

## DS4000 Specifications

All the specifications are guaranteed except the parameters marked with "Typical" and the oscilloscope needs to operate for more than 30 minutes under the specified operation temperature.

### Sample

Sample Mode	Real-time Sample
Real Time Sample Rate	4.0 GSa/s (single-channel) 2.0 Gsa/s (dual-channel)
Peak Detect	250 ps (single-channel) 500 ps (dual-channel)
Averaging	After all the channels finish N samples at the same time, N can be 2, 4, 8, 16, 32, 64, 128, 256, 512, 1024, 2048, 4096 or 8192.
High Resolution	12 bits of resolution when $\geq 5 \mu\text{s}/\text{div}$ @ 4 GSa/s (or $\geq 10 \mu\text{s}/\text{div}$ @ 2 GSa/s).
Memory Depth	single-channel: Auto, 14k pts, 140k pts, 1.4M pts, 14M pts and 140M pts are available dual-channel: Auto, 7k pts, 70k pts, 700k pts, 7M pts and 70M pts are available

### Input

Number of Channels	DS40X4: four channels DS40x2: two channels
Input Coupling	DC, AC or GND
Input Impedance	(1 $\text{M}\Omega \pm 1\%$ )    (14 pF $\pm 3$ pF) or 50 $\Omega \pm 1.5\%$
Probe Attenuation Coefficient	0.01X to 1000X, in 1-2-5 step

Maximum Input Voltage (1M $\Omega$ )	Maximum Input Voltage of the Analog Channel CAT I 300 Vrms, CAT II 100 Vrms, Transient Overvoltage 1000 Vpk with RP2200 10:1 probe: CAT II 300 Vrms with RP3300 10:1 probe: CAT II 300 Vrms with RP3500 10:1 probe: CAT II 300 Vrms with RP5600 10:1 probe: CAT II 300 Vrms
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## Horizontal

Timebase Scale	DS405x: 1 ns/div to 50 s/div DS403x: 2 ns/div to 50 s/div DS402x: 2 ns/div to 50 s/div DS401x: 5 ns/div to 50 s/div
Timebase Accuracy	$\leq \pm 4\text{ppm}$
Clock Drift	$\leq \pm 2$ ppm/year
Delay Range	Pre-trigger (negative delay): $\geq 1$ screen width Post-trigger (positive delay): 1 s to 1000 s
Timebase Mode	Y-T, X-Y, Roll, Delayed Sweep
Number of XYs	2 simultaneously (four-channel model)
Waveform Capture Rate <sup>1</sup>	110,000 wfms/s (dots display)

## Vertical

Bandwidth (-3dB)	DS405x: DC to 500 MHz DS403x: DC to 350 MHz DS402x: DC to 200 MHz DS401x: DC to 100 MHz
Single-shot Bandwidth	DS405x: DC to 500 MHz DS403x: DC to 350 MHz DS402x: DC to 200 MHz DS401x: DC to 100 MHz
Vertical Resolution	8bits, two channels sample at the same time

Vertical Scale	1 mV/div to 5 V/div ( <b>1 M<math>\Omega</math></b> ) 1 mV/div to 1 V/div ( <b>50 <math>\Omega</math></b> )
Offset Range	1 mV/div to 124 mV/div: <b><math>\pm 1.2V</math> (50 <math>\Omega</math>)</b> 126 mV/div to 1 V/div: <b><math>\pm 12V</math> (50 <math>\Omega</math>)</b> 1 mV/div to 225 mV/div: <b><math>\pm 2V</math> (1M<math>\Omega</math>)</b> 230 mV/div to 5 V/div: <b><math>\pm 40V</math> (1M<math>\Omega</math>)</b>
Dynamic Range	$\pm 5$ div
Bandwidth Limit <sup>2</sup>	DS405x/ DS403x: 20 MHz/100 MHz/200 MHz DS402x: 20 MHz/100 MHz DS401x: 20 MHz
Low Frequency Response (AC Coupling -3dB)	<b><math>\leq 5</math> Hz</b> (on BNC)
Calculated Rise Time <sup>2</sup>	DS405x: 700 ps DS403x: 1 ns DS402x: 1.8 ns DS401x: 3.5 ns
DC Gain Accuracy	$\pm 2\%$ full scale
DC Offset Accuracy	200 mV/div to 5 V/div: 0.1 div $\pm 2$ mV $\pm 0.5\%$ offset value 1 mV/div to 195 mV/div: 0.1 div $\pm 2$ mV $\pm 1.5\%$ offset value
ESD Tolerance	$\pm 2$ kV
Channel to Channel Isolation	DC to maximum bandwidth: $>40$ dB

## Trigger

Trigger Level Range	Internal	$\pm 6$ div from center of the screen
	EXT	$\pm 0.8$ V
Trigger Mode	Auto, Normal, Single	
Holdoff Range	100 ns to 10 s	
High Frequency Rejection <sup>2</sup>	50 kHz	
Low Frequency Rejection <sup>2</sup>	5 kHz	

## Edge Trigger

Edge Type	Rising, Falling, Rising&Falling
<b>Pulse Trigger</b>	
Pulse Condition	Positive Pulse Width (greater than, lower than, within specific interval) Negative Pulse Width (greater than, lower than, within specific interval)
Pulse Width Range	4 ns to 4 s
<b>Runt Trigger</b>	
Pulse Polarity	Positive, Negative
Qualifier	None, >, <, <>
<b>Nth Edge Trigger</b>	
Edge Type	Rising, Falling
Idle Time	40 ns to 1 s
Edge Number	1 to 65535
<b>Slope Trigger</b>	
Slope Condition	Positive Slope (greater than, lower than, within specific interval) Negative Slope (greater than, lower than, within specific interval)
Time Setting	10 ns to 1 s
<b>Video Trigger</b>	
Signal Standard	Support standard NTSC, PAL and SECAM broadcasting standards; support 480P, 576P, 720P, 1080P and 1080I HDTV standards
<b>Pattern Trigger</b>	
Pattern Setting	H, L, X, Rising Edge, Falling Edge
<b>RS232/UART Trigger</b>	
Trigger Condition	Start, Error, Check Error, Data
Baud Rate	2400bps, 4800bps, 9600bps, 19200bps, 38400bps, 57600bps, 115200bps, User
Data Bits	5 bit, 6 bit, 7 bit, 8 bit
<b>I2C Trigger</b>	
Trigger Condition	Start, Restart, Stop, Missing ACK, Address, Data, A&D
Address Bits	7 bit, 10 bit
Address Range	0 to 127, 0 to 1023
Byte Length	1 to 5

<b>SPI Trigger</b>	
Trigger Condition	CS, Timeout
Timeout Value	100 ns to 1 s
Data Bits	4 bit to 32 bit
Data Line Setting	H, L, X
Clock Edge	Rising Edge, Falling Edge
<b>CAN Trigger</b>	
Signal Type	Rx, Tx, CAN_H, CAN_L, Differential
Trigger Condition	SOF, EOF, Frame Type, Frame Error
Baud Rate	10kbps, 20kbps, 33.3kbps, 50kbps, 62.5kbps, 83.3kbps, 100kbps, 125kbps, 250kbps, 500kbps, 800kbps, 1Mbps, User
Sample Point	5% to 95%
Frame Type	Data, Remote, Error, OverLoad
<b>USB Trigger</b>	
Signal Speed	Low Speed, Full Speed
Trigger condition	SOP, EOP, RC, Suspend, Exit Suspend

## Measure

Cursor	Manual Mode	Voltage Deviation between Cursors ( $\Delta V$ ) Time Deviation between Cursors ( $\Delta T$ ) Reciprocal of $\Delta T$ (Hz) ( $1/\Delta T$ )
	Track Mode	Voltage and Time Values of the Waveform Point
	Auto Mode	Allow to display cursors during auto measurement
Auto Measurement	Measurements of Maximum, Minimum, Peak-Peak Value, Top Value, Bottom Value, Amplitude, Average, Mean Square Root, Overshoot, Pre-shoot, Frequency, Period, Rise Time, Fall Time, Positive Pulse Width, Negative Pulse Width, Positive Duty Cycle, Negative Duty Cycle, Delay A→B $\bar{f}$ , Delay A→B $\bar{t}$ , Phase A→B $\bar{f}$ , Phase A→B $\bar{t}$	
Number of Measurements	Display 5 measurements at the same time.	

Measurement Range	Screen or cursor.
Measurement Statistic	Average, Max, Min, Standard Deviation, Number of Measurements
Frequency Counter	Hardware 6 bits frequency counter (channels are selectable)

## Math Operation

Waveform Operation	A+B, A-B, A×B, A/B, FFT, Editable Advanced Operation, Logic Operation
FFT Window Function	Rectangle, Hanning, Blackman, Hamming
FFT Display	Split, Full Screen
FFT Vertical Scale	Linear RMS, dBV RMS
Logic Operation	AND, OR, NOT, XOR
Math Function	Intg, Diff, Log, Exp, Sqrt, Sine, Cosine, Tangent
Number of Buses for Decoding	2
Decoding Type	Parallel (standard), RS232/UART (option), I2C (option) , SPI (DS4XX4 option), CAN (option), FlexRay (option)

## Display

Display Type	9 inches (229 mm) TFT LCD display
Display Resolution	800 Horizontal × RGB× 480 Vertical Pixel
Display Color	160,000 Color
Persistence Time	Min, 50ms, 100ms, 200ms, 500ms, 1 s, 2 s, 5 s, 10 s, 20 s, Infinite
Display Type	Dots, Vectors
Real-time Clock	Time and Date (user adjustable)

## I/O

Standard Ports	Dual USB HOST, USB DEVICE, LAN, VGA Output, 10 MHz Input/Output, Aux Output (TrigOut, Fast, PassFail, GND)
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## General Specifications

### Probe Compensation Output

Output Voltage <sup>2</sup>	About 3 V, peak-peak
Frequency <sup>2</sup>	1 kHz

### Power

Power Voltage	100 to 127 V, 45 to 440Hz 100 to 240 V, 45 to 65Hz
Power	Maximum 120W
Fuse	3 A, T Degree, 250 V

### Environment

Temperature Range	Operating: 0 °C to +50 °C
	Non-operating: -20 °C to +70 °C
Cooling Method	fan cooling
Humidity Range	Under +35 °C: ≤90% Relative Humidity
	+35 °C to +50 °C: ≤60% Relative Humidity
Altitude	Operating: under 3,000 meters
	Non-operating: under 15,000 meters

### Physical Characteristics

Size <sup>3</sup>	Width× Height× Depth = 440.0 mm× 218.0 mm× 130.0 mm	
Weight	Package Excluded	4.8 kg ± 0.2 kg
	Package Included	7.1 kg ± 1.0 kg

### Calibration Interval

The recommended calibration interval is one year.

### Regulatory Information

Electromagnetic Compatibility	2004/108/EC
Safety	Execution standard EN 61326-1:2006 EN 61326-2-1:2006
	UL 61010-1:2004; CAN/CSA-C22.2 NO. 61010-1-2004; EN 61010-1:2001; IEC 61010-1:2001

- 1** Maximum value. In single-channel mode, sine signal with 10 ns horizontal scale, 4 div input amplitude and 10 MHz frequency, edge trigger.
- 2** Typical.
- 3** Supporting legs and handle folded, knob height included, front panel cover excluded.