

Digital Storage Oscilloscope SMO5000X Series



Advance Features

- 1 GHz, 500 MHz, 350 MHz models with real-time sample rate up to 5 GSa/s, Bandwidth upgrade option is available.
- Waveform Capture rates up to 110,000 wfm/s (normal mode) and 500,000 wfm/s (sequence mode)
- Supports 256-level intensity grading and color temperature display modes
- Record length up to 250 Mpts/ch, 500 Mpts in total for all 4 channels
- Digital trigger system
- Intelligent trigger: Edge, Slope, Pulse, Window, Runt, Interval, Dropout, Pattern, Qualified and Video (HDTV supported). Trigger zone helps to simplify advanced triggering
- Serial bus triggering and decoder, supports protocols I²C, SPI, UART, CAN, LIN, CAN FD, FlexRay, I²S and MIL-STD-1553B
- Low background noise, supports 0.5 mV/div to 10 V/div voltage scales
- Segmented acquisition (Sequence) mode, dividing the maximum record length into multiple segments (up to 100,000), according to trigger conditions set by the user, with a very small dead time between segments to capture the qualifying event
- History waveform record (History) function, the maximum recorded waveform length is 100,000 frames
- Automatic measurement function on 39 parameters, supports statistics with histogram, Gating measurement, Math measurement, History measurement and Ref measurement
- Math function (2 Mpts FFT, addition, subtraction, multiplication, division, integration, differential, square root), supports math on math
- Search and Navigate
- Digital Voltmeter
- Waveform Histogram
- Bode plot & Power Analysis
- High Speed hardware-based Average, Eres (Enhanced Resolution)
- High Speed hardware-based Mask Test function, with Mask Editor tool for creating user-defined masks
- 16 digital channels (optional) with sample rate up to 1.25 GSa/s, record length up to 62.5 Mpts
- 25 MHz function/arbitrary waveform generator, built-in multiple predefined waveforms
- Large 10.1" TFT-LCD display with 1024 * 600 resolution; Capacitive touch screen supports multi-touch gestures
- Supports external mouse and keyboard
- Multiple interfaces: USB Host, USB Device (USBTMC), LAN (VXI-11, telnet, socket, web), Pass/Fail, Trigger Out, 10 MHz In, 10 MHz Out, VGA output
- Built-in web server supports remote control by the LAN port using a web browser
- Supports SCPI remote control commands

Technical Specification	SMO5034X	SMO5054X	SMO5104X
Bandwidth	350 MHz	500 MHz	1 GHz
Sample Rate	5 GSa/s (interleaving mode), 2.5 GSa/s (non-interleaving mode)		
Memory Depth	250 Mpts (interleaving mode), 125 Mpts (non-interleaving mode)		
Peak detect	400 ps		
Average	4, 16, 32, 64, 128, 256, 512		
Eres	Enhanced bit : 0.5, 1, 1.5, 2, 2.5, 3		
Sequence	Up to 100,000 segments, dead time = 2 μ s min		
History	Up to 100,000 frames		
Interpolation	Sinx/x, x		

Technical Specification		SMO5034X	SMO5054X	SMO5104X
Vertical System				
Analog Channels		4 + EXT		
Bandwidth (- 3dB) @ 50 Ω		350 MHz*	500 MHz**	1 GHz**
Rise Time (Typical) @ 50 Ω		1.0 ns	0.7 ns	0.4 ns
Vertical Range		8 divisions		
Vertical Resolution		8 bits		
Vertical Scale		1 MΩ : 500 μV/div to 10 V/div (setting range), 1 mV/div to 10 V/div (specified range)		
		50 Ω : 500 μV/div to 1 V/div (setting range), 1 mv/div to 1 V/div (specified range)		
DC Gain Accuracy		≤ 3.0%		
Offset Range		0.5 mV/div ~ 100 mV/div : ± 2 V 102 mV/div ~ 1 V/div : ± 20 V 1.02 V/div ~ 10 V/div : ± 200 V	0.5 mV/div ~ 20 mV/div : ± 2 V 20.5 mV/div ~ 100 mV/div : ± 5 V 102 mV/div ~ 200 mV/div : ± 20 V 205 mV/div ~ 1 V/div : ± 50 V 1.02 V/div ~ 2 V/div : ± 200 V 2.05 V/div ~ 10 V/div : ± 400 V	
Offset Accuracy		± (1.5% x offset + 1.5% x full scale + 1 mV)		
Bandwidth Limit		20 MHz (± 40%) 200 MHz (± 40%)		
Low frequency response (AC coupling -3dB)		5 Hz (Typical)		
Coupling		DC, AC, GND		
Impedance		(1 MΩ ± 2%) (16 pF ± 2 pF), 50 Ω : 50 Ω ± 1%		
Max. Input voltage		1 MΩ : ≤ 400 Vpk (DC + AC), (DC – 10 kHz) 50 Ω : ≤ 5 Vrms, ± 10 V Peak		
Probe Attenuation		1X, 10X, 100X, Custom		
* Below 1 mv/div (included) the bandwidth is limited to 200 MHz ** Below 2.45 mv/div (included) the bandwidth is limited to 200 MHz				
Horizontal System				
Time Scale		1 ns/div to 1000 s/div	500 ps/div to 1000 s/div	200 ps/div to 1000 s/div
Waveform update rate		Up to 110,000 wfm/s		
Intensity grading		256 level		
Display Format		Y–T, X–Y, Roll		
Roll mode		≥ 50 ms / div		
Skew (CH1 to CH4)		< 150 ps		
Time base Accuracy		± 1ppm initial; ± 1ppm 1st year aging; ± 3.5 ppm 10 year aging		
Trigger System				
Trigger Mode		Auto, Normal, Single		
Trigger Level Range		Internal : ± 4.1 div from screen center EXT : ± 0.61 V EXT/5 : ± 3.05 V		
Hold off Ranges		By time : 8 ns to 30 s (8 ns step) By event : 1 to 10 ⁸		
Trigger Coupling	(CH1 to CH4)	DC : Passes all components of the signal AC : Blocks DC components and attenuates signals below 8 Hz LFRJ : Attenuates the frequency component below 1.2 MHz HFRJ : Attenuates the frequency component above 740 kHz Noise RJ : Increase the trigger hysteresis		
	(EXT)	DC : Passes all components of the signal AC : Blocks DC components and attenuates signals below 10 Hz LFRJ : Attenuates the frequency components below 400 kHz HFRJ ; Attenuates the frequency components above 1.6 MHz		
Accuracy (Typical)		CH1 to CH4 ± 0.2 div, EXT : ± 0.3 div		
Sensitivity	(CH1 to CH4)	>10 mV/div : 0.3 div (Noise RJ = OFF), 0.7 div (Noise RJ = ON)		
		5 mV/div - 10mV/div : 0.5 div (Noise RJ = OFF), 0.7 div (Noise RJ = ON)		
	EXT :	≤ 2 mV/div : 1 div (Noise RJ = OFF), 1.5 div (Noise RJ = ON)		
		200 mVpp (DC - 10 Mhz), 300 mVpp (10 MHz - bandwidth)		
Jitter	EXT/5 :	1 Vpp (DC - 10 MHz) 1.5 Vpp (10 MHz - bandwidth)		
		< 100 ps (CH1 to CH4)		
Displacement		Pre-Trigger : 0 to 100% memory Delay-Trigger : 0 to 5,000 div		
Edge Trigger				
Source		CH1 to CH4 / EXT / (EXT/5) / AC Line / D0 to D15		
Slope		Rising, Falling, Rising & Falling		
Slope Trigger				
Source		CH1 to CH4		
Slope		Rising, Falling		

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Limit Range	<, >, < >, > <		
Time Range	2 ns to 20 s		
Resolution	1 ns		
Pulse Width Trigger			
Source	CH1 to CH4 / D0 to D15		
Polarity	+ wid, - wid		
Limit Range	<, >, < >, > <		
Pulse Range	2 ns to 20 s		
Resolution	1 ns		
Video Trigger			
Source	CH1 to CH4		
Signal Standard	NTSC, PAL, 720p/50, 720p/60,1080p/50, 1080p/60,1080i/50,1080i/60, Custom		
Sync	ANY, Select		
Trigger Condition	Line, Field		
Window Trigger			
Source	CH1 to CH4		
Window Type	Absolute, Relative		
Interval Trigger			
Source	CH1 to CH4 / D0 to D15		
Slope	Rising, Falling		
Limit Range	≤, ≥, < >, > <		
Time Range	2 ns to 20 s		
Resolution	1 ns		
Dropout Trigger			
Source	CH1 to CH4 / D0 to D15		
Timeout Type	Edge, State		
Slope	Rising, Falling		
Time Range	2 ns to 20 s		
Resolution	1 ns		
Runt Trigger			
Source	CH1 to CH4		
Slope	Rising, Falling		
Limit Range	≤, ≥, < >, < >		
Time Range	2 ns to 20 s		
Resolution	1 ns		
Pattern Trigger			
Source	CH1 to CH4 / D0 to D15		
Pattern Setting	Don't Care, Low, High		
Logic	AND, OR, NAND, NOR		
Limit Range	≤, ≥, < >, > <		
Time Range	2 ns to 20 s		
Resolution	1 ns		
Qualified Trigger			
Type	State, State with Delay, Edge, Edge with Delay		
Qualified Source	CH1 to CH4 / D0 to D15		
Edge Trigger Source	CH1 to CH4 / D0 to D15		
Serial Trigger			
Source	CH1 to CH4 / D0 to D15		
Protocol	I ² C, SPI, UART, CAN, LIN, CAN FD, FlexRay, I ² S, MIL-STD-1553B		
I ² C Trigger	Type : Start, Stop, Restart, No Ack, EEPROM, Address & Data, Data Length		
SPI Trigger	Type : Data		
UART Trigger	Type : Start, Stop, Data, Parity Error		
CAN Trigger	Type : All, Remote, ID, ID+Data, Error		
LIN Trigger	Type : Break, Frame ID, ID+Data Error		
CAN FD Trigger	Type : Start, Remote, ID, ID+Data, Error		
Flex Ray Trigger	Type : TSS, Frame, Symbol, Errors		
I ² S Trigger	Type : Data, Mute, Clip, Glitch, Rising Edge, Falling Edge		
Serial Decoder			
Decoders	2		
Decoder Type	Full duplex		
Threshold	- 4.1 to 4.1 div		

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List	1 to 7 lines		
I2C			
Signal	SCL, SDA		
Address	7 bit, 10 bit		
SPI			
Signal	CLK, MISO, MOSI, CS		
Edge Select	Rising, Failing		
Chip Select	Active high, Active low, Clock timeout		
Bit Order	LSB, MSB		
UART			
Signal	RX, TX		
Data Width	5 bit, 6 bit,7 bit, 8 bit		
Parity Check	None, Odd, Even		
Stop Bit	1 bit,1.5 bit, 2 bit		
Idle Level	Low, High		
Bit Order	LSB, MSB		
CAN			
Source	CH1 to CH4 / D0 to D15		
LIN			
LIN Specification Package Revision	Ver 1.3, Ver 2.0		
Baud Rate	5kbps, 10kbps, 20kbps, 50kbps, 100kbps, 125kbps, 250kbps, 500kbps, 800kbps, 1Mbps, Custom		
CAN FD			
Source	CH1 to CH4 / D0 to D15		
Nominal Baud Rate	10kbps, 25kbps, 50kbps, 100kbps, 250kbps, 1Mbps, Custom		
Data Baud Rate	500kbps, 1Mbps, 2Mbps, 5Mbps, 8Mbps, 10Mbps, Custom		
Flex Ray			
Source	CH1 to CH4 / D0 to D15		
Data Baud Rate	2.5 Mbps, 5 Mbps, 10 Mbps, Custom		
I2S			
Signal	BCLK, WS, DATA		
Audio Variant	Audio-I2S, Audio L-J, Audio RJ		
Start Bits	0 to 32		
Data Bits	0 to 32		
MIL-STD-1553B			
Source	CH1 to CH4		
Measurement			
Source	CH1 to CH4, Math, Ref, History, Zoom		
No. of Measurement	Display 5 measurements at the same time		
Range	Screen, Gating		
Measurement Parameters			
Vertical	Max, Min, Pk-Pk, Top, Base, Amplitude, Mean, Cycle Mean, Stdev, Cycle Stdev, RMS, Cycle RMS, FOV FPRE, ROV, RPRE, L@T		
Horizontal	Period, Freq, +Width, -Width, Rise, Fall, BWidth, + Duty, - Duty, Delay, T@M, CCJ		
Delay	Phase, FRFR, FRFF, FFFR, FFFF, FRLR, FRLF, FFLR, FFLF, Skew		
Cursors	Manual : Time X1, X2, (X1-X2), (1/ΔT) Voltage / Current : Y1, Y2, (Y1-Y2) Track : Time X1, X2, (X1-X2)		
Statistics	Current, Mean, Min, Max, Sdev, Count, Histogram		
Frequency Counter	7 digits		
Math			
Mode	f(x), g[f(x)]		
Operation	+, -, *, /, FFT, d/dt, fdt, square root		
FFT	Window : Rectangular , Blackman, Hanning, Hamming, Flattop Display : Full Screen, Split, Exclusive Mode : Normal, Max hold Average		
Function/Arbitrary Waveform Generator (Optional)			
Channels	1		
Max. output frequency	25 MHz		
Sampling Rate	125 MSa/s		
Frequency Resolution	1 μHz		
Frequency Accuracy	± 50 ppm		
Vertical Resolution	14-bit		

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Amplitude Range	-1.5 V to + 1.5 V (into 50 Ω) - 3 V +3 V (into Hi-Z)		
Waveforms	Sine, Square, Ramp, Pulse, DC, Noise, 45 Arbs		
Output Impedance	50 Ω ± 2 %		
Protection	Over voltage protection, Current limit		
Insulation Voltage	± 42 Vpk		
Sine			
Frequency	1 μHz to 25 MHz		
Offset Accuracy (10 kHz)	± (1% offset setting value + 3 mVpp)		
Amplitude flatness	± 0.3dB, compare to 10 kHz, 5 Vpp		
SFDR	DC - 1 MHz - 60 dBC 1 MHz - 5 MHz - 55 dBC 5 MHz - 25 MHz - 50 dBC		
Harmonic distortion	DC - 5 MHz - 50 dBC 5 MHz - 25 MHz - 45 dBC 5 MHz - 25 MHz - 50 dBC		
Sequence / Pulse			
Frequency	1 μHz to 10 MHz		
Duty cycle	1% to 99%		
Edge	< 24 ns (10% to 90%)		
Overshoot	< 3% (typical, 1 kHz, 1 Vpp)		
Pulse width	> 50 ns		
Jitter (cycle-cycle)	< 500 ps + 10 ppm		
Ramp			
Frequency	1 μHz to 300 kHz		
Linearity	< 0.1% of Pk-Pk (typical, 1 kHz, 1 Vpp, 50% symmetry)		
Symmetry	0% to 100%		
DC			
Offset Range	±1.5 V (into 50 Ω) ± 3 V (into Hi-Z)		
Accuracy	± (setting value * 1% + 3 mV)		
Noise			
Bandwidth	> 25 MHz (-3dB)		
Arb			
Frequency	1 μHz to 5 MHz		
Waveform Memory	16 kpts		
Sample Rate	125 MSa/s		
Wave Import	From Easy Wave or U-disk		
Digital Channels (Optional)			
No. of Channels	16		
Max. Sampling Rate	1.25 GSa/s		
Memory Depth	62.5 Mpts/ch		
Min. Detectable Pulse Width	3.3 ns		
Level Group	D0 to D7, D8 to D15		
Level Range	-10 V to 10 V		
Logic Type	TTL, CMOS, LVCMOS3.3 , LVCMOS2.5, Custom		
Skew	D0 to D15 : ±1 Sampling Interval Digital to Analog : ± (1 sampling interval +1 ns)		
I/O			
Standard	3 USB Hosts, 1 USB Device, LAN, AUX(Pass/Fail+Trigger Out), 10 MHz In/ Out		
Pass/Fail	3.3 V TTL Output		
Display			
Display Type	10.1 TFT LCD		
Resolution	1024 × 600		
Range	8 x 10 grid		
Touch Screen Type	Capacitive		
Waveform Display			
Type	Dot, Vector		
Persistence Time	OFF, 1 s, 5 s, 10 s, 30 s, infinite		
Color Display	Normal, Color		

Technical Specification	SMO5034X	SMO5054X	SMO5104X
Bode Plot			
Source	Ch1 to Ch4		
Supported signal sources	SAG1021I (Connection : USB) SMG Series waveform generators (Connection: USB, LAN)		
Sweep type	Simple, Vari-level		
Frequency	Mode: Linear, Logarithmic Range: 10Hz~120MHz		
Measure	Upper cutoff frequency, Lower cutoff frequency, Bandwidth, Gain margin, Phase margin		
Power Analysis (Optional)			
Measure	Power quality, Current Harmonics, Inrush current, Switching loss, Slew rate, Modulation, Output ripple, Turn on/Turn off, Transient response, PSRR, Efficiency, SOA		
Histogram			
Source	CH1 to CH4		
Type	Horizontal, Vertical, Both		
Counter			
Source	Ch1 to CH4		
Frequency Resolution	7 digit		
Totalizer	Counter on edges, supports Gate and Trigger		
General Specifications			
Input Voltage & Frequency	100 to 240 Vrms (± 10%), 50/60 Hz (± 5%) 100 to 120 Vrms 400 Hz		
Power Consumption	100 W Max, 70 W Typical, 4 W typical standby mode		
Humidity	Operating : 85% RH, 40°C , 24 hours Non-operating : 85% RH, 65°C, 24 hours		
Temperature	0°C to 50°C		
Electromagnetic Compatibility	EN 61326-1:2013		
Safety	EN 61010-1:2010		
Dimension	W : 370 mm, D : 144 mm, H : 231 mm		
Weight	N.W : 4.0 Kg, G.W. : 5.6 Kg (4 Channel Model)		
Standard Accessories	USB cable, Passive probe : SP2035A for 350 MHz model and SP3050A for 500 MHz/1 GHz models (1/Channel), CD, Power Cord		
Available Options	Description	Option No.	
	16 channel MSO Function for SMO5000X series (inclusive of 16 channel Logic Probe SPL2016 + MSO Function Software)	SMO5000X-16LA	
	USB AWG Option for SMO5000X series (inclusive of USB Isolated AWG Module Hardware SAG1021I + USB AWG Software)	SMO5000X-FG	
	I2S Trigger & Decode Software	SMO5000X-I2S	
	MIL-STD-1553B Trigger & Decode Software	SMO5000X-1553B	
	Flexray Trigger & Decode Software	SMO5000X-FlexRay	
	CANFD Trigger & Decode Software	SMO5000X-CANFD	
	350 MHz to 500 MHz BW upgrade for 4 Channel model SMO5034X	SMO5000X-4BW05	
	500 MHz to 1 GHz BW upgrade for 4 Channel model SMO5054X	SMO5000X-4BW10	

Subject to change

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