

Geniatech

Hailo-8™

M.2 AI Acceleration Module

(M.2 2242/2280 Key M Card)



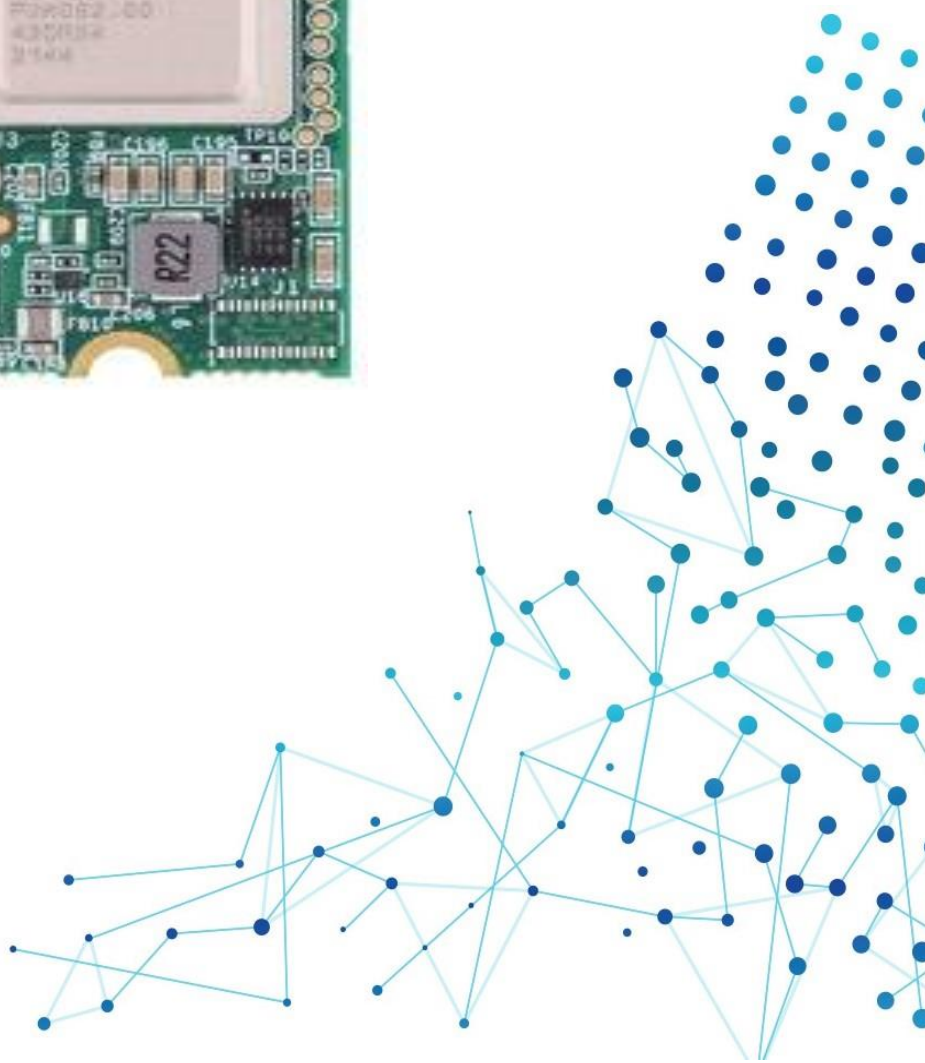
Data Sheet

2242: HM218B1C2HAE

2280: HM218B1C2FAE

Rev. 2.1

November 2022



Documentation Control

Revision History

Version	Date	Description
0.8	January 2022	Extended temperature preliminary release
1.0	February 2022	Extended temperature mass production release
2.0	October 2022	Updated board images and added module photos for configurations A and B
2.1	November 2022	Added new part numbers

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1. Overview

1.1. Introduction

The Hailo-8™ M.2 Key M ET AI Acceleration Module, compatible with the M.2 Key M form factor, is a 26 TOPS acceleration module, supports extended operating temperature range (see section 2.3 for details) targeting artificial intelligence (AI) applications. It is a member of Hailo's comprehensive family of PCI Express (PCIe) based acceleration modules that meet industry standards for a range of form factors and performance objectives.

The module has two form-factors: 2242 (part number HM218B1C2HAE) and 2280 (part number HM218B1C2FAE).

The module is based on the Hailo-8™ AI processor and features a full PCIe Gen 3 4-lane interface (x4), which enables high throughput of input and output data.

As a PCIe device, the module can be used to perform real-time, low latency neural network inference, using PCIe for streaming input data and for streaming inference results.

1.2. System Requirements

- **Hardware:**
 - CPU Architecture
 - x86 based; or
 - ARM aarch-64 based
 - At least 1 available M.2 slot (Key M, Socket 3 type, sometimes called NVME)
- **Software:**
 - Linux Ubuntu or other distributions
 - Supported kernel versions: multiple, tested on Linux kernel versions 4.15.0-39-generic and 5.0.16-050016-generic.

Or

- Microsoft Windows 10 64 bits

1.3. System Level Block Diagram

The following block diagram illustrates the Hailo-8™ M.2 Key M ET AI Acceleration Module:

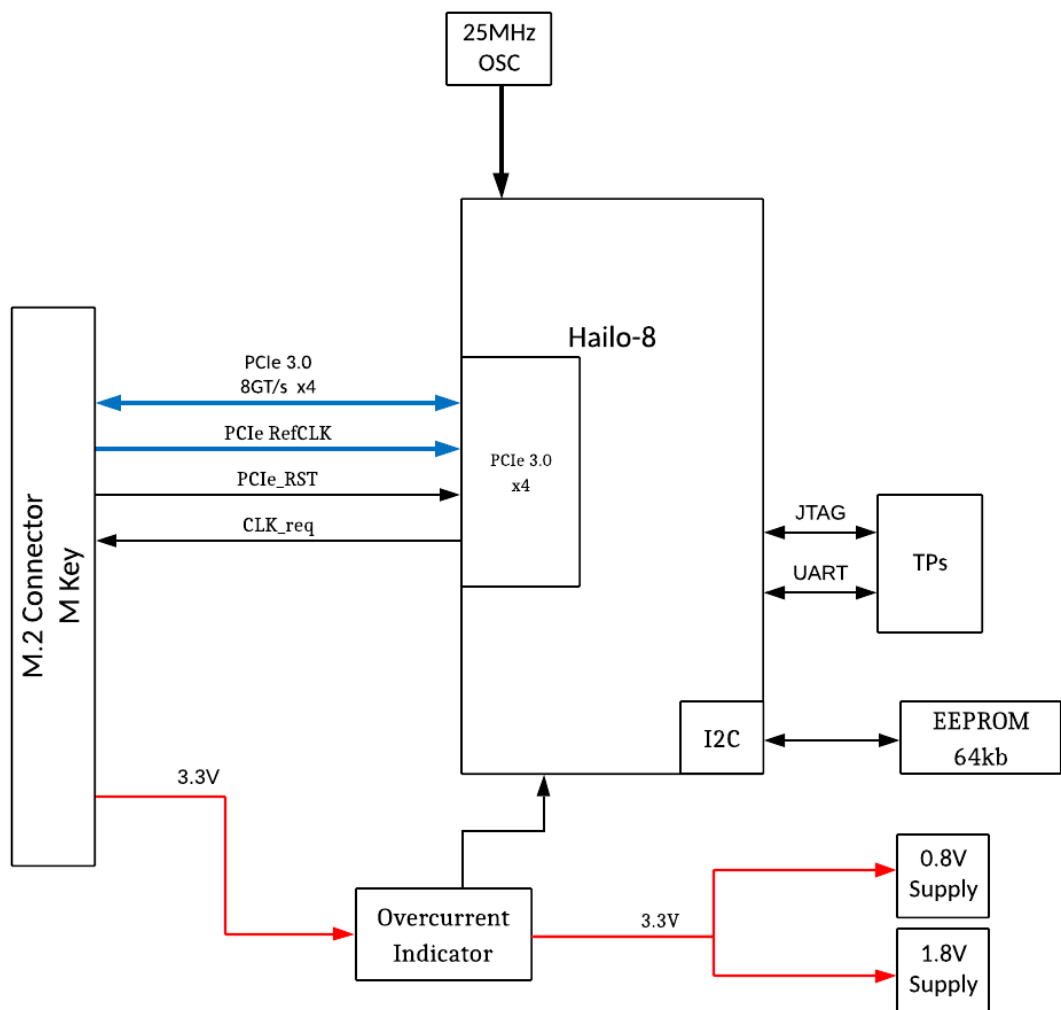


Figure 1: Hailo-8™ M.2 Key M ET Functional Block Diagram

2. Specifications

2.1. Key Properties

Compliance	
Certification	CE; FCC Class A
Environmental	
Storage Temperature	-40° -85° C
Operating Temperature	-40° -85° C (<i>refer to section 3.2 for further details</i>)
Storage/Operating Humidity	5% to 90% RH (non-condensing)
Physical	
Form Factor	M.2 Key M
Dimensions	22 x 42 / 22 x 60 / 22 x 80 mm
Electrical	
Power supply	3.3V ± 5%
Thermal design power (TDP)	8.65W
Interface	PCIe Gen 3, 4-lanes (x4)
Peak Performance (INT8)	26 TOPS

2.2. PCIe Connector Pinout

Pin Number(s)	Signal	Type
21	CONFIG_0 (GND)	Defines module type: SSD-PCIe
69	CONFIG_1 (NC)	
75	CONFIG_2 (GND)	
1	CONFIG_3 (GND)	
3,9,15,27,33,39,45,51,57,71,73	GND	Power
2,4,12,14,16,18,70,72,74	3.3V	Power
50	PERST#	I
52	CLKREQ#	I/O
54	PEWAKE#	I/O
53,55	REFCLK[n/p]	I
41,43	PET[n/p]0	O
47,49	PER[n/p]0	I
29,31	PET[n/p]1	O
35,37	PER[n/p]1	I
17,19	PET[n/p]2	O
23,25	PER[n/p]2	I
5,7	PET[n/p]3	O
11,13	PER[n/p]3	I

Table 1: Hailo-8™ M.2 Key M ET Pin Description

For more information, see the *PCI Express M.2 Specification Revision 3.0* on the [PCISIG website](https://www.pcisig.com).

2.3. Mechanical Properties

Below is a mechanical outline for the Hailo-8™ M.2 Key M ET module. Note that even though the module is a small form factor 22mm*42mm (2242), it may be provided with removable tabs to accommodate systems which only support 2280 modules mechanically.

Note that this module has 2 different part numbers: HM218B1C2HAE (for the 2242 form-factor) and HM218B1C2FAE (for the 2280 form-factor)

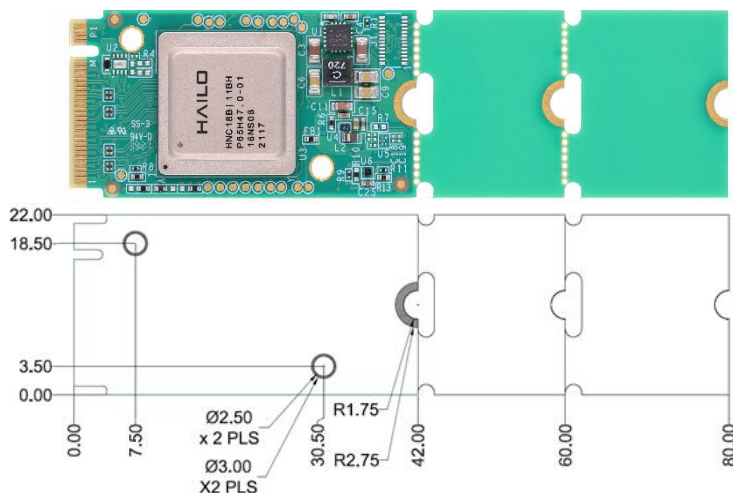


Figure 2: HM218B1C2HAE and HM218B1C2FAE Mechanical Outline (Top View)

For more information, see the *PCI Express M.2 Specification Revision 3.0, Version 1.2* on the [PCISIG website](https://www.pcisig.com).

2.4. Module Configurations

This module is being offered in two different form factors 2242 and 2280 and two configurations with similar characteristics (performance,

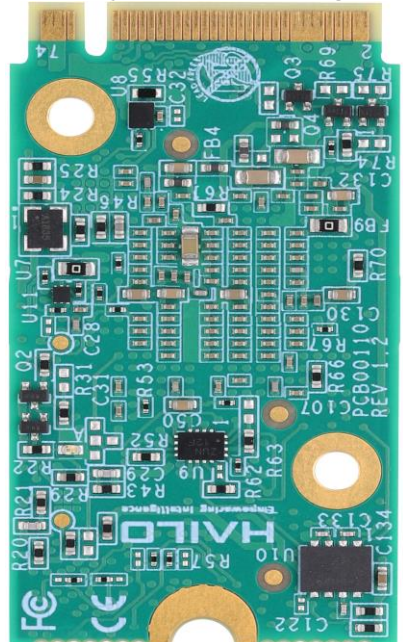
power consumption, reliability), due to multi-sourcing of the power supply components. See below photos for the module in it's two configurations.



Hailo-8™ M.2 Key M ET 2242 Configuration M2A



Hailo-8™ M.2 Key M ET 2242 Configuration M2B

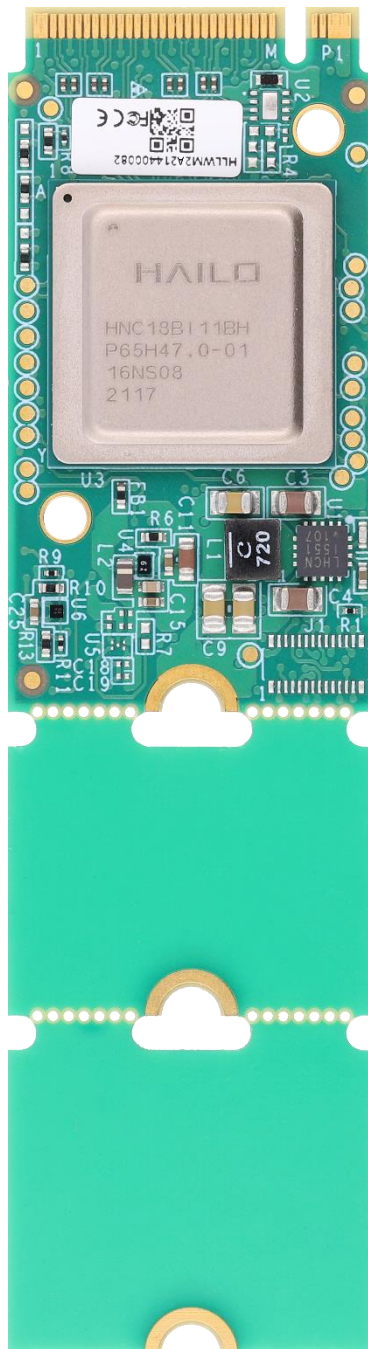


Hailo-8™ M.2 Key M ET 2242 Configuration M2A
Back side

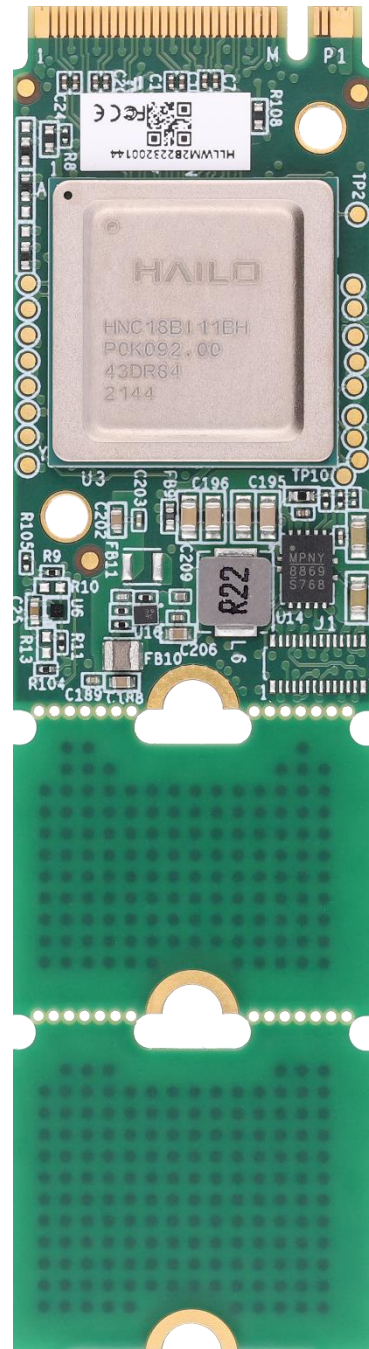


Hailo-8™ M.2 Key M ET 2242 Configuration M2B
Back side

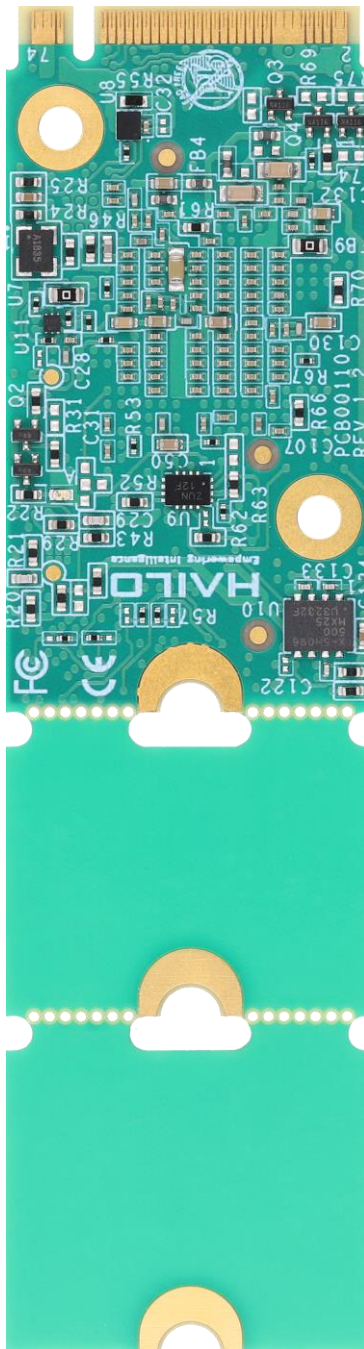
Figure 3: Two module configurations for Hailo-8™ M.2 Key M ET 2242



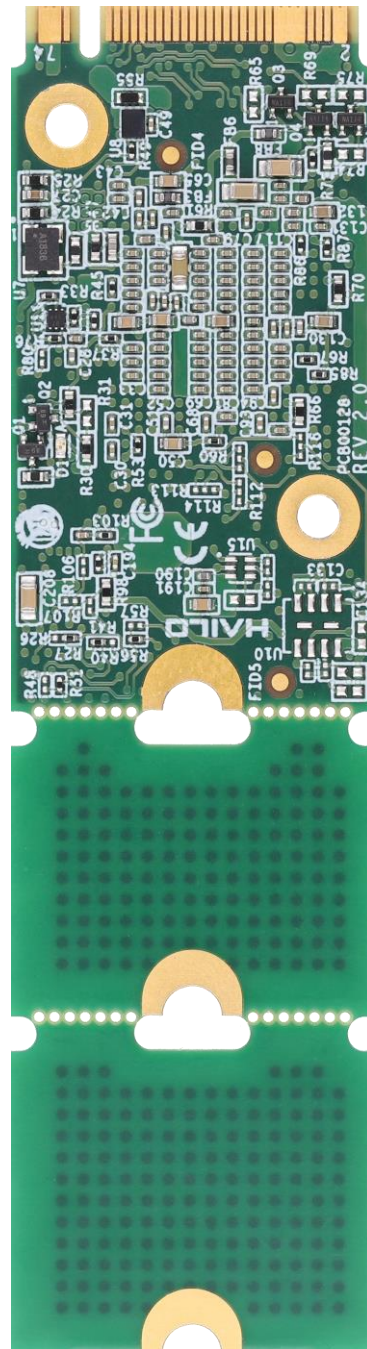
Hailo-8™ M.2 Key M ET 2280 Configuration M2A



Hailo-8™ M.2 Key M ET 2280 Configuration M2A



Hailo-8™ M.2 Key M ET 2280 Configuration M2A
Back side



Hailo-8™ M.2 Key M ET 2280 Configuration M2B
Back side

Figure 4: Two module configurations for Hailo-8™ M.2 Key M ET 2280

3. Power Consumption and Thermal Management

3.1. Module Power Consumption

The module requires a 3.3V supply (power pins are as detailed in Table 1).

The module's power consumption is dependent on the resources utilized for inference. Maximum power consumption is 8.25W (or 2.5A total current draw from 3.3V pins) at full utilization.

The module's power consumption (typical at 25° C) is listed below for typical configurations:

Configuration	Power [W]
Resnet-50 224x224 @ 915 FPS	3.3
MobileNet-SSD 300x300 @ 996 FPS	2.4

Table 2 - Power Consumption for Typical Configurations

For up-to-date benchmark performance please visit the benchmarks page on Hailo's website.

3.2. Thermal Management Requirements

The Hailo-8™ M.2 Key M ET was tested and validated for industrial temperature grade (–40°C – 85°C) when mounted in a test fixture.

Proper heat dissipation must be employed to ensure that the Hailo-8™

chip does not overheat. The Hailo-8™ is designed to dissipate most of the heat to the top surface of the package.

For more information on typical use configurations and design guidelines, see Hailo's *Hailo-8™ AI Acceleration Module Thermal Design Considerations Application Note*.

3.3. Overheat and Overcurrent Protection

The module features monitoring and protection from overheat conditions and excessive power consumption.

For additional information on thermal design, see sec. 3.2.

For more information on power consumption limits, see the *PCI Express M.2 Specification Revision 3.0* on the [PCISIG website](#).

4. Installation and Troubleshooting

4.1. Hardware Installation

1. Make sure that the host computer is turned off.
2. Firmly attach the M.2 module into a proper Key M slot (make sure it is a Socket 3 type suitable for Key M cards).
3. Power up the computer and log on to Linux.
4. Verify that the Hailo-8™ is detected on the PCIe bus. From a Linux terminal, type:

```
>> lspci | grep "Co-processor: Shenzhen Geniatech Inc., Ltd. Hailo-8 AI  
Processor (rev 01)"
```

4.2. Software Installation¹

1. Please note that the first HailoRT supporting the extended temperature is 4.6LTS.
2. Power up the computer and log on to Linux.

The HailoRT package includes 3 files:

- platform.tar.gz – Archive of the HailoRT binaries and Python modules.
 - install.sh – Installation script.
 - md5s.txt – MD5 hashes of the HailoRT files.
3. Run the following command to install HailoRT including the PCIe

¹ All software related guidelines are based on pre-released software and may change upon product release. Any such changes will be included in future versions of this document.

driver:

```
>> chmod u+x install.sh  
>> ./install.sh
```

4. Reboot the machine after the installation is done. The driver will be loaded automatically after reboot. Run the

following commands in order to verify it:

Start the Hailo-RT virtual environment. From a Linux terminal type, at the location where the Hailo-RT package was installed:

```
>> source hailo_virtualenv/bin/activate  
>> hailo scan
```

The hailo scan command should identify the device.

For further information and instructions, see *Running HailoRT installation* in the HailoRT User Guide.

4.3. Troubleshooting

A. Improper PCIe device enumeration	
How to verify:	From a Linux terminal type: <pre>>> lspci grep "Co-processor: Shenzhen Geniatech Inc., Ltd. Hailo-8 AI Processor (rev 01)"</pre> The device should be listed in the terminal output
Possible root cause:	Improper mechanical installation
Solution:	Verify the module is properly attached and secured into the M.2 slot.
Possible root cause:	Slot is not functional
Solution:	Verify the slot in use is a valid M.2 Key M slot. Check to see if the slot is disabled in platform BIOS.

B. Device driver not properly installed	
How to verify:	From a Linux terminal type: <pre>>> lsmod grep <TBD></pre> The device should be listed in the terminal output
Possible root cause:	Driver not installed
Solution:	Obtain the driver installation package provided by Hailo and follows SW installation instructions (section 4.2)

C. Module not identified by Hailo-RT	
How to verify:	From a python shell type: <pre>>> from hailo_platform.drivers.hw_object import HailoPcieObject >> p = HailoPcieObject() >> p.control.identify()</pre> The device should be listed in the interpreter output

Possible root cause:	Improper installation of the Hailo-RT package
Solution:	Re-install the Hailo-RT package by following the installation instructions.