Embedded Microcontrollers

Flexis™ AC DEMO51ACKIT
Lab tutorial
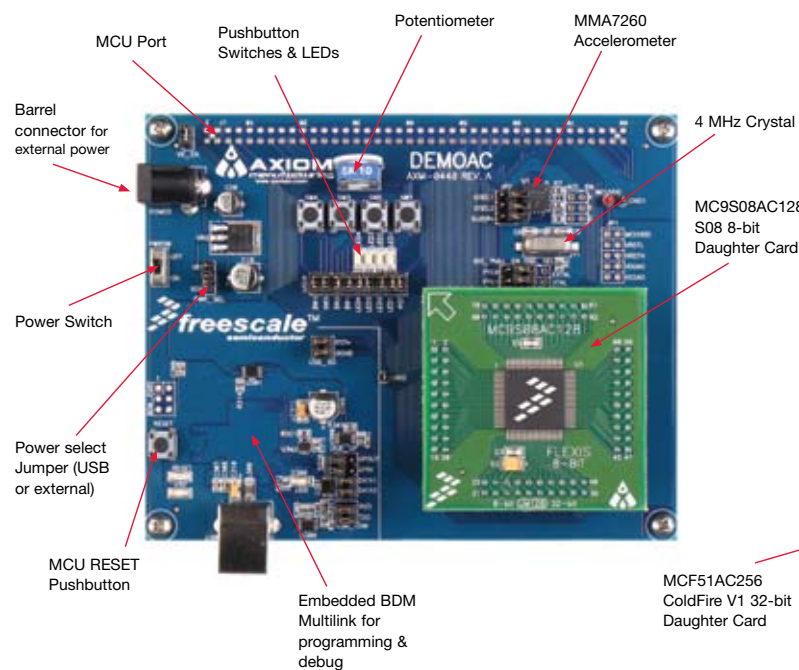
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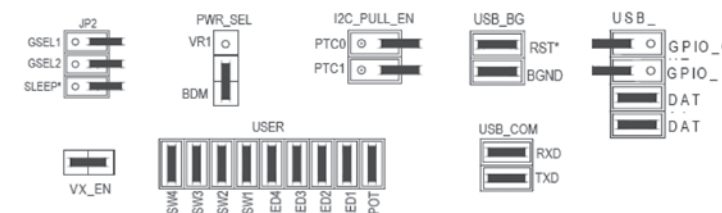
Doc Number: DEMO51ACLAB / REV 0

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Figure 1.
DEMOAC KIT

MCU Port
Pushbutton Switches & LEDs
Potentiometer
MMA7260 Accelerometer
Barrel connector for external power
4 MHz Crystal
MC9S08AC128 S08 8-bit Daughter Card
Power Switch
Power select Jumper (USB or external)
MCU RESET Pushbutton
Embedded BDM Multilink for programming & debug
MCF51AC256 ColdFire V1 32-bit Daughter Card

Default Jumper and Switch Settings

The default jumper settings for the DEMOAC board are shown below.

Jumper	Default Settings
VX_EN	ON
PWR_SEL	Set to BDM
USER	All ON
JP2	All OFF
I2C_PULL_EN	All OFF
USB_BG	All ON
GP_IN	OFF
GP_OUT	OFF
DATA1	ON
DATA2	ON
RXD	ON
TXD	ON

DEMO51ACKIT

DEMOAC Labs

These labs will show you how to get the most out of your DEMOAC board toolkit. The DEMOAC board comes in several versions depending on the target AC family MCU:

- DEMOS08AC16KIT
- DEMOS08AC60KIT
- DEMOS08AC128KIT
- DEMO51AC256KIT
- DEMOACKIT which includes both the MC9S08AC128 and MCF51AC256

This lab document applies to DEMO51AC256KIT.

Start each lab with the board powered ON. Make sure to use only one utility at a time, as they share the same USB source. Familiarize yourself with these buttons:

Start/Continue (F5) button

MCU Change Wizard button

Debug button

LAB 1

Learn How to Use the DEMOAC Board Toolkit Utilities

This lab will show you how to use one of several graphical utilities in the DEMOAC Board Toolkit included with your board. Instructions to download these utilities to your computer are provided in Step 2 of the Quick Start Guide (DEMOACQSG.pdf).

We will use the CodeWarrior IDE to program a new software example into the AC256 and use the DEMOAC Logic Analyzer utility. This PC-based utility graphs the IN0 and IN1 signals on the board. For convenience, if both DATA1 and DATA2 jumpers are installed, IN0 graphs PTF2 activity and IN1 graphs PTF3 activity. To graph other microcontroller signals, use wire jumpers from the USB side of DATA1 and DATA2 to the respective signals on the board's MCU PORT.

1. Open CodeWarrior for Microcontrollers. From Windows start menu you can locate it using the "Programs>Freescale CodeWarrior>CW for Microcontroller V6.1>CodeWarrior IDE.exe" path.

2. Click on "Load Example Project" from CodeWarrior startup dialog. If the startup dialog is not shown, it may be opened from the CodeWarrior menu by clicking "File" and then "Startup Dialog…".

3. From example projects menu, open tree to select "ColdFire V1>Evaluation Board Examples>DEMOAC>DEMO51AC256_Logic_Analyzer"

4. Create a new project name (ex. Lab1), set desired location and click "Create Project". This will open the project for the logic analyzer application for the 32-bit microcontroller.

5. Ensure the 80-Pin LQFP 32-bit ColdFire® V1 AC256 microcontroller daughter card is installed on the DEMOAC board.

6. Turn board power switch to ON.

7. ▢ Compile and program the logic analyzer application by clicking on "Debug" button.

8. From Connection Manager menu, select "USB1:DEMOAC(PEnnnnnnn)" port and click on "Connect (Reset)."

9. From Loader Warning menu, click on "OK" to allow the debugger to mass erase the microcontroller's on-chip flash memory and program it with the new application.

10. ▢ Click on "Start/Continue (F5)" button in debugger to run application.

11. Open the DEMOAC Board Logic Analyzer utility from Windows start menu: Programs>P&E Embedded Multilink Toolkit>Utilities>Logic Analyzer Utility.

12. In the utility, click on the "Connect to Embedded Multilink Analyzer and Graph Pins" button to begin graphing IN0 and IN1. These signals will be continually graphed at a sampling rate of 10Khz.

13. Rotate the potentiometer RV1 clockwise and counter-clockwise. This will change the duty cycle of the variable pulse-width modulation signals output on the PTF2 and PTF3 pins. The PTF2 waveform is shown on analyzer channel IN0.
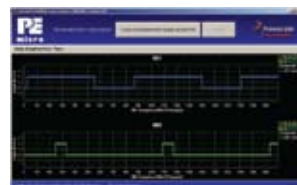
14. Click on "Close Port" button when finished.

For more information on the DEMOAC Board Toolkit read the board user manual (DEMOAC_UM.pdf) on www.freescale.com/flexis or on the DVD under Documentation > Development System Documentation > DEMOAC User Manual of the DVD menu. For new and upgraded utilities to the DEMOAC Board Toolkit, visit http://www.pemicro.com/

LAB 2

Monitor the 32-Bit AC256 Microcontroller Performance with the Accelerometer Application.

This lab will highlight the performance of the 32-bit AC256 and show how this microcontroller can easily interface with a sensor. This lab will also detail how to use another one of several software utilities included with your board to help you in your development. Instructions to download these utilities to your computer were provided in Step 2 of the Quick Start Guide.

The Accelerometer Application reads the X, Y, and Z axes of the 3-axis accelerometer on the DEMOAC board using the microcontroller's A/D converter. It outputs a processed version of the accelerometer data on the microcontroller's serial communication interface. This processed data is a rolling average of the raw accelerometer data, or a filtered version of the raw accelerometer data, depending on the selected mode.

1. Open CodeWarrior for Microcontrollers. From Windows start menu, you can locate it using the "Programs>Freescale CodeWarrior>CW for Microcontroller V6.1>CodeWarrior IDE.exe" path.

2. Click on "Load Example Project" from CodeWarrior startup dialog.

3. From example projects menu, open tree to select: "ColdFire V1>Evaluation Board Examples>DEMOAC>DEMO51AC256_Accelerometer_test."

4. Create a new project name (ex. Lab2), set desired location, and click "Create Project." This will open the project for the Accelerometer Application for the 32-bit AC256 microcontroller.

5. Launch Accelerometer Demo utility from Windows start menu: Programs>P&E Embedded Multilink Toolkit>Utilities>Accelerometer Demo. *See DEMOAC User Manual for details on the Accelerometer Demo utility.

6. Set port to USB COM.

7. Set Baud rate to 115200.

8. Turn board power switch to OFF position.

9. Make sure the red 32-bit ColdFire V1® MCF51AC256 daughter card is plugged in to board. Board jumpers should all be set to the default settings shown in Quick Start Guide.

10. Turn board power switch to ON position.

11. ▢ Compile and program the 32-bit AC256 microcontroller with Accelerometer Application by clicking on "Debug" button, launching Debugger.

12. From Connection Manager menu, select "USB1:DEMOAC (PEnnnnnnn)" port and click on "Connect (Reset)."

13. From Erase and Program Flash menu, click on "Yes" to allow the debugger to mass erase the microcontroller's on-chip flash memory and program it with the new application.

14. ▢ Click on the "Start/Continue (F5)" button in debugger to run application.

15. Bring Accelerometer Demo utility to front and click the "Open Serial Port and Start Demo" button.

16. Move board around to demonstrate 3-axis accelerometer.

17. Observe output in Accelerometer Demo utility.

18. Click button labeled "SW1" on board to enable data averaging. Move board.

19. Click button labeled "SW2" on board to enable data filtering. Move board.

Accelerometer Demo running on 32-bit AC256 in data averaging mode. The orange bar graph labeled "C" highlights the bus cycles required to average the last 16 readings of the 3 axes. The values shown in fourth column of text are the number of bus cycles in hex.

The accelerometer demo clearly shows the CPU performance of the 32-bit ColdFire V1 AC256 microcontroller. In the data averaging and data filtering modes, a considerable amount of 16-bit and 32-bit math is required yet the CPU is capable of performing these tasks using only a very small portion of it's bandwidth.

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