

C What Happens

INTRODUCTION

PIC MICROCONTROLLER PRODUCT OVERVIEW

SELECTING A DEVICE FOR EXPERIMENTS

PIC16F818

- Pins and functions
- Package
- Clock oscillator
- Reset
- Ports
- Special Features
- PIC microcontroller architecture
- Code and data protection
- Configuration bits

CIRCUIT FOR PIC16F818 EXPERIMENTS

CHOOSING DEVELOPMENT TOOLS

- CCS compiler
- Device programming methods
 - Device programmers and ease of running code examples
 - Device programmer
 - In-circuit serial programmer
- Choosing a device programmer
 - Microchip PICSTART Plus
- Choosing an in-circuit programmer/debugger
 - CCS ICD-U40 (or -S40)
 - Microchip PICKit 2
 - Microchip ICD 2

PROGRAMMING A DEVICE USING THE ICD-U40 (or -S40)

PROGRAMMING A DEVICE USING THE PICKit 2

PROGRAMMING A DEVICE USING THE ICD 2

PROGRAMMING A DEVICE USING THE PICSTART Plus

CCS COMPILER

C SOURCE CODE

- What it looks like
- Typing accuracy
- Comments
- Text And Formatting

BITS, BYTES, ETC.

- Bit
- Nibble
- Byte
- Binary.
- Hexadecimal

CONSTANTS

VARIABLES

DATA

- Data types
- ASCII characters

NAMING CONSTANTS AND VARIABLES

- Reserved words in C

OPERATORS - SHORT LIST

TRUE vs. FALSE

DEVICE FILES

PRE-PROCESSOR DIRECTIVES - SHORT LIST

INs AND OUTS OF DIGITAL I/O

CONFIGURATION REGISTER(S) FUSES

FUNCTIONS

- main() function
- Functions
- Built-in functions - short list

STATEMENTS

- Executable statements
 - Blocks
- Conditional statements
- Semicolon use rules

PROGRAM DESIGN

Program design - control flow

- if
- if/else
- while loop
- do/while loop
- for loop
- switch/case
- break
- continue
- return
- goto

Rule

Modular programming

WRITING PROGRAMS (With Experiments)

Programming concepts

Programming examples

Simple data transfers

Loop - endless

- While loop

- Do/while loop

- Port registers accessed as variables

- Port addresses defined using #byte directives

- Port addresses defined using user-created

- include file

- Port addresses defined using get environment

- built-in function

Loop with a counter

- For loop

Loop until

- While loop

Comparisons

- Relational operators

- If/else

Switch/case

Function calls and time delays

Bit-level I/O using built-in functions

- Bit toggle

- If statement - read switch position

- ! logical operator

- && logical operator (two switches)

- || logical operator (two switches)

- if/else, else, else

- Read input bit, write output bit

- Event counting

Bit manipulation using bit manipulation functions

- Bit set/clear

- Bit testing

Flags

- #bit pre-processor directive example

- typedef example

- Bit manipulation using bitwise operators
 - Shift bits right or left
 - Change specific bit to "1"
 - Change specific bit to "0"
 - Change specific bit to it's complement
- Goto
- Function library
- Cut and paste

TALKING TO A PIC MICROCONTROLLER WITH A PC VIA A WINDOWS TERMINAL PROGRAM

- "U"-turn experiment
- PC-to-PC "2-lane highway" experiment
- PC/PIC microcontroller
 - PC baud rates
- RS-232 interface for a PIC microcontroller
- PIC microcontroller-to-PC serial communication
- Formatting PIC microcontroller data on a PC screen

STRINGS

ARRAYS

- Index to an array
- Step through array elements
- Extract nth element from array
- Add offset to index
- Lookup tables
 - 7-segment LED display

STRUCTURES

- Structures and ports - bit fields

MATH AND MANIPULATING NUMBERS

- Mathematical operators
- Operator precedence
- Data type selection considerations
- Formatting variables such as math results for printing

PASSING VARIABLES

- Passing arguments
- Returning values
- Prototyping functions

OPERATORS

- Assignment operator
- Relational operators
- Logical operators
- Increment and decrement
- Mathematical operators
- Bitwise operators
- Pointer operators
- Structure operators
- Operators that don't fit the categories

INTERRUPTS

- External interrupt sources
- Internal interrupt sources
 - Timer 0 interrupt
 - Port B interrupt on change - bits 7,6,5,4
 - Interrupts generated by other peripherals
- Global interrupt enable flag (GIE)
- Return from interrupt
- Where to put the interrupt service routine in program memory
- Interrupt latency
- Multiple external interrupt sources
- Interrupts in C
 - Functions - Built-in
 - Pre-processor directives used to identify interrupt service routines
- Example - external interrupt

TIMING AND COUNTING USING TIMER 0

- Digital output waveforms
- Using timer 0
- Prescaler
- Putting timer 0 to work
 - Setting up timer 0
 - Starting timer 0
 - Counter
 - How do we know timer 0 is doing something?
 - Timer 0 will keep on counting as long as:
 - Timer 0 must be reloaded after each overflow for repeating time intervals
 - Stopping timer 0
- Timer 0 experiments
 - Digital output waveform using timer 0 - internal clock
 - Single time interval - internal clock
 - Free running mode - internal clock - 0.1 second period
 - Single time interval - external clock
 - Free running mode - internal clock
 - Counting events (pulses)
- Going further

ANALOG TO DIGITAL CONVERSION

INSERTING ASSEMBLY CODE IN C CODE

APPENDIX A - PULSER

APPENDIX B - SOURCES

APPENDIX C - HEXADECIMAL NUMBERS

APPENDIX D - PROGRAM LISTINGS vs. PAGE NUMBERS