

ZT410PCI & PXI Specifications



Digital Storage Oscilloscope

14-bit, 500 MS/s, 250 MHz, 2 Ch

16-bit, 400 MS/s, 250 MHz, 2 Ch

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Analog Input

Channels	Quantity 2
Bandwidth	DC to 250 MHz typical, 200 MHz minimum (50 Ω) DC to 125 MHz typical, 100 MHz minimum (1 MΩ)
Slew Rate	4000 V/μs (50 Ω) 800 V/μs (1 MΩ)
Maximum Input (50 Ω)	±5V (DC + peak AC) Input load protection @ ±6 VDC
Maximum Input (1 MΩ)	±25V [DC + peak AC (<10 MHz)] Peak AC, de-rated 20 dB/decade above 10 MHz

Full Scale Input Range & Offset Adjust

Impedance	Range	Offset
1 MΩ	50 Vpp	0V
	25 Vpp	±12.5V
	10 Vpp	±5V
	5 Vpp	±5V
	2.5 Vpp	±5V
	1.25 Vpp	±5V
	0.5 Vpp	±5V
	0.25 Vpp	±5V
50Ω	10 Vpp	0V
	5 Vpp	±2.5V
	2 Vpp	±1V
	1 Vpp	±1V
	0.5 Vpp	±1V
	0.25 Vpp	±1V
	0.1 Vpp	±1V
	0.05 Vpp	±1V

DC Gain Accuracy	< ±0.25% full scale range (50 Ω) < ±0.25% full scale range (1 MΩ)
Zero DC Offset	< ±(0.25% full scale range + 1 mV) @ +25 °C (50 Ω) < ±(0.25% full scale range + 5 mV) @ +25 °C (1 MΩ)
Zero DC Offset Drift	< ± 0.05% maximum offset adjust/°C
Offset Adjust Accuracy	< ± 1%
Impedance	1 MΩ 12 pF or 50 Ω

Impedance Accuracy	$\pm 1\%$
Input VSWR (50 Ω)	$\leq 1.3:1$, DC to 250 MHz
Input Bias	$\leq \pm 25 \mu\text{A}$ (50 Ω) $\leq \pm 1 \text{ nA}$ (1 M Ω)
Coupling	DC or AC
AC Coupling	200 kHz high pass (50 Ω) 10 Hz high pass (1 M Ω)
Probe Attenuation	0.9 to 1000:1
RMS Noise	$\leq (0.1\% \text{ of range} + 150 \mu\text{V})$ (50 Ω) $\leq (0.1\% \text{ of range} + 1.25 \text{ mV})$ (1M Ω)
Connectors	BNC

Analog-to-Digital Converter

Sample Rate	10 kS/s to 200 MS/s in 1, 2.5, 4, and 5 steps 250 MS/s (ZT410-20 only) 400 MS/s, 1 channel interleaved 500 MS/s, 1 channel interleaved (ZT410-2X only)
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Resolution & Maximum Sample Rate

Product Option	ADC Resolution	1 Channel Maximum Sample Rate	2 Channel Maximum Sample Rate
ZT410-2X	14-bit	500 MS/s	250 MS/s
ZT410-5X	16-bit	400 MS/s	200 MS/s

Acquisition Time Range

Product Option	Minimum Acquisition Time	Maximum Acquisition Time
ZT410-2X	200 ns	3,355 seconds
ZT410-5X	250 ns	3,355 seconds

Channel-to-Channel Skew	$\leq 100 \text{ ps}$ difference with channels at same input settings
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Dynamic Range

10.7 MHz (Typical)

50Ω Input Range (Vpp)	Signal-to Noise Ratio (SNR)	Total Harmonic Distortion (THD)	Signal-to-Noise + Distortion (SINAD)
1.0 to 10.0	74.5 dBc	70.2 dBc	68.8 dBc
0.5	70.5 dBc	70.2 dBc	67.3 dBc
0.25	64.5 dBc	70.5 dBc	63.5 dBc
0.1	56.5 dBc	70.9 dBc	56.3 dBc
0.05	50.5 dBc	70.9 dBc	50.5 dBc

60.1 MHz (Typical)

50Ω Input Range (Vpp)	Signal-to Noise Ratio (SNR)	Total Harmonic Distortion (THD)	Signal-to-Noise + Distortion (SINAD)
1.0 to 10.0	74.5 dBc	50.1 dBc	50.1 dBc
0.5	70.5 dBc	50.1 dBc	50.0 dBc
0.25	64.5 dBc	50.5 dBc	50.3 dBc
0.1	56.5 dBc	50.8 dBc	49.8 dBc
0.05	50.5 dBc	50.8 dBc	47.6 dBc

Note: Dynamic range for interleaved sample rates is degraded by 4 dB for input channel 2.

Waveform Memory

Total Memory	Up to 8M samples/channel Up to 16M samples/channel (1 channel interleaved)
Memory Options	1M samples total (ZT410-X0) 16M samples total (ZT410-X1)

Acquisition Modes

Types	Normal, Average, Envelope, and Equivalent-Time
Channels	Quantity 2, both inputs simultaneous
Waveform Size	100 samples to total memory (Normal) 100 samples to 32k samples (Average, Envelope, Equivalent-Time)
Waveform Count	2 to 65535 waveforms
Averaging	16-bit waveform averaging resolution

Envelope	Minimum and Maximum Envelope
Equivalent-Time	High sample rate waveform reconstruction
Equivalent-Time Points	2 to 100 equivalent-time points per real-time point 2 to 100 times equivalent-time sample rate

Trigger

Trigger Source	Channels 1 to 2, External Trigger, Pattern, Software, Star Trigger, TTL Trigger0–7 (PXI Backplane or PCI Timing Expansion Connector)
Trigger Slope/Polarity	Positive or Negative
Trigger Position	0% to 100% of waveform time + trigger delay ±1 sample interval position accuracy
Post-Trigger Delay	0 to 655 seconds
Pre-Trigger Delay	0 to waveform time
Trigger Hold Off	Programmable delay after trigger before recognizing next trigger event
Hold Off Range	0 to 655 seconds
Trigger B	Second edge trigger event qualifier
Pattern Trigger	Pattern match true or false
Pattern Sources	Channels 1 to 2, External Trigger, Star Trigger (PXI Backplane or PCI Timing Expansion Connector)
Event Trigger	Event Counter: 1 to 65535 trigger events
Trigger Modes	Edge, Pulse Width, Video
Edge Trigger Mode	Rising or Falling Edge
Pulse Width Trigger Mode	Triggers on pulse width greater than, less than, or between limits
Pulse Width Type	< limit1, > limit1, < limit1 & > limit2, > limit1 & < limit2
Pulse Width Range	20 ns to 655 seconds
Pulse Width Resolution	10 ns

Video Trigger Mode	PAL (50 Hz), NTSC (60 Hz), SECAM (50 Hz) Standard, Field, Line selectable
Ch 1–2 Trigger Level	offset – full scale/2) to (offset + full scale/2)
Ch 1–2 Trigger Sensitivity	5% of full scale (DC to 75 MHz)
Ch 1–2 Trigger Bandwidth	≥ 200 MHz
Ch 1–2 Trigger Hysteresis	2.5% of full scale (overdrive required)
Ch 1–2 Level Resolution	0.025% of full scale
Ch 1–2 Level Accuracy	±(2% full scale + 5 mV + offset accuracy)
Trigger Timestamp	100 ns resolution, 1 second rollover

TTL Trigger Outputs

Functionality	Event Output Signals
Outputs	TTL Trigger0–7 (PXI Backplane or PCI Timing Expansion Connector)
Source	Trigger Event, Arm Event, OPC, Constant State

External Trigger

Functionality	Trigger Input or Output
Maximum Input	0V to 5V, no damage
Trigger Input	TTL Compatible, 10 kΩ Input Impedance
Trigger Output	TTL Compatible into 50Ω
Trigger Output Source	Trigger Event, Arm Event, OPC, Constant State, 10MHz Reference Clock, 500 Hz Clock, 10 ns Pulse at 1 ms Repetition Interval
Connector	SMB

Arm

Functionality	Arm to qualify trigger event
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Source External Trigger, Software, Star Trigger, TTL Trigger0–7 (PXI Backplane or PCI Timing Expansion Connector)

Polarity Positive or Negative

External Arm Input

Maximum Input 0V to 5V, no damage

Nominal Level TTL Compatible

Input Impedance 10 k Ω \pm 2%

Connector SMB (Shared with Trigger I/O)

External Sampling Clock

Functionality External Sampling Clock bypasses Phase Locked Loop

Synchronization Both channels synchronized to external clock

Clock Rates 40 MHz to maximum external clock frequency
1 channel enabled: sample at external frequency
2 channels enabled: sample at half external frequency

Product Option	Maximum Ext Clock Frequency	1 Channel Maximum Sample Rate	2 Channel Maximum Sample Rate
ZT410-2X	500 MHz	500 MS/s	250 MS/s
ZT410-5X	400 MHz	400 MS/s	200 MS/s

Maximum Input \pm 5VDC, no damage

Input Signal Level 500 mVpp to 1 Vpp, sine or square wave

Input Impedance AC coupled, 50 Ω \pm 2%

Connector SMB

10 MHz Time Base Reference

Clock Source Internal TCXO, PXI Backplane or PCI Timing Expansion Connector

Internal TCXO \pm 2.5 ppm accuracy

Data Processing

Auto Scale	Automatic adjust to input signals: Input Range, Offset, Sample Rate, Trigger Source, and Trigger Level
Self-Calibration	Automatic internal calibration: Input DC Offset Zero, Input DC Offset Adjust Scale Factor, ADC balance

Measurements

Measurements	Min, Max, Low, High, Mid, Average, Amplitude, Peak-to-Peak, DC RMS, AC RMS, +Width, -Width, Period, Frequency, +Duty, -Duty, Phase, Rise Time, Rise Overshoot, Rise Preshoot, Rise Crossing Time, Fall Time, Fall Overshoot, Fall Preshoot, Fall Crossing Time, Time of Maximum, Time of Minimum, Cycle Average, Cycle RMS, Cycle Frequency, Cycle Period, AC High-Precision, DC High-Precision, SNR, THD, SINAD, ENOB, SFDR								
Measurement Methods	Entire Waveform, Gated by Time, Gated by Points								
Measurement Levels	Low, Mid, High reference levels for edge measurements set in absolute voltages or relative percentages								
Measurement Accuracy	<table><tr><td>Delta DC Voltage</td><td>\pm (DC gain accuracy)</td></tr><tr><td>Absolute DC Voltage</td><td>\pm [(DC gain accuracy)+(offset accuracy)]</td></tr><tr><td>Time</td><td>\pm (time resolution)</td></tr><tr><td>Frequency</td><td>\pm [1/(time resolution)]</td></tr></table> <p>Note: time resolution = one sample interval or one ETS sample interval (for ETS acquisition)</p>	Delta DC Voltage	\pm (DC gain accuracy)	Absolute DC Voltage	\pm [(DC gain accuracy)+(offset accuracy)]	Time	\pm (time resolution)	Frequency	\pm [1/(time resolution)]
Delta DC Voltage	\pm (DC gain accuracy)								
Absolute DC Voltage	\pm [(DC gain accuracy)+(offset accuracy)]								
Time	\pm (time resolution)								
Frequency	\pm [1/(time resolution)]								

Reference Waveforms

Reference Channels	Quantity 4
Reference Storage	Non-volatile memory storage
Reference Size	32k maximum waveform size

Calculations

Calculate Channels	Quantity 2
Calculate Size	32k maximum waveform size

Calculate Functions	Add, Subtract, Multiply, Copy, Invert, Integral, Derivative, Absolute Value, Limit Test, Mask Test, Frequency Transform, Time Transform
Limit Test	Measurement Limit Range Testing or Waveform Mask Testing
Limit Test Reports	Measurement maximum, minimum, average, current value, and pass/fail counts
Frequency Transform	FFT Magnitude
FFT Windowing	Rectangular, Hamming, Hanning, Blackman
Time Transform	Infinite Impulse Response (IIR) filtering
IIR Filter Count	2 to 40 data points

Instrument Setup Storage

Reset	Non-volatile storage of default instrument setup configuration
Save & Recall	Non-volatile storage of 31 instrument setup configurations

Data Interface

PCI Bus	33 MHz, 32 bit address, 16 bit data
PCI Voltage	Universal, +3.3V or +5V
PCI Compatibility	Version 2.2
PXI Signals	PXI_TRGn input/output selectable PXI_STAR input 10 MHz reference input Left and right side buses not used
Manufacturer ID	4172 (104C ₁₆)
Model Code	44128 (AC60 ₁₆)

PXI J2 Trigger & Clock Pin Usage

Pin A16	PXI Trigger 1	(TTL level bidirectional)
Pin A17	PXI Trigger 2	(TTL level bidirectional)

Pin A18	PXI Trigger 3	(TTL level bidirectional)
Pin B16	PXI Trigger 0	(TTL level bidirectional)
Pin B18	PXI Trigger 4	(TTL level bidirectional)
Pin C18	PXI Trigger 5	(TTL level bidirectional)
Pin D17	PXI Star Trigger (TTL level input)	
Pin E16	PXI Trigger 7	(TTL level bidirectional)
Pin E17	PXI CLK10 In	(TTL level input)
Pin E18	PXI Trigger 6	(TTL level bidirectional)

LED Indicators

RDY	Unit has passed power-up self-diagnostics. Toggles when unit has an error pending in error queue.
TRG	Flashes when trigger event occurs

Physical

Physical size	Single-Wide 3U CompactPCI/PXI Instrument (PXI) Single-Slot Short PCI Card (PCI)
Weight	1 lb.

DC Power

Cooling & Power Consumption

Product Option	Typical Cooling & Power	Maximum Cooling & Power
ZT410-20	23.1 W	27.9 W
ZT410-21	27.2 W	32.0 W
ZT410-50	23.4 W	28.3 W
ZT410-51	27.6 W	32.4 W

PCI Cooling Fan adds 0.12A to +5VDC current requirements and 0.6W to total power consumption.

Product Option	Voltage	Typical Current	Maximum Current
ZT410-20	+3.3V	3.9A	3.9A
	+5V	0.9A	1.4A
	+12V	0.2A	0.25A
	-12V	0.2A	0.4A
ZT410-21	+3.3V	5.4A	5.4A
	+5V	0.9A	1.4A
	+12V	0.2A	0.25A
	-12V	0.2A	0.4A
ZT410-50	+3.3V	3.9A	3.9A
	+5V	1.1A	1.5A
	+12V	0.2A	0.25A
	-12V	0.2A	0.4A
ZT410-51	+3.3V	5.3A	5.3A
	+5V	1.1A	1.5A
	+12V	0.2A	0.25A
	-12V	0.2A	0.4A

Temperature Range

Operating	0 °C to +40 °C Ambient
Storage	-40 °C to +75 °C
Over-Temp Protection	Automatic shutdown if internal temperature is greater than +65 °C (PCI)
Calibration Range	+20 °C to +30 °C Ambient, after a 20 minute warm-up period, to meet all calibration specification accuracies.

Relative Humidity

Operating or Storage	10 to 90%, non-condensing, up to +40 °C
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Altitude

Operating	Up to 2,000 m
Storage	Up to 15,000 m

Safety

This product is designed to meet the requirements of the following standard of safety for electrical equipment for measurement, control and laboratory use:

EN 61010-1

Electromagnetic Compatibility

CE Marking EN 61326-1:1997 with A1:1998 and A2:2001 Compliant
FCC Part 15 (Class A) Compliant

Emissions

EN 55011	Radiated Emissions, ISM Group 1, Class A, distance 10 m, emissions < 1 GHz
EN 55011	Conducted Emissions, Class A, emissions < 30 MHz

Immunity

EN 61000-4-2	Electrostatic Discharge (ESD), 4 kV by Contact, 8 kV by Air
EN 61000-4-3	RF Radiated Susceptibility, 10 V/m
EN 61000-4-4	Electrical Fast Transient Burst (EFTB), 2 kV AC Power Lines
EN 61000-4-5	Surge
EN 61000-4-6	Conducted Immunity
EN 61000-4-8	Power Frequency Magnetic Field, 30 A/m
EN 61000-4-11	Voltage Dips and Interrupts

CE Compliance

This product meets the necessary requirements of applicable European Directives for CE Marking as follows:

73/23/EEC	Low Voltage Directive (Safety)
89/336/EEC	Electromagnetic Compatibility Directive (EMC)

See Declaration of Conformity for this product for additional regulatory compliance information.