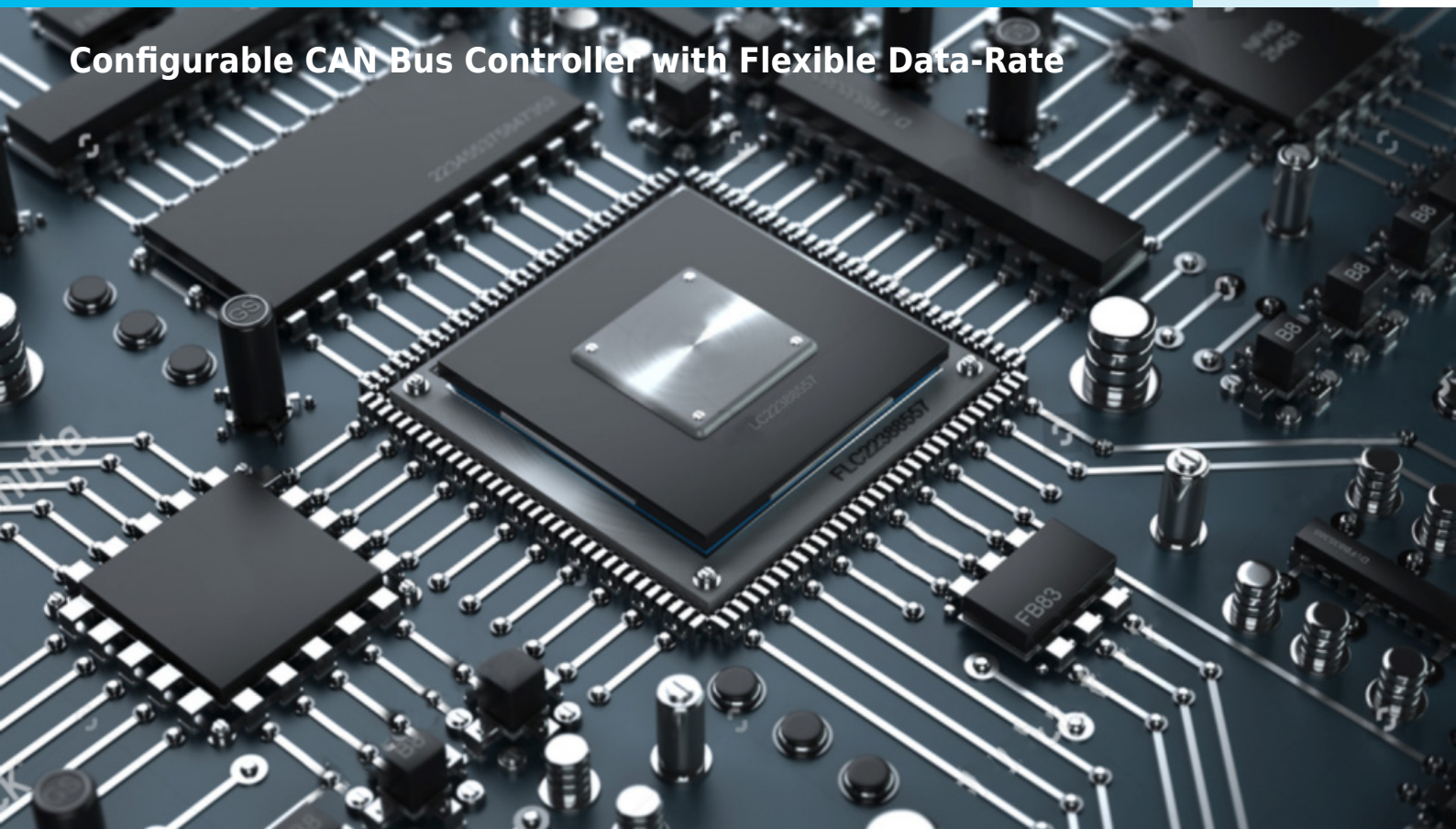




# CAN-ALL



Configurable CAN Bus Controller with Flexible Data-Rate



## COMPANY OVERVIEW

DCD-SEMI 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

**DCAN FD** bridge to APB, AHB, AXI bus, it is a standalone controller for the Controller Area Network (CAN), widely used in automotive and industrial applications. The DCAN FD was designed in accordance with **ISO 11898-1:2015** and conforms to:

- **Bosch CAN 2.0B** specification (2.0B Active) and
- **CAN FD** (flexible data-rate).

**Sophisticated error detection functions** (which increase communication reliability) and unique fault confinement (which guarantees network-wide data consistency) has decided about CAN's popularity. Because of its fundamental role in all aspects of security and safety, trustworthy implementations are crucial. That's why DCD-SEMI developed a unique IP Core, which **delimits the highest quality standards**. The improved **protocol overcomes standard CAN limits**: data can be transmitted faster than with 1 Mbit/s and the payload (data field) is up to 64 bytes long and limited to 8 bytes anymore. When only one node is transmitting, the bit rate can be increased, because no nodes need to be synchronized. Of course, before the transmission of the ACK slot bit, the nodes need to be re-synchronized. The core has a **simple CPU interface** (8/16/32 bit configurable data width), with a small or big-endian addressing scheme. Hardware message filtering (32 filters) and 128 bytes receive FIFO enable back-to-back message reception, with **minimum CPU load**. The DCAN FD is provided as HDL source code, allowing target use in FPGA and ASIC technologies.

**The IP core is available in two versions - Basic and Safety-Enhanced.**

This sophisticated solution's been developed as **ISO26262-10 Safety Element out of Context**. It can optionally be improved by necessary safety mechanisms and provide detailed safety documentation: all **ISO26262 soft IP SEooC** required work products, which include complete **Failure Modes Effects and Detection Analysis FMEDA** analysis with step by step instruction to help to integrate the IP into the customer's system and to conduct the system-level safety analysis. All the safety-related work products were checked by a third-party, independent audit.

The conducted safety analysis depicts, that the safety metrics

are fulfilled and both IPs reach the Automotive Safety Integrity Level ASIL-B (**Single Point Fault Metric SPFM > 90%**, **Latent Fault Metric LFM > 60%**). DCD-SEMI delivers a complete **FMEDA analysis** with step-by-step instruction to help to integrate the IP into the customer's system and to conduct the system-level safety analysis.

This **ASIL-B ready design** may easily be used in **Automotive Safety Systems at the ASIL-B level**, but DCD-SEMI may optionally deliver higher ASIL level ready IP. For further information and the optional features please contact our support.

**CAN FuSa white papers**

## KEY FEATURES

- Designed in accordance to **ISO 11898-1:2015**
- Supports **CAN 2.0B** and **CAN FD** frames
- Support up to 64 bytes data frames
- **Flexible data-rates supported**
- Supports emotas CANopen FD stack
- 8/16/32-bit CPU slave interface with small or big endianness
- Simple interface allows easy connection to CPU
- Supports both standard (11-bit identifier) and extended (29 bit identifier) frames
- **Data rate up to 8 Mbps**
- Hardware message filtering (dual/single filter)
- 128 byte receive FIFO and transmit buffer
- Overload frame is generated on FIFO overflow
- **Normal & Listen Only Mode**
- Transceiver Delay Compensation up to three data bit long
- Single Shot transmission
- Ability to abort transmission
- Readable error counters
- **Last Error Code**
- Fully synthesizable
- Static synchronous design with positive edge clocking and synchronous reset
- No internal tri-states
- Scan test ready
- **Available system interface wrappers:**
- **Available system interface wrappers:**
  - **AMBA - APB / AHB / AXI Lite Bus**
  - **Altera Avalon Bus**
  - **Xilinx OPB Bus**

## UNITS SUMMARY

**Interface Management Logic (IML)** - interprets commands from the CPU, provides interrupt and status indication.

**Bit Stream Processor (BSP)** - translates messages into frames and vice versa.

**Baud Rate Prescaler (BRP)** - defines the length of time quantum.

**Bit Timing Logic (BTL)** - processes the bit time, calculates position of the sample point and performs synchronization.

**Error Management Logic (EML)** - is responsible for fault confinement handling.

**Acceptance Filter (ACF)** - decides, whether incoming

messages are accepted or not, based on filter registers settings.

**TX/RX RAM interfaces** - interfaces to external dual port memories used by the DCAN core, to store received and transmitted frames.

## PERFORMANCE

The following table gives a survey about the Core area and performance in **XILINX®** devices after Place & Route:

Device	Speed grade	LUT	Memory bytes
KINTEX 7	-3	2 371	256
ARTIX 7	-3	2 373	256
SPARTAN 7	1	2 433	256
Zynq UltraScale+	1	2 365	256

Core performance in XILINX® devices with CAN FD option

Device	Speed grade	LUT	Memory bytes
KINTEX 7	-3	1 392	80
ARTIX 7	-3	1 393	80
SPARTAN 7	1	1 411	80
Zynq UltraScale+	1	1 417	80

Core performance in XILINX® devices without CAN FD option

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

- Datasheet
- **Technical support**
  - IP Core implementation
  - 12 months maintenance
    - Delivery of the IP Core and documentation updates
    - Phone & email support
    - Design consulting

## APPLICATIONS

- Automotive, industrial
- Embedded communication systems

## 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:

- Verilog or VHDL 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

### DCD-SEMI Headquarters:

Wroclawska 94, 41-902 Bytom, POLAND

E-mail: [info@dcd-semi.com](mailto:info@dcd-semi.com)

tel.: +48 32 282 82 66

fax: +48 32 282 74 37

### Distributors:

Please check: [dcd-semi.com/contact-us/](http://dcd-semi.com/contact-us/)