Chapter 10
How to Read a Datasheet

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10.1 Introduction

The following chapter will try to give a methodology and a guideline to read a datasheet of Multi-Chip. It contains so much information that sometimes it will not be immediately understandable. But once the main points of the datasheet have been explained, it will be easier to understand it. At the end of this chapter you will find an example of a datasheet, not for an existing product, but created on purpose to explain the different parts.

10.2 Contents of the First Page

The first page of the datasheet can be compared with the identity card of the device. At the top is placed the **commercial product** which is the name (normally it’s placed on the top of the package). On the last page of the datasheet there is the **part numbering** scheme which explains the meaning of all the digits, in order to give the customer an accurate explanation of them. On the first page, below the product name, are shown the different types of memory that make up the Multi-Chip. The

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1 Datasheet is the word used to explain the set of specifications that fully describe the device. The datasheet is similar to a contract between supplier and customer. The DS of the memories to which we shall refer can be found at: www.st.com in Products/Technical Literature/Datasheets. The part numbers of each component are: Flash NOR M29WR128F, Flash NAND NAND128W4A, PSRAM M69AB128BB, and SRAM M68AR512D.
memories which are included inside the Multi-Chip are: NOR Flash, NAND Flash, PseudoRAM (PSRAM), and Static RAM (SRAM). Of each single memory follows a brief description of main features and, moreover, there is a common part for all memories. Before describing in detail each single memory, it is important to understand the architectural differences on which depend the different characteristics of memory size, timing, access time, and data storage. The memories are divided into volatile and nonvolatile. The memories SRAM and PSRAM belong to the category of volatile memories, in the sense that all information stored is lost if the memory supply voltage is removed. On the other hand, the nonvolatile Flash memories with architecture NOR or NAND don’t lose the information. With NOR architecture all cells are arranged in rows (wordline) and columns (bitline). The wordline is represented by all the control gates of the cells that belong to the same line. The bitline is represented by all drains that belong to the same column. The source line is the line where the sources of all cells belonging to the same sector are connected. This structure is typically made to 8, 16, or 32 bits, to agree with the number of input/outputs available from the memory on the data bus, organized, respectively, as byte, word, or double word. The NAND architecture is obtained by connecting 16 cells in series between a bitline and a source line. The most important advantages of this solution are the reduction of the array due to a lower number of contacts (each 16 cells) and the scaling of the junctions of source and drain. There is a different structure for the SRAM memory, whose cell is nothing more than a FlipFlop set-reset type, so a single bit is composed of 6 transistors; this structure allows for fast memory access, but requires a greater area of the silicon. PSRAM is used for a large memory capacity because, having a memory cell consisting of a pass transistor and a capacitor, it requires an area of silicon much smaller than in the case of SRAM [1,2]. So we note that:

- The NOR Flash has fast access time (90 ns) compared to NAND Flash (12 μs), but once all the contents of the page have been transferred into its internal buffer, it can read data sequentially with access times (for a page) of 50 ns.
- The NAND Flash has an address/data bus multiplexed (so a lower pin numbers to bring out), unlike NOR Flash.
- The two Flash memory types have different organization arrays: the NOR is organized into four banks (16Mb + 48Mb + 48Mb + 16Mb) with the parameters block placed both at the top and at the bottom of the array, while the NAND is organized in blocks, each block containing 32 pages and each page made up of 264 words.
- The two Flashes moreover have a number of different characteristics depending on the applications that will be used.

The differences between PSRAM and SRAM, at the datasheet level, are not as evident as in the case shown above, but we can observe that: