

## **Hitachi Releases HD66768 Single-Chip LSI for Passive Color Liquid Crystal Display System for European Market and Back-Side Color Liquid Crystal Displays in Mobile Phone Field**

— Support for compact 104 × 84-pixel screen size and 65,000 colors, offering high-quality, multicolor, flicker-free display —

Tokyo, October 10, 2002— Hitachi, Ltd. (TSE: 6501) today announced the HD66768 LSI for passive color liquid crystal display system, supporting a 104 × 84-pixel screen size and 65,000-color display on a single chip, for liquid crystal display system use in mobile communication terminals such as digital mobile phones. Sample shipments will begin in November 2002 in Japan.

The HD66768 is designed for use in the European mobile phone market and for folding-type back-side color liquid crystal displays, and offers a high-quality, multicolor, flicker-free display that enables more realistic depiction of photographic images, etc. In addition, the low power consumption typical of passive color liquid crystals provides a long battery life.

While color displays are becoming more widespread in the European digital mobile phone market as a greater variety of services become available, the general tendency is to retain the compact screen size of monochrome models. Meanwhile, in the Japanese market, photographic image display via miniature cameras is becoming increasingly popular, and to make folding-type phones even more convenient, there is a trend of implementing displays with liquid crystals also provided on the back side, bringing a demand an LSI supporting multicolor display in a compact screen size for a liquid crystal display system.

Hitachi has previously released the single-chip HD66760 (256 colors, 104 × 80 pixels) and HD66766 (65,536 colors, 132 × 176 pixels) for passive color liquid crystal display system using for mobile communication terminals, and has now completed commercial development of the HD66768 single-chip LSI for passive color liquid crystal display system to meet the needs of the European market and the back-side liquid crystal display.

The HD66768 offers a 65,000-color display in a 104 × 84-pixel screen size, making it suitable for the compact screen displays of straight-type mobile phones as well as back-side color liquid crystal displays on folding models. The HD66768 employs a 0.35-micron process that offers extreme fineness together with a high 17 V withstand voltage, and provides a total of 396 outputs--312 segment outputs and 84 common outputs--all in a 13.59 mm × 2.10 mm die size that ranks among the industry's smallest and employs 38-micron-pitch pad spacing that allows ultra-fine COG\*<sup>1</sup> mounting.

A color display not only requires a high liquid crystal drive current, but is also susceptible to degradation of image quality, such as fluctuations in contrast, caused by differences in the display system power supply voltage due to variations among individual display panels and different operating states. To solve this problem, the HD66768 incorporates a liquid crystal drive power supply circuit that includes a reference voltage generation circuit. This circuit enables degradation of image quality to be suppressed by providing liquid crystal drive output signals at a stable reference voltage, and also makes it easy to handle power supply specifications that differ according to the display system.

Also, whereas earlier devices required around 15 external capacitors to stabilize the output voltages from the liquid crystal drive power supply circuit, the HD66768 employs power supply circuit techniques that make it possible to almost halve the number of external capacitors, and so achieve a lower-priced system.

An interface is provided for direct connection of external EEPROM, in which register values for control of the HD66768 can be saved. Adjustment values, liquid crystal drive voltage values, and so forth, which differ according to the display system, can be written to EEPROM beforehand, and these values can be read and settings made at system start-up, enabling screen display to be implemented easily with the appropriate settings.

A drawback of the conventional frame-elimination gradation\*<sup>2</sup> method when liquid crystal panel responsiveness is improved to handle moving image displays, for example, is the occurrence of flicker due to the absence of a liquid crystal panel afterimage, resulting in lower image quality. The HD66768 uses a pulse-width gradation method\*<sup>3</sup> that does not depend on an afterimage, making it possible to eliminate flicker and achieve high image quality.

The supported mounting method is COG mounting, in which the device is directly connected face-down on the LCD glass substrate. In addition, for the pin arrangement inside the LSI, common drivers are arrayed at both sides of the segment driver area, allowing compact mounting through a central placement that enables balanced wiring at both sides of the LCD display unit.

Hitachi plans to further extend the product lineup in the future with the development of models capable of handling a variety of display screen sizes.

- Notes: 1. COG (Chip On Glass): A mounting method in which a chip with gold bumps is directly mounted face-down on the LCD glass substrate.
2. Frame-elimination gradation: Intermediate tones are achieved by performing on/off control on a line-by-line basis according to gradation data and employing the liquid crystal afterimage.
3. Pulse-width gradation: Intermediate tones are achieved by adding an on/off waveform to the liquid crystal panel on a line-by-line basis only at certain times in accordance with gradation data. As the on/off interval is short, a more flicker-free image can be achieved than with frame-elimination gradation.

#### < Typical Applications >

- Mobile phones handling e-mail and WWW content services
- Mobile phones supporting high-speed data transfer (GSM, W-CDMA, PDC, etc.)
- Small PDAs, handheld GPS terminals, handheld POS terminals
- Portable digital audio players

#### < Prices in Japan >(For Reference)

Product Code	Shipment Form	Sample Price (Yen)
HD66768 (HCD667A68BP)	Straight-array chip with gold bumps	1,160

**< Specifications >**

<b>Item</b>	<b>Specifications</b>
Display size and colors	104 × 84 pixels <ul style="list-style-type: none"><li>• 65,000 colors (16 bits/pixel)</li><li>• 4,096 colors (12 bits/pixel)</li><li>• 256 colors (8 bits/pixel)</li></ul>
Number of outputs	312 segment outputs 84 common outputs
Display RAM size	17,472 bytes
Display functions	<ul style="list-style-type: none"><li>• Rectangular area rewriting by means of a window address function</li><li>• Split-screen partial display function (screen division at arbitrary line)</li><li>• Bit-unit write data masking function</li><li>• Specified color comparison drawing determination function</li></ul>
Liquid crystal drive duty	1/8 to 1/84 (programmable in 8-line units)
Interfaces	<ul style="list-style-type: none"><li>• 80-system 8-bit bus</li><li>• 3/4-wire synchronous serial interface</li></ul>
Write cycle	100 ns (V <sub>cc</sub> = 2.4 V) 200 ns (V <sub>cc</sub> = 1.8 V)
Logic power supply voltage	1.7 V to 3.6 V
Liquid crystal drive voltages	5 V to 17 V
AC inversion	<ul style="list-style-type: none"><li>• B waveform inversion</li><li>• C waveform inversion</li></ul>

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Information contained in this news release is current as of the date of the press announcement, but may be subject to change without prior notice.

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