



# **MCP1602**

## **Evaluation Board**

### **User's Guide**

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## Preface

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### 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](http://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.

For the most up-to-date information on development tools, see the MPLAB® IDE on-line help. Select the Help menu, and then Topics to open a list of available on-line help files.

## INTRODUCTION

This chapter contains general information that will be useful to know before using the MCP1602 Evaluation 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 MCP1602 Evaluation Board as a development tool. The manual layout is as follows:

- **Chapter 1. “Product Overview”** – Important information about the MCP1602 Evaluation Board.
- **Chapter 2. “Installation and Operation”** – Includes instructions on how to get started with this user's guide and a description of the user's guide.
- **Appendix A. “Schematic and Layouts”** – Shows the schematic and layout diagrams for the MCP1602 Evaluation Board.
- **Appendix B. “Bill Of Materials (BOM)”** – Lists the parts used to build the MCP1602 Evaluation Board.

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## CONVENTIONS USED IN THIS GUIDE

This manual uses the following documentation conventions:

### DOCUMENTATION CONVENTIONS

| Description                                      | Represents                                                                                          | Examples                                                    |
|--------------------------------------------------|-----------------------------------------------------------------------------------------------------|-------------------------------------------------------------|
| <b>Arial font:</b>                               |                                                                                                     |                                                             |
| 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&gt;Save</i></u>                                  |
| Bold characters                                  | A dialog button                                                                                     | Click <b>OK</b>                                             |
|                                                  | A tab                                                                                               | Click the <b>Power</b> 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>                                         |
| <b>Courier New font:</b>                         |                                                                                                     |                                                             |
| 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                                                                                 | <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)<br>{ ...<br>}                              |

## RECOMMENDED READING

This user's guide describes how to use MCP1602 Evaluation Board. Other useful documents are listed below. The following Microchip documents are available and recommended as supplemental reference resources.

**MCP1602 Data Sheet, "2.0 MHz, 500 mA Synchronous Buck Regulator with Power-Good", DS22061A**

This data sheet provides detailed information regarding the MCP1602 product family.

## THE MICROCHIP WEB SITE

Microchip provides online support via our web site at [www.microchip.com](http://www.microchip.com). This web site is used as a means to make files and information easily available to customers. Accessible by using your favorite Internet browser, the web site contains the following information:

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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 (November 2007)

- Initial Release of this Document.

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NOTES:

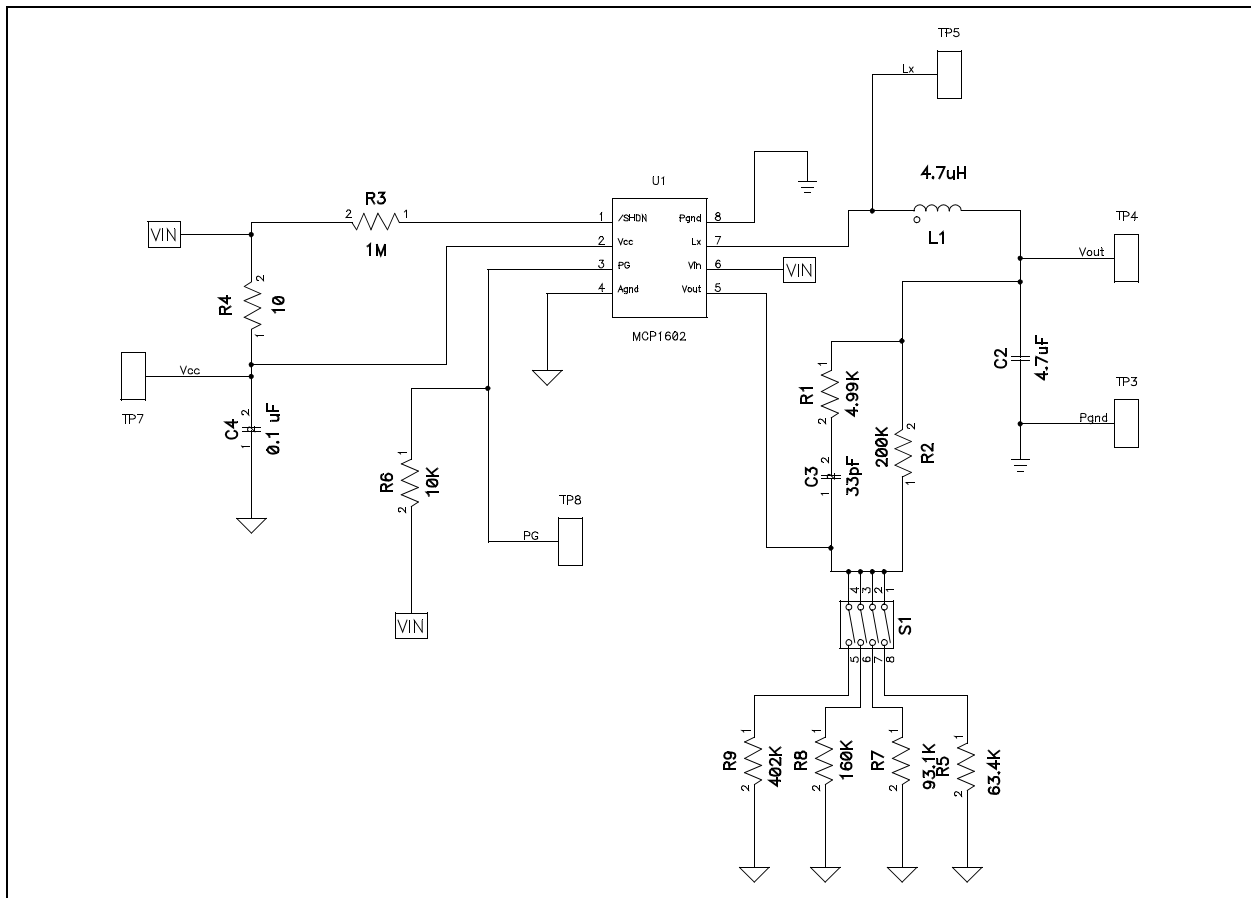
## Chapter 1. Product Overview

### 1.1 INTRODUCTION

The MCP1602 Evaluation Board demonstrates the features and capabilities of Microchip's MCP1602 Evaluation Board 500 mA PFM/PWM Synchronous Buck Regulator. The MCP1602 is a step-down (Buck) switching regulator with a Power-Good monitor to provide a highly integrated solution for systems that require supply voltage between 0.8V to 4.5V. The MCP1602 requires input voltage range from 2.7V to 5.5V. The MCP1602 Evaluation Board includes a MCP1602 circuit that has a Shutdown feature and a 4-position Dip Switch to select between different output voltages. MCP1602 Evaluation Board is available in 0.8V, 1.2V, 1.8V, 2.5V and 3.3V. Additional test points are available on the MCP1602 Evaluation Board for reviewing the performances and features of MCP1602 Evaluation Board.

This chapter covers the following topics:

- What is the MCP1602 Evaluation Board?
- What the MCP1602 Evaluation Board Kit includes



**FIGURE 1-1:** MCP1602 Typical Applications With Adjustable Output Voltage.

# MCP1602 Evaluation Board User's Guide

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## 1.2 WHAT IS THE MCP1602 EVALUATION BOARD?

The MCP1602 Evaluation Board demonstrates the use of PFM/PWM Synchronous Buck Controller that regulates output voltages from 0.8V to 4.5V with Adjustable version or 1.2V, 1.5V, 1.8V, 2.5V and 3.3V with Fixed-Output version.

The MCP1602 Evaluation Board Evaluation Board is setup to evaluate simple DC-to-DC conversion. This board utilizes Microchip's MCP1602 Evaluation Board (PFM/PWM Synchronous Buck Regulator) that effectively steps down from  $V_{IN}$  to regulated  $V_{OUT}$ . The Power Good function can be observed via the output signal on the PG pin. The MCP1602 on the MCP1602 Evaluation Board is enabled and can be turned off by pulling the  $\overline{SHDN}$  pin low.

The MCP1602 Evaluation Board is designed to observe the performance and features on the circuit via multiple test points. Users can also discover the compact size of the layout in addition to the device itself. The circuit can also be implemented into suitable applications without extra work.

## 1.3 WHAT THE MCP1602 EVALUATION BOARD KIT INCLUDES

This MCP1602 Evaluation Board Kit includes:

- MCP1602 Evaluation Board, 102-00120
- MCP1602 Device with adjustable output voltage (Installed)
- Analog and Interface Products Demonstration Boards CD-ROM (DS21912)
  - MCP1602 Evaluation Board User's Guide, DS51691
  - MCP1602 Evaluation Board Data Sheet, "2.0 MHz, 500 mA Synchronous Buck Regulator with Power-Good", DS22061

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## Chapter 2. Installation and Operation

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### 2.1 INTRODUCTION

The MCP1602 Evaluation Board demonstrates Microchip's MCP1602 device. This device is a 500 mA, 2.0 MHz PFM/PWM Step-Down DC/DC Regulators With Power-Good feature. It is available in adjustable and fixed outputs. The MCP1602 features Shutdown, Power-Good Monitor, Output Short Circuit Protection and Over-temperature Protection.

The device requires only minimum components to implement a complete Step-Down DC/DC Circuit. The MCP1602 is designed to operate in PFM (Pulse Frequency Modulation) and PWM (Pulse Width Modulation) modes with various load conditions that is ideal for battery-powered portable applications.

The MCP1602 Evaluation Board provides five regulated output voltages for evaluation. Available output voltages are: 0.8V, 1.2V, 1.8V, 2.5V and 3.3V.

Typical applications for the MCP1602 device are: PDAs, Portable Computers, Portable Media Players, USB-Powered Systems, Digital Cameras, Handheld Medical Instruments, Ultra-Mobile PCs and Portable Communicators.

### 2.2 FEATURES

The MCP1602 Evaluation Board has the following features:

- Adjustable Output Voltages: 0.8V, 1.2V, 1.8V, 2.5V and 3.3V
- Input Voltage Range: 2.7V to 5.5V
- Shutdown Test Point
- Power-Good Test Point
- Easy  $V_{OUT}$  setup with Slide Style Dip Switch
- $L_X$  Test Point for switching behavior observation.

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## 2.3 GETTING STARTED

The MCP1602 Evaluation Board is fully assembled and tested for generating a regulated 0.8V, 1.2V, 1.8V, 2.5V and 3.3V output voltage from the MCP1602 device with a 2.7V to 5.5V input voltage source for  $V_{IN} > V_{OUT}$ .

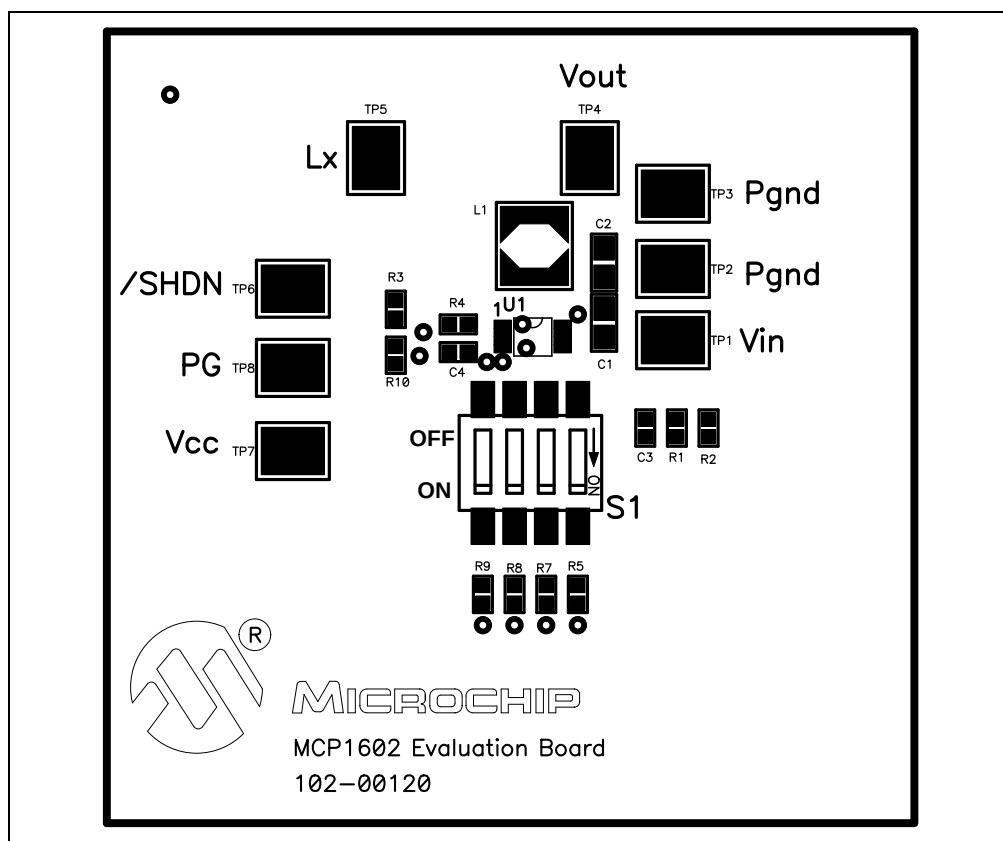
### 2.3.1 Power Input and Output Connection

#### 2.3.1.1 POWERING THE MCP1602 EVALUATION BOARD

1. Connect the negative terminal of the DC power supply to  $P_{GND}$ .
2. Connect the positive terminal of the DC power supply to  $V_{IN}$ .
3. Connect the positive terminal of the multimeter to  $V_{OUT}$  and the negative terminal to  $P_{GND}$ . The multimeter should display a regulated output voltage.
4. Adjust the DIP Switch to the desired value and the multimeter should read the desired output voltage. Refer to Table 2-1 for the voltage regulation.

|                                                                                                                                                                    |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p><b>Note:</b> The number labels on the DIP SWITCH may have slightly different way to demonstrate the mark, but will not affect the performance of the board.</p> |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|

5. The  $\overline{SHDN}$  pin defaults to the enabled position on the MCP1602 Evaluation Board. To enter the shutdown mode, drive the  $\overline{SHDN}$  pin low.
6. The  $L_X$  pin is available to observe the switching waveforms. By adjusting a variable load that is connected to  $V_{OUT}$ , the transitions between PFM/PWM can be easily observed.
7. The PG pin is available to monitor the Power-Good signal.



**FIGURE 2-1:** Board Top Assembly.

**TABLE 2-1: OUTPUT VOLTAGE REGULATION DIP POSITION**

| Voltage (V) | 1   | 2   | 3   | 4   |
|-------------|-----|-----|-----|-----|
| 0.8V        | OFF | OFF | OFF | OFF |
| 1.2V        | ON  | OFF | OFF | OFF |
| 1.8V        | OFF | ON  | OFF | OFF |
| 2.5V        | OFF | OFF | ON  | OFF |
| 3.3V        | OFF | OFF | OFF | ON  |

# MCP1602 Evaluation Board User's Guide

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# MCP1602 EVALUATION BOARD USER'S GUIDE

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## Appendix A. Schematic and Layouts

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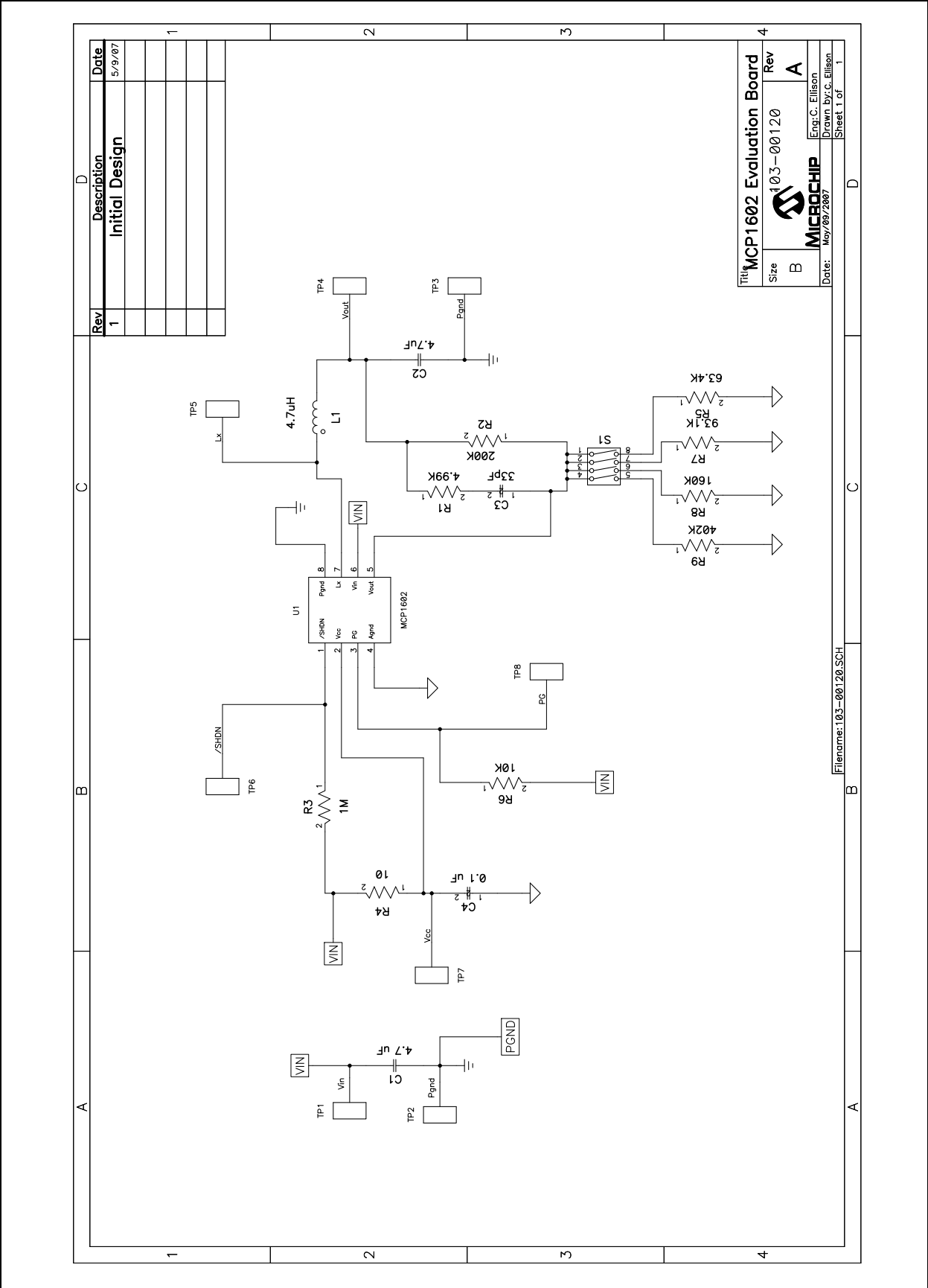
### A.1 INTRODUCTION

This appendix contains the following schematics and layouts for the MCP1602 Evaluation Board:

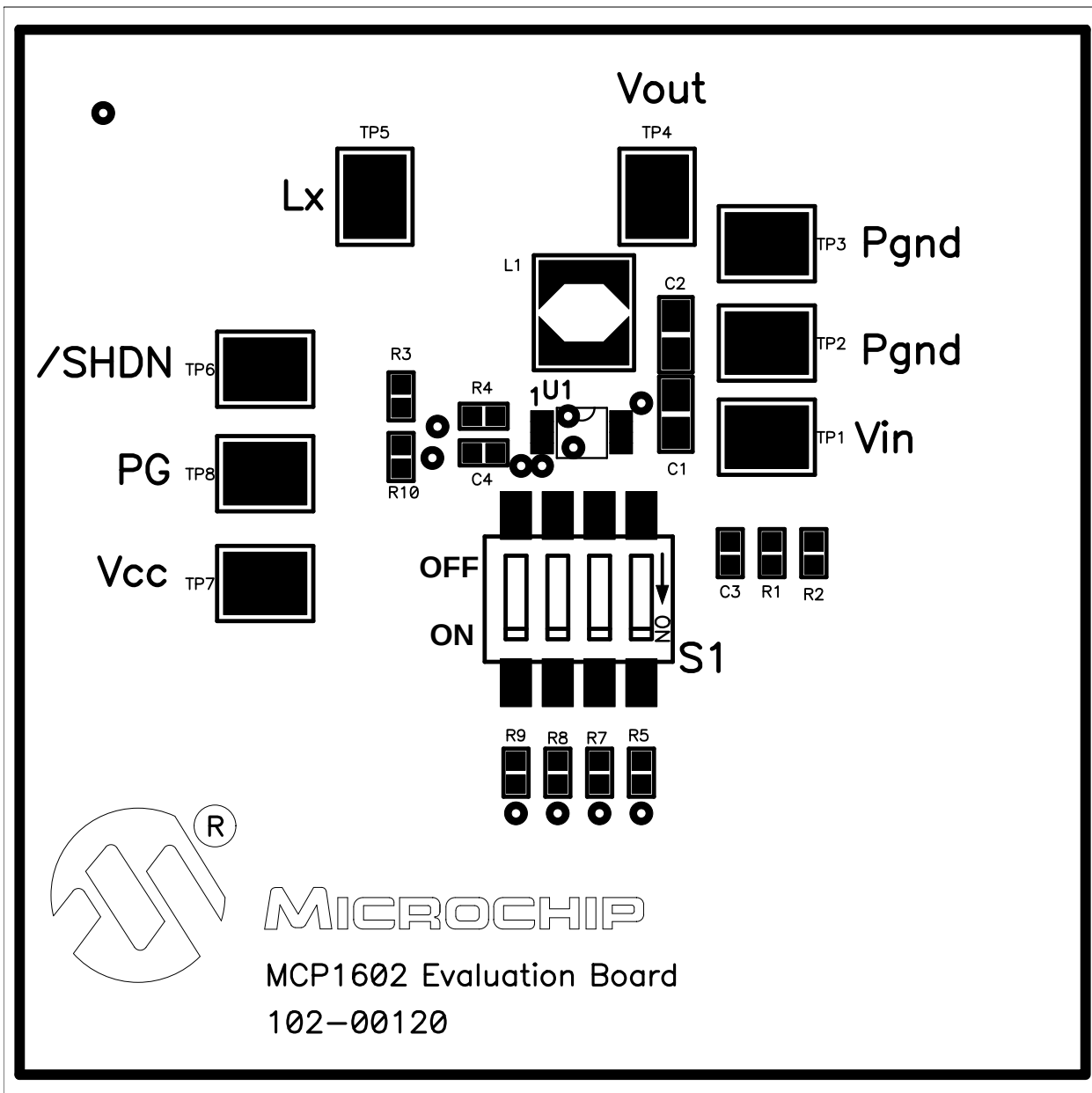
- Board – Schematic Sheet
- Board – Top Layer
- Board – Top Metal Layer
- Board – Bottom Layer

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## A.2 BOARD – SCHEMATIC



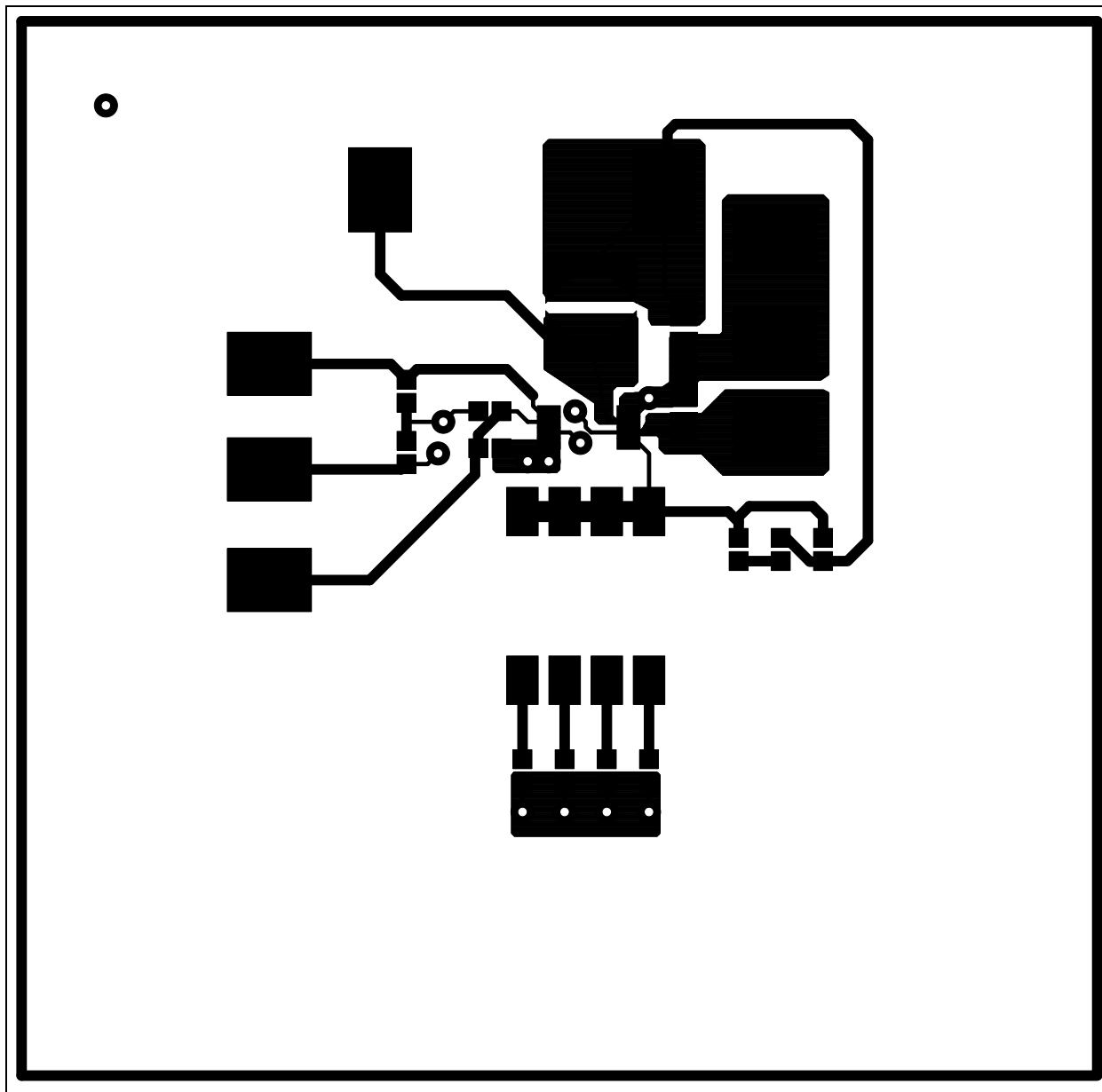
## A.3 BOARD – TOP LAYER



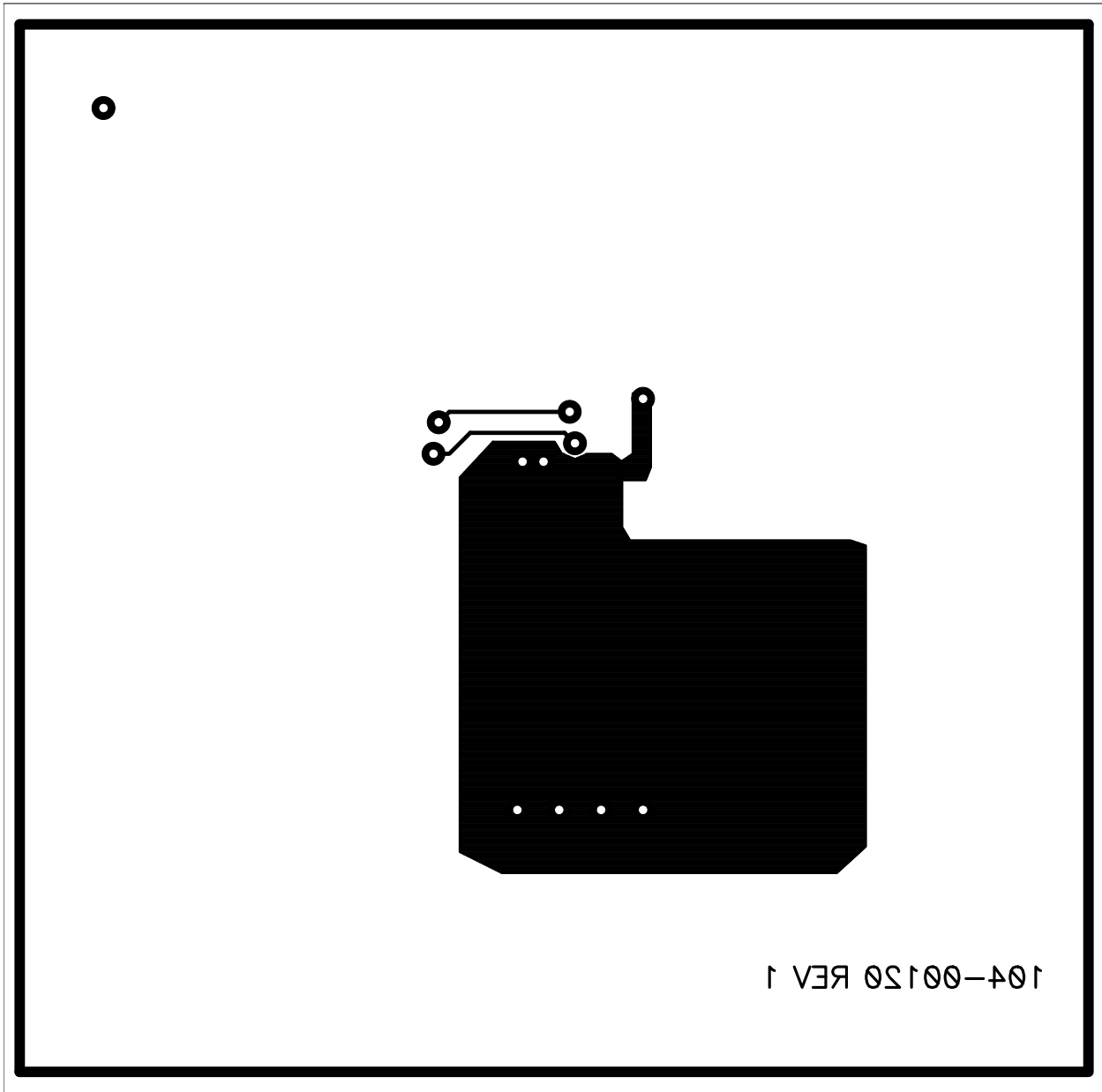
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## A.4 BOARD – TOP METAL LAYER



## A.5 BOARD – BOTTOM LAYER



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## Appendix B. Bill Of Materials (BOM)

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

| Qty | Reference                              | Description                               | Manufacturer              | Part Number     |
|-----|----------------------------------------|-------------------------------------------|---------------------------|-----------------|
| 2   | C1, C2                                 | CAP CERAMIC 4.7 $\mu$ F 16V X5R 0805      | Panasonic® - ECG          | ECJ-2FB1C475K   |
| 1   | C3                                     | CAP CERAMIC 33 pF 25V NP0 0201            | Panasonic - ECG           | ECJ-ZEC1E330J   |
| 1   | C4                                     | CAP CERAMIC .1 $\mu$ F 16V X7R 0603       | Panasonic - ECG           | ECJ-1VB1C104K   |
| 1   | R1                                     | RES 4.99K OHM 1/10W 1% 0603 SMD           | Panasonic - ECG           | ERJ-3EKF4991V   |
| 1   | R2                                     | RES 200K OHM 1/10W 5% 0603 SMD            | Panasonic - ECG           | ERJ-3GEYJ204V   |
| 1   | R3                                     | RES 1.00M OHM 1/10W 1% 0603 SMD           | Panasonic - ECG           | ERJ-3EKF1004V   |
| 1   | R4                                     | RES 10.0 OHM 1/10W 1% 0603 SMD            | Panasonic - ECG           | ERJ-3EKF10R0V   |
| 1   | R5                                     | RES 63.4K OHM 1/10W 1% 0603 SMD           | Panasonic - ECG           | ERJ-3EKF6342V   |
| 1   | R6                                     | RES 10.0K OHM 1/10W 1% 0603 SMD           | Panasonic - ECG           | ERJ-3EKF1002V   |
| 1   | R7                                     | RES 93.1K OHM 1/10W 1% 0603 SMD           | Panasonic - ECG           | ERJ-3EKF9312V   |
| 1   | R8                                     | RES 160K OHM 1/10W 5% 0603 SMD            | Panasonic - ECG           | ERJ-3GEYJ164V   |
| 1   | R9                                     | RES 402K OHM 1/10W 1% 0603 SMD            | Panasonic - ECG           | ERJ-3EKF4023V   |
| 1   | S1                                     | SWITCH DIP SPST SEALED 4POS SMD           | Copal Electronics Inc     | SD04H1SB        |
| 1   | L1                                     | INDUCTOR POWER SHIELD 4.7 $\mu$ H SMD     | Coiltronics               | SD18-4R7-R      |
| 8   | TP1, TP2, TP3, TP4, TP5, TP6, TP7, TP8 | PC Test Point Compact SMT                 | Keystone Electronics®     | 5016            |
| 1   | U1                                     | 500 mA PFM/PWM Synchronous Buck Regulator | Microchip Technology, Inc | MCP1602-ADJI/MF |
| 1   | ---                                    | Printed Circuit Board                     | —                         | 104-00120-R1    |

**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.



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**Стандарт  
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Связь**

Мы молодая и активно развивающаяся компания в области поставок электронных компонентов. Мы поставляем электронные компоненты отечественного и импортного производства напрямую от производителей и с крупнейших складов мира.

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С нами вы становитесь еще успешнее!

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