# CM5-P1000

NVIDIA Pascal™ GP107 Quadro® P1000
PCIe/104 Graphics Module

**User's Manual**

| | |
|---|---|
| **Manual Rev.:** | 1.0 |
| **Revision Date:** | November 1, 2021 |
| **Part No:** | 50M-00052-1000 |

LEADING EDGE COMPUTING

# Revision History

| Revision | Release Date | Description of Change(s) |
|---|---|---|
| 1.0 | 2021-11-01 | intitial release |

# Preface

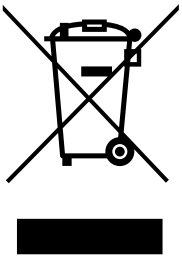


## Disclaimer

The information in this document is subject to change without prior notice in order to improve reliability, design, and function and does not represent a commitment on the part of the manufacturer.

In no event will the manufacturer be liable for direct, indirect, special, incidental, or consequential damages arising out of the use or inability to use the product or documentation, even if advised of the possibility of such damages.

## Environmental Responsibility



ADLINK is committed to fulfill its social responsibility to global environmental preservation through compliance with the European Union's Restriction of Hazardous Substances (RoHS) directive and Waste Electrical and Electronic Equipment (WEEE) directive. Environmental protection is a top priority for ADLINK. We have enforced measures to ensure that our products, manufacturing processes, components, and raw materials have as little impact on the environment as possible. When products are at their end of life, our customers are encouraged to dispose of them in accordance with the product disposal and/or recovery programs prescribed by their nation or company.

**Battery Labels** (for products with battery)

## California Proposition 65 Warning

**WARNING:** This product can expose you to chemicals including acrylamide, arsenic, benzene, cadmium, Tris(1,3-dichloro-2-propyl) phosphate (TDCPP), 1,4-Dioxane, formaldehyde, lead, DEHP, styrene, DINP, BBP, PVC, and vinyl materials, which are known to the State of California to cause cancer, and acrylamide, benzene, cadmium, lead, mercury, phthalates, toluene, DEHP, DIDP, DnHP, DBP, BBP, PVC, and vinyl materials, which are known to the State of California to cause birth defects or other reproductive harm. For more information go to www.P65Warnings.ca.gov.

## Trademarks

Product names mentioned herein are used for identification purposes only and may be trademarks and/or registered trademarks of their respective companies.

## Conventions

Take note of the following conventions used throughout this manual to make sure that users perform certain tasks and instructions properly.


Additional information, aids, and tips that help users perform tasks.


Information to prevent ***minor*** physical injury, component damage, data loss, and/or program corruption when trying to complete a task.


Information to prevent ***serious*** physical injury, component damage, data loss, and/or program corruption when trying to complete a specific task.

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# 1 Introduction

## 1.1 Overview

The CM5-P1000 PCIe104 module is a compact, thin graphics module solution based on the PCI/104-Express™ & PCIe/104™ version 3.0 specification, delivering the latest, leading-edge GPU benefits for your embedded system. Its superior graphics performance, GPU computing and video capabilities are the ideal solution for performance demanding systems such as digital signage, medical image, defense and aerospace application.

## 1.2 Features

- NVIDIA Quadro P1000 GPU
- PCIe/104 Type 1 (116 x 96 mm)
- 640 CUDA cores
- 1.8 TFLOPS peak FP32 performance
- 4GB GDDR5 memory
- 96GB/s maximum memory bandwidth
- 4x UHD DisplayPort outputs
- Wide operating temperature range: -40°C to +85°C

## 1.3 Specifications

| | |
|---|---|
| **Graphics Core** | |
| Architecture | NVIDIA Pascal™ GP107, 640 CUDA cores |
| GPU | Quadro® P1000 |
| Display Outputs | 4x DisplayPort 1.4 digital video outputs<br>Support for High Dynamic Range (HDR) video<br>4K at 120Hz or 5K at 60Hz with 10-bit color depth |
| Signal Interface | PCI Express x16 Gen3 bus, PCI device IE 0x1CBB |
| **GPGPU Computing** | |
| GFLOPS | 1.8 TFLOPS peak FP32 performance |
| **Memory** | |
| GDDR5 Memory | 4GB |
| Memory Width | 128-bit |
| Bandwidth | 96 GB/s |
| **Physical** | |
| Dimensions | 116 (W) x 96 (D) mm |
| Interface | PCIe/104 Type 1 |
| **Environmental** | |
| Operating Temp. | -40˚C to 85˚C |
| Storage Temp. | -40˚C to 85˚C |
| Operating Humidity | ~95% @40 ˚C (non-condensing) |
| Vibration | MIL-STD-810H<br>Operating: 7.7 Grms, 20-2000 Hz, 1 hr each axis |
| Shock | MIL-STD-810H<br>Operating: 20 G peak, 11 ms duration, half-sine,<br>3 shocks each axis |
| ESD | Contact +/- 4kV, air +/- 8kV |
| EMC | CE, FCC Class B, EN55032, EN55035 |
| **Operating System** | |
| Supported OS | Windows 10 & Linux Drivers, 64-bit |
| **Miscellaneous** | |
| Power Consumption | Max. 50W |
| MTBF | 250,000 hrs commercial 40˚C ambient (according to MIL calculation) |

**Table 1-1: CM5-P1000 Specifications**

## 1.4 Display Support and Options

### DisplayPort

- Version 1.4
- Max. pixel clock: 1050 MP/s
- Max. bandwidth: 25.9 GB/s/connector

### Resolution

- Up to 5120 x 3200 at 60Hz, with 10-bit color depth
- Support for High Dynamic Range (HDR) video

## 1.5 Software Support

- CUDA Toolkit 8.0
- CUDA Compute version 6.1
- OpenCL™ 1.2
- DirectX® 12
- OpenGL 4.5

## 1.6 Functional Block Diagram

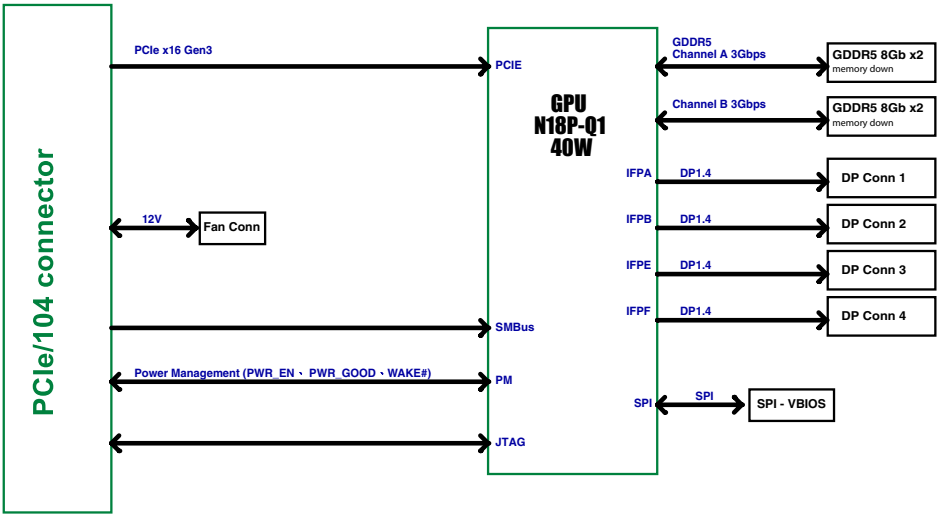



**Figure 1-1: CM5-P1000 Functional Block Diagram**

## 1.7 Mechanical Dimensions

NOTE:

All dimensions shown in mm [thou].

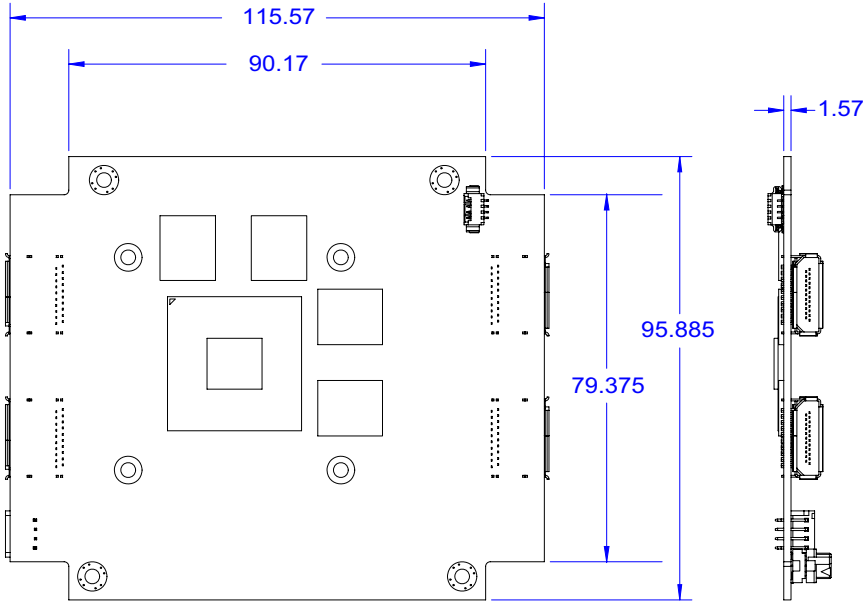



**Figure 1-2: CM5-P1000 Dimensions**

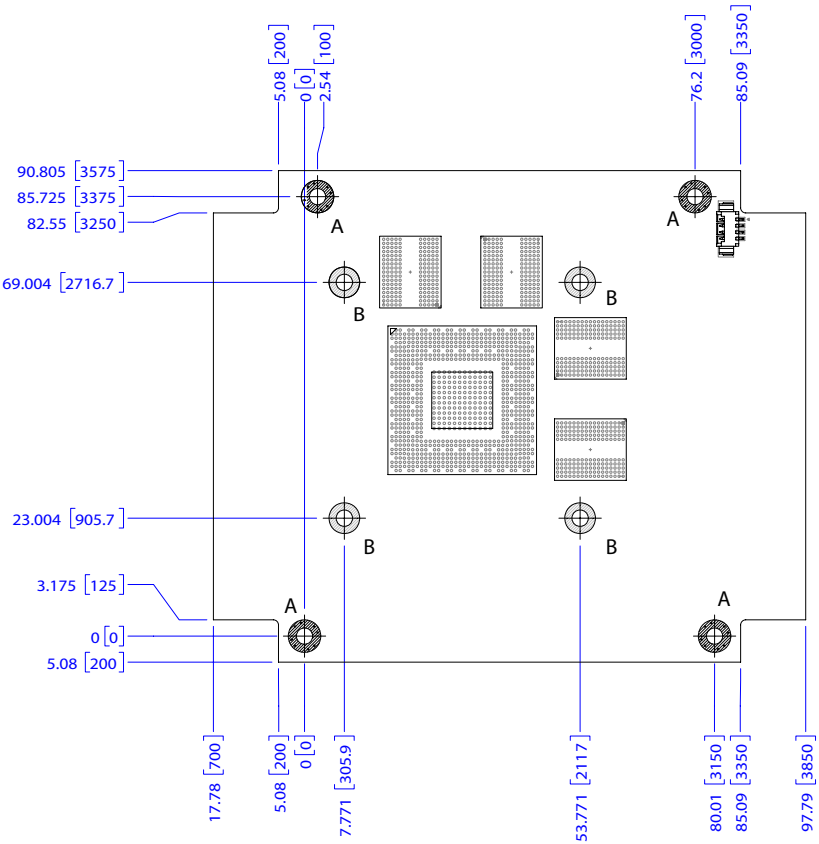



**Figure 1-3: CM5-P1000 Mounting Specifications**

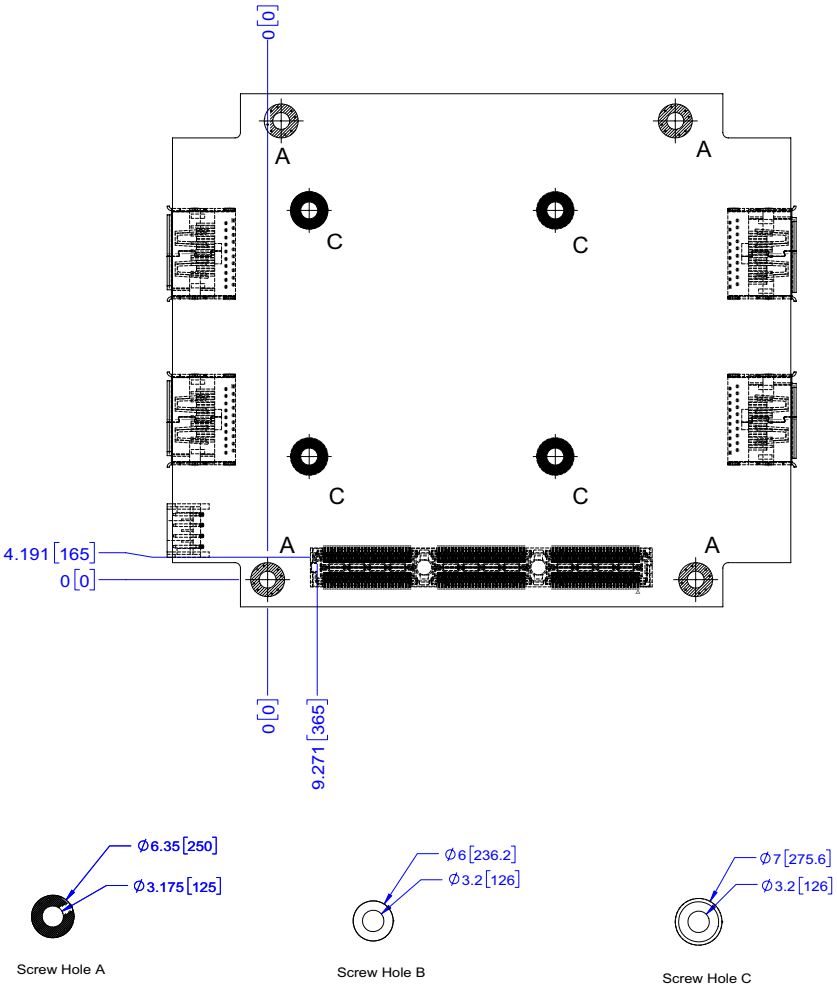



**Figure 1-4: CM5-P1000 PCB Specifications**

## 1.8 Ordering Information

- **CM5-P1000-DP**
  PCIe/104 Type 1 graphics module, NVIDIA Quadro P1000 (640 CUDA cores), 4GB GDDR5, 0°C to +60°C
- **CM5-P1000-DP-ETT**
  PCIe/104 Type 1 graphics module, NVIDIA Quadro P1000 (640 CUDA cores), 4GB GDDR5, -40°C to +85°C

For conformal coating please contact your local sales representative.

## 1.9 Unpacking Checklist

Before unpacking, check the shipping carton for any damage. If the shipping carton and/or contents are damaged, inform your dealer immediately. Retain the shipping carton and packing materials for inspection. Obtain authorization from your dealer before returning any product to ADLINK. Ensure that the following items are included in the package.

- **CM5-P1000 PCIe/104 Graphics Module**

## 1.10 Optional Cooling Solutions

The following cooling solutions are available for purchase separately. Please contact your ADLINK representative for detailed more information and mechanical drawings.

- **CMx-P1000TM-00**
  CM5-P1000 heat spreader, -40°C to 85°C
  (P/N: 91-95291-100E)

- **CMx-P1000TM-10**
  CM5-P1000 passive heat sink, -40°C to 85°C with air flow
  (P/N: 91-95291-200E)

- **CMx-P1000TM-20**
  CM5-P1000 active heat sink, -10°C to 70°C
  (P/N: 91-95291-300E)

- **CMx-P1000TM-30**
  CM5-P1000 active heat sink (for ETT testing only, requires external 4-pin Molex power), -40°C to 85°C
  (P/N: 91-95291-400E)

# 2 Interfaces

## 2.1 Board Layout

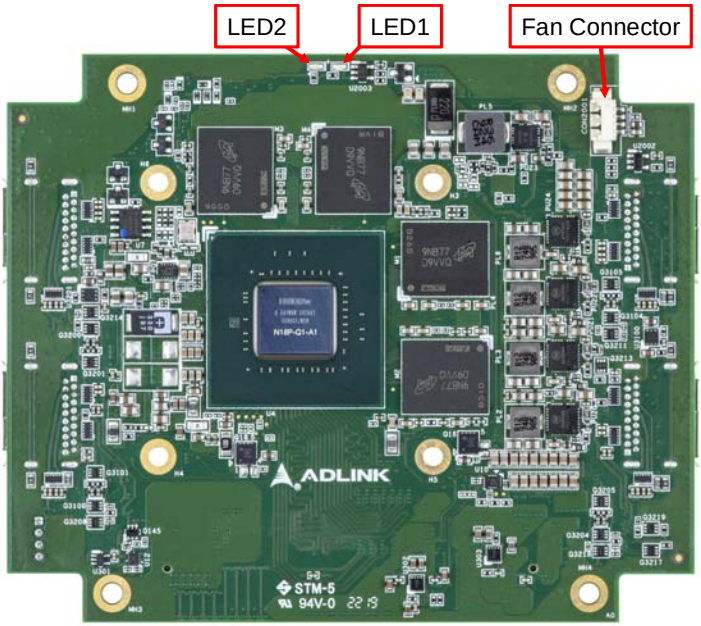



**Figure 2-1: CM5-P1000 Top Side Layout**

| | |
|---|---|
| **LED1** | Power on LED |
| **LED2** | Over-temperature LED |

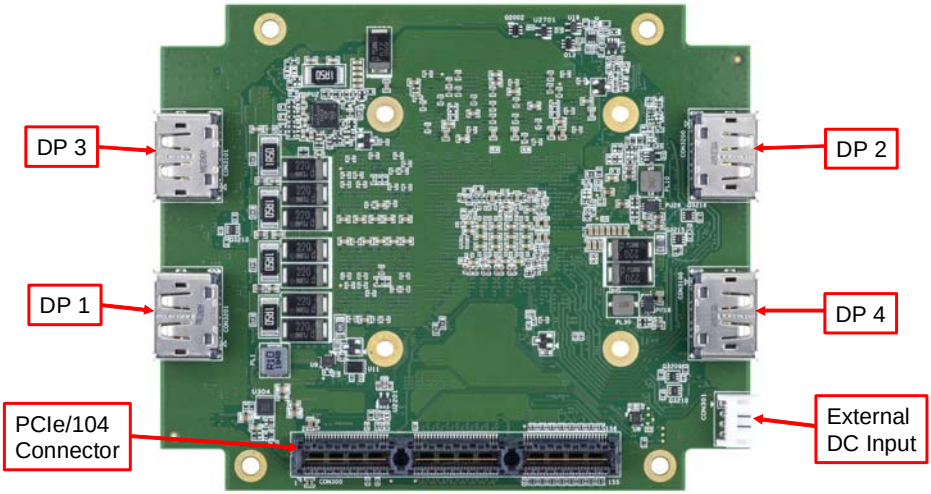



**Figure 2-2: CM5-P1000 Bottom Side Layout**

## 2.2 Connectors

### Fan Connector (1.25mm pitch wafer)

| Pin | Signal |
|---|---|
| 1 | FAN_ON |
| 2 | FAN_TACH |
| 3 | 12V |
| 4 | GND |


### External DC Input (2.00mm pitch wafer)

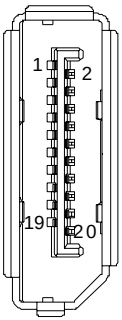
| Pin | Signal |
|---|---|
| 1 | 12V* |
| 2 | 12V* |
| 3 | GND |
| 4 | GND |


NOTE:

Use the same power source as "+12V" of the PCIe104 connector

## DisplayPort Connectors

| Pin | Signal |
|---|---|
| 1 | IFPA_L0_C_P |
| 2 | GND |
| 3 | IFPA_L0_C_N |
| 4 | IFPA_L1_C_P |
| 5 | GND |
| 6 | IFPA_L1_C_N |
| 7 | IFPA_L2_C_P |
| 8 | GND |
| 9 | IFPA_L2_C_N |
| 10 | IFPA_L3_C_P |
| 11 | GND |
| 12 | IFPA_L3_C_N |
| 13 | IFPA_AUX_SEL |
| 14 | DP_A_CFG2 |
| 15 | IFPA_AUX_C_P |
| 16 | GND |
| 17 | IFPA_AUX_C_N |
| 18 | IFPA_HPD |
| 19 | GND |
| 20 | P_+3V3 |
| 21 | CHA_GND |
| 22 | CHA_GND |
| 23 | CHA_GND |
| 24 | CHA_GND |



# 3 System Requirements

## 3.1 Power Sequencing

For initial power on, or to Resume from S3 and S4, this sequence must be followed.

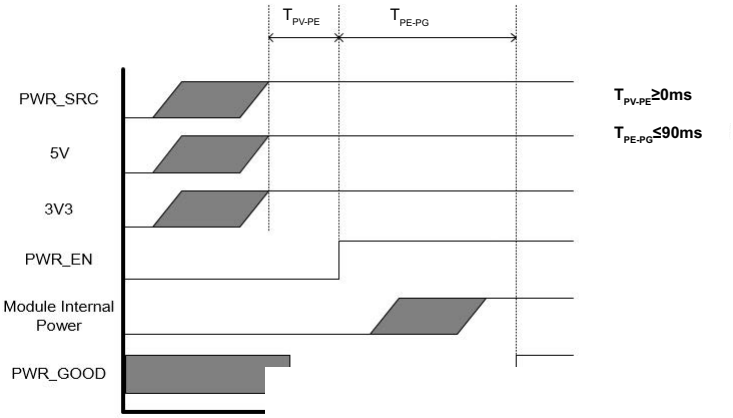



**Figure 3-1: Power Sequencing**

## 3.2 Module Power Up and Down

Issuing the PWR_EN signal powers the CM5-P1000 module down, and the system designer can decide whether to keep the module input power when the CM5-P1000 module is powered down.

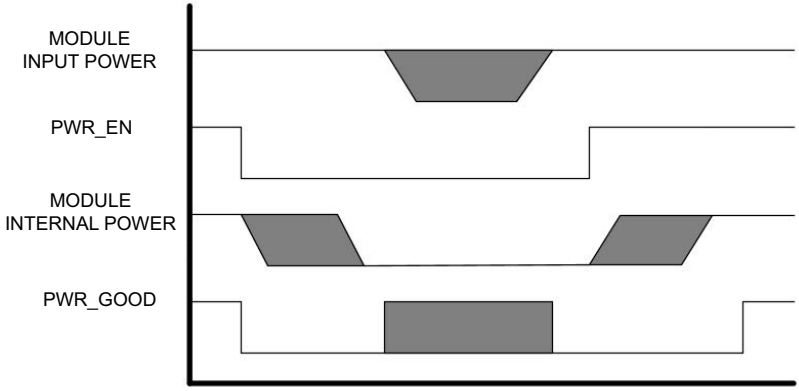



**Figure 3-2: Module Power Down**

## 3.3 Reset Requirements

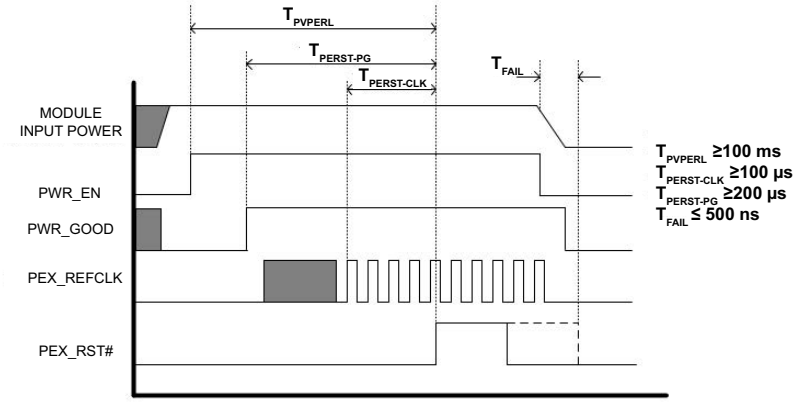



**Figure 3-3: Reset Sequencing**

## 3.4 Thermal Policy

The GPU core clock throttles at temperatures ($T_J$) past the thresholds shown with the behaviors as listed. Thermal throttling ensures that the highest temperature on the die does not exceed the sense temperature for prolonged periods of time.

| Parameter | Value | Unit |
|---|---|---|
| Thermal Resistance (Junction to Case, $R_{JC}$) | 0.03 | °C/W |
| Thermal Resistance (Junction to PCB Board, $R_{JB}$) | 3.0 | °C/W |
| GPU Maximum Operating Temperature[1] | 94 | °C |
| GPU Slowdown Temperature (THERM_ALERT)[2] | 97 | °C |
| GPU Shutdown Temperature (OVERT)[3] | 102 | °C |

**Table 3-1: Thermal Policy**


[1]Max.GPU operating temperature is the maximum at which the GPU is guaranteed to operate at target performance (base clock) under total board power level

[2]THERM_ALERT generates a 50% (÷2) hardware clock slowdown.

[3]OVERT generates a 87.5% (÷8) hardware clock slowdown

## 3.5 BIOS Settings

When the CM5-P1000 is used with the ADLINK CM4-SL2 PCI/104-Express SBC, please use the following BIOS settings to ensure proper graphics functionality.

1. ***Advanced > Graphics > Primary Display*****:** set to ***PCIE***
2. ***Boot > CSM > Video:*** set to **UEFI**
3. ***Boot > CSM > CSM Support:*** set to ***Disabled***

For detailed information about the ADLINK CM4-SL2's BIOS settings, please refer to the CMx-SLx Technical Reference*, Section 4.1 BIOS Setup*, downloadable from the ADLINK website.

For BIOS setting information when used with other PCI/104-Express or PCIe/104 SBCs, please consult the manufacturer's documentation.

## 3.6 Driver Installation

Drivers can be downloaded from https://www.adlinktech.com/Products/PC104SBCs/PCIe104/CM5-P1000.

## 3.7 Certifications & Agencies

- Windows Hardware Quality Lab (WHQL) certified Windows 7, and Windows 10
- EU Reduction of Hazardous Substances (EU-RoHS)
- Conformité Européenne (CE)
- Federal Communications Commission (FCC)

# Important Safety Instructions

For user safety, please read and follow all instructions, Warnings, Cautions, and Notes marked in this manual and on the associated device before handling/operating the device, to avoid injury or damage.

*S'il vous plaît prêter attention stricte à tous les avertissements et mises en garde figurant sur l'appareil , pour éviter des blessures ou des dommages.*

- Read these safety instructions carefully
- Keep the User's Manual for future reference
- Read the Specifications section of this manual for detailed information on the recommended operating environment
- The device can be operated at an ambient temperature of 50ºC
- When installing/mounting or uninstalling/removing device; or when removal of a chassis cover is required for user servicing:
  - Turn off power and unplug any power cords/cables
  - Reinstall all chassis covers before restoring power
- To avoid electrical shock and/or damage to device:
  - Keep device away from water or liquid sources
  - Keep device away from high heat or humidity
  - Keep device properly ventilated (do not block or cover ventilation openings)
  - Always use recommended voltage and power source settings
  - Always install and operate device near an easily accessible electrical outlet
  - Secure the power cord (do not place any object on/over the power cord)
  - Only install/attach and operate device on stable surfaces and/or recommended mountings
- If the device will not be used for long periods of time, turn off and unplug from its power source

- Never attempt to repair the device, which should only be serviced by qualified technical personnel using suitable tools
- A Lithium-type battery may be provided for uninterrupted backup or emergency power.


Risk of explosion if battery is replaced with one of an incorrect type; please dispose of used batteries appropriately.
*Risque d'explosion si la pile est remplacée par une autre de type incorrect. Veuillez jeter les piles usagées de façon appropriée.*

- The device must be serviced by authorized technicians when:
  - The power cord or plug is damaged
  - Liquid has entered the device interior
  - The device has been exposed to high humidity and/or moisture
  - The device is not functioning or does not function according to the User's Manual
  - The device has been dropped and/or damaged and/or shows obvious signs of breakage
- Disconnect the power supply cord before loosening the thumbscrews and always fasten the thumbscrews with a screwdriver before starting the system up
- It is recommended that the device be installed only in a computer room where access is:
  - Restricted to qualified service personnel or users familiar with restrictions applied to the location, reasons therefor, and any precautions required
  - Only afforded by the use of a tool or lock and key, or other means of security, and controlled by the authority responsible for the location

| | |
|---|---|
|  | **BURN HAZARD**<br>Touching this surface could result in bodily injury. To reduce risk, allow the surface to cool before touching.<br>***RISQUE DE BRÛLURES***<br>*Ne touchez pas cette surface, cela pourrait entraîner des blessures.*<br>*Pour éviter tout danger, laissez la surface refroidir avant de la toucher.* |

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# Getting Service

**Ask an Expert:** http://askanexpert.adlinktech.com

**ADLINK Technology, Inc.**
No. 66, Huaya 1st Rd., Guishan Dist.,
Taoyuan City 333411, Taiwan
Tel: +886-3-216-5088
Fax: +886-3-328-5706
Email: service@adlinktech.com

**Ampro ADLINK Technology, Inc.**
6450 Via Del Oro
San Jose, CA 95119-1208, USA
Tel: +1-408-360-0200
Toll Free: +1-800-966-5200 (USA only)
Fax: +1-408-600-1189
Email: info@adlinktech.com

**ADLINK Technology (China) Co., Ltd.**
300 Fang Chun Rd., Zhangjiang Hi-Tech Park
Pudong New Area, Shanghai, 201203 China
Tel: +86-21-5132-8988
Fax: +86-21-5132-3588
Email: market@adlinktech.com

**ADLINK Technology GmbH**
Hans-Thoma-Strasse 11
D-68163 Mannheim, Germany
Tel: +49-621-43214-0
Fax: +49-621 43214-30
Email: emea@adlinktech.com

Please visit the Contact page at www.adlinktech.com for information on how to contact the ADLINK regional office nearest you: