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Debug Board v2

From Openmoko

This page provides information on the architecture of the second version of the Neo1973 debug board (the one shipped with the "Advanced" Neo 1973 kits).

Debug Board

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Debug

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Debug

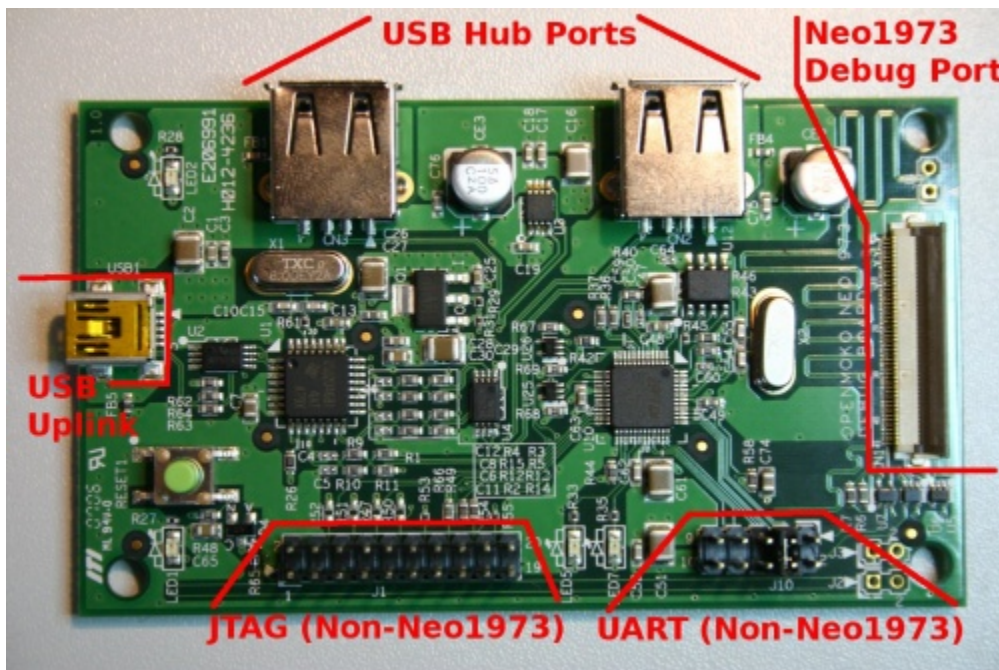
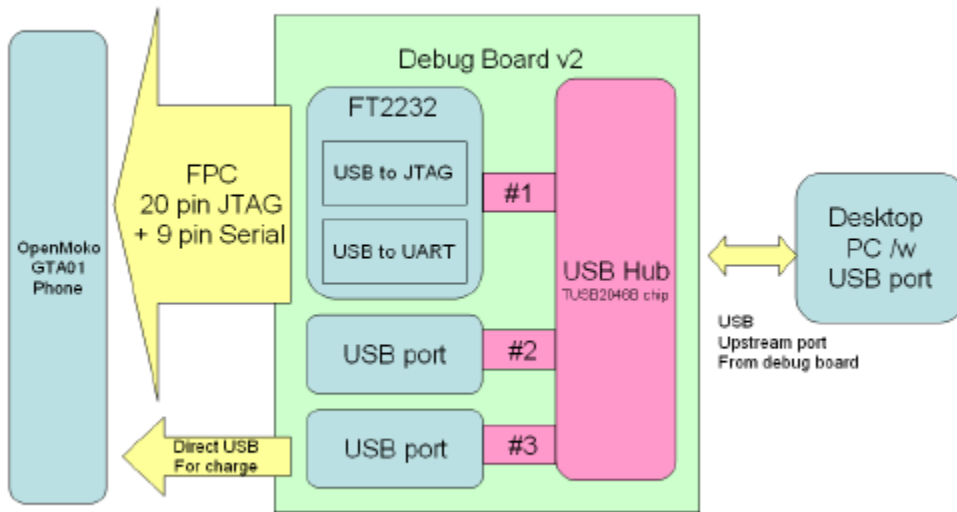
Board v2

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Overview

The debug board provides these key components.

- USB Hub
- JTAG using FT2232
- Serial Port

Schematics

The Schematics of this board can be found at http://people.openmoko.org/laforge/doc/hardware/neo1973_debug_board/neo1973_debugboard_v2_schematics.pdf

USB Hub

This bus-powered hub

- attaches to the laptop using its upstream port
- attaches to the FT2232D for JTAG and serial console on downstream port 1
- attaches to USB-A connectors using downstream ports 2 and 3

For the USB hub we use the TUSB2046B chip.

Using the hub, you can have access to the phone, JTAG and serial simultaneously, through a single USB cable. You can actually even charge the phone (100mA slow charge) using that downstream port.

If you have 2 free USB ports on your PC, it is better to plug the debug board and the Neo1973 into the PC independently (rather than using the hub). This will allow the Neo1973 to charge at the full 500mA rate, and will also allow the debug-board USB to be unplugged/reconnected without affecting the Neo1973.

JTAG using FT2232

Basically, we integrate a USB-JTAG adaptor similar to the Amontec JTAGkey-tiny. The actual reference design that we used (Thanks to Joern!) can be found at <http://www.oocdlink.com>

This provides us full JTAG debugging, at about 150times the speed of the wiggler

The actual JTAG port is connected with

- the phone (via debug flex cable)
- A separate 20-pin header using standard ARM-JTAG pinout
 - this allows the user to use this device as JTAG adaptor even for other arm-based devices

Serial Port

Instead of replicating a true RS232 port, we wanted to use a USB serial converter chip, such as the FT232 or the PL2303.

As it turns out, we can even use the second port of the FT2232 simultaneously with the JTAG. So no extra FT232 or PL2303 is required.

Tri-State Serial Port

The serial port needs a tri-state driver, since it is both connected to the GSM modem AND to the debug board. We drive the tri-state driver by an inverted GSM_EN signal (pin 7 on FPC connector).

Usage Instructions

Preconditions

FT2232D EEPROM

Please see Neo1973 Debug Board v2/EEPROM if you have an "early adopter" board with USB ID 0403:0610. If your board shows up as USB ID 1457:5118 then you can ignore this step.

Drivers

libftdi

Please make sure you have libftdi-0.8 or later. Earlier versions are known to cause problems. This should not be an issue if you are using statically-linked binaries.

ftdi_sio module

This module must be loaded with parameters that identify the debug board:

```
-----  
|rmmod ftdi_sio  
|modprobe ftdi_sio vendor=0x1457 product=0x5118  
|-----
```

or the equivalent in your modules.conf

udev rule

Please install the rules from http://people.openmoko.org/laforge/misc/debug_board_v2/udev_rules/

Windows Driver

Please use the driver from http://people.openmoko.org/laforge/misc/debug_board_v2/windows_drivers/

Applications

openocd

openocd is required. It is recommended to use a statically-linked binary produced by the Openmoko build system. Other versions may give

"unrecognized command" errors while parsing the configuration file.

openocd.cfg

Openocd requires a configuration file in the directory from which you run the application. A typical example is shown below:

```
telnet_port 4444
gdb_port 3333
interface ft2232
jtag_speed 0
ft2232_vid_pid 0x1457 0x5118
ft2232_layout "jtagkey"
reset_config trst_and_srst
jtag_device 4 0x1 0xf 0xe
daemon_startup attach
target arm920t little reset_run 0 arm920t
working_area 0 0x200000 0x4000 backup
run_and_halt_time 0 5000
ft2232_device_desc "Debug Board for Neo1973"
```

dfu-util

dfu-util is used to write images to the NAND flash once you have a functional u-boot. It is recommended to use a statically-linked binary produced by the Openmoko build system.

Hardware connection

Refer to Connecting Neo1973 with Debug Board v2. The recommended connection sequence is:

- Unplug both USB cables
- Remove the Neo1973 battery
- Connect the FPC between the Neo1973 and the debug board
- Replace the Neo1973 battery
- Plug the Neo1973 USB cable into your PC
- If the Neo1973 does not turn on automatically at this point, hold the power button for 5 seconds
- Plug the debug-board USB cable into your PC

A Neo1973 with a working u-boot should power on when its USB cable is plugged in, but a "bricked" one will not. Note that there will be no visible feedback from the power-button press on a bricked device.

Pinouts

The Debug Board v2 may be used for other embedded projects. It provides the following connectors:

- J1 - is a regular 20 pin ARM JTAG at 3.3V level with 5V tolerance
- J10 - is a 3.3V serial connected to portB of the FTDI2232D

```

-----
pin name
1 TXD
2 RXD
3 RTS
4 CTS
5 DSR
6 DTR
7 DCD
8 RI
9 GND
10 VCC (3.3V)
-----

```

Actually using it

On Linux

Serial Port

The Linux kernel of your host system will create virtual serial devices called **/dev/ttyUSBx** where 'x' is a sequentially assigned number. If you don't have any other USB serial converters attached to your machine, the device name will be **/dev/ttyUSB1** for the serial port. A **/dev/ttyUSB0** will also be created initially, but will disappear once openocd connects to the JTAG port.

You can use your favourite terminal emulator (screen, minicom, cu, zc, ...) just like for any other/real serial port. The baud rate should be set to 115200. You may use gdb as well (eg. target remote /dev/ttya).

The /dev/ttyUSB1 device node will be removed if the debug-board USB cable is unplugged. You should exit your terminal program before unplugging the cable, and then re-run it after the cable is plugged back in.

Note

After Neo's boot, this last line will be displayed at the console:

```

-----
gta01-pm-gsm gta01-pm-gsm.0: powering up GSM, thus disconnecting serial console
-----

```

for reconnecting your serial console, please stop the gsmd daemon from ssh :

```
/etc/init.d/gsmcd stop
```

and respawn getty on ttySAC0.

For example, if getty is on tty1 (given by: **ps -aux | grep getty**) then you could type:

```
cd /dev
mv tty1 tty10
ln -s ttySAC0 tty1
pkill getty
```

if kernel messages on the console are too verbose, use klogd or dmesg (e.g. **klogd -c 4**).

JTAG

Once you have connected the hardware as described above, run "openocd" from the directory containing its configuration file. You should see output similar to the following:

```
linux$ ./openocd
Info:   openocd.c:93 main(): Open On-Chip Debugger 1.0 (2007-12-13-14:05) svn:226M
Info:   openocd.c:94 main(): $URL: svn://svn.berlios.de/openocd/trunk/src/openocd.c $
Info:   jtag.c:1291 jtag_examine_chain(): JTAG device found: 0x0032409d (Manufacturer: 0x04e, Part:
```

Note that the Neo1973 must be powered on for this step to succeed. Otherwise, you will see:

```
Error:   jtag.c:1253 jtag_examine_chain(): JTAG communication failure, check connection, JTAG interfa
Error:   jtag.c:1440 jtag_init(): trying to validate configured JTAG chain anyway...
Error:   jtag.c:1346 jtag_validate_chain(): Error validating JTAG scan chain, IR mismatch, scan retu
```

Once openocd is running, open another terminal window and connect to its telnet port:

```
linux$ telnet localhost 4444
Trying 127.0.0.1...
Connected to localhost.
Escape character is '^]'.
Open On-Chip Debugger
>
```

You may now reset the device, set breakpoints, upload images, etc.

Unbricking Procedure

Refer to Neo1973 Debug Board v2/Unbricking for a manual procedure to re-flash a "bricked" phone (one with a damaged u-boot or environment, where the normal Flashing_openmoko update procedure cannot be used).

Further Reading

The following Wiki pages contain useful information about what can be done with the debug board and the u-boot console. Note, however, that some of the information applies to earlier versions of the product and is not suitable for use with purchased GTA01Bv4 phones.

- [OpenOCD#OpenOCD_and_Debug_Board](#)
- [Bootloader#Using_JTAG_to_boot_from_RAM](#)
- [Devirginator](#)
- [NAND_bad_blocks](#)

History

We previously had Debug Board v1. Version 1 was never shipped to phase-0 or phase-1, and not sold to anyone.

Changes from v1 to v2

- get rid of ethernet
 - we don't need it, and
 - we especially don't want a 40pin parallel 66MHz bus going between two pcb's
- get rid of 7-segment LED displays
 - not really needed. We have a serial port
 - could be replaced by one or two GPIO LEDs
- get rid of built-in wiggler
 - nobody has a parallel port on the laptop these days
- get rid of li-ion battery (including charger)
 - the device can be fully usb powered by the laptop

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