Yano Research Institute
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RESEARCH SUMMARY

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Power Semiconductors Market: Latest Trends 2008

Research Outline

Yano Research Institute has conducted a study on the power semiconductors market with following conditions.

1. Research period: July to September 2008
2. Research targets: Semiconductor manufacturers, device manufacturers
3. Research methodologies:
   Face-to-face interviews with relevant personnel were primarily employed, being supplemented by interviews via telephone and e-mail, and literature researches.

<What is Power Semiconductor?>

Power semiconductors are the semiconductor elements used in electric power switching and control devices. Included in this research are Power MOSFET (Metal oxide semiconductor field effect transistor), IPD (Intelligent power device) and diodes, IGBT (Insulated gate bipolar transistor) and power modules.

Key Findings

- **World market size of power semiconductors is expected to reach to 16.8 billion dollars in 2008, which is 4.3 percent increase over the preceding year, in spite of the toughening economic environment.**

  The power semiconductor market size in value for 2007 was 16.1 billion US dollars with the increase of 5.2 percent over the preceding year. Tough market condition has been continuing since the latter half of 2006, due to the negative impacts of cost reduction of household electric appliances and economic recession in the US market. The market size in 2008 is expected to be 16.8 billion US dollars, with somewhat reduced growth rate of 4.3 percent from the previous year.

- **The market will continue to grow steadily after 2009, supported by the demand for energy-saving and environmental measures**

  In 2009 and after, the power semiconductor market is expected to grow steadily based on the demand for energy-saving applications and environmental measures. The growth of the market in 2009 will be limited to 4.2 percent against the preceding year, resulting in the market size of 17.5 billion US dollars. It is expected that the market will start growing again after 2010.

Report format:

Published report: “Growing Power Semiconductors Market 2008 - 2009”
Issued in: September 2008
Language: Japanese
Format: 97 pages in A4 format
Price: 130,000 yen (6,500 yen of consumption tax shall be charged for the sales in Japan.)

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Research Summary

1. Market trends for power semiconductors in 2006 to 2008

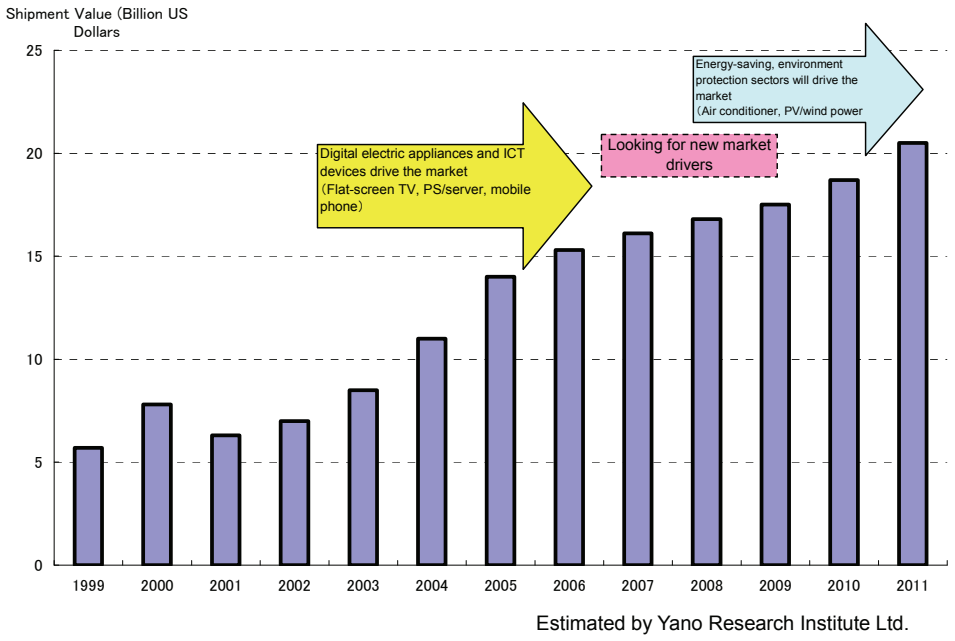
- During the period from 2003 to 2005, the power semiconductors market has continued to record 2-digit growth over the preceding year. Since 2006, however, the growth rate has lowered down to below 10 percent level, and the tough market condition has been continuing up to date. The market size of power semiconductor in 2008 is estimated to be 16.8 billion US dollars, increased by 4.3 percent against the previous year. The average annual growth rate from 1999 to 2008, then, will be reduced down to 12.8 percent, which is a substantial 3.4 percent decrease from the previous survey (in 2006).

- Factors such as the price reduction of electric home appliances driven by toughening competitions and economic recessions in the United States can be pointed out as the factors for the slowed down growth rate. Since 2004, price reduction has been progressing on flat-screen televisions such as LCD (Liquid Crystal Display) and PDP (Plasma Display Panel) TVs, which has severely impacted the selling price of power semiconductors. Another factor was that there had been much greater demand for power conductors than the supply capacity during the period from 2003 to 2006, due to the rapid growth of the flat-screen televisions. As power semiconductor manufacturers have invested and increased their production capacity, the demand and supply relationship has become stabilized, and they are entering into the price competition. As the demand for power semiconductors is increasing in the applications such as protection circuits of lithium ion batteries for mobile devices and inverters for air conditioners, however, the market in total has been growing steadily.

2. Future perspectives for the power conductors in 2009 and after

- Tough market condition for power semiconductor is expected to continue into 2009. As the growth rate will continue to be in a similar level as in 2008, the market size in 2009 is expected to increase by 4.2 percent to become 17.5 billion US dollars. The market is likely to enter into an up-trend again in the latter part of 2009, with demand increase focused on energy-saving and environment protection industries boosting the market in total. The market is expected to exceed 20 billion US dollars in 2011.

Graph 1 World Power Semiconductor Market Size Transition



Note 1: Based on shipment value from the manufacturers

Note 2: Power MOSFET, diode, IGBT, power module and IPD are included.

- In the future, it is expected that the demand for power semiconductor will increase in the environment and energy industries such as photovoltaic and wind power generations being developed mainly centered in European countries. As the production facility improvement of solar cell manufacturers will be completed in 2010, many power semiconductor manufacturers are reinforcing their production facilities in expectation of demand increase. As to inverters for air conditioners, the adoption of inverter has been increased to 50 percent level in the European market, increasing the demand for power semiconductors. From now on, the China market may have critical importance for the power semiconductor demand for inverter applications, where only 3 to 4 percent of air conditioners are inverter drive. If the China government imposes any kind of regulations in favor of inverter-drive air conditioners, the demand for power semiconductor may be boosted in a short period of time.

3. Market trend power semiconductor by application

- Power semiconductor market size in 2008 for ICT industries including PC/servers and mobile phones is 5.7 billion US dollars, which account for 33.9 percent of the total market. Majority of the market is for power MOSFET (Metal Oxide Semiconductor Field Effect Transistor) for voltage up to 100V. As CPU for PC/servers has become faster in processing speed and bigger in electric current, power supply circuits are likely to be multi-layered to suppress the heat generation, which in turn is increasing the demand for power MOSFET. Due to the downsizing of mobile phones in thickness and higher integration of circuit employed, there is a strong demand for miniaturization of power MOSFET as well, increasing the adaptation of chip-scale packaging. Also, there is an increasing demand for down-sizing the power MOSFET used in the protection circuit of lithium ion battery for mobile phones.

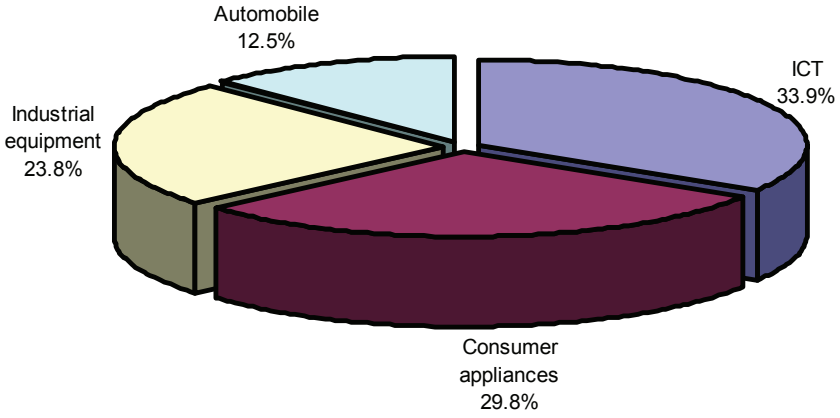
- Consumer electric appliances include white goods to digital appliances. The power semiconductor market for this segment is 5 billion US dollars in 2008, accounting for 29.8 percent of the total market. For the display panel circuit of flat-screen television, power MOSFET and diode are used for LCD, while IGBT (Insulate Gate Bipolar Transistor) and diode for PDP. In the past, there were some manufacturers who use power MOSFET for PDP. All the PDP manufacturers, however, have adopted IGBT for their PDP, in consideration of energy saving and cost reduction. The number of power semiconductors used per panel has also been reduced down to the half as well. For white goods such as air conditioners and refrigerators, IGBT for 500 to 600V capacity is used. Increasing number of manufacturers is starting to ship in modules instead of simple IGBT parts. It is hoped that the demand will be expanded by the conversion of air conditioners from conventional types to inverter drive in the emerging countries including China.

- Industrial equipment field includes semiconductor manufacturing equipment, UPS (Uninterruptible Power Supply) and electric trains. The market size in 2008 is 4 billion US dollars, accounting for 23.8 percent of the total market. Energy and environmental applications are expected to become important applications for power semiconductors in the near future, with increased demand for photovoltaic and wind power generations centered in the European market. As IGBT has become necessary for inverters for 600 or higher voltage applications, manufacturers who have been supplying IGBT for electric trains are reinforcing their production facilities in view of expanding their business in this application field.

- In the automotive applications, power semiconductors such as power MOSFET, diodes and IGBT are used in various controls of actuators/motors, ECU surge absorption, HEV (Hybrid Electric Vehicle)/EV (Electric Vehicle) and so forth. The market size in 2008 is 2.1 billion US dollars, accounting for 12.5 percent of the total market. The demand of power MOSFET for electric power steering has been strong and steady. Further, the electric current increase has been progressing as the electric power steering system has been adopted into medium to full size vehicles. In order to meet the requirement for higher accuracy and reliability from the automakers, the adoption of IPD (Intelligent Power Device), an integrated package of protection circuit and power MOSFET, is being

accelerated. As to in-vehicle use diodes, the demand for surge absorption diodes is growing because the number of ECU installed on one vehicle is increasing. The electric power capacity of diode itself also has been increasing. For HEV/EV applications, it is expected that the demand will start expanding in 2012 to 2013 period when battery technology innovation has progressed and plug-in hybrid and compact EV will become popular.

Graph 2 Distribution of World Power Semiconductor Market by Application



Estimated by Yano Research Institute Ltd.

Note 3: Projection for 2008

Note 4: Based on shipment value from the manufacturers
Note 5: Power MOSFET, diode, IGBT, power module and IPD are included.