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roboRIO-FRC Specifications

2023-04-04

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NI roboRIO

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.

Processor

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

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, $\mathbf{V_{IL}}$	0.0 V min; 0.8 V max
Input high voltage, $\mathbf{V_{IH}}$	2.0 V min; 5.25 V max

Output logic levels	
Output low voltage, $\mathbf{V_{OL}}$, sinking 4 mA	0.0 V min; 0.4 V max
Output high voltage, $\mathbf{V_{OH}}$, 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 minimum; 5.25 V maximum
Relay sourcing 0.1 mA	4.75 V minimum; 5.25 V maximum
Output low voltage, V_{OL}	
PWM sinking 0.1 mA	0.0 V minimum; 0.25 V maximum
Relay sourcing 0.1 mA	0.0 V minimum; 0.25 V maximum
Maximum frequency	150 kHz

RSL

RSL port	Switched VIN output
Voltage range	7 V to 16 V (VIN)
Current range	120 mA maximum

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
Power Consumption	
Maximum	45 W
Typical idle	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% RH to 90% RH, noncondensing
Storage humidity (IEC 60068-2-56)	10% RH to 90% RH, noncondensing
Pollution Degree (IEC 60664)	2
Maximum altitude	2,000 m

Indoor use only.

Shock and Vibration

Operating vibration	
Random	5 g RMS, 10 Hz to 500 Hz
Sinusoidal	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 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.

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

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:

- 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.

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/environment/rohs_china.)