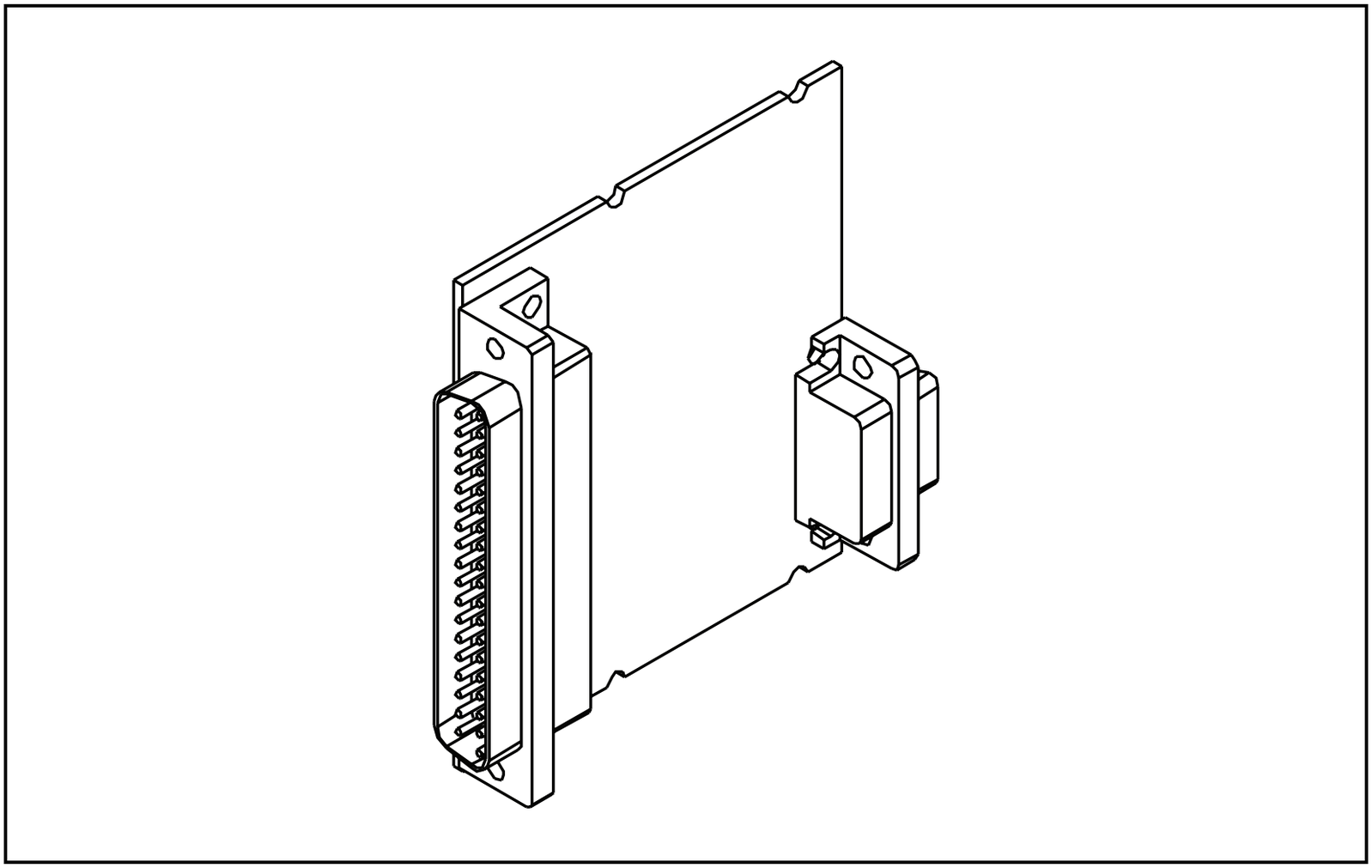
OPERATING INSTRUCTIONS AND SPECIFICATIONS

NI 9403E

32-Channel, TTL Digital Input/Output Module



NATIONAL INSTRUMENTS™

This document describes how to use the National Instruments 9403E and includes dimensions, pin assignments, and specifications for the NI 9403E. 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 9403E. The end-product supplier is responsible for conformity to any and all compliance requirements.

Caution The NI 9403E must be installed inside a suitable enclosure prior to use. Hazardous voltages may be present.

NI 9403E Dimensions

The following figure shows the dimensions of the NI 9403E.

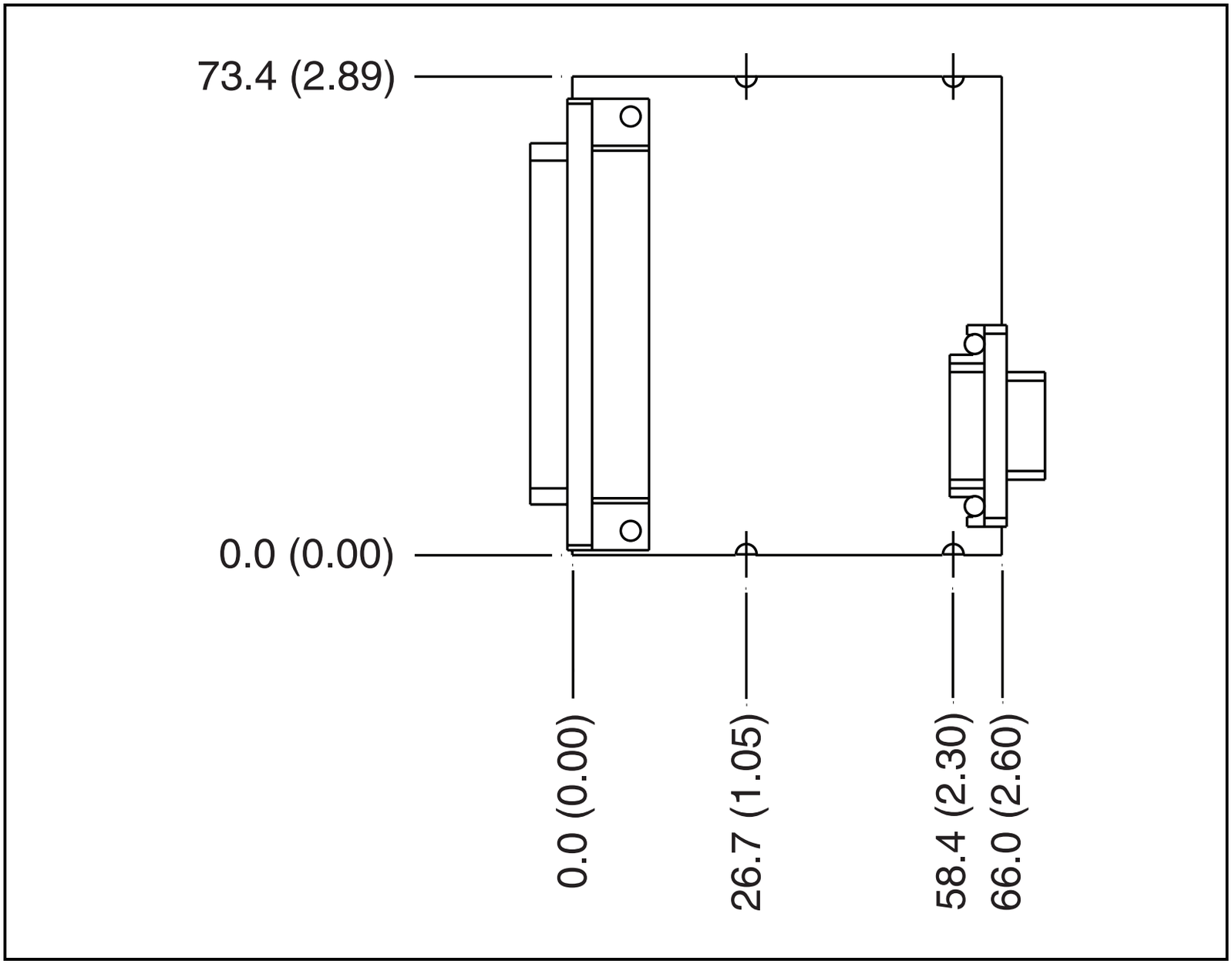


Figure 1. NI 9403E Dimensions in Millimeters (Inches)

Connecting the NI 9403E

The NI 9403E has a 37-pin DSUB connector that provides connections for the 32 digital input/output channels.

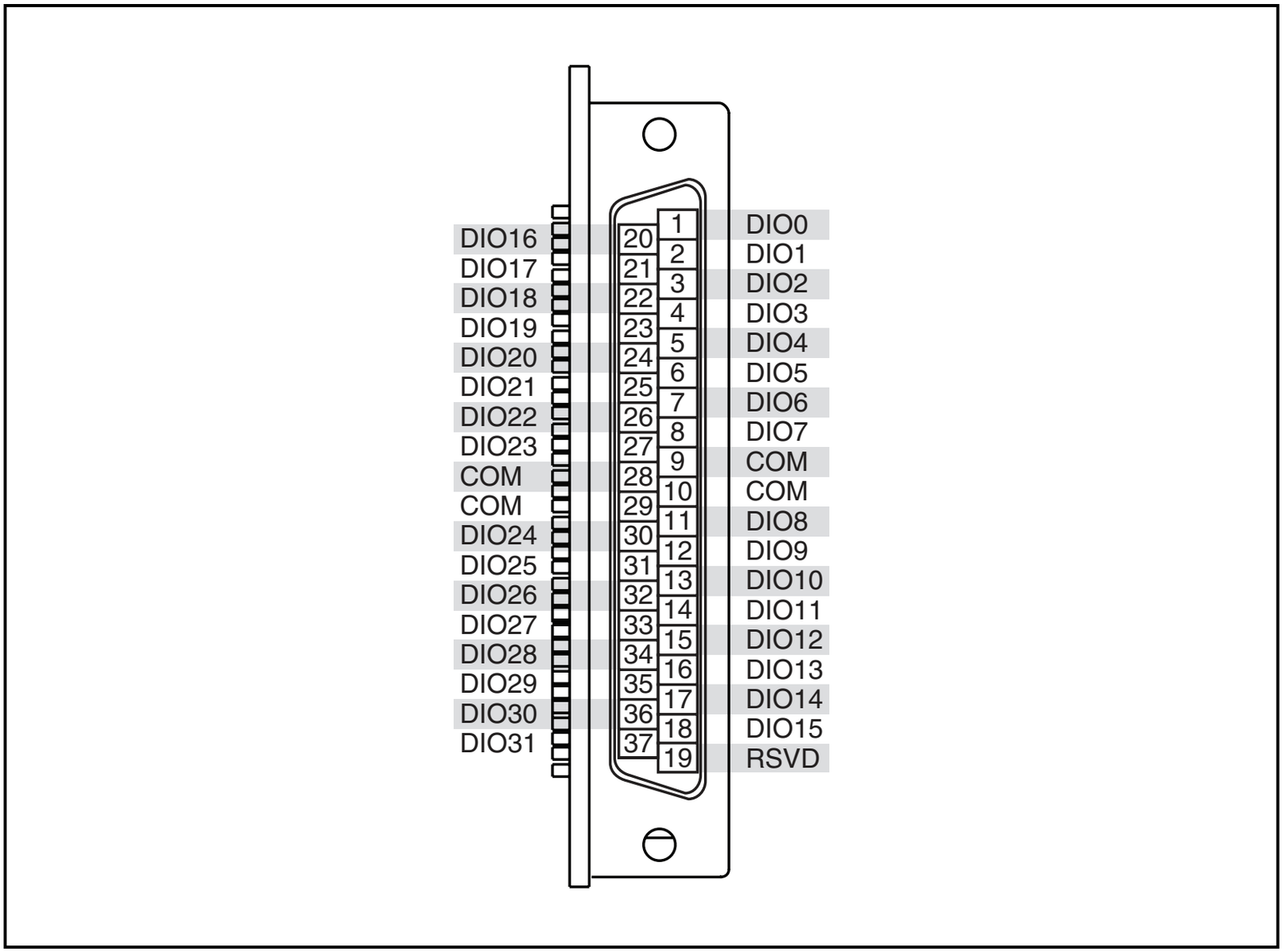


Figure 2. NI 9403E Pin Assignments

Each channel has a DIO pin to which you can connect a digital input or output device. The 32 DIO channels are internally referenced to COM, so you can use any of the four COM lines as a reference for the external signal.

You can independently configure each DIO channel in software for input or output. The DIO channels have Schmitt trigger inputs and are compatible with 5 V TTL logic devices. Each input channel has hysteresis for improved performance with noisy and non-monotonic input signals. Each channel also has a pull-down resistor and includes overvoltage, overcurrent, and short-circuit protection. Refer to the *Specifications* section for more information about input thresholds and overvoltage protection. Refer to the *Overcurrent/Short-Circuit Protection* section for more information about overcurrent and short-circuit protection.

Refer to Figure 3 for an illustration of several types of digital devices connected to the NI 9403E.

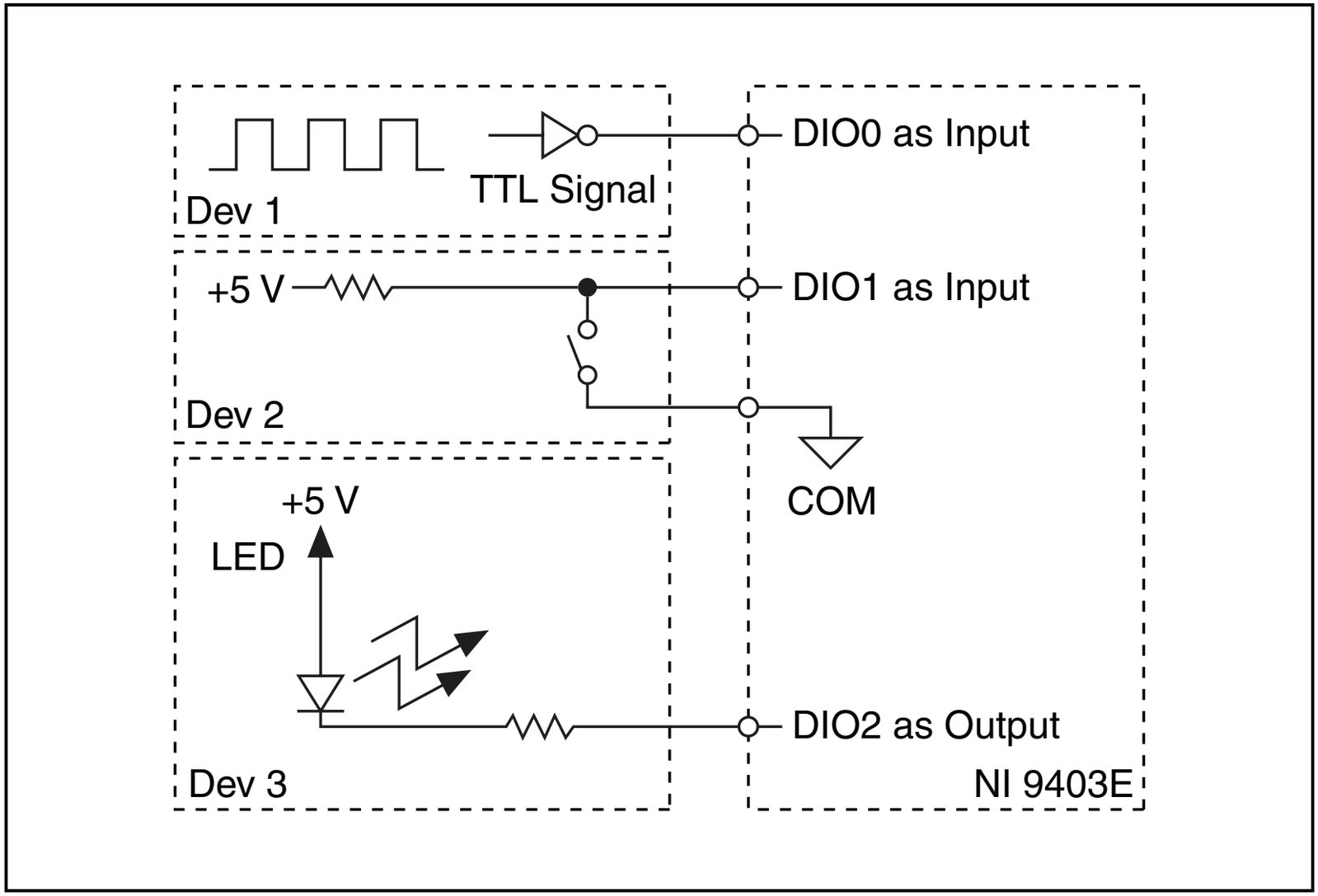


Figure 3. Connecting Digital Devices to the NI 9403E

Overcurrent/Short-Circuit Protection

The overcurrent protection allows only a specified amount of current through the output channels to protect the NI 9403E from short circuits. If the NI 9403E goes into an overcurrent state, the module sets all the DIO channels to high impedance for approximately 280 milliseconds. When the channels are in this state, the NI 9403E can accept new line direction configuration and output state data but cannot pass valid input data to the software. After the protection period, the NI 9403E automatically recovers to the latest direction configuration and output state. If the overcurrent condition still exists, the module again sets the channels to high impedance. This cycle continues until the overcurrent condition is removed. Refer to the *Specifications* section for more information about the maximum output current.

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.

Specifications

The following specifications are typical for the range –40 to 85 °C unless otherwise noted. All voltages are relative to COM unless otherwise noted.

Input/Output Characteristics

Number of channels ..... 32 DIO channels

Input/output type ..... TTL, single-ended

Default power-on line direction ..... Input

Digital logic levels

Input

Voltage ..... –0.25 to 5.25 V

High, V_{IH} ..... 2.2 V min

Low, V_{IL} ..... 0.8 V max

Hysteresis, V_H ..... 0.2 V min

Output

High, V_{OH} ..... 5.2 V max

Sourcing 100 µA ..... 4.75 V min

Sourcing 2 mA ..... 4.4 V min

Low, V_{OL}

Sinking 100 µA ..... 0.1 V max

Sinking 2 mA ..... 0.26 V max

Input current ($0 V \leq V_{in} \leq 4.5 V$) ..... ±250 µA max

Module output current[1] ..... 64 mA max

Input capacitance ..... 30 pF

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[1] Module output current is the maximum guaranteed current that the module can drive from all the I/O lines without going into an overcurrent state.

Timing

Input

Setup time[1] ..... 10 ns min

Hold time[2] ..... 60 ns min

Output

Propagation delay[3] ..... 330 ns max

Channel-to-channel skew[4] ... 265 ns max

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[1] *Setup time* is the amount of time input signals must be stable before reading from the module.

[2] *Hold time* is the amount of time input signals must be stable after initiating a read from the module.

[3] *Propagation delay* is the amount of time after writing to the module that the output signals become valid.

[4] *Channel-to-channel skew* is the amount of time between the first output signal updating and the last output signal updating.

Update/transfer time[1]

cRIO-9151 R Series

Expansion chassis ..... 8 µS max

All other chassis ..... 7 µS max

Direction change time[1] ..... 18 µS max

Overvoltage protection

Channel-to-COM ..... ±30 V max on up to 8 channels at a time; however, continued use at this level will degrade the life of the module.

[1] The update/transfer and direction change times are valid when the module is used in a CompactRIO system. When used in other systems, driver software and system latencies impact these times.

MTBF ..... 763,325 hours at 25 °C; Bellcore Issue 2, Method 1, Case 3, Limited Part Stress Method

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

Power Requirements

Power consumption from chassis

- Active mode ..... 1 W max
- Sleep mode ..... 25 µW max

Thermal dissipation (at 70 °C)

- Active mode ..... 1 W max
- Sleep mode ..... 25 µW max

Physical Characteristics

If you need to clean the module, wipe it with a dry towel.

Weight ..... 47 g (1.7 oz)

Safety

Safety Voltages

Connect only voltages that are within the following limits.

Channel-to-COM ..... ±30 V max on up to 8 channels at a time, Measurement Category I

Isolation

- Channel-to-channel ..... None
- Channel-to-earth ground
  - Continuous ..... 60 VDC, Measurement Category I
  - Withstand ..... 1,000 V_{rms}, verified by a 5 s dielectric withstand test

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 9403E 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.

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

Maximum altitude..... 2,000 m

Pollution Degree (IEC 60664) 2

Environmental Management

NI 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.

Waste Electrical and Electronic Equipment (WEEE)

EU Customers At the end of the life cycle, all products *must* be sent to a WEEE recycling center. For more information about WEEE recycling centers and National Instruments WEEE initiatives, visit `ni.com/environment/weee`.

电子信息产品污染控制管理办法 （中国 RoHS）

中国客户 National Instruments 符合中国电子信息产品中限制使用某些有害物质指令 (RoHS)。关于 National Instruments 中国 RoHS 合规性信息，请登录 `ni.com/environment/rohs_china`。(For information about China RoHS compliance, go to `ni.com/environment/rohs_china`.)

Where to Go for Support

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.

National Instruments corporate headquarters is located at 11500 North Mopac Expressway, Austin, Texas, 78759-3504. National Instruments also has offices located around the world to help address your support needs. For telephone support in the United States, create your service request at `ni.com/support` and follow the calling instructions or dial 512 795 8248. For telephone support outside the United States, contact your local branch office:

Australia 1800 300 800, Austria 43 662 457990-0,
Belgium 32 (0) 2 757 0020, Brazil 55 11 3262 3599,
Canada 800 433 3488, China 86 21 5050 9800,
Czech Republic 420 224 235 774, Denmark 45 45 76 26 00,
Finland 358 (0) 9 725 72511, France 01 57 66 24 24,
Germany 49 89 7413130, India 91 80 41190000,
Israel 972 3 6393737, Italy 39 02 41309277, Japan 0120-527196,

Korea 82 02 3451 3400, Lebanon 961 (0) 1 33 28 28,
Malaysia 1800 887710, Mexico 01 800 010 0793,
Netherlands 31 (0) 348 433 466, New Zealand 0800 553 322,
Norway 47 (0) 66 90 76 60, Poland 48 22 3390150,
Portugal 351 210 311 210, Russia 7 495 783 6851,
Singapore 1800 226 5886, Slovenia 386 3 425 42 00,
South Africa 27 0 11 805 8197, Spain 34 91 640 0085,
Sweden 46 (0) 8 587 895 00, Switzerland 41 56 2005151,
Taiwan 886 02 2377 2222, Thailand 662 278 6777,
Turkey 90 212 279 3031, United Kingdom 44 (0) 1635 523545

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