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**EVB-KSZ9563
Evaluation Board
User's Guide**

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NOTES:

Preface

NOTICE TO CUSTOMERS

All documentation becomes dated, and this manual is no exception. Microchip tools and documentation are constantly evolving to meet customer needs, so some actual dialogs and/or tool descriptions may differ from those in this document. Please refer to our web site (www.microchip.com) to obtain the latest documentation available.

Documents are identified with a “DS” number. This number is located on the bottom of each page, in front of the page number. The numbering convention for the DS number is “DSXXXXA”, where “XXXX” is the document number and “A” is the revision level of the document.

For the most up-to-date information on development tools, see the MPLAB® IDE online help. Select the Help menu, and then Topics to open a list of available online help files.

INTRODUCTION

This chapter contains general information that will be useful to know before using the KSZ9563. Items discussed in this chapter include:

- [Document Layout](#)
- [Conventions Used in this Guide](#)
- [The Microchip Web Site](#)
- [Development Systems Customer Change Notification Service](#)
- [Customer Support](#)
- [Document Revision History](#)

DOCUMENT LAYOUT

This document describes how to use the EVB-KSZ9563 evaluation board as a development tool for the KSZ9563, 3-Port Gigabit Ethernet Switch with RGMII Interface and IEEE 1588v2/802.1AS support.

- **Chapter 1. “Overview”** – Provides a brief description of the EVB-KSZ9563 evaluation board.
- **Chapter 2. “Board Details and Configuration”** – Includes instructions on how to get started with the EVB-KSZ9563 evaluation board.
- **Appendix A. “EVB-KSZ9563 Evaluation Board”** – This appendix shows the physical EVB-KSZ9563 evaluation board.
- **Appendix B. “Schematics”** – This appendix shows the EVB-KSZ9563 evaluation board schematics.
- **Appendix C. “Bill of Materials (BOM)”** – This appendix includes the EVB-KSZ9563 evaluation board Bill of Materials (BOM).
- **Appendix D. “Silk Screen”** – This appendix includes the EVB-KSZ9563 evaluation board silk screen.

CONVENTIONS USED IN THIS GUIDE

This manual uses the following documentation conventions:

DOCUMENTATION CONVENTIONS

Description	Represents	Examples
Arial font:		
Italic characters	Referenced books	<i>MPLAB[®] IDE User's Guide</i>
	Emphasized text	...is the <i>only</i> compiler...
Initial caps	A window	the Output window
	A dialog	the Settings dialog
	A menu selection	select Enable Programmer
Quotes	A field name in a window or dialog	"Save project before build"
Underlined, italic text with right angle bracket	A menu path	<u><i>File>Save</i></u>
Bold characters	A dialog button	Click OK
	A tab	Click the Power tab
N'Rnnnn	A number in verilog format, where N is the total number of digits, R is the radix and n is a digit.	4'b0010, 2'hF1
Text in angle brackets < >	A key on the keyboard	Press <Enter>, <F1>
Courier New font:		
Plain Courier New	Sample source code	#define START
	Filenames	autoexec.bat
	File paths	c:\mcc18\h
	Keywords	_asm, _endasm, static
	Command-line options	-Opa+, -Opa-
	Bit values	0, 1
	Constants	0xFF, 'A'
Italic Courier New	A variable argument	<i>file.o</i> , where <i>file</i> can be any valid filename
Square brackets []	Optional arguments	mcc18 [options] <i>file</i> [options]
Curly brackets and pipe character: { }	Choice of mutually exclusive arguments; an OR selection	errorlevel {0 1}
Ellipses...	Replaces repeated text	var_name [, var_name...]
	Represents code supplied by user	void main (void) { ... }

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- **General Technical Support** – Frequently Asked Questions (FAQs), technical support requests, online discussion groups, Microchip consultant program member listing
- **Business of Microchip** – Product selector and ordering guides, latest Microchip press releases, listing of seminars and events, listings of Microchip sales offices, distributors and factory representatives

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- **Emulators** – The latest information on Microchip in-circuit emulators. This includes the MPLAB REAL ICE and MPLAB ICE 2000 in-circuit emulators.
- **In-Circuit Debuggers** – The latest information on the Microchip in-circuit debuggers. This includes MPLAB ICD 3 in-circuit debuggers and PICkit 3 debug express.
- **MPLAB IDE** – The latest information on Microchip MPLAB IDE, the Windows Integrated Development Environment for development systems tools. This list is focused on the MPLAB IDE, MPLAB IDE Project Manager, MPLAB Editor and MPLAB SIM simulator, as well as general editing and debugging features.
- **Programmers** – The latest information on Microchip programmers. These include production programmers such as MPLAB REAL ICE in-circuit emulator, MPLAB ICD 3 in-circuit debugger and MPLAB PM3 device programmers. Also included are nonproduction development programmers such as PICSTART Plus and PIC-kit 2 and 3.

CUSTOMER SUPPORT

Users of Microchip products can receive assistance through several channels:

- Distributor or Representative
- Local Sales Office
- Field Application Engineer (FAE)
- Technical Support

EVB-KSZ9563 Evaluation Board User's Guide

Customers should contact their distributor, representative or field application engineer (FAE) for support. Local sales offices are also available to help customers. A listing of sales offices and locations is included in the back of this document.

Technical support is available through the web site at:

<http://www.microchip.com/support>

DOCUMENT REVISION HISTORY

Revisions	Section/Figure/Entry	Correction
DS50002726A (02-07-18)	Initial release	

Chapter 1. Overview

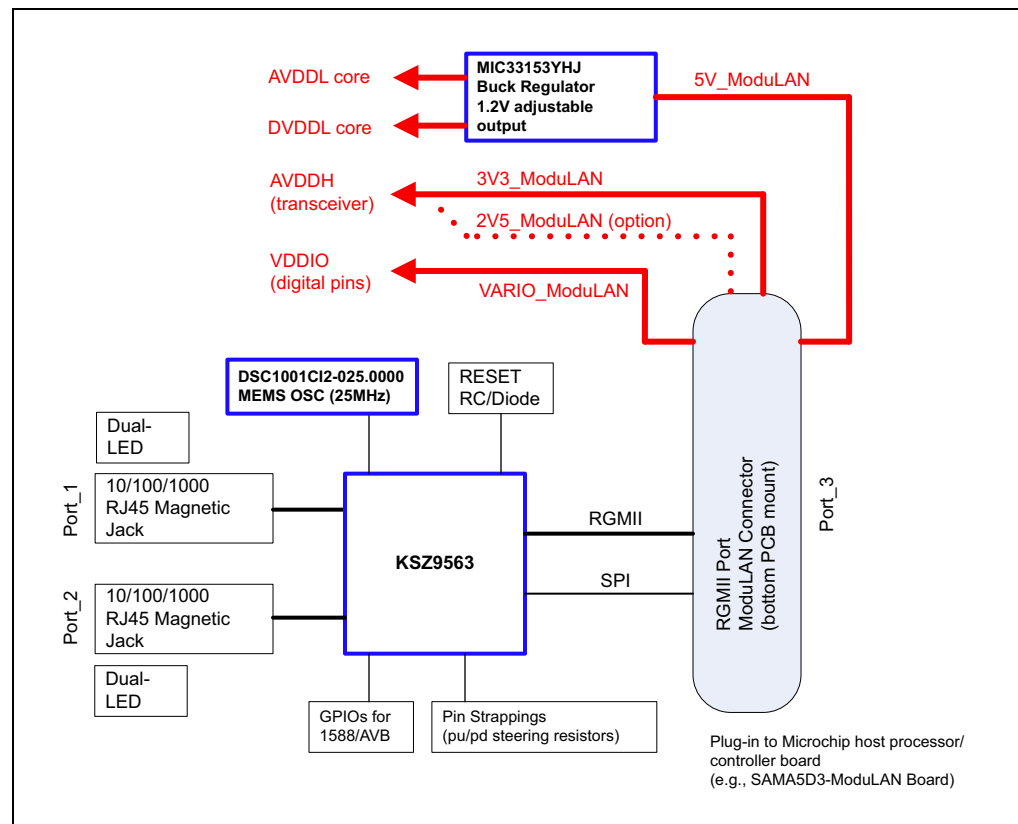
1.1 INTRODUCTION

The EVB-KSZ9563 evaluation board is a plug-in card that interfaces directly with a mating Microchip host processor or controller board, such as the SAMA5D3-ModuLAN Board. It features the KSZ9563, a highly-integrated networking device that incorporates a layer-2+ managed Gigabit Ethernet switch, two 10BASE-T/100BASE-TX/1000BASE-T physical layer transceivers (PHYs) and associated MAC units, and one MAC port configured as the RGMII interface. The board's two PHY ports are connected to RJ45 Ethernet jacks with integrated magnetics, and the RGMII MAC interface is brought out to a high bandwidth multi-pin (ModuLAN) connector.

As a set, the EVB-KSZ9563 and SAMA5D3-ModuLAN Board provide a highly-flexible platform to enable evaluation of basic KSZ9563 PHY/Switch features using static control-status registers (CSRs) to develop firmware of advanced KSZ9563 MAC/Switch features, such as IEEE1588 PTP, AVB, and RSTP/MSTP that require interaction with upper network layers.

The scope of this document is to describe the EVB-KSZ9563 evaluation board setup and its user interface features. A simplified block diagram of the board is shown in [Figure 1-1](#).

FIGURE 1-1: EVB-KSZ9563 FUNCTIONAL BLOCK DIAGRAM



1.2 REFERENCES

Concepts and materials available in the following documents may be helpful when reading this document. Visit www.microchip.com for the latest documentation.

- *KSZ9563 Data Sheet*
- *EVB-KSZ9563 Schematics*
- *SAMA5D3-ModuLAN Schematics*
- *SAMA5D3-ModuLAN Board User's Guide*
- *MIC33153YHJ Data Sheet*
- *DSC1001 Data Sheet*

Chapter 2. Board Details and Configuration

2.1 INTRODUCTION

The EVB-KSZ9563 is designed as a plug-in card to interface directly with a mating Microchip host processor or controller board, such as the SAMA5D3-ModuLAN Board, that supplies full power and provides full register access and configuration via IBA, SPI, or I²C bus management.

2.2 POWER SOURCE

The EVB-KSZ9563 is completely bus-powered from its mating Microchip host processor or controller board. Input power is delivered via ModuLAN connector. Refer to [Figure 2-3](#) and the board schematics in [Appendix B. “Schematics”](#) for details.

2.2.1 Power Probe Points

The power probe points along with the ground test points are shown in [Figure 2-2](#).

2.2.2 Current Access Rework/Probe Points

The EVB-KSZ9563 design is not intended to perform current measurements on the device. If needed, the current access points to measure the current consumptions of the KSZ9563 power rails are across the following series ferrite beads to the board powers.

- DVDDL: FB2
- AVDDL: FB3
- VDDIO: FB6
- AVDDH: FB4 for 3.3V (default populate), and FB1 for 2.5V (default not populate)

Remove the above ferrite beads and place the current probes in series across the power probe points ([Section 2.2.1 “Power Probe Points”](#)) that are joined by the ferrite beads. See also [Appendix B. “Schematics”](#).

Board LED components are connected to the VDDIO power rail, and thus the measured current is higher than the amount consumed by only the KSZ9563 device.

2.3 CLOCK

The EVB-KSZ9563 utilizes the on-board Microchip DSC1001CI2-025.0000 clock chip, a 25-MHz MEMS oscillator, as the input reference clock to the KSZ9563 device. Refer to [Figure 2-1](#) and the board schematics in [Appendix B. “Schematics”](#) for details.

2.4 RESET

2.4.1 Power-On Reset

The discrete RC/Diode (R12, C8, D3) circuit provides power-on reset to the KSZ9563 device.

2.4.2 Manual Reset

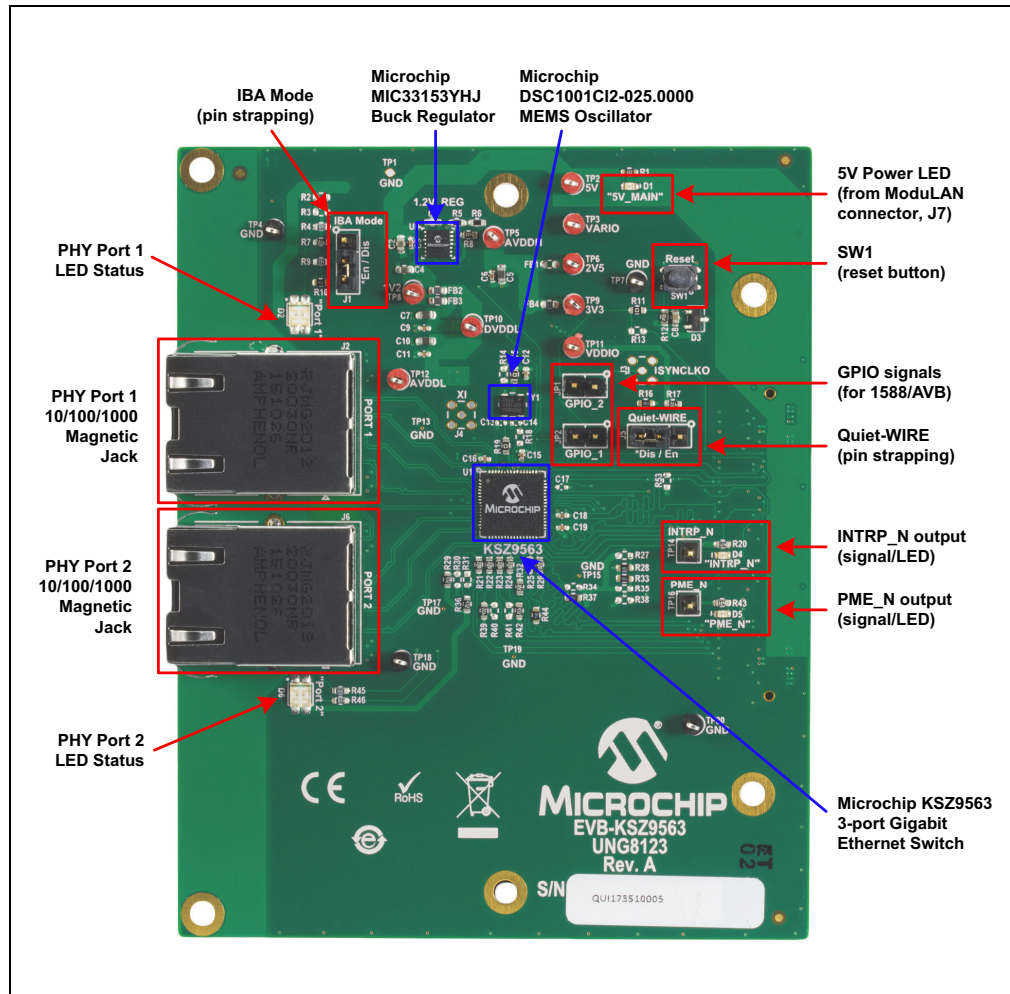
The SW1 reset button can be pressed and released to provide manual reset to the KSZ9563 device after power-up. Refer to [Figure 2-1](#) and the board schematics in [Appendix B. "Schematics"](#) for details.

2.5 BOARD FEATURES AND CONFIGURATION

The following sub-sections describe the board features and configuration settings.

[Figure 2-1](#) displays the top view of the EVB-KSZ9563 with key features, jumpers, and headers highlighted in red, and with Microchip components highlighted in blue.

FIGURE 2-1: EVB-KSZ9563 TOP VIEW WITH CALLOUTS



Board Details and Configuration

Figure 2-2 displays the power probe points along with the ground test points.

FIGURE 2-2: EVB-KSZ9563 POWER/GROUND CALLOUTS

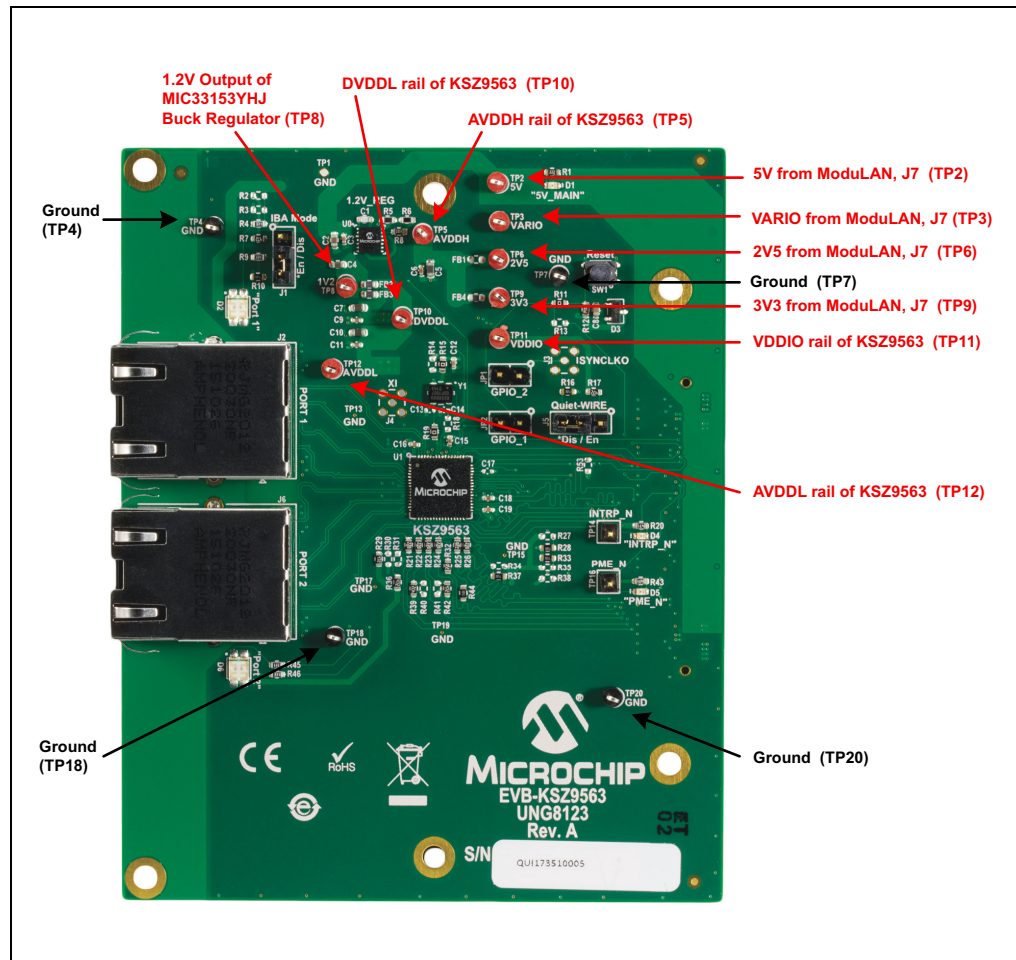
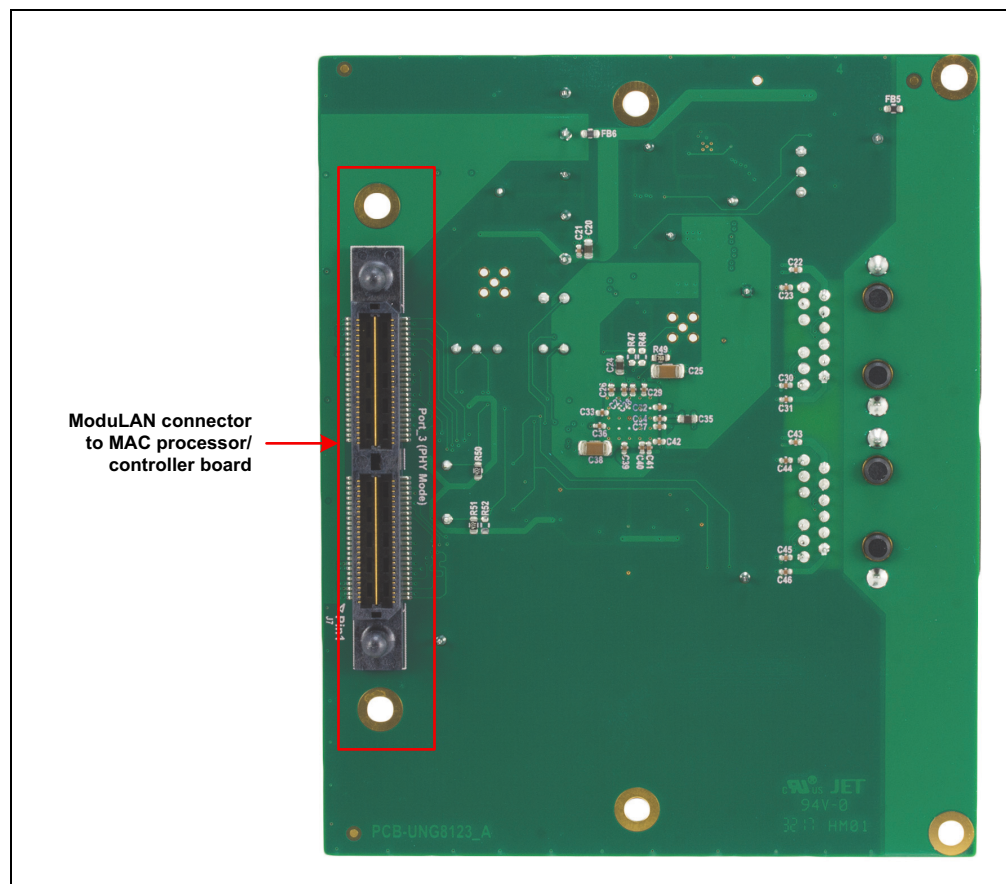


Figure 2-3 displays the bottom view of the EVB-KSZ9563 with ModuLAN connector (J7) (highlighted in red) that plugs directly into a mating Microchip MAC processor or controller board.

FIGURE 2-3: EVB-KSZ9563 BOTTOM VIEW WITH CALLOUT



Board Details and Configuration

2.5.1 PHY Ports - Integrated Magnetic Jacks

PHY ports 1 and 2 (J2 and J6) support 10BASE-T/100BASE-TX/1000BASE-T with both Auto-Negotiation and Auto MDI/MDI-X enabled as the power-up defaults.

2.5.2 PHY Ports - LEDs

Two Dual-LEDs (D2 and D6) provide the link status for PHY ports 1 and 2, respectively. The LED descriptions are listed in [Table 2-1](#).

TABLE 2-1: PHY PORTS - LED DESCRIPTION

LED	LED Color	Description
D2, D6	Green	Solid color: 1-Gbps Link Blinking: Activity (RX, TX)
	Red	Solid color: 100-Mbps Link Blinking: Activity (RX, TX)
	Orange	Solid color: 10-Mbps Link Blinking: Activity (RX, TX)
	Off	Link off

2.5.3 Pin Strapping Configuration

As the power-up or reset defaults, the KSZ9563 device is configured via internal or external pull-up or pull-down resistors to the following settings:

- **PHY Ports 1 and 2:** Auto-Negotiation enabled and Energy-Efficient Ethernet (EEE) enabled
- **MAC Port 3:** RGMII Mode at 1000-Mbps speed
- **Start Switch:** The switch forwards packets immediately after hardware reset.
- **Management:** SPI Slave mode

The In-band Management Access (IBA) mode and Quiet-Wire® pin strappings can be enabled or disabled using the 3-pin jumpers in [Table 2-2](#). Set the desired jumper settings prior to board power-up, hardware reset, or both.

TABLE 2-2: PIN STRAPPING JUMPERS

Jumper	Label	Description	Close pins 1-2	Close pins 2-3
J1	IBA mode	IBA provides full register read and write access via any one of the three data ports.	Disable	Enable (default)
J5	Quiet-Wire	Quiet-Wire filtering is implemented on-chip to enhance 100BASE-TX EMC performance by reducing both conducted and radiated emissions from the TXP/M signal differential pair.	Enable	Disable (default)

Refer to the board schematics in **Appendix B. “Schematics”** and the KSZ9563 data sheet for further details on the pin strappings.

2.5.4 GPIO Signal Headers

[Table 2-3](#) shows the GPIO signals that support the IEEE 1588 Precision Time Protocol (PTP).

TABLE 2-3: GPIO SIGNAL HEADERS

Header	Label	Description	Pin 1	Pin 2
J1	GPIO_2	The GPIO_2 pin is configurable to implement IEEE1588 event trigger outputs and timestamp capture inputs to support real-time application requirements.	No Connect	GPIO_2 (KSZ9563 pin 40)
J5	GPIO_1	The GPIO_1 pin is configurable to implement IEEE1588 event trigger outputs and timestamp capture inputs to support real-time application requirements.	Ground	GPIO_1 (KSZ9563 pin 39)

Refer to the board schematics in **Appendix B. “Schematics”** and the KSZ9563 data sheet for further details and usage on the GPIO signal pins.

2.5.5 INTRP_N Output

The INTRP_N output at test point TP14 provides the interrupt output from the KSZ9563 device. By default, it is active low and drives low to turn on D4 when asserted.

Refer to the board schematics in **Appendix B. “Schematics”** and the KSZ9563 data sheet for further details and usage on the INTRP_N signal.

2.5.6 PME_N Output

The PME_N output at test point TP16 provides the Power Management Event (PME) interrupt output for Wake-on-LAN (WoL) from the KSZ9563 device. By default, it is active low and drives low to turn on D5 when asserted.

Refer to the board schematics in **Appendix B. “Schematics”** and the KSZ9563 data sheet for further details and usage on the PME_N signal.

2.6 USING THE EVB-KSZ9563

The EVB-KSZ9563 plugs in directly to a mating Microchip host controller or processor board, such as the SAMA5D3-ModuLAN Board, that delivers full power and provides full register access and configuration via IBA, SPI, or I²C bus management.

Together, the EVB-KSZ9563 and the SAMA5D3-ModuLAN enable 10/100/1000-Mbps Ethernet traffic switching across all three data ports of the KSZ9563 device, with RGMII MAC port 3 connecting to the SAMA5D3 processor and PHY ports 1 and 2 connecting via copper Ethernet cable (CAT-5 UTP or better) to external Ethernet devices.

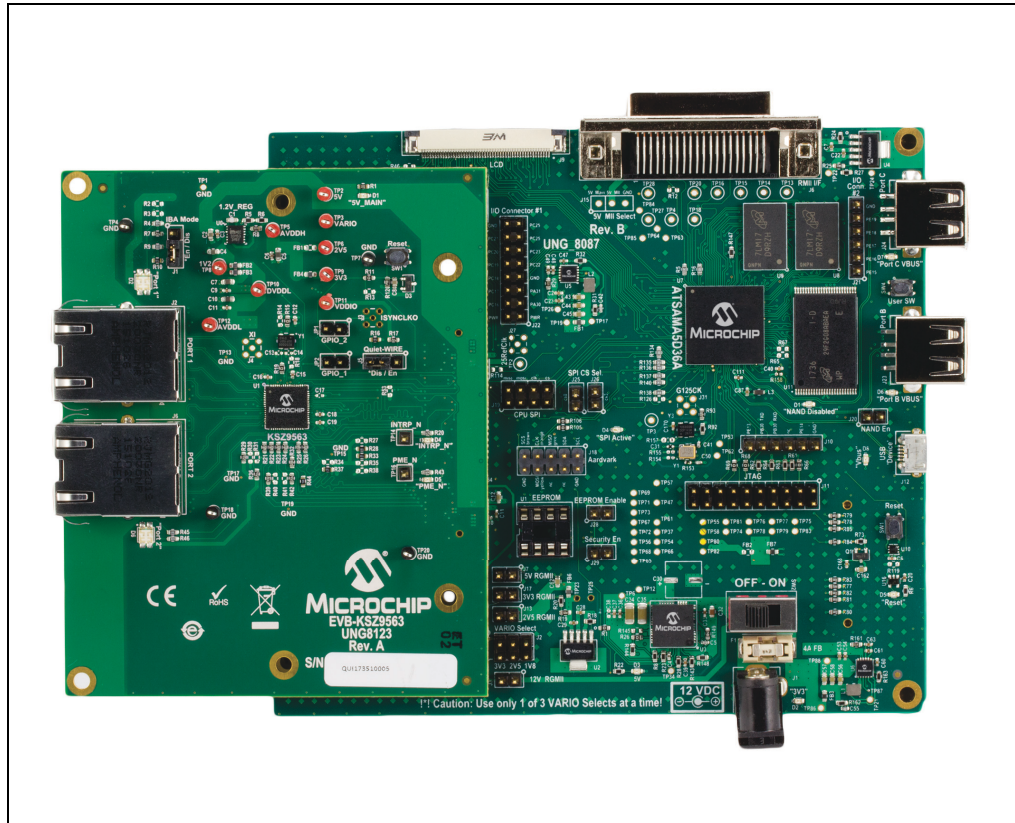
All KSZ9563 registers are accessible via IBA, SPI, or I²C bus management from the SAMA5D3-ModuLAN Board, enabling full evaluation and firmware development for all KSZ9563 MAC/Switch features and interaction with upper network layers.

Refer to the SAMA5D3-ModuLAN Board documentation on its usage.

[Figure 2-4](#) shows the EVB-KSZ9563 connected to the SAMA5D3-ModuLAN Board.

Board Details and Configuration

FIGURE 2-4: EVB-KS29563 AND SAMA5D3-MODULAN EVALUATION AND FIRMWARE DEVELOPMENT PLATFORM

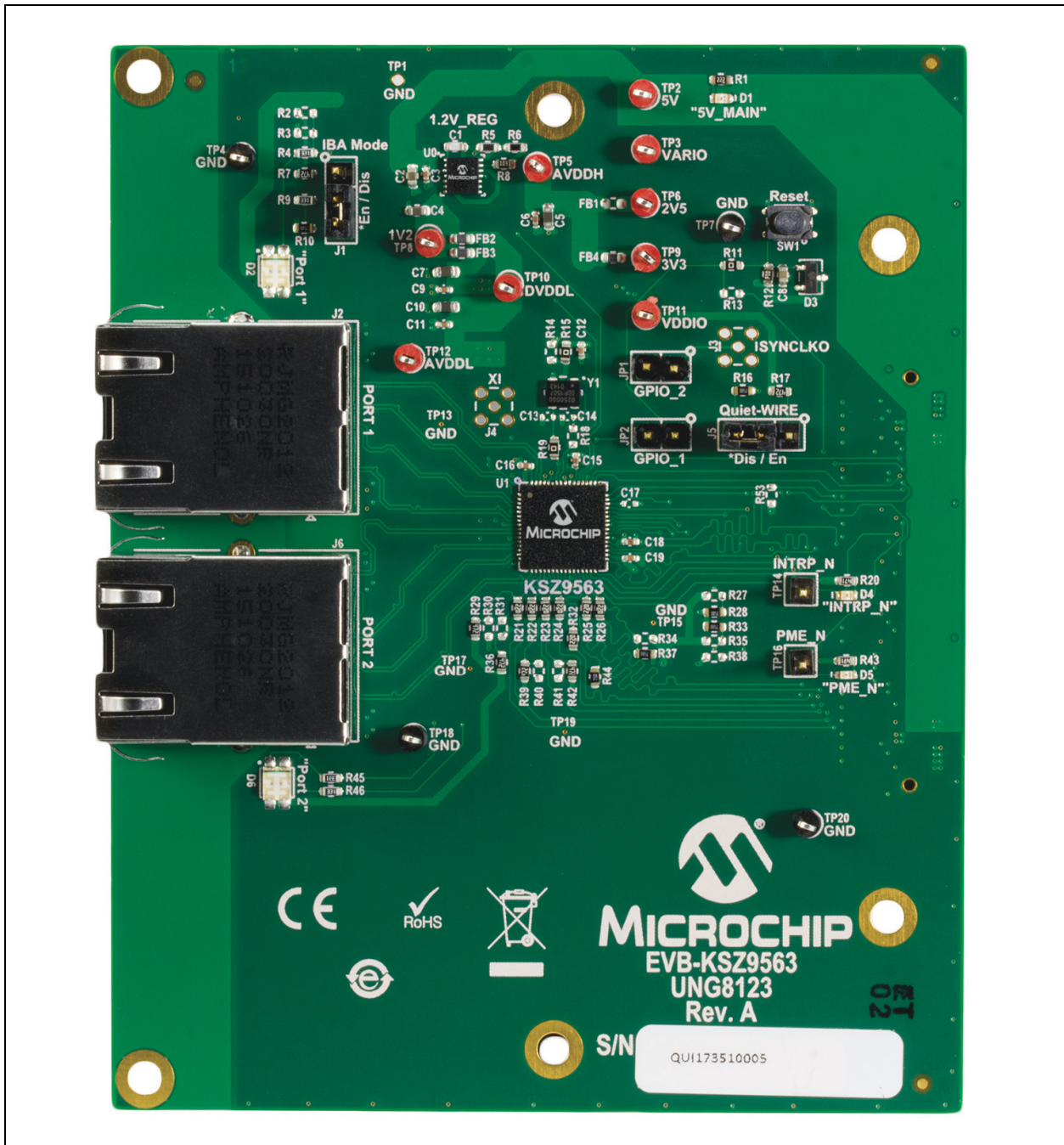


Appendix A. EVB-KSZ9563 Evaluation Board

A.1 INTRODUCTION

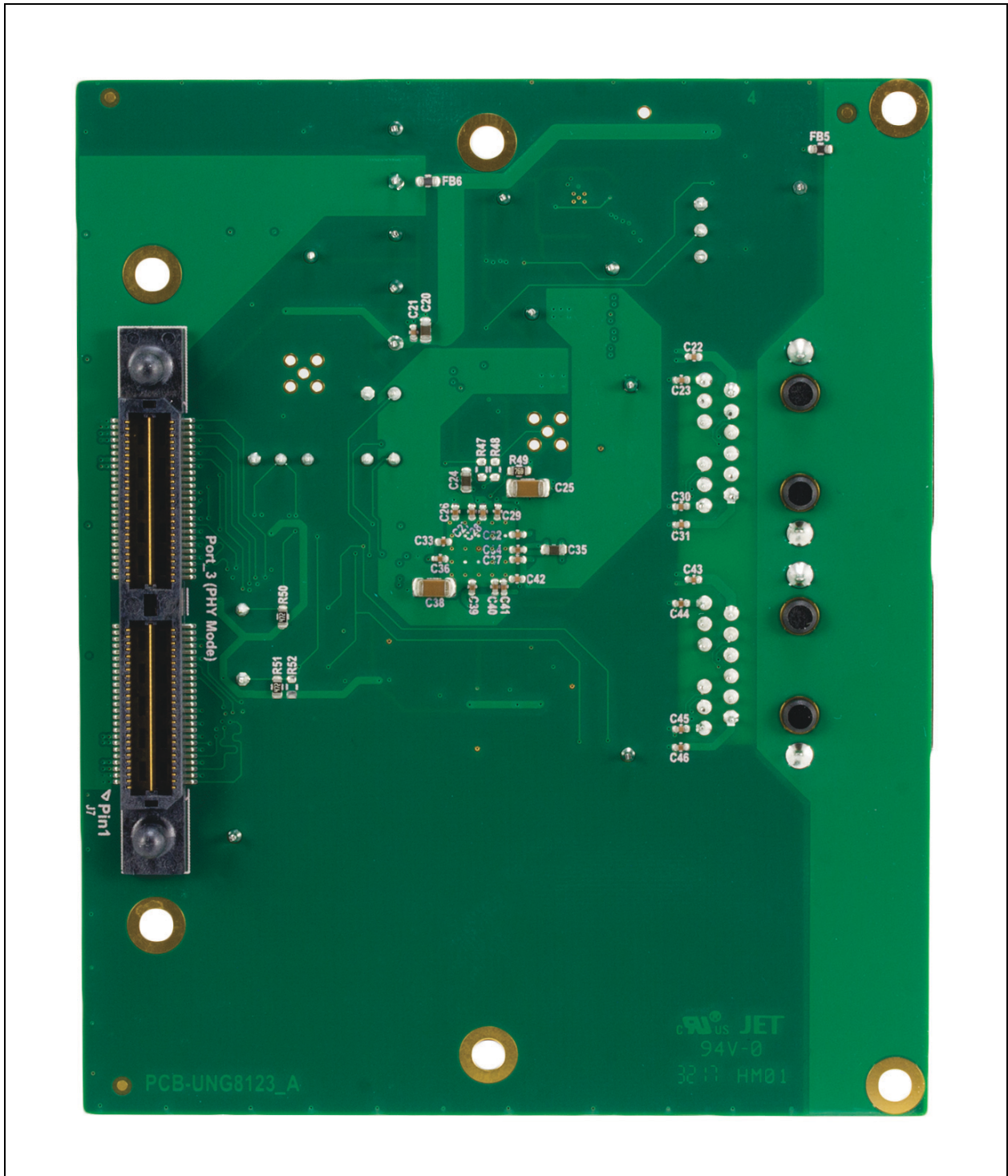
This appendix shows the EVB-KSZ9563 evaluation board.

FIGURE A-1: EVB-KSZ9563 EVALUATION BOARD (TOP VIEW)



EVB-KSZ9563 Evaluation Board

FIGURE A-2: EVB-KSZ9563 EVALUATION BOARD (BOTTOM VIEW)





Appendix B. Schematics

B.1 INTRODUCTION

This appendix includes the EVB-KSZ9563 schematics.

FIGURE B-1: EVB-KSZ9563 SCHEMATICS - KSZ9563 DEVICE, PIN STRAPPING, CLOCK, AND RESET

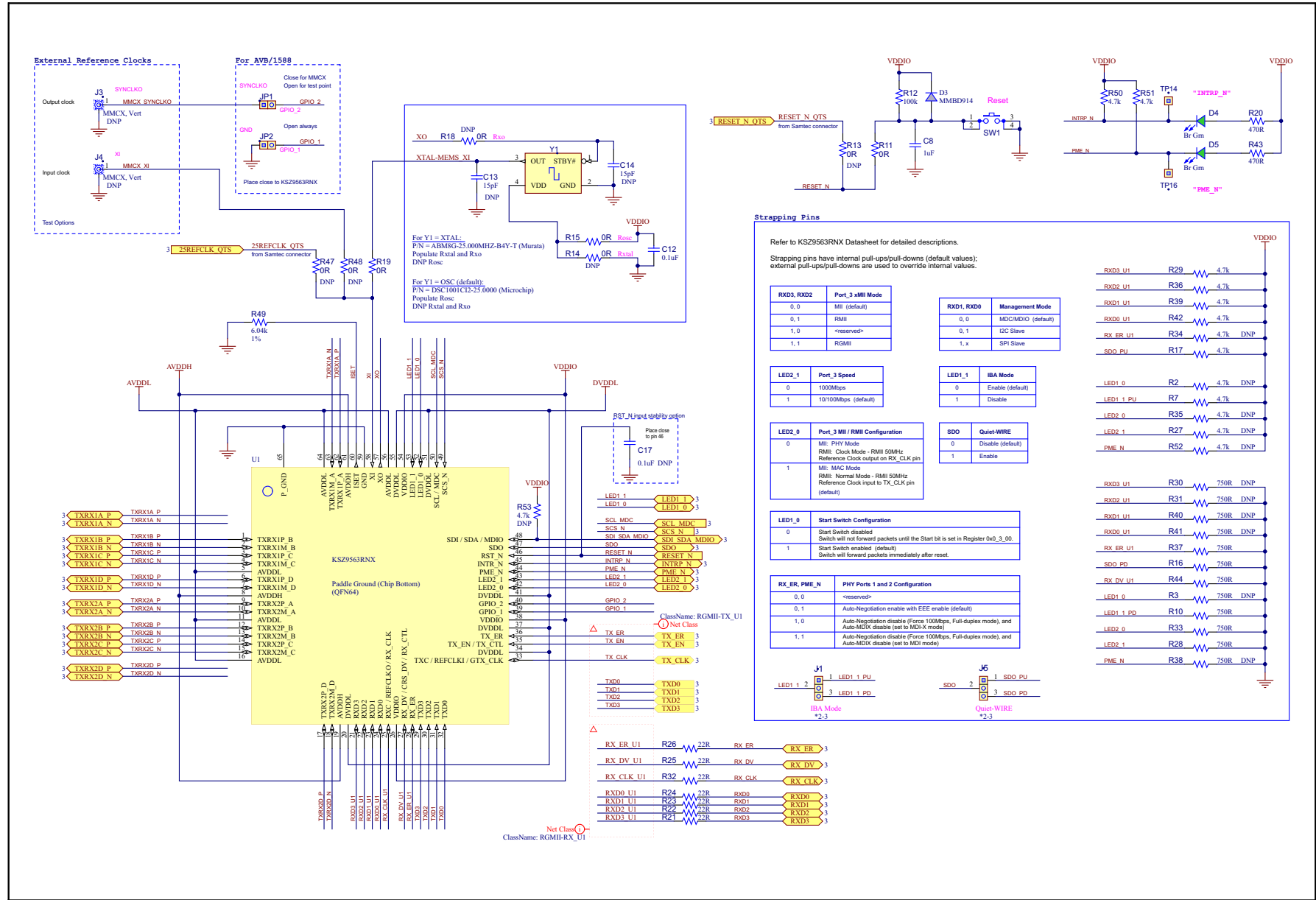


FIGURE B-2: EVB-KSZ9563 SCHEMATICS - PORTS 1 AND 2 PHYS; PORT 3 MAC - MII/RMII/RGMII CONNECTOR

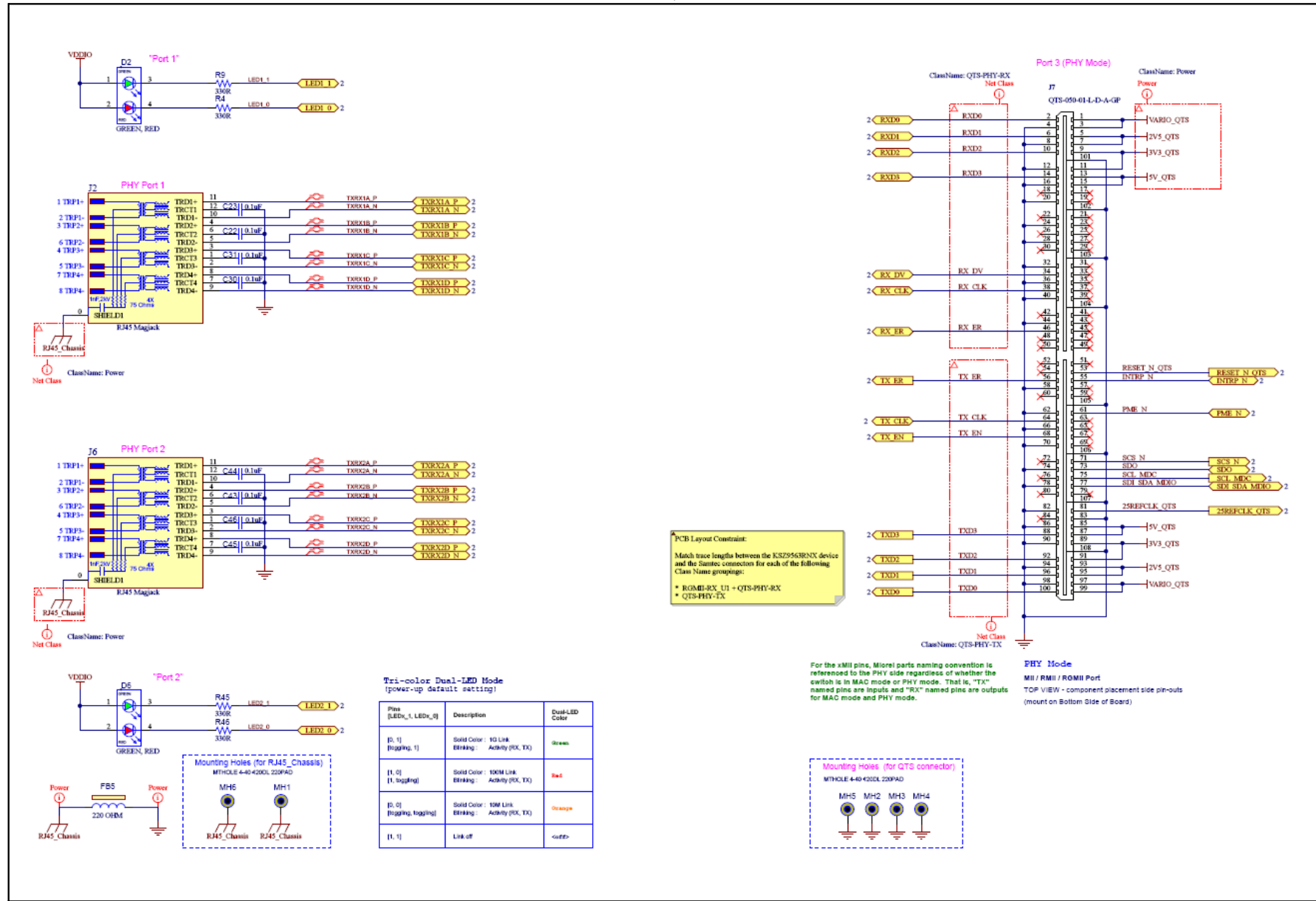
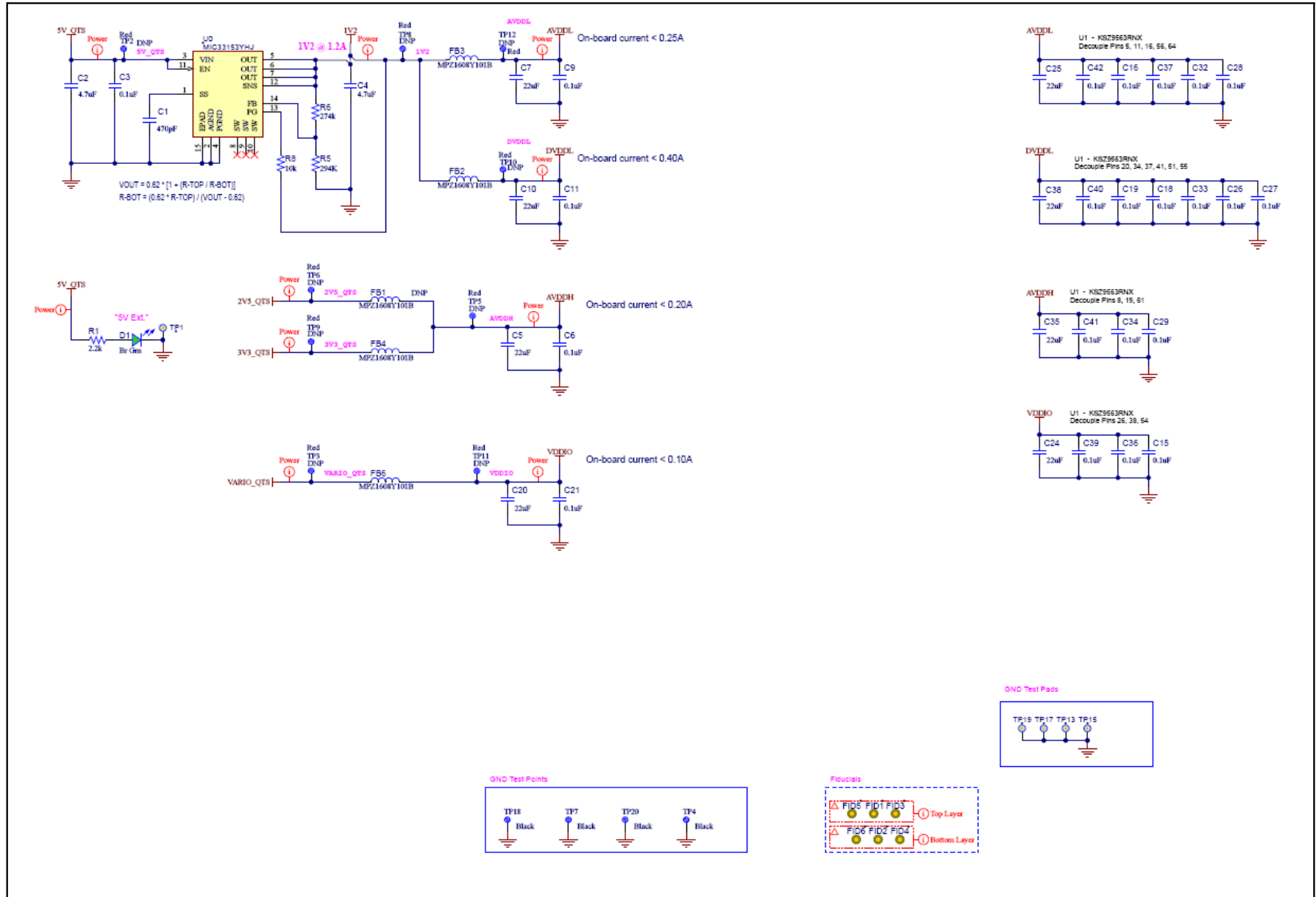


FIGURE B-3: EVB-KSZ9563 SCHEMATICS - BOARD POWER I/O AND REGULATORS





Appendix C. Bill of Materials (BOM)

C.1 INTRODUCTION

This appendix includes the EVB-KSZ9563 Bill of Materials (BOM).

TABLE C-1: BILL OF MATERIALS

Item	Qty	Reference	Description	Populated	Manufacturer	Manufacturer Part Number
1	1	C1	CAP CER 470pF 25V 5% NP0 SMD 0603	YES	AVX	06033A471JAT2A
2	2	C2, C4	CAP CER 4.7uF 10V 10% X5R SMD 0603	YES	KEMET	C0603C475K8PACTU
3	22	C3, C6, C9, C11, C15, C16, C18, C19, C21, C26, C27, C28, C29, C32, C33, C34, C36, C37, C39, C40, C41, C42	CAP CER 0.1uF 50V 10% X7R SMD 0402	YES	TDK Corporation	C1005X7R1H104K050BB
4	6	C5, C7, C10, C20, C24, C35	CAP CER 22uF 10V 20% X5R SMD 0603	YES	TDK Corporation	C1608X5R1A226M080AC
5	1	C8	CAP CER 1uF 16V 10% X5R SMD 0603	YES	AVX	0603YD105KAT2A
6	9	C12, C22, C23, C30, C31, C43, C44, C45, C46	CAP CER 0.1uF 50V 10% X7R SMD 0402	YES	TDK Corporation	C1005X7R1H104K050BB
7	2	C25, C38	CAP CER 22uF 10V 20% X5R SMD 1206	YES	Taiyo Yuden	LMK316BJ226ML-T
8	3	D1, D4, D5	LED, Bright Green, 0603	YES	Lite-On	LTST-C191KGKT
9	2	D2, D6	DIO LED BI GREEN, RED 2V 30mA 1210	YES	Lite-On	LTST-C155KGJRK
10	1	D3	DIO RECT MMBD914LT1G 1V 10mA 100V SMD SOT-23-3	YES	ON Semiconductor	MMBD914LT1G
11	4	FB2, FB3, FB4, FB6	FERRITE CHIP 100 OHM 2A 0603	YES	TDK Corporation	MPZ1608Y101B
12	1	FB5	FERRITE 500mA 220R SMD 0603	YES	Murata Electronics North America	BLM18AG221SN1D
13	2	J1, J5	HDR 3POS .100" SGL GOLD	YES	Samtec Inc.	TSW-103-07-G-S
14	2	J2, J6	CON MODULAR RJ45 MAGJACK TH R/A, NO LED	YES	Amphenol Commercial Products	RJMG201220030NR
15	2	JP1, JP2	CON HDR-2.54 MALE 1x2 GOLD 5.84MH TH VERT	YES	FCI	68000-236HLF
16	1	R1	RES TKF 2.2k 1% 1/10W SMD 0603	YES	Panasonic	ERJ-3EKF2201V
17	4	R4, R9, R45, R46	RES TKF 330R 5% 1/10W SMD 0603	YES	Panasonic Electronic Components	ERJ-3GEYJ331V
18	1	R5	RES TKF 294K 1% 1/10W SMD 0603	YES	Panasonic Electronic Components	ERJ-3EKF2943V
19	1	R6	RES TKF 274K 1% 1/10W SMD 0603	YES	Panasonic Electronic Components	ERJ-3EKF2743V
20	8	R7, R17, R29, R36, R39, R42, R50, R51	RES TKF 4.7k 5% 1/10W SMD 0603	YES	Yageo	RC0603JR-074K7L
21	1	R8	RES TKF 10k 5% 1/10W SMD 0603	YES	Panasonic	ERJ-3GEYJ103V
22	6	R10, R16, R28, R33, R37, R44	RES TKF 750R 1% 1/10W SMD 0603	YES	Vishay	CRCW0603750RFKEA
23	3	R11, R15, R19	RES TKF 0R 1/10W SMD 0603	YES	NIC Components	NRC06Z0TRF
24	1	R12	RES TKF 100k 1% 1/10W SMD 0603	YES	Panasonic	ERJ-3EKF1003V
25	2	R20, R43	RES TKF 470R 5% 1/10W SMD 0603	YES	Panasonic	ERJ-3GEYJ471V
26	7	R21, R22, R23, R24, R25, R26, R32	RES TKF 22R 1% 1/10W SMD 0603	YES	Yageo	RC0603FR-0722RL
27	1	R49	RES TKF 6.04k 1% 1/10W SMD 0603	YES	Yageo	9T06031A6041FBHFT
28	1	SW1	Switch, Tactile, SPST, 50mA, 16VDC, J-lead, 4.2 x 3.2 mm, PTS810, NO	YES	C&K	PTS810 SJM 250 SMTR LFS
29	4	TP4, TP7, TP18, TP20	TEST POINT PC MINI .040"D BLACK	YES	Keystone Electronics	5001

TABLE C-1: BILL OF MATERIALS (CONTINUED)

Item	Qty	Reference	Description	Populated	Manufacturer	Manufacturer Part Number
30	2	TP14, TP16	CON HDR-2.54 MALE 1x1 GOLD 5.84MH TH VERT	YES	Samtec	TSW-101-07-G-S
31	1	U1	KSZ9563RNX 3-Port Gigabit Ethernet Switch with AVB/1588	YES	Microchip Technology	KSZ9563RNX
32	1	U0	IC, 2.7V to 5.5V input, 1.2A, Synchronous 4MHz Buck Regulator with adjustable output	YES	Microchip Technology	MIC33153YHJ
33	1	J7	SAMTEC - QTS-050-01-L-D-A-GP - .635mm DOUBLE ROW HS SOCKET ASSEMBLY	YES	SAMTEC	QTS-050-01-L-D-A-GP
34	1	Y1	OSC MEMS 25.000MHZ CMOS SMD	YES	Microchip Technology	DSC1001CI2-025.0000
35	0	C13, C14	CAP CER 15pF 50V 5% NP0 SMD 0402	NO	Murata	GRM1555C1H150JA01D
36	0	C17	CAP CER 0.1uF 50V 10% X7R SMD 0402	NO	TDK Corporation	C1005X7R1H104K050BB
37	0	FB1	FERRITE CHIP 100 OHM 2A 0603	NO	TDK Corporation	MPZ1608Y101B
38	0	J3, J4	CONN MMCX JACK STR 50 OHM PCB	NO	Cinch Connectivity Solutions Johnson	135-3701-211
39	0	R2, R27, R34, R35, R52, R53	RES TKF 4.7k 5% 1/10W SMD 0603	NO	Yageo	RC0603JR-074K7L
40	0	R3, R30, R31, R38, R40, R41	RES TKF 750R 1% 1/10W SMD 0603	NO	Vishay	CRCW0603750RFKEA
41	0	R13, R14, R18, R47, R48	RES TKF 0R 1/10W SMD 0603	NO	NIC Components	NRC06Z0TRF
42	0	TP2, TP3, TP5, TP6, TP8, TP9, TP10, TP11, TP12	TEST POINT PC MINI .040"D RED	NO	Keystone Electronics	5000

Appendix D. Silk Screen

D.1 INTRODUCTION

This appendix shows the EVB-KSZ9563 top and bottom silk screen images.

FIGURE D-1: EVB-KSZ9563 TOP SILK SCREEN

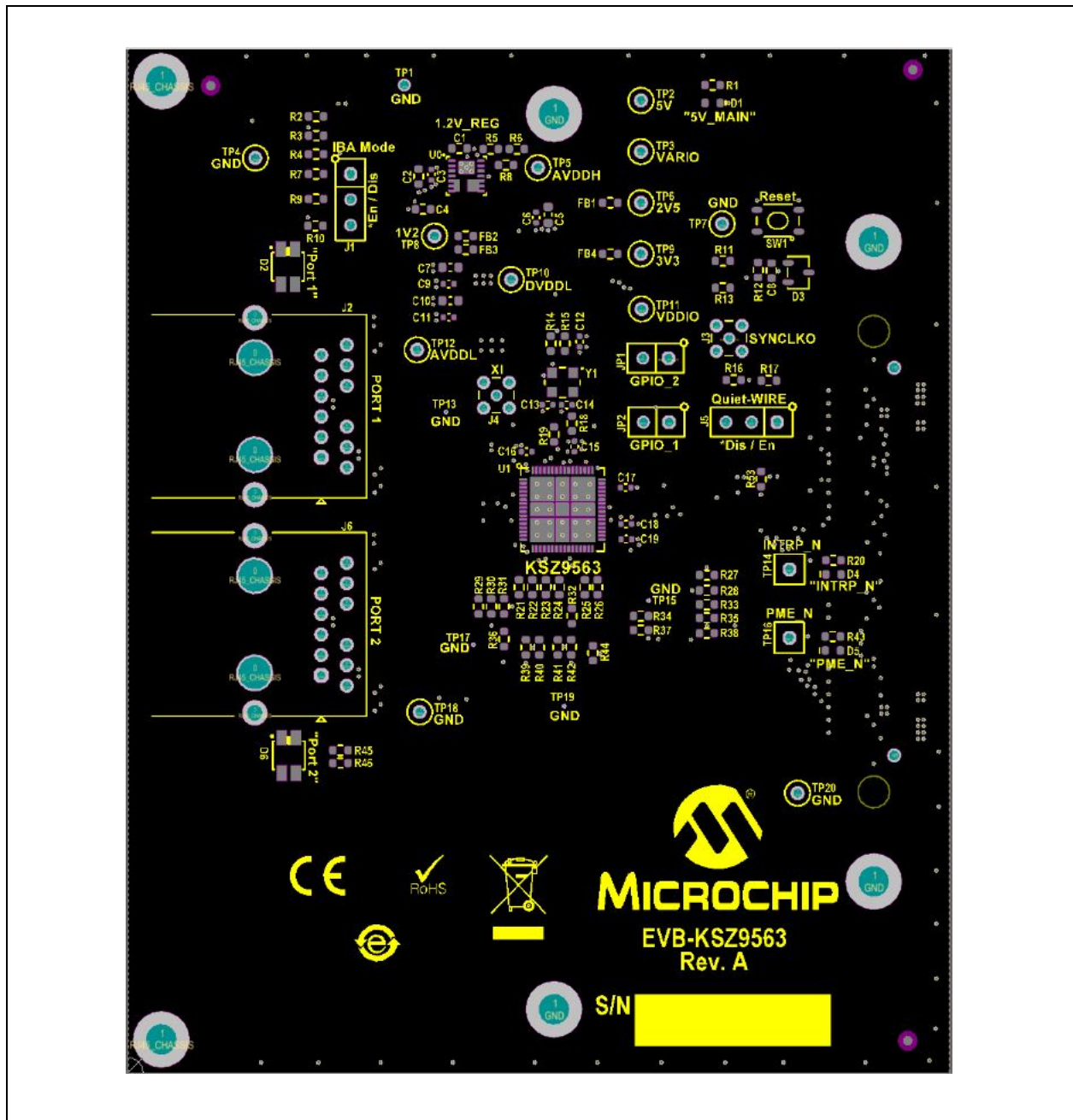
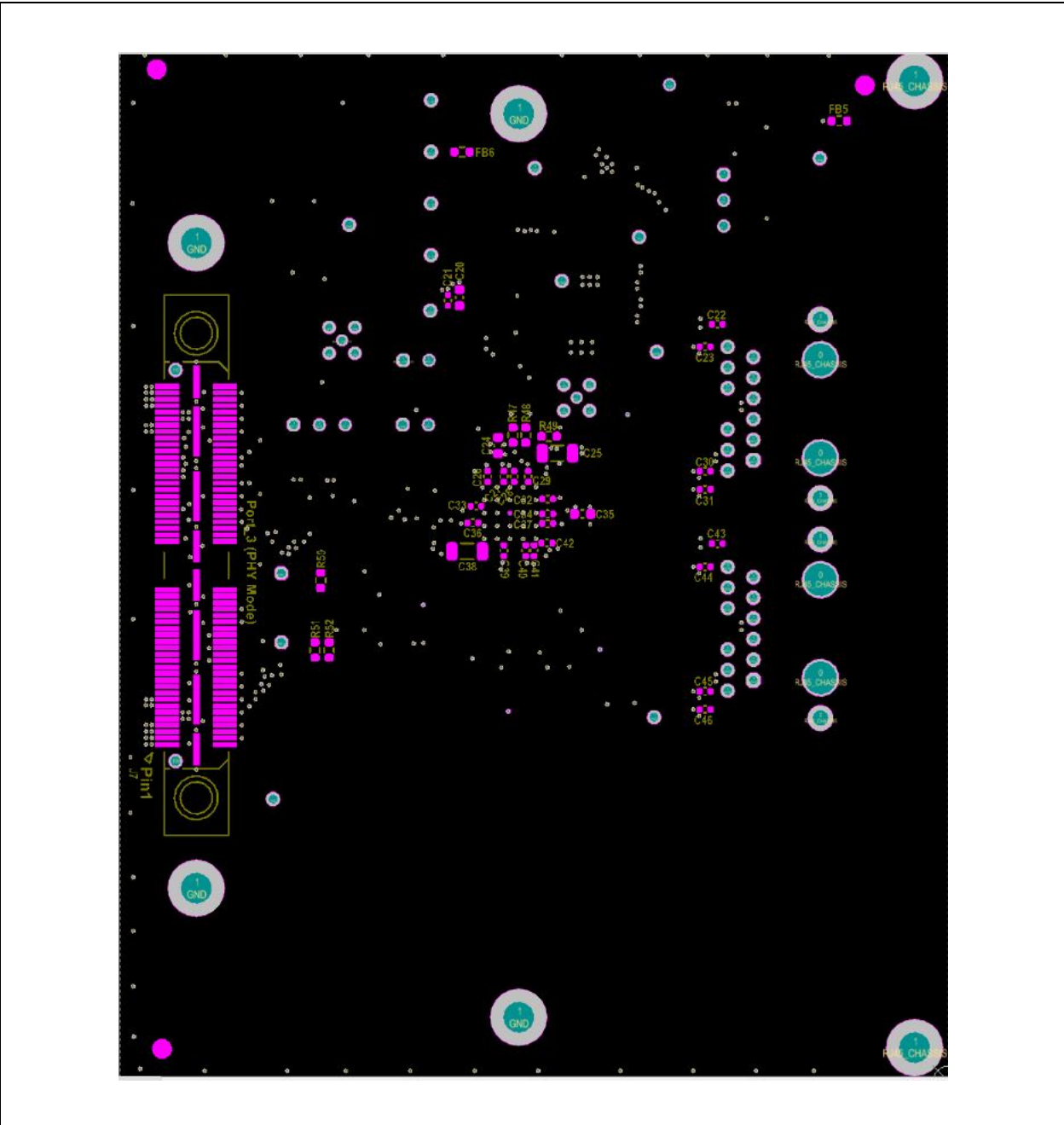


FIGURE D-2: EVB-KSZ9563 BOTTOM SILK SCREEN



NOTES:



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