AN140

INTEGRATING HI-TECH 8051 TOOLS INTO THE SILICON LABS IDE

1. Introduction

This application note describes how to integrate the HI-TECH 8051 Tools into the Silicon Laboratories IDE (Integrated Development Environment). Integration provides an efficient development environment with compose, edit, build, download and debug operations integrated in the same program.

2. Key Points

- The Intel OMF-51 absolute object file generated by the HI-TECH 8051 tools enables source-level debug from the Silicon Labs IDE.
- Once HI-TECH Tools are integrated into the IDE they are called by simply pressing the 'Assemble/Compile Current File' button or the 'Build/Make Project' button.
- See the included software, AN140SW, for an example using the HI-TECH tools.
- Information in this application note applies to Version 2.8 and later of the Silicon Labs IDE and Version 9.01 and later of the HI-TECH 8051 Tools.

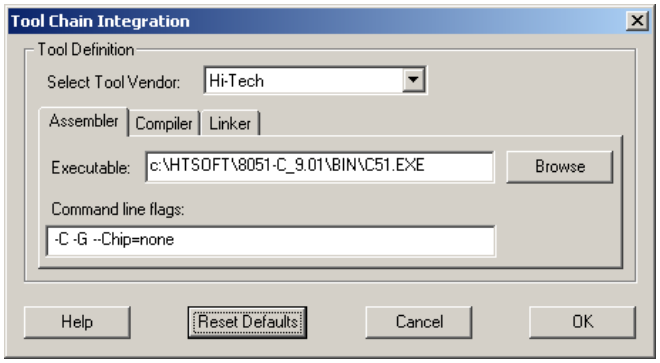
3. Create a Project in the Silicon Labs IDE

A project is necessary in order to link assembly files created by the compiler and build an absolute 'OMF-51' output file. Follow these steps to create a project:

1. Under the 'Project' menu, select 'Add Files to Project...'. Select the 'C' source files that you want to add and click 'Open'. Continue adding files until all project files have been added.
2. To add files to the build process, right-click on the file name in the 'Project Window' and select 'Add *filename* to build'.
3. Under the 'Project' menu, select 'Save Project As...'. Enter a project workspace name and click 'Save'.

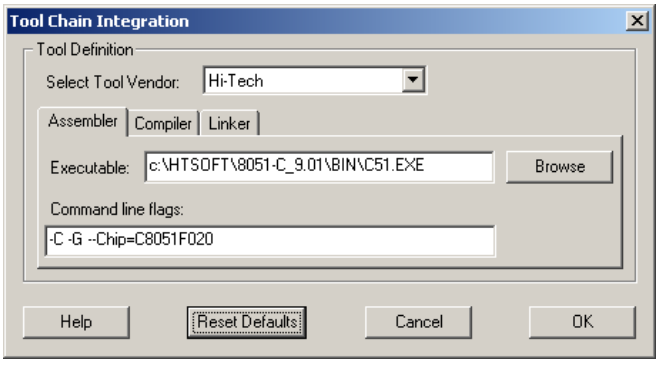
4. Configure the Tool Chain Integration Dialog

Under the 'Project' menu select 'Tool Chain Integration' to bring up the dialog box shown below. First, select 'Hi-Tech' from the 'Select Tool Vendor' drop down list. Next, define the HI-TECH assembler, compiler, and linker as shown in the following sections.



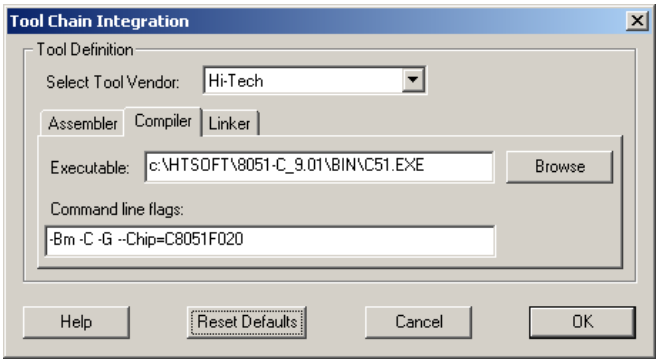
4.1. Assembler Definition

1. Under the 'Assembler' tab, if the assembler executable is not already defined, click the browse button next to the 'Executable:' text box, and locate the assembler executable. The default location for the HI-TECH assembler is "c:\HTSOFT\8051-C_9.01\BIN\C51.EXE".
2. Enter the processor command line flag directly in the 'Command Line Flags' box. This flag designates which processor the code will be running on. It takes the form of '--Chip=C8051Fxxx' (For example, the flag for the C8051F020 processor is '--Chip=C8051F020').
3. Enter any additional command line flags directly in the 'Command Line Flags' box.
4. See the following figure for the 'Assembler' tab with the default HI-TECH settings and the '--Chip=C8051F020' flag.



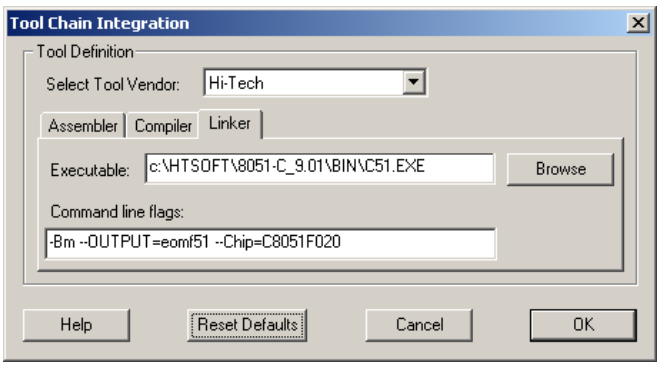
4.2. Compiler Definition

1. Under the ‘Compiler’ tab, if the compiler executable is not already defined, click the browse button next to the ‘Executable:’ text box, and locate the compiler executable. The default location for the HI-TECH compiler is “c:\HTSOFT\8051-C_9.01\BIN\C51.EXE”.
2. Enter the processor command line flag directly in the ‘Command Line Flags’ box. This flag designates which processor the code will be running on. It takes the form of '--Chip=C8051Fxxx' (For example, the flag for the C8051F020 processor is '--Chip=C8051F020').
3. Enter any additional command line flags directly in the ‘Command Line Flags’ box.
4. See the following figure for the ‘Compiler’ tab with the default HI-TECH settings and the ‘--Chip=C8051F020' flag.



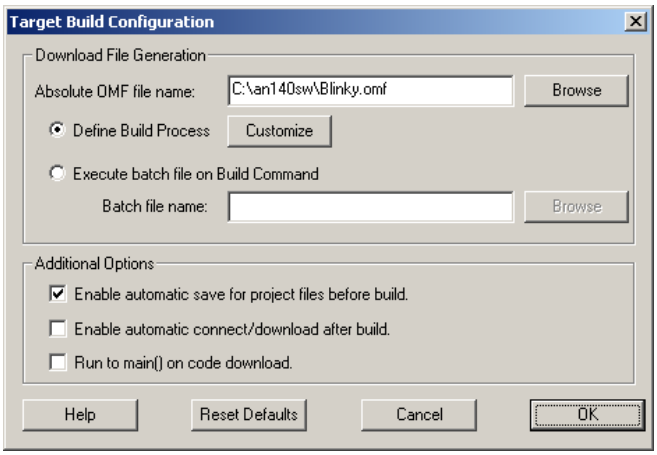
4.3. Linker Definition

1. Under the ‘Linker’ tab, if the linker executable is not already defined, click the browse button next to the ‘Executable:’ text box, and locate the linker executable. The default location for the HI-TECH linker is “c:\HTSOFT\8051-C_9.01\BIN\C51.EXE”.
2. Enter the processor command line flag directly in the ‘Command Line Flags’ box. This flag designates which processor the code will be running on. It takes the form of '--Chip=C8051Fxxx' (For example, the flag for the C8051F020 processor is '--Chip=C8051F020').
3. Enter any additional command line flags directly in the ‘Command line flags’ box.
4. See the following figure for the ‘Linker’ tab with the default HI-TECH settings and the ‘--Chip=C8051F020’ flag.



5. Target Build Configuration

Under the ‘Project’ menu select ‘Target Build Configuration’ to bring up the dialog box shown below.

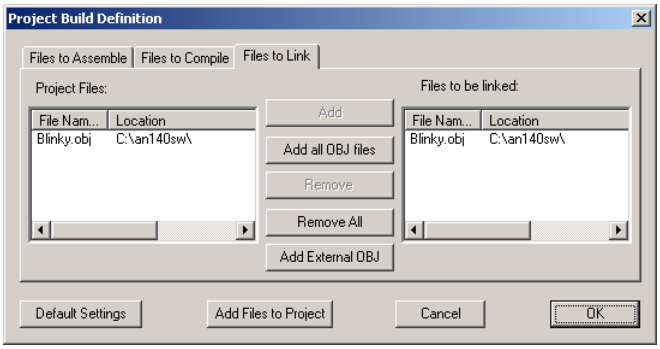


5.1. Output Filename

To customize a default filename or to create a new filename, click the browse button next to the ‘Absolute OMF file name:’ edit box. Select a path and enter an output filename with a ‘.omf’ extension (ex. blinky.omf).

5.2. Project Build Definition

Click the ‘Customize’ button to bring up the ‘Project Build Definition’ window shown below. This window allows selection of the files to be included in the build process. Although, default assemble and compile selections will be made, ensure that all files have been correctly included in the build process. Under each tab, add Files to assemble or compile by selecting the desired file and clicking the ‘Add’ button. Files are removed in the same manner.



5.3. Additional Options

1. If the 'Enable automatic save for project files before build.' box is checked, then all files included in the project will be automatically saved when the 'Build/ Make project' button is pressed.
2. If the 'Enable automatic connect/download after build.' box is checked, then the project will be automatically downloaded to the target board when the 'Build/Make project' button is pressed.

6. Building the Project

See the included software, AN140SW, for an example file (blinky.c) created for use with the HI-TECH compiler.

1. After saving all files that have been edited, the previous revisions will be saved in backup files. Backups are saved as the name of the file with the extension #1, #2, #3, and so on up to the number of backups (N) created and available. '#1' being the most recent and 'N' being the least recent.
2. Click the 'Assemble/Compile current file' button to compile just the current file.
3. Click the 'Build/Make project' button to compile and link all the files in the project.
4. Review the errors and warnings generated during the build process located in the 'Build' tab of the Output window (typically found at the bottom of the screen). Double-clicking on an error that is associated with a line number will automatically move the cursor to the proper line number in the source file that generated the error.

7. Source File Example

```
//-----------------------------------------------------------------------------
// Blinky.c
//-----------------------------------------------------------------------------
// Copyright (C) 2007 Silicon Laboratories, Inc.
//
// AUTH: JM
// DATE: 10 JUNE 03
// Description: This program flashes the green LED on the C8051F020 target board about
// five times a second using the interrupt handler for Timer3.
// Target: C8051F02x
//
// Tool chain: HI-TECH Evaluation 'C'
//

//-----------------------------------------------------------------------------
// Includes
//-----------------------------------------------------------------------------
#include "8051.h"                                       // SFR declarations
#include "intrpt.h"                                         // Interrupt declarations

//-----------------------------------------------------------------------------
// Global CONSTANTS
//-----------------------------------------------------------------------------
#define SYSCLK 2000000                    // approximate SYSCLK frequency in Hz

static volatile bit LED @ 0x96;           // green LED: '1' = ON; '0' = OFF

//-----------------------------------------------------------------------------
// Function PROTOTYPES
//-----------------------------------------------------------------------------
void PORT_Init (void);
void Timer3_Init (int counts);
interrupt void Timer3_ISR (void);

//-----------------------------------------------------------------------------
// MAIN Routine
//-----------------------------------------------------------------------------
void main (void) {

   ROM_VECTOR(TIMER3, Timer3_ISR);        //Interrupt vector TIMER3 (0x73) points to
                                          //TIMER3_ISR for interrupt handling

   // disable watchdog timer
   WDTCN = 0xde;
   WDTCN = 0xad;

   PORT_Init ();
   Timer3_Init (SYSCLK / 12 / 10);        // Init Timer3 to generate interrupts
                                          // at a 10Hz rate.

   EA = 1;                                // Enable global interrupts

   while (1) {                            // spin forever
   }
}
```

```
//-----------------------------------------------------------------------------
// PORT_Init
//-----------------------------------------------------------------------------
//
// Configure the Crossbar and GPIO ports
//
void PORT_Init (void)
{
   XBR2    = 0x40;                     // Enable crossbar and weak pull-ups
   P1MDOUT |= 0x40;                    // enable P1.6 (LED) as push-pull output
}

//-----------------------------------------------------------------------------
// Timer3_Init
//-----------------------------------------------------------------------------
//
// Configure Timer3 to auto-reload and generate an interrupt at interval
// specified by <counts> using SYSCLK/12 as its time base.
//
void Timer3_Init (int counts)
{
   TMR3CN = 0x00;                      // Stop Timer3; Clear TF3;
                                       // use SYSCLK/12 as timebase
   TMR3RLL = -counts;                  // Init reload values
   TMR3RLH = -counts >> 8;             // Init reload values

   TMR3L = 0xff;                       // set to reload immediately
   TMR3H = 0xff;                       // set to reload immediately

   EIE2   |= 0x01;                     // enable Timer3 interrupts
   TMR3CN |= 0x04;                     // start Timer3
}

//-----------------------------------------------------------------------------
// Interrupt Service Routines
//-----------------------------------------------------------------------------

//-----------------------------------------------------------------------------
// Timer3_ISR
//-----------------------------------------------------------------------------
// This routine changes the state of the LED whenever Timer3 overflows.
//
interrupt void Timer3_ISR (void)
{
   TMR3CN &= ~(0x80);                     // clear TF3
   LED = !(LED);                          // change state of LED
}
```

8. Include File Example

HI-TECH provides include files for several Silicon Labs device families with the installation of their tools. For any 8051 device you would use the 8051.h file, located by default in the “C:\HTSOFT\8051-C_9.01\include” directory. When this file is included, the compiler will know which device-specific header file to include based on the processor command line flag.

DOCUMENT CHANGE LIST

Revision 1.2 to Revision 1.3

- Paths updated to support HI-TECH tools Version 9.01.
- Screenshots updated to support Silicon Labs IDE Version 2.8.
- Reference to application note software updated from AN040SW to AN140SW.
- Command line flag to specify the target device updated from -c8051F020 to --Chip=C8051F020.

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