

Integrated Development Environment e² studio

How to use Cyclomatic Complexity measurement tool in e² studio

Introduction

There is the cyclomatic complexity which is one method to measure the software quality. It is a numerical indicator of how complex the source code is.

This document describes how to use e^2 studio with two tools to measure the cyclomatic complexity of source code.

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1. Overview

1.1 Purpose

e² studio is an integrated development environment for Renesas microcontrollers based on the open source "Eclipse".

There is the cyclomatic complexity which is one method to measure the software quality.

Refer to: Cyclomatic complexity - Wikipedia

The cyclomatic complexity is a numerical indicator of how complex source code is. The higher the number, the more complex the source code and the higher the probability of introducing bugs. Keeping that number low makes your program more readable, maintainable, and portable.

This document describes how to use e^2 studio with two tools below to measure the cyclomatic complexity of source code.

- SourceMonitor
- Lizard

1.2 Method of cooperation of e² studio

In order to call the feature of the cyclomatic complexity tool from e^2 studio, you need to use the external tools feature in e^2 studio.

The external tools feature is the function, with which you can easily run the registered external tools, only by selecting the menu of e^2 studio in which you set the procedure of launching the tools beforehand.

Registering the cyclomatic complexity tool as an external tool of e^2 studio enables you to measure the cyclomatic complexity from e^2 studio easily.

1.3 Environment

Renesas have confirmed the operating procedure explained in this document in the environment below.

[OS]

OS Windows 10 x64

[Tool]

• e² studio 2024-01

[Project]

• This document does not explain how to create a project. Please prepare the project yourself.

"Renesas" does not warrant the general behavior of that tools with e² studio. Because it is Open-Source Software which we cannot manage. We really appreciate your understanding in advance.



2. SourceMonitor

derpaul.net/SourceMonitor/

2.1 Installation

This chapter describes the operating procedure for installing SourceMonitor.

To install SourceMonitor:

- 1) Download the "SMSetupV3516.exe" from the above web site.
- 2) Next, execute the "SMSetupV3516.exe" to install SourceMonitor.

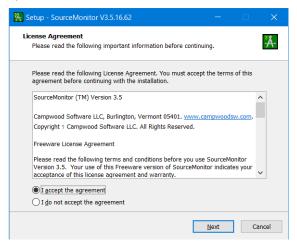


Figure 1

3) Proceed to complete that install according to the installer wizard.

2.2 Configuration

This chapter describes the operating procedure for the setup SourceMonitor on e² studio.

You need to register two commands below to the external tools function.

- Command for "Measuring" (to measure the cyclomatic complexity by running the SourceMonitor from e² studio)
- Command for "Display the result" (to display the measurement result by launching the GUI of SourceMonitor from e² studio)

And you need to create a batch command XML file for SourceMonitor.

2.2.1 Register command for "Measuring"

To register a command for "Measuring" as steps below.

- 1) Start e² studio.
- 2) Select the menu [Run] > [External Tools] > [External Tools Configurations...].
- 3) The [External Tools Configurations] dialog is appeared. Select "Program" and click the [New launch configuration] button to create a new configuration.
- 4) When selecting the created new configuration, the right panel on the dialog will switch to the configuration panel. Click the [Main] tab and input the contents below.
 - [Name:] textbox

SourceMonitor - Parse Source Code



- [Location:] textbox
 - Install path of SourceMonitor.exe
 - Ex: C:\Program Files (x86)\SourceMonitor\SourceMonitor.exe
- [Arguments:] textbox
 - /C \${resource_loc}

("\${resource_loc}" is the variable to designate the absolute path to the selected resources)

External Tools Configuration	ns – 🗆 🗙	<
Create, manage, and run Run a program	configurations Oracle Configurations	1
Image: Second system Image: Second system Image: Second system Ima	Name: SourceMonitor - Parse Source Code	
	Browse Workspace Browse File System Variables Arguments:	
	Variables Variables Variables	·
Filter matched 2 of 2 items	Run Close	

Figure 2

- 5) Click the [Environment] tab and press the [New...] button (on e² studio 64-bit version, [New...] should read [Add...] instead.) to register the environment variables below.
 - Variable: PROJECT_LOC
 - Value: \${project_loc}

("\${project_loc}" is a value of the variable to designate an absolute path of the project which includes the selected resources)

External Tools Configuration	ons				
Create, manage, and run	configurations			0,	-
Run a program				1	
🗋 🖻 🗞 🗎 🗶	Name: SourceMonitor	- Parse Source Code			
type filter text	📄 Main 🧬 Refresh	🔂 Build 📧 Environment 🔲 Common			
V 🂁 Program	Environment variables	to set:			^
🌯 * New_configurati	Variable	Value		Add	
	PROJECT_LOC	\${project_loc}		Select	
					×
< >		Show Command Line Reven		Apply	
Filter matched 2 of 2 items		Show command line	·	Арріу	
?		Ru	n	Close	e

Figure 3

6) Click the [Common] tab and check the checkbox of [External Tools] in [Displayed in favorite menu].



External Tools Configuration	ons – 🗆 X
Create, manage, and run Run a program	configurations O
Image: Second system Image: Second system Image: Second system Ima	Name: SourceMonitor - Parse Source Code Main Refresh Build Environment Common Save as Cocal file Shared file: Browse. Display in favorites menu Encoding Use system encoding (windows-31j) Display in favorites menu Display in
Filter matched 2 of 2 items	Cother ISO-8850-1

Figure 4

7) After setting, press the [Apply] button.

2.2.2 Register command for "Display the result"

To register a command for "Display the result" as steps below.

- 1) Press the [New launch configuration] button to create a new configuration.
- 2) Click the [Main] tab and input the contents below.
 - [Name:] textbox

SourceMonitor - Display the result

- [Location:] textbox
 Install path of SourceMonitor.exe
 Ex: C:\Program Files (x86)\SourceMonitor\SourceMonitor.exe
- [Arguments:] textbox
 \${resource_loc}

("\${resource_loc}" is the variable to designate the absolute path to the selected resources)



External Tools Configuratio	ns	– D X							
Create, manage, and run	configurations	0							
Run a program									
C 🖻 🌤 🗎 🗙 🖻 🏹	Name: SourceMonitor - Display the result								
type filter text	📄 Main 🤣 Refresh 🔒 Build 📧 Environmen	t 🔲 Common							
V 🂁 Program	Location:	^							
थे * New_configurati थे * SourceMonitor -	C:¥Program Files (x86)¥SourceMonitor¥Source	Monitor.exe							
Sourcewonitor -	Browse Workspace	Browse File System Variables							
	Working Directory:								
	Browse Workspace	Browse File System Variables							
	Arguments:								
	{resource_loc}	^ ~							
		Variables 🗸							
< >>									
Filter matched 3 of 3 items	Show Comma	nd Line Revert Apply							
?		Run Close							

Figure 5

- 3) Click the [Common] tab and check the checkbox of [External tool] in [Displayed in favorite menu].
- 4) After setting, press the [Apply] button and [Close] button to close the dialog.

2.2.3 Create the batch command XML file

To measure the cyclomatic complexity of the project by using SourceMonitor, it is necessary to create a batch command XML file in which the measuring procedure is written and put it in the project folder.

- 1) Create a batch command XML file for SourceMonitor. Please set the file extension as ".xml".
- 2) Copy and paste the contents below into the created file.

This file is described in the command language (XML syntax) which is defined in SourceMonitor. Regarding the details of this language specification, please refer to the help document of SourceMonitor.

```
<?xml version="1.0" encoding="UTF-8" ?>
<sourcemonitor_commands>
<write_log>true</write_log>
<command>
  <project_file_wrt_script>SourceMonitorProject.smproj</project_file_wrt_script>
  <parse_utf8_files>true</parse_utf8_files>
  <project_language>C</project_language>
  <source_directory>%PROJECT_LOC%</source_directory>
  <file_extensions>*.h,*.c</file_extensions>
  <include_subdirectories>true</include_subdirectories>
  <modified_complexity>true</modified_complexity>
  <ignore_blank_lines>false</ignore_blank_lines>
  </command>
  </sourcemonitor_commands>
```

- 3) Edit the information below in the created file as necessary.
 - For C++ projects, change "C" in <project_language> to "C++".



- If you want to measure only a specific folder, change "%PROJECT_LOC%" in <source_directory> to, for example, "%PROJECT_LOC%\src".
- If the extension of the target file is missing, add the extension to <file_extensions>.

2.3 Execution

This chapter describes how to measure the cyclomatic complexity for a project and confirm the result of measurement.

- 1) In the [Project Explorer] view, select the batch command XML file for SourceMonitor, and select the [RUN] > [External tools] > [1. SourceMonitor Parse Source Code].
- 2) Then, the "SourceMonitorProject.smproj" is created in the same folder in which the command batch file for SourceMonitor is located. The result of measurement has been recorded in this file.

e – – –	
🖹 Console 🗙 🐘 🔜 🐶 🥃 🖉 🚽 🖬 🖬 🖓 👘	
terminated > SourceMonitor - Parse Source Code [Program] C:¥Program Files (x86)¥SourceMonitor¥SourceMonitor.exe [pid: 1292] (Mar 27, 2024, 2:35:32 P	M – 2:35:3
1024-03-27 14:35:32.087 DEBUG [18684] [CSMApp::WriteDebugMessageToConsole@1324] Start up logging	^
2024-03-27 14:35:32.088 DEBUG [18684] [CSMApp::WriteLog@1250] ****** SourceMonitor (V3.5.16.62): Begin Session	
1024-03-27 14:35:32.088 DEBUG [18684] [CSMApp::WriteLog@1250] Command Line Option: Process '/C E:\e2_studio\works	pace\s
2024-03-27 14:35:32.088 DEBUG [18684] [CSMApp::WriteDebugMessageToConsole@1324] Process command script	
2024-03-27 14:35:32.088 DEBUG [18684] [CSMApp::WriteDebugMessageToConsole@1324] Command script processing starting	g
1024-03-27 14:35:32.091 DEBUG [18684] [CSMApp::WriteLog@1250] Command File: Process Command File 'E:\e2_studio\wo	rkspac
2024-03-27 14:35:32.091 DEBUG [18684] [CSMApp::WriteLog@1250] Parameter Error: Parse error (cause unknown). [Line	1]
2024-03-27 14:35:32.091 DEBUG [18684] [CSMApp::WriteLog@1250] Command File: End Command File Processing	
2024-03-27 14:35:32.091 DEBUG [18684] [CSMApp::WriteDebugMessageToConsole@1324] Command script processing done	
2024-03-27 14:35:32.091 DEBUG [18684] [CSMApp::WriteLog@1250] ****** SourceMonitor (V3.5.16.62): ****** End Sessic	on 🗸
	>

Figure 6

- 3) In the [Project Explorer] view, select the "SourceMonitorProject.smproj" which is created int the measurement, and select the [Launch] > [External tools] > [2. SourceMonitor Display the result].
- 4) Then, the GUI of SourceMonitor is invoked, the measurement result which recorded in the "SourceMonitorProject.smproj" is displayed.

👯 SourceMonitor	- [C Checkpoint	ts In Pro	ject 'Sour	ceMonitorPro	ject']						-		×
🏶 File Edit View	Checkpoint	Windo	w Help									-	. <i>8</i> ×
	5 Q × 2	K? 🚨]										
Checkpoint Name	Created 🗸	Files	Lines	Statements	% Branches	% Comments	Functions	Avg Stmts/Function	Max Complexity	Max Depth	Avg Depth	Avg Com	plexity
Checkpoint1	22 Mar 2024	71	38,305	19,496	2.4	24.5	175	11.1	54*	5	1.80		3.49*
For Help, press F1													



2.4 Tips

This chapter describes some points to use SourceMonitor conveniently.

2.4.1 Measurable data

SourceMonitor can measure the data below.

- Whole project, or each source file
 - Number of code lines, Number of statements, Rate of branch statements, Rate of comment lines, Number of functions, Number of statements per one function, Complexity (Maximal value, Average value), Depth of nested (Maximal value, Average value), Number of Classes, Number of methods per 1 Class
- Each method

Complexity, Number of statements, Depth of nested, Number of calling method



2.4.2 Confirm the result of project

In SourceMonitor GUI, the measurement summary of project is displayed in chronological order (descending order) at each past check point. The check point is the point for comparing the measurement results in chronological order. A check point is created one by one for every time is measured.

In addition, if you select any check point in this view and the right click menu [Display Checkpoint Metrics Summary...], you can confirm the detail of metrics at the check point.

Metrics Summary For Checkpoint 'Checkpoin	it1'	
Parameter	Value	^
Project Directory Project Name Checkpoint Name Created On Files Lines Statements Percent Branch Statements Percent Lines with Comments Functions Average Statements per Function Line Number of Most Complex Function Name of Most Complex Function	E:le2_studio\workspace\sample\ SourceMonitorProject Checkpoint1 22 Mar 2024, 18:52:43 71 19,496 2.4 24.5 175 11.1 {undefined} bsp_gr_int_enable_disable()*	
Complexity of Most Complex Function Line Number of Deepest Block	54* {undefined}	~
Kiviat Graph:	Block Histogram (statements vs. depth):	
% Branches Avg Complexity Avg Depth Max Depth Max Complexity	hetion $0 = 0$	Help Copy Print Done

Figure 8

2.4.3 Confirm the result of source file

If you select any check point in the project view and double click, "Checkpoint View" opens. In this view, you can confirm the result for each source file in the project.

Edit View Window Help											
C Checkpoints In Project 'SourceMonitorProject' [Base Directory	v: 'E·¥e2 studio¥wo	rksnace¥sample	¥src¥'l					×			
					o						
heckpoint Name Created V Files Lines Statements											
heckpoint1 22 Mar 2024 71 38,305 19,496	2.4	24.5	175	11.1	54*	5 1.80	3.49)*			
E Files in C Project 'SourceMonitorProject', Checkpoint 'Checkpo	oint1' [Base Direct	ory: 'E:¥e2_studi	o¥workspace¥sar	nple¥src¥']						- 0	
Files in C Project 'SourceMonitorProject', Checkpoint 'Checkpo File Name					unctions Avg St	mts/Function Max 0	Complexity Max	Depth A			
					unctions Avg St	mts/Function Max C	Complexity Max	C Depth A		Complex	exity
File Name	∆ Lir	es Statement	% Branches	% Comments F	unctions Avg St 1 3		Complexity Max 1* 1*	CDepth A	vg Depth Avg	Complex 1.0	exity
File Name sample.c	∠ Lir	es Statement	% Branches	% Comments F 52.9	1	0.0	1*	CDepth Av	vg Depth Avg 0.00	Complex 1.0 1.0	exity 00*
File Name sample.c smc_gen\Config_CMT0\Config_CMT0.c	∠ Lir	17 Statement 08 16	% Branches 0.0 0.0	% Comments F 52.9 63.0	1	0.0 3.3	1*	0	vg Depth Avg 0.00 0.62	Complex 1.0 1.0 0.0	
File Name sample.c smc_gen/Config_CMT0/Config_CMT0.c smc_gen/Config_CMT0/Config_CMT0.h smc_gen/Config_ORTC.c smc_gen/Config_PORTC.c	∠ Lir	Image Statements 17 10 08 16 60 12 80 16 72 12	% Branches 0.0 0.0 0.0 0.0 0.0 0.0	% Comments F 52.9 63.0 70.0 71.2 66.7	1	0.0 3.3 0.0 0.0 8.0	1*	0 1 0 0 1	vg Depth Avg 0.00 0.62 0.00 0.00 0.67	Complex 1.0 1.0 0.0 1.0 1.0 1.0	exity 00* 00* 00* 00*
File Name sample.c smc_geniConfig_CMT0iConfig_CMT0.c smc_geniConfig_CMT0iConfig_CMT0.h smc_geniConfig_CMT0iConfig_CMT0.user.c smc_geniConfig_PORTiConfig_PORT.h	∠ Lir	Image Statements 17 10 08 16 60 12 80 12 72 12 54 12	% Branches 0.0 0.0 0.0 0.0 0.0 0.0 0.0	% Comments F 52.9 63.0 70.0 71.2 66.7 75.9	1	0.0 3.3 0.0 0.0 8.0 0.0	1*	0 1 0 0 1 0	vg Depth Avg 0.00 0.62 0.00 0.00 0.67 0.00	Complex 1.0 0.0 1.0 1.0 1.0 0.0	exity .00* .00* .00* .00* .00*
File Name sample.c smc_gen/Config_CMT0/Config_CMT0.c smc_gen/Config_CMT0/Config_CMT0.h smc_gen/Config_ORTC.c smc_gen/Config_PORTC.c	∠ Lir	Statement: 17 3 08 16 60 9 80 6 72 12 54 5	% Branches 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0	% Comments F 52.9 63.0 70.0 71.2 66.7	1	0.0 3.3 0.0 0.0 8.0	1*	0 1 0 0 1	vg Depth Avg 0.00 0.62 0.00 0.00 0.67	Complex 1.0 0.0 1.0 1.0 1.0 0.0	exity .00* .00* .00* .00* .00*
File Name sample.c smc_geniConfig_CMT0iConfig_CMT0.c smc_geniConfig_CMT0iConfig_CMT0.h smc_geniConfig_CMT0iConfig_CMT0.user.c smc_geniConfig_PORTiConfig_PORT.h	∠ Lir	Statement: 17 10 08 10 60 10 80 10 72 11 54 10 81 25	% Branches 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0	% Comments F 52.9 63.0 70.0 71.2 66.7 75.9	1	0.0 3.3 0.0 0.0 8.0 0.0	1*	0 1 0 0 1 0	vg Depth Avg 0.00 0.62 0.00 0.00 0.67 0.00	Complex 1.0 1.0 1.0 1.0 1.0 0.0 1.0 0.0 1.0 0.0 1.0 0.0 1.0 0.0 1.0 0.0 0	exity 00* 00* 00*
File Name Sample.c smc.gen/Config_CMT0/Config_CMT0.c smc.gen/Config_CMT0/Config_CMT0.h smc.gen/Config_CMT0/Config_PORT.c smc.gen/Config_PORT/Config_PORT.c smc_gen/Config_PORT/Config_PORT.user.c	▲ Lir 1 1	Statement: 17 3 08 10 60 9 80 6 72 12 54 5	% Branches 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	% Comments F 52.9 63.0 70.0 71.2 66.7 75.9 77.8	1	0.0 3.3 0.0 0.0 8.0 0.0 0.0	1* 1* 0* 1* 1* 0* 1*	0 1 0 1 1 0 0	vg Depth Avg 0.00 0.62 0.00 0.00 0.67 0.00 0.00 0.00	Complex 1.0 1.0 0.0 1.0 1.0 0.0 1.0 0.0 1.0 0.0 1.0 0.0 1.0 0.0 1.0 0.0 1.0 0.0 0	exity .00* .00* .00* .00* .00* .00*

Figure 9

And, if you select any source file in this view and the right click menu [Display File Metrics Details...], you can confirm the detail result for the source file.



Metrics Details For File 'smc_gen¥r_bsp\ Metrics Details For File 'smc_gen¥r_bsp\	ŧmcu¥all¥r_bsp_common.c'	×
Parameter Project Directory Project Name Checkpoint Name File Name Lines Statements Percent Branch Statements Percent Branch Statements Percent Branch Statements Percent Directory Functions Average Statements per Function Line Number of Most Complex Function Name of Most Complex Function Complexity of Most Complex Function Line Number of Deepest Block Maximum Block Depth	Value E:le2_studio\workspace\sample\src\ SourceMonitorProject Checkpoint1 smc_genir_bsp\mcu\allir_bsp_common.c 245 44 20.5 59.2 5 6.6 147 R_BSP_SoftwareDelay()* 14* 179 3	~
Kiviat Graph: Avg Complexity Avg Depth Max Depth Max Complexity	s/Function 5 - Copy Print	

Figure 10

2.4.4 Confirm the result of function

If you select any check point in the "Project View" and select the right click menu [Display Function Metrics...], the "Method View" opens. In this view, you can confirm the metrics for each method in the project.

K SourceMonitor					- 0	
File Edit View Window Help						
C Checkpoints In Project 'SourceMonitorProject' [Base Directory: 'E:¥e						
Checkpoint Name Created V Files Lines Statements % Bra						
Checkpoint1 22 Mar 2024 71 38,305 19,496	2.4 24.5 175	11.1	54*	5 1.80	3	.49*
	All Functions in C Project 'Sour	eMonitorProject', Checkpo	int 'Checkpoint1'			
	Name of Function	▲ Complexity	Statements Max	imum Depth Calls		^
	read	3*	8	2 1		
	write	5*	11	2 1		
	_read	1*	4	1 3		
	_top_of_heap write	1* 2*	1	1 0		
	bsp adc initial configure	2*	11	2 4		
	bsp bsc initial configure	1*	8	1 0		
	bsp_bus_priority_initialize	4*	18	1 3		
	bsp_calc_atan_fsp	1*	0	0 9		~
For Help, press F1						

Figure 11



3. Lizard

lizard.ws

3.1 Installation

This chapter describes the operating procedure for installing Lizard.

To download Lizard:

- 1) Click the [Download >>] button on the above page.
- 2) Lizard project page is displayed. Click the [Download files] in the [Navigation] area.
- 3) The [Download files] panel is displayed. Click the [lizard-1.17.10-py2.py3-none-any.whl] for download.

Lizard is the Python command. You need to execute the pip install command to install Lizard after installing Python according to the steps below.

- 4) Open the <u>Welcome to Python.org</u> page.
- 5) Select the [Download] menu and click the [Python 3.12.2] button.
- 6) After downloading, execute that installer to install Python.

And check [Add python.exe to PATH] checkbox at the panel below.



Figure 12

- 7) When the Python installation is finished, start the command prompt of Windows.
- 8) Input and execute "py --version" in the command prompt window.

If Python is installed correctly, "Python 3.12.2" will be displayed. If an error occurs, please check that Python is installed correctly and that the Python installation folder is correctly specified in the PATH environment variable.

- 9) Input and execute "pip --version" in the command prompt window.
- 10) Move the current folder to a folder which the "lizard-1.17.10-py2.py3-none-any.whl" is put.
- 11) Input and execute "pip install lizard" in the command prompt window.

When Lizard is installed, you will see the message below:

Collecting lizard

Using cached lizard-1.17.10-py2.py3-none-any.whl.metadata (15 kB)

Using cached lizard-1.17.10-py2.py3-none-any.whl (66 kB)

Installing collected packages: lizard



Successfully installed lizard-1.17.10

3.2 Configuration

This chapter describes the operating procedure for the setup Lizard on e^2 studio.

You need to register one command below to the external tool configuration.

 Command for "Measuring and display the result" (to measure the cyclomatic conplexity by running the Lizard from e² studio and to display the measurement result)

3.2.1 Register command for "Measuring and display the result"

To register a command as steps below.

- 1) Start e² studio.
- 2) Select the menu [Run] > [External Tools] > [External Tools Configurations...].
- 3) The [External Tools Configurations] dialog is appeared. Select "Program" and click the [New launch configuration] button to create a new configuration.
- 4) When selecting the created new configuration, the right panel on the dialog will switch to the configuration panel. Click the [Main] tab and input the contents below.

(If you need to add an environment variable, click the [Environment] tab and setup the environment variable.)

[Name:] textbox

Lizard - Parse Source Code and display the result

• [Location:] textbox

Install path of lizard.exe

Ex: C:\Users\<User name>\AppData\Local\Programs\Python\Python312\Scripts\lizard.exe

• [Arguments:] textbox

\${resource_loc}/ -l cpp

("\${resource_loc}" is the variable to designate the absolute path to the selected resources)

External Tools Configuratio	ns – 🗆 X
Create, manage, and run	configurations
Run a program	
📑 🖻 🗭 🗎 🗶 🖻 🍸	Name: Lizard - Parse Source Code and display the result
type filter text	🗐 Main 🤣 Refresh 🚮 Build 🖾 Environment 🔲 Common
🗸 🂁 Program	Location:
№ * New_configuratic № * SourceMonitor -	C:¥Users¥ ¥AppData¥Local¥Programs¥Python¥Python312¥Scripts¥lizard.exe
 SourceMonitor - * SourceMonitor - 	Browse Workspace Browse File System Variables
	Working Directory:
	Browse Workspace Browse File System Variables
	Arguments:
	{resource_loc}/ -l cpp
	Variables v
< >	
Filter matched 4 of 4 items	Show Command Line Revert Apply
?	Run Close

Figure 13



- 5) Click the [Common] tab and check the checkbox of [External Tools] in [Displayed in favorite menu].
- 6) After setting, press the [Apply] button and [Close] button to close the dialog.

3.3 Execution

This chapter describes how to measure the cyclomatic complexity for a project and confirm the result of measurement.

- 1) In the [Project Explorer] view, select the folder you want to measure, and select the [RUN] > [External tools] > [3. Lizard Parse Source Code and display the result].
- 2) Then, Lizard is invoked, the measurement result is displayed.

e					– D X
Console	×				III 🗙 💥 🗟 🖬 💭 🛃 🖬 🖘 🖬 🖬 🗸 🖛 🖬 🖛
terminated	> Lizard	- Parse So	ource Cod	le and displ	ay the result [Program] C:¥Users¥a5088664¥AppData¥Local¥Programs¥Python¥Python312¥Scripts¥lizard.exe [pid: 8096] (Mar 28, 2
NLOC	CCN	token	PARAM	length	location
9	1				R_Config_CMT0_Create@55-73@E:\e2_studio\workspace\sample\src/smc_gen\Config_CMT0\Config_CMT0.c
2	1				R_Config_CMT0_Start@82-89@E:\e2_studio\workspace\sample\src/smc_gen\Config_CMT0\Config_CMT0.c
2	1		-		<pre>R_Config_CMT0_Stop@98-105@E:\e2_studio\workspace\sample\src/smc_gen\Config_CMT0\Config_CMT0.c</pre>
2	1	-	-		R_Config_CMT0_Create_UserInit@55-59@E:\e2_studio\workspace\sample\src/smc_gen\Config_CMT0\Confi r Config_CMT0_cmi0_interrupt@73-77@E:\e2_studio\workspace\sample\src/smc_gen\Config_CMT0\Config_ CMT0\Config_CMT0_cmi0_interrupt@73-77@E:\e2_studio\workspace\sample\src/smc_gen\Config_CMT0\Config
13	1	-	-		<pre>R_Config_PORT_Create@55-69@E:\e2_studio\workspace\sample\src/smc_gen\Config_PORT\Config_PORT.c</pre>
3	1				R_Config_PORT_Create_UserInit@55-59@E:\e2_studio\workspace\sample\src/smc_gen\Config_PORT\Config_PORT\Confi
3	1	-	-		r_undefined_exception@60-64@E:\e2_studio\workspace\sample\src/smc_gen\general\r_cg_hardware_se
14	3	-	-		R Systeminit@74-108@E:\e2_studio\workspace\sample\src/smc_gen\general\r_cg_hardware_se
4	1				R_CGC_Create@55-58@E:\e2_studio\workspace\sample\src/smc_gen\general\r_smc_cgc.c
3	1		-		R CGC Create UserInit@54-58@E:\e2_studio\workspace\sample\src/smc_gen\general\r_smc_ge.c
3	1	-	-		R_Interrupt_Create@55-58@E:\e2_studio\workspace\sample\src/smc_gen\general\r_smc_ge_user.c
10	6	-	-		hardware_setup@115-139@E:\e2_studio\workspace\sample\src/smc_gen\r_bsp\board\generic_rx65n\hws4
10	3				rom cache function set@150-167@E:\e2_studio\workspace\sample\src/smc_gen\r_osp\ooard\generic_r:
4	1		-		output ports configure@179-183@E:\e2_studio\workspace\sample\src/smc_gen\r_bsp\board\generic_r;
4	1		-		interrupts configure@191-195@E:\e2_studio\workspace\sample\src/smc_gen\r_bsp\board\generic_rx6
4	2		-		peripheral modules enable@204-211@E:\e2_studio\workspace\sample\src/smc_gen\r_bsp\board\generic
16	2		-		bsp adc initial configure@223-255@E:\e2_studio\workspace\sample\src/smc_gen\r_bsp\board\generic
11	1		-		bsp_bsc_initial_configure@265-279@E:\c2_studio\workspace\sample\src/smc_gen\r_bsp\board\generic
9	3		-		charput@80-98@E:\e2_studio\workspace\sample\src/smc_gen\r_bsp\mcu\all\lowlvl.c
9	3		-		charget@106-124@E:\e2_studio\workspace\sample\src/smc_gen\r_bsp\mcu\all\lowlvl.c
25	4		-		init_iolib@155-191@E:\e2_studio\workspace\sample\src/smc_gen\r_bsp\mcu\all\lowsrc.c
11	3		-		<pre>close_all@199-212@E:\e2_studio\workspace\sample\src/smc_gen\r_bsp\mcu\all\lowsrc.c</pre>
		51	1	14	<pre>close_arrests zrzet. (cz_statio (workspace (sumple (sr e) sine_Ben (r_bsp (incd (arr (lows) cre)))))))))))))))))))))))))))))))))))</pre>

Figure 14

3.4 Tips

This chapter describes some points to use Lizard conveniently.

3.4.1 Measurable data

Lizard can measure the data below.

- NLOC: Number of lines excluding comments and blank lines from "length"
- CCN: Number of cyclomatic complexity
- Token: Token number of each function
- PARAM: Parameter number of each function
- Length: Number of lines for each function
- Location: <Function name>@<Start line number>-<End line number>@<File path>



Revision History

		Description	
Rev.	Date	Page	Summary
Rev.1.00	Apr.01.24	All	New creation



General Precautions in the Handling of Microprocessing Unit and Microcontroller Unit Products

The following usage notes are applicable to all Microprocessing unit and Microcontroller unit products from Renesas. For detailed usage notes on the products covered by this document, refer to the relevant sections of the document as well as any technical updates that have been issued for the products.

1. Precaution against Electrostatic Discharge (ESD)

A strong electrical field, when exposed to a CMOS device, can cause destruction of the gate oxide and ultimately degrade the device operation. Steps must be taken to stop the generation of static electricity as much as possible, and quickly dissipate it when it occurs. Environmental control must be adequate. When it is dry, a humidifier should be used. This is recommended to avoid using insulators that can easily build up static electricity. Semiconductor devices must be stored and transported in an anti-static container, static shielding bag or conductive material. All test and measurement tools including work benches and floors must be grounded. The operator must also be grounded using a wrist strap. Semiconductor devices must not be touched with bare hands. Similar precautions must be taken for printed circuit boards with mounted semiconductor devices.

2. Processing at power-on

The state of the product is undefined at the time when power is supplied. The states of internal circuits in the LSI are indeterminate and the states of register settings and pins are undefined at the time when power is supplied. In a finished product where the reset signal is applied to the external reset pin, the states of pins are not guaranteed from the time when power is supplied until the reset process is completed. In a similar way, the states of pins in a product that is reset by an on-chip power-on reset function are not guaranteed from the time when power is supplied until the power is supplied until the power is supplied until the power reaches the level at which resetting is specified.

3. Input of signal during power-off state

Do not input signals or an I/O pull-up power supply while the device is powered off. The current injection that results from input of such a signal or I/O pull-up power supply may cause malfunction and the abnormal current that passes in the device at this time may cause degradation of internal elements. Follow the guideline for input signal during power-off state as described in your product documentation.

4. Handling of unused pins

Handle unused pins in accordance with the directions given under handling of unused pins in the manual. The input pins of CMOS products are generally in the high-impedance state. In operation with an unused pin in the open-circuit state, extra electromagnetic noise is induced in the vicinity of the LSI, an associated shoot-through current flows internally, and malfunctions occur due to the false recognition of the pin state as an input signal become possible.

5. Clock signals

After applying a reset, only release the reset line after the operating clock signal becomes stable. When switching the clock signal during program execution, wait until the target clock signal is stabilized. When the clock signal is generated with an external resonator or from an external oscillator during a reset, ensure that the reset line is only released after full stabilization of the clock signal. Additionally, when switching to a clock signal produced with an external resonator or by an external oscillator while program execution is in progress, wait until the target clock signal is stable.

6. Voltage application waveform at input pin

Waveform distortion due to input noise or a reflected wave may cause malfunction. If the input of the CMOS device stays in the area between V_{IL} (Max.) and V_{IH} (Min.) due to noise, for example, the device may malfunction. Take care to prevent chattering noise from entering the device when the input level is fixed, and also in the transition period when the input level passes through the area between V_{IL} (Max.) and V_{IH} (Min.).

7. Prohibition of access to reserved addresses

Access to reserved addresses is prohibited. The reserved addresses are provided for possible future expansion of functions. Do not access these addresses as the correct operation of the LSI is not guaranteed.

8. Differences between products

Before changing from one product to another, for example to a product with a different part number, confirm that the change will not lead to problems. The characteristics of a microprocessing unit or microcontroller unit products in the same group but having a different part number might differ in terms of internal memory capacity, layout pattern, and other factors, which can affect the ranges of electrical characteristics, such as characteristic values, operating margins, immunity to noise, and amount of radiated noise. When changing to a product with a different part number, implement a systemevaluation test for the given product.

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