Wiimote connector

The wiimote connector is designed to:

- Power a wii remote (aka. *wiimote*) externally using a USB bus as power source.
- Create a stable voltage source for the wiimote of 2.5V to 3.3V. Over-volting (that is above 3.3V) may destroy the wiimote.
- Be able to cycle the power to the wiimote, that is removing the power, pausing (for some milliseconds), and reapply power.

This setup enables an automated and unattended connection to the wiimote. The former need for a manual pressing of the “1-2” wiimote keys are not needed anymore, since the wiimote is put into automatic discoverable mode through a power-down, power-up cycle.

It is necessary to keep the “1-2” keys pressed during the cycle. This can be accomplished via simple duck tape, hence keeping the keys pressed at all times.

Wiimote power module design

DC-DC designs

The power module design primary consist of a voltage regulator. This can be a 5V to 2.85V, 3.3V, or 5V with the final voltage regulated by diodes, LEDs, or simple resistors.

The appendix list some designs with a 5-to-3.3/5V with a secondary resistor voltage regulator to get the voltage below the critical 3.3V. These revisions can be controlled directly from the USB bus.

Power consumption

The wiimote draws the following currents

- 15-35 mA @ startup.
- 21.5 mA @ startup.

The DC-DC converters used in revision 1 and 2 uses

- TME 0505S, 1W, 5-5V: 200 mA @ max.
- TMR 0511, 2W, 5-5V: 400 mA @ max.

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- TEN 3-0510, 3W, 5-3.3V: 600 mA @ max.

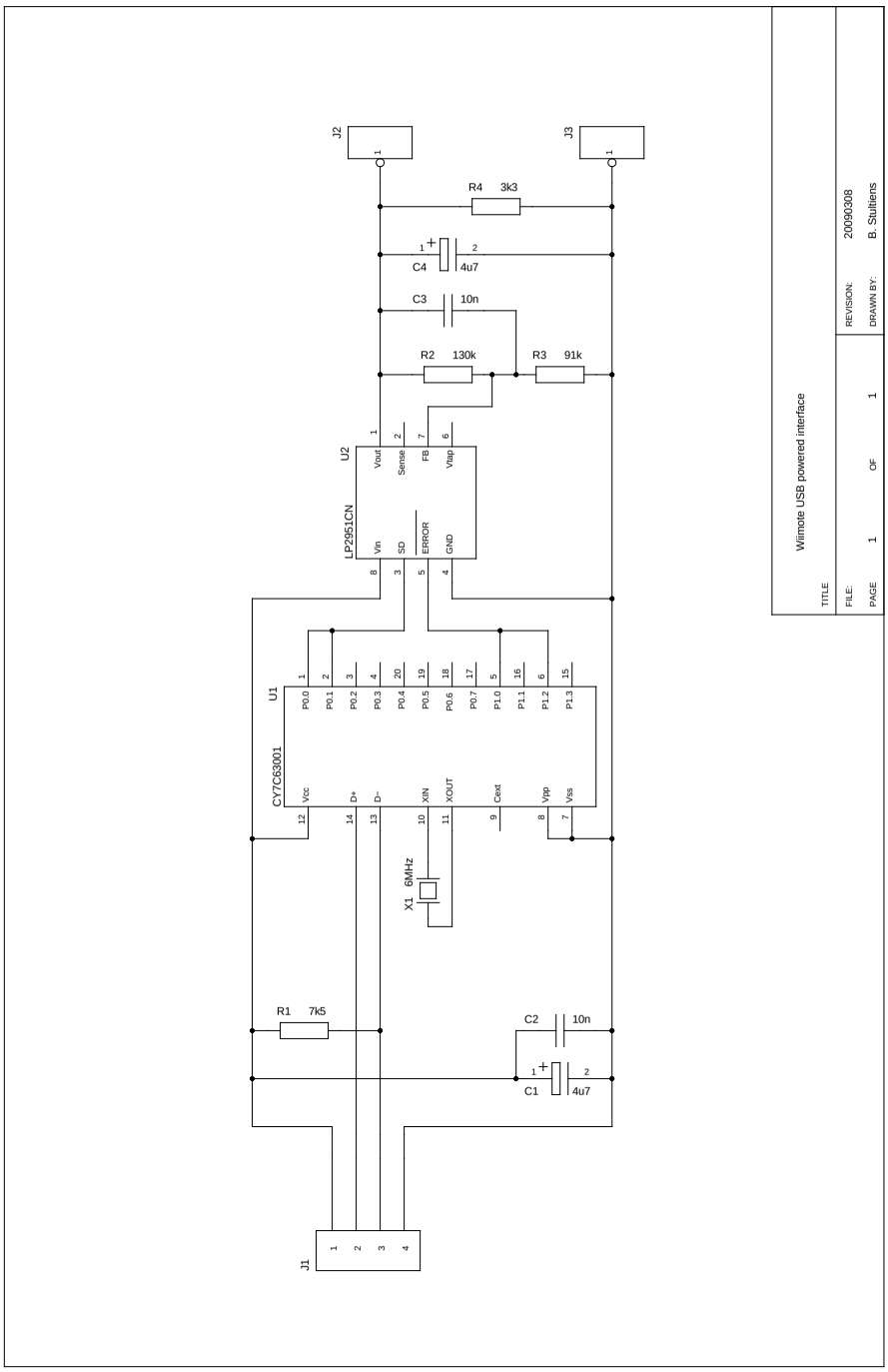
with the National Semiconductor LM1117 having a current output of 800 mA.

The problem with revision 1 and 2 are, that they need external power reset via the USB bus. If this is not possible (see USB Power Control in the appendix), an alternate design is to use some sort of digital IO board.

USB Delcom design

Wiimote power module - revision 4

This is the current final design, based on a Delcom USB, and using no DC-DC converters.



USBmicro design

A small versatile IO board is made by USBmicro, found in two package: the U401 USB and U421 USB interface, the greatest difference being the size only. (http://usbmicro.com/odn/index.html)

The device has the following properties

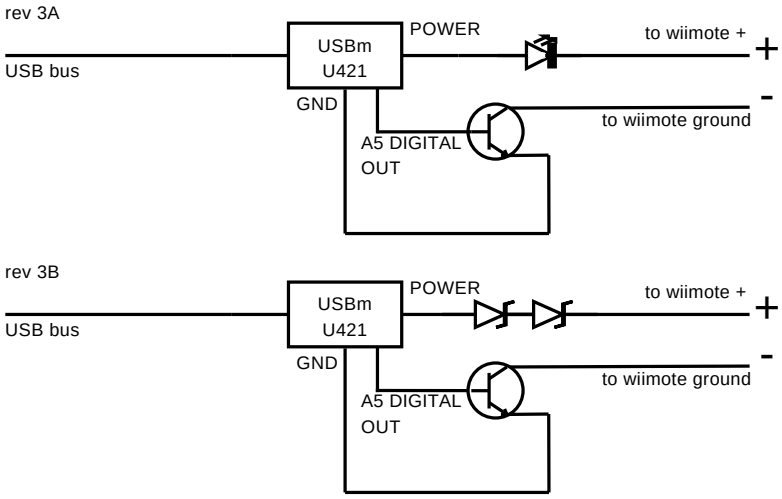
- USB Interface to PC.
- Uses HID Drivers Inherent in OS (runs on Win and Linux).
- Sixteen IO Lines, configured as input or output.
- Board Size: 3.5 inches (88.9mm) long and 1.0 inches (25.4mm) wide.
- Board Type: SimmStick(TM) Compatible, (but not intended for SIMM socket).
- USB Power Type: Bus powered, uses the 5V provided by the USB interface.
- Specified USB allowed current draw: 100mA standard, total.
- Bandwidth: 800 bytes per second as a HID device.
- USB Bus Speed: 1.5Mbits/s. (Low speed)
- Device Interface: 16 CMOS lines, selectable as inputs/outputs.
- Controller Device: Cypress CY7C63743.
  (C-SXC 0801, A 02,605217).

The problem with revision 1 and 2 where that they may draw too much current to be connected directly to the USBmicro device. Revision 2 draws about 50 to 70 mA without any wiimotes connected.

Wiimote power module - revision 3

A design based on the USBmicro device.

A simple design with the wiimote directly powered by the USBmicro board. The voltage is dropped via a LED and a transistor. The transistor also drives the wiimote power, using a USBmicro output CMOS port as base input to a transistor.



Hardware list for REV3

- USBmicro U421.
- Transistor, with voltage drop $U_{\text{drop,trans.}}$= 0.76 V (C5578 PH87 of unknown origin).
- REV3A: LED, red, with voltage drop $U_{\text{drop,LED}}$= 1.67 V.
- REV3B: Dual normal or zener diode, with total voltage drop $U_{\text{drop,two diodes}}$= 1.64 V.

An important design issue is the exact voltage delivered to the wiimote. The mote has the following operation voltage range

- $U_{\text{max,wiimote}} = 3.3$ V.
- $U_{\text{min,wiimote}} = 2.5$ V.

preferable with the voltage pinned at U_{wiimote} 2.85 V (as can be done with a DC-DC voltage regulator). The wiimote is able to connect below 2.5 V, but drops the connection again when trying to acquire any data from it!

This should be coupled with the voltage and current range from the USB specification

- $U_{\text{USB}} = 5\text{ V} \pm 0.25\text{ V}$ (that is 5 V $\pm$ 5%).
- $I_{\text{USB}} = 100$ mA maximum in low-power mode, 500 mA in high-power mode.

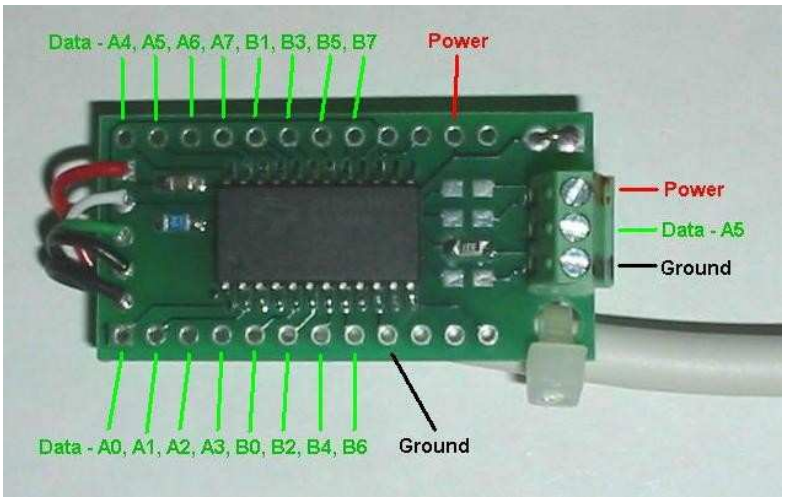
with $U_{\text{USB,eee}} = 4.95$ V and $U_{\text{USB,Lenovo}} = 5.17$ V for two particular computers, that for design revision 3A and 3B gives U_{wiimote}= 2.54 V and 2.7-2.8 V respectively (eee=3A, Lenovo=3B).

Note on REV3B: it is unimportant that the diodes is of zener type, what is important is the total voltage drop across them.

Note: starting the whiteboard software, makes the wiimote draw extra power, and a “battery level” of 7% correspond to a voltage drop over the wiimote of $U_{\text{min,wiimote}} = 2.3$ V, that is very close to the absolute minimum, before the wiimote is powered down, and the connection lost.

Note on a final design: *the voltage to the wiimote is the single most important design issue. It should be kept at the specified range, preferable at 2.85 V, taking into account the 5% voltage range on in the USB specification.*

USBmicro U421 layout



Packaging

The USBmicro board, LEDs and transistors should preferably be fitted into the wiimote battery bay. This has the size of two AA-batteries.

The package should have an external connector on the wiimote, so it will be robust towards strains and pulls in the cable. The cable should disconnect at a large force. The USB cable should be as long as possible, but no more than 5 meters (the max. length in the USB specification),

If is possible, the LED should be visible from the back of the wiimote

(drill a small hole in the battery cover), and later we may also need room for a USB Bluetooth dongle inside the battery bay.

An alternative design is to place the electronics at the vicinity of the USB connection at the computer, and just cabling the power to the wiimote. This should enable cable lengths of more than 5 meters.

Appendix

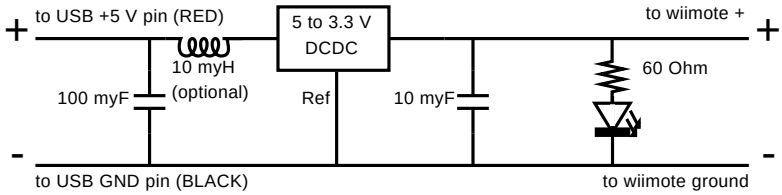
Wiimote power module - revision 0

A preliminary LED, resistor, zener diode based system. Did work but lacked power robustness.

Wiimote power module - revision 1

A 5-3.3V regulator design.

The 100μF and 10μH pre-stage is only a stabilizing system, a final layout may disregard the inductor.



Hardware list for REV2

- DC-DC converter: 5-3.3V 3W, TEN3-0510 (ELFA: 69-580-03)
- Capacitor: Mini ellyt. 100μF/16V (ELFA: 67-195-32)
- Capacitor: Mini ellyt. 10μF/35V (ELFA: 67-195-38)
- Inductor: Axiell drossel 10μH/2.8A (ELFA: 58-084-49)
- LED: EL383-2SURC LED 5mm Rød (ELFA: 75-036-75)
- Resistor: 60,4 Ohm 1% 0.6W (ELFA: 60-708-90)

ELFA deliverers the following suitable DC-DC converters

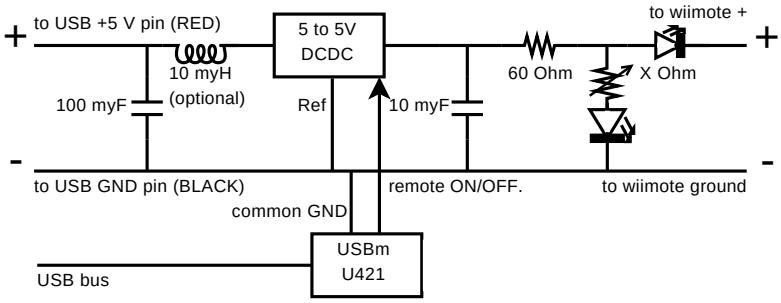
- DC-DC converter: 5-5V 1W, TME0505S (ELFA: 69-560-07)
- DC-DC converter: 5-5V 2W, TMR0511 (ELFA: 69-598-03)
- DC-DC converter: 5-3.3V 3W, TEN3-0510 (ELFA: 69-580-03)

none of the perfectly suitable for the task. The 5-3.3 only comes in the 3W, that is far to large for the system. An alternate DC-DC controller is the “LM 1117DT 285” from National Semiconductor, that is a 7V-to-2.85V regulator, perfectly suited for the wiimote.

Wiimote power module - revision 2

A 5-5V regulator design, with remote power control via the USBmicro device.

Otherwise equal to the REV2, except for the variable voltage divisor (that did not work). Remote control of power is done by the “Remote ON/OFF” pin 3 on the DC-DC package. The 2W TMR0511 is the only DC-DC that has this option.

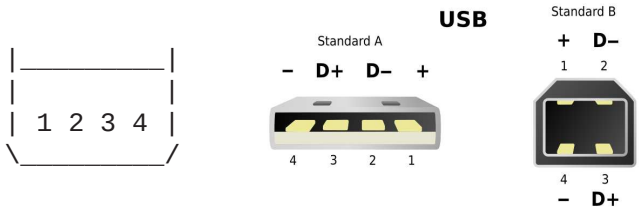


Hardware list for REV2 (resistors, LEDs, capacitors, and inductors as REV1)

- DC-DC converter: 5-5V 2W, TMR0511 (ELFA: 69-598-03)

USB spec

The 4 pin USB A connector has a layout of (seen from the front)



Pin	Cable color	Description
1	Red	Vcc, 5V ± 0.25V
2	White	D-, serial Data
3	Green	D+, serial Data
4	Black	Ground

The max current drawn from a USB controller is 500 mA. Shield should only be connected to Ground at the host. No device should connect Shield to Ground.

Wiimote Compatible Bluetooth Devices

A compatibility list of bluetooth dongles, that works with the wiimote, is maintained at http://www.wiili.org/index.php/Compatible_Bluetooth_Devices

USB Power Control

The power-cycle can be controlled directly from the USB controller. In the USB 2.0 specification the USB hub (connected directly to a USB controller) has features to control the port power.

The USB power ability can be found via (on Linux)

```
$>  sudo lsusb -v | grep -A 3 wHubCharacter
```

that for my particular hardware gives

```
wHubCharacteristic 0x000a
No power switching (usb 1.0)
Per-port overcurrent protection
TT think time 8 FS bits
--
wHubCharacteristic 0x000a
No power switching (usb 1.0)
Per-port overcurrent protection
TT think time 8 FS bits
--
wHubCharacteristic 0x0002
No power switching (usb 1.0)
Ganged overcurrent protection
bPwrOn2PwrGood 1 * 2 milli seconds
--
wHubCharacteristic 0x0004
Ganged power switching
Compound device
Ganged overcurrent protection
--
wHubCharacteristic 0x0002
No power switching (usb 1.0)
Ganged overcurrent protection
bPwrOn2PwrGood 1 * 2 milli seconds
```

Only one hub has power switching, all the other do not have power switching. This particular USB system will not work since we are looking for a `Per-port power switching`.

Currently tested USB controllers

Working:

- Intel(R) ICH9 Family
- Elecom U2J-G4S
- Sanwa supply USB-HUB14GPH
- Targus Inc. PAUH212
- Hawking Technology UH214

Not working:

- Intel(R) 82801G (ICH7 Family)
- Dick Smith Electronics XH6777