BROADCOM®

BCM957454M4540C

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

GENERAL DESCRIPTION

The Broadcom® BCM957454M4540C is a single-port 1/10/25/40/50/100 Gb/s adapter designed to the Open Compute Project (OCP) mezzanine card specification with a QSFP28 network connector. The adapter is designed to the OCP Mezzanine v2.0 specification as a Type 1 adapter with the board outline adhering to the original v0.5 dimensions. The adapter supports both QSFP28/QSFP+ optical modules and copper direct-attach cables.

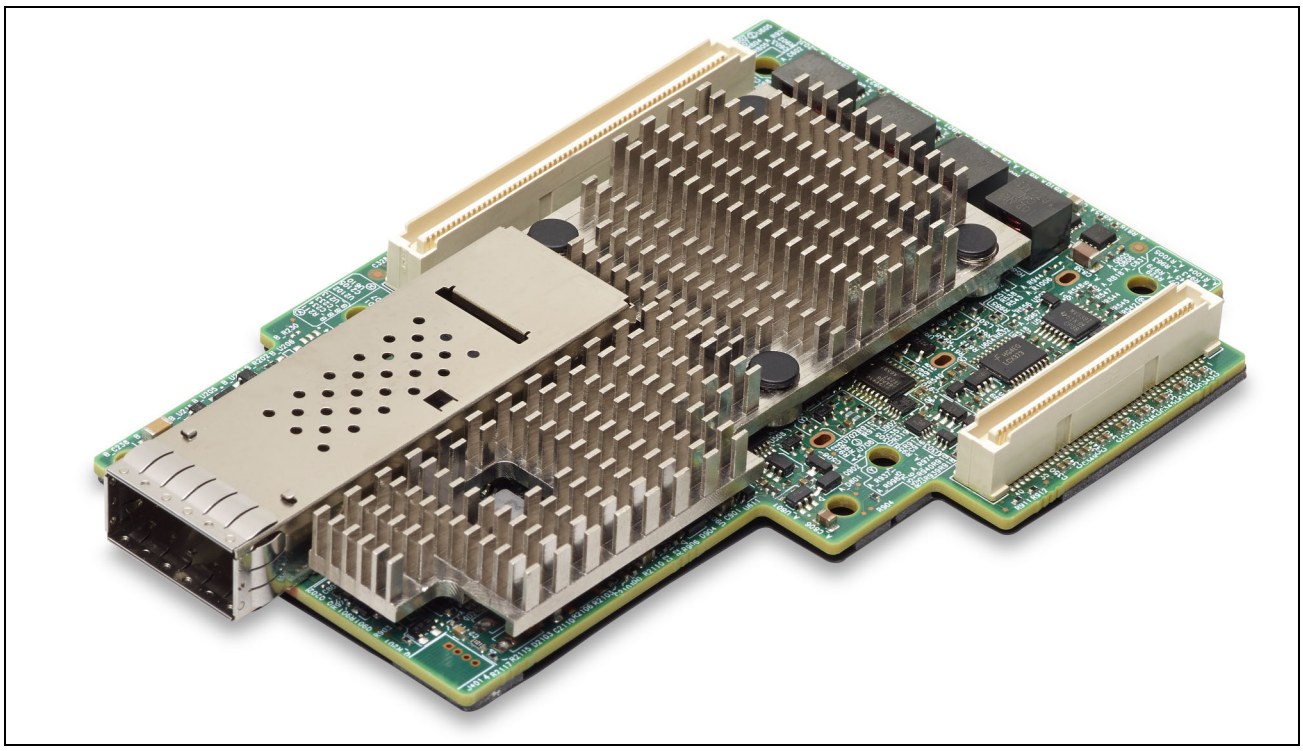
FEATURES

- 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. Support for up to four external hosts (for example, it has four PCIe endpoints) multiplexed through the Multi-Host Bridge (MHB).
- 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.
- DCB support: PFC, ETS, QCN, DCBx.
- TruManage™ integrated BMC.
- Network Controller Sideband Interface (NC-SI).
- SMBus 2.0.

FEATURES

- 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
- Single-port 1/10/25/40/50/100-Gigabit Ethernet adapter for Open Compute Platform systems

Figure 1: BCM957454M4540C OCP Mezzanine Card



For a comprehensive list of changes to this document, see the Revision History.

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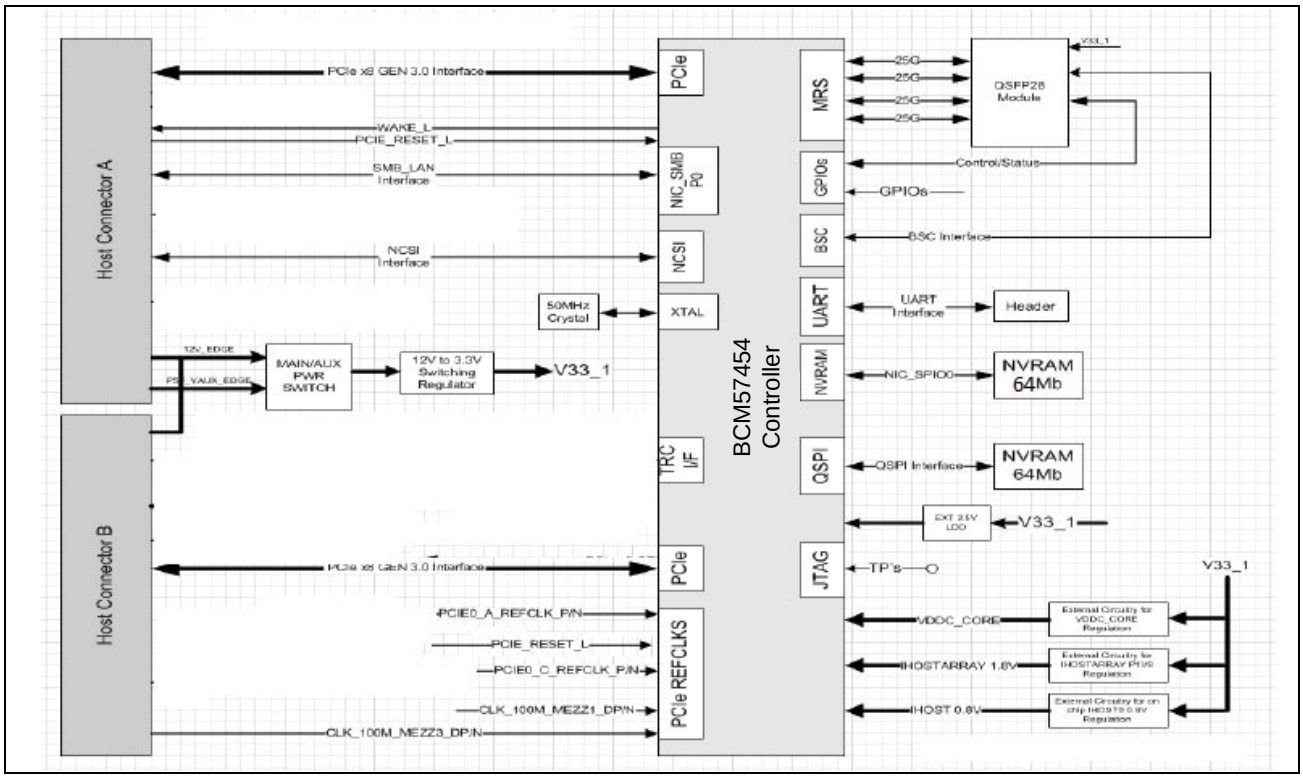
Section 1: Functional Description

This section provides the functional description of the BCM957454M4540C OCP Mezzanine Card.

Block Diagram

Figure 2 shows the main functional blocks on the BCM957454M4540C OCP Mezzanine Card.

Figure 2: BCM957454M4540C Block Diagram



Host Interface Connectors

The BCM957454M4540C OCP Mezzanine Card interfaces with the system baseboard via two vertical-stacked card-to-card connectors. The PCIe bus, NC-SI bus, SMBus interface, various other sideband signals, and power are assigned to these two connectors. The pinout complies with that of Connector A and Connector B as described in the OCP Mezzanine Card 2.0 Design Specification. Table 1 shows the signal pinout for both connectors per the specification. Definitions of the signals at this connector are provided in the OCP Mezzanine Card Specification.

Table 1: Signal Descriptions

Connector A				***Connector B***			
Signal	***Pin***	***Pin***	***Signal***	***Signal***	***Pin***	***Pin***	***Signal***
P12V_AUX	A61	A1	MEZZ_PRSNT1_N	P12V_AUX	B41	B1	MEZZ_PRSNTB1_N/MEZZ_ID
P12V_AUX	A62	A2	PSV_AUX	P12V_AUX	B42	B2	GND
P12V_AUX	A63	A3	PSV_AUX	RSVD	B43	B3	MEZZ_RX_DP<8>
GND	A64	A4	PSV_AUX	GND	B44	B4	MEZZ_RX_DN<8>
GND	A65	A5	GND	MEZZ_TX_DP<8>	B45	B5	GND
P3V3_AUX	A66	A6	GND	MEZZ_TX_DN<8>	B46	B6	GND
GND	A67	A7	P3V3_AUX	GND	B47	B7	MEZZ_RX_DP<9>
GND	A68	A8	GND	GND	B48	B8	MEZZ_RX_DN<9>
P3V3	A69	A9	GND	MEZZ_TX_DP<9>	B49	B9	GND
P3V3	A70	A10	P3V3	MEZZ_TX__DN<9>	B50	B10	GND
P3V3	A71	A11	P3V3	GND	B51	B11	MEZZ_RX_DP<10>
P3V3	A72	A12	P3V3	GND	B52	B12	MEZZ_RX_DN<10>
GND	A73	A13	P3V3	MEZZ_TX_DP<10>	B53	B13	GND
LAN_3V3STB_ALERT_N	A74	A14	NCSI_RCSDV	MEZZ_TX__DN<10>	B54	B14	GND
SMB_LAN_3V3STB_CLK	A75	A15	NCSI_RCLK	GND	B55	B15	MEZZ_RX_DP<11>
SMB_LAN_3V3STB_DAT	A76	A16	NCSI_TXEN	GND	B56	B16	MEZZ_RX_DN<11>
PCIE_WAKE_N	A77	A17	PERST_N0	MEZZ_TX_DP<11>	B57	B17	GND
NCSI_RXER	A78	A18	MEZZ_SMCLK	MEZZ_TX__DN<11>	B58	B18	GND
GND	A79	A19	MEZZ_SMDATA	GND	B59	B19	MEZZ_RX_DP<12>
NCSI_TXD0	A80	A20	GND	GND	B60	B20	MEZZ_RX_DN<12>
NCSI_TXD1	A81	A21	GND	MEZZ_TX_DP<12>	B61	B21	GND
GND	A82	A22	NCSI_RXD0	MEZZ_TX__DN<12>	B62	B22	GND
GND	A83	A23	NCSI_RXD1	GND	B63	B23	MEZZ_RX_DP<13>
CLK_100M_MEZZ1_DP	A84	A24	GND	GND	B64	B24	MEZZ_RX_DN<13>

Table 2: Pinout Connector A

Signal	*Pin*
CLK_100M_MEZZ1_DN	A85
GND	A86
GND	A87
MEZZ_TX_DP_C<0>	A88
MEZZ_TX_DN_C<0>	A89
GND	A90
GND	A91
MEZZ_TX_DP_C<1>	A92
MEZZ_TX_DN_C<1>	A93
GND	A94
GND	A95
MEZZ_TX_DP_C<2>	A96
MEZZ_TX_DN_C<2>	A97
GND	A98
GND	A99
MEZZ_TX_DP_C<3>	A100
MEZZ_TX_DN_C<3>	A101
GND	A102
GND	A103
MEZZ_TX_DP_C<4>	A104
MEZZ_TX_DN_C<4>	A105
GND	A106
GND	A107
MEZZ_TX_DP_C<5>	A108
MEZZ_TX_DN_C<5>	A109
GND	A110
GND	A111
MEZZ_TX_DP_C<6>	A112
MEZZ_TX_DN_C<6>	A113
GND	A114
GND	A115
MEZZ_TX_DP_C<7>	A116
MEZZ_TX_DN_C<7>	A117
GND	A118
GND	A119
MEZZ_PRSNT2_N/MEZZ_ID	A120
GND	A25

Signal	*Pin*
CLK_100M_MEZZ3_DP	A26
CLK_100M_MEZZ2_DN	A27
GND	A28
GND	A29
MEZZ_RX_DP<0>	A30
MEZZ_RX_DN<0>	A31
GND	A32
GND	A33
MEZZ_RX_DP<1>	A34
MEZZ_RX_DN<1>	A35
GND	A36
GND	A37
MEZZ_RX_DP<2>	A38
MEZZ_RX_DN<2>	A39
GND	A40
GND	A41
MEZZ_RX_DP<3>	A42
MEZZ_RX_DN<3>	A43
GND	A44
GND	A45
MEZZ_RX_DP<4>	A46
MEZZ_RX_DN<4>	A47
GND	A48
GND	A49
MEZZ_RX_DP<5>	A50
MEZZ_RX_DN<5>	A51
GND	A52
GND	A53
MEZZ_RX_DP<6>	A54
MEZZ_RX_DN<6>	A55
GND	A56
GND	A57
MEZZ_RX_DP<7>	A58
MEZZ_RX_DN<7>	A59
GND	A60

Table 3: Pinout Connector B

Signal	*Pin*
MEZZ_TX_DP<13>	B65
MEZZ_TX_DN<13>	B66
GND	B67
GND	B68
MEZZ_TX_DP<14>	B69
MEZZ_TX_DN<14>	B70
GND	B71
GND	B72
MEZZ_TX_DP<15>	B73
MEZZ_TX_DN<15>	B74
GND	B75
GND	B76
CLK_100M_MEZZ4_DP	B77
CLK_100M_MEZZ4_DN	B78
GND	B79
MEZZ_PRSNTB2_N/MEZZ_ID	B80

Signal	*Pin*
GND	B25
GND	B26
MEZZ_RX_DP<14>	B27
MEZZ_RX_DN<14>	B28
GND	B29
GND	B30
MEZZ_RX_DP<15>	B31
MEZZ_RX_DN<15>	B32
GND	B33
GND	B34
CLK_100M_MEZZ3_DP	B35
CLK_100M_MEZZ3_DN	B36
GND	B37
PERST_N1	B38
PERST_N2	B39
PERST_N3	B40

BCM57454

The BCM57454 Ethernet controller used in the BCM957454M4540C card is configured for single-port 100 Gb/s operation with integrated QSFP28 optical interface to the line side and x16 PCI Express v3.0 interface to the system host.

Clock Requirements

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

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 BCM57454 complies with the PCI Express Base Specification Revision 3.0, and supports a 16-lane PCIe v3.0 interface via the host interface connector.

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.

SMBus Interface

The BCM57454 Ethernet Controller SMBus interface supports serial communications between the BCM57454 and the system. The interface allows the Ethernet Controller to act as an SMBus master or a slave device.

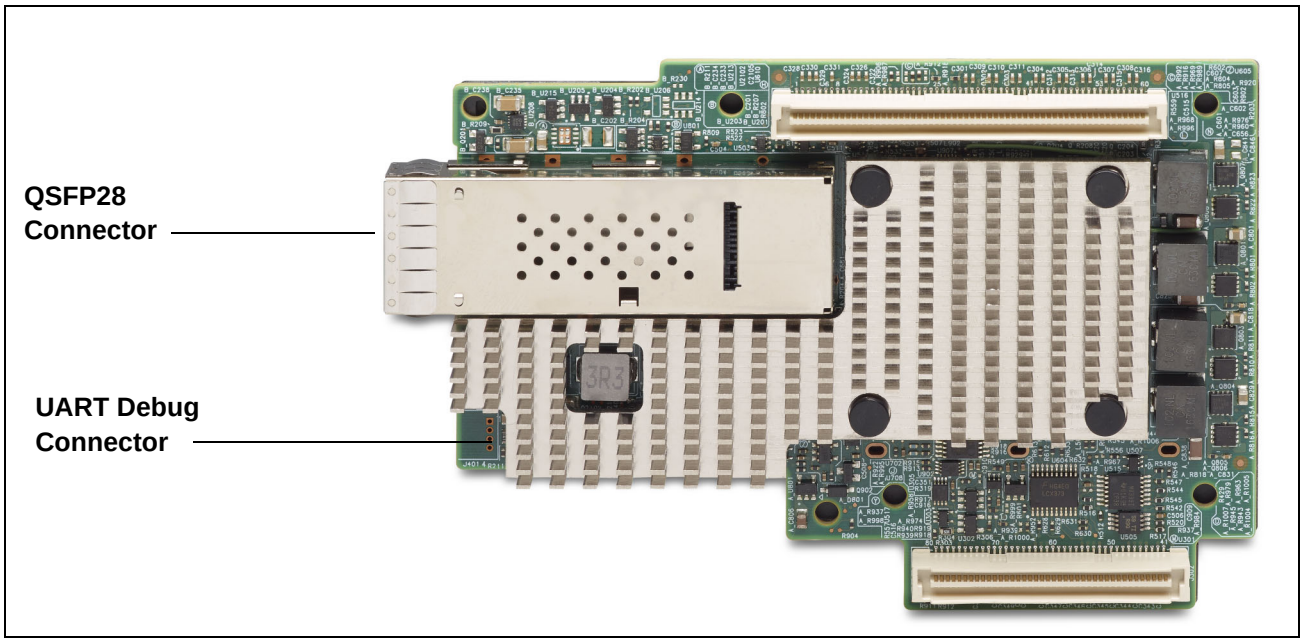
UART Interface

The BCM57454 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 4: UART Connector Pinout

Pin	*Signal*
1	UART_TXD
2	UART_RXD
3	V33
4	GND

Figure 3: UART Debug Connector



Non-volatile RAM

The BCM57454 Ethernet Controller requires a non-volatile 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. A 64 Mb flash is recommended for NVRAM.

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 BCM57454 Ethernet Controller in the event of a missing heat sink, the mezzanine card is not allowed to power up. However, the FRU remains accessible.

DC/DC Regulators

The on-board voltage regulators use the 12V edge main power and 5V auxiliary supply from the host interface connector to derive the necessary power rails for different circuits and components on the board.

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 switching power supplies that power the card's various power rails.

LED Functions and Locations

The QSFP28 port supports two LEDs to indicate traffic activities and link speed. The LEDs are visible on the bottom side as shown in Figure 4. Their locations and form factors conform to the OCP Mezzanine Card specification.

Figure 4: Activity and Link LED Locations

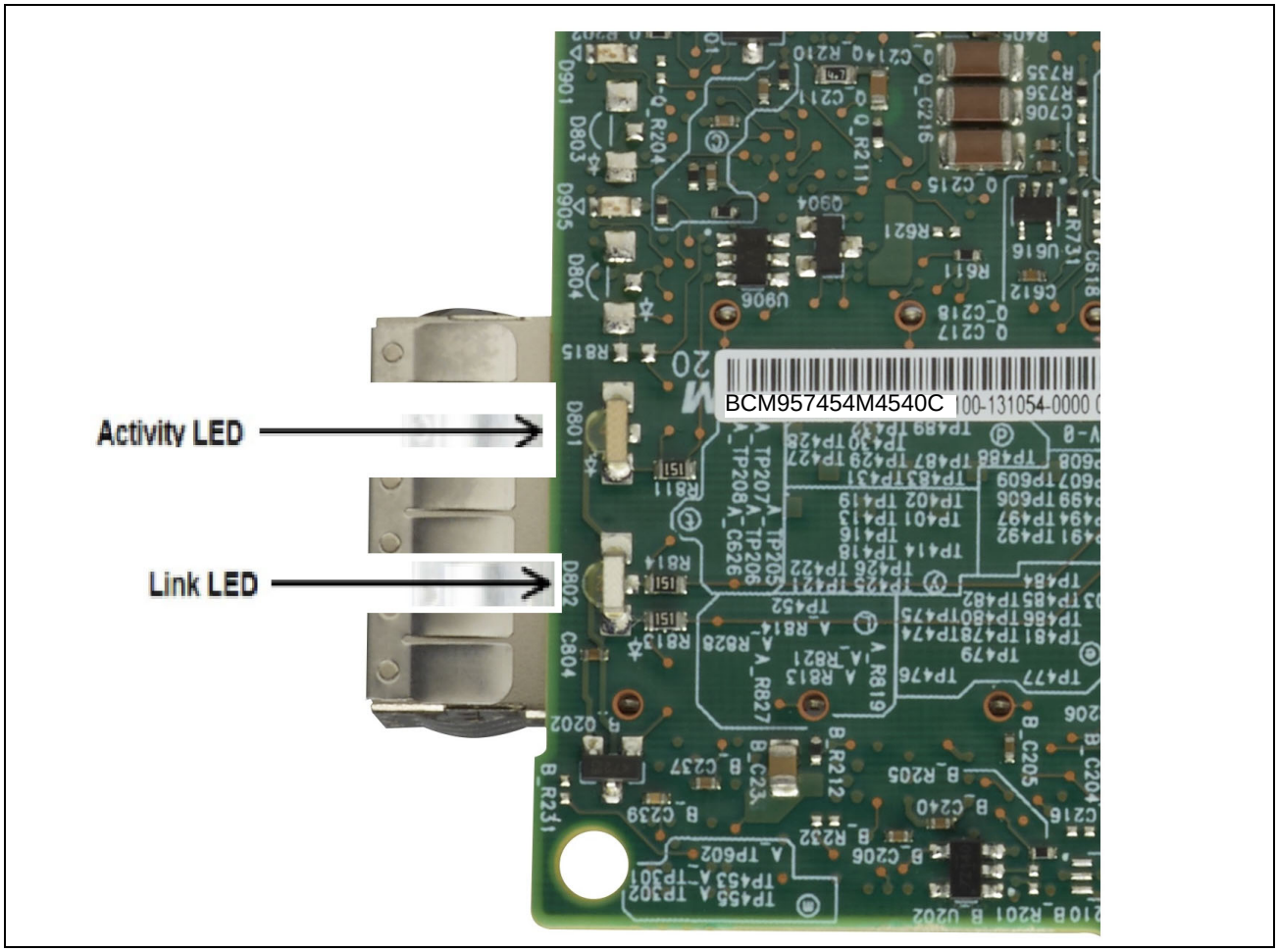


Table 5: LED Functions

NVRAM Manufacturer	*Device*	*Mbit*
Activity	Off	No activity
	Green blinking	Traffic flowing activity
Link	Off	No link
	Green	Linked at 100G, 50G, or 40G
	Yellow	Linked at 25G or 10G

Section 2: Regulatory and Safety Approvals

The following sections detail the Regulatory, Safety, Electromagnetic Compatibility (EMC), and Electrostatic Discharge (ESD) Compliance for the BCM957454M4540C OCP Mezzanine Card.

Regulatory

Table 6: 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

Safety

Table 7: 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

Electromagnetic Compatibility (EMC)

Table 8: Electromagnetic Compatibility

Standard/Country	*Certification Type*	*Compliance*
CE/European Union	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
BSMI/Taiwan	CNS 13438 (2006) Class A	BSMI certificate
BSMI/Taiwan	CNS 15663	BSMI certificate/RoHS table
MIC/South Korea	KN32 Class A KN35	Korea certificate R mark
VCCI/Japan	VCCI CISPR 32: 2016	Copy of VCCI online certificate

Electrostatic Discharge (ESD) Compliance

Table 9: ESD Compliance Summary

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

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.

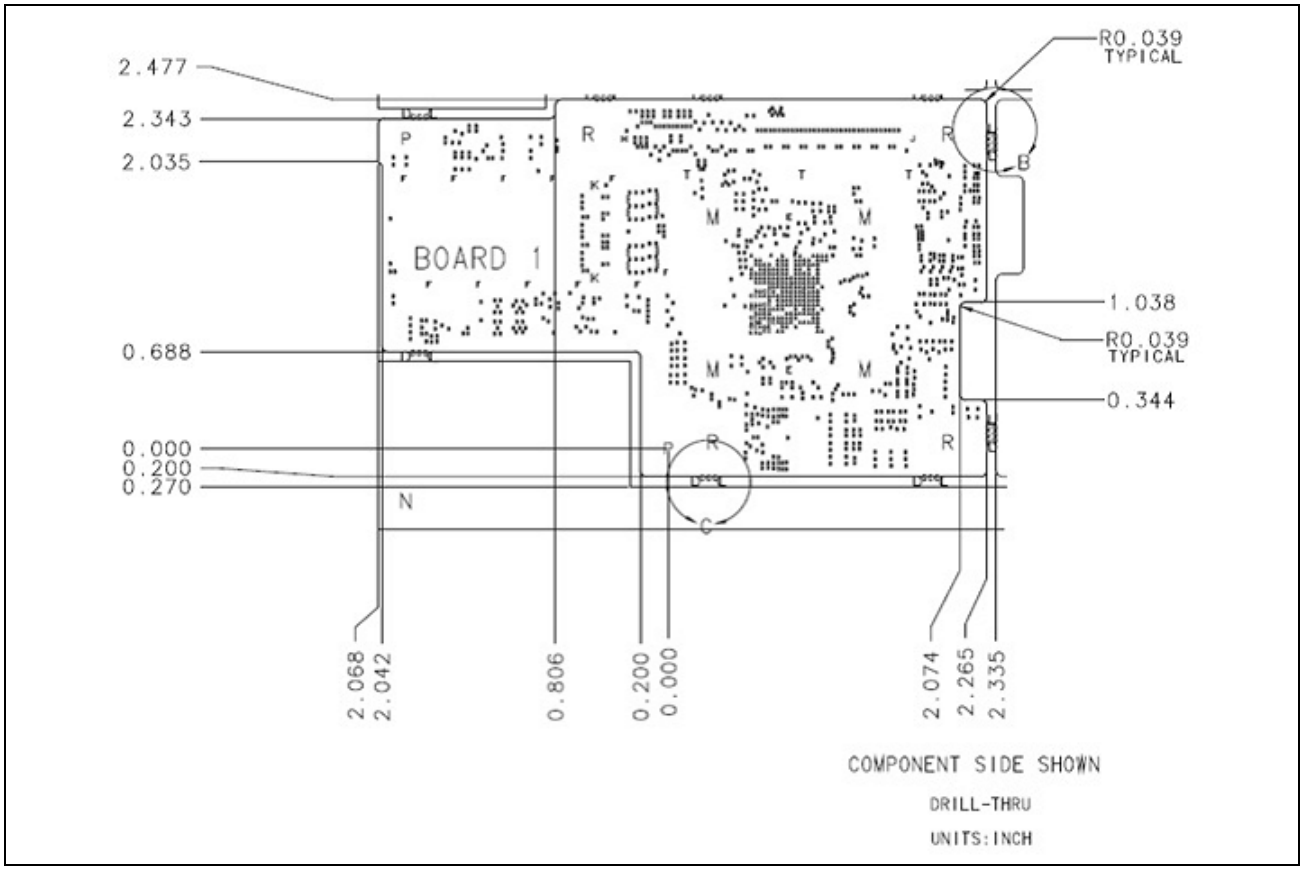
Section 3: Physical and Environmental Specifications

This section outlines the mechanicals of the BCM957454M4540C OCP Mezzanine Card as well as the environmental specifications.

Board Physical Dimensions

The BCM957454M4540C board dimensions are shown in Figure 5.

Figure 5: Board Physical Dimensions



Environment Specifications

The Mezzanine Card meets the same environmental requirements specified in the OCP systems.

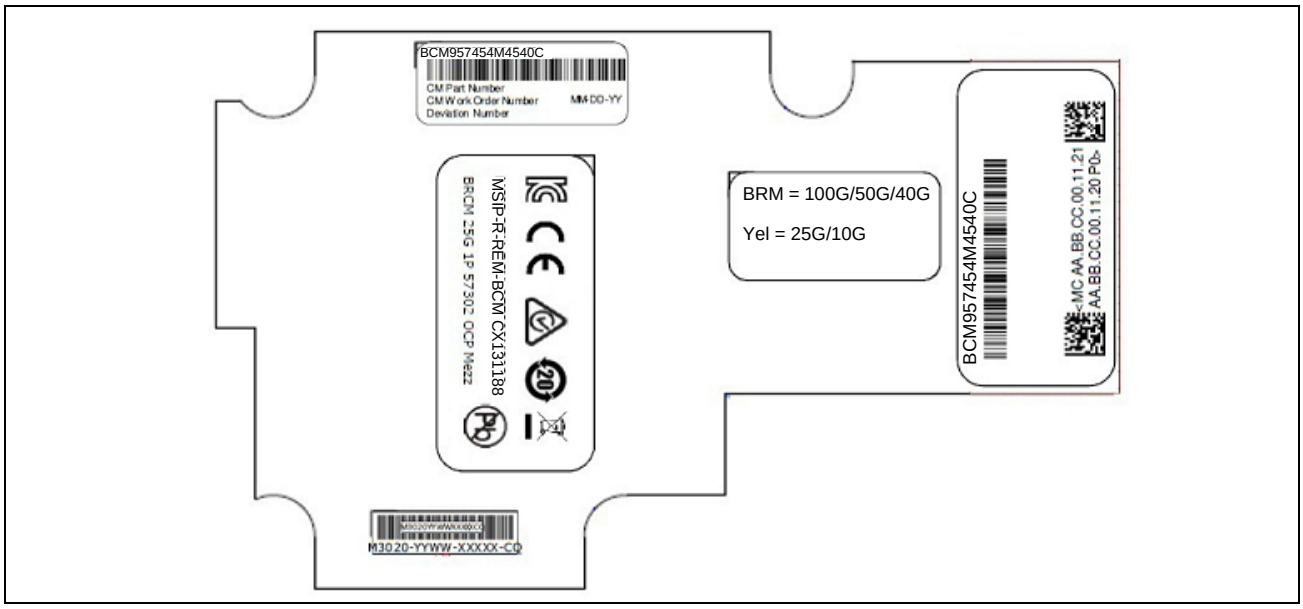
Table 10: Environment Specifications

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

Label Information

This section provides the label information of the BCM957454M4540C OCP Mezzanine Card. Figure 6 outlines the label and corresponding locations.

Figure 6: Label Overview



MAC Address Label

In the example shown in Figure 7, BCM957454M4540C is the Part Number with 1D bar code, AA-BB-CC-00-11-20 is the MAC address of data network interface with 2D bar code, and AA-BB-CC-00-11-21 is the MAC address of management network interface with 2D bar code.

Figure 7: MAC Address Label (BCM957454M4540CCBK)

Section 4: Ordering Information

Table 11: Ordering Information

Part Number	*Description*
BCM957454M4540C	Single-port 100 Gb/s, 50 Gb/s, or 40 Gb/s QSFP28 Ethernet x16 PCI Express OCP Mezzanine 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 12: 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

Section 5: Revision History

Revision	*Date*	*Change Description*
957454M4540C-DS101	12/27/17	**Updated:** • “Regulatory and Safety Approvals” on page 12
957454M4540C-DS100	06/16/17	Initial release

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