USB-6009 Specifications

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USB-6009 Specifications

Definitions

Warranted specifications describe the performance of a model under stated operating conditions and are covered by the model warranty.

Characteristics describe values that are relevant to the use of the model under stated operating conditions but are not covered by the model warranty.

- **Typical** specifications describe the performance met by a majority of models.
- **Nominal** specifications describe an attribute that is based on design, conformance testing, or supplemental testing.

Specifications are **Typical** unless otherwise noted.

Conditions

Specifications are valid at 25 °C unless otherwise noted.

Analog Input

Analog inputs	
Differential	4
Single-ended	8, software-selectable
Input resolution	
Differential	14 bits

Single-ended	13 bits
Maximum sample rate (aggregate)	48 kS/s, system dependent
Converter type	Successive approximation
AI FIFO	512 bytes
Timing resolution	41.67 ns (24 MHz timebase)
Timing accuracy	100 ppm of actual sample rate

Input range

Differential	±20 V [1], ±10 V, ±5 V, ±4 V, ±2.5 V, ±2 V, ±1.25 V, ±1 V
Single-ended	±10 V

Working voltage	±10 V
Input impedance	144 kΩ
Overvoltage protection	±35 V
Trigger source	Software or external digital trigger

System noise[2]

Differential

±20 V range	5 mV_{rms}
±1 V range	0.5 mV_{rms}

Single-ended, ±10 V range	5 mV_{rms}

Range (V)	Typical at 25 °C (mV)	Maximum over Temperature (mV)
±20	14.7	138
±10	7.73	84.8
±5	4.28	58.4
±4	3.59	53.1
±2.5	2.56	45.1
±2	2.21	42.5
±1.25	1.70	38.9
±1	1.53	37.5

Table 1. Absolute Accuracy at Full Scale, Differential

Note Input voltages may not exceed the working voltage range.

Range (V)	Typical at 25 °C (mV)	Maximum over Temperature (mV)
±10	14.7	138

Table 2. Absolute Accuracy at Full Scale, Single-Ended

Analog Output

Analog outputs	2
Output resolution	12 bits
Maximum update rate	150 Hz, software-timed
Output range	0 V to +5 V
Output impedance	50 Ω

Output current drive	5 mA
Power-on state	0 V
Slew rate	1 V/µs
Short circuit current	50 mA

Absolute accuracy (no load)	
Typical	7 mV
Maximum at full scale	36.4 mV

Digital I/O

Digital I/O lines	
P0.<0..7>	8 lines
P1.<0..3>	4 lines

Direction control	Each channel individually programmable as input or output
Output driver type[3]	Each channel individually programmable as open collector or active drive
Compatibility	TTL, LVTTL, CMOS
Absolute maximum voltage range	-0.5 V to 5.8 V with respect to GND
Pull-up resistor	4.7 kΩ to 5 V

Power-on state	Input

Level	Minimum	Maximum
Input low voltage	-0.3 V	0.8 V
Input high voltage	2.0 V	5.8 V
Input leakage current	—	50 µA
Output low voltage (I = 8.5 mA)	—	0.8 V
Output high voltage, active drive (I = -8.5 mA)	2.0 V	3.5 V
Output high voltage, open collector (I = -0.6 mA, nominal)	2.0 V	5.0 V
Output high voltage, open collector (I = -8.5 mA, with external pull-up resistor)	2.0 V	—

Table 3. Digital Logic Levels

External Voltage

+5 V output (200 mA maximum)	
Minimum	+4.85 V
Typical	+5 V
+2.5 V output (1 mA maximum)	+2.5 V
+2.5 V accuracy	0.25% maximum
Reference temperature drift	50 ppm/°C maximum

Event Counter

Number of counters	1

Resolution	32 bits
Counter measurements	Edge counting (falling-edge)
Counter direction	Count up
Pull-up resistor	4.7 kΩ to 5 V
Maximum input frequency	5 MHz
Minimum high pulse width	100 ns
Minimum low pulse width	100 ns
Input high voltage	2.0 V
Input low voltage	0.8 V

Bus Interface

USB specification	USB 2.0 full-speed (12 Mb/s)

Power Requirements

USB, 4.10 VDC to 5.25 VDC	
Typical	80 mA
Maximum	500 mA
USB suspend	

Typical	300 µA
Maximum	500 µA

Physical Characteristics

Dimensions	
Without connectors	63.5 mm × 85.1 mm × 23.2 mm(2.50 in. × 3.35 in. × 0.91 in.)
With connectors	81.8 mm × 85.1 mm × 23.2 mm(3.22 in. × 3.35 in. × 0.91 in.)

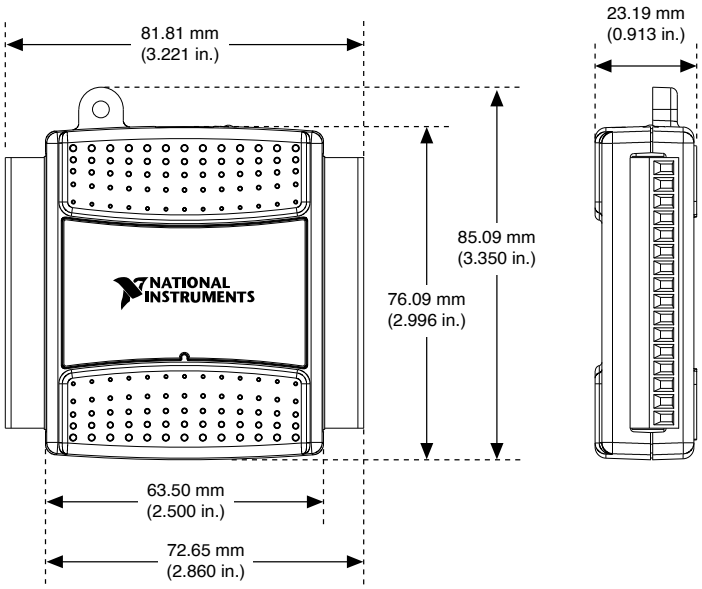
Weight	
Without connectors	54 g (1.9 oz)
With connectors	84 g (3 oz)

USB connector	USB series B receptacle (1)

I/O connectors	
Type	16-position screw terminal plugs (2)
Screw-terminal wiring	16 AWG to 28 AWG
Torque for screw terminals	0.22 N · m to 0.25 N · m(2.0 lb · in. to 2.2 lb · in.)

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

Figure 1. USB-6009 Dimensions



Safety Voltages

Connect only voltages that are within these limits.

Channel-to-GND	±30 V max, Measurement Category I

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 use this module for connection to signals or for measurements within Measurement Categories II, III, or IV

Note Measurement Categories CAT I and CAT O (Other) are equivalent. These test and measurement circuits are not intended for direct

connection to the MAINS building installations of Measurement Categories CAT II, CAT III, or CAT IV.

Environmental

Temperature (IEC 60068-2-1 and IEC 60068-2-2)	
Operating	0 °C to 55 °C
Storage	-40 °C to 85 °C
Humidity (IEC 60068-2-56)	
Operating	5% RH to 95% RH, noncondensing
Storage	5% RH to 90% RH, noncondensing
Pollution Degree (IEC 60664)	2
Maximum altitude	2,000 m

Indoor use only.

Safety Compliance Standards

This product is designed to meet the requirements of the following electrical equipment safety standards for measurement, control, and laboratory use:

- IEC 61010-1, EN 61010-1
- UL 61010-1, CSA C22.2 No. 61010-1

Note For safety certifications, refer to the product label or the Product Certifications and Declarations section.

Electromagnetic Compatibility

CE Compliance CE

This product meets the essential requirements of applicable European Directives, as follows:

- 2014/35/EU; Low-Voltage Directive (safety)
- 2014/30/EU; Electromagnetic Compatibility Directive (EMC)
- 2011/65/EU; Restriction of Hazardous Substances (RoHS)
- 2014/53/EU; Radio Equipment Directive (RED)
- 2014/34/EU; Potentially Explosive Atmospheres (ATEX)

Product Certifications and Declarations

Refer to the product Declaration of Conformity (DoC) for additional regulatory compliance information. To obtain product certifications and the DoC for NI products, visit ni.com/product-certifications, search by model number, and click the appropriate link.

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 **Engineering a Healthy Planet** 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** This symbol indicates that waste products should be disposed of separately from municipal household waste according to WEEE Directive 2002/96/EC of the European Parliament and the Council on waste electrical and electronic equipment (WEEE). All products at the end of their life cycle must be sent to a WEEE collection and recycling center. Proper WEEE disposal reduces environmental impact and the risk to human health due to potentially hazardous substances used in such equipment. Your cooperation in proper WEEE disposal will contribute to the effective usage of natural resources. For information about the available collection and recycling scheme in a particular country, go to ni.com/environment/weee.

电子信息产品污染控制管理办法（中国 RoHS）

- **中国 RoHS**— NI 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 NI 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.)

[1] ±20 V means that |AI+ – (AI–)| ≤ 20 V. However, AI+ and AI– must both be within ±10 V of GND. Refer to the **Taking Differential Measurements** section of the **NI USB-6008/6009 User Guide** for more information.

[2] System noise measured at maximum sample rate.

[3] This document uses NI-DAQmx naming conventions. Open-drain is called open collector and push-pull is called active drive.