Customer training workshop: How to Debug on ModusToolBox™ for TRAVEO™ T2G

TRAVEO™ T2G CYT4BF series Microcontroller Training
V1.0.0 2022-12

Scope of work

- This document explains how to set up and use the CYT4BF evaluation kit, which mounts the CYT4BFBCH device. It also describes debugging with single-core and multi-core applications in the ModusToolbox™ (MTB) environment.

- ModusToolbox™ tools package version
  - 3.0.0

- Device
  - The TRAVEO™ T2G CYT4BFBCH device is used in this code example.
- Board
  - The TRAVEO™ T2G KIT_T2G-B-H_EVK board is used for testing.

Getting started

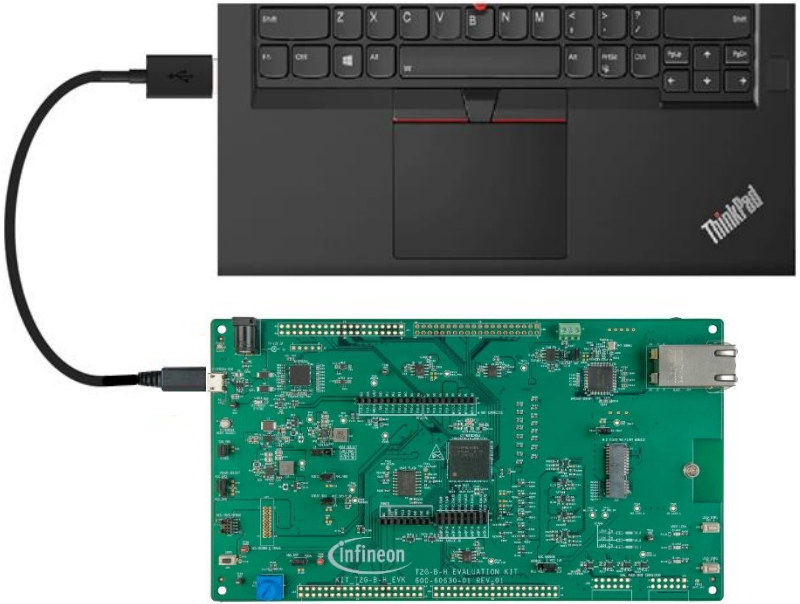
› This section explains the hardware setup. The following table lists the prerequisites for the setup.

Quantity	Description	Remarks
1	KIT_T2G-B-H_EVK	CYT4BF evaluation kit
1	Micro USB cable	For power and communication
1	PC	With USB port
1	ModusToolbox 3.0	Downloaded from the web

Getting started (contd.)

› **Connection setup**

– Connect the USB cable from the PC to the evaluation kit. The PC powers the evaluation kit via the USB cable (5V).



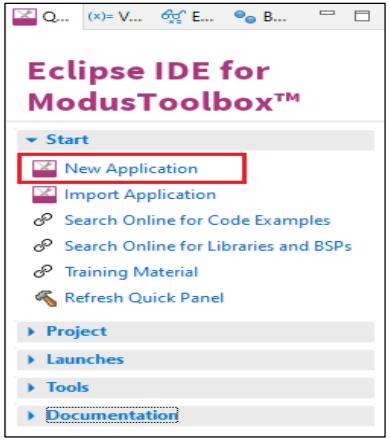
ModusToolbox™ setup

- **Launch ModusToolbox™**
  - The Eclipse IDE is installed in the following directory by default:

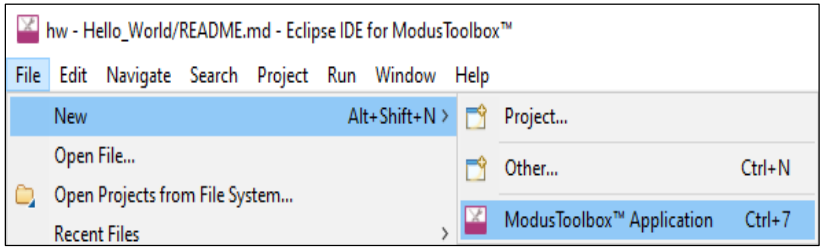
    <install_path>\ModusToolbox\ide_<version>\eclipse
  - To launch the Eclipse IDE:
    - On Windows, select the **Eclipse IDE for ModusToolbox™ <version>** item from the **Start** menu
    - For other operating systems, run the "modustoolbox" executable file
  - When launching the Eclipse IDE, there is an option to select the workspace location on your machine. This location is used by the IDE for creating and storing the files as part of application creation for a particular platform. The default workspace location is a folder called "mtw" in your home directory. You may add additional folders under the "mtw" folder or to choose any other location for each workspace.
  - For more details about Eclipse, see the Eclipse documentation and the **Eclipse survival guide**.

ModusToolbox™ setup (contd.)

- **Create an application**
- **Choose the board support package (BSP)**
  - To choose the BSP, do one of these:
    - Click the **New Application** link in the **Eclipse IDE Quick Panel**

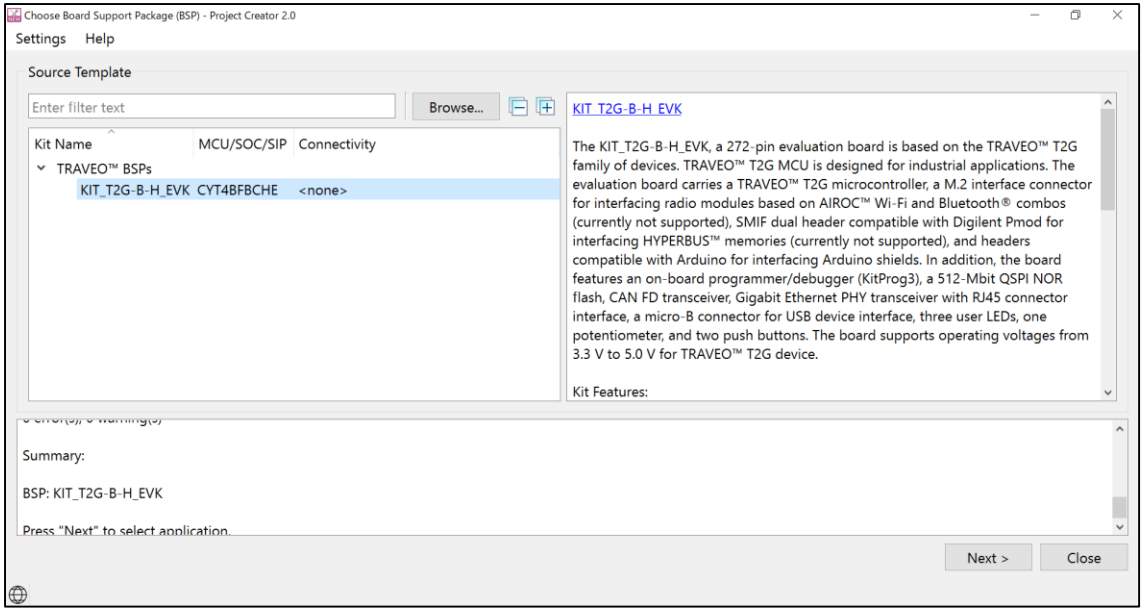


    - Select **File** > **New** > **ModusToolbox™ Application**



ModusToolbox™ setup (contd.)

- These commands launch the Project Creator tool, which provides several applications for use with different development kits, and the kits available may change over time. This example uses the KIT_T2G-B-H_EVK kit.



- For more details about using this tool, see the **Project Creator user guide**

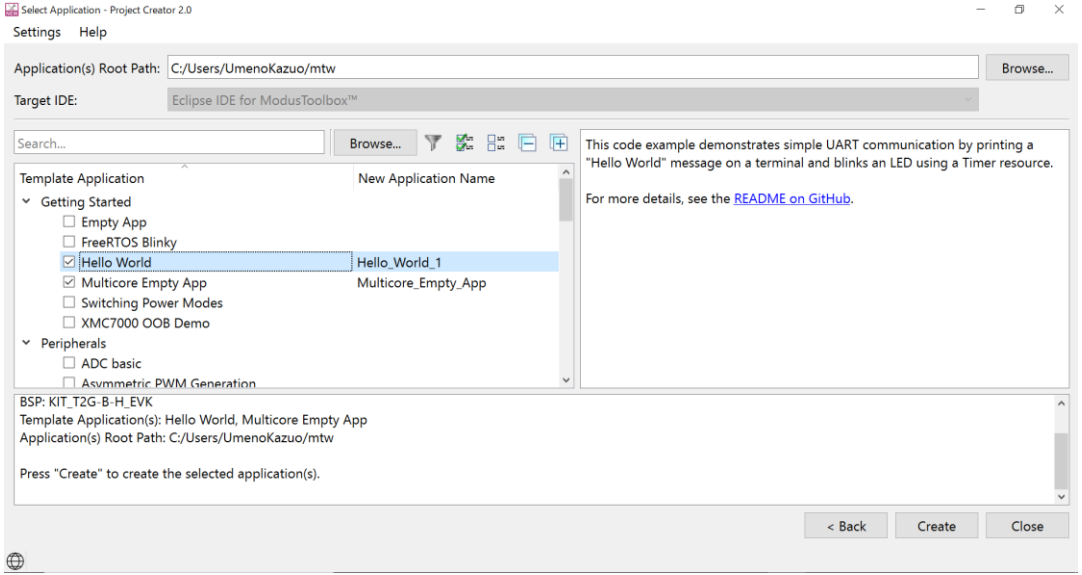
ModusToolbox™ setup (contd.)

› Select application

- On the **Choose Board Support Package (BSP)** – **Project Creator 2.0** window, click **Next** > to open the **Select Application** page
- This page lists various applications available for the selected kit. As you choose an application, a description displays on the right. You can select multiple applications for the selected BSP by enabling the check box next for those applicable.

› For this example:

- Select the check box next to the "*Hello World*" application and "*Multicore Empty APP*" application
- If desired, type a name for the application under **New Application Name**. Do not use spaces in the application name. In this case, we use the default "*Hello_World*" and "*Multicore_Empty_App*" as the name.

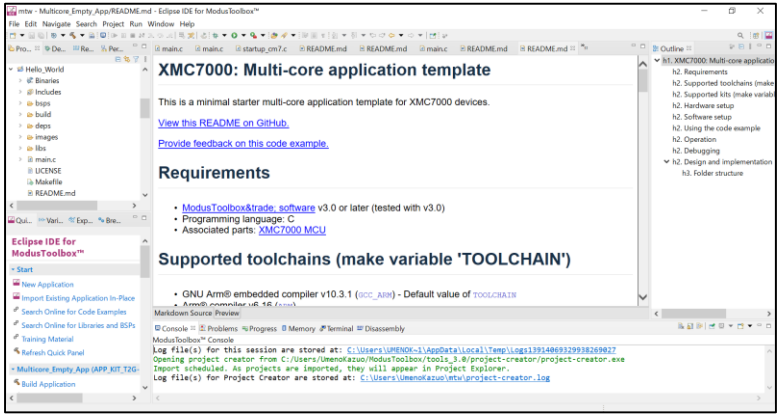


ModusToolbox™ setup (contd.)

› Create application

- Click **Create** to begin the project creation process.

- When complete, the Project Creator tool closes automatically. After several moments, the application opens with the *Hello_World* and *Multicore_Empty_App* in Project Explorer, and the *README.md* file opens in the file viewer.



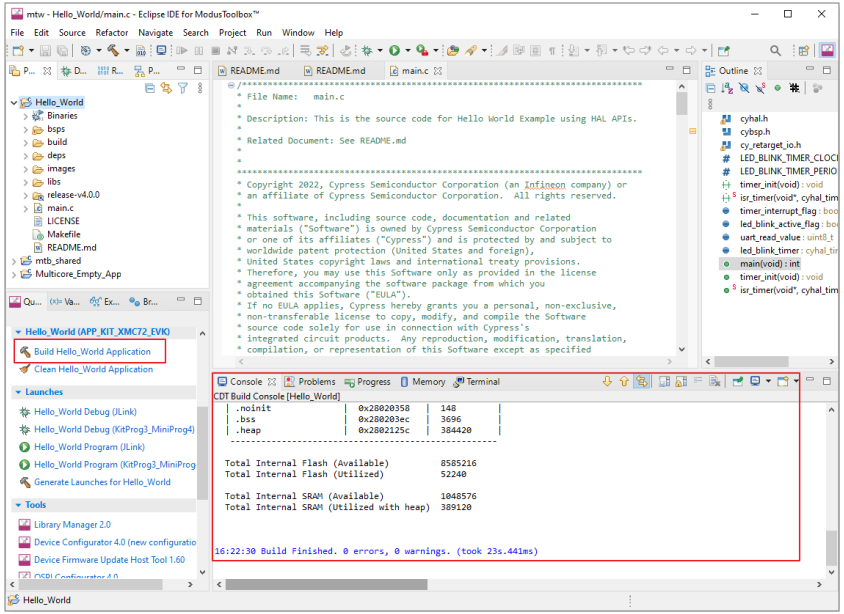
Download and debug with evaluation kit

- **The following types of applications are created:**
  - **Single core application (Hello_World):**
    - This application contains the prebuilt CM0+ image, and the main application function runs on the CM7_0 core. The prebuilt CM0P image only starts CM7 cores and puts CM0+ core into Deep Sleep mode.
    - For details on the prebuilt CM0+ image, please refer to **CAT1 Cortex M0+ prebuilt images**.
  - **Multi-core application (Multicore_Empty_App):**
    - This application contains the CM0+ project, CM7_0 project, and CM7_1 project.
    - CM0+ and CM7 can do normal code execution, but from an architectural point, only CM7 is considered the application core (CM7 cores for primary processing and CM0+ core for peripheral and security processing). After a reset, the default core is always the CM0+ core. To enable the CM7 core, CM0+ must call Cy_SysEnableCM7().

Download and debug with evaluation kit (contd.)

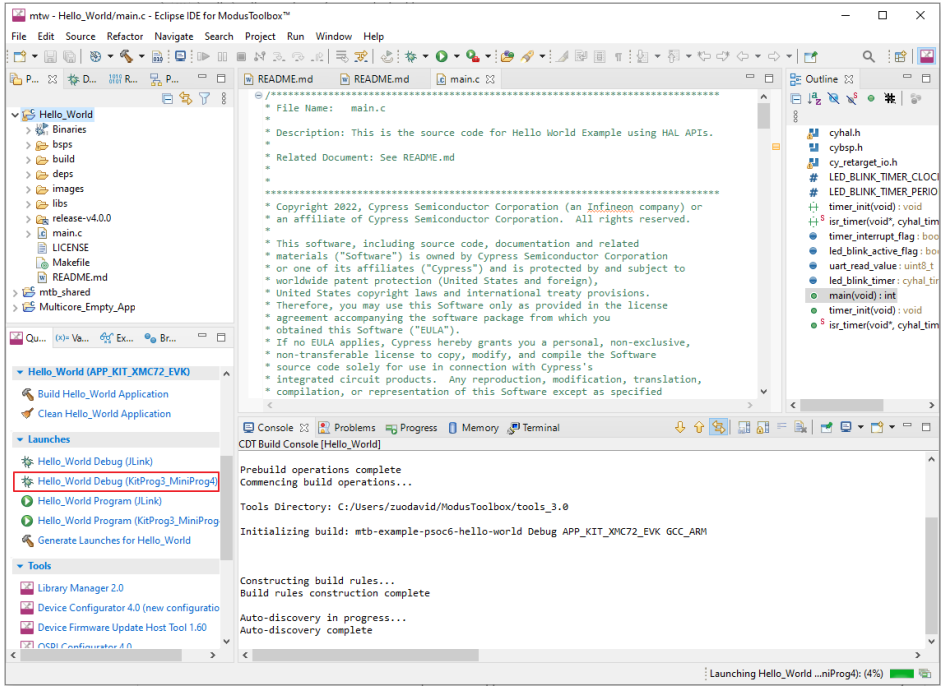
› **Debugging with single core application:**

1. Build the application
   - a) Select the Hello_World project in the Project Explorer window and click on the **Build Hello_World Application** shortcut under the **Hello_World** group in the Quick Panel. It selects the **Debug** build configuration and compiles/links all projects that constitute the application.
   - b) The **Console** view lists the results of the build operation, as the following figure shows.
   - If you encounter errors, revisit previous steps to ensure that you accomplished all the required tasks.



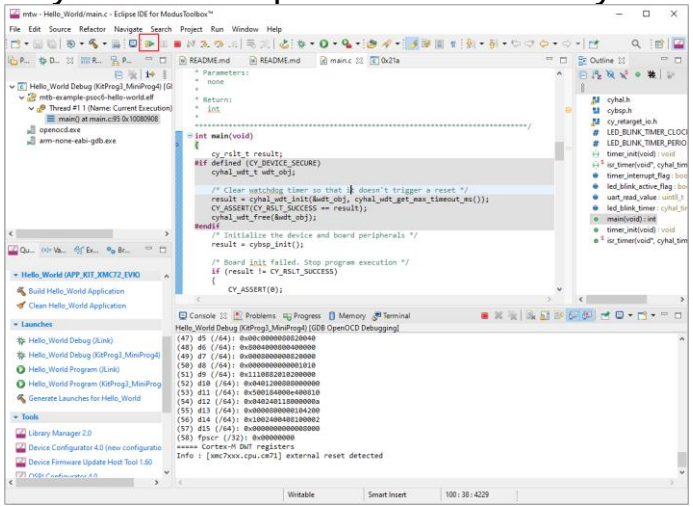
Download and debug with evaluation kit (contd.)

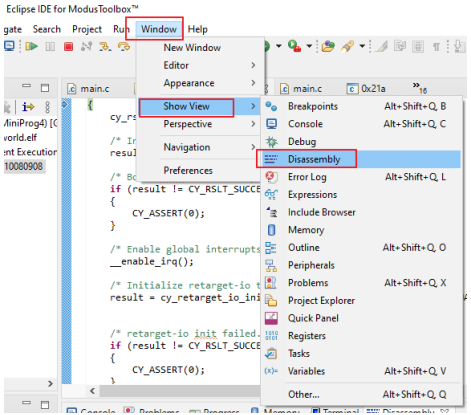
2. Debug the application:
   - The CYT4BF evaluation kit has a KitProg3 onboard programmer/debugger. It supports Cortex® Microcontroller Software Interface Standard - Debug Access Port (CMSIS-DAP). See the KitProg3 user guide for details.
   - ModusToolbox™ software uses the OpenOCD protocol to program and debug applications on the CYT4BF MCU devices. ModusToolbox™ software will identify the device on the kit only if the kit is running KitProg3.
   - In the **Quick Panel**, click the **Hello_World Debug (KitProg3)** link under **Launches**.



Download and debug with evaluation kit (contd.)

- If needed, the IDE builds the application, and messages display in the Console. If the build is successful, the IDE switches to debug mode automatically, as the following figure shows.
- If you want to open the disassembly window, click **Window** > **Show View** > **Disassembly**.



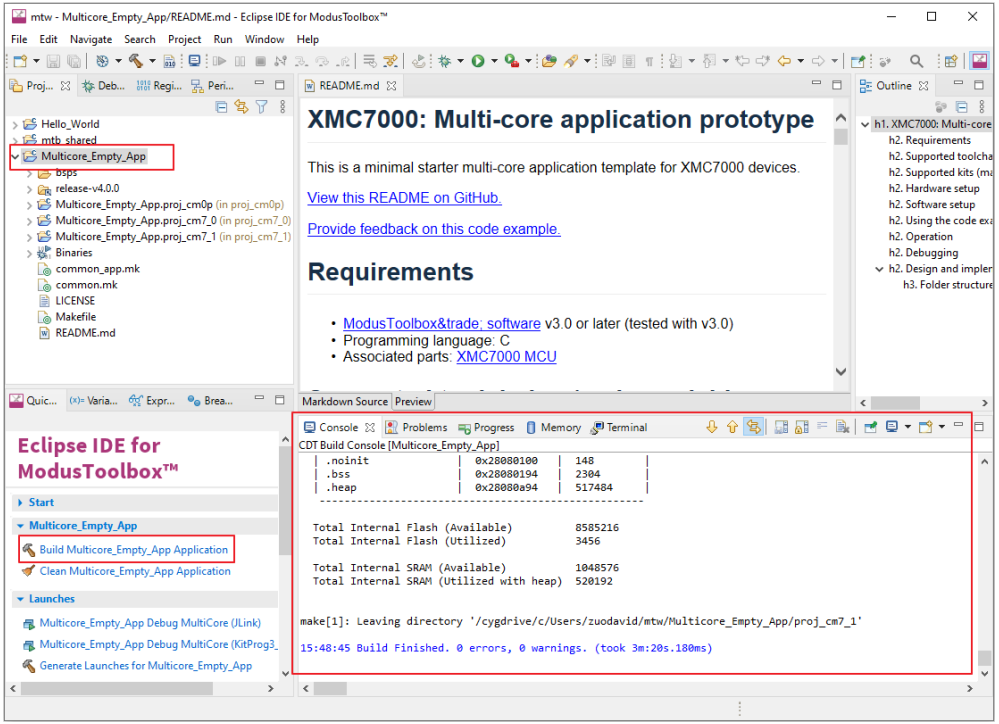


3. Click the **Resume** icon or press the **F8** to start execution. LED1 should start blinking.
   - You can also use the function keys in the Debug window: Resume (F8), Step Into (F5), Step Over (F6), Terminate (Ctrl+F2).

Download and debug with evaluation kit (contd.)

› Debugging with multi-core application:

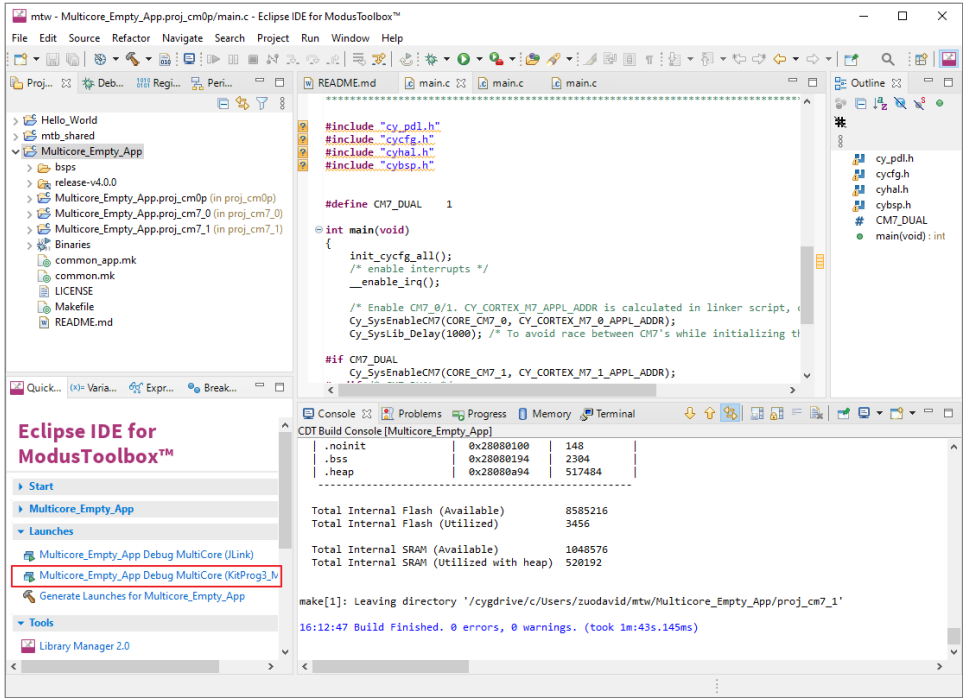
1. Build the multi-core application
   - a) In the **Project Explorer** window, click the **Multicore_Empty_App** project.
   - b) Click on the **Build Multicore_Empty_App Application** shortcut under the **Multicore_Empty_App** group in the Quick Panel. It selects the Debug build configuration and compiles/links all projects that constitute the application.
   - c) The **Console** view lists the results of the build operation, as the following figure shows.



- If you have selected **Multicore_Empty_App**, you can also select **Build Project** from the **Project** menu or the right-click menu.

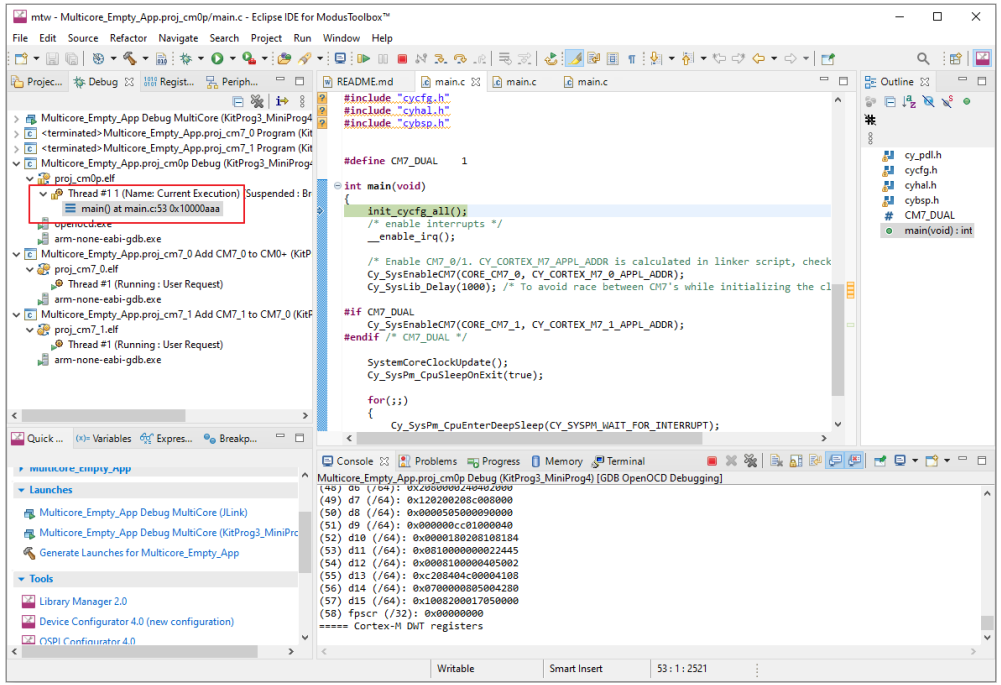
Download and debug with evaluation kit (contd.)

2. In the **Quick Panel**, click the **Multicore_Empty_App MultiCore (KitProg3)** link under **Launches**.



Download and debug with evaluation kit (contd.)

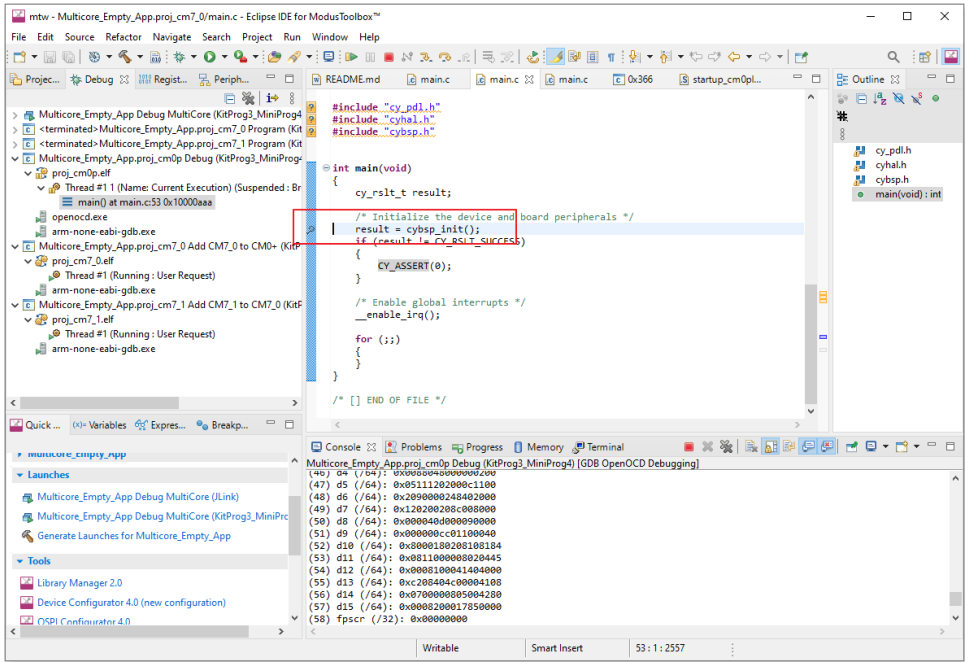
- This will automatically program the CM0P, CM7_0, and CM7_1 code into the flash region of respective cores; then, the IDE switches to debug mode automatically, as the following figure shows.
- CM0P debug session is started and halted at the beginning of the main () function, CM7_0 and CM7_1 debug session started, and CPU is not yet started in the following figure.



Download and debug with evaluation kit (contd.)

3. Place a breakpoint in the `cybsp_init()` API in the mian.c of CM7_0 core, you can also place another breakpoint in main.c of CM7_1 core. CM7_0 core and CM7_1 core will start executing after being enabled by CM0+ core. You can debug three cores simultaneously.

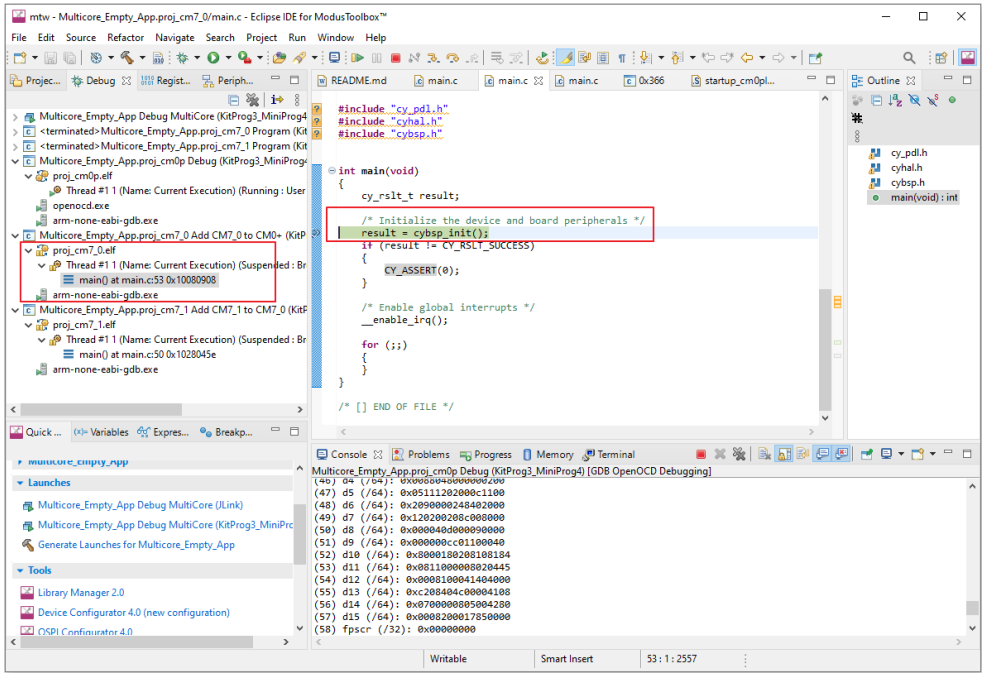
› To place a breakpoint at the target instruction, click the white space between the editor window (left pane).



Download and debug with evaluation kit (contd.)

4. Click the **Resume** icon or press the **F8** in the CM0P project to start execution.

- After executing `Cy_SysEnableCM7(CORE_CM7_0, CY_CORTEX_M7_0_APPL_ADDR)` and `Cy_SysEnableCM7(CORE_CM7_1, CY_CORTEX_M7_1_APPL_ADDR)`, CM7_0 core and CM7_1 core will be enabled and the execution will be halted at the very beginning of CM7's main () function.
- You can click the **Resume** icon or press the **F8** in the CM7_0 and CM7_1 project, the execution will reach the breakpoint in the CM7_0 project and CM7_1 project. You can now continue to debug the code from CM7 cores.



Troubleshooting

› Connection troubleshooting

- **Error:** Evaluation kit is not detected on the target system
  - Connect the USB cable that comes with the evaluation kit. Other USB cables may not connect data lines
  - Make sure LED D5 is ON (CMSIS-DAP mode). If not, press SW3 to change the KitProg3 device mode
  - If LED D5 is ON (CMSIS-DAP mode), change the KitProg3 device mode by pressing SW3. Now LED3 blinks smoothly. Then try to reconnect the debug session. Later, check if this works independently; stop the debug session again and switch the KitProg3 device mode to “LED D5 is always ON” (CMSIS-DAP mode)

› Driver troubleshooting

- **Error:** Driver is not detected on the target system or “KitProg3” is not visible
  - For more information on the supported driver, see the **KitProg3 user guide**

› Debugger troubleshooting

- **Error:** While programming the XMC7000 device, the CMSIS-DAP device is not found
  - Check the USB cable connection and the state of LED3 (LED should be ON for CMSIS-DAP mode)

› Key points

- The prebuilt CM0+ image should be disabled with the multi-core application; you must add the XMC7xDUAL_CM0P_SLEEP to DISABLE_COMPONENTS for XMC7xxxD device in the project CM7_0 Makefile

References

Datasheet

› CYT4BF datasheet 32-bit Arm® Cortex®-M7 microcontroller TRAVEO™ T2G family

Architecture Technical reference manual

› TRAVEO™ T2G automotive body controller high family architecture technical reference manual

Registers Technical reference manual

› TRAVEO™ T2G Automotive body controller high registers technical reference manual

PDL/HAL

› PDL

› HAL

Training

› TRAVEO™ T2G Training

Application note

› AN235305 - Getting started for ModusToolbox™ in TRAVEO™ T2G family MCUs

References (contd.)

User guide

› **KitPro3 user guide**

Revision History

Revision	ECN	Submission Date	Description of Change
**	7845778	2022/12/9	Initial release

Important notice and warnings

All referenced product or service names and trademarks are the property of their respective owners.

Edition 2022-12
Published by
Infineon Technologies AG
81726 Munich, Germany

Do you have a question about this document?
Go to:
www.infineon.com/support

Document reference
002-36716 Rev. **

IMPORTANT NOTICE

The information given in this document shall in no event be regarded as a guarantee of conditions or characteristics ("Beschaffenheitsgarantie") .

With respect to any examples, hints or any typical values stated herein and/or any information regarding the application of the product, Infineon Technologies hereby disclaims any and all warranties and liabilities of any kind, including without limitation warranties of non-infringement of intellectual property rights of any third party.

In addition, any information given in this document is subject to customer's compliance with its obligations stated in this document and any applicable legal requirements, norms and standards concerning customer's products and any use of the product of Infineon Technologies in customer's applications.

The data contained in this document is exclusively intended for technically trained staff. It is the responsibility of customer's technical departments to evaluate the suitability of the product for the intended application and the completeness of the product information given in this document with respect to such application.
For further information on the product, technology, delivery terms and conditions and prices please contact your nearest Infineon Technologies office (**www.infineon.com**).

WARNINGS

Due to technical requirements products may contain dangerous substances. For information on the types in question please contact your nearest Infineon Technologies office.

Except as otherwise explicitly approved by Infineon Technologies in a written document signed by authorized representatives of Infineon Technologies, Infineon Technologies' products may not be used in any applications where a failure of the product or any consequences of the use thereof can reasonably be expected to result in personal injury.