



MCP1630 1A Bias Supply Demo Board User's Guide

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MCP1630 1A BIAS SUPPLY DEMO BOARD USER'S GUIDE

Table of Contents

| | |
|---|-----------|
| Preface | 1 |
| Chapter 1. Product Overview | 5 |
| 1.1 Introduction | 5 |
| 1.2 What is the MCP1630 1A Bias Supply Demo Board? | 6 |
| 1.3 What the MCP1630 1A Bias Supply Demo Board Kit Includes | 6 |
| Chapter 2. Installation and Operation | 7 |
| 2.1 Introduction | 7 |
| 2.2 Features | 7 |
| 2.3 Getting Started | 8 |
| Appendix A. Schematic and Layouts | 11 |
| A.1 Introduction | 11 |
| A.2 Board Schematic | 12 |
| A.3 Board – Assembly Drawing | 13 |
| A.4 Board – Top Overlay | 14 |
| A.5 Board – Top Layer | 15 |
| A.6 Board – Bottom Layer | 16 |
| Appendix B. Bill-Of-Materials (BOM) | 17 |
| Appendix C. Evaluation Board Firmware | 19 |
| C.1 Device Firmware | 19 |
| Worldwide Sales and Service | 20 |

MCP1630 1A Bias Supply Demo Board User's Guide

NOTES:



MCP1630 1A BIAS SUPPLY DEMO BOARD USER'S GUIDE

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 "DSXXXXA", where "XXXX" is the document number and "A" is the revision level of the document.

INTRODUCTION

This chapter contains general information that will be useful to know before using the MCP1630 1A Bias Supply 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 MCP1630 1A Bias Supply Demo Board. The manual layout is as follows:

- **Chapter 1. "Product Overview"** – Important information about the MCP1630 1A Bias Supply Demo Board.
- **Chapter 2. "Installation and Operation"** – Includes a description of the demo board, as well as instructions on how to get started.
- **Appendix A. "Schematic and Layouts"** – Shows the schematic and layout diagrams for the MCP1630 1A Bias Supply Demo Board.
- **Appendix B. "Bill-Of-Materials (BOM)"** – Lists the parts used to build the MCP1630 1A Bias Supply Demo Board.
- **Appendix C. "Evaluation Board Firmware"** – Provides information about the application firmware and the location of the source code.

MCP1630 1A Bias Supply Demo Board User's Guide

CONVENTIONS USED IN THIS GUIDE

This manual uses the following documentation conventions:

DOCUMENTATION CONVENTIONS

| Description | Represents | Examples |
|--|---|---|
| Arial font: | | |
| Italic characters | Referenced books | <i>MPLAB[®] IDE User's Guide</i> |
| | Emphasized text | ...is the <i>only</i> 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 | <u><i>File>Save</i></u> |
| Bold characters | A dialog button | Click OK |
| | A tab | Click the Power tab |
| Text in angle brackets < > | A key on the keyboard | Press <Enter>, <F1> |
| Courier font: | | |
| Plain Courier | 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 | A variable argument | <i>file.o</i> , where <i>file</i> can be any valid filename |
| Square brackets [] | Optional arguments | mcc18 [options] <i>file</i> [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 MCP1630 1A Bias Supply Demo Board. The following Microchip documents are available and recommended as supplemental reference resources.

MCP1630 Data Sheet, “High-Speed, Microcontroller-Adaptable, Pulse Width Modulator”, (DS21896)

This data sheet provides detailed information regarding the MCP1630 product family.

MCP1701 Data Sheet, “2 μ A Low-Dropout Positive Voltage Regulator”, (DS21874)

This data sheet provides detailed information regarding the MCP1701 product family.

PIC10F200 Data Sheet, “6-Pin, 8-Bit Flash Microcontrollers”, (DS41239)

This data sheet provides detailed information regarding the PIC10F200 product family.

THE MICROCHIP WEB SITE

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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

MCP1630 1A Bias Supply Demo Board User's Guide

CUSTOMER SUPPORT

Users of Microchip products can receive assistance through several channels:

- Distributor or Representative
- Local Sales Office
- Field Application Engineer (FAE)
- Technical Support
- Development Systems Information Line

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://support.microchip.com>

DOCUMENT REVISION HISTORY

Revision A (June 2005)

- Initial Release of this Document.

Chapter 1. Product Overview

1.1 INTRODUCTION

The MCP1630 1A Bias Supply Demo Board is used to evaluate Microchip's MCP1630 in a SEPIC power converter application. As provided, the MCP1630 1A Bias Supply Demo Board generates a 3.3V or 5.0V output from an input voltage of 9V, $\pm 20\%$. The MCP1630 1A Bias Supply Demo Board provides a regulated output for load currents up to 1A.

This chapter covers the following topics:

- What is the MCP1630 1A Bias Supply Demo Board?
- What the MCP1630 1A Bias Supply Demo Board Kit Includes

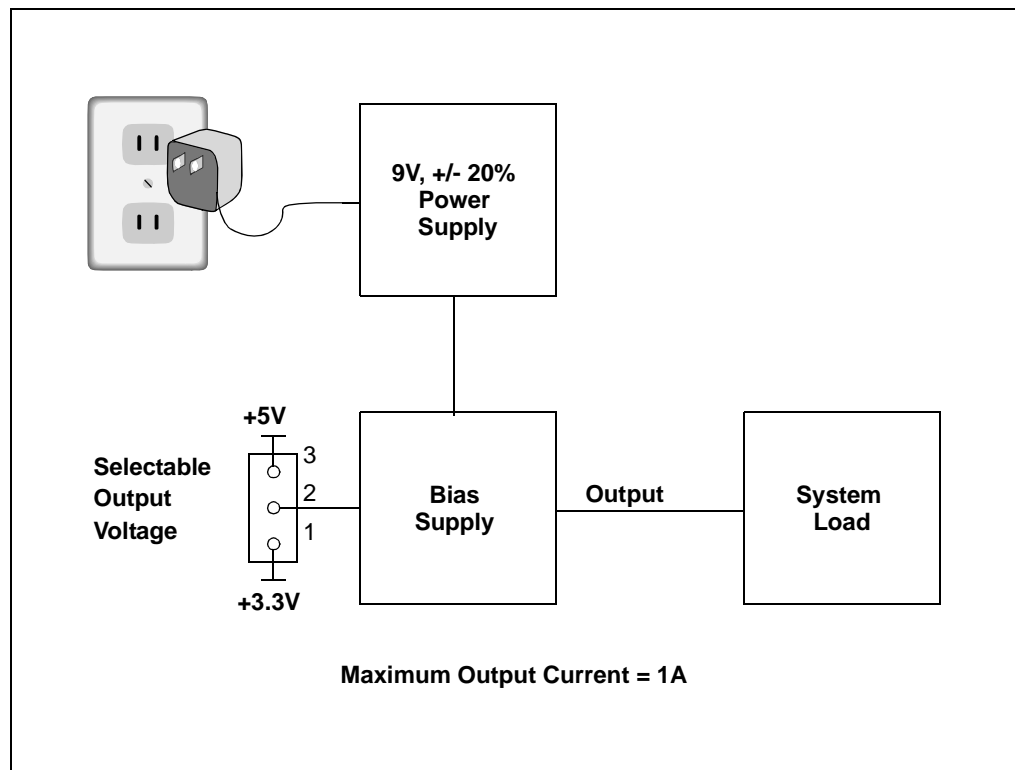


FIGURE 1-1: MCP1630 1A Bias Supply Demo Board System Block Diagram.

MCP1630 1A Bias Supply Demo Board User's Guide

1.2 WHAT IS THE MCP1630 1A BIAS SUPPLY DEMO BOARD?

The MCP1630 1A Bias Supply Demo Board is a complete, step-down, switch-mode, dc-dc power converter. The MCP1630 1A Bias Supply Demo Board generates a regulated output voltage for systems requiring a bias of 3.3V or 5V at load currents up to 1A. Different output voltages can be obtained with minor modifications to the firmware and/or hardware.

This board utilizes Microchip's MCP1630 (High-Speed PIC[®] MCU PWM MSOP8), MCP1701 (Low-Dropout Linear Regulator SOT-23A) and PIC10F200 (Flash MCU SOT23-6). The input voltage range for the demo board is 7.2V to 11.8V. The output is capable of providing up to 1A constant output current.

An input power jack is provided to apply the input voltage to the bias supply. An output header is provided as a means to connect the external system load. A programming header is available for updating the firmware contained in the PIC10F200.

1.3 WHAT THE MCP1630 1A BIAS SUPPLY DEMO BOARD KIT INCLUDES

This MCP1630 1A Bias Supply Demo Board Kit includes:

- The MCP1630 1A Bias Supply Demo Board Board (102-00046)
- MCP1630 1A Bias Supply Demo Board User's Guide (DS51564A).
- MCP1630 Data Sheet, "*High-Speed, Microcontroller-Adaptable, Pulse Width Modulator*", (DS21896)
- MCP1701 Data Sheet, "*2 μ A Low-Dropout Positive Voltage Regulator*", (DS21874)
- PIC10F200 Data Sheet, "*6-Pin, 8-Bit Flash Microcontrollers*", (DS41239)

Chapter 2. Installation and Operation

2.1 INTRODUCTION

The MCP1630 1A Bias Supply Demo Board demonstrates Microchip's MCP1630 high-speed Pulse Width Modulator (PWM) used in a step-down, switch-mode, dc-dc power converter. The MCP1630 is a high-speed, microcontroller-adaptable PWM. When used in conjunction with a microcontroller, the MCP1630 will control the power system duty cycle to provide output voltage or current regulation. The PIC10F200 microcontroller can be used to regulate output voltage or current, switching frequency and maximum duty cycle. The MCP1630 generates duty cycle and provides fast overcurrent protection based on various external inputs. External signals include the input oscillator, the reference voltage, the feedback voltage and the current sense. The output signal is a square-wave pulse. The power train used for the MCP1630 1A Bias Supply Demo Board is a Single-Ended Primary Inductive Converter (SEPIC).

2.2 FEATURES

The MCP1630 1A Bias Supply Demo Board has the following features:

- Selectable regulated output voltage: 3.3V or 5.0V
- Maximum output current: 1A
- Foldback current limiting
- Cycle-by-cycle peak current limit
- Output present indicator
- Soft-start capability by holding the reference voltage low during power-up
- The MCP1630 1A Bias Supply Demo Board has the flexibility to modify the regulated output voltage, optimize the soft-start time or disable the output by modifying the firmware contained in the PIC10F200
- Proprietary features can be added by modifying the firmware contained in the PIC10F200
- The factory-programmed source code is available
- Adaptable to environmental effects such as ambient temperature
- Typical efficiency: 85%

MCP1630 1A Bias Supply Demo Board User's Guide

2.3 GETTING STARTED

The MCP1630 1A Bias Supply Demo Board is fully assembled and tested for generating a regulated, selectable 3.3V or 5.0V output voltage. The MCP1630 1A Bias Supply Demo Board requires the use of an external input voltage source (+9V, $\pm 20\%$).

2.3.1 Power Input and Output Connections

Powering the MCP1630 1A Bias Supply Demo Board

1. Apply the input voltage to the input power jack (J2). The input voltage source should be limited to the 0V to +11.8V range. For normal operation, the input voltage should be between +7.2V and +11.8V, not to exceed an absolute maximum of +12V.
2. The inside portion of the input power plug must be positive. The outer jacket of the input power plug must be negative. Refer to Figure 2-1.

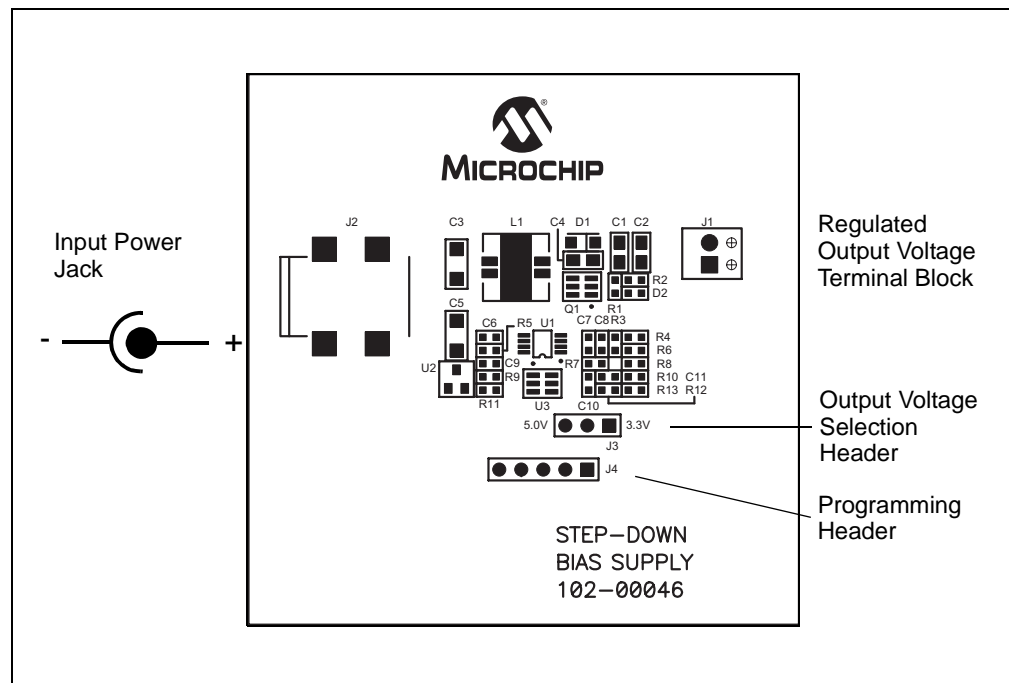


FIGURE 2-1: Set-Up Configuration Diagram.

Apply the load to the regulated output voltage terminal block

1. To apply a load to the MCP1630 1A Bias Supply Demo Board, the positive side (+) of the load should be connected to pin 2 of J1. The negative side (-) of the load should be connected to pin 1 of J1. Care should be taken when using electronic loads.

Regulated output voltage selection

1. The regulated output voltage can be selected to be either 3.3V or 5.0V. The regulated output voltage is selected by placing a shorting jumper on the Output Voltage Selection Header (J3). By shorting pins 1 and 2, the regulated output voltage will be 3.3V. By shorting pins 2 and 3, the regulated output voltage will be 5.0V.
2. If a shorting jumper is not present, the regulated output voltage will default to 5.0V.
3. The output voltage selection input is read by the PIC10F200 at power-up only. Therefore, the output voltage cannot be changed dynamically without modification of the factory-installed firmware. Input power must be removed or cycled in order for a change to take effect.

Output voltage present indication

The MCP1630 1A Bias Supply Demo Board has a LED to indicate the presence of output voltage. The LED will be illuminated when the output voltage is present.

Programming

Header J4 is provided for in-system circuit programming.

MCP1630 1A Bias Supply Demo Board User's Guide

NOTES:



MCP1630 1A BIAS SUPPLY DEMO BOARD USER'S GUIDE

Appendix A. Schematic and Layouts

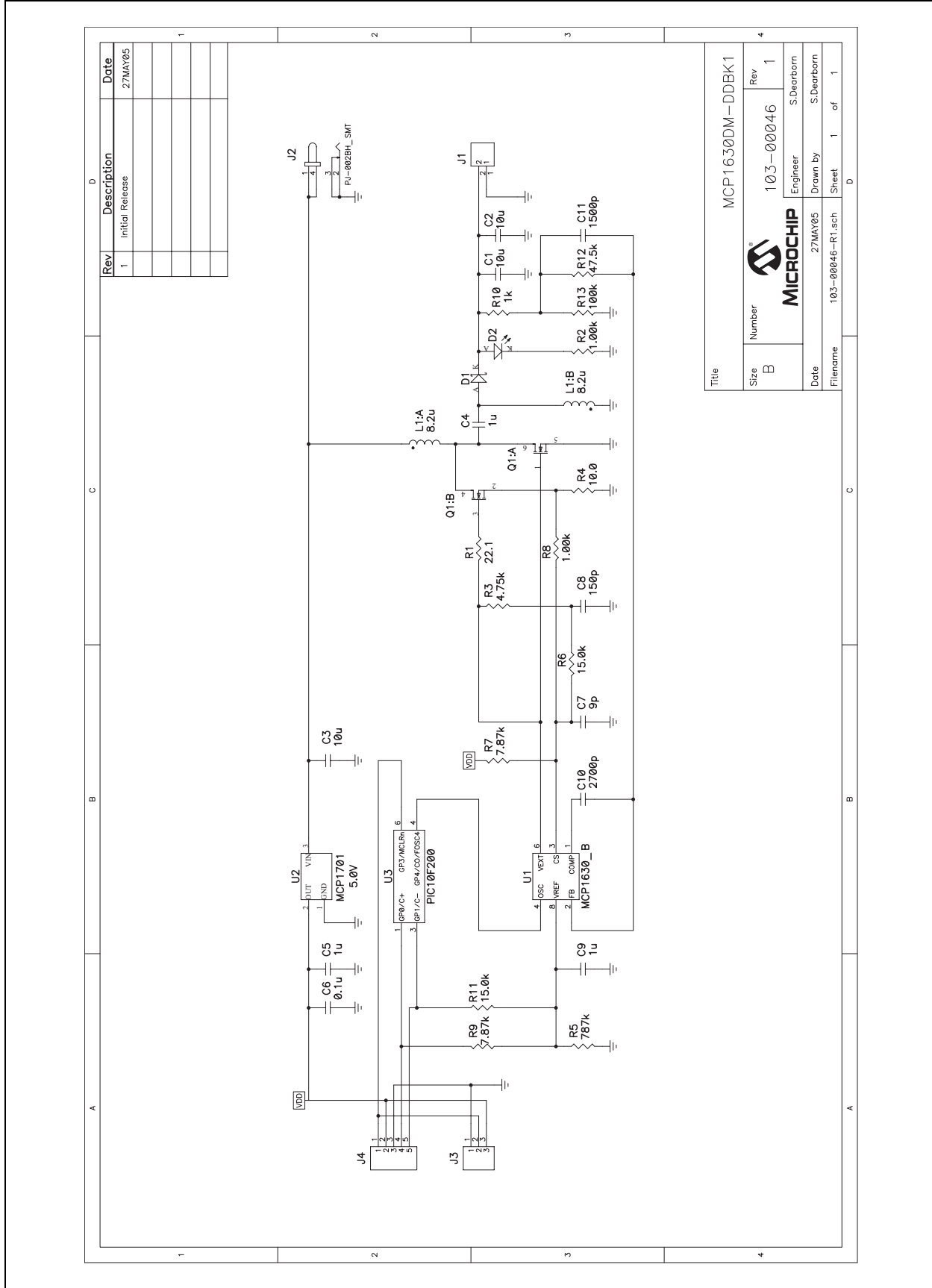
A.1 INTRODUCTION

This appendix contains the following schematics and layouts for the MCP1630 1A Bias Supply Demo Board:

- Board Schematic
- Board – Assembly Drawing
- Board – Top Overlay
- Board – Top Layer
- Board – Bottom Layer

MCP1630 1A Bias Supply Demo Board User's Guide

A.2 BOARD SCHEMATIC



A.3 BOARD – ASSEMBLY DRAWING

| | | | |
|---|---|---|---|
| A | B | C | D |
| 1 | 2 | 3 | 4 |

NOTES:

MATERIAL: FR-4, THICKNESS 0.062 COPPER 1 OZ – SIG LYRS

TWO LAYER BOARD

FINISH: SOLDERMASK OVER BARE COPPER (SMOBC) WITH HOT-AIR-LEVELED SOLDER
 SMOBC WITH SELECTIVE GOLD PLATING ON LANDS INDICATED, 100ul GOLD OVER 50-100ul NICKEL.
 60/40 TIN-LEAD REFLOW

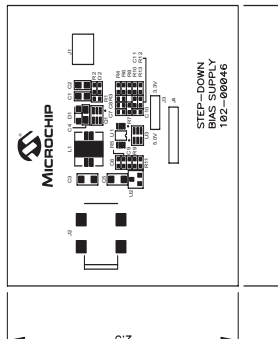
SOLDERMASK – DYNACHEM EPIC 200 LPI OR EQUIVALENT.
 COLOR-Green High Gloss
 SILKSCREEN – White

USE ARTWORK SET NO. 105-00046 REV 1

ANY ALTERNATIVES TO THE ABOVE SPECIFICATIONS MUST BE APPROVED BY THE ENGINEERING DEPARTMENT AT MICROCHIP.
 THIS PCB TO BE MANUFACTURED TO MEET ALL ACCEPTANCE LEVELS OF A CLASS 2 PCB PER ANSI/IPC-A-600F.

| | | |
|-----|----------------|---------|
| REV | DESCRIPTION | DATE |
| 1 | Initial Design | 27MAY05 |
| | | |
| | | |
| | | |

| Hole Dia. (inch) | Symbol | Quantity | Plated |
|------------------|--------|----------|--------|
| 0.035 | X | 20 | Yes |
| 0.045 | Y | 2 | Yes |
| 0.045 | Y | 2 | No |
| 0.072 | X | 2 | No |



STEP-DOWN
102-00046

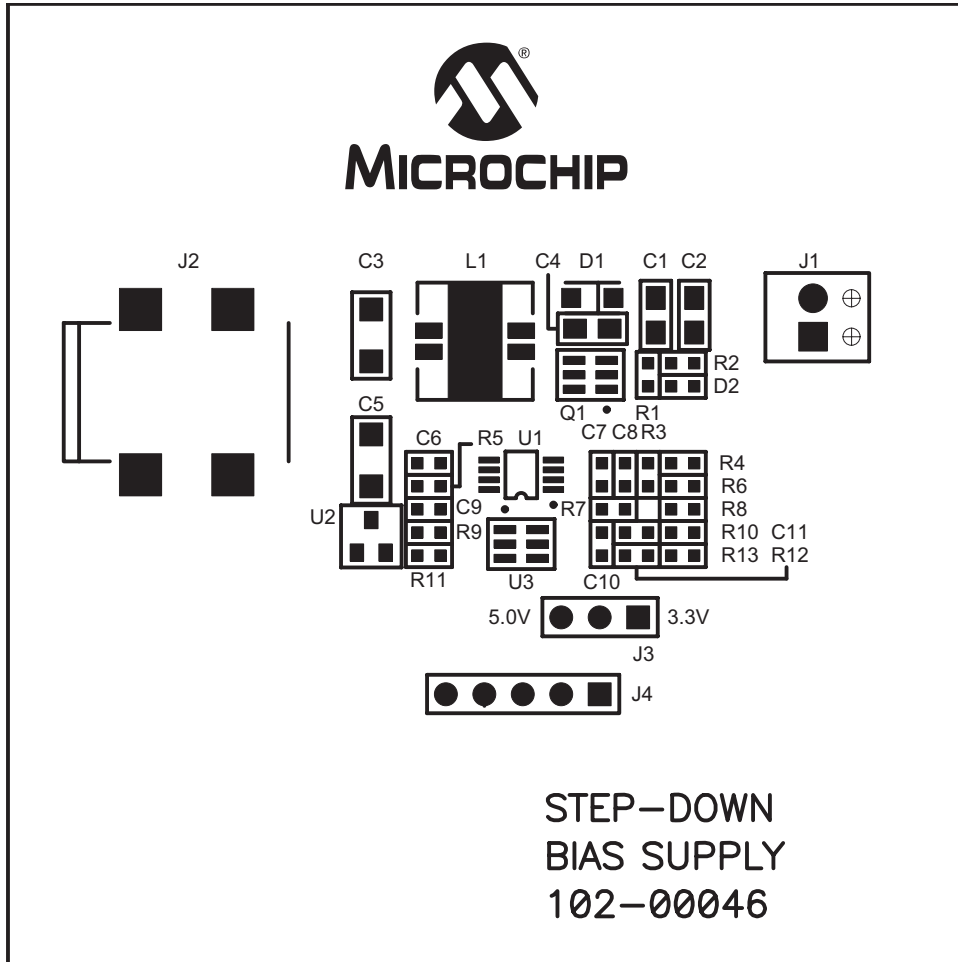
ASSEMBLY NOTES:

- ALL UNUSED COMPONENTS SHALL BE FREE OF SOLDER.
- ALL COMPONENTS SHALL BE MOUNTED FLUSH TO THE BOARD, EXCEPT AS NOTED.
- MAXIMUM COMPONENT HEIGHT NOT TO EXCEED: 0.500 TOP SIDE, 0.048 BOTTOM SIDE.
- FINISHED BOARD SHALL BE FREE OF ALL RESIDUES.
- THESE COMPONENTS REQUIRE SOCKETS.
- ALL LEADS SHALL BE TRIMED TO A MAXIMUM HEIGHT OF 0.045.

| | | | |
|----------|------------------|-------------------|--------|
| Title | | MCP1630DM – DDBK1 | |
| Size | Number | Rev | Rev |
| B | MICROCHIP | 104-00046 | 1 |
| Date | Engineer | Drawn by | Sheet |
| 27MAY05 | S. Beerborn | 104-00046-R1.pcb | 1 of 1 |
| Filename | 104-00046-R1.pcb | Sheet | 1 of 1 |

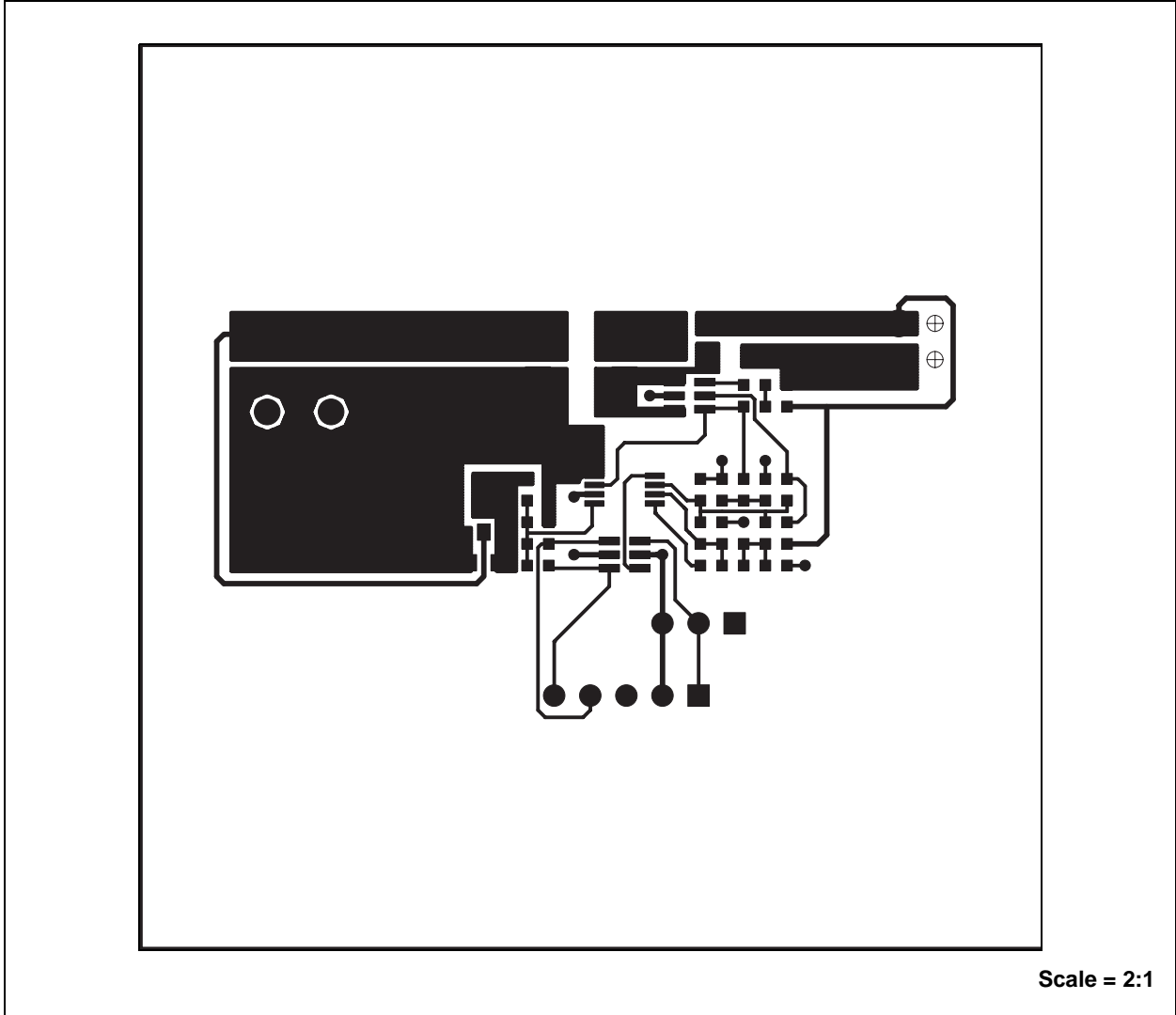
MCP1630 1A Bias Supply Demo Board User's Guide

A.4 BOARD – TOP OVERLAY



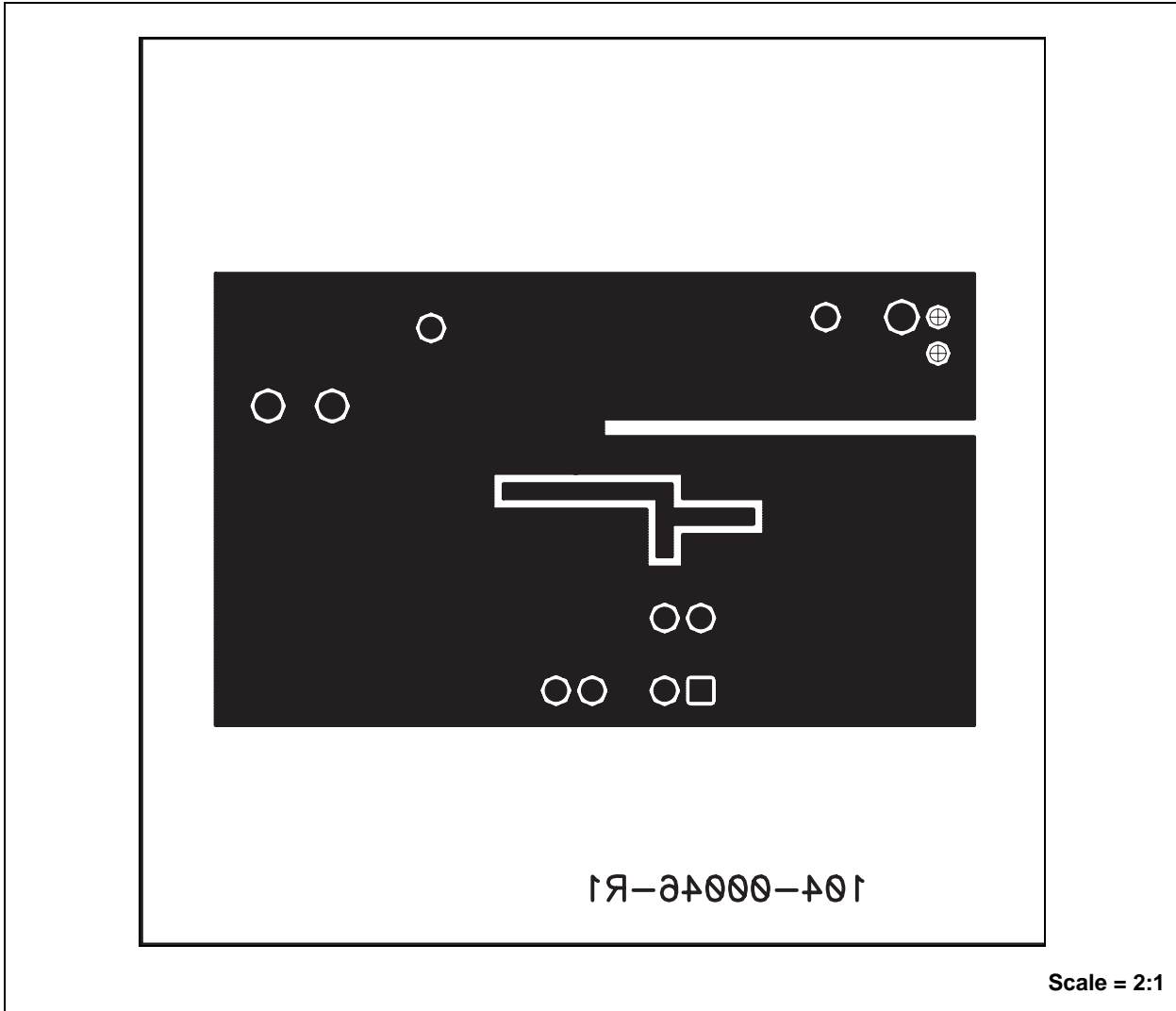
Scale = 2:1

A.5 BOARD – TOP LAYER



MCP1630 1A Bias Supply Demo Board User's Guide

A.6 BOARD – BOTTOM LAYER



Appendix B. Bill-Of-Materials (BOM)

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

| Qty. | Reference | Description | Mfgr. | Part Number |
|------|-----------|---|--|-------------------|
| 2 | C1,C2 | 10 μ F, X5R Ceramic, 6.3V, 0805 | Panasonic [®] -ECG | ECJ-2FB0J106M |
| 1 | C3 | 10 μ F, X5R Ceramic, 25V, 1206 | Panasonic-ECG | ECJ-3YB1E106M |
| 1 | C4 | 1 μ F, X5R Ceramic, 16V, 0805 | Panasonic-ECG | ECJ-2FB1C105K |
| 1 | C5 | 1 μ F, Tantalum, 16V, 1206 | Kemet [®] Electronics [®] | T491A105K016AS |
| 1 | C6 | 0.1 μ F, X7R Ceramic, 16V, 0603 | Panasonic-ECG | ECJ-1VB1C104K |
| 1 | C7 | 9 pF, NPO Ceramic, 50V, 0603 | Panasonic-ECG | ECJ-1VC1H090D |
| 1 | C8 | 150 pF, NPO Ceramic, 50V, 0603 | Panasonic-ECG | ECJ-1VC1H151J |
| 1 | C9 | 1 μ F, X7R Ceramic, 6.3V, 0603 | Panasonic-ECG | ECJ-1VB0J105K |
| 1 | C10 | 2700 pF, X7R Ceramic, 50V, 0603 | Panasonic-ECG | ECJ-1VB1H272K |
| 1 | C11 | 1500 pF, X7R Ceramic, 50V, 0603 | Panasonic-ECG | ECJ-1VB1H152K |
| 1 | D1 | 1.5A, 30V Schottky Diode, SMA | Toshiba [®] | CRS08(TE85L) |
| 1 | D2 | Super Red LED, 0603 | Lumex [®] Opto/Components | SML-LX0603SRW-TR |
| 1 | J1 | Connector Terminal Block, 2 Pos., 2.54mm, TB254-2 | Phoenix Contact | 1725656 |
| 1 | J2 | Connector Power Jack, 2.5 x 5.5 mm, SMD | CUI Inc. | PJ-002B-SMT |
| 1 | J3 | Connector Header, 3 Pos., 2.54 mm, HDR1X3 | Molex [®] /Waldom [®] | 22-03-2031 |
| 1 | J4 | Connector Header, 5 Pos., 2.54 mm, HDR1X5 | Molex | 22-03-2051 |
| 1 | L1 | 8.2 μ H, Coupled Inductor, DRQ74 | Coiltronics [®] | DRQ74-8R2 |
| 1 | Q1 | Dual N-Channel MOSFET, SOT23-6 | Siliconix | Si3900DV-T1 |
| 1 | R1 | 22.1, 1/16W, 1%, Chip Resistor, 0603 | Panasonic-ECG | ERJ-3EKF22R1V |
| 3 | R2,R8,R10 | 1.00k, 1/16W, 1%, Chip Resistor, 0603 | Panasonic-ECG | ERJ-3EKF1001V |
| 1 | R3 | 4.75k, 1/16W, 1%, Chip Resistor, 0603 | Panasonic-ECG | ERJ-3EKF4751V |
| 1 | R4 | 10.0, 1/16W, 1%, Chip Resistor, 0603 | Panasonic-ECG | ERJ-3EKF10R0V |
| 1 | R5 | 787k, 1/16W, 1%, Chip Resistor, 0603 | Panasonic-ECG | ERJ-3EKF7873V |
| 2 | R6,R11 | 15.0k, 1/16W, 1%, Chip Resistor, 0603 | Panasonic-ECG | ERJ-3EKF1502V |
| 2 | R7,R9 | 7.87k, 1/16W, 1%, Chip Resistor, 0603 | Panasonic-ECG | ERJ-3EKF7871V |
| 1 | R12 | 47.5k, 1/16W, 1%, Chip Resistor, 0603 | Panasonic-ECG | ERJ-3EKF4752V |
| 1 | R13 | 100k, 1/16W, 1%, Chip Resistor, 0603 | Panasonic-ECG | ERJ-3EKF1003V |
| 1 | U1 | 5.0V, 250 mA, Voltage Regulator, SOT23 | Microchip Technology Inc. | MCP1701T-5002I/CB |
| 1 | U2 | PWM Building Block, MSOP8 | Microchip Technology Inc. | MCP1630-E/MS |
| 1 | U3 | 8-Bit Flash Microcontroller, SOT23-6 | Microchip Technology Inc. | PIC10F200T-I/OT |
| 1 | | Shorting Jumper, 2 Pos., 2.54mm | Sullins [™] | STC025YAN |

MCP1630 1A Bias Supply Demo Board User's Guide

NOTES:



MCP1630 1A BIAS SUPPLY DEMO BOARD USER'S GUIDE

Appendix C. Evaluation Board Firmware

C.1 DEVICE FIRMWARE

For the latest copy of the MCP1630 1A Bias Supply Demo Board firmware, visit our web site at www.microchip.com.



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Fax: 972-818-2924

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Kokomo, IN
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Fax: 765-864-8387

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Fax: 949-462-9608

San Jose

Mountain View, CA
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Fax: 650-961-0286

Toronto

Mississauga, Ontario,
Canada
Tel: 905-673-0699
Fax: 905-673-6509

ASIA/PACIFIC

Australia - Sydney
Tel: 61-2-9868-6733
Fax: 61-2-9868-6755

China - Beijing
Tel: 86-10-8528-2100
Fax: 86-10-8528-2104

China - Chengdu
Tel: 86-28-8676-6200
Fax: 86-28-8676-6599

China - Fuzhou
Tel: 86-591-8750-3506
Fax: 86-591-8750-3521

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Tel: 852-2401-1200
Fax: 852-2401-3431

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Tel: 86-21-5407-5533
Fax: 86-21-5407-5066

China - Shenyang
Tel: 86-24-2334-2829
Fax: 86-24-2334-2393

China - Shenzhen
Tel: 86-755-8203-2660
Fax: 86-755-8203-1760

China - Shunde
Tel: 86-757-2839-5507
Fax: 86-757-2839-5571

China - Qingdao
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Fax: 86-532-502-7205

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