



Microchip's Accessory Framework for Android(tm)



Portions of this page are modifications based on work created and shared by Google and used according to terms described in the Creative Commons 3.0 Attribution License.

Android is a trademark of Google Inc. Use of this trademark is subject to Google Permissions.

Microchip Technology Inc. Copyright (c) 2011. All rights reserved.

Android is a trademark of Google Inc. Use of this trademark is subject to Google Permissions.

Table of Contents

Introduction	1
SW License Agreement	2
Release Notes	10
Terms and Definitions	10
Supported Demo Boards	10
Requirements, Limitations, and Potential Issues	11
Getting the Source Code	11
What's Next?	11
Revision History	12
1.01.03	12
1.01.02	12
Using the Library	13
Library Architecture	13
How the Library Works	13
Configuring the Library	13
Required USB callbacks	13
HardwareProfile.h	15
usb_config.h	15
usb_config.c	16
Initialization	17
Keeping the Stack Running	18
Detecting a Connection/Disconnection to an Android Device	18
Sending Data	19
Receiving Data	20
Firmware API	22
API Functions	22
AndroidApplsReadComplete Function	22
AndroidApplsWriteComplete Function	23
AndroidAppRead Function	24
AndroidAppStart Function	25

AndroidAppWrite Function	26
AndroidTasks Function	26
Error Codes	27
USB_ERROR_BUFFER_TOO_SMALL Macro	27
Configuration Definitions	28
NUM_ANDROID_DEVICES_SUPPORTED Macro	28
Configuration Functions	28
AndroidAppDataEventHandler Function	28
AndroidAppEventHandler Function	29
AndroidAppInitialize Function	30
Events	31
EVENT_ANDROID_ATTACH Macro	31
EVENT_ANDROID_DETACH Macro	31
Type Definitions	32
ANDROID_ACCESSORY_INFORMATION Structure	32
 Running the Demos	 34
Creating the Setup	34
New to Microchip	34
Getting the Tools	34
New to Android	34
Updating the Android OS	35
Nexus S	35
Updating the SDK	36
Eclipse IDE	36
Version v2.3.x	36
Version v3.x	37
Basic Accessory Demo	38
Getting the Android Application	38
From source	38
From Android Marketplace	38
Preparing the Hardware	38
Running the demo	39
 Creating an Android Accessory Application using the Open Accessory Framework	 40
Creating the Project	40
Accessing the Accessory From the Application	42

FAQs, Tips, and Troubleshooting **43**

My PIC32 project gets a run time exception. What could be wrong?	43
How do I debug without access to ADB?	43
What if I need design assistance creating my accessory?	44
The firmware stops working when I hit a breakpoint.	44
If I hit the "Home" or "Back" buttons while the accessory is attached, the demo no longer works.	44
Why don't all of the features of the demo work?	45
What if I need more support than what is here?	45
Why doesn't my phone work? -or- Does this phone work?	45
v2.3.x App	46
v3.1+ App	49

Index **a**

1 Introduction

Microchip's Accessory Framework for Android

for

Microchip Microcontrollers

The Microchip's Accessory Framework for Android for Android provides a mechanism to transfer data to and from an Android application through the USB of the microcontroller.

2 SW License Agreement

IMPORTANT:

MICROCHIP IS WILLING TO LICENSE THE ACCOMPANYING SOFTWARE AND DOCUMENTATION TO YOU ONLY ON THE CONDITION THAT YOU ACCEPT ALL OF THE FOLLOWING TERMS. TO ACCEPT THE TERMS OF THIS LICENSE, CLICK "I ACCEPT" AND PROCEED WITH THE DOWNLOAD OR INSTALL. IF YOU DO NOT ACCEPT THESE LICENSE TERMS, CLICK "I DO NOT ACCEPT," AND DO NOT DOWNLOAD OR INSTALL THIS SOFTWARE.

NON-EXCLUSIVE SOFTWARE LICENSE AGREEMENT FOR ACCOMPANYING MICROCHIP SOFTWARE AND DOCUMENTATION INCLUDING, BUT NOT LIMITED TO:

GRAPHICS LIBRARY SOFTWARE,

IrDA STACK SOFTWARE,

MCHPFSUSB STACK SOFTWARE,

MEMORY DISK DRIVE FILE SYSTEM SOFTWARE,

mTOUCH(TM) CAPACITIVE LIBRARY SOFTWARE,

PC PROGRAMS,

SMART CARD LIBRARY SOFTWARE,

TCP/IP STACK SOFTWARE,

AND/OR

MiWi(tm) DE SOFTWARE

IMPORTANT - READ CAREFULLY.

This Nonexclusive Software License Agreement ("Agreement") is a contract between you, your heirs, successors and assigns ("Licensee") and Microchip Technology Incorporated, a Delaware corporation, with a principal place of business at 2355 W. Chandler Blvd., Chandler, AZ 85224-6199, and its subsidiary, Microchip Technology (Barbados) Incorporated (collectively, "Microchip") for the accompanying Microchip software including, but not limited to, Graphics Library Software, IrDA Stack Software, MCHPFSUSB Stack Software, Memory Disk Drive File System Software, mTouch(TM) Capacitive Library Software, PC programs, Smart Card Library Software, TCP/IP Stack Software, MiWi(TM) DE Software, and any updates thereto (collectively, the "Software"), and accompanying documentation, including images and any other graphic resources provided by Microchip ("Documentation").

The Software and Documentation are licensed under this Agreement and not sold. U.S. copyright laws, international copyright treaties, and other intellectual property laws and treaties protect the Software and Documentation. Microchip reserves all rights not expressly granted to Licensee in this Agreement.

1. License and Sublicense Grant.

(a) Definitions. As used in this Agreement, the following capitalized terms will have the meanings defined below:

- (i) "Microchip Products" means Microchip microcontrollers, Microchip digital signal controllers, or other Microchip products that use or implement the Software.
- (ii) "Licensee Products" means Licensee products that use or incorporate Microchip Products.
- (iii) "Object Code" means the Software computer programming code that is in binary form (including related documentation, if any), and error corrections, improvements, modifications, and updates.
- (iv) "Source Code" means the Software computer programming code that may be printed out or displayed in human readable form (including related programmer comments and documentation, if any), and error corrections, improvements, modifications, and updates.
- (v) "Third Party" means Licensee's agents, representatives, consultants, clients, customers, or contract manufacturers.
- (vi) "Third Party Products" means Third Party products that use or incorporate Microchip Products.

(b) Software License Grant. Microchip grants strictly to Licensee a non-exclusive, non-transferable, worldwide license to use the Software, as described below:

(i) Graphics Library Software, MCHPFSUSB Stack Software, Memory Disk Drive File System Software, mTouch(TM) Capacitive Library Software, Smart Card Library, TCP/IP Stack Software, and other accompanying Microchip software not otherwise expressly addressed in Section 1(b)(ii) or Section 1(b)(iii) below:

(1) Licensee may use, modify, copy, and distribute the Software identified in the subheading of this Section 1(b)(i) when such Software is embedded in a Microchip Product that is either integrated into Licensee Product or Third Party Product pursuant to Section 1(d) below.

(2) Further, with respect to the TCP/IP Stack Software, Licensee may only port the ENC28J60.c, ENC28J60.h, ENC24J600.c, and ENC24J600.h driver source files to a non-Microchip device used in conjunction with a Microchip ethernet controller for the sole purpose of interfacing with such ethernet controller.

(ii) IrDA Stack Software:

(1) Licensee may install the IrDA Stack Software on a single computer and use with Microchip Products; and

(2) Use, modify, copy, and distribute the device driver source files of the IrDA Stack Software ("Device Drivers"); provided that (x) such Device Drivers are only used with Microchip Products, and (y) no Open Source Components (defined in Section 2(c) below) are incorporated into such Device Drivers.

(iii) PC Programs:

(1) Licensee may install, use, modify (if Microchip provides Source Code), copy, and distribute the PC programs on an unlimited number of computers; provided that (x) such PC programs are used with Microchip products, and (y) the following conditions are met when Licensee redistributes any PC programs:

"Copyright (c) Microchip Technology Inc. All rights reserved. Microchip PC programs are provided for your use with Microchip products only.

Redistributions and use in source and binary forms, with or without modification, are permitted provided that the following conditions are met:

- * Redistributions of source code must retain the above copyright notice, this list of conditions and the following disclaimer.
- * Redistributions in binary form must reproduce the above copyright notice, this list of conditions and the following disclaimer in the documentation and/or other materials provided with the distribution.
- * Neither the name of Microchip nor the names of its contributors may be used to endorse or promote products derived from this software without specific prior written permission.

THIS SOFTWARE IS PROVIDED BY MICROCHIP "AS IS" AND ANY

EXPRESS OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE DISCLAIMED. IN NO EVENT WILL MICROCHIP BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO, PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES; LOSS OF USE, DATA, OR PROFITS; OR BUSINESS INTERRUPTION) HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE) ARISING IN ANY WAY OUT OF THE USE OF THIS SOFTWARE, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGE."

(iv) MiWi(TM) DE Software: Licensee may use, modify, copy and distribute the Software only when embedded on a Microchip Product and used with either a Microchip radio frequency transceiver or UBEC UZ2400 radio frequency transceiver, which are integrated into Licensee Products or Third Party Products pursuant to Section 1(d) below.

For purposes of clarity, Licensee may NOT embed the Software identified in Section 1(b)(i) (including derivatives or modifications thereof) on a non-Microchip Product, except as described in Section 1(b)(i)(2). Licensee may NOT use, copy, modify or distribute the IrDA Stack Software, except as described in Section 1(b)(ii)(2) above (relating to Device Drivers) and Section 1(d) below (relating to sublicenses). Licensee may NOT distribute Source Code or Object Code of the Software on a standalone basis, except as described in Section 1(b)(iii) above (relating to PC programs) and Section 1(d) below (relating to sublicense rights). For the MiWi(TM) DE Software, Licensee may NOT embed the Software (including derivatives or modifications thereof) on a non-Microchip Product, use the Software with a radio frequency transceiver other than the Microchip and UBEC transceivers listed in Section 1(b)(iv), or distribute the Software (in Source Code or Object Code) except as described in Section 1(d) below.

(c) Documentation License Grant. Microchip grants strictly to Licensee a non-exclusive, non-transferable, worldwide license to use the Documentation in support of Licensee's authorized use of the Software.

(d) Sublicense Grants. Licensee may grant a sublicense to a Third Party to use the Software as described in this subparagraph (d) provided that Licensee first obtains such Third Party's agreement in writing to comply with the terms of this Agreement:

(i) Graphics Library Software, MCHPFSUSB Stack Software, Memory Disk Drive File System Software, mTouch(TM) Capacitive Library Software, Smart Card Library, TCP/IP Stack Software, MiWi(TM) DE Software, and other accompanying Microchip software not otherwise expressly addressed in Section 1(b)(iii) above or Section 1(d)(ii) below:

With respect to Software identified in this Section 1(d)(i), Third Party may:

- (1) Modify Source Code for Licensee.
- (2) Program Software into Microchip Products for Licensee.
- (3) Use the Software to develop and/or manufacture Licensee Products.

(4) Use the Software to develop and/or manufacture Third Party Products where either: (x) the sublicensed Software contains Source Code modified or otherwise optimized by Licensee for integration into Third Party Products; and/or (y) the sublicensed Software is programmed into Microchip Products by Licensee on behalf of such Third Party.

(5) Use the Documentation in support of Third Party's authorized use of the Software in conformance with this Section 1(d)(i).

(ii) IrDA Stack Software:

With respect to IrDA Stack Software, Third Party may:

(1) Modify ONLY Device Drivers for Licensee.

(2) Program Software into Microchip Products for Licensee.

(3) Use the Documentation in support of Third Party's authorized use of the Software in conformance with this Section 1(d)(ii).

(e) Audit. Microchip's authorized representatives will have the right to reasonably inspect, announced or unannounced, and its sole and absolute discretion, Licensee's premises and to audit Licensee's records and inventory of Licensee Products, whether located on Licensee's premises or elsewhere at any time, in order to ensure Licensee's adherence to the terms of this Agreement.

2. Third Party Requirements; Open Source Components. Licensee acknowledges that it is Licensee's responsibility to comply with any third party license terms or requirements applicable to the use of such third party software, specifications, systems, or tools. Microchip is not responsible and will not be held responsible in any manner for Licensee's failure to comply with such applicable terms or requirements.

(a) IrDA Stack Software. With respect to the IrDA Stack Software, Licensee further acknowledges that it is Licensee's responsibility to obtain a copy of, to familiarize itself fully with, and comply with the requirements of the Infrared Data Association, especially regarding the use of IrDA specifications and development of IrDA-compliant products. At the time of this Software release, it is Microchip's understanding that Licensee may obtain a copy of IrDA specifications from the IrDA website by either paying an access fee or becoming a member of the Infrared Data Association. For more information go to www.irda.org.

(b) Memory Disk Drive File System Software. With respect to the Memory Disk Drive File Systems Software, Licensee further acknowledges that it is Licensee's responsibility to obtain a copy of, familiarize itself fully with, and comply with the requirements and licensing obligations applicable to the use of flash-based media and FAT files systems available from Compact Flash Association, SD Card Association, Multi Media Card Association, and Microsoft Corporation.

(c) Open Source Components. Notwithstanding the license grant in Section 1 above, Licensee further acknowledges that certain components of the Software may be covered by so-called "open source" software licenses ("Open Source Components"). Open Source Components means any software licenses approved as open source licenses by the Open Source Initiative or any substantially similar licenses, including without limitation any license that, as a condition of distribution of the software licensed under such license, requires that the distributor make the software available in source code format.

To the extent required by the licenses covering Open Source Components, the terms of such license will apply in lieu of the terms of this Agreement, and Microchip hereby represents and warrants that the licenses granted to such Open Source

Components will be no less broad than the license granted in Section 1. To the extent the terms of the licenses applicable to Open Source Components prohibit any of the restrictions in this Agreement with respect to such Open Source Components, such restrictions will not apply to such Open Source Component.

For purposes of clarity:

QT Framework Version 3: The MCHPFSUSB Stack Software is accompanied by a PC program, the "USB Device - LibUSB - Generic Driver Demo - Linux Application" or "LibUSB Linux example," that is developed by Microchip using the Qt framework version 3. Such Qt framework version 3 is governed by the GNU General Public License version 2 ("GPL"). Accordingly, Microchip offers the LibUSB Linux example, including Source Code for such program, under the terms of GPL version 2 as well. For copies of the GPL version 2, please go to <http://www.fsf.org>.

QT Framework Version 4.7.0: The MCHPFSUSB Stack Software is accompanied by a PC program, the "USB Device - HID - Custom Demos - Generic HID PnP Demo - Cross Platform" or "Custom HID Cross Platform example," that is developed by Microchip using the Qt framework version 4.7.0. Such Qt framework version 4.7.0 is governed by the GNU Lesser General Public License version 2.1 ("LGPL"). For copies of the LGPL version 2.1, please go to <http://www.fsf.org>. The Custom HID Cross Platform example is governed by the terms of this Non-Exclusive Software License Agreement.

JPEG Software: Independent JPEG Group's software and accompanying third party files including, but not limited to, GIF compressed format files are governed by the terms described in IJG's license. This license is posted in the "IJG License.pdf" file located at: <Installed Folder>\Microchip\Image Decoders.

(d) Google Static Maps API: Google Static Maps API and Google server usage are governed by the legal notices, terms and conditions posted on the Google website at www.google.com, including but not limited to the Static Maps API Developer Guide, the Legal Notices for Google Maps/Google Earth and Google Maps/Google Earth API, the Google Maps/Google Earth Terms of Service, and the Google Maps/Google Earth API Terms of Service.

3. Licensee Obligations.

(a) Licensee will ensure Third Party compliance with the terms of this Agreement, and will be liable for any breach of this Agreement committed by such Third Party.

(b) Licensee will not: (i) engage in unauthorized use, modification, disclosure or distribution of Software or Documentation, or its derivatives; (ii) use all or any portion of the Software, Documentation, or its derivatives except in conjunction with Microchip Products or Third Party Products; or (iii) reverse engineer (by disassembly, decompilation or otherwise) Software or any portion thereof.

(c) Licensee may not remove or alter any Microchip copyright or other proprietary rights notice posted in any portion of the Software or Documentation.

(d) Licensee will defend, indemnify and hold Microchip and its subsidiaries harmless from and against any and all claims, costs, damages, expenses (including reasonable attorney's fees), liabilities, and losses, including without limitation product liability claims, directly or indirectly arising from or related to: (i) the use, modification, disclosure or distribution of the Software, Documentation, or any intellectual property rights related thereto; (ii) the use, sale and distribution of Licensee Products or Third Party Products; and (iii) breach of of this Agreement. THIS SECTION 3(d) STATES THE SOLE AND

EXCLUSIVE LIABILITY OF THE PARTIES FOR INTELLECTUAL PROPERTY INFRINGEMENT.

4. Confidentiality.

(a) Licensee agrees that the Software (including but not limited to the Source Code, Object Code and library files) and its derivatives, Documentation and underlying inventions, algorithms, know-how and ideas relating to the Software and the Documentation are proprietary information belonging to Microchip and its licensors ("Proprietary Information"). Except as expressly and unambiguously allowed herein, Licensee will hold in confidence and not use or disclose any Proprietary Information and will similarly bind its employees and Third Party(ies) in writing. Proprietary Information will not include information that: (i) is in or enters the public domain without breach of this Agreement and through no fault of the receiving party; (ii) the receiving party was legally in possession of prior to receiving it; (iii) the receiving party can demonstrate was developed by the receiving party independently and without use of or reference to the disclosing party's Proprietary Information; or (iv) the receiving party receives from a third party without restriction on disclosure. If Licensee is required to disclose Proprietary Information by law, court order, or government agency, such disclosure will not be deemed a breach of this Agreement provided that Licensee: (x) gives Microchip prompt notice of such requirement in order to allow Microchip to object or limit such disclosure; (y) cooperates with Microchip to protect Proprietary Information; and (z) Licensee complies with any protective order in place and discloses only the information required by process of law.

(b) Licensee agrees that the provisions of this Agreement regarding unauthorized use and nondisclosure of the Software, Documentation and related Proprietary Rights are necessary to protect the legitimate business interests of Microchip and its licensors and that monetary damages alone cannot adequately compensate Microchip or its licensors if such provisions are violated. Licensee, therefore, agrees that if Microchip alleges that Licensee or Third Party has breached or violated such provision then Microchip will have the right to petition for injunctive relief, without the requirement for the posting of a bond, in addition to all other remedies at law or in equity.

5. Ownership of Proprietary Rights.

(a) Microchip and its licensors retain all right, title and interest in and to the Software and Documentation ("Proprietary Rights") including, but not limited to: (i) patent, copyright, trade secret and other intellectual property rights in the Software, Documentation, and underlying technology; (ii) the Software as implemented in any device or system, including all hardware and software implementations of the Software technology (expressly excluding Licensee and Third Party code developed and used in conformance with this Agreement solely to interface with the Software and Licensee Products and/or Third Party Products); and (iii) all copies and derivative works thereof (by whomever produced). Further, copies and derivative works will be considered works made for hire with ownership vesting in Microchip on creation. To the extent such modifications and derivatives do not qualify as a "work for hire," Licensee hereby irrevocably transfers, assigns and conveys the exclusive copyright thereof to Microchip, free and clear of any and all liens, claims or other encumbrances, to the fullest extent permitted by law. Licensee and Third Party use of such modifications and derivatives is limited to the license rights described in Sections 1 and 2 above.

(b) Licensee will have no right to sell, assign or otherwise transfer all or any portion of the Software, Documentation, or any related intellectual property rights except as expressly set forth in this Agreement.

6. Termination of Agreement. Without prejudice to any other rights, this Agreement terminates immediately, without notice by Microchip, upon a failure by Licensee or Third Party to comply with any provision of this Agreement. Further, Microchip may also terminate this Agreement upon reasonable belief that Licensee or Third Party failed to comply with this Agreement. Upon termination, Licensee and Third Party will immediately stop using the Software, Documentation, and derivatives thereof, and immediately destroy all such copies.

7. Warranties and Disclaimers. THE SOFTWARE AND DOCUMENTATION ARE PROVIDED "AS IS" WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION, ANY WARRANTY OF MERCHANTABILITY, TITLE, NON-INFRINGEMENT AND FITNESS FOR A PARTICULAR PURPOSE. MICROCHIP AND ITS LICENSORS ASSUME NO RESPONSIBILITY FOR THE ACCURACY, RELIABILITY OR APPLICATION OF THE SOFTWARE OR DOCUMENTATION. MICROCHIP AND ITS LICENSORS DO NOT WARRANT THAT THE SOFTWARE WILL MEET REQUIREMENTS OF LICENSEE OR THIRD PARTY, BE UNINTERRUPTED OR ERROR-FREE. MICROCHIP AND ITS LICENSORS HAVE NO OBLIGATION TO CORRECT ANY DEFECTS IN THE SOFTWARE. LICENSEE AND THIRD PARTY ASSUME THE ENTIRE RISK ARISING OUT OF USE OR PERFORMANCE OF THE SOFTWARE AND DOCUMENTATION PROVIDED UNDER THIS AGREEMENT.

8. Limited Liability. IN NO EVENT WILL MICROCHIP OR ITS LICENSORS BE LIABLE OR OBLIGATED UNDER CONTRACT, NEGLIGENCE, STRICT LIABILITY, CONTRIBUTION, BREACH OF WARRANTY, OR OTHER LEGAL OR EQUITABLE THEORY FOR ANY DIRECT OR INDIRECT DAMAGES OR EXPENSES INCLUDING BUT NOT LIMITED TO INCIDENTAL, SPECIAL, INDIRECT, PUNITIVE OR CONSEQUENTIAL DAMAGES, LOST PROFITS OR LOST DATA, COST OF PROCUREMENT OF SUBSTITUTE GOODS, TECHNOLOGY, SERVICES, OR ANY CLAIMS BY THIRD PARTIES (INCLUDING BUT NOT LIMITED TO ANY DEFENSE THEREOF), OR OTHER SIMILAR COSTS. The aggregate and cumulative liability of Microchip and its licensors for damages hereunder will in no event exceed \$1000 or the amount Licensee paid Microchip for the Software and Documentation, whichever is greater. Licensee acknowledges that the foregoing limitations are reasonable and an essential part of this Agreement.

9. General.

(a) Governing Law, Venue and Waiver of Trial by Jury. THIS AGREEMENT WILL BE GOVERNED BY AND CONSTRUED UNDER THE LAWS OF THE STATE OF ARIZONA AND THE UNITED STATES WITHOUT REGARD TO CONFLICTS OF LAWS PROVISIONS. Licensee agrees that any disputes arising out of or related to this Agreement, Software or Documentation will be brought in the courts of the State of Arizona. The parties agree to waive their rights to a jury trial in actions relating to this Agreement.

(b) Attorneys' Fees. If either the Microchip or Licensee employs attorneys to enforce any rights arising out of or relating to this Agreement, the prevailing party will be entitled to recover its reasonable attorneys' fees, costs and other expenses.

(c) Entire Agreement. This Agreement will constitute the entire agreement between the parties with respect to the subject matter hereof. It will not be modified except by a written agreement signed by an authorized representative of the Microchip.

(d) Severability. If any provision of this Agreement will be held by a court of competent jurisdiction to be illegal, invalid or unenforceable, that provision will be limited or eliminated to the minimum extent necessary so that this Agreement will otherwise remain in full force and effect and enforceable.

(e) Waiver. No waiver of any breach of any provision of this Agreement will constitute a waiver of any prior, concurrent or subsequent breach of the same or any other provisions hereof, and no waiver will be effective unless made in writing and signed by an authorized representative of the waiving party.

(f) Export Regulation. Licensee agrees to comply with all export laws and restrictions and regulations of the Department of Commerce or other United States or foreign agency or authority.

(g) Survival. The indemnities, obligations of confidentiality, and limitations on liability described herein, and any right of action

for breach of this Agreement prior to termination, will survive any termination of this Agreement.

(h) Assignment. Neither this Agreement nor any rights, licenses or obligations hereunder, may be assigned by Licensee without the prior written approval of Microchip except pursuant to a merger, sale of all assets of Licensee or other corporate reorganization, provided that assignee agrees in writing to be bound by the Agreement.

(i) Restricted Rights. Use, duplication or disclosure by the United States Government is subject to restrictions set forth in subparagraphs (a) through (d) of the Commercial Computer-Restricted Rights clause of FAR 52.227-19 when applicable, or in subparagraph (c)(1)(ii) of the Rights in Technical Data and Computer Software clause at DFARS 252.227-7013, and in similar clauses in the NASA FAR Supplement. Contractor/manufacturer is Microchip Technology Inc., 2355 W. Chandler Blvd., Chandler, AZ 85225-6199.

If Licensee has any questions about this Agreement, please write to Microchip Technology Inc., 2355 W. Chandler Blvd., Chandler, AZ 85224-6199 USA. ATTN: Marketing.

Copyright (C) 2010 Microchip Technology Inc. All rights reserved.

License Rev. No. 02-020111

3 Release Notes

Microchip's Accessory Framework for Android Version 1.01.03, July 2012

Peripherals

Type/Use	Specific/Configurable	Polled/Interrupt	Limitations (see page 11)
USB module in host mode	USB1 module	Interrupt	None

3.1 Terms and Definitions

This section defines some of the terms used in this document.

Open Accessory API or **Open Accessory Framework** - this is the API/framework in the Android development environment that allows the Android applications to transmit data in and out of the available USB port. This is provided by Google through the Android SDK.

Microchip's Accessory Framework for Android - This defines the firmware library and Android application examples provided in this package by Microchip.

3.2 Supported Demo Boards

The following demo boards are supported in this release:

- Accessory Development Starter Kit for Android (PIC24F Version) ([DM240415](#))
- Explorer 16 ([DM240001](#)) with USB PICtail+ Board ([AC164131](#)) with any of the following Processor Modules:
 - PIC24FJ256GB110 PIM ([MA240014](#))
 - PIC24FJ64GB004 PIM ([MA240019](#))
 - PIC24FJ256GB210 PIM ([MA240021](#))
 - PIC32MX460F512L PIM ([MA320002](#))
 - PIC32MX795F512L PIM ([MA320003](#))
- PIC24F Starter Kit 1 ([DM240011](#))
- PIC32 USB Starter Kit I or II ([DM320003-2](#))
- PIC32 Ethernet Starter Kit ([DM320004](#))

Since each board has different hardware features, there may be limitations on some of the boards for each of the demos. For example, if the board does not have a potentiometer but the demo uses one, that feature of the demo will not work.

3.3 Requirements, Limitations, and Potential Issues

This section describes the limitations and requirements for using the Microchip's Accessory Framework for Android.

Requirements:

The Microchip's Accessory Framework for Android requires Android versions v2.3.4 or v3.1 or later. The Open Accessory API is not available in OS versions earlier than this. If the target device is using an older version than this, the library will not be able to connect to that device.

Please see the Creating the Setup (see page 34) section for details about how to get the correct tool versions. Please refer to the Creating the Android Application (see page 40) section for more information about how to select the right tool set when creating a new Android application.

Limitations and Potential Issues:

1. The read() function in the Android OS will not throw an IOException when the file stream under it is closed on file streams created from the USB Open Accessory API. This creates issues when applications or services close down and try to free resources. If a read is in progress, then this can result in the ParcelFileDescriptor object being locked until the accessory is detached from the Android device. This is present in version v2.3.4 and v3.1 of the Android OS.
 - Workaround: Since the Read() request never completes resulting in locked resources, a workaround can be implemented in the application layer. If the accessory and the application implement a command for the application to indicate to the accessory that the app is closing (or is being paused), then the accessory can respond back with an acknowledge packet. When the app receives this ACK packet, it knows not to start a new read() (since that read() request will not be able to terminated once started).
2. The available() function in the Open Accessory API in the Android OS always throws an IOException error. This function is not available for use.
3. This release only shows connecting to an Android device with the Android device as the USB device. Most phones and tablets operate in this mode. A few Android devices at the time of this release are capable of being a USB host as well. Examples for using this mode of operation are not provided in this release. Firmware to talk to these host capable Android devices can be found at www.microchip.com/usb or www.microchip.com/mal. Application example to access accessories running in device mode will follow shortly. The Open Accessory API allows connections in either direction.

3.4 Getting the Source Code

If you are working from the pre-compiled version and would like to get the source code version of these projects, please visit www.microchip.com/mal. The source code is provided in that download (version 2011-06-xx or later).

3.5 What's Next?

This section describes what Microchip is working on or considering next. This section makes no statement that these items will ever actually be released. Projects on this list may be discontinued indefinitely.

1. Example boot loader for Android Accessories.
2. Examples using the Host mode features of the Open Accessory Framework

3.6 Revision History

3.6.1 1.01.03

1. Updated to enable XC16.

3.6.2 1.01.02

1. Fixed issue in Android OpenAccessory driver that could cause a memory leak.
 - Stack files affected: usb_host_android.c (USB stack files)

4 Using the Library

4.1 Library Architecture

The Android Accessory driver when in host mode is just a client driver on top on top of the Microchip USB host stack as seen in the below diagram.



Users interface through the Android driver API described in this document to access the Android device.

4.2 How the Library Works

4.2.1 Configuring the Library

There are two distributions of the Microchip's Accessory Framework for Android. One includes pre-compiled library files and the second includes the source code files.

The pre-compiled version can be found at www.microchip.com/android.

The source code version can be found at www.microchip.com/mal.

Please select the instructions in the following sections that correspond to the version that you are using.

4.2.1.1 Required USB callbacks

Microchip's Accessory Framework for Android is currently based off of Microchip's USB host stack. The USB host stack uses a couple of call back functions to allow the user to make key decisions about the stack operation at run time. These functions must be implemented for the library to compile correctly. These two functions are

USB_ApplicationDataEventHandler() and USB_ApplicationEventHandler() for the pre-compiled example. For the source example the function names are configurable through the usb_config.h (see page 15) file (see the usb_config.h (see page 15) section for more information). For more detailed information about these functions or the USB library, please refer to www.microchip.com/mal. This download includes the USB host library code as well as more detailed documentation about that library.

The data events are consumed by the Android client driver. So the user application data event handler doesn't need to do anything. It needs to be present for the library to link successfully but it can just return FALSE.

```

BOOL USB_ApplicationDataEventHandler( BYTE address, USB_EVENT event, void *data, DWORD size
)
{
    return FALSE;
}

```

The regular event handler has a little more work that needs to be done. This handler notifies the user of device attach and detach events. For Android devices this is covered in the Detecting a Connection/Disconnection to an Android Device (see page 18) section. This function also notifies the user about errors that might occur in the USB subsystem. These can be useful for debugging development issues or logging issue once released in the field. The last important duty that this function provides is determining if the power required by the attached device is available. This is done through the EVENT_VBUS_REQUEST_POWER event. Remember in this event that the amount of power requested through the USB bus is the power required/2, not the power required. Below is full implementation of the USB event handler that will work with a single attached Android device.

```

BOOL USB_ApplicationEventHandler( BYTE address, USB_EVENT event, void *data, DWORD size )
{
    switch( event )
    {
        case EVENT_VBUS_REQUEST_POWER:
            // The data pointer points to a byte that represents the amount of power
            // requested in mA, divided by two. If the device wants too much power,
            // we reject it.
            if (((USB_VBUS_POWER_EVENT_DATA*)data)->current <= (MAX_ALLOWED_CURRENT / 2))
            {
                return TRUE;
            }
            else
            {
                DEBUG_ERROR( "Device requires too much current\r\n" );
            }
            break;

        case EVENT_VBUS_RELEASE_POWER:
        case EVENT_HUB_ATTACH:
        case EVENT_UNSUPPORTED_DEVICE:
        case EVENT_CANNOT_ENUMERATE:
        case EVENT_CLIENT_INIT_ERROR:
        case EVENT_OUT_OF_MEMORY:
        case EVENT_UNSPECIFIED_ERROR:
        case EVENT_DETACH:
            //Fall-through
        case EVENT_ANDROID_DETACH:
            device_attached = FALSE;
            return TRUE;
            break;

        // Android Specific events
        case EVENT_ANDROID_ATTACH:
            device_attached = TRUE;
            device_handle = data;
            return TRUE;

        default :
            break;
    }
    return FALSE;
}

```

4.2.1.2 HardwareProfile.h

HardwareProfile.h provides configuration information to the source version of the library. This tells the library and demo code information about the hardware that it needs to know for configuration, such as the system clock speed, which pins are being used for certain stack or demo features, etc.

When moving this library to your own hardware platform, you will need to create your own HardwareProfile.h file that specifies the requirements of your board.

4.2.1.3 usb_config.h

usb_config.h is used to configure the build options of the source version of this library. At the moment this is also required in the pre-compiled format as well.

When using with the pre-compiled format, please do not modify this file as it must match exactly how the library was built.

For users developing with the source version of the library, this file provides several configuration options for customizing the USB stack. There are a few options that are required.

The USB_SUPPORT_HOST option must be enabled.

The USB_ENABLE_TRANSFER_EVENT option must be enabled.

The USB_HOST_APP_DATA_EVENT_HANDLER must be defined and the function that is referenced must be implemented.

The USB_ENABLE_1MS_EVENT must be enabled.

The AndroidTasks (see page 26)() function should be added to the USBTasks() function call or it should be called periodically from the user application.

```
#define USBTasks() \
{ \
    USBHostTasks(); \
    AndroidTasks(); \
}
```

The USB_SUPPORT_BULK_TRANSFERS should be defined.

For use with PIC32, the USB_PING_PONG_MODE option must be set to USB_PING_PONG__FULL_PING_PONG. This is also recommended for PIC24F but not required.

```
#define USB_PING_PONG_MODE    USB_PING_PONG__FULL_PING_PONG
```

If you modify the TPL in the usb_config.c (see page 16) file (see section usb_config.c (see page 16) for more details), then the NUM_TPL_ENTRIES and NUM_CLIENT_DRIVER_ENTRIES entries in the usb_config.h file should be updated to match.

Below is a complete example of a usb_config.h file for an Android accessory demo:

```
#define USB_SUPPORT_HOST

#define USB_PING_PONG_MODE    USB_PING_PONG__FULL_PING_PONG

#define NUM_TPL_ENTRIES 2
#define NUM_CLIENT_DRIVER_ENTRIES 1

#define USB_ENABLE_TRANSFER_EVENT

#define USB_HOST_APP_DATA_EVENT_HANDLER USB_ApplicationDataEventHandler
#define USB_ENABLE_1MS_EVENT

#define USB_MAX_GENERIC_DEVICES 1
#define USB_NUM_CONTROL_NAKS 20
#define USB_SUPPORT_INTERRUPT_TRANSFERS
```

```

#define USB_SUPPORT_BULK_TRANSFERS
#define USB_NUM_INTERRUPT_NAKS 3
#define USB_INITIAL_VBUS_CURRENT (100/2)
#define USB_INSERT_TIME (250+1)
#define USB_HOST_APP_EVENT_HANDLER USB_ApplicationEventHandler

#define USBTasks() \
{ \
    USBHostTasks(); \
    AndroidTasks(); \
}

#define USBInitialize(x) \
{ \
    USBHostInit(x); \
}

```

For more information about the usb_config.h file, please refer to the MCHPFSUSB stack help file.

4.2.1.4 usb_config.c

The usb_config.c file is only required for those working with the source code implementation of the library. This file is not used in the pre-compiled version of the library.

There are two main sections to the usb_config.c file. The first is the Targeted Peripheral List (TPL). The TPL is defined by the USB OTG specification as the list of devices that are allowed to enumerate on the device. The TPL is just an array of USB_TPL objects that specify the devices that can be attached. There are two ways that these devices are entered into the table. They are either entered as Class/Subclass/Protocol pairs (CL/SC/P). The second method is by Vendor ID (VID) and Product ID (PID) pairs. This will allow a specific device, not device type, to enumerate.

There are two entries that are needed for Android devices. Since each Android device may appear different to the host controller, there isn't an easy way to add support for a given Class/Subclass/Protocol pair since each Android device might expose different USB interface types. Likewise, since there isn't a list of all VID/PIDs for Android devices, and this implementation isn't future-proof, you can use the normal VID/PID entry either. For cases like these Microchip has implemented the VID/PID combination of 0xFFFF/0xFFFF to indicate that this driver should enumerate every device regardless of its interfaces or its actual VID/PID pair.

The other entry in the table is the entry for the Android device once it has actually entered accessory mode. This can be either entered using the CL/SC/P of the Accessory interface or the magic VID/PID combinations specified by Google Inc. The magic VID/PID combination method is probably the preferred method (seen below):

```

// *****
// USB Embedded Host Targeted Peripheral List (TPL)
// *****
USB_TPL usbTPL[] =
{
    /*[1] Device identification information
    [2] Initial USB configuration to use
    [3] Client driver table entry
    [4] Flags (HNP supported, client driver entry, SetConfiguration() commands allowed
    -----
           [1]                [2][3] [4]
    -----*/
    { INIT_VID_PID( 0x18D1u1, 0x2D00u1 ), 0, 0, {0} }, // Android accessory
    { INIT_VID_PID( 0x18D1u1, 0x2D01u1 ), 0, 0, {0} }, // Android accessory
    { INIT_VID_PID( 0xFFFFu1, 0xFFFFu1 ), 0, 0, {0} }, // Enumerates everything
};

```

All of the entries that correspond to the Android accessory device should point to the entry in the Client Driver table the corresponds to the Android drivers. In the above example all three entries point to the client driver entry 0 (as noted by entry [3] set to 0). The client driver table needs register the functions used by each driver. The functions that need to be registered are the Initialization function, the event handler, the data event handler (if implemented), and the initialization flags value (see example below).

```

// *****

```

```
// Client Driver Function Pointer Table for the USB Embedded Host foundation
// *****
CLIENT_DRIVER_TABLE usbClientDrvTable[] =
{
    {
        AndroidAppInitialize,
        AndroidAppEventHandler,
        AndroidAppDataEventHandler,
        0
    }
};
```

For more information about the usb_config.c file, please refer to the MCHPFSUSB documentation available in the installation found at www.microchip.com/mal.

4.2.2 Initialization

There are two main steps to initializing the firmware. The first is to initialize the USB host stack. This is done via the USBInitialize() function as seen below:

```
USBInitialize(0);
```

The second step that is required for the initialization is for the application to describe the accessory to the Android client driver so that it can pass this information to the Android device when attached. This is done through the AndroidAppStart (see page 25)() function. This function takes in a pointer an ANDROID_ACCESSORY_INFORMATION (see page 32) structure which contains all of the information about the accessory. An example is seen below:

```
//Define all of my string information here
char manufacturer[] = "Microchip Technology Inc.";
char model[] = "Basic Accessory Demo";
char description[] = "ADK - Accessory Development Starter Kit for Android (PIC24F)";
char version[] = "1.0";
char uri[] = "http://www.microchip.com/android";
char serial[] = "N/A";

//Pack all of the strings and their lengths into an
// ANDROID_ACCESSORY_INFORMATION structure
ANDROID_ACCESSORY_INFORMATION myDeviceInfo =
{
    manufacturer,
    sizeof(manufacturer),
    model,
    sizeof(model),
    description,
    sizeof(description),
    version,
    sizeof(version),
    uri,
    sizeof(uri),
    serial,
    sizeof(serial)
};

int main(void)
{
    //Initialize the USB host stack
    USBInitialize(0);

    //Send my accessory information to the Android client driver.
    AndroidAppStart(&myDeviceInfo);

    //Go on with my application here...
```

Note that the AndroidAppStarter() function should be called before the Android device is attached. It is recommended to call this function after initializing the USB Android client driver but before calling the USBTasks() function.

4.2.3 Keeping the Stack Running

The Microchip USB host stack receives and logs events via an interrupt handler, but processes them as the USBTasks() (or USBHostTasks()) function is called. This limits the amount of time spent in an interrupt context and helps limit context related issues. This means that in order to keep the USB host stack running, the USBTasks() function needs to be called periodically in order to keep processing these events.

```
int main(void)
{
    //Initialize the USB stack
    USBInitialize(0);

    //Pass my accessory information to the Android client driver
    AndroidAppStart(&myDeviceInfo);

    while(1)
    {
        //Keep the USB stack running
        USBTasks();

        //Do my application specific stuff here
        //...
    }
}
```

The rate at which USBTasks() is called will contribute to determining the throughput that the stack is able to get, the timeliness of the data reception, and the accuracy and latency of the events thrown from the stack.

4.2.4 Detecting a Connection/Disconnection to an Android Device

The USB Host stack notifies users of attachment and detachment events through an event handler call back function. The name of this function is configurable in source code projects. In pre-compiled projects, this function is named USB_ApplicationEventHandler().

The Android client driver uses this same event handler function to notify the user of the attachment or detachment of Android devices. The Android client driver adds the EVENT_ANDROID_ATTACH (see page 31) and EVENT_ANDROID_DETACH (see page 31) events. These two events are key to interfacing to the attached Android device. The data field of the attach event provides the handle to the Android device. This handle must be passed to all of the read/write functions to it is important to save this information when it is received. Similarly the detach event specifies the handle of the device that detached so that the application knows which device detached (if multiple devices are attached).

```
void* device_handle = NULL;
static BOOL device_attached = FALSE;

int main(void)
{
    //Initialize the USB stack
    USBInitialize(0);

    //Send the accessory information to the Android client driver
    AndroidAppStart(&myDeviceInfo);

    while(1)
    {
        //Keep the USB stack running
        USBTasks();

        //If the device isn't attached yet,
```

```

    if(device_attached == FALSE)
    {
        //Continue to the top of the while loop to start the check over again.
        continue;
    }

    //If the accessory is ready, then this is where we run all of the demo code

    if(readInProgress == FALSE)
    {
        //This example shows how the handle is required for the transfer functions
        errorCode = AndroidAppRead(device_handle,
                                   (BYTE*)&command_packet,
                                   (DWORD)sizeof(ACCESSORY_APP_PACKET));

        //If the device is attached, then lets wait for a command from the application
        if( errorCode != USB_SUCCESS)
        {
            //Error
            DEBUG_ERROR("Error trying to start read");
        }
        else
        {
            readInProgress = TRUE;
        }
    }
}

BOOL USB_ApplicationEventHandler( BYTE address, USB_EVENT event, void *data, DWORD size )
{
    switch( event )
    {
        //Android device has been removed.
        case EVENT_ANDROID_DETACH:
            device_attached = FALSE;
            device_handle = NULL;
            return TRUE;
            break;

        //Android device has been added. Must record the device handle
        case EVENT_ANDROID_ATTACH:
            device_attached = TRUE;
            device_handle = data;
            return TRUE;

        //Handle other events here that are required...
        //...
    }
}

```

4.2.5 Sending Data

There are two functions that are associated with sending data from the Accessory to the device: `AndroidAppIsWriteComplete` (see page 23)() and `AndroidAppWrite` (see page 26)(). The `AndroidAppWrite` (see page 26)() function is used to send data from the Accessory to the Android device. The `AndroidAppIsWriteComplete` (see page 23)() function is used to determine if a previous transfer has completed. Remember from the Keeping the Stack Running (see page 18) section that the `USBTasks()` function needs to be called in order to keep the stack running. This means that you shouldn't loop on the `AndroidAppIsWriteComplete` (see page 23)() function. Instead use either a state machine or booleans to indicate what you need to do.

```

while(1)
{
    USBTasks();

    //Do some extra stuff here to see if the buttons have updated

    if( writeInProgress == TRUE )
    {

```



```

    if(AndroidAppIsWriteComplete(device_handle, &errorCode, &size) == TRUE)
    {
        writeInProgress = FALSE;

        if(errorCode != USB_SUCCESS)
        {
            //Error
            DEBUG_ERROR("Error trying to complete write");
        }
    }

    if((buttonsNeedUpdate == TRUE) && (writeInProgress == FALSE))
    {
        response_packet.command = COMMAND_UPDATE_PUSHBUTTONS;
        response_packet.data = pushButtonValues;

        errorCode = AndroidAppWrite(device_handle, (BYTE*)&response_packet, 2);
        if( errorCode != USB_SUCCESS )
        {
            DEBUG_ERROR("Error trying to send button update");
        }
        else
        {
            buttonsNeedUpdate = FALSE;
            writeInProgress = TRUE;
        }
    }
}

```

4.2.6 Receiving Data

Receiving data from the Android device is very similar to sending data. There are two functions that are used: `AndroidAppIsReadComplete` (see page 22)() and `AndroidAppRead` (see page 24)().

The `AndroidAppRead` (see page 24)() function is used to start a read request from the Android device. In the situation where the Android device is the USB peripheral, this will initiate an IN request on the bus. If the Android device doesn't have any information it will respond with NAKs. One key thing to know about the read function is that the buffer passed to the read function must always be able to receive at least one packets worth of USB data. For full-speed USB devices this is 64 bytes.

The `AndroidAppIsReadComplete` (see page 22)() function is used to determine if a read request was completed. The read request will terminate if a couple of conditions occur. The first is if the total number of bytes requested has been read. The second is if a packet with less than the maximum packet length is received. This typically indicates that fewer bytes than requested are available and that no more packets are immediately pending. While this is true for most cases, it may not be true for every case. If the target application is one of those exceptions, keep in mind that you may have to call the read function multiple times in order to receive a complete transmission from the applications perspective. Remember from the Keeping the Stack Running (see page 18) section that the `USBTasks()` function needs to be called in order to keep the stack running. This means that you shouldn't loop on the `AndroidAppIsReadComplete` (see page 22)() function. Instead use either a state machine or booleans to indicate what you need to do.

```

while(1)
{
    //Keep the stack running
    USBTasks();

    //Do some extra stuff here

    if(readInProgress == FALSE)
    {
        errorCode = AndroidAppRead(device_handle,
                                   (BYTE*)&command_packet,
                                   (DWORD)sizeof(ACCESSORY_APP_PACKET));
        //If the device is attached, then lets wait for a command from the application
    }
}

```

```
        if( errorCode != USB_SUCCESS)
        {
            //Error
            DEBUG_ERROR("Error trying to start read");
        }
        else
        {
            readInProgress = TRUE;
        }
    }

    if(AndroidAppIsReadComplete(device_handle, &errorCode, &size) == TRUE)
    {
        readInProgress = FALSE;

        //We've received a command over the USB from the Android device.
        if(errorCode == USB_SUCCESS)
        {
            //We've received data, process it here (or elsewhere if desired)
            switch(command_packet.command)
            {
                case COMMAND_SET_LEDS:
                    SetLEDs(command_packet.data);
                    break;
                default:
                    //Error, unknown command
                    DEBUG_ERROR("Error: unknown command received");
                    break;
            }
        }
        else
        {
            //Error
            DEBUG_ERROR("Error trying to complete read request");
        }
    }
}
```

5 Firmware API

This section covers the API routines available in this distribution. These descriptions cover more of the interface of these functions. For example usages and more details about how to use these functions in conjunction with each other and in your system, please refer to the Using the Library (see page 13) section of the document.

5.1 API Functions

Functions

	Name	Description
⇒	AndroidApplsReadComplete (see page 22)	Check to see if the last read to the Android device was completed
⇒	AndroidApplsWriteComplete (see page 23)	Check to see if the last write to the Android device was completed
⇒	AndroidAppRead (see page 24)	Attempts to read information from the specified Android device
⇒	AndroidAppStart (see page 25)	Sets the accessory information and initializes the client driver information after the initial power cycles.
⇒	AndroidAppWrite (see page 26)	Sends data to the Android device specified by the passed in handle.
⇒	AndroidTasks (see page 26)	Tasks function that keeps the Android client driver moving

5.1.1 AndroidApplsReadComplete Function

Check to see if the last read to the Android device was completed

File

usb_host_android.h

C

```

BOOL AndroidAppIsReadComplete(
    void* handle,
    BYTE* errorCode,
    DWORD* size
);

```

Description

Check to see if the last read to the Android device was completed. If complete, returns the amount of data that was sent and the corresponding error code for the transmission.

Remarks

Possible values for errorCode are:

- USB_SUCCESS - Transfer successful
- USB_UNKNOWN_DEVICE - Device not attached
- USB_ENDPOINT_STALLED - Endpoint STALL'd
- USB_ENDPOINT_ERROR_ILLEGAL_PID - Illegal PID returned

- USB_ENDPOINT_ERROR_BIT_STUFF
- USB_ENDPOINT_ERROR_DMA
- USB_ENDPOINT_ERROR_TIMEOUT
- USB_ENDPOINT_ERROR_DATA_FIELD
- USB_ENDPOINT_ERROR_CRC16
- USB_ENDPOINT_ERROR_END_OF_FRAME
- USB_ENDPOINT_ERROR_PID_CHECK
- USB_ENDPOINT_ERROR - Other error

Preconditions

Transfer has previously been requested from an Android device.

Parameters

Parameters	Description
void* handle	the handle passed to the device in the EVENT_ANDROID_ATTACH (see page 31) event
BYTE* errorCode	a pointer to the location where the resulting error code should be written
DWORD* size	a pointer to the location where the resulting size information should be written

Return Values

Return Values	Description
TRUE	Transfer is complete.
FALSE	Transfer is not complete.

Function

BOOL AndroidApplsReadComplete(void* handle, BYTE* errorCode, DWORD* size)

5.1.2 AndroidApplsWriteComplete Function

Check to see if the last write to the Android device was completed

File

usb_host_android.h

C

```
BOOL AndroidApplsWriteComplete(  
    void* handle,  
    BYTE* errorCode,  
    DWORD* size  
);
```

Description

Check to see if the last write to the Android device was completed. If complete, returns the amount of data that was sent and the corresponding error code for the transmission.

Remarks

Possible values for errorCode are:

- USB_SUCCESS - Transfer successful
- USB_UNKNOWN_DEVICE - Device not attached
- USB_ENDPOINT_STALLED - Endpoint STALL'd
- USB_ENDPOINT_ERROR_ILLEGAL_PID - Illegal PID returned

- USB_ENDPOINT_ERROR_BIT_STUFF
- USB_ENDPOINT_ERROR_DMA
- USB_ENDPOINT_ERROR_TIMEOUT
- USB_ENDPOINT_ERROR_DATA_FIELD
- USB_ENDPOINT_ERROR_CRC16
- USB_ENDPOINT_ERROR_END_OF_FRAME
- USB_ENDPOINT_ERROR_PID_CHECK
- USB_ENDPOINT_ERROR - Other error

Preconditions

Transfer has previously been sent to Android device.

Parameters

Parameters	Description
void* handle	the handle passed to the device in the EVENT_ANDROID_ATTACH (see page 31) event
BYTE* errorCode	a pointer to the location where the resulting error code should be written
DWORD* size	a pointer to the location where the resulting size information should be written

Return Values

Return Values	Description
TRUE	Transfer is complete.
FALSE	Transfer is not complete.

Function

BOOL AndroidApplsWriteComplete(void* handle, BYTE* errorCode, DWORD* size)

5.1.3 AndroidAppRead Function

Attempts to read information from the specified Android device

File

usb_host_android.h

C

```
BYTE AndroidAppRead(  
    void* handle,  
    BYTE* data,  
    DWORD size  
);
```

Description

Attempts to read information from the specified Android device. This function does not block. Data availability is checked via the AndroidApplsReadComplete (see page 22)() function.

Remarks

None

Preconditions

A read request is not already in progress and an Android device is attached.

Parameters

Parameters	Description
void* handle	the handle passed to the device in the EVENT_ANDROID_ATTACH (see page 31) event
BYTE* data	a pointer to the location of where the data should be stored. This location should be accessible by the USB module
DWORD size	the amount of data to read.

Return Values

Return Values	Description
USB_SUCCESS	Read started successfully.
USB_UNKNOWN_DEVICE	Device with the specified address not found.
USB_INVALID_STATE	We are not in a normal running state.
USB_ENDPOINT_ILLEGAL_TYPE	Must use USBHostControlRead to read from a control endpoint.
USB_ENDPOINT_ILLEGAL_DIRECTION	Must read from an IN endpoint.
USB_ENDPOINT_STALLED	Endpoint is stalled. Must be cleared by the application.
USB_ENDPOINT_ERROR	Endpoint has too many errors. Must be cleared by the application.
USB_ENDPOINT_BUSY	A Read is already in progress.
USB_ENDPOINT_NOT_FOUND	Invalid endpoint.
USB_ERROR_BUFFER_TOO_SMALL (see page 27)	The buffer passed to the read function was smaller than the endpoint size being used (buffer must be larger than or equal to the endpoint size).

Function

BYTE AndroidAppRead(void* handle, BYTE* data, DWORD size)

5.1.4 AndroidAppStart Function

Sets the accessory information and initializes the client driver information after the initial power cycles.

File

usb_host_android.h

C

```
void AndroidAppStart(
    ANDROID_ACCESSORY_INFORMATION* accessoryInfo
);
```

Description

Sets the accessory information and initializes the client driver information after the initial power cycles. Since this resets all device information this function should be used only after a complete system reset. This should not be called while the USB is active or while connected to a device.

Remarks

None

Preconditions

USB module should not be in operation

Parameters

Parameters	Description
ANDROID_ACCESSORY_INFORMATION* info	the information about the Android accessory

Function

void AndroidAppStart(ANDROID_ACCESSORY_INFORMATION (see page 32) *info)

5.1.5 AndroidAppWrite Function

Sends data to the Android device specified by the passed in handle.

File

usb_host_android.h

C

```
BYTE AndroidAppWrite(  
    void* handle,  
    BYTE* data,  
    DWORD size  
);
```

Description

Sends data to the Android device specified by the passed in handle.

Remarks

None

Preconditions

Transfer is not already in progress. USB module is initialized and Android device has attached.

Parameters

Parameters	Description
void* handle	the handle passed to the device in the EVENT_ANDROID_ATTACH (see page 31) event
BYTE* data	the data to send to the Android device
DWORD size	the size of the data that needs to be sent

Return Values

Return Values	Description
USB_SUCCESS	Write started successfully.
USB_UNKNOWN_DEVICE	Device with the specified address not found.
USB_INVALID_STATE	We are not in a normal running state.
USB_ENDPOINT_ILLEGAL_TYPE	Must use USBHostControlWrite to write to a control endpoint.
USB_ENDPOINT_ILLEGAL_DIRECTION	Must write to an OUT endpoint.
USB_ENDPOINT_STALLED	Endpoint is stalled. Must be cleared by the application.
USB_ENDPOINT_ERROR	Endpoint has too many errors. Must be cleared by the application.
USB_ENDPOINT_BUSY	A Write is already in progress.
USB_ENDPOINT_NOT_FOUND	Invalid endpoint.

Function

BYTE AndroidAppWrite(void* handle, BYTE* data, DWORD size)

5.1.6 AndroidTasks Function

Tasks function that keeps the Android client driver moving

File

usb_host_android.h

C

```
void AndroidTasks();
```

Description

Tasks function that keeps the Android client driver moving. Keeps the driver processing requests and handling events. This function should be called periodically (the same frequency as USBHostTasks() would be helpful).

Remarks

This function should be called periodically to keep the Android driver moving.

Preconditions


AndroidAppStart (see page 25)() function has been called before the first calling of this function

Function

```
void AndroidTasks(void)
```

5.2 Error Codes

Macros

	Name	Description
	USB_ERROR_BUFFER_TOO_SMALL (see page 27)	Error code indicating that the buffer passed to the read function was too small. Since the USB host can't control how much data it will receive in a single packet, the user must provide a buffer that is at least the size of the endpoint of the attached device. If a buffer is passed in that is too small, the read will not start and this error is returned to the user.

5.2.1 USB_ERROR_BUFFER_TOO_SMALL Macro

File

usb_host_android.h

C



```
#define USB_ERROR_BUFFER_TOO_SMALL USB_ERROR_CLASS_DEFINED + 0
```

Description

Error code indicating that the buffer passed to the read function was too small. Since the USB host can't control how much data it will receive in a single packet, the user must provide a buffer that is at least the size of the endpoint of the attached device. If a buffer is passed in that is too small, the read will not start and this error is returned to the user.

5.3 Configuration Definitions

Macros

	Name	Description
	NUM_ANDROID_DEVICES_SUPPORTED ( see page 28)	Defines the number of concurrent Android devices this implementation is allowed to talk to. This definition is only used for implementations where the accessory is the host and the Android device is the slave. This is also most often defined to be 1. If this is not defined by the user, a default of 1 is used. This option is only used when compiling the source version of the library. This value is set to 1 for pre-compiled versions of the library.

5.3.1 NUM_ANDROID_DEVICES_SUPPORTED Macro

File

usb_host_android.h

C

```
#define NUM_ANDROID_DEVICES_SUPPORTED 1
```







Description

Defines the number of concurrent Android devices this implementation is allowed to talk to. This definition is only used for implementations where the accessory is the host and the Android device is the slave. This is also most often defined to be 1. If this is not defined by the user, a default of 1 is used.

This option is only used when compiling the source version of the library. This value is set to 1 for pre-compiled versions of the library.

5.4 Configuration Functions

Functions

	Name	Description
	AndroidAppDataEventHandler ( see page 28)	Handles data events from the host stack
	AndroidAppEventHandler ( see page 29)	Handles events from the host stack
	AndroidAppInitialize ( see page 30)	Per instance client driver for Android device. Called by USB host stack from the client driver table.

5.4.1 AndroidAppDataEventHandler Function

Handles data events from the host stack

File

usb_host_android.h

C

```
BOOL AndroidAppDataEventHandler(  
    BYTE address,  
    USB_EVENT event,  
    void * data,  
    DWORD size  
);
```

Description

Handles data events from the host stack

Remarks

This is a internal API only. This should not be called by anything other than the USB host stack via the client driver table

Preconditions

None

Parameters

Parameters	Description
BYTE address	the address of the device that caused the event
USB_EVENT event	the event that occurred
void* data	the data for the event
DWORD size	the size of the data in bytes

Return Values

Return Values	Description
TRUE	the event was handled
FALSE	the event was not handled

Function

BOOL AndroidAppDataEventHandler(BYTE address, USB_EVENT event, void *data, DWORD size)

5.4.2 AndroidAppEventHandler Function

Handles events from the host stack

File

usb_host_android.h

C

```
BOOL AndroidAppEventHandler(  
    BYTE address,  
    USB_EVENT event,  
    void * data,  
    DWORD size  
);
```

Description

Handles events from the host stack

Remarks

This is a internal API only. This should not be called by anything other than the USB host stack via the client driver table

Preconditions

None

Parameters

Parameters	Description
BYTE address	the address of the device that caused the event
USB_EVENT event	the event that occurred
void* data	the data for the event
DWORD size	the size of the data in bytes

Return Values

Return Values	Description
TRUE	the event was handled
FALSE	the event was not handled

Function

BOOL AndroidAppEventHandler(BYTE address, USB_EVENT event, void *data, DWORD size)

5.4.3 AndroidAppInitialize Function

Per instance client driver for Android device. Called by USB host stack from the client driver table.

File

usb_host_android.h

C

```
BOOL AndroidAppInitialize(  
    BYTE address,  
    DWORD flags,  
    BYTE clientDriverID  
) ;
```

Description

Per instance client driver for Android device. Called by USB host stack from the client driver table.

Remarks

This is a internal API only. This should not be called by anything other than the USB host stack via the client driver table

Preconditions

None

Parameters

Parameters	Description
BYTE address	the address of the device that is being initialized
DWORD flags	the initialization flags for the device
BYTE clientDriverID	the clientDriverID for the device

Return Values





Return Values	Description
TRUE	initialized successfully
FALSE	does not support this device

Function

BOOL AndroidApplInitialize(BYTE address, DWORD flags, BYTE clientDriverID)

5.5 Events

Macros

	Name	Description
	EVENT_ANDROID_ATTACH ( see page 31)	This event is thrown when an Android device is attached and successfully entered into accessory mode already. The data portion of this event is the handle that is required to communicate to the device and should be saved so that it can be passed to all of the transfer functions. Always use this definition in the code and never put a static value as the value of this event may change based on various build options.
	EVENT_ANDROID_DETACH ( see page 31)	This event is thrown when an Android device is removed. The data portion of the event is the handle of the device that has been removed. Always use this definition in the code and never put a static value as the value of this event may change based on various build options.

5.5.1 EVENT_ANDROID_ATTACH Macro

File

usb_host_android.h

C

```
#define EVENT_ANDROID_ATTACH ANDROID_EVENT_BASE + 0
```

Description

This event is thrown when an Android device is attached and successfully entered into accessory mode already. The data portion of this event is the handle that is required to communicate to the device and should be saved so that it can be passed to all of the transfer functions. Always use this definition in the code and never put a static value as the value of this event may change based on various build options.

5.5.2 EVENT_ANDROID_DETACH Macro

File

usb_host_android.h

C


```
#define EVENT_ANDROID_DETACH ANDROID_EVENT_BASE + 1
```

Description

This event is thrown when an Android device is removed. The data portion of the event is the handle of the device that has been removed. Always use this definition in the code and never put a static value as the value of this event may change based on various build options.

5.6 Type Definitions

Structures

	Name	Description
	ANDROID_ACCESSORY_INFORMATION (see page 32)	This structure contains the informatin that is required to successfully create a link between the Android device and the accessory. This information must match the information entered in the accessory filter in the Android application in order for the Android application to access the device. An instance of this structure should be passed into the AndroidAppStart (see page 25)() at initialization.

5.6.1 ANDROID_ACCESSORY_INFORMATION Structure

File

usb_host_android.h

C

```
typedef struct {
    char* manufacturer;
    BYTE manufacturer_size;
    char* model;
    BYTE model_size;
    char* description;
    BYTE description_size;
    char* version;
    BYTE version_size;
    char* URI;
    BYTE URI_size;
    char* serial;
    BYTE serial_size;
} ANDROID_ACCESSORY_INFORMATION;
```

Members

Members	Description
char* manufacturer;	String: manufacturer name
BYTE manufacturer_size;	length of manufacturer string
char* model;	String: model name
BYTE model_size;	length of model name string
char* description;	String: description of the accessory
BYTE description_size;	length of the description string
char* version;	String: version number
BYTE version_size;	length of the version number string
char* URI;	String: URI for the accessory (most commonly a URL)
BYTE URI_size;	length of the URI string
char* serial;	String: serial number of the device
BYTE serial_size;	length of the serial number string

Description

This structure contains the informatin that is required to successfully create a link between the Android device and the accessory. This information must match the information entered in the accessory filter in the Android application in order for

the Android application to access the device. An instance of this structure should be passed into the `AndroidAppStart` (see page 25)() at initialization.

6 Running the Demos

6.1 Creating the Setup

6.1.1 New to Microchip

This section covers where to find Microchip tools and how to set those tools up for those that are new to Microchip.

6.1.1.1 Getting the Tools

If you are new to Microchip, then we welcome you to development on our line of processors. There are a few tools that you will need in order to get started developing.

You will need our IDE, MPLAB. There are two versions of the IDE available. The current released version of the IDE is available for Windows based computers and can be downloaded from www.microchip.com/mplab. For Macintosh or Linux users, you are welcome to use the beta version of MPLAB X, our upcoming IDE version, from http://ww1.microchip.com/downloads/mplab/X_Beta/index.html.

You will need a compiler. Windows users can download the appropriate compilers from www.microchip.com/c30 for the 16-bit based processors and www.microchip.com/c32 for the 32-based processors. Linux or Macintosh users can download versions of the compilers at http://ww1.microchip.com/downloads/mplab/X_Beta/index.html.

Finally you will need a programmer or debugger. If you order the Accessory Development Starter Kit for Android, you will have received our PICkit 3 programmer/debugger with that board. This is one of our lower end programmer/debuggers. Other programmer/debuggers are available from the following links:

- www.microchip.com/icd3
- www.microchip.com/realice

6.1.2 New to Android

This section points users to resources and tools for those that are new to developing on the Android platform.

Description

If you are new to developing under Android, there is extensive information available from the Android developer's website: <http://developer.android.com/index.html>.

For instructions on where to find the development tools and how to install them, please refer to the following links:

- <http://developer.android.com/sdk/index.html>
- <http://developer.android.com/sdk/installing.html>

Once the tools are installed, we recommend that you follow through a few of the example tutorials provided below as well as read through some of the below web pages for more information about Android development before moving forward to your

Open Accessory project:

- <http://developer.android.com/guide/index.html>
- <http://developer.android.com/guide/topics/fundamentals.html>
- <http://developer.android.com/resources/tutorials/hello-world.html>

6.1.3 Updating the Android OS

Description

This section describes how to update the Android device to the versions required for use with the Open Accessory framework.

6.1.3.1 Nexus S

This section covers how to update the Nexus S to Android OS version 2.3.4.

Description

1. Look at the phones current version number by going to "Settings->About Phone->Android Version". If the version number is 2.3, go to step 2. If the version number is 2.3.1, go to step 4, if the version number is 2.3.2, go to step 6, if the version number is 2.3.3, go to step 8, if the version number is 2.3.4, then skip all of these instructions and just go to the firmware/APK file installation instructions.
2. Download the following file to your computer:
http://android.clients.google.com/packages/ota/google_crespo/a71a2082d553.signed-soju-GRH78-from-GRH55.a71a2082.zip
3. Rename the file `update_v2_3_1.zip`
4. Download the following file to your computer:
http://android.clients.google.com/packages/ota/google_crespo/353e267378cd.signed-soju-GRH78C-from-GRH78.353e2673.zip
5. Rename the file `update_v2_3_2.zip`
6. Download the following file to your computer:
http://android.clients.google.com/packages/ota/google_crespo/98f3836cef9e.signed-soju-GRI40-from-GRH78C.98f3836c.zip
7. Rename the file `update_v2_3_3.zip`
8. Download the following file to your computer:
http://android.clients.google.com/packages/ota/google_crespo/a14a2dd09749.signed-soju-GRJ22-from-GRI40.a14a2dd0.zip
9. Rename the file `update_v2_3_4.zip`
10. Now connect the Nexus S phone to your computer. Enable the USB Mass Storage drive support on your phone (if it doesn't pop-up with the request, then slide down the notification bar from the top to enable it).
11. Copy all of the .zip files to the root directory of the drive created by the phone.
12. Make sure that the phone has at least ¼ of a charge left. Disconnect the phone from the computer.
13. Turn the phone off by holding the power button and selecting the Power-off option.
14. Hold down the up volume button on the phone.
15. While still holding the volume up button, press and hold the power button. The phone should boot into a boot loader menu. You may now let go of the buttons.
16. Use the volume down button to go to the "Recovery" option of the boot loader. Press the power button. This will make it appear as if the phone is rebooting. It will stop at a screen that has a triangle with a "!" mark inside of it.

17. Press and hold the power button. While still holding the power button, press the up volume button.
18. You will now see a system recovery menu. From this menu use the volume down button to select "apply update from /sdcard". Press the power button to select this option.
19. Use the volume down button to navigate to the lowest version number of files that you loaded onto the phone (so if you are running v2.3.1, you will need to point to the update_v2_3_2.zip file, etc). Press the power button to install that file.
20. Repeat steps 18-19 until you have applied all of the updates for all of the versions successfully.
21. Once complete, select the reboot system option from the menu. Verify that the phone version is now v2.3.4.

6.1.4 Updating the SDK

Description

This section discusses how to update to the correct API version to call the Open Accessory framework API.

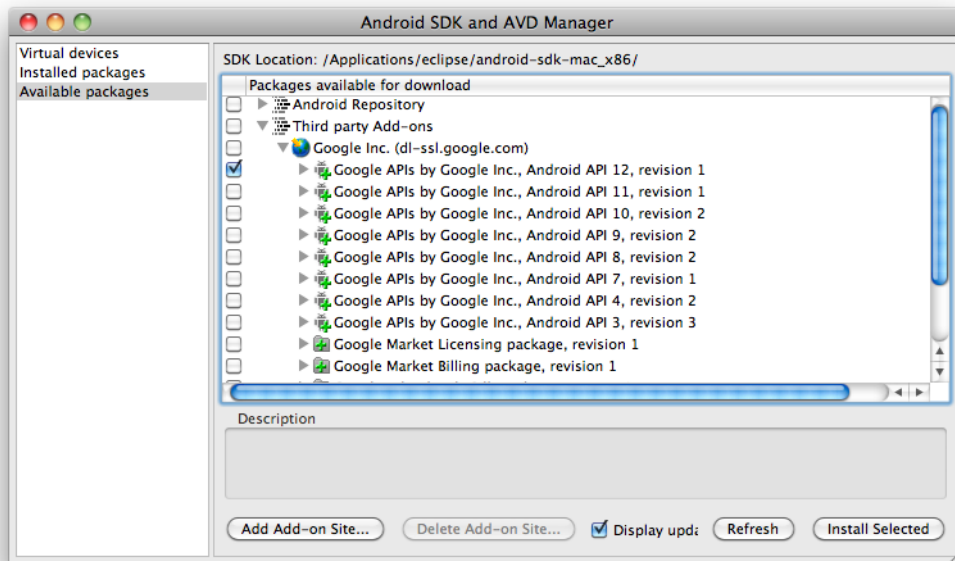
6.1.4.1 Eclipse IDE

The Open Accessory API is available in API level 12. There are two different ways to get API level 12 based on which OS version you are developing for.

6.1.4.1.1 Version v2.3.x

To enable development for the Gingerbread OS line, versions v2.3.4 and later, you will need to get the API level 12 add-on for the Eclipse IDE.

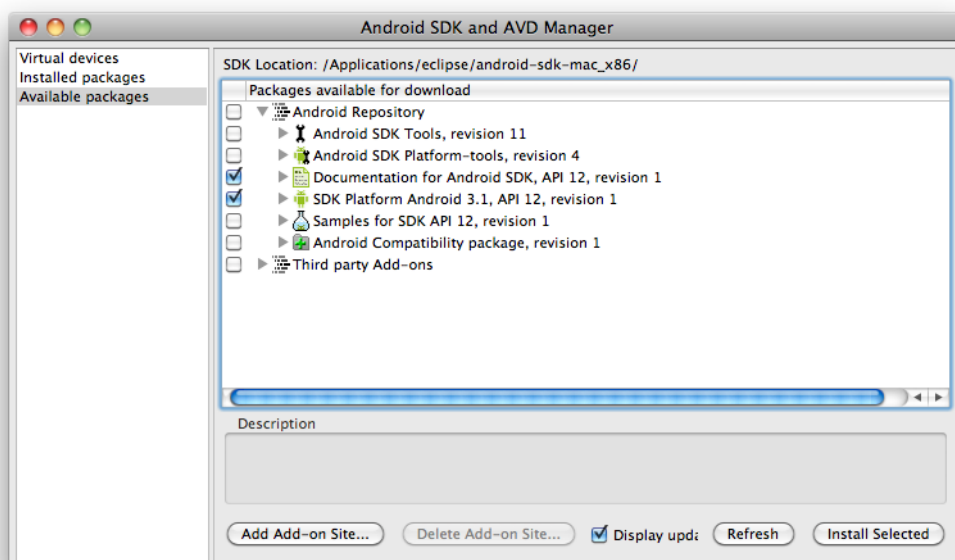
1. Launch the "Android SDK and AVD Manager" either through the Eclipse IDE or through the command line.
2. In the manager window's leftmost panel, select "Available Packages".
3. Expand the "Third Party Add-ons" option
4. Expand the "Google Inc. (dl-ssl.google.com)" option
5. Check the box next to the "Google APIs by Google Inc., Android API 12" option. You may also select other software packages or APIs that you wish to download.
6. Click the "Install Selected" button.



6.1.4.1.2 Version v3.x

To enable development for the Honeycomb OS line, versions v3.x and later, you will need to get the API level 12 add-on for the Eclipse IDE.

1. Launch the "Android SDK and AVD Manager" either through the Eclipse IDE or through the command line.
2. In the manager window's leftmost panel, select "Available Packages".
3. Expand the "Android Repository" option
4. Check the box next to the "SDK Platform Android 3.1, API 12" option and the "Documentation for Android SDK, API 12" options. You may also select other software packages or APIs that you wish to download.
5. Click the "Install Selected" button.



6.2 Basic Accessory Demo

This is the basic accessory demo that shows simple bi-directional communication from the Android device to the attached accessory.

6.2.1 Getting the Android Application

There are several methods for getting the example Android application running on the target Android device. Before attempting any of these methods, please insure that the Android device is running the appropriate version of the Android OS (Updating the Android OS (see page 35)).

Once the proper OS version is installed, please use one of the following methods to get the application into the Android device.

6.2.1.1 From source

The source code for the example Android application is included in this installation. You should be able to compile and use the IDE of your choice to directly load the example application as you would any other Android example program. Once the application is loaded on the Android device you can remove the USB connection to the IDE and connect it to target accessory to run the demo.

6.2.1.2 From Android Marketplace

The example application can be downloaded from the Android Marketplace. You should be able to find the demo application by searching for "Microchip" and looking for the "Basic Accessory Demo" application.

You can also download the file by:

1) Go to the following link in the browser:

https://market.android.com/details?id=com.microchip.android.BasicAccessoryDemo&feature=search_result

2) Click on the below link from an Android device capable of running the demo:

<market://details?id=com.microchip.android.BasicAccessoryDemo>

3) Use a bar code scanner to scan the following QR code:

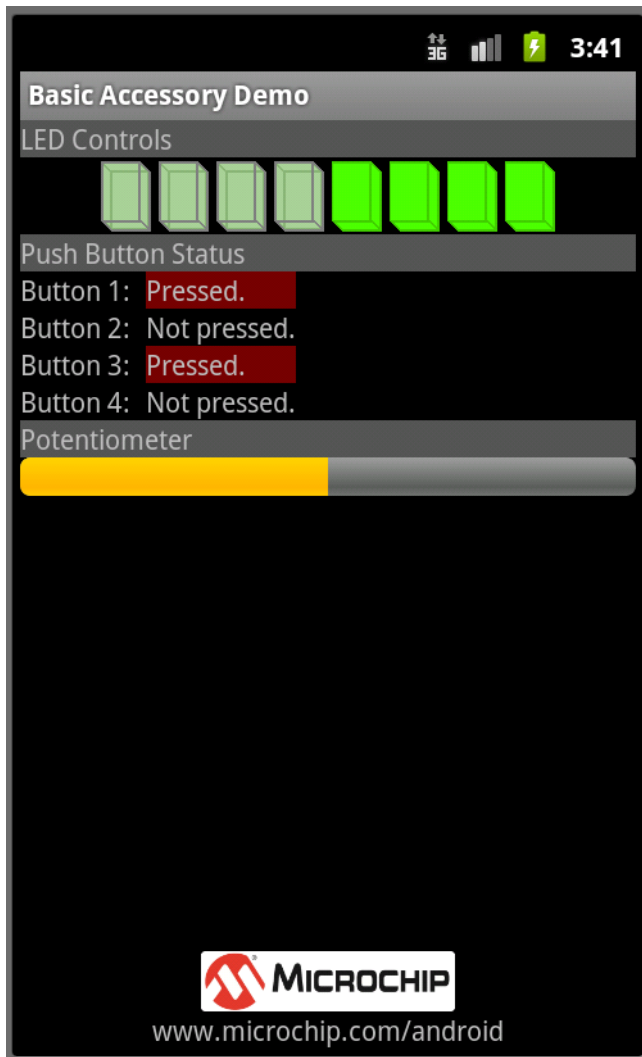
6.2.2 Preparing the Hardware

Before attempting to run the demo application, insure that the correct firmware for the demo application has been loaded into the target firmware.

The firmware for this example can be found in the "Basic Accessory Demo/Firmware" folder of this distribution. Open the correct project file for your hardware platform for MPLAB 8. If you are using MPLAB X, open the MPLAB.X project folder and change the configuration in the configuration drop down box. Compile and program the firmware into the device.

6.2.3 Running the demo

1. Attach the Accessory Development Starter Board to the Android device using the connector provided by the Android device's manufacturer. Please make sure that the accessory is attached to the Android device before launching the application.
2. Once the demonstration application has been loaded, go to the Application folder on the Android device. Open the "Basic Accessory Demo" application.



When the application launches, there are three general sections to the application:

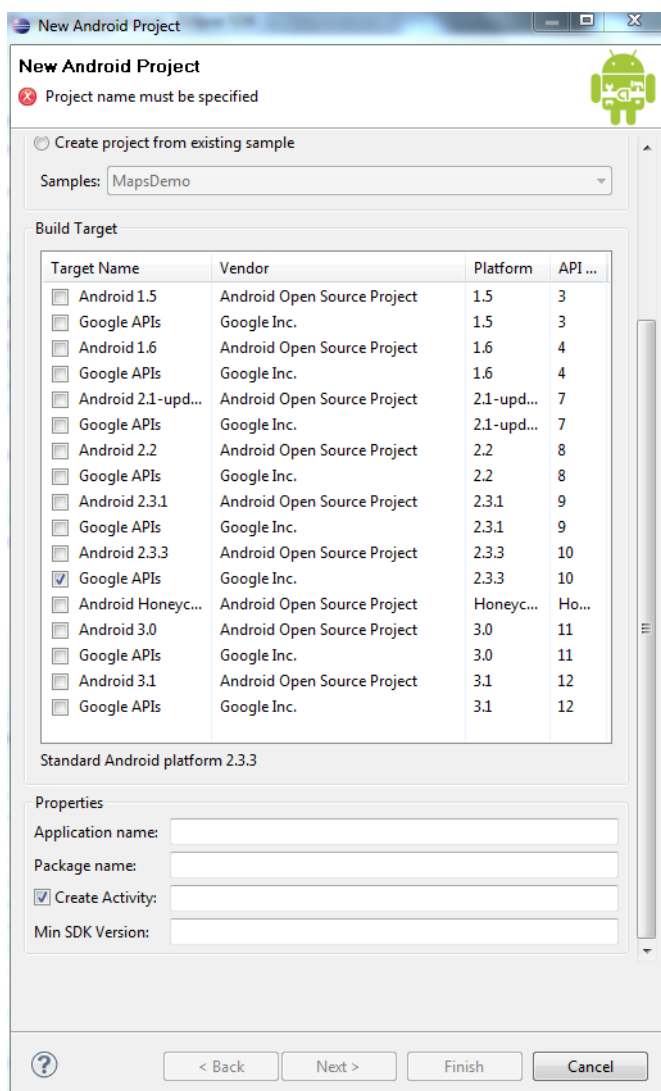
- LED Controls – Pressing any of the 8 buttons on the Android screen sends a command from the Android device to the accessory, indicating that the LED status has changed and provides the new LED settings. The image on the screen toggles to show the state of the LEDs.
- Push Button Status – This section indicates the status of the push buttons on the accessory board. When a button is pressed, the text will change to Pressed.
- Potentiometer – This indicates the percentage of the potentiometer on the accessory board.

7 Creating an Android Accessory Application using the Open Accessory Framework

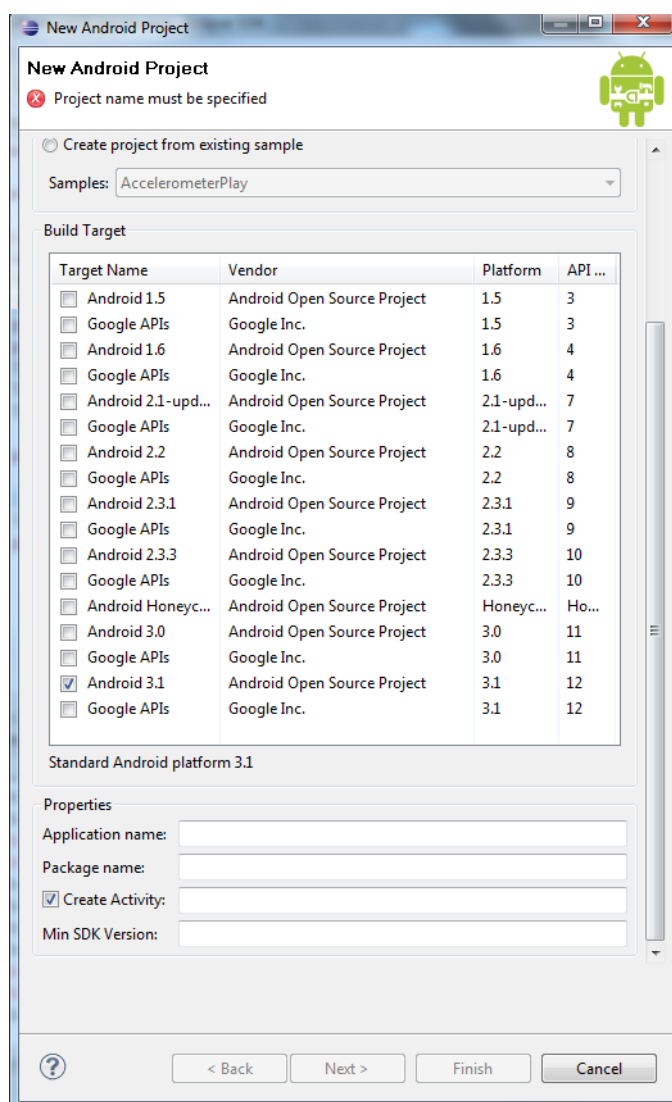
7.1 Creating the Project

When creating a new Android application that is going to be using the Open Accessory framework, it is important to select the correct API settings in order to be able to build the project successfully. Please make sure that your SDK is up to date and has the correct components by following the instructions in the Updating the SDK (see page 36). Also insure that the device that you will working with as the correct OS version that enables these features (Updating the Android OS (see page 35) section).

When creating the Android Application project that will use the Open Accessory Framework, you need to make sure select the correct Target OS version. For Gingerbread devices (v2.3.4 or later) you need to select API level 10 with the additional Google APIs (seen below).



For Honeycomb devices (v3.1 or later), select any of the API 12 versions (seen below):



This is the only special requirement for developing an application for Android accessories.

7.2 Accessing the Accessory From the Application

There are several steps that are required in order to gain access to the accessory from the application. These topics are covered in detail at the following link: <http://developer.android.com/guide/topics/usb/index.html>. This site covers all of the steps required to access the device in either of the modes. Please also refer to the demo applications provided in this distribution.

8 FAQs, Tips, and Troubleshooting

8.1 My PIC32 project gets a run time exception. What could be wrong?

There are several issues that could be causing the runtime exceptions in a PIC32 project. Here are some things to check that might help you find the source of the issue.

1. Check to make sure that you have a heap size defined. The USB host stack uses dynamic memory allocation, thus needs a heap size defined. To add a heap to the project, go to the linker settings. This can be found in the "Project->Build Options->Project->MPLAB PIC32 Linker" menu in MPLAB 8. This can be found in the "File->Project Properties->(current build configuration)->C32->pic32-ld" in MPLAB X.

2. If a heap size is defined you can use the general exception vector to trap the error and determine what address caused the exception. This can be done using something similar to the following code:

```
#if defined(__C32__)
void _general_exception_handler(unsigned cause, unsigned status)
{
    unsigned long address = _CP0_GET_EPC();

    DEBUG_ERROR("exception");
    while(1){}
}
#endif
```

This will catch the exception and lock the code in a while(1). From this point you can halt the code and look at the address variable to see what address caused the exception. Use the disassembly listing to determine the corresponding line of C code.

8.2 How do I debug without access to ADB?

Though the USB is connected to the accessory now instead of the IDE for debugging, you can still access the ADB interface through a network. Please see <http://developer.android.com/guide/topics/usb/index.html> for more information about how to set this up.

You might also consider using a USB analyzer to determine what is actually happening on the USB bus. Please refer to the Debugging the USB connection section for more details.

8.3 What if I need design assistance creating my accessory?

If you have questions about the library, our parts, or any of our reference codes/boards, please feel free to contact Microchip for support (What if I need more support than what is here? (see page 45)).

If you need someone to assist you in creating a portion of your design, Microchip has design partners that can assist in the portion of your design that you need help with. You can find a list of design partners at the following address: http://microchip.newanglemedia.com/partner_matrix. At the moment there isn't an option to filter for Android specialists. The best option to filter by right now is USB.

8.4 The firmware stops working when I hit a breakpoint.

The USB protocol has periodic packets sent out that keep the attached device active. Without this packet, the bus goes into an idle state. Normally when a breakpoint is hit in the code both the CPU and all peripherals halt at that instruction. This causes the USB module to stop running resulting in the attached peripheral to go into the idle state. The firmware still thinks that the peripheral is active. This results in a break in communication.

There is a way to tell the microcontroller to leave the peripheral enabled when a breakpoint is hit. This will allow the USB module to continue to run and sent out the Start-of-Frame(SOF) packets required to keep the bus alive. This is done via the following methods:

MPLAB 8

Under the debugger->settings menu option, select the "Freeze on Halt" tab. Uncheck the "USB" or "U1CNFG" setting in the list. If neither of these items are in the list of peripherals, uncheck the "All other peripherals" option at the bottom of the list.

MPLAB X

Go under "File->Project Properties". In the project configuration window, select the project configuration that you are using. Under that configuration, select the debugger that is in use. In the resulting debugger menu, select the "Freeze Peripherals" option in the drop down box. Uncheck the "USB" or "U1CNFG" options if you see them. If you don't see these options, uncheck the "All other peripherals" option.

8.5 If I hit the "Home" or "Back" buttons while the accessory is attached, the demo no longer works.

If you hit the "Home" or "Back" buttons while the accessory is attached and the demo no longer runs, the code likely tried to close the `FileInputStream` to release control of the accessory. v2.3.4 and v3.1 of the Android OS have an issue where closing the `ParcelFileDescriptor` or `FileInputStream` will not cause an `IOException` in a `read()` call on the `FileInputStream`. This results in the `ParcelFileDescriptor` being locked until either the accessory detaches or until the read function returns for

some other reason. Please see the Requirements, Limitations, and Potential Issues (see page 11) section for other known issues or limitations.

- Workaround: Since the Read() request never completes resulting in locked resources, a workaround can be implemented in the application layer. If the accessory and the application implement a command for the application to indicate to the accessory that the app is closing (or is being paused), then the accessory can respond back with an acknowledge packet. When the app receives this ACK packet, it knows not to start a new read() (since that read() request will not be able to terminated once started).

8.6 Why don't all of the features of the demo work?

The demo application on the Android device was written with the assumption that there were 8 LEDs, 4 push buttons, and a potentiometer available on the accessory. Not all of these features are available on the supported hardware platforms. Where these features are not available, these functions do not work.

The Explorer 16 board is an even more complex situation. Even though the base board does include these features, some processor modules don't have all of these features routed to the processor. Also on some processor modules the features are routed to the same pin as other features so both can't be used easily in the same demo.

8.7 What if I need more support than what is here?

There are several options that you can use to get various kinds of help.

- You can try our forums at forum.microchip.com. The answers provided here will be by fellow developers and typically not from Microchip employees. The forum often provides a way to get answers very quickly to questions that might take longer for other support routes to answer.
- You can contact your local sales office for support. You can find the local office from www.microchip.com/sales. The local sales team should be able to direct you to a local support team that can help address some issues.
- You can submit support requests to our support system at support.microchip.com or search through the existing hot topics.
- You can also contact androidsupport@microchip.com for support.

8.8 Why doesn't my phone work? -or- Does this phone work?

The OpenAccessory interface was added to the Android OS in versions 2.3.4 and 3.1 of the Android OS. Version 2.3.3 and earlier devices will not work as well as version 3.0 devices.

The OpenAccessory interface library is also an option library. An Android device manufacturer is not required to include this library in their device. As a result, not all devices with a capable version of the OS actually have the library. It is up to the discretion of the manufacturer of the device. Support for this library may also change with an update from the manufacturer

(either adding support or removing support).

For developing at Microchip, we have used the Nexus S phones, running v2.3.4 and v4.0 as well as a Motorola Xoom running v3.2.

The Android market does provide a list of devices that should support a specific released app. The below lists detail the devices specified by the market around the release date of this document. The devices on this list may or may not actually function. We have not tested these devices so we can not verify that they work. Also note that since the support may vary due to manufacturer updates, a device that is on this list may only be supported for specific updates for those devices. Also note that many devices have multiple entries per model phone and that some of these sub-models may be supported, while other sub-models might not be supported. Model numbers on this list may also not match the model numbers listed on the company websites or packaging information.

8.8.1 v2.3.x App

Below is a list of devices listed as supported by the Android market for the v2.3.x App as of the release of this document. This list is subject to change and these devices have not been tested by Microchip to verify that they actually do function. Please see the Why doesn't my phone work? -or- Does this phone work? (see page 45) topic for more information about device support and how it can change.

Acer

Liquid MT(a4)

Enspert

E-TAB(E-TAB)

ESP_E301V(ESP_E301)

Fujitsu

F-03D(f11sky)

HTC

ADR6330VW(blissc)

ADR6425LVW(vigor)

Aria(liberty)

Desire S(saga)

EVO 3D(shooter)

HTC EVO 3D X515m(shooteru)

HTC Explorer A310e(pico)

HTC Hero S(kingdom)

HTC PH39100(holiday)

HTC Rhyme S510b(bliss)

HTC Ruby(ruby)

HTC Sensation XL with Beats Audio X315e(runnymede)

HTC-PG762(marvelc)
HTC_X515E(rider)
ISW12HT(shooterk)
Incredible 2(vivow)
Nexus One(passion)
Sensation 4G(pyramid)
Wildfire(buzz)
Wildfire S(marvel)

Huawei

u8800(u8800)

KT Tech

KM-S120(s120)
KM-S220(s220)
KM-S220H(s220H)
KM-S300(s300)

KYOCERA corporation

C5120(C5120)
C5121(C5121)

LG

Optimus 2X(p990)

Pantech

IM-A800S(ef39s)
IM-A810K(ef40k)
IM-A810S(ef40s)
MIRACH_J(mirachj)
PantechP9060(mini)

SEMC

Experia Acro(IS11S)
Xperia Arc(LT15i)
Xperia Arc(SO-01C)
Xperia Arco(SO-02C)

Xperia Neo(MT15i)
Xperia Play(R800i)
Xperia X10 Mini Pro(U20i)
Xperia X10 Mini Pro(mimmi)

Samsung

Droid Charge(SCH-I510)
Galaxy A(archer)
Galaxy Ace(SHW-M240S)
Galaxy Neo(SHW-M220L)
Galaxy S(SHW-M110S)
Galaxy S(SHW-M130L)
Galaxy S(SHW-M190S)
Droid Charge(SCH-I510)
Galaxy Tab(SHW-M180L)
Galaxy Tab(SHW-M180S)
Nexus S(crespo)
Nexus S(crespo4g)
SCH-I405(SCH-I405)
SHW-M180W(SHW-M180W)
SHW-M290K(SHW-M290K)
SHW-M290S(SHW-M290S)

Sharp

DM010SH(DM010SH)
DM011SH(DM011SH)
IS13SH(SHI13)
SBM009SH(SBM009SH)
SBM009SHY(SBM009SHY)
SBM101SH(SBM101SH)
SBM102SH(SBM102SH)
SH-01D(SH01D)
SH-02D(SH02D)
SH7218T(SH7218T)
SH8188U(SH8188U)

Sony Ericsson

LT15a(LT15a)

LT18i(LT18i)
MK16a(MK16a)
MK16i(MK16i)
MT11i(MT11i)
MT15a(MT15a)
S51SE(S51SE)
SK17i(SK17i)
SO-01D(SO-01D)
SO-03C(SO-03C)
ST15i(ST15i)
ST17i(ST17i)
ST18i(ST18i)
WT19a(WT19a)
WT19i(WT19i)

8.8.2 v3.1+ App

Below is a list of devices listed as supported by the Android market for the v3.1+ App as of the release of this document. This list is subject to change and these devices have not been tested by Microchip to verify that they actually do function. Please see the Why doesn't my phone work? -or- Does this phone work? (see page 45) topic for more information about device support and how it can change.

Acer

A200(picasso_e)
Iconia Tab A100 (VanGogh)(vangogh)
Picasso(picasso)
Picasso(ventana)
TPA60W(maya)

Archos

ARCHOS 101G9(A101)
ARCHOS 101G9(A101S)
ARCHOS 70it2(A70it2)
ARCHOS 80G9(A80)
ARCHOS 80G9(A80S)

Asus

ETBW11AA(ETBW11AA)
Eee Pad(EeePad)

EeePad Slider SL101(SL101)

EeePad Transformer TF101(TF101)

Transformer Prime TF201(TF201)

Transformer TF101G(TF101G)

Dell

Dell Streak 10 Pro(Streak10Pro)

Dell Streak 7(streak7)

Foxconn

ViewPad7x(viewpad7x)

Fujitsu

F-01D(blaze_tablet)

HTC

ADR6425LVW(vigor)

Desire(bravo)

Desire S(saga)

Droid Incredible(inc)

Evo 4G(supersonic)

Flyer(flyer)

Nexus One(passion)

PG41200(express)

Puccini(puccinilte)

Sensation 4G(pyramid)

Hisense

M1101AT(TP9102)

Huawei

HUAWEI MediaPad(hws7300u)

HUAWEI MediaPad(hws7300w)

LG

Optimus Pad(l06c)

Optimus Pad(v900)

Optimus Pad(v901kr)

Optimus Pad(v905r)

Optimus Pad(v909)

Lenovo

Indigo(Indigo)

K1(K1)

Lenovo Mobile

IdeaTab S2007A-F(msm8660_surf)

IdeaTabV2007A(sanpaolo)

IdeaTabV2010A-W(santiago)

ThinkPad Tablet(18382AU)

Motorola

MZ505(Graham)

MZ617(pasteur)

XOOM(stingray)

XOOM(umts_everest)

XOOM(umts_hubble)

XOOM(wifi_hubble)

XOOM(wingray)

XOOM 2 ME(fleming)

Panasonic

JT-H580VT(H580VT_A)

JT-H581VT(H581VT_A)

Pantech

PantechP4100(pororo)

Pegatron

Android Tablet PC(Duke3G)

Android Tablet PC(DukeWifi)

Android Tablet PC(TabletPC)

Chagall 10.1 WiFi(chagall)

Philips Electronics

PI7000(Tablet_8)

Quanta Corporation

IGS-1000(nk1)

LIFETAB_P9514(LIFETAB_P9514)

Nirvana_Tablet(Nirvana_Tablet)

OP110(OP110)

Samsung

GT-P6200(GT-P6200)

GT-P6200L(GT-P6200L)

GT-P6210(GT-P6210)

GT-P6800(GT-P6800)

GT-P6810(GT-P6810)

GT-P7300B(GT-P7300B)

GT-P7500D(GT-P7500D)

GT-P7500M(GT-P7500M)

GT-P7500R(GT-P7500R)

GT-P7501(GT-P7501)

GT-P7511(GT-P7511)

Galaxy Nexus(maguro)

Galaxy Nexus(toro)

Galaxy S(GT-I9000)

Galaxy S(SGH-I897)

Galaxy S(SGH-T959)

Galaxy Tab 10.1(GT-P7300)

Galaxy Tab 10.1(GT-P7310)

Galaxy Tab 10.1(GT-P7500)

Galaxy Tab 10.1(GT-P7510)

Galaxy Tab 10.1(SCH-I905)

Galaxy Tab 10.1(SHW-M300W)

Galaxy Tab 10.1(SHW-M380K)

Galaxy Tab 10.1(SHW-M380S)

Galaxy Tab 10.1(SHW-M380W)

Galaxy Tab 8.9(SGH-I957)

Nexus S(crespo)

Nexus S(crespo4g)

SC-01D(SC-01D)
SC-02D(SC-02D)
SCH-I815(SCH-I815)
SGH-I957D(SGH-I957D)
SGH-I957M(SGH-I957M)
SGH-T859(SGH-T859)
SGH-T869(SGH-T869)
SHV-E140K(SHV-E140K)
SHV-E140L(SHV-E140L)
SHV-E140S(SHV-E140S)
SHW-M305W(SHW-M305W)
SHW-M430W(SHW-M430W)

Sharp

A01SH(A01SH)
EB-A71GJ(EB-A71GJ)

Sony

Sony Tablet P(nbx02)
Tablet S(nbx03)

Toshiba

AT100(tostab03)

ZTE

SmartTab10(V11A)
SmartTab7(V71A)
V55(V55)
V66(V66)
V68(V68)

Index

1

1.01.02 12

1.01.03 12

A

Accessing the Accessory From the Application 42

ANDROID_ACCESSORY_INFORMATION structure 32

AndroidAppDataEventHandler function 28

AndroidAppEventHandler function 29

AndroidAppInitialize function 30

AndroidAppIsReadComplete function 22

AndroidAppIsWriteComplete function 23

AndroidAppRead function 24

AndroidAppStart function 25

AndroidAppWrite function 26

AndroidTasks function 26

API Functions 22

B

Basic Accessory Demo 38

C

Configuration Definitions 28

Configuration Functions 28

Configuring the Library 13

Creating an Android Accessory Application using the Open Accessory Framework 40

Creating the Project 40

Creating the Setup 34

D

Detecting a Connection/Disconnection to an Android Device 18

E

Eclipse IDE 36

Error Codes 27

EVENT_ANDROID_ATTACH macro 31

EVENT_ANDROID_DETACH macro 31

Events 31

F

FAQs, Tips, and Troubleshooting 43

Firmware API 22

From Android Marketplace 38

From source 38

G

Getting the Android Application 38

Getting the Source Code 11

Getting the Tools 34

H

HardwareProfile.h 15

How do I debug without access to ADB? 43

How the Library Works 13

I

If I hit the "Home" or "Back" buttons while the accessory is attached, the demo no longer works. 44

Initialization 17

Introduction 1

K

Keeping the Stack Running 18

L

Library Architecture 13

M

My PIC32 project gets a run time exception. What could be wrong? 43

N

New to Android 34

New to Microchip 34

Nexus S 35

NUM_ANDROID_DEVICES_SUPPORTED macro 28

P

Preparing the Hardware 38

R

Receiving Data 20

Release Notes 10

Required USB callbacks 13

Requirements, Limitations, and Potential Issues 11

Revision History 12

Running the demo 39

Running the Demos 34

S

Sending Data 19

Supported Demo Boards 10

SW License Agreement 2

T

Terms and Definitions 10

The firmware stops working when I hit a breakpoint. 44

Type Definitions 32

U

Updating the Android OS 35

Updating the SDK 36

usb_config.c 16

usb_config.h 15

USB_ERROR_BUFFER_TOO_SMALL macro 27

Using the Library 13

V

v2.3.x App 46

v3.1+ App 49

Version v2.3.x 36

Version v3.x 37

W

What if I need design assistance creating my accessory? 44

What if I need more support than what is here? 45

What's Next? 11

Why doesn't my phone work? -or- Does this phone work? 45

Why don't all of the features of the demo work? 45