Hitachi Releases The World's First Single-Chip STN Color Liquid Crystal Controller Driver HD66766 For 65K Colors

— The single chip handles display of 65,536 colors and a large screen of 132 $\times$ 176 pixels and also can display 260K colors through multi-color software —

Tokyo, September 26, 2001 — Hitachi, Ltd. (TSE: 6501) today announced the world's first single-chip STN color liquid crystal display controller driver "HD66766" that handles 65,536 colors as liquid crystal display for mobile communication terminals such as digital portable telephones and the largest screen in the industry, 132$\times$176 pixels. Hitachi will start sample shipment on October 1, 2001 in Japan.

This product enables display of various colors and high-quality pictures without irregularities, enabling real display such as photographic images. A combined use of multi-color software enables display of 260K colors.

Recently, the roles of digital mobile phones have been increasing rapidly as data communication terminals in information distribution services such as electronic mail and Internet contents. In addition, display information has become more diverse such as photo images created by installing a portable camera, as well as text and graphic information. As a result, introduction of a large screen for handling display of continuously increasing information and multi-color feature for more realistic display is advancing for the liquid crystal display panel that is installed in mobile phones. There is strong demand for a liquid crystal control driver that handles these features.

Hitachi has developed a single-chip "HD66761 (256 colors, 128$\times$80 pixels)" and chip sets "HD66765 and HD66764 (4,096 colors, 132$\times$176 pixels)" as controller drivers for STN color liquid crystal display for mobile communication terminals. This time, Hitachi developed a single-chip controller driver for STN color liquid crystal display "HD66766" for 65,536 colors first in the world by 48V high voltage and fine process to respond to the strong demand from the market for further increase of colors, a large screen, and compact mounting.

The HD66766 enables display of 65,536 colors and a large screen of 132$\times$176 pixels. As a result, photographic images created by cameras can be displayed more realistically. By combining with multi-color software through dither processing [1], 260K colors can be displayed. In the conventional 4,096-color display, one pixel data consists of 12 bits. This product incorporates large capacity RAM of 372K bits and data of one pixel consists of 16 bits. Since the CPU processes 2-byte data in the same way, display of 65,536 colors can be achieved without increasing the CPU load.

An increase of screen size or introduction of color display not only requires a higher liquid crystal driving voltage, but also means a deterioration of the quality of images displayed and an increase of current consumption. Since the general method of applying a conventional liquid crystal driving voltage drives segment signals and common signals within the same voltage range, the current consumption of liquid crystal display devices increases as the liquid crystal driving voltage increases. However, since this product uses a Hi-FAS liquid crystal driving [2] method that can drive segment signals operating at high speed with a low voltage, it requires 30% to 40% less current consumption for liquid crystal display devices in comparison to the existing method.

Improvement of response performance of a liquid crystal panel for displaying animation causes flickers due to the absence of afterimages on the liquid crystal panel in the frame thinning gradation [3], causing deterioration of picture quality. This product applies a pulse-width gradation method [4], which does not depend on afterimages to display images without flickers, achieving high-quality images.

A COG [5] installation method that connects a controller by directly facing down on a LCD glass substrate is applied. Common drivers are assigned on both ends of the segment driver area as pin assignment within LSI, achieving center assignment where wiring on both ends of the LCD display unit is well balanced, thereby enabling compact installation.

Hitachi will continuously improve the lineup by developing products corresponding to various display screen sizes.

Notes: 1. Dither processing: Processing that increases the number of colors by controlling generation of half tones through the picture element layout pattern on liquid crystal display

2. Hi-FAS (Hi-Frequency Amplitude Selection) driving: Method that drives signals in different voltage ranges by increasing the driving voltage of common signals that operate at a low speed and reducing the driving voltage of segment signals that operate at a high speed. As a result, a voltage difference between segment signals and common signals can be secured for actual liquid crystal display. Although the circuit structure becomes more complicated, current consumption of a liquid crystal display unit can be reduced.

3. Frame thinning gradation method: Method that achieves half tones by using afterimages of liquid crystal through ON/OFF control according to the gradation data for each frame

4. Pulse width gradation method: Method that achieves half tones by adding ON/OFF waveforms to the liquid crystal panel only for a period matching the gradation data for each line. Since the ON/OFF time interval is short, this method can achieve picture quality with less flicker than that of frame thinning gradation method.

5. COG (Chip On Glass): Method that installs a chip with a gold bump by directly facing down on a LCD glass substrate

< Typical Applications >

• Mobile phones that handle electronic mail and WWW contents services

• Mobile phones that handle high-speed data transfer (W-CDWA, GSM, etc.)

• Portable PDA, handy GSP terminal, and handy POS

• Portable digital audio player

< Prices in Japan > (For Reference)

Product Code	Shipment type	Sample price (yen/unit)
HCD667A66BP	Straight assignment die with gold bump	1,500
HCD667B66BP	Zigzag assignment die with gold bump	1,500

< Specifications >

Item	Specification
Display size and display color	132 ×176 pixel, 65,536 colors
Number of outputs	Segment: 396 Common: 176
Display RAM capacity	372K bits
Display function	• The window address function enables rewriting in a rectangular area • Two-window split partial display function (windows can be split at any line) • Write data mask function (bit units) • Specified color comparative drawing judgment function
Liquid crystal driving duty	1/8 to 1/176 (programmable in 8-line units)
Interface	68 type/80 type 8/16-bit bus Handles clock synchronous serial interface
Write cycle	100 ns (Vcc = 2.4 V) 200 ns (Vcc = 1.8 V)
Logic power supply voltage	1.7 V to 3.6 V
Liquid crystal driving voltage: Segment	2 V to 4 V
Liquid crystal driving voltage: Common	± 4 to ± 22 V (Amplitude voltage: 8 V to 44 V)
Shipment type	• Straight assignment chip with gold bump • Zigzag assignment chip with gold bump