Rocket 1608A (R1608A)

NVMe Switch AIC User Guide

V1.00 - Apr. 24, 2024

Table of Contents

1. Overview

The R1608A is the latest member of our PCIe Gen5 NVMe Switch AIC product family.

HighPoint Rocket Series NVMe connectivity AICs address the needs of solution providers and system integrators that cater to vertical marketplaces for high-speed industrial, corporate, and media applications. They were designed for professional applications that demand uncompromised storage performance, scalability, and adaptability in a compact, easy-to-integrate package that is universally compatible with industry-standard x86-64 (Intel/AMD) platforms.

The R1608A's eight independent device ports can support M.2 NVMe SSDs.

All major Windows operating systems and current distributions of Linux natively support the R1608A. You won't need to juggle a series of device drivers, install a complex software suite, or master a specialized management interface. Your NVMe SSDs will be automatically recognized and can be prepped and mounted using the operating system's standard tool set.

1.1. Key Features

- Dedicated PCIe 5.0 x16 host interface
- Support data transfer rate 64GB/s
- Support eight dedicated M.2 NVMe devices
- Synthetic Hierarchy
- Software Secure Boot
- Hardware Secure Boot
- FRU Inventory support
- Support LED Management
- Support all the operating systems with a native NVMe driver

1.1.1. FRU

The *Field Replacement Unit (FRU)* ensures smooth operation and efficient maintenance of complex systems. The unit is designed to house and protect vital product data (VPD).

Information fields within a VPD resource type contain a three-byte header and some data. The three-byte header contains a two-byte keyword and a one-byte length. A keyword is a two-character (ASCII) mnemonic that uniquely identifies the information in the field. The last byte of the header is binary and represents the length value (in bytes) of the following data.

In the event of a hardware failure, the *FRU* can be quickly replaced, returning the device to a fully functional state without requiring extensive diagnostics or data recovery. This reduces downtime and minimizes the possibility of data loss, ensuring that critical operations can continue uninterrupted.

The following table describes the details and descriptions of the VPD.

Table 1: Details and Descriptions of the VPD

Key Word	Details	Descriptions
PN	AIC Part Number	This keyword is an extension to the Device ID (or Subsystem ID) in the Configuration Space header.
EC	Engineering Change Level	The characters are alphanumeric and represent the engineering change level for this add-in card.
MN	Manufacture ID	This keyword is provided as an extension to the Vendor ID (or Subsystem Vendor ID) in the Configuration Space header. This allows vendors to identify an additional level of detail regarding the sourcing of this device.
SN	Serial Number	The characters are alphanumeric and represent the unique add-in card Serial Number.
Vx	Vendor Specific	This is a vendor-specific item, and the characters are alphanumeric. The keyword's second character (x) can be 0 through 9 or A through Z. V0 indicates the Vendor Name V1 indicates the Main Chip

1.1.2. Synthetic Hierarchy

A synthetic hierarchy can be created to isolate the host from these physical PCIe topology changes and errors.

1.1.3. Hardware Secure Boot

The secure boot feature permits only authenticated firmware to execute. The switch boots the root of the trusted firmware from the internal boot ROM(IBR)and uses that firmware to authenticate the external firmware stored in the SPI flash and prevent the execution of unauthenticated code.

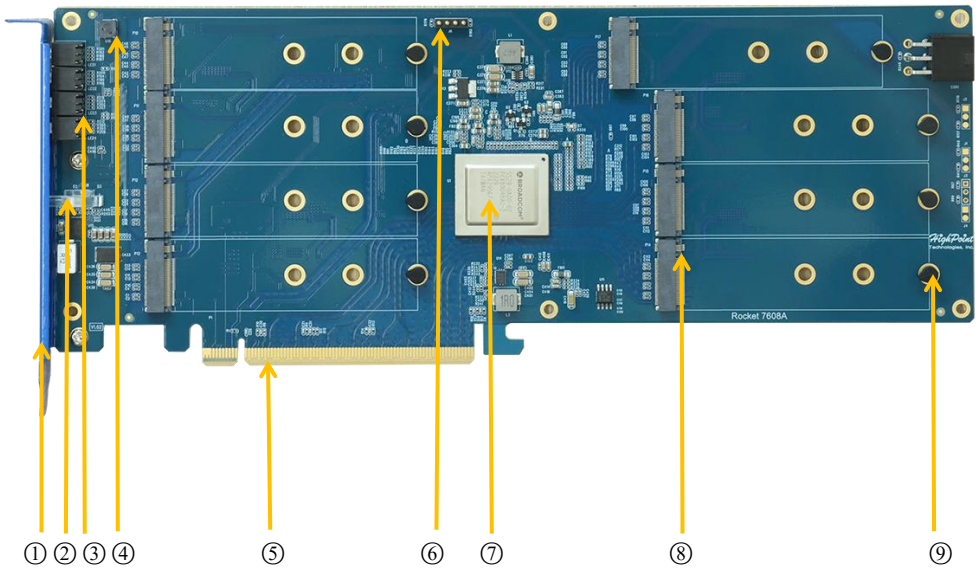
2. R1608A Hardware Description

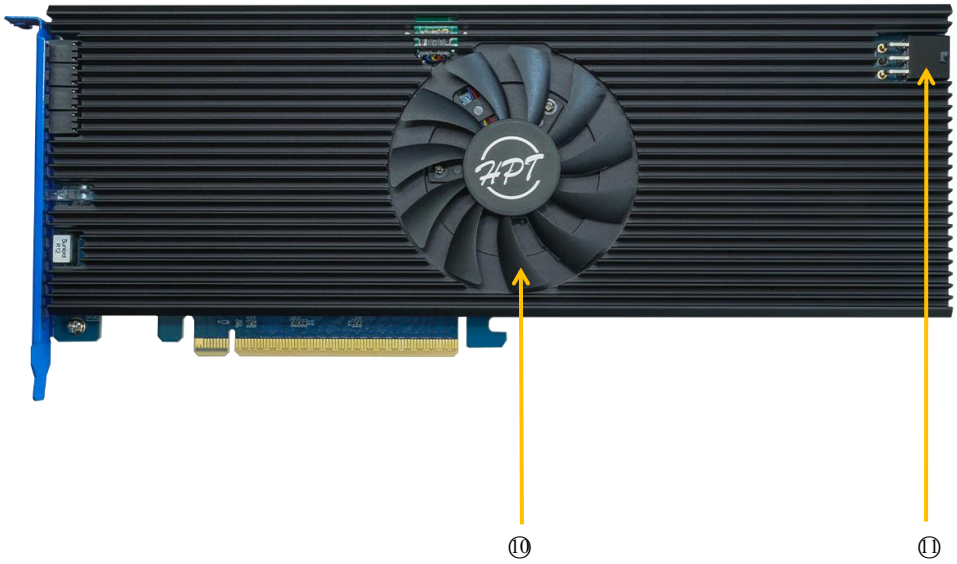
2.1. R1608A Layout

The layout of the R1608A is presented in two parts.

- **Front View**

The following figure shows the key components of the R1608A.





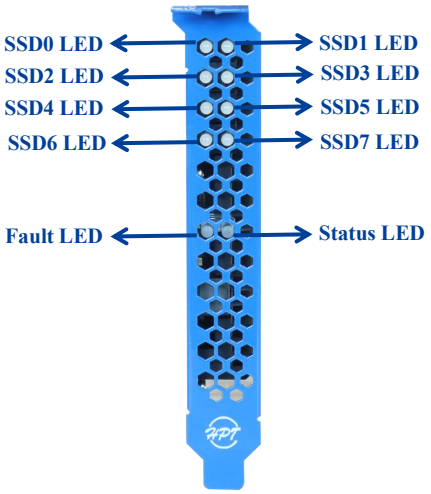
The following table describes the key components of the R1608A.

Table 2: Key component of the R1608A

Number	Type	Description
①	Bracket	Full-height bracket (optional low-profile bracket included) The R1608A is secured to the chassis by a bracket.
②	RGB	Status LED and Fault LED. ● Status LED -- The state of R1608A PCIe bandwidth。 ● Fault LED -- The state of the Broadcom chipset temperature and fan speed.
③	LED	Eight SSD LED. SSD LED indicates the state of SSD bandwidth.
④	Beeper	Only to be used for field testing.
⑤	PCIe Host Interface	PCIe 5.0 x16 host interface. The interface between the R1608A and the host system. With the PCIe interface, this connector provides power to the board.
⑥	J6	Fan module probe. Used to connect the fan module on the heatsink. Used to power the fan module.
⑦	Chip	Broadcom PEX 89048 chip.
⑧	Storage Interface	Eight PCIe 5.0 x4 M.2 connector. Connect the SSD to the R1608A.
⑨	Rubber	Eight rubbers. Used to secure the retention hole on the end of the NVMe SSD.
⑩	Cooling System	Heatsink with a built-in Low-Decibel fan. Used to dissipate heat from electronic components that are prone to heat generation.
⑪	External power port	The system power supply unit powers the R1608A through this port connected to the external 6-pin PCIe power cable.

- **LED View**

The following figure shows the LED Indicators of the R1608A.



The following table describes the SSD LED, Status LED, and Fault LED of the R1608A.

Table 3: Description of LED

LED	Color	Status	Description
SSD LED		**OFF**	The R1608A is powered off, or the SSD is not detected.
		**Solid Green**	The SSD is detected.
		Fast Flash Green	The LED blinks green at 4 Hz to indicate that the SSD is doing I/O in the PCIe 5.0 x4 status.
		Interval Flash Green	The LED blinks green twice in the first second, then goes out for one second and continues to cycle this process. This indicates the SSD is doing I/O in the PCIe 5.0 x2 or PCIe 4.0 x4 status.
		Slow Flash Green	The LED blinks green at 1 Hz to indicate that the SSD is doing I/O at a bandwidth not shown above.
		**Solid Red**	The SSD has failed.
Status LED		**OFF**	The R1608A is powered off.
		**Interval Flash Blue**	The LED blinks blue twice in the first second, then goes out for one second and continues to cycle this process. This indicates the R1608A's bandwidth is PCIe 5.0 x16.
		**Interval Flash Green**	The LED blinks green twice in the first second, then goes out for one second and continues to cycle this process. This indicates the R1608A's bandwidth is PCIe 5.0 x8 or PCIe 4.0 x16.
		**Interval Flash Yellow**	The LED blinks yellow twice in the first second, then goes out for one second and continues to cycle this process. This indicates the R1608A's bandwidth is PCIe 5.0 x4, PCIe 4.0 x8, or PCIe 3.0 x16.
		**Interval Flash Cyan**	The LED blinks cyan twice in the first second, then goes out for one second and continues to cycle this process. This indicates the R1608A's bandwidth is PCIe 4.0 x4 or PCIe 3.0 x8.
		**Interval Flash White**	The LED blinks white twice in the first second, then goes out for one second and continues to cycle this process. This indicates the R1608A's bandwidth is PCIe 3.0 x4.
		**Interval Flash Red**	The LED blinks red twice in the first second, then goes out for one second and continues to cycle this process. This indicates the R1608A's bandwidth does not appear as above.
Fault LED		**OFF**	The R1608A is powered off.
		**Fast Flash Red**	The LED blinks red at 4 Hz to indicate that the Broadcom chipset temperature has exceeded the recommended temperature threshold (105℃) or fan speed lower than 600 RPM.

2.2. PCIe Host Interface

The R1608A's PCIe 5.0 host interface provides maximum transmission.

Other PCIe host interface features include the following:

- 16-lane PCIe host interface
- Support of x16 link width
- 16-lane aggregate bandwidth of up to 64GB/s

2.3. Storage Interface

The R1608A has eight M.2 connectors.

Other storage interface features include the following:

- Dedicated PCIe 5.0 x4 per port
- Supports up to eight NVMe devices (up to x4 lanes, M.2 media)
- Data transfer at 16 GB/s

2.4. Basic Specifications

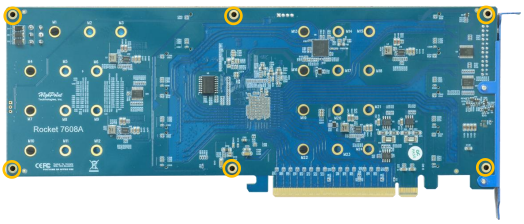
The following table describes the basic specifications of the R1608A.

Table 4: Basic Specifications of R1608A

Model		**R1608A**
Form Factor		Full-Height, Single-Width
Weight		1.015kg
Dimension	**Length**	11.18"
	Height	4.33"
Power consumption		82.64W
Power supply		PCIe: 12V(±8%), 3.3V (±8%)
Work temperature		+5°C ~ + 55°C
Storage temperature		-20°C ~ +80°C
MTBF (Mean Time Before Failure)		920,585 Hours

3. R1608A Installation Instructions

1. Use a wired ESD wrist strap that is properly grounded.
2. Unpack and remove the R1608A and check it for damage. If it appears damaged, please get in touch with HighPoint Technical Support.
3. Remove the six screws on the back of the R1608A that secure the heat sink to the PCB and lift the heat sink up from the right side to remove it.

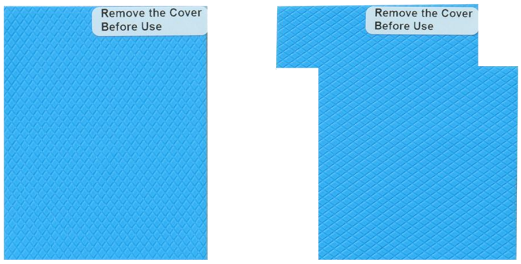


4. Install the thermal pads onto the R1608A PCB.

   1) Determine whether your disk is a single-sided or a double-sided M.2 NVMe SSD.
   Notes:
   Single-sided M.2 NVMe SSDs only have chips on one side of the PCB.
   Double-sided M.2 NMVe SSDs have chips on both sides of the PCB.

   2) Select the thermal pad that corresponds to the NVMe SSD.

PCB	Single-sided	Double-sided
Left	K=3 70mm*90mm*1.5mm	K=8 70mm*90mm*0.75mm
Right	K=3 84mm*90mm*1.5mm	K=8 84mm*90mm*0.75mm

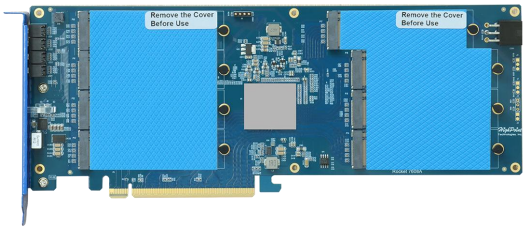


Left **Right**

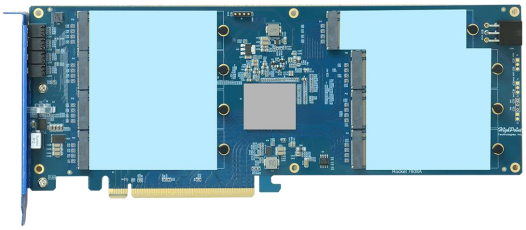
Note: This picture only shows the thermal pads on the left and right positions; please follow the table above for specific thermal pad options.

   3) Remove the blue film from one side of the thermal pads.

   4) Align the thermal pad with the M.2 port and press gently to ensure a tight fit.

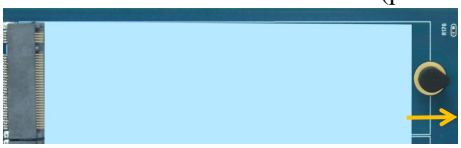


5) Remove the blue film from the other side of the thermal pads.



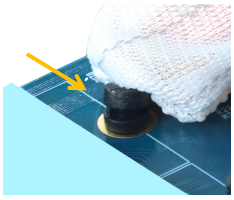
5. Install the NVMe SSDs to the R1608A.

1) Confirm the direction of the rubber (pointing in the opposite direction of the M.2 port).

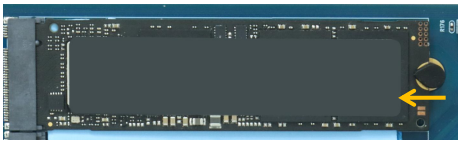


2) Gently insert the NVMe SSD into the M.2 connector.

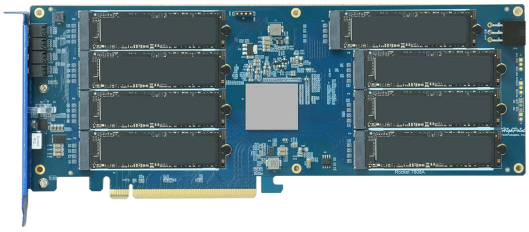
3) Press the side of the rubber to align it and insert it into the retention hole on the end of the NVMe SSD.



4) Rotate the direction of the rubber so that it points to the M.2 port to secure the NVMe SSD better.

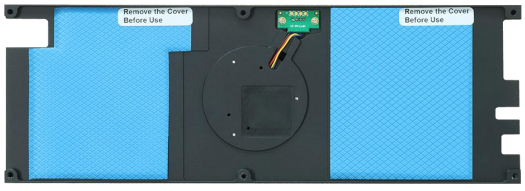


5) Repeat the above steps to install the remaining NVMe SSDs.



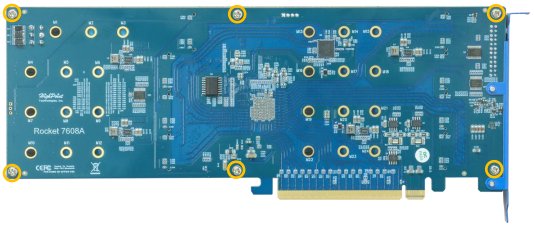
6. Install the heat sink to the R1608A PCB.

1) Remove the blue film from the thermal pad on the heat sink.



2) Align the left side of the heat sink with the PCB and carefully lower the right side.

3) Carefully and properly align the heat sink with the PCB and retighten the six screws that were removed in step 3.



Note: If the screws are not tightened, there will be fan stalling, poor heat dissipation, and other situations.

7. Insert the R1608A into an available PCIe slot.

1) Shut down the system and disconnect the AC power cord.

2) Align the R1608A to one of the motherboard's available slots. Press down gently but firmly to seat the R1608A correctly in the slot.

3) Connect the 6-pin PCIe power cable to the external power connector on the right side of the R1608A. Power up the SSD external power supply.

8. Turn on the power to the system.

4. Revision History

Version 1.00, Apr. 24, 2024

Initial version.