

One Technology Way • P.O. Box 9106 • Norwood, MA 02062-9106, U.S.A. • Tel: 781.329.4700 • Fax: 781.461.3113 • www.analog.com

ADuCRF101 Development System Getting Started Tutorial

INTRODUCTION

The ADuCRF101 is a fully integrated data acquisition solution designed for low power wireless applications. It features a 12-bit ADC, a low power Cortex[™]-M3 core from ARM, a 431 MHz to 464 MHz and 862 MHz to 928 MHz RF transceiver, and Flash/EE memory packaged in a 9 mm × 9 mm LFCSP.

Refer to the ADuCRF101 product page for future updates.

Additional support for the ADuCRF101 is available through the EngineerZone[®] website.

GENERAL DESCRIPTION

The ADuCRF101 development system allows evaluation of ADuCRF101 silicon. This getting started guide introduces the support features and tools supplied with the evaluation kit. In addition, it shows and describes how to connect the evaluation hardware and explains when external components are required for operation.

This guide describes the software files that are included on the DVD and explains how to download them. This guide works as a tutorial by providing a step-by-step account of how to download evaluation versions of third-party software tools. Instructions are provided for how to load code examples that are supplied on the DVD. These examples demonstrate the simple operation of the ADuCRF101.

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

The radio interface engine (RIE) is the software programming interface that controls the ADuCRF101 radio. This interface allows users to easily configure and use the radio.

The Analog Devices, Inc., ADRadioNet[™] wireless networking solution is available on request.



ADuCRF101 MINI BOARD AND EMULATOR BOARD

Figure 1.

ADuCRF101 Getting Started Guide

TABLE OF CONTENTS

Introduction 1
General Description
ADuCRF101 Mini Board and Emulator Board1
Revision History
Development Systems Overview
ADRadioNet Wireless Networking
Assembling the Hardware 3
DVD Contents
Software Installation
Warning
Software Content Provided 4
Copying the Contents from the DVD4
Installing the J-Link OB Driver
Conclusion
IAR Installation and Tools
IAR Tools Installation
IAR Demo Code

Using the Radio Example	8
Introduction	8
Hardware Setup	8
Downloading the Radio Transmit Example	9
Downloading the Radio Receive Example	10
Runnning the Example	11
Appendix A	12
Software Documentation	12
Appendix B	13
IAR Download Initial Setup and Troubleshooting	13
Appendix C	15
Windows Serial Downloader	15
Appendix D	16
Using Elves.exe	16
Appendix E	17
Serial Communication with the PC	17
Related Links	18

REVISION HISTORY

1/15—Revision 0: Initial Version

DEVELOPMENT SYSTEMS OVERVIEW

Different systems are available that are optimized for the various types of evaluation requirements.

Table 1 lists the contents available for each type of system.

Table 1. Development Systems Content

Content	Mini Kit (MK)	QuickStart (QS)	QuickStart Plus (QSP)
Mini Board	1	1	2
Antenna	1	1	2
Emulator Board	0	1	1
Battery Holder	0	0	1
DVD	1	1	1

The mini board is optimized for 433 MHz or 868 MHz/915 MHz operation. Table 2 lists the models and their optimized communication frequency.

Table 2. Development Systems Models

Model	Description	Frequency
EV-ADuCRF101MK1Z	Mini kit	868 MHz/915 MHz
EV-ADuCRF101MK3Z	Mini kit	433 MHz
EV-ADuCRF101QS1Z	QuickStart	868 MHz/915 MHz
EV-ADuCRF101QS3Z	QuickStart	433 MHz
EV-ADuCRF101QSP1Z	QuickStart Plus	868 MHz/915 MHz
EV-ADuCRF101QSP3Z	QuickStart Plus	433 MHz

This getting started guide assumes that a mini board and an emulator board are available.

ADRadioNet WIRELESS NETWORKING

ADRadioNet is a wireless networking solution for the ISM band. It uses IPv6 addresses and combines most of the features expected in such solutions, that is, low power, multi-hop, endto-end acknowledgement, self-healing, and so on. Even with all of these features, the main feature of ADRadioNet is ease of use.

ASSEMBLING THE HARDWARE

Do not plug in the hardware before the software is installed (see the Software Installation section).



Figure 2. ADuCRF101 Mini Board and Emulator Board

DVD CONTENTS

Each kit contains a DVD with the following contents:

- Documentation
- Analog Devices utilities
- Third-party software
- Comprehensive example code

SOFTWARE INSTALLATION

Each kit includes a DVD containing software to be installed on the PC before the evaluation board is used.

WARNING

The J-Link OB driver must be installed before plugging the emulator board USB device into the PC.

SOFTWARE CONTENT PROVIDED

Table 3 shows the tools provided on the DVD.

Table 3. 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, and J-Mem
CM3WSD	A utility that accepts a hex file and allows it to be downloaded via the USB interface to the ADuCRF101 device on your evaluation board
Elves	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

There are three parts to the installation:

- ADuCRF101 documentation and code example copy.
- J-Link OB driver installation.
- Integrated software development tool installation (Keil µVision or IAR Embedded Workbench for ARM (EWARM)).

COPYING THE CONTENTS FROM THE DVD

To copy documentation, code examples, and utilities, insert the DVD into the CD-ROM drive, and copy the **ADuCRF101v1.0** folder to the PC hard drive.

All subsequent steps assume that this folder has been copied directly onto the C drive.

CM3WSD.exe

The folder **\ADuCRF101V1.0\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 ADuCRF101 device on your evaluation board.

You may want to add a shortcut link for this executable to your desktop.

Elves.exe

The **\ADuCRF101V1.0\Software Tools\Elves** folder contains the **elves.exe** files. These files are useful tools that accompany the software function libraries in

\ADuCRF101v1.0\Code\ADuCRF101\DasLib. Again,

installation is not required, but you may want to add a shortcut link for this executable to your desktop.

INSTALLING THE J-LINK OB DRIVER

The J-Link OB USB driver is required to be installed before using a serial wire interface, such as the interface of the IAR Embedded Workbench, to download and debug code.

To install the J-Link OB USB driver,

- 1. Double-click the **Setup_JLinkARM_V470.exe** executable file located in the Segger folder on the DVD.
- Follow the on-screen instructions to complete the installation. Ensure that the Install USB Driver for J-Link-OB with CDC option is checked as shown in Figure 3.



Figure 3. Segger Driver Install Options

3. Plug in the emulator board and check the device manager (see Figure 4).

4. Check that the emulator board appears in the Windows[®] Device Manager in both the communications port and the USB controllers lists.



CONCLUSION

After following the software installation procedures, the USB driver for the J-Link OB is installed and verified.

You can, therefore, proceed to developing code and down-loading it to the ADuCRF101.

IAR INSTALLATION AND TOOLS

IAR TOOLS INSTALLATION

The IAR Embedded Workbench is required for building the supplied examples and for downloading and debugging applications via the serial wire interface.

To install the IAR Embedded Workbench, double-click the **EWARM-CD-6503.exe** executable file located in the **IAR** folder on the DVD—this folder was not copied onto the hard drive during the software installation procedure.

Note that installing the IAR Embedded Workbench requires an active Internet connection to register on the IAR website and to obtain a free license key.

Follow the on-screen instructions to install the IAR Embedded Workbench.

IAR DEMO CODE

Several example projects are available in the IAR workspace located in the following directory:

C:\ ADuCRF101v1.0\Code\Examples\ADUCRF101.eww

To open this workspace, from the **File** menu, choose **Open>Workspace...**, and navigate to the workspace file.



Figure 5. Opening the IAR Workspace

Several relevant projects are available within this workspace as shown in Figure 6.



Figure 6. Available Projects in the Workspace

Each example includes a comprehensive low level peripheral function library called DasLib, which can be used to interface to the peripherals of the ADuCRF101.

Comprehensive documentation for both the libraries and the examples are included as shown in Figure 7.

ADuCRF101v1.0\Documentation\DasLib\index.html



Figure 7. DasLib Library Set

Changing Projects

To change projects, right-click on a different project in the workspace and click **Set as Active** from the menu that appears (see Figure 8).



Figure 8. Changing Projects

Modifying a Project

To modify a project,

- 1. Make a change to one of the source files contained in the project.
- 2. Save the file. (The project then requires recompiling before downloading to the ADuCRF101.)
- 3. Click **make** (see Figure 9) to recompile the project as shown in Figure 10.



Figure 9. IAR Make Toolbar Button



Downloading and Debugging a Project

To download and debug a project,

1. Click **debug**. (Debugging of the code execution starts at the beginning of the main function. The following debug features can be used: single step, step over, breakpoint.)



Click **go** as shown in Figure 12.

💥 IAR Embedded Wo	orkbench IDE					
<u>File Edit View Pr</u>	roject <u>D</u> ebug	Disassembly	<u>J</u> -Link	<u>T</u> ools	<u>W</u> indow	<u>H</u> elp
🗅 🛥 🖬 🞒 🚭) X 📴 💼				•	
5 8 8 2 2	6 3 9 7 7					
ETM SWO						

Figure 12. IAR Go Toolbar Button

The code then executes on the ADuCRF101.

UG-481

2.

USING THE RADIO EXAMPLE

INTRODUCTION

The following is required for use with the radio example project:

- Two mini boards
- Two emulator boards
- Two antennas
- Two USB cables

The example workspace described in the IAR Demo Code section should still be opened within the IAR Embedded Workbench.

The following two radio examples are provided in the example workspace:

- Radio transmit (see Radio Transmit in Figure 15)
- Radio receive (see Radio Receive in Figure 15)

One mini board is used to demonstrate how to transmit a radio packet. The other mini board is used to receive the radio packet that was transmitted.

These examples use the radio interface engine, which is the mechanism for accessing the radio on the ADuCRF101.

The full documentation for the radio interface engine functions can be found in the following document in the **Documentation** folder:

ADuCRF101RadioInterfaceEngineFunctions_Rev0_1326.pdf

HARDWARE SETUP

For the purpose of this example, designate one mini board as the transmitter and the other as the receiver. The hardware contained within these kits should be connected as shown in Figure 13.



1101-105

Figure 13. Radio Demo Hardware Setup

Note the serial number of the emulator board connected to the transmitter and also of that connected to the receiver. The serial number of the emulator board is marked on the underside of the emulator board as shown in Figure 14. It will be needed to identify the transmitter and receiver to IAR EWARM in a later step.



Figure 14. Emulator Board Serial Number

DOWNLOADING THE RADIO TRANSMIT EXAMPLE

To download the radio transmit example to the mini board designated as the transmitter,

1. Select the **Radio – Transmit** example program in the IAR Embedded Workspace as shown in Figure 15.

🧏 IAR Embedded Workbench IDE			
File Edit View Project Tools Window Help			
Workspace			×
Radio - Transmit			~
ADC - ADCchannels ADC - ADCcont ADC - ADCcontDMA ADC - ADCtimerDMA ADC - ADCtimerOverflow ADC - RatioMetric ADC - TempSensor DIO - Debug GPTimers - Capture GPTimers - Capture GPTimers - Timers PMU - External Interrupt PMU - Wakeup Timer PMU - Shutdown			
Radio - Receive			
Radio - Transmit			
ISPL-Slave			- 11
SPI - Master Interrupts			- 11
SPI - Slave Interrupts			- 11
ISPI - Master DMA			- 11
WDTimer - Debug			- 11
WUTimer - Compare			- 11
WUT mer - FromSleep			_
	Ť		
	Ĵ		
u u u u u u u u u u u u u u u u u u u		*	
└ └── Common		*	
		+	
📙 🖵 Output			~
	1		
Overview ADC DIO GPTimers PMU Radio SPI		₩ ∢	>

Figure 15. Selecting the Radio Transmit Example Program

 Select Rebuild All from the Project menu, as shown in Figure 16. (Note that you should always perform a Rebuild All action after switching projects.)

1	Project Tools Window Help	
	Add Files	ì.
1	Add Group	ł.
	Import File List	
	Edit Configurations	
	Remove	ŀ
1	Create New Project	ŀ
1	Add Existing Project	Ľ
1	Options ALT+F7	
1	Version Control System	
4	Make F7	I.
1	Compile CTRL+F7	Ł
1	Rebuild All	ŀ
1	Clean	Ł
i	Batch build F8	Ł
	Stop Build CTRL+Break	
1	Download and Debug CTRL+D	ŀ
1	Debug without Downloading	Ł
1	Make & Restart Debugger CTRL+R	ŀ
i	Restart Debugger CTRL+SHIFT+R	ŀ
Ì	Download •	ŀ
	Open Device File	
1	shootion	-

Figure 16. Rebuild the Project

3. Download the project by selecting **Download active application** as shown in Figure 17. You will be prompted to select the correct emulator board as shown in Figure 18. Select the serial number of the emulator board that you designated previously as the transmitter.



Figure 17. Download the Radio Transmit Example

1101-016



Figure 18. Selecting the Transmitter Mini Board

An example of a radio transmit program is shown in Figure 19.



Figure 19. Transmit Example Program

DOWNLOADING THE RADIO RECEIVE EXAMPLE

To download the radio receive example to the mini board designated as the receiver,

1. Select the **Radio – Receive** example program in IAR Embedded Workspace as shown in Figure 20.

ADuCRF101 Getting Started Guide



Figure 20. Selecting the Radio Receive Example Program

- 2. Select **Rebuild All** from the **Project** menu as shown in Figure 16. (Note that you should always perform a **Rebuild All** action when switching projects.)
- 3. Download the project by selecting **Download active application** as shown in Figure 17. You will be prompted to select the correct emulator board as shown in Figure 21. Select the serial number of the emulator board that you designated previously as the receiver.

J-Link V4.70 - Emulator selectio	n	— × —
	Please select the emulator you want to connect to:	
	# USB Identification	
	0 SN 541000022	
	1 SN 541000024	
÷ ÷ ;/inf" ;.'+ ;	OK Can	cel

Figure 21. Selecting the Receiver Mini Board

An example of a radio receive program is shown in Figure 22.

```
// Initialise the Radio
if (RIE_Response == RIE_Success)
   RIE_Response = RadioInit(DR_38_4kbps_Dev20kbps);
// Set the Frequency to operate at 915 MHz
if (RIE_Response == RIE_Success)
   RIE_Response = RadioSetFrequency(915000000);
if (RIE_Response == RIE_Success)
  if (VAR_LENGTH)
    RIE_Response = RadioRxPacketVariableLen();
  else
   RIE_Response = RadioRxPacketFixedLen(12);
   printf("waiting for a packet\n");
3
if (RIE_Response == RIE_Success)
   while (!RadioRxPacketAvailable());
   }
```

Figure 22. Receive Example Program

RUNNNING THE EXAMPLE

To run an example,

- 1. Press the RESET switch on the mini board designated as the receiver to place the board in receive mode. (Observe that the LED on this board is not blinking.)
- 2. Press the RESET switch on the mini board designated as the transmitter to transmit a single packet.
- 3. The LED on the mini board designated as the receiver should begin blinking, indicating that a packet has been received.
- 4. A terminal program, such as HyperTerminal, can be connected to the COM port of the receiver to get a visual indicator of the packet received.

waiting for a packet

.120

11101-

-> HELLO WORLD @ RSSI -28

11101-109

Figure 23. Receiver Terminal Program Output

APPENDIX A

SOFTWARE DOCUMENTATION

The documentation described in Table 4 is available on the DVD. Any user of the ADuCRF101 development systems should consult these documents before proceeding to explore the ADuCRF101.

Table 4. Software Documentation Included on DVD

Folder	File Name	Description
Beta_ADuCRF101v1.0\Documentation\	ADuCRF101GetStarted_UG481.pdf	ADuCRF101 tutorial guide for use with the ADuCRF101 development system
Beta_ADuCRF101v1.0\Documentation\DasLib\	index.html	DasLib low level function library reference
Beta_ADuCRF101v1.0\Documentation\DataSheet\	ADuCRF101Datasheet.pdf	ADuCRF101 Sp0 data sheet
	ADuCRF101_UG_231.pdf	ADuCRF101 user guide
Beta_ADuCRF101v1.0\Documentation\Evaluation Board\	ADuCRF101_EvalBrdGuide_UG480.pdf	ADuCRF101 Evaluation Board User Guide
Beta_ADuCRF101v1.0\Documentation\RadioInterfaceEngine\	ADuCRF101RadioInterfaceEngineFunctions.pdf	Describes the RIE functions implemented on the ADuCRF101
Beta_ADuCRF101v1.0\Documentation\Technotes\	AN-772.pdf	A Design and Manufacturing Guide for the Lead Frame Chip Scale Package (LFCSP)
	AN-1159.pdf	I ² C-Compatible Interface on Cortex-M3 Based Precision Analog Microcontroller (ADuCxxx Family)
	AN-1160.pdf	Cortex-M3 Based ADuCxxx Serial Download Protocol

11101-022

11101-023

APPENDIX B

IAR DOWNLOAD INITIAL SETUP AND TROUBLESHOOTING

To set up the configuration for an IAR project,

- 1. Right-click the project name in the workspace area or in the project pull-down menu to access the project configuration.
- 2. Click **General Options** in the **Category** box, and select **AnalogDevices ADUCRF101** as the device in the **Target** tab as shown in Figure 24.

Options for node "Blink"	
Categoy: CrC++ Compiler Assembler Output Converter Custom Build Build Actions Linker Debugger Simulator Angel GDB Server IAR ROM-monitor J-Ink/J-Trace TI Stellaris FTDI Macraigor PE micro RDI ST-LINK Third-Party Driver	y Options MISRA-C:200 ()
	OK Cancel

Figure 24. Selecting the Device

3. Click C/C++ Compiler in the Category box, and specify the include directory as shown in Figure 25 in the **Preprocessor** tab.

Options for node "Si	imple1"
Category: General Options C/C++ Compiler Assembler	Multi-file Compilation Discard Unused Publics
Output Converter Custom Build Build Actions Linker Debugger Simulator Angel GDB Server	Language Code Optimizations Output List Treprocesso Output Ignore standard include directories STOOLKIT_DIRS\INC\ Additional include directories: (one per line) SPROJ_DIRS\.\.\include
LIAR ROM-monitor J-Link/J-Trace LMI FTDI Macraigor RDI ST-Link Third-Party Driver	Preinclude file: Defined symbols: (one per line) Preprocessor output to file Preserve comments Generate #line directives
	OK Cancel

Figure 25. Specifying the Include Directory

 Click Linker in the Category box, and override the linker configuration file by selecting Override default in the Linker configuration file section of the Config tab as shown in Figure 26.

Figure 26. Overriding the Linker Configuration File

 Click Debugger in the Category box, and select J-Link/ J-Trace from the Driver box and Run to main in the Setup tab as shown in Figure 27.

Figure 27. Setting Up the Driver

11101-021

 Click Debugger in the Category box, select Verify download and Use flash loader(s) in the Download tab as shown in Figure 28.

Category: General Options C/C++ Compiler Assembler Custom Build Build Actions Linker Debugger Simulator Angel GDB Server LAR ROM-monitor J-Link/J-Trace LMI FTDI Macraigor RDI ST-Link Third-Party Driver	Factory Settings Setup Download Attach to program Verify download Suppress download V Use flash loader(s) Ovemde default board file \$TOOLKIT_DIRS*config Vlashloader\AnalogDevices Edit
--	--

Figure 28. Setting the Debugger Download Options

7. Click **J-Link/J-Trace** in the **Category** box, and configure the **Setup** tab as shown in Figure 29.

Options for node "Blink"	
Category: Factory Settings General Options C/C++ Compler Assembler Output Converter Output Converter Build Actions Linker Bebugger Simulator Angel GDB Server LAR ROM-monitor Tit Stellars FTDI Macraigor PE micro RDI ST-LINK Third-Party Driver	
DK Cancel	11101-025

Figure 29. Configuring the J-Link/J-Trace Settings

8. With **J-Link/J-Trace** still selected in the **Category** box, configure the **Connection** tab as shown in Figure 30.



Figure 30. Selecting the Connection Options

APPENDIX C windows serial downloader

The Windows serial downloader for a Cortex-M3 based part (CM3WSD) is a Windows software program that allows a user to serially download Intel extended hex files as created by assembler/compilers to the ADuCRF101 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.

See the Installing the J-Link OB Driver section for information on how to determine the correct COM port to use on the PC. This COM port should be used in all subsequent steps.

The emulator board USB driver should be installed as per the Installing the J-Link OB Driver section before proceeding.

Preparing for Downloading

Prepare the system for downloading by configuring the board as follows:

- 1. Connect the ADuCRF101 mini board to the emulator board.
- 2. Connect the interface board to the PC using a USB cable.



Figure 31. ADuCRF101 Mini Board Connected to Emulator Board

- 3. Place the ADuCRF101 into serial download mode using the following sequence:
 - a. Hold down the BOOT switch on the mini board.
 - b. Press and release the RESET switch on the mini board.
 - c. Release the BOOT switch on the mini board.



Figure 32. Boot and Reset Switches

Downloading

To begin a download,

 Launch the Windows serial downloader by double-clicking CM3WSD.exe in the following directory: C:\ADuCRF101v1.0\Software Tools\CM3WSD

з смзwsd	- • •
File to download	
C:\ADuCRF101v1.0\Software Tools\CM3WSD\Sample.hex	Browse
Serial <u>P</u> ort <u>B</u> audrate	
COM2 (JLink CDC UART Port) I15200	•
Flash Action	
Program and Verify	
🗖 Autorun 🔲 Autoflash	
Monitor Status	
Connect test board to PC COM1 at 115200 Baud. Click Start. Connect test board to PC COM2 at 115200 Baud. Click Start. Ready @ 115200 baud n,81. Press Download and pulse Reset on hardware. ADuCRF101 128 E30 received. Erasing 14 pages of 512 bytes each. Downloading 6776 bytes Veritying 6776 bytes Flashing Complete. Click Reset to run program.	
Start Beset Cano	el <u>Exit</u>

- Figure 33. Downloading Using CM3WSD
- Select the following file: C:\ADuCRF101v1.0\Software Tools\CM3WSD\ sample.hex

(The **sample.hex** file is a simple program that causes an LED to continuously blink, indicating the successful download of code.)

- 3. Select the correct JLINK CDC UART COM port from the **Serial Port** box.
- 4. Select a baud rate of **115200** from the **Baudrate** box.
- 5. Click **Start** in the **CM3WSD** dialog box. The CM3WSD sends a reset command to the ADuCRF101.
 - a. If the ADuCRF101 is in serial download mode and the COM port between the PC and the mini board is set up correctly, the CM3WSD starts downloading the .hex file and display a progress bar.
 - b. After the file is successfully downloaded, the **Monitor Status** box displays the message **Flashing Complete**.
- 6. Click **Reset** in the **CM3WSD** dialog box to run the program.
 - a. An LED begins blinking on the mini board indicating that the .hex file has been downloaded and is executing.
 - b. The Monitor Status box displays the message Running.

APPENDIX D using elves.exe

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 ADuCRF101 registers.

 In the folder, C:\ADuCRF101v1.0\Software Tools\Elves, double click the file Elves.exe to launch Elves.

Bankova Unew Behb End C:\ADUCDFIDIO1.0\Code\DestLib\Pealsb.T C:\ADUCDFIDIO1.0\Code\DestLib\Pealsb.T uncion Detals	elect Function Set		1
C:\AbuCPFIDiv1.0\Code\Duslib.\Penils.1 unction Details C:\AbuCPFIDiv1.0\Code\Duslib.\Penils.1 Cover Choose Function [Add Bemove View	Help	East
Inclos Details	C:\ADuCDF101s	vl.0\Code\DasLi	b\PumLib.h
Choose Function Concernation C	- Function Details		
Droome Function (Outcome Function (Outcome Function (Other (Correl
Droome Function []	€	3	_7ota
ChooseFunction (outro Code fination (
ourorCode file Publib.h Brite Ees of NMP peripheral functions. Powrzion V0.1 Bauchor PAD COS group Géase Suprember 2010 perovided by ADT, including this file, are provided as is vithout warranty of any Mind, either appressed or implied. The user samues may mod all risk from the use of this code. N is the responsibility of the person independent of this code into an application h is the responsibility of the person independent of this code into an application	Choose Function ()
ouro Code		,	
DevenCode		,	- 1
et al. Positib.h dfile Positib.h (brief fee of NWE perpheral functions. eversion V0.1 gaschor 3AD CSH group (date September 2012 uil files for ADuCDFIOI provided by ADI, including this file, are rovided as is without warranty of any kind, either supressed or implied. The user assumes any modeal risk from the use of this code. The user assumes any modeal lisk from the use of this code.			- 1
@file PMALLD-h @brief fee of FNF partphoral functions. @pwartion V0.1 g Samchor FAL CS1 group @data feetputsher fBU2 g Lif files for ADuCPFIOL provided by ADT, including this file, are provided as is without warranty of any Kind, either appressed or implied. The user assumes may mod all tisk from the use of this code. The sit whe responsibility of the press, independent of this code into an application h	ource Code		
0file PMALD.h D Divisit for of PME paripheral functions. E Number Ab.C 58 group E Gauchor Ab.C 58 group E Gauchor Ab.C 58 group E Mathematical Structure E Divisition Sarrandy of any kind, either supressed of implied. For user summary of any kind, either supressed or implied. Sarrandy of any kind, either supressed on application on onnowe that the resultion sumilication metrics are summarized and is grid.	ource Code		
<pre>gbrief fet of DWS portphoral functions. gbrearies VD. 01 Seachor DAD CSS groups and the search of the searc</pre>	ource Eode		
<pre>averagine V0.1 Searchor 2A.0 CSB group Gdate September 2012 11 files for AACUFJOL provided by ADT, isocluding this file, are revolved as is without warranty of any Alad, sither septemend of implied. The user armame may and all risks from the use of this code for iso the responsibility of the person integrating this code into an application to answer that the arealized an anticeton matterns as remained and is site. *</pre>	suce Code		
Baccor failed for the set of the	ouro Code *** @file Prmilib.h @file cf PMT perspheral functions.		j
<pre>umax exploration to the Infiles for ADDFDID provided by ADT_ including this file, are newided as is without warranty of any kind, either expressed or implied. The user arranges may and all risk from the use of this code. S is the responsibility of the person integrating this code into an application to answer that the arabitom anticeton materna as remained and is gift. *</pre>	ourofCode 		Î
L1 files for ADxCFFIO1 provided by ADX, including this file, are royided as is without warrance of any hind, either appreciated or implied. The user assumes may mode all risk from the use of this code. A is the responsibility of the person, independent of this code into an application A is the responsibility.	ouro Code *** @file Pratikb.h @brist Est of PWT perspheral functions. @version V0.1 @aschor 28.0 C68 group @aschor 28.0 C68 group		,
rowided as is without warranty of any kind, either expressed or implied. The user arrund as a structure of the second structu	ours Code /** 0:114 Punibb.h gbrind En of XMP paripheral functions. fyersion V0.1 Baschor PAD CS3 group gdats Stytemahar 2012		*
The user assumes any and all risk from the use of this code. It is the responsibility of the person integrating this code into an application to ensure that the resulting amplication performs as remnired and is safe.	ourceCode @file Prails.h @file fract for JWN perspheral functions. @version V0.1 @achor JAC CSH group: @date depicaber 2012 [file for AlcorFile Jourgeded by ADI, including this file, are		×
It is the responsibility of the person integrating this code into an application	ource Code dfile Puminb.h gbrist Ent of SWT perspheral functions. @version V0.1 @wchor PAD CSI group @dea Stycesher 2012 stifile for ADuCSFIOI proorded by ADT, including this file, are provided as is unchook varrandry of any kind, wither expressed or implic		
o ensure that the resulting application performs as remired and is safe.	oursCode 5/10 Bfile PMLLS.h gbrief Set of DWT pergheral functions. Assentor 32.0 SI group Match September 5012 11 files (est Aud/2010) provided by ADT, isolating this file, are provided as is without warmanty of any kind, sizher septembed or hapits her user armane any and all is from the use of this code.	, 	
the second	ourse Code 2011s Penils.h. Define Sen of NMP peripheral functions. Powersion VO.1 Baschor PAD CST group Datase September 2012 Nil files for ADVCSTIO1 provided by ADT, including this file, are provided as is without warranty of any kind, wither expressed or implif The user assumes any and all tisk from the use of this code. Is is the responsibility of the presen integrating this code into an ago	ed.	×

Figure 34. Launching Elves

 To add a library, click Add and go to the directory C:\ADuCRF101v1.0\Code\DasLib.

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

)rganize 🔻 New	/ folder			III - II	0
lame	·	Date modified	Туре	Size	-
h] AdcLib.h		10/08/2012 16:56	C/C++ Header	2 KB	
🖻 ClkLib.h		14/03/2012 14:28	C/C++ Header	1 KB	
🖻 DioLib.h		03/10/2012 11:06	C/C++ Header	3 KB	
🖻 DmaLib.h		29/01/2013 12:09	C/C++ Header	2 KB	
💼 FeeLib.h		13/12/2012 12:34	C/C++ Header	2 KB	
💼 GptLib.h		14/03/2012 14:28	C/C++ Header	2 KB	
🖻 I2cLib.h		05/10/2012 10:02	C/C++ Header	2 KB	
💼 IntLib.h		14/03/2012 14:28	C/C++ Header	1 KB	
🖻 PwmLib.h		19/09/2012 14:18	C/C++ Header	2 KB	
🖻 PwrLib.h		14/03/2012 14:28	C/C++ Header	1 KB	
🖻 RstLib.h		14/03/2012 14:28	C/C++ Header	1 KB	
🖻 SpiLib.h		14/03/2012 14:28	C/C++ Header	2 KB	
💼 UrtLib.h		13/12/2012 13:35	C/C++ Header	2 KB	_
🖞 WdtLib.h		14/03/2012 14:28	C/C++ Header	1 KB	-
	File name: Add ih h		- Header(*	h)	-

Figure 35. Select Source Library

For example, if the AdcLib.h library is added (see Figure 35), the user can generate functions to control the ADC.

Add Remove View		Help	Exit
	C: \ADuCRF10	lv1.0\Code\DasLib\&d	ScLib.h
Function Details			_
			Conv
e		, _	
Chasses Exercises (
Choose Punction [·	,	
Choose Function Int. AdvCfracint, 1Chap. Int. 1	Ref int ifik int ik	2013	-
int AdcCfg(int iChan, int i	Def. int iClk. int iA	(a)	
int AdcCnv(int iNode, int i	Start)		
/** int AdcInit(int iRefBuf, in	t iInt, int iDMA)		
Sbrief int AdcCfg int AdcPd(int iPd)			
int AdcRd(int iCal)			
int AdcSta(vold)			
Sparan ichan : (ADCCFG_CHSEL_ADCO, ADCCFG_C	HSEL_ADCI, ADCCFG_CHSE	L_ADCZ,ADCCFG_CHSEL_	AC I
- ADCCFG_CHSEL_ADCU selects sing.	te ended ADC1 input.		
- ADCORG CHARL ADDI Selects sing.	a ended ADC1 input.		
- ADCORC CHERL ADC2 selects sing.	a anded ADC2 input.		
- ADCORG CHSRL ADC4 selects sing	anded ADC4 input.		
- ADCCFG CHSEL ADC5 selects sing	le ended ADC5 input.		
- ADCORG CHESKL DIERO selects diff	ferential ADCO - ADC1	input s	

Figure 36. List of Functions

Take, for example, the function **AdcCfg**, in the **Choose Function** section as shown in Figure 36. 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 37.

Elves			-		- X
Add Remove	View			Help	Exit
·			C:\ADuCPF101v1.	0\Code\DasLil	>\AdcLib.h
Function Details					
dcchg(ADCCFG_CHSEL	_VBATDIV4. ADCCFG_REI	F_INTERNAL125V, ADCCFG_C	LK_FCOREDIV4. ADCC	FG_ACQ_2)	Copy
Choose P	ef = [100000000000000000000000000000000000	COMMUNICATI			
ource Code	ADCCFG REF INT	ERNAL125V D			-
Sparam iBef : - ADCCFG - ADCCFG	(ADCCFG_BEF_INTERNAL REF_INTERNAL125V for REF_LVDD for LVDD for	AL125V, ADCCFG_BEF_LVDD or select the internal as the ADC reference.) 1.25 V reference	e as the ADC	refere
<pre>@param iClk :</pre>	(ADCCFG_CLK_FCORED CLK_FCOREDIV4 for CLK_FCOREDIV8 for CLK_FCOREDIV36 for CLK_FCOREDIV32 for	IV4,ADCCFG_CLK_FCOREDI fcore / 4 (default). fcore / 0. fcore / 16. fcore / 32.	V8, ADCCFG_CLE_FC	DREDIV16,ADCC	FC_CLF
@param iAcq : - 0 or AI - 1 or AI	(ADCCFC_ACQ_2,ADCC) CCFC_ACQ_2 for 2 A CCFC_ACQ_4 for 4 A	FC_ACQ_4,ADCCFC_ACQ_8, equisition clocks. equisition clocks.	WDCC&C_FC0_1e)		

Figure 37. Selecting Parameters

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

APPENDIX E

SERIAL COMMUNICATION WITH THE PC

Examples that use the UART can be communicated with using the following HyperTerminal setup:

- 1. Open HyperTerminal or an equivalent serial communication tool.
- 2. Select the COM port that corresponds with the USB emulator board.
- 3. Configure this COM port as shown in Figure 38.

COM4 Properties	? 🛛
Port Settings	
Bits per second: 19200	~
Data bita:	
Data bits. 8	<u> </u>
Parity: None	~
Stop bits: 1	✓
Flow control: None	<u> </u>
	Restore Defaults
ОК	Cancel Apply

Figure 38. COM Port Setup

RELATED LINKS

Resource	Description
ADuCRF101	Product Page, ADuCRF101 Precision Analog Microcontroller ARM Cortex-M3 with ISM Band Transceiver
AN-772	Application Note, A Design and Manufacturing Guide for the Lead Frame Chip Scale Package (LFCSP)
AN-1160	Application Note, Cortex-M3 Based ADuCxxx Serial Download Protocol
AN-1159	Application Note, I ² C-Compatible Interface on Cortex-M3 Based Precision Analog Microcontroller (ADuCxxx Family)

NOTES

NOTES



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.

Legal Terms and Conditions

By using the evaluation board discussed herein (together with any tools, components documentation or support materials, the "Evaluation Board"), you are agreeing to be bound by the terms and conditions set forth below ("Agreement") unless you have purchased the Evaluation Board, in which case the Analog Devices Standard Terms and Conditions of Sale shall govern. Do not use the Evaluation Board until you have read and agreed to the Agreement. Your use of the Evaluation Board shall signify your acceptance of the Agreement. This Agreement is made by and between you ("Customer") and Analog Devices, Inc. ("ADI"), with its principal place of business at One Technology Way, Norwood, MA 02062, USA. Subject to the terms and conditions of the Agreement, ADI hereby grants to Customer a free, limited, personal, temporary, non-exclusive, non-sublicensable, non-transferable license to use the Evaluation Board FOR EVALUATION PURPOSES ONLY. Customer understands and agrees that the Evaluation Board is provided for the sole and exclusive purpose referenced above, and agrees not to use the Evaluation Board for any other purpose. Furthermore, the license granted is expressly made subject to the following additional limitations: Customer shall not (i) rent, lease, display, sell, transfer, assign, sublicense, or distribute the Evaluation Board; and (ii) permit any Third Party to access the Evaluation Board. As used herein, the term "Third Party" includes any entity other than ADI, Customer, their employees, affiliates and in-house consultants. The Evaluation Board is NOT sold to Customer; all rights not expressly granted herein, including ownership of the Evaluation Board, are reserved by ADI. CONFIDENTIALITY. This Agreement and the Evaluation Board shall all be considered the confidential and proprietary information of ADI. Customer may not disclose or transfer any portion of the Evaluation Board to any other party for any reason. Upon discontinuation of use of the Evaluation Board or termination of this Agreement, Customer agrees to promptly return the Evaluation Board to ADI. ADDITIONAL RESTRICTIONS. Customer may not disassemble, decompile or reverse engineer chips on the Evaluation Board. Customer shall inform ADI of any occurred damages or any modifications or alterations it makes to the Evaluation Board, including but not limited to soldering or any other activity that affects the material content of the Evaluation Board. Modifications to the Evaluation Board must comply with applicable law, including but not limited to the RoHS Directive. TERMINATION. ADI may terminate this Agreement at any time upon giving written notice to Customer. Customer agrees to return to ADI the Evaluation Board at that time. LIMITATION OF LIABILITY. THE EVALUATION BOARD PROVIDED HEREUNDER IS PROVIDED "AS IS" AND ADI MAKES NO WARRANTIES OR REPRESENTATIONS OF ANY KIND WITH RESPECT TO IT. ADI SPECIFICALLY DISCLAIMS ANY REPRESENTATIONS, ENDORSEMENTS, GUARANTEES, OR WARRANTIES, EXPRESS OR IMPLIED, RELATED TO THE EVALUATION BOARD INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTY OF MERCHANTABILITY, TITLE, FITNESS FOR A PARTICULAR PURPOSE OR NONINFRINGEMENT OF INTELLECTUAL PROPERTY RIGHTS. IN NO EVENT WILL ADI AND ITS LICENSORS BE LIABLE FOR ANY INCIDENTAL, SPECIAL, INDIRECT, OR CONSEQUENTIAL DAMAGES RESULTING FROM CUSTOMER'S POSSESSION OR USE OF THE EVALUATION BOARD. INCLUDING BUT NOT LIMITED TO LOST PROFITS. DELAY COSTS, LABOR COSTS OR LOSS OF GOODWILL, ADI'S TOTAL LIABILITY FROM ANY AND ALL CAUSES SHALL BE LIMITED TO THE AMOUNT OF ONE HUNDRED US DOLLARS (\$100.00). EXPORT. Customer agrees that it will not directly or indirectly export the Evaluation Board to another country, and that it will comply with all applicable United States federal laws and regulations relating to exports. GOVERNING LAW. This Agreement shall be governed by and construed in accordance with the substantive laws of the Commonwealth of Massachusetts (excluding conflict of law rules). Any legal action regarding this Agreement will be heard in the state or federal courts having jurisdiction in Suffolk County, Massachusetts, and Customer hereby submits to the personal jurisdiction and venue of such courts. The United Nations Convention on Contracts for the International Sale of Goods shall not apply to this Agreement and is expressly disclaimed.

©2015 Analog Devices, Inc. All rights reserved. Trademarks and registered trademarks are the property of their respective owners. UG11101-0-1/15(0)



www.analog.com

Rev. 0 | Page 20 of 20