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Find the *National Instruments PXIe-6738* at our website: ***Click HERE***

DEVICE SPECIFICATIONS

NI PXIe-6738

32-Channel High-Density Analog Output

This document lists the specifications for the NI 6738 analog output device. The following specifications are typical at 25 °C unless otherwise noted.

Analog Output

Number of channels ..... 32 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
- 8 channels (1 channel per bank)[3] ..... 1 MS/s
- 32 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.

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

Settling time, full scale step ..... 15 µs to ±4 LSB

Slew rate ..... 3.0 V/µs

Noise ..... 1.0 mV_{rms}, 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

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 (µV)
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.

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AO Absolute Accuracy Equation

$$AbsoluteAccuracy = OutputValue \cdot (GainError) + Range \cdot (OffsetError)$$

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

$$OffsetError = ResidualOffsetError + OffsetTempco \cdot (TempChangeFromLastInternalCal) + INL_Error$$

Digital I/O/PFI

Static Characteristics

Number of channels ..... 10 total, 2 (P0.<0..1>), 8 (PFI <0..7>/P1.<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..1>)

Port/sample size ..... Up to 2 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.

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PFI/Port 1 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 (V_{IH}) ..... 2.2 V minimum, 5.25 V maximum

Input low voltage (V_{IL}) ..... 0 V minimum, 0.8 V maximum

Output high current (I_{OH})

P0.<0..1> ..... -24 mA maximum

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

Output low current (I_{OL})

P0.<0..1> ..... 24 mA maximum

PFI <0..7>/P1<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	—
I_{IL} input low current (V_{in} = 0 V)	—	-10 µA
I_{IH} input high current (V_{in} = 5 V)	—	250 µA

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Digital I/O Characteristics

Figure 1. P0.<0..1>: I_{OH} versus V_{OH}

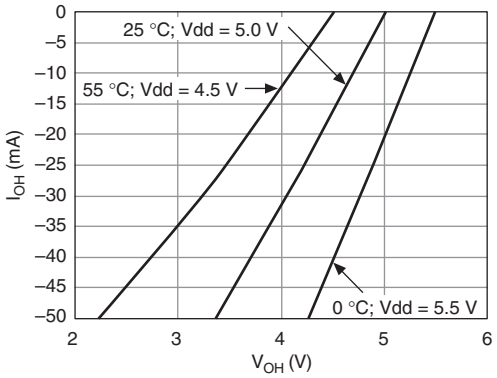
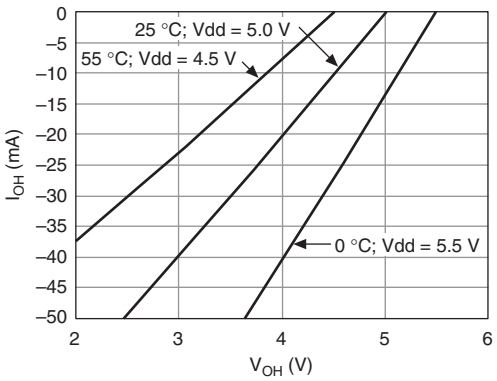


Figure 2. PFI <0..7>/P1: I_{OH} versus V_{OH}



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Figure 3. P0.<0..1>: I_{OL} versus V_{OL}

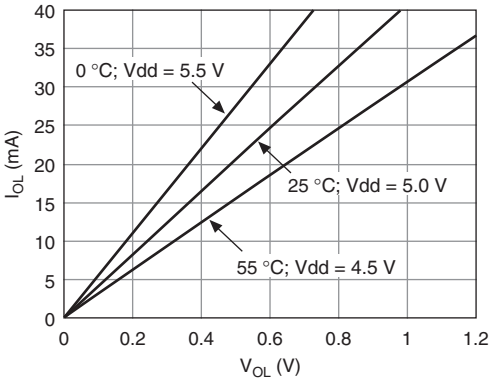
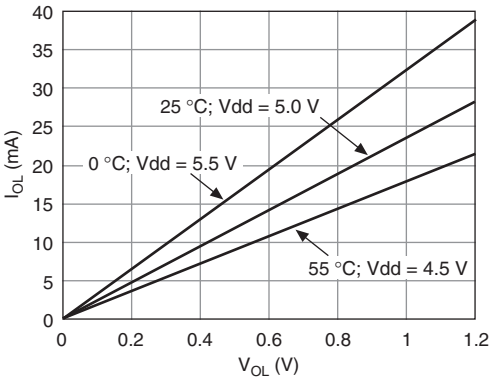


Figure 4. PFI <0..7>/P1: I_{OL} versus V_{OL}



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

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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..7>	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

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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 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-6738 can be impaired if it is used in a manner not described in the user documentation.

+3.3 V ..... 3.0 W

+12 V ..... 14.0 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]

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

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

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Physical

Dimensions (not including connectors)..... 16 cm × 10 cm (6.3 in. × 3.9 in.)

Weight..... 164 g (5.8 oz)

I/O connector ..... 1 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.)

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Environmental

The NI 6738 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.

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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 CE

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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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.

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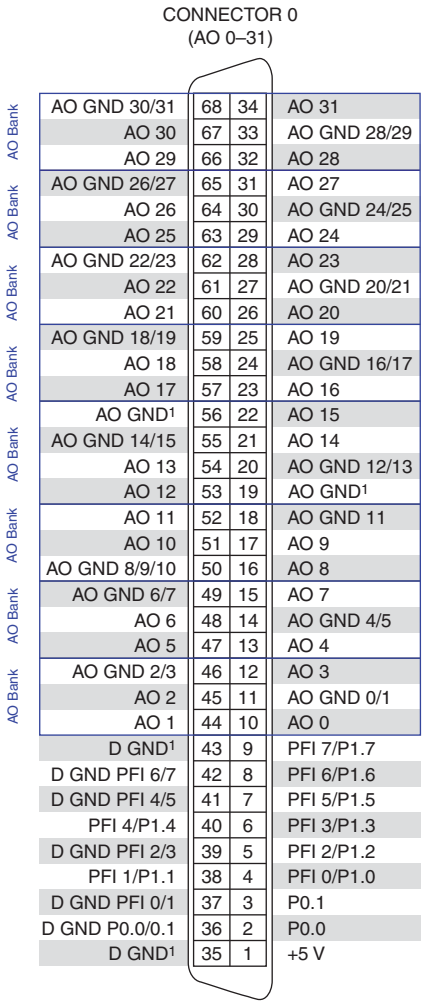
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Device Pinouts

Figure 5. NI PXIe-6738 Pinout



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

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