

*The major challenge facing the portable computer industry is the development of cost-effective, low-power, full-screen, flat panel displays. Here is a technology that can help.*

## **Active-Matrix Liquid Crystal Displays Using Amorphous Silicon Thin-Film Transistors**

H. A. Fieszk and S. H. Fahnberg  
Alphasil, Inc.

During the last two decades, a number of industries have improved the hope that semiconductor technology would develop into a valuable new thin-film semiconductor technology.<sup>1-4</sup> Amorphous silicon thin-film transistor (TFT) technology has now developed to the point that large-area, high-density, liquid crystal displays can be produced with acceptable yields and at reasonable cost. Although basic TFT technology can be applied to a broad spectrum of product applications areas, including microprocessors and radiation-hardened integrated circuits, clearly flat panel displays for use in portable computers offer the most immediate commercial potential.

### **Background**

As integrated circuit technology moves toward the million transistor chip and small, multichip modules, compact disk drives become available, the ability to pack tremendous computing power into small, lightweight packages is becoming a reality. Shrinking die size, increasing clock rates, and the availability of sophisticated software have contributed to this process.

The limiting factor in the design of smaller, full-function, truly portable computer systems is the machine human interface. The keyboard is likely to remain the primary input device for some time. The future of voice recognition depends on increased processing power and the development of voice recognition software. Since a person can speak as fast as five to six characters per second, voice recognition should not decrease the data transfer rate. Nor should

data be a burden to command scope in many applications. A similar analysis, however, does not apply to machine-to-human output.

Machine voice output involves significant performance degradation in many applications, when compared with standard video terminal output. While voice output may be limited to a few words per second, video output can be orders of magnitude higher. Additionally, many pointer functions such as word processing formatting, spreadsheet display, and graphics presentation are simply not acceptable in machine voice output. Thus, the major challenge facing the portable computer industry is the development of cost-effective, low-power, full-screen flat panel displays.

Cathode ray tube technology will not produce the output device of choice for the portable computer market. The disadvantages of power consumption, weight, and size are formidable.

### **Qualities**

Many data sources indicate that annual sales of portable computers will exceed several million units by the late 1980's, with vigorous continued growth expected. To foster and participate in this market, flat panel display manufacturers should offer several desirable qualities to their products.

The cost of flat panel displays to computer system manufacturers, whether such displays are purchased or produced internally, must be comparable to the cost of a

# Active Matrix Liquid Crystal Displays

**Sang Soo Kim**



## **Active Matrix Liquid Crystal Displays:**

*Active Matrix Liquid Crystal Displays* Willem den Boer, 2011-03-15 Active matrix liquid crystal displays AMLCDs are the preferred choice when thin low power high quality and lightweight flat panel displays are required Here is the definitive guide to the theory and applications of AMLCDs Contemporary portable communication and computing devices need high image quality light weight thin and low power flat panel displays The answer to this need is the color active matrix liquid crystal display AMLCD The rides of AMLCD technology over less than two decades to undisputed dominance as a flat panel display has been breathtaking and designers of portable devices need a thorough understanding of the theory and applications of AMLCDs Willem den Boer a holder of over 30 patents in imaging technologies has created this guide to AMLCD theory operating principles addressing methods driver circuits application circuits and alternate flat display technologies including active matrix flat panel image sensors Numerous design and applications examples illustrate key points and make them relevant to real world engineering tasks Need more information on Mobile Displays go to <http://www.insightmedia.info/newsletters.php> mdr Systematically discusses the principles of liquid crystal displays and active matrix addressing Describes methods of enhancing AMLCD image quality Extensive coverage of AMLCD manufacturing techniques Thorough examination of performance characteristics and specifications of AMLCDs **Active Matrix Liquid Crystal Displays** Willem den Boer, 2005 **International Workshop on Active-Matrix Liquid-Crystal Displays**, 1994\*

Active Matrix Liquid Crystal Displays Technology and Applications Tolis Voutsas, 1997 **Fundamentals of Active-matrix Liquid-crystal Displays** Sang Soo Kim, 2001 The primary goal of this 4 hour tutorial is to provide an overview on the fundamentals of active matrix liquid crystal displays AMLCDs It is specifically targeted for an audience that has not been directly involved in AMLCDs but more commonly as a refresher course for those already involved in the AMLCD industry TFT LCD structure design and performance parameters TFT array process color filter fabrication process liquid crystal cell process module assembly and basic operation will be reviewed Page 1 Liquid Crystal Display Drivers David J.R. Cristaldi, Salvatore Pennisi, Francesco Pulvirenti, 2009-03-25 Liquid Crystal Display Drivers deals with Liquid Crystal Displays from the electronic engineering point of view and is the first expressively focused on their driving circuits After introducing the physical chemical properties of the LC substances their evolution and application to LCDs the book converges to the examination and in depth explanation of those reliable techniques architectures and design solutions amenable to efficiently design drivers for passive matrix and active matrix LCDs both for small size and large size panels Practical approaches regularly adopted for mass production but also emerging ones are discussed The topics treated have in many cases general validity and found application also in alternative display technologies OLEDs Electrophoretic Displays etc **Active-matrix Liquid-crystal Displays- TFT Technologies and Related Materials** Mutsuko Hatano, 2006 1994 *International Workshop on Active Matrix Liquid Crystal Displays* Ōyō Butsuri Gakkai, SID. Japan Chapter, 1994 High

*Efficiency Active Matrix Liquid Crystal Displays (HEAMLCD)*. ,2003 This high efficiency active matrix liquid crystal display HEAMLCD effort examined several alternatives to increasing the total power efficiency of an AMLCD flat panel display FPD It was determined that the color filters passed just one sixth of incident light and that a re design of the addressed cell assembly ACA based on color separation physical phenomena represented the best new technology opportunity to improve overall display power efficiency Current liquid crystal display LCD sub pixels are covered by red green or blue absorptive color filters this method discards two thirds of available white light by structure while transmitting just 50% of the desired color Micro optical elements based on refractive diffractive or interferometric color separation were selected for pursuit in this effort A diffractive color separation filter DCSF was designed to separate the colors and focus the desired red green blue wavelength bands onto the subpixel apertures The black matrix already used in AMLCD designs is used to block the spill over of undesired wavebands from adjacent subpixels Several prototypes of a DCSF were designed fabricated tested analyzed and reported An alternative approach using reflective color separation RCS dichroic filters was also tested Several other potential techniques for improving the efficiency of AMLCD displays including inorganic light emitting diode LED backlight technology were examined and are discussed **AM-LCD 2000** Ōyō Butsuri Gakkai,Denshi Jōhō Tsūshin Gakkai (Japan),Kogakuin University,2000 **Active-Matrix Liquid Crystal Displays - Operation, Electronics and Analog Circuits Design** Ilias Pappas,2009 Active Matrix Liquid Crystal Displays Operation Electronics and Analog Circuits Design *Liquid Crystal Displays* Source Wikipedia,2013-09 Please note that the content of this book primarily consists of articles available from Wikipedia or other free sources online Commentary plays not included Pages 44 Chapters 4 Cyano 4 pentylbiphenyl Active matrix liquid crystal display Active shutter 3D system Anisotropic conductive film Backlight Blue Phase Mode LCD Burst dimming Daylight Viewable LCD Display contrast Display lag Dual Scan Dynamic scattering mode Ferro Liquid Display Forth Dimension Displays Frontlight Graphics tablet Hitachi DX07 Hitachi HD44780 LCD controller Image persistence IPS panel Lapfit LCD classification LCD crosstalk LCD memory effect LCD projector LCD Smartie LCD television Liquid crystal on silicon List of LCD matrices List of liquid crystal display manufacturers Optical film Passive matrix addressing Quattron Response Time Compensation Retina Display Sanyo PLV Z4 System monitor Twisted nematic field effect Viewing cone Visual Planet [Liquid Crystal Displays](#) Robert H. Chen,2011-08-04 An unprecedented look into the basic physics chemistry and technology behind the LCD Most notably used for computer screens televisions and mobile phones LCDs liquid crystal displays are a pervasive and increasingly indispensable part of our lives Providing both an historical and a business minded context this extensive resource describes the unique scientific and engineering techniques used to create these beautiful clever and eminently useful devices In this book the history of the science and technology behind the LCD is described in a prelude to the development of the device presenting a rational development theme and pinpointing innovations The book begins with Maxwell s theory of electromagnetism and the ultimately profound realization that light is an electromagnetic

wave and an electromagnetic wave is light The power of mathematical physics thus was brought to bear upon the study of light and particularly the polarization of light by material bodies including liquid crystals After a brief historical description of polarization a physical interpretation provides substance to the mathematical concepts Subsequent chapters cover Thermodynamics for liquid crystals The Maier Saupe mean field phenomenological static continuum and dynamic continuum theories The transistor and integrated circuit Glass panels and modules The calculus of variations The active matrix Semiconductor fabrication The global LCD business Additionally the book illustrates how mathematics physics and chemistry are put to practical use in the LCDs we use every day By describing the science from an historical perspective and in practical terms in the context of a device very familiar to readers the book presents an engaging and unique view of the technology for everyone from science students to engineers product designers and indeed anyone curious about LCDs Series Editor Anthony C Lowe The Lambert Consultancy Braishfield UK The Society for Information Display SID is an international society which has the aim of encouraging the development of all aspects of the field of information display Complementary to the aims of the society the Wiley SID series is intended to explain the latest developments in information display technology at a professional level The broad scope of the series addresses all facets of information displays from technical aspects through systems and prototypes to standards and ergonomics

**Liquid Crystal Flat Panel Displays** William C. O Mara, 2012-12-06 We live in the silicon age and the quintessential item that defines our world is the computer Silicon chips power the computer as well as many other products for work and leisure such as calculators radios and televisions In the forty years since the transistor was invented the solid state revolution has affected the lives of almost everyone in the world Based on silicon solid state devices and integrated circuits have revolutionized electronics data processing communications and the like The computer especially the personal computer would be impossible without silicon devices Only one computer was ever built using vacuum tubes and the tubes had to be constantly replaced because they generated too much heat and burned out Silicon devices allowed for reliable switching operations in arrays of hundreds and thousands of discrete devices As a result the very substantial industrial base that existed for producing vacuum tubes disappeared with one exception That exception is of course the CRT which is evident in televisions computer displays and a host of other information display terminals Until recently there was nothing that could take its place and it seemed that the CRT would remain as the electronic medium for all except the simplest displays The CRT is about to go the way of the other vacuum tubes It's dead but doesn't know it yet

*AM-LCD 94*, 1994\* **AM-LCD 96** Ōyō Butsuri Gakkai, Society for Information Display. Japan Chapter, 1996 Motion Effects on Active Matrix Liquid Crystal Displays, 1996 *AM-LCD 04* Ōyō Butsuri Gakkai, Denshi Jōhō Tsūshin Gakkai (Japan), 2004 AM-LCD 98, 1998 **Active Matrix Liquid Crystal Displays**, 2006

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