# EVBUM2595/D

# DVK-AXM0F243-xxx-x-GEVK Evaluation Kit User's Manual

ON Semiconductor®

www.onsemi.com

**EVAL BOARD USER'S MANUAL**

### Introduction

The *DVK−AXM0F243−868−x−GEVK* and *DVK−AXM0F243−915−x−GEVK* kits are designed as quick start solution for the development of applications with the AXM0F243 RF System On Chip (SoC). This SoC combines an ARM Cortex M0+ ultra−low power microcontroller with the AX5043 ultra−low power RF transceiver in a single IC package. The DVK−AXM0F243−868−x−GEVK is optimized for 868 MHz frequency, and the DVK−AXM0F243−915−x−GEVK development kit is enhanced for 915 MHz. The DVK−AXM0F243−xxx−x−GEVK's are compatible with AX−RadioLab and AxCode::Blocks development software for the PC.

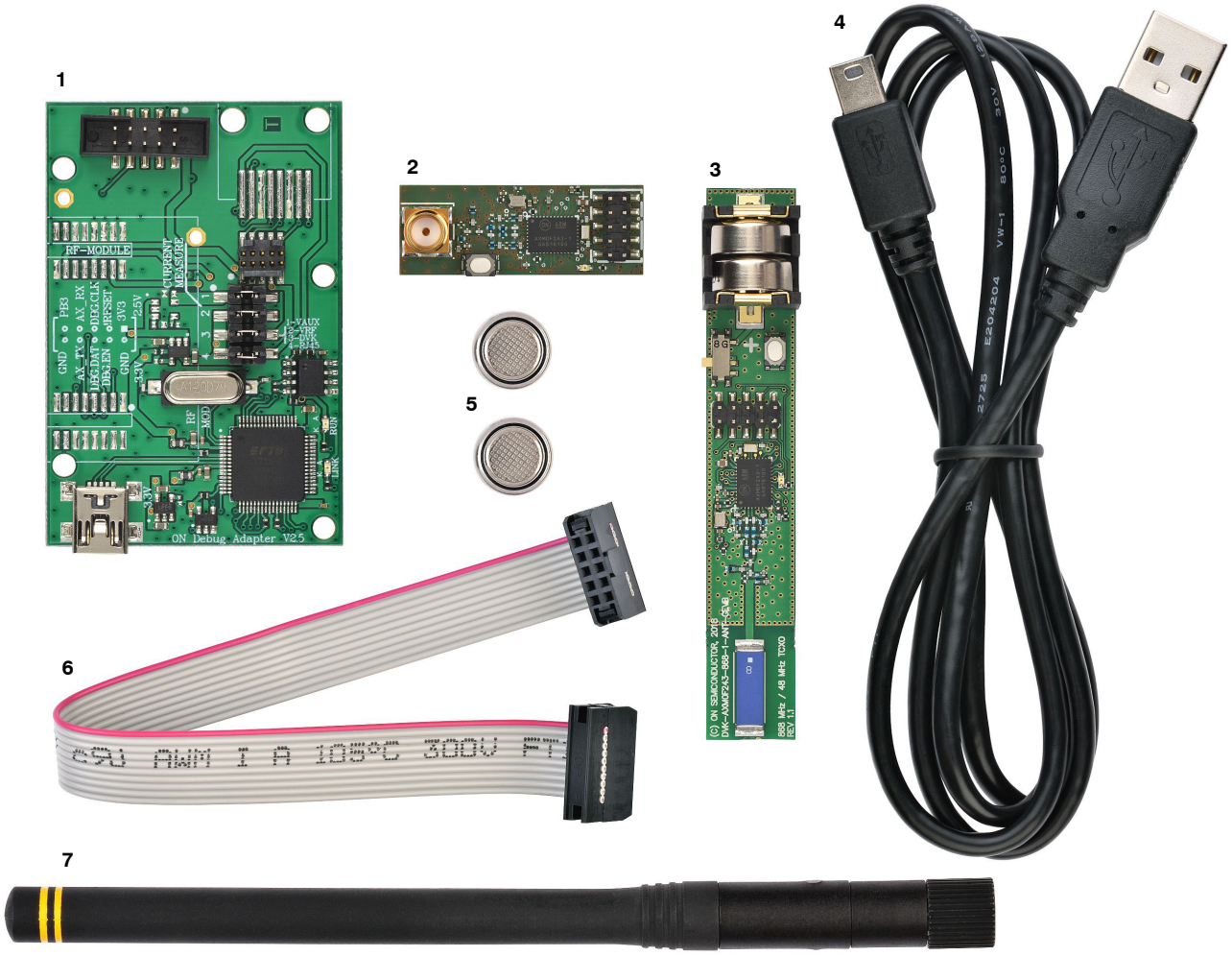


**Figure 1. DVK−AXM0F243−868−x−GEVK Kit**

© Semiconductor Components Industries, LLC, 2018

The development kits DVK−AXM0F243−868−x−GEVK and DVK−AXM0F243−915−x−GEVK come with:

| Designator | DVK−AXM0F243−868−x−GEVK | DVK−AXM0F243−915−x−GEVK | Quantity |
|---|---|---|---|
| 1 | AXDBG Debug adapter | | 1 piece |
| 2 | DVK−AXM0F243−868−x−SMA−GEVB (SMA connector) | DVK−AXM0F243−915−x−SMA−GEVB (SMA connector) | 1 piece |
| 3 | DVK−AXM0F243−868−x−ANT−GEVB (chip antenna, LR44 button cell battery holder) | DVK−AXM0F243−915−x−ANT−GEVB (chip antenna, LR44 button cell battery holder) | 1 piece |
| 4 | Mini USB cable | | 1 piece |
| 5 | LR4 cell batteries | | 2 pieces |
| 6 | Flat Debug cable | | 1 piece |
| 7 | Antenna 868 MHz 1/2 wave SMA | Antenna 915 MHz 1/2 wave SMA | 1 piece |

### DVK−AXM0F243−XXX−x−SMA−GEVB Overview

The *DVK−AXM0F243−868−x−SMA−GEVB* mainboard is the first of two boards in the DVK−AXM0F243−868−x−GEVK kit. It features the AXM0F243 ultra−low power SoC, as well as a LED, a button, and a 50 Ω SMA port. In addition to the antennas shipped with the kit, various 50 Ω antennas with male SMA connector can be used. The SMA port can also be used to connect the DVK to RF measurement equipment for conducted−mode testing.

Similarly the DVK−AXM0F243−915−x−SMA−GEVB mainboard is the first of two boards in the DVK−AXM0F243−915−x−GEVK kit.

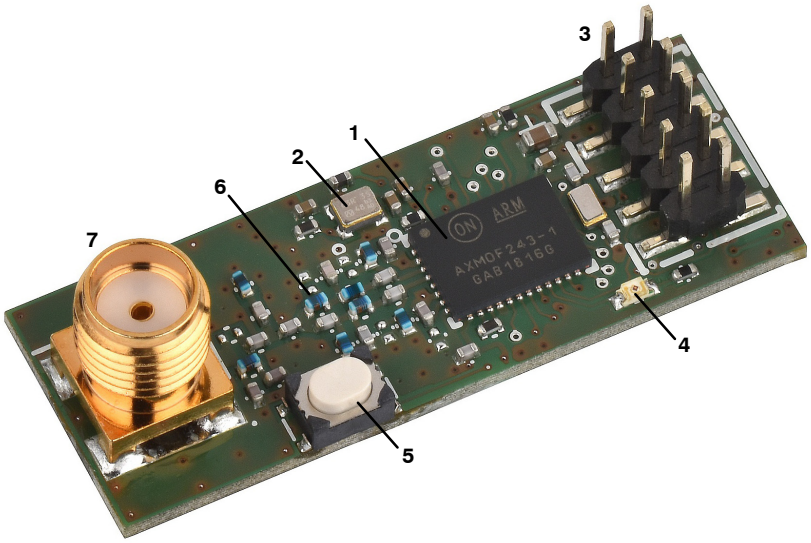


**Figure 2. DVK−AXM0F243−xxx−x−SMA−GEVB**

| Designator | DVK−AXM0F243−868−x−SMA−GEVB | DVK−AXM0F243−915−x−SMA−GEVB |
|---|---|---|
| 1 | AXM0F243 ultra−low power RF SoC | |
| 2 | 48 MHz TCXO | |
| 3 | AX debug link connector | |
| 4 | Programmable LED | |
| 5 | Programmable button | |
| 6 | Matching circuit optimized for 868 MHz | Matching circuit optimized for 915 MHz |
| 7 | 50 Ω SMA connector | |

### DVK−AXM0F243−XXX−x−ANT−GEVB Overview

The *DVK−AXM0F243−868−x−ANT−GEVB* mainboard is the second of two boards in the DVK−AXM0F243−868−x−GEVK kit.

It features the AXM0F243 ultra−low power SoC, as well as a LED, a button, battery, and chip antenna.

Similarly the DVK−AXM0F243−915−x−ANT−GEVB mainboard is the first of two boards in the DVK−AXM0F243−915−x−GEVK kit.

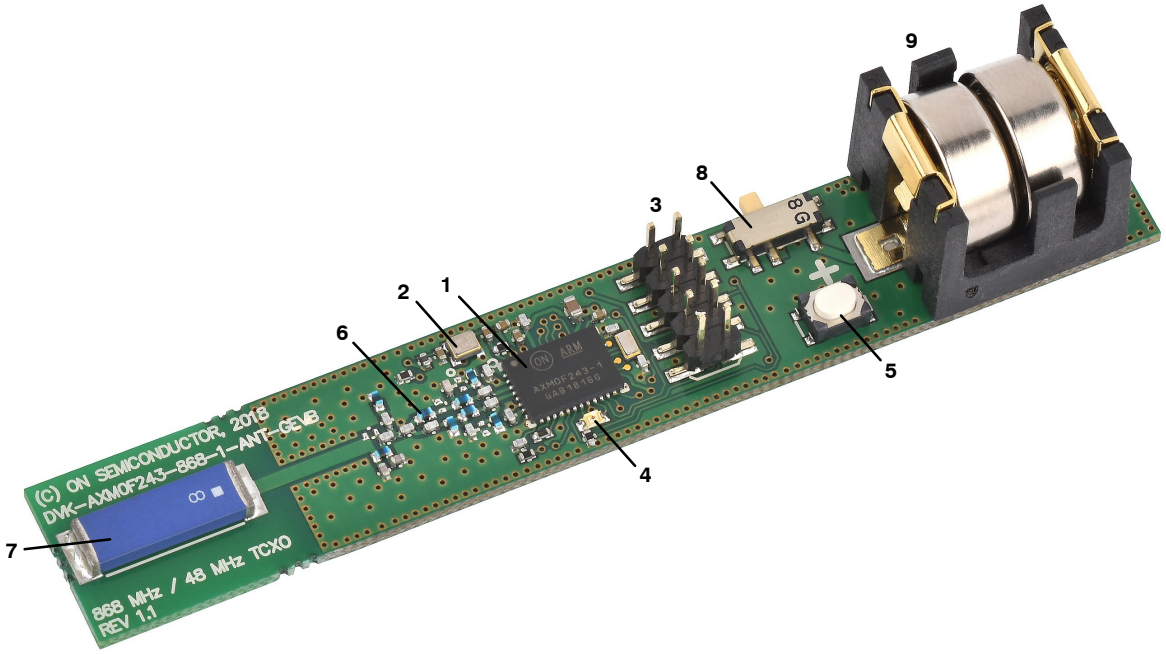


**Figure 3. DVK−AXM0F243−xxx−x−ANT−GEVB**

| Designator | DVK−AXM0F243−868−x−ANT−GEVB | DVK−AXM0F243−915−x−ANT−GEVB |
|---|---|---|
| 1 | AXM0F243 ultra−low power RF SoC | |
| 2 | 48 MHz TCXO | |
| 3 | AX debug link connector | |
| 4 | Programmable LED | |
| 5 | Programmable button | |
| 6 | Matching circuit optimized for 868 MHz | Matching circuit optimized for 915 MHz |
| 7 | 868 MHz Chip antenna | 915 MHz Chip antenna |
| 8 | Power supply switch (select between debug link and battery powered operation) | |
| 9 | LR44 Button cell battery holder | |

### AXDBG Debug Adapter Overview

The *AXDBG debug adapter* is the interface between the PC and the mainboards. It can be used for programming and debugging the AXM0F243 microcontroller. It interfaces with the PC via windows drivers and the AXSDB software interface, which is then used by AX−RadioLab and AxCode::Blocks development software for the PC. The AXSDB can also be used in mass production with the scriptable AXSDB software.

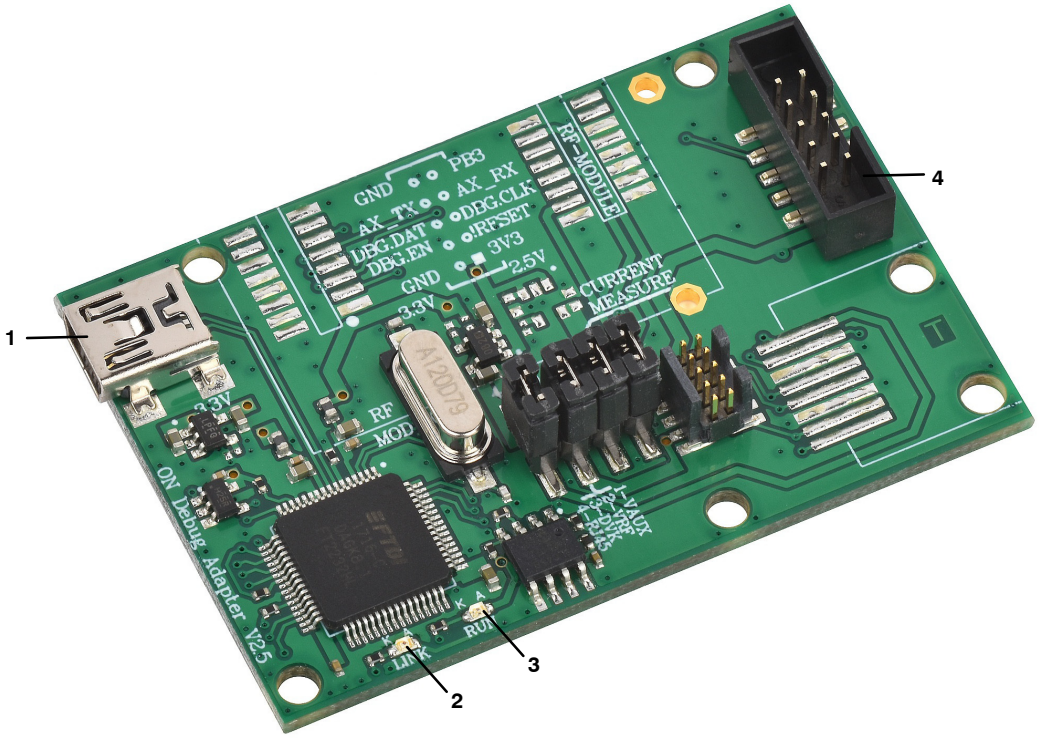


**Figure 4. AXDBG Debug Adapter**

| Designator | AXDBG Debug Adapter |
|---|---|
| 1 | Mini USB PC interface |
| 2 | LED red indicating the debug link is active, MCU in debug mode |
| 3 | LED green indicating a program is executed on the MCU |
| 4 | Debug link connector |

### Out of the Box RF Functionality

RF functionality are already programmed on both mainboards. It's possible to make the first RF experience sending data packages from DVK−AXM0F243−XXX−x−**SMA**−GEVB, programmed as transmitter, to the DVK−AXM0F243−XXX−x−**ANT**−GEVB, programmed as receiver, just following these simply steps.

Preparing DVK−AXM0F243−XXX−x−**SMA**−GEVB:

- Screw the antenna to the *DVK−AXM0F243−XXX−x−**SMA**−GEVB* board
- Connect the *DVK−AXM0F243−XXX−x−**SMA**−GEVB* board to the *AXDBG Debug adapter board* with the *Flat Debug cable*
- Connect the *AXDBG Debug adapter board* to the PC with *Mini USB cable*
- DVK−AXM0F243−XXX−x−**SMA**−GEVB LED is blinking when transmitting data packages

Preparing DVK−AXM0F243−XXX−x−**ANT**−GEVB:

- Insert the *LR4 cell batteries* in *DVK−AXM0F243−XXX−x−**ANT**−GEVB* battery holder.
- Set the DVK−AXM0F243−XXX−x−**ANT**−GEVB *Power supply switch* in position 1 for battery powered operation. Position 2 is for *debug link connector* powered operation.

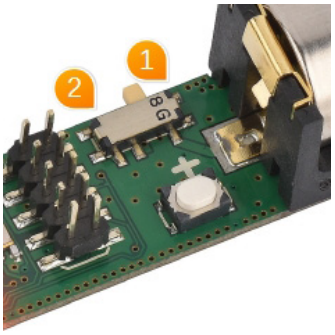


**Figure 5. Power Supply Switch. Position 1 − Battery Powered Operation, Position 2 − Debug Link Connector Powered Operation**

- DVK−AXM0F243−XXX−x−**ANT**−GEVB LED is blinking when receiving data packages from DVK−AXM0F243−XXX−x−**SMA**−GEVB

See *Figure 6: DVK−AXM0F243−xxx−x−SMA−GEVB connection* for more details.

**Figure 6. DVK−AXM0F243−xxx−x−SMA−GEVB Connection**

### Required Software

To build applications and configure the AXM0F243 is necessary to install the *AX−IDE Development tool for Windows*. It contains all tools for developing and debugging C source code applications and can be found on the AXM0F243 Product page under Software:

http://www.onsemi.com/PowerSolutions/product.do?id=AXM0F243−1−TX40

The development system architecture is visible in Figure 7: Development System Architecture.

Radio Link parameters are set using the AX−RadioLAB GUI. AX−RadioLAB produces source code, compiles it and downloads it into the target board.

AxCode::Blocks is the graphical Integrated Development Environment (IDE) for AXM0F243 projects. It is a customized version of the popular Code::Blocks IDE.

It can be used to further customize the AX−RadioLAB generated code, or it can be used to create new projects (such as those that do not involve a radio link).

Both AX−RadioLAB and AxCode::Blocks talk to the Symbolic (command line) Debugger AXSDB for programming and debugging the microcontroller. Normally, users need not directly interact with AXSDB. AXSDB can however be useful for automated or scripted tasks, thanks to its command line and TCL scripting features.

For AXM0F243 microcontroller, OpenOCD debug interface software is used for programming and debugging using the GDB (GNU) debugger.

The *AXDBG debug adapter* provides the link between the developer's workstation and the target board.

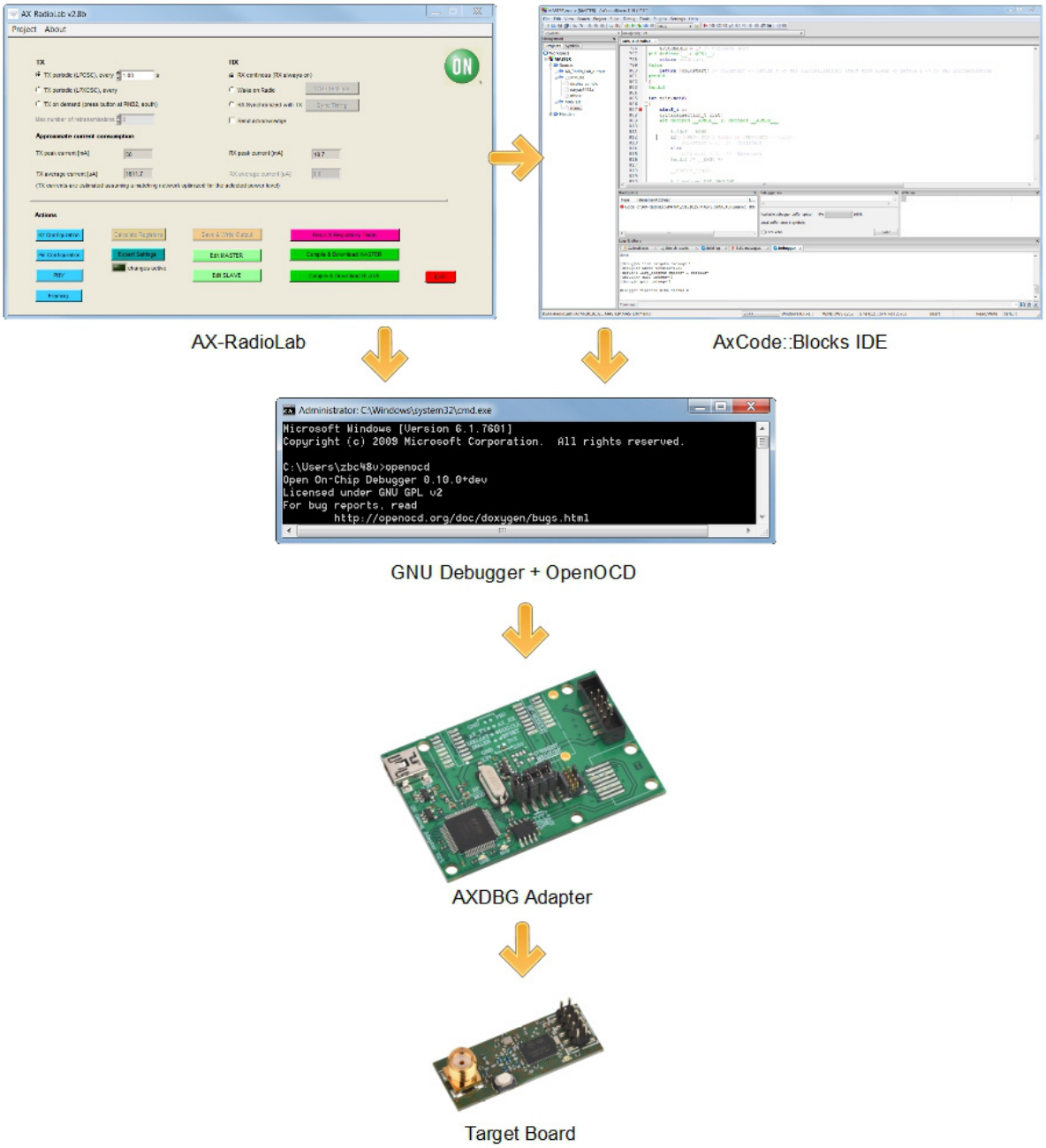


**Figure 7. Development System Architecture**

### Installing AX−IDE

The AX−IDE installer contains everything you need: the SDCC compiler, GNU GCC Compiler for ARM, AxCode::Blocks, AX−RadioLab, debug adapter drivers, the AXSDB debugger software, OpenOCD software, example files and libraries.

- Launch the installer

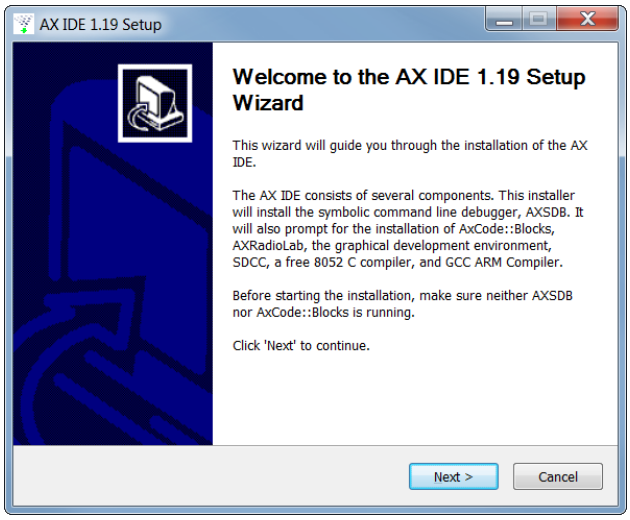


**Figure 8. AX−IDE Installer Wizard**

- After accepting the terms of agreement you are asked to select the components to be installed. It's strongly suggested to install all components.

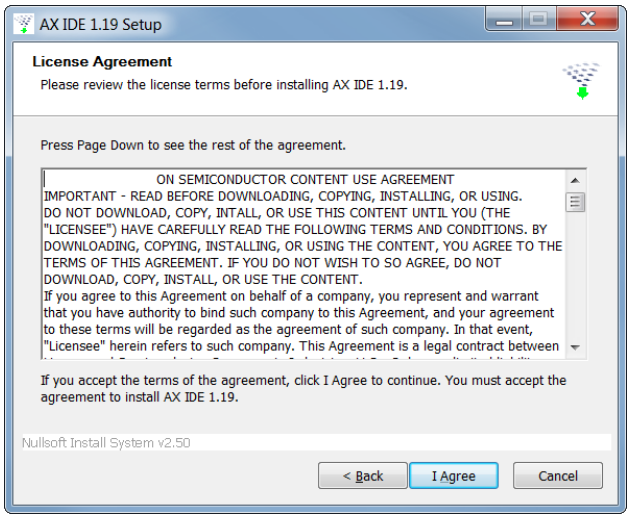


**Figure 9. License Agreement**

- Continue installing all software packages

### Getting Started

Before building the first application is **necessary** to set the AxCode::Blocks compiler.

This operation has to be executed only once.

- Start AxCode::Blocks.
- The first time AxCode::Block starts, it scans for installed compilers and presents a list of the compilers found. Select *GNU GCC Compiler for ARM* as default, see Figure 9: GNU GCC compiler for ARM.

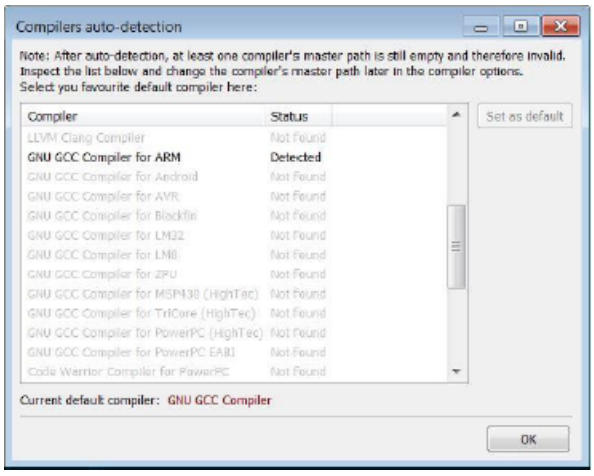


**Figure 10. GNU GCC Compiler for ARM**

### Connection

- Connect one of the *DVK−AXM0F243−XXX−x−ANT−GEVB* or *DVK−AXM0F243−XXX−x−SMA−GEVB* mainboards to the *AXDBG Debug adapter board* with the *Flat Debug cable*
- Connect the *AXDBG Debug adapter board* to the PC with *Mini USB cable*

More connection details are visible in *Figure 11: DVK−AXM0F243−XXX−x−SMA−GEVB connection to AXDBG Debug Adapter* or *Figure 12: DVK−AXM0F243−XXX−x−ANT−GEVB connection to AXDBG Debug Adapter.*

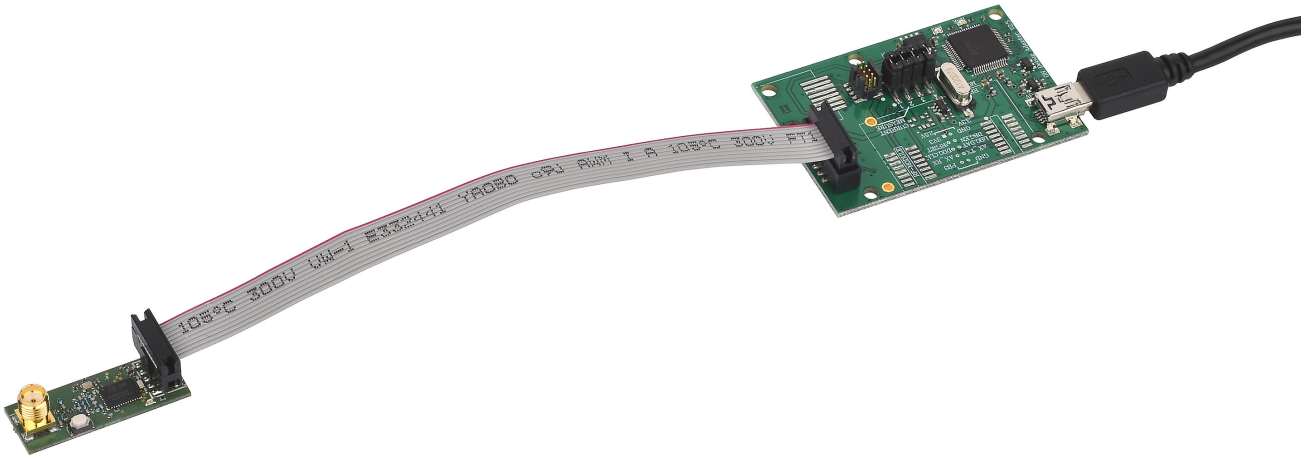

**Figure 11. DVK−AXM0F243−xxx−x−SMA−GEVB Connection to AXDBG Debug Adapter**

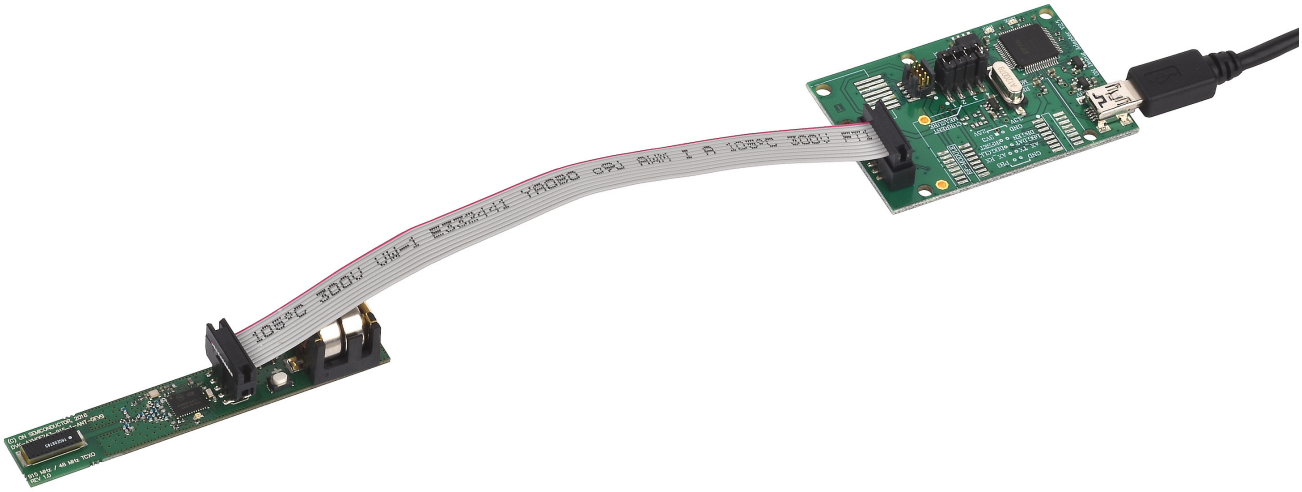

**Figure 12. DVK−AXM0F243−xxx−x−ANT−GEVB Connection to AXDBG Debug Adapter**

### Working with AX−RadioLab

AX−RadioLab is the most advanced development tool for Software Defined Radio (SDR) applications.

It offers a variety of transmitter and receiver options such as

- periodic transmission of packets timed with the RC oscillator of the radio block
- periodic transmission of packets timed with the 32 kHz XTAL oscillator of the MCU
- Transmit on push−button
- Wake−on−radio reception with programmable wake−up interval
- Synchronous transmit and receive with programmable wake−up interval
- Optional acknowledge package send for all modes

Additionally, AX−RadioLab allows the user to configure the packet format, as well as Physical (PHY) parameters.

Since AX−RadioLab is a source code generator, the developer can use the generated C code example project as a robust foundation upon which to build the end application.

Additional documentation for AX−RadioLab can be found directly under Start −> All Programs −> AX−RadioLab −> AX−RadioLAB_AX5043_user_manual

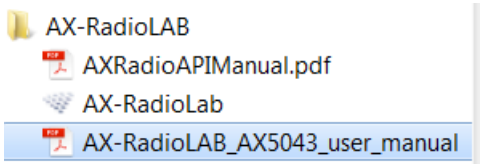


**Figure 13. AX−RadioLab Manual**

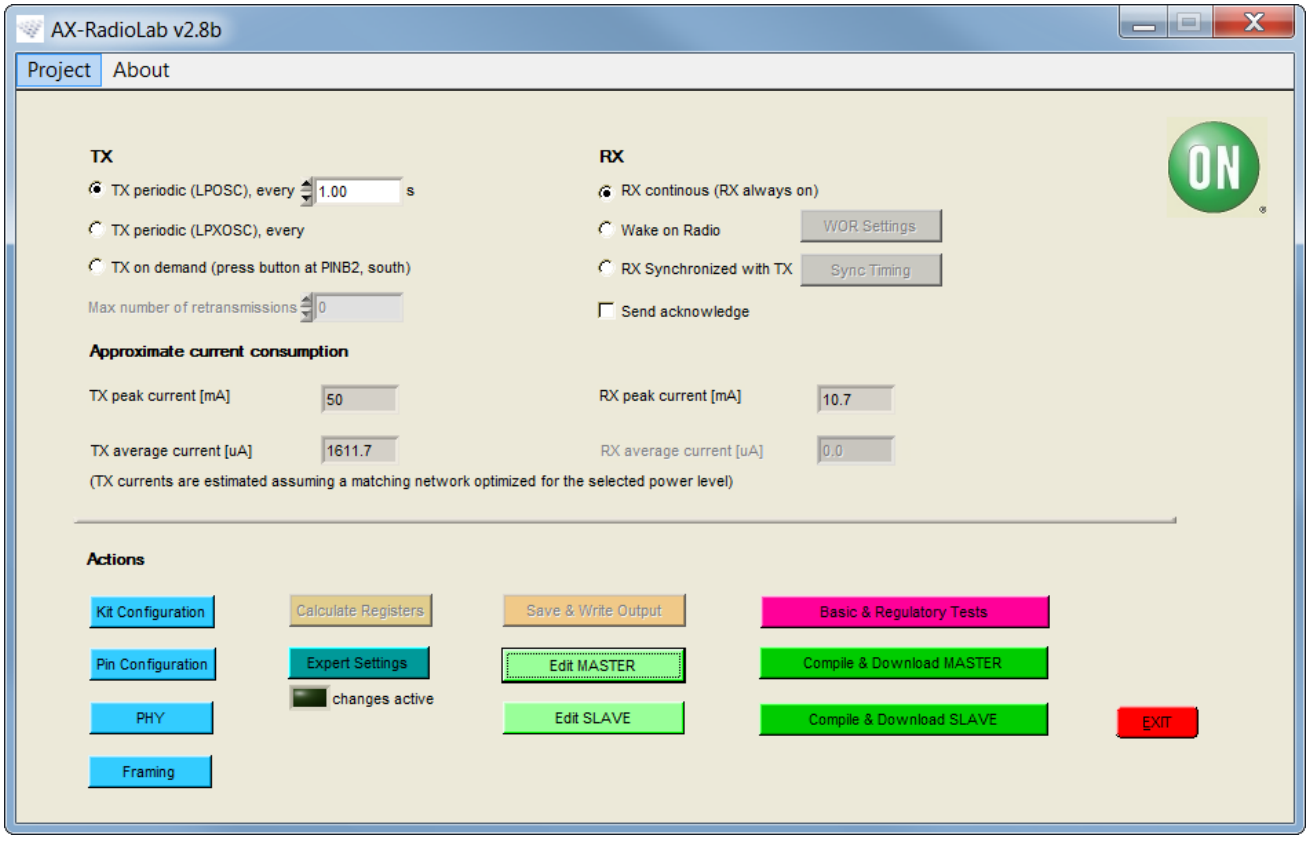


**Figure 14. AX−RadioLab**

### Working With AxCode::Blocks

AxCode::Blocks is the graphical IDE for code development on AX micro−controllers. It enables the developer to access all the debugging features of the AX microcontrollers, in particular:

- Setting break points
- Access to AXM0F243 MCU registers as well as to all AX radio chip registers
- Debug link UART in a window for debugging printf style without the need of extra hardware
- GNU GCC Compiler for ARM installed and ready to go

Additional documentation for AxCode::Blocks can be found under

- Start −> All Programs −> AxCodeBlocks −> AxCodeBlocksQuickStart
- Start −> All Programs −> AxCodeBlocks −> CodeBlocksDoc

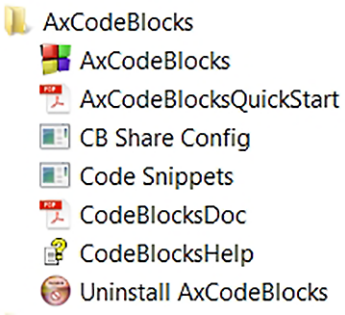


**Figure 15. AxCode::Blocks Manuals**

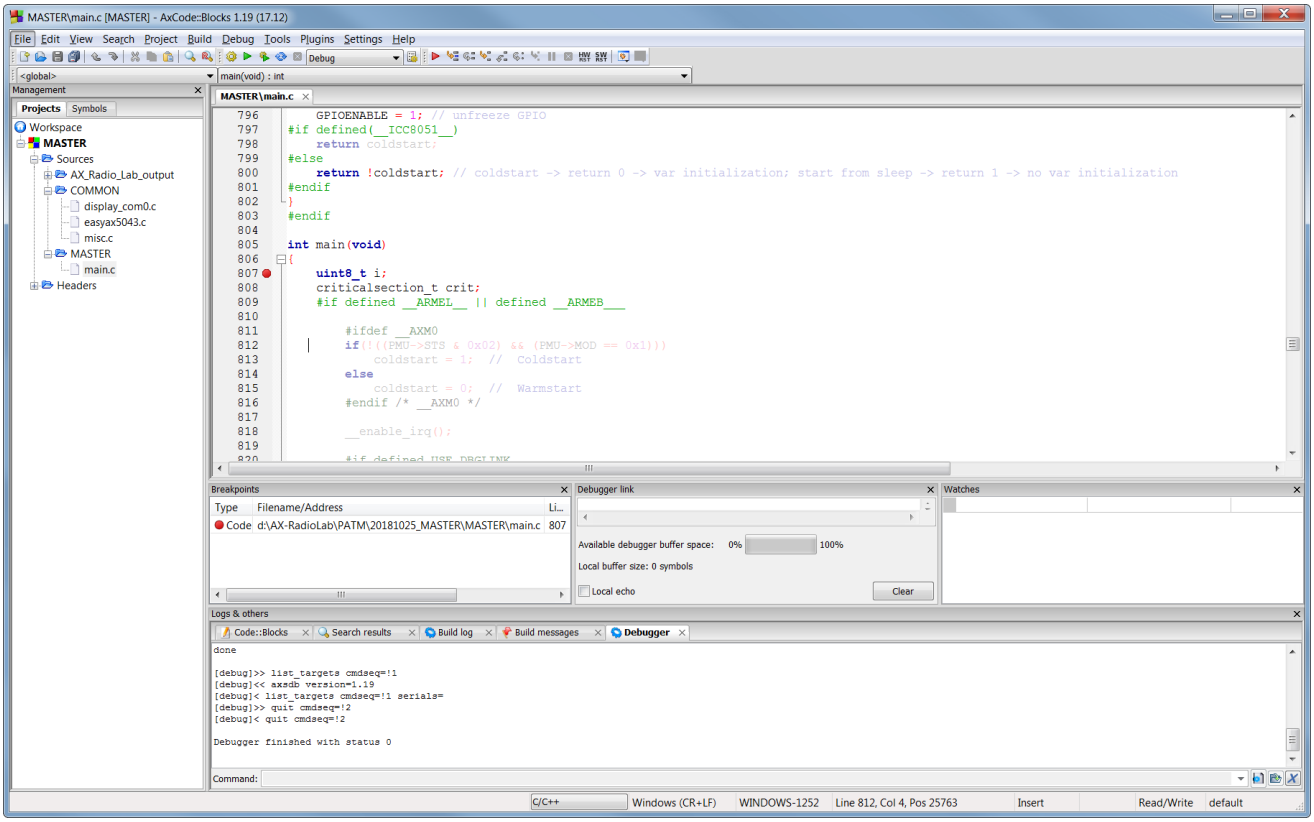


**Figure 16. AxCode::Blocks**

### UART Communication

Debug link data are transmitted and received on the PC via UART communication. Any serial terminal software is suitable utilizing the following settings:

- baud rate 9600 bit/s
- data bits 8
- stop bit 1
- parity none

The actual active COM port number is visible in the Control Panel –> Device Manager console under Ports (COM & LPT).

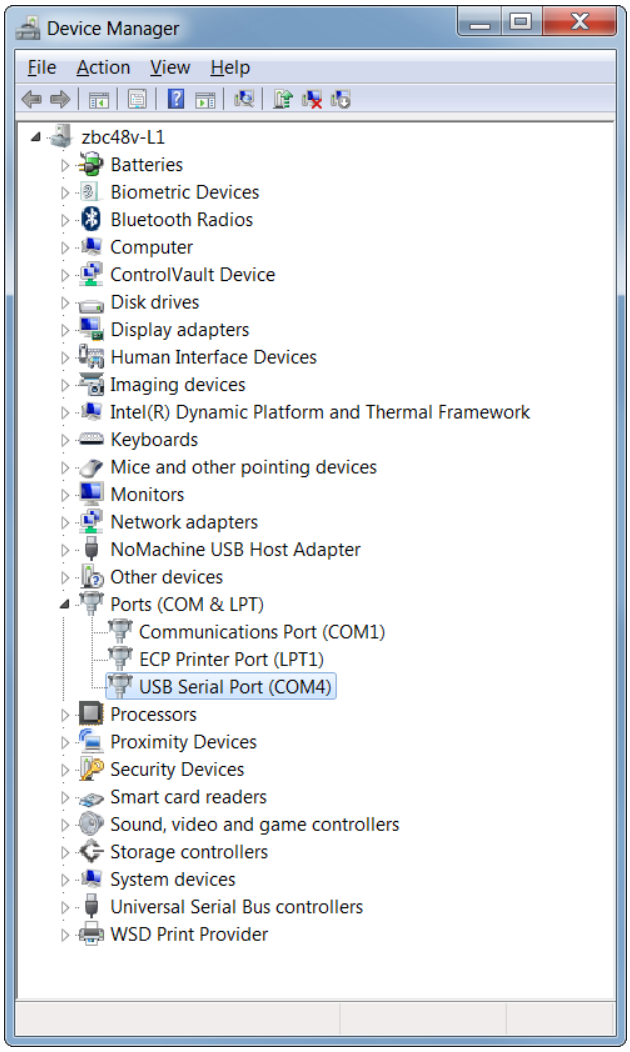


**Figure 17. Device Manager**

Typical received data are for example packages data, RSSI, frequency offset values

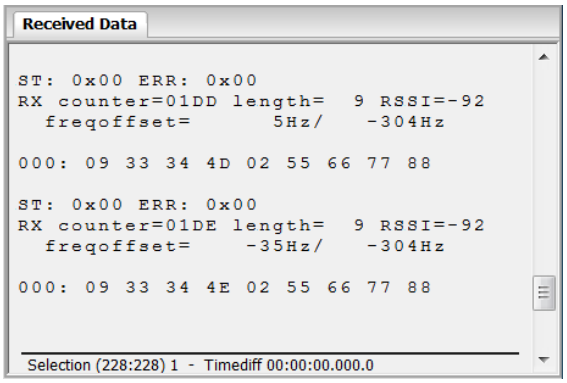


**Figure 18. Terminal Software Received Data**

### Glossary

**AxCode::Blocks**: an Integrated Development Environment (IDE) for AXM0F243 SoC.

**AX−RadioLab**: advanced development tool for Software Defined Radio (SDR) applications. Is a source code and settings generator.

**Debug link**: the interface between AXDBG debug adapter and AXM0F243 SoC microcontroller.

**AXSDB**: Symbolic command line Debugger.

ON Semiconductor and the ON Semiconductor logo are trademarks of Semiconductor Components Industries, LLC dba ON Semiconductor or its subsidiaries in the United States and/or other countries. ON Semiconductor owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of ON Semiconductor's product/patent coverage may be accessed at www.onsemi.com/site/pdf/Patent−Marking.pdf. ON Semiconductor is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

The evaluation board/kit (research and development board/kit) (hereinafter the "board") is not a finished product and is as such not available for sale to consumers. The board is only intended for research, development, demonstration and evaluation purposes and should as such only be used in laboratory/development areas by persons with an engineering/technical training and familiar with the risks associated with handling electrical/mechanical components, systems and subsystems. This person assumes full responsibility/liability for proper and safe handling. Any other use, resale or redistribution for any other purpose is strictly prohibited.

The board is delivered "AS IS" and without warranty of any kind including, but not limited to, that the board is production−worthy, that the functions contained in the board will meet your requirements, or that the operation of the board will be uninterrupted or error free. ON Semiconductor expressly disclaims all warranties, express, implied or otherwise, including without limitation, warranties of fitness for a particular purpose and non−infringement of intellectual property rights.

ON Semiconductor reserves the right to make changes without further notice to any board.

You are responsible for determining whether the board will be suitable for your intended use or application or will achieve your intended results. Prior to using or distributing any systems that have been evaluated, designed or tested using the board, you agree to test and validate your design to confirm the functionality for your application. Any technical, applications or design information or advice, quality characterization, reliability data or other services provided by ON Semiconductor shall not constitute any representation or warranty by ON Semiconductor, and no additional obligations or liabilities shall arise from ON Semiconductor having provided such information or services.

The boards are not designed, intended, or authorized for use in life support systems, or any FDA Class 3 medical devices or medical devices with a similar or equivalent classification in a foreign jurisdiction, or any devices intended for implantation in the human body. Should you purchase or use the board for any such unintended or unauthorized application, you shall indemnify and hold ON Semiconductor and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that ON Semiconductor was negligent regarding the design or manufacture of the board.

This evaluation board/kit does not fall within the scope of the European Union directives regarding electromagnetic compatibility, restricted substances (RoHS), recycling (WEEE), FCC, CE or UL, and may not meet the technical requirements of these or other related directives.

FCC WARNING − This evaluation board/kit is intended for use for engineering development, demonstration, or evaluation purposes only and is not considered by ON Semiconductor to be a finished end product fit for general consumer use. It may generate, use, or radiate radio frequency energy and has not been tested for compliance with the limits of computing devices pursuant to part 15 of FCC rules, which are designed to provide reasonable protection against radio frequency interference. Operation of this equipment may cause interference with radio communications, in which case the user shall be responsible, at its expense, to take whatever measures may be required to correct this interference.

ON Semiconductor does not convey any license under its patent rights nor the rights of others.

LIMITATIONS OF LIABILITY: ON Semiconductor shall not be liable for any special, consequential, incidental, indirect or punitive damages, including, but not limited to the costs of requalification, delay, loss of profits or goodwill, arising out of or in connection with the board, even if ON Semiconductor is advised of the possibility of such damages. In no event shall ON Semiconductor's aggregate liability from any obligation arising out of or in connection with the board, under any theory of liability, exceed the purchase price paid for the board, if any.

For more information and documentation, please visit www.onsemi.com.

## PUBLICATION ORDERING INFORMATION

**LITERATURE FULFILLMENT**:
**Email Requests to:** orderlit@onsemi.com

**ON Semiconductor Website:** www.onsemi.com

**TECHNICAL SUPPORT**
**North American Technical Support:**
Voice Mail: 1 800−282−9855 Toll Free USA/Canada
Phone: 011 421 33 790 2910

**Europe, Middle East and Africa Technical Support:**
Phone: 00421 33 790 2910
For additional information, please contact your local Sales Representative

◊