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BCM35421
PRODUCT Brief

FRC PANEL PROCESSOR

FEATURES

- **Advanced 100/120 Hz, Full HD 1080p Frame Rate Converter (FRC) System-On-a-Chip (SoC)**

- **Significantly reduces LCD motion blur and film judder**

- **Automatically detects film-based content and provides special algorithms for dejuddering**

- **Highly programmable/high-performance architecture based on Broadcom's mediaDSP® engine**

- **Low delay (maximum of 2.5 input frame end-to-end delay)**

- **Converts 50/60 Hz, Full HD 1080p input to 100/120 Hz, Full HD 1080p output for LCD TVs and panel electronics**

- **Dual LVDS pixel input interface (accepts both film and video data)**

- **Quad LVDS/high-speed LVDS output interface**
  - Optional dual/quad high-speed LVDS output interface support
  - Single- or dual-frame mode support (current/previous frame outputs) for BOM cost savings

- **32-bit wide GDDR3 memory interface to a single RAM**

- **Application Programming Interface (API) supported over I²C-compatible Broadcom Serial Control (BSC) hardware interface**
  - Supports several FRC mode and picture quality settings, enabling FRC type/strength adjustments based on customer preferences and specific applications (API use is optional.)

- **PC-based LCD Tuning Environment (LTE) GUI tool for tuning, testing, debugging, evaluation, and demonstrations**

SUMMARY OF BENEFITS

- **Excellent picture quality using innovative FRC algorithms.**

- **Highly programmable and flexible**
  - Continual picture quality improvements
  - Custom tuning for product differentiation and unique customer algorithms

- **System BOM cost savings**
  - Only requires one external RAM component
  - No external microcontroller required
  - High-speed LVDS dual-frame output mode to eliminate TCON memories, enable lower-cost TCON ICs, and reduce interface connections
  - Ideal for integration into LCD panels to reduce connectors and cables

- **Low video delay to preserve video/audio synchronization in home stereo systems**

- **Compatible with all DTV SoCs**

- **Additional features and combined picture tuning when used in conjunction with Broadcom's DTV SoCs**

- **Broadcom's expertise in DTV and FRC yields PCB reference designs optimized for performance, cost, and time-to-market.**

- **Customer Application Ready Design (CARD) – Complete 120 Hz turnkey software/hardware system solutions with Broadcom DTV SoCs provide fast time-to-market.**
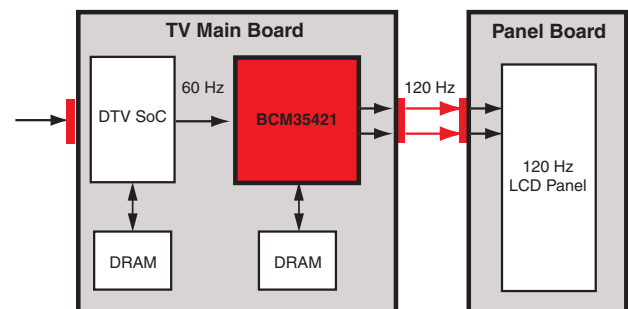
APPLICATIONS

- **Digital TVs**
- **LCD panel electronics**

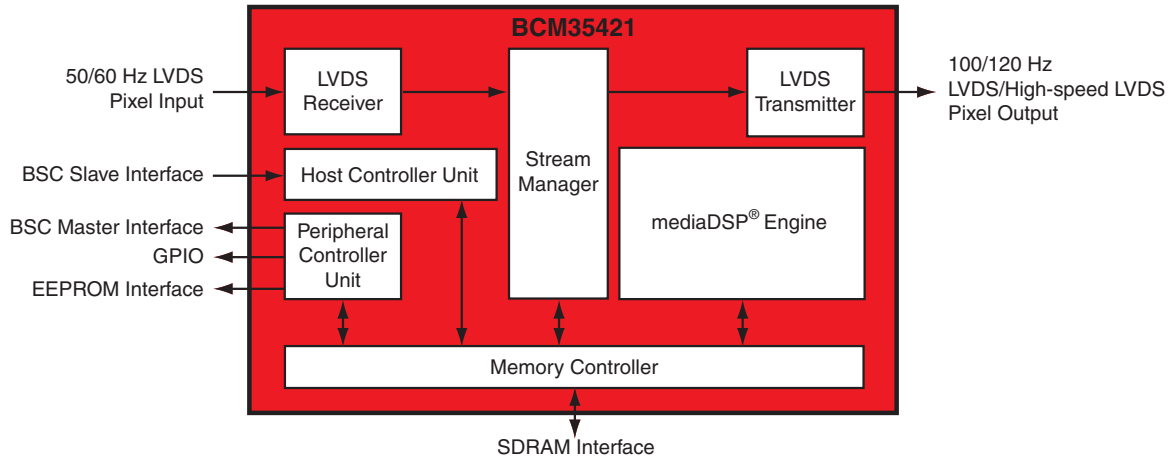## Full HD TV System (1080p) Block Diagrams
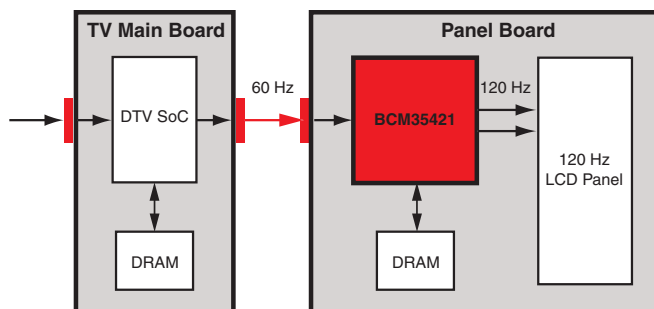
BCM35421 Located in the Panel

BCM35421 Located on the TV Motherboard

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BCM35421 Block Diagram

The Broadcom BCM35421 panel processor is an advanced motion-compensated Frame Rate Converter for use in LCD TVs and panels. It is designed to improve the watchability and total end-user experience when viewing TV programs and movies on an LCD TV. The BCM35421 contains Broadcom's high performance mediaDSP engine that processes innovative FRC algorithms to achieve excellent picture quality. It also enables many cost saving features allowing TV manufacturers to reduce overall system BOM costs.

The BCM35421 implements special algorithms that improve LCD TV picture quality by reducing LCD motion blur and film judder. The BCM35421 accepts 50/60 Hz pixel input from an LCD TV's image-processor (DTV SoC). The BCM35421 creates interpolated frames between two input frames to essentially double the amount of video data, thereby, creating a 100/120 Hz frame rate output capable of driving a 100/120 Hz LCD TV panel.

The BCM35421 supports Full HD 1080p input and output video resolutions on both of its LVDS input and output ports. The dual LVDS input ports accept both film (movie) and video source formats. In the case of film source data, the BCM35421 automatically detects the film cadence, and then performs a reverse pull-down to extract the original 24/25 Hz frames. Spread-spectrum LVDS input signals are supported, as specified.

The BCM35421's quad LVDS output ports connect directly to the 1080p LVDS input ports of a 100/120 Hz LCD panel. The BCM35421 supports Mode 1 and Mode 2 panel data format types and spread-spectrum LVDS outputs. Optionally, the BCM35421 supports a faster, specially formatted high-speed LVDS output interface that permits 1 or 2 output frames (current and previous) to be output in one 100/120 Hz frame window. This special Dual-frame mode allows manufacturers to reduce system BOM cost by eliminating the need for external LCD Panel Timing Controller (TCON) memories and reducing interface costs between the BCM35421 FRC component and the TCON.

The BCM35421 only requires a single external RAM component to further reduce system BOM costs. It operates with a single 64 MB, 32-bit wide GDDR3 component.

SPI flash memory is supported for booting and non-volatile code storage. Most applications operate with a single low-cost 1 MB SPI flash component. Up to 2 MB of flash can be supported.

The BCM35421 contains many general-purpose I/O signals, supports an I^2C-compatible Broadcom Serial Control (BSC) interface, and uses a 40 MHz crystal. It is packaged in a 23 mm x 23 mm, 548-ball, flip chip BGA.

The BCM35421 is very programmable and flexible. It is fully firmware upgradeable and can be customized to meet customer-specific requirements and to implement unique customer algorithms. The BCM35421 allows manufacturers to take advantage of continual FRC algorithm and firmware improvements as Broadcom's leading-edge FRC technology continues to increase picture quality.

An Application Programming Interface (API) is supported over the BCM35421's I^2C-compatible interface. The APIs allow manufacturers to select from several FRC modes and picture quality settings, such as choosing a specific FRC strength or a special PC mode (frame repeat) for gaming applications. The APIs also allow custom tuning for different TV models or user-selected modes based on a manufacturer's preferences.

The LCD Tuning Environment (LTE) GUI, a PC-based software tuning and evaluation tool available with the BCM35421, can be used for customer picture quality tuning, testing, debugging, evaluations, and demonstrations.

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