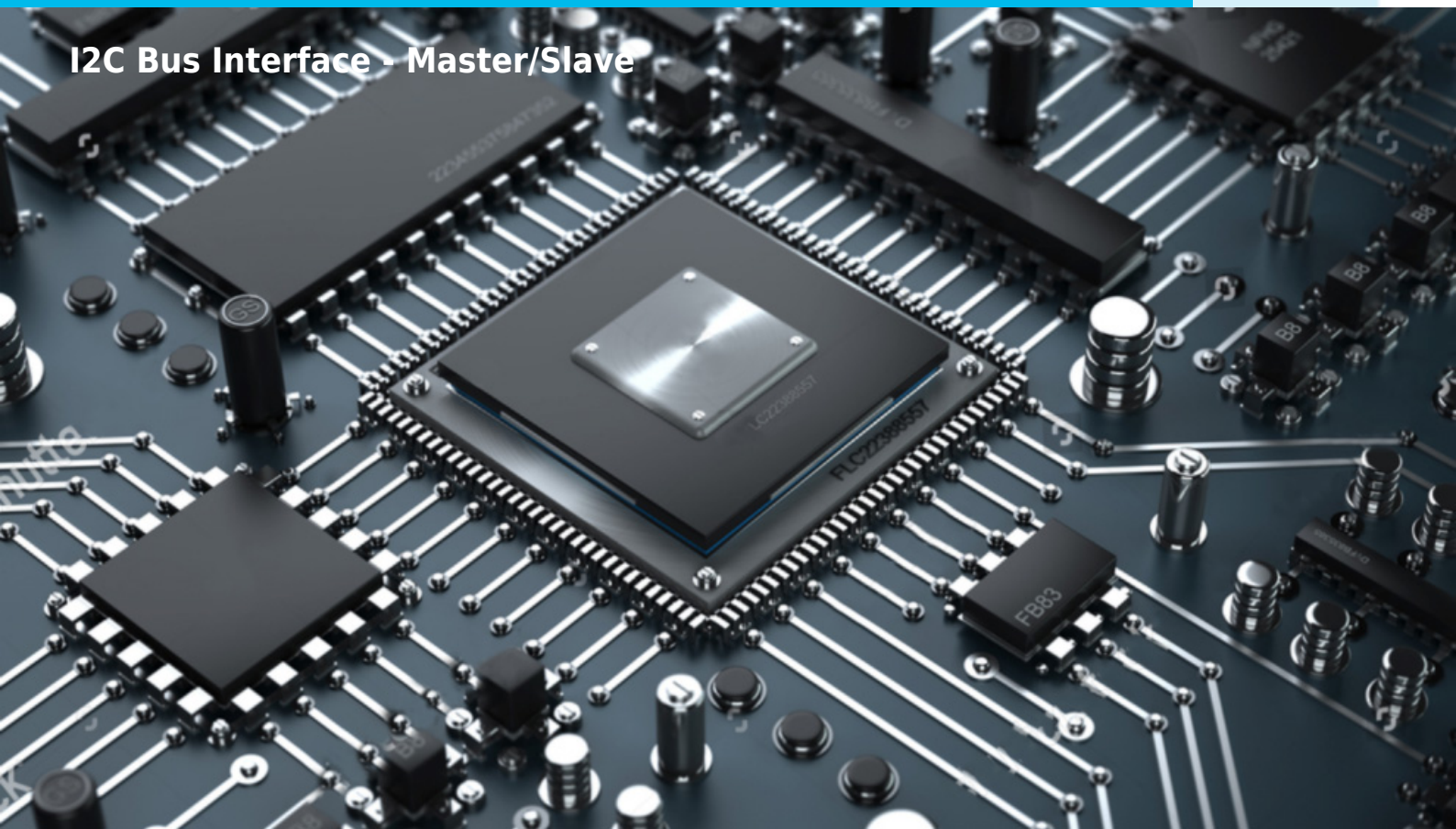


# DI2CMS



I2C Bus Interface - Master/Slave



## 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

The I2C is a two-wire, bi-directional serial bus, which provides a simple and efficient method of short distance data transmission between many devices. The DI2CMS core provides an interface between a microprocessor / microcontroller and I2C bus. It can work as:

- a master or
- slave transmitter/receiver

depending on a working mode determined by the microprocessor/microcontroller. The DI2CMS core **incorporates all features required by the latest I2C specification**, including clock synchronization, arbitration, multi-master systems and a high-speed transmission mode (the DI2CMS **supports all transmission speed modes**). **Built-in timer allows operation from wide range of clk frequencies**. The DI2CMS is **technology independent**, so either VHDL or VERILOG design can be implemented in variety of process technologies. Furthermore, it can be also completely customized in accordance to your needs. The DI2CMS is delivered with **fully automated test bench** and **complete set of tests**, allowing easy package validation at each stage of SoC design flow.

## KEY FEATURES

- Conforms to v.3.0 of the **I2C specification**
- Master mode
  - Master operation
    - Master transmitter
    - Master receiver
  - Support for all transmission speeds
    - Standard (up to 100 kb/s)
    - Fast (up to 400 kb/s)
    - Fast Plus (up to 1 Mb/s)
    - High Speed (up to 3,4 Mb/s)
  - Arbitration and clock synchronization
  - Support for multi-master systems
  - Support for both 7-bit and 10-bit addressing formats on the I2C bus
  - Build-in 8-bit timer for data transfers speed adjusting
- Slave mode
  - Slave operation

- Slave transmitter
- Slave receiver
- Supports 3 transmission speed modes
  - Standard (up to 100 kb/s)
  - Fast (up to 400 kb/s)
  - Fast Plus (up to 1 Mb/s)
  - High Speed (up to 3,4 Mb/s)
- Allows operation from a wide range of input clock frequencies
  - User-defined data setup time
- User-defined timing (data setup, start setup, start hold, etc.)
- Simple interface allows easy connection to microprocessor/microcontroller devices
- Interrupt generation
- **Available system interface wrappers:**
  - AMBA – APB Bus
  - Altera Avalon Bus
  - Xilinx OPB Bus
- Fully synthesizable
- Static synchronous design
- Positive edge clocking and no internal tri-states
- Scan test ready

## APPLICATIONS

- Embedded microprocessor boards
- Consumer and professional audio/video
- Home and automotive radio
- Low-power applications
- Communication systems
- Cost-effective reliable automotive systems

## UNITS SUMMARY

**CPU Interface** – Performs the interface functions between DI2CMS internal blocks and microprocessor. Allows easy connection between the core and a microprocessor / microcontroller system.

**Control Logic** – Manages execution of all commands sent via interface. Synchronizes internal data flow.

**Shift Register** – Controls SDA line, performs data and address shifts during the data transmission and reception.

**Control Register** – Contains five control bits, used for performing all types of I<sup>2</sup>C Bus transmissions.

**Status Register** – Contains seven status bits that indicate state of the I<sup>2</sup>C Bus and the DI2CMS core.

**Input Filter** – Performs spike filtering.

**Clock Control Logic** – Performs clock synchronization, clock generation in master mode and clock stretching in slave mode.

**Arbitration Logic** – Performs arbitration during operations in multi-master systems.

**Timer** – Allows operation from a wide range of the input frequencies. It is programmed by the user before transmission and can be reprogrammed to change the SCL frequency.

**CPU Interface** – Performs the interface functions between DI2CMS internal blocks and microprocessor. Allows easy connection between the core and a microprocessor/microcontroller system.

**Control Logic** - Manages execution of all commands sent via interface. Synchronizes internal data flow.

**Shift Register** - Controls SDA line, performs data and address shifts during the data transmission and reception.

**Control Register** - Contains five control bits, used for performing all types of I<sup>2</sup>C Bus transmissions.

**Status Register** - Contains seven status bits that indicate state of the I<sup>2</sup>C Bus and the DI2CMS core.

**Input Filter** - Performs spike filtering.

**Clock Control Logic** - Performs clock synchronization, clock generation in master mode and clock stretching in slave mode.

**Arbitration Logic** - Performs arbitration during operations in multi-master systems.

**Timer** - Allows operation from a wide range of the input frequencies. It is programmed by the user before transmission and can be reprogrammed to change the SCL frequency.

- Installation notes
- HDL core specification
- Datasheet
- Synthesis scripts
- Example application

• **Netlist**

- Netlist for selected FPGA family
- Sample FPGA project
- Technical documentation
  - HDL core specification
  - Datasheet

• **Technical support**

- IP Core implementation
- 3 months maintenance
  - Delivery of the IP Core and documentation updates
  - Phone & email support
  - Design consulting

## PERFORMANCE

The following table gives a survey about the Core area and performance in **INTEL FPGA®** devices after Place & Route (all key features included):

Device	Speed grade	LE/ALM	F <sub>max</sub>
STRATIX-II	-3	337	380 MHz
CYCOLNE-II	-6	354	263 MHz
MERCURY	-5	414	210 MHz
STRATIX	-5	370	254 MHz
CYCLONE	-6	370	220 MHz
APEX II	-7	394	192 MHz
APEX20KC	-7	394	150 MHz
APEX20KE	-1	394	120 MHz
APEX20K	-1	394	90 MHz
ACEX1K	-1	411	107 MHz
FLEX10KE	-1	411	107 MHz
MAX 2	-3	291	187 MHz
MAX 7000AE	-5	198	67 MHz
MAX 3000A	-7	198	49 MHz

## DELIVERABLES

- **Source code:**
  - VERILOG or VHDL Source Code
  - VERILOG or VHDL test bench environment
    - Active-HDL automatic simulation macros
    - ModelSim automatic simulation macros
    - Tests with reference responses
- Technical documentation

## 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.

- **Multi-Site license option** - dedicated to corporate customers which operate at several locations. The licensed product can be used at selected company branches.

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.

There are two formats of the delivered IP Core that you can choose from:

- VHDL or Verilog RTL synthesizable source code (called HDL Source code)

- FPGA EDIF/NGO/NGD/QXP/VQM (called Netlist)

HDL Source code is suitable for ASIC and FPGA projects. The Netlist license is intended for FPGA projects only.

## CONTACT

**Digital Core Design Headquarters:**

Wroclawska 94, 41-902 Bytom, POLAND

E-mail: info@dcd.pl

tel.: 0048 32 282 82 66

fax: 0048 32 282 74 37

**Distributors:**

Please check: dcd.pl/contact-us/