

## DEVICE SPECIFICATIONS

# NI VB-8034

## NI VirtualBench™ All-In-One Instrument

These specifications are for the National Instruments VirtualBench VB-8034 only. These specifications are valid following 30 minutes of warmup and are typical at 25 °C, unless otherwise noted. For feature differences between the VirtualBench application for Windows and iPad, go to [ni.com/info](http://ni.com/info) and enter `vbfeatures`.

## Mixed Signal Oscilloscope

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### Analog Channels

#### Vertical System

Number of channels	4 single-ended, non-isolated
Bandwidth (-3 dB) <sup>1</sup>	350 MHz
Resolution	8 bits
Accuracy <sup>2</sup>	±2% of input ±1% full scale ( $V_{pk-pk}$ )
Input coupling	DC, AC
Vertical sensitivity (range)	5 mV/div (40 mV <sub>pk-pk</sub> ) 10 mV/div (100 mV <sub>pk-pk</sub> ) 20 mV/div (200 mV <sub>pk-pk</sub> ) 50 mV/div (400 mV <sub>pk-pk</sub> ) 100 mV/div (1 V <sub>pk-pk</sub> ) 200 mV/div (2 V <sub>pk-pk</sub> ) 500 mV/div (4 V <sub>pk-pk</sub> ) 1 V/div (10 V <sub>pk-pk</sub> ) 2 V/div (20 V <sub>pk-pk</sub> ) 5 V/div (40 V <sub>pk-pk</sub> )
Input impedance (user selectable)	1 MΩ    15 pF or 50 Ω

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<sup>1</sup> Bandwidth using 50 Ω mode or 1 MΩ mode with the accessory oscilloscope probe.

<sup>2</sup> Indicates warranted specifications valid at  $T_{cal} \pm 5$  °C. Temperature coefficients are calculated using the temperature change from last external calibration.

**Table 1. DC Offset Range**

Range	Programmable Offset Range
5 mV/div, 10 mV/div, 20 mV/div, 50 mV/div	±5 V
100 mV/div, 200 mV/div, 500 mV/div, 1 V/div, 2 V/div, 5 V/div	±20 V

Acquisition modes	Sample, peak detect, averaging
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## Horizontal System

Maximum sample rate	1.5 GS/s/channel
Maximum record length	1 MS/channel

## Digital Channels/Logic Analyzer

### Vertical System

Number of channels	34
Maximum input frequency	100 MHz
Input voltage	0 V to 5 V
Input current	≤50 μA



**Note** Mixed signal oscilloscope digital channels are designed to withstand accidental overvoltage from signals on the VB-8034 or similar devices. They are not recommended for use with signals likely to exceed 0 V to 5 V in normal operation.

Input threshold	Programmable, 0 V to 2.0 V
Threshold accuracy	350 mV
Input impedance	100 kΩ    7.5 pF (nominal) pulled to -2.0 V to +6.5 V, varies with the input threshold setting
Additional/internal channels	Digital I/O lines, function generator start, external trigger (TRIG), power line frequency

## Horizontal System

Timing mode sample rate <sup>3</sup>	1 GS/s (down to ~15 kS/s)
Maximum external sample clock rate	100 MHz
Record length	
Typical	1 MS
Minimum <sup>4</sup>	4 kS
Decimation	External Sample Clock, 1:1, 2:1, and n*4:1 where n is an integer
Maximum sample compression	2 <sup>15</sup> to 1

## Triggering

Trigger modes	Normal, Auto, Single, Force
Trigger sources	Oscilloscope analog channels, oscilloscope digital channels, function generator start, digital I/O lines, external trigger (TRIG), power line frequency
Trigger types	
Analog	Edge with hysteresis
Digital	Edge, glitch <sup>5</sup> , level, pattern
Trigger resolution	
Analog/oscilloscope	667 ps
Digital/logic analyzer	1 ns
Trigger export	Available through external trigger (TRIG)

<sup>3</sup> Indicates warranted specifications valid at  $T_{cal} \pm 5$  °C. Temperature coefficients are calculated using the temperature change from last external calibration.

<sup>4</sup> Under most conditions, the logic analyzer can acquire 1 MS of data. Under some conditions with very high sustained activity on multiple inputs, the logic analyzer may only capture 4 kS of data.

<sup>5</sup> Glitch triggers are only available with the NI VirtualBench driver.

## Waveform Measurements

Oscilloscope time <sup>6</sup>	Period, frequency, positive duty cycle, negative duty cycle, positive pulse width, negative pulse width, rise time, fall time, rise rate, fall rate
Oscilloscope voltage <sup>6</sup>	High, low, amplitude, maximum, minimum, peak-to-peak, overshoot, undershoot, RMS, mean, cycle RMS, cycle mean
Logic analyzer time <sup>6</sup>	Period, frequency, positive duty cycle, negative duty cycle, positive pulse width, negative pulse width

## Waveform Math

Operations <sup>7</sup>	A + B, A - B, A * B, A/B, FFT
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## Function Generator (FGEN)

Waveforms	Sine, square, ramp/triangle, DC, arbitrary <sup>8</sup>
Update rate	125 MS/s
Resolution	14 bits
Number of channels	1
Output impedance	50 $\Omega$
Switchable filter <sup>9</sup>	36 MHz lowpass, 7-pole, elliptical
Sine	
Maximum frequency	20 MHz
Total Harmonic Distortion (THD)	
1 MHz	-55 dBc
10 MHz	-50 dBc
Spurious Free Dynamic Range (SFDR)	-70 dB at 1 MHz (non-harmonic)
Phase noise (1 MHz)	-125 dBc/Hz at 10 kHz offset

<sup>6</sup> Waveform measurements are only available in the VirtualBench application.

<sup>7</sup> Waveform math is only available in the VirtualBench application.

<sup>8</sup> Arbitrary waveforms are only available with the NI VirtualBench driver.

<sup>9</sup> Switchable filters are only available with the NI VirtualBench driver. The VirtualBench application automatically enables the lowpass filter in sine mode.

## Square

Maximum frequency	5 MHz
Rise/fall time	<20 ns (10% to 90%)
Overshoot	<5%
Jitter	8 ns cycle-to-cycle
Ramp/triangle maximum frequency	1 MHz
Accuracy (with >10 k $\Omega$ load)	
Amplitude (1 kHz sine)	$\pm(1\%$ of output value $\pm 5$ mV)
DC	$\pm(1\%$ of output value $\pm 5$ mV)
Output range	
50 $\Omega$	$\pm 6$ V
Hi-Z (>10 k $\Omega$ )	$\pm 12$ V
DC offset	
50 $\Omega$	$\pm 6$ V
Hi-Z (>10 k $\Omega$ )	$\pm 12$ V



**Note** The combination of signal amplitude and DC offset cannot exceed the output range specifications. The impedances listed are the loads applied by the user to the FGEN output.

## Frequency

Accuracy	$\leq 100$ ppm
Resolution	1 $\mu$ Hz
Arbitrary waveform	
Points	1 MS
Sample rate	125 MS/s
Flatness	$\pm 0.3$ dB to 20 MHz
Protection	Short-circuit protected

## Triggering

Trigger types	Start of buffer <sup>10</sup>
Trigger resolution	8 ns
Trigger export	Available through external trigger (TRIG)

<sup>10</sup> The function generator can only produce a trigger.

# Digital I/O

Number of channels	8
Direction control	Input or output, software-selectable
Logic level	5 V compatible TTL input, 3.3 V LVTTTL output
Drive strength	4 mA
Input voltage	0 V to 5 V



**Note** Digital I/O lines are designed to withstand accidental overvoltage from signals on the VB-8034 or similar devices. They are not recommended for use with signals likely to exceed 0 V to 5 V in normal operation.

DIO channel pull resistors	10 k $\Omega$ , pull-down on dig/<0..7>, 1.5 k $\Omega$ , configurable pull-up to 3.3 V on dig/<6,7>
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## External Power

3.3 V output	
Voltage	3.3 V $\pm$ 10%
Current	20 mA

## Digital Multimeter

Functions	DC voltage, AC voltage, DC current, AC current, resistance, diode, continuity
Resolution	5½ digits
Sample rate	5 S/s



**Caution** Do not use this device for connection to signals or for measurements within Measurement Categories III or IV. For more information about Measurement Categories, refer to the [Safety Voltages](#) section.

Input protection	
Resistance, diode	Up to 300 V DC
DC and AC voltage	Up to 300 V DC or 265 V AC <sub>rms</sub> , 400 V AC peak

## DC and AC current

DMM A current connector fuse	Internal ceramic fuse, 11 A, 1 kV AC, 10.3 × 38 mm, F 11A 1000V (SIBA part number 5019906.11 at <a href="http://www.siba-fuses.com">www.siba-fuses.com</a> )
DMM mA current connector fuse	Internal ceramic fuse, 1 A, 500 V AC, 5 × 20 mm, T 1A H 400V (Littelfuse part number 0477001.MXP at <a href="http://www.littelfuse.com">www.littelfuse.com</a> )



**Caution** Fuses are located on bottom of device underneath door. Use Phillips #1 screwdriver for removal. Ensure all hazardous voltages are disconnected from the device prior to removal of door.



**Fuse** When this fuse symbol is marked on a device, take proper precautions.

Maximum common-mode voltage 300 V DC or AC<sub>rms</sub>

## DC

**Table 2.** DC Voltage Accuracy

Range	Input Impedance	1-Year Accuracy <sup>11</sup> ± (% of Reading + % of Range)	Temperature Coefficient <sup>11</sup> ± (% of Reading + % of Range)/°C
100 mV*	>10 GΩ, 10 MΩ	0.015 + 0.005	0.001 + 0.0005
1 V	>10 GΩ, 10 MΩ	0.015 + 0.005	0.001 + 0.0005
10 V	>10 GΩ, 10 MΩ	0.015 + 0.005	0.001 + 0.0005
100 V	10 MΩ	0.035 + 0.005	0.005 + 0.0005
300 V	10 MΩ	0.035 + 0.005	0.005 + 0.0005

\* Add 15 μV if not immediately following offset null.

<sup>11</sup> Indicates warranted specifications valid at T<sub>cal</sub> ±5 °C. Temperature coefficients are calculated using the temperature change from last external calibration.



Effective Common-Mode Rejection Ratio >100 dB  
(CMRR), 1 kΩ resistance in LO lead

Normal-Mode Rejection Ratio (NMRR), >100 dB  
50/60 Hz ±0.1%

Overrange 105% of range except 300 V

## AC

**Table 5. AC Voltage Accuracy**

Range (rms)	Peak Voltage	Frequency	1-Year Accuracy <sup>13</sup> ± (% of Reading + % of Range)	Temperature Coefficient <sup>13</sup> ± (% of Reading + % of Range)/°C
100 mV, 1 V, 10 V, 100 V, 265 V	±210 mV, ±2.1 V, ±21 V, ±210 V, ±400 V	20 Hz to 45 Hz	0.91 + 0.10	0.01 + 0.005
		45 Hz to 65 Hz	0.30 + 0.05	0.01 + 0.005
		65 Hz to 1 kHz	0.21 + 0.05	0.01 + 0.005
		1 kHz to 5 kHz	0.12 + 0.05	0.01 + 0.005
		5 kHz to 20 kHz	0.35 + 0.05	0.01 + 0.005

**Table 6. AC Current Accuracy**

Range (rms)	Peak Current	Burden Voltage (rms)	Frequency	1-Year Accuracy <sup>13</sup> ± (% of Reading + % of Range)	Temperature Coefficient <sup>13</sup> ± (% of Reading + % of Range)/°C
5 mA	±10.5 mA	<0.02 V	20 Hz to 1 kHz	0.20 + 0.01	0.01 + 0.005
			1 kHz to 5 kHz	0.60 + 0.01	

<sup>13</sup> Indicates warranted specifications valid at T<sub>cal</sub> ±5 °C. Temperature coefficients are calculated using the temperature change from last external calibration.

**Table 6. AC Current Accuracy (Continued)**

Range (rms)	Peak Current	Burden Voltage (rms)	Frequency	1-Year Accuracy <sup>13</sup> ± (% of Reading + % of Range)	Temperature Coefficient <sup>13</sup> ± (% of Reading + % of Range)/°C
50 mA	±105 mA	<0.2 V	20 Hz to 1 kHz	0.20 + 0.01	0.01 + 0.005
			1 kHz to 5 kHz	0.50 + 0.01	
500 mA	±1.05 A	<0.02 V	20 Hz to 1 kHz	0.15 + 0.01	0.01 + 0.005
			1 kHz to 5 kHz	0.50 + 0.01	
5 A	±10.5 A	<0.2 V	20 Hz to 1 kHz	0.25 + 0.03	0.01 + 0.005
			1 kHz to 5 kHz	0.60 + 0.03	



**Caution** The input terminals of the DMM are not protected for electromagnetic interference. As a result, the DMM may experience reduced measurement accuracy or other temporary performance degradation when connected to unshielded test leads in an environment with radiated or conducted radio frequency electromagnetic interference.

Input impedance	10 MΩ    200 pF
CMRR, 1 kΩ resistance in LO lead	>70 dB (DC to 60 Hz)

## DC Power Supply

Outputs	0 V to +6 V/0 A to 3 A, 0 V to +25 V/0 A to 1 A (isolated), 0 V to -25 V/0 A to 1 A (isolated)
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**Note** The +25 V and -25 V channels are bank isolated from ground but not from each other.

**Table 7. DC Accuracy/Resolution**

Output	Type	+6 V	+25 V	-25 V
DC output <sup>14</sup>	Voltage	0 V to +6 V	0 V to +25 V	0 V to -25 V
	Current <sup>15</sup>	3 A	1 A	1 A
Programming accuracy <sup>14,15</sup> ± (% of reading + offset)	Voltage	0.1% + 5 mV	0.1% + 20 mV	0.1% + 20 mV
	Current	0.2% + 10 mA	0.15% + 4 mA	0.15% + 4 mA
Readback accuracy <sup>14,16</sup> ± (% of reading + offset)	Voltage	0.1% + 5 mV	0.1% + 20 mV	0.1% + 20 mV
	Current	0.2% + 10 mA	0.15% + 4 mA	0.15% + 4 mA
Programming resolution	Voltage	1.6 mV	6.6 mV	6.6 mV
	Current	0.90 mA	0.30 mA	0.30 mA
Readback resolution	Voltage	0.40 mV	1.7 mV	1.7 mV
	Current	210 μA	70 μA	70 μA
Load regulation <sup>17</sup> ± (% of reading + offset)	Voltage	0.01% + 25 mV	0.03% + 5 mV	0.03% + 5 mV

Overvoltage protection 30 V (all channels)

Reverse voltage protection Reverse clamp diode, protected by self-resetting fuse

## External Trigger (TRIG)

Direction control Input or output, software-selectable

Logic level 5 V compatible TTL input,  
3.3 V LVTTTL output

<sup>14</sup> Indicates warranted specifications valid at  $T_{cal} \pm 5$  °C. Temperature coefficients are calculated using the temperature change from last external calibration.

<sup>15</sup> Minimum programmable current limit is 1% of range.

<sup>16</sup> Programming and readback accuracy specified at no load.

<sup>17</sup> Change in output voltage for any load within range.

Drive strength	4 mA
Input voltage	0 V to 5 V



**Note** The external trigger line is designed to withstand accidental overvoltage from signals on the VB-8034 or similar devices. It is not recommended for use with signals likely to exceed 0 V to 5 V in normal operation.

## Connectivity

### Wired USB Interface

USB specification	USB 2.0 Hi-Speed
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### Wired Ethernet Interface

Network interface	1000 Base-TX, full-duplex; 100 Base-TX, full-duplex; 100 Base-TX, half-duplex; 10 Base-T, full-duplex; 10 Base-T, half-duplex
Communication rates	10/100/1000 Mbps, auto-negotiated
Maximum cabling distance	100 m/segment
Network IP configuration	IPv4, DHCP Client

**Table 8.** Network Protocols and Ports Used

Port	Protocol	Function
Port 80/TCP	HTTP	Device configuration (web, MAX)
Port 443/TCP	HTTP	Device configuration (web, MAX)
Port 3580/TCP	Service locator	Device configuration (web, MAX)
Port 9090/TCP	Configuration only	VirtualBench instrument protocol
Port 5353/UDP	Multicast DNS	Device discovery

# Wireless Interface

**Table 9.** Network Protocols and Ports Used

Port	Protocol	Function
Port 80/TCP	HTTP	Device configuration (web, MAX)
Port 443/TCP	HTTP	Device configuration (web, MAX)
Port 3580/TCP	Service locator	Device configuration (web, MAX)
Port 9090/TCP	Configuration only	VirtualBench instrument protocol
Port 5353/UDP	Multicast DNS	Device discovery

Network IP configuration	IPv4, DHCP Client/Server
Radio mode	IEEE 802.11 b,g,n
Wireless modes	AP mode (default), client mode
Frequency band	2.4 GHz ISM
Channel width	20 MHz
Channels	USA 1-11, International 1-13 (12 and 13 client mode only)
TX power	+10 dBm maximum (10 mW)
Security	Open, WPA, WPA2, WPA2-Enterprise
Enterprise security EAP types	EAP-TLS, EAP-TTLS/MS-CHAPv2, PEAPv0/MS-CHAPv2
Antenna	External RP-SMA omnidirectional dipole

## Power Requirements



**Caution** The protection provided by the VirtualBench hardware can be impaired if it is used in a manner not described in the *NI VB-8034 Safety, Environmental, and Regulatory Information* document.

Voltage input range	100 VAC to 240 VAC, 50/60 Hz
Power consumption	150 W maximum

Power input connector	IEC C13 power connector
Power disconnect	The AC power cable provides main power disconnect. Do not position the equipment so that it is difficult to disconnect the power cable. Depressing the front panel power button does not inhibit the internal power supply.

## Calibration

Calibration cycle (digital multimeter, mixed signal oscilloscope, function generator, DC power supply)	1 year
Specified temperature	$T_{\text{cal}} \pm 5 \text{ }^{\circ}\text{C}$
Warmup time	30 minutes

## Physical Characteristics

### Dimensions

Enclosure	30.48 cm × 20.32 cm × 9.40 cm (12.0 in. × 8.0 in. × 3.7 in.)
Enclosure with connectors and antenna	30.48 cm × 25.40 cm × 16.00 cm (12.0 in. × 10.0 in. × 6.3 in.)



**Note** Use the VirtualBench instrument in a horizontal orientation. Allow at least 10.16 cm (4.0 in.) of clearance in front, on the sides, and behind the VirtualBench instrument for airflow clearances, and USB, power, and common connector cabling.

Weight	3.130 kg (6 lb 4.4 oz)
<b>Connectivity</b>	
Mixed signal oscilloscope	4, BNC
Logic analyzer	1, 2x20 shrouded IDC header
External trigger	1, BNC
Function generator	1, BNC
<b>Digital I/O</b>	
Type	1, pluggable screw terminal, 3.5 mm (14 position)
Screw terminal wiring	0.1 mm <sup>2</sup> to 2.0 mm <sup>2</sup> (30 AWG to 14 AWG)
Torque	0.25 N · m (2.2 lb · in.)

Digital multimeter	4, 4 mm banana jacks
DC power supply	6, 4 mm binding posts
Security cable slot	1, complies with Kensington security slot dimensions

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

## Safety Voltages

Connect only voltages that are within these limits.

### DMM Isolation Voltages



**Hazardous Voltage** This icon denotes a warning advising you to take precautions to avoid electrical shock.

Channel-to-earth ground

Continuous	300 V, Measurement Category II
Withstand	3,000 V <sub>RMS</sub> , verified by a 5 s dielectric withstand test

Measurement Category II is for measurements performed on circuits directly connected to the electrical distribution system. This category refers to local-level electrical distribution, such as that provided by a standard wall outlet, for example, 115 V for U.S. or 230 V for Europe.



**Caution** Do not connect the VirtualBench hardware to signals or use for measurements within Measurement Categories III or IV.

### DC Power Supply Isolation Voltages

+25 V and -25 V-to-earth ground continuous 60 VDC, Measurement Category I



**Note** Measurement Categories CAT I and CAT O 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

Operating temperature	0 °C to 40 °C
Storage temperature	-20 °C to 70 °C
Operating humidity	10% to 90% RH, noncondensing DMM full accuracy at 10% to 80%

Storage humidity	5% to 95% RH, noncondensing
Cooling	Forced air circulation (negative pressurization) through a fan. Fan speed automatically adjusts according to operating conditions. Intake locations are on the sides of device. Exhaust location is on the rear of device. Ensure that the intake and exhaust locations are not obstructed.
Pollution Degree	2
Maximum altitude	2,000 m

Indoor use only.

## Shock and Vibration

Operational shock	30 g peak, half-sine, 11 ms pulse (Tested in accordance with IEC 60068-2-27. Test profile developed in accordance with MIL-PRF-28800F.)
Random vibration	
Operating	5 to 500 Hz, 0.3 g <sub>rms</sub>
Nonoperating	5 to 500 Hz, 2.4 g <sub>rms</sub> (Tested in accordance with IEC-60068-2-64. Nonoperating test profile exceeds the requirements of MIL-PRF-28800F, Class 3.)

## 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

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

- 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 and certifications, and additional information, refer to the [Online Product Certification](#) section.

## CE Compliance

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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)
- 2014/53/EU; Radio Equipment Directive (RED)

## Online Product Certification

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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](https://ni.com/certification), search by model number or product line, and click the appropriate link in the Certification column.

# Environmental Management

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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](http://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](http://ni.com/environment/weee).

## 电子信息产品污染控制管理办法（中国 RoHS）



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