

XMC1000 LED lighting application kit

XMC™ microcontrollers
July 2016



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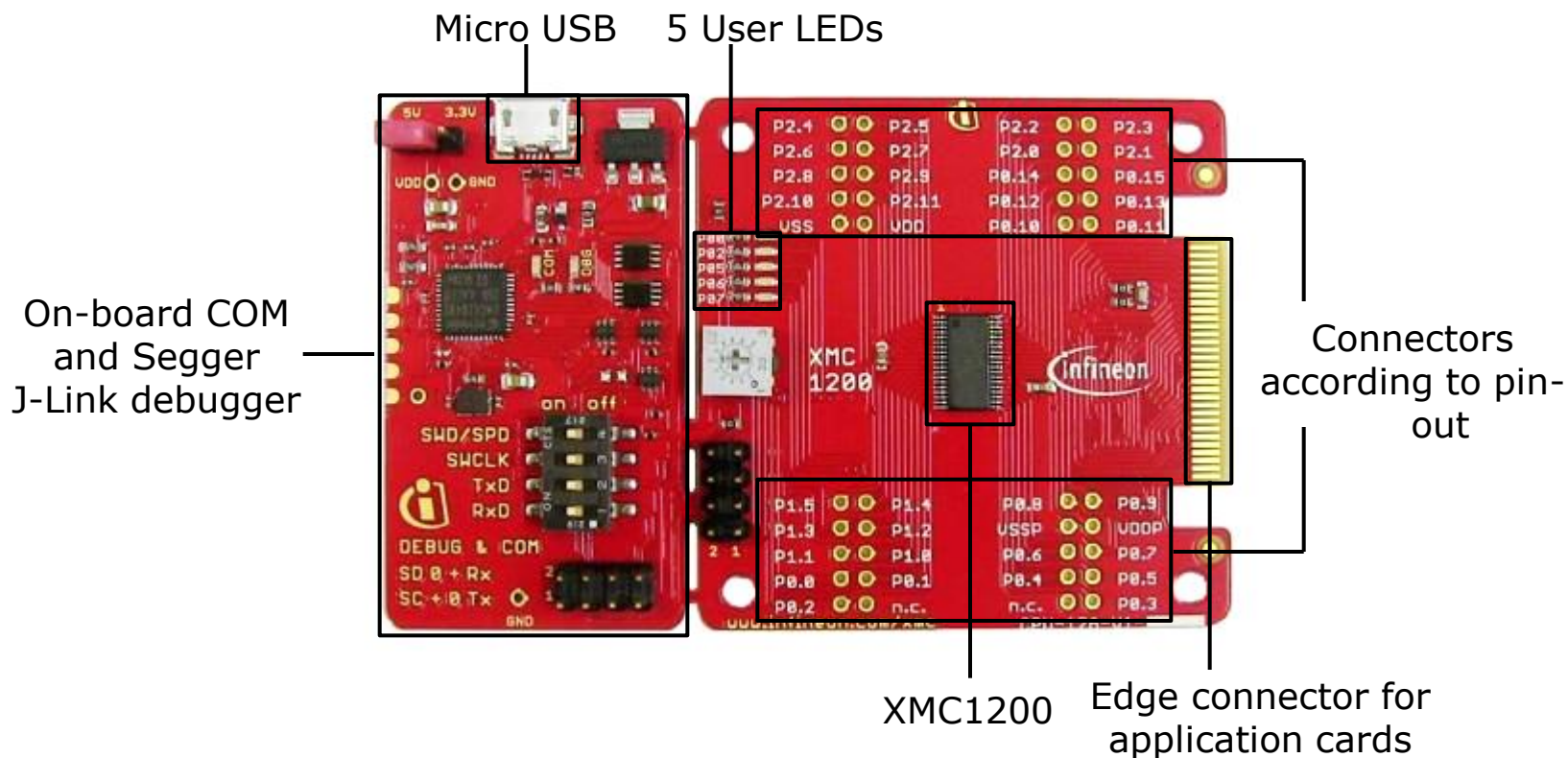
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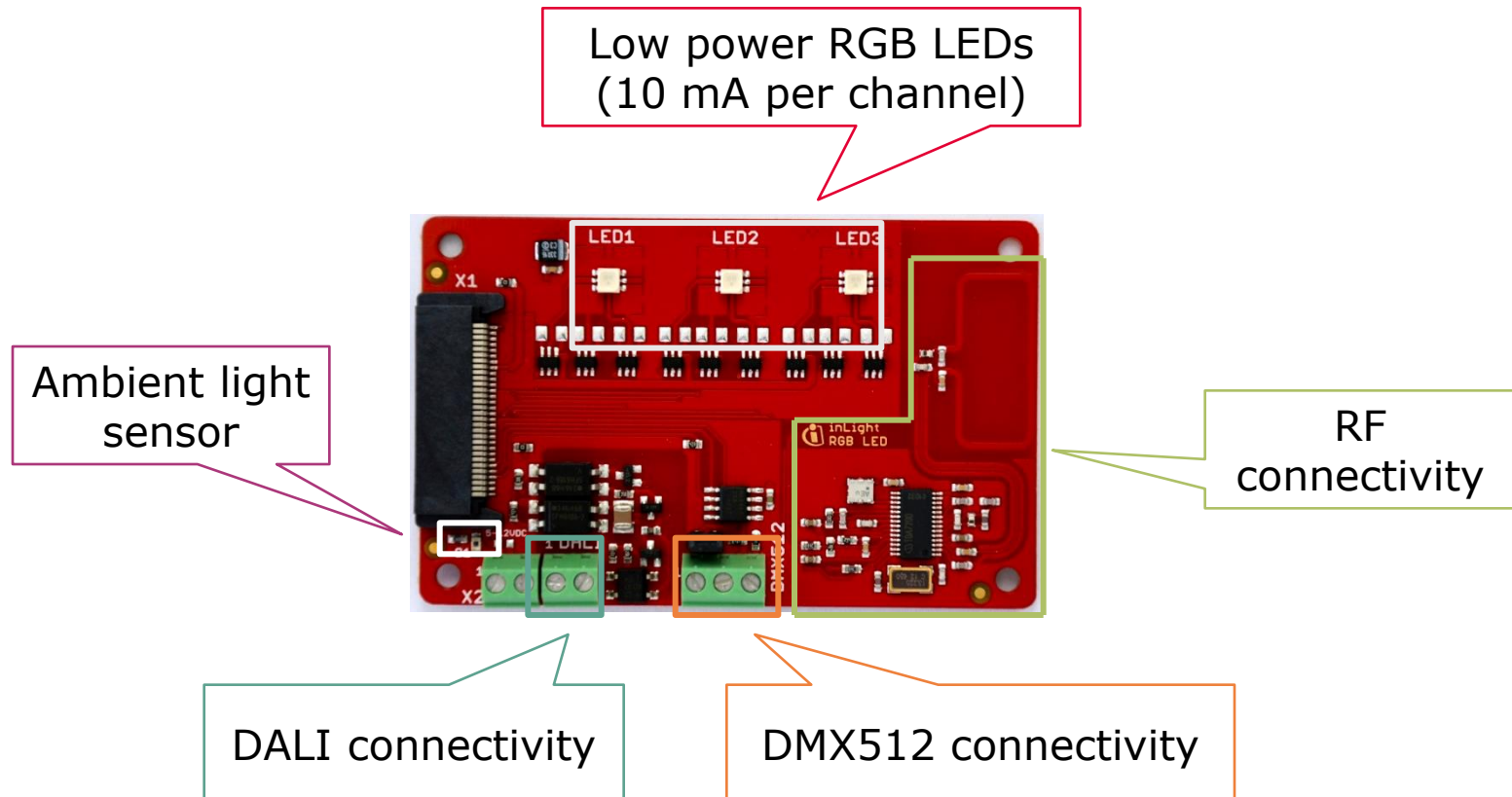
Kit overview (1/3)

> XMC1200 CPU Card



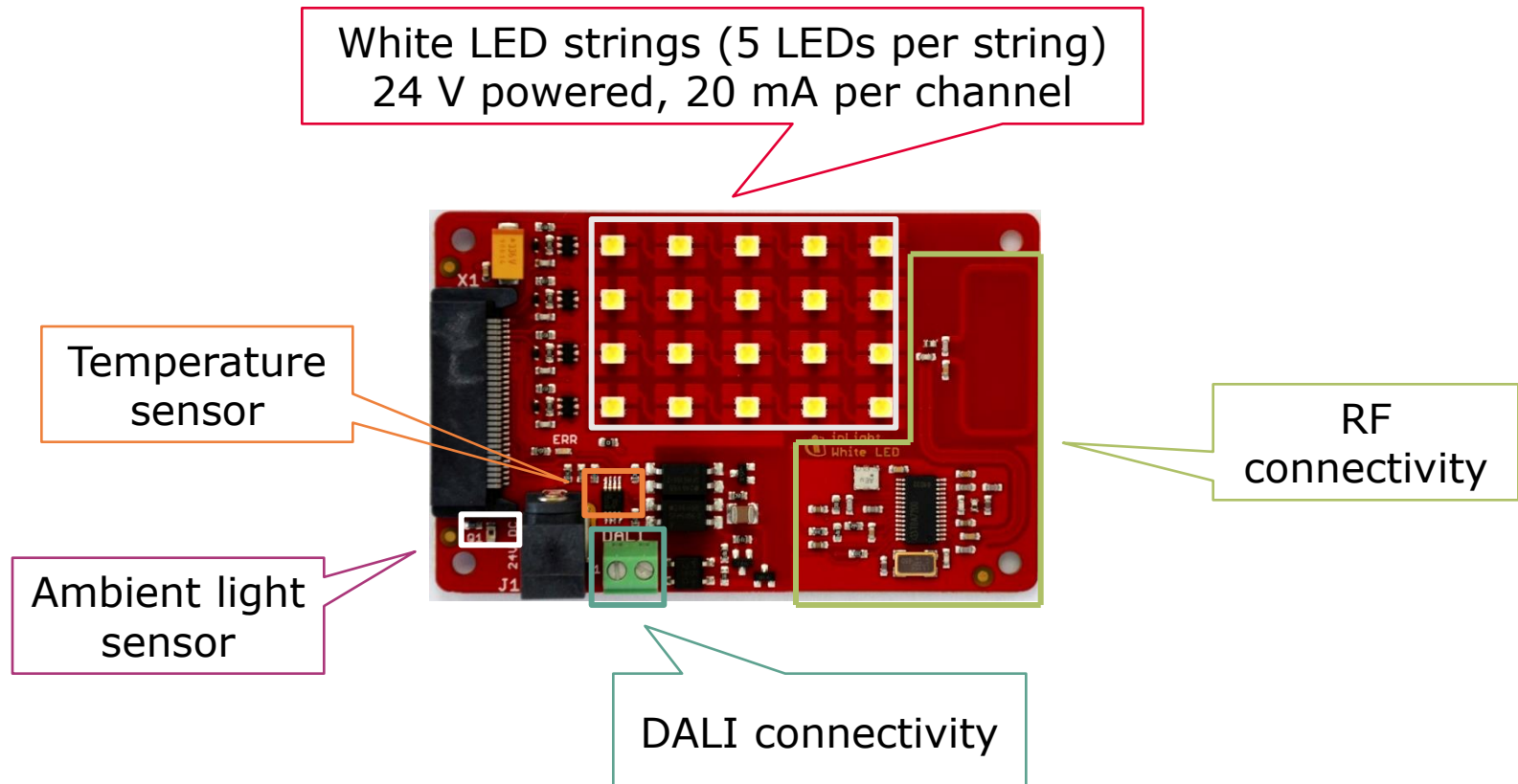
Kit overview (2/3)

- › Color LED card
 - Showcases color control



Kit overview (3/3)

- › White LED card
 - Showcases brightness control



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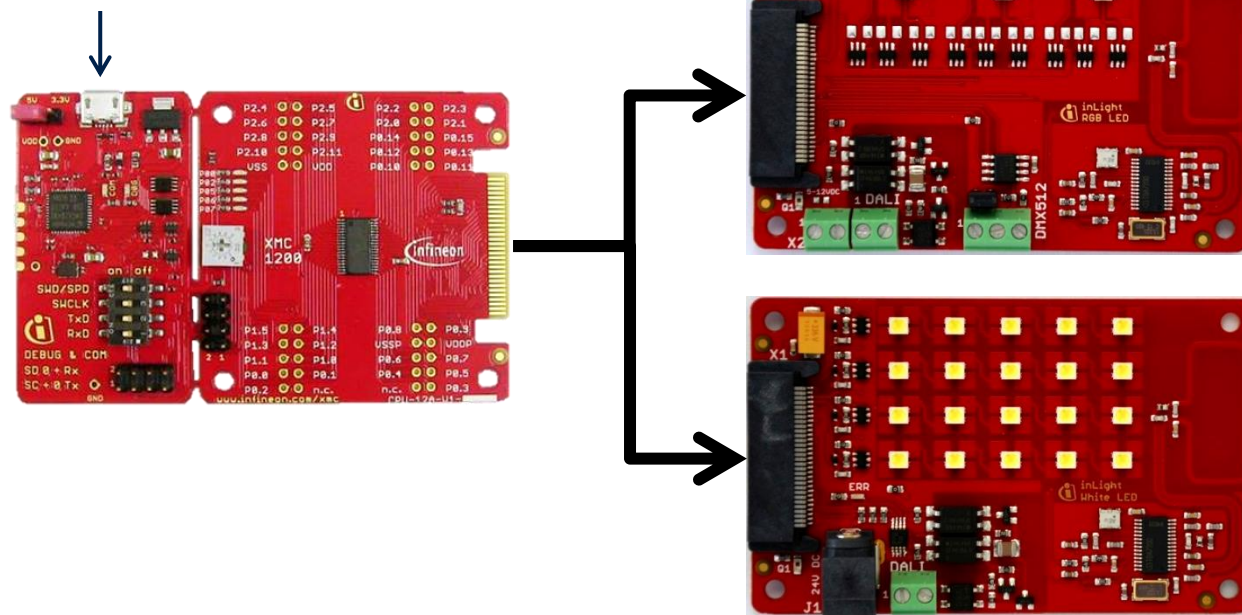
7

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Hardware overview

- › Attach color LED or white LED card to XMC1200 CPU card
- › Connect XMC1200 CPU card to PC via USB cable
- › CPU card is powered up (as indicated by LED on the card)

CPU card powered
via USB cable



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Tooling overview

Boot modes



- › Boot modes available
 - UART bootstrap-loader mode
 - User mode (Halt after reset)
 - User mode (Debug) **Default mode of device on boot kit**
 - User mode (Productive)

- › Boot modes can be configured via:
 - DAVE™
 - Download DAVE™
<http://www.infineon.com/dave/v4>
 - MemTool
 - Download MemTool
<http://www.infineon.com/cms/en/product/channel.html?channel=ff80808112ab681d0112ab6b50fe07c9>

- › For more information on how to configure the BMI value, please refer to the XMC1000 tooling guide

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- › DAVE™ is a free development platform for code generation by Infineon
- › It can be downloaded from:
 - <http://www.infineon.com/dave/v4>
- › For a guide on setting up DAVE™, please refer to XMC1x00 boot kit getting started

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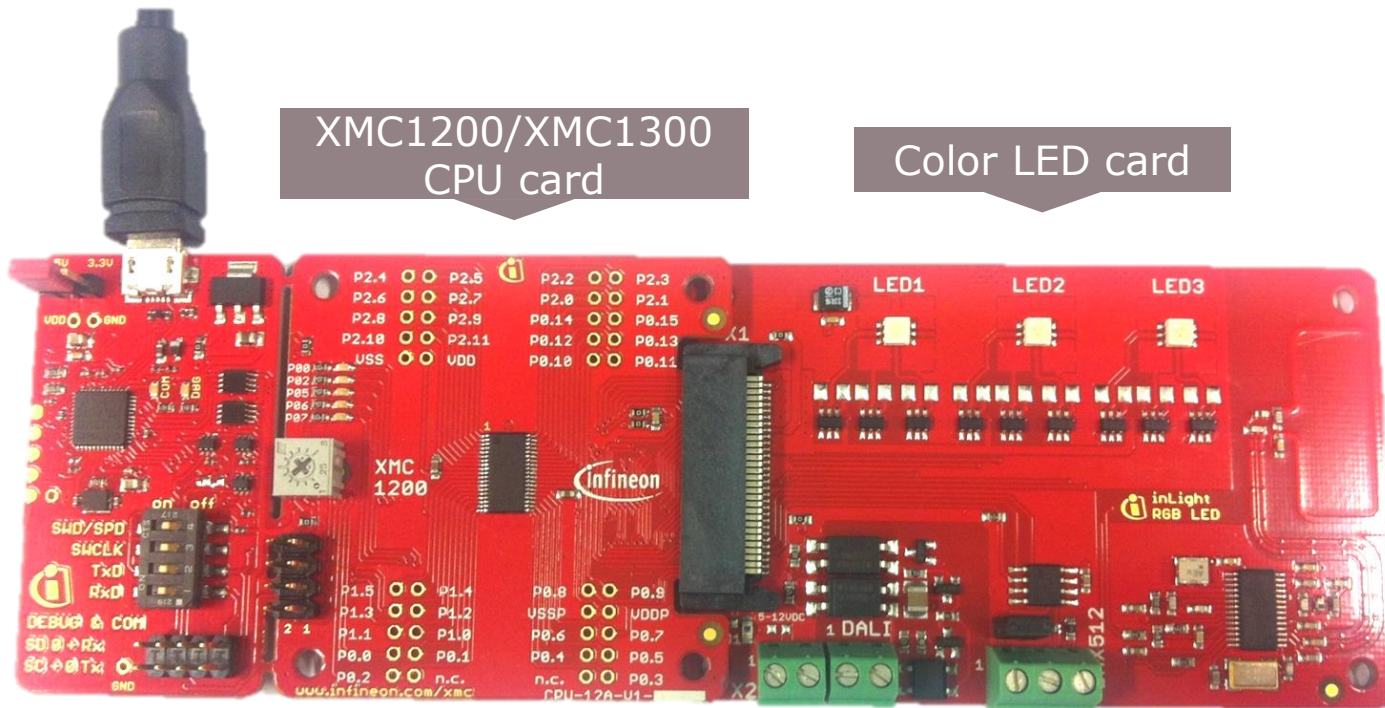
RGB lamp using LED_LAMP APP (1/20)

Example 1: RGB lamp using LED_LAMP APP

Connect to PC

XMC1200/XMC1300
CPU card

Color LED card



Getting started – Example 1

RGB lamp using LED_LAMP APP (2/20)

1. Open DAVE™



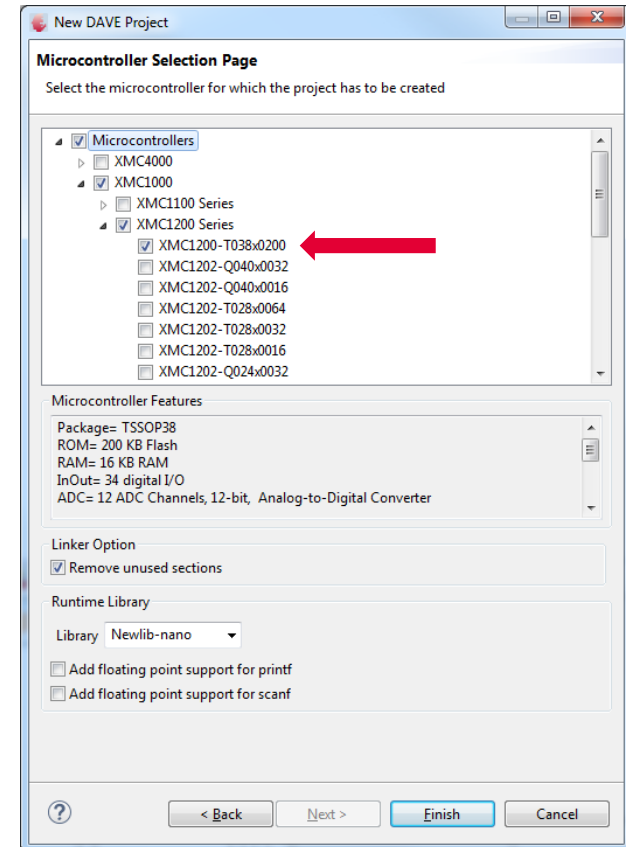
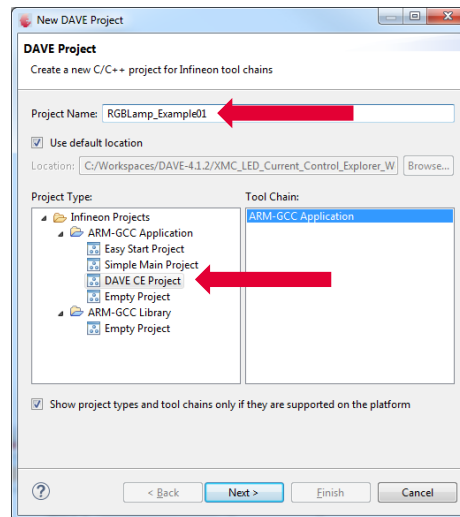
2. In DAVE™ workspace, create a new “DAVE™ CE” project:

› File->New->DAVE™ Project

› Give the project a name e.g.
“RGB_LAMP_EXAMPLE”

› Select “DAVE™ CE Project” as project type

3. Select the device accordingly



Getting started – Example 1

RGB lamp using LED_LAMP APP (3/20)



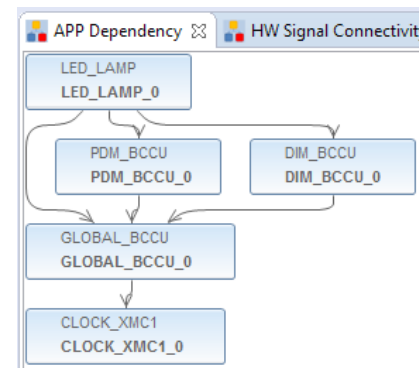
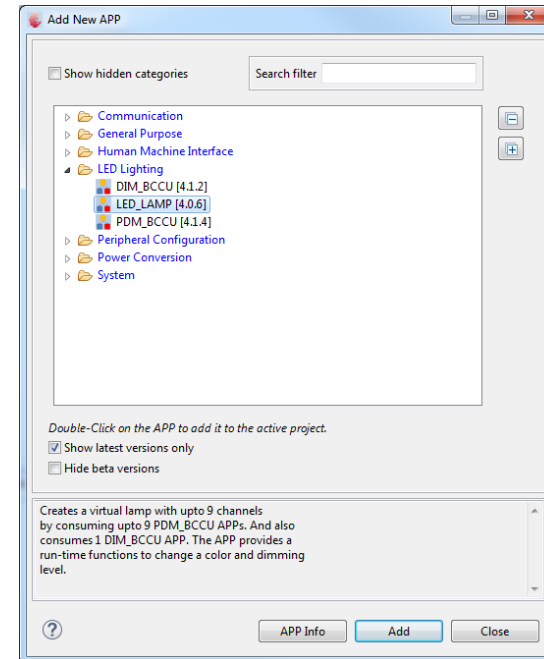
- › This example demonstrates RGB lamp functionality using LED_LAMP APP
- › We will use the system timer (SysTick) as the time base for the interrupt
 - Time base of 1 s
 - In the interrupt, a new target dimming level or target color is regularly set with a 7 s transition time
- › Next, we will show you the steps to creating this project:
 1. Instantiate LED_LAMP APP
 2. Configure LED_LAMP APP
 3. Configure BCCU Channels
 4. Assign PDM_BCCU APPs to the right channels
 5. Configure Brightness and Color Control Unit (BCCU) global settings
 6. Configure Port Pins
 7. Configure SysTick
 8. Define the SYSTIMER callback function

Getting started – Example 1

RGB lamp using LED_LAMP APP (4/20)

1. Instantiate LED_LAMP APP

- › Click  to add new APP
- › Select the **LED_LAMP** APP
- › LED_LAMP APP automatically aggregates a BCCU channel app (**PDM_BCCU**), a BCCU dimming engine app (**DIM_BCCU**) and a BCCU global app (**GLOBAL_BCCU**)

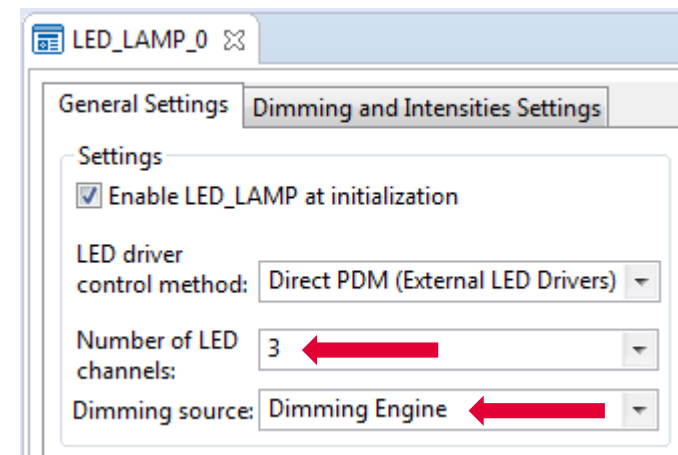
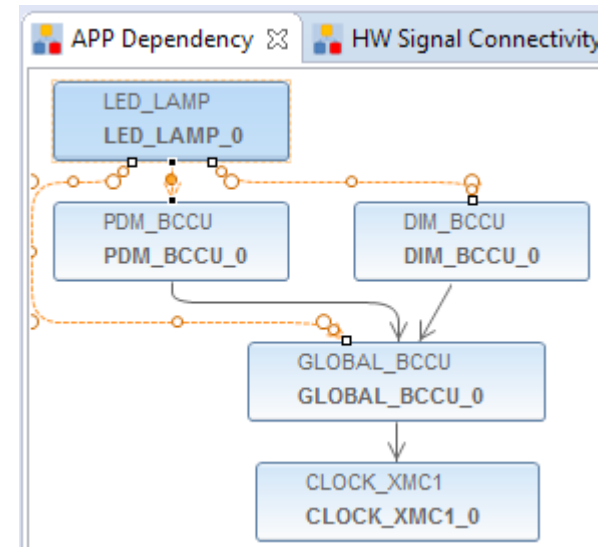


Getting started – Example 1

RGB lamp using LED_LAMP APP (5/20)

2. Configure LED_LAMP APP

- › Double-click **LED_LAMP_0** to open UI
- › Under **General Settings** tab,
 - set **Number of LED channels** to **3**
 - select **Dimming Engine** as **Dimming Source**



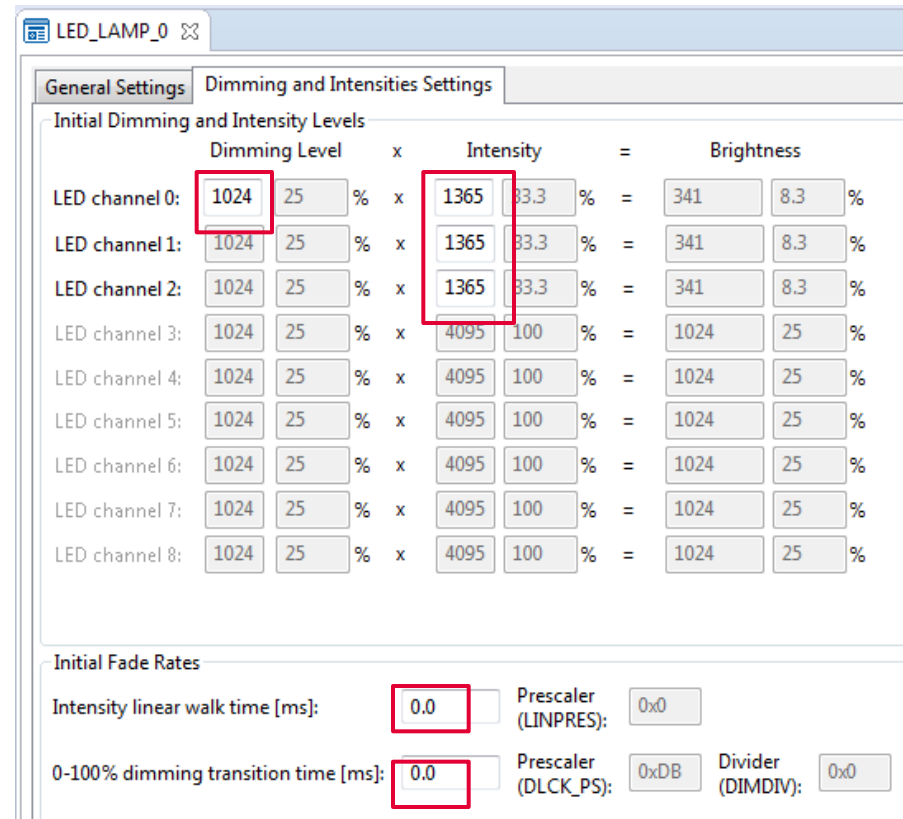
Getting started – Example 1

RGB lamp using LED_LAMP APP (6/20)

2. Configure LED_LAMP APP (continued)

> Under **Dimming and Intensities Settings** tab

- set initial **Dimming Level** to **1024**
- set initial **Channel Intensities** to **1365**
- set initial **Intensity linear walk time** to **0 ms**
- Set initial **0-100% dimming transition time** to **0 ms**



The screenshot shows the 'LED_LAMP_0' configuration window with the 'Dimming and Intensities Settings' tab selected. The 'Initial Dimming and Intensity Levels' section contains a table with 9 rows for LED channels 0 through 8. The columns are 'Dimming Level', 'Intensity', and 'Brightness'. The 'Dimming Level' column has a value of 1024 for all channels. The 'Intensity' column has values of 1365 for channels 0-2 and 4095 for channels 3-8. The 'Brightness' column has values of 8.3% for channels 0-2 and 25% for channels 3-8. The 'Initial Fade Rates' section at the bottom has two rows: 'Intensity linear walk time [ms]' and '0-100% dimming transition time [ms]', both with a value of 0.0. The 'Prescaler (LINPRES)' is set to 0x0, and the 'Prescaler (DLCK_PS)' is set to 0xDB. The 'Divider (DIMDIV)' is set to 0x0.

LED channel	Dimming Level	Intensity	Brightness
LED channel 0:	1024	1365	8.3 %
LED channel 1:	1024	1365	8.3 %
LED channel 2:	1024	1365	8.3 %
LED channel 3:	1024	4095	25 %
LED channel 4:	1024	4095	25 %
LED channel 5:	1024	4095	25 %
LED channel 6:	1024	4095	25 %
LED channel 7:	1024	4095	25 %
LED channel 8:	1024	4095	25 %

Initial Fade Rates

Intensity linear walk time [ms]: 0.0 Prescaler (LINPRES): 0x0

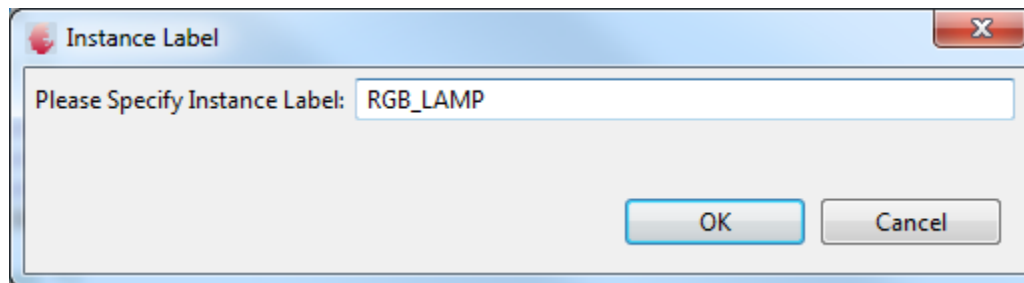
0-100% dimming transition time [ms]: 0.0 Prescaler (DLCK_PS): 0xDB Divider (DIMDIV): 0x0

Getting started – Example 1

RGB lamp using LED_LAMP APP (7/20)

2. Configure LED_LAMP APP (continued)

- › Rename Instance Label
 - **Right-click** LED_LAMP APP
 - Select **Rename Instance Label...**
 - Rename as **RGB_LAMP**

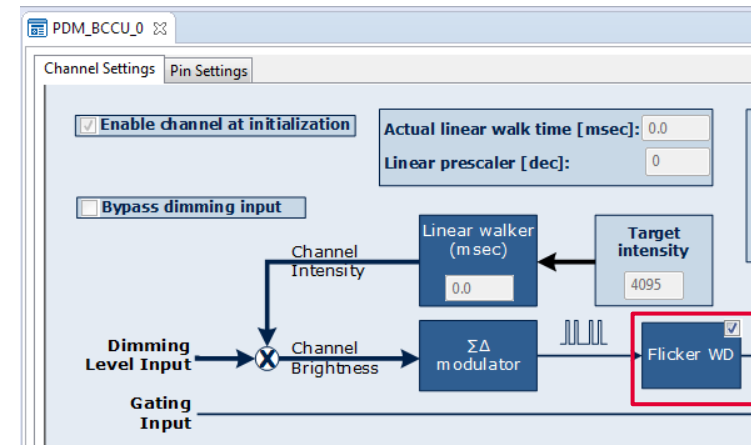
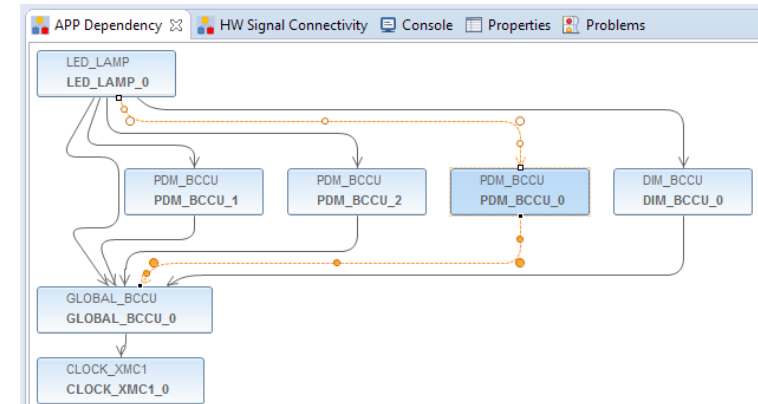


Getting started – Example 1

RGB lamp using LED_LAMP APP (8/20)

3. Configure BCCU Channels

- › Double-click a **PDM_BCCU APP**
- › Select **Flicker Watchdog (WD)** to enable
- › Repeat for the other 2 PDM_BCCU APP instances

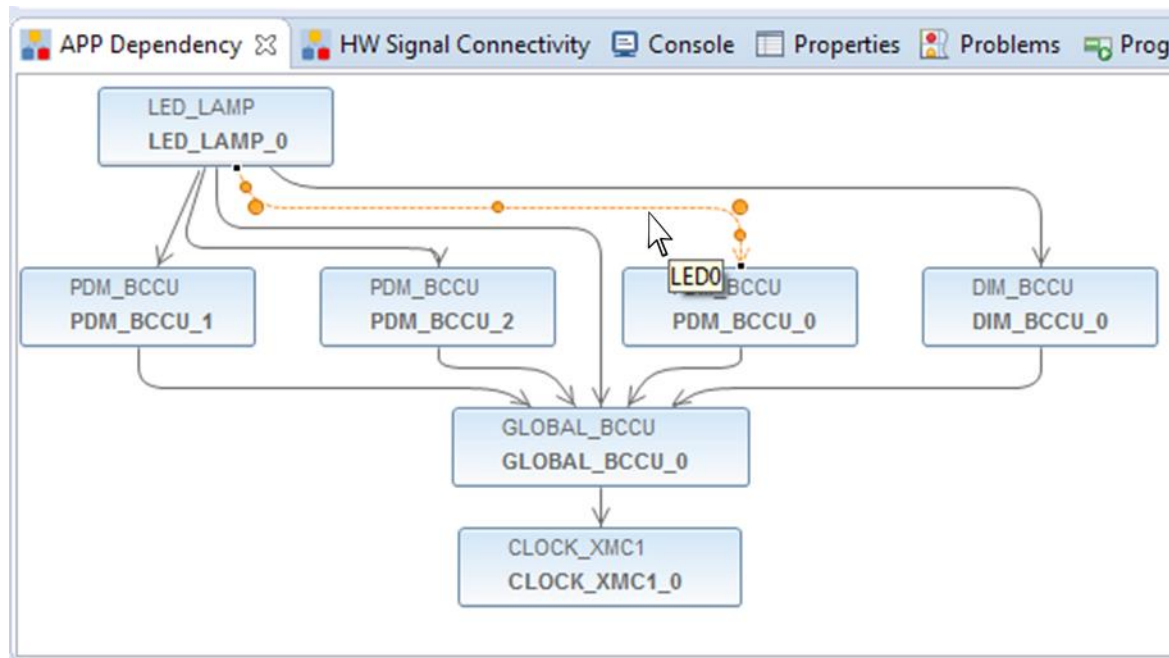


Getting started – Example 1

RGB lamp using LED_LAMP APP (9/20)

4. Assign PDM_BCCU APPs to the right channels

- › Hover mouse cursor over the connecting arrow to a PDM_BCCU APP
- › A label will appear momentarily e.g. LED0/LED1/LED2

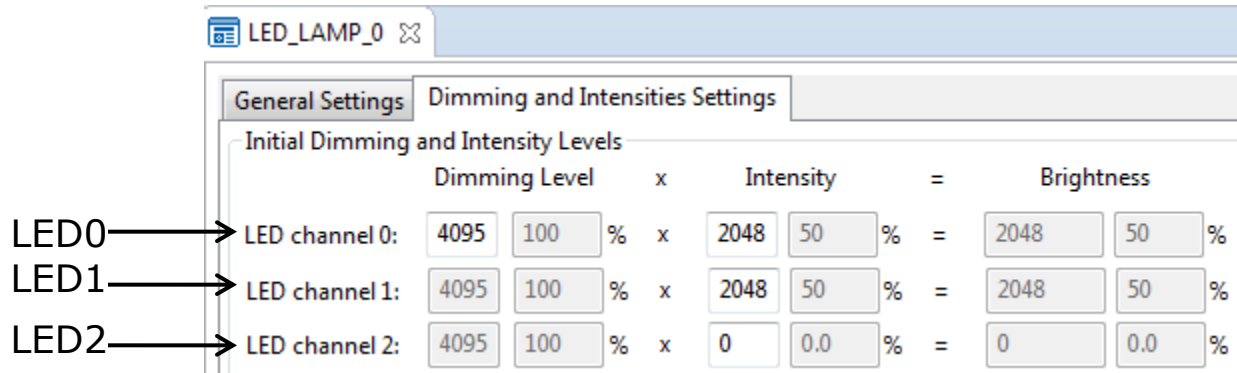


Getting started – Example 1

RGB lamp using LED_LAMP APP (10/20)

4. Assign PDM_BCCU APPs to the right channels (continued)

- › The labels correspond to the LED channels in the UI



LED_LAMP_0

General Settings | Dimming and Intensities Settings

Initial Dimming and Intensity Levels

		Dimming Level	x	Intensity	=	Brightness
LED0	→ LED channel 0:	4095	100 %	x	2048	50 %
LED1	→ LED channel 1:	4095	100 %	x	2048	50 %
LED2	→ LED channel 2:	4095	100 %	x	0	0.0 %

- › Rename the PDM_BCCU instance label according to the table below
 - Right-click PDM_BCCU APP
 - Select “Rename Instance Label”

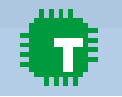
Label	New Label
LED0	R_LED1
LED1	G_LED1
LED2	B_LED1

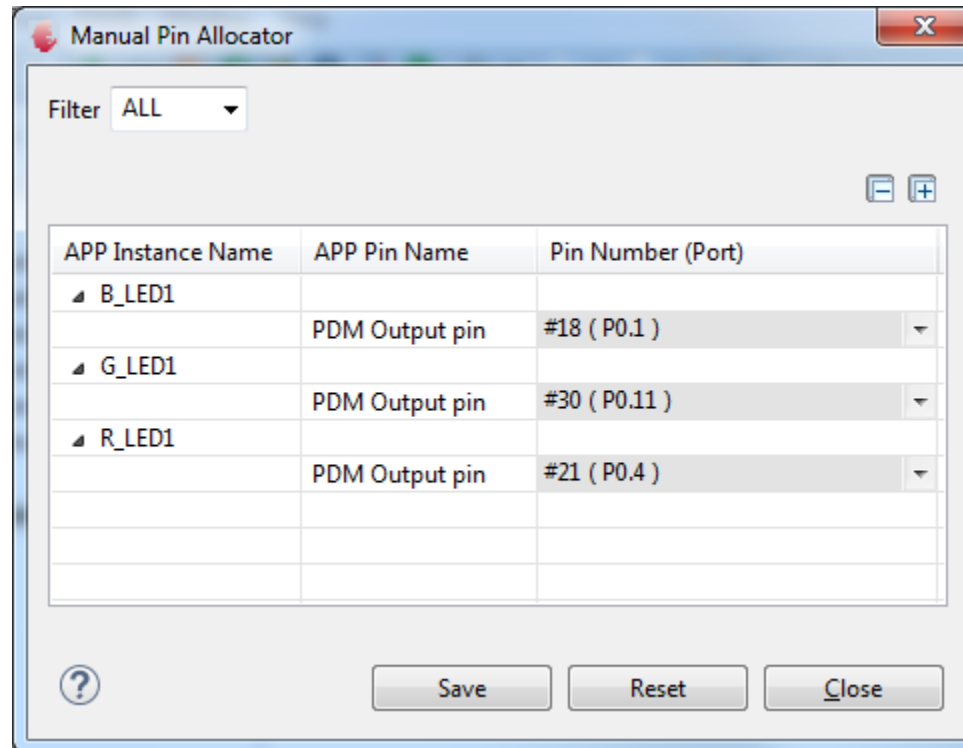
- Repeat the above steps with the other 2 PDM_BCCU APP instances

Getting started – Example 1

RGB lamp using LED_LAMP APP (11/20)

4. Assign PDM_BCCU APPs to the right channels (continued)

- › Click  to assign pins to PDM_BCCU APPs
- › Assign pins as shown:

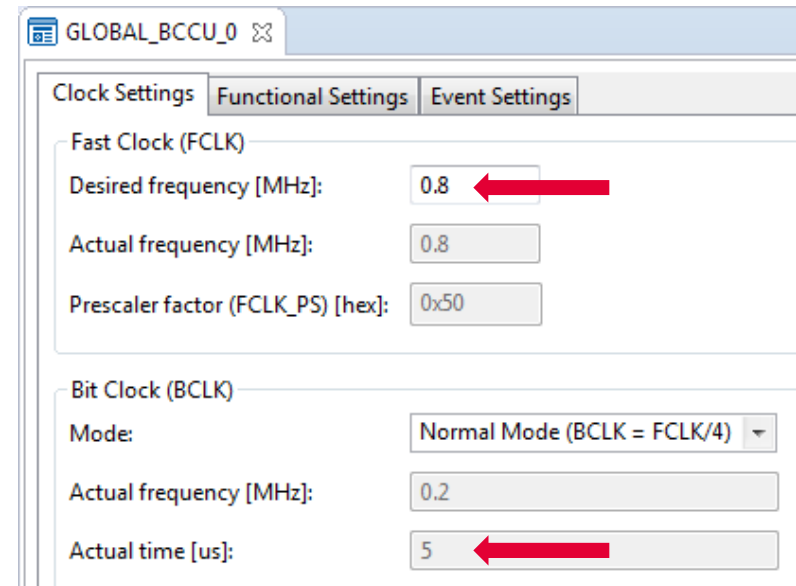
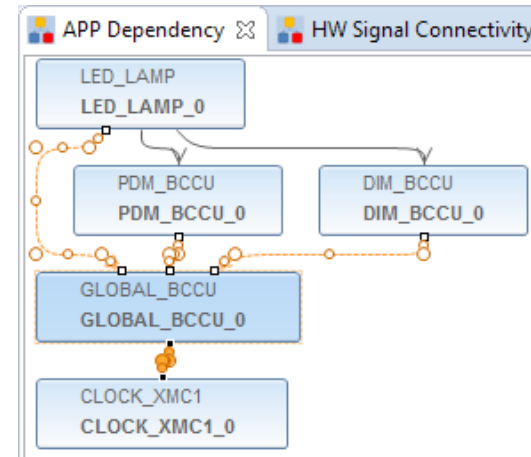


Getting started – Example 1

RGB lamp using LED_LAMP APP (12/20)

5. Configure BCCU global settings

- › Double-click **GLOBAL_BCCU_0** in **APP Dependency** tab
- › Under **Clock Settings** tab,
 - to get a bit time of 5 us
 - change the **Desired Fast Clock Frequency** to **0.8 MHz**



The image shows the configuration window for the GLOBAL_BCCU_0 block, specifically the Clock Settings tab. The window has three tabs: Clock Settings, Functional Settings, and Event Settings. The Clock Settings tab is active, showing the following parameters:

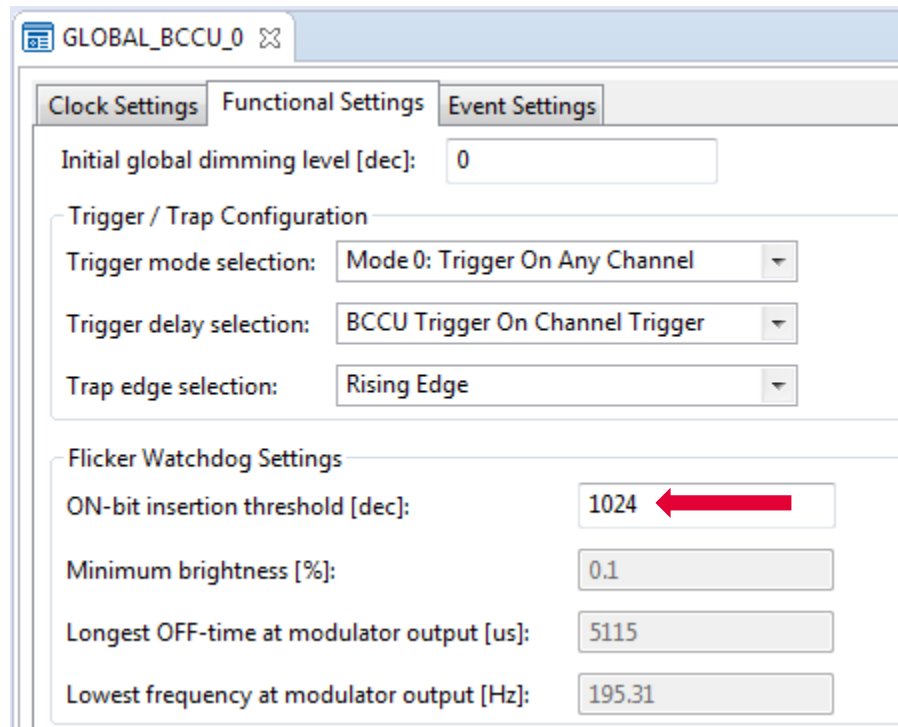
- Fast Clock (FCLK)**
 - Desired frequency [MHz]: 0.8 (indicated by a red arrow)
 - Actual frequency [MHz]: 0.8
 - Prescaler factor (FCLK_PS) [hex]: 0x50
- Bit Clock (BCLK)**
 - Mode: Normal Mode (BCLK = FCLK/4)
 - Actual frequency [MHz]: 0.2
 - Actual time [us]: 5 (indicated by a red arrow)

Getting started – Example 1

RGB lamp using LED_LAMP APP (13/20)

5. Configure BCCU global settings (continued)

- › Under **Functional Settings** tab,
 - limit the maximum possible off time to approx. 5ms (no flicker)
 - change **ON-bit insertion threshold** to **1024**



The screenshot shows the 'GLOBAL_BCCU_0' configuration window with the 'Functional Settings' tab selected. The 'Initial global dimming level [dec]' is set to 0. Under 'Trigger / Trap Configuration', 'Trigger mode selection' is 'Mode 0: Trigger On Any Channel', 'Trigger delay selection' is 'BCCU Trigger On Channel Trigger', and 'Trap edge selection' is 'Rising Edge'. Under 'Flicker Watchdog Settings', the 'ON-bit insertion threshold [dec]' is set to 1024, highlighted with a red arrow. Other settings include 'Minimum brightness [%]' at 0.1, 'Longest OFF-time at modulator output [us]' at 5115, and 'Lowest frequency at modulator output [Hz]' at 195.31.

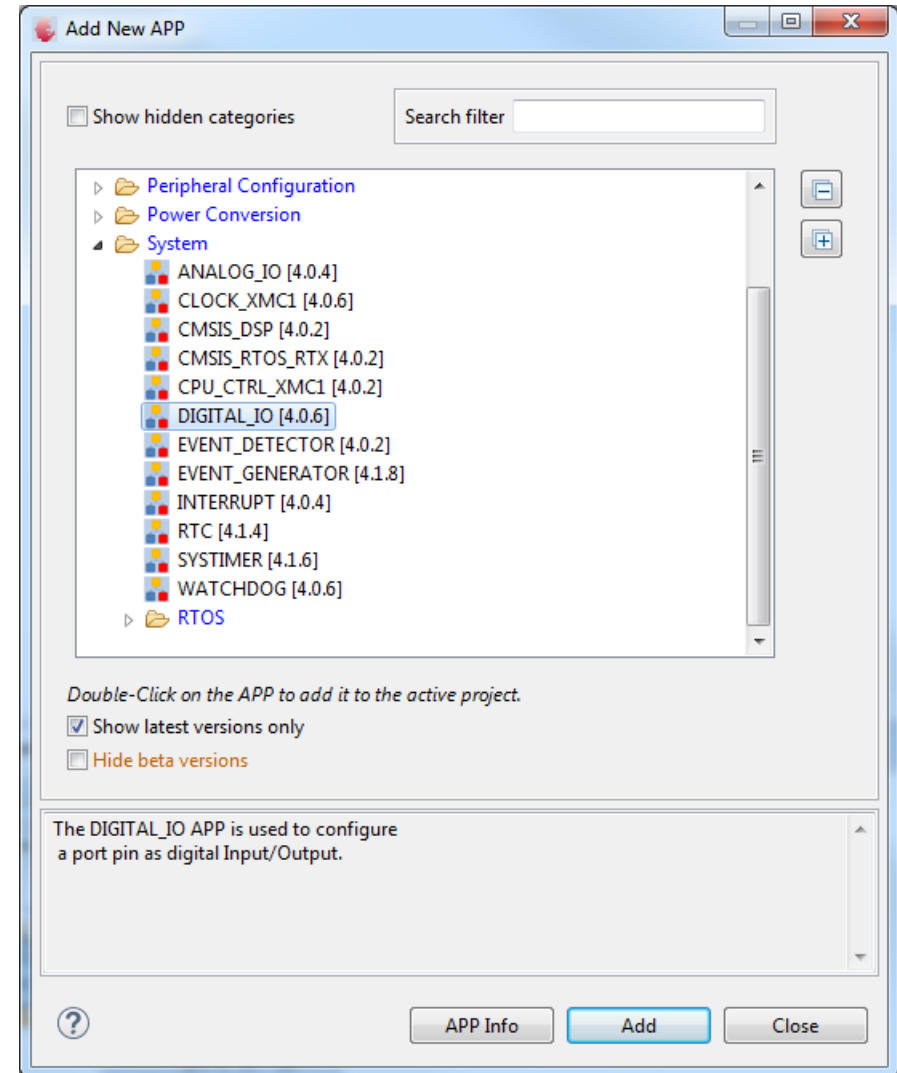
Setting	Value
Initial global dimming level [dec]	0
Trigger mode selection	Mode 0: Trigger On Any Channel
Trigger delay selection	BCCU Trigger On Channel Trigger
Trap edge selection	Rising Edge
ON-bit insertion threshold [dec]	1024
Minimum brightness [%]	0.1
Longest OFF-time at modulator output [us]	5115
Lowest frequency at modulator output [Hz]	195.31

Getting started – Example 1

RGB lamp using LED_LAMP APP (14/20)

6. Configure PORT Pins

- › The intention of this step is to ensure that the unused pins (to the LED2 and LED3) are not left in a floating state
- › Add **6** instances of **DIGITAL_IO** APP to the project

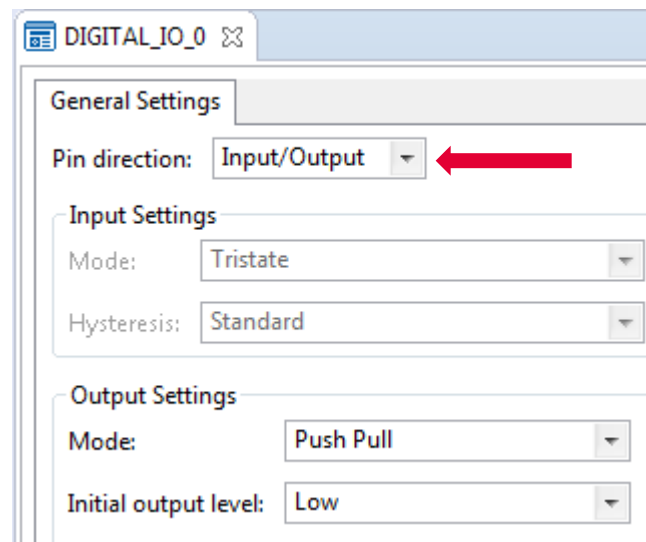


Getting started – Example 1

RGB lamp using LED_LAMP APP (15/20)

6. Configure PORT Pins (continued)

- › Double-click a **DIGITAL_IO** APP to open UI
- › Set **Pin Direction** to **Input/Output**

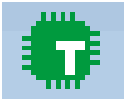


- › Repeat for other 5 instances of DIGITAL_IO APP

Getting started – Example 1

RGB lamp using LED_LAMP APP (16/20)

6. Configure PORT Pins (continued)

- › Click  to assign pins to DIGITAL_IO APPs
- › Assign pins as shown:

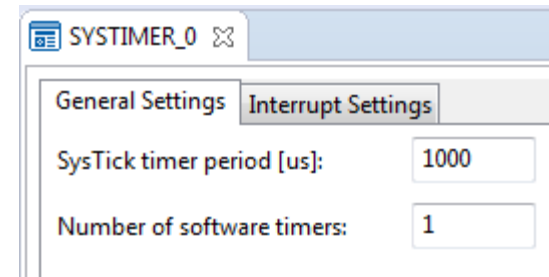
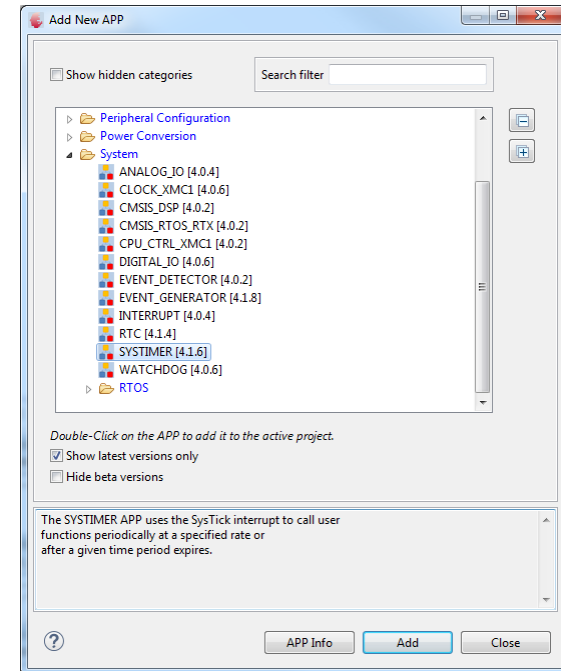
▲ DIGITAL_IO_0		
	pin	#22 (P0.5) ▼
▲ DIGITAL_IO_1		
	pin	#23 (P0.6) ▼
▲ DIGITAL_IO_2		
	pin	#24 (P0.7) ▼
▲ DIGITAL_IO_3		
	pin	#27 (P0.8) ▼
▲ DIGITAL_IO_4		
	pin	#28 (P0.9) ▼
▲ DIGITAL_IO_5		
	pin	#29 (P0.10) ▼

Getting started – Example 1

RGB lamp using LED_LAMP APP (17/20)

7. Configure SysTick

- › Add **SYSTIMER** to the project
- › Double-click **SYSTIMER** APP to open UI
 - Set **SysTick timer period** to **1000 us**
 - Set **Number of software timers** to **1**
- › Click  to generate code



Getting started – Example 1

RGB lamp using LED_LAMP APP (18/20)



8. Define SYSTIMER callback function

- › Purpose of callback function is to change the colour and brightness of LED every 7 seconds
- › Initialize callback function

```
void OneSecTick(void);
```

- › Create software timer and start timer

```
uint32_t timer_id;  
TimerId = SYSTIMER_CreateTimer(1000000, SYSTIMER_MODE_PERIODIC, OneSecTick, NULL);  
SYSTIMER_StartTimer(TimerId);
```

Getting started – Example 1

RGB lamp using LED_LAMP APP (19/20)



8. Define SYSTIMER callback function (continued)

```
void OneSecTick(void)
{
    static uint8_t step = 0;
    if (++step==1) { // change color to red
        RGB_LAMP_config.led_intensity[0] = 4095;
        RGB_LAMP_config.led_intensity[1] = 0;
        RGB_LAMP_config.led_intensity[2] = 0;
        LED_LAMP_SetColorAdv(&RGB_LAMP, 0x2AC);
    }
    else if (step==9) { // change color to green
        RGB_LAMP_config.led_intensity[0] = 0;
        RGB_LAMP_config.led_intensity[1] = 4095;
        RGB_LAMP_config.led_intensity[2] = 0;
        LED_LAMP_SetColorAdv(&RGB_LAMP, 0x2AC);
    }
    else if (step==17) { // change color to blue
        RGB_LAMP_config.led_intensity[0] = 0;
        RGB_LAMP_config.led_intensity[1] = 0;
        RGB_LAMP_config.led_intensity[2] = 4095;
        LED_LAMP_SetColorAdv(&RGB_LAMP, 0x2AC);
    }
    else if (step==25) { // change color to white
        RGB_LAMP_config.led_intensity[0] = 1365;
        RGB_LAMP_config.led_intensity[1] = 1365;
        RGB_LAMP_config.led_intensity[2] = 1365;
        LED_LAMP_SetColorAdv(&RGB_LAMP, 0x2AC);
    }
    else if (step==33) { // dim down slowly to 0%
        RGB_LAMP_config.dim_level = 0;
        LED_LAMP_SetDimLevelExponentialAdv(&RGB_LAMP, 0x64, 0xDB);
    }
    else if (step==40) { // dim up slowly to 25%
        RGB_LAMP_config.dim_level = 1024;
        LED_LAMP_SetDimLevelExponentialAdv(&RGB_LAMP, 0x64, 0xDB);
    }
    else if (step==47) {
        step = 0;
    }
}
```


Getting started – Example 1

RGB lamp using LED_LAMP APP (20/20)

› Build project

1. Click 
2. Wait for Build to finish

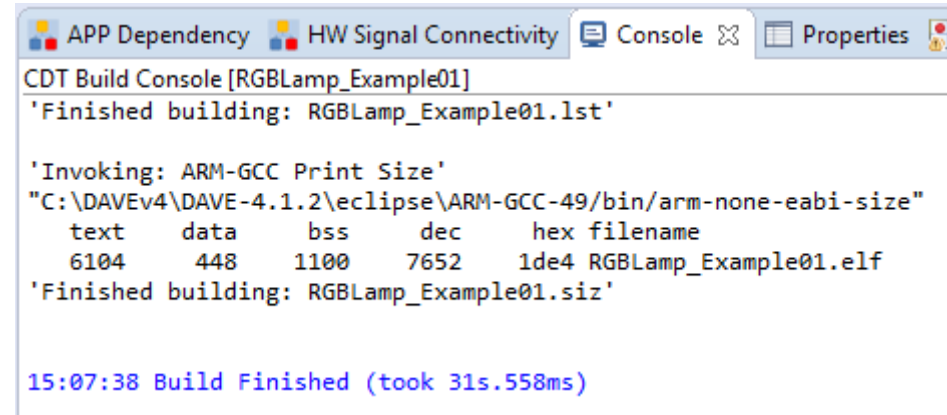
› Download code

1. Click 
2. Switch to Debug view



3. Click  to run code

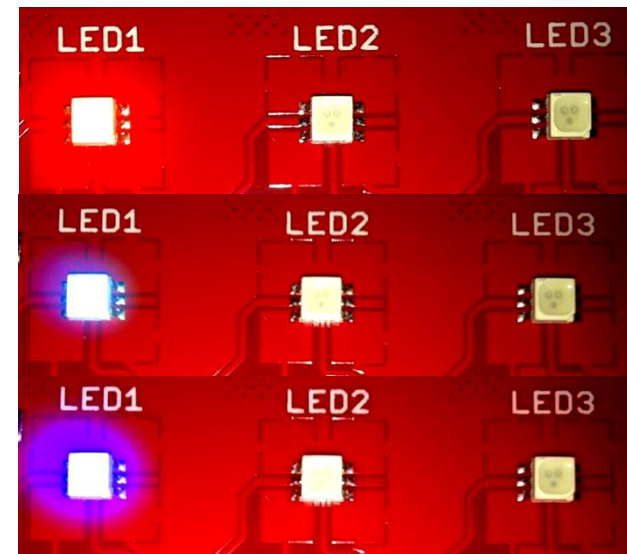
› LED1 regularly changes color and brightness



```
CDT Build Console [RGBLamp_Example01]
'Finished building: RGBLamp_Example01.lst'

'Invoking: ARM-GCC Print Size'
"C:\DAVEv4\DAVE-4.1.2\eclipse\ARM-GCC-49\bin\arm-none-eabi-size"
  text    data    bss     dec     hex filename
  6104     448    1100    7652    1de4 RGBLamp_Example01.elf
'Finished building: RGBLamp_Example01.siz'

15:07:38 Build Finished (took 31s.558ms)
```



Connect to PC

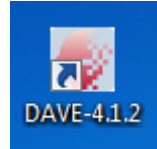
White LED Card



Getting started – Example 2

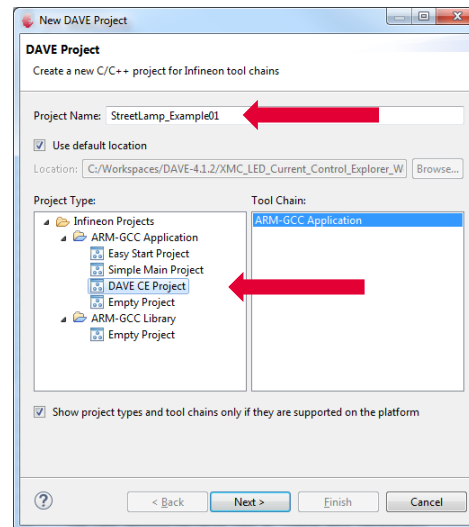
White lamp using LED_LAMP APP (2/19)

1. Open DAVE™

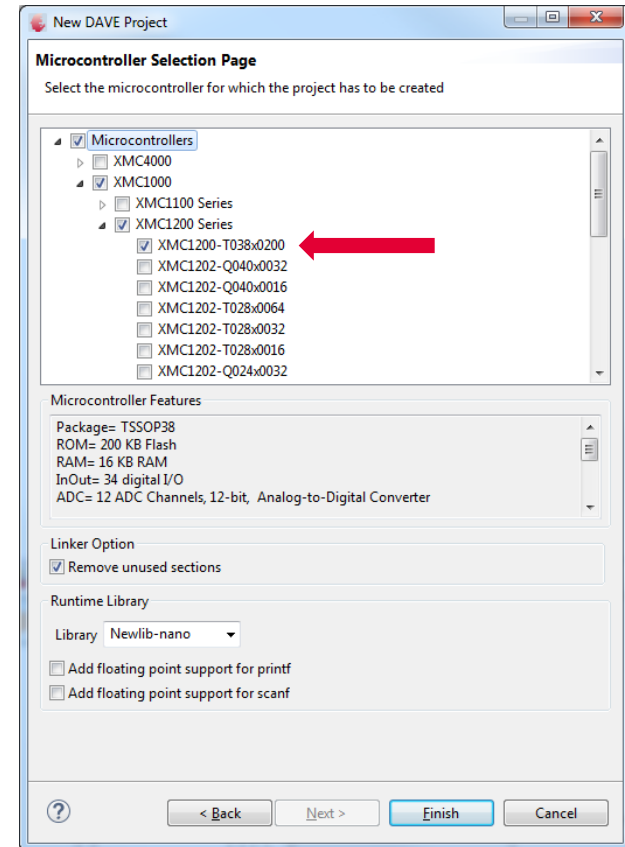


2. In DAVE™ workspace, create a new "DAVE™ CE" project:

- › File->New->DAVE™ Project
- › Give the project a name e.g. "WHITE_LAMP_EXAMPLE"
- › Select "DAVE™ CE Project" as Project Type



3. Select the device accordingly



Getting started – Example 2

White lamp using LED_LAMP APP (3/19)

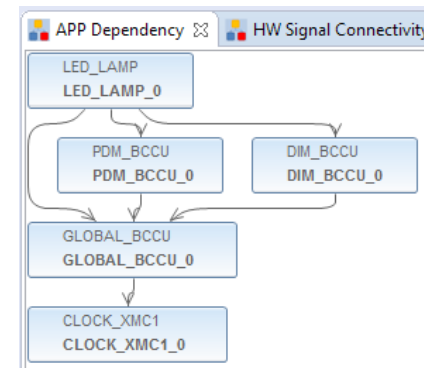
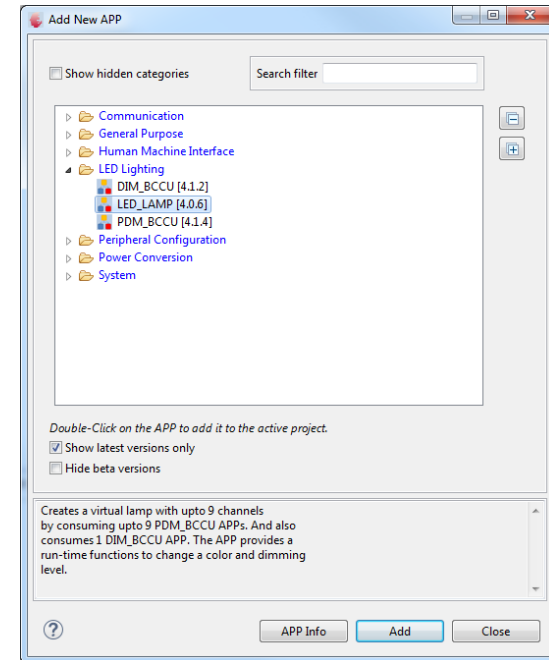


- › This example demonstrates White Lamp functionality using LED_LAMP APP
- › We will use the System Timer (SysTick) as the time base for the interrupt
 - Time base of 1 s
 - In the interrupt, a new target dimming level is set and the dimming process is started
- › Next, we will show you the steps to creating this project:
 1. Instantiate LED_LAMP APP
 2. Configure LED_LAMP APP
 3. Assign PDM_BCCU APPs to the right channels
 4. Configure BCCU Channels
 5. Configure Brightness and Color Control Unit (BCCU) global settings
 6. Configure SysTick
 7. Define the SYSTIMER callback function

Getting started – Example – White lamp using LED_LAMP APP (4/19)

1. Instantiate LED_LAMP APP

- › Click  to add new APP
- › Select the **LED_LAMP** APP
- › LED_LAMP APP automatically aggregates a BCCU channel app (**PDM_BCCU**), a BCCU dimming engine app (**DIM_BCCU**) and a BCCU global app (**GLOBAL_BCCU**)

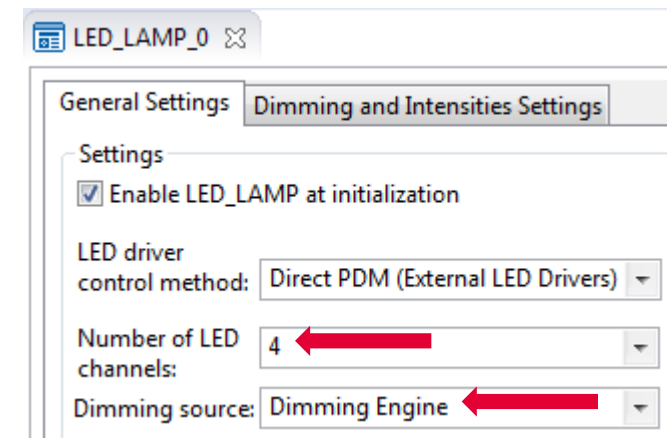
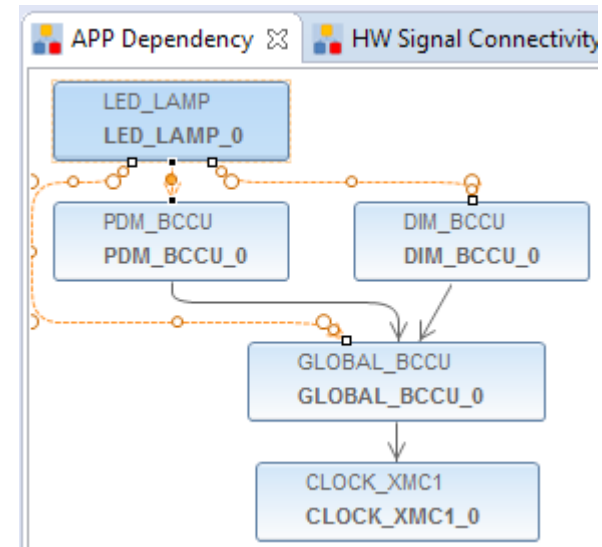


Getting started – Example 2

White lamp using LED_LAMP APP (5/19)

2. Configure LED_LAMP APP

- › Double-click **LED_LAMP_0** to open UI
- › Under **General Settings** tab,
 - set **Number of LED channels** to **4**
 - select **Dimming Engine** as **Dimming Source**



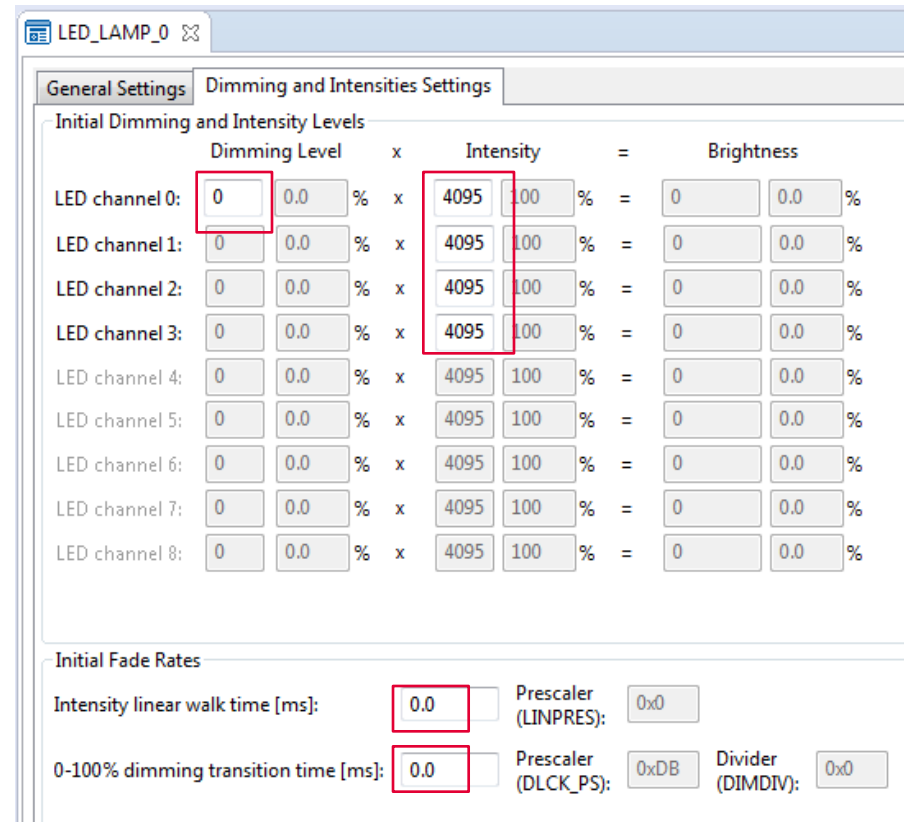
Getting started – Example 2

White lamp using LED_LAMP APP (6/19)

2. Configure LED_LAMP APP (continued)

> Under **Dimming and Intensities Settings** tab

- set initial **Dimming Level** to **0**
- set initial **Channel Intensities** to **4095**
- set initial **Intensity linear walk time** to **0 ms**
- Set initial **0-100% dimming transition time** to **0 ms**



The screenshot shows the 'LED_LAMP_0' configuration window with the 'Dimming and Intensities Settings' tab selected. The 'Initial Dimming and Intensity Levels' section contains a table with 9 rows for LED channels 0 through 8. Each row has input fields for 'Dimming Level' (set to 0), 'Intensity' (set to 4095), and 'Brightness' (set to 0.0%). The 'Initial Fade Rates' section at the bottom has input fields for 'Intensity linear walk time [ms]' and '0-100% dimming transition time [ms]', both set to 0.0. Other settings like 'Prescaler (LINPRES)', 'Prescaler (DLCK_PS)', and 'Divider (DIMDIV)' are also visible.

	Dimming Level	x	Intensity	=	Brightness
LED channel 0:	0	x	4095	=	0.0 %
LED channel 1:	0	x	4095	=	0.0 %
LED channel 2:	0	x	4095	=	0.0 %
LED channel 3:	0	x	4095	=	0.0 %
LED channel 4:	0	x	4095	=	0.0 %
LED channel 5:	0	x	4095	=	0.0 %
LED channel 6:	0	x	4095	=	0.0 %
LED channel 7:	0	x	4095	=	0.0 %
LED channel 8:	0	x	4095	=	0.0 %

Initial Fade Rates

Intensity linear walk time [ms]: 0.0 Prescaler (LINPRES): 0x0

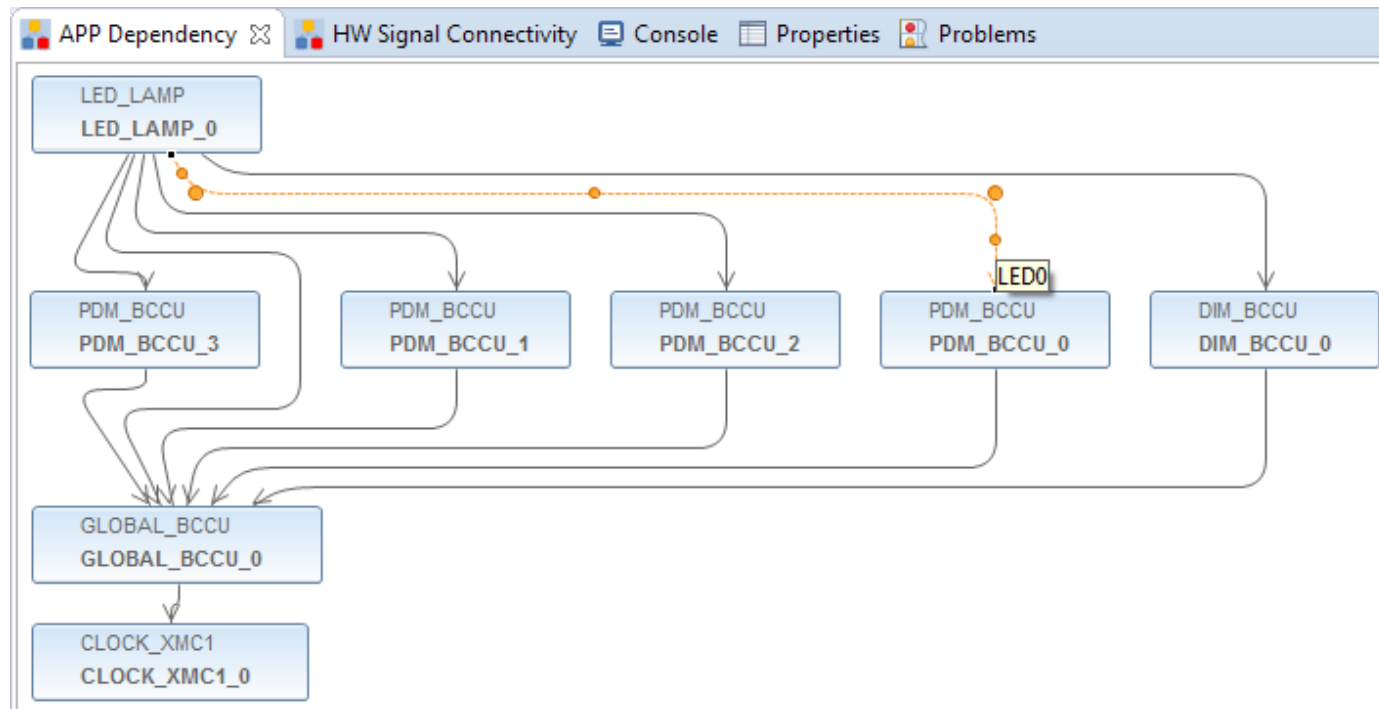
0-100% dimming transition time [ms]: 0.0 Prescaler (DLCK_PS): 0xDB Divider (DIMDIV): 0x0

Getting started – Example 2

White lamp using LED_LAMP APP (7/19)

3. Assign PDM_BCCU APPs to the right channels

- › Hover mouse cursor over the connecting arrow to a PDM_BCCU APP
- › A label will appear momentarily e.g. LED0/LED1/LED2/LED3

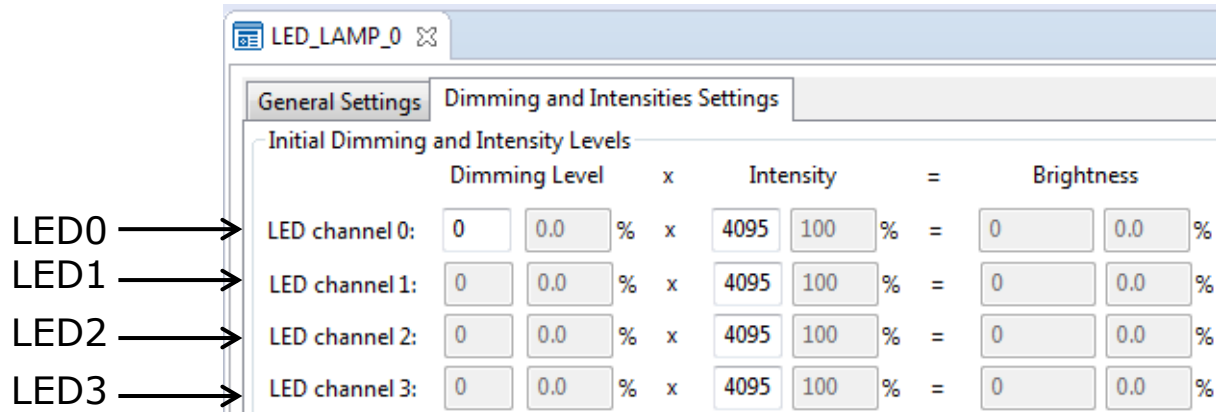


Getting started – Example 2

White lamp using LED_LAMP APP (8/19)

3. Assign PDM_BCCU APPs to the right channels (continued)

- › The labels correspond to the LED channels in the UI



Initial Dimming and Intensity Levels					
	Dimming Level	x	Intensity	=	Brightness
LED0	LED channel 0:	0 0.0 %	x 4095 100 %	=	0 0.0 %
LED1	LED channel 1:	0 0.0 %	x 4095 100 %	=	0 0.0 %
LED2	LED channel 2:	0 0.0 %	x 4095 100 %	=	0 0.0 %
LED3	LED channel 3:	0 0.0 %	x 4095 100 %	=	0 0.0 %

- › Rename the PDM_BCCU instance label according to the table below

- Right-click PDM_BCCU APP
- Select "Rename Instance Label"

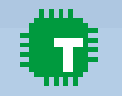
Label	New Label
LED0	D_LED1
LED1	D_LED2
LED2	D_LED3
LED3	D_LED4

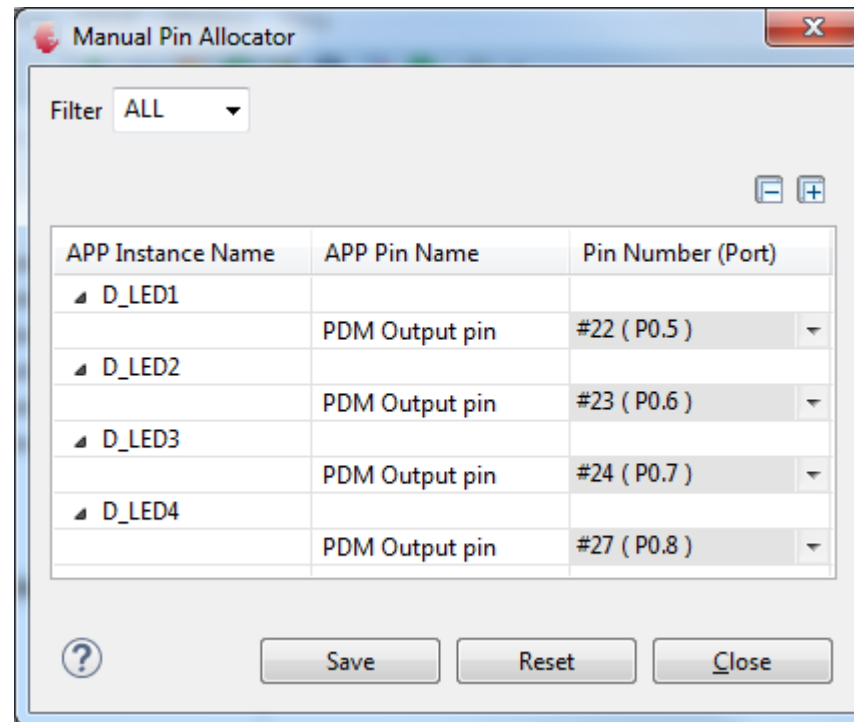
- Repeat the above steps with the other 2 PDM_BCCU APP instances

Getting started – Example 2

White Lamp using LED_LAMP APP (9/19)

3. Assign PDM_BCCU APPs to the right channels (continued)

- › Click  to assign pins to PDM_BCCU APPs
- › Assign pins as shown:

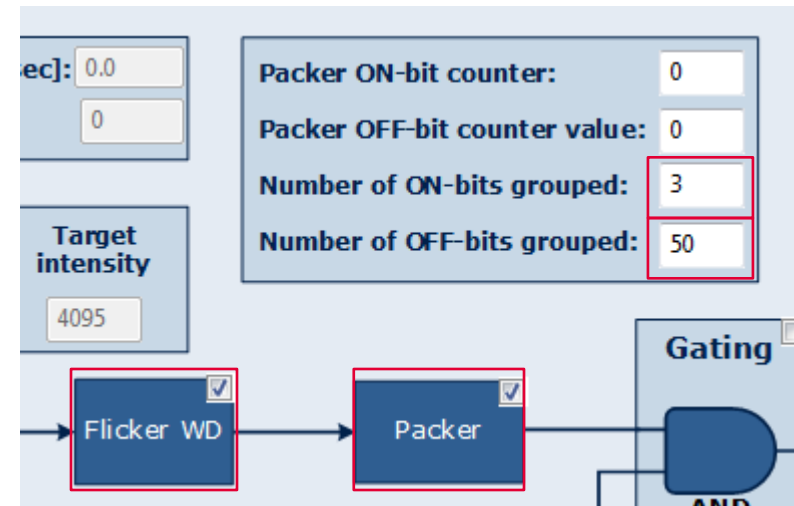
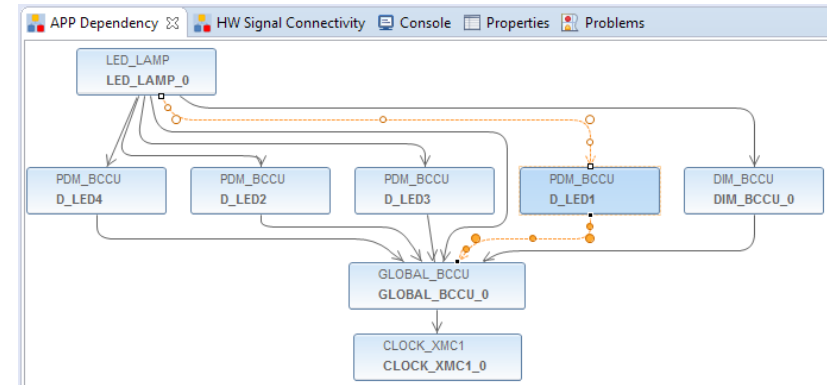


Getting started – Example 2

White Lamp using LED_LAMP APP (10/19)

4. Configure BCCU Channels

- › Double-click PDM_BCCU instance **D_LED1**
- › Select **Flicker Watchdog (WD)** to enable
- › Select **Packer** to enable
- › Set **Number of ON-bits grouped** to **3**
- › Set **Number of OFF-bits grouped** to **50**

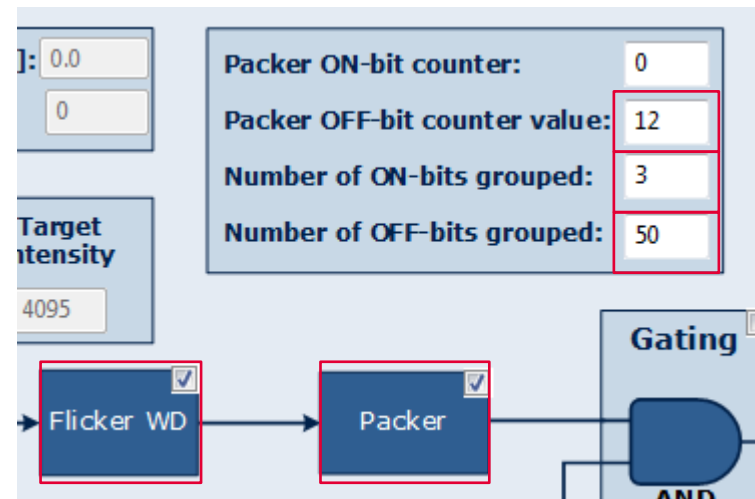
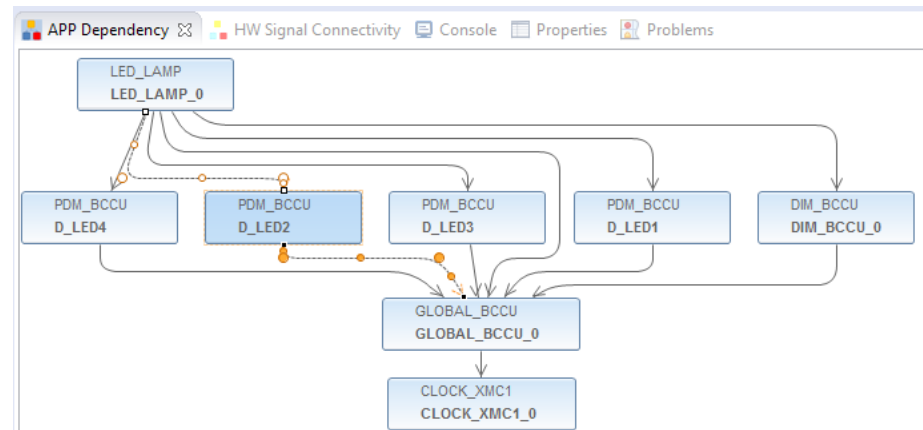


Getting started – Example 2

White lamp using LED_LAMP APP (11/19)

4. Configure BCCU Channels (continued)

- › Double-click PDM_BCCU instance **D_LED2**
- › Select **Flicker Watchdog (WD)** to enable
- › Select **Packer** to enable
- › Set **Packer OFF-bit counter value** to **12**
- › Set **Number of ON-bits grouped** to **3**
- › Set **Number of OFF-bits grouped** to **50**

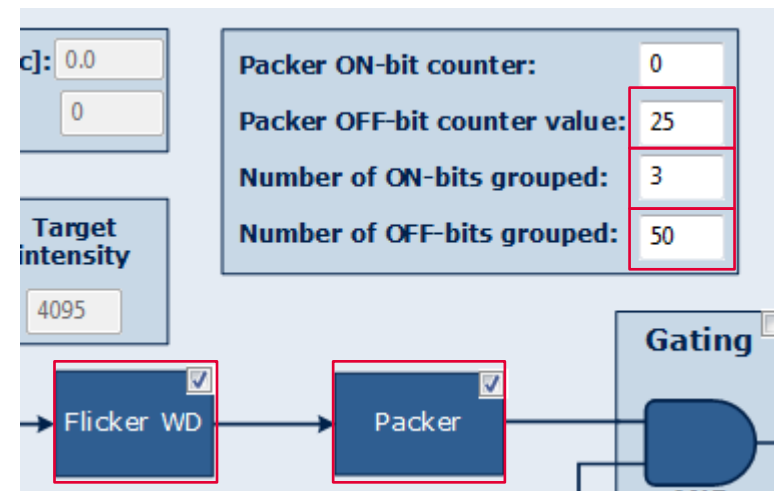
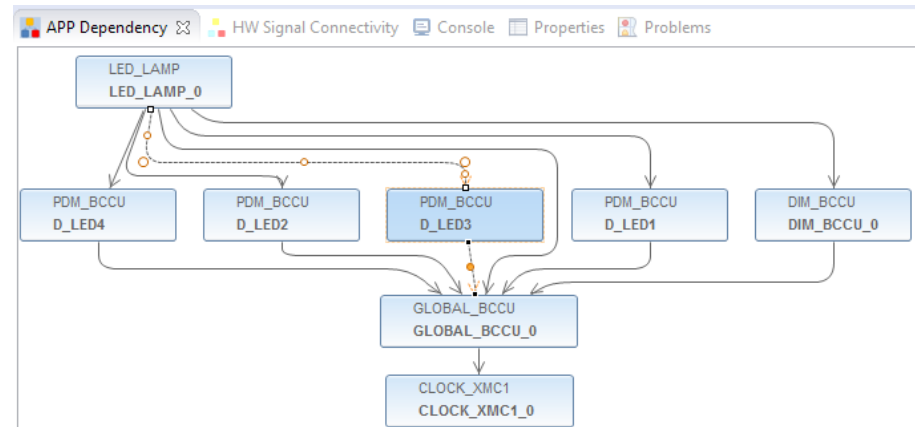


Getting started – Example 2

White lamp using LED_LAMP APP (12/19)

4. Configure BCCU Channels (continued)

- › Double-click PDM_BCCU instance **D_LED3**
- › Select **Flicker Watchdog (WD)** to enable
- › Select **Packer** to enable
- › Set **Packer OFF-bit counter value** to **25**
- › Set **Number of ON-bits grouped** to **3**
- › Set **Number of OFF-bits grouped** to **50**

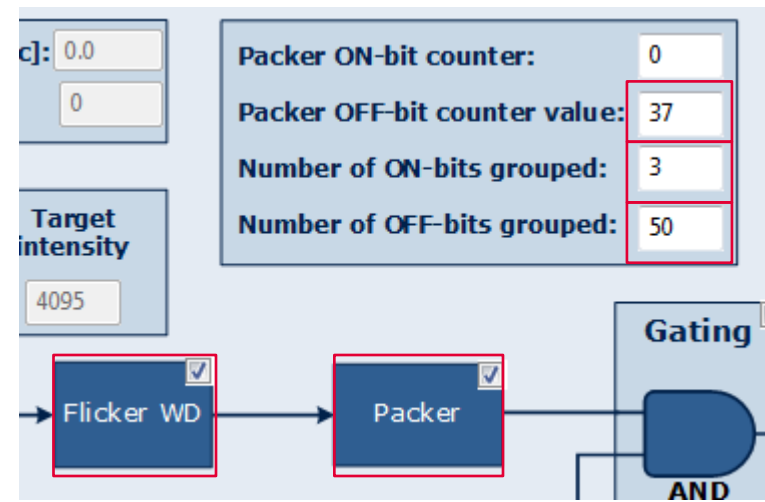
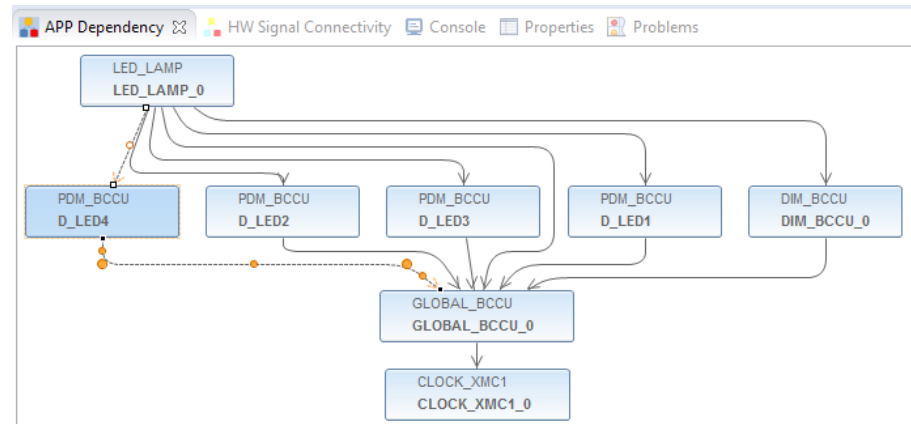


Getting started – Example 2

White lamp using LED_LAMP APP (13/19)

4. Configure BCCU Channels (continued)

- › Double-click PDM_BCCU instance **D_LED4**
- › Select **Flicker Watchdog (WD)** to enable
- › Select **Packer** to enable
- › Set **Packer OFF-bit counter value** to **37**
- › Set **Number of ON-bits grouped** to **3**
- › Set **Number of OFF-bits grouped** to **50**

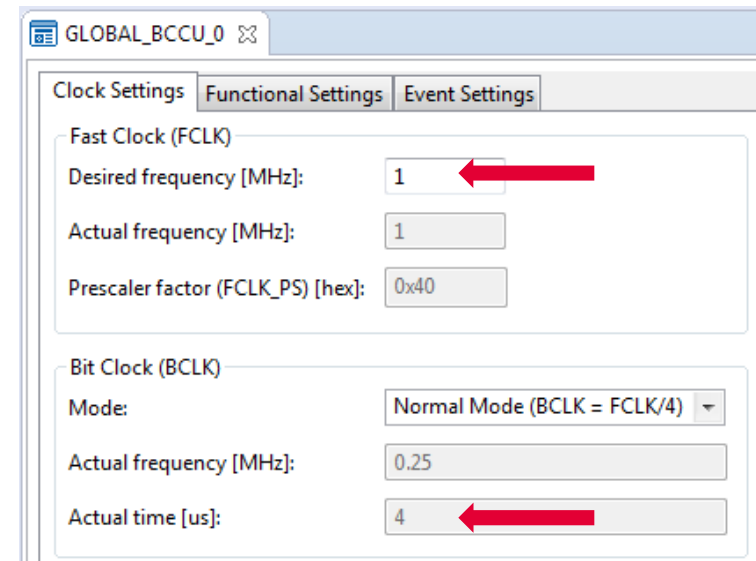
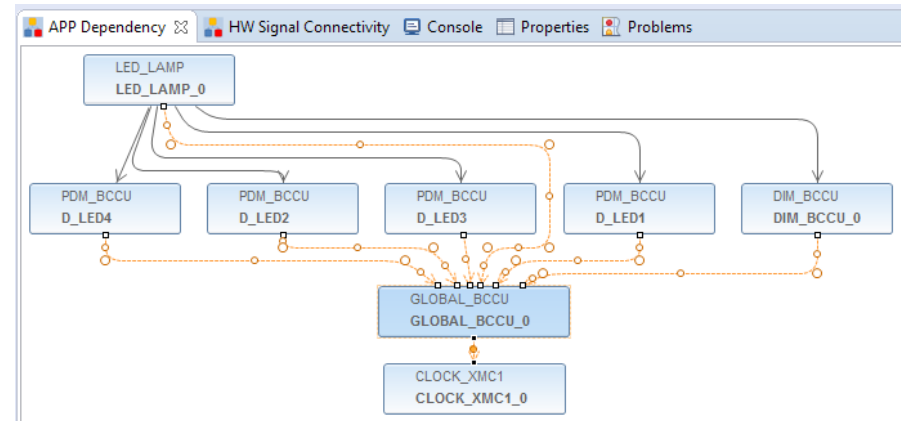


Getting started – Example 2

White lamp using LED_LAMP APP (14/19)

5. Configure BCCU global settings

- › Double-click **GLOBAL_BCCU_0** in **APP Dependency** tab
- › Under **Clock Settings** tab,
 - to get a bit time of 4 us
 - change the **Desired Fast Clock Frequency** to **1 MHz**



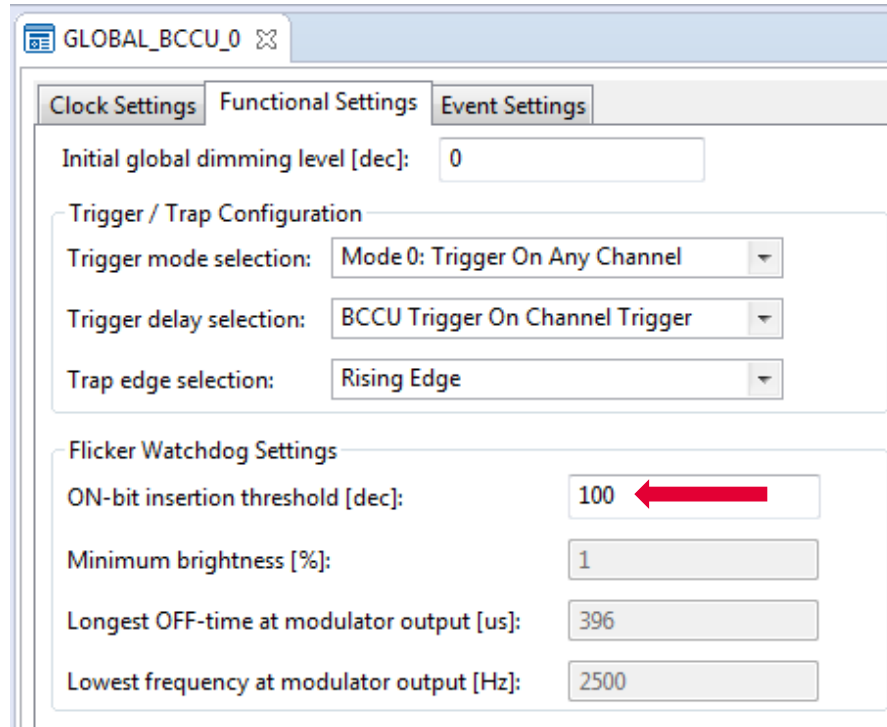
The image shows the configuration window for 'GLOBAL_BCCU_0' with the 'Clock Settings' tab selected. The 'Fast Clock (FCLK)' section has the following values: 'Desired frequency [MHz]' is 1 (highlighted with a red arrow), 'Actual frequency [MHz]' is 1, and 'Prescaler factor (FCLK_PS) [hex]' is 0x40. The 'Bit Clock (BCLK)' section has the following values: 'Mode' is 'Normal Mode (BCLK = FCLK/4)', 'Actual frequency [MHz]' is 0.25, and 'Actual time [us]' is 4 (highlighted with a red arrow).

Getting started – Example 2

White lamp using LED_LAMP APP (15/19)

5. Configure BCCU global settings (continued)

- › Under **Functional Settings** tab,
 - limit the minimum brightness to 1%
 - change **ON-bit insertion threshold** to **100**



The screenshot shows the 'GLOBAL_BCCU_0' configuration window with the 'Functional Settings' tab selected. The 'Initial global dimming level [dec]' is set to 0. Under 'Trigger / Trap Configuration', 'Trigger mode selection' is 'Mode 0: Trigger On Any Channel', 'Trigger delay selection' is 'BCCU Trigger On Channel Trigger', and 'Trap edge selection' is 'Rising Edge'. Under 'Flicker Watchdog Settings', the 'ON-bit insertion threshold [dec]' is set to 100, indicated by a red arrow. Other settings include 'Minimum brightness [%]' at 1, 'Longest OFF-time at modulator output [us]' at 396, and 'Lowest frequency at modulator output [Hz]' at 2500.

Setting	Value
Initial global dimming level [dec]	0
Trigger mode selection	Mode 0: Trigger On Any Channel
Trigger delay selection	BCCU Trigger On Channel Trigger
Trap edge selection	Rising Edge
ON-bit insertion threshold [dec]	100
Minimum brightness [%]	1
Longest OFF-time at modulator output [us]	396
Lowest frequency at modulator output [Hz]	2500

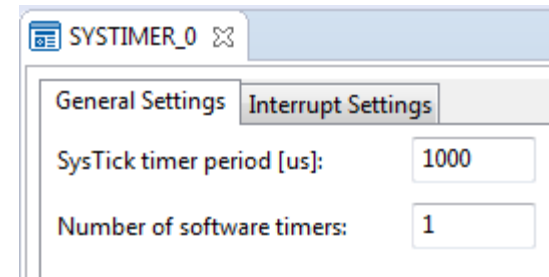
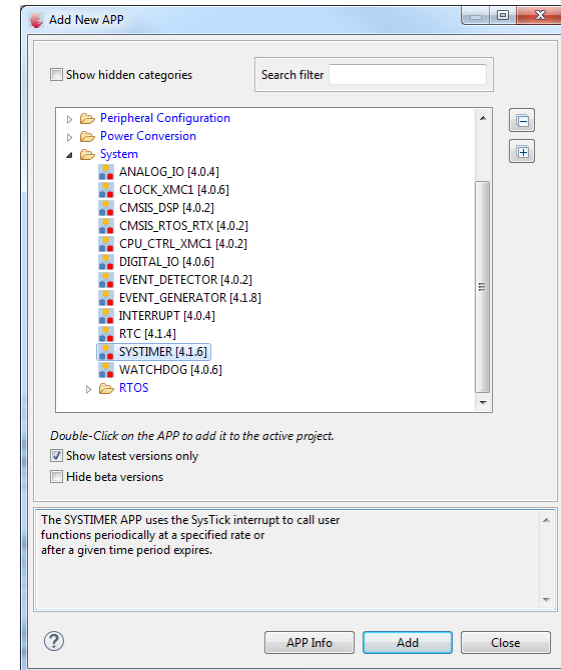
Getting started – Example 2

White lamp using LED_LAMP APP (16/19)

6. Configure SysTick

- › Add **SYSTIMER** to the project
- › Double-click **SYSTIMER** APP to open UI
 - Set **SysTick timer period** to **1000 us**
 - Set **Number of software timers** to **1**

- › Click  to generate code



Getting started – Example 2

White lamp using LED_LAMP APP (17/19)



7. Define SYSTIMER callback function

- › Purpose of callback function is to change the brightness of lamp every 10 seconds
- › Initialize callback function

```
void OneSecTick(void);
```

- › Create software timer and start timer

```
uint32_t timer_id;  
TimerId = SYSTIMER_CreateTimer(1000000, SYSTIMER_MODE_PERIODIC, OneSecTick, NULL);  
SYSTIMER_StartTimer(TimerId);
```

Getting started – Example 2

White lamp using LED_LAMP APP (18/19)



7. Define SYSTIMER callback function (continued)

```
void OneSecTick(void)
{
    static uint8_t step = 0;

    if (++step==1) {
        /* Dim up to 10% slowly */
        LED_LAMP_0_config.dim_level = 410;
        LED_LAMP_SetDimLevelExponentialAdv(&LED_LAMP_0, 0x64, 0xDB);
    }
    else if (step==10) {
        /* Dim up to 100% slowly */
        LED_LAMP_0_config.dim_level = 4095;
        LED_LAMP_SetDimLevelExponentialAdv(&LED_LAMP_0, 0x64, 0xDB);
    }
    else if (step==20) {
        /* Dim down to 0% slowly */
        LED_LAMP_0_config.dim_level = 0;
        LED_LAMP_SetDimLevelExponentialAdv(&LED_LAMP_0, 0x64, 0xDB);
    }
    else if (step==30) {
        step = 0;
    }
}
```

Getting started – Example 2

White lamp using LED_LAMP APP (19/19)

› Build project

1. Click 
2. Wait for Build to finish

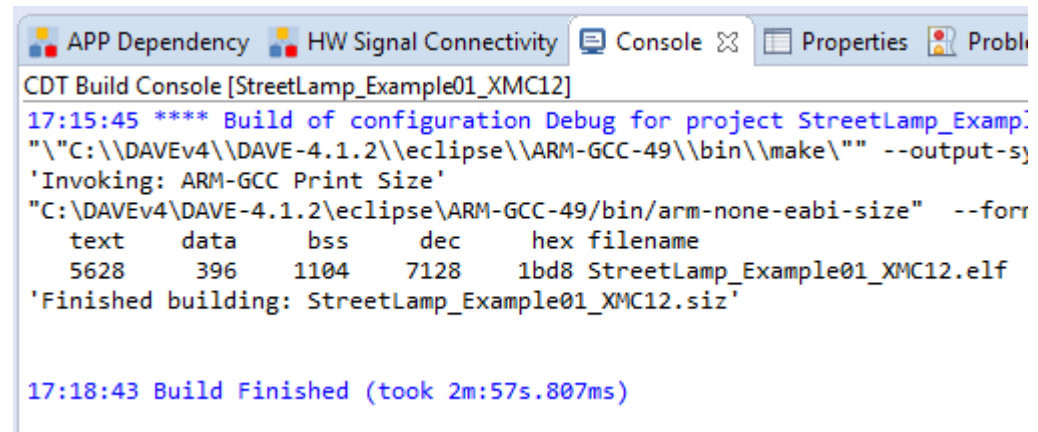
› Download code

1. Click 
2. Switch to Debug view



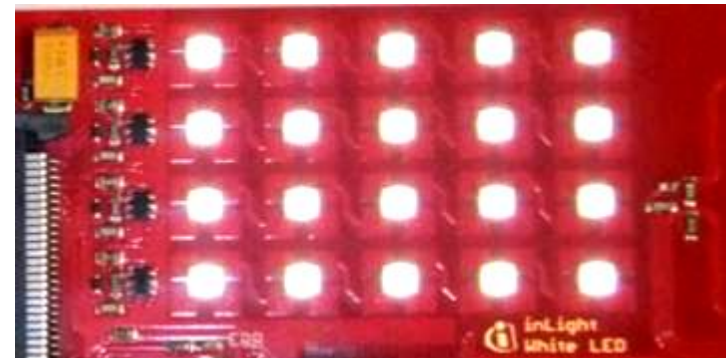
3. Click  to run code

› LEDs regularly change brightness

The screenshot shows the 'Console' tab of the IDE. The text in the console window is as follows:

```
CDT Build Console [StreetLamp_Example01_XMC12]
17:15:45 **** Build of configuration Debug for project StreetLamp_Example01_XMC12
"C:\DAVEv4\DAVE-4.1.2\eclipse\ARM-GCC-49\bin\make\" --output-sy
'Invoking: ARM-GCC Print Size'
"C:\DAVEv4\DAVE-4.1.2\eclipse\ARM-GCC-49\bin/arm-none-eabi-size" --forr
text      data      bss      dec      hex filename
5628       396      1104     7128     1bd8 StreetLamp_Example01_XMC12.elf
'Finished building: StreetLamp_Example01_XMC12.siz'

17:18:43 Build Finished (took 2m:57s.807ms)
```



Agenda

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Kit overview

2

Hardware overview

3

Tooling overview – boot modes

4

Tooling overview – DAVE™

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Getting started - examples

6

General information

7

References

General information (1/2)

- › Where to buy kit:
 - <http://ehitex.com/starter-kits/for-xmc1000>
 - Order Number: KIT_XMC1x_AK_LED_001

- › Infineon parts utilized on kit:

Infineon parts	Order number
XMC1200 Microcontroller	XMC1200-T038F0200
XMC4200 Microcontroller	XMC4200-Q48F256
5 V regulator	IFX25001TFV50
3V3 regulator	IFX25001MEV33
BCR421/SC74 LED Driver	BCR421UE6327HTSA1
BCR450 LED Driver	BCR450E6327HTSA1
TDA7200 RF Receiver	TDA7200XUMA1

General information (2/2)

- › Kit documentation:
 - [LED Lighting Application Kit](#)

- › Video series: XMC1000 boot kit getting started
 - [Introduction](#)
 - [DAVE™ \(Version 4\) - Project Management](#)
 - [Boot Mode Index Configuration via DAVE™ or MemTool](#)
 - [Example Projects Download](#)

Agenda

1

Kit overview

2

Hardware overview

3

Tooling overview – boot modes

4

Tooling overview – DAVE™

5

Getting started - examples

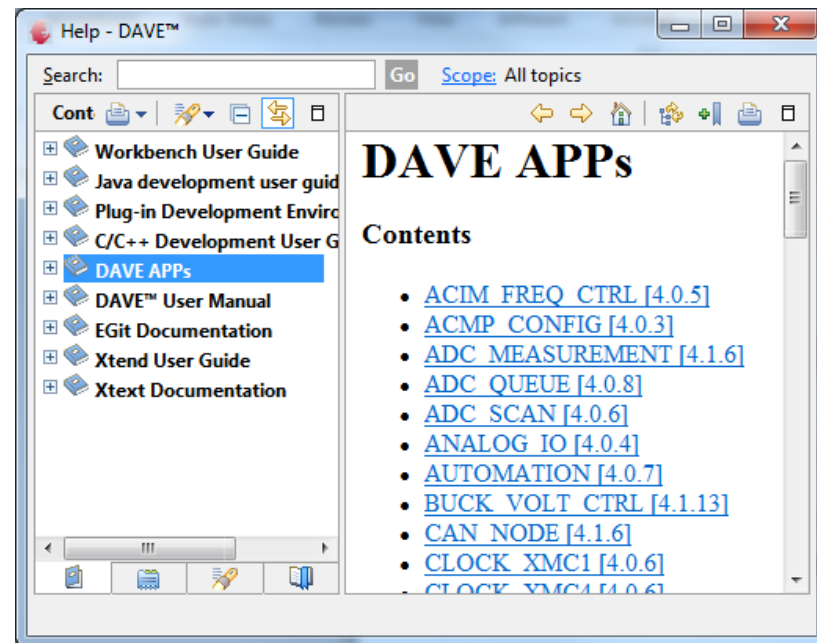
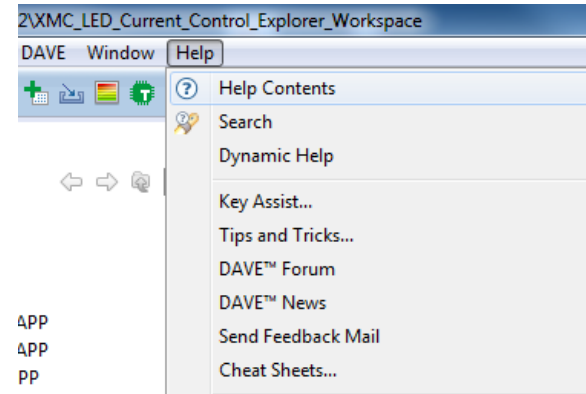
6

General information

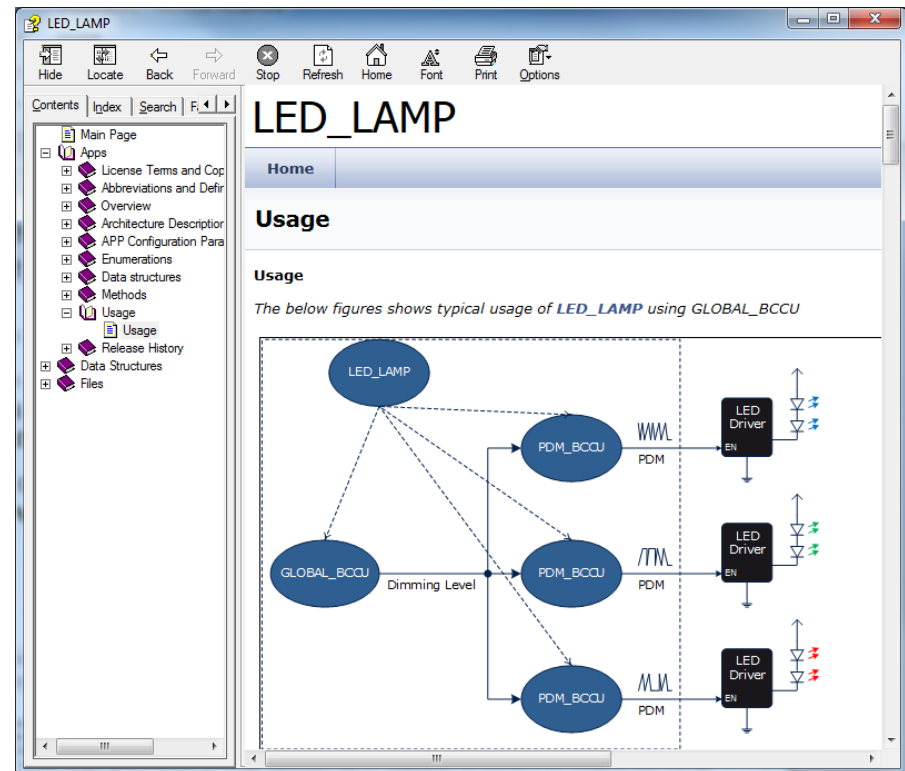
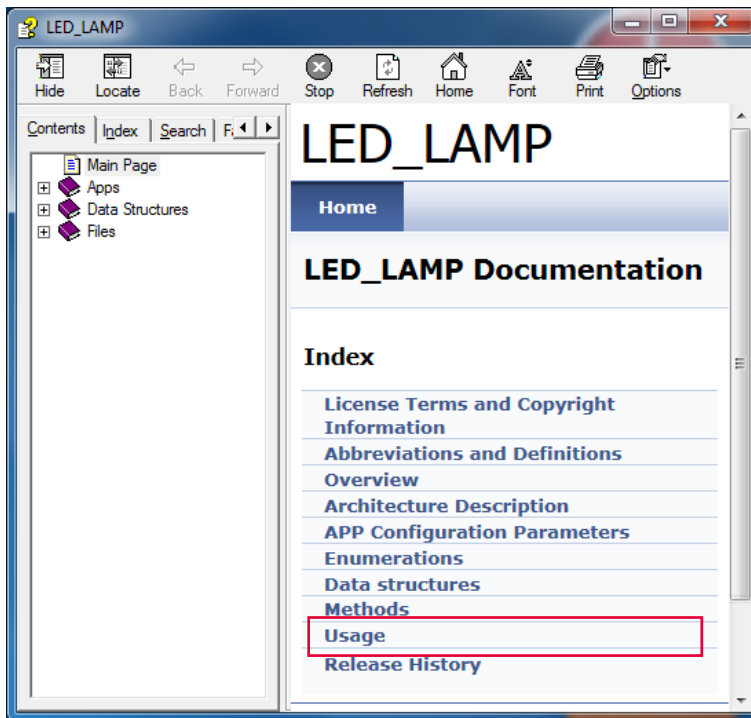
7

References

- › Go to **Help** → **Help Contents**
- › Click **DAVE™ APPs**
- › Click APP_Name (e.g. **LED_LAMP**)



- › Usage information can be found under **Usage** section



Where to download example projects?

- › Two sets of example projects available
 - Additional application examples
 - Can be downloaded directly from the web
 - DAVE™ project library examples
 - Can be downloaded from library in DAVE™
 - Can also be downloaded directly from the web

Where to download example projects?

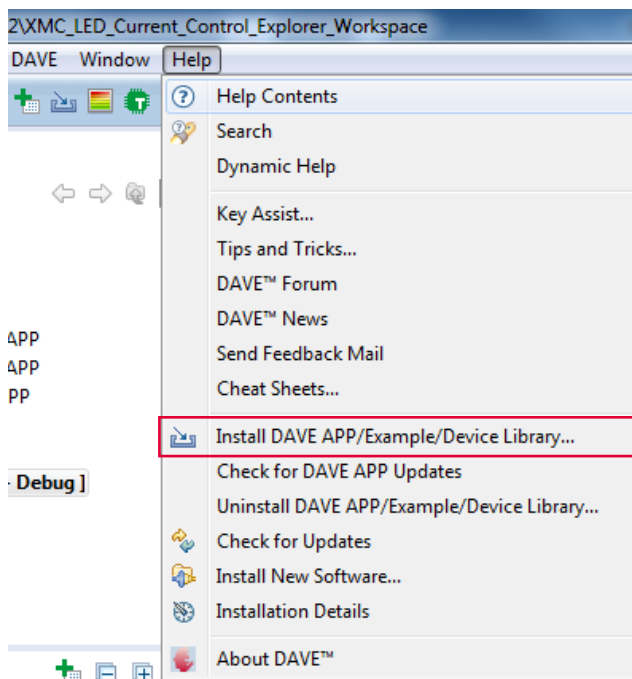
- › Additional application examples available
 - RGB Lamps Example with Apps
(LED_LAMP_3RGB_EXAMPLE_XMC12.zip)
 - Demonstrates 3 RGB Lamps functionality using 3 LED_LAMP APPs
(9 Channels, 3 Dimming Engines)
 - RGB Lamp Example
(BCCU_RGB_LAMP_EXAMPLE.zip)
 - Demonstrates 1 RGB Lamp functionality using XMC™ Lib

Where to download example projects?

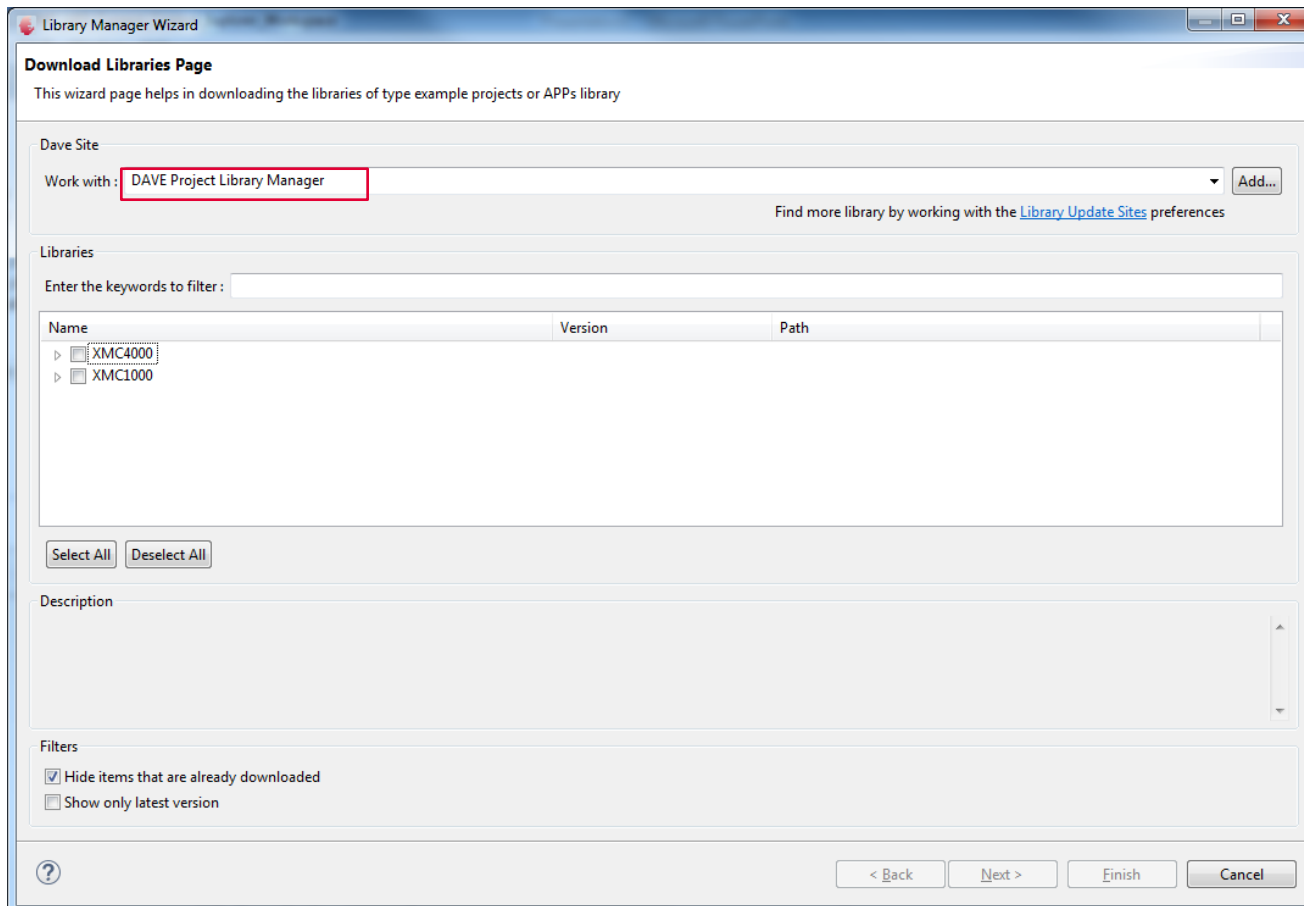
- › Additional application examples available
 - White Lamp Example
(BCCU_WHITE_LAMP_EXAMPLE.zip)
 - Demonstrates white lamp functionality using XMC™ Lib
- › Can be downloaded from the web [HERE](#)

How to load example project in DAVE™? (1/5)

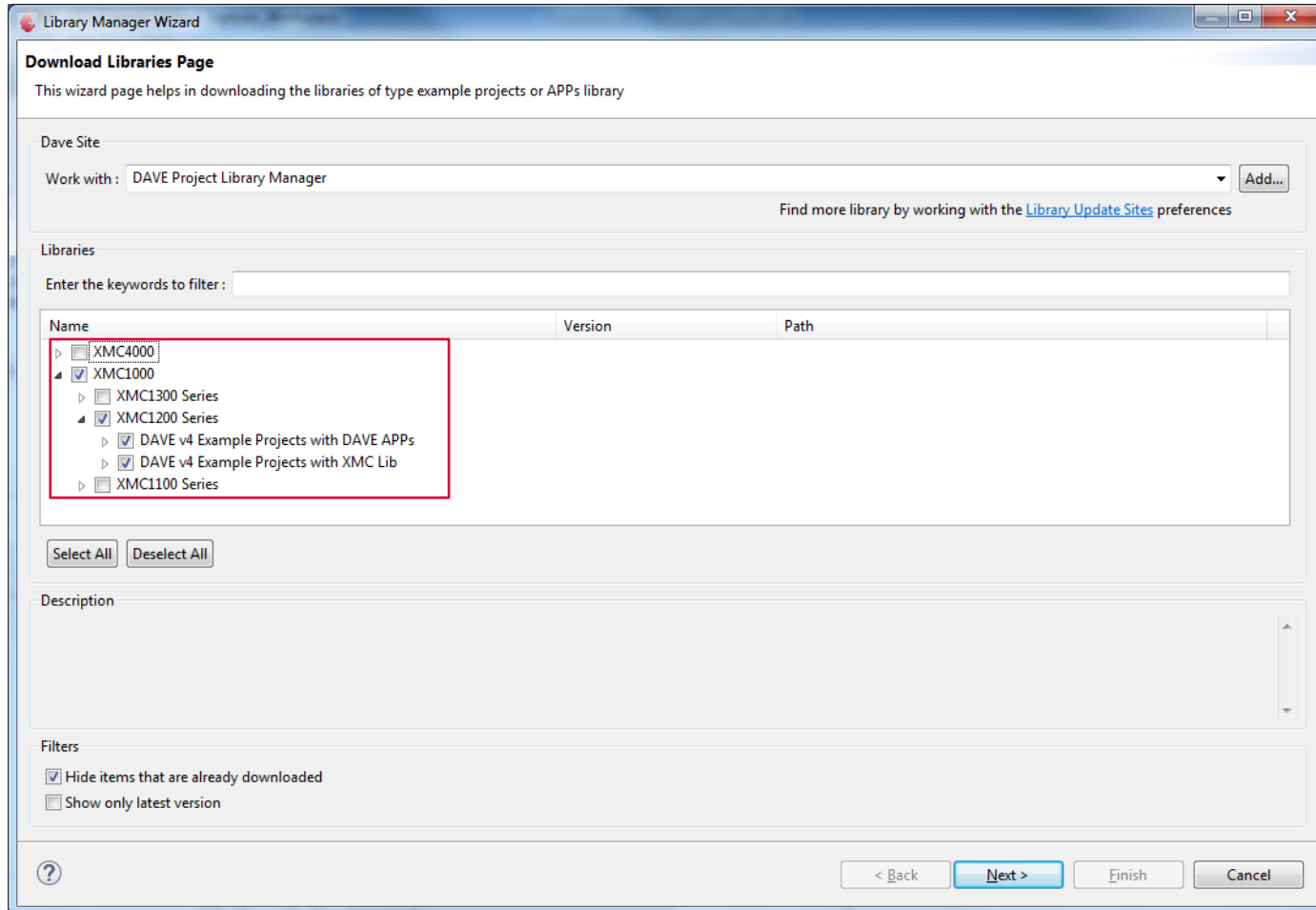
- › Download example projects via DAVE™ library store
 - **Help → Install DAVE™ APP/Example/Device Library...**



- › Select **DAVE™ Project Library Manager** in the drop-down menu

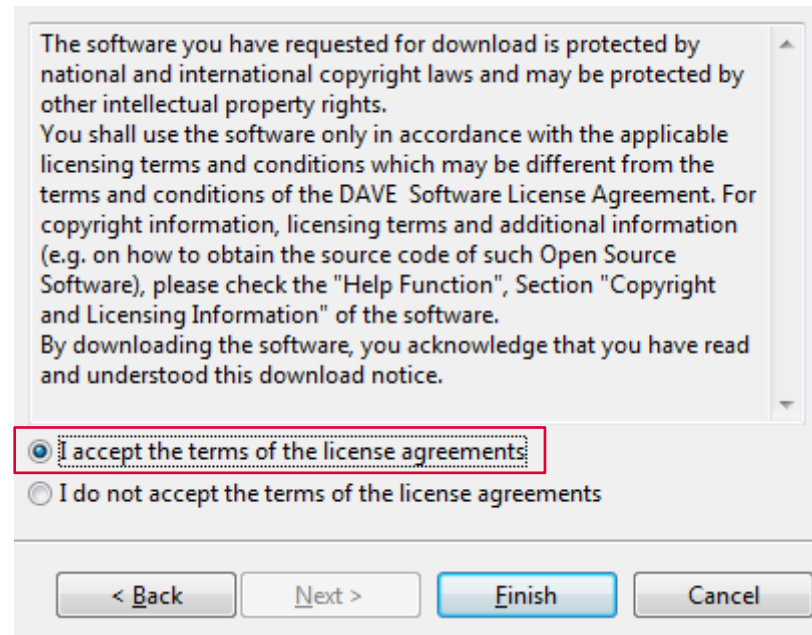


- › Select examples in the **Libraries** window and click Next



How to load example project in DAVE™? (4/5)

- › Accept terms of the license agreement and click Finish



- › DAVE™ example projects are installed

How to load example project in DAVE™? (5/5)

- › Download Example Projects from the web

<http://www.infineon.com/dave/v4>



XMC™ Lib (Low Level Driver for XMC™ MCUs) and DAVE™ APPs composed to application examples



- Download the project zip file and unzip to a known location
- Open **DAVE™** and go to **File** → **Import** → **Infineon** → **DAVE™ Project**
- Select **Select Archive File**
- Browse to the downloaded DAVE™ project zip file
- Click **Open**
- Click **Finish**

Support material

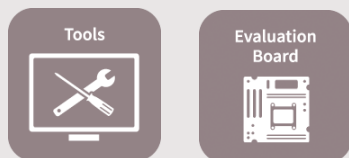
Collaterals and Brochures



- › Product Briefs
- › Selection Guides
- › Application Brochures
- › Presentations
- › Press Releases, Ads

› www.infineon.com/XMC

Technical Material



- › Application Notes
- › Technical Articles
- › Simulation Models
- › Datasheets, MCDS Files
- › PCB Design Data

› www.infineon.com/XMC

› [Kits and Boards](#)

› [DAVE™](#)

› [Software and Tool Ecosystem](#)

Videos



- › Technical Videos
- › Product Information Videos

› [Infineon Media Center](#)

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› [Technical Assistance Center \(TAC\)](#)

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