# DEVICE SPECIFICATIONS NI PXIe-6739

#### 64-Channel High-Density Analog Output

This document lists the specifications for the NI 6739 analog output device. The following specifications are typical at 25 °C unless otherwise noted.

# Analog Output

Number of channels	64 voltage outputs
Resolution	16 bits, 1 in 65,536
DNL	±1.0 LSB maximum
Unscaled data format <sup>1</sup>	Unsigned integer (0 to 65,535)
Monotonicity	16 bits
Accuracy	Refer to the AO Absolute Accuracy table
Maximum update rate (using local FIFO <sup>2</sup> )	
1 channel	1 MS/s
16 channels (1 channel per bank) <sup>3</sup>	1 MS/s
64 channels <sup>3</sup>	350 kS/s
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	±10 mA
Overdrive protection	±15 V
Overdrive current	15 mA

<sup>&</sup>lt;sup>1</sup> Used for writing unscaled or raw data and covers the range from negative full scale (0) to positive full scale (65,535).

<sup>3</sup> All analog output channels are grouped into banks, as shown in the *Device Pinouts* section. Each bank consists of four AO channels using one DAC. Any channels being used within a single bank will update simultaneously.



<sup>&</sup>lt;sup>2</sup> These numbers apply to continuous waveform generation using onboard memory only, which allows for the highest update rate by doing a single transfer of data over the bus. The maximum update rate in FIFO mode does not change regardless of the number of devices in the system.

Power-on state	±200 mV
Power-on/off glitch	2.5 V peak for 100 ms
FIFO buffer size	65,535 samples shared among channels used
Data transfers	DMA (scatter-gather), programmed I/O
AO waveform modes	
Nonperiodic waveform	
• Periodic waveform regeneration mode fr	om onboard FIFO
• Periodic waveform regeneration from ho	st buffer including dynamic update
Settling time, full scale step	$15 \ \mu s \ to \pm 4 \ LSB$
Slew rate	3.0 V/µs
Noise	1.0 mVrms, DC to 1 MHz
AO update glitch	
Magnitude	3.0 mV
Duration	10 μs
Glitch energy	3 nVs
Channel crosstalk	65 dB with SHC68-68-A2 cable (generating a 10 V, 100 point sinusoidal at 100 kHz on the reference channel)
Output stability	Any passive load

Output stability ......Any passive load

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**Note** AO update glitch is the glitch energy that occurs on all channels on the same bank as the result of a channel update, regardless of value. For example, if you update the value of AO 0, all channels within that bank AO <0..3> will experience this glitch regardless of whether their output voltages change.

#### Absolute Accuracy

Absolute accuracy at full-scale number is valid immediately following self calibration and assumes the device is operating within 10 °C of the last external calibration.

Nominal Range Positive Full Scale	Nominal Range Negative Full Scale	Residual Gain Error (ppm of Reading)	Gain Tempco (ppm/ °C)	Reference Tempco (ppm/°C)	Offset Tempco (ppm)	Residual Offset Error (ppm of Range)	INL Error (ppm of Range)	Absolute Accuracy at Full Scale (μV)
10	-10	109	12	1	4	95	64	2,940

Table 1. AO Absolute Accuracy



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

#### AO Absolute Accuracy Equation

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

$$\label{eq:GainError} \begin{split} GainError = ResidualGainError + GainTempco \cdot (TempChangeFromLastInternalCal) + \\ ReferenceTempco \cdot (TempChangeFromLastExternalCal) \end{split}$$

 $OffsetError = ResidualOffsetError + OffsetTempco \cdot (TempChangeFromLastInternalCal) + INL\_Error$ 

# Digital I/O/PFI

#### Static Characteristics

Number of channels	20 total, 4 (P0.<03>), 16 (PFI <07>/P1.<07>, PFI <815>/P2.<07>)
Ground reference	. D GND
Direction control	. Each terminal individually programmable as input or output
Pull-down resistor	. 50 k $\Omega$ typical, 20 k $\Omega$ minimum
Input voltage protection <sup>1</sup>	$\pm 20$ V on up to two pins

#### Waveform Characteristics (Port 0 Only)

Terminals used	Port 0 (P0.<03>)
Port/sample size	Up to 4 bits
Waveform generation (DO) FIFO	2,047 samples
Waveform acquisition (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 μs, 5.12 ms, disable

<sup>&</sup>lt;sup>1</sup> 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 Operating Conditions**

Input high voltage (VIH)2.2 V minimum, 5.25 V maximum
Input low voltage (VIL)0 V minimum, 0.8 V maximum
Output high current (IOH)
P0.<03>24 mA maximum
PFI <015>/P1.<07>/P2.<07>16 mA maximum
Output low current (IOL)
P0.<03>
PFI <015>/P1.<07>/P2.<07>

#### **Electrical Characteristics**

Level	Minimum	Maximum
Positive-going threshold (VT+)	—	2.2 V
Negative-going threshold (VT-)	0.8 V	—
Delta VT hysteresis (VT+ - VT-)	0.2 V	_
IIL input low current (Vin = 0 V)	—	-10 μA
IIH input high current (Vin = $5 \text{ V}$ )	—	250 μΑ

#### **Digital I/O Characteristics**

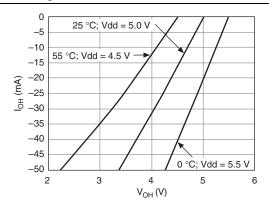


Figure 1. P0.<0..3>: IOH versus VOH



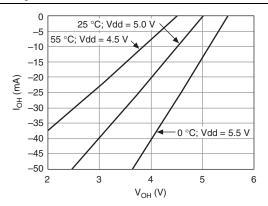


Figure 3. P0.<0..3>: IOL versus VOL

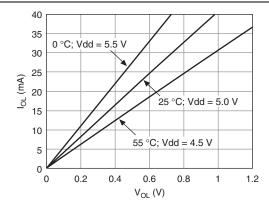
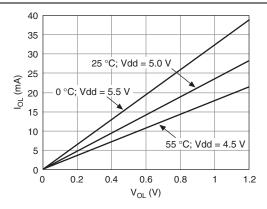


Figure 4. PFI <0..15>/P1/P2: IOL versus VOL



# Timing I/O

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, PXIe_DSTAR <a,b>, PXI_TRIG, PXI_STAR, many internal signals</a,b>
FIFO	127 samples per counter
Data transfers	Dedicated scatter-gather DMA controller for each counter/timer, programmed I/O

# Phase-Locked Loop (PLL)

Number of PLLs ......1

#### Table 2. Reference Clock Locking Frequencies

Reference Signal	Locking Input Frequency (MHz)
PXIe_DSTAR <a,b></a,b>	10, 20, 100
PXI_STAR	10, 20
PXIe_CLK100	100
PXI_TRIG <07>	10, 20
PFI <015>	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**

Source	. Any PFI, PXIe_DSTAR <a,b>, PXI_TRIG, PXI_STAR</a,b>
Polarity	. Software-selectable for most signals
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	PXI TRIG <07>, PXI STAR,
	PXIe_DSTAR <a,b></a,b>
Output destination	PXI_TRIG <07>, PXIe_DSTARC
Output selections	10 MHz Clock; 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

## **Bus Interface**

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	7 DMA, 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 PXIe-6739 can be impaired if it is used in a manner not described in the user documentation.

+3.3 V	3.0 W
+12 V	20.8 W

# **Current Limits**

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

+5 V terminal (connector 0).....1 A maximum<sup>1</sup>

+5 V terminal (connector 1).....1 A maximum<sup>1</sup>

P0/P1/P2/PFI and +5 V terminals combined .... 1.4 A maximum

<sup>&</sup>lt;sup>1</sup> Has a self-resetting fuse that opens when current exceeds this specification.

# Physical

Dimensions (not including connectors)	$.16 \text{ cm} \times 10 \text{ cm} (6.3 \text{ in.} \times 3.9 \text{ in.})$
Weight	. 173 g (6.1 oz)

# Calibration

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

Calibration interval ...... 2 years

# Maximum Working Voltage

Maximum working voltage refers to the signal voltage plus the common-mode voltage.

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

Channel-to-channel......±22 V, Measurement Category I



**Caution** Do not use this module for connection to signals or for measurements within Measurement Categories II, III, or IV.



**Note** Measurement Categories CAT I and CAT O (Other) are equivalent. The input circuits are not intended for direct connection to the MAINs building installations of Categories CAT II, CAT III, or CAT IV.

# Shock and Vibration

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 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.)

# Environmental

The NI 6739 is intended for indoor use only.

Maximum altitude......2,000 meters



**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.

#### **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% RH, 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% RH, noncondensing (Tested in accordance with IEC-60068-2-56.)

# 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; 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 refer to the *Online Product Certification* section.

# CE Compliance $\zeta \in$

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)
- 2011/65/EU; Restriction of Hazardous Substances (RoHS)

# **Online Product Certification**

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#### Device Pinouts

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AO GND 30/31 AO 30	67 33	AO GND 28/29		AO 62	67	33	AO GND 60/61	AO Bank
AO 29	66 32	AO 28		AO 61	66	32	AO 60	릇
¥ AO GND 26/27	65 31	AO 27		AO GND 58/59	65	31	AO 59	⊳
AO GND 26/27 AO 26	64 30	AO GND 24/25		AO 58	64	30	AO GND 56/57	AO Bank
AO 25	63 29	AO 24		AO 57	63	29	AO 56	ank
AO GND 22/23	62 28	AO 23		AO GND 54/55	62	28	AO 55	
AO GIND 22/23 AO 22	61 27	AO GND 20/21		AO 54	61	27	AO GND 52/53	AO Bank
₽ AO 21	60 26	AO 20		AO 53	60	26	AO 52	lank
AO GND 18/19	59 25	AO 19		AO GND 50/51	59	25	AO 51	
AO 18	58 24	AO GND 16/17		AO 50	58	24	AO GND 48/49	AO Bank
AO 17	57 23	AO 16		AO 49	57	23	AO 48	Bank
AO GND <sup>1</sup>	56 22	AO 15		AO GND <sup>1</sup>	56	22	AO 47	
AO GND 14/15	55 21	AO 14		AO GND 46/47	55	21	AO 46	ð
AO 13	54 20	AO GND 12/13		AO 45	54	20	AO GND 44/45	Bank
AO 12	53 19	AO GND <sup>1</sup>		AO 44	53	19	AO GND <sup>1</sup>	*
AO 11	52 18	AO GND 11		AO 43	52	18	AO GND 43	ð
AO 10	51 17	AO 9		AO 42	51	17	AO 41	Bank
AO GND 8/9/10	50 16	AO 8		AO GND 40/41/42	50	16	AO 40	릇
AO GND 6/7	49 15	AO 7		AO GND 38/39	49	15	AO 39	ð
	48 14	AO GND 4/5		AO 38	48	14	AO GND 36/37	0 Bank
AO 0 AO 5	47 13	AO 4		AO 37	47	13	AO 36	Ě
¥ AO GND 2/3	46 12	AO 3		AO GND 34/35	46	12	AO 35	⊳
AO GND 2/3 AO 2	45 11	AO GND 0/1		AO 34	45	11	AO GND 32/33	AO Bank
AO 1	44 10	AO 0		AO 33	44	10	AO 32	ank
D GND <sup>1</sup>	43 9	PFI 7/P1.7		D GND <sup>1</sup>	43	9	PFI 15/P2.7	
D GND PFI 6/7	42 8	PFI 6/P1.6		D GND PFI 14/15	42	8	PFI 14/P2.6	
D GND PFI 4/5	41 7	PFI 5/P1.5		D GND PFI 12/13	41	7	PFI 13/P2.5	
PFI 4/P1.4	40 6	PFI 3/P1.3		PFI 12/P2.4	40	6	PFI 11/P2.3	
D GND PFI 2/3	39 5	PFI 2/P1.2		D GND PFI 10/11	39	5	PFI 10/P2.2	
PFI 1/P1.1	38 4	PFI 0/P1.0		PFI 9/P2.1	38	4	PFI 8/P2.0	
D GND PFI 0/1	37 3	P0.1		D GND PFI 8/9	37	3	P0.3	
D GND P0.0/0.1	36 2	P0.0		D GND P0.2/0.3	36	2	P0.2	
D GND <sup>1</sup>	35 1	+5 V		D GND <sup>1</sup>	35	1	+5 V	
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Figure 5. NI PXIe-6739 Pinout

<sup>1</sup> No connect when using the SHC68-68-A2 cable.

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