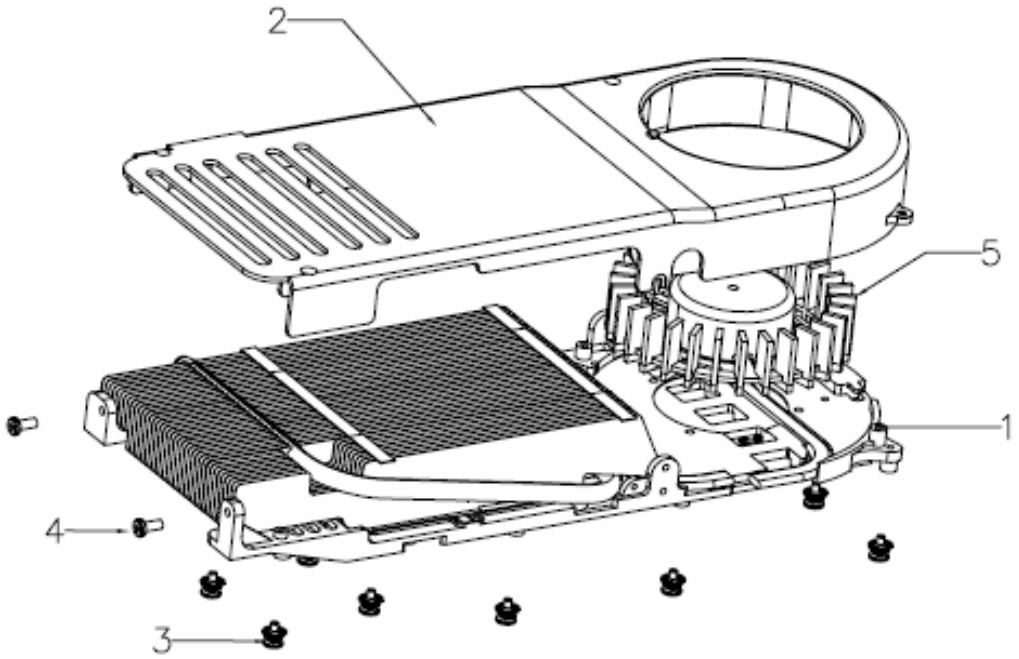
Table 6. Sample Thermal Results and Specification

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

The Tesla C870 utilizes 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	

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

Certificates and Agencies

Certifications

Windows Hardware Quality Lab (WHQL):

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)