



**Embedded MXM module**

# **MX500B-QA Series**

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**USER MANUAL**

## Document Change History

| Version | Date       | Description                                | Authors   |
|---------|------------|--------------------------------------------|-----------|
| V0.1    | 2026/06/23 | Initial Release.                           | Vic Chien |
| V0.2    | 2026/06/30 | Update 2.11 Pin Define                     | Vic Chien |
| V1.0    | 2026/07/08 | Initial official release after validation. | Vic Chien |

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Version 1.0

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- 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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- 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 MX500B-QA series, a Type-A MXM module powered by the NVIDIA RTX PRO 500 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 MX500B-QA adopts the MXM 3.1 Type A form factor with Blackwell architecture, featuring **1,792 CUDA cores, 14 RT cores, 56 Tensor cores, and 6GB 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.

Combining real-time ray tracing, AI acceleration, and high-performance graphics processing, the MX500B-QA is well suited for professional applications such as scientific and medical visualization, digital content creation, robotics, and AI and machine learning workloads.



## 1.1 Features

- Powered by NVIDIA Blackwell architecture
- 1792 CUDA cores, 14 RT cores and 56 Tensor cores, 6GB GDDR7
- 9.2 TFLOPS peak FP32
- PCIe Gen 4 x8 interface
- 5 years longevity product supply service
- **GPU**
  - NVIDIA RTX PRO 500 Blackwell Embedded GPU
  - Stream Processing Unites: 1792
  - Voltage: Variable
- **Board**
  - 12-layer printed circuit board (PCB)
  - 8-lanes PCI Express 4.0 capable
  - Physical dimensions: 70mm x 82mm
  - Board power: 60 W (PWR\_SRC 19V)
- **Connectors**
  - MXM 3.1 Connector Interoperability
- **Memory Configuration**
  - Memory Type: GDDR7
  - Memory Capacity: 6 GB
  - Memory Interface: 96-bit
  - Memory Data Rate: 24.0 Gbps
  - Memory Bandwidth: 288 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 500 graphics board.

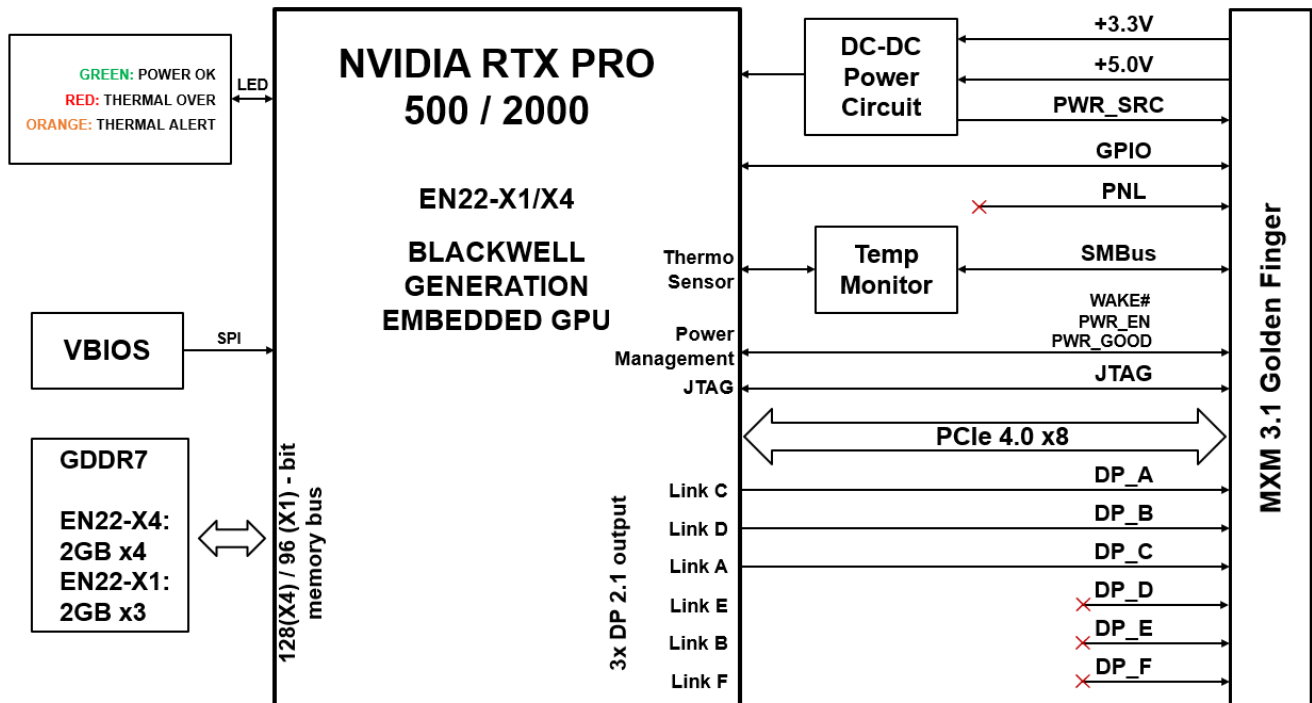
### ■ Board configuration

| Specification                 | MX500B-QAA-A1                                                                    | MX500B-QAA-A2             |
|-------------------------------|----------------------------------------------------------------------------------|---------------------------|
| Chip                          | NVIDIA RTX PRO 500 Blackwell Embedded GPU                                        |                           |
| Core clock (MHz)              | Base= 2160<br>Boost= 2565                                                        | Base= 1357<br>Boost= 1792 |
| Memory speed                  | 24.0 Gbps                                                                        |                           |
| Frame buffer                  | 6GB GDDR7                                                                        |                           |
| Memory interface              | 96-bit                                                                           |                           |
| Memory type                   | 512M x 32 GDDR7 FBGA266 package                                                  |                           |
| Memory AVL                    | SAMSUNG K4VAF325ZC-SC28<br>SAMSUNG K4VAF325ZC-SC28000<br>SK HYNIX H57G42MP2AX006 |                           |
| Maximum board power           | 60 W                                                                             | 35 W                      |
| PCI Express interface         | PCIe Gen4.0 x8                                                                   |                           |
| Connectors                    | DisplayPort 2.1a / HDMI 2.1b output via MXM golden finger is supported           |                           |
| Supplementary Power Connector | N/A                                                                              |                           |
| Maximum output                | 3                                                                                |                           |
| 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 MX500B-QA is based on PCI Express 4.0 form factor.



MX500B-QA Block diagram

### 2.2 General Purpose Graphics Processing Unit

The Aetina MX500B-QA is based on NVIDIA RTX PRO 500 Blackwell Embedded GPU. Blackwell GPUs are based on NVIDIA CUDA Compute Capability 12.0 architecture.

- **GPU Resources**

- **GDDR7 SDRAM**
  - 3 pieces 512 M x 32 GDDR7, total capacity of 6144 MBytes
  - 96bit data bus width
  - 24.0 Gbps speed
- **BIOS ROM**
  - 32Mbit SPI FLASH for BIOS image

## 2.3 Display Interface

The MX500B-QA provides four digital output channels that can be active at the same time.

- Digital Output
  - The MX500B-QA 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 MX500B-QA 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 C  | Link D  | Link A  | N/A  | N/A  | N/A  |
| DisplayPort (DP++)<br>DP2.1a (DSC 1.2a) | Support | Support | Support | N/A  | N/A  | N/A  |
| HDMI 2.1b                               | Support | Support | Support | N/A  | N/A  | N/A  |

Note:

The DP\_A / DP\_B / DP\_C 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.

## 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 MX500B-QA provides PCI Express x16 mechanism while data transmission via PCI Express 4.0 x8.

## 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. | $\leq 60$ | $\leq 80$  | psi           |
| $e_{max}$  | Max. allowable strain during PCA, system assembly or operation    |      |           | $\leq 500$ | $\mu$ strains |

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 1x1mm<sup>2</sup> for the pressure sensor
3. Strain measurement shall follow IPC-9704, the max. allowable strain must be no more than 500  $\mu$ strains for the board thickness from 1.0 to 3.2mm

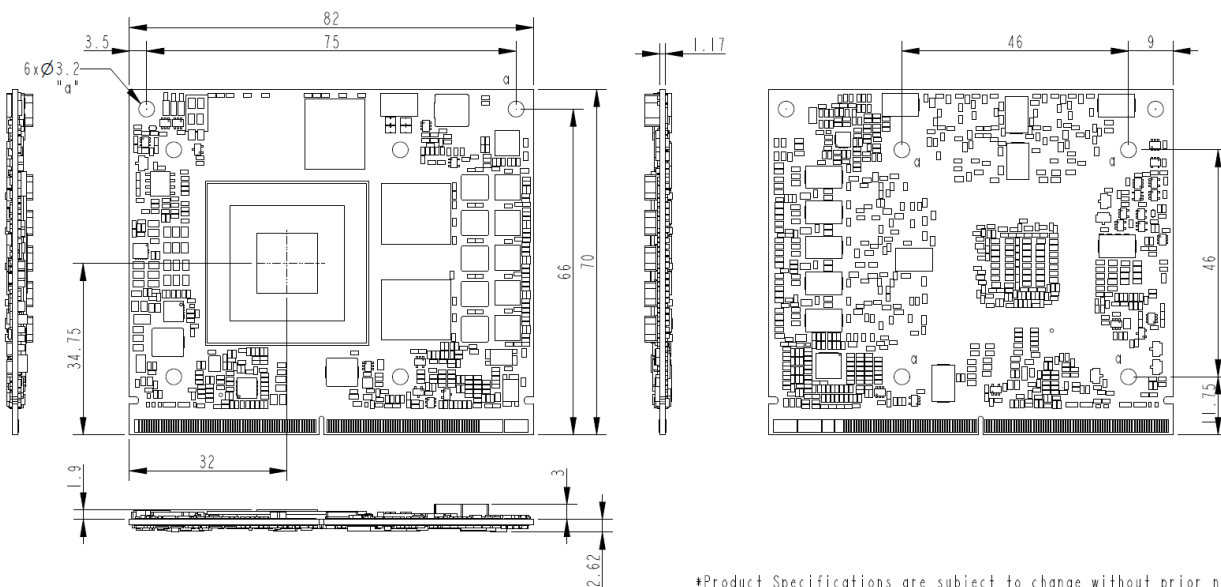
## 2.9 Dual-Mode DP (DP++) Support Requirement

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

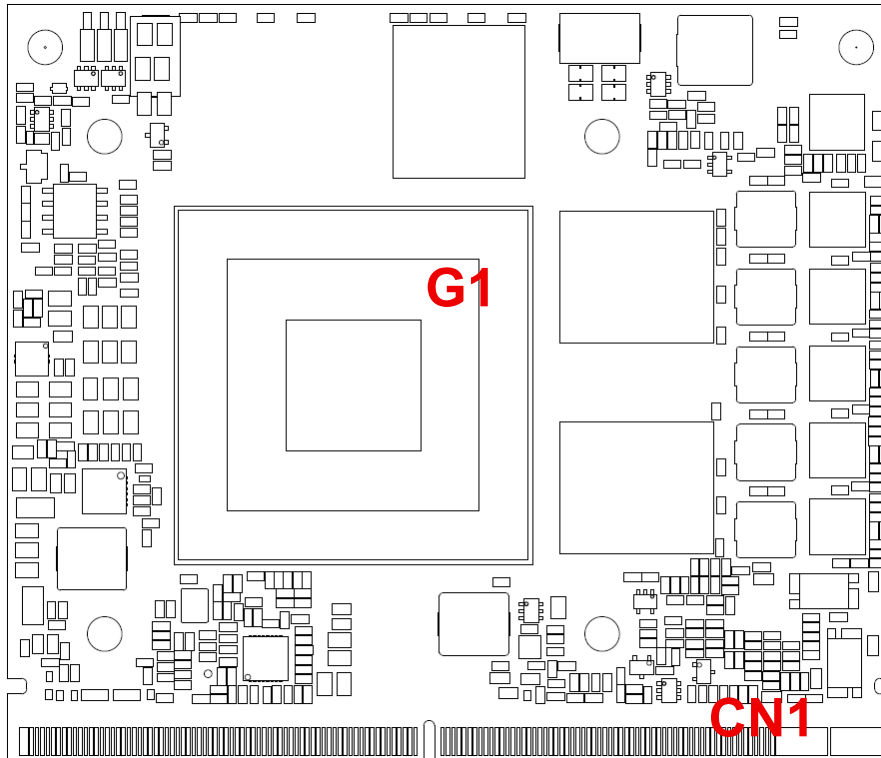
## 2.10 Mechanical Dimensions



Dimensions of MX500B-QA

## 2.11 Pin Definition

- Board Interface

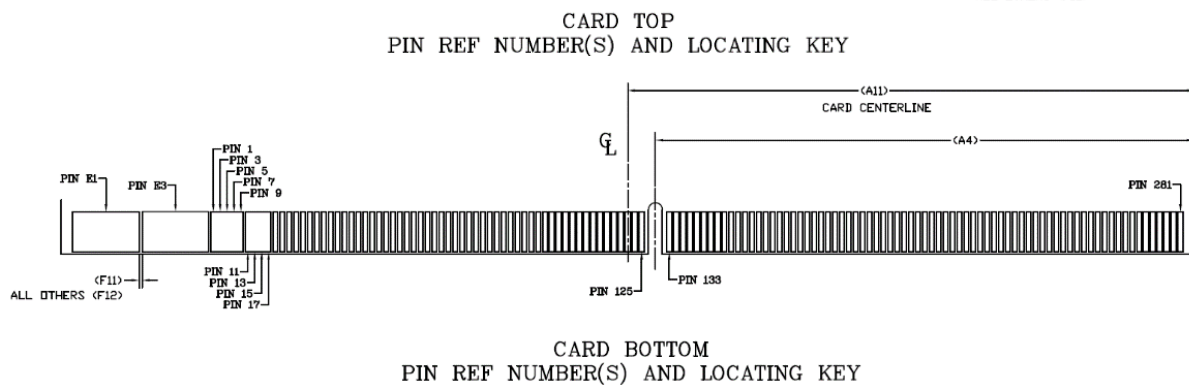
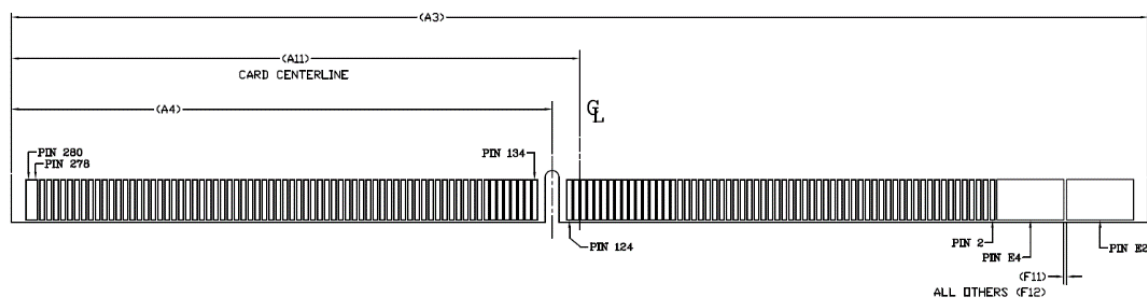


MXM Board layout

| Specification | Describe                         |
|---------------|----------------------------------|
| G1            | NVIDIA RTX PRO 500 Blackwell GPU |
| CN1           | MXM connector (Golden finger)    |

Board layout and connectors

- MXM Pin Assignments



● 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<br>(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#          | N   | 191 | GND             | Y   | 192 | GND          | Y   |
| 49   | PEX_RX15#       | N   | 50  | PEX_TX15           | N   | 193 | LVDS_UTX0#      | N   | 194 | LVDS_LT1#    | N   |
| 51   | PEX_RX15        | N   | 52  | GND                | Y   | 195 | LVDS_UTX0       | N   | 196 | LVDS_LT1     | N   |
| 53   | GND             | Y   | 54  | PEX_TX14#          | N   | 197 | GND             | Y   | 198 | GND          | Y   |
| 55   | PEX_RX14#       | N   | 56  | PEX_TX14           | N   | 199 | DP_C_L0#        | Y   | 200 | LVDS_LT0#    | N   |
| 57   | PEX_RX14        | N   | 58  | GND                | Y   | 201 | DP_C_L0         | Y   | 202 | LVDS_LT0     | N   |
| 59   | GND             | Y   | 60  | PEX_TX13#          | N   | 203 | GND             | Y   | 204 | GND          | Y   |
| 61   | PEX_RX13#       | N   | 62  | PEX_TX13           | N   | 205 | DP_C_L1#        | Y   | 206 | DP_D_L0#     | N   |
| 63   | PEX_RX13        | N   | 64  | GND                | Y   | 207 | DP_C_L1         | Y   | 208 | DP_D_L0      | N   |

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#    | N   | 209 | GND             | Y                | 210 | GND          | Y   |
| 67  | PEX_RX12#       | N   | 68  | PEX_TX12     | N   | 211 | DP_C_L2#        | Y                | 212 | DP_D_L1#     | N   |
| 69  | PEX_RX12        | N   | 70  | GND          | Y   | 213 | DP_C_L2         | Y                | 214 | DP_D_L1      | N   |
| 71  | GND             | Y   | 72  | PEX_TX11#    | N   | 215 | GND             | Y                | 216 | GND          | Y   |
| 73  | PEX_RX11#       | N   | 74  | PEX_TX11     | N   | 217 | DP_C_L3#        | Y                | 218 | DP_D_L2#     | N   |
| 75  | PEX_RX11        | N   | 76  | GND          | Y   | 219 | DP_C_L3         | Y                | 220 | DP_D_L2      | N   |
| 77  | GND             | Y   | 78  | PEX_TX10#    | N   | 221 | GND             | Y                | 222 | GND          | Y   |
| 79  | PEX_RX10#       | N   | 80  | PEX_TX10     | N   | 223 | DP_C_AUX#       | Y                | 224 | DP_D_L3#     | N   |
| 81  | PEX_RX10        | N   | 82  | GND          | Y   | 225 | DP_C_AUX        | Y                | 226 | DP_D_L3      | N   |
| 83  | GND             | Y   | 84  | PEX_TX9#     | N   | 227 | RSVD            | IFPA_DP_HPD_R    | 228 | GND          | Y   |
| 85  | PEX_RX9#        | N   | 86  | PEX_TX9      | N   | 229 | RSVD            | IFPD_DP_HPD_R    | 230 | DP_D_AUX#    | N   |
| 87  | PEX_RX9         | N   | 88  | GND          | Y   | 231 | RSVD            | IFPC_DP_HPD_R    | 232 | DP_D_AUX     | N   |
| 89  | GND             | Y   | 90  | PEX_TX8#     | N   | 233 | RSVD            | N                | 234 | DP_C_HPD     | Y   |
| 91  | PEX_RX8#        | N   | 92  | PEX_TX8      | N   | 235 | RSVD            | N                | 236 | DP_D_HPD     | N   |
| 93  | PEX_RX8         | N   | 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 | 248 | DP_B_L0      | Y   |
| 105 | PEX_RX6         | Y   | 106 | GND          | Y   | 249 | RSVD            | MXM_THERM_DN_GPU | 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 C.

## 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 (2<sup>n</sup> 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.

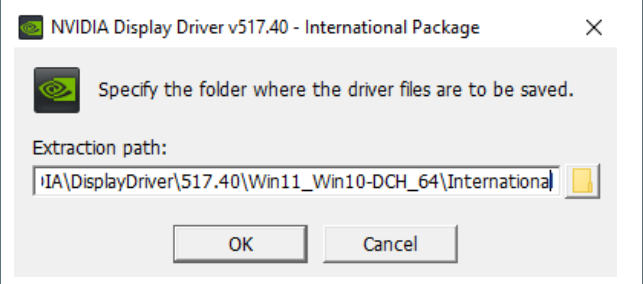
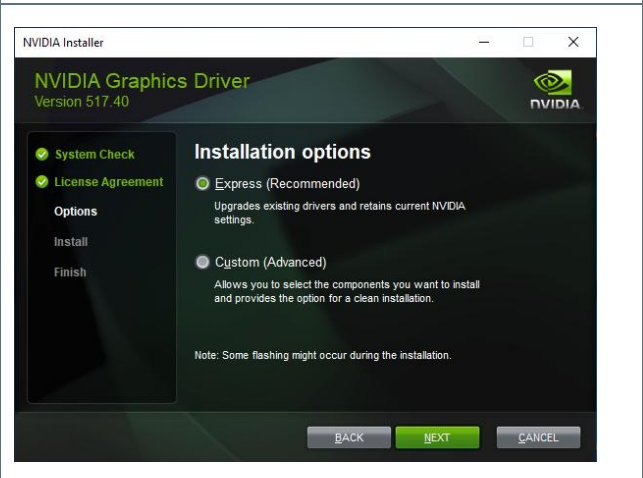
\*Note: If you are using a motherboard containing an on-board graphics solution and do not intend to use it as part of a multiple monitor display, disable it.

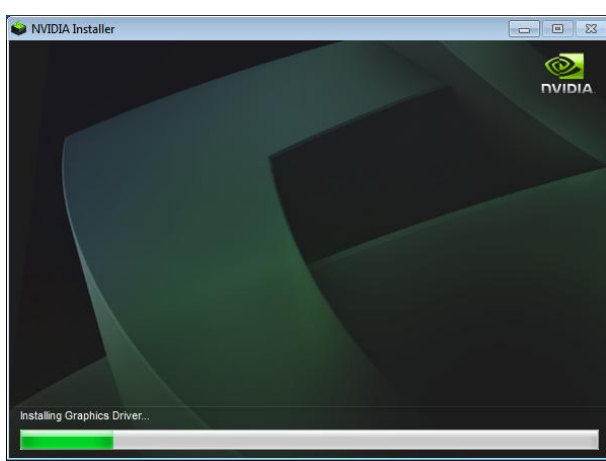
## 3.3 Install Graphics Driver

Notice the following guidelines before installing the drivers:

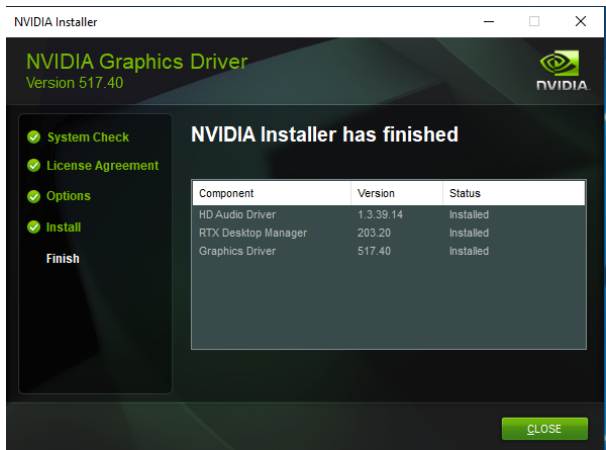
1. First, uninstall previous graphics card driver.
2. Make sure your system has installed DirectX 11 or later version.
3. Make sure your system has installed the appropriate motherboard drivers (for the motherboard drivers, please contact the motherboard manufacturer).

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.

|                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                           |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------|
|  The screenshot shows a dialog box titled "NVIDIA Display Driver v517.40 - International Package". It contains the text "Specify the folder where the driver files are to be saved." and "Extraction path:". The path field is filled with "IA\DisplayDriver\517.40\Win11_Win10-DCH_64\International". There are "OK" and "Cancel" buttons at the bottom. | <ul style="list-style-type: none"><li>● Click the “OK” button to install driver.</li></ul>                                |
|  The screenshot shows the "NVIDIA Installer" window. The "License Agreement" tab is selected. It displays the "NVIDIA software license agreement" with a scrollable text area containing the terms. At the bottom, there are "AGREE AND CONTINUE" and "CANCEL" buttons.                                                                                  | <ul style="list-style-type: none"><li>● Click the “AGREE AND CONTINUE”</li></ul>                                          |
|  The screenshot shows the "NVIDIA Installer" window. The "Installation options" tab is selected. It shows two options: "Express (Recommended)" which is selected, and "Custom (Advanced)". There are "BACK", "NEXT", and "CANCEL" buttons at the bottom.                                                                                                | <ul style="list-style-type: none"><li>● Choose “Express (Recommended)” or “Custom (Advanced)” then click “NEXT”</li></ul> |



- 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, $R_{JC}$ ) | 0.049°C/W                        |
| Thermal Resistance (Junction to PCB, $R_{JB}$ )  | 2.147°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) | 60W   | 35W |
| GPU TDP (Note 4)           | 47W   | 26W |
| Memory TDP (Note 5)        | 12W   | 12W |

#### Notes:

1. OVERT assertion results in a shutdown
2. THERM\_ALERT assertion results in a 50% ( $\pm 2$ ) 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)

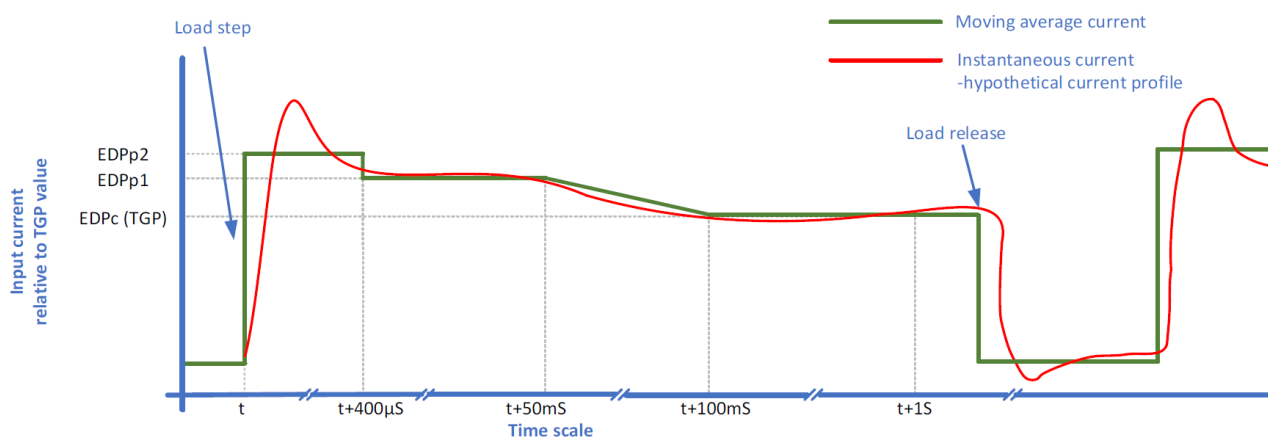
Input EDPc is the average input current consumption of the graphics subsystem, measured at a 1 second moving average. Thus, input EDPc is the maximum sustained DC current that the system power supply needs to provide.

- Input EDP peak (Input EDPp)

Input EDP peak is defined as the maximum input current for the graphics subsystem, measured at 400  $\mu$ 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<sub>c</sub>), and Input EDP peak (EDP<sub>p1</sub>, EDP<sub>p2</sub>). Input EDP<sub>c</sub> and EDP<sub>p1</sub> are part of an input power control system consisting of a hardware power control to limit input EDP<sub>p1</sub> levels and a software power-capping control to limit input EDP<sub>c</sub> levels. The EDP<sub>p1</sub> is proportional to the electrical power limit (maximum TGP plus maximum dynamic boost).

| GPU     | Power Source & Input Voltage (V) | Input EDP <sub>p2</sub> Limit (400us, W)   | Input EDP <sub>p1</sub> Limit (50ms, W)    | Input EDP <sub>c</sub> (1 sec, W) |
|---------|----------------------------------|--------------------------------------------|--------------------------------------------|-----------------------------------|
| EN22-X1 | AC adapter 19V                   | EDP <sub>p2</sub> : EDP <sub>c</sub> = 1.6 | EDP <sub>p1</sub> : EDP <sub>c</sub> = 1.2 | 35 to 75                          |

### Notes:

1. NVIDIA Input EDP<sub>p</sub> controller scales the input EDP<sub>p</sub>, 50 ms moving average values proportionately with the max TGP limit (EDP<sub>c</sub>).
2. The Input EDP<sub>p2</sub> (400 us) instantaneous value depends on the regulator design and PDN. With proper input power controller (OVR) tuning (P, I, D), input EDP<sub>p2</sub> (400 us moving values should be proportional to the active TGP limit (EDP<sub>c</sub>). 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<sub>c</sub> is calculated as 5.26A, based on the table below, EDP<sub>p1</sub> is decided as  $5.26A \times 1.2 = 6.31A$ , and EDP<sub>p2</sub> is  $5.26A \times 1.6 = 8.41A$ . The input power control system does not control the input EDP<sub>p2</sub>. The Input EDP<sub>p2</sub> instantaneous value depends on PDN, regulator response time, and GPU workload. The Input EDP<sub>p2</sub> 400 us moving average value depends on PDN, regulator response time, and the Input EDP<sub>p2</sub> instantaneous value. Refer to the Hardware Design Guide ("Power" chapter) for the input and Output EDP<sub>c</sub>/p/e definitions and time scale.

## 5. Appendix

### 5.1 Ordering Information

#### ■ Models available

| Model Number  | Description                                                                             |
|---------------|-----------------------------------------------------------------------------------------|
| MX500B-QAA-A1 | MXM-B, NVIDIA RTX PRO 500 BLACKWELL, Gen4.0 x8, 6GB GDDR7, 3xDP, 19V, 60W, 0°C to +55°C |
| MX500B-QAA-A2 | MXM-B, NVIDIA RTX PRO 500 BLACKWELL, Gen4.0 x8, 6GB GDDR7, 3xDP, 19V, 35W, 0°C to +55°C |



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