Cyclone V FPGAs

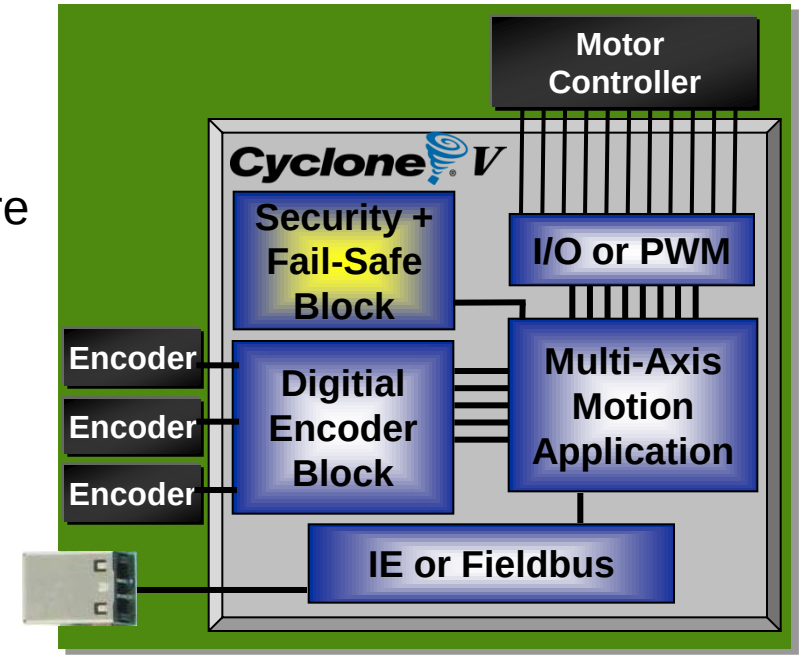
Target Applications and Key IP

Cyclone V FPGAs: Ideal for Industrial Applications

Need	Cyclone V FPGA Feature	Customer Benefit
High Function and Small Form Factor	• 3.3-V I/O with 16mA drive • PCIe multifunction • Integrated security and safety • HiSPi™, Sub-LVDS I/O • Just two voltages for core and transceiver power	• Less components → reduced BOM cost • Single hardware supports multiple SKU's
Low Power	• Up to 40% lower total power	• Easier thermal management • Increased functionality while staying within fixed power budgets
Long Life	• >15 years of life cycle • Integrated security and safety	• Obsolescence proof • Supports legacy ASSP I/Os • Prevents cloning and reverse engineering

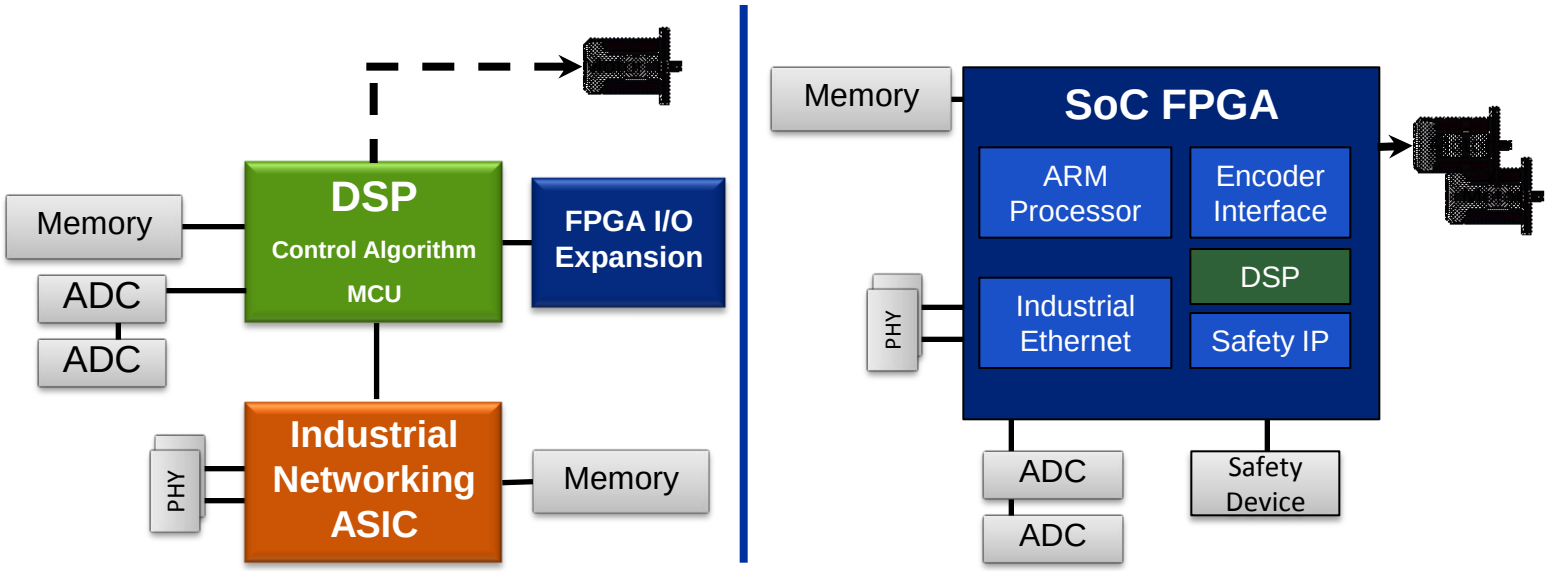
Industrial: Single-Device Motion and Motor Control

- High-precision control
  - Multi-axis motion control
  - Higher performance
    - Hardware acceleration vs. software drivers



- Integration of protocols (industrial Ethernet and fieldbus) and control logic, and driving of specific peripherals
  - Increases reliability
  - Minimizes footprint
  - Lowers cost

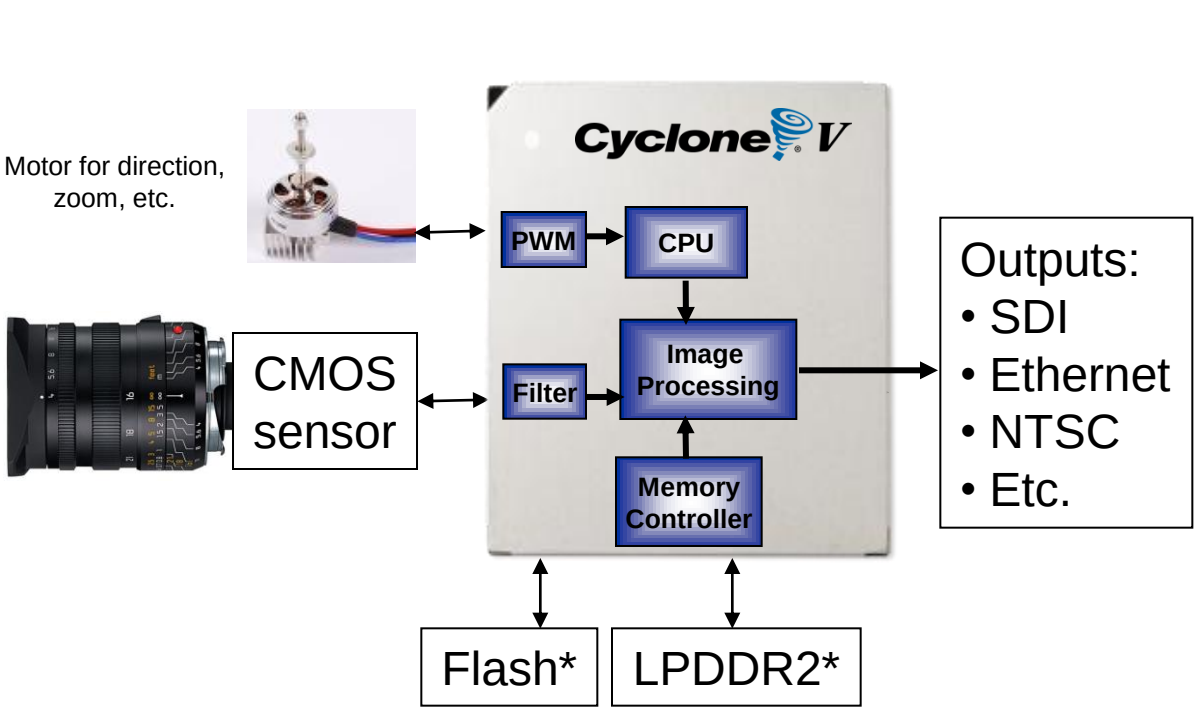
Industrial: Energy Efficiency for Next Generation Drives

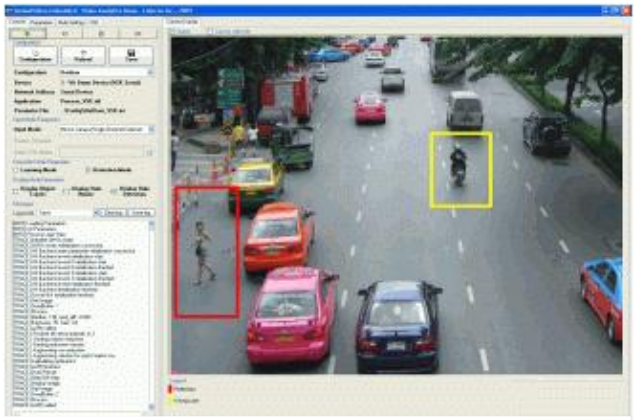


	Drive Designs Today	Future Drive on SoC FPGA
Capability	Single motor/axis, 100µs control loop, fixed-point DSP	Multiple motor/axis, ~5 µs control loop; floating point, safety
Processor Performance and Power	480 MIPS @ 3.2W	1500 MIPS @ 2W
Flexibility w/ Networking	Fixed networking protocol	Multiple networking protocols
Form Factor	1.5” L x 1.4” W	1” L x 1” W

Integration + Multi-Motor/Axis Control

Industrial: IP / CCTV Surveillance



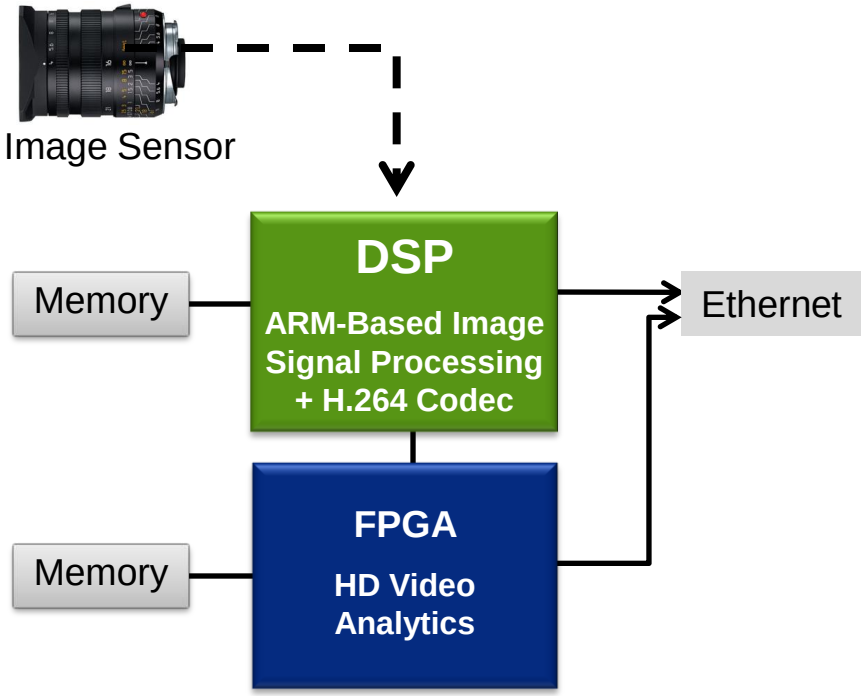


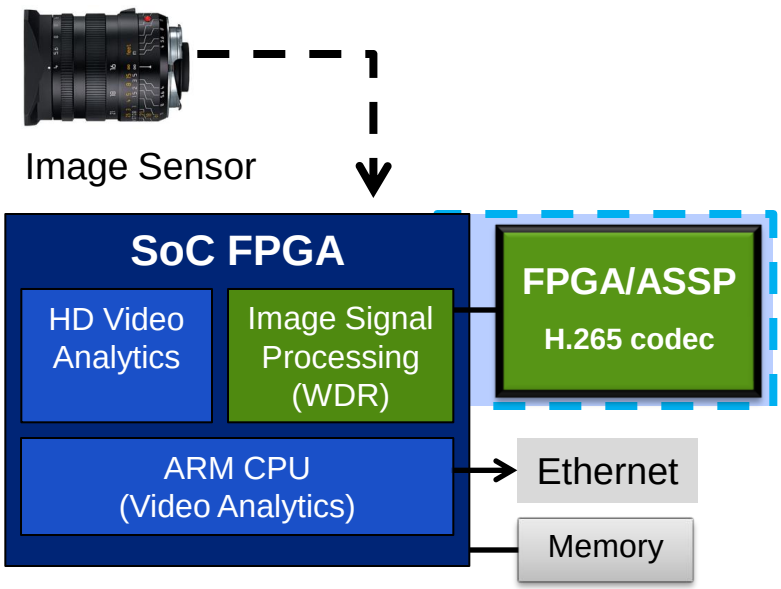
"Analytics" = Digital video analysis becomes automated

Combined with VIP Suite & Nios® II CPU enables lower cost & power single chip solution

**** Optional depending on choice of CMOS sensor and image processing requirements.***

Industrial: High Definition (HD) IP Camera





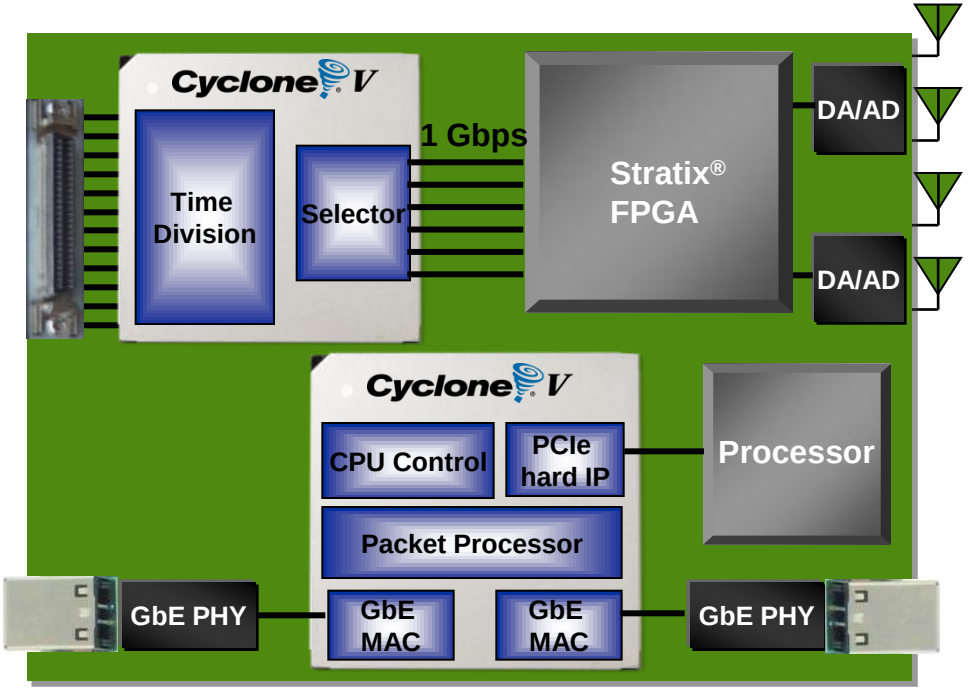
	HD IP cameras today w/ H.264 Codec	Future HD IP cameras w/ H.265 Codec
Capability	HD 1080p video analytics, (WDR not possible in DSP), stationary platform	HD 1080p video analytics, WDR, moving platform, extensible to H.265 for higher resolution displays
Performance	1 GHz ARM Cortex A8	800 MHz dual-core ARM Cortex A9
Form Factor	2.4” L x 2.6” W	1.73” L x 1.86” W

Cyclone V FPGAs: Enhanced for Wireless Applications

- Integration of high-speed data links
  - Up to 4.9 Gbps Common Public Radio Interface (CPRI) and 3.072 Gbps OBSAI links
  - Lowest total system cost
- Lowest power consumption
  - 40% lower power compared to prior generations
  - Operate in thermally constrained environments
  - Reduce operation costs
- High-performance variable-precision DSP blocks for digital predistortion (DPD) and crest-factor reduction (CFR)
  - Hard pre-adders
  - Hard accumulators
  - Output cascade

Wireless: Wireless Backhaul

- Integration simplifies system design
  - Integrated 5G transceivers
  - Integrated PCIe Hardware Interoperability Platform
  - IP suite for common functions
- Reduces operating costs
  - 40% lower total power
  - 88 mW power per channel
  - Cost-effective thermal cooling

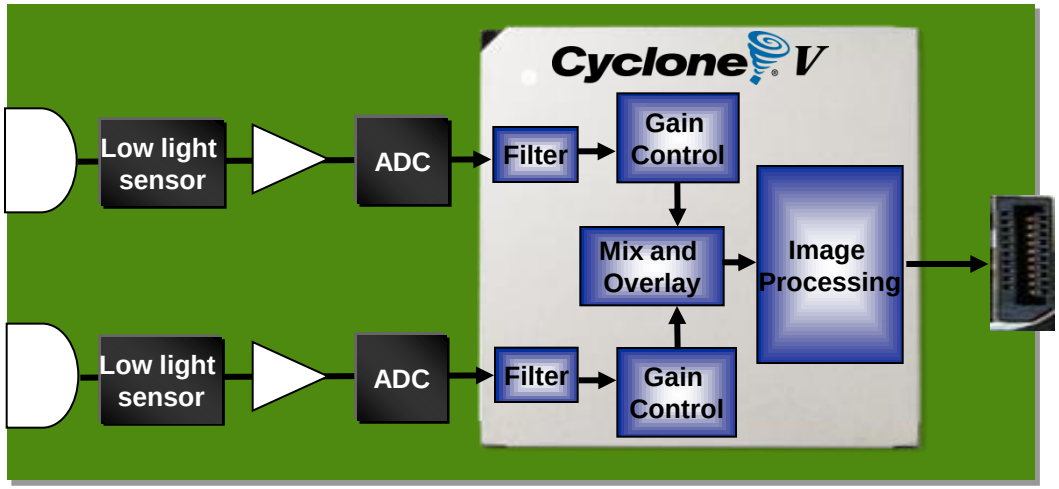


Cyclone V FPGAs: Optimized for Military Applications

- Designed to meet SWaP requirements
  - Extend battery life
    - Up to 40% lower total power from previous generations
  - Ability to operate in thermally constrained environments
  - Fewer support components
  - Compact packages

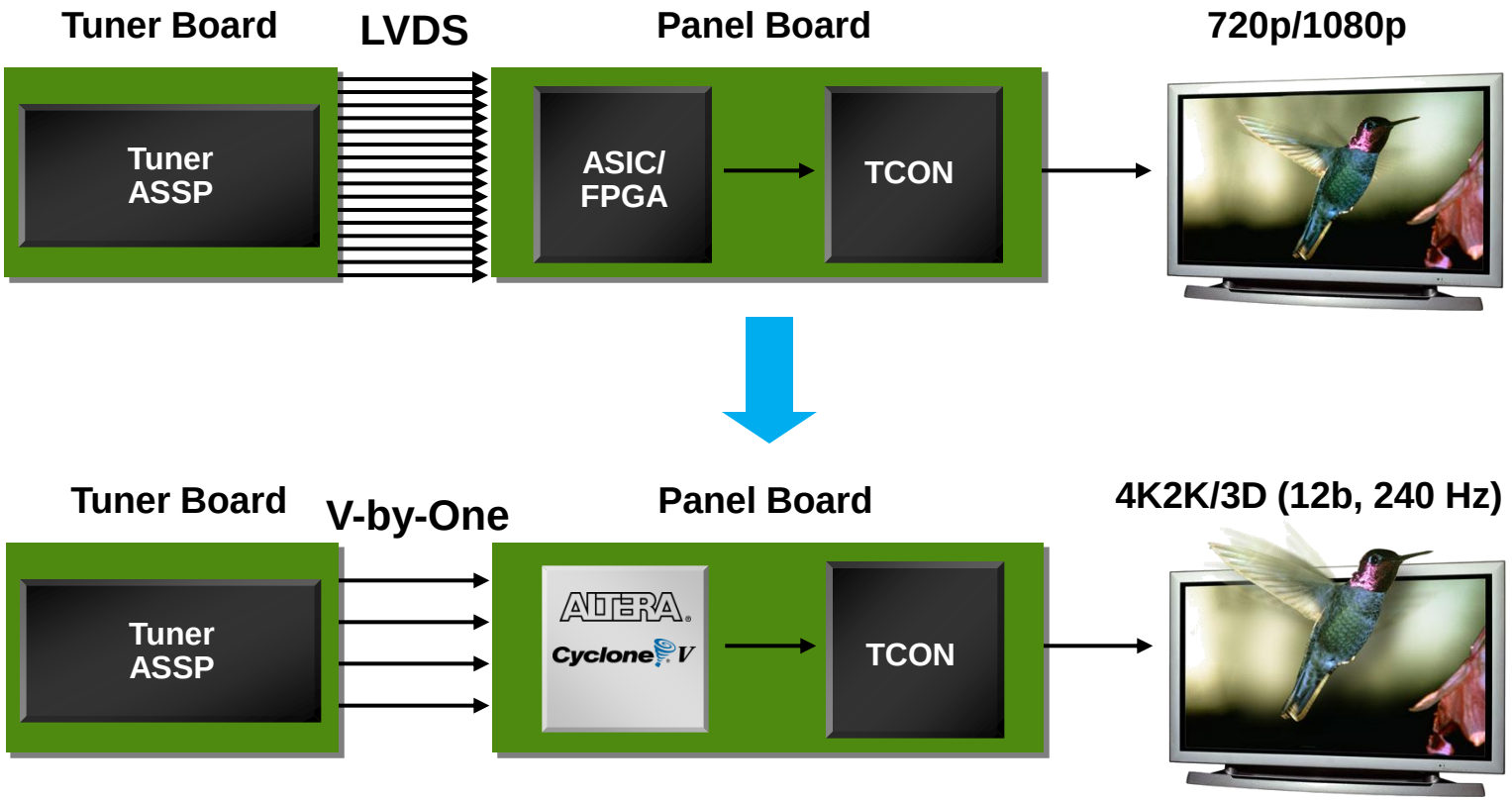
- Most comprehensive security suite in an FPGA
  - JTAG port protection
  - 256-bit volatile and non-volatile AES encryption
  - Error detection circuitry
  - Unique ID

Military: Night Vision Goggles



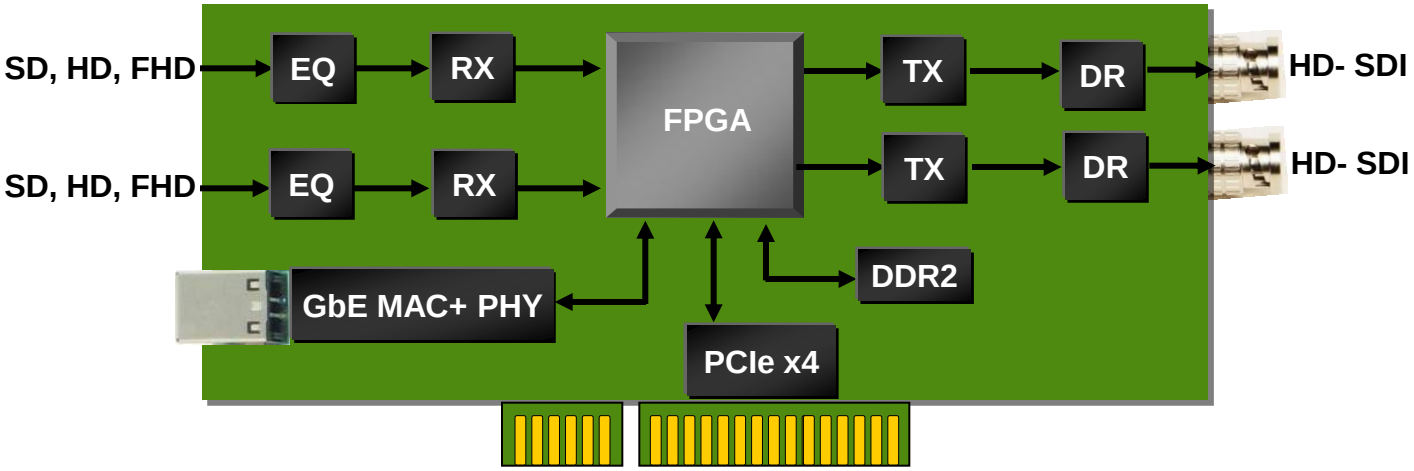
- Save power
  - Power down unused hard IP blocks
  - LPDDR2 support in hard memory controller
- Save cost
  - DSP blocks for efficient video processing
  - Fully tested and verified Video and Image Processing (IP) Suite allows you to focus on differentiating features

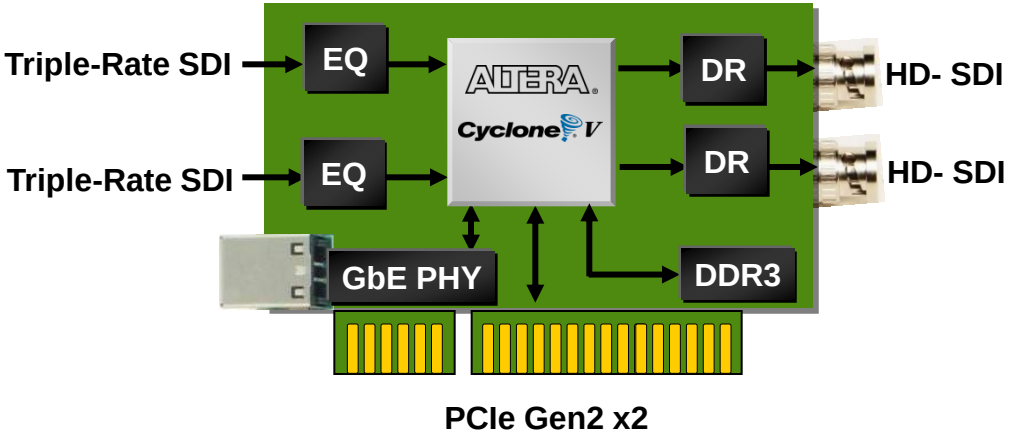
Consumer: Video Displays



Meet 3D Video Requirements Quickly and Within Power Budgets

Broadcast: Converter and Capture Box





Over 30% System Cost Savings and More Bandwidth