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DEVICE SPECIFICATIONS

NI 5783

Four Channel Transceiver Adapter Module

This document lists specifications for the NI 5783 adapter module. Pair these specifications with the specifications listed in your FlexRIO FPGA module specifications document or your Controller for FlexRIO specifications document.

Caution The protection provided by the NI 5783 can be impaired if it is used in a manner not described in this document.

Caution To avoid permanent damage to the NI 5783, disconnect all signals connected to the NI 5783 before powering down the module, and only connect signals after the module has been powered on by the FlexRIO FPGA module or the Controller for FlexRIO.

Note All numeric specifications are typical unless otherwise noted. All graphs illustrate the performance of a representative module.

Specifications are subject to change without notice. For the most recent device specifications, visit *ni.com/manuals*.

Contents

NATIONAL INSTRUMENTS

FlexRIO Documentation

Table 1. FlexRIO Documentation Locations and Descriptions

Document	Location	Description
Getting started guide for your FlexRIO FPGA module or Controller for FlexRIO	Available from the Start menu and at *ni.com/manuals*.	Contains installation instructions for your FlexRIO system.
Specifications document for your FlexRIO FPGA module or Controller for FlexRIO	Available from the Start menu and at *ni.com/manuals*.	Contains specifications for your FlexRIO FPGA module or Controller for FlexRIO.
Getting started guide for your adapter module	Available from the Start menu and at *ni.com/manuals*.	Contains signal information, examples, and CLIP details for your adapter module.
Specifications document for your adapter module	Available from the Start menu and at *ni.com/manuals*.	Contains specifications for your adapter module.
LabVIEW FPGA Module Help	Embedded in *LabVIEW Help* and at *ni.com/manuals*.	Contains information about the basic functionality of the LabVIEW FPGA Module.
Real-Time Module Help	Embedded in *LabVIEW Help* and at *ni.com/manuals*.	Contains information about real-time programming concepts, step-by-step instructions for using LabVIEW with the Real-Time Module, reference information about Real-Time Module VIs and functions, and information about LabVIEW features on real-time operating systems.

Table 1. FlexRIO Documentation Locations and Descriptions (Continued)

Document	Location	Description
FlexRIO Help	Available from the Start menu and at *ni.com/manuals*.	Contains information about the FPGA module front panel connectors and I/O, controller for FlexRIO front panel connectors and I/O, programming instructions, and adapter module component-level IP (CLIP).
FlexRIO Adapter Module Development Kit User Manual	Available from the Start menu at **Start»All Programs» National Instruments»NI FlexRIO»NI FlexRIO Adapter Module Development Kit»Documentation**.	Contains information about how to create custom adapter modules for use with FlexRIO FPGA modules.
LabVIEW Examples	Available in NI Example Finder. In LabVIEW, click **Help»Find Examples» Hardware Input and Output» FlexRIO**.	Contains examples of how to run FPGA VIs and Host VIs on your device.
IPNet	Located at *ni.com/ipnet*.	Contains LabVIEW FPGA functions and intellectual property to share.
FlexRIO product page	Located at *ni.com/flexrio*.	Contains product information and data sheets for FlexRIO devices.

Analog Input

General Characteristics

Number of channels	Four, single-ended, simultaneously sampled
Connector Type	HDBNC (high-density BNC)
Input type	50 Ω
Input coupling	DC

Sample rate	
Internal Sample Clock	100 MHz
External Sample Clock	60 MHz to 100 MHz
Analog-to-digital converter (ADC)	
Type	Quad, 16-bit
Part number	AD9653

Related Information

For more information about the ADC, refer to the AD9653 datasheet at www.analog.com.

Typical Specifications

Full-scale input range (normal operating conditions)	
Elliptic	2.030 V_{pk-pk}
Butterworth	2.037 V_{pk-pk}
DC accuracy	
Elliptic	±[(0.80% × reading) + 3.5 mV]
Butterworth	±[(1.00% × reading) + 3.75 mV]
Input impedance	
Elliptic	50 Ω ± 0.5%
Butterworth	50 Ω ± 0.8%
Bandwidth (-3 dB)	
Elliptic	39.4 MHz
Butterworth	39.5 MHz

Table 2. AI Spectral Performance

SNR[1]	SINAD[1]	ENOB (bits)[2]	SFDR[3]
74.5 dBFS	74.3 dBFS	12.05	-87 dBc

Note All AI spectral performance values apply to both the Elliptic and Butterworth variants.

1 Measured at 10.1 MHz with a -1 dBFS signal adjusted to full-scale.
2 Calculated from SINAD corrected to fullscale.
3 Measured at 10.1 MHz with a -1 dBFS signal.

Table 3. AI Noise Spectral Density

Filter Variant	nV/√(Hz)	dBm/Hz	dBFS/Hz
Elliptic	17.5	-142.1	-152.2
Butterworth	17.8	-142.0	-152.1

Table 4. AI Channel Crosstalk (10 MHz)

Channel N±1	Channel N±2	Channel N±3
-79 dBc	-87 dBc	-91 dBc

Note All AI channel crosstalk values apply to both the Elliptic and Butterworth variants.

Figure 1. AI Crosstalk

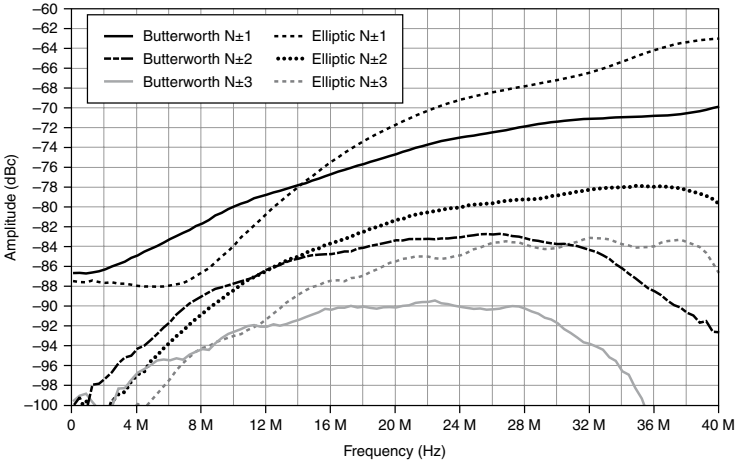


Figure 2. AI Frequency Response (Zoomed Out)

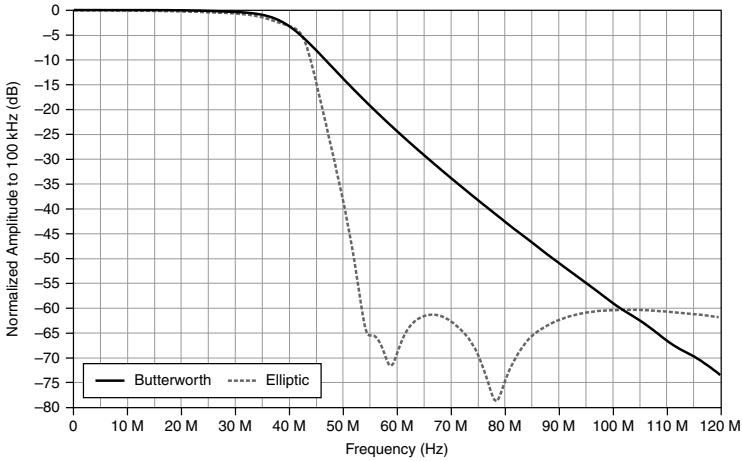


Figure 3. AI Frequency Response (Zoomed In)

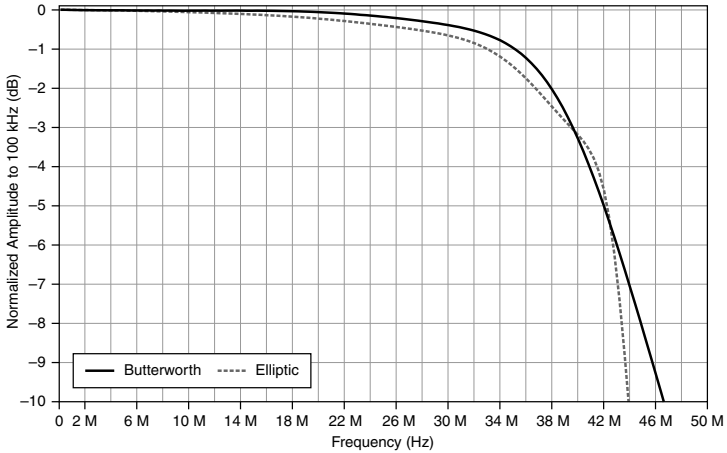


Figure 4. AI Step Response (Butterworth)

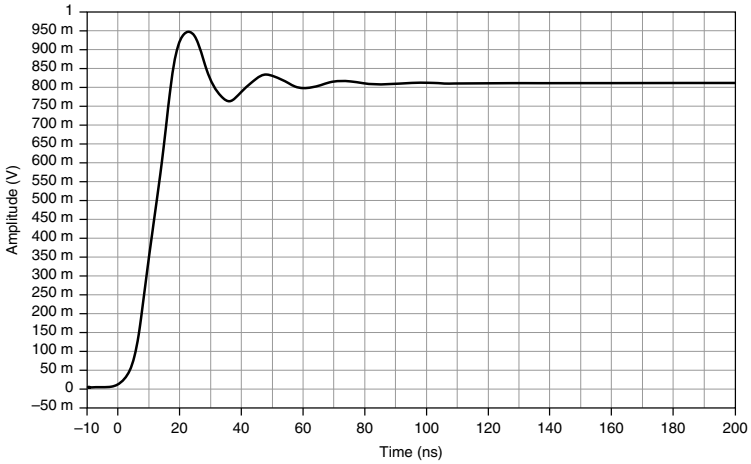


Figure 5. AI Step Response (Elliptic)

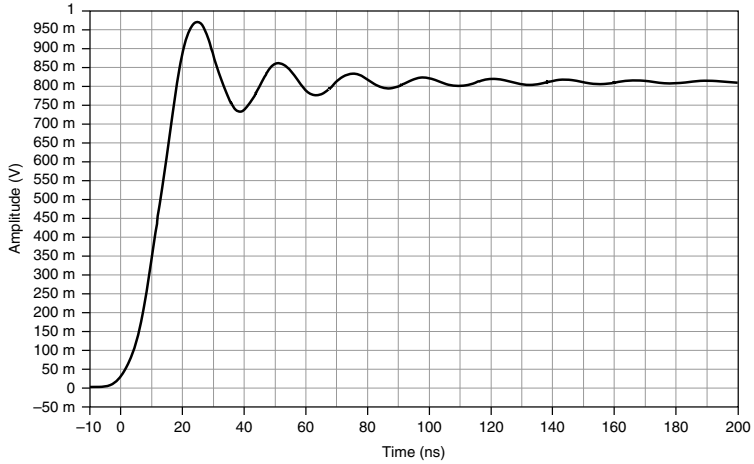
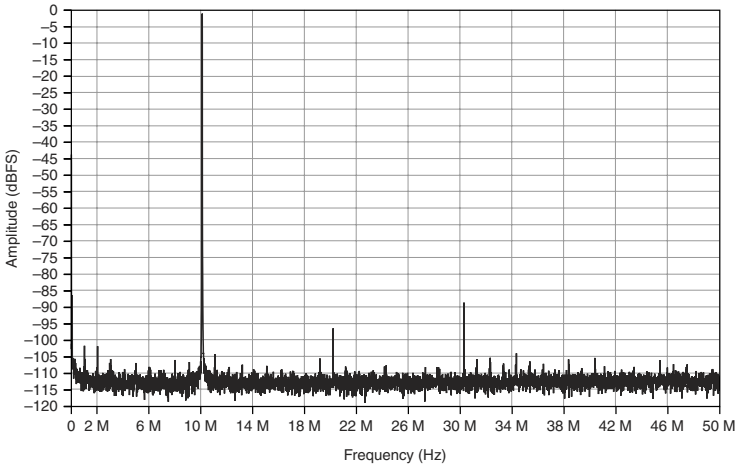
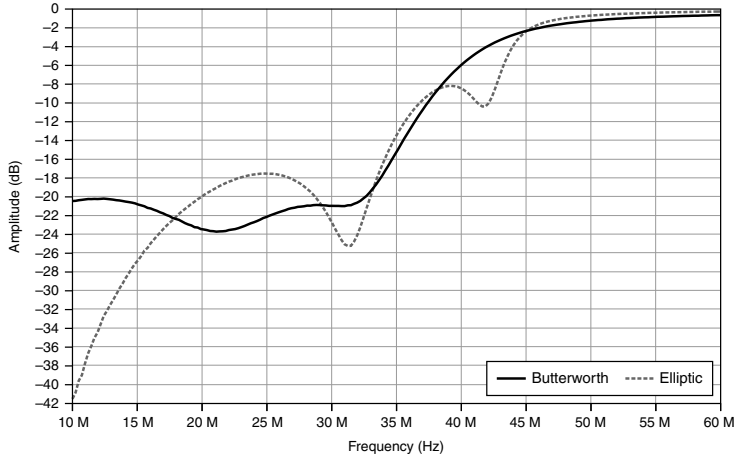


Figure 6. AI Spectral (10.1 MHz at -1 dBFS input signal, 6.1 kHz RBW, 10 Averages)



Note AI Spectral figure applies to both the Elliptic and Butterworth variants.

Figure 7. AI Return Loss



Analog Output

General Characteristics

Number of channels	Four, single-ended, simultaneously updated
Connector type	HDBNC (high-density BNC)
Output type	50 Ω
Output coupling	DC
Digital-to-analog converter (DAC)	
Type	Quad, 16-bit
Part number	DAC3484
Minimum analog input to analog output response time[4]	
100 MS/s	1130 ns
200 MS/s	720 ns
400 MS/s	550 ns

Table 5. AO Sample Rates

Clocking Mode	Data Rate (per channel)	DAC Update Rate (per channel)
Internal Clock, 2x interpolation[5]	400 MS/s	800 MS/s
Internal Clock, 4x interpolation (default clocking mode)	200 MS/s	800 MS/s
Internal Clock, 8x interpolation	100 MS/s	800 MS/s
External Clock, 2x interpolation[5]	240 MS/s to 400 MS/s	480 MS/s to 800 MS/s
External Clock, 4x interpolation	120 MS/s to 200 MS/s	480 MS/s to 800 MS/s
External Clock, 8x interpolation	60 MS/s to 100 MS/s	480 MS/s to 800 MS/s

Related Information

For more information about the DAC, refer to the DAC3484 datasheet at www.ti.com.

[4] Minimum time to digitize a signal (AI) and output a response (AO). Time measured from signal entering the AI connector, passing into and out of the LabVIEW FPGA diagram, and observed at the AO connector.

[5] 400 MS/s with 2x interpolation is available only when operating in 2 channel analog output mode.

Typical Specifications

Full-scale output range (normal operation conditions)	
50 Ω	1.001 V_{pk-pk}
High-Z	2.002 V_{pk-pk}
DC accuracy (into High-Z)	±[(2.0% × desired voltage) + 4.4 mV]
Output impedance	50 Ω ± 0.7%
SFDR[6]	-81 dBc

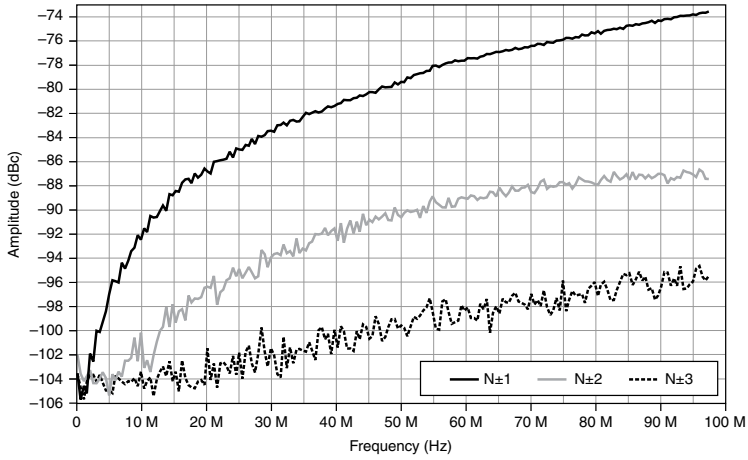
Table 6. AO Noise Spectral Density (into 50 Ω)

nV/√(Hz)	dBm/Hz	dBFS/Hz
5.8	-151.7	-155.7

Table 7. AO Channel Crosstalk (10 MHz)

Channel N±1	Channel N±2	Channel N±3
-90 dBc	-98 dBc	-99 dBc

Figure 8. AO Crosstalk (into 50 Ω Load)



[6] 10.1 MHz tone at -1 dBFS.

Figure 9. AO Frequency Response Across Data Rate

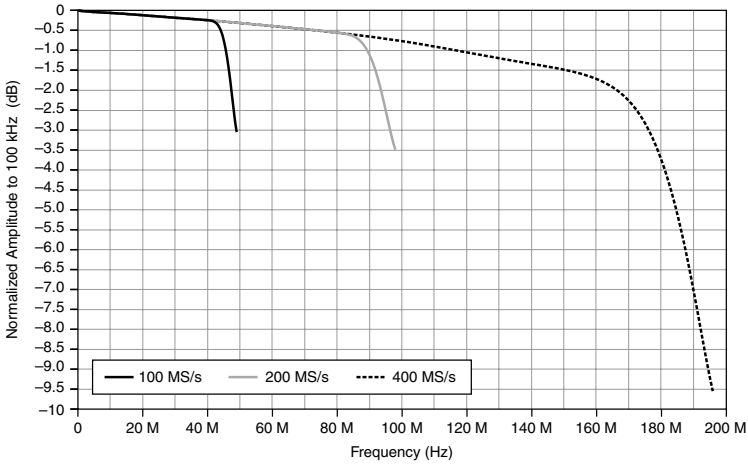


Figure 10. AO Phase Noise (Signal at 12.1 MHz)

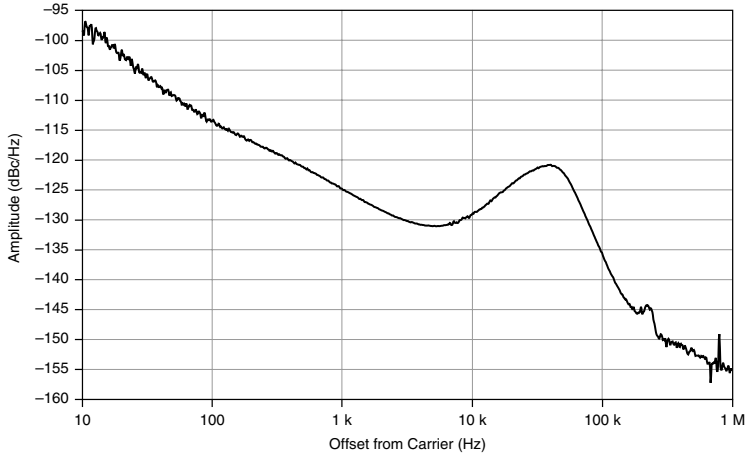


Figure 11. AO Return Loss

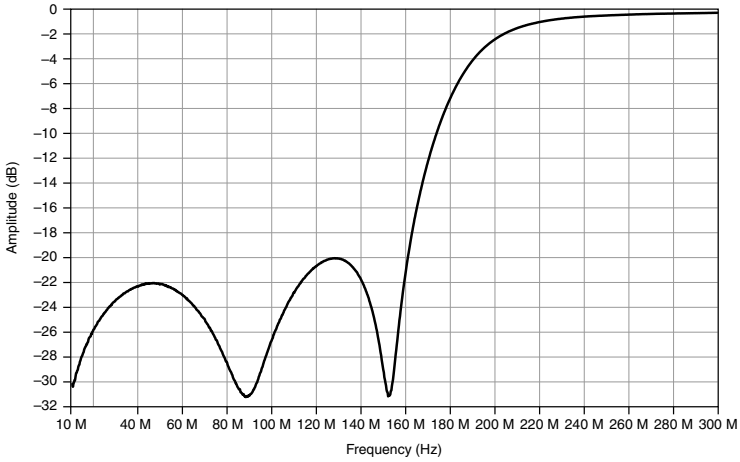
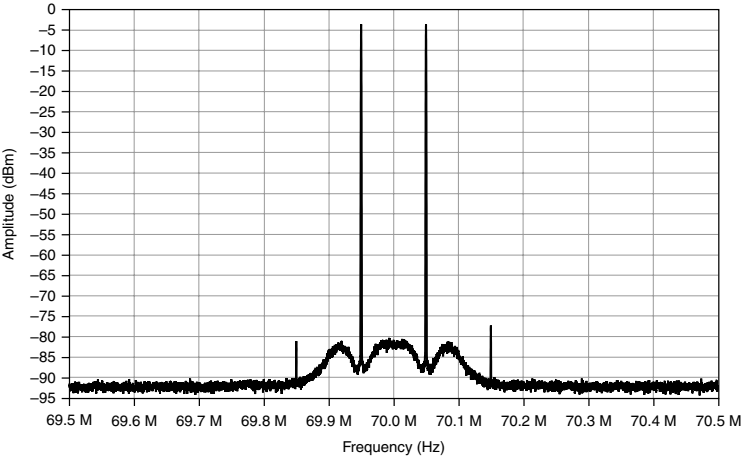


Figure 12. AO Two Tone, Each Tone at -7 dBFS, 69.95 MHz, and 70.05 MHz, 500 Hz RBW



Note The noise floor in the above figure is limited by the noise floor of the measurement device. Refer to the AO Noise Spectral Density table for more information.

CLK/REF IN

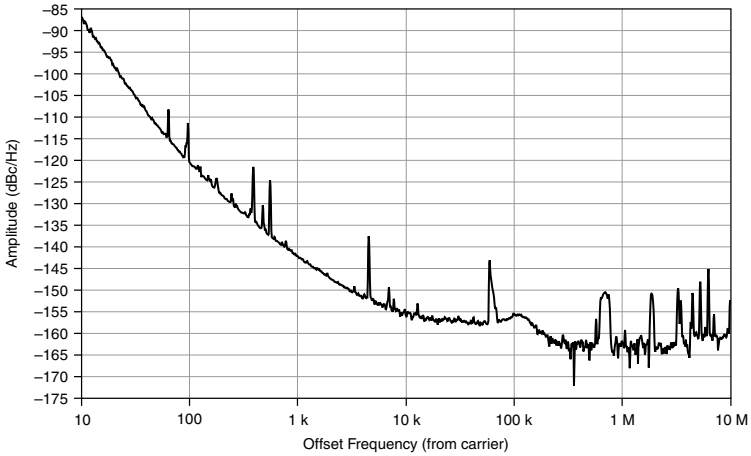
Connector type	HDBNC (high-density BNC)
Input impedance	50 Ω
Input coupling	AC
Reference input voltage range	0.75 V_{pk-pk} to 5.2 V_{pk-pk}
Sample Clock input voltage range	0.4 V_{pk-pk} to 5.2 V_{pk-pk}
Absolute maximum voltage	±8.0 VDC, 8.0 V_{pk-pk} AC
Duty cycle	45% - 55%

Clock Configuration	External Clock Type	External Clock Frequency	Description
Internal Clock PLL Off[7]			The internal VCXO acts as a free-running Sample Clock.
Internal Clock PLL On (TbRef)		10 MHz	The internal VCXO locks to TbRefClk, which is provided through the backplane.
Internal Clock PLL On (CLK/REF IN)	Reference Clock	10 MHz	The internal VCXO locks to an external Reference Clock, which is provided through the CLK/REF IN front panel connector.
External Clock PLL Off (CLK/REF IN)	Sample Clock	60 MHz to 100 MHz	An external Sample Clock can be provided through the CLK/REF IN front panel connector.

Internal VCXO phase noise	
10 Hz	-80 dBc/Hz
100 Hz	-110 dBc/Hz
1 kHz	-140 dBc/Hz
10 kHz	-150 dBc/Hz
100 kHz	-155 dBc/Hz
1 MHz	-160 dBc/Hz
10 MHz	-162 dBc/Hz

[7] Default clocking configuration.

Figure 13. Internal Sample Clock Phase Noise



TRIG General Characteristics

Number of channels	1, single-ended
Connector type	HDBNC
Coupling	DC
Impedance	
Input	10 kΩ
Output	50 Ω
Logic level	3.3 V LVCMOS
Voltage	
V_{IH_MIN}	2 V
V_{IL_MAX}	0.8 V
V_{OH_MIN} (unloaded)	3.1 V
V_{OL_MAX} (unloaded)	0.2 V
Absolute maximum voltage	±20 VDC, +21 dBm (7.1 V_{pk-pk})

AUX I/O (Port 0 DIO <0..3>, Port 1 DIO <0..3>, and PFI <0..3>

Number of channels	12 bidirectional (8 DIO and 4 PFI)
Connector type	HDMI
Interface standard	3.3 V LVCMOS
Interface logic	
Maximum V_{IL}	0.8 V
Minimum V_{IH}	2.0 V
Maximum V_{OL}	0.4 V
Minimum V_{OH}	2.7 V
Maximum V_{OH}	3.6 V
Z_{out}	50 Ω ± 20%
I_{out} (DC)	±2 mA
Pull-down resistor	150 kΩ
Recommended operating voltage	-0.3 V to 3.6 V
Overvoltage protection	±10 V
Maximum toggle frequency	100 MHz
+5 V maximum current	10 mA
+5 V voltage tolerance	4.2 V to 5 V

Power

Total power, typical operation	4.6 W

Physical

Dimensions	12.9 x 2.0 x 12.1 cm (5.1 x 0.8 x 4.7 in.)
Weight	420 g (14.8 oz)
Front panel connectors	Ten HDBNC and one HDMI

Environment

Maximum altitude	2,000 m (800 mbar) (at 25 °C ambient temperature)
Pollution Degree	2

Indoor use only.

Operating Environment

Ambient temperature range	0 °C to 55 °C (Tested in accordance with IEC 60068-2-1 and IEC 60068-2-2. Meets MIL-PRF-28800F Class 3 low temperature limit and MIL-PRF-28800F Class 2 high temperature limit.)
Relative humidity range	10% to 90%, noncondensing (Tested in accordance with IEC 60068-2-56.)

Storage Environment

Ambient temperature range	-20 °C to 70 °C (Tested in accordance with IEC 60068-2-1 and IEC 60068-2-2. Meets MIL-PRF-28800F Class 3 limits.)
Relative humidity range	5% to 95%, noncondensing (Tested in accordance with IEC 60068-2-56.)

Shock and Vibration

Operating shock	30 g peak, half-sine, 11 ms pulse (Tested in accordance with IEC 60068-2-27. Meets MIL-PRF-28800F Class 2 limits.)
Random vibration	
Operating	5 Hz to 500 Hz, 0.3 g_{rms}
Nonoperating	5 Hz to 500 Hz, 2.4 g_{rms} (Tested in accordance with IEC 60068-2-64. Nonoperating test profile exceeds the requirements of MIL-PRF-28800F, Class 3.)

Compliance and Certifications

Safety

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 61010-1

Note For UL and other safety certifications, refer to the product label or the *Online Product Certification* section.

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
- EN 55022 (CISPR 22): Class A emissions
- EN 55024 (CISPR 24): Immunity
- AS/NZS CISPR 11: Group 1, Class A emissions
- AS/NZS CISPR 22: Class A emissions
- FCC 47 CFR Part 15B: Class A emissions
- ICES-001: Class A emissions

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

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)

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.

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