

SDG3000X Series Arbitrary Waveform Generator



Data Sheet EN01A



SIGLENT TECHNOLOGIES CO., LTD.

SDG3082X SDG3162X SDG3202X

Product Overview

The SDG3000X series dual-channel function/arbitrary waveform generator has a maximum bandwidth of 200MHz, an excellent sampling system specifications of 1.2 GSa/s sampling rate and 16-bit vertical resolution. Based on the traditional DDS technology, it adopts the innovative TrueArb and EasyPulse technologies, which overcome the inherent defects of DDS technology in outputting arbitrary waves and square waves/pulses, and can provide users with high-fidelity, low-jitter signals. In addition, the SDG3000X also provides PRBS pattern generation, sequence, dual pulse, and vector signal output functions to meet a wider range of application needs.

Key Features

- Dual channels, maximum output frequency 200 MHz, maximum output amplitude 20 Vpp
- 1.2 GSa/s sampling rate, 16-bit vertical resolution
- Using TrueArb technology, arbitrary waveforms can be output point by point. Under the premise of not losing waveform details, low-jitter waveforms can be output at a sampling rate of 10 mSa/s ~ 600 MSa/s
- Supports sequence wave playback function, with a maximum waveform memory of 40 Mpts per channel
- Using EasyPulse technology, it can output low-jitter square waves/pulses, and the pulse wave can achieve fine adjustment of pulse width, rising/falling edges, with extremely high adjustment resolution and adjustment range
- Supports dual pulse output function, which can be used to measure the switching parameters of power devices and evaluate their dynamic characteristics
- Supports PRBS up to 120 Mbps
- Rich analog and digital modulation functions: AM, DSB-SC, FM, PM, FSK, ASK, PSK and PWM
- Sweep and Burst functions
- Harmonic function
- Waveform Combining function
- High precision Frequency Counter
- 196 built-in arbitrary waveforms
- Standard interfaces: USB Host, USB Device (USBTMC), LAN (VXI-11); optional GPIB
- Built-in WebServer supports instrument control via web browser
- 7-inch display touch screen

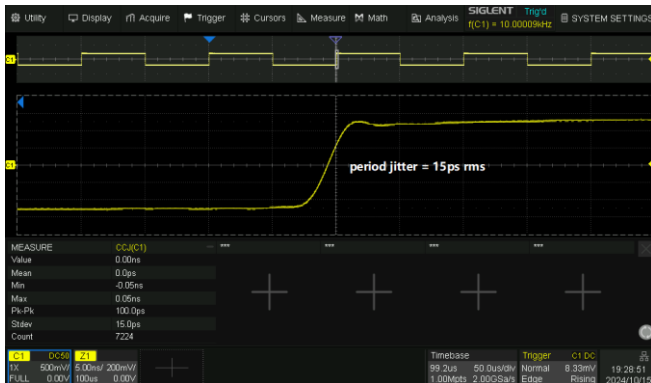


Models and Key Specifications

Model	SDG3082X	SDG3162X	SDG3202X
Max output frequency	80 MHz	160 MHz	200 MHz
Number of channels	2		
Sampling rate	1.2 GSa/s (2X Interpolation)		
Vertical resolution	16 bits		
Arbitrary waveform length	20 Mpts/ch (40 Mpts/ch Optional) Support sequence		
Vector signal (Optional)	50 MS/s max symbol rate; Includes modulation modes such as ASK, PSK, FSK and QAM. SigIQPro software provides vector signal creation and editing		
Max. amplitude	± 10 V		
Display	7" touch screen		
Interface	Standard: USB Host, USB Device, LAN Optional: GPIB (USB-GPIB adaptor)		

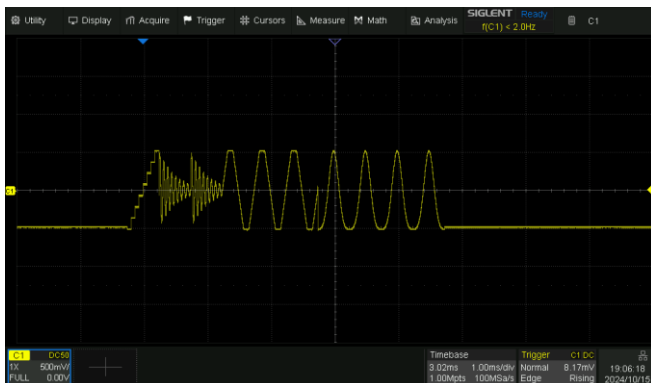
Characteristics

Innovative EasyPulse Technology

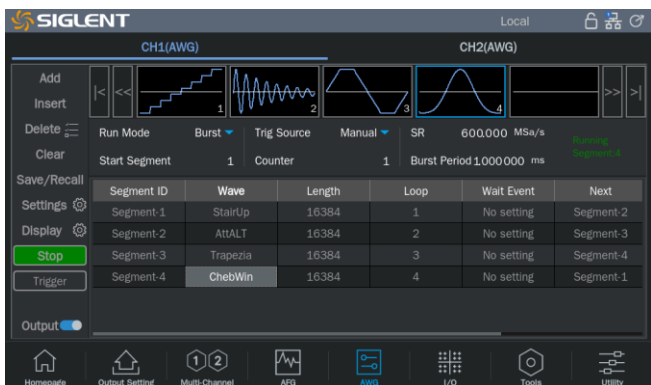


When a Square/Pulse waveform is generated by DDS, there will be a one-clock-jitter if the sampling rate is not an integer-related multiple of the output frequency. EasyPulse technology successfully overcomes this weakness in DDS designs and helps to produce low jitter Square/Pulse waveforms.

Powerful sequence playback function



Provides flexible sequence playback function to easily cope with various scenario tests. The maximum waveform storage depth of each channel is 40 Mpts.



Easily set the number of cycle times for each waveform and the order of waveform playback.

It supports up to 1024 segments. During playback, it can also indicate the segment currently being played, allowing you to control the test.

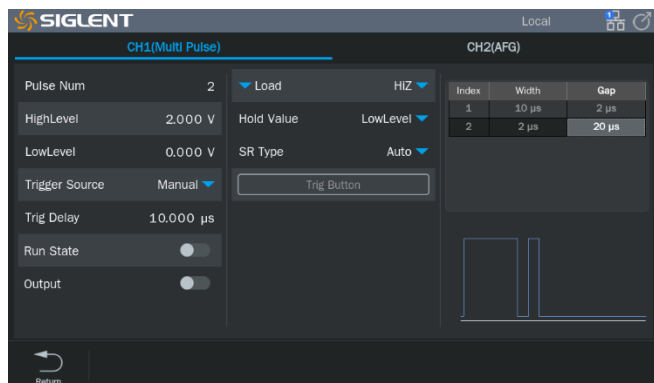
Five operating modes: continuous, triggered, burst, single, and advanced. The advanced operating mode allows you to set the trigger mode for each segment.

Four trigger sources are available: "Auto", "External", "Manual" and "Timer".

Built-in multi-pulse function



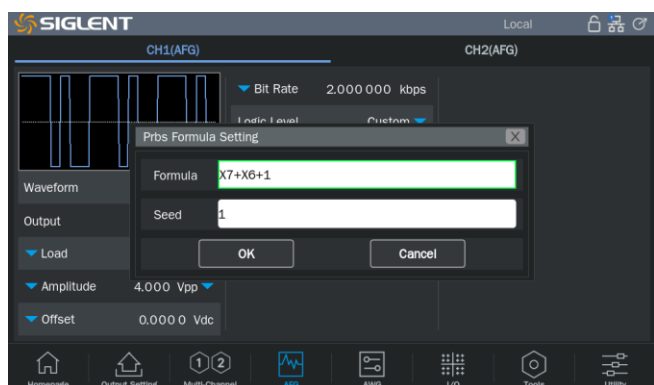
Built-in dual pulse output function, combined with siglent's oscilloscope, can quickly measure the switching parameters and dynamic characteristics of power devices without the need for host computer software.



Supports up to 30 pulses, and can set each pulse width and pulse interval.

Four trigger sources are available: "Internal", "External", "Manual" and "Timer".

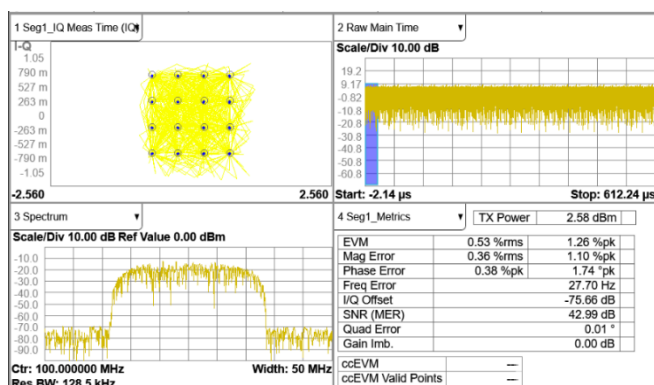
Customizable polynomial PRBS pattern output



Provides PRBS3 ~ PRBS32 multiple pattern outputs, with a maximum bit rate of up to 120 Mbps. In addition to outputting single-ended signals, the two channels can also be set to differential output.

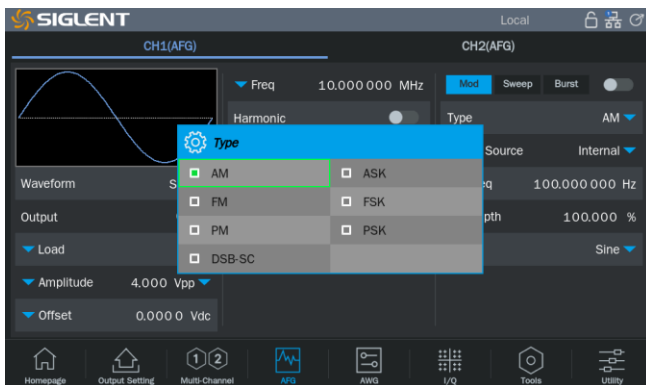
In addition to using the built-in PRBS generator polynomial, you can also customize the PRBS generator polynomial to make the test more flexible.

Vector signal output



SDG3000X supports baseband or IF signals and can generate IQ signals of commonly used modulation types such as ASK, FSK, PSK, QAM, etc. SDG3000X can achieve excellent EVM performance at any symbol rate in the range of 250 Symb/s ~ 50 MSymb/s. The built-in digital orthogonal modulator can modulate the IQ signal to any frequency in the range of 200 MHz.

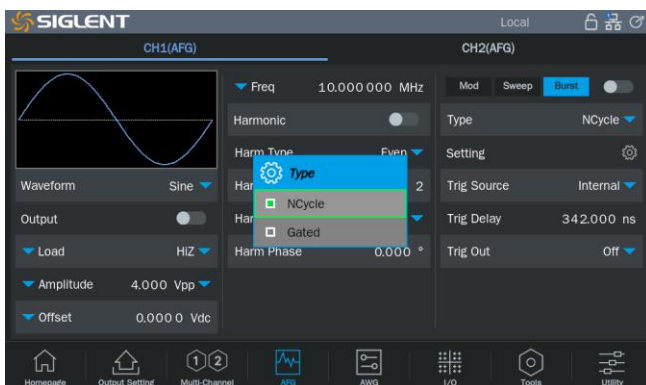
Modulation



Rich modulation functions, supporting commonly used AM/DSB-SC/ FM/ PM/ ASK/ FSK/ PSK/ PWM modulation methods.

Two modulation sources are available: internal and external.

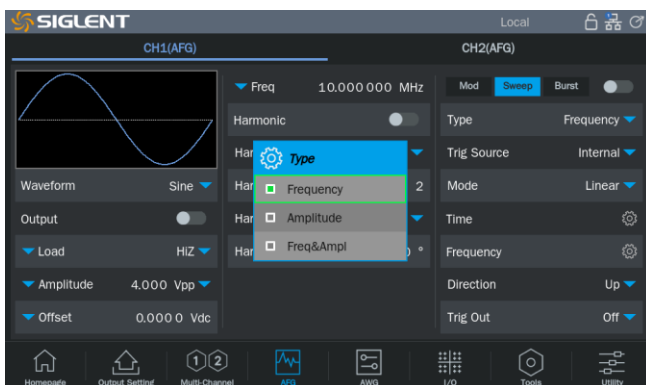
Burst



Supports two Burst modes: N cycle and Gating.

Three trigger sources are available: internal, external and manual.

Sweep

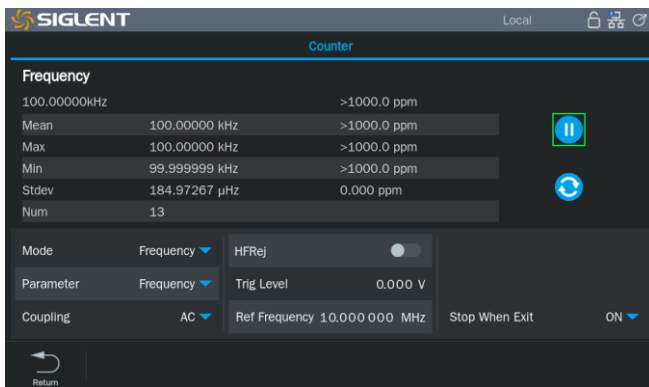


Supports three sweep modes: frequency, amplitude, and frequency and amplitude, making it easy to implement frequency sweep and amplitude sweep tests.

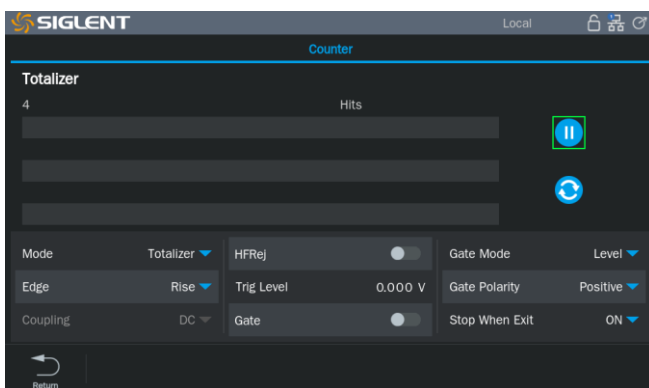
Supports three sweep type: linear, log and step, and three sweep directions of up, down and up_down.

Three trigger sources are available: internal, external and manual.

Counter

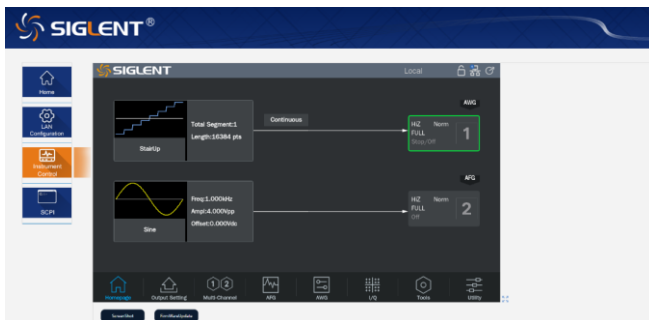


When the counter is in frequency counter mode, it can be used to measure the frequency, period, and duty cycle of a signal. The measurement range is 0.1 Hz ~ 200 MHz.



When operating in totalizer mode, the specified trigger events can be counted.

Built-in WebServer



Supports instrument control through a web browser, allowing testing tasks to be completed remotely.

Specifications

Unless otherwise specified, all specifications can be guaranteed to meet the following conditions:

- Within the validity period of product calibration.
- Within the ambient temperature range of 18 °C ~ 28 °C.
- The instrument is powered on and operating for more than 30 minutes.

Frequency Characteristics					
Parameter	Min.	Typ.	Max.	Unit	Condition
Resolution	1 μ			Hz	
Initial accuracy	-1		+1	ppm	25 °C
	-2		+2		0 ~ 40 °C
1st-year aging	-1		+1	ppm	25 °C
10-year aging	-3.5		+3.5	ppm	25 °C

Sine Characteristics					
Parameter	Min.	Typ.	Max.	Unit	Condition
Frequency	1 μ		200 M	Hz	SDG3202X
	1 μ		160 M		SDG3162X
	1 μ		80 M		SDG3082X
Harmonic distortion (0 dBm, 50 Ω Load)			-65	dBc	≤ 1 MHz
			-60		1 MHz ~ 60 MHz (included)
			-50		60 MHz ~ 100 MHz (included)
			-40		100 MHz ~ 200 MHz (included)
Total Harmonic Distortion			0.075	%	0 dBm, 10 Hz ~ 20 kHz
Non-harmonic spurious (0 dBm, 50 Ω Load)			-70	dBc	≤ 50 MHz
			-65		50 MHz ~ 120 MHz (included)
			-60		120 MHz ~ 200 MHz (included)

Square Characteristics					
Parameter	Min.	Typ.	Max.	Unit	Condition
Parameter	1 μ		60 M	Hz	
Frequency		3	4.5	ns	10% ~ 90%, 1 Vpp, 50 Ω Load
Rise/fall times		3	5	%	100 kHz, 1 Vpp, 50 Ω Load
Overshoot	0.001		99.999	%	Limited by frequency setting
Duty cycle			150	ps	1 Vpp, 50 Ω Load

Pulse Characteristics					
Parameter	Min.	Typ.	Max.	Unit	Condition
Frequency	1 μ		60 M	Hz	
Pulse width	8			ns	
Pulse width accuracy			$\pm (0.01\%+0.5 \text{ ns})$		
Rise/fall times	3 n		22.4	s	10% ~ 90%, 1 Vpp, 50 Ω Load Specifications such as overshoot, jitter, output range, and pulse width accuracy can only be met within this range. The minimum value that can be set is limited by the output amplitude.
Rise/fall times accuracy			± 1	ns	10% ~ 90%, 1 Vpp, 50 Ω Load
Overshoot		3	5	%	100 kHz, 1 Vpp, 50 Ω Load
Duty cycle	0.001		99.999	%	Limited by frequency setting
Jitter (rms), Cycle to cycle			150	ps	1 Vpp, 4 ns edge, 50 Ω Load

Noise Characteristics					
Parameter	Min.	Typ.	Max.	Unit	Condition
-3 dB bandwidth		200		MHz	
Adjustable bandwidth range	20 M		200 M	Hz	

Ramp Characteristics					
Parameter	Min.	Typ.	Max.	Unit	Condition
Frequency	1 μ		5 M	Hz	
Symmetry	0		100	%	
Linearity		1	1.5	%	Percentage of peak-peak output, 1 kHz, 1 Vpp, 100% symmetry

Arbitrary Wave characteristics (AFG Mode)					
Parameter	Min.	Typ.	Max.	Unit	Condition
Frequency	1 μ		60 M	Hz	Sampling rate 600 M Sa/s
Waveform length	16384			pts	
Rise/fall times		3		ns	10% ~ 90%, 1 Vpp step, 50 Ω Load

Sequence characteristics (AWG Mode)					
Parameter	Min.	Typ.	Max.	Unit	Condition
Sampling rate	10 m		600 M	Sa/s	
Waveform length	64		40 M	pts	When the waveform length is less than 256 points, the waveform length must be an integer multiple of 16 points. 1 Mpts = 2^{20} pts
Number of segments			1024		
jitter (rms)			150	ps	Cycle to cycle, "010101" pattern, 1 Vpp, 50 Ω Load, 600 MSa/s
Interpolation mode	0-order hold, linear, sinc, sinc27, sinc13				
Run mode	Continuous, Triggered, Single/Burst, Step, Advance				

PRBS characteristics					
Parameter	Min.	Typ.	Max.	Unit	Condition
Bit rate	2 μ		120 M	bps	
Pattern length	2m-1, m = 3,4,...,32				
Rise/fall time	2.5 n		1 μ	s	10% ~ 90%, 1 Vpp, 50 Ω Load

DC characteristics					
Parameter	Min.	Typ.	Max.	Unit	Condition
Output Range	-10		+10	V	Hiz Load. Final option disable.
Accuracy	$\pm(1\%+2\text{ mV})$				Hiz Load

Harmonic Output characteristics					
Parameter	Min.	Typ.	Max.	Unit	Condition
Order			20		
Type	Even, Odd, All				

Output Characteristics					
Parameter	Min.	Typ.	Max.	Unit	Condition
Range (HiZ Load) (The specification will be divided by 2 while applied to a 50 Ω load)	2m		20	Vpp	≤60 MHz
	2m		10		60 MHz ~ 150 MHz (included)
	2m		5		150 MHz ~ 200 MHz (included)
Accuracy	±(1%+1 mV)				10 Hz sine , 0 V offset

Amplitude flatness	-0.3		+0.3	dB	50 Ω , 0.5 Vpp, compare to 1 MHz sine
Output impedance		50		Ω	10 kHz sine
Output current	-200		+200	mA	
Crosstalk		-60		dBc	

Vector (I/Q) signal (optional)					
Parameter	Min.	Typ.	Max.	Unit	Condition
Symbol rate	250		50 M	Symbol/s	Limited by oversampling multiple
Waveform length			40 M	pts	
Carrier frequency	0		200 M	Hz	Limited by the bandwidth parameter
Modulation type	2ASK, 4ASK, 8ASK, BPSK, QPSK, 8PSK, DBPSK, DQPSK, OQPSK, D8PSK, 8QAM, 16QAM, 32QAM, 64QAM, 128QAM, 256QAM, 2FSK, 4FSK, 8FSK, 16FSK, MSK, MultiTone, Custom				Supported by EasyIQ software
Data type	PN7, PN9, PN15, PN23, User files, Custom constellation				Supported by EasyIQ software
Data source	Built-In, external file				
IQ compensation	Gain Balance, Offset, Angle				

Modulation Characteristics					
AM					
Parameter	Min.	Typ.	Max.	Unit	Condition
Carrier	Sine, Square, Ramp, Arb				
Modulation source	Internal/External				
Modulating wave	Sine, Square, Ramp, Noise, Arb				
Modulation depth	0		120	%	10 kHz sine
Modulation frequency	1 m		1 M	Hz	Source = Internal
FM					
Parameter	Min.	Typ.	Max.	Unit	Condition
Carrier	Sine, Square, Ramp, Arb				
Modulation source	Internal/External				
Modulating wave	Sine, Square, Ramp, Noise, Arb				
Frequency deviation	0		0.5*BW		BW is the max. output frequency. Limited by frequency setting
Modulation frequency	1 m		1 M	Hz	Source = Internal
PM					

Parameter	Min.	Typ.	Max.	Unit	Condition
Carrier	Sine, Square, Ramp, Arb				
Modulation source	Internal/External				
Modulating wave	Sine, Square, Ramp, Noise, Arb				
Phase deviation	0		360	°	
Modulation frequency	1 m		1 M	Hz	Source = Internal
ASK					
Parameter	Min.	Typ.	Max.	Unit	Condition
Carrier	Sine, Square, Ramp, Arb				
Modulation source	Internal/External				
Modulating wave	Square with 50% duty cycle				
Keying frequency	1 m		1 M	Hz	Source = Internal
FSK					
Parameter	Min.	Typ.	Max.	Unit	Condition
Carrier	Sine, Square, Ramp, Arb				
Modulation source	Internal/External				
Modulating wave	Square with 50% duty cycle				
Keying frequency	1 m		1 M	Hz	Source = Internal
PSK					
Parameter	Min.	Typ.	Max.	Unit	Condition
Carrier	Sine, Square, Ramp, Arb				
Modulation source	Internal/External				
Modulating wave	Square with 50% duty cycle				
Keying frequency	1 m		1 M	Hz	Source = Internal
PWM					
Parameter	Min.	Typ.	Max.	Unit	Condition
Carrier	Pulse				
Modulation source	Internal/External				
Modulating wave	Sine, Square, Ramp, Noise, Arb				
Modulation frequency	1 m		1 M	Hz	Source = Internal
Pulse width deviation resolution	8			ns	

Burst Characteristics					
Parameter	Min.	Typ.	Max.	Unit	Condition
Carrier	Sine, Square, Ramp, Pulse, Noise, Arb				
Type	Count (1-1000000 Cycles), Infinite, Gated				
Carrier frequency	2 m		BW	Hz	BW is the max. output frequency
Phase	-360		360	°	
Internal period	1 μ		1000	s	
Trigger source	Internal, External, Manual				
Gated source	Internal/External				
Trigger delay			100	s	The min. delay is limited by waveform and frequency

Sweep Characteristics					
Parameter	Min.	Typ.	Max.	Unit	Condition
Carrier	Sine, Square, Ramp, Arb				
Sweep mode	Frequency, Amplitude, Frequency and Amplitude				
Sweep type	Linear, Log, Step				
Direction	Up, Down, Up_Down				
Carrier frequency	1 μ		BW	Hz	BW is the max. output frequency
Sweep time	1 m		500	s	
Trigger source	Internal, External, Manual				

Frequency Counter Characteristics					
Parameter	Min.	Typ.	Max.	Unit	Condition
Mode	Totalizer, Frequency				
Measurement Parameters	Frequency, Period, Positive/Negative Pulse Width, Duty Cycle				
Coupling mode	AC, DC, HF REJ				
Frequency range	100 m		200 M	Hz	DC coupling
	10		200 M		AC coupling
Input amplitude	0.1 Vrms		± 2.5 V		DC coupling, ≤ 100 MHz
	0.2 Vrms		± 2.5 V		DC coupling, > 100 MHz
	0.1 Vrms		5 Vpp		AC coupling, ≤ 100 MHz
	0.2 Vrms		5 Vpp		AC coupling, > 100 MHz
Input impedance		1M		Ω	

Reference Clock Input/Output

Reference Clock Input

Parameter	Min.	Typ.	Max.	Unit	Condition
Frequency		10		MHz	
Amplitude	1.4			V _{pp}	
Input impedance	5			k Ω	AC coupling

Reference Clock Output

Parameter	Min.	Typ.	Max.	Unit	Condition
Frequency		10		MHz	Synchronized to internal reference clock
Amplitude	2	3.3		V _{pp}	Hiz Load
Output impedance		50		Ω	

Auxiliary In/Out Characteristics

Trigger Input

Parameter	Min.	Typ.	Max.	Unit	Condition
V _{IH}	2		5.5	V	
V _{IL}	-0.5		0.8	V	
Input impedance		100		k Ω	10 kHz sine
Pulse width	100			ns	
Response time			620	ns	

Trigger Output

Parameter	Min.	Typ.	Max.	Unit	Condition
V _{OH}	3.8			V	I _{OH} = -8 mA
V _{OL}			0.44	V	I _{OL} = 8 mA
Output impedance		50		Ω	
Frequency			1	MHz	

Sync Output

Parameter	Min.	Typ.	Max.	Unit	Condition
V _{OH}	3.8			V	I _{OH} = -8 mA
V _{OL}			0.44	V	I _{OL} = 8 mA
Output impedance		50		Ω	
Pulse width		26.7		ns	
Frequency			5	MHz	

Modulation Input (AM/PM/FM/PWM)

Parameter	Min.	Typ.	Max.	Unit	Condition
Frequency	0		50	kHz	
Input impedance	10			kΩ	
Amplitude @ 100% Modulation depth	11	12	13	V _{pp}	
Modulation Input (ASK/PSK/FSK)					
Parameter	Min.	Typ.	Max.	Unit	Condition
V _{IH}	2		5.5	V	
V _{IL}	-0.5		0.8	V	
Input impedance		100		kΩ	10 kHz sine
Pulse width	100			ns	

General Characteristics

Power

Parameter	Min.	Typ.	Max.	Unit	Condition
Voltage	100 – 240 V _{rms} (± 10%), 50/60 Hz				
	100 – 120 V _{rms} (± 10%), 400 Hz				
Power consumption		30	50	W	

Display

Display type	7 TFT LCD with capacitive touch screen				
Resolution	1024 x 600				
Contrast (typical)	500:1				
Backlight (typical)	500 nit				

Environment

Parameter	Min.	Typ.	Max.	Unit	Condition
Operating temperature	0		40	°C	
Storage temperature	-20		60	°C	
Operating humidity	5		90	%	≤ 30 °C
	5		50		40 °C
Non-operating humidity	5		95	%	
Operating altitude			3048	m	≤ 30 °C
Non-operating altitude			15000	m	
EMC/EMI	EMC directive (2014/30/EU), IEC 61326-1:2021				

Safety	UL 61010-1:2012/R: 2024-11; CAN/CSA-C22.2 No. 61010-1:2012/U4:2024-11				
RoHS	EU 2015/863				
Calibration					
Parameter	Min.	Typ.	Max.	Unit	Condition
Calibration interval		1		year	
Mechanical					
Parameter	Min.	Typ.	Max.	Unit	Condition
Dimensions	W×H×D = 312.02 mm × 162.29 mm × 126.4 mm				
Net weight		2.73		kg	
Gross weight		3.7		kg	

Ordering Information

Product Model	Description
SDG3082X	80 MHz, 2 CH, 1.2 GSa/s, 16-bit, 20 Mpts, Sequence playback
SDG3162X	160 MHz, 2 CH, 1.2 GSa/s, 16-bit, 20 Mpts, Sequence playback
SDG3202X	200 MHz, 2 CH, 1.2 GSa/s, 16-bit, 20 Mpts, Sequence playback

Standard Configurations	Quantity
Quick Start	1
Power Cord	1
USB Cable	1
BNC Cable	1
Calibration Certificate	1

Optional Configurations	Model
IQ Signal Generator Function	SDG-3000X-IQ
40 Mpts Waveform Memory	SDG-3000X-40MPTS
20 dB Attenuator	ATT-20 dB
USB-GPIB Adapter	USB-GPIB
BNC Coaxial Cable	SDG-BNC
10W Power Amplifier	SPA1010



About SIGLENT

SIGLENT is an international high-tech company, concentrating on R&D, sales, production and services of electronic test & measurement instruments.

SIGLENT first began developing digital oscilloscopes independently in 2002. After more than a decade of continuous development, SIGLENT has extended its product line to include digital oscilloscopes, isolated handheld oscilloscopes, function/arbitrary waveform generators, RF/MW signal generators, spectrum analyzers, vector network analyzers, digital multimeters, DC power supplies, electronic loads and other general purpose test instrumentation. Since its first oscilloscope was launched in 2005, SIGLENT has become the fastest growing manufacturer of digital oscilloscopes. We firmly believe that today SIGLENT is the best value in electronic test & measurement

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