# Introduction

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| IP quick facts | |
| Supported device families | Zynq®-7000, 7 series |
| Supported user interfaces | Xilinx®: AXI4-Lite, AXI-Stream |
| **Provided with core** | |
| Design files | C++  VHDL/Verilog (generated) |
| Simulation model | HLS Cosimulation |
| Constraints file | XDC |
| Software driver | HLS Generated |
| **Tested design flows** | |
| Design entry | Vitis™ HLS 2021.1 |
| Synthesis | Vivado Synthesis 2021.1 |

This user guide describes the Digilent **AXI4-Stream Decimator** Intellectual Property. It takes an input streaming signal consisting of 32-bit samples over a slave AXI4-Stream interface, **decimates the signal by a factor** configured by the user and outputs on a master AXI4-Stream interface. It has an AXI4-Lite interface for control.

# Features

* Configurable **packet length** (for DMA integration)
* Configurable **decimation factor**
* Xilinx interfaces used: AXI4-Lite, AXI-Stream

# Designing with the core

The IP has been initially designed for a xc7z020clg400-1 target device with a target clock frequency of 125MHz (8.00 ns).

Decimation by a factor of N is done by **keeping only every Nth sample** up to **65535**.

The AXI4-Stream interfaces have their signals **registered**.

A **TLAST** signal is generated whenever the **number of samples sent** is equal to the **packet length** up to **32767**.

The **latency** of the IP is of 3 clock cycles.

## Customization

Changes to the target device and target clock frequency can be done from the project GUI after the project was generated or by modifying the **SOLUTION\_PART/SOLUTION\_CLKP**variables found inside the *run\_hls\_standalone.tcl* file and then generating the project, according to the steps found in [Generating the HLS Project](#_Generating_the_HLS).

# Register map

| Offset | Register Name | Description |
| --- | --- | --- |
| 0x00 | Control signals | bit 0 - ap\_start (Read/Write/COH)  bit 1 - ap\_done (Read/COR)  bit 2 - ap\_idle (Read)  bit 3 - ap\_ready (Read)  bit 7 - auto\_restart (Read/Write)  others - reserved |
| 0x04 | Global Interrupt Enable Register | bit 0 - Global Interrupt Enable (Read/Write) |
| 0x08 | IP Interrupt Enable Register (Read/Write) | bit 0 - Channel 0 (ap\_done)  bit 1 - Channel 1 (ap\_ready) |
| 0x0C | IP Interrupt Status Register (Read/TOW) | bit 0 - Channel 0 (ap\_done)  bit 1 - Channel 1 (ap\_ready) |
| 0x10 | Configuration Register | bit 31~16 – Decimation Factor (Read/Write)  bit 15~1 – Packet Length (Read/Write)  bit 0 – Decimation Internal Counter Reset  (Read/Write) |

// (SC = Self Clear, COR = Clear on Read, TOW = Toggle on Write, COH = Clear on Handshake)

**Bit 0** of the **control register**, **ap\_start**, kicks off the core from software. Writing 1 to this bit applies the decimation process to a **single sample**.

**To set the core in free running mode, bit 7 of this register, auto\_restart, must be set to 1.**

Details on the **0x00-0x0C registers** can be found in [Vitis High-Level Synthesis User Guide (UG1399)[1].](#_References)

# Generating the HLS Project

**Opening the IP** in HLS is possible by executing the following command in the Vitis HLS Command Prompt:

cd <path\_to\_IP>/hls\_proj

vitis\_hls -f run\_hls\_standalone.tcl

Besides creating the project, the script will also **synthesize** the design and **export** the IP as an archive.

The **source files** of the project can be found in the **src** directory.

The **generated project** will be found inside the **ws** directory.

# References

## <https://www.xilinx.com/support/documentation/sw_manuals/xilinx2021_1/ug1399-vitis-hls.pdf>