

# PCIe-6340 Specifications

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# PCle-6340 Specifications PCI Express, 16 AI (16-Bit, 500 kS/s), 24 DIO Multifunction I/O Device

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# PCIe-6340 Specifications


These specifications apply to the PCIe-6340.

## Revision History

Version	Date changed	Description
379193A-01	July 2025	Initial release.

## Looking For Something Else?

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## Definitions

*Warranted* specifications describe the performance of a model under stated operating conditions and are covered by the model warranty.

*Characteristics* describe values that are relevant to the use of the model under stated operating conditions but are not covered by the model warranty.

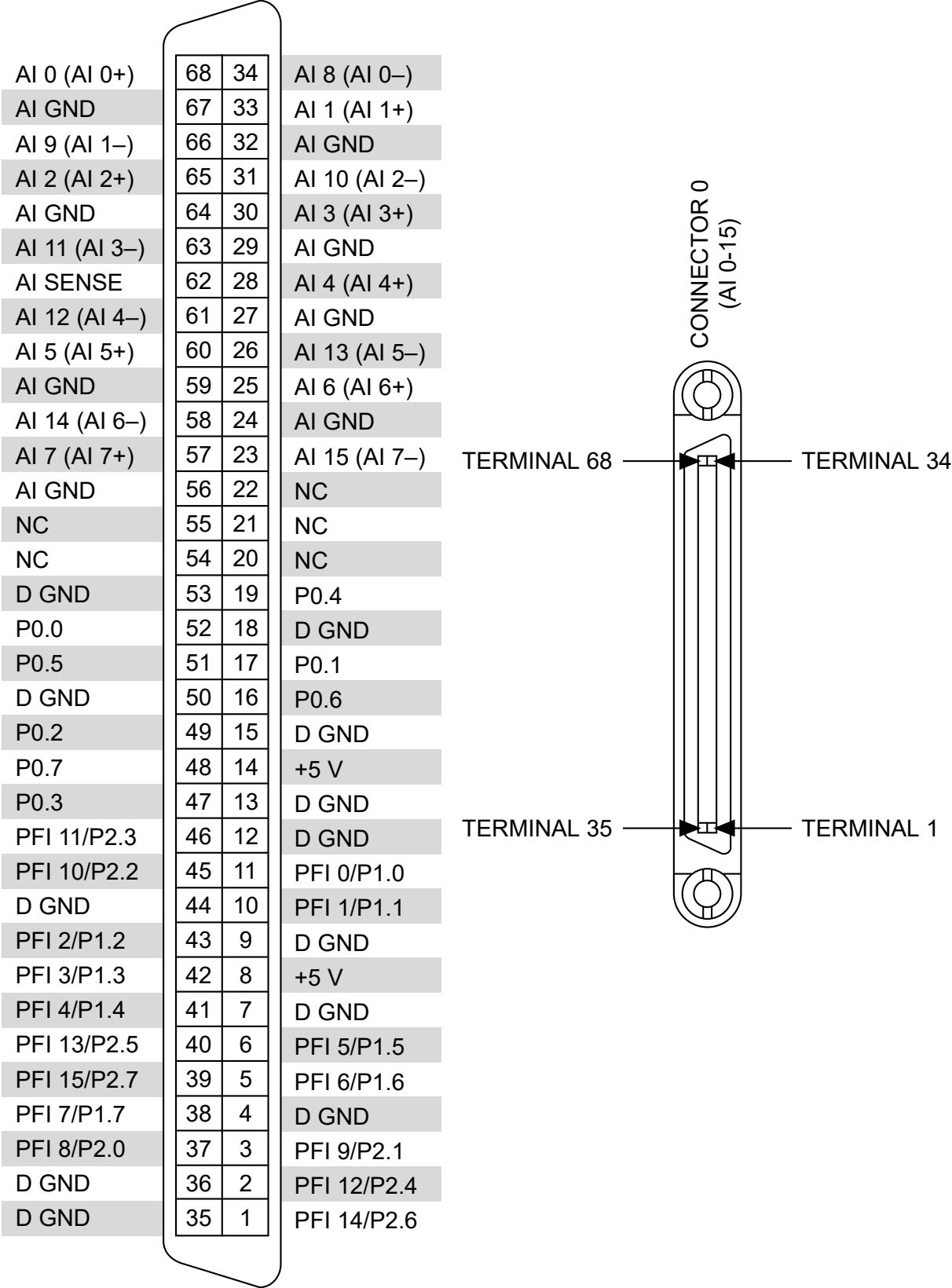
- *Typical* specifications describe the performance met by a majority of models.
- *Nominal* describes an attribute that is based on design, conformance testing, or supplemental testing.

Specifications are *Typical* unless otherwise noted.

## Conditions

Specifications are valid at 25 °C unless otherwise noted.

# PCIE-6340 Pinout



NC = No Connect

**Table 1 :** Default Counter/Timer Terminals

Counter/Timer Signal	Default PFI Terminal
CTR 0 SRC	PFI 8
CTR 0 GATE	PFI 9
CTR 0 AUX	PFI 10
CTR 0 OUT	PFI 12
CTR 0 A	PFI 8
CTR 0 Z	PFI 9
CTR 0 B	PFI 10
CTR 1 SRC	PFI 3
CTR 1 GATE	PFI 4
CTR 1 AUX	PFI 11
CTR 1 OUT	PFI 13
CTR 1 A	PFI 3
CTR 1 Z	PFI 4
CTR 1 B	PFI 11
CTR 2 SRC	PFI 0
CTR 2 GATE	PFI 1
CTR 2 AUX	PFI 2
CTR 2 OUT	PFI 14
CTR 2 A	PFI 0
CTR 2 Z	PFI 1
CTR 2 B	PFI 2
CTR 3 SRC	PFI 5
CTR 3 GATE	PFI 6
CTR 3 AUX	PFI 7
CTR 3 OUT	PFI 15
CTR 3 A	PFI 5
CTR 3 Z	PFI 6

**Table 1 :** Default Counter/Timer Terminals (Continued)

Counter/Timer Signal	Default PFI Terminal
CTR 3 B	PFI 7
FREQ OUT	PFI 14

**Table 2 :** Signal Descriptions

Signal	Reference	Description
AI GND	—	Analog Input Ground—These terminals are the reference point for single-ended AI measurements in RSE mode and the bias current return point for DIFF measurements. All ground references—AI GND and D GND—are connected on the device. Though AI GND and D GND are connected on the device, they are connected by small traces to reduce crosstalk between subsystems. Each ground has a slight difference in potential.
AI <0..15>	Varies	Analog Input Channels—For single-ended measurements, each signal is an analog input voltage channel. In RSE mode, AI GND is the reference for these signals. In NRSE mode, the reference for each AI signal is an AI SENSE.  For differential measurements, AI 0 and AI 8 are the positive and negative inputs of differential analog input channel 0. Similarly, the following signal pairs also form differential input channels: AI <1,9>, AI <2,10>, and so on.
AI SENSE	—	Analog Input Sense—In NRSE mode, the reference for each AI <0..15> signal is AI SENSE.
D GND	—	Digital Ground—D GND supplies the reference for port 0, port 1, port 2 digital channels, PFI, and +5 V. All ground references—AI GND and D GND—are connected on the device. Though AI GND and D GND are connected on the device, they are connected by small traces to reduce crosstalk between subsystems. Each ground has a slight difference in potential.
P0.<0..7>	D GND	Port 0 Digital I/O Channels—You can configure each signal individually as an input or output.
+5 V	D GND	+5 V Power Source—These terminals provide a fused +5 V power source.

**Table 2 :** Signal Descriptions (Continued)

Signal	Reference	Description
PFI <0..7>/ P1.<0..7>, PFI <8..15>/ P2.<0..7>	D GND	Programmable Function Interface or Digital I/O Channels—Each of these terminals can be individually configured as a PFI terminal or a digital I/O terminal.  As an input, each PFI terminal can be used to supply an external source for AI, DI, and DO timing signals or counter/timer inputs. As a PFI output, you can route many different internal AI, DI, or DO timing signals to each PFI terminal. You can also route the counter/timer outputs to each PFI terminal. As a port 1 or port 2 digital I/O signal, you can individually configure each signal as an input or output.
NC	—	No connect—Do not connect signals to this terminal.

## Analog Input

Number of channels	16 single ended or 8 differential
ADC resolution	16 bits
DNL	No missing codes guaranteed
INL	Refer to AI Absolute Accuracy.
<b>Sample rate</b>	
Single channel maximum	500 kSample/s
Multichannel maximum (aggregate)	500 kSample/s
Minimum	No minimum
Timing resolution	10 ns
Timing accuracy	50 ppm of sample rate
Input coupling	DC
Input range	±0.2 V, ±1 V, ±5 V, ±10 V
Maximum working voltage for analog inputs (signal + common mode)	±11 V of AI GND
CMRR (DC to 60 Hz)	100 dB

**Input impedance**



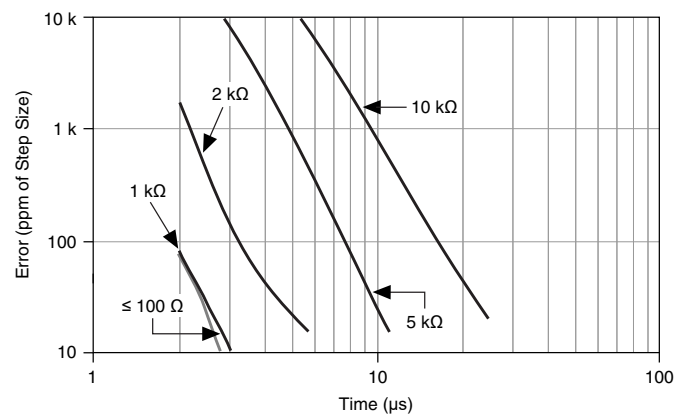
<b>Device on</b>	
AI+ to AI GND	>10 GΩ in parallel with 100 pF
AI- to AI GND	>10 GΩ in parallel with 100 pF
<b>Device off</b>	
AI+ to AI GND	1,200 Ω
AI- to AI GND	1,200 Ω
Input bias current	±100 pA
<b>Crosstalk (at 100 kHz)</b>	
Adjacent channels	-75 dB
Non-adjacent channels	-90 dB
Small signal bandwidth (-3 dB)	1.2 MHz
Input FIFO size	2,047 samples
Scan list memory	4,095 entries
Data transfers	DMA (scatter-gather), programmed I/O
<b>Overvoltage protection for all analog input and sense channels</b>	
Device on	±25 V for up to two AI pins
Device off	±15 V for up to two AI pins
Input current during overvoltage condition	±20 mA maximum/AI pin

## Settling Time for Multichannel Measurements

<b>Settling time for multichannel measurements, accuracy, full-scale step, all ranges</b>	
±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

# Typical Performance Graph

**Figure 1 :** Settling Error versus Time for Different Source Impedances



# AI Absolute Accuracy (Warranted)

**Table 3 :** Table 1. AI Absolute Accuracy

Nominal Range Positive Full Scale (V)	Nominal Range Negative Full Scale (V)	Residual Gain Error (ppm of Reading)	Residual Offset Error (ppm of Range)	Offset Tempco (ppm of Range/°C)	Random Noise, σ (μVrms)	Absolute Accuracy at Full Scale (μV)
10	-10	65	13	23	270	2,190
5	-5	72	13	23	135	1,130
1	-1	78	17	26	28	240
0.2	-0.2	105	27	39	9	60

Gain tempco	7.3 ppm/°C
Reference tempco	5 ppm/°C

INL error

60 ppm of range

**NOTE***Absolute Accuracy at Full Scale* is determined using the following assumptions:

- TempChangeFromLastExternalCal = 10 °C
- TempChangeFromLastInternalCal = 1 °C
- NumberOfReadings = 10,000
- CoverageFactor = 3  $\sigma$

For more information about absolute accuracy at full scale, refer to the *AI Absolute Accuracy Example* section.

**NOTE**

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

## AI Absolute Accuracy Equation

$$\text{AbsoluteAccuracy} = \text{Reading} \cdot (\text{GainError}) + \text{Range} \cdot (\text{OffsetError}) + \text{NoiseUncertainty}$$

$$\text{GainError} = \text{ResidualGainError} + \text{GainTempco} \cdot (\text{TempChangeFromLastInternalCal}) + \text{ReferenceTempco} \cdot (\text{TempChangeFromLastExternalCal})$$

$$\text{OffsetError} = \text{ResidualOffsetError} + \text{OffsetTempco} \cdot (\text{TempChangeFromLastInternalCal}) + \text{INLError}$$

$$\text{NoiseUncertainty} = \frac{\text{Random Noise} \cdot 3}{\sqrt{10,000}} \text{ for a coverage factor of } 3 \sigma \text{ and averaging } 10,000 \text{ points.}$$

## AI Absolute Accuracy Example

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

$$\text{GainError: } 65 \text{ ppm} + 7.3 \text{ ppm} \cdot 1 + 5 \text{ ppm} \cdot 10 = 122 \text{ ppm}$$

$$\text{OffsetError: } 13 \text{ ppm} + 23 \text{ ppm} \cdot 1 + 60 \text{ ppm} = 96 \text{ ppm}$$


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

$$\text{AbsoluteAccuracy: } 10 \text{ V} \cdot (\text{GainError}) + 10 \text{ V} \cdot (\text{OffsetError}) + \text{NoiseUncertainty} = 2,190 \text{ } \mu\text{V}$$

# Digital I/O/PFI

## Static Characteristics

Number of channels	24 total, 8 (P0.<0..7>), 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	±20 V on up to two pins



**CAUTION**

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

## Waveform Characteristics (Port 0 Only)

Terminals used	Port 0 (P0.<0..7>)
Port/sample size	Up to 8 bits
Waveform generation (DO) FIFO	2,047 samples
Waveform acquisition (DI) FIFO	255 samples
DO or DI Sample Clock frequency	0 to 1 MHz, system and bus activity dependent
Data transfers	DMA (scatter-gather), programmed I/O
Digital line filter settings	160 ns, 10.24 μs, 5.12 ms, disable

## PFI/Port 1/Port 2 Functionality

Functionality	Static digital input, static digital output, timing input, timing output
Timing output sources	Many AI, 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

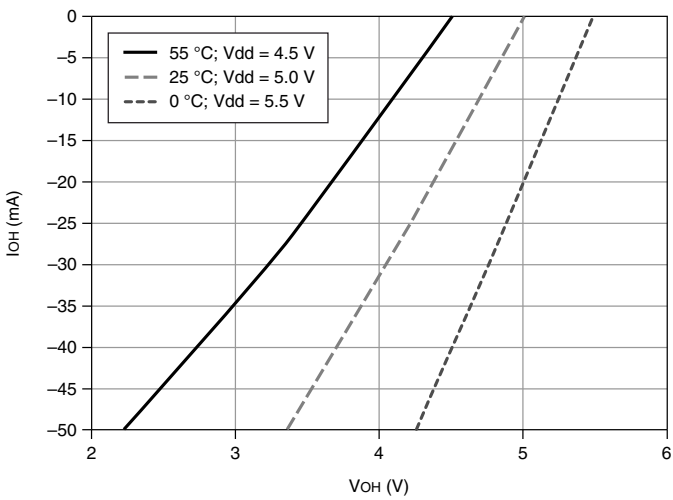
## Recommended Operating Conditions

<b>Input high voltage (<math>V_{IH}</math>)</b>	
Minimum	2.2 V
Maximum	5.25 V
<b>Input low voltage (<math>V_{IL}</math>)</b>	
Minimum	0 V
Maximum	0.8 V
<b>Output high current (<math>I_{OH}</math>)</b>	
P0.<0..7>	-24 mA maximum
PFI <0..15>/P1/P2	-16 mA maximum
<b>Output low current (<math>I_{OL}</math>)</b>	
P0.<0..7>	24 mA maximum
PFI <0..15>/P1/P2	16 mA maximum

## Digital I/O Characteristics

Positive-going threshold ( $V_{T+}$ )	2.2 V maximum
Negative-going threshold ( $V_{T-}$ )	0.8 V minimum
Delta VT hysteresis ( $V_{T+} - V_{T-}$ )	0.2 V minimum
$I_{IL}$ input low current ( $V_{IN} = 0$ V)	-10 $\mu$ A maximum
$I_{IH}$ input high current ( $V_{IN} = 5$ V)	250 $\mu$ A maximum

**Figure 2 :** P0.<0..7>:  $I_{OH}$  versus  $V_{OH}$



**Figure 3 :** P0.<0..7>:  $I_{OL}$  versus  $V_{OL}$

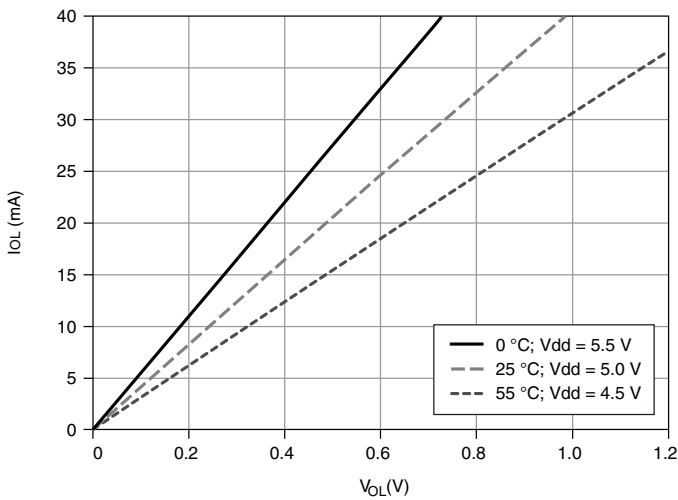


Figure 4 : PFI <0..15>/P1/P2: I<sub>OH</sub> versus V<sub>OH</sub>

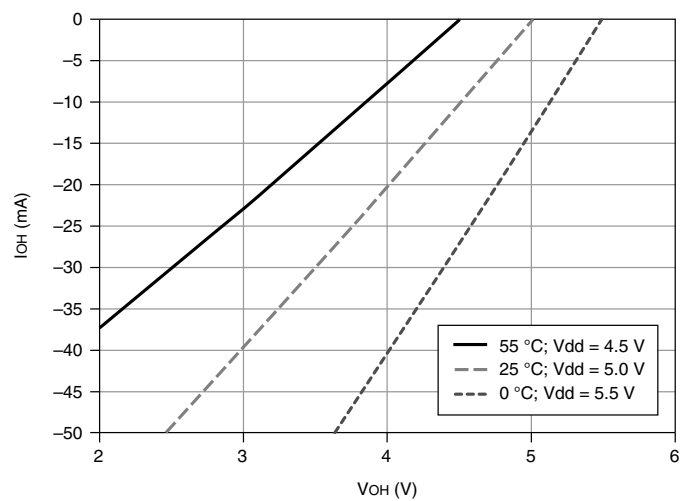
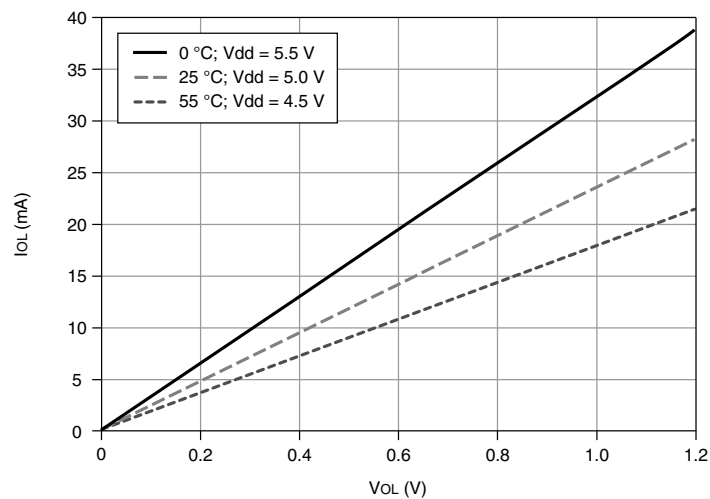


Figure 5 : PFI <0..15>/P1/P2: I<sub>OL</sub> versus V<sub>OL</sub>



## General-Purpose Counters

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	0 MHz to 25 MHz
Base clock accuracy	50 ppm
Inputs	Gate, Source, HW_Arm, Aux, A, B, Z, Up_Down, Sample Clock
Routing options for inputs	Any PFI, RTSI, many internal signals
FIFO	127 samples per counter
Data transfers	Dedicated scatter-gather DMA controller for each counter/timer, 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.

## Phased-Locked Loop (PLL)

Number of PLLs	1
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**Table 4 :** Reference Clock Locking Frequencies

Reference Signal	Locking Input Frequency (MHz)
RTSI <0..7>	10, 20
PFI <0..15>	10, 20



Output of PLL	100 MHz Timebase; other signals derived from 100 MHz Timebase including 20 MHz and 100 kHz Timebases
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## External Digital Triggers

Source	Any PFI, RTSI
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	RTSI <0..7>
Output destination	RTSI <0..7>
Output selections	10 MHz Clock, frequency generator output, many internal signals
Debounce filter settings	90 ns, 5.12 $\mu$ s, 2.56 ms, custom interval, disable; programmable high and low transitions; selectable per input

## Current Limits



**CAUTION**  
Exceeding the current limits may cause unpredictable device behavior.

<b>Without disk drive power connector installed</b>	
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
P0/PFI/P1/P2 combined	1 A max
† Has a self-resetting fuse that opens when current exceeds this specification.	


Bus Interface

Form factor	x1 PCI Express, specification v1.1 compliant
Slot compatibility	x1, x4, x8, and x16 PCI Express slots †
DMA channels	8, analog input, analog output, digital input, digital output, counter/timer 0, counter/timer 1, counter/timer 2, counter/timer 3
† Some motherboards reserve the x16 slot for graphics use. For PCI Express guidelines, visit <a href="https://www.ni.com/info">ni.com/info</a> and enter the Info Code pciexpress.	

Safety Voltages

Table 5 : Rated Voltages

AI+ or AI- to GND	±11 V DC
DIO-to-GND	+5 V DC
+5V pin to GND	+5 V DC



**CAUTION**  
Any external sources must be limited to not exceed these maximum rated voltages.

**ATTENTION**  
Les sources externes doivent être limitées pour ne pas dépasser ces tensions nominales maximales.

Current Ratings

DIO Maximum continuous current	Per channel	±10 mA
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	Sum of all channels	±160 mA
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**CAUTION**

Any external sources must be limited to not exceed these maximum rated currents.

**ATTENTION**

Les sources externes doivent être limitées pour ne pas dépasser ces tensions nominales maximales.

## Measurement Category

This product is rated for Measurement Category I (or other non-MAINS circuits).



**CAUTION**

Do not connect the product to signals or use for measurements within Measurement Categories II, III, or IV.

**ATTENTION**

Ne pas connecter le produit à des signaux dans les catégories de mesure II, III ou IV et ne pas l'utiliser pour effectuer des mesures dans ces catégories.

Measurement Category I is for measurements performed on circuits not directly connected to the electrical distribution system referred to as *MAINS* voltage. MAINS is a hazardous live electrical supply system that powers equipment. This category is for measurements of voltages from specially protected secondary circuits. Such voltage measurements include signal levels, special equipment, limited-energy parts of equipment, circuits powered by regulated low-voltage sources, and electronics.



**NOTE**

Measurement Categories CAT I and CAT O are equivalent. These test and measurement circuits are for other circuits not intended for direct connection to the MAINS building installations of Measurement Categories CAT II, CAT III, or CAT IV.

## Environmental Guidelines



**NOTICE**

Failure to follow the mounting instructions in the product documentation can cause temperature derating.



**NOTICE**  
This product is intended for use in indoor applications only.

## Environmental Characteristics

Temperature	
Operating	0 °C to 50 °C
Storage	-40 °C to 70 °C
Humidity	
Operating	10% to 90% RH, noncondensing
Storage	5% to 95% RH, noncondensing
Pollution Degree	2
Maximum altitude	2,000 m

Indoor use only.

## Power Requirements


**Table 6 :** Power Specifications Without Disk Drive Power Connector Installed

PCIe Bus	Voltage/current rating	0.5 A at 3.3 V DC 0.8 A at 12 V DC
	Power rating	10 W

**Table 7 :** Power Specifications With Disk Drive Power Connector Installed

PCIe Bus	Voltage/current rating	0.5 A at 3.3 V DC 0.3 A at 12 V DC 3.0 A at 5 V DC
	Power rating	19.4 W

# Physical Characteristics

Device dimensions	9.9 cm × 16.8 cm (3.9 in. × 6.6 in.) (half-length)
Weight	104 g (3.6 oz)
<b>I/O connectors</b>	
Device connector	68-Pos Right Angle Dual Stack PCB-Mount VHDCI (Receptacle)
Cable connector	68-Pos Offset IDC Cable Connector (Plug) (SHC68-*)
<div> <b>NOTE</b> For more information about the connectors used for DAQ devices, refer to the document, <i>NI DAQ Device Custom Cables, Replacement Connectors, and Screws</i>, by going to <a href="https://ni.com/info">ni.com/info</a> and entering the Info Code rdsymb.</div>	
Disk drive power connector	Standard ATX peripheral connector (not serial ATA)

# Calibration

Recommended warm-up time	15 minutes
Calibration interval	2 years





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