# TC115
# PFM/PWM
# Evaluation Board
# User's Guide

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# TC115 EVALUATION BOARD USER'S GUIDE

# Table of Contents

**NOTES:**

# TC115 EVALUATION BOARD USER'S GUIDE

## Preface

## INTRODUCTION

This chapter contains general information that will be useful to know before using the TC115 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 TC115 Evaluation Board as a development tool to emulate and debug firmware on a target board. The manual layout is as follows:

- **Chapter 1. "Product Overview"** – Important information about the TC115 Evaluation Board.
- **Chapter 2. "Installation and Operation"** – Includes a description of the evaluation board, as well as instructions on how to get started.
- **Appendix A. "Schematic and Layouts"** – Shows the schematic and layout diagrams for the TC115 Evaluation Board.
- **Appendix B. "Bill of Materials (BOM)"** – Lists the parts used to build the TC115 Evaluation Board.

# TC115 Evaluation 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 | *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)`<br>`{ ...`<br>`}` |

# Preface

## RECOMMENDED READING

This user's guide describes how to use TC115 Evaluation Board. Other useful documents are listed below. The following Microchip documents are available and recommended as supplemental reference resources.

- **TC115 Data Sheet -** *"PFM/PWM Step-Up DC/DC Converter"* **(DS21361)**

This data sheet provides detailed information regarding the TC115 step-up converter.

## THE MICROCHIP WEB SITE

Microchip provides online support via our web site at 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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- **General Technical Support** – Frequently Asked Questions (FAQs), technical support requests, online discussion groups, Microchip consultant program member listing
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- Local Sales Office
- Field Application Engineer (FAE)
- Technical Support

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Technical support is available through the web site at: http://support.microchip.com.

## DOCUMENT REVISION HISTORY

### Revision B (January 2009)

- Updated Board Schematic (see **Appendix A. "Schematic and Layouts"**).
- Updated **Appendix B. "Bill of Materials (BOM)"**.

### Revision A (September 2005)

- Initial Release of this Document.

**NOTES:**

# Chapter 1.  Product Overview

## 1.1    INTRODUCTION

The TC115 Evaluation Board is used to evaluate Microchip's TC115 in a single-cell boost converter application. As provided, the TC115 Evaluation Board generates a 3.0V output from a single-cell battery.

This chapter covers the following topics:

- What is the TC115 Evaluation Board?
- What the TC115 Evaluation Board Kit Includes?

## 1.2    WHAT IS THE TC115 EVALUATION BOARD?

The TC115 Evaluation Board is a complete, step-up, switch-mode, dc-dc power converter. The TC115 Evaluation Board generates a regulated 3.0V output at load currents up to 110 mA. Different output voltages are obtainable by replacing the fixed 3.0V output TC115 with a fixed 3.3V or 5.0V device. Since the TC115 operates from a minimum input voltage of 0.9V, the input voltage can be provided by a single-cell battery.

The TC115 Evaluation Board is provided with an aluminum electrolytic output capacitor. However, there are ceramic and tantalum capacitor pads so other capacitor technologies can be evaluated.

Test points are provided for input power, output load and shutdown control.

## 1.3    WHAT THE TC115 EVALUATION BOARD KIT INCLUDES?

This TC115 Evaluation Board Kit includes:

- The TC115 Evaluation Board (102-00074)
- Analog and Interface Products Demonstration Boards CD-ROM (DS21912) includes:
    - TC115 Evaluation Board User's Guide (DS51578)

# TC115 Evaluation Board User's Guide

**NOTES:**

# Chapter 2. Installation and Operation

## 2.1    INTRODUCTION

The TC115 Evaluation Board demonstrates Microchip's TC115 PFM/PWM step-up dc-dc converter in a single cell battery powered application. The TC115 is a high-efficiency step-up, dc-dc converter for small, low input voltage or battery-powered systems. The device has a start-up voltage of 0.9V. Due to its integrated MOSFET feature, the TC115 may be used in conjunction with only an external diode, an inductor and a capacitor to design a complete boost converter.

The TC115 Evaluation Board is shipped with an aluminum electrolytic output capacitor. However, there are additional surface-mount pads on the board to evaluate tantalum or ceramic capacitors.

## 2.2    FEATURES

The TC115 Evaluation Board has the following features:

• Regulated 3.0V output voltage
• Maximum output current: 110 mA
• Automatic PFM/PWM modes of operation
• Test point to apply external Enable signal

## 2.3 GETTING STARTED

The TC115 Evaluation Board is fully assembled and tested for generating a regulated 3.0V output voltage. The TC115 Evaluation Board requires the use of an external input voltage source (0.9V - 3.0V).

### 2.3.1 Power Input and Output Connections

2.3.1.1 POWERING THE TC115 EVALUATION BOARD

1. Apply the input voltage to the $V_{IN}$ test point (TP1) and GND test point (TP4). The input voltage should be limited to the 0V to +3.0V range. For normal operation, the input voltage should be between +0.9V and +3.0V.

> **Note 1:** Since the TC115 Evaluation Board is a boost converter, applying an input voltage greater than 3.0V will result in an output voltage equal to the input voltage. The TC115 Evaluation Board cannot regulate to an output voltage that is lower than the input voltage.
>
> **2:** With the boost topology, there always exist a path from the input source to the output load.

2.3.1.2 APPLY THE LOAD TO THE REGULATED OUTPUT VOLTAGE TEST POINTS

1. To apply a load to the TC115 Evaluation Board, the positive side (+) of the load should be connected to the $V_{OUT}$ test point (TP3). The negative side (–) of the load should be connected to the GND test point (TP2).

> **Note:** Since the TC115 device receives bias from the output, it may be necessary to remove the load before starting the TC115 Evaluation Board.

2. The TC115 Evaluation Board is supplied with a fixed 3.0V output voltage version of the TC115. However, by changing the TC115 device, other output voltages can be achieved. Besides the fixed 3.0V version, the TC115 is also offered in a fixed 3.3V or 5.0V version.

2.3.1.3 ENABLING/DISABLING THE TC115 EVALUATION BOARD

The $\overline{SHDN}$ pin of the TC115 is pulled-up to $V_{IN}$ to always enable the device. Test point TP5 can be used to apply an external Enable signal to the device.

# Appendix A. Schematic and Layouts

## A.1 INTRODUCTION

This appendix contains the following schematic and layout diagrams for the TC115 Evaluation Board:

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

# TC115 Evaluation Board User's Guide

## A.2    BOARD SCHEMATIC
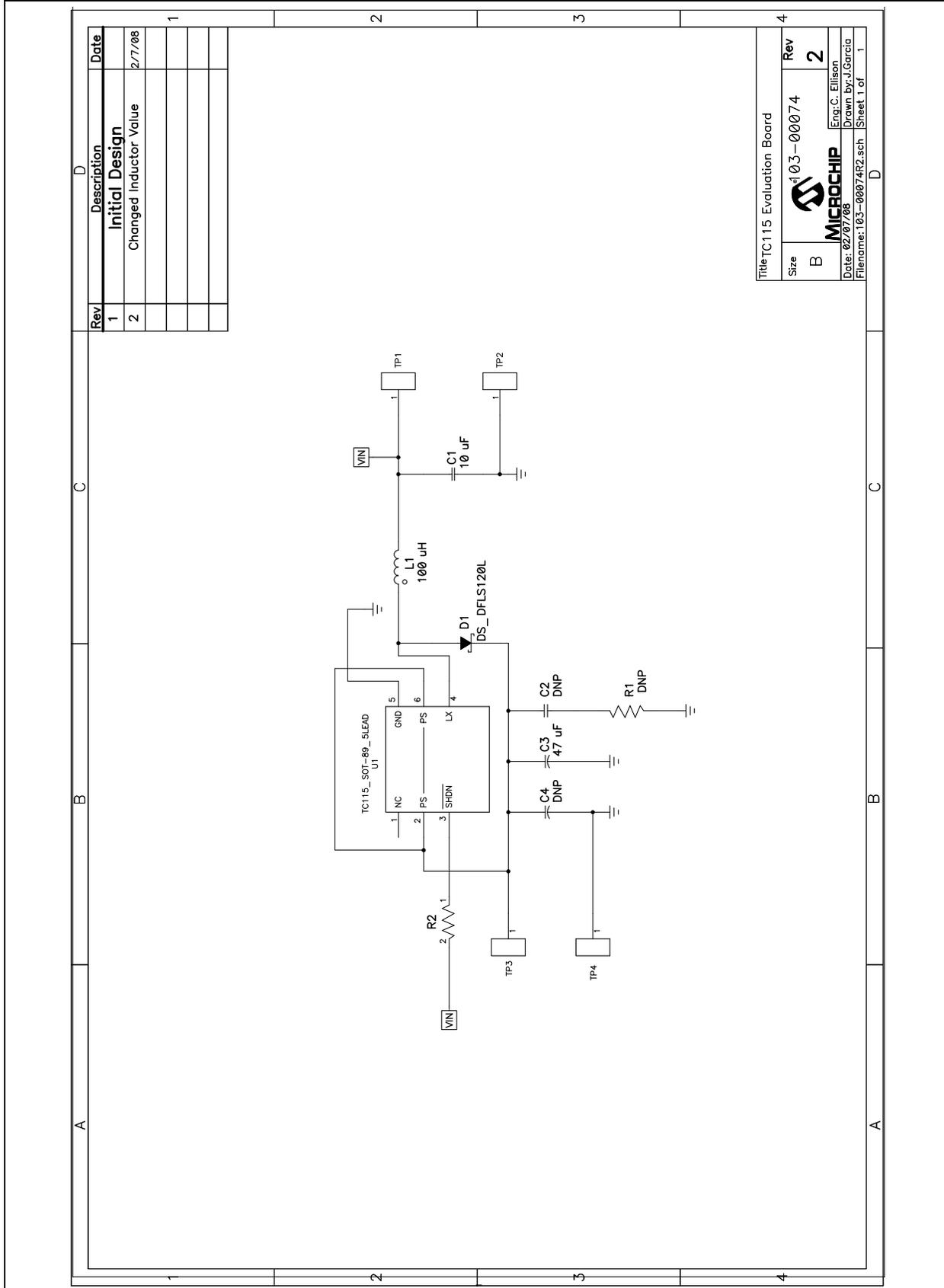
## A.3 BOARD – TOP OVERLAY



TC115 EVALUATION BOARD 102-00074

GND

GND

VIN

+

VOUT

# TC115 Evaluation Board User's Guide

**A.4    BOARD – TOP LAYER**

# Schematic and Layouts
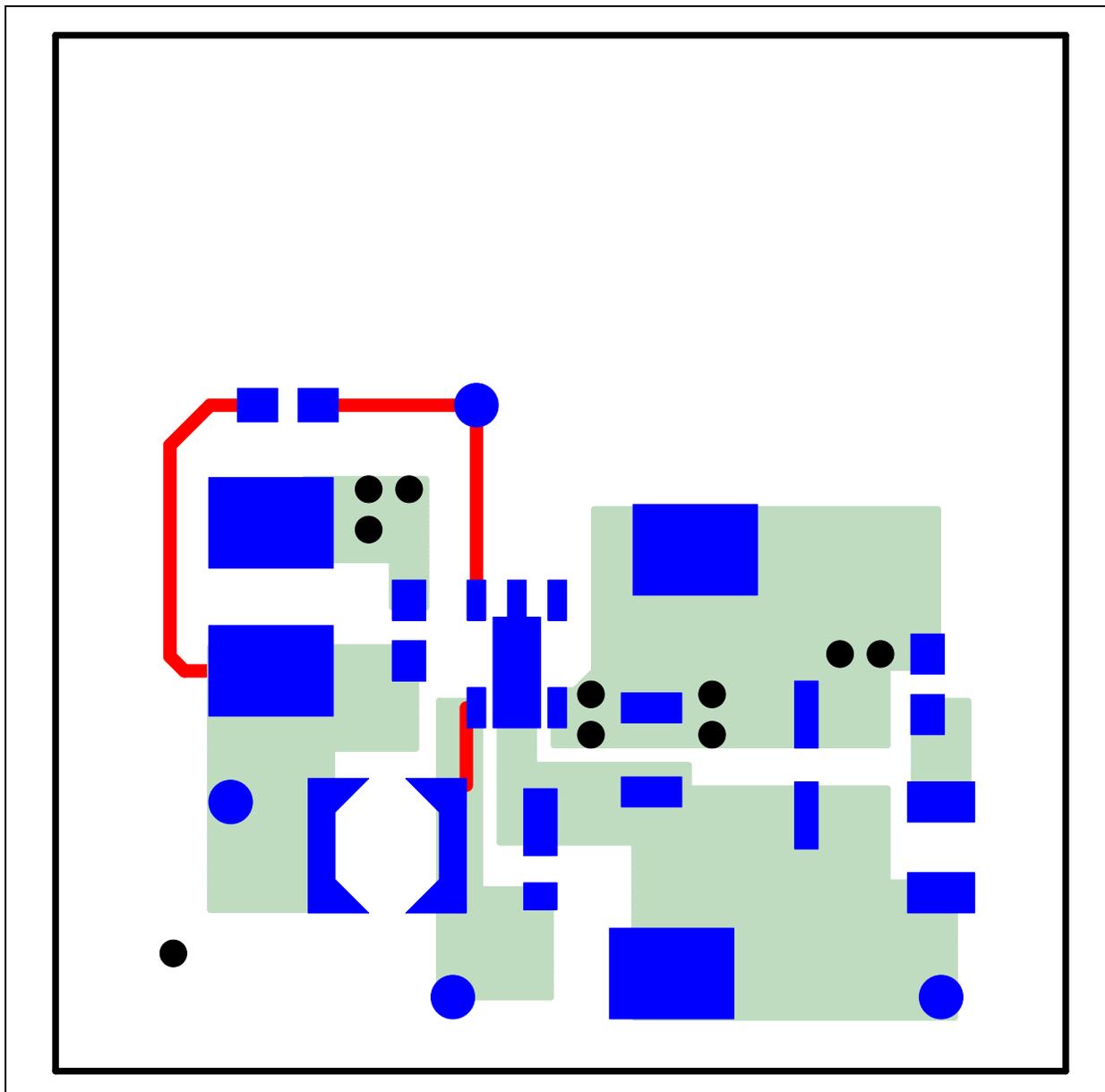
## A.5    BOARD – BOTTOM LAYER
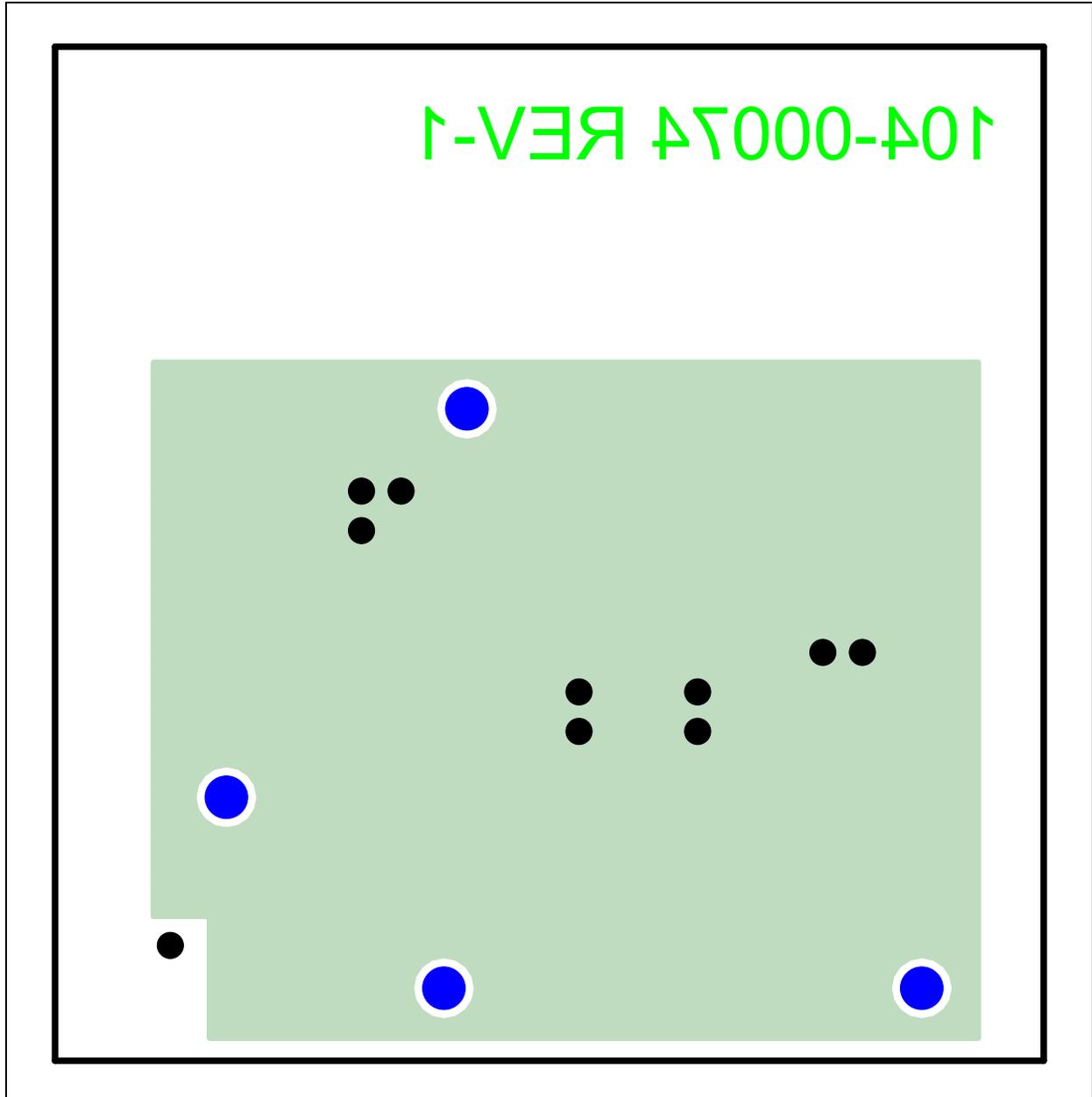
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# Appendix B. Bill of Materials (BOM)

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

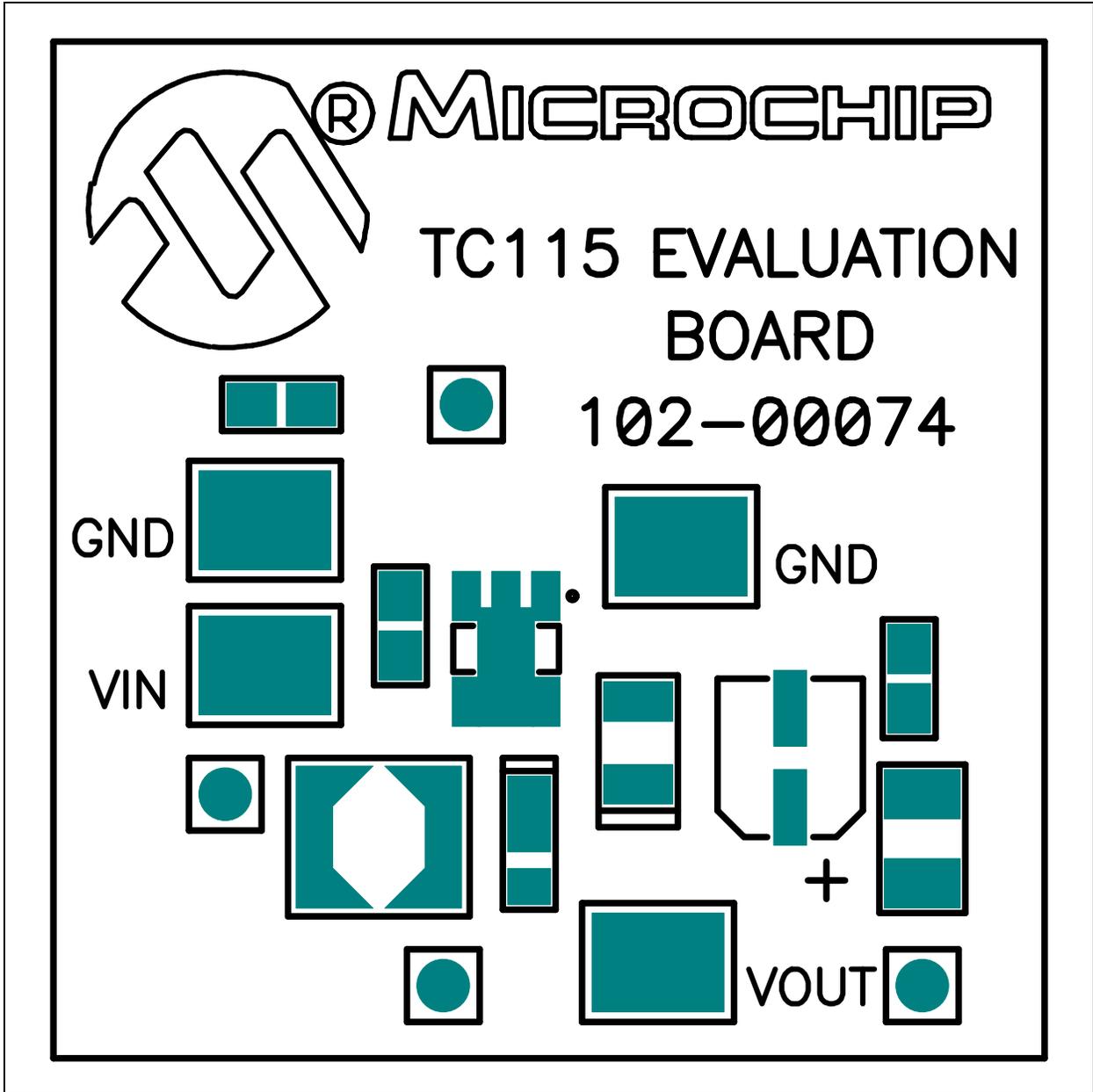| Qty. | Reference | Description | Mfgr. | Part Number |
|---|---|---|---|---|
| 1 | C1 | 10 µF, X5R Ceramic, 6.3V 0805 | Panasonic® | ECJ-CV50J106M |
| - | C2 | Do Not Populate | — | — |
| 1 | C3 | 47 µF, Electrolytic Capacitator, 6.3V | Nichicon | UWT0J470MCL1GB |
| - | C4 | Do Not Populate | — | — |
| 1 | D1 | 1A, 20V Shottky Diode | Diodes Inc. | DFLS120L |
| 1 | L1 | 100 µH, Inductor, SD25 | Coiltronics® | SD25-101-R |
| 1 | PCB | RoHS Compliant Bare PCB, TC115 PFM/PWM Boost Evaluation Board | — | 104-00074 |
| - | R1 | Do Not Populate | — | — |
| 1 | R2 | 475K, 1/8W,1%, Chip Resistor, 0805 | Rohm | MCR10EZHF4753 |
| 4 | TP1,TP2, TP3, TP4 | Test Point | Keystone Electronics® | 5016 |
| 1 | U1 | TC115 Step-up dc-dc Converter | Microchip Technology Inc. | TC115301EMTTR |

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