



# Quick Start Guide for SimpleLink MSP432E4 SDK

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## 1. Introduction

This guide is intended to assist users in the initial setup and demonstration of running their first sample application. The guide explains how to install the SimpleLink™ MSP432E4™ SDK and lists the various other tools required to get started with your first application.

## 2. Prerequisites

The user is expected to have the following:

- MSP-EXP432E401Y LaunchPad
- A computer running a supported operating system listed in the [Release Notes](#)
- At least one of the following IDE supported by the SimpleLink MSP432E4 SDK: Refer to Release Notes for the IDE/Tools Versions
  - [CCS](#)
  - [IAR for ARM](#)
  - [Keil uVision](#) with the following packs installed:
    - [TexasInstruments.MSP432E4\\_DFP](#)
    - ARM::CMSIS Pack
  - [GNU ARM Embedded Toolchain](#)
- FreeRTOS (Optional) The SimpleLink MSP432E4 SDK does not deliver FreeRTOS sources. User is expected to download the same from [www.freertos.org](http://www.freertos.org) if they want to use FreeRTOS with the SDK.

## 3 SDK - Download and Installation

### 3.1 Using the SDK Online

A quick and easy way to start working with the SDK is to use TI Resource Explorer on [dev.ti.com](http://dev.ti.com). This online tool lets you explore the contents of the SimpleLink MSP432E4 SDK. You can build the examples directly using the cloud version of Code Composer Studio. If you choose to use the SDK online, there is no need to download anything to your local computer or install any tools.

### 3.2 Installing the SDK

You can also download the SimpleLink MSP432E4 SDK from TI Resource Explorer or the software product page on [TI's website](#).

## 4. Quick Start for CCS IDE (CCS or GCC Projects)

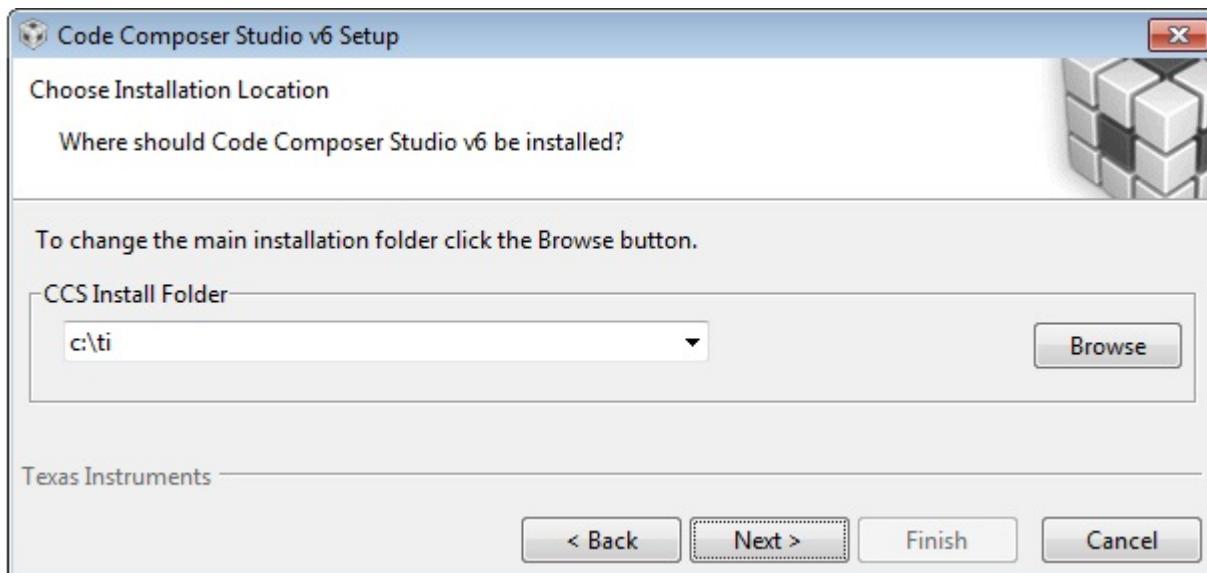
This section is going to cover the required settings for a CCS installation and how to build and load examples

### 4.1 Download and Installation

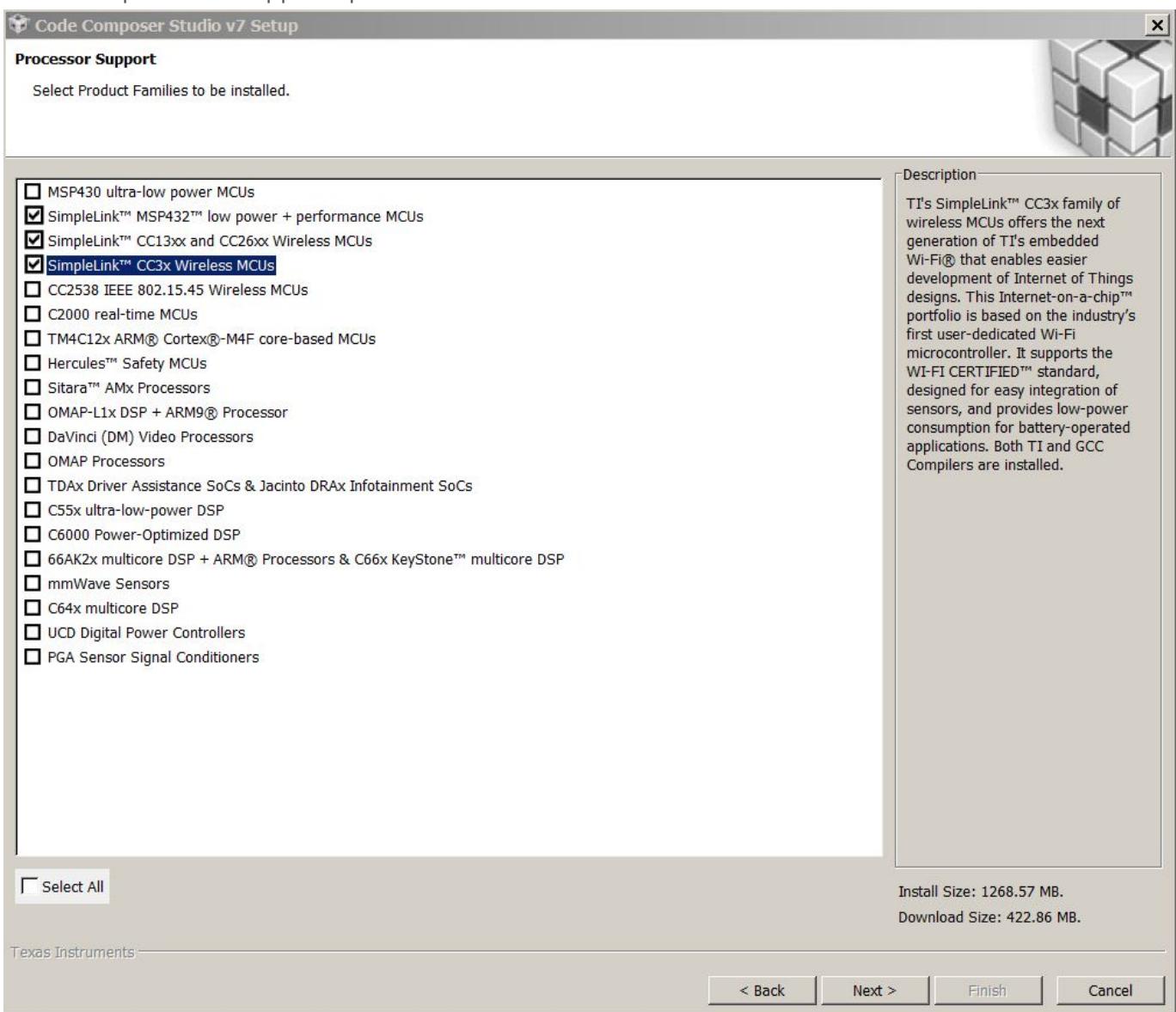
#### [Download CCS](#)

During the installation, the following options are recommended:

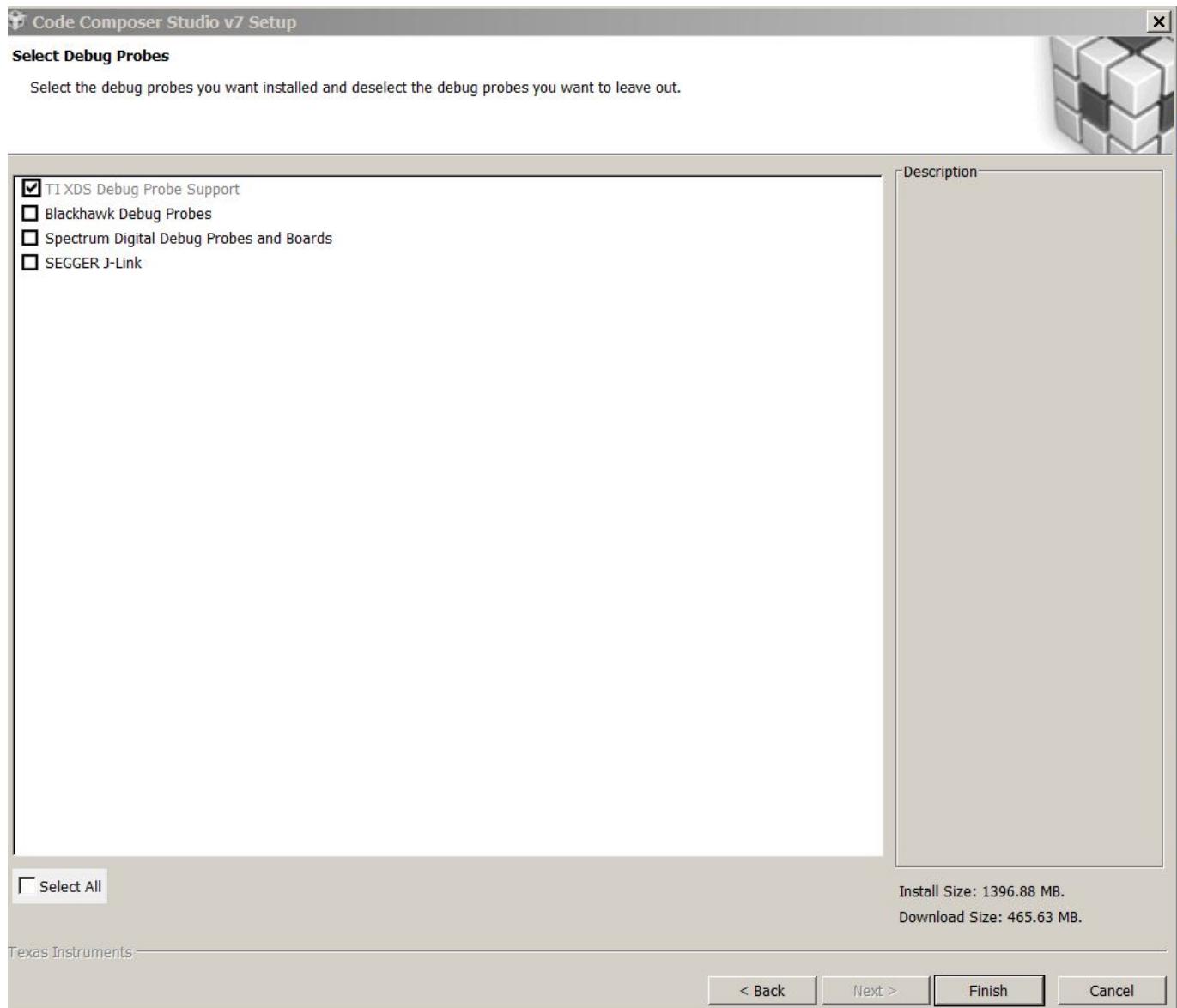
- We recommend that you use the default installation folder



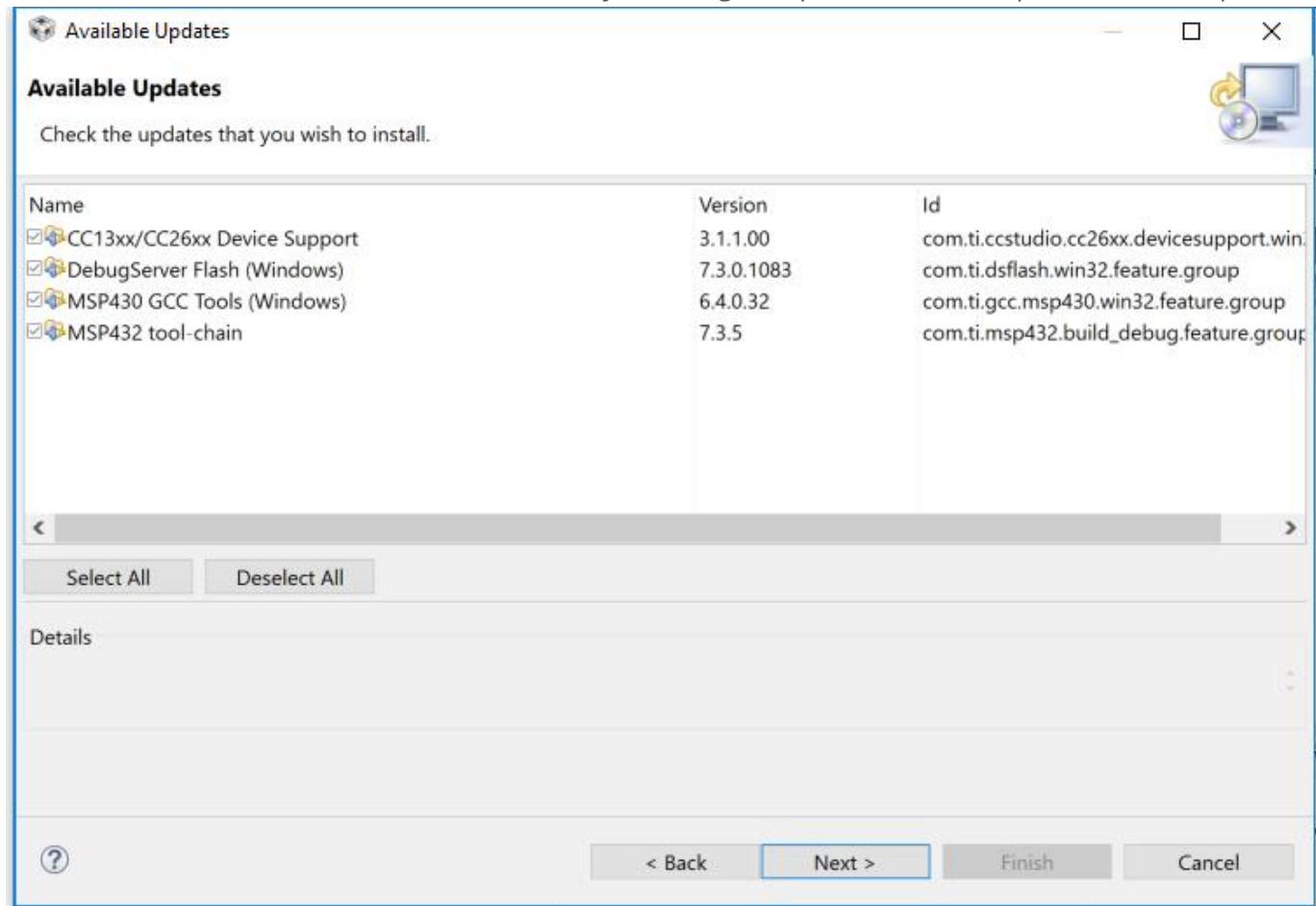
- Make sure that SimpleLink MSP432 low power + performance MCUs is selected. You can select additional processor support options as needed.



- To use a debug probe, select TI XDS Debug Probe Support and any other options you would like. The MSP-EXP432E401Y Launchpad uses TI XDS Debug Probe by default.



- Make sure that MSP432 Tool Chain is installed by checking for updates under Help → Check for Updates



[www.ti.com/lit/pdf/slau575](http://www.ti.com/lit/pdf/slau575) has more details about MSP432E4 device

#### 4.1.1 Discovering the SDK in CCS

Install the SDK in the default location pointed to by the installer - `c:\ti` and Re-start CCS. CCS will automatically detect the latest install.

### 4.2 Running Your First Example

This section will show how to import, build and load an example

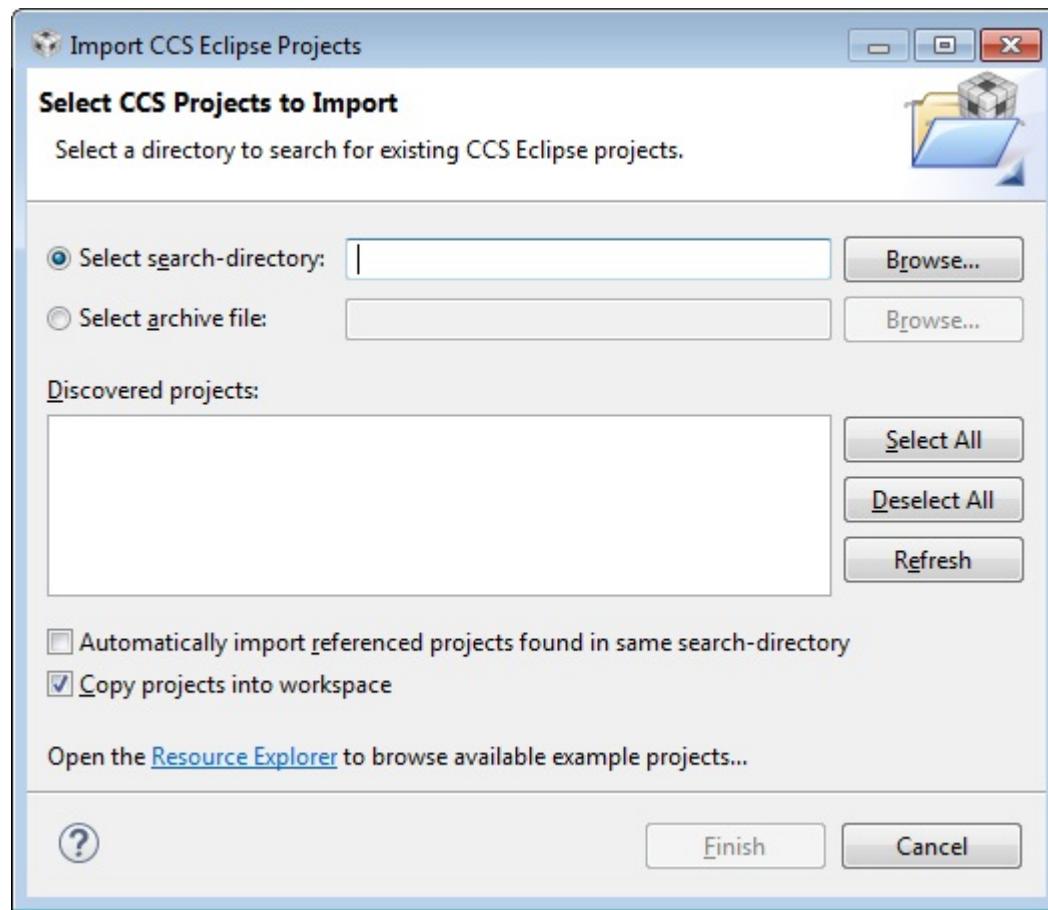
#### 4.2.1 TI Resource Explorer

A quick and easy way to start working with the SDK is to use the TI Resource Explorer on [dev.ti.com/tirex](http://dev.ti.com/tirex). Step by step instructions are available [here](#).

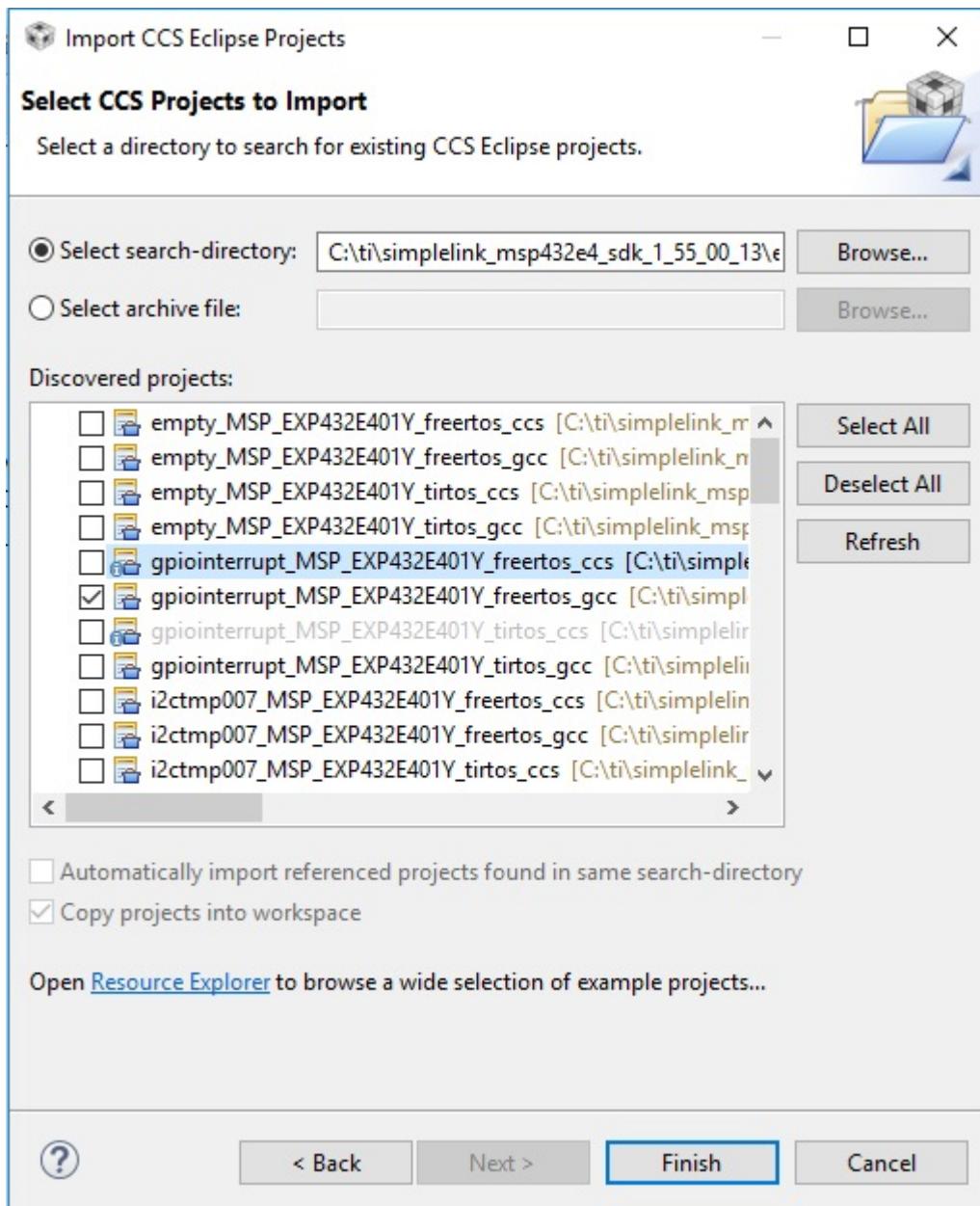
#### 4.2.2 Import via CCS IDE

- Open CCS
- Choose Project → Import CCS Projects from the menu.
- Select the Browse button in the Import CCS Projects dialog and select the directory

`<SDK_INSTALL_DIR>/examples`



- The SDK provides no RTOS, TI-RTOS and FreeRTOS based examples. TI-RTOS and FreeRTOS examples have the word "tirtos" or "freertos" in the project name
- CCS discovers both CCS and GCC based examples.
- Importing TI-RTOS and FreeRTOS examples will bring import kernel projects in the same workspace. The kernel project is a dependent project and will be automatically built when the example is built. For more details and how change configurations look at the [SimpleLink MSP432E4 SDK User's Guide](#).
- Select any Code Example you would like to use. In this example `gpiointerrupt_MSP_EXP432E401Y_tirtos_ccs` is chosen

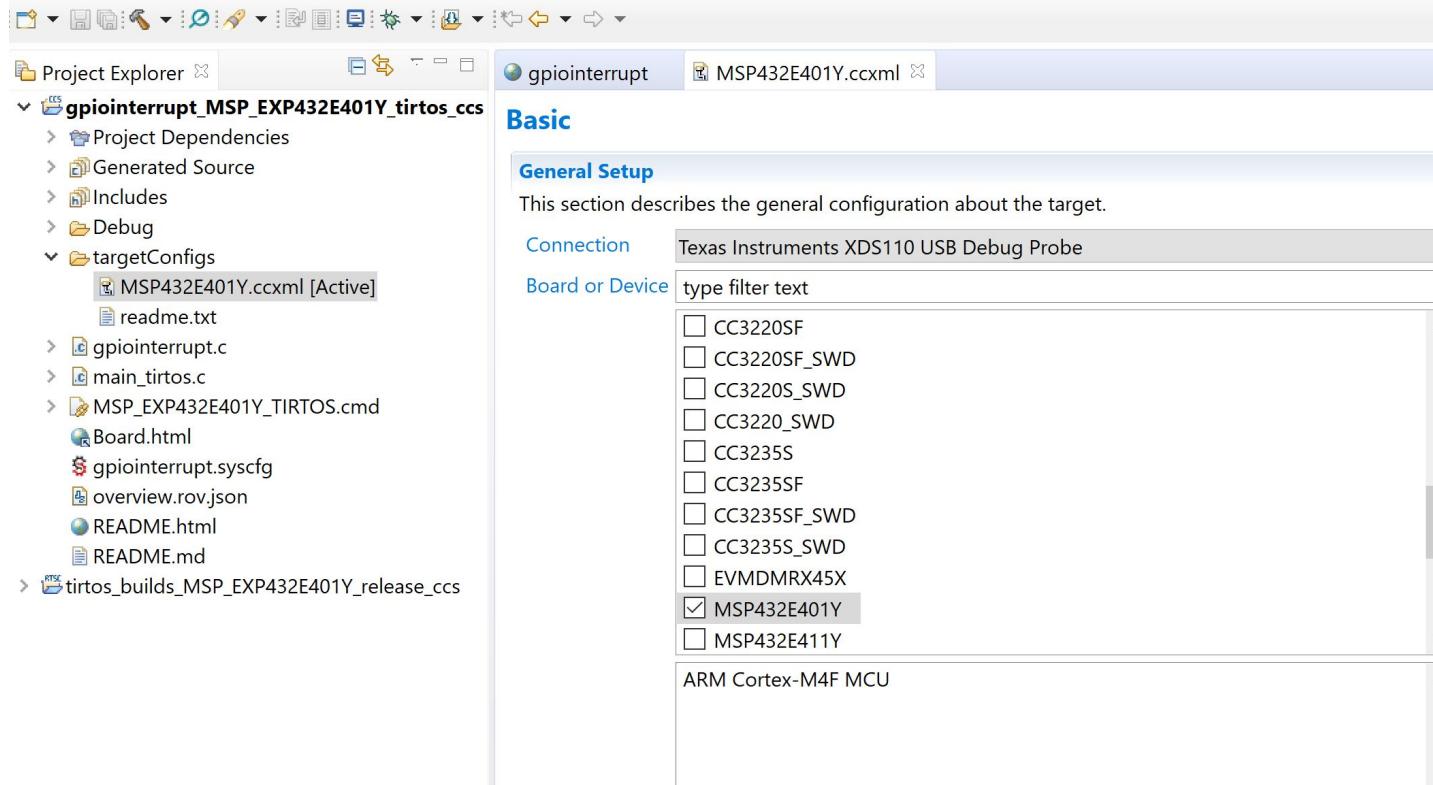


- Choose target configuration

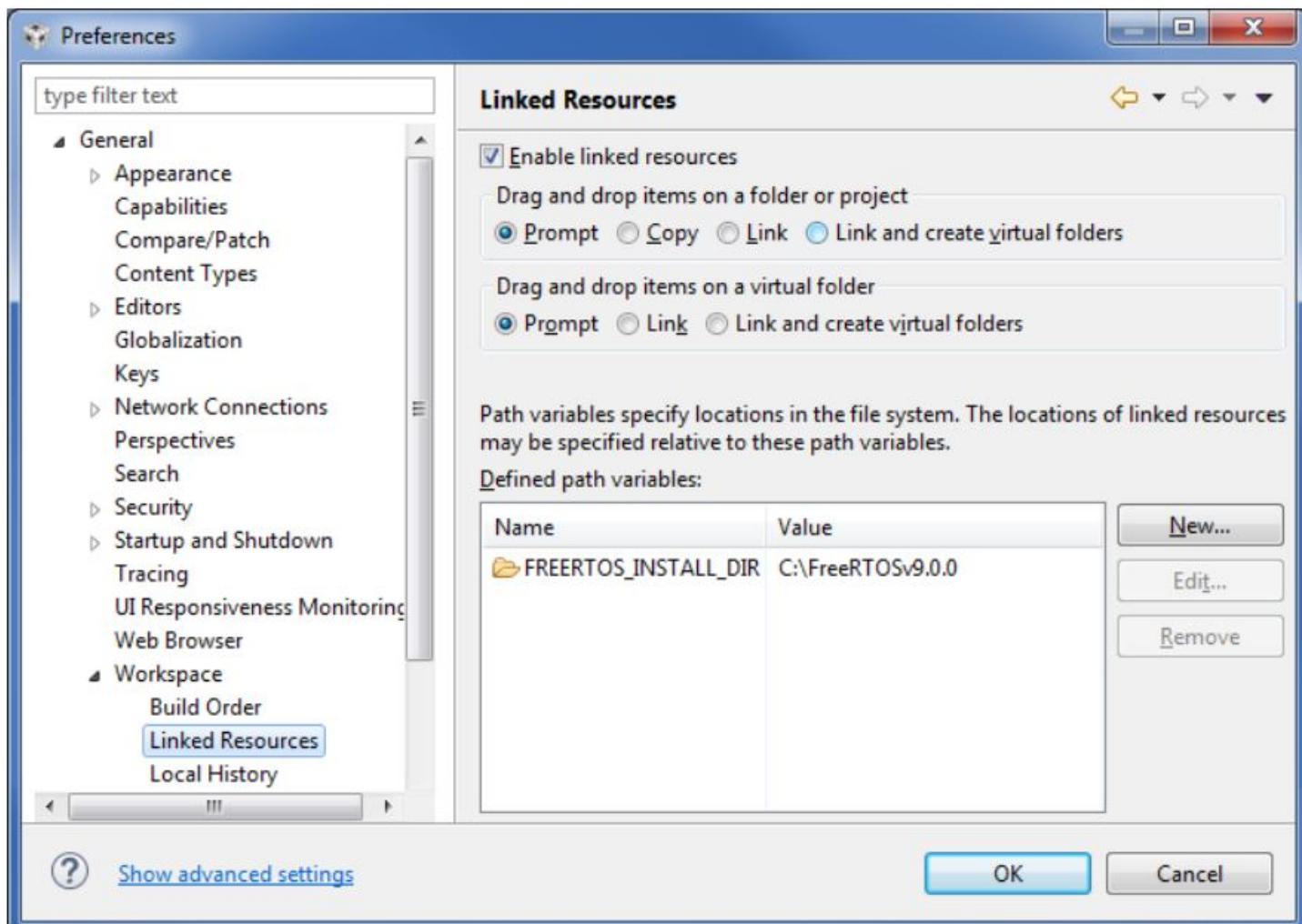
You may have to expand the project in the Project Explorer window to view the target configuration. If you are using the Launchpad, double click on MSP432E401Y.ccxml

workspace\_v9aalkl - gpiointerrupt\_MSP\_EXP432E401Y\_tirtos\_ccs/targetConfigs/MSP432E401Y.ccxml - Code Composer Studio

File Edit View Navigate Project Run Scripts Window Help

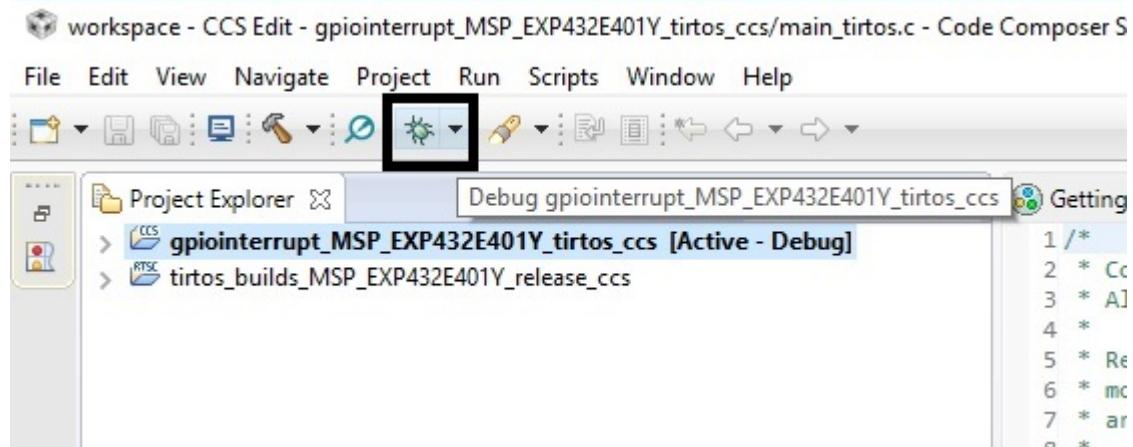


- In order to use FreeRTOS within CCS, you must specify the location of the FreeRTOS installation



- Build and Download

Plug in your launchpad, Click the build and download icon in CCS. The RTOS build for the first time takes a



couple of minutes.

- The XDS110 may require a firmware update. If a firmware update is requested click ok.



[www.ti.com/lit/pdf/slau575](http://www.ti.com/lit/pdf/slau575) has more details about MSP432E4 device

- Every RTOS example has a README.html that details the Example Application Design Details and how each example works. This feature will soon be added to the No RTOS based examples

workspace\_v9aalkl - file:///C:/Users/a0133097/workspace\_v9aalkl/gpioninterrupt\_MSP\_EXP432P401R\_tirtos\_ccs/README.html - Code

File Edit View Navigate Project Run Scripts Window Help

Project Explorer      gpioninterrupt

gpioninterrupt\_MSP\_EXP432E401Y\_tirtos\_ccs

- Project Dependencies
- Generated Source
- Includes
- Debug
- targetConfigs
- gpioninterrupt.c
- main\_tirtos.c
- MSP\_EXP432E401Y\_TIRTOS.cmd
- Board.html
- gpioninterrupt.syscfg
- overview.rov.json
- README.html
- README.md

tirtos\_builds\_MSP\_EXP432E401Y\_release\_ccs

TEXAS INSTRUMENTS

## gpioninterrupt

### Example Summary

Application that toggles an LED(s) using a GPIO pin interrupt.

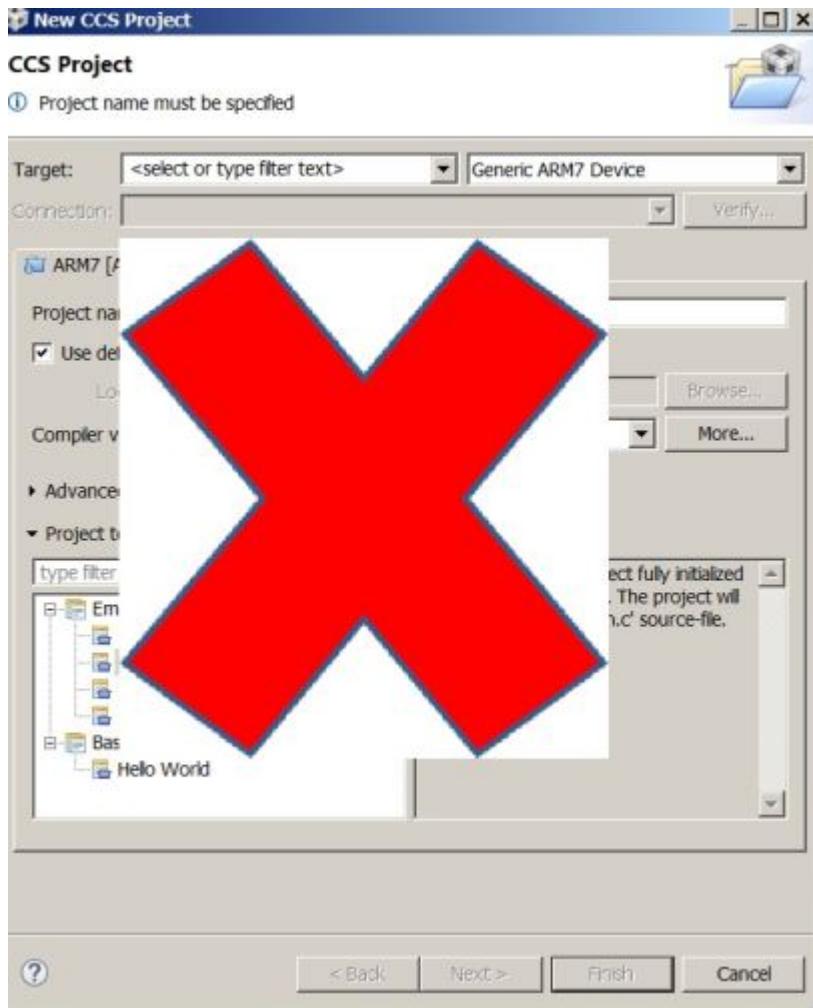
### Peripherals & Pin Assignments

SysConfig generates the driver configurations into the **ti\_drivers**. SysConfig user interface can also be utilized to determine pins assigned to peripherals.

- CONFIG\_GPIO\_LED\_0 - Indicates that the board was initialized via the TI-RTOS API.
- CONETG GPIO LED 1 - Toggled by CONETG GPIO BUTTON 1

## 4.3 Create a new SDK based User Application

Do not use the New Project Creation Wizard



- Start with one of the example projects or empty project template shipped inside the SDK. Each software component in the SDK comes with its own set of examples. If your project depends on multiple TI provided software libraries, start from the empty template then add the necessary components into your projects.
- Import one of the empty project template shown below to your IDE and start your application from there. All the necessary include paths and SDK specific defines if any are already part of the Empty Project Template

#### 4.3.1 Non-RTOS Based Empty Project Template

Windows (C:) > ti > simplelink_msp432e4_sdk_1_55_00_13 > examples > nortos > MSP_EXP432E401Y > driverlib > empty			
	Name	Date modified	Type
ccs		10/12/2017 1:08 PM	File folder
gcc		10/12/2017 1:08 PM	File folder
iar		10/12/2017 1:08 PM	File folder
keil		10/12/2017 1:08 PM	File folder
main.c		10/11/2017 5:46 PM	C File
system_msp432e401y.c		10/11/2017 5:46 PM	C File

## 4.3.2 TIRTOS Based Empty Project Template

Windows (C:) > ti > simplelink\_msp432e4\_sdk\_3\_30\_00\_13\_eng > examples > rtos > MSP\_EXP432E401Y > drivers > empty > tirtos

<input type="checkbox"/> Name	Date modified	Type	Size
ccs	9/9/2019 10:38 AM	File folder	
gcc	9/9/2019 10:38 AM	File folder	
iar	9/9/2019 10:38 AM	File folder	
empty.syscfg	9/6/2019 5:44 PM	SYSCFG File	2 KB
main_tirtos.c	9/6/2019 5:44 PM	C File	4 KB

## 4.3.3 FreeRTOS Based Empty Project Template

Windows (C:) > ti > simplelink\_msp432e4\_sdk\_3\_30\_00\_13\_eng > examples > rtos > MSP\_EXP432E401Y > drivers > empty > freertos

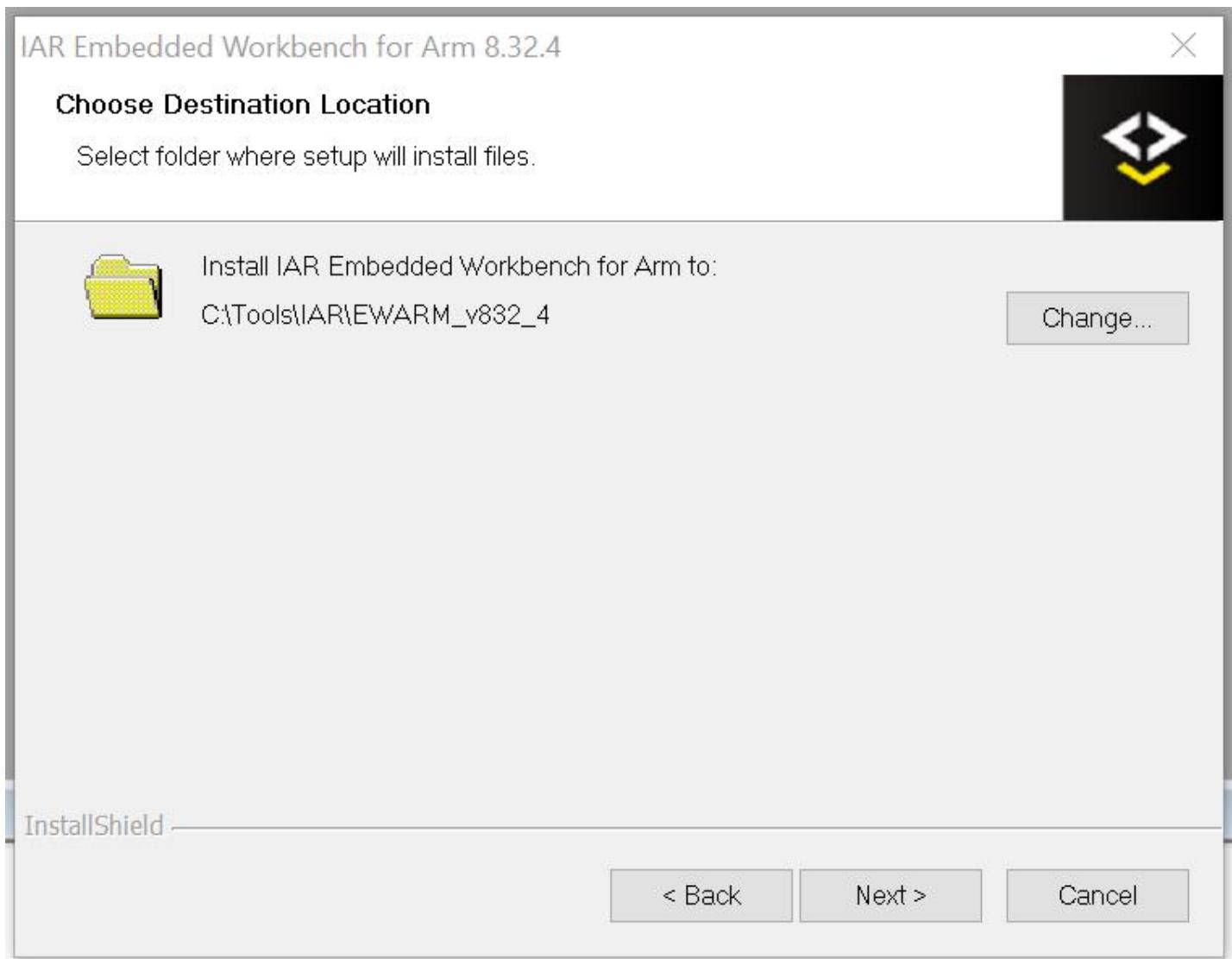
<input type="checkbox"/> Name	Date modified	Type	Size
ccs	9/9/2019 10:38 AM	File folder	
gcc	9/9/2019 10:38 AM	File folder	
iar	9/9/2019 10:38 AM	File folder	
empty.syscfg	9/6/2019 5:44 PM	SYSCFG File	2 KB
main_freertos.c	9/6/2019 5:44 PM	C File	4 KB

# 5. Quick Start for IAR IDE

This section is going to cover the required settings for a IAR installation and how to build and load examples.

## 5.1 Download and Installation

Download and install IAR Embedded Workbench for ARM. You can get IAR for ARM [here](#).



- Make sure to select TI XDS as one of the debug probe drivers. You may also select other drivers. The driver will be installed towards the end of the installation of IAR.

IAR Embedded Workbench for Arm 8.32.4

### USB Driver installation

Select the USB drivers to install for your debug probes

Select the USB drivers you want to install on your system

	Description
<input checked="" type="checkbox"/> Debug probe drivers	XDS Emulation Software Package and USB driver installer for the TI debug probes XDS100, XDS110 and XDS200.
<input checked="" type="checkbox"/> I-jet	
<input checked="" type="checkbox"/> J-Link	
<input type="checkbox"/> ST-LINK	
<input type="checkbox"/> PEMicro	
<input checked="" type="checkbox"/> TI XDS	
<input checked="" type="checkbox"/> TI FTDI	
<input checked="" type="checkbox"/> TI ICDI	
<input checked="" type="checkbox"/> TI FET	
<input type="checkbox"/> NU-LINK	
<input type="checkbox"/> Dongle drivers	

6.12 GB of space required on the C drive  
388.61 GB of space available on the C drive

InstallShield

< Back      Next >      Cancel

IAR 8.11.3 requires a patch for proper debug support with the MSP-EXP432E401Y LaunchPad. The patch is provided in the SDK in the `C:\ti\simplelink_msp432e4_sdk_4_20_00_12\tools\iar` directory or at [www.iar.com/mypages](http://www.iar.com/mypages). This patch only works with IAR 8.11.3 and should not be used with any other IAR versions.

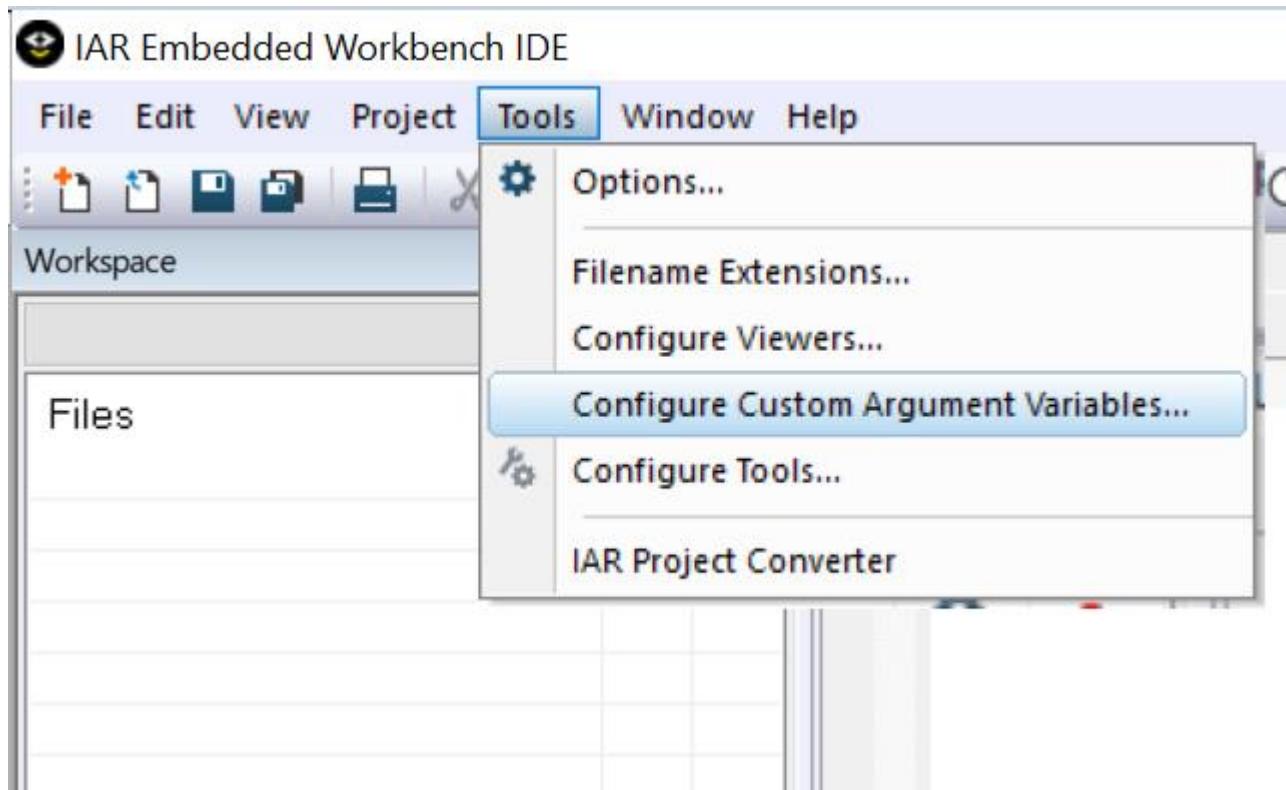
To install the patch, simple extract the zip where you have IAR Embedded Workbench installed within the `\Embedded Workbench 8.0` directory.

For more information refer to the `PatchReadme-8.11.3.14204.html` file contained within the patch.

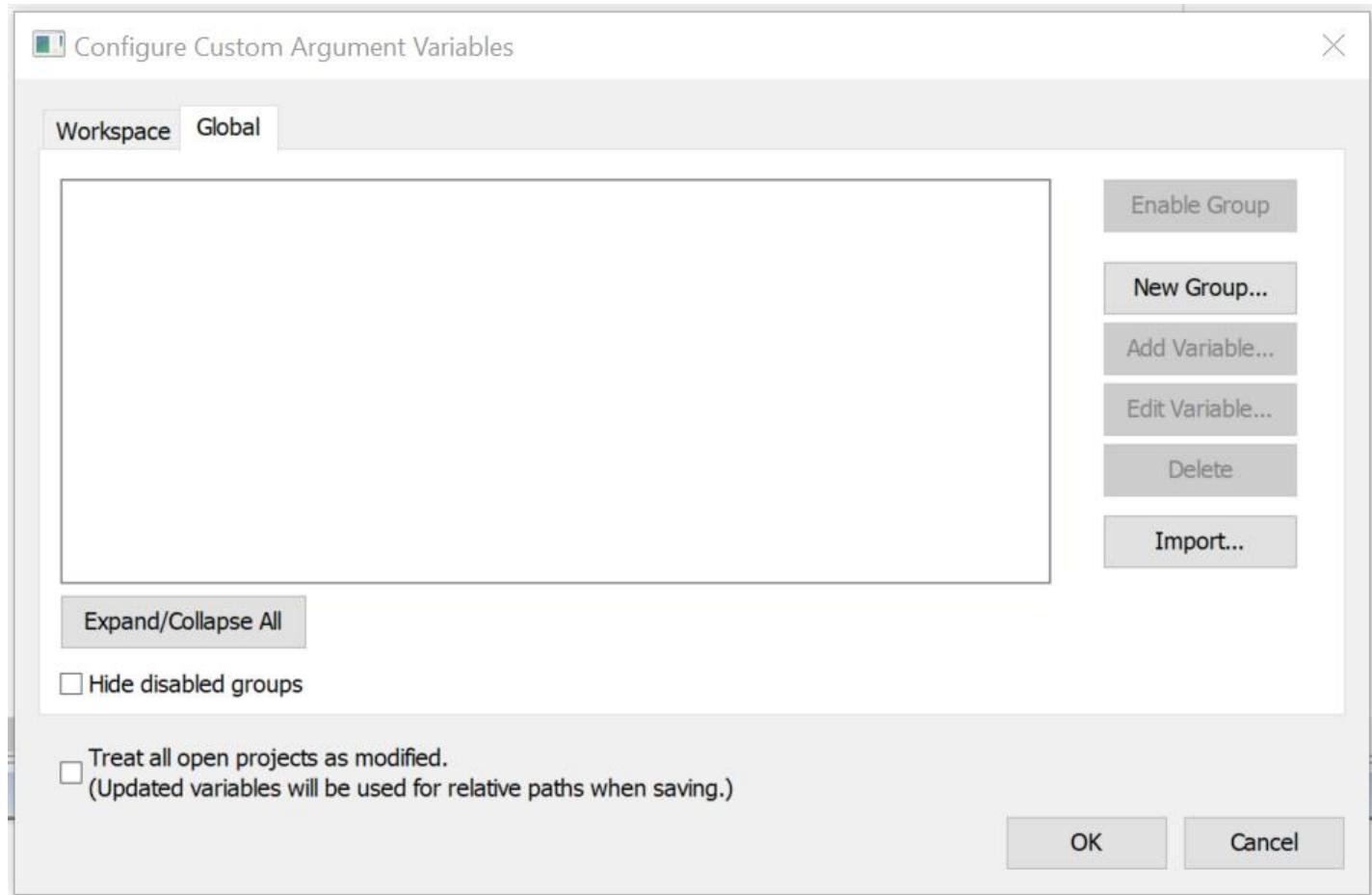
### 5.1.1 Configuring Custom Argument Variables

Before starting to work with any of the projects in the SDK, you need to load a set of variables that will be set for your current workspace:

- Choose Tools -> Configure Custom Argument Variables



- Click Global -> Import



- Import the custom argvars from the SDK. The argvars are stored in a SIMPLELINK\_MSP432E4\_SDK.custom\_argvars file, which is located in the tools directory of the SDK

(<SDK\_INSTALL\_PATH>/tools/iar/SIMPLELINK\_MSP432E4\_SDK.custom\_argvars)

Windows (C:) > ti > simplelink\_msp432p4\_sdk\_1\_50\_00\_08 > tools > iar

Name	Date
Examples.html	8/30
SIMPLELINK_MSP432P4_SDK.custom_argvars	8/30

- You can open (<SDK\_INSTALL\_PATH>/tools/iar/SIMPLELINK\_MSP432E4\_SDK.custom\_argvars) in a text editor if you need to modify the default path argument variables.

```

1  <?xml version="1.0" encoding="iso-8859-1"?>
2
3  <iarUserArgVars>
4      <group active="true" name="SIMPLELINK_MSP432_SDK">
5          <variable>
6              <name>XDCPATH</name>
7              <value>c:/ti/simplelink_msp432p4_sdk_1_50_00_08/kernel/tirtos/packages;c:/ti/simplelink_msp432p4_sdk_1_50_00_08/source</value>
8          </variable>
9          <variable>
10             <name>XDROOT</name>
11             <value>c:/xdctools_3_50_03_33_core</value>
12         </variable>
13         <variable>
14             <name>FREERTOS_INSTALL_DIR</name>
15             <value>c:/FreeRTOSv9.0.0</value>
16         </variable>
17         <variable>
18             <name>SIMPLELINK_MSP432_SDK_INSTALL_DIR</name>
19             <value>c:/ti/simplelink_msp432p4_sdk_1_50_00_08</value>
20         </variable>
21         <variable>
22             <name>EXAMPLE_ROOT</name>
23             <value>c:/ti/simplelink_msp432p4_sdk_1_50_00_08/tools/iar</value>
24         </variable>
25     </group>
26 </iarUserArgVars>
27

```

- Restart IAR.

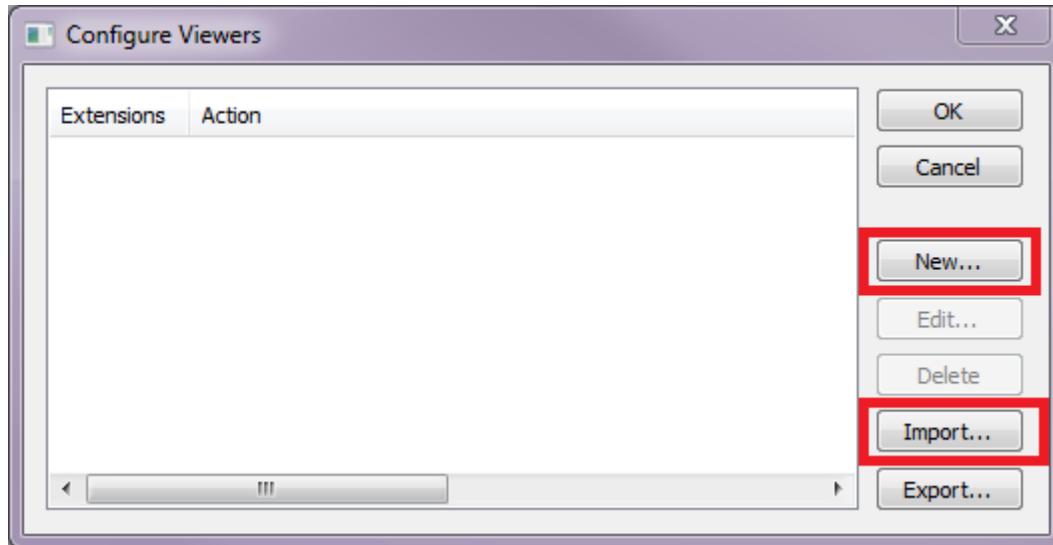
## 5.2 Using SysConfig with IAR Workbench

If you are using the IAR toolchain, you can use SysConfig as a standalone desktop tool to generate the configuration files to be compiled and linked with your application. In order to do so you have to open SysConfig from the IAR EWARM IDE like described below. If you open device configurations with SysConfig otherwise some parameters provided by the IDE will be missing.

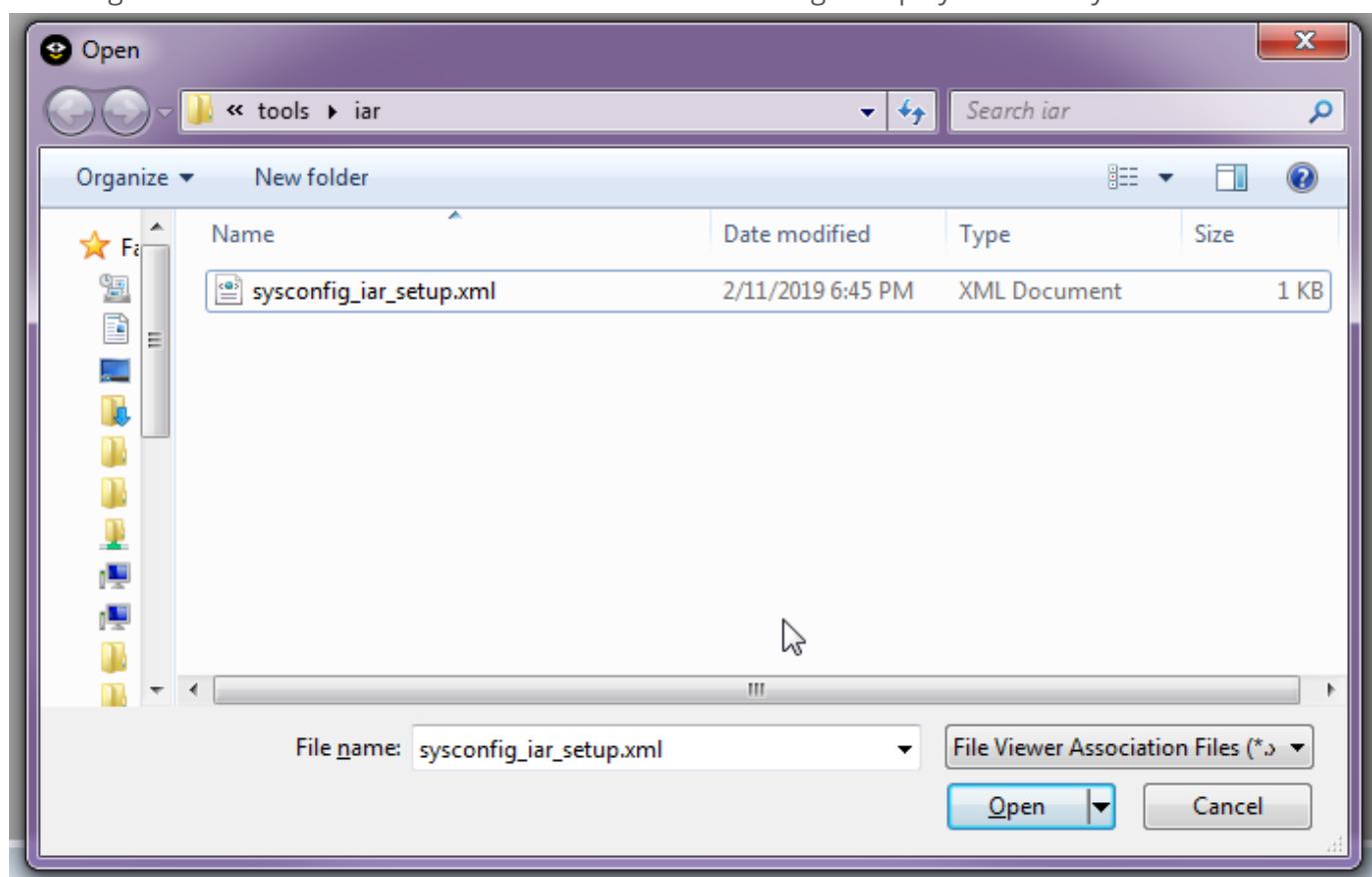
The steps that follow use the **SysConfig** standalone installer and **IAR-EWARM** - use the tool versions from release notes. The figures use the MSP432 SDK as an example, but other SimpleLink SDKs follow the same procedure. These steps assume the TI Code Generation Tools are installed in the default location.

1. Install SysConfig as a standalone tool ([download here](#)) within the default location (C:\ti).
2. Open IAR and follow these steps to configure it to use the correct viewer for \*.syscfg files:

a. Choose **Tools > Configure Viewers** from the menus, and click **Import**.(Possible with IAR EWARM 8.32.2 or higher)



b. Navigate to the SDK installation directory (\tools\iar) and select the file 'sysconfig\_iar\_setup.xml' like in the image shown below. Click "Edit" to and make sure the string is displayed correctly.

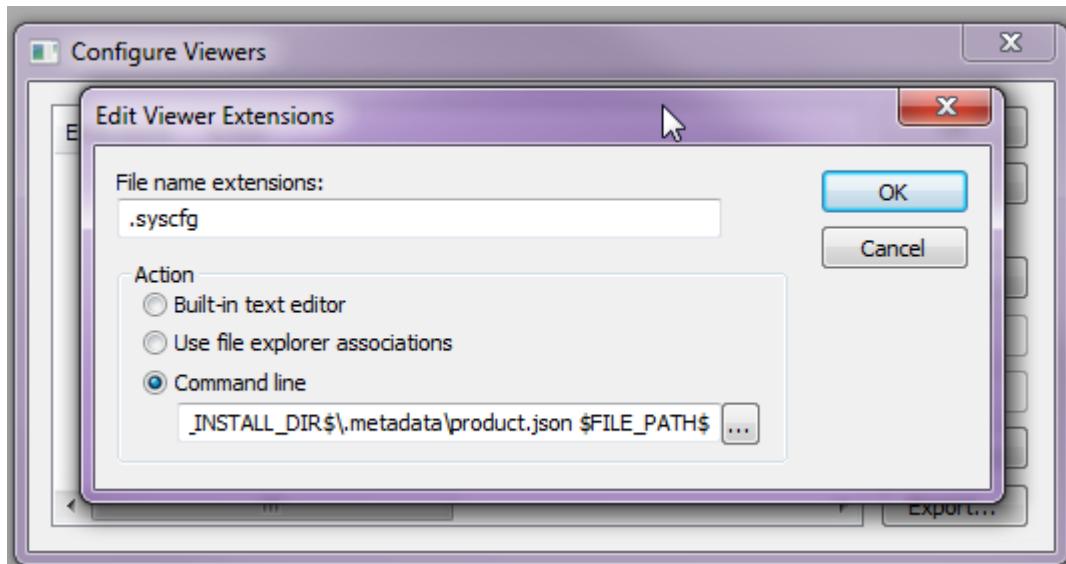


c. Alternatavily you can add the configuration manually by pressing the **New** button.

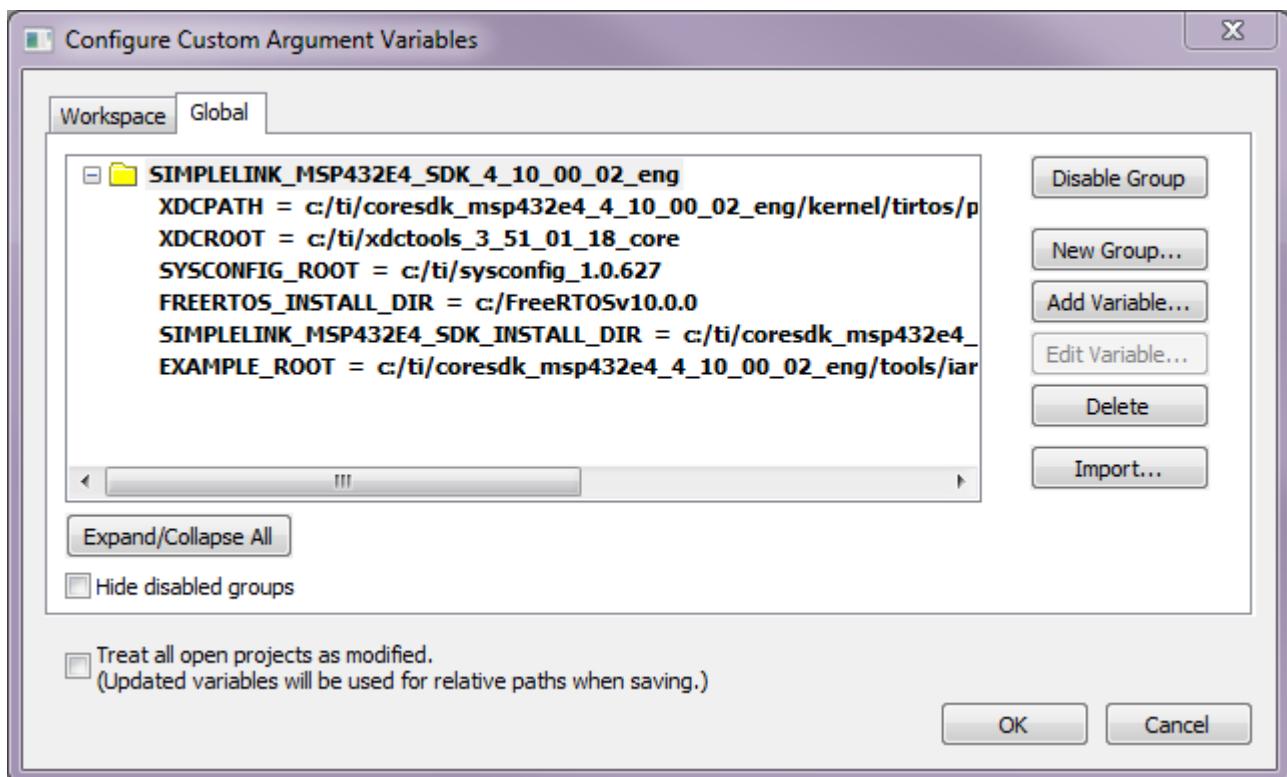
i. In this case type .syscfg in the **File name extensions** field.

ii. Select the Command line option and type the following into the field (this string can also be found in the tools/iar/sysconfig\_iar\_setup.xml files if you want to copy-paste it from there).

```
$SYSCONFIG_ROOT$\nw\ nw.exe $SYSCONFIG_ROOT$ -compiler iar -product  
$SIMPLELINK_SDK_INSTALL_DIR$.metadata\product.json -output $PROJ_DIR$ $FILE_PATH$
```

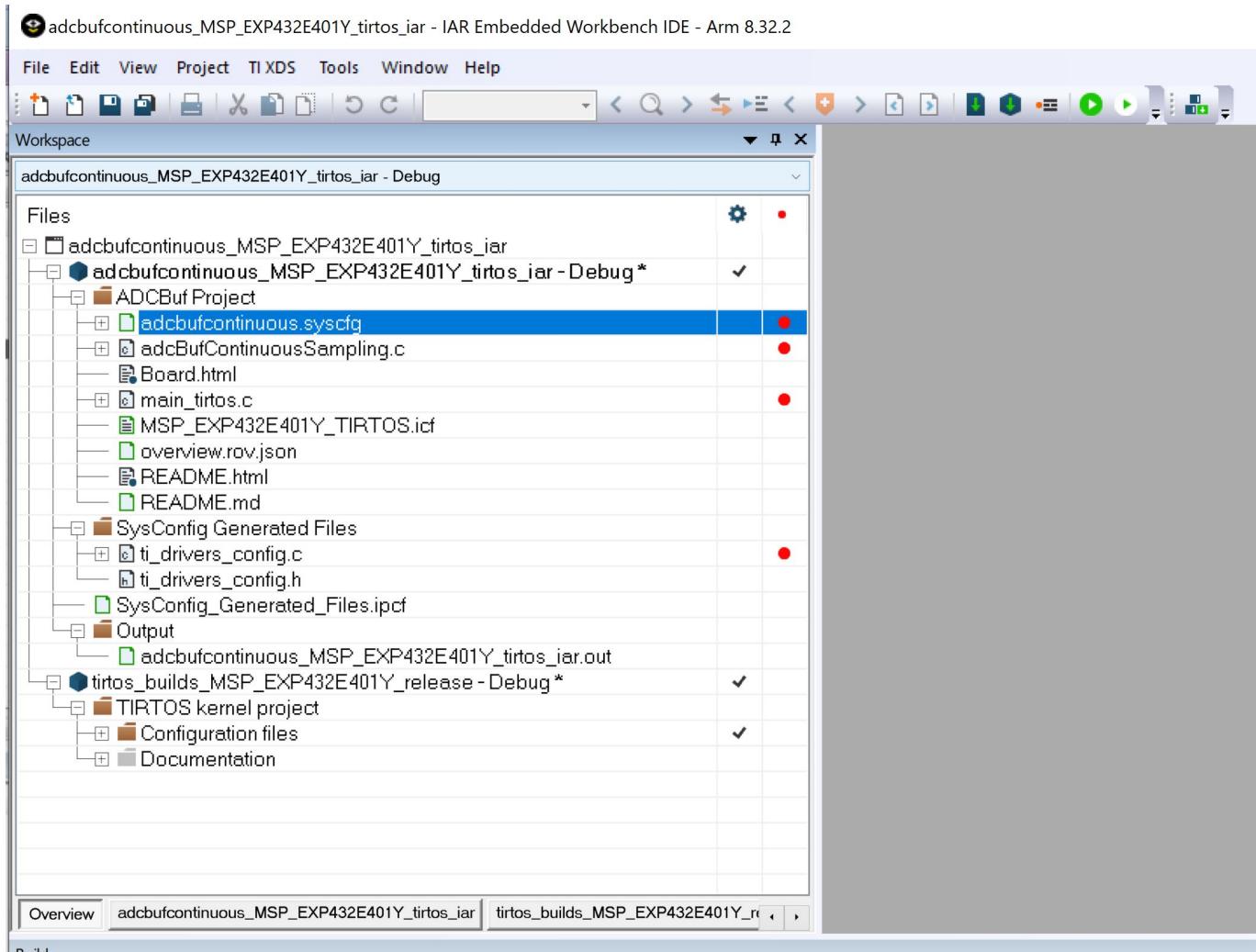


3. Make sure you imported the custom argument variables (See chapter 5.1.1) and that the paths are correct

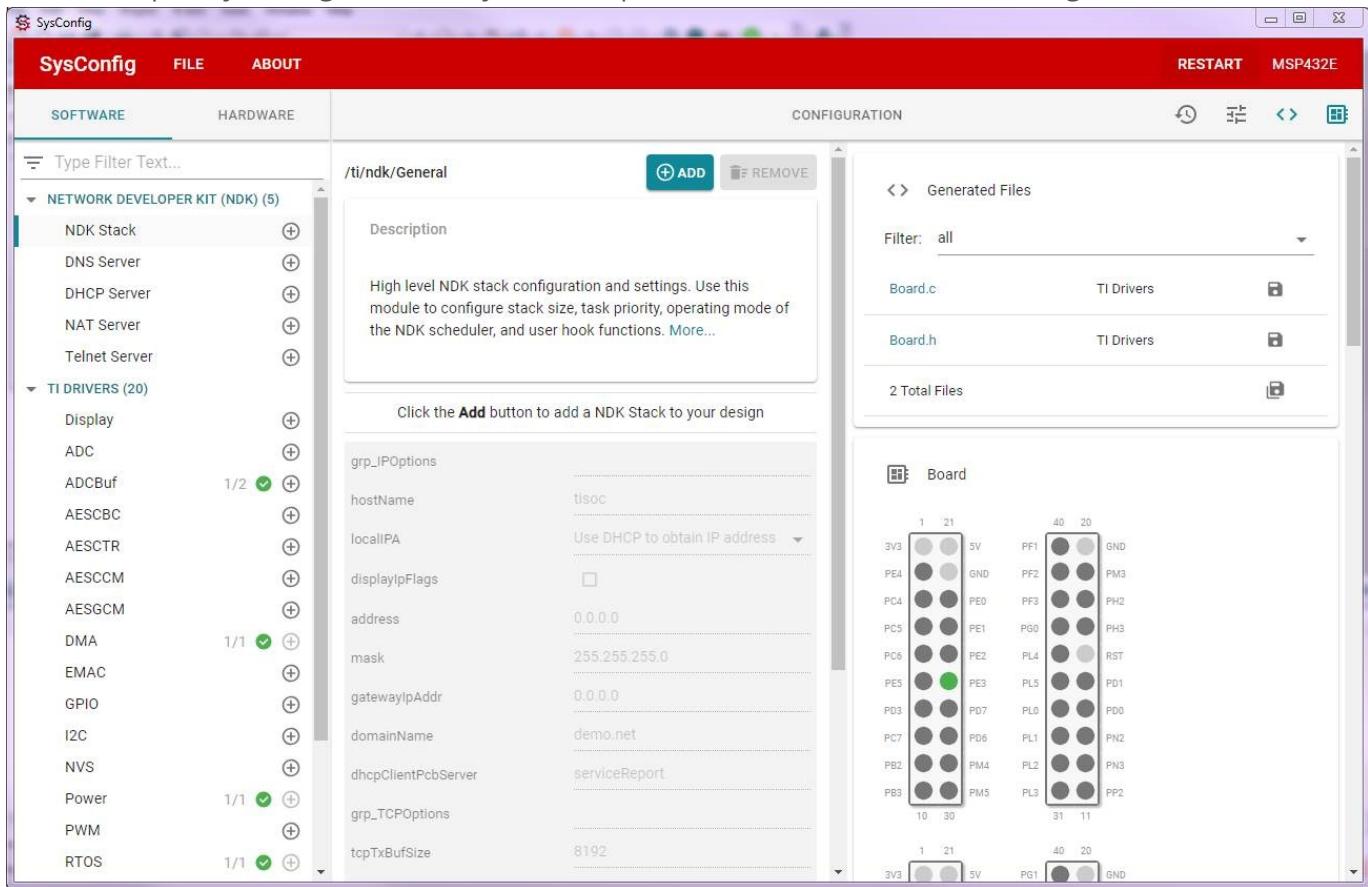


4. Import an example project workspace like described in the previous chapters. Make sure to take it from the syscfg\_preview folder.

## 5. Double click on the \*.syscfg file in your project



## 6. This shall open SysConfig and offers you to adapt drivers, IO Pins and other settings



7. Save your changes and switch back to IAR EWARM.

8. ebuild the project to perform the custom build step, which uses command line scripts to adapt your IAR project to the changes made in SysConfig.

## 5.3 Running Your First Example / Importing Your First project

This section will show how to import, build and load an example

**Directly accessing workspace from example folder** All Code Examples that are shipped with the SDK come with an IAR workspace. Double-Clicking the specific template workspace allows you to open the project, save a copy of workspace and project in separately selected locations to disk and build it.

/windows (C:) > ti > simplelink\_msp432e4\_sdk\_3\_30\_00\_13\_eng > examples > rtos > MSP\_EXP432E401Y > drivers > spiloopback > tirtos > iar

<input type="checkbox"/> Name	Date modified	Type	Size
makefile	9/6/2019 5:44 PM	File	3 KB
MSP_EXP432E401Y_TIRTOS.icf	9/6/2019 5:44 PM	ICF File	4 KB
spiloopback_MSP_EXP432E401Y_tirtos_iar.ewd	9/6/2019 5:44 PM	EWD File	2 KB
spiloopback_MSP_EXP432E401Y_tirtos_iar.epw	9/6/2019 5:44 PM	EWP File	33 KB
spiloopback_MSP_EXP432E401Y_tirtos_iar.ipcf	9/6/2019 5:44 PM	IPCF File	5 KB
spiloopback_MSP_EXP432E401Y_tirtos_iar.temp...	9/6/2019 5:44 PM	IAR IDE Workspace	1 KB
SysConfig_Generated_Files.ipcf	9/6/2019 5:44 PM	IPCF File	1 KB

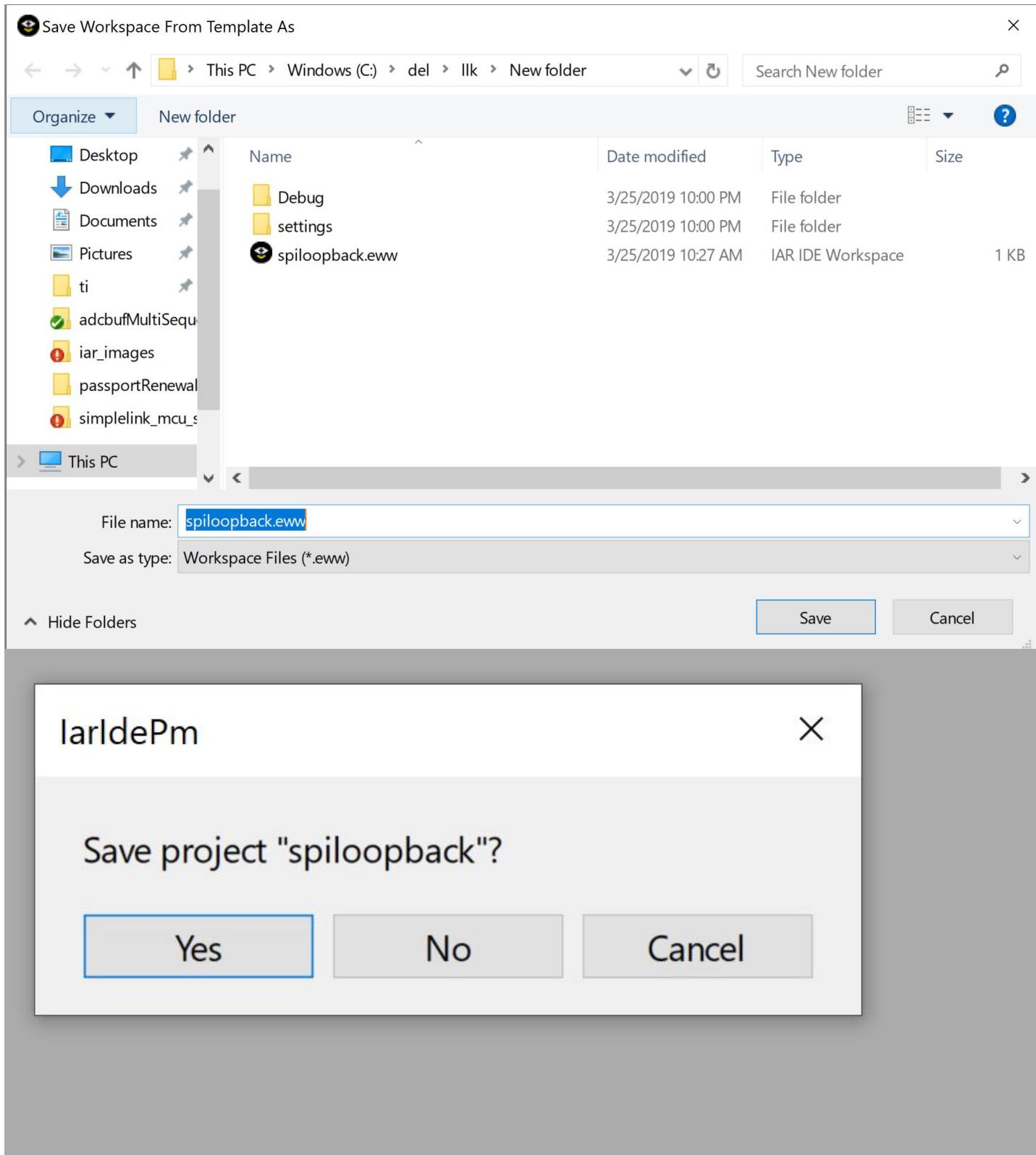
IarIdePm



This will open a workspace from a template and save it in a new folder.

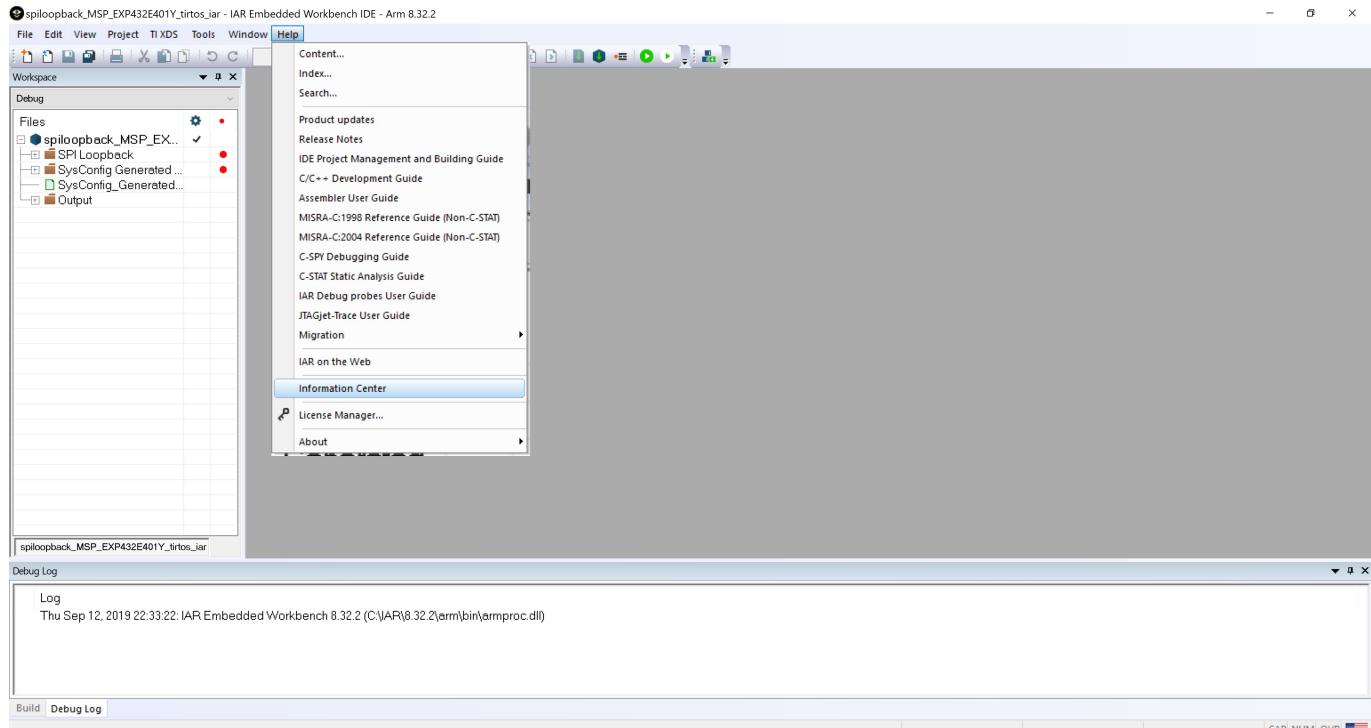
OK

Cancel

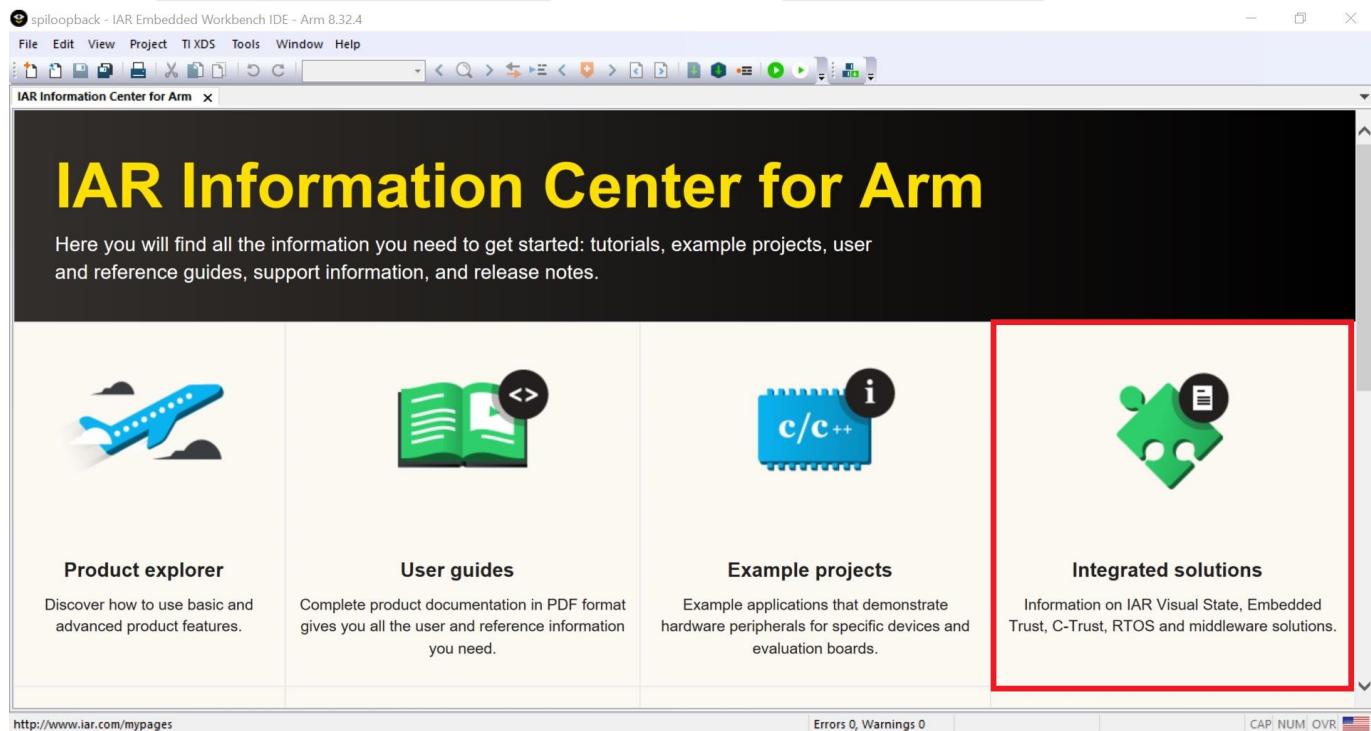


Browse the example list

- In the IAR-IDE go to the **Help** tab and click on **Information Center**



- In the new IAR Information Center for ARM window, click on **Integrated Solutions**



- Then, click on Example projects under Texas Instruments

The screenshot shows the IAR Embedded Workbench IDE interface. The main window displays the "IAR Information Center for Arm - Integrated solutions" page. On the right side, there is a sidebar with various links:

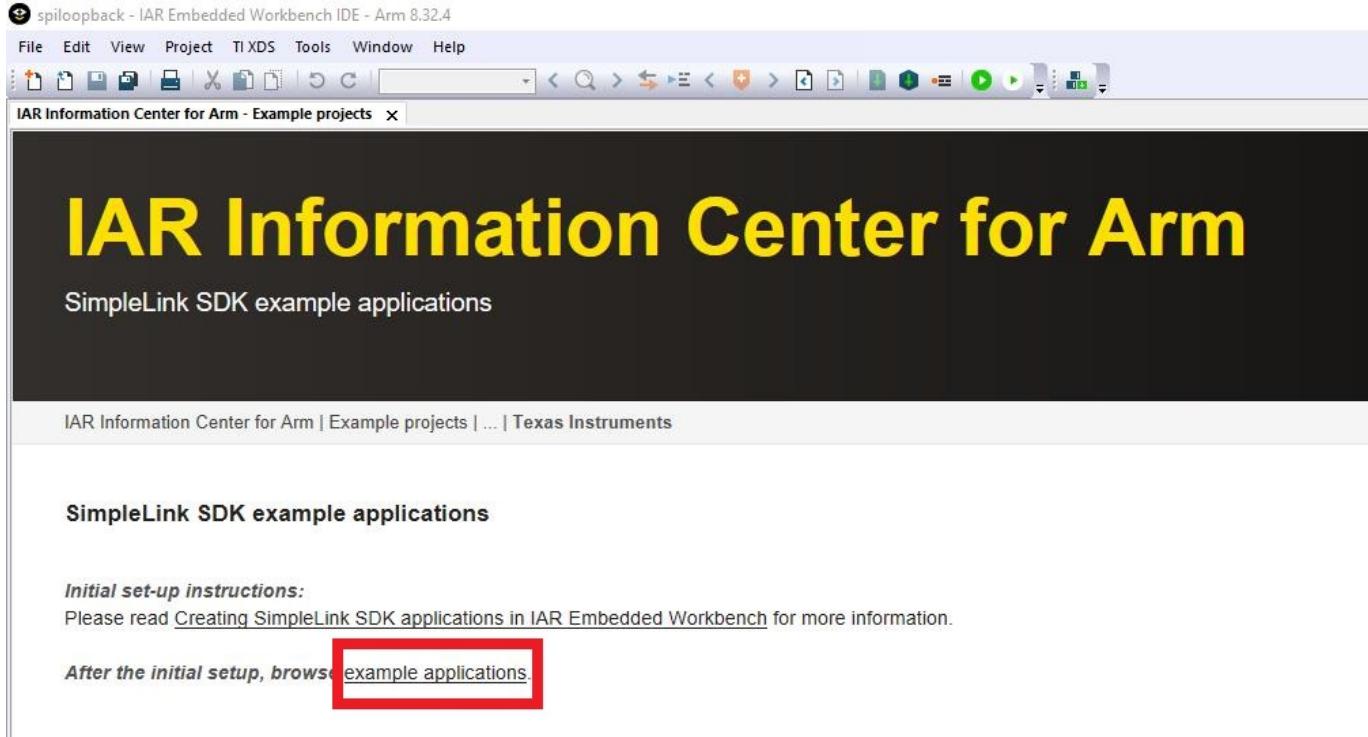
- Product explorer
- User guides
- Example projects
- Integrated solutions
- Hardware solutions
- Support
- Release notes
- My pages

The main content area on the left contains sections for "INTEGRATED SOLUTIONS", "IAR Visual State®", "Embedded Trust™ and C-Trust™", "RTOS and middleware", and "Partners with integrated solutions for IAR Embedded Workbench". Each section includes descriptive text and links to more information.

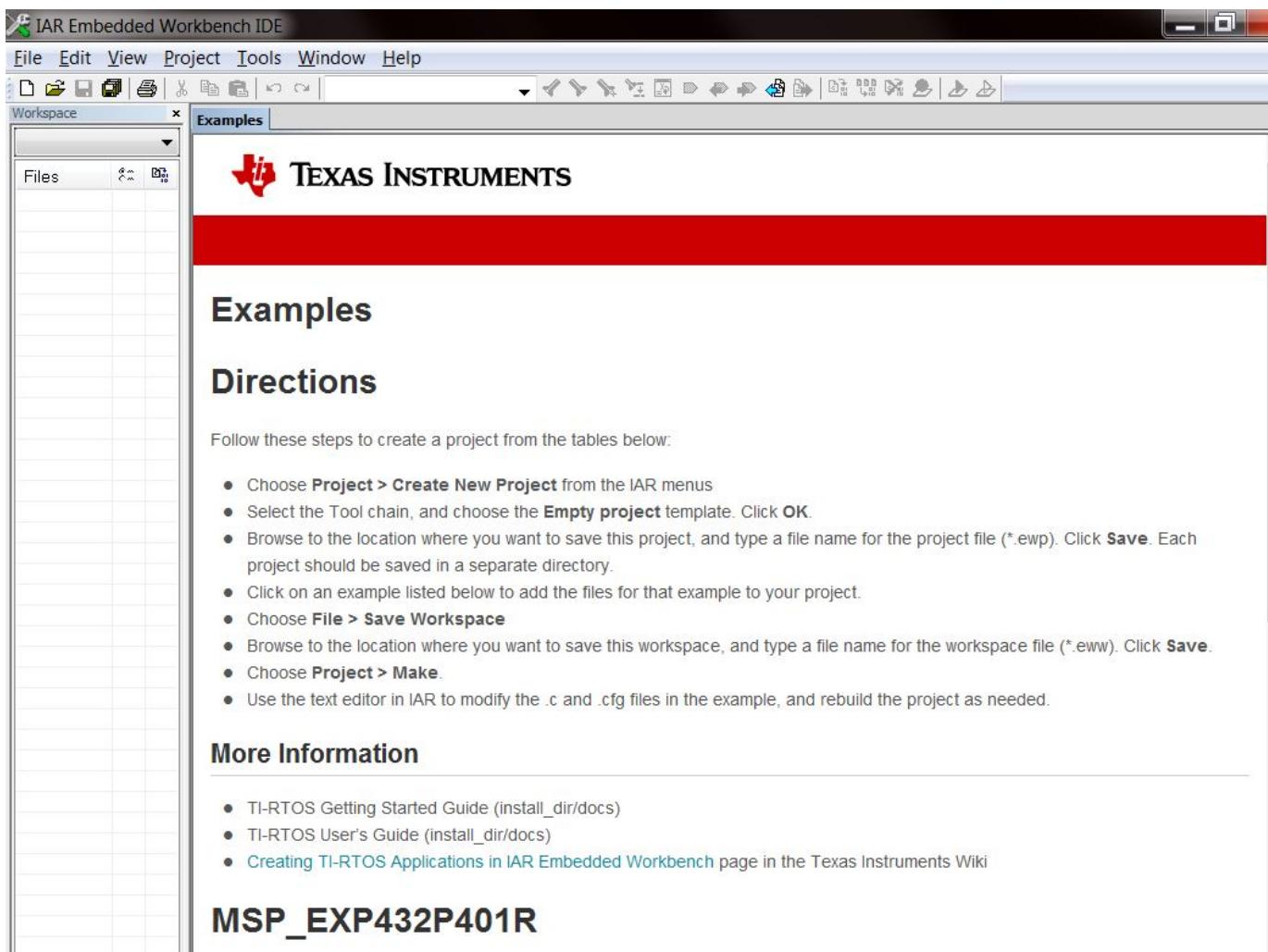
## Partners with integrated solutions for IAR Embedded Workbench

Name	Product Information	Example projects
<b>CMX Systems, Inc.</b>		
<b>ThreadX RTOS</b>		
<b>FreeRTOS / SafeRTOS</b>		
<b>Freescale MQX</b>		
<b>HCC-Embedded</b>		
<b>Micrium</b>		
<b>Micro Digital SMX</b>		
<b>Percepio Tracealyzer</b>		
<b>Quadros Systems, Inc.</b>		
<b>Sciopta</b>		
<b>SEGGER Microcontroller</b>		
<b>Texas Instruments</b>		(highlighted with a red box)

- Then, click on `example applications` link



- This `Examples` page contains information on how to create a new project, and links to import example projects



The screenshot shows the IAR Embedded Workbench IDE interface. The title bar says "IAR Embedded Workbench IDE". The menu bar includes File, Edit, View, Project, Tools, Window, and Help. The toolbar has various icons for file operations like Open, Save, and Build. The left sidebar is labeled "Workspace" and contains a "Files" section. The main area is titled "Examples" and features the Texas Instruments logo. Below it, there's a red header bar with the word "Examples". The main content area has a heading "Directions" and a sub-section "More Information".

**Directions**

Follow these steps to create a project from the tables below:

- Choose **Project > Create New Project** from the IAR menus
- Select the Tool chain, and choose the **Empty project** template. Click **OK**.
- Browse to the location where you want to save this project, and type a file name for the project file (\*.ewp). Click **Save**. Each project should be saved in a separate directory.
- Click on an example listed below to add the files for that example to your project.
- Choose **File > Save Workspace**
- Browse to the location where you want to save this workspace, and type a file name for the workspace file (\*.eww). Click **Save**.
- Choose **Project > Make**.
- Use the text editor in IAR to modify the .c and .cfg files in the example, and rebuild the project as needed.

**More Information**

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- TI-RTOS Getting Started Guide (install\_dir/docs)
- TI-RTOS User's Guide (install\_dir/docs)
- [Creating TI-RTOS Applications in IAR Embedded Workbench](#) page in the Texas Instruments Wiki

**MSP\_EXP432P401R**

- Scroll through the page and click on the project you are interested in. In this example let us click on

pwmled	TI-RTOS	FreeRTOS
spiloopback	TI-RTOS	FreeRTOS
spiloopback4wiremode	TI-RTOS	FreeRTOS
timerled	TI-RTOS	FreeRTOS
uartecho	TI-RTOS	FreeRTOS
watchdog	TI-RTOS	FreeRTOS

- When prompted, click **Yes** to save a copy of the project workspace, **No** otherwise
- If **Yes**, browse to the location where you want to save this workspace. Click **Choose**

## TI Drivers

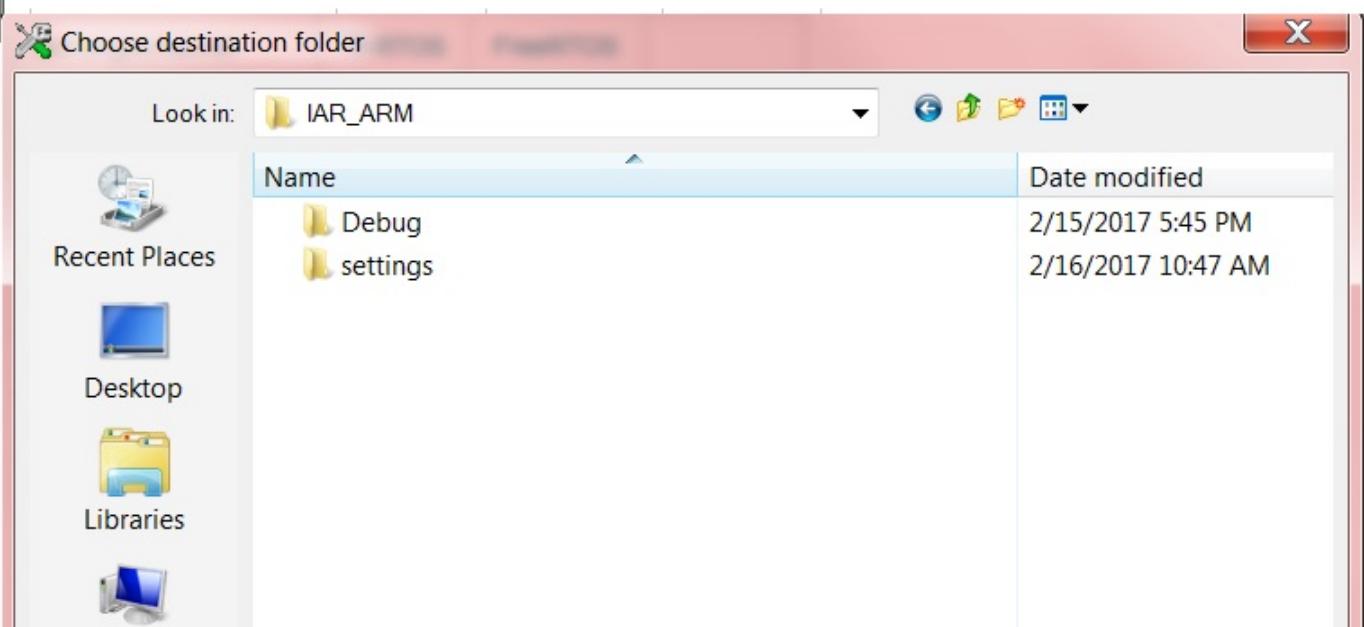
Example	TI-RTOS	FreeRTOS	No RTOS
---------	---------	----------	---------

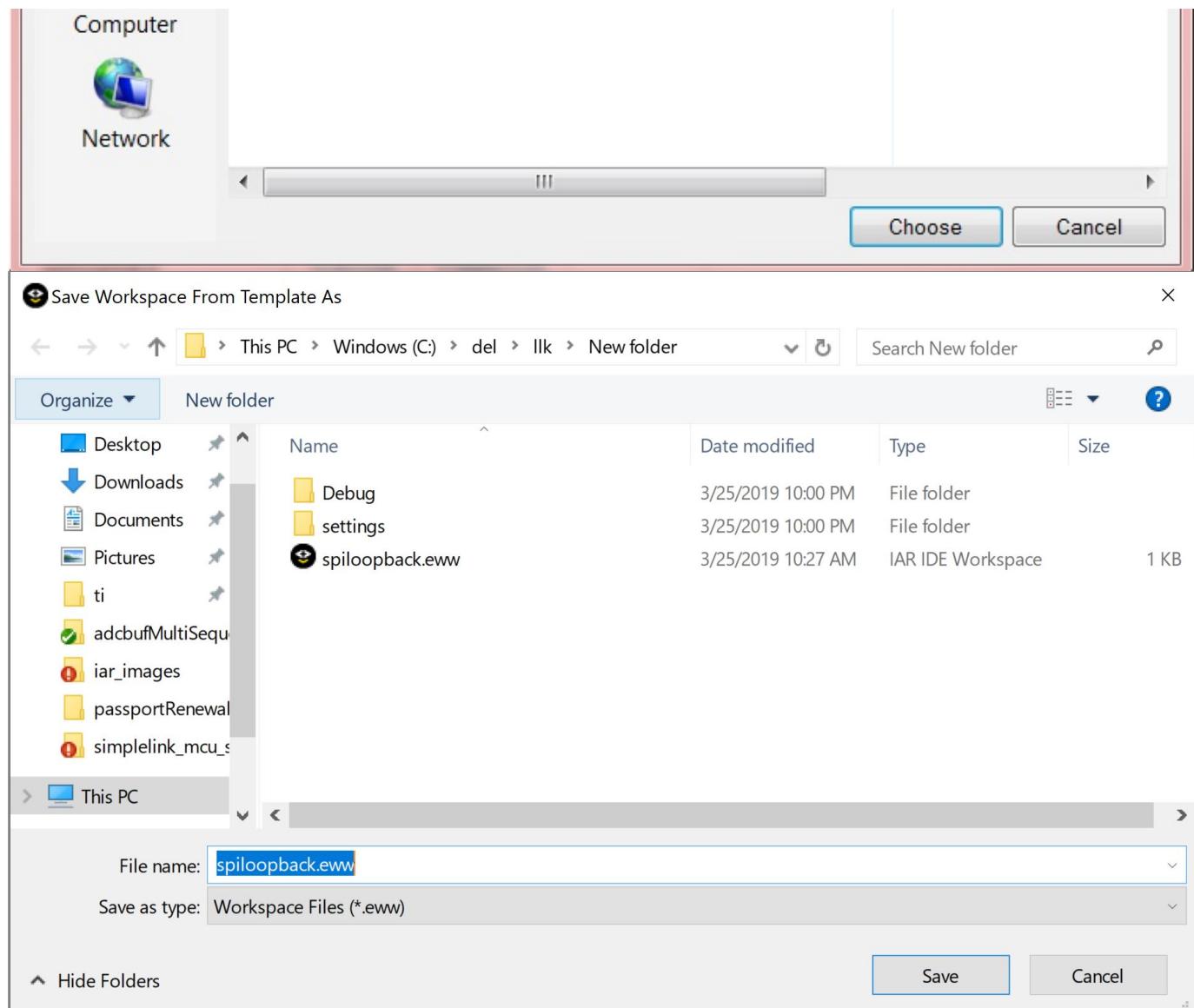
adcbufcontinuous	TI-RTOS	FreeRTOS	
adcsinglechannel	TI-RTOS	FreeRTOS	
capturepwmdisplay	TI-RTOS	FreeRTOS	
empty	TI-RTOS	FreeRTOS	
fatsdraw	TI-RTOS	FreeRTOS	
gpointerrupt			
i2cmasterexample1			
i2cslaveexample1			
i2ctmp007			
i2ctpl0401evm			
powerdeepsleep			
powerperformance			
powershutdown	TI-RTOS	FreeRTOS	
powersleep	TI-RTOS	FreeRTOS	
pwmled	TI-RTOS	FreeRTOS	
spiloopback	TI-RTOS	FreeRTOS	
spiloopback4wiremode	TI-RTOS	FreeRTOS	

IarIdePm

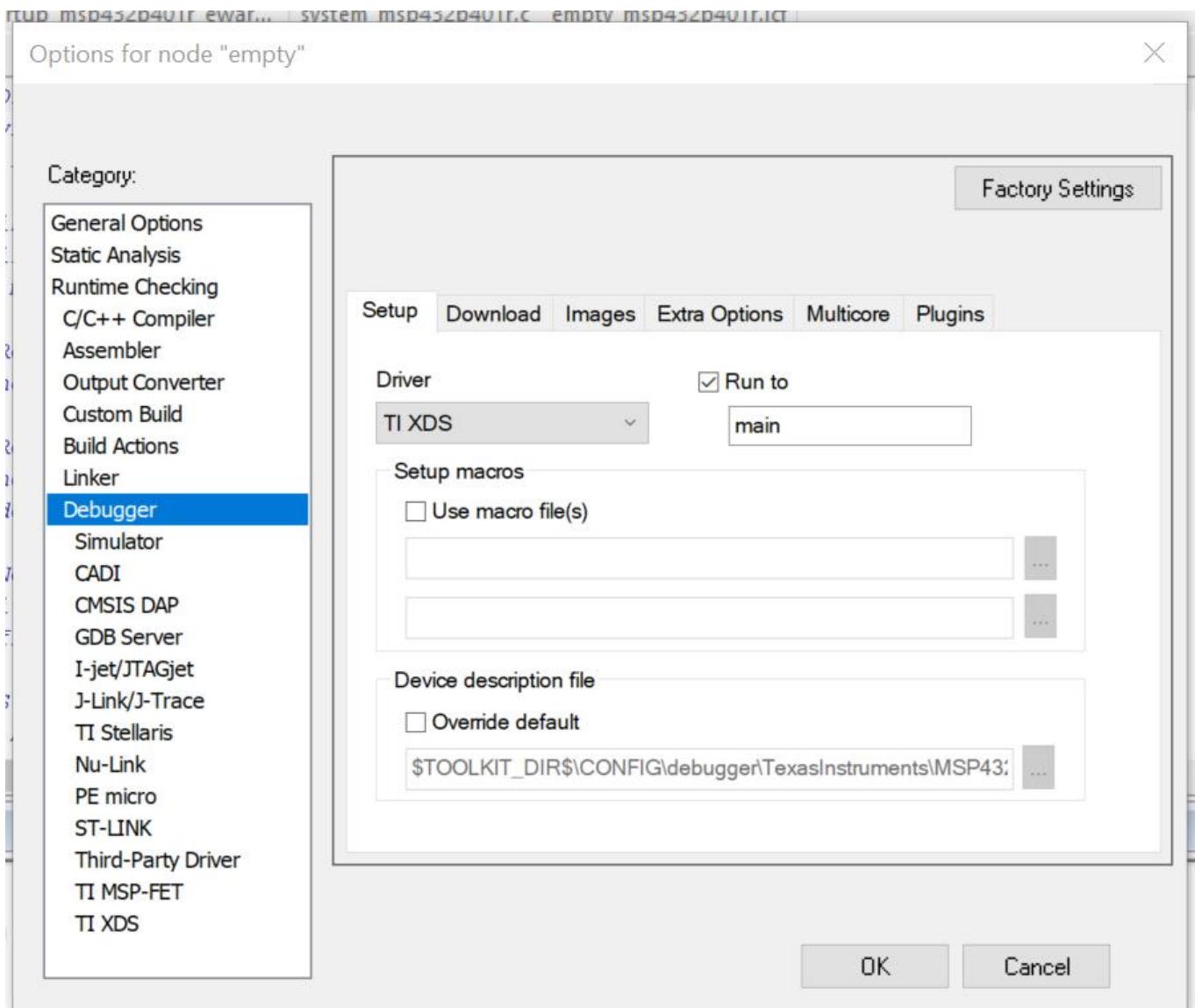
A copy of the example project will be opened.  
Do you want to specify the location for this copy?

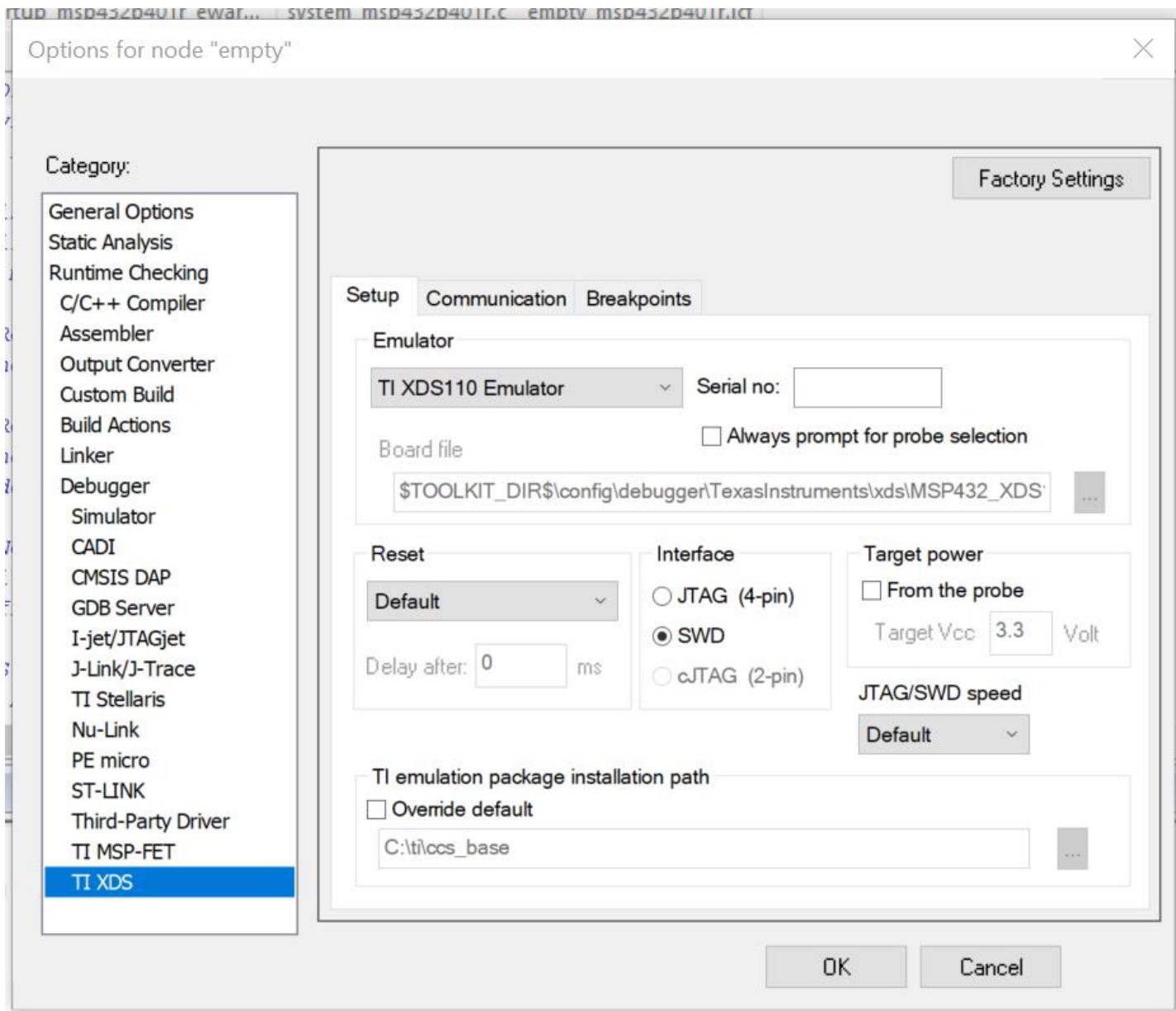
Yes      No





- By default, the project Debug settings is configured for TI XDS110, but the user may change them as needed





- Choose Project > Make

Double click on the \*.syscfg file in your project. This shall open SysConfig and offers you to adapt drivers, IO Pins and other settings. Save your changes and switch back to IAR EWARM. Saving the configuration in SysConfig does not yet generate new driver and other files; It just saves the configuration.

Rebuild the project to perform the custom build step, which uses command line scripts to adapt your IAR project to the changes made in SysConfig. If you later on do changes in SysConfig and don't want to rebuild the whole project you can select the \*.syscfg file in your IAR project explorer and compile only that one. This will trigger the creation of driver and other files with the changes you made in SysConfig. After that a simple "Make" will detect all changed files for the IAR compiler and linker tool chain.

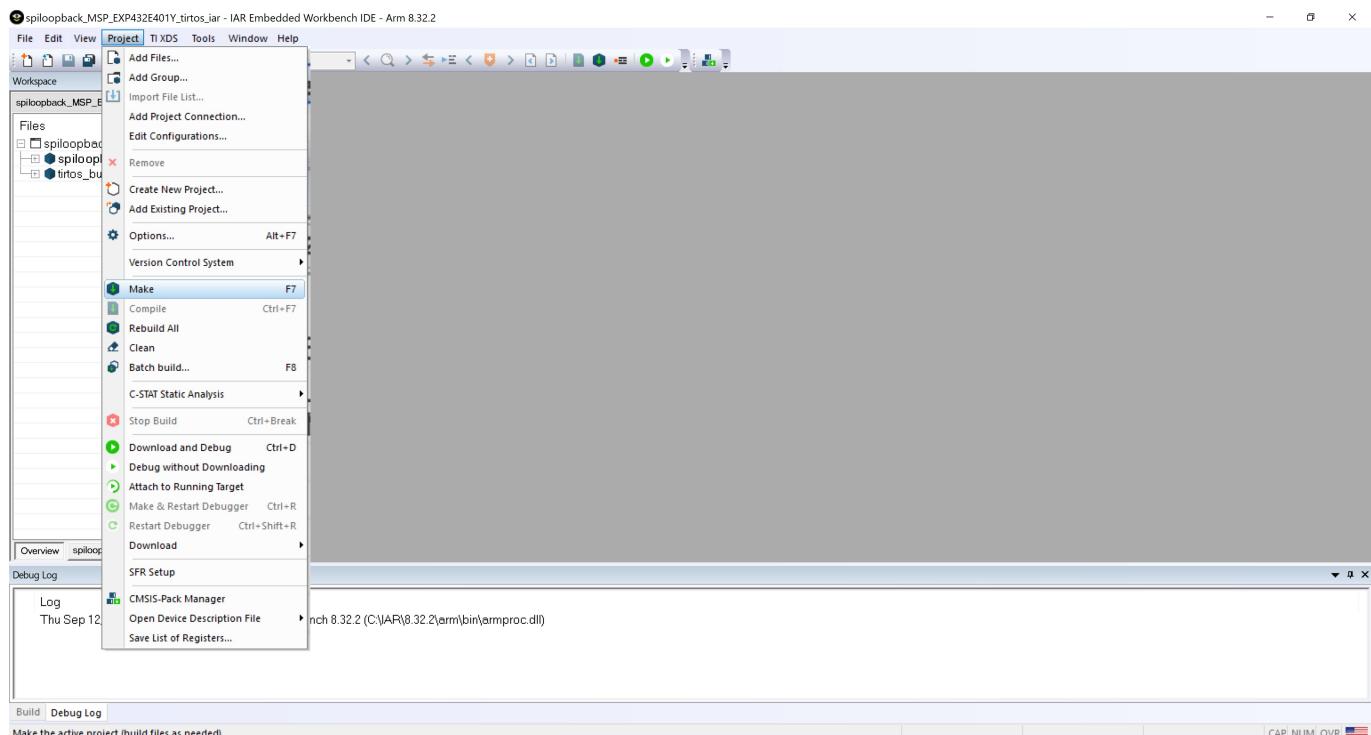
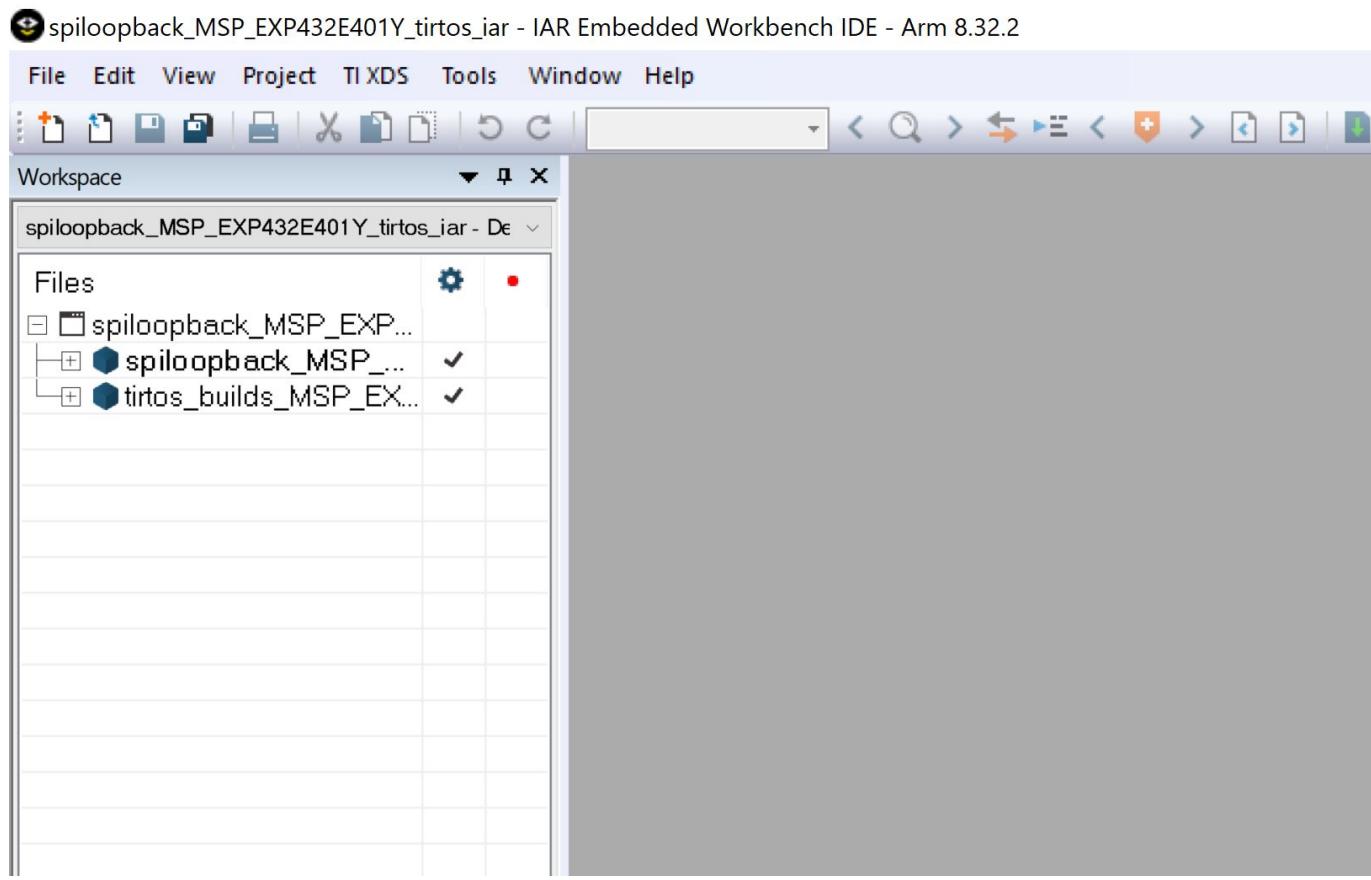
Make/Build the Example Project. Make [(Project->Make) Shortcut F7]. For RTOS based Projects - Note that the RTOS(kernel) build is a dependent project which is automatically pre-built before the example project builds.

The RTOS kernel(TI-RTOS or FreeRTOS build) project is linked to the workspace but the Example Project is copied into the workspace. SO the RTOS kernel needs to be built only once within the scope of the SDK but

each workspace has its own copy of the example project.

For noRTOS Projects - There is not RTOS(kernel) build dependent project imported into the workspace

- Plug in the launchpad and download Click `Project->Download and Debug - Shortcut (Ctrl + D)`



[www.ti.com/lit/pdf/slau574](http://www.ti.com/lit/pdf/slau574) has more details on IDE specific of MSP432E4

- Every RTOS example has a README.html that details the Example Application Design Details and how each example works

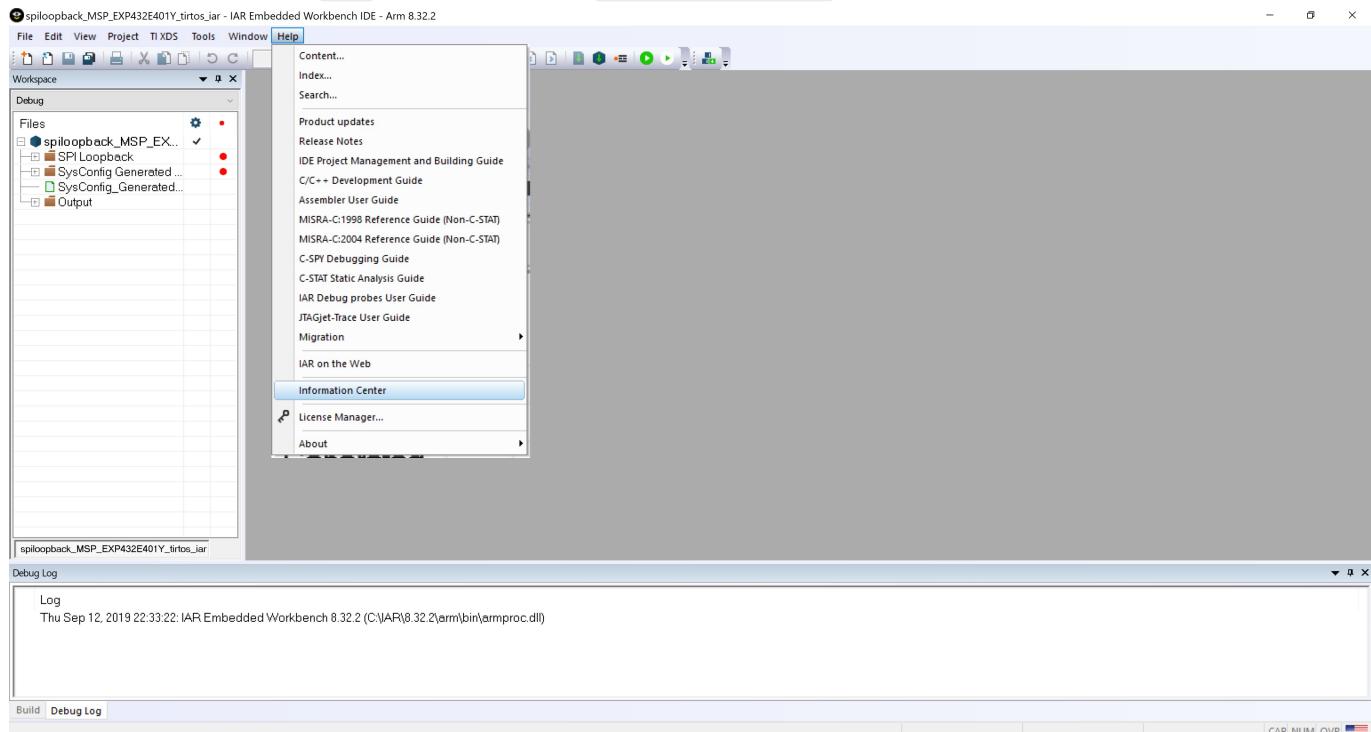
Windows (C:) > ti > simplelink\_msp432e4\_sdk\_3\_30\_00\_13\_eng > examples > rtos > MSP\_EXP432E401Y > drivers > spiloopback

Name	Date modified	Type	Size
freertos	9/9/2019 10:38 AM	File folder	
tirtos	9/9/2019 10:38 AM	File folder	
overview.rov.json	9/6/2019 5:44 PM	JSON File	8 KB
README.html	9/6/2019 5:44 PM	HTML File	74 KB
README.md	9/6/2019 5:44 PM	MD File	6 KB
spiloopback.c	9/6/2019 5:44 PM	C File	9 KB

## 5.4 Create a New SDK Based User Application

This section will show how to create a new SDK user application

- In the IAR-IDE go to the Help tab and click on Information Center



- In the new IAR Information Center for ARM window, click on Integrated Solutions

IAR Information Center for Arm

Here you will find all the information you need to get started: tutorials, example projects, user and reference guides, support information, and release notes.

**Product explorer**  
Discover how to use basic and advanced product features.

**User guides**  
Complete product documentation in PDF format gives you all the user and reference information you need.

**Example projects**  
Example applications that demonstrate hardware peripherals for specific devices and evaluation boards.

**Integrated solutions**  
Information on IAR Visual State, Embedded Trust, C-Trust, RTOS and middleware solutions.

- Then, click on Example projects under Texas Instruments

IAR Information Center for Arm - Integrated solutions

**INTEGRATED SOLUTIONS**

IAR Embedded Workbench integrates seamlessly with the state machine tool IAR Visual State as well as industry-leading real time operating systems and middleware. Our successful RTOS Partner Program provides a broad and comprehensive development tools ecosystem of RTOS and middleware products, all highly integrated with IAR Embedded Workbench.

**IAR Visual State**  
IAR Visual State is a set of highly sophisticated and easy-to-use development tools for designing, testing and implementing embedded applications based on state machines.

[More information about IAR Visual State](#)

**Embedded Trust™ and C-Trust™**  
Embedded Trust and C-Trust are part of a security development environment providing streamlined security development in IAR Embedded Workbench. The environment leverages the secure hardware built into next-generation microcontrollers to provide the low-level trust anchors and secure services needed for trustworthy IoT solutions. It also provides the functionality to deliver your code in an encrypted package that can be consumed by the Secure Deploy platform from Secure Thingz.

[More information about Embedded Trust/C-Trust](#)  
[Additional downloads and support files](#)

**RTOS and middleware**  
Product information, evaluation versions, and example projects for third party RTOS and middleware solutions integrated into IAR Embedded Workbench.

[RTOS aware debugging in C-SPY](#)

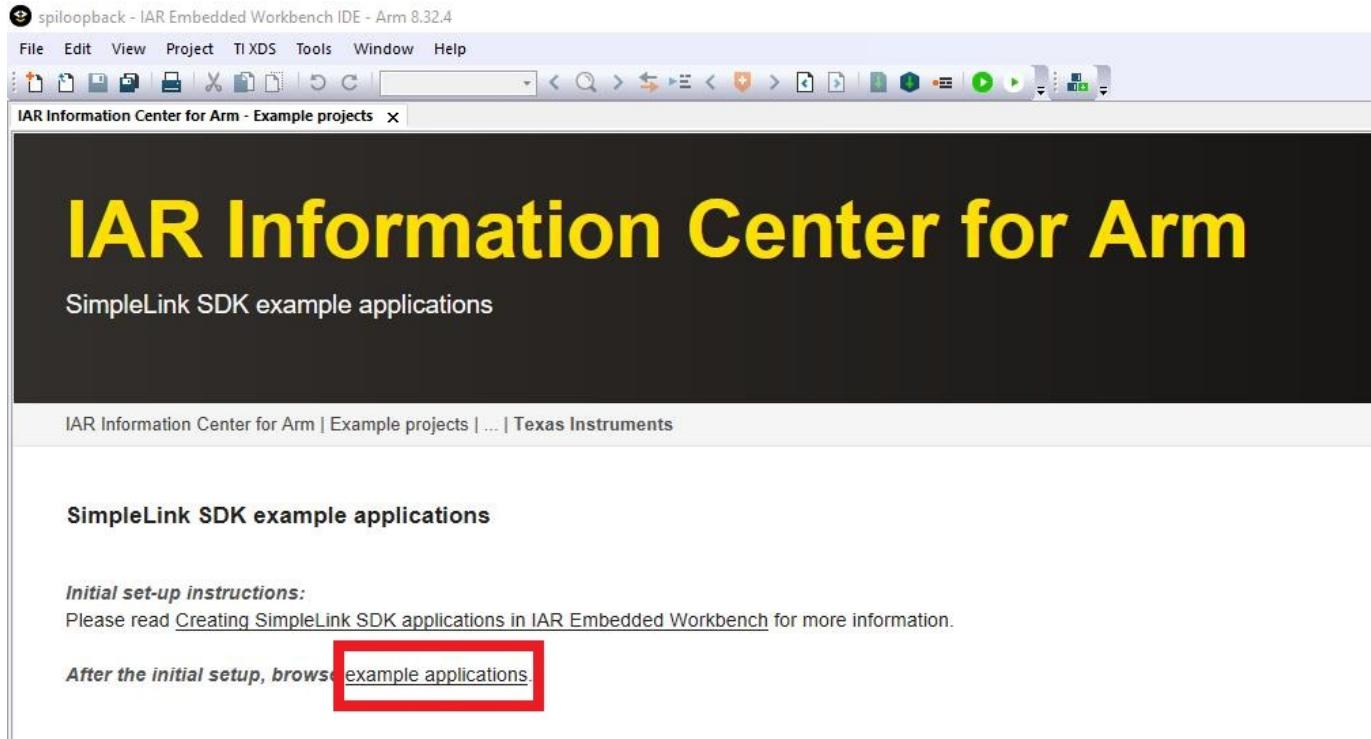
**Partners with integrated solutions for IAR Embedded Workbench**

Product explorer  
User guides  
Example projects  
Integrated solutions  
Hardware solutions  
Support  
Release notes  
My pages

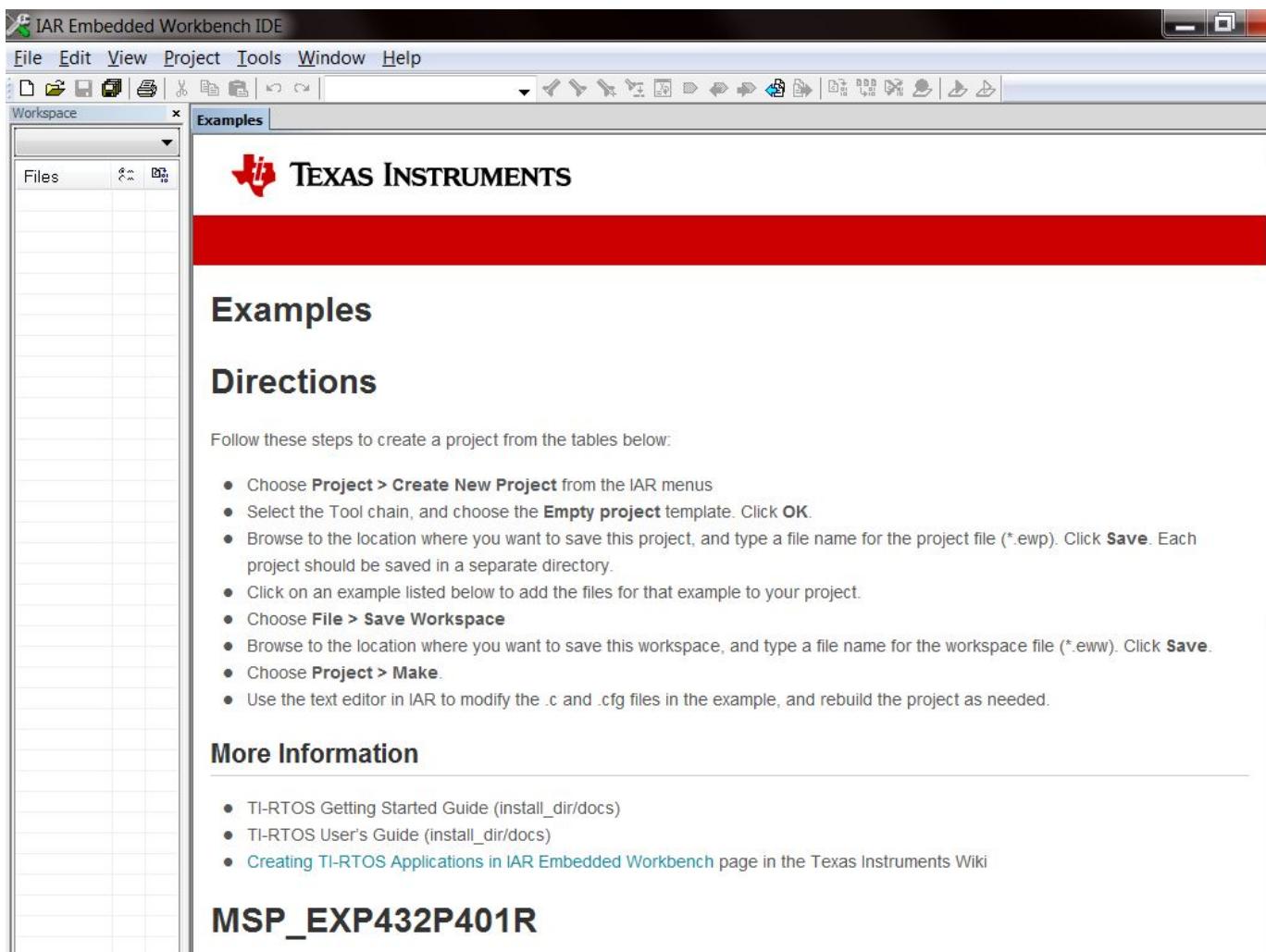
## Partners with integrated solutions for IAR Embedded Workbench

Name	Product Information	Example projects
<b>CMX Systems, Inc.</b>		
<b>ThreadX RTOS</b>		
<b>FreeRTOS / SafeRTOS</b>		
<b>Freescale MQX</b>		
<b>HCC-Embedded</b>		
<b>Micrium</b>		
<b>Micro Digital SMX</b>		
<b>Percepio Tracealyzer</b>		
<b>Quadros Systems, Inc.</b>		
<b>Sciopta</b>		
<b>SEGGER Microcontroller</b>		
<b>Texas Instruments</b>		(highlighted with a red box)

- Then, click on `example applications` link



- This `Examples` page contains information on how to create a new project, and links to import example projects



The screenshot shows the IAR Embedded Workbench IDE interface. The title bar reads "IAR Embedded Workbench IDE". The menu bar includes File, Edit, View, Project, Tools, Window, and Help. The workspace is titled "Examples". The main content area displays the Texas Instruments logo and the word "TEXAS INSTRUMENTS". Below this, there are two sections: "Examples" and "Directions". The "Examples" section contains a list of projects: adcbufcontinuous, adcsinglechannel, capturepwmdisplay, empty, fatsdraw, gpiointerrupt, i2cmasterexample1, i2cslaveexample1, and i2ctmp007. The "empty" project is highlighted with a red border. The "Directions" section provides instructions for creating a project from these examples.

**Examples**

**Directions**

Follow these steps to create a project from the tables below:

- Choose **Project > Create New Project** from the IAR menus
- Select the Tool chain, and choose the **Empty project** template. Click **OK**.
- Browse to the location where you want to save this project, and type a file name for the project file (\*.ewp). Click **Save**. Each project should be saved in a separate directory.
- Click on an example listed below to add the files for that example to your project.
- Choose **File > Save Workspace**
- Browse to the location where you want to save this workspace, and type a file name for the workspace file (\*.eww). Click **Save**.
- Choose **Project > Make**.
- Use the text editor in IAR to modify the .c and .cfg files in the example, and rebuild the project as needed.

**More Information**

- TI-RTOS Getting Started Guide (install\_dir/docs)
- TI-RTOS User's Guide (install\_dir/docs)
- [Creating TI-RTOS Applications in IAR Embedded Workbench](#) page in the Texas Instruments Wiki

**MSP\_EXP432P401R**

- Scroll through the page and click on the empty project (os or non\_os based) you are interested in.

## TI Drivers

Example	TI-RTOS	FreeRTOS	No RTOS
adcbufcontinuous	TI-RTOS	FreeRTOS	
adcsinglechannel	TI-RTOS	FreeRTOS	
capturepwmdisplay	TI-RTOS	FreeRTOS	
empty	TI-RTOS	FreeRTOS	
fatsdraw	TI-RTOS	FreeRTOS	
gpiointerrupt	TI-RTOS	FreeRTOS	
i2cmasterexample1	TI-RTOS	FreeRTOS	
i2cslaveexample1	TI-RTOS	FreeRTOS	
i2ctmp007	TI-RTOS	FreeRTOS	

i2ctpl0401evm	TI-RTOS	FreeRTOS	
powerdeepsleep	TI-RTOS	FreeRTOS	
powerperformance	TI-RTOS	FreeRTOS	
powershutdown	TI-RTOS	FreeRTOS	
powersleep	TI-RTOS	FreeRTOS	
pwmled	TI-RTOS	FreeRTOS	
spiloopback	TI-RTOS	FreeRTOS	
spiloopback4wiremode	TI-RTOS	FreeRTOS	
timerled	TI-RTOS	FreeRTOS	
uartecho	TI-RTOS	FreeRTOS	
uartmonitor	TI-RTOS	FreeRTOS	
watchdog	TI-RTOS	FreeRTOS	

dma_eusci_spi_loopback			No RTOS
empty			No RTOS
flash_mass_erase			No RTOS

- When prompted, click **Yes** to save a copy of the project workspace, **No** otherwise
- If **Yes**, browse to the location where you want to save this workspace. Click **Choose**

## TI Drivers

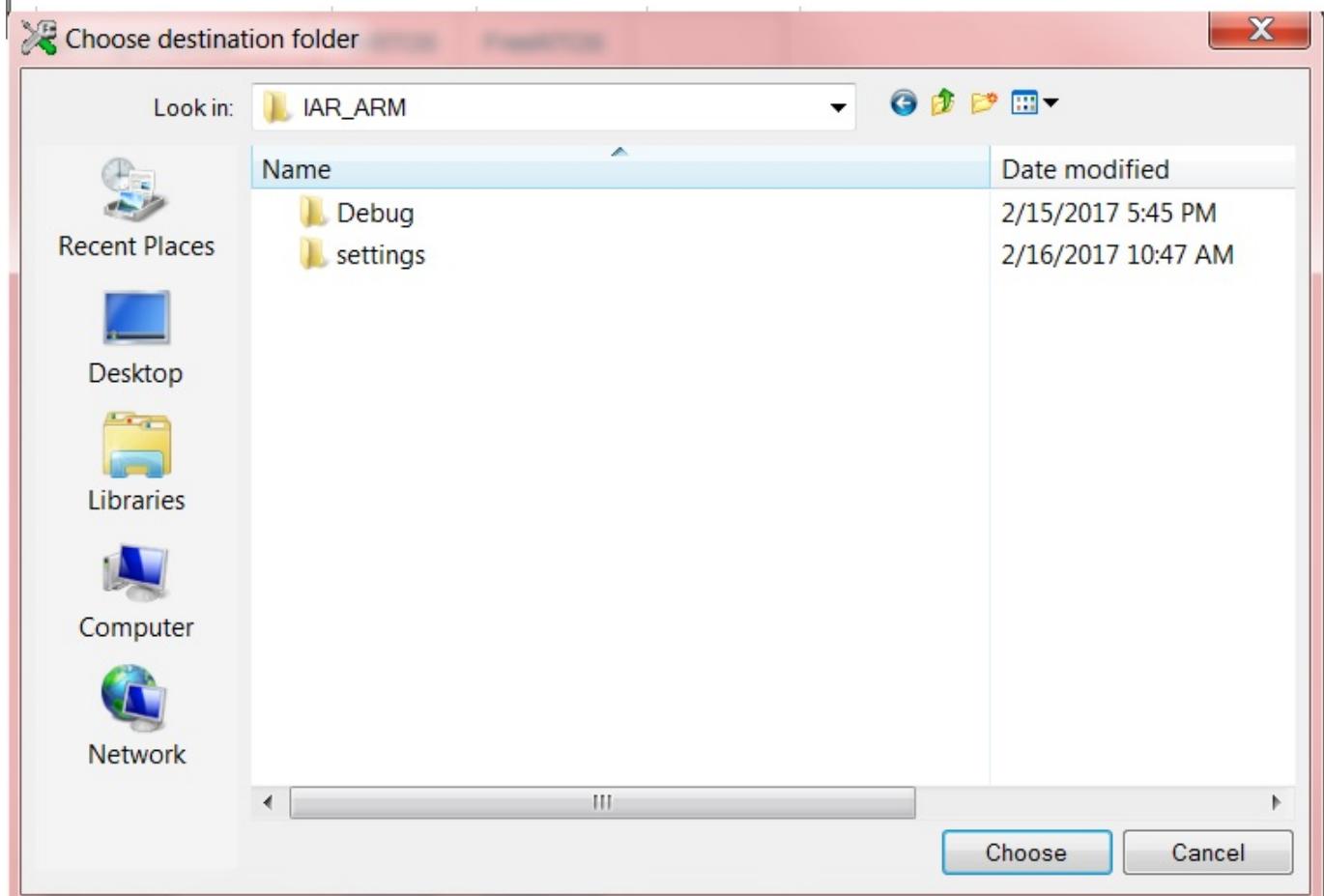
Example	TI-RTOS	FreeRTOS	No RTOS
adcbufcontinuous	TI-RTOS	FreeRTOS	
adcsinglechannel	TI-RTOS	FreeRTOS	
capturepwmdisplay	TI-RTOS	FreeRTOS	
empty	TI-RTOS	FreeRTOS	
fatsdraw	TI-RTOS	FreeRTOS	
gpointerrupt	IarIdePm		X
i2cmasterexample1			

A copy of the example project will be opened.

Do you want to specify the location for this copy?

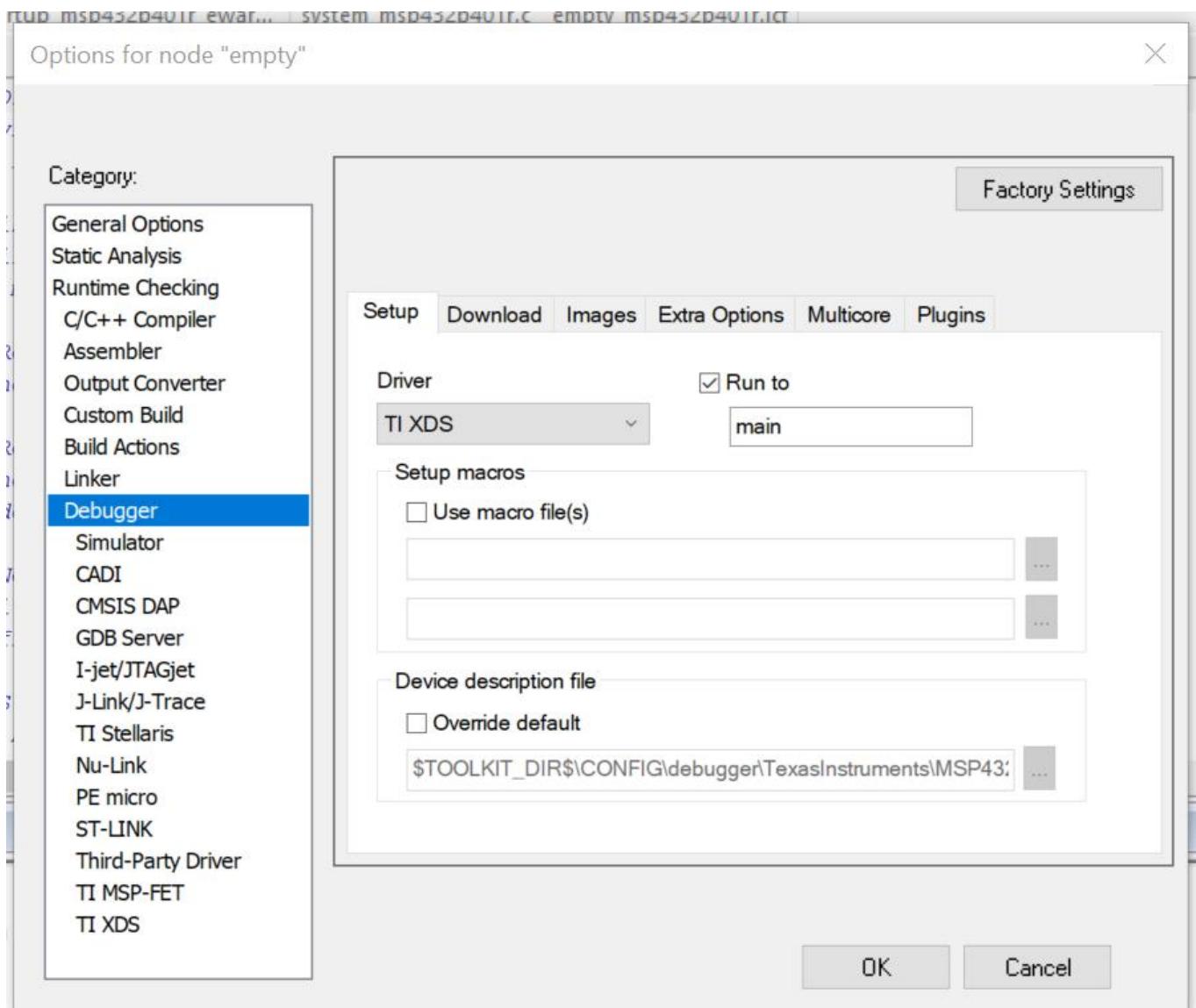
Yes      No

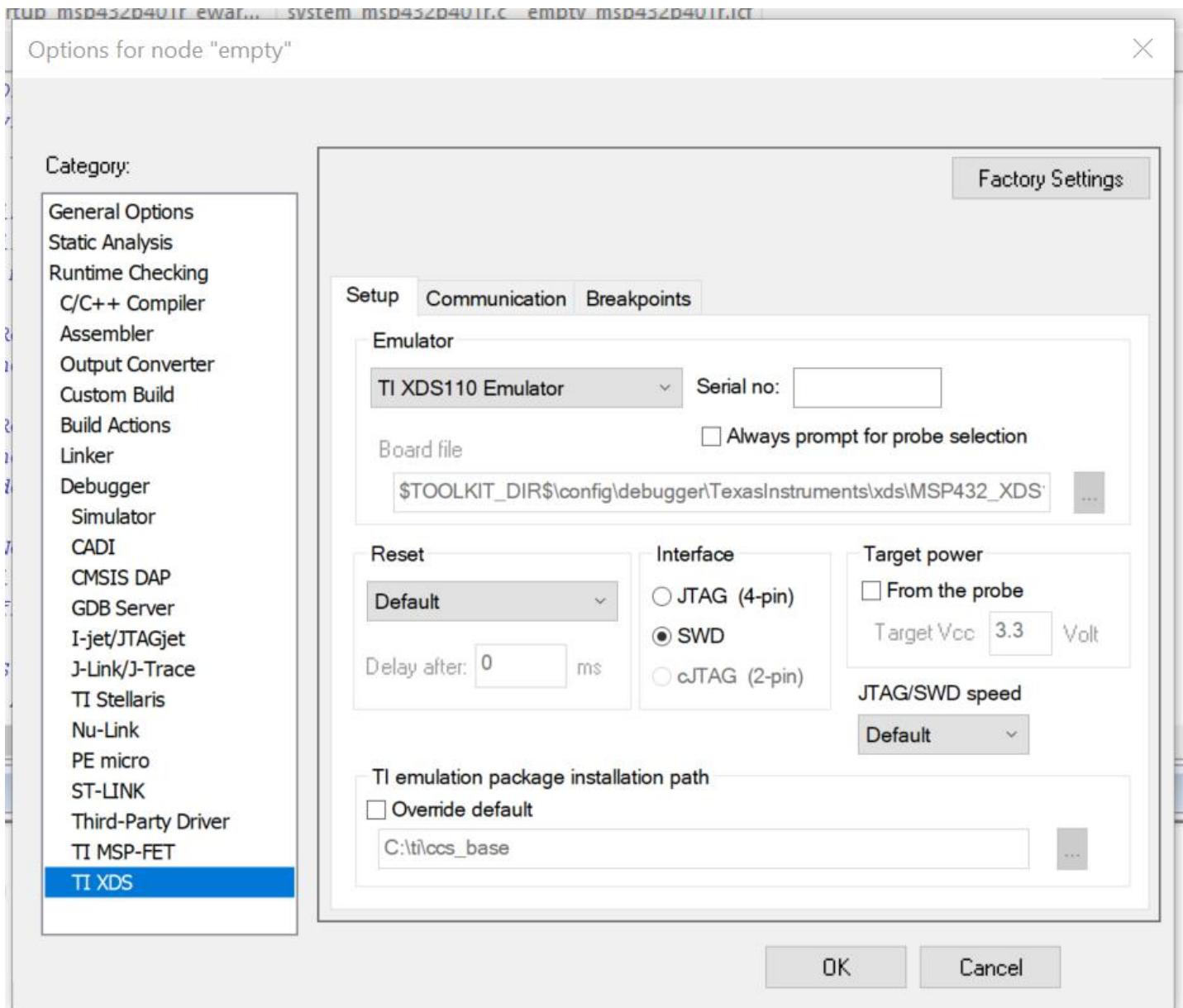
i2cslaveexample1		
i2ctmp007		
i2ctpl0401evm		
powerdeepsleep	TI-RTOS	FreeRTOS
powerperformance		
powershutdown	TI-RTOS	FreeRTOS
powersleep	TI-RTOS	FreeRTOS
pwmled	TI-RTOS	FreeRTOS
spiloopback	TI-RTOS	FreeRTOS
spiloopback4wiremode	TI-RTOS	FreeRTOS



- Add user source/application files

- By default, the project Debug settings is configured for TI XDS110, but the user may change them as needed





- Plug in your launchpad, make and download.

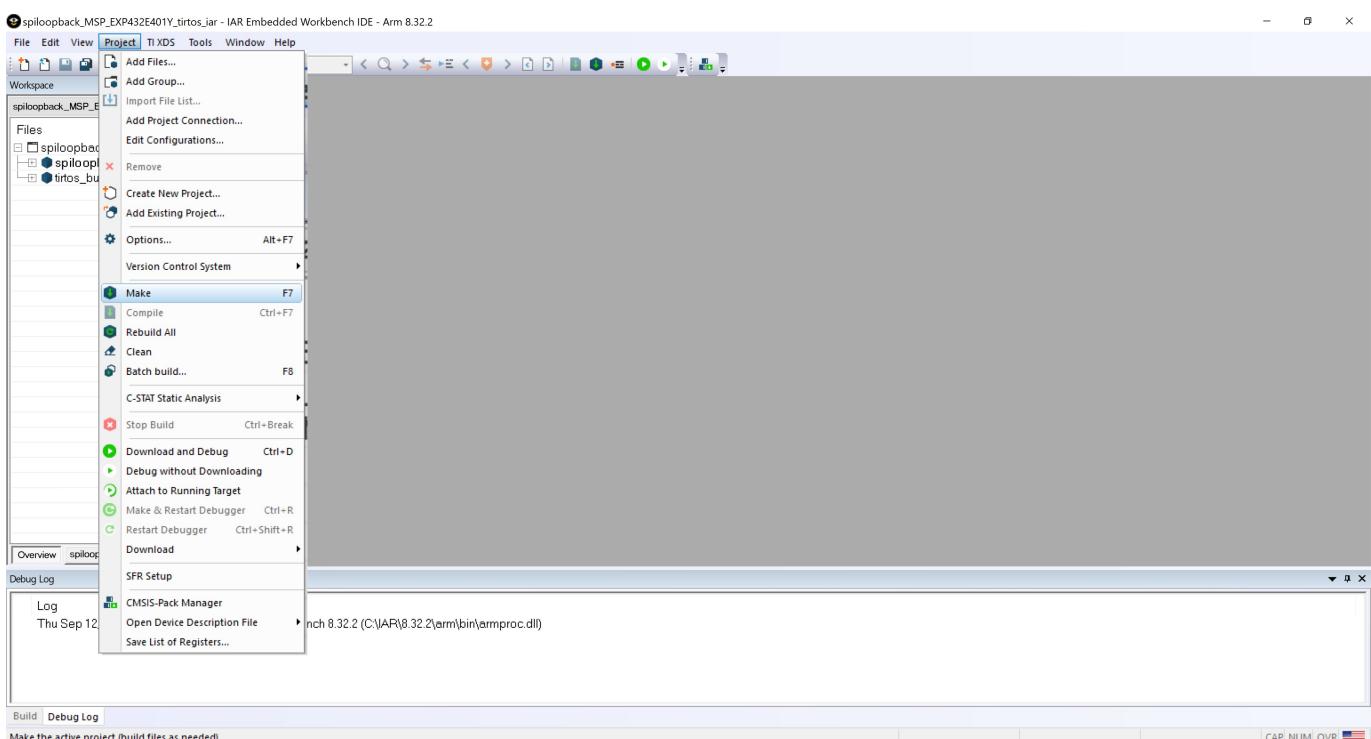
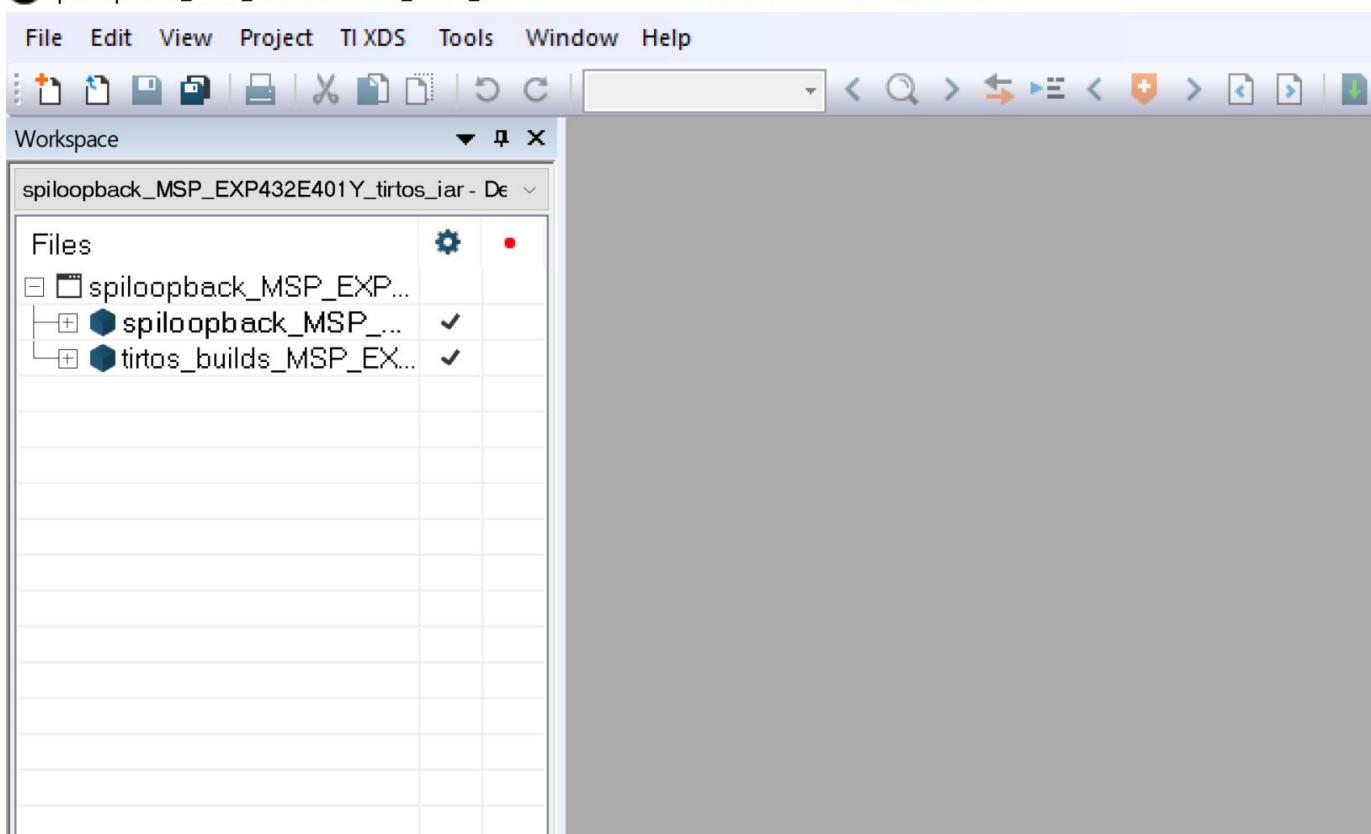
[www.ti.com/lit/pdf/slau574](http://www.ti.com/lit/pdf/slau574) has more details on IDE specific of MSP432E4

- Choose Project > Make

Make/Build the Project Make [(Project->Make) Shortcut F7].

- Plug in the launchpad and download Click Project->Download and Debug - Shortcut (Ctrl + D)

 spiloopback\_MSP\_EXP432E401Y\_tirtos\_iar - IAR Embedded Workbench IDE - Arm 8.32.2



## 6 Quick Start for Keil

This section is going to cover the required settings for a Keil installation and how to build and load examples.

Keil support is available for some components of the SDK. The RTOS and Drivers components currently do not support Keil.

## 6.1 Download and Installation

- Download and Install Keil uVision 5.23
- Install the TexasInstruments::MSP432E4xx\_DFP pack
- Install the ARM::CMSIS pack

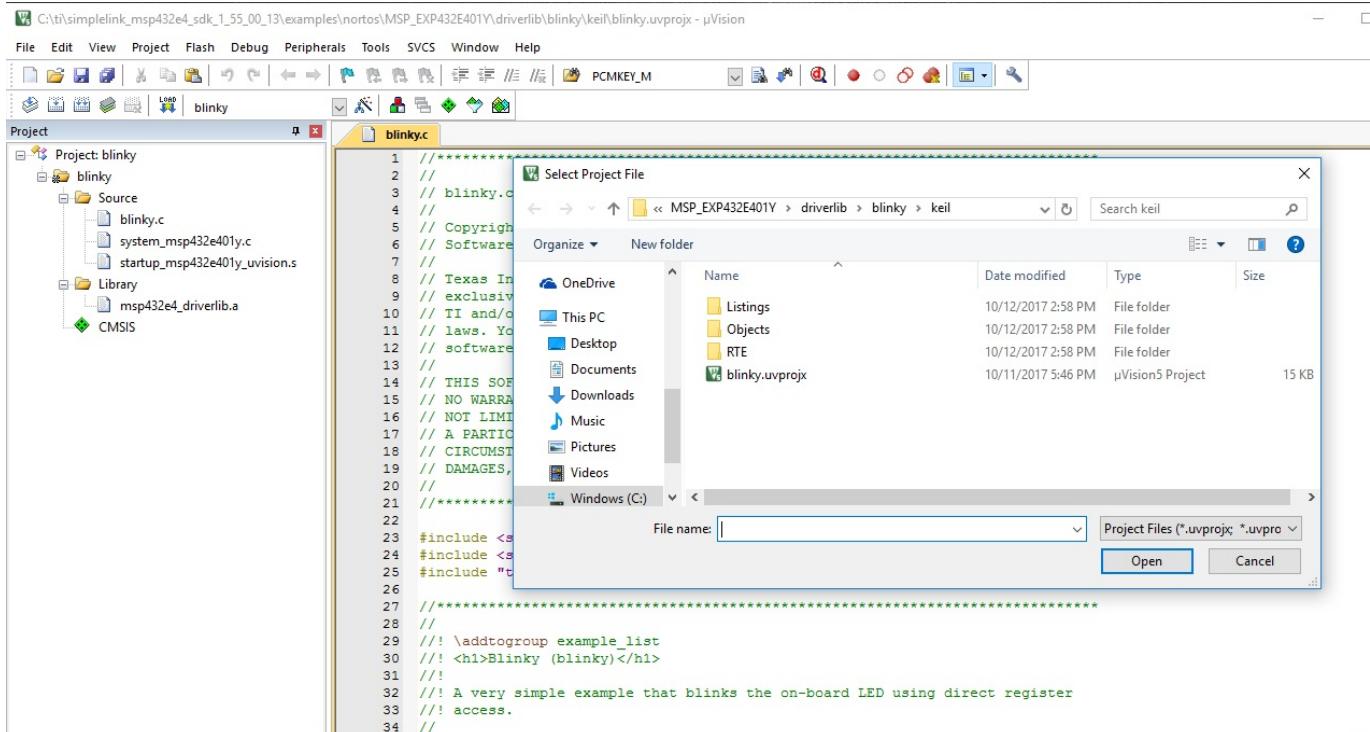
## 6.2 Running Your First Example

This section will show how to import/build/load an example

Keil support is available for some components of the SDK

- Browse through the `<SDK_INSTALL_DIR>/examples/nortos` folder. Keil projects are available for many of the components
- Import one of the projects. In this example the

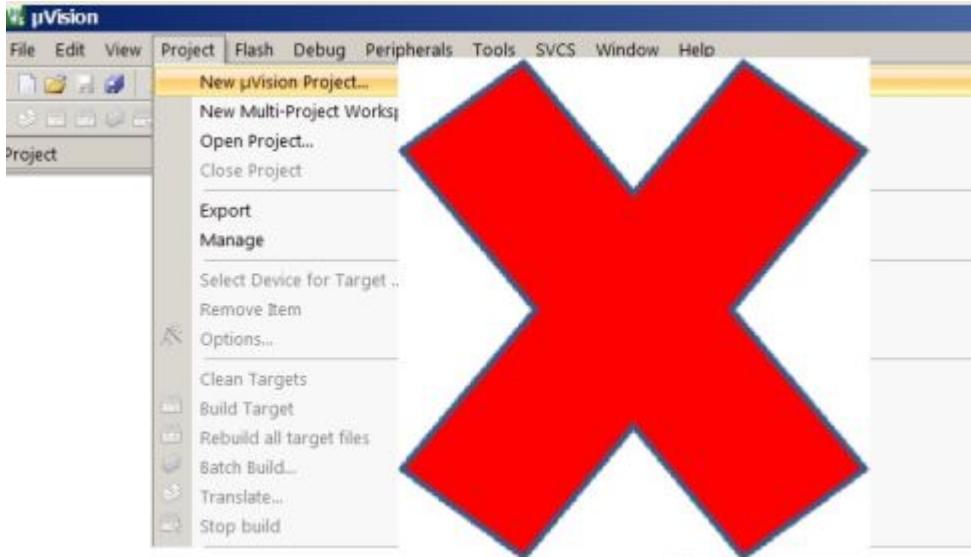
`<SDK_INSTALL_DIR>/examples/nortos/MSP_EXP432E401Y/driverlib/gpio_toggle_output/keil` project is shown



- Build the selected project by clicking `Project->Build Target` (Shortcut F7), plug in your launchpad and click download `Flash->Download` (Shortcut F8).

## 6.3 Create a New SDK Based User Application

Do not use the New Project Creation Wizard



- Start with one of the example projects or empty project template shipped inside the SDK. Each software component in the SDK comes with its own set of examples. If your project depends on multiple TI provided software libraries, start from the empty template then add the necessary components into your projects.
- Import one of the empty project template shown below to your IDE and start your application from there. All the necessary include paths and SDK specific defines if any are already part of the Empty Project Template

Windows (C:) > ti > simplelink_msp432e4_sdk_1_55_00_13 > examples > nortos > MSP_EXP432E401Y > driverlib > empty			
Name	Date modified	Type	Size
ccs	10/12/2017 1:08 PM	File folder	
gcc	10/12/2017 1:08 PM	File folder	
iar	10/12/2017 1:08 PM	File folder	
keil	10/12/2017 1:08 PM	File folder	
main.c	10/11/2017 5:46 PM	C File	3 KB
system_msp432e401y.c	10/11/2017 5:46 PM	C File	5 KB

- Start your application code development from this template
- Build the selected project by clicking Project->Build Target( Shortcut F7), plug in your launchpad and click download Flash->Download ( Shortcut F8).

[www.ti.com/lit/pdf/SLAU590](http://www.ti.com/lit/pdf/SLAU590) has more details about Keil for MSP432E4

## 7. Quick Start for Makefile Users

The SDK examples and RTOS configuration projects ship Makefiles in addition to IDE specific projects.

### 7.1 Update imports.mak

Update the top level `<SDK_INSTALL_DIR>/imports.mak` to point to actual install locations on the user's machine

## 7.2 Build RTOS config

Skip this step if you are not using an RTOS.

If the code example in use is an RTOS based example, the RTOS config must be built first. The makefile for RTOS config are available in

```
<SDK_INSTALL_DIR>\kernel\tirtos\freertos\builds\MSP_EXP432E401Y\<debug/release>\<ccs/gcc/iar>
```

For example: `<SDK_INSTALL_DIR>\kernel\tirtos\builds\MSP_EXP432E401Y\release\ccs\makefile`

```
C:\ti\simplelink_msp432e4_sdk_1_55_00_13\kernel\tirtos\builds\MSP_EXP432E401Y\release\gcc>C:\ti\ccs73\xdctool
s_3_50_03_33_core\gmake.exe
making package.mak (because of package.bld) ...
generating interfaces for package gcc (because package/package.xdc.inc is older than package.xdc) ...
configuring release.xm4fg from package/cfg/release_pm4fg.cfg ...
generating custom ti.sysbios library makefile ...
Starting build of library sources ...
making C:/ti/simplelink_msp432e4_sdk_1_55_00_13/kernel/tirtos/builds/MSP_EXP432E401Y/release/gcc/package/cfg/
release_pm4fg_src/sysbios/sysbios.am4fg ...
gmake[1]: Entering directory `C:/ti/simplelink_msp432e4_sdk_1_55_00_13/kernel/tirtos/builds/MSP_EXP432E401Y/r
elease/gcc/package/cfg/release_pm4fg_src/sysbios'
asm4fg C:/ti/simplelink_msp432e4_sdk_1_55_00_13/kernel/tirtos/packages/ti/sysbios/family/arm/m3/Hwi_asm_gnu.
sv7M ...
asm4fg C:/ti/simplelink_msp432e4_sdk_1_55_00_13/kernel/tirtos/packages/ti/sysbios/family/arm/m3/Hwi_asm_swit
ch_gnu.sv7M ...
asm4fg C:/ti/simplelink_msp432e4_sdk_1_55_00_13/kernel/tirtos/packages/ti/sysbios/family/arm/m3/IntrinsicsSu
pport_asm_gnu.sv7M ...
```

## 7.3 Build the makefile

- Identify the makefile for the project and build it.

```
C:\ti\simplelink_msp432e4_sdk_1_55_00_13\examples\nortos\MSP_EXP432E401Y\driverlib\adc0_adc1_phasecontrol\ccs>C:\ti\xdctools_3_50_03_33_core\gmake.exe
Building uartstdio.obj
Building system_msp432e401y.obj
Building startup_msp432e401y_ccs.obj
Building adc0_adc1_phasecontrol.obj
linking...
<Linking>

C:\ti\simplelink_msp432e4_sdk_1_55_00_13\examples\nortos\MSP_EXP432E401Y\driverlib\adc0_adc1_phasecontrol\ccs>
```

- Every RTOS example has a README.html that details the Example Application Design Details and how each example works. This feature will soon be added to the No RTOS based examples

Windows (C:) > ti > simplelink\_msp432e4\_sdk\_3\_30\_00\_13\_eng > examples > rtos > MSP\_EXP432E401Y > drivers > gpointerinterrupt

<input type="checkbox"/> Name	Date modified	Type	Size
freertos	9/9/2019 10:38 AM	File folder	
tirtos	9/9/2019 10:38 AM	File folder	
gpointerinterrupt.c	9/6/2019 5:44 PM	C File	4 KB
overview.rov.json	9/6/2019 5:44 PM	JSON File	8 KB
<input checked="" type="checkbox"/> README.html	9/6/2019 5:44 PM	HTML File	69 KB
README.md	9/6/2019 5:44 PM	MD File	3 KB

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