VSIDE User's Manual

Revision 2.01

Aug 4, 2010

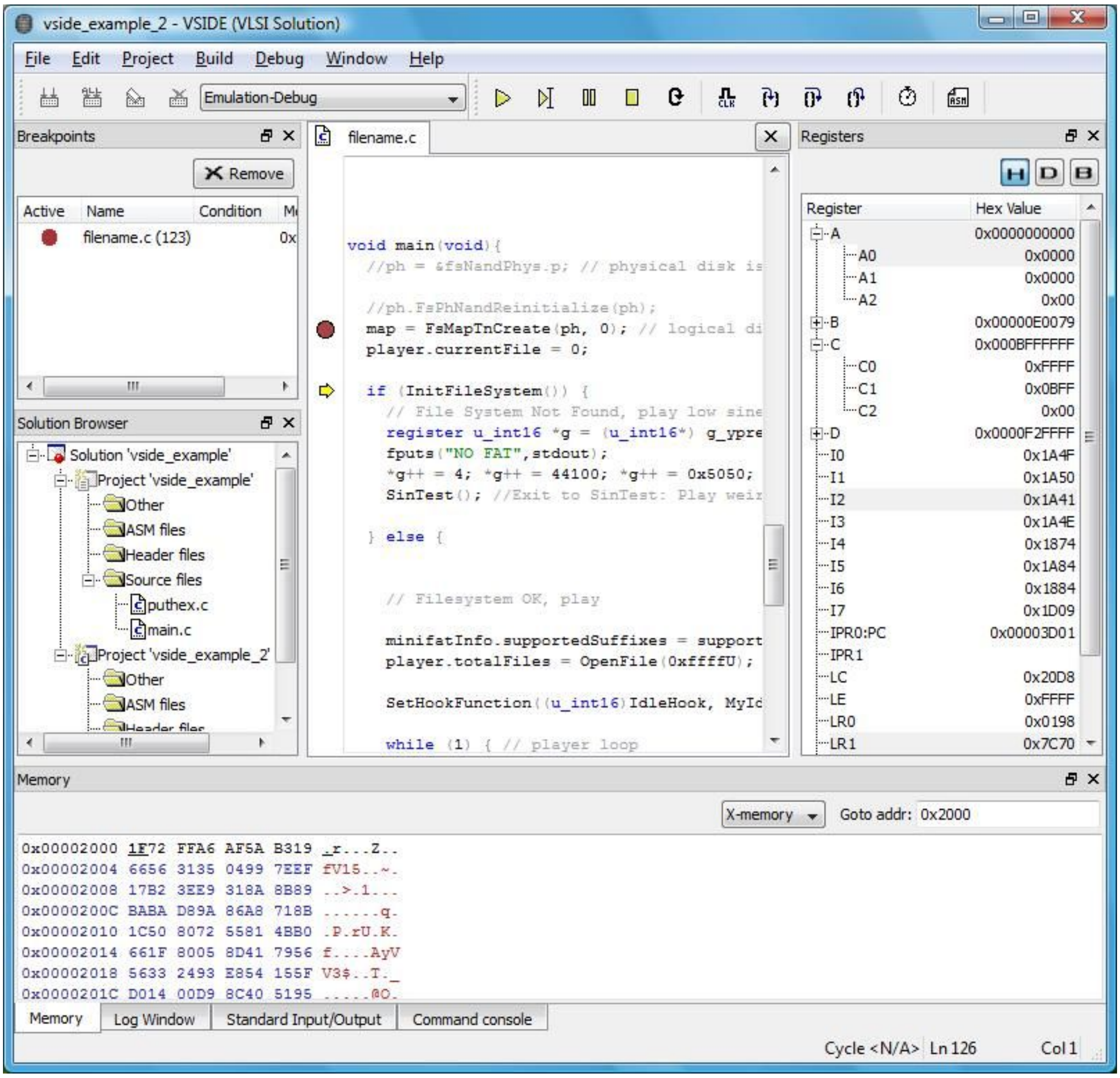
Revision history:

Rev.	**Date**	**Description**
1.00	04/08/2003	First edition
1.01	04/15/2003	Typo corrections
2.00	04/07/2008	VSIDE 2.00b, complete rewrite
2.01	08/04/2010	VSIDE 2.01 update

Table of Contents

1. Introduction

VSIDE is an integrated software development environment for VLSI Solution's DSP cores.



Active	Name	Condition	M
●	filename.c (123)		0x

```
void main(void){
  //ph = &fsNandPhys.p; // physical disk is

  //ph.FsPhNandReinitialize(ph);
  map = FsMapTnCreate(ph, 0); // logical di
  player.currentFile = 0;

  if (InitFileSystem()) {
    // File System Not Found, play low sine
    register u_int16 *g = (u_int16*) g_ypre
    fputs("NO FAT",stdout);
    *g++ = 4; *g++ = 44100; *g++ = 0x5050;
    SinTest(); //Exit to SinTest: Play weir

  } else {


    // Filesystem OK, play

    minifatInfo.supportedSuffixes = support
    player.totalFiles = OpenFile(0xffffU);

    SetHookFunction((u_int16)IdleHook, MyIc

    while (1) { // player loop
```

Register	Hex Value
A	0x0000000000
A0	0x0000
A1	0x0000
A2	0x00
B	0x00000E0079
C	0x000BFFFFFF
C0	0xFFFF
C1	0x0BFF
C2	0x00
D	0x0000F2FFFF
I0	0x1A4F
I1	0x1A50
I2	0x1A41
I3	0x1A4E
I4	0x1874
I5	0x1A84
I6	0x1884
I7	0x1D09
IPR0:PC	0x00003D01
IPR1	
LC	0x20D8
LE	0xFFFF
LR0	0x0198
LR1	0x7C70

Goto addr: 0x2000

```
0x00002000 1F72 FFA6 AF5A B319 _r...Z..
0x00002004 6656 3135 0499 7EEF fV15..~.
0x00002008 17B2 3EE9 318A 8B89 ..>.1...
0x0000200C BABA D89A 86A8 718B ......q.
0x00002010 1C50 8072 5581 4BB0 .P.rU.K.
0x00002014 661F 8005 8D41 7956 f....AyV
0x00002018 5633 2493 E854 155F V3$..T._
0x0000201C D014 00D9 8C40 5195 .....@O.
```

1.1. Features

- Integrated development environment (IDE) for VSDSP cores, including:
    - project management
    - code editor (with syntax highlighting)

  - C compiler
  - assembler
  - debugger
- C and assembly level debugging using hardware emulator (and/or simulator)
- Two-point profiling (simulator only)
- System simulation using C-modeled custom peripherals
- Multi-OS support: Windows XP / Vista, Red Hat Linux (available upon request)

1.2. Requirements

Windows:

- Microsoft Windows XP Professional (SP2) or Windows Vista
- PC x86 architecture

Linux:

- Red Hat Linux 7.0 (or newer)
- PC x86 architecture

2. Installation

2.1. Installing under Windows

Make sure you have administrator privileges and run **vside_win32.exe** to start setup. Please read the license agreement carefully and click agree to proceed. The installer will prompt for a destination directory, typically “C:\Program Files\VSIDE” is a good choice.

After the installation completes, VSIDE shortcut should appear in the start menu. Click the shortcut to launch VSIDE.

Installer will also deploy automatic un-installer program which can be invoked from the start menu as well.

2.2. Installing under Linux

1) Unpack VSIDE tar.gz package to any directory. This directory is now referred as VSIDE.

E.g. Installing package at /tmp/ to /usr/local/:

```
cd /usr/local
tar xfvz /tmp/vside_linux.tar.gz
```

2) Set VSDSP_DIR environment variable to point to VSIDE/config.

For bash:

```
VSDSP_DIR=/usr/local/vside/config
export VSDSP_DIR
```

For csh or tcsh:

```
setenv VSDSP_DIR  /usr/local/vside/config
```

3) Add VSIDE/bin path to $PATH. Without this, compiling won't work in IDE.

For bash:

```
PATH=/usr/local/vside/bin:$PATH
export PATH
```

For csh or tcsh:

```
setenv PATH /usr/local/vside/bin:PATH
```

4) CD to VSIDE path and run VSIDE:

```
cd vside
./vside
```

3. Getting started with VSIDE

3.1. Introduction

This chapter describes the basics of VSIDE. If you have used similar integrated development environments before, you may find that you're already familiar with most of the content. The C programming language will be used throughout this chapter; any experience or knowledge on low-level programming of the VSDSP cores is not required.

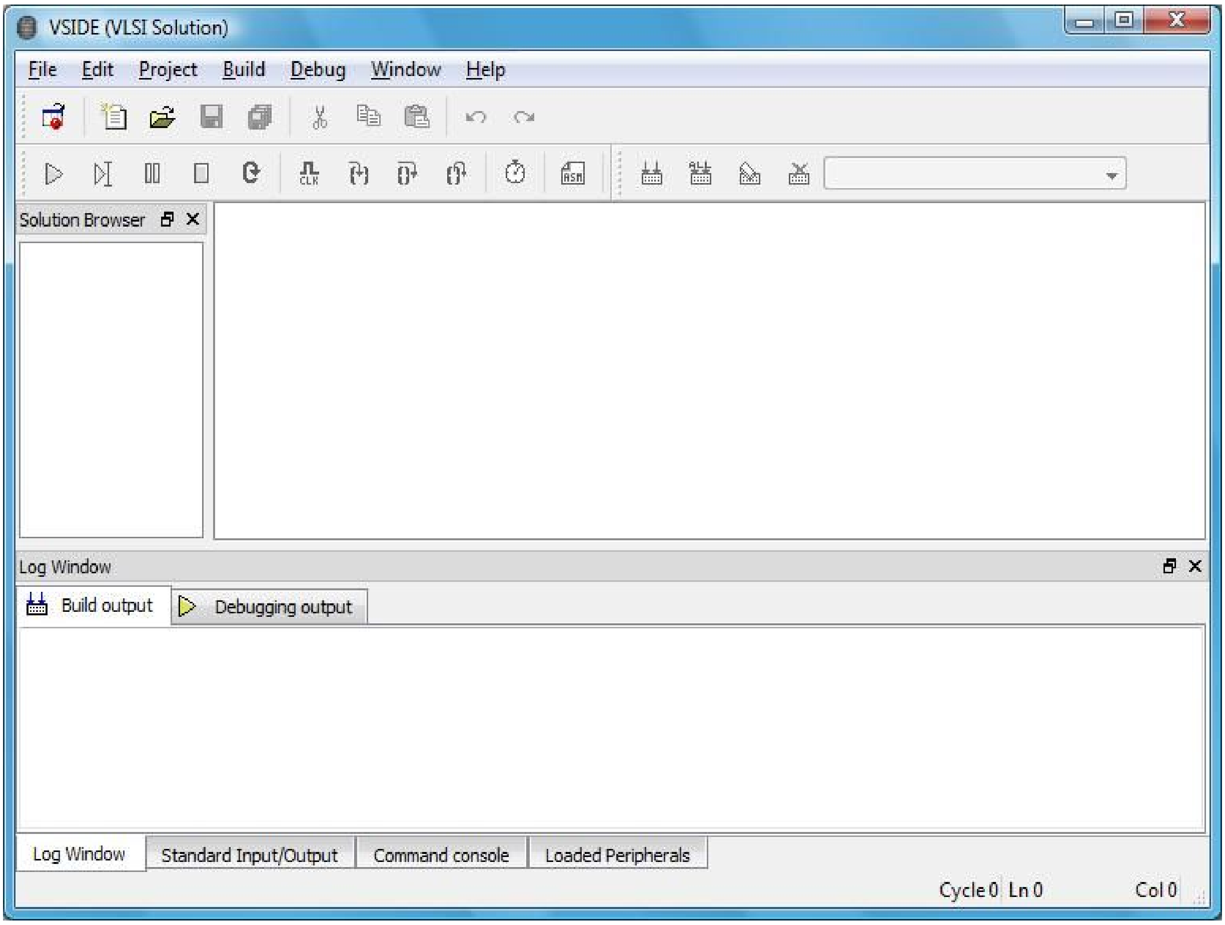
As an exercise we will create a “Hello world” project. With this project we will learn how to execute code and how to use the basic debugging features.

The target platform for this tutorial will be VLSI Solution's versatile audio chip, *VS1053*, which will be used through a hardware emulator. You will need a functional VS1053 developer board connected to your system in order to follow the exercise properly. If you do not have one, you can purchase it from the VLSI Web Store.

To begin the tutorial, start up VSIDE.

The main window should look something like the illustration below.

All windows are empty and most features are disabled, since no projects are open.



3.2. Creating a project

Let's start the tutorial by creating the “Hello world” project.

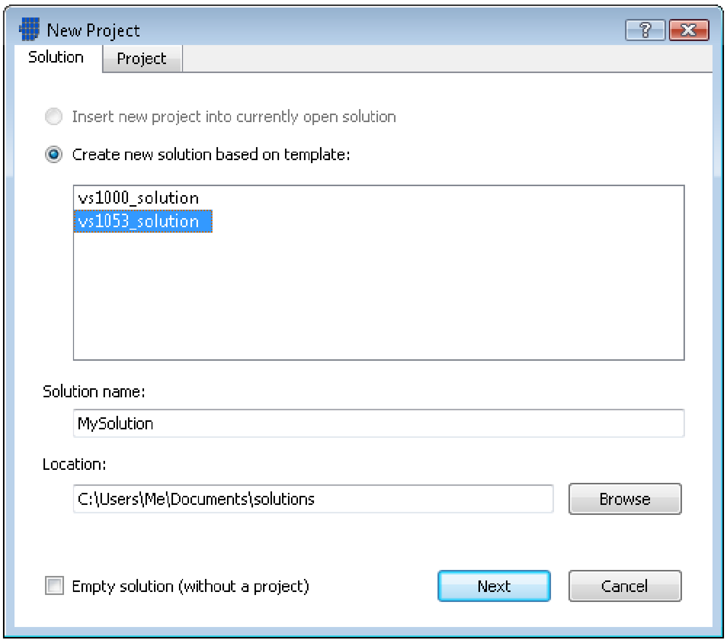
The easiest way to create a new project is to use a project template which contains “main.c” source file and proper project settings.

- **Under the *File* menu, click *New* and then click *Project/solution*.**

A “New Project” dialog will appear (illustrated below[*]).

The first task is to define a host solution for the project. A solution is a logical entity which contains hardware-specific options (emulation settings for example) for the project. Each VSIDE project must be associated with exactly one solution. A solution, on the other hand, can contain any number of projects.

- **Check the radio button *“Create new solution based on template”* and select *“vs1053_solution”.***
- **Enter a memorable name for the solution (e.g. “hello”)**



○ Insert new project into currently open solution

● Create new solution based on template:

vs1000_solution
vs1053_solution

Solution name: MySolution

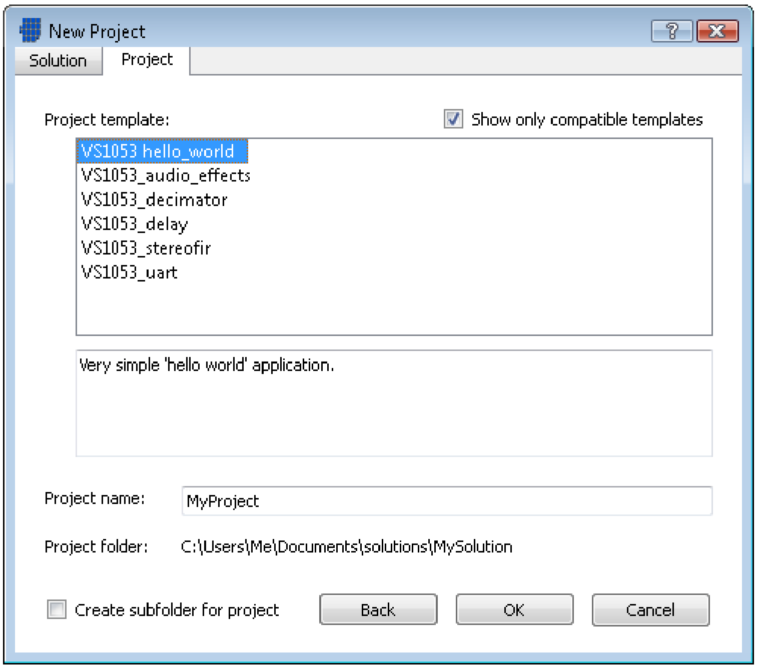
Location: C:\Users\Me\Documents\solutions

□ Empty solution (without a project)

- **Click *Next***

[*] please note that the actual set of available templates may differ as VLSI solution's product family evolves

Now you will see a list of available project templates. Content of the list varies depending on which solution type was selected. To display all project templates, uncheck *"Show only compatible templates"* option.



Project template: ☑ Show only compatible templates

VS1053 hello_world
VS1053_audio_effects
VS1053_decimator
VS1053_delay
VS1053_stereofir
VS1053_uart

Very simple 'hello world' application.

Project name: MyProject

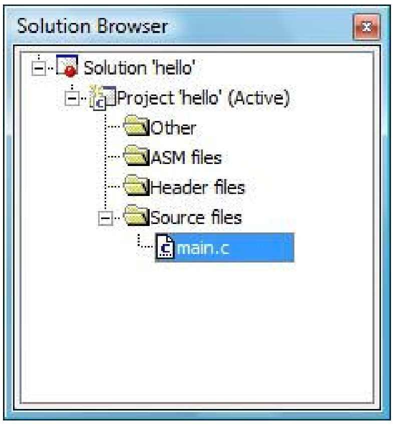
Project folder: C:\Users\Me\Documents\solutions\MySolution

□ Create subfolder for project

A short description of each alternative is available below the list box.

- **Select *"vs1053 hello_world"* as the starting point and click OK to dismiss the project creation dialog.**

Shortly, the solution browser will populate with the new project, "hello", which is located under a solution with the same name. *Solution browser* displays the solution and project hierarchy, as well as all the related source files (in this case, there is only one source file, "main.c").



3.3. Modifying source code

- **Double-click “main.c” inside the solution browser. This will open the “main.c” file in the integrated editor.**
- **Inside the editor, modify the string “Hello world!” to something different, e.g. “This is fun!”.**

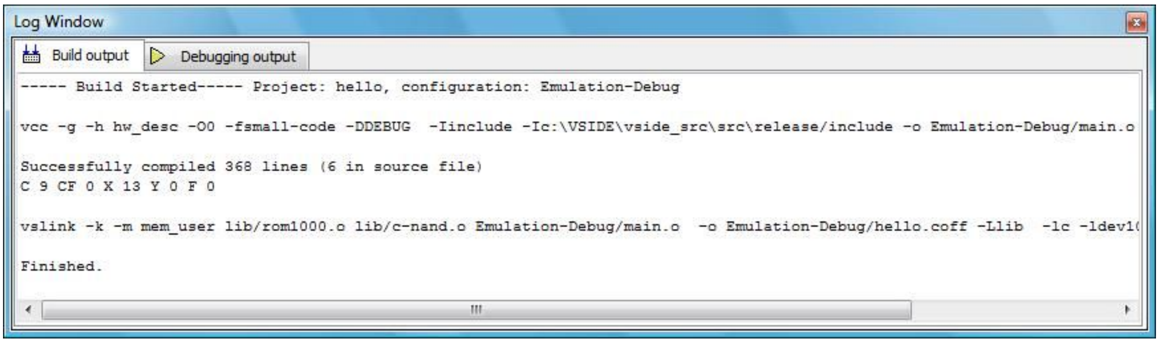
You will notice that “main.c” tab will change to “main.c*”: the asterisk informs that the file has been modified but not saved.

3.4. Compiling

Now its time to build the executable. Note that all unsaved sources will be automatically saved when the compile process is started.

- **From the *Build* menu, select *Build solution*. You can also do this by pressing F7.**

The build output (on the bottom of the screen by default) should display the following.



```
----- Build Started----- Project: hello, configuration: Emulation-Debug

vcc -g -h hw_desc -O0 -fsmall-code -DDEBUG  -Iinclude -Ic:\VSIDE\vside_src\src\release/include -o Emulation-Debug/main.o

Successfully compiled 368 lines (6 in source file)
C 9 CF 0 X 13 Y 0 F 0

vslink -k -m mem_user lib/rom1000.o lib/c-nand.o Emulation-Debug/main.o  -o Emulation-Debug/hello.coff -Llib  -lc -ldev1(

Finished.
```

You can see a line with gray background, which informs of a compilation warning. Any possible errors are shown with red background (as for now, there should be none).

- **Double click with left mouse button on the gray line, IDE will display the row of the source code that the warning is referring to.**

You can ignore this warning.

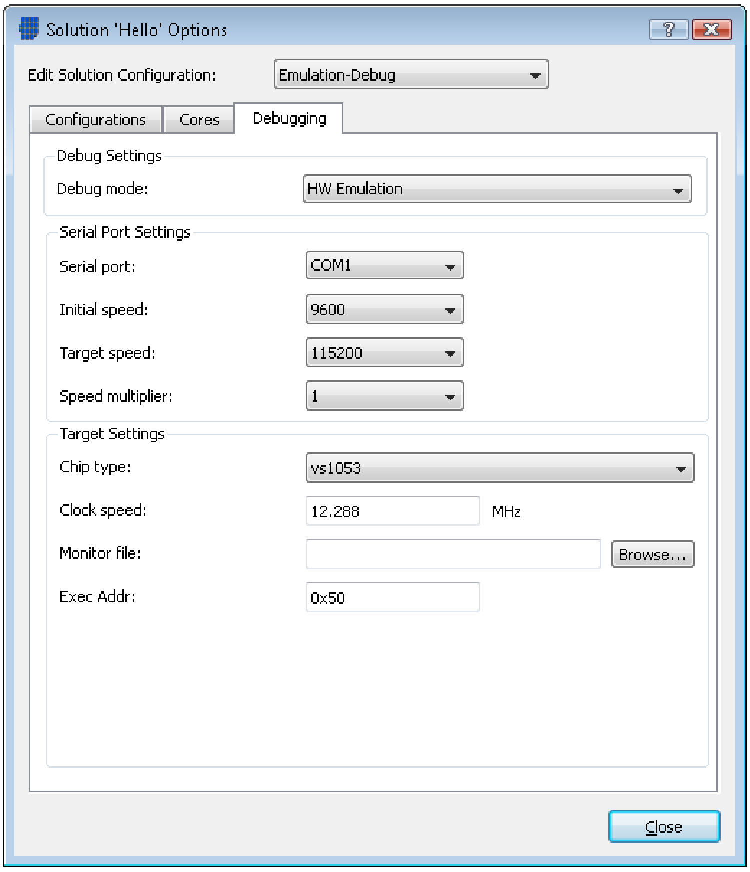
3.5. Executing and debugging

Now that the project executable is successfully built, we can test it using the hardware emulator. The emulator executes the code using the real DSP core but allows setting breakpoints and tracking the values of the registers and memory locations (variables).

VSIDE communicates with the developer board using a serial port interface. Before executing the program for the first time, it is a good idea to check that serial port parameters are correctly set up.

- **Right-click on *Solution* "hello" in the solution explorer window.**
- **From the pop-up menu, select *Properties*.**

The solution options dialog will open.



Solution 'Hello' Options

Edit Solution Configuration: Emulation-Debug

Debug Settings

Debug mode: HW Emulation

Serial Port Settings

Serial port: COM1

Initial speed: 9600

Target speed: 115200

Speed multiplier: 1

Target Settings

Chip type: vs1053

Clock speed: 12.288 MHz

Monitor file:

Exec Addr: 0x50

- **Click on the *Debugging* tab to see the emulator parameters.**

Make sure that debug mode is set to "HW Emulation". Serial port parameters are located right below. If your developer board is connected to a serial port other than COM1, select the appropriate port from the pull down list.

In this example, we use *VS1053* chip**.** Thus, make sure "vs1053" is selected as the chip type. Execution address should be "0x50" for this configuration. Once everything seems right, click close to dismiss the dialog and accept any changes made.

At this point, if your hardware is properly connected to the PC and powered up, you should be able to execute the program. Please note that the **hardware must be reset every time** before the program is loaded. There is a dedicated reset button on the developer board, press it shortly to make the chip reset itself.

You can execute the program as a whole by clicking the yellow triangle icon ("Play") at the toolbar or by selecting *Run* from the Debug menu (or easier yet, by using the keyboard shortcut, F5).

- **Reset the board and press F5 to execute the program**

VSIDE will now switch to debug mode, and the window layout will change. The program should execute and display the greeting text in the *standard input/output* window.

- **If *standard input/output* tab (located at the bottom of the VSIDE window on the default screen layout) is not visible, click the title to see the output.**

Note that the program is still running. There is an infinite loop after the *puts()* statement in the program. Let's stop it.

- **Click the yellow square ("Stop") icon or select Stop from the Debug menu to stop the program and return to edit mode.**

3.5.1. Problems with the emulator?

If you get "Invalid serial port or handshaking error" message while trying to execute, the reason might be that

- **developer board is not properly connected. Check that it is powered up (power led is lit) and the serial cable is connected and functional.**

- **The chip is not in reset state. Press the on board and try loading the program again.**

3.6. Adding files to the project

Next, we will create a new source file that will be included in the current project.

- **Select *File* in the main menu, click *New,* then *New Source File*.**

An empty document will appear. Using the integrated editor, type the following into the document:

```
#include <stdio.h>

void puthex(unsigned int a) {
    static const char hex[]="0123456789abcdef";
    char tmp[8];
    tmp[0]=hex[(a>>12)&15];
    tmp[1]=hex[(a>>8)&15];
    tmp[2]=hex[(a>>4)&15];
    tmp[3]=hex[a&15];
    tmp[4]=' ';
    tmp[5]='\0';
    puts(tmp);
}

void foo() {
    static int z;
    for (z = 0; z < 100; z++) {
        fputs("z=",stdout);
        puthex(z);
    }
}
```

Note the unusual *static* declaration of variable 'z'. This is to make sure its value is always available for debugging (for more information, see page 20). Also note that even though the standard library function *printf* would achieve the above more elegantly, it can't be used in this case because of memory limitations.

Let's save the file and include it in our project.

- **Under file menu, click *Save* (or press CTRL-S) and then select a save path and a filename. Save the file under the newly created project path (i.e. "\solutions\hello"), and name it as "foo.c".**

- **Inside the solution Browser, right-click *"Project 'hello'"*. From the pop-up menu, select *Add existing item.***

- **A file selection dialog appears. Select “foo.c” and click *Open*.**

The file “foo.c” should now appear in the solution browser. We want our *main()* function to call *foo()*, so we need to modify “main.c”.

- **Double click “main.c” under solution browser (or just select “main.c” tab in the editor, if it is still open). Modify “main.c” so that it looks as follows (changes are shown with gray background):**

```
#include <stdio.h>

void foo(); /* Introduce foo() function */

main() {
    int i;
    puts("This is fun!\n");
    foo(); /* Call foo() */
    while(1) ;
    return 0;
}
```

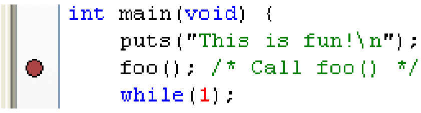
- **Now compile the program, like described above. Should there be any errors, fix them and compile again.**

The new function *foo()* should now be integrated into our project. We will test it in the next section.

3.7. Setting breakpoints

The next thing to do is to learn how to use breakpoints. A breakpoint stops the program's execution when the location of the breakpoint is reached. Breakpoints can be set in the edit mode, or during debugging.

- **Under “main.c”, set a breakpoint to the line “foo(); /* Call foo() */”. You can add breakpoints either by left-clicking the gray area of the code editor (margin) or by moving text cursor to the appropriate line and pressing F6. A red marker dot should appear in the margin next to the source line. See the illustration below.**



```
int main(void) {
    puts("This is fun!\n");
    foo(); /* Call foo() */
    while(1);
```

You can clear (remove) breakpoints by repeating the action described above.

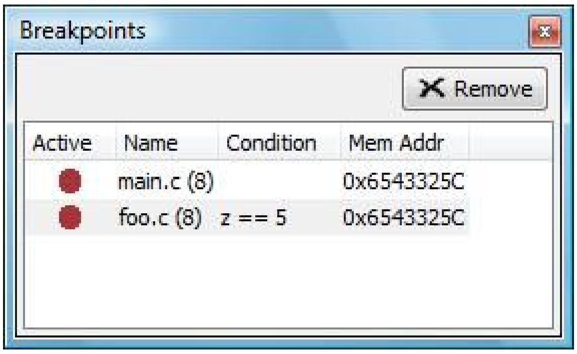
We will now create another breakpoint.

- **Under "foo.c", set another breakpoint to the first line of the for-loop: *fputs("z=",stdout)*.**

We want this second breakpoint to be active only when C language condition "z == 5" is true. To make the second breakpoint conditional, we need to open the breakpoint window.

- **From the *Windows* menu, select *View Breakpoints* (or press CTRL-3).**

A window like the following should appear (by default, it is located on the tab bar at the bottom of the IDE window, click the tab titled *breakpoints* to make it visible):



Active	Name	Condition	Mem Addr
●	main.c (8)		0x6543325C
●	foo.c (8)	z == 5	0x6543325C

To make the "foo.c" conditional, click on the foo.c() breakpoint line under the *condition* column. This is the position where the "z == 5" is located in the picture above. Type the condition "z == 5" (without quotation marks). **Remember to use spaces around "=="!**

Note that conditional breakpoints may cause the simulation to run slower, depending on the breakpoint position. Each time the execution reaches position where a breakpoint is located, it causes a slight delay regardless of whether the condition is true or not.

- **Build the program and execute (press F5).**

The program should now hit the first breakpoint inside *main()*. You will see a small arrow indicating the position of the execution. Let's proceed to the next breakpoint.

- **Continue running the program (press F5 again).**

The program should pause again. Study the *standard input/output* window output. It should contain the following lines:

```
This is fun!
z = 0000
z = 0001
z = 0002
z = 0003
z = 0004
```

3.8. Variable evaluation

You can track the values of variables using the *active variables* window.

Please note that values of all variables may not be available at all times. This is especially true for local variables within a function's scope. If you need the value of a certain local variable during debugging, try declaring it global when possible (the easiest way to achieve this is by declaring the variable *static*, like in the example code above). However, it is advisable remove the static declaration when debugging is no longer needed. Extensive use of local variables will generally result in faster and smaller code.

- **Locate the *Active Variables* window in the screen. If it is not visible, use the Windows menu and select *View Active Variables*. 'z' should be visible there.**

Now let's try to change the value of 'z' on the fly.

- **Under the *Active Variables* window, click the left mouse button on 'z' value. A typing cursor will appear. Type '0' (a zero without the quotation marks) as the new value. This will effectively start the loop from the beginning.**

- **Continue program's execution (press F5 again).**

Program should break again at the conditional foo() breakpoint. The standard input/output should now contain the following:

```
This is fun!
z = 0000
z = 0001
z = 0002
z = 0003
z = 0004
z = 0000
z = 0001
z = 0002
z = 0003
z = 0004
```

Another way to deal with variables is to use the *Watches* window. You can type variable names in the watch window, VSIDE will evaluate them with every screen update.

- **Locate the watches window on the screen. If it's not visible, use the *Window* menu and select *View Watches*.**
- **Left-click <*add new...*>. Type 'z' (again, without quotation marks) and press enter. Whenever 'z' is visible at the current code location, its value will be displayed. When it is not, the value will be displayed as '?'.**

When you're done, you can stop the debugging session for now.

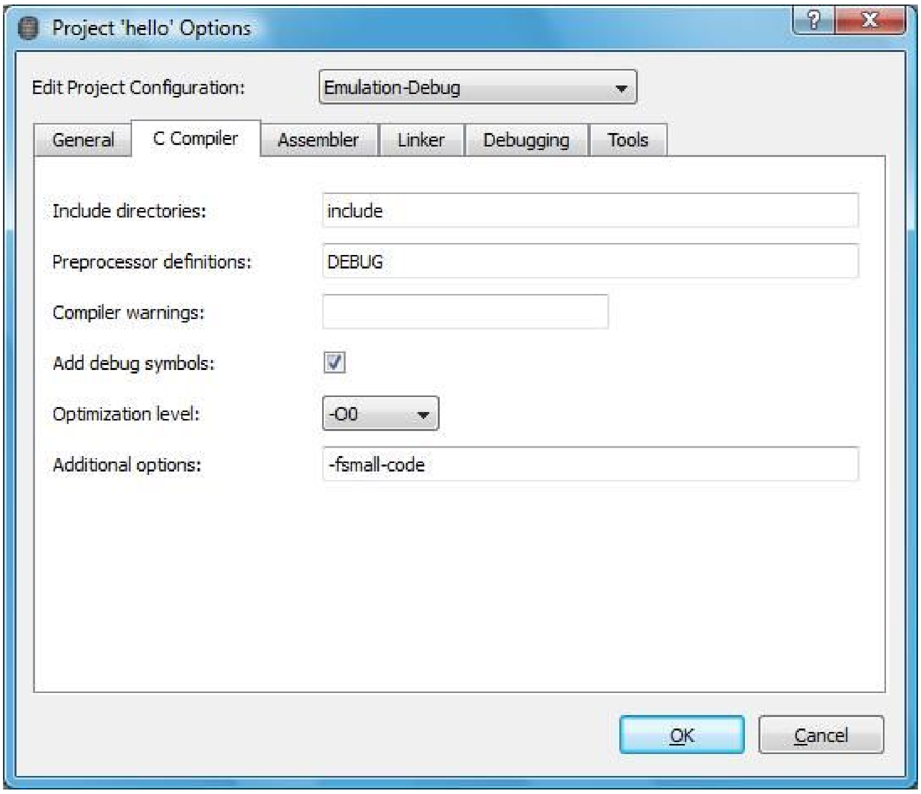
3.9. Modifying project options

Let's take a look at project options. You can find all settings related to how to build the project (compilation, linking, custom build steps etc) here.

- **Under *Solution Browser*, right-click *Project*. Select *Properties*.**

Project options dialog will open.

- **Select *C Compiler* tab, as shown in the picture below.**



Project 'hello' Options

Edit Project Configuration: Emulation-Debug

Include directories: include

Preprocessor definitions: DEBUG

Compiler warnings:

Add debug symbols: ☑

Optimization level: -O0

Additional options: -fsmall-code

We want the compiler to optimize the code. We can do it by changing the optimization level from -O0 to -O6.

- **Set the optimization level to -O6. Click *OK*.**

To put the new settings into effect, the executable must be rebuilt.

- **From the build menu, select *Rebuild solution*. Note that since we have only one project under solution, it would have the same effect to select 'Rebuild project'.**

This is the end of the introduction tutorial. Hopefully you now have a basic insight on how VSIDE can be utilized for software development on the VSDSP platform. The rest of this document will describe the features of VSIDE in more detail.

4. Development environment

4.1. Introduction

This section provides a description of the basic concepts of VSIDE.

4.1.1. Projects and solutions

Project management in VSIDE is based on two conceptual objects called *solutions* and *projects:*

- **A project represents a single executable or a static library. A project contains a set of source files and describes the build steps that are required to produce a binary file, the target. You can find all compilation and linking related settings from the project's properties.**
- **A solution contains the dependency relationships among projects (e.g. “Executable” project with a depending “Static library” project).**

Solutions and projects have “one-to-many” relationship. A solution can contain any number of projects, but a project always belongs to exactly one solution.

While a solution can contain several projects, only one of the projects are *active* at a time. The active project is what receives the actions (e.g. gets compiled) when instructed. Small applications can usually be developed using no more than one project.

4.1.2. Configurations

A configuration represents the settings of a particular project/solution.

For example, a typical project can have different configurations for debugging and release purposes. Usually the debug version can be less optimized and include symbol information for debugging, whereas the release version should be as small and fast as possible and contain no symbol information. Instead of having to edit project options constantly (switching on and off the debug symbol option), creating two project configurations and then switching then between them makes more sense.

Solution configuration works in this way. Switching between solution configurations also switches current active project configuration; this is because solution contains also information for each project which configuration is active.

Every project and solution must have one or more configurations each.

4.1.3. Dock windows

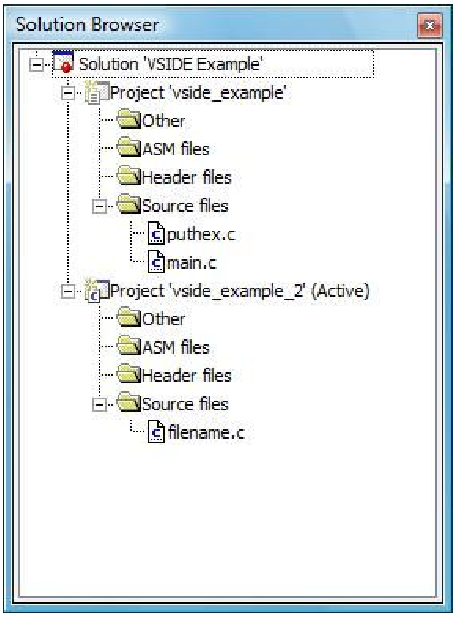
VSIDE's user interface is based on the dock window concept. Most visible components of the user interface are actually dock windows. Such window can be freely moved and resized within the main VSIDE window, or even outside from it.

Dock windows can be dragged into dock positions (located at the edges of the main window) by holding the left mouse button on the window's title bar and moving the mouse cursor to a dock position. Note that dock windows can be “cascaded” on top of each other. If several dock windows are cascaded on the same edge, a tab bar will appear with tabs representing each of the cascaded windows.

Note that VSIDE maintains separate window position information for debugging, project edit and initialization states.

4.2. Solution browser

Currently open solution and its context is shown in the *Solution browser* window.



In the picture above, there is a solution called “VSIDE Example”. It contains two projects. Within each project, there are folders that contain the individual files. These folders are used to group similar types of files together, they do not reflect the directory structure on the hard drive.

One of the projects is always selected as active. When invoking project actions (such as *Build project*), the active project is affected by the operation. To change the active project, right-click on the top of the project icon (inside the solution browser window) and select *Set as active project*.

To quickly open source file for viewing or editing, double-click on the file's icon.

There are several useful features that can be accessed through the solution browser. They are invoked by right-clicking either files, folders, projects or solutions. These operations are described below.

4.2.1. File operations

Item	*Description*
Compile	Compile the file.
Remove	Remove file from project. This will not physically remove the file from hard disk.
Properties	Edit file properties. See section 4.7 for more information.

4.2.2. Folder operations

Item	*Description*
Add existing item...	Add new source file(s) to the project.
Remove	Remove the folder and its contents from the project. Again, this will not physically remove any files from the hard disk. This option is not available to some of the folders that must exist in the project.
Rename	Rename the folder. This option is not available to some of the folders that must exist in the project.

4.2.3. Project operations

Item	*Description*
Set as active project	Select project as active. Active project is affected by project-specific commands.
Build	Build the target of the active project.
Rebuild All	Clean and then build the target of the active project.
Clean	Clean project's target and any temporary object files.
Save project	Write changes to the project to disk.

Item	*Description*
Remove project	Remove a project from solution. This will not physically remove any project files from the hard disk.
Add folder	Add a (virtual) folder to the project.
Add existing item...	Add an existing item to project. The proper folder for the file is automatically selected.
Properties	Edit project properties. See Section 4.8 for more information.

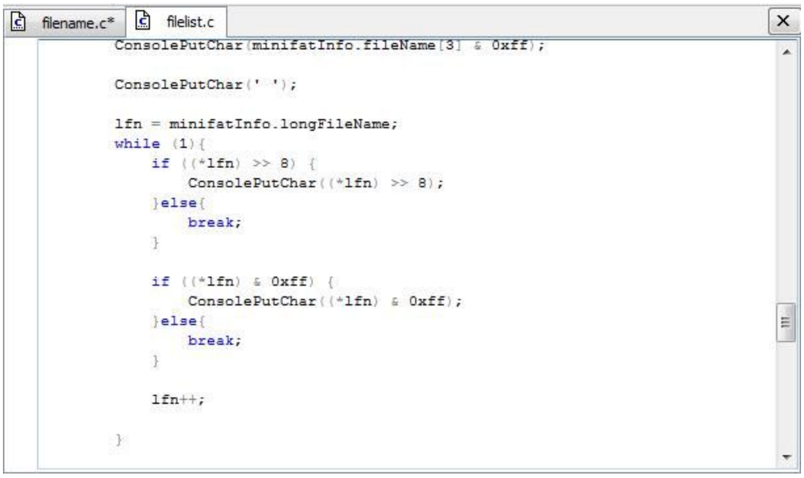
4.2.4. Solution operations

Item	*Description*
Build Solution	Build all projects within a solution.
Rebuild Solution	Rebuild all projects within a solution.
Clean Solution	Clean all projects within a solution.
Add new project...	Add a new project to the solution.
Add existing project...	Add an existing project to the current solution.
Properties	Edit solution properties. See section 4.9 for more information.

4.3. Editor

Integrated source code editor is a regular text file editor that supports the basic editing features including C syntax highlighting.

The code editor is also used to display code during the debugging state.



```
ConsolePutChar(minifatInfo.fileName[3] & 0xff);

ConsolePutChar(' ');

lfn = minifatInfo.longFileName;
while (1){
    if ((*lfn) >> 8) {
        ConsolePutChar((*lfn) >> 8);
    }else{
        break;
    }

    if ((*lfn) & 0xff) {
        ConsolePutChar((*lfn) & 0xff);
    }else{
        break;
    }

    lfn++;

}
```

Editor window is tabbed, i.e. each open source file has its own tab in the top of the editor window. By clicking the tab, the particular source file will be shown. By clicking the close button on the right top corner of the editor (or pressing CTRL-W), the current source file will be closed.

Basic editor commands are found in the Edit menu:

Editor menu item	***Keyboard shortcut***	***Description***
Undo	CTRL-Z	Undo previous edit command
Redo	CTRL-Y	Redo previous edit command
Cut	CTRL-X	Cut selected text
Copy	CTRL-C	Copy selected text
Paste	CTRL-V	Paste previously cut/copied text into cursor position
Go to line	CTRL-G	Go to source code line. New dialog will appear where the line number is entered.
Find...	CTRL-F	Find text within the current source file. New dialog will appear with more options.

Editor menu item	*Keyboard shortcut*	*Description*
Find next	F3	Repeat find operation.

To find out the full path name to source file, hover the mouse cursor over a file tab (where the filename is shown), and after one second a tool tip window will appear with the full pathname.

If any text files are modified outside the VSIDE editor, VSIDE will notify the user and ask if the modified files should be loaded into the editor.

4.4. Building

The VSIDE build commands are described below.

Note that project build commands affect the active project. If you have multiple projects, you can select the active project by right-clicking on project icon in solution browser window and selecting *Set as active project*.

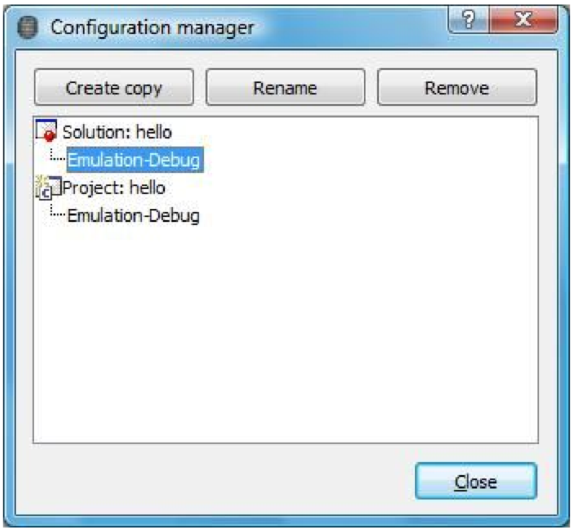
4.4.1. Build commands

Item	*Icon*	*Keyboard shortcut*	*Description*
Build solution		F7	Build all projects within the current solution.
Rebuild solution	ALL		Clean and build all projects within the current solution.
Clean solution			Delete all intermediate files used during building.
Build project		SHIFT-F7	Build the active project.
Rebuild project		CTRL-SHIFT-F7	Cleans and builds the active project.

Item	***Icon***	***Keyboard shortcut***	***Description***
Clean project			Delete all active project's intermediate files used during building .
Stop build	✗		Stop the current undergoing build process.
Configuration manager			Open configuration manager. More information below.

4.4.2. Configuration manager

Configuration manager is used for managing the solution and project configurations.



To create new configuration, select a previous configuration and click *Create copy*.

To rename a configuration, select the configuration and click *Rename*.

To remove a configuration, use *Remove*. Note that both solution and project must have at least one configuration at all times, so the last configuration can not be removed.

4.5. Menus

Commands accessible through menus are described below.

4.5.1. File menu

File menu item	***Description***
New->Project	Create a new project. *New Project* dialog will open, which contains more options for project creation.
New->File	Open a new text file in the editor.
New->Blank solution	Create a blank solution. *New Solution* dialog will open, which contains more options for project creation. Any currently open solutions will be closed.

File menu item	***Description***
Open->Solution	Open an existing solution from disk. Any currently open solutions will be closed.
Open->Source	Open an existing source file from disk.
Open->Executable into simulator	Simulate an executable without projects/solution. See Section 5.3 for more information.
Close	Close the currently active text file.
Close solution	Close the currently open solution.
Save	Save the currently open source file to disk. If the file has no name, this command behaves like "Save As".
Save As	Save the currently active source file to disk with a different name.
Save All	Save all unsaved text files to disk.
Recent Files	Display a list of recently used files. Selecting a file from the list will load the file into the editor. VSIDE remembers four most recently viewed files.
Recent Solutions	Display a list of recently used solutions. Selecting a solution from the list will close any currently open solution and load the selected solution. VSIDE remembers four most recently opened solutions.
Exit	Closes VSIDE.

4.5.2. Edit menu

See Section 4.3 for more information.

4.5.3. Project menu

Project menu item	***Description***
Add existing item...	Add an existing item to project. The proper folder for the file is automatically selected.

Project menu item	*Description*
New folder	Add a (virtual) folder to the project. These folders are only used to group similar files together.
Generate makefile	Generates makefile named Makefile_<projectname> into the project folder.
Properties	Edit project properties. See section 4.8 for more information.

4.5.4. Build menu

See section 4.4 for more information.

4.5.5. Debug menu

See section 5.1 for more information.

4.5.6. Windows menu

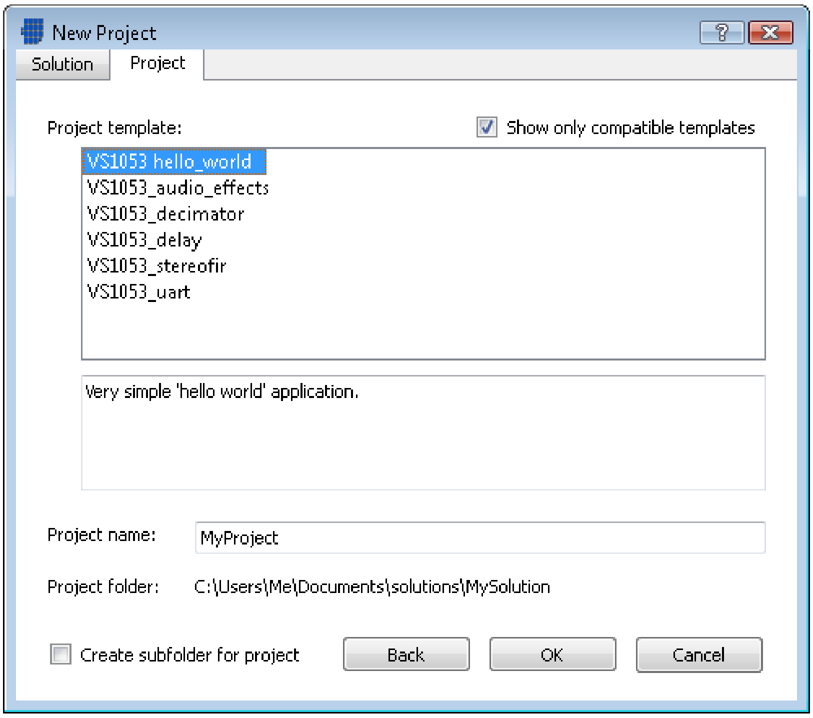
Window menu item	*Description*
Close all documents	Close all files in the integrated editor.
View <dock window name>	Show/hide <dock window>.

4.5.7. Help menu

Help menu item	*Description*
Help	Open the VSIDE help viewer.
About	Show VSIDE copyright and version information.

4.6. Creating a new project

Select *New project* from the *File* menu to create a new project.



Project template: ☑ Show only compatible templates

VS1053 hello_world
VS1053_audio_effects
VS1053_decimator
VS1053_delay
VS1053_stereofir
VS1053_uart

Very simple 'hello world' application.

Project name: MyProject

Project folder: C:\Users\Me\Documents\solutions\MySolution

□ Create subfolder for project

If existing solution is already open in VSIDE, new project can be added into it. If solution is not available, new project dialog will create an empty solution. In this case, name and template must be specified for the empty solution. You must also provide a location on the hard drive where files associated with the solution and its projects will be stored. Click the *Browse* button to open a directory selector dialog.

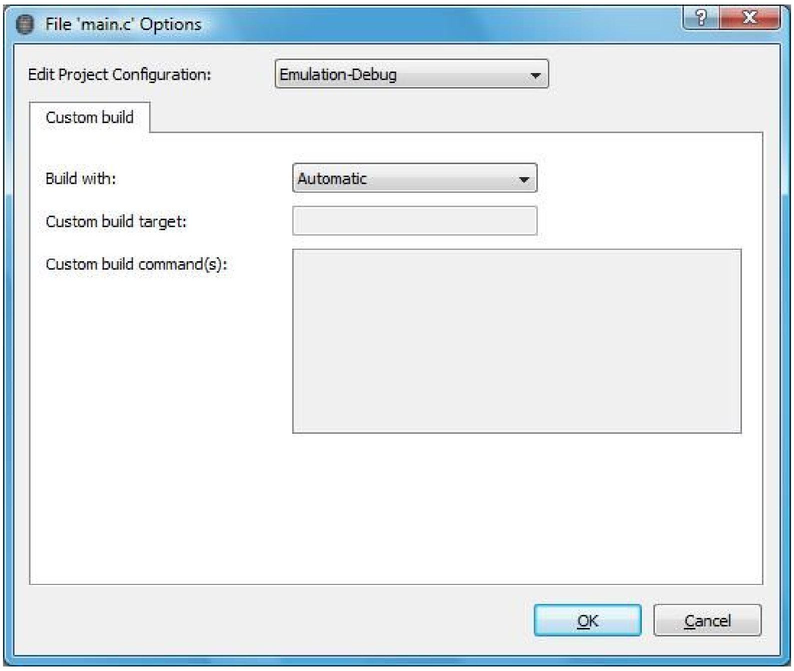
A project template contains default settings and source files - aimed to speed up the process of starting a new project. There can be a different number of project templates available depending on the VSIDE distribution.

Remember to enter a name for your project in the corresponding input box.

If a solution is already open, there is an option to add the new project under the current solution or to close the current solution and create a new solution.

When creating a new solution, check “*Create subfolder for project”* to create additional project directory under the solution directory. The full project path is determined by combining base path with solution's name and possibly with the project's name.

4.7. File options



The build process of an individual file can be customized, thus bypassing the automatic builder. Build command can be manually overridden, or the file can be completely excluded from the build.

To configure individual file build settings, right-click on a source file's icon (under solution browser) and select *properties* from the pop-up menu. *File Options* dialog (illustrated above) will appear.

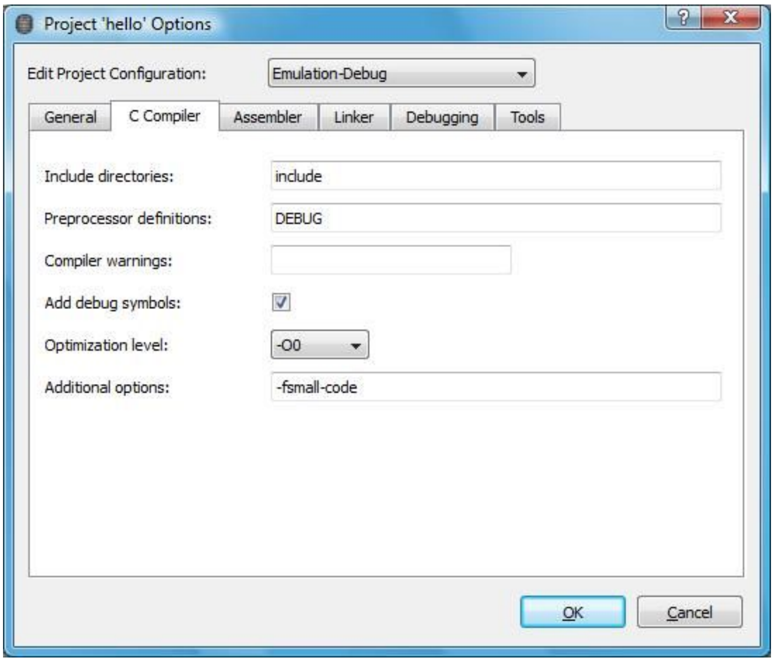
Select the project configuration that you wish to make this change for. Changes only apply to the selected project configuration, others remain unchanged.

Select the desired build method from the combo box next to *Build with* label. The options are:

Item	***Description***
Automatic	Use the automatic builder

Item	***Description***
Custom build	Custom build commands must be entered to the *Custom build command(s)* input box. The commands are executed in the shell as they are written here. Use Carriage Return (CR) to separate commands from each other. Example: echo "Building test.c..."<CR> vcc -c test.c
None (exclude from build)	The file will not be processed in any way.

4.8. Project options



Project 'hello' Options

Edit Project Configuration: Emulation-Debug

Include directories: include

Preprocessor definitions: DEBUG

Compiler warnings:

Add debug symbols: ☑

Optimization level: -O0

Additional options: -fsmall-code

The active configuration is shown at the top of the dialog. Any changes will affect this configuration only.

It is possible to override all these settings for individual files by using custom file configurations.

Any directory name can be either absolute or relative to the project's path.

4.8.1. General

This section contains the general project settings.

Item	***Description***
Project type	*Executable*, *Static Library* or *NAND Flash/EEPROM image*. Executable contains a linked application, while static library is a collection of object files. Last option behaves like executable, but produces an additional image file (.img) suitable for firmware creation (either for Flash or EEPROM).
Target filename	Name of the target that will be created when the solution is compiled.
Target directory	Directory name where the build target will be created.

Item	*Description*
HW Description file	Hardware description file that will be passed to both C compiler and assembler when compiling “.c” or “.s” files.

4.8.2. C Compiler

This section contains the settings for compiling C language (.c) files.

Item	*Description*
Include directories	Add directories to the include search path. Separate with comma (',').
Preprocessor definitions	Define preprocessor symbols. Separate with comma (',').
Compiler warnings	Add any compiler warning control flags here.
Add debug symbols	If checked, debug symbols are added to object files (and to any resulting executables). Without debug symbols you cannot debug executables at C language level.
Optimization level	Define optimization level: 0 (off) .. 6 (max)
Additional options	Any options added here will be added to every C compilation command. Separate options with spaces.

4.8.3. Assembler

This section contains the settings for compiling assembly (.asm, .s) files.

Item	*Description*
Generate List file	Defines a file where to output a verbose listing of the program. Leave blank if list file is not needed.
Additional options	Any options added here will be added to every assembler command. Separate options with spaces.

4.8.4. Linker

This section contains the settings for linking object files. These settings are valid only if project type is “Executable”.

Item	***Description***
Library directories	Add directories to the library search path. Separate with comma (',').
Libraries	Libraries to be linked with the executable. Separate with comma (',').
Startup module	Filename of a startup module object to be linked with executable.
Mem Description file	Memory description file to be used during linking.
Linker command file	A linker command file can be used to map and force sections into specific memory areas as found in `mem_desc`. Use this parameter to override the default command file.
Incremental linking	Enable incremental linking. See VSLINK documentation for more information.
Keep relocations	Prevents relocations to be deleted. See VSLINK documentation for more information.
Strip symbols	Discards any symbol information from objects.
Additional options	Any options added here will be added to every linker command. Separate options with spaces.

4.8.5. Debugging

These settings are valid only if project type is “Executable”.

Item	***Description***
Mem Description file	Memory description file to be used when debugging the system. This may differ from one used during linking.

4.8.6. Tools

This section defines which executables will be used for C compiler, assembler, linker and archiver when building a project.

Item	***Description***
C Compiler EXE:	Executable for C compiler. Default is “lcc”.
Assembler EXE:	Executable for assembler. Default is “vsa”.
Linker EXE:	Executable for linker. Default is “vslink”.
Archiver EXE:	Executable for archiver. Default is “vsar”.

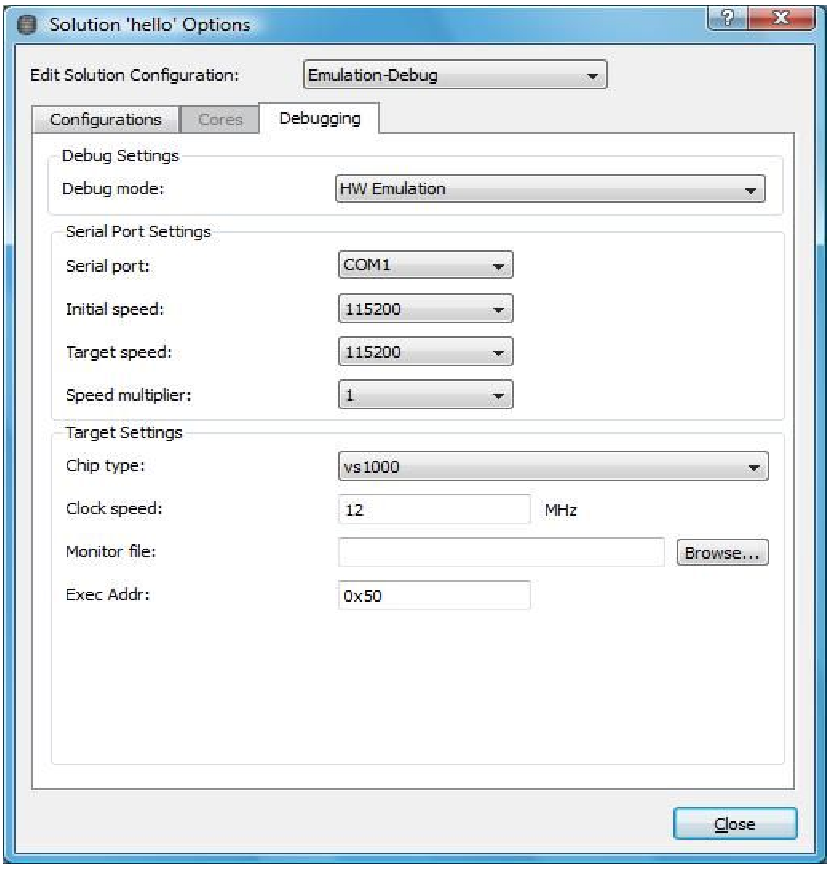
4.9. Solution options

Solution options are divided into three tabs;

- “Configurations” - for associating active project configurations with solution
- “Cores” - for configuring debugged cores (note: currently disabled)
- “Debugging”- for configuring debugging mode

On the top of the dialog, configuration under modification is shown.

Solution options are automatically saved when they are modified.



Solution 'hello' Options

Edit Solution Configuration: Emulation-Debug

Debug Settings

Debug mode: HW Emulation

Serial Port Settings

Serial port: COM1

Initial speed: 115200

Target speed: 115200

Speed multiplier: 1

Target Settings

Chip type: vs1000

Clock speed: 12 MHz

Monitor file:

Exec Addr: 0x50

Any directory name can be either absolute or relative.

4.9.1. Configurations

Each solution configuration contains the information of which of the project configurations are active. Thus, the solution configuration acts like a group selector for active project configurations. Switching active solution configuration from one to another will switch all the active project configurations.

The *active project configuration* list contains a list of all the projects and the selected project active configuration.

By clicking the project name, the active project can be changed from the *Project settings* group below.

4.9.2. Cores

Cores tab configures the DSP cores used during debugging. This version of VSIDE does not support multi-core debugging, thus this section is always disabled.

4.9.3. Debugging

Debug target for the solution is defined in the *debugging* tab. There are two options; software-based simulation and hardware-based emulation.

In case simulation is being selected as the debug mode, no further options are needed. For the hardware emulation, the following parameters must be given:

Item	***Description***
Serial port	Name of the serial port which will be used for communicating with the hardware.
Initial speed	Initial speed is the serial port speed that the target communicates right after reset.
Target speed	Serial port speed that will be used to communicate with the target (except for the initialization phase which uses “Initial speed” setting).

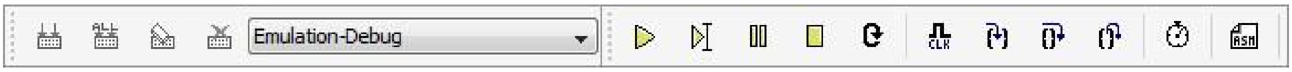
Item	***Description***
Speed multiplier	If a high-speed serial port is available, it is possible to use this value to get serial speeds over 115200 bps.
Chip type	VSDSP chip type which is used in the target board.
Clock speed	VSDSP clock speed which is used in the target board.
Monitor file	Hardware emulator's monitor file to be loaded into the target. Not applicable for VSDSP4.

5. Debugging

This chapter describes the integrated debugger of VSIDE. This information applies to both software simulation and hardware emulation.

5.1. Debug commands

Debugger can be controlled by using debug menu, debug toolbar or keyboard shortcuts. Layout of the debug toolbar is shown below.



The following debug operations are available:

Item	*Icon*	*Keyboard shortcut*	*Description*
Run	▷	F5	Run the executable. The execution will continue until breakpoint is hit, or Break command is activated. Note: During hardware emulation, it may not be possible to break execution without previously set breakpoints.
Run to Cursor			As above, except the execution will stop when location of the cursor is reached (or any breakpoint before the cursor location).
Break	▯▯	F6	Break the execution. This command is not available during hardware emulation.
Stop debugging	▯	SHIFT-F5	Break the execution and exit the debug mode.

Item	***Icon***	***Keyboard shortcut***	***Description***
Restart	⟳	F4	Unload current executable, reload executable again, reset the VSDSP and run the executable until *main()* is reached.
Step single core clock	CLK	F8	Execute a single clock cycle. Useful for debugging in the disassembly view.
C-level step into	{↓}	F11	Continue execution until the the next C line, or execution moves into another function.
C-level step over	{}↷	F10	Continue execution until the execution reaches the next C line. Currently not supported in software simulation.
C-level step out	{↑}	SHIFT-F11	Continue execution until the current function exits. Currently not supported in software simulation.
Profiling toggling	⏱	Scroll Lock	Start / stop profiling. For further information on profiling output file, see VS DSP Software Tools User’s Manual, section 9.6. Not supported in hardware emulation mode.
View assembly		-	Toggles the source disassembly view. Available during debugging only.
Refresh		F2	Refresh all windows. Use this to refresh in simulation mode to get up-to-date simulation status.

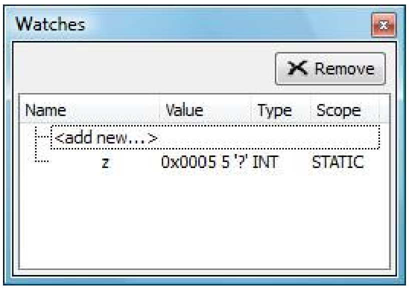
5.2. Debug windows

This section describes the debugging windows. These, like most other dock windows, can be shown and hidden individually by using the *Window* menu.

5.2.1. Watch window

Watch window contains an user-defined list of variables to be viewed.

To enter a new value to be viewed, click on <*add new...*> and type variable name, e.g. “a” or “hexTable[10]”. The variable is then added to the list, with it's current value shown on the right.



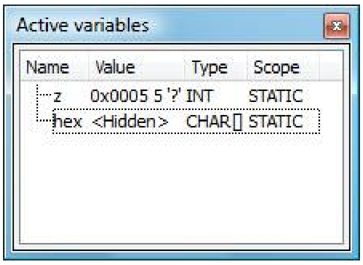
Name	Value	Type	Scope
<add new...>			
z	0x0005 5 '?'	INT	STATIC

If a variable cannot be evaluated at the current execution address, all the parameters will be set to '?'. Please see page 20 for important notes regarding the availability of values of variables.

To delete variable from the watch list, select the variable by clicking it and select *Remove*.

5.2.2. Active variables window

Active variable window shows C language variables that are visible at the current execution address.



Name	Value	Type	Scope
z	0x0005 5 '?'	INT	STATIC
hex	<Hidden>	CHAR[]	STATIC

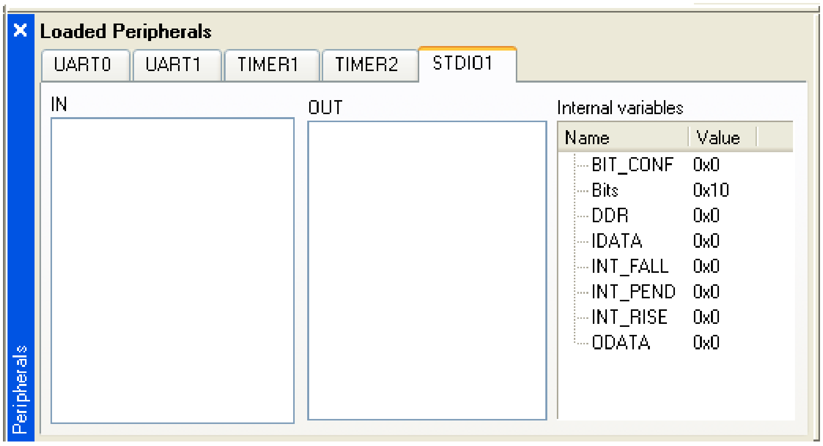
To modify the value of a variable, click on the variable's *value* column and type a new value. The new value can be decimal, hexadecimal (prefixed with '0x') or symbol.

Please note that the contents of arrays are not downloaded when using hardware emulation. Instead, the array fields will display <*hidden*>. This is done to speed up debugging over the serial port. Use the watch window to inspect array contents in the hardware emulation mode.

5.2.3. Peripheral window

Peripherals are only supported by the software simulator. Peripherals are used to make system-level simulation possible.

The peripheral window displays the status of the loaded peripherals. Each peripheral instance that supports the peripheral GUI API is shown here.



Name	Value
BIT_CONF	0x0
Bits	0x10
DDR	0x0
IDATA	0x0
INT_FALL	0x0
INT_PEND	0x0
INT_RISE	0x0
ODATA	0x0

Each peripheral can define individual graphical user interface. Some of the elements may allow user interaction, depending on the implementation of the peripheral.

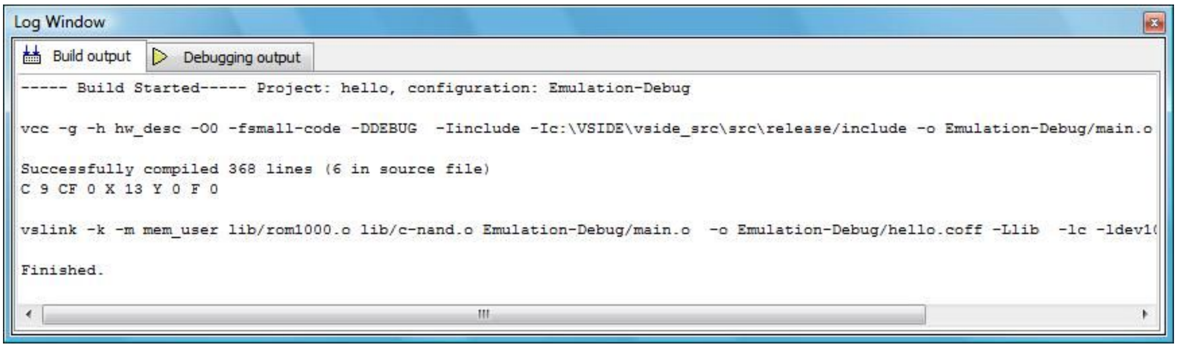
To use one or more peripherals during the simulation, add the required peripherals to project's mem_desc file under *PERIPHERAL* section. Configured peripheral plugins must be located in VSIDE/plugins directory.

For more information on peripherals, see separate Peripheral GUI API documentation.

5.2.4. Log window

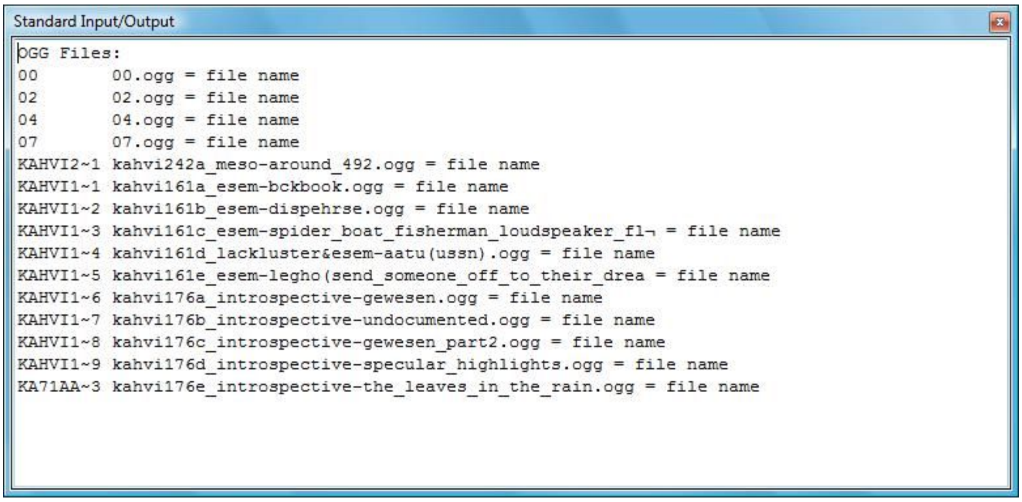
Log window shows build and debug messages.

5.2.5. Standard input/output window



```
----- Build Started----- Project: hello, configuration: Emulation-Debug

vcc -g -h hw_desc -O0 -fsmall-code -DDEBUG  -Iinclude -Ic:\VSIDE\vside_src\src\release/include -o Emulation-Debug/main.o

Successfully compiled 368 lines (6 in source file)
C 9 CF 0 X 13 Y 0 F 0

vslink -k -m mem_user lib/rom1000.o lib/c-nand.o Emulation-Debug/main.o  -o Emulation-Debug/hello.coff -Llib  -lc -ldev1(

Finished.
```

The standard input/output window displays VSDSP core output, as well as sends key-presses to the *stdin* stream.



```
OGG Files:
00       00.ogg = file name
02       02.ogg = file name
04       04.ogg = file name
07       07.ogg = file name
KAHVI2~1 kahvi242a_meso-around_492.ogg = file name
KAHVI1~1 kahvi161a_esem-bckbook.ogg = file name
KAHVI1~2 kahvi161b_esem-dispehrse.ogg = file name
KAHVI1~3 kahvi161c_esem-spider_boat_fisherman_loudspeaker_fl¬ = file name
KAHVI1~4 kahvi161d_lackluster&esem-aatu(ussn).ogg = file name
KAHVI1~5 kahvi161e_esem-legho(send_someone_off_to_their_drea = file name
KAHVI1~6 kahvi176a_introspective-gewesen.ogg = file name
KAHVI1~7 kahvi176b_introspective-undocumented.ogg = file name
KAHVI1~8 kahvi176c_introspective-gewesen_part2.ogg = file name
KAHVI1~9 kahvi176d_introspective-specular_highlights.ogg = file name
KA71AA~3 kahvi176e_introspective-the_leaves_in_the_rain.ogg = file name
```

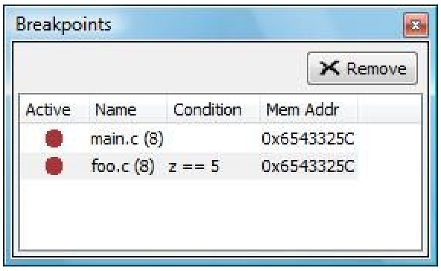
If the *stdout* data grows too large, the window will cut off the oldest data from the top.

5.2.6. Breakpoint window

The breakpoint window displays the currently set breakpoints.

Breakpoints are used to stop program execution at requested positions. When the program execution reaches the breakpoint address, the execution will be break.

Breakpoints can be added under disassembly window (during debugging only), or directly at C source lines, regardless of the debugging state. Source-line breakpoints are automatically inspected and added to the corresponding program memory addresses.



Active	Name	Condition	Mem Addr
●	main.c (8)		0x6543325C
●	foo.c (8)	z == 5	0x6543325C

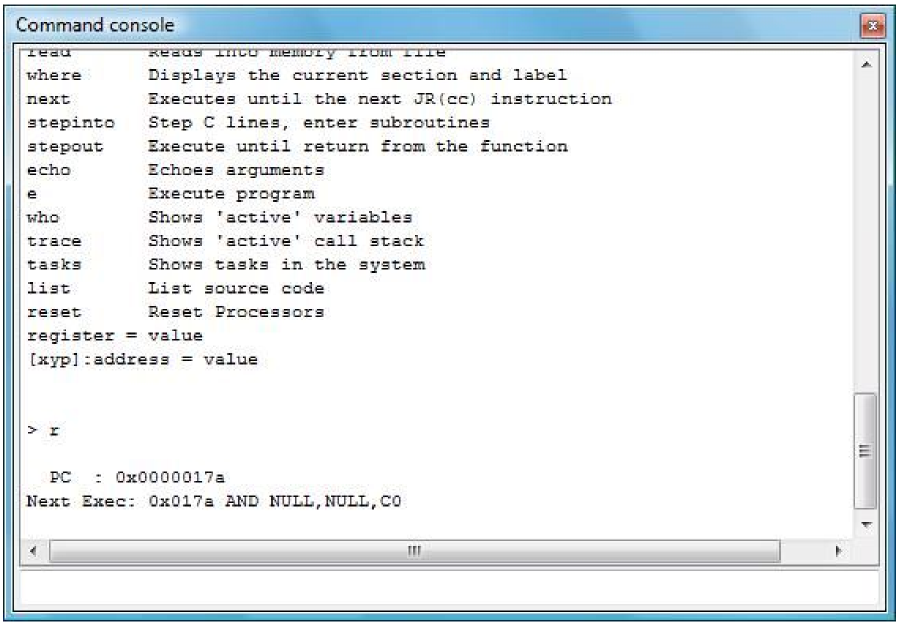
To remove a breakpoint, select the breakpoint by clicking on its name, and then press *Remove* (or press DEL key).

A breakpoint can be either active or inactive. An inactive breakpoint has no effect on program execution. To make a breakpoint inactive, click the red dot in the breakpoint window. The red dot will turn gray. To re-activate it, click the gray dot, and it will change red again.

VSIDE also supports conditional breakpoints. You can enter C level conditional expressions by clicking the breakpoint's *Condition* field and entering a condition, e.g. “z != 0”. Remember to use spaces around conditional operators. In case the condition was incorrect, VSIDE will show an error when the code reaches the breakpoint for the first time.

5.2.7. Command console window

Command console provides a text-based interface to the simulator and the emulator.



Command console

```
read        Reads into memory from file
where       Displays the current section and label
next        Executes until the next JR(cc) instruction
stepinto    Step C lines, enter subroutines
stepout     Execute until return from the function
echo        Echoes arguments
e           Execute program
who         Shows 'active' variables
trace       Shows 'active' call stack
tasks       Shows tasks in the system
list        List source code
reset       Reset Processors
register = value
[xyp]:address = value


> r

  PC  : 0x0000017a
Next Exec: 0x017a AND NULL,NULL,C0
```

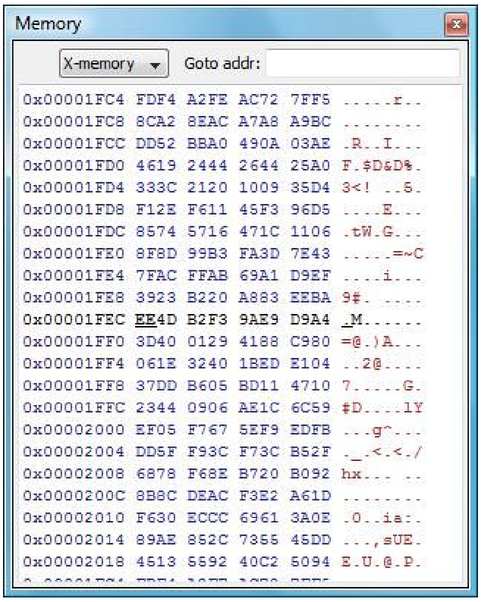
To use the command console, enter commands into the edit box on the bottom of the command console window. You can use command history by using the cursor keys.

To see the list of commands available, type *help* and press <*enter*>. To see the syntax of a specific command, type *help* followed by the name of the command. Further documentation can be found from the *VSDSP Software Tools User's Manual*.

5.2.8. Memory window

Memory window will display memory contents in hex and ASCII format.

Displayed memory type (X/Y/I) can be changed by using combo box on the top of the memory window. Below is an example output from the memory window. Please note that contents of unconnected memory will show up as dashes ('-').



```
0x00001FC4 FDF4 A2FE AC72 7FF5 .....r..
0x00001FC8 8CA2 8EAC A7A8 A9BC ........
0x00001FCC DD52 BBA0 490A 03AE .R..I...
0x00001FD0 4619 2444 2644 25A0 F.$D&D%.
0x00001FD4 333C 2120 1009 35D4 3<! ..5.
0x00001FD8 F12E F611 45F3 96D5 ....E...
0x00001FDC 8574 5716 471C 1106 .tW.G...
0x00001FE0 8F8D 99B3 FA3D 7E43 .....=~C
0x00001FE4 7FAC FFAB 69A1 D9EF ....i...
0x00001FE8 3923 B220 A883 EEBA 9#. ....
0x00001FEC EE4D B2F3 9AE9 D9A4 .M......
0x00001FF0 3D40 0129 4188 C980 =@.)A...
0x00001FF4 061E 3240 1BED E104 ..2@....
0x00001FF8 37DD B605 BD11 4710 7.....G.
0x00001FFC 2344 0906 AE1C 6C59 #D....lY
0x00002000 EF05 F767 5EF9 EDFB ...g^...
0x00002004 DD5F F93C F73C B52F ._.<.<./
0x00002008 6878 F68E B720 B092 hx... ..
0x0000200C 8B8C DEAC F3E2 A61D ........
0x00002010 F630 ECCC 6961 3A0E .0..ia:.
0x00002014 89AE 852C 7355 45DD ...,sUE.
0x00002018 4513 5592 40C2 5094 E.U.@.P.
```

There are several ways to change the displayed memory address. Address or variable name can be entered into the *Goto address* edit box. It is possible to use hex or decimal format, or symbol names (e.g. “main”).

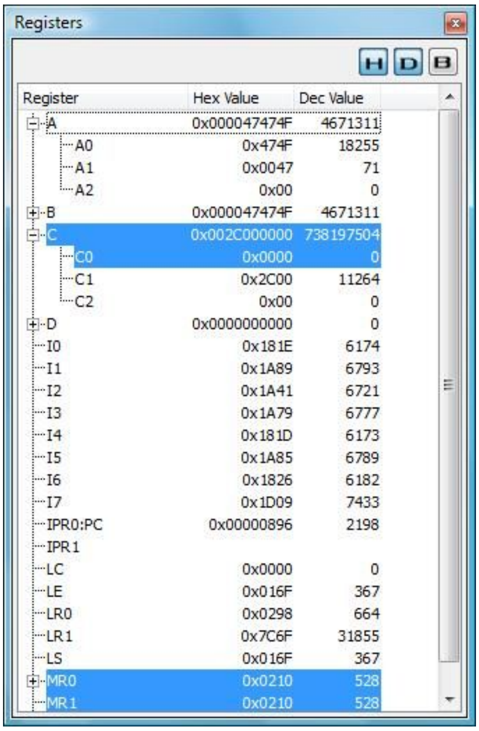
To freely browse memory, use keyboard cursor keys and PAGE UP and PAGE DOWN or mouse wheel.

To modify memory contents, just move the “memory cursor” (underlined and bolded value) to the desired address and type new hex values using the keyboard.

5.2.9. Register window

The register window displays the current VSDSP core register values.

The register window can display register values in hex, decimal and binary formats. Use buttons “H”, “D” and “B” to toggle between these.



Register	Hex Value	Dec Value
A	0x000047474F	4671311
A0	0x474F	18255
A1	0x0047	71
A2	0x00	0
B	0x000047474F	4671311
C	0x002C000000	738197504
C0	0x0000	0
C1	0x2C00	11264
C2	0x00	0
D	0x0000000000	0
I0	0x181E	6174
I1	0x1A89	6793
I2	0x1A41	6721
I3	0x1A79	6777
I4	0x181D	6173
I5	0x1A85	6789
I6	0x1826	6182
I7	0x1D09	7433
IPR0:PC	0x00000896	2198
IPR1		
LC	0x0000	0
LE	0x016F	367
LR0	0x0298	664
LR1	0x7C6F	31855
LS	0x016F	367
MR0	0x0210	528
MR1	0x0210	528

To modify register values, left-click on field and enter a new value.

5.2.10. Disassembly window

The disassembler window can be used to view the machine language representation of the source code. It is useful during debugging only. To display (and hide) the disassembler view, click on the assembler icon on the toolbar.

The viewing position can be changed by scrolling the window, PAGE UP and PAGE DOWN, cursor keys or using the mouse wheel. To jump to a specific address, type the program memory (I-page) address or a function name to *View addr/function* edit box and press enter.

You can toggle breakpoints by clicking the area next to the disassembly code (margin).

5.3. Simulating executables directly

It is possible to simulate executables directly without creating a project or solution.

To simulate executables, open the *File* menu and select *Open* and then *Executable into simulator*. Then select the appropriate executable file (typically a .coff file) and required mem_desc file. The simulator will now open.

Please note that the harware emulator does not support direct program execution.

6. Miscellaneous

6.1. Command line options

VSIDE supports some command line options.

For all operating systems, it is possible to automatically open a solution file by giving the solution's filename as a command line argument. Other file types as parameters will be opened in the editor.

All VSIDE versions also support style parameter:

- **style <*style*>**, changes the GUI style. Style can be one of:
  - windows
  - motif
  - platinum

The X11 version of VSIDE also supports some traditional X11 command line options:

- **-geometry <*geometry*>**, sets the client geometry

- **-fn** or **-font <*font*>**, defines the application font. The font should be specified using an X logical font description.

- **-bg** or **-background <*color*>**, sets the default background color and an application palette (light and dark shades are calculated).

- **-fg** or **-foreground <*color*>**, sets the default foreground color.

- **-btn** or **-button <*color*>**, sets the default button color.

- **-visual TrueColor**, forces the application to use a TrueColor visual on an 8-bit display.

- **-cmap**, causes the application to install a private color map on an 8-bit display.

6.2. Creating project templates

Project templates are frameworks that are used as a starting point when a new project is being created. Available project templates are shown in “New Project” dialog.

Project template contains:

- project configuration information
- any files related to project, e.g. C source files, mem_desc files, libraries, documentation, etc.

Creating a new project templates is simple:

- Use New project and select a project template that resembles the template project you want to create.
- Modify it normally with VSIDE it until it contains the project settings and files you'd like to have as a template. All files should be located under the project's directory.
- Go to operating systems file manager, and make a copy of the project folder to (VSIDE_DIR)/templates/project/. Rename the new folder to something that describes the template project.
- Under this new folder, rename the project file (with prefix “.project”) to “template.project”.
- Open “template.project” with a text editor, and find string “[Project]” in the beginning of the file. Under this group, there is a variable named “ Name”. Set the name variable to:

```
Name = “$$$PROJECTNAME”
```

You may also want to change the target filename to :

```
TargetFilename          = ""$$$PROJECTNAME.coff"
```

The new project template should be now available in “New project” dialog.

Note: creating new solution templates is not currently supported.

6.3. mem_desc file format

The default name for the memory description file is **`mem_desc`**, but any name can be used as long as the new name is specified for the linker and simulation/emulation tools. Memory description file used by the linker can be changed from the project settings dialog.

If the memory description file is not found in the current working directory, it is searched for in the directory pointed by the **`VSDSP_DIR`** environmental variable.

The memory description file consists of several parts that define different things.

- *MEMORY* section defines the general memory layout and memory types.
- *CORE* section defines clock frequency and boot address.
- *PERIPHERAL* section defines peripheral register mapping. Individual peripheral instantiations configure the peripherals themselves.

6.3.1. MEMORY Section

Below is an example of a memory section of a mem_desc file.

```
MEMORY {
    page 0:
        i_ram:  origin = 0000h, length = 1000h
        i_rom:  origin = 4000h, length = 800h, option = "ROM"
    page 1:
        bss_x:  origin = 0000h, length = 800h
    page 2:
        bss_y:  origin = 0000h, length = 800h
        perip_y: origin = 4000h, length = 400h, option = "OLDPERIPHERAL"
        host_mem:  origin = 4400h, length = 400h
        stdio: origin = 0x7000, length = 2, option = "vsstdio"
    page 3:
}
```

Each entry in the memory configuration file consists of four fields. The first one, *page*, defines the memory page for that entry. The page definition can be omitted when the page does not change. The second field defines a logical name for the entry, e.g. *bss_x*. The third field, *origin*, sets the starting address, and the fourth field, *length*, defines the length of the memory block. Start addresses and lengths are currently not restricted in any way except that they may not overlap.

An optional field, *option*, may be used to define special attributes for the memory entries. These definitions are used only by the simulator. Hardware emulator will ignore any memory area definitions with the option field present.

Currently the following special options are available:

- *option=”ROM”* flags a memory area as read-only.
- *option=”quit”* defines an end-address for program execution. If instructions are fetched from memory address that has this option, the simulation is stopped with success return value. This option is only available in page 0 (the instruction memory space).
- *option=”>file”* and *option=”<file”* option starting with a '<' defines an input file, and option starting with a '>' defines an output file. These options are only available in pages 1, 2, and 3. Pages 1 and 2 are data memories X and Y, respectively. Page 3 refers to both of them, meaning that page 3 can be accessed from both X- and Y-bus.
- *option=”vsstdio”* is a special module that provides C standard input/output support. It must be defined into the right location for the libc16 and libc32 libraries. The normal location is Y memory (page 1) at 0x7000.
- *option=”PERIPHERAL“* defines an area as a peripheral bus bridge access point. Writes are pipelined, reads cause one wait state. The actual peripheral register mapping is defined in the *PERIPHERAL* section.
- *OLDPERIPHERAL* defines an area as a peripheral bus bridge access point. Writes are pipelined, reads do not cause wait states. The actual peripheral register mapping is defined in the *PERIPHERAL* section.

6.3.2. CORE Section

```
CORE {
   frequency = 48.0MHz
   bootaddr = 0x4000
}
```

The core section sets some parameters for the core. By setting a clock frequency (or cycle time) the simulation can show and understand 'realtime'.

6.3.3. PERIPHERAL Section

Below is an example peripheral section of a mem_desc file.

```
PERIPHERAL {
    Y:0x4000 = 15-0:INTERRUPT.enablel0
    Y:0x4002 = 15-0:INTERRUPT.enableh0
    Y:0x4004 = 15-0:INTERRUPT.origin0
    Y:0x4006 = 15-5:0,4-0:INTERRUPT.vector
    Y:0x4007 = 15-3:0,2-0:INTERRUPT.encount
    Y:0x4008 = 15-0:INTERRUPT.glob_dis
    Y:0x4009 = 15-0:INTERRUPT.glob_en

    Y:0x4020 = 15-0:IO.ddr
    Y:0x4021 = 15-0:IO.odata
    Y:0x4022 = 15-0:IO.idata
    Y:0x4023 = 15-0:IO.int_fall
    Y:0x4024 = 15-0:IO.int_rise
    Y:0x4025 = 15-0:IO.int_pend
    Y:0x4026 = 15-0:IO.set_mask
    Y:0x4027 = 15-0:IO.clear_mask
    Y:0x4028 = 15-0:IO.bit_conf
    Y:0x4029 = 15-0:IO.bit_eng0
    Y:0x402a = 15-0:IO.bit_eng1

    y:0x4040 = 3-0:UART0.ssr
    y:0x4041 = 7-0:UART0.data
    y:0x4042 = 15-8:UART0.data
    y:0x4043 = 15-8:UART0.div0,7-0:UART0.div1
    y:0x4060 = 3-0:UART1.ssr
    y:0x4061 = 7-0:UART1.data
    y:0x4062 = 15-8:UART1.data
    y:0x4063 = 15-8:UART1.div0,7-0:UART1.div1

    y:0x40a0 = 15-0:WDOG.config
    y:0x40a1 = 15-0:WDOG.reset
    y:0x40a2 = 15-0:WDOG.dummy
}
```

The peripheral section defines the mapping of peripheral registers into memory. The memory area must have been set aside in the memory section by using the option *PERIPHERAL* (asynchronous peripheral bus, 1 wait state in read, pipelined write) or *OLDPERIPHERAL* (synchronous peripheral bus, no wait states).

The peripherals must be instantiated with the same names that are used in the *PERIPHERAL* section.

6.3.4. INTERRUPT Section

Below is an example interrupt section of a mem_desc file.

```
INTERRUPT {
  type = vsdsp4
  interrupts = 16
}
```

The interrupt section configures the interrupt block. Depending on the interrupt handler type, different registers are available.

6.3.5. Peripheral instantiation

All other peripherals are configured and instantiated similarly to the interrupt handler. The peripheral definition begins with a unique name. The following block defines the characteristics of the peripheral instance.

```
IO {
        type = "stdio"
        infile = "gpioin.dat"
#       outfile = "gpioout.dat"
        bits = 16
        intnum = 0
        verbose = 1
}
```

The example instantiation above creates a peripheral called *IO*, which is the standard VSDSP4 interruptable GPIO block and gives it some parameters. Lines starting with a hash ('#') are regarded as comments.