TigerBoard User Guide

Nano River Technologies
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Congratulations on the purchase of the TigerBoard from Nano River Technologies! We trust that this board will be a valuable asset in the development or test of your own electronics.

… Nano River Technologies development team

ABBREVIATIONS

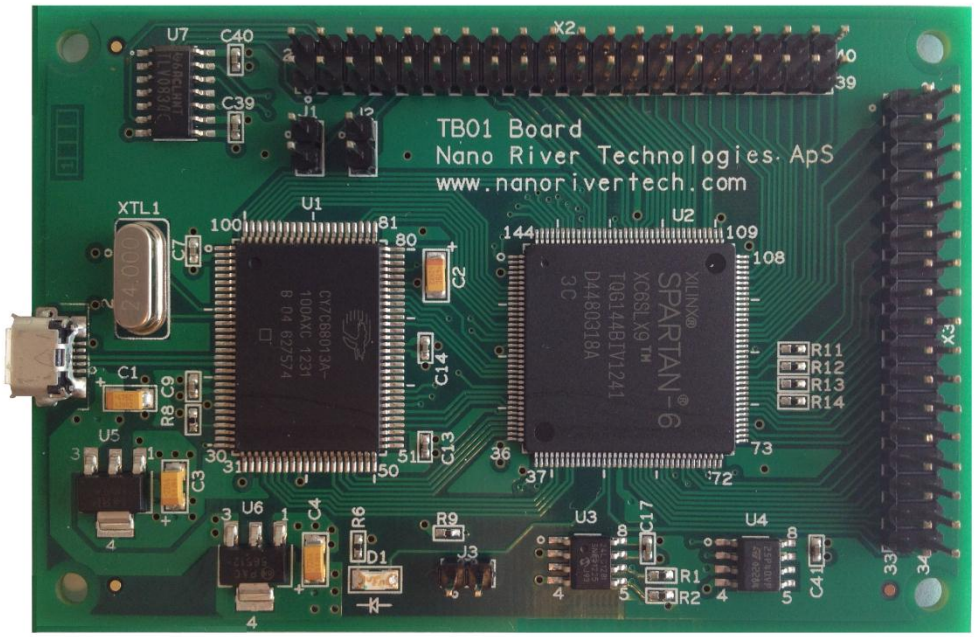
API	Application Programming Interface
EEPROM	Electrically Erasable Programmable Read Only Memory
G++	C++ compiler for Linux (part of GCC)
GCC	GNU Compiler Collection
GPIO	General Purpose IO
GPIOA	TigerBoard GPIO Port A (advanced GPIO interface)
GPIOB	TigerBoard GPIO Port B (digital IO interface)
GUI	Graphical User Interface
I2C	Inter-Integrated Circuit
IIC	Inter-Integrated Circuit (same as I2C)
IO	Input / Output
LED	Light Emitting Diode
Master	An interface which supplies the clock like the SPI master or I2C master on TigerBoard
NRT	Nano River Technologies
Slave	An interface which receives the clock like the SPI slave or I2C slave on TigerBoard
SPI	Serial Peripheral Interface
USB	Universal Serial Bus

1. Preliminaries

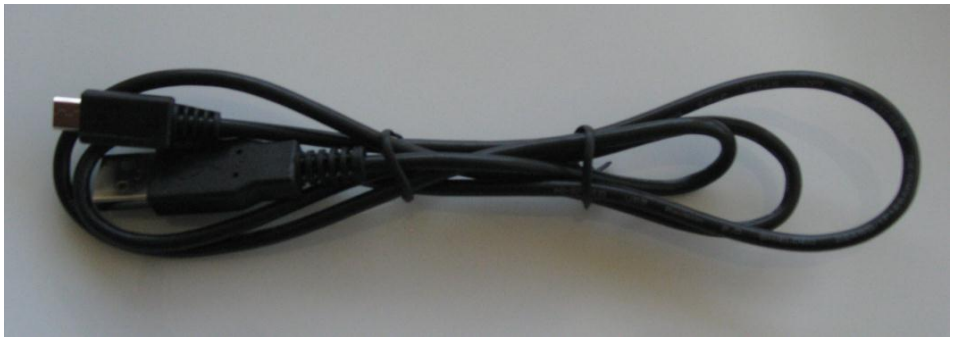
1.1. Packaging List

Your TigerBoard comes standard with the following items.

- One TigerBoard circuit board assembly



- One USB cable – regular type A to micro-USB type B



PC software, example applications and documentation for use with this product is available downloadable from our web-site.

www.nanorivertech.com

1.2. Getting Help

Most questions relating to installation and usage of the TigerBoard are available from our web-site.

www.nanorivertech.com

If however you have further questions, then please do not hesitate to contact us via email.

support@nanorivertech.com

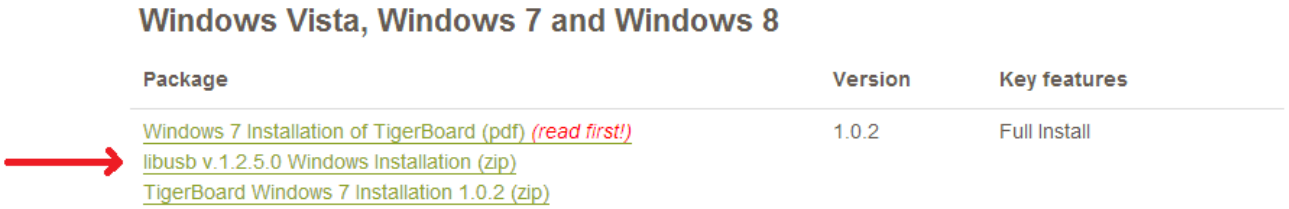
For any sales related questions, please contact:

sales@nanorivertech.com

2. Installation (Windows 7, Windows 8 and Vista)

Step 1:
Open the Windows Device Manager and remove all previous drivers for TigerBoard. This is of course not needed if you have not installed TigerBoard before. Old versions may be located as a libusb-win32 device.

Step 2:
Copy the latest device driver binary package (libusb-win32-bin-1.2.5.0.zip) from our Web page.



Windows Vista, Windows 7 and Windows 8

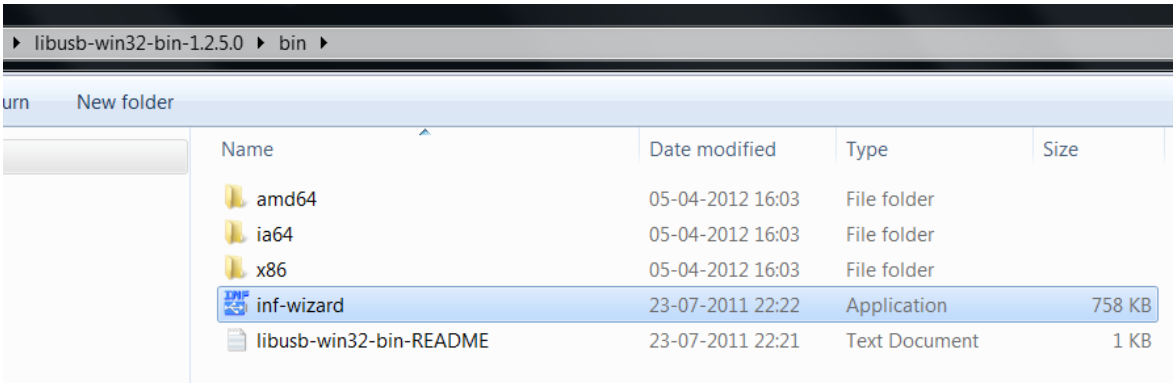
Package	Version	Key features
Windows 7 Installation of TigerBoard (pdf) *(read first!)*	1.0.2	Full Install
libusb v.1.2.5.0 Windows Installation (zip)		
TigerBoard Windows 7 Installation 1.0.2 (zip)		

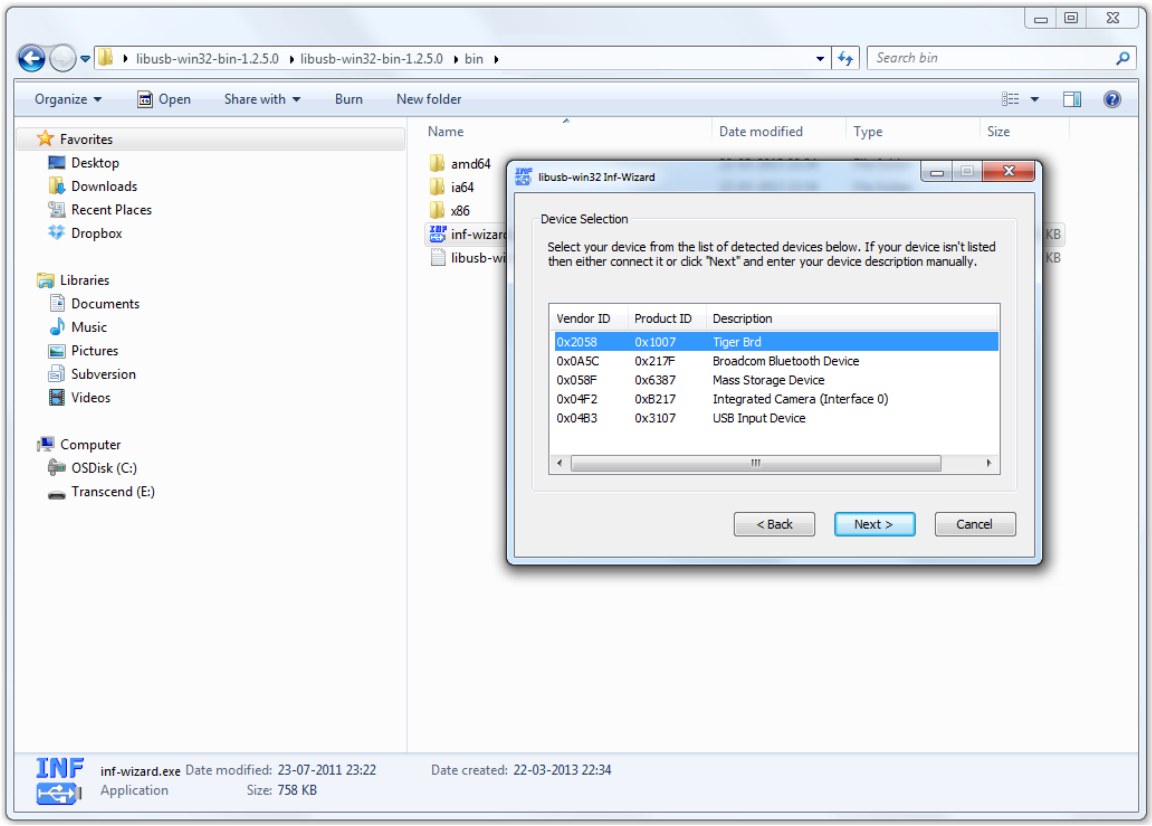
Step 3:
Extract it to a temporary directory.

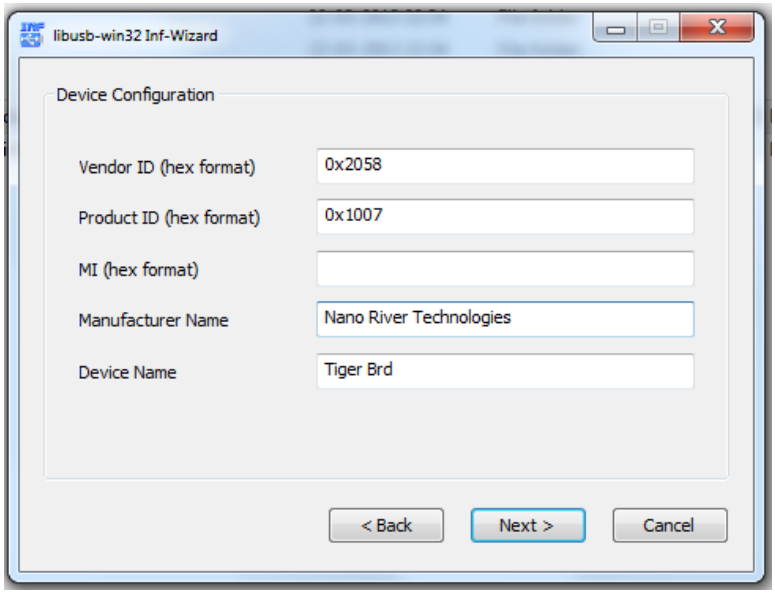
Step 4:
Connect your TigerBoard.

Step 5:

Navigate to the bin/ directory and then run the INF-Wizard program to generate the INF file.
To do this you will see other devices including TigerBoard. You should see the TigerBoard is VID=2058 and PID=1007. Select TigerBoard and then you need to enter the Manufacturer as "Nano River Technologies".

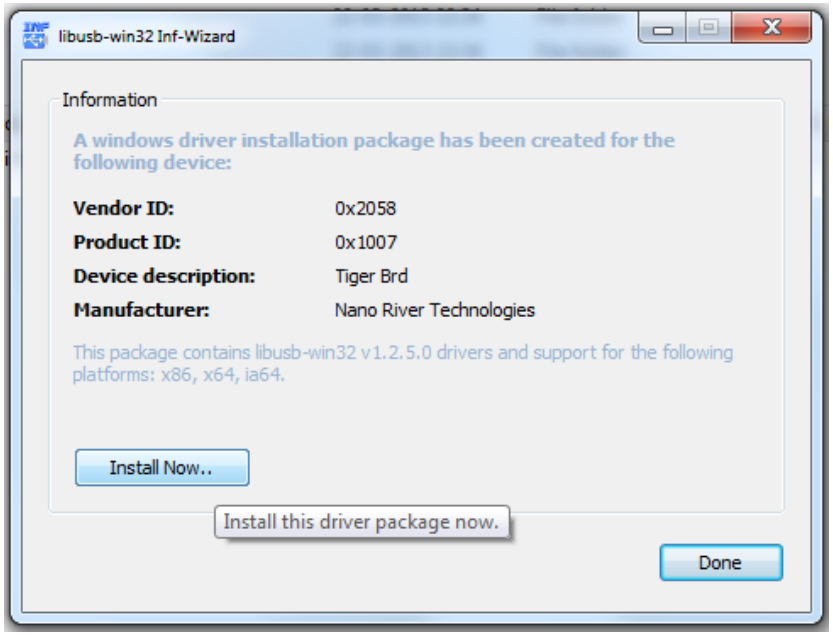




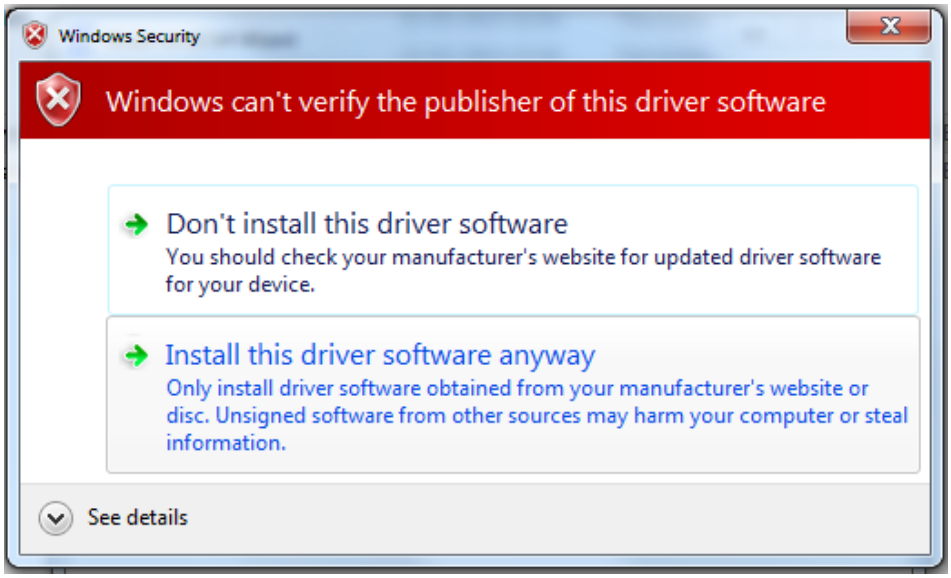


Step 6:

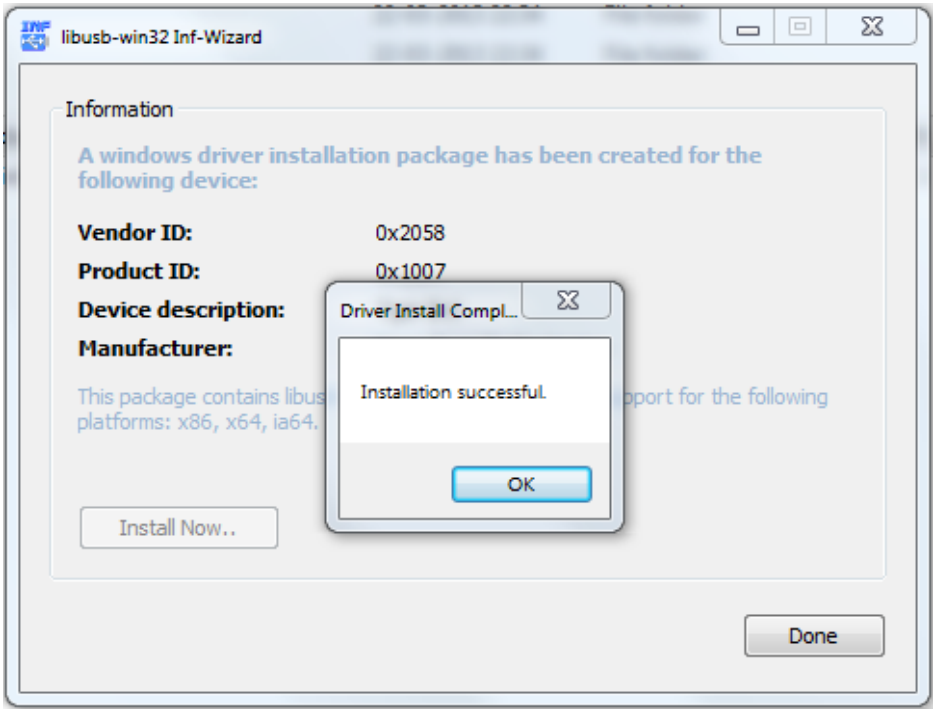
From within the INF-Wizard there is an option to install. Please click this to install.



Step 8:
It will warn about the publisher of the software but choose install anyway.

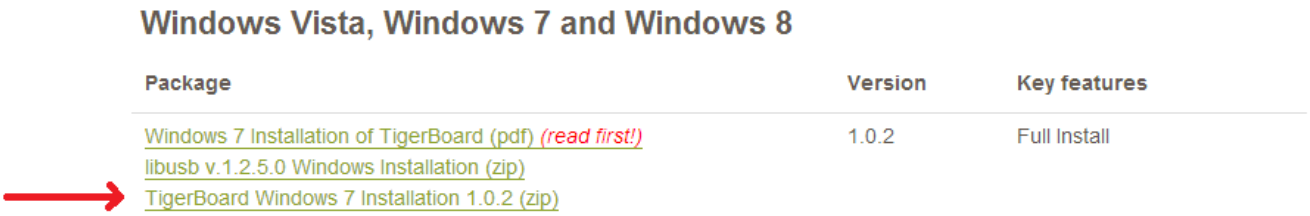


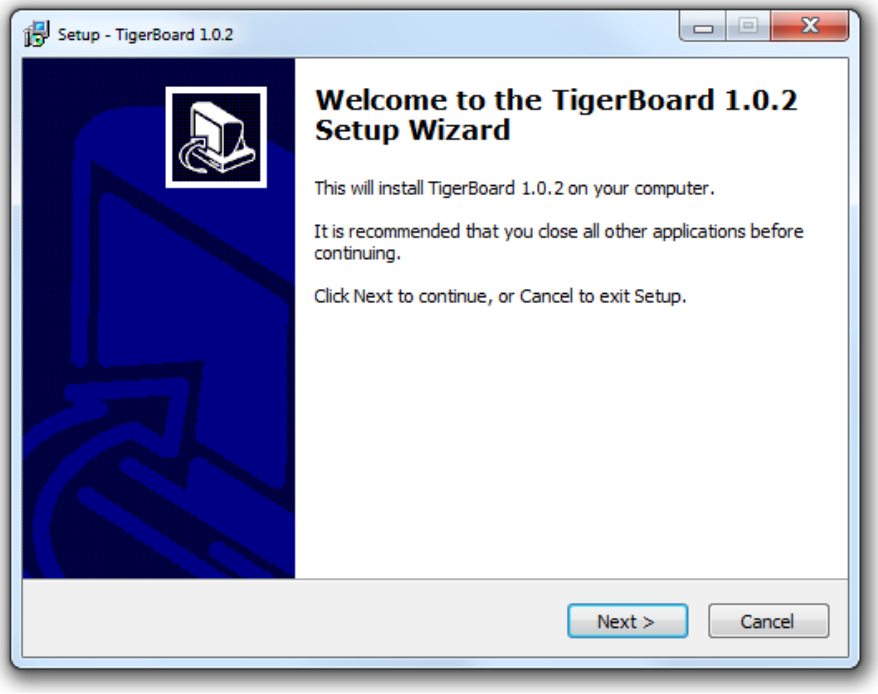
So eventually the driver is installed and complete.

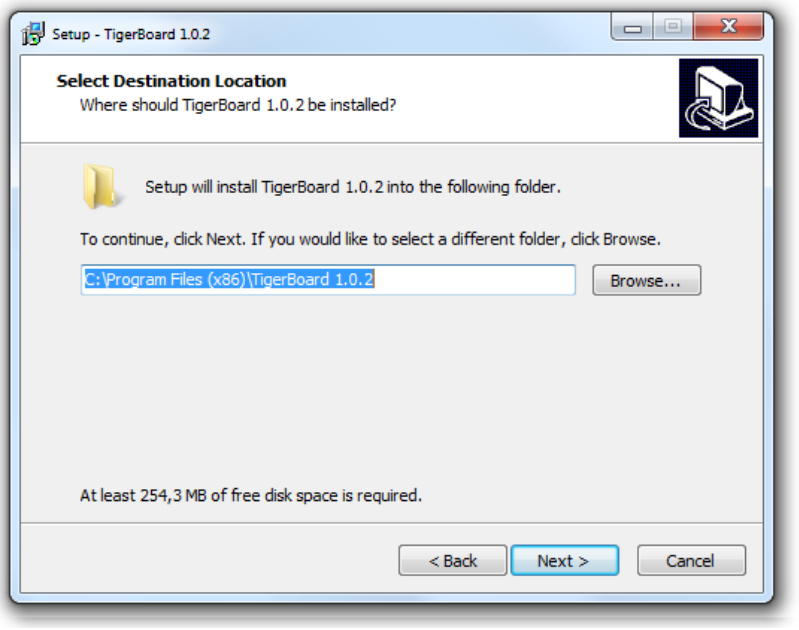


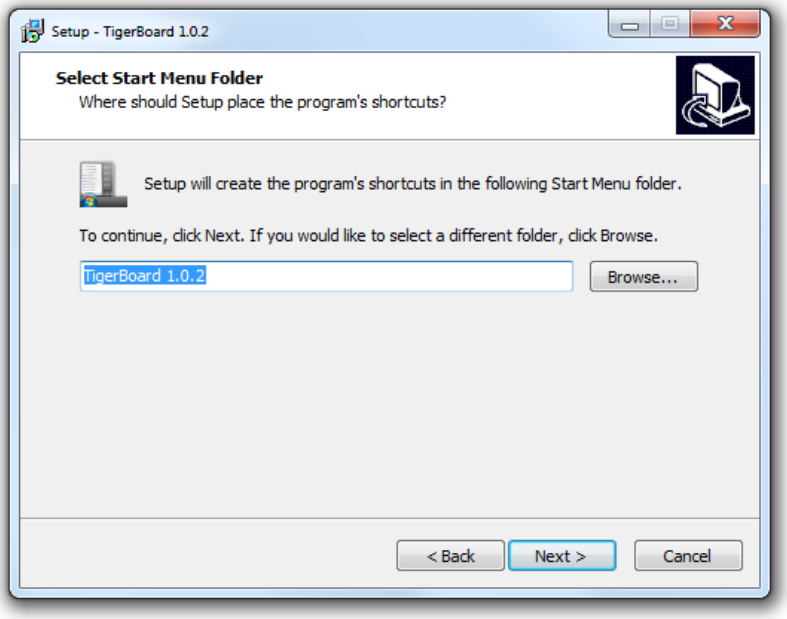
Step 9:

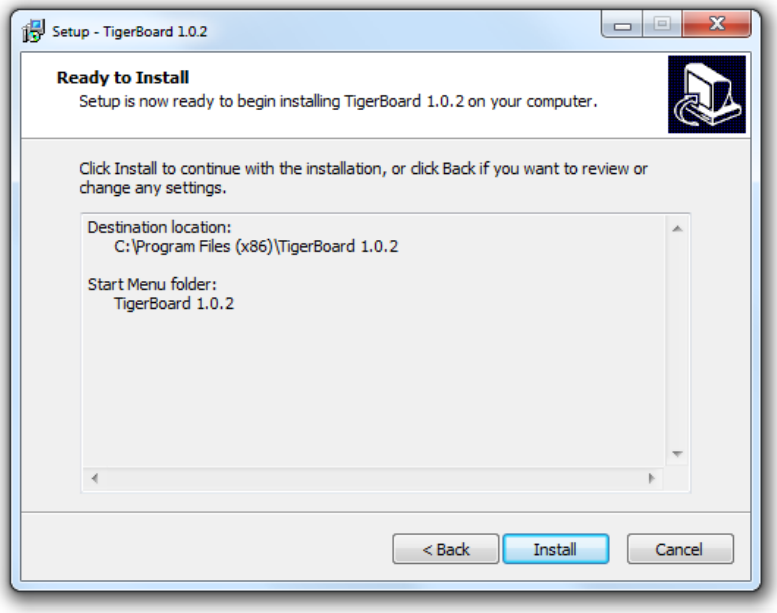
Next you will need to install the TigerBoard application examples. Just choose the default settings.

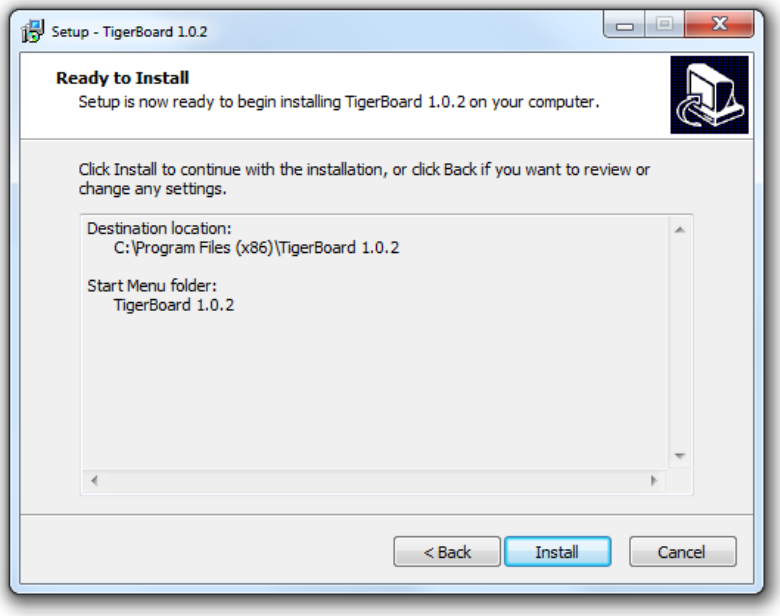


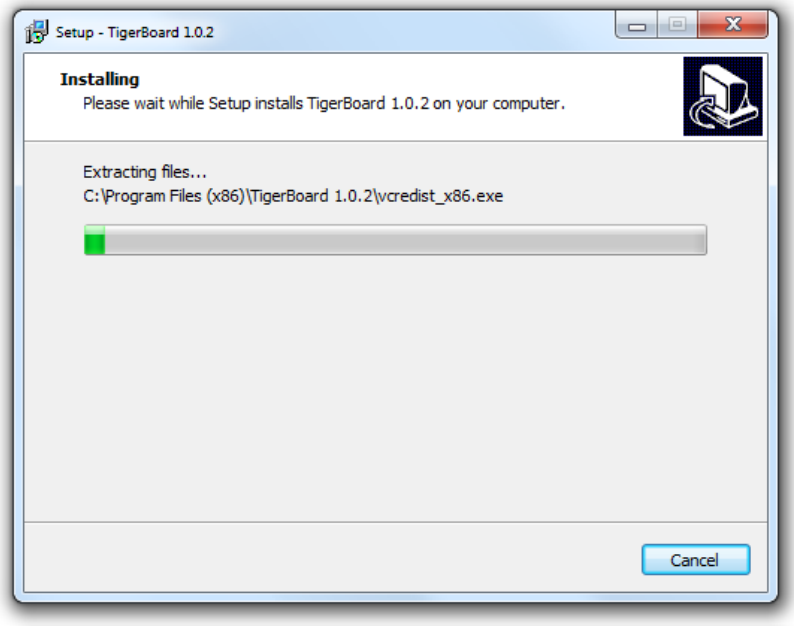



Setup - TigerBoard 1.0.2
Select Destination Location
Where should TigerBoard 1.0.2 be installed?
Setup will install TigerBoard 1.0.2 into the following folder.
To continue, click Next. If you would like to select a different folder, click Browse.
C:\Program Files (x86)\TigerBoard 1.0.2
Browse...
At least 254,3 MB of free disk space is required.
< Back
Next >
Cancel


Setup - TigerBoard 1.0.2
Select Start Menu Folder
Where should Setup place the program's shortcuts?
Setup will create the program's shortcuts in the following Start Menu folder.
To continue, click Next. If you would like to select a different folder, click Browse.
TigerBoard 1.0.2
Browse...
< Back
Next >
Cancel

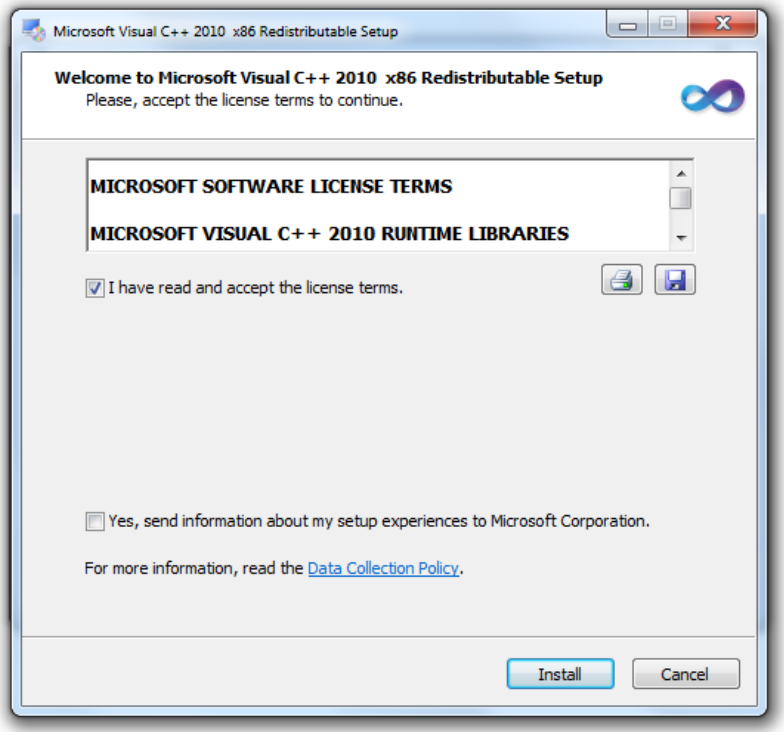

Setup - TigerBoard 1.0.2
Ready to Install
Setup is now ready to begin installing TigerBoard 1.0.2 on your computer.
Click Install to continue with the installation, or click Back if you want to review or change any settings.
Destination location:
C:\Program Files (x86)\TigerBoard 1.0.2
Start Menu folder:
TigerBoard 1.0.2
< Back
Install
Cancel

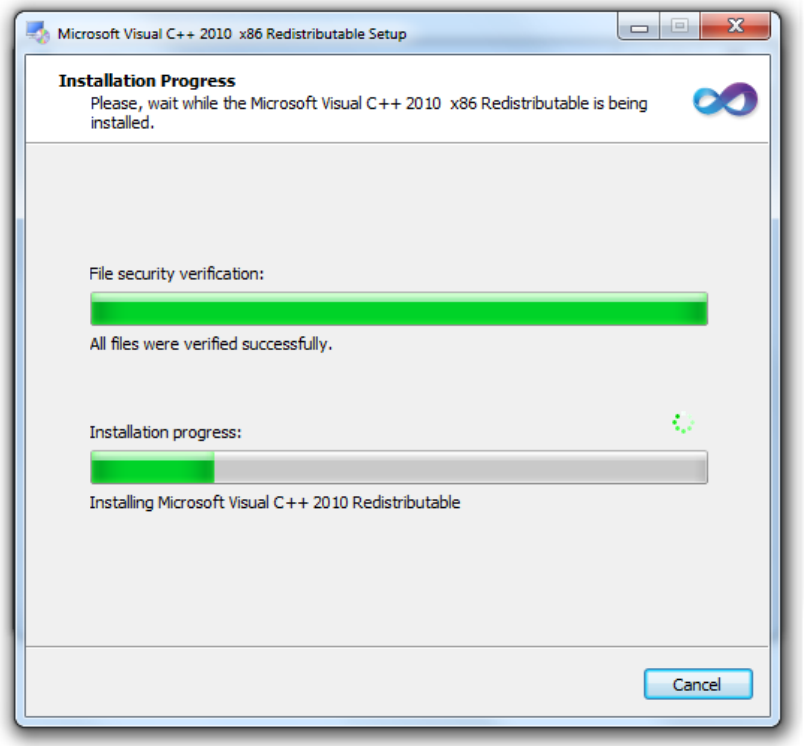

Setup - TigerBoard 1.0.2
Ready to Install
Setup is now ready to begin installing TigerBoard 1.0.2 on your computer.
Click Install to continue with the installation, or click Back if you want to review or change any settings.
Destination location:
C:\Program Files (x86)\TigerBoard 1.0.2
Start Menu folder:
TigerBoard 1.0.2
< Back
Install
Cancel

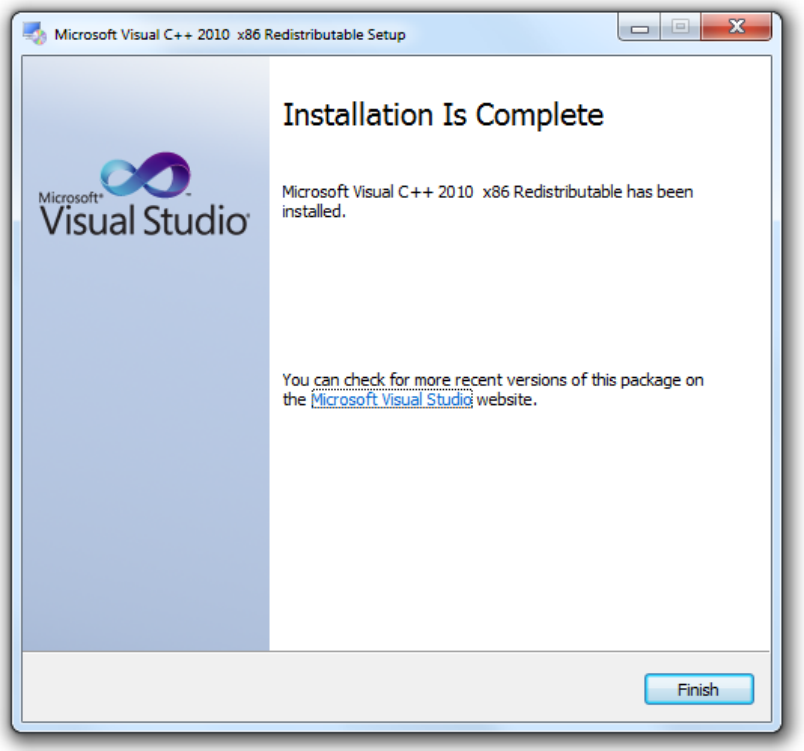


Step 10:

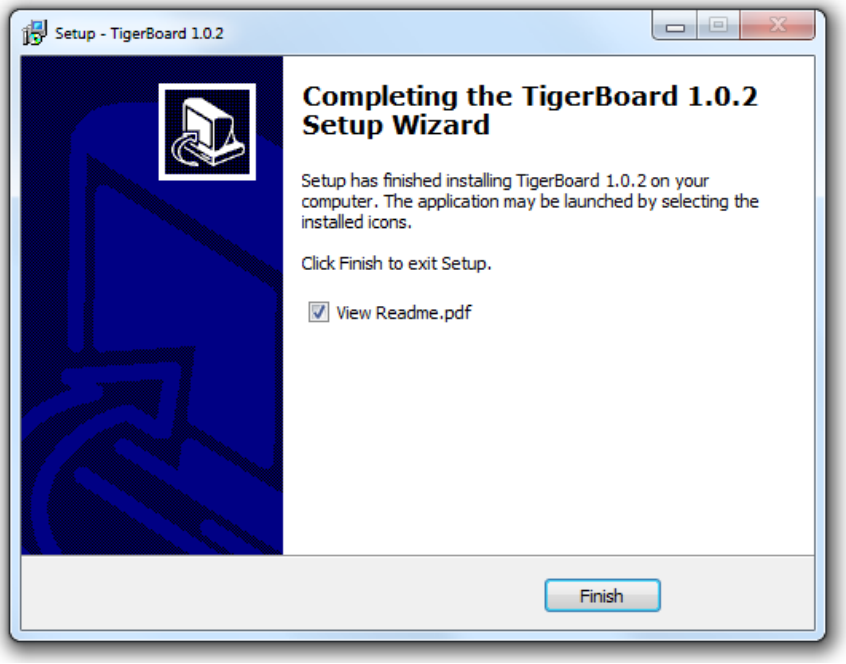
It will then attempt to install the redistribution pack for Visual C++ 2010. Please read and accept the license terms.




Microsoft Visual C++ 2010 x86 Redistributable Setup
Installation Progress
Please, wait while the Microsoft Visual C++ 2010 x86 Redistributable is being installed.
File security verification:
All files were verified successfully.
Installation progress:
Installing Microsoft Visual C++ 2010 Redistributable
Cancel


Microsoft Visual C++ 2010 x86 Redistributable Setup
Microsoft Visual Studio
Installation Is Complete
Microsoft Visual C++ 2010 x86 Redistributable has been installed.
You can check for more recent versions of this package on the Microsoft Visual Studio website.
Finish

Step 11:
You will then be complete and able to connect your board and run the example applications.



3. Installation (Linux)

Installation of TigerBoard under Linux consists of two steps. First OpenSource LibUsb for Linux is installed. Secondly the TigerBoard example applications and documentation is installed.

3.1. Step 1: LibUsb Installation

LibUsb is an OpenSource USB driver available for usage for commercial applications. The TigerBoard class library will make low level USB calls to LibUsb to implement the desired high level functions available through the TigerBoard API.

The LibUsb installation is contained within "libusb-0.1.12.tar.gz".

Installation consists of the following:

a) One should first ensure that GNU g++ is available on the Linux machine. This will be needed during the installation.

b) In a working directory untar the file using

```
linux%> gzip -cd libusb-0.1.12.tar.gz | tar xvf -
```

c) Move to the created directory using

```
linux%> cd libusb-0.1.12
```

d) Run the configure script

```
linux%> ./configure
```

e) Run make (become root if necessary) to build LibUsb

```
linux%> make
```

f) Install LibUsb

```
linux%> make install
```

At this point you should have installed LibUsb for Linux. Unfortunately in most cases it seems that the library can only be seen by the root user. This means that applications would only work as root. To fix this one needs to edit one of the rule files in UDEV.

g) Change to be root

```
linux%> sudo bash
```

h) Edit for example your `/etc/udev/rules.d/40-basic-permissions.rules` to include the following two new lines (in red). This makes the TigerBoard USB connection able to be seen by someone other than root.

```
# USB devices (usbfs replacement)
SUBSYSTEM=="usb", ENV{DEVTYPE}=="usb_device", MODE="0664"
SUBSYSTEM=="usb_device",                      MODE="0664"
#New lines for Tigerboard
SUBSYSTEM=="usb", ENV{DEVTYPE}=="usb_device",SYSFS{idVendor}=="04b4",
SYSFS{idProduct}=="1004", MODE="0666"
SUBSYSTEM=="usb", ENV{DEVTYPE}=="usb_device",SYSFS{idVendor}=="2058",
SYSFS{idProduct}=="1007", MODE="0666"
```

The above change to permissions shows how to change USB permissions for Ubuntu Linux. For other kernels permissions may need to be changed in other files. For example in Federa 11, one needs to make the modification to `/lib/udev/rules.d/50-udev-default.rules`.

i) You can return from being root now and you are ready to install the TigerBoard examples and documentation.

3.2. Step 2: TigerBoard Examples and Documentation Installation

a) Documents and the example applications are all contained in TigerBoard_Installation_1.0.2.tar.gz. Untar this in some suitable place.

```
linux%> tar xvfz TigerBoard_Installation_1.0.2.tar.gz
```

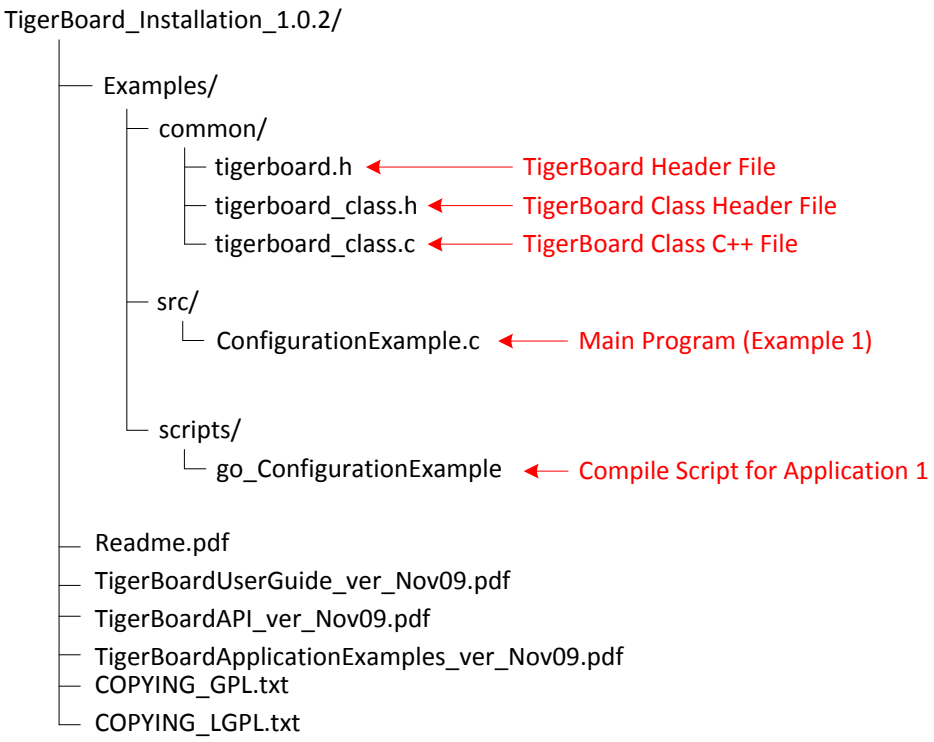
b) Move to the created directory.

```
linux%> cd TigerBoard_Installation_1.0.2
```

c) You will see the following documents to read:

Readme.pdf
TigerBoardUserGuide_ver_Jan13.pdf
TigerBoardAPI_ver_ Jan13.pdf
TigerBoardApplicationExamples_ver_ Jan13.pdf

d) You will find the application examples in the Examples/ directory. Read **TigerBoardApplicationExamples_ver_Jan13.pdf** to learn about running these. The file structure should appear as below.



4. Installation (MacOS)

Installation of TigerBoard for MacOS consists of two steps. First OpenSource LibUsb for MacOS is installed. Secondly the TigerBoard example applications and documentation is installed.

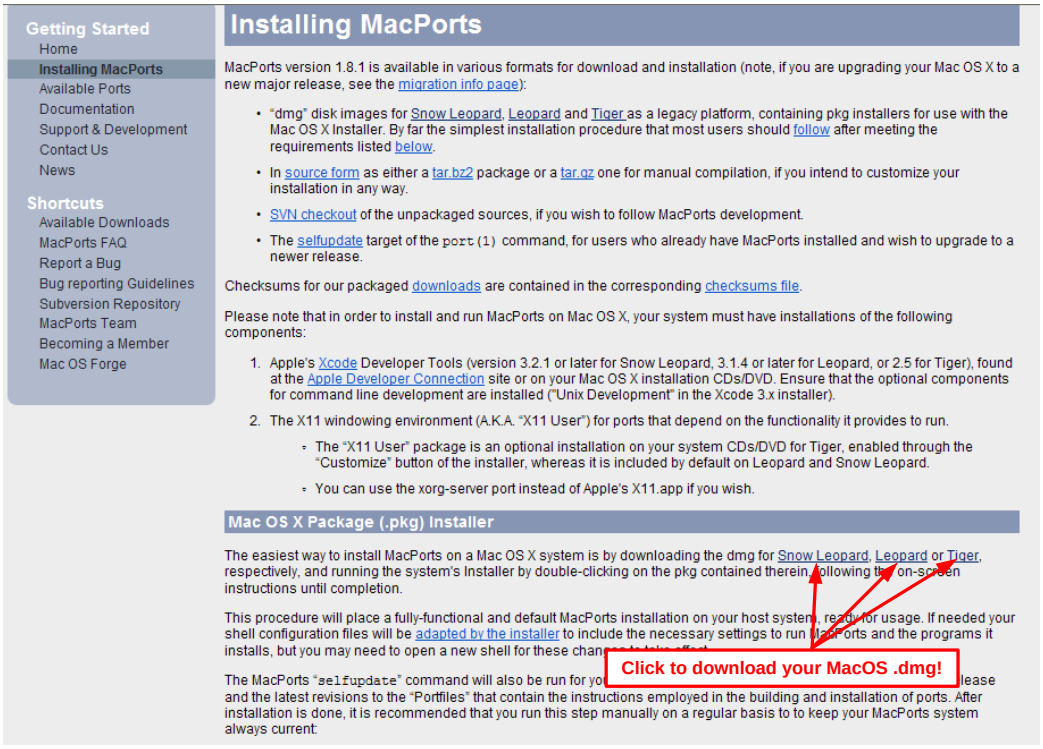
4.1. Step 1: LibUsb Installation

LibUSB 0.1.12 must be first installed under MacOS. The simplest way to achieve this is to make use of the installation already included in MacPorts.

First visit the MacPorts installation page:

http://www.macports.org/install.php

Download the MacPorts installation for your version of MacOS by selecting Snow Leopard, Leopard or Tiger. A .dmg file will be downloaded (it will be called something like `MacPorts-1.8.1-10.6-SnowLeopard.dmg`).



Double click on the downloaded file to mount it and execute the package file (.pkg) to install it.

In a command tool install version 0.1.12 of LibUsb using the following command:

```
%  sudo port install libusb-legacy
```

At this point you should have installed LibUsb for MacOS and you are ready to install the TigerBoard examples and documentation.

4.2. Step 2: TigerBoard Examples and Documentation Installation

a) Documents and the example applications are all contained in TigerBoard_Installation_1.0.2.tar.gz which comes from the TigerBoard software downloads page for MacOS. Untar this in some suitable place.

```
macos %> tar xvfz TigerBoard_Installation_1.0.2.tar.gz
```

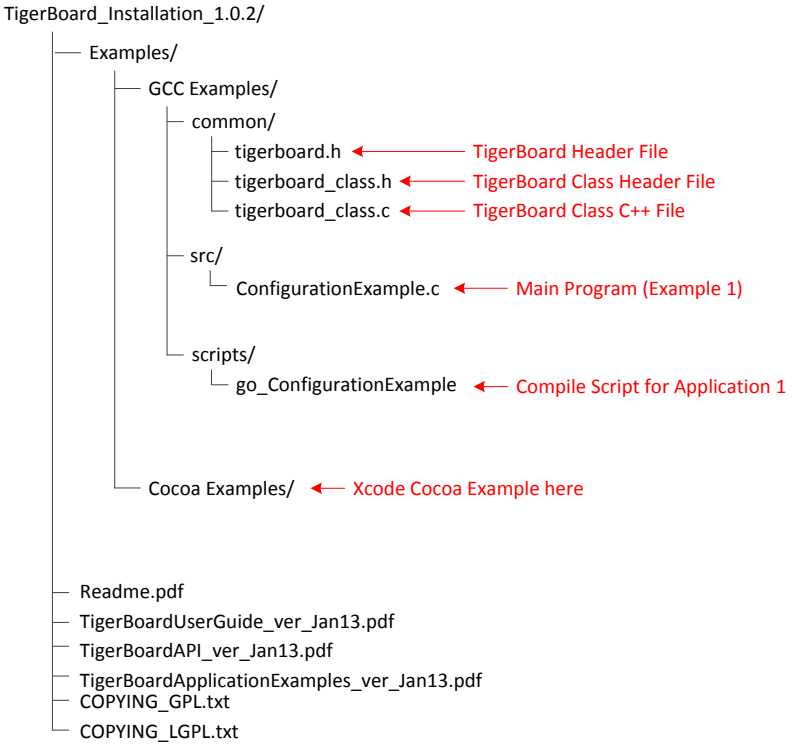
b) Move to the created directory.

```
macos %> cd TigerBoard_Installation_1.0.2
```

c) You will see the following documents to read:

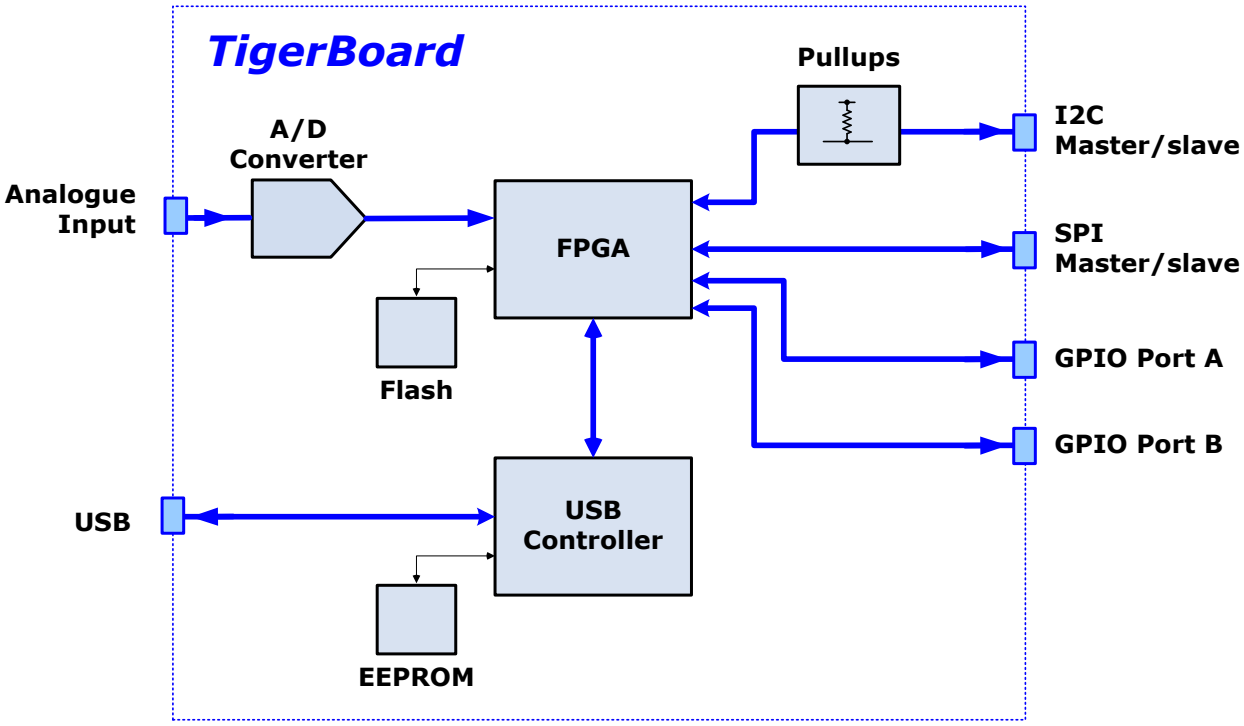
Readme.pdf
TigerBoardUserGuide_ver_Jan13.pdf
TigerBoardAPI_ver_Jan13.pdf
TigerBoardApplicationExamples_ver_Jan13.pdf

d) You will find the application examples in the Examples/ directory. Read **TigerBoardApplicationExamples_ver_Jan13.pdf** to learn about running these. The file structure should appear as below.



5. TigerBoard Hardware

5.1. Overview



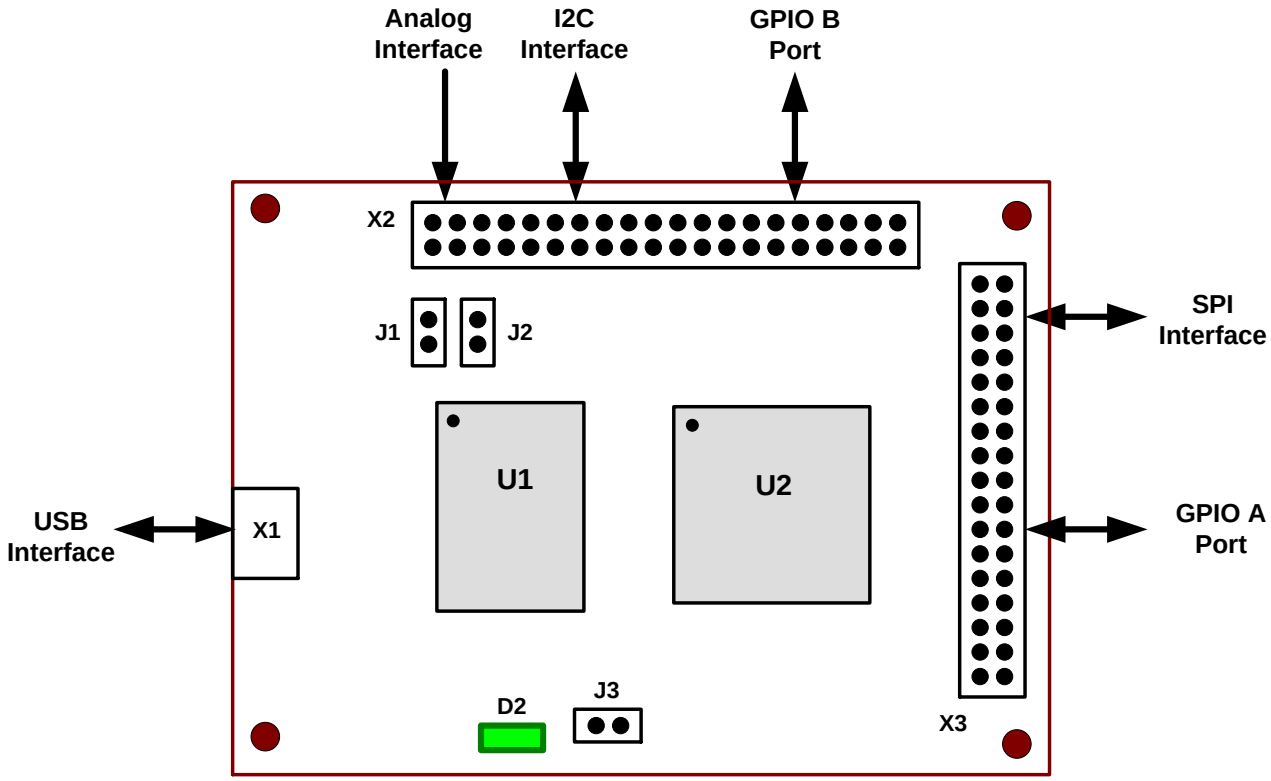
TigerBoard is built around a Cypress USB controller chip and FPGA. It accepts commands across the USB bus and then translates these into I2C, SPI and GPIO bus protocols as required. Key features of the TigerBoard include:

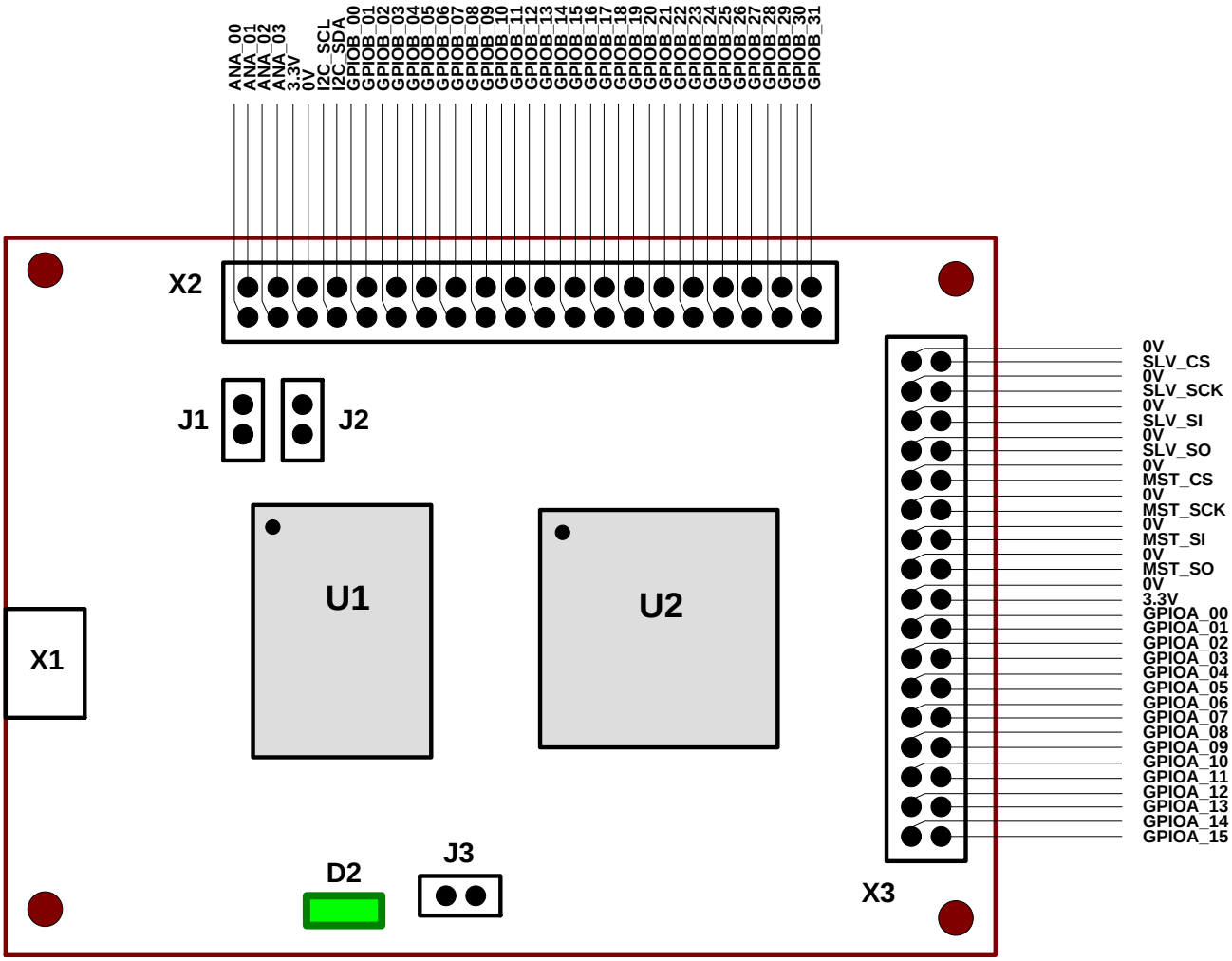
- high speed SPI master and slave (up to 17 channels)
  (Master to 50MHz, Slave to 25MHz)
- high speed I2C master and slave with optional pull-ups
  (Master and Slave to 6.25MHz)
- 16 bit GPIO Port A capable of digital I/O, interrupts, PWM
- 16 bit GPIO Port B capable of digital I/O
- 4 bit analogue input

A full schematic for the TigerBoard can be seen in Appendix A.

5.2. Interfaces

Separate connectors are provided for each of the I2C, SPI, GPIO and Analogue interfaces. With pins as specified in the following diagrams.




ANA_00
ANA_01
ANA_02
ANA_03
3.3V
0V
I2C_SCL
I2C_SDA
GPIOB_00
GPIOB_01
GPIOB_02
GPIOB_03
GPIOB_04
GPIOB_05
GPIOB_06
GPIOB_07
GPIOB_08
GPIOB_09
GPIOB_10
GPIOB_11
GPIOB_12
GPIOB_13
GPIOB_14
GPIOB_15
GPIOB_16
GPIOB_17
GPIOB_18
GPIOB_19
GPIOB_20
GPIOB_21
GPIOB_22
GPIOB_23
GPIOB_24
GPIOB_25
GPIOB_26
GPIOB_27
GPIOB_28
GPIOB_29
GPIOB_30
GPIOB_31
X2
J1
J2
U1
U2
X1
D2
J3
X3
0V
SLV_CS
0V
SLV_SCK
0V
SLV_SI
0V
SLV_SO
0V
MST_CS
0V
MST_SCK
0V
MST_SI
0V
MST_SO
0V
3.3V
GPIOA_00
GPIOA_01
GPIOA_02
GPIOA_03
GPIOA_04
GPIOA_05
GPIOA_06
GPIOA_07
GPIOA_08
GPIOA_09
GPIOA_10
GPIOA_11
GPIOA_12
GPIOA_13
GPIOA_14
GPIOA_15

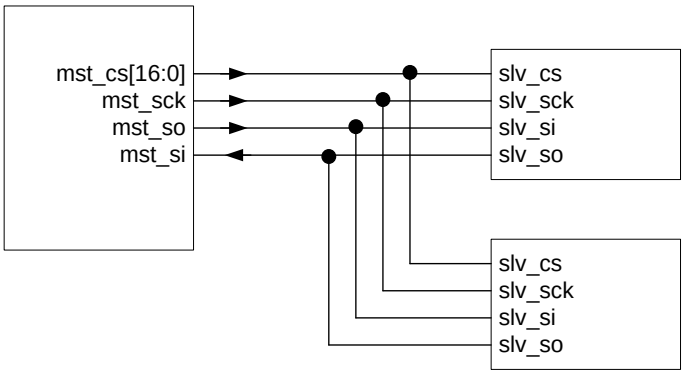
5.3. SPI Interface

Connector X3 contains the SPI interface.

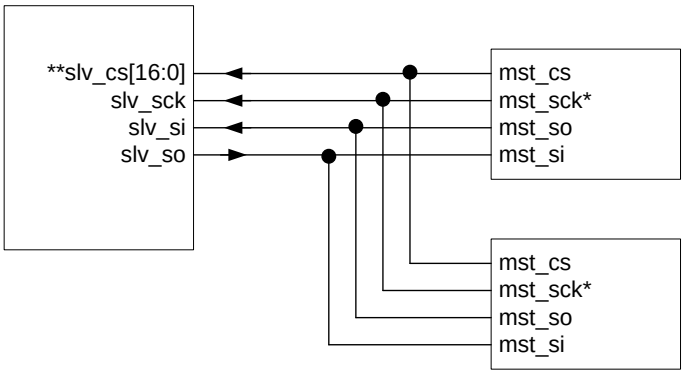
MST_CS[0]	Output	SPI master chip select output (channel 0).
MST_SCK	Output	SPI master serial clock output.
MST_SO	Output	SPI master serial data output.
MST_SI	Input	SPI master serial data input.
SLV_CS[0]	Input	SPI slave chip select input (channel 0).
SLV_SCK	Input	SPI slave serial clock input.
SLV_SO	Output	SPI slave serial data output.
SLV_SI	Input	SPI slave serial data input.
3.3V	Supply	
0V	Supply	

The interface includes separate master and slave SPI interfaces. Pins of the GPIOA port can be sacrificed to either SPI master or SPI slave chip selects. These then form the remaining bits of the chip select buses mst_cs[16:0] or slv_cs[16:0]. In general three usages of the SPI interface become possible, as shown over:

Master Mode



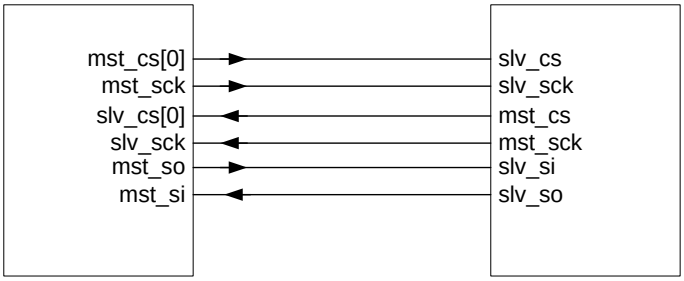
Slave Mode



*) When connecting multiple slaves, care needs to be taken to make sure the clock outputs can be connected. For example they could be externally gated or made open drain.

**) Always make sure that for channels configured to be SPI slaves always have their chip select inputs driven and not left floating.

Hybrid Master-Slave Mode

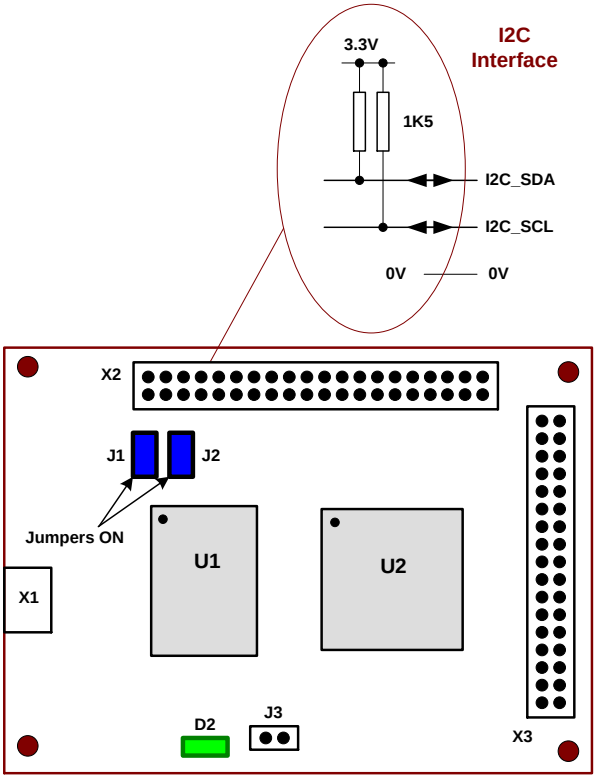


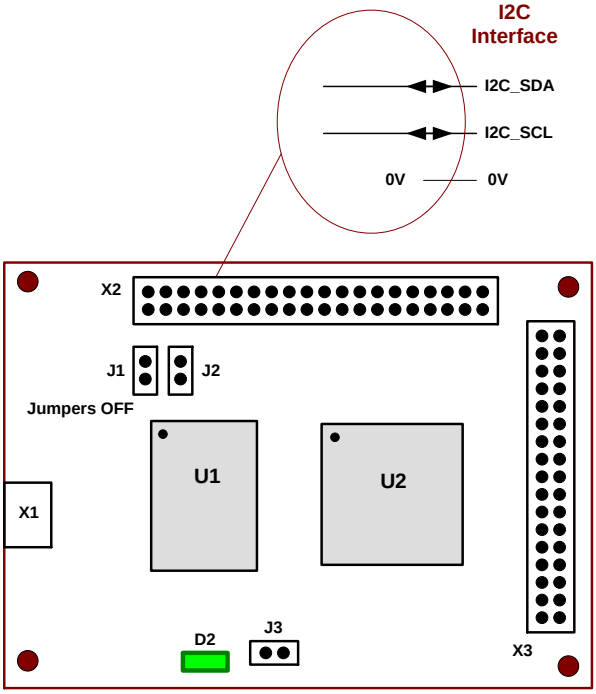
5.4. IIC Interface

Connector X2 contains the I2C interface.

IIC_SCL	Input/Output	I2C serial clock.
IIC_SDA	Input/Output	I2C serial clock.
3.3V	Supply	
0V	Supply	

Configuration jumpers J1 and J2 can be used to switch in/out on-board pull-up resistors for the I2C lines up to 3.3 as per the following drawings.


I2C
Interface
3.3V
1K5
I2C_SDA
I2C_SCL
0V
0V
X2
J1
J2
Jumpers ON
U1
U2
X1
D2
J3
X3


I2C
Interface
I2C_SDA
I2C_SCL
0V
0V
X2
J1
J2
Jumpers OFF
U1
U2
X1
D2
J3
X3

5.5. GPIO Port A Interface

Connector X3 contains GPIO Port A interface.

GPIOA_00	Input/Output	Digital I/O, PWM, interrupt or pulsed. Can be filtered to form an analogue output.
GPIOA_01	Input/Output	Digital I/O, PWM, interrupt or pulsed. Can be filtered to form an analogue output.
GPIOA_02	Input/Output	Digital I/O, PWM, interrupt or pulsed.
GPIOA_03	Input/Output	Digital I/O, PWM, interrupt or pulsed.
GPIOA_04	Input/Output	Digital I/O, PWM, interrupt or pulsed.
GPIOA_05	Input/Output	Digital I/O, PWM, interrupt or pulsed.
GPIOA_06	Input/Output	Digital I/O, PWM, interrupt or pulsed.
GPIOA_07	Input/Output	Digital I/O, PWM, interrupt or pulsed.
GPIOA_08	Input/Output	Digital I/O, PWM, interrupt or pulsed.
GPIOA_09	Input/Output	Digital I/O, PWM, interrupt or pulsed.
GPIOA_10	Input/Output	Digital I/O, PWM, interrupt or pulsed.
GPIOA_11	Input/Output	Digital I/O, PWM, interrupt or pulsed.
GPIOA_12	Input/Output	Digital I/O, PWM, interrupt or pulsed.
GPIOA_13	Input/Output	Digital I/O, PWM, interrupt or pulsed.
GPIOA_14	Input/Output	Digital I/O, PWM, interrupt or pulsed.
GPIOA_15	Input/Output	Digital I/O, PWM, interrupt or pulsed.
3.3V	Supply	
0V	Supply	

The GPIO pins can all be separately configured as digital input, digital output, PWM outputs, pulsed output or interrupt input. These pins can also be sacrificed as SPI chip selects as either a SPI master or SPI slave as described in section 5.3.

5.6. GPIO Port B Interface

Connector X2 contains GPIO Port B interface.

GPIOB_00	Input/Output	Digital I/O.
GPIOB _01	Input/Output	Digital I/O.
GPIOB _02	Input/Output	Digital I/O.
GPIOB _03	Input/Output	Digital I/O.
GPIOB _04	Input/Output	Digital I/O.
GPIOB _05	Input/Output	Digital I/O.
GPIOB _06	Input/Output	Digital I/O.
GPIOB _07	Input/Output	Digital I/O.
GPIOB _08	Input/Output	Digital I/O.
GPIOB _09	Input/Output	Digital I/O.
GPIOB _10	Input/Output	Digital I/O.
GPIOB _11	Input/Output	Digital I/O.
GPIOB _12	Input/Output	Digital I/O.
GPIOB _13	Input/Output	Digital I/O.
GPIOB _14	Input/Output	Digital I/O.
GPIOB _15	Input/Output	Digital I/O.
GPIOB _16	Input/Output	Digital I/O.
GPIOB _17	Input/Output	Digital I/O.
GPIOB _18	Input/Output	Digital I/O.
GPIOB _19	Input/Output	Digital I/O.
GPIOB _20	Input/Output	Digital I/O.
GPIOB _21	Input/Output	Digital I/O.
GPIOB _22	Input/Output	Digital I/O.
GPIOB _23	Input/Output	Digital I/O.
GPIOB _24	Input/Output	Digital I/O.
GPIOB _25	Input/Output	Digital I/O.
GPIOB _26	Input/Output	Digital I/O.
GPIOB _27	Input/Output	Digital I/O.
GPIOB _28	Input/Output	Digital I/O.
GPIOB _29	Input/Output	Digital I/O.
GPIOB _30	Input/Output	Digital I/O.
GPIOB _31	Input/Output	Digital I/O.
3.3V	Supply	
0V	Supply	

5.7. Analogue Interface

Connector X2 the analogue interface.

ANA_00	Input	Analogue input.
ANA_01	Input	Analogue input.
ANA_02	Input	Analogue input.
ANA_03	Input	Analogue input.
3.3V	Supply	
0V	Supply	

5.8. LED Indicator

The TigerBoard includes a green LED indicator to indicate that the circuit is powered correctly.

6. Getting Started

Use of the TigerBoard typically involves writing a C/C++ console application or a Visual C++ Windows GUI application which calls functions and tasks in the TigerBoard API provided by Nano River Technologies. A full definition of the API is provided in the **"TigerBoard API Specification",** provided on the web-site.

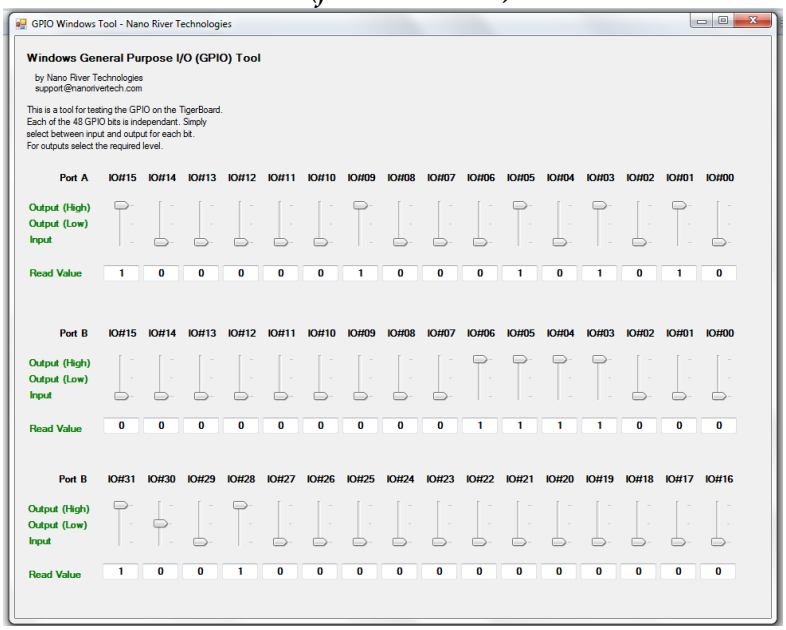
In order to rapidly build up applications and see how to link to the API, eight example applications have been built up. The example applications provided are described below. These are all fully documented in the **"TigerBoard Example Applications"** document, provided on the web-site.

Configuration Example (for Windows)

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
++ NANO RIVER TECHNOLOGIES                                              ++
++   CONFIGURATION EXAMPLE FOR TIGERBOARD (27 Jan 2013)                 ++
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Open Device....
   -> TigerBoard Connected!!!
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

 Initialisation
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

++++++++++++++++++++++
 GPIO A Test
++++++++++++++++++++++
 Write AA
 Write 55
 Make bit 0 pulsed
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

++++++++++++++++++++++
 GPIO B Test
++++++++++++++++++++++
 Write AA
 Write 55
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

++++++++++++++++++++++
 Analogue Input Test
++++++++++++++++++++++
Analogue Channel #00 : 00
Analogue Channel #01 : 00
Analogue Channel #02 : 00
Analogue Channel #03 : 00
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

++++++++++++++++++++++
 SPI Test
++++++++++++++++++++++
SPI Configure Channel 0...
SPI Set Frequency ...

SPI Slave Data (Written)  : AABBCCDD
SPI Master Data (To send) : 11223344

SPI Master Send Channel 0...

SPI Master Data (Read)    : AABBCCDD
SPI Slave Data (Read)     : 11223344
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

++++++++++++++++++++++
 I2C Test
++++++++++++++++++++++
I2C Devices Connected ... 0x2B

Master I2C write...
Master Buffer   : AABBCCDDFF
Slave Buffer    : AABBCCDDFF

Master I2C read...
Slave Buffer    : 1122334455
Master Buffer   : 1122334455


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
 TEST COMPLETE ....
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
```

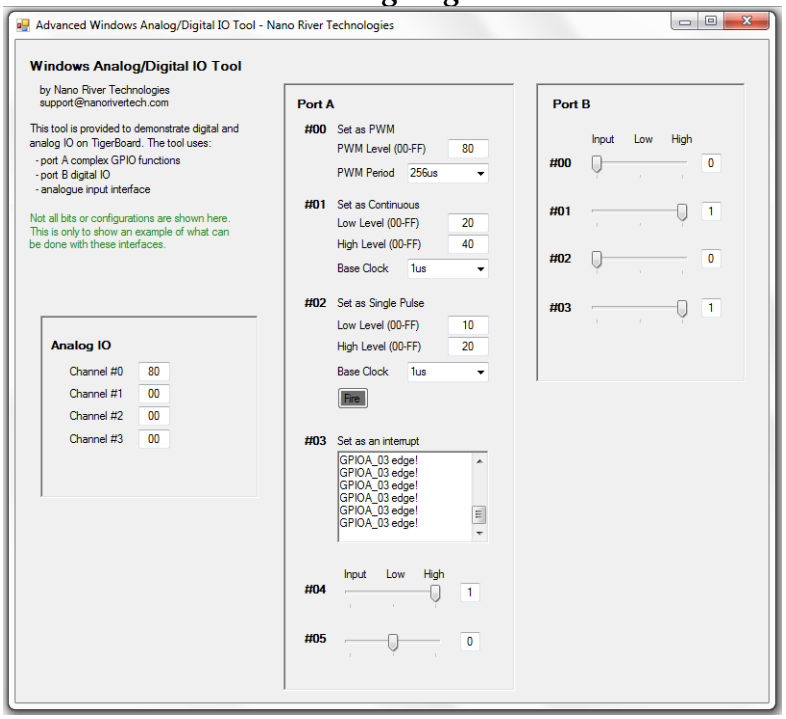
This example is very simple C/C++ console application for Windows showing how to call basic functions associated with SPI, I2C, GPIO and analogue IO. The example is a good starting point if you want to try the TigerBoard for the first time and want to see a simple console application.

Windows GPIOTool (for Windows)



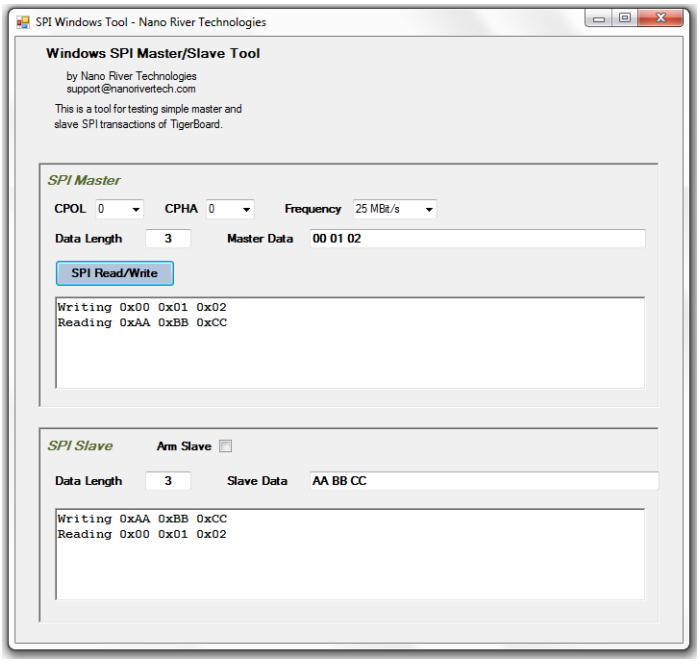
This example application is a very simple Visual C++ GUI application showing how to interface to the general purpose IO (GPIO) pins. This includes both port A and port B GPIOs.

Advanced Windows Analog/Digital IO Tool



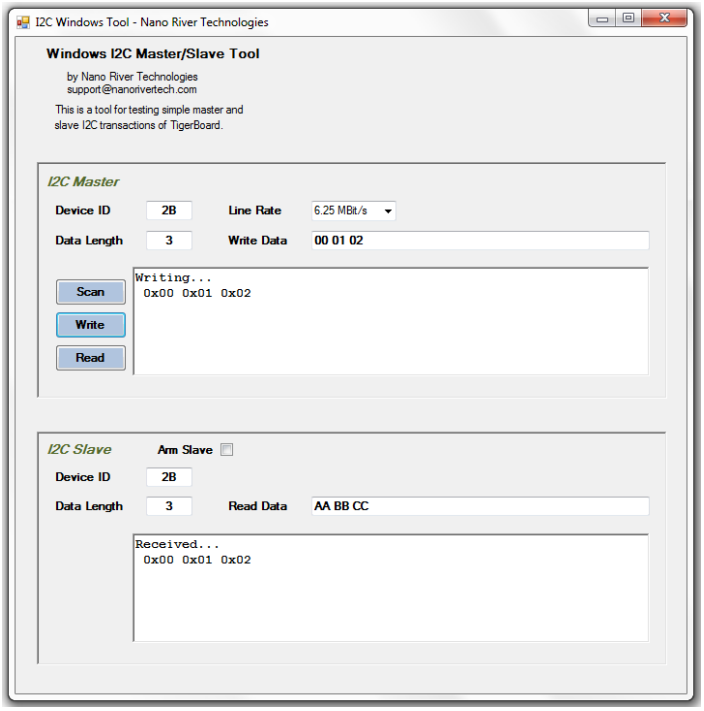
This is a more complex Visual C++ GUI application showing some of the more complex GPIO and analog input functions.

Windows SPI Tool



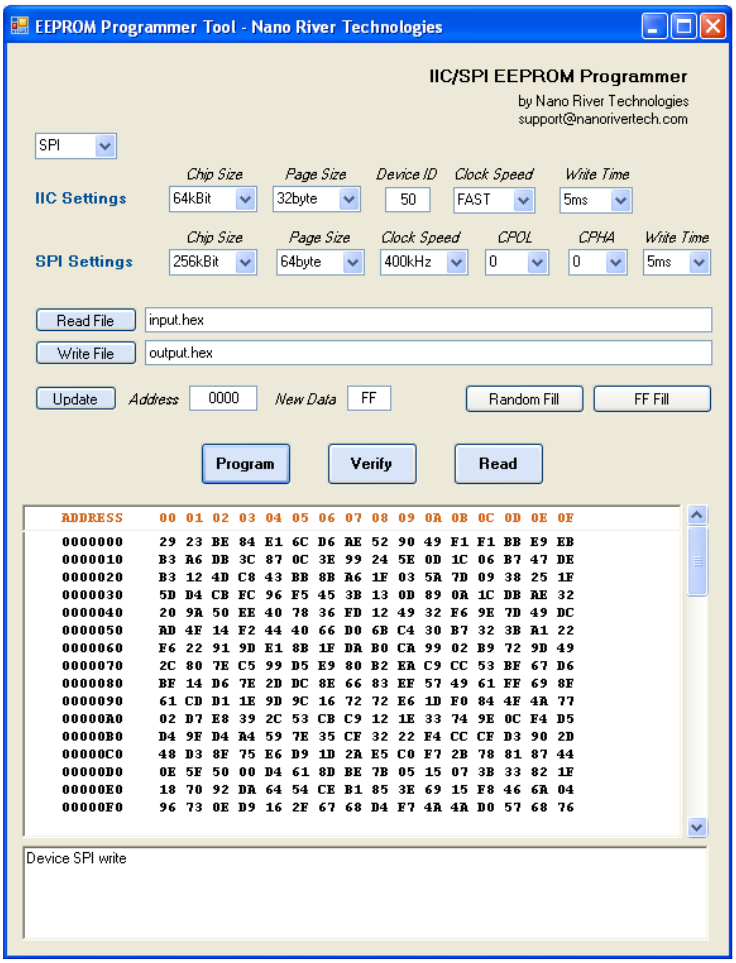
The Windows SPI tool is a windows GUI application in Visual C++ used to demonstrate both master and slave operation of the SPI interface for TigerBoard.

Windows I2C Tool



The Windows I2C tool is a windows GUI application in Visual C++ used to demonstrate both master and slave operation of the I2C interface for TigerBoard.

Windows EEPROM Programmer



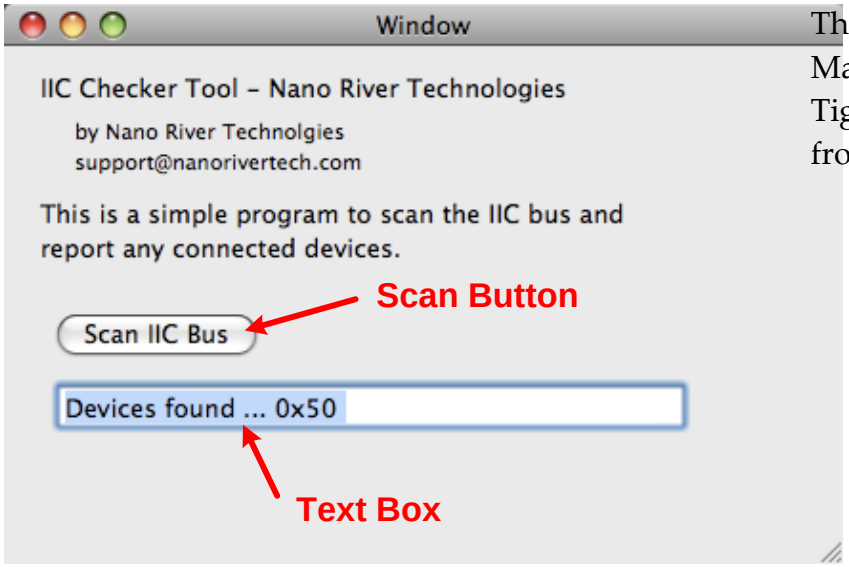
This is a simple I2C and SPI EEPROM programmer written as a windows GUI application in Visual C++. It illustrates how to build a more complex application and also how to link to both I2C and SPI functions in the API.

Configuration Example (for Linux and MacOS)

This is a simple GCC program for Linux and MacOS to show basic setup of GPIO, I2C, SPI and Anlogue IO interfaces.

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
++ NANO RIVER TECHNOLOGIES                                            ++
++   CONFIGURATION EXAMPLE FOR VIPERBOARD (05 Nov 2009)               ++
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Open Device....
   -> ViperBoard Connected!!!
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

++++++++++++++++++++++
 GPIO A Test
++++++++++++++++++++++
 Write AA

 Write 55

 Make bit 0 pulsed
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
++++++++++++++++++++++
 GPIO B Test
++++++++++++++++++++++
 Write AA

 Write 55
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

++++++++++++++++++++++
 Analogue Input Test
++++++++++++++++++++++
Analogue Channel #00 : FF
Analogue Channel #01 : FF
Analogue Channel #02 : FF
Analogue Channel #03 : FF
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

++++++++++++++++++++++
 SPI Test
++++++++++++++++++++++
SPI Configure Channel 0...
SPI Set Frequency ...

SPI Slave Data (Written)  : AABBCCDD
SPI Master Data (To send) : 11223344

SPI Master Send Channel 0...

SPI Master Data (Read)    : AABBCCDD
SPI Slave Data (Read)     : 11223344

++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
++++++++++++++++++++++
 I2C Test
++++++++++++++++++++++
I2C Devices Connected ... 0x2B
Master I2C write...
Master Buffer   : AABBCCDDFF
Slave Buffer    : AABBCCDDFF

Master I2C read...
Slave Buffer    : 1122334455
Master Buffer   : 1122334455


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
```

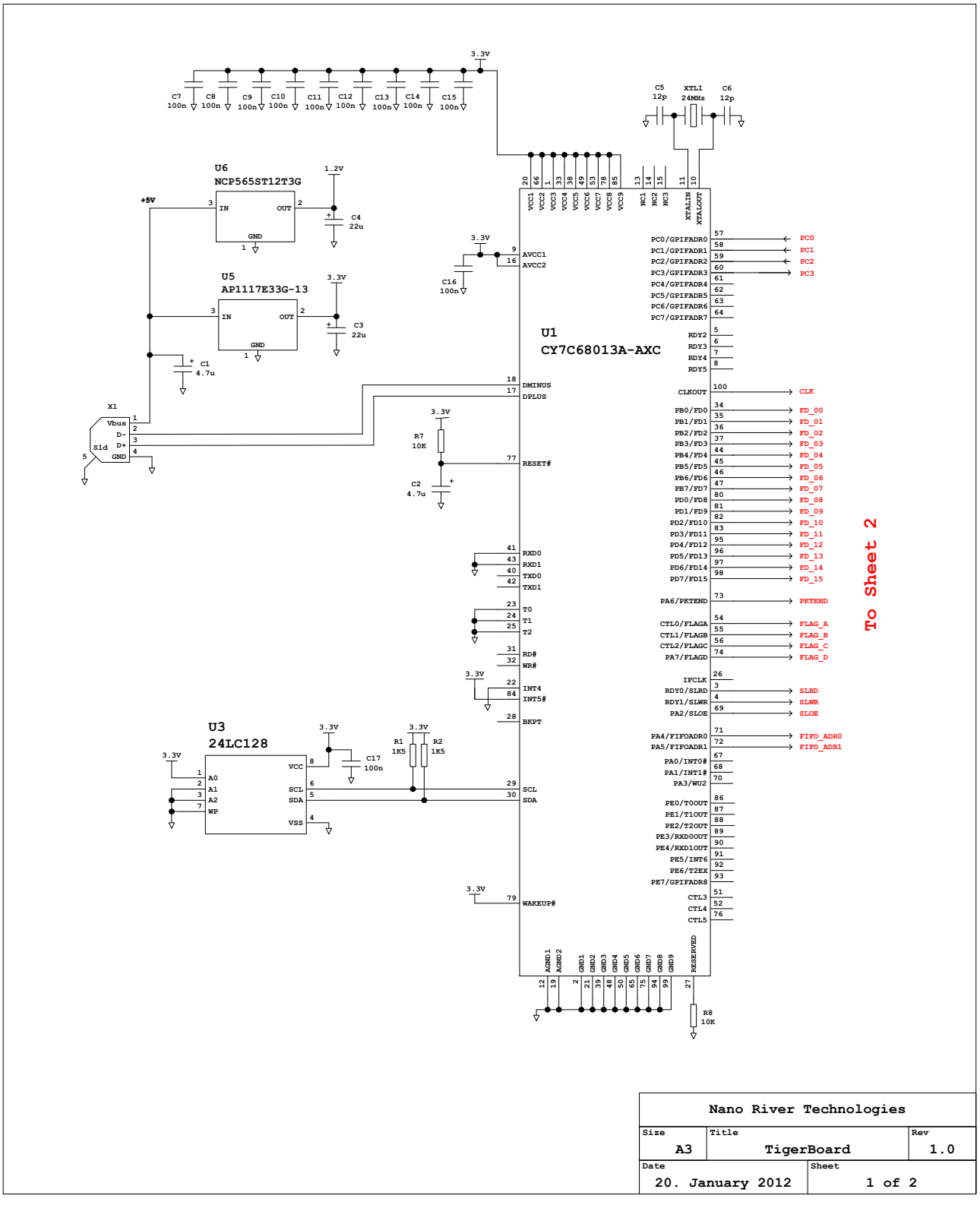
I2C Checker Tool ***(for MacOS Xcode Cocoa)***

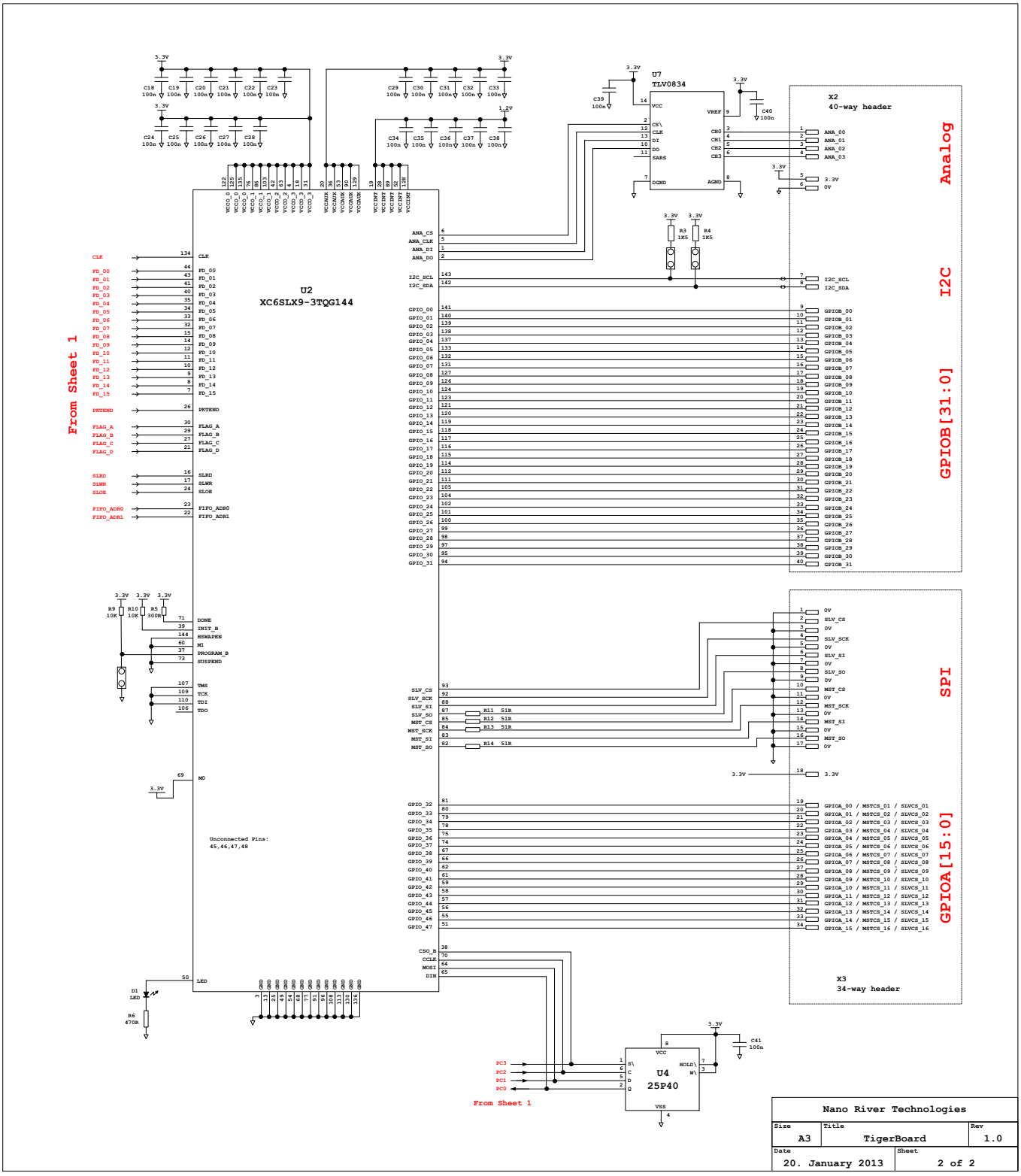


This is a simple GUI program for MacOS showing how to use TigerBoard to scan IIC devices from Xcode Cocoa.

7. Appendix A : Schematic

See over.


U1
CY7C68013A-AXC
U6
NCP565ST12T3G
U5
AP1117E33G-13
U3
24LC128
X1
3.3V
1.2V
+5V
To Sheet 2
Nano River Technologies
TigerBoard
1.0
A3
20. January 2012
1 of 2


U2
XC6SLX9-3TQG144
U7
TLV0834
U4
25P40
X2
40-way header
X3
34-way header
Analog
I2C
SPI
GPIOB[31:0]
GPIOA[15:0]
From Sheet 1
Unconnected Pins:
45,46,47,48
Nano River Technologies
TigerBoard
1.0
20. January 2013
2 of 2