PCAN-miniPCIe

CAN Interface for PCI Express Mini

User Manual

PEAK
System

Relevant products

Product name	Model	Part number
PCAN-miniPCIe Single Channel	One CAN channel, galvanic isolation for CAN connection	IPEH-003048
PCAN-miniPCIe Dual Channel	Two CAN channels, galvanic isolation for CAN connections	IPEH-003049

The cover picture shows the product PCAN-miniPCIe Dual Channel. The Single Channel model has an identical form factor but varies in equipment.

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Contents

1 Introduction

The PCAN-miniPCIe card enables the connection of embedded PCs and laptops with PCI Express Mini slots to CAN networks. There is galvanic isolation of up to 300 Volts between the computer and CAN sides. The card is available as a single or dual channel version.

The package is also supplied with the CAN monitor PCAN-View for Windows and the programming interface PCAN-Basic.

Device drivers exist for different operating systems, so programs can easily access a connected CAN bus.

Tip: At the end of this manual (Appendix C) you can find a Quick Reference with brief information about the installation and operation of the PCAN-miniPCIe card.

1.1 Properties at a Glance

- CAN interface for the PCI Express Mini slot (uses PCIe lane)
- 1 or 2 High-speed CAN channels (ISO 11989-2)
- CAN bus connection via connection cable and D-Sub, 9-pin (in accordance with CiA® 303-1)
- Bit rates from 5 kbit/s up to 1 Mbit/s
- Compliant with CAN specifications 2.0A (11-bit ID) and 2.0B (29-bit ID)
- FPGA implementation of the CAN controller (SJA1000 compatible)
- NXP PCA82C251 CAN transceiver

- Galvanic isolation on the CAN connection up to 300 V, separate for each CAN channel
- Space-saving dimensions thanks to SMD technology
- Extended operating temperature range of -40 to 85 °C (-40 to 185 °F)

> **Note:** This manual describes the use of the PCAN-miniPCIe card with **Windows**. You can find device drivers for **Linux** and the corresponding application information on the provided DVD in the `Develop` directory branch and on our website under www.peak-system.com/linux.

1.2 System Requirements

- A vacant PCI Express Mini slot in the computer (specification 1.x)
- Operating system Windows 10, 8.1, 7 (32/64-bit) or Linux (32/64-bit)

1.3 Scope of Supply

- Plug-in card PCAN-miniPCIe
- Connection cable including D-Sub plug for each channel
- Device drivers for Windows 10, 8.1, 7 and Linux (32/64-bit)
- CAN monitor PCAN-View for Windows
- Programming interface PCAN-Basic for developing applications with CAN connection
- Programming interfaces for standardized protocols from the automotive sector
- Manual in PDF format

2 Installing the Software and the Card

This chapter covers the software setup for the PCAN-miniPCIe card in Windows and the installation of the card in the computer.

Setup the driver <u>before</u> installing the PCAN-miniPCIe card.

▶ Do the following to install the driver:

1. Start `Intro.exe` from the supplied DVD.

   The navigation program starts.

2. In the main menu, select **Drivers** and click on **Install now**.

3. Confirm the message of the User Account Control related to "Installer database of PEAK Drivers".

   The driver setup starts.

4. Follow the program instructions.

▶ Do the following to install the card:

⚠ **Attention!** Electrostatic discharge (ESD) can damage or destroy components on the card. Take precautions to avoid ESD.

1. Shut down the computer.

2. Disconnect the computer's power supply.

3. Open the computer case.

4. Insert the PCAN-miniPCIe card into an empty PCI Express Mini slot.

5. For each CAN channel, mount a D-Sub connector with connection circuit board into a respective hole of the computer casing.

6. For each CAN channel interconnect a D-Sub connector and the corresponding port on the PCAN-miniPCIe card.

7. Close the computer case.

8. Reconnect the power supply of the computer.

9. Turn on the computer and start Windows.

Windows detects the new hardware and completes the driver installation.

▶ Do the following to check the operational readiness:

1. Open the Windows Start menu.

2. Type `peakcpl` and press Enter .

The information window for PEAK hardware appears. The plug-in card must be displayed in the table on the **CAN Hardware** tab.

3 Connecting the CAN Bus

3.1 Connection over D-Sub Connector

A High-speed CAN bus (ISO 11898-2) is connected to the 9-pin D-Sub connector. The pin assignment for CAN corresponds to the specification CiA® 303-1.
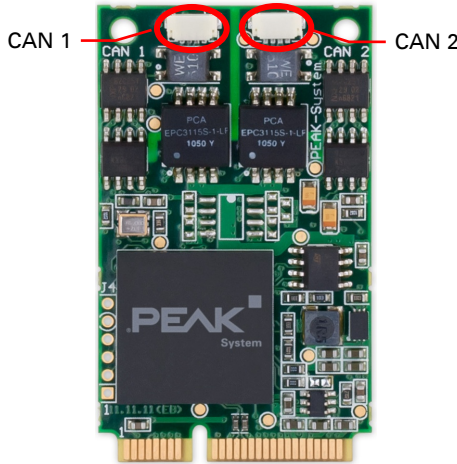

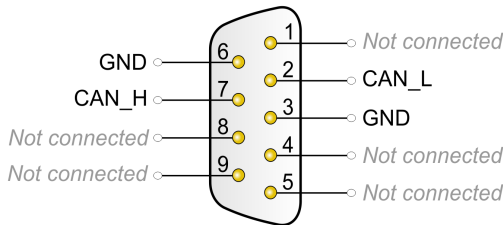Figure 1: Positions of the CAN ports on the PCAN-miniPCIe card

Figure 2: Pin assignment High-speed CAN
(view onto a D-Sub connector)
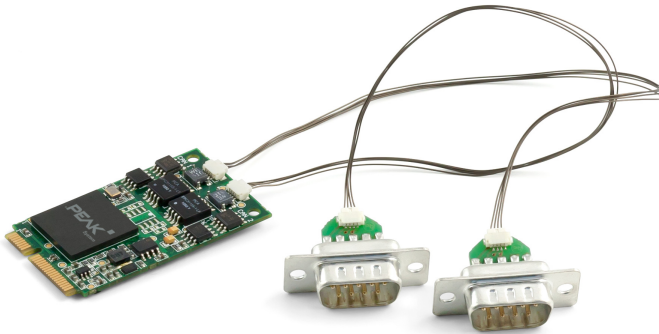
Figure 3: PCAN-miniPCIe card with connection cables

To connect a CAN bus to the PCAN-miniPCIe card, use the supplied special connection cables. After you've plugged in the cable on the card, you can connect a CAN bus to the D-sub socket.

The pin assignment between the D-Sub port and the 4-pin connector[1] on the PCAN-miniPCIe card is as follows:
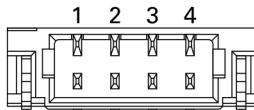
Figure 4: Front view of a CAN connector (SUR)
on the PCAN-miniPCIe card (CAN 1, CAN 2)

Pin SUR	Function	Pin D-Sub
1	Not used	1
2	GND	3, 6
3	CAN_H	7
4	CAN_L	2

[1] Connector type SUR from JST (www.jst-mfg.com),
name of the matching plug: 04SUR-32S

3.2   Cabling

3.2.1   Termination

A High-speed CAN bus (ISO 11898-2) must be terminated at both ends with 120 Ohms. Otherwise, there are interfering signal reflections and the transceivers of the connected CAN nodes (CAN interface, control unit) do not work.

The PCAN-miniPCIe card does not have an internal termination. Use the adapter on a terminated CAN bus.

3.2.2   Example of a Connection
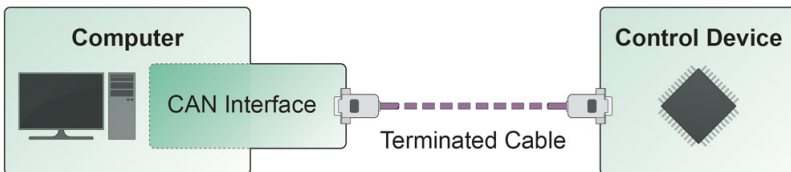
Figure 5: Simple CAN connection

This example shows a connection between the PCAN-miniPCIe card and a control unit. The connection cable is terminated with 120 ohms at both ends.

3.2.3   Maximum Bus Length

High-speed CAN networks have bit rates up to 1 Mbit/s. The maximum bus length primarily depends on the bit rate.

The following table shows different maximum possible CAN bus length with different bit rates:

Bit rate	Bus length
1 Mbit/s	40 m
500 kbit/s	110 m
250 kbit/s	240 m
125 kbit/s	500 m
50 kbit/s	1.3 km
20 kbit/s	3.3 km
10 kbit/s	6.6 km
5 kbit/s	13.0 km

The listed values have been calculated on the basis of an idealized system and can differ from reality.

4 Software and API

This chapter covers the provided software PCAN-View and the programming interface PCAN-Basic.

4.1   Monitor Software PCAN-View

PCAN-View is simple Windows software for viewing, transmitting, and logging CAN and CAN FD messages.

Note: This chapter describes the use of PCAN-View with a CAN adapter.

Figure 6: PCAN-View for Windows

▶ Do the following to start and initialize PCAN-View:

1. Open the Windows Start menu and select **PCAN-View**.

   The **Connect** dialog box appears.
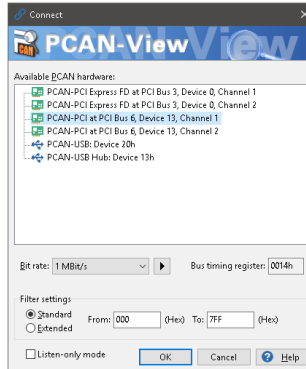
Figure 7: Selection of the specific hardware and parameters

2. Select an interface from the list.

3. From the drop-down list, select the **Bit rate** that is used by all nodes on the CAN bus.

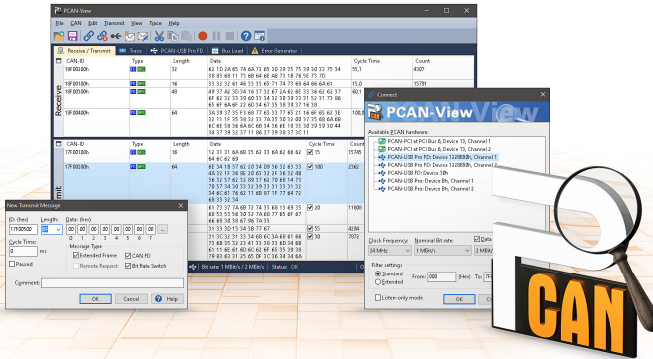**Tip**: Create custom bit rates by using the arrow button (▶).

4. Under **Filter settings** you can limit the range of CAN IDs to be received, either for standard frames (11-bit IDs) or for extended frames (29-bit IDs).

5. Activate the **Listen-only mode** if you do not actively participate in the CAN traffic and just want to observe. This also avoids an unintended disruption of an unknown CAN environment (e.g. due to different bit rates).

6. Confirm the settings in the dialog box with **OK**. The main window of PCAN-View appears (see Figure 8).

4.1.1   Receive/Transmit Tab
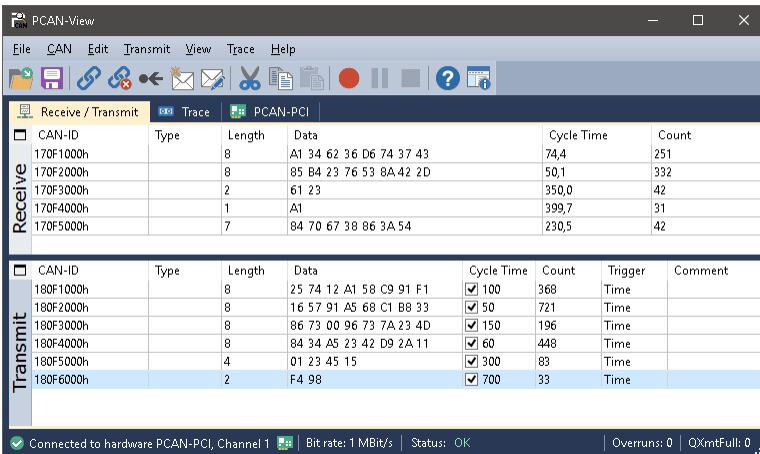
Figure 8: Receive/Transmit tab

The **Receive/Transmit** tab is the main element of PCAN-View. It contains two lists, one for received messages and one for the transmit messages. The CAN data format is hexadecimal by default.

▶ Do the following to transmit a CAN message with PCAN-View:

1. Select the menu command **Transmit** > **New Message** (alternatively ✉ or Ins).

    The **New Transmit Message** dialog box appears.
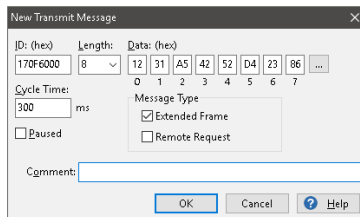
Figure 9: Dialog box New transmit message

2. Enter the **ID**, the data **Length,** and the CAN message **Data**.

Note: With the program version 4 of PCAN-View, the DLC field was renamed to **Length**. Latter reflects the actual data length.

3. Enter a value into the **Cycle Time** field to choose manually or periodically message transmission. Enter a value greater than 0 to transmit periodically. Enter the value 0 to transmit only manually.

4. Confirm the entries with **OK**.

   The created transmit message appears on the **Receive/Transmit** tab.

5. Trigger selected transmit messages manually with the menu command **Transmit** > **Send** (alternatively Space bar). The manual transmission for CAN messages being transmitted periodically is carried out additionally.

Tip: Under the menu command **File > Save,** you can save the current transmit messages into a transmit list. Saved transmit lists are available for reuse.

4.1.2 Trace Tab
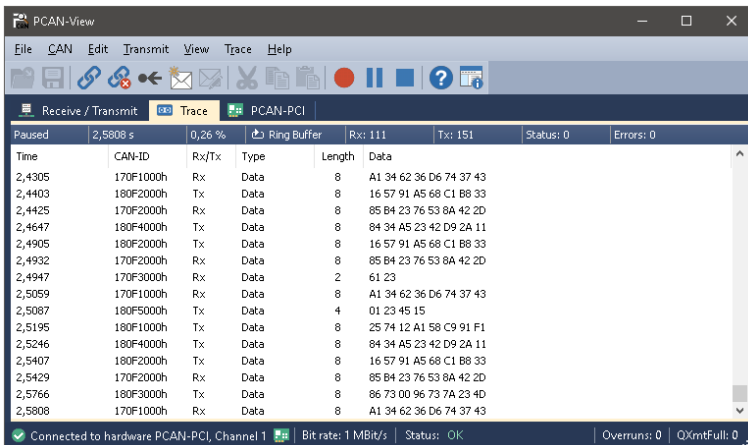
Figure 10: Trace tab

On the **Trace** tab, the data tracer (data logger) of PCAN-View is used for logging the communication on a CAN bus. During this process the messages are cached in the working memory of the PC. Afterwards they can be saved to a file.

The Tracer runs either in linear or in ring buffer mode. The linear buffer mode stops the Tracer as soon as the buffer is full. The ring buffer mode overwrites the oldest messages by new ones as soon as the buffer is full.

4.1.3   PCAN-miniPCIe Tab
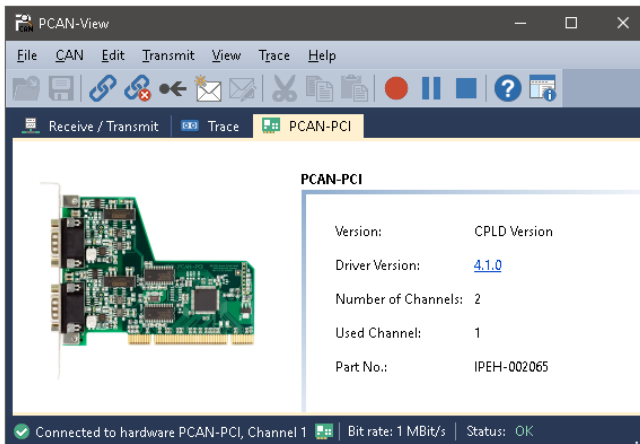
Figure 11: PCAN-PCI tab (example)

The **PCAN-miniPCIe** tab contains some detailed information about the hardware and driver.

4.1.4   Status Bar

Figure 12: Example of the status bar

The status bar shows information about the current CAN connection, about error counters (Overruns, QXmtFull) and shows error messages.

You can find further information about the use of PCAN-View in the help which you can invoke in the program via the **Help** menu or with the F1 key.

4.2   Linking Own Programs with PCAN-Basic
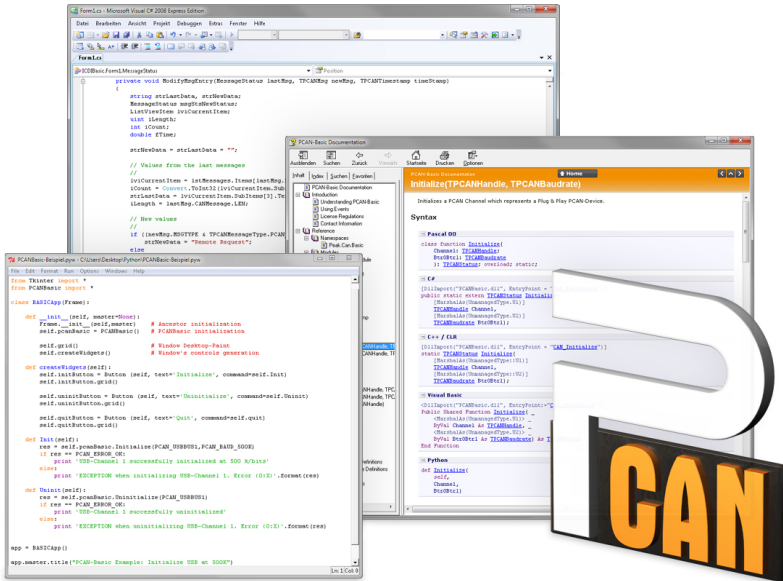
Figure 13: PCAN-Basic

On the provided DVD, you can find files of the PCAN-Basic programming interface in the directory branch `Develop`. This API provides basic functions for linking own programs to CAN and CAN FD interfaces by PEAK-System and can be used for the following operating systems:

- Windows 10, 8.1, 7 (32/64-bit)

- Windows CE 6.x (x86/ARMv4)

- Linux (32/64-bit)

The API is designed for cross-platform use. Therefore, software projects can easily ported between platforms with low efforts. For all common programming languages examples are available.

Beginning with version 4, PCAN-Basic supports the new CAN FD standard (CAN with Flexible Data Rate) which is primarily characterized by higher bandwidth for data transfer.

4.2.1   Features of PCAN-Basic

- API for developing applications with CAN and CAN FD connection

- Access to the CAN channels of a PCAN-Gateway via the new PCAN-LAN device type

- Supports the operating systems Windows 10, 8.1, 7 (32/64-bit), Windows CE 6.x, and Linux (32/64-bit)

- Multiple PEAK-System applications and your own can be operated on a physical channel at the same time

- Use of a single DLL for all supported hardware types

- Use of up to 16 channels for each hardware unit (depending on the PEAK CAN interface used)

- Simple switching between channels of a PEAK CAN interface

- Driver-internal buffer for 32,768 messages per CAN channel

- Precision of time stamps on received messages up to 1 µs (depending on the PEAK CAN interface used)

- Supports PEAK-System's trace formats version 1.1 and 2.0 (for CAN FD applications)

- Access to specific hardware parameters, such as listen-only mode

- Notification of the application through Windows events when a message is received

- Extended system for debugging operations

- Multilingual debugging output

- Output language depends on operating system

- Debugging information can be defined individually

- Thread-safe AP

> **Tip**: An overview of the API functions is located in the header files. You can find detailed information about the PCAN-Basic API on the provided DVD in the text and help files (file name extensions .txt and .chm).

4.2.2   Principle Description of the API

The PCAN-Basic API is the interface between the user application and device driver. In Windows operating systems this is a DLL (Dynamic Link Library).

The sequence of accessing the CAN interface is divided into three phases:

1. Initialization

2. Interaction

3. Completion

Initialization

A channel must be initialized before using it. This is done by the simple call of the function `CAN_Initialize` for CAN and `CAN_InitializeFD` for CAN FD. After a successful initialization the CAN channel is ready. No further configuration steps are required.

Interaction

For receiving and transmitting messages the functions `CAN_Read` and `CAN_Write` as well as `CAN_ReadFD` and `CAN_WriteFD` are available.

Additional settings can be made, e.g. setting up message filters to confine to specific CAN IDs or setting the CAN controller to listen-only mode.

When receiving CAN messages, events are used for an automatic notification of an application (client). This offers the following advantages:

- The application no longer needs to check for received messages periodically (no polling).

- The response time at reception is reduced.

Completion

To end the communication the function `CAN_Uninitialize` is called in order to release the reserved resources for the CAN channel, among others. In addition the CAN channel is marked as "Free" and is available to other applications.

4.2.3   Notes about the License

Device drivers, the interface DLL, and further files needed for linking are property of the PEAK-System Technik GmbH and may be used only in connection with a hardware component purchased from PEAK-System or one of its partners. If a CAN hardware component of third-party suppliers should be compatible to one of PEAK-System, then you are not allowed to use or to pass on the driver software of PEAK-System.

If a third-party supplier develops software based on the PCAN-Basic and problems occur during the use of this software, consult the software provider.

5 Technical Specifications

Connectors	
Computer	PCI Express Mini (uses PCIe lane, not USB), 52-pin; electromechanical specifications 1.1 and 1.2
CAN (via cable)	D-Sub (m), 9-pin, assignment according to specification CiA® 303-1
CAN (on card)	Connector type SUR from JST (www.jst-mfg.com), name of the matching plug: 04SUR-32S

CAN	
Specification	ISO 11898-2, High-speed CAN 2.0A (Standard format) and 2.0B (Extended format)
Bit rates	5 kbit/s - 1 Mbit/s
Controller	FPGA implementation (SJA1000 compatible)
Transceiver	NXP PCA82C251
Galvanic isolation	up to 300 V (separate for each CAN connector)
Internal termination	none

Power supply			
Supply voltage	1.5 V and 3.3 V		
Current consumption	Product version	at 1.5-V pin	at 3.3-V pin
	Single Channel	max.180 mA	max.230 mA
	Dual Channel	max. 180 mA	max. 330 mA

Measures	
Size	30 x 51 x 4 mm (W x L x H) See also dimension drawing in Appendix B on page 25.
Weight	Card: max. 7 g Cable + D-Sub: max. 16 g
Length connection cable (card - D-Sub)	20 cm, other cable lengths on request

Continued on the next page

Environment	
Operating temperature	-40 - 85 °C (-40 - 185 °F)
Temperature for storage and transport	-40 - 100 °C (-40 - 212 °F)
Relative humidity	15 - 90 %, not condensing
EMC	Directive 2014/30/EU DIN EN 55024:2016-05 DIN EN 55022:2011-12

Appendix A CE Certificate

PCAN-miniPCIe IPEH-003048/49 – EC Declaration of Conformity
PEAK-System Technik GmbH

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Notes on the CE Symbol C E

The following applies to the "PCAN-miniPCIe" product with the item number(s) IPEH-003048/49.

EU Directive This product fulfills the requirements of EU EMC Directive 2014/30/EU (Electromagnetic Compatibility) and is designed for the following fields of application as for the CE marking:

Electromagnetic Immunity
DIN EN 55024, publication date 2016-05
Information technology equipment – Immunity characteristics – Limits and methods of measurement (CISPR 24:2010 + Cor.:2011 + A1:2015);
German version EN 55024:2010 + A1:2015

Electromagnetic Emission
DIN EN 55022, publication date 2011-12
Information technology equipment – Radio disturbance characteristics – Limits and methods of measurement (CISPR 22:2008, modified);
German version EN 55022:2010

Declarations of Conformity In accordance with the above mentioned EU Directive, the EU declarations of conformity and the associated documentation are held at the disposal of the competent authorities at the address below:

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Signed this 23th day of January 2017
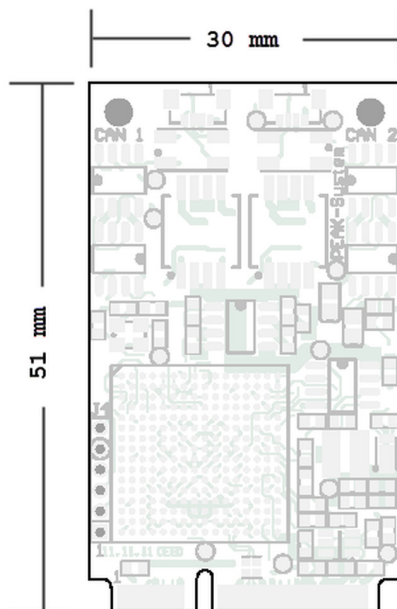
Appendix B Dimension Drawing

Figure 14: View PCAN-miniPCIe

The figure does not show the actual size of the product.

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Appendix C Quick Reference

Software/Hardware Installation under Windows

Install the driver from the supplied DVD, before you insert the plug-in card. Turn off the computer and insert the PCAN-miniPCIe into an available PCI Express Mini slot.

The new hardware is detected at the next Windows start and the driver is initialized. Check the operational readiness. Open the Windows Start menu. Type `peakcpl` and press Enter .
An information window for PEAK Hardware opens. The plug-in card must be displayed in the table on the **CAN Hardware** tab.

Getting Started under Windows

Run the CAN monitor PCAN-View from the Windows Start menu as a sample application for accessing the card. For initialization of the PCI Express Mini Card select the desired CAN channel and CAN bit rate.

High-speed CAN connector (D-Sub, 9 pins)

GND — 6
CAN_H — 7
Not connected — 8
Not connected — 9

1 — *Not connected*
2 — CAN_L
3 — GND
4 — *Not connected*
5 — *Not connected*