

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 ¹	Unsigned integer (0 to 65,535)
Monotonicity	16 bits
Accuracy	Refer to the AO Absolute Accuracy table
Maximum update rate (using local FIFO ²)	
1 channel	1 MS/s
16 channels (1 channel per bank) ³	1 MS/s
64 channels ³	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

¹ Used for writing unscaled or raw data and covers the range from negative full scale (0) to positive full scale (65,535).

² 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.

³ 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.

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 transfersDMA (scatter-gather), programmed I/O

AO waveform modes

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

Settling time, full scale step..... 15 μ s to \pm 4 LSB

Slew rate3.0 V/ μ s

Noise 1.0 mVrms, DC to 1 MHz

AO update glitch

- Magnitude 3.0 mV
- Duration 10 μ s
- 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 stabilityAny passive load



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.

Table 1. AO Absolute Accuracy

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 (μ V)
10	-10	109	12	1	4	95	64	2,940



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

AO Absolute Accuracy Equation

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.....	20 total, 4 (P0.<0..3>), 16 (PFI <0..7>/P1.<0..7>, PFI <8..15>/P2.<0..7>)
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.....	Port 0 (P0.<0..3>)
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

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 μ s, 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.<0..3> -24 mA maximum

 PFI <0..15>/P1.<0..7>/P2.<0..7> -16 mA maximum

Output low current (IOL)

 P0.<0..3> 24 mA maximum

 PFI <0..15>/P1.<0..7>/P2.<0..7> 16 mA maximum

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 μ A
IIH input high current (Vin = 5 V)	—	250 μ A

Digital I/O Characteristics

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

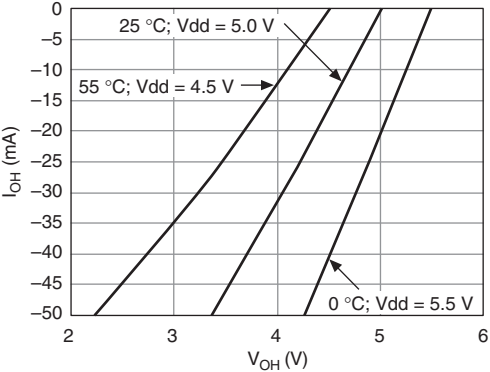


Figure 2. PFI <0..15>/P1/P2: IOH versus VOH

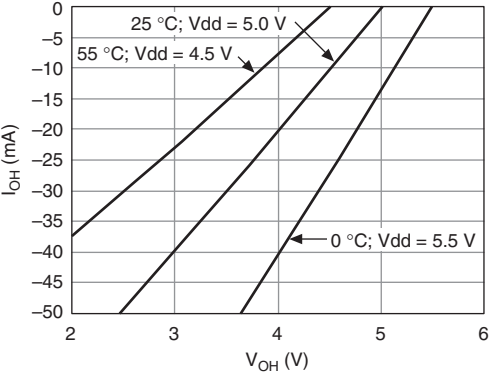


Figure 3. P0.<0..3>: IOL versus VOL

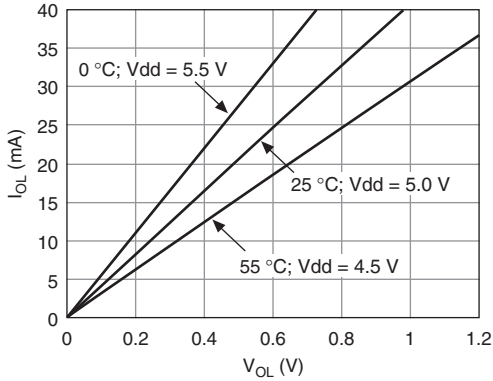
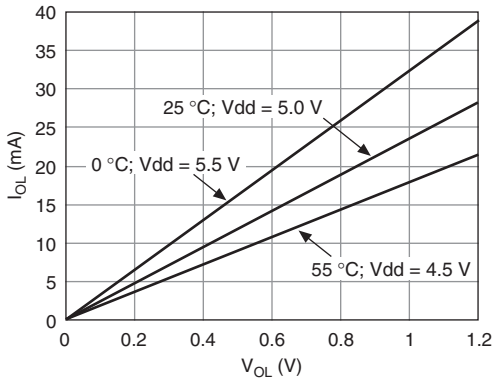


Figure 4. PFI <0..15>/P1/P2: IOL versus VOL



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
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>	10, 20, 100
PXI_STAR	10, 20
PXIe_CLK100	100
PXI_TRIG <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

External Digital Triggers

Source	Any PFI, PXIe_DSTAR<A,B>, PXI_TRIG, PXI_STAR
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 <0..7>, PXI_STAR, PXIe_DSTAR<A,B>
Output destination.....	PXI_TRIG <0..7>, PXIe_DSTARC
Output selections.....	10 MHz Clock; many internal signals
Debounce filter settings	90 ns, 5.12 μ s, 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 ¹
+5 V terminal (connector 1).....	1 A maximum ¹
P0/P1/P2/PFI and +5 V terminals combined	1.4 A maximum

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

Physical

Dimensions (not including connectors).....	16 cm × 10 cm (6.3 in. × 3.9 in.)
Weight.....	173 g (6.1 oz)
I/O connector	2 68-pin VHDCI

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 _{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.)

Environmental

The NI 6739 is intended for indoor use only.

Maximum altitude.....2,000 meters

Pollution Degree 2



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

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

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.

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Device Pinouts

Figure 5. NI PXIe-6739 Pinout

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

¹ No connect when using the SHC68-68-A2 cable.

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