EVB-KSZ8563 Evaluation Board User's Guide

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Preface

NOTICE TO CUSTOMERS

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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 "DSXXXXXA", where "XXXXX" 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 KSZ8563. 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-KSZ8563 Evaluation Board as a development tool for the KSZ8563, 3-Port Fast Ethernet Switch with RGMII Interface and IEEE 1588v2 support.

- **Chapter 1. "Overview"** – This chapter provides a brief description of the EVB-KSZ8563 Evaluation Board.
- **Chapter 2. "Board Details and Configuration"** – This chapter includes instructions on how to get started with the EVB-KSZ8563 Evaluation Board.
- **Appendix A. "EVB-KSZ8563 Evaluation Board"** – This appendix shows the physical EVB-KSZ8563 Evaluation Board.
- **Appendix B. "Schematics"** – This appendix shows the EVB-KSZ8563 Evaluation Board schematics.
- **Appendix C. "Bill of Materials"** – This appendix includes the EVB-KSZ8563 Evaluation Board Bill of Materials (BOM).
- **Appendix D. "Silk Screen"** – This appendix includes the EVB-KSZ8563 Evaluation Board silk screen.

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CONVENTIONS USED IN THIS GUIDE

This manual uses the following documentation conventions:

Description	Represents	Examples
Arial font:		
Italic characters	Referenced books	*MPLAB® IDE User's Guide*
	Emphasized text	...is the *only* 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	*File>Save*
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	*`file`*`.o`, where *`file`* can be any valid filename
Square brackets [ ]	Optional arguments	`mcc18 [options]` *`file`* `[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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- **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.

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- Field Application Engineer (FAE)
- Technical Support

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Technical support is available through the web site at:
http://www.microchip.com/support

DOCUMENT REVISION HISTORY

Revisions	Section/Figure/Entry	Correction
DS50002755B (04-17-19)	Figure 2-1, Figure 2-2, Figure 2-3, Figure 2-4, Figure A-1, Figure A-2, Figure D-1, and Figure D-2	Updated the figures.
	Appendix B. "Schematics", **Appendix C. "Bill of Materials"**, and **Appendix D. "Silk Screen"**	Updated the appendix titles.
	All	Removed AVB and 802.1AS references.
DS50002755A (05-10-18)	Initial release.	

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Chapter 1. Overview

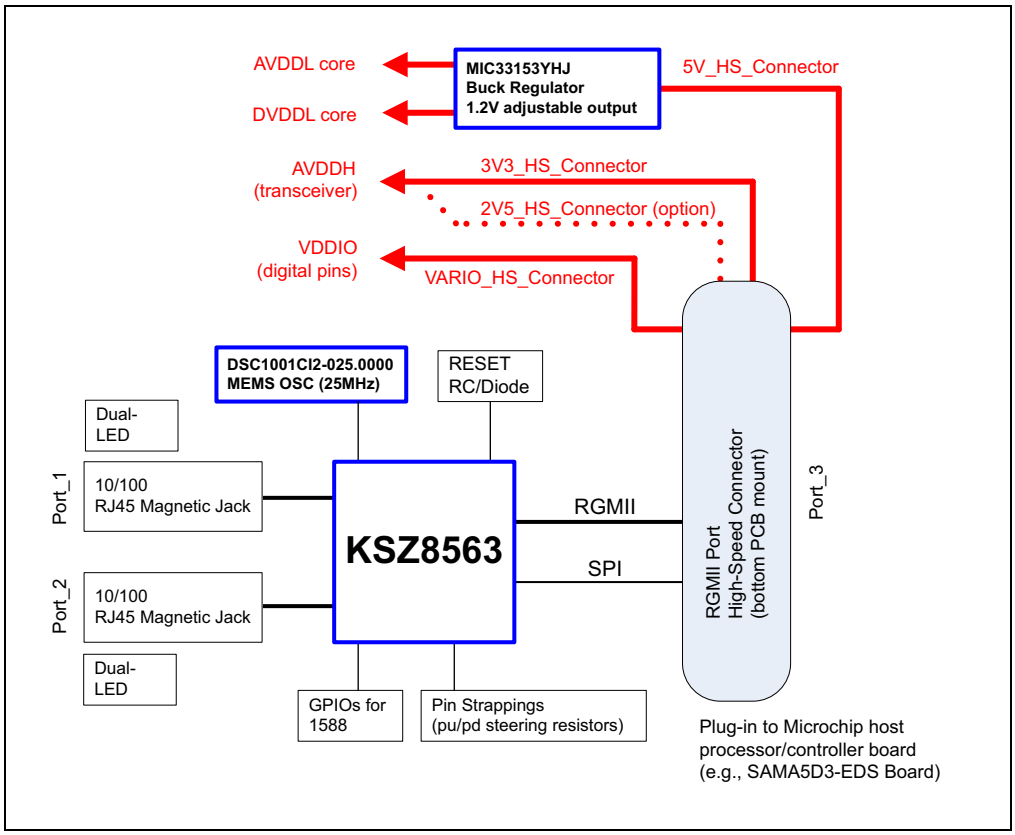
1.1 INTRODUCTION

The EVB-KSZ8563 evaluation board is a plug-in card that interfaces directly with a mating Microchip host processor/controller board, such as the SAMA5D3-EDS board. It features the KSZ8563, a highly-integrated networking device that incorporates a layer-2+ managed Fast Ethernet switch, two 10BASE-T/100BASE-TX 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-speed multi-pin (HS) connector.

As a set, the EVB-KSZ8563 and SAMA5D3-EDS boards provide a highly-flexible platform to allow evaluation of basic KSZ8563 PHY/Switch features using static control-status registers (CSRs) to develop firmware of advanced KSZ8563 MAC/Switch features, such as IEEE1588 PTP and RSTP/MSTP that require interaction with upper network layers.

The scope of this document is meant to describe the EVB-KSZ8563 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-KSZ8563 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.

- *KSZ8563 Data Sheet*
- *EVB-KSZ8563 Schematics*
- *SAMA5D3-EDS Schematics*
- *SAMA5D3-EDS Board User's Guide*
- *MIC33153YHJ Data Sheet*
- *DSC1001 Data Sheet*

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Chapter 2. Board Details and Configuration

2.1 INTRODUCTION

The EVB-KSZ8563 is designed as a plug-in card to interface directly with a mating Microchip host processor or controller board, such as the SAMA5D3-EDS board, that supplies full power and provides full register access and configuration via IBA, SPI, or I^2C bus management.

2.2 POWER SOURCE

The EVB-KSZ8563 is completely bus-powered from its mating Microchip host processor or controller board. Input power is delivered via the high-speed multi-pin (HS) 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-KSZ8563 design is not intended to perform current measurements on the device. If needed, the current access points to measure the current consumption of the KSZ8563 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); FB1 for 2.5V (default not populate)

Note: Populate either FB4 only or FB1 only. If 2.5V AVDDH is desired, FB4 should be 'do not populate' (DNP) and FB1 should be populated.

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 KSZ8563 device.

2.3 CLOCK

The EVB-KSZ8563 utilizes the on-board Microchip DSC1001CI2-025.0000 clock chip, a 25-MHz MEMS oscillator, as the input reference clock to the KSZ8563 device. Refer to Figure 2-1 and the board schematics in **Appendix B. "Schematics"** for details.

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2.4 RESET

2.4.1 Power-On Reset

The discrete RC/Diode (R12, C8, and D3) circuit provides power-on reset to the KSZ8563 device.

2.4.2 Manual Reset

The SW1 reset button can be pressed and released to provide manual reset to the KSZ8563 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-KSZ8563 with key features, jumpers, and headers highlighted in red, and with Microchip components highlighted in blue.

FIGURE 2-1: EVB-KSZ8563 TOP VIEW WITH CALLOUTS

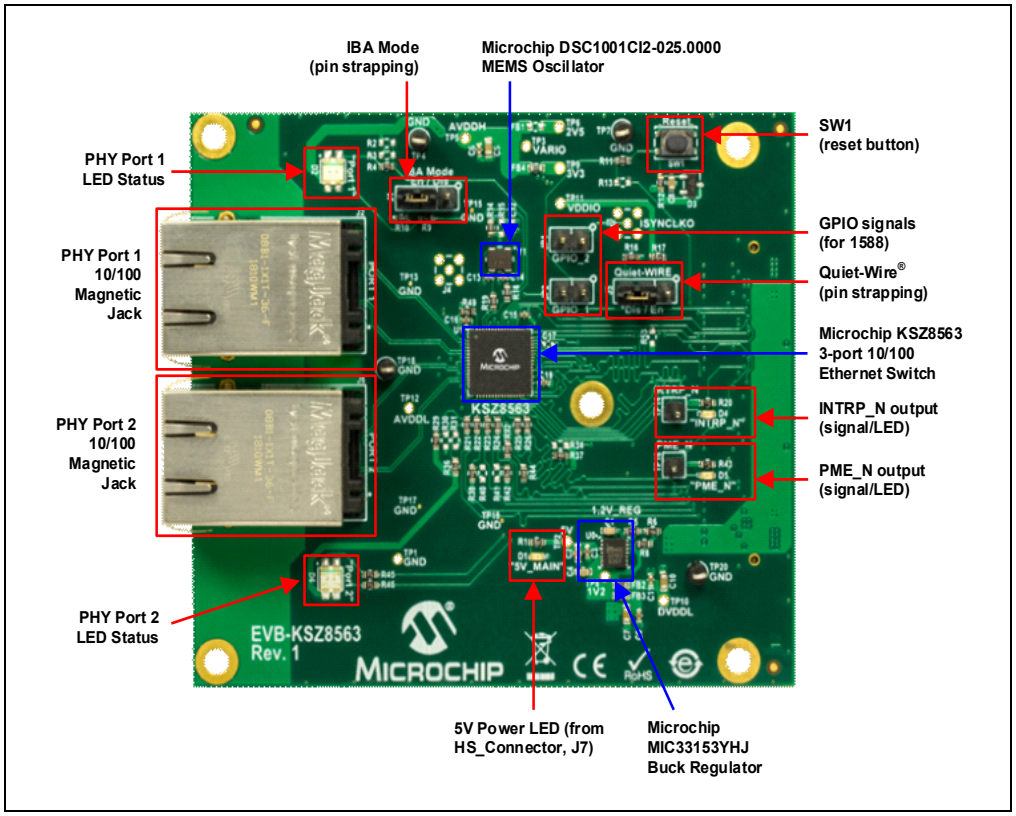

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Figure 2-2 displays the power probe points along with the ground test points.

FIGURE 2-2: EVB-KSZ8563 POWER/GROUND CALLOUTS

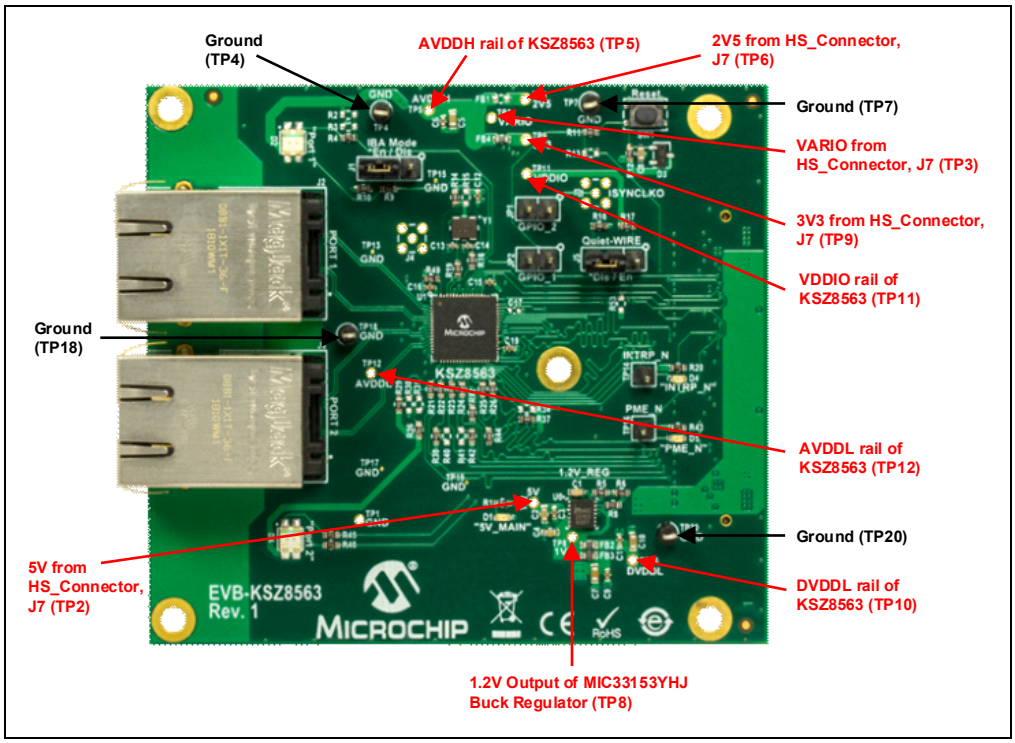
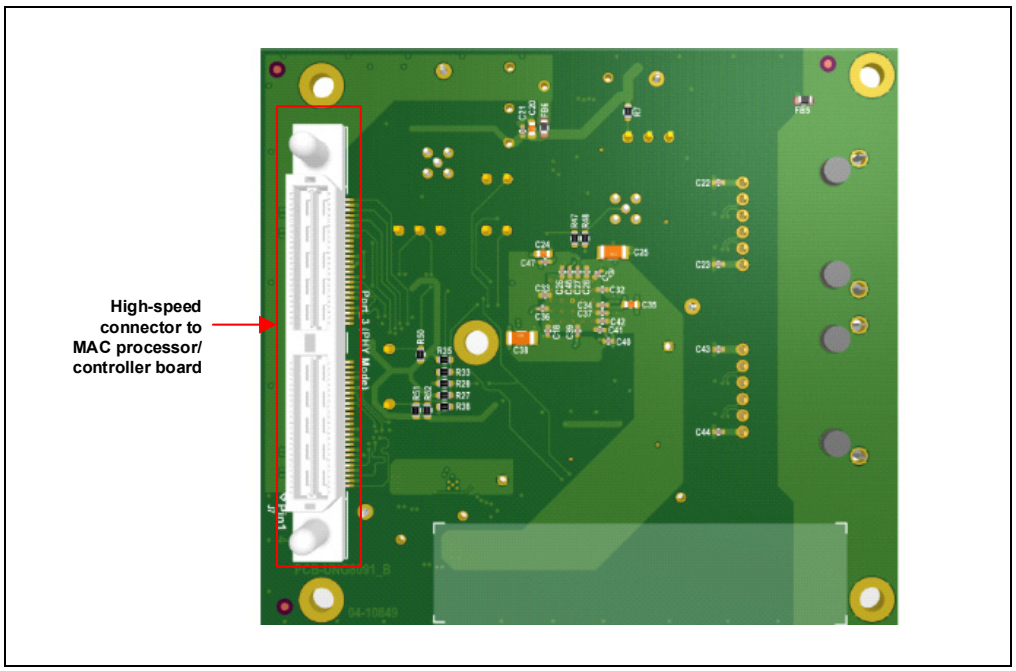


Figure 2-3 displays the bottom view of the EVB-KSZ8563 with the HS connector (J7) (highlighted in red) that plugs directly into a mating Microchip MAC processor or controller board.

FIGURE 2-3: EVB-KSZ8563 BOTTOM VIEW WITH CALLOUT



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2.5.1 PHY Ports - Integrated Magnetic Jacks

PHY ports 1 and 2 (J2 and J6) support 10BASE-T/100BASE-TX 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	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 KSZ8563 device is configured via internal or external pull-up/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 the 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 shown 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. When enabled by pin strapping, IBA defaults to PHY port 1. SPI or I^2C management access is required to enable IBA for MAC port 3 or PHY port 2.	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 *KSZ8563 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
JP1	GPIO_2	The GPIO_2 pin is configurable to implement IEEE1588 event trigger outputs and time stamp capture inputs to support real-time application requirements.	No Connect	GPIO_2 (KSZ8563 pin 41)
JP2	GPIO_1	The GPIO_1 pin is configurable to implement IEEE1588 event trigger outputs and time stamp capture inputs to support real-time application requirements.	Ground	GPIO_1 (KSZ8563 pin 40)

Refer to the board schematics in **Appendix B. "Schematics"** and the *KSZ8563 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 KSZ8563 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 *KSZ8563 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 KSZ8563 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 *KSZ8563 Data Sheet* for further details and usage on the PME_N signal.

2.6 USING THE EVB-KSZ8563

The EVB-KSZ8563 plugs in directly to a mating Microchip host controller or processor board, such as the SAMA5D3-EDS board, that delivers full power and provides full register access and configuration via IBA, SPI, or I^2C bus management.

Together, the EVB-KSZ8563 and the SAMA5D3-EDS enable Ethernet traffic switching across all three data ports of the KSZ8563 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 KSZ8563 registers are accessible via IBA, SPI, or I^2C bus management from the SAMA5D3-EDS board, enabling full evaluation and firmware development for all KSZ8563 MAC/Switch features and interaction with upper network layers.

Refer to the SAMA5D3-EDS board documentation on its usage.

Figure 2-4 shows a switch EVB connected to the SAMA5D3-EDS board.

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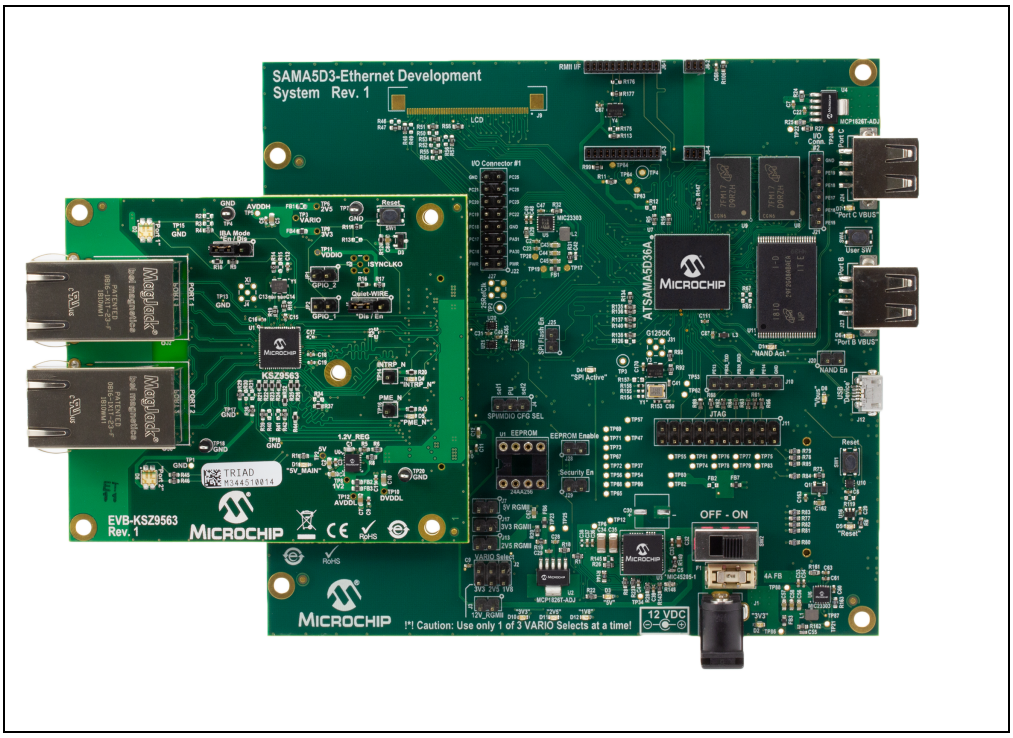
FIGURE 2-4: EXAMPLE OF SWITCH EVB WITH SAMA5D3-EDS FOR FIRMWARE DEVELOPMENT



NOTES:

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Appendix A. EVB-KSZ8563 Evaluation Board

A.1 INTRODUCTION

This appendix shows the EVB-KSZ8563 evaluation board.

FIGURE A-1: EVB-KSZ8563 EVALUATION BOARD (TOP VIEW)

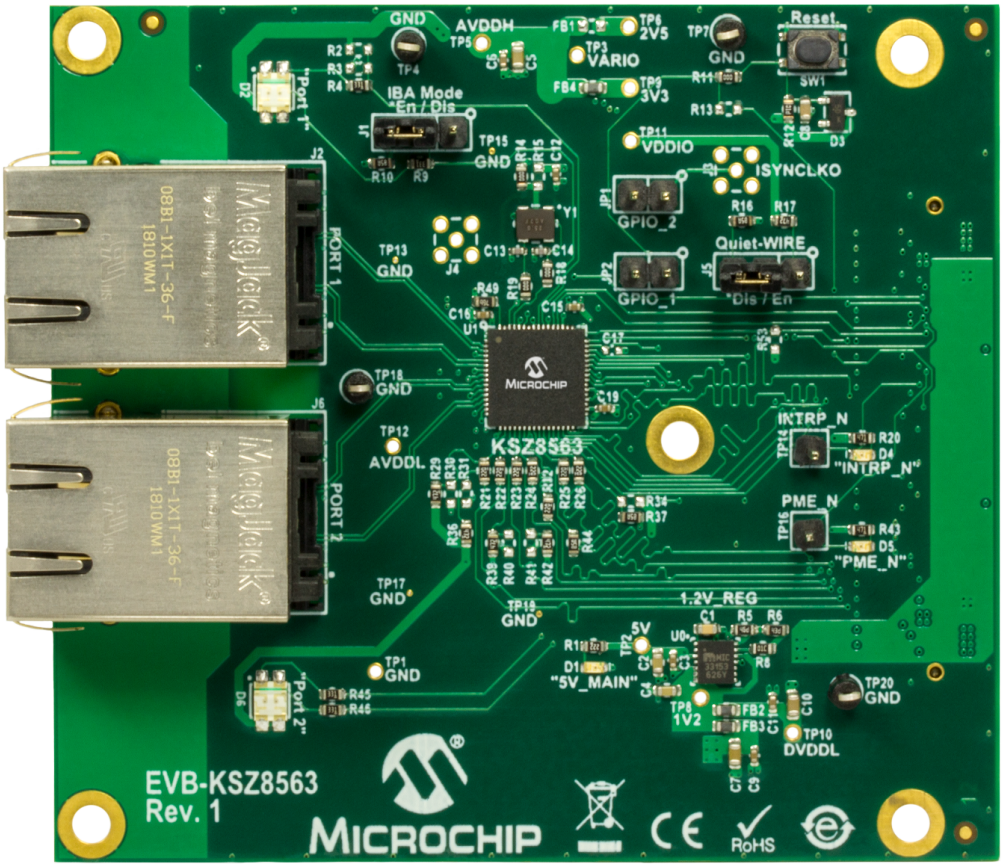
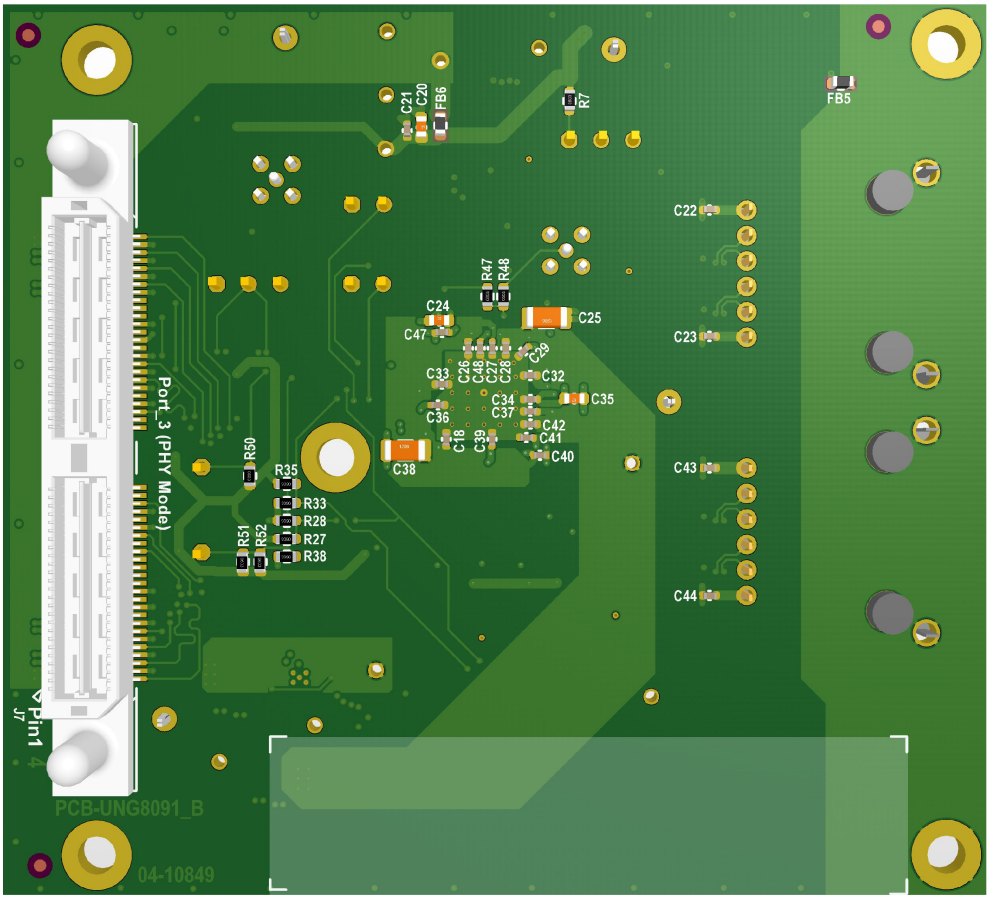


FIGURE A-2: EVB-KSZ8563 EVALUATION BOARD (BOTTOM VIEW)



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Appendix B. Schematics

B.1 INTRODUCTION

This appendix includes the EVB-KSZ8563 schematics.

FIGURE B-1: EVB-KSZ8563 SCHEMATICS - KSZ8563 DEVICE, PIN STRAPPING, CLOCK, AND RESET

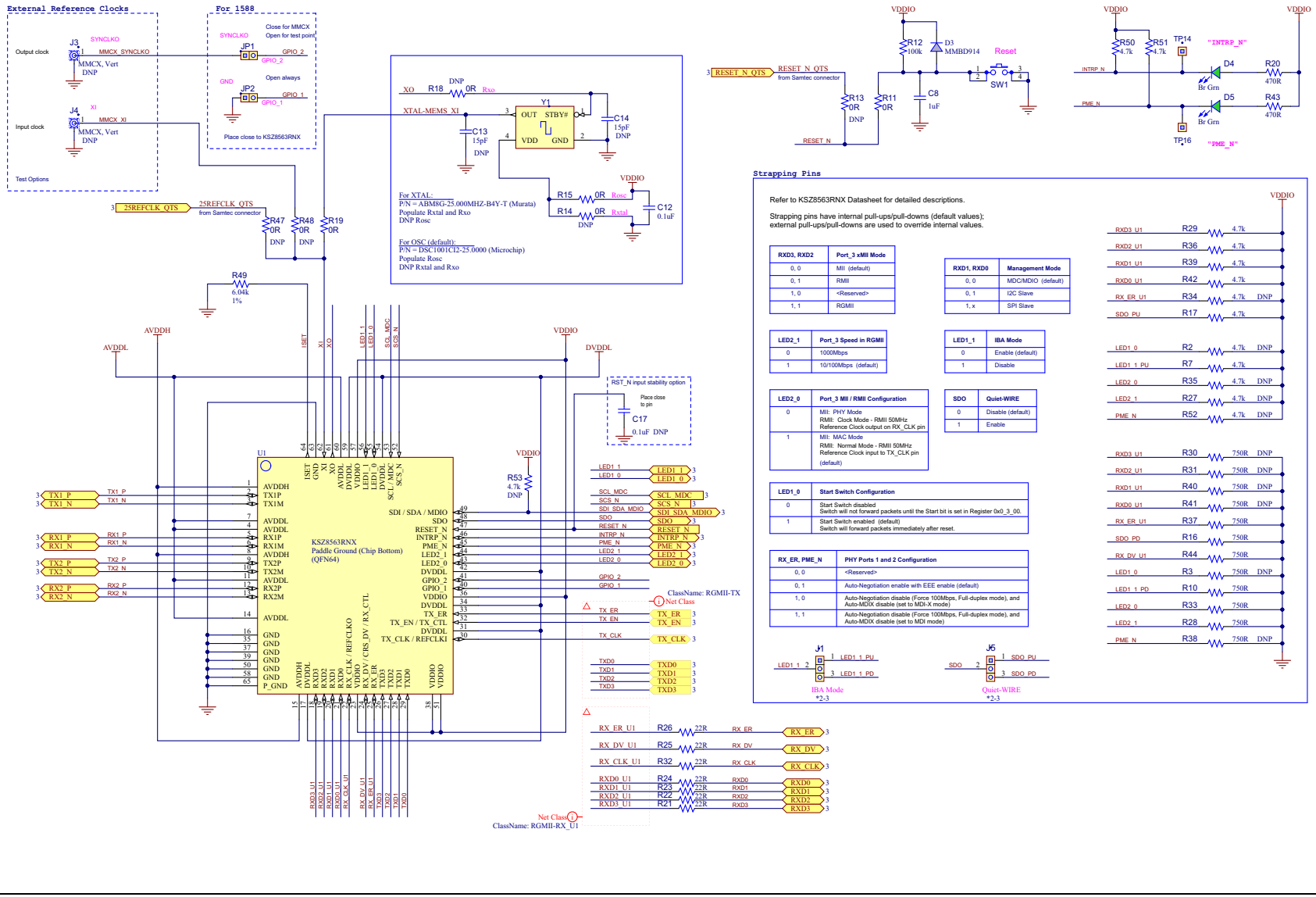

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FIGURE B-2: EVB-KSZ8563 SCHEMATICS - PORTS 1, 2 PHYS; PORT 3 MAC - MII/RMII/RGMII CONNECTOR

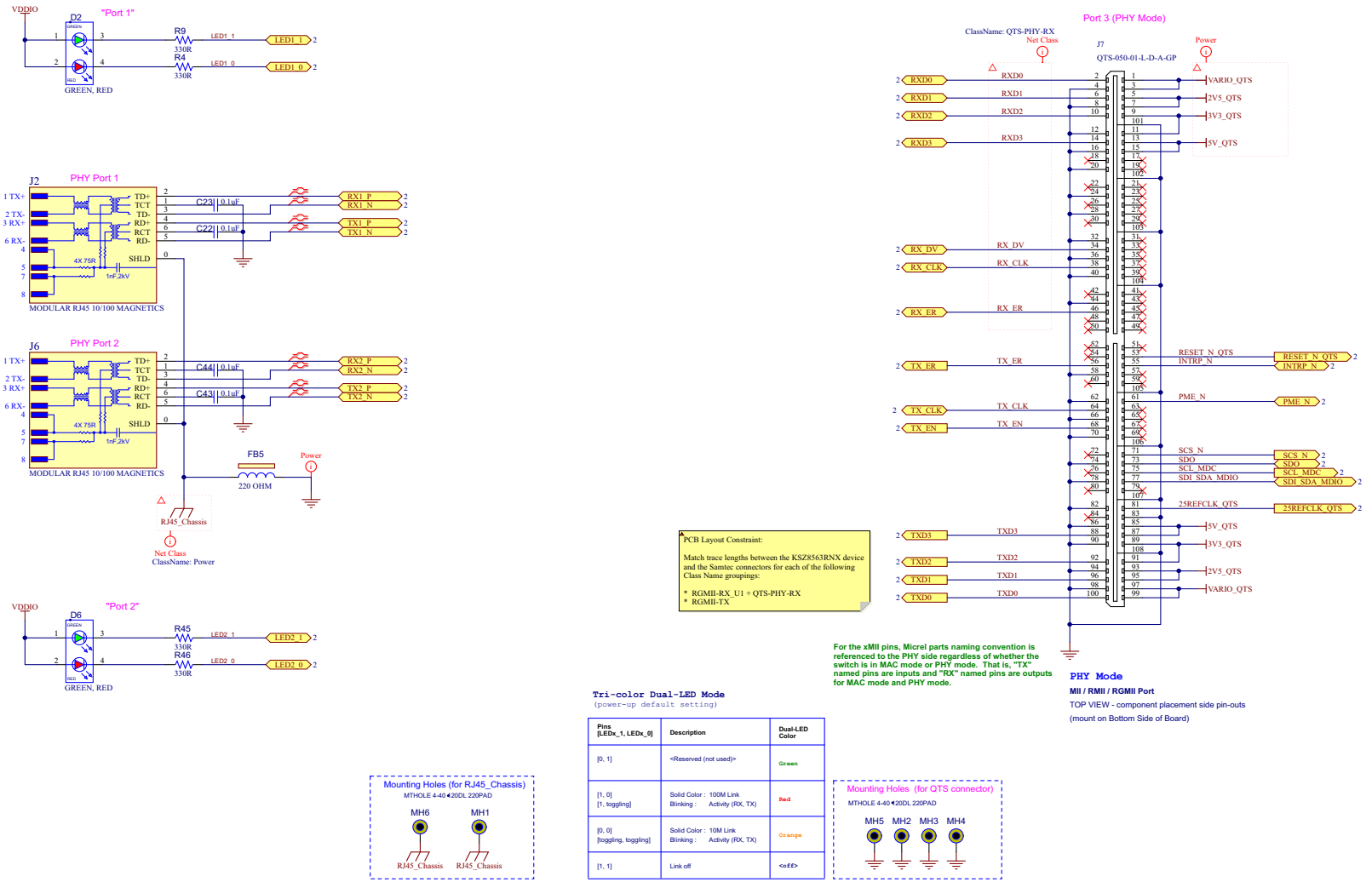
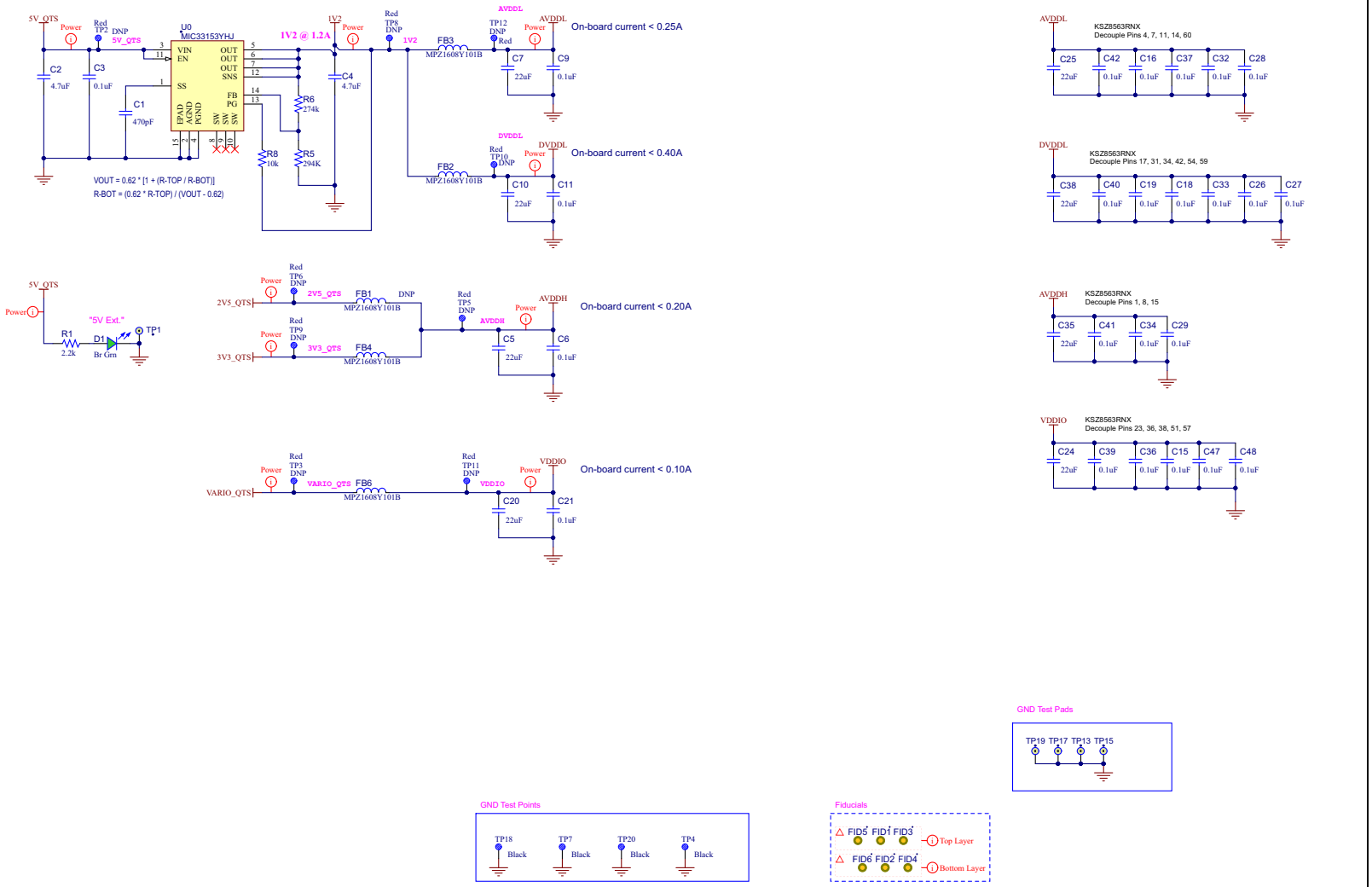


FIGURE B-3: EVB-KSZ8563 SCHEMATICS - BOARD POWER I/O AND REGULATORS



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Appendix C. Bill of Materials

C.1 INTRODUCTION

This appendix includes the EVB-KSZ8563 Bill of Materials (BOM).

TABLE C-1: EVB-KSZ8563 BILL OF MATERIALS

Item	Qty	Reference	Description	Populated	Manufacturer	Manufacturer Part Number
1	2	C13, C14	CAP CER 15 pF 50V 5% NP0 SMD 0402	YES	Murata	GRM1555C1H150JA01D
2	1	C1	CAP CER 470 pF 25V 5% NP0 SMD 0603	YES	AVX	06033A471JAT2A
3	2	C2, C4	CAP CER 4.7 uF 10V 10% X5R SMD 0603	YES	KEMET	C0603C475K8PACTU
4	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 0.1 uF 50V 10% X7R SMD 0402	YES	TDK Corporation	C1005X7R1H104K050BB
5	6	C5, C7, C10, C20, C24, C35	CAP CER 22 uF 10V 20% X5R SMD 0603	YES	TDK Corporation	C1608X5R1A226M080AC
6	1	C8	CAP CER 1 uF 16V 10% X5R SMD 0603	YES	AVX	0603YD105KAT2A
7	7	C12, C22, C23, C43, C44, C47, C48	CAP CER 0.1 uF 50V 10% X7R SMD 0402	YES	TDK Corporation	C1005X7R1H104K050BB
8	2	C25, C38	CAP CER 22 uF 10V 20% X5R SMD 1206	YES	Taiyo Yuden	LMK316BJ226ML-T
9	3	D1, D4, D5	LED, Bright Green, 0603	YES	Lite-On	LTST-C191KGKT
10	2	D2, D6	DIO LED BI GREEN, RED 2V 30 mA 1210	YES	Lite-On	LTST-C155KGJRKT
11	1	D3	DIO RECT MMBD914LT1G 1V 10 mA 100V SMD SOT-23-3	YES	ON Semiconductor	MMBD914LT1G
12	4	FB2, FB3, FB4, FB6	FERRITE CHIP 100 OHM 2A 0603	YES	TDK Corporation	MPZ1608Y101B
13	1	FB5	FERRITE 500 mA 220R SMD 0603	YES	Murata Electronics North America	BLM18AG221SN1D
14	2	J1, J5	HDR 3POS 100" SGL GOLD	YES	Samtec Inc.	TSW-103-07-G-S
15	2	J2, J6	CON MODULAR RJ45 MAGJACK TH R/A, NO LED	YES	Bel Fuse Inc.	08B1-1X1T-36-F
16	2	JP1, JP2	CON HDR-2.54 MALE 1x2 GOLD 5.84 MH TH VERT	YES	FCI	68000-236HLF
17	1	R1	RES TKF 2.2k 1% 1/10W SMD 0603	YES	Panasonic	ERJ-3EKF2201V
18	4	R4, R9, R45, R46	RES TKF 330R 5% 1/10W SMD 0603	YES	Panasonic Electronic Components	ERJ-3GEYJ331V
19	1	R5	RES TKF 294K 1% 1/10W SMD 0603	YES	Panasonic Electronic Components	ERJ-3EKF2943V
20	1	R6	RES TKF 274K 1% 1/10W SMD 0603	YES	Panasonic Electronic Components	ERJ-3EKF2743V
21	8	R7, R17, R29, R36, R39, R42, R50, R51	RES TKF 4.7k 5% 1/10W SMD 0603	YES	Yageo	RC0603JR-074K7L
22	1	R8	RES TKF 10k 5% 1/10W SMD 0603	YES	Panasonic	ERJ-3GEYJ103V
23	6	R10, R16, R28, R33, R37, R44	RES TKF 750R 1% 1/10W SMD 0603	YES	Vishay	CRCW0603750RFKEA
24	4	R11, R14, R18, R19	RES TKF 0R 1/10W SMD 0603	YES	NIC Components	NRC06Z0TRF
25	1	R12	RES TKF 100k 1% 1/10W SMD 0603	YES	Panasonic	ERJ-3EKF1003V
26	2	R20, R43	RES TKF 470R 5% 1/10W SMD 0603	YES	Panasonic	ERJ-3GEYJ471V
27	7	R21, R22, R23, R24, R25, R26, R32	RES TKF 22R 1% 1/10W SMD 0603	YES	Yageo	RC0603FR-0722RL
28	1	R49	RES TKF 6.04k 1% 1/10W SMD 0603	YES	Yageo	9T06031A6041FBHFT
29	1	SW1	Switch, Tactile, SPST, 50 mA, 16VDC, J-lead, 4.2 x 3.2 mm, PTS810, NO	YES	C&K	PTS810 SJM 250 SMTR LFS
30	4	TP4, TP7, TP18, TP20	TEST POINT PC MINI 0.040"D BLACK	YES	Keystone Electronics	5001

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TABLE C-1: EVB-KSZ8563 BILL OF MATERIALS (CONTINUED)

Item	Qty	Reference	Description	Populated	Manufacturer	Manufacturer Part Number
31	2	TP14, TP16	CON HDR-2.54 MALE 1x1 GOLD 5.84 MH TH VERT	YES	Samtec	TSW-101-07-G-S
32	1	U1	KSZ8563RNX 3-Port 10/100 Ethernet Switch with 1588	YES	Microchip Technology	KSZ8563RNX
33	1	U0	IC, 2.7V to 5.5V input, 1.2A, Synchronous 4MHz Buck Regulator with adjustable output	YES	Microchip Technology	MIC33153YHJ
34	1	J7	SAMTEC - QTS-050-01-L-D-A-GP -0.635 mm DOUBLE ROW HS SOCKET ASSEMBLY	YES	SAMTEC	QTS-050-01-L-D-A-GP
35	1	Y1	CRYSTAL 25 MHz 10 pF SMD ABM8G	YES	Abracon LLC	ABM8G-25.000MHZ-4Y-T3
36	0	C13, C14	CAP CER 15 pF 50V 5% NP0 SMD 0402	NO	Murata	GRM1555C1H150JA01D
37	0	C17	CAP CER 0.1 uF 50V 10% X7R SMD 0402	NO	TDK Corporation	C1005X7R1H104K050BB
38	0	FB1	FERRITE CHIP 100 OHM 2A 0603	NO	TDK Corporation	MPZ1608Y101B
39	0	J3, J4	CONN MMCX JACK STR 50 OHM PCB	NO	Cinch Connectivity Solutions Johnson	135-3701-211
40	0	R2, R27, R34, R35, R52, R53	RES TKF 4.7k 5% 1/10W SMD 0603	NO	Yageo	RC0603JR-074K7L
41	0	R3, R30, R31, R38, R40, R41	RES TKF 750R 1% 1/10W SMD 0603	NO	Vishay	CRCW0603750RFKEA
42	0	R13, R15, R47, R48	RES TKF 0R 1/10W SMD 0603	NO	NIC Components	NRC06Z0TRF
43	0	TP2, TP3, TP5, TP6, TP8, TP9, TP10, TP11, TP12	TEST POINT PC MINI 0.040"D RED	NO	Keystone Electronics	5000

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NOTES:

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Appendix D. Silk Screen

D.1 INTRODUCTION

This appendix shows the EVB-KSZ8563 top and bottom silk screen images.

FIGURE D-1: EVB-KSZ8563 TOP SILK SCREEN

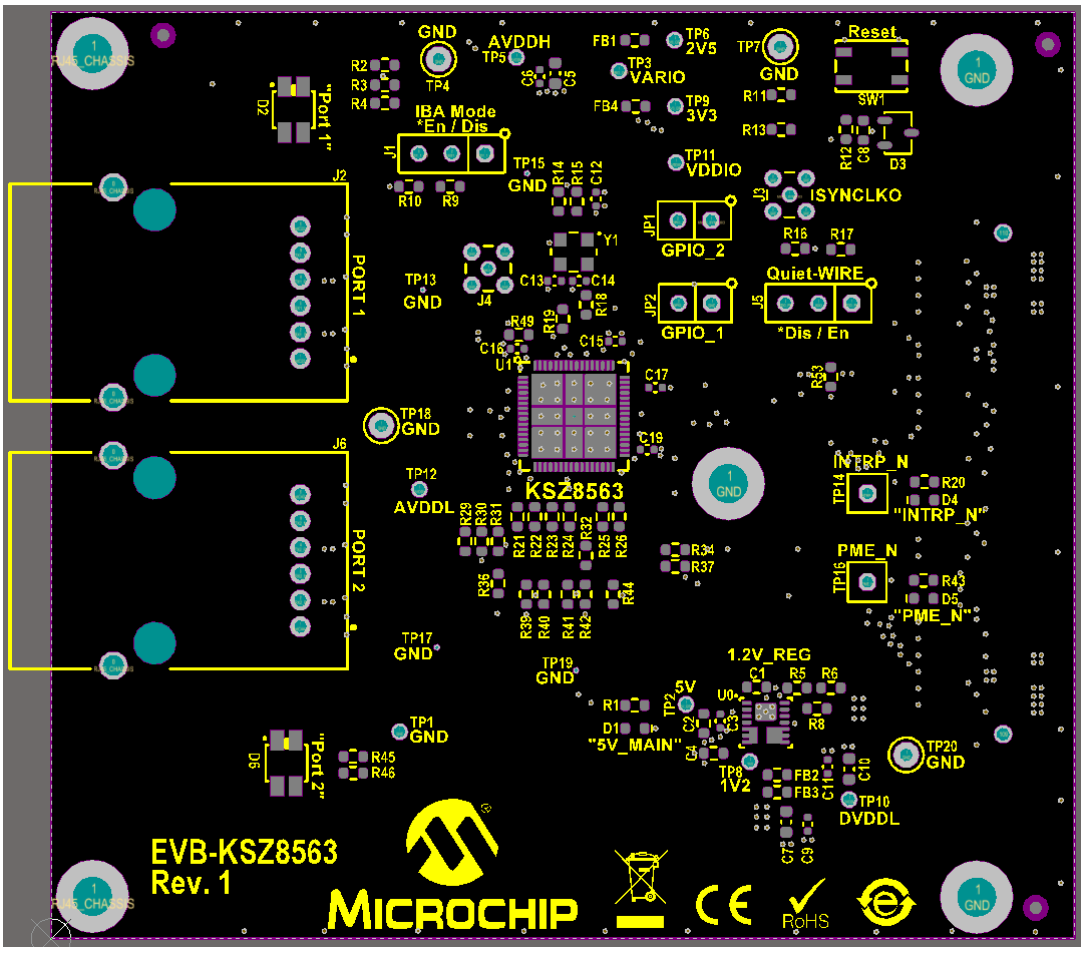
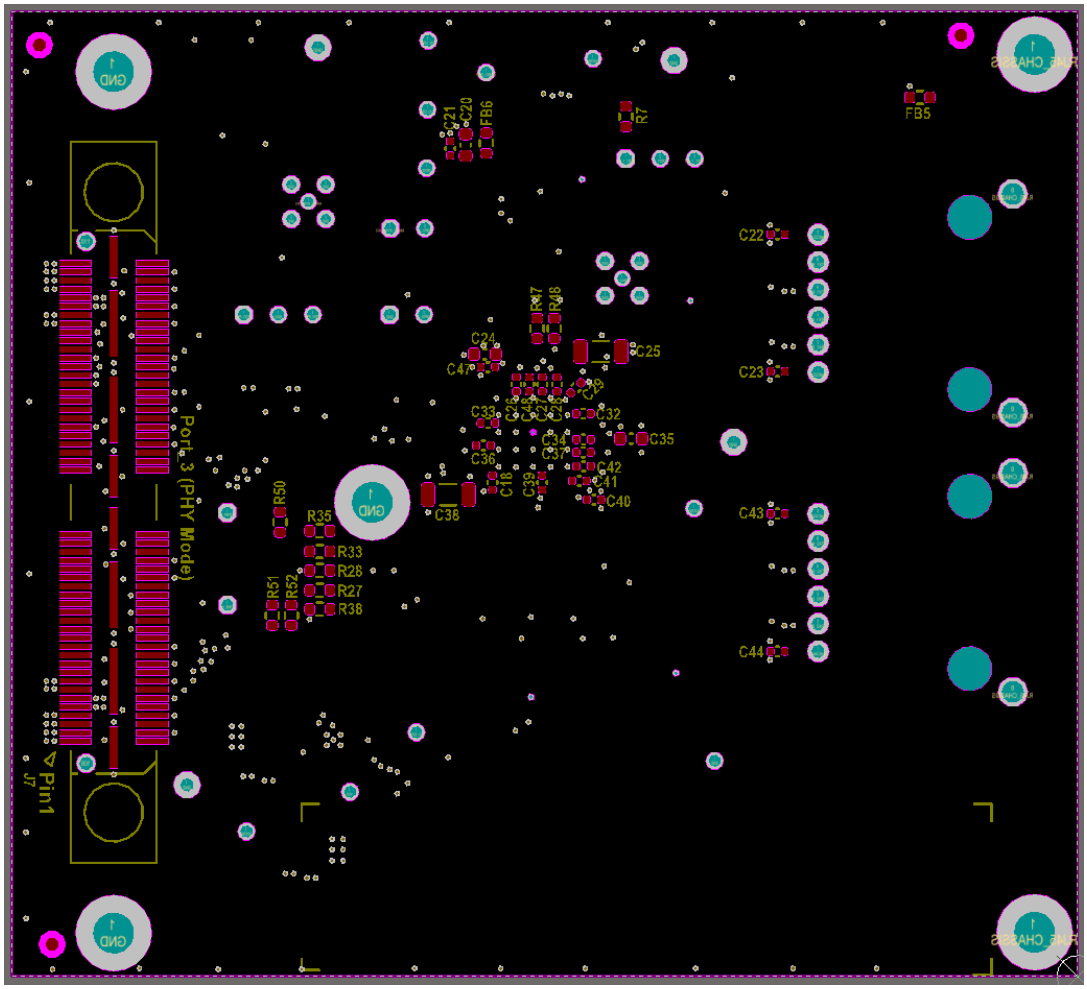


FIGURE D-2: EVB-KSZ8563 BOTTOM SILK SCREEN



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