LX7219/20 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 website (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 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 LX7219/20 Evaluation Board. Items discussed in this chapter include:

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

DOCUMENT LAYOUT

This document describes how to use the LX7219/20 Evaluation Board as a development tool. The manual layout is as follows:

- **Chapter 1. "Product Overview"** – Important information about the LX7219/20 Evaluation Board.
- **Chapter 2. "Installation and Operation"** – Includes instructions on how to get started with the LX7219/20 Evaluation Board and a description of each function.
- **Chapter 3. "GUI Installation and Operation"** – Includes instructions on how to install the Graphical User Interface (GUI).
- **Chapter 4. "GUI Description"** – Describes the items in the GUI.
- **Appendix A. "Schematic and Layouts"** – Shows the schematic and PCB layout for the LX7219/20 Evaluation Board.
- **Appendix B. "Bill of Materials"** – Lists the parts used to build the LX7219/20 Evaluation Board.
- **Appendix C. "LX7219-01 Control Register Bit Definition"** – Describes the internal registers.

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) { ... }`

RECOMMENDED READING

This user's guide describes how to use the LX7219/20 Evaluation Board. Other useful documents include the following Microchip documents listed below, which are available and recommended as supplemental reference resources:

- **LX7219 Data Sheet – *"6A Hysteretic Synchronous Buck Regulator with I^2C Production"***
- **LX7220 Data Sheet – *"2.7V to 5.5V, 6A Constant Frequency Hysteretic Synchronous Buck Regulator with I^2C" (DS2006704A)***

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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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- 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 website at:
https://www.microchip.com/support

DOCUMENT REVISION HISTORY

Revision A (May 2024)

- Initial release of this document.

NOTES:

Chapter 1. Product Overview

1.1 INTRODUCTION

This chapter provides an overview of the LX7219/20 Evaluation Board and covers the following topics:

- LX7219/20 Short Overview
- What is the LX7219/20 Evaluation Board?
- Contents of the LX7219/20 Evaluation Board Kit

1.2 LX7219/20 SHORT OVERVIEW

The LX7219/20 are 6A step-down regulators with integrated MOSFETs, packaged in a space-saving 14-lead, 2 mm x 3 mm VQFN, for today's mobile devices. They use an ultra-fast, constant frequency hysteretic control method to minimize external filter components while maintaining excellent regulation. The LX7219/20 reference voltage is programmable from 0.6V to 1.195V through a high-speed (up to 3.4 MHz), bidirectional I^2C bus.

The LX7219/20 operate from 2.7V to 5.5V and outputs 0.6V to 3.3V.

Cycle-by-cycle current limiting protects against overcurrent conditions. Hiccup mode provides protection against heavy overload or short-circuit faults. Thermal protection shuts down the regulator under overtemperature conditions. Overvoltage conditions will immediately shut off the output to protect against permanent damage. The LX7219/20 automatically restart when all faults disappear.

This LX7219/20 Evaluation Board is compatible with LX7219-01, LX7219-02 and LX7220. The evaluation board is the same for all devices, but there are small differences between their operation. The default output voltage is 0.8V for LX7219-01, 0.9V for LX7219-02 and 0.95V for LX7220.

The purpose of this evaluation board is to demonstrate the features of the LX7219/20 devices.

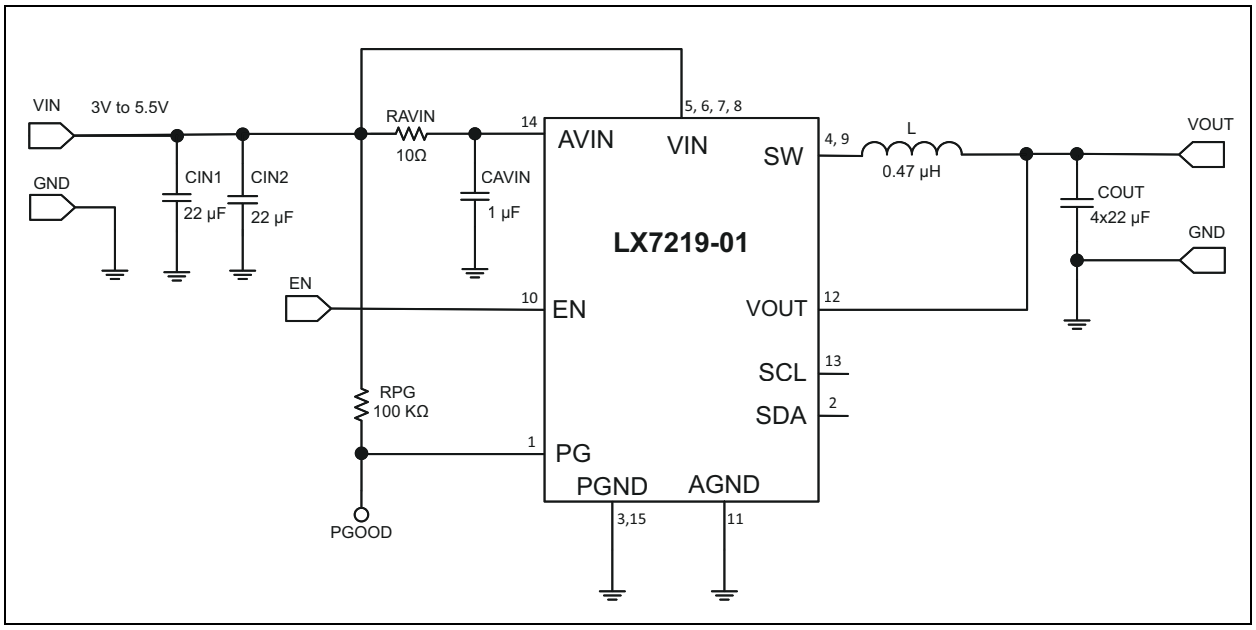


FIGURE 1-1: *Typical LX7219-01 Buck Converter Application @ 0.8V Output.*

1.3 WHAT IS THE LX7219/20 EVALUATION BOARD?

The LX7219/20 Evaluation Board is used to evaluate Microchip's Technology LX7219/20 devices. The input voltage range for a typical output voltage of 0.8V for the LX7219-01 is 3-5.5V. The load current can go up to 6A.

1.4 CONTENTS OF THE LX7219/20 EVALUATION BOARD KIT

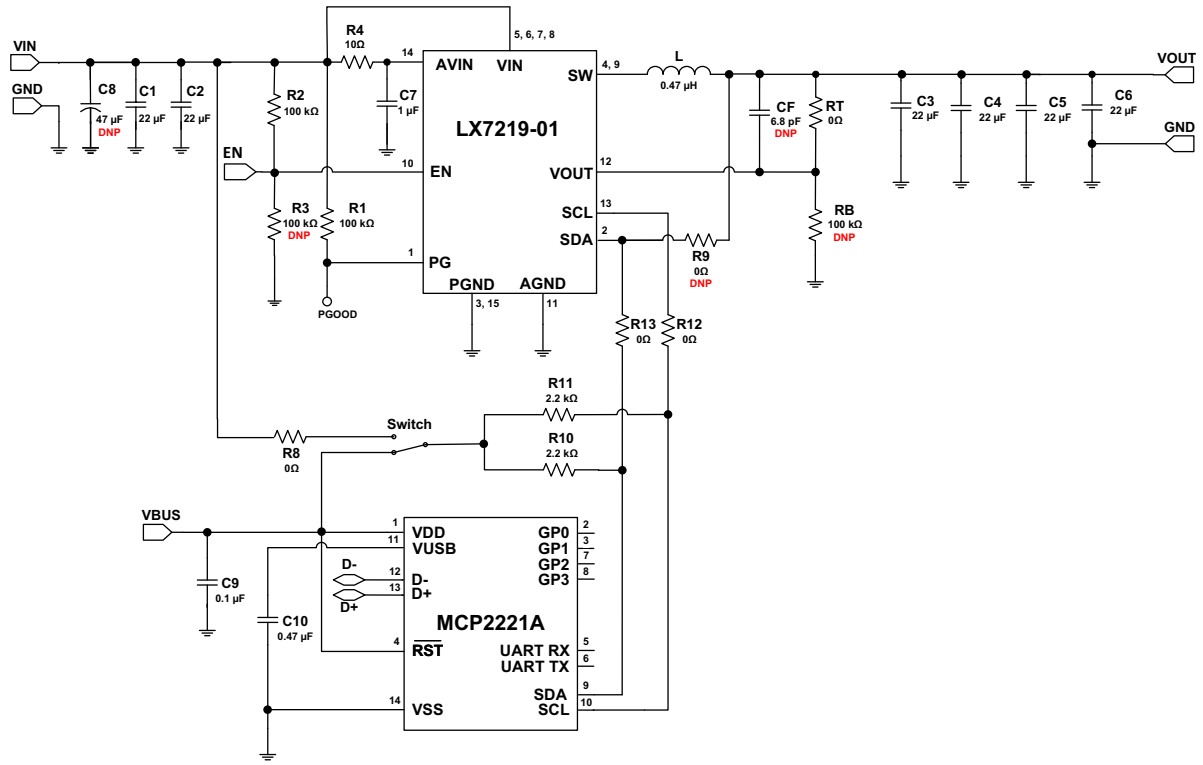
The LX7219/20 Evaluation Board kit includes:

- LX7219/20 Evaluation Board (EV97L85A)
- Important Information Sheet

Chapter 2. Installation and Operation

2.1 INTRODUCTION

The LX7219/20 Evaluation Board is offered with the LX7219-01 installed. The LX7219-01 operates using a 2.7V to 5.5V input rail, outputs 0.6V to 3.3V and can deliver an output current of up to 6A. Using the I^2C interface, V_{OUT} can be adjusted between 0.6V and 1.195V. The reference voltage is programmed via the I^2C bus, using the VSEL register value. In case a higher output voltage is needed, it must be programmed through an external resistive divider; the regulated voltage (V_{OUT}) should be lower than the input voltage (V_{IN}).



Note: The "DNP" marked components are optional and can be used for different configurations. Check the LX7219/20 Data Sheet for more information.

FIGURE 2-1: *Typical LX7219-01 Step-Down Converter Application: @ 0.8V Output and MCP2221A for I^2C Communication.*

2.2 FEATURES

The LX7219/20 Evaluation Board has the following features:

- Input Voltage Range (V_{IN}): 2.7V - 5.5V
- Output Voltage: 0.6V to 3.3V
- Output Current: typically, 6A @ 0.8V Output, 5V Input
- Power Save Mode (PSM) can be selected to improve light load efficiency
- PWM Switching Frequency: 1.2 MHz
- Hysteretic Control offers optimized transient response
- Input Undervoltage and Overvoltage Protection
- Enable and Power Good Functions
- I^2C Serial Interface at 3.4 Mbps
- Internal Soft Start
- Cycle-by-Cycle Overcurrent Protection
- Hiccup mode protects against short circuit Faults
- Seven Bit Adjustable Reference Voltage via I^2C Bus
- Available in a 14L VQFN Package, 2 mm x 3 mm
- Overtemperature Protection (if the die temperature exceeds 150°C, with 20°C hysteresis)
- RoHS Compliant

2.3 GETTING STARTED

The LX7219/20 Evaluation Board is fully assembled and tested to evaluate and demonstrate the features of the LX7219 and LX7220 devices and comes with the LX7219-01 installed. This board requires the use of an external laboratory power supply and load. For I^2C operation, the I^2C Monitor GUI can be used (for more details, see **Chapter 3. "GUI Installation and Operation"** and **Chapter 4. "GUI Description"**). The differences among the various devices are described in the LX7219 and LX7220 Data Sheets.

This document describes the setup and operation of the board when the LX7219-01 is installed. The default output voltage is 0.8V. The LX7219-02, with a default output voltage of 0.9V, and LX7220, with a default output voltage of 0.95V, can also be installed. All device options may be fitted on the board as is.

2.3.1 Power Input and Output Connection

2.3.1.1 POWERING THE LX7219/20 EVALUATION BOARD

The LX7219/20 Evaluation Board provides a typical circuit application for a 0.8V output, used to evaluate the LX7219-01 product.

The switch peak current limit will provide a safe maximum current value. The maximum output current for the converter will vary with input and output voltage. Refer to the LX7219 Data Sheet for more information on the maximum output current.

2.3.1.2 BOARD POWER-UP PROCEDURE

For the power-up procedure, follow the steps below:

1. Connect the power supply to the input terminals of the evaluation board. The input voltage should be higher than V_{OUT}, but it should not exceed the Absolute Maximum Ratings specified in the data sheet.
   Connect the load to VOUT and GND terminals; maximum load varies with input and output voltage (see the LX7219 and LX7220 Data Sheets for more information on the maximum load). Connect the (+) side of the load to VOUT terminal

and the (-) side of the load to GND terminal of the board, see Figure 2-2.

2. Connect the board to a PC, using a USB to Micro-USB Cable.
3. To modify the mode of operation, to enable/disable the Input Overvoltage Protection and other features of the part, use the I²C Monitor GUI (for more details, see **Chapter 3. "GUI Installation and Operation"** and **Chapter 4. "GUI Description"**). By default, the EN pin is pulled high through a resistor. In addition to the EN pin, the regulator can be enabled and disabled through the I²C bus by programming the control register. While disabled, the regulator and most of the support circuitry is turned off. However, the I²C bus circuitry is still active and may be programmed.
4. After the power supply is turned on, a voltmeter can be used to monitor V_{OUT}. The measured output voltage should be 0.8V, 0.9V or 0.95V, depending on the installed device. Adjusting the input voltage and load should not cause the output to vary more than a few mV over the operating range of the converter.

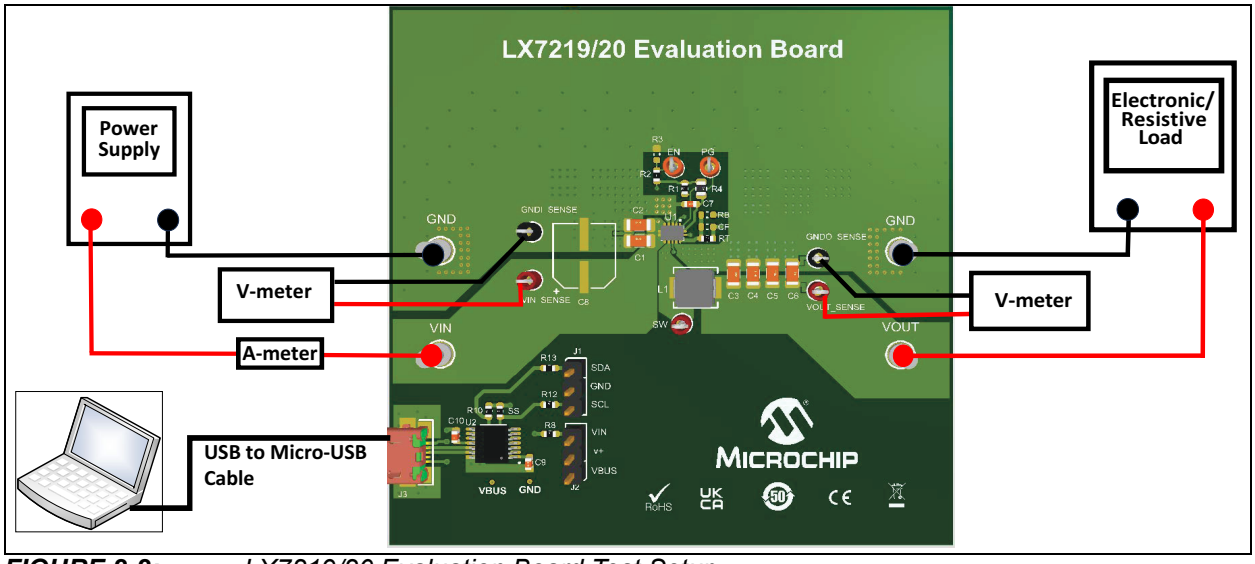


FIGURE 2-2: *LX7219/20 Evaluation Board Test Setup.*

2.3.1.3 ADJUSTABLE V_{OUT} SETTING

Using the I²C interface, the output voltage can be adjusted from 0.6V to 1.195V. The reference voltage is programmed using the I²C bus VSEL register value.

EQUATION 2-1: V_{REF} PROGRAMMING WITH THE I²C BUS VSEL REGISTER

$$V_{REF} = 0.6V + V_{SEL} \times 0.0047V$$

Where:
V_{SEL} = the decimal value of the 7 VSEL bits.

In case a higher output voltage is needed, it must be programmed through an external resistive divider. The following formula calculates the value of V_{OUT} based on the resistive divider components R_{TOP} and R_{BOT}.

EQUATION 2-2: OUTPUT VOLTAGE CALCULATION

$$V_{OUT} = V_{REF} \times \left(1 + \frac{R_{TOP}}{R_{BOT}}\right)$$

Where:
V_{REF} default is determined by the chip (0.8V, 0.9V and 0.95V options are available).

2.3.1.4 PERFORMANCE EVALUATION

The following plots show efficiency in PSM/PWM mode vs. load current and load transient response for the LX7219-01.

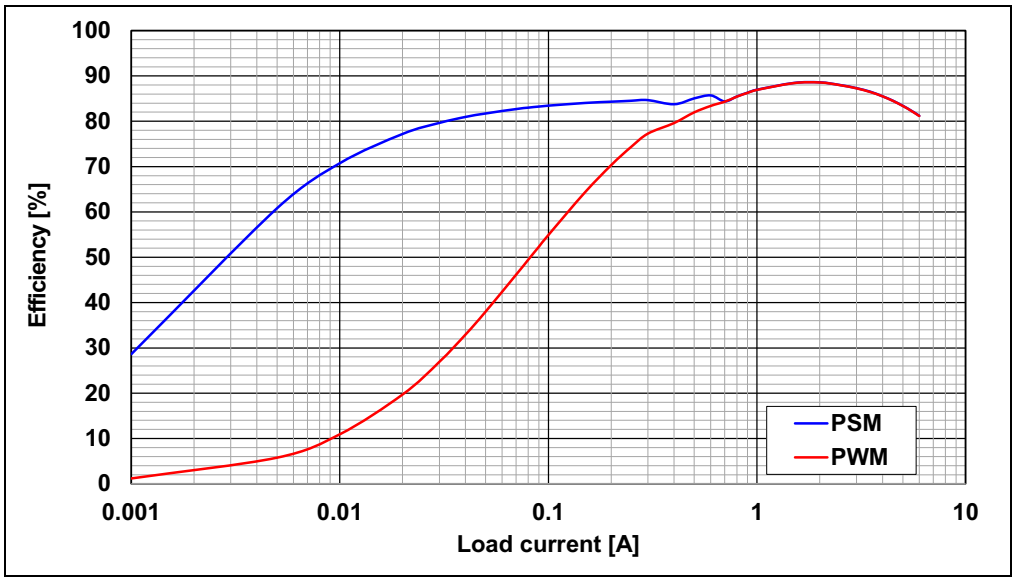


FIGURE 2-3: *LX7219-01, Efficiency PSM/PWM Mode @ V_{OUT} = 0.8V, V_{IN} = 5.0V, L = 0.47 µH, C_{IN} = 2 × 22 µF, C_{OUT} = 4 × 22 µF.*

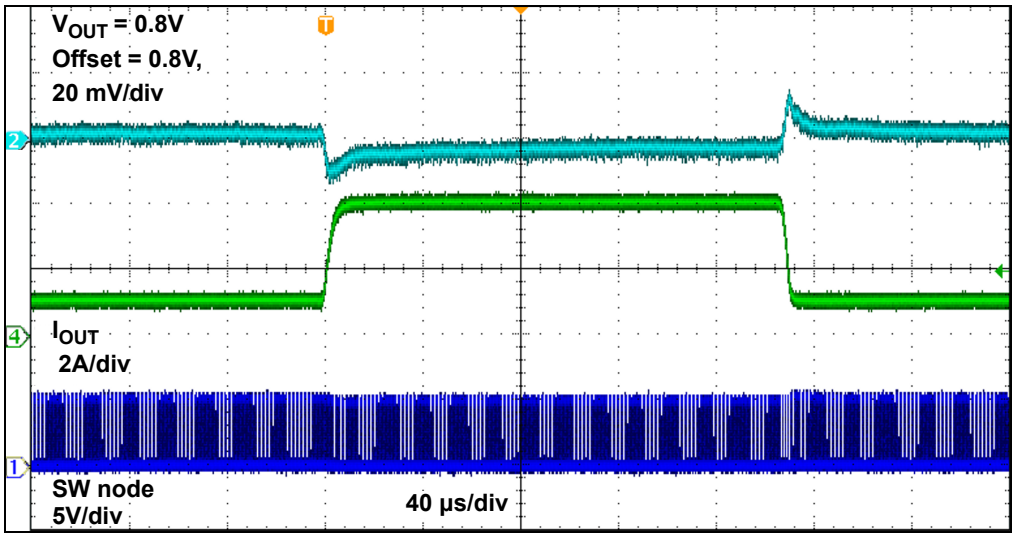


FIGURE 2-4: *LX7219-01, Load Step Response, I_{OUT} = 1A to 4A, L = 0.47 µH, C_{IN} =2 × 22 µF, C_{OUT} =4 × 22 µF, V_{IN} = 5.0V, V_{OUT} = 0.8V.*

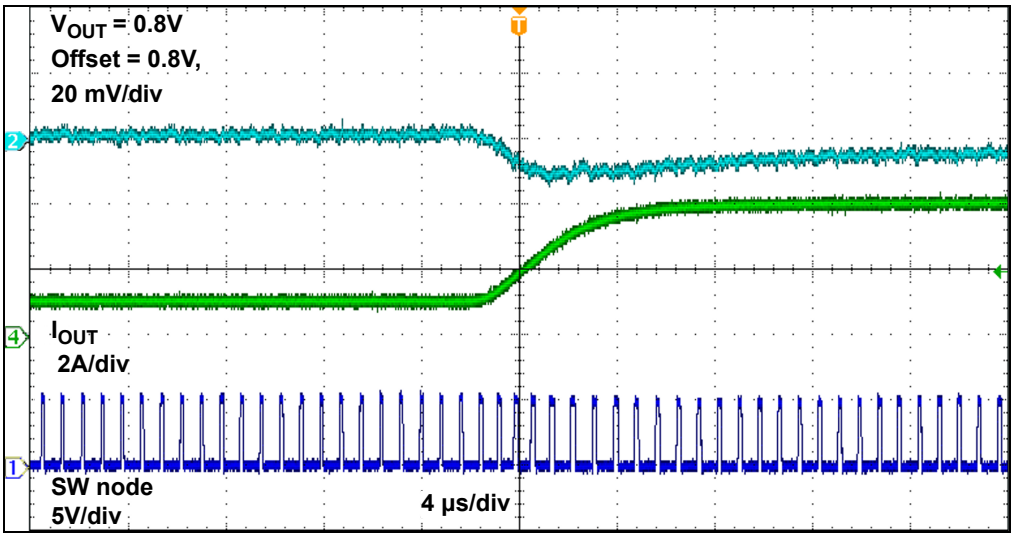


FIGURE 2-5: *LX7219-01, Load Step Response, I_{OUT} = 1A to 4A, L = 0.47 µH, C_{IN} =2 × 22 µF, C_{OUT} =4 × 22 µF, Rising Edge, V_{IN} = 5.0V, V_{OUT} = 0.8V.*

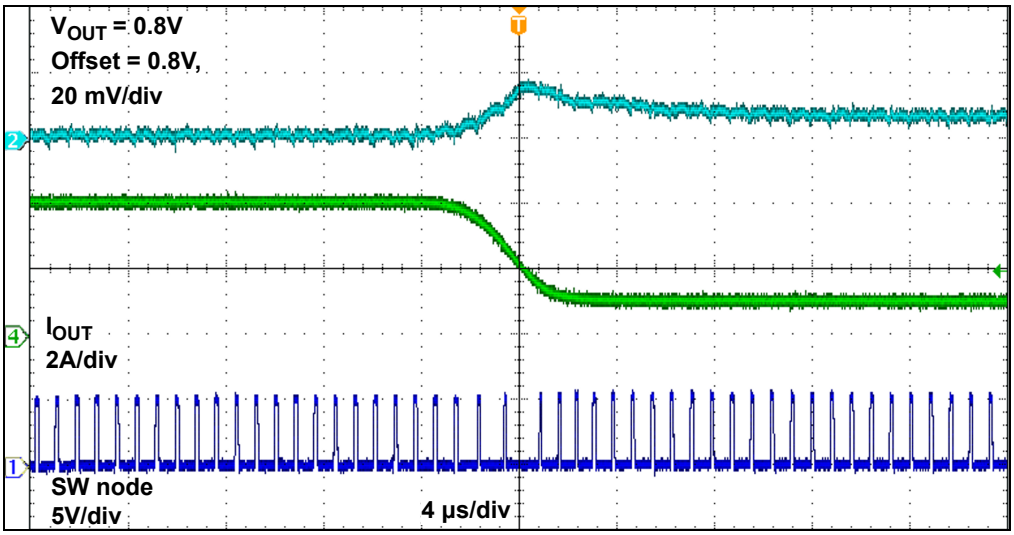


FIGURE 2-6: *LX7219-01, Load Step Response, I_{OUT} = 1A to 4A, L = 0.47 µH, C_{IN} =2 × 22 µF, C_{OUT} =4 × 22 µF, Falling Edge, V_{IN} = 5.0V, V_{OUT} = 0.8V.*

2.3.1.5 I²C PULL-UP VOLTAGE SELECTION

The LX7219/20 Evaluation Board is equipped with a jumper (JP2) for selecting the I²C pull-up supply voltage. The J2 header can be used to select the I²C pull-up voltage to either VBUS or VIN. If a different pull-up voltage is desired, it can be injected into the v+ pin of J2. In this case, please make sure that no jumper is inserted in header J2, to prevent shorting the externally injected pull-up voltage to either VBUS or VIN.

NOTES:

Chapter 3. GUI Installation and Operation

3.1 GETTING STARTED

In order to install, use, and evaluate the product, several software and hardware tools are required.

3.1.1 Required Software

- I^2C Monitor GUI (minimum v8.0)
- Microsoft®.NET Framework 4.5 or higher

3.1.2 Required Hardware

- LX7219/20 Evaluation Board
- USB to micro-USB Cable

3.2 GRAPHICAL USER INTERFACE (GUI) INSTALLATION

The following steps describe how to install the I^2C Monitor GUI:

1. If Microsoft.NET Framework is already installed, go to Step 2. If not, download Microsoft.NET Framework from www.microsoft.com and follow the installation instructions.
2. Download the I^2C Monitor GUI (v8.0) archive from www.microchip.com/LX7219 under "Embedded Software".
3. Unzip the I^2C Monitor GUI archive, which contains the `setup.exe` file.
4. Double click the `setup.exe` file to open the Setup Wizard window and wait for the extraction to complete. If required, the installation can be stopped by pressing the **Cancel** button.

5. In the Welcome to the I^{2}C Monitor Setup Wizard window, click the **Next** button to start the installation.

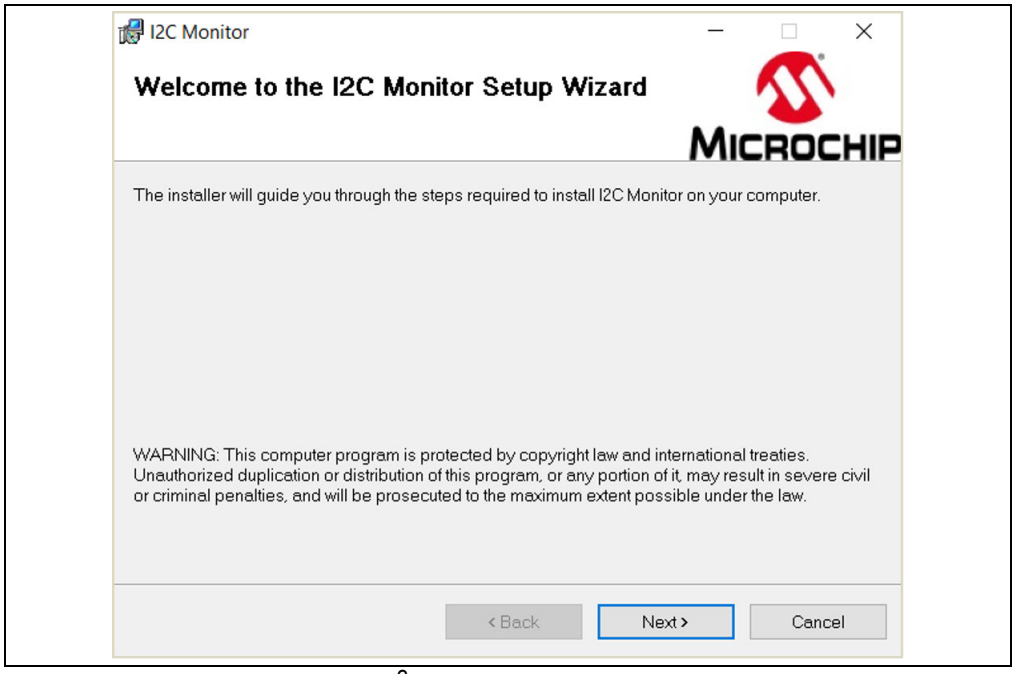


FIGURE 3-1: *Starting the I^{2}C Monitor GUI Installation.*

6. Read the Software License Agreement, check the agreement box, then click the **Next** button.

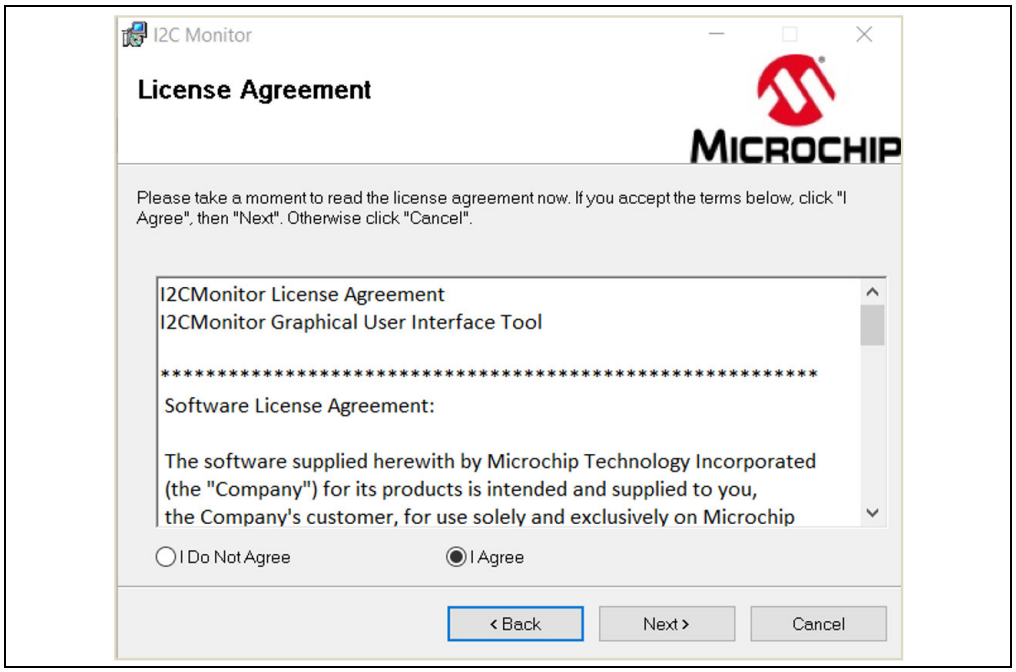


FIGURE 3-2: *License Agreement.*

7. The installation path can be changed, although it is recommended to keep the default path. Click **Next** to continue.

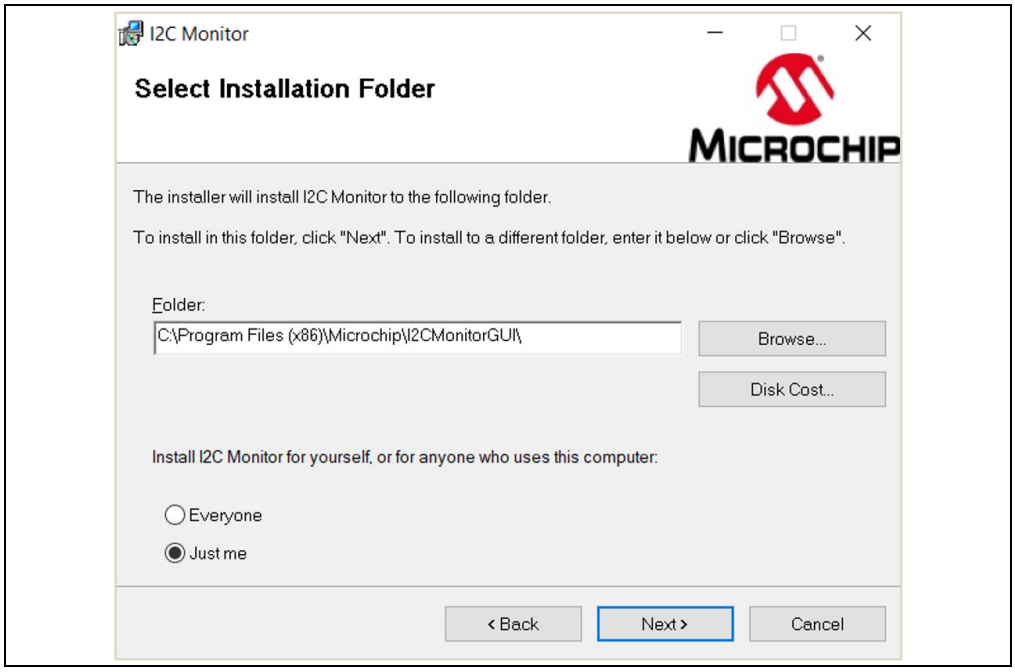


FIGURE 3-3: *Selecting the Destination Folder.*

8. Click the **Next** button to start the installation.

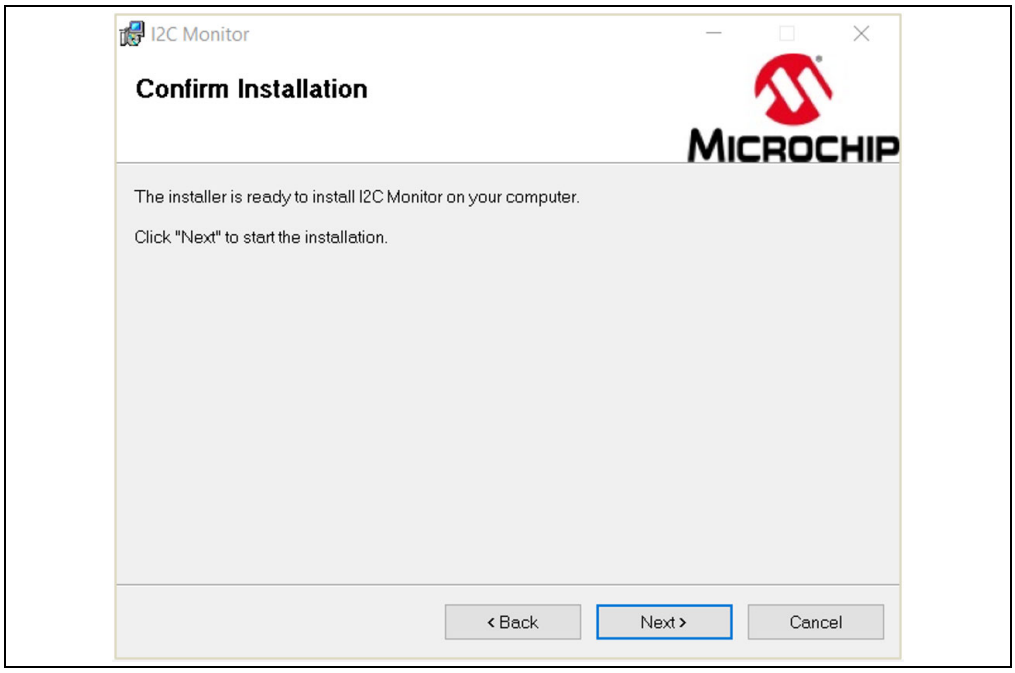


FIGURE 3-4: *Confirm Installation.*

9. The installation progress can be observed in the Installing I^{2}C Monitor window.

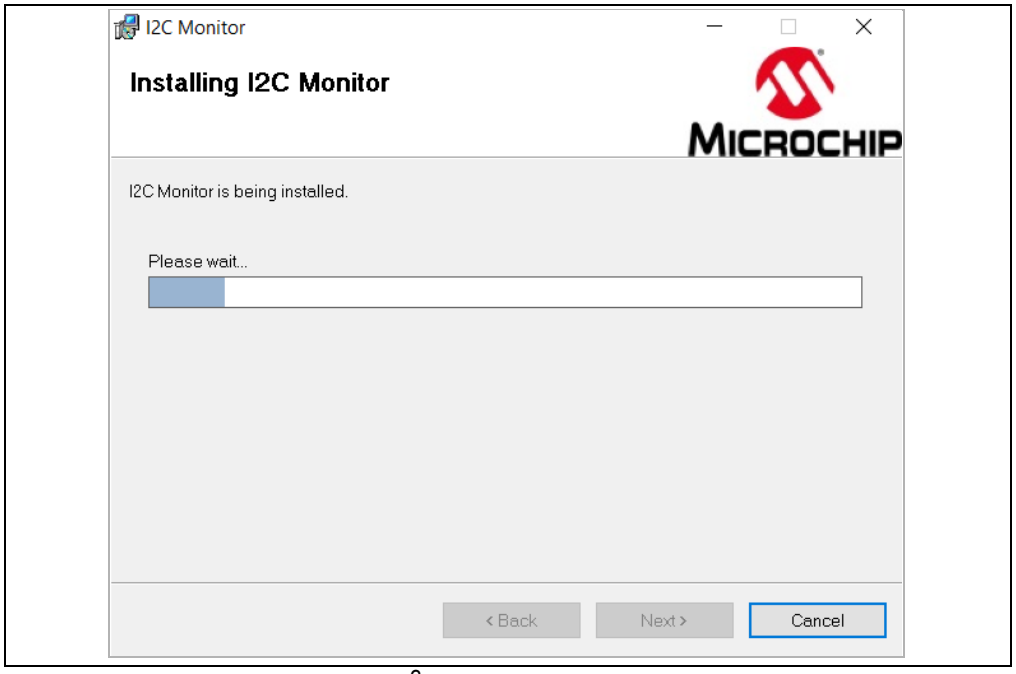


FIGURE 3-5: *Installing the I^{2}C Monitor GUI.*

10. Once the installation is complete, click **Close** to end the installation.
    To start the GUI, either double-click the desktop icon or browse for "I^{2}C Monitor" in the Windows Search bar.

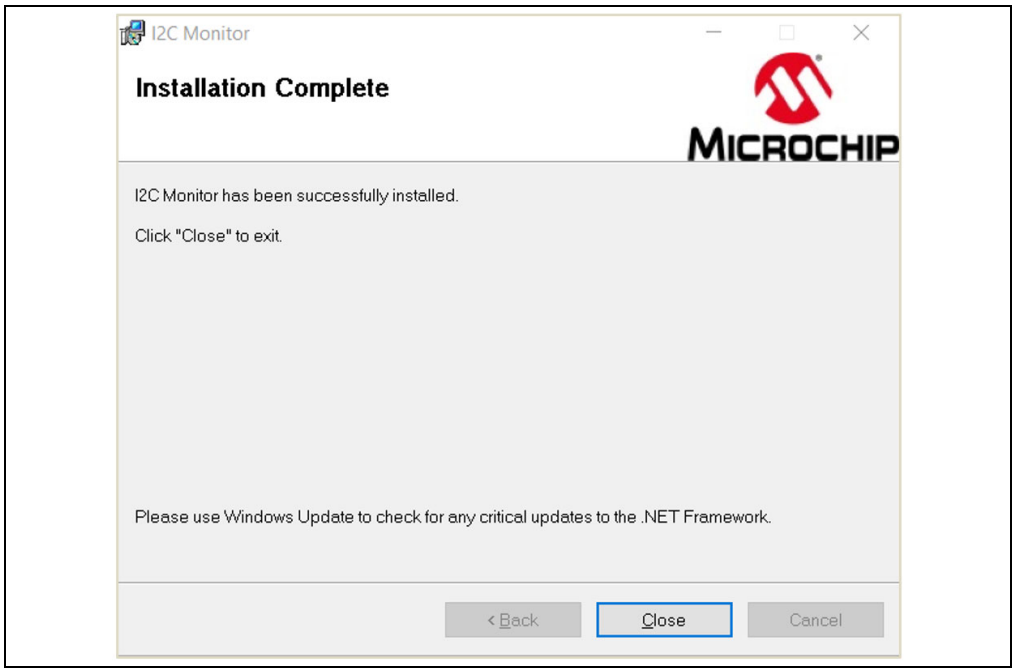


FIGURE 3-6: *The Installation Complete Window.*

Chapter 4. GUI Description

4.1 INTRODUCTION

This chapter describes how to use the I²C Monitor GUI when connected to the LX7219/20 Evaluation Board included in the kit.

NOTICE

This chapter provides information regarding the use of the GUI that applies only to the LX7219/20 devices. For other devices using the I²C Monitor GUI, please refer to their specific Data Sheets and User's Guides.

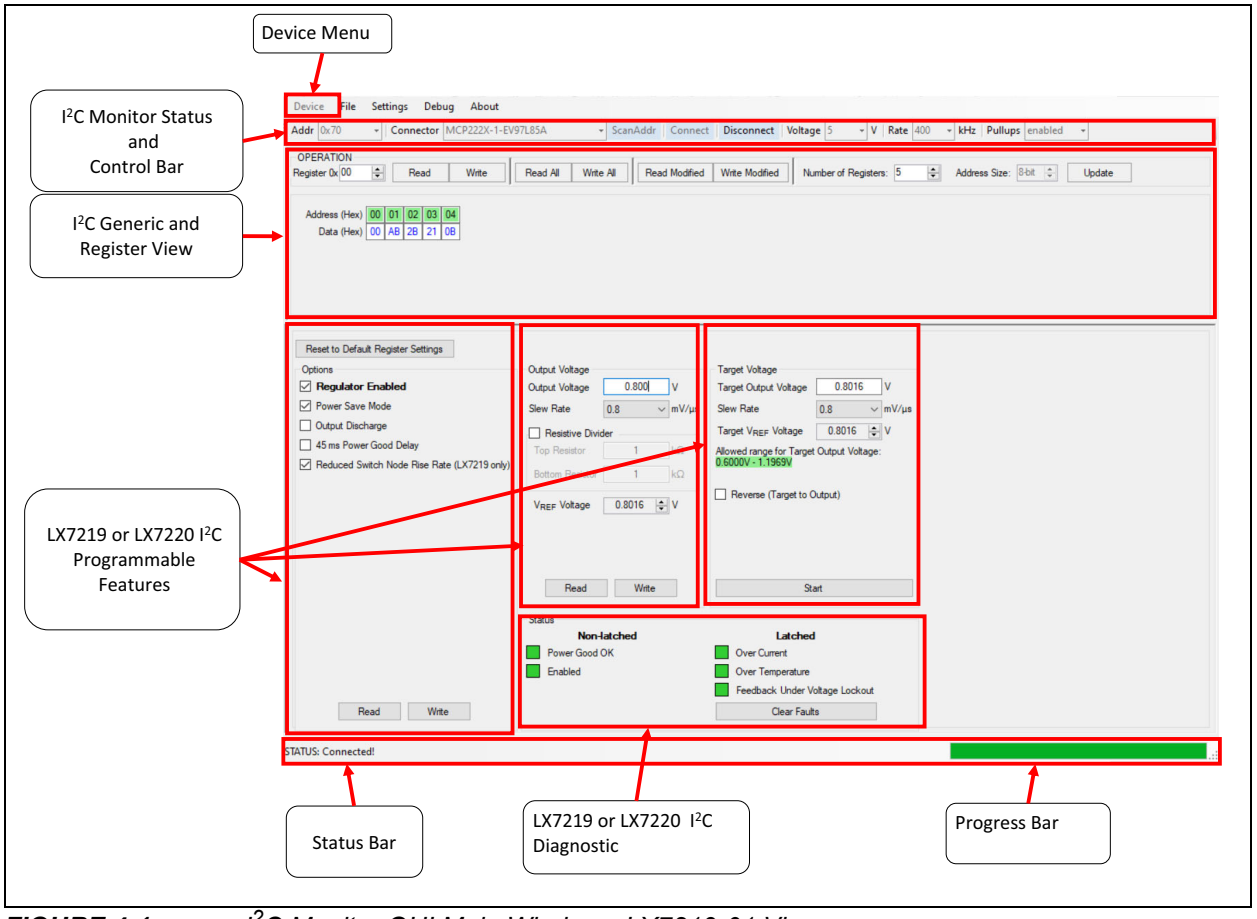


FIGURE 4-1: *I²C Monitor GUI Main Window - LX7219-01 View.*

4.2 THE GRAPHICAL USER INTERFACE (GUI)

The following sections describe the items depicted in the GUI.

4.2.1 Device Menu

The Device drop-down menu allows the user to select the device to be evaluated. If an evaluation (or added custom) board is used, the profile will automatically change to the preselected profile.

4.2.2 File Menu

The File menu allows the user to save (**Save registers to file**) the registers of the currently selected device to a file that can then be loaded into the GUI by using the **Load registers from file** button. The saved file can also be edited (open it with a text editor).

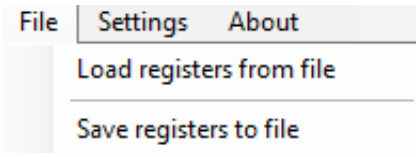


FIGURE 4-2: *File Menu.*

4.2.3 Settings Menu

From the Settings menu, add a new custom board to be automatically detected and switch to its profile. To do this, go to *Settings > Device descriptors* and in the Descriptors window, add the desired "Board" descriptor and select the desired "Device" profile.

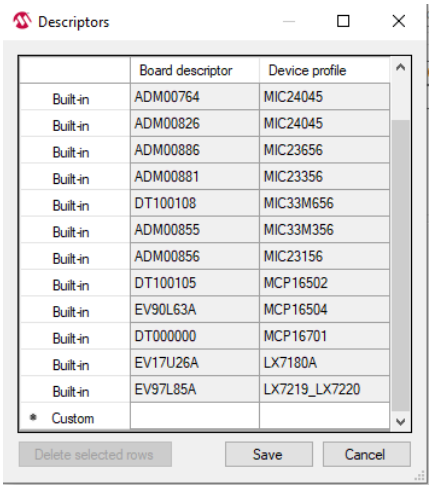


FIGURE 4-3: *Custom Board Menu.*

4.2.4 I^2C Monitor Status and Control Bar

The "Status and Control" bar contains the items listed in Table 4-1.

FIGURE 4-4: *I^2C Monitor Status and Control Bar.*

TABLE 4-1: MONITOR STATUS AND CONTROL BAR

Item	Description
Addr	This drop-down menu shows the address of the available devices.
Connector	This drop-down menu shows the type of connector used to connect the board.
ScanAddr	This button is used to scan for a valid address.
Connect/Disconnect	These buttons are used to connect/disconnect the currently selected device.
Voltage	Not applicable.
Rate	This drop-down menu is used to select the corresponding communication rate for the device.
Pull Ups	Not applicable.

In the “Status and Control” bar, the user can choose the hardware tool used to communicate with the device and the settings it should allow.

In order to connect to a device, the user must follow the steps described in **Section 3.1 “Getting Started”**. After connecting the Micro-USB cable, the user must scan for a valid address. Once a valid address is detected, clicking the **Connect** button will initialize the connection with the device and the registers will be available for read and write operations.

4.2.5 I²C Generic Register View

The “I²C Generic Register View” area contains the items listed in Table 4-2. This section of the I²C Monitor GUI is common for all evaluated devices.

FIGURE 4-5: *Generic Register View Area.*

TABLE 4-2: I²C GENERIC REGISTER VIEW ITEMS

Panel	Item	Description
Operation	Register	This section shows the registers available for read/write operations.
	Read/Write	These buttons are used for single read/write operations.
	Read All/Write All	These buttons are used for reading/writing all the available registers.
	Read Modified/ Write Modified	These buttons are used for reading/writing the content of the modified registers.
	Number of Registers	In this section, the user can set the number of the available registers for read/write operations.
	Address Size	In this section, the Address Size is specified.
	Update	This button sets/updates the number of available registers for read/write operations in the register area.
Register Area		This section shows the current status of the register addresses and their content.

The specific registers for LX7219-01 are described in the device data sheet, in section **6.8 “Control Register Bit Definitions”**.

4.2.6 LX7219-01 I²C Programmable Features

The LX7219-01 I²C "Programmable Features" area contains the items listed in Table 4-3.

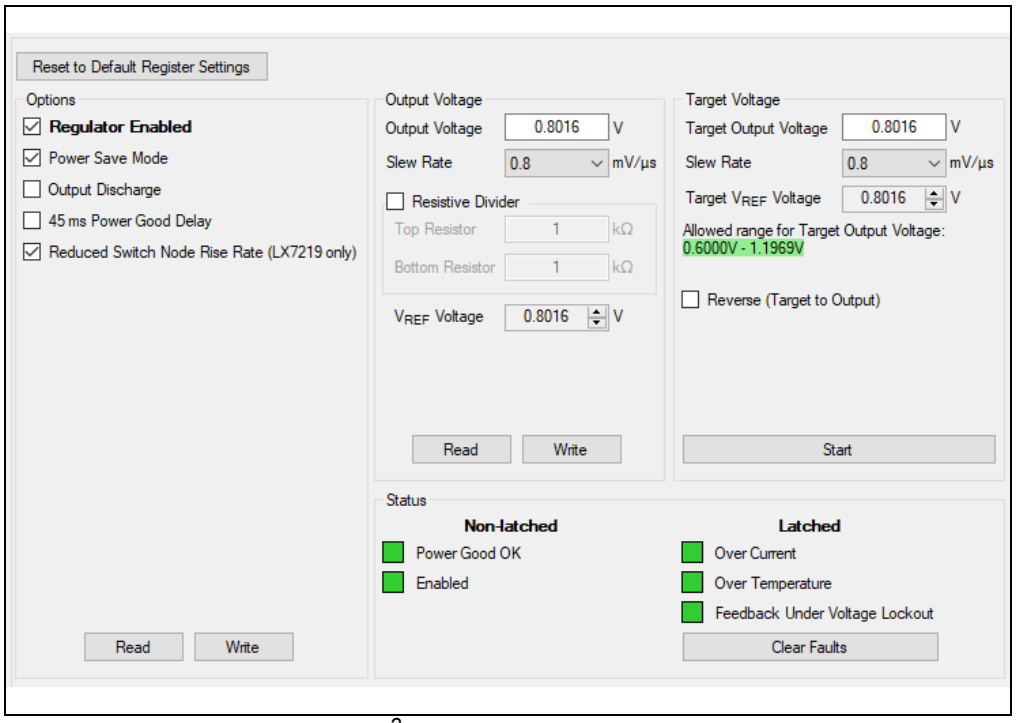


FIGURE 4-6: *LX7219-01 I²C Programmable Features, Resistive Divider Disabled.*

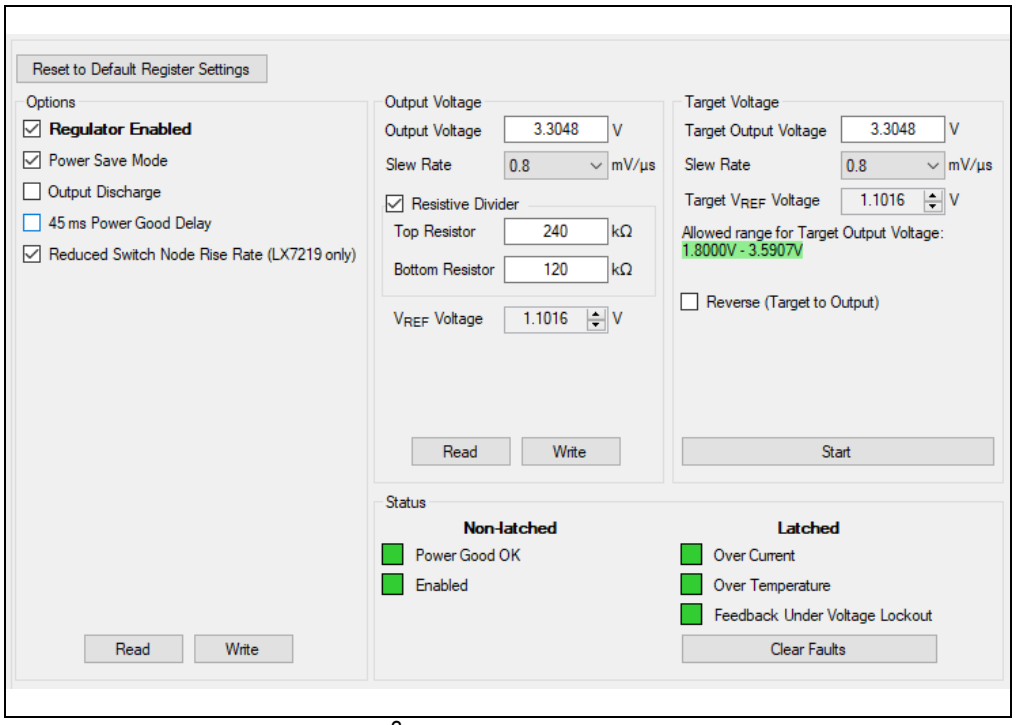


FIGURE 4-7: *LX7219-01 I²C Programmable Features, Resistive Divider Enabled.*

TABLE 4-3: LX7219-01 I²C PROGRAMMABLE FEATURES

Panel/Button	Items	Description
Options	Regulator Enabled	This check box allows the user to enable/disable the regulator via the I^2C bus. Uncheck the box to disable the regulator. During disable, the regulator and most of the support circuitry is turned off; however, the I^2C bus circuitry is still active and may be programmed.
	Power Save Mode	This check box allows the switch between auto PSM mode and PWM only mode. Check the box to enable the Power Save mode, uncheck the box for PWM only mode.
	Output Discharge	This check box allows the user to configure the Output Discharge option. If the box is checked, when the regulator is disabled, the output voltage is discharged through the SW pin.
	45 ms Power Good Delay	This check box controls the Power Good Delay. If checked, it will introduce a 45 ms delay on PGOOD.
	Reduced Switch Node Rise Rate	This check box allows the user to select between Reduced and Normal Switch Node Rise Rate. If the box is checked, then the Reduced Switch Node Rise Rate is enabled. This feature is available only for LX7219-01 and LX7219-02. The LX7220 does not have this feature.
	Read/Write	These buttons are used to read/write the registers that contain the information described above.
Output Voltage	Output Voltage	This box allows the setting of the output voltage. If the Resistive Divider box is unchecked, then the allowed V_{OUT} range is 0.6V-1.195V. If the Resistive Divider option is enabled, the V_{OUT} range can be extended to 3.3V.
	Slew Rate	This box contains a drop-down list with all possible slew rate settings.
	Resistive Divider	This check box enables/disables the resistive divider configuration. If the box is checked, the Top Resistor and Bottom Resistor fields become active and it is requested to fill in the configured values on the hardware.
	V_{REF} Voltage	This spin box displays the resulting V_{REF} Voltage.
	Error Message	An error message is displayed in this area if the entered V_{OUT} value is not valid.
	Read/Write	These buttons are used to read/write the registers that contain the information described above.

TABLE 4-3: LX7219-01 I²C PROGRAMMABLE FEATURES (CONTINUED)

Panel/Button	Items	Description
Target Voltage	Target Output Voltage	This box allows setting the target output voltage for V_{OUT} transitions. If the Resistive Divider is unchecked, then the allowed target V_{OUT} range is 0.6V-1.195V. If the Resistive Divider option is checked, then the target V_{OUT} range can be extended to 3.3V. Depending on the hardware-configured resistive divider, information about the permitted target V_{OUT} range is provided in the message area.
	Slew Rate	This box contains a drop-down list with all possible slew rate settings.
	Target V_{REF} Voltage	This spin box displays the resulting Target V_{REF} Voltage.
	Info/Error Message	This area provides information about the allowed target V_{OUT} range. If a value that is not valid is set, then an **Out of range!** message is displayed.
	Reverse (Target to Output)	If V_{OUT} is already set to the *Target Output Voltage* value and the box is checked, when the **Start** button is pressed, V_{OUT} will return to the *Output Voltage* value. If V_{OUT} is set to the *Output Voltage* value and the box is checked, when the **Start** button is pressed, V_{OUT} will transition to the *Target Output Voltage* value and, after approximately 80 ms, will return to the *Output Voltage* value, see Figure 4-8 (case C).
	Start	When this button is pressed, a transition from the *Output Voltage* to the *Target Output Voltage* starts; see Figure 4-8 (case A). If the Reverse (Target to Output) is checked, then a transition from the *Target Output Voltage* to the *Output Voltage* occurs; see Figure 4-8 (case B).
Reset to Default Register Settings		When this button is pressed, the registers are (re)set to their default values. The default values can be found in section **6.8 "Control Register Bit Definitions"** of the device data sheet.

This area of the GUI allows the user to modify the device features. For additional information about the part, please refer to its data sheet.

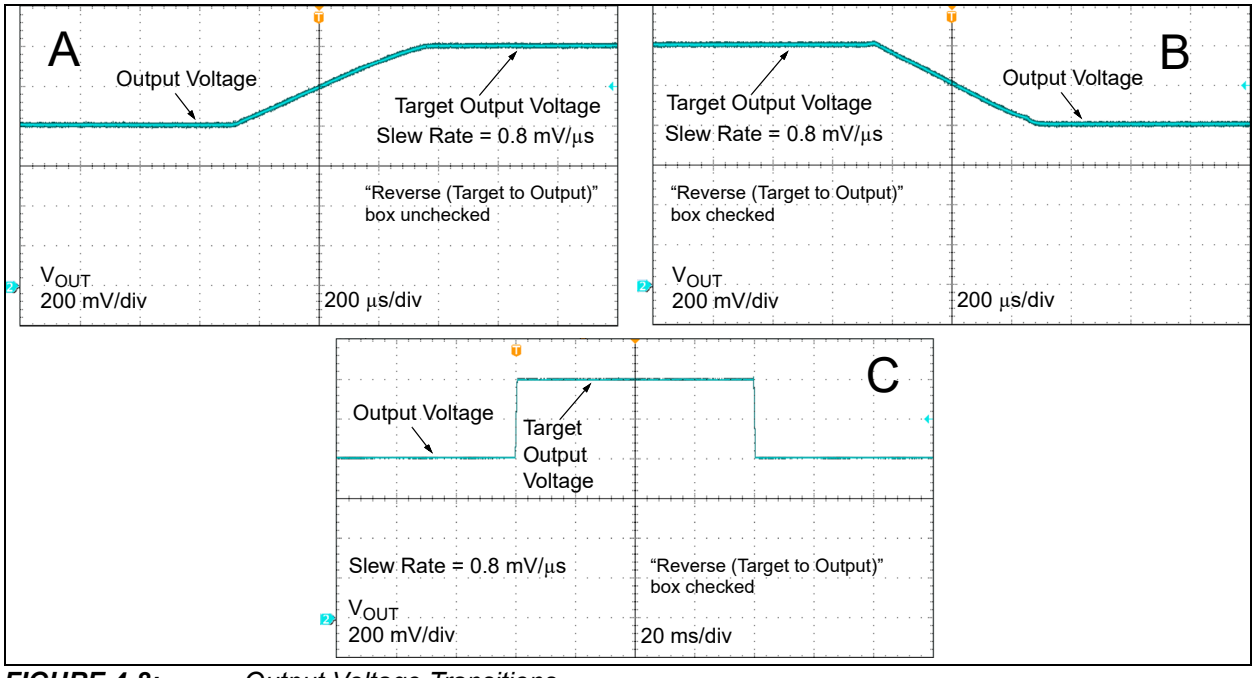


FIGURE 4-8: *Output Voltage Transitions.*

4.2.7 LX7219-01 I²C Diagnostic

The LX7219-01 Diagnostic area contains the items listed in Table 4-4.

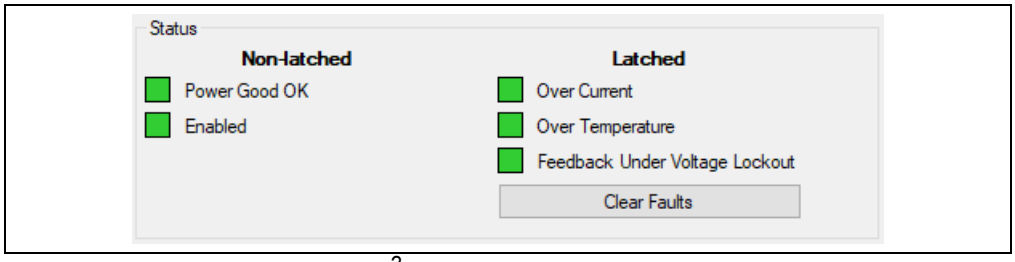


FIGURE 4-9: *LX7219-01 I²C Diagnostic Area.*

TABLE 4-4: LX7219-01 I²C DIAGNOSTIC AREA

Panel	Items	Description
Status	Power Good OK	This box indicates green if the output voltage has reached 90% of its set value. It indicates red when the output voltage is in transition or the regulator is disabled.
	Enabled	This box indicates green if the regulator is enabled. When the **Regulator Enabled** box is unchecked, the **Enabled** box indicates red.
	Over Current	This box indicates red if the overcurrent limit is reached and it is latched to '1'. Press **Clear Faults** button to reset the status flag.
	Over Temperature	This box indicates red if an overtemperature event occurs and it is latched to '1'. Press **Clear Faults** button to reset the status flag.
	Feedback Under Voltage Lockout	This box indicates red if a feedback undervoltage event occurs and it is latched to '1'. Press **Clear Faults** button to reset the status flag.

The LX7219-01 I²C Diagnostic area summarizes the information contained in the "Status" section. The "Status" section contains latched (Flag) or non-latched (Status) bits. Flag bits are set when the corresponding Fault condition occurs and do not return to zero once the Fault condition ceases. If such a Fault occurs, the user can clear the Faults by clicking on the **Clear Faults** button or by power cycling the device. Status bits are set when the corresponding Fault condition has occurred and return to '0' automatically once the Fault condition has ceased. This information is refreshed once every two seconds.

TABLE 4-5: STATUS BAR ITEMS

Item	Description
Status Label	The status label shows if there is any device connected to the board. Refer to Table 4-6 for a list of possible labels.
Progress Bar	This bar shows the progress for a given command.

TABLE 4-6: STATUS LABELS

Item	Description
STATUS: Connected!	This message is shown when the GUI is connected to a device.
STATUS: Disconnected!	This message is shown when the GUI is not connected to a device.

NOTES:

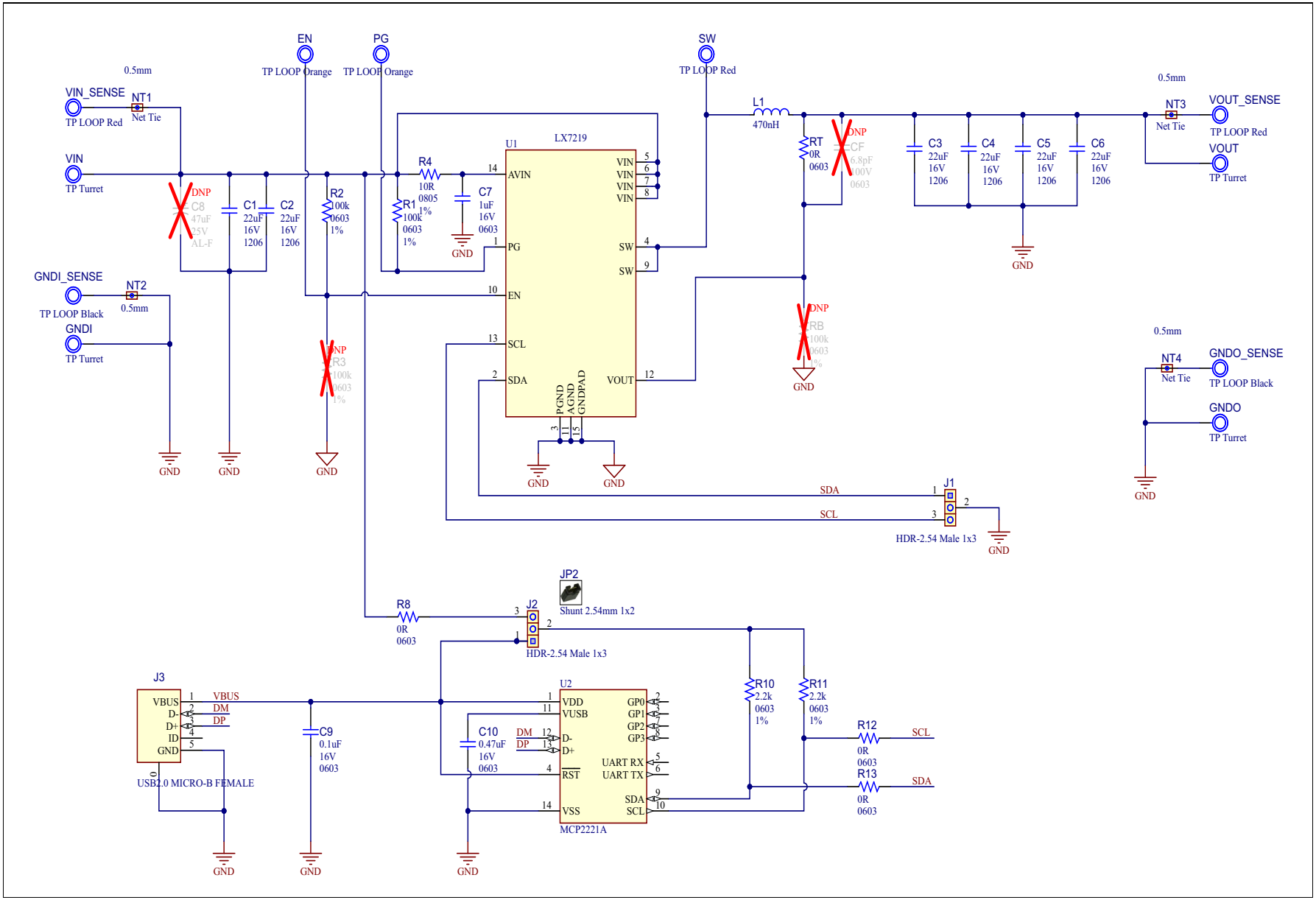
Appendix A. Schematic and Layouts

A.1 INTRODUCTION

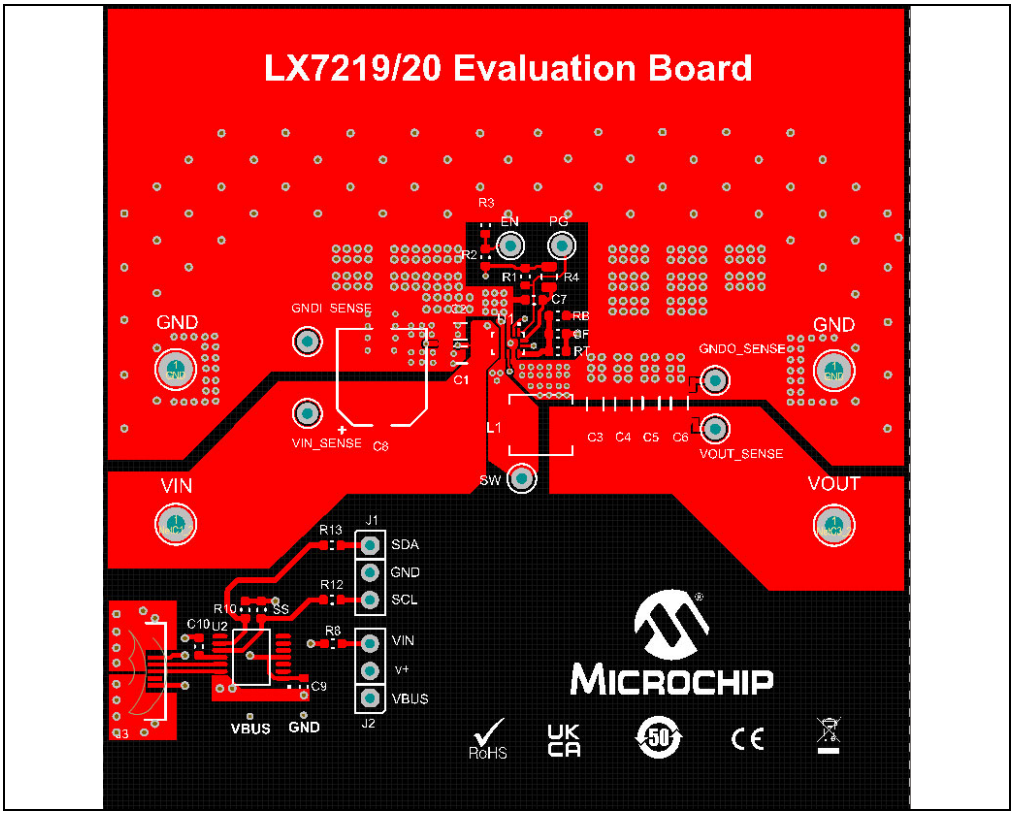
This appendix contains the following schematic and layouts for the LX7219/20 Evaluation Board:

- Board – Schematic
- Board – Top Copper and Silk
- Board – Signal Layer 1
- Board – Signal Layer 2
- Board – Bottom Copper and Silk

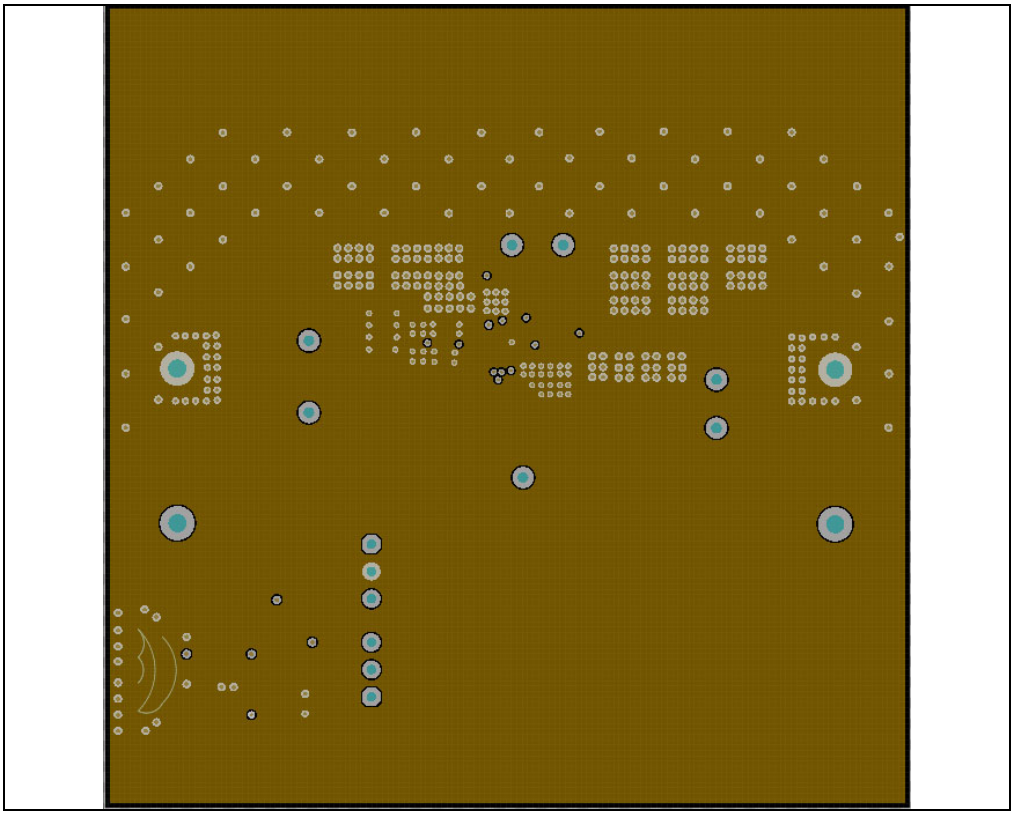
A.2 BOARD – SCHEMATIC



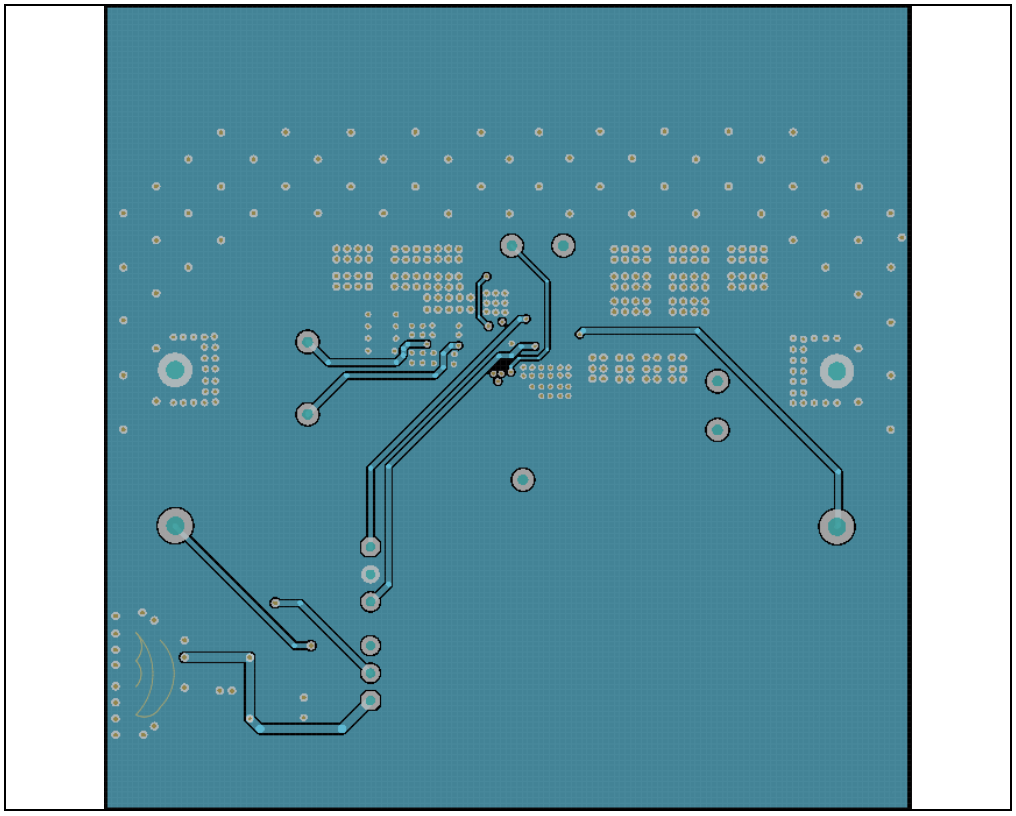
A.3 BOARD – TOP COPPER AND SILK



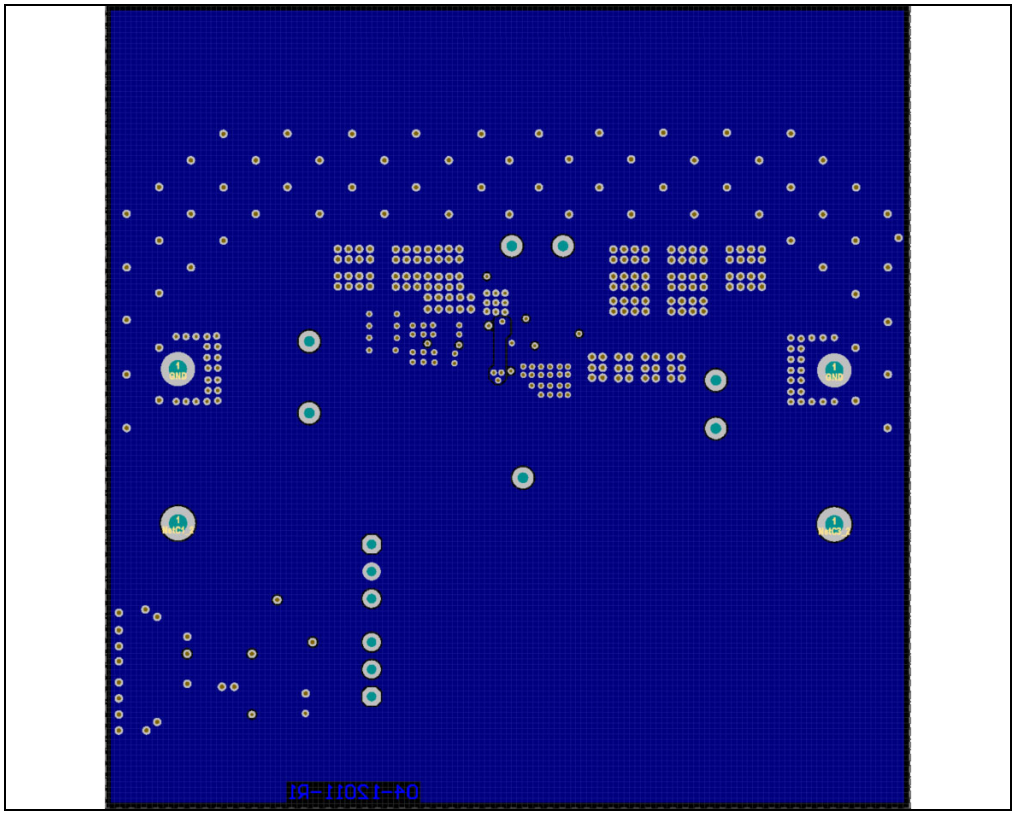
A.4 BOARD – SIGNAL LAYER 1



A.5 BOARD – SIGNAL LAYER 2



A.6 BOARD – BOTTOM COPPER AND SILK



Appendix B. Bill of Materials

TABLE B-1: BILL OF MATERIALS (BOM)

Qty	Reference	Description	Manufacturer	Part Number
6	C1, C2, C3, C4, C5, C6	Capacitor, Ceramic, 22 µF, 16V, 20%, X7R, SMD, 1206	Murata Manufacturing Co., Ltd.	GRM31CZ71C226ME15L
1	C7	Capacitor, Ceramic, 1 µF, 16V, 10%, X7R, SMD, 0603	Yageo Corporation	CC0603KRX7R7BB105
1	C9	Capacitor, Ceramic, 0.1 µF, 16V, 10%, X7R, SMD, 0603	Kyocera AVX®	0603YC104KAT2A
1	C10	Capacitor, Ceramic, 0.47 µF, 16V, 10%, X7R, SMD, 0603	Murata Manufacturing Co., Ltd.	GRM188R71C474KA88D
2	EN, PG	Test Point, LOOP, Orange, TH	Keystone® Electronics Corp.	5003
4	GNDI, GNDO, VIN, VOUT	Test Point, PIN Tin, TH	Harwin Plc.	H2121-01
2	GNDI_SENSE, GNDO_SENSE	Test Point, Multi Purpose, Mini Black	Keystone Electronics Corp.	5001
2	J1, J2	Connector, Header, 2.54 mm, Male, 1x3 Tin, 5.84 MH, TH, VERT	Samtec, Inc.	TSW-103-07-T-S
1	J3	Connector, USB 2.0, Micro-B, Female, SMD	FCI	10118192-0001LF
1	L1	Inductor, 470 nH, 12.2A, 20%, SMD	Vishay® Dale	IHLP2020CZERR47M01
4	PAD1, PAD2, PAD3, PAD4	Mechanical HW Rubber Pad, Bumpon™ Hemisphere, 0.44" x 0.20", Black	3M	SJ-5003 (BLACK)
2	R1, R2	Resistor, Thick Film, 100 kΩ, 1%, 1/10W, SMD, 0603	Vishay® Beyschlag	MCT06030C1003FP500
1	R4	Resistor, Thick Film, 10R, 1%, 1/8W, SMD, 0805	Bourns®, Inc.	CR0805-FX-10R0ELF
4	R8, R12, R13, RT	Resistor, Thick Film, 0Ω, 1/10W, SMD, 0603	Panasonic® - ECG	ERJ-3GEY0R00V
2	R10, R11	Resistor, Thin Film, 2.2 kΩ, 1%, 1/8W, SMD, 0603	Vishay Beyschlag	MCT06030C2201FP500
3	SW, VIN_SENSE, VOUT_SENSE	Test Point, Multi Purpose, Mini, Red	Keystone Electronics Corp.	5000
1	PCB	LX72XX Evaluation Board Printed Circuit Board	—	04-12011

Note 1: 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: BILL OF MATERIALS (BOM) – MICROCHIP PARTS

Qty	Reference	Description	Manufacturer	Part Number
1	U1	Analog Hysteretic Synchronous Buck Regulator, 6A, VQFN-14	Microchip Technology Inc.	LX7219-01-02ILQTR
1	U2	Interface USB I2C UART, TSSOP-14	Microchip Technology Inc.	MCP2221A-I/ST

Note 1: 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-3: BILL OF MATERIALS (BOM) – MECHANICAL PARTS

Qty	Reference	Description	Manufacturer	Part Number
1	JP2	Mechanical HW Jumper, 2.54 mm, 1 x 2	Amphenol Corporation	63429-202LF
1	LABEL1	Label, ASSY, W/REV Level (Small Modules), PER, MTS-0002	Raynen	10010276
4	PAD1, PAD2, PAD3, PAD4	Mechanical HW Rubber Pad, Bumpon Hemisphere, 0.44" x 0.20", Black	3M	SJ-5003 (BLACK)

Note 1: 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-4: BILL OF MATERIALS (BOM) – DO NOT POPULATE PARTS

Qty	Reference	Description	Manufacturer	Part Number
0	C8	Capacitor, Aluminum, 47 µF, 50V, 20%, SMD F	KEMET	EDT476M050S9MAA
0	CF	Capacitor, Ceramic, 6.8 pF, 100V, 5%, C0G, SMD, 0603	Kyocera AVX	06031A6R8JAT2A
0	R3, RB	Resistor, Thin Film, 100 kΩ,1%, 1/8W, SMD, 0603	Vishay Beyschlag	MCT06030C1003FP500

Note 1: 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.

Appendix C. LX7219-01 Control Register Bit Definition

TABLE C-1: LX7219-01 CONTROL REGISTER BIT DEFINITION

Bit	Name	Value	Description
Status, Address 00h			
7:3	Reserved		
2	OCP	0-d	Latched to 1 if the overcurrent limit is reached. Write a '1' to reset the status flag.
1	OTP	0-d	Latched to 1 if an overtemperature event occurs. Write a '1' to reset the status flag.
0	FB_UVLO	0-d	Latched to 1 if a FB_UVLO event occurs. Write a '1' to reset the status flag.
VSEL, Address 01h, (aka dac)			
7	EN	1-d	Device enabled.
		0	Device disabled.
6:0	VSEL[6:0]		7-bit DAC value to set V_{REF}. The default value is determined by the REF ordering code of the part.
Ctrl1, Address 02h, (aka reg2)			
7:6	Reserved	00-d	
5	ctrl1	1-d	Not used.
4	DLY_DIS	1	45 ms delay on PGOOD is enabled when this bit is high.
		0-d	Disable 45 ms delay on PGOOD.
3	SW_RATE (LX7219-01 only)	1-d	Reduced switch node rise rate.
		0	High switch node rise rate.
2	Reserved	1-d	
		0	
1	Reserved	1-d	
		0	
0	MODE	1-d	PSM - Power Save mode allows the converter to run in Discontinuous Conduction mode.
		0	PWM - Always run in Continuous Conduction mode.
Vendor ID, Address 03h (Read Only)			
7:4	VID[3:0]	0010	Microchip Vendor ID.
3:2	A1A0	00	Designates the client address version. These bits will correspond to the two LSB.
1:0	VOUT	01	Designates the default output voltage version. The default value is determined by the REF ordering code of the part.
Ctrl2, Address 04h, (reg4)			
7:6	Reserved	00-d	
5	GO	1	Write '1' to start a V_{REF} transition.
		0-d	The V_{OUT} is ramped to the default VSEL value.
4	Discharge	1	When the regulator is disabled, the output voltage is discharged through the SW pin.
		0-d	When the regulator is disabled, the output voltage is not discharged.
3	PGOK	1	Is high when output is in regulation; read-only dynamic signal.
		0	Is low during an output voltage transition; read-only dynamic signal.

TABLE C-1: LX7219-01 CONTROL REGISTER BIT DEFINITION (CONTINUED)

Bit	Name	Value	Description
2:1	SLEW	00	Do not select.
		01-d	V_{REF} slews at 0.8 mV/µs.
		10	V_{REF} slews at 2.2 mV/µs.
		11	V_{REF} slews at 8.4 mV/µs.
0	Reserved	1-d	

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