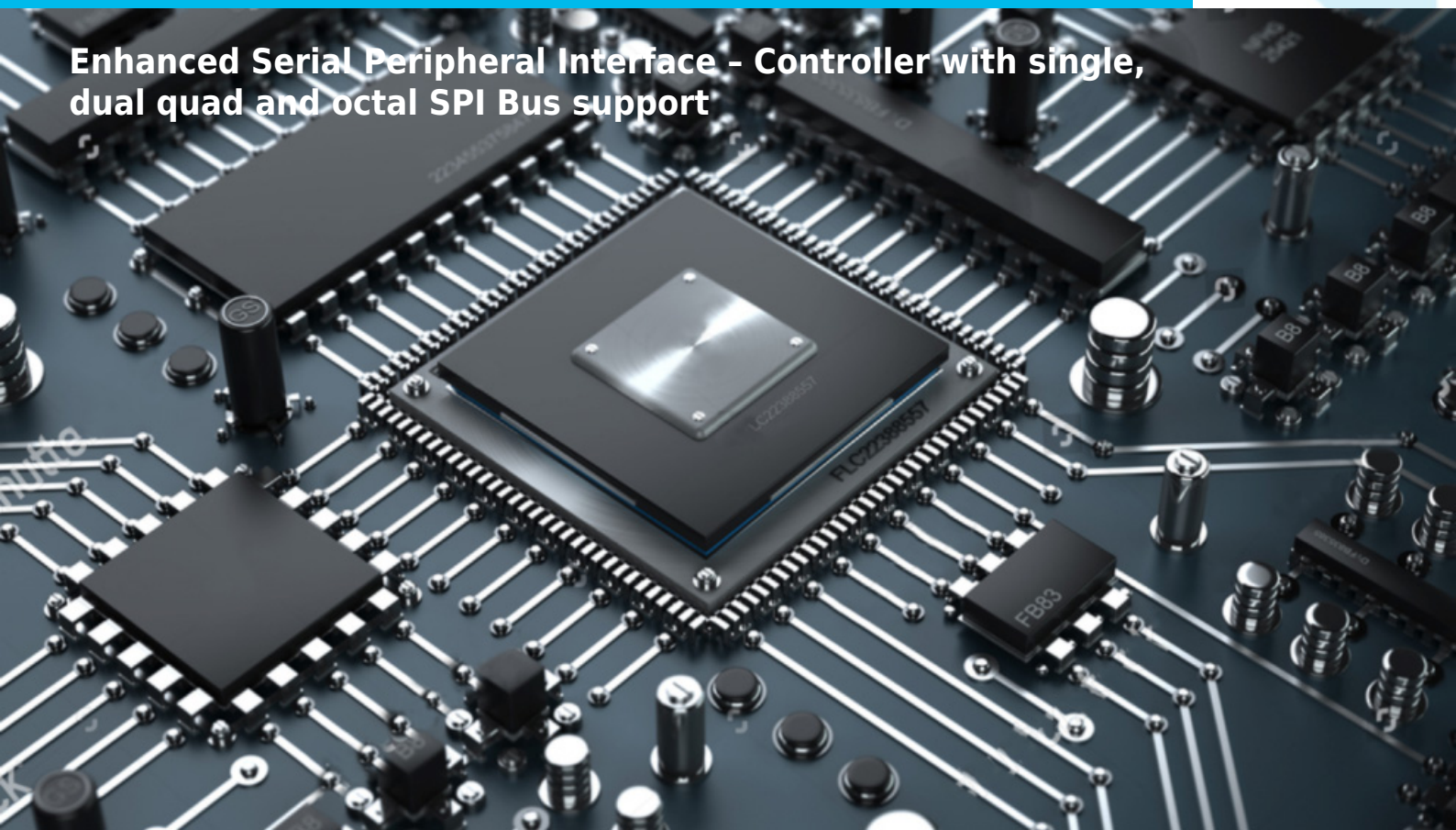
DIGITAL CORE DESIGN

# DESPI CONTROLLER IP

**Enhanced Serial Peripheral Interface – Controller with single, dual quad and octal SPI Bus support**



## COMPANY OVERVIEW

Digital Core Design is a leading IP Core provider and a System-on-Chip design house. The company was founded in 1999 and since the very beginning has been focused on IP Core architecture improvements. Our innovative, silicon proven solutions have been employed by over 300 customers and with more than 500 hundred licenses sold to companies like Intel, Siemens, Philips, General Electric, Sony and Toyota. Based on more than 70 different architectures, starting from serial interfaces to advanced microcontrollers and SoCs, we are designing solutions tailored to your needs.

## IP CORE OVERVIEW

### DESPI eSPI Controller IP Core – High-Speed, Fully Configurable eSPI Controller for FPGA and ASIC

The DESPI eSPI Controller IP Core is a fully configurable Enhanced Serial Peripheral Interface (eSPI) Controller, compliant with the eSPI Base Specification Revision 1.6. It is designed for high-performance embedded systems, enabling reliable, low-latency communication between host processors, microcontrollers, and eSPI-enabled peripheral devices, including Embedded Controllers (EC) in Intel-based platforms.

As a modern replacement for the legacy LPC (Low Pin Count) interface, the DESPI Controller IP delivers high-speed serial communication with support for single, dual, and quad SPI modes. With serial clock frequencies up to 66 MHz, it ensures efficient data transfer, reduced pin count, and improved system throughput in advanced SoC designs.

Its modular and scalable architecture allows seamless integration into FPGA and ASIC environments, making it suitable for a wide range of applications requiring robust eSPI host/controller functionality.

**Key Features**

- eSPI Controller IP compliant with eSPI Base Specification Rev. 1.6
- Configurable Controller mode for integration into complex SoC architectures (looking for an eSPI Target? here it is)
- High-speed SPI interface up to 66 MHz for low-latency communication
- Support for Single, Dual, and Quad SPI transfers to maximize bandwidth and performance
- Large, highly configurable shared memory buffer enables efficient and flexible frame and data storage to fit any needs.
- Customizable peripheral channels, including memory-mapped I/O, Virtual Wire signals, and event signaling
- Technology-agnostic RTL design compatible with all major FPGA and ASIC vendors
- Optimized for Intel-based systems and embedded controller communication

**Typical Applications**

- Host interface for Embedded Controllers (EC) in Intel CPU platforms
- FPGA and ASIC-based SoC designs requiring eSPI Master functionality
- High-speed data acquisition systems and industrial embedded platforms
- Multi-slave microcontroller systems with low-latency communication requirements
- Replacement of legacy LPC interfaces in modern hardware architectures

The DESPI eSPI Controller IP Core is fully customizable to meet specific system and integration requirements, making it a reliable solution for next-generation embedded systems, microcontrollers, and high-performance digital designs.

**ALL DCD'S IP CORES ARE TECHNOLOGY AGNOSTIC, ENSURING 100% COMPATIBILITY WITH ALL FPGA AND ASIC VENDORS.**

For further details, email info@dcd-semi.com.

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## DCD-SEMI SPI / eSPI IP Cores

| | DSPI | DQSPI | DOSPI | DFSPI | DOSPIS | DESPI-C | DESPI-T |
|---|---|---|---|---|---|---|---|
| SPI mode | SINGLE | SINGLE, DUAL, QUAD | SINGLE, DUAL, QUAD, OCTAL | SINGLE, DUAL, QUAD, OCTAL | SINGLE, DUAL, QUAD, OCTAL | SINGLE, DUAL, QUAD | SINGLE, DUAL, QUAD |
| Operation mode | Master only | Master only | Master only | Master only | Slave only | Master only | Slave only |
| Data rate | Low | Middle | High | High | High | Middle | Middle |
| Cost / complexity | Low | Middle | Middle | High | Middle | High | High |
| XIP support | Optional | Optional | Optional | Yes | No | No | No |
| DDR support | Yes | Yes | Yes | Yes | No | No | No |
| Standard supported | xSPI partially | xSPI partially | xSPI partially | xSPI, HyperBus, XCELLA | xSPI partially | Intel eSPI 1.6 | Intel eSPI 1.6 |
| Best option for | Memory controller, SPI peripheral controller i.e. sensors | Memory controller, SPI peripheral controller i.e. sensors | Memory controller, SPI peripheral controller i.e. sensors | Memory controller (Flash, DRAM, PSRAM, HyperRAM and other), program code execution | Serial bus to parallel bus bridge, RAM connection to SPI interface | PC motherboards | PC motherboards |

## KEY FEATURES

- Compliant with eSPI base specification as defined in Enhanced Serial Peripheral Interface (eSPI) Specification rev.1.6
  - Supports Master Mode
  - Supports Single, Dual and Quad modes
  - Supports TX and RX operation as per specs
  - Support for
    - Command Phase
    - Turn-Around Phase
    - Response Phase
  - Baud Rate selection
  - Slave Triggered Transactions
  - Power management Event
  - Interrupts and Alerts
  - In-band reset
  - Support for multiple channels
    - Peripheral channel
    - Virtual wire Channel
    - OOB Message (Tunneled SMBus) Channel
    - Run-time Flash Access Channel
  - Various Master/Slave errors detection
  - CRC Checking and generation
  - Simple interface allows easy connection to microcontrollers
  - Fully synthesizable, static synchronous design with no internal tri-states

## APPLICATIONS

- Embedded microprocessor boards
- Consumer and professional audio/video
- Home and automotive radio
- Low-power applications
- Communication systems
- Digital multimeters

## BLOCK DIAGRAM

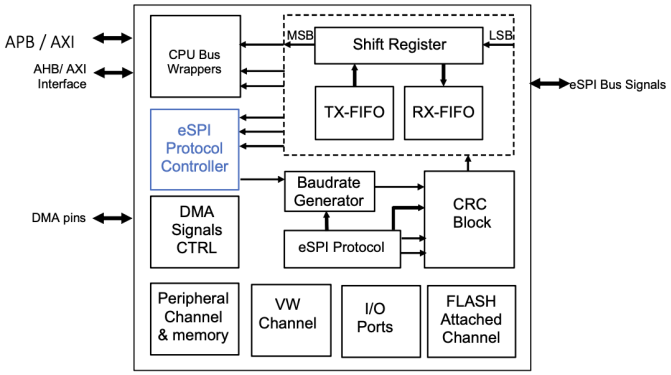


*Figure 4. DESPI Block Diagram*

## PERFORMANCE

For precise LATTICE performance insights, reach out to us at info@dcd.pl. Our dedicated team is ready to assist you with any inquiries.

## DELIVERABLES

- HDL Source Code
- Testbench environment
  - Automatic Simulation macros
  - Tests with reference responses
- Synthesis scripts
- Technical documentation
- 12 months of technical support

## LICENSING

Comprehensible and clearly defined licensing methods without royalty-per-chip fees make use of our IP Cores easy and simple.
***– Single-Site license option*** – dedicated to small and middle sized companies which run their business at one place.
***– Remote Access license option*** – allows authorized users to access and use the licensed product from a remote location.
In all cases the number of IP Core instantiations within a project and the number of manufactured chips are unlimited. There are no restrictions regarding the time of use.

The IP is delivered in HDL Source code suitable for ASIC and FPGA projects.

## CONTACT

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