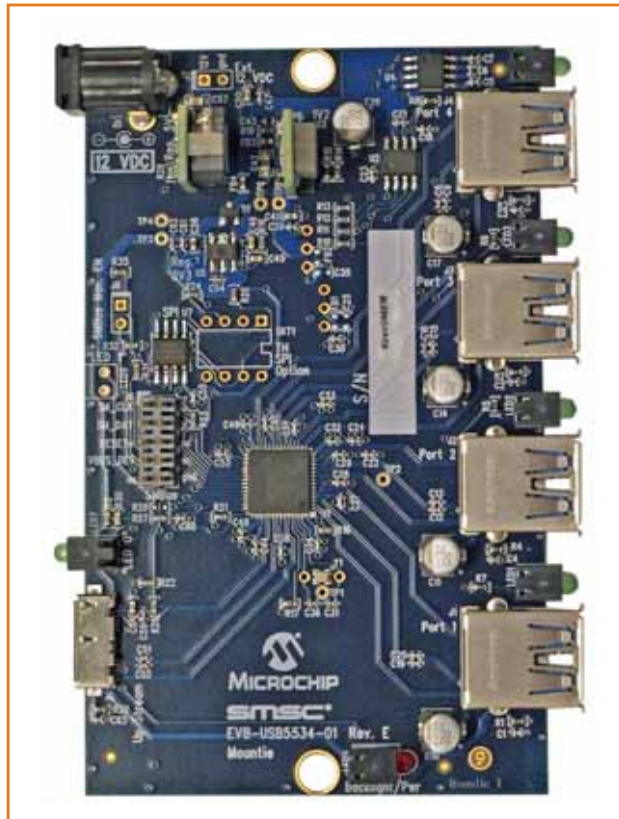


EVB-USB5534-01 Evaluation Board User Manual



Copyright © 2013 SMSC or its subsidiaries. All rights reserved.

Circuit diagrams and other information relating to SMSC products are included as a means of illustrating typical applications. Consequently, complete information sufficient for construction purposes is not necessarily given. Although the information has been checked and is believed to be accurate, no responsibility is assumed for inaccuracies. SMSC reserves the right to make changes to specifications and product descriptions at any time without notice. Contact your local SMSC sales office to obtain the latest specifications before placing your product order. The provision of this information does not convey to the purchaser of the described semiconductor devices any licenses under any patent rights or other intellectual property rights of SMSC or others. All sales are expressly conditional on your agreement to the terms and conditions of the most recently dated version of SMSC's standard Terms of Sale Agreement dated before the date of your order (the "Terms of Sale Agreement"). The product may contain design defects or errors known as anomalies which may cause the product's functions to deviate from published specifications. Anomaly sheets are available upon request. SMSC products are not designed, intended, authorized or warranted for use in any life support or other application where product failure could cause or contribute to personal injury or severe property damage. Any and all such uses without prior written approval of an Officer of SMSC and further testing and/or modification will be fully at the risk of the customer. Copies of this document or other SMSC literature, as well as the Terms of Sale Agreement, may be obtained by visiting SMSC's website at <http://www.smsc.com>. SMSC is a registered trademark of Standard Microsystems Corporation ("SMSC"). Product names and company names are the trademarks of their respective holders.

The Microchip name and logo, and the Microchip logo are registered trademarks of Microchip Technology Incorporated in the U.S.A. and other countries.

SMSC DISCLAIMS AND EXCLUDES ANY AND ALL WARRANTIES, INCLUDING WITHOUT LIMITATION ANY AND ALL IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, TITLE, AND AGAINST INFRINGEMENT AND THE LIKE, AND ANY AND ALL WARRANTIES ARISING FROM ANY COURSE OF DEALING OR USAGE OF TRADE. IN NO EVENT SHALL SMSC BE LIABLE FOR ANY DIRECT, INCIDENTAL, INDIRECT, SPECIAL, PUNITIVE, OR CONSEQUENTIAL DAMAGES; OR FOR LOST DATA, PROFITS, SAVINGS OR REVENUES OF ANY KIND; REGARDLESS OF THE FORM OF ACTION, WHETHER BASED ON CONTRACT; TORT; NEGLIGENCE OF SMSC OR OTHERS; STRICT LIABILITY; BREACH OF WARRANTY; OR OTHERWISE; WHETHER OR NOT ANY REMEDY OF BUYER IS HELD TO HAVE FAILED OF ITS ESSENTIAL PURPOSE, AND WHETHER OR NOT SMSC HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.

Chapter 1 Overview

The EVB-USB5534-01 Revision E Evaluation Board is a demonstration and evaluation platform featuring the SMSC USB5534B 4-port USB 3.0/2.0 hub on a 4-layer RoHS-compliant printed circuit board. The USB5534B is fully compliant with the *USB 3.0 USB Specification* and supports SuperSpeed (SS), Hi-Speed (HS), Full-Speed (FS), and Low-Speed (LS) USB signalling for complete coverage of all defined USB operating speeds. All four of the downstream ports are USB 2.0 and USB 3.0 compliant. The EVB-USB5534-01 demonstrates driver compatibility with Microsoft Windows 8, Windows 7, WinXP, Mac OS X 10.4+ and Linux Hub Drivers. The USB5534B is configured for operation through internal default settings and supports custom configurations through SMBus or an optional external 2-Mbit SPI Flash device, U7.

1.1 Features

- USB5534B in a 64-pin QFN RoHS compliant package
- USB 3.0 compliant (SS, HS, FS, and LS operation)
- USB pins are 5 V tolerant
- Self powered operation
- Four downstream USB 2.0/3.0 ports
- All downstream ports support individual port power and overcurrent sense
- Optional onboard SPI Flash for external downloadable firmware
- Low-cost 4-layer space saving design
- Operates from one single voltage (+12.0 V, regulated) external power supply
- Two GPIO LED indicators (LED0 and LED1)
- Single 25 MHz crystal or external clock input
- Single onboard +3.3 V, 0.5 Amp regulator
- Single onboard +1.25 V, 3 Amp regulator
- +3.3 V and port power LED indicators

Chapter 2 Getting Started

The SMSC EVB-USB5534-01 is designed for flexible configuration solutions. It can be configured via default internal register settings, downloadable external firmware to an onboard SPI Flash, or through SMBus. When configured with the default internal register settings, the device operates as a USB 3.0/2.0 hub with four USB ports and SMSC's standard VID/PID/DID settings.

2.1 Configuration Source - Internal Default

When the USB5534B does not detect a valid SPI Flash image or SMBus configuration upon power-up, the EVB-USB5534-01 uses internal default register settings. It also sets the Vendor ID, Product ID, Language ID, and Device ID, and additional settings from internal ROM code.

2.2 Configuration Source - External SPI Flash and SMBus

Upon power-up, the USB5534B first looks for an external SPI Flash device and a valid signature in the flash. If one is found, the external ROM is enabled and code execution is initiated from the external SPI device. If an SPI Flash device is not found, the firmware checks if the SMBus is enabled. The SMBus can operate in either legacy mode (USB 2.0 only) or advanced mode (access to both USB 2.0 and USB 3.0 registers).

By default, the SPI Flash (U7) is populated. The 10 k Ω pull-up resistors R20 and R24 must also be populated to use external flash. R31 must be populated to select 60MHz SPI operation, rather than 30MHz operation. There is also an alternative SPI 8-pin DIP option available that is not populated by default. To use a DIP SPI flash chip, remove U7 and solder down the flash chip or a DIP8 socket in the SKT1 footprint (see Figure 2.1). The external flash can be programmed using the SMSC ProTouch MPT software tool which can be download from the smsc.com E-Services portal.

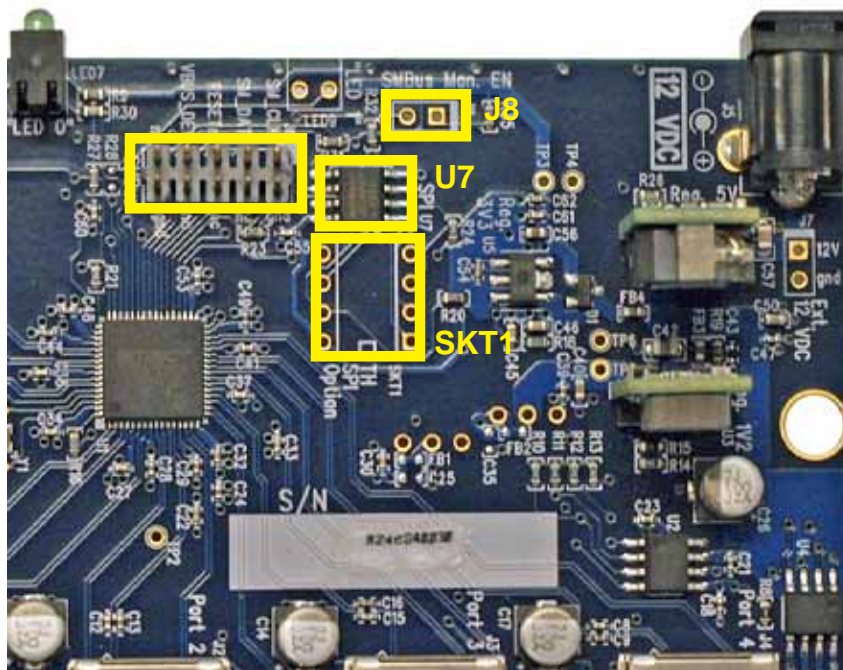


Figure 2.1 Notable Component Locations

SMBus data and clock can be controlled via the onboard SMBus header, J6. To enable SMBus, pins 1 and 2 must be shorted on the J8 *SMBus Man. EN* header, which pulls **SM_CLK** high. An Aardvark tool will pull **SM_CLK** high when connected to the SMBus header, and J8 does not need to be shorted. When SMBus is enabled, the USB5534B configures the GPIOs to act as an SMBus slave. As an SMBus slave, the USB5534B will wait indefinitely for the SMBus configuration. If no external options are detected, the it will be configured from the internal default registers.

Note: Refer to the Protouch MPT User Manual on using this software to program the configuration.

2.3 Power Source - Self-Powered

The EVB-USB5534-01 only supports self-powered operation, and is powered through one +12.0 V regulated 'wall wart' external power supply. The +12.0 V 'wall wart' plugs into the 2.5 mm connector J5 on the board. Alternatively, an external voltage can be injected onto the J7 *Ext. 12 V* header, which is not populated by default. The +12.0 V feeds a 6 A regulator which outputs +5.0 V across the board. This +5.0 V output controls the +3.3 V and +1.25 V onboard regulators.

2.4 Downstream Port Power Control

All four USB downstream port powers are controlled via two 1 A port power devices (AP2176S). All four downstream ports have individual overcurrent sensing available and all sensing signals are pulled high to +3.3 V through external 10 k Ω resistors. The port power devices, U2 and U4, are enabled through the **PRT_CTL[4:1]** signals on the USB5534B. The overcurrent sense signals from the port power devices are monitored on the **OCS[4:1]** pins of the USB5534B.

2.5 Conclusion

The EVB-USB5534-01 provides the necessary requirements and interface options for evaluating the USB5534B four port SuperSpeed USB hub controller. This will allow the user to gain a complete understanding of the product, and accelerate the integration of the USB5534B into the user's design.

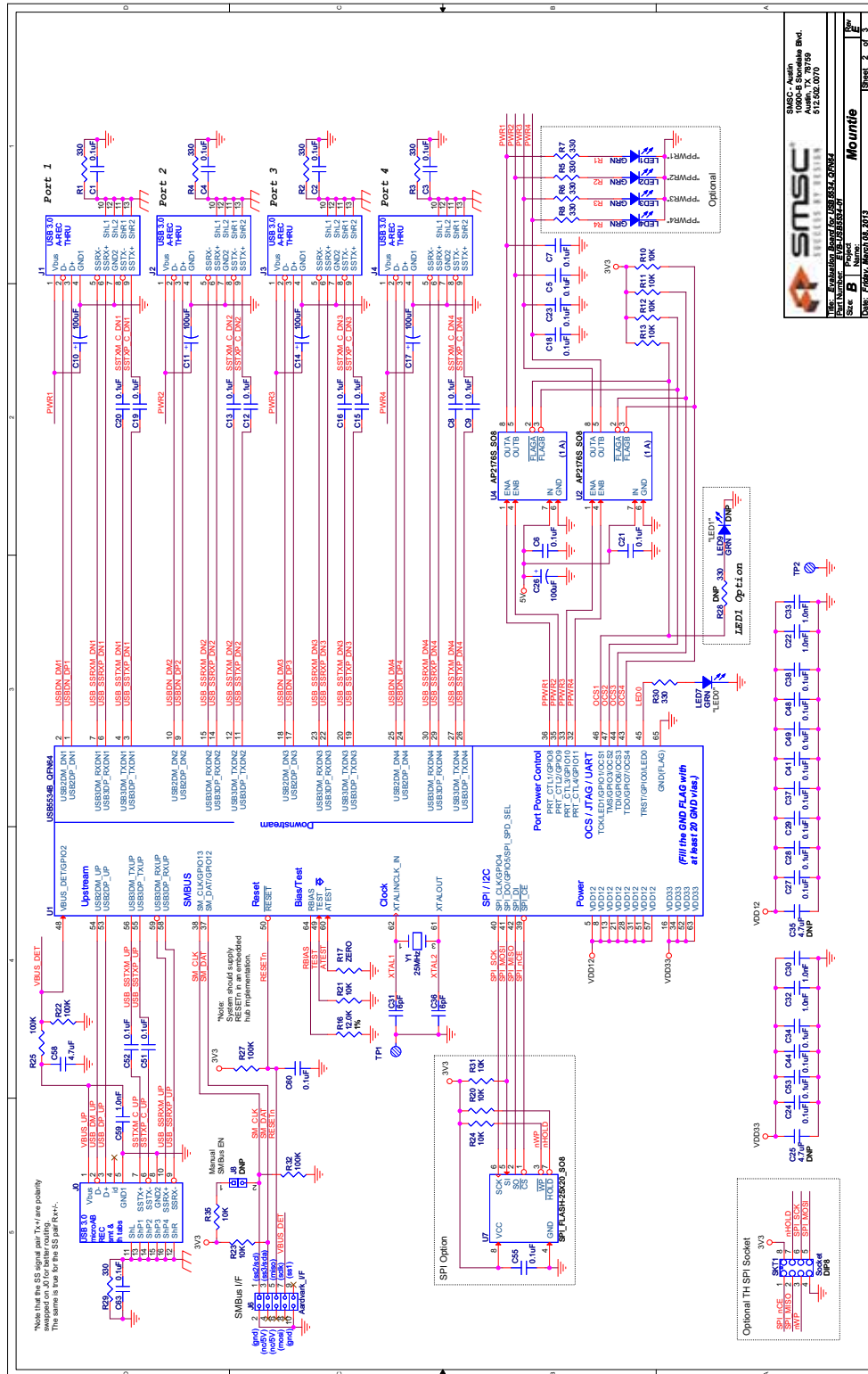


Figure 2.2 EVB-USB5534-01 Schematic Page 1

SMSC

 15000 North Central Expressway

 Austin, TX 78759

 512.506.1070

Part Number: **EVBS5534-01**

 Date: **Friday, March 09, 2013**

 Sheet: **2** of **3**

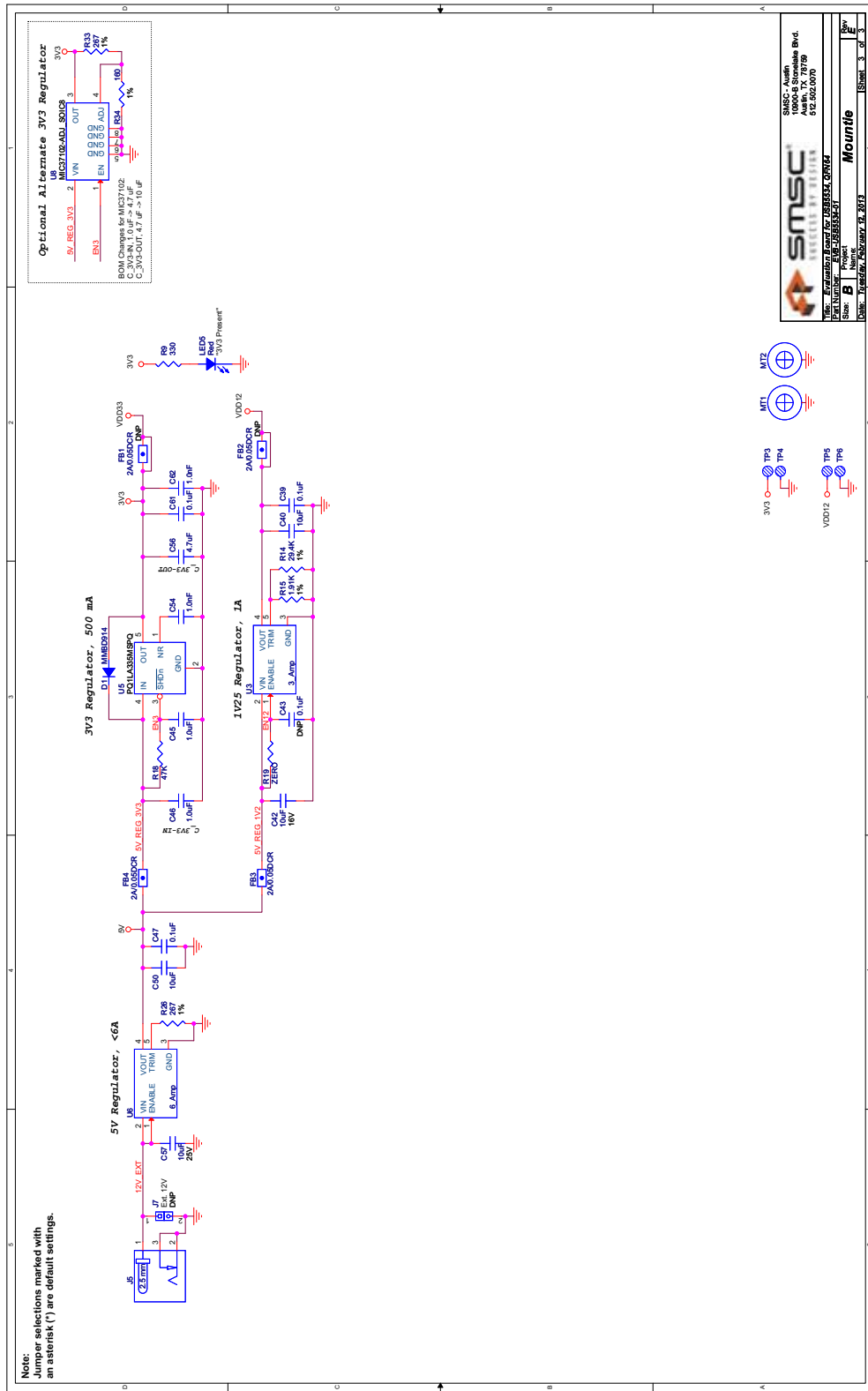


Figure 2.3 EVB-USB5534-01 Schematic Page 2

| Item | Qty | Reference Designator(s) | Description | Manufacturer | Manufacturer Part Number | Notes |
|------|-----|---|---|-----------------------|--------------------------|--|
| 1 | 1 | U1 | IC, USB5534B, USB 2.0 and 3.0 Hub, 4-port, QFN64 | SMSC | USB5534B_QFN64 | Supplied by SMSC |
| 2 | 38 | C1, C2, C3, C4, C5, C6, C7, C8, C9, C10, C11, C12, C13, C14, C15, C16, C17, C18, C19, C20, C21, C22, C23, C24, C25, C26, C27, C28, C29, C30, C31, C32, C33, C34, C35, C36, C37, C38, C39, C40, C41, C42, C43, C44, C45, C46, C47, C48, C49, C50, C51, C52, C53, C54, C55, C56, C57, C58, C59, C60, C61, C62, C63, C64, C65, C66, C67, C68, C69, C70, C71, C72, C73, C74, C75, C76, C77, C78, C79, C80, C81, C82, C83, C84, C85, C86, C87, C88, C89, C90, C91, C92, C93, C94, C95, C96, C97, C98, C99, C100, C101, C102, C103, C104, C105, C106, C107, C108, C109, C110, C111, C112, C113, C114, C115, C116, C117, C118, C119, C120, C121, C122, C123, C124, C125, C126, C127, C128, C129, C130, C131, C132, C133, C134, C135, C136, C137, C138, C139, C140, C141, C142, C143, C144, C145, C146, C147, C148, C149, C150, C151, C152, C153, C154, C155, C156, C157, C158, C159, C160, C161, C162, C163, C164, C165, C166, C167, C168, C169, C170, C171, C172, C173, C174, C175, C176, C177, C178, C179, C180, C181, C182, C183, C184, C185, C186, C187, C188, C189, C190, C191, C192, C193, C194, C195, C196, C197, C198, C199, C200, C201, C202, C203, C204, C205, C206, C207, C208, C209, C210, C211, C212, C213, C214, C215, C216, C217, C218, C219, C220, C221, C222, C223, C224, C225, C226, C227, C228, C229, C230, C231, C232, C233, C234, C235, C236, C237, C238, C239, C240, C241, C242, C243, C244, C245, C246, C247, C248, C249, C250, C251, C252, C253, C254, C255, C256, C257, C258, C259, C260, C261, C262, C263, C264, C265, C266, C267, C268, C269, C270, C271, C272, C273, C274, C275, C276, C277, C278, C279, C280, C281, C282, C283, C284, C285, C286, C287, C288, C289, C290, C291, C292, C293, C294, C295, C296, C297, C298, C299, C300, C301, C302, C303, C304, C305, C306, C307, C308, C309, C310, C311, C312, C313, C314, C315, C316, C317, C318, C319, C320, C321, C322, C323, C324, C325, C326, C327, C328, C329, C330, C331, C332, C333, C334, C335, C336, C337, C338, C339, C340, C341, C342, C343, C344, C345, C346, C347, C348, C349, C350, C351, C352, C353, C354, C355, C356, C357, C358, C359, C360, C361, C362, C363, C364, C365, C366, C367, C368, C369, C370, C371, C372, C373, C374, C375, C376, C377, C378, C379, C380, C381, C382, C383, C384, C385, C386, C387, C388, C389, C390, C391, C392, C393, C394, C395, C396, C397, C398, C399, C400, C401, C402, C403, C404, C405, C406, C407, C408, C409, C410, C411, C412, C413, C414, C415, C416, C417, C418, C419, C420, C421, C422, C423, C424, C425, C426, C427, C428, C429, C430, C431, C432, C433, C434, C435, C436, C437, C438, C439, C440, C441, C442, C443, C444, C445, C446, C447, C448, C449, C450, C451, C452, C453, C454, C455, C456, C457, C458, C459, C460, C461, C462, C463, C464, C465, C466, C467, C468, C469, C470, C471, C472, C473, C474, C475, C476, C477, C478, C479, C480, C481, C482, C483, C484, C485, C486, C487, C488, C489, C490, C491, C492, C493, C494, C495, C496, C497, C498, C499, C500, C501, C502, C503, C504, C505, C506, C507, C508, C509, C510, C511, C512, C513, C514, C515, C516, C517, C518, C519, C520, C521, C522, C523, C524, C525, C526, C527, C528, C529, C530, C531, C532, C533, C534, C535, C536, C537, C538, C539, C540, C541, C542, C543, C544, C545, C546, C547, C548, C549, C550, C551, C552, C553, C554, C555, C556, C557, C558, C559, C560, C561, C562, C563, C564, C565, C566, C567, C568, C569, C570, C571, C572, C573, C574, C575, C576, C577, C578, C579, C580, C581, C582, C583, C584, C585, C586, C587, C588, C589, C590, C591, C592, C593, C594, C595, C596, C597, C598, C599, C600, C601, C602, C603, C604, C605, C606, C607, C608, C609, C610, C611, C612, C613, C614, C615, C616, C617, C618, C619, C620, C621, C622, C623, C624, C625, C626, C627, C628, C629, C630, C631, C632, C633, C634, C635, C636, C637, C638, C639, C640, C641, C642, C643, C644, C645, C646, C647, C648, C649, C650, C651, C652, C653, C654, C655, C656, C657, C658, C659, C660, C661, C662, C663, C664, C665, C666, C667, C668, C669, C670, C671, C672, C673, C674, C675, C676, C677, C678, C679, C680, C681, C682, C683, C684, C685, C686, C687, C688, C689, C690, C691, C692, C693, C694, C695, C696, C697, C698, C699, C700, C701, C702, C703, C704, C705, C706, C707, C708, C709, C710, C711, C712, C713, C714, C715, C716, C717, C718, C719, C720, C721, C722, C723, C724, C725, C726, C727, C728, C729, C730, C731, C732, C733, C734, C735, C736, C737, C738, C739, C740, C741, C742, C743, C744, C745, C746, C747, C748, C749, C750, C751, C752, C753, C754, C755, C756, C757, C758, C759, C760, C761, C762, C763, C764, C765, C766, C767, C768, C769, C770, C771, C772, C773, C774, C775, C776, C777, C778, C779, C780, C781, C782, C783, C784, C785, C786, C787, C788, C789, C790, C791, C792, C793, C794, C795, C796, C797, C798, C799, C800, C801, C802, C803, C804, C805, C806, C807, C808, C809, C810, C811, C812, C813, C814, C815, C816, C817, C818, C819, C820, C821, C822, C823, C824, C825, C826, C827, C828, C829, C830, C831, C832, C833, C834, C835, C836, C837, C838, C839, C840, C841, C842, C843, C844, C845, C846, C847, C848, C849, C850, C851, C852, C853, C854, C855, C856, C857, C858, C859, C860, C861, C862, C863, C864, C865, C866, C867, C868, C869, C870, C871, C872, C873, C874, C875, C876, C877, C878, C879, C880, C881, C882, C883, C884, C885, C886, C887, C888, C889, C890, C891, C892, C893, C894, C895, C896, C897, C898, C899, C900, C901, C902, C903, C904, C905, C906, C907, C908, C909, C910, C911, C912, C913, C914, C915, C916, C917, C918, C919, C920, C921, C922, C923, C924, C925, C926, C927, C928, C929, C930, C931, C932, C933, C934, C935, C936, C937, C938, C939, C940, C941, C942, C943, C944, C945, C946, C947, C948, C949, C950, C951, C952, C953, C954, C955, C956, C957, C958, C959, C960, C961, C962, C963, C964, C965, C966, C967, C968, C969, C970, C971, C972, C973, C974, C975, C976, C977, C978, C979, C980, C981, C982, C983, C984, C985, C986, C987, C988, C989, C990, C991, C992, C993, C994, C995, C996, C997, C998, C999, C1000 | SMSC Murata | | | |
| 3 | 5 | C10, C11, C14, C17, C26 | Capacitor, Low ESR, 100uF, 6.3VDC, 20%, Aluminum, Radial-SMT, 5mm x 5.8mm | United Chemi-Con | EMZAGRADA101ME6TG | |
| 4 | 7 | C22, C30, C32, C33, C54, C59, C6 | Capacitor, 1000pF, 50V, 10%, X7R, 0402 | Murata | GRM156R7H102KA01D | |
| 5 | 2 | C31, C36 | Capacitor, 6pF, 50V, +/-0.5pF, NPO, 0402 | Murata | GRM1555C1H6R0D201D | |
| 6 | 2 | C40, C50 | Capacitor, 10uF, 6.3VDC, 20%, XGR, 0603 | Murata | GRM156R60T106ME7D | |
| 7 | 1 | C42 | Capacitor, 10uF, 16VDC, 10%, 0605 | Murata | GRM21BR81C10RKE15L | |
| 8 | 2 | C49, C56 | Capacitor, 10uF, 4VDC, 10%, XGR, 0603 | Murata | GRM156R0104RKE15D | |
| 9 | 2 | C58, C66 | Capacitor, 10uF, 25VDC, 10%, 0805 | Murata | GRM156R81025RKE15D | |
| 10 | 1 | C57 | Capacitor, 10uF, 25VDC, 10%, 0805 | Murata | GRV21BR81E10RKA73L | |
| 11 | 1 | D1 | Diode, MMBD914LT, Fast Switching, 100VDC, 200mA, SOT-23 | On Semiconductor | MMBD914LT | |
| 12 | 2 | F83, F84 | Ferrite Bead, 220 Ohm, 2A, 0.050CR, 0603 | Murata | BLM18EG221SN1D | |
| 13 | 1 | U0 | Receptacle, USB 3.0, Style MicroB, Right Angle, SMT, TH Tabs | Kycon | KMAX-B1D-SMT-SB30TR | |
| 14 | 4 | J1, J2, J3, J4 | Receptacle, USB 3.0, Style A, Right Angle, Through-hole | Amphenol | GSE311131HR | |
| 15 | 1 | J5 | Connector, Power Jack, 2.5 mm x 5.5 mm, 12 V, 4 A, Right Angle, TH | Cul Stick | PLJ02BH | |
| 16 | 1 | J6 | Header, 2 x 5, 0.1 inch, Vertical | AMP | 146256-5 | Cut from long header |
| 17 | 5 | LED1, LED2, LED3, LED4, LED7 | LED, Green, 3mm, Diffused, 0.2" Cl.-vert, TH, Right Angle | Lumex | SSE1-XH103D | |
| 18 | 1 | LED5 | LED, Red, 3mm, Diffused, 0.2" Cl.-vert, TH, Right Angle | Lumex | SSE1-XH103D | |
| 19 | 11 | R1, R2, R3, R4, R5, R6, R7, R8, R9, R20, R30 | Resistor, 330, 5%, 1/16W, 0603 | Panasonic | ERJ-3GEYJ831V | |
| 20 | 10 | R10, R11, R12, R13, R20, R21, R2 | Resistor, 10K, 5%, 1/16W, 0603 | Panasonic | ERJ-3GEYJ103V | |
| 21 | 1 | R14 | Resistor, 28.4K, 1%, 1/10W, 0603 | Panasonic | ERJ-3EKF2842V | |
| 22 | 1 | R15 | Resistor, 1.81K, 1%, 1/10W, 0603 | Stackpole Electronics | RMCF0603FT1K91 | |
| 23 | 1 | R16 | Resistor, 120K, 1%, 1/16W, 0603 | Panasonic | ERJ-3EKF1202V | |
| 24 | 2 | R17, R19 | Resistor, ZERO, 0.1W, 0603 | Panasonic | ERJ-3GEY0R600V | |
| 25 | 4 | R2, R3, R10, R11, R12, R13, R14, R15, R16, R17, R18, R21, R22, R23, R24, R25, R27, R32 | Resistor, 47K, 5%, 1/10W, 0603 | Stackpole Electronics | RMCF0603FT47K5 | |
| 26 | 4 | R26, R27, R28, R29 | Resistor, 267, 1%, 1/10W, 0603 | Stackpole Electronics | RMCF0603FT2671 | |
| 27 | 1 | R28 | Resistor, 267, 1%, 1/10W, 0603 | Stackpole Electronics | RMCF0603FT2671 | |
| 28 | 2 | U2, U4 | IC, Power Distribution Switch, Dual, 1 A continuous, SO-8 | Diodes Inc. | AP2176SG-13 | |
| 29 | 1 | U3 | IC, DC-DC Converter Module, 0.591-6 Volt, -12 Vin, 0.591-6 VDC out, 3A, 5 pin SIP, 0.41" Wide | Murata | OKR-T3-W1Z-C | |
| 30 | 1 | U5 | IC, PDI LA335MSPO, Voltage Regulator, 3.3V, 500mA, Low Dropout, SOT-89-5 | Sharp | PQILA335MSPO | |
| 31 | 1 | U6 | IC, DC-DC Converter Module, 0.591-6 Volt, -12 Vin, 0.591-6 VDC out, 6A, 5 pin SIP, 0.41" Wide | Murata | OKR-T6-W1Z-C | |
| 32 | 1 | U7 | IC, 25x20, 2Mb (256K x 8) SPI Serial FLASH, 2.5V-3.3V, 75MHz, Dual Read, SO8 | Winbond | W25X20BVSNIG | |
| 33 | 1 | Y1 | Crystal, 25.000MHz, 30ppm, 6P, SMT 20MM X 1.6MM | Murata | XRCGB23M00DF3M00R0 | |
| 34 | 4 | none | Foot, Silicone Rubber, Adhesive, Clear, Cylindrical, .500" x .250" | Bumper Specialties | BBS-6 | Place at each Board corner on the bottom |

Figure 2.4 EVB-USB5534-01 Bill of Materials

Chapter 3 User Manual Revision History

Table 3.1 Revision History

| REVISION LEVEL & DATE | SECTION/FIGURE/ENTRY | CORRECTION |
|----------------------------------|-----------------------------|-------------------|
| Rev. 1.0 (06-19-13) | Document Release | |