BROADCOM®

BCM957416M4163C

## Dual-Port 10GBASE-T Ethernet PCI Express 3.0 x8 OCP Mezzanine Card

General Description

The Broadcom® BCM957416M4163C is a dual-port 10GBASE-T PCI Express 3.0 x8 Mezzanine Card designed to the Open Compute Project (OCP) that supports a dual-port 10GBASE-T media interface that is fully compliant with the IEEE 802.3an standard. The adapter is designed to the OCP Mezzanine v2.0 specification as a Type 1 adapter, with the board outline adhering to a form factor called out in v0.5 of the specification. The adapter uses the Broadcom BCM57416 Ethernet controller with an integrated dual-channel 10GBASE-T transceiver.

Features

- Dual-port 10-Gigabit Ethernet:
  - 10GBASE-T IEEE 802.3an
  - 1000BASE-T IEEE 802.3ab
- x8 PCI Express 3.0 compliant.
- RDMA over Converged Ethernet (RoCE).
- SR-IOV with up to 128 virtual functions (VFs).
- Function-Level Reset (FLR) support.
- TruFlow™ flow processing engine.
- Virtual Network Termination—XVXLAN, NVGRE, Geneve, GRE encap/decap.
- Switch acceleration.
- MCTP over SMBus.
- PCIe-based UART and KCS.
- Jumbo frames up to 9 KB.
- 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 OCP Mezzanine Card Design Specification v2.0 Type 1.

Applications

Dual-port 10GBASE-T Ethernet adapter for Open Compute Platform systems.

Figure 1: BCM957416M4163C OCP Mezzanine Card
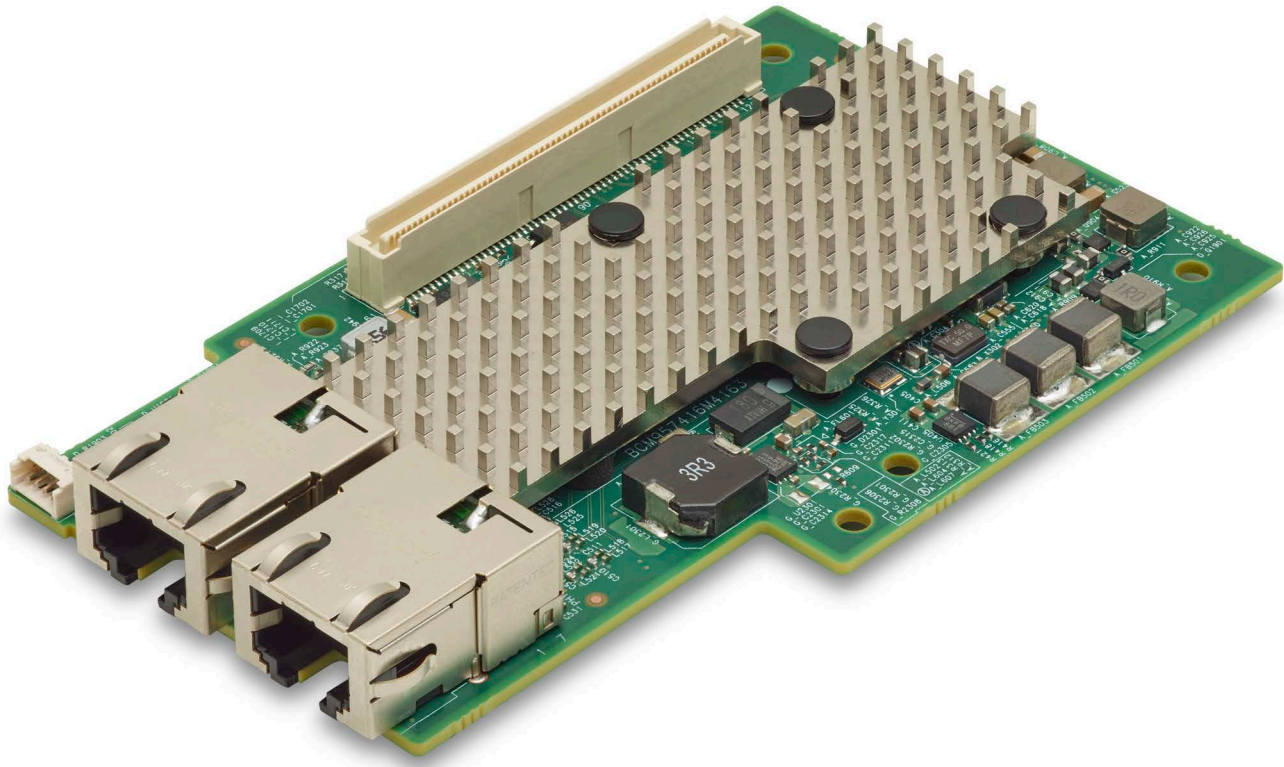
NOTE: The surface markings of the component may not reflect the product received. Broadcom reserves the right to change any component on the printed circuit board with the same functionality.
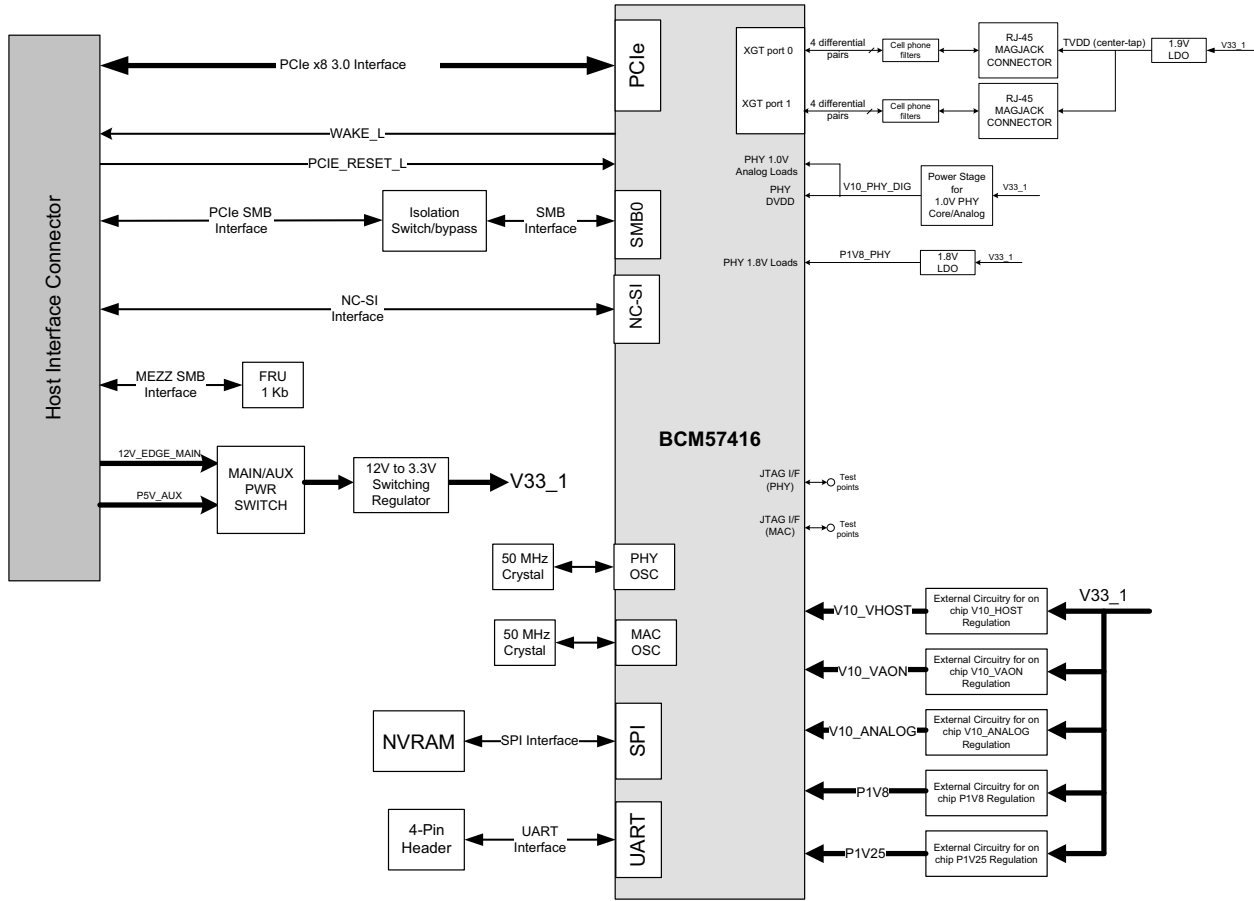
Table of Contents

1 Functional Description

This section provides the functional description of the BCM957416M4163C mezzanine card.

1.1 Block Diagram

Figure 2 shows the main functional blocks on the BCM957416M4163C mezzanine card.

Figure 2: BCM957416M4163C Block Diagram

1.2 Host Interface Connector

The BCM957416M4163C OCP Mezzanine Card interfaces with the system baseboard via a vertical-stacked card-to-card connector, FCI/61083-124402LF. The PCIe bus, NC-SI bus, SMBus interface, various other sideband signals, and power are assigned to this connector. The connector pinout complies with that of Connector A, as described in the OCP Mezzanine Card 2.0 Design Specification. Table 1 shows the signal pinout. Definitions of the signals at this connector are provided in the OCP Mezzanine Card Specification.

Table 1: Host Interface Connector Signal Pinout

Pin	Signal	Pin	Signal	Pin	Signal	Pin	Signal
A1	MEZZ_PRSNTA1_N/ BASEBOARD_A_ID	A34	MEZZ_RX_DP<1>	A69	P3V3	A101	MEZZ_TX_DN_C<3>
A2	P5V_AUX	A35	MEZZ_RX_DN<1>	A70	P3V3	A102	GND
A3	P5V_AUX	A36	GND	A71	P3V3	A103	GND
A4	P5V_AUX	A37	GND	A72	P3V3	A104	MEZZ_TX_DP_C<4>
A5	GND	A38	MEZZ_RX_DP<2>	A73	GND	A105	MEZZ_TX_DN_C<4>
A6	GND	A39	MEZZ_RX_DN<2>	A74	LAN_3V3STB_ALERT_N	A106	GND
A7	P3V3_AUX	A40	GND	A75	SMB_LAN_3V3STB_CLK	A107	GND
A8	GND	A41	GND	A76	SMB_LAN_3V3STB_DAT	A108	MEZZ_TX_DP_C<5>
A9	GND	A42	MEZZ_RX_DP<3>	A77	PCIE_WAKE_N	A109	MEZZ_TX_DN_C<5>
A10	P3V3	A43	MEZZ_RX_DN<3>	A78	NCSI_RXER	A110	GND
A11	P3V3	A44	GND	A79	GND	A111	GND
A12	P3V3	A45	GND	A80	NCSI_TXD0	A112	MEZZ_TX_DP_C<6>
A13	P3V3	A46	MEZZ_RX_DP<4>	A81	NCSI_TXD1	A113	MEZZ_TX_DN_C<6>
A14	NCSI_RCSDV	A47	MEZZ_RX_DN<4>	A82	GND	A114	GND
A15	NCSI_RCLK	A48	GND	A83	GND	A115	GND
A16	NCSI_TXEN	A49	GND	A84	CLK_100M_MEZZ0_DP	A116	MEZZ_TX_DP_C<7>
A17	PERST_N0	A50	MEZZ_RX_DP<5>	A85	CLK_100M_MEZZ0_DN	A117	MEZZ_TX_DN_C<7>
A18	MEZZ_SMCLK	A51	MEZZ_RX_DN<5>	A86	GND	A118	GND
A19	MEZZ_SMDATA	A52	GND	A87	GND	A119	GND
A20	GND	A53	GND	A88	MEZZ_TX_DP_C<0>	A120	MEZZ_PRSNTA2_N
A21	GND	A54	MEZZ_RX_DP<6>	A89	MEZZ_TX_DN_C<0>		
A22	NCSI_RXD0	A55	MEZZ_RX_DN<6>	A90	GND		
A23	NCSI_RXD1	A56	GND	A91	GND		
A24	GND	A57	GND	A92	MEZZ_TX_DP_C<1>		
A25	GND	A58	MEZZ_RX_DP<7>	A93	MEZZ_TX_DN_C<1>		
A26	CLK_100M_MEZZ1_DP	A59	MEZZ_RX_DN<7>	A94	GND		
A27	CLK_100M_MEZZ1_DN	A60	GND	A95	GND		
A28	GND	A61	P12V_AUX/P12V	A96	MEZZ_TX_DP_C<2>		
A29	GND	A62	P12V_AUX/P12V	A97	MEZZ_TX_DN_C<2>		
A30	MEZZ_RX_DP<0>	A63	P12V_AUX/P12V	A98	GND		
A31	MEZZ_RX_DN<0>	A64	GND	A99	GND		
A32	GND	A65	GND	A100	MEZZ_TX_DP_C<3>		
A33	GND	A66	P3V3_AUX				
		A67	GND				
		A68	GND				

1.3 BCM57416 Ethernet Controller

The BCM57416 Ethernet Controller is configured as a dual-port 10 Gb/s MAC with integrated 10GBASE-T Ethernet transceiver to the line side and x8 PCI Express 3.0 interface to the system host.

1.4 Internal Clock

The BCM57416 has an integrated differential oscillator circuit that operates from an external 50 MHz crystal.

1.5 PCI Express Interface

PCIe is a high-bandwidth serial bus providing a low pin-count interface as an alternative to parallel PCI. It is part of the Host Interface Connector. The BCM57416 complies with the PCI Express Base Specification Revision 3.0, and supports an 8-lane PCIe 3.0 interface via the host interface connector.

1.6 NC-SI Interface

The BCM57416 Ethernet Controller supports the Network Controller Sideband Interface (NC-SI) Specification version 1.1.0. The NCSI provides a standardized interface between the system Baseboard Management Controller (BMC) and the integrated NCSI module of the BCM57416.

1.7 SMBus Interface

The BCM57416 Ethernet Controller SMB0 interface supports serial communications between BCM57416 and the system. The interface allows the Ethernet Controller to act as a SMBus primary or a secondary device.

1.8 UART Interface

The BCM57416 Ethernet Controller has an integrated UART interface that supports 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 2: UART Connector Pinout

Pin	Signal
1	UART_TXD
2	UART_RXD
3	V33
4	GND

Figure 3: UART Debug Connector
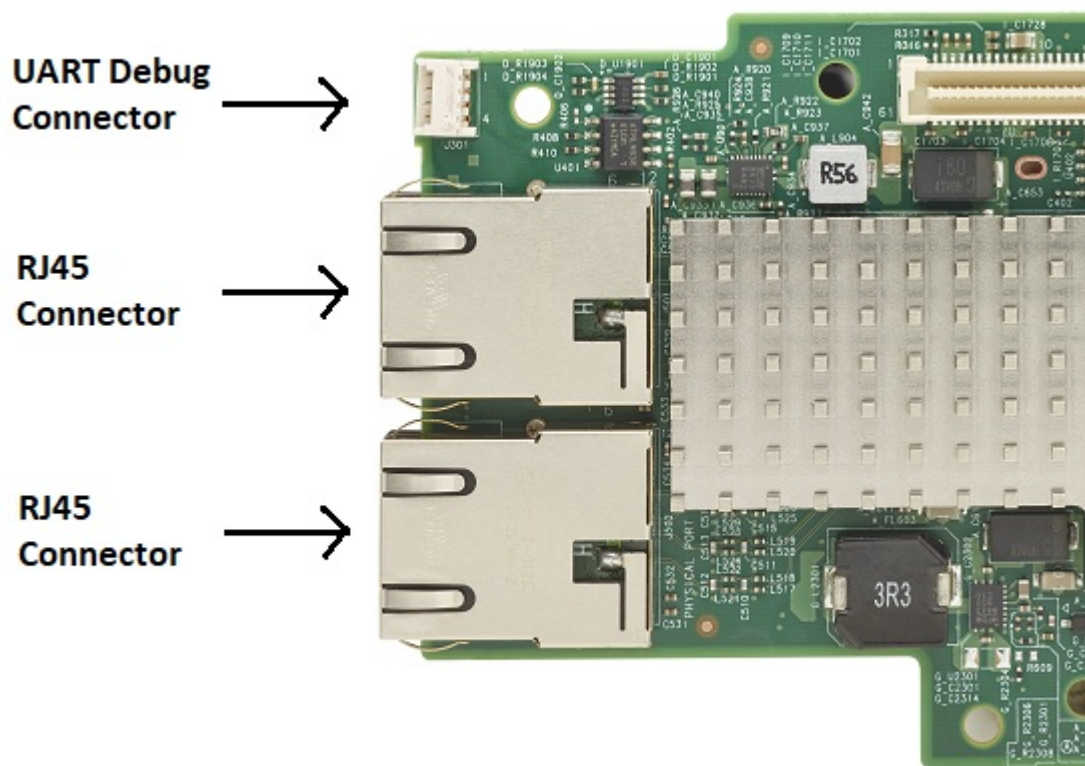
1.9 Nonvolatile RAM

The BCM57416 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.

1.10 Heat Sink

The passive 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 BCM57416 Ethernet Controller in the event of a missing heat sink, the mezzanine card is not allowed to power up.

1.11 DC/DC Regulators

The onboard 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.

1.12 Power Supplies

All power is derived from the Mezzanine Card Host Interface Connector 12V/5V supply pins. These voltage supply pins feed on-board regulators that provide the necessary power to the various components on the card. The mezzanine card has six switching power supplies that power the card's various +1.0V, +1.25V, +1.8V, and +3.3V loads.

1.13 LED Functions and Locations

The 10GBASE-T port supports two LEDs to indicate traffic activities and link speed. The LEDs are visible on the bottom side, as shown in Figure 4. The LEDs' locations and form factors conform to the OCP Mezzanine Card Specification.
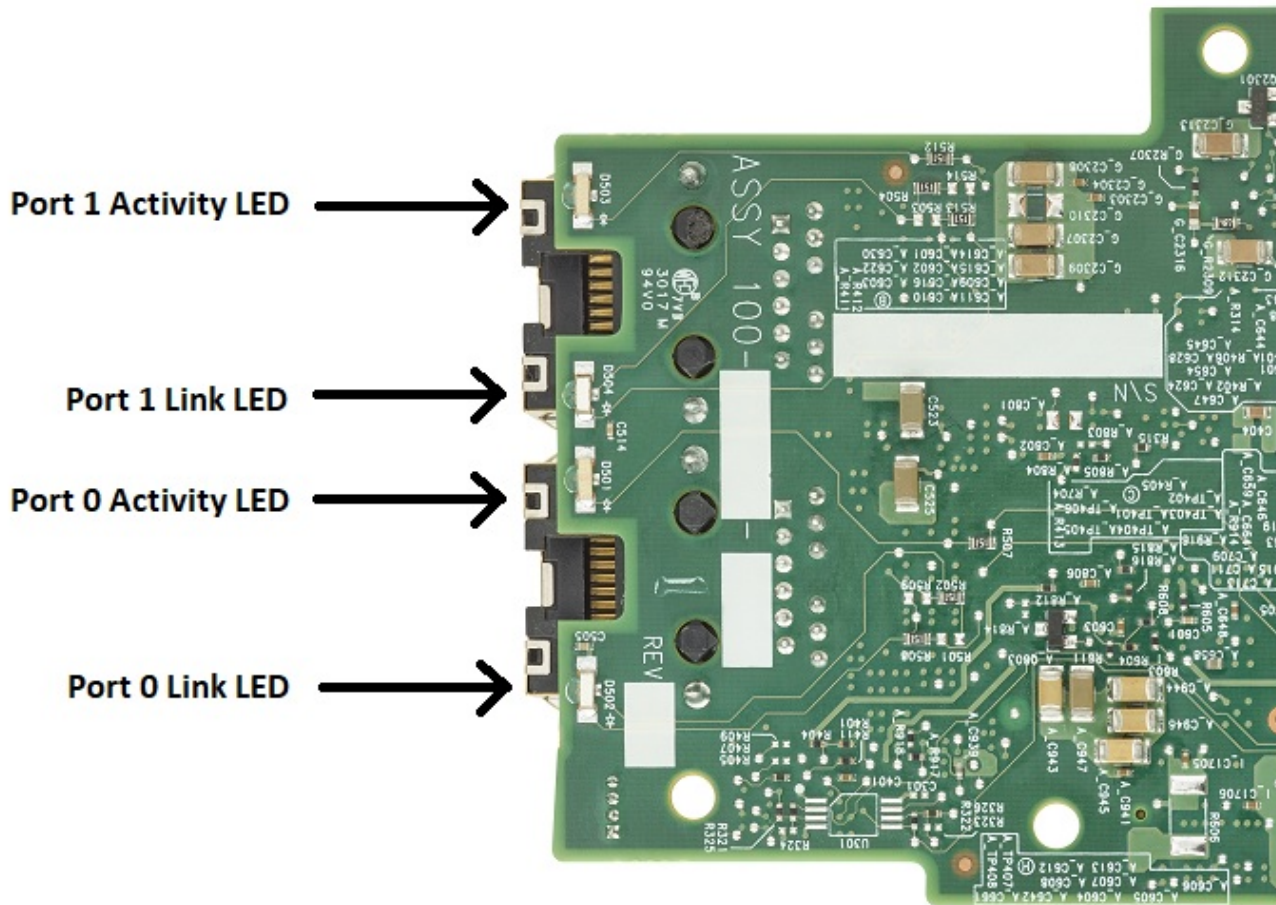
Figure 4: Activity and Link LED Locations

Table 3: LED Functions

LED Type	Color/Behavior	Note
Activity	Off	No Activity
	Green	Traffic Flowing Activity
Link	Off	No Link
	Green	Linked at 10 Gb/s
	Yellow	Linked at 1 Gb/s

2 Regulatory and Safety Approvals

The following sections detail the Regulatory, Safety, Electromagnetic Compatibility (EMC), and Electrostatic Discharge (ESD) standard compliance for the BCM957416M4163C mezzanine card.

2.1 Regulatory

Table 4: 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 5: 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 6: 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	RRL KN22 Class A KN24	Korea certificate MSIP mark
VCCI/Japan	VCCI-CISPR 32:2016	Copy of VCCI online certificate

2.4 Electrostatic Discharge (ESD) Compliance

Table 7: ESD Compliance Summary

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

2.5 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.

3 Physical and Electrical Specifications

This section outlines the mechanicals of the BCM957416M4163C mezzanine card as well as the Environmental Specifications.

3.1 Board Physical Dimensions

The BCM957416M4163C board dimensions are shown in Figure 5. The dimensions are in inches with a tolerance of ±0.005 inches.

Figure 5: Board Physical Dimensions

COMPONENT SIDE SHOWN
DRILL-THRU
(SHOWN IN INCHES)
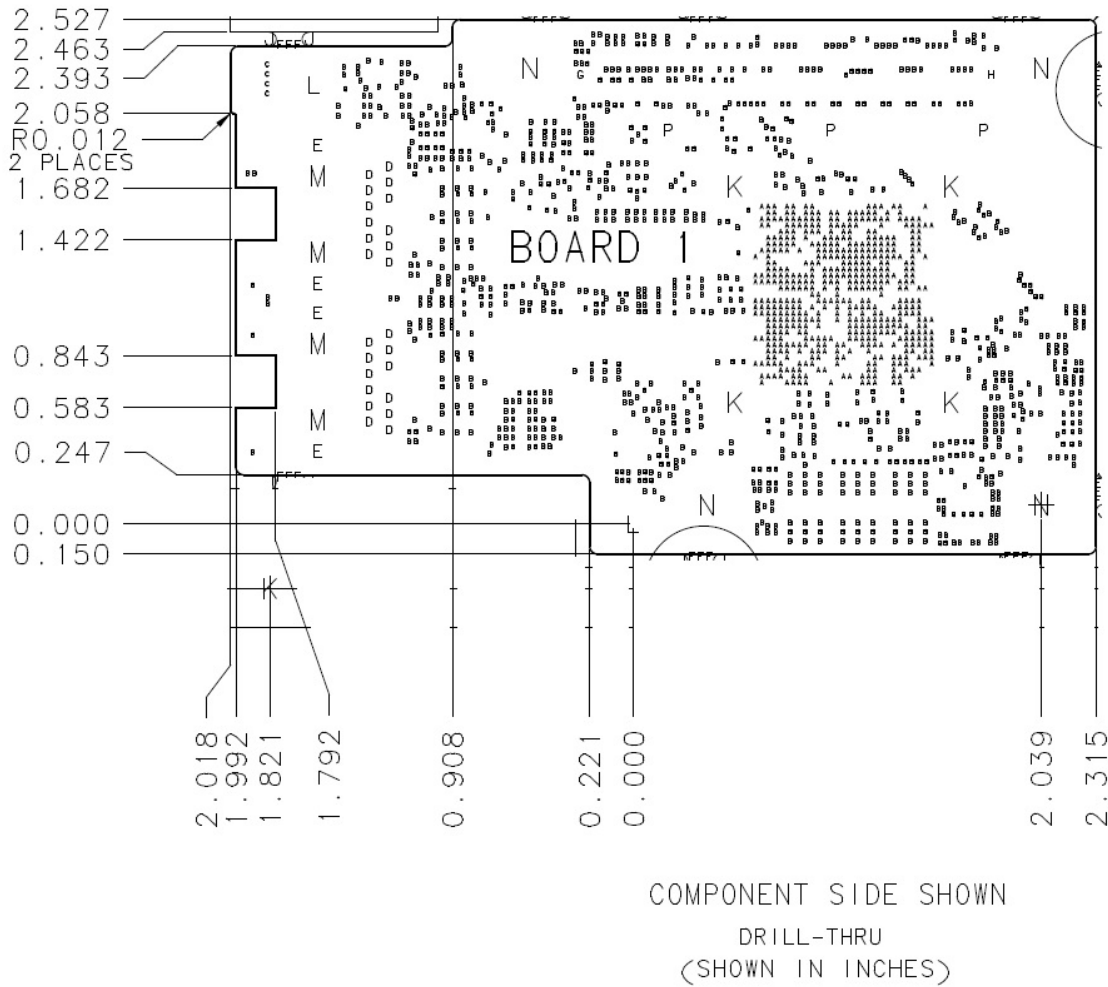
3.2 Environment Specifications

The mezzanine card meets the same environmental requirements specified in the OCP systems.

Table 8: Environment Specifications

Parameter	Condition
Storage Temperature	–40°C to +70°C
Storage Humidity	5% to 95% non-condensing
Vibration and Shock	IEC78-2-(*) and IEC721-3-(*)

3.3 Label Information

This section provides the label information of the BCM957416M4163C OCP Mezzanine Card. Figure 6 outlines the label and corresponding locations.

NOTE: Figure 6 is used for label locations only.

Figure 6: Labels Overview
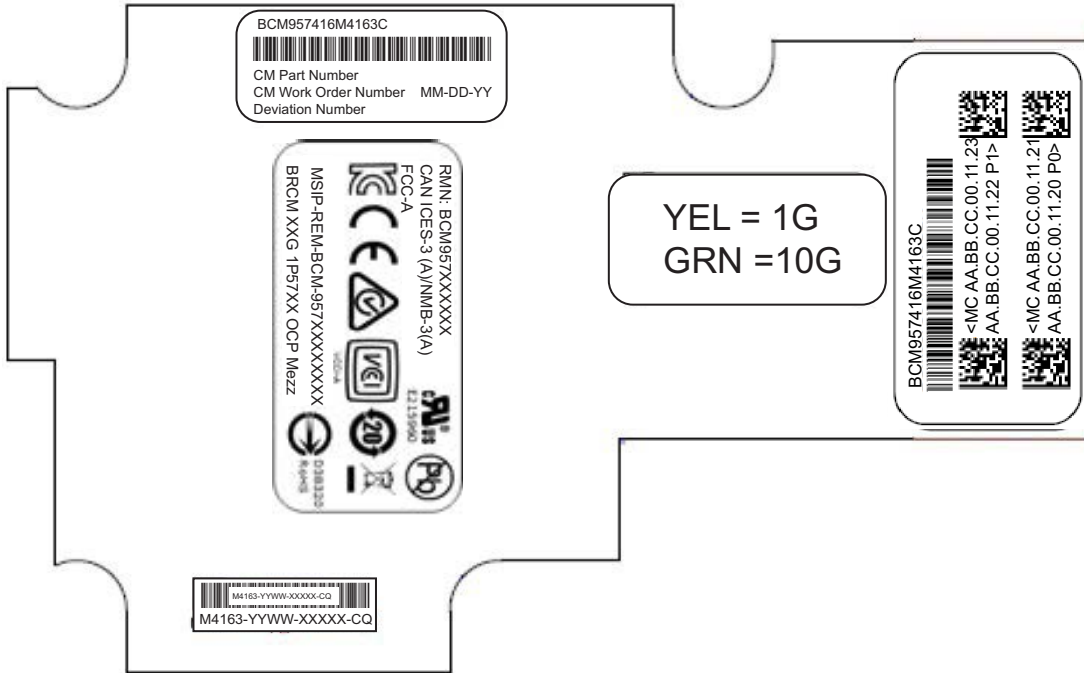
3.3.1 MAC Address Label

In the example shown in Figure 7, BCM957416M4163C is the Part Number with 1D bar code, AA-BB-CC-00-11-20 is the MAC address of the data network interface with 2D bar code for Port 0, and AA-BB-CC-00-11-21 is the MAC address of the management network interface with 2D bar code for Port 0. AA-BB-CC-00-11-22 is the MAC address of the data network interface with 2D bar code for Port 1, and AA-BB-CC-00-11-23 is the MAC address of the management network interface with 2D bar code for Port 1.

Figure 7: MAC Address Label
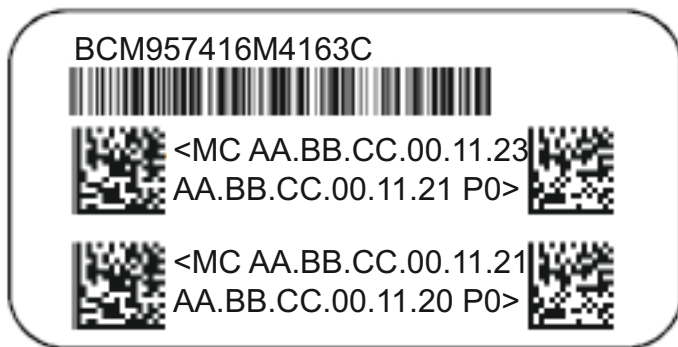
4 Ordering Information

Table 9: Ordering Information

Part Number	Description
BCM957416M4163C	Dual-Port 10GBASE-T Ethernet PCI Express 3.0 x8 OCP Mezzanine Card; Halogen-Free

Revision History

957416M4163C-103; March 25, 2022

Updated:

- SMBus Interface – Updated section.

957416M4163C-102; October 30, 2018

Updated:

- Table 6, Labels Overview

957416M4163C-101; December 26, 2017

Updated:

- Regulatory and Safety Approvals

957416M4163C-100; September 14, 2017

Initial release.

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