



NVIDIA BlueField BF1500 Ethernet Controller Card User Guide

Table of Contents

Introduction.....	7
Product Overview	7
Features and Benefits	8
Operating Systems/Distributions	11
Connectivity	11
Package Contents	11
Supported Interfaces	12
BF1500 Controller Card Layout and Interface Information	12
Interfaces Detailed Description.....	14
BlueField System-on-Chip (SoC)	14
Ethernet QSFP28 Interface	14
PCI Express Interface	14
DDR4 SDRAM On-Board Memory.....	15
NC-SI Management Interface	15
3 Pin Header Interface	16
UART Interface Connectivity	16
Mini USB Type B Interface	17
JTAG CoreSight 10 Interface	17
LEDs Interface	17

Pin Description	19
PCI Express Pins Description.....	19
NC-SI Management Interface	22
JTAG CoreSight 10	24
Hardware Installation	26
Safety Warnings	26
Installation Procedure Overview.....	26
System Requirements	27
Hardware Requirements	27
Airflow Requirements	27
Software Requirements	28
Safety Precautions	28
Unpacking the Package	29
Pre-Installation Checklist	29
Bracket Replacement Instructions	29
Installation Instructions	30
Cables and Modules.....	33
Cable Installation	33
Identify the BF1500 Controller Card in your System	34
Network Adapter Environment	34
On Windows.....	34

On Linux	35
Uninstalling the BF1500 Controller Card	35
Bring-Up and Driver Installation	38
Troubleshooting	39
General Troubleshooting	39
Specifications.....	40
MBF1L516B-CSNAT Specifications.....	40
Mechanical Drawing and Dimensions.....	42
Mechanical Drawing of the BF1500 Controller Card - Component Side.....	42
Mechanical Drawing of the BF1500 Controller Card - Print Side.....	43
Bracket Mechanical Drawing	44
Finding the MAC on the Adapter Card	45
Document Revision History	46

About This Manual

This User Manual describes NVIDIA® BlueField® Ethernet BF1500 Controller Card. It provides details as to the interfaces of the board, specifications, required software and firmware for operating the board, and a step-by-step plan of how to bring up the BlueField Controller Card.

EOL'ed (End of Life) Ordering Part Numbers

The table below provides the ordering part numbers (OPNs) for available BlueField BF1500 Controller Card.

NVIDIA SKU	OPN	Marketing Description
900-9D1A2-0056-SN0	MBF1L516B-CSNAT	BlueField® Controller card, Dual-Port 100GbE QSFP28, BlueField® G-Series 16 cores, PCIe Gen3.0/4.0 x16 , Crypto disabled, 16GB on-board DDR, FHHL , Single Slot, Tall Bracket

Intended Audience

This manual is intended for the installer and user of these cards. The manual assumes basic familiarity with Ethernet network and architecture specifications.

Technical Support

Customers who purchased NVIDIA products directly from NVIDIA are invited to contact us through the following methods:

- URL: <https://www.nvidia.com> > Support
- E-mail: enterprisesupport@nvidia.com

Customers who purchased Mellanox M-1 Global Support Services, please see your contract for details regarding Technical Support.
Customers who purchased Mellanox products through a Mellanox approved reseller should first seek assistance through their reseller.

Related Documentation

IEEE Std 802.3 Specification	IEEE Ethernet specification at http://standards.ieee.org
PCI Express Specifications	Industry Standard PCI Express Base and Card Electromechanical Specifications at https://pcisig.com/specifications

IEEE Std 802.3 Specification	IEEE Ethernet specification at http://standards.ieee.org
Mellanox LinkX Interconnect Solutions	Mellanox LinkX InfiniBand cables and transceivers are designed to maximize the performance of High-Performance Computing networks, requiring high-bandwidth, low-latency connections between compute nodes and switch nodes. Mellanox offers one of the industry's broadest portfolio of QDR/FDR10 (40Gb/s), FDR (56Gb/s), EDR/HDR100 (100Gb/s), and HDR (200Gb/s) cables, including Direct Attach Copper cables (DACs), copper splitter cables, Active Optical Cables (AOCs) and transceivers in a wide range of lengths from 0.5m to 10km. In addition to meeting IBTA standards, Mellanox tests every product in an end-to-end environment ensuring a Bit Error Rate of less than 1E-15. Read more at https://www.nvidia.com/en-us/networking/interconnect/

Document Conventions

When discussing memory sizes, MB and MBytes are used in this document to mean size in mega Bytes. The use of Mb or Mbits (small b) indicates size in mega bits. In this document PCIe is used to mean PCI Express.



Revision History

A list of the changes made to this document are provided in [Document Revision History](#).

Introduction

Product Overview

The BlueField BF1500 Controller Card is the perfect solution for managing NVMe storage drives in storage and hyper-converged systems. The BF1500 Controller Card delivers the highest NVMe-oF target performance, reducing TCO and increasing ROI. It can transform existing JBOF systems into NVMe-oF compliant solutions, simply by plugging the card into an existing PCIe slot. The card’s small form factor allows customers to install multiple controller cards in a single system to support a larger number of SSDs and high-availability storage architecture.

-  The BF1500 Controller card connectivity to NVMe SSD devices is possible through the PCIe switch.
-  The BlueField Controller Card should be installed only in a JBOF System as it functions as a PCIe root-complex (RC) initiating PCIe bus operations. Installing it in a regular host system may damage the card.

BlueField Multicore System-on-chip (SoC)

BlueField SoC is a highly integrated and efficient controller, optimized for NVMe storage systems, Network Functions Virtualization (NFV), Cloud, and AI workloads. BlueField SoC integrates all the discrete components of a storage system appliance into a single chip (CPU, PCIe switch, and Network controller), making it the premier SoC solution for building Just-a-Bunch-Of-Flash (JBOF) systems, All-Flash-Array, and storage appliances for NVMe over-Fabrics.

With an integrated NVMe-oF offload accelerator, the BlueField SoC gives the BF1500 Controller Card a superior performance advantage over existing JBOF systems, significantly reducing storage transaction latency, while increasing IOPs (I/O operations per second).

BlueField SoC also offers cost-effective and integrative solutions for Machine Learning appliances, enabling efficient data delivery for real-time analytics and data insights based on superior RDMA and GPUDirect® RDMA technologies. Support for PCIe Gen4.0 helps future-proof the next generation of high-performance GPU cards.

BlueField BF1500 Ethernet Controller Card

Part Number	MBF1L516A-CSNAT
Form Factor	Full-Height, Half-Length (FHHL)

Ethernet Data Rate	1/10/25/40/50/100 GbE
Network Connector Type	Dual-port QSFP28
PCI Express Connectors	PCIe Gen 3.0 (8GT/s) / Gen 4.0 (16GT/s) x16 lanes
On-board DDR4 Memory ^(a)	Single-channel with 8 DDR4 8 bit + ECC (64bit + 8bit ECC) 16GB @ 2400MT/s
BlueField IC OPN	MT41M16E23A0-CDRC-TTEV
RoHS	RoHS Compliant
Crypto	Disabled
BlueField IC Cores Series and NIC/Arm Frequency	16 Cores G-Series - 275/800MHz

For more detailed information see [Specifications](#).

Features and Benefits



This section describes hardware features and capabilities. Please refer to the relevant driver and/or firmware release notes for feature availability.

Feature	Description
PCI Express (PCIe)	Uses PCIe Gen 3.0 (8GT/s) and Gen 4.0 (16GT/s) through an x16 edge connector. Gen 1.1 and 2.0 compatible.
Up to 100 Gigabit Ethernet	NVIDIA Controllers comply with the following IEEE 802.3 standards: <ul style="list-style-type: none"> - 100GbE / 50GbE / 40GbE / 25GbE / 10GbE / 1GbE - IEEE 802.3bj, 802.3bm 100 Gigabit Ethernet - IEEE 802.3by, Ethernet Consortium25, 50 Gigabit Ethernet, supporting all FEC modes

Feature	Description
	<ul style="list-style-type: none"> - IEEE 802.3ba 40 Gigabit Ethernet - IEEE 802.3by 25 Gigabit Ethernet - IEEE 802.3ae 10 Gigabit Ethernet - IEEE 802.3az Energy Efficient Ethernet - IEEE 802.3ap based auto-negotiation and KR startups - Proprietary Ethernet protocols (20BASE-R2) - IEEE 802.3ad, 802.1AX Link Aggregation - IEEE 802.1Q, 802.1P VLAN tags and priority - IEEE 802.1Qau (QCN) - Congestion Notification - IEEE 802.1Qaz (ETS) - IEEE 802.1Qbb (PFC) - IEEE 802.1Qbg - IEEE 1588v2 - Jumbo frame support (9.6KB)
On-board Memory	<ul style="list-style-type: none"> • Quad SPI NOR FLASH - includes 128Mbit for Firmware image (W25Q128FVSIQ device by Winbond-Nuvoton). • UVPS EEPROM - includes 512Kbit (M24512-DFMC6TG by STMICROELECTRONICS). • FRU EEPROM - includes a 128Kbit (M24128-DFMC6TG by STMICROELECTRONICS) • eMMC - x8 16GB NAND flash Memory for SoC BIOS. • DDR4 SDRAM - single-channel DDR4 SDRAM memory with 8 components of 8 bit + ECC (64bit + 8bit ECC), 8/16GB @2400MT/s.
BlueField SoC	The BlueField SoC integrates four, eight or sixteen 64-bit Armv8 A72 cores interconnected by a coherent mesh network, one DRAM controller, a dual port RDMA intelligent Ethernet adapter supporting up to 100Gb/s, an embedded PCIe switch with endpoint and root complex functionality, and up to 8 lanes of PCIe Gen 3.0/4.0.
Overlay Networks	In order to better scale their networks, data center operators often create overlay networks that carry traffic from individual virtual machines over logical tunnels in encapsulated formats such as NVGRE and VXLAN. While this solves network scalability issues, it hides the TCP packet from the hardware offloading engines, placing higher loads on the host CPU. NVIDIA BF1500 Controller Card effectively addresses this by providing advanced NVGRE and VXLAN hardware offloading engines that encapsulate and de-capsulate the overlay protocol.
RDMA and RDMA over Converged Ethernet (RoCE)	NVIDIA BF1500 Controller Card, utilizing IBTA RDMA (Remote Data Memory Access) and RoCE (RDMA over Converged Ethernet) technology, delivers low-latency and high-performance over Ethernet networks. Leveraging data center bridging (DCB) capabilities as well as advanced congestion control hardware mechanisms, RoCE provides efficient low-latency RDMA services over Layer 2 and Layer 3 networks.
NVIDIA PeerDirect™	PeerDirect™ communication provides high-efficiency RDMA access by eliminating unnecessary internal data copies between components on the PCIe bus (for example, from GPU to CPU), and therefore significantly reduces application run time. NVIDIA BF1500 Controller Card advanced acceleration technology enables higher cluster efficiency and scalability to tens of thousands of nodes.

Feature	Description
Quality of Service (QoS)	Support for port-based Quality of Service enabling various application requirements for latency and SLA.
Storage Acceleration	<p>A consolidated compute and storage network achieves significant cost-performance advantages over multi-fabric networks. Standard block and file access protocols can leverage RDMA for high-performance storage access.</p> <ul style="list-style-type: none"> • NVMe over Fabric offloads for the target machine • T10-DIF Signature Handover <p>BlueField BF1500 Controller Card may operate as a co-processor offloading specific storage tasks from the host, isolating part of the storage media from the host, or enabling abstraction of software-defined storage logic using the BlueField Arm cores. On the storage initiator side, BlueField BF1500 card can prove an efficient solution for hyper-converged systems to enable the host CPU to focus on compute while all the storage interface is handled through the Arm cores.</p>
NVMe-oF	Nonvolatile Memory Express (NVMe) over Fabrics is a protocol for communicating block storage IO requests over RDMA to transfer data between a host computer and a target solid-state storage device or system over a network. BlueField BF1500 Controller Card may operate as a co-processor offloading specific storage tasks from the host using its powerful NVMe over Fabrics Offload accelerator.
SR-IOV	NVIDIA BF1500 Controller Card SR-IOV technology provides dedicated adapter resources and guaranteed isolation and protection for virtual machines (VM) within the server.
High-Performance Accelerations	<ul style="list-style-type: none"> • Tag Matching and Rendezvous Offloads • Adaptive Routing on Reliable Transport • Burst Buffer Offloads for Background Checkpointing
GPU Direct	The latest advancement in GPU-GPU communications is GPUDirect RDMA. This new technology provides a direct P2P (Peer-to-Peer) data path between the GPU Memory directly to/from the NVIDIA HCA devices. This provides a significant decrease in GPU-GPU communication latency and completely offloads the CPU, removing it from all GPU-GPU communications across the network. NVIDIA BF1500 Controller Card uses high-speed DMA transfers to copy data between P2P devices resulting in more efficient system applications
Security Accelerators	A consolidated compute and network solution based on BF1500 Controller Card achieves significant advantages over a centralized security server solution. Standard encryption protocols and security applications can leverage BlueField compute capabilities and network offloads for security application solutions such as Layer4 Statefull Firewall.

Operating Systems/Distributions

The BF1500 Controller Card is shipped with Linux based Operating System burned on it which includes all needed drivers. For more information, please refer to the [BlueField Software User Manual](#).

Connectivity

- Interoperable with 1/10/25/40/50/100 Gb/s Ethernet switches
- Passive copper cable with ESD protection
- Powered connectors for optical and active cable support

Package Contents

Category	Quantity	Item
Cards	1	BF1500 Controller Card
Cables	1	USB 2.0 Type A to Mini USB Type B cable
	1	3 pin UART to USB cable
Accessories	1	Tall bracket (shipped assembled)
	1	Short bracket

Supported Interfaces

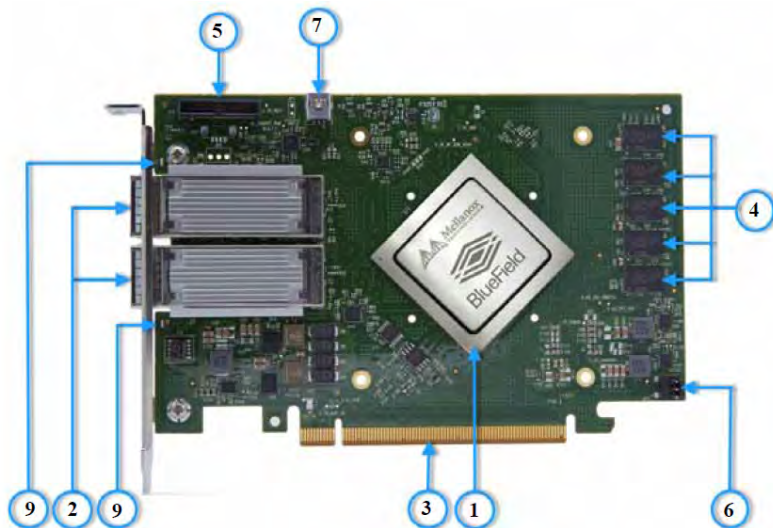
BF1500 Controller Card Layout and Interface Information

The below figures show the component and print sides of BF1500 Controller Card. Each numbered interface that is referenced in the figures is described in the following table with a link to detailed information.

⚠ The BF1500 Controller Card include special circuits to protect from ESD shocks to the card/server when plugging copper cables

⚠ The below figures are for illustration purposes only and might not reflect the current revision of the BF1500 Controller Card.

BF1500 Controller Card Interfaces - Component Side



BF1500 Controller Card Interface - Print Side



Item	Interface	Description
1	"BlueField System-on-Chip (SoC)"	Mellanox BlueField SoC 16 cores
2	"Ethernet QSFP28 Interface"	Ethernet traffic is transmitted through the BF1500 Controller Card QSFP28 connectors. The QSFP28 connectors allow for the use of modules, optical and passive cable interconnect solutions
3	"PCI Express Interface"	PCIe Gen 3.0/4.0 through an x16 edge connector
4	"DDR4 SDRAM On-Board Memory"	Single channel with 8 DDR4 8 bit + ECC (64bit + 8bit ECC) 16GB @ 2400MT/s
5	"NC-SI Management Interface"	BMC connection for remote management
6		Access to Arm console.
6	"Mini USB Type B Interface"	Mounted on the Controller Card for OS image loading
7	"JTAG CoreSight 10 Interface"	Arm debug tool
8	"LEDs Interface"	One bi-color LED per port for the link and physical status

Interfaces Detailed Description

BlueField System-on-Chip (SoC)

BlueField is a Mellanox family of advanced SoC solutions that integrate a coherent mesh of 64-bit Arm v8 A72 cores, a ConnectX network adapter front-end and a PCI Express switch into a single chip. The powerful SoC architecture includes an ARMv8 multicore processor array and enables customers to develop sophisticated applications and highly differentiated feature sets. BlueField leverages the rich ARM software ecosystem and introduces the ability to offload the x86 software stack.

At the heart of BlueField is the ConnectX-5 network offload controller with RDMA and RDMA over Converged Ethernet (RoCE) technology, delivering cutting-edge performance for networking and storage applications such as NVMe over Fabrics. Advanced features include an embedded virtual switch with programmable access lists (ACLs), transport offloads and stateless encaps/decaps of NVGRE, VXLAN, and MPLS overlay protocols.

Ethernet QSFP28 Interface

The network ports of BF1500 Controller Card are compliant with the IEEE 802.3 Ethernet standards listed in [Features and Benefits](#). Ethernet traffic is transmitted through the cards' QSFP28 connectors.

PCI Express Interface

The BF1500 Controller Card supports PCI Express Gen 3.0/4.0 (1.1 and 2.0 compatible) through an x16 edge connector. The device is a slave responding to the PCIe bus operations (end-point). Please refer to [PCI Express Pins Description](#) for pinouts description.

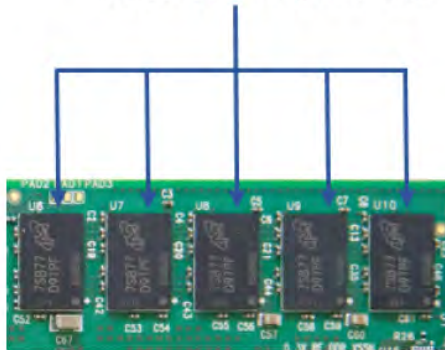
The following lists PCIe interface features:

- PCIe Gen 3.0 and 4.0 compliant, 2.0 and 1.1 compatible
- 2.5, 5.0, or 8.0, or 16.0 GT/s link rate x16 lanes
- Auto-negotiates to x16, x8, x4, x2, or x1
- Support for MSI/MSI-X mechanisms

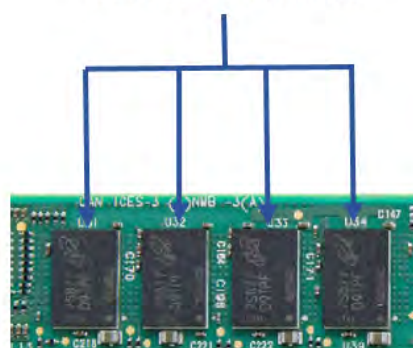
DDR4 SDRAM On-Board Memory

The BF1500 Controller Card incorporates a single channel DDR4 SDRAM memory with 8 components of 8 bit + ECC (64bit + 8bit ECC), 16GB @2400MT/s.

DDR4 SDRAM - Components Side



DDR4 SDRAM - Print Side



NC-SI Management Interface

The BlueField Controller Card enables the connection of a Baseboard Management Controller (BMC) to a set of Network Interface Controller (NICs) for the purpose of enabling out-of-band remote manageability. The NC-SI management is supported over RMII and has a connector on the Controller Card. Please refer to [NC-SI Management Interface](#) for pins.

NC-SI Interface




3 Pin Header Interface

The 3 pin header interface enables access to the Arm console through UART0 through the following pins:

- Pin # 1 - UART0 RX
- Pin # 2 - GND
- Pin # 3 - UART0 TX

UART Interface Connectivity

The USB to UART cable that supports TTL voltage levels can be used to connect the UART Interface. See an example of TTL 3.3V voltage levels cable in the below figure.

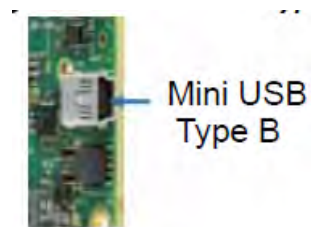
 It is prohibited to directly connect any RS-232 cable! Only TTL 3.3V voltage level cables are supported!

USB to UART Cable - Example



Mini USB Type B Interface

The BF1500 Controller Card uses a Mini USB Type B. The USB connector is mounted on the card. The purpose of the USB connector is loading operating system images for the operating systems. In order to use this interface, please use a standard Mini USB Type-B to Mini USB Type A cable.



JTAG CoreSight 10 Interface

The BF1500 Controller Card uses JTAG CoreSight 10-Pin Header. The purpose of the JTAG CoreSight 10 is for debugging the Arm with Arm DSTREAM debug tool. For JTAG CoreSight 10 pins, please refer [JTAG CoreSight 10](#).

LEDs Interface

There is a one bi-color I/O LED per port to indicate link and physical status.

Physical and Logical Link Indications (Ethernet Mode)

LED Color and State	Description
Off	A link has not been established
Blinking Amber ^(a)	4 Hz blinking amber indicates a problem with the link
Solid Green	Indicates a valid link with no active traffic
Blinking Green	Indicates a valid logical link with active traffic

Note a. 1Hz Blinking amber occurs due to running a beacon command for locating the adapter card.

Pin Description

PCI Express Pins Description

The below table lists the PCI Express pins description. For further details, please refer to [PCI Express Interface](#).

PCI Express Pin Description

Pin #	Signal Name	Description	Pin #	Signal Name	Description
A1	PRSNT1#	Mechanical Present	B1	12V	
A2	12V		B2	12V	
A3	12V		B3	12V	
A4	GND		B4	GND	
A5	TCK	JTAG	B5	SMCLK	Host SMBus
A6	TDI	JTAG	B6	SMDAT	Host SMBus
A7	TDO	JTAG	B7	GND	
A8	TMS	JTAG	B8	3.3V	
A9	3.3V		B9	TRST#	JTAG
A10	3.3V		B10	3.3V_AUX	
A11	PERST#	PCIe Reset	B11	WAKW#/RSVD	

Pin #	Signal Name	Description	Pin #	Signal Name	Description
A12	GND		B12	RSVD	
A13	REFCLK+	Host Reference Clock	B13	GND	
A14	REFCLK-	Host Reference Clock	B14	PETP0	
A15	GND		B15	PETN0	
A16	PERP0		B16	GND	
A17	PERN0		B17	RSVD	
A18	GND		B18	GND	
A19	RSVD		B19	PETP1	
A20	GND		B20	PETN1	
A21	PERP1		B21	GND	
A22	PERN1		B22	GND	
A23	GND		B23	PETP2	
A24	GND		B24	PETN2	
A25	PERP2		B25	GND	
A26	PERN2		B26	GND	
A27	GND		B27	PETP3	

Pin #	Signal Name	Description	Pin #	Signal Name	Description
A28	GND		B28	PETN3	
A29	PERP3		B29	GND	
A30	PERN3		B30	RSVD	
A31	GND		B31	RSVD	
A32	RSVD		B32	GND	
A33	RSVD		B33	PETP4	
A34	GND		B34	PETN4	
A35	PERP4		B35	GND	
A36	PERN4		B36	GND	
A37	GND		B37	PETP5	
A38	GND		B38	PETN5	
A39	PERP5		B39	GND	
A40	PERN5		B40	GND	
A41	GND		B41	PETP6	
A42	GND		B42	PETN6	
A43	PERP6		B43	GND	

Pin #	Signal Name	Description	Pin #	Signal Name	Description
A44	PERN6		B44	GND	
A45	GND		B45	PETP7	
A46	GND		B46	PETN7	
A47	PERP7		B47	GND	
A48	PERN07		B48	PRSNT2#	Mechanical Present
A49	GND		B49	GND	

NC-SI Management Interface

The below table lists the NC-SI pins description. For further details, please refer to [NC-SI Management Interface](#).

NC-SI Management Pins Description

Pin #	Type	I/O	Description
1	REF_CLK	Input	Clock reference for receive, transmit, and control interface
2	GND	Power	Ground
3	ARB_IN	Input	Network Controller hardware arbitration
4	GND	Power	Ground

Pin #	Type	I/O	Description
5	ARB_OUT	Output	Network Controller hardware arbitration
6	GND	Power	Ground
7	RXD0	Output	Receive data
8	GND	Power	Ground
9	RXD1	Output	Receive data
10	GND	Power	Ground
11	CRS_DV	Output	Carrier Sense/Receive Data Valid
12	GND	Power	Ground
13	TXD0	Input	Transmit data
14	GND	Power	Ground
15	TXD1	Input	Transmit data
16	GND	Power	Ground
17	TX_EN	Input	Transmit enable
18	GND	Power	Ground
19	Not Connected	-	-
20	GND	Power	Ground

Pin #	Type	I/O	Description
21	SDA (Not Used)	I/O	N/A
22	GND	Power	Ground
23	SCL (Not Used)	Input	N/A
24	GND	Power	Ground
25	GND	Power	Ground
26	GND	Power	Ground
27	3.3V (Not Used)	Power	-
28	3.3V (Not Used)	Power	-
29	3.3V (Not Used)	Power	-
30	3.3V (Not Used)	Power	-

JTAG CoreSight 10

The below table lists the JTAG CoreSight 10 pins description. For further details, please refer to [JTAG CoreSight 10 Interface](#).


JTAG CoreSight 10 Pins Description

Pin#	Signal Name	Voltage Domain	Description
1	VTREF	A	The Voltage Target Reference pin supplies DSTREAM with the debug rail voltage of the target to match its I/O logic levels. VTREF can be tied HIGH on the target. If VTREF is pulled HIGH by a resistor, its value must be no greater than 100Ω.
2	TMS	A	The Test Mode Select pin sets the state of the Test Access Port (TAP) controller on the target. TMS can be pulled HIGH on the target to keep the TAP controller inactive when not in use.
3	GND	NA	Ground.
4	TCK	A	The Test Clock pin clocks data into the TDI and TMS inputs of the target. TCK is typically pulled HIGH on the target.
5	GND	NA	Ground.
6	TDO	A	The Test Data Out pin receives serial data from the target during debugging. You are advised to series terminate TDO close to the target processor. TDO is typically pulled HIGH on the target.
7	KEY (NC)	NA	This pin must not be present on the target connector.
8	TDI	A	The Test Data In pin provides serial data to the target during debugging. TDI can be pulled HIGH on the target.
9	GND	NA	Ground.
10	nSRST	A	The System Reset pin fully resets the target. This signal can be initiated by DSTREAM or by the target board (which is then detected by DSTREAM). nSRST is typically pulled HIGH on the target and pulled strong-LOW to initiate a reset. The polarity and strength of nSRST is configurable.

Hardware Installation

Installation and initialization of the BlueField BF1500 Controller Card require attention to the mechanical attributes, power specification, and precautions for electronic equipment.

Safety Warnings

 Safety warnings are provided here in the English language. For safety warnings in other languages, refer to the [BF1500 Controller Card Installation Safety Instructions](#).

Please observe all safety warnings to avoid injury and prevent damage to system components. Note that not all warnings are relevant to all models.

Unable to render include or excerpt-include. Could not retrieve page.

Installation Procedure Overview

The installation procedure of BlueField BF1500 Controller Card involves the following steps:

Step	Procedure	Direct Link
1	Check the system's hardware and software requirements.	Refer to System Requirements
2	Pay attention to the airflow consideration within the host system	Refer to Airflow Requirements
3	Follow the safety precautions	Refer to Safety Precautions
4	Unpack the package	Refer to Pre-Installation Checklist
5	Follow the pre-installation checklist	Refer to Pre-Installation Checklist
6	(Optional) Replace the full-height mounting bracket with the supplied short bracket	Refer to Bracket Replacement Instructions

7	Install the BF1500 Controller Card	Refer to Installation Instructions
8	Connect cables or modules to the card	Refer to Cables and Modules Installation
9	Identify the BF1500 Controller Card in the system	Refer to Identify the BF1500 Controller Card in Your System

System Requirements

Hardware Requirements

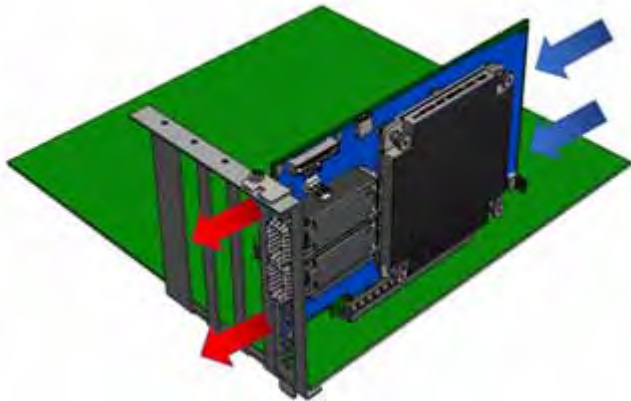
⚠ Unless otherwise specified, Mellanox products are designed to work in an environmentally controlled data center with low levels of gaseous and dust (particulate) contamination.
The operation environment should meet severity level G1 as per ISA 71.04 for gaseous contamination and ISO 14644-1 class 8 for cleanliness level.

⚠ The user must install the BlueField Controller Card into a high power PCI Express x8 slot as the card consumes up to 55W.

A system with a PCI Express high power slot that supports 75W is required for installing the card.

Airflow Requirements

BlueField BF1500 Controller Card is offered with one airflow pattern: from the heatsink to the network ports, as described in the below figure.



⚠ It is prohibited to use port-to-heatsink airflow as it may cause damage to the BlueField BF1500 Controller Card.

Please refer to the [Specifications](#) section for airflow numbers for each specific card model.

Software Requirements

- See [Operating Systems/Distributions](#) section under the Introduction section.
- Software Stacks - The BF1500 Controller Card is shipped with Linux based Operating System burned on it which includes all needed drivers. For more information, please refer to the BlueField Software User Manual.

Safety Precautions

The BF1500 Controller Card being installed in a system that operates with voltages that can be lethal. Before opening the case of the system, observe the following precautions to avoid injury and prevent damage to system components.

- Remove any metallic objects from your hands and wrists.

- Make sure to use only insulated tools.
- Verify that the system is powered off and is unplugged.
- It is strongly recommended to use an ESD strap or other antistatic devices.

Unpacking the Package

Check against the package contents list that all the parts have been sent. Check the parts for visible damage that may have occurred during shipping. Please note that the cards must be placed on an antistatic surface.

Pre-Installation Checklist

1. Verify that your system meets the hardware and software requirements stated above.
2. Shut down your system if active.
Turn off the power to the system, and disconnect the power cord. Refer to the system documentation for instructions. Before you install the BlueField BF1500 Controller Card, make sure that the system is disconnected from power.
3. (Optional) Check the mounting bracket on the BlueField BF1500 Controller Card.
If required for your system, replace the full-height mounting bracket that is shipped mounted on the card with the supplied low-profile bracket. Refer to [Bracket Replacement Instructions](#).

Bracket Replacement Instructions

The BF1500 Controller Card is usually shipped with an assembled high-profile bracket. If this form factor is suitable for your requirements, you can skip the remainder of this section and move to [Installation Instructions](#). If you need to replace the high-profile bracket with the short bracket that is included in the shipping box, please follow the instructions in this section.




Due to risk of damaging the EMI gasket, it is not recommended to replace the bracket more than three times.

To replace the bracket you will need the following parts:

- The new brackets of the proper height
- The 2 screws saved from the removal of the bracket

Removing the Existing Bracket


1. Using a torque driver, remove the two screws holding the bracket in place.

 Be careful not to put stress on BF1500 Controller Card LEDs.


2. Separate the bracket from the BF1500 Controller Card.
3. Save the two screws.

Installing the New Bracket

1. Place the bracket onto the card until the screw holes line up.


 Do not force the bracket onto the BF1500 Controller Card.

2. Screw on the bracket using the screws saved from the bracket removal procedure above.


 Use a torque driver to apply up to 2 lbs-in torque on the screws.

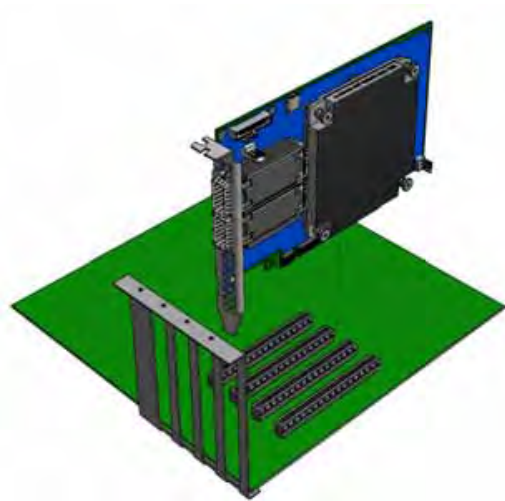
Installation Instructions

This section provides detailed instructions on how to install your BF1500 Controller Card in a system.

 Please note that the following figures are for illustration purposes only.

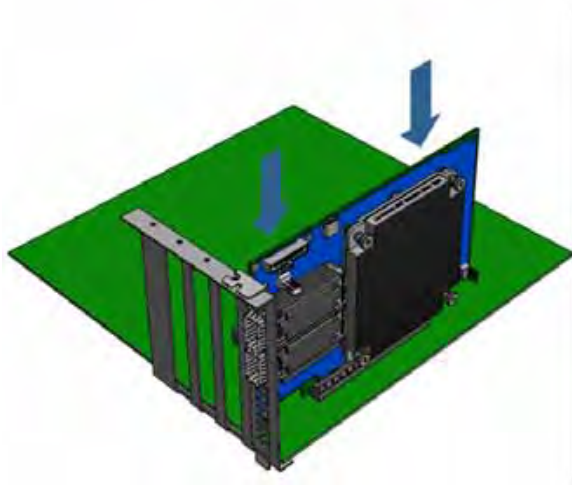
1. Open the system case.
2. Place the BF1500 Controller Card in an available PCI Express slot.

 The BlueField BF1500 Controller Card should be installed in a high power PCI Express x8 slot as the card consumes up to 55W.

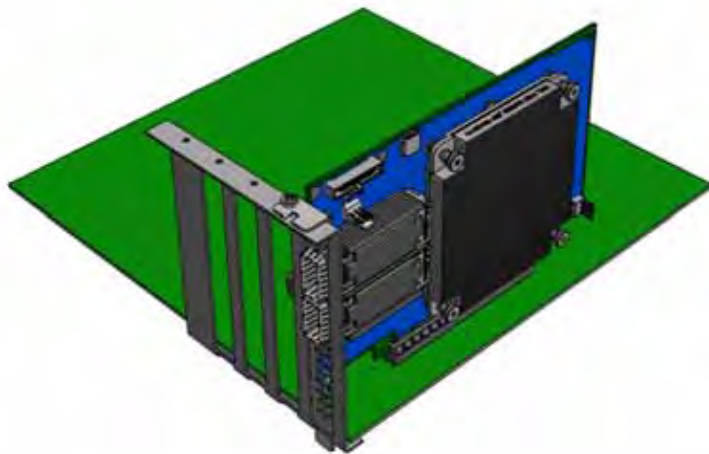


3. Applying even pressure at both corners of the card, insert the BF1500 Controller Card into the PCI Express slot until firmly seated.

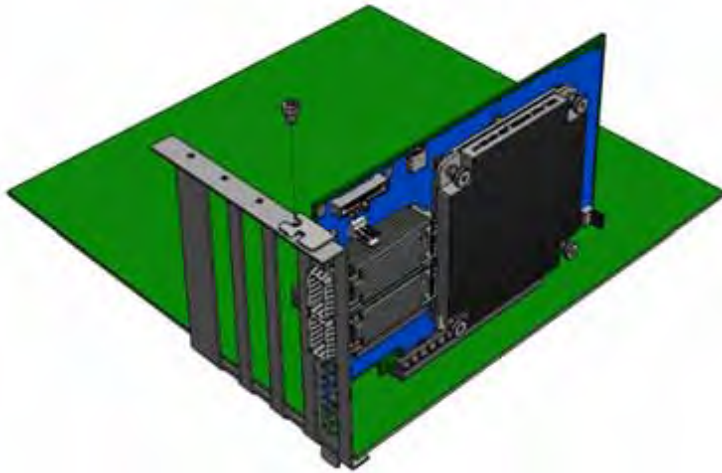
⚠ Do not use excessive force when seating the card, as this may damage the system or the BF1500 Controller Card.



4. When the BF1500 Controller Card is properly seated, the port connectors are aligned with the slot opening, and the BF1500 Controller Card faceplate is visible against the system chassis.



5. Secure the BF1500 Controller Card with the screw.



6. Close the system case.


 To uninstall the BF1500 Controller Card card, see [Uninstalling the Card](#).


Cables and Modules

Cable Installation

1. All cables can be inserted or removed with the unit powered on.
2. To insert a cable, press the connector into the port receptacle until the connector is firmly seated.
 - a. Support the weight of the cable before connecting the cable to the BF1500 Controller Card card. Do this by using a cable holder or tying the cable to the rack.

- b. Determine the correct orientation of the connector to the card before inserting the connector. Do not try and insert the connector upside down. This may damage the BF1500 Controller Card card.
- c. Insert the connector into the BF1500 Controller Card card. Be careful to insert the connector straight into the cage. Do not apply any torque, up or down, to the connector cage in the BF1500 Controller Card card.
- d. Make sure that the connector locks in place.

 When installing cables make sure that the latches engage.

 Always install and remove cables by pushing or pulling the cable and connector in a straight line with the card.

3. After inserting a cable into a port, the Green LED indicator will light when the physical connection is established (that is, when the unit is powered on and a cable is plugged into the port with the other end of the connector plugged into a functioning port). See [LED Interface](#) under the Interfaces section.
4. After plugging in a cable, lock the connector using the latching mechanism particular to the cable vendor. When data is being transferred the Green LED will blink. See [LED Interface](#) under the Interfaces section.
5. Care should be taken as not to impede the air exhaust flow through the ventilation holes. Use cable lengths which allow for routing horizontally around to the side of the chassis before bending upward or downward in the rack.
6. To remove a cable, disengage the locks and slowly pull the connector away from the port receptacle. LED indicator will turn off when the cable is unseated.

Identify the BF1500 Controller Card in your System

Network Adapter Environment

On Windows

1. Open Device Manager on the server. Click Start => Run, and then enter “devmgmt.msc”.
2. Expand System Devices and locate your BF1500 Controller Card.
3. Right click the mouse on your BF1500 Controller Card's row and select Properties to display the BF1500 Controller Card properties window.
4. Click the Details tab and select Hardware Ids (Windows 2012/R2/2016) from the Properties pull-down menu.

5. In the Value display box, check the fields VEN and DEV (fields are separated by '&'). In the display example above, notice the sub-string "PCI\VEN_15B3&DEV_A2D2/A2D3": VEN is equal to 0x15B3 - this is the Vendor ID of Mellanox Technologies; and DEV is equal to A2D2 or A2D3- this is a valid Mellanox Technologies PCI Device ID.

 If the PCI device does not have a BF1500 Controller Card ID, return to Step 2 to check another device

On Linux

Get the device location on the PCI bus by running lspci and locating lines with the string "Mellanox Technologies":

```
lspci |grep -i Mellanox
Network controller: Mellanox Technologies MT416842 (BlueField)
```

Uninstalling the BF1500 Controller Card

Safety Precautions

The BF1500 Controller Card is installed in a system that operates with voltages that can be lethal. Before uninstalling the BF1500 Controller Card, please observe the following precautions to avoid injury and prevent damage to system components.

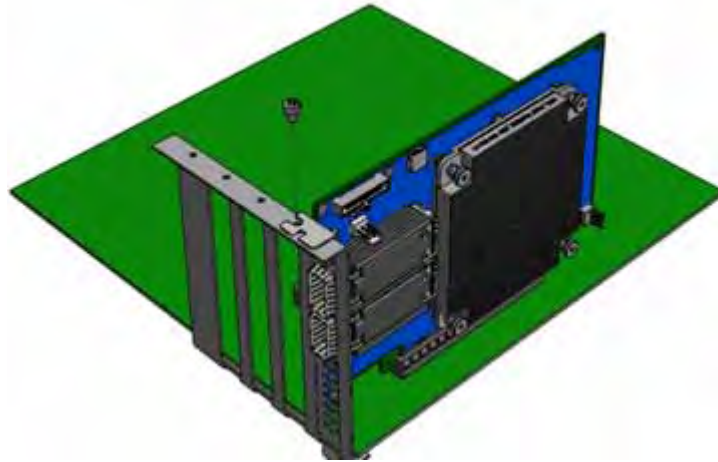
1. Remove any metallic objects from your hands and wrists.
2. It is strongly recommended to use an ESD strap or other antistatic devices.
3. Turn off the system and disconnect the power cord from the server.

Card Removal

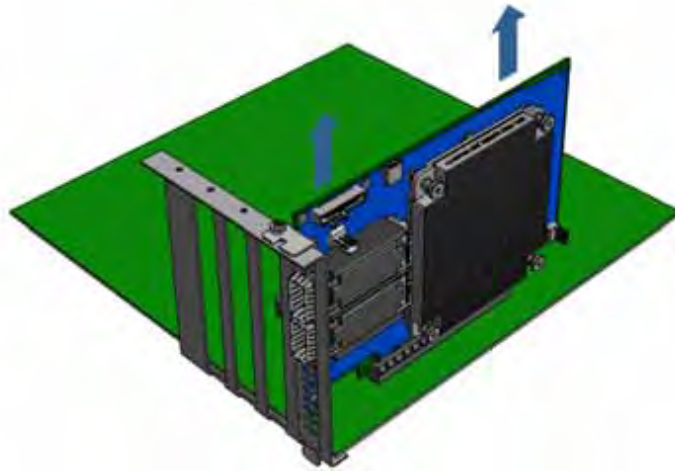
Please note that the following images are for illustration purposes only.

 Please note that the following images are for illustration purposes only.

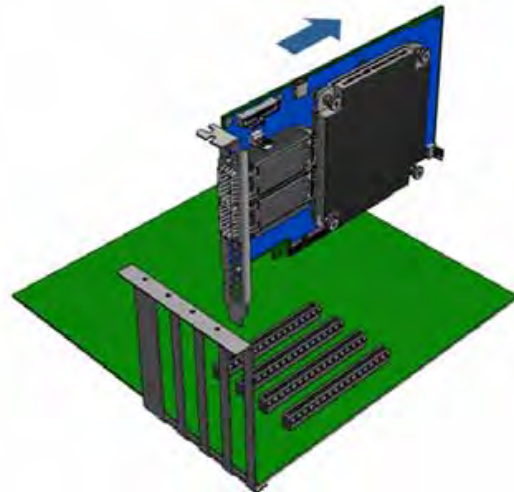
1. Verify that the system is powered off and unplugged.
2. Wait 30 seconds.
3. To remove the card, disengage the retention mechanism on the bracket (screws).



4. Holding the BF1500 Controller Card from its center, gently pull the BF1500 Controller Card out of the PCI Express slot.



5. When the port connectors reach the top of the chassis window, gently pull the BF1500 Controller Card in parallel to the motherboard.



Bring-Up and Driver Installation



It is recommended to upgrade your BlueField product to the latest software and firmware versions in order to enjoy the latest features and bug fixes.

Instructions for the BlueField Controller card bring-up and driver installation are located in the BlueField Software documentation at [Controller Card Bring-Up and Driver Installation](#).

Troubleshooting

General Troubleshooting

Server unable to find the BF1500 Controller Card	<ul style="list-style-type: none">• Ensure that the BF1500 Controller Card is placed correctly• Make sure the BF1500 Controller Card slot and the BF1500 Controller Card are compatible Install the BF1500 Controller Card in a different PCI Express slot• Use the drivers that came with the BF1500 Controller Card or download the latest• Make sure your motherboard has the latest BIOS• Try to reboot the server
The BF1500 Controller Card no longer works	<ul style="list-style-type: none">• Reseat the BF1500 Controller Card in its slot or a different slot, if necessary• Try using another cable• Reinstall the drivers for the network driver files may be damaged or deleted• Reboot the server
BF1500 Controller Cards stopped working after installing another BF1500 Controller Card	<ul style="list-style-type: none">• Try removing and re-installing all BF1500 Controller Cards• Check that cables are connected properly• Make sure your motherboard has the latest BIOS
Link indicator light is off	<ul style="list-style-type: none">• Try another port on the switch• Make sure the cable is securely attached• Check you are using the proper cables that do not exceed the recommended lengths• Verify that your switch and BF1500 Controller Card port are compatible
Link light is on, but with no communication established	<ul style="list-style-type: none">• Check that the latest driver is loaded• Check that both the BF1500 Controller Card and its link are set to the same speed and duplex settings

Specifications

MBF1L516B-CSNAT Specifications

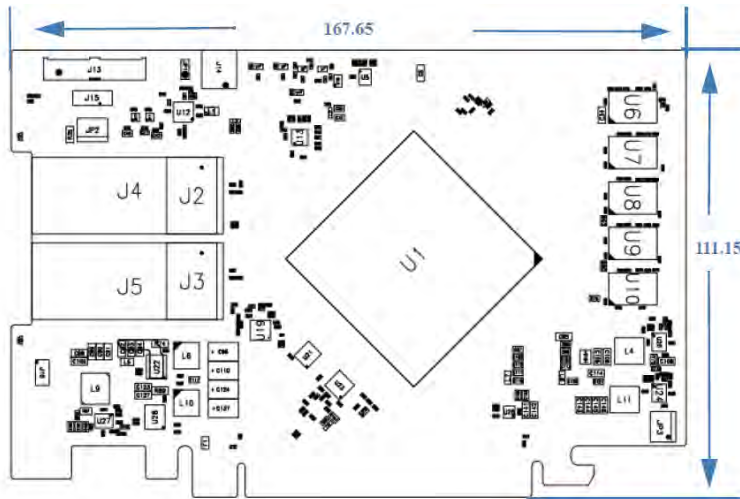
BlueField SoC	BlueField™ G-Series 16 Cores		
Physical	Size: 4.37in. x 6.6 in. (111.15mm x 167.65 mm)		
	Connector: Dual QSFP28 (copper and optical)		
Protocol Support	Ethernet: 100GBASE-CR4, 100GBASE-KR4, 100GBASE-SR4, 50GBASE-R2, 50GBASE-R4, 40GBASE-CR4, 40GBASE-KR4, 40GBASE-SR4, 40GBASE-LR4, 40GBASE-ER4, 40GBASE-R2, 25GBASE-R, 20GBASE-KR2, 10GBASE-LR, 10GBASE-ER, 10GBASE-CX4, 10GBASE-KX4, 10GBASE-CR, 10GBASE-KR, SGMII, 1000BASE-CX, 1000BASE-KX, 10GBASE-SR		
	Data Rate: 1/10/25/40/50/100 Gb/s Ethernet		
	PCI Express Gen3.0/4.0: SERDES @ 8.0 / 16.0GT/s, 16 lanes (2.0 and 1.1 compatible)		
On-board Memory	16GB On-board DDR4		
Power	Voltage: 12V		
	Power	Cable	
	Typical Power	Passive Cables	51.28W
	Maximum Power	Passive Cables	55.83W
		1.5W Active Cables	59.24W
		2.5W Active Cables	61.51W
		3.5W Active Cables	63.78W
	Maximum power available through SFP28 port: 3.5W		

Environmental	Temperature	Operational	0 °C to 45 °C	
		Non-operational	-40 °C to 70 °C	
	Humidity	90% relative humidity ^(a)		
	Airflow (Heatsink-to-port)	Cable Type	At 35 °C Ambient	At 45 °C Ambient
		Passive Cables	TBD	TBD
		Active 3.5W Cables	TBD	TBD
Regulatory	Safety	CB / cTUVus / CE		
	EMC	CE / FCC / VCCI / ICES / RCM		
	RoHS	RoHS compliant		

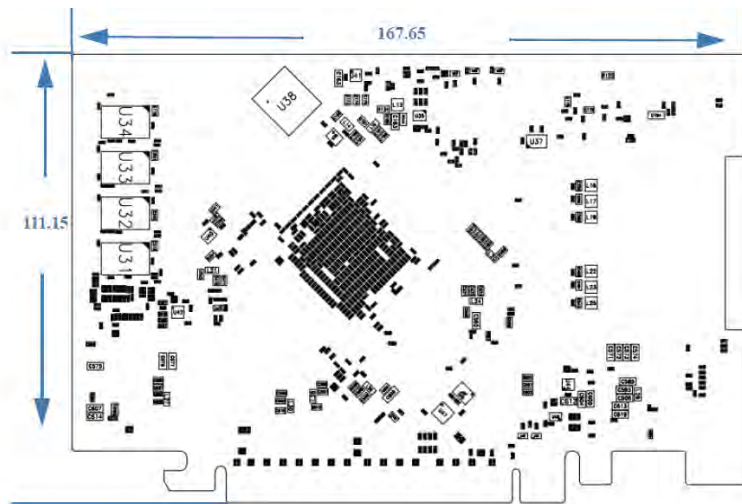
a. For both operational and non-operational states.

Mechanical Drawing and Dimensions

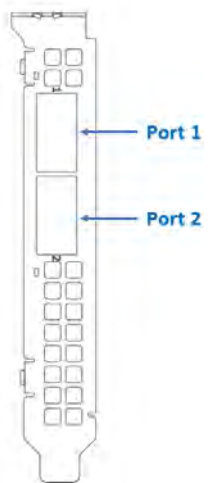
Mechanical Drawing of the BF1500 Controller Card - Component Side



Mechanical Drawing of the BF1500 Controller Card - Print Side




Bracket Mechanical Drawing



Finding the MAC on the Adapter Card

Each controller card has a different identifier printed on the label: serial number and the card MAC for the Ethernet protocol

 The product revisions indicated on the labels in the following figures do not necessarily represent the latest revisions of the cards.



Document Revision History

Date	Comments/Changes
May. 2023	Updated Specifications - added non-operational storage temperature specifications
Mar. 2020	First release

Notice

This document is provided for information purposes only and shall not be regarded as a warranty of a certain functionality, condition, or quality of a product. Neither NVIDIA Corporation nor any of its direct or indirect subsidiaries and affiliates (collectively: “NVIDIA”) make any representations or warranties, expressed or implied, as to the accuracy or completeness of the information contained in this document and assumes no responsibility for any errors contained herein. NVIDIA shall have no liability for the consequences or use of such information or for any infringement of patents or other rights of third parties that may result from its use. This document is not a commitment to develop, release, or deliver any Material (defined below), code, or functionality.

NVIDIA reserves the right to make corrections, modifications, enhancements, improvements, and any other changes to this document, at any time without notice. Customer should obtain the latest relevant information before placing orders and should verify that such information is current and complete. NVIDIA products are sold subject to the NVIDIA standard terms and conditions of sale supplied at the time of order acknowledgement, unless otherwise agreed in an individual sales agreement signed by authorized representatives of NVIDIA and customer (“Terms of Sale”). NVIDIA hereby expressly objects to applying any customer general terms and conditions with regards to the purchase of the NVIDIA product referenced in this document. No contractual obligations are formed either directly or indirectly by this document.

NVIDIA products are not designed, authorized, or warranted to be suitable for use in medical, military, aircraft, space, or life support equipment, nor in applications where failure or malfunction of the NVIDIA product can reasonably be expected to result in personal injury, death, or property or environmental damage. NVIDIA accepts no liability for inclusion and/or use of NVIDIA products in such equipment or applications and therefore such inclusion and/or use is at customer’s own risk.

NVIDIA makes no representation or warranty that products based on this document will be suitable for any specified use. Testing of all parameters of each product is not necessarily performed by NVIDIA. It is customer’s sole responsibility to evaluate and determine the applicability of any information contained in this document, ensure the product is suitable and fit for the application planned by customer, and perform the necessary testing for the application in order to avoid a default of the application or the product. Weaknesses in customer’s product designs may affect the quality and reliability of the NVIDIA product and may result in additional or different conditions and/or requirements beyond those contained in this document. NVIDIA accepts no liability related to any default, damage, costs, or problem which may be based on or attributable to: (i) the use of the NVIDIA product in any manner that is contrary to this document or (ii) customer product designs.

No license, either expressed or implied, is granted under any NVIDIA patent right, copyright, or other NVIDIA intellectual property right under this document. Information published by NVIDIA regarding third-party products or services does not constitute a license from NVIDIA to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property rights of the third party, or a license from NVIDIA under the patents or other intellectual property rights of NVIDIA.

Reproduction of information in this document is permissible only if approved in advance by NVIDIA in writing, reproduced without alteration and in full compliance with all applicable export laws and regulations, and accompanied by all associated conditions, limitations, and notices.

THIS DOCUMENT AND ALL NVIDIA DESIGN SPECIFICATIONS, REFERENCE BOARDS, FILES, DRAWINGS, DIAGNOSTICS, LISTS, AND OTHER DOCUMENTS (TOGETHER AND SEPARATELY, “MATERIALS”) ARE BEING PROVIDED “AS IS.” NVIDIA MAKES NO WARRANTIES, EXPRESSED, IMPLIED, STATUTORY, OR OTHERWISE WITH RESPECT TO THE MATERIALS, AND EXPRESSLY DISCLAIMS ALL IMPLIED WARRANTIES OF NONINFRINGEMENT, MERCHANTABILITY, AND FITNESS FOR A PARTICULAR PURPOSE. TO THE EXTENT NOT PROHIBITED BY LAW, IN NO EVENT WILL NVIDIA BE LIABLE FOR ANY DAMAGES, INCLUDING WITHOUT LIMITATION ANY DIRECT,



INDIRECT, SPECIAL, INCIDENTAL, PUNITIVE, OR CONSEQUENTIAL DAMAGES, HOWEVER CAUSED AND REGARDLESS OF THE THEORY OF LIABILITY, ARISING OUT OF ANY USE OF THIS DOCUMENT, EVEN IF NVIDIA HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. Notwithstanding any damages that customer might incur for any reason whatsoever, NVIDIA's aggregate and cumulative liability towards customer for the products described herein shall be limited in accordance with the Terms of Sale for the product.

Trademarks

NVIDIA, the NVIDIA logo, and Mellanox are trademarks and/or registered trademarks of NVIDIA Corporation and/or Mellanox Technologies Ltd. in the U.S. and in other countries. Other company and product names may be trademarks of the respective companies with which they are associated.

Copyright

© 2023 NVIDIA Corporation & affiliates. All Rights Reserved.

