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## AVR 8-bit GNU Toolchain: Release 3.3.2.485

The AVR 8-bit GNU Toolchain supports all AVR 8-bit devices. The AVR 8-bit Toolchain is based on the free and open-source GCC compiler. The toolchain includes compiler, assembler, linker and binutils (GCC and Binutils), source code libraries (AVRLibC).



8/32-bit **AVR**<sup>®</sup>  
Microcontrollers

Release 3.3.2.485





## Installation Instructions

### System Requirements

AVR 8-bits GNU Toolchain is supported under the following configurations

#### Hardware requirements

- ? Minimum processor Pentium 4, 1GHz
- ? Minimum 512 MB RAM
- ? Minimum 500 MB free disk space

AVR 8-bits GNU Toolchain has not been tested on computers with less resources, but may run satisfactorily depending on the number and size of projects and the user's patience.

#### Software requirements

- ? Windows 2000, Windows XP, Windows Vista or Windows 7 (x86 or x86-64).
- ? Fedora 13 or 12 (x86 or x86-64), RedHat Enterprise Linux 4 or 5, Ubuntu Linux 10.04 or 8.04 (x86 or x86-64), or SUSE Linux 11.2 or 11.1 (x86 or x86-64). AVR 8-bits GNU Toolchain may very well work on other distributions. However those would be untested and unsupported.

AVR 8-bits GNU Toolchain is not supported on Windows 98, NT or ME.

### Downloading and Installing

The package comes in several forms.

- ? As part of a standalone installer (avr-toolchain-installer)
- ? As part of AVR Studio 5 Installer

It can be downloaded from Atmel's website at <http://www.atmel.com>

#### Installing on Windows

When installing as a part of AVR Studio 5 you do not have to do anything. See Release Notes for AVR Studio 5 for more details.

The AVR Toolchain Installer can be downloaded from the website as noted above. After downloading, double-click the installer executable file to install. If you wish to specify the location where the AVR Toolchain software is installed, choose "Custom Installation".

#### Installing on Linux

On Linux AVR 8-bits GNU Toolchain is available as a TAR.GZ archive which can be extracted using the 'tar' utility. Simply extract to the location where you want the application to run from.

### Upgrading from previous versions

If it is installed via AVR Studio 5 it will be upgrade trough the AVR Studio 5 upgrade. See AVR Studio 5 release notes for details.

If you used the standalone installer on MS-Windows, you might do a clean upgrade by first un-installing the old version or just upgrade using the latest installer.

On Linux, if you have it unpacked to a local folder, you just delete the old folder and unpack the latest version in a new folder.

### Manifest

1. AVR 8-bits GNU Binutils 2.20.1
  - ? Binary utilities for AVR 8-bits target (including assembler, linker, etc.).
2. AVR 8-bits GNU Compiler Collection (avr-gcc) 4.5.1
  - ? C language and C++ language compiler for AVR 8-bits target.
3. AVRLibC 1.7.1
  - ? C Standard Library for AVR 8-bits

### Layout

Listed below are some directories you might want to know about.

`<install\_dir>` = The directory where you installed AVR 8-bits GNU Toolchain.

- ? <install\_dir>\bin
  - ? The AVR software development programs. This directory should be in your `PATH` environment variable. This includes:
    - ? GNU Binutils
    - ? GCC
- ? <install\_dir>\avr\lib
  - ? avr-libc libraries, startup files, linker scripts, and stuff.
- ? <install\_dir>\avr\include
  - ? avr-libc header files for AVR 8-bits.
- ? <install\_dir>\avr\include\avr
  - ? header files specific to the AVR 8-bits MCU. This is where, for example, `#include <avr/io.h>` comes from.
- ? <install\_dir>\lib
  - ? GCC libraries, other libraries, headers and stuff.
- ? <install\_dir>\libexec
  - ? GCC program components
- ? <install\_dir>\doc
  - ? Various documentation.
- ? <install\_dir>\source
  - ? Documentation on where to find the source code for the various projects and source code patches that were used to build the tools.

### Toolset Background

AVR 8-bits GNU Toolchain is a collection of executable, open source software development tools for the Atmel AVR 8-bit series of Micro Controller Units (MCU). It includes the GNU GCC compiler for C and C++.

### Compiler

The compiler is the GNU Compiler Collection, or GCC. This compiler is incredibly flexible and can be hosted on many platforms, it can target many different processors/operating systems (back-ends), and can be configured for multiple different languages (front-ends).



The GCC included in AVR 8-bits GNU Toolchain is targeted for the AVR 8-bits MCU, and is configured to compile C, or C++.

CAUTION: There are caveats on using C++. See the avr-libc FAQ.

Because this GCC is targeted for the AVR 8-bits MCU, the main executable that is created is prefixed with the target name: ``avr-gcc`` (with `.exe` extension on MS Windows). It is also referred to as AVR GCC.

``avr-gcc`` is just a "driver" program only. The compiler itself is called ``cc1.exe`` for C, or ``cc1plus.exe`` for C++. Also, the preprocessor ``cpp.exe`` will usually automatically be prepended with the target name: ``avr-cpp``. The actual set of component programs called is usually derived from the suffix of each source code file being processed.

GCC compiles a high-level computer language into assembly, and that is all. It cannot work alone. GCC is coupled with another project, GNU Binutils, which provides the assembler, linker, librarian and more. Since GCC is just a "driver" program, it can automatically call the assembler and linker directly to build the final program.

### Assembler, Linker, Librarian and More

GNU Binutils is a collection of binary utilities. This also includes the assembler, `as`. Sometimes you will see it referenced as GNU `as` or `gas`. Binutils includes the linker, `ld`; the librarian or archiver, `ar`. There are many other programs included that provide various functionality.

Note that while the assembler uses the same mnemonics as proposed by Atmel, the "glue" (pseudo-ops, operators, expression syntax) is derived from the common assembler syntax used in Unix assemblers, so it is not directly compatible to Atmel assembler source files.

Binutils is configured for the AVR target and each of the programs is prefixed with the target name. So you have programs such as:

- ? **avr-as**: The Assembler.
- ? **avr-ld**: The Linker.
- ? **avr-ar**: Create, modify, and extract from archives (libraries).
- ? **avr-ranlib**: Generate index to archive (library) contents.
- ? **avr-objcopy**: Copy and translate object files.
- ? **avr-objdump**: Display information from object files including disassembly.
- ? **avr-size**: List section sizes and total size.
- ? **avr-nm**: List symbols from object files.
- ? **avr-strings**: List printable strings from files.
- ? **avr-strip**: Discard symbols.
- ? **avr-readelf**: Display the contents of ELF format files.
- ? **avr-addr2line**: Convert addresses to file and line.
- ? **avr-c++filt**: Filter to demangle encoded C++ symbols.

See the binutils user manual for more information on what each program can do.

### C Library

avr-libc is the Standard C Library for AVR 8-bits GCC. It contains many of the standard C routines, and many non-standard routines that are specific and useful for the AVR 8-bits MCU.

**NOTE:** The actual library is currently split into two main parts, `libc.a` and `libm.a`, where the latter contains mathematical functions (everything mentioned in `<math.h>`, and a bit more). Thus it is a good idea to always include the `-lm` linker option. Also, there are additional libraries which allow a customization of the `printf` and `scanf` function families.

avr-libc also contains the most documentation on how to use (and build) the entire toolset, including code examples. The avr-libc user manual also contains the FAQ on using the toolset.

### Debugging

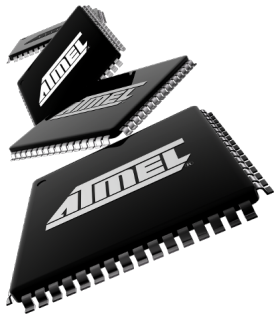
Atmel AVR Studio 5.x provides a debugger and also provides simulators for the parts that can be used for debugging as well. Note that `AVR Studio 5` is currently free to the public, but it is not Open Source.

## New and Noteworthy

This chapter lists new and noteworthy items for the AVR 8-bit GNU Toolchain release.

### AVR 8-bit GNU Toolchain

#### Supported Devices



AVR 8-bit GNU Toolchain supports the following devices:

Note:- Devices which are supported in this release are marked with \*

at90s2313	at90s2323	at90s2333	at90s2343	attiny22
at90s4414	at90s4433	at90s4434	at90s8515	at90c8534
ata6289	attiny13	attiny13a	attiny2313	attiny2313a
attiny24a	attiny4313	attiny44	attiny44a	attiny84
attiny25	attiny45	attiny85	attiny261	attiny261a
attiny461a	attiny861	attiny861a	attiny43u	attiny87
attiny88	at86rf401	at43usb355	at76c711	atmega103
at90usb82	at90usb162	atmega8u2	atmega16u2	atmega32u2
attiny1634	atmega8	atmega8a*	atmega48	atmega48a
atmega48pa	atmega88	atmega88a	atmega88p	atmega88pa
atmega8515	atmega8hva	at90pwm1	at90pwm2	at90pwm2b
at90pwm3	at90pwm81	at90pwm161	atmega16	atmega16a
atmega161	atmega163	atmega164a	atmega164p	atmega164pa*
atmega165	atmega165a	atmega165pa	atmega168	atmega168a
atmega168p	atmega168pa*	atmega169	atmega169a	atmega169pa
atmega16hva	atmega16hva2	atmega16hvb	atmega16hvbrevb	atmega16u4
atmega32	atmega32a*	atmega323	atmega324a	atmega324p
atmega325	atmega325a	atmega325p	atmega325pa	atmega3250
atmega3250p	atmega3250pa	atmega328	atmega328p	atmega329
atmega329p	atmega329pa	atmega3290	atmega3290a	atmega3290p
atmega32c1	atmega32m1	atmega32u4	atmega32u6	atmega406
atmega640	atmega644	atmega644a	atmega644p	atmega644pa
atmega645p	atmega645	atmega6450	atmega6450a	atmega6450p
atmega649a	atmega649p	atmega6490	atmega6490a	atmega6490a
atmega64a*	atmega64c1	atmega64m1	atmega64hve	atmega32hvb
atmega32hvbrevb	at90can64	at90pwm216	at90pwm316	atmega16c1
atmega32c1	atmega16m1	atmega32m1	atmega16u4	atmega32u4
at90scr100	at90usb646	at90usb647	at94k	m3000

atmega128a*	atmega1280	atmega1281	atmega1284*	atmega1284p
atmega128rfal	at90can128	at90usb1287	atmega2560	atmega2561
atxmega16a4	atxmega16a4u	atxmega16d4	atxmega32a4	atxmega32a4u
atxmega32d4	atxmega32x1	atxmega64a3	atxmega64a3u	atxmega64d3
atxmega64a1u	atxmega64a4u*	atxmega64b1*	atxmega64b3*	atxmega128a3
atxmega128a3u	atxmega128b1	atxmega128b3*	atxmega128d3	atxmega128d4*
atxmega192a3	atxmega192a3u	atxmega256a3	atxmega256a3b	atxmega256a3bu
atxmega256a3u	atxmega256d3	atxmega128a1	attiny4	attiny5
attiny9	attiny10	attiny20	at90s1200	attiny11
attiny12	attiny15			

### Component Upgrades

No components are upgraded in this release

### Known Issues

- ? Support for AVR Tiny 4/5/9/10/20/40 devices are in beta stage
- ? Support for ATtiny1634 does not include `clock_prescaler_set()` and `wdt_enable()` macros



## Contact Information

For support on AVR 8-bit GNU Toolchain please contact [avr@atmel.com](mailto:avr@atmel.com).

Users of AVR 8-bit GNU Toolchain are also welcome to discuss on the AVRfreaks website forum for AVR Software Tools.

## Disclaimer and Credits

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