Rocket 1604A (R1604A)

NVMe Switch AIC User Guide

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1. Overview

The R1604A 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 R1604A's eight independent device ports can support M.2 NVMe SSDs.

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 four dedicated M.2 NVMe devices

- Synthetic Hierarchy

- Host CPU Architect Support (X86/ ARM)

- Software Secure Boot

- Hardware Secure Boot

- FRU Inventory support

- Support LED Management

- Support all the Operating Systems with 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.
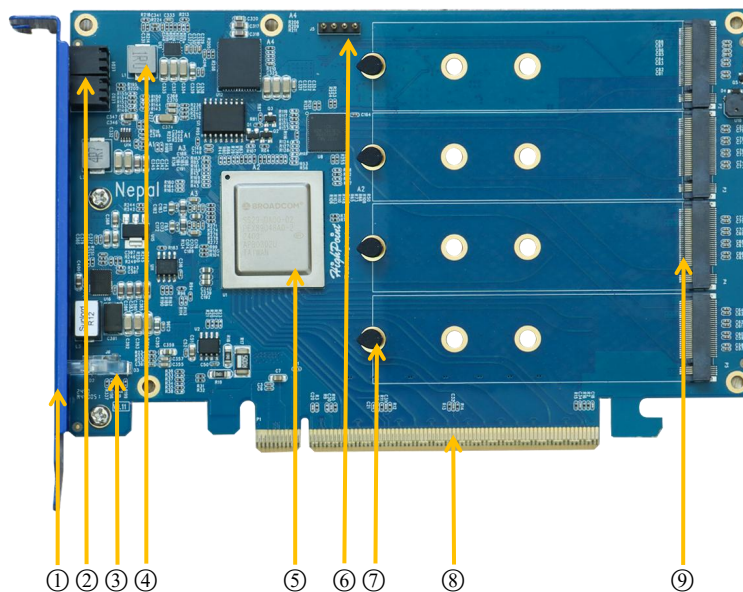
2. R1604A Hardware Description

2.1. R1604A Layout

The layout of the R1604A is presented in four parts.

2.1.1. Front View

The following figure shows the key components of the R1604A.

The following table describes the key components of the R1604A.

Table 2: Key component of the R1604A

| Number	Type	Description
①	Bracket	Full-height bracket The R1604A is secured to the chassis by a bracket.
②	LED	Four SSD LED. SSD LED indicates the state of SSD.
③	RGB	Status LED and Fault LED. ● Status LED -- The state of R1604A PCIe bandwidth. ● Fault LED -- The state of the Broadcom chipset temperature and fan speed.
④	Beeper	Only to be used for field testing.
⑤	Chip	Broadcom PEX 89048 chip.
⑥	J5	Fan module probe. Used to connect the fan module on the heatsink. Used to power the fan module.
⑦	Rubber	Four rubbers. Used to secure the retention hole on the end of the NVMe SSD.
⑧	PCIe Host Interface	PCIe 5.0 x16 host interface. The interface between the R1604A and the host system. With the PCIe interface, this connector provides power to the board.
⑨	Storage Interface	Four PCIe 5.0 x4 M.2 connector. Connect the NVMe SSD to the R1604A.
⑩	Cooling System	Heatsink with a built-in fan. Used to dissipate heat from electronic components that are prone to heat generation.

2.1.2. Diagnostic LED View

The following figure shows the LED Indicators of the R1604A.
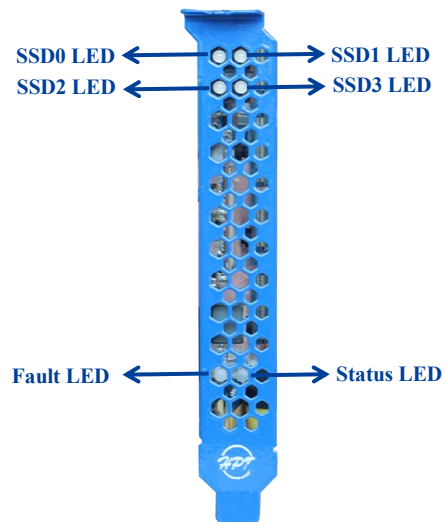

The following table describes the SSD LED, Status LED, and Fault LED of the R1604A.

Table 3: Description of LED

LED	Color	Status	Description
SSD LED	⚪	**OFF**	The R1604A 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 R1604A is powered off.
		Notes: The LED blinks blue twice in the first second, then goes out for one second and continues to cycle this process. The following represents the bandwidth status of the R1604A.	
	🔵	**Interval Flash Blue**	PCIe 5.0 x16.

		Interval Flash Green	PCIe 5.0 x8 or PCIe 4.0 x16.
		Interval Flash Yellow	PCIe 5.0 x4, PCIe 4.0 x8, or PCIe 3.0 x16.
		Interval Flash Cyan	PCIe 4.0 x4 or PCIe 3.0 x8.
		Interval Flash White	PCIe 3.0 x4.
		Interval Flash Red	Not appear as above.
Fault LED		OFF	The R1604A is powered off or not in error.
		Fast Flash Red	The LED blinks red at 4 Hz to indicate that any of the following have been triggered. ● The Broadcom chipset temperature ＞105℃. ● The fan speed is ＜600 RPM.
		Solid Red	Both "**Fast Flash Red**" and "**Slow Flash Red**" above occur at the same time.

2.2. PCIe Host Interface

The R1604A'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 R1604A has four M.2 connectors.

Other storage interface features include the following:

● Dedicated PCIe 5.0 x4 per port

● Supports up to four 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 R1604A.

Table 4: Basic Specifications of R1604A

Model		R1604A
Form Factor		Full-Height, Half Length, Single-Width
Weight		365g
Dimension	**Length**	167mm
	Height	110mm
Power consumption		● **Idle mode**: 11.74W ● **I/Os mode**: 58.76W Notes: The I/Os mode power consumption is measured with the four Crucial T705 2TB SSDs. Actual power consumption may differ based on system hardware and configuration.
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. R1604A Installation Instructions

1. Use a wired ESD wrist strap that is properly grounded.
2. Unpack and remove the R1604A and check it for damage. If it appears damaged, please get in touch with HighPoint Technical Support.
3. Remove the five screws on the back of the R1604A that secure the heat sink to the PCB and lift the heat sink up from the right side to remove it.
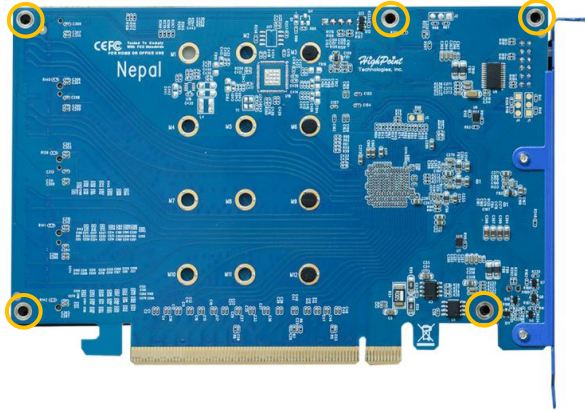
4. Install the thermal pads onto the R1604A PCB.
   Note: Omission of thermal pads on the R1604A PCB is permissible if your disk exhibits adequate heat dissipation.
   1) Remove the blue film from one side of the thermal pads.
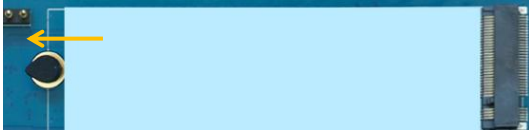   2) Align the thermal pad with the M.2 port and press gently to ensure a tight fit.
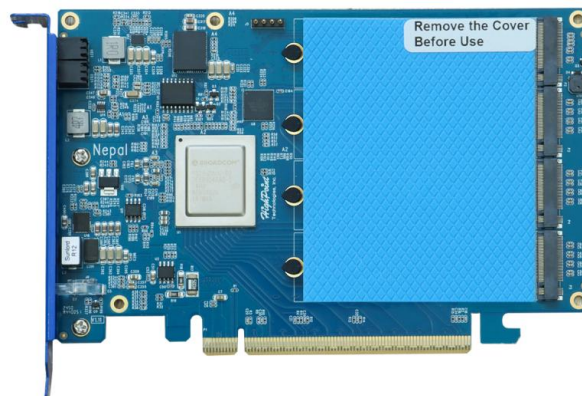
   3) Remove the blue film from the other side of the thermal pads.
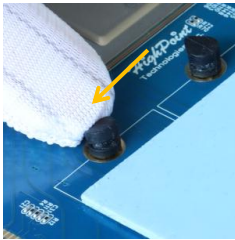
5. Install the NVMe SSDs to the R1604A.
   1) Confirm the direction of the rubber (pointing in the opposite direction of the M.2 port).

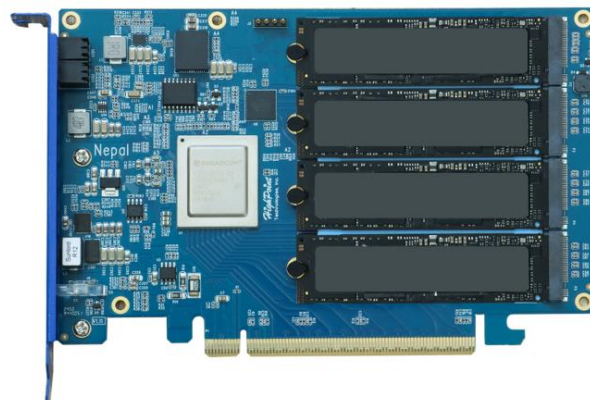
   2) Gently insert the NVMe SSD into the M.2 connector.

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

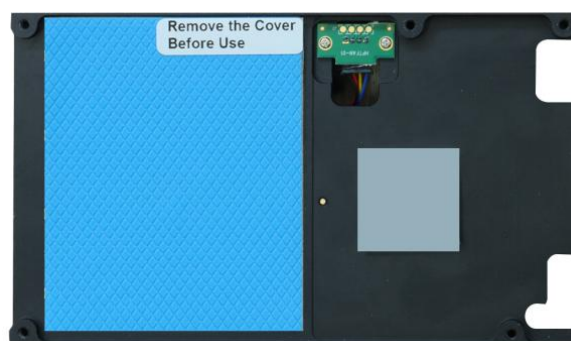   4) Rotate the direction of the rubber so that it points to the M.2 port to secure the NVMe SSD better.

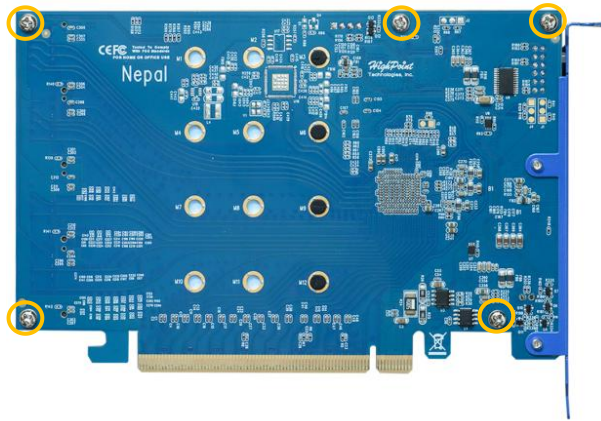   5) Repeat the above steps to install the remaining NVMe SSDs.

6. Install the heat sink to the R1604A 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 five 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 R1604A into an available PCIe slot.
   1) Shut down the system and disconnect the AC power cord.
   2) Align the R1604A to one of the motherboard's available slots. Press down gently but firmly to seat the R1604A correctly in the slot.

8. Turn on the power to the system.

4. Revision History

4.1. Version 1.00, April 14, 2025

Initial version.

4.2. Version 1.01, June 23, 2025

Adjust the description format of the Status LED (be more concise).