11018 VDI

Introduction to the Visual Device Initializer (MPLAB® IDE VDI)

Class Objectives

When you finish this class you will:

- Understand what VDI *is*
- Have used VDI to initialize a microcontroller
- Know the benefits of using VDI

Agenda

- **Talk/Demo Section**
  - What is MPLAB® IDE VDI?
  - Feature Configuration
  - Conflict Detection & Resolution
  - Initialization-Code Generation
  - Miscellany
- **Hands-On Section**
  - Lab 1 - Configure Oscillator, Port, Timer, and UART
  - Lab 2 - Build a Voltage Meter

What is MPLAB® IDE VDI?

VDI Is…

- **A graphical configuration tool for PIC® MCUs**
- **An initialization-code generator**
  - Selectable optimization/robustness
  - Callable from either asm or C
- **A project-report generator**
- **A way to access to Datasheets & Errata**
- **Integrated with MPLAB® IDE**
  - MPLAB IDE Plug-in

Feature Configuration

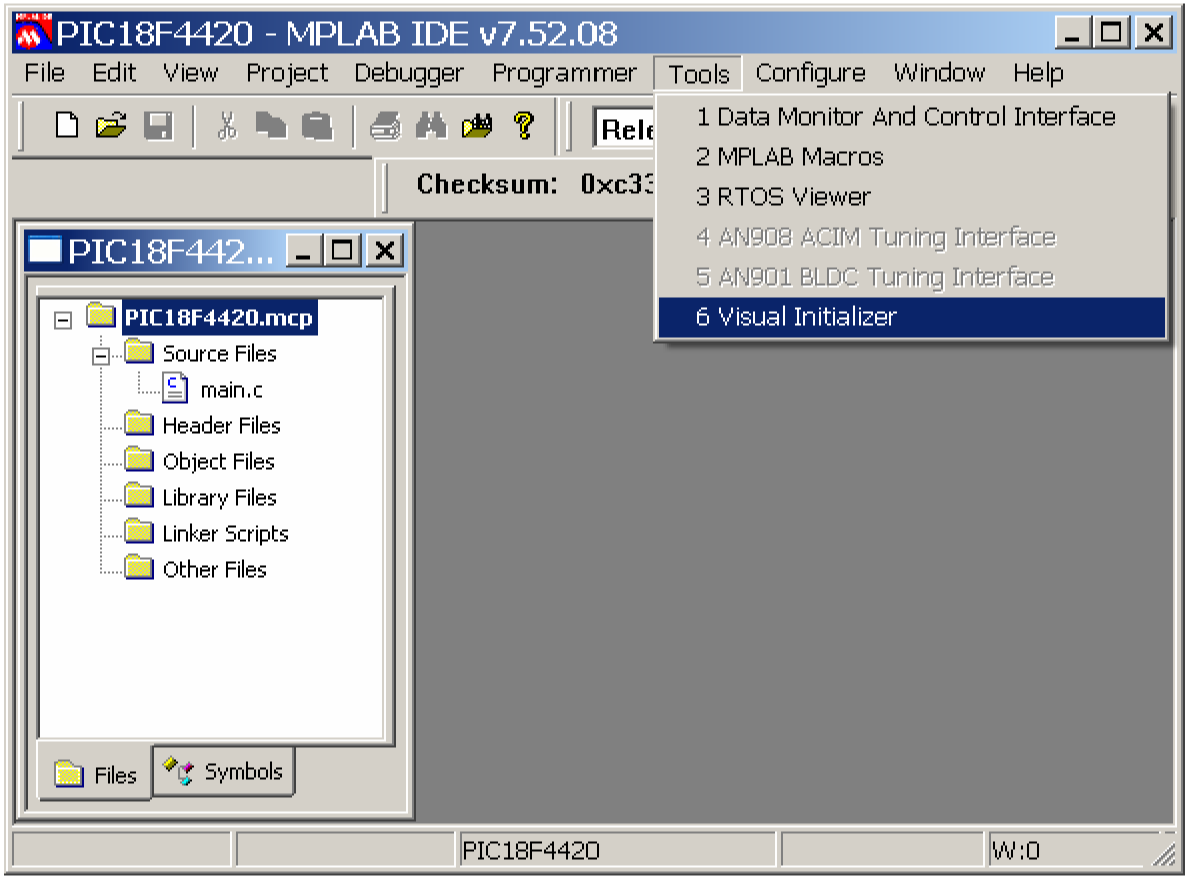
What is a VDI "Feature"?

- **We configure a device by adding, removing, and configuring its features**
- **A "feature" represents a device capability (functional, not physical)**
- **Different VDI features may share the same silicon**
  - Counter 1, Timer 1 and RTC
- **Represented as icons on the palette and on the chip outline**

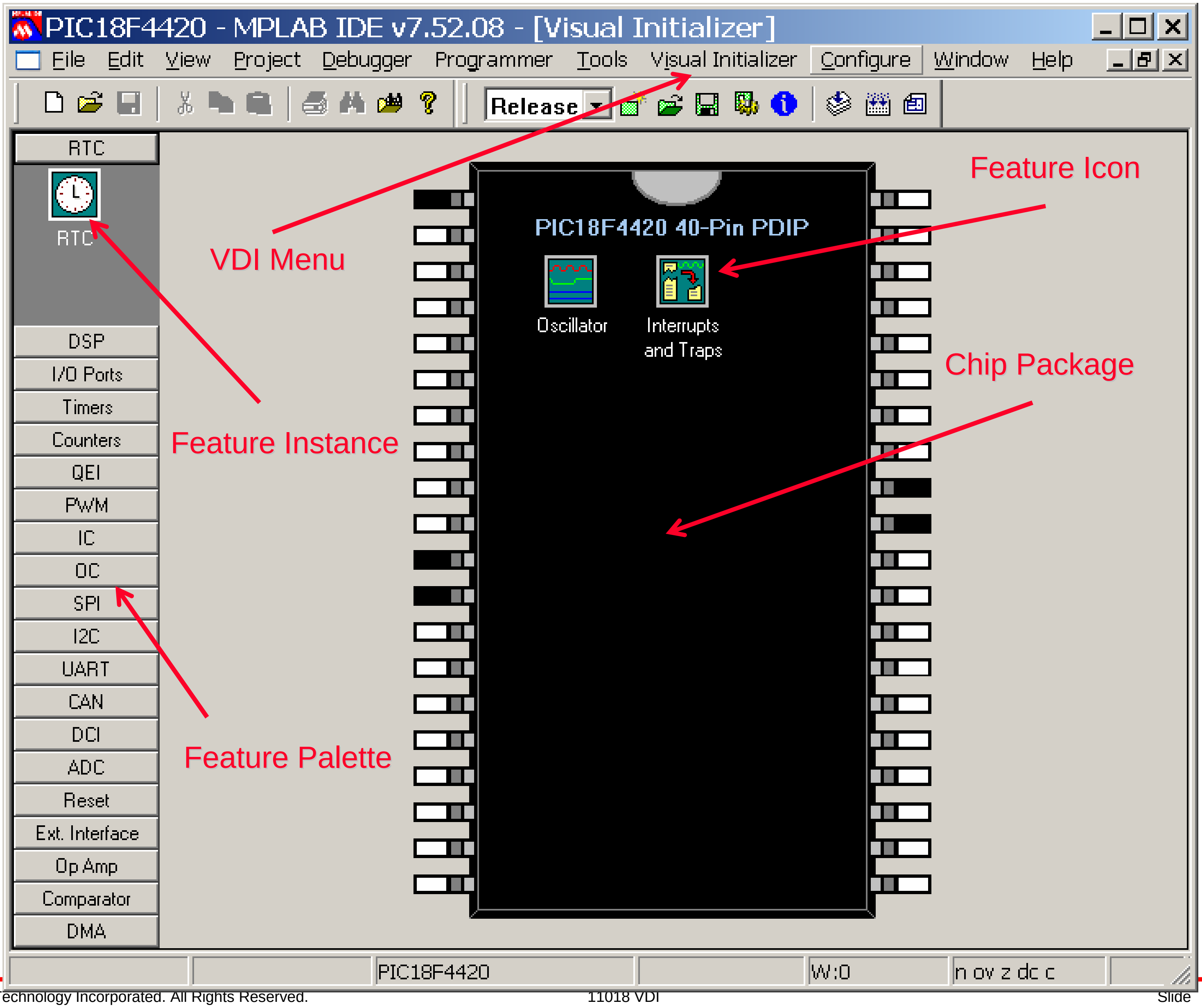
How to Start VDI

- Start MPLAB® IDE if it is not yet running
- Select the "Tools" menu
- Select "Visual Initializer"
- The "Visual Initializer" window pops up
  - Chip outline of selected part and package
  - Palette of available features
- The "Visual Initializer" menu appears with the following menu items:
  - Data Sheet and Errata
  - Report Generation
  - Code Generation
  - (Others too)

How to Start VDI



Hello VDI!



VDI Menu

Feature Instance

Feature Palette

Feature Icon

Chip Package

Why is Stuff Already on Chip?

- **Oscillators and Interrupts**
  - Can’t live without them
- **Oscillators**
  - No heartbeat - no life
- **Interrupts**
  - One-stop-shop for all interrupts
    - **Both used and unused**
  - Can provision interrupts from dialog

How to Add a Feature

- **Click palette “drawer” for the type of feature**
  - I/O Ports, ADC, Timer, etc.
- **Scroll palette to the feature you want**
  - Port A, Timer 3, CAN 2, etc.
- **Click it and drag it onto the chip outline**
- **Drop it!**
  - Feature icons self-organize
  - Scroll-bar appears when chip outline overfull

How to Remove a Feature

- **Click the feature icon on the chip that you want to remove**
  - Port A, Timer 3, CAN 2, etc.
- **Drag it out of the chip outline**
- **Drop it**
  - Feature icon will disappear

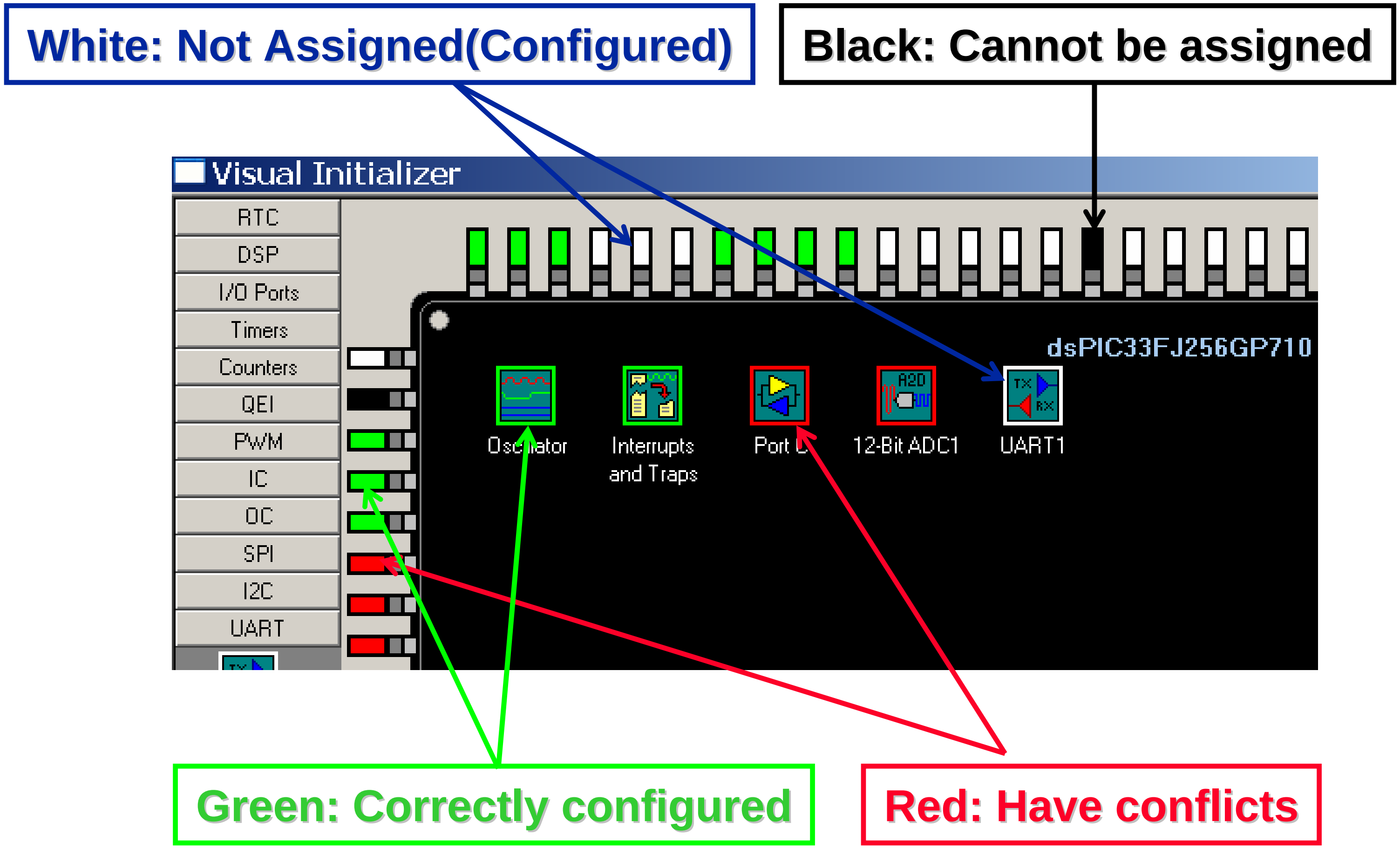
What Can I Do with a Feature?

- **Right-click on a feature icon on chip**
  - Brings up a context menu of possible actions
- **Configure**
  - Same as clicking a gray or green feature icon
- **Error**
  - Show conflict information
- **Zoom**
  - Shows connections between features and pins
- **Help**

VDI Color Code

- **Black**
  - Pin which cannot be assigned (V_{DD}, V_{SS})
- **White**
  - Pin/feature which has not been assigned/configured
- **Green**
  - Pin or feature correctly assigned/configured
- **Red**
  - Pin/feature conflicts* with another pin/feature

VDI Color Code



White: Not Assigned(Configured)

Black: Cannot be assigned

Green: Correctly configured

Red: Have conflicts

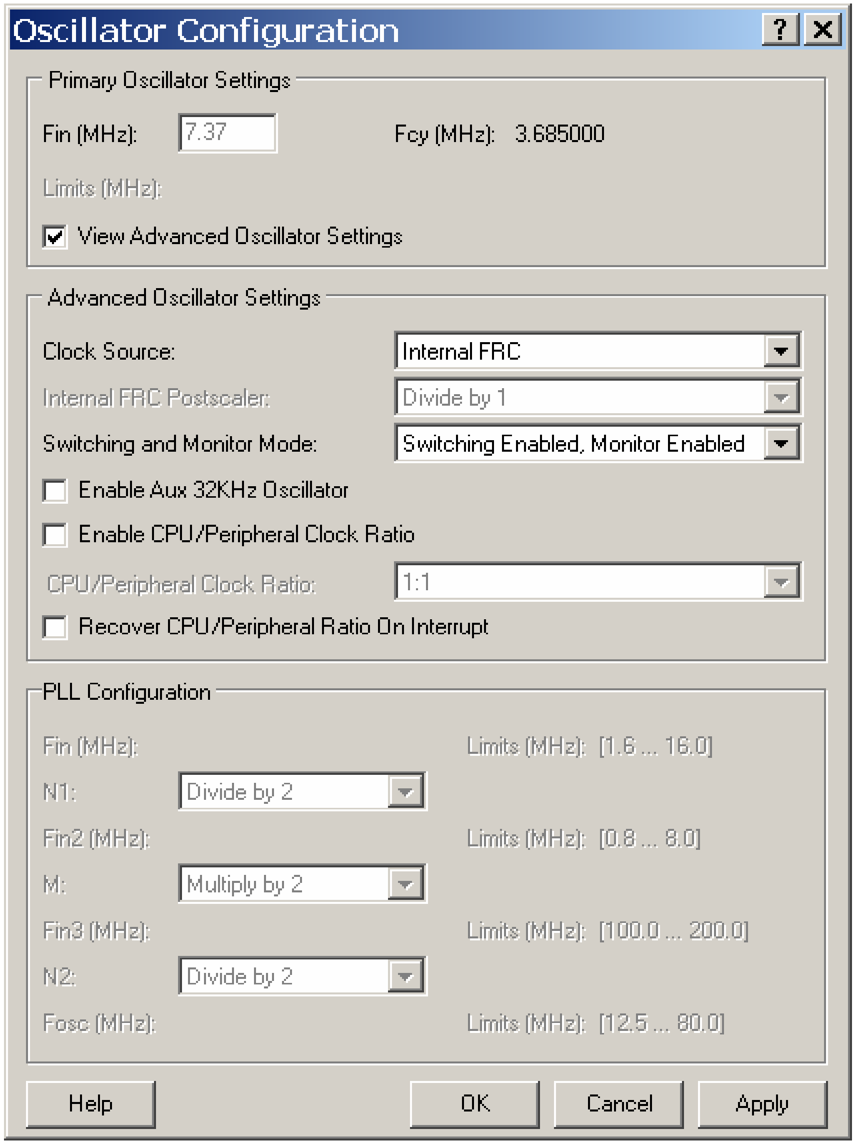
How to Configure a Feature

- Click on the icon of the feature that you want to configure
- The feature-configuration dialog will pop up
- Select/type-in the desired parameters in the configuration dialog
- Click Apply button to set those parameters

How to Configure the Oscillator

- **Select the clock source**
- **Specify Fin (Fosc, if internal is not used)**
- **Specify desired PLL factors if PLL mode is used**
- **Specify other desired parameters**
- **Oscillator frequency used to calculate**
  - Baud rate
  - Timer periods
  - Etc.

How to Configure the Oscillator



Oscillator Configuration

Primary Oscillator Settings

Fin (MHz): 7.37

Fcy (MHz): 3.685000

Limits (MHz):

☑ View Advanced Oscillator Settings

Advanced Oscillator Settings

Clock Source: Internal FRC

Internal FRC Postscaler: Divide by 1

Switching and Monitor Mode: Switching Enabled, Monitor Enabled

☐ Enable Aux 32KHz Oscillator

☐ Enable CPU/Peripheral Clock Ratio

CPU/Peripheral Clock Ratio: 1:1

☐ Recover CPU/Peripheral Ratio On Interrupt

PLL Configuration

Fin (MHz): Limits (MHz): [1.6 ... 16.0]

N1: Divide by 2

Fin2 (MHz): Limits (MHz): [0.8 ... 8.0]

M: Multiply by 2

Fin3 (MHz): Limits (MHz): [100.0 ... 200.0]

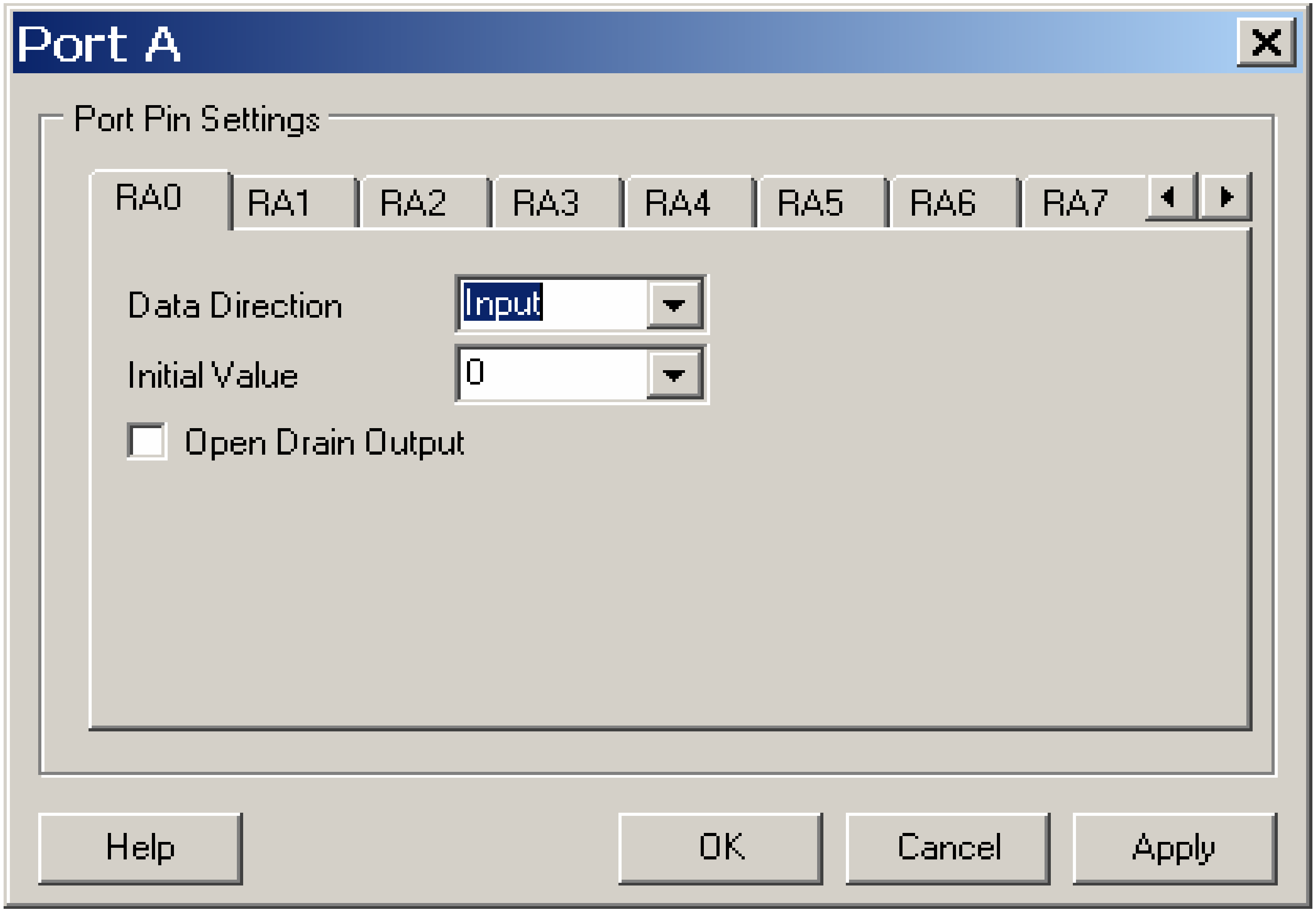
N2: Divide by 2

Fosc (MHz): Limits (MHz): [12.5 ... 80.0]

How to Configure a Port

- **Select I/O ports from the palette**
- **Pick a port, drag it onto the chip outline**
- **Click the feature icon to configure it**
- **For each bit of the port specify:**
  - Input or output
  - If output, initial value
- **Currently there is no way to group port bits**

How to Configure a Port



Port A

Port Pin Settings

Data Direction: Input

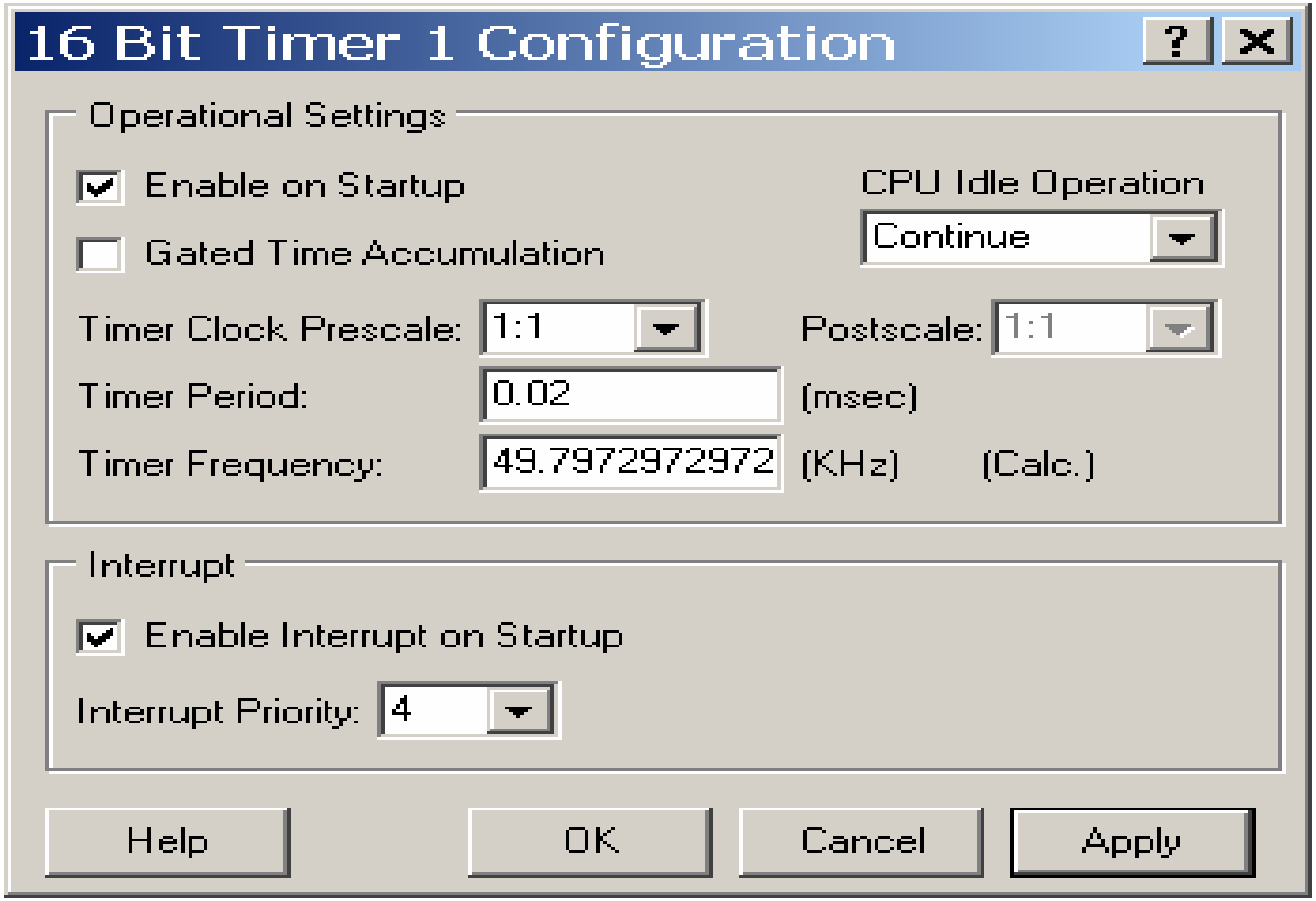
Initial Value: 0

□ Open Drain Output

How to Configure a Timer

- **Select timers from the palette**
- **Pick a timer, drag it onto the chip outline**
  - TIP: Some timers have special functions
- **Click the feature icon to configure it**
- **Timer period in milliseconds**
  - Not register values
  - Derived from oscillator settings
- **Operation enable on startup**
- **Interrupt enable on startup**

How to Configure a Timer



16 Bit Timer 1 Configuration

Operational Settings

☑ Enable on Startup

□ Gated Time Accumulation

CPU Idle Operation: Continue

Timer Clock Prescale: 1:1

Postscale: 1:1

Timer Period: 0.02 (msec)

Timer Frequency: 49.7972972972 (KHz) (Calc.)

Interrupt

☑ Enable Interrupt on Startup

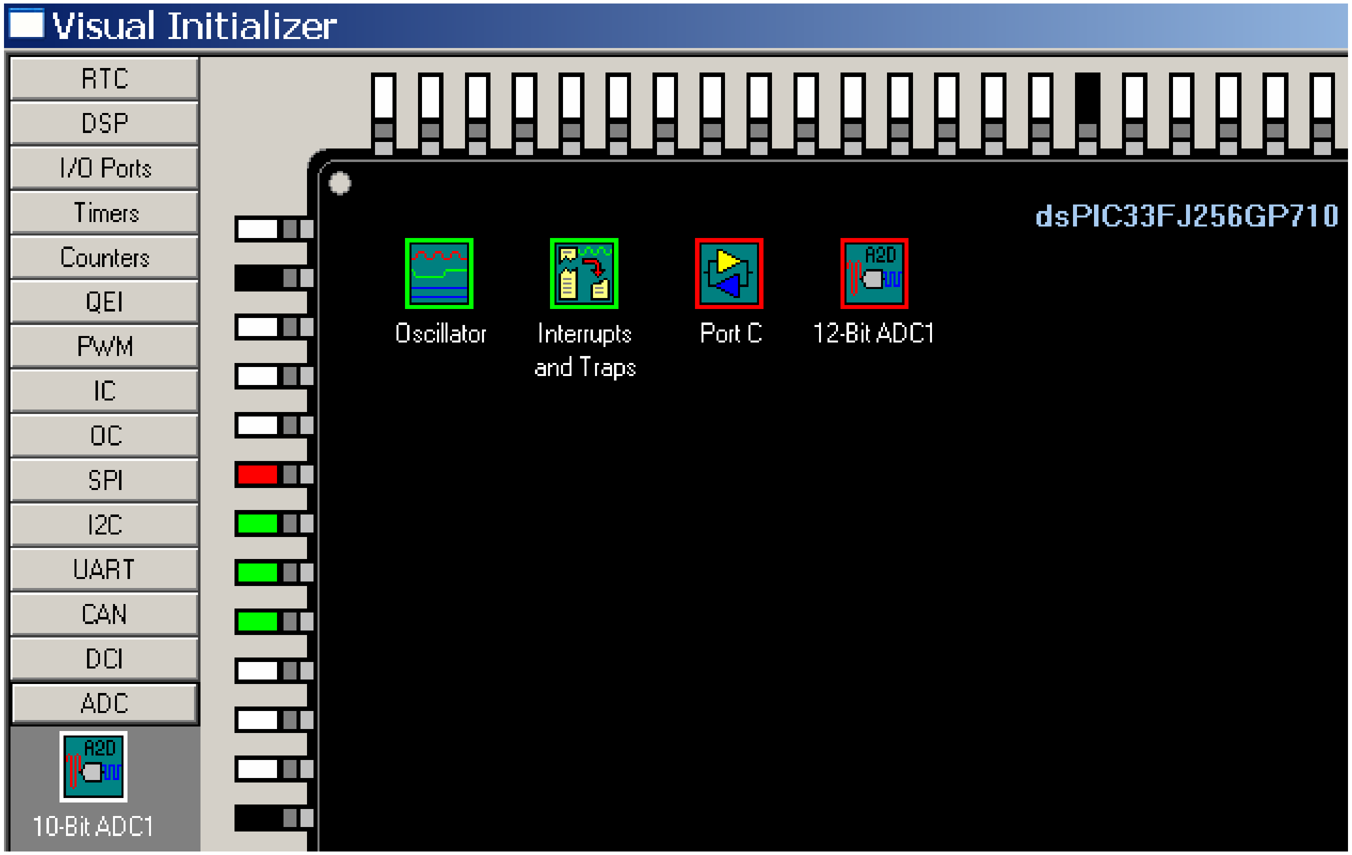
Interrupt Priority: 4

Conflict Detection & Resolution

A Conflict Example

- Claim A2D input pin 16
- Claim Port C pin RC1

A Conflict Example



Oh No! There are Conflicts!

- **Relax, breathe deeply**
- **What is a "Resource"?**
  - An interrupt, register, or pin
- **What is a "Resource Conflict"?**
  - Two or more conflicting demands on the same resource

Conflict-Resolution Tips

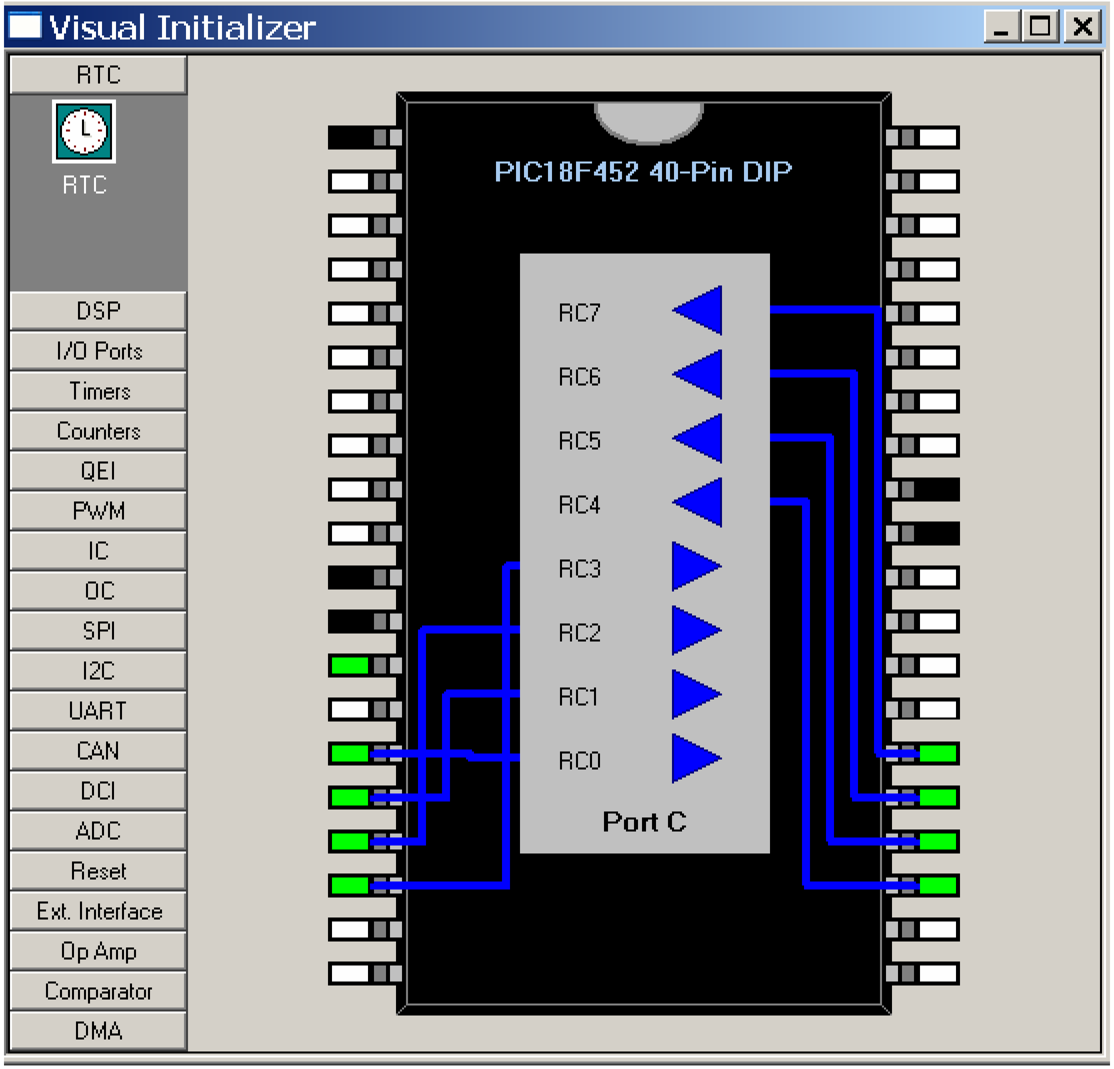
- **Find the conflicted resource**
  - Gather information from MPLAB® IDE output window
- **Is the conflict really a problem?**
- **VDI doesn’t force a solution**
  - VDI’s conflict checking is “static”
  - VDI doesn’t lock you out of conflicting configuration choices
- **Configure less-flexible features first**
- **Apply configuration changes incrementally**

Feature Menu Revisited

- Right-click on a feature icon on chip
  - Brings up a context menu of possible actions
- Configure
  - Same as clicking a gray or green feature icon
- Error
  - Show conflict information
- Zoom
  - Shows connections between features and pins
- Help

Zoom

Shows connections between features and pins



Initialization-Code Generation

How to Generate Code

- **Select the “Visual Initializer” menu**
- **Select “Code Generation Options”**
  - Choose options that fit your application
- **Select “Code Generation”**
- **Click the “Save to Project” button**

The Generated Code...

- **Initialization code for selected features**
  - Assembly code for optimal performance
  - Callable from C and Assembly
- **Files automatically added to project**
  - C-callable assembly source code
  - Header file with function prototype

...Calling It From C

- `#include` the .h file
- Call `VisualInitialization();`
- Your PIC® MCU is in the requested state

...Calling It From Assembly

- `INCLUDE` the .inc file
- `CALL _VisualInitialization`
- Your PIC® MCU is in the requested state

What’s Left For You to Write?

- **Your application code!** ***;-)***
- **ISRs (Interrupt Service Routines)**
  - See PIC® MCU Programming Guide
  - See C18, C30 User’s Guide

Building & Running the Demo

- Add application-specific code
- Build the project
- Debug the project

Miscellany

Saving the VDI Configuration

- **VDI configuration is saved in the Workspace**
  - Select the File menu
  - Select the “Save Workspace” menu item

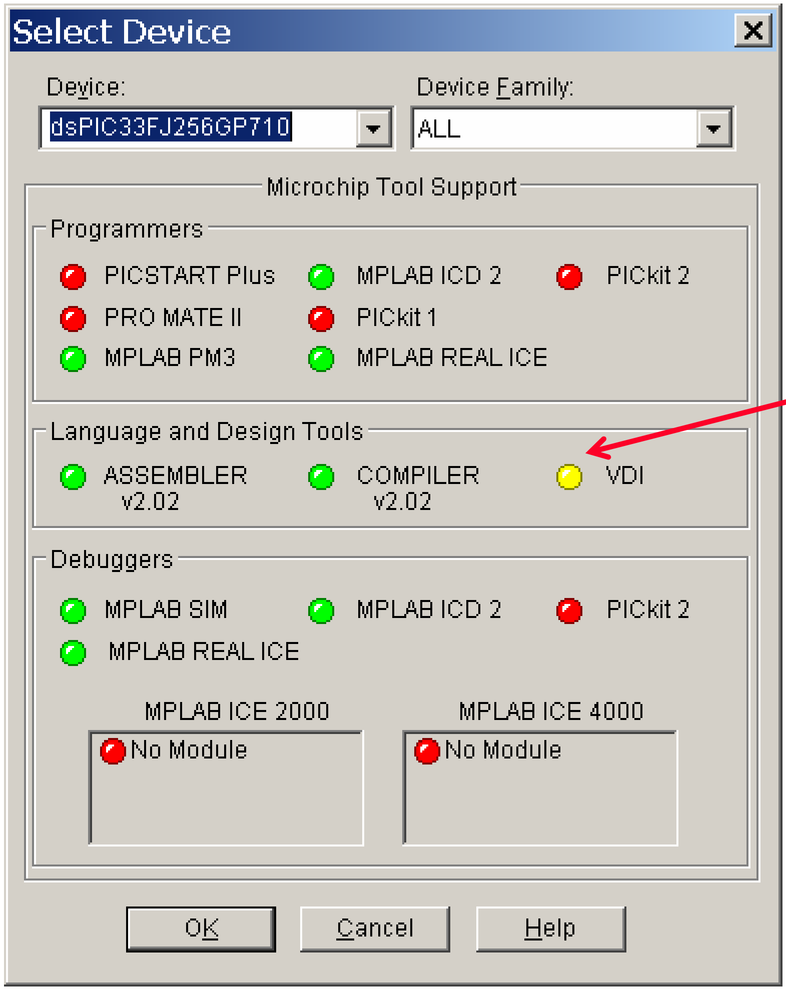
VDI Part Support

- **dsPIC® Digital Signal Controller Family**
  - 29 dsPIC30F devices
  - 19 dsPIC33F devices
- **31 PIC24F Devices**
- **46 PIC18 devices**
- **PIC16F785**

Checking If A Part Is Supported

- **Go to the Configure menu**
- **Select Device menu item**
- **Device dialog box will pop up**
- **Pick the device the you want to check from device combo box**
- **Check the VDI GYR (green, yellow, red) light**
  - Green: Full support
  - Yellow: Beta support
  - Red: No support

Select Device Dialog



Select Device

Device: dsPIC33FJ256GP710

Device Family: ALL

Microchip Tool Support

Programmers

🔴 PICSTART Plus	🟢 MPLAB ICD 2	🔴 PICkit 2
🔴 PRO MATE II	🔴 PICkit 1	
🟢 MPLAB PM3	🟢 MPLAB REAL ICE	

Language and Design Tools

🟢 ASSEMBLER v2.02	🟢 COMPILER v2.02	🟡 VDI

Debuggers

🟢 MPLAB SIM	🟢 MPLAB ICD 2	🔴 PICkit 2
🟢 MPLAB REAL ICE		

MPLAB ICE 2000: 🔴 No Module

MPLAB ICE 4000: 🔴 No Module

VDI GYR Light

What’s Next in VDI Development?

- **Any thing that will help you!**
- **Configurable Library in VDI**
  - Configurable Library is a collection of configurable library modules
  - The library module implements firmware functionality
  - It has parameters that you can configure
- **More devices support**
  - All dsPIC33F devices are expected to be supported by the end of this year
  - All PIC24HJ devices are expected to be supported by the end of this year

Benefits of Using VDI

- Interactively evaluate a PIC® MCU for fit
- Configure the whole device for your job
- Generate code for feature initialization
- Maintain device setup for later modification
- Access datasheets and errata
- Generate project reports

Where Can I Find VDI?

- **On the MPLAB® IDE CD-ROM**
- **On the Microchip Web Site**
  - Under Development Tools, Software
  - http://ww1.microchip.com/downloads/en/DeviceDoc/vdisetup.zip
- **From your local Microchip Sales Office**

Questions?

Lab 1 – Use VDI to Configure Osc, Port, Timer, and UART

- **Use dsPIC33FJ256GP710 MPLAB® IDE SIM**
- **Functionalities**
  - Increase the value of LATA by 1 every second
  - Send the value of LATA to UART
  - Enable/Disable Sending the value of LATA to UART by sending E/D to UART.
- **Features to be configured**
  - Oscillator
  - Port A
  - Timer 1
  - UART 1
- **See handout for detailed information**

Lab 2 – Build a Voltage Meter
Using dsPIC33FJ256GP710

- **Functionalities**
- **Use Explorer 16 Development Board (DM240001)**
  - Convert analog voltage input at RA5
  - Configure RTC
  - Display the voltage on the LCD
  - Display the time (on RTC) on the LCD
  - Send the value of the voltage to UART2
- **Features to be configured**
  - Oscillator
  - Port A
  - RTC
  - 12-bits ADC
- **See handout for detailed information**

References

- dsPIC33F Family Data Sheet
- Explorer 16 Development Board User’s Guide
- C30 Compiler User’s Guide
- C18 Compiler User’s Guide

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