NI 6052E Family Specifications

This document lists the I/O terminal summary and specifications for the devices that make up the NI 6052E family of devices. This family includes the following devices:

- NI DAQPad-6052E
- NI PCI-6052E
- NI PXI-6052E

I/O Terminal Summary

Note  With NI-DAQmx, National Instruments revised its terminal names so they are easier to understand and more consistent among NI hardware and software products. The revised terminal names used in this document are usually similar to the names they replace. For a complete list of Traditional NI-DAQ (Legacy) terminal names and their NI-DAQmx equivalents, refer to Terminal Name Equivalents of the E Series Help.

<table>
<thead>
<tr>
<th>Terminal Name</th>
<th>Terminal Type and Direction</th>
<th>Impedance (V)</th>
<th>Protection (V) On/Off</th>
<th>Source (mA at V)</th>
<th>Sink (mA at V)</th>
<th>Rise Time (ns)</th>
<th>Bias</th>
</tr>
</thead>
<tbody>
<tr>
<td>AI &lt;0..15&gt;</td>
<td>AI</td>
<td>100 GΩ in parallel with 100 pF</td>
<td>±25/15</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>±200 pA</td>
</tr>
<tr>
<td>AI SENSE, AI SENSE 2</td>
<td>AI</td>
<td>100 GΩ in parallel with 100 pF</td>
<td>±25/15</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>±200 pA</td>
</tr>
<tr>
<td>AI GND</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>AO 0</td>
<td>AO</td>
<td>0.1 Ω</td>
<td>Short-circuit to ground</td>
<td>5 at 10</td>
<td>5 at –10</td>
<td>20 V/µs</td>
<td>—</td>
</tr>
<tr>
<td>AO 1</td>
<td>AO</td>
<td>0.1 Ω</td>
<td>Short-circuit to ground</td>
<td>5 at 10</td>
<td>5 at –10</td>
<td>20 V/µs</td>
<td>—</td>
</tr>
<tr>
<td>AO EXT REF</td>
<td>AI</td>
<td>10 kΩ</td>
<td>±25/15</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>AO GND</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>D GND</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>±5 V</td>
<td>—</td>
<td>0.1 Ω</td>
<td>Short-circuit to ground</td>
<td>1 A at 5</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Terminal Name</td>
<td>Terminal Type and Direction</td>
<td>Impedance (V)</td>
<td>Protection (V) On/Off</td>
<td>Source (mA at V)</td>
<td>Sink (mA at V)</td>
<td>Rise Time (ns)</td>
<td>Bias</td>
</tr>
<tr>
<td>----------------</td>
<td>-----------------------------</td>
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<td>-----------------------</td>
<td>------------------</td>
<td>---------------</td>
<td>----------------</td>
<td>---------------</td>
</tr>
<tr>
<td>P0.&lt;0..7&gt;</td>
<td>DIO</td>
<td>—</td>
<td>V&lt;sub&gt;CC&lt;/sub&gt; + 0.5</td>
<td>13 at (V&lt;sub&gt;CC&lt;/sub&gt; – 0.4)</td>
<td>24 at 0.4</td>
<td>1.1</td>
<td>50 kΩ pu</td>
</tr>
<tr>
<td>AI HOLD COMP</td>
<td>DO</td>
<td>—</td>
<td>—</td>
<td>3.5 at (V&lt;sub&gt;CC&lt;/sub&gt; – 0.4)</td>
<td>5 at 0.4</td>
<td>1.5</td>
<td>50 kΩ pu</td>
</tr>
<tr>
<td>EXT STROBE*</td>
<td>DO</td>
<td>—</td>
<td>—</td>
<td>3.5 at (V&lt;sub&gt;CC&lt;/sub&gt; – 0.4)</td>
<td>5 at 0.4</td>
<td>1.5</td>
<td>50 kΩ pu</td>
</tr>
<tr>
<td>PFI 0/ (AI START TRIG)</td>
<td>AI/DIO</td>
<td>10 kΩ</td>
<td>V&lt;sub&gt;CC&lt;/sub&gt; + 0.5 ± 35</td>
<td>3.5 at (V&lt;sub&gt;CC&lt;/sub&gt; – 0.4)</td>
<td>5 at 0.4</td>
<td>1.5</td>
<td>9 kΩ pu, 10 kΩ pd</td>
</tr>
<tr>
<td>PFI 1/ (AI REF TRIG)</td>
<td>DIO</td>
<td>—</td>
<td>V&lt;sub&gt;CC&lt;/sub&gt; + 0.5</td>
<td>3.5 at (V&lt;sub&gt;CC&lt;/sub&gt; – 0.4)</td>
<td>5 at 0.4</td>
<td>1.5</td>
<td>50 kΩ pu</td>
</tr>
<tr>
<td>PFI 2/ (AI CONV CLK)*</td>
<td>DIO</td>
<td>—</td>
<td>V&lt;sub&gt;CC&lt;/sub&gt; + 0.5</td>
<td>3.5 at (V&lt;sub&gt;CC&lt;/sub&gt; – 0.4)</td>
<td>5 at 0.4</td>
<td>1.5</td>
<td>50 kΩ pu</td>
</tr>
<tr>
<td>PFI 3/ CTR 1 SOURCE</td>
<td>DIO</td>
<td>—</td>
<td>V&lt;sub&gt;CC&lt;/sub&gt; + 0.5</td>
<td>3.5 at (V&lt;sub&gt;CC&lt;/sub&gt; – 0.4)</td>
<td>5 at 0.4</td>
<td>1.5</td>
<td>50 kΩ pu</td>
</tr>
<tr>
<td>PFI 4/CTR 1 GATE</td>
<td>DIO</td>
<td>—</td>
<td>V&lt;sub&gt;CC&lt;/sub&gt; + 0.5</td>
<td>3.5 at (V&lt;sub&gt;CC&lt;/sub&gt; – 0.4)</td>
<td>5 at 0.4</td>
<td>1.5</td>
<td>50 kΩ pu</td>
</tr>
<tr>
<td>CTR 1 OUT</td>
<td>DO</td>
<td>—</td>
<td>—</td>
<td>3.5 at (V&lt;sub&gt;CC&lt;/sub&gt; – 0.4)</td>
<td>5 at 0.4</td>
<td>1.5</td>
<td>50 kΩ pu</td>
</tr>
<tr>
<td>PFI 5/ (AO SAMP CLK)*</td>
<td>DIO</td>
<td>—</td>
<td>V&lt;sub&gt;CC&lt;/sub&gt; + 0.5</td>
<td>3.5 at (V&lt;sub&gt;CC&lt;/sub&gt; – 0.4)</td>
<td>5 at 0.4</td>
<td>1.5</td>
<td>50 kΩ pu</td>
</tr>
<tr>
<td>PFI 6/ (AO START TRIG)</td>
<td>DIO</td>
<td>—</td>
<td>V&lt;sub&gt;CC&lt;/sub&gt; + 0.5</td>
<td>3.5 at (V&lt;sub&gt;CC&lt;/sub&gt; – 0.4)</td>
<td>5 at 0.4</td>
<td>1.5</td>
<td>50 kΩ pu</td>
</tr>
<tr>
<td>PFI 7/ (AI SAMP CLK)</td>
<td>DIO</td>
<td>—</td>
<td>V&lt;sub&gt;CC&lt;/sub&gt; + 0.5</td>
<td>3.5 at (V&lt;sub&gt;CC&lt;/sub&gt; – 0.4)</td>
<td>5 at 0.4</td>
<td>1.5</td>
<td>50 kΩ pu</td>
</tr>
<tr>
<td>PFI 8/ CTR 0 SOURCE</td>
<td>DIO</td>
<td>—</td>
<td>V&lt;sub&gt;CC&lt;/sub&gt; + 0.5</td>
<td>3.5 at (V&lt;sub&gt;CC&lt;/sub&gt; – 0.4)</td>
<td>5 at 0.4</td>
<td>1.5</td>
<td>50 kΩ pu</td>
</tr>
<tr>
<td>PFI 9/CTR 0 GATE</td>
<td>DIO</td>
<td>—</td>
<td>V&lt;sub&gt;CC&lt;/sub&gt; + 0.5</td>
<td>3.5 at (V&lt;sub&gt;CC&lt;/sub&gt; – 0.4)</td>
<td>5 at 0.4</td>
<td>1.5</td>
<td>50 kΩ pu</td>
</tr>
<tr>
<td>CTR 0 OUT</td>
<td>DO</td>
<td>—</td>
<td>—</td>
<td>3.5 at (V&lt;sub&gt;CC&lt;/sub&gt; – 0.4)</td>
<td>5 at 0.4</td>
<td>1.5</td>
<td>50 kΩ pu</td>
</tr>
<tr>
<td>FREQ OUT</td>
<td>DO</td>
<td>—</td>
<td>—</td>
<td>3.5 at (V&lt;sub&gt;CC&lt;/sub&gt; – 0.4)</td>
<td>5 at 0.4</td>
<td>1.5</td>
<td>50 kΩ pu</td>
</tr>
</tbody>
</table>

* Indicates active low.

AI = Analog Input  DIO = Digital Input/Output  pd = pull-down
AO = Analog Output  DO = Digital Output  pu = pull-up
AI/DIO = Analog Input/Digital Input/Output

**Note:** The tolerance on the 50 kΩ pull-up and pull-down resistors is large. Actual value may range between 17 kΩ and 100 kΩ.
Specifications
The following specifications are typical at 25 °C unless otherwise noted.

Analog Input

Input Characteristics
Number of channels ........................ 16 single-ended or 8 differential (software-selectable per channel)

Type of A/D converter (ADC)........ Successive approximation

Resolution ................................. 16 bits, 1 in 65,536

Max sampling rate ....................... 333 kS/s guaranteed

Input signal ranges

<table>
<thead>
<tr>
<th>Range (Software-Selectable)</th>
<th>Input Range</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Bipolar</td>
</tr>
<tr>
<td>20 V</td>
<td>±10 V</td>
</tr>
<tr>
<td>10 V</td>
<td>±5 V</td>
</tr>
<tr>
<td>5 V</td>
<td>±2.5 V</td>
</tr>
<tr>
<td>2 V</td>
<td>±1 V</td>
</tr>
<tr>
<td>1 V</td>
<td>±500 mV</td>
</tr>
<tr>
<td>500 mV</td>
<td>±250 mV</td>
</tr>
<tr>
<td>200 mV</td>
<td>±100 mV</td>
</tr>
<tr>
<td>100 mV</td>
<td>±50 mV</td>
</tr>
</tbody>
</table>
### Accuracy Information

<table>
<thead>
<tr>
<th>Nominal Range (V)</th>
<th>Positive Full Scale</th>
<th>Negative Full Scale</th>
<th>% of Reading</th>
<th>Absolute Accuracy</th>
<th>Relative Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>24 Hours</td>
<td>1 Year</td>
<td>Offset (µV)</td>
<td>Noise + Quantization (µV)</td>
<td>Temp Drift (%/°C)</td>
</tr>
<tr>
<td>10</td>
<td>0.0354</td>
<td>0.0371</td>
<td>947.0</td>
<td>981.0</td>
<td>87.0</td>
</tr>
<tr>
<td>5</td>
<td>0.0054</td>
<td>0.0071</td>
<td>476.0</td>
<td>491.0</td>
<td>43.5</td>
</tr>
<tr>
<td>2.5</td>
<td>0.0354</td>
<td>0.0371</td>
<td>241.0</td>
<td>245.0</td>
<td>21.7</td>
</tr>
<tr>
<td>1</td>
<td>0.0354</td>
<td>0.0371</td>
<td>99.2</td>
<td>98.1</td>
<td>8.7</td>
</tr>
<tr>
<td>0.5</td>
<td>0.0354</td>
<td>0.0371</td>
<td>52.1</td>
<td>56.2</td>
<td>5.0</td>
</tr>
<tr>
<td>0.25</td>
<td>0.0404</td>
<td>0.0421</td>
<td>28.6</td>
<td>32.8</td>
<td>3.0</td>
</tr>
<tr>
<td>0.1</td>
<td>0.0454</td>
<td>0.0471</td>
<td>14.4</td>
<td>22.4</td>
<td>2.1</td>
</tr>
<tr>
<td>0.05</td>
<td>0.0454</td>
<td>0.0471</td>
<td>9.7</td>
<td>19.9</td>
<td>1.9</td>
</tr>
<tr>
<td>10</td>
<td>0.0054</td>
<td>0.0071</td>
<td>476.0</td>
<td>491.0</td>
<td>43.5</td>
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<td>5</td>
<td>0.0354</td>
<td>0.0371</td>
<td>241.0</td>
<td>245.0</td>
<td>21.7</td>
</tr>
<tr>
<td>2</td>
<td>0.0354</td>
<td>0.0371</td>
<td>99.2</td>
<td>98.1</td>
<td>8.7</td>
</tr>
<tr>
<td>1</td>
<td>0.0354</td>
<td>0.0371</td>
<td>52.1</td>
<td>56.2</td>
<td>5.0</td>
</tr>
<tr>
<td>0.5</td>
<td>0.0404</td>
<td>0.0421</td>
<td>28.6</td>
<td>39.8</td>
<td>3.0</td>
</tr>
<tr>
<td>0.2</td>
<td>0.0454</td>
<td>0.0471</td>
<td>14.4</td>
<td>22.4</td>
<td>2.1</td>
</tr>
<tr>
<td>0.1</td>
<td>0.0454</td>
<td>0.0471</td>
<td>9.7</td>
<td>19.9</td>
<td>1.9</td>
</tr>
</tbody>
</table>

**Note:** Accuracies are valid for measurements following an internal E Series calibration. Averaged numbers assume dithering and averaging of 100 single-channel readings. Measurement accuracies are listed for operational temperatures within ±1 °C of internal calibration temperature and ±10 °C of external or factory-calibration temperature. NI recommends a one-year calibration interval. The Absolute Accuracy at Full Scale calculations were performed for a maximum range input voltage (for example, 10 V for the ±10 V range) after one year, assuming 100 points of averaged data. Go to ni.com/info and enter info code rdspec for example calculations.
Input coupling ......................... DC
Max working voltage
(signal + common-mode)........... Each input should remain within ±11 V of ground.
Overvoltage protection
Powered on ...................... ±25 V
Powered off ...................... ±15 V
Inputs protected ................... AI <0..15>, AI SENSE
FIFO buffer size .................... 512 samples (S)
DMA (PCI and PXI only)
Channels ............................... 3
Data sources/destinations .... Analog input, analog output, counter/timer 0, or counter/timer 1
Data transfers ......................... Direct memory access (DMA), interrupts, programmed I/O
DMA modes ........................... Scatter-gather
Configuration memory size ...... 512 words

Transfer Characteristics
Relative accuracy .................. ±1.5 LSB typ, ±3.0 LSB max
Differential nonlinearity (DNL) .... ±0.5 LSB typ, ±1.0 LSB max
No missing codes .................. 16 bits, guaranteed
Offset error
Pregain error after calibration .... ±1.0 µV max
Pregain error before calibration .......... ±2.6 mV max
Postgain error after calibration ... ±76 µV
Postgain error before calibration .......... ±82 mV
Gain error (relative to calibration reference)
After calibration (gain = 1) .... ±30.5 ppm of reading max
Before calibration ................... ±22,000 ppm of reading max
Gain ≠ 1 with gain error adjusted to 0 at gain = 1 ........ ±200 ppm of reading max

Amplifier Characteristics
Input impedance
Normal powered on ................. 100 GΩ in parallel with 100 pF
Powered off .................... 820 Ω min
Overload ........................ 820 Ω min
Input bias current ................ ±200 pA
Input offset current ............ ±100 pA
Common-mode rejection ratio (CMRR), DC to 60 Hz

<table>
<thead>
<tr>
<th>Range</th>
<th>Bipolar</th>
<th>Unipolar</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 V</td>
<td>92 dB</td>
<td>—</td>
</tr>
<tr>
<td>10 V</td>
<td>97 dB</td>
<td>97 dB</td>
</tr>
<tr>
<td>5 V</td>
<td>101 dB</td>
<td>101 dB</td>
</tr>
<tr>
<td>2 V</td>
<td>104 dB</td>
<td>104 dB</td>
</tr>
<tr>
<td>100 mV to 1 V</td>
<td>105 dB</td>
<td>105 dB</td>
</tr>
</tbody>
</table>

Dynamic Characteristics
Bandwidth
Small signal (–3 dB) ........... 480 kHz
Large signal (1% THD) ....... 500 kHz
Dynamic range
Gain 0.5 to 5 ................. 87 dB, ±10 V input
Gain 10 ........................ 83 dB

Settling time for full-scale step

<table>
<thead>
<tr>
<th>Full-Scale Step Accuracy*</th>
<th>Settling Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>±6 LSB</td>
<td>3 μs max</td>
</tr>
<tr>
<td>±4 LSB</td>
<td>4 μs max</td>
</tr>
</tbody>
</table>
| ±2 LSB                    | 5 μs max, gain 0.5 to 10
                           | 10 μs max, gain 20 to 50
                           | 10 μs typ, gain 100 |
| ±1 LSB                    | 10 μs max, gain 0.5 to 2
                           | 15 μs max, gain 5 to 10
                           | 15 μs typ, gain 20 to 100 |

* Settling times are valid for source impedances <1 kΩ.
Refer to Multichannel Scanning Considerations of the E Series Help for more information.
System noise (LSB<sub>max</sub>, including quantization)

<table>
<thead>
<tr>
<th>Range</th>
<th>Bipolar</th>
<th>Unipolar</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 to 20 V</td>
<td>0.95</td>
<td>0.95</td>
</tr>
<tr>
<td>1 V</td>
<td>1.1</td>
<td>1.1</td>
</tr>
<tr>
<td>500 mV</td>
<td>1.3</td>
<td>1.3</td>
</tr>
<tr>
<td>200 mV</td>
<td>2.7</td>
<td>2.7</td>
</tr>
<tr>
<td>100 mV</td>
<td>5.0</td>
<td>5.0</td>
</tr>
</tbody>
</table>

Crosstalk (DC to 100 kHz)
- Adjacent channels .............. −75 dB
- All other channels .............. −90 dB

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

Offset temperature coefficient
- Pregain ........................................±4 µV/°C
- Bipolar postgain ....................±120 µV/°C
- Unipolar postgain ...................±30 µV/°C

Gain temperature coefficient .......... ±17 ppm/°C

Onboard calibration reference
- Level ...........................................5.000 V (±1.0 mV),
  (over full operating temperature, actual value stored in EEPROM)
- Temperature coefficient .......... ±0.6 ppm/°C max
- Long-term stability .....................±6 ppm/√1,000 h

**Analog Output**

**Output Characteristics**
- Number of channels .................. 2 voltage
- Resolution ................................16 bits, 1 in 65,536
- Max update rate .......................... 333 kS/s
- Type of D/A converter (DAC) ......... Double-buffered, multiplying
- FIFO buffer size ....................... 2,048 Samples (S)
- Data transfers .......................... DMA, interrupts, programmed I/O
- DMA modes .............................. Scatter-gather
### Accuracy Information

#### Nominal Range (V)

<table>
<thead>
<tr>
<th>Positive Full Scale</th>
<th>Negative Full Scale</th>
<th>% of Reading</th>
<th>Offset (µV)</th>
<th>Temp Drift (%/°C)</th>
<th>Absolute Accuracy at Full Scale (mV)</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>–10</td>
<td>24 Hours</td>
<td>90 Days</td>
<td>1 Year</td>
<td>798</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.0044</td>
<td>0.0052</td>
<td>0.0061</td>
<td>0.0001</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.405</td>
<td>1.176</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>0</td>
<td>24 Hours</td>
<td>90 Days</td>
<td>1 Year</td>
<td>569</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.176</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Note:** Accuracies are valid for measurements following an internal E Series calibration. Averaged numbers assume dithering and averaging of 100 single-channel readings. Measurement accuracies are listed for operational temperatures within ±1 °C of internal calibration temperature and ±10 °C of external or factory-calibration temperature. NI recommends a one-year calibration interval. The Absolute Accuracy at Full Scale calculations were performed for a maximum range input voltage (for example, 10 V for the ±10 V range) after one year, assuming 100 points of averaged data. Go to ni.com/info and enter info code rdspec for example calculations.

#### Transfer Characteristics

Relative accuracy, or integral nonlinearity (INL)
- After calibration: ±0.35 LSB typ, ±1.0 LSB max
- Before calibration: ±4 LSB max

DNL
- After calibration: ±0.5 LSB typ, ±1.0 LSB max
- Before calibration: ±3 LSB max

Monotonicity: 16 bits, guaranteed after calibration

Offset error
- After calibration: ±305 µV max
- Before calibration: ±17 mV max

Gain error (relative to internal reference)
- After calibration: ±30.5 ppm of output max
- Before calibration: ±9,000 ppm of output max

Gain error (relative to external reference): +0% to +0.5% of output max, not adjustable

#### Voltage Output

Ranges: ±10 V, 0 to 10 V, ±AO EXT REF,
0 V to AO EXT REF (software-selectable)

Output coupling: DC

Output impedance: 0.1 Ω max

Current drive: ±5 mA max

Protection: Short-circuit to ground
**Dynamic Characteristics**

Settling time for full-scale step ..........3.5 µs to ±1.0 LSB accuracy

Settling time for half-scale step........3.0 µs to ±1.0 LSB accuracy

Slew rate ........................................ 15 V/µs

Noise ........................................... 60 µVrms, DC to 1 MHz

Glitch energy (at mid-scale transition)
  Magnitude ................................... 10 mV
  Duration ..................................... 1 µs

**Stability**

Offset temperature coefficient.........±35 µV/°C

Gain temperature coefficient
  Internal reference .................... ±6.5 ppm/°C
  External reference ................... ±5 ppm/°C

Onboard calibration reference
  Level ........................................ 5.000 V (±1.0 mV), (over full operating temperature, actual value stored in EEPROM)

Temperature coefficient ..............±0.6 ppm/°C max

Long-term stability .................±6 ppm/√t, 1,000 h

---

**Digital I/O**

Number of channels ...................... 8 input/output

Compatibility .............................. 5 V TTL/CMOS

Digital logic levels on P0.0-7

<table>
<thead>
<tr>
<th>Level</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input low voltage</td>
<td>0 V</td>
<td>0.8 V</td>
</tr>
<tr>
<td>Input high voltage</td>
<td>2.0 V</td>
<td>5.0 V</td>
</tr>
<tr>
<td>Input low current (V_in = 0 V)</td>
<td>—</td>
<td>−320 µA</td>
</tr>
<tr>
<td>Input high current (V_in = 5 V)</td>
<td>—</td>
<td>10 µA</td>
</tr>
<tr>
<td>Output low voltage (I_{OL} = 24 mA)</td>
<td>—</td>
<td>0.4 V</td>
</tr>
<tr>
<td>Output high voltage (I_{OH} = −13 mA)</td>
<td>4.35 V</td>
<td>—</td>
</tr>
</tbody>
</table>

Power-on state ............................... Input (high-impedance)

Data transfers ............................... Programmed I/O

Max transfer rate ......................... 50 kwords/s, system-dependent

Constant sustainable rate .......... 1 to 10 kwords/s, typ

---

**Timing I/O**

Number of channels
  Up/down counter/timers .......... 2
  Frequency scaler .............. 1

Resolution
  Up/down counter/timers .......... 24 bits
  Frequency scaler ............ 4 bits

Compatibility .............................. 5 V TTL/CMOS

Digital logic levels

<table>
<thead>
<tr>
<th>Level</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input low voltage</td>
<td>0.0 V</td>
<td>0.8 V</td>
</tr>
<tr>
<td>Input high voltage</td>
<td>2.0 V</td>
<td>5.0 V</td>
</tr>
<tr>
<td>Output low voltage (I_{OUT} = 5 mA)</td>
<td>—</td>
<td>0.4 V</td>
</tr>
<tr>
<td>Output high voltage (I_{OUT} = −3.5 mA)</td>
<td>4.35 V</td>
<td>—</td>
</tr>
</tbody>
</table>

Base clocks available
  Up/down counter/timers .......... 20 MHz, 100 kHz
  Frequency scaler ............ 10 MHz, 100 kHz

Base clock accuracy .................... ±0.01%
Max external source frequency
Up/down counter/timers ............. 20 MHz

External source selections ........... PFI <0..9>, RTSI <0..6>,
                                   analog trigger,
                                   software-selectable

External gate selections .............. PFI <0..9>, RTSI <0..6>,
                                    analog trigger,
                                    software-selectable

Min source pulse duration ........... 10 ns in edge-detect mode
Min gate pulse duration .............. 10 ns in edge-detect mode

Data transfers
PCI/PXI up/down counter/timer ........ DMA (scatter-gather),
                                       interrupts,
                                       programmed I/O

DAQPad up/down counter/timer .......... Interrupts,
                                      programmed I/O

Frequency scaler ....................... Programmed I/O

Triggers

Analog Trigger
Purpose
Analog input............................. Start, reference,
                                      and pause trigger,
                                      sample clock
Analog output............................ Start and pause trigger,
                                      sample clock
Counter/timers........................... Source, gate
Source ...................................... AI <0..15>,
                                      PFI 0/AI START TRIG

Level
Internal.................................. ±Full-scale
External .................................. ±10 V

Slope ..................................... Positive or negative
                                      (software-selectable)

Resolution ............................... 12 bits, 1 in 4,096

Hysteresis ................................ Programmable

Bandwidth (–3 dB)
Internal.................................. 700 kHz
External .................................. 700 kHz

External input (PFI 0/AI START TRIG)
Impedance ................................ 10 kΩ
Coupling .................................. DC

Protection
When configured as a
digital signal ......................... –0.5 to VCC + 0.5 V
When configured as an analog trigger
signal or disabled .................... ±35 V
Powered off ............................. ±35 V

Accuracy ................................. ±1.0% of full-scale range
                                      max

Digital Trigger
Purpose
Analog input ......................... Start, reference,
                                      and pause trigger,
                                      sample clock
Analog output ......................... Start and pause trigger,
                                      sample clock
Counter/timers ......................... Source, gate
Source ..................................... PFI <0..9>, RTSI <0..6>

Compatibility ......................... 5 V TTL
Response ................................. Rising or falling edge
Pulse width .............................. 10 ns min

RTSI
Trigger lines
NI PCI-6052E ......................... 7
NI DAQPad-6052E .................... 4
Clock line .............................. 1

PXI Trigger Bus (PXI Only)
Trigger lines ....................... 6
Star trigger ......................... 1

Calibration
Recommended warm-up time .......... 15 minutes
Calibration interval .................. 1 year

Onboard calibration
reference level ........................ 5.000 V (±3.5 mV),
                                      (over full operating
temperature, actual value
                                      stored in EEPROM)

Temperature coefficient ............. ±0.6 ppm/°C max
Long-term stability .................. ±6.0 ppm/√1,000 h
**Bus Interface**
- NI PCI/PXI-6052E: Master, slave
- NI DAQPad-6052E: Master, slave, asynchronous, 400 Mb/s

**Power Requirement**
- Power available at I/O connector: +4.65 VDC to +5.25 VDC at 1 A
- NI PCI/PXI-6052E: +5 VDC (±5%) to 1.3 A (does not include current drawn from 5 V fuse on I/O connector)
- NI DAQPad-6052E: 9–24 VDC, 20 W

**Physical**
- Dimensions (not including connectors):
  - NI PCI-6052E: 17.5 cm × 10.6 cm (6.9 in. × 4.2 in.)
  - NI PXI-6052E: 16 cm × 10 cm (6.3 in. × 3.9 in.)
  - NI DAQPad-6052E: 30.7 cm × 25.4 cm × 4.3 cm (12.1 in. × 10 in. × 1.7 in.)
  - Weight:
    - NI PCI-6052E: 160 g (5.6 oz)
    - NI PXI-6052E: 206 g (7.2 oz)
    - NI DAQPad-6052E: 1951 g (4 lb 4.8 oz)
- I/O connector:
  - NI PCI/PXI-6052E: 68-pin male SCSI-II type
  - NI DAQPad-6052E: 68-pin male SCSI-II type, or 15 BNCs and 30 removable screw terminals

**Maximum Working Voltage**
- Maximum working voltage refers to the signal voltage plus the common-mode voltage.
  - Channel-to-earth: 11 V, Installation Category I
  - Channel-to-channel: 11 V, Installation Category I

**Environmental**
- Operating temperature: 0 to 55 °C
- Storage temperature: −20 to 70 °C
- Relative humidity: 10 to 90%, noncondensing
- Maximum altitude: 2,000 m

**Safety**
- NI PCI/PXI-6052E: The NI PCI/PXI-6052E devices meet the requirements of the following standards for safety and electrical equipment for measurement, control, and laboratory use:
  - IEC 61010-1, EN 61010-1
  - UL 61010-1
  - CAN/CSA-C22.2 No. 61010.1
  - Note: For UL and other safety certifications, refer to the product label, or visit ni.com/certification, search by model number or product line, and click the appropriate link in the Certification column.

- NI DAQPad-6052E: The NI DAQPad-6052E devices meet the requirements of the following standards for safety and electrical equipment for measurement, control, and laboratory use:
  - IEC 60950-1, EN 60950-1
  - UL 60950-1
  - CAN/CSA-C22.2 No. 60950-1
  - Note: For UL and other safety certifications, refer to the product label, or visit ni.com/certification, search by model number or product line, and click the appropriate link in the Certification column.

**Electromagnetic Compatibility**
- Emissions: EN 55011 Class A at 10 m, FCC Part 15A above 1 GHz
- Immunity: EN 61326:1997 A2:2001, Table 1
- CE, C-Tick, and FCC Part 15 (Class A) Compliant
  - Note: For EMC compliance, operate this device with shielded cabling.
CE Compliance
This product meets the essential requirements of applicable European Directives, as amended for CE marking, as follows:

Low-Voltage Directive (safety) ..... 73/23/EEC
Electromagnetic Compatibility Directive (EMC) ..................... 89/336/EEC

Note Refer to the Declaration of Conformity (DoC) for this product for any additional regulatory compliance information. To obtain the DoC for this product, visit ni.com/certification, search by model number or product line, and click the appropriate link in the Certification column.
Figure 1. NI PCI/PXI-6052E Pinout
Figure 2. NI DAQPad-6052E BNC Pinout

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>PFI 9</td>
<td>2</td>
<td>1</td>
<td>P0.7</td>
<td></td>
</tr>
<tr>
<td>PFI 8</td>
<td>4</td>
<td>3</td>
<td>P0.6</td>
<td></td>
</tr>
<tr>
<td>PFI 7</td>
<td>6</td>
<td>5</td>
<td>P0.5</td>
<td></td>
</tr>
<tr>
<td>PFI 6</td>
<td>8</td>
<td>7</td>
<td>P0.4</td>
<td></td>
</tr>
<tr>
<td>PFI 5</td>
<td>10</td>
<td>9</td>
<td>P0.3</td>
<td></td>
</tr>
<tr>
<td>PFI 4</td>
<td>12</td>
<td>11</td>
<td>P0.2</td>
<td></td>
</tr>
<tr>
<td>PFI 3</td>
<td>14</td>
<td>13</td>
<td>P0.1</td>
<td></td>
</tr>
<tr>
<td>PFI 2</td>
<td>16</td>
<td>15</td>
<td>P0.0</td>
<td></td>
</tr>
<tr>
<td>PFI 1</td>
<td>18</td>
<td>17</td>
<td>CTR 1 OUT</td>
<td></td>
</tr>
<tr>
<td>D GND</td>
<td>20</td>
<td>19</td>
<td>D GND</td>
<td></td>
</tr>
<tr>
<td>USER 2</td>
<td>22</td>
<td>21</td>
<td>USER 1</td>
<td></td>
</tr>
<tr>
<td>FREQ OUT</td>
<td>24</td>
<td>23</td>
<td>AI HOLD COMP</td>
<td></td>
</tr>
<tr>
<td>+5 V</td>
<td>26</td>
<td>25</td>
<td>EXT STROBE</td>
<td></td>
</tr>
<tr>
<td>+5 V</td>
<td>28</td>
<td>27</td>
<td>AI SENSE</td>
<td></td>
</tr>
<tr>
<td>D GND</td>
<td>30</td>
<td>29</td>
<td>AI GND</td>
<td></td>
</tr>
</tbody>
</table>