Organic/Polymer LED & its Driver/Controller IC

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Display Technology is always under evolution. It might take a little bit longer time from cocoon to become a life form, however, it will give you more fancy and beauty that you can't imagine.

"Organic Light Emissive Diode "

OLED/PLED is not an unfamiliar term to all the display technology related firms. It does exist for more than 10 years and under closely monitor and care. In the recent years, this baby is growing up fast and looking for a revenue generation. She might change the world on the concept of display by an irregular shape, light-weight and "roll of display". The total revenue generation of OLED/PLED, which includes Passive and Active OLED/PLED, is forecasted from US$12K at yr1999 to US$3.1 Billion at yr2005. (Data from Flat Panel Video Analyst, DisplaySearch)
Being a display technology challenger, Solomon Systech Limited is committing to put this technology to real. A new OLED/PLED Driver IC had been developed for new OLED mobile and portable devices.

"What kind of species is it?"

OLED can be catalogued into 3 families, i.e. Small Molecule, Polymer and Anthraine. Each family has its own characteristics. Nevertheless, they will not fall out the basic electrical model as a Light Emissive Diode (LED) in parallel with a capacitor.

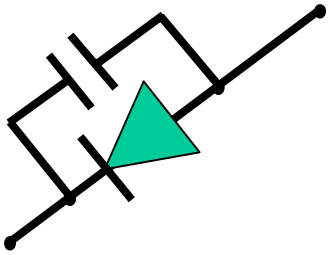

Fig. 1 Electrical Model of OLED/PLED

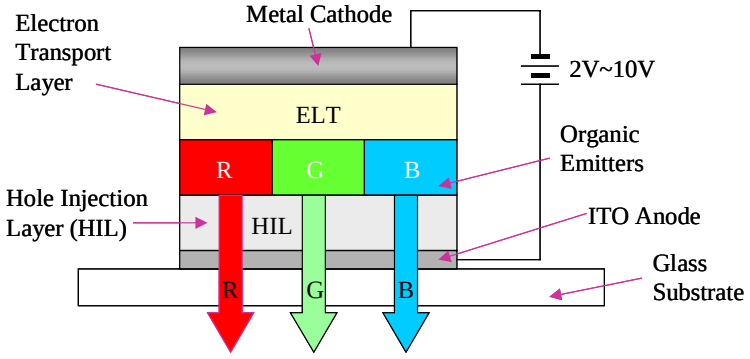

Fig. 2 Physical layout of OLED/PLED cell

Several giant companies own huge tons of patents on these material-technology, however, to make it bright is another story of IC technology.
[For the materials of making OLED, it wouldn't be discussed in this article.]

The major food for OLED/PLED is current, no longer voltage (i.e. Voltage-Drive for STN and TFT display). Too much and too small current will make it unhappy or either do the customer. Same as SUN in universe, OLED/PLED has its own life:

Green: 10,000 hours
Red: 4000 hours
Blue: 700 hours

[Above data is only given reader some idea of its life time, they are not represented the most up-to-date figure of each material.]

When it becomes older and older, more and more current is required to generate the same brightness. Finally, it will die and leave the "Black spot" there forever. Anyway, the forecast life cycle of OLED/PLED will be longer and longer for the material process is under a fast and rapid tuning to make it perfect for users. Also, a matching driving-scheme can help to extend the lifetime of those appliances with display.

The merits of OLED/PLED over the other display technologies are:

- Simple construction
- Thin
- Better viewing angle (160 degree)
- Saturated emissive color
- Low power consumption
- Plastic can be used as a substrate

	STN	TFT	OLED
Viewing Angle	50	100	160
Response Time	Tenth to hundredth ms	Less than 1ms	Less than 1ms
Driving Method	Passive	Active	Passive /Active *
Contrast Ratio	~8:1	~25:1	~100:1
Power Consumption /w backlight (Units)	Several hundredth (mW)	Several (W)	Several tenth (mW)

*PMOLED required passive driving
*AMOLED required active driving

Fig. 3 Comparison of different flat panel display technologies

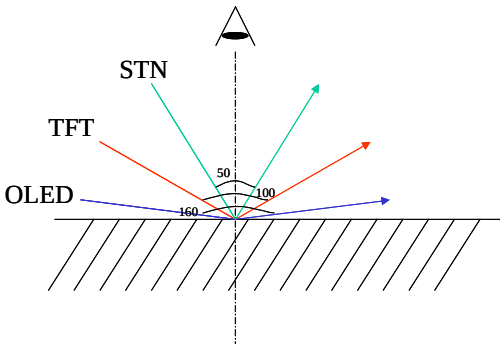

Fig. 4 Viewing angle of different flat panel display technologies

The upper portion of this article focuses on a single cell of OLED/PLED. Once more cells discipline to form a "MATRIX" (i.e. panel), then, more and more problems come out. Those problems cannot be solved by organic material itself, but it can be solved by external driving force, the driver technology and the driving scheme.

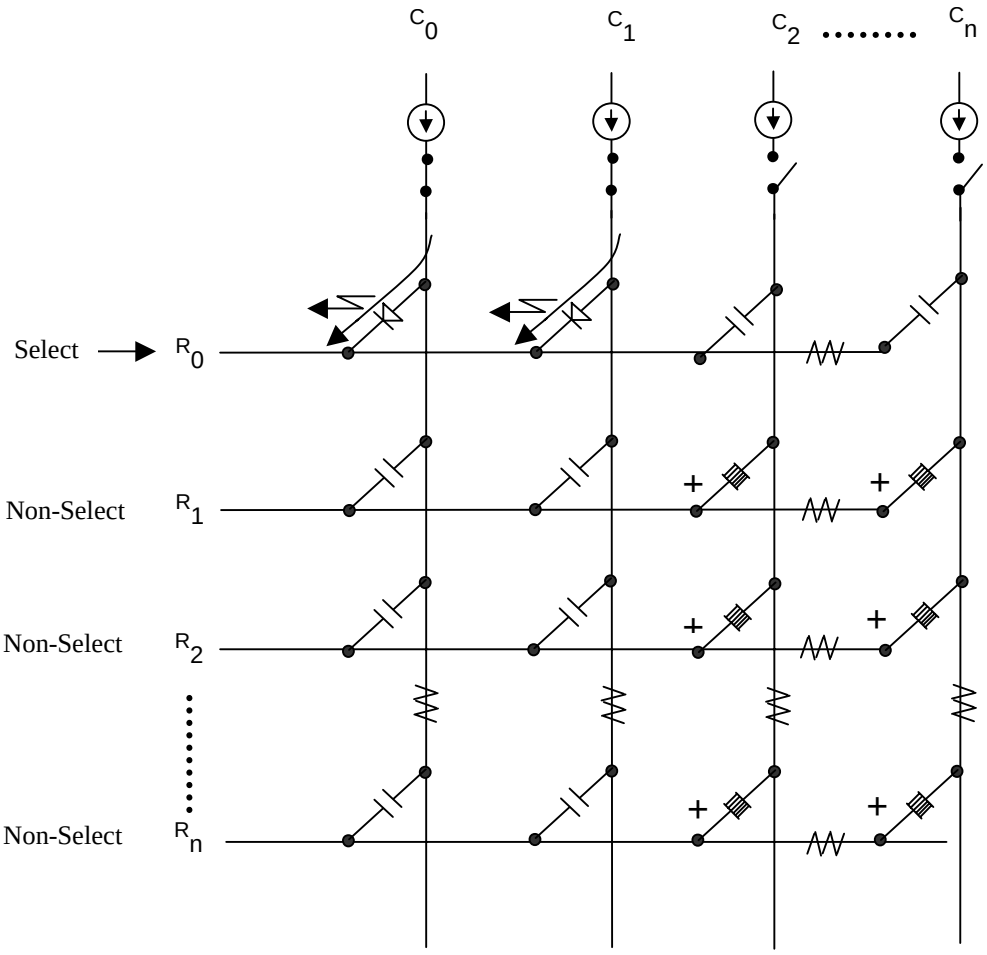

Fig. 5 Electrical Model of OLED/PLED panel

Every time you feed the panel, each cell will keep some residue charge, which is caused by the parasitic capacitor. This residue charge is one of the major problems in OLED/PLED panel. The effects of this charge will cause cross-talk, shadow and uneven contrast. The simple way to solve this problem is by discharging them all. As a result of that, clever driver needs to take away all the residue charge by resetting the panel such as cathode reset or anode reset. This method solves the problem but it costs too much in power consumption area. Solomon Systech Limited (SSL) has developed its own methodology to tackle the problem of power consumption and display performance. The hardware implementation of SSL's proprietary algorithm can help to save up to approx. 25% power consumption comparing with panel resetting driving method. With this algorithm, the parasitic capacitance effect will be reduced to minimum and let the OLED/PLED panel to achieve the maximum performance.

“The OLED/PLED Driver with Controller IC”

The basic requirement of an OLED/PLED driver IC is to provide the current drive required for optimum performance of the displays. In addition, SSL has integrated controller function into the driver IC to simply the system and minimize interface pins. It is the first OLED/PLED driver IC in the market with controller function which includes: embedded 132 x 65 bit SRAM display buffer, on-chip oscillator, SSL’s proprietary driving scheme, 256 step contrast control on monochrome passive OLED/PLED panel, programmable frame rate.

It also has high compatibility interfaces for most common MCUs, powerful command set for easy programming and power management to save system power.

The IC is a single-chip driver with controller for OLED/PLED displays of 132x65 dot matrix. It consists of common/segment driver outputs, a current reference generator, contrast control, on-chip oscillator and serial/parallel interface in one chip. Package shown is a Chip-On-Film (COF) example. The integrated driver utilizes the widely adopted LCD driver interface and control engine that can shorten the development time for the existing LCD design

Fig. 6 The OLED/PLED Driver with Controller IC

OLED/PLED is extremely good for rich content display such as video and movie that require very fast response time and true color. It can apply to WAP/Communicators, PDA, mobiles, portable games console or even 3G phones.

“Due date is already passed.
R&D is almost done.
Commercialization is on the way.”