AN1040
APPLICATION NOTE

MONITORING THE V_{BUS} SIGNAL FOR USB SELF-POWERED DEVICES

by Microcontroller Division

INTRODUCTION

One of the USB Compliance Checklist for Peripherals items asks the following question: “Is the device’s pull-up active only when V_{BUS} is high?”.

This item refers to chapter 7.1.5 “Device Speed Identification” of the USB Specification. It is mentioned that “the voltage source on the pull-up resistor must be derived from or controlled by the power supplied on the USB cable such that when V_{BUS} is removed, the pull-up resistor does not supply current on the data line to which it is attached”

This applies only to self-powered devices where power does not come from V_{BUS}.

1 V_{BUS} MONITORING

ST7 and ST9 microcontrollers with an embedded USB interface are equipped with an on-chip 3.3V voltage regulator that pulls up the appropriate data line with a 1.5 kΩ ±5% resistor.

This regulator can be switched on or off by software via the PDWN (*Power Down*) bit.

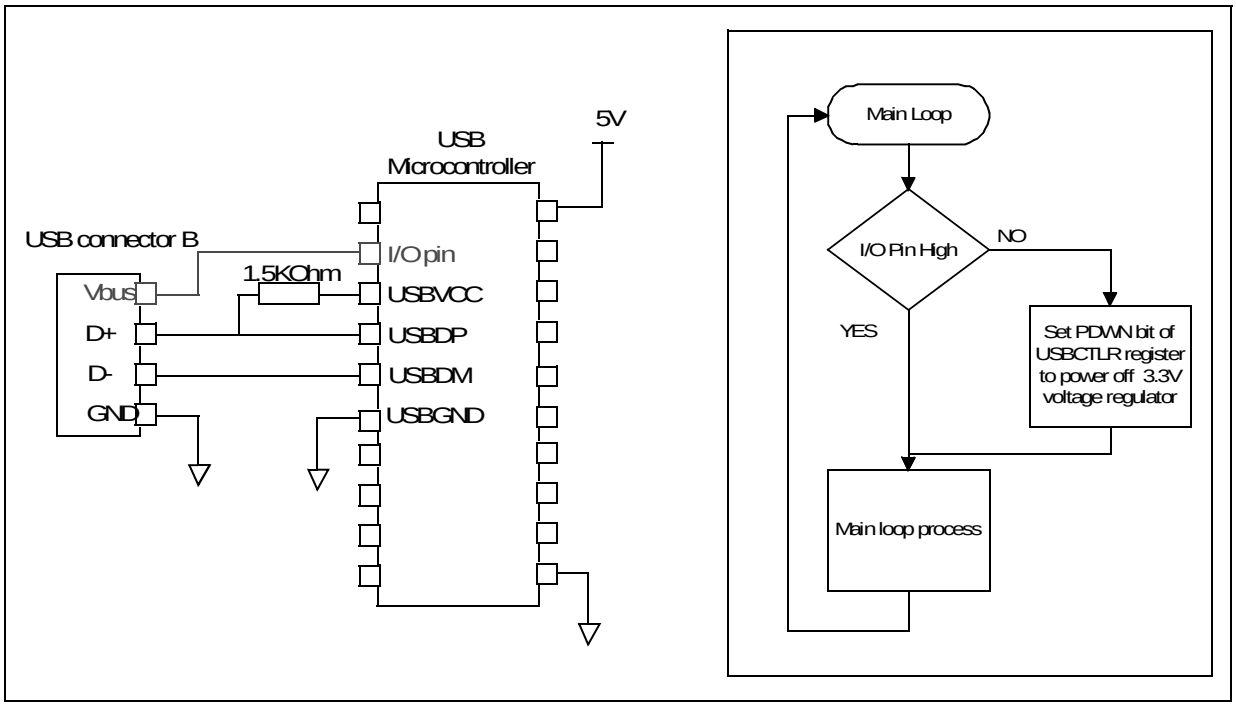
When the USB microcontroller is used in a self-powered application, it has to monitor the V_{BUS} signal to power off the 3.3 V voltage regulator if the USB cable is removed or if the V_{BUS} is switched off.

This can be implemented using an I/O pin configured as input CMOS.

Two monitoring schemes are possible:

1. Monitoring by polling the I/O pin in the main loop of the microcontroller program.
2. Monitoring by interrupt if the I/O pin connected to the V_{BUS} signal has interrupt capability. If V_{BUS} is removed, an interrupt will be generated on the falling edge.

Figure 1. V_{BUS} Configuration



When the V_{BUS} signal is removed, the program must set the PDWN bit. This will power off the 3.3V on-chip voltage regulator that supplies the external pull-up resistor and the transceiver and as a result, current will not be supplied on the data line attached to the V_{BUS} signal.

2 REFERENCE DOCUMENTS

1. Universal Serial Bus Specification, Compaq Intel Microsoft NEC, Revision 1.1, September 23, 1998

2. USB Compliance Checklist, “Peripherals (excluding Hubs) for the Universal Serial Bus Specification (version 1.1)”, USB Implementors Forum, Version 1.06, August 16, 1999

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