NI 6341/6343 Specifications

Français Deutsch 日本語 한국어 简体中文

ni.com/manuals

Specifications listed below are typical at 25 °C unless otherwise noted. Refer to the *X Series User Manual* for more information about NI PCIe-6341/6343, NI PXIe-6341, and NI USB-6341/6343 devices.

Analog Input

Number of channels
- NI 6341 ..... 8 differential or 16 single ended
- NI 6343 ..... 16 differential or 32 single ended

ADC resolution ..... 16 bits

DNL ..... No missing codes guaranteed

INL ..... Refer to the *AI Absolute Accuracy Table*

Sample rate
- Maximum ..... 500 kS/s single channel, 500 kS/s multichannel (aggregate)
- Minimum ..... No minimum
- Timing accuracy ..... 50 ppm of sample rate
- Timing resolution ..... 10 ns

Input coupling ..... DC

Input range ..... ±10 V, ±5 V, ±1 V, ±0.2 V

Maximum working voltage for analog inputs (signal + common mode) ..... ±11 V of AI GND

CMRR (DC to 60 Hz) ..... 100 dB

Input impedance
- Device powered on
  - AI+ to AI GND ..... >10 GΩ in parallel with 100 pF
  - AI- to AI GND ..... >10 GΩ in parallel with 100 pF
- Device powered off
  - AI+ to AI GND ..... 1200 Ω
  - AI- to AI GND ..... 1200 Ω

Input bias current ..... ±100 pA

NATIONAL INSTRUMENTS

Crosstalk (at 100 kHz)

Adjacent channels ..... -75 dB

Nonadjacent channels ..... -90 dB

Small signal bandwidth (-3 dB) ..... 1.2 MHz

Input FIFO size ..... 4,095 samples

Scan list memory ..... 4,095 entries

Data transfers

NI PCIe/PXIe-6341/6343 ..... DMA (scatter-gather), programmed I/O

NI USB-6341/6343 ..... USB Signal Stream, programmed I/O

Overvoltage protection (AI <0..31>, AI SENSE, AI SENSE 2)

Device powered on ..... ±25 V for up to two AI pins

Device powered off ..... ±15 V for up to two AI pins

Input current during
overvoltage condition ..... ±20 mA max/AI pin

Settling Time for Multichannel Measurements

Accuracy, full scale step, all ranges

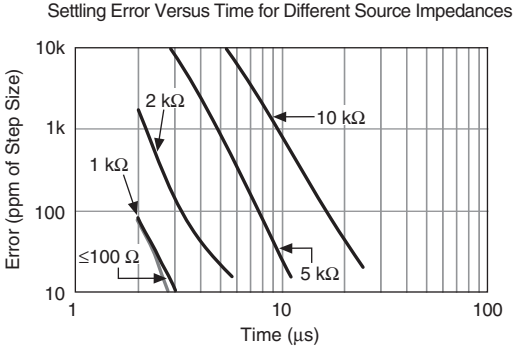
±90 ppm of step (±6 LSB) ..... 2 µs convert interval

±30 ppm of step (±2 LSB) ..... 3 µs convert interval

±15 ppm of step (±1 LSB) ..... 5 µs convert interval

Analog triggers ..... None

Typical Performance Graph



Analog Output

Number of channels
- NI 6341 2
- NI 6343 4

DAC resolution ..... 16 bits

DNL ..... ±1 LSB

Monotonicity ..... 16 bit guaranteed

Maximum update rate (simultaneous)
- 1 channel ..... 900 kS/s
- 2 channels ..... 840 kS/s per channel
- 3 channels ..... 775 kS/s per channel
- 4 channels ..... 719 kS/s per channel

Timing accuracy ..... 50 ppm of sample rate

Timing resolution ..... 10 ns

Output range ..... ±10 V

Output coupling ..... DC

Output impedance ..... 0.2 Ω

Output current drive ..... ±5 mA

Overdrive protection ..... ±15 V

Overdrive current ..... 15 mA

Power-on state ..... ±20 mV

Power-on/off glitch
- NI PCIe/PXIe-6341/6343 ..... 2 V for 500 ms
- NI USB-6341/6343 ..... 1.5 V for 1.2 s[1]

Output FIFO size ..... 8,191 samples shared among channels used

Data transfers
- NI PCIe/PXIe-6341/6343 ..... DMA (scatter-gather), programmed I/O
- NI USB-6341/6343 ..... USB Signal Stream, programmed I/O

AO waveform modes:

- Non-periodic waveform
- Periodic waveform regeneration mode from onboard FIFO
- Periodic waveform regeneration from host buffer including dynamic update

[1] Typical behavior. Time period may be longer due to host system USB performance. Time period will be longer during firmware updates.

Settling time, full scale step
15 ppm (1 LSB) ..... 6 µs

Slew rate ..... 15 V/µs

Glitch energy

- Magnitude ..... 100 mV
- Duration ..... 2.6 µs

Calibration (AI and AO)

Recommended warm-up time ..... 15 minutes

Calibration interval ..... 2 years

AI Absolute Accuracy Table

Nominal Range		Residual Gain Error (ppm of Reading)	Gain Tempco (ppm/°C)	Reference Tempco (ppm/°C)	Residual Offset Error (ppm of Range)	Offset Tempco (ppm of Range/°C)	INLError (ppm of Range)	Random Noise, σ (μVrms)	Absolute Accuracy at Full Scale[1] (μV)
Positive Full Scale	Negative Full Scale								
10	-10	65	7.3	5	13	23	60	270	2190
5	-5	72	7.3	5	13	23	60	135	1130
1	-1	78	7.3	5	17	26	60	28	240
0.2	-0.2	105	7.3	5	27	39	60	9	60

AbsoluteAccuracy = Reading · (GainError) + Range · (OffsetError) + NoiseUncertainty

GainError = ResidualGainError + GainTempco · (TempChangeFromLastInternalCal) + ReferenceTempco · (TempChangeFromLastExternalCal)
OffsetError = ResidualOffsetError + OffsetTempco · (TempChangeFromLastInternalCal) + INL_Error

$$\text{NoiseUncertainty} = \frac{\text{RandomNoise} \cdot 3}{\sqrt{10{,}000}}$$ For a coverage factor of 3 σ and averaging 10,000 points.

[1] Absolute accuracy at full scale on the analog input channels is determined using the following assumptions:
TempChangeFromLastExternalCal = 10 °C
TempChangeFromLastInternalCal = 1 °C
number_of_readings = 10,000
CoverageFactor = 3 σ

For example, on the 10 V range, the absolute accuracy at full scale is as follows:

GainError = 65 ppm + 7.3 ppm · 1 + 5 ppm · 10 GainError = 122 ppm
OffsetError = 13 ppm + 23 ppm · 1 + 60 ppm OffsetError = 96 ppm

$$\text{NoiseUncertainty} = \frac{270\ \mu\text{V} \cdot 3}{\sqrt{10{,}000}}$$ Noise Uncertainty = 8.1 μV

AbsoluteAccuracy = 10 V · (GainError) + 10 V · (OffsetError) + NoiseUncertainty AbsoluteAccuracy = 2,190 μV

Accuracies listed are valid for up to two years from the device external calibration.

AO Absolute Accuracy Table

Nominal Range		Residual Gain Error (ppm of Reading)	Gain Tempco (ppm/°C)	Reference Tempco (ppm/°C)	Residual Offset Error (ppm of Range)	Offset Tempco (ppm of Range/°C)	INL Error (ppm of Range)	Absolute Accuracy at Full Scale[1] (µV)
Positive Full Scale	Negative Full Scale							
10	-10	80	11.3	5	53	4.8	128	3,271

[1] Absolute Accuracy at full scale numbers is valid immediately following internal calibration and assumes the device is operating within 10 °C of the last external calibration.

Accuracies listed are valid for up to two years from the device external calibration.

AbsoluteAccuracy = OutputValue · (GainError) + Range · (OffsetError)

GainError = ResidualGainError + GainTempco · (TempChangeFromLastInternalCal) + ReferenceTempco · (TempChangeFromLastExternalCal)

OffsetError = ResidualOffsetError + OffsetTempco · (TempChangeFromLastInternalCal) + INL_Error

Digital I/O/PFI

Static Characteristics

Number of channels

- NI 6341 ..... 24 total, 8 (P0.<0..7>)
  16 (PFI <0..7>/P1, PFI <8..15>/P2)
- NI 6343 ..... 48 total, 32 (P0.<0..31>)
  16 (PFI <0..7>/P1, PFI <8..15>/P2)

Ground reference ..... D GND

Direction control ..... Each terminal individually programmable as input or output

Pull-down resistor ..... 50 kΩ typical, 20 kΩ minimum

Input voltage protection[1] ..... ±20 V on up to two pins

Waveform Characteristics (Port 0 Only)

Terminals used

- NI 6341 ..... Port 0 (P0.<0..7>)
- NI 6343 ..... Port 0 (P0.<0..31>)

Port/sample size

- NI 6341 ..... Up to 8 bits
- NI 6343 ..... Up to 32 bits

Waveform generation (DO) FIFO ..... 2,047 samples

Waveform acquisition (DI) FIFO ..... 255 samples

DO or DI Sample Clock frequency

- NI PCIe/PXIe-6341/6343 ..... 0 to 1 MHz, system and bus activity dependent
- NI USB-6341/6343 ..... 0 to 1 MHz, system and bus activity dependent

Data transfers

- NI PCIe/PXIe-6341/6343 ..... DMA (scatter-gather), programmed I/O
- NI USB-6341/6343 ..... USB Signal Stream, programmed I/O

Digital line filter settings ..... 160 ns, 10.24 µs, 5.12 ms, disable

[1] Stresses beyond those listed under *Input voltage protection* may cause permanent damage to the device.

PFI/Port 1/Port 2 Functionality

Functionality ..... Static digital input, static digital output, timing input, timing output

Timing output sources..... Many AI, AO, counter, DI, DO timing signals

Debounce filter settings ..... 90 ns, 5.12 µs, 2.56 ms, custom interval, disable; programmable high and low transitions; selectable per input

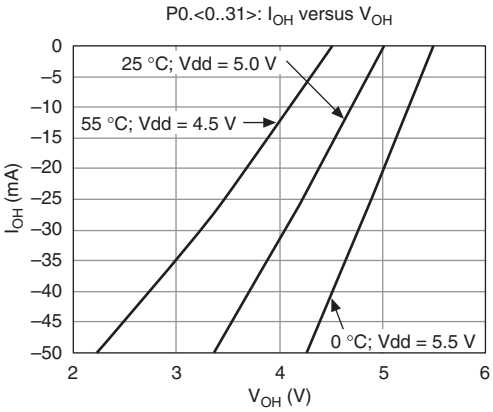
Recommended Operation Conditions

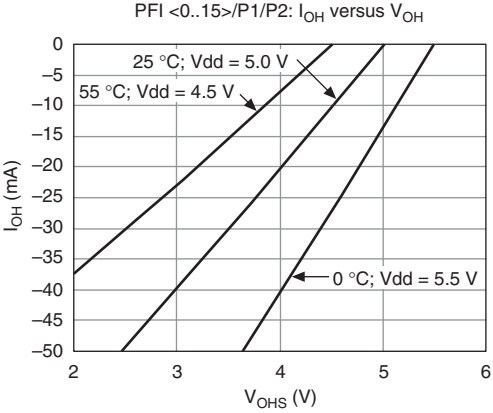
Level	Min	Max
Input high voltage (V_{IH})	2.2 V	5.25 V
Input low voltage (V_{IL})	0 V	0.8 V
Output high current (I_{OH})		
P0.<0..31>	—	-24 mA
PFI <0..15>/P1/P2	—	-16 mA
Output low current (I_{OL})		
P0.<0..31>	—	24 mA
PFI <0..15>/P1/P2	—	16 mA

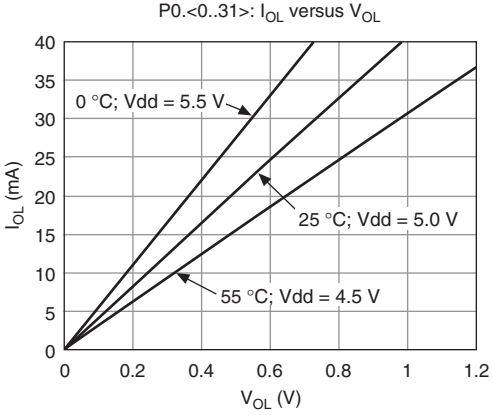
Electrical Characteristics

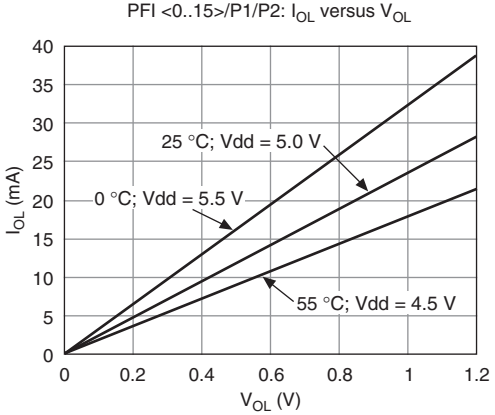
Level	Min	Max
Positive-going threshold (VT+)	—	2.2 V
Negative-going threshold (VT-)	0.8 V	—
Delta VT hysteresis (VT+ - VT-)	0.2 V	—
I_{IL} input low current (V_{in} = 0 V)	—	-10 µA
I_{IH} input high current (V_{in} = 5 V)	—	250 µA

Digital I/O Characteristics









General-Purpose Counter/Timers

Number of counter/timers 4

Resolution ..... 32 bits

Counter measurements ..... Edge counting, pulse, pulse width, semi-period, period, two-edge separation

Position measurements ..... X1, X2, X4 quadrature encoding with Channel Z reloading; two-pulse encoding

Output applications ..... Pulse, pulse train with dynamic updates, frequency division, equivalent time sampling

Internal base clocks ..... 100 MHz, 20 MHz, 100 kHz

External base clock frequency

- NI PCIe/USB-6341/6343 ..... 0 MHz to 25 MHz
- NI PXIe-6341 ..... 0 MHz to 25 MHz; 0 MHz to 100 MHz on PXIe-DSTAR<A,B>

Base clock accuracy ..... 50 ppm

Inputs ..... Gate, Source, HW_Arm, Aux, A, B, Z, Up_Down, Sample Clock

Routing options for inputs

- NI PCIe-6341/6343 ..... Any PFI, RTSI, many internal signals
- NI PXIe-6341 ..... Any PFI, PXIe-DSTAR<A,B>, PXI_TRIG, PXI_STAR, many internal signals
- NI USB-6341/6343 ..... Any PFI, many internal signals

FIFO..... 127 samples per counter

Data transfers

NI PCIe/PXIe-6341/6343 ..... Dedicated scatter-gather DMA controller for each counter/timer, programmed I/O

NI USB-6341/6343..... USB Signal Stream, programmed I/O

Frequency Generator

Number of channels..... 1

Base clocks ..... 20 MHz, 10 MHz, 100 kHz

Divisors..... 1 to 16

Base clock accuracy..... 50 ppm

Output can be available on any PFI or RTSI terminal.

Phase-Locked Loop (PLL)

Number of PLLs 1

Reference clock locking frequencies

Reference Signal	Locking Input Frequency (MHz)		
	PCIe	PXIe	USB
PXIe-DSTAR<A,B>	—	10, 20, 100	—
PXI_STAR	—	10, 20	—
PXIe_CLK100	—	100	—
PXI_TRIG <0..7>	—	10, 20	—
RTSI <0..7>	10, 20	—	—
PFI <0..15>	10, 20	10, 20	10

Output of PLL..... 100 MHz Timebase; other signals derived from 100 MHz Timebase including 20 MHz and 100 kHz Timebases

External Digital Triggers

Source

NI PCIe-6341/6343..... Any PFI, RTSI

NI PXIe-6341 ..... Any PFI, PXIe-DSTAR<A,B>, PXI_TRIG, PXI_STAR

NI USB-6341/6343..... Any PFI

Polarity ..... Software-selectable for most signals

Analog input function ..... Start Trigger, Reference Trigger, Pause Trigger, Sample Clock, Convert Clock, Sample Clock Timebase

Analog output function ..... Start Trigger, Pause Trigger, Sample Clock, Sample Clock Timebase

Counter/timer functions ..... Gate, Source, HW_Arm, Aux, A, B, Z, Up_Down, Sample Clock

Digital waveform generation (DO) function .... Start Trigger, Pause Trigger, Sample Clock, Sample Clock Timebase

Digital waveform acquisition (DI) function ..... Start Trigger, Reference Trigger, Pause Trigger, Sample Clock, Sample Clock Timebase

Device-To-Device Trigger Bus

Input source

- NI PCIe-6341/6343 ..... RTSI <0..7>[1]
- NI PXIe-6341 ..... PXI_TRIG <0..7>, PXI_STAR, PXIe-DSTAR<A,B>
- NI USB-6341/6343 ..... None

Output destination

- NI PCIe-6341/6343 ..... RTSI <0..7>[2]
- NI PXIe-6341 ..... PXI_TRIG <0..7>, PXIe-DSTARC
- NI USB-6341/6343 ..... None

Output selections ..... 10 MHz Clock, frequency generator output, many internal signals

Debounce filter settings ..... 90 ns, 5.12 µs, 2.56 ms, custom interval, disable; programmable high and low transitions; selectable per input

[1] In other sections of this document, *RTSI* refers to RTSI <0..7> for NI PCIe-6341/6343 or PXI_TRIG <0..7> for NI PXIe-6341.

[2] In other sections of this document, *RTSI* refers to RTSI <0..7> for NI PCIe-6341/6343 or PXI_TRIG <0..7> for NI PXIe-6341.

Bus Interface

NI PCIe-6341/6343

- Form factor ..... x1 PCI Express, specification v1.1 compliant
- Slot compatibility ..... x1, x4, x8, and x16 PCI Express slots[1]
- DMA channels ..... 8, analog input, analog output, digital input, digital output, counter/timer 0, counter/timer 1, counter/timer 2, counter/timer 3

NI PXIe-6341

- Form factor ..... x1 PXI Express peripheral module, specification rev 1.0 compliant
- Slot compatibility ..... x1 and x4 PXI Express or PXI Express hybrid slots
- DMA channels ..... 8, analog input, analog output, digital input, digital output, counter/timer 0, counter/timer 1, counter/timer 2, counter/timer 3

All NI PXIe-6341 devices may be installed in PXI Express slots or PXI Express hybrid slots.

NI USB-6341/6343

- USB compatibility ..... USB 2.0 Hi-Speed or full-speed[2]
- USB Signal Stream ..... 8, can be used for analog input, analog output, digital input, digital output, counter/timer 0, counter/timer 1, counter/timer 2, counter/timer 3

Power Requirements

Caution The protection provided by the NI 6341/6343 can be impaired if it is used in a manner not described in the *X Series User Manual*.

NI PCIe-6341/6343

Without disk drive power connector installed

- +3.3 V ..... 1.4 W
- +12 V ..... 8.6 W

With disk drive power connector installed

- +3.3 V ..... 1.4 W
- +12 V ..... 3 W
- +5 V ..... 15 W

[1] Some motherboards reserve the x16 slot for graphics use. For PCI Express guidelines, refer to `ni.com/pciexpress`.

[2] Operating on a full-speed bus will result in lower performance and you might not be able to achieve maximum sampling/update rates.

NI PXIe-6341

+3.3 V ..... 1.6 W

+12 V ..... 19.8 W

Caution NI USB-6341/6343 devices *must* be powered with NI offered AC adapter or a National Electric Code (NEC) Class 2 DC source that meets the power requirements for the device and has appropriate safety certification marks for country of use.

NI USB-6341/6343

Power supply requirements..... 11 to 30 VDC, 30 W, 2 positions 3.5 mm pitch pluggable screw terminal with screw locks similar to Phoenix Contact MC 1,5/2-STF-3,5 BK

Power input mating connector ..... Phoenix Contact MC 1,5/2-GF-3,5 BK or equivalent

Current Limits

Caution Exceeding the current limits may cause unpredictable behavior by the device and/or PC/chassis.

NI PCIe-6341/6343

Without disk drive power connector installed

P0/PFI/P1/P2 and +5 V terminals combined..... 1 A max

With disk drive power connector installed

+5 V terminal (connector 0)..... 1 A max[1]

+5 V terminal (connector 1)..... 1 A max[1]

P0/PFI/P1/P2 combined..... 1 A max

NI PXIe-6341

+5 V terminal (connector 0)..... 1 A max[1]

P0/PFI/P1/P2 and +5 V terminals combined..... 2 A max

NI USB-6341/6343

+5 V terminal ..... 1 A max[1]

P0/PFI/P1/P2 and +5 V terminals combined..... 2 A max

[1] Has a self-resetting fuse that opens when current exceeds this specification.

Physical Requirements

Printed circuit board dimensions

- NI PCIe-6341/6343 ..... 9.9 × 16.8 cm (3.9 × 6.6 in.) (half-length)
- NI PXIe-6341 ..... Standard 3U PXI

Enclosure dimensions (includes connectors)

- NI USB-6341/6343
  - Screw Terminal ..... 26.4 × 17.3 × 3.6 cm (10.4 × 6.8 × 1.4 in.)
  - BNC ..... 20.3 × 18.5 × 6.8 cm (8.0 × 7.3 × 2.7 in)

Weight

- NI PCIe-6341 ..... 104 g (3.6 oz)
- NI PCIe-6343 ..... 114 g (4.0 oz)
- NI PXIe-6341 ..... 157 g (5.5 oz)
- NI USB-6341
  - Screw Terminal ..... 1.406 kg (3 lb 1.6 oz)
  - BNC ..... 1.520 kg (3 lb 5.6 oz)
- NI USB-6343
  - Screw Terminal ..... 1.445 kg (3 lb 3 oz)
  - BNC ..... 1.803 kg (3 lb 15.6 oz)

I/O connector

- NI PCIe/PXIe-6341 ..... 1 68-pin VHDCI
- NI PCIe/PXIe-6343 ..... 2 68-pin VHDCI
- NI USB-6341
  - Screw Terminal ..... 64 screw terminals
  - BNC ..... 20 BNCs and 30 screw terminals
- NI USB-6343
  - Screw Terminal ..... 128 screw terminals
  - BNC ..... 30 BNCs and 60 screw terminals

NI PCIe/PXIe-6341/6343 mating connectors:

- 68-Pos Right Angle Single Stack PCB-Mount VHDCI (Receptacle), MOLEX 71430-0011
- 68-Pos Right Angle Dual Stack PCB-Mount VHDCI (Receptacle), MOLEX 74337-0016
- 68-Pos Offset IDC Cable Connector (Plug) (SHC68-*), MOLEX 71425-3001

NI PCIe-6341/6343
disk drive power connector ..... Standard ATX peripheral connector (not serial ATA)

NI USB-6341/6343 screw terminal wiring ..... 16-24 AWG

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

Maximum Working Voltage[1]

Channel to earth ..... 11 V, Measurement Category I

Caution Do *not* use for measurements within Categories II, III, or IV.

Environmental

Operating temperature

- NI PCIe-6341/6343 ..... 0 to 50 °C
- NI PXIe-6341 ..... 0 to 55 °C
- NI USB-6341/6343 ..... 0 to 45 °C

Storage temperature ..... -40 to 70 °C

Operating humidity ..... 10 to 90% RH, noncondensing

Storage humidity ..... 5 to 90% RH, noncondensing

Pollution Degree 2

Maximum altitude ..... 2,000 m

Indoor use only

Shock and Vibration (NI PXIe-6341 Only)

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_{rms}
- Nonoperating ..... 5 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.)

[1] *Maximum working voltage* refers to the signal voltage plus the common-mode voltage.

Safety

This product meets 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.

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

Caution When operating this product, use shielded cables and accessories

Note For EMC declarations and 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:

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

Online Product Certification

To obtain product certifications and the Declaration of Conformity (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 products *must* be sent to a WEEE recycling center. For more information about WEEE recycling centers, National Instruments WEEE initiatives, and compliance with WEEE Directive 2002/96/EC on Waste Electrical and Electronic Equipment, visit `ni.com/environment/weee.htm`.

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`.)

Contact Information

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512 795 8248
`ni.com/niglobal`

Figure 1. NI PCIe/PXIe-6341 Pinout

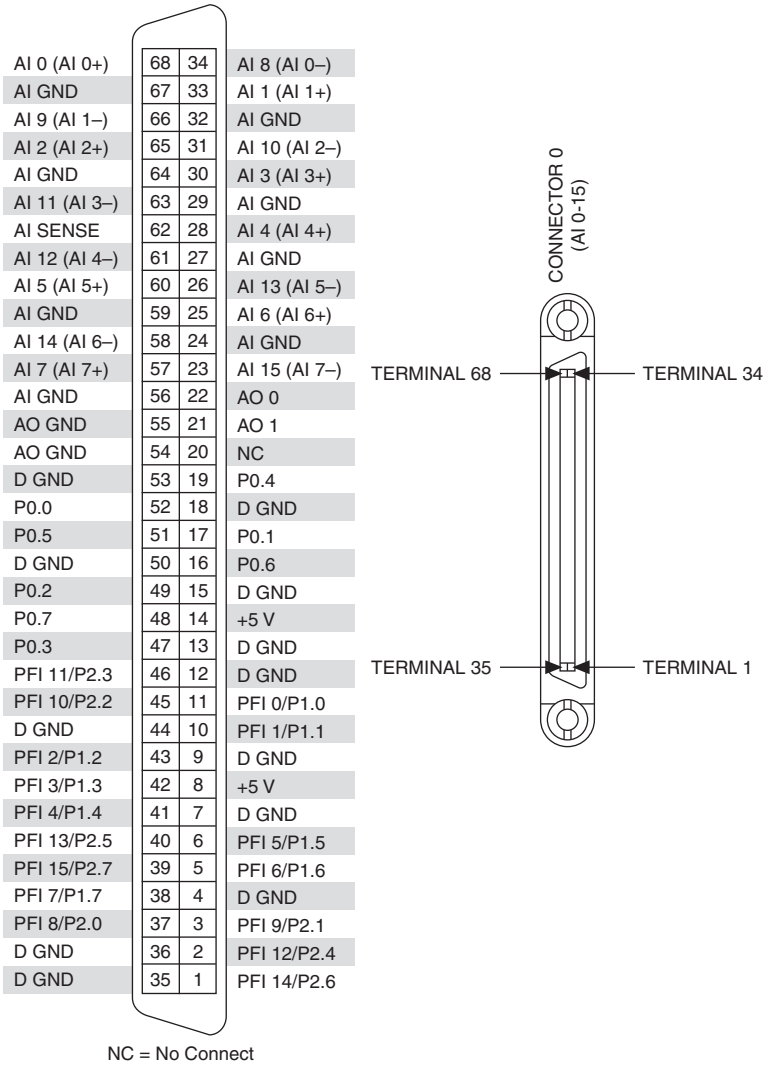
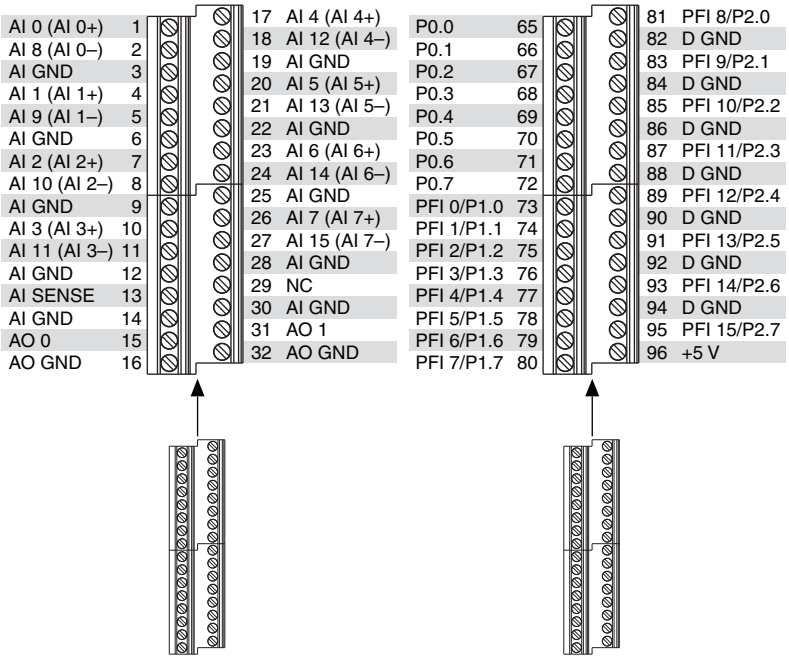


Figure 2. NI USB-6341 Screw Terminal Pinout



NC = No Connect

Figure 3. NI USB-6341 BNC Front Panel and Pinout

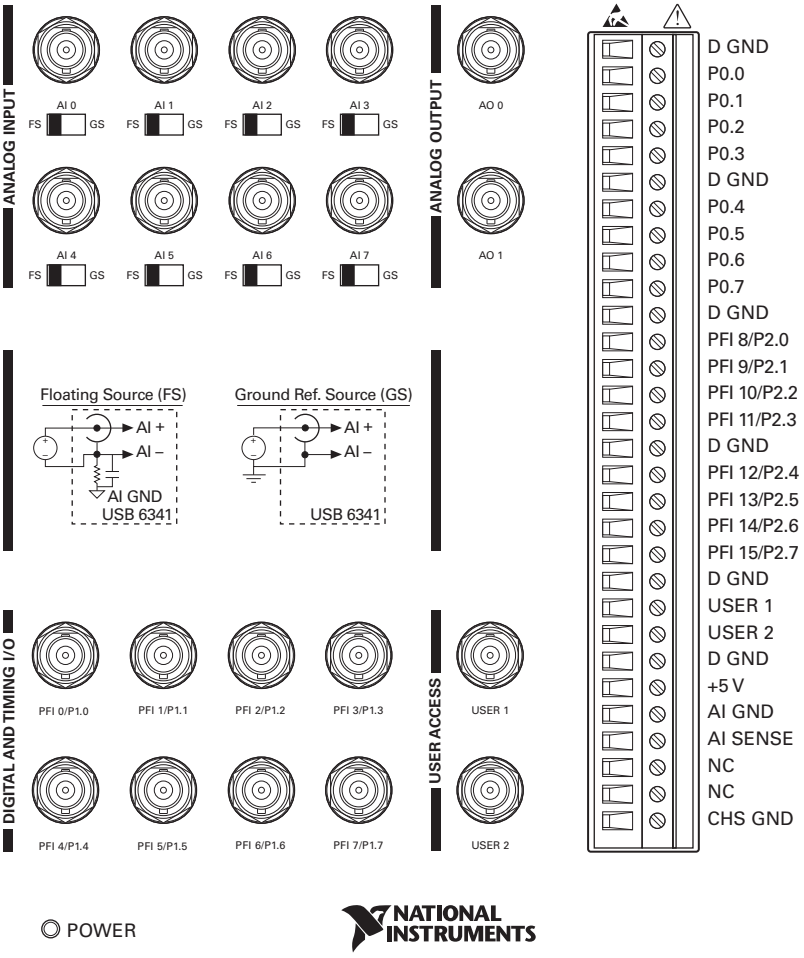


Figure 4. NI PCIe-6343 Pinout

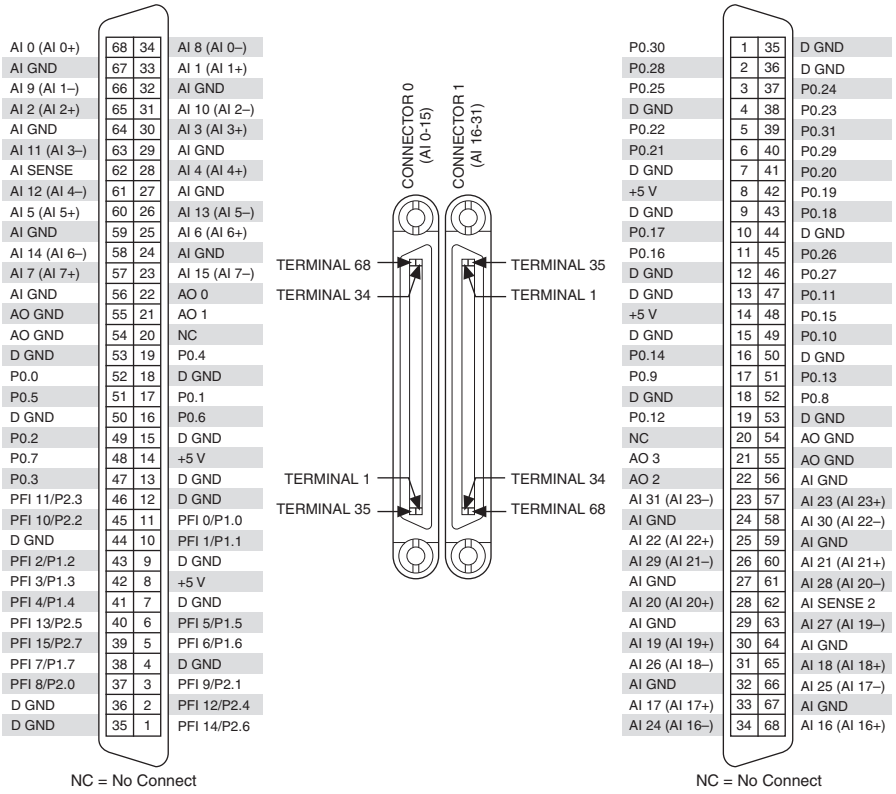
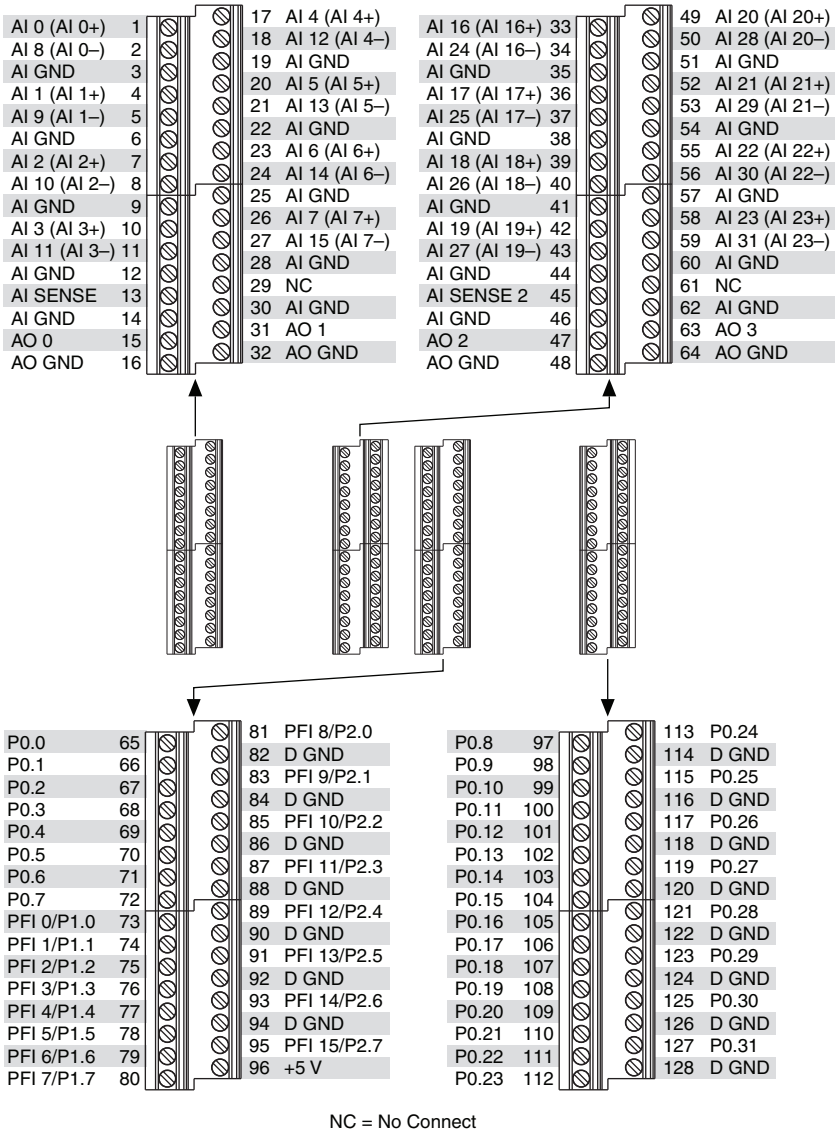


Figure 5. NI USB-6343 Screw Terminal Pinout



NC = No Connect

Figure 6. NI USB-6343 BNC Front Panel and Pinout