BROADCOM®

Broadcom® MegaRAID™ 9540-2M2 Boot Adapter

User Guide
Version 1.1

Documentation Legal Notice

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Broadcom MegaRAID 9540-2M2 Boot Adapter User Guide

This document is the primary reference and user guide for the Broadcom® MegaRAID™ 9540-2M2 boot storage adapter. The adapter supports two M.2 SSDs for high performance from an easy-to-install board designed to boot a server's operating system. The M and B+M key solution allow SATA and PCIe (NVMe) compatibility, providing a boot adapter solution with reliability and various transfer rates. The adapter negotiates between the speeds and the protocols to recognize and concurrently interface with the two storage devices types. This document contains the complete installation instructions and specifications for the boot adapter.

RAID Features

The following list includes primary RAID features that the adapter supports. For a full description of the RAID features, refer to the *12Gb/s MegaRAID Tri-Mode Software User Guide*, located at http://www.broadcom.com/support/download-search.

- RAID level 0 and 1
- Online Capacity Expansion (OCE)
- Auto resume after loss of system power during array rebuild or OCE
- Fast initialization for quick array setup
- Check Consistency for background data integrity
- SSD support with SSD Guard™ technology
- Patrol read for media scanning and repairing
- Disk data format (DDF)-compliant Configuration on Disk (COD)
- Self-Monitoring, Analysis, and Reporting Technology (S.M.A.R.T) support
- MegaRAID SafeStore™ Software for SafeStore disk encryption (SED) key management

Operating System Support

The tri-mode storage adapters support the operating systems in the following list. For specific version information, refer to the *MegaRAID Tri-Mode Device Driver Installation User Guide*, located at http://www.broadcom.com/support/download-search.

- Microsoft Windows
- VMware vSphere/ESXi
- Red Hat Enterprise Linux
- SuSE Linux
- Ubuntu Linux
- Citrix XenServer
- CentOS Linux
- Debian Linux
- Oracle Enterprise Linux
- Fedora
- FreeBSD

The firmware and drivers are routinely updated and made available on the Broadcom Support and Download center. Visit http://www.broadcom.com/support/download-search and download the latest firmware and driver for the adapter.

PCIe Host Interface

The adapter's PCIe 4.0 host interface provides maximum transmission and reception rates of up to 128 GT/s (16GB/s per lane). The tri-mode controller uses a packet-based communication protocol to communicate over the serial interconnect. Other PCIe host interface features include the following:

- Eight-lane PCIe host interface
- PCIe Hot Plug
- Power management:
  - Supports the *PCI Bus Power Management Interface Specification Revision 1.2*
  - Supports Active State Power Management, including the L0 states, by placing links in a power-saving mode during times of no link activity
- Error handling
- High bandwidth per pin with low overhead and low latency
- Lane reversal and polarity inversion
- Single-phy (one-lane) link transfer rate of 16 GT/s, 8 GT/s, 5 GT/s, and 2.5 GT/s in each direction
- Eight-lane aggregate bandwidth of up to 16GB/s (16,000 MB/s)
- Support of x8, x4, x2, and x1 link widths

Storage Interface Features

The adapter's SerDes technology enables maximum flexibility by supporting NVMe or SATA M.2 drives for operating system boot applications. The adapter detects the drive type and negotiates between speeds and protocols to automatically recognize and function with NVMe or SATA M.2 drives.

- PCIe (NVMe) interface features:
  - x1, x2, or x4 NVMe drive support
  - Data transfer at 16GT/s, 8GT/s, 5GT/s, and 2.5GT/s
- SATA interface features:
  - SATA data transfer rates of 6Gb/s and 3Gb/s

Adapter Security

The adapter hardware secure boot security feature protects your system from malicious activity.

Hardware secure boot permits only authenticated firmware to execute on the adapter. The adapter boots from an internal boot ROM, which establishes the initial root of trust (RoT). Hardware secure boot authenticates and builds a chain of trust (CoT) with succeeding firmware images by using the RoT, meaning only authorized firmware executes on the adapter.

Figure 1: Authenticated Firmware Example
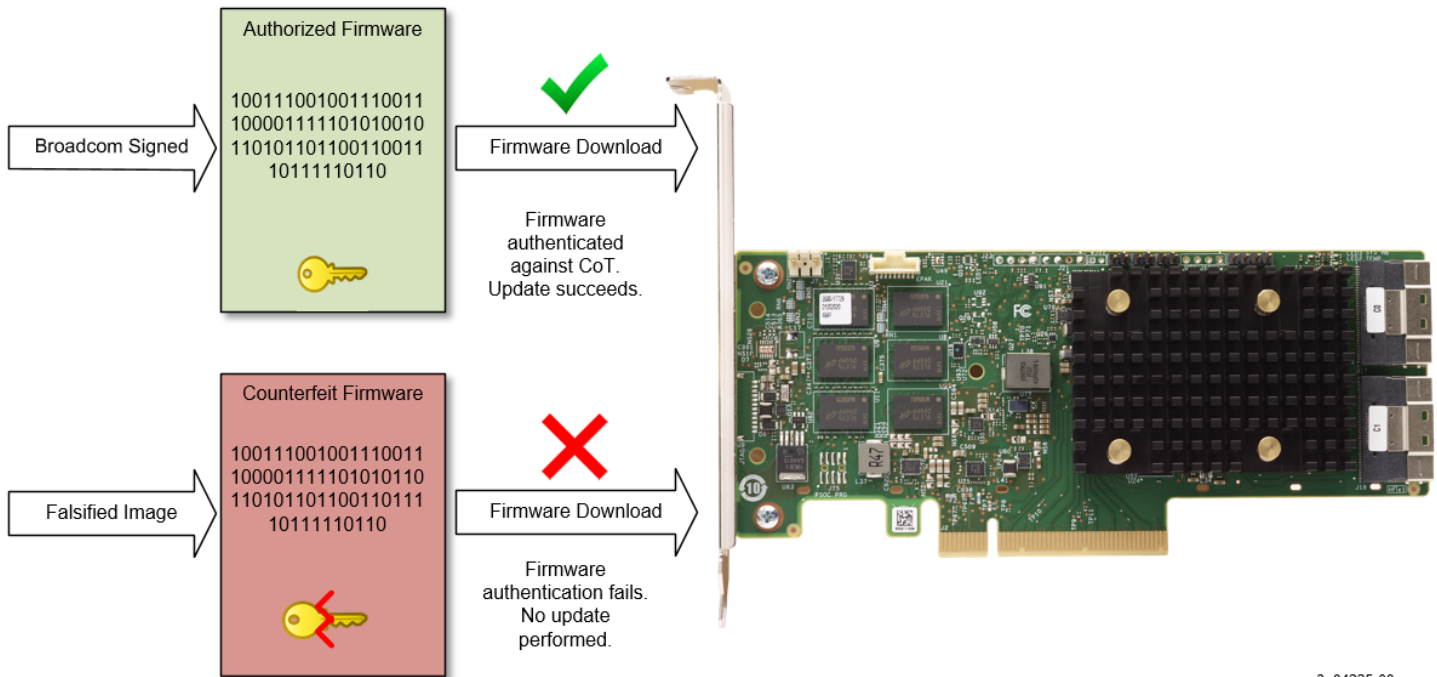
3_04225-00

Hardware secure boot requires that each image be signed with a valid digital signature; otherwise, the image is considered invalid and does not execute. The adapter ships with a valid signed firmware image. All Broadcom-supplied firmware includes a valid digital signature; therefore, the hardware secure boot process is transparent unless the adapter encounters a counterfeit image. If the adapter downloads a counterfeit image, the image authentication fails and the download utility, such as StorCLI2, displays the appropriate failure messages. Contact Broadcom Technical Support for assistance.

Adapter Installation Instructions

Use the following steps to install the adapter:

1. **Unpack your adapter.**

   Unpack and remove the adapter. Inspect the adapter for damage. If it appears damaged, contact Broadcom Technical Support.

   > **ATTENTION**
   > To avoid the risk of data loss, back up your data before you change your system configuration.

2. **Turn off the power to the system.**

   Turn off the power to the computer and disconnect the AC power cord. Remove the computer cover. Refer to the system documentation for instructions. Before you install the adapter, make sure that the computer is disconnected from the power and from any networks.

   > **CAUTION**
   > Disconnect the computer from the power supply and from any networks to which you will install the adapter, or you risk damaging the system or experiencing electrical shock.

3. **Review the adapter connectors.** See MegaRAID 9540-2M2 Boot Adapter – Connector and LED Designations for descriptions of the adapters that show their connectors.

4. **Check the mounting bracket on the adapter.**

   If required for your system, replace the full-profile mounting bracket that ships on the adapter with the low-profile bracket supplied. Complete the following steps to attach the low-profile bracket:

   a) Using a No. 1 Phillips screwdriver that is ESD safe, remove the two Phillips screws that connect the full-profile bracket to the board. Unscrew the two screws located at the top and bottom edges of the board. Avoid touching any board components with the screwdriver or the bracket.

   b) Remove the full-profile bracket. Do not damage the adapter.

   c) Place the adapter on top of the low-profile bracket. Position the bracket so that the screw holes in the tabs align with the openings in the board.

   d) Using a No. 1 Phillips torque screwdriver that is ESD safe, set to a maximum torque of 4.8 ± 0.5 inch-pounds. Replace the two Phillips screws removed in Step a.

   > **ATTENTION**
   >
   > Exceeding this torque specification can damage the board, connectors, or screws, and can void the warranty on the board.

   > **ATTENTION**
   >
   > Damage caused to the board as a result of changing the bracket can void the warranty on the board. Adapters returned without a bracket mounted on the board will be sent back without return merchandise authorization (RMA) processing.

5. **Install the stand-offs.** Two black plastic stand-offs with attached fasteners are provided with the adapter. Insert the stand-offs in the appropriate holes for the M.2 drive length and press to snap into place.

6. **Install the M.2 drives.** Install the M.2 SSDs into the adapter's connectors. Secure the SSDs into place by pushing the fastener through the notch on the M.2 drive into the stand-off. The adapter supports the following M.2 drive lengths:

   - 110 mm
   - 80 mm
   - 60 mm
   - 42 mm
   - 30 mm

7. **Insert the adapter into an available PCIe slot.** Select a PCIe slot and align the adapter's PCIe bus connector to the slot, as shown in the following figure. Press down gently, but firmly, to make sure that the adapter is seated correctly in the slot. Secure the bracket to the computer chassis with the bracket screw.

   > **NOTE**
   > Adapters with a x8 host interface can operate in x8 or x16 slots. However, some x16 PCIe slots support only PCIe graphics cards; an adapter installed in one of these slots will not function. Refer to the guide for your motherboard for information about the PCIe slots.

Figure 2: Installing an Adapter in a PCIe Slot
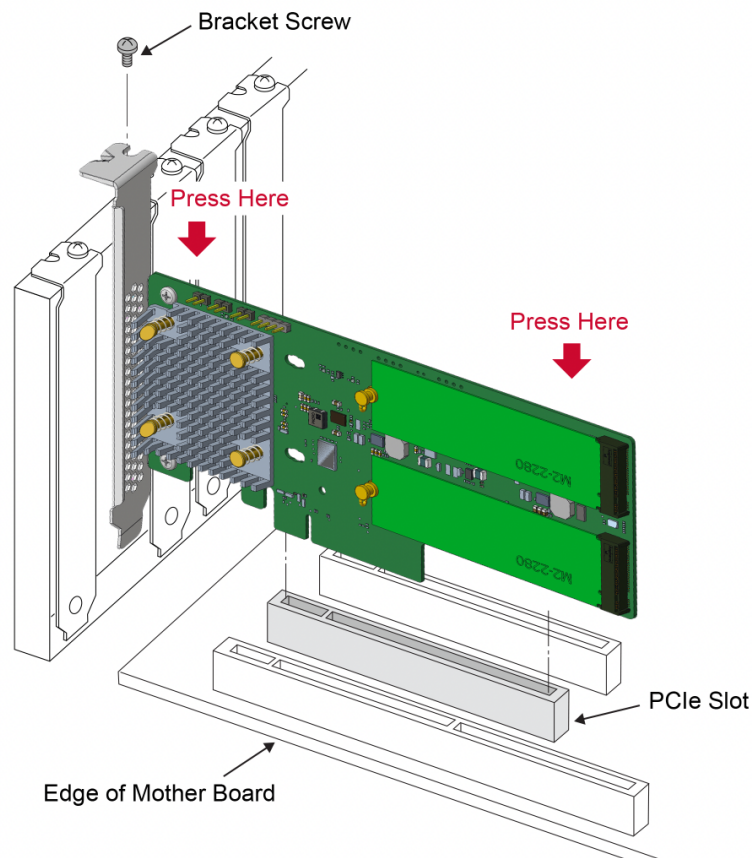
8. **Provide the required airflow for the installed adapter.** See MegaRAID 9540-2M2 Boot Adapter Technical Specifications to find the adapter's cooling requirements.

9. **Turn on the power to the system.** Reinstall the computer cover and reconnect the AC power cords. Turn on power to the host computer.

   During boot, a BIOS message appears. The firmware takes several seconds to initialize. The configuration utility prompt times out after several seconds. The second portion of the BIOS message shows the adapter controller number, and firmware version. The numbering of the adapters follows the PCIe slot scanning order used by the host motherboard.

10. **Choose the correct storage profile.** Refer to the *12Gb/s MegaRAID Tri-Mode Software User Guide* and *LSI® Storage Authority Software User Guide* for details about setting up your adapter.

11. **Install the operating system driver.** The adapters can operate under various operating systems. To operate under these operating systems, you must install the software drivers. The firmware and drivers are routinely updated and

made available on the Support and Download center. Visit http://www.broadcom.com/support/download-search and download the latest firmware and driver for the adapter.

MegaRAID 9540-2M2 Boot Adapter – Connector and LED Designations

The adapter is a 167.51 (± 0.13) mm × 68.77 (± 0.13) mm board. The component height on the top and bottom of the adapter complies with the PCIe Card Electromechanical specification.

The following figure shows the connectors and LED locations on the adapter. A red circle near each header and connector identifies pin 1 in the figure.

Figure 3: Card Layout for the MegaRAID 9540-2M2 Boot Adapter

Table 1: Headers and Connectors

Connector	Type	Description
J2	Standard edge card connector	The interface between the storage adapter and the host system. With the PCIe interface, this connector provides power to the board and an I^2C interface connected to the I^2C bus for the IPMI.
J4	Default SBR header	2-pin connector. Reserved for Broadcom use.
J8	Onboard serial UART connector	4-pin connector. Reserved for Broadcom use.

Connector	Type	Description
J10	Global HDD activity LED header	2-pin connector. Connects to an LED that indicates activity on the drives connected to the controller.
J11	Global drive fault LED header	2-pin connector. Connects to an LED that indicates whether a drive is in a fault condition.
J114, J115	SSD connector	Two M.2 SSD connectors.

The following table describes the LEDs on the adapter.

Table 2: LED Designations

LED	Type	Description
LED2	Yellow IOC over temperature	Stays on solid to indicate that the SAS3808 IOC temperature sensor is over the temperature threshold. When the IOC is in the proper temperature range, this LED is off.
LED3	Green system heartbeat	Indicates that the SAS3808 IOC is operating normally.

MegaRAID 9540-2M2 Boot Adapter Technical Specifications

The operating (thermal and atmospheric) conditions for the adapter are as follows:

- Relative humidity range (non-condensing): 5% to 90%
- Temperature range: 0°C to +55°C

The minimum airflow required depends on the installed M.2 SSDs. The minimal airflow without any M.2 drives is 150 LFPM measured at 55°C (ambient). When attaching M.2 drives, you must supply enough airflow to cool the M.2 drives and to keep the SAS3808 IOC processor's junction temperature at 105°C or less. The M.2 drives might require heat sinks. M.2 drive heat sinks are available from third-party suppliers.

The non-operating (such as storage and transit) conditions for the adapter are as follows:

- Relative humidity range (non-condensing): 5% to 95%
- Temperature range: –40°C to +70°C

Power Supply Requirements

All power, included that used to power the onboard M.2 drives, is supplied to the adapter through the PCIe 3.3V rail (3.3V ± 9%) and the 12V rail (12V ± 8%). Onboard switching regulator circuitry operates from the 3.3V rail and the 12V rail to provide the necessary voltages. Each M.2 drive may use a maximum of 11.55W.

The M.2 drives are powered from the 12V rail with the 1.5V and 1.8V SAS3808 supplies. Using the 12V rail, the adapter can support the maximum power requirements of the M.2 drives. The SAS3808 core rail is powered from the 3.3V rail which requires approximately 6W. This means, depending on the drives being used, the adapter might draw more than 25W total (the limit of some x8 slots). However, many systems combine the 12V and 3.3V rails to supply up to 35W (25W from the 12V rail and 10W from the 3.3V rail). The total power consumed depends on which M.2 SSDs drives are used. You must complete a power analysis based on the drive selection for your system.

The following values represent typical power using two 500 GB x4 NVMe PCIe 16GT/s drives:

- PCIe 3.3V: 6W
- PCIe +12V: 11.5W
- Total power: 17.5W

Typical power is measured with maximum I/O traffic, typical silicon process material, and nominal voltages operating the card at an ambient temperature of 45°C with required airflow.

Marks, Certifications, Compliance, and Safety Characteristics

Marks, Certifications, and Compliance

The design and implementation of the boot adapter minimizes electromagnetic emissions, susceptibility to radio frequency energy, and the effects of electrostatic discharge. The MegaRAID 9540-2M2 boot adapter, model 50148, shows the following marks and certifications.

Table 3: Adapter Marks and Certifications

Mark	Symbol	Description
Australia and New Zealand RCM		Meets the following standards: • AS/NZS CISPR 32 • CISPR 32:2015, Class B • AS/NZS CISPR 32:2015, Class B
Canada EMC	CANADA ICES-OO3 CLASS B CANADA NMB-003 CLASSE B CAN ICES-3 (B)/NMB-3 (B)	Meets the following standards: • ICES-003:2016 Issue 6: 2016, Class B • CAN/CSA CISPR 22-10 • CISPR 22:2008
Europe (CE)		Meets the following standards: • EN 55022/EN 55024 EN 55032 • EN 55032:2015 +AC:2016, Class B • EN 50022:2010 +AC:2011, Class B • EN 55024:2010 +A1:2015
Korea (RRL)	 MSIP-REM-A8T-XXXXX	xxxxx = model number Meets the KN32/KN35 testing requirements.
Taiwan (BSMI)	 D3B320 RoHS	Meets the following standards: • CNS 13438 • CNS15663

Mark	Symbol	Description
USA / Canada Safety (UL Listed)	cULus LISTED ITE Accessory E257743 cRUus®	For use with UL listed ITE equipment only. Meets the following standards: • UL 62368-1, Third Edition • CAN/CSA C22.2 No. 62368-1-19, Third Edition
CB Scheme Safety	—	Meets the following standards: • IEC 60950-1:2005 (Second edition) + Am 1:2009 + Am 2:2013 • EN 60950-1: 2006 + A11: 2009 + A1: 2010 + A12: 2011 + A2: 2013 • IEC 62368-1:2014 (Second edition) • EN 62368-1:2014+A11: 2017
Japan (VCCI)	VCI	Meets the following standards: • V-3/2015.04, Class B • V-4/2012.04 • VCCI-CISPR 32:2016 • CISPR 32:2015
USA / Canada (FCC)	FC	Meets the following standards: • 47 CFR FCC Part 15, Subpart B, Class B • ANSI C63.4:2014 • CISPR 32:2008
Morocco (CMIM)		Meets the following standards: • EN 55022/EN 55024 EN 55032 • EN 55032:2015 +AC:2016, Class B • EN 50022:2010 +AC:2011, Class B • EN 55024:2010 +A1:2015
Country of Origin	Made in XXXX	XXXX indicates the country of origin.

Safety Characteristics

The adapter meets or exceeds the requirements of UL flammability rating 94 V0. Each bare board is also marked with the supplier name or trademark, type, and UL flammability rating. For the boards installed in a PCIe bus slot, all voltages are lower than the SELV 42.4V limit.

Revision History

Version 1.1, April 5, 2023

Update the board dimensions in MegaRAID 9540-2M2 Boot Adapter – Connector and LED Designations.

Version 1.0, November 11, 2022

Initial document release.