MCP2515 CAN Bus Monitor Demo Board User's Guide

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Object of Declaration: MCP2515 CAN Bus Monitor Demo Board

EU Declaration of Conformity

Manufacturer: Microchip Technology Inc.
2355 W. Chandler Blvd.
Chandler, Arizona, 85224-6199
USA

This declaration of conformity is issued by the manufacturer.

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

Derek Carlson
VP Development Tools

12-Sep-14
Date

NOTES:

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MCP2515 CAN BUS MONITOR DEMO 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 "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 on-line 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 MCP2515 CAN Bus Monitor Demo Board. Items discussed in this chapter include:

- Document Layout
- Conventions Used in this Guide
- Recommended Reading
- The Microchip Web Site
- Customer Support
- Document Revision History

DOCUMENT LAYOUT

This document describes how to use the MCP2515 CAN Bus Monitor Demo Board as a development tool to emulate and debug firmware on a target board. The manual layout is as follows:

- **Chapter 1. "Product Overview"** – Important information about the MCP2515 CAN Bus Monitor Demo Board.
- **Chapter 2. "Installation and Operation"** – This chapter includes a detailed description of each function of the demo board and instructions for how to begin using the board.
- **Appendix A. "Schematic and Layouts"** – Shows the schematic and layout diagrams for the MCP2515 CAN Bus Monitor Demo Board.
- **Appendix B. "Bill Of Materials (BOM)"** – Lists the parts used to build the MCP2515 CAN Bus Monitor Demo 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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RECOMMENDED READING

This user's guide describes how to use MCP2515 CAN Bus Monitor Demo Board. The following Microchip documents are available and recommended as supplemental reference resources.

MCP2515 Data Sheet – *"Stand-Alone CAN Controller With SPI Interface"*, (DS21801)

This data sheet provides detailed information regarding the MCP2515 product family.

MCP2561 Data Sheet – *"High Speed CAN Transceiver"*, (DS20005167)

This data sheet provides detailed information regarding the MCP2561 product family.

PIC18F2455/2550/4455/4550 Data Sheet – *"28/40/44-Pin, High-Performance, Enhanced Flash, USB Microcontrollers with nanoWatt Technology"* (DS39632)

This data sheet provides detailed information regarding the PIC18F4550 product family.

THE MICROCHIP WEB SITE

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- **Product Support** – Data sheets and errata, application notes and sample programs, design resources, user's guides and hardware support documents, latest software releases and archived software
- **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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- 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

Revision B (October 2014)

The following is the list of modifications:

1. Added MCP2561 Data Sheet – "High Speed CAN Transceiver", (DS20005167) to the **Recommended Reading** section.
2. Modified **Section 2.3 "Getting Started"**.
3. Updated **Appendix A. "Schematic and Layouts"**.
4. Updated **Appendix B. "Bill Of Materials (BOM)"**.
5. Corrected minor typographical errors.

Revision A (August 2008)

- Initial Release of this Document.

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Chapter 1. Product Overview

1.1 INTRODUCTION

This chapter provides an overview of the MCP2515 CAN Bus Monitor Demo Board and covers the following topics:

- What is the MCP2515 CAN Bus Monitor Demo Board?
- What does the MCP2515 CAN Bus Monitor Demo Board Kit include?

1.2 WHAT IS THE MCP2515 CAN BUS MONITOR DEMO BOARD?

The MCP2515 CAN Bus Monitor Demo Board kit contains two identical boards which can be connected together to create a simple two node Controller Area Network (CAN) bus, which can be controlled and/or monitored via the included PC interface. The board(s) can also be connected to an existing CAN bus.

By using the PC interface, the users can configure the MCP2515 registers, send CAN messages and receive CAN messages. CAN traffic can be generated using a button on the board that is not connected to the PC.

There are also several headers (test points) so the MCP2515 pins can be monitored.

1.3 WHAT DOES THE MCP2515 CAN BUS MONITOR DEMO BOARD KIT INCLUDE?

The MCP2515 CAN Bus Monitor Demo Board Kit includes:

- Two MCP2515 CAN Bus Monitor Demo Board boards (102-00108)
- Connector cable to connect the two boards together
- USB A Male to Mini USB B 5 pin Cable
- Information Sheet

NOTES:

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Chapter 2. Installation and Operation

2.1 INTRODUCTION

The MCP2515 CAN Bus Monitor Demo Board demonstrates the MCP2515 Stand-Alone CAN Controller interfacing to a CAN bus. The MCP2515 CAN Bus Monitor Demo Board kit consists of two identical boards which, when connected together, create a small, 2-node CAN bus. This bus can be interfaced to a PC by connecting one of the two boards via the universal serial bus (USB) port and running the custom software.

The two nodes are identical in form, however, the function is determined by the connection to each other and the PC. One node (connected to the PC) will become the monitor and the other one will become the Traffic Generator. The boards are reversible (i.e., they can take either role, depending on the connection scheme).

Additionally, the board(s) can be connected to an existing CAN bus where the software can monitor the traffic and the user can interact with the bus as needed. The software allows some of the MCP2515 registers to be modified, as well as messages to be received and transmitted.

The user can gain an understanding of the capabilities of the MCP2515.

2.2 FEATURES

The MCP2515 CAN Bus Monitor Demo Board has the following features:

- Two identical boards and a CAN cable for creating a small CAN bus
- USB interface and PC software to interface to the CAN bus
- CAN bus PC software, which can be downloaded from http://www.microchip.com
- Button for changing the bus load on the Traffic Generator node
- Headers (test points) for monitoring the MCP2515 pins (CAN, SPI, and status/interrupt pins)
- PIC18F4550 PIC® Microcontroller (MCU) with ICD2 interface/header for in-circuit programming.

2.3 GETTING STARTED

The MCP2515 CAN Bus Monitor Demo Board is a fully functional, assembled, and tested kit used to demonstrate the MCP2515 in a CAN bus environment. The following describes the basic setup and operation. See Figure 2-1 and Figure 2-2 for a simplified functional diagram and block diagram.

1. Connect the two boards together using the cable.
2. Connect the USB cable to PC.
3. The TX LED (D2) on both boards will blink for about two seconds to indicate the Power-on Reset de-bounce routine executed by the microcontroller. D9 LED will remain ON to indicate the monitoring board is ready.
4. Start the bus monitor software. Both boards will be configured to 125 kbps CAN rate by default. Select *Device > Connect* to connect the board to the GUI.
5. Traffic can now be generated by pressing the **LOAD** button on the traffic generator board.

FIGURE 2-1: BLOCK DIAGRAM

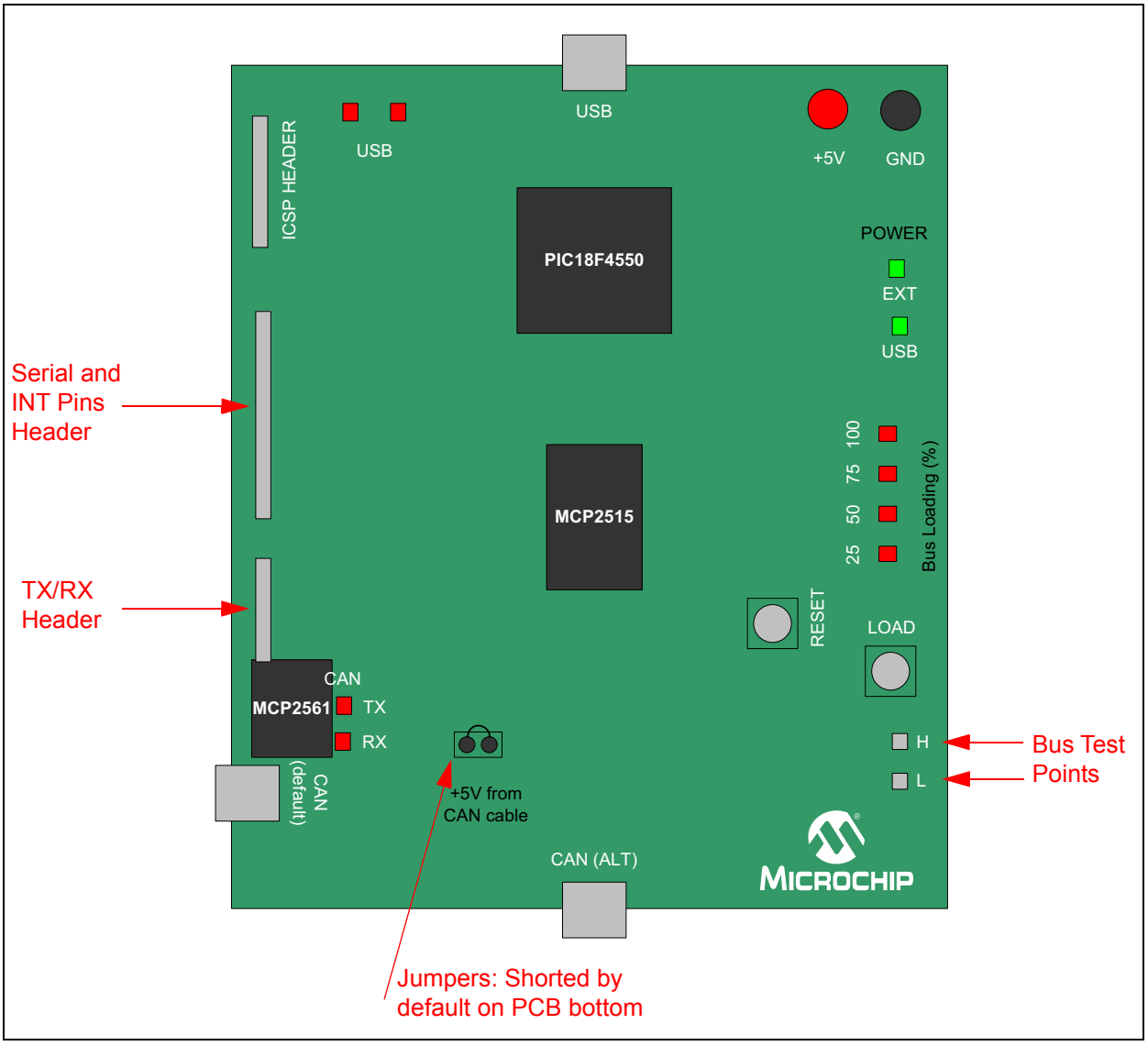

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FIGURE 2-2: FUNCTIONAL DIAGRAM

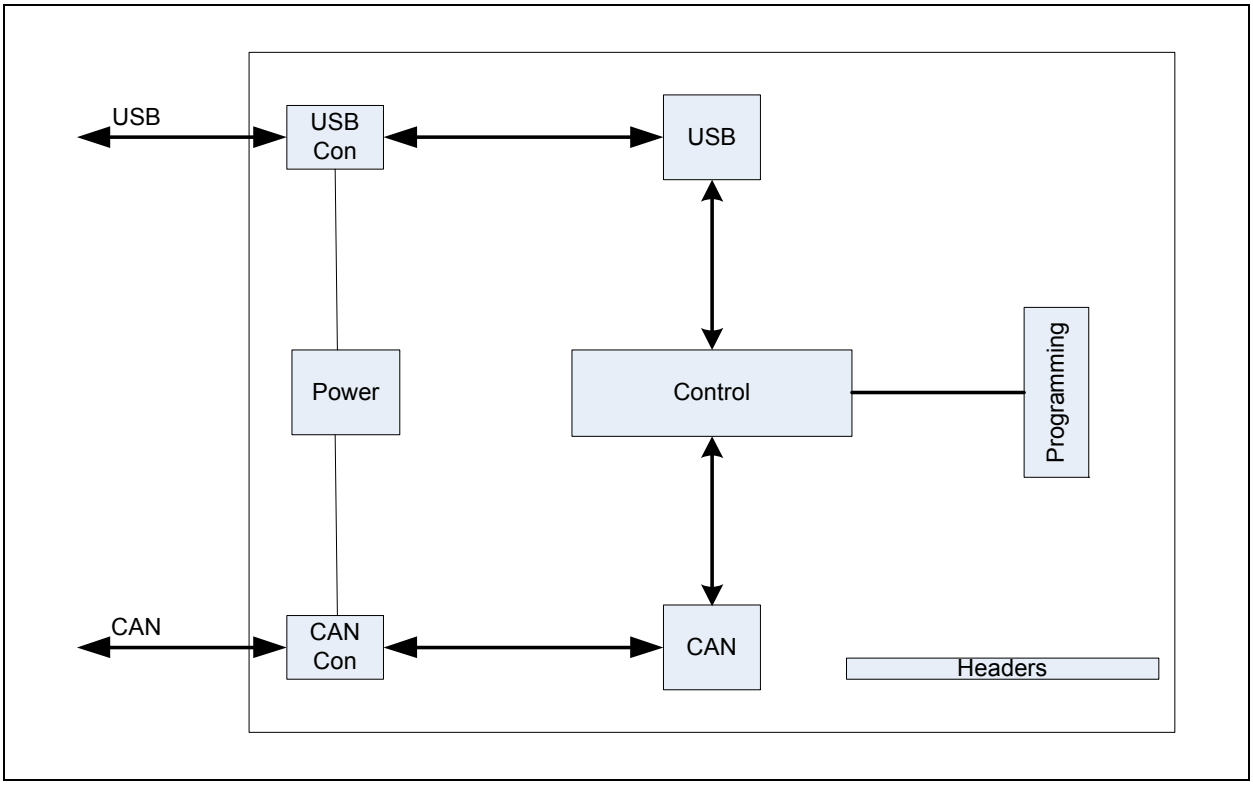
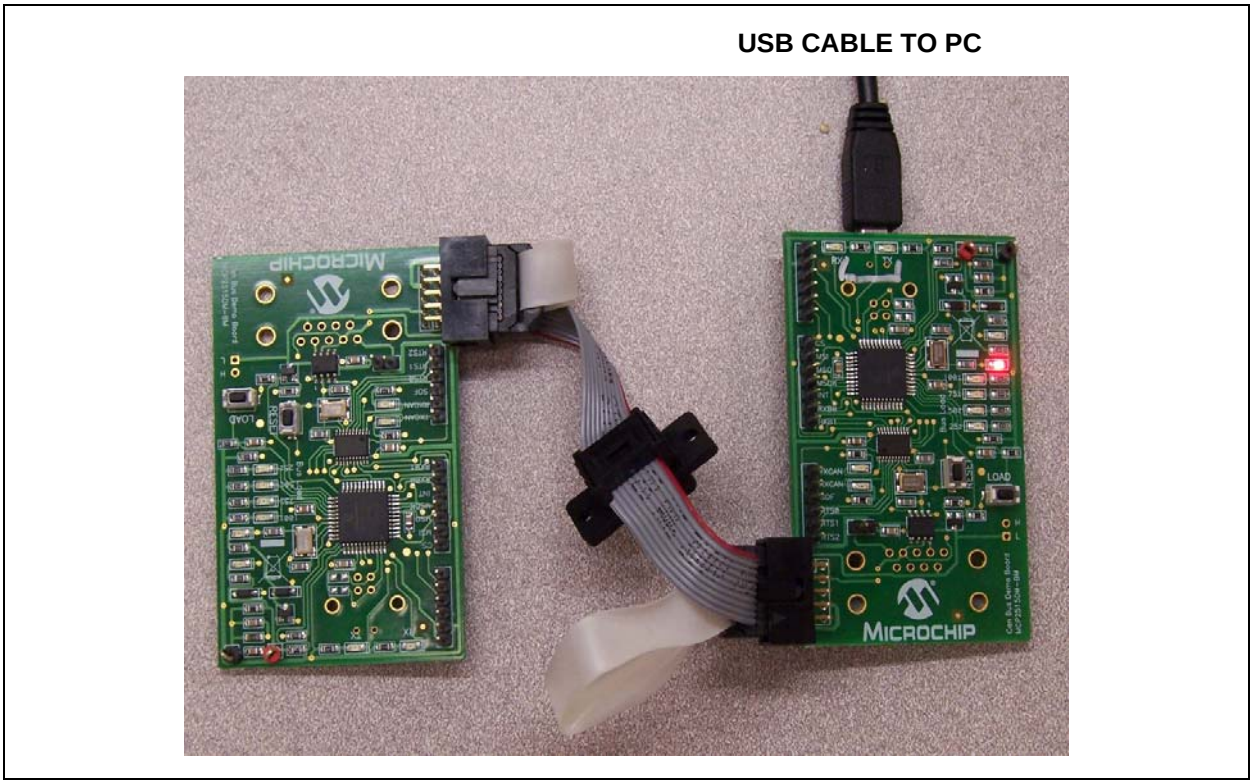


FIGURE 2-3: BOARD SET-UP CONFIGURATION



2.4 FUNCTIONAL OPERATION

The MCP2515 CAN Bus Monitor Demo Board is basically a USB-to-CAN board which provides visual feedback of Controller Area Network operation. The two boards included in the kit can be used together to create a 2-node CAN bus.

The function of the board is determined by how it is powered.

2.4.1 Bus Monitor (Sniffer) Configuration

The board is designated as a Bus Monitor when the board detects a connection to the USB power (and enumerates to USB).

By default, this node is configured for 125 kbps and the receive buffers are wide open (i.e., will receive all messages on the bus). The PC software communicates with this node.

2.4.2 Traffic Generator Configuration

The board is designated as a Traffic Generator when it is powered by a source other than USB (in this case, the other board is being powered by the CAN cable). In this configuration, the node responds to pressing the **Traffic Generator** button. Each depression of the button increments the bus load to the next step until it rolls around to zero again, at which time, the load will increment again for every depression.

Note: The silkscreen on the board indicates that the bus loading ranges from 25% to 100% when pressing the **LOAD** button. While the node can handle these loads, the display in the Output window becomes meaningless at loads above 5% - 8%. Therefore, the bus loading is reduced for demonstration purposes. The firmware can be modified to increase the traffic as needed.

2.4.3 Headers/Test Points

Two of the headers are connected to the MCP2515 pins so the pins can be monitored. The SPI and CAN serial interfaces, interrupt pin(s), and SOF pin are routed to headers/test points.

The ICSP™ signals from the PIC18F4550 are routed to a header.

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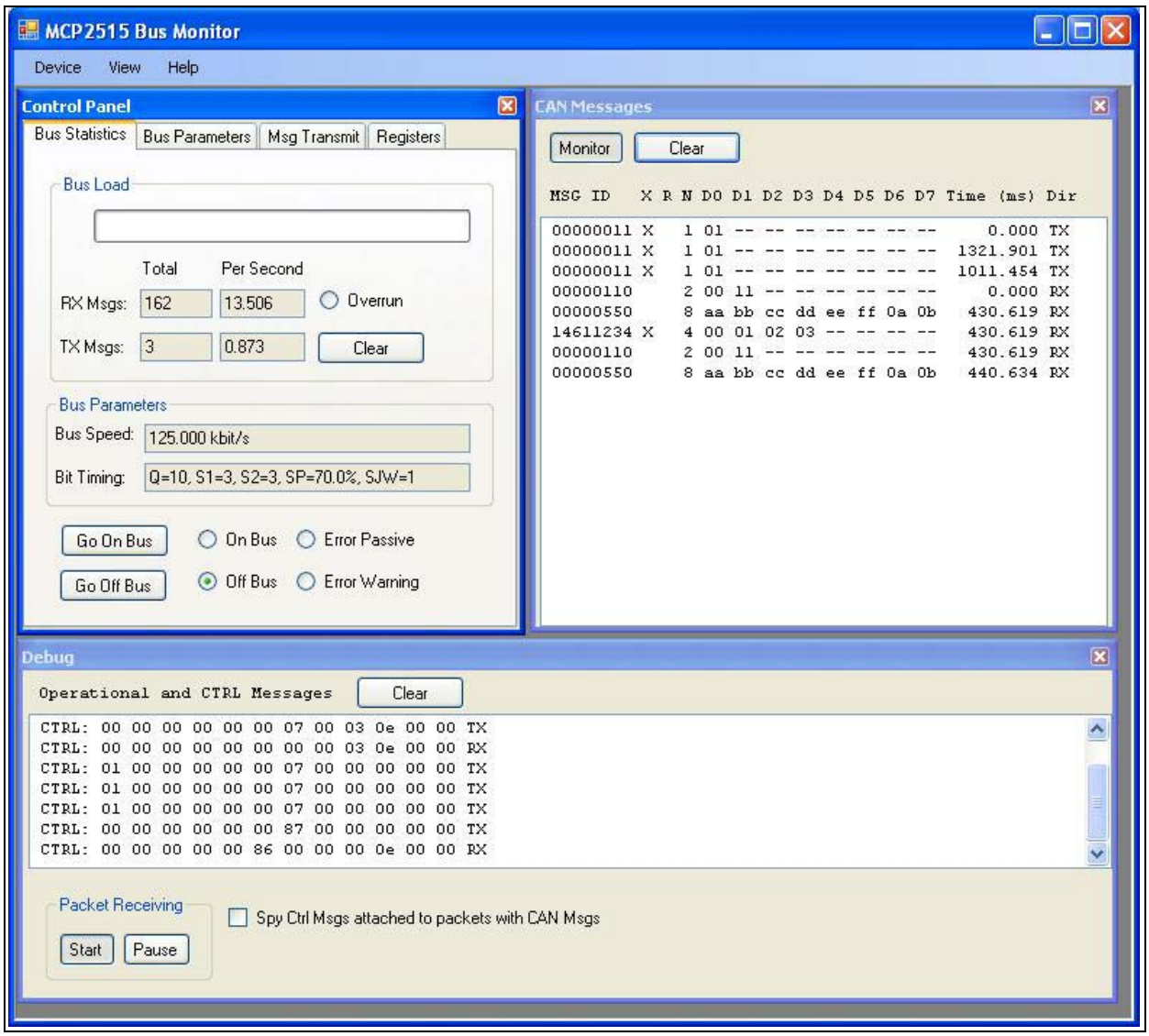
2.5 SOFTWARE OPERATION

Once the MCP2515DM-BM PC Software Rev 2.0 is downloaded and installed on the PC, open the MCP2515 Bus Monitor Graphical User Interface (GUI). To enable the communication between the boards and the GUI, click on Device menu and select Connect.

The GUI consists of thee main panels: Control Panel, CAN Messages, and Debug. The Control Panel window includes four tabs: Bus Statistics, Bus Parameters, Msg Transmit and Registers, as shown in Figure 2-4.

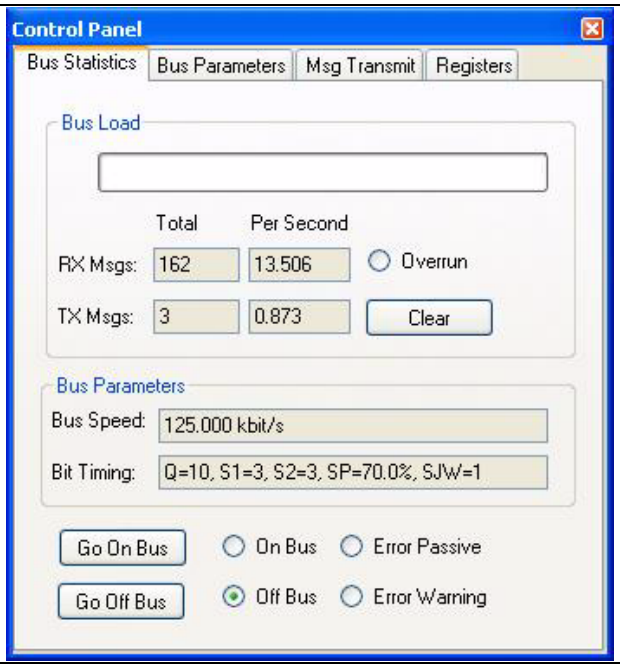
FIGURE 2-4: MCP CAN BUS MONITOR



2.5.1 Bus Statistics Tab

This tab shows the status of the bus, including on/off the bus, bus loading, number of transmitted and received messages, and bit timing settings status (see Figure 2-5).

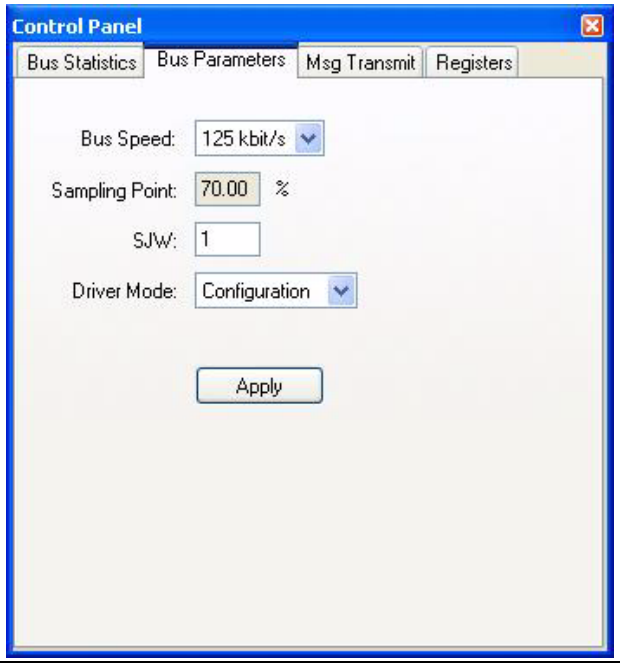
FIGURE 2-5: BUS STATISTICS TAB



2.5.2 Bus Parameters Tab

This tab is used to set basic bit timing. The bus speeds are limited to the values in the pull-down box. To set custom bit timing, refer to the MCP2515 Configuration Window (see Figure 2-6).

FIGURE 2-6: BUS PARAMETERS TAB



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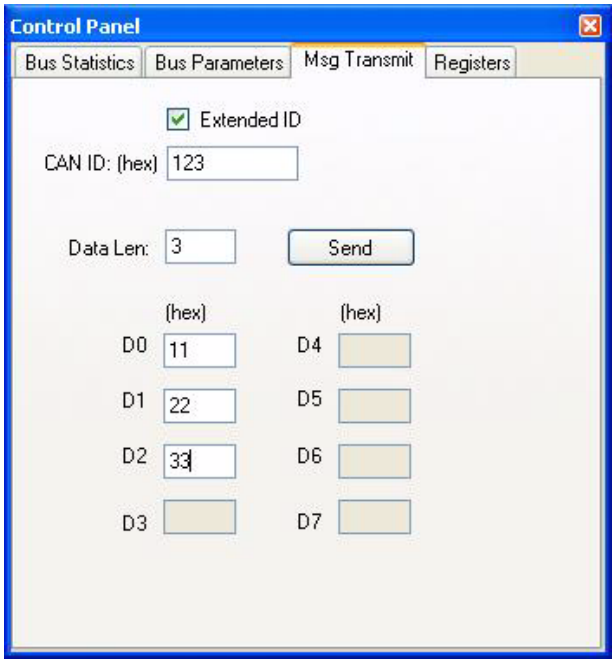
2.5.3 Transmit Tab:

This screen is used to configure and transmit CAN messages (see Figure 2-7).

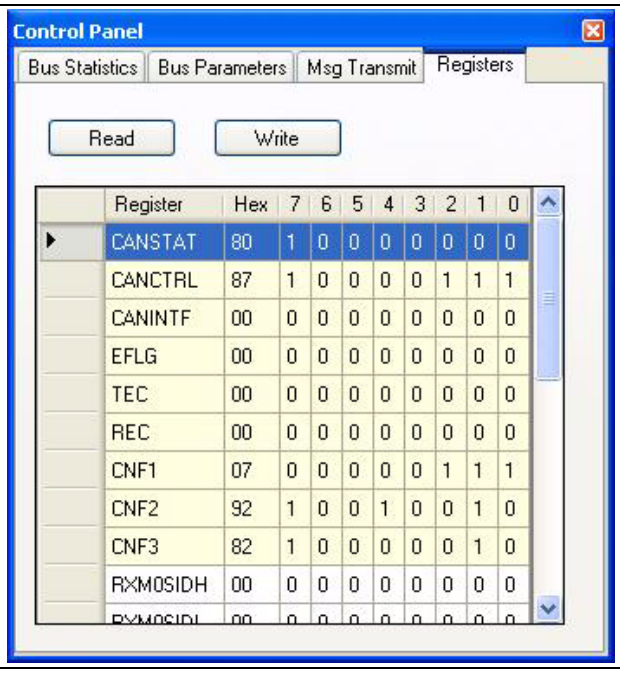
FIGURE 2-7: TRANSMIT TAB



2.5.4 MCP2515 Configuration Tab

This tab allows access to the MCP2515 registers. SPI commands can be issued (see Figure 2-8).

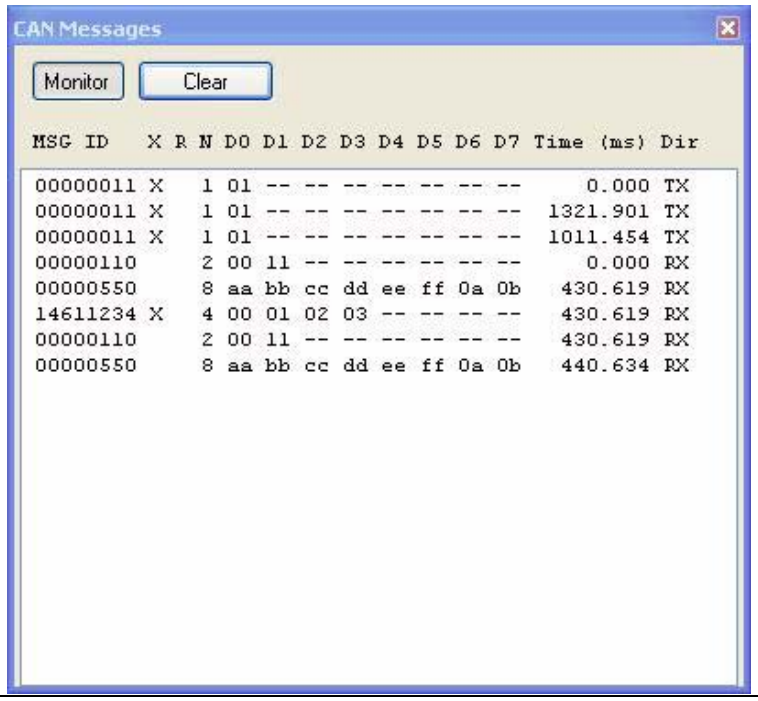
FIGURE 2-8: CONFIGURATION TAB



2.5.5 CAN Messages Output Panel:

This panel displays the messages transmitted and received by the MCP2515. The right mouse button can be used to display the time in free running or delta (see Figure 2-9).

FIGURE 2-9: OUTPUT WINDOW



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Appendix A. Schematic and Layouts

A.1 INTRODUCTION

This appendix contains the following schematics and layouts for the MCP2515 CAN Bus Monitor Demo Board:

- Board – Schematic Page 1
- Board – Schematic Page 2
- Board – Top Copper and Silk
- Board – Top Copper
- Board – Top Silk
- Board – Bottom Copper
- Board – Bottom Silk

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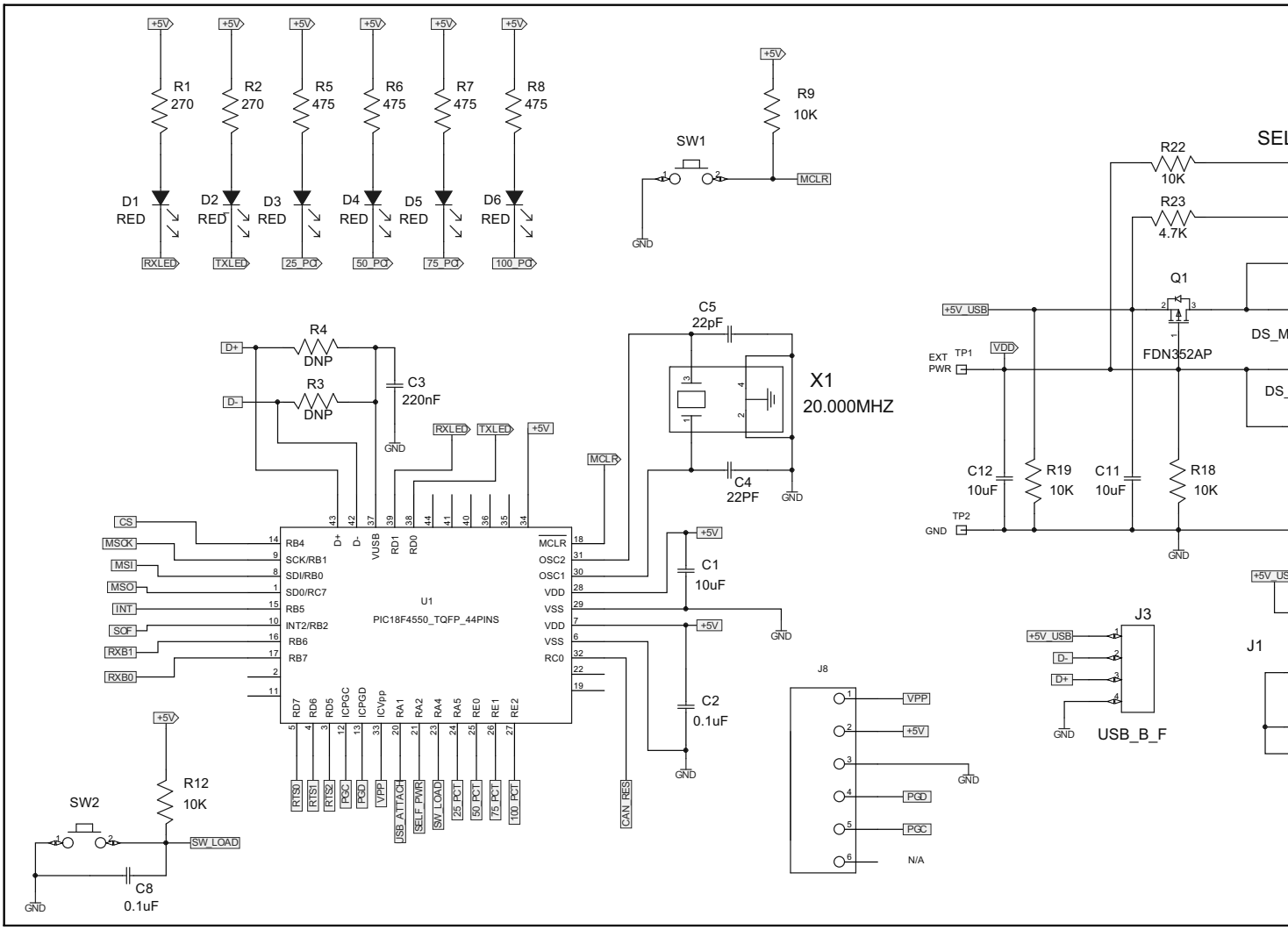
A.2 BOARD – SCHEMATIC PAGE 1



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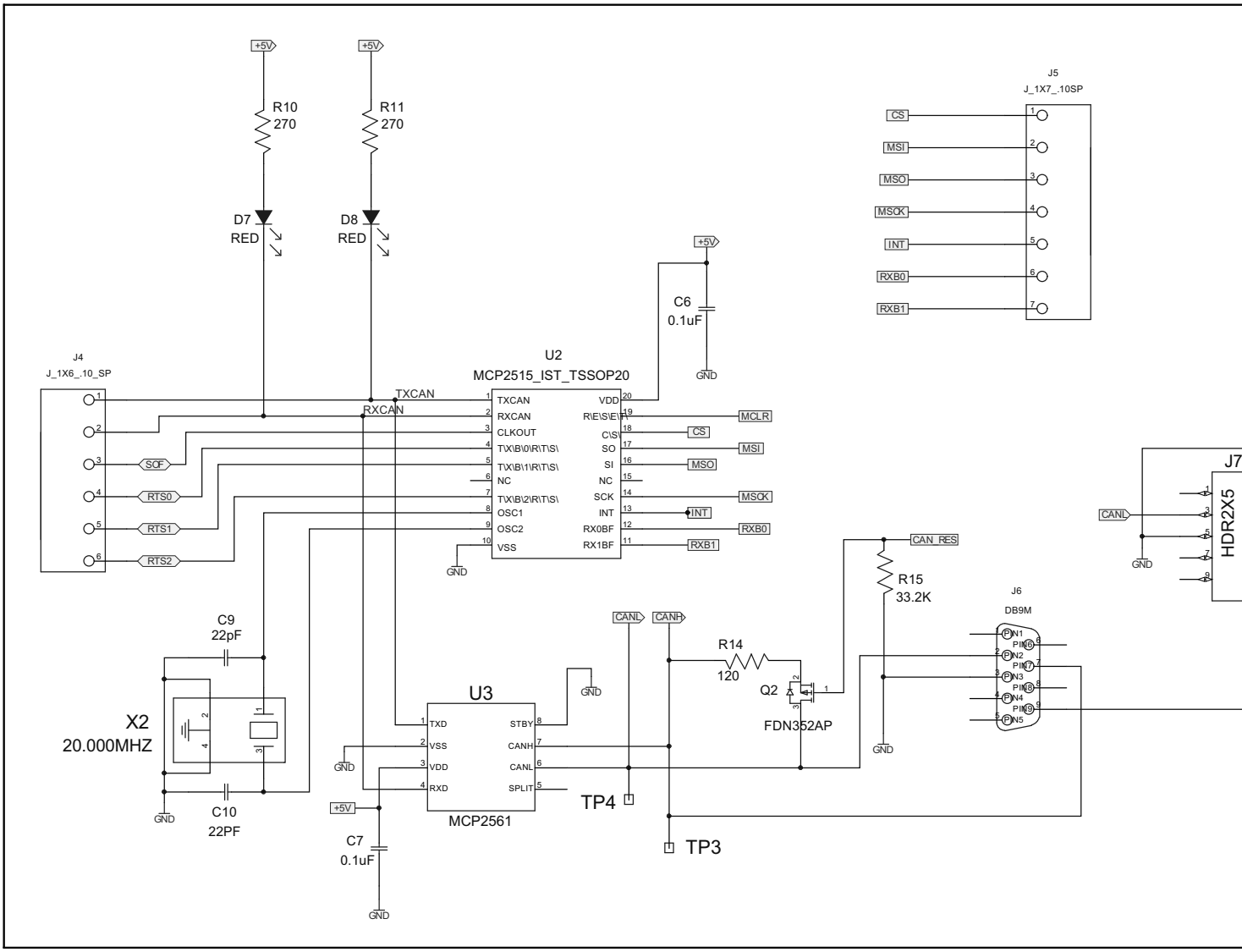
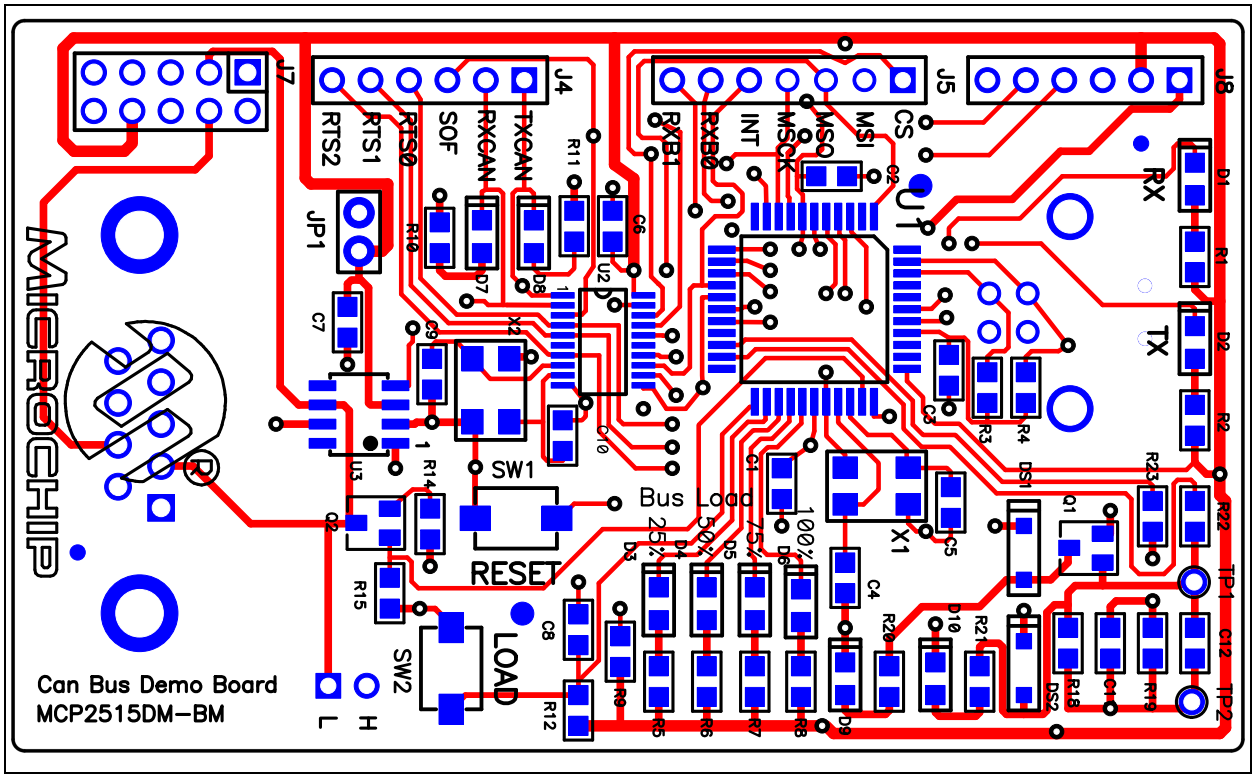
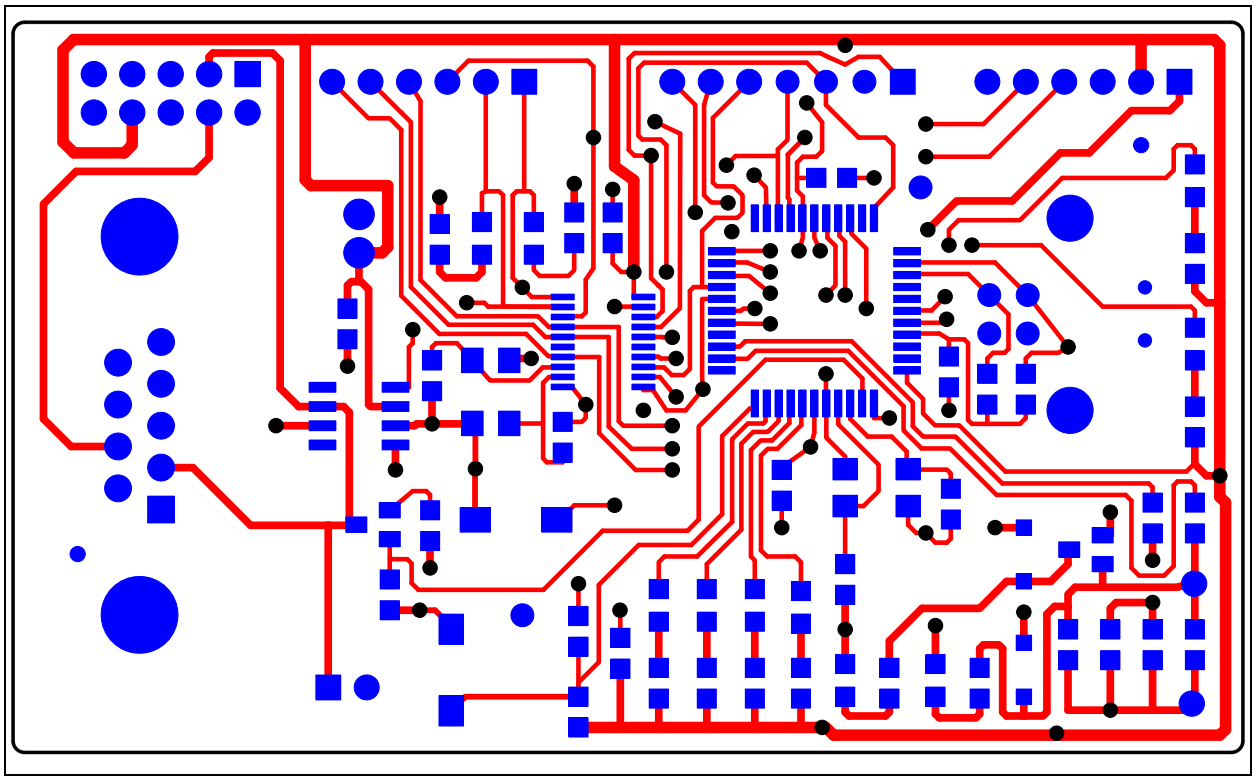
A.3 BOARD – SCHEMATIC PAGE 2



A.4 BOARD – TOP COPPER AND SILK



A.5 BOARD – TOP COPPER



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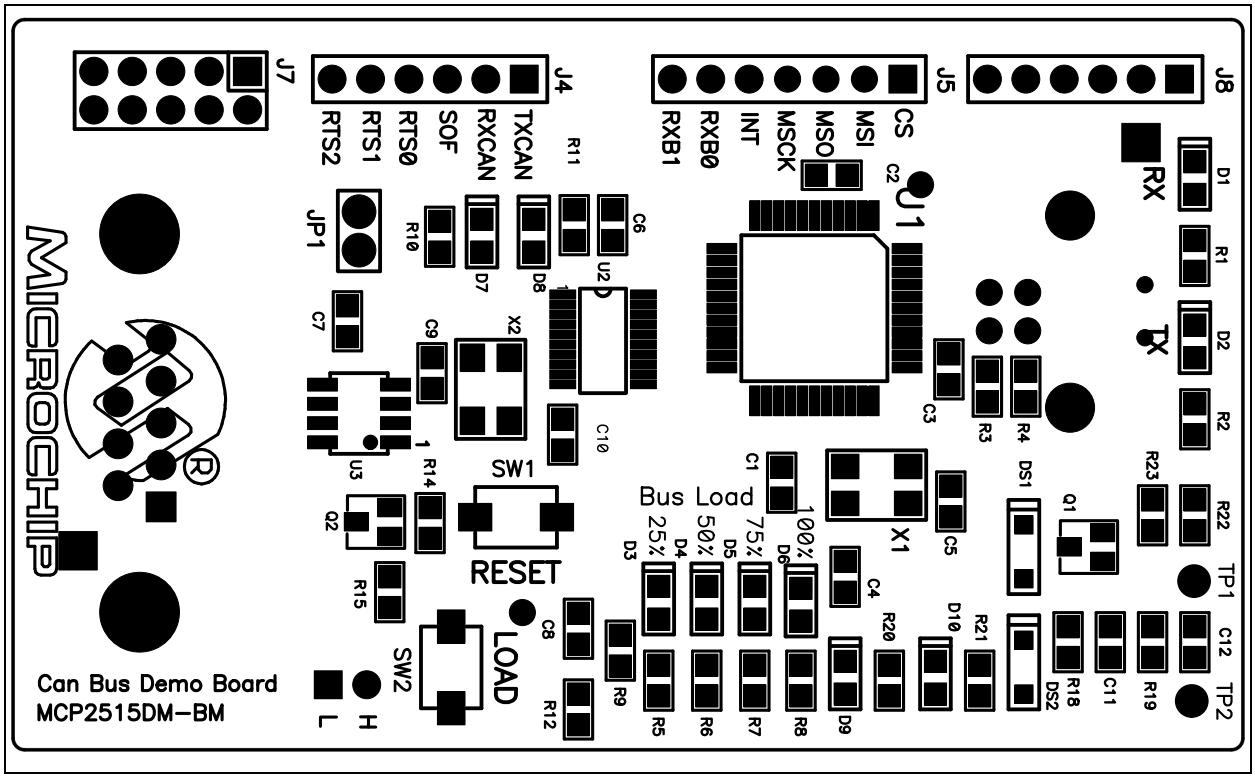
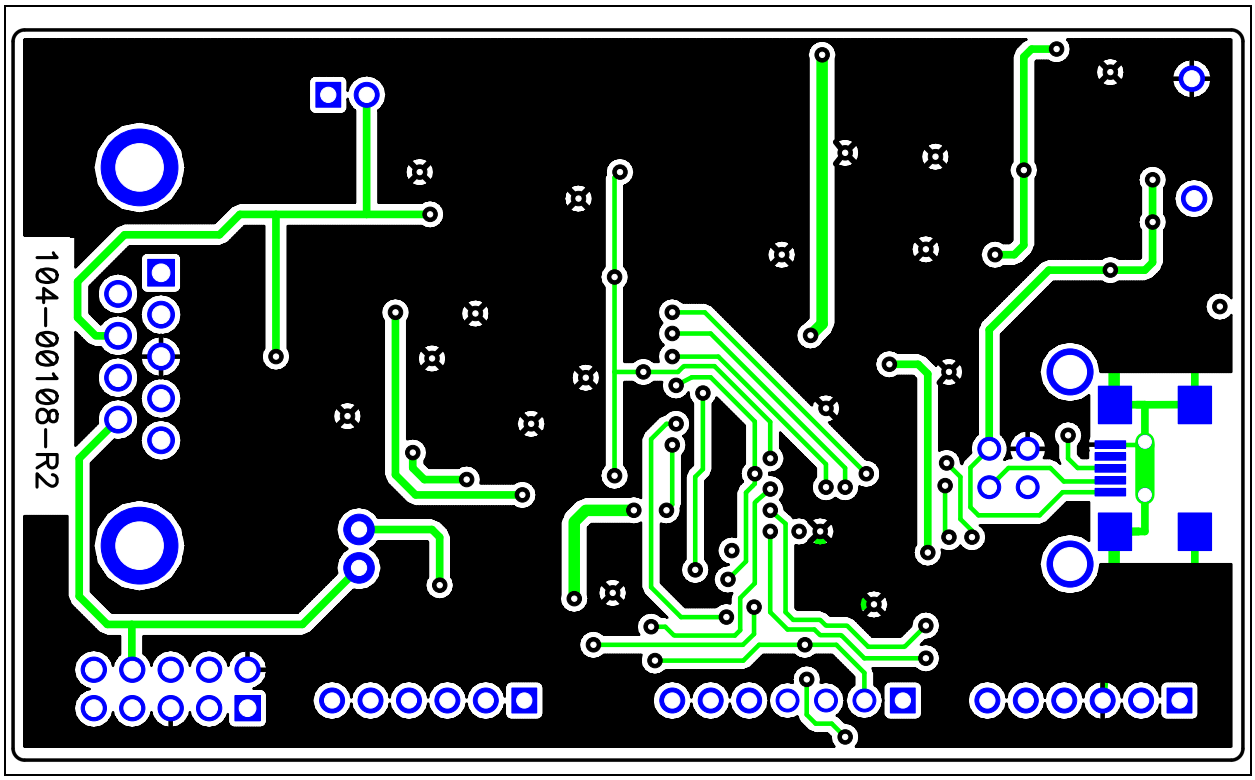
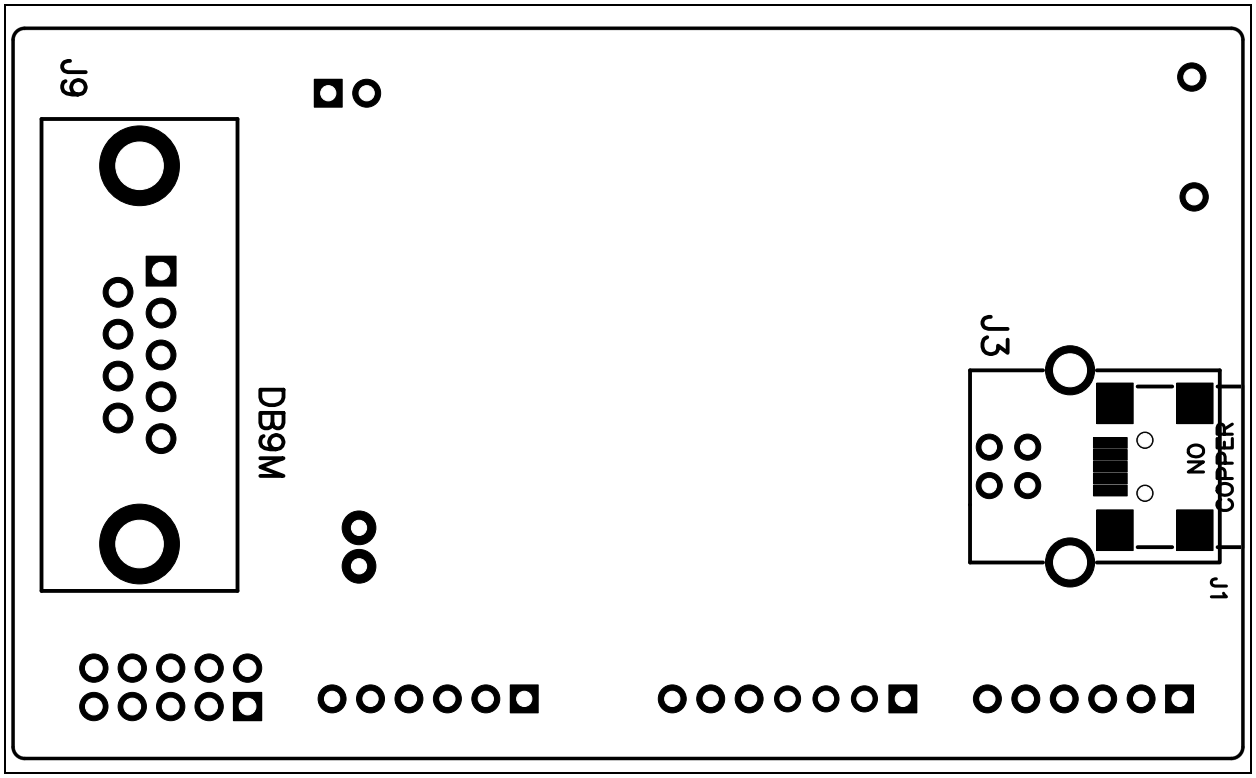
A.6 BOARD – TOP SILK



A.7 BOARD – BOTTOM COPPER



A.8 BOARD – BOTTOM SILK



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Appendix B. Bill Of Materials (BOM)

TABLE B-1: BILL OF MATERIALS (BOM)

Qty	Reference	Description	Manufacturer	Part Number
3	C1, C11, C12	CAP 10 µF 16V CERAMIC X7R 0805	Taiyo Yuden Co., Ltd.	EMK212BB7106MGT
4	C2, C6, C7, C8	CAP 10 µF 50V CERAMIC X7R 0805	KEMET®	C0805C104K5RACTU
1	C3	CAP .22 µF 16V CERAMIC X7R 0805	Panasonic® – ECG	ECJ-2VB1C224K
4	C4, C5, C9, C10	CAP CERAMIC 22 pF 50V NP0 0805	Yageo®	CC0805JRNP09BN220
10	D1<->D10	LED THIN 635 NM RED DIFF 0805 SMD	Lumex® Inc.	SML-LXT0805IW-TR
2	DS1, DS2	DIODE SCHOTTKY 20V 0.5A SOD123	ON Semiconductor®	MBR0520LT1G
1	J1	CONN RECEPT MINI USB 2.0 5POS (mini USB)	Hirose Electronic Co., Ltd.	UX60-MB-5ST
0	J2	**DO NOT POPULATE**	—	—
0	J3	**DO NOT POPULATE**	—	—
2	J4, J8	CONN HEADER VERT 6 POS .100 TIN	TE Connectivity, Ltd.	3-644695-6
1	J5	CONN HEADER VERT 7 POS .100 TIN	TE Connectivity, Ltd.	3-644695-7
0	J6	**DO NOT POPULATE**	—	—
1	J7	CONN HEADER LOPRO R/A 10POS 15AU	TE Connectivity, Ltd.	103310-1
1	JP1	CONN HEADER VERT 2 POS .100 TIN	TE Connectivity, Ltd.	3-644695-2
1	PCB	RoHS Compliant Bare PCB, CAN Bus Monitor Demonstration Board	Microchip Technology Inc.	104-000108
2	Q1, Q2	(NDS352P) MPSFET P-CH - 20V .5Ω SSOT3	Fairchild Semiconductor®	NDS352P
4	R1, R2, R10, R11	RES 270Ω 1/8W 5% 0805 SMD	Panasonic – ECG	ERJ-6GEYJ271V
0	R3, R4	**DO NOT POPULATE**	—	—
6	R5, R6, R7, R8, R20, R21	RES 470Ω 1/8W 5% 0805 SMD	Panasonic – ECG	ERJ-6GEYJ471V
3	R9, R12, R22	RES 10 kΩ 1/8W 5% 0805 SMD	Panasonic – ECG	ERJ-6GEYJ103V
1	R14	RES 120 Ω 1/8W 5% 0805 SMD	Panasonic – ECG	ERJ-6GEYJ121V
1	R15	RES 33.2 kΩ 1/8W 1% 0805 SMD	Panasonic – ECG	ERJ-6ENF3322V
2	R18, R19	RES 10 kΩ 1/8W 1% 0805 SMD	Panasonic – ECG	ERJ-6ENF1002V
1	R23	RES 4.7 kΩ 1/8W 5% 0805 SMD	Panasonic – ECG	ERJ-6GEYJ472V
2	SW1, SW2	SWITCH LT TOUCH 6X3.5 100GF SMD	Panasonic – ECG	EVQ-PJS04K

Note: The components listed in this Bill of Materials are representative of the PCB assembly. The released BOM used in manufacturing uses all RoHS-compliant components.

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

Qty	Reference	Description	Manufacturer	Part Number
2	V_{DD} and GND	PC TEST POINT COMPACT SMT	Keystone Electronics Corp.	5016
1	U1	PIC18F4550 High-Performance, Enhanced Flash, USB Microcontroller with nanoWatt Technology	Microchip Technology Inc.	**PIC18F4550-I/PT**
1	U2	Stand-alone Controller Area Network (CAN) Controller	Microchip Technology Inc.	**MCP2515-I/ST**
1	U3	High-Speed CAN Transceiver	Microchip Technology Inc.	**MCP2561-I/SN**
2	X1, X2	CRYSTAL 20.000 MHz 18 pF FUND SMD	Abracon® Corporation	ABM3B-20.000MHZ-B2-T
1	Mini USB Cable	**Note**: This item is packaged with Kit USB A Male to Mini USB B 5 pin Cable – 3 ft. http://ktusasys.stores.yahoo.net/usb-matomib5p1.html	—	KT143-3

Note: The components listed in this Bill of Materials are representative of the PCB assembly. The released BOM used in manufacturing uses all RoHS-compliant components.

TABLE B-2: PARTS FOR RIBBON CABLE ASSEMBLY

Qty	Reference	Description	Manufacturer	Part Number
1	Cable	CABLE 10 COND 100 FT FLAT, GREY	3M/ESD	3365/10(300SF)
2	P2,P3	CONN IDC SKT 10 POS W/POL 15 GOLD	TE Connectivity, Ltd.	1658621-1
2	P2,P3	PULL TAB LOOP 10 POS SOCKET CONN (P2 P3)	TE Connectivity, Ltd.	88450-2
2	P2,P3	STRAIN RELIEF 10 POS SOCKET CONN	TE Connectivity, Ltd.	499252-5
1	DB9 Conn	CONN DB9 FEMALE PLASTIC SHELL	Assmann Electronics Inc.	A-DFF09LPIII/FP-R

Note: The components listed in this Bill of Materials are representative of the PCB assembly. The released BOM used in manufacturing uses all RoHS-compliant components.

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