LX7180A 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 LX7180A 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 LX7180A Evaluation Board as a development tool. The manual layout is as follows:

- **Chapter 1. "Product Overview"** – Important information about the LX7180A Evaluation Board.
- **Chapter 2. "Installation and Operation"** – Includes instructions on how to get started with the LX7180A 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 LX7180A Evaluation Board.
- **Appendix B. "Bill of Materials"** – Lists the parts used to build the LX7180A Evaluation Board.
- **Appendix C. "LX7180A 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 LX7180A Evaluation Board. Another useful document is the following Microchip document listed below, which is available and recommended as a supplemental reference resource:

- **LX7180A Data Sheet – *"4A Step-Down Regulator"***

THE MICROCHIP WEBSITE

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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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- 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 B (May 2024)

- Correcting the header/footer misalignment on the horizontal page for the Board Schematic in this user guide.

Revision A (November 2023)

- Initial release of this document.

NOTES:

Chapter 1. Product Overview

1.1 INTRODUCTION

This chapter provides an overview of the LX7180A Evaluation Board and covers the following topics:

- LX7180A Short Overview
- What is the LX7180A Evaluation Board?
- Contents of the LX7180A Evaluation Board Kit

1.2 LX7180A SHORT OVERVIEW

The LX7180A is a 4A step-down regulator with integrated MOSFETs, packaged in a space-saving 2 mm × 2 mm QFN12, for today's mobile devices. It uses an ultra-fast, constant frequency hysteretic control method to minimize external filter components while maintaining excellent regulation. The LX7180A reference voltage is programmable from 0.6V to 1.195V through a high-speed (up to 3.4 MHz), bidirectional I^2C bus.

The LX7180A operates from 3V to 5.5V rails and outputs 0.6V to 100% of the input voltage.

Cycle-by-cycle current limiting protects against over-current conditions. Hiccup mode provides protection for heavy over-load or short-circuit faults. Thermal protection shuts down the regulator under over-temperature conditions. Over-voltage conditions will immediately shut off the output to protect against permanent damage. The LX7180A automatically restarts when all fault conditions are cleared.

The scope of this evaluation board is to demonstrate the features of the LX7180A product.

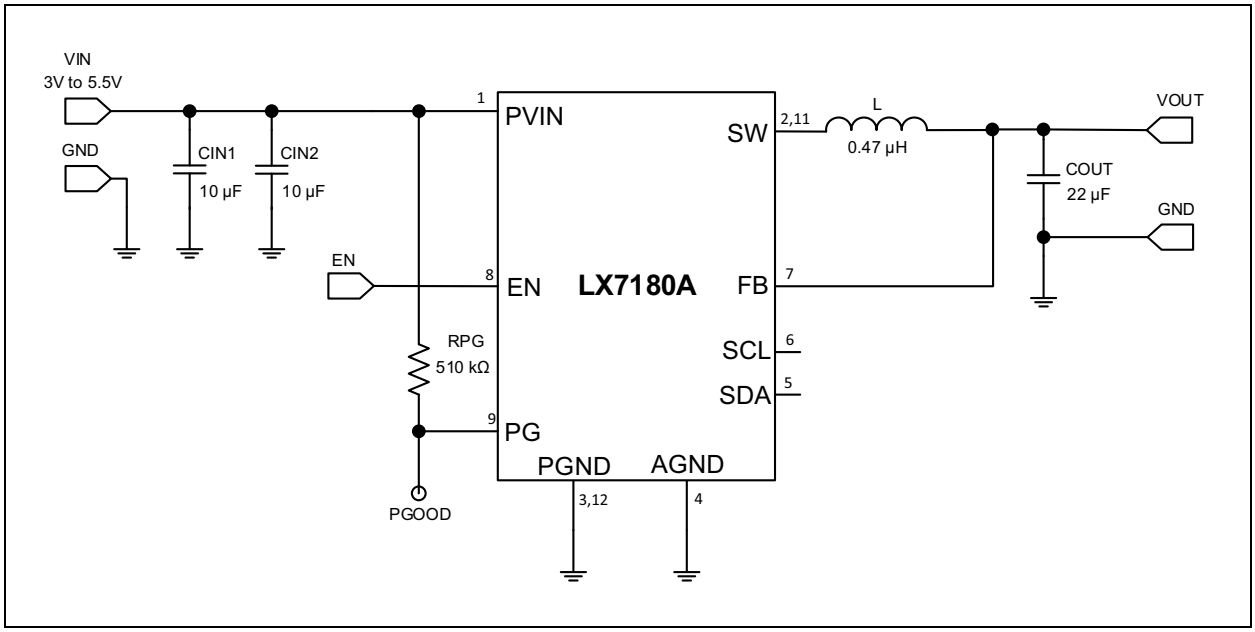


FIGURE 1-1: *Typical LX7180A Buck Converter Application @ 0.6V Output.*

1.3 WHAT IS THE LX7180A EVALUATION BOARD?

The LX7180A Evaluation Board is used to evaluate Microchip's Technology LX7180A product. The input voltage range for a typical 0.6V output application is 3V-5.5V and the load current can go up to 4A.

1.4 CONTENTS OF THE LX7180A EVALUATION BOARD KIT

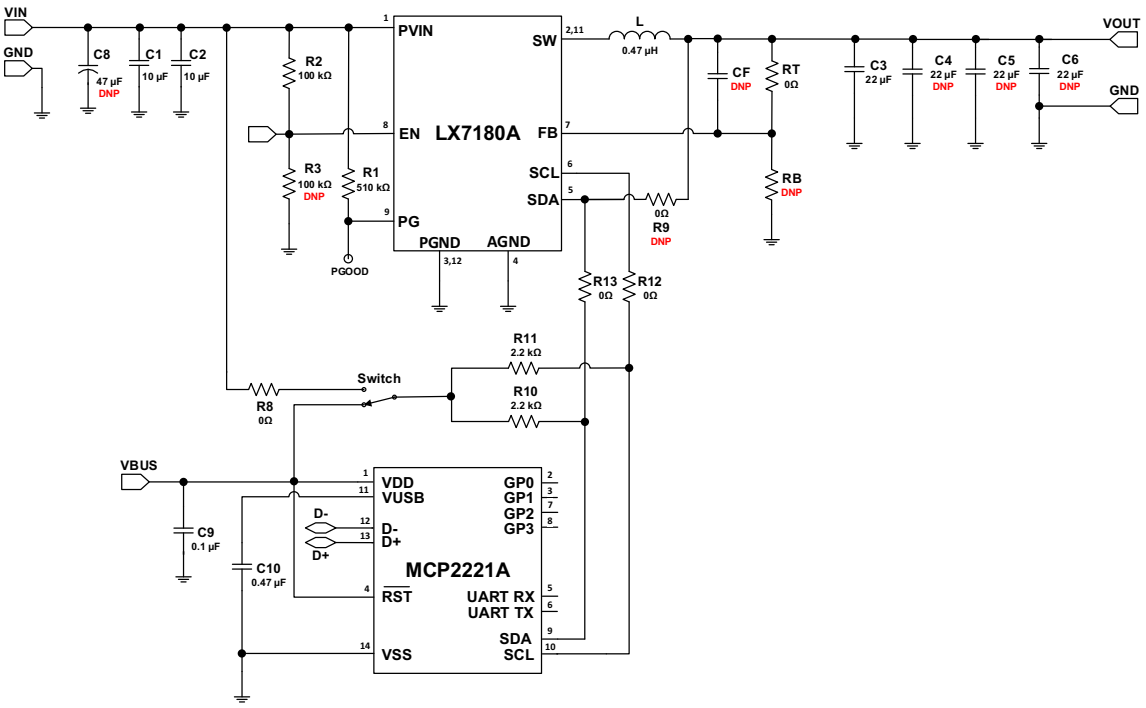
The LX7180A Evaluation Board kit includes:

- LX7180A Evaluation Board (EV17U26A)
- Important Information Sheet

Chapter 2. Installation and Operation

2.1 INTRODUCTION

The LX7180A operates from 3V to 5.5V rails, outputs 0.6V to 100% of the input voltage and can deliver an output current of up to 4A. Using the I^2C interface, V_{OUT} can be adjusted between 0.6V and 1.195V. The reference voltage is programmed with the I^2C bus 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 LX7180A Data Sheet for more information.

FIGURE 2-1: *Typical LX7180A Step-Down Converter Application @ 0.6V Output and MCP2221A for I^2C Communication.*

2.2 FEATURES

The LX7180A Evaluation Board has the following features:

- Input Voltage Range (V_{IN}): 3V - 5.5V (transients of up to 6.5V, for short durations)
- Output Voltage: 0.6V
- Output Current: typically, 4A @ 0.6V Output, 5V Input
- Power Save Mode (PSM) can be selected to improve light load efficiency
- PWM Switching Frequency: 1.65 MHz
- Hysteretic Control offers best transient response
- 100% Duty Ratio Operation
- Input Under Voltage and Over Voltage Protection
- Enable and Power Good Function
- I^2C Serial Interface at 3.4 Mbps
- Internal Soft Start
- Cycle-by-Cycle Over Current Protection
- Hiccup Mode protects against short circuit faults
- Seven Bit Adjustable Reference Voltage via I^2C Bus
- Overtemperature Protection (if the die temperature exceeds 150°C, with 25°C hysteresis)
- Ro-HS Compliant

2.3 GETTING STARTED

The LX7180A Evaluation Board is fully assembled and tested to evaluate and demonstrate the features of LX7180A. 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"**).

2.3.1 Power Input and Output Connection

2.3.1.1 POWERING THE LX7180A EVALUATION BOARD

The Evaluation Board provides a typical circuit application for a 0.6V output, used to evaluate the LX7180A 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 LX7180A 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 bellow:

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 Rating specified in the Data Sheet.
   Connect the load to VOUT and GND terminals; maximum load varies with input and output voltage (see the LX7180A Data Sheet 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 the PC, using a USB to Micro USB Cable.
3. To change the Mode of operation, to enable/disable the Input Overvoltage Protection and other features of the part, use the I^2C 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. During disable, 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 0.6V. 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.

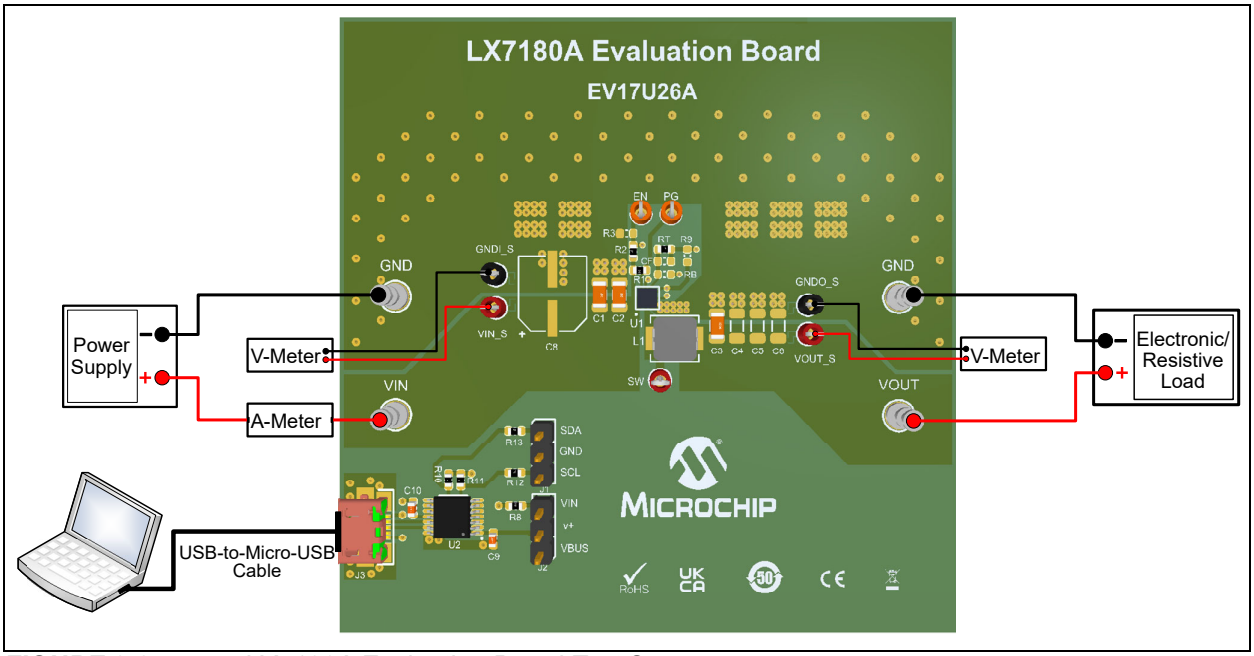


FIGURE 2-2: *LX7180A Evaluation Board Test Setup.*

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 with 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 (0.6V and 0.9V options available).

Note: Check the LX7180A Data Sheet for the Recommended Output Filter Components table.

2.3.1.4 PERFORMANCE EVALUATION

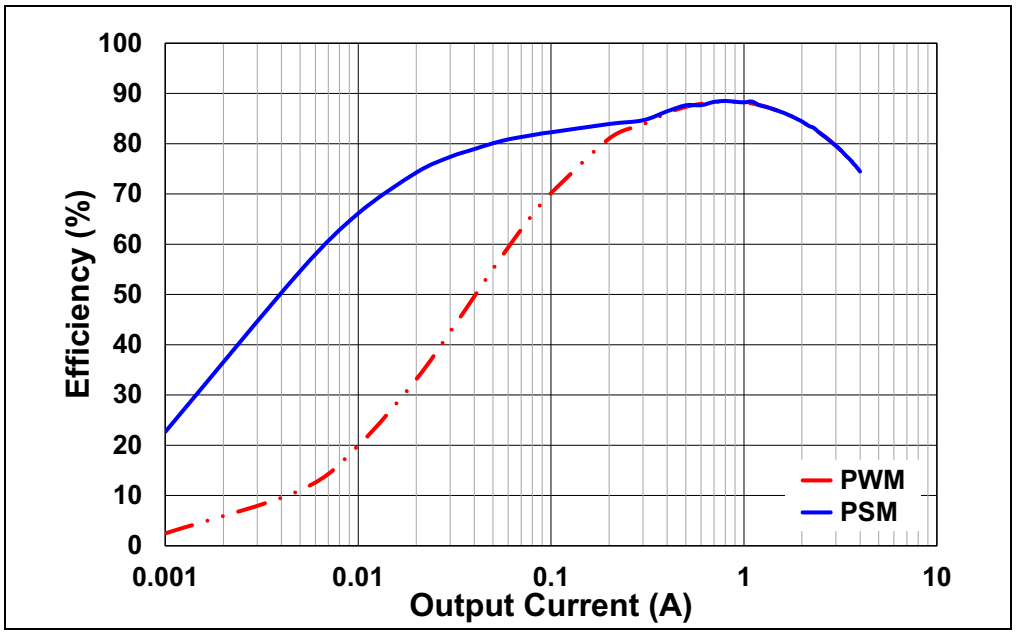


FIGURE 2-3: *LX7180A, Efficiency @ V_{OUT} = 0.6V, V_{IN} = 5V, L = 1 µH, C_{OUT} = 3 x 22 µF.*

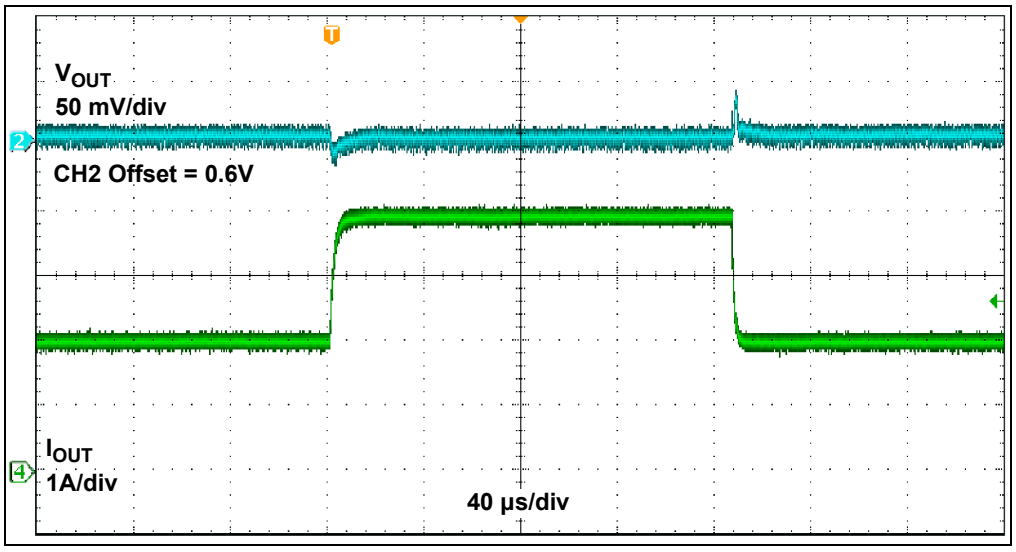


FIGURE 2-4: *LX7180A, Load Step Response, I_{LOAD} = 2A to 4A, L = 0.47 µH, C_{OUT} = 22 µF.*

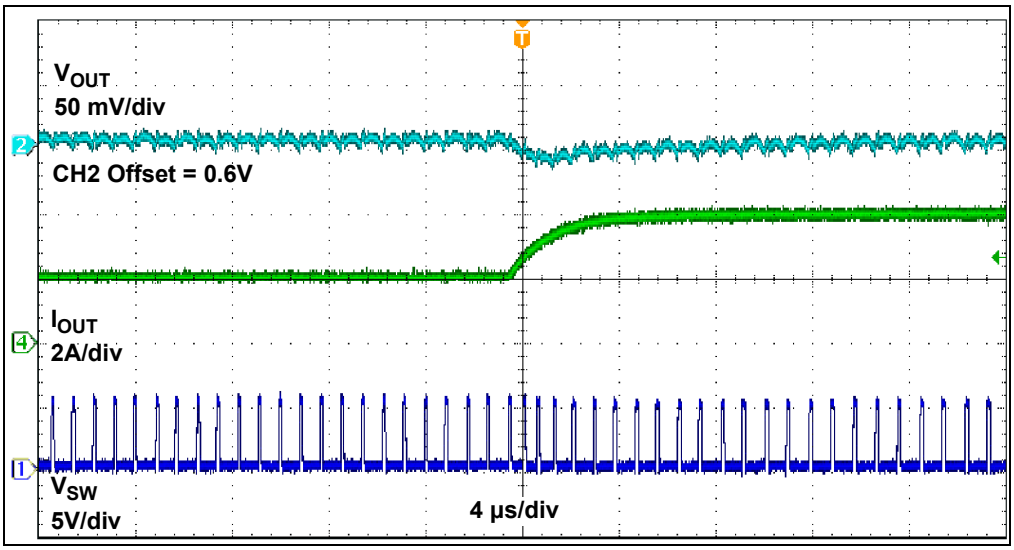


FIGURE 2-5: *LX7180A, Load Step Response, I_{LOAD} = 2A to 4A, L = 0.47 µH, C_{OUT} = 22 µF, Rising Edge.*

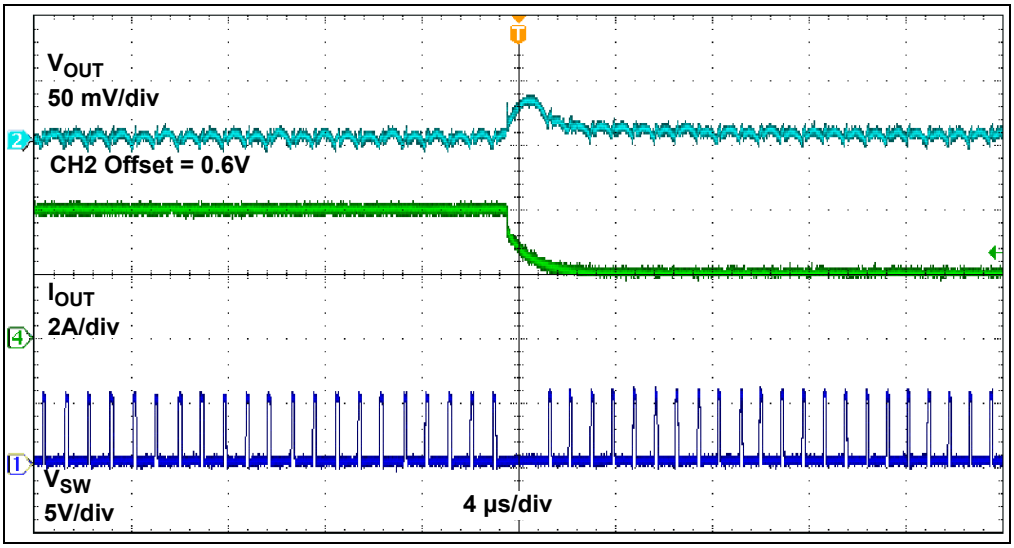


FIGURE 2-6: *LX7180A, Load Step Response, I_{LOAD} = 2A to 4A, L = 0.47 µH, C_{OUT} = 22 µF, Falling Edge.*

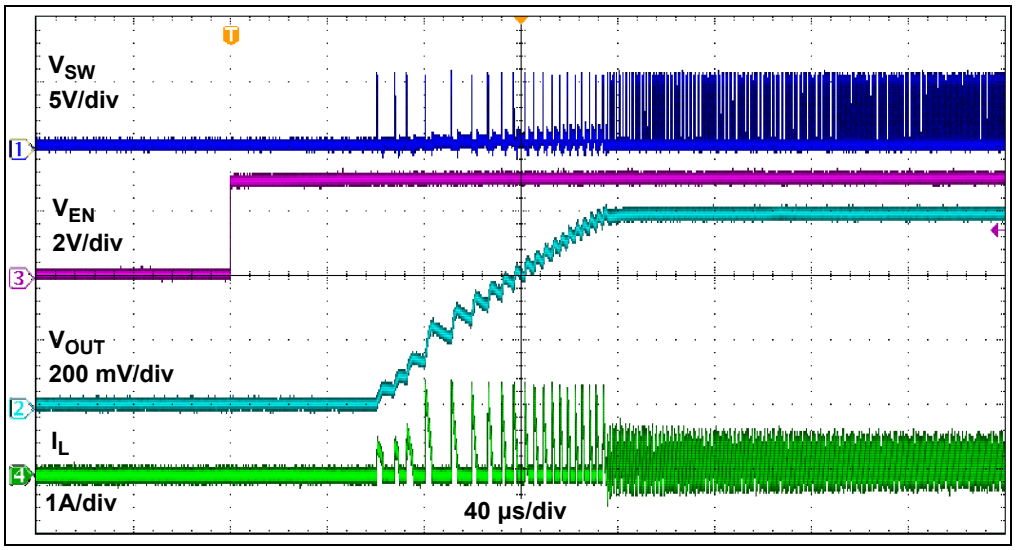


FIGURE 2-7: *LX7180A, Start-Up with Enable Pin Toggled, L = 0.47 µH, C_{OUT} = 22 µF.*

2.3.1.5 I²C PULL-UP VOLTAGE SELECTION

The LX7180A Evaluation Board is equipped with a jumper (JP2) for selecting the I^2C pull-up supply voltage. The J2 header can be used to select the I^2C pull-up voltage to either V_{BUS} or V_{IN}. If a different pull-up voltage is desired, it can be injected into the v+ pin of J2. In this case, make sure that no jumper is installed on header J2, to prevent shorting the externally injected pull-up voltage to either V_{BUS} or V_{IN}.

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 v.7.0.0.0)
- Microsoft®.NET Framework 4.5 or higher

3.1.2 Required Hardware

- LX7180A 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 (v.7.0.0.0) archive from www.microchip.com/LX7180A 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^2C Monitor Setup Wizard window, click the **Next** button to start the installation.

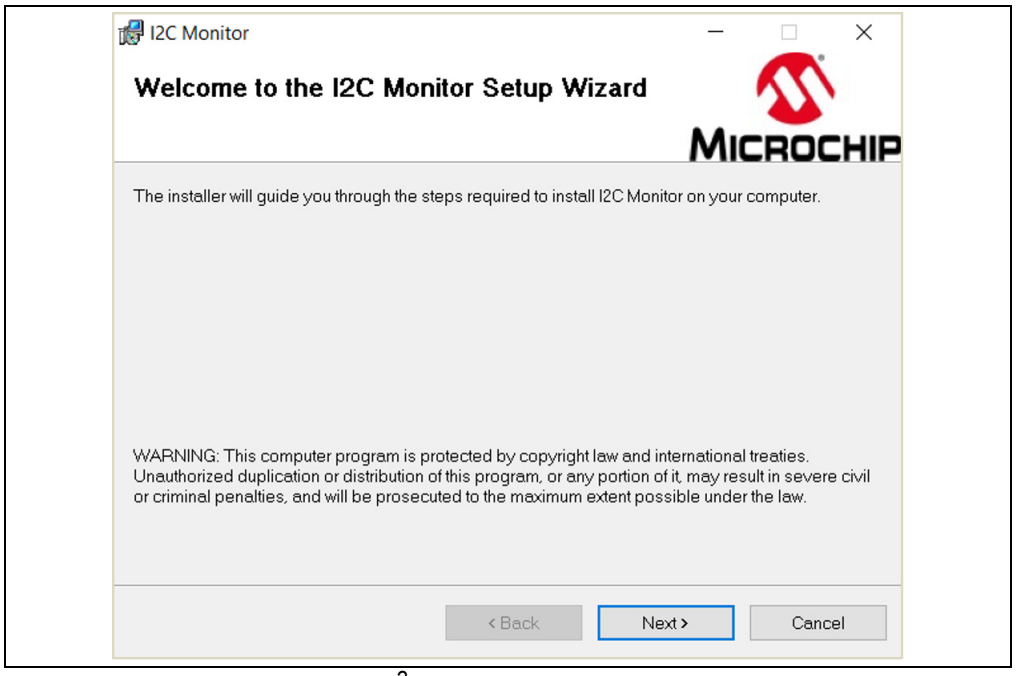


FIGURE 3-1: *Starting the I²C Monitor GUI Installation.*

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

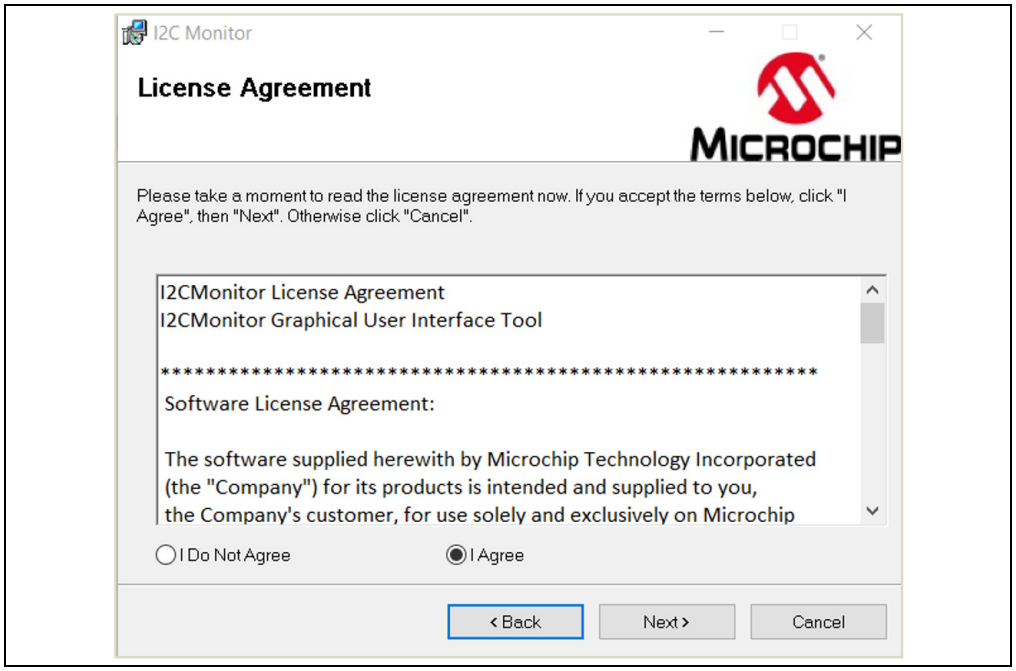


FIGURE 3-2: *License Agreement.*

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

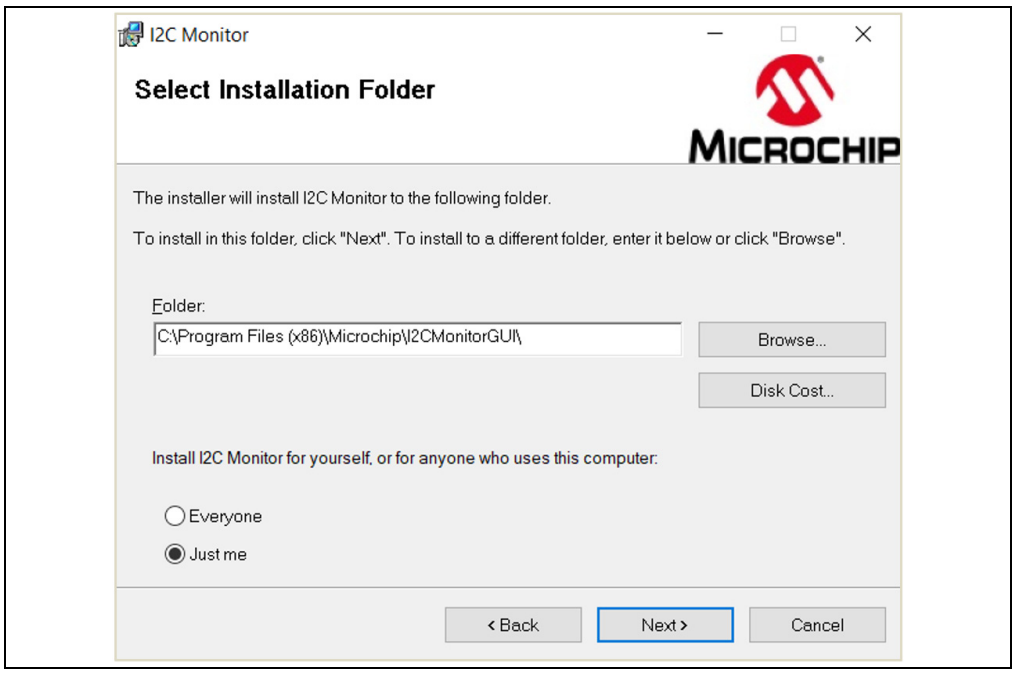


FIGURE 3-3: *Selecting the Destination Folder.*

8. To confirm installation, click the **Next** button to start the installation.

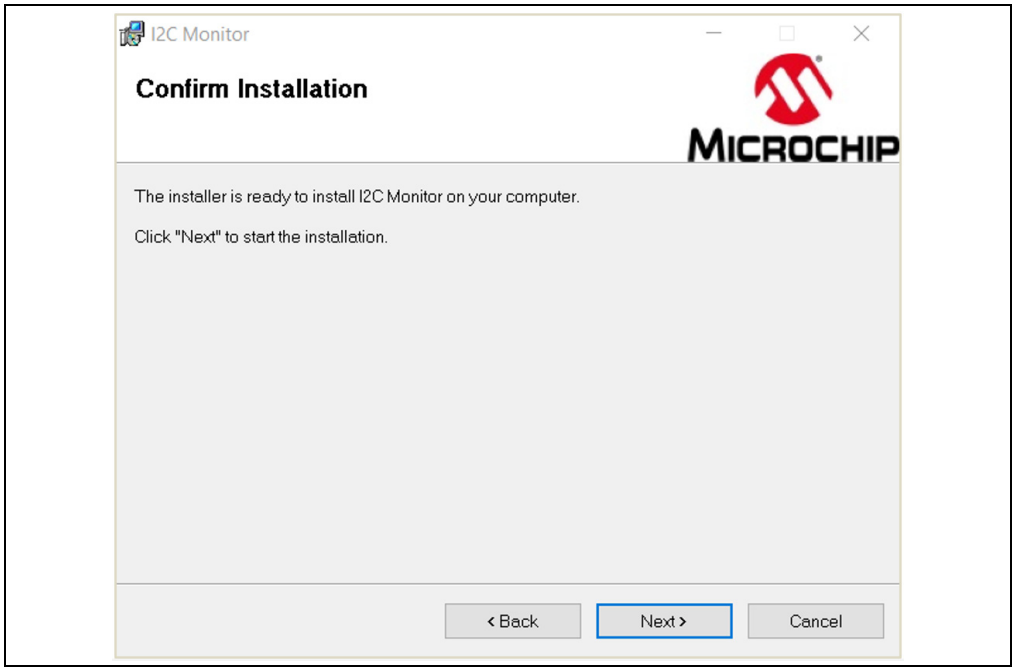


FIGURE 3-4: *Confirm Installation.*

9. In the Installing I2C Monitor window, the progress can be observed.

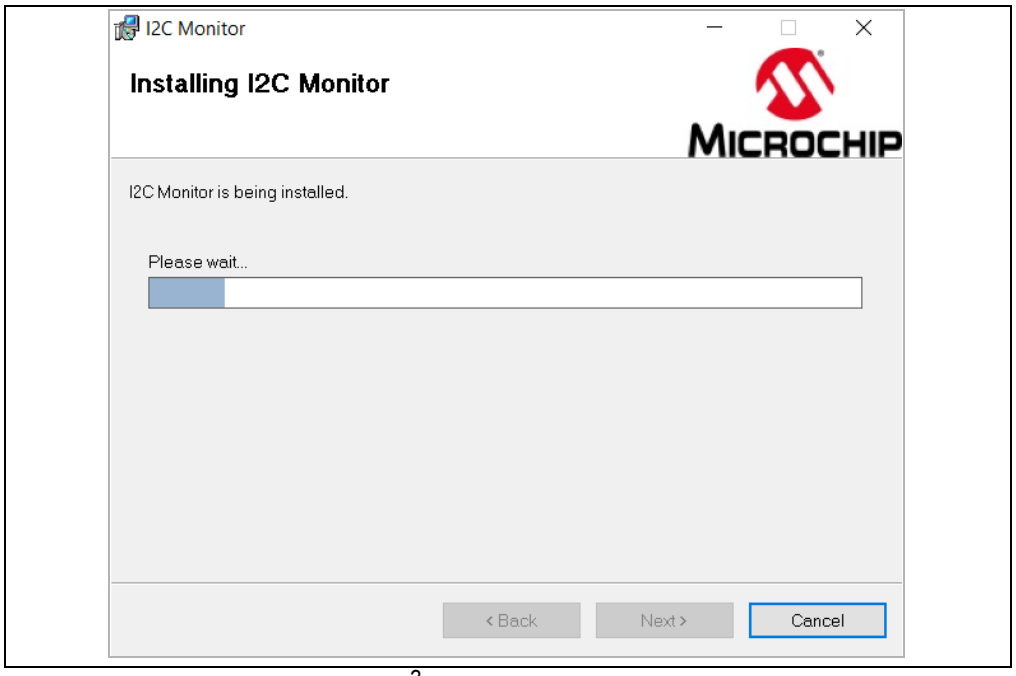


FIGURE 3-5: *Installing the I2C Monitor GUI.*

10. Once the installation is complete, click **Close** to end the installation. To start the GUI, either click the desktop icon or browse for "I2C Monitor" in the Windows Search bar.

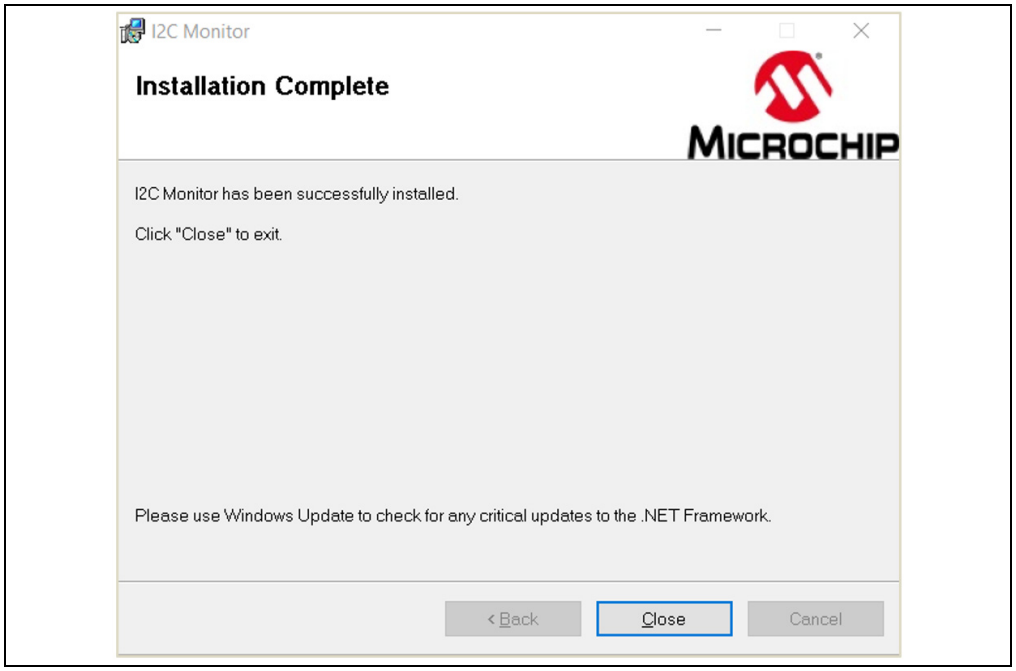


FIGURE 3-6: *The Installation Complete Window.*

Chapter 4. GUI Description

4.1 INTRODUCTION

This chapter describes how to operate the I²C Monitor GUI, using the LX7180A Evaluation Board included in the kit.

NOTICE

This chapter provides information regarding the use of the GUI that applies only for the LX7180A device. For other devices using the I²C Monitor GUI, refer to their specific Data Sheets and User's Guides.

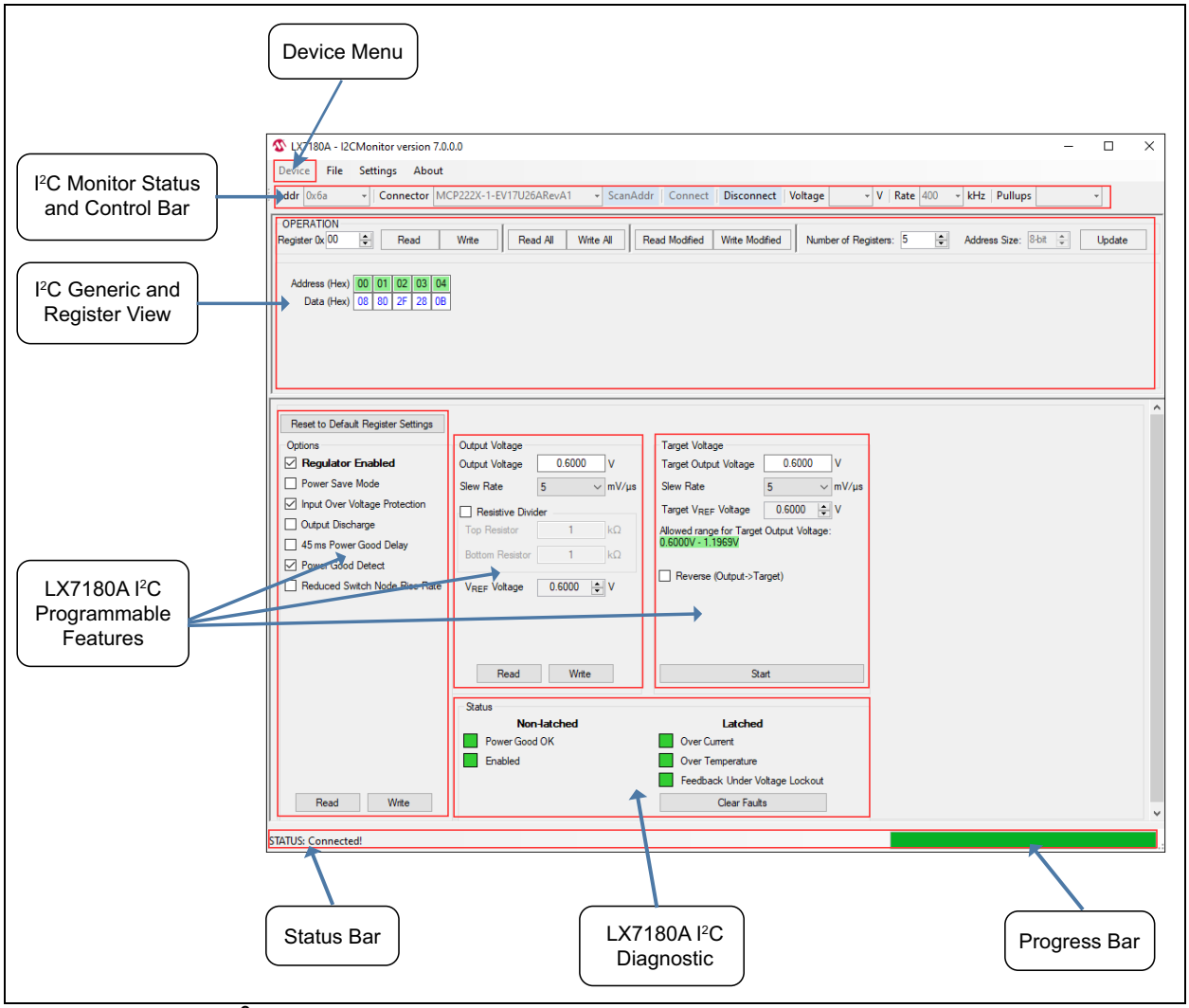


FIGURE 4-1: *I²C Monitor GUI Main Window - LX7180A View.*

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).

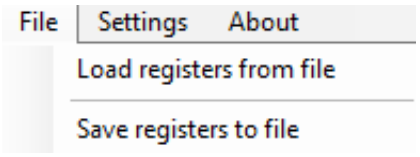


FIGURE 4-2: *File Menu.*

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.

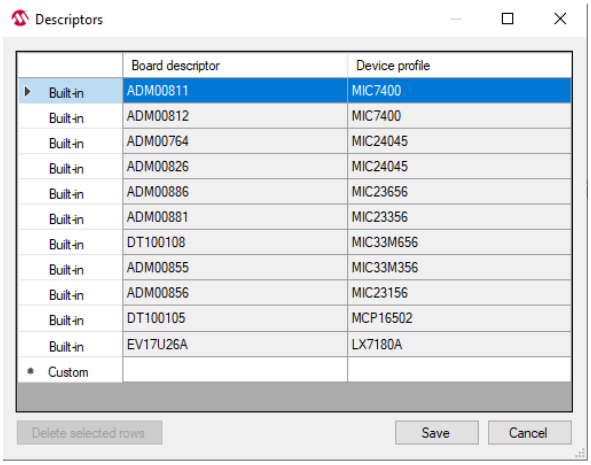


FIGURE 4-3: *Custom Board Menu.*

4.2.4 I²C Monitor Status and Control Bar

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

FIGURE 4-4: *I²C 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 bridge the board.
ScanAddr	This button is used to scan for a valid address.
Connect/Disconnect	These buttons are used to connect/disconnect the current 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 for the communication 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 any evaluated device.

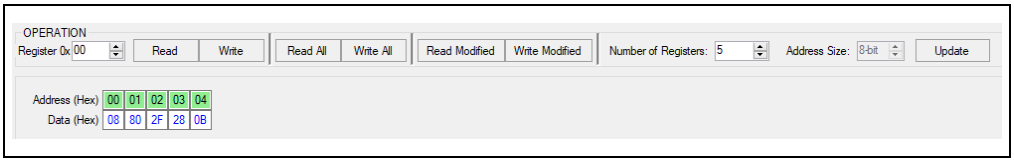


FIGURE 4-5: *Generic Register View Area.*

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 the number of available registers for read/write operations in the register area.
Register Area		This section shows the current status of the registers address and their content.

The specific registers for LX7180A are described in **Appendix C. “LX7180A Control Register Bit Definition”**.

4.2.6 LX7180A I²C Programmable Features

The LX7180A I²C "Programmable Features" area contains the items listed in Table 4-3.

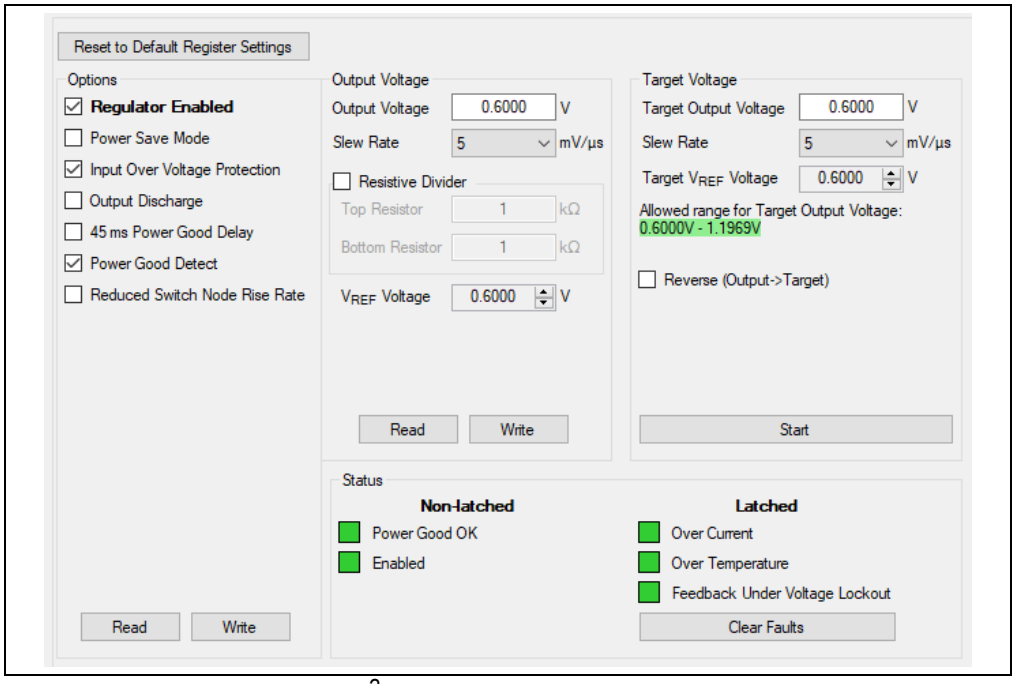


FIGURE 4-6: *LX7180A I²C Programmable Features, Resistive Divider Disabled.*

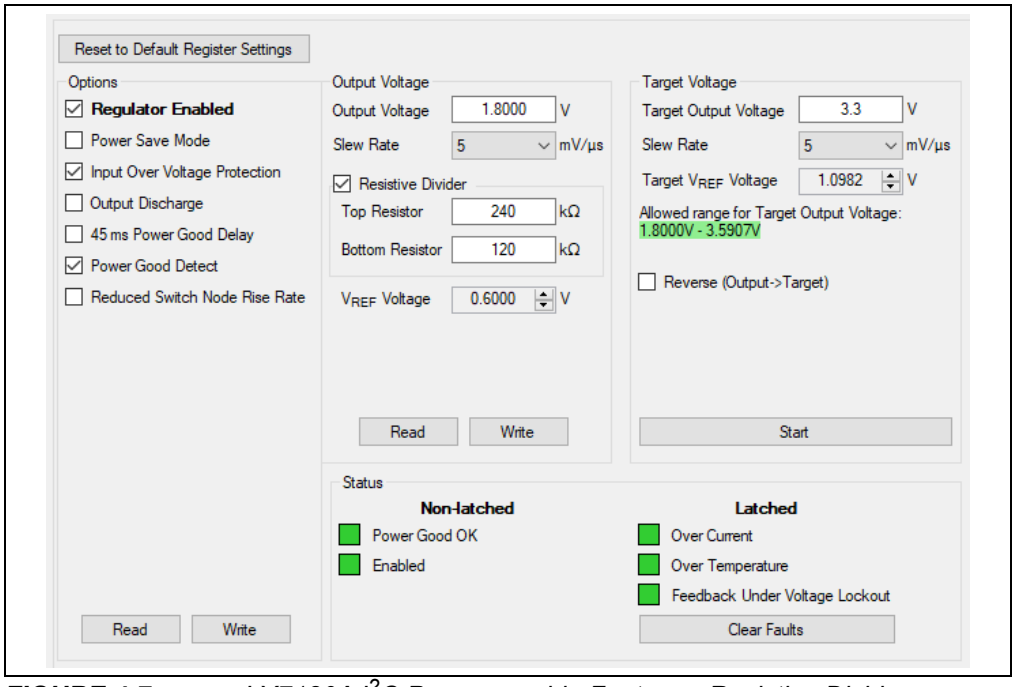


FIGURE 4-7: *LX7180A I²C Programmable Features, Resistive Divider Enabled.*

TABLE 4-3: LX7180A I²C PROGRAMMABLE FEATURES

Panel/Button	Items	Description
Options	Regulator Enabled	This check box allows 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 for enabling the Power Save Mode, uncheck the box for PWM only mode.
	Input Overvoltage Protection	This check box allows to enable/disable the Input Overvoltage Protection. If the box is checked, when the Over Voltage Rising Threshold (see LX7180A Data Sheet, Electrical Characteristics table) is exceeded, the output is immediately shut off to protect against permanent damage. If the box is unchecked, the device will continue to operate even after the Over Voltage Rising Threshold is exceeded.
	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.
	Power Good Detect	This check box allows the Power Good detection configuration. If checked, PGOOD will detect both a positive and a negative excursion of V_{OUT} from the reference. If unchecked, PGOOD senses only a negative excursion of V_{OUT} from the reference.
	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.
	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-1.1969V. If the Resistive Divider option is enabled, the V_{OUT} range can be extended to 5.5V.
	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	In this area, an error message is displayed 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: LX7180A 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-1.1969V. If the Resistive Divider option is checked, then the target V_{OUT} range can be extended to 5.5V. 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 an invalid value is set, then an **Out of range!** message is displayed.
	Reverse (Output ->Target)	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, it will return to the *Output Voltage* value, see Figure 4-8 (case 3).
	Start	When this button is pressed, a transition from the *Output Voltage* to the *Target Output Voltage* starts, see Figure 4-8 (case 1). If the Reverse (Output -> Target) is checked, then a transition from the *Target Output Voltage* to the *Output Voltage* occurs, see Figure 4-8 (case 2).
Reset to Default Register Settings		When this button is pressed, the registers are set to their default values. Check **Appendix C. "LX7180A Control Register Bit Definition"**.

This area of the GUI allows the user to modify the device features. For additional information on the part, refer to the Data Sheet.

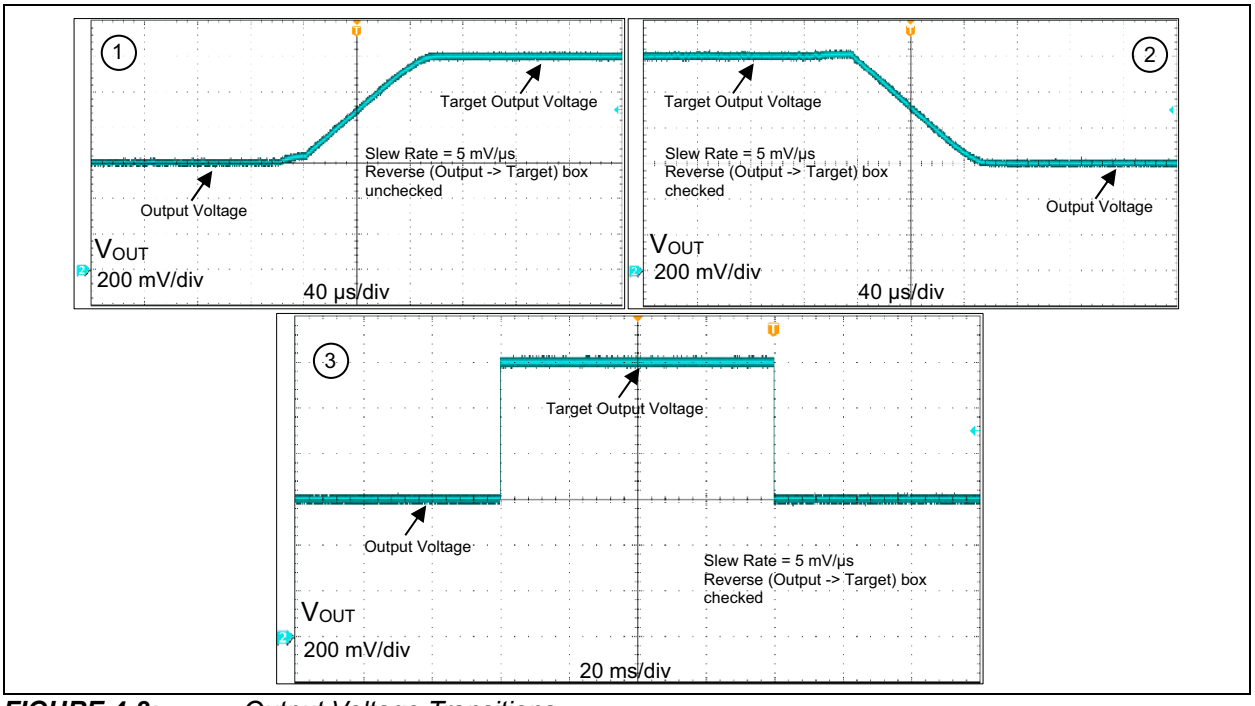


FIGURE 4-8: *Output Voltage Transitions.*

4.2.7 LX7180A I²C Diagnostic

The LX7180A Diagnostic area contains the items listed in Table 4-4.

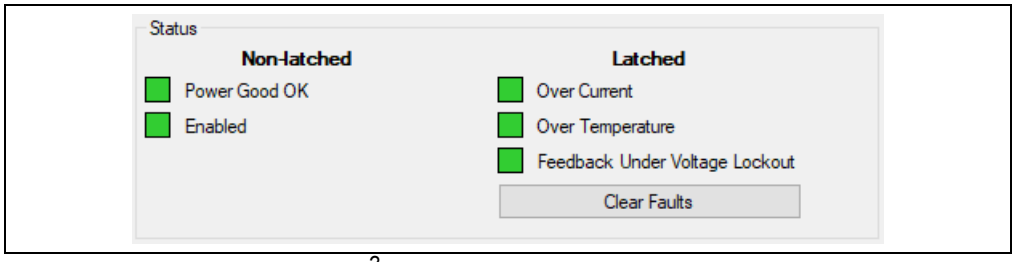


FIGURE 4-9: *LX7180A I²C Diagnostic Area.*

TABLE 4-4: LX7180A 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 over current 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 over temperature 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 under voltage event occurs and it is latched to '1'. Press **Clear Faults** button to reset the status flag.

The LX7180A 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 pressing the **Clear Faults** button or by power cycling the device. Status bits are set when the corresponding Fault condition has occurred and return to '1' 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 LABLES

Item	Description
STATUS: Connected!	This message is shown when the GUI gets connected to a device.
STATUS: Disconnected!	This message is shown when the GUI gets disconnected from a device.

NOTES:

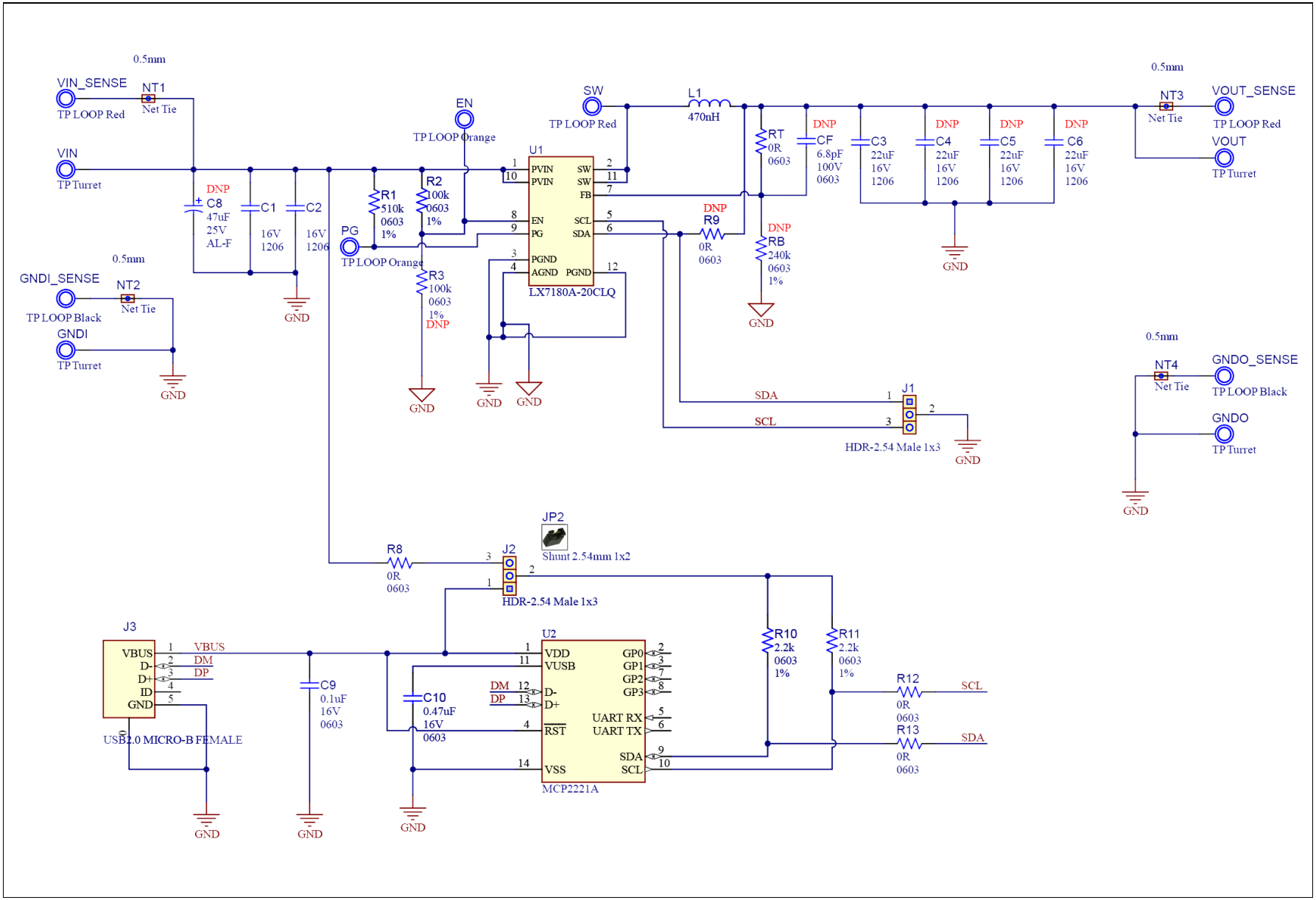
Appendix A. Schematic and Layouts

A.1 INTRODUCTION

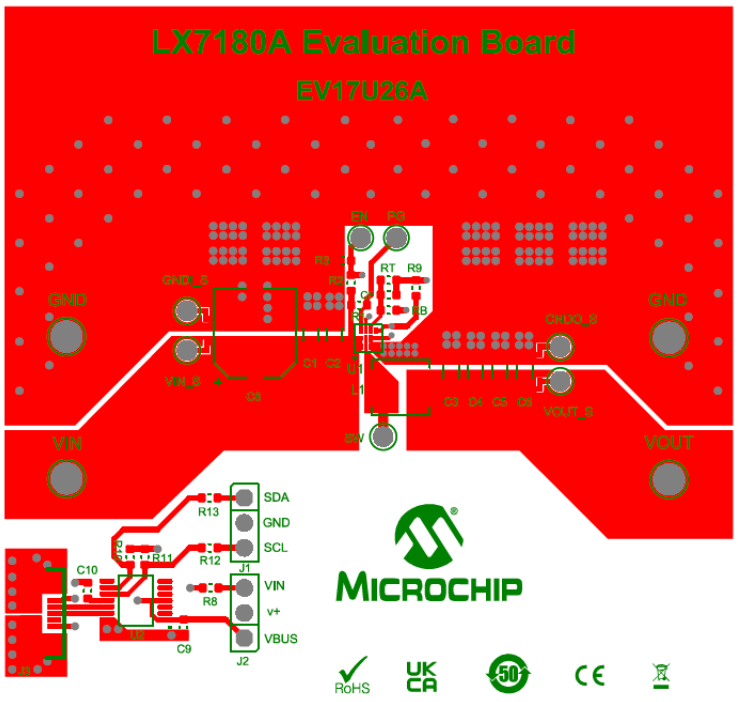
This appendix contains the following schematic and layouts for the LX7180A Evaluation Board:

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

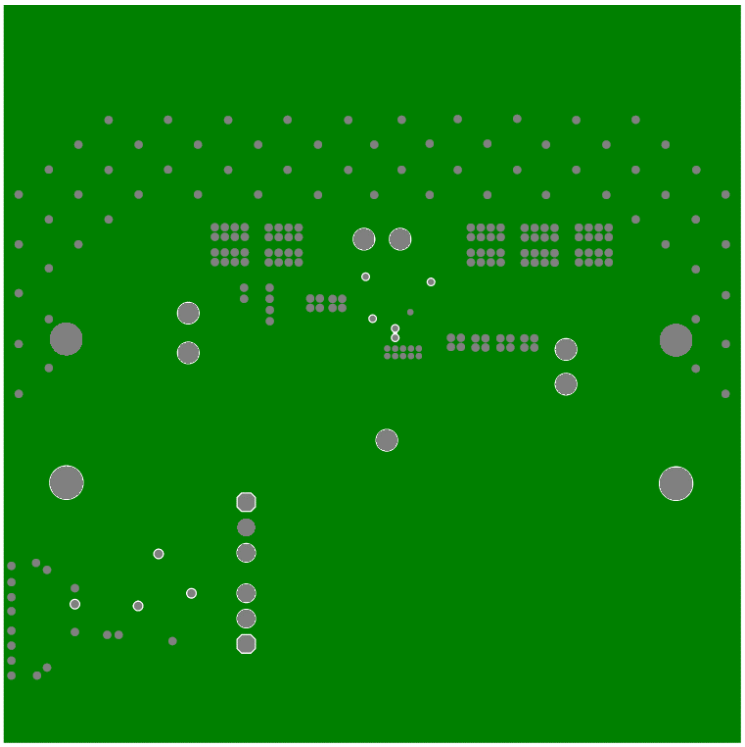
A.2 BOARD – SCHEMATIC



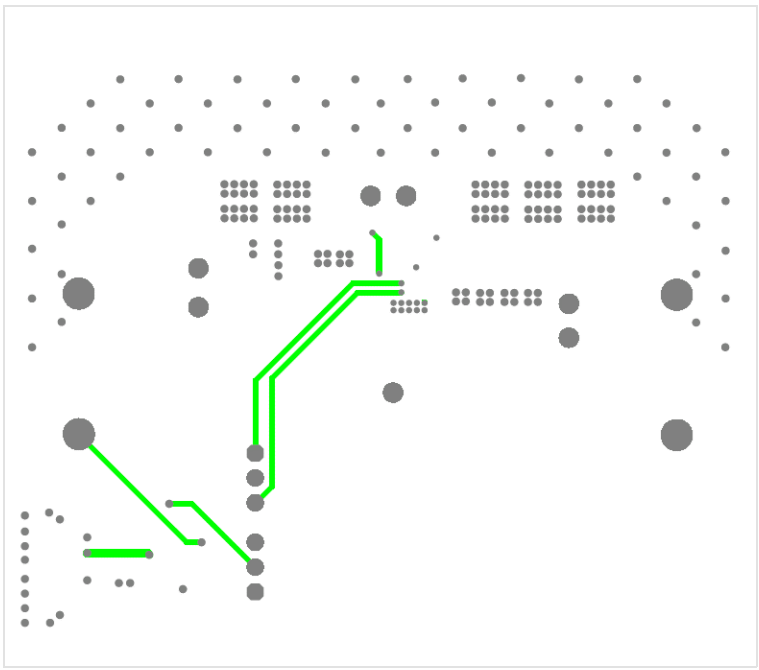
A.3 BOARD – TOP COPPER AND SILK LAYER



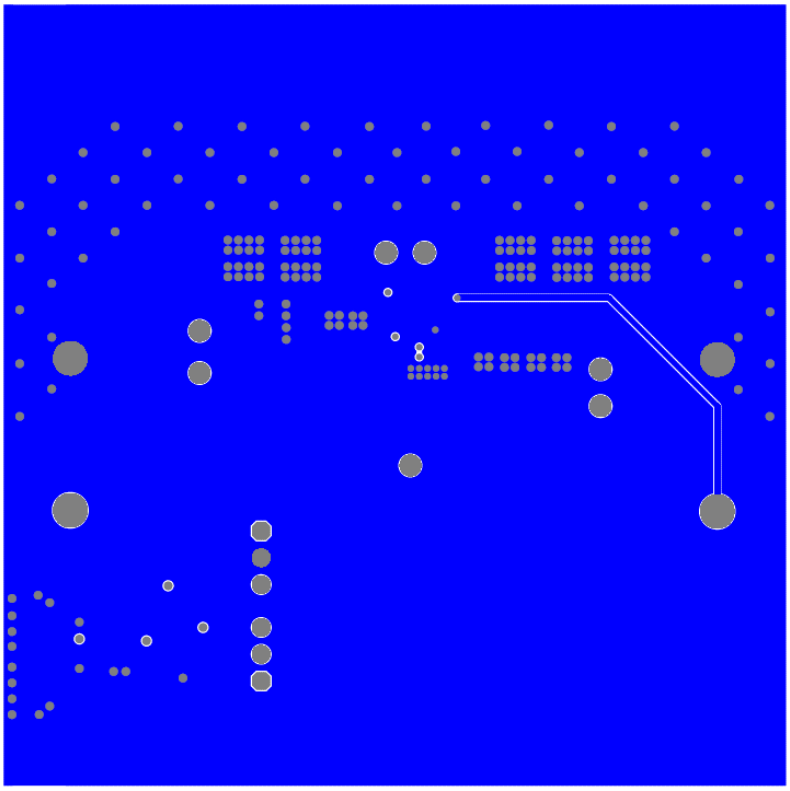
A.4 BOARD – SIGNAL LAYER 1



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
2	C1, C2	Capacitor, Ceramic, 10 µF, 16V, 10%, X7R, SMD, 1206	Kyocera AVX	1206YC106KAT2A
1	C3	Capacitor, Ceramic, 22 µF, 16V, 20%, X7R, SMD, 1206	Taiyo Yuden Co., Ltd.	EMK316BB7226ML-T
1	C9	Capacitor, Ceramic, 0.1 µF, 16V, 10%, X7R, SMD, 0603	Taiyo Yuden Co., Ltd.	EMK107B7104KA-T
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	Amphenol ICC (FCI)	10118192-0001LF
1	JP2	Mechanical HW Jumper, 2.54 mm, 1x2	Amphenol ICC (FCI)	63429-202LF
1	L1	Inductor, 470 nH, 12.2A, 20%, SMD	Vishay Intertechnology, Inc.	IHLP2020CZERR47M01
4	PAD1, PAD2, PAD3, PAD4	Mechanical HW Rubber Pad, Bumpon™ Hemisphere, 0.44" x 0.20", Black	3M	SJ-5003 (BLACK)
1	R1	Resistor, TKF, 510 kΩ, 1%, 1/10W, SMD, 0603	Panasonic® - ECG	ERJ-3EKF5103V
1	R2	Resistor, TF, 100 kΩ, 1%, 1/8W, SMD, 0603	Vishay Intertechnology, Inc.	MCT06030C1003FP500
4	R8, R12, R13, RT	Resistor, TKF, 0Ω, 1/10W, SMD, 0603	Panasonic® - ECG	ERJ-3GEY0R00V
2	R10, R11	Resistor, TF, 2.2 kΩ, 1%, 1/8W, SMD, 0603	Vishay Intertechnology, Inc.	MCT06030C2201FP500
3	SW, VIN_SENSE, VOUT_SENSE	Test Point, Multi Purpose, Mini, Red	Keystone® Electronics Corp.	5000
1	PCB	LX7180A Evaluation Board – Printed Circuit Board	—	04-11729

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 Switcher Buck, 5.5V to 0.6V, QFN-12	Microchip Technology Inc.	LX7180A-20CLQ-TR
1	U2	Interface, USB I^2C UART, MCP2221A-I/ST, 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) – DO NOT POPULATE PARTS

Qty	Reference	Description	Manufacturer	Part Number
3	C4, C5, C6	Capacitor, Ceramic, 22 µF, 16V, 20%, X7R, SMD, 1206	Taiyo Yuden Co., Ltd.	EMK316BB7226ML-T
1	C8	Capacitor, Aluminum, 47 µF, 25V, 20%, SMD F	Panasonic® - ECG	ECE-V1HA470UP
1	CF	Capacitor, Ceramic, 6.8 pF, 100V, 5%, C0G, SMD, 0603	Kyocera AVX	06031A6R8JAT2A
1	R3	Resistor, TF, 100 kΩ,1%, 1/8W, SMD, 0603	Vishay Intertechnology, Inc.	MCT06030C1003FP500
1	R9	Resistor, TKF, 0Ω, 1/10W, SMD, 0603	Panasonic® - ECG	ERJ-3GEY0R00V
1	RB	Resistor, TKF, 240 kΩ, 1%, 1/10W, SMD, 0603	Panasonic® - ECG	ERJ-3EKF2403V

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. LX7180A Control Register Bit Definition

TABLE C-1: LX7180A CONTROL REGISTER BIT DEFINITION

Bit	Name	Value	Description
Status, Address 00h			
7:3	Reserved		
2	OCP	0-d	Latched to 1 if the over current limit is reached. Write a '1' to reset the status flag.
1	OTP	0-d	Latched to 1 if an over temperature 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 0.6V.
Ctrl1, Address 02h, (aka reg2)			
7:6	Reserved	00-d	
5	DLY_DIS	1-d	45 ms delay on PGOOD is disabled when this bit is high.
4	ctrl1	0-d	Not used.
3	SW_RATE	1-d	Normal high efficiency rise rate.
		0	Reduced switch node rise rate.
2	PG_LOHI	1-d	PGOOD will detect both positive and negative excursion of V_{OUT} from the reference.
		0	PGOOD senses only the negative voltage excursion of V_{OUT} from the reference.
1	VIN_OVP	1-d	When V_{IN} reaches the Over Voltage Rising Threshold OVP_R, the converter turns off.
		0	V_{IN} OVP disabled. The Converter will continue to operate.
0	MODE	1-d	PWM - Always run in Continuous Conduction Mode.
		0	PSM - Power Save Mode allows the converter to run in Discontinuous 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	VREF	00	Designates the default output voltage version: 00 = 0.6 V; 01 = 0.9 V.
Ctrl2, Address 04h, (aka reg4)			
7:6	Reserved		
5	GO	1	Write '1' to this bit 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: LX7180A CONTROL REGISTER BIT DEFINITION (CONTINUED)

Bit	Name	Value	Description
2:0	SLEW	000	Reserved.
		001	Reserved.
		010	V_{REF} slews at 2.5 mV/µs.
		011-d	V_{REF} slews at 5 mV/µs; this is the default setting.
		100	V_{REF} slews at 10 mV/µs.
		101	V_{REF} slews at 20 mV/µs.
		110	V_{REF} slews at 40 mV/µs.
		111	Single Step Mode: No slew rate limiting.

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