

# SPECIFICATIONS

# NI 6612

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[ni.com/manuals](http://ni.com/manuals)

This document lists the specifications of the NI PCIe/PXIe-6612. Unless otherwise noted, the following specifications are typical at 25 °C and are valid after a 15 minute warm-up time.

## Digital I/O/PFI

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### Physical Characteristics

Number of channels	40 total, Port 0 (P0.<0..31>), Port 1 (P1.<0..7); or PFI <0..39>
Ground reference	GND
Direction control	Each terminal individually programmable as input or output
Pull-down resistor	51 k $\Omega$ , pulled down to ground
Input voltage protection <sup>1</sup>	-3 V to 8 V
Output impedance	75 $\Omega$

### Waveform DIO Functionality

Terminals used	Port 0 (P0.<0..31>)
Port/sample size	Up to 32 bits
Waveform generation (DO) FIFO	2,047 samples
Waveform generation (DI) FIFO	255 samples
DI Sample Clock frequency	0 to 10 MHz, system and bus activity dependent
DO Sample Clock frequency	
Regenerate from FIFO	0 to 10 MHz
Streaming from memory	0 to 10 MHz, system and bus activity dependent
Data transfers	DMA (scatter-gather), programmed I/O
Digital line filter settings	160 ns, 10.24 $\mu$ s, 5.12 ms, disable

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<sup>1</sup> Stresses beyond those listed under *Input voltage protection* may cause permanent damage to the device.

# Timing I/O (PFI) Functionality

Terminals used .....	PFI <0..39>
Functionality .....	Static digital input, static digital output, timing input, timing output
Timing output sources.....	Many counter, DI, and DO timing signals
Debounce filter settings .....	90 ns, 5.12 $\mu$ s, 2.56 ms, customer interval, disable; programmable high and low transitions; selectable per input

## Recommended Operation Conditions

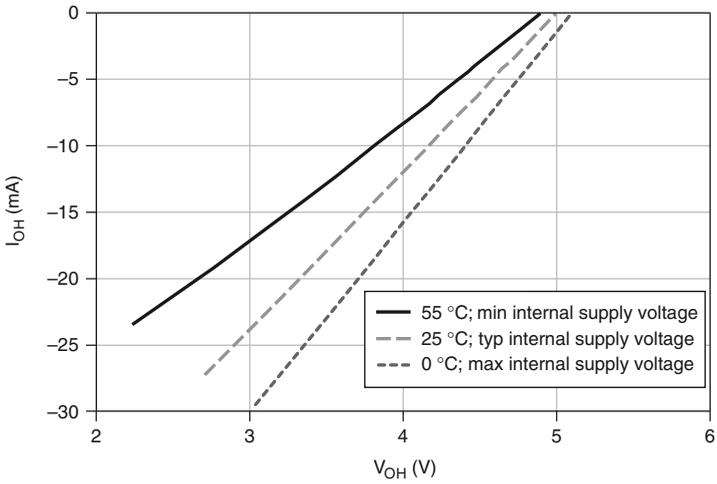
Level	Minimum	Maximum
Input High voltage, $V_{IH}$	2 V	5.25 V
Input Low voltage, $V_{IL}$	0 V	0.8 V
Output High current, $I_{OH}$	—	-6 mA
Output Low current, $I_{OL}$	—	6 mA

## Electrical Characteristics

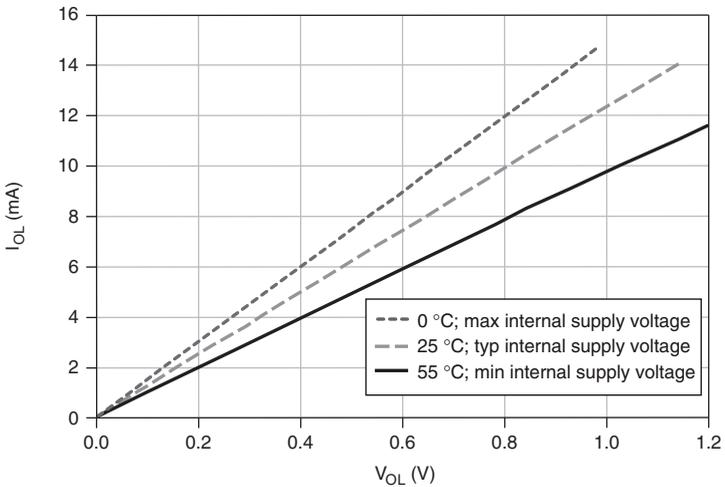
Level	Minimum	Maximum
Positive-going threshold, $V_{T+}$	—	2.0 V
Negative-going threshold, $V_{T-}$	0.8 V	—
Delta VT hysteresis, $V_{T+} - V_{T-}$	0.5 V	—
$I_{IL}$ input low current ( $V_{in} = 0$ V)	—	-10 $\mu$ A
$I_{IH}$ input high current ( $V_{in} = 5$ V)	—	200 $\mu$ A

# Digital I/O Characteristics

**Figure 1.** PFI <0..39>/P0/P1:  $I_{OH}$  versus  $V_{OH}$



**Figure 2.** PFI <0..39>/P0/P1:  $I_{OL}$  versus  $V_{OL}$



# Counters/Timers

Number of counters/timers ..... 8  
 Resolution ..... 32 bits

## Counter Measurements

Measurements supported ..... Frequency, edge counting, pulse, pulse-width, semi-period, period, two-edge separation

**Table 1. Maximum Source Frequency**

<b>Applications</b>	<b>Default Source PFI Lines<sup>*,†</sup></b>	<b>Other PFI Lines<sup>*</sup></b>	<b>RTSI Lines</b>	<b>PXI Trigger</b>	<b>PXI Star</b>	<b>PXI_DSTAR &lt;A/B&gt;</b>
Frequency measurement (MHz)	80	50	20	20	80	100
Edge counting without prescaling (MHz)	25	25	20	20	25	25
Edge counting with 2x prescaling (MHz)	50	50	20	20	50	50
Edge counting with 8x prescaling (MHz)	80	50	20	20	80	100
<p>* The maximum source frequency is dependent on the external source used to drive the PFI lines as well as any cables and accessories used to connect the source to the NI 6612. Refer to the <i>NI 6612 User Manual</i> at <a href="http://nicom/manuals">nicom/manuals</a> for more information.</p> <p>† Default source PFI lines are PFI 11, PFI 15, PFI 19, PFI 23, PFI 27, PFI 31, PFI 35, and PFI 39.</p>						

**Table 2. Minimum Pulse Width**

<b>Applications</b>	<b>Default Source PFI Lines</b>	<b>Other PFI Lines</b>	<b>RTSI Lines</b>	<b>PXI Trigger</b>	<b>PXI Star</b>	<b>PXI_DSTAR &lt;A/B&gt;</b>
Frequency measurement (ns)	6.25	10	25	25	6.25	5
Pulse, pulse width, semi-period, period, two-edge separation (ns)	20	20	25	25	20	20
Edge counting without prescaling (ns)	20	20	25	25	20	20
Edge counting with 2x prescaling (ns)	10	10	25	25	10	10
Edge counting with 8x prescaling (ns)	6.25	10	25	25	6.25	5

Position measurement..... x1, x2, x 4 quadrature encoding with Channel Z reloading; two-pulse encoding

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

Internal timebases ..... 100 kHz, 20 MHz, 100 MHz

External timebases

    NI PCIe-6612..... 0 MHz to 25 MHz

    NI PXIe-6612 ..... 0 MHz to 25 MHz; 0 MHz to 100 MHz on PXIe-DSTAR<A,B>

Base clock accuracy..... ±50 ppm (aging, temperature, and power supply drift)

Inputs ..... Gate, Source, HW\_Arm, AUX, A, B, Z, Up\_Down, Sample Clock

Routing options for inputs

    NI PCIe-6612..... Any PFI, RTSI, many internal signals

    NI PXIe-6612 ..... Any PFI, PXIe-DSTAR<A,B>, PXI\_TRIG, PXI\_STAR, many internal signals

FIFO..... 127 samples per counter

Data transfers ..... Dedicated scatter-gather, DMA controller for each counter/timer

# Frequency Generator

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Number of channels ..... 1  
 Base clocks ..... 100 kHz, 10 MHz, 20 MHz  
 Base clock accuracy ..... Refer to the *Counter Measurements* section  
 Routing options for outputs  
     NI PCIe-6612 ..... Any PFI, RTSI, many internal signals  
     NI PXIe-6612 ..... Any PFI, PXI\_TRIG, PXIe-DSTARC

## Phase-Lock Loop (PLL)

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Number of PLLs ..... 1  
 Reference clock locking frequencies

Reference Signal	Locking Input Frequency (MHz)	
	NI PCIe-6612	NI PXIe-6612
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..39>	10, 20	10, 20

Output of PLL ..... 100 MHz timebase; other signals derived from  
 100 MHz timebase including 20 MHz and  
 100 kHz timebases

## External Digital Triggers

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Source  
     NI PCIe-6612 ..... Any PFI, RTSI  
     NI PXIe-6612 ..... Any PFI, PXIe-DSTAR <A,B>, PXI\_TRIG,  
     PXI\_STAR  
 Polarity ..... Software-selectable for most signals  
 Counter/timer function ..... 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-6612 ..... RTSI <0..7><sup>1</sup>  
NI PXIe-6612 ..... PXI\_TRIG <0..7>, PXI\_STAR, PXIe-DSTAR<A,B>

### Output destination

NI PCIe-6612 ..... RTSI <0..7><sup>1</sup>  
NI PXIe-6612 ..... PXI\_TRIG <0..7>, PXIe\_DSTAR<C>

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

## Bus Interface

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### Form factor

NI PCIe-6612 ..... x1 PCI Express Standard Height, Half Length, PCI Express Card Electromechanical Specification Revision 1.1  
NI PXIe-6612 ..... x1 PXI Express, single slot, PXI Express Hardware Specification Revision 1.0 ECN-1 compliant

### Slot compatibility

NI PCIe-6612 ..... x1, x4, x8, x16 PCI Express slot compatibility.  
NI PXIe-6612 ..... x1 and x4 PXI Express, PXI Express hybrid, or PXI Express System Timing Slot

## Power Requirements

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### +3.3 V

NI PCIe-6612 ..... 4.3 W maximum  
NI PXIe-6612 ..... 6.1 W maximum

### +12 V

NI PCIe-6612 ..... 6.0 W maximum  
NI PXIe-6612 ..... 10.1 W maximum

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<sup>1</sup> In other sections of this document, *RTSI* refers to RTSI <0..7> for NI PCIe-6612 or PXI\_TRIG <0..7> for NI PXIe-6612.

# Physical Requirements

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## Weight

- NI PCIe-6612 ..... 110 g
- NI PXIe-6612 ..... 175 g



**Caution** The protection provided by the NI 6612 can be impaired if it is used in a manner not described in this document.



**Note** Clean the device with a soft, non-metallic brush. Make sure that the device is completely dry and free from contaminants before returning it to service.

# Current Limits

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

+5 V Terminal (at Pin 1 of Figure 3) ..... +4.25 V to +5.10 V, 1 A maximum

**(NI PCIe-6612 only)** On the NI PCIe-6612, the +5 V supply and the PFI/DIO lines share the same power source. Consequently, power available at the +5 V terminal is reduced by certain DIO/PFI use cases.

DIO/PFI Output Condition	Current Reduction (per Terminal)
DIO/PFI output toggling at 25 MHz*	17.5 mA
DIO/PFO output driving logic 1 into 6 mA load	6 mA
* Using a 2 m cable driving a high-impedance load	

For example, if you have an NI PCIe-6612 with 18 DIO/PFI lines configured as outputs toggling at 25 MHz and 22 DIO/PFI lines driving logic 1 into 6 mA loads, you would calculate power available at the +5 V terminal as follows:

$$18 \times 17.5 \text{ mA} = 315 \text{ mA}$$

$$22 \times 6 \text{ mA} = 132 \text{ mA}$$

$$1 \text{ A (max)} - 315 \text{ mA} - 132 \text{ mA} = 553 \text{ mA max available at +5 V power connector}$$

# Environmental

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Maximum altitude ..... 2,000 m (at 25 °C ambient temperature)

Pollution Degree ..... 2

Indoor use only.

## Operating Environment

Ambient temperature range .....	0 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 .....	-40 to 71 °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 (NI PXIe-6612 Only)

Operational 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 <sub>rms</sub>
Nonoperating .....	5 Hz 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

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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

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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 generates 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:

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

## Online Product Certification

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To obtain product certifications and the Declaration of Conformity (DoC) for this product, visit [ni.com/certification](http://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 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 and Electronic Equipment, visit [ni.com/environment/weee](http://ni.com/environment/weee).

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# Pinout Diagram

**Figure 3. NI 6612 Pinout**

PFI 31/P0.31/CTR 2 SOURCE	34	68	D GND
D GND	33	67	PFI 30/P0.30/CTR 2 GATE
PFI 28/P0.28/CTR 2 OUT	32	66	PFI 29/P0.29/CTR 2 AUX
PFI 27/P0.27/CTR 3 SOURCE	31	65	D GND
D GND	30	64	PFI 26/P0.26/CTR 3 GATE
PFI 24/P0.24/CTR 3 OUT	29	63	PFI 25/P0.25/CTR 3 AUX
PFI 23/P0.23/CTR 4 SOURCE	28	62	D GND
D GND	27	61	PFI 22/P0.22/CTR 4 GATE
CTR 4 OUT/PFI 20/P0.20	26	60	PFI 21/P0.21/CTR 4 AUX
PFI 19/P0.19/CTR 5 SOURCE	25	59	D GND
D GND	24	58	PFI 18/P0.18/CTR 5 GATE
CTR 5 OUT/PFI 16/P0.16	23	57	PFI 17/P0.17/CTR 5 AUX
PFI 15/P0.15/CTR 6 SOURCE	22	56	R GND
PFI 14/P0.14/CTR 6 GATE	21	55	D GND
D GND	20	54	PFI 13/P0.13/CTR 6 AUX
R GND	19	53	CTR 6 OUT/PFI 12/P0.12
D GND	18	52	PFI 11/P0.11/CTR 7 SOURCE
PFI 9/P0.9/CTR 7 AUX	17	51	PFI 10/P0.10/CTR 7 GATE
CTR 7 OUT/PFI 8/P0.8	16	50	D GND
PFI 7/P0.7	15	49	D GND
D GND	14	48	PFI 6/P0.6
PFI 4/P0.4	13	47	PFI 5/P0.5
PFI 3/P0.3	12	46	D GND
D GND	11	45	PFI 2/P0.2
PFI 0/P0.0	10	44	PFI 1/P0.1
PFI 32/P1.0/CTR 1 OUT	9	43	R GND
PFI 34/P1.2/CTR 1 GATE	8	42	D GND
PFI 35/P1.3/CTR 1 SOURCE	7	41	D GND
PFI 33/PFI1.1/CTR 1 AUX	6	40	PFI 37/P1.5/CTR 0 AUX
PFI 36/P1.4/CTR 0 OUT	5	39	D GND
RESERVED	4	38	RESERVED
PFI 38/P1.6/CTR 0 GATE	3	37	RESERVED
PFI 39/P1.7/CTR 0 SOURCE	2	36	D GND
+5 V	1	35	R GND

R GND: Pins are not connected to Ground if using an SH68-68-D1 shielded cable;  
Pins are connected to D GND if using an R6868 ribbon cable.

RESERVED: Should not be used as these pins are weakly pulled down to D GND.

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