2001
JUNE

Ordering Number: EP105

SANYO

■ Preliminary Specifications

*: These specifications were measured from prototype products.

Organic light emitting diode displays (2.4 and 5.5 inch): full-color active matrix displays

Parameter	Specifications		Unit
	2.4-inch	5.5-inch	
Active area diagonal	6.1/2.4	14.0/5.5	cm/inch
Number of dots (h × v)	852 × 222	320 × RGB × 240 (QVGA)	dot
Dot pitch (h × v)	0.057 × 0.165	0.116 × 0.348	mm
Display colors	Full color	Full color	—
Dot arrangement	RGB Delta	RGB Stripe	—
Active area dimensions (h × v)	48.6 × 36.6	111.4 × 83.5	mm
Luminance	200 or higher	200 or higher	cd/m²

Organic light emitting diode display (1.3 inch): area-color passive matrix display

Parameter	Specifications	Unit
Active area diagonal	3.4/1.3	cm/inch
Number of dots (h × v)	120 × 60	dot
Dot pitch (h × v)	0.192 × 0.416	mm
Active area dimensions (h × v)	23 × 25	
Colors	Red, green, blue, yellow, white	
[Operating Conditions]		
Driving scheme	Consecutive line scanning	
Duty cycle	1/60	

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Printed in Japan / June 2001 6k OTE

Flat Panel Displays for the New Century ---

Organic Light Emitting Diode Displays

SANYO Electric Co., Ltd. Semiconductor Company

Two Leading-Edge Technologies: Bringing Changes to Displays.

Fusion, and then Beauty

Kodak and SANYO—Two companies that have always been influential in the world of displays. Their leading-edge technologies have now met. A new era of beauty in video scenes is about to begin.

SANYO: Low-temperature polysilicon TFT LCD technology

Achieving the extremes of sharpness, image quality, and response speed. SANYO develops LCD modules based on its low-temperature polysilicon TFT technology, which feature an electron mobility 100 times higher than amorphous silicon TFT devices. SANYO has continued to respond to the unrelenting desires for improved color fidelity from both video creators and designers of information equipment.

Kodak: Organic electroluminescent technology

This technology is the leading contender for the next generation of display devices. Organic electroluminescent devices are self emitting and thus do not require a backlight. This allows them to achieve low power, high brightness, and thin form factors. They also feature an unlimited viewing angle, presenting a bright clear image at any angle.

Fusion, and then Innovation

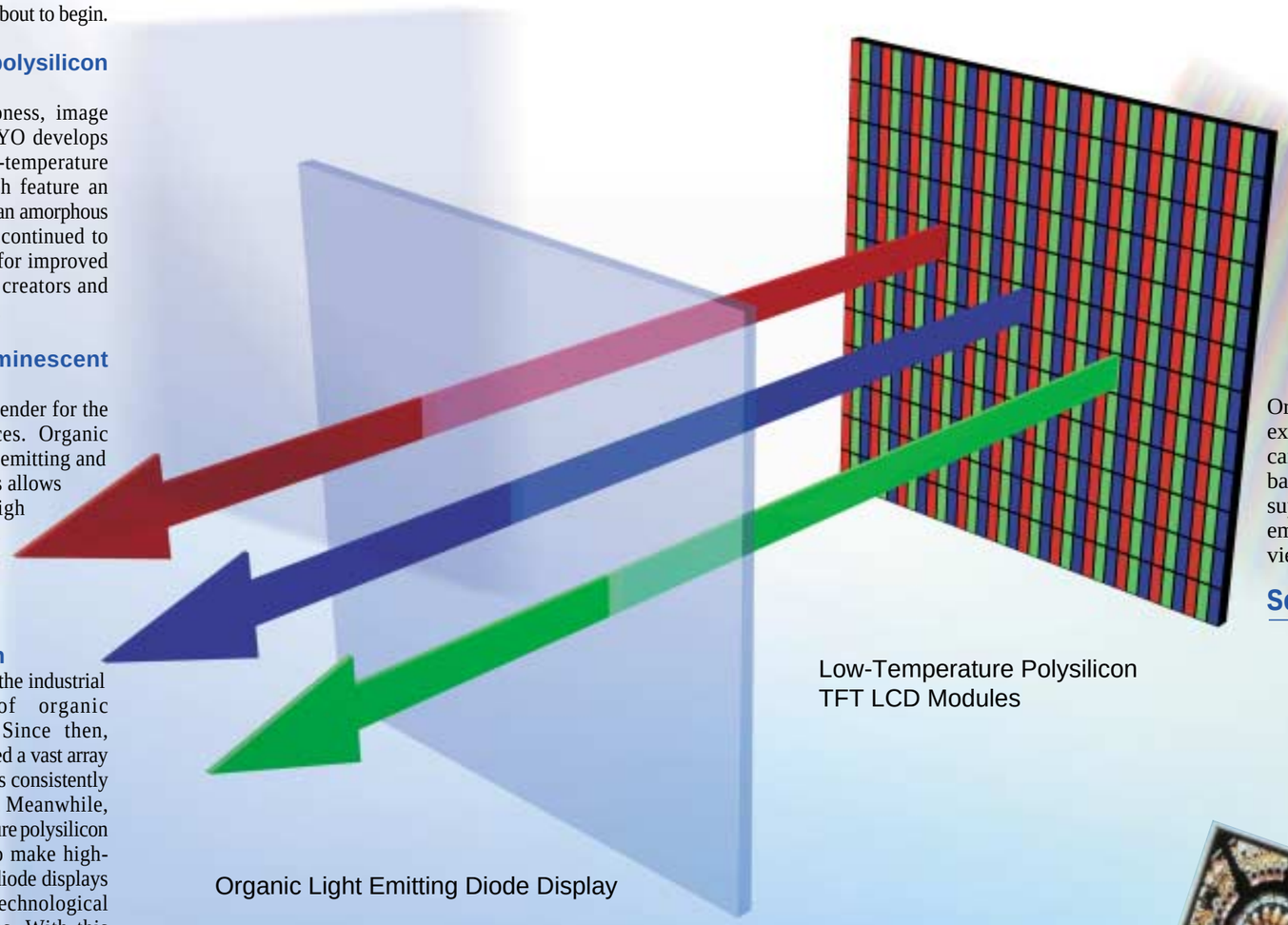
Since the late 1980s, Kodak has led the industrial world in the development of organic electroluminescent technology. Since then, Kodak has developed and accumulated a vast array of related basic technologies, and has consistently maintained the lead in this area. Meanwhile, SANYO developed the low-temperature polysilicon TFT LCD technology necessary to make high-performance organic light emitting diode displays a reality. These two sources of technological innovation have now joined forces. With this alliance, full-scale progress is now underway towards the realization of organic light emitting diode displays as the next generation of flat panel displays.

History of the Alliance

February 1999: Kodak and SANYO formed a comprehensive agreement for the joint development, manufacturing, and sales of organic light emitting diode displays.

September 1999: The industry's first active matrix full-color 2.4-inch organic light emitting diode display was jointly developed using SANYO's low-temperature polysilicon TFT technology.

May 2000: The industry's largest (5.5-inch) organic light emitting diode display was developed.



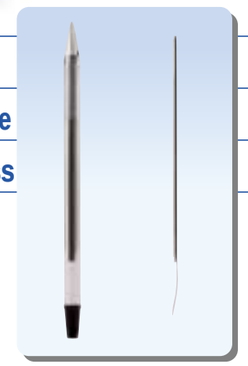
Organic Light Emitting Diode Display

Low-Temperature Polysilicon
TFT LCD Modules

Far beyond the LCD

Organic light emitting diode displays provide features that far exceed those of existing LCD technology. When used in digital cameras and PDAs, these displays can provide both extended battery life and thinner form factors at the same time as providing superlative display quality. Furthermore, since the element is self emitting, they provide high image quality over a wide range of viewing angles.

- Self emitting
- Fast response
- Supports both full color and area color display
- Low power
- Thin form factor
- High contrast
- Wide viewing angle
- High brightness



Comparison of an organic light emitting diode display (right) with a ball-point pen (left) shows the thinness of the device.

The market for organic light emitting diode displays is expected* to be over 100 million units with a value of over 714 million US dollars in 2005.

*: According to the 2000/Organic Light-Emitting Diodes (OLEDs): Technology Trends and Display Market Assessment produced by Stanford Resources, Inc. and Strategies Unlimited.

Expanding the Possibilities for Information Equipment.

The industry's first active-matrix full-color display using low-temperature polysilicon TFT technology

In September 1999, SANYO and Kodak succeed in creating the industry's first active matrix full-color organic light emitting diode display, a 2.4-inch device. At this time, SANYO developed a new current drive low-temperature polysilicon TFT driver circuit for organic light emitting diode displays. Furthermore, in May 2000 they succeeded in creating the industry's largest (5.5 inch) active matrix display of this type, demonstrating the way towards large-screen displays using this technology.

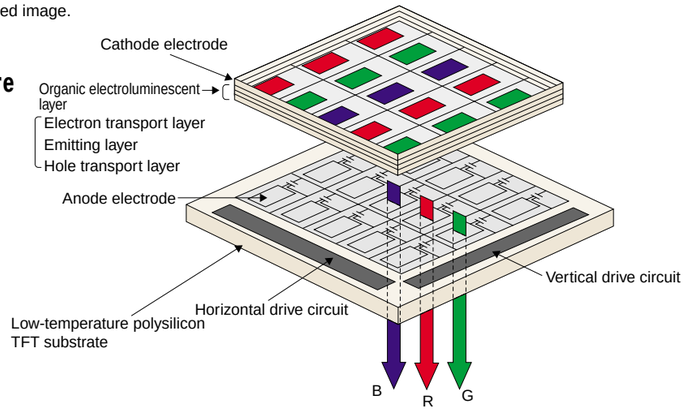
Organic light emitting diode display (2.4- and 5.5-inch sizes)

*: The photograph above is a simulated image.

■ **Applications: support for high-quality graphics**

- PDAs
- Car navigation systems
- All types of display systems
- Office and factory automation applications

■ **Three-dimensional structure on the device substrate**



A simple structure that supports a wide range of applications: the area color type passive matrix display

SANYO and Kodak have simultaneously developed a passive matrix area color type organic light emitting diode display that can display five colors: red, green, blue, yellow, and white. This device has specifications that make it particularly appropriate for use as cellular telephone displays, and these brilliant self-emitting screens not only improve the display functionality, but can contribute to the stylishness of the end product as well.

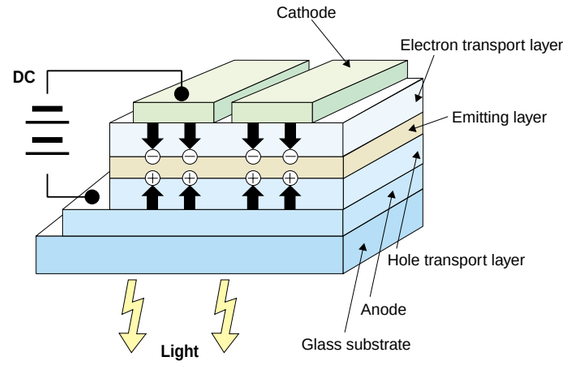
Organic light emitting diode display (1.3 inch)

* The photograph above is a simulated image.

■ **Applications: Improving the attractiveness of a wide range of information equipment**

- Car AV equipment
- Cellular telephones, business telephones, and pagers
- Business and office equipment
- All types of display equipment

■ **Structure**



potential——
Structure · Possibilities · Issues · Technology for Realization
——breakthrough

Organic light emitting diode displays consist of a cathode, three layers of organic materials (a hole transport layer, an optical emission layer, and an electron transport layer), and an anode layered in that order on a glass substrate. These organic molecules have the property that after accepting energy (going to the excited state), they attempt to return to their original state (the ground state) by releasing that energy as light. In an organic electroluminescent device, when a voltage is applied, the holes (+) injected from the anode and the electrons (-) injected from the cathode recombine in the optical emission layer to excite the organic molecules and emit light.

Similar to their LCD predecessors, organic light emitting diode displays can be driven by either passive matrix or active matrix techniques. The latter technique uses a TFT at each pixel to control the light emission from that pixel to achieve higher brightness and contrast.

The main keys to the practical application of full-color organic light emitting diode displays are the following two technology areas. The first are technologies that improve the color purity, efficiency of the luminescence, and lifetime and forming technology of the red, green, and blue organic electroluminescent materials. The other is applying TFT technology, which has been nurtured over the years in SANYO's LCD research and development efforts, to take maximum advantage of the merits of this new generation of display device. Breakthroughs in both these areas have become possible due to this joint development effort.