CAN-M.2/402-4-FD
M.2 Card with 4 CAN FD Interfaces

Single Lane M.2 PCIe Card with FPGA for 4x CAN FD
- 4 CAN FD interfaces with TTL level
- Bus mastering and local data management by FPGA
- Supports MSI (Message Signaled Interrupts)
- 2280, 2260 or 2242 form factor with B & M-Key
- Extended operating temperature range version available: -40°C … +85°C
- Cable for connecting up to 4 adapters included in the scope of delivery

Wide Range of OS Support and Advanced CAN Diagnostics
- Software drivers for Windows® and Linux® included
- Optional CAN layer 2 software drivers for real-time operating systems
- High resolution hardware timestamps

Adapter converts CAN-TTL Level Signals to CAN FD Signal Level
- Galvanic isolation of CAN interface
- Selectable CAN Termination
- DSUB9 connector
- The adapters are not scope of delivery and can be ordered as required

Hardware Designs
The CAN-M.2/402-2-FD is an M.2 Card, that features four CAN FD interfaces (TTL level).

CAN-M.2/402-4-FD with four adapters CAN-Mini/402-DSUB9-ISOL

The adapter cable is included in delivery. The card length can be easily reduced. The CAN-M.2/402-4-FD-T variant is designed for use in the extended temperature range.

Adapter with galvanic Isolation
The CAN interfaces can be connected individually via the adapters CAN-Mini/402-DSUB9-ISOL. The small adapter board is equipped with a galvanically isolated physical CAN interface according to ISO11898-2 a jumper for selectable on-board CAN termination and a DSUB9 connector.
The CAN FD interfaces are fully backwards compatible with CAN CC environments.

CAN Data Management
The independent CAN nets are controlled by the ISO 16845:2004 certified esdACC (esd Advanced CAN Core) implemented in the Intel FPGA. The FPGA supports bus

mastering (first-party DMA) to transfer data to the host memory. This results in a reduction of overall latency on servicing I/O transactions, in particular at higher data rates and a reduced host CPU load.
Due to the usage of MSI (Message Signaled Interrupts) the CAN-M.2/402-4-FD can be operated for example in Hypervisor environments. The CAN-M.2/402-4-FD provides high resolution 64-bit hardware timestamps for CAN messages.

Software Support
Windows and Linux (NTCAN-API)
The CAN layer 2 drivers for Windows and Linux are included in the scope of delivery.

Real-time OS (NTCAN-API)
The CAN layer 2 drivers for QNX®, RTX64®, VxWorks® and INtime® can be ordered separately. Others are available on request.
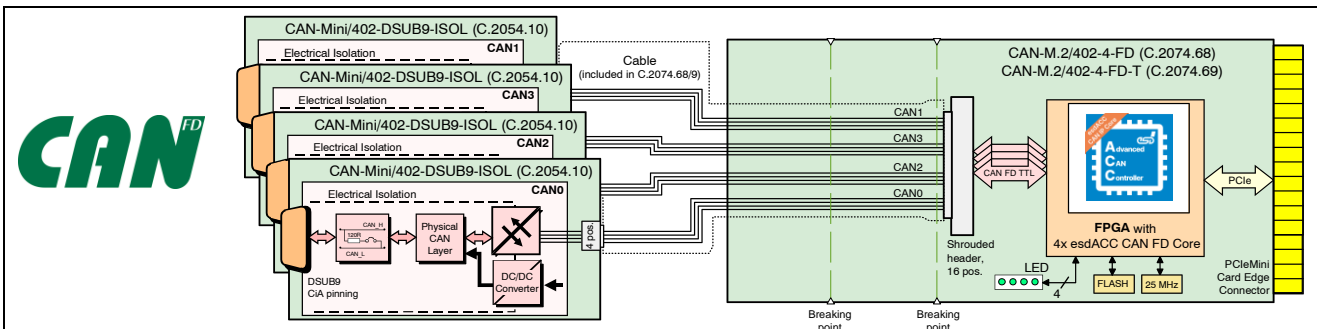
Higher Layer Protocols
(CAN Classic environment only)
Higher Layer Protocols are available for many operating systems (see order info):
- CANopen Master- and Slave-Stack
- J1939
- ARINC825

This product is under development. It will be available Q3 2024. All data specified here are preliminary and may be subject to change!

Technical Specifications:

M.2 Interface:

PCIe Port	PCI Express Spec. R1.1, Link width 1x
Form factor	2280, can be reduced to 2260 or 2242. The component heights on the PCB top side exceed the requirements of the PCI Express M.2 specification. The maximum component height is 2.24 mm instead of 1.5 mm

CAN:

Interface	4 CAN FD interfaces (TTL level), Bit rates up to 8 Mbit/s,
Controller	esdACC in FPGA, acc.to ISO 11898-1
Cable	1-to-4 adapter cable 150mm
Adapter	CAN-Mini/402-DSUB9-ISOL with galvanic isolation, physical CAN layer according to ISO 11898-2 and selectable CAN termination, order separately

General:

Power supply	3.3 V; I_{MAX} = 900 mA	
Ambient temperature	Standard range	0 °C … +70 °C (C.2074.68)
	Extended range	-40 °C … +85 °C (C.2074.69)
Rel. humidity	Max. 90 % (non-condensing)	
Dimensions	22 mm x 80 mm x 4.4 mm (Printed circuit board can be re-sized to 22 mm x 60 mm x 4.4 mm or 22 mm x 42 mm x 4.4 mm)	
Weight	Board: 5 g;	Adapter: each 10 g
Connectors	M.2:	B & M-Key connector
	CAN:	1x shrouded header,16-pos., (4x CAN FD, TTL level) via adapter to up to 4x 9-pin DSUB plugs (1x CAN FD)

Order Information:

Hardware

		Order No.
CAN-M.2/402-4-FD	CAN Interface Card for M.2, 4x CAN FD (TTL level), cable included	C.2074.68
CAN-M.2/402-4-FD-T	As C.2074.68, but for extended temperature range: -40 °C … +85	C.2074.69

Accessories

		Order No.
CAN-Mini/402-DSUB9-ISOL	Adapter to DSUB9 plug, 1xCAN FD, galvanically isolated	C.2054.10

Software Support[1]

CAN layer 2 drivers for Windows/Linux are included in delivery free of charge.

Additional CAN layer 2 object licences including CD-ROM:

		Order No.
CAN-DRV-LCD QNX	Object Licence for QNX6, QNX7	C.1101.32
CAN-DRV-LCD RTX	Object Licence for RTX64	C.1101.35
CAN-DRV-LCD VxWorks	Object Lic. for VxWorks 6.x and newer	C.1101.55
CAN-DRV-LCD Intime	Object Licence for INtime 6 und 7	C.1101.65

Higher CAN layer protocols including CD-ROM for Classical CAN:

		Order No.
CANopen-LCD Windows/Linux, QNX, RTX or VxWorks		C.1101.xx
J1939 stack for Windows or Linux		C.1130.xx
ARINC 825-LCD for Windows/Linux, QNX, RTX or VxWorks		C.1140.xx

1 For detailed information about driver availability for your operating system please contact our sales team.

CAN-M.2/402-4-FD
Driven by esdACC (Advanced CAN Core)

Basic Product Features:

- CAN ISO 11898-1:2015 protocol compatibility
- Tested and certified acc. to ISO CAN Conformance Tests "ISO 16845:2004 Road vehicles - Controller area network (CAN) - Conformance test plan"
- 11-bit and 29-bit CAN IDs
- Supported bit rates from 10 kbit/s up to 8 Mbit/s
- Receive buffer (64 CAN messages)
- Complete access to CAN error counters
- Programmable error warning limit
- Error code capture register
- Error interrupt for each CAN bus error
- Arbitration lost interrupt with detailed bit position
- Disable Automatic Retransmission (DAR) (Single-shot transmission)
- Listen only mode (no acknowledge, no active error flags)
- Automatic bit rate detection (hardware supported bit rate detection)
- Self-reception mode (reception of 'own' messages)
- Busload measurement

esdACC CAN IP Core

Advanced
CAN
Controller

Superior esdACC Features [1]:

- Operating system independently programmable via esd's NTCAN-API
- 32-bit register interface optimized for CAN needs
  - Easy to program
  - Transmission and reception of CAN frames with a minimum of register accesses
- RX and TX timestamping (64-bit wide, bit accurate, resolution may vary with input clock, in any case $\leq$ 62.5 ns, usually 12.5 ns)
  - Timestamping complies with the CiA 603 specification
  - On hardware with IRIG-B interfaces IRIG-B time is used for timestamping
- TX FIFO (16 CAN frames deep)
  - Providing the means to generate 100% busload even with non-real-time operating systems
  - Providing the means for real back-to-back transmission
- Timestamped Tx FIFO (16 CAN frames deep)
  - High priority
  - 64-bit timestamp
  - Bit time accuracy for CAN transmission
- Frame accurate abortion of transmissions with minimum delay
  - e.g. for driver timeouts
  - ISO11898-1:2015 conform
  - Aborted frames in FIFO won't be blocked by low priority TX

Superior esdACC Features (continued) [1]:

- Hardware timer to provide accurate software timeouts beyond operating system accuracy
- Bus mastering in RX direction takes the load off host CPU (needs bus master capable local bus to host interface)
- Optional different sources for timestamps (e.g. IRIG-B)
- Using FPGA technology provides the option to tailor any feature to any customer's needs, including optional integration with customer's FPGA content
- The esdACC IP core has been verified on Xilinx[TM] Spartan[TM] and Altera® Cyclone® FPGAs.

[1] Availability of the Superior esdACC Features depends on the operating system. Please contact our sales team for further information.

For further information on the esdACC IP Core please contact our sales team.