# USB-6421 Specifications

2024-09-20

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# USB-6421 Specifications

## 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*** specifications describe 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.

## USB-6421 AI Connector Pinout

Use the pinout to connect to analog input terminals on the USB-6421.

**Figure 1.** USB-6421 AI Connector Pinout

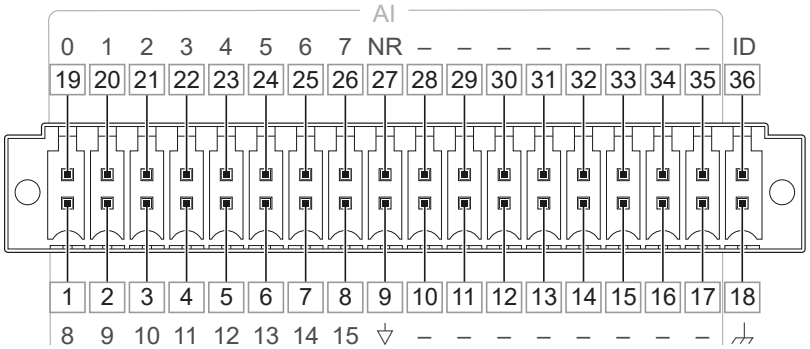


**Table 1.** USB-6421 AI Connector Pin Assignments

| Pin | Signal |
|---|---|
| 1 | AI 8 |
| 2 | AI 9 |
| 3 | AI 10 |
| 4 | AI 11 |
| 5 | AI 12 |
| 6 | AI 13 |
| 7 | AI 14 |
| 8 | AI 15 |
| 9 | AI GND |
| 10 | No connect |
| 11 | No connect |
| 12 | No connect |
| 13 | No connect |
| 14 | No connect |
| 15 | No connect |
| 16 | No connect |
| 17 | No connect |
| 18 | CHSGND |
| 19 | AI 0 |
| 20 | AI 1 |
| 21 | AI 2 |
| 22 | AI 3 |
| 23 | AI 4 |
| 24 | AI 5 |
| 25 | AI 6 |
| 26 | AI 7 |

| Pin | Signal |
|---|---|
| 27 | NR (AI SENSE) |
| 28 | No connect |
| 29 | No connect |
| 30 | No connect |
| 31 | No connect |
| 32 | No connect |
| 33 | No connect |
| 34 | No connect |
| 35 | No connect |
| 36 | ID 0 |

**Table 2.** USB-6421 AI Connector Signal Descriptions

| Signal | Function | Reference | Direction | Description |
|---|---|---|---|---|
| AI <0..7> | Analog input channels | Varies | Input | Supports differential or single-ended measurement modes. The default configuration is differential mode.<br><br>In differential mode, these channels are the positive input for the differential pair. The negative input of the differential pair is located directly beneath the positive input.<br><br>In single-ended |

| Signal | Function | Reference | Direction | Description |
|---|---|---|---|---|
| | | | | mode, each signal is a separate analog input voltage channel. The ground reference in single-ended mode is configurable. In referenced single-ended (RSE) mode, AI GND is the reference for the voltage measurement. In non-referenced single-ended (NRSE) mode, the NR pin is the reference.<br><br>**Note** You can configure the input mode per channel. |
| AI <8..15> | Analog input channels | Varies | Input | Supports single-ended measurements only. The default configuration is RSE mode. In RSE mode, AI GND is the reference for the voltage measurement. In NRSE mode, the NR |

| Signal | Function | Reference | Direction | Description |
|---|---|---|---|---|
| | | | | pin is the reference.<br><br>For differential measurements, refer to the descriptions for AI <0..7>. |
| AI GND | Analog input ground | — | — | The reference point for single-ended measurements in RSE mode and the bias current return point for differential measurements.<br><br>AI GND, AO GND, D GND, and CHSGND are all connected internally. |
| NR (AI SENSE) | AI SENSE for NRSE mode | — | Input | The AI SENSE pin is labeled "NR" because it is used when the input terminal is configured to NRSE mode. In NRSE mode, AI SENSE acts as a remote sense of a reference voltage that can be at a different voltage potential than AI GND. |
| CHSGND | Chassis ground | — | — | Connects directly to the chassis ground of the USB-6421 enclosure. It can be |

| Signal | Function | Reference | Direction | Description |
|---|---|---|---|---|
| | | | | used as a termination point for shielded cables to help improve measurement quality. |
| ID 0 | — | — | — | This feature is not supported yet. |

# USB-6421 AO/DIO Connector Pinout

Use the pinout to connect to analog output and digital input/output terminals on the USB-6421.

**Figure 2.** USB-6421 AO/DIO Connector Pinout

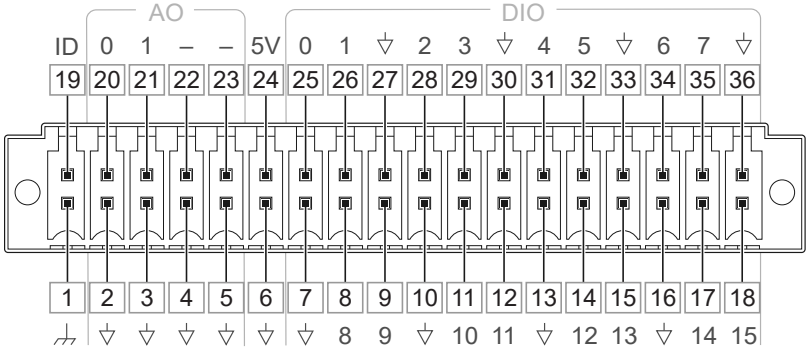



**Table 3.** USB-6421 AO/DIO Connector Pin Assignments

| Pin | Signal |
|---|---|
| 1 | CHSGND |
| 2 | AO GND |
| 3 | AO GND |
| 4 | AO GND |
| 5 | AO GND |
| 6 | D GND |
| 7 | D GND |
| 8 | PFI 8/P0.8 (port0/line8) |

| Pin | Signal |
|---|---|
| 9 | PFI 9/P0.9 (port0/line9) |
| 10 | D GND |
| 11 | PFI 10/P0.10 (port0/line10) |
| 12 | PFI 11/P0.11 (port0/line11) |
| 13 | D GND |
| 14 | PFI 12/P0.12 (port0/line12) |
| 15 | PFI 13/P0.13 (port0/line13) |
| 16 | D GND |
| 17 | PFI 14/P0.14 (port0/line14) |
| 18 | PFI 15/P0.15 (port0/line15) |
| 19 | ID 1 |
| 20 | AO 0 |
| 21 | AO 1 |
| 22 | No connect |
| 23 | No connect |
| 24 | +5 V |
| 25 | PFI 0/P0.0 (port0/line0) |
| 26 | PFI 1/P0.1 (port0/line1) |
| 27 | D GND |
| 28 | PFI 2/P0.2 (port0/line2) |
| 29 | PFI 3/P0.3 (port0/line3) |
| 30 | D GND |
| 31 | PFI 4/P0.4 (port0/line4) |
| 32 | PFI 5/P0.5 (port0/line5) |
| 33 | D GND |
| 34 | PFI 6/P0.6 (port0/line6) |
| 35 | PFI 7/P0.7 (port0/line7) |

| Pin | Signal |
|---|---|
| 36 | D GND |

**Table 4.** USB-6421 AO/DIO Connector Signal Descriptions

| Signal | Function | Reference | Direction | Description |
|---|---|---|---|---|
| AO <0..1> | Analog output channels | AO GND | Output | Supplies the voltage output of the AO channels. |
| AO GND | Analog output ground | — | — | AO GND is the reference for the AO channels.<br><br>AI GND, AO GND, D GND, and CHSGND are all connected internally. |
| +5 V | +5 V power source | D GND | Output | Provides current limited +5 V power output that can be used to power external circuitry. Refer to the ***+5 V Power Source*** section for more information. Leave this pin open if you do not use it. |
| PFI <0..15>/P0.<0..15> | Port 0 digital I/O channels | D GND | Input or output | Digital channels that can be individually configured as input or output.<br><br>These channels |

| Signal | Function | Reference | Direction | Description |
|---|---|---|---|---|
| | | | | are referred to as port0/line0:15 in software when used as digital I/O. They are referred to as PFI 0:15 when used for other purposes, like timing I/O.<br><br>Can also be individually configured for the following uses.<br><br>• Digital I/O<br>• Counter/ timer input<br>• Counter/ timer output<br>• External timing or trigger signal input for AI, AO, DI, DO, counter, or timers.<br>• Timing or trigger signal output from AI, AO, DI, DO, counter, or timers. |
| D GND | Digital ground | — | — | Supplies the reference for the P0.<0..15> pins and +5 V pin.<br><br>AI GND, AO GND, D |

| Signal | Function | Reference | Direction | Description |
|---|---|---|---|---|
| | | | | GND, and CHSGND are all connected internally. |
| CHSGND | Chassis ground | — | — | Connects directly to the chassis ground of the USB-6421 enclosure. It can be used as a termination point for shielded cables to help improve measurement quality. |
| ID 1 | — | — | — | This feature is not supported yet. |

**Related information:**

- +5 V Power Source

# 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*** |

| **Sample rate** | |
|---|---|
| Single channel maximum | 250 kS/s |
| Multichannel maximum (aggregate) | 250 kS/s |
| Minimum | No minimum |
| Timing resolution | 10 ns |
| Timing accuracy | 50 ppm of sample rate |

| | |
|---|---|
| Input coupling | DC |
| Input range | ±0.2 V<br>±1 V<br>±5 V<br>±10 V |
| Power on state | Differential Mode at 10 V Range |

| **Maximum working voltage for analog inputs (signal + common mode)** |
|---|

| | |
|---|---|
| All input ranges (±0.2V, ±1 V, ±5 V, ±10 V) | ±11 V to AI GND |

**Table 5.** Input Impedance

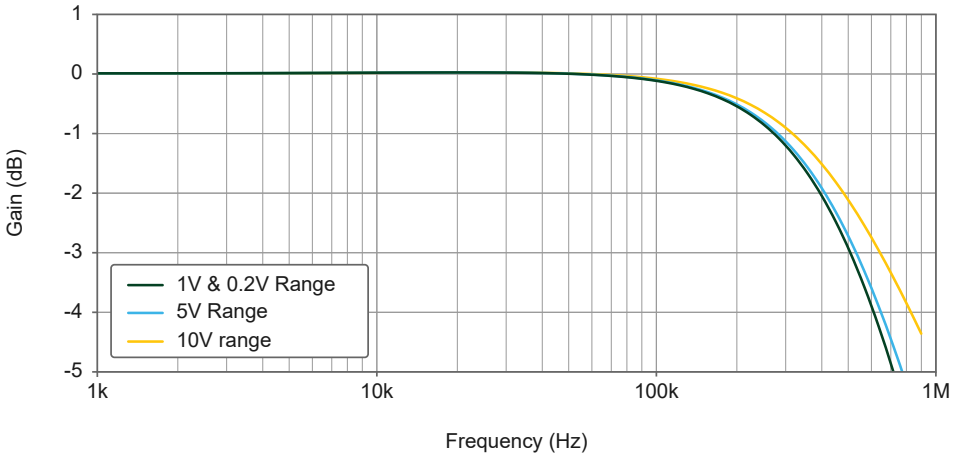
| | | |
|---|---|---|
| Device on | AI+ to AI GND | >10 GΩ in parallel with 50 pF |
| | AI- to AI GND | >10 GΩ in parallel with 50 pF |
| Device off | AI+ to AI GND | 1,250 Ω |
| | AI- to AI GND | 1,250 Ω |

| | |
|---|---|
| Input bias current | ±30 pA typical<br>±1 nA maximum over full temperature range |

| **Crosstalk (at 100 kHz)** | |
|---|---|
| Differential channels | -65 dB |
| Single-ended channels | -50 dB |

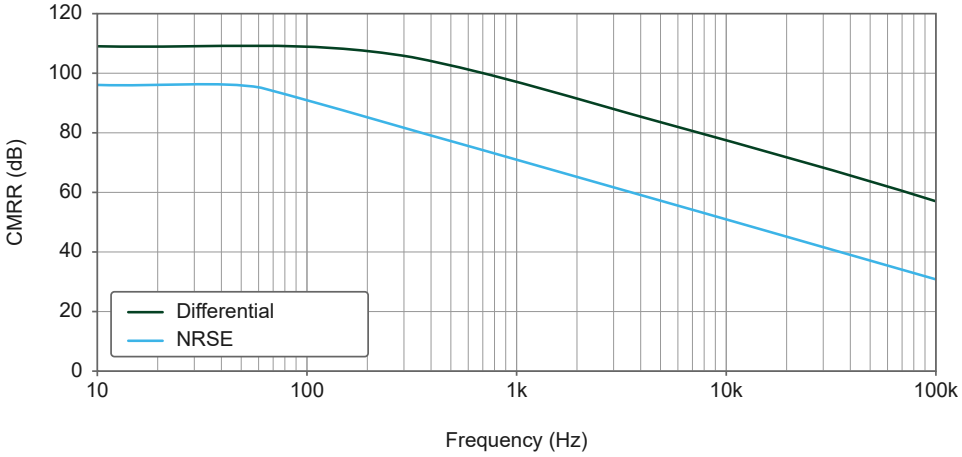
| **Small signal bandwidth (-3 dB)** | |
|---|---|
| Input range ±10 V | 630 kHz |
| Input range ±5 V | 510 kHz |
| Input range ±1 V, ±0.2 V | 490 kHz |

**Figure 3.** USB-6421 Small Signal Bandwidth versus Frequency




| CMRR (DC to 60 Hz) | |
|---|---|
| Differential mode | 100 dB |
| Non-referenced single-ended (NRSE) mode | 90 dB |

**Figure 4.** USB-6421 CMRR versus Frequency




| | |
|---|---|
| Input FIFO size | 8,191 samples shared among channels used |
| Scan list memory | 4,095 entries |

| | |
|---|---|
| Data transfers | USB Signal Stream, programmed I/O |

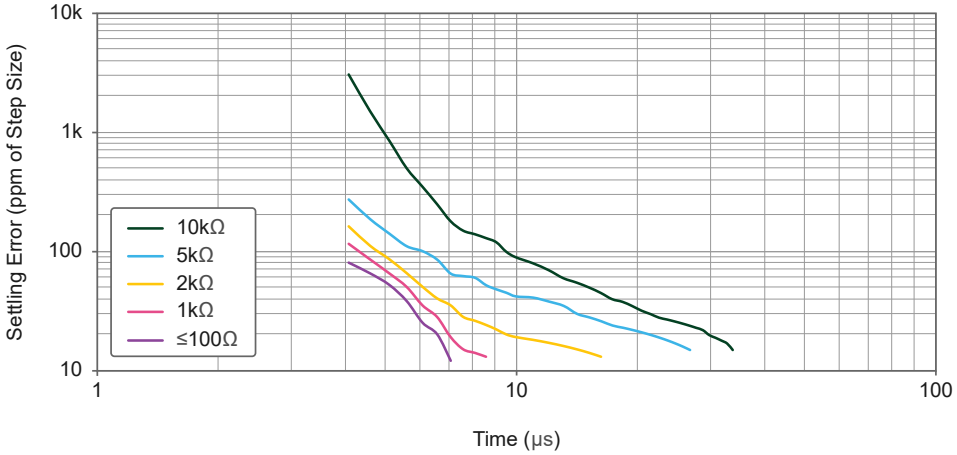
| **Overvoltage protection for AI<0..15> and NR (AI Sense) pins** | |
|---|---|
| Device on | ±30 V for up to two AI pins |
| Device off | ±20 V for up to two AI pins |
| Input current during overvoltage condition | ±16 mA maximum per AI pin<br>±16 mA maximum per NR pin |

**Table 6.** Settling Time for Multi-channel Measurements at Full-Scale Step

| Input Range | ±90 ppm (6 LSB) | ±30 ppm (2 LSB) | ±15 ppm (1 LSB) |
|---|---|---|---|
| ±0.2 V, ±1 V, ±5 V, ±10 V | 4 µs | 6 µs | 7 µs |

**Note** Refer to the ***Multi-channel Scanning Considerations*** section in the ***USB-6421 User Manual*** for the best settling time performance.

**Figure 5.** USB-6421 Settling Error versus Time for Different Source Impedances




## Related information:

- Multi-channel Scanning Considerations

## AI Absolute Accuracy (Warranted)

**Notice** The input channels of the USB-6421 are sensitive to electromagnetic interference (EMI). As a result, you might experience reduced measurement accuracy or temporary performance degradation with cables routed through strong EMI environments. To ensure optimal performance, either avoid such environments, or carefully select and route cables or probes connected to the USB-6421.

**Table 8.** AI Absolute Accuracy

| Nominal Range, Positive Full Scale (V) | Nominal Range, Negative Full Scale (V) | 2 Years Residual Gain Error (ppm of Reading) | 10 Years Residual Gain Error (ppm of Reading) | Gain Tempco (ppm of Range/°C) | Residual Offset Error (ppm of Range) | Offset Tempco (ppm of Range/°C) | Random Noise, σ (µV RMS) | 2 Years Absolute Accuracy at Full Scale (µV) | 10 Years Absolute Accuracy at Full Scale (µV) |
|---|---|---|---|---|---|---|---|---|---|
| 10 | -10 | 102 | 172 | 15 | 21 | 40 | 240 | 2,607 | 3,307 |
| 5 | -5 | 110 | 180 | 15 | 23 | 40 | 122 | 1,354 | 1,704 |
| 1 | -1 | 110 | 180 | 15 | 26 | 44 | 28 | 278 | 348 |
| 0.2 | -0.2 | 122 | 192 | 15 | 78 | 60 | 13 | 72 | 86 |

**Note** Absolute accuracy at full scale on the analog input channels is determined using the following assumptions:

- ***Temp Change From Last External Cal*** = 10 °C
- ***Temp Change From Last Internal Cal*** = 1 °C
- ***Number of readings*** = 10,000
- ***Coverage Factor*** = 3σ

**Note** Accuracies listed are valid for up to 2 and 10 years from the device external calibration.

| | |
|---|---|
| Reference Tempco | 5 ppm/°C |
| INL error | 32 ppm of range |

## AI Absolute Accuracy Equation

$$Absolute\ Accuracy = Reading * (Gain\ Error) + Range * (Offset\ Error) + Noise\ Uncertainty$$

- $Gain\ Error = Residual\ Gain\ Error + Gain\ Tempco * (Temp\ Change\ From\ Last\ Internal\ Cal) + Reference\ Tempco * (Temp\ Change\ From\ Last\ External\ Cal)$
- $Offset\ Error = Residual\ Offset\ Error + Offset\ Tempco * (Temp\ Change\ From\ Last\ Internal\ Cal) + INL\ Error$
- $Noise\ Uncertainty = \frac{Random\ Noise * 3}{\sqrt{10,000}}$

For a coverage factor of 3 σ and averaging 10,000 points.

## AI Absolute Accuracy Example

For example, on the 10 V range for 2 years calibration interval, the absolute accuracy at full scale is as follows:

- $Gain\ Error: 102\ ppm + 15\ ppm * 1 + 5\ ppm * 10 = 167\ ppm$
- $Offset\ Error: 21\ ppm + 40\ ppm * 1 + 32\ ppm = 93\ ppm$
- $Noise\ Uncertainty: \frac{240\ \mu V * 3}{\sqrt{10,000}} = 7.2\ \mu V$
- $Absolute\ Accuracy: 10\ V * (Gain\ Error) + 10\ V * (Offset\ Error) + Noise\ Uncertainty = 2,607\ \mu V$

# Analog Output

| | |
|---|---|
| Number of channels | 2 |
| DAC resolution | 16 bits |
| DNL | ±1 LSB |

| | |
|---|---|
| Monotonicity | 16 bits guaranteed |

| **Maximum update rate (simultaneous)** | |
|---|---|
| All channels | 250 kS/s |
| Timing accuracy | 50 ppm of sample rate |
| Timing resolution | 10 ns |

| | |
|---|---|
| Output range | ±10 V |
| Output coupling | DC |
| Output impedance[1] | 0.05 Ω |
| Output current drive | ±2 mA |
| Overdrive protection during power on/off | ±30 V |
| Overdrive current | 2.8 mA |
| Power-on state | Less than ±5 mV |

1. Output impedance excludes cabling impedance.

| | |
|---|---|
| Output FIFO size | 16,383 samples shared among channels used |
| Data transfers | USB Signal Stream, programmed I/O |
| AO waveform modes | Non-periodic waveform<br>Periodic waveform regeneration mode from onboard FIFO<br>Periodic waveform regeneration from host buffer, including dynamic update |
| Settling time, full-scale step, 15 ppm (1 LSB) | 25 µs with 50 pF load |
| Slew rate | 8 V/µs |

| **AO glitch** | |
|---|---|
| Device power up | ±0.9 V peak for 8 ms |
| Device power down, reset, or USB hot unplug | -1.4 V peak for 400 ns |

| | |
|---|---|
| Glitch energy mid-scale code transition | ±5 mV for 5 µs |
| Crosstalk (at 10 kHz) | < -100 dB |

## AO Absolute Accuracy (Warranted)

**Notice** The output channels of the USB-6421 are sensitive to electromagnetic interference (EMI). As a result, you might experience reduced measurement accuracy or temporary performance degradation with cables routed through strong EMI environments. To ensure optimal performance, either avoid such environments, or carefully select and route cables or probes connected to the USB-6421.

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

**Table 8.** AO Absolute Accuracy

| Nominal Range, Positive Full Scale (V) | Nominal Range, Negative Full Scale (V) | 2 Years Residual Gain Error (ppm of Reading) | 10 Years Residual Gain Error (ppm of Reading) | Gain Tempco (ppm of Range/°C) | Residual Offset Error (ppm of Range) | Offset Tempco (ppm of Range/°C) | 2 Years Absolute Accuracy at Full Scale (µV) | 10 Years Absolute Accuracy at Full Scale (µV) |
|---|---|---|---|---|---|---|---|---|
| 10 | -10 | 106 | 176 | 17 | 34 | 40.7 | 2,787 | 3,487 |

**Note** Accuracies listed are valid for up to 2 and 10 years from the device external calibration.

| | |
|---|---|
| Reference Tempco | 5 ppm/°C |
| INL error | 31 ppm of range |

## AO Absolute Accuracy Equation

$$Absolute\ Accuracy = Output\ Value * (Gain\ Error) + Range * (Offset\ Error)$$

- *Gain Error = Residual Gain Error + Gain Tempco * (Temp Change From Last Internal Cal) + Reference Tempco * (Temp Change From Last External Cal)*
- *Offset Error = Residual Offset Error + Offset Tempco * (Temp Change From Last Internal Cal) + INL Error*

# Digital I/O (PFI)

| | |
|---|---|
| Number of channels | 16 |
| Capabilities | Static Digital I/O, Waveform Digital I/O, PFI, Counter, or Timer |
| Direction control | Each terminal can be programmed individually as input or output |
| Logic Family | 5 V (LVCMOS) |

## Electrical Characteristics

| | |
|---|---|
| Ground reference | D GND |
| Direction control | Program each as input or output individually |
| Pull-down resistor | 47 kΩ |
| Input voltage protection | ±20 V per line, up to two lines simultaneously |

**Notice** Stresses beyond those listed under the Input voltage protection specification may cause permanent damage to the USB-6421.

## Static Digital I/O Capabilities

| | |
|---|---|
| Channel names in software | Port0/line0:15 |

## Waveform Digital I/O Capabilities

| | |
|---|---|
| Channel names in software | Port0/line0:15 |
| Port/sample size | Up to 16 bits |
| Waveform generation (DO) FIFO | 8,191 samples |
| Waveform acquisition (DI) FIFO | 1,023 samples |
| DO or DI sample clock frequency | 0 MHz to 10 MHz, system and bus activity dependent |
| Data transfers | USB Signal Stream, programmed I/O |

## PFI Functionality

| | |
|---|---|
| Channel names in software | PFI0:15 |
| Functionality | Timing input<br>Timing output |

| | |
|---|---|
| Timing output sources | Many AI, AO, counter, DI, and DO timing signals |

## Recommended Operating Conditions

| **Output high current ($I_{OH}$)** | |
|---|---|
| DIO<0..15> | -10 mA maximum per channel |

| **Output low current ($I_{OL}$)** | |
|---|---|
| DIO<0..15> | 10 mA maximum per channel |

**Note** The maximum output current is shared between all channels and the +5 V power source.

**Table 9.** Digital Input Logic Levels

| **Logic Family** | **Input Low Voltage ($V_{IL}$)** | | **Input High Voltage ($V_{IH}$)** | |
|---|---|---|---|---|
| | **Minimum** | **Maximum** | **Minimum** | **Maximum** |
| 5.0 V | -0.5 V | 1.46 V | 3.66 V | 5.5 V |

**Table 10.** Digital Output Logic Level

| **Logic Family** | **Current** | **Output Low Voltage ($V_{OL}$) Maximum** | **Output High Voltage ($V_{OH}$) Minimum** |
|---|---|---|---|
| 5.0 V | 4 mA | 0.30 V | 4.59 V |

## Digital I/O Characteristics

| | |
|---|---|
| $I_{IL}$ input low current ($V_{IN}$ = 0 V) | -1 µA maximum |

| | |
|---|---|
| $I_{IH}$ input low current ($V_{IN}$ = 5 V) | 110 µA maximum |

**Figure 6.** $I_{OH}$ versus $V_{OH}$, 5.0 V Logic Family

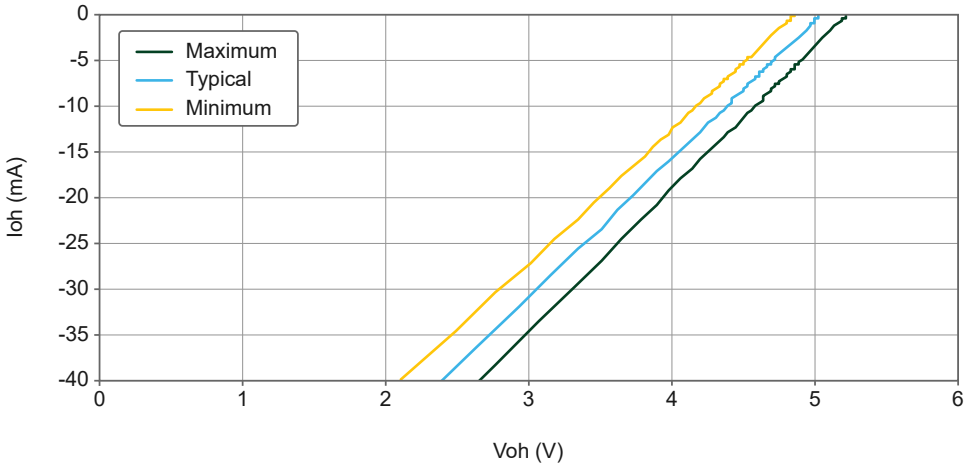
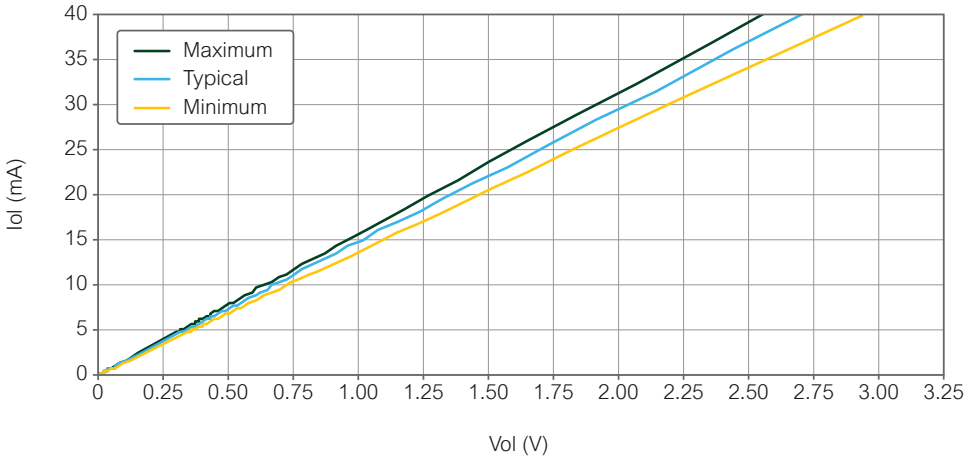



**Figure 7.** $I_{OL}$ versus $V_{OL}$, 5.0 V Logic Family




# General-Purpose Counters

| | |
|---|---|
| Number of counters/timers | 4 |
| Resolution | 32 bits |
| Counter measurements | Edge counting |

| | |
|---|---|
| | Pulse<br>Pulse width<br>Semi-period<br>Period<br>Two-edge separation |
| Position measurements | X1, X2, X4 quadrature encoding with Channel Z reloading<br>Two-pulse encoding |
| Output applications | Pulse<br>Pulse train<br>Frequency division<br>Equivalent time sampling |
| Internal base clocks | 100 MHz<br>20 MHz<br>100 kHz |
| External base clock frequency | 0 MHz to 25 MHz |
| Base clock accuracy | 50 ppm |
| Inputs | Gate |

| | |
|---|---|
| | Source<br>HW_Arm<br>Aux<br>A<br>B<br>Z<br>Up_Down<br>Sample Clock |
| Routing options for inputs | Any PFI, many internal signals |
| Data transfers | Programmed I/O |

## Frequency Generator

| | |
|---|---|
| Number of channels | 1 |
| Base clocks | 100 MHz<br>20 MHz<br>100 kHz |
| Divisors | 1 to 16 |
| Base clock accuracy | 50 ppm |

Output can be available on any PFI terminal.

## Bus Interface

| | |
|---|---|
| USB compatibility | USB 3.0/USB 3.1 Gen 1/USB 3.2 Gen 1 SuperSpeed or USB 2.0 Hi-Speed[2] |
| USB Signal Stream | 8, can be used for analog input, analog output, digital input, or digital output |
| USB connector | USB Type-C |

## +5 V Power Source

| | | |
|---|---|---|
| Voltage accuracy | No load | +4.87 V to +5.22 V |
| | Maximum current | +4.76 V to 5.17 V |

| **Maximum load current**[3] | |
|---|---|
| Connected to USB 2.0 Hi-Speed port with 2.5 W power | 50 mA |
| Connected to USB 3.0 SuperSpeed port with ≥4.5 W power | 280 mA |

| | |
|---|---|
| Power on state | Always on (no user control) |

2. Operating on a Hi-Speed bus results in lower performance, and you might not be able to achieve maximum sampling/update rates.
3. The USB-6421 will self-detect the power capability of USB host to configure the current limit. If the USB-6421 is at 280 mA limit, it will lower the current limit to 50 mA if there is overdrive or fault condition. The current limit will be reset back to the default 280 mA limit when the fault or load is removed.

| | |
|---|---|
| Overdrive protection during power on/off | ±30 V |

## Power Requirements

**Caution** The protection provided by the USB-6421 can be impaired if it is used in a manner not described in the ***USB-6421 User Manual***.

| | |
|---|---|
| USB power rating | 3.8 W (760 mA at nominal 5 V) |
| Power input mating connector | USB Type-C plug for power and data |

**Related information:**

- USB-6421 User Manual

## Current Limit

| | | |
|---|---|---|
| DIO and +5 V terminals combined[4] | Connected to USB 2.0 Hi-Speed port with 2.5 W power | 50 mA |
| | Connected to USB 3.0 SuperSpeed port with ≥4.5 W power | 280 mA |

## Maximum Working Voltage

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

4. The USB-6421 will self-detect the power capability of the USB host to configure the current limit. If the USB-6421 is at 280 mA limit, it will lower the current limit to 50 mA if there is an overdrive or fault condition. The current limit will be reset back to the default 280 mA limit when the fault or load is removed.

| | |
|---|---|
| Channel to earth | 11 V, Measurement Category I |

## Measurement Category

This product is rated for Measurement Category I.

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

**Remarque** 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.

## Physical Characteristics

| | |
|---|---|
| I/O connector | 2x 36-position spring terminals |
| Dimensions | 116.7 mm x 177.0 mm x 30.4 mm |

| | |
|---|---|
| | (4.59 in. x 6.97 in. x 1.20 in.) |
| Weight | 590 g (1.30 lb) |

# Field Wiring Specifications

Use copper wiring for all connections unless otherwise stated.

| | |
|---|---|
| Gauge | 0.14 $mm^2$ to 1.5 $mm^2$ (26 AWG to 16 AWG) copper conductor wire |
| Wire strip length | 10 mm (0.394 in.) of insulation stripped from the end |
| Temperature rating | -25 °C to 120 °C |
| Wires per terminal | One wire per spring terminal; two wires per spring terminal using a 2-wire ferrule |

| **Ferrules** | |
|---|---|
| Single ferrule, uninsulated | 0.14 $mm^2$ to 1.5 $mm^2$ (26 AWG to 16 AWG)<br>10 mm barrel length |
| Single ferrule, insulated | 0.14 $mm^2$ to 1.0 $mm^2$ (26 AWG to 18 AWG)<br>12 mm barrel length |

| | |
|---|---|
| Two-wire ferrule, insulated | 2x 0.34 $mm^2$ (22 AWG)<br>12 mm barrel length |

| **Connector securement** | |
|---|---|
| Securement type | Screw flanges |
| Torque for screw flanges | 0.2 N · m (1.80 lb · in.) |

# Environmental Characteristics

| **Temperature** | |
|---|---|
| Operating temperature | 0 °C to 55 °C |
| Storage temperature | -20 °C to 70 °C |

| **Humidity** | |
|---|---|
| Operating humidity[5] | 10% RH to 90% RH, noncondensing |
| Storage humidity | 5% RH to 95% RH, noncondensing |

| | |
|---|---|
| Pollution Degree | 2 |

5. The USB-6421 will perform at the full accuracy specification up to 90% RH operating humidity at ≤40 °C.

| | |
|---|---|
| Maximum altitude | 2,000 m |

| **Shock and vibration** | |
|---|---|
| Operating vibration | 5 Hz to 500 Hz, 0.3 g RMS |
| Non-operating vibration | 5 Hz to 500 Hz, 2.4 g RMS |
| Operating shock | 30 g, half-sine, 11 ms pulse |

# Calibration

| | |
|---|---|
| Recommended warm-up time | 15 minutes |
| Recommended calibration interval | 2 years |

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