EVB-USB2534BC Evaluation Board User's Guide

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Object of Declaration: EVB-USB2534BC Evaluation Board
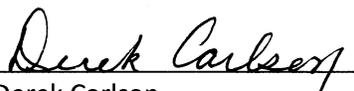
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The development/evaluation tool is designed to be used for research and development in a laboratory environment. This development/evaluation tool is not a Finished Appliance, nor is it intended for incorporation into Finished Appliances that are made 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).

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

Derek Carlson
VP Development Tools

16-July-2013
Date

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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 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 "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 PIC18F1220/1320. Items discussed in this chapter include:

- Document Layout
- Conventions Used in this Guide
- The Microchip Web Site
- Development Systems Customer Change Notification Service
- Customer Support
- Document Revision History

DOCUMENT LAYOUT

This document describes how to use the EVB-USB2534BC Evaluation Board as a development tool for the USB2534 4-port USB 2.0 hub with battery charging features. The manual layout is as follows:

- **Chapter 1. "Overview"** – Shows a brief description of the EVB-USB2534BC Evaluation Board
- **Chapter 2. "Hardware Configuration"** – Includes instructions on how to get started with the EVB-USB2534BC Evaluation Board.
- **Appendix A. "EVB-USB2534BC Evaluation Board"** – This appendix shows the EVB-USB2534BC Evaluation Board.
- **Appendix B. "EVB-USB2534BC Evaluation Board Schematics"** – This appendix shows the EVB-USB2534BC Evaluation Board schematics.
- **Appendix C. "Bill of Materials (BOM)"** – This appendix shows the EVB-USB2534BC Evaluation Board Bill of Materials (BOM).

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)`
		`{ ...`
		`}`

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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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- **Compilers** – The latest information on Microchip C compilers, assemblers, linkers and other language tools. These include all MPLAB C compilers; all MPLAB assemblers (including MPASM assembler); all MPLAB linkers (including MPLINK object linker); and all MPLAB librarians (including MPLIB object librarian).
- **Emulators** – The latest information on Microchip in-circuit emulators.This includes the MPLAB REAL ICE and MPLAB ICE 2000 in-circuit emulators.
- **In-Circuit Debuggers** – The latest information on the Microchip in-circuit debuggers. This includes MPLAB ICD 3 in-circuit debuggers and PICkit 3 debug express.
- **MPLAB IDE** – The latest information on Microchip MPLAB IDE, the Windows Integrated Development Environment for development systems tools. This list is focused on the MPLAB IDE, MPLAB IDE Project Manager, MPLAB Editor and MPLAB SIM simulator, as well as general editing and debugging features.
- **Programmers** – The latest information on Microchip programmers. These include production programmers such as MPLAB REAL ICE in-circuit emulator, MPLAB ICD 3 in-circuit debugger and MPLAB PM3 device programmers. Also included are nonproduction development programmers such as PICSTART Plus and PIC-kit 2 and 3.

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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 web site at:
http://www.microchip.com/support

DOCUMENT REVISION HISTORY

Revision A (October 2013)

• Initial Release of this Document.

Chapter 1. Overview

1.1 INTRODUCTION

The USB2534 is a low-power, full-featured and OEM configurable, High-Speed USB 2.0 compliant hub with four downstream ports, each capable of supporting battery charging. The EVB-USB2534BC Evaluation Board demonstrates a stand-alone hub application, advanced power saving options and configurable port assignments. See **1.2 "Features"** for more information.

1.2 FEATURES

- 36-pin QFN RoHS compliant package
- Four USB 2.0 downstream hub ports with individual port power and overcurrent sense (OCS)
- High-Speed (480 Mbps), Full-Speed (12 Mbps) and Low-Speed (1.5 Mbps) compatible
- USB Battery Charging is supported on all downstream USB ports up to 2A
- Multi-Transaction Translator (MTT) is enabled
- Supports internal default hub configuration. Optionally supports configuration from external EEPROM
- Low-Cost, 4-Layer space saving design with two outer signal layers, a power inner layer and a ground inner layer
- Individual port power control with LEDs for port power indication
- Self-Powered operation
- Operates from a single voltage (12.0 VDC, regulated) external power supply
- External supply provides up to 6A of 5.0 VDC for system use and USB downstream power through an on board 5 VDC regulator
- On board MCP1725 3.3 VDC regulator provides power to the USB2534 circuits and RESETn control
- LED indicator for "Suspend" hub state (optional)
- EMI suppression provided by selection of capacitors and inner power/ground Printed Circuit Board (PCB) layers
- ESD component footprints provided (optional)
- Single crystal clock source
- Schematics, layout and bill of materials are available to minimize new product development time

1.3 GENERAL DESCRIPTION

The EVB-USB2534BC is an evaluation and demonstration platform featuring the USB2534 USB 2.0 hub on a 4-layer RoHS compliant Printed Circuit Board (PCB).

The EVB-USB2534BC is designed to demonstrate the unique features of this device using a low-cost PCB implementation with individual port power control for the downstream USB 2.0 ports. All downstream USB 2.0 ports include a high current port power controller to fully support USB battery charging as a high current walk-up port.

> **Note:** Do not exceed 6A total current consumption from 5 VDC.

The EVB-USB2534BC is designed to support internal default configuration settings and an external I^2C™ EEPROM (optional) for custom configured functionality. A location is provided for an external I^2C EEPROM device for configuration at U8 Figure 2-1 and Figure 2-2 show the top and bottom level silk screen and copper layers.

Chapter 2. Hardware Configuration

2.1   HARDWARE DESCRIPTION

The EVB-USB2534BC includes two on board regulators. The first generates 5 VDC from an external 12 VDC regulated power supply. This supplies power to the downstream USB ports and to the 3.3 VDC regulator. The second is an MCP1725, which generates 3.3 VDC for the hub device circuitry and performs voltage supervisor and RESETn functions. The USB2534 generates its own 1.2 VDC for internal use with on-chip 1.2 VDC regulators. The internal 1.2 VDC regulator tied to the oscillator and the PLL is turned off during suspend to minimize suspend current. Downstream port power is distributed by four independent power switches at up to 2A per port. Upstream and downstream port connectors have USB 2.0 compliant decoupling and a separate shield ground.

> **Note:**   Do not exceed 6A total current consumption from 5 VDC.

2.1.1   Port Assignment

Downstream ports are numbered 1 through 4. The USB2534 allows any or all of the downstream ports to be configured for high current battery USB charging, and the EVB-USB2534BC is designed to demonstrate this feature.

In the default configuration, battery charging can be independently configured for each port with the Battery Charging Strapping header. Battery charging can also be configured using an external configuration, as described below.

2.1.2   USB2534 Configuration

Default: The EVB-USB2534BC has been set up to support an internal default configuration as determined by the state of the CFG_SEL1 and CFG_SEL0 pins immediately after reset. The vendor ID, product ID, language ID, device ID and other choices have been set using ROM code defaults.

EEPROM Option: The EVB-USB2534BC can load configuration from an external two-wire, I^{2}C EEPROM (U8). The EEPROM must be installed and the configuration option resistors on the CFG_SEL1 and CFG_SEL0 pins changed to enable this option. The EEPROM may be pre-programmed before installation, or programmed via the USB Host. This option allows access to all USB2534 configuration registers and ID strings, providing detailed functional analysis and exercise as desired. The EVB-USB2534BC is compatible with I^{2}C EEPROMs from several manufacturers. The memory capacity must be at least 512 bytes.

2.1.3   Powered State LED

An optional LED (D5) indicates when +5 VDC and +3.3 VDC power is present.

2.1.4   RESETn LED

An optional LED (D7) indicates when the RESETn signal is driven low and the USB2534 is held in the Reset state.

2.1.5   Port Power LEDs

D1, D2, D3 and D4 indicate when 5 VDC port power is available to the associated downstream USB port(s).

2.1.6   Suspend LED

An optional LED (D6) indicates the active state of the hub.

2.1.7   Connector Description

The EVB-USB2534BC provides a set of standard USB style connectors, one of type B for the upstream port and four of type A for downstream ports. Power is supplied via a 2.5 mm power jack. Table 2-1 lists all of the connectors. For more details on the pinout of these connectors, please refer to the EVB-USB2534BC schematics.

TABLE 2-1:   CONNECTOR DESCRIPTION

Connector	Type	Description
J0	USB B	Upstream USB Port 0
J1	USB A	Downstream USB Port 1
J2	USB A	Downstream USB Port 2
J3	USB A	Downstream USB Port 3
J4	USB A	Downstream USB Port 4
J5	2x4 header	Battery Charging Strap Selector
J6	1x2 header (not populated)	Optional Ext. +12 VDC supply header
J7	1x2 header	External Reset Control
J8	Power Jack 2.5 mm	+12 VDC Regulated Power Supply
J10	1x2 header	I^2C and SMBus Enable
J11, J12	1x2 headers	Configuration
J13	2x5 header	SMBus IF connection

2.1.8   Layout Considerations

The EVB-USB2534BC is designed on four PCB layers – two signal layers and two supply layers. The PCB layer stackup is shown in Table 2-2. All signals are routed on the top and bottom layers, while the internal layers are ground and power. Note that the differential signals from the USB2534 neatly fan out to match the upstream and downstream port placement, thus simplifying routing of these critical signals.

TABLE 2-2:   PCB LAYER STACKS

Component Side	
Solder Mask	
Layer 1	1.9-2.8 mil, finished
Pre-preg	4.25 mil, +/- 0.25 mil FR-4
Layer 2 – GND	1.3 mil (nominal)
Core	~24 mil FR-4
Layer 3 – POWER	1.3 mil (nominal)
Pre-preg	4.25 mil, +/- 0.25 mil FR-4
Layer 4	1.9-2.8 mil, finished
Solder Mask	
Solder Side	

Component side top layer is shown in Figure 2-1 with silk screen information to identify component locations.

FIGURE 2-1: EVB-USB2534BC TOP LAYER – COMPONENT SIDE
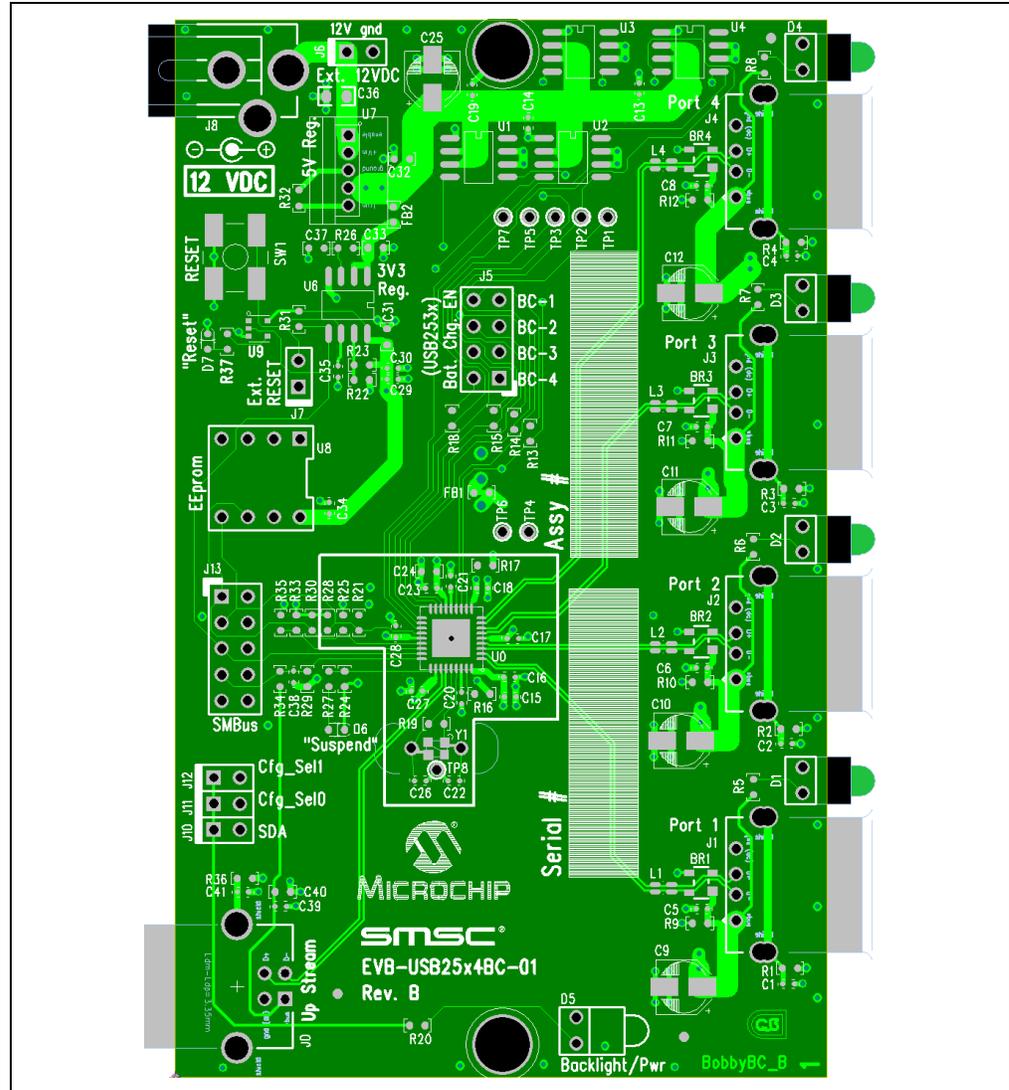
FIGURE 2-2: **EVB-USB2534BC BOTTOM LAYER – SOLDER SIDE**
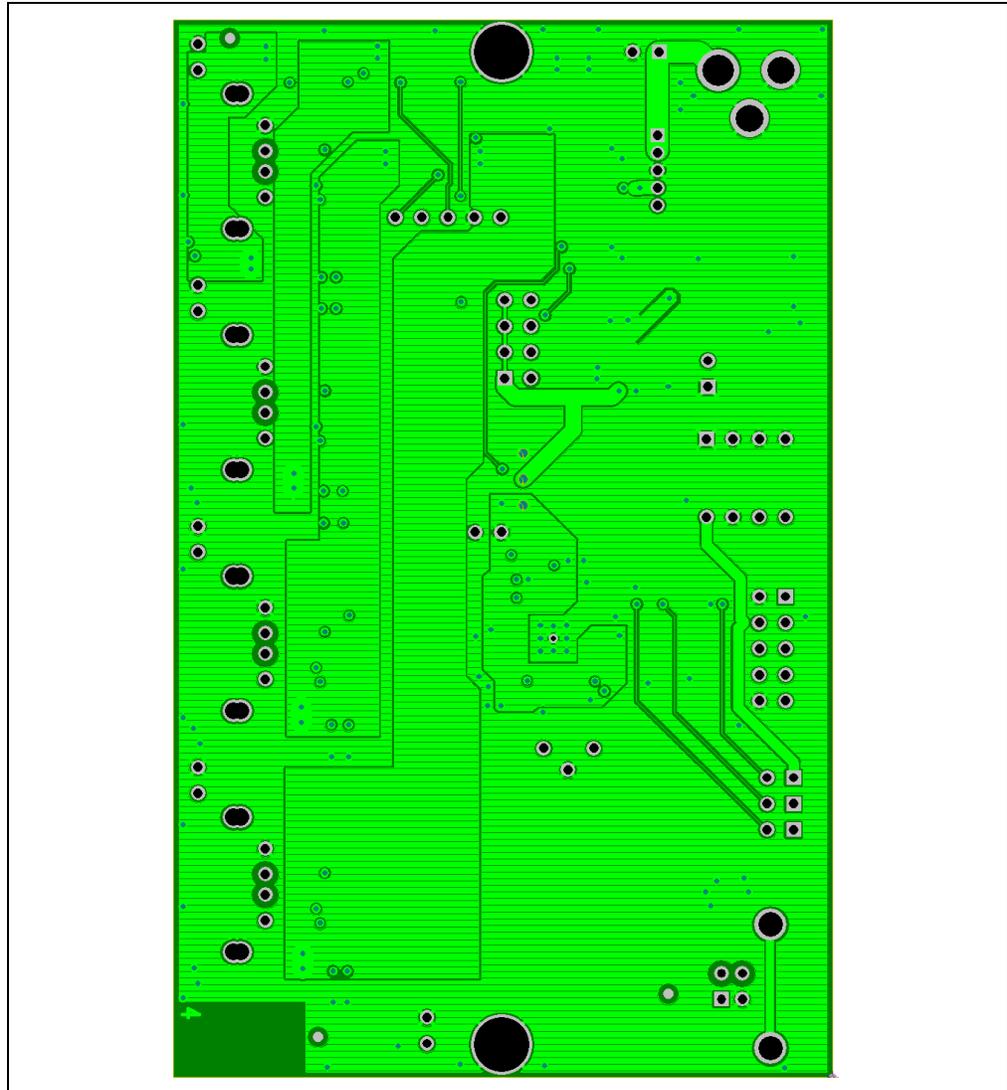
Appendix A. EVB-USB2534BC Evaluation Board

A.1   INTRODUCTION

This appendix shows the EVB-USB2534BC Evaluation Board.

FIGURE A-1:   EVB-USB2534BC EVALUATION BOARD
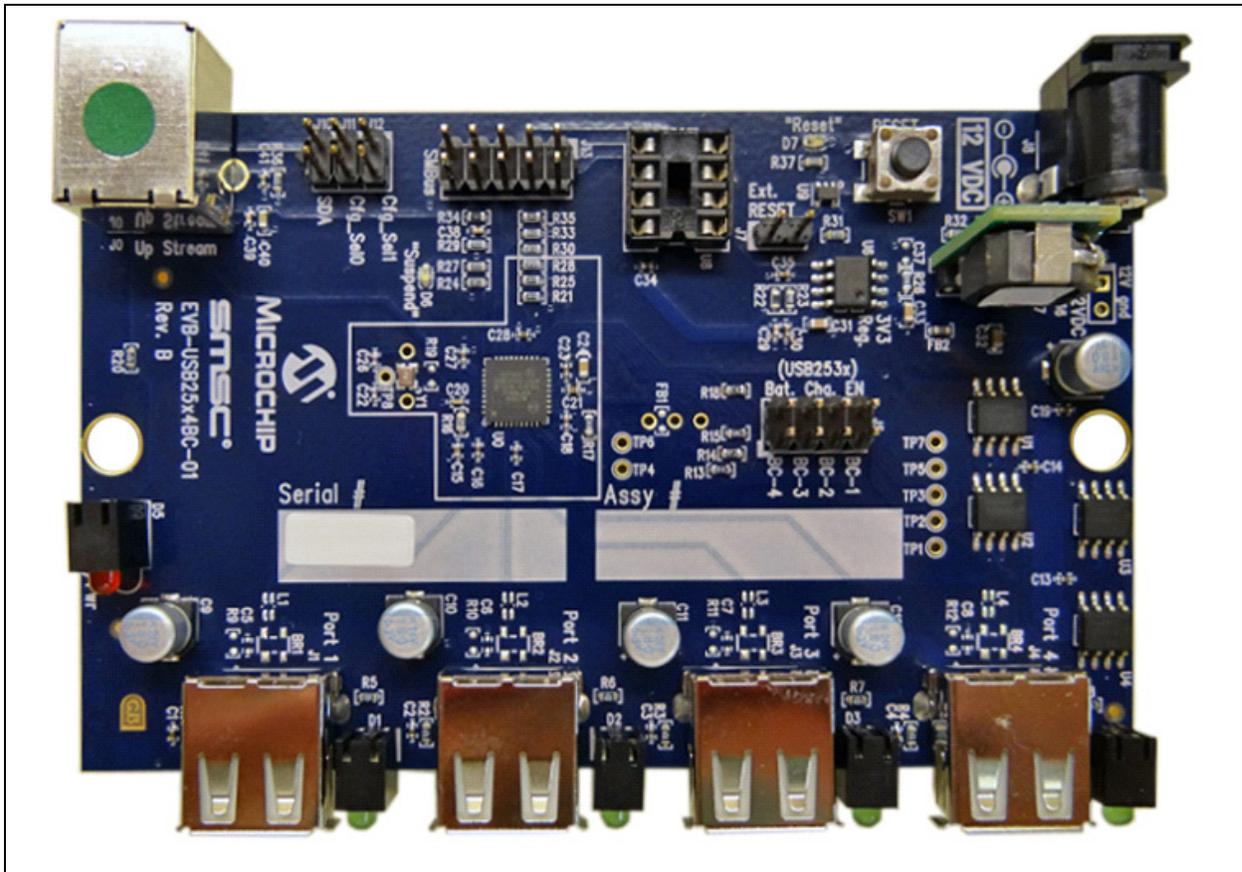
NOTES:

Appendix B. EVB-USB2534BC Evaluation Board Schematics

B.1   INTRODUCTION

This appendix shows the EVB-USB2534BC Evaluation Board schematics.

EVB-USB2534BC Evaluation Board User's Guide

FIGURE B-1: **EVB-USB2534BC EVALUATION BOARD SCHEMATIC 1**

NOTES:

Appendix C. Bill of Materials (BOM)

C.1 INTRODUCTION

This appendix shows the EVB-USB2534BC Evaluation Board Bill of Materials (BOM).

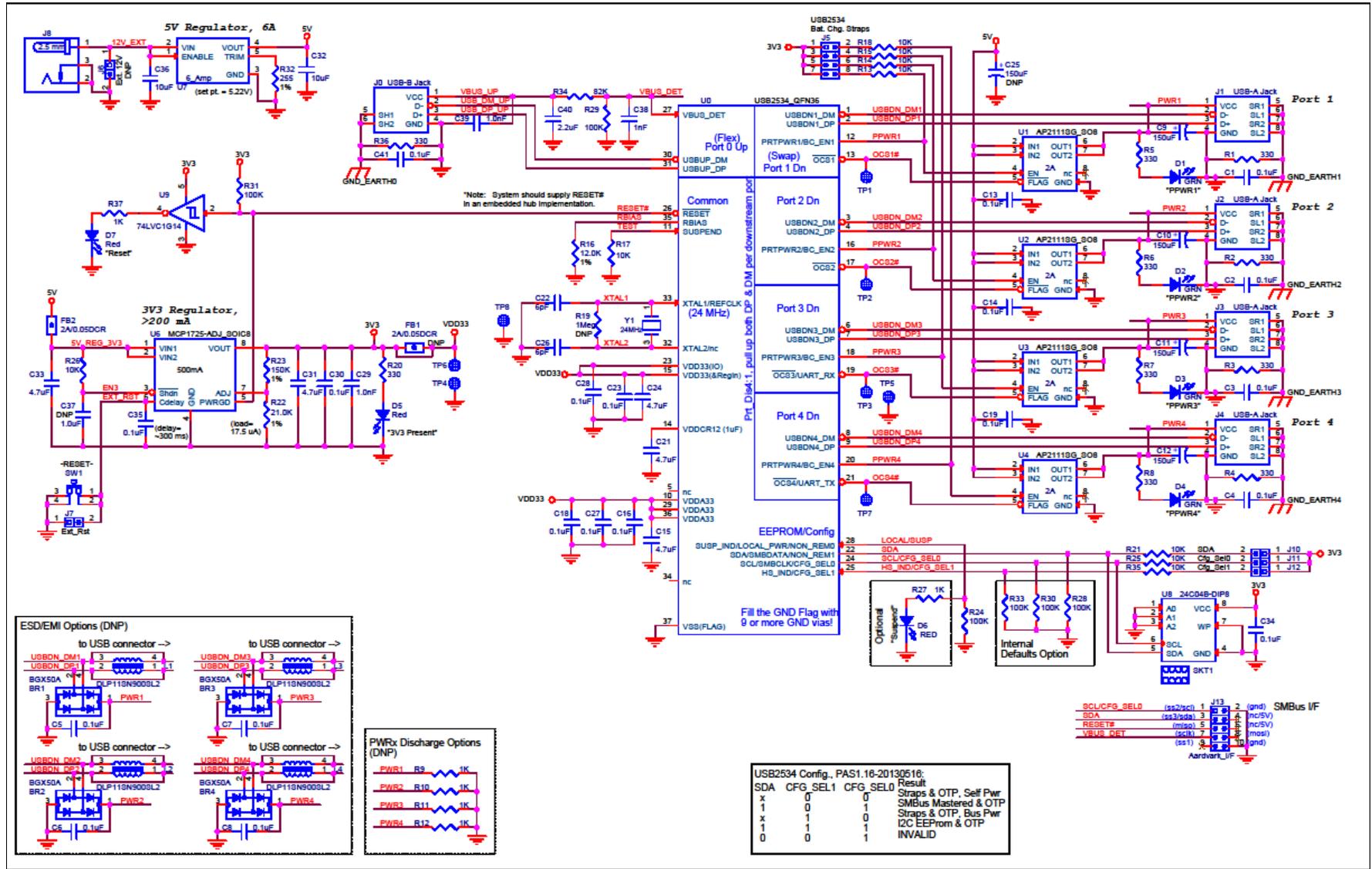**TABLE C-1:** **EVB-USB2534BC EVALUATION BOARD BILL OF MATERIALS**

Item	Qty	Qty Populated	Reference Designator(s)	Description	Manufacturer	Manufacturer Part Number	Notes
1	1	1	Assembly	Assembly, BobbyBC (EVB-USB2534BC-01), Rev. B2		EVB-USB2534BC-01	
2	4	0	BR1,BR2,BR3,BR4	Diode, Bridge, Switching, 50V, 140mA,KCAC, SOT-143	Infineon Tech	BGX50A	ESD
3	15	15	C1,C2,C3,C4,C13,C14,C16,C18, C19,C23,C27,C28,C30,C35,C41	Capacitor, 0.1uF, 25V, 10%, X5R, 0402	Murata	GRM155R61E104KA7D	
4	4	0	C5,C6,C7,C8	Capacitor, 0.1uF, 25V, 10%, X5R, 0402	Murata	GRM155R61E104KA7D	ESD
5	4	4	C9,C10,C11,C12	Capacitor, Low ESR, 150uF, 6.3VDC, 20%, Aluminum, Radial-SMT, 5mm x 5.7mm	Lelon	VZS151M0JTR-0506	
6	2	2	C15,C21	Capacitor, 4.7uF, 6.3VDC, 20%, X5R, 0402	TDK	C1005X5R0J475M	
7	1	0	C17	Capacitor, 0.1uF, 25V, 10%, X5R, 0402	Murata	GRM155R61E104KA7D	DNP
8	1	0	C20	Capacitor, 1.0uF, 10%, 6.3V, X5R, 0402	Murata	GRM155R60J105KE19D	DNP
9	2	2	C22,C26	Capacitor, 6pF, 50V, +/-0.5pF, NPO, 0402	Murata	GRM1555C1H6R0DZ01D	
10	3	3	C24,C31,C33	Capacitor, 4.7uF, 6.3VDC, 20%, X5R, 0603	Murata	GRM188R60J475KE19D	
11	1	0	C25	Capacitor, Low ESR, 150uF, 6.3VDC, 20%, Aluminum, Radial-SMT, 5mm x 5.7mm	Lelon	VZS151M0JTR-0506	DNP
12	3	3	C29,C38,C39	Capacitor, 1000pF, 50V, 10%, X7R, 0402	Murata	GRM155R71H102KA01D	
13	1	1	C32	Capacitor, 10uF, 6.3VDC, 20%, X5R, 0603	Murata	GRM188R60J106ME47D	
14	1	1	C34	Capacitor, 0.1uF, 25V, 10%, X5R, 0402	Murata	GRM155R61E104KA7D	EEPROM
15	1	1	C36	Capacitor, 10uF, 25 VDC, 10%, 0805	Murata	GRM21BR61E106KA73L	
16	1	0	C37	Capacitor, 1.0uF, 16VDC, 10%, X5R, 0603	Murata	GRM188R61C105KA93D	DNP
17	1	1	C40	Capacitor, 2.2uF, 6.3VDC, 10%, X5R, 0603	Murata	GRM185R60J225KE26D	
18	4	4	D1,D2,D3,D4	LED, Green, 3mm, Diffused, 0.2" CL-vert, TH, Right Angle	Lumex	SSF-LXH103GD	
19	1	1	D5	LED, Red, 3mm, Diffused, 0.2" CL-vert, TH, Right Angle	Lumex	SSF-LXH103ID	
20	2	2	D6,D7	LED, Red, 0603	Stanley Electric	BR1111C-TR	
21	1	0	FB1	Ferrite Bead, 220 Ohm, 2A, 0.05DCR, 0603	Murata	BLM18EG221SN1D	DNP
22	1	1	FB2	Ferrite Bead, 220 Ohm, 2A, 0.05DCR, 0603	Murata	BLM18EG221SN1D	
23	1	1	J0	Receptacle, USB, Style B, Right Angle, Through-hole	FCI TE	61729-1011BLF 292304-1	

TABLE C-1:   EVB-USB2534BC EVALUATION BOARD BILL OF MATERIALS

Item	Qty	Qty Populated	Reference Designator(s)	Description	Manufacturer	Manufacturer Part Number	Notes
24	4	4	J1,J2,J3,J4	Receptacle, USB, Style A, Right Angle, Through-hole	Assmann TE TE	AU-Y1005-R 292303-1 787616-1	
25	1	1	J5	Header, 2 x 4, 0.1 Inch, Vertical (cut from 2x36)	FCI	67996-272HLF	Cut from 2x36 strip
26	1	0	J6	Header, 1 x 2, 0.1 Inch, Vertical	Samtec	TSW-102-14-L-S	DNP
27	1	1	J7	Header, 1 x 2, 0.1 Inch, Vertical (cut from 1x36)	FCI	68000-236HLF	Cut from 1x36 strip
28	1	1	J8	Connector, Power Jack, 2.5 mm x 5.5 mm, 12 V, 4 A, Right Angle, TH	Cui Stack	PJ-002BH	
29	1	1	<J10,J11,J12>	Header, 2 x 3, 0.1 Inch, Vertical (cut from 2x36)	FCI	67996-272HLF	Cut from 2x36 strip
30	1	1	J13	Header, 2 x 5, 0.1 Inch, Vertical (cut from 2x36)	FCI	67996-272HLF	Cut from 2x36 strip (SMBus)
31	4	0	L1,L2,L3,L4	Inductor, Common Mode Choke, DLP11SN900SL2, 0504	Murata	DLP11SN900SL2	ESD
32	1	1	PCB Fab	PCB, BobbyBC (EVB-USB2534BC-01), Rev. B		EVB-USB2534BC-01	Supplied by SMSC
33	10	10	R1,R2,R3,R4,R5,R6,R7,R8,R20, R36	Resistor, 330, 5%, 1/16W, 0603	Panasonic	ERJ-3GEYJ331V	
34	4	0	R9,R10,R11,R12	Resistor, 1K, 5%, 1/16W, 0603	Panasonic	ERJ-3GEYJ102V	Disch
35	6	6	R13,R14,R15,R17,R18,R26	Resistor, 10K, 5%, 1/16W, 0603	Panasonic	ERJ-3GEYJ103V	
36	1	1	R16	Resistor, 12.0K, 1%, 1/16W, 0603	Panasonic	ERJ-3EKF1202V	
37	1	0	R19	Resistor, 1Meg, 5%, 1/16W, 0603	Panasonic	ERJ-3GEYJ105V	DNP
38	3	3	R21,R25,R35	Resistor, 10K, 5%, 1/16W, 0603	Panasonic	ERJ-3GEYJ103V	EEPROM
39	1	1	R22	Resistor, 21.0K, 1%, 1/16W, 0603	Yageo America	9C06031A2102FKHFT	
40	1	1	R23	Resistor, 150K, 1%, 1/10W, 0603	Panasonic	ERJ-3EKF1503V	
41	3	3	R24,R29,R31	Resistor, 100K, 5%, 1/16W, 0603	Panasonic	ERJ-3GEYJ104V	
42	2	2	R27,R37	Resistor, 1K, 5%, 1/16W, 0603	Panasonic	ERJ-3GEYJ102V	
43	3	3	R28,R30,R33	Resistor, 100K, 5%, 1/16W, 0603	Panasonic	ERJ-3GEYJ104V	IntDflt
44	1	1	R32	Resistor, 255, 1%, 1/10W, 0603	Panasonic	ERJ-3EKF2550V	
45	1	1	R34	Resistor, 82K, 5%, 1/16W, 0603	Panasonic	ERJ-3GEYJ823V	
46	7	0	SHUNT1-SHUNT7	Shunt, Insulated, 0.1 Inch	AMP	881545-2	DNP

TABLE C-1: EVB-USB2534BC EVALUATION BOARD BILL OF MATERIALS

Item	Qty	Qty Populated	Reference Designator(s)	Description	Manufacturer	Manufacturer Part Number	Notes
47	1	1	SKT1	Socket, IC, 8 Pin DIP, Leaf Contacts, Through Hole	Assmann	A08-LC-TT-R	Place at U8 (EEPROM)
48	1	1	SW1	Switch, Momentary, SPST, 100mA, J-lead, NO	E-Switch Panasonic	TL3301AF160QJ EVQ-Q2P02W	
49	1	1	U0	IC, USB2534-A1_QFN36, 4 Port USB 2.0 Hub w/ Battery Chg, QFN36	SMSC	USB2534-A1_QFN36	Supplied by SMSC
50	4	4	U1,U2,U3,U4	IC, AP2111SG-13, Power Distribution Switch, SOP-8	Diodes Inc.	AP2111SG-13	
51	1	1	U6	IC, MCP1725-ADJE/SN, LDO Regulator, Adj., 500 mA, SOIC8	Microchip Technology	MCP1725-ADJE/SN	
52	1	1	U7	IC, DC-DC Converter Module, 0.591-6 Vout, ~12 Vin, 0.591-6 VDC out, 6A, 5 pin SIP, 0.41" Wide	Murata	OKR-T/6-W12-C	
53	1	0	U8	IC, 24C04, 2 Wire Serial EPROM, 4Kb, 2.7V, DIP-8	Microchip Technology	24LC04B-I/P	EEPROM
54	1	1	U9	IC, 74LVC1G14, Inverter, Shottky, DCK	TI	SN74LVC1G14DCKR	
55	1	1	Y1	Crystal, 24.000MHz, 30ppm, 6pF, SMT 2.0MM X 1.6MM	Murata	XRCGB24M000F3M00R0	
56	1	1	-none	Foot, Silicone Rubber, Adhesive, Clear, Hemispherical, .38"x.150"	3M Bumper Specialties Richco	SJ-5306 BS-12 RBS-12	Place near each board corner
57	1	1	-none	Assembly Label, "EVB-USB2534BC-01_B2"	ASSEMBLER		Place in white Assy # box on TOP side
58	1	1	-none	Serial Number Labels	ASSEMBLER		Place in white Serial # box on TOP side

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