

Bootloaders

Many embedded processors have flash memory. This allows us to alter a product even though it is in the users hands:

- fix bugs
- upgrade or enhance the product

The flash memory in many AVR microcontrollers is configured so that a *bootloader* can be created to reprogram the flash memory.

A bootloader is a small program which runs at startup time that can load a complete application program into a processor's memory.

With such a feature, a uC is able to receive firmware updates from outside sources and reprogram itself.

The flash object code can arrive via any available data interface.

Bootloaders

A bootloader has the capability to write into the entire flash space including its own bootloader space.

Thus the bootloader can modify itself or even erase itself from memory if its no longer needed.

The size of the bootloader memory is configurable via fuses. (0.5-4K bytes)

The bootloader has various levels of protection that can protect itself and the application code.

Some bootloader routines have built in decryption code so that downloaded code may be sent in a secure fashion.

Bootloaders

AVR program memory is divided into two sections:

- the Bootloader section (BLS) and
- the Application Section.

Both sections have dedicated lock bits for read and write protection.

Thus bootloaded code may be secured in the BLS while still being able to update the code in the application area.

The application code area can never hold bootloader code since the load program memory instruction (SPM) will not execute there.

SPM can access all of program memory, but it only works in BLS space.

Bootloaders

Entering the bootloader:

- by jump or call from application program
- a trigger from USART, SPI, USB, etc.
- Boot Reset Fuse points to start of bootloader

Once the bootloader is done:

- jump to application code and begin executing

The fuses cannot be changed by the CPU itself. Thus, if the boot reset fuse is set it may not be changed except by SPI, JTAG or parallel programming methods.