DI2CS

I2C Bus Interface - 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 DI2CS core provides an interface between a microprocessor / microcontroller and I2C bus. It can work as:

- a slave transmitter or
- slave receiver

depending on a working mode determined by the master device. The DI2CS core incorporates all features required by the latest I2C specification, including:

- clock synchronization,
- arbitration,
- high-speed transmission mode.

The DI2CS supports all 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)

DCD’s IP Core is a technology independent design and can be implemented in various process technologies.

KEY FEATURES

- Conforms to v.3.0 of the I2C specification
- 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
- Simple interface allows easy connection to microprocessor/microcontroller devices
- Interrupt generation
- User-defined data setup time
- Available system interface wrappers:
  - AMBA - APB Bus
  - Altera Avalon Bus

APPLICTIONS

- 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 DI2CS internal blocks and microprocessor. It allows easy connection of the core with the 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 I2C Bus transmissions.

Status Register - Contains seven status bits that indicate state of the I2C Bus and the DI2CS core.

Input Filter - Performs spike filtering.

Synchronization Logic - Performs DI2CS core synchronization.

Clock Stretching - Performs I2C SCL clock stretching when DI2CS core is not ready for next transmission.

PERFORMANCE

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

<table>
<thead>
<tr>
<th>Device</th>
<th>Speed grade</th>
<th>LE/ALM</th>
<th>F_max</th>
</tr>
</thead>
<tbody>
<tr>
<td>MERCURY</td>
<td>-5</td>
<td>170</td>
<td>250 MHz</td>
</tr>
<tr>
<td>STRATIX</td>
<td>-5</td>
<td>170</td>
<td>260 MHz</td>
</tr>
<tr>
<td>CYCLONE</td>
<td>-6</td>
<td>170</td>
<td>220 MHz</td>
</tr>
<tr>
<td>APEX II</td>
<td>-7</td>
<td>170</td>
<td>270 MHz</td>
</tr>
<tr>
<td>APEX20KC</td>
<td>-7</td>
<td>170</td>
<td>150 MHz</td>
</tr>
<tr>
<td>APEX20KE</td>
<td>-1</td>
<td>170</td>
<td>120 MHz</td>
</tr>
<tr>
<td>APEX20K</td>
<td>-1</td>
<td>170</td>
<td>90 MHz</td>
</tr>
<tr>
<td>ACEX1K</td>
<td>-1</td>
<td>170</td>
<td>107 MHz</td>
</tr>
<tr>
<td>FLEX10KE</td>
<td>-1</td>
<td>170</td>
<td>107 MHz</td>
</tr>
<tr>
<td>MAX 7000AE</td>
<td>-5</td>
<td>83</td>
<td>96 MHz</td>
</tr>
<tr>
<td>MAX 3000A</td>
<td>-5</td>
<td>83</td>
<td>104 MHz</td>
</tr>
</tbody>
</table>

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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**
  - 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, minor and major versions changes
    - Phone & email support

LICENSING

Transparent and clearly defined licensing methods without royalty-per-chip fees, make use of our IP Cores easy & simple.

- **Single-Site license option** - dedicated to small and middle sized companies, which run their business in one place.
- **Multi-Site license option** - dedicated to corporate customers who operate at several locations. The licensed product can be used in selected company branches.

In all cases the number of IP Core instantiations within a project and the number of manufactured chips are unlimited.

The license is royalty-per-chip free. There are no restrictions regarding the time of use.

There are two formats of the delivered IP Core:
- VHDL or Verilog RTL synthesizable HDL Source code
- FPGA EDIF/NGO/NGD/QXP/VQM Netlist

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