

R&D and Intellectual Property

R&D Strategy

Based on the fundamental policy of “selection and concentration,” Sharp conducts R&D activities with the goal of developing the technologies needed to constantly create one-of-a-kind products from the perspective of users. The final objective is to ensure that customers are satisfied with Sharp products. To accomplish this objective, we focus on three approaches to R&D. First is creating unique products through the vertical integration of our core technologies. Second is leveraging commodity technologies shared in and outside of Sharp. Third is using “open innovation” and cooperation with partners to gain expertise in fields of technology that are new to Sharp. Using all three approaches allows us to perform R&D that is distinctive, speedy, and efficient.

Mobile LCDs using oxide semiconductor

Sharp has developed*1 high performance mobile LCDs using oxide semiconductor, InGaZnO (IGZO*2), and is working to commercialize them, marking a world’s first. The electron mobility of this new material is approximately 20 to 50 times that of the existing amorphous silicon, which makes it possible to downsize the thin-film transistor in the LCD panel. This increases light transmittance per pixel and therefore allows to reduce power consumption. Also, high display quality can be achieved by employing proprietary UV²A technology.

Sharp will utilize some of the existing production lines at the Kameyama No. 2 Plant, which accommodates 8th generation glass substrates, to produce cost-competitive, cutting-edge mobile LCDs.

*1 Developed in collaboration with Semiconductor Energy Laboratory Co., Ltd.

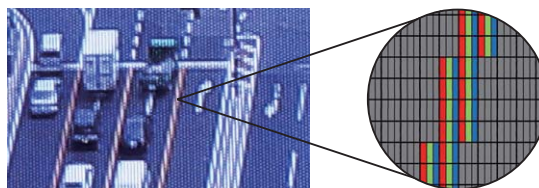
*2 An oxide consisting of In (Indium), Ga (Gallium), and Zn (Zinc)

Quattron high-resolution technology

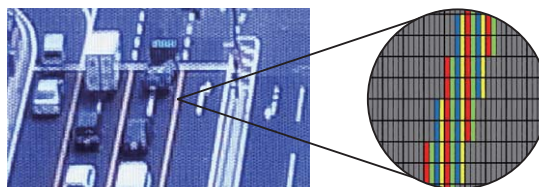
Sharp has developed signal processing technology that doubles horizontal resolution by fully utilizing its latest Quattron LCD panel with four primary colors.

For example, on a conventional LCD panel with three primary colors of red, green, and blue (RGB), white can only be reproduced by a specific combination of RGB colors. However, on Quattron LCD panel, which employs yellow primary besides RGB, white can also be reproduced by other combinations of primaries such as blue, yellow, and red. Our signal processing algorithm separates input signals into the sub-pixel luminance levels for red, green, blue, and yellow, controls them individ-

ually, and then computes an optimal solution for combination of primary colors, which doubles the horizontal resolution. In addition to expanded color gamut realized by the Quattron technology, this signal processing algorithm reproduces images with very fine details.



Conventional display



Quattron high-resolution display

Enlarged image of pixels

Protein detection system using a personal protein chip

Sharp has been developing a highly sensitive protein detection system, which is able to detect specific proteins associated with human diseases. We are able to analyze approximately 1,000 kinds of proteins with a detection limit of one-billionth of a gram protein and are planning to use this system in medical and health care businesses. Moreover, the results of our collaboration with a medical school research group showed that using this system we were able to differentiate between groups of patients that were sensitive or insensitive to a number of anticancer drugs. This technology is expected to contribute to personalized medicine and the diagnosis of diseases in their early stages. Sharp plans to commercialize this system for use in medical and pharmaceutical research.



Protein detection system using a personal protein chip

Quantum dot solar cells

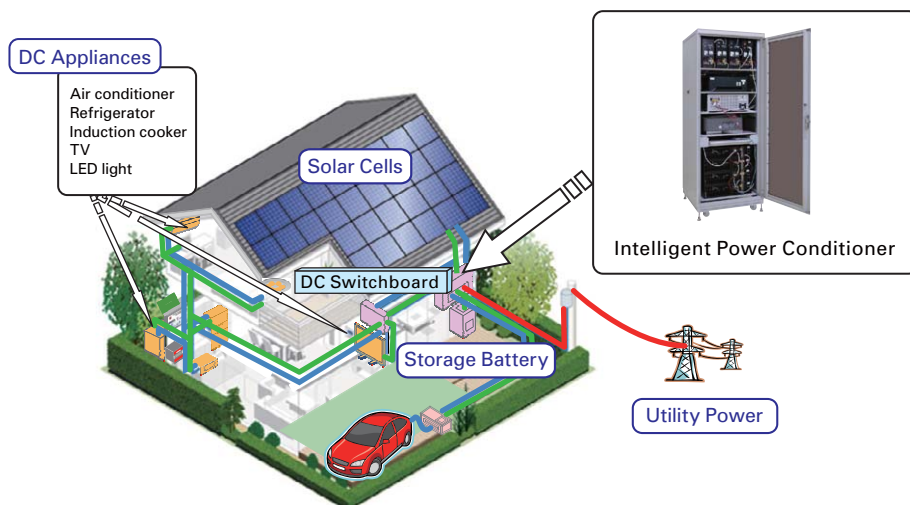
Sharp is promoting the development of quantum dot solar cells, much anticipated ultra-high efficiency solar cells. In a joint research project with the University of Tokyo, our investigations into device structure capable of absorbing the maximum amount of sunlight have shown that quantum dot solar cells have a theoretical conversion efficiency of 75%, higher than the upper limit of 63% calculated in previous studies. This result indicates that quantum dot solar cells have greater potential than originally believed. Using these recent findings, we will continue trials aimed at discovering the optimum structure for quantum dot solar cells.

Intelligent Power Conditioner

Sharp has developed the Intelligent Power Conditioner, which enables solar cells and storage batteries to operate in conjunction with utility power to supply electrical power on a consistent basis. Developed by drawing on power control technology amassed in the course of developing a power conditioner for a solar power generation system, the Intelligent Power Conditioner is a step forward towards realizing Sharp's "Eco House" concept, which contributes to the reduction of CO₂ emissions in the home. The Intelligent Power Conditioner is also designed to supply direct current (DC) electricity in anticipation of the widespread use of DC appliances* in the future. In addition, the Intelligent Power Conditioner enables electric vehicle traction batteries to be used as storage batteries for residential power storage systems.

Responding to growing awareness regarding environmentally friendly and energy-saving lifestyles, Sharp aims for the early commercialization of this Intelligent Power Conditioner. We will conduct tests to confirm the safety and reliability of the system, as well as its compatibility with home appliances and vehicles.

* Appliances running on direct current



Basic concept of Sharp's "Eco House" and Intelligent Power Conditioner

Intellectual Property Strategy

Sharp views its intellectual property strategy as one of its key management measures, promoting it in a coherent manner with business and R&D strategies. In order to secure a competitive edge with one-of-a-kind products and one-of-a-kind devices for stronger business foundations, Sharp is aggressively promoting patent right obtainment.

Sharp has clearly delineated the fields that are central to each business group and has assigned engineers well versed in patent matters to each of these core business areas to conduct strategic patent development*¹ close to the frontline. Sharp also obtains useful patents arising from alliance activities from collaboration with other companies or universities. As of March 31, 2011, Sharp had approximately 19,400 patents in Japan and 24,100 overseas.

Sharp utilizes these patents to strengthen its strategic businesses. In addition, we take actions to protect our patents, such as by examining the products of competitors. We exercise care concerning the intellectual property of other companies, however, our policy is to have other companies respect our intellectual property in return. If we discover an infringement on any of our patents, we issue a warning. In certain cases, more aggressive action is taken, including filing lawsuits. Sharp is also promoting obtainment of design and trademark registrations based on its brand strategy and aiming to increase the number of applications and registrations globally*².

*¹ International patent applications (PCT applications) in 2010: Sharp ranked 8th among applicants (WIPO data).

*² Sharp received the Fiscal 2010 Intellectual Property Achievement Award from the Ministry of Economy, Trade and Industry for its outstanding utilization of trademarks.