



## RELEASE NOTES

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### AVR8 GNU Toolchain 3.4.5.1522

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#### AVR8 GNU Toolchain

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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), Standard C library (AVR-libc) and GNU Debugger (GDB).

## Table of Contents

AVR8 GNU Toolchain .....	1
1. Installation Instructions .....	3
1.1. System requirements .....	3
1.1.1. Hardware requirements .....	3
1.1.2. Software Requirements .....	3
1.2. Downloading, Installing and Upgrading .....	3
1.2.1. Downloading/Installing on Windows .....	3
1.2.2. Downloading/Installing on Linux .....	3
1.2.3. Upgrading from previous versions .....	3
1.3. Layout .....	3
2. Toolset Background .....	5
2.1. Component Versions .....	5
2.2. Compiler .....	5
2.3. Assembler, Linker, Librarian and More .....	5
2.4. C Library .....	6
2.5. Debugging .....	6
2.6. Source Code .....	6
3. Bugs and New Features .....	7
3.1. New features .....	7
3.2. Notable bugs fixed .....	7
3.3. Known issues .....	8
4. Supported Devices .....	9
5. Contact Information and Disclaimer .....	11
5.1. Disclaimer .....	11

# 1. Installation Instructions

## 1.1 System requirements

### 1.1.1 Hardware requirements

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

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

### 1.1.2 Software Requirements

- Windows 2000, Windows XP, Windows Vista, Windows 7 (x86 or x86-64) or Windows 8 (x86 or x86-64)
- AVR 8-bit GNU Toolchain is not supported on Windows 98, NT or ME.
- The toolchain should work on the Linux distributions Fedora, RedHat Enterprise, Arch Linux and Ubuntu for both 32-bits and 64-bits architecture. AVR 8-bit GNU Toolchain may very well work on other distributions. However those are untested and unsupported.

## 1.2 Downloading, Installing and Upgrading

The AVR8 GNU toolchain provided by Atmel<sup>®</sup> is available for download and install in one of the following ways.

### 1.2.1 Downloading/Installing on Windows

- If you want to try the Atmel AVR8 GNU toolchain alone, you can download it from [here](#)<sup>1</sup>
- If you want to try the Atmel AVR8 GNU Toolchain along with Atmel studio, you can download and install Atmel studio 6.0 or (newer) which will also install the Atmel<sup>®</sup> AVR8 GNU toolchain. See Atmel studio release notes for more details.

### 1.2.2 Downloading/Installing on Linux

For Linux, the Atmel<sup>®</sup> AVR8 GNU Toolchain is available as a tar.gz archive which can be extracted using the tar utility. In order to install, simply extract to the location from where you want to run it from. Linux builds are available from [here](#)<sup>2</sup>.

### 1.2.3 Upgrading from previous versions

If the Atmel<sup>®</sup> AVR8 GNU Toolchain is installed by Atmel studio installation, it can be upgraded from [Atmel Gallery](#)<sup>3</sup>

If the toolchain is installed separately, upgrading is not supported. You can install the new package side-by-side to the old package and use it.

## 1.3 Layout

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

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

- `<install_dir>\bin`  
The AVR software development programs. This directory should be in your `PATH` environment variable. This includes:
  - GNU Binutils

<sup>1</sup> <http://www.atmel.com/tools/atmelavrtoolchainforwindows.aspx>

<sup>2</sup> <http://www.atmel.com/tools/ATMELAVRTOOLCHAINFORLINUX.aspx>

<sup>3</sup> <http://gallery.atmel.com>

- GCC
- GDB
- <install\_dir>\avr\lib  
avr-libc libraries, startup files, linker scripts, and stuff.
- <install\_dir>\avr\include  
avr-libc header files for AVR 8-bit.
- <install\_dir>\avr\include\avr  
header files specific to the AVR 8-bit 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.

## 2. Toolset Background

AVR 8-bit GNU Toolchain is a collection of executable, open source software development tools for the Atmel AVR 8-bit series of microcontrollers. It includes the GNU GCC compiler for C and C++.

### 2.1 Component Versions

GCC: 4.8.1

binutils: 2.24

avr-libc: "1.8.0svn"

gdb: 7.8

### 2.2 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-bit GNU Toolchain is targeted for the AVR 8-bit microcontroller and is configured to compile C or C++.

**CAUTION:** There are caveats on using C++. See the avr-libc FAQ. C++ language is not fully supported and has some limitations. libstdc++ is unsupported.

Because this GCC is targeted for the AVR 8-bit MCUs, 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.

### 2.3 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.
- *avr-gdb*: GDB, the GNU debugger, allows you to see what is going on 'inside' another program targeted to AVR, while it executes.

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

## 2.4 C Library

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

*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). Also, there are additional libraries which allow a customization of the printf and scanf function families. avr-libc contains 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.

## 2.5 Debugging

Atmel Studio provides a debugger and also provides simulators for the parts that can be used for debugging as well. Note that 'Atmel Studio' is currently free to the public, but it is not Open Source. The GNU debugger is now shipped along with the toolchain.

## 2.6 Source Code

Atmel AVR 8-bit GNU Toolchain uses modified source code from GCC, Binutils and AVR-LibC. The source code and the build scripts used for building the packaged binaries are available at:

<http://distribute.atmel.no/tools/opensource/Atmel-AVR-GNU-Toolchain/3.4.5/>

Please refer to the README for the instructions on how to use the supplied script to build the toolchain.

## 3. Bugs and New Features

### 3.1 New features

#### Issue #AVRTC-725:

Add ATA5831 and ATA5782 devices under avr5 architecture. Pass the text section start as linker flag as it is not default value (zero).

#### Issue #AVRTC-727:

Device macros `__AVR_ATmega16HVBrevB__` and `__AVR_ATmega32HVBrevB__` are renamed to `__AVR_ATmega16HVBREVB__` and `__AVR_ATmega32HVBREVB__` respectively.

#### Issue #AVRTC-728:

Update avrtiny arch id to 100. Relocation orders are updated. Relocation `BFD_RELOC_AVR_7_LDS16` is changed to `BFD_RELOC_AVR_LDS_STS_16`.

#### Issue #AVRTC-729:

`__AVR_DEVICE_NAME__` macro is predefined to have device name.

#### Issue #AVRTC-730:

Added missing RAM size information such as `RAMSIZE`, `RAMSTART` in device header files.

### 3.2 Notable bugs fixed

#### Issue #AVRTC-692:

`sleep_bod_disable` does not work in attiny13a. define `BOD_CONTROL_REG` based on `BODCR` or `MCUCR` so that `sleep_bod_disable` macro can use that instead of `MCUCR` always.

#### Issue #AVRTC-700:

`SPM_PAGESIZE` value is updated as 64 for `iotn48.h` and `iotn88.h`

#### Issue #AVRTC-716:

The assembler template for indirect stores of 24 bit types had an off-by-one bug that left the frame pointer pointing at an address one byte higher than intended.

See GCC bugzilla PR 60991 for more details.

#### Issue #AVRTC-717:

The ICE occurs when var tracking gets turned on (either explicitly or through a debug flag), and gcc picks the address mode of the outer pointer type, rather than the pointed to expression.

See GCC bugzilla PR 52472 for more details.

#### Issue #AVRTC-734:

Add `RAMSTART` for device `IO86RF401`.

For `AT90PWMX` device, Define `TIMER1_COMPA_vect_num` as a number instead of vector. To access the vector use `TIMER1_COMPA_vect` macro.

Correct the `signature2` value for `mega164`. It should be `0x0A` instead of `0x0F`.

Correct the `signature2` value for `mega165`, `mega165A`.

Add missing defines `SPMEN`, `SIGRD` for `mega168p`, `mega48p`, `mega88p`, `mega88pa`.

Add missing defines `SPMEN`. Conditionally define `SIGNATURE_2` based on whether the device is `mega328` or `mega328P`.

`Tiny43U`, `Tiny 43U`, `mega32U4` : Change the macro `ASSEMBLER` to `_ASSEMBLER_` which is correct.

`Tiny2313A`, `Tiny4313A` : Add missing `USI` module. Add missing defines. Define `USART,PCINT` vector's.

`Tiny24A` : Add missing `WATCHDOG` interrupt vector definition.

`Tiny40` : Add missing `ADC` interrupt vector definition. Modify the `_VECTORS_SIZE` definition accordingly.

USBxx6\_7 : Define TWI\_vect\_num as a number instead of vector.

### 3.3 Known issues

**Issue #AVRTC-731:**

libgcc implementation has some known limitations.

Standard C / Math library implementation is very limited or not present.

**Issue #AVRTC-732:**

Program memory images beyond 128KBytes are supported by the toolchain, subject to the limitations mentioned in "3.17.4.1 EIND and Devices with more than 128 Ki Bytes of Flash" at <http://gcc.gnu.org/onlinedocs/gcc/AVR-Options.html>

**Issue #AVRTC-733:**

Named address spaces are supported by the toolchain, subject to the limitations mentioned in "6.16.1 AVR Named Address Spaces" at

<http://gcc.gnu.org/onlinedocs/gcc/Named-Address-Spaces.html#AVR%20Named%20Address%20Spaces>



## 4. Supported Devices

### avr2

at90s2313	at90s2343	at90s4414	at90s8515
at90s2323	attiny22	at90s4433	at90c8534
at90s2333	attiny26	at90s4434	at90s8535

### avr25

ata5272	attiny4313	attiny85	attiny87
ata6616c	attiny44	attiny261	attiny48
attiny13	attiny44a	attiny261a	attiny88
attiny13a	attiny441	attiny461	attiny828
attiny2313	attiny84	attiny461a	attiny841
attiny2313a	attiny84a	attiny861	at86rf401
attiny24	attiny25	attiny861a	
attiny24a	attiny45	attiny43u	

### avr3

at43usb355	at76c711
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### avr31

atmega103	at43usb320
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### avr35

ata5505	at90usb82	atmega16u2	attiny1634
ata6617c	at90usb162	atmega32u2	
ata664251	atmega8u2	attiny167	

### avr4

ata6285	atmega48a	atmega88pa	at90pwm2b
ata6286	atmega48p	atmega88pb	at90pwm3
ata6289	atmega48pa	atmega8515	at90pwm3b
ata6612c	atmega48pb	atmega8535	at90pwm81
atmega8	atmega88	atmega8hva	
atmega8a	atmega88a	at90pwm1	
atmega48	atmega88p	at90pwm2	

### avr5

ata5702m322	atmega169a	atmega329pa	atmega6490
ata5782	atmega169p	atmega3290	atmega16hva
ata5790	atmega169pa	atmega3290a	atmega16hva2
ata5790n	atmega16hvb	atmega3290p	atmega32hvb
ata5795	atmega16hvbrevb	atmega3290pa	atmega6490a
ata5831	atmega16m1	atmega32c1	atmega6490p
ata6613c	atmega16u4	atmega32m1	atmega64c1
ata6614q	atmega32a	atmega32u4	atmega64m1
atmega16	atmega32	atmega32u6	atmega64hve
atmega16a	atmega323	atmega406	atmega64hve2
atmega161	atmega324a	atmega64	atmega64rfr2
atmega162	atmega324p	atmega64a	atmega644rfr2
atmega163	atmega324pa	atmega640	atmega32hvbrevb
atmega164a	atmega325	atmega644	at90can32
atmega164p	atmega325a	atmega644a	at90can64
atmega164pa	atmega325p	atmega644p	at90pwm161
atmega165	atmega325pa	atmega644pa	at90pwm216
atmega165a	atmega3250	atmega645	at90pwm316
atmega165p	atmega3250a	atmega645a	at90scr100
atmega165pa	atmega3250p	atmega645p	at90usb646
atmega168	atmega3250pa	atmega6450	at90usb647
atmega168a	atmega328	atmega6450a	at94k
atmega168p	atmega328p	atmega6450p	m3000
atmega168pa	atmega329	atmega649	
atmega168pb	atmega329a	atmega649a	
atmega169	atmega329p	atmega649p	

**avr51**

atmega128  
atmega128a  
atmega1280

atmega1281  
atmega1284  
atmega1284p

atmega128rfa1  
atmega128rfr2  
atmega1284rfr2

at90can128  
at90usb1286  
at90usb1287

**avr6**

atmega2560

atmega2561

atmega256rfr2

atmega2564rfr2

**avrxmega2**

atxmega8e5  
atxmega16a4  
atxmega16a4u  
atxmega16c4

atxmega16d4  
atxmega16e5  
atxmega32a4  
atxmega32a4u

atxmega32c3  
atxmega32c4  
atxmega32d3  
atxmega32d4

atxmega32e5

**avrxmega4**

atxmega64a3  
atxmega64a3u

atxmega64a4u  
atxmega64b1

atxmega64b3  
atxmega64c3

atxmega64d3  
atxmega64d4

**avrxmega5**

atxmega64a1

atxmega64a1u

**avrxmega6**

atxmega128a3  
atxmega128a3u  
atxmega128b1  
atxmega128b3  
atxmega128c3

atxmega128d3  
atxmega128d4  
atxmega192a3  
atxmega192a3u  
atxmega192c3

atxmega192d3  
atxmega256a3  
atxmega256a3b  
atxmega256a3bu  
atxmega256a3u

atxmega256c3  
atxmega256d3  
atxmega384c3  
atxmega384d3

**avrxmega7**

atxmega128a1

atxmega128a1u

atxmega128a4u

**avrtiny**

attiny4  
attiny5

attiny9  
attiny10

attiny20  
attiny40

**avr1**

at90s1200  
attiny11

attiny12  
attiny15

attiny28

## 5. Contact Information and Disclaimer

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.

### 5.1 Disclaimer

AVR 8-bit GNU Toolchain is distributed free of charge for the purpose of developing applications for Atmel AVR processors. AVR 8-bit GNU Toolchain comes without any warranty.



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