Metis M.2 AI Accelerator Card Datasheet

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Document revision history

Revision	Date	Description
1 – PRELIMINARY	2024-10-31	First Issue
2 – PRELIMINARY	2024-11-06	Minor adjustments relevant for AXE-BME20M1AB01A01.
3 – PRELIMINARY	2024-11-06	Small text correction.
4 – PRELIMINARY	2025-01-10	Added Safety compliance information. Compliance the Low Voltage Directive 2014/35/EU.
5 – PRELIMINARY	2025-01-30	Minor non-technical updates to text to reflect product name.
6 – PRELIMINARY	2025-01-30	Corrected broken link.
7	2025-03-24	Updated active cooling diagram. Updated section 7 Model numbers. Minor text updates and technical corrections.
8	2025-07-23	Added weight of AXE-BME20M1AR01B02 and updated certifications in section 2.
9	2025-07-25	Formal issue.

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TABLE OF CONTENTS

DOCUMENT AND PROPRIETARY INFORMATION 2

1 INTRODUCTION 4

1.1 METIS M.2 AI ACCELERATOR CARD OVERVIEW 4

1.2 KEY FEATURES 4

2 SPECIFICATIONS 5

2.1 BOARD AND PRODUCT CHARACTERISTICS 5

2.2 BOARD MECHANICAL DETAILS 6

2.3 CONNECTOR PINOUT 7

2.4 COOLING SOLUTION 9

2.5 SECURITY 10

3 SAFETY INFORMATION 11

4 INSTALLATION INSTRUCTIONS 12

5 TROUBLESHOOTING 12

6 SUPPORT 12

7 MODEL/PART NUMBERS 13

8 LEGAL NOTICE 14

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1 Introduction

The Axelera AI Metis M.2 AI Accelerator Card is an advanced AI processing module that provides AI acceleration in edge systems with requirements for high performance and low power consumption.

This datasheet provides instructions and safety information to ensure the Metis M.2 AIPU AI Accelerator Card can be installed, operated, stored, maintained, repaired, and disposed of safely.

1.1 Metis M.2 AI Accelerator Card overview

The Metis M.2 AI Accelerator Card (referred to as the *Metis M.2* card) has a single Axelera AI Metis AIPU (AI processing unit) chip and can deliver up to 214 TOPS. It comes with a minimum of 1 GB of LPDDR4X dedicated memory. It is designed to provide a significant boost for AI inference processing in any system that has an NGFF (Next Generation Form Factor) socket.

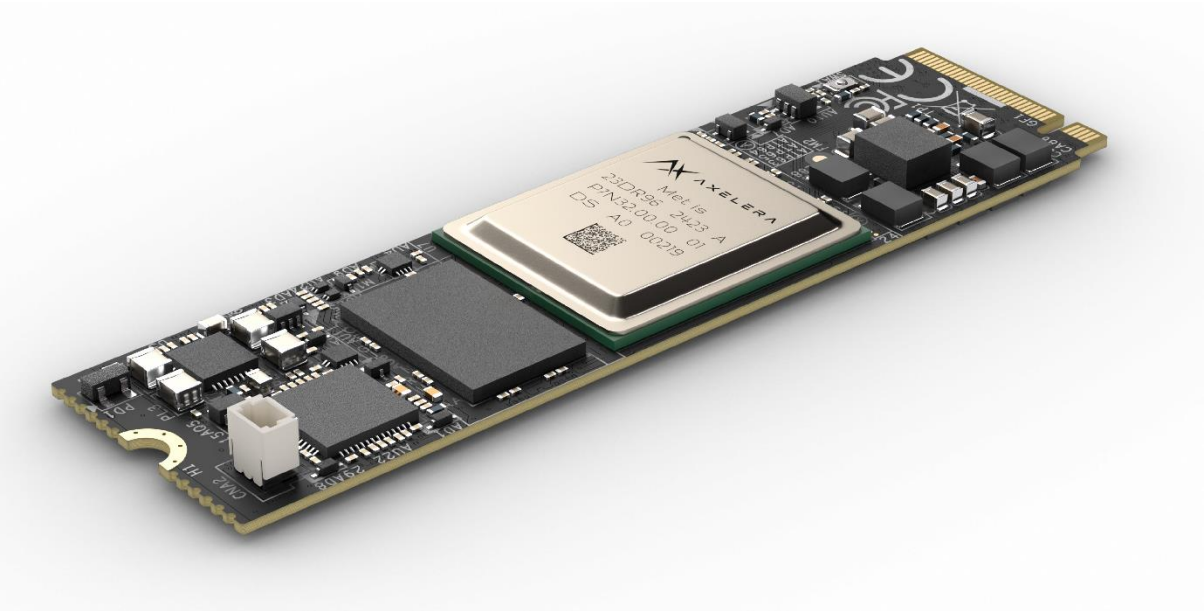

Figure 1: Axelera AI Metis M.2 card AI module fits to systems with an NGFF socket

1.2 Key features

- A high-performance M.2 card that features a Metis AIPU to enable state-of-the-art AI inference in small footprint devices.
- A single board can run inference on multiple cameras as well as support multiple independent parallel neural networks.
- A wide range of end-to-end AI pipelines and models are available out of the box.
- Hassle free evaluation and software integration thanks to Voyager SDK.
- Uncompromised prediction accuracy thanks to advanced quantization tools.

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2 Specifications

2.1 Board and product characteristics

The tables in this section list the board characteristics, including physical and software characteristics.

Table 1: Characteristics and of the Metis M.2 card

Specification	Description
Product name	Metis M.2 AI Accelerator Card
Main chip	Axelera AI Metis AIPU (AI Processing Unit)
Memory	1 GB LPDDR4X.
Thermal solution	Active fan-cooled. For further details see section *2.4 Cooling solution*.
Host interface	PCIe Gen. 3.0, 4-lanes Bandwidth: Up to 4 GB/s.
Certification	CE, FCC, UKCA, ROHS

Table 2: Physical characteristics

Specification	Description
Mechanical form factor	M.2 2280 M-key, requires H5.6 connector height. See *2.2 Board mechanical details*.
Dimensions	22 mm x 80 mm. For full details see section *2.2 Board mechanical details*.
Weight	100 grams for AXE-BME20M1AM01A02 (card with active cooling) 15 grams for AXE-BME20M1AR01B02 (card with no cooling)
Power Rating	The Metis M.2 card is compliant with PCI-SIG's M.2 Specification revision 4.0, which indicates the following power rating for M-key M.2 cards: - Max. average power (over 1 s): 11.55 W (3500 mA at 3.3 V). - Peak power (over 100 µs): 23.1 W (7000 mA at 3.3 V).
Thermal Design Power	10 W
Typical Power	3.5 – 9 W. Typical average power of Metis when running Deep Neural Networks at maximum performance at an ambient temperature of 25°C.

Table 3: Environmental characteristics

Specification	Description
Standard operating temperature (ambient)	-20~70°C
Storage temperature	-40~85°C
Storage Humidity	0%~85% RH, non-condensing

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2.2 Board mechanical details

This section provides the board package information of the Metis M.2 card.

- Figure 2 shows the board layout and dimensions.
- Table 4 describes the board and gives the package dimensions.

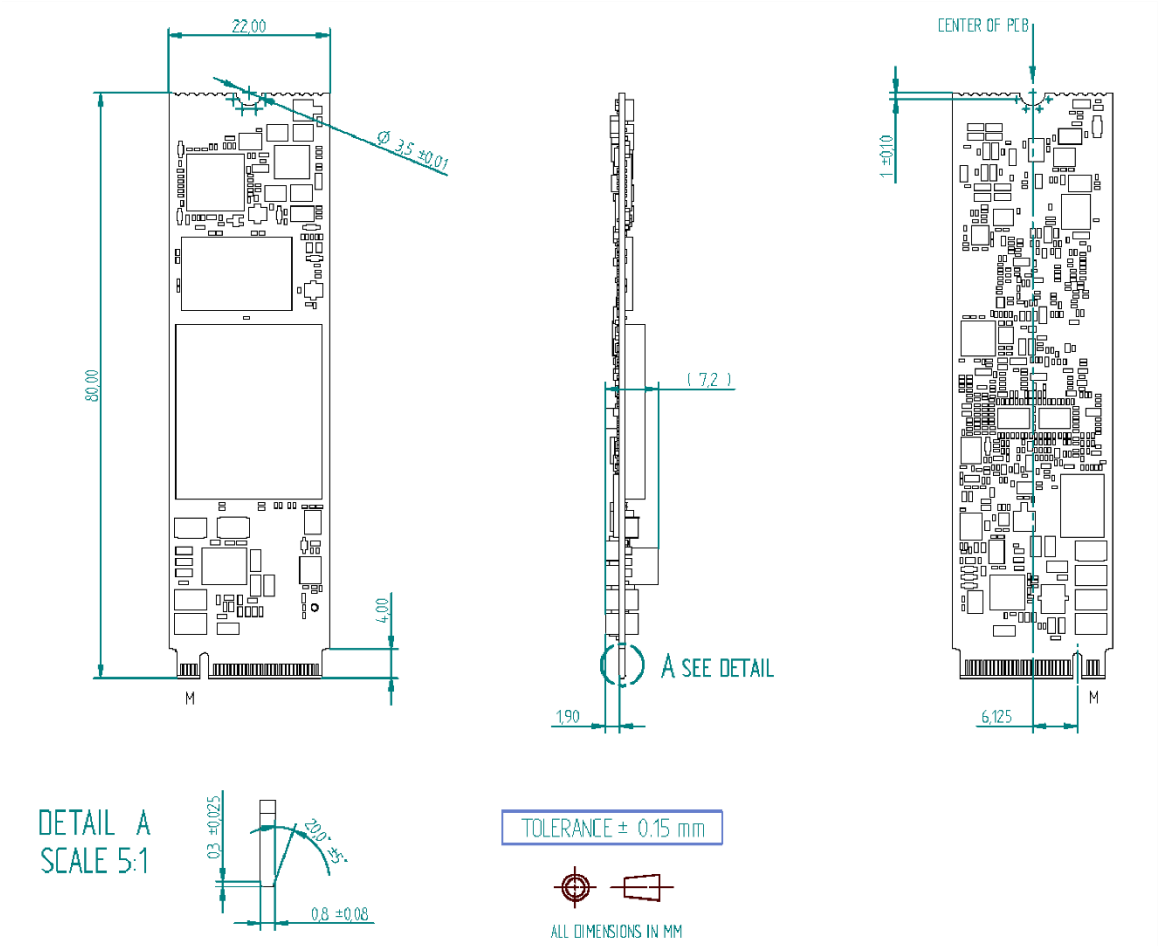

Figure 2: Board dimensions of the Metis M.2 card

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Table 4: Metis M.2 card package dimensions

Item	Dimensions (mm. tolerance ±0.15 mm)
Top view	
PCB board length	80.00
Board width	22.00
PCB mounting hole radius	3.50 ±0.01
Length of connector	4.00
Edge dimensions	
Max. height	7.2
Underside clearance	1.90
Detail A	
Board thickness	0.80 ±0.08
Edge chamfer length (to full thickness)	0.30 ±0.25
Edge chamfer angle	20.0° ±5.°
Underside view	
M-key to PCB central line	6.125
PCB edge to PCB layer stack	1.00 ±0.10

2.3 Connector pinout

Table 5 shows the connector pinout for the Metis M.2 card alongside signals from the Metis AIPU chip.

Table 5: Metis M.2 card connector pinout and signals

Pin name	Pin reference	Signal name (other side)
+3.3V	2	3.3V Power
+3.3V	4	3.3V Power
+3.3V	12	3.3V Power
+3.3V	14	3.3V Power
+3.3V	16	3.3V Power
+3.3V	18	3.3V Power
GND	1	Ground
GND	3	Ground
GND	9	Ground
GND	15	Ground
GND	21	Ground
GND	27	Ground

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Pin name	Pin reference	Signal name (other side)
GND	33	Ground
GND	39	Ground
GND	45	Ground
GND	51	Ground
GND	57	Ground
GND	71	Ground
GND	75	Ground
PETn0	41	PCIe TX Negative (Lane 0)
PETn1	29	PCIe TX Negative (Lane 1)
PETn2	17	PCIe TX Negative (Lane 2)
PETn3	5	PCIe TX Negative (Lane 3)
PETp0	43	PCIe TX Positive (Lane 0)
PETp1	31	PCIe TX Positive (Lane 1)
PETp2	19	PCIe TX Positive (Lane 2)
PETp3	7	PCIe TX Positive (Lane 3)
PERn0	47	PCIe RX Negative (Lane 0)
PERn1	35	PCIe RX Negative (Lane 1)
PERn2	23	PCIe RX Negative (Lane 2)
PERn3	11	PCIe RX Negative (Lane 3)
PERp0	49	PCIe RX Positive (Lane 0)
PERp1	37	PCIe RX Positive (Lane 1)
PERp2	25	PCIe RX Positive (Lane 2)
PERp3	13	PCIe RX Positive (Lane 3)
PCIE_REF_CLK_N	53	PCIe Reference Clock Negative
PCIE_REF_CLK_P	55	PCIe Reference Clock Positive
PERST#	50	PCIe Reset

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2.4 Cooling solution

This section provides details of the fan-cooled heatsink used in the Metis M.2 card.

- Figure 3 shows the fan-cooled heatsink for the Metis M.2 card.
- Table 6 describes the package and gives the dimensions of the heatsink.

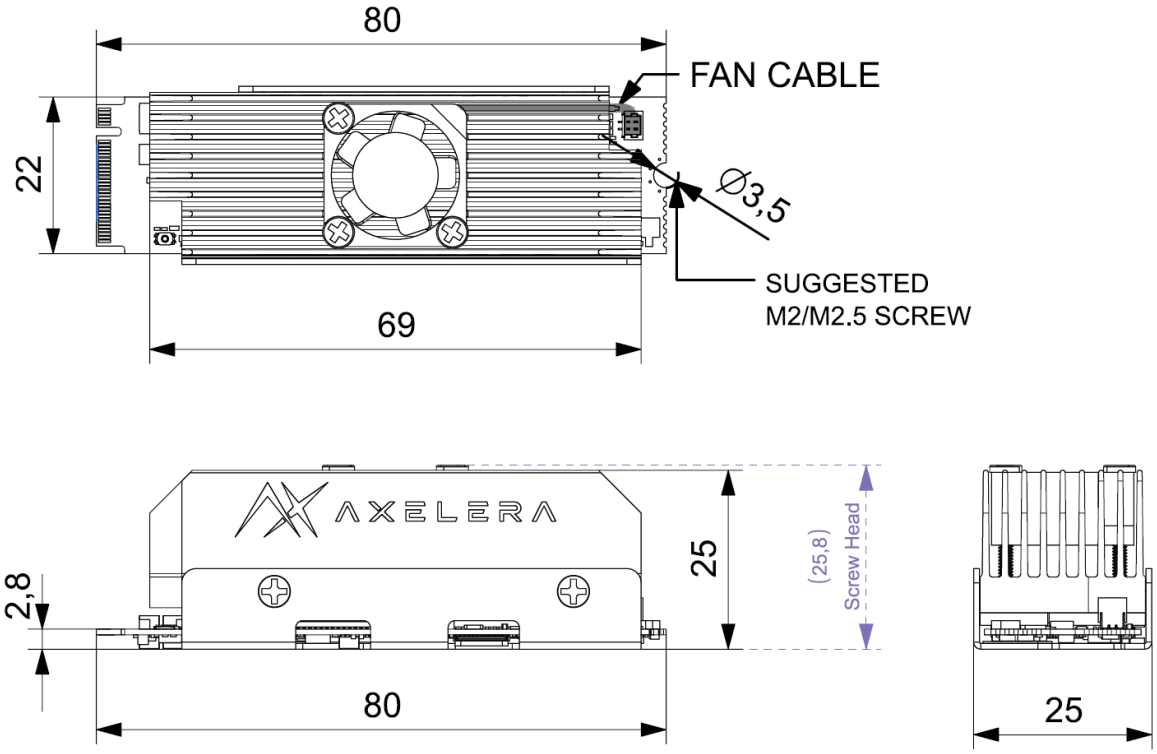

Figure 3: The fan-cooled heatsink for the Metis M.2 card

Table 6: Dimensions of the fan-cooled heatsink for the Metis M.2 card

Item	Dimensions (mm)
Total length	80.00
Length (heatsink only)	69.00
Height (to top of heatsink)	25.10
Height (to top of mounting screws)	25.80
Width	25.00

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The fan-cooled heatsink fan dissipates hot air on either side of the heatsink. Figure 4 shows the airflow directions: the blue arrow indicates cold air, the red indicates hot air.

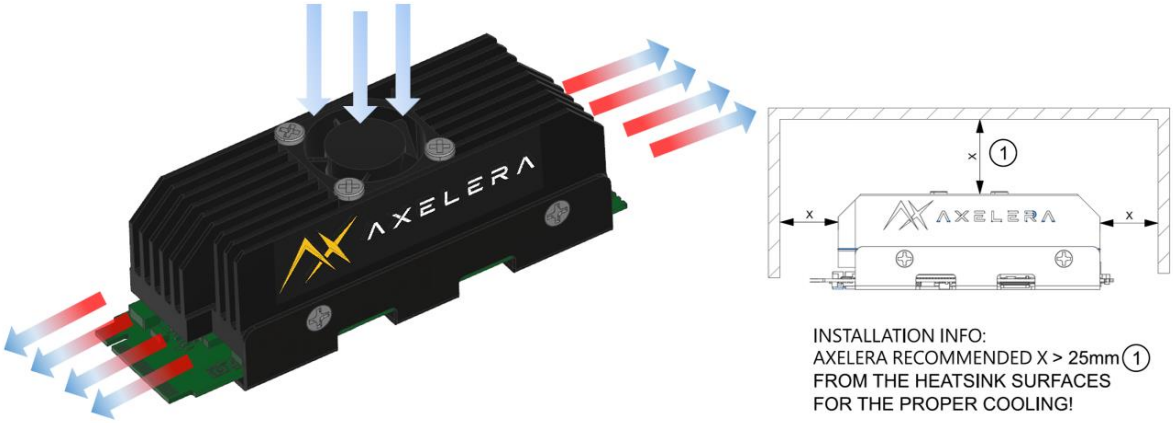

Figure 4: Air flow directions for the Metis M.2 card

2.5 Security

The Metis AIPU chip features a Root of Trust (RoT) that can be securely provisioned during chipset manufacturing. Secure Boot and other security features built on this foundational RoT will be enabled in future revisions. For more information, please see Axelera contact details in section *6 Support*.

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3 Safety information

Before installing the Metis M.2 card and to ensure the safe use of the card, follow these guidelines:

- **General handling**:
  - Handle the card with care to avoid physical damage.
  - Wear an anti-static wrist strap during installation to prevent electrostatic discharge (ESD).
  - Disconnect the power source before handling, installing, or maintaining the product.

- **Installation:**
  - Ensure the card is installed in a M.2-compliant slot.
  - Verify that the power source complies with the product's power requirements.

- **Operation:**
  - Do not block the airflow to the fan or heatsink during operation.
  - Monitor system temperatures regularly to prevent overheating.
  - Operate within the specified ambient temperature range (-20°C to 70°C) as much as possible.

- **Storage:**
  - Store the product in a dry environment within -40°C to 85°C and 0%–85% relative humidity (non-condensing).

- **Maintenance:**
  - Regularly clean the fan and heatsink to prevent dust buildup.
  - Ensure software and firmware are updated to maintain performance and security.
  - Inspect the card and connectors periodically for signs of wear or damage.

- **Disposal:**
  - Dispose of the product in accordance with local electronic waste regulations.

WARNING: Improper handling, installation, or use may result in injury, equipment damage, or voiding of warranty.

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4 Installation instructions

1. **Card installation**:
    - Align the card with the chosen M.2 slot in your system slot and gently insert it.
    - Secure the card using the bracket screws.
2. **Cooling verification**:
    - Ensure the fan is securely attached and unobstructed.
    - Verify airflow in the system chassis.
3. **Power connection**:
    - Confirm that your system provides sufficient power directly through the M.2 slot.
4. **Software Setup**:
    - Install the Voyager SDK for model configuration and optimization.

5 Troubleshooting

Issue: The system does not detect the card.

Solution:

1. Verify the card is properly seated in the M.2 slot.
2. Check the system's BIOS/UEFI to confirm M.2 lane availability.

Issue: Overheating during operation.

Solution:

1. Ensure adequate airflow within the chassis.
2. Clean the fan and verify its operation.

6 Support

For further information and support please visit:

- Axelera AI Community: https://community.axelera.ai/
- Axelera AI Customer Portal: https://support.axelera.ai

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7 Model/Part numbers

The **Model type** of the Metis M.2 AI Accelerator Card with one AIPU is **AXE-BME20M1.** Table 7 shows the part numbers for the various configurations.

Table 7: Metis M.2 AI Accelerator Card reference identification

Part number	Description
AXE-BME20M1AM01A02	Metis M.2 AI Accelerator Card with 1x AIPU, 1 GB of RAM and active cooling, Rev1.1
AXE-BME20M1AR01B02	Metis AI Accelerator M.2 Card with 1x AIPU, 1 GB of RAM and no cooling, Rev1.1
AXE-BME20M1AB01A01	**(Not orderable)** Metis AI Accelerator M.2 Card with 1x AIPU, 1 GB of RAM and active cooling, Rev1.0

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