SPECIFICATIONS

NI roboRIO

RIO Device for Robotics

This document provides specifications for the NI roboRIO. These specifications are typical for the 0° C to 40° C operating temperature range unless otherwise noted.

Contents

Processor

Type	Xilinx Z-7020 All Programmable SoC dual-core ARM Cortex-A9
Speed	667 MHz
Cores	2

NATIONAL INSTRUMENTS

Memory

Nonvolatile.....512 MB

DDR3

- Amount.....256 MB
- Clock frequency.....533 MHz
- Data bus width.....16 bits

For information about the life span of the nonvolatile memory and about best practices for using nonvolatile memory, visit `ni.com/info` and enter the Info Code `SSDBP`.

FPGA

Type.....Xilinx Z-7020

Network

Network interface.....10BaseT and 100BaseTX Ethernet

Compatibility.....IEEE 802.3

Communication rates.....10 Mbps, 100 Mbps, auto-negotiated

Maximum cabling distance.....100 m/segment

USB Ports

Host

- Number of ports.....2
- Type.....USB 2.0 Hi-Speed
- VBus current.....900 mA maximum per port

Device

- Number of ports.....1
- Type.....USB 2.0 Hi-Speed

Analog Input

Aggregate sample rate.....500 kS/s

Resolution.....12 bits

Overvoltage protection.....±16 V

Expansion port configuration.....4 single-ended channels

Integrated AI connector configuration.....4 single-ended channels

Input impedance.....>500 kΩ acquiring at 500 kS/s,
1 MΩ powered on and idle,
4.7 kΩ powered off

Recommended source impedance.....3 kΩ or less

Nominal range.....0 V to +5 V

Absolute accuracy.....±50 mV

Bandwidth.....20 kHz minimum, >50 kHz typical

Analog Output

Aggregate maximum update rate.....345 kS/s

Resolution.....12 bits

Overload protection.....±16 V

Startup voltage.....0 V after FPGA initialization

Configuration.....2 single-ended channels on expansion port

Range.....0 V to +5 V

Absolute accuracy.....50 mV

Current drive.....3 mA

Slew rate.....0.3 V/µs

Digital I/O

Number of lines

- Expansion port.....16 DIO lines; one UART
- Integrated DIO, I^2C, and SPI bus
  - DIO lines.....10 DIO lines
  - I^2C lines.....1 SDA and 1 CLK
  - SPI lines.....Drives up to four devices

Direction control.....Each DIO line individually programmable as input or output

Logic level.....5 V compatible LVTTL input; 3.3 V LTTL output

Input logic levels

- Input low voltage, V_{IL}.....0.0 V min; 0.8 V max
- Input high voltage, V_{IH}.....2.0 V min; 5.25 V max

Output logic levels

- Output low voltage, V_{OL}, sinking 4 mA.....0.0 V min; 0.4 V max
- Output high voltage, V_{OH}, sourcing 4 mA.....2.4 V min; 3.465 V max

Minimum pulse width.....20 ns

Maximum frequencies for secondary digital functions

- SPI.....4 MHz
- I^2C.....400 kHz

UART lines

- Maximum baud rate.....230,400 bps
- Data bits.....5, 6, 7, 8
- Stop bits.....1, 2
- Parity.....Odd, Even, Mark, Space
- Flow control.....XON/XOFF

RS-232 Serial Port

Maximum baud rate.....115,200 bps

Data bits.....5, 6, 7, 8

Stop bits.....1, 2

Parity.....Odd, Even, Mark, Space

Flow control.....XON/XOFF

Logic level

- Standard ..... Meets or exceeds TIA/EIA-232-F voltage levels
- Receiver input voltage ..... +30 V maximum
- Driver output high voltage ..... 5 V minimum
- Driver output low voltage ..... -5 V maximum

PWM and Relay Lines

PWM port ..... 10 PWM lines

Relay port ..... 4 forward; 4 reverse

Direction control ..... Output only

Logic level ..... 5 V output

Maximum output current

- PWM ..... 15.0 mA
- Relay ..... 7.5 mA

Series resistor in each output path

- PWM ..... 330 Ω
- Relay ..... 680 Ω

Output high voltage, V_{OH}

- PWM sourcing 0.1 mA ..... 4.75 V min; 5.25 V max
- Relay sourcing 0.1 mA ..... 4.75 V min; 5.25 V max

Output low voltage, V_{OL}

- PWM sinking 0.1 mA ..... 0.0 V min; 0.25 V max
- Relay sourcing 0.1 mA ..... 0.0 V min; 0.25 V max

Maximum frequency ..... 150 kHz

RSL

RSL port ..... Switched VIN output

Voltage range ..... 7 V to 16 V (VIN)

Current range ..... 120 mA max

Accelerometer

Number of axes.....3

Range.....±8 g

Resolution.....12 bits

Sample rate.....800 S/s

Noise.....3.9 mg_{ms} typical at 25° C

Power Output

+6.0 V power output

- Output voltage.....5.5 V to 6.1 V
- Output voltage with load > 360 mA.....5.75 V to 6.1 V
- Maximum current.....2.2 A total

+5.0 V power output

- Output voltage with and without load.....4.7 V to 5.25 V
- Maximum current.....1.0 A total

+3.3 V power output

- Output voltage with and without load.....3.1 V to 3.465 V
- Maximum current.....1.225 A total

Power Requirements

The NI roboRIO requires a power supply connected to the power connector.

Power supply voltage range.....7 VDC to 16 VDC

Maximum power consumption.....45 W

Typical idle power consumption.....5 W

Environmental

Local ambient temperature near device (IEC 60068-2-1, IEC 600682-2) ..... 0° C to 40° C

Storage temperature (IEC 60068-2-1, IEC 60068-2-2) ..... -20° C to 70° C

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

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

Pollution Degree (IEC 60664) 2

Maximum altitude ..... 2,000 m

Indoor use only.

Shock and Vibration

Operating vibration

Random (IEC 60068-2-64) ..... 5 g_{rms}, 10 Hz to 500 Hz

Sinusoidal (IEC 60068-2-6) ..... 5 g, 10 Hz to 500 Hz

Operating shock (IEC 60068-2-27) ..... 50 g, 3 ms half sine, 30 g, 11 ms half sine, 18 shocks at 6 orientations

Physical Characteristics

Weight ..... 330 g (11.64 oz)

Safety Standards

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

- 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 of this document.

Caution Using the NI roboRIO in a manner not described in this document may impair the protection the NI roboRIO provides.

Hazardous Locations

This device is not certified for use in hazardous locations.

Electromagnetic Compatibility

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

- EN 61326-1 (IEC 61326-1): 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

Note Group 1 equipment (per CISPR 11) is any industrial, scientific, or medical equipment that does not intentionally generate radio frequency energy for the treatment of material or inspection/analysis purposes.

Note In the United States (per FCC 47 CFR), Class A equipment is intended for use in commercial, light-industrial, and heavy-industrial locations. In Europe, Canada, Australia and New Zealand (per CISPR 11) Class A equipment is intended for use only in heavy-industrial locations.

Note For EMC declarations and certifications, refer to the *Online Product Certification* section of this document.

CE Compliance CE

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

- 2006/95/EC; Low-Voltage Directive (safety)
- 2004/108/EC; Electromagnetic Compatibility Directive (EMC)

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 model number or product line, and click the appropriate link in the Certification column.

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 *Minimize Our Environmental Impact* 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 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`.)

374661A-01 Oct14