

## FPD94128 528-Ch Small Format a-Si AMLCD Controller / Column Driver with Integrated Frame Buffer

Check for Samples: [FPD94128](#)

### FEATURES

- Video port accepts 18-bit video (NTSC R'G'B') or 8/16-bit video (BT.601 Y'CbCr 4:2:2) at up to 150 QCIF fps (4 Mpix/s).
- CPU port accepts packed graphics data (1.1.1, 3.3.2, 4.4.4, 5.6.5, 6.6.6 RGB) via SPI or parallel 8/16-bit (80x/68x) interfaces
- Internal frame buffer supports up to 176RGB x 240 (18-bit pixels).
- Flexible mounting/scan options provide for symmetric display layout
- Programmable for smaller display resolutions such as 176RGB x 220, 144RGB x 176, 132RGB x 176, etc.
- No external components.
- Quiescent power ~2.5mW in 18-bit mode
- Programmable color-depth allows selection of 3, 9, 12, or 18-bit color modes to further reduce power.
- Power-saving automatic backlight intensity reduction based on statistics of image data or by direct system control.
- Two-region partial display option for ultra-low power in handset stand-by mode.
- Frame, line, or n-line inversion modes.
- Programmable gamma curve control allows easy adjustment for optimum gray level placement and minimum flicker.
- Programmable line rate supports up to 125Hz display refresh rate.
- Separate addressing of two memory regions allows simultaneous loading of both streaming video and graphic/icon data
- Versatile auto-increment addressing modes allow horizontal or vertical raster scanning.
- Factory-calibrated internal clock provides accurate refresh control with no external components.

### DESCRIPTION

The FPD94128 is a Controller/Column Driver for use in low-power small format color TFT LCD displays. The FPD94128 contains a frame buffer, display refresh controller, programmable gamma reference, 528-channel column driver, and a backlight intensity modulator. The FPD94128 and the companion FPD93140 (gate driver with power supply) form a complete 2-chip solution for driving TFT LCD panels containing up to 176RGB x 240 pixels with versatile mounting and scan options. 262,144 colors are supported in 18-bit color mode, and 12-bit, 9-bit, and 3-bit color modes are provided for reduced power. Data may be loaded via serial, 8/16-bit parallel, and video interfaces (18-bit NTSC R'G'B' or 8/16-bit BT.601 4:2:2 Y'CbCr).

The video frame rate and the refresh rate of the LCD panel are independent. The LCD panel refresh rate and the polarity inversion interval are programmable. The LCD panel refresh rate may be up to 125 fps. Two partial-display regions, reduced-color modes, and an automatic backlight control are provided to minimize total system power consumption. The FPD94128 requires no external components.

Parts are provided as gold bumped flip-chip devices. The nominal range for VDD is [1.8V-3.3] V, and the nominal range for the LCD drive voltage is [3.3-5.5] V.



Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

All trademarks are the property of their respective owners.



These devices have limited built-in ESD protection. The leads should be shorted together or the device placed in conductive foam during storage or handling to prevent electrostatic damage to the MOS gates.

## Block Diagram

**Figure 1. Typical Application**

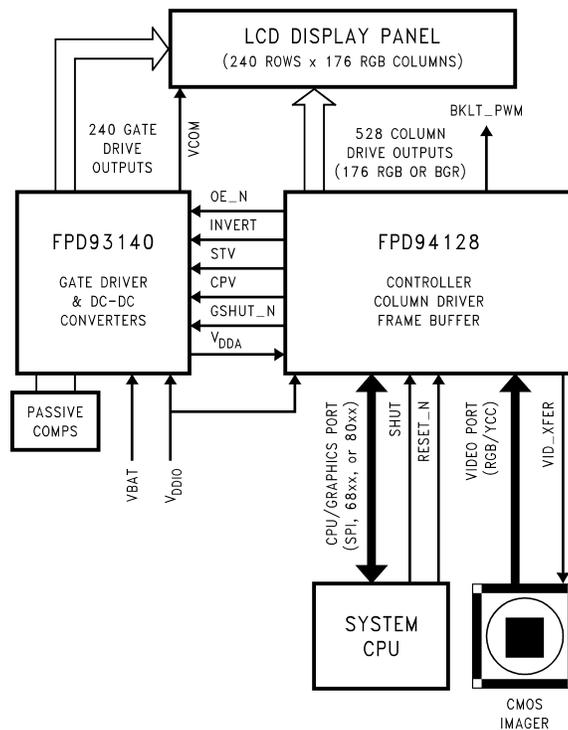
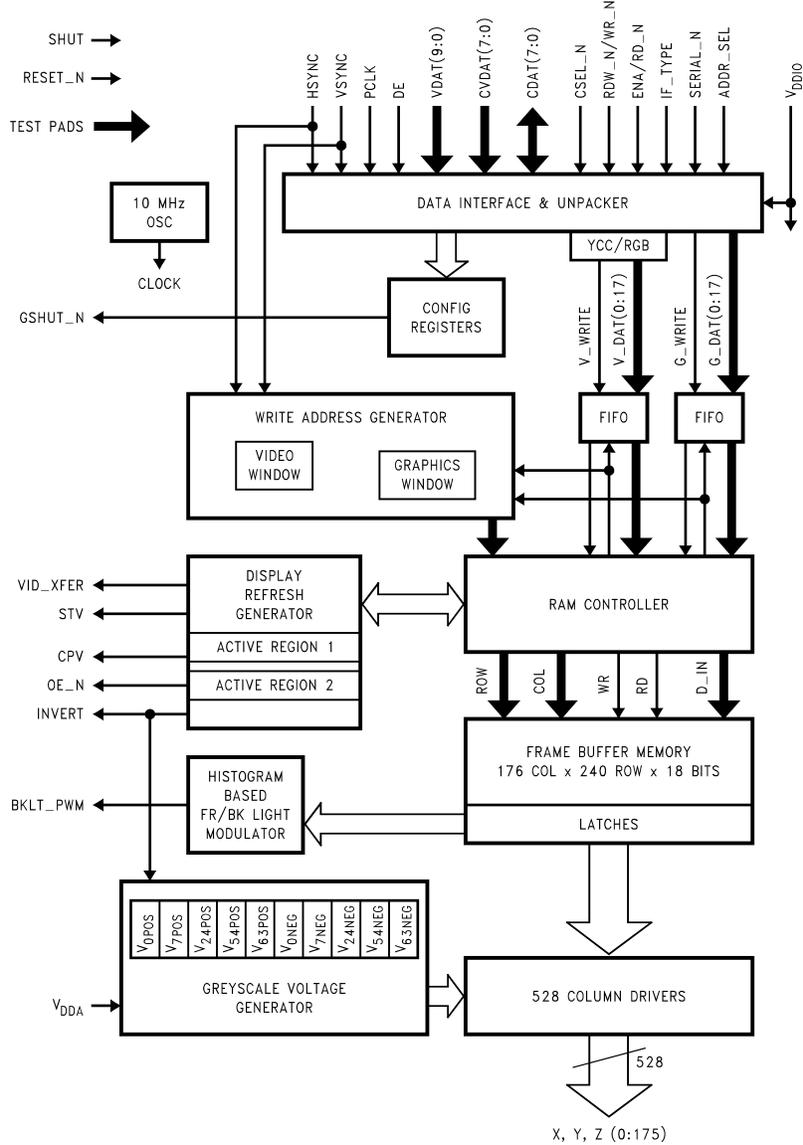


Figure 2. FPD94128 Block Diagram



## IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, enhancements, improvements and other changes to its semiconductor products and services per JESD46, latest issue, and to discontinue any product or service per JESD48, latest issue. Buyers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All semiconductor products (also referred to herein as "components") are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its components to the specifications applicable at the time of sale, in accordance with the warranty in TI's terms and conditions of sale of semiconductor products. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by applicable law, testing of all parameters of each component is not necessarily performed.

TI assumes no liability for applications assistance or the design of Buyers' products. Buyers are responsible for their products and applications using TI components. To minimize the risks associated with Buyers' products and applications, Buyers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any patent right, copyright, mask work right, or other intellectual property right relating to any combination, machine, or process in which TI components or services are used. Information published by TI regarding third-party products or services does not constitute a license to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of significant portions of TI information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

Resale of TI components or services with statements different from or beyond the parameters stated by TI for that component or service voids all express and any implied warranties for the associated TI component or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

Buyer acknowledges and agrees that it is solely responsible for compliance with all legal, regulatory and safety-related requirements concerning its products, and any use of TI components in its applications, notwithstanding any applications-related information or support that may be provided by TI. Buyer represents and agrees that it has all the necessary expertise to create and implement safeguards which anticipate dangerous consequences of failures, monitor failures and their consequences, lessen the likelihood of failures that might cause harm and take appropriate remedial actions. Buyer will fully indemnify TI and its representatives against any damages arising out of the use of any TI components in safety-critical applications.

In some cases, TI components may be promoted specifically to facilitate safety-related applications. With such components, TI's goal is to help enable customers to design and create their own end-product solutions that meet applicable functional safety standards and requirements. Nonetheless, such components are subject to these terms.

No TI components are authorized for use in FDA Class III (or similar life-critical medical equipment) unless authorized officers of the parties have executed a special agreement specifically governing such use.

Only those TI components which TI has specifically designated as military grade or "enhanced plastic" are designed and intended for use in military/aerospace applications or environments. Buyer acknowledges and agrees that any military or aerospace use of TI components which have **not** been so designated is solely at the Buyer's risk, and that Buyer is solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI has specifically designated certain components which meet ISO/TS16949 requirements, mainly for automotive use. Components which have not been so designated are neither designed nor intended for automotive use; and TI will not be responsible for any failure of such components to meet such requirements.

### Products

Audio	<a href="http://www.ti.com/audio">www.ti.com/audio</a>
Amplifiers	<a href="http://amplifier.ti.com">amplifier.ti.com</a>
Data Converters	<a href="http://dataconverter.ti.com">dataconverter.ti.com</a>
DLP® Products	<a href="http://www.dlp.com">www.dlp.com</a>
DSP	<a href="http://dsp.ti.com">dsp.ti.com</a>
Clocks and Timers	<a href="http://www.ti.com/clocks">www.ti.com/clocks</a>
Interface	<a href="http://interface.ti.com">interface.ti.com</a>
Logic	<a href="http://logic.ti.com">logic.ti.com</a>
Power Mgmt	<a href="http://power.ti.com">power.ti.com</a>
Microcontrollers	<a href="http://microcontroller.ti.com">microcontroller.ti.com</a>
RFID	<a href="http://www.ti-rfid.com">www.ti-rfid.com</a>
OMAP Applications Processors	<a href="http://www.ti.com/omap">www.ti.com/omap</a>
Wireless Connectivity	<a href="http://www.ti.com/wirelessconnectivity">www.ti.com/wirelessconnectivity</a>

### Applications

Automotive and Transportation	<a href="http://www.ti.com/automotive">www.ti.com/automotive</a>
Communications and Telecom	<a href="http://www.ti.com/communications">www.ti.com/communications</a>
Computers and Peripherals	<a href="http://www.ti.com/computers">www.ti.com/computers</a>
Consumer Electronics	<a href="http://www.ti.com/consumer-apps">www.ti.com/consumer-apps</a>
Energy and Lighting	<a href="http://www.ti.com/energy">www.ti.com/energy</a>
Industrial	<a href="http://www.ti.com/industrial">www.ti.com/industrial</a>
Medical	<a href="http://www.ti.com/medical">www.ti.com/medical</a>
Security	<a href="http://www.ti.com/security">www.ti.com/security</a>
Space, Avionics and Defense	<a href="http://www.ti.com/space-avionics-defense">www.ti.com/space-avionics-defense</a>
Video and Imaging	<a href="http://www.ti.com/video">www.ti.com/video</a>

### TI E2E Community

[e2e.ti.com](http://e2e.ti.com)