BCM957454A4540C

Single-Port 1/10/25/40/50/100 Gb/s Ethernet PCI Express Gen3 x16 Network Interface Card

Overview

The Broadcom® BCM957454A4540C is a single-port 1/10/25/40/50/100 Gb/s adapter that supports both QSFP28/QSFP+ optical modules and copper direct-attach cable. The card uses the Broadcom BCM57454 100 Gb/s Ethernet LAN controller targeted at Public, Private Cloud, and specifically, Big Data, and Multitenant applications. The BCM57454 supports single-port 1/10/25/40/50/100 Gb/s, Dual-Port 1/10/25/50 Gb/s, and Quad-Port 1/10/25 Gb/s Ethernet speeds. The device includes a FalconCore, providing a 4-lane Multi- Rate SerDes (MRS) transceiver. It is focused on providing high performance, low latency, and value-added features for end-to-end solutions using Broadcom switches and controllers.

Features

- Single-port pluggable media interface, which may be equipped with 100 Gb/s or 40 Gb/s QSFP28/QSFP+ optical transceiver or with copper direct-attach cable.
- Fully compliant with the SFF-8665 standard.
- 16-lane PCI Express host interface that is designed to operate to the PCI Express v3.0 specifications.
- SR-IOV with up to 1K virtual functions (VFs).
- Function-Level Reset (FLR) support.
- TruFlow™ flow processing engine.
- Virtual Network Termination-VXLAN, NVGRE, Geneve, GRE encap/decap.
- vSwitch acceleration.
- Tunnel-aware stateless offloads.
- OCB support: PFC, ETS, QCN, DCBx.
- TruManage™ integrated BMC.
- Network Controller Sideband Interface (NC-SI).
- SMBus 2.0.
- MCTP over SMBus.
- PCIe-based UART.
- Jumbo frames up to 9600 bytes.
- Advanced Congestion Avoidance.
- Multiqueue, NetQueue, and VMQ.
- IPv4 and IPv6 offloads.

- TCP, UDP, and IP checksum offloads
- Large Send Offload (LSO)
- Large Receive Offload (LRO)
- TCP Segmentation Offload (TSO)
- Receive-side Scaling (RSS)
- Transmit-side Scaling (TSS)
- VLAN insertion/removal
- Interrupt coalescing
- Network boot – PXE, UEFI
- iSCSI boot
- Wake-on-LAN (WOL)
- MSI and MSI.X
- Conforms to the PCI Express Card Electromechanical Specification Rev. 3.0.

Figure 1: BCM957454A4540C Network Interface Card
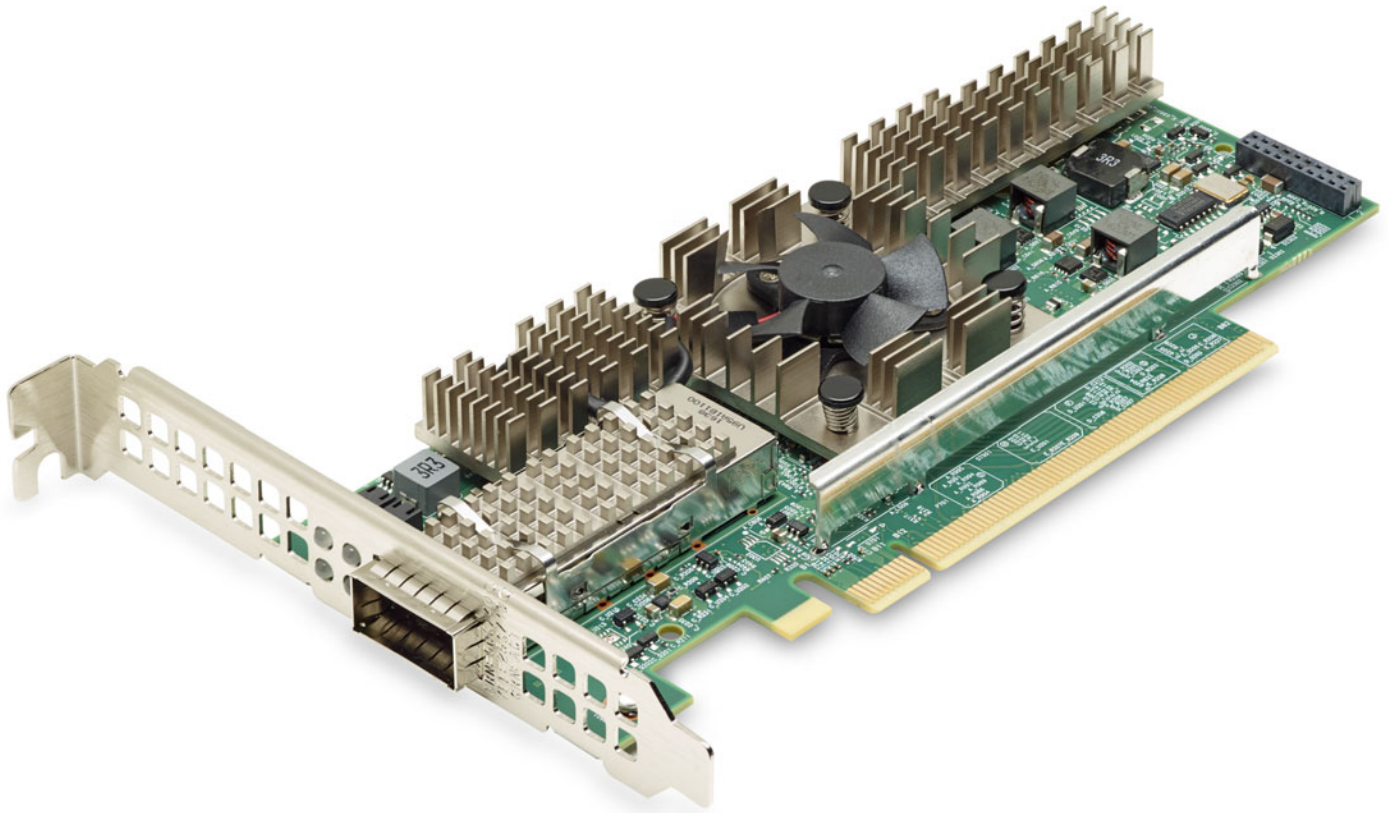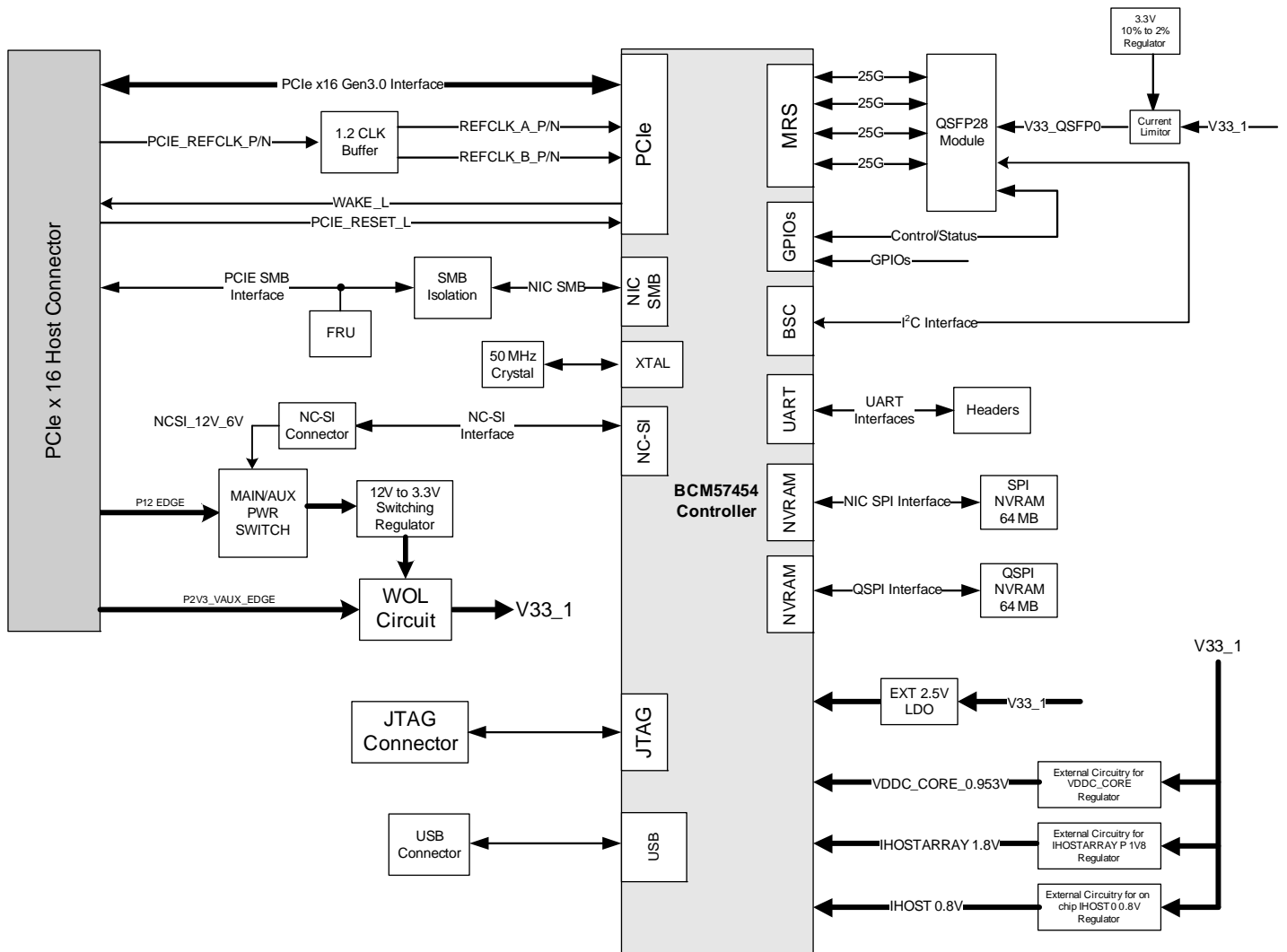
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Chapter 1: Functional Description

This section provides the functional description of the BCM957454A4540C network interface card.

1.1 Block Diagram

Figure 1 shows the main functional blocks on the BCM957454A4540C Network Interface Card.

Figure 1: Block Diagram

1.2 Host Interface Connector

The BCM957454A4540C NIC is a PCI Express Gen3 x16 add-in card with standard height bracket. The card edge connector complies with the PCI Express Gen3 x16 standard pinout for add-in cards outlined in the PCI Express Electromechanical Specification v3.0 section 6.1, table 6-1.

The PCI Express interface is Gen3 compliant.

NOTE: Refer to section 6 of the PCI Express Electromechanical Specification v3.0 for additional details on the card edge connector pinout, and to section 9 for add-in card mechanical information.

1.2.1 BCM57454

The BCM57454 Ethernet Controller supports single-port 1/10/25/40/50/100 Gb/s, dual-port 1/10/25/50 Gb/s, and quad-port 1/10/25 Gb/s Ethernet speeds to the line side and x16 PCI Express v3.0 interface to the system host.

1.2.2 Clock Requirements

The BCM57454 Ethernet controller has an integrated differential oscillator circuit that operates from an external 50 MHz crystal.

1.2.3 Internal Clocks

The BCM57454 has an integrated differential oscillator circuit that operates from an external 50 MHz crystal. The 50 MHz clock source is used to generate the clock frequencies for the device internal circuitries.

1.2.4 NC-SI Interface

The BCM57454 Ethernet Controller supports the NC-SI specification, version 1.1.0. The NC-SI provides a standardized interface between the system BMC and the integrated NC-SI module of the BCM57454.

1.2.5 SMBus Interface

The BCM57454 device supports two SMBus interfaces, which are compliant with the SMBus specification version 2.0. Both master and slave operations are supported, and the configurable slave SMBus address is stored in NVRAM. The BCM57454 SMBus supports a Management Component Transport Protocol (MCTP) payload, since it supports block write transactions with up to 64-byte MCTP packet payload and a total packet size of 73 bytes, including the SMBus packet header, MCTP packet header, MCTP packet payload, and PEC.

1.3 UART Interface

The BCM57454 Ethernet Controller has two integrated UART interfaces, one for Port0 and another for Port1, that support external access to its registers. The UART signals are brought out to the 4-pin header for connecting a remote access host. The UART debug connector is placed near the I/O connector to be accessible from outside, for ease of in-system debug.

Table 1: UART Connector Pinout

Pin	Signal
1	UART_TXD
2	UART_RXD
3	V33
4	GND

Figure 2: UART Debug Connector

UART headers are J301 for Port0 and J302 for Port1 (located on the reverse side)
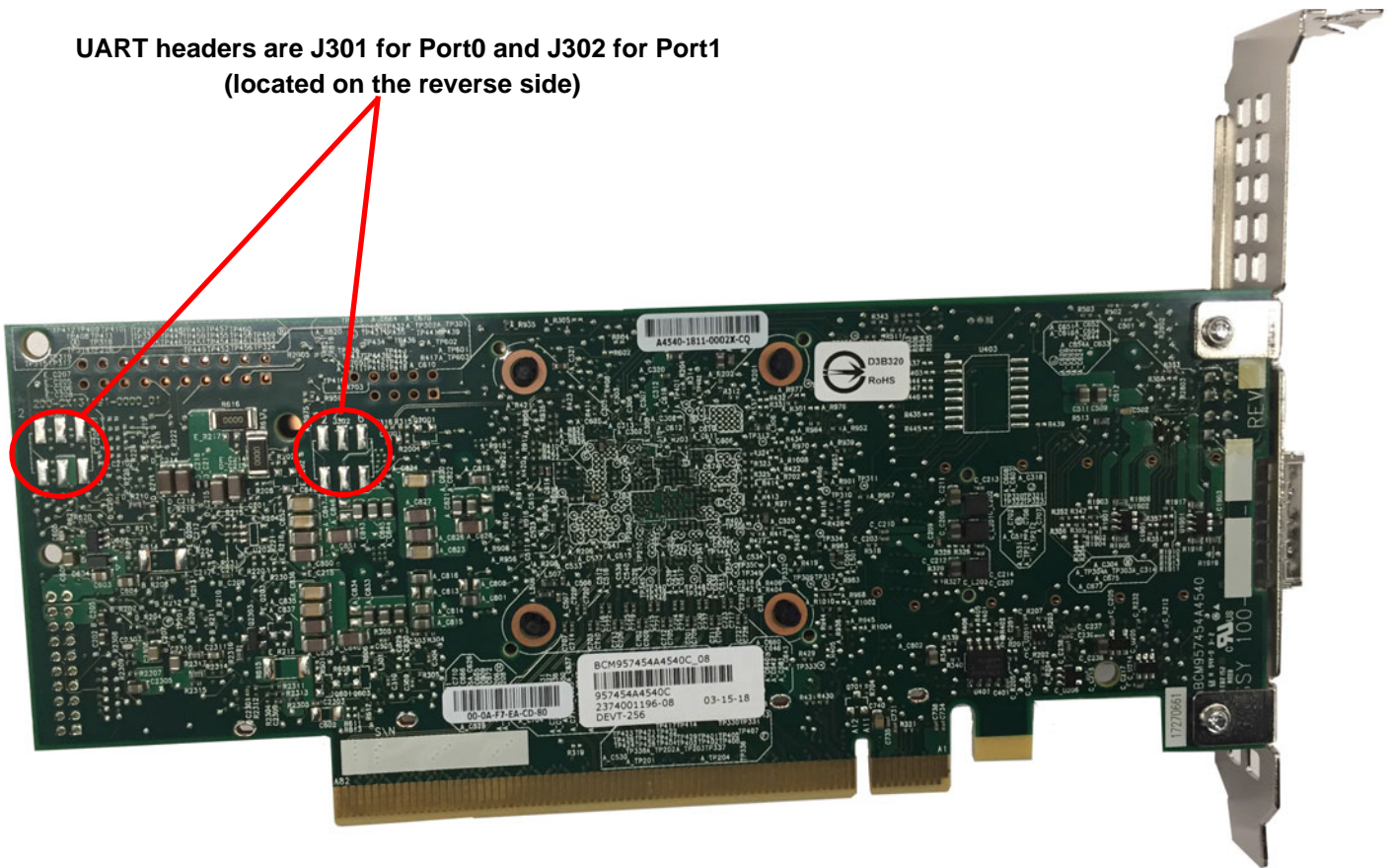
1.4 Nonvolatile RAM

The BCM57454 Ethernet Controller requires a nonvolatile serial Flash memory (NVRAM) to store the device firmware, PCI Configuration space settings (for example, Device ID, Vendor ID), MAC address, and so on. After power-up, the firmware is downloaded into the device memory and executed by the on-chip processor.

1.5 Heat Sink

The active heat sink is attached to the Ethernet Controller using four spring-loaded push pins that insert into four mounting holes.

To prevent damage to the BCM57454 Ethernet Controller in the event of a missing heat sink, the Network Interface Card is not allowed to power up.

1.6 DC/DC Regulators

The on-board voltage regulators use the 12V edge main power from the host interface connector to derive the necessary power rails for different circuits and components on the board.

1.7 Power Supplies

All power is derived from the PCI Express Host Interface Connector 12V supply pins. These voltage supply pins feed on-board regulators that provide the necessary power to the various components on the card. The NIC has switching regulators, which power the card's various power supplies. The 3.3V power (+3.3V) and 3.3V auxiliary power (3.3Vaux) from the PCIe edge connector are also used to supply the power control logic.

1.8 LED Functions and Locations

The QSFP28 port supports two LEDs to indicate traffic activities and link speed. The LEDs are visible through the cutout on the bracket, as shown in Figure 3. The LED functionality is described in Table 2.

Figure 3: Activity and Link LED Locations

Port 1 Activity LED ——————⟶ ⟵—————— Port 1 Link LED
Port 0 Activity LED ——————⟶ ⟵—————— Port 0 Link LED

QSFP28 cage ——————⟶
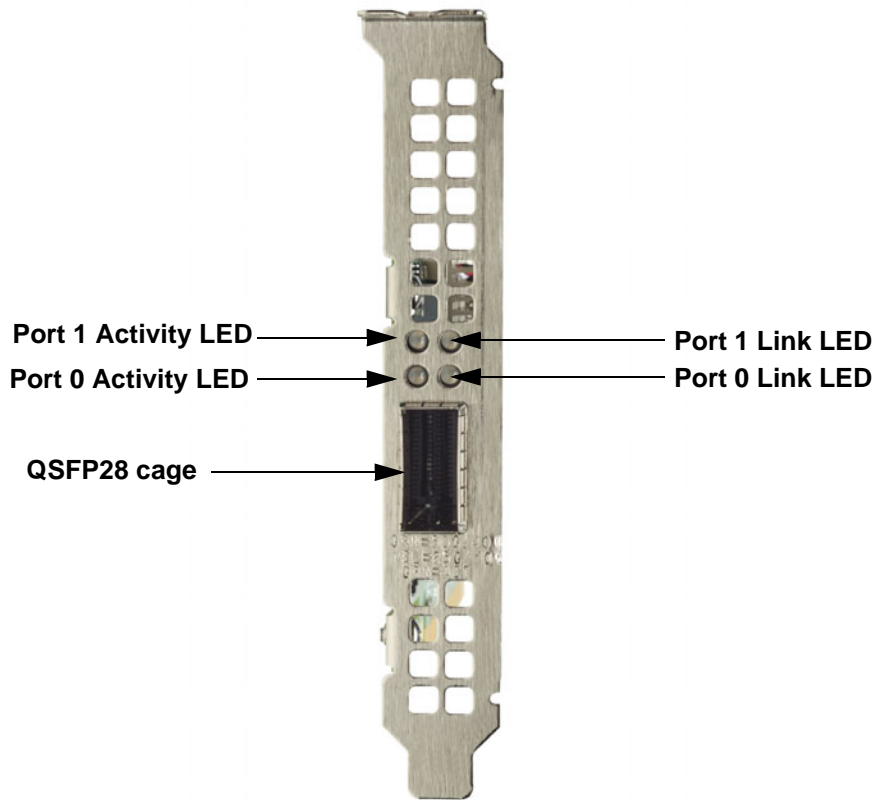
Table 2: LED Functions

NVRAM Manufacturer	Device	Mbit
Activity	Off	No Activity
	Green blinking	Traffic Flowing Activity
Link	Off	No Link
	Green	Linked at 100 Gb/s, 50 Gb/s, or 40 Gb/s
	Yellow	Linked at 25 Gb/s or 10 Gb/s

Chapter 2: Regulatory and Safety Approvals

The following sections detail the regulatory, safety, electromagnetic compatibility (EMC), and electrostatic discharge (ESD) standard compliance for the BCM957454A4540C Network Interface Card.

2.1 Regulatory

Table 3: Regulatory Approvals

Item	Applicable Standard	Approval (A)/Certificate (C)
CE/European Union	EN 62368-1:2014	CB report and certificate
UL/USA	IEC 62368-1 (ed. 2)	CB report and certificate

2.2 Safety

Table 4: Safety Approvals

Country	Certification Type/Standard	Compliance
International	CB Scheme ICES 003 – Digital Device UL 1977 (connector safety) UL 796 (PCB wiring safety) UL 94 (flammability of parts)	Yes

2.3 Electromagnetic Compatibility (EMC)

Table 5: Electromagnetic Compatibility

Standard/Country	Certification Type	Compliance
CE/EU	EN 55032:2012/AC:2013 Class A EN 55024:2010 EN 61000-3-2:2014 EN 61000-3-3:2013	CE report and CE DoC
FCC/USA	CFR47 Part 15 Subpart B Class A	FCC/IC DoC and EMC report referencing FCC and IC standards
IC/Canada	ICES-003 Class A	FCC/IC DoC and report referencing FCC and IC standards
ACA/Australia, New Zealand	AS/NZS CISPR 32:2015	ACA certificate RCM mark
BSM/Taiwan	CNS 13438 (2006) Class A	BSMI certificate
BSMI/Taiwan	CNS 15663	BSMI certificate/RoHS table
MSIP/S. Korea	KN32 Class A KN35	Korea certificate R mark
VCCI/Japan	VCCI-CISPR 32:2016	Copy of VCCI online certificate

2.3.1 Electrostatic Discharge (ESD) Compliance

Table 6: ESD Compliance Summary

Standard	Certification Type	Compliance
EN 55024:2010 (EN 61000-4-2)	Air/Direct discharge	Yes

2.4 FCC Statement

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Consult the dealer or an experienced radio/TV technician for help.

NOTE: Changes or modifications not expressly approved by the manufacture responsible for compliance could void the user's authority to operate the equipment.

Chapter 3: Physical and Electrical Specifications

This section outlines the mechanicals of the BCM957454A4540C network interface card as well as the Environmental
Specifications.

3.1 Board Physical Dimensions

The BCM957454A4540C board dimensions are shown in Figure 4. All dimensions are in inches with tolerances within
±0.0005.

Figure 4: Board Physical Dimensions

3.2 Bracket Outlines and Dimensions

The BCM957454A4540C supports a standard-profile bracket.

Standard-profile bracket outline and physical dimensions are shown in Figure 5.

Figure 5: Standard-Profile Bracket Outline and Dimensions
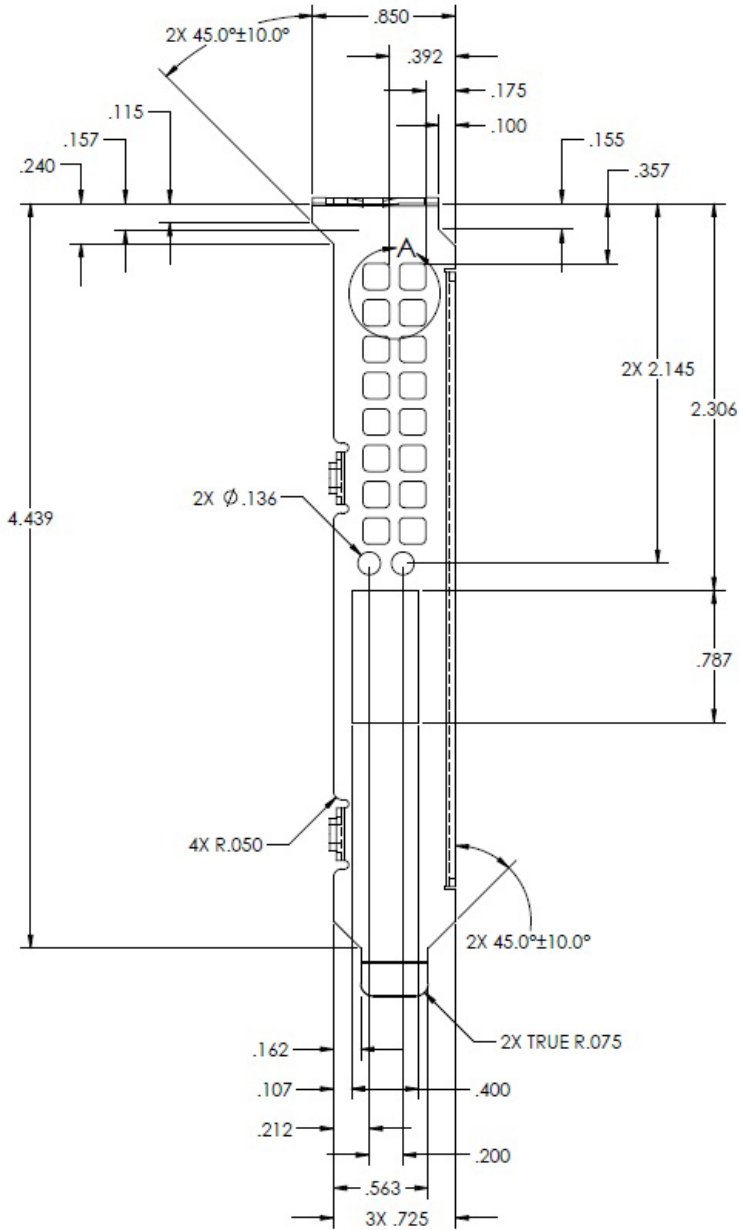
3.3 Environment Specifications

Table 7: Environment Specifications

Parameter	Condition
Storage Temperature	–40°C to +65°C
Storage Humidity	5% to 95% non-condensing
Vibration and Shock	IEC78-2-(*) and IEC721-3-(*)

3.4 MAC Address Label

In the example shown in Figure 6, BCM957454A4540C is the part number with 1D bar code and 00-0A-F7-EA-CD-80 is the MAC address of the NIC.

Figure 6: Part number and MAC address

Chapter 4: Ordering Information

Part Number	Description
BCM957454A4540C	Single-Port 100 Gb/s QSFP28/QSFP+ Ethernet PCI Express Gen3 x16 Network Interface Card; RoHS-compliant

Appendix A: Acronyms and Abbreviations

For a more complete list of acronyms and other terms used by Broadcom documents, go to: http://www.broadcom.com/press/glossary.php.

Table 8: Acronyms and Abbreviations

Term	Description
BMC	Baseboard Management Controller
EMC	Electromagnetic Compatibility
ESD	Electrostatic Discharge
FLR	Function-Level Reset
LED	Light Emitting Diode
LRO	Large Receive Offload
LSO	Large Send Offload
NC-SI	Network Controller Sideband Interface
NVRAM	Non-volatile serial flash memory
OCP	Open Compute Project
RSS	Receive-side Scaling
TSO	TCP Segmentation Offload
TSS	Transmit-side Scaling
UART	Universal Asynchronous Receiver/Transmitter
WOL	Wake-on-LAN

Revision History

957454A4540C-DS102; March 29, 2018

Updated:

- Board Physical Dimensions
- MAC Address Label

957454A4540C-DS101; December 27, 2017

Updated:

- Regulatory and Safety Approvals

957454A4540-DS100; October 6, 2017

Initial release.

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