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**EVB-KSZ9131RNX Evaluation
Board User's Guide**

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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 EVB-KSZ9131RNX Evaluation Board. Items discussed in this chapter include:

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

DOCUMENT LAYOUT

This document provides details on how to use the EVB-KSZ9131RNX as a development tool for the KSZ9131RNX Gigabit Ethernet Transceiver with RGMII™. The manual layout is as follows:

- **Chapter 1. “Overview”** – This chapter shows a brief description of the EVB-KSZ9131RNX.
- **Chapter 2. “Getting Started”** – This chapter provides information about setup and operation of the EVB-KSZ9131RNX.
- **Appendix A. “Schematics”** – This appendix shows the EVB-KSZ9131RNX schematics.
- **Appendix B. “Bill of Materials”** – This appendix includes the EVB-KSZ9131RNX Bill of Materials.

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	%fghkpg"UVCTV
	Filenames	cwvqgzge0dcv
	File paths	e<^oe3:^j
	Keywords	acuo."agpfcuo."uvcvke
	Command-line options	-Qrc-."-Qrc/
	Bit values	2."3
	Constants	2zHH."ÈCÍ
Italic Courier New	A variable argument	<i>hkng</i> 0q, where <i>hkng</i> can be any valid filename
Square brackets []	Optional arguments	oe3:"]qrvkqpu_" <i>hkng</i> "]qrvkqpu_
Curly brackets and pipe character: { }	Choice of mutually exclusive arguments; an OR selection	gttqtngxgn"}2~3;
Ellipses...	Replaces repeated text	var_name [, var_name...]
	Represents code supplied by user	void main (void) { ... }

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- **Compilers** – The latest information on Microchip C compilers, assemblers, linkers and other language tools. These include all MPLABCC compilers; all MPLAB assemblers (including MPASM™ assembler); all MPLAB linkers (including MPLINK™ object linker); and all MPLAB librarians (including MPLIB™ object librarian).
- **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

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- Distributor or Representative
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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
DS50002950A (1-20-2020)	Initial release	

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NOTES:

Chapter 1. Overview

1.1 INTRODUCTION

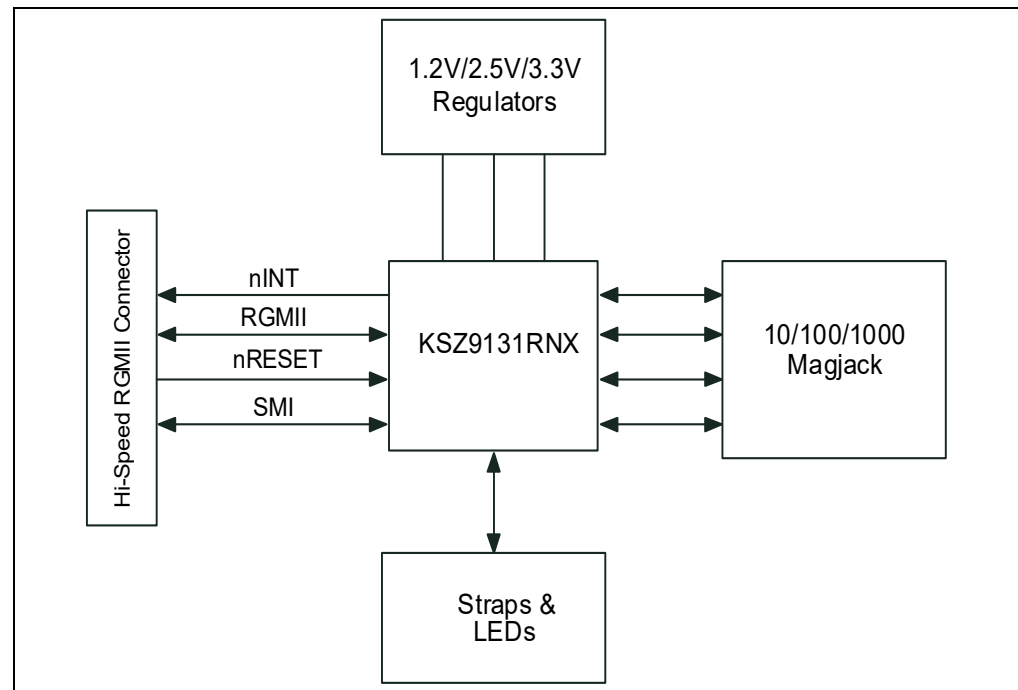
The EVB-KSZ9131RNX Evaluation Board is a plug-in card that interfaces directly with a mating Microchip host processor or controller board, such as the SAMA5D3 Ethernet Development System (EDS) Board. It features the KSZ9131, a highly integrated networking device that incorporates a 10BASE-T/100BASE-TX/1000BASE-T physical layer transceiver (PHY). The board's PHY port is connected to an RJ45 Ethernet jack with integrated magnetics, and the PHY's RGMII™ connections are brought out to a high-speed multi-pin (HS) connector.

Together, the EVB-KSZ9131RNX and the SAMA5D3-EDS provide a highly-flexible platform for evaluation of basic PHY features via static Control-Status Registers (CSR).

The scope of this document is meant to describe the EVB-KSZ9131RNX setup and its user interface features. A simplified block diagram of the board is shown in [Figure 1-1](#).

1.2 BLOCK DIAGRAM

FIGURE 1-1: EVB-KSZ9131RNX BLOCK DIAGRAM



1.3 TERMS AND ABBREVIATIONS

Below are the terms and their corresponding abbreviations used in this document:

- MDC – Management Data Clock
- MDIO – Management Data Input/Output
- RGMII™ – Reduced Gigabit Media Independent Interface
- UTP – Unshielded Twisted Pair

1.4 REFERENCES

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

- *KSZ9131MNX Gigabit Ethernet Transceiver with GMII/MII Support Data Sheet*
- *KSZ9131RNX Gigabit Ethernet Transceiver with RGMII Support Data Sheet*
- EVB-KSZ9131RNX Schematics
- SAMA5D3 Ethernet Development System Schematics
- *SAMA5D3 Ethernet Development System Board User's Guide*
- *MIC33153 4 MHz 1.2A Internal Inductor PWM Buck Regulator with HyperLight Load® and Power Good Data Sheet*
- *MIC5207 180 mA Low-Noise LDO Regulator Data Sheet*

Chapter 2. Getting Started

2.1 INTRODUCTION

The EVB-KSZ9131RNX Evaluation Board 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. The board supplies full power and provides full register access and configuration via MDIO/MDC bus management.

2.1.1 EDS-Powered Operation

For EDS-Powered Operation, J1 needs a jumper on the 3.3 EDS pins, and J2 needs a jumper on the VDDIO as shown in [Figure 2-1](#).

2.1.2 External-Powered Operation

For External-Powered operation, J1 needs a jumper on the center and EXT, while J2 needs a jumper on either 3.3V or 2.5V.

2.2 POWER SOURCE

The EVB-KSZ9131RNX is completely bus-powered from its mating Microchip host processor or control board. Alternatively, EVB-KSZ9131RNX can be powered with an external 3.3V supply.

Refer to [Figure 2-1](#) and board schematics in [Figure A-1](#) for details.

2.3 CLOCK

The EVB-KSZ9131RNX utilizes a 25 MHz crystal to generate the input reference clock for the KSZ9131RNX device. Refer to [Figure 2-1](#) and the board schematics in [Appendix A. "Schematics"](#) for details.

2.4 RESET CIRCUIT

2.4.1 Power-On Reset – EDS Reset

The SAMA5D3-EDS can provide the KSZ9131RNX reset when a jumper is placed on EVB-KSZ9131RNX J4 positions 2-3 (EDS Reset).

2.4.2 Power-On Reset – RC Circuit

The discrete RC/Diode (R25, C37, and D2) circuit provides power-on reset to the KSZ9131RNX device when a jumper is placed on EVB-KSZ9131RNX J4 positions 1-2 (Reset).

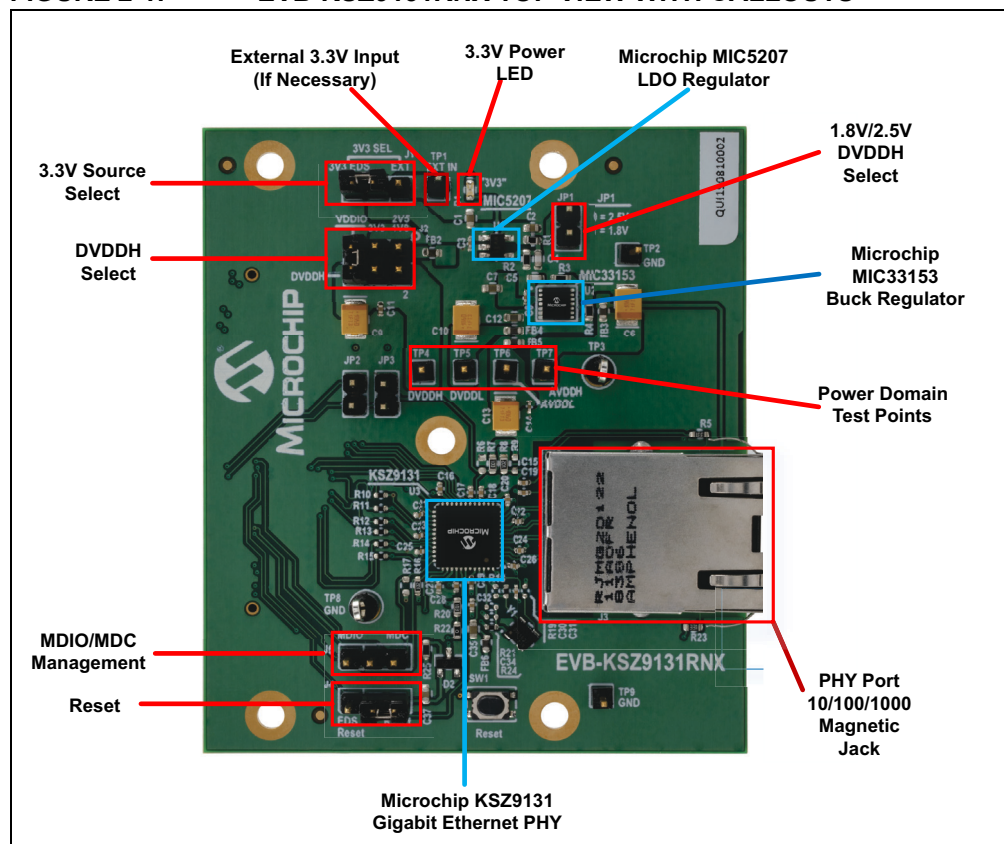
2.4.3 Manual Reset

EVB-KSZ9131RNX SW1 can be pressed and released to provide KSZ9131RNX reset after device power-up. EVB-KSZ9131RNX J4 must have a jumper between positions 2-3 (EDS Reset) to utilize this manual reset

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-KSZ9131RXN with key features, jumpers, power and headers are enclosed in red boxes. The Microchip components are enclosed in blue boxes.

FIGURE 2-1: EVB-KSZ9131RXN TOP VIEW WITH CALLOUTS



2.5.1 PHY Port

PHY port (J3) support 10BASE-T/100BASE-TX/1000BASE-T with both Auto-negotiation enabled and Auto-MDI/MDI-X enabled as the power-up defaults.

2.5.2 Pin Strapping Configurations

As the power-up or reset defaults, the KSZ9131RXN device is configured via internal or external pull-up or pull-down resistors to the following settings:

- **PHY Port:** Auto-negotiation enabled and Energy-Efficient Ethernet (EEE) enabled. Port speed is at 1000 Mbps.
- **PHY Address:** Set to 0x03. ALLPHYAD feature disabled. (PHY can respond to its own PHY address and PHY address 0x00 when enabled.)
- **125 MHz Reference Output:** Disabled
- **LED Mode:** Individual LED Mode. LED2 indicates Link Activity. LED1 indicates Link Up/Down.

2.6 USING THE EVB-KSZ9131RNX

The EVB-KSZ9131RNX directly plugs into a mating Microchip host controller or processor board, such as the SAMA5D3-EDS, that delivers full power and provides full register access and configuration via MDIO/MDC bus management.

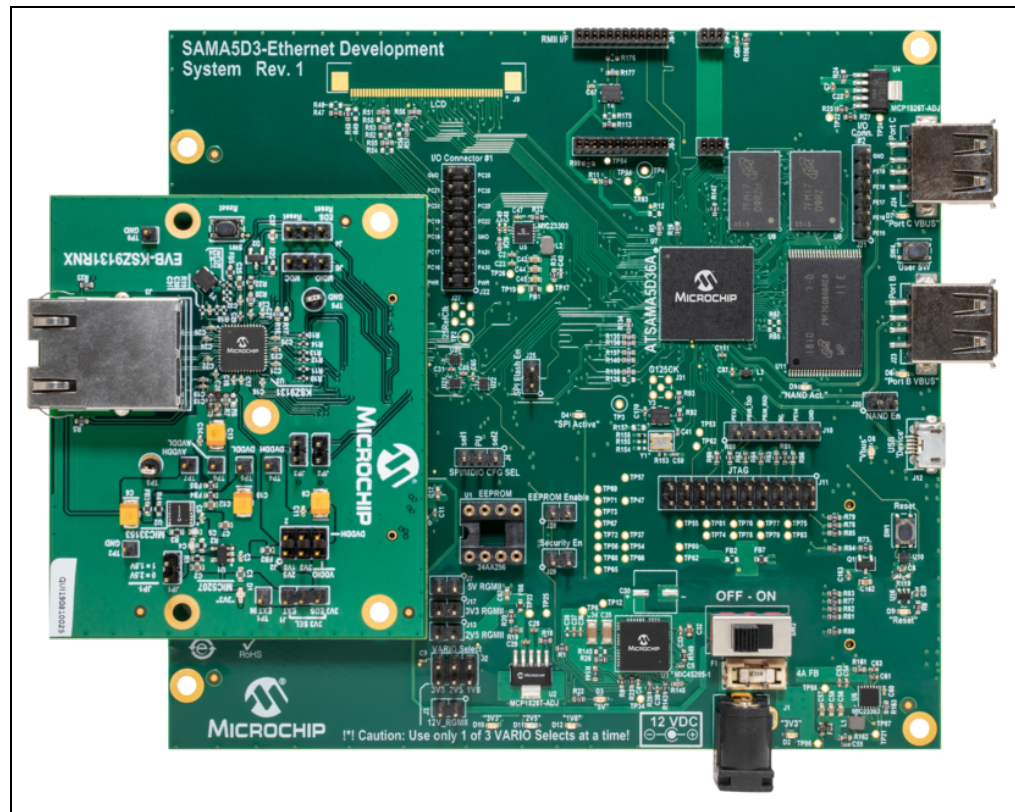
Together, the EVB-KSZ9131RNX and the SAMA5D3-EDS enable 10/100/1000 Mbps Ethernet traffic through RGMII™ and the PHY port of the KSZ9131RNX device, with the RGMII port connecting to the SAMA5D3 processor and the PHY Port connecting via copper Ethernet cable (CAT-5 UTP or better) to external Ethernet devices.

All KSZ9131RNX registers are accessible via MDIO/MDC bus management from the SAMA5D3-EDS Board, enabling full evaluation and firmware development for all KSZ9131RNX features.

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

Figure 2-2 shows the EVB-KSZ9131RNX connected to the SAMA5D3-EDS Board.

FIGURE 2-2: EVB-KSZ9131RNX AND SAMA5D3-EDS BOARD TOP VIEW



NOTES:

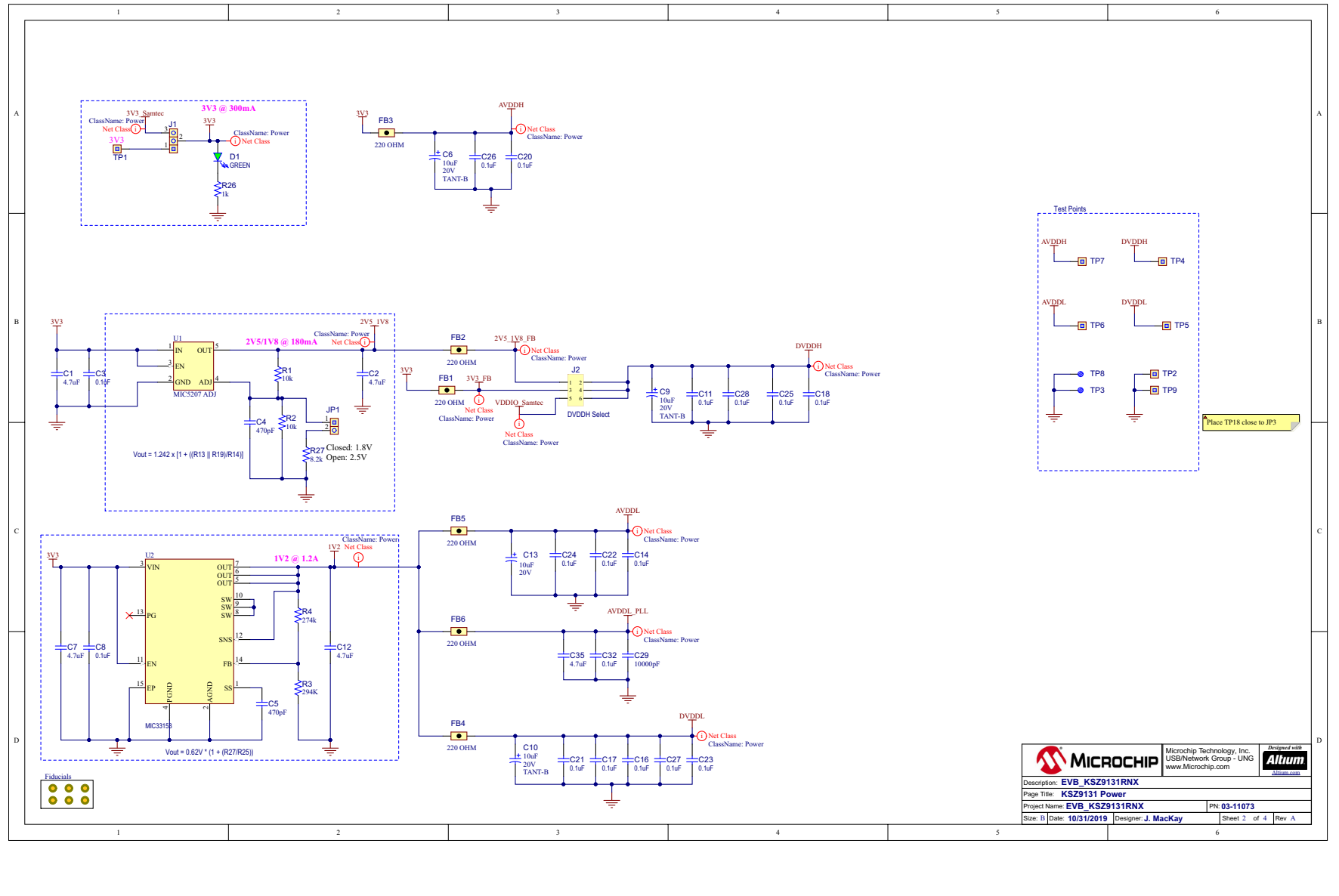


Appendix A. Schematics

A.1 INTRODUCTION

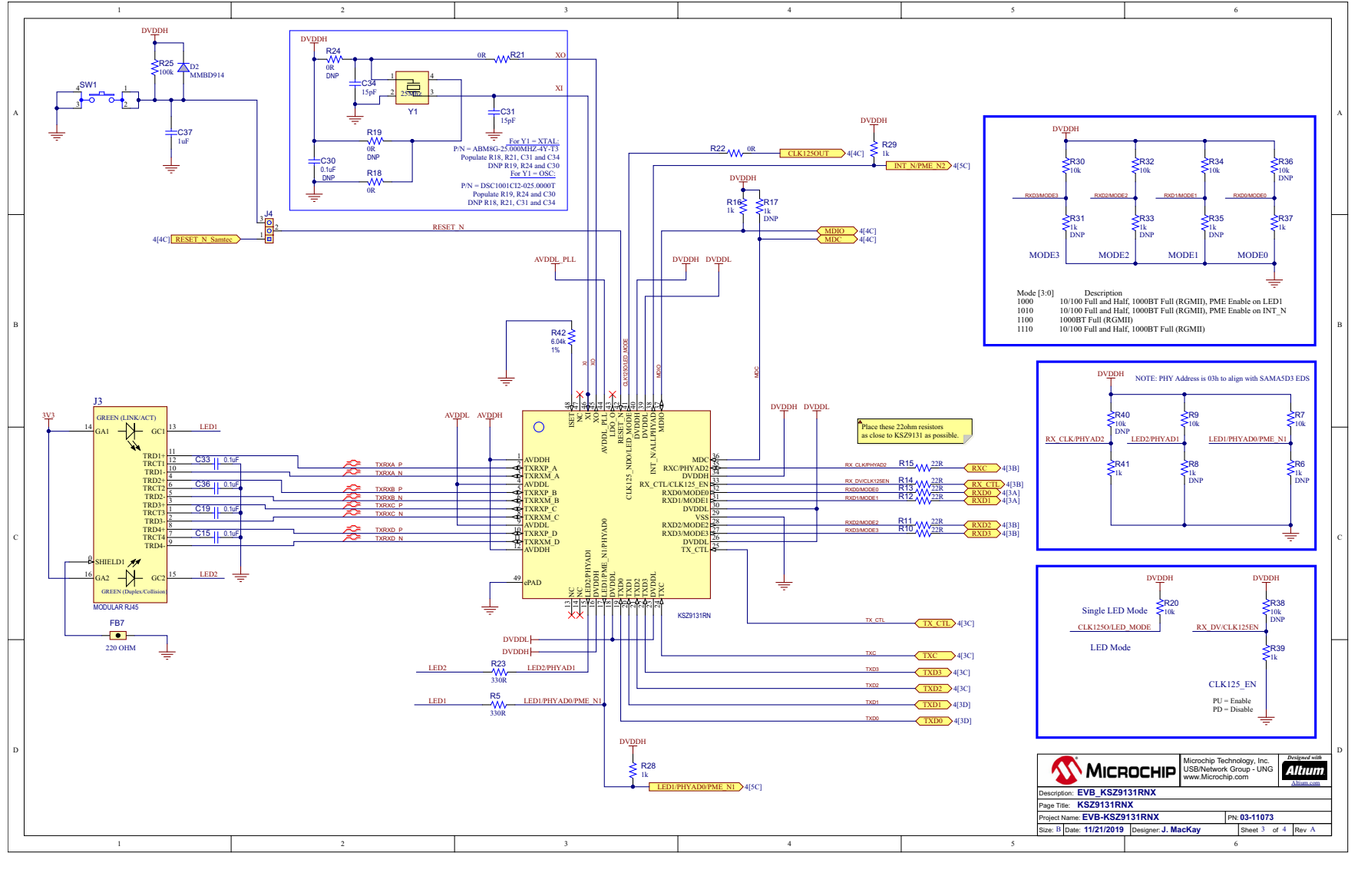
This appendix shows the EVB-KSZ9131RNX Schematics.

FIGURE A-1: EVB-KSZ9131RNX SCHEMATIC 1



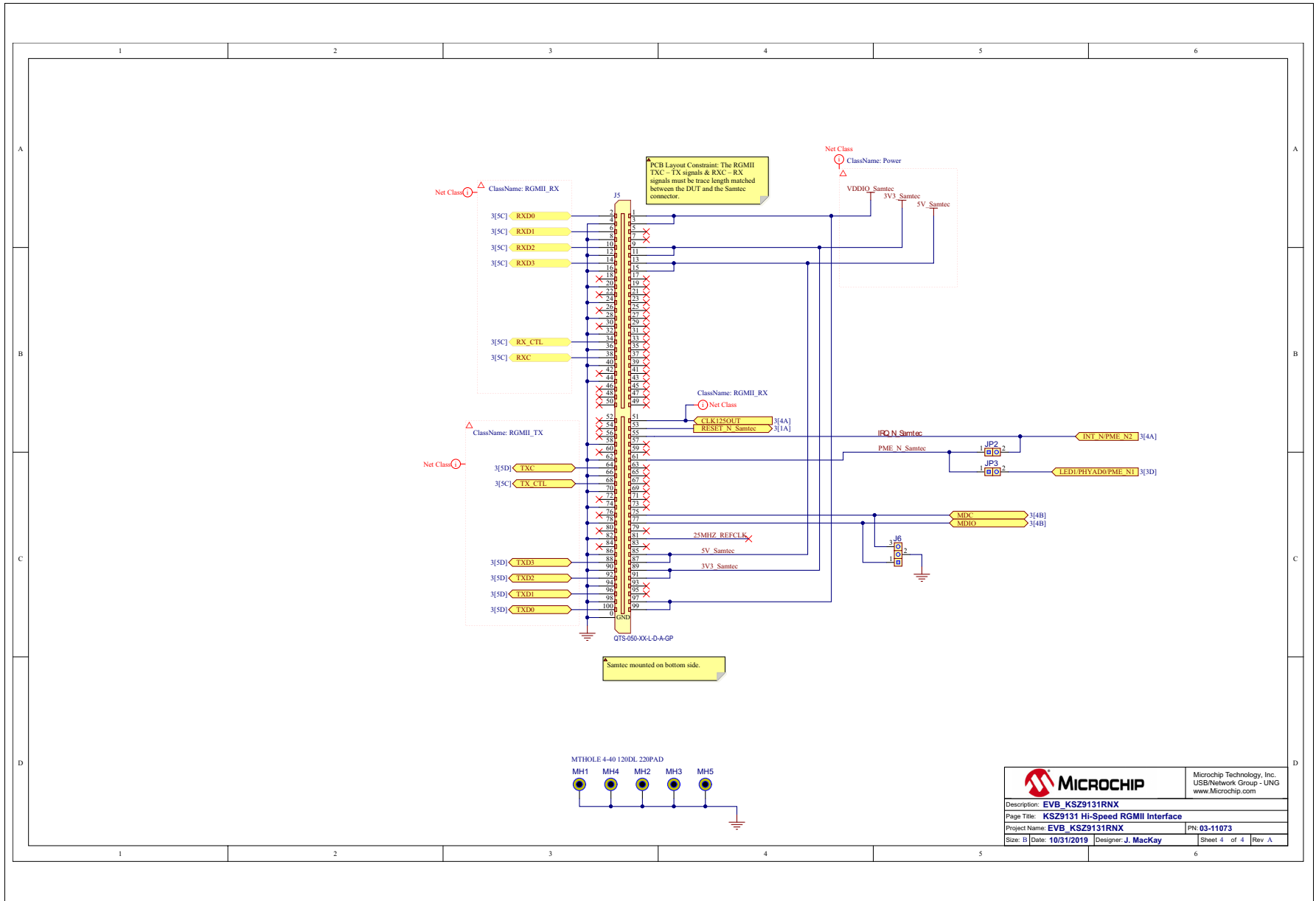
	Microchip Technology, Inc. USB/Network Group - UNG www.microchip.com	
Description: EVB_KSZ9131RNX		
Page Title: KSZ9131 Power		
Project Name: EVB_KSZ9131RNX		PN: 03-11073
Size: B	Date: 10/31/2019	Designer: J. MacKay
		Sheet 2 of 4 Rev. A

FIGURE A-2: EVB-KSZ9131RNX SCHEMATIC 2



	Microchip Technology, Inc. USB/Network Group - UNG www.microchip.com	
Description: EVB_KSZ9131RNX		
Page Title: KSZ9131RNX		
Project Name: EVB-KSZ9131RNX		PN: 03-11073
Size: B	Date: 11/21/2019	Designer: J. MacKay
		Sheet 3 of 4 Rev A

FIGURE A-3: EVB-KSZ9131RNX SCHEMATIC 3



		Microchip Technology, Inc. USB/Network Group - UNG www.Microchip.com	
		Description: EVB_KSZ9131RNX	
Page Title: KSZ9131 Hi-Speed RGMII Interface		PN: 03-11073	
Project Name: EVB_KSZ9131RNX		Date: 10/31/2019	
Size: B	Date: 10/31/2019	Designer: J. MacKay	Sheet 4 of 4 Rev. A

NOTES:



Appendix B. Bill of Materials

B.1 INTRODUCTION

This appendix contains the EVB-KSZ9131RNX Bill of Materials (BOM).

TABLE B-1: EVB-KSZ9131RNX BILL OF MATERIALS

Item	Quantity	Designator	Description	Populated	Manufacturer	Manufacturer Part Number
1	5	C1, C2, C7, C12, C35	CAP CER 4.7 μ F 10V 10% X5R SMD 0603	YES	KEMET	C0603C475K8PACTU
2	21	C3, C8, C11, C14, C15, C16, C17, C18, C19, C20, C21, C22, C23, C24, C25, C26, C27, C28, C32, C33, C36	CAP CER 0.1 μ F 50V 10% X7R SMD 0402	YES	TDK Corporation	C1005X7R1H104K050BB
3	2	C4, C5	CAP CER 470 pF 25V 5% NPO SMD 0603	YES	AVX	06033A471JAT2A
4	4	C6, C9, C10, C13	CAP TANT 10 μ F 20V 10% 2.1 ohm SMD B	YES	AVX	TAJB106K020RNJ
5	1	C29	CAP CER 10000 pF 16V 10% X7R SMD 0402	YES	KEMET	C0402C103K4RACTU
6	2	C31, C34	CAP CER 15 pF 50V 5% NPO SMD 0402	YES	Murata	GRM1555C1H150JA01D
7	1	C37	CAP CER 1 μ F 16V 10% X5R SMD 0603	YES	AVX	0603YD105KAT2A
8	1	D1	DIO LED GREEN 2V 30 mA 35 mcd Clear SMD 0603	YES	Lite-On Inc	LTST-C191KGKT
9	1	D2	DIO RECT MMBD914LT1G 1V 10 mA 100V SMD SOT-23-3	YES	ON Semiconductor	MMBD914LT1G
10	7	FB1, FB2, FB3, FB4, FB5, FB6, FB7	FERRITE 500 mA 220R SMD 0603	YES	Murata Electronics North America	BLM18AG221SN1D
11	3	J1, J4, J6	CON HDR-2.54 Male 1x3 Gold 5.84 MH TH VERT	YES	FCI	68000-103HLF
12	1	J2	CON HDR-2.54 Male 2x3 Gold 5.84 MH TH VERT	YES	Samtec	TSW-103-07-S-D
13	1	J3	CON MODULAR JACK RJ45 10/100/1000 MAGNETICS 2xLEDs SHIELD TH R/A	YES	Amphenol Commercial Products	RJMG2012211A0FR
14	1	J5	CON STRIP High Speed Stacker 5 mm Male 2x50 SMD VERT	YES	Samtec	QTS-050-01-L-D-A-GP
15	3	JP1, JP2, JP3	CON HDR-2.54 Male 1x2 Gold 5.84 MH TH VERT	YES	Wurth Electronics Inc.	61300211121
16	2	R1, R2	RES TKF 10k 1% 1/10W SMD 0603	YES	Panasonic	ERJ-3EKF1002V
17	1	R3	RES TKF 294K 1% 1/10W SMD 0603	YES	Panasonic	ERJ-3EKF2943V
18	1	R4	RES TKF 274K 1% 1/10W SMD 0603	YES	Panasonic	ERJ-3EKF2743V
19	2	R5, R23	RES TKF 330R 5% 1/10W SMD 0603	YES	ROHM	MCR03EZPJ331
20	6	R7, R9, R20, R30, R32, R34	RES TKF 10k 5% 1/10W SMD 0603	YES	Panasonic	ERJ-3GEYJ103V
21	6	R10, R11, R12, R13, R14, R15	RES TKF 22R 1% 1/20W SMD 0402	YES	Panasonic	ERJ-2RKF22R0X
22	7	R16, R26, R28, R29, R37, R39, R41	RES TKF 1k 5% 1/10W SMD 0603	YES	Panasonic	ERJ-3GEYJ102V
23	2	R18, R21	RES TKF OR 1/16W SMD 0402	YES	Yageo	RC0402JR-070RL
24	1	R22	RES TKF OR 1/10W SMD 0603	YES	Panasonic	ERJ-3GSY0R00V
25	1	R25	RES TKF 100k 1% 1/10W SMD 0603	YES	Panasonic	77311-118-02LF
26	1	R27	RES TKF 8.2k 1% 1/10W SMD 0603	YES	Panasonic	5-146280-1

TABLE B-1: EVB-KSZ9131RNX BILL OF MATERIALS (CONTINUED)

Item	Quantity	Designator	Description	Populated	Manufacturer	Manufacturer Part Number
27	1	R42	RES TKF 6.04k 1% 1/10W SMD 0603	YES	Yageo	TSW-102-07-G-T
28	1	SW1	SWITCH TACT SPST-NO 16V 0.05A PTS810 SMD	YES	C&K Components	PTS810 SJM 250 SMTR LFS
29	7	TP1, TP2, TP4, TP5, TP6, TP7, TP9	CON HDR-2.54 Male 1x1 Gold 5.84 MH TH VERT	YES	TE Connectivity	5-146280-1
30	2	TP3, TP8	CON TP LOOP Black TH	YES	Keystone	5011
31	1	U1	MCHP ANALOG LDO ADJ MIC5207YM5 SOT-23-5	YES	Microchip	MIC5207YM5-TR
32	1	U2	MCHP ANALOG SWITCHER Buck 0.6V to 3.6V MIC33153YHJ-TR VFDFN-14	YES	Microchip	MIC33153YHJ-TR
33	1	U3	MCHP INTERFACE KSZ9131RNX 10/100/1000BASE-T QFN-48	YES	Microchip	KSZ9131RNXC
34	1	Y1	CRYSTAL 25 MHz 10 pF SMD ABM8G	YES	Abracon LLC	ABM8G-25.000MHZ-4Y-T3
35	1	C30	CAP CER 0.1 μ F 50V 10% X7R SMD 0402	DNP	TDK Corporation	C1005X7R1H104K050BB
36	3	R36, R38, R40	RES TKF 10k 5% 1/10W SMD 0603	DNP	Panasonic	ERJ-3GEYJ103V
37	2	R19, R24	RES TKF 0R 1/16W SMD 0402	DNP	Yageo	RC0402JR-070RL
38	6	R6, R8, R17, R31, R33, R35	RES TKF 1k 5% 1/10W SMD 0603	DNP	Panasonic	ERJ-3GEYJ102V

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