



Embedded MXM module

MX4000B-WA Series

USER MANUAL

Document Change History

Version	Date	Description	Authors
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Version 1.0

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Contact your distributor, sales representative, or Aetina's customer service center for technical support if you need additional assistance. Please have the following information ready:

- Product name and serial number
- Description of your peripheral attachments
- Description of your software (operating system, version, application software, etc.)
- A complete description of the problem
- The exact wording of any error messages

Visit the Aetina website at <https://www.aetina.com> where you can find the latest information about the product.

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Product Warranty

Aetina warrants the original purchaser, that each of its products will be free from defects in materials and workmanship which refers to “Aetina warranty policy” on Aetina’s official website: <https://www.aetina.com/>. Aetina warranty policy will be updated from time to time, and the last version shall be binding on the parties.

For out of warranty repairs, you will be billed according to the cost of replacement materials, service time and freight. Please consult your dealer for more details.

If you have a defective product, please follow those steps which refers to “Aetina RMA Service” on Aetina’s official website: <https://www.aetina.com/>.

ESD Warning

This product, like all electronic products, uses the product that can be damaged by electrostatic discharge (ESD). When handling, care must be taken so that the devices are not damaged. Damage due to inappropriate handling is not covered by Aetina warranty policy. The following precautions must be taken:

- Do not open the protective conductive packaging until you have read the following and are at an approved anti-static workstation.
- If working on a prototyping board, use a soldering iron or station that is marked as ESD-safe.
- Always disconnect the product from the prototyping board when it is being worked on.
- Always discharge yourself by touching a grounded bare metal surface or approved anti-static mat before picking up an ESD - sensitive electronic component.
- Use an approved anti-static mat to cover your work surface.

Safety Precautions

Please read the following safety instructions carefully. It is advised that you keep this manual for future references:

1. All cautions and warnings on the equipment should be noted.
2. Make sure the power source matches the power rating specifications of the device.
3. Position the power cord away from obstructions and avoid stepping on it. Do not place anything over the power cord.
4. For plug-in equipment, the power outlet socket must be located near the equipment and must be easily accessible.
5. Disconnect this equipment from any AC outlet before cleaning. Use a damp cloth. Do not use liquid or spray detergents for cleaning.
6. Always completely disconnect the power before working on the system’s hardware.

7. Keep this equipment away from humidity.
8. Put this equipment on a reliable surface during installation. Dropping it or letting it fall may cause damage.
9. The openings on the enclosure are for air convection. Protect the equipment from overheating.
DO NOT COVER THE OPENINGS.
10. Be sure that the room in which you choose to operate your system has adequate air circulation.
Ensure that the chassis cover is secure.
11. The chassis design allows cooling air to circulate effectively. An open chassis permits air leaks, which may interrupt and redirect the flow of cooling air from internal components.
12. Never pour any liquid into an opening. This may cause fire or electrical shock.
13. If the equipment is not used for a long time, disconnect it from the power source to avoid damage by transient overvoltage.
14. Never open the equipment. For safety reasons, the equipment should be opened only by qualified service personnel.
15. If any of the following situations arises, please the contact Aetina's service personnel:
 - Power cord or plug is damaged
 - Liquid intrusion to the device
 - Exposure to moisture
 - Device is not working as expected or in a manner as described in this manual
 - The device is dropped or damaged
 - Any obvious signs of damage displayed on the device

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1. Product Specification

Aetina introduces the MX4000B-WA series, a Type-B MXM module powered by the NVIDIA RTX PRO 4000 BLACKWELL embedded GPU. Built for generative AI and accelerated computing, it delivers high performance and power efficiency across applications from diagnostic imaging to robotics.

The MX4000B-WA adopts the MXM 3.1 Type B form factor with Blackwell architecture, featuring **7,680 CUDA cores, 60 RT cores, 240 Tensor cores, and 16GB GDDR7 memory.** Supporting PCIe Gen 4 interface per MXM 3.1 spec, it delivers hardware-accelerated graphics and compute performance with excellent power efficiency for diverse embedded applications.

The BLACKWELL architecture delivers major AI neural graphics gains with new FP4 precision Tensor Core acceleration for more capable AI models in smaller footprints. Neural Shaders enable real-time cinematic-quality textures and lighting, while the AI Management Processor optimizes GPU workload scheduling.

The MX4000B-WA features ECC memory support, real-time ray tracing, and graphics acceleration, making it ideal for scientific and medical visualization, digital content creation, and AI/ML applications.



1.1 Features

- Powered by NVIDIA Blackwell architecture
- 7680 CUDA cores, 60 RT cores and 240 Tensor cores, 16GB GDDR7
- 33.7 TFLOPS peak FP32
- PCIe Gen 4 x16 interface
- 5 years longevity product supply service
- **GPU**
 - NVIDIA RTX PRO 4000 Blackwell Embedded GPU
 - Stream Processing Unites: 7680
 - Voltage: Variable
- **Board**
 - 14-layer printed circuit board (PCB)
 - 16-lanes PCI Express 4.0 capable
 - Physical dimensions: 110mm x 82mm
 - Board power: 115 W (PWR_SRC 19V)
- **Connectors**
 - MXM 3.1 Connector Interoperability
- **Memory Configuration**
 - Memory Type: GDDR7
 - Memory Capacity: 16 GB
 - Memory Interface: 256-bit
 - Memory Data Rate: 28.0 Gbps
 - Memory Bandwidth: 896 GB/s
- **Display Support**
 - DisplayPort Maximum resolution: 7680 x 4320
 - High-Bandwidth Digital Content Protection (HDCP) support
- **Cooling System**
 - N/A
- **Operating System Support**
 - Windows® 10 / 11 64-bit
 - Linux 64-bit

1.2 Configuration

Lists the SKU configuration currently available for the NVIDIA RTX PRO 4000 graphics board.

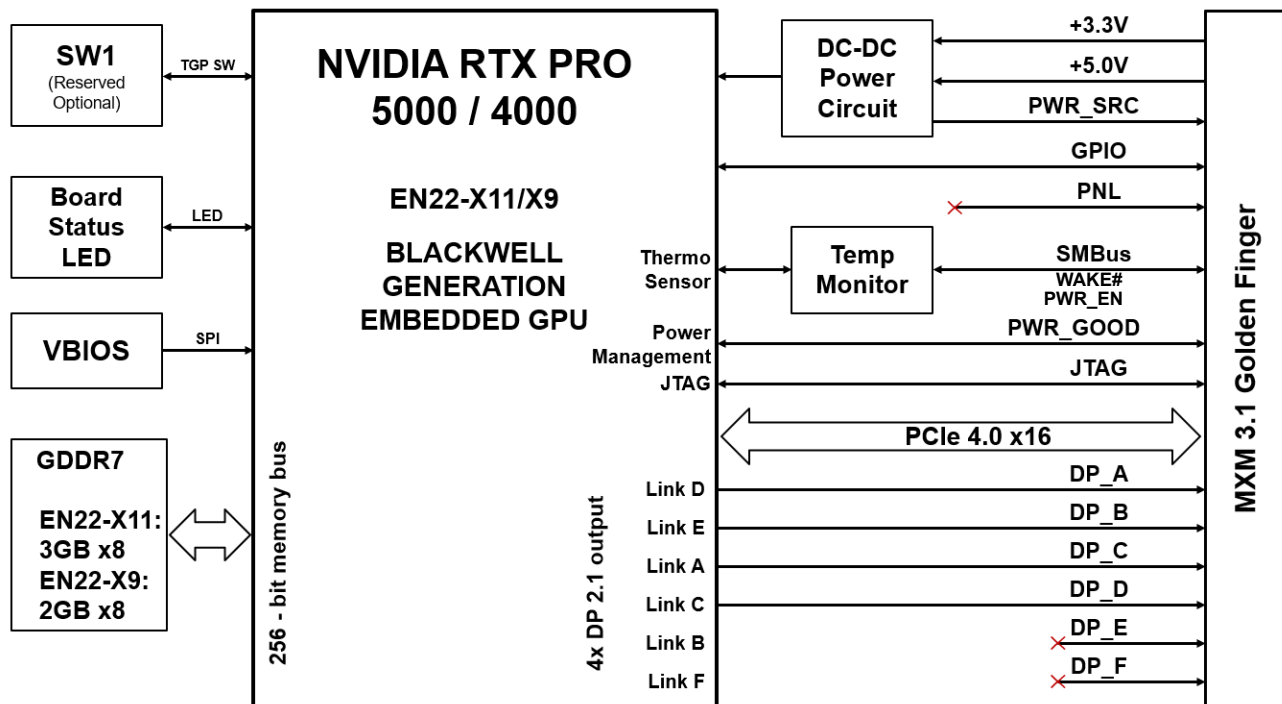
■ Board configuration

Specification	MX4000B-WAA-A1	MX4000B-WAA-A2
Chip	NVIDIA RTX PRO 4000 Blackwell Embedded GPU	
Core clock (MHz)	Base= 1545 Boost= 2197	Base= 975 Boost= 1695
Memory speed	28.0 Gbps	
Frame buffer	16GB GDDR7	
Memory interface	256-bit	
Memory type	512M x 32 GDDR7 FBGA266 package	
Memory AVL	SAMSUNG K4VAF325ZC-SC28	
Maximum board power	115 W	80 W
PCI Express interface	PCIe Gen4.0 x16	
Connectors	DisplayPort 2.1a / HDMI 2.1b output via MXM golden finger is supported	
Supplementary Power Connector	N/A	
Maximum output	4	
HDCP support	Yes	
Operating Temperature	0 to +55 °C	
Wide Temperature	By request	
Operating Humidity	40°C @ 95%, Non-condensing	

2. Hardware Information

2.1 Block Diagram

The Aetina MX4000B-WA is based on PCI Express 4.0 form factor.



MX4000B-WA Block diagram

2.2 General Purpose Graphics Processing Unit

The Aetina MX4000B-WA is based on NVIDIA RTX PRO 4000 Blackwell Embedded GPU. Blackwell GPUs are based on NVIDIA CUDA Compute Capability 12.0 architecture.

- **GPU Resources**

- **GDDR7 SDRAM**
 - 8 pieces 512 M x 32 GDDR7, total capacity of 16,384 Mbytes
 - 256bit data bus width
 - 28.0 Gbps speed
- **BIOS ROM**
 - 32Mbit SPI FLASH for BIOS image

2.3 Display Interface

The MX4000B-WA provides four digital output channels that can be active at the same time.

- Digital Output
 - The MX4000B-WA supports DisplayPort and HDMI output.
- Analog Output
 - This model does not support Analog output.
- Hot Plug
 - This model supports Hot Plug detect for digital monitors.
- Display Options
 - The following list is MX4000B-WA graphics module display options.
 - **If the VBIOS is set to MSH mode, there will be no display output.**

Display Supported for Each Interface						
MXM Conn	DP_A	DP_B	DP_C	DP_D	DP_E	DP_F
GPU Link	Link D	Link E	Link A	Link C	N/A	N/A
DisplayPort (DP++) DP2.1a (DSC 1.2a)	Support	Support	Support	Support	N/A	N/A
HDMI 2.1b	Support	Support	Support	Support	N/A	N/A

Note:

The DP_A / DP_B / DP_C / DP_D names in the Pin Define table refer to the MXM connector output ports.

The actual GPU output source should follow the GPU Link mapping table.

Example: Pin 265 DP_A_L2# belongs to MXM DP_A, and DP_A is mapped to GPU Link D.

2.4 Power Saving Features

GPU feature	Guidance
GC6	Not supported
GC OFF	Not supported
GPC-RG	Not supported
ASPM	Not supported
Modern Standby	Not supported

2.5 Display Interface

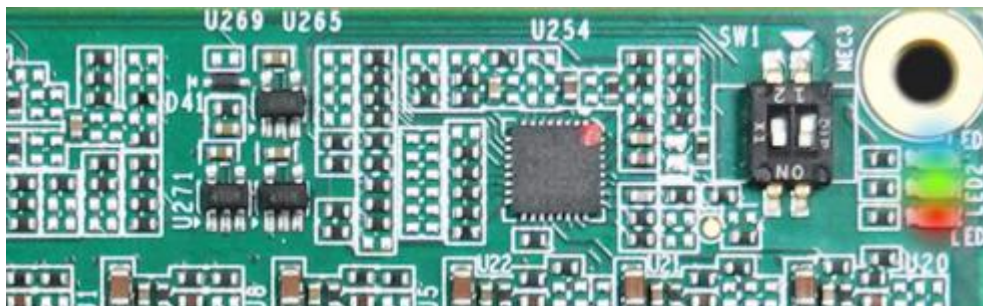
The MX4000B-WA provides PCI Express x16 mechanism while data transmission via PCI Express 4.0 x16.

2.6 SMBus Interface

SMBus address	Description
0x9E	Internal thermal sensor readout address
0x9C	Slave address reserved for dual card configuration
-	Other addresses are reserved for debug and should not be accessed

2.7 LED Indicator

LED	Color	Description
Power OK	Green	Turn on when GPU_PGOOD and XTALCLK_READY are high
Thermal Over*	Red	Turn on when THERM_OVERT* is high
Thermal Alert*	Blue	Turn on when THERM_ALERT* is high



2.8 GPU Mechanical Characteristics

Symbol	Parameter	Min.	Nominal	Max.	Units
P _{cont}	Max. allowable pressure during PCA, system assembly and operation	N.A.	≤60	≤80	psi
e _{max}	Max. allowable strain during PCA, system assembly or operation			≤500	μstrains

Notes:

1. When a compliant thermal interface is used between die and heatsink, the bond line thickness must have less than 20% in variation
2. The pressure should be measured on the top of the die surface with grid resolution of 1x1mm² for the pressure sensor
3. Strain measurement shall follow IPC-9704, the max. allowable strain must be no more than 500 μstrains for the board thickness from 1.0 to 3.2mm

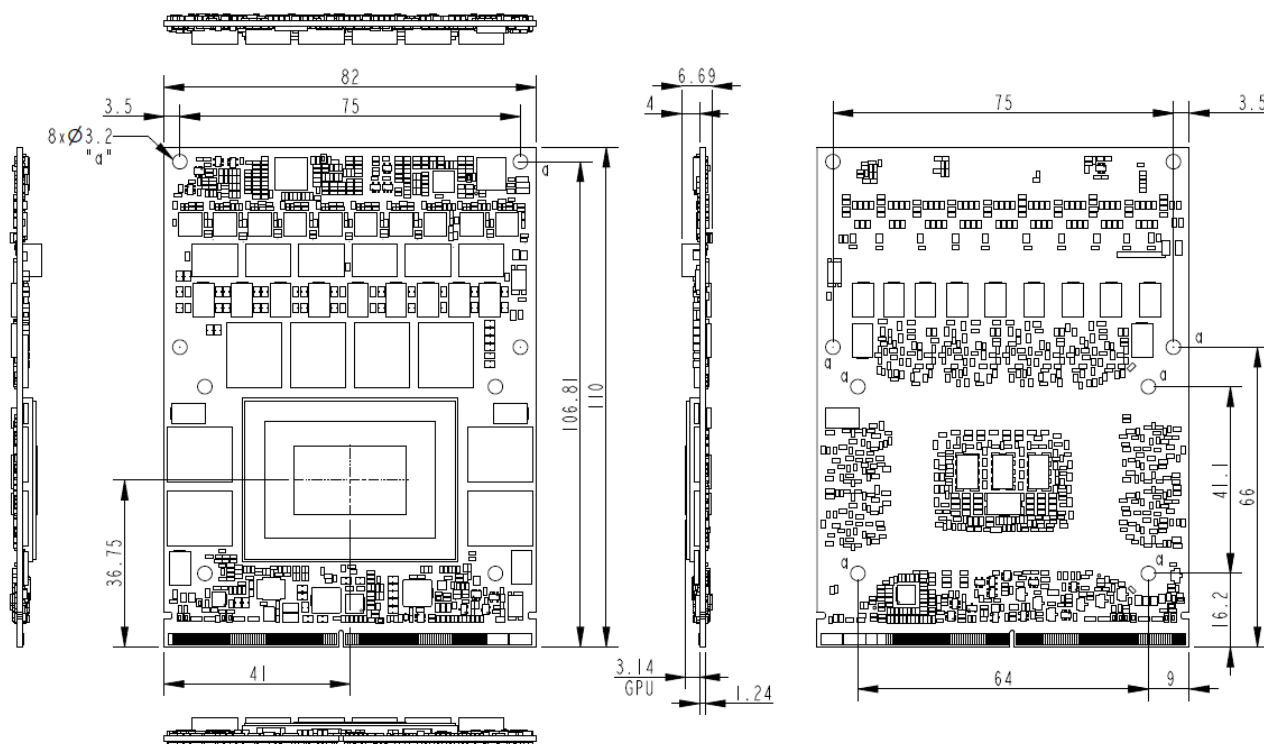
2.9 Dual-Mode DP (DP++) Support Requirement

Dual-mode DP (DP++) support requires one of the following external DP-AUX device apply on main board when driving an external connector directly:

DIODES : PI3AUX221ZTAEX

ANPEC : APL3585

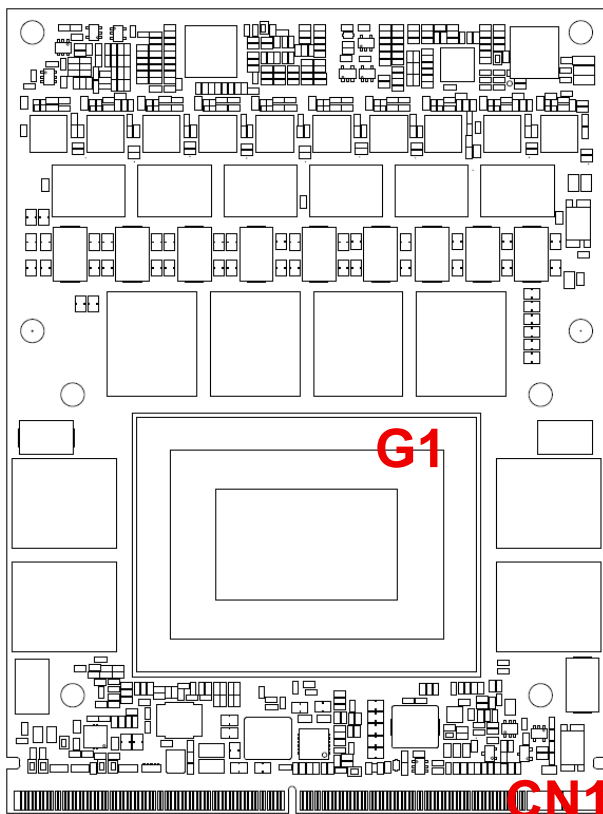
2.10 Mechanical Dimensions



Dimensions of MX4000B-WA

2.11 Pin Definition

- Board Interface

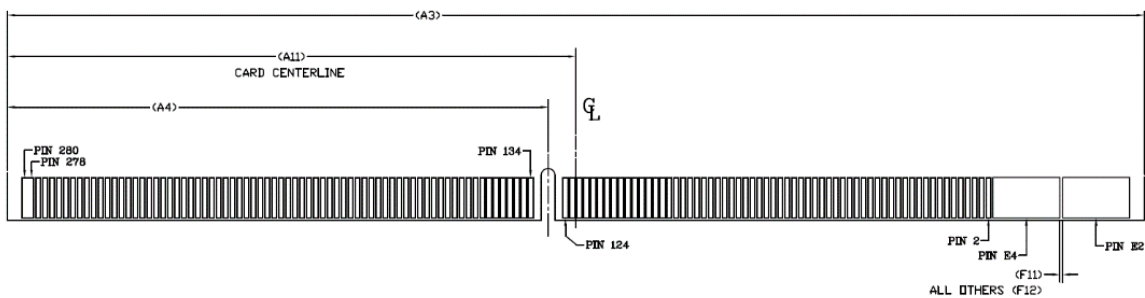


MXM Board layout

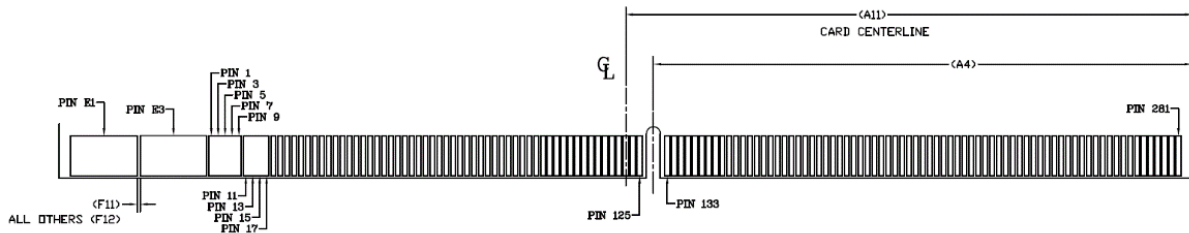
Specification	Describe
G1	NVIDIA RTX PRO 4000 Blackwell GPU
CN1	MXM connector (Golden finger)

Board layout and connectors

- MXM Pin Assignments



CARD TOP
PIN REF NUMBER(S) AND LOCATING KEY



CARD BOTTOM
PIN REF NUMBER(S) AND LOCATING KEY

● MXM connector Pinout

Pinn	Signal (bottom)	Y/N	Pin	Signal (top)	Y/N	Pin	Signal (bottom)	Y/N	Pin	Signal (top)	Y/N
E1	PWR_SRC	Y	E2	PWR_SRC	Y	141	PEX_RX1#	Y	142	PEX_TX1#	Y
E3	GND	Y	E4	GND	Y	143	PEX_RX1	Y	144	PEX_TX1	Y
1	5V	Y	2	PRSNT_R#	Y	145	GND	Y	146	GND	Y
3	5V	Y	4	WAKE#	N	147	PEX_RX0#	Y	148	PEX_TX0#	Y
5	5V	Y	6	PWR_GOOD (3.3V)	Y	149	PEX_RX0	Y	150	PEX_TX0	Y
7	5V	Y	8	PWR_EN	Y	151	GND	Y	152	GND	Y
9	5V	Y	10	27MHZ_REF	N	153	PEX_REFCLK#	Y	154	PEX_CLK_REQ#	Y
11	GND	Y	12	GND	Y	155	PEX_REFCLK	Y	156	PEX_RST#	Y
13	GND	Y	14	LVDS_U_HPD	N	157	GND	Y	158	VGA_DDC_DAT	N
15	GND	Y	16	PCH_RST*	Y	159	JTAG_TDO	N	160	VGA_DCC_CLK	N
17	GND	Y	18	PWR_LEVEL	Y	161	JTAG_TDI	N	162	VGA_VSYNC	N
19	PEX_STD_SW#	Y	20	TH_OVERT#	Y	163	JTAG_TCLK	N	164	VGA_HSYNC	N
21	VGA_DISABLE#	N	22	TH_ALERT#	Y	165	JTAG_TMS	N	166	GND	Y
23	PNL_PWR_EN	N	24	TH_PWM	N	167	JTAG_TRST#	N	168	VGA_RED	N
25	PNL_BL_EN	N	26	GPIO0	N	169	LVDS_UCLK#	N	170	VGA_GREEN	N
27	PNL_BL_PWN	N	28	GPIO1	N	171	LVDS_UCLK	N	172	VGA_BLUE	N
29	HDMI_CEC	N	30	GPIO2	N	173	GND	Y	174	GND	Y
31	LVDS_L_HPD	N	32	SMB_DAT	Y	175	LVDS_UTX3#	N	176	LVDS_LCLK#	N
33	LVDS_DDC_DAT	N	34	SMB_CLK	Y	177	LVDS_UTX3	N	178	LVDS_LCLK	N
35	LVDS_DDC_CLK	N	36	GND	Y	179	GND	Y	180	GND	Y
37	GND	Y	38	OEM0	N	181	LVDS_UTX2#	N	182	LVDS_LT3#	N
39	OEM1	N	40	OEM2	N	183	LVDS_UTX2	N	184	LVDS_LT3	N
41	OEM3	N	42	OEM4	N	185	GND	Y	186	GND	Y
43	OEM5	N	44	OEM6	N	187	LVDS_UTX1#	N	188	LVDS_LT2#	N
45	OEM7	N	46	GND	Y	189	LVDS_UTX1	N	190	LVDS_LT2	N
47	GND	Y	48	PEX_TX15#	Y	191	GND	Y	192	GND	Y
49	PEX_RX15#	Y	50	PEX_TX15	Y	193	LVDS_UTX0#	N	194	LVDS_LT1#	N
51	PEX_RX15	Y	52	GND	Y	195	LVDS_UTX0	N	196	LVDS_LT1	N
53	GND	Y	54	PEX_TX14#	Y	197	GND	Y	198	GND	Y
55	PEX_RX14#	Y	56	PEX_TX14	Y	199	DP_C_L0#	Y	200	LVDS_LT0#	N
57	PEX_RX14	Y	58	GND	Y	201	DP_C_L0	Y	202	LVDS_LT0	N
59	GND	Y	60	PEX_TX13#	Y	203	GND	Y	204	GND	Y
61	PEX_RX13#	Y	62	PEX_TX13	Y	205	DP_C_L1#	Y	206	DP_D_L0#	Y
63	PEX_RX13	Y	64	GND	Y	207	DP_C_L1	Y	208	DP_D_L0	Y

MXM connector pinout

Pin	Signal (bottom)	Y/N	Pin	Signal (top)	Y/N	Pin	Signal (bottom)	Y/N	Pin	Signal (top)	Y/N
65	GND	Y	66	PEX_TX12#	Y	209	GND	Y	210	GND	Y
67	PEX_RX12#	Y	68	PEX_TX12	Y	211	DP_C_L2#	Y	212	DP_D_L1#	Y
69	PEX_RX12	Y	70	GND	Y	213	DP_C_L2	Y	214	DP_D_L1	Y
71	GND	Y	72	PEX_TX11#	Y	215	GND	Y	216	GND	Y
73	PEX_RX11#	Y	74	PEX_TX11	Y	217	DP_C_L3#	Y	218	DP_D_L2#	Y
75	PEX_RX11	Y	76	GND	Y	219	DP_C_L3	Y	220	DP_D_L2	Y
77	GND	Y	78	PEX_TX10#	Y	221	GND	Y	222	GND	Y
79	PEX_RX10#	Y	80	PEX_TX10	Y	223	DP_C_AUX#	Y	224	DP_D_L3#	Y
81	PEX_RX10	Y	82	GND	Y	225	DP_C_AUX	Y	226	DP_D_L3	Y
83	GND	Y	84	PEX_TX9#	Y	227	RSVD	IFPA_DP_HPD_R	228	GND	Y
85	PEX_RX9#	Y	86	PEX_TX9	Y	229	RSVD	IFPD_DP_HPD_R	230	DP_D_AUX#	Y
87	PEX_RX9	Y	88	GND	Y	231	RSVD	IFPC_DP_HPD_R	232	DP_D_AUX	Y
89	GND	Y	90	PEX_TX8#	Y	233	RSVD	IFPE_DP_HPD_R	234	DP_C_HPD	Y
91	PEX_RX8#	Y	92	PEX_TX8	Y	235	RSVD	N	236	DP_D_HPD	Y
93	PEX_RX8	Y	94	GND	Y	237	RSVD	N	238	RSVD	N
95	GND	Y	96	PEX_TX7#	Y	239	RSVD	N	240	3V3	Y
97	PEX_RX7#	Y	98	PEX_TX7	Y	241	RSVD	N	242	3V3	Y
99	PEX_RX7	Y	100	GND	Y	243	RSVD	N	244	GND	Y
101	GND	Y	102	PEX_TX6#	Y	245	RSVD	N	246	DP_B_L0#	Y
103	PEX_RX6#	Y	104	PEX_TX6	Y	247	RSVD	MXM_THERM DP_GPU (Floating)	248	DP_B_L0	Y
105	PEX_RX6	Y	106	GND	Y	249	RSVD	MXM_THERM DN_GPU (Floating)	250	GND	Y
107	GND	Y	108	PEX_TX5#	Y	251	GND	Y	252	DP_B_L1#	Y
109	PEX_RX5#	Y	110	PEX_TX5	Y	253	DP_A_L0#	Y	254	DP_B_L1	Y
111	PEX_RX5	Y	112	GND	Y	255	DP_A_L0	Y	256	GND	Y
113	GND	Y	114	PEX_TX4#	Y	257	GND	Y	258	DP_B_L2#	Y
115	PEX_RX4#	Y	116	PEX_TX4	Y	259	DP_A_L1#	Y	260	DP_B_L2	Y

MXM connector pinout (continued)

Pin	Signal (bottom)	Y/N	Pin	Signal (top)	Y/N	Pin	Signal (bottom)	Y/N	Pin	Signal (top)	Y/N
117	PEX_RX4	Y	118	GND	Y	261	DP_A_L1	Y	262	GND	Y
119	GND	Y	120	PEX_TX3#	Y	263	GND	Y	264	DP_B_L3#	Y
121	PEX_RX3#	Y	122	PEX_TX3	Y	265	DP_A_L2#	Y	266	DP_B_L3	Y
123	PEX_RX3	Y	124	GND	Y	267	DP_A_L2	Y	268	GND	Y
125	GND	Y	126	KEY	Y	269	GND	Y	270	DP_B_AUX#	Y
127	KEY	Y	128	KEY	Y	271	DP_A_L3#	Y	272	DP_B_AUX	Y
129	KEY	Y	130	KEY	Y	273	DP_A_L3	Y	274	DP_B_HPD	Y
131	KEY	Y	132	KEY	Y	275	GND	Y	276	DP_A_HPD	Y
133	GND	Y	134	GND	Y	277	DP_A_AUX#	Y	278	3V3	Y
135	PEX_RX2#	Y	136	PEX_TX2#	Y	279	DP_A_AUX	Y	280	3V3	Y
137	PEX_RX2	Y	138	PEX_TX2	Y	281	PRSNT_L#	Y			
139	GND	Y	140	GND	Y						

MXM connector pinout (continued)

Notes:

1. KEY = Key (or notch) on the PCB edge finger
2. PD = Pull-down resistor on module
3. n.c. = Not Connect
4. Reserved = Reserved pin and do NOT connect on system
5. Y= Yes (Functional) / N= No Connection
6. The DP_A / DP_B / DP_C / DP_D names in the Pin Define table refer to the MXM connector output ports.
The actual GPU output source should follow the GPU Link mapping table.
Example: Pin 265 DP_A_L2# belongs to MXM DP_A, and DP_A is mapped to GPU Link D.

3. Software Installation

Before you begin installing your new graphics card, please make sure you have the proper system requirements and have completed the required pre-installation tasks as outlined in this chapter.

3.1 System Recommended

- AMD Ryzen 7 or Intel Core i7 processor or latest.
 - 16GB of system memory; 24GB or more recommended for better performance.
 - Motherboard with available PCI Express® 4.0 ×16 lane MXM connection slot.
 - Internet access for software installation.
 - NVIDIA GPUs support a resizable BAR1, This is implemented on laptops through a large BAR1. User must support a resizable BAR1 with a BAR1 size that is equal to or greater than the frame buffer size for best performance. Note that the BAR1 size must be a power of two (2ⁿ GB). Below is criteria must meet:
 - SBIOS must support “Above 4GB decoding” feature to support resizable BAR1 size
 - SBIOS must enable “Above 4G decoding” at default shipping configuration
 - User should run full functional and stability test with resizable BAR1 VBIOS and SBIOS at DVT and PVT
- Notes: The memory resource does not mean the system memory, 8G Bar1 size means 8G memory address resource and this memory access (PCI MMIO access) will be decoded to GPU, not system memory.
- Operating System:
 - Windows® 10 - 11 64-bit
 - Linux® 64-bit

3.2 Performing a Quick Installation

Experienced users and system administrators can follow these brief instructions for installing Aetina graphics card. Other users should refer to the detailed installation instructions.

1. Uninstall the drivers and software for any installed graphics card(s).
2. Shut down and disconnect your computer system.
3. Remove any installed graphics card(s).
4. Install your new Aetina graphics card.
5. Reassemble and connect to your computer system.
6. Install the Aetina graphics drivers from the Aetina official website.

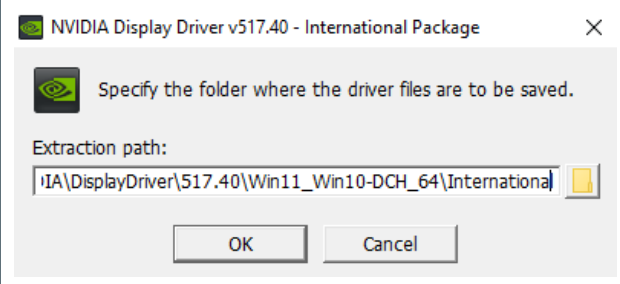
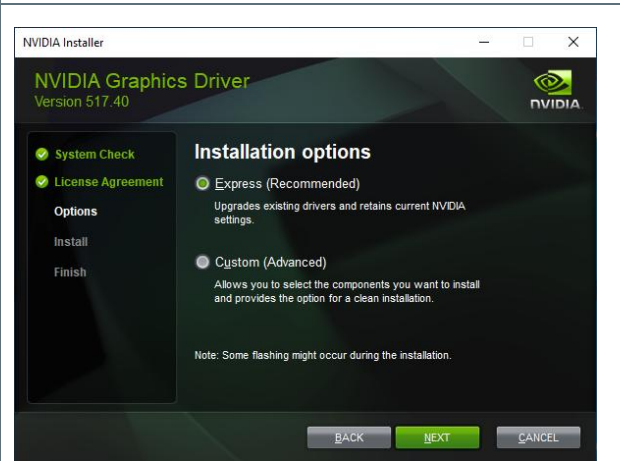
*Note: If you are using a motherboard containing an on-board graphics solution and do not intend to use it as part of a multiple monitor display, disable it.

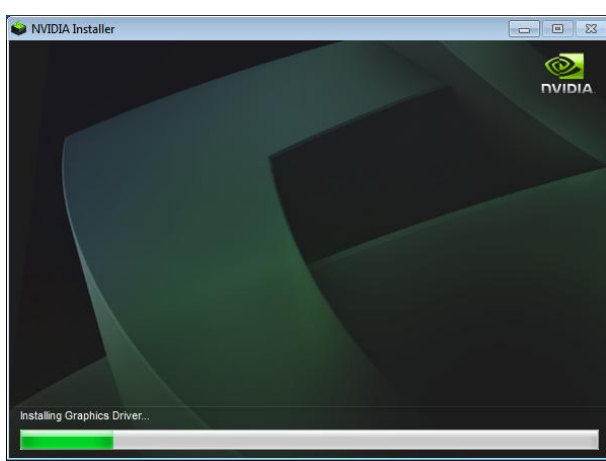
3.3 Install Graphics Driver

Notice the following guidelines before installing the drivers:

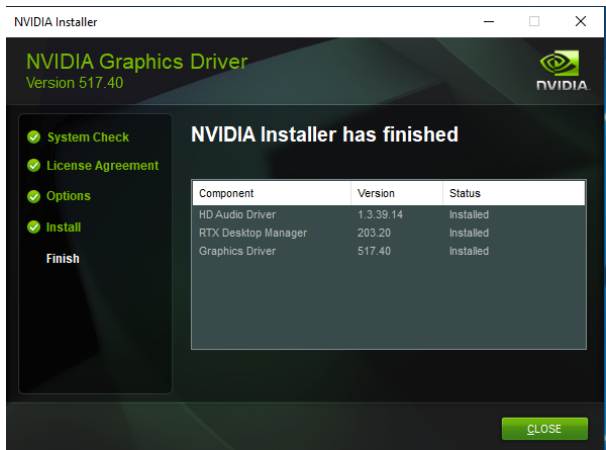
1. First, uninstall previous graphics card driver.
2. Make sure your system has installed DirectX 11 or later version.
3. Make sure your system has installed the appropriate motherboard drivers (for the motherboard drivers, please contact the motherboard manufacturer).

After installing the operating system, download driver from Aetina official website. Then, go to My Computer, double-click the Download folder and execute the setup.exe program.

	● Click the “OK” button to install driver.
	● Click the “AGREE AND CONTINUE”
	● Choose “Express (Recommended)” or “Custom (Advanced)” then click “NEXT”



- The system is installing the components



- Click the “RESTART NOW” button to restart the computer. Then the driver installation is done

4. Initial Setup

4.1 Thermal Specifications

■ Thermal Specification

Parameter	Value
Thermal Resistance (Junction to Case, R_{JC})	0.019°C/W
Thermal Resistance (Junction to PCB, R_{JB})	1.012°C/W
GPU shutdown temperature (OVERT) (Note 1)	100°C
GPU slowdown temperature (THERM_ALERT) (Note 2)	97°C
GPU maximum operating temperature (Note 3)	89°C
GPU target temperature	>87°C (default); >75°C (minimum)

Thermal Design Power (TDP)	Value	
Total Graphics Power (TGP)	115W	80W
GPU TDP (Note 4)	91W	63W
Memory TDP (Note 5)	26W	26W

Notes:

1. OVERT assertion results in a shutdown
2. THERM_ALERT assertion results in a 50% (± 2) hardware clock slowdown
3. The GPU max operating temperature is the max GPU temperature at which the GPU is guaranteed to operate at the target performance (Base Clock) under the total board power level
4. GPU TDP = GPU core + GPU FBIO + PCIe + IO/PLL/VDD + Other. TDP is achievable when running GPU Heater if the system meets the GPU max operating temperature specification.
5. Memory TDP = Memory core + Memory IO. These values are with nominal memory and are taken without temperature control on memory. Refer to memory manufacturer for absolute ratings.
6. Power is based on PCI Express Gen4 x16 / Gen3 x16, ASPM disabled.

4.2 GDDR7 Thermal Specification

Parameter	GDDR7	Units
Memory Aggressive Slowdown Temperature (T_J)	103	°C
Memory Maximum Operating Temperature (T_J)	105	°C

4.3 Power Delivery Design Requirement

For given design conditions such as ambient temperature, derating requirement, thermal solution, space constraint, cost target, and so on, the aim of power supply design can be categorized into two main areas:

- To sustain continuous (DC) current (EDPc) with the target efficiency and thermal performance.
- To achieve a target output voltage overshoot/undershoot spec (or generally referred to noise or peak-to-peak noise spec) under a specified large load transient event (EDPp)

The following are EDP currents available per GPU SKU for regulator design:

- Input EDP continuous (Input EDPc)

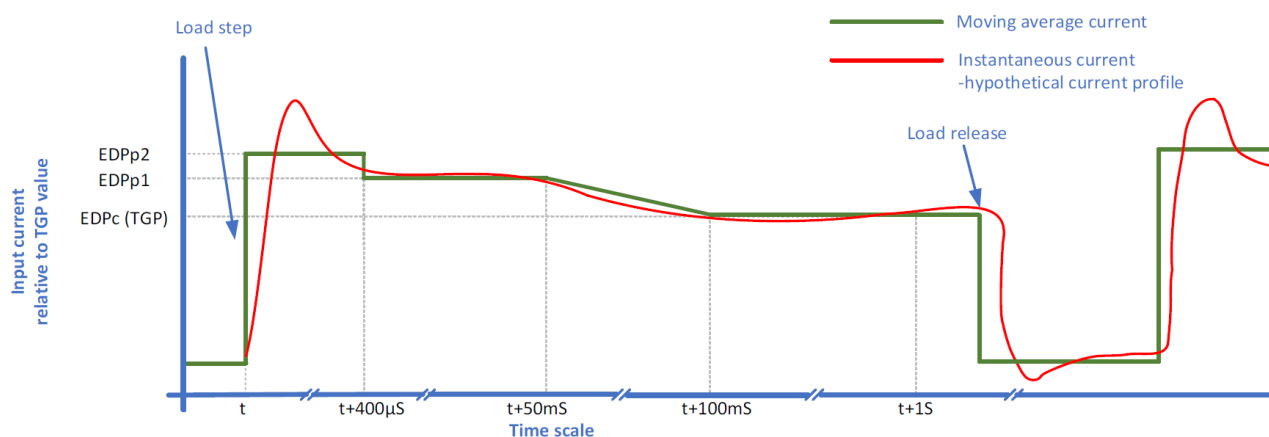
Input EDPc is the average input current consumption of the graphics subsystem, measured at a 1 second moving average. Thus, input EDPc is the maximum sustained DC current that the system power supply needs to provide.

- Input EDP peak (Input EDPp)

Input EDP peak is defined as the maximum input current for the graphics subsystem, measured at 400 μ s and at 50 ms moving average. For MXM designs, the input current is measured at the MXM connector's PWR_SRC pin.

The maximum duration of the input EDPp current is 50 ms. After 50 ms worst case, the software power-capping mechanism will kick in and reduce power by lowering the VF (voltage-frequency) operating point until the EDPc average current levels are restored.

F Timing Diagram for Input EDPp and Input EDPc Response Time



Note: Two power control mechanisms are used to limit the input current:

- Hardware power control (ICL) is used to limit the input EDP peak magnitude and duration. The maximum duration of the input EDPp is 50 ms.
- Software power control is used to restore the input power consumption back to the input EDP continuous (average power) level. The input EDPc value is restored within 100 ms.

4.4 Electrical Specifications

The EN22 GPUs specify the Input EDP (Electrical Design Point) parameters for system-level power supply design purposes. Three parameters are provided, Input EDP Continuous (EDP_c), and Input EDP peak (EDP_{p1}, EDP_{p2}). Input EDP_c and EDP_{p1} are part of an input power control system consisting of a hardware power control to limit input EDP_{p1} levels and a software power-capping control to limit input EDP_c levels. The EDP_{p1} is proportional to the electrical power limit (maximum TGP plus maximum dynamic boost).

GPU	Power Source & Input Voltage (V)	Input EDP _{p2} Limit (400us, W)	Input EDP _{p1} Limit (50ms, W)	Input EDP _c (1 sec, W)
EN22-X9	AC adapter 19V	EDP _{p2} : EDP _c = 1.6	EDP _{p1} : EDP _c = 1.2	80 to 175

Notes:

1. NVIDIA Input EDP_p controller scales the input EDP_p, 50 ms moving average values proportionately with the max TGP limit (EDP_c).
2. The Input EDP_{p2} (400 us) instantaneous value depends on the regulator design and PDN. With proper input power controller (OVR) tuning (P, I, D), input EDP_{p2} (400 us moving values should be proportional to the active TGP limit (EDP_c). Refer to the Hardware Design Guide for detailed input power capping tuning procedures.

For example, if the electrical power limit is 100W, Ac power source voltage is 19V and EDP_c is calculated as 5.26A, based on the table below, EDP_{p1} is decided as $5.26A \times 1.2 = 6.31A$, and EDP_{p2} is $5.26A \times 1.6 = 8.41A$. The input power control system does not control the input EDP_{p2}. The Input EDP_{p2} instantaneous value depends on PDN, regulator response time, and GPU workload. The Input EDP_{p2} 400 us moving average value depends on PDN, regulator response time, and the Input EDP_{p2} instantaneous value. Refer to the Hardware Design Guide ("Power" chapter) for the input and Output EDP_c/p/e definitions and time scale.

5. Appendix

5.1 Ordering Information

■ Models available

Model Number	Description
MX4000B-WAA-A1	MXM-B, NVIDIA RTX PRO 4000 BLACKWELL, Gen4.0 x16, 16GB GDDR7, DP, 19V, 115W, 0°C to +55°C
MX4000B-WAA-A2	MXM-B, NVIDIA RTX PRO 4000 BLACKWELL, Gen4.0 x16, 16GB GDDR7, DP, 19V, 80W, 0°C to +55°C

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