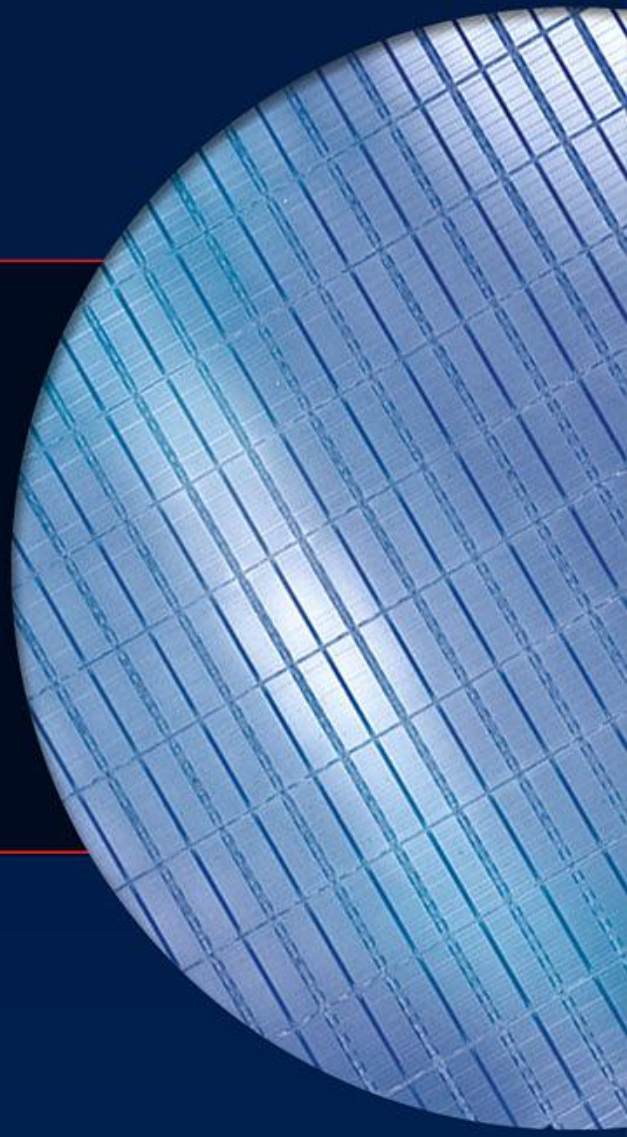
Мікропроцесорна техніка (лекція 2)

Благітко Б.Я.

2018 р.

PSoC Designer 5.4

Designing with PSoC



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PSoC's Routing Resources

Цифрова частина системи

Digital PSoC Blocks

- Counter
- PWM
- Timer

PWMs, Timers and Counters

- PWMs, Timers and Counters share many capabilities but each provides specific capabilities.

- **When to Use a PWM**

- The most common use of the **PWM** is to generate periodic waveforms with adjustable duty cycles. The PWM also provides optimized features for power control, motor control, switching regulators and lighting control. The PWM can also be used as a clock divider by driving a clock into the clock input and using the terminal count or a PWM output as the divided clock output.

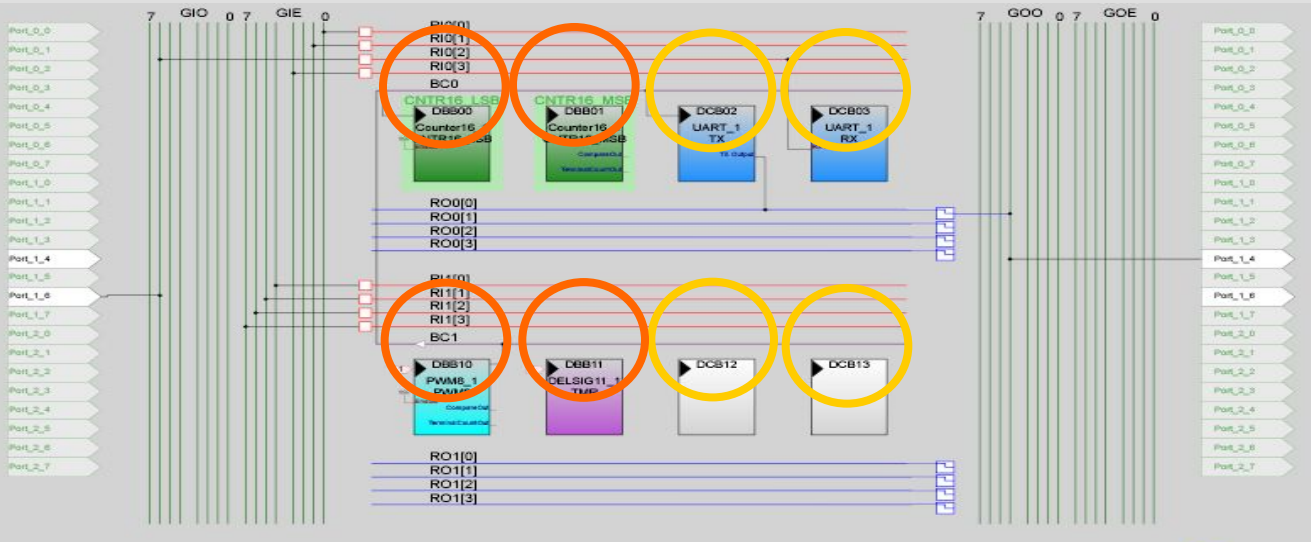
PWMs, Timers and Counters

- **When to Use a Counter**
- A **Counter** component is better used in situations that require the counting of a number of events but also provides rising edge capture input as well as a compare output.

- **When to Use a Timer**
- A **Timer** component is better used in situations focused on timing the length of events, measuring the interval of multiple rising and/or falling edges, or for multiple capture events.

Цифрові блоки

- Multiple Rows of Digital Blocks*
- Each Row Contains:
  - Two Digital Basic Bocks (DBB)
  - Two Digital Communication Blocks (DCB)

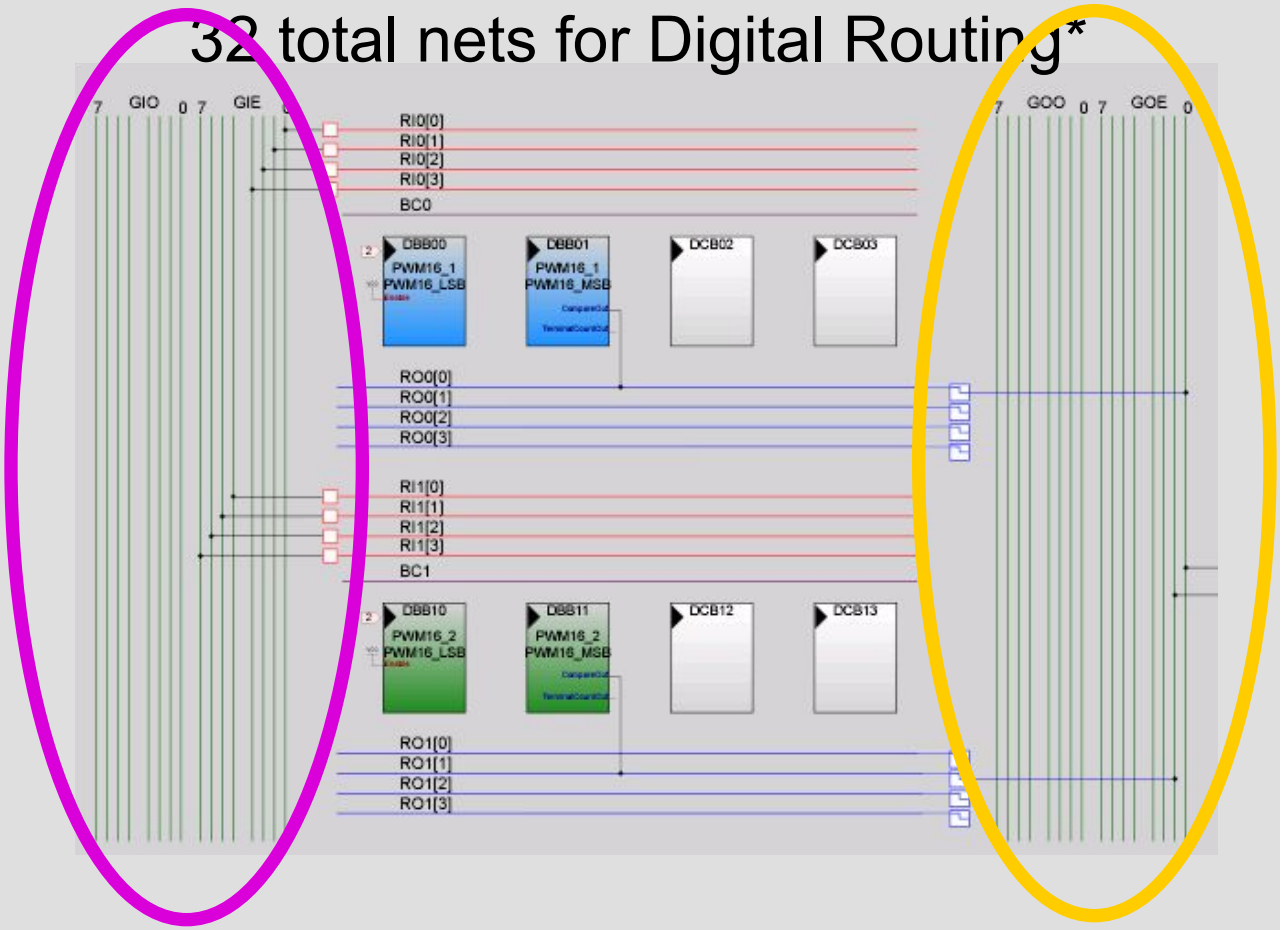


*Number of rows depends on the family

Global Digital Interconnect

16 Окремих загальних входів*

32 total nets for Digital Routing*



16 Окремих загальних виходів*

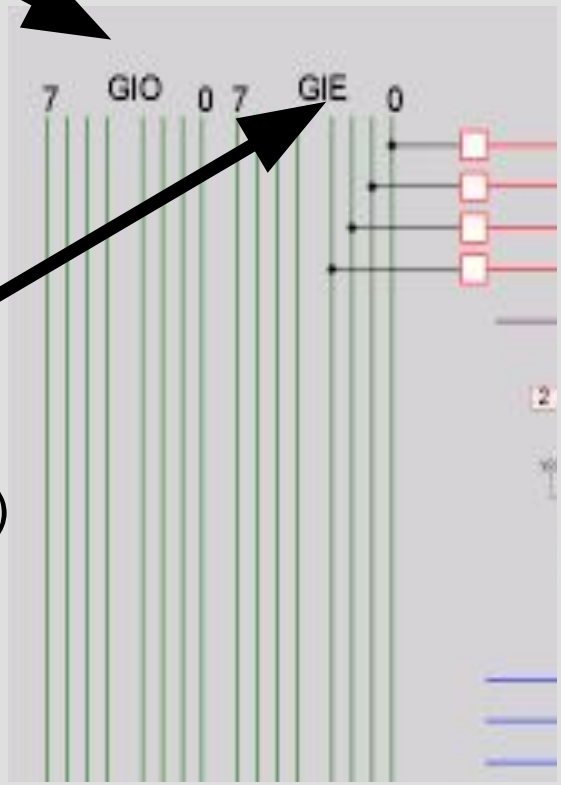
*Depends on the PSoC family

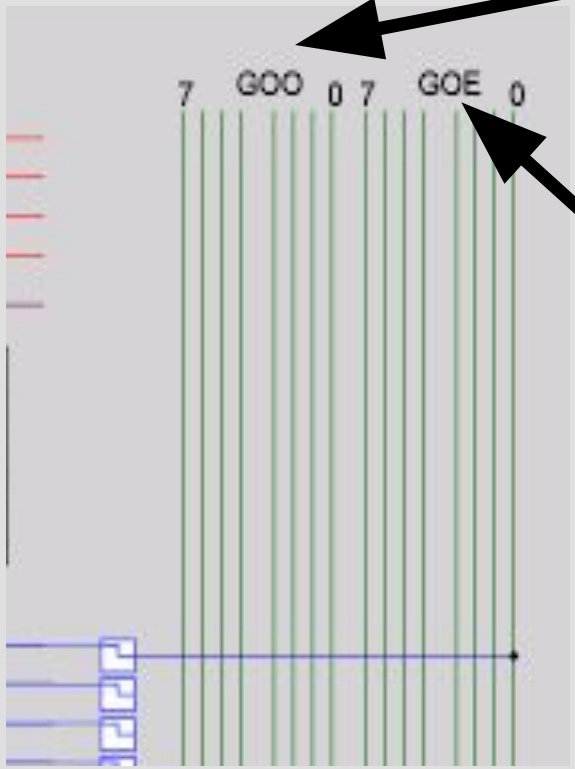
Global Digital Interconnect

Окремі загальні входи/ виходи поділяються на парні та непарні

GIO = Окремі загальні входи (парні)

GIE = Окремі загальні входи (непарні)



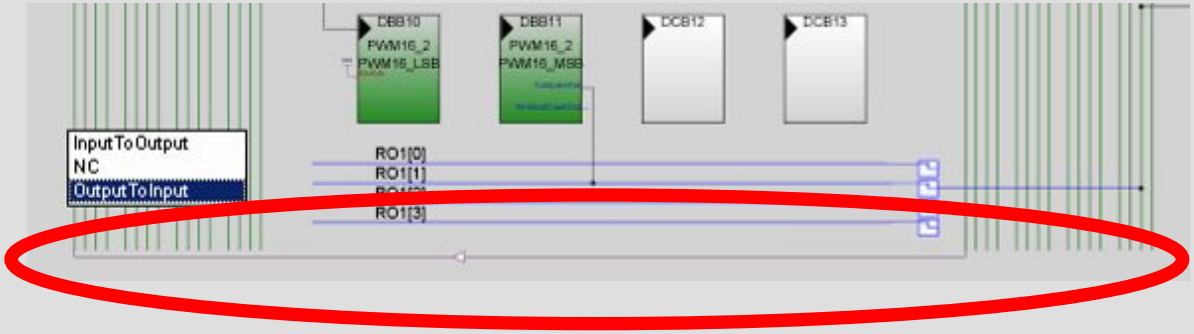


GOO = Окремі загальні виходи (парні)

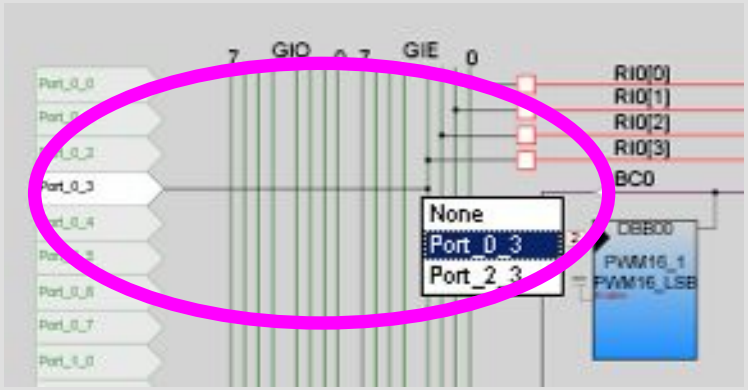
GOE = Окремі загальні виходи (непарні)

Global Digital Interconnect

- Global nets can be used to:
  - Під'єднання до інших Global nets
  - Під'єднання до Pins



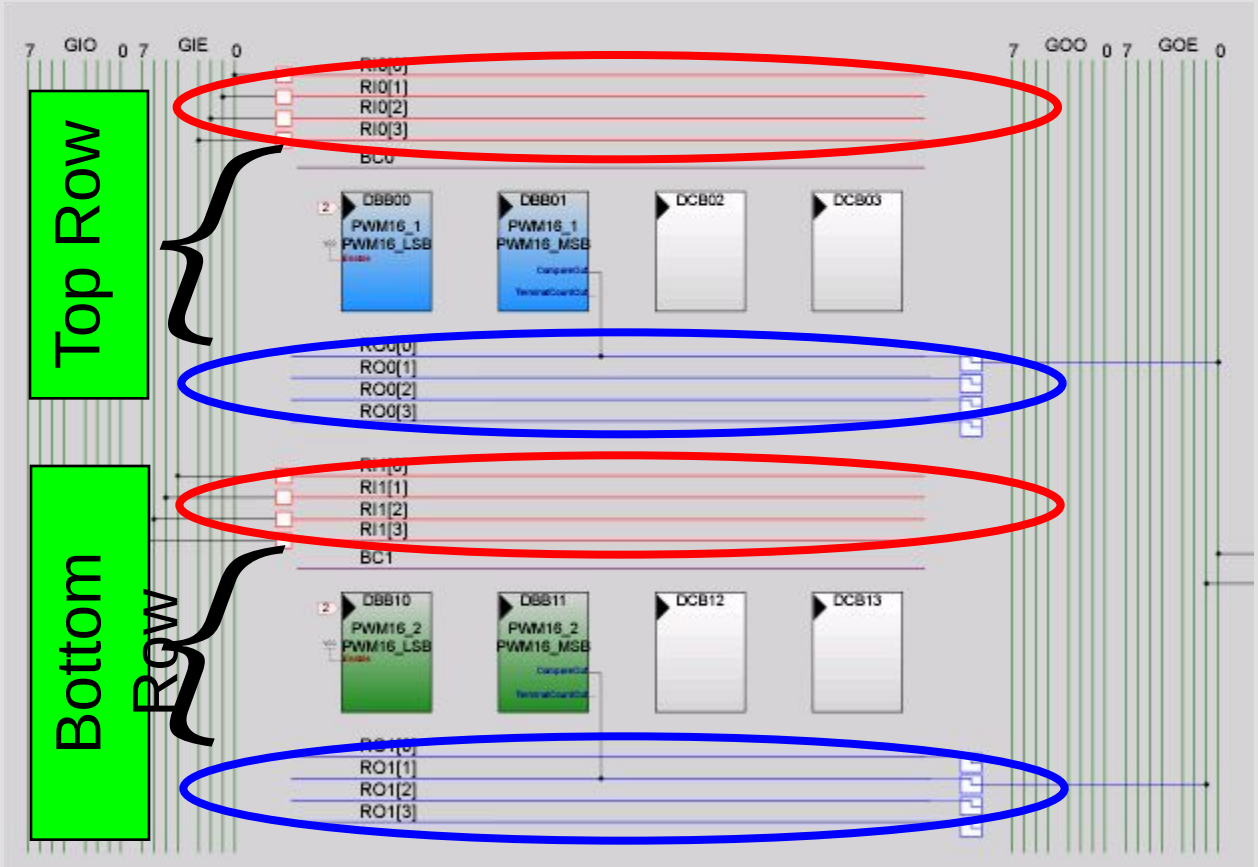
Вхід:



Вихід:

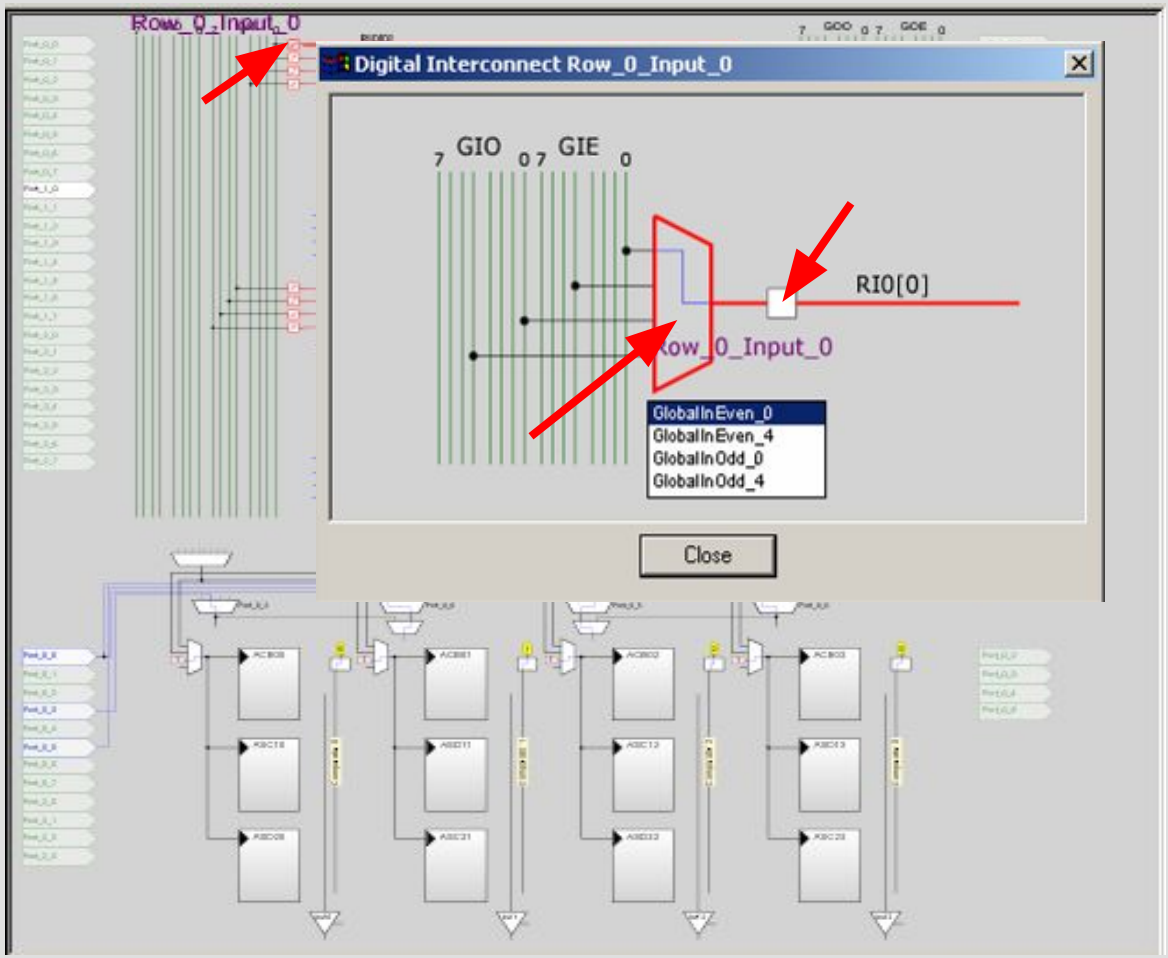
Row Digital Interconnect

- Each row of Digital Blocks has its own set of Row Interconnects
- 4 Input Rows and
- 4 Output Rows for the top row of digital blocks
- 4 Input Rows and
- 4 Output Rows for the bottom row of digital blocks



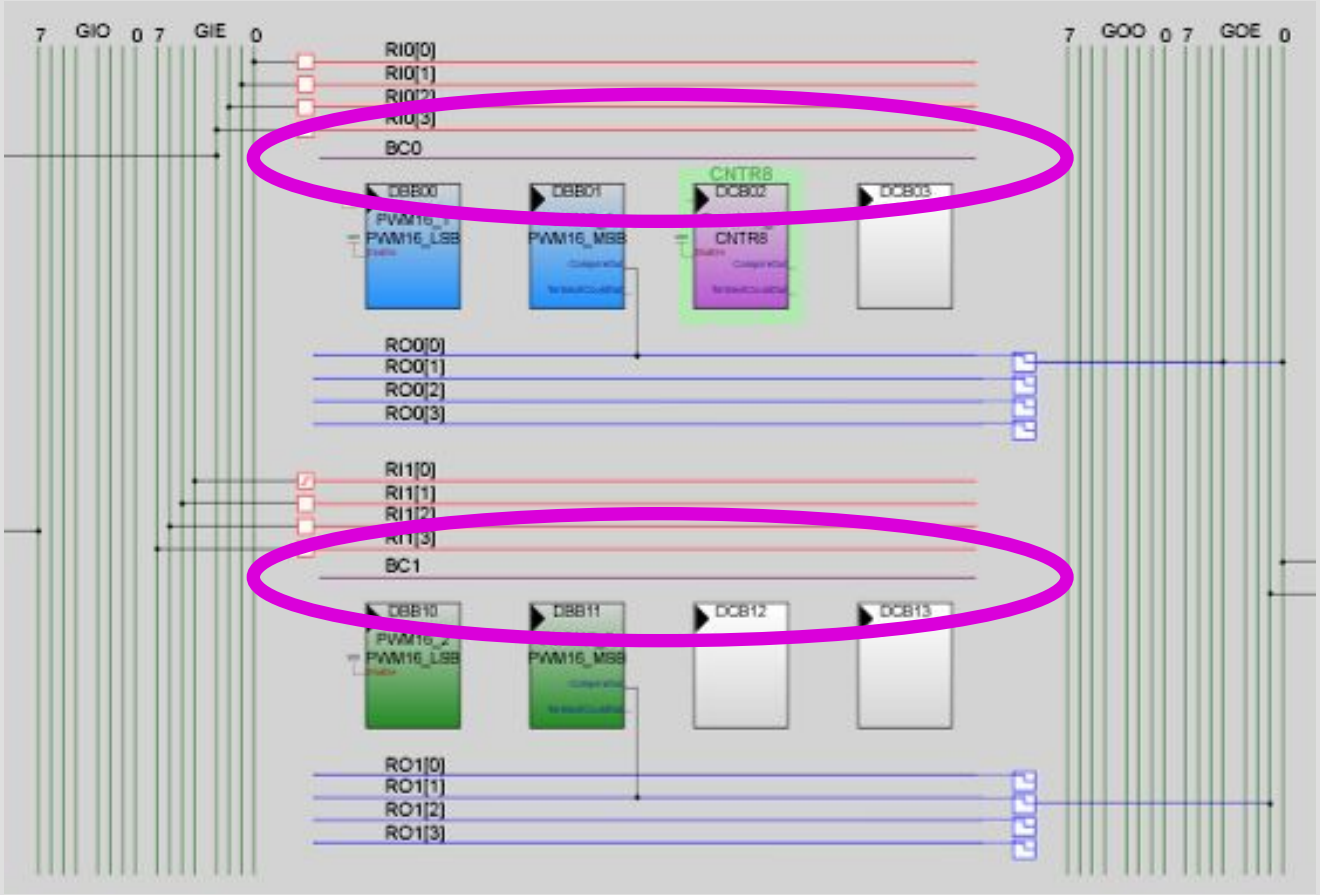
Input Row Nets for Digital Signals

- Input Row Nets can be used for:
  - Connection to Input Global Nets
  - Clock Synchronization



Row Broadcast Nets for Digital Signals

For every digital block row, there is one Row Broadcast Net



Global Resources

Module Objectives

At the end of this module, you should be able to:

- List the three types of PSoC datasheets
- Give examples of when to use each type of datasheet
- Describe the process of routing user modules out to pins
- Outline the various design considerations of using PSoC

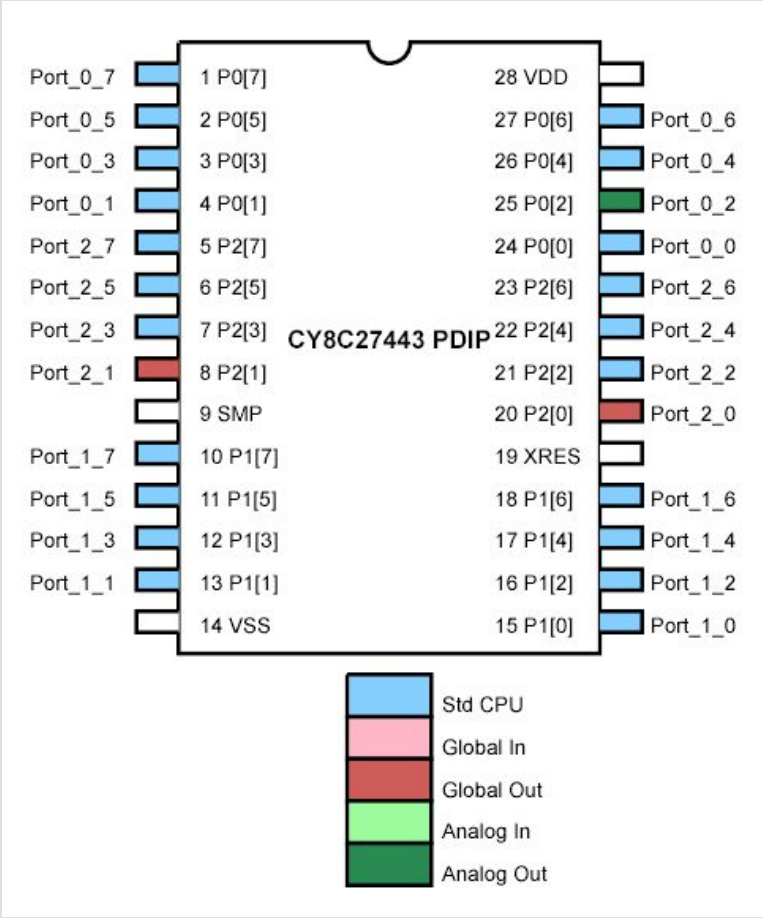
User Module Datasheets

Each user module has its own datasheet contained within the PSoC Designer software

- User module block diagrams
- Detailed user module specifications
- Placement considerations
- Example code

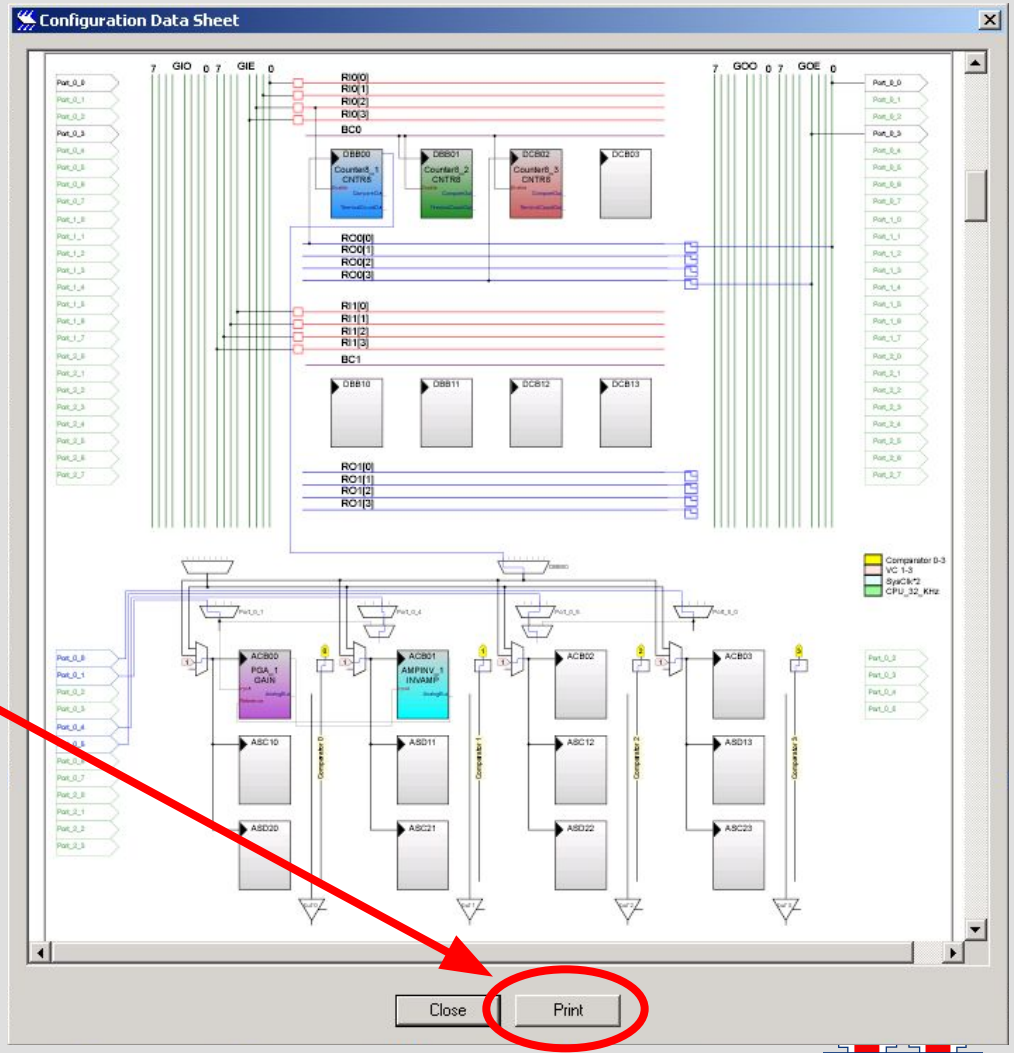
PSoC Project Configuration Datasheet

- User-defined pin outs are color-coded and detailed in the project configuration datasheet.

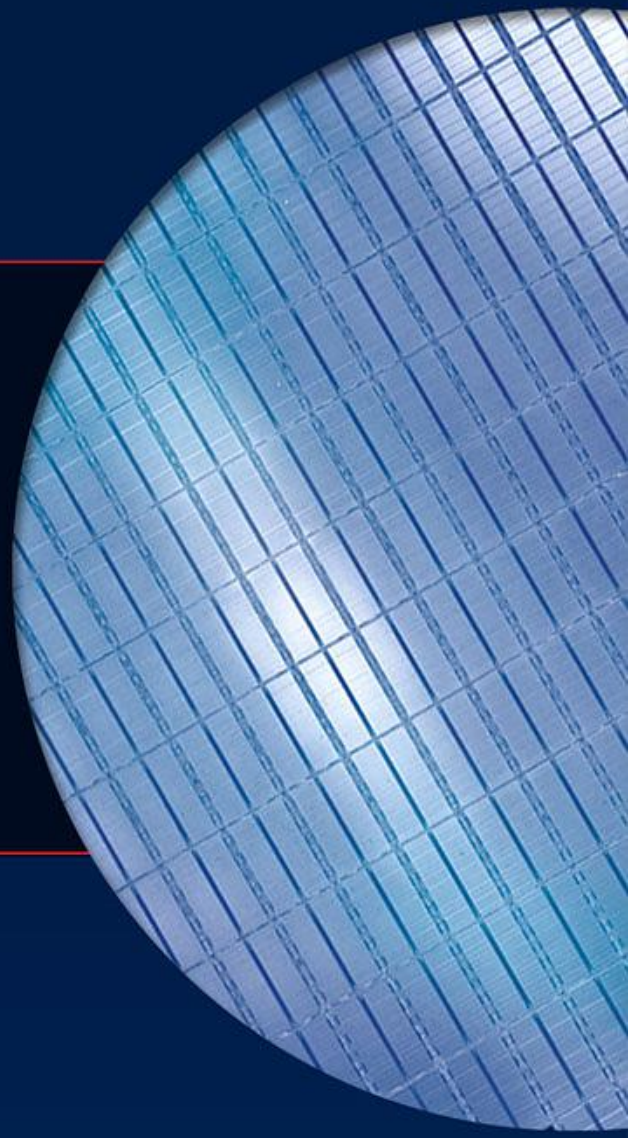


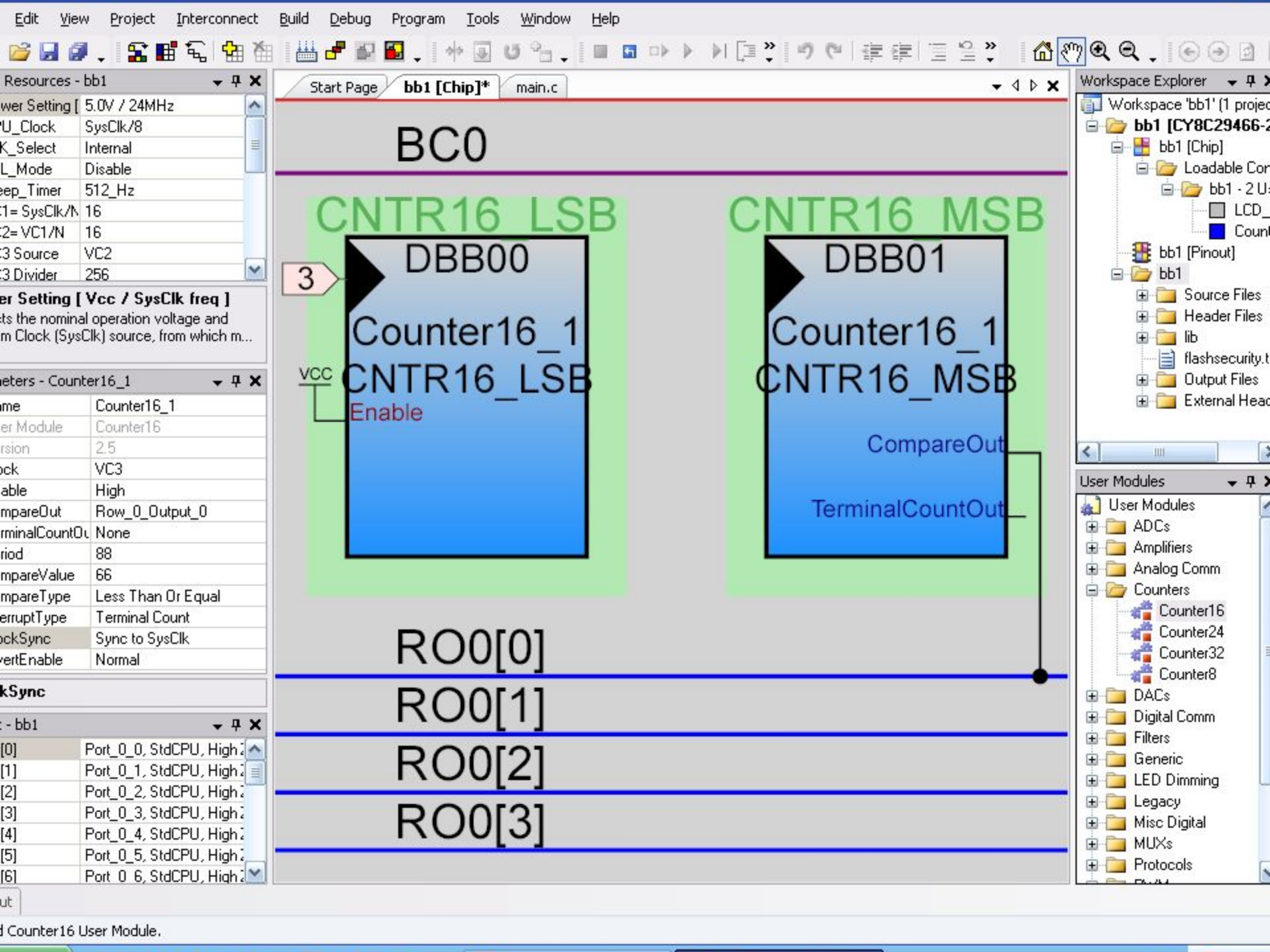
PSoC Project Configuration Datasheet

- Project configuration datasheets also contain the placement and routing of user modules
- Project configuration datasheets are printable with the click of a button

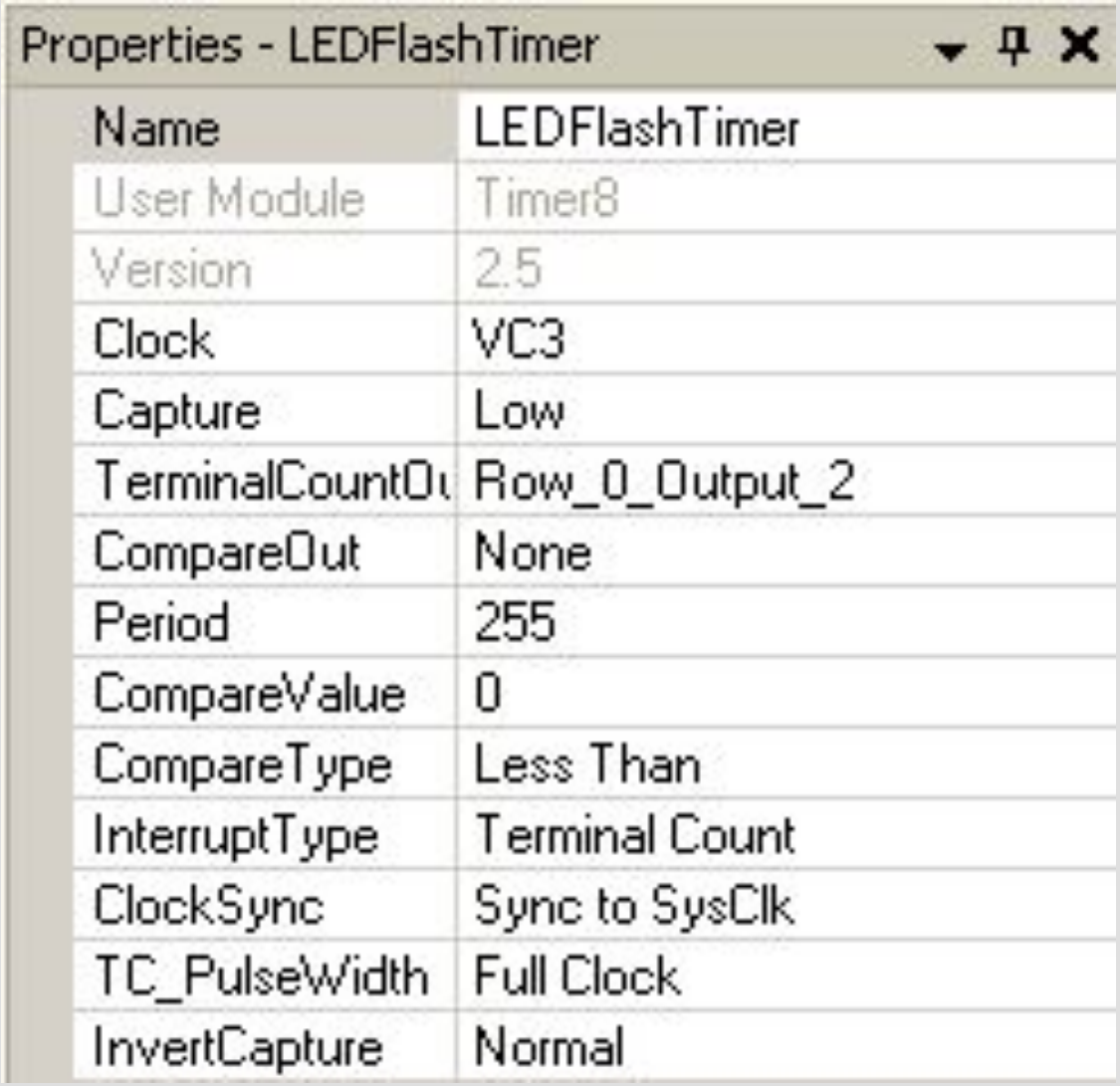


Секція 1: Counters



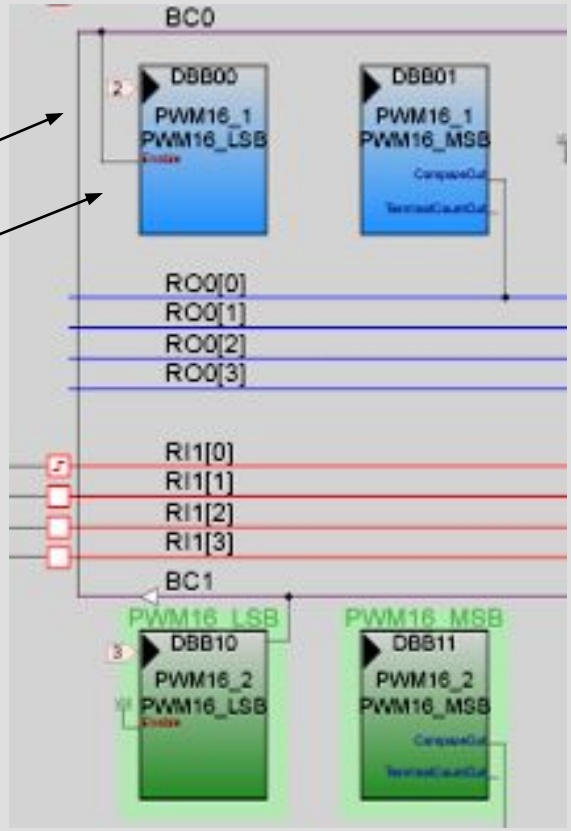

Edit View Project Interconnect Build Debug Program Tools Window Help
Resources - bb1
wer Setting [5.0V / 24MHz
U_Clock SysClk/8
K_Select Internal
L_Mode Disable
eep_Timer 512_Hz
C1= SysClk/N 16
C2= VC1/N 16
C3 Source VC2
C3 Divider 256
er Setting [Vcc / SysClk freq]
ts the nominal operation voltage and
m Clock (SysClk) source, from which m...
eters - Counter16_1
me Counter16_1
er Module Counter16
rsion 2.5
ock VC3
able High
mpareOut Row_0_Output_0
rminalCountOu None
riod 88
mpareValue 66
mpareType Less Than Or Equal
errupt Type Terminal Count
ockSync Sync to SysClk
vertEnable Normal
kSync
- bb1
[0] Port_0_0, StdCPU, High
[1] Port_0_1, StdCPU, High
[2] Port_0_2, StdCPU, High
[3] Port_0_3, StdCPU, High
[4] Port_0_4, StdCPU, High
[5] Port_0_5, StdCPU, High
[6] Port_0_6, StdCPU, High
Start Page
bb1 [Chip]*
main.c
BC0
CNTR16_LSB
CNTR16_MSB
DBB00
DBB01
3
Counter16_1
CNTR16_LSB
Counter16_1
CNTR16_MSB
VCC
Enable
CompareOut
TerminalCountOut
RO0[0]
RO0[1]
RO0[2]
RO0[3]
Workspace Explorer
Workspace 'bb1' (1 projec
bb1 [CY8C29466-2
bb1 [Chip]
Loadable Cor
bb1 - 2 Us
LCD_
Count
bb1 [Pinout]
bb1
Source Files
Header Files
lib
flashsecurity.t
Output Files
External Head
User Modules
User Modules
ADCs
Amplifiers
Analog Comm
Counters
Counter16
Counter24
Counter32
Counter8
DACs
Digital Comm
Filters
Generic
LED Dimming
Legacy
Misc Digital
MUXs
Protocols
d Counter16 User Module.

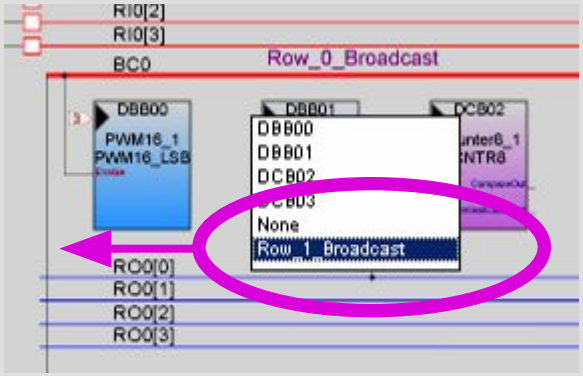
Properties Counter

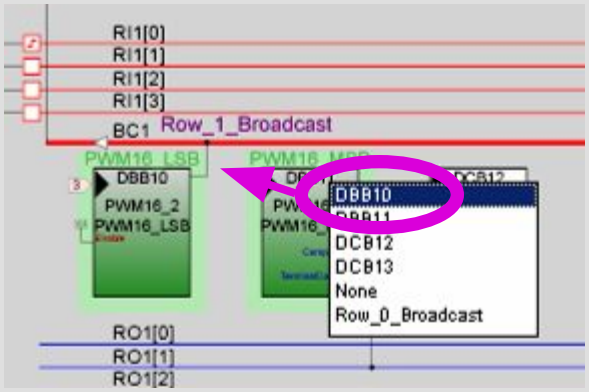


Row Broadcast Nets for Digital Signals

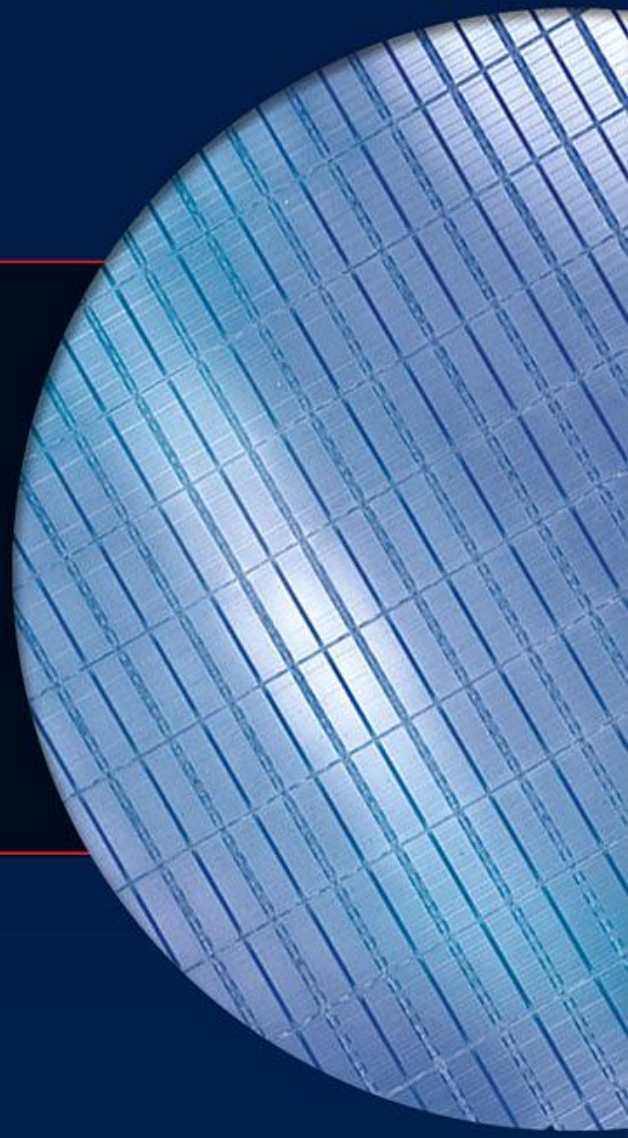
- Row Broadcast Nets can be connected to
  - Each other
  - A digital block
- Thus, any digital block can drive any other digital block or blocks

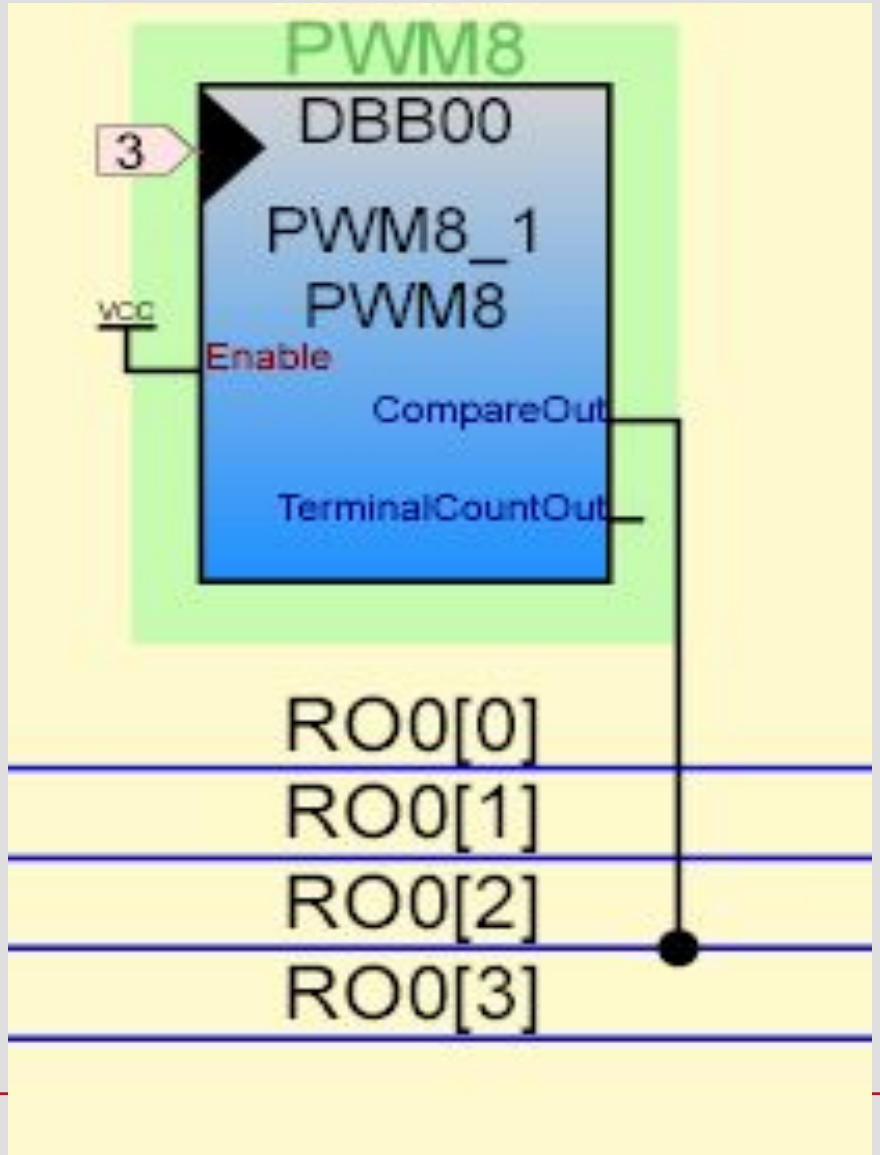




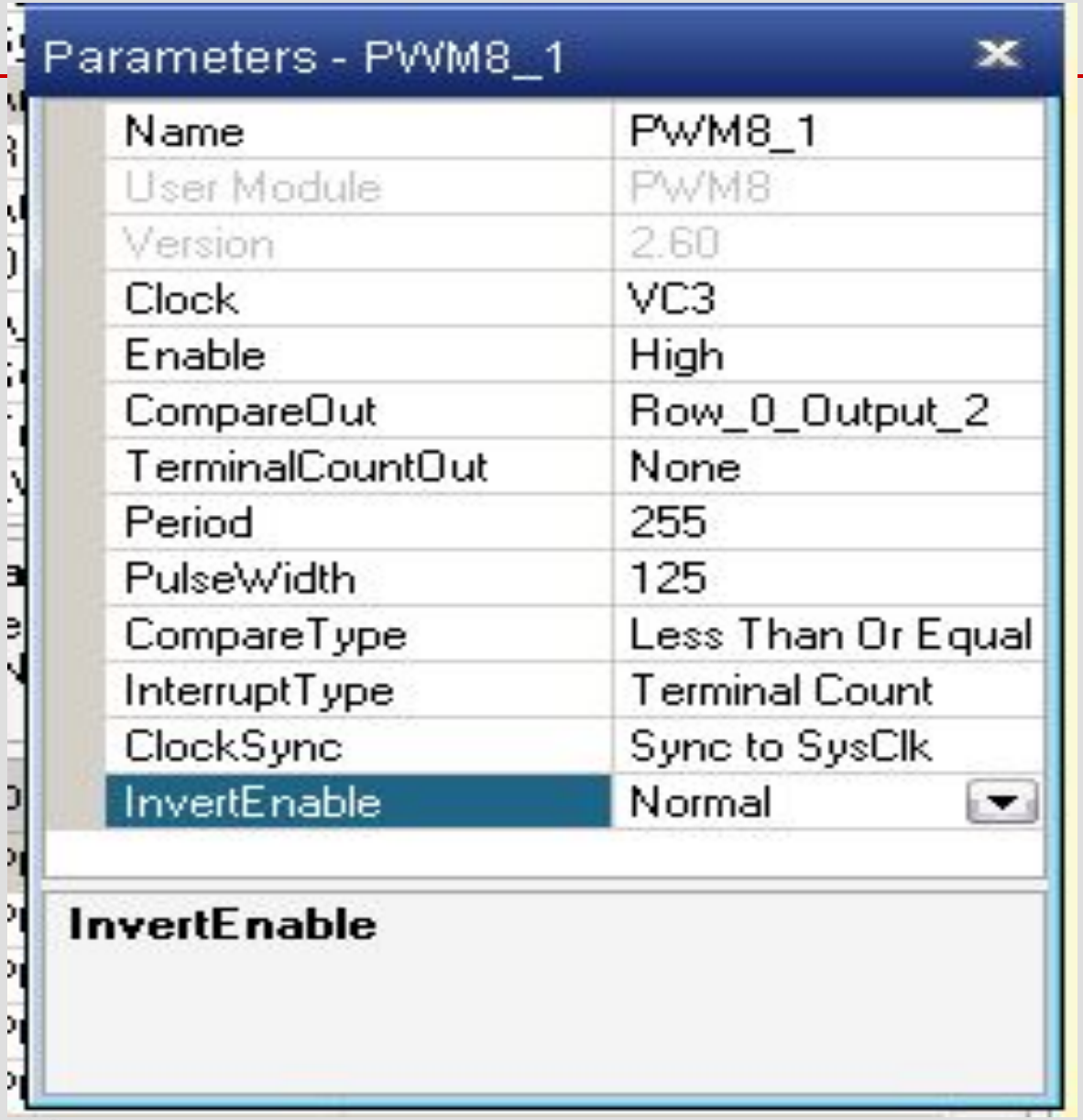


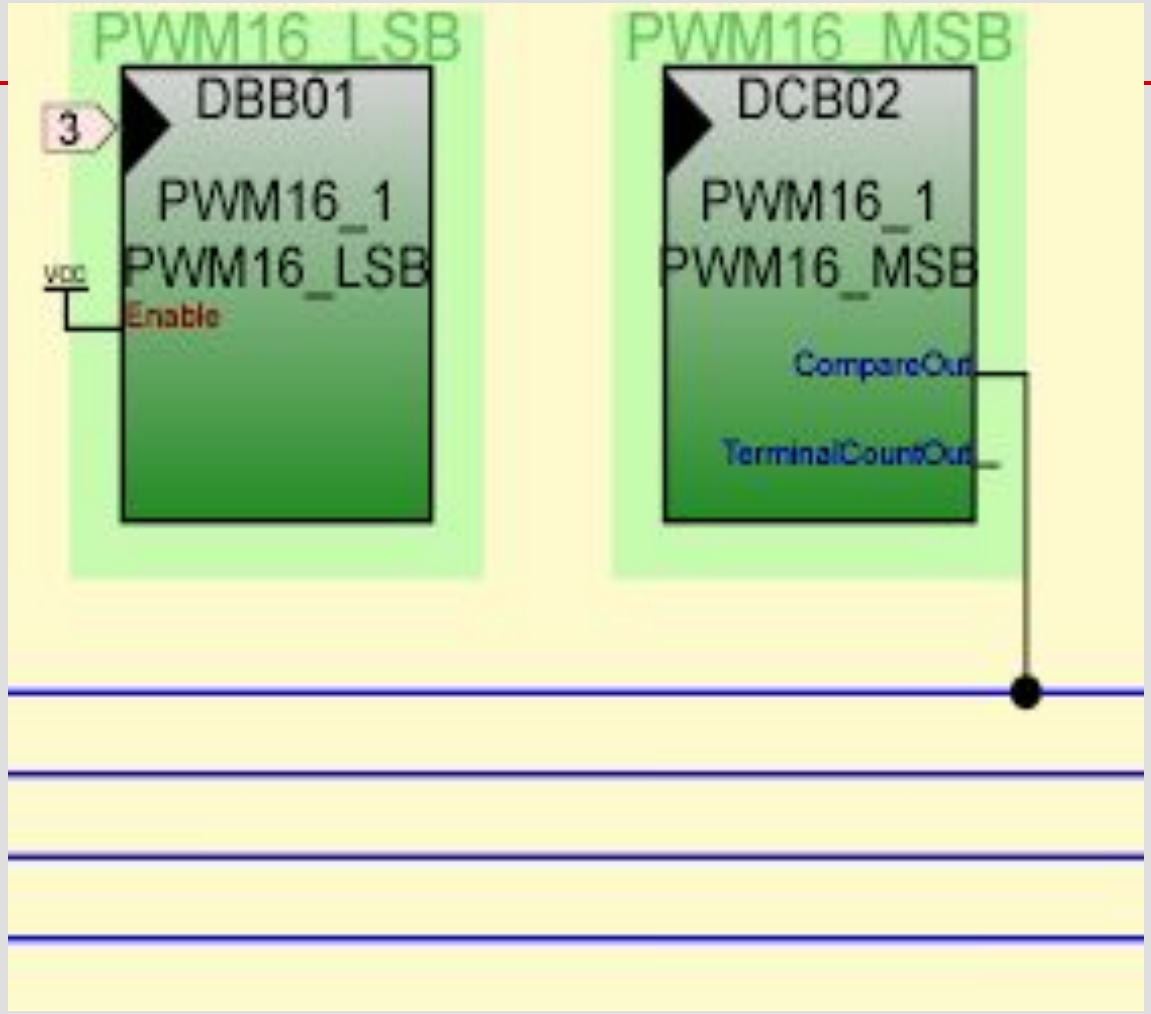
Секція 2: PWM



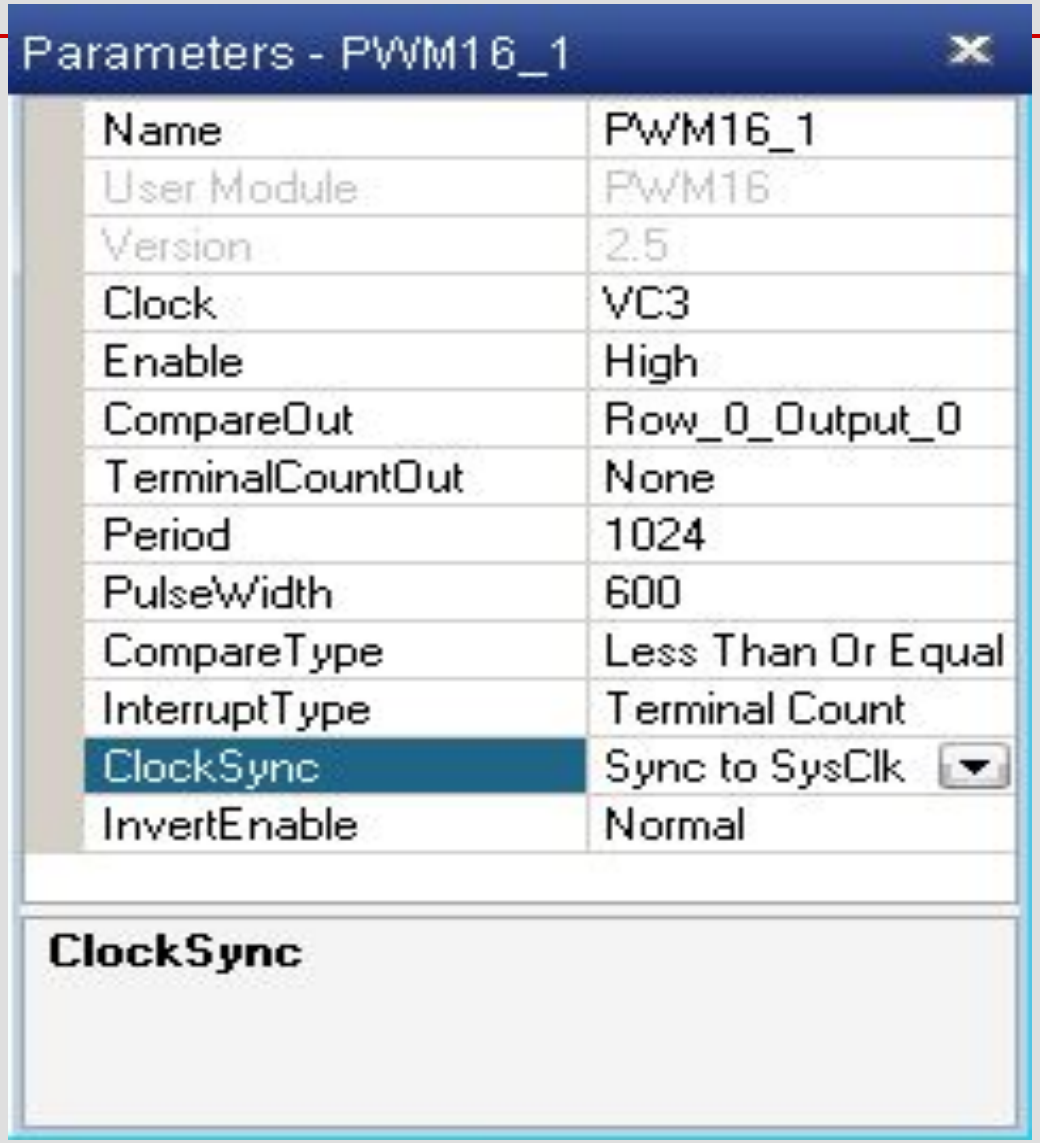

PWM8
DBB00
3
PWM8_1
PWM8
VCC
Enable
CompareOut
TerminalCountOut
RO0[0]
RO0[1]
RO0[2]
RO0[3]

Properties PWM

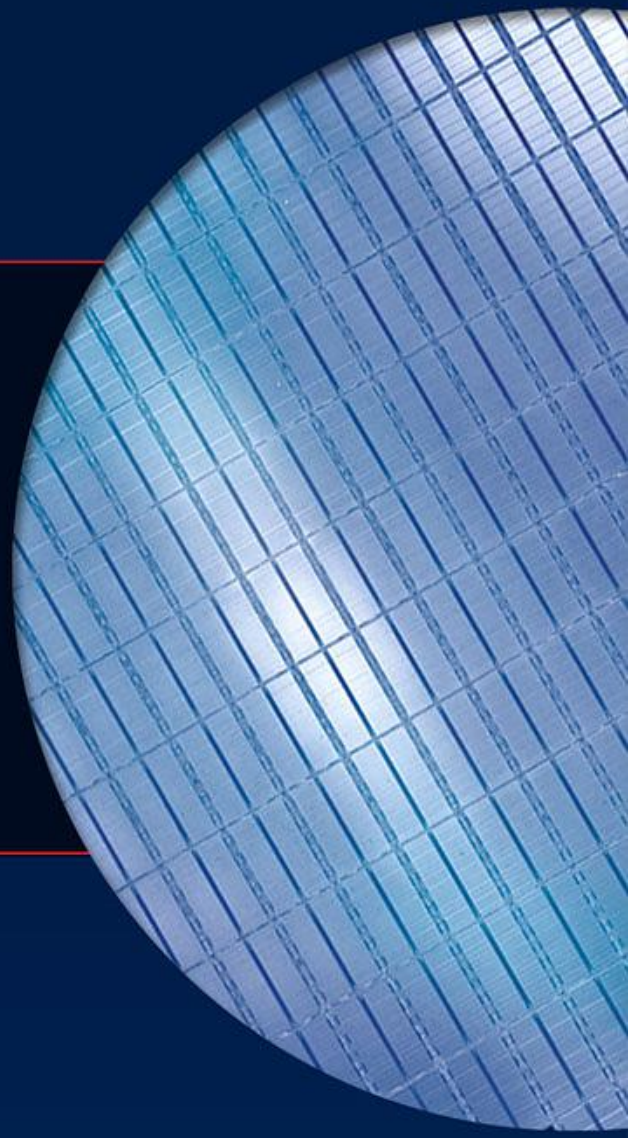



PWM16_LSB
DBB01
3
PWM16_1
PWM16_LSB
VDC
Enable
PWM16_MSB
DCB02
PWM16_1
PWM16_MSB
CompareOut
TerminalCountOut

Properties PWM



Секція 3: TIMER



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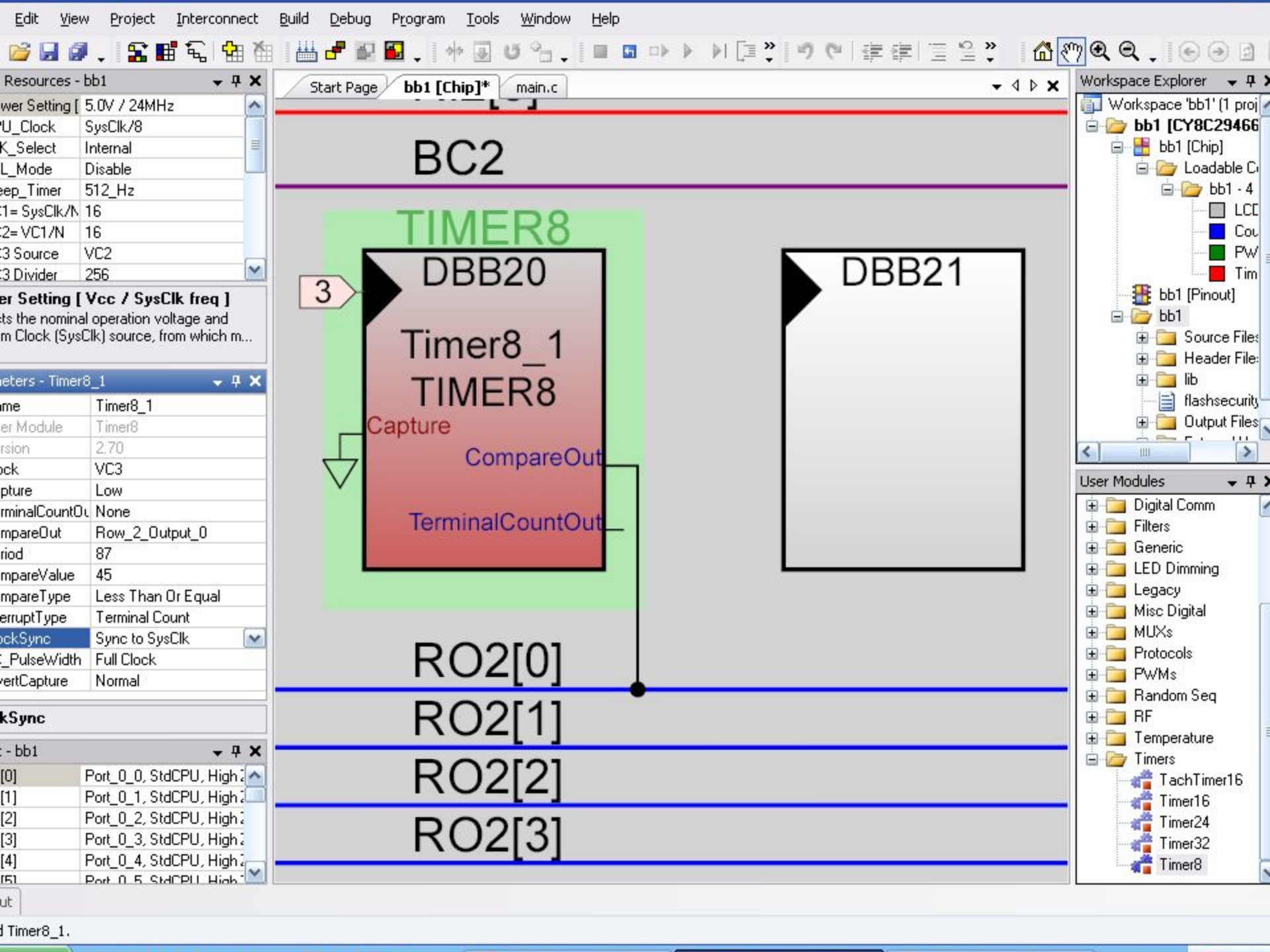
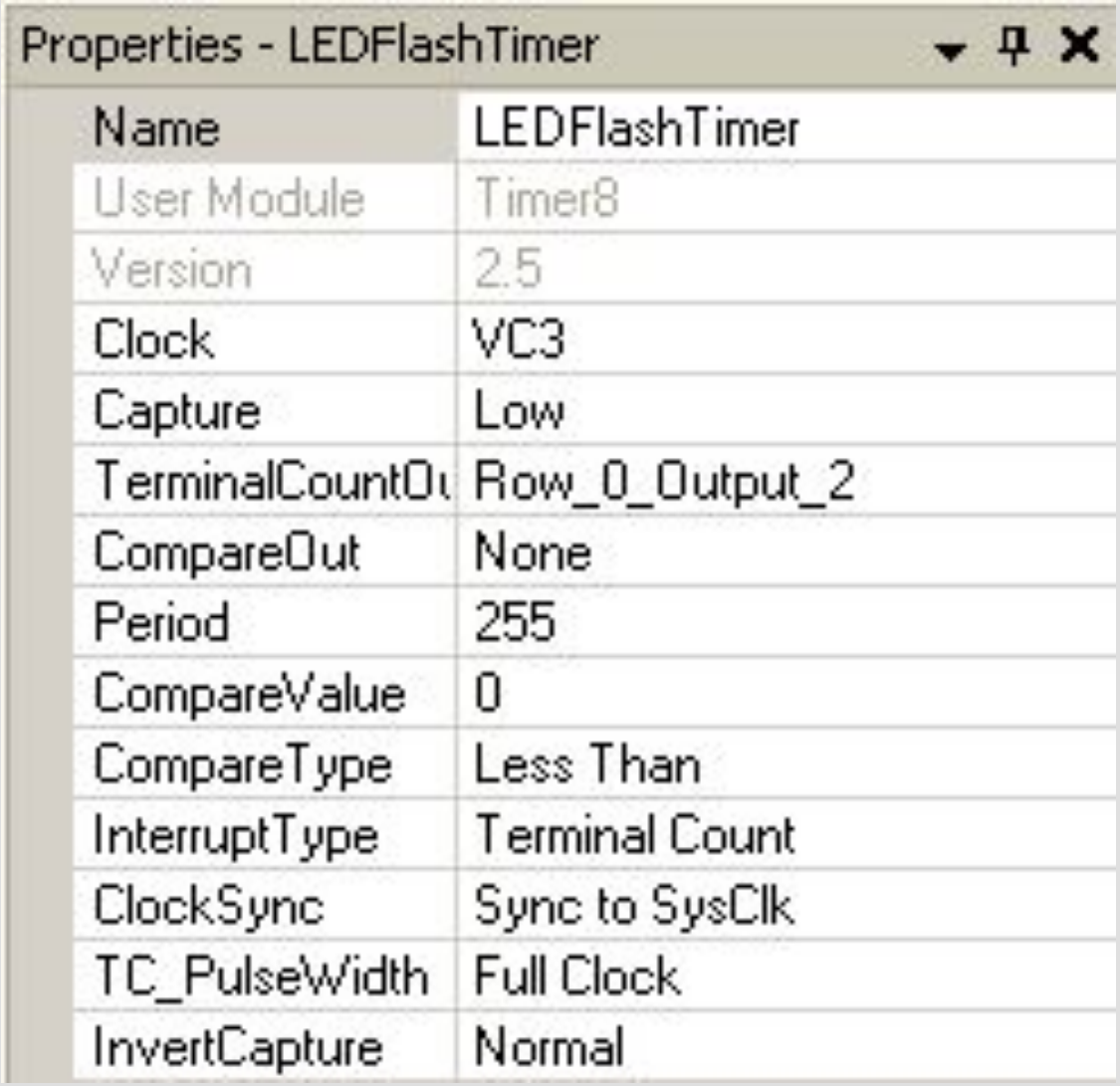

Edit View Project Interconnect Build Debug Program Tools Window Help
Resources - bb1
5.0V / 24MHz
SysClk/8
Internal
Disable
512_Hz
16
16
VC2
256
Start Page
bb1 [Chip]*
main.c
BC2
TIMER8
DBB20
3
Timer8_1
TIMER8
Capture
CompareOut
TerminalCountOut
DBB21
RO2[0]
RO2[1]
RO2[2]
RO2[3]
Workspace Explorer
Workspace 'bb1' (1 proj
bb1 [CY8C29466
bb1 [Chip]
bb1 [Pinout]
bb1
Source Files
Header Files
lib
Output Files
User Modules
Digital Comm
Filters
Generic
LED Dimming
Legacy
Misc Digital
MUXs
Protocols
PWMs
Random Seq
RF
Temperature
Timers
TachTimer16
Timer16
Timer24
Timer32
Timer8
Timer8_1.

Properties Timer8



The 8-bit timer is used to flash the LED periodically. It uses the interrupt generated by the timer to toggle the LED.

- 1. Place a **Timer8** user module and rename it *LEDFlashTimer*.
- 2. Set the **Clock** to **VC3**.
- 3. Set **Capture** to **Low**.
- 4. Set **TerminalCountOut** to **Row_0_Output_2**.
- You'll route the Terminal Count output to a pin so you can get some practice routing resources in PSoC Designer. You will connect the pin to an LED and set the Drive mode on the pin so that it will flash the LED for a single clock cycle every time the timer reaches terminal count.
- 5. Set **CompareOut** to **None**.
- 6. Set the **Period** to **250**.

The 8-bit timer is used to flash the LED periodically. It uses the interrupt generated by the timer to toggle the LED.

- 7. Set the **CompareValue** to **0**.
- 8. Set the **CompareType** to **Less Than**.
- 9. Set the **InterruptType** to **Terminal Count**.
- 10. Set **ClockSync** to **Sync to SysClk**.

The 8-bit timer is used to flash the LED periodically. It uses the interrupt generated by the timer to toggle the LED.

- The flash rate of the LED will be 1/4 second. (24 Mhz ч 3 (VC1) ч 16 (VC2) ч 250 (VC3 Divider) ч 250 (Period)) The timer will hit terminal count 8 times per second and each of these terminal counts toggles the LED.

Мікропроцесорна техніка (лекція 2, кінець) Благітко Б.Я. 2018р.

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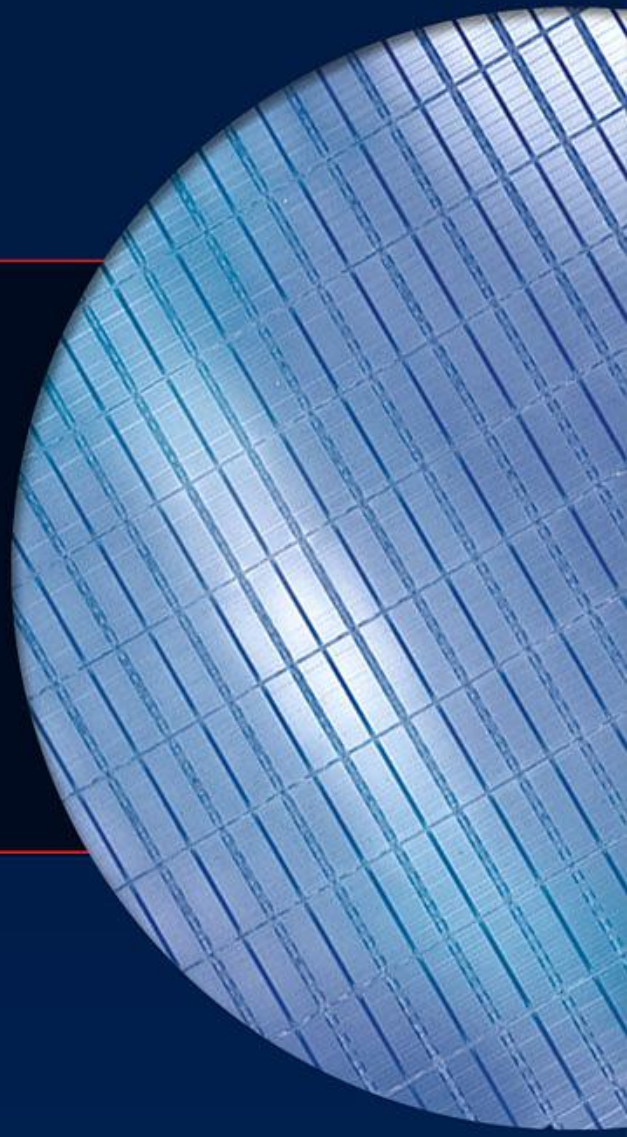
Designing with PSoC



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