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Chapter 1 : Electronic visual display - Wikipedia

Electronic Displays, Inc. designs, manufacturers, and markets a wide variety of products which utilize Light Emitting Diodes (LEDs) to display alphabetical and numeric information. Our product line includes Electronic Message Signs, Industrial & Lean Scoreboards, LED Counters, Timers, and similar display products.

Technological advancements, expansion of consumer electronics industry and increasing applications across different end-use segments are expected to drive the global market growth. The industry has evolved significantly over the last few years owing to several new technological developments. Emergence of advanced consumer electronics such as smartphones, tablets, smart wearables and smart televisions is expected to drive the market over the next seven years. Moreover, increasing purchasing power across different sections of the society has opened up greater avenues for industry growth. However, the adoption of such innovative technologies involves high initial costs resulting in an increase in the cost of the device, and may hinder the market growth over the next few years. Product Insights LCD displays have dominated the market over the last few years. However, advanced LED and OLED display technologies are increasingly gaining popularity due high operational reliability and suitability towards various applications. These electronic technologies are widely used in digital signage applications and smart devices such as phones, tablets and wearables. Application Insights Display forms an essential component in every other consumer electronic devices and act as an interface between the user and the device. Large scale adoption of digital signage across different end-use segments is expected favorably impact the market. Key developments such as advanced digital signage 2. End-Use Insights Advanced electronic displays are extensively used in a range of end-use segments including retail, entertainment, corporate, healthcare and government. Significant expansion of console and mobile gaming industry has significantly contributed to the growth of the segment. Additionally, increasing use of digital signage in retailing industry coupled with surging adoption of modern the m-commerce retailing has made it the fastest growing application segment in the industry. Regional Insights Asia Pacific regional market is estimated to dominate the global electronic displays industry amounting for over billion in Lower manufacturing costs combined with less stringent government regulations in the region has led major technology giants to establish manufacturing bases in the region, thus driving the regional industry growth. North America is expected to be the flourishing regional market and is expected to grow over the forecast period. High disposable incomes and improved lifestyle amongst the people is expected to generate a steady demand for such advanced display based applications. Consumer electronics and smartphone producers are establishing alliances with display technology manufacturers in order to outsource the manufacturing of electronic display related components. For instance, Apple Inc.

Chapter 2 : Polycomp | Home

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As easy as it seems today, in the late 60s and early 70s it was quite hard to devise a display system for a calculator, especially a portable one. This article will describe the construction and operation of the major types of electronic displays both past and present. The CRT shoots a focused electron beam from the back of the tube to the front of the tube. The front of the tube is coated with phosphors that glow when they are struck by the electron beam. An image is created by moving the electron beam back and forth across the back of the screen. The beam moves in a pattern from left to right, top to bottom and then it repeats. Each time the beam makes a pass across the screen, it lights up phosphor dots on the inside of the glass tube, thereby illuminating the active portions of the screen. The intensity of the beam is modulated thus causing the screen phosphors to glow with different intensities or to even not glow at all. The desired images to be displayed are actually retraced between 30 to 70 times each second. This keeps the images continually refreshed in the glowing screen phosphors without a flicker being perceivable to the eye. The electron beam is generated from a filament and electrically charged cathode in the back neck of the CRT. The electron beam is first passed through a control grid. The control grid modulates the intensity of the electron beam. The higher the intensity the brighter the phosphor dot it strikes will glow. Next the beam passes through an accelerating electrode, this will speed up the electron beam. Then the beam passes through a focusing anode. This will focus or tighten the stream of electrons. All of these elements comprise the electron gun structure housed in the neck of the CRT. The structure on the neck of the CRT is the yoke. The yoke contains four electromagnets placed around the neck of the CRT in 90 degree increments. By varying the voltage of these four electromagnets, the electron beam can be deflected or bent to reach any location on the phosphor coated screen. A final stage of acceleration is achieved with the high voltage anode. The familiar suction cup wire that attaches to the side of the CRT is connected to this anode. This anode is often a metalized surface on the inside of the picture tube. Many thousands of volts are applied to the anode to pull the electrons towards the phosphor coated screen. Phosphors can be formulated to emit many colors though white and green are the most popular for monochrome screens. A simpler form of a CRT is formed by replacing the external electromagnetic yoke with four internal electrostatic deflection plates. These plates are placed in pairs on the horizontal and vertical axes. The electron beam is deflected by the application of a positive voltage on the plates as the beam passes through. The beam will bend towards the most positive plate. Though this type of CRT is not as precise as magnetic deflection it is much less expensive and quite effective for simple calculator and oscilloscope displays. Additional circuitry in the calculator can create numbers, letters, and other symbols by using the control grid to turn the electron beam on and off, while simultaneously applying positive potentials to the deflection plates to bend the beam to the desired locations on the screen. The cathodes are stacked so that different numerals appear at different depths, unlike a planar display in which all numerals are on the same plane relative to the viewer. The anode is a transparent metal mesh wrapped around the front of the display. The tube is filled with the inert gas neon with a small amount of mercury. When an electric potential of to volts DC is applied between the anode and any cathode, the gas near the cathode breaks down and glows. The digits glow with a orange-red color. The name Nixie came about accidentally. Interestingly enough the Nixie design is considered "failsafe". If a filament cathode fails, the numeral is not illuminated. Whereas, in a seven-segment display if one segment fails, a number other than the intended number may be displayed. This display is typically a seven segment style of display where each display segment is formed with a conductive anode tungsten filament. A small voltage placed across a filament will cause it to heat to incandescence. They emit a yellowish-white light that can be filtered to any desired color. The filament voltage vdc can also be varied to change the brightness level of the display. The biggest problem with Incandescent displays is they have a slow response time and they consume a large amount of current. A popular version of this type of display was the RCA Numitron. Some early electronic kits used the Incandescent Filament display. A thick

conductive paint forms the Cathodes on the inside of the ceramic back. The Cathodes form the segments of each digit. Each digit is covered by a separate Anode that is deposited on the inside of the glass front. The Anodes are formed from a thin transparent layer of tin oxide. Like the Nixie tube, the digits glow with a orange-red color. Voltage requirements for these displays are typically volts DC. The filament or filaments is a very fine wire that is heated to a temperature just below incandescence. At that temperature it remains virtually invisible but it emits electrons. A transparent metal mesh grid covers each digit and controls the electrons emitted from the filament toward that digit. Seven phosphor coated anodes, arranged in the seven-segment configuration that form a square eight , glow when struck by the electrons. When a positive voltage of 12 to 25 volts is applied to the grid and the anodes, the electrons emitted by the cathode filament are accelerated and attracted to the positive anode segments which in-turn glow. If the grid has a negative potential then it will block the electrons from passing regardless of the potential of the anodes under the grid. Early versions of VFDs were individual digits housed in vacuum tubes like the Nixie tube and Incandescent Filament displays. VFD Phosphors can be formulated to emit red, yellow, and green as well as the more common blue-green color. Later versions would house all of the digits and other graphics and indicators in one large glass assembly. Transparent electrodes tin-oxide are deposited on the insides of the glass plates. ELD phosphors can be mixed with pigments to emit many colors of light including green, blue-green, lemon-yellow, orange, red as well as white light. This type of solid state display can endure extreme conditions with exceptional tolerance to shock, vibration, temperature, and humidity, while response times remain less than one millisecond. I have not seen ELDs used in calculators but they are used in some laptops, office machines and in the cockpit of the Spaceshuttle. They are also used to backlight LCD panels. LEDs usually produce red light but yellow, green and blue versions are also now available. Calculators used LEDs that were arranged to form either a seven-segment display or a dot-matrix display. Also early LED displays were made small in order to keep power consumption down. A clear plastic bubble lens was fabricated into the package to magnify the display for easier viewing. A dot matrix of 4x7 or 5x7 is typically used. Notice how the 4x7 matrix makes up for the missing 5th column by slightly slanting the columns. This is the simple reason for their demise from being used in calculators. LCDs are optically passive displays they do not produce light. As a result, LCDs require all most no power to operate. Many LCD calculators can operate from the power of a solar cell, others can operate for years from small button cell batteries. LCDs work from the ability of liquid crystals LC to rotate polarized light relative to a pair of crossed polarizers laminated to the outside of the display. There are two main types of LCD displays used for calculators today: TN displays twist polarized light to 90 degrees and have a limited viewing angle. STN displays were developed to twist polarized light between to degrees resulting in better contrast and a wider viewing angle. A LCD consists of two plates of glass, sealed around the perimeter, with a layer of liquid crystal fluid between them. Transparent, conductive electrodes are deposited on the inner surfaces of the glass plates. The electrodes define the segments, pixels, or special symbols of the display. Next a thin polymer layer is applied on top of the electrodes. Finally, polarizing films are laminated to the outer surfaces of the glass plates at 90 degree angles. Normally, two polarizing films at 90 degrees should be dark, preventing any transmission of light but due to the ability of LC to rotate polarized light the display appears clear. When AC voltage is passed through the LC, the crystals within this field align so that the polarized light is not twisted. This allows the light to be blocked by the crossed polarizers thus making the activated segment or symbol to appear dark. Unfortunately these advanced display are too expensive for most of the calculator market. TN LCDs almost completely dominate todays calculator market due to their extremely low power requirements, thin size, and low cost.

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A display device is an output device for presentation of information in visual or tactile form (the latter used for example in tactile electronic displays for blind people). When the input information that is supplied has an electrical signal, the display is called an electronic display.

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