How to Make
An Application Specific Memory

This document describes ST's "Puzzle Model", a powerful facility for streamlining the process by which the customer can specify a new product for STMicroelectronics to fabricate.

STMicroelectronics has always prided itself with its track record in "differentiated products": that is, products that are tailored to individual customer's needs.

At its simplest, this might take the form of an "Application Specific Standard Product". This is a standard device with a small variation: two leads swapped over, or a different package to those offered in the catalogue, or different material used in the assembly stage.

At the next level, it might take the form of an "Added Value Product". The customer might specify a particular interface to a standard memory core: perhaps an unusual protocol on a serial bus, or a non-standard synchronizing signal from the customer's application, or an application-specific write-protect signal for a specified area of the memory array.

At the final level, ST undertakes the design or implementation of a "Full Custom Product" to the customer's specification.

Application Specific Standard Product. The customer identifies the ST memory product that comes closest to the desired specification, and notes what changes are necessary for it to meet the specification more precisely. ST's engineers liaise with those of the customer, until the final specification is agreed. Normally, we would take it in to full production within 6 months.

Added Value Product. As with ASSP, ST's engineers liaise with those of the customer – exchanging ideas face-to-face, or on paper, or via computer documents, until the final specification is agreed. ST then designs the integrated circuit to meet the specification, manufactures it, and ships it to the customer. Normally, we would take it in to full production within 12 months.

Full Custom Product. The customer might prefer to undertake a large part of the design and simulation, and to pass VHDL files to ST. Liaison is still required with ST engineers, but greatly streamlined. The new device is quickly brought to manufacture, and shipped to the customer. The time to production, in this case, depends entirely on the customer.

In the majority of cases, ST signs a development contract with the customer. In most cases, the customer pays NRE for the design.

PUZZLE MODEL

As stated before, ST's "Puzzle Model" enormously streamlines the design processes in the huge majority of case, allowing the customer to "mix and match" various options within a standard design. Figure 1 illustrates the concept.

Figure 1. Puzzle Model
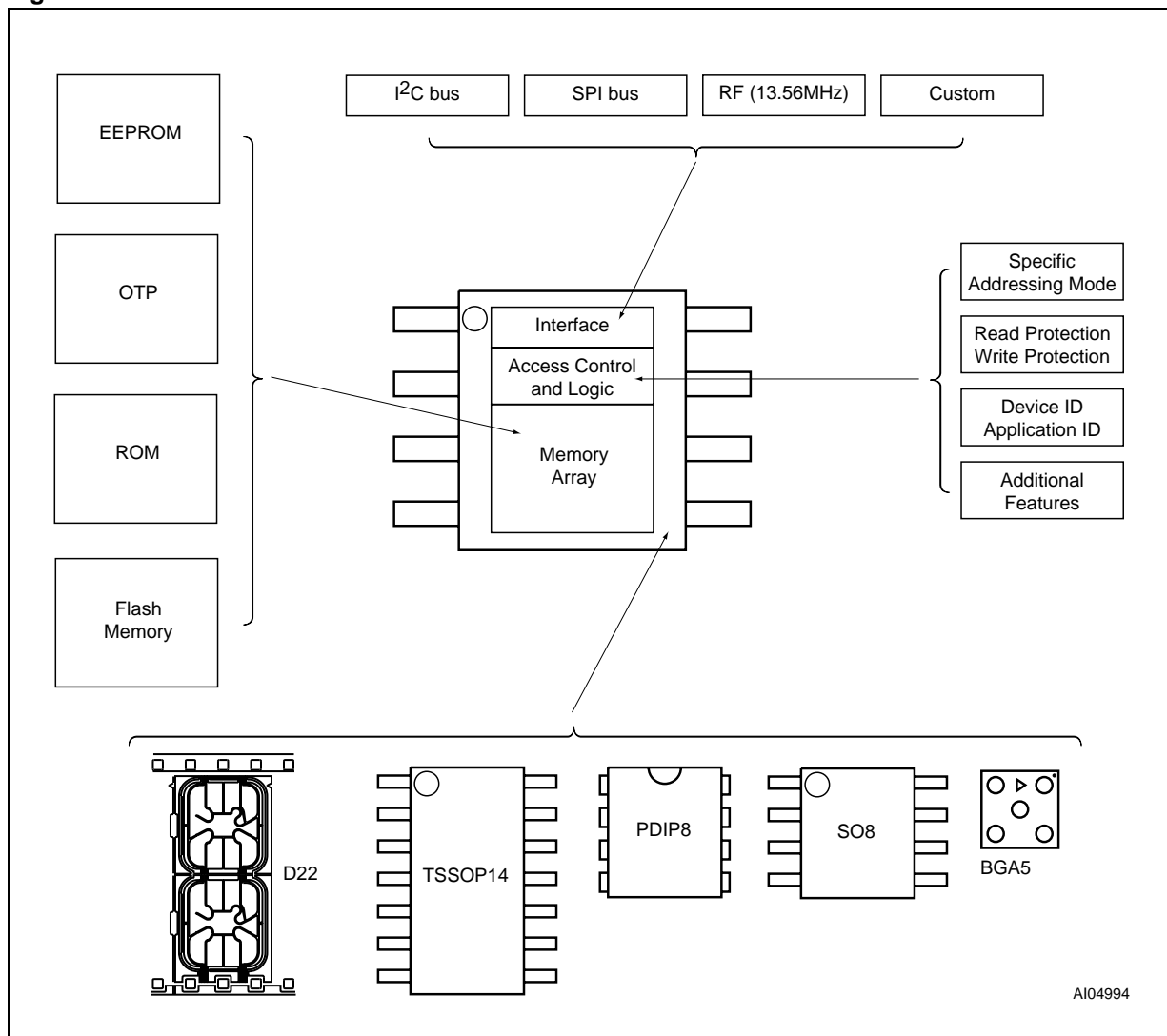
Memory Array

The options for populating the memory array are:

■ M1: Standard EEPROM

– Read and write allowed at byte or bit level

■ M2: One Time Programmable (OTM) functionality (implemented in EEPROM technology)

– Any bit still at 1 can be programmed to 0

■ M3: Read Only Memory (ROM) functionality (implemented in EEPROM technology)

– Read any bit or byte, preprogrammed at fabrication time

■ M4: Standard Flash memory

– Write allowed at sector level

The memory array can be composed of any one of the above memory types, or any combination of several or all of these memory types.

Access Control and Logic

The options for the Access Control and Logic are:

- Specific addressing mode
  - Read and write allowed at byte or bit level
- Protection
  - OTP/ROM emulation in the EEPROM array
  - various options for Read protection (such as issuer or user password)
  - various options for write protection (software or hardware)
- Identification
  - circuit ID (special and unique device ID)
  - manufacturing data (special and unique application ID)
- Additional functions
  - secured increment counter
  - anti-tearing (for memory cards)
- Miscellaneous
  - Anti-clone protection
  - Configuration fuses
  - upon request

Interface

The options for the interface are:

- I1: I^{2}C bus
  - 2-wire market standard interface
- I2: SPI bus
  - 3-wire market standard interface
- I3: MICROWIRE bus
  - 3-wire market standard interface
- I4: Radio frequency (13.56 MHz) contactless
  - ISO 14443 short range device protocol (10 cm)
  - ISO 15693 long range device protocol (1 m)
- I5: Custom
  - 1-wire interface
  - others

The interface can be composed of any one of the above interface types, or any combination of several.

Package

The options for the package are:

■ P1: Market standard packages (DIP, SO, TSSOP, etc.)

■ P2: Dedicated packages
   – custom outline
   – PCB

■ P3: Chip scale packages (CSP)
   – offering the die itself as the package outline (BGA, LGA, etc.)

■ P4: Micromodules
   – standard micromodules (as currently used in production for memory cards)
   – contactless micromodules (as currently used in production for contactless memory cards)
   – dedicated micromodules

CONFIDENTIALITY AND EXCLUSIVITY

The methods of co-operation between ST and the customer can be classified:

■ Customized variation on an existing ST memory product
   – fast design cycle (approximately 6 months to production)
   – cheapest solution
   – low confidentiality, standard security

■ Completely new design
   – long design cycle (approximately 1 year to production)
   – more expensive solution
   – high confidentiality, more security

In the latter case, the customer might demand sole rights over the design. The product is kept confidential, and is only shipped to the one customer. Other commercial arrangements are also possible, though. For instance, the customer might commission the new design, and specify a time-limit after which ST can make the product public if it wishes, and add it to its catalogue of standard circuits. Before the time-limit, the customer has exclusive use of the device, ahead of its competitors.

SUMMARY

This document can only hope to sketch out some of the possibilities. New specifications, new ways of working between ST and the customer, and new commercial arrangements are being invented all the time. It is impossible to give an exhaustive list of what ST and the customer can do together.

ST's range of "Application Specific Standard Products" are typical of the devices we have made in the past for the general audience (such as the M34C02 for the PC DIMM manufacturer, the ST24LW21 for the video display manufacturer, and the ST24C04 for the customer who needs a particular type of write-protection).

Understandably, the published lists of existing ASM products is very slim. Most of our work is done under exclusive and confidential conditions to one customer. The products listed only represent the tip of the iceberg of the work that ST undertakes annually.

If you have any questions or suggestions concerning the matters raised in this document, please send them to the following electronic mail addresses:

apps.eeprom@st.com   (for application support)

ask.memory@st.com   (for general enquiries)

Please remember to include your name, company, location, telephone number and fax number.