Understanding In-System Programming

In-System Programming (ISP) is a technique where a programmable device is programmed after the device is placed in a circuit board. While in earlier days a chip had been removed from the target board and placed in a programming device, today's microcontrollers and external memory chips can be re-programmed without being removed from the circuit. This is called in-circuit or in-system programming.

 ISP eliminates the extra handling step required in the manufacturing process to program the devices on an external programmer before placing them on your circuit board. Eliminating this step reduces the possibility of damaging the delicate leads of high pin count surface mount devices or damaging the device through electrostatic discharge (ESD). ISP also allows you to make design changes and field upgrades without removing the Atmel ISP devices from the circuit board. In addition, ISP allows you to use your Automatic Test Equipment (ATE) to perform ISP operations on your ISP devices and integrate these ISP operations with the normal production test flow.

 In-System Programming (ISP) is the ability of some programmable logic devices (PLD), microcontrollers (MCU), and other programmable electronic chips to be programmed while installed in a complete system, rather than requiring the chip to be programmed prior to installing it into the system.   Traditionally, programmable logic devices have been programmed on external device programmers that provide the necessary programming signals and algorithms to program the devices. With the advent of In-System Programming (ISP), ISP devices can now be programmed on your own circuit board. The primary advantage of this feature is that it allows manufacturers of electronic devices to integrate programming and testing into a single production phase, rather than requiring a separate programming stage prior to assembling the system. This may allow manufacturers to program the chips in their own system's production line instead of buying preprogrammed chips from a manufacturer or distributor, making it feasible to apply code or design changes in the middle of a production run. Typically, chips supporting ISP have internal circuitry to generate any necessary programming voltage from the system's normal supply voltage, and communicate with the programmer via a serial protocol. Most programmable logic devices use a variant of the Joint Test Action Group (JTAG) IEEE 1149.1a-1993 Standard protocol for ISP, in order to facilitate easier integration with automated testing procedures. Other devices usually use proprietary protocols or protocols defined by older standards. In systems complex enough to require moderately large glue logic, designers may implement a JTAG-controlled programming subsystem for non-JTAG devices such as flash memory and microcontrollers, allowing the entire programming and test procedure to be accomplished under the control of a single protocol. An example of devices using ISP is the AVR line of micro-controllers by Atmel such as the ATmega series.

In-circuit programming is more complicated than in-socket programming. It is possible to use a programmer that was not designed for in-circuit programming if the hardware designer takes extreme measures to make the device appear to be in-socket. In other words, completely isolate the device from the target during programming.

The programming of devices In-Circuit or In-System (ISP) eliminates limitations associated with traditional programmable devices (On-Socket or Pre-Programmed). ISP delivers benefits to In-Board and System Level design, manufacturing and programming processes. In-System Programming is a technique where a device can be program while it's still in the circuit board. It's quite different from traditional programming where the devices have to be removed from the board and place into a programmer. This is important since it makes manufacturing a lot easier and much cheaper than the traditional method. For instance, ISP eliminates the need of an external programmer which saves costs greatly. Furthermore, by eliminating the step of removing the devices from the PCB into the external programmer reduce the possibility of damage the device. That is a major advantage because it speed up the manufacturing process and integrates both programming and testing into one production phase rather than having to separate the programming stage before the assembling stage. Another advantage that ISP can offers is that it makes the cost of programming much cheaper in which they no longer depend on external

programmers manufacture to upgrade the system firmware; which means that it will reduce manufacturing delay.

The decreasing cost of programmable devices has caused their popularity to explode during recent years. However, the wide variety of available devices and programming methods requires users to acquire and maintain different types of in-system programmers specific to each device manufacturer. As a result, engineers must learn new tools and programming algorithms to program each device causing an inefficient use of engineering resources. In order to save development time and cost of in-circuit programming system, engineers may purchase cost effective development tools from device manufacturers which generally including both software and hardware tools. It will speed up the manufacturing process and integrate both programming and testing into one production phase rather than having to separate the programming stage before the assembling stage. Recently, many of device manufacturers such as Atmel, Microchip, and Xilinx provide low-cost ISP solutions including development tools (debuggers). This is one advantage that development engineers should take advantage of by using these low cost IPS development tools that the device manufactures have to offer. Whereas EE Tools programmers have advantage that allows the more recent introduced high density(large scaled) flash memories in single socket programmers and focus more on fast programming speed in multiple socket programmers. We will like to suggest to the customers who is looking for ISP to review the once that are introduced by other device manufacturers such as Microchip, Atmel, Xilinx because they would catering to your specific needs and as well as providing a better performance to price ratio.