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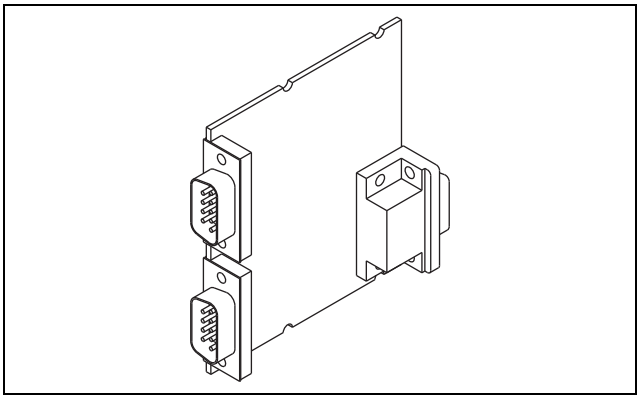
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OPERATING INSTRUCTIONS AND SPECIFICATIONS

NI 9853E

2-Port, High-Speed CAN Module



NATIONAL INSTRUMENTS

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This document describes how to use the National Instruments 9853E board and includes dimensions, pin assignments, and specifications for the NI 9853E. Visit `ni.com/info` and enter `rdsoftwareversion` to determine which software you need for the modules you are using. For information about installing, configuring, and programming the system, refer to the system documentation. Visit `ni.com/info` and enter `cseriesdoc` for information about C Series documentation.

Caution National Instruments makes no electromagnetic compatibility (EMC) or CE marking compliance claims for the NI 9853E. The end-product supplier is responsible for conformity to any and all compliance requirements.

Caution The NI 9853E must be installed inside a suitable enclosure prior to use. Hazardous voltages may be present.

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NI 9853E Dimensions

The following figure shows the dimensions of the NI 9853E.

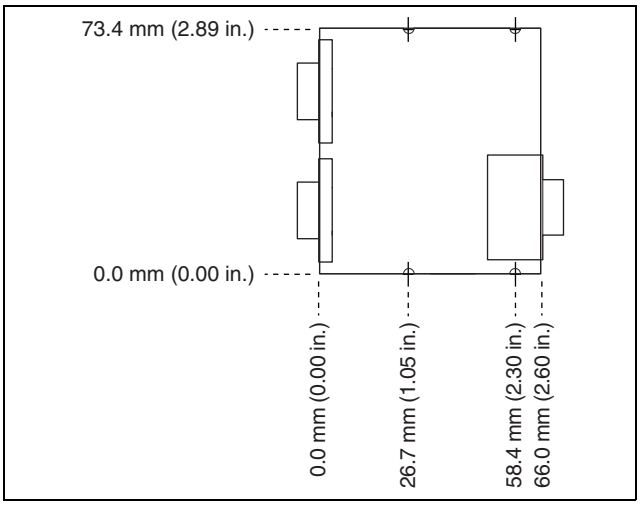


Figure 1. NI 9853E Dimensions in Millimeters (Inches)

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NI 9853E Hardware Overview

The NI 9853E has two full-featured, independent High-Speed CAN ports that are isolated from each other, and from the other modules in the system. Each port of the NI 9853E has a NXP SJA1000 CAN controller that is CAN 2.0B-compatible and fully supports both 11-bit and 29-bit identifiers. Each port also has a NXP TJA1041 High-Speed CAN transceiver that is fully compatible with the ISO 11898 standard and supports baud rates up to 1 Mbps.

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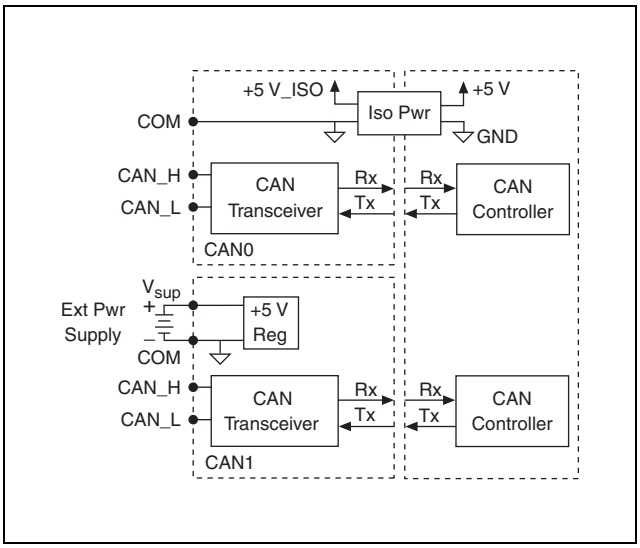


Figure 2. NI 9853E Hardware Overview

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Connecting the NI 9853E

The NI 9853E has two 9-pin male D-Sub connectors that provide connections to a CAN bus. Each port on the NI 9853E has pins for CAN_H and CAN_L, to which you connect the CAN bus signals. These signals should be connected using twisted-pair cable.

Each port has two common pins (COM) that are internally connected to the isolated reference of the module and serve as the reference ground for CAN_H and CAN_L. You can connect the CAN bus reference ground (sometimes referred to as CAN_V–) to one or both of the COM pins. Each port also has an optional shield pin, SHLD, that can be connected to a shielded CAN cable. Connecting SHLD may improve signal integrity and EMC performance in a noisy environment.

CAN0 of the NI 9853E is internally powered, and therefore requires no external power supply. CAN1 requires an external power supply of +8 to +25 V to operate. Supply power to the V_{SUP} pin of CAN1 from the CAN bus.

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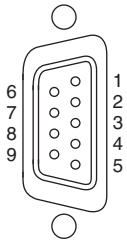
Note Although CAN0 of the NI 9853E does not require an external power supply to operate, it can be connected to a powered CAN bus without being damaged.

Pinouts for CAN0 and CAN1 of the NI 9853E are listed in Table 1 and Table 2.

Table 4 lists recommended termination resistor values.

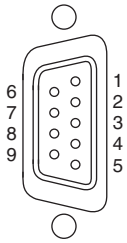
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Table 1. Pin Assignments for CAN0

Connector	Pin	Signal
	1	No Connection (NC)
	2	CAN_L
	3	COM
	4	NC
	5	SHLD
	6	COM
	7	CAN_H
	8	NC
	9	NC

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Table 2. Pin Assignments for CAN1

Connector	Pin	Signal
	1	No Connection (NC)
	2	CAN_L
	3	COM
	4	NC
	5	SHLD
	6	COM
	7	CAN_H
	8	NC
	9	V_{SUP}

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CAN Bus Topology and Termination

A CAN bus consists of two or more CAN nodes cabled together. The CAN_H and CAN_L pins of each node are connected to the main CAN bus cable through a short connection known as a “stub.” The pair of signal wires, CAN_H and CAN_L constitutes a transmission line. If the transmission line is not terminated, each signal change on the bus causes reflections that may cause communication errors. Because the CAN bus is bidirectional, both ends of the cable must be terminated. However, this requirement does not mean that every node on the bus should have a termination resistor—only the nodes at the end of the cable should have termination resistors.

Figure 3 shows a simplified diagram of a CAN bus with multiple CAN nodes, and proper termination resistor (R_t) locations.

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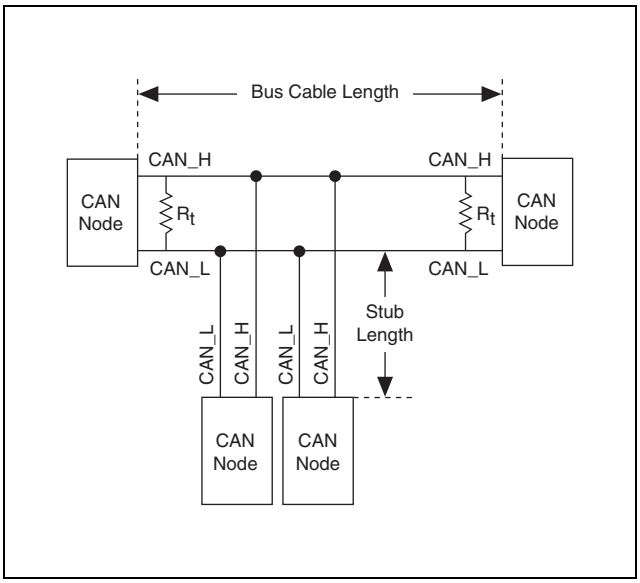


Figure 3. CAN Bus Topology and Termination Resistor Locations

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Connecting a CAN Bus to the NI 9853E

Each port of the NI 9853E can be connected to any location on a CAN bus. Figure 4 shows one example of the connection of CAN0 of the NI 9853E directly to one CAN node, and CAN1 directly to another CAN node. CAN1 requires an external power supply on the CAN bus.

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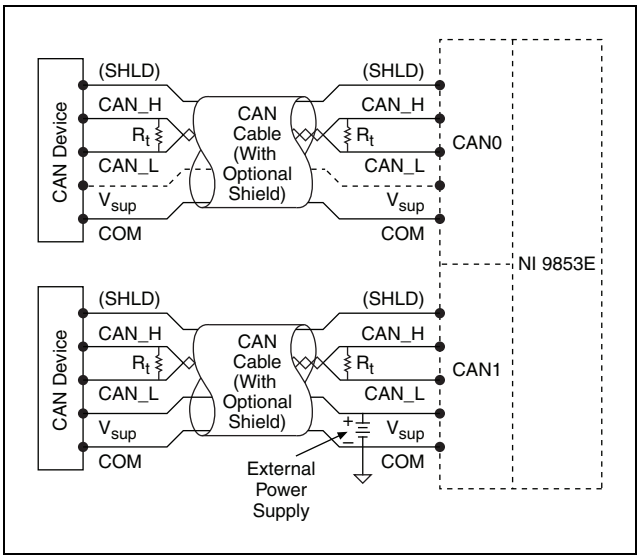


Figure 4. Connecting Both Ports of the NI 9853E to CAN Buses

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Cabling Requirements for NI 9853E

This section deals with cabling specifications, termination resistors, cable lengths, and the number of CAN nodes that can exist in a system.

Cable Specifications

Cables should meet the physical medium requirements specified in ISO 11898, shown in Table 3. Belden cable (3084A) meets all of those requirements, and should be suitable for most applications.

Table 3. ISO 11898 Specifications for Characteristics of a CAN_H and CAN_L Pair of Wires

Characteristic	Value
Impedance	95 Ω minimum, 120 Ω nominal, 140 Ω maximum
Length-related resistance	70 mΩ/m nominal
Specific line delay	5 ns/m nominal

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Termination Resistors

The termination resistors (R_t) should match the nominal impedance of the CAN cable, and therefore comply with the values in Table 4.

Table 4. Termination Resistor Specification

Characteristic	Value	Condition
Termination resistor, R_t	100 Ω min, 120 Ω nominal, 130 Ω max	Minimum power dissipation: 220 mW

Cable Lengths

The allowable cable length is affected by the characteristics of the cabling and the desired bit transmission rates. Detailed cable length recommendations can be found in the ISO 11898, CiA DS 102, and DeviceNet specifications.

ISO 11898 specifies 40 m total cable length with a maximum stub length of 0.3 m for a bit rate of 1 Mb/s. The ISO 11898 specification says that significantly longer cable lengths may be allowed at lower bit rates, but each node should be analyzed for signal integrity problems.

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Number of CAN Nodes

The maximum number of nodes depends on the electrical characteristics of the nodes on the network. If all of the nodes meet the requirements of ISO 11898, at least 30 nodes may be connected to the bus. Higher numbers of nodes may be connected if the electrical characteristics of the nodes do not degrade signal quality below ISO 11898 signal level specifications.

The electrical characteristics of the NI 9853E allow at least 110 CAN ports on a network.

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Sleep Mode

This module supports a low-power sleep mode. Support for sleep mode at the system level depends on the chassis that the module is plugged into. Refer to the chassis manual for information about support for sleep mode. If the chassis supports sleep mode, refer to the software help for information about enabling sleep mode. Visit `ni.com/info` and enter `cseriesdoc` for information about C Series documentation.

Typically, when a system is in sleep mode, you cannot communicate with the modules. In sleep mode, the system consumes minimal power and may dissipate less heat than it does in normal mode. Refer to the *Specifications* section for more information about power consumption and thermal dissipation.

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Specifications

The following specifications are typical for the range –40 to 85 °C internal to any enclosures unless otherwise noted.

High-Speed CAN Characteristics

Transceiver ..... NXP TJA1041

Max baud rate ..... 1 Mbps

CAN_H, CAN_L bus lines voltage ..... –27 to +40 VDC

Supply voltage range (V_{SUP})

- CAN0 ..... N/A
- CAN1 ..... +8 to +25 VDC

MTBF ..... 1,816,913 hours at 25 °C; Bellcore Issue 6, Method 1, Case 3, Limited Part Stress Method

Note Contact NI for Bellcore MTBF specifications at other temperatures or for MIL-HDBK-217F specifications.

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Power Requirements

Power consumption from chassis

- Active mode
  - Transmitting ..... 625 mW max
  - Receiving ..... 400 mW max
- Sleep mode ..... 25 µW max

Thermal dissipation (at 85 °C)

- Active mode ..... 1 W max
- Sleep mode ..... 250 mW max

Physical Characteristics

Use a dry, low-velocity stream of air to clean the module. If needed, use a soft-bristle brush for cleaning around components.

Note For two-dimensional drawings and three-dimensional models of the C Series module and connectors, visit `ni.com/dimensions` and search by module number.

Weight ..... Approx. 42 g (1.48 oz)

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Safety

Safety Voltages

Connect only voltages that are within the following limits.

Port-to-COM ..... –27 to +40 VDC max, Measurement Category I

Isolation

- Port-to-port
  - Continuous ..... 60 VDC, verified by a 5 s dielectric withstand test
  - Withstand ..... 500 V_{rms}, 5 s Measurement Category I, (Basic insulation)
- Port-to-earth ground
  - Continuous ..... 60 VDC, verified by a 5 s dielectric withstand test
  - Withstand ..... 500 V_{rms}, 5 s Measurement Category I, (Double insulation)

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Measurement Category I is for measurements performed on circuits not directly connected to the electrical distribution system referred to as *MAINS* voltage. MAINS is a hazardous live electrical supply system that powers equipment. This category is for measurements of voltages from specially protected secondary circuits. Such voltage measurements include signal levels, special equipment, limited-energy parts of equipment, circuits powered by regulated low-voltage sources, and electronics.

Caution Do *not* connect the NI 9853E to signals or use for measurements within Measurement Categories II, III, or IV.

Safety Standards

This product meets the requirements of the following standards of safety for electrical equipment for measurement, control, and laboratory use when installed in a suitable enclosure:

- IEC 61010-1, EN 61010-1
- UL 61010-1, CSA 61010-1

Note For UL and other safety certifications, refer to the product label or the *Online Product Certification* section.

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Online Product Certification

Refer to the product Declaration of Conformity (DoC) for additional regulatory compliance information. To obtain product certifications and the DoC for this product, visit `ni.com/certification`, search by module number or product line, and click the appropriate link in the Certification column.

Environmental

National Instruments C Series modules are intended for indoor use only but may be used outdoors if installed in a suitable enclosure. Refer to the manual for the chassis you are using for more information about meeting these specifications.

Operating temperature
(IEC 60068-2-1, IEC 60068-2-2) ..... –40 to 85 °C

Storage temperature
(IEC 60068-2-1, IEC 60068-2-2) ..... –40 to 85 °C

Operating humidity
(IEC 60068-2-56)..... 10 to 90% RH, noncondensing

Storage humidity
(IEC 60068-2-56)..... 5 to 95% RH, noncondensing

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Maximum altitude..... 2,000 m

Pollution Degree 2

Environmental Management

National Instruments is committed to designing and manufacturing products in an environmentally responsible manner. NI recognizes that eliminating certain hazardous substances from our products is beneficial to the environment and to NI customers.

For additional environmental information, refer to the *NI and the Environment* Web page at `ni.com/environment`. This page contains the environmental regulations and directives with which NI complies, as well as other environmental information not included in this document.

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The National Instruments Web site is your complete resource for technical support. At `ni.com/support` you have access to everything from troubleshooting and application development self-help resources to email and phone assistance from NI Application Engineers.

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