Flat Panel Displays

Programmable Solutions for the Broadcast Industry
FPGA Companion Chips

• FPGA can be added to ASSP to increase flexibility and/or performance
  – Various storage interfaces
  – Various peripheral interfaces
  – Used in conjunction with programmable nature of the platform to add enhanced services
  – Video Enhancement algorithms

• Offload intensive algorithms to FPGA for hardware acceleration
Panel Board

- Scalar (ASSP Chip)
- Gamma Correction
- Dem-Interlace
- OSD
- Timing Control
- Over Drive
- Gamma Correction
- DDR SDRAM Controller
- Flash Memory
- CPLD
- S3 configuration and glue logic

Connections:
- 7x LVDS to LVTTL
- R,G,B 8-bit LVTTL
- H Sync and V Sync
- SSTL2_II
- SSTL2_II
- DDR SDRAM
- DDR SDRAM
- Video Data
- Gate Driver
- Source Driver

Other Components:
- S3 configuration and glue logic
- LCD Panel
- DDR SDRAM
- SSTL2_II

Miscellaneous:
- Mixed Signal
- Non-Xilinx
- Embedded Logic
- Xilinx
- Memory
- CPU
- Non-Xilinx
- Mixed Signal
- Embedded Logic

Flat Panel Displays 3
Video Board

- Tuner
- TV Video Decoder (ASSP Chip)
- NTSC/PAL/SECAM
- YCrCb
- YPrPb
- S-Video
- SCART
- D-SUB
- DVI-A
- DVI-B
- TMDS
- DVI Switch

- GPIO
- I2C
- MCU
- SDRAM
- GPIO

- 7x LVDS
- LVDS
- DDR SDRAM

- PDP / LCD Panel
- R, G, B

- Xilinx
- Memory
- CPU
- Non-Xilinx
- Mixed Signal
- Embedded Logic

- (Spartan-3E Pre / Post Processing)
- Picture Quality processing
- 3D Color Management
- Precise Gamma Correction
FPGAs For Video Processing

*Where and Why Does It Make Sense?*

- **Customer need**
  - Superior image quality and differentiation
  - Custom algorithms - Retain IP - Improve and update
  - Quick time-to-market

- **FPGA attributes that help customers**
  - Low-cost FPGAs
  - High-performance DSP fabric - Embedded multipliers
    - Allows experimentation and ability to retain and improve IP
  - Business demands
    - Zero-NRE and quick time-to-market
    - Manage customer demand and inventory
FPGAs For Panel Driver/Controller

Where and Why Does It Make Sense?

- **Customer need**
  - Leverage *same* Image processing chipset for different panels
    - Sizes, suppliers, resolutions, newer technology
  - Minimize EMI and number of external components
  - Quick time-to-market

- **FPGA attributes that help customers - Cost is king!**
  - High-performance panel driver solutions - LVDS and RSDS
    - Dramatically lower EMI
  - Sophisticated DCMs and state machines for timing control
  - High-performance memory solutions - internal and external I/F
  - Soft processor solutions to improve logic efficiency
Storage Reference Designs

- **PCMCIA**
  - Card-side (Spartan & CPLD)
  - Host-side (Spartan only)
- **CompactFlash+**
  - Card-side (Spartan & CPLD)
  - Host-side (Spartan only)
- **SD/MMC**
  - Card-side (Spartan & CPLD)
  - Host-side (Spartan only)
- **IDE/ATA**
  - Host-side only (Spartan)
Display IP & Ref Design Solutions

- 7:1 LVDS Rx
- TCON
- Precise Gamma Correction
- Image Dithering Engine
- Color Temperature Adjustment
- Dynamic False Contour Reduction
- RSDS Tx
- Mini-LVDS Tx
- PPDS I/F

Dynamic Gamma Correction
- Motion Artifact Estimation and Compensation
- FCT – Favorite Color Transform
- Brightness & Contrast Adjustment
- Hue and Saturation Adjustment
- Sharpness Enhancement
- Noise Reduction
- LVDS Tx
System Setup – Display Panel Application

Reference Design
- 266Mbps DDR SDRAM Memory Controller (Now available from TED)
- 105MHz LVDS Channel Link I/F (Tx/Rx) ← 10bit supported RSDS Controller
- TCON with image enhancement algorithm
- DVI I/F

Video signal can be input from Graphics operation board to this evaluation board through LVDS (Channel Link).

Connect to Column driver directly from RSDS I/F for the data which is converted by FPGA.

To Display driver IC.
System Setup – Video Board Application

Reference Design
- 266Mbps DDR SDRAM Memory Controller
- Support DVI I/F
- 105MHz LVDS Channel Link I/F (Tx/Rx)
- Image Enhancement/Processing Algorithm

Video signal can be input from Graphics operation board to this evaluation board DVI I/F

Connect to panel TCON board directly through LVDS (Channel Link)
FIR Filters for Xilinx FPGAs

- Most audio, image and video processing can be done based around finite impulse response (FIR) filters
  - Programmability allows experimentation with different coefficients, filter windows etc to get the best quality

See www.xilinx.com/ipcenter for more details
Why FPGAs for A/V Processing?

High Computational Workloads

256-tap Filter Example

Conventional DSP Processor - Serial

FPGA-based DSP - Parallelism

1 GHz

256 clock cycles

= 4 MSPS

500 MHz

1 clock cycle

= 500 MSPS
Spartan-3 Video Advantages

- Off the shelf devices
- Faster time-to-market
- Rapid adoption of standards
- Real time prototyping

- Parallel processing
- Support high data rates
- Optimal bit widths
- No real-time software coding

Spartan-3 DSP Solutions Offer the Best of Both Worlds With Low Cost!
FPGA-Based DSP for Video

• Unrivalled DSP Performance
  – TeraMAC/s via FPGA and Embedded Multiplier fabric for:
    • Multimedia Compression - MPEG2, MPEG4, H.264, MJPEG, JPEG2000
    • Video Processing - Integrated Line Buffers, Enhancement, Pattern Recognition, Noise Reduction, Resizing, Rotation, Scalability
    • Convergence of emerging technologies in Multimedia over IP & wireless

• For Standard Definition Pixel Rates (13.5 MHz pixels)
  • SDTV Test equipment, Broadcast test equipment, Studio effects equipment, scan rate converters, frame rate converters, MPEG-2 codecs

• For High Definition Pixel Rates or Multiple Channels of Standard Definition (74.25 MHz pixels)
  • HDTV Test equipment, Broadcast test equipment, Home Theatre projection devices, Advanced studio effects, Conversions from SDTV, MPEG-2 4:2:2 profile codecs
Video Effects FPGA Solutions

- SDTV, HDTV, Dual-Link, 2K/4K Film resolutions
- Real Time 3D Effects
  - Transforms, splits, warps
- Editing functions
  - Keyers, Mixes, Wipes, Fades, Dissolves
- 3D Cube Colour Correction
- De-interlacer, HD-SD up-down conversion
- Phong shading model & textures for 3D surfaces
- Real time image transfer over PCI Express
  - To or from graphics, disk and PC memory

Effects done in FPGA frees up valuable CPU resources

Real Time - All The Time
Low Cost Packaging Options

Pb-Free Packaging Available
Time-to-Market Value

Quicker time to market and reprogrammability provide the best chance of achieving full product profit potential.
Receiver Solutions

• Xilinx CPLDs and FPGAs provide time-to-market and flexibility advantages for receiver systems
  – Quickly interface receiver chipsets to host processor without waiting for ASSP/ASIC re-spin
  – Or add extra features to receiver units, like hard drive or smart card reader

• Ease of integration
  – Small packaging and minimal thermal impact

• Power saving benefits without performance sacrifice
  – Operating mode and battery management
  – Support higher automotive voltages or lower consumer voltages

• Adds additional performance
  – Reduce processor workload by handling interfaces
  – Expand microprocessor I/O
Xilinx Flat Panel Solutions

- Reprogrammability allows rapid evaluation of differentiating features/algorithms
  - Base system on market leading ASSPs but add your own flavour with FPGA coprocessing
- Time-to-market of programmable solution is a key benefit
- Various system connectivity options supported
  - Easily create flexible bridges between disparate protocols
- Full flexibility to support numerous resolutions, frame rates and formats
- System integration for lower BOM plus EMI & power management
Xilinx in the Broadcast Chain

Gamma Correction
Codecs
Scaling/Resampling
Colour Space
Network Interfacing
Chip Interfacing
Video Filtering
Effects (Wipe/Key)
Memory Control
FEC/Modulation
System Control
Real Time HD/Multichannel DSP

- Highest performance on-chip DSP blocks, multipliers and memory
- Reduce size of DSP farms
- Support real time HD processing
- Support multiple channels of SD processing through resource sharing
- Reduce cost-per-channel for FEC and modulation
Cost Effective Connectivity

- Significant cost-per-channel reductions
- Portfolio of audio/video connectivity solutions
  - SDI, HD-SDI and DVB-ASI
  - Video-over-IP
- Wide range of general telecom, datacom and backplane solutions available
  - Ethernet, PCI Express, ATM, Fibre Channel, SONET, SPI RapidIO, HyperTransport...

~70% cheaper than ASSP SDI solutions!
Flexible Embedded Processing

**PicoBlaze**
- 8-bit Microcontroller
- Simple state-machines and “localised” on-chip control
- Pixel processing & display control

**MicroBlaze PowerPC™**
- 32-bit Microprocessors
- Cost/performance tradeoffs
- Extensive peripherals, RTOS & bus structures
- Networking & wireless comms, control & instrumentation
Xilinx in Broadcast

Programmable Solutions for the Broadcast Industry

More info on a wide range of applications and technologies

www.xilinx.com/broadcast