Application Note 10.4

Using the USB20H04 with an On-The-Go Host

APPLICATION NOTE



80 Arkay Drive
Hauppauge, NY 11788
(631) 435-6000
FAX (631) 273-3123

Copyright © SMSC 2004. All rights reserved.

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

SMSC DISCLAIMS AND EXCLUDES ANY AND ALL WARRANTIES, INCLUDING WITHOUT LIMITATION ANY AND ALL IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, TITLE, AND AGAINST INFRINGEMENT AND THE LIKE, AND ANY AND ALL WARRANTIES ARISING FROM ANY COURSE OF DEALING OR USAGE OF TRADE.

IN NO EVENT SHALL SMSC BE LIABLE FOR ANY DIRECT, INCIDENTAL, INDIRECT, SPECIAL, PUNITIVE, OR CONSEQUENTIAL DAMAGES; OR FOR LOST DATA, PROFITS, SAVINGS OR REVENUES OF ANY KIND; REGARDLESS OF THE FORM OF ACTION, WHETHER BASED ON CONTRACT; TORT; NEGLIGENCE OF SMSC OR OTHERS; STRICT LIABILITY; BREACH OF WARRANTY; OR OTHERWISE; WHETHER OR NOT ANY REMEDY OF BUYER IS HELD TO HAVE FAILED OF ITS ESSENTIAL PURPOSE, AND WHETHER OR NOT SMSC HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.

Preface

This Application Note provides detailed information on how the USB20H04 can be used with an On-The-Go (OTG) Host.

Overview

The SMSC 4-port hub controller supports the Session Request Protocol (SRP) as defined in the OTG Supplement. This feature is used for cases that the USB20H04 has an OTG host plugged into its upstream facing port. An example of this can be seen in Figure 1.

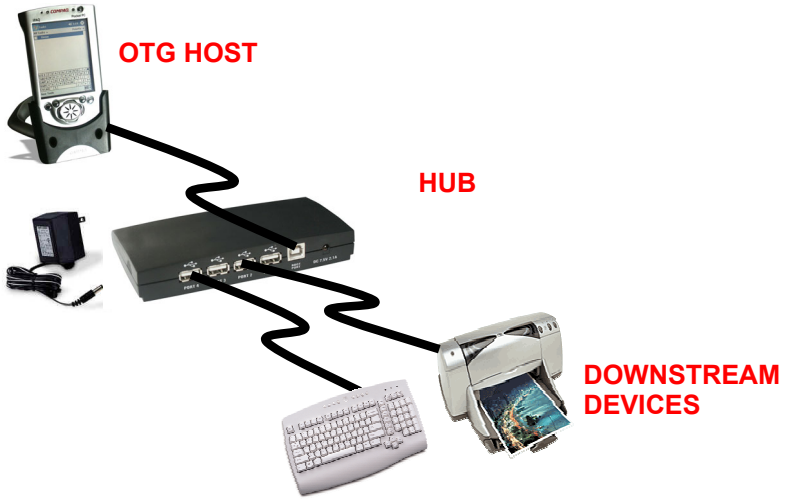


Figure 1 – USB20HO4 in OTG SRP Configuration

In order to conserve power, the OTG Supplement allows an A-device to leave V_{BUS} turned off when the bus is not being used. Then, when the B-device wants to use the bus, it follows the SRP pulsing protocol to request that the A-device supply power to V_{BUS}. In the configuration in Figure 1, the “OTG Host” would be considered the A-device, and the USB20H04 Hub would be considered the B-device.

For example, if the OTG Host were to turn off V_{BUS}, and the USB20H04 were configured in self-powered mode, downstream ports would remain powered. The downstream devices would then go into a suspend state based on inactivity. In the event that one of the downstream devices needed to communicate with the OTG Host, the downstream device would signal a standard USB resume to the Hub, and the Hub would then communicate with the OTG Host by following the SRP pulsing protocol to awaken sleeping OTG Host.

The SRP pulsing protocol is important because it allows the A-device, which may be battery powered, to conserve power by turning V_{BUS} off when there is no bus activity, while still providing a way for the B-device to initiate bus activity.

Protocol Definition

The SRP pulsing protocol works by using two signaling methods: Data-Line Pulsing, and V_{BUS} Pulsing.

Before attempting either of these two methods, the USB20H04 must determine that the following two initial conditions have been met:

- V_{BUS} < 800mV
- DP/DM lines on OTG Host idle (SE0) for 2ms

Once the initial conditions have been satisfied, both pulsing methods will be tried by the hub. First, the data-line pulsing will be issued, if there is no response, the V_{BUS} pulsing method will be issued. The A-device is only required to support one method, while the B-device is required to support both methods.

- Data Line Pulsing: USB20H04 turns on its data line pull-up resistor (either DP or DM) for a period of 5 ms to 10 ms. If the OTG-Host is designed to support the data-line pulsing method of SRP, it will detect that a data line (either DP or DM) has gone high and generate an indication that SRP has been detected. This indication will be the assertion of V_{BUS}, followed by the initiation of a standard USB reset.
- V_{BUS} Pulsing: USB20H04 will drive V_{BUS} long enough to cause the capacitance on VBUS to be charged to 2.1V when connected to an OTG Host. Because the maximum allowed capacitance on a dual-role OTG device is 6.5uF, the line will be driven to at least 2.1V. This pulse will wake up the sleeping OTG Host. However, if the USB20H04 is connected to a standard host, the capacitance will be greater than 96uF; therefore the line will never exceed 2.0V and will not be detected by standard host. This technique has been designed to avoid damage to a standard USB host.

After the OTG Host detects one of the above pulsing methods, it will reset the entire USB tree, and will re-enumerate each device. After completion of enumeration, the downstream device will be capable of communicating through Hub, to the Host.