Мікропроцесорна техніка

(лекція 2)

Благітко Б.Я.

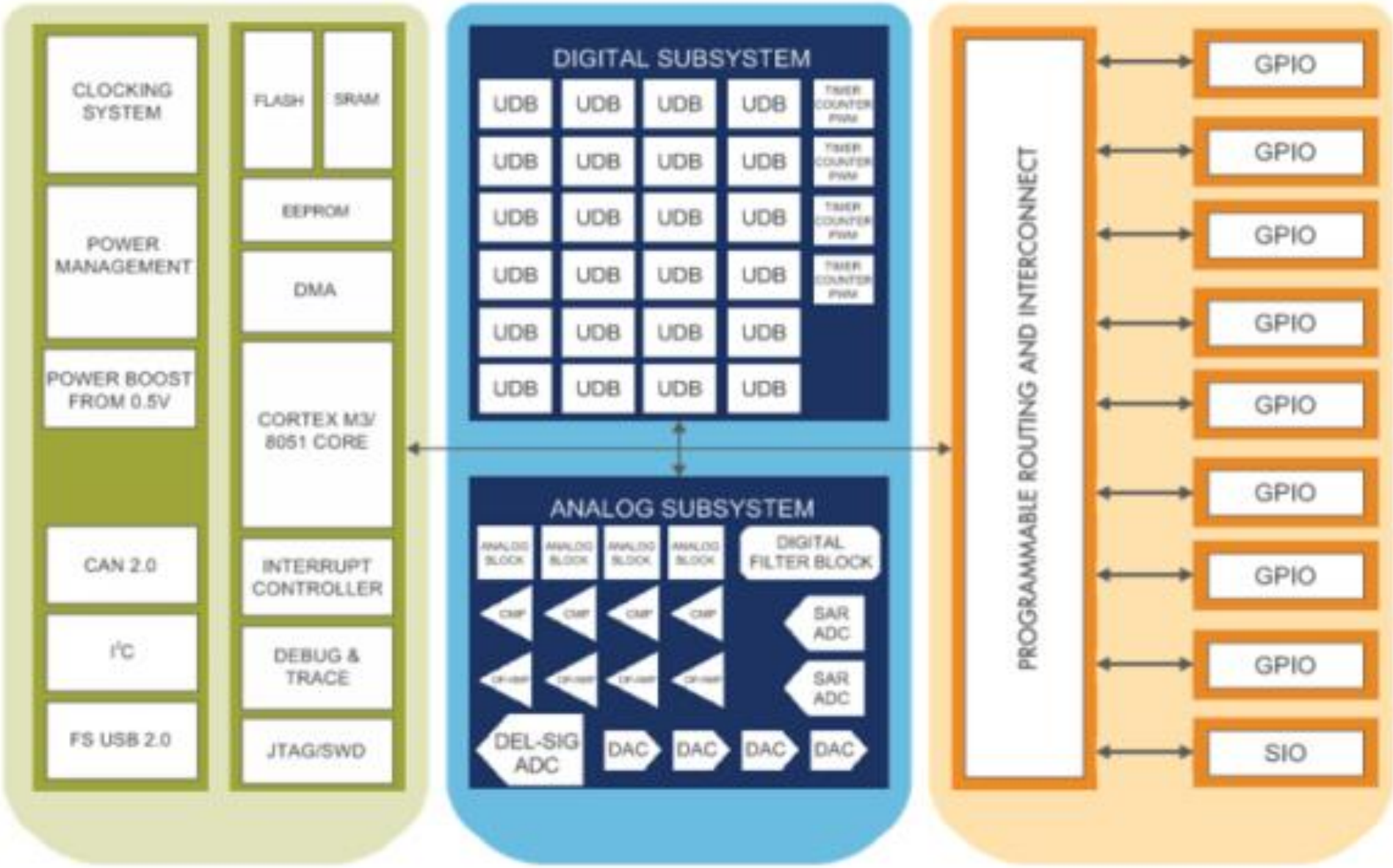
2019 р.

PSoC Creator 4.2
Designing with PSoC 3/5

PSoC@3/5
PWM

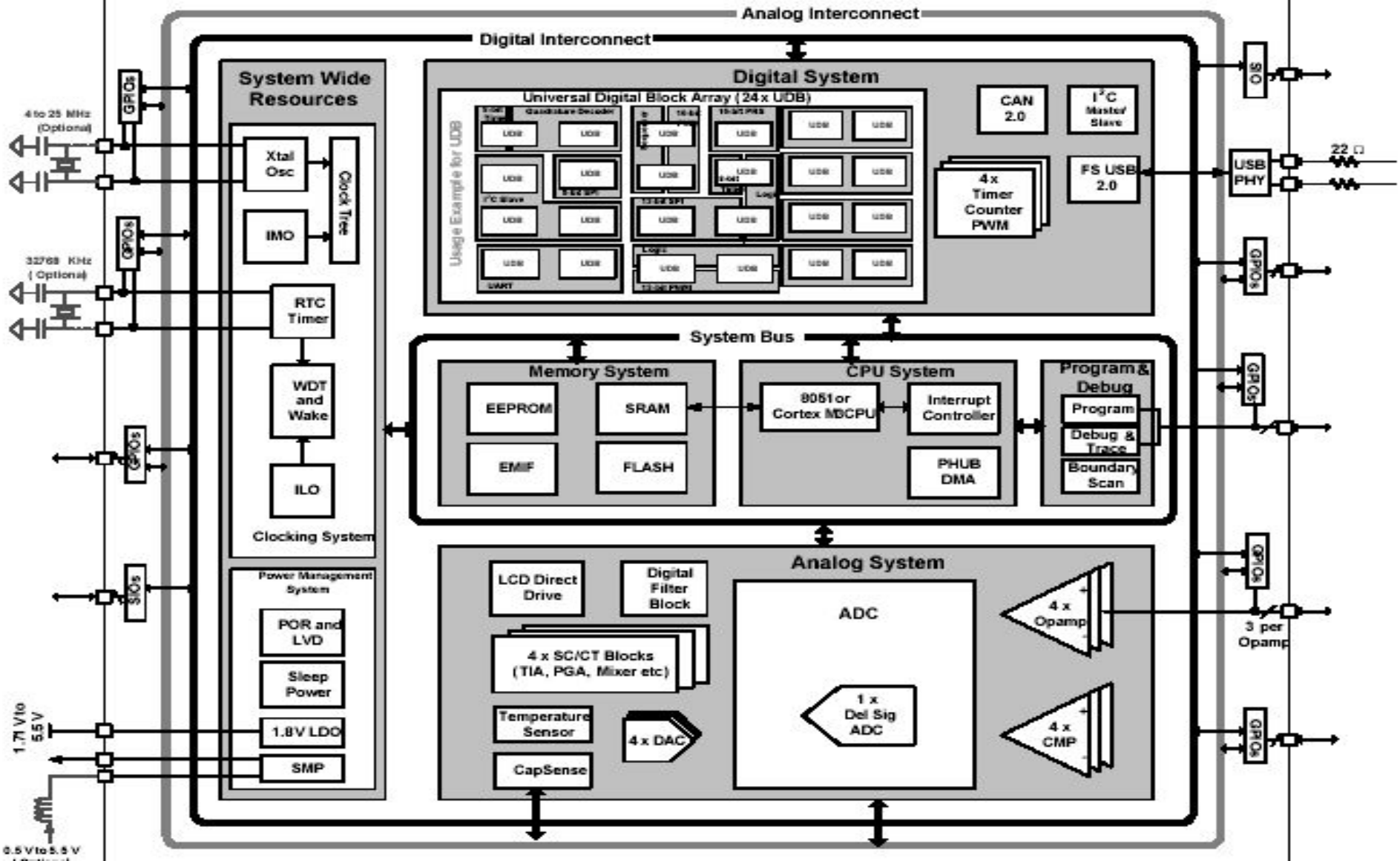
PSoC Creator 4.2
Designing with PSoC 3/5

Цифрові модулі



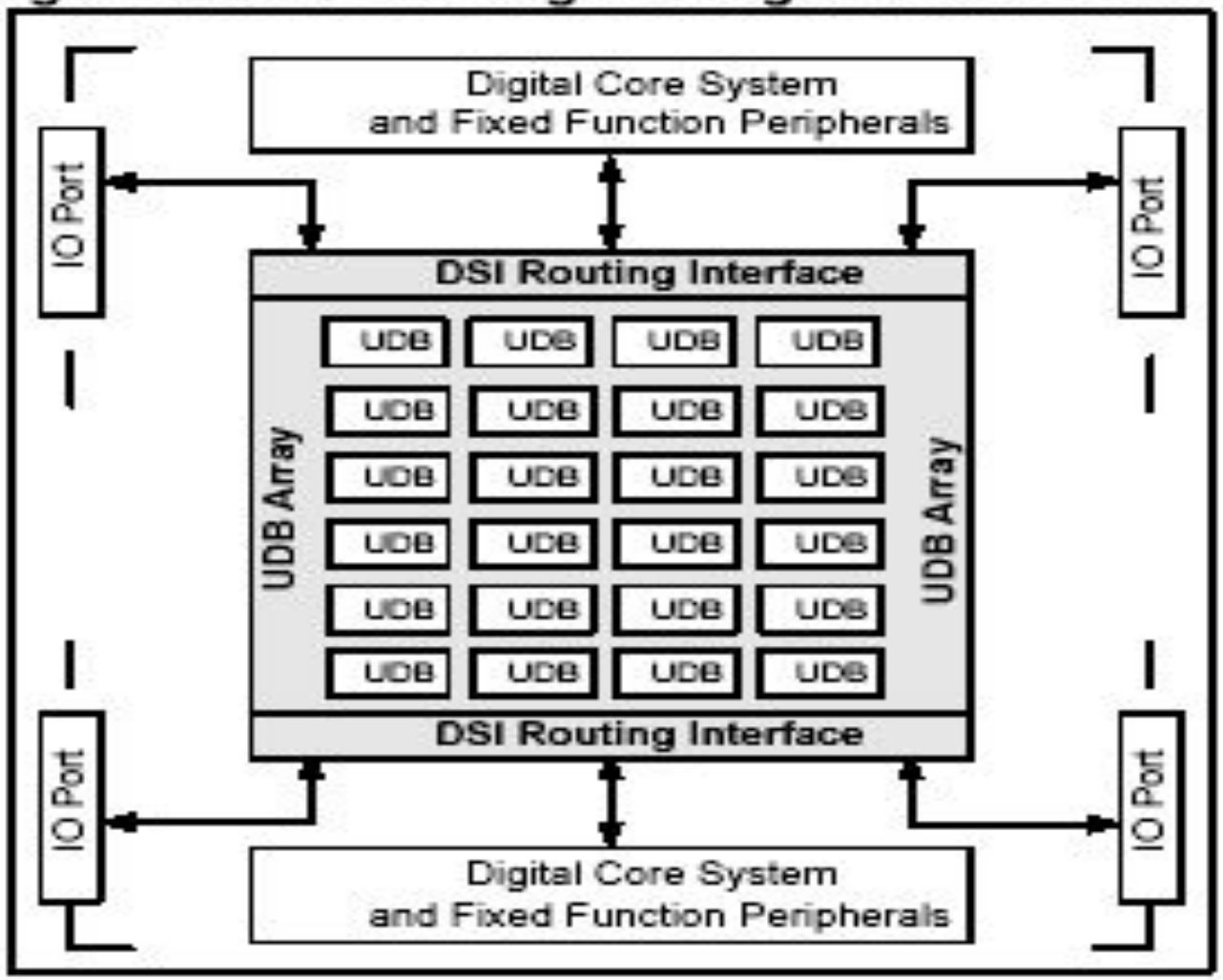
Цифрові модулі

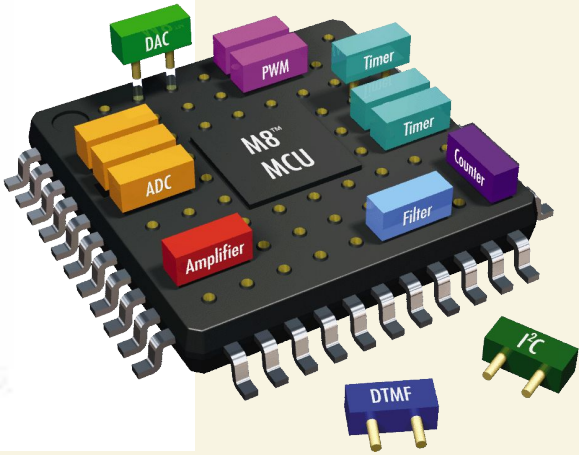
Figure 1-1. Simplified Block Diagram



Цифрові модулі

Figure 7-1. CY8C38 Digital Programmable Architecture





Цифрові модулі

Figure 7-3. Component Catalog

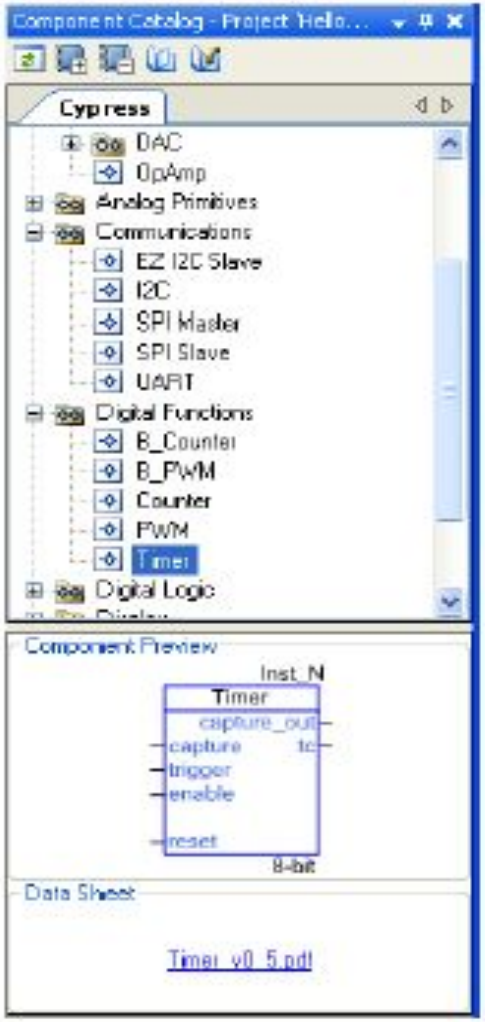
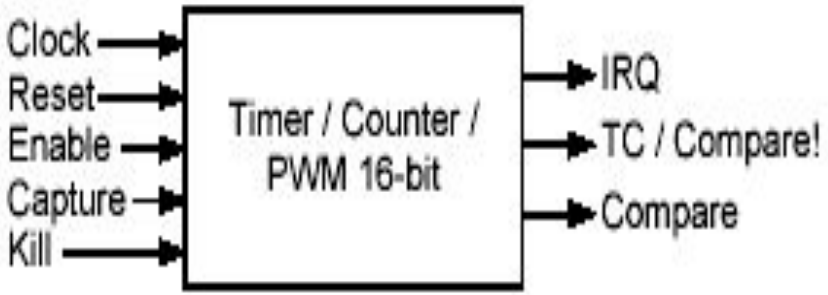
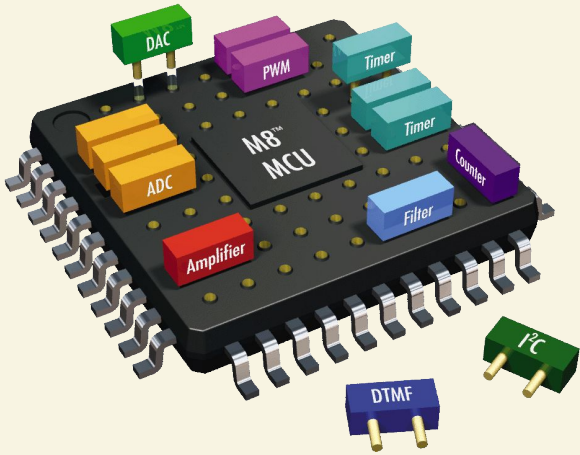


Figure 7-21. Timer/Counter/PWM





PWMs, Timers and Counters

PWMs, **Timer**s and **Counter**s 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.

When to Use a Counter

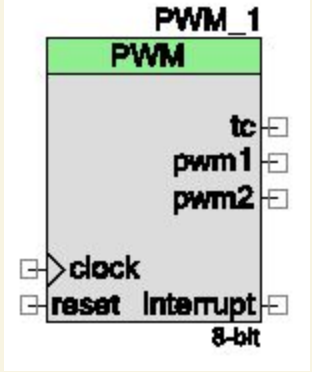
A **Counter** component is better used in situations that require the counting of a number of events but also provides rising edge capture input as well as a compare output.

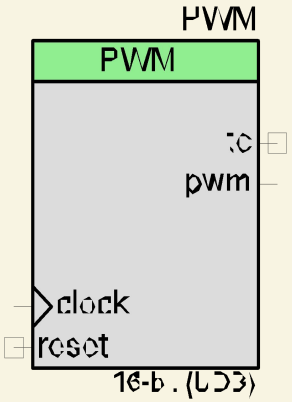
When to Use a Timer

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.

PWM

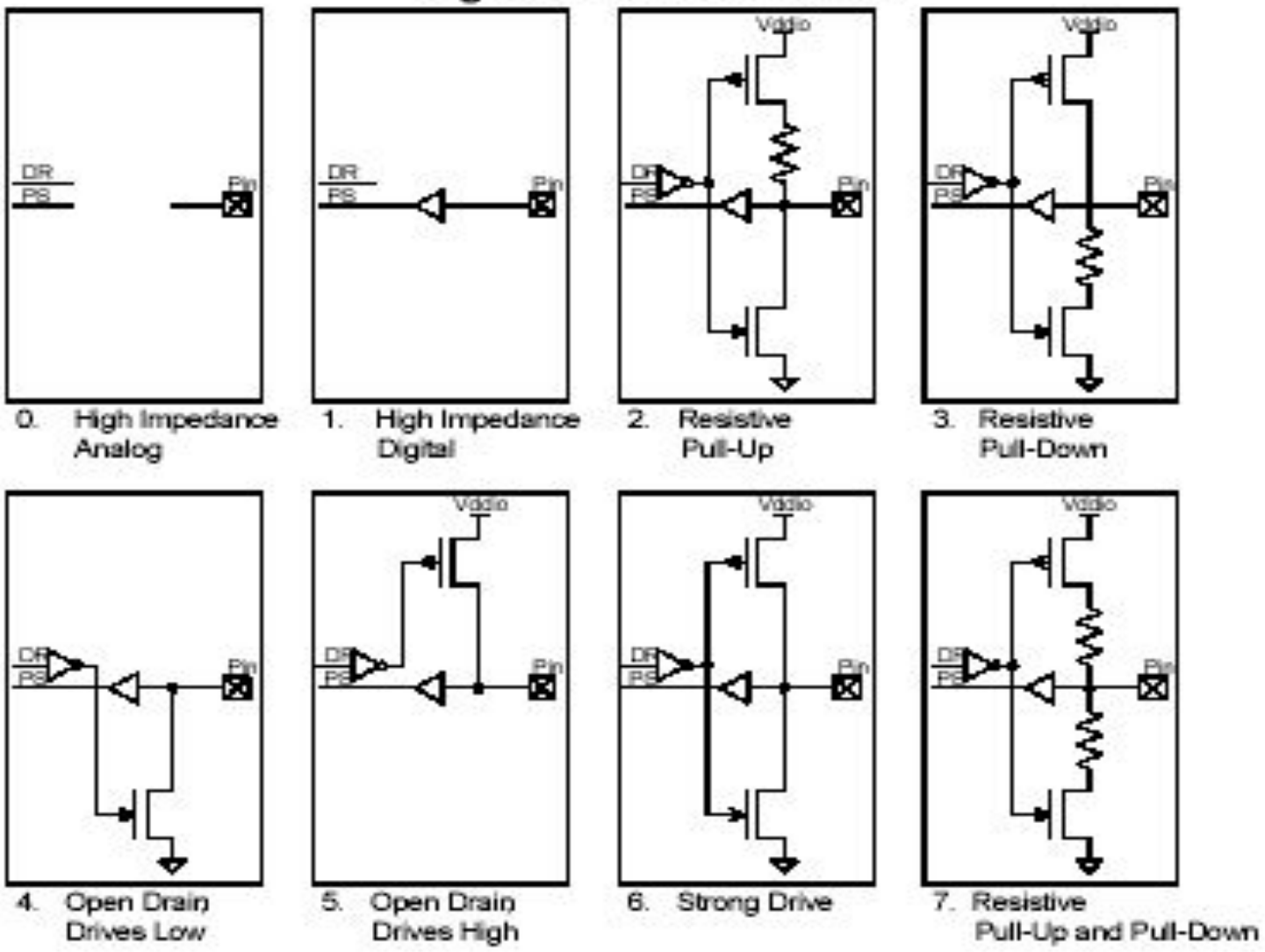
Output	May Be Hidden	Description
tc	N	The terminal count output is '1' when the period counter is equal to zero. In normal operation this output will be '1' for a single cycle where the counter is reloaded with period. If the PWM is stopped with the period counter equal to zero then this signal will remain high until the period counter is no longer zero. This output is synchronized to the block clock input of the component.
interrupt	Y	The interrupt output is the logical OR of the group of possible interrupt sources. This signal will go high while any of the enabled interrupt sources are true. The interrupt output shall remain asserted until the Status Register is read out by the software. In order to receive subsequent interrupts, the interrupt shall be cleared by reading the Status Register using the PWM_ReadStatusRegister() API. The interrupt output is not visible if the Use Interrupt parameter is not set. This allows the status register to be removed for resource optimization as necessary.
pwm/pwm1	Y	The pwm or pwm1 output is the first or only pulse width modulated output. This signal is defined by PWM Mode, compare modes(s), and compare value(s) as indicated in waveforms in the Configure dialog. When the instance is configured in one output, Dual Edged, Hardware Select, Center Aligned, or Dither PWM Modes, then the output "pwm" is visible. Otherwise the output "pwm1" is visible with "pwm2" the other pulse width signal. This output is synchronized to the block clock input of the component.



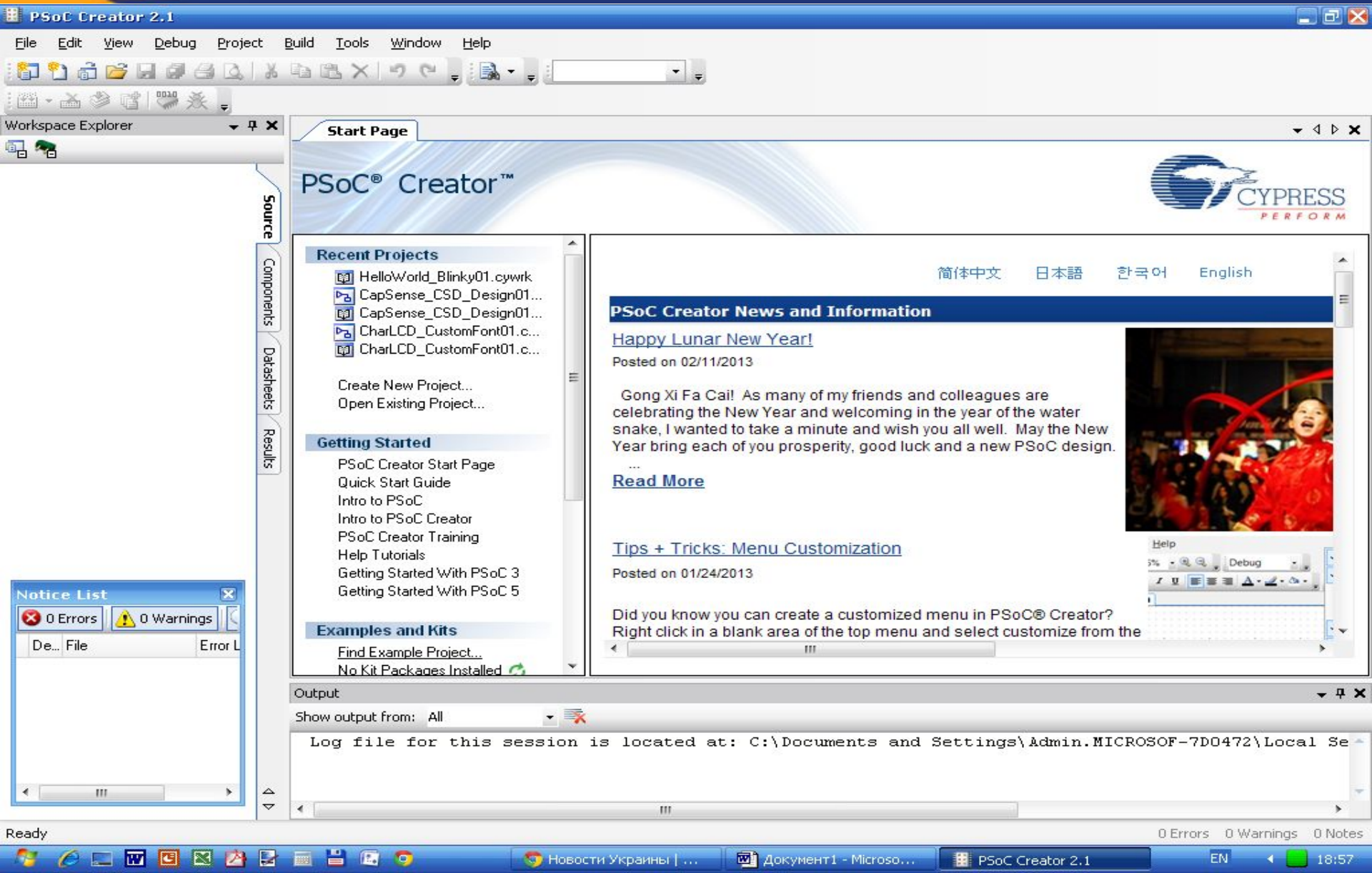


Port's Pins

Figure 6-11. Drive Mode



Creator


PSoC Creator 2.1
File Edit View Debug Project Build Tools Window Help
Workspace Explorer
Source
Components
Datasheets
Results
Start Page
PSoC® Creator™
CYPRESS PERFORM
Recent Projects
HelloWorld_Blinky01.cywrk
CapSense_CSD_Design01...
CapSense_CSD_Design01...
CharLCD_CustomFont01.c...
CharLCD_CustomFont01.c...
Create New Project...
Open Existing Project...
Getting Started
PSoC Creator Start Page
Quick Start Guide
Intro to PSoC
Intro to PSoC Creator
PSoC Creator Training
Help Tutorials
Getting Started With PSoC 3
Getting Started With PSoC 5
Examples and Kits
Find Example Project...
No Kit Packages Installed
简体中文 日本語 한국어 English
PSoC Creator News and Information
Happy Lunar New Year!
Posted on 02/11/2013
Gong Xi Fa Cai! As many of my friends and colleagues are celebrating the New Year and welcoming in the year of the water snake, I wanted to take a minute and wish you all well. May the New Year bring each of you prosperity, good luck and a new PSoC design.
...
Read More
Tips + Tricks: Menu Customization
Posted on 01/24/2013
Did you know you can create a customized menu in PSoC® Creator? Right click in a blank area of the top menu and select customize from the
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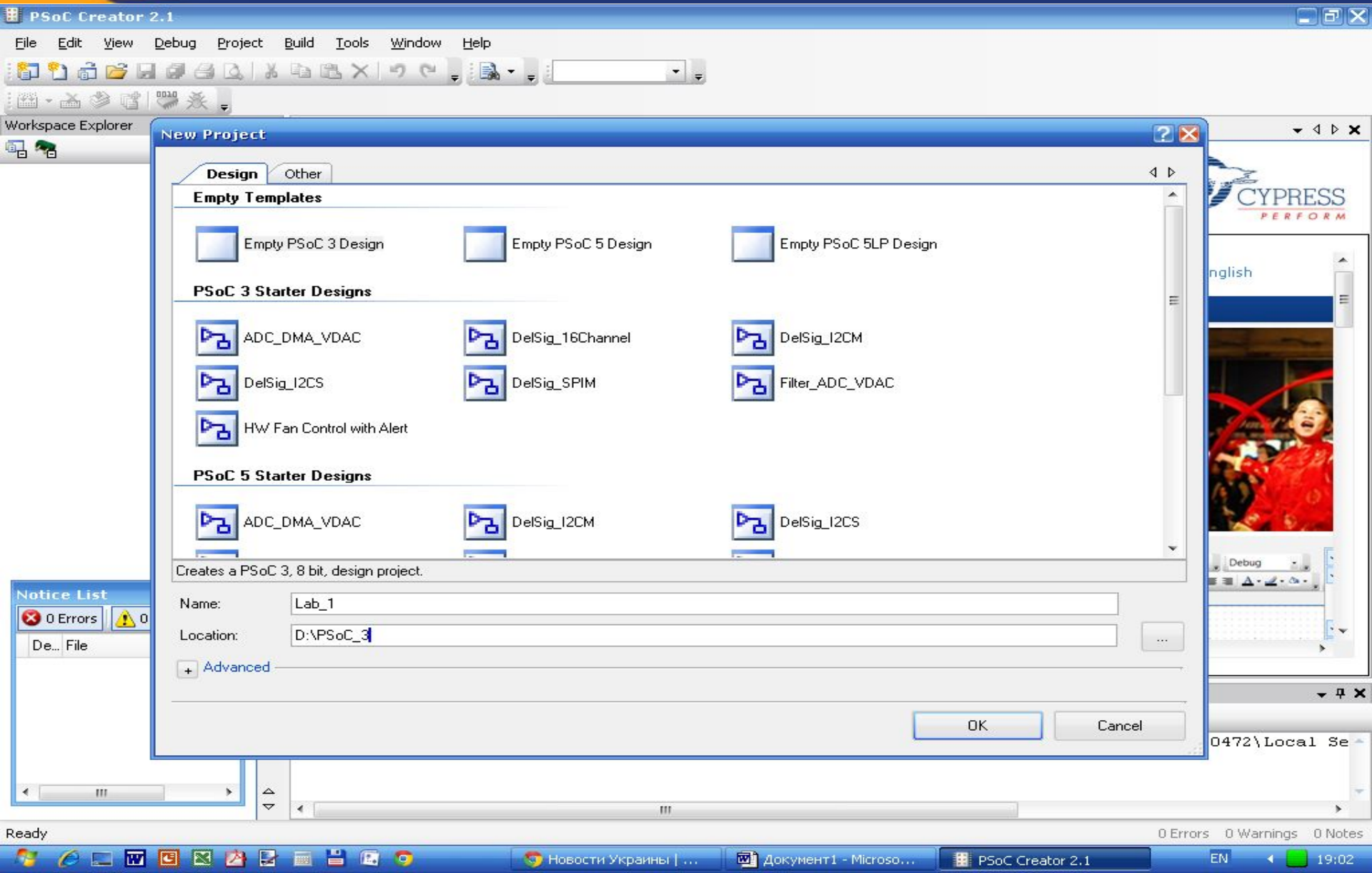
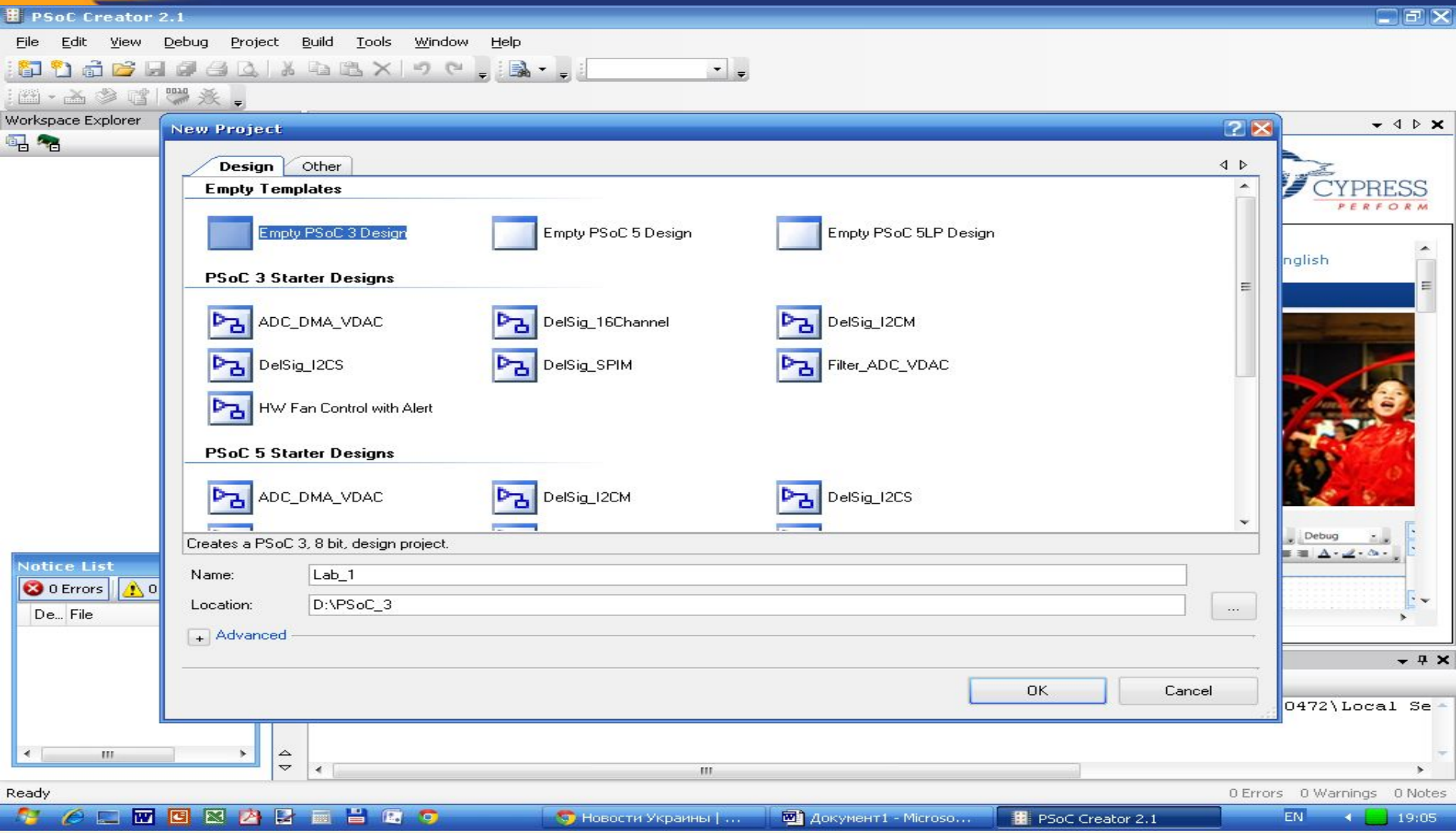
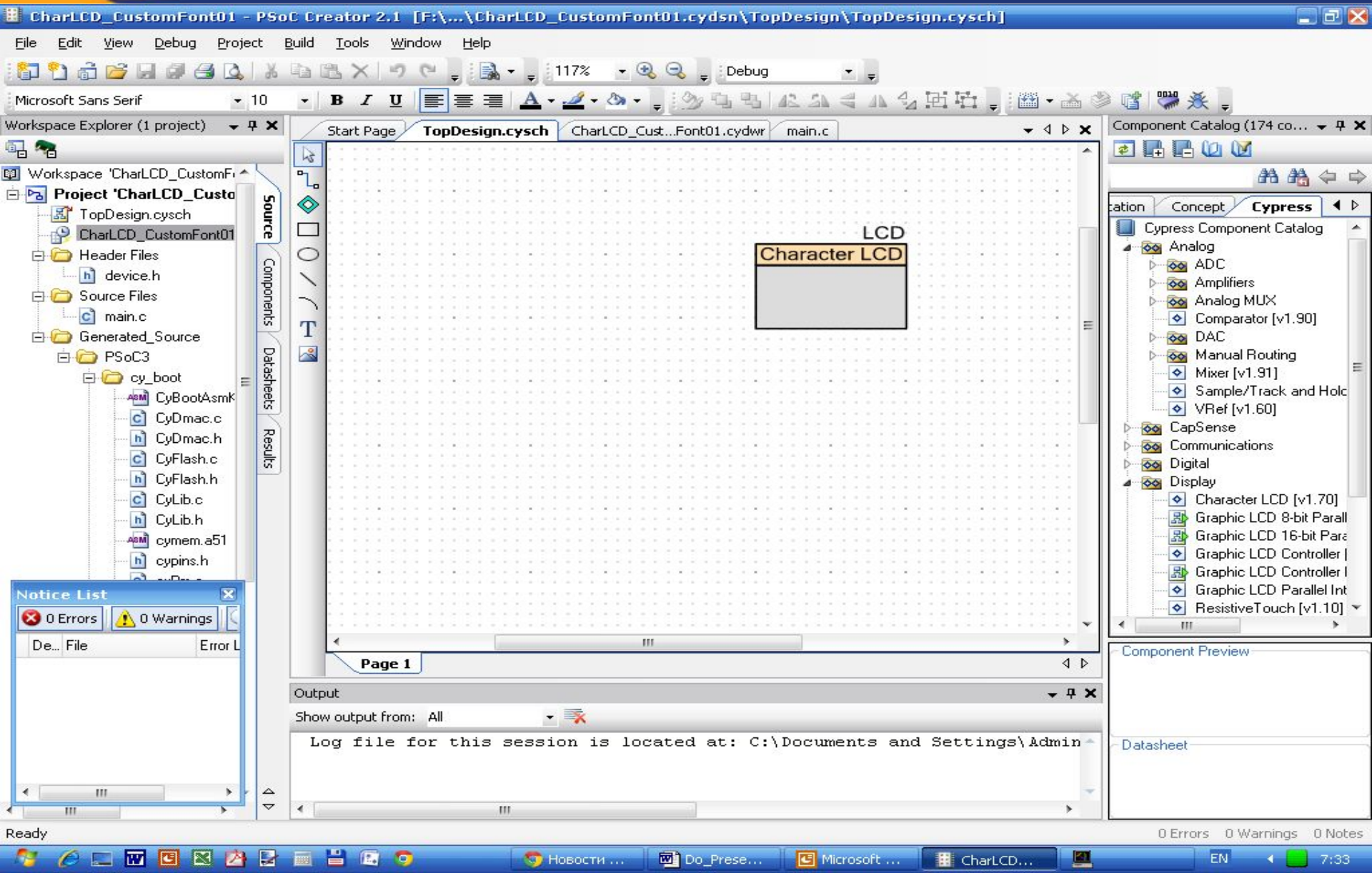


Empty PSoC 3 Design



Lab_2 PWM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Comparator [v1.90]
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Mixer [v1.91]
Sample/Track and Hold
VRef [v1.60]
CapSense
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Character LCD [v1.70]
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Graphic LCD 16-bit Para
Graphic LCD Controller
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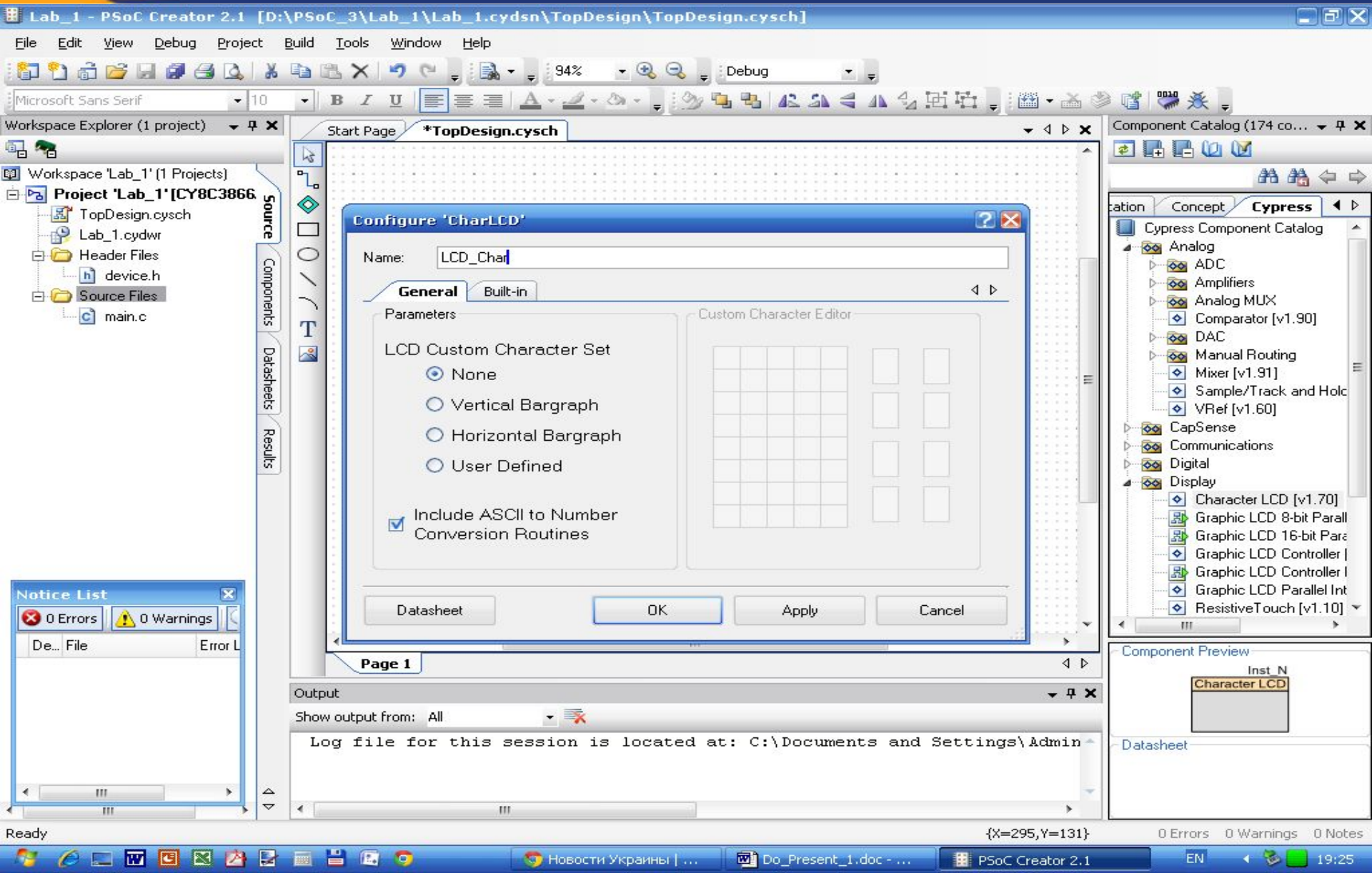
Configure LCD



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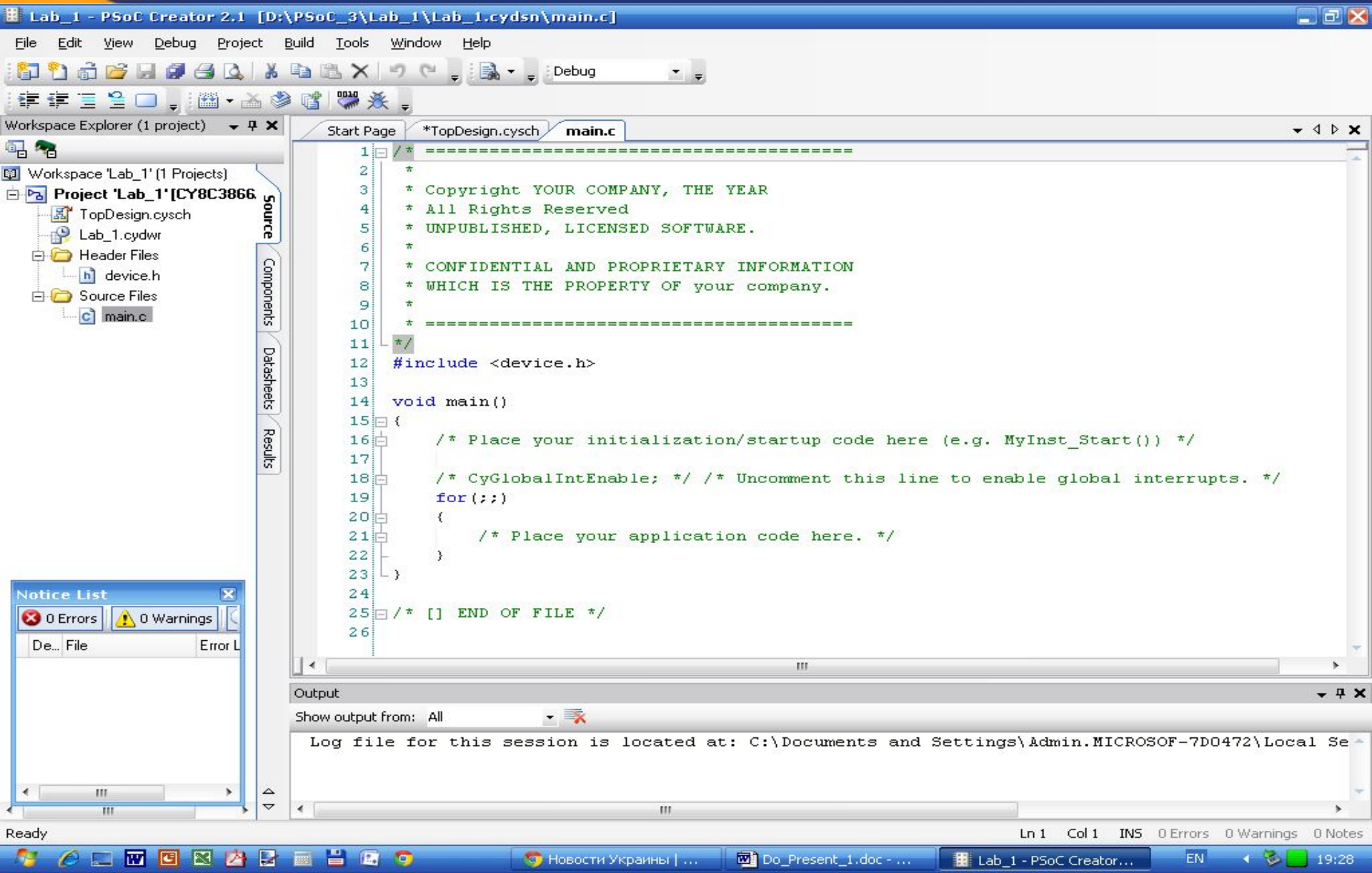
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main.c
1 /* ==
2 *
3 * Copyright YOUR COMPANY, THE YEAR
4 * All Rights Reserved
5 * UNPUBLISHED, LICENSED SOFTWARE.
6 *
7 * CONFIDENTIAL AND PROPRIETARY INFORMATION
8 * WHICH IS THE PROPERTY OF your company.
9 *
10 * ==
11 */
12 #include <device.h>
13
14 void main()
15 {
16 /* Place your initialization/startup code here (e.g. MyInst_Start()) */
17
18 /* CyGlobalIntEnable; */ /* Uncomment this line to enable global interrupts. */
19 for(;;)
20 {
21 /* Place your application code here. */
22 }
23 }
24
25 /* [] END OF FILE */
26
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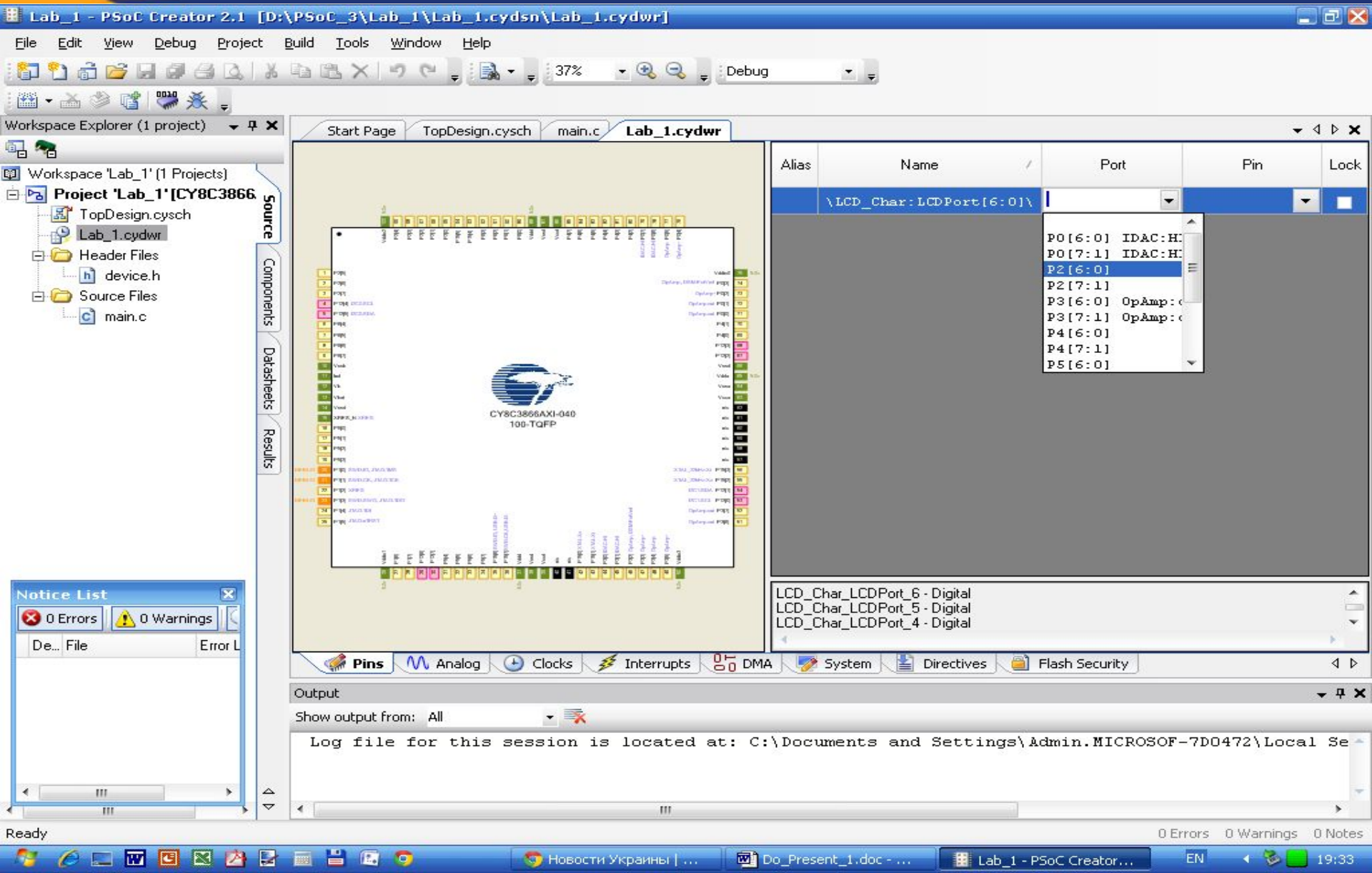
Lab_2.cywr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P0[7:1] IDAC:H
P2[6:0]
P2[7:1]
P3[6:0] OpAmp:
P3[7:1] OpAmp:
P4[6:0]
P4[7:1]
P5[6:0]
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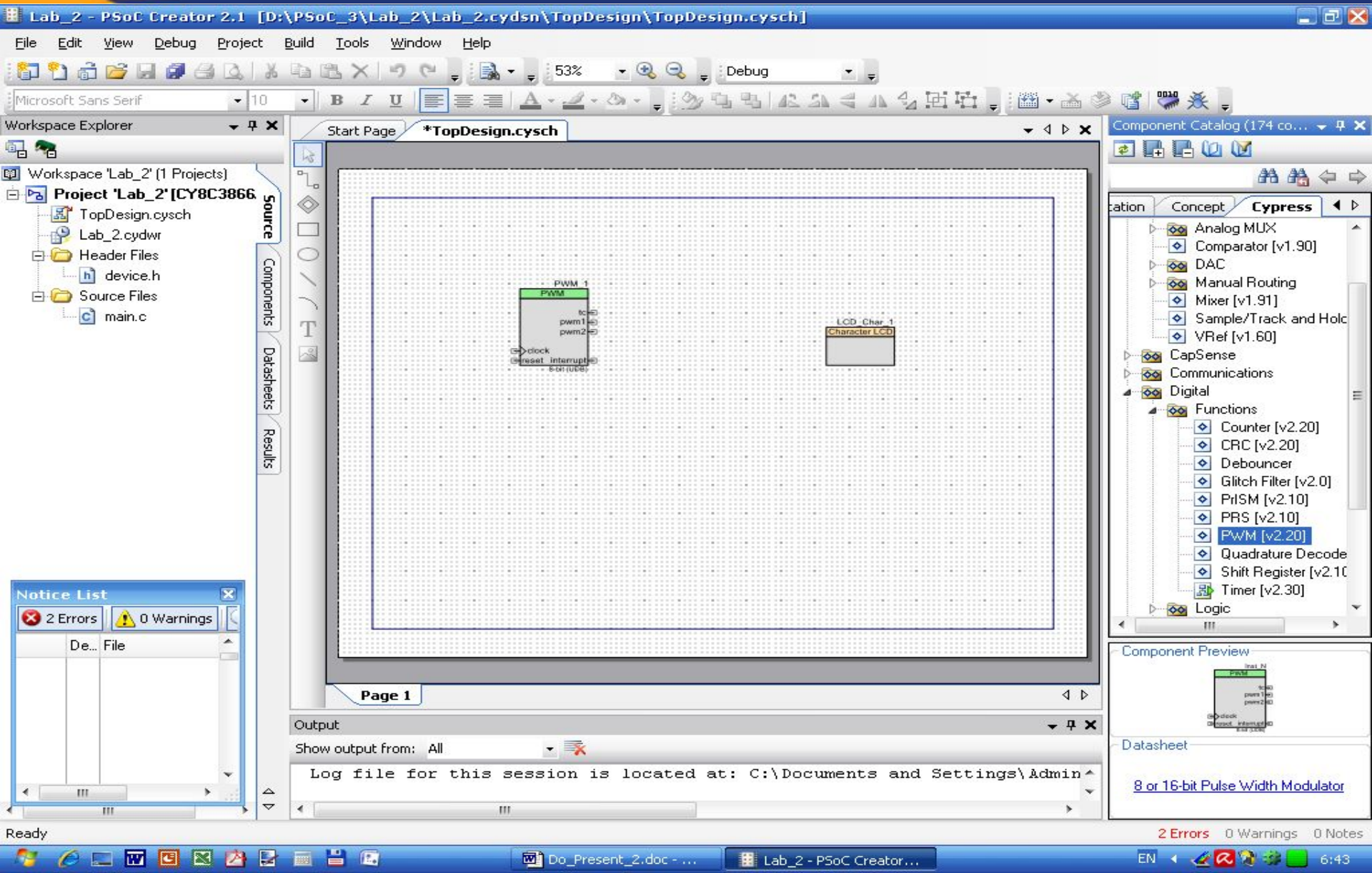
Lab_2 PWM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Quadrature Decode
Shift Register [v2.1
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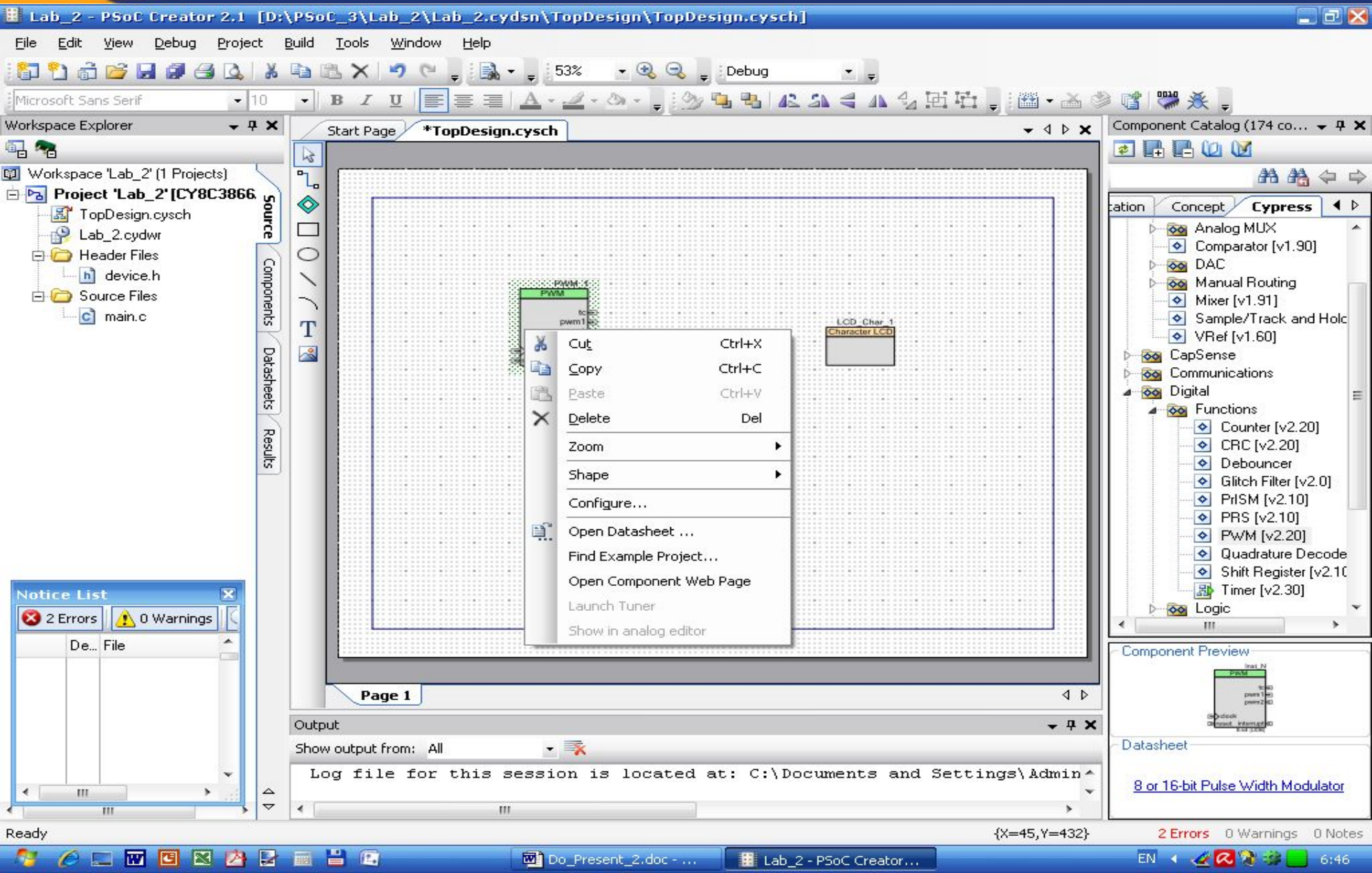
Lab_2 PWM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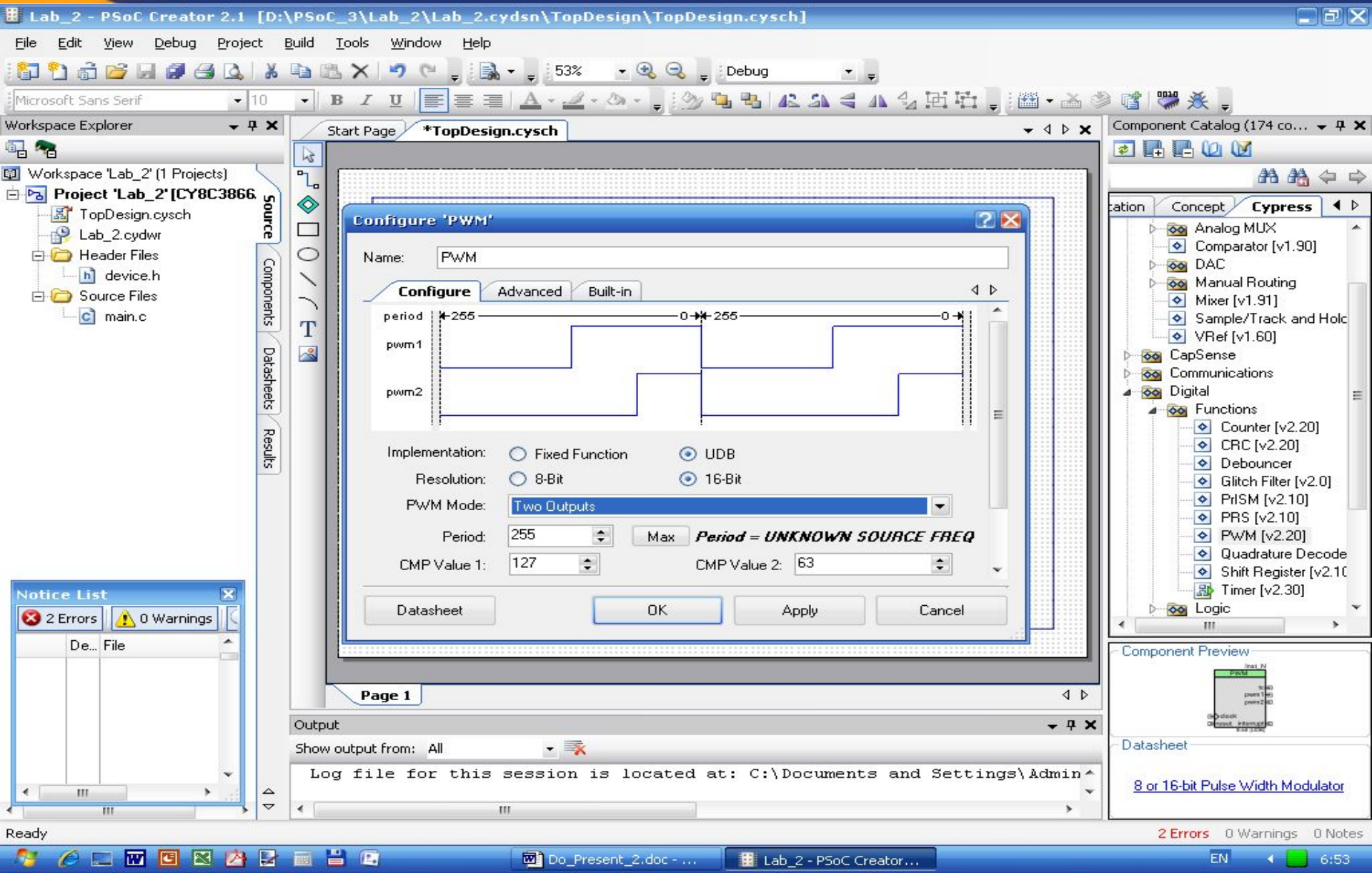
Lab_2 PWM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Configure 'PWM'
Name: PWM
Configure
Advanced
Built-in
period
255
0
pwm1
pwm2
Implementation: Fixed Function UDB
Resolution: 8-Bit 16-Bit
PWM Mode: Two Outputs
Period: 255
Max
Period = UNKNOWN SOURCE FREQ
CMP Value 1: 127
CMP Value 2: 63
Datasheet
OK
Apply
Cancel
Page 1
Component Catalog (174 co...
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Comparator [v1.90]
DAC
Manual Routing
Mixer [v1.91]
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8 or 16-bit Pulse Width Modulator
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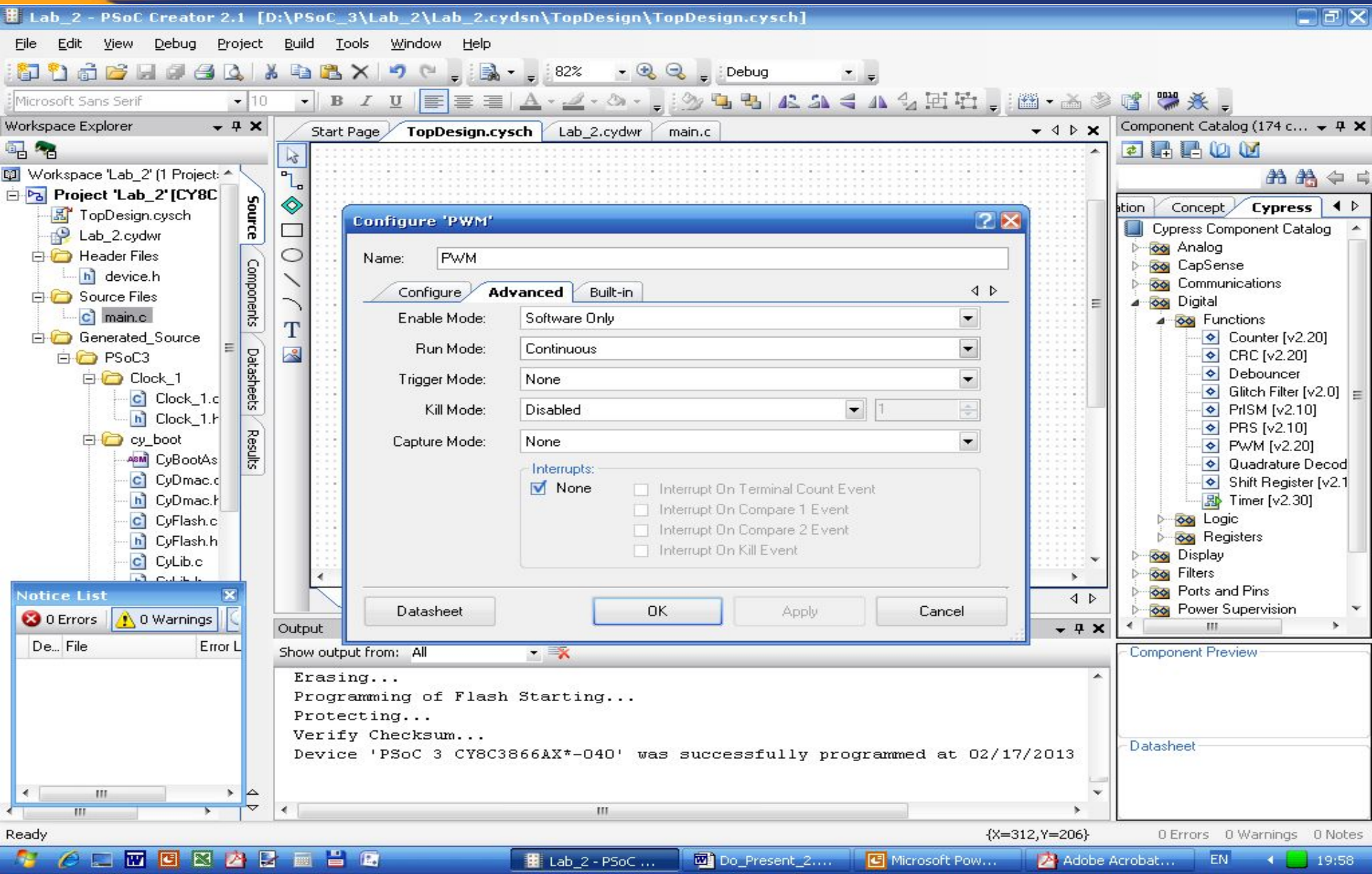
Lab_2 PWM


Lab_2 - PSoC Creator 2.1 [D:\PSoC_3\Lab_2\Lab_2.cydsn\TopDesign\TopDesign.cysch]
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Start Page
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Lab_2.cydwr
main.c
Configure 'PWM'
Name: PWM
Configure
Advanced
Built-in
Enable Mode: Software Only
Run Mode: Continuous
Trigger Mode: None
Kill Mode: Disabled
Capture Mode: None
Interrupts:
None
Interrupt On Terminal Count Event
Interrupt On Compare 1 Event
Interrupt On Compare 2 Event
Interrupt On Kill Event
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Erasing...
Programming of Flash Starting...
Protecting...
Verify Checksum...
Device 'PSoC 3 CY8C3866AX*-040' was successfully programmed at 02/17/2013
Component Preview
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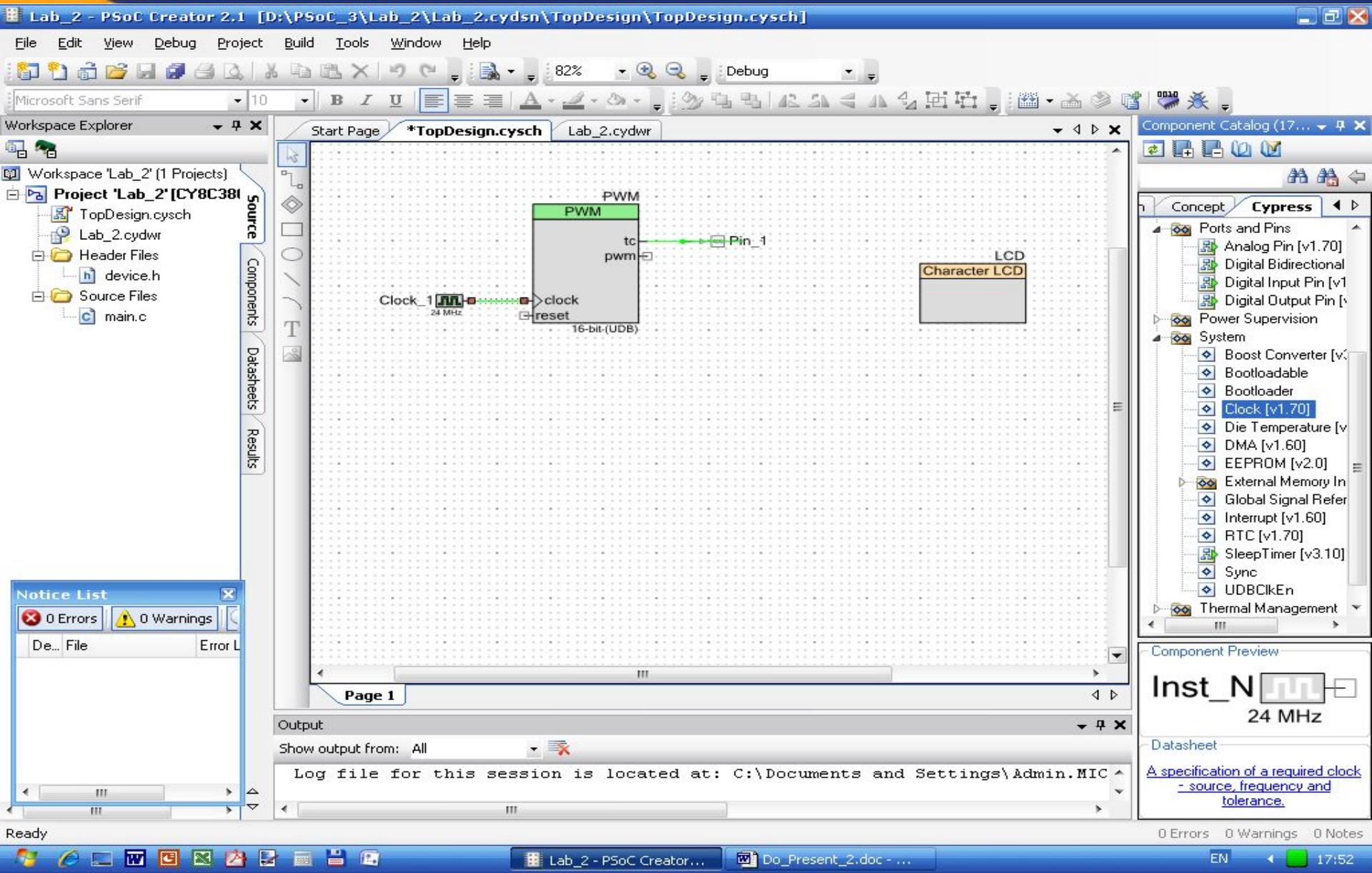
EN
19:58

Lab_2 PWM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main.c
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Lab_2.cydwr
PWM
PWM
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pwm
Pin_1
Clock_1
24 MHz
clock
reset
16-bit-(UDB)
LCD
Character LCD
Page 1
Component Catalog (17...
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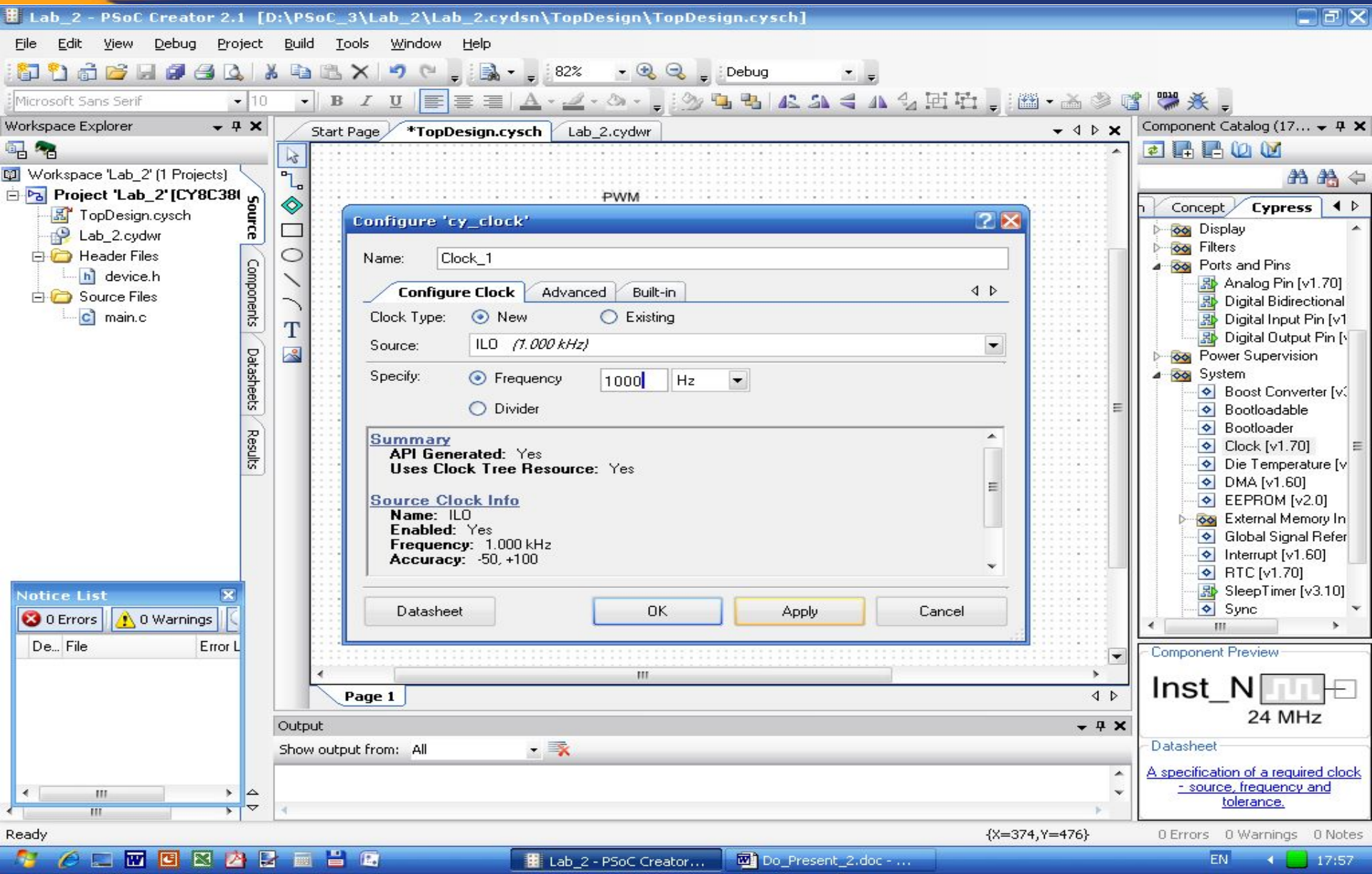
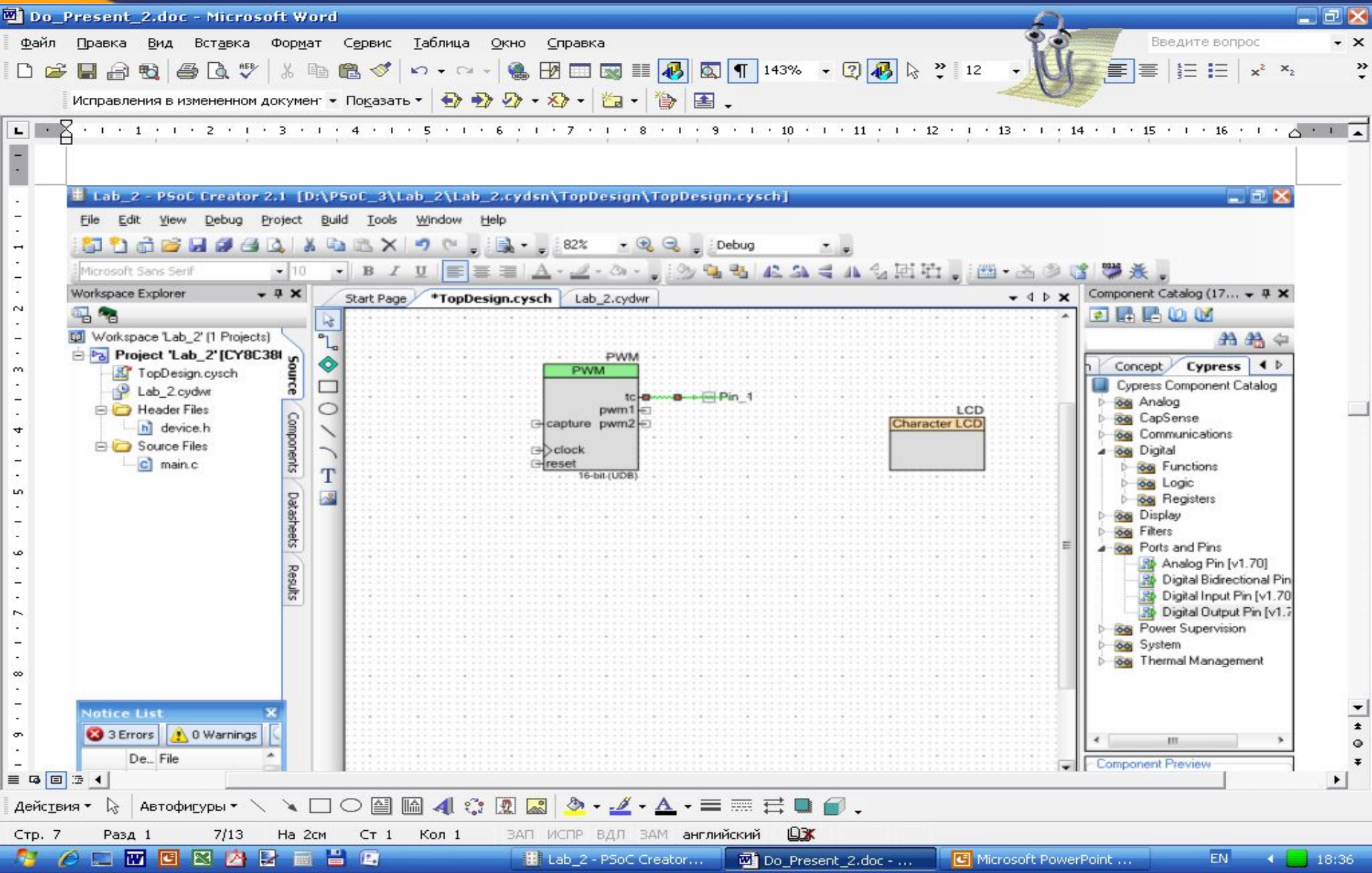
Digital Bidirectional
Digital Input Pin [v1
Digital Output Pin [v
Power Supervision
System
Boost Converter [v
Bootloadable
Bootloader
Clock [v1.70]
Die Temperature [v
DMA [v1.60]
EEPROM [v2.0]
External Memory In
Global Signal Refer
Interrupt [v1.60]
RTC [v1.70]
SleepTimer [v3.10]
Sync
UDBClkEn
Thermal Management
Component Preview
Inst_N
24 MHz
Datasheet
A specification of a required clock - source, frequency and tolerance.
Notice List
0 Errors
0 Warnings
De...
File
Error L
Output
Show output from: All
Log file for this session is located at: C:\Documents and Settings\Admin.MIC
Ready
0 Errors 0 Warnings 0 Notes
Lab_2 - PSoC Creator...
Do_Present_2.doc - ...
EN
17:52

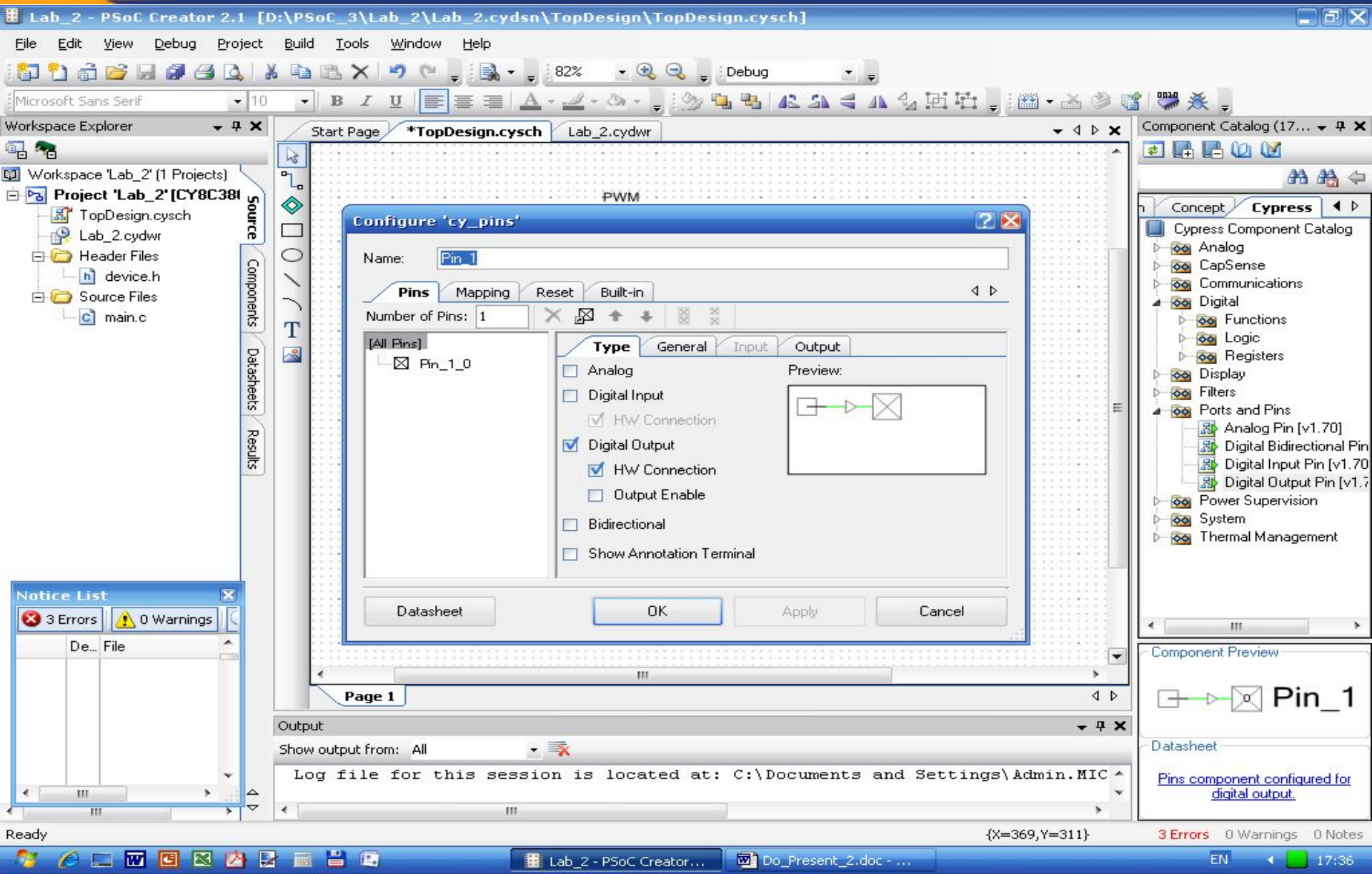
Lab_2 PWM


Lab_2 - PSoC Creator 2.1 [D:\PSoC_3\Lab_2\Lab_2.cydsn\TopDesign\TopDesign.cysch]
File Edit View Debug Project Build Tools Window Help
Workspace Explorer
Workspace 'Lab_2' (1 Projects)
Project 'Lab_2' [CY8C38
TopDesign.cysch
Lab_2.cydwr
Header Files
device.h
Source Files
main.c
Source
Components
Datasheets
Results
Start Page
*TopDesign.cysch
Lab_2.cydwr
PWM
Configure 'cy_clock'
Name: Clock_1
Configure Clock
Advanced
Built-in
Clock Type: New Existing
Source: ILO (1.000 kHz)
Specify: Frequency 1000 Hz
Divider
Summary
API Generated: Yes
Uses Clock Tree Resource: Yes
Source Clock Info
Name: ILO
Enabled: Yes
Frequency: 1.000 kHz
Accuracy: -50, +100
Datasheet
OK
Apply
Cancel
Page 1
Notice List
0 Errors
0 Warnings
De... File Error L
Output
Show output from: All
Component Catalog (17...
Concept
Cypress
Display
Filters
Ports and Pins
Analog Pin [v1.70]
Digital Bidirectional
Digital Input Pin [v1
Digital Output Pin [v
Power Supervision
System
Boost Converter [v
Bootloadable
Bootloader
Clock [v1.70]
Die Temperature [v
DMA [v1.60]
EEPROM [v2.0]
External Memory In
Global Signal Refer
Interrupt [v1.60]
RTC [v1.70]
SleepTimer [v3.10]
Sync
Component Preview
Inst_N
24 MHz
Datasheet
A specification of a required clock - source, frequency and tolerance.
Ready
{X=374,Y=476}
0 Errors 0 Warnings 0 Notes
Lab_2 - PSoC Creator...
Do_Present_2.doc - ...
EN
17:57

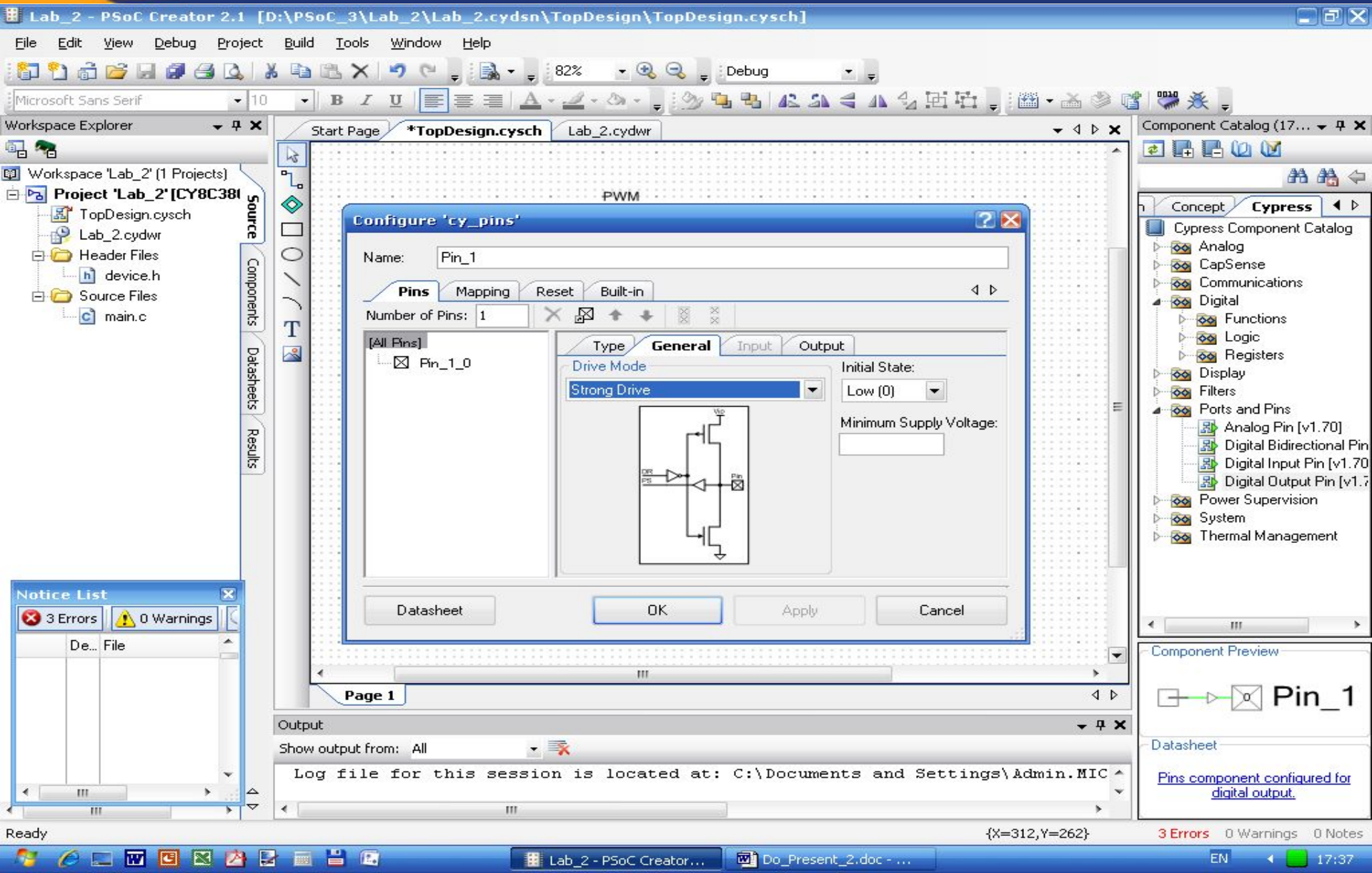
Lab_2 PWM


Do_Present_2.doc - Microsoft Word
Lab_2 - PSoC Creator 2.1 [D:\PSoC_3\Lab_2\Lab_2.cydsn\TopDesign\TopDesign.cysch]
Workspace Explorer
Start Page
*TopDesign.cysch
Lab_2.cydwr
Component Catalog
PWM
tc
pwm1
pwm2
capture
clock
reset
16-bit (UDB)
Pin_1
LCD
Character LCD
Notice List
3 Errors
0 Warnings

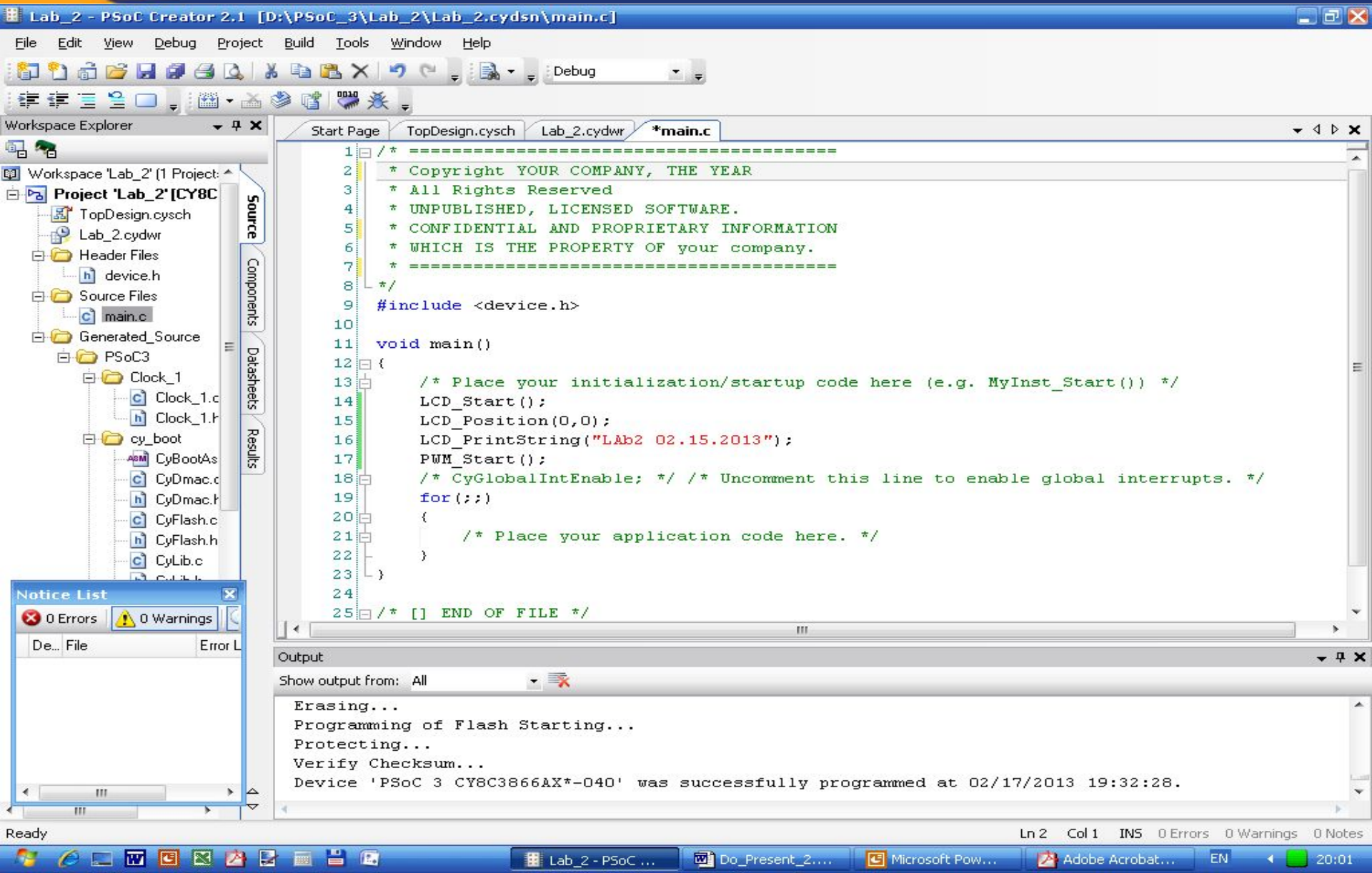
Lab_2 PWM


Lab_2 - PSoC Creator 2.1 [D:\PSoC_3\Lab_2\Lab_2.cydsn\TopDesign\TopDesign.cysch]
File Edit View Debug Project Build Tools Window Help
Workspace Explorer
Workspace 'Lab_2' (1 Projects)
Project 'Lab_2' [CY8C38
TopDesign.cysch
Lab_2.cydwr
Header Files
device.h
Source Files
main.c
Source
Components
Datasheets
Results
Start Page
*TopDesign.cysch
Lab_2.cydwr
PWM
Configure 'cy_pins'
Name: Pin_1
Pins
Mapping
Reset
Built-in
Number of Pins: 1
[All Pins]
Pin_1_0
Type
General
Input
Output
Analog
Digital Input
HW Connection
Digital Output
HW Connection
Output Enable
Bidirectional
Show Annotation Terminal
Preview:
Datasheet
OK
Apply
Cancel
Page 1
Component Catalog (17...
Concept
Cypress
Cypress Component Catalog
Analog
CapSense
Communications
Digital
Functions
Logic
Registers
Display
Filters
Ports and Pins
Analog Pin [v1.70]
Digital Bidirectional Pin
Digital Input Pin [v1.70
Digital Output Pin [v1.7
Power Supervision
System
Thermal Management
Component Preview
Pin_1
Datasheet
Pins component configured for digital output.
Notice List
3 Errors
0 Warnings
De...
File
Output
Show output from: All
Log file for this session is located at: C:\Documents and Settings\Admin.MIC
Ready
{X=369,Y=311}
3 Errors
0 Warnings
0 Notes
Lab_2 - PSoC Creator...
Do_Present_2.doc - ...
EN
17:36

Lab_2 PWM

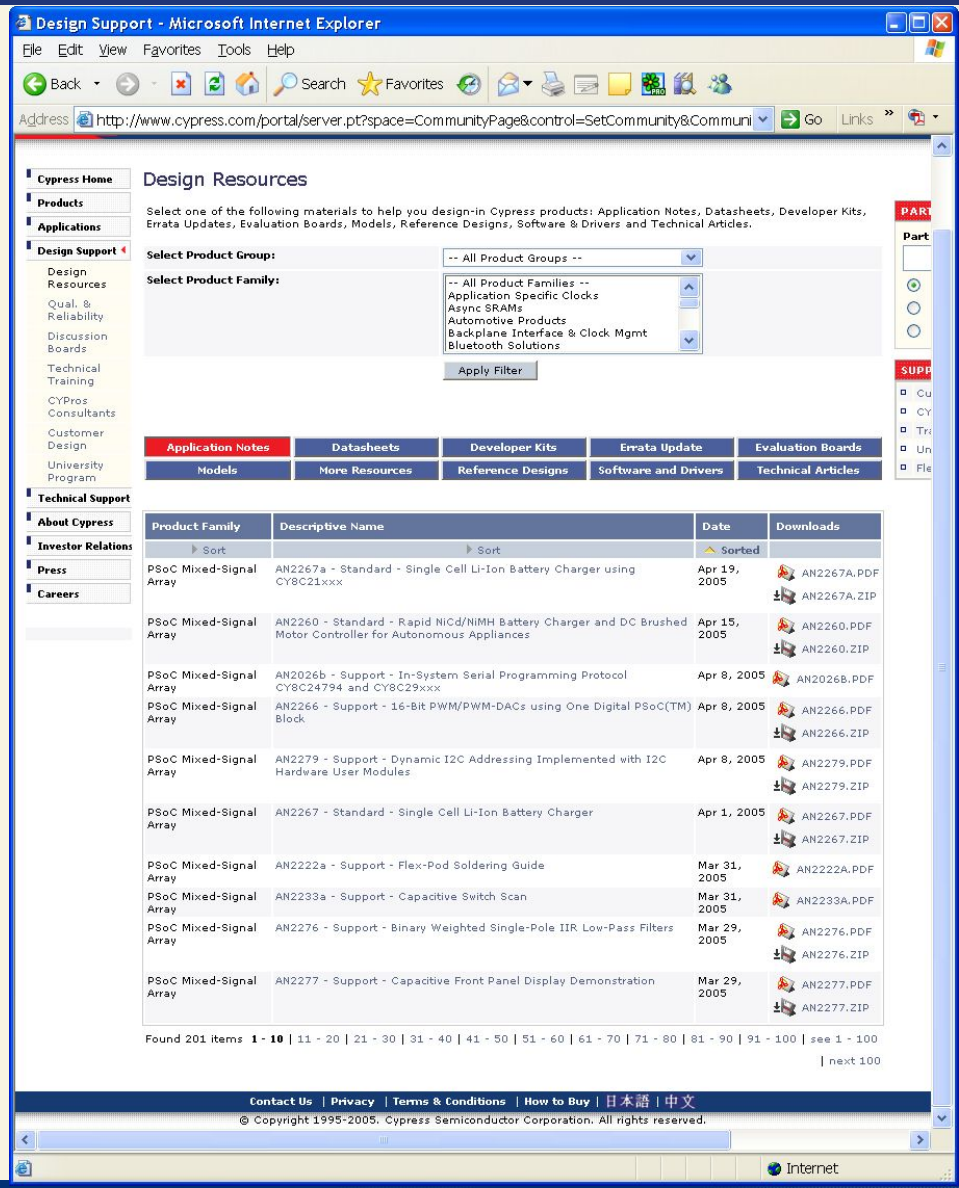

Lab_2 - PSoC Creator 2.1 [D:\PSoC_3\Lab_2\Lab_2.cydsn\TopDesign\TopDesign.cysch]
File Edit View Debug Project Build Tools Window Help
Workspace Explorer
Workspace 'Lab_2' (1 Projects)
Project 'Lab_2' [CY8C38
TopDesign.cysch
Lab_2.cydwr
Header Files
device.h
Source Files
main.c
Source
Components
Datasheets
Results
Start Page
*TopDesign.cysch
Lab_2.cydwr
PWM
Configure 'cy_pins'
Name: Pin_1
Pins Mapping Reset Built-in
Number of Pins: 1
[All Pins]
Pin_1_0
Type General Input Output
Drive Mode
Strong Drive
Initial State:
Low (0)
Minimum Supply Voltage:
Datasheet
OK
Apply
Cancel
Page 1
Component Catalog (17...
Concept Cypress
Cypress Component Catalog
Analog
CapSense
Communications
Digital
Functions
Logic
Registers
Display
Filters
Ports and Pins
Analog Pin [v1.70]
Digital Bidirectional Pin
Digital Input Pin [v1.70
Digital Output Pin [v1.7
Power Supervision
System
Thermal Management
Component Preview
Pin_1
Datasheet
Pins component configured for digital output.
Notice List
3 Errors
0 Warnings
De... File
Output
Show output from: All
Log file for this session is located at: C:\Documents and Settings\Admin.MIC
Ready
{X=312,Y=262}
3 Errors 0 Warnings 0 Notes
Lab_2 - PSoC Creator...
Do_Present_2.doc - ...
EN
17:37

Lab_2 PWM


Lab_2 - PSoC Creator 2.1 [D:\PSoC_3\Lab_2\Lab_2.cydsn\main.c]
File Edit View Debug Project Build Tools Window Help
Debug
Workspace Explorer
Workspace 'Lab_2' (1 Project
Project 'Lab_2' [CY8C
TopDesign.cysch
Lab_2.cydwr
Header Files
device.h
Source Files
main.c
Generated_Source
PSoC3
Clock_1
Clock_1.c
Clock_1.h
cy_boot
CyBootAs
CyDmac.c
CyDmac.h
CyFlash.c
CyFlash.h
CyLib.c
Source
Components
Datasheets
Results
Start Page
TopDesign.cysch
Lab_2.cydwr
*main.c
/* ==
* Copyright YOUR COMPANY, THE YEAR
* All Rights Reserved
* UNPUBLISHED, LICENSED SOFTWARE.
* CONFIDENTIAL AND PROPRIETARY INFORMATION
* WHICH IS THE PROPERTY OF your company.
* ==
*/
#include <device.h>
void main()
{
/* Place your initialization/startup code here (e.g. MyInst_Start()) */
LCD_Start();
LCD_Position(0,0);
LCD_PrintString("LAb2 02.15.2013");
PWM_Start();
/* CyGlobalIntEnable; */ /* Uncomment this line to enable global interrupts. */
for(;;)
{
/* Place your application code here. */
}
}
/* [] END OF FILE */
Notice List
0 Errors
0 Warnings
De... File Error L
Output
Show output from: All
Erasing...
Programming of Flash Starting...
Protecting...
Verify Checksum...
Device 'PSoC 3 CY8C3866AX*-040' was successfully programmed at 02/17/2013 19:32:28.
Ready
Ln 2 Col 1 INS 0 Errors 0 Warnings 0 Notes
Lab_2 - PSoC ...
Do_Present_2....
Microsoft Pow...
Adobe Acrobat...
EN
20:01

Приклади застосування МК PSOC

На сайті фірми Cypress знаходиться більше 200 Application Notes і Reference Designs, які ілюструють області застосування мікроконтролерів PSoC.



Мікропроцесорна техніка

(лекція 2, кінець)

Благітко Б.Я.

2019 р.