EVB-LAN8770M_MC Evaluation Board User's Guide

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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-LAN8770M_MC Evaluation Board. Items discussed in this chapter include:

- Document Layout
- Conventions Used in this Guide
- Warranty Registration
- The Microchip Web Site
- Development Systems Customer Change Notification Service
- Customer Support
- Document Revision History

DOCUMENT LAYOUT

This document describes the setup and use of the EVB-LAN8770M_MC hardware and software, and how to optionally reprogram the preprogrammed on-board microcontroller.

The manual layout is as follows:

- **Chapter 1. "Overview"** – Shows a brief description of the EVB-LAN8770M_MC.
- **Chapter 2. "Getting Started"** – Provides information about setup and operation of the EVB-LAN8770M_MC.
- **Chapter 3. "Hardware Configuration"** – Includes information about the hardware configuration of the EVB-LAN8770M_MC.
- **Appendix A. "Schematics"** – This appendix shows the EVB-LAN8770M_MC schematics.
- **Appendix B. "Bill of Materials"** – This appendix includes the EVB-LAN8770M_MC Bill of Materials.

- **Appendix C. "Silk Screens"** – This appendix includes the EVB-LAN8770M_MC silk screen.
- **Appendix D. "PIC® MCU Programming"** – This appendix includes instructions for users who wish to reprogram the EVB-LAN8770M_MC with modified initialization code.

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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- **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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- **Compilers** – The latest information on Microchip C compilers, assemblers, linkers and other language tools. These include all MPLAB C 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.

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

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
DS50002979A (04-17-20)	Initial release	

Chapter 1. Overview

1.1 INTRODUCTION

The EVB-LAN8770M_MC evaluation board is a 100BASE-T1 (single-pair Ethernet) to 100BASE-TX (Fast Ethernet) media converter that is used for evaluating the LAN8770 100BASE-T1 Ethernet transceiver.

The 100BASE-TX side of the EVB-LAN8770M_MC uses a KSZ8081MNX transceiver and a conventional RJ45 jack with integrated magnetics. It features auto-negotiation and auto-crossover.

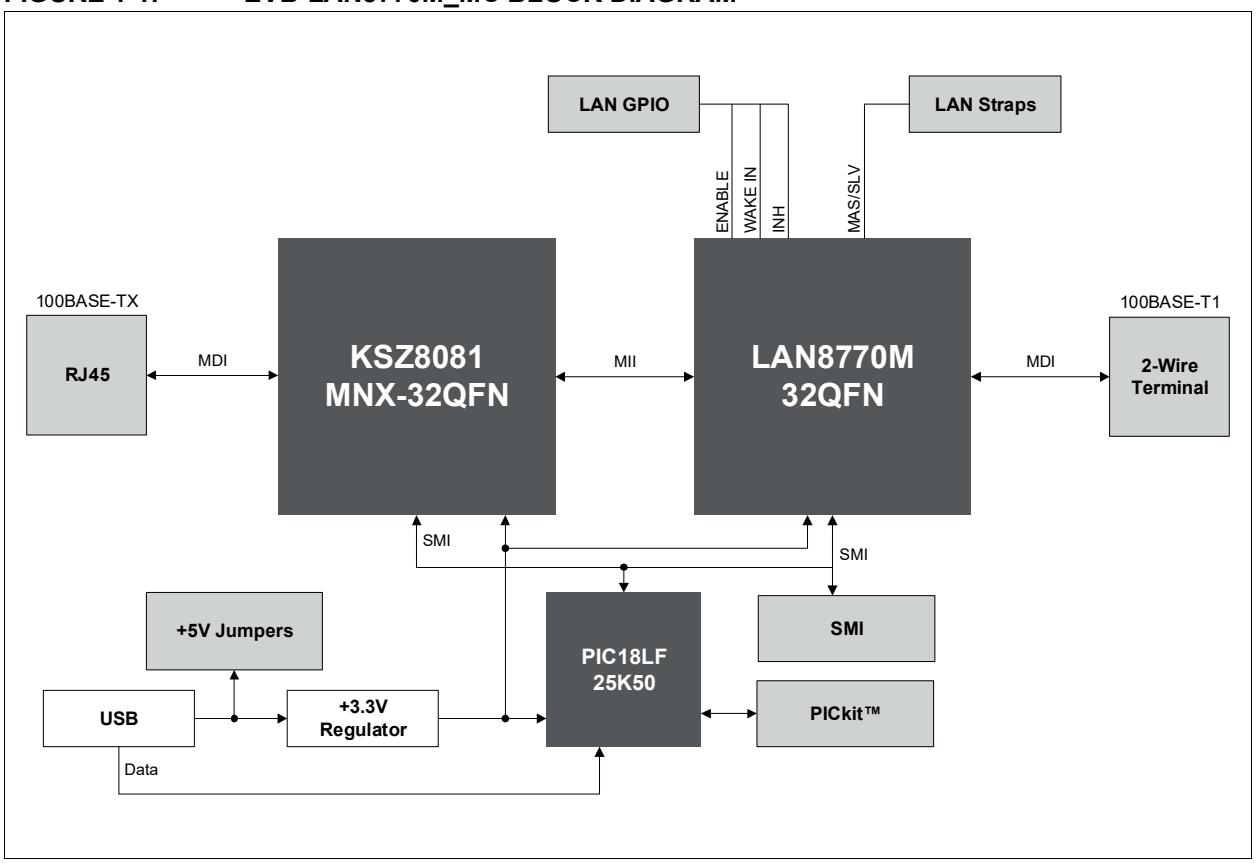
The 100BASE-T1 side uses a LAN8770M transceiver with a 2-wire, screw-down terminal block. The board also has footprint for a 4-pin connector in place of the terminal block. The LAN8770M is configured in reverse MII mode, and connects directly to the MII interface of the KSZ8081MNX.

Software is provided to allow users to access the LAN8770 registers from a PC via the USB port and an on-board PIC® microcontroller. The board is powered from the USB port.

This document describes setup and use of the hardware and software. It also explains how to optionally reprogram the preprogrammed on-board microcontroller. A simplified block diagram of the board is shown in Figure 1-1.

1.2 BLOCK DIAGRAM

FIGURE 1-1: EVB-LAN8770M_MC BLOCK DIAGRAM



1.3 REFERENCES

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

- *LAN8770 Data Sheet*

Chapter 2. Getting Started

2.1 PHYSICAL SETUP

The Microchip EVB-LAN8770M_MC media converter is simple to set up, as shown in Figure 2-1.

1. Verify that jumpers are installed on headers J6 and J11.
2. To configure the 100BASE-T1 port as slave, install a jumper on header J3. To configure it as master, do not install the J3 jumper.
3. The board is powered via a micro-USB cable.
4. A CAT-5 Ethernet cable can be connected to the RJ45 jack for 100BASE-TX.
5. For 100BASE-T1, connect the single twisted pair cable to the screw terminal J9.

FIGURE 2-1: EVB-LAN8770M_MC EVALUATION BOARD CONNECTIONS

No further steps are needed for the board to pass Full-duplex 100 Mbps traffic between the two ports. Note that the CAT-5 port must be linked at 100 Mbps, and not 10 Mbps.

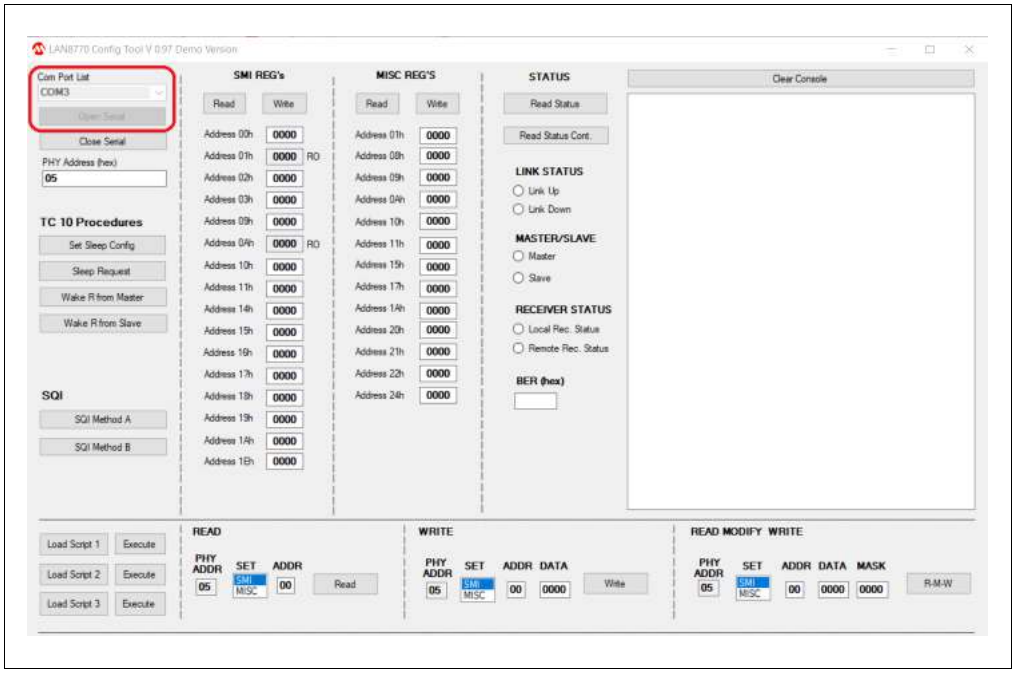
2.2 EVB-LAN8770M_MC CONFIGURATION TOOL SOFTWARE

The optional EVB-LAN8770M_MC Configuration Tool Software is available to monitor and configure the LAN8770M transceiver. Microsoft® .Net 4.5 or a newer version must be installed on the PC. The software comes as an executable (`.exe`) file for Windows®operating systems, and no installation is required. To run it, double click the file.

The PIC microcontroller on the board is running as a communications device class (CDC) device, so it sets up a serial communication port on the PC.

Once the software is started and the application window has opened, select the appropriate COM port for the evaluation board, and click the **Connect** button as shown in Figure 2-2.

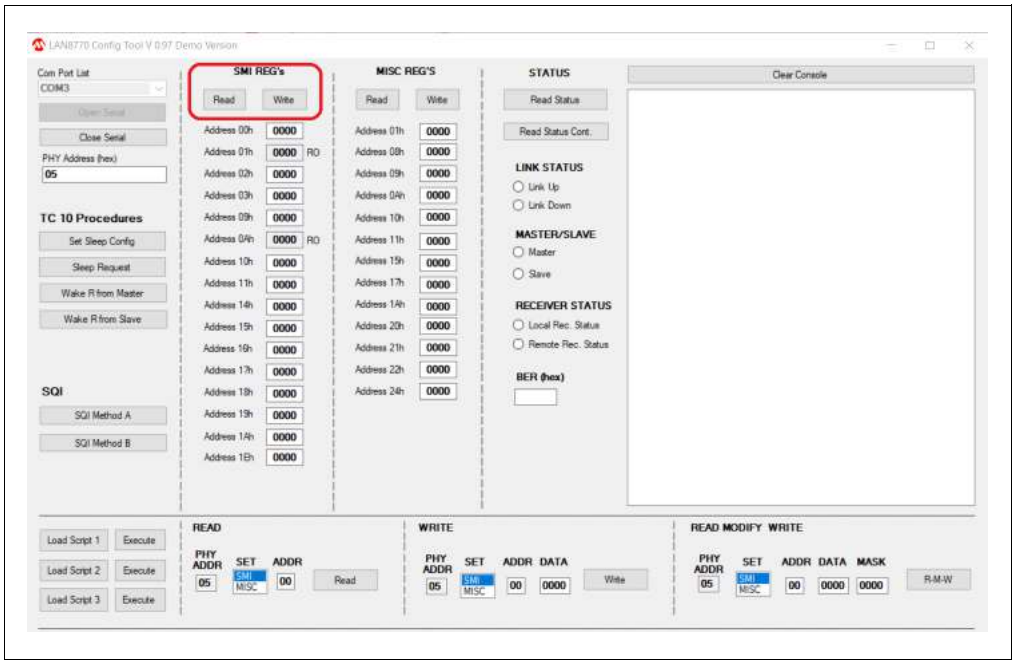
FIGURE 2-2: COM PORT SELECTIONS



The initial condition is a blank form with all values filled in with zero. Click the **Read** buttons to update the registers. With a successful connection to the board, you should be able to:

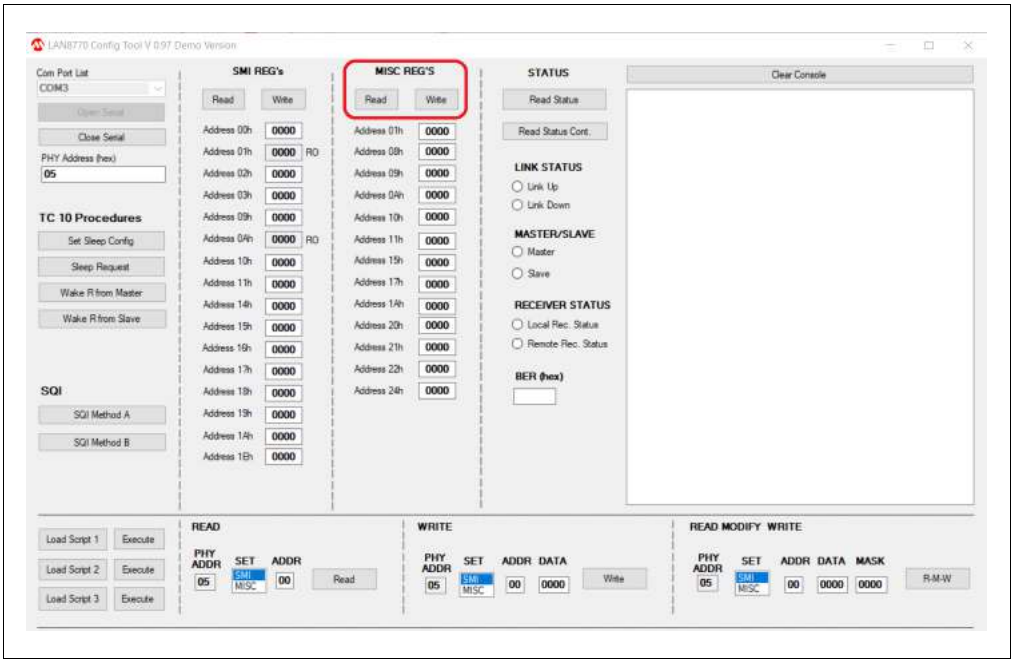
- Read and write the SMI Control and Status Registers (Bank 0).

FIGURE 2-3: SMI REGISTERS READ AND WRITE



- Read and write the Miscellaneous Registers (Bank 1).

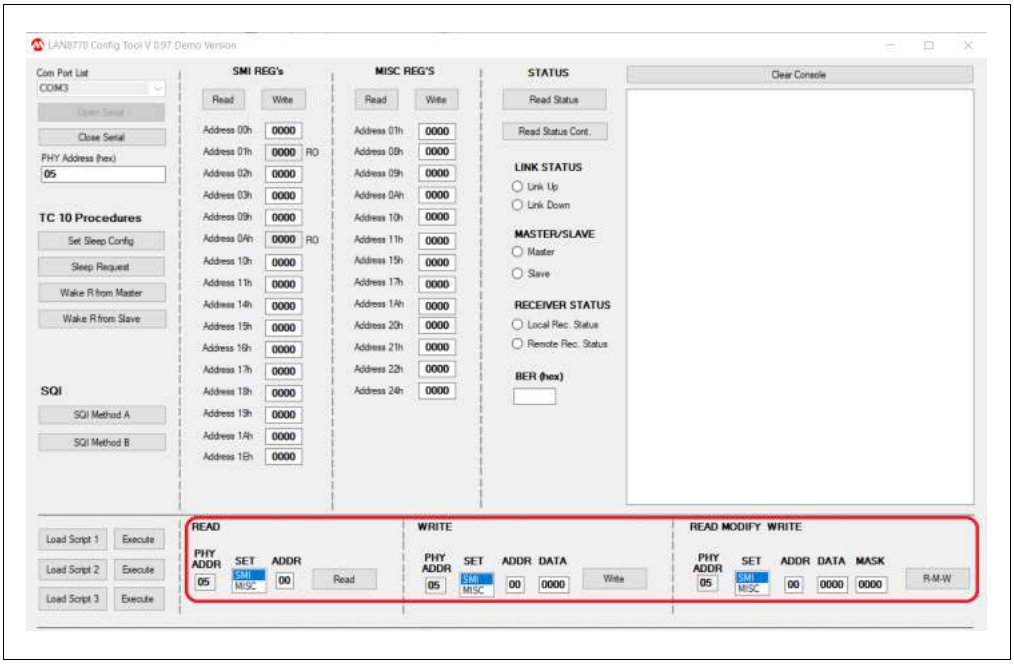
FIGURE 2-4: MISCELLANEOUS REGISTERS READ AND WRITE



If you use the **Write** buttons in the above figures, the whole buffer with all page-values, except the Read Only values, is written to the device. This enables you to alter more than one word at a time.

Single READ, WRITE, or READ MODIFY WRITE commands are easily accomplished using the controls highlighted in Figure 2-5.

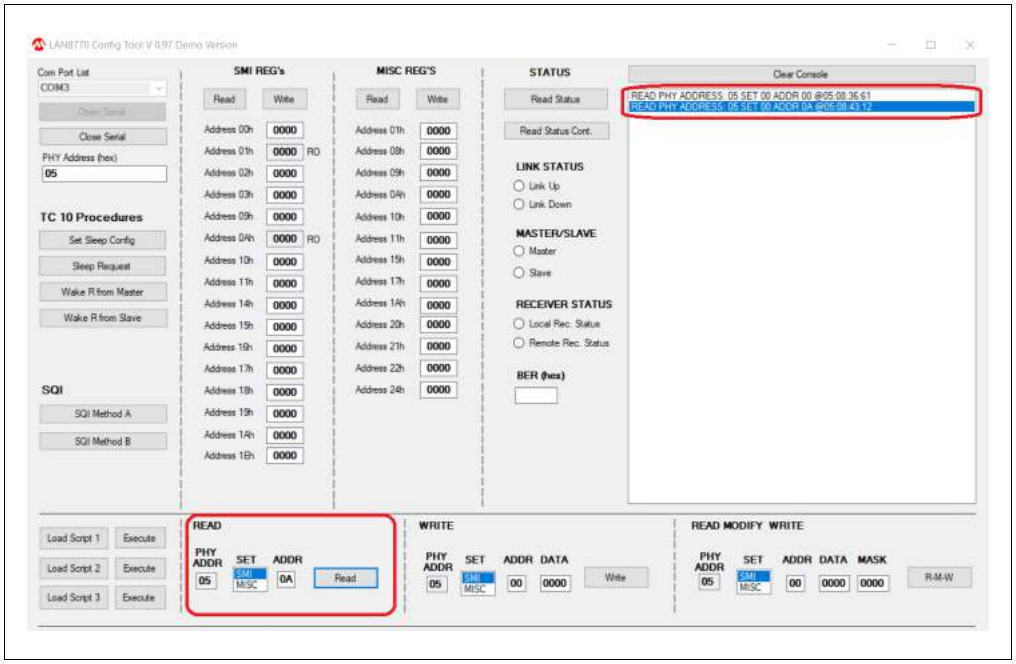
FIGURE 2-5: INDIVIDUAL REGISTER COMMANDS



The PHY Address is copied from the general setup field (PHY ADDR (hex)).

For the READ command, select the appropriate **SET** value (register bank), and an address. After clicking the **Read** button, the value is displayed into the Clear Console window as shown in Figure 2-6.

FIGURE 2-6: SINGLE REGISTER READ COMMANDS



The **Read Status** button gives quick access to the following status information for the 100BASE-T1 port:

- Link Up/Down
- Master/Slave
- Local Receiver Status
- Remote Receiver Status
- DSP Bit Error Rate

After clicking the **Read Status Cont** button, these status information are read every 200 ms, and this function stops automatically when another read or write operation is requested.

The **Load Script** buttons lets you load three different scripts to execute when the appropriate **Execute** button is clicked. Script execution is displayed in the Clear Console window.

Commands supported inside the script are:

- Blank Lines
- # Comment Lines
- Sleep command
- r - Read command
- w - Write command
- RMW - Read-Modify-Write command

The script has to be in a `.txt` format. All commands are lowercase letters. The sleep command is followed with a sleep time in [ms] as a decimal value. All other values for the address and data fields have to be provided in hexadecimal with a leading `0x`.

EXAMPLE 2-1: EXAMPLE OF SUPPORTED COMMANDS

```
#this is a comment line
rmw afe 0x00 0x0518 0x3FF8
w dsp 0x34 0x0001
w pcs 0x00 0x7FFF
w smi 0x17 0x0080
rmw smi 0x10 0x0000 0x0040
rmw afe 0x0B 0x000A 0x001E
w dsp 0x25 0x23E0
sleep 500
r smi 0x01
```

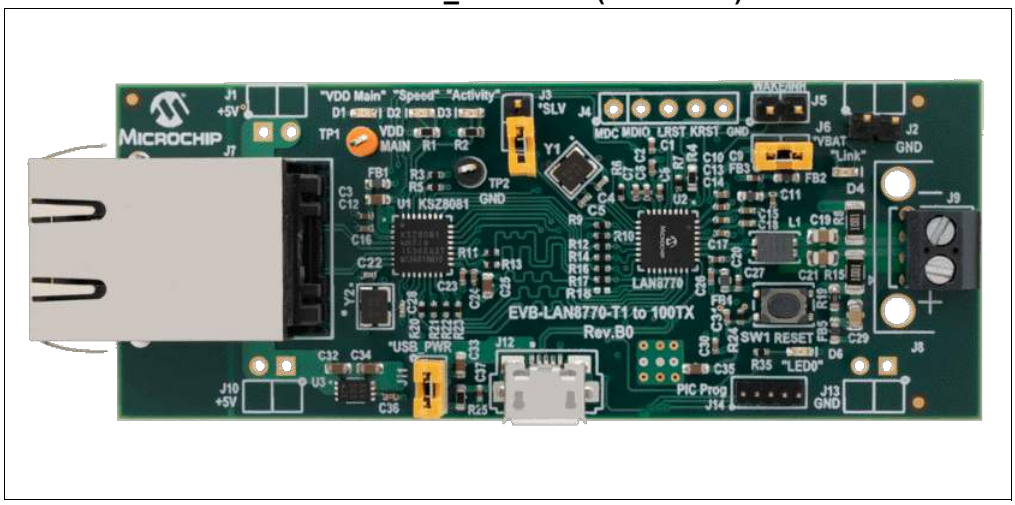
NOTES:

Chapter 3. Hardware Configuration

3.1 HARDWARE CONFIGURATION OPTIONS

Figure 3-1 shows the top view of the EVB-LAN8770M_MC evaluation board.

FIGURE 3-1: EVB-LAN8770M_MC REV B (TOP VIEW)



3.1.1 Jumpers and Headers

Section 2.1 "Physical Setup" describes the basic setup of this media converter board. When configuring the board, it has to be decided whether it will be set up as a 100BASE-T1 master or a 100BASE-T1 slave. This is determined using the J3 jumper. 100BASE-T1 links must always be statically configured with one end as a master and the other end as a slave. If both ends are the same type, the connection will not work.

Table 3-1 lists the descriptions of the jumpers, and Table 3-2 lists the header descriptions.

TABLE 3-1: JUMPER DESCRIPTIONS

Jumpers	Description
J3	Master/Slave mode selection. Open for master. Closed for slave.
J6	In-line jumper on the VBAT power rail for VBAT current measurement. Always close it for operation.
J11	In-line jumper on the USB 5V power rail. It must be closed when the board is powered from USB.

TABLE 3-2: HEADER DESCRIPTIONS

Headers	Description
J4	These signals are controlled by the PIC microcontroller. They should not be controlled externally, but they may be monitored. Pin 1: MDC Pin 2: MDIO Pin 3: KSZ8081 Reset Pin 4: LAN8770 Reset Pin 5: Ground
J5	These signals are either controlled by the PIC microcontroller or outputs of the LAN8770. Do not drive them externally. Pin 1: WAKE_IN - Input to the LAN8770 Pin 2: INH - Output from the LAN8770
J14	5-pin PIC programming header

3.1.2 Status LEDs

Descriptions of the status LEDs are shown in Table 3-3.

TABLE 3-3: LED DESCRIPTIONS

LEDs	Description
D1	"VDD Main" = 3.3V power, green
D2	"Speed" indicates KSZ8081 100 Mbps (off is 10 Mbps), yellow
D3	"Activity" indicates KSZ8081 traffic, green
D4	"Link" is driven by the LAN8770M dual-function LED/IRQ_N pin. By default, this pin is IRQ_N (interrupt) output. For LED indication of link status, the pin function must be changed via register write. Green
D6	"LED0" indicates that the PIC microcontroller is programmed, green

3.1.3 100BASE-T1 Connector

The board comes with a screw terminal connector for the single twisted pair cable. Optionally, the screw terminal can be removed, and a Molex® Mini50 2 mm 4-pin jack can be installed. See the Bill of Materials (BOM) for component J8.

3.1.4 Reset Push Button

The **SW1 Reset** push button resets the PIC microcontroller, which in turn resets both transceivers.

Appendix A. Schematics

A.1 INTRODUCTION

This appendix shows the EVB-LAN8770M_MC schematic diagrams.

FIGURE A-1: EVB-LAN8770M_MC SCHEMATIC (1/2)

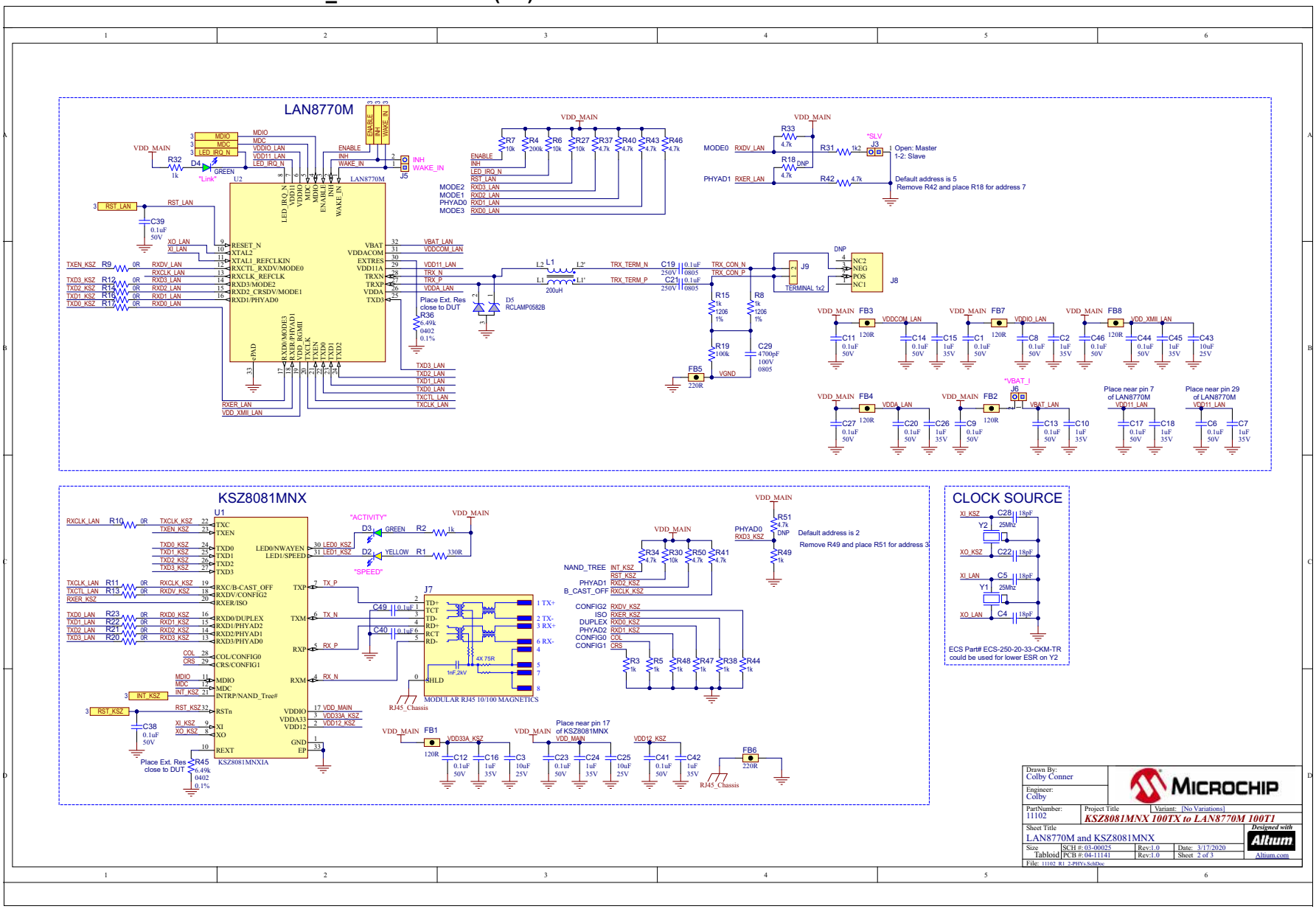
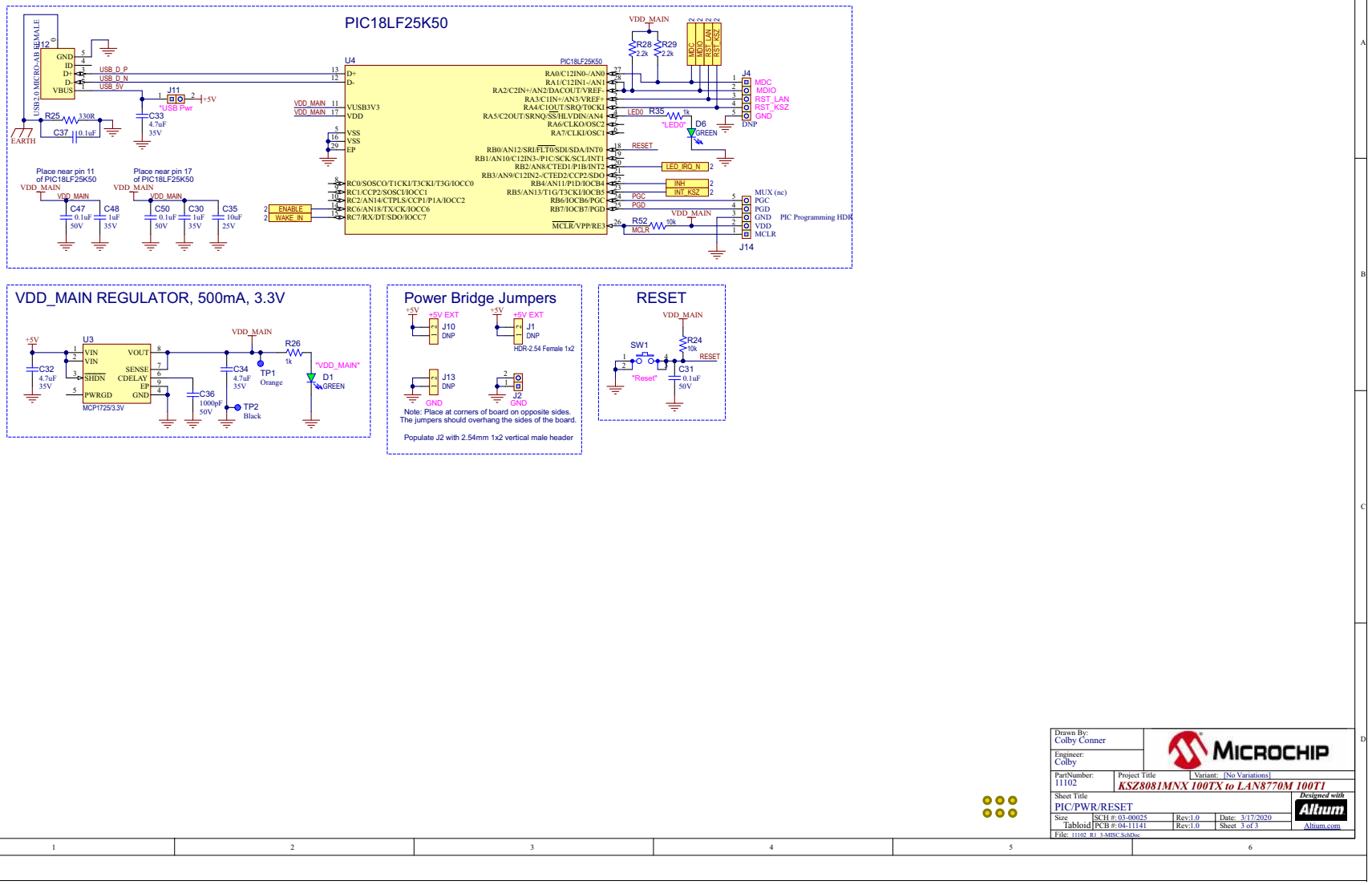


FIGURE A-2: EVB-LAN8770M_MC SCHEMATIC (2/2)



NOTES:

Appendix B. Bill of Materials

B.1 INTRODUCTION

This appendix contains the EVB-LAN8770M_MC Bill of Materials (BOM).

TABLE B-1: EVB-LAN8770M_MC BILL OF MATERIALS

Item	Qty	Designator	Description	Populated	Manufacturer	Manufacturer Part Number
1	23	C1, C6, C8, C9, C11, C12, C13, C14, C17, C20, C23, C27, C31, C37, C38, C39, C40, C41, C44, C46, C47, C49, C50	CAP CER 0.1uF 50V 10% X7R SMD 0402	YES	TDK Corporation	C1005X7R1H104K050BB
2	12	C2, C7, C10, C15, C16, C18, C24, C26, C30, C42, C45, C48	CAP CER 1uF 35V 10% X5R SMD 0402	YES	Murata Electronics North America	GRM155R6YA105KE11D
3	4	C3, C25, C35, C43	CAP CER 10UF 25V 20% X5R SMD 0603	YES	Murata Electronics North America	GRM188R61E106MA73D
4	4	C4, C5, C22, C28	CAP CER 18pF 50V 5% C0G SMD 0402	YES	Murata	GRM1555C1H180JA01D
5	2	C19, C21	CAP CER 0.1uF 250V 10% X7T SMD 0805	YES	TDK Corporation	C2012X7T2E104K125AA
6	1	C29	CAP CER 4700pF 100V 10% X7R SMD 0805	YES	TDK Corporation	C2012X7R2A472K
7	3	C32, C33, C34	CAP CER 4.7uF 35V 10% X5R SMD 0603	YES	Murata Electronics North America	GRM188R6YA475KE15D
8	1	C36	CAP CER 1000pF 50V 10% X7R SMD 0402	YES	Murata	GRM155R71H102KA01D
9	4	D1, D3, D4, D6	DIO LED GREEN 2V 30mA 35mcd Clear SMD 0603	YES	Lite-On Inc	LTST-C191KGKT
10	1	D2	DIO LED YELLOW 2.2V 25mA 3.4mcd Diffuse SMD 0603	YES	Stanley Electric Co	FY1111C-TR
11	1	D5	DIO TVS ARRAY RCLAMP0582BQTCT 5V 300W SMD SC-75-3	YES	Semtech Corporation	RCLAMP0582BQTCT
12	6	FB1, FB2, FB3, FB4, FB7, FB8	FERRITE 600mA 120R SMD 0603	YES	TDK Corporation	MMZ1608B121CTAH0
13	2	FB5, FB6	FERRITE 220R@100MHZ 2A SMD 0603	YES	Murata Electronics North America	BLM18EG221SN1D
14	1	J1	CON HDR-2.54 Female 1x2 Gold TH R/A	DNP	Sullins Connector Solutions	PPPC021LGBN-RC
15	5	J2, J3, J5, J6, J11	CON HDR-2.54 Male 1x2 Gold 5.84MH TH VERT	YES	FCI	77311-118-02LF
16	1	J4	CON HDR-2.54 Male 1x5 Gold 5.84MH TH VERT	DNP	FCI	68000-105HLF
17	1	J7	CON MODULAR JACK RJ45 10/100 MAGNETICS 0xLEDs SHIELD TH R/A	YES	Bel Fuse Inc.	08B1-1X1T-36-F
18	1	J8	CON JACK MINI50 2MM BLACK MALE TH R/A	DNP	Molex, LLC	0347930040
19	1	J9	CON TERMINAL 3.5mm 1x2 Female 16-28AWG 6A TH R/A	YES	On Shore Technology Inc	ED555/2DS
20	2	J10, J13	CON HDR-2.54 Male 1x2 Gold 6.75MH TH R/A	DNP	Molex, LLC	0901210762
21	1	J12	CON USB2.0 MICRO-AB FEMALE SMD R/A	YES	Hirose	ZX62-AB-5PA(31)
22	1	J14	CON HDR-1.27 Male 1x5 TH VERT	YES	Sullins Connector Solutions	GRPB051VWVN-RC
23	1	L1	CM CHOKE 5.5R@100kHZ 200UH SMD 3.2X2.5MM	YES	TDK Corporation	ACT1210L-201-2P-TL00
24	2	R1, R25	RES TKF 330R 1% 1/10W SMD 0603	YES	Panasonic	ERJ-3EKF3300V
25	2	R2, R32	RES TKF 1k 1% 1/10W SMD 0603	YES	Panasonic	ERJ-3EKF1001V
26	10	R3, R5, R26, R31, R35, R38, R44, R47, R48, R49	RES TF 1k 0.1% 1/16W SMD 0402	YES	Yageo	RT0402BRD071KL
27	1	R4	RES TKF 200k 1% 1/10W SMD 0603	YES	Panasonic	ERJ-3EKF2003V
28	6	R6, R7, R24, R27, R30, R52	RES TKF 10k 5% 1/16W SMD 0402	YES	Vishay	CRCW040210K0JNED
29	2	R8, R15	RES TF 1k 1% 1/2W SMD 1206	YES	Stackpole Electronics Inc.	RNCP1206FTD1K00
30	12	R9, R10, R11, R12, R13, R14, R16, R17, R20, R21, R22, R23	RES TKF 0R 1/16W SMD 0402	YES	Yageo	RC0402JR-070RL

TABLE B-1: EVB-LAN8770M_MC BILL OF MATERIALS (CONTINUED)

Item	Qty	Designator	Description	Populated	Manufacturer	Manufacturer Part Number
31	2	R18, R51	RES TKF 4.7k 1% 1/16W SMD 0402	DNP	Yageo	RC0402FR-074K7L
32	1	R19	RES TKF 100k 1% 1/4W SMD 0603	YES	Vishay	CRCW0603100KFKEAHP
33	2	R28, R29	RES TKF 2.2k 1% 1/10W SMD 0402	YES	Panasonic	ERJ-2RKF2201X
34	9	R33, R34, R37, R40, R41, R42, R43, R46, R50	RES TKF 4.7k 1% 1/16W SMD 0402	YES	Yageo	RC0402FR-074K7L
35	2	R36, R45	RES TkF 6.49K 0.1% 1/16W SMD 0402	YES	Panasonic Electronic Components	ERA-2ARB6491X
36	1	SW1	SWITCH TACT SPST 16V 50mA PTS810 SJM 250 SMTR LFS SMD	YES	C&K Components	PTS810 SJM 250 SMTR LFS
37	1	TP1	CON TP LOOP Orange TH	YES	Keystone Electronics	5003
38	1	TP2	MISC, TEST POINT MULTI PURPOSE MINI BLACK	YES	Keystone	5001
39	1	U1	MCHP INTERFACE ETHERNET KSZ8081MNXIA QFN-32	YES	Microchip Technology	KSZ8081MNXIA-TR
40	1	U2	MCHP INTERFACE T1 ETHERNET LAN8770M QFN-32	YES	Microchip Technology	LAN8770M/PRA
41	1	U3	MCHP ANALOG LDO 3.3V MCP1725T-3302E/MC DFN-8	YES	Microchip	MCP1725T-3302E/MC
42	1	U4	MCHP MCU 8-BIT 48MHz 32kB 2kB PIC18LF25K50-I/ML QFN-28	YES	Microchip Technology	PIC18LF25K50-I/ML
43	2	Y1, Y2	CRYSTAL 25MHz 10pF SMD ABM8G	YES	Abracon LLC	ABM8G-25.000MHZ-B4Y-T

NOTES:

Appendix C. Silk Screens

C.1 INTRODUCTION

This appendix shows the top and bottom silk screen images of the EVB-LAN8770M_MC.

FIGURE C-1: EVB-LAN8770M_MC TOP SILK SCREEN IMAGE

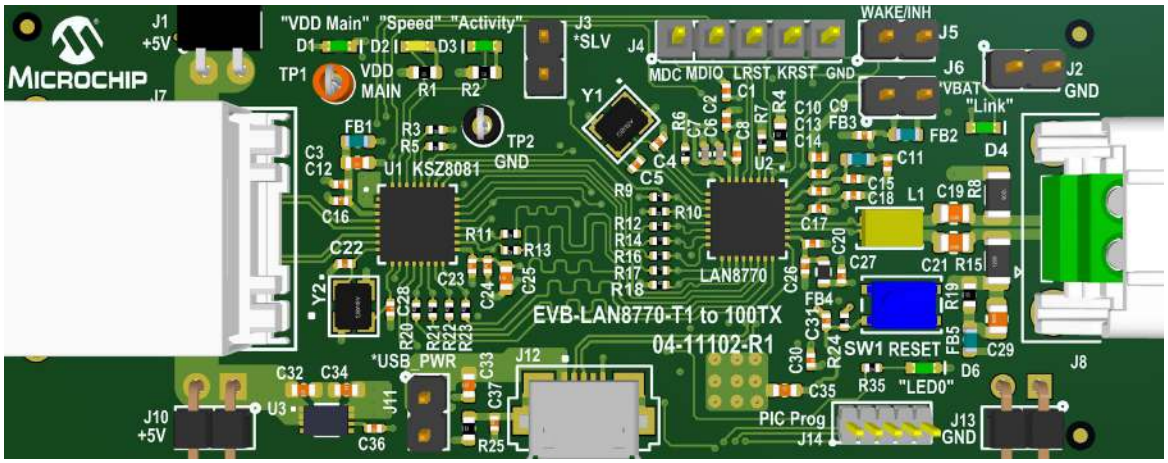
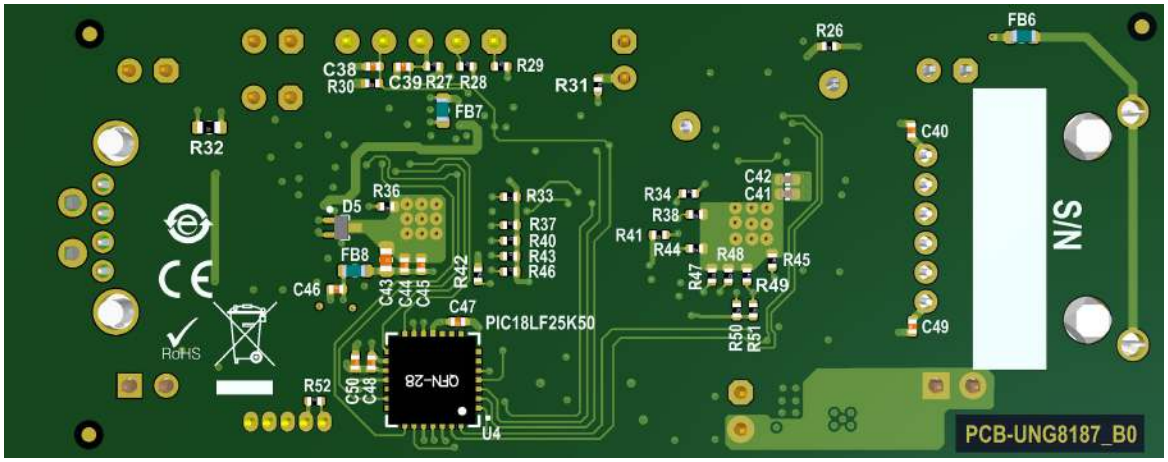


FIGURE C-2: EVB-LAN8770M_MC BOTTOM SILK SCREEN IMAGE



NOTES:

Appendix D. PIC® MCU Programming

D.1 INTRODUCTION

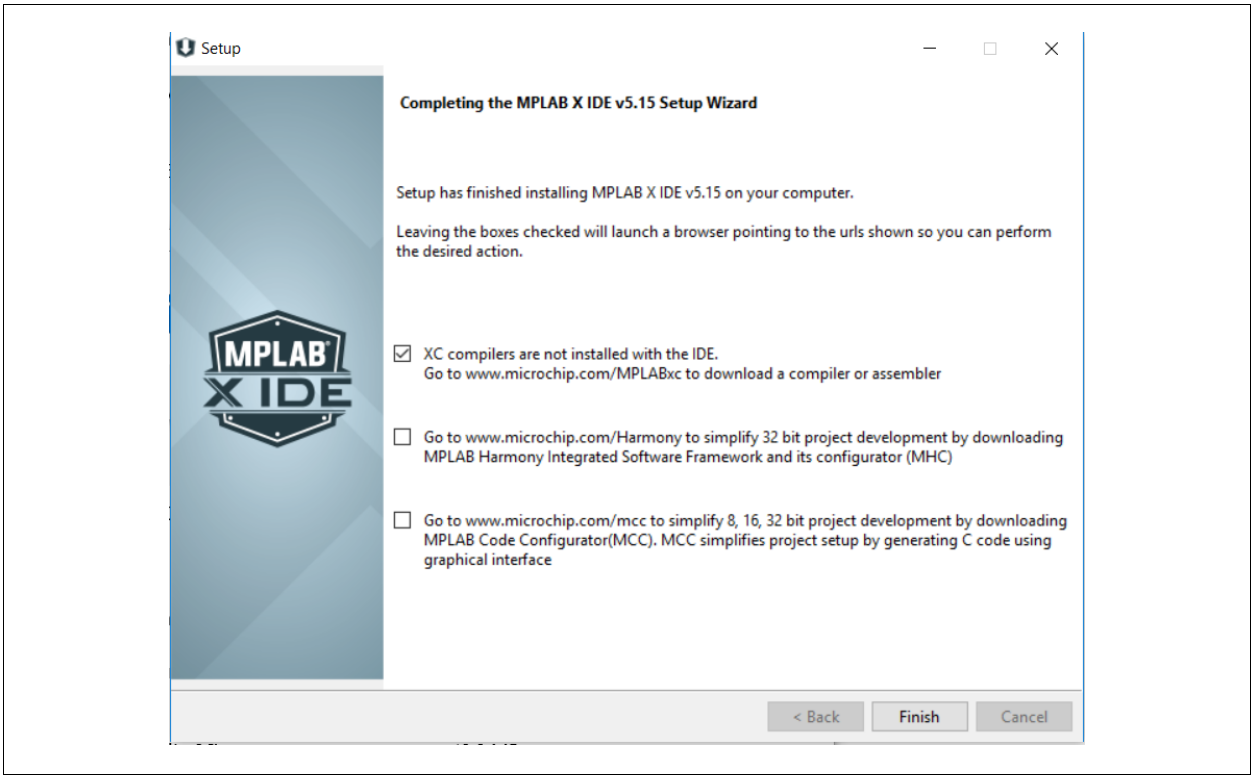
The EVB-LAN8770M_MC has a PIC18LF25K50 microcontroller that initializes the LAN8770M at power-on, and provides user access to the registers via the USB interface. The PIC microcontroller is already programmed, so users are not expected to reprogram it. However, the following instructions are provided for users who wish to reprogram it with modified initialization code.

D.2 SETTING UP MPLAB® X IDE AND MPLAB® XC8 COMPILER

To set up the MPLAB X IDE and MPLAB XC8 Compiler:

1. Download the latest MPLAB X IDE (5.xx) from the Microchip X IDE website.
2. Open the installer. (In Windows, it will be in the `Downloads` directory.) Accept the license agreement and click **Next** on every step to launch the installation.
3. When installation is finished, additional items to install are prompted. For this, only the MPLAB XC8 Compiler is necessary. See Figure D-1 for items to check and then click **Finish**. This opens a web page to the Microchip XC Compilers.

FIGURE D-1: MPLAB® X IDE SETUP WIZARD SCREEN

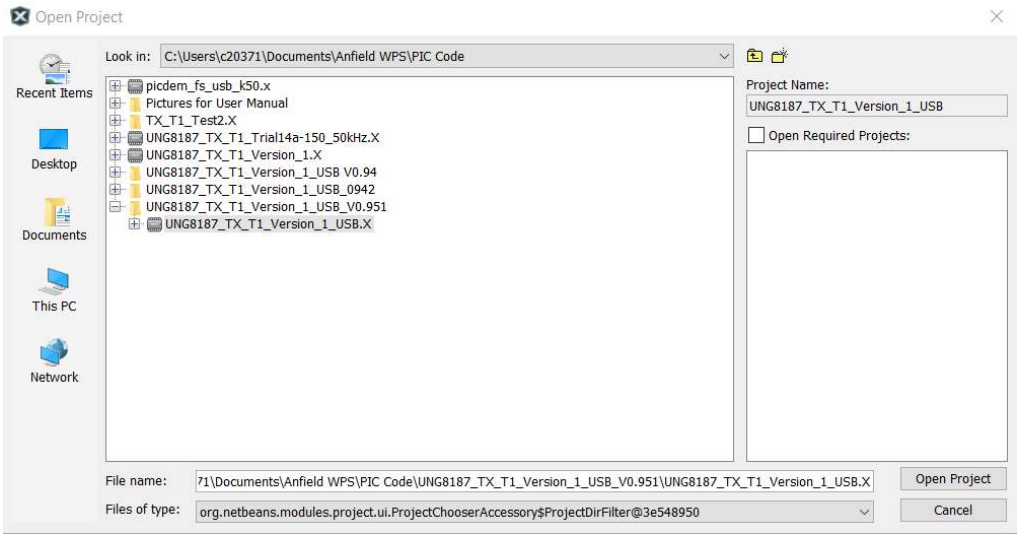


4. On the Microchip XC Compilers website, download the MPLAB XC8 Compiler.
5. Open the XC8 Compiler installer (same directory as in step 2). Accept the license agreement and click **Next** on every step of the installation.
6. Once the installation is complete, click **Next** (if activating a license, which is not necessary), activate your license, and then click **Next**.

D.3 SETTING UP PROJECT IN MPLAB® X IDE

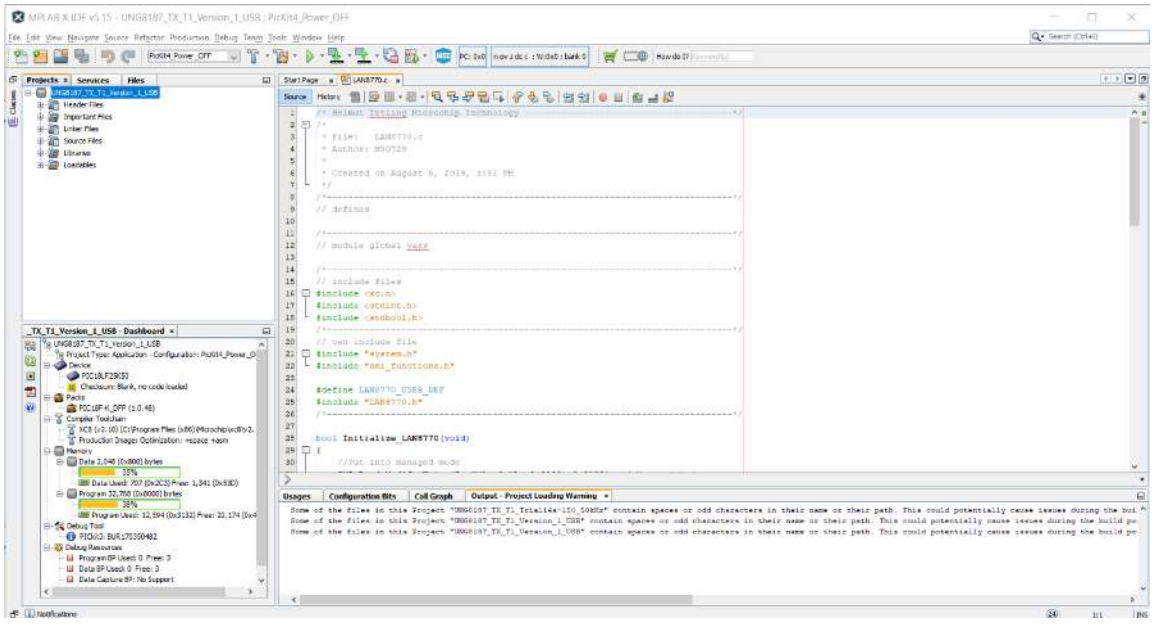
1. Open MPLAB X IDE.
2. Go to *File>Open Project*.
3. Navigate to the folder where `UNG8187_TX_T1_Version_1_USB.X` folder is located. Select it and click **Open Project**.

FIGURE D-2: UNG8187_TX_T1_VERSION_1_USB.X FOLDER NAVIGATION



4. The project for the 100BASETX to 100BASET1 PIC Program opens. Expand the project in the upper-left corner. The PIC microcontroller is programmed with the register read and write functions in the `Initialize_LAN8770() function in the LAN8770.c` file. Double click to open. The default programming in this function is to set the EVB-LAN8770M_MC to its best interoperability with other 100BASE-T1 link partners, but other read and write functions can be done after the default initialization.

FIGURE D-3: 100BASE-TX TO 100BASE-T1 PIC® PROGRAM PROJECT SCREEN



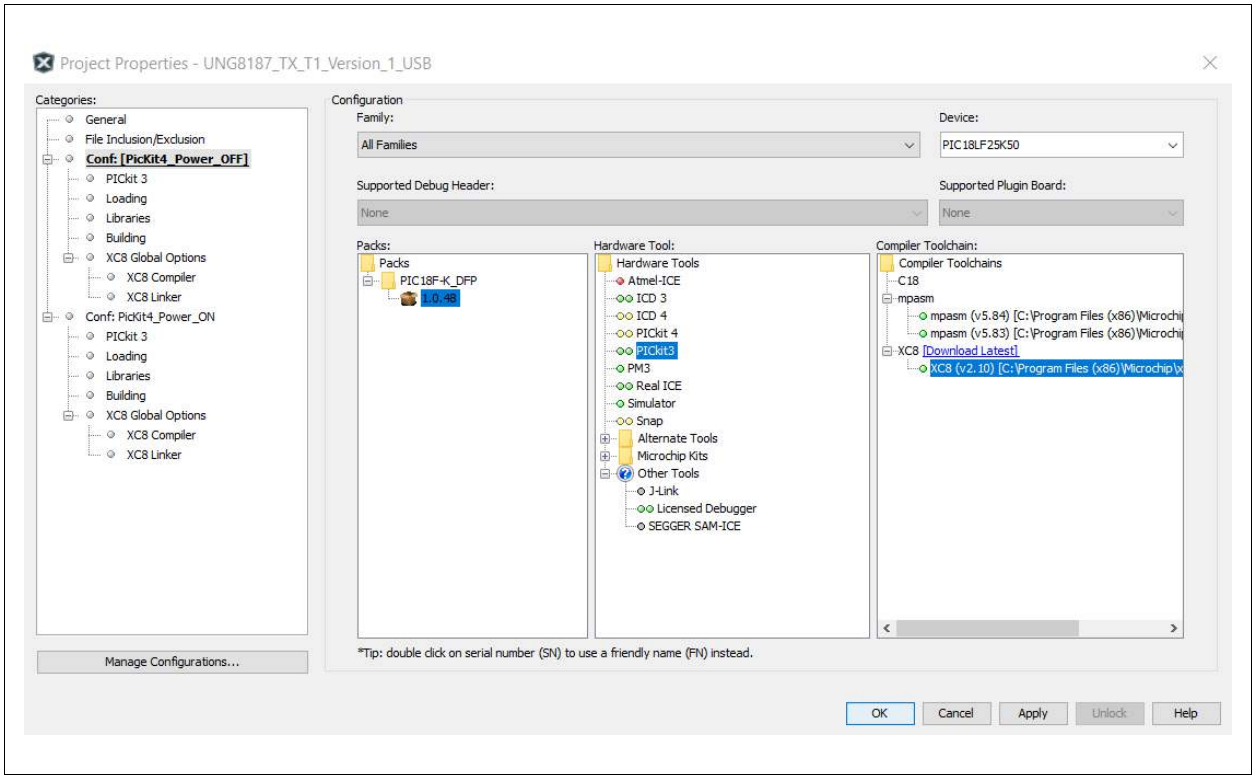
D.4 PROGRAMMING THE PIC® MICROCONTROLLER

1. To program the PIC microcontroller, connect the programmer to J14 on the EVB-LAN8770M_MC, with pin 1 of J14 lining up with pin 1 of the programmer.

   Note: The programmer may have additional lines that are not connected to the J14 pins of the board, which are acceptable.

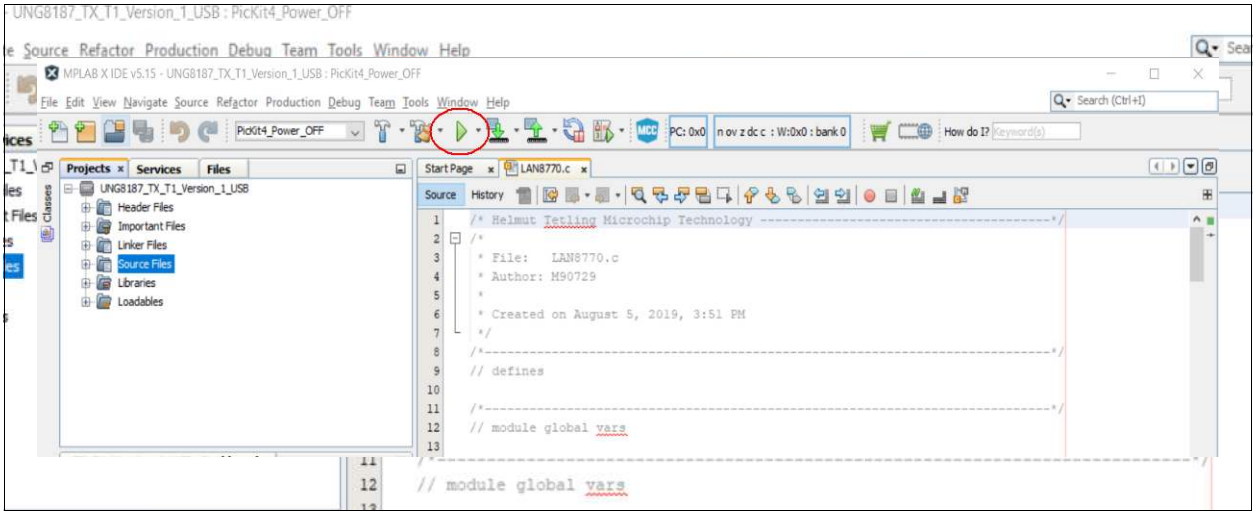
2. Go to *Production>Set Project Configuration>Customize*. The following window (Figure D-4) appears. Choose the Hardware Tool (PICKit3, PICKit4, and so on) and XC8 compiler. Click **Apply** and then click **OK**.

FIGURE D-4: PROJECT CONFIGURATION SCREEN



3. Click the green play button in the toolbar to program the PIC microcontroller (Figure D-5).

FIGURE D-5: PROGRAMMING BUTTON IN TOOLBAR



This programs the PIC microcontroller. The bottom-right window will display the following messages as in Figure D-6 when the PIC programming is successful.

FIGURE D-6: PROGRAMMING CONFIRMATION

4. On the EVB-LAN8770M_MC, press the **Reset** button. This resets the PIC microcontroller, which then initializes the EVB-LAN8770M_MC registers.

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