
USB-8451

Specifications

2025-07-22



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USB-8451 Specifications

USB-8451 Specifications

This section lists specifications for the USB-8451.

The following specifications are typical at 25 °C unless otherwise noted.



Note Specifications are subject to change without notice.

Definitions

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

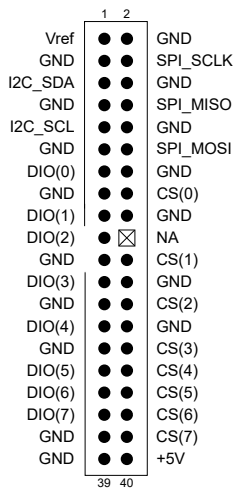
Characteristics describe values that are relevant to the use of the model under stated operating conditions but are not covered by the model warranty.

- **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.

USB-8451 Pinout

Use the pinout to connect to terminals on the USB-8451.



Signal Name	Direction	Description
SPI_SCLK	Output	SPI Clock: SPI output clock signal to slave devices capable of clock rates up to 50 MHz.
SPI_MOSI	Output	Master Output Slave Input: SPI communication signal to slave device.
SPI_MISO	Input	Master Input Slave Output: SPI communication signal from slave device.
CS<0..7> ¹	Output	Chip Select Signals: Outputs used to select the desired SPI peripheral device.
DIO<0..7> ²	Input or Output	Digital I/O Ports: You can individually configure each signal as an input or push-pull output.
I ² C_SCL	Open-drain ³	I ² C Clock: I ² C clock signal to slave devices, capable of clock rates up to 3.3 MHz.
I ² C_SDA	Open-drain ³	I ² C Serial Data: Data signal for I ² C communication.
+5V	Output	+5 V: Fixed 5 V output with $\pm 5\%$ tolerance, with a maximum output drive capability of 20 mA.
Vref	Output	Vref: User programmable ² IC/SPI/DIO reference voltage output. Used for internal and external voltage reference. Maximum output drive capability of 20 mA.
GND		Ground: Ground reference for all IO interfaces and +5 V, Vref voltage references.

NA		Not available.
¹You can configure CS(O) as hardware-timed chip-select, which has a fixed timing relationship to SPI signal lines. ²Some of these pins have special functionality in SPI stream mode. ³ You can enable or disable onboard pull-up resistors. You must enable these for $V_{ref} \leq 1.8$ V for the FPGA to properly detect a low-to-high transition.		

Digital I/O (DIO)

Number of lines	
P0.<0..7>	8
Direction control	Input or output, software selectable
Output driver type	Push-pull (active drive) or open-drain, software selectable
Absolute voltage range	-0.5 V to +5.8 V with respect to GND
Power-on state	Input (high impedance)

Digital logic levels

Level	Min	Max	Units
Input			
Input low voltage	-0.3	0.8	V

Level	Min	Max	Units
Input high voltage	2.0	5.8	V
Input leakage current	—	50	μA
Output low voltage (I = 8.5 mA)	—	0.8	V
Output high voltage			
Push-pull (active drive), I = -8.5 mA	2.0	3.5	V
Open-drain	V _{CC} ¹	V _{CC} ¹	V
¹ V _{CC} refers to the pull-up voltage you select.			

SPI Interface

Signal	
SPI CS <0..7>	Output
SPI MOSI (SDO)	Output

SPI MISO (SDI)		Input
SPI CLK (SCLK)		Output (12 MHz max)
Supported clock rates	48 kHz, 50 kHz, 60 kHz, 75 kHz, 80 kHz, 96 kHz, 100 kHz, 120 kHz, 125 kHz, 150 kHz, 160 kHz, 200 kHz, 240 kHz, 250 kHz, 300 kHz, 375 kHz, 400 kHz, 480 kHz, 500 kHz, 600 kHz, 750 kHz, 800 kHz, 1 MHz, 1.2 MHz, 1.5 MHz, 2 MHz, 2.4 MHz, 3 MHz, 4 MHz, 6 MHz, 12 MHz	
Output driver type	Push-pull (active drive)	
Absolute voltage range	-0.5 V to +5.8 V with respect to GND	
Power-on state	Input (high impedance)	
Transfer size	8 bits	

Digital logic levels

Level	Min	Max	Units
Input			
Input low voltage	-0.3	0.8	V

Level	Min	Max	Units
Input high voltage	2.0	5.8	V
Input leakage current	—	50	μA
Output low voltage (I = 8.5 mA)	—	0.8	V
Output high voltage			
Push-pull (active drive), I = -8.5 mA	2.0	3.5	V

I²C Interface

Signals	
SDA	Output/input
SCL	Output (250 kHz max)
Supported clock rates	
I ² C Standard Mode	32 kHz, 40 kHz, 50 kHz, 64 kHz, 80 kHz, 100 kHz

I ² C Fast Mode	125 kHz, 160 kHz, 200 kHz, 250 kHz
Fast Mode Plus	Not supported
I ² C High Speed Mode	Not supported
Output driver type	Open-drain
Absolute voltage range	-0.5 V to +5.8 V with respect to GND
Power-on state	Input (high impedance)

Digital logic levels

Level	Min	Max	Units
Output			
Output low voltage (I = 8.5 mA)	—	0.8	V
Output high voltage			
Open-drain with external pull-up resistor	2.0	—	V



Note This interface is compatible with both I²C and SMBus devices.

Bus Interface

USB specification	Full-speed (12 Mb/s)
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Power Requirements

USB	
4.10 VDC to 5.25 VDC	80 mA typical, 500 mA max
USB Suspend	300 µA standby mode, 500 µA max

Output Voltage Sources

+5 V output	
Voltage	4.10 V min, 5.25 V max
Current	230 mA max

Physical Characteristics

USB-8451

Dimensions	
Without connectors	6.35 cm × 8.51 cm × 2.31 cm (2.50 in. × 3.35 in. × 0.91 in.)

With connectors	8.18 cm × 8.51 cm × 2.31 cm (3.22 in. × 3.35 in. × 0.91 in.)
I/O connectors	USB series B receptacle, two 16-position (screw terminal) plug headers
Screw-terminal wiring	16 AWG to 28 AWG copper conductor wire with 10 mm (0.39 in.) of insulation stripped from the end
Torque for screw terminals	0.22 N • m to 0.25 N • m (2.0 lb • in. to 2.2 lb • in.)
Weight	84 g (3 oz)

USB-8451 OEM

Dimensions	5.74 cm × 6.73 cm × 1.15 cm (2.26 in. × 2.65 in. × 0.45 in.)
I/O connectors	USB series B receptacle; 34-p IDC ribbon cable header
Weight	21 g (0.74 oz)

Dimensional drawings

Figure 1. USB-8451 OEM Dimensions (Top View)

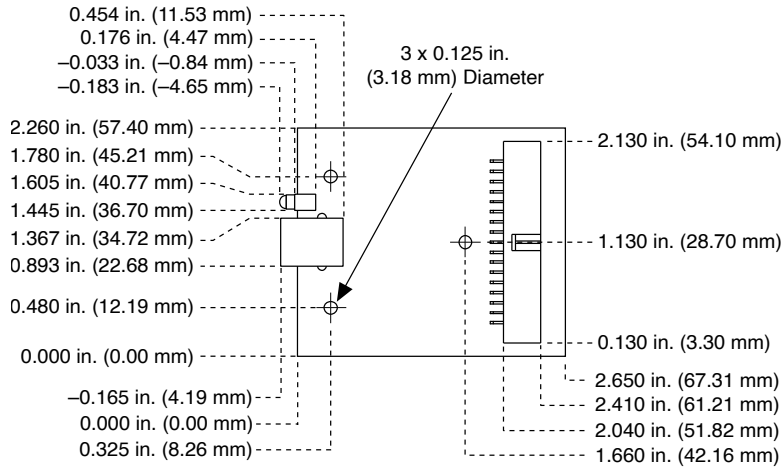
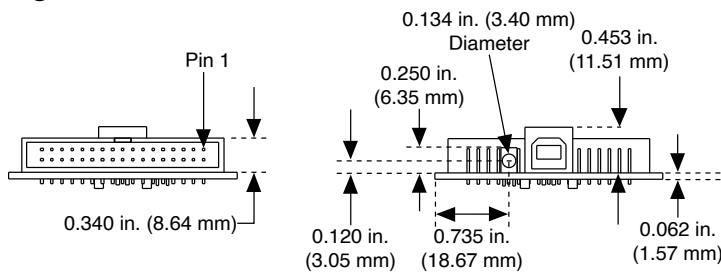


Figure 2. USB-8451 OEM Dimensions (Front and Rear Views)



Overvoltage Protection

Connect only voltages that are within these limits.

Channel-to-COM (one channel)	± 30 V max, Measurement Category I
Channels-to-COM (one port, all channels)	± 8.9 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.

Safety

Safety Standards

This product is designed to meet the requirements of the following standards of safety for information technology equipment:

- 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 [Product Certifications and Declarations](#) section.

Hazardous Locations

The NI USB-845x modules are not certified for use in hazardous locations.

Electromagnetic Compatibility

USB-8451

This product meets the requirements of the following EMC standards for electrical equipment for measurement, control, and laboratory use:

- EN 61326 (IEC 61326): Class A emissions; Basic immunity
- EN 55011 (CISPR 11): Group 1, Class A emissions
- AS/NZS CISPR 11: Group 1, Class A emissions
- FCC 47 CFR Part 15B: Class A emissions
- ICES-001: Class A emissions

USB-8451 OEM

The USB-8451 OEM device is intended for use as part of a system. To ensure that your system meets the appropriate EMC standards, you must test the entire system.



Note For EMC declarations and certifications, and additional information, refer to the **Online Product Certification** section.



Note For EMC compliance, operate this product according to the documentation.

CE Compliance

USB-8451

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)

USB-8451 OEM

The USB-8451 OEM device is intended for use as part of a system. To ensure that your system meets the appropriate CE Compliance regulations, you must test the entire system.

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

The NI USB-845x modules are intended for indoor use only.

Operating temperature (IEC 60068-2-1 and IEC 60068-2-2)	0 °C to 45 °C
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Operating humidity (IEC 60068-2-56)	10% to 90% RH, noncondensing
Maximum altitude	2,000 m (at 25 °C ambient temperature)
Storage temperature (IEC 60068-2-1 and IEC 60068-2-2)	-40 °C to 85 °C
Storage humidity (IEC 60068-2-56)	5% to 90% RH, noncondensing
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 ***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.

EU and UK Customers

-  **Waste Electrical and Electronic Equipment (WEEE)**—At the end of the product life cycle, all NI products must be disposed of according to local laws and regulations. For more information about how to recycle NI products in your region, visit 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/rohs_china.)

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