CoLinkEx_LPC11C14 EVB Kit User Guide

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Revision history

Rev	Date	Description
1.0	2012-05-07	Initial version

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1. CoLinkEx_LPC11C14 EVB Kit Overview

1.1 The Microcontroller Introduction

CoLinkEx_LPC11C14 EVB Kit uses the LPC11C14x301FBD48 for NXP. The LPC11Cxx are ARM Cortex-M0 based microcontrollers for embedded applications featuring a high level of integration and low power consumption.

The LPC11xx operate at CPU frequencies of up to 50 MHz, the peripheral complement of the LPC11xx series includes up to 32KB of flash memory, up to 8 KB of data memory, one Fast-mode Plus I2C-bus interface, one RS-485/EIA-485 UART, up to two SPI interfaces with SSP features, four general purpose timers, a 10-bit ADC, and up to 42 general purpose I/O pins. It integrated ARM Cortex-M0 built-in Nested Vectored Interrupt Controller (NVIC), integrated PMU (Power Management Unit) to minimize power consumption during Sleep, Deep-sleep, and Deep power-down modes.

The LPC11Cxx operates in the -40 to +85 °C temperature range, from a 1.8 to 3.6 V power supply. A comprehensive set of power-saving mode allows the design of low-power applications. It includes:

- Emetering
- Lighting
- Industrial networking
- Alarm systems
- White goods

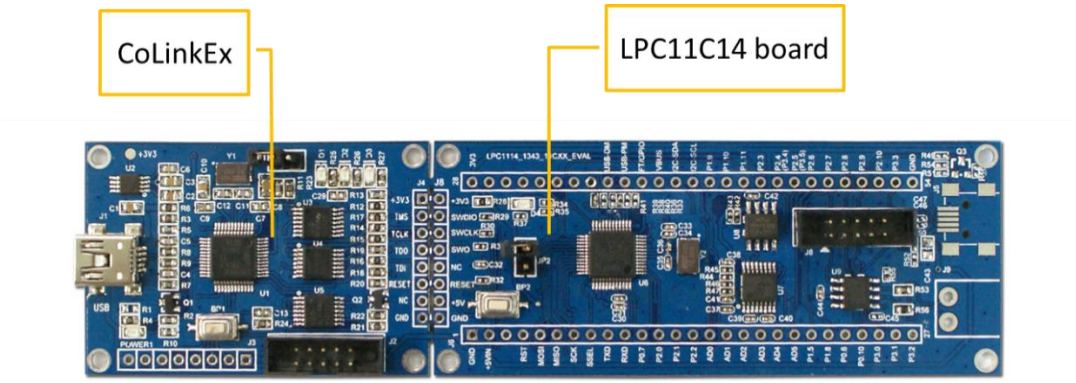
1.2 Evaluation Boards Introduction

CooCox's CoLinkEx_LPC11C14 EVB Kit is a brand new, cost-effective but high-performance evaluation tool of the ARM Cortex-M0 based LPC11xx controller family from NXP, allowing you to create and test working programs for this advanced architecture. The board has UART Interface which support RS-485 and EIA-485 modes, 8 channel 10 bit ADC Converter, 2 16bit timer and 2 32bit timer, includes a wide range of interfaces such as SPI, I2C, integrates PMU(Power Manage Unit). It supports IO extensions, which is compatible with LPCXpresso Base Board, making it a great starting point for your next Cortex-M0 project. The onboard adapter: CoLinkEx support MDK and IAR, help you execute download and debug the project.

You can use the CoLinkEx_LPC11C14 EVB Kit to generate and test application programs for the NXP LPC11xx microcontroller family. The example and source in the CD will help you quickly start project development and personal learning.

1.3 Hardware resources list

CoLinkEx_LPC11C14 EVB Kit contains CoLinkEx and LPC11C14 board:



On board CoLinkEx	LPC11C14_Dev_Board
A mini-type USB socket, power supply and communicate with PC	CAN Interface
2mm*10pin Debug Interface, can debug other devices	An Serial connection socket (support RS-485 / EIA-485)
a power supply LED	1 LED(P2.9)
3 CoLinkEx Status LED: D1~D3	Full function IO extension, support I2C, SPI, ADC

The suite contains the CoLinkEx_LPC11C14 EVB Kit and the following issues:

MiniUSB Line

2mm*10pin to DB9 serial line

Two 2.54mm Jumper cap

A CD and Publicity Color Pages

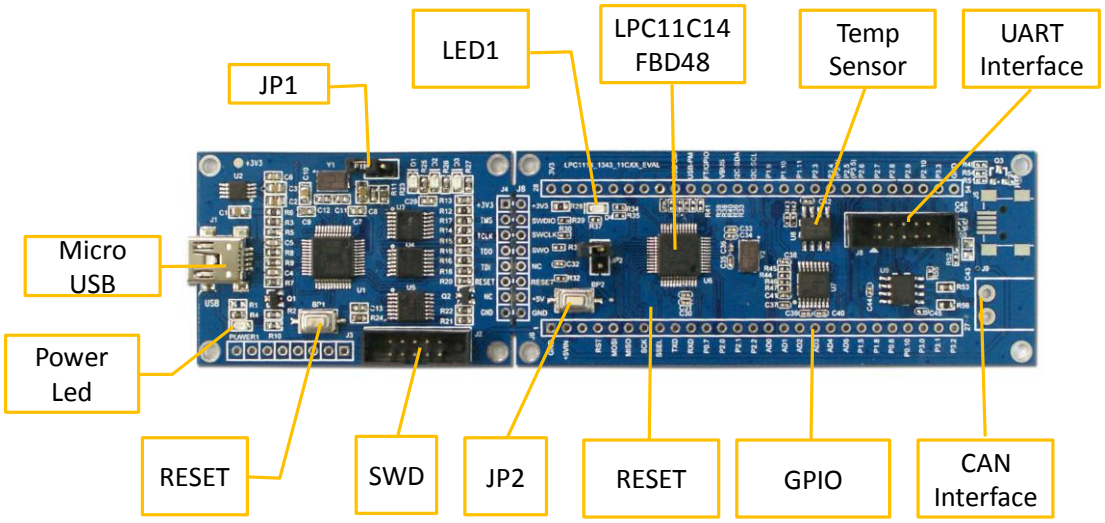
1.4 Software resources list

Example Name	Function Description
Default factory program	LED4 Blink, UART Send data, I2C Read Temperature sensor
Blinky	LED4 Blink
UART_Print	UART Send data
Master_Transfer	Read data though I2C (Need to connect EEPROM)
WDT_Reset	Watchdog application example.

Simple_ADC	ADC Convert application example.
Capture	32-bits timer capture example
Printchar for NXP	Retarget printf to Serial output in CoIDE
Semihosting	Retarget printf to Semi hosting in CoIDE(Debug only)
CoOS_App_Framework	CoOS simple example for how to create task

2. CoLinkEx_LPC11C14 EVB Kit Introduction

2.1 Board Interface Overview



ID	Description	ID	Description
BP1	CoLinkEx Reset Button	J6	GPIO IO Extension Interface
BP2	LPC11C14 Board Reset Button	J8	UART232 Serial Socket
D1	Red LED, CoLinkEx Error status	J9	CAN Interface
D2	Yellow LED, CoLinkEx Connection	JP1	CoLinkEx Update Pin
D3	Blue LED, CoLinkEx Busy status	JP2	LPC11C14board ISP Pin
D4	LPC11C14 Board LED	U6	LPC11C14x301FBD48
J1	CoLinkEx Micro-USB Interface	U7	RS232 Transceiver
J2	CoLinkEx SWD Interface	U8	Temperature Sensor (Though I2C)
J4	CoLinkEx Debug Interface, connect with LPC11C14	U9	CAN Controller

2.2 Jumpers settings

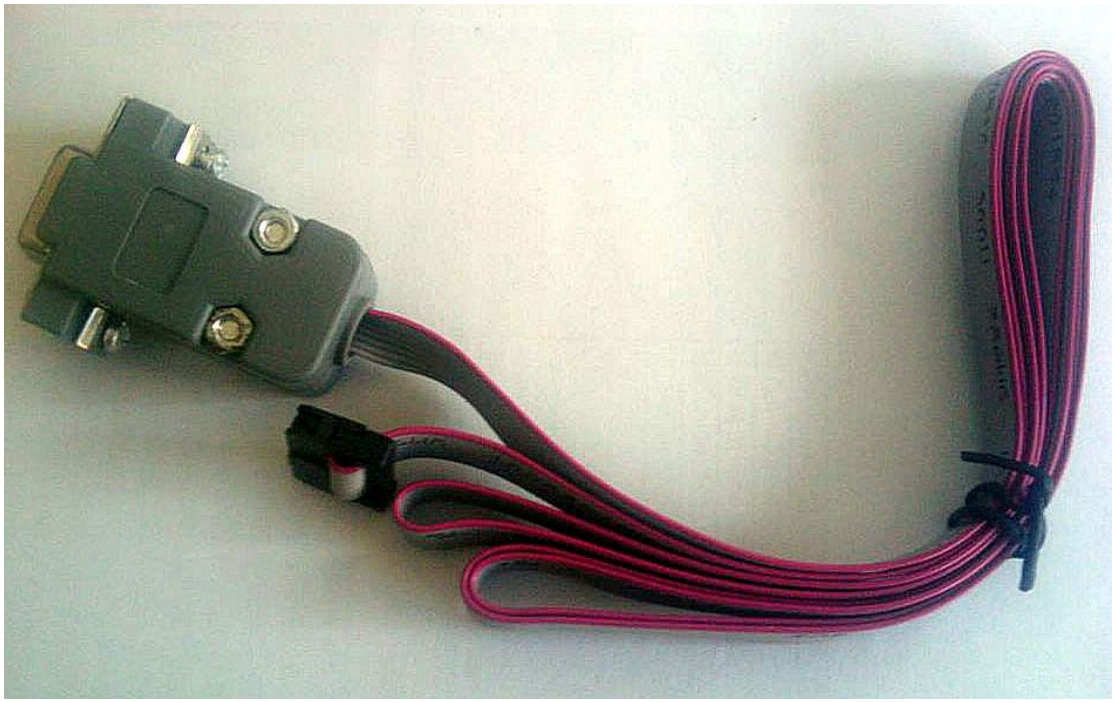
ID	Name	Default Settings	Note
JP1	UPDATE	Open	Allow user to update the firmware of CoLinkEx when this jumper is closed.
JP2	ISP	Open	Allow user to download the code using ISP software when this jumper is closed.

2.3 SW/JTAG Debug Interface

CoLinkEx_LPC11C14 EVB Kit use ARM standard 2mm*10 pin SW/JTAG Interface. You can use this interface to debug other devices. See: How to use CoLinkEx to debug other devices. You can also use other adapter to debug the LPC11C14board, such as ULink2, J-Link.

2.4 UART

The Universal Asynchronous Receiver Transmitter features a 9-pin UART that can be used for communication and trace purposes. It offers an ideal channel for ISP downloading. Use the following line to connect the board and PC.



2.5 CAN

CAN Interface, use TJA1040 Controller, can connect through J9. It offers an ideal channel for ISP downloading, too.

2.6 Mini USB Port

A Mini USB AB interface supplies 5V voltage to the Board. CoLinkEx communicate with the PC through this port.

2.7 LM75 Temperature Sensor

A LM75 Temperature Sensor is connected to the I2C bus in CoLinkEx_LPC11C14 EVB Kit.

2.8 LED

CoLinkEx+LPC11C14_Dev Board provide LEDs D4, it respectively connect with PIO2.9 IO pins, and can be used for user output.

3. Getting Started

3.1 Version Information

- Firmware: 0.4
- Driver: 1.2.0（or 1.2.1）
- Software:
  - CoIDE 1.4.0 or higher
  - CoFlash 1.4.0 or higher
  - MDK 4.03(or higher) plus CoMDKPlugin1.4.0 or higher

3.2 Hardware Source Requirement

When you use CoLinkEx_LPC11C14 EVB Kit, The PC is required to use the following sources:

- ✓ CPU: 2.0GHz (at least)
- ✓ Memory: 512M (at least)
- ✓ USB Interface: 1 (at least)
- ✓ Serial Line interface use COM1
- ✓ Operation System: Windows XP/Windows Vista/Win 7
- ✓ Software need: CoIDE, MDK, IAR(with CoMDKPlugin, CoIARPlugin)

3.3 Preparation

- Install CoIDE or the corresponding Plugin
- Update the firmware and install the driver, Refer to: CoLinkEx Installation and Use
- Jumpers' setting: JP1, JP2 both OFF.
- USB Connection: Using USB cable, one end plugged into the Mini USB port on the board CoLinkEx (J1), the other end connected to PC.
- If serial communication is needed:

  Serial Connection: Connect com of board and the COM of PC through serial port cable.

  Serial Port Receive Settings: In the PC, run HyperTerminal serial communication program, select the serial port used and set the following parameters (to set status: Baud rate (115200), data bits (8 bits), stop bits (1 bit), parity bit (no), data flow control (no)).

- If CAN Communication is needed:

Connect J9 (CAN Interface) with PC or other devices.

3.4 Use the default factory program

The board has load the following program by default. You can use it to test the hardware. You can also get the code through CooCox CoFlash.

1. Test Objective: The onboard hardware: Adapter, LPC11C14 chip, LED, UART and Temperature sensor can work normally.
2. Test Hardware Resources: MiniUSB Line, 2mm*10 pin to COM serial line, CoLinkEx_LPC11C14 EVB (all included in the CoLinkEx_LPC11C14 EVB Kit)
3. Test Prepareation: Connect the lines and set the HyperTerminal, you can refer to 3.3
4. procedure:
   1） Power on the board and press the Reset button.
   2） HyperTerminal will display “Welcome to use CooCox!” the tests begin.
   3） LED Blink Test: The board execute blinky test, D4 will light 5 times, means test OK. When the execute end, HyperTerminal will display “LED Blink Test OK!”
   4） UART Test: HyperTerminal will display “UART Print Test OK!”
   5） Temperature sensor and I2C Test: HyperTerminal will display the temperature value, and “I2C Temperature Sensor Test OK!” when the test ends.
   6） When the entire test ends, you will see “All test ended!” on the screen. If your board works normally, you will see the following lines on the HyperTerminal.

```
Welcome to use CooCox!
LED Blink Test: LED blink 5 times!
LED Blink Test OK!
UART Print Test:
UART Print Test OK!
I2C LM75 Digital Temperature Sensor Test:
The temperature is 25!
I2C Temperature Sensor Test OK!
All test ended!
_
```

5. If you need to reload the default factory program to the board, you can use CoFlash. Refer to: How to use CoLinkEx in CoFlash. Just load the “LPC11CxxTest.bin” to your board.

4. CoLinkEx Installation and Use

4.1 Installation

To install CoLinkEx, you need to do the following:

Update the firmware

Install the Driver of CoLinkEx

Connect CoLinkEx to PC

4.1.1 Update the firmware

If you are using CoMDKPlugin V1.4.0, CoIDE V1.4.0, or CoFlash V1.4.0, you need to update CoLinkEx driver and firmware before using CooCox CoLinkEx.

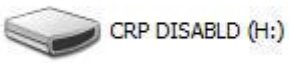
The firmware can be found in the disk: Tools\ColinkEx_Driver\ColinkEx_firmware_v0.4.bin

How to update the firmware:

1）Short-circuit JP1.

2）Connect CoLinkEx to the PC.

Wait for the PC enumerates the removable disk whose label is "CRP2 ENABLD" or "CRP DISABLD". If it does not, you could press the reset button (BP1) for several times or power on again.



Delete the firmware.bin file in removable disk.

3）Copy the downloaded firmware: ColinkEx_firmware_v0.4.bin into the removable disk.

4）Disconnect JP1, power on again, then CoLinkEx will work normally.

4.1.2 Install the Driver of CoLinkEx

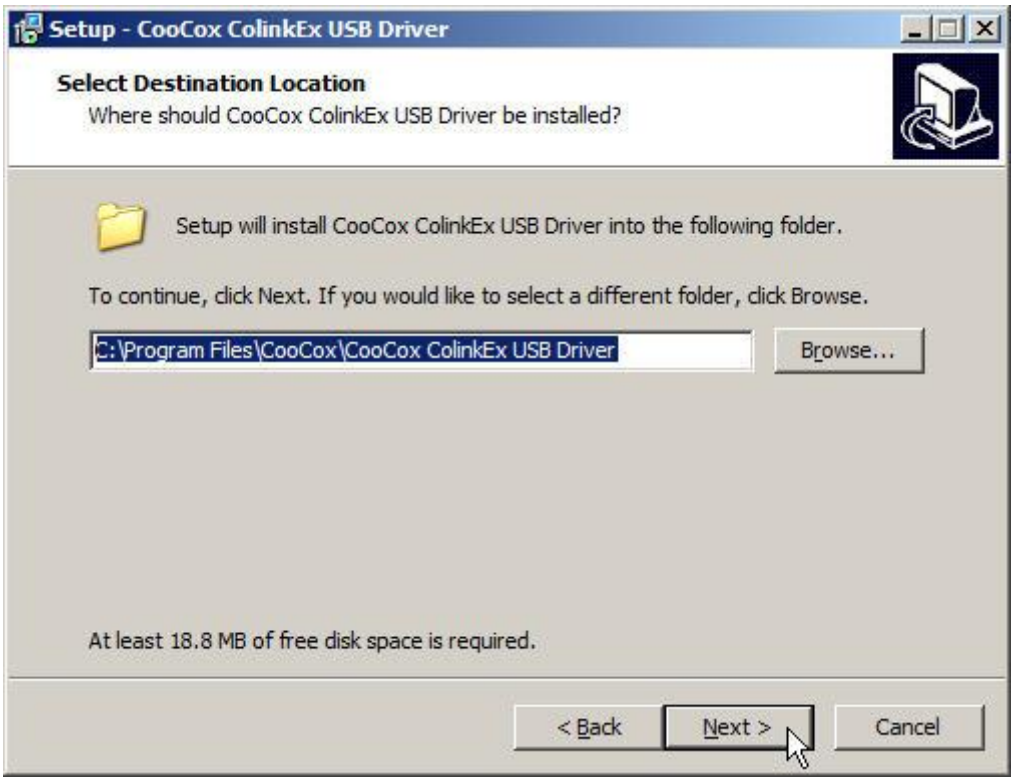
You need to select the version of CoLinkExUSBDriver according to your Windows OS first.

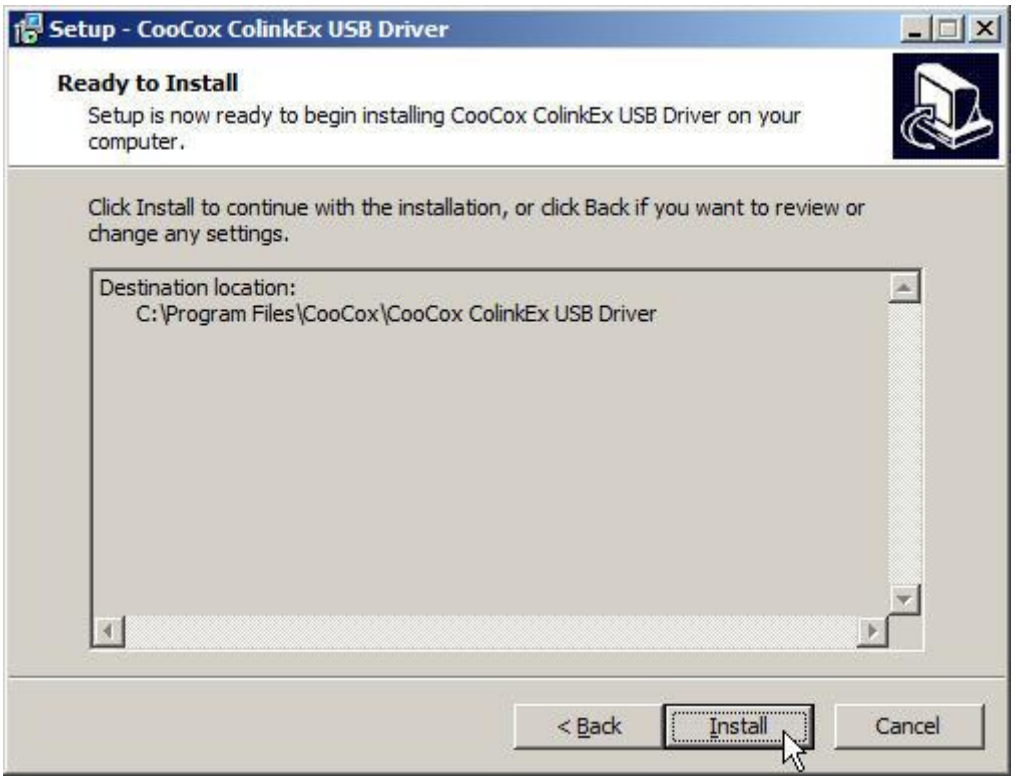
1） If you're using the 32 bit windows system, for example:

Windows XP/Windows Vista 32bit/Windows 7 32bit.

Installation file: Tools\ColinkEx_Driver\CoLinkExUsbDriver-1.1.0.exe

Do the operations shown in the following picture.


Setup - CooCox ColinkEx USB Driver
Select Destination Location
Where should CooCox ColinkEx USB Driver be installed?
Setup will install CooCox ColinkEx USB Driver into the following folder.
To continue, click Next. If you would like to select a different folder, click Browse.
C:\Program Files\CooCox\CooCox ColinkEx USB Driver
Browse...
At least 18.8 MB of free disk space is required.
< Back
Next >
Cancel


Setup - CooCox ColinkEx USB Driver
Ready to Install
Setup is now ready to begin installing CooCox ColinkEx USB Driver 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\CooCox\CooCox ColinkEx USB Driver
< Back
Install
Cancel

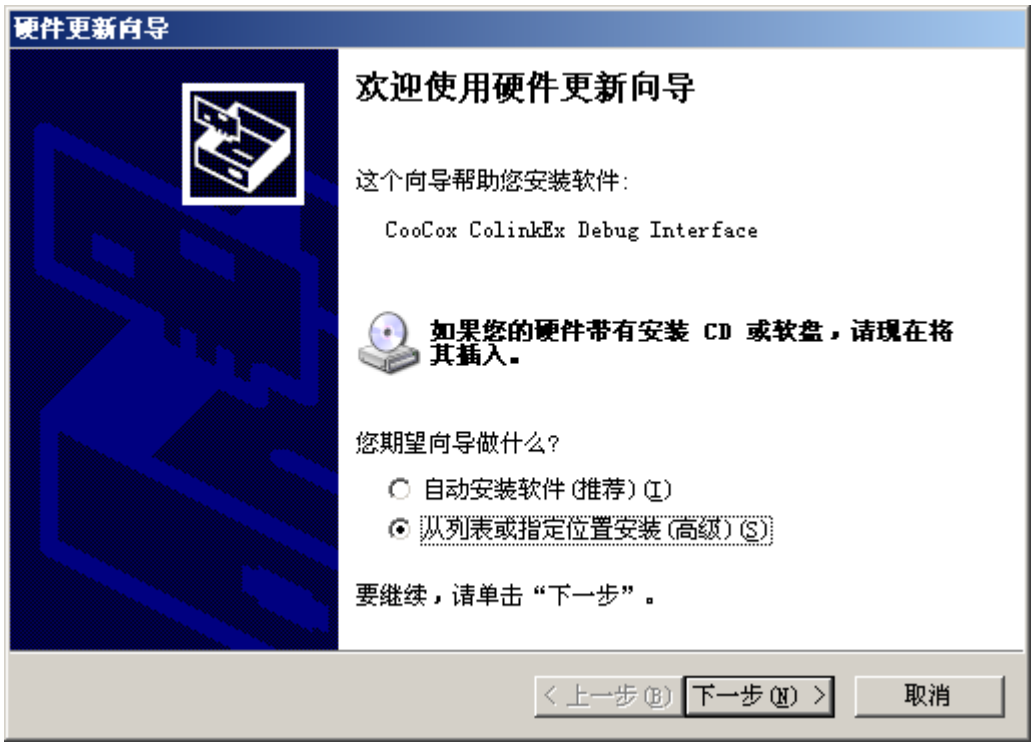
2） If you are using Windows Vista 64bit or Windows 7 64bit.

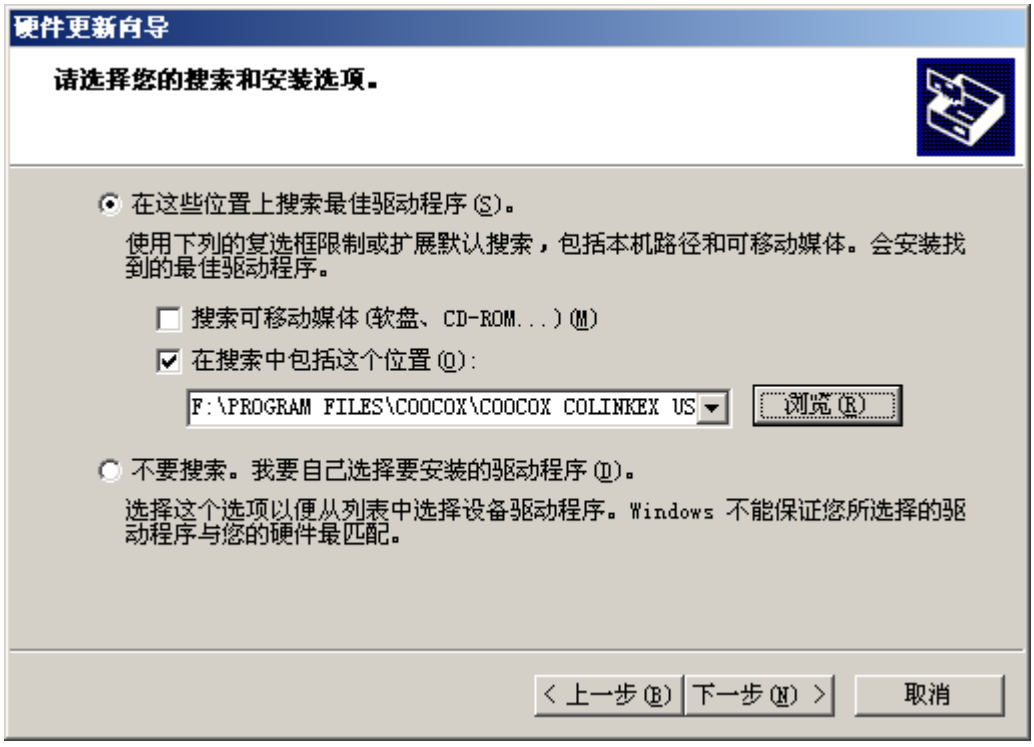
Installation file: Tools\ColinkEx_Driver \ColinkExUsbDriver-1.1.1.exe

Please connect CoLinkEx to the computer before you start installing this driver.

4.1.3 Connect CoLinkEx to PC

When you connect CoLinkEx to PC, it will ask you to install the driver to system for the new detected devices. Then you may need to specify the path for CoLinkEx Driver:





When you install the driver, in device manager, you will found CooCox（COM *x*）under Port and CooCox CoLinkEx Debug Interface under USB Controller.

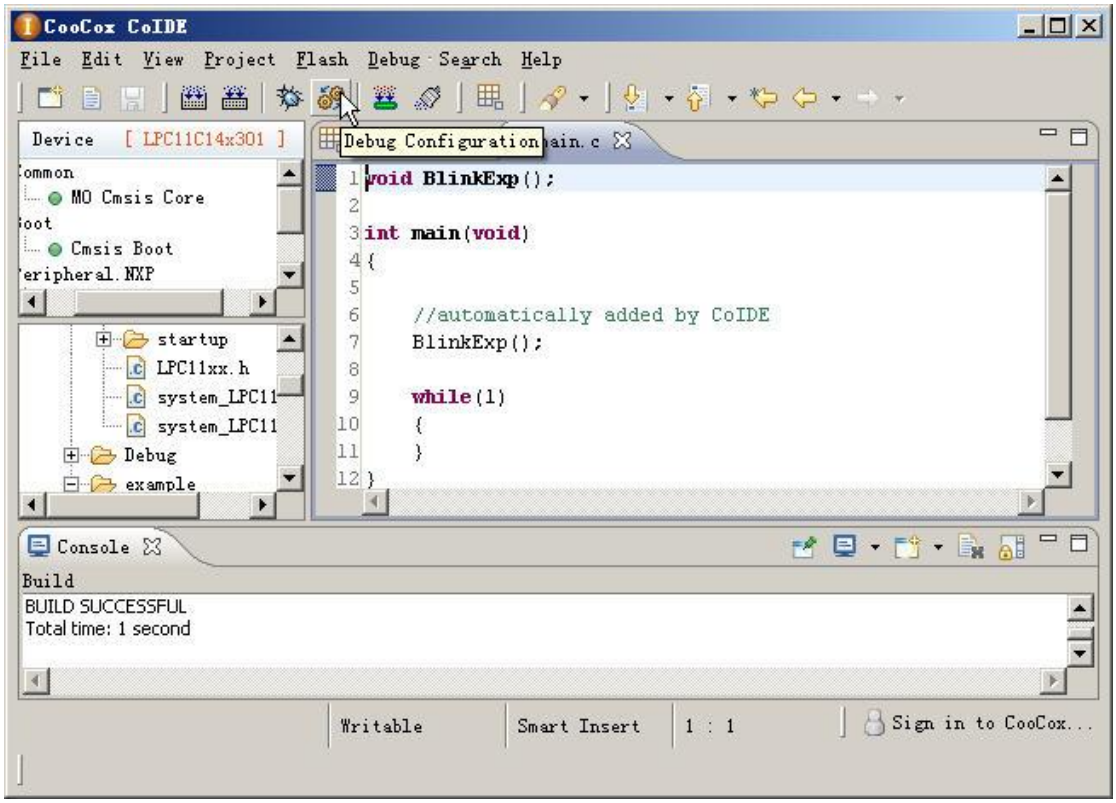
If there “?” in front of the two devices, it means that the driver have not been installed to the system or install failed; if there isn’t CooCox Port, it means that your CoLinkEx firmware and driver is old version.

4.2 Use CoLinkEx

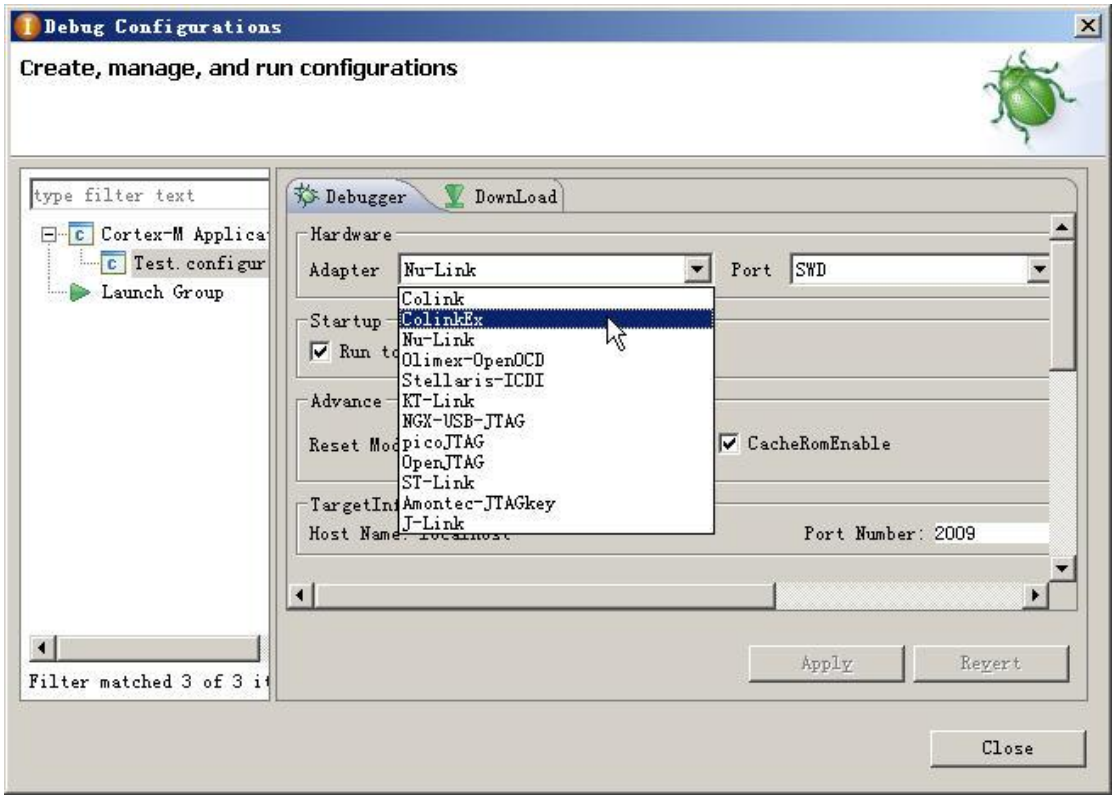
Now CoLinkEx support CoIDE, CoFlash 和 CoMDKPlugin. The following is the configuration to use CoLinkEx in this software.

4.2.1 How to use CoLinkEx in CoIDE

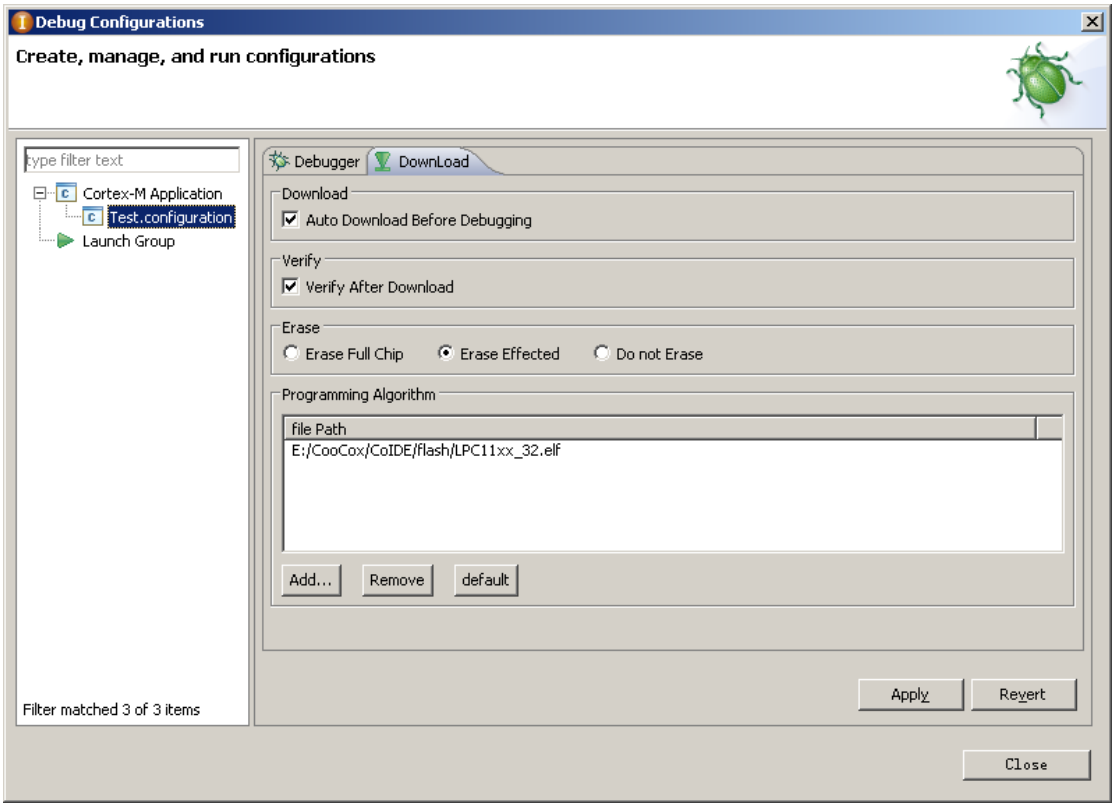
1) After create CoIDE Project, click Debug Configuration button:



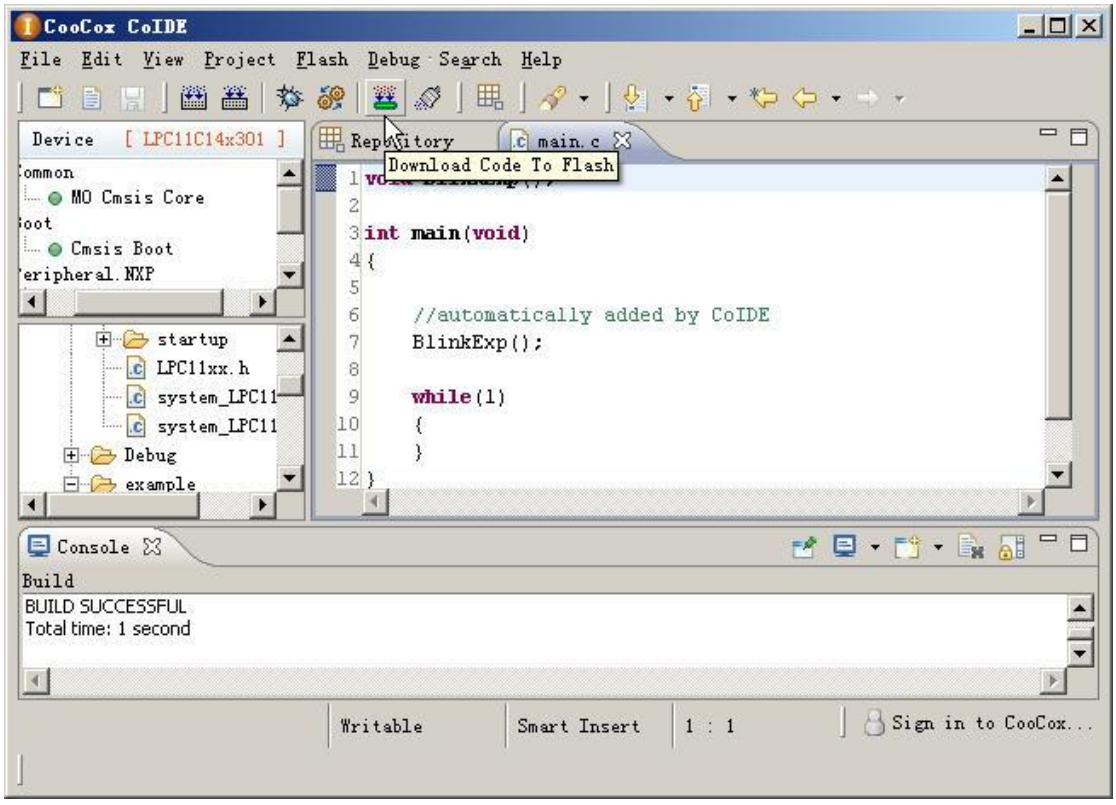
2) In “debug configuration” page, select CoLinkEx, and set other parameters.



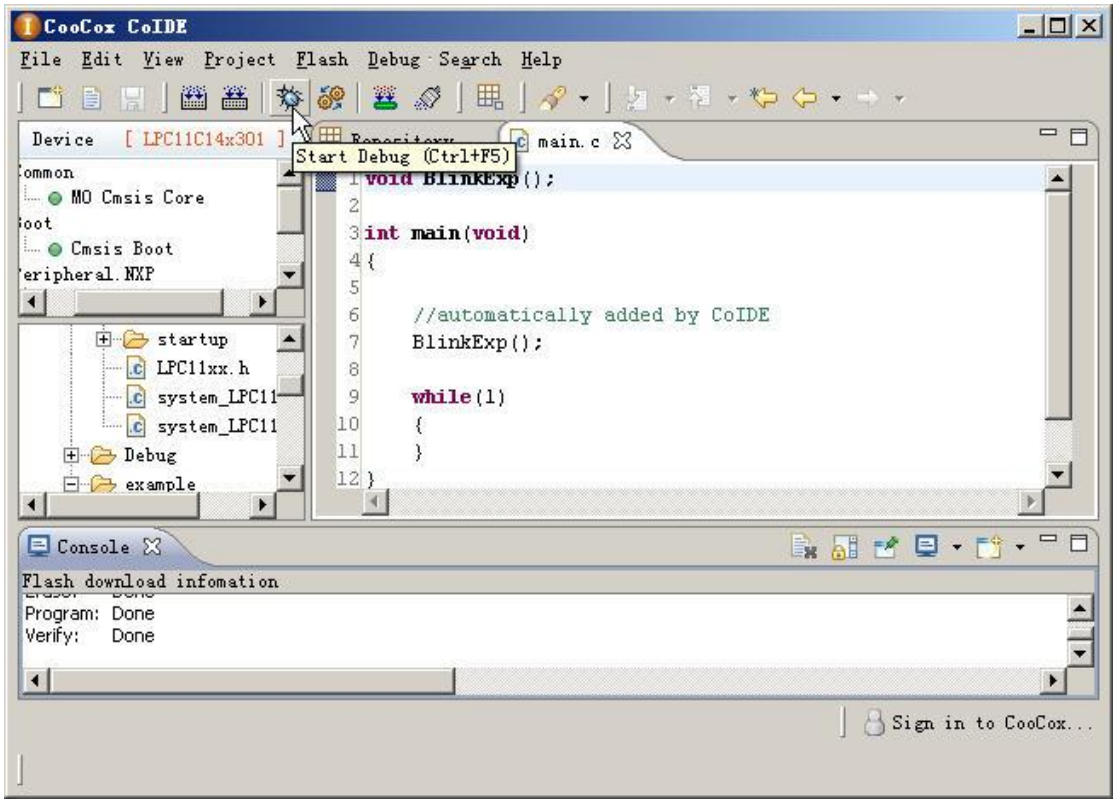
3) In Download page, configure the flash algorithm.



4) After compile the project, click the download button to Download code to Flash

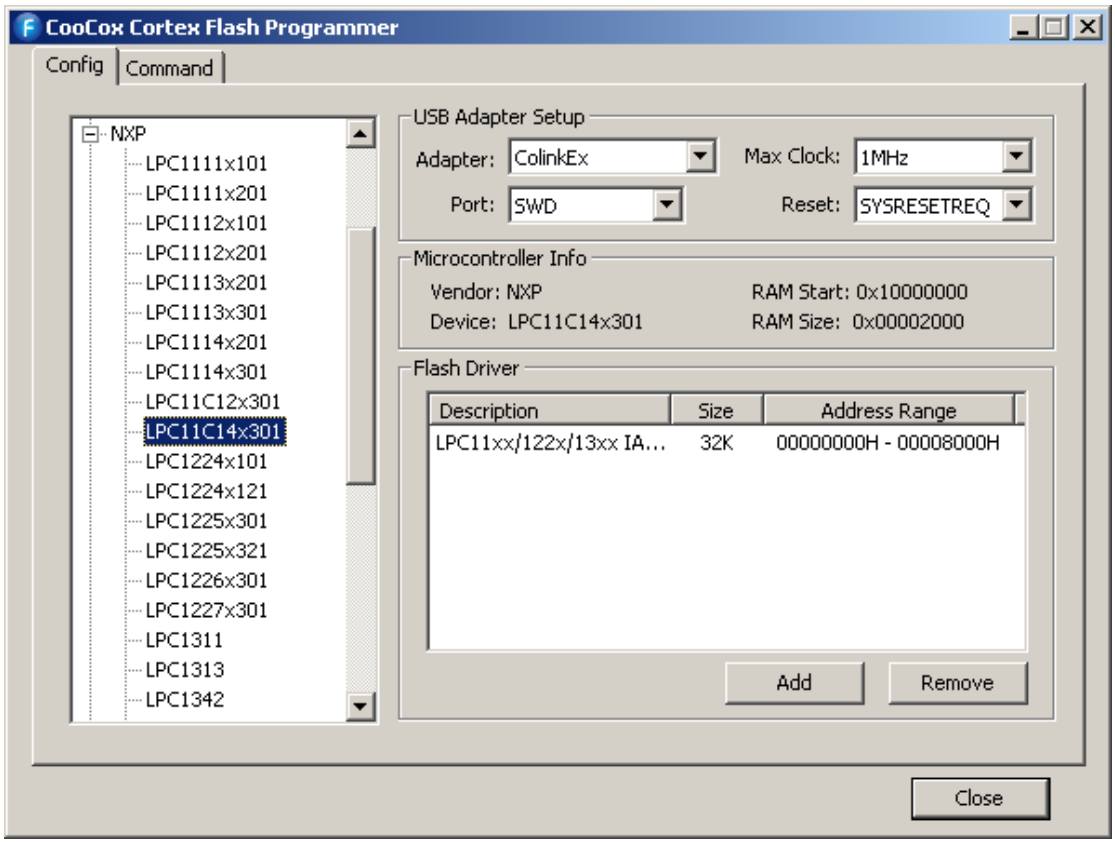


5) Click Debug button to debug the program.

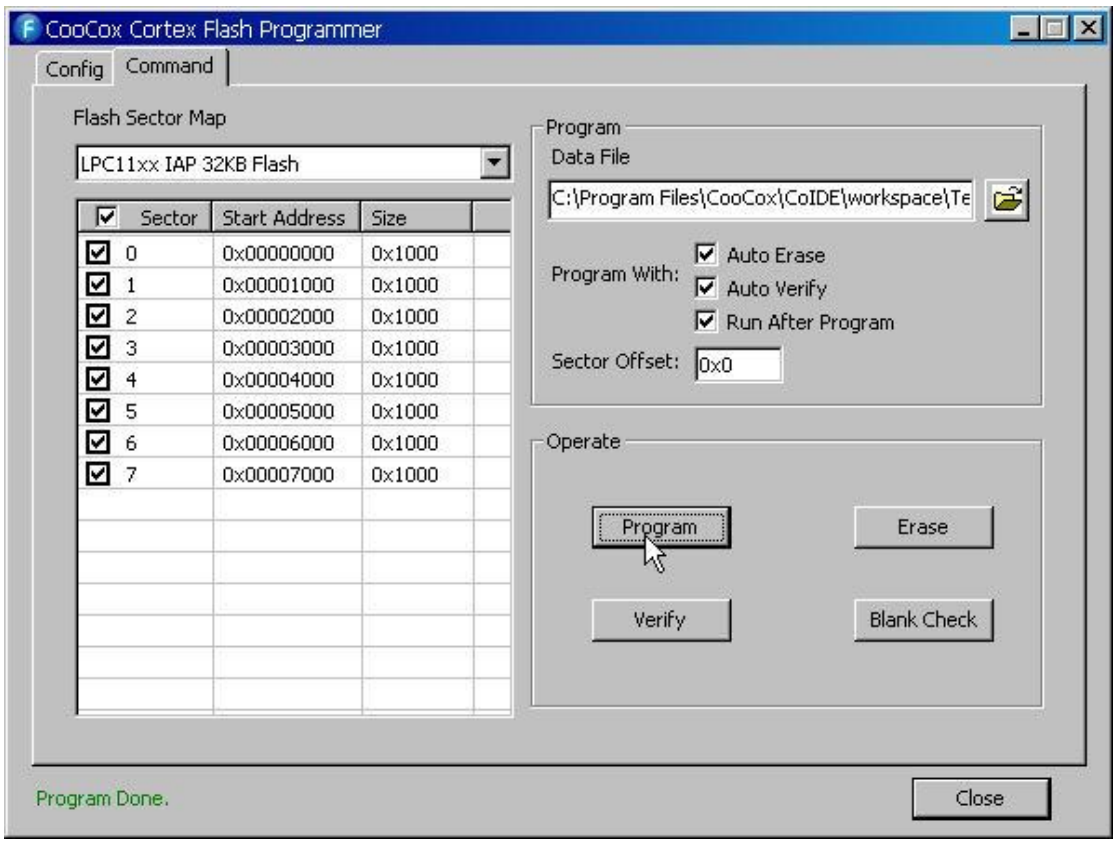


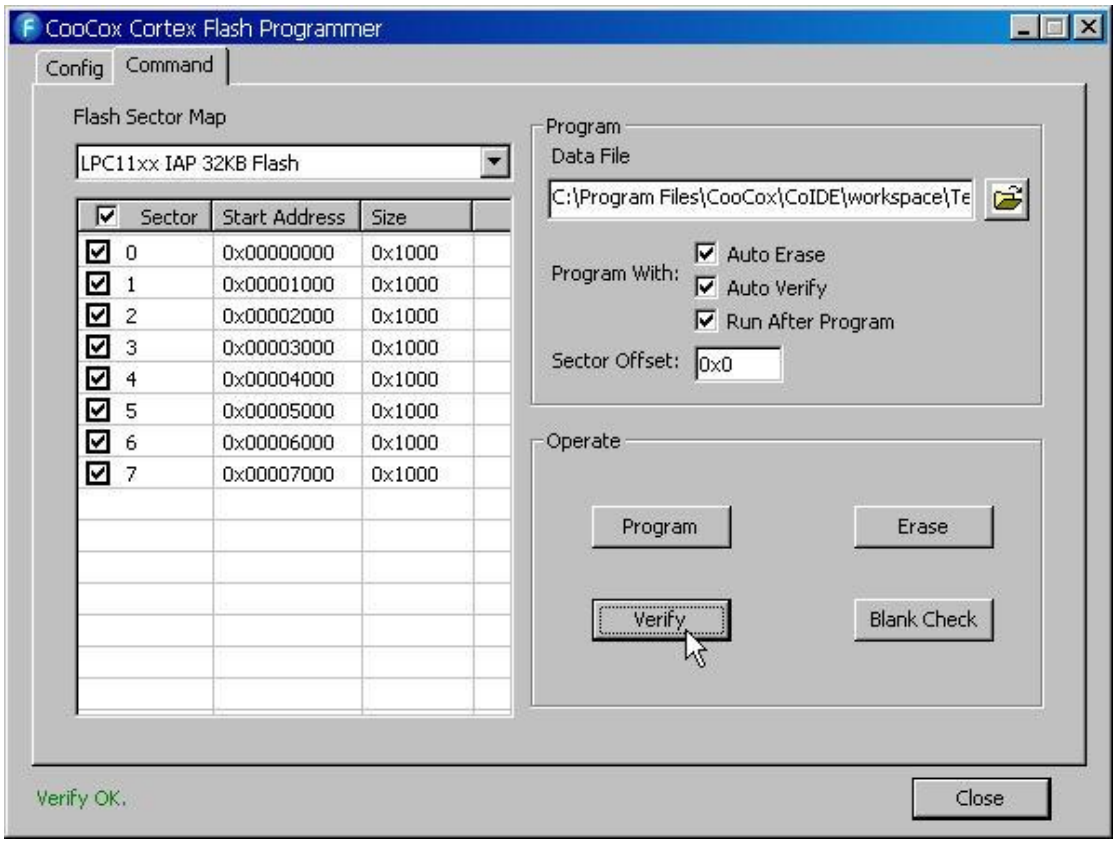
4.2.1 How to use CoLinkEx in CoFlash

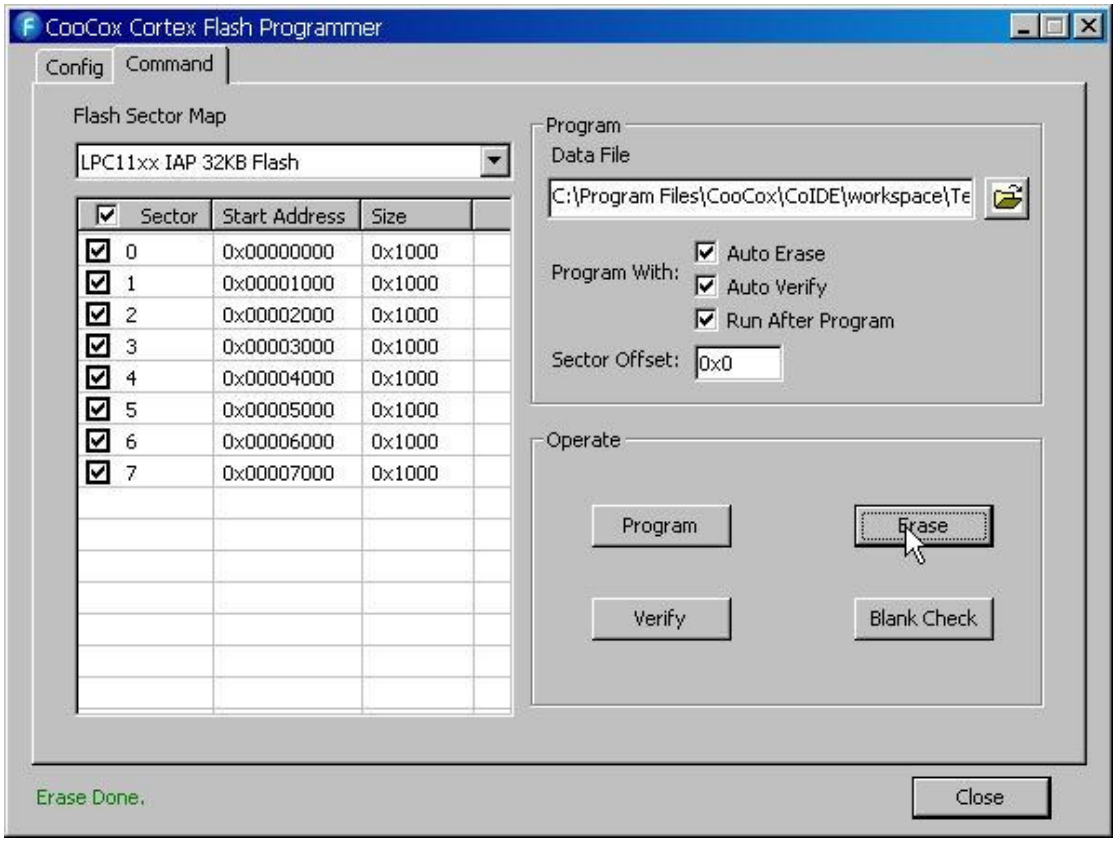
1) Open CoFlash, select LPC11C14x301 from NXP, CoLinkEx, and modify the related parameter if you need. You can refer to the following picture.

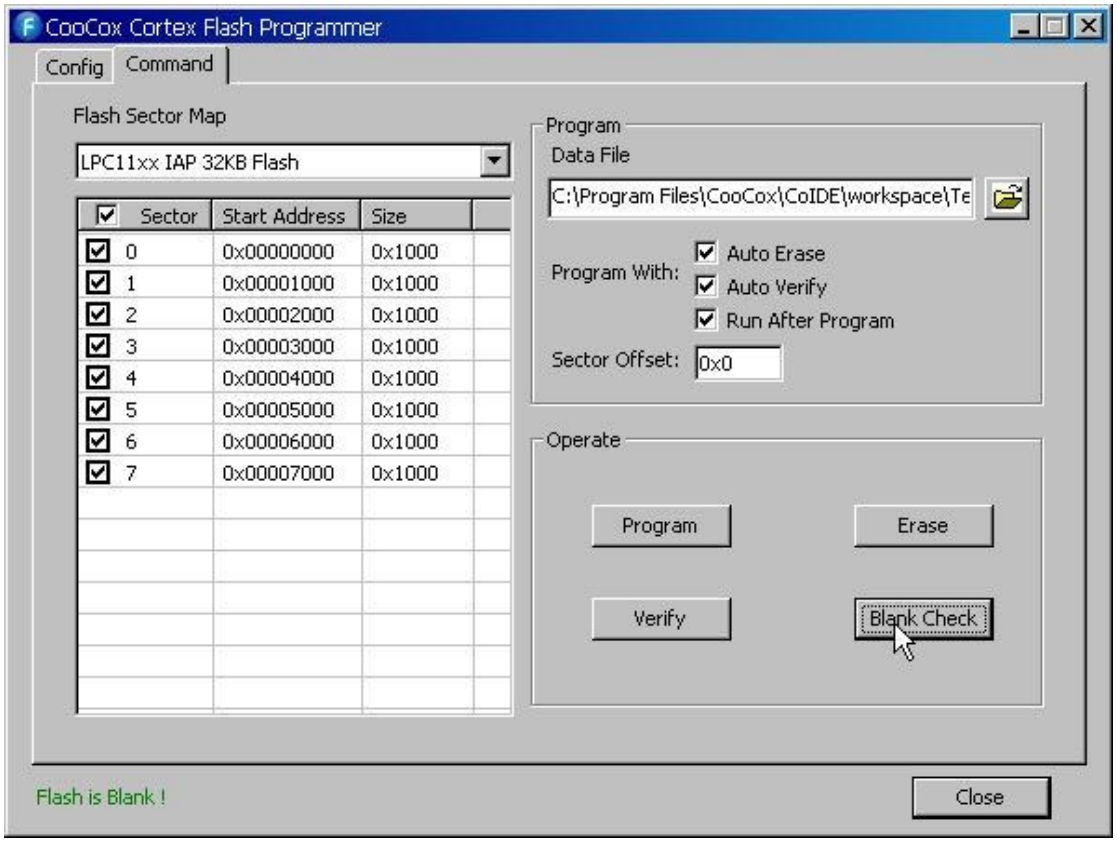


2) Switch to Download page to execute Download, Erase, Verify, Blank Check, etc.



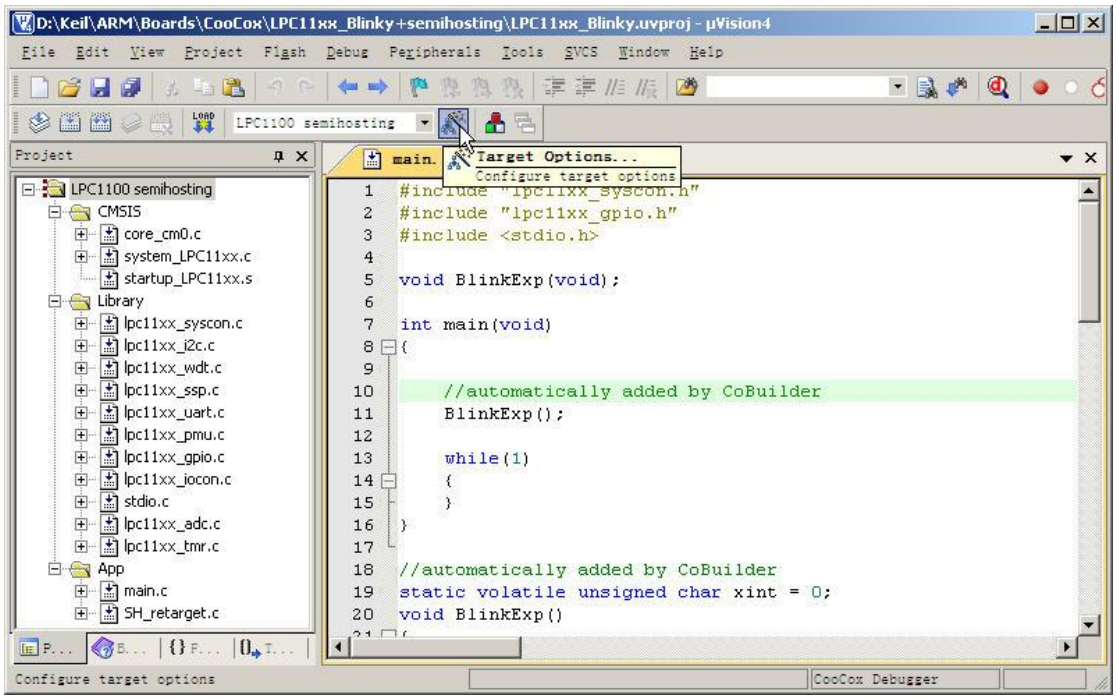



CooCox Cortex Flash Programmer
Config
Command
Flash Sector Map
LPC11xx IAP 32KB Flash
Sector
Start Address
Size
0 0x00000000 0x1000
1 0x00001000 0x1000
2 0x00002000 0x1000
3 0x00003000 0x1000
4 0x00004000 0x1000
5 0x00005000 0x1000
6 0x00006000 0x1000
7 0x00007000 0x1000
Program
Data File
C:\Program Files\CooCox\CoIDE\workspace\Te
Program With:
Auto Erase
Auto Verify
Run After Program
Sector Offset:
0x0
Operate
Program
Erase
Verify
Blank Check
Erase Done.
Close

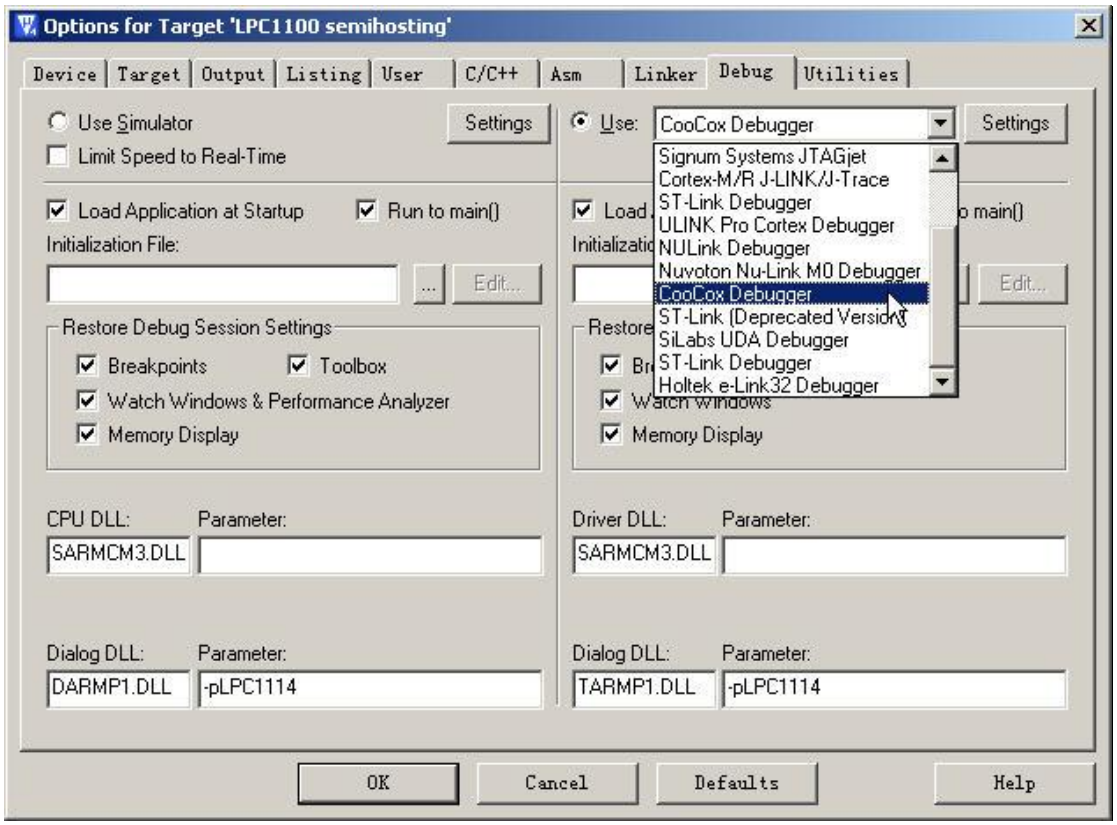

CooCox Cortex Flash Programmer
Config
Command
Flash Sector Map
LPC11xx IAP 32KB Flash
Sector
Start Address
Size
0 0x00000000 0x1000
1 0x00001000 0x1000
2 0x00002000 0x1000
3 0x00003000 0x1000
4 0x00004000 0x1000
5 0x00005000 0x1000
6 0x00006000 0x1000
7 0x00007000 0x1000
Program
Data File
C:\Program Files\CooCox\CoIDE\workspace\Te
Program With:
Auto Erase
Auto Verify
Run After Program
Sector Offset:
0x0
Operate
Program
Erase
Verify
Blank Check
Flash is Blank !
Close

4.2.2 How to use CoLinkEx in MDK

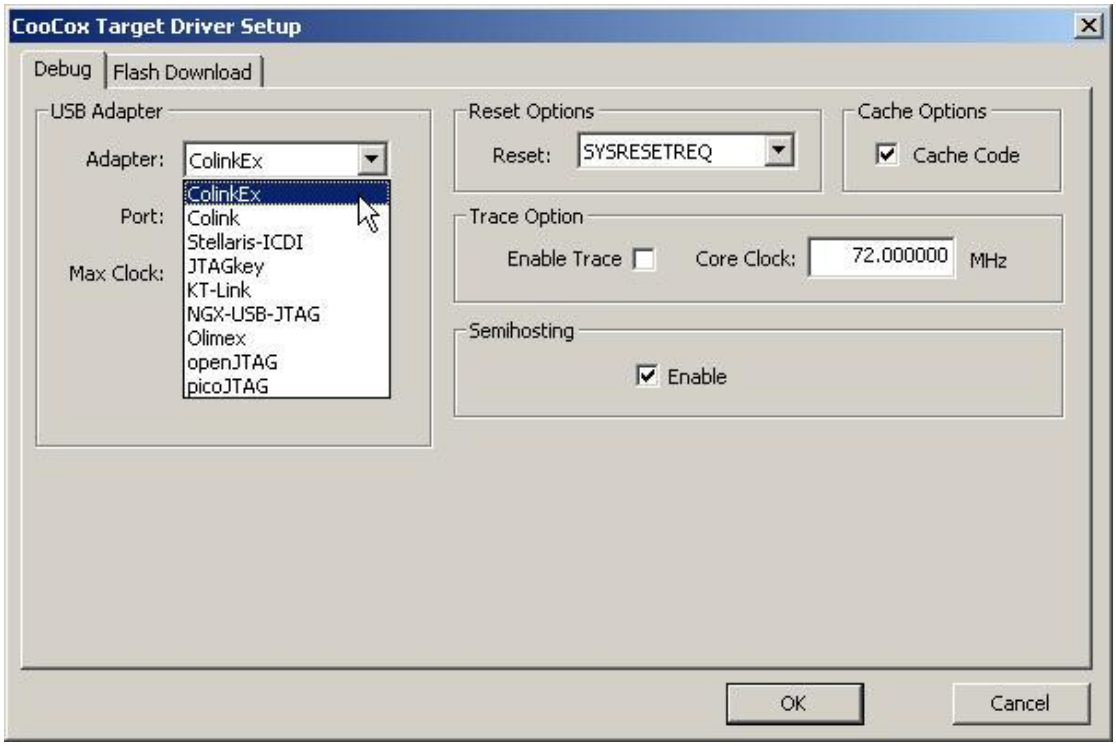
1) Open MDK Project, Click Target options to configure the project:



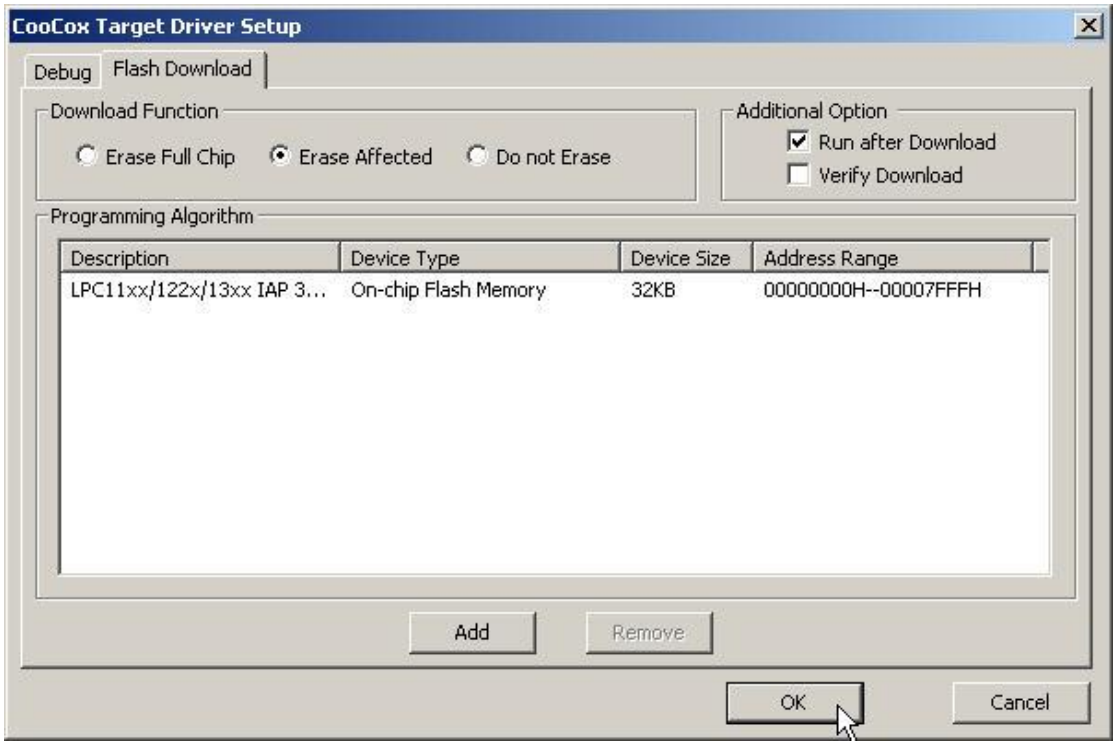
2) “Debug -> Use”, open the configuration dialog and selects "CooCox Debugger".



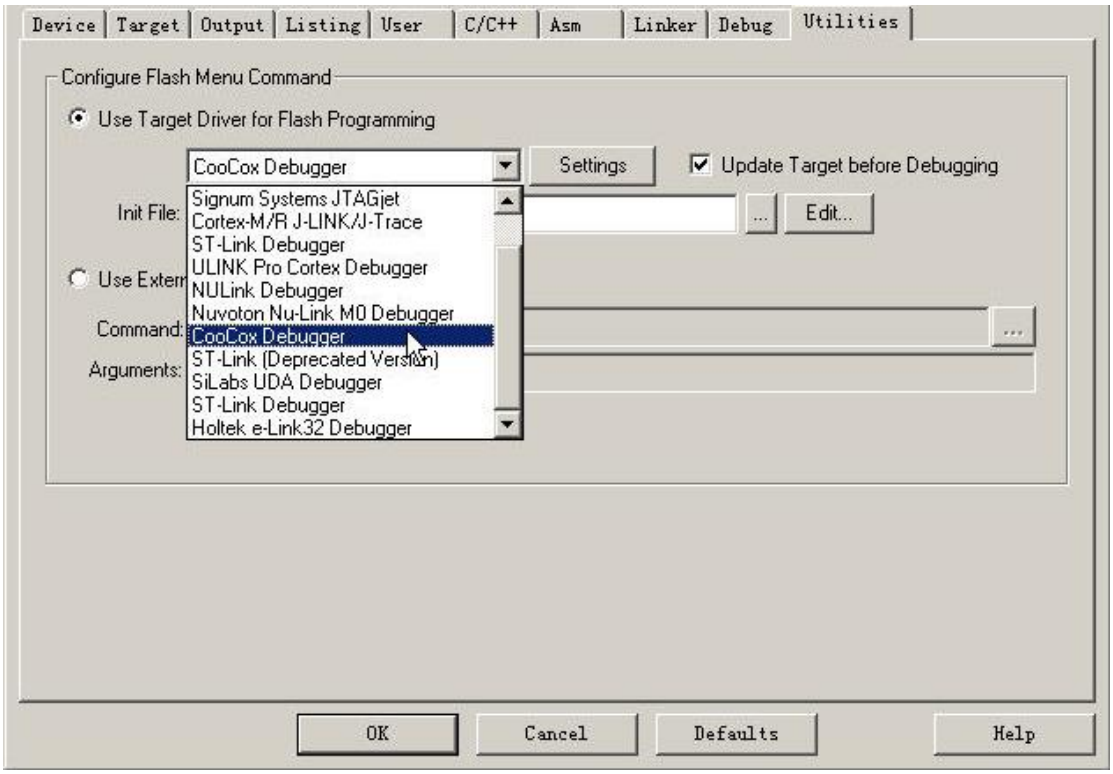
3) Click "Settings", and then select the “CoLinkEx” as the adapter. You can also modify the Port, Max Clock for the adapter, Reset, Cache, Trace or Semihosting Options, etc.



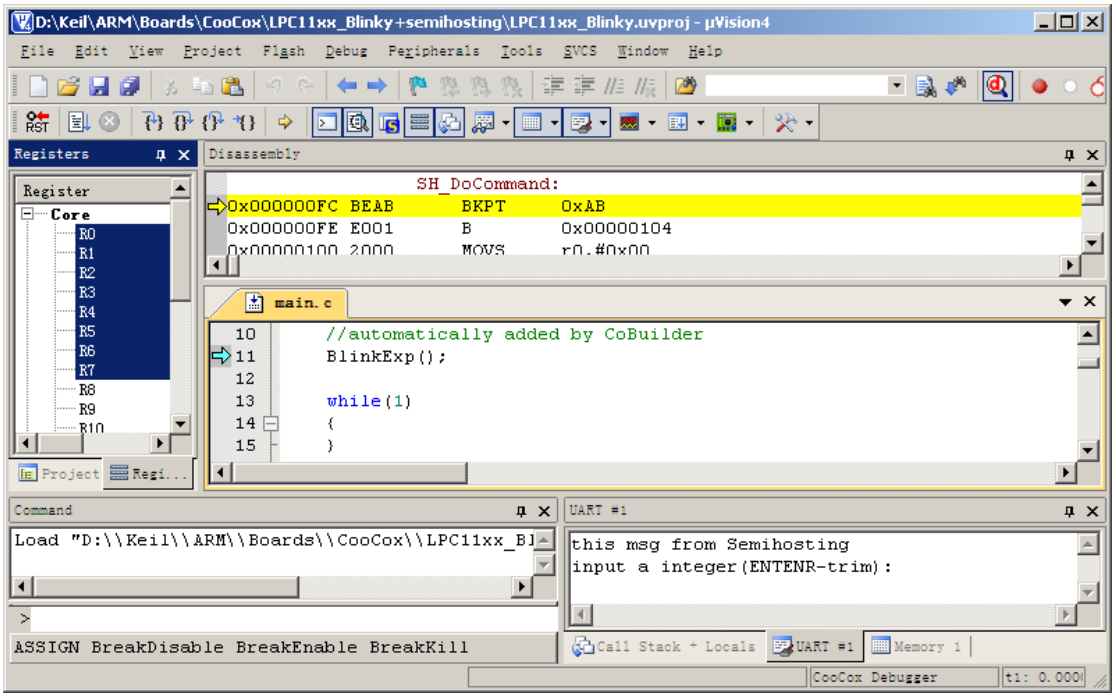
4) Switch to Flash Download to set the flash options and the flash algorithm.



5) Then, if you debug your program in flash, you also have to configure "Utilities" by selecting "CooCox Debugger" for Flash Programming.



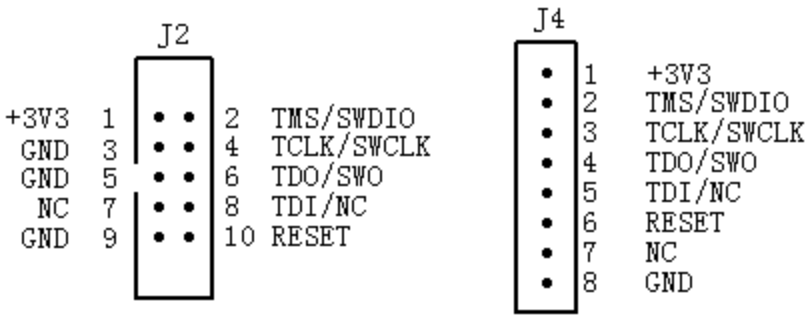
6) You can use the example for CoLinkEx_LPC11C14 EVB Kit directly. The project is included in the CoMDKPlugin. You can find it under the path: Keil\ARM\Boards\CooCox\LPC11xx_Blinky+semihosting



5. How to use CoLinkEx to debug other devices

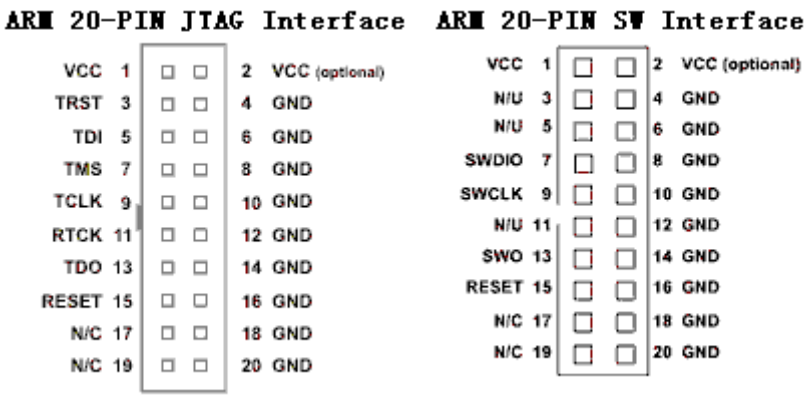
If you want to use CoLinkEx to program/debug other devices, you can break off the kit and use CoLinkEx alone. It is recommended to do that to avoid the disturbance come from the LPC1114 part. Then you can use the J2 or J4 to connect other devices.

5.1 CoLinkEx Debug Pin Description:



J2 is compatible with the standard ARM 10 PIN SW/JTAG Interface. So if you have the 10pin(2mm) to 20pin(2.54mm) connector, you can use it to connect J2 to ARM 20-PIN Interface directly.

5.2 Standard 20-PIN SW/JTAG Interface:



5.3 Connection method used in SW Debug:

Pin Function	CoLinkEx J2	CoLinkEx J4	ARM 20-PIN SW Interface
VCC (Optional)	1	1	1
SWDIO	2	2	7
SWCLK	4	3	9
SWO (Optional)	6	4	13

RESET	10	6	15
GND	3,5,9	8	4,6,…20

Note:

1) If you don't use ColinkEx to supply voltage to target board, VCC can be not connected.
2) If you don't need to use SW Trace function, SWO can be not connected.

5.4 Connection method used in JTAG Debug:

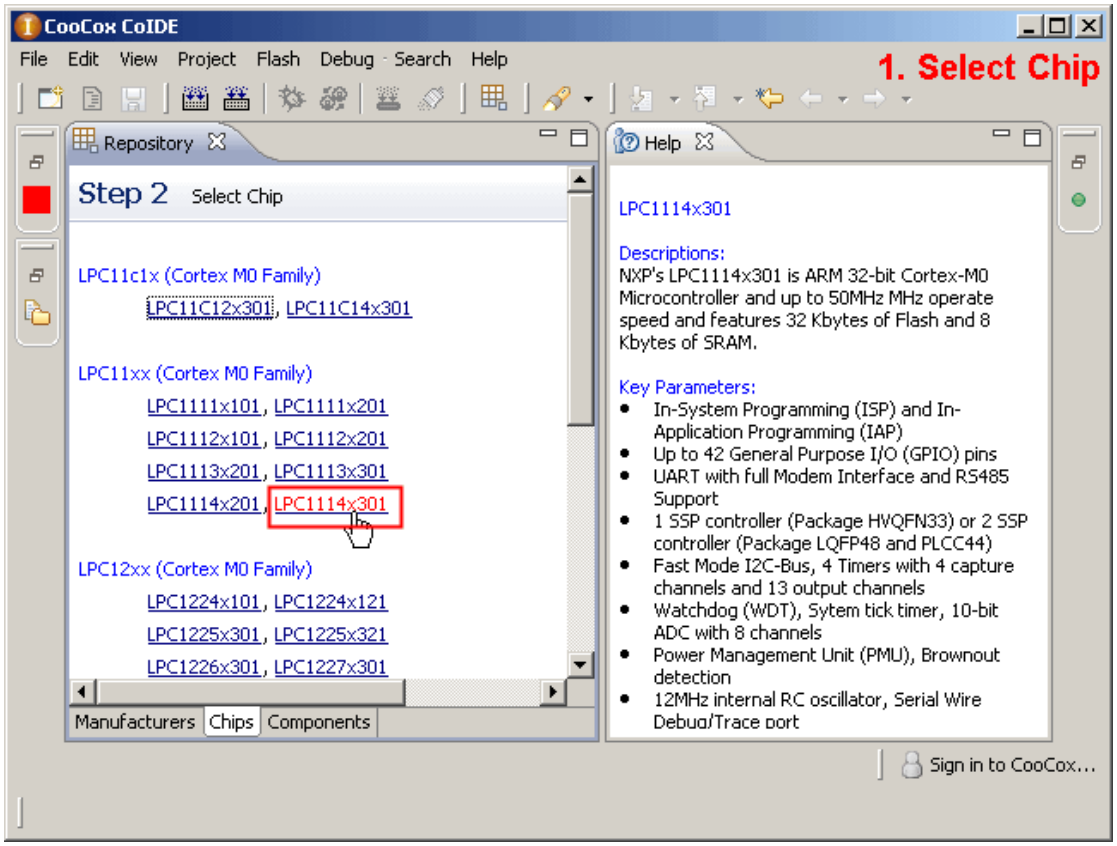
Pin Function	CoLinkEx J2	CoLinkEx J4	ARM 20-PIN JTAG Interface
VCC(Optional)	1	1	1
TMS	2	2	7
TCLK	4	3	9
TDO	6	4	13
TDI	8	5	5
RESET	10	6	15
GND	3,5,9	8	4,6,…20

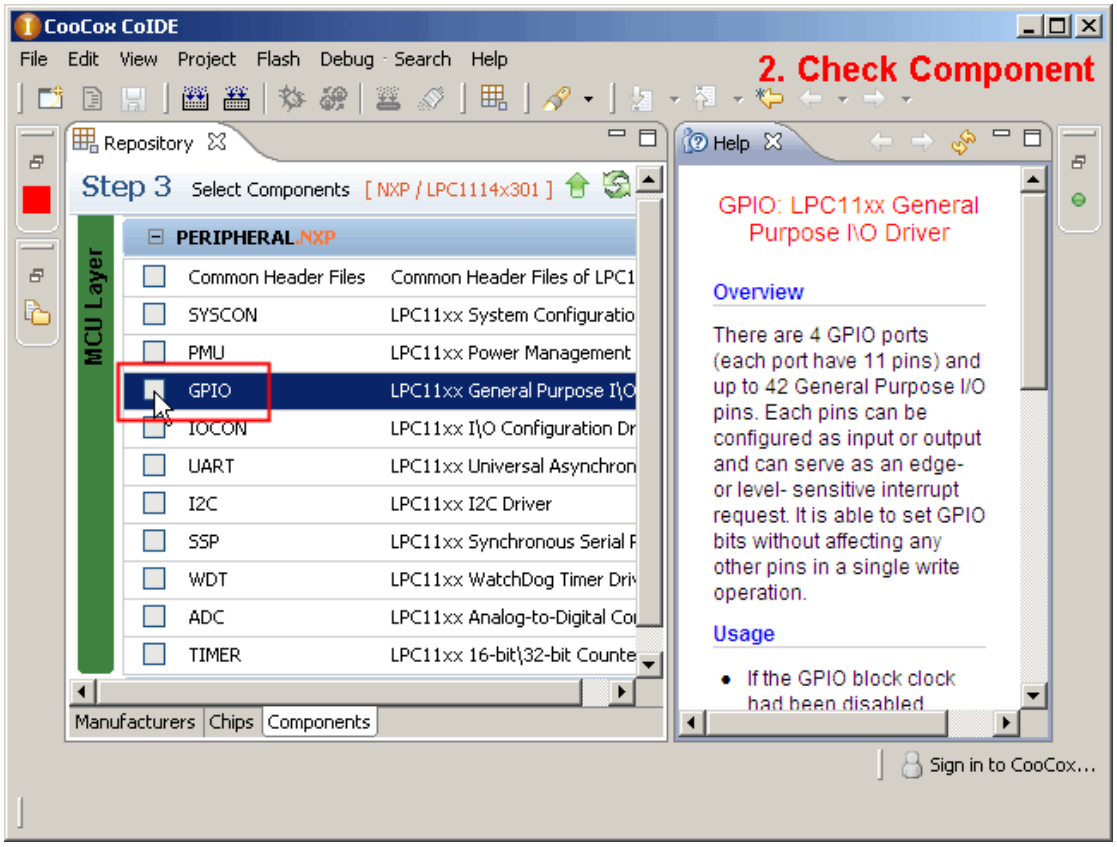
Note:

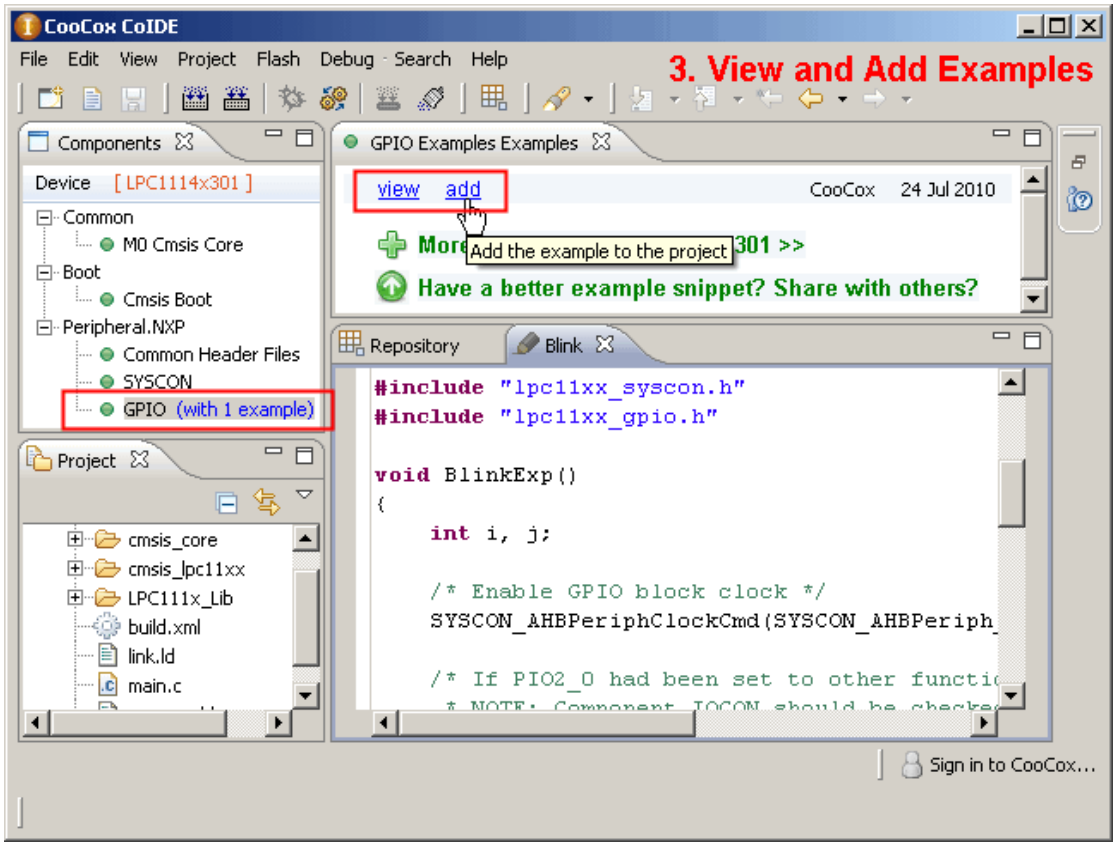
1) If you don't use CoLinkEx to supply voltage to target board, VCC can be not connected.

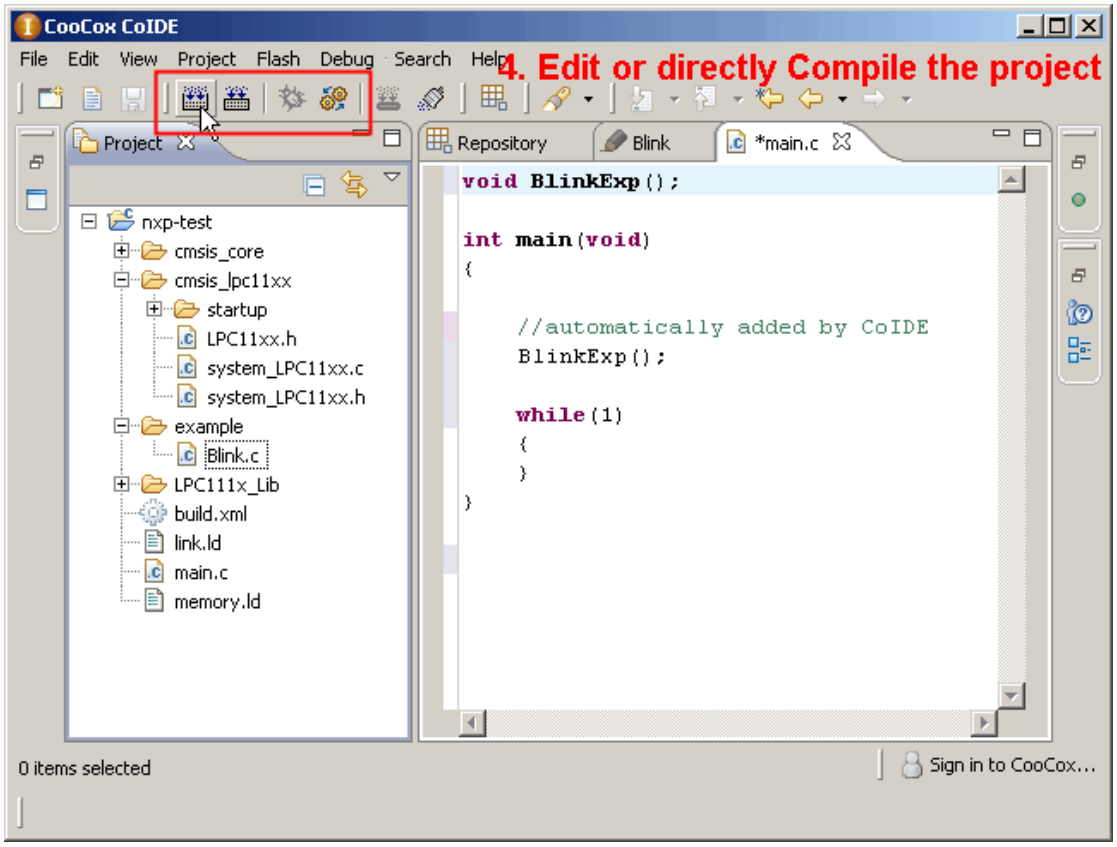
6. Examples

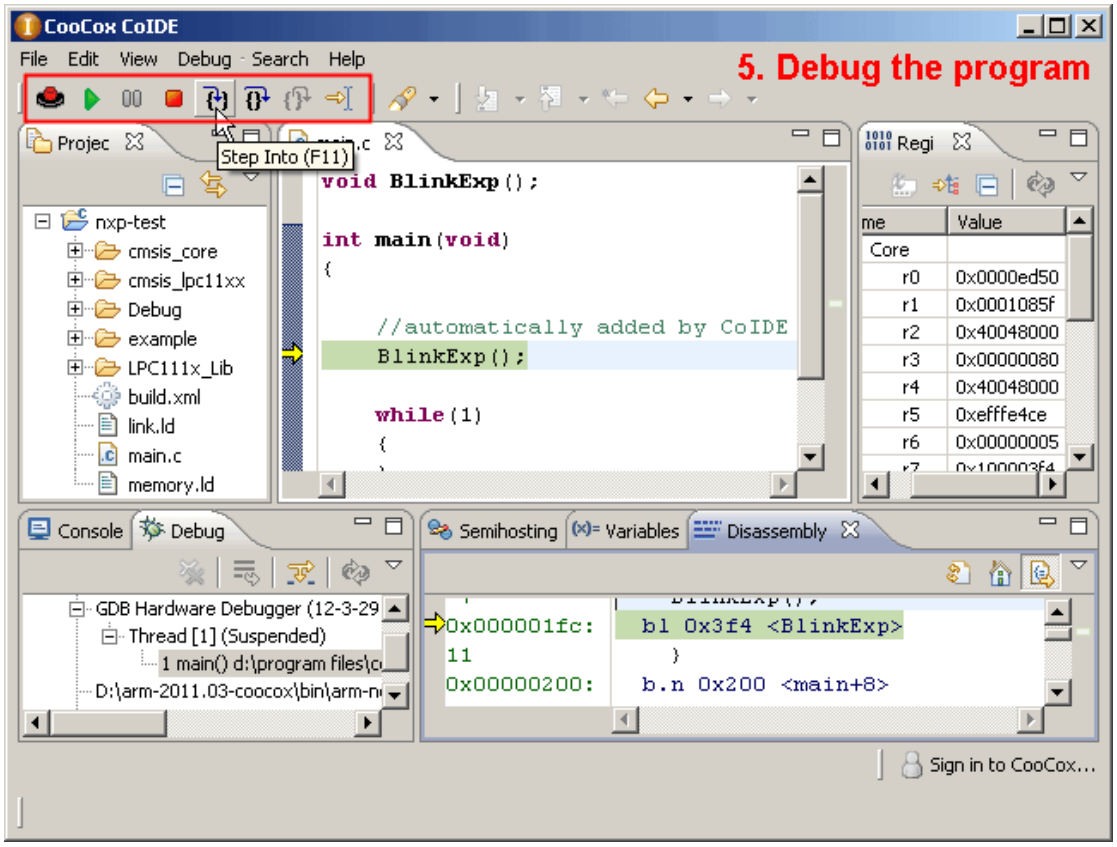
6.1 Use CoIDE to develop a project




CooCox CoIDE
File Edit View Project Flash Debug Search Help
2. Check Component
Repository
Step 3 Select Components [NXP / LPC1114x301]
MCU Layer
PERIPHERAL.NXP
Common Header Files Common Header Files of LPC1
SYSCON LPC11xx System Configuratio
PMU LPC11xx Power Management
GPIO LPC11xx General Purpose I\O
IOCON LPC11xx I\O Configuration Dr
UART LPC11xx Universal Asynchron
I2C LPC11xx I2C Driver
SSP LPC11xx Synchronous Serial F
WDT LPC11xx WatchDog Timer Dri
ADC LPC11xx Analog-to-Digital Co
TIMER LPC11xx 16-bit\32-bit Counte
Manufacturers Chips Components
Help
GPIO: LPC11xx General Purpose I\O Driver
Overview
There are 4 GPIO ports (each port have 11 pins) and up to 42 General Purpose I/O pins. Each pins can be configured as input or output and can serve as an edge- or level- sensitive interrupt request. It is able to set GPIO bits without affecting any other pins in a single write operation.
Usage
If the GPIO block clock had been disabled
Sign in to CooCox...


CooCox CoIDE
File Edit View Project Flash Debug Search Help
3. View and Add Examples
Components
Device [LPC1114x301]
Common
M0 Cmsis Core
Boot
Cmsis Boot
Peripheral.NXP
Common Header Files
SYSCON
GPIO (with 1 example)
GPIO Examples Examples
view add
CooCox 24 Jul 2010
Add the example to the project
Have a better example snippet? Share with others?
Repository
Blink
#include "lpc11xx_syscon.h"
#include "lpc11xx_gpio.h"
void BlinkExp()
{
int i, j;
/* Enable GPIO block clock */
SYSCON_AHBPeriphClockCmd(SYSCON_AHBPeriph
/* If PIO2_0 had been set to other functi
Project
cmsis_core
cmsis_lpc11xx
LPC111x_Lib
build.xml
link.ld
main.c
Sign in to CooCox...


CooCox CoIDE
File Edit View Project Flash Debug Search Help
4. Edit or directly Compile the project
Project
Repository
Blink
*main.c
nxp-test
cmsis_core
cmsis_lpc11xx
startup
LPC11xx.h
system_LPC11xx.c
system_LPC11xx.h
example
Blink.c
LPC111x_Lib
build.xml
link.ld
main.c
memory.ld
void BlinkExp();
int main(void)
{
//automatically added by CoIDE
BlinkExp();
while(1)
{
}
}
0 items selected
Sign in to CooCox...


CooCox CoIDE
File Edit View Debug Search Help
5. Debug the program
Step Into (F11)
Projec
Regi
nxp-test
cmsis_core
cmsis_lpc11xx
Debug
example
LPC111x_Lib
build.xml
link.ld
main.c
memory.ld
void BlinkExp();
int main(void)
{
//automatically added by CoIDE
BlinkExp();
while(1)
{
Value
Core
r0 0x0000ed50
r1 0x0001085f
r2 0x40048000
r3 0x00000080
r4 0x40048000
r5 0xefffe4ce
r6 0x00000005
Console
Debug
Semihosting
Variables
Disassembly
GDB Hardware Debugger (12-3-29
Thread [1] (Suspended)
1 main() d:\program files\c
D:\arm-2011.03-coocox\bin\arm-n
0x000001fc: bl 0x3f4 <BlinkExp>
11 }
0x00000200: b.n 0x200 <main+8>
Sign in to CooCox...

You can also go to our website for more information:

CoIDE Quick Start Guide: http://www.coocox.org/CoIDE/CoIDE_QuickStart.htm

CoIDE Guide: http://www.coocox.org/CooCox_CoIDE.htm

6.2 CoIDE Example Description

6.2.1 Blinky

The example shows how to use the LPC111x PIO API to drive a LED.

This example mainly uses the SYSCON and GPIO components. It enable GPIO block clock and set PIO2_9 to be output and blinking. You can see the D4 Blinking when you load the project to board.

6.2.2 UART_Print

A simple example shows how to use the UART to print a string.

It sends a "Hello, World!" to UART Interface. After using the Serial line to connect J8 to the DB9 COM on the computer, you can see the result in HyperTerminal.

The HyperTerminal's configuration must be:

Baud rate: 115200

Parity: NONE

Data bits: 8 bits

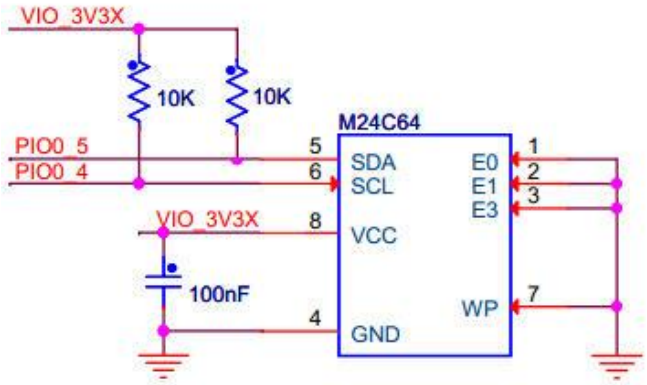
Stop bits: 1 bit

You can see "Hello, World!" in the HyperTerminal screen after you press the reset button BP2.

6.2.3 Master_Transfer

This example describes how to configure I2C working in master mode, and Read/Write EEPROM using I2C bus. The example sends some data to EEPROM and then read back.

To use this example, you need to connect LPC11C14 board with an EEPROM: M24C64. Here is the recommended connection:



6.2.4 WDT_Reset

A simple WDT reset example, if TIM_MatchConfigStruct. MatchValue is greater than 8, Watchdog reset will occur. (Component TMR should be checked). It has no phenomenon on board.

6.2.5 Simple_ADC

A simple ADC example.

It use ADC Channel 5 to get data, users can select to printf the data through UART printf. (Need to set UART and retarget printf.)

6.2.6 Capture

A simple example to use TIMER capture function

Use PIO1_5 as the TMR32B0 Capture pin, capture on CAPn.0 rising edge and falling edge, Generate capture interrupt. You can use printf to get the capture value in the interrupt function. (Need to set UART and retarget printf.)

6.2.7 Printchar for NXP

Retarget printf to UART of the LPC1100 and LPC11C00 series. If you want to use printf function in your code, you need to select the “Retarget Printf” component. And use the Printchar function to replace the one in Printf.c.

6.2.8 Semihosting

This example is a little different from others. If you want to use Semihosting function, you need to use the example. Then in your application, you can use printf function to print the code to Semihosting IP. You should enable the Semihosting function in debug configuration. Then in debug mode, Semihosting will work. It works only in Debug mode.

This example shows how to retarget printf to Semihosting output. It cannot be add directly. You need to copy the content of PrintChar to the PrintChar function in printf.c

It means that you need to use the following code in the example:

```
#include "semihosting.h"


void PrintChar(char c)

{

    /* Send a char like:

     While (Transfer not completed);

     Transmit a char;

    */

    SH_SendChar(c);

}
```

To replace the following in printf.c:

```
void PrintChar(char c)

{

    /* Send a char like:

     While (Transfer not completed);

     Transmit a char;

    */

}
```

6.2.9 CoOS_App_Framework

A simple example shows how to create task, init and start CoOS. This example cannot be automatically added to the application code.

To use this example, you must note the following issues:

CoOS is just an OS, to make it work on LPC11C14, you need to add CMSIS Boot code at least.

The example contains a main function, so you may need to delete the main.c or move the main function to that file.

The example is a simple example tells you how to create task, init and start CoOS. It shows no phenomenon on board. To get more CoOS Applications for that board, you can go to: http://www.coocox.org/CoOS.htm