# UTC2000
# Evaluation Kit
# User's Guide

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**QUALITY MANAGEMENT SYSTEM**
**CERTIFIED BY DNV**
**═ ISO/TS 16949 ═**

**Object of Declaration: UTC2000**

EU Declaration of Conformity

Manufacturer:         Microchip Technology Inc.
                      2355 W. Chandler Blvd.
                      Chandler, Arizona, 85224-6199
                      USA

This declaration of conformity is issued by the manufacturer.

The development/evaluation tool is designed to be used for research and development in a laboratory environment. This development/evaluation tool is not a Finished Appliance, nor is it intended for incorporation into Finished Appliances that are made commercially available as single functional units to end users under EU EMC Directive 2004/108/EC and as supported by the European Commission's Guide for the EMC Directive 2004/108/EC (8th February 2010).

This development/evaluation tool complies with EU RoHS2 Directive 2011/65/EU.

This development/evaluation tool, when incorporating wireless and radio-telecom functionality, is in compliance with the essential requirement and other relevant provisions of the R&TTE Directive 1999/5/EC and the FCC rules as stated in the declaration of conformity provided in the module datasheet and the module product page available at www.microchip.com.

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Signed for and on behalf of Microchip Technology Inc. at Chandler, Arizona, USA

_12-Sep-14_

Derek Carlson                          Date
VP Development Tools

**NOTES:**

# Table of Contents

# 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 UTC2000 Evaluation Kit User's Guide. Items discussed in this chapter include:

- Document Layout EVK-UTC2000
- Conventions Used in this Guide
- Warranty Registration
- The Microchip Website
- Customer Support
- Document Revision History

## DOCUMENT LAYOUT EVK-UTC2000

This document describes how to use the UTC2000 Evaluation Kit as a demonstration platform optimized for portable applications. The manual layout is as follows:

- **Chapter 1. "Overview"** – Shows a brief description of the UTC2000 Evaluation Kit
- **Chapter 2. "Getting Started"** – Provides information about set-up and operation of the UTC2000 Evaluation Kit.
- **Chapter 3. "Hardware Configuration"** – Includes information about the hardware configuration of the UTC2000 Evaluation Kit.
- **Appendix A. "UTC2000 Schematics"**
- **Appendix B. "EVK-UTC2000 BOM"**
- **Appendix C. "EVK-UTC2000 PCB Silk Screens"**

> **Note:** USB Type-C™ USB-C™ are trademarks of USB Implementation Forum.

## 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) { ... }` |

## WARRANTY REGISTRATION

Please complete the enclosed Warranty Registration Card and mail it promptly. Sending the Warranty Registration Card entitles users to receive new product updates. Interim software releases are available at 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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- Technical Support

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Technical support is available through the website at:
http://www.microchip.com/support

## DOCUMENT REVISION HISTORY

| Revision | Section/Figure/Entry | Correction |
|---|---|---|
| DS50002399A (07-30-15) | Initial Release of Document | |
| DS50002399B (11-20-15) | **Section 2.1 "Contents of the Kit"** | Updated grammar. |
| | **Section 2.2.2 "EVB-UTC2000-DFP Legacy Charging Operation"** | Updated first paragraph to replace 56 k? with 56 kΩ. |
| | **Section 2.2.4 "3.0A Charging Operation"** | Updated steps to reflect correct information. |
| | Figure 3-3 | Updated image to remove black square in middle of the diagram. |
| | Figure 3-6 | Added trademark symbol to USB Type-C™. |
| | Figure 3-7 | Replaced incorrect image. |
| | Figure 3-8 | Added trademark symbol to USB Type-C™. |
| | **Appendix A. "UTC2000 Schematics"** | Updated all images to remove extraneous information. |
| | **Appendix B. "EVK-UTC2000 BOM"** | Fixed inconsistent text size. |

# Chapter 1.  Overview

## 1.1 UTC2000 EVALUATION KIT OVERVIEW AND FEATURES

The UTC2000 Evaluation Kit is intended to demonstrate the form factor and reversibility of the USB Type-C™ cable operation as enabled by the UTC2000 basic Type-C controller. The kit includes a downstream facing port board, an upstream facing port board, and a USB Type-C cable, as shown in Figure 1-1. A basic USB Type-C connection can be demonstrated with a standard USB 2.0 or USB 3.1* host port, the UTC2000 EVK and any USB 2.0 or USB 3.1 device. See **Section 1.2 "Features"** for more information.

> **Note:** EVK-UTC2000 is enabled with a USB 3.1 Gen 1 switch. USB 3.1 Gen 2 can be supported by using a compliant USB 3.1 Gen 2 switch.

**FIGURE 1-1:     UTC2000 EVALUATION KIT**
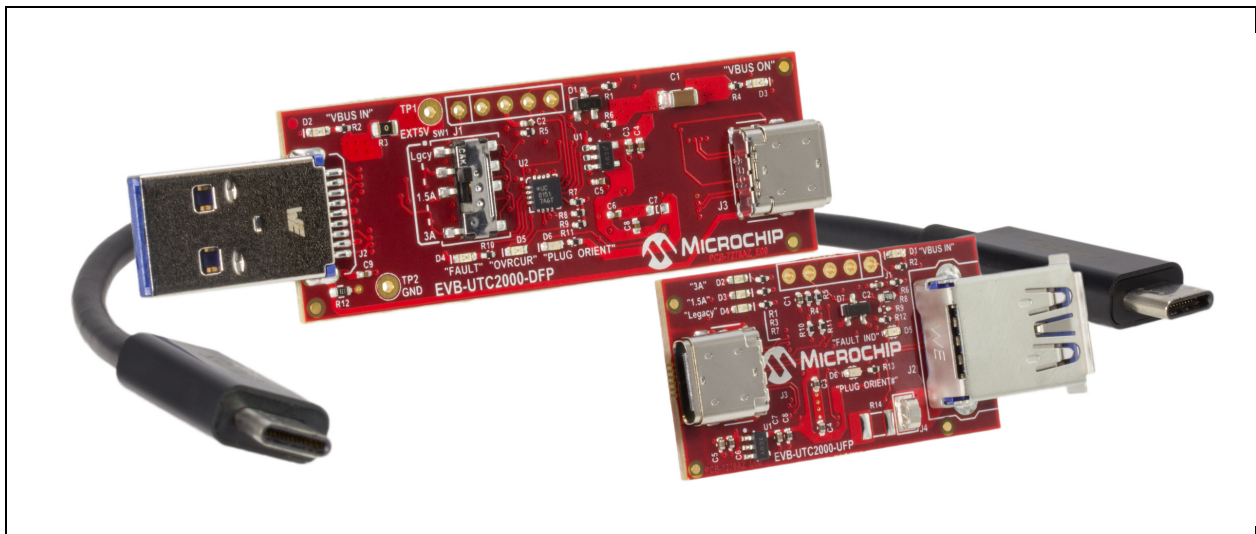


## 1.2 FEATURES

- EVB-UTC2000-DFP converts any USB Type-A port to a USB Type-C port
- EVB-UTC2000-UFP converts any USB device to a USB Type-C device
- Compatible with USB 2.0 and USB 3.1 host ports and devices
- Supports basic USB Type-C 5V charging at:
  - Legacy 500mA (USB 2.0)/900mA (USB 3.1)
  - 1.5A
  - 3.0A
- LED status indicators on the downstream facing port (DFP) board include:
  - 5V board supply indicators
  - "Overcurrent" and "Fault" indicators
  - Plug orientation

- LED status indicators on the upstream facing port (UFP) board include:
  - 5 V board supply indicator
  - Legacy, 1.5A, 3.0A charging detecting indicators
- DP3T switch on DFP board for legacy, 1.5A, 3.0A charging mode selection
- Reversible USB Type-C receptacle
- USB 3.1 passive Type-C Cable

## 1.3    GENERAL DESCRIPTION

**FIGURE 1-2:        EVB-UTC2000-DFP BLOCK DIAGRAM**

**FIGURE 1-3:** **EVB-UTC2000-UFP BLOCK DIAGRAM**



## 1.4 REFERENCES

- USB Type-C™ Specification
- UTC2000 Data Sheet
- Introduction to USB Type-C™ Application Note
  (http://ww1.microchip.com/downloads/en/AppNotes/00001953A.pdf)
- Basic USB Type-C™ Upstream Facing Port Implementation
  (http://ww1.microchip.com/downloads/jp/AppNotes/jp574170.pdf)

## 1.5 DEFINITION

- **DFP** - Downstream Facing Port
- **EVB** - Evaluation Board
- **EVK** - Evaluation Kit
- **UFP** - Upstream Facing Port

**NOTES:**

# Chapter 2. Getting Started

## 2.1 CONTENTS OF THE KIT

The UTC2000 Evaluation kit includes the basic equipment necessary for evaluation. The items included in the kit are:

1. EVB-UTC2000-DFP Evaluation Board
2. EVB-UTC2000-UFP Evaluation Board
3. USB Type-C Cable

## 2.2 BRING-UP AND TESTING

### 2.2.1 Setup and Requirements

- EVB-UTC2000-DFP: Before use, slide SW1 to the legacy charging mode. To use, simply insert the device into any USB Type-A USB 2.0 or USB 3.1 host port. Any USB Type-C device may now be connected to the USB Type-C port. The reversibility of the USB Type-C cable can be demonstrated by connecting it in the opposite direction.
- **EVB-UTC2000-UFP:** To use, connect to any USB Type-C host or hub port. If there is no native USB Type-C host available, the EVB-UTC2000-DFP board may be used. Insert a USB 2.0 or USB 3.1 device into the Type-A receptacle (J2) of the EVB-UTC2000-UFP. The device may then be used normally.

### 2.2.2 EVB-UTC2000-DFP Legacy Charging Operation

The EVB-UTC2000-DFP board is configured to Legacy 500mA (USB2.0)/900mA (USB3.1 Gen1) charging mode by default. Ensure that SW1 is in the "Lgcy" position. The switch will select 56 kΩ CC1/CC2 Rp pull-up resistors and set the CFG_SEL voltage to the appropriate level.

When connecting the EVB-UTC2000-DFP board to the EVB-UTC2000-UFP while in Legacy charging mode, the "Legacy" charging capability LED indicator (D4) on the EVB-UTC2000-UFP will be illuminated.

### 2.2.3 1.5A Charging Operation

The EVB-UTC2000-DFP is designed to plug in and operate from any legacy USB Type-A port. To protect your computer from possible overcurrent issues, 1.5A and 3.0A modes have been disabled by default.

To test 1.5A charging mode, perform the following steps:

1. Remove R15 and R17 56k Rp pull-up resistors.
2. Populate R18 and R23 with 22k, 0402 footprint resistors.
3. Set SW1 to the "1.5A" position.
4. Remove R3 to isolate the 5V domain on the EVB-UTC200-DFP from the 5V domain on your host PC.
5. Connect an external power supply as shown in **Section 3.1.1 "Power Source"**.

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When connecting the EVB-UTC2000-DFP board to the EVB-UTC2000-UFP while in 1.5A charging mode, the "1.5A" charging capability LED (D3) indicator on the EVB-UTC2000-UFP will be illuminated.

### 2.2.4    3.0A Charging Operation

The EVB-UTC2000-DFP is designed to plug in and operate from any legacy USB Type-A port. To protect your computer from possible overcurrent issues, 1.5A and 3.0A modes have been disabled by default.

To test 3.0A charging mode, perform the following steps:

1. Remove R15 and R17 56k Rp pull-up resistors.
2. Populate R24 and R27 with 10k, 0402 footprint resistors.
3. Set SW1 to the "3.0A" position.
4. Remove R3 to isolate the 5V domain on the EVB-UTC200-DFP from the 5V domain on your host PC.
5. Connect an external power supply as shown in **Section 3.1.1 "Power Source"**.

When connecting the EVB-UTC2000-DFP board to the EVB-UTC2000-UFP while in 3.0A charging mode, the "3.0A" charging capability LED indicator (D2) on the EVB-UTC2000-UFP will be illuminated.

# Chapter 3. Hardware Configuration

## 3.1 HARDWARE DESCRIPTION

**FIGURE 3-1:** **EVB-UTC2000-UFP (TOP-SIDE)**
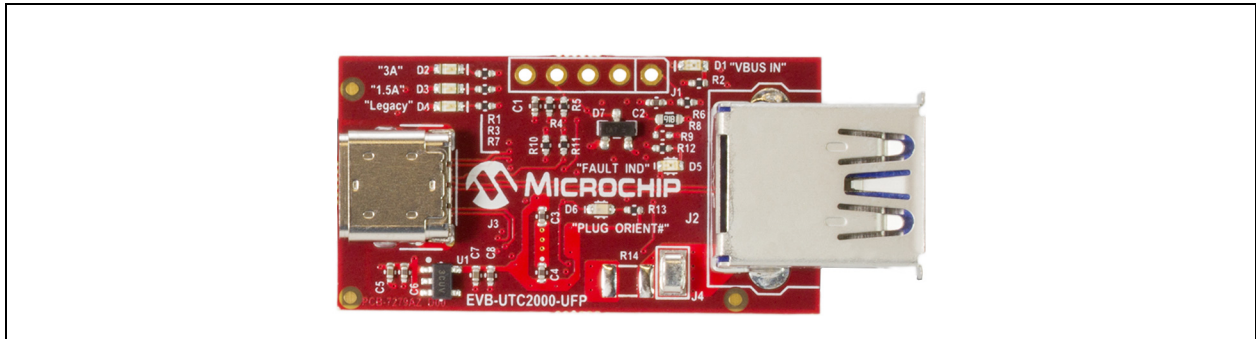


**FIGURE 3-2:** **EVB-UTC2000-DFP (TOP-SIDE)**
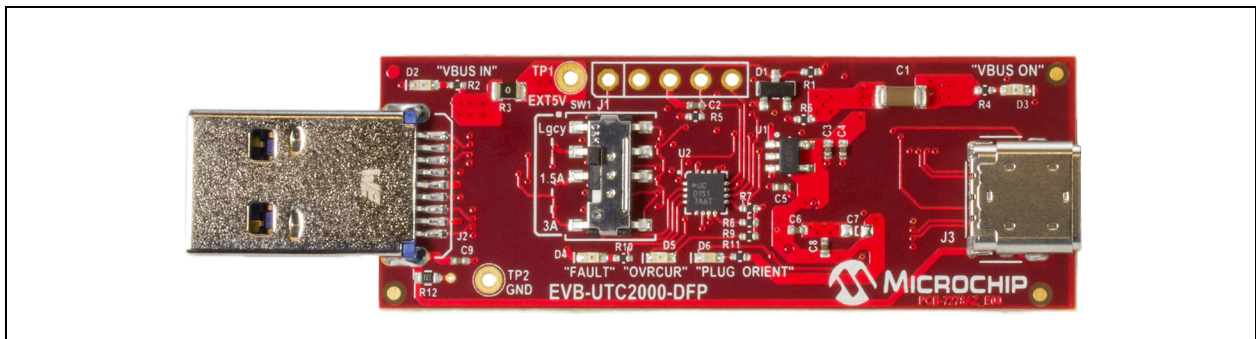


### 3.1.1 Power Source

The EVB-UTC2000-DFP can be powered in one of two ways:

1. **Host/Hub Port VBUS:** The board can be powered by 5V VBUS sourced from the connected host port. Do not operate with SW1 in the 1.5A or 3.0A modes and attempt to draw 1.5A or 3.0A when connected in this way, as Legacy USB Type-A host ports typically cannot support this amount of current draw.

2. **External 5V Supply:** An external 5V supply may be connected to TP1 to test 1.5A and 3.0A charging. Be sure to remove the R3 zero-ohm resistor to prevent voltage back drive to the host/hub port, as shown in Figure 3-3.

**FIGURE 3-3:          EVB-UTC2000-DFP EXTERNAL 5V SUPPLY**
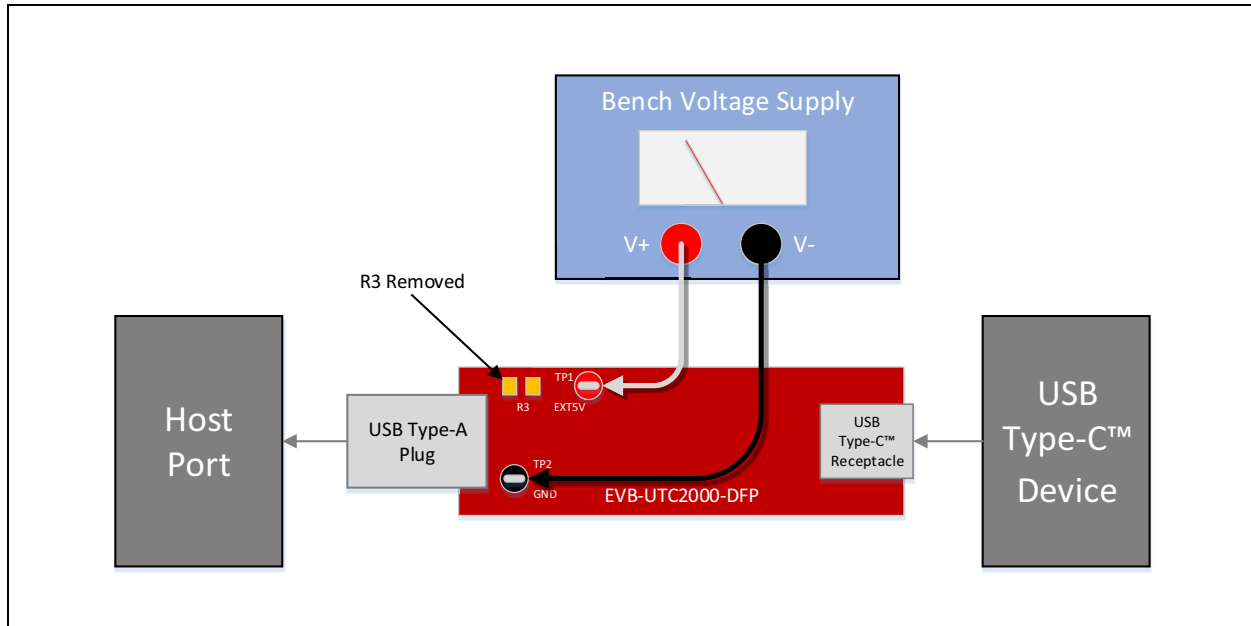


The EVB-UTC2000-UFP is always powered from VBUS supplied by the downstream facing port it is attached to.

### 3.1.2    LED Indicators for EVB-UTC2000-DFP

Table 3-1 describes the LED indicators included on the EVB-UTC2000-DFP.

**TABLE 3-1:      LED INDICATOR DESCRIPTIONS**

| REF. DES. | LABEL | DESCRIPTION |
|---|---|---|
| D2 | "VBUS IN" | Indicates that 5V board power is present. |
| D3 | "VBUS ON" | Indicates 5V is being supplied to VBUS on the Type-C port. |
| D4 | "FAULT" | Indicates an overvoltage or overcurrent event has occurred. This indicator will reset with a power cycle of the board. |
| D5 | "OVRCUR" | Indicates an overcurrent event is occurring. This signal is driven by the 5V port power controller. |
| D6 | "PLUG ORIENT" | Indicates the state of the PLUG_ORIENTATION# signal. When illuminated, PLUG_ORIENTATION is being driven low by the UTC2000. |

Figure 3-4 shows their location on the PCB.

**FIGURE 3-4:** **EVB-UTC2000-DFP LED INDICATOR LOCATIONS**
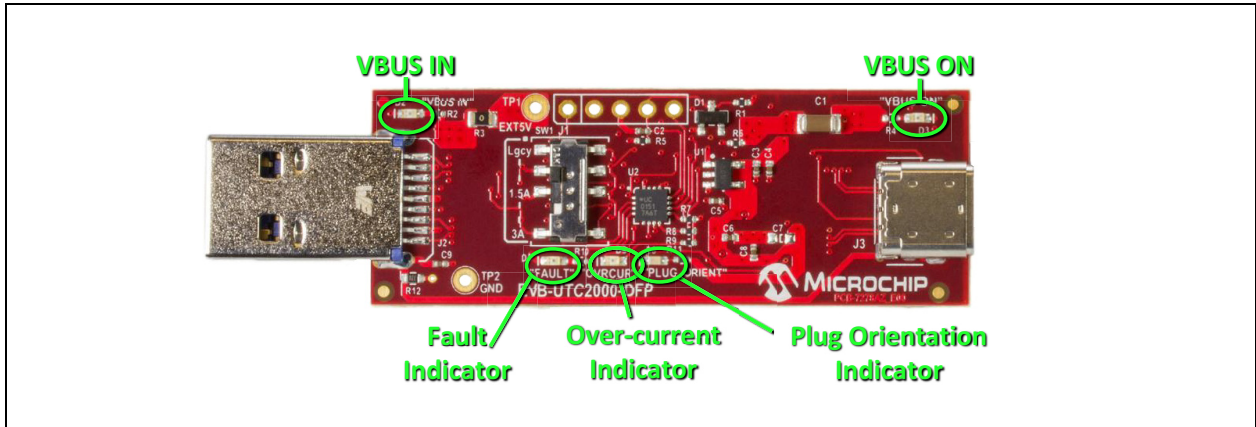


### 3.1.3 Switches on EVB-UTC2000-DFP

Table 3-2 describes the switches included on the EVB-UTC2000-DFP.

**TABLE 3-2:** **SWITCH DESCRIPTIONS**

| REF. DES. | LABEL | DESCRIPTION |
|-----------|-------|-------------|
| SW1 | "Lgcy -- 1.5A -- 3A" | Selects between the DFP modes of operation: "Lgcy", "1.5A", "3.0A" |

**Note:** The EVB-UTC2000-DFP is configured for Legacy mode of operation by default. See **Section 2.2.3 "1.5A Charging Operation"**/**Section 2.2.4 "3.0A Charging Operation"** for information on testing 1.5A/3.0A modes respectively.

Figure 3-5 shows their location on the PCB.

**FIGURE 3-5:** **EVB-UTC2000-DFP SWITCH LOCATIONS**
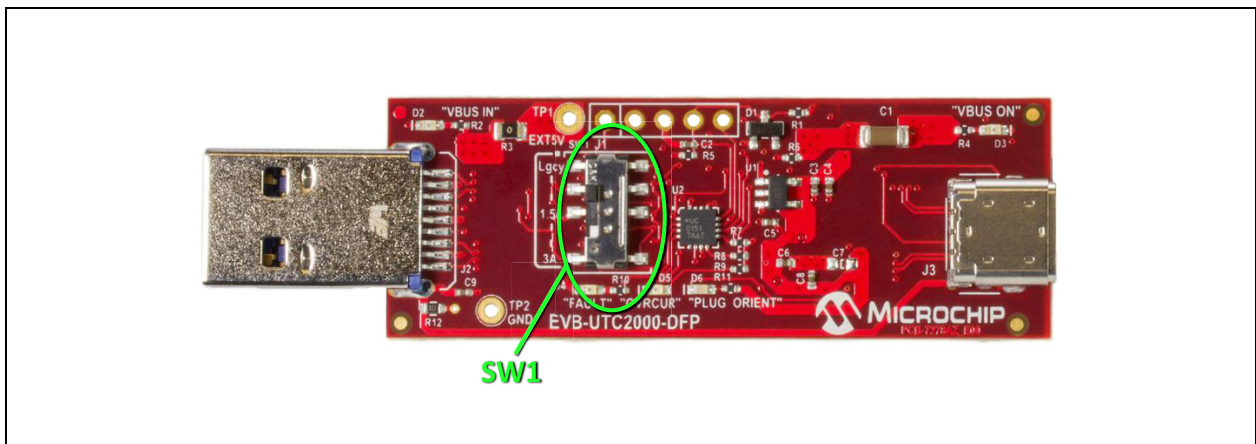
### 3.1.4 Connector Descriptions for EVB-UTC2000-DFP

Table 3-3 describes the connectors included on the EVB-UTC2000-DFP.

**TABLE 3-3:    CONNECTOR DESCRIPTIONS**

| REF. DES. | TYPE | LABEL | DESCRIPTION |
|-----------|------|-------|-------------|
| J1 | 1x5 Header | - | 5-pin debug header (internal MCHP use only) |
| J2 | USB 3.1 Type-A Plug | - | Type-A male plug |
| J3 | USB 3.1 Type-C Receptacle | - | Type-C receptacle |

**FIGURE 3-6:    EVB-UTC2000-DFP CONNECTOR LOCATIONS**
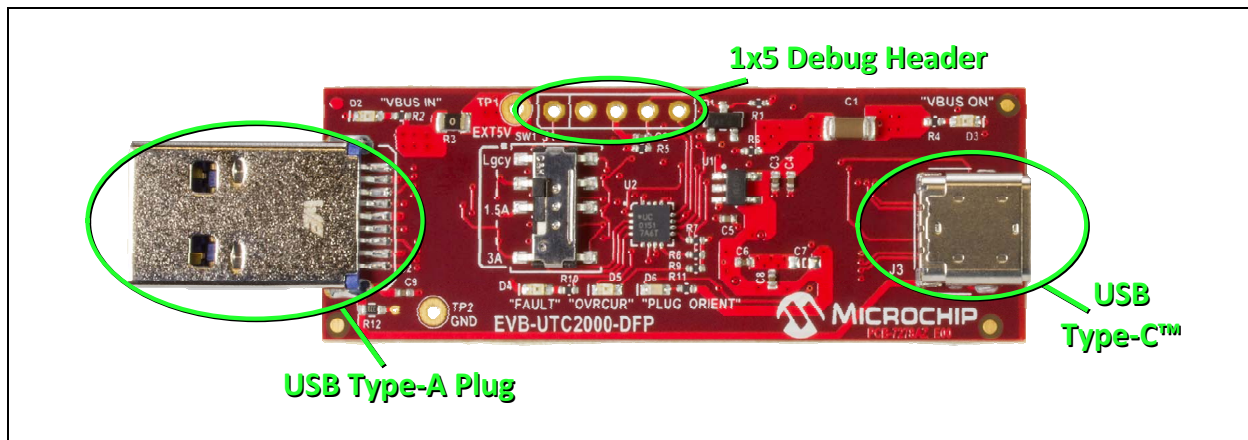


### 3.1.5 Test Points on EVB-UTC2000-DFP

Table 3-4 describes the test points included on the EVB-UTC2000-DFP. A header may be permanently installed on the through-hole test points if needed.

**TABLE 3-4:    EVB-UTC2000-DFP TEST POINT DESCRIPTIONS**

| REF. DES. | TYPE | DESCRIPTION |
|-----------|------|-------------|
| TP1 | Thru-Hole | 5V probe point or external 5V supply point |
| TP2 | Thru-Hole | GND |

### 3.1.6 LED Indicators for EVB-UTC2000-UFP

Table 3-5 describes the LED indicators included on the EVB-UTC2000-UFP.

**TABLE 3-5:    EVB-UTC2000-UFP LED INDICATOR DESCRIPTIONS**

| REF. DES. | LABEL | DESCRIPTION |
|-----------|-------|-------------|
| D1 | "VBUS IN" | Indicates that a valid VBUS (5.5V-4.0V) is being supplied to the EVB-UTC2000-UFP from the USB Type-C™ connection and that 5V is being passed to the USB Type-A receptacle. |
| D2 | "3A" | Indicates when a 3.0 A capable DFP connection is detected. |
| D3 | "1.5A" | Indicates when a 1.5 A capable DFP connection is detected. |
| D4 | "Legacy" | Indicates when legacy 500 mA (USB 2.0)/900 mA (USB 3.1) capable DFP connection is detected. |

Figure 3-7 shows their location on the PCB.

**FIGURE 3-7:** **EVB-UTC2000-UFP LED INDICATOR LOCATIONS**
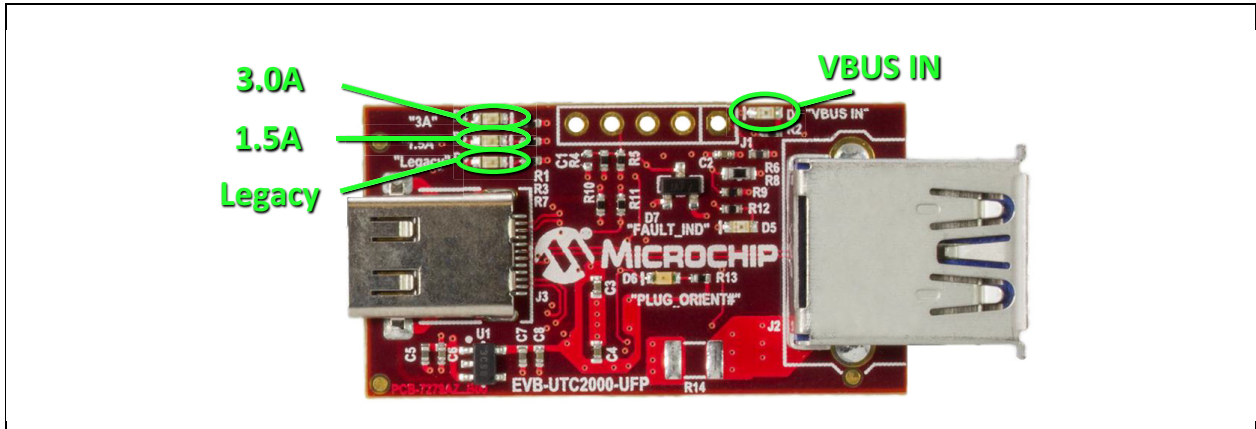


### 3.1.7 Switches on EVB-UTC2000-UFP

There are no switches present on the EVB-UTC2000-UFP.

### 3.1.8 Connector Descriptions for EVB-UTC2000-UFP

Table 3-6 describes the connectors included on the EVB-UTC2000-UFP.

**TABLE 3-6:** **EVB-UTC2000-UFP CONNECTOR DESCRIPTIONS**

| REF. DES. | TYPE | LABEL | DESCRIPTION |
|-----------|------|-------|-------------|
| J1 | 1x5 Header | - | 5-pin debug header (internal Microchip use only) |
| J2 | USB 3.1 Type-A Plug | - | USB Type-A receptacle |
| J3 | USB 3.1 Type-C Receptacle | - | USB Type-C™ receptacle |
| J4 | Load Loop | - | An external load may be connected between this load loop and GND (pin 3 of J1) |

**FIGURE 3-8:** **EVB-UTC2000-UFP CONNECTOR LOCATIONS**
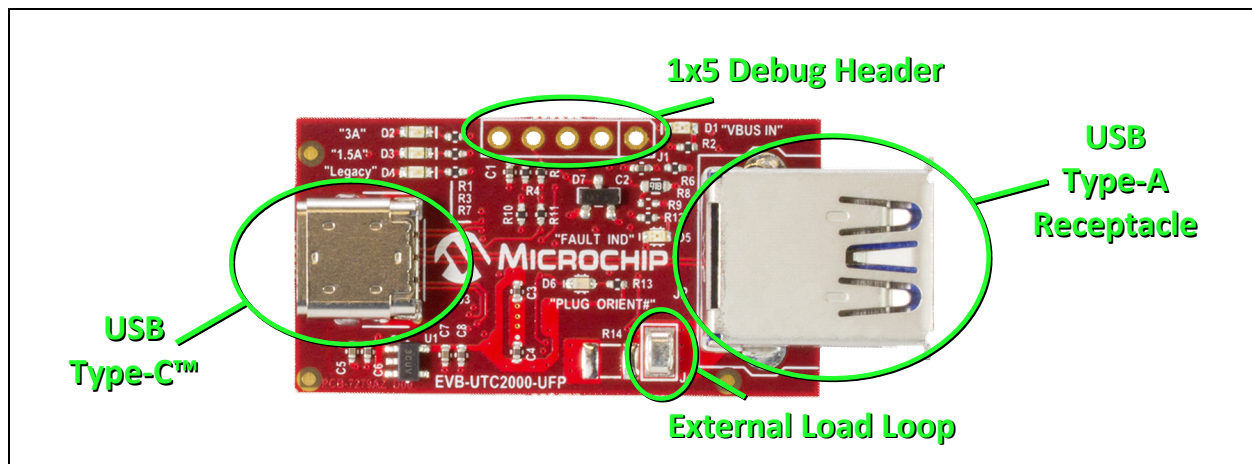


### 3.1.9    Test Points on EVB-UTC2000-UFP

There are no test points available on the EVB-UTC2000-UFP.

# Appendix A. UTC2000 Schematics

## A.1    INTRODUCTION

This appendix shows the UTC2000 Evaluation Kit Schematic.

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**FIGURE A-1:**        **UTC2000 EVALUATION KIT SCHEMATICS**

**FIGURE A-1:     UTC2000 EVALUATION KIT SCHEMATICS (CONTINUED)**

### UTC2000

U2 / UTC2000

VDD — 16
VSS — 13, 17
EPAD
ENABLE — 3
CFG_SEL — 2
NC — 15, 14

VMON — 12
CC1 — 7
CC2 — 6
VCONN1_OUT#/1.5A_IND# — 9
VCONN2_OUT#/LEGACY_IND# — 8
OCS# — 5
FAULT_IND — 4
PLUG_ORIENTATION# — 11
PPC_EN/3.0A_IND# — 10
AUDIO_ADPT/CONNECTED# — 5

5V
C14  0.1µF  16V  0402
R14  10k  0402
ENABLE
CFG_SEL

VMON

**"OverCurrent"**
R9  1k  0402
D5  Br Red
OCS#

R10  0402  1k
D4  Br Red
**"Fault"**
FAULT_IND

PLUG_ORIENTATION#
PPC_EN

3.3V
R11  1k  0402
1%  **"Plug Orientation"**
R30  10k  0402
D6  YELLOW
PLUG_ORIENTATION#

PLUG_ORIENTATION# indicates the Type-C cable insertion orientation.

HIGH = not connected or connected or unflipped
i.e.: CC >> CC1

LOW = connected and flipped
i.e.: CC >> CC2

### Debug Header (Internal Use Only)

Debug Header
J1
DNP
ENABLE
PLUG_ORIENTATION#
VMON
5V

### 3.3V Supply

U1   MCP1755T-3302E/OT
VIN — 1
VOUT — 5
SHDN — 3
GND — 2
PWRGD — 4

5V
C5  1.0µF
3.3V
C4  1.0µF
C3  0.1µF  16V

### Configuration Selection

CFG_SEL = 0.00V : Legacy 500mA/900mA Mode
CFG_SEL = 0.75V : 1.5A Mode
CFG_SEL = 1.25V : 3.0A Mode

5V
R21  56k  0402  1%
R25  30k  0402  1%
Q5A  PMDXB600UNE  1.5A_SEL
Q5B  PMDXB600UNE  3A_SEL
R19  100k  0402  1%
R29  100k  0402  1%
CFG_SEL
R28  10k  0402  1%

### CC Pins

5V
R7  100k  0402
R8  100k  0402
Q1A  CMLDM8005
Q2A  CMLDM8005
VCONN1#  Q1B  CMLDM8005
VCONN2#  Q2B  CMLDM8005

### Current Capability Marker Selector

Pos 1 - Legacy USB (900mA)
Pos 2 - 1.5A Capable
Pos 3 - 3.0A Capable

*R18/R23, R24/R27 are not populated by default because this EVB is designed to plug into any legacy USB port.*
*In order to test higher current modes, ensure to do the following:*
*1. Remove R15 and R17*
*2. Populate R18/R23 for 1.5A mode, or R24/R27 for 3.0A*
*3. Set SW1 in the corresponding position*
*4. Remove R3 to isolate 5V from the host PC*
*5. Connect an external high current bench supply to TP1/TP2*
*> 5.5V is recommended if testing 3A mode*

5V
R15  56k  0402  1%
R17  56k  0402  1%
R18  22k  0402  1%  DNP
R23  22k  0402  1%  DNP
R24  10k  0402  1%  DNP
R27  10k  0402  1%  DNP
Q3A  Q3B  PMDXB600UNE
Q4A  Q4B  PMDXB600UNE
Q6A  Q6B  PMDXB600UNE
R16  100k  0402  1%
R20  100k  0402  1%
R26  100k  0402  1%
SW1  AYZ0203AGRLC
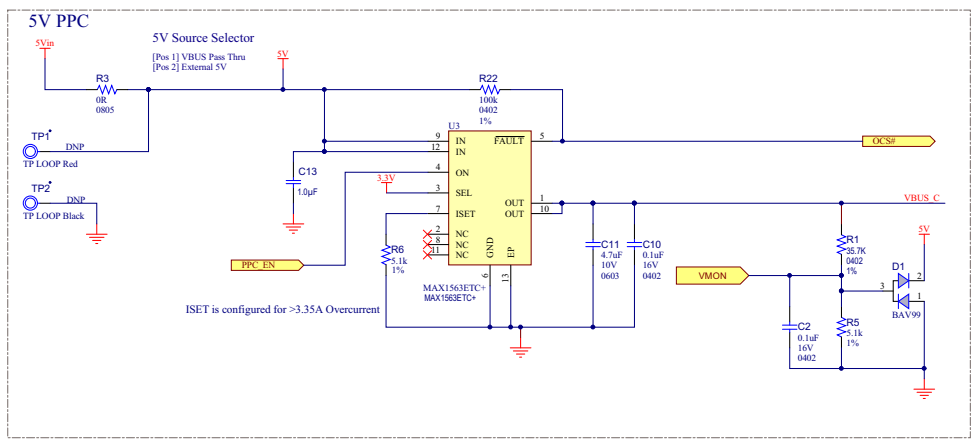1.5A_SEL
3A_SEL
CC1
CC2
5V

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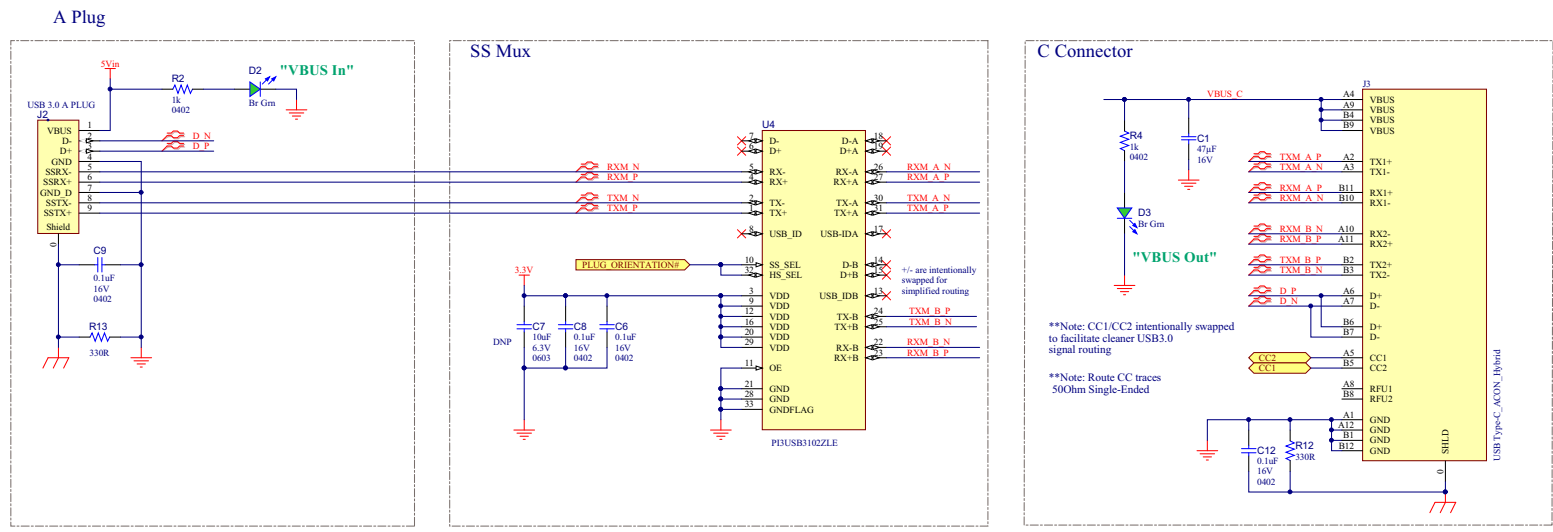**FIGURE A-1:** **UTC2000 EVALUATION KIT SCHEMATICS (CONTINUED)**

# Appendix B. EVK-UTC2000 BOM

## B.1    INTRODUCTION
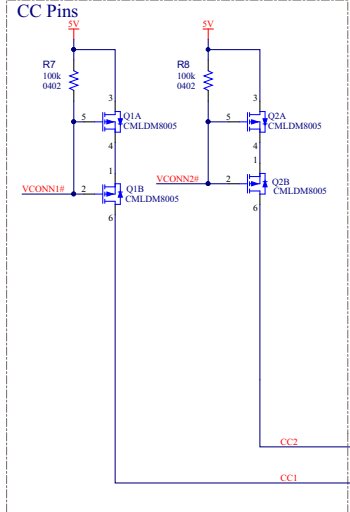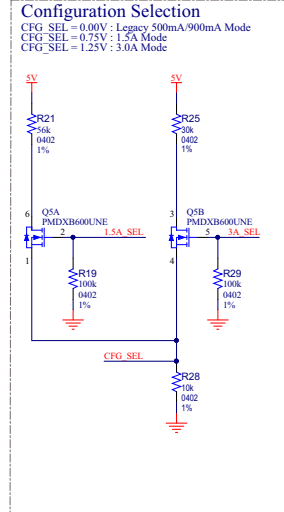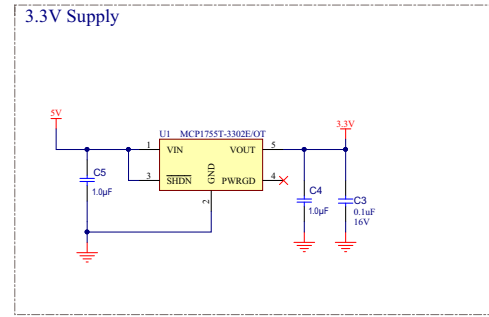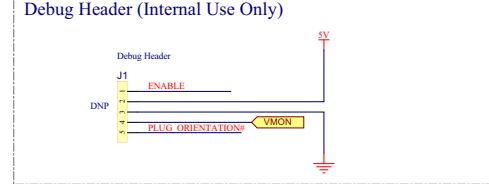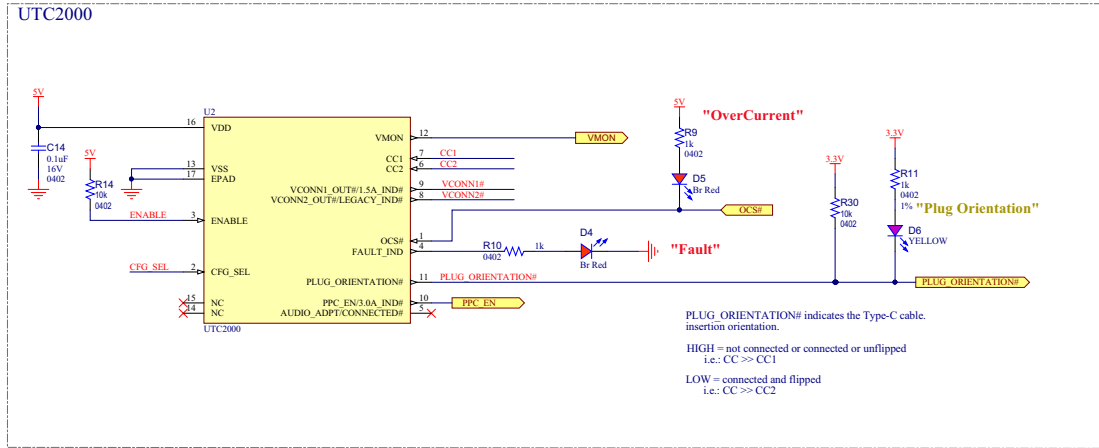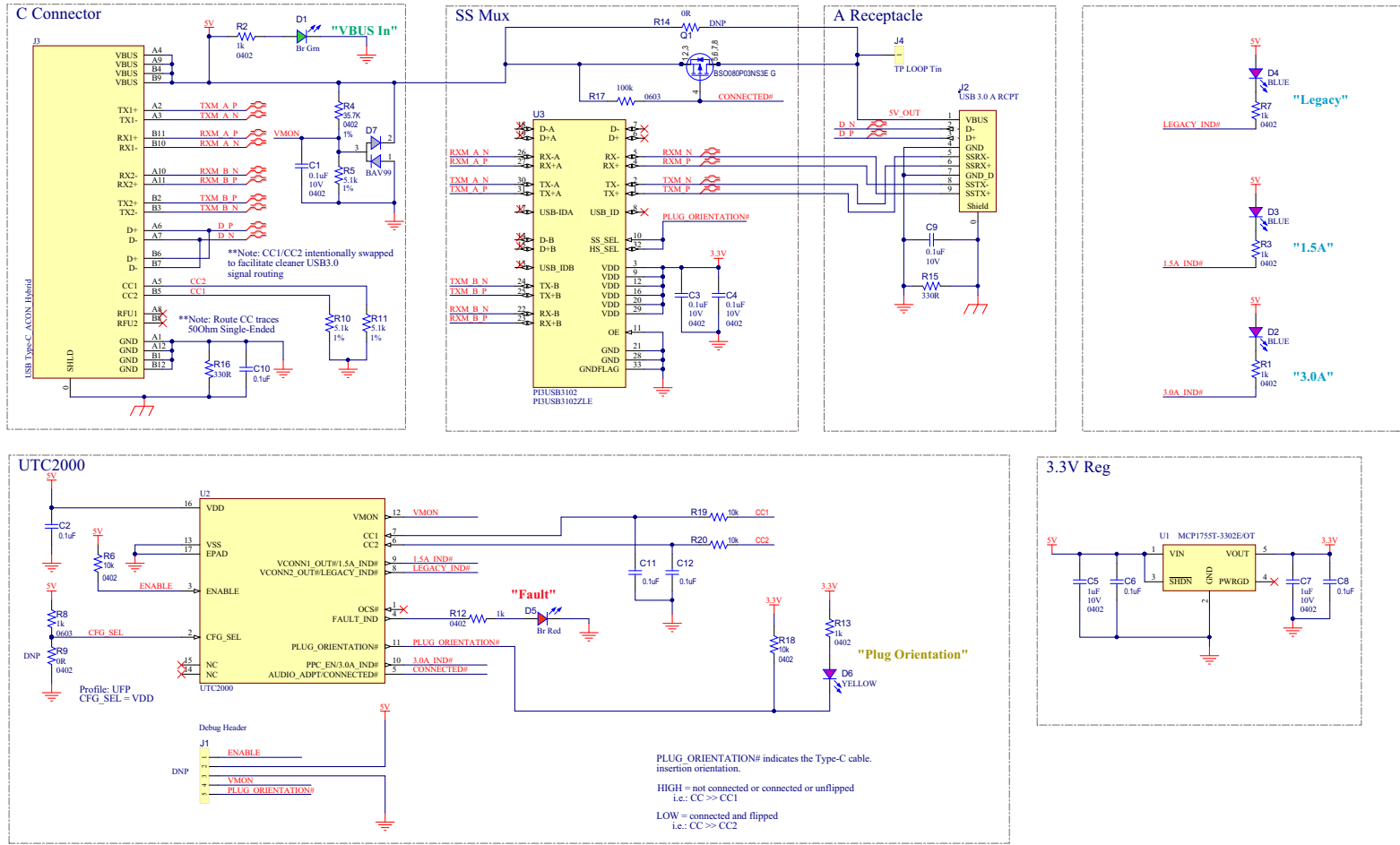
This appendix shows the EVK-UTC2000 Evaluation Bill of Materials.

**TABLE B-1:** **EVK-UTC2000-DFP BILL OF MATERIALS**

| Item | Qty | Qty Pop'd | Reference Designator(s) | Description | Manufacturer | Manufacturer Part Number |
|---|---|---|---|---|---|---|
| 1 | 1 | 1 | C1 | CAP CER, 47uF, 16V, 20%, X5R, 1206 | TDK Corporation | C3216X5R1C476M160AB |
| 2 | 8 | 8 | C2, C3, C6, C8, C9, C10, C12, C14 | CAP CER, 0.1uF, 16V, 80%, SMD, 0402 | Yageo | CC0402ZRY5V7BB104 |
| 3 | 3 | 3 | C4, C5, C13 | CAP CER, 1uF, 16V, 10%, X5R, 0402 | TDK Corporation | C1005X5R1C105K050BC |
| 4 | 1 | 1 | C7 | CAP CER, 10uF, 6.3V, 20%, X5R SMD, 0603 | AVX | 06036D106MAT2A |
| 5 | 1 | 1 | C11 | CAP CER, 4.7uF, 10V, 10%, X5R SMD, 0603 | Taiyo Yuden | LMK107BJ475KA-T |
| 6 | 1 | 1 | D1 | DIO RECTARR, BAV99, 1.25V, 200mA, 70V, SOT-23-3 | Fairchild | BAV99 |
| 7 | 2 | 2 | D2, D3 | LED, Bright Green, 0603 | Lite-On | LTST-C191KGKT |
| 8 | 2 | 2 | D4, D5 | LED, Bright Red, 0603 | Lite-On | LTST-C191KRKT |
| 9 | 1 | 1 | D6 | DIO LED YELLOW 2V 25mA 162.5mcd Diffuse SMD 0603 | OSRAM | LY Q976-P1S2-36 |
| 10 | 1 | 1 | J1 | CON HDR-2.54 Male 1x5 Gold 5.84MH TH VERT | Samtec | TSW-105-07-S-S |
| 11 | 1 | 1 | J2 | CON USB 3.1 Gen 1 STD-A PLUG SMD R/A | Wurth Electronics Inc | 692112030100 |
| 12 | 1 | 1 | J3 | CON USB 3.1 Gen 1 Hybrid Type-C | ACON | |
| 13 | 2 | 2 | Q1, Q2 | MOSFET SMD- Small Signal P-Channel Mosfet | Central Semiconductor | CMLDM8005 TR |
| 14 | 4 | 4 | Q3, Q4, Q5, Q6 | MOSFET TRENCH 2N-CH 20V 600MA SOT-1216 | NXP Semiconductors | PMDXB600UNE |
| 15 | 1 | 1 | R1 | RES SMD 35.7K OHM 1% 1/10W 0402 | Panasonic | ERJ-2RKF3572X |
| 16 | 5 | 5 | R2, R4, R9, R10, R11 | RES TKF 1k 1% 1/10W SMD 0402 | Panasonic | ERJ-2RKF1001X |
| 17 | 1 | 1 | R3 | RES TKF 0R 1/8W SMD 0805 | Panasonic | ERJ-6GEY0R00V |
| 18 | 2 | 2 | R5, R6 | RES SMD 5.1K OHM 1% 1/10W 0402 | Panasonic | ERJ-2RKF5101X |
| 19 | 8 | 8 | R7, R8, R16, R19, R20, R22, R26, R29 | RES TKF 100k 1% 1/10W SMD 0402 | Panasonic | ERJ-2RKF1003X |
| 20 | 2 | 2 | R12, R13 | RES TKF 330R 1% 1/10W SMD 0603 | ROHM | MCR03EZPFX3300 |
| 21 | 3 | 3 | R14, R28, R30 | RES TKF 10k 1% 1/10W SMD 0402 | Panasonic | ERJ-2RKF1002X |
| 22 | 3 | 3 | R15, R17, R21 | RES TKF 56k 1% 1/16W SMD 0402 | ROHM | MCR01MZPF5602 |
| 23 | 1 | 1 | R25 | RES SMD 30K OHM 1% 1/10W 0402 | Panasonic | ERJ-2RKF3002X |
| 24 | 1 | 1 | SW1 | SW SLIDE DP3T 12VDC 100MA SMT | C&K Components | AYZ0203AGRLC |

**TABLE B-1:** **EVK-UTC2000-DFP BILL OF MATERIALS (CONTINUED)**

| Item | Qty | Qty Pop'd | Reference Designator(s) | Description | Manufacturer | Manufacturer Part Number |
|---|---|---|---|---|---|---|
| 25 | 1 | 1 | TP1 | MISC, TEST POINT MULTI PURPOSE MINI RED | Keystone | 5000 |
| 26 | 1 | 1 | TP2 | MISC, TEST POINT MULTI PURPOSE MINI BLACK | Keystone | 5001 |
| 27 | 1 | 1 | U1 | IC REG LDO 3.3V 0.3A SOT23-5 | Microchip Technology | MCP1755T-3302E/OT |
| 28 | 1 | 1 | U2 | UTC2000 TYPEC CONTROLLER 16QFN | Microchip Technology | UTC2000/MG |
| 29 | 1 | 1 | U3 | IC CURR-LIM SW SNGL PROG 12-TQFN | Maxim Integrated | MAX1563ETC+ |
| 30 | 1 | 1 | U4 | IC USB 3.1 Gen 1 & USB 2.0 SWITCH 32TQFN | Pericom | PI3USB3102ZLE |

**TABLE B-2:** **EVK-UTC2000-UFP BILL OF MATERIALS**

| Item | Qty | Qty Pop'd | Reference Designator(s) | Description | Manufacturer | Manufacturer Part Number |
|---|---|---|---|---|---|---|
| 1 | 8 | 8 | C1, C2, C3, C4, C6, C8, C9, C10 | CAP CER 0.1uF 10V 10% X5R SMD 0402 | KEMET | C0402C104K8PACTU |
| 2 | 2 | 2 | C5, C7 | CAP CER 1uF 10V 10% X5R 0402 | Murata Electronics North America | GRM155R61A105KE15D |
| 3 | 1 | 1 | D1 | LED, Bright Green, 0603 | Lite-On | LTST-C191KGKT |
| 4 | 3 | 3 | D2, D3, D4 | DIO LED BLUE 2.8V 20mA 15mcd Clear SMD 0603 | Lite-On | LTST-C193TBKT-5A |
| 5 | 1 | 1 | D5 | LED, Bright Red, 0603 | Lite-On | LTST-C191KRKT |
| 6 | 1 | 1 | D6 | DIO LED YELLOW 2V 25mA 162.5mcd Diffuse SMD 0603 | OSRAM | LY Q976-P1S2-36 |
| 7 | 1 | 1 | D7 | DIO RECTARR BAV99 1.25V 200mA 70V SOT-23-3 | Fairchild | BAV99 |
| 8 | 1 | 1 | J1 | CON HDR-2.54 Male 1x5 Gold 5.84MH TH VERT | Samtec | TSW-105-07-S-S |
| 9 | 1 | 1 | J2 | CON USB 3.1 Gen 1 STD-A RCPT TH R/A | Wurth Electronics Inc | 692121030100 |
| 10 | 1 | 1 | J3 | CON USB 3.1 Gen 1 Hybrid Type-C | ACON | |
| 11 | 1 | 1 | J4 | CON TP LOOP Tin SMD | Harwin Inc | S1751-46R |
| 12 | 1 | 1 | Q1 | MOSFET P-CH 30V 12A 8DSO | Infineon Technologies | BSO080P03NS3E G |
| 13 | 6 | 6 | R1, R2, R3, R7, R12, R13 | RES TKF 1k 1% 1/10W SMD 0402 | Panasonic | ERJ-2RKF1001X |
| 14 | 1 | 1 | R4 | RES SMD 35.7K OHM 1% 1/10W 0402 | Panasonic | ERJ-2RKF3572X |
| 15 | 3 | 3 | R5, R10, R11 | RES SMD 5.1K OHM 1% 1/10W 0402 | Panasonic | ERJ-2RKF5101X |
| 16 | 2 | 2 | R6, R18 | RES TKF 10k 1% 1/10W SMD 0402 | Panasonic | ERJ-2RKF1002X |
| 17 | 1 | 1 | R8 | RES TKF 1k 1% 1/10W SMD 0603 | Yageo | RC0603FR-071KL |

**TABLE B-2:** **EVK-UTC2000-UFP BILL OF MATERIALS (CONTINUED)**

| Item | Qty | Qty Pop'd | Reference Designator(s) | Description | Manufacturer | Manufacturer Part Number |
|------|-----|-----------|-------------------------|-------------|--------------|---------------------------|
| 18 | 1 | 1 | R14 | RES TKF 0R 1/3W SMD 1210 | Vishay | CRCW12100000Z0EA |
| 19 | 2 | 2 | R15, R16 | RES TKF 330R 1% 1/10W SMD 0603 | ROHM | MCR03EZPFX3300 |
| 20 | 1 | 1 | R17 | RES TKF 100k 1% 1/10W SMD 0603 | Panasonic | ERJ-3EKF1003V |
| 21 | 1 | 1 | U1 | IC REG LDO 3.3V 0.3A SOT23-5 | Microchip Technology | MCP1755T-3302E/OT |
| 22 | 1 | 1 | U2 | UTC2000 TYPEC CONTROLLER 16QFN | Microchip Technology | EVK-UTC2000-UFP |
| 23 | 1 | 1 | U3 | IC USB 3.1 Gen 1 & USB 2.0 SWITCH 32TQFN | Pericom | PI3USB3102ZLE |

# Appendix C. EVK-UTC2000 PCB Silk Screens

## C.1 INTRODUCTION

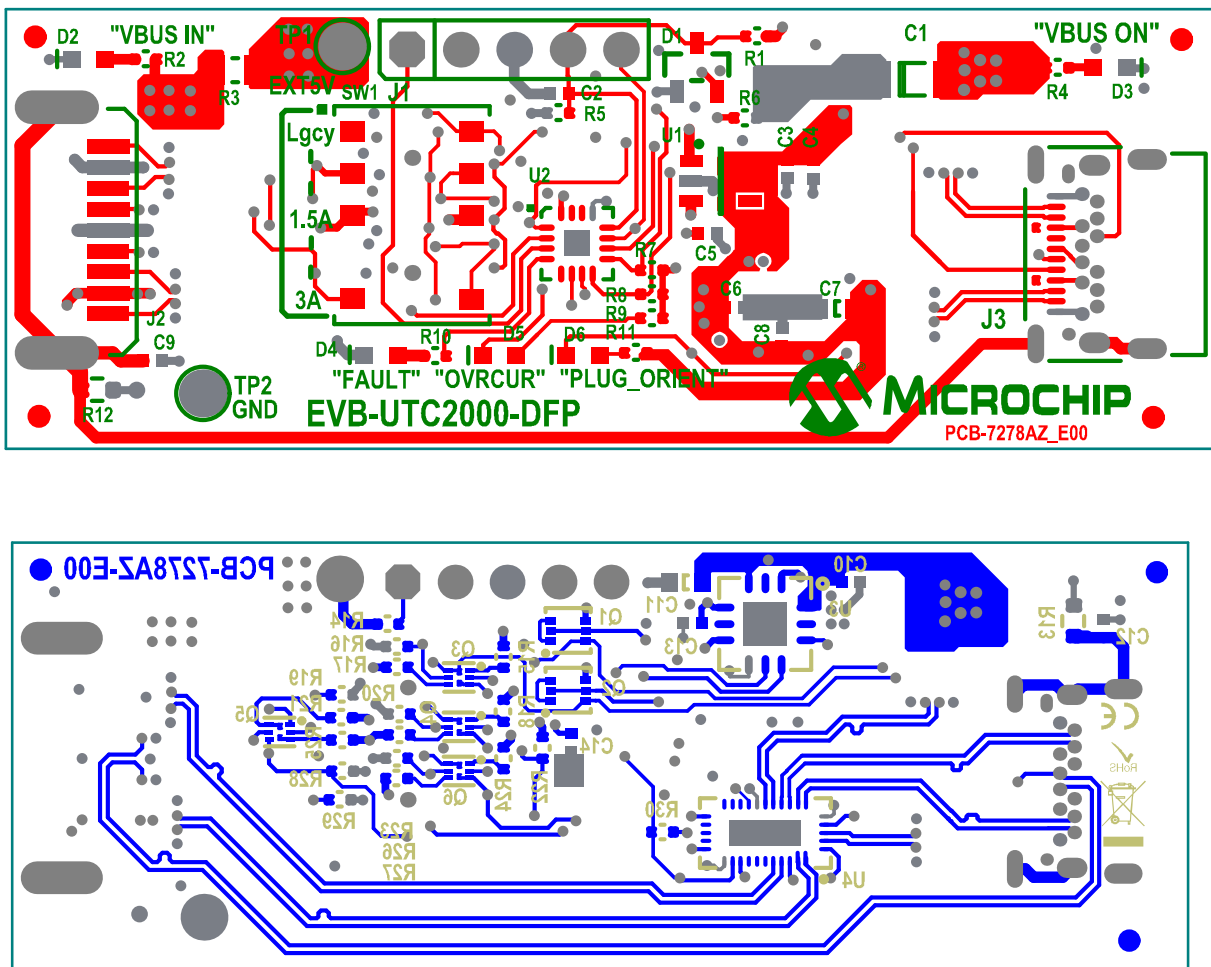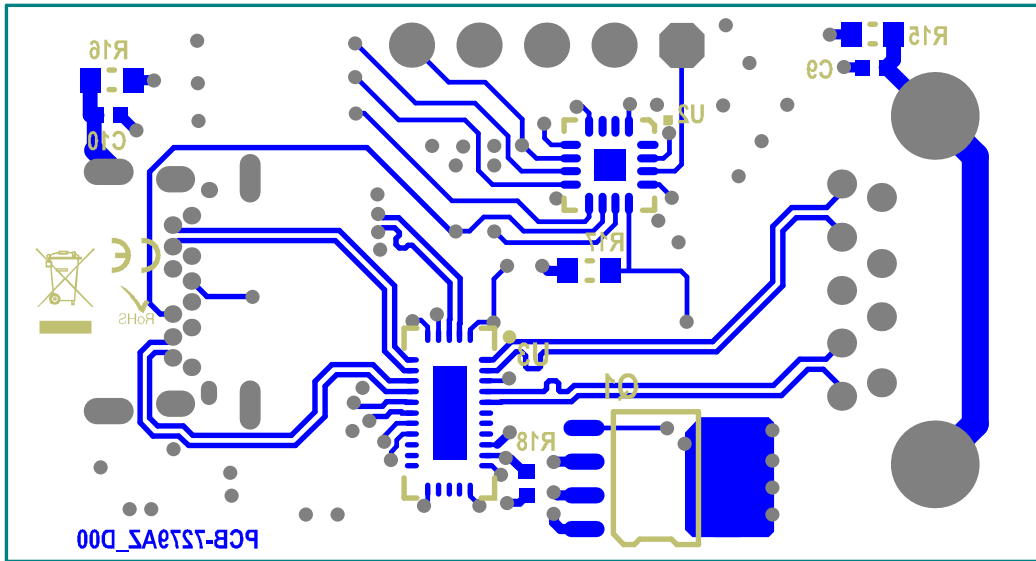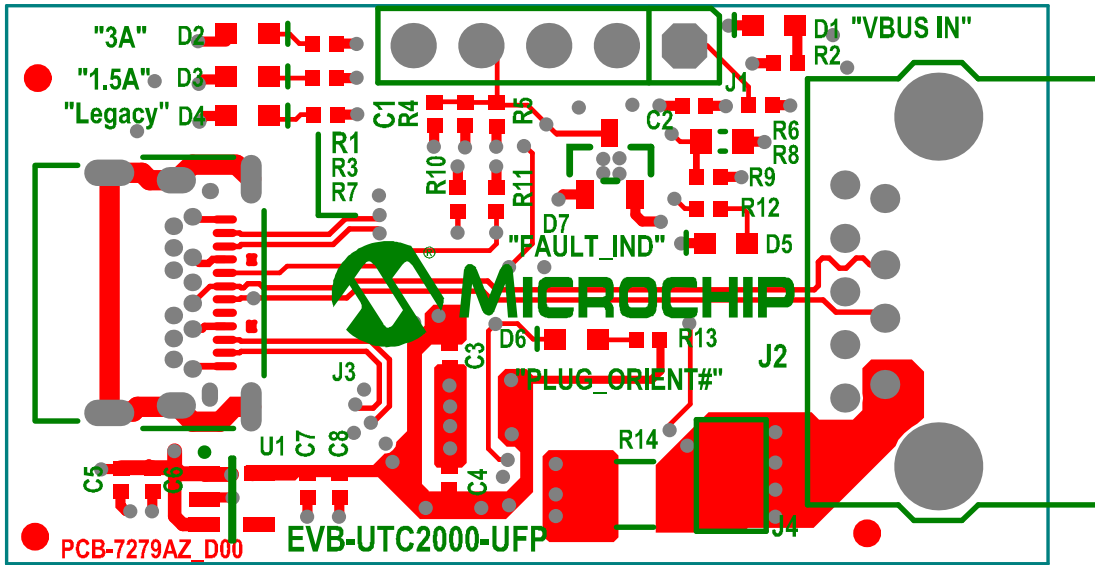This appendix shows the EVK-UTC2000 Top and Bottom Silk Screen Images.

**FIGURE C-1:** **EVB-UTC2000-DFP TOP AND BOTTOM SILK SCREEN IMAGES**

**FIGURE C-2:**       **EVB-UTC2000-UFP TOP AND BOTTOM SILK SCREEN IMAGES**

**NOTES:**

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