### Micrium® uC/Probe™ XMC<sup>™</sup> getting started

XMC<sup>™</sup> microcontrollers July 2016





1	Objective of this tutorial
2	What we need to follow this tutorial?
3	Introduction to Micrium® uC/Probe <sup>™</sup> XMC <sup>™</sup>
4	Using the dashboard
5	Using the oscilloscope
6	Other features
7	References
8	Support material



1	Objective of this tutorial
2	What we need to follow this tutorial?
3	Introduction to Micrium® uC/Probe <sup>™</sup> XMC <sup>™</sup>
4	Using the dashboard
5	Using the oscilloscope
6	Other features
7	References
8	Support material



### Objective of this tutorial

- 1. Download provided example application to your board
- → Using DAVE<sup>TM</sup> 4 integrated debugger
- → Using XMC<sup>TM</sup> Flasher tool
- Control and monitor your application using the Micrium<sup>®</sup> uC/Probe<sup>™</sup> XMC<sup>™</sup> dash board
- 3. Monitor variables using the Micrium® uC/Probe<sup>™</sup> XMC<sup>™</sup> oscilloscope control

	0 1 2000         House,Chief         In B         II           Image: Insert         Image: Insert         Image: Imag
Detescree Confineon XMC4700 Micrium uc/Probe XMC Demo	
Channel 0  Square Triangle  Channel 1  Sin  Square Triangle	a a a a a a a a a a a a a a a a a a a
Frequency (Hz) 1 Frequency (Hz) 1	Deptembra         Deptembra <thdeptembra< th=""> <thdeptembra< th=""> <thd< th=""></thd<></thdeptembra<></thdeptembra<>
Offset 0.00 Offset 0.00	B         M
Amplitude 1.00 Scale 1.00	Image: Section of the section of







### What we need to follow this tutorial?

#### <u>Software</u>

> To download to the target the provided example application, use either:

#### - DAVE<sup>™</sup> version 4

Development Platform for XMC<sup>™</sup> microcontrollers Go to <u>www.infineon.com/DAVE</u> and download DAVE<sup>™</sup> version 4

#### - XMC<sup>™</sup> Flasher

Free of charge programming tool Go to <u>XMC<sup>™</sup> Software Download</u> and download XMC<sup>™</sup> Flasher

#### Micrium uC/Probe<sup>™</sup> XMC<sup>™</sup> version 4

Go to <u>www.infineon.com/ucProbeXMC</u> and download the latest version of Micrium® uC/Probe<sup>TM</sup> XMC<sup>TM</sup>

> Example application project for DAVE<sup>TM</sup> version 4 accompanying this document



### What we need to follow this tutorial?

#### <u>Hardware</u>

- → Any Infineon XMC<sup>TM</sup> board
- In this document XMC4700 Relax Kit is used featuring:
  - XMC4700-F144 microcontroller based on ARM<sup>®</sup> Cortex<sup>®</sup>-M4 at 144 MHz, 2 MB Flash and 352 KB RAM
  - On-board debugger (Segger J-Link)
  - Power over USB
  - ESD and reverse current protection
  - 2 x user button and 2 x user LED
  - Arduino hardware compatible 3.3 V pinout
- > On board debugger is used
- Connect the board to your PC using a micro USB cable





	Objective of this tutorial
2	What we need to follow this tutorial?
3	Introduction to Micrium® uC/Probe <sup>™</sup> XMC <sup>™</sup>
4	Using the dashboard
5	Using the oscilloscope
6	Other features
7	References
8	Support material



### What is Micrium<sup>®</sup> uC/Probe<sup>™</sup> XMC<sup>™</sup>?

- uC/Probe<sup>™</sup> XMC<sup>™</sup> is a Windows<sup>®</sup> based application that let's you control and monitor a running embedded system
- Allows easy visual access to the internals of your application using the oscilloscope control, gauges, spreadsheets, LEDs and other widgets
- > Create rich visually appealing user interfaces for your applications
- Can be used with any toolchain that can generate an ELF fileCan connect to the embedded system using SWD/JTAG, UART, Ethernet or USB
  - SWD communication does not need any target firmware to set or retrieve the values of variables
  - Other communication interfaces need adding a C library to your application to respond to the requests from µC/Probe<sup>™</sup> running on the Windows<sup>®</sup> PC. Library can be obtained at µC/Probe Embedded Target <u>Code</u>



### Introduction to Micrium® uC/Probe<sup>TM</sup> XMC<sup>TM</sup>

#### **uC/Probe™ XMC™ example for XMC™ Digital Power Explorer Kit**





### Introduction to Micrium® uC/Probe<sup>TM</sup> XMC<sup>TM</sup>

#### How it works?

- uC/Probe<sup>™</sup> XMC<sup>™</sup> obtains the address of the variables from the ELF file
- Design your dash board by dragging and dropping widgets
- Associate a variable to each of the widgets
- Configure the communication interface
- > Start uC/Probe<sup>™</sup> XMC<sup>™</sup>
- uC/Probe<sup>™</sup> make requests to read the value of all variables used in the dashboard



## Download the application to your target using XMC<sup>™</sup> Flasher



- 1. Connect your board to the PC using a micro USB cable
- 2. Start XMC<sup>™</sup> Flasher
- 3. Select the hex file
  - > Click on File in the menu bar
  - Browse to the location of your file

XMC <sup>TM</sup> Flasher BETA File Configurations BMI Target Log About	
Connect Disconnect	Select File File:
Connection Status: Not connected Selected Emulator Serial Numb	Program
Selected Device Name:	Verify
	Erase
Infineon	

## Download the application to your target using $XMC^{TM}$ Flasher



- 4. Connect to your device
  - > Click on Connect...
  - > Select your device



## Download the application to your target using $XMC^{TM}$ Flasher



5. Click on *Program...* 

💞 XMC™ Flasher BETA	
File Configurations BMI Target Log About	
Connect Disconnect	Select File.
Connection Status:     Connected       Selected Emulator Serial Numb     591045661       Selected Device Name:     XMC4700-2048	Program       Verify       Erase
infineon	Connect      Select File.
	File:       xmc4700_relaxit; wrc4700_relaxit; wrc47
	(infineon Silver

# Download the application to your target using $DAVE^{TM}$ version 4



- 1. Start DAVE<sup>TM</sup> version 4
- 2. Import the example project
- > Click on *File* > *Import...*
- > Select *Infineon* > *DAVE Project*
- > Click on Next
- > Select Archive File
- > Click on *Browse*

- Concerning of the state of the
- > Browse to the location of the example project and select the zip file
- > Click on Finish
- 3. Compile the project
- > Click on Rebuild Active Project button in the tool bar



## Download the application to your target using DAVE<sup>TM</sup> version 4



- 4. Start debugger
- > Click on *Debug* button in the toolbar

| 🖩 🕼 🚬 🌌 🌽 🖳 않 🖏 🐜 🔤 🗊 💷 🕒 🖻 📢 🏇 -) @ -| 🖉 - ½ - ½ - ∜- ↔ - → -

- > Double click on GDB SEGGER J-Link Debugging
- > Click on *Debug*

w Debug Configurations			<u> </u>
Create, manage, and run configu	rations		Ť.
Image: Second Secon	Name: Innef700_relask#_ucprobe_ex_Debug Main \$2 Debugger \$2 Source Sourc	Variables Search Project	Bonse
Filter matched 3 of 41 items		Apply	Revert
?		Debug	Close

> The debugger will program your board. In the debugger view click on *Resume* button in the toolbar to start your application









- This section shows you how to monitor and control your application using the dash board
- By having a dashboard for your C code, you will gain a firm understanding of what the embedded system is doing at any given time
- > Use xmc4700\_relaxkit\_ucprobe\_ex1.zip example project
- 1. Start Micrium<sup>®</sup> uC/Probe<sup>™</sup> XMC<sup>™</sup>
  - Click on Micrium uc-Probe XMC
     in your desktop
    - uC-Probe XMC
- 2. Setup communication to board
  - Click on Settings button in the toolbar



- Select Debug Interfaces > J-Link
- Click Ok

infineon

- 3. Load an ELF file
- > Click on *ELF* button in Symbol Browser window
- Browse to the location of the ELF file in the Debug folder of the example project
- > Select the file. Click Open
- > Now you are ready to start designing your graphical UI





- 4. Drag and drop controls to build your user interface
- In this example we will monitor and control a global variable of our application
- Add a **Textbox** from the Writable Controls. We will use this control to change the value of the variable
- In the Properties Editor you could apply scaling to the read value of the form y = scale\*x + offset. You can also adjust the Decimal Places. These settings are available for almost all controls





- Add a Radial 1 from the Angular Gauges. We will use this control to monitor the value of the variable.
  - In the Range and Colors of the control select maximum value 255



- Add a Cylinder 1 from the Linear Gauges. We will use this control to monitor the value of the variable.
  - In the Range and Colors of the control select maximum value 255



- > Your dash board should look like as shown below
- You can always save your workspace by Ctrl-S or File > Save for later use or for sharing





- 5. Associate variables to controls
- > Search for the **g\_var** symbol in the Symbol Browser:
  - Either use the search function if you know the name of the variable
  - Or unfold the ELF file and navigate through the modules
- > Drag the **g\_var** variable and drop it over the Textbox control
  - Do the same for all the other controls



Alternatively you can associate a variable to a control by double clicking on the variable if previously the control was selected by clicking on it.

i 🖫 🕼 | 🎽 🌌 🄑 i 🖳 i 🔨 🗈 🕕 🔳 🖷 🕺 🎿 👁 🔐 🖶 🛒 🕹 i

- 6. Since we are connecting to a XMC4700 board, select XMC4000 in the Infineon XMC<sup>™</sup> Family window
- 7. Before the next step ensure your board is running,i.e. not halted by debugger

- 6. Click on Run button in toolbar
- The controls visualization will get updated periodically according to the value of the variable g\_var
- > In this case the application increments the variable **g\_var** in a loop
- > You can also modify the value of the variable in run time

No programming is required! No need to instrument your embedded code nor need to write any single line of code in the PC to get insight of your application.









### Using Micrium® uC/Probe<sup>™</sup> XMC<sup>™</sup> Oscilloscope control



In this section will explore the capabilities of the oscilloscope control of Micrium® uC/Probe<sup>TM</sup> XMC<sup>TM</sup>

- Use xmc4700\_relaxkit\_ucprobe\_ex2.zip example project
- 1. In this section you will open an existing Workspace (.wspx)
- > Simply double click on the provided .wspx file in the example project.
- Micrium® uC/Probe™ XMC<sup>™</sup> will start, showing the panel control for a software "signal generator"

			5	liorium µC/Probe				
Full         Settings         Bun         Bun         Bung forward         Bung forward           Appication         Clobased         Appication         Clobased         Appication	Group * Show/Hide Grid Aten * Show/Hide Rulers Show/Hide Rulers Units * 😡 Zoom Pactor * Arrange						Micriµm µC <b>Professi</b> a	Probe for XMC <sup>TW</sup> ver. 4.0.16.6 nal Edition for Infineor
Tooloo Writebile Centrols	142Green Coscionospe 50 500 550 500	250 500 550 MC4700 licrium uc/P	400 450 500 550 600 robe XMC Demo	450 730 750 K	oo 850 900 950	1000 1090 13	00 1100 1200 1200 1300 1390	Verspace Depose     Fill Screents     Graphics     G
Chexiton Senten	© Sin Square Triangle	nel O	Sin Square Triangle	nel 1				
Wirhabie Controls	Frequency (Hz)	1	Frequency (Hz)	10				
Liner Gauges     Charts     Numeric Indicators	Amplitude	1.00	Scale	1.00				Infinean XMC Family
Misselareous								
Symbol Browser	Search by	Name   🗢 Search by Data Ty	pe 🕃 🐔 RAM Barge Min O	Max FIFFFFF				
> iii 🗙 xmc4700_relaskit_ucprobe_ex.eV	Name		4	Type N/A	52e 225,028	Size Filtered 225,028	Memory Address N/A	

### Using Micrium® uC/Probe<sup>™</sup> XMC<sup>™</sup> Oscilloscope control



#### 2. Add uC/Probe<sup>™</sup> Embedded Target code

- > To use the oscilloscope control, it requires adding to your application the Scope library which is part of the Target Code included in the  $\mu$ C/Probe<sup>TM</sup> XMC<sup>TM</sup> download package or can be downloaded from  $\mu$ C/Probe Embedded Target Code
  - Add folder and adjust the compiler settings, i.e. Include Paths
  - Include probe\_scope.h into your application code
- > The library provide two functions:

#### - ProbeScope\_Init()

Initializes the internals of the Oscilloscope module. It sets the time base indicated as a parameter to the function, i.e. the frequency of calling the sampling function

#### ProbeScope\_Sampling()

Take a sample of each active oscilloscope channel. This function should be called in periodic function, i.e. control loop or timer ISR like in the example

- > The library can be configured adapting the defines in probe\_scope\_cfg.h
  - Number of channels
  - Number of sample per channel
    - It determines the length of the waveform, i.e. T = sampling period X number of samples per channel



### Using Micrium<sup>®</sup> uC/Probe<sup>™</sup> XMC<sup>™</sup> Oscilloscope control

>

>

Oscilloscope DataScreen

Scope Setting Ch Ch En

Symbol

NONE

NONE

NONE

.

•

Label





### Using Micrium® uC/Probe<sup>™</sup> XMC<sup>™</sup> Oscilloscope control



- 4. Associate variables to the oscilloscope channels
- Using the symbol browser drag and drop the variables channel\_0.value and channel\_1.value to the oscilloscope channels

File Home					۵ 👔
Image: Settings     Run       Formation     Paste       Settings     Run	d v 📜 Group v 🗰 Show/Hide Grid d v 📮 Align v 💭 Show/Hide Rulers			Micriµm µC/Probe	for XMC <sup>™</sup> ver. 4.0.16.6
Application Clipboard	Arrange			Professional E	dition for Infineon
Toolbox 4	Oscilloscope DataScreen			×	Workspace Explorer 4
Writable Controls				۸. ۱	🕼 Screens 🕆 🍟
L Sider					⊿- 💾 Project
T sider					Te DataScreen
Horizontal Slider				a provincia de la composición	- Oscilloscope
⇒ ⊂ustom Slider					
		Trigger Position			
Writable Controls	scope settings				
Angular Gauges	Ch Ch En Symbol Label	Type Max / Min Trig Level Trig Sel Bit En Bit #	# Gain Offset	Status	
	1 Symbol : value		1.0000 0.0000	Triggered Sampling	
Linear Gauges	7 Type : float 2 Memory Address : 0x3/ffe8820			Scope Mode Sampling Clock	
K Charts	Size : 4			Stop Divider 1	
Numeric Indicators	Add the selected symbol to the node.	0 0 0		Continuous Sampling Clock (	
Miscellaneous	4 NONE -		1.0000 0.0000	Single Trig	Infineon XMC Family
Advanced	5			Triggered Sampling Rate ()	○ XMC1000
3				Trigger	
	Gearch hy Name     Gearch		FFFFFFF		
			Cine Cine Cilesered	Manuari Addana	
	Varrie	Type	Size Size Filtered	Memory Address	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
□ channel_0		channel	24 24	Ox1ffe8810	
amplitude		float	4 4	Ox1ffe8818	g
frequency		long unsigned int	4 4	0x1ffe8810	- Contraction ( )
offset		ficat	4 4	0x1ffe8814	
> value		/ foat	4 4	0x1ffe8820	
Stopped		J-Link (SWD) - 12000 kHz - Device : Cortex-M4			
	1				

# Using Micrium® uC/Probe<sup>™</sup> XMC<sup>™</sup> Oscilloscope control



- 5. Change the layout of the workspace
- To easily access the controls of the dashboard and simultaneously observe the oscilloscope, right click on the tab Oscilloscope and select *Floating*. The oscilloscope window will be detached from the main window of Micrium® uC/Probe<sup>™</sup> XMC<sup>™</sup>

0 ) 9 C O			Micrium µC/Probe					focce	<b>8</b> ×
File Home							۵ 📦		
🖳 🏭 🜔 👘 🐇 📙 Bring Forward	Group - Histow/Hide Grid						Cinfineon		
Full Settings Run Paste X R.R. + O 10	till Units Y Ro Zoom Factor					Micrium uC/Pro	be for XMC <sup>™</sup> ver. 4.0.16.6		
Application Clipboard	Arrange					Professiona	I Edition for Infineon	90 90	
Toolbox #	DataScreen						x Workspace Explorer 4		
Writable Controls	0 50 100 150 200	250 800 850	400 450 500 550 600	650 700 75	0 830 850	900 950 5000 5050	Te Screens *		
							A Project		
A river	· · ·						E DataScreen		
C Horizontal Silder		icrium uc/	Probe XMC Demo				Csciloscope		
Custom Sider									
Custom Switch					_				
Checkbox +	Channe Sin	el O	Channel	1				30 30	
Writable Controls	Square Triangle		Square Triangle						
Angular Gauges					_				
Linear Gauges	Frequency (Hz)	1	Frequency (Hz)	10					
🔥 crans				1			Infineon XMC Family	5 Trigger Peakion	
Numeric Indicators	Offset	0.00	Offset	0.00			XMC1000 @ XMC4000	Scope Settings	
Miscelaneous								Ch Ch En Symbol Label Type Max / Min Trig Level Trig Sel Bit En Ett # Gain Offset Status	
£0	Amplitude	1.00	Scale	1.00				Channel, 0, value	
Autorited E								Scope Mode Sampling Clock Tools	
* E.	< []								
Symbol Browser							* · · · · · · · · · · · · · · · · · · ·	3 NONE • 0 0 0 1.0000 0.0000 0 Sampling Clock Otd	
🗳 EUF 🚰 COF 🚰 CSF 🚰 MQTT 🔎	Search by !	Name   🔘 Search by Data	Type 🖲 😤 RAM Range Min 0	Max FFFFFFF				NONE         Image: Control of the second secon	
	Name		Type	Size	Size Filtered	Memory Address		General Control Contro Control Control Control Control Control Control Control Control Co	
E channel_1		4	channel	24	24	0x1ffe8828		Trigger Samples Par Channel	
ampitude		1	ficet	4	4	0x1ffe8830		O     O	
frequency		4	long unsigned int	4	4	0x1ffe8828			
Ground			Hink (SWD) - 12000 kHz - Device : Cottex-M4					Hold Off	

# Using Micrium® uC/Probe<sup>TM</sup> XMC<sup>TM</sup> Oscilloscope control



- 6. Ensure target is running.
- 7. Click on Run button in toolbar.
- 8. Adjust the oscilloscope channel scale.
- > Click on **Set Multiple Scales** (1) in Tools to adjust the vertical scale.
- > Set the **Sampling Clock Divider** (2) to adjust the time base scale.



### Using Micrium® uC/Probe<sup>™</sup> XMC<sup>™</sup> Oscilloscope control



- 9. Use the dash board to control your application and observe the effect on the oscilloscope
- For example, change frequency of the waveform generator channel 0
   Hz to 5 Hz. You should observe something similar to the picture below



### Using Micrium® uC/Probe<sup>™</sup> XMC<sup>™</sup> Oscilloscope control



10. Oscilloscope trigger options

- One of the main features of the Oscilloscope control is the capability of triggering with the following options:
  - Trigger channel selection (1)
  - Trigger level (2)
  - Rising or falling edge (3)
  - Pre trigger (4)
  - Single trigger or continuous trigger (5)



# Using Micrium® uC/Probe<sup>™</sup> XMC<sup>™</sup> Oscilloscope control



- 11. Oscilloscope other features
- > Time axis zoom
  - Use the scroll bars in the top area of the Oscilloscope window (1)
- > Individual Y vertical channel scale (2)
- > Offset and gain of channels (3)









#### > Data logging control

Log the values of any variable(s) in your symbols browser to a CSV file

#### Microsoft<sup>®</sup> Excel<sup>®</sup> Bridge

Map an embedded target's symbol to a cell in Microsoft<sup>®</sup> Excel<sup>®</sup>

#### > uC/OS Kernel Awareness

The  $\mu$ C/OS Kernel Awareness in  $\mu$ C/Probe<sup>TM</sup> is a series of prebuilt screens that allows you to see the run time behavior of all the  $\mu$ C/OS-II kernel objects used in your embedded application

#### > Terminal Window

Interact with your embedded target in a shell-like fashion



1	Objective of this tutorial
2	What we need to follow this tutorial?
3	Introduction to Micrium uC/Probe <sup>TM</sup> XMC <sup>TM</sup>
4	Using the dashboard
5	Using the oscilloscope
6	Other features
7	References
8	Support material

#### References

- Micrium® uC/Probe<sup>™</sup> XMC<sup>™</sup> documentation
  - Accessible in the Start menu of Windows<sup>®</sup>
  - Or in the File tab
- Micrium® uC/Probe<sup>™</sup> XMC<sup>™</sup> features <u>https://www.micrium.com/tools/ucprobe/features/</u>
- > uC/Probe<sup>™</sup> Oscilloscope Feature: BLDC Design Case Study https://www.micrium.com/new-%C2%B5cprobe-features-

<u>https://www.micrium.com/new-%C2%B5cprobe-features-</u> <u>simplify-bldc-design/</u>





1	Objective of this tutorial
2	What we need to follow this tutorial?
3	Introduction to Micrium uC/Probe <sup>TM</sup> XMC <sup>TM</sup>
4	Using the dashboard
5	Using the oscilloscope
6	Other features
7	References
8	Support material

### Support material



Collaterals and Brochures	<ul> <li>&gt; Product Briefs</li> <li>&gt; Selection Guides</li> <li>&gt; Application Brochures</li> <li>&gt; Presentations</li> <li>&gt; Press Releases, Ads</li> </ul>	www.infineon.com/XMC
Technical Material	<ul> <li>&gt; Application Notes</li> <li>&gt; Technical Articles</li> <li>&gt; Simulation Models</li> <li>&gt; Datasheets, MCDS Files</li> <li>&gt; PCB Design Data</li> </ul>	<ul> <li>&gt; <u>www.infineon.com/XMC</u></li> <li>&gt; <u>Kits and Boards</u></li> <li>&gt; <u>DAVE™</u></li> <li>&gt; <u>Software and Tool Ecosystem</u></li> </ul>
Videos Play	<ul> <li>&gt; Technical Videos</li> <li>&gt; Product Information Videos</li> </ul>	<ul> <li>&gt; <u>Infineon Media Center</u></li> <li>&gt; <u>XMC<sup>™</sup> Mediathek</u></li> </ul>
Contact Support	<ul><li>&gt; Forums</li><li>&gt; Product Support</li></ul>	<ul> <li>Infineon Forums</li> <li>Technical Assistance Center (TAC)</li> </ul>

### Disclaimer



The information given in this training materials is given as a hint for the implementation of the Infineon Technologies component only and shall not be regarded as any description or warranty of a certain functionality, condition or quality of the Infineon Technologies component.

Infineon Technologies hereby disclaims any and all warranties and liabilities of any kind (including without limitation warranties of noninfringement of intellectual property rights of any third party) with respect to any and all information given in this training material.



Part of your life. Part of tomorrow.

