

Hercules™ Software Diagnostic Library CSP Without LDRA

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Introduction

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1 Introduction

Hercules Software Diagnostic Library CSP contains Test Automation unit (Software Diagnostic Library TAU), which is a tool that helps the user generate dynamic coverage analysis reports and regression reports for the diagnostic application program interface (APIs) provided in the library to support ISO26262 and IEC61508 assessments.

TI provides a compliance support package (CSP) for the Software Diagnostic Library to help safety customers go through ISO26262 and IEC61508 assessments.

The Software Diagnostic Library TAU comes with unit test cases for all the modules supported by the Software Diagnostic Library for Hercules Family of devices and the necessary Test Infrastructure to run these test cases. The Software Diagnostic Library TAU also provides infrastructure for the Hercules customers to add their own test cases.

NOTE: Since all of the device families do not provide same Hardware features, it should be noted that the Test cases listed or created anew in TAU shall vary depending on the device selected. Customers are advised to see the device-specific Technical Reference Manuals and Data Sheets to ensure any new test cases to be added to TAU are valid for the target device.

2 Software Requirements

- OS: Windows version 7 or higher
- Software Diagnostic Library v02.02.00 (or higher)
- Perl 5.x. Download Link http://www.perl.org/get.html#win32
- Code Composer Studio[™] 6.0 (or higher)
- Microsoft Office 2007 (or higher)
- LDRAunit-TI-Qual 9.4.3 (or higher)
 - **NOTE:** LDRA Unit is not provided as a part of the CSP download. To re-run the unit tests using the included Test automation unit software, customers are required to purchase and install LDRA Unit software from LDRA. This guide explains LDRA Unit installation settings required for the Test automation unit.

3 Software Diagnostic Library TAU Tool Restrictions

- This tool supports device families TMS570LS31x, TMS570LS21x, RM48x, TMS570LS12x, TMS570LS11x, RM46x, TMS570LS04x, TMS570LS03x, RM42x, TMS570LS09x, TMS570LS07x, RM44x, TMS570LCx, RM57x only.
- This tool does not support testing of assembly files.

4 Terminologies Used in Software Diagnostic Library TAU

4.1 What is Unit Testing?

2

In simple words, unit testing is a single function tested in isolation. Unit testing generally involves taking a subset of the software, linking it with a test driver and exercising it, and checking that the unit behaves as expected. This subset of the software could be anything from just a function to the entire software. The source file under test is instrumented and tested in white box mode to get the code coverage.





4.2 What is a Test Sequence?

A test sequence is a set of test cases, unit or functional (not both), targeted on a single c file. A test sequence is written in the form an Excel sheet listing the following:

- Global declarations
- Global code
- Function tested in each test case
- Input parameters for each test case
- Pass or fail criteria for each test case
- · Variable declarations, startup code, and cleanup code for each test case

In addition for the traceability report generation, the following artifacts are also added for each test case:

- Test case ID
- Requirements covered by the test case

Each test sequence is converted to the TCF file, which is the actual input to the LDRA tool. Figure 1 shows an example of a test case in the sequence. See Section 10 for more information on how to write test cases.

	TestCase Description	DMA5A:4		
	StartupCode	failinfo.stResult = ST_FAIL; while (1 != SL_SelfTest_Status_PBIST(&failinfo));		
5\\safety_library\source\sl_selftest.c	Name	param1	%	failinfo.stResult
SL_SelfTest_Status_PBIST	Decl_type	SL_PBIST_FailInfo*	boolean	SL_SelfTest_Result
	3 User_type	Input parameter applied at call	Function result	Output global
	Value	&failinfo	FALSE	ST_PASS
Global Variables	File 3 Variable Name Variable type	\\\safety_library\source\sl_selftest.c failinfo SL_PBIST_FailInfo	\\\safety_library\source\sl_selftest.c adcconfig SL_ADC_Config	\\\safety_library\source\sl_selftest.c adcpinstatus SL_ADC_Pinstatus

Figure 1. Excel Test Case Snapshot

Each test case in a sequence does the following:

- Runs any initialization code
- Configures I/O variables
- · Invokes a single function with specified arguments
- · Captures any return values that are to be checked
- Captures the value of any I/O variables that are to be checked
- Runs any custom checks, such as checking execution time
- Saves the results
- Runs any cleanup code

4.3 What is a TCF?

The test case file (TCF) contains all of the information required to run or re-run the test cases. The sequences are converted into TCF. The TCF contains the tags for the test case ids and requirement ids, which help with traceability. The LDRA tool can group TCFs with regression reports and can be stored for regression verification. This information can either be saved with the source file through a software configuration management (SCM) system, or it can be used as an annotation. Requirements based testing documentation, including why particular values were chosen and tags to map to a requirement management system, can be added for storage. The TCFs can be re-run from the command line and in batch mode so that as the source code changes, module interfaces and outputs can be verified.

4.4 What is Code Coverage?

Code coverage is a measure used to describe the degree to which the source code of a program is tested by a particular test suite. A program with high code coverage has been more thoroughly tested and has a lower chance of containing software bugs than a program with low code coverage.

The Software Diagnostic Library TAU uses LDRA in the back to generate the following code-coverage criteria:

- Statement coverage
- Branch coverage
- MC and DC Coverage

4.5 What is Regression Report?

Regression report is the consolidated test results report generated by LDRA running the functional and unit tests selected through the Software Diagnostic Library TAU.

5 Functional Blocks of Software Diagnostic Library TAU

The functional blocks of the Software Diagnostic Library TAU are the following:

- LDRAunit-TI-Qual
 - Helps generate dynamic analysis reports
 - Interfaces to CCS debug server scripts
- CCS Debug Scripts
 - Helps load and execute the test codes
- TI Test Cases
 - Excel-based unit test cases (per module) that are supported in the Software Diagnostic Library
- TI Test Script Engine
 - Instruments the targeted C file(s) through LDRA
 - Generates TCF files, which invokes LDRA
 - Generated and is executable through an automatically generated make file
 - Helps in consolidating the code coverage report and regression report generated by LDRA
- Software Diagnostic Library TAU GUI
 - GUI to help the user choose the following:
 - Device family to test with
 - Test select (Software Diagnostic Library or TPS Driver—currently TPS Driver is not supported)
 - Build options based on the device
 - Target configuration based on the boards and the debugger
 - Update the status information of every test sequence selected



6 Software Diagnostic Library TAU Test Flow

Figure 2 and Figure 3 show the typical automated test flow followed by the Software Diagnostic Library TAU.

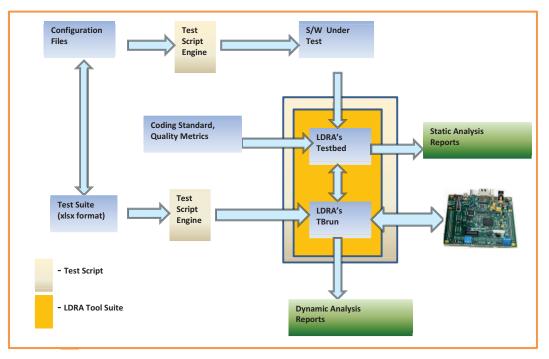


Figure 2. Automated Static and Dynamic Analysis Flow



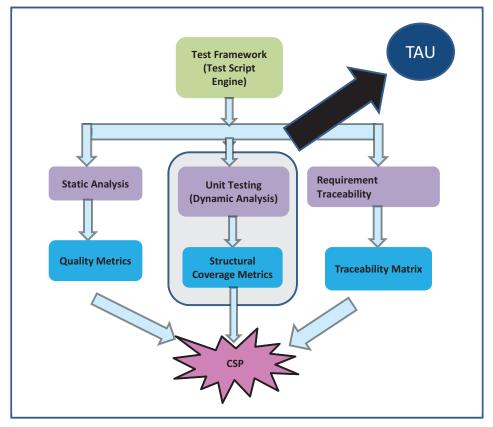


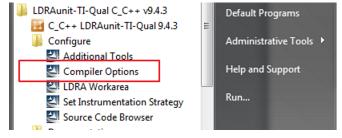
Figure 3. Test Automation Framework for CSP

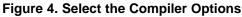


7 Manual Settings to the LDRA Install Needed by the User

1. If the user has already installed LDRAunit-TI-Qual_C_CPP_9.4.3 for HALCogen, then the compiler option must be changed using the "compiler options" executable from the

LDRAunit-TI-Qual_C_CPP_9.4.3 (run this program in administrative mode). Figure 4 and Figure 5 explain how to change the compiler options.





DRAunit-TI-Qual - InstallShield Wizard	23
Select Compiler	
Select a compiler from the options below.	
Texas Instruments Code Composer v5.0	
Texas Instruments Code Composer v5.0 TMS320F2808 eZdsp	
Texas Instruments Code Composer v5.0 TMS320F28335 Serial	
Texas Instruments Code Composer v5.0 MSP430 LaunchPad	
Texas Instruments Code Composer v5.0 RM48L950 Hercules Serial	
Texas Instruments Code Composer v5.0 ARM Lauterbach Trace32	
☐ Texas Instruments Code Composer v4.0 C5510 Simulator	
Texas instruments code composer v4.0 Mor 450 e2450	
nstallShield	
< <u>B</u> ack <u>N</u> ext >	Cancel

Figure 5. Select Compiler

- 2. Open the file LDRA_execute.bat under the LDRA installation directory (typically C:\Program Files (x86)\LDRA\LDRAunit-TI-Qual_C_CPP_9.4.3\Compiler_spec\Ticcs50\Rm48l950_hercules_serial\).
 - In the beginning of the file, find a line similar to the following: cd "C:\Program Files (x86)\LDRA\LDRAunit-TI-Qual_C_CPP_9.4.3\Utils\Comporter"
 - Change the above line to: "cd /d C:\Program Files (x86)\LDRA\LDRAunit-TI-Qual_C_CPP_9.4.3\Utils\Comporter"
 - **NOTE:** The software may require administrative privileges to change this file. Changing the file is necessary because the CD only works when trying to change the directory in the current working drive. If the TAU is installed in another drive other than C: drive, the CD fails to change the directory.

- Connect the device board to the system (PC) for test, depending on the Target Board HW configuration, using either of the following:
 - 1. USB cable on the SCI port, as SCI is used for testing with XDS100/XDS110 USB emulator integrated on board
 - 2. USB-JTAG External Debugger XDS510 connected using the JTAG lines on board
- When selecting a HALCoGen project or modifying an existing project under demo_app\HALCoGen, take care to see that the SCI continue on suspend bit (bit 17 in SCI Global Control Register 1 (SCIGCR1) in the SCI module) is enabled.
- 5. If LDRAunit-TI-Qual_C_CPP_9.4.3 for HalCogen has already installed, then the compiler option must be changed using the compiler, which is executable from the LDRAunit-TI-Qual_C_CPP_9.4.3 file.
- 6. In cases where issues occur when building and running test cases, the user may have a corrupt LDRAunit-TI-Qual_C_CPP_9.4.3 work area. To fix the issue, delete the existing sets (an LDRA work item) as shown in Figure 6 through Figure 8, and then start running the test cases again.

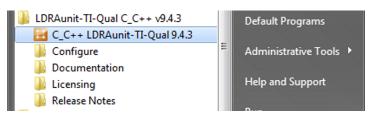


Figure 6. Open LDRAunit

📴 C,	/C <mark>++</mark> LDRAunit-TI-Qual Vers	ion 9.4.3 ©	2014 l	DRA	Ltd.				-		
Sou	rce Sequence Test Case	Run Driver	Stu	ıb Ma	nager	nent	Global	Varial	oles D	iction	ary Re
	Single file			漸	ē	stop =		ß		m	G
5	Previously Analysed File						*		4		
¢,	Multiple files										
Ð	File/Set from TCF										
	Run Static Analysis										
	Run Instrumentation										
	Delete Workfiles										
	Analysis Scope Wizard										
	Recent Sets	•									
	Recent Files	+									
×	Exit	Ctrl+Q									

Figure 7. Select Multiple Files

Texas

TRUMENTS

Select / Create Set		Files in Set		
RM46x_TPS_Library	•	Add / Remove Source Files		
Gets		File - Input Order	Folder	Туре
Sets - Input Order		Tps_Driver.c	D:\git_reps\A01319~2\TPS_D	
TMS570LS04x SafeTI Library		Tps_Interface.c	D:\git_reps\A01319~2\TPS_D	
RM46x_TPS_Library		TPS_DebugSupport.c	D:\git_reps\A01319~2\TPS_D	.c Fil
RM48x_SafeTI_Library				
TMS570LS12x_SafeTI_Library				
RM42x_SafeTI_Library				
RM48x_TPS_Library				
RM46x_SafeTI_Library				
TMS570LS12x_TPS_Library				
TMS570LS31x_SafeTI_Library				
Change Property		•	II	- F

Figure 8. Delete the Set for the Device Under Test (Here RM46x Software Diagnostic Library is Selected Here)

- 7. Sometimes when the system hangs, the test execution is halted and the source code may be corrupted. That is, the user may leave the source code in an instrumented state (LDRA instrumentation). In that case, LDRA creates the source backup folder in: <installation directory>\safety_library\source Replace the corrupted source code using this backup.
- 8. The RTS libraries used for building the .out file for the test cases may sometimes be missing in the compiler. Automatic build of the RTS libraries may fail when the environment variables are not correctly set for the shell that is used for building the RTS library. The user must ensure that the required RTS libraries are available in the compiler.
- In some cases, for example: forcibly closing test execution, ending the test automation task, or due to a power loss when the test execution is running, the LDRA analysis may lock (see Figure 9). This lock must be deleted to allow successful execution of test cases.

•	Computer	● OSDisk (C:) ● Use	ers 🕨 a0131910 🕨	AppData 🕨	Local 🕨 LD	RA 🕨 LDRAunit-TI-Qual_	C_CPP ▶ 9.4.3 ▶	
•	📜 Open	Include in library 🔻	Share with 🔻	Burn	New folde	er		
			Name	^		Date modified	Туре	Size
			퉬 Locks			2/5/2015 1:59 PM	File folder	
			ldra.cfg			2/5/2015 1:59 PM	CFG File	6 KB
			🔠 Idra			2/5/2015 1:59 PM	LDRA Results File	43,775 KB





8 Steps for Using the Software Diagnostic Library TAU

Step 1: Open the Software Diagnostic Library TAU tool.

🚾 Safety Library TAU 00	01.01					- 0 -
Help						
General						
Device Family:		·	Test Select:	Safety Library	TPS	
Target Configuration:		2	Emulator Used:			
Build Options File:			Compiler Path:			
Testcases						
	TestCase ID	Description				
]
	Flash TPS	Run	Stop	Open Re	ports Folder	
Output:						
Please select a Device Fa	mily					*
						-
						4

Figure 10. Software Diagnostic Library GUI Open Page



Step 2: Select a particular device from the Device Family drop-down menu.

Safety Library TAU 00	.01.01		
lp General			
Device Family:	RM48x	Test Select:	Safety Library TPS
Target Configuration:	it\Test\RM48x\SafetyLibrary\Tests\target.ccxml	Emulator Used:	Texas Instruments XDS100v2 USB Debug Probe_0
Build Options File:	D:\Work\git\safety-mcu-safetylibrary-new-int\Te	Compiler Path:	C: \ti\ccsv6 \tools \compiler \arm_5.1.9
lestcases			
ADC	TestCase ID Description		
CAN UnitTest DMA			
UnitTest EFUSE	_		The default options, if found in
UnitTest ESM	E		the device directory, are
UnitTest			displayed here
UnitTest			
FEE VunitTest	Added test sequences		
FLA	are displayed here		
HET			
INC			
MSP	-	m	Þ
	Flash TPS Run	Stop	Open Reports Folder
itput:			
			4

Figure 11. Device Family Selection



Steps for Using the Software Diagnostic Library TAU

Step 3: Browse for the target configuration file and the build options file.

For more information about the target configuration file, see Section 9.2. For more information about the build options file, see Section 9.3.

lp	0.01.01							
ip General								
	_			Test	alasta @ C C	Life o	700	
Bevice Family:	RM4	8x	•	Test Se	elect: Safe 	ety Library	TPS	
			rary\Tests\target.ccxml			Instruments XDS 1		
Build Options File:	: D:\W	/ork\git\safety-mcu-	safetylibrary-new-int\Te	e 📴 Compiler I	Path: C:\ti\co	sv6\tools\compile	r arm_5.1.9	
lestcases								
ADC UnitTest	Â.	TestCase ID	Description					
CAN								
✓ UnitTest								
DMA UnitTest								
EFUSE	=						\	
UnitTest	-		The e	mulator selec	ted in the	target	1	
ESM UnitTest				guration file i			\	
ETH			conng	guration men	s displaye	a nere	\	
UnitTest							1	
							1	
FEE						Check the co	ompiler path	n mentio
FEE UnitTest FLA							ompiler path build option	
UnitTest FLA UnitTest								
UnitTest FLA UnitTest HET								
UnitTest FLA UnitTest								
VunitTest FLA VunitTest HET VunitTest INC VunitTest								ns file
♥UnitTest FLA ♥UnitTest HET ♥UnitTest INC	•	•		.111				
VunitTest FLA VunitTest HET VunitTest INC VunitTest	•	Flash TPS	Run	TI Stop			build option	ns file
VunitTest FLA VunitTest HET VunitTest INC VunitTest	•		Run			in the	build option	ns file
VUhitTest FLA VUhitTest HET VUhitTest INC VUhitTest MSP	•		Run			in the	build option	ns file
VUhitTest FLA VUhitTest HET VUhitTest INC VUhitTest MSP	Ţ		Run			in the	build option	ns file
VUhitTest FLA VUhitTest HET VUhitTest INC VUhitTest MSP	-		Run			in the	build option	ns file
VUhitTest FLA VUhitTest HET VUhitTest INC VUhitTest MSP	-		Run			in the	build option	ns file
VUhitTest FLA VUhitTest HET VUhitTest INC VUhitTest MSP	•		Run			in the	build option	ns file
VUhitTest FLA VUhitTest HET VUhitTest INC VUhitTest MSP			Run			in the	build option	ns file
VUhitTest FLA VUhitTest HET VUhitTest INC VUhitTest MSP	•		Run			in the	build option	ns file
VUhitTest FLA VUhitTest HET VUhitTest INC VUhitTest MSP	•		Run			in the	build option	ns file
VUhitTest FLA VUhitTest HET VUhitTest INC VUhitTest MSP	•		Run			in the	build option	ns file
VUhitTest FLA VUhitTest HET VUhitTest INC VUhitTest MSP	•		Run			in the	build option	ns file

Figure 12. Target and Build Option Selection



Step 4: Select the tests to be run, then connect the board and click the "Run" button.

p					
eneral					
Device Family:	RM48x	v	Test Select:	Safety Library TPS	
Target Configuration:	ıt\Test\RM48x\SafetyLit	orary\Tests\target.ccxml 📴	Emulator Used:	Texas Instruments XDS 100v2 USB Debug Pr	robe_0
Build Options File:	D:\Work\git\safety-mcu	-safetylibrary-new-int\Te 💕	Compiler Path:	C:\ti\ccsv6\tools\compiler\arm_5.1.9	
estcases					
ADC	 TestCase ID 	Description			
UnitTest	ADC1:1		per values for add	Config structure- PASS if evaluation is false	
CAN	ADC1:2			Config structure-PASS if evaluation is false	
UnitTest	ADC1:2 ADC1:3			Config structure- PASS if evaluation is false	
DMA	ADC1:3 ADC1:4			Config structure-PASS if evaluation is false	
Unit est				-	
EFUSE	ADC1:5			Config structure- PASS if evaluation is false	Ξ
UnitTest	ADC1:6			Config structure- PASS if evaluation is false	
ESM	ADC1:7			Config structure- PASS if evaluation is false	
UnitTest	ADC1:8			- PASS if evaluation is false	
ETH UnitTest	ADC1:9	entry condition check - a			
FEE	ADC 1: 10			n - PASS if evaluation is false	
UnitTest	ADC1:11	entry condition - user m			
FLA	ADC1:12	functional - channel 8 - I		= =	
UnitTest	ADC1:13	functional - channel 9 - I			
HET	ADC1:14	functional - channel 7 - I			
UnitTest	ADC1:15	functional - channel 8 - I			
INC	ADC1:16	functional - channel 8 - I			
UnitTest	ADC2A:1	entry condition check - a	adc is in reset state	- PASS if evaluation is false	-
MSP	▼				F.
		\sim			
the test sequer	nce to view the	Run	Stop	Open Reports Folder	
tailed test case	description				
tput:					
ease wait a few minute	es if you are executing th	e test sequence for the Device	the first time		
vecuting testsequences	s in the folder D+\Work\ai	t\safety-mcu-safetylibrary-nev	-int\Test\RM48v\S	afetyl ibrary\Tests\	
coung conceptione.	and to be to be to the total of total of the total of	conception of the sources and the sources of the so	- inclusion p		
est Sequence : D:\Wor Generating MakeFileI		prary-new-int\Test\RM48x\Safi	etyLibrary\Tests\AL	DC/UnitTest/ADC_UT.xisx	
	Validating and building th	e test sequence			

Figure 13. Test Case Selection and Run



When the build is successful and the .out file is created, the tool starts executing the test cases. The details of the test case execution is shown in a new pop-up window (see Figure 14).

Step 6: Test Execution

	Safety Library TAU 00.01.01	1	
	Help	L. L	
	General		
	Device Family: RM48x	Test Select: Safety Library TPS	
	Toront Conference di TartiOMdQuiCafatul in anulTarteltaront o	manil and Emulator Used: Texas Instruments XDS 100v2 US8 Del	hun Probe 0
C:\Windows\system32\cmd.exe			
*** Executing LDRA Script		ath: C:\ti\ccsv6\tools\compiler\arm_5.1.9	
ART: 00:05:10 GMT+0530 (IST)			
nfiguring Debug Server for a	specified target		
ne RGEI: Texas Instruments XDS1		adcConfig structure- PASS if evaluation is fa	lse
		adcConfig structure - PASS if evaluation is fa adcConfig structure - PASS if evaluation is faile - PASS if evaluation is false down - PASS if evaluation is false valuation is FALSE tabus is ADC_PIN_GOOD tabus is ADC_PIN_GOOD	ilse ilse ∷ ilse
		• at •	
	Hease wait a rew minutes in you are executing the test sequence for	the Device the first time	
	Executing testsequences in the folder D:\Work\git\safety-mcu-safety Test Sequence : D:\Work\git\safety-mcu-safety\lbrary-new-int\Test\P Generating MakeFilePassed Generating TCF File Validating and building the test sequence Build Successful Executing testcases		

Figure 14. Test Execution

The generated reports are saved in the <install_dir>\Test\<device>\SafetyLibrary\Reports\ folder.

NOTE: Do not close the Software Diagnostic Library TAU window until the test execution is completed or successfully terminated after clicking the Stop button. Never kill the process while the test sequence is under analysis.



9 Inputs to Software Diagnostic Library TAU

9.1 Device Selection

Select the specific device to test the Software Diagnostic diagnostic library API on.

9.2 Target Configuration File

The target configuration file (.ccxml file) can be generated using the Code Composer Studio. Sample files are provided in the **<HALCoGen TAU install directory>\TargetConfiguration** folder. These sample files enable connection and flashing of the .out files to the device.

9.3 Build Options File

The build options file is a text file in the following format:

Compiler Options:
Linker Options:
Run time Library:
CG Tool Root Path:
COMPortNumber: 5
COMPortBaudRate: 9600
COMPortParity: N
COMPortDatabits: 8
COMPortStopBits: 2

NOTE: The options corresponding to the COMPort are default settings in the corresponding HALCoGen project (default SCI settings) of the device variant. If these settings are changed in the build options file, the test cases will not execute successfully unless the HALCoGen project configuration is also changed and the code is re-generated.

Some sample build options files are provided in the folder **<install directory>\Test\Misc\BuildOptions**. Users can use it as is in their project.

- Compiler Options:
 - ARM compiler options can be obtained from the appropriate device project file in the Code Composer Studio as shown in Figure 15 (Step 1).
- Linker Options
 - ARM linker options can be obtained from Code Composer Studio as shown in Figure 16 (Step 2).
- Run Time Library
 - Runtime support library is used for the CCS project as shown in Figure 17 (Step 3).
- CG Tool Root Path
 - The root path is where the CCS compiler is installed.
- COMPortNumber, COMPortBaudRate, COMPortParity, COMPortDatabits, COMPortStopBits
 - These options correspond to the SCI settings of the connected device.
 - **NOTE:** These settings must be in sync with the HALCoGen project corresponding to the device as in the demo_app\HALCoGen.



Step 1: Compiler Option Selection

😯 Properties for	
type filter text	ARM Compiler 🗢 👻 👻
 Resource General Build ARM Compiler Processor Options Optimization 	Configuration: Debug [Active] Manage Configurations Command: "\${CG_TOOL_CL}"
Debug Options Include Options	Command-line pattern: \${command} \${flags} \${inputs}
MISRA-C:2004 Advanced Options	Summary of flags set:
 ▲ ARM Linker Basic Options File Search Path ▷ Advanced Options Debug 	-mv7R4code_state=32float_support=VFPv3D16abi=eabi -g include_path="C:/ti/ccsv5/tools/compiler/arm_5.0.4/include" include_path="D:/HALCOGEN/HandsOn/etpwm_test/include"diag_warning=225 display_error_numberdiag_wrap=offenum_type=packed
	Set Additional Flags
	See <u>'General'</u> for changing tool versions and device settings
Show advanced settings	OK Cancel

Figure 15. Compiler Option Select



)

Step 2: Linker Option Selection

Properties for		
type filter text Resource General Build ARM Compiler Processor Options 	ARM Linker 🔅 👻 🗟	· • •
	Configuration: Debug [Active]	tions
Optimization Debug Options	Command: "\${CG_TOOL_CL}"	
Include Options MISRA-C:2004	Command-line pattern: \${command} \${flags} \${output_flag} \${output} \${inputs}	
Advanced Options ARM Linker Basic Options File Search Path Advanced Options Debug	Summary of flags set:	
	-mv7R4code_state=32float_support=VFPv3D16abi=eabi -gdiag_warning=2 display_error_numberdiag_wrap=offenum_type=packed -z -m"etpwm_test.m -i"C:/ti/ccsv5/tools/compiler/arm_5.0.4/lib" - i"C:/ti/ccsv5/tools/compiler/arm_5.0.4/include"reread_libswarn_sections display_error_numberdiag_wrap=offxml_link_info="etpwm_test_linkInfo.xml" - rom_modelbe32	nap"
	Set Additional	Flags
	See <u>'General'</u> for changing tool versions and device settings	
Show advanced settings	OK	cel

Figure 16. Linker Option Select



Step 3: Runtime Library Selection

General 🔶 👻 👻
Configuration: Debug [Active] Manage Configurations Main Output type: Executable Device
OK Cancel

Figure 17. Runtime Library Selection



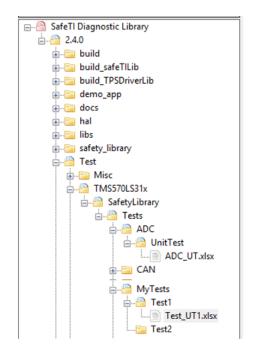
10 How to Add Individual Test Cases

Add a new folder and type "MyTests" in the test folder created by the tool. Define the test sequence and save it in the folder "Test1" inside MyTests. Figure 18 shows a template of a test sequence. Add more test sequences by adding more folders in MyTests.

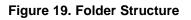
4	1 2	3	4	5	6	
1		TCF Description	<test description="" sequence=""></test>			
			<global code="" for="" sequence="" test="" the=""></global>			
2		GlobalCode	(Remove this row if not applicable)			
			<startup case="" code="" for="" test="" the=""></startup>			
3		StartupCode	(Remove this row if not applicable)			
			<cleanup case="" code="" for="" test="" the=""></cleanup>			
4		CleanupCode	(Remove this row if not applicable)			
5		TestCase Description	<description></description>			
			<test case="" id=""></test>			
6		TestCase ID & Requirement	<requirements></requirements>			
7	1 <filename></filename>	Name	<pre><parameter 1="" name=""></parameter></pre>	%	<global 1="" name=""></global>	
8	<function name=""></function>	Decl_type	<pre><parameter 1="" type=""></parameter></pre>	<return type=""></return>	<global 1="" type=""></global>	- F
9		Df_type	Z	0	н	
10	<no.of +="" globals="" params="" return=""></no.of>	User_type	Input parameter applied through loc	Function result	Output global	
11		Value	<parameter 1=""></parameter>	<expected value=""></expected>	<expected value=""></expected>	
12						
			<variable any="" declarations="" if=""></variable>			
13		UserDeclarations	(Remove this row if not applicable)			
			<startup case="" code="" for="" test="" the=""></startup>			
14		StartupCode	(Remove this row if not applicable)			
_			<cleanup case="" code="" for="" test="" the=""></cleanup>			
15		CleanupCode	(Remove this row if not applicable)			8
16		TestCase Description	<description></description>			
			<test case="" id=""></test>			F
17		TestCase ID & Requirement	<requirements></requirements>			
18	2 <filename></filename>	Name	<pre><parameter 1="" name=""></parameter></pre>	%	<global 1="" name=""></global>	1
19	<function name=""></function>	Decl_type	<pre><pre>parameter 1 type></pre></pre>	<return type=""></return>	<global 1="" type=""></global>	
20		Df_type	Z	0	н	
21	<no.of +="" globals="" params="" return=""></no.of>	User_type	Input parameter applied through loc	Function result	Output global	
22		Value	<parameter 1=""></parameter>	<expected value=""></expected>	<expected value=""></expected>	
23						
24		End of Test Sequence				

Figure 18. Test Sequence Template

Folder structure as shown in Figure 19 must be followed strictly.



- New test case files/folders to be created as shown in the figure for 'MyTests' added for specific platform as per directory structure of installed CSP folder.
- Test case Excel file extension should be .xlsx, NOT .xls
- Each Folder should contain just 1 Test sequence (1 xlsx file)
- The sheet inside test.xlsx should be named 'Test'. Other sheets in the workbook are ignored.



NOTE:

- The Excel sheets must be saved as .xlsx and not .xls.
- One test folder must contain only one test sequence.
- The sheet containing the test cases must be named "Test". Other sheets in the workbook are ignored.

Points to keep in mind while writing a test sequence:

- The test sequence must begin with "TCF Description" and end with "End of Test Sequence".
- The global declarations and code must be inserted in the beginning of the test sequence after TCF description.
- User Declarations, Startup code, and Cleanup code (if needed) must be inserted above each test case.
- The test case description, ID, and requirements covered for each test case must be inserted above each test case.
- The total number of parameters of the test case (including the function input parameters, return value, and global variables checked) must be mentioned for each test case, as shown in Figure 20 and Figure 21.
- The file under test must be mentioned for each test case, and the function tested must be defined in each file.
- Two test cases must be separated by a blank row.
- End of the test sequence must be written in column 3 after the last test case. Leave a blank row after each test case.
- Each test sequence can test only one file.
- The Excel sheet must be saved as *_UT.xlsx (where UT stands for Unit Test). A code coverage report is also generated along with the regression report.

Figure 20 and Figure 21 show a few examples of a test case.

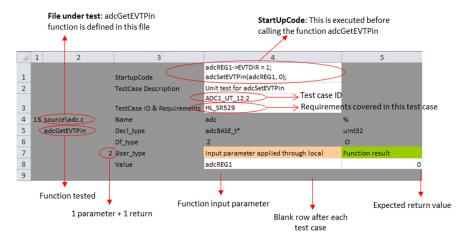


Figure 20. Test Case Example 1



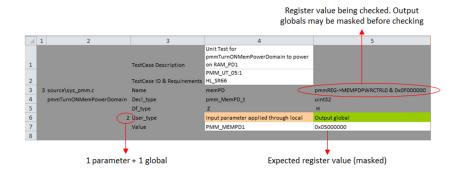


Figure 21. Test Case Example 2

Tip: Right-click on the test list field and click "Refresh" to regenerate the list.

11 Reports

The following sections define the reports generated at the end of test execution.

11.1 Regression Report

A regression report is generated for both unit and functional test sequences. The report is regenerated every time the test sequence is executed. No record of the previous test runs is stored.

11.2 Dynamic Coverage Analysis Report

A dynamic coverage analysis report is only generated for the unit test sequence. The following metrics are obtained in dynamic coverage analysis:

- Statement Coverage
- Branch and Decision Coverage
- MC and DC Coverage (Modified Condition and Decision Coverage)

Unlike the regression report, the dynamic coverage analysis report is an accumulated report of all the previous runs.



12 FAQ

- 1. The TCF generation fails when:
 - The test sequence is open in Microsoft Excel
 - A test case (including the last one) is not terminated by a blank row
 - The keyword "End of Test Sequence" is not found in the Excel sheet
- 2. What are the possible reasons for build failure?
 - License initialization failure
 - Check whether the LDRA license is properly installed or if it is expired
 - Validation failure
 - The file name mentioned is wrong or the function is not defined in the mentioned file name
 - The number of parameters for the test case mentioned in the Excel does not match the actual value

NOTE: The number of parameters includes function input parameters, function return, and the global variables (or peripheral registers) checked.

- Previous analysis was terminated in the middle of execution
- Delete the analysis folder
- Compile error
 - Users can check the CompileLog.txt in the <test folder>\Debug folder for the details
- Invalid entries in build options file
- 3. Where do I see the instrumented code?
 - It is saved in LDRA work area.
- 4. The software says test execution is completed, but I cannot find the report in the reports folder. This happens when the tool was unable to connect to the target and execute the test.
 - Check whether the target is connected properly
 - Check the target configuration file

In case of unit tests, the tool fails to generate the code coverage report if the test execution was terminated in the middle of execution.

- 5. Test execution stuck in the middle of execution. What to do? What is the reason?
 - To terminate the test execution, close the pop-up window. Never kill the process through the task manager. To stop executing the subsequent test sequences, click the "Stop" button and wait until the running process is completed. Do not close the TAU window before the process is completed.
 - The reason this happens is because of wrong configuration or wrong selection of functional test.
- 6. I use the full version of LDRA Tool Suite instead of LDRAUnit. Can I use this tool with this license?
 - Currently, the Software Diagnostic Library TAU supports only LDRAUnit.
- 7. How to Get LDRA Unit and Setting up the License After Downloading Software-Diagnostic-Library-CSP From TI?
 - After downloading Software-Diagnostic-Library-CSP LDRA Less package, the customer can contact LDRA and acquire the LDRAunit-TI-Qual 9.4.3 (or higher).
 - The customer can request for the LDRAUnit and full license from LDRA by sharing the following info with LDRA:
 - 1. Product Name: LDRAunit-SafeTI-CSP (C/C++, Windows)
 - 2. Exact part number: LPSN7W56SafeTI



- Instructions to procure LDRA:
 - 1. Contact LDRA at sales@ldra.com to request a quotation by sharing 'Product Name' and 'Exact Part Number' given above
 - 2. LDRA will issue a quotation and upon receipt of purchase order will send the customer a download link for the software and provide a license key.
 - 3. LDRA will set-up the web store page and provide a link to this so that customers can simply order and pay online.

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