



Section 57 of the Competition Act (Cap. 50B)

Grounds of Decision issued by the Commission

Notification for Decision: Anticipated Joint Venture between Intel Corporation and STMicroelectronics N.V.

2 October 2007

Case number: CCS 400/004/07

Confidential information in the original version of this Decision has been redacted from published version on the public register. Redacted confidential information in the text of the published version of the Decision is denoted by [REDACTED].

I. INTRODUCTION

1. On 29 August 2007, the Commission received a notification for decision pertaining to an anticipated joint venture (“Newco”) between Intel Corporation (“Intel”) and STMicroelectronics N.V. (“STM”) (“the parties”).
2. The Commission has concluded that the notified joint venture, if carried into effect, will not infringe the section 54 prohibition.

II. THE PARTIES

3. Intel designs, develops, manufactures, and markets microprocessors, chipsets, and other semiconductor components, as well as platform solutions for data processing and communications devices.
4. STM designs, develops, manufactures, and markets semiconductor products used in a variety of microelectronic applications, including automotive products, computer peripherals, telecommunications systems, consumer products, industrial automation, and control systems.

III. THE MERGER

5. The proposed transaction consists of the creation, for an indefinite term, of a joint venture in the research and development, manufacture, marketing, and sale of flash memory.
6. Newco will be constituted under the laws of the Netherlands. STM will contribute the assets and certain liabilities of its NOR and NAND flash memory business. Intel will contribute the assets and certain liabilities of its NOR flash memory business. Francisco Partners (“FP”), a financial investor, will invest US\$150 million in cash. Furthermore, STM will transfer to Newco most of its current research and development activities in the field of phase change memory (“PCM”), a future new type of non-volatile memory, and Intel will transfer a significant portion of its PCM assets and liabilities.
7. On completion, Intel will own 45.1%, STM will own 48.6% and FP will own the remaining 6.3%, of the stock of Newco. According to the Shareholders’ Agreement, each of the merger parties will nominate 3 out of 8 directors on Newco’s board. A “Super Majority” of 6 members is required for strategic decisions of Newco, giving each party the ability to veto decisions relating to the approval of the annual business and financial plan of Newco (including the annual operating budget, R&D, budget, and capital expenditure budget) and any expenditure, agreement to make expenditure or any other action inconsistent with an approved annual plan. FP will not have veto rights. The Commission hence considers that the parties will have joint control of Newco.
8. Newco will receive from the parties flash memory assets that include R&D, manufacturing, distribution, and sales assets, as well as most of the parties’ current R&D activities in the field of PCM.
9. The creation of Newco thus constitutes a merger under section 54(5) of the Competition Act (“the Act”), as it entails the creation of a joint venture to perform, on a lasting basis, all the functions of an autonomous economic entity.

IV. RELEVANT MARKETS

10. Flash memory is a form of nonvolatile memory (a type of semiconductor memory that retains its contents when it is not powered by an electrical charge). Flash memory is integrated into a broad range of electronic products. Most electronic products use flash memory to store important program instructions, known as software code, as well as multimedia or other digital content, known as data (e.g. photos, music, videos and text files). Code storage allows the basic operating instructions, operating

system software or program code to be retained, which in turn allows an electronic product to function. Data storage allows digital content, such as multimedia files, to be retained.

11. There are currently two major architectures of flash memory in the market: NOR and NAND. As data can be read from NOR more quickly than from NAND, NOR traditionally has been used primarily in applications or devices that require flash memory for software code storage. As data can be written onto NAND more quickly than onto NOR, NAND traditionally has been used in applications that require flash memory for data storage.

Product market

Parties' submission

12. The parties submit that a single product market for flash memory, comprising both NOR and NAND flash memory, exists. The parties argue that NAND memory imposes a direct and significant competitive constraint on NOR memory used in applications requiring flash memory for significant code and data storage. The parties claim that such applications account for the bulk of flash memory currently and will continue to capture much of the growth of future demand for flash memory. The parties explain that NAND and NOR are typically combined with some form of volatile memory, albeit that NAND-based devices typically must be paired with twice as much volatile memory as NOR devices. However, NAND memory is cheaper than NOR memory of the same storage capacity. To this end, the parties claim that competition between NOR and NAND is largely driven by the relative bill of materials (which factors into account the total cost of the flash memory and the volatile memory which it is combined with) for NAND-based and NOR-based solutions.
13. Further, the parties argue that falling NAND prices impose a competitive constraint on higher density NOR (density refers to storage capacity, typically measured in megabits). In turn, prices of higher density NOR impose a competitive constraint on prices of lower density NOR.

Commission's assessment

14. The Commission's investigations found limited physical substitutability between the use of NOR and NAND especially at the post-design stages. Due to the distinct characteristics of NOR and NAND (mentioned at paragraph 11 above), it appears that customers' choice of using NOR or NAND typically depends on the end-application in question. However, once applications are designed to use either NOR or NAND, significant costs will have to be incurred to re-configure the application and manufacturing process to switch from NOR to NAND or vice versa. These

costs mean that it is not economically feasible to switch between NOR and NAND after an application is designed. While there are applications that have been designed to accept both NOR and NAND, this practice does not appear to be commonplace.

15. There also appears to be limited substitutability on the supply side. Comments from respondents to the Commission's investigations noted that while switching production between NOR and NAND is technically possible, suppliers incur significant costs in doing so.
16. As such, views from respondents do not support a finding of a single market for flash memory. As an alternative, the Commission considers that it is more likely that separate product markets exist for NOR and NAND.
17. In addition, the respondents offered an alternative product market definition, defined according to the predominant use of the flash memory. This view consists of three markets segmented by memory densities, namely for code-intensive applications¹ (comprising flash memory densities from 0 to 128Mb), combined code-and-data applications² (comprising densities from 256Mb to 2Gb), and data-intensive applications³ (comprising densities from 4Gb and up).
18. The Commission has assessed the merger under the alternative product market definitions, and considers that a precise market definition is not necessary, as the merger is unlikely lead to competition concerns under any of the alternative product market definitions.

Geographic market

Parties' submission

19. The parties submit that the geographic market for flash memory is worldwide. They note that customers purchase their flash memory products on a worldwide basis. Similarly, suppliers are international entities that operate globally. There are no quotas, tariffs or technical specifications operating as barriers to shipping. There are no significant price differences between countries and transport costs are low. The establishment of a local presence is also not necessary, given that there is no need to produce or sell the products locally.

¹ Such devices include personal and portable stereos (excluding MP3 players), home audio components, television sets (including digital television sets), video cassette recorders, DVD players and recorders, older design set-top boxes, and older design video game consoles.

² Such applications include mobile handsets that incorporate various multimedia functions in addition to simple telephony such as Internet connectivity, television viewing, and photography, and some communications equipment such as switches and routers.

³ Such applications include those devices requiring flash memory primarily for large amounts of data storage, such as MP3 music players, removable memory cards, and USB memory drives.

Commission's assessment

20. In the course of the Commission's investigations, respondents' comments were consonant with the parties' claims of global purchasing patterns and uniformity in prices across geographic boundaries. As such, the Commission is of the view that the geographic market is worldwide.

V. COMPETITIVE ASSESSMENT

Market concentration

21. **Table 1** below shows the worldwide market share figures for the flash memory market, as of 2006:

Table 1: Worldwide market shares (%), flash memory market, 2006

2006	Intel	STM	STM+Intel	Samsung	Toshiba	Spansion	Hynix	Others
Overall flash memory	[5-15]	[5-15]	[15-25]	[25-35]	[10-20]	[5-15]	[5-15]	[5-15]
NOR	[20-30]	[10-20]	[35-45]	[5-15]	[less than 5]	[25-35]	[less than 5]	[10-20]
NAND	[less than 5]	[less than 5]	[less than 5]	[40-50]	[20-30]	[less than 5]	[15-25]	[5-15]
Code intensive (0 - 128Mb)	[10-20]	[10-20]	[25-35]	[10-20]	[0-10]	[20-30]	[less than 5]	[20-30]
Code & Data (256Mb - 2Gb)	[15-25]	[5-15]	[20-30]	[20-30]	[5-15]	[10-20]	[10-20]	[5-15]
Data intensive (4Gb and greater)	[less than 5]	[less than 5]	[Less than 5]	[50-60]	[15-25]	[less than 5]	[20-30]	[less than 5]

Note: *Figures are taken from iSupply "Q4 and CY 2006 Final Market Share Revenue by Supplier," 15 March 2007. According to the parties, Intel's NAND market share figures include estimates of Intel's share of the output from IMFT (Intel's joint venture with Micron). IMFT produces only NAND, solely for its parents, Intel and Micron.

22. It can be seen that the market share figures for the NAND flash memory market, as well as for the alternative market definition based on use (i.e. code intensive; code & data; data intensive), fail to cross the indicative thresholds prescribed in the CCS Guidelines on the Substantive Assessment of Mergers. Although the post-merger CR3 ratios in the overall flash memory market, as well as for the code-intensive and code-and-data markets, come fairly close to the threshold, the Commission's investigations did not find any indication of competition concerns in these markets. However, as regards the NOR flash memory market, Newco will have a [X]% market share, which marginally crosses the CCS' indicative threshold of 40%. A greater portion of the Commission's assessment is thus focused on the NOR flash memory market.

Non-coordinated effects

23. The Commission's investigations found that customers typically source from a number of producers, to hedge against market uncertainties and to reduce over-reliance on any one producer. While flash memory products

from different producers are not identical, the Commission found that customers' product design and procurement processes enable them to switch between NOR flash memory producers, or between NAND flash memory producers, fairly easily.

24. Respondents also reported that customers will have sufficient choices post-merger, as existing competitors such as Spansion and Samsung are strong enough to act as competitive constraints on Newco. Respondents gave no indication of any capacity constraints that could hamper competitors' ability to do so. In this regard, it is noted that Samsung has been increasing its presence in the NOR flash memory market, with market shares of [X] % in 2003, rising to [X] % in 2006. However, respondents also noted that significant entry costs exist, in the form of high start-up costs and significant IP and technological know-how requirements.
25. Respondents mentioned that post-merger, customers are likely to re-balance their purchases among the remaining flash memory producers, to reduce over-reliance on any particular producer. This could therefore impact on Newco's market shares.
26. In view of the considerations above, the Commission is of the view that the joint venture is unlikely to give rise to non-coordinated effects.

Coordinated effects

27. Even though, the combined market share of the remaining three major players in the NOR flash memory market post-merger is [X] %, investigations by the Commission revealed that there appears to be no concern for coordinated effects, at least in the market for NOR.
28. Respondents indicated that demand tends to be lumpy, with customers typically entering into annual purchasing contracts with flash memory producers which account for the bulk of their flash memory needs, thereby making coordination by flash memory producers difficult.
29. In light of the above, the Commission is of the view that the merger is unlikely to give rise to coordinated effects.

Effect on innovation

30. The joint venture will also pool the parties' research resources in PCM, a type of flash memory which is regarded as a potential replacement for both NOR and NAND. Respondents to the Commission's investigations recognised that the parties are leading players in PCM.
31. However, the Commission is of the view that it is too early to ascertain the impact of PCM on the flash memory market. Respondents raised no

concerns on this aspect of the joint venture, and noted that it will take at least two years before PCM is ready for the market. There are also a number of other competing replacement technologies in development such as MRAM and FeRAM, and it is too early to determine which will become a competitive force to NOR and NAND.

Effect on Singapore

32. Respondents to the Commission's investigations tended not to view Singapore as an individual or distinct geographic market, citing the global nature of the flash memory industry. As such, they similarly do not consider that the joint venture will lessen competition for their Singapore operations. Other respondents opined that the proposed joint venture could bring benefits to the firms providing supporting services based in Singapore, such as those providing chips packaging and testing services.
33. Neither the joint venture parties or other respondents identified any other product markets that were likely to be affected in Singapore.

VI. ANCILLARY RESTRAINTS

34. The parties have also notified ancillary restrictions to the Commission, comprising:
 - a. an undertaking by Intel and its affiliates to refrain from competing with Newco in certain aspects of the NOR business; and
 - b. an undertaking by STM and its affiliates to refrain from competing with Newco in certain aspects of the NAND and NOR business;for a period of 5 years.
35. The Commission has considered these non-compete clauses and is of the opinion that they are directly related and necessary to the implementation of the joint venture. Consequently, they fall under the exclusion in paragraph 10 of the Third Schedule to the Act.

VII. CONCLUSION

36. For the reasons stated above and based on the information available to the Commission, the Commission has assessed that the proposed joint venture, if carried into effect, will not infringe the section 54 prohibition.



Foo Tuat Yien (Ms)
Acting Chief Executive
Competition Commission of Singapore