

# CSENT

## SENT/SAE J2716 Controller



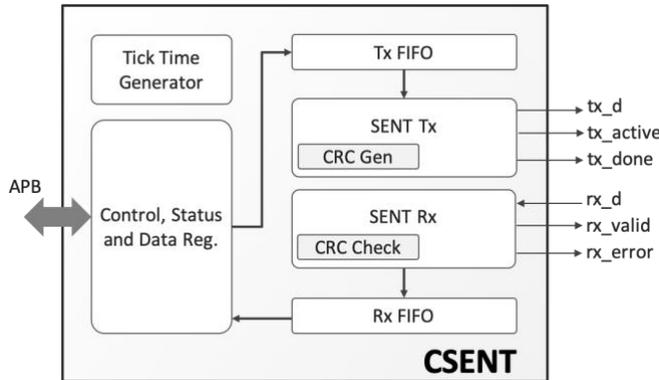
The CSENT core implements a controller for the Single Edge Nibble Transmission (SENT) protocol. It complies with the SAE J2716 standard and also the industry de-facto standard Short PWM Code

(SPC) protocol. It can be used for conveying data from one or multiple sensors to a centralized controller using a single SENT line.

The CSENT core can be configured as a Transmitter and/or as a Receiver, and therefore it is suitable for adding a SENT interface to devices transmitting sensor data or controllers receiving sensor data. It provides access to its control, status, and data registers 32-bit APB bus interface, a comprehensive set of interrupt signals facilitates

interrupt-based operation. The core allows for Transmitter operation without requiring any external programming or control. The reset values for all its control registers are defined at synthesis time, and at run time the system only needs to write sensor data to the core.

The CSENT core is designed with industry best practices. The core contains no latches or tri-states, and is fully synchronous with a single clock domain. The core is available in Verilog or as targeted FPGA netlist. Deliverables provide everything required for a successful implementation, including sample scripts, an extensive testbench, and comprehensive documentation.



### Applications

The CSENT core is suitable for designing low-cost digital automotive sensors and automotive controller units.

### Size and Performance

The following are sample Xilinx implementation results, which do not represent the highest and do not include the area for the implementation of the FIFOs.

Configuration	Target Technology	Area	Fmax
Tx and Rx no FIFO	Kintex7 / xc7k480t-3	781 Slice LUTs, 639 Slice Regs	361 MHz
Tx only no FIFO	Kintex7 / xc7k480t-3	430 Slice LUTs, 316 Slice Regs	358 MHz
Tx and Rx no FIFO	Artix7 / xc7a200t-3	773 Slice LUTs, 637 Slice Regs	246 MHz
Tx only no FIFO	Artix7 / xc7a200t-3	401 Slice LUTs, 316 Slice Regs	247 MHz
Tx and Rx no FIFO	Virtex7 / xc7vx330t-3	782 Slice LUTs, 637 Slice Regs	364 MHz
Tx only no FIFO	Virtex7 / xc7vx330t-3	430 Slice LUTs, 316 Slice Regs	379 MHz
Tx and Rx no FIFO	US Kintex / xcku035-3	766 CLB LUTs, 638 CLB Regs	460 MHz
Tx only no FIFO	US Kintex / xcku035-3	405 CLB LUTs, 316 CLB Regs	427 MHz
Tx and Rx no FIFO	US Virtex / xcvu095-3	798 CLB LUTs, 638 CLB Regs	472 MHz
Tx only no FIFO	US Virtex / xcvu095-3	407 CLB LUTs, 319 CLB Regs	446 MHz

### FEATURES

#### SENT/SAE J2716 Receiver & Transmitter

- Fast and Slow Channel Transmit or Receive
- CRC generation for Transmitter, and CRC checking for Receiver
- All types of SENT Frames
  - Programmable data length (4 to 24 bits) for Fast Channel Frames
  - Short (8-bit data) and Enhanced (12- or 16-bit data) Message Formats for Slow Channel
- Optional Pause Pulse with programmable length
- Supports inverted SENT protocol

#### Short PWM Code (SPC) Receiver & Transmitter

- Allows up to four sensors (transmitters) to use the same physical SENT connection
- Programmable master trigger pulse length

#### Ease of Integration

- 32-bit APB interface, and comprehensive set of interrupts
- Programmable 4-bit clock divider and high precision 16-bit clock pre-scale
- Receive and Transmit FIFO of configurable size for Fast Channel data
- Run-time programmable configuration registers
- Synthesis-time defined reset values for all registers, enables data transmit without control from host processor
- LINT-clean, single-clock domain, scan-ready design

#### Deliverables

- Targeted netlist
- Testbench
- Sample synthesis and simulation scripts
- Documentation

