EE4800-03
Embedded Control Systems

Lesson 1
Course Overview,
68HC12 Overview
Overview

• Course objectives
• Course overview
• Course policies
• 68HC12 and HCS12 Overview
Course Objectives

• Provide you:
  – fundamental microcontroller programming skills in C, assembly, and mixed language applications
  – functional understanding of microprocessor subsystems
    • Review: ATD, TIM, SCI
    • New: PWM, CAN, RTOS
Course Objectives - continued

– skills to interface to a wide variety of external devices
– methodical procedures for designing complex embedded control systems
– exposure to the most complex embedded control systems
  • multi-processor distributed system
  • single processor, multi-task systems - RTOS
Course Overview

• Structured Design Techniques
• Review C Programming Skills
• Microcontroller Systems Review
• Interrupts
• Input/Output Interfacing Concepts
• Logic Analyzers
• Real World Design Issues
• Real Time Operating Systems
• Distributed Processing Systems - msCAN
• Case Studies
Laboratory Work

• Integral part of course
• Develop:
  – Programming Skills
  – Design Skills
  – Team work skills
  – Team exercise skills
  – Troubleshooting skills
Laboratory Exercises

- Introduction Lab
- Measure Gravitational Constant with TIM System and Interrupt Driven System
- Interrupts: IRQ and RTI
- Multiple Interrupts: Output Compare
- Logic Analyzers
- Weather Station - multi-system laboratory
- Motor Speed Control - multi-system, team exercise
Course Policies

• Review Syllabus

• Key reminders:
  – Must attend and complete all lab assignments
  – Ensure you understand all aspects of lab, you will be tested on lab material
  – Don’t allow yourself to be carried through lab assignments by strong lab partner
68HC12 Overview

• Introduced by Motorola 1997
• Instruction Set
  – 209 instructions, multiple addressing modes
• CPU12
  – 16 bit processor
  – variants:
    • “A4”: expanded mode, 8 MHz
    • “B32”: single chip mode, 8 MHz
    • HCS12 series: larger onboard memory, 25 MHz
• Clock speed: 16 MHz crystal, divide by 2 for 8 MHz system clock
  – clock generated by crystal or ceramic resonator
68HC12 Overview (cont)

- Memory: 1K-byte RAM, 4K-bytes EEPROM, expandable to 5M-bytes
- Serial communications: SCI and SPI
  - asynchronous vs. synchronous communication
  - SCI: communications - asynchronous
  - SPI: extend features of 68HC12 - synchronous
- 8 channel analog-to-digital converter
- 8 channel timer
  - input capture, output compare, pulse accumulation
- Background Debug Mode (BDM) - troubleshooting
- Memory-mapped input/output
Figure 1.3 The block diagram of the MC68HC812A4 (Motorola).

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1.6 Block Diagrams

Figure 1-1. Block Diagram for MC68HC912B32 and MC68HC12BE32