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**EVB-LAN9252_SAM D51
Evaluation Board
User's Guide**

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ISBN: 978-1-5224-6497-6

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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-LAN9252_SAM D51. 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 features the EVB-LAN9252_SAM D51. The manual layout is as follows:

- **Chapter 1. “Overview”** – This chapter provides a brief description of the EVB-LAN9252_SAM D51.
- **Chapter 2. “Getting Started”** – This chapter provides information on the setup and operation of the EVB-LAN9252_SAM D51.
- **Chapter 3. “Hardware Configuration”** – This chapter includes information on the hardware configuration of the EVB-LAN9252_SAM D51.
- **Appendix A. “Schematics”** – This appendix shows the EVB-LAN9252_SAM D51 schematics.
- **Appendix B. “Bill of Materials”** – This appendix includes the EVB-LAN9252_SAM D51 Bill of Materials.
- **Appendix C. “Silk Screens”** – This appendix includes the EVB-LAN9252_SAM D51 silk screens.
- **Appendix D. “Slave Stack Code Generation”** – This appendix details the procedure for generating a Slave Stack Code for EtherCAT operation on EVB-LAN9252_SAM D51.

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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- **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.
- **Programmings** – 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 non-production development programmers such as PICSTART® Plus and PICKIT™ 2 and 3.

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- Distributor or Representative
- Local Sales Office
- 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
DS50003012A (07-30-20)	Initial release	

Chapter 1. Overview

1.1 INTRODUCTION

The EVB-LAN9252_SAM D51 Evaluation Board is an EtherCAT slave controller with dual integrated Ethernet PHYs. Each Ethernet PHY contains a Full-Duplex 100BASE-TX transceiver and supports 100 Mbps (100BASE-TX) operation.

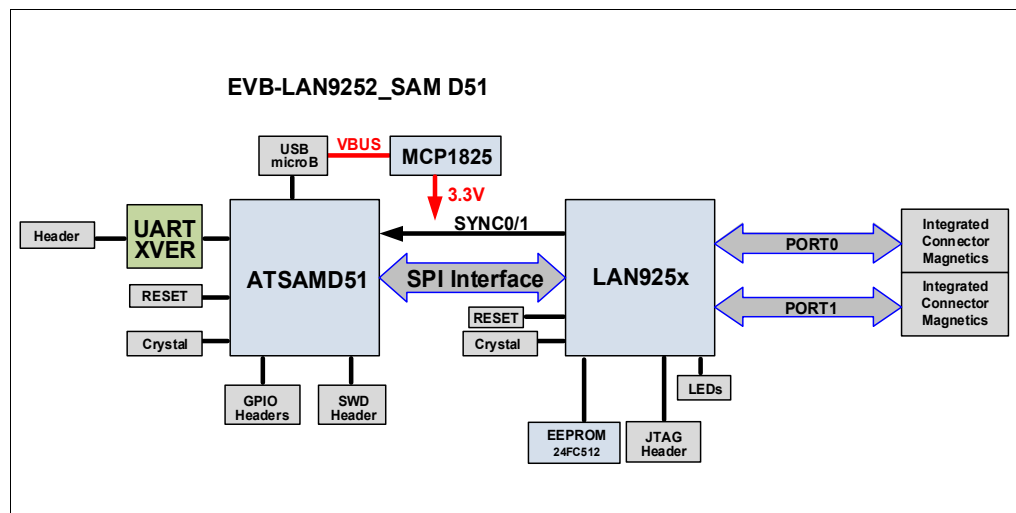
The EVB-LAN9252_SAM D51 allows users to gain understanding of the product and accelerate integration of the LAN9252 into their design. The evaluation platform supports two EtherCAT ports, and the SAMD51 processor enables the configuration of the evaluation board for EtherCAT operation. The EVB is on a four-layer RoHS-compliant Printed Circuit Board (PCB). For more information about EVB-LAN9252_SAM D51, see [Section 1.2 “Features”](#).

1.2 FEATURES

- Two-port 100BASE-TX Full-Duplex EtherCAT slave controller with integrated Ethernet PHYs
- LAN9252 in a 64-pin QFN RoHS-compliant package
- SAM D51 processor for EtherCAT configuration through EEPROM
- USB Micro-B connector for board power
- MikroBUS™ connection for external peripherals
- Two RJ-45 ports with LED link/activity indicators
- Atmel-ICE 10 pin-connector
- PICKit™ 4 8-pin header for SAM D51 programming

1.3 BLOCK DIAGRAM

FIGURE 1-1: EVB-LAN9252_SAM D51 BLOCK DIAGRAM



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.

- *LAN9252 2/3-Port EtherCAT® Slave Controller with Integrated Ethernet PHYs Data Sheet*
- *SAM D5X/E5X Family Data Sheet*
- *AN 8.13 Suggested Magnetics*
- *EVB-LAN9252_SAM D51 Schematics*
- *AN1920 Microchip LAN9252 EEPROM Configuration and Programming Application Note*
- *MPLAB® PICkit™ 4 In-Circuit Debugger User's Guide*

1.5 TERMS AND ABBREVIATIONS

The following are the terms and abbreviations used in this document:

- DNP – Do Not Populate
- EEPROM – Electrically Erasable Programmable Read-Only Memory
- ESC – EtherCAT Slave Controller
- EVB – Engineering Validation Board
- EtherCAT – Ethernet for Control Automation Technology
- IDE – Integrated Development Environment
- LOS – Loss of Signal
- RJ-45 - Ethernet Port
- SD – Signal Detect
- SPI – Serial Protocol Interface
- SSC – Slave Stack Code
- TwinCAT – EtherCAT Runtime System Tool
- USB – Universal Serial Bus

Chapter 2. Getting Started

2.1 INTRODUCTION

The Microchip EVB-LAN9252_SAM D51 Evaluation Board is designed for flexible configuration solutions. It can be configured via MPLAB Harmony, TwinCAT, and Slave Stack Coding Tools. Refer to [Section 2.3 “Tools for EVB-LAN9252_SAM D51 Setup Procedure”](#) for the tools needed to configure the board for EtherCAT functionality.

2.2 KIT CONTENTS

The EVB-LAN9252_SAM D51 Evaluation Board includes the basic equipment necessary for evaluation. The items included in the board are:

- EVB-LAN9252_SAM D51 Evaluation Board
- Type-A to micro USB 2.0 cable

Note: The EVB-LAN9252_SAM D51 Evaluation Board requires a PICKit™ 4 In-Circuit Debugger as additional hardware for configuration.
--

2.3 TOOLS FOR EVB-LAN9252_SAM D51 SETUP PROCEDURE

The following are the software and tools necessary for setting up the control or management PC and programming the EVB-LAN9252_SAM D51 Evaluation Board:

- Beckhoff TwinCAT Software
- Microchip MPLAB® X IDE (v5.30 or newer)
- Microchip XC32 Compiler
- Microchip PICKit™ 4 In-Circuit Debugger
- Microchip Harmony Plug-In (through MPLAB X IDE)
- EtherCAT® Slave Stack Code (Refer to [Appendix D. “Slave Stack Code Generation”](#))
- GitHub MPLAB Harmony v3 EtherCAT repository, which provides detailed information on creating an EtherCAT application using Harmony

On the board, jumpers are essential for the following:

- J6, positions 1-2
- J11

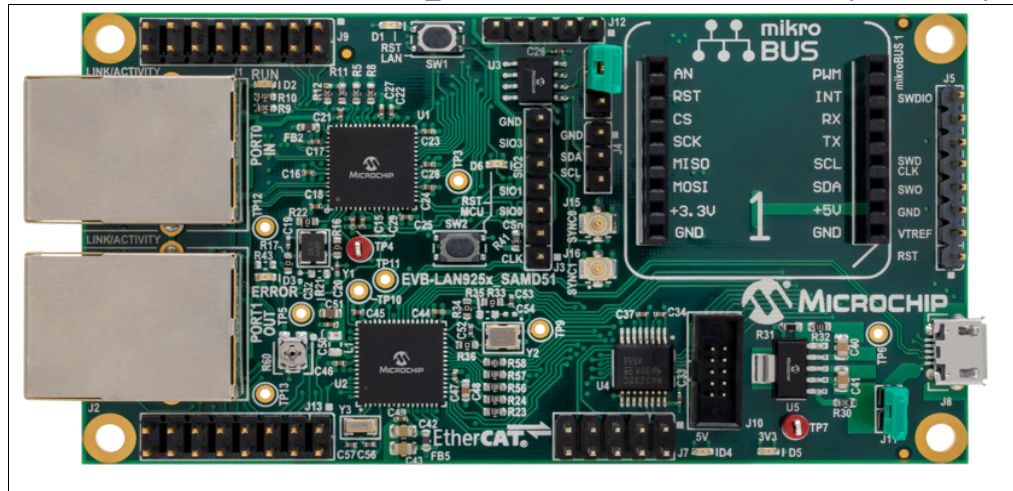
NOTES:

Chapter 3. Hardware Configuration

3.1 HARDWARE CONFIGURATION OPTIONS

Figure 3-1 shows the top view of the EVB-LAN9252_SAM D51 Evaluation Board.

FIGURE 3-1: EVB-LAN9252_SAM D51 EVALUATION BOARD (TOP VIEW)



3.1.1 Power

The EVB-LAN9252_SAM D51 can be powered by a USB cable or +5V supply. This delivers +5V and +3.3V supplies to the board. The +5V indication is provided by D4, while the +3.3V indication is provided by D5.

3.1.2 MikroBUS™

The EVB-LAN9252_SAM D51 supports click boards with an on-board MikroBUS™ connection. This allows for LCD displays, motor control, and other click board interfaces. To enable a click board, some settings need to be configured with the MCU.

3.1.3 Clocks

The EVB-LAN9252_SAM D51 Evaluation Board has the following three clocks:

1. A 25 MHz reference crystal for LAN9252 (also has an option for 25 MHz oscillator)
2. A 16 MHz crystal for SAM D51
3. A 32.768 KHz crystal for SAM D51

3.1.4 Ethernet Ports

The EVB-LAN9252_SAM D51 has two 100BASE-TX Ethernet ports for EtherCAT operation namely, J1 (PORT0 IN) and J2 (PORT1 OUT).

3.1.5 LED Indicators

Table 3-1 describes the LED indicators on the EVB-LAN9252_SAM D51.

TABLE 3-1: EVB-LAN9252_SAM D51 LED INDICATOR DESCRIPTIONS

Ref. Des.	Label	Description
D1	RST LAN	Indicates LAN9252 Reset
D2	RUN	Indicates LAN9252 RUN status
D3	ERROR	Indicates LAN9252 ERROR status
D4	5V	Illuminates when the 5V supply is present
D5	3V3	Illuminates when the 3.3V supply is present
D6	RST MCU	Indicates SAM D51 Reset
J1 (Green LED)	LINK0	Indicates the link status of Port 0
J2 (Green LED)	LINK1	Indicates the link status of Port 1

3.1.6 Switches

Table 3-2 describes the switches on the EVB-LAN9252_SAM D51.

TABLE 3-2: EVB-LAN9252_SAM D51 SWITCH DESCRIPTIONS

Ref. Des.	Label	Description
SW1	RST LAN	Momentary push-button switch to assert LAN9252 Reset
SW2	RST MCU	Momentary push-button switch to assert SAM D51 Reset

3.1.7 Connector Descriptions

Table 3-3 describes the connectors included on the PCB.

TABLE 3-3: EVB-LAN9252_SAM D51 CONNECTOR DESCRIPTIONS

Ref. Des.	Type	Label	Description
J1	RJ-45 Ethernet Port	PORT0 IN	100BASE-TX Ethernet port for EtherCAT ingress traffic
J2	RJ-45 Ethernet Port	PORT1 OUT	100BASE-TX Ethernet port for Ethernet egress traffic
J3	1x5 Header	QSPI	QSPI communication header
J4	1x3 Header	I2C	I ² C communication to the I ² C EEPROM. To enable, J6 must have jumper in positions 1 and 2.
J5	1x8 Header	PICKit-4	PICKit™ 4 programming header/port
J6	1x3 Header	—	Selects between EEPROM programming (positions 1 and 2) and JTAG (positions 2 and 3).
J7	2x5 Header	UART	UART header to SAM D51. SAM D51 calls this Universal Synchronous and Asynchronous Receiver and Transmitter (USART).
J8	Micro USB Connector	—	USB connector for power through USB cable to connected device
J9	2x8 Header	GPIO	LAN9252 GPIO test header for all LAN9252 GPIO signals (0 to 15)
J10	2x5 Header	SAM-ICE	SAM-ICE™ programming port
J11	1x2 Header	5V	+5V voltage supply header. In a closed position, VBUS from J8 is used as the +5V supply. In an open position, external +5V must be applied to position 2.
J12	1x5 Header	JTAG	JTAG port. To enable, J6 must have jumper in positions 2 and 3.
J13	2x8 Header	—	SAM D51 input/output test header
J15	Micro Coax (UMC) Jack	SYNC0	SYNC0 reference to synchronize clocks
J16	Micro Coax (UMC) Jack	SYNC1	SYNC1 reference to synchronize clocks
Mikro-BUS1	MikroBUS™ Connector	MIKROBUS	MikroBUS connection for click board connection

3.1.8 Test Points

Table 3-4 describes the test points on the EVB-LAN9252_SAM D51. A header may be permanently installed on the through-hole test points if needed.

TABLE 3-4: EVB-LAN9252_SAM D51 TEST POINT DESCRIPTIONS

Ref. Des.	Type	Description
TP4	Test Loop (Red)	1.2V oscillator supply
TP7	Test Loop (Red)	3.3V supply

NOTES:



Appendix A. Schematics

A.1 INTRODUCTION

This appendix shows the EVB-LAN9252_SAM D51 Evaluation Board schematics.

FIGURE A-1: EVB-LAN9252_SAM D51 SCHEMATIC 1

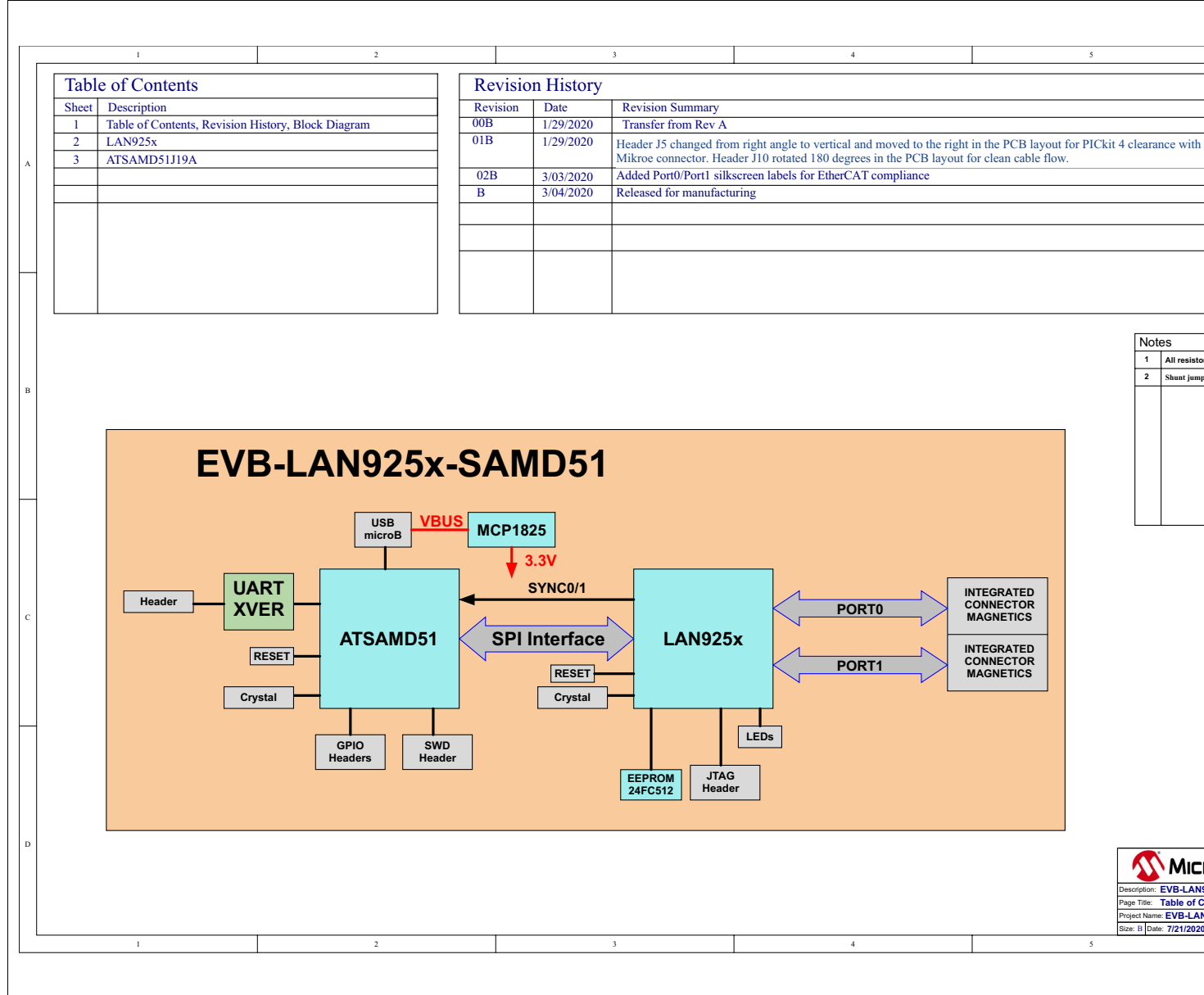


FIGURE A-2: EVB-LAN9252_SAM D51 SCHEMATIC 2

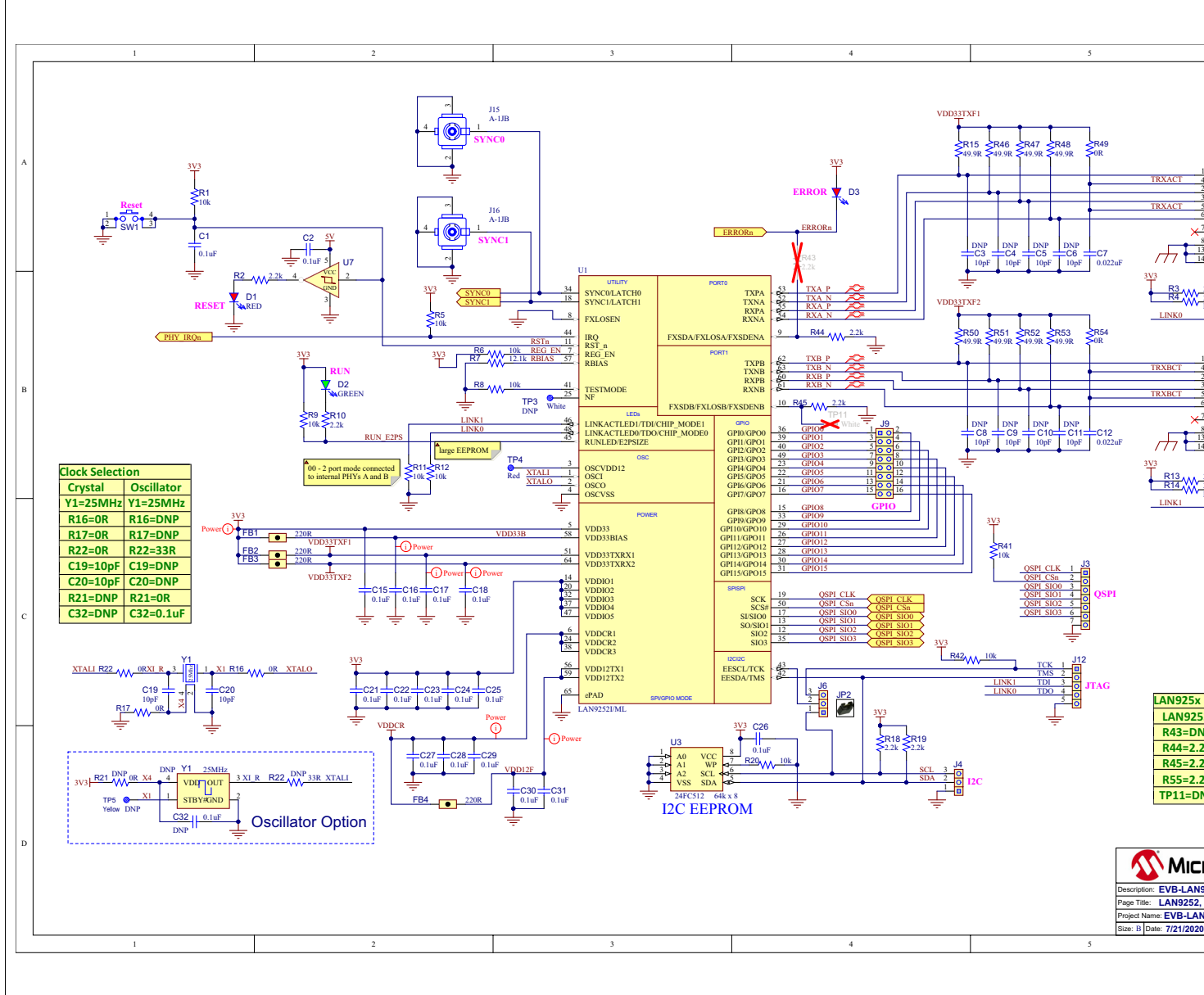
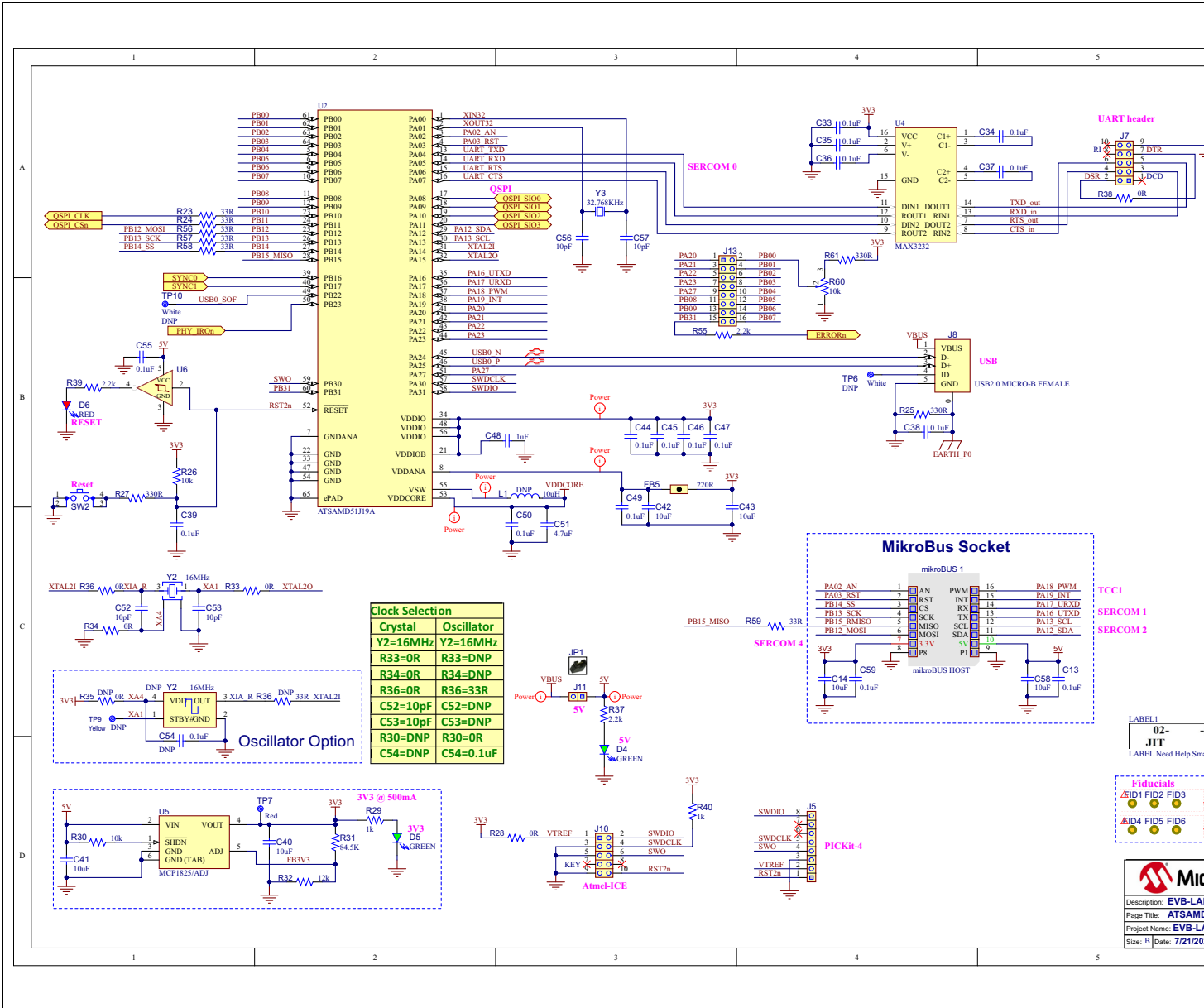


FIGURE A-3: EVB-LAN9252_SAM D51 SCHEMATIC 3





Appendix B. Bill of Materials

B.1 INTRODUCTION

This appendix contains the EVB-LAN9252_SAM D51 Evaluation Board Bill of Materials (BOM).

TABLE B-1: EVB-LAN9252_SAM D51 BILL OF MATERIALS (BOM)

Item	Qty.	Reference	Description	Populated	Manufacturer
1	33	C1, C2, C13, C15, C16, C17, C18, C21, C22, C23, C24, C25, C26, C27, C28, C29, C30, C31, C33, C34, C35, C36, C37, C38, C39, C44, C45, C46, C47, C49, C50, C55, C59	CAP CER 0.1uF 16V 10% X7R SMD 0402	Yes	Murata
2	8	C3, C4, C5, C6, C8, C9, C10, C11	CAP CER 10pF 50V 5% NP0 SMD 0402	DNP	AVX Corporation
3	2	C7, C12	CAP CER 0.022uF 50V 10% X7R SMD 0402	Yes	Murata Electronics
4	6	C14, C40, C41, C42, C43, C58	CAP CER 10uF 16V 10% X5R SMD 0805	Yes	Murata
5	6	C19, C20, C52, C53, C56, C57	CAP CER 10pF 50V 5% NP0 SMD 0402	Yes	AVX Corporation
6	2	C32, C54	CAP CER 0.1uF 50V 10% X7R SMD 0402	DNP	TDK Corporation
7	1	C48	CAP CER 1uF 16V 10% X5R SMD 0603	Yes	AVX
8	1	C51	CAP CER 4.7uF 10V 10% X5R SMD 0603	Yes	KEMET
9	3	D1, D3, D6	DIO RED 2V 20mA 54mcd CLEAR SMD 0603	Yes	Lite-On Inc.
10	3	D2, D4, D5	DIO LED GREEN 2V 30mA 35mcd Clear SMD 0603	Yes	Lite-On Inc
11	5	FB1, FB2, FB3, FB4, FB5	FERRITE 220R@100MHz 1.4A SMD 0603	Yes	Murata Electronics North America
12	2	J1, J2	CON MODULAR JACK RJ45 100 2xLEDS SHIELD TH R/A	Yes	Pulse Electronics Network
13	1	J3	CON HDR-2.54 Male 1x7 Gold 5.84MH TH VERT	Yes	Würth Electronics Inc
14	2	J4, J6	CON HDR-2.54 Male 1x3 Gold 5.84MH TH VERT	Yes	FCI
15	1	J5	CON HDR-2.54 Male 1x8 Gold 5.84MH TH	Yes	FCI
16	1	J7	CON HDR-2.54 Male 2x5 0.100" (2.54mm) TH VERT	Yes	Metz Connect
17	1	J8	CON USB2.0 MICRO-B FEMALE TH/SMD R/A	Yes	FCI
18	2	J9, J13	CON HDR-2.54 Male 2x8 Gold 5.84MH TH VERT	Yes	FCI
19	1	J10	HDR 1.27mm 2x5 shrouded	Yes	CNC Tech
20	1	J11	CON HDR-2.54 Male 1x2 Gold 5.84MH TH VERT	Yes	FCI
21	1	J12	CON HDR-2.54 Male 1x5 Gold 5.84MH TH VERT	Yes	FCI
22	2	J15, J16	CON RF Micro Coaxial U.FL Male 4P SMD VERT	Yes	Amphenol RF Division
23	2	JP1, JP2	MECH HW JUMPER 2.54mm 1x2	MECH	Sullins Connector Solutions
24	1	L1	INDUCTOR 10uH 430mA 10% SMD 0805	DNP	Coilcraft
25	1	mikroBUS 1	SOCKET mikroBUS HOST DIP 16 TH	Yes	Sullins Connector Solutions
26	12	R1, R5, R6, R8, R9, R11, R12, R20, R26, R30, R41, R42	RES TKF 10k 1% 1/10W SMD 0603	Yes	Vishay
27	9	R2, R10, R18, R19, R37, R39, R44, R45, R55	RES TKF 2.2k 1% 1/10W SMD 0603	Yes	Panasonic

TABLE B-1: EVB-LAN9252_SAM D51 BILL OF MATERIALS (BOM) (CONTINUED)

Item	Qty.	Reference	Description	Populated	Manufacturer
28	5	R3, R13, R25, R27, R61	RES TKF 330R 1% 1/10W SMD 0603	Yes	ROHM, Panasonic
29	2	R4, R14	RES TKF 330R 1% 1/10W SMD 0603	DNP	ROHM
30	1	R7	RES TKF 12.1k 1% 1/10W SMD 0603	Yes	Panasonic
31	8	R15, R46, R47, R48, R50, R51, R52, R53	RES TKF 49.9R 1% 1/10W SMD 0603	Yes	Panasonic
32	10	R16, R17, R22, R28, R33, R34, R36, R38, R49, R54	RES TKF 0R 1/10W SMD 0603	Yes	Panasonic
33	2	R21, R35	RES TKF 0R 1/10W SMD 0603	DNP	Panasonic
34	6	R23, R24, R56, R57, R58, R59	RES TKF 33R 1% 1/10W SMD 0603	Yes	ROHM
35	2	R29, R40	RES TKF 1k 1% 1/10W SMD 0603	Yes	Panasonic
36	1	R31	RES TKF 84.5k 1% 1/10W SMD 0603	Yes	Yageo
37	1	R32	RES TKF 12k 1% 1/10W SMD 0603	Yes	Yageo
38	1	R60	RES TRIMMER 10k 25% 0.1W SMD TC33	Yes	Bourns Inc.
39	2	SW1, SW2	SWITCH TACT SPST 16V 50mA PTS810 SJM 250 SMTR LFS SMD	Yes	C&K Components
40	5	TP3, TP6, TP10, TP12, TP13	MISC, TEST POINT MULTI PURPOSE MINI WHITE	DNP	Keystone
41	2	TP4, TP7	MISC, TEST POINT MULTI PURPOSE MINI RED	Yes	Keystone
42	2	TP5, TP9	MISC, TEST POINT PC MINI, 0.040" D YELLOW	DNP	Keystone
43	1	U1	MCHP INTERFACE ETHERNET LAN9252I/ML 64QFN	Yes	Microchip Technology
44	1	U2	MCHP MCU 32-BIT 120MHz 1MB ATSAMD51J19A-MFT VQFN-64	Yes	Microchip Technology
45	1	U3	MCHP MEMORY SERIAL EEPROM 512kb 1MHz I2C 24FC512T-I/SN SOIC-8	Yes	Microchip Technology
46	1	U4	IC TRANSCEIVER MAX3232 SSOP-16	Yes	Texas Instruments
47	1	U5	MCHP ANALOG LDO ADJ MCP1825T-ADJE/DC SOT-223-5	Yes	Microchip
48	2	U6, U7	74LVC1G14GW,125 SCHMITT-TRG INVERTER	Yes	NXP
49	1	Y1	CRYSTAL 25MHz 10pF SMD ABM8G	Yes	Abracon LLC
50	1	Y2	CRYSTAL 16MHz 9pF 26ppm SMD L3.2W2.5H0.6	Yes	AVX Corp/Kyocera Corp
51	1	Y3	CRYSTAL 32.768KHz 12.5pF SMD L3.2W1.5H0.9	Yes	Fox Electronics

NOTES:



Appendix C. Silk Screens

C.1 INTRODUCTION

This appendix shows the top and bottom silk screen images of the EVB-LAN9252_SAM D51 Evaluation Board.

EVB-LAN9252_SAM D51 Evaluation Board User's Guide

FIGURE C-1: EVB-LAN9252_SAM D51 TOP SILK SCREEN IMAGE

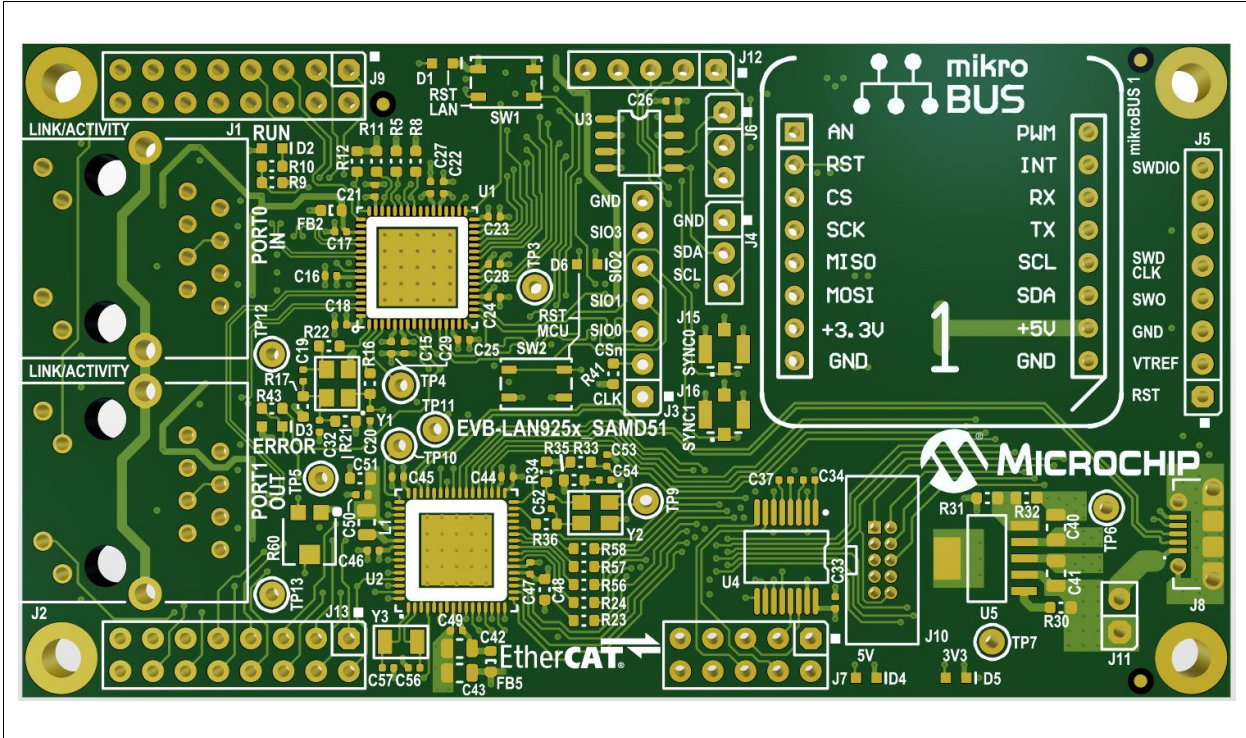
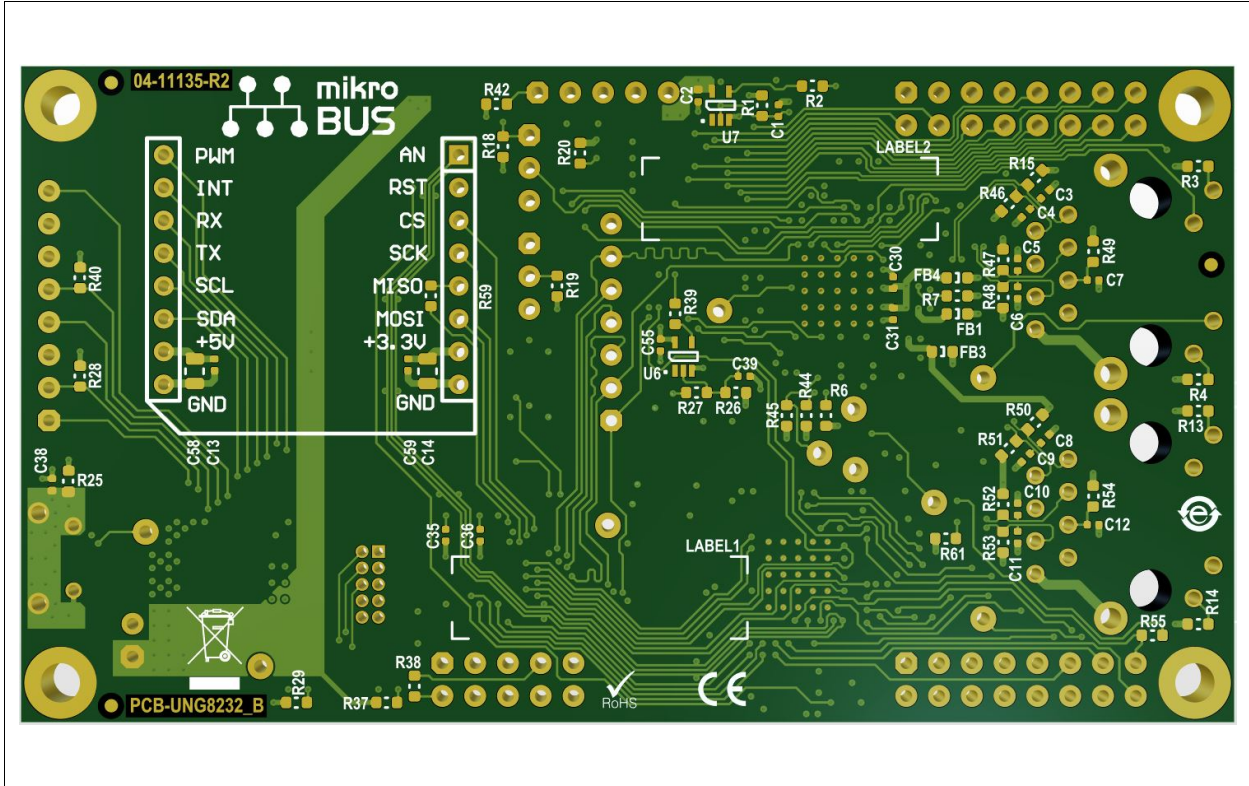


FIGURE C-2: EVB-LAN9252_SAM D51 BOTTOM SILK SCREEN IMAGE



NOTES:

Appendix D. Slave Stack Code Generation

D.1 INTRODUCTION

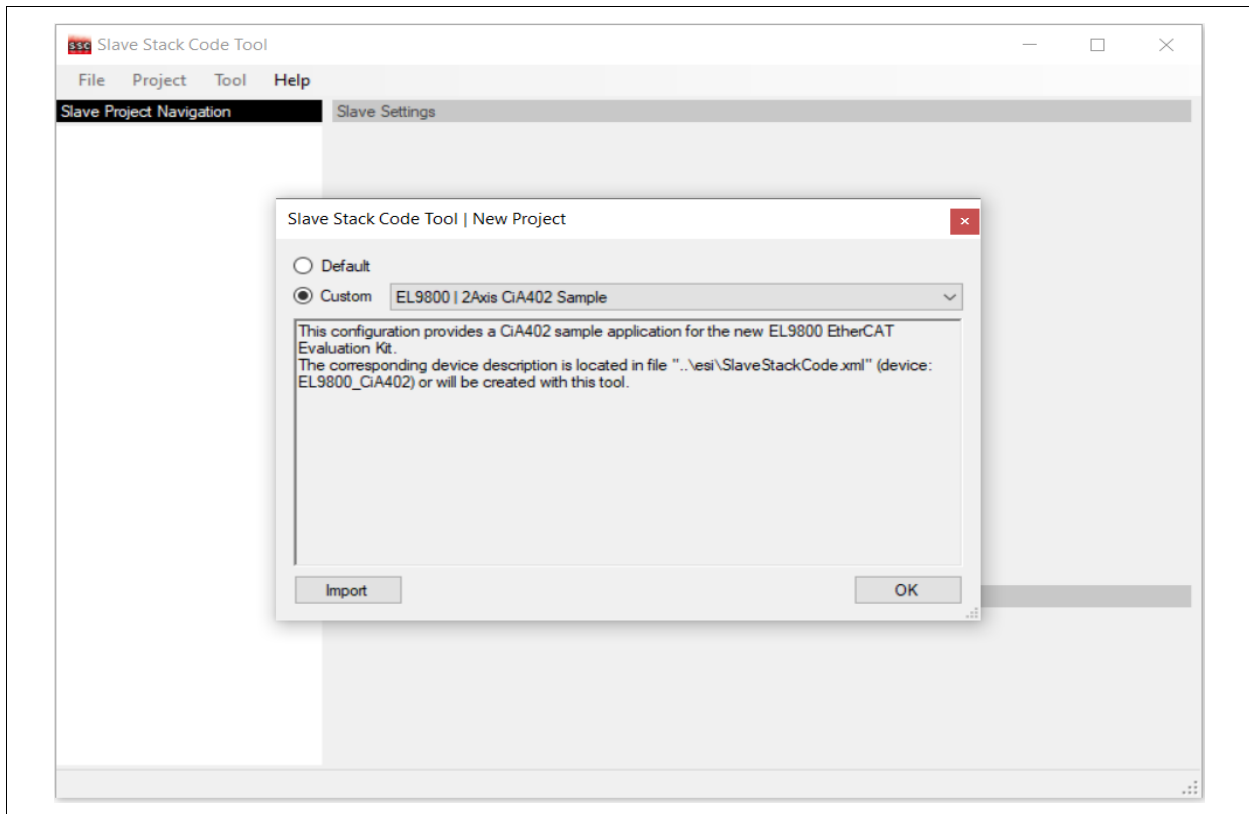
This appendix details the procedure for generating the Slave Stack Code for EtherCAT operation on the EVB-LAN9252_SAM D51 Evaluation Board.

D.2 SLAVE STACK CODE GENERATION

Perform the following steps to generate the slave stack code:

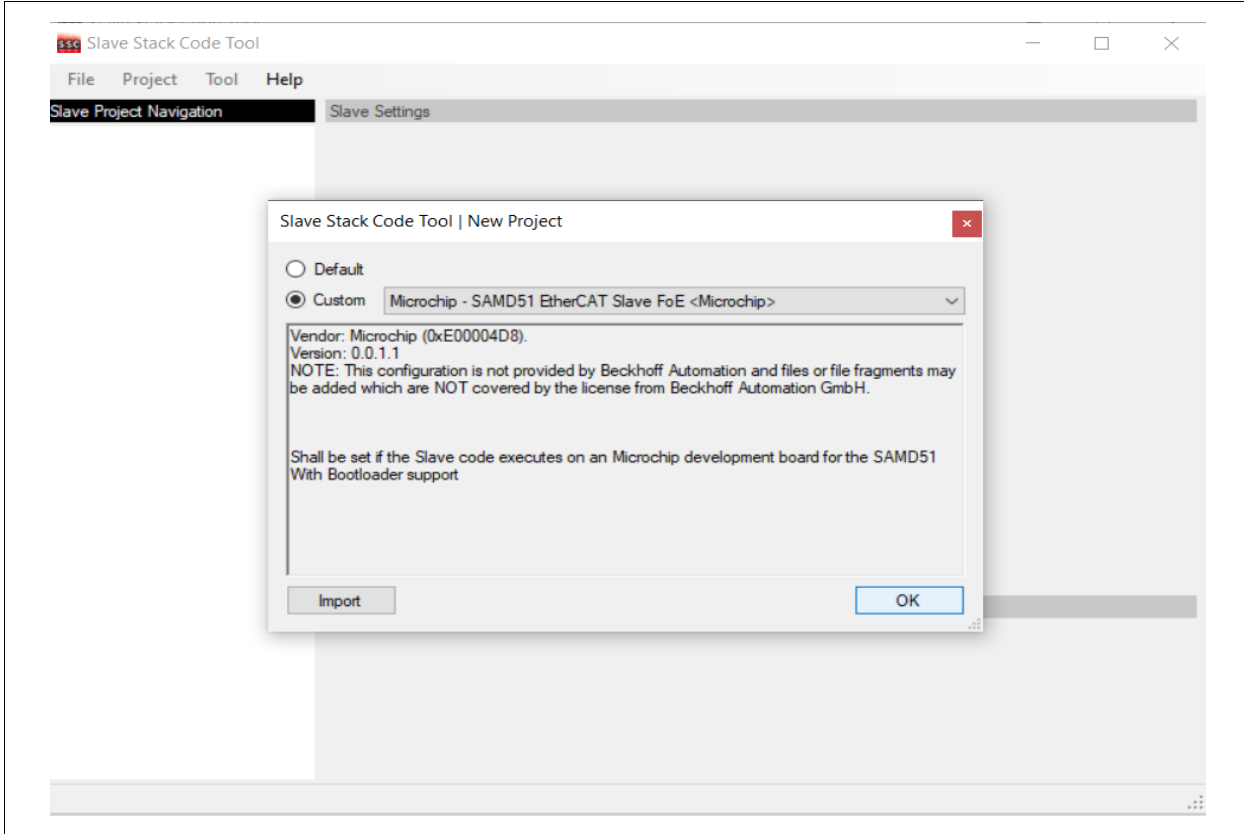
1. Download the Slave Stack Code (SCC) tool from EtherCAT.org website. An EtherCAT membership is necessary for downloading the code.
2. Install the SSC tool on the control or management PC.
3. Open the SSC tool and navigate to *File>New* to create a new project.
4. Select Custom and then click on **Import**. See [Figure D-1](#).

FIGURE D-1: SLAVE STACK CODE GENERATION – IMPORT CONFIGURATION FILE



5. Import the `Microchip-SAMD51-LAN925x-SSC_Config.xml` configuration file from `<Harmony Directory>\ethercat\apps\ethercat_counter_foe_app\firmware\src\slave_stack`. After importing this configuration file, the Microchip SAM D51 will appear in the "Custom" field. Select this and click on **OK**. Click on **Yes** for the next two prompts. See [Figure D-2](#).

FIGURE D-2: SLAVE STACK CODE GENERATION – NEW PROJECT CREATION

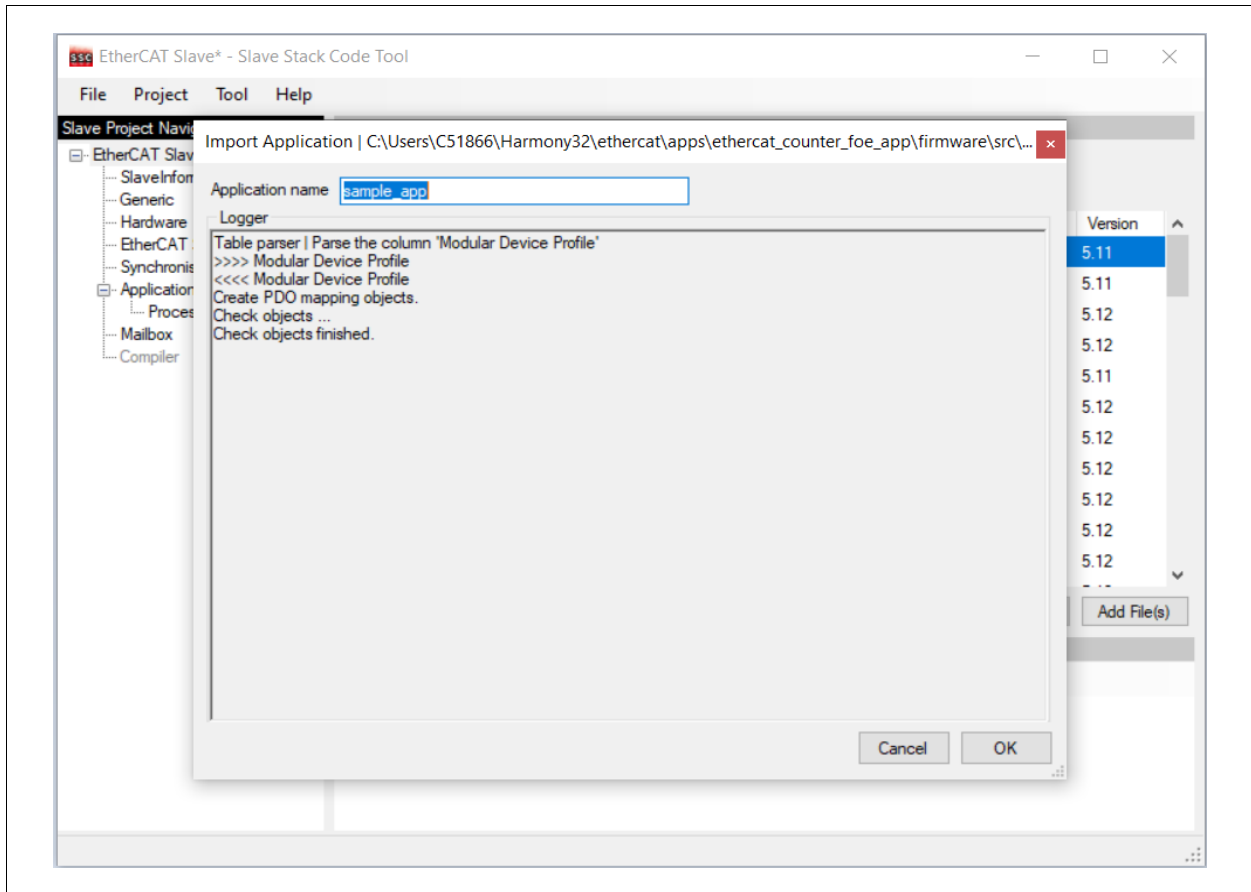


6. Navigate to the `<Harmony Directory>\ethercat\apps\ethercat_counter_foe_app\firmware\src\config\sam_d51_lan9252_evb\driver\lan9252` directory to point to the `drv_lan9252.c` file and click on **Open**. This will load the code.

Slave Stack Code Generation

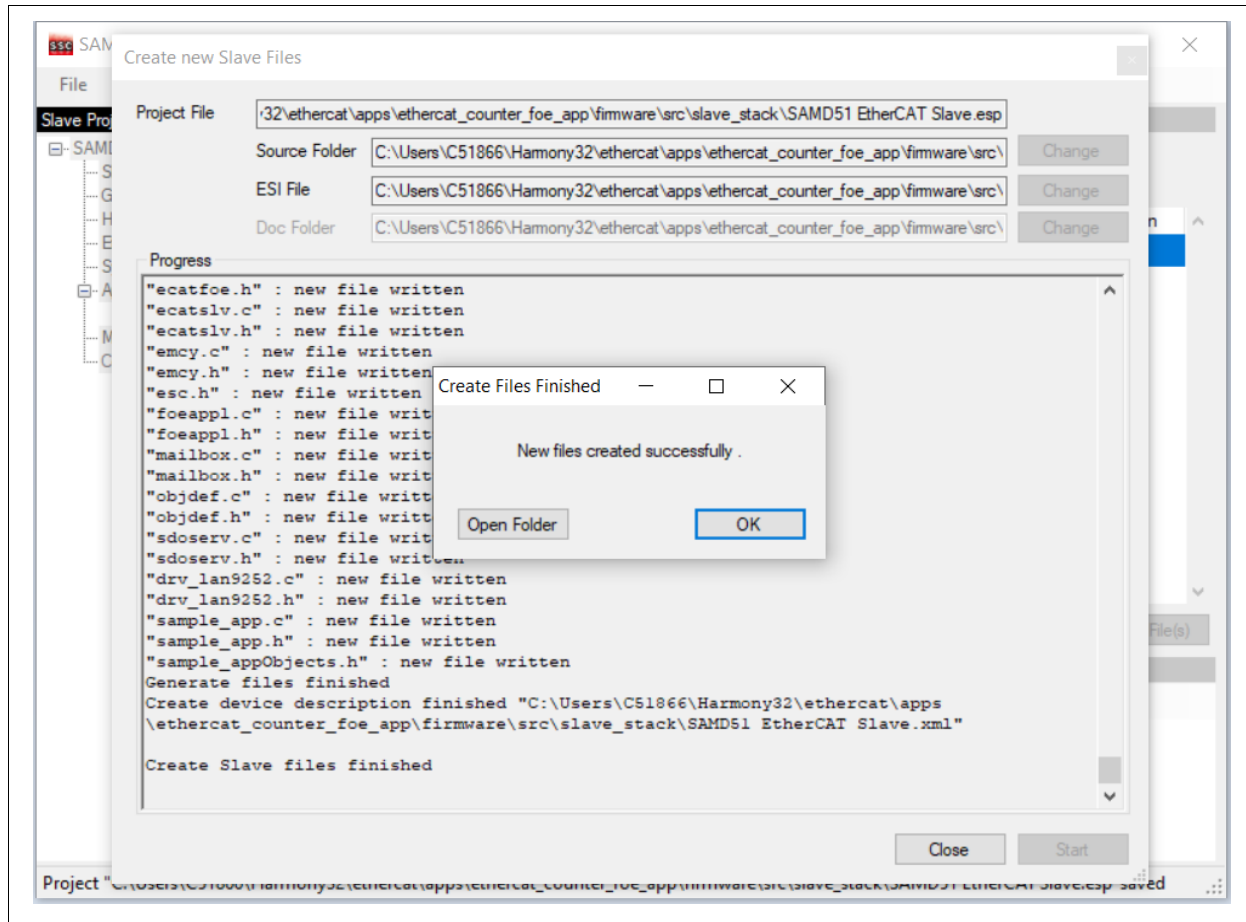
7. Go to **Tools>Application>Import Application**. In the “Application name” field, enter “sample_app” in the <Harmony Directory>\ethercat\apps\ethercat_counter_foe_app\firmware\src\slave_stack. Click on **OK**. See [Figure D-3](#).

FIGURE D-3: SLAVE STACK CODE GENERATION – IMPORT APPLICATION FILE



8. Go to **Tools>Create New Slave Files**. When prompted to save the project, save it in the directory provided. Click on the **Start** button to create the slave files. When complete, click on the **Open Folder** to open a window with all of the slave files. See [Figure D-4](#).

FIGURE D-4: SLAVE STACK CODE GENERATION – CREATE NEW SLAVE FILES



9. Copy these files from the directory in the previous step (including the `sample_app.c`, `sample_app.h`, `sample_appObject.h` and the `SAMD51 EtherCAT Slave.xml` files) and paste them to the `<Harmony Directory>\ethercat\slave_stack` directory.

NOTES:



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