

Getting Started Guide ADuCM360/ADuCM361

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ADuCM360 Development Systems Getting Started Tutorial

INTRODUCTION

The ADuCM360 is a fully integrated, 4 kSPS, 24-bit data acquisition system that incorporates dual, high performance multichannel sigma-delta (Σ - Δ) analog-to-digital converters (ADCs), a 32-bit ARM Cortex[™]-M3 processor, and Flash/EE memory on a single chip.

The ADuCM360 is designed for direct interfacing to external precision sensors in both wired and battery-powered applications. The ADuCM361 contains all the features of the ADuCM360 except for the ADC0, which was removed.

Refer to the ADuCM360/ADuCM361 product page for future updates.

Additional support for the ADuCM360/ADuCM361 is available through the EngineerZone[®] website.

GENERAL DESCRIPTION

The ADuCM360 development system allows evaluation of ADuCM360 silicon. This getting started guide introduces the support features and the tools supplied with the evaluation kit. In addition, it shows and describes how to connect the evaluation hardware.

This guide describes the software files that are included on the DVD and FTP site, and how to download them. The FTP site, should be opened in Windows[®] Explorer.

This guide works as a tutorial by providing a step-by-step account of how to download evaluation versions of thirdparty software tools. Instructions are provided on how to load code examples that are supplied on the CD and on the FTP site. These examples demonstrate simple operation of the ADuCM360.

Working through this guide brings the user to the stage where they can start to generate and download their own user code for use in their own unique end-system requirements.

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Figure 1. ADuCM360 Mini-Board Connected to Analog Devices, Inc., J-Link OB Emulator

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REVISION HISTORY

4/13—Rev. 0 to Rev. A

Changes to Interface Board, Emulator, and Software....Universal Replaced All Sections, Tables, and FiguresUniversal

9/12—Revision 0: Initial Version

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DEVELOPMENT SYSTEM CONTENTS

The EVAL-ADuCM360QSPZ is an evaluation kit for the ADuCM360 and ADuCM361. This kit features a mini-board (EVAL-ADuCM360MKZ) and an Analog Devices J-Link OB emulator (USB-SWD/UART-EMUZ) that connects to a PC USB port via a USB cable. A comprehensive set of development tools is included on the DVD.



Figure 2. ADuCM360 Mini-Board Connected to J-Link OB Emulator

The development system contains the following:

- An ADuCM360 mini-board
- An Analog Devices J-Link OB emulator
- 1 USB cable
- A DVD.

EVALUATION BOARD

The EVAL-ADuCM360MKZ mini-board facilitates performance evaluation of the device with a minimum of external components. The board schematic is available after installation of the software in the documentation folder. By default, this is

\ADuCMxxxV1.3\Documentation\ADuCM360\Evaluation Board\Eval-ADuCM360MKZ.

J-LINK OB EMULATOR

The J-Link OB emulator provides nonintrusive emulation via a serial wire, and also provides supply and UART communication with the ADuCM360 mini-board. Figure 3 shows a top view of the emulator board. J2 connector plugs into the ADuCM360 mini board. The J2 connector pinout is shown in Figure 4.



Figure 3. Emulator Top View



Figure 4. J2 Connector

For downloading and debugging, LK1, LK2, LK4, and LK6 must be inserted. LK3 and LK5 are required to communicate via UART. Required software for the J-Link OB is included in the software installation.

Note that the J-Link OB emulator replaces the J-Link Lite and related interface boards previously shipped with the ADuCM360 development system.

CONNECTING THE HARDWARE

Do not plug in the emulator and mini-board before the software is installed. See the Software Installation section.

SOFTWARE INSTALLATION

A DVD is included in the development system. The DVD content is also available for download on the FTP site.

SOFTWARE CONTENT PROVIDED

Table 1 shows the tools provided on the DVD.

Table 1. Tools

Tools	Functions
Keil µVision	For compiling/debugging and code development, a 32 kB limited version
IAR Embedded Workbench	For compiling/debugging and code development, a 32 kB limited version
Segger J-Link Software	J-Link software and documentation pack includes USB drivers for the emulator, J-Link Commander, J-Mem, and so on
CM3WSD	This utility accepts a hex file and allows it to be downloaded via the USB interface to the ADuCM360 device on your evaluation board
Elves	Elves.exe is an application that helps a C programmer choose appropriate functions from Analog Devices libraries and simplifies deciding which values to place in the function parameters.

SOFTWARE INSTALLATION INSTRUCTIONS

Perform the steps described in this section before plugging any of the USB devices into the PC.

- 1. Close all open applications.
- 2. Insert the development system DVD into your DVD drive. Optionally, download the ADuCMxxxV1.3 folder from the FTP and save it to your machine using the same folder structure as on the FTP site. To reduce the download time, consider excluding either the IAR or Keil folders depending on which development environment you chose to use.
- Double-click on ADuCMxxxV1.3.exe and follow the onscreen instructions. A menu displays installation options as shown in Figure 5.



Figure 5. Installation Options

You can choose to install Keil and/or IAR tools as part of the installation, or at later stage by launching

- mdk470.exe to install this version of Keil µVision.
- **EWARM-CD-6502.exe** to install this version of the IAR Embedded Workbench. The IAR Embedded Workbench requires registering on the IAR website to obtain a free license key.

The Segger J-link software is selected by default in the installation menu. It is advised to leave it selected. This automatically installs the J-Link serial port driver (keep the default settings that appear in the next Segger messages windows).

However, if you decide to unselect the **Segger J-Link Software** install, and install it at a later stage, you will, at that time, need to run the **Setup_JLinkARM_V459d.exe** located under ADuCMxxxV1.3\Segger. Then, select **Install J-Link Serial Port Driver** as shown in Figure 6. Alternatively, you can run **JLinkCDCInstaller_V1.2b.exe** located under ADuCMxxxV1.3\Segger.

🔏 Choose options	
	Choose optional components that should be installed: Install J-Link USB Driver Install J-Link Serial Port Drived Choose options for creating shortcuts Image: Grade entry in start menu Add shortcuts to desktop
	< <u>B</u> ack <u>N</u> ext > Cancel

Figure 6. Installing Link Software

Although the development system, the IAR Embedded Workbench^{*}, and the Keil[™] software can be installed onto any hard drive and into any directory, for the purposes of simplicity, this user guide assumes it is installed at the default location of C:\ADuCMxxxV1.3, C:\Program Files and C:\keil. In addition, the Keil tools are automatically installed under an ARM directory and are fully compatible with µVision3 or tools for 8051.

If you choose the IAR tools, these will be installed by default into **\Program Files\IAR Systems\Embedded Workbench 6.5**.

PROGRAMS INSTALLED

The software described in this section has now been copied or installed.

CM3WSD.exe

The folder \ADuCMxxxV1.3\Software Tools\CM3WSD

provides an executable called **CM3WSD.exe**. This software accepts a hex file and allows it to be downloaded via the USB interface to the ADuCM360 device on your evaluation board. You may want to add a shortcut link for this executable to your desktop.

elves.exe

The \ADuCMxxxV1.3\Software Tools\Elves folder contains the elves.exe files. These files are useful tools that accompany the software function libraries in

ADuCMxxxV1.3**Code****ADuCM360****common**. Again, no installation is required here, but you may want to add a shortcut link for this executable to your desktop.

Driver

The J-Link OB emulator requires a driver, which is installed automatically when the **Segger J-Link Software** is selected (see Step 3 of the Software Installation Instructions section). At this point, check that the driver is installed correctly.

Plug in the emulator and check the device manager (see Figure 7).

Check that it appears in the Windows Device Manager in both the communications port and the USB controllers lists.



Figure 7. Device Manager

The J-Link OB emulator drivers **JLinkCDCInstaller_V1.2b.exe** can be installed from the **ADuCMxxxV1.3\Segger** folder, if J-Link does not appear in the device manager as shown in Figure 7.

Note that the drivers for J-Link Lite and interface boards previously shipped in the ADuCM360 development system are available online.

KEIL µVISION4 INTEGRATED DEVELOPMENT ENVIRONMENT

INTRODUCTION

The µVision4 Integrated Development Environment (IDE) integrates all the tools necessary to edit, assemble, and debug code. The ADuCM360 development system supports nonintrusive emulation limited to 32 kB code. This section describes the project setup steps in order to download and debug code on an ADuCM360 evaluation system. Analog Devices recommends using the J-Link debugger driver.

QUICK START STEPS

From the **Start** menu, choose **All Programs>Keil μVision4**. This loads the μVision4 IDE. The μVision4 executable is located at **C:\Keil\UV4\Uv4.exe**.

 To open one of the prepared Keil μVision example projects in μVision, select Project>Open Project.



Figure 8. Open an Example Project

2. In the folder

\ADuCMxxxV1.3\Code\ADuCM360\examples\ RTD_Demo, select the file RTD_Demo.uvproj. This opens the RTD example project.



Figure 9. RTD Example Project

To compile and build all files, select the Build All icon

1

Once the build has completed, the code shown in Figure 10 appears.

Build Output
assembling startup_ADuCM360.s
compiling RTD_Demo.c
compiling UrtLib.c
compiling AdcLib.c
compiling ClkLib.c
compiling DacLib.c
compiling DioLib.c
compiling IexcLib.c
compiling WdtLib.c
linking
Program Size: Code=11012 RO-data=556 RW-data=56 ZI-data=1728
FromELF: creating hex file
"RTD_Demo.axf" - O Error(s), O Warning(s).
4

Figure 10. Build Output

- 3. To download the code to the EVAL-ADuCM360MKZ board and begin a debug session, connect the J-Link OB emulator to the ADuCM360 mini-board and to your PC using the provided USB cable.
- 4. In µVision, click the Start/Stop Debug session icon



or press Ctrl + F5 to start a debugging session.

5. Click **OK** when the window shown in Figure 11 appears.

µ∀ision		
⚠	EVALUATION MODE Running with Code Size Limit: 32K	
	OK	

Figure 11. Evaluation Mode

6. Begin debugging your source code.



Figure 12. Debug Source Code

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EXTRA OPTIONAL DETAILS ON µVISION

This section provides a more detailed explanation of the setup described in the Quick Start Steps section. Some users may prefer to setup via the Quick Start Steps section.

Toolbars

Under the View menu, two toolbars are available.

- File toolbar
- Build toolbar/Debug toolbar

The **File** toolbar is always available. The **Build** toolbar is active only when the IDE is in edit/compile mode. The **Debug** toolbar is active only in download/debug mode.

Starting a Project

1. From the **Project** menu, select **New µVision Project**.

ect	<u>D</u> ebug	Fl <u>a</u> sh	Peripherals	<u>T</u> ools	<u>S</u> VCS	<u>W</u> indow	<u>H</u> elp
Ner	w µ <u>V</u> isior	n Projec	t				
Nei	w Projec	t <u>W</u> orks	pace				
Imp	port µVis	ion 1 Pro	oject				
<u>O</u> p	en Proje	ct					
<u>C</u> lo	se Proje	ct					
Ma	na <u>q</u> e						•
	Ner Ner Imp Qp Clo Ma	ect Debug New µVisior New Projec Import µVis Open Proje Close Proje Manage	ett Debug Flash New µVjision Project New Project Works Import µVision1 Pro Open Project Close Project Manage	Debug Flash Peripherals New µVjsion Project New Project Workspace Import y Vision 1 Project Import µVision 1 Project Open Project Open Project Glose Project Manage Manage	Debug Flash Peripherals Tools New µVision Project New Project Workspace Import µVision Project Import µVision Project Open Project Glose Project Manage Import µVision Project	Debug Flash Peripherals Iools SVCS New µYjsion Project New Project Workspace Import µVision 1 Project I	Debug Flash Peripherals Tools SVCS Window New µYision Project New Project Workspace Import µVision 1 Project Import µVision 1 Projec

Figure 13. Project Menu

 Create a new folder (ADIdemo). To do so, go to C:\ADuCMxxxV1.3\Code\ADuCM360\examples\ ADIdemo and enter Demo as the project name. If asked to Select a CPU Data Base File, select the Generic CPU Data Base.

Select a CPU Data Base File	
Generic CPU Data Base 💌	
OK Cancel	

Figure 14. Select a CPU Data Base File

3. Select the ADuCM360 in the Generic CPU Data Base.

Select Device for Target 'Target 1'		
Vendor: Analog Devices Device: ADuCH/350 Toolset: ARM Data base C. ADuC831 C. ADuC831 C. ADuC834 C. ADuC834 C. ADuC845 C. ADUC845 C	Description: ARM Cortex-M3 32-bit processor - Serial wice download and debug - Internal watch oysial for watc-up timer - Internal watch oysial for watc-up timer - IS MH2 oxitized with 9-way programable divider - 128 kB ShaM Analog I/0 - Ultra high precision, Multichannel, Dual 24 bit ADCs - Single Ender and July differential input - Independently Programmable ADC output ale (H42 to 4KHz) - Simula Result SHA/SIML reselvance - Simula Result SHA/SIML reselvance - Pireabite input MUX for input channel selection to both ADCs - Pirmaly and Auxiliany (24-bit) ADC channel	× • •
	OK Cancel	Help

Figure 15. Select ADuCM360

4. Select **No** to the question that appears (see Figure 16). This indicates you are not automatically including the start-up file **startup_ADuCM360.s** to your project.

µVision	
2	Copy 'startup_ADuCM360.s' to Project Folder and Add File to Project ?
	<u>Yes</u> <u>N</u> o
	Figure 16. µVision Startup Question

Note that it is possible to change the compiler by selecting the File Extensions, Books and Environment folder extension.

ect	Flash	Debug	Peripher	als Tool	s SV(IS Win	dow	Help			
C)	8	5 (2)	$\leftarrow \Rightarrow$	10 12	12.1	東津	運 //	1/k	1		
LOAD	Targe	et 1		× 🔊	a 7	5					
9	3					File Exte	nsions,	Books	and Ei	nvironme	nt
						Configur	re file e nent	tensio	ns, bo	oks and	

Figure 17. File Extensions, Books and Environment

5. For this demo, select **Use RealView** under the **Folders/Extensions** tab.

Components, Enviro	nment and Books							
Project Components F	olders/Extensions Boo	ks						
Development Tool Folders: Default File Extensions:								
🔲 📙 se Settings from				C Source:	".c	- 11		
Tool Base Fold	der: C:\Keil\ARM\			C++ Source:	*.cpp	- 11		
BIN: C:\Kei	VARM\BIN\			Asm Source:	".s"; ".src; ".a"	- 11		
INC:				Object:	*.obj			
LIB:				Library:	*.lib			
<u>R</u> egfile:				Document:	*.txt; *.h; *.inc			
Select ARM Developm	ent Tools:							
✓ Use Real⊻iew	RealVie <u>w</u> Folder:	.\ARMCC\bin\						
	CMSIS Folder:							
	RTX-ARM Folder:							
	RL-ARM Folder:					.		
∏ Use <u>G</u> CC	GNU-Tool-Prefig:	arm-none-eabi-	1					
	GNU-Tool Folder:	C:\Program Files\GNU To		M Embedded\4.7 201	12q4\ .			
		OK Cano	el		He	p		

Figure 18. Components, Environment and Books

- In the project window, right-click on Target1 and select Option for Target1 to configure the settings for this project. By default, μVision4 uses the RealView compiler.
 - Select the **Target** tab.
 - Ensure the **IROM1** and **IRAM1 Start** and **Size** fields are filled as shown in Figure 19.
 - Ensure that the **Use MicroLIB** option is enabled.

🛛 Option	s for Ta	rget 'Target	1'						X
Device	Target 0	utput Listing	User C/C++	Asm	Linker	Debug l	Jtilities		
Analog D	evices AD	uCM360			- Code (Generation			
			≚tal (MHz): 16.	0					
Operating	g system:	None		•		se Cross-N	Aodule Optimiza	ation	
System-V	/iewer File	[.Sfr]:			la li	se MicroLl	IBj I	Big Endian	
⊢ Read∕	Only Memo	rv Areas			- Read/	Write Men	norv Areas		
default	off-chip	Start	Size	Startup	default	off-chip	Start	Size	Nolnit
	ROM1:			0	Г	RAM1:			
	ROM2:			0	Г	RAM2:			
	ROM3:			0	Г	RAM3:			
	on-chip		La. 00000			on-chip			
	IROM1:	0x0	0x20000	•	V	IRAM1:	0x20000000	0x2000	
	IROM2:]	0		IRAM2:]		
			OK	Can	cel	Defa	ults		Help

Figure 19. Options for Target

 Select the Linker tab and then select Use Memory Layout from Target Dialog.

Options for Target 'Target 1'		
Device Target Output Listing U	ser C/C++ Asm Linker Debug Utilities	
Use Memory Layout from Target Make RW Sections Position Make R0 Sections Position Don's Search Standard Libra Report 'might fail' Conditions :	Dialog ndependent R/O Base: 0+00000000 dependent R/W Base 0+20000000 es es Errors disable Warnings:	-
Scatter File		Edit
Misc controls		
Linker control string	t -scatter "Test1,sct" err -info summarysizes -map -xref -callgraph -symbols	~
	OK Cancel Defaults	Help

Figure 20. Linker Options

 In the Output tab, select Create HEX File. The hex file can be used by the Windows Serial Downloader (CM3WSD). Then, select OK.

Options for Target 'Target 1'	
Device Target Output Listing User C/C++ Asm Linker Debug Utilities	
Select Folder for Objects Name of Executable: ADIDEMO	
Cigate Executable: .\ADIDEMO If Debug Information Cireate Bate Cireate	h File
✓ Browse Information	
C Create Library: .\ADIDEMO.LIB	
OK Cancel Defaults	Help

Figure 21. Output Tab

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- 9. Connect the emulator to the ADuCM360 mini-board and to your PC's USB port using a USB cable.

Note that an LED on the J-Link OB emulator blinks several times before staying on, indicating that the emulator is communicating correctly with the PC.

Configuring the J-Link Debugger Driver

- In the project window, right-click on Target1 and select Option for Target1 to configure the settings of this project.
- 2. In the **Debug** tab, select **Use:** and then select **J-LINK**/ **J-Trace Cortex**.

evice Target Output Listing User C/C++ Asm	Linker Debug Utilities
C Use Simulator Settings	Use: J-LINK / J-Trace Cortex Settings RDI Interface Driver Atma Plastra Screen Patranen
Load Application at Startup Initialization File: Initialization File: Initialization File:	Allefe blaster Lottex Debugger Market blaster Lottex Debugger Market blaster Lottex Debugger main() Minitalizabi (LINK X-JF race Contex ST-Link (Deprecated Version) ULINK Pro Contex Debugger Edd
Restore Debug Session Settings V Breakpoints V Toolbox V Watch Windows & Performance Analyzer V Memory Display	Restors Lichik Debugger P By ST-Link Debugger Water Write Stopper Water Write Stopper Memory Display
CPU DLL: Parameter: SARMCM3.DLL	Driver DLL: Parameter:
Dialog DLL: Parameter: DLM.DLL PEMBER	Dialog DLL: Parameter: TLM.DLL -pEMBER

Figure 22. Choose a Debugger

- 3. Select **Run to main()**.
- 4. Select **Settings** in Figure 22 and then configure as shown in Figure 23.

IDCODE Device Name Move SWD © 0x2BA01477 ARM CoreSight SW-DP Up
SWD O 0x2BA01477 ARM CoreSight SW-DP
Down
Contraction ID CODE:
C Manual Configuration Device Name
Device Name.
Add Delete Update IR len:
Casha Ostiona Download Ostiona
Halt after Kennel
Cache Memory Venry Lode Download
Mise
ettings
Dea (b.a., 0) Autodetect JLink Info
0.0.1 : 0 Ping Unik Cod

Figure 23. Target Driver Setup

- 5. Select OK.
- Under Utilities, select Use Target Driver for Flash Programming. Then, choose J-LINK/J-Trace Cortex and select the option Update Target before Debugging.

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🛚 Options for Target 'Target 1'
Device Target Output Listing User C/C++ Asm Linker Debug Utilities
Configure Flash Meru Command Cute Target Driver for Flash Programming U-UNEX 2NE contro Celose Settings UUNEX 2NE contro Celose Celose Signum Style Contro Celose Signum Style Contro Celose Stude UCA Debugger Auguments Command Stude UCA Debugger Auguments File Contro Celose File Celose F
OK Cancel Defaults Help

Figure 24. Continuing with Target Driver Setup

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7. Select **Settings** to display the dialog box shown in Figure 25.

nojindea contexan rurgat	oriver setup				
ebug Trace Flash Download - Download Function		- RAM for A	lgorithm		
C Erase Full Chip Erase Sectors C Do not Erase	 ✓ Program ✓ Venify ✓ Reset and Run 	Start: 0	x20000000	Size: 0x0800	
Programming Algorithm					_
Description	Device Type	Device Size	Addres	is Range	
		Start 🗌		Size:	-
 	Add	Start:		Size:	
	Add	Start:		Size:	_
	Add	Start:		Size:	
	Add	Start:		Size:	_
1	Add	Start:		Size:	
	Add	Start:		Size:	
	Add	Start:]	Size	

Figure 25. J-Link/J-Trace Cortex Setup

8. Select **Add** to display the window shown in Figure 26.

Select the driver for the generic that you are evaluating. For this example, use **ADuCM360 128kB Flash** and then select **Add**.

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ld Flash Programming Al	gorithm		X
Description	Device Type	Device Size	^
A2FxxxM3 128kB Flash	On-chip Flash	128k	
A2FxxxM3 256kB Flash	On-chip Flash	256k	
A2FxxxM3 512kB Flash	On-chip Flash	512k	
ADuCM330 96kB Flash (v1.2)	On-chip Flash	96k	
ADuCM331 128kB Flash (v1.0)	On-chip Flash	128k	
ADuCM331 Data Flash (v1.0)	On-chip Flash	6k	
ADuCRF101 128kB Flash	On-chip Flash	128k	
ADuCM360 128kB Flash	On-chip Flash	128k	
AM29x128 Flash	Ext. Flash 16-bit	16M	
ATSAM3N 128kB Flash	On-chip Flash	128k	
ATSAM3N 256kB Flash	On-chip Flash	256k	
ATSAM3N 64kB Flash	On-chip Flash	64k	
ATSAM3N GPNVM bits	On-chip Flash	16	
ATSAM3S 128kB Flash	On-chip Flash	128k	
ATSAM3S 256kB Flash	On-chip Flash	256k	
ATSAM3S 512kB Flash	On-chip Flash	512k	~
Add	Cancel		

Figure 26. Add Flash Programming Algorithm

9. Select **OK** when the window shown in Figure 27 appears.

Download Euroction		BAM for A	laarithm	
C Erase Full Chip C Erase Sectors C Do not Erase	 ✓ Program ✓ Verify ✓ Reset and Run 	Start: 0	x20000000 Size: 0x00	800
Programming Algorithm				
Description	Device Type	Device Size	Address Range	
		Start: 0	x00000000 Size: 0x00	0020000
	Add	Remove]	

Figure 27. Finishing Target Driver Setup

- 10. In the C/C++ tab, add the include path as shown in Figure 28.
- 11. Select **OK**. All the options should be properly configured to compile, assemble, link, download, and debug using J-Link Lite.





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Adding Project Files

All the files relative to the project are in the folder \ADuCMxxxV1.3\Code\ADuCM360\examples\Adc.

Copy the file

\ADuCMxxxV1.3\Code\ADuCM360\examples\Adc \ADCMeter.c into the new directory C:\\ADuCMxxxV1.3\ Code\ADuCM360\examples\ADIdemo.

 To add the files to the project, right-click on the Source Group folder in the Project window and select Add Files to Group.



Figure 29. Adding Files to the Project

Note that under **Project>Manage**, the option **Components, Environment, Books** can be used to rename the target and add the file relative to your project.

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2. Add all the files listed in Figure 31 from the directory \ADuCMxxxV1.3\Code\ADuCM360\common. The Startup file is located in the RealView folder.

Project 🧭 🗙	
🖃 🚵 Target 1	
🖨 📇 Startup	
🔜 🔝 startup_ADuCM360.s	
🖨 📇 Application	
🗄 🔝 ADCMeter.c	
🖻 📇 Common	
🗄 🗠 🔛 AdcLib.c	
🕂 🕀 🔝 ClkLib.c	
庄 🔛 DioLib.c	
庄 🔛 UrtLib.c	
🗄 🗹 🔛 WdtLib.c	31
🗄 🗄 DacLib.c	0952-0
Figure 31. Project Files	-

3. Double-click on the file name (**ADCMeter.c**) in the **Project** window to open the source file.

Assembling/Compiling Code

To compile/link ADCMeter.c, click on the (translate current file) icon in the toolbar. The file should compile correctly and the information shown in Figure 32 should appear in the Build Output window. If there are errors in your source code, these appear in the status window. To identify the line of code that corresponds to the error, double-click on the error in the Build Output window and an arrow highlights the line of code in error.

Before the code can be downloaded to the ADuCM360,

the entire project must be built. This is done by clicking on the

(rebuild all target files) icon on the toolbar. It will also create a demo.elf file used by the debugger.

Rebuild target 'Target 1' assembling startup_ADuCM360.s compiling ADCMeter.c compiling AdcLib.c compiling DioLib.c compiling DioLib.c compiling UrtLib.c compiling WdLib.c compiling DacLib.c linking
assembling startup_AbuCM360.s compiling AbCMeter.c compiling AdcLib.c compiling ClkLib.c compiling UicLib.c compiling WttLib.c compiling WatLib.c compiling WatLib.c
<pre>compiling ADCMeter.c compiling Adclib.c compiling ClkLib.c compiling DioLib.c compiling WatLib.c compiling WatLib.c compiling WatLib.c linking</pre>
compiling AdCLib.c compiling DioLib.c compiling DioLib.c compiling WttLib.c compiling WdtLib.c compiling DacLib.c linking
compiling ClkLib.c compiling DioLib.c compiling UrtLib.c compiling WdtLib.c compiling DacLib.c linking
compiling DioLib.c compiling UrtLib.c compiling WdtLib.c compiling DacLib.c linking
compiling UrtLib.c compiling WatLib.c compiling DacLib.c linking
compiling WdtLib.c compiling DacLib.c linking
compiling DacLib.c linking
linking
Program Size: Code=6152 RO-data=256 RW-data=20 ZI-data=1092
FromELF: creating hex file
"ADIdemo.axf" - O Error(s), O Warning(s).

Figure 32. Build Output

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Downloading/Debugging Code

Select **Start/Stop Debug** or press the icon to start debugging (start/stop debug session). The debugger indicates that you are using an evaluation version. Select **OK**.



- 1. Close the disassembly window.
- 2. Go to the **ADCMeter.c** file.
- 3. Set a breakpoint on the instruction UARTInit(). This is done by right-clicking on the line of code and then selecting **insert/remove breakpoint** or by double-clicking to the left of the instruction. Notice that the breakpoint is indicated by a large red dot to the left of the line in Figure 34.

	📩 🔝	CMeter.c Startup_ADuCM360.s
	51	
	52	<pre>void delay(long int);</pre>
	53	<pre>volatile unsigned char bSendResultToUART = 0; // Flag used</pre>
	54	<pre>unsigned char szTemp[64] = ""; // Used to store i</pre>
	55	<pre>unsigned char ucTxBufferEmpty = 0; // Used to indic</pre>
	56	<pre>volatile long ulADC1Result = 0; // Variable the second secon</pre>
	57	volatile unsigned char ucComRx = 0;
	58	volatile unsigned char ucADCOERR = 0;
	59	float fVoltage = 0.0; // ADC value com
	60	float fVolts = 0.0;
	61	
	62	int main (void)
N	63 E	{
	64	unsigned char i = 0;
	65	unsigned char nLen = 0;
_	66	
	67	pADI_WDT ->T3CON = 0;
	68	DioOen(pADI_GP1,0x8); // Set P1.
	69	Watcig(T3CON_PRE_DIV1,T3CON_IRQ_EN,T3CON_PD_DIS); // D:
-	70	//Disable clock to unused peripherals
	71	CIRDIB(CLKDIS_DISSPIUCLK CLKDIS_DISSPIICLK CLKDIS_DISI2
	72	CIRCEG(CLK_CDU,CLK_HF,CLKSYSDIV_DIVZEN_DIS,CLK_UCLKCG);
	73	CIRSEI(ULK_CD6,CLK_CD7,CLK_CD0,CLK_CD7); // Select
N	74	Adego(pADI_ADCI, ADCHDE_ADCHD_IDLE); // Place ADCI
	75	DARINII(); // Init Uart
	70	ADCINIT(); // Configu
	70	AddGo(maDI ADC1 ADCMDE ADCMD CONT), // Stort ADC1
	70	MUCGO (PADI_ADCI, ADCHDE_ADCHD_CONI); // Start ADCI
	80	NVIC EnableIRO(HART IROn) :
	00	MAIC FUGDICING(OWNI INGU);
		Figure 34. ADCMeter.c File

Press the run code button twice. The program measures the input signal applied across AIN0 and AIN1, converts this to a voltage, and sends this information in an ASCII string to the UART – baud rate 9600-8-N-1.

To stop the code from running, press 🤒.

To stop debugging, press

IAR EMBEDDED WORKBENCH IDE

The IAR Embedded Workbench IDE integrates all the tools necessary to edit, assemble, and debug code. The ADuCM360 development system supports nonintrusive emulation limited to 32 kB code. This section describes the project setup steps in order to download and debug code on an ADuCM360 evaluation system. Analog Devices recommends using the J-Link debugger driver.

STARTING IAR EMBEDDED WORKBENCH

From the **Start** menu, choose **All Programs>IAR Systems> IAR Embedded Workbench for ARM 6.50>IAR Embedded Workbench**. This loads the Embedded Workbench IDE.

QUICK START STEPS

Follow the steps in this section to get up and running with the example code provided with the evaluation software.

These steps use the default driver and compiler settings.

 To open the prepared IAR example projects using the Embedded Workbench tools, select File>Open> Workspace. Open the file ADuCM360.eww in the directory \ADuCMxxxV1.3\Code\ADuCM360\examples.



Figure 35. IAR Embedded Workbench

2. The workspace opens and the individual projects are launched as shown in Figure 36.



Figure 36. Individual Projects

3. To change the selected project, select the required project from the drop-down list.

Workspace	×
PowerDown - Debug	*
Adc - Debug ADC_DMA - ADC0 ADC_DMA - ADC1	
Blink - Debug	
CN0300 - Debug	
DAC_DMA - Debug	
Flash - FlashSign	1
Flash - FlashWrite	cao
ElashProtect - ElashProtect	;
Figure 37. Changing Selected Projects	

Choosing, for example, the **Blink** project, toggles the LED connected to P1.3 on the EVAL-ADuCM360MKZ board.

Getting Started Guide

4. To compile all files, select Project>Rebuild All files.

🔏 ADuCM360 -	- IAR Embedded Workben	ch IDE
<u>File E</u> dit <u>V</u> iew	Project Tools Window Help)
D 🛩 🖃 🖬 Workspace Blink - Debug	Add Eiles Add <u>G</u> roup Import File List Add Project Connection	
Files	Edit Configurations	
□ 🖸 ADuCM3 ├── 🗊 Adc -	Remo <u>v</u> e	
🗕 🗕 🖓 🗀 Ар	Create <u>N</u> ew Project	
└─⊞ 💽 ,	Add Existing Project	
⊡ Cor	Options	ALT+F7
📙 🖵 🗀 Our	Version Control System	•
— — — — — — — — — — — — — — — — — — —	<u>Make</u> Compile	F7
-⊞ 🗋 ,	Compile Rebuild All	CIRCHI7
\square	Clean	
-⊞ 🗀 cor -⊞ 🗀 Sta	B <u>a</u> tch build	F8
└─⊞ 🗀 Our	<u>S</u> top Build	CTRL+Break
	Download and Debug Debug without Downloading	CTRL+D
	Ma <u>k</u> e & Restart Debugger	CTRL+R
-⊞ 🗀 Ste	Restart Debugger Do <u>w</u> nload	CTRL+SHIFT+R
	SFR Setup	
-₽⊇Ap	Open Device File	•

Figure 38. Compiling All Files

5. If the build is successful, the information is displayed in the **Build** details window.

~		
î	Messages	
	7 file(s) deleted.	
	Updating build tree	
	Clift is a Diat is a last is a Batt is a Watt is a Blink a	
	startura ADuQM200 a	
	startup_ADuCM360.s	
	Linking	
	Blink.out	
	Total number of errors: 0	
	Total number of warnings: 0	
ъ		039
Ĩ,	Build Find in Files Debug Log	52-4
		100

Figure 39. Build Details

6. To program the device and to begin debugging the source code, select **Project>Download and Debug**.

ADuCM360/ADuCM361

😽 ADuCM 360 -	- IAR Embedde	d Work	bench IDE
<u>-</u> ile <u>E</u> dit <u>V</u> iew	Project <u>T</u> ools	<u>W</u> indow	Help
D 😅 🖬 🖬 Workspace Blink - Debug	Add <u>F</u> iles Add <u>G</u> roup Import File List Add <u>P</u> roject Co	 Innection	
Files	Edi <u>t</u> Configurat Remo <u>v</u> e	ions	
	Create <u>N</u> ew Pr Add <u>E</u> xisting Pr	oject roject	
-⊞ 🗀 cor -⊞ 🗀 Sta	Options	l System	ALT+F7
	<u>M</u> ake ⊆ompile Re <u>b</u> uild All		F7 CTRL+F7
⊞ 🗀 cor	Clean B <u>a</u> tch build		F8
	Stop Build		CTRL+Break
	Download and Debug without Make & Restar Restart Debug Download SFR Setup	Debug Downloa t Debugg ger	CTRL+D ding er CTRL+R CTRL+SHIFT+R
	Open Device F Figure 40. Be	^{ile} gin Deb	► uqqinq

This launches the debugger.



7. To begin code execution, select the Go icon,



You should now see the LED toggle on your EVAL-ADuCM360MKZ board.

ELVES

USING ELVES.EXE WITH $\mu\text{VISION4}$

Elves is a useful tool for generating simple C function libraries to get started on evaluating any peripheral. All the user needs to do is choose the required parameters for each function and Elves generates the C source code that configures all the appropriate ADuCM360 registers.

1. In the folder, C:\ADuCMxxxV1.3\Software Tools\Elves, open the file Elves.exe to launch Elves.

should have	
elect Library	Show Units Add
cose Function	
carros Proda	
	2
hoose Parameters	Copy

Figure 42. Launching Elves

0952-042

2. To add a library, click **Add** and go to the directory **C:\ADuCMxxxV1.3\Code\ADuCM360\common**.

A list of header files is available. Add the header file(s) that you wish to use.

Select Library	y Source			? 🗙	
Look jn: 🗀 c	ommon	•	(+ 🖻 🖻	* 🎟 •	
AR Realview AdcLib.h Acklib.h Acklib.h Acre_cm3.h	h Dastib.h h DioLib.h h DmaLib.h h Feetib.h h GptLib.h	IexcLib.h IntLib.h PwmLib.h RevrLib.h ARstLib.h	<u>∷h</u> UrtLi <u>∷h</u> WdtL <u>∷h</u> WutL	b.h .ib.h .ib.h	
Library	AdcLib.h		[<u>S</u> elect	
Files of <u>type</u> :	Header(*.h)		•	Cancel	

Figure 43. Select Source Library

For example, if the AdcLib.h library is added, the user can generate functions to control the ADC.

Elvos		
Select Library	Show	Unit Add
¥	C:\ADuCHxxxV1.0\code\ADuC	3360\common\AdcLib.h
Choose Euroction		
int AdcBias(A	ADC_TypeDef *pPort, int iBiasPin, int iBiasBoost, int iCndSu)	*
int AdeBias(A int AdeDetCon int AdeDetCon int AdeDetSta int AdeDetSta int AdeDiag(A int AdeDiag(A int AdeDiag(A int AdeDiag(A int AdeDiag(A) int AdeDiag(A) int AdeDiag(A) - 102 - 159	7. MC Typelef (press, tex (Reading, tex (Micklears, tex (Godder) MC Typelef Typelef (Typelef), and (MicKey), and (MicKey) MS (MicKey), and (MicKey), and (MicKey), and (MicKey), (MicKey), and (MicKey), and (MicKey), and (MicKey), (MicKey), and (MicKey), and (MicKey), and (MicKey), AC Typelef Typelef, and (MicKey), and (MicKey), AC Typelef Typelef, and (MicKey), and (MicKey), AC Typelef Typelef, (MicKey), and (MicKey), and (MicKey), (MicKey), and (MicKey), (MicKey), and (MicKey), (MicKey), and (MicKey), (MicKey), and (MicKey)	×
Choose Paramete	(Qopy
Help F1-Help Setu		Egt

Figure 44. List of Functions

Take, for example, the function **AdcBias**, in the **Choose Function** section as shown in Figure 44. The user configures the parameters to meet their needs and each parameter is explained in the **Source Code** section of the window shown in Figure 45.

🐉 Elves 📃 🗖 🙋
Skogg Unlist Add
C:\ADuCHxxxV1.3\code\ADuCH360\common\AdcLib.h
Choose <u>F</u> unction
int AdcBias(ADI_ADC_TypeDef *pPort, int iBiasPin, int iBiasBoost, int iGndSw)
<pre>guard tode @param iBiasPin :(ADC_BIAS_OFF, ADCCFG_PINSEL_AIN7, ADCCFG_PINSEL_AIN1)) - ADCOFF0.8-10 - 0 or ADC_BIAS_OFF to switch off bias. - 1024 or ADCCFG_PINSEL_AIN7 to switch bias current to AIN7. - 1556 or ADCCFG_PINSEL_AINT to switch bias current to AIN1. Byaram IBiasDoot :(ADC_BIAS_VL, ADCCFG_BO0STIS, ADCCKFG_BO0ST30) - An an IBiasDoot :(ADC_BIAS_VL, ADCCFG_BO0STIS, ADCCKFG_BO0ST30) - Alos or ADCCFE_BO0ST31 to boost Wias by 15 times. - 4096 or ADCCFE_BO0ST31 to boost Wias by 15 times. - 6192 or ADCCFF_BO0ST31 to boost Wias by 30 times. @param iGndSw :(ADC_GND_0FF ADCCFG_GNDSWDN ADCCFG_GNDSWDESIN)</pre>
Choose Parameters Prot BiasPin BiasBoost GodSw Copy AdcBias (pADLADCO ADC_BIAS_OFF ADC_BIAS_X1 ADC_GND_OFF 1
Heb F1-Heb Setup

Figure 45. Source Code

0952-045

3. Once satisfied with the register settings, select **Copy** and then paste this function into your source code in Keil or IAR as shown in Figure 46.

		1	Configu	res ADCO	6	0 450	Int z	ef,	
			G=4, bi	-polar n	500	le			
2	AdcHsk1 (0, ADC H RDY, 1) ;	11	Elves	Library	-	setup	ADCO	189	
3	AdoFit(0,0x7d,0x0,FLT NORMAL);	11	Elves	Library	-	setup	ADCO	Filte	ir .
14	AdeRng (0, ADC REF INT, ADC G16, ADC INT) ;	11	Elves	Library	-	Setup	Gain	and V	zef
5	AdcPin(0, AIN2, AIN0);	11	Elves	Library	-	Setup	input	chaz	nels
86									
87	ADCOMDE = 0x100;	11	Enable	PGA					

Figure 46. Copying and Pasting Source Code

 Before using the Help option, click Setup and point to the following file: C:\ADuCMxxxV1.3\Software Tools\Elves\help docs\Docs\Start_P.html.

WINDOWS SERIAL DOWNLOADER

The Windows[®] Serial Downloader for Cortex-M3 based parts (CM3WSD) is a Windows software program that allows a user to serially download Intel Extended Hex files as created by assembler/compilers to the ADuCM360 via the serial port. The Intel Extended Hex file is downloaded into the on-chip Flash/EE program memory via a selected PC serial port.

PREPARING FOR DOWNLOAD

- Connect the ADuCM360 mini-board (EVAL-ADuCM360MKZ) to the emulator board, and the emulator board to the PC using a USB cable.
- 2. Ensure all the links are inserted on both boards.
- 3. Place the ADuCM360 into serial download mode using the following sequence:
 - Pull P2.2 low.
 - Pull the RESET pin low and then high (float).
 - P2.2 can be left floating once RESET is high.

DOWNLOADING USING CM3WSD

 In the software tools \CM3WSD folder, open the file CM3WSD.exe.

- 2. Select the file at C:\ADuCMxxxV1.3\Code \examples\Adc\AdcExample.hex.
- 3. In the **Serial Port** drop-down menu, select the **JLink CDC UART Port** and a baud rate of 38400.
- 4. Select Start. The CM3WSD sends a reset command to the ADuCM360. If the ADuCM360 is in serial download mode, and the COM port between the PC and the miniboard are setup correctly, then the CM3WSD should start downloading the hex file and display a progress bar while the file is downloading. Once the file has been successfully downloaded, the monitor status box is updated with Flashing Complete Click Reset to run program.

RUNNING THE DOWNLOADED FILE Running Using the CM3WSD

740-6790

Select **Reset** with P2.2 floating or pulled high. The monitor status box updates with the message: **Running**.

Manual Run Option

Pull RESET low, then high (or float) on the mini-board (EVAL-ADuCM360MKZ) to reset the ADuCM360, with P2.2 floating or pulled high. The program starts running automatically.

C:\ADuCMxxxV1	.3\code\ADuCM36I)\examples\Adc\Ob	j\AdcExample.I	hex B	rowse
Serial <u>P</u> ort COM2 (Communi COM3 (Intel(R) A COM47 (JLink CI Flash Action	cations Port) ctive Management 1 DC UART Port)	▼ [echnology - SOL)	Baudrate 38400	•	
Autorun Monitor Status Connect test I Click Start. COM1 doesn't e	Autoflash	at 38400 Baud.	l port		

Figure 47. Preparing for Download

NOTES

I²C refers to a communications protocol originally developed by Philips Semiconductors (now NXP Semiconductors).



ESD Caution

ESD (electrostatic discharge) sensitive device. Charged devices and circuit boards can discharge without detection. Although this product features patented or proprietary protection circuitry, damage may occur on devices subjected to high energy ESD. Therefore, proper ESD precautions should be taken to avoid performance degradation or loss of functionality.

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