

Introduction to Flash Memory

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Information is one of the most important forms of knowledge, gathering data and vital in communication. With new technology, information can be stored in numerous devices such as computers, CDs and even TVs. One of the main components that enable this information to be stored and accessed is flash memory. The main focus of this paper is to explain what flash memory is and how it is used in correspondence with a microprocessor.

Keywords:

CMOS: complementary metal–oxide–semiconductor

WE: write-enable

CE: chip-enable

OE: output-enable

I/O: input/output

Introduction.

Compared to old days, techniques in retrieving and gathering data have changed drastically. From the old ways such as, call numbers in libraries, to data look up tables, technology has drastically change search criteria's within seconds. The fastest and most efficient way to collect and distribute this data is through flash memory. Flash memory is a convenient way to store and access data within milliseconds. The objective of this report is to explain how the memory communicates with the microprocessor in both storing and receiving data when specified by the user.

Before going into detail, we first must understand what flash memory is. Flash memory is computer memory that can be electrically erased and reprogrammed being non-volatile. This means that the chip does not need power to maintain data that is stored on it. Even though flash memory can be erased and reprogrammed, limitation on these operations is around ten thousand cycles or more. For the purpose of the project and this report, the standard AT49F040A flash memory from Atmel along with microprocessor, PIC18F4520, designed by Microchip, will be used.

Description.

The AT49FO40A is a reprogrammable flash memory chip that will only operate on 5-volts. These 4 megabits of memory are manufactured by Atmel's nonvolatile CMOS technology. Consuming just 165mW of power, this devise has an access time of 55ns. For programming purposes, the AT49FO40A does not required a high input voltage and once in standby mode, draws a current less the 70uA. Programming each byte roughly takes 20us. This device is organized as 524,288 words by 8 bits. There are two 8K byte block sections along with one boot block and eight main memory blocks. As for the pin configuration, nineteen of the pins for address lines, eight input/output lines and one pin each for the ground, power, WE, CE and OE (figure 1).

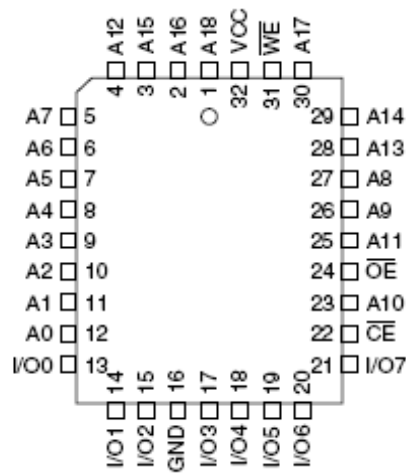


Figure 1

PIC18F4520 is an enhanced flash microprocessor with 10-bit A/D and nano-Watt technology. This microprocessor operates at a high current of 25mA and has three programmable external interrupts. With two external clock modes that operate up to 40 MHz makes the timing very accurate. This device also includes C compiler architecture, 100,000 erase/write cycles enhanced flash memory and an in-circuit debug. The physical feature contains 44-pins. For this experiment, we will be using four ports on the microprocessor. RA, RB, RC and RD are the names of these ports and all ports vary with the amount of pins (figure 2).

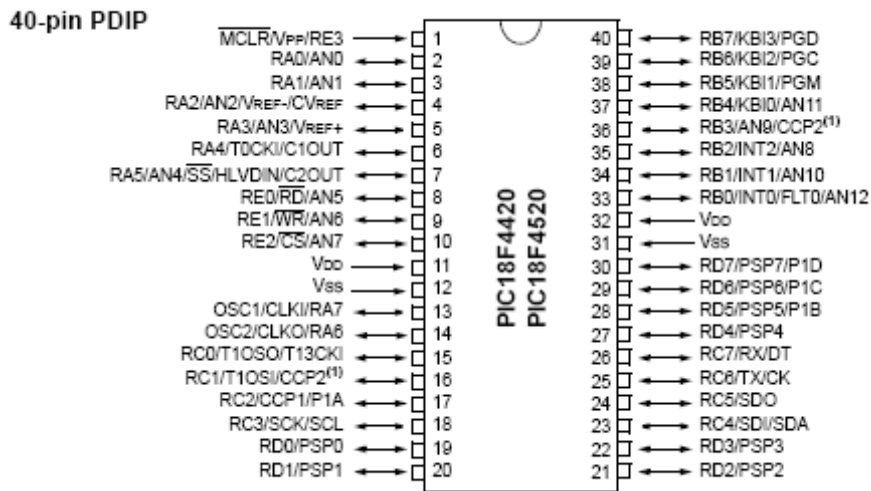


Figure 2

Procedure.

In order to read and write data from the microprocessor, we first have to wire the two chips together. This is a very simple process but is quite tedious. When wiring these chips, there is no order that is set in stone so you must keep track of which wire goes where. The ports on the memory can match up to any port on the microprocessor. The easiest way to know which wire goes where is to draw each chip out on paper and label the ports. This is also known as drawing a schematic. Once this portion is complete we then have to understand how the memory functions.

When looking at the AT49FO40A we have to understand the function the I/O ports, address ports, CE, OE and WE ports. The I/O ports carry the data from the microprocessor to the memory and back. Once this data reaches the memory, it is then stored in one of the address ports. These operations are controlled through the CE, OE and WE ports. The way in which the data is being transferred to and from the microprocessor is shown below. In figure 3, shown below, CE controls data transfer into the memory. As for figure 4, data is being polled off the memory. These operations are among many other that the memory can do.

\overline{CE} Controlled

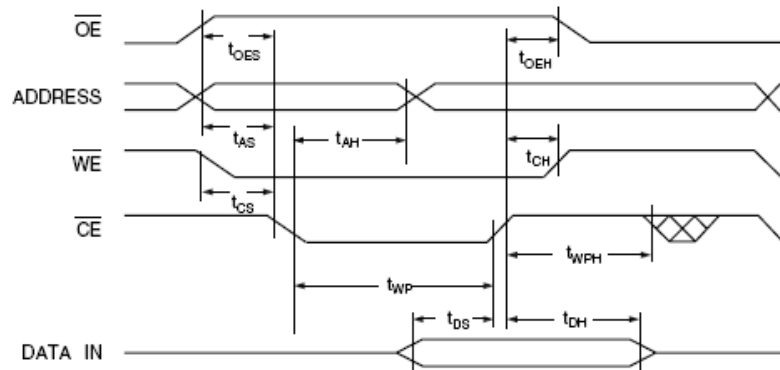


Figure 3

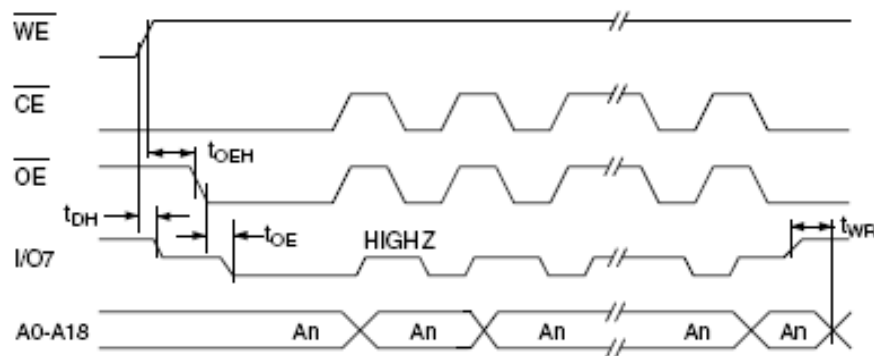


Figure 4

Once the memory operations are clear and understood, the next step requires communication between the memory and the microprocessor. Communication is done with C programming. Depending on the order of operations, whether you want to store data and retrieve it or just store data for a long period is specified in the C code. The user specifies the C code. Below is an example of C code. This code is a basic loop that specifies if eight data lines are high or low:

```
void main()
{
    long int count;
    while(1)
    {
        PRT1DR &= ~0xFF;
        for (count = 1; count < 20000; count++);
        PRT1DR |= 0xFF;
        for (count = 1; count < 20000; count++);
    }
}
```

Conclusion.

For conclusion of this paper, interfacing between the memory and the microprocessor take numerous hours of programming and patience. Once communication is established and it feels like progress is being made relieves stress and tension. In all, flash memory is a very useful device. It is vital to the completion of this project and to numerous applications in today's world.

Reference.

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