# MICROCHIP

# EVB-LAN9500A-LC
# Evaluation Board
# User's Guide

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**Object of Declaration:   EVB-LAN9500A-LC Evaluation Board**

EU Declaration of Conformity
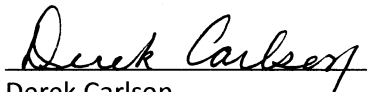
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Signed for and on behalf of Microchip Technology Inc. at Chandler, Arizona, USA

_Derek Carlson_

Derek Carlson
VP Development Tools

_16-July-2013_

Date

NOTES:

# Table of Contents

**NOTES:**

# Preface

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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 EVB-LAN9500A-LC Evaluation Board. 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-LAN9500A-LC Evaluation Board as a high-performance and low-cost USB/Ethernet connectivity solution.

The manual layout is as follows:

- **Chapter 1. "Overview"** – Shows a brief description of the EVB-LAN9500A-LC Evaluation Board.
- **Chapter 2. "Getting Started"** – Includes information about the EVB-LAN9500A-LC Evaluation Board.
- **Appendix A. "EVB-LAN9500A-LC Evaluation Board"** – This appendix shows the EVB-LAN9500A-LC Evaluation Board.
- **Appendix B. "EVB-LAN9500A-LC Evaluation Board Schematic"** – This appendix shows the EVB-LAN9500A-LC Evaluation Board schematic.
- **Appendix C. "Bill of Materials (BOM)"** – This appendix includes the EVB-LAN9500A-LC Evaluation Board Bill of Materials (BOM).
- **Appendix D. "References"** – This appendix shows the reference documents related to the EVB-LAN9500A-LC Evaluation Board.

## CONVENTIONS USED IN THIS GUIDE

This manual uses the following documentation conventions:

### 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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- 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

### Revision A (January 2014)

• Initial release of this document.

# Chapter 1. Overview

## 1.1 INTRODUCTION

The LAN9500A is a high-performance, small form factor solution for USB to 10/100 Ethernet port bridging. With applications ranging from embedded systems, set-top boxes, and PVR's, to USB port replicators, USB to Ethernet adapters, PC docking stations, and test instrumentation, the LAN9500A is targeted as a high-performance and low-cost USB/Ethernet connectivity solution.

The LAN9500A contains an integrated 10/100 Ethernet PHY, USB PHY, Hi-Speed USB 2.0 device controller, 10/100 Ethernet MAC, TAP controller, EEPROM controller, and a FIFO controller with a total of 30 KB of internal packet buffering. The LAN9500A complies with the IEEE 802.3 (full/half-duplex 10BASE-T and 100BASE-TX) Ethernet protocol and USB 2.0 specification, enabling compatibility with industry standard Fast Ethernet and USB 2.0 applications.

The EVB-LAN9500A-LC is an evaluation board that utilizes the LAN9500A to provide a fully-functional, bus-powered USB to Ethernet interface. The EVB-LAN9500A-LC provides fully-integrated Ethernet and USB ports via the on-board RJ45 and USB Type A connectors. The on-board 256x8 EEPROM is used to load the EVB-LAN9500A-LC's USB configuration parameters and MAC address.

DSTEMP software drivers are available for Windows XP, Windows Vista, Mac OS X, Linux, and Windows CE. Additional manufacturing and diagnostic tools are available for debugging and external EEPROM configuration. For complete details, refer to the "DSTEMP Software User Manual".

A simplified block diagram of the EVB-LAN9500A-LC can be seen in Figure 1-1.

**FIGURE 1-1:          EVB-LAN9500A-LC BLOCK DIAGRAM**
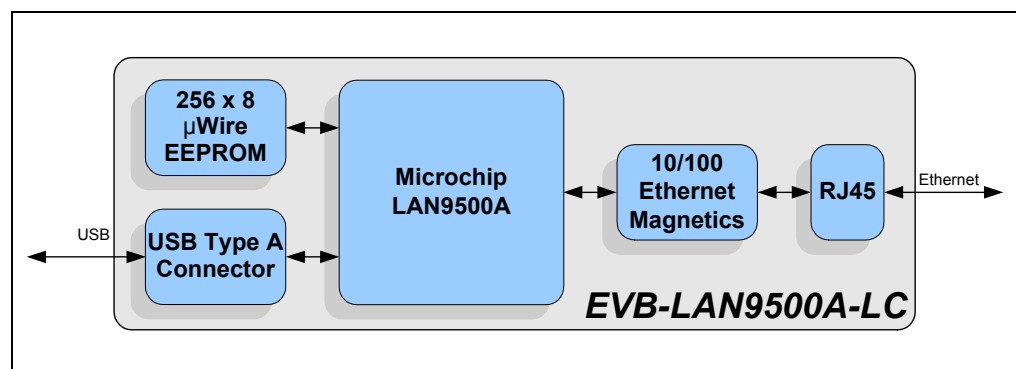
**NOTES:**

# Chapter 2. Getting Started

## 2.1 BOARD DETAILS
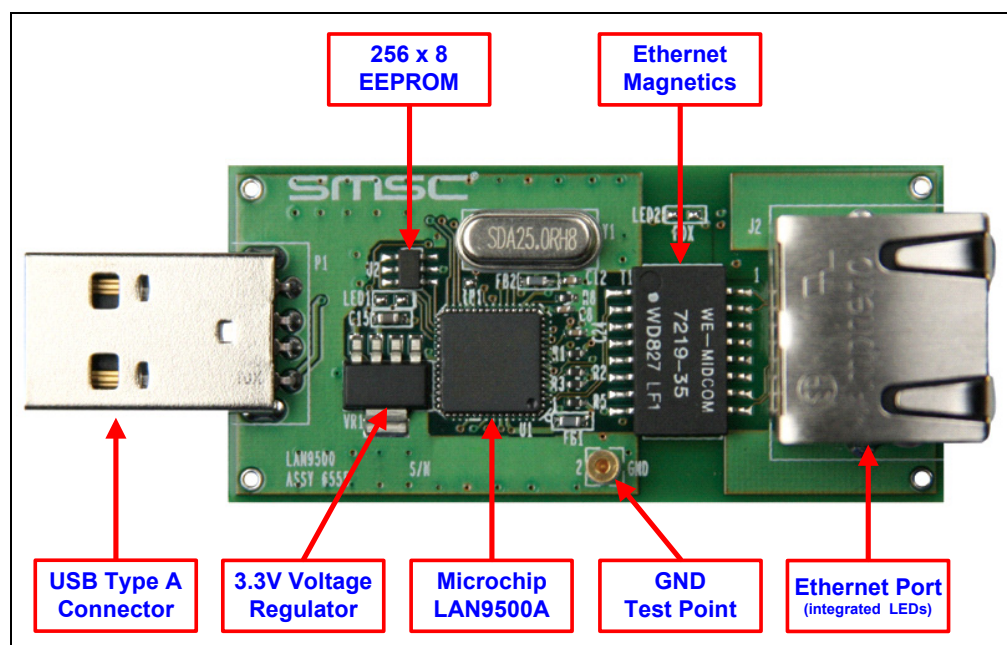
This section includes the following EVB-LAN9500A-LC board details:

- Configuration
- Mechanicals

### 2.1.1 Configuration

The following sub-sections describe the various board features including LEDs, test points, and system connections. A top view of the EVB-LAN9500A-LC is shown in Figure 2-1.

**FIGURE 2-1:     EVB-LAN9500A-LC TOP VIEW**



2.1.1.1     LEDS

Table 2-1 describes the EVB-LAN9500A-LC LEDs.

**TABLE 2-1:     LEDS**

| REFERENCES | COLOR | INDICATION |
|---|---|---|
| J2 | Green | Ethernet Link/Activity<br>**Solid:** Link established<br>**Blinking:** Link activity<br>**OFF:** No link |
| | Yellow | Ethernet Speed<br>**ON:** 100BASE-TX<br>**OFF:** 10BASE-T |

### 2.1.1.2 TEST POINTS

Table 2-2 describes the EVB-LAN9500A-LC test point.

**TABLE 2-2:** **TEST POINTS**

| TEST POINT | DESCRIPTION | CONNECTION |
|:---:|---|---|
| TP2 | Single Pin Gold Post GND Test Point | GND |

### 2.1.1.3 SYSTEM CONNECTIONS

Table 2-3 describes the EVB-LAN9500A-LC system connections.

**TABLE 2-3:** **SYSTEM CONNECTIONS**

| PLUG/HEADER | DESCRIPTION | PART |
|:---:|---|---|
| P1 | USB Type-A Plug | Molex 48037-0001 |
| J2 | RJ45 with Integrated LEDs | Amphenol RJHSE-5281 |

## 2.1.2 Mechanicals

Figure 2-2 shows a detailed the EVB-LAN9500A-LC mechanical dimensions.

**FIGURE 2-2:** **EVB-LAN9500A-LC MECHANICALS**
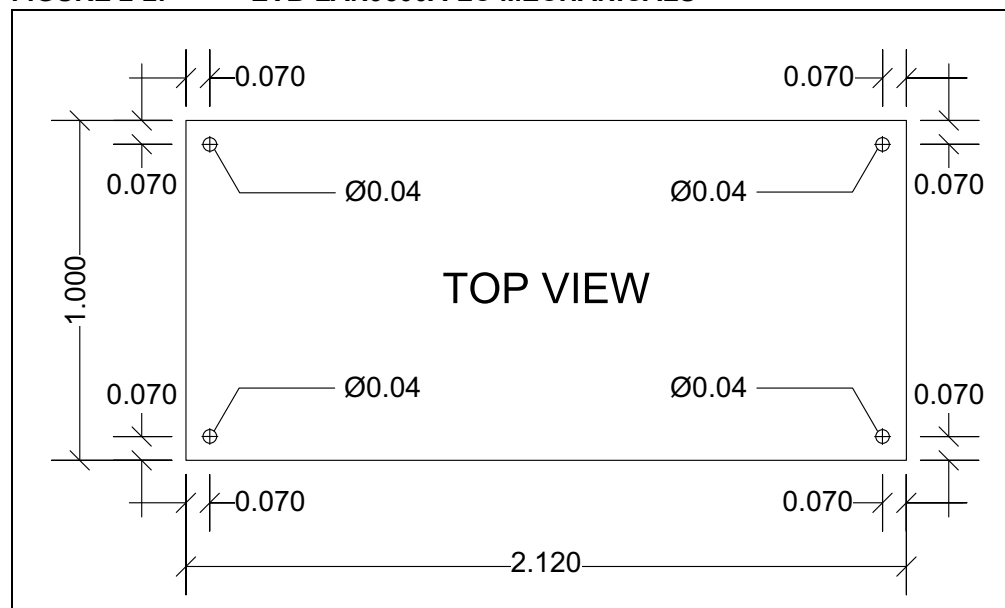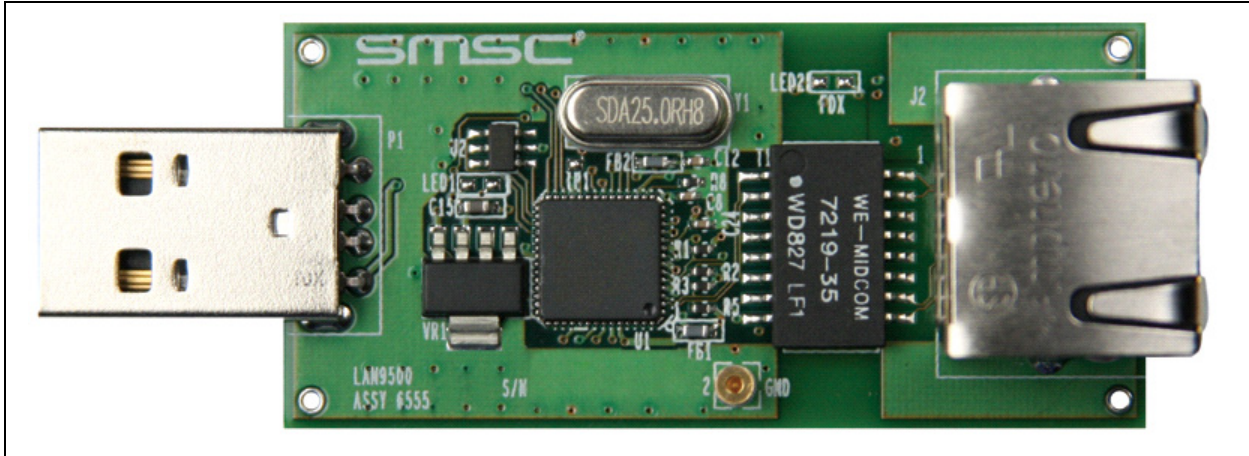
# Appendix A. EVB-LAN9500A-LC Evaluation Board

## A.1    INTRODUCTION

This appendix shows the EVB-LAN9500A-LC Evaluation Board.

**FIGURE A-1:        EVB-LAN9500A-LC EVALUATION BOARD**

**NOTES:**

# Appendix B. EVB-LAN9500A-LC Evaluation Board Schematic

## B.1    INTRODUCTION

This appendix shows the EVB-LAN9500A-LC Evaluation Board schematic.

**EVB-LAN9500A-LC Evaluation Board User's Guide**

**FIGURE B-1:** **EVB-LAN9500A-LC EVALUATION BOARD SCHEMATIC**



LAN9500 / LAN9500A

Ethernet

U1
LAN9500/LAN9500A
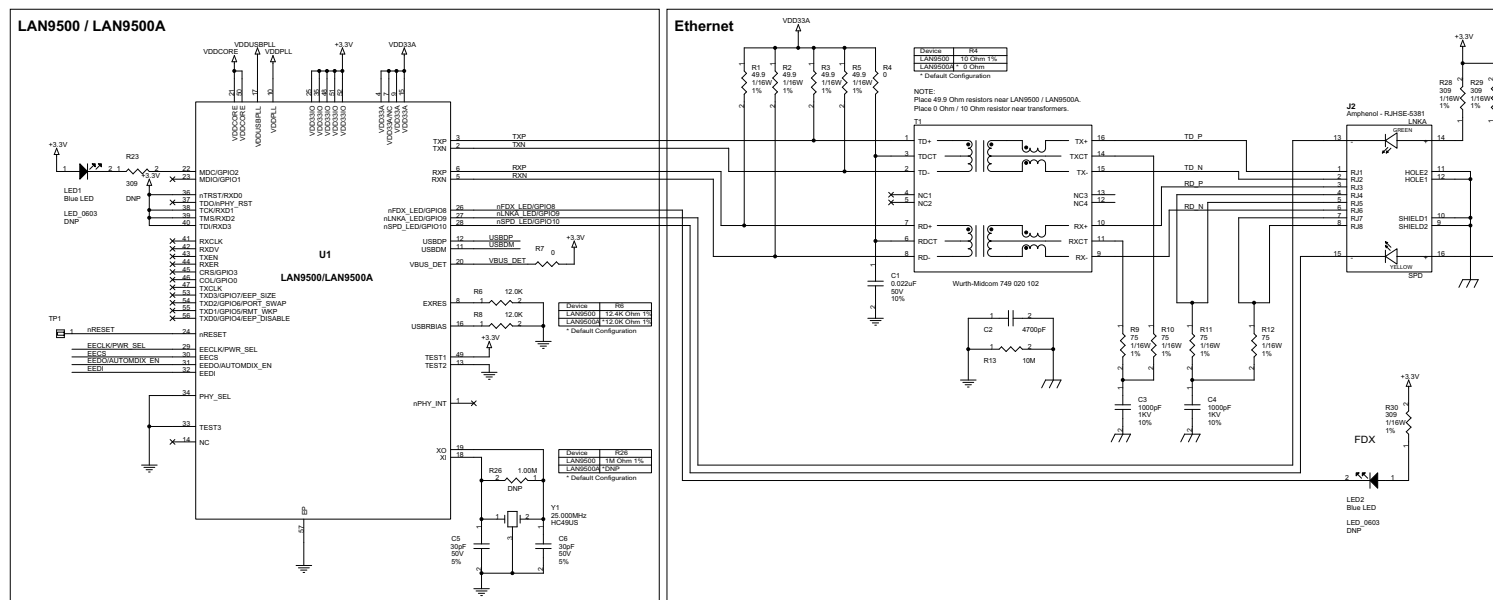
AUTO_MDIX disable optional strap.
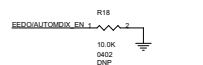
GND Test Point
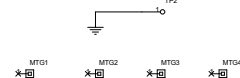
uWire EEPROM
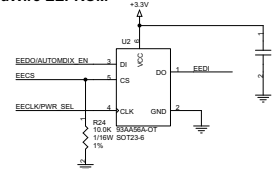
+3.3V Regulator
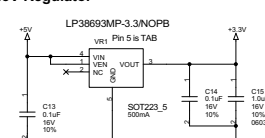
Power Supply Filtering
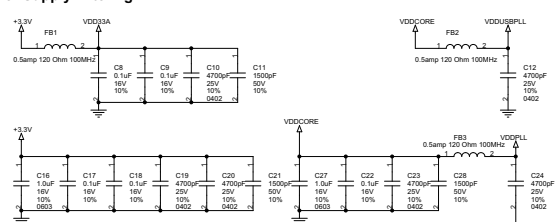
USB Connector
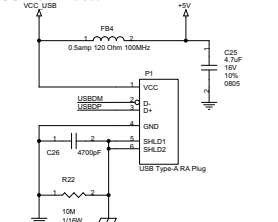
Optional Reset Monitor
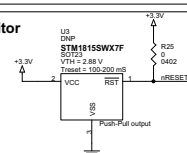
# Appendix C. Bill of Materials (BOM)

## C.1 INTRODUCTION

This appendix includes the EVB-LAN9500A-LC Evaluation Board Bill of Materials.

**TABLE C-1:    EVB-LAN9500A-LC EVALUATION BOARD BILL OF MATERIALS**

| Item | Quantity | Reference | Part | | PCB Footprint | Manufacturer Part Number |
|---|---|---|---|---|---|---|
| 1 | 1 | C1 | 0.022 uF | 50V | 0805 | Kemet C0805C223K5RACTU |
| 2 | 2 | C2, C26 | 4700 pF | 50V | 0603 | Kemet C0603C472K5RACTU |
| 3 | 2 | C3, C4 | 1000 pF | 1 KV | 0805 | Kemet C0805C102KDRACTU |
| 4 | 2 | C5, C6 | 30 pF | 50V | 0603 | Murata GRM1885C1H300JA01D |
| 5 | 8 | C7, C8, C9, C13, C14, C17, C18, C22 | 0.1 uF | 16V | 0402 | Panasonic ECJ-0EX1C104K |
| 6 | 6 | C10, C12, C19, C20, C23, C24 | 4700 pF | 25V | 0402 | Panasonic ECJ-0EX1C104K |
| 7 | 3 | C11, C21, C28 | 1500 pF | 50V | 0402 | Kemet C0402C472K3RACTU |
| 8 | 3 | C15, C16, C27 | 1.0 uF | 16V | 0603 | Kemet C0603C105K4PACTU |
| 9 | 1 | C25 | 4.7 uF | 16V | 0805 | Panasonic ECJ-2FB1C475K |
| 10 | 4 | FB1, FB2, FB3, FB4 | 0.5A/120 Ohm/100 MHz | | 0603 | TDK MMZ 1608S121A |
| 11 | 1 | J2 | RJ45 with Green, Yellow LEDs | | THRU-HOLE | Amphenol RJHSE-5381 |
| 12 | DNP 2 | LED1, LED2 | LED – Blue | | 0603 | Panasonic-SSG LNJ926W8CRA |
| 13 | 1 | P1 | USB Type-A RA Plug | | THRU-HOLE | Molex 48037-0001 |
| 14 | 4 | R1, R2, R3, R5 | 49.9 | | 0402 | Rohm MCR01MZPF49R9 |
| 15 | 3 | R4*, R7, R25 | 0 | | 0402 | Rohm MCR01MZPF10R0 |
| 16 | 2 | R6*, R8 | 12.0K | | 0402 | Rohm MCR01MZPF1202 |
| 17 | 4 | R9, R10, R11, R12 | 75.0 | | 0402 | Rohm MCR01MZPF75R0 |
| 18 | 2 | R13, R22 | 10M | | 0402 | Vishay CRCW040210M0JNED |
| 19 | DNP 1 | R18 | 10.0K | | 0402 | Rohm MCR01MZPF1002 |
| 20 | DNP 1 | R23 | 309 | | 0402 | Rohm MCR01MZPF3090 |
| 21 | 1 | R24 | 10.0K | | 0402 | Rohm MCR01MZPF1002 |
| 22 | DNP 1 | R26* | 1.00M | | 0603 | Rohm MCR03EZPFX1004 |
| 23 | 3 | R28, R29, R30 | 309 | | 0402 | Rohm MCR01MZPF3090 |
| 24 | 1 | TP2 | Test Point-Gold Post | | THRU-HOLE | Mill-Max 3132-0-00-15-00-00-08-0 |
| 25 | 1 | T1 | Wurth-Midcom 749 020 102 | | SMD | Wurth-Midcom 749 020 102 or equivalent |
| 26 | 1 | U1 | LAN9500A | | QFN56_8x8 MM | LAN9500A-ABZJ |
| 27 | 1 | U2 | 93AA56A-OT | | SOT23-6 | Microchip 93AA56AT-I/OT |
| 28 | DNP 1 | U3 | STM1815SWX7F | | SOT-23 | ST Micro STM1815SWX7F |

**TABLE C-1:** **EVB-LAN9500A-LC EVALUATION BOARD BILL OF MATERIALS (CONTINUED)**

| Item | Quantity | Reference | Part | PCB Footprint | Manufacturer Part Number |
|------|----------|-----------|------|---------------|--------------------------|
| 29 | 1 | VR1 | LP38693MP-3.3/NOPB | SOT223-5 | National LP38693MP-3.3/NOPB |
| 30 | 1 | Y1 | 25.000 MHz | HC49US | Suntsu Freq. SCS20D-25.000 MHz |

**Note:** The LAN9500 and LAN9500A devices are pin compatible. However, some resistor values and population options differ between devices. Table C-2 shows a list of the differences and proper values for LAN9500 and LAN9500A.

**TABLE C-2:** **LAN9500/LAN9500A SPECIFIC RESISTOR VALUES**

| Device | R4 | R6 | R26 |
|--------|-----|-----|------|
| LAN9500 | 10.0 Ohm 1% | 12.4K Ohm 1% | 1.0M Ohm 1% |
| LAN9500A | 0 Ohm | 12.0K Ohm 1% | DNP |

NOTES:

# Appendix D. References

## D.1    INTRODUCTION

Concepts and material available in the following documents may be helpful when using EVB-LAN9500A-LC.

- LAN9500A Data Sheet
- AN 8.13 Suggested Magnetics
- EVB-LAN9500A-LC Evaluation Board Schematic
- LAN9500A Software User Manual

**NOTES:**

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