# SDG6000X Series Pulse/Arbitrary Waveform Generator



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SIGLENT TECHNOLOGIES CO..LTD

**SDG6052X** 

**SDG6032X** 

**SDG6022X** 

#### **Overview**

SIGLENT'S SDG6000X is a series of dual-channel Pulse/ Arbitrary Waveform Generators that feature up to 500 MHz bandwidth, a maximum sample rate of 2.4 GSa/s and 16-bit vertical resolution. They also include proprietary TrueArb & EasyPulse technology that help to solve the weaknesses inherent in traditional DDS generators when generating arbitrary, square and pulse waveforms. In addition, the SDG6000X is a multi-function device which can generate Noise, IQ signals and PRBS patterns. These features enable the SDG6000X to provide a variety of high fidelity and low jitter signals, meeting the growing requirements of complex and intensive applications.



## **Key Features**

- Dual-Channel, 500 MHz maximum bandwidth, 20 Vpp maximum output amplitude, high fidelity output with 80 dB dynamic range
- High-performance sampling system with 2.4 GSa/s sampling rate and 16-bit vertical resolution
- Multi-function signal generator, meeting requirements in wide range

Sine	Continuous Wave Generator	Up to 500 MHz sine wave, supporting sweep and user-defined harmonics. Low cost replacement of RF signal generators below 500 MHz
Pulse	Pulse Generator	Up to 150 MHz Pulse, with finely adjustable width, rising edge and falling edge; 3.3 ns minimum width and 1 ns minimum edge at full frequency range
Arb	Function Arbitrary Waveform Generator	Basic Function/Arbitrary Waveform Generator and complex signals generating capability including modulation, sweep, burst and waveform combination.
1/Q ####	IQ Signal Generator (optional)	Base Band and IF IQ signals supporting basic modulation and an arbitrary symbol rate between 250 Symb/s ~ 37.5 MSymb/s
Noise 	Noise Generator	Up to 500 MHz bandwidth White Gaussian Noise with adjustable bandwidth
PRBS	PRBS Generator	Up to 300 Mbps PRBS3 ~ PRBS32 with fine bit rate and edge adjustments

- Sweep and Burst function
- Harmonics function
- Maveform Combining function
- 196 built-in arbitrary waveforms
- Standard interfaces include: USB Host, USB Device (USBTMC), LAN (VXI-11, Socket, Telnet). Optional Interface: GPIB
- 4.3" touch screen display for easier operation

Model	SDG6022X	SDG6032X	SDG6052X				
Bandwidth	200 MHz	350 MHz	500 MHz				
Number of channels	2						
Sampling rate	2.4 GSa/s (2X Interpolation)						
Vertical resolution	16 bit						
Arbitrary waveform length	2 ~ 20 Mpts						
Display	4.3" touch screen display, 480 x 272 x RGB						
Interface	Standard: USB Host, USB Device, LAN Optional: GPIB (USB-GPIB adaptor)						

# Characteristics

#### Continuous Wave



Up to 500MHz continuous sine wave.







Pulse

#### Adjustable Pulse Width

The pulse width can be fine-tuned to the minimum of 3.3ns with an adjustment step as small as 100 ps, at any frequency.

Adjustable Edge

The rise/fall times can be set independently to the minimum of 1ns at any frequency with a minimum adjustment step as small as 100  $\,\rm ps.$ 

#### Low Jitter

When a Square/Pulse waveform is generated by traditional DDS, there can be additional jitter if the sampling rate is not an integerrelated multiple of the output frequency. EasyPulse technology successfully overcomes this weakness in DDS designs and helps to produce low jitter Square/Pulse waveforms.

#### Arbitrary Waveform

Traditional DDS designs can lead to additional jitter and distortion when sourcing arbitrary waveforms. The SIGLENT TrueArb design minimizes jitter and distortion to help deliver high fidelity arbitrary waveforms.



#### Point by Point Output

TrueArb generates arbitrary waveforms point-by-point. It never skips any point so that it can reconstruct all the details of the waveform, as defined. Two interpolation modes are available: linear and zero-order hold.



#### Low Jitter

As with EasyPulse, TrueArb effectively overcomes the clock jitter that can effect traditional DDS generators.



#### Arbitrary Waveform Software EasyWave

EasyWave is an arbitrary waveform software platform that supports waveform creation and editing. It features manual drawing, as-wellas line, equation, and coordinate editing modes. It is also a convenient way for users to edit their own arbitrary waveforms.

#### Noise



Gaussian noise with bandwidth up to 500 MHz. The repetition period is more than 100 years, and the bandwidth is adjustable.



Wideband Gaussian noise can be easily added to other waveforms to simulate real-world scenarios in which the signal contains a large degree of noise. WWW.SIGLENT.COM

#### IQ (optional)





The SDG6000X supports popular modulation types such as ASK, FSK, PSK, and QAM. Proprietary resampling technology provides excellent EVM performance at arbitrary symbol rates between 250 Symb/s  $\sim$  37.5 MSymb/s. Built-in digital quadrature modulator provides the possibility to generate IQ signals from baseband to 500 MHz intermediate frequency.



IQ waveforms can be generated by the PC software EasyIQ.

#### PRBS



PRBS3  $\sim$  PRBS32 with finely adjustable  $10^{\text{-6}}$  bps  $\sim$  300 Mbps bit rate and 1 ns  $\sim$  1us edge.

CH1:PF	RBS.ON.50	Ω	CH2:PRBS.ON.50Ω				
			Bit Rate Amplitude Offset Length Rise/Fall	122.880 800.0m <sup>3</sup> 850.0m <sup>3</sup> <b>PRBS-3</b> 2.0ns	000Mbps Vpp Vdc 0		
			Load Output	50 Ω ON			
TTL/CMOS	LVTTL LVCOMS	ECL	LVPECL	LVDS	Differential ON		

Preset common logic levels such as TTL, LVCMOS, LVPECL and LVDS. An added differential mode provides an easy way to generate differential signals using the both channels.



#### High Fidelity Output with 80dB Dynamic Range



Large Signals at High Frequencies Dual-channel, 20 Vpp amplitude sine wave guaranteed at up to 40 MHz.



**Small Signals** Low noise floor, improves signal-to-noise ratio.

#### Complex Signals Generation



#### Modulation

Plenty of modulation types, such as AM, FM, PM, FSK, ASK, PSK, DSB-AM, PWM are supported. The modulation source can be configured as "Internal" or "External".



#### Sweep and Burst

Sweep modes include "Linear" and "Log". Burst modes includes "N cycle" and "Gated". Both Sweep and Burst can be triggered by "Internal", "External" or "Manual" source.

#### Waveform Combining

The waveform combining function superimposes CH1 and CH2 waveforms internally and provides the combined waveform to a user-selected output. Easily combine basic waveforms, random noise, modulation signals, sweep signals, burst signals, EasyPulse waveforms and TrueArb waveforms



#### **Harmonics Function**

Harmonics function gives you the ability to add higher-order elements to your signal.

°CH1:Sine.ON.50Ω	CH2:Sine.ON.50Ω	10 1	
$\sim$	Frequency 100.000 000kHz Amplitude 0.000dBm	-10 Marker 🎍 2 4	
	Offset 0.000 Vdc Phase 0.000 0 °	-20 .30 200.000 kHz -20 26 dBm	
	Harm Type All Harm Order 2		8
1 2 3 4 5 6 7 8 9 10 F	Harm Ampl <mark>-20,000dBc</mark> Harm Phase 0.000 0 ° 🔒 😤	-60 -70	9
Type Order Harmoni	C Harmonic Return	-80	- Annala - A

#### I Two Dual-channel Operation Mode



"Phase-Locked" mode automatically aligns the phases of each output. While "Independent" mode permit the two channels to be used as two independent generators. Independent mode also smoothes parameter (frequency, amplitude) changes made to an active channel.

#### Frequency Counter

Counter:0N								
Value Mean Min Max Sdev	Fr 9.9 9.9 9.9 9.9	equency )99 997 OMHz )99 996 8MHz )99 996 6MHz )99 997 OMHz )000 000 0 Hz 2	Pwidth 50.2ns 50.2ns 50.1ns 50.2ns 50.2ns 0.000 000 s	C 5 5 5 5 5 5	Outy i0.2 % i0.2 % i0.1 % i0.2 % i3 m%	Freq Dev -0.300ppi -0.322ppi -0.340ppi -0.300ppi 0.010ppm	r m m m n	
Ref Fro	eq	2 [10	.000 000MHz		22	122	6 문물	
State On		Frequency Period	Pwidth Nwidth	Reff Trig	<sup>-</sup> req Lev	Setup	Clear	

8-digit hardware frequency counter with statistics function and input range of 0.1 Hz  $\sim$  400 MHz.

All specifications apply to both channels. Unless otherwise stated, all specifications are not guaranteed unless the following conditions are met:

- The generator is within the valid calibration period
- The generator has been working continuously for at least 30 minutes at a specified temperature (18  $^\circ$ C  $\sim$  28  $^\circ$ C )

Frequency								
Parameter	Min.	Тур.	Max.	Unit	Condition & Note			
Resolution	1μ			Hz				
- ··· I	-1		+1	ppm	<b>25℃</b>			
	-2		+2	ppm	0~40℃			
1 <sup>st</sup> -year aging	-1		+1	ppm	<b>25℃</b>			
10-year aging	-3.5		+3.5	ppm	25℃			

Sine					
Parameter	Min.	Тур.	Max.	Unit	Condition & Note
	1μ		500M	Hz	SDG6052X
Frequency	1µ		350M	Hz	SDG6032X
	1µ		200M	Hz	SDG6022X
			-65	dBc	0 dBm, 0~1 MHz ( included )
			-60	dBc	0 dBm, 1~60 MHz ( included )
Harmonic distortion			-50	dBc	0 dBm, 60~100 MHz ( included )
			-40	dBc	0 dBm, 100~200 MHz ( included )
			-30	dBc	0 dBm, 200~300 MHz ( included )
			-28	dBc	0 dBm, above 300 MHz
Total Harmonic Distortion			0.075	%	0 dBm, 10 Hz ~ 20 kHz
Non harmonic courious			-60	dBc	0 dBm, ≤350 MHz
Non-narmonic spurious			-55	dBc	0 dBm, >350 MHz
	2m		20	Vpp	≤ 40 MHz, HiZ load
	2m		10	Vpp	40 MHz $\sim$ 120 MHz ( included ), HiZ load
Output Range (Note)	2m		5	Vpp	120 MHz $\sim$ 160 MHz ( included ), HiZ load
	2m		3	Vpp	160 MHz $\sim$ 350 MHz ( included ), HiZ load
	2m		1.28	Vpp	above 350MHz, HiZ load
Harmonics Order			10		
Туре	Even, Odd, All				

Note : The specification will be divided by 2 while applied to a  $50\Omega$  load.

SDG6000X Pulse/Arbitrary Waveform Generator

Pulse					
Parameter	Min.	Тур.	Max.	Unit	Condition & Note
Frequency	1µ		150 M	Hz	SDG6052X, SDG6032X
riequency	1µ		80 M	Hz	SDG6022X
Pulce Width	3.3			ns	SDG6052X, SDG6032X
	3.4			ns	SDG6022X
Pulse width resolution	100			ps	
Pulse width accuracy			±(0.01%+0.3ns)		
Rise time	1n			S	SDG6052X, SDG6032X 10% ~ 90%
( setting range )	2n			S	SDG6022X 10% ~ 90%
Fall time	1n			S	SDG6052X, SDG6032X 90% ~ 10%
(setting range )	2n			S	SDG6022X 90% ~ 10%
Rise time (specified range)	2n			s	10% $\sim$ 90%. Overshoot, jitter, output range and pulse width
Fall time (specified range)	2n			S	accuracy specifications are only guaranteed in specified rise/fall times range
Rise/fall times resolution	100			ps	
Overshoot			3	%	100 kHz, 1 Vpp, 50 $\Omega$ load , 2 ns edge
Duty cycle	0.001		99.999	%	Limited by frequency setting
Duty cycle resolution	0.001			%	
Jitter (rms) cycle to cycle			100	ps	1 Vpp, 50Ω load
	2m		20	Vpp	$\leq$ 20 MHz, HiZ load , 2ns edge , $\geq$ 10 ns width
Output Range (Note)	2m		10	Vpp	20 MHz $\sim$ 120 MHz ( included ), HiZ load , 2ns edge , $\geq$ 10 ns width
	2m		5	Vpp	Above 120 MHz , HiZ load , 2ns edge , $\geq$ 10 ns width

Note : The specification will be divided by 2 while applied to a  $50\Omega$  load.

Square					
Parameter	Min.	Тур.	Max.	Unit	Condition & Note
Frequency	1μ		120M	Hz	SDG6052X, SDG6032X
Trequency	1µ		80M	Hz	SDG6022X
Rise /fall times		2	2.4	ns	10% ~ 90%, 1 Vpp, 50 $\Omega$ load
Overshoot			3	%	100 kHz, 1 Vpp, 50Ω load
Duty cycle	10		90	%	Limited by frequency setting
Jitter (rms) cycle to cycle			100	ps	1 Vpp, 50Ω load
Output Range (Note)	2m		20	Vpp	$\leq$ 20 MHz, HiZ load
	2m		10	Vpp	Above 20 MHz , HiZ load

Note : The specification will be divided by 2 while applied to a  $50\Omega$  load.

Ramp					
Parameter	Min.	Тур.	Max.	Unit	Condition & Note
Frequency	1μ		5M	Hz	
Symmetry	0		100	%	
Linearity			1	%	Percentage of peak output, 1 kHz, 1 Vpp, 50% symmetry
Output Range (Note)	2m		20	Vpp	

Note : The specification will be divided by 2 while applied to a  $50\Omega$  load.

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Noise							
Parameter	Min.	Тур.	Max.	Unit	Condition & Note		
		500		MHz	SDG6052X		
Bandwidth (-3dB)		350		MHz	SDG6032X		
		200		MHz	SDG6022X		
Bandwidth setting range	1m		BW	Hz	BW is the max. frequency		
Output Range (Note)	2m		1.084	Vrms	Mean = 0 Bandwidth limit = OFF		

Note : The specification will be divided by 2 while applied to a  $50\Omega$  load.

#### Arbitrary Wave

Parameter	Min.	Тур.	Max.	Unit	Condition & Note			
Frequency setting range	1µ		50M	Hz				
Waveform length	2		20M	pts				
Sampling rate	1u		300M	Sa/s	TrueArb mode			
Sampling fate	1.2G			Sa/s	DDS mode			
Vertical resolution		16		bit				
Rise/fall times		2.6		ns	10% $\sim$ 90%, 1Vpp step signal , DDS mode			
Jitter (rms) cycle to cycle			100	ps	1 Vpp, 50 $\Omega$ load , TrueArb mode			
Output Range (Note)	2m		20	Vpp	$\leq$ 20 MHz, HiZ load			
	2m		10	Vpp	Above 20 MHz , HiZ load			

Note : The specification will be divided by 2 while applied to a  $50\Omega$  load.

DC								
Parameter	Min.	Тур.	Max.	Unit	Condition & Note			
Output Range	-10		10	V	HiZ load			
	-5		5	V	50Ω load			
Accuracy			±(1%+2mV)		HiZ load			

IQ (optional)								
Parameter	Min. Typ. Max.			Unit	Condition & Note			
Symbol rate	250		37.5M	Symb/s	Limited by the oversampling factor			
Vertical resolution	16 bit							
Modulation type	2ASK, 4ASK, 8/ 8QAM, 16QAM, 8FSK, 16FSK, M	ASK, BPSK, QPSK 32QAM, 64QAM, SK, MultiTone, cus	, 8PSK, DBPSK, 128QAM, 256QA stom	DQPSK, D8PSK, M, 2FSK, 4FSK,	Supported by EasyIQ software			
Pattern	PN7, PN9, PN15	, PN23, User file,	Custom		Supported by EasyIQ software			
Output Range	1m		0.5	Vrms	$\sqrt{I^2+Q^2}$ , 50  load			
			500M	Hz	SDG6052X			
Carrier frequency			350M	Hz	SDG6032X			
			200M	Hz	SDG6022X			

PRBS					
Parameter	Min.	Тур.	Max.	Unit	Condition & Note
Rit rate	1u		300M	bps	SDG6052X, SDG6032X
Dit Tate	1u		160M	bps	SDG6022X
Sequence length	$2^{m-1}$ , m = 3, 4, .	, 32			
Pice/fall times	1n		1u	S	SDG6052X, SDG6032X. 10% $\sim$ 90%, 1 Vpp, 50 $\Omega$ load
Rise/rail unles	2n		1u	S	SDG6022X. 10% $\sim$ 90%, 1 Vpp, 50 $\Omega$ load
	2m		20	Vpp	$\leq$ 40 Mbps, HiZ load ,
Output Range (Note)	2m		10	Vpp	40 $\sim$ 240 Mbps ( included ), HiZ load
	2m		5	Vpp	Above 240 Mbps , HiZ load

Note : The specification will be divided by 2 while applied to a  $50\Omega$  load.

Output					
Parameter	Min.	Тур.	Max.	Unit	Condition & Note
Accuracy	±(1%+1mVpp)				10 kHz sine, 0 V offset
Amplitude flatness	-0.3		+0.3	dB	$50\Omega$ load, 0.5 Vpp, compare to 1MHz Sine
Output impedance	49.5	50	50.5	Ω	100 kHz sine
Output current	-200		200	mA	
Crosstalk			-60	dBc	CH1=CH2=0 dBm, Sine, 50 $\Omega$ load
Protection	Current limiting,	Over voltage pro	tection		
Current-limit threshold		±200		mA	
Over voltage protection	±3.5	±4	±4.5	V	The amplitude of the generator <3.2Vpp and the DC offset < 2VDC
threshold	±10.5	±11	±11.5	v	The amplitude of the generator $\geq$ 3.2Vpp or the DC offset $\geq$  2VDC

Modulation						
AM						
Parameter	Min.	Тур.	Max.	Unit	Condition & Note	
Carrier	Sine, Square, Ra	amp, Arb				
Modulation source	Internal/Externa	I				
Modulation wave	Sine, Square, Ra	mp, Noise, Arb				
Modulation depth	0		120	%		
Modulation frequency	1m		1M	Hz	While modulation source is "Internal"	
FM						
Parameter	Min.	Тур.	Max.	Unit	Condition & Note	
Carrier	Sine, Square, Ra	amp, Arb				
Modulation source	Internal/Externa	I				
Modulation wave	Sine, Square, Ra	mp, Noise, Arb				
Frequency deviation	0		0.5*BW		BW is the max. frequency. Limited by frequency setting	
Modulation frequency	1m		1M	Hz	While modulation source is "Internal"	
РМ						
Parameter	Min.	Тур.	Max.	Unit	Condition & Note	
Carrier	Sine, Square, Ra	amp, Arb				
Modulation source	Internal/External					
Modulation wave	Sine, Square, Ra	mp, Noise, Arb				
Phase deviation	0		360	0		
Modulation frequency	1m		1M	Hz	While modulation source is "Internal"	

Min.	Тур.	Max.	Unit	Condition & Note	
Sine, Square, Ra	amp, Arb				
Internal/Externa	I				
Square with 50%	6 duty cycle				
1m		1M	Hz	While modulation source is "Internal"	
Min.	Тур.	Max.	Unit	Condition & Note	
Sine, Square, Ra	imp, Arb				
Internal/Externa	I				
Square with 50%	6 duty cycle				
1m		1M	Hz	While modulation source is "Internal"	
Min.	Тур.	Max.	Unit	Condition & Note	
Sine, Square, Ra	imp, Arb				
Internal/Externa	I				
Square with 50%	6 duty cycle				
1m		1M	Hz	While modulation source is "Internal"	
Min.	Тур.	Max.	Unit	Condition & Note	
Pulse					
Internal/External					
Sine, Square, Ra	imp, Noise, Arb				
1m		1M	Hz	While modulation source is "Internal"	
	Min.       Sine, Square, Ra       Internal/External       Square with 50%       1m       Sine, Square, Ra       Internal/External       Square with 50%       1m       Sine, Square, Ra       Internal/External       Square with 50%       1m       Square with 50%       1m       Square with 50%       1m       Sine, Square, Ra       Internal/External       Square with 50%       1m       Square with 50%       1m	Nin.Typ.Sine, Square, JArbanSine, Square with 32*Siquare with 32*Square with 32*Typ.ImTyp.Min.Typ.Sine, Square, JArbanSquare with 32*ArbanSquare with 32*ArbanSine, Square, JTyp.Sine, Square, JTyp.Sine, Square, JArbanSine, Square, JArbanSine, Square, JArbanSine, Square, JArbanSine, Square, JArbanSine, Square, JTyp.Sine, Square, JTyp.Min.Typ.Sine, Square, JTyp.Sine, Square, STyp.Sine, Square, STyp.Sine, Square, STyp.Sine, Square, STyp.Sine, S<	Min.Typ.Max.Min.Typ.Max.Sine, Square, W, ArbISquare with 50* Uty cycleMax.ImIMax.Min.Typ.Max.Sine, Square, W, ArbMax.Sine, Square, W, ArbISquare with 50* Uty cycleISquare with 50* Uty cycleIMin.Typ.Max.Min.Typ.Max.Square with 50* Uty cycleIMin.Typ.Max.Sine, Square, ArbISine, Square, ArbISquare with 50* Uty cycleIInternal/ExterIMin.Typ.Max.Min.Typ.Max.Min.Typ.Max.Min.Typ.Max.Internal/ExterISine, Square, Noise, ArbISine, Square, Noise, ArbIMin.Typ.Min.Max.Min.Typ.Min.Max.Min.Typ.Min.Max.Min.Typ.Min.Max.Min.Typ.Min.Max.Min.Max.Min.Max.Min.Max.Min.Max.Min.Max.Min.Max.Min.Max.Min.Max.Min.Max.Min.Max.Min.Max.Min.Max.Min.Max.Min.	Nin.Typ.Max.UnitSine,Square,W, ArbVarianSineSquare with South CycleInAndSquare with South CycleInMax.Min.Typ.Max.UnitMin.Typ.Max.UnitSine,Square,W, ArbVarianMax.Square with South CycleInMax.Square with South CycleInMax.Square with South CycleMax.Max.Min.Typ.Max.Max.Min.Typ.Max.Max.Sine,Square,W, ArbInitMax.Square with South CycleInitMax.Min.Typ.Max.Max.Min.Typ.Max.Max.Square with South CycleInitMax.Sine,Square, Factor South CycleInitMin.Typ.Max.Max.Min.Typ.Max.Max.Min.Typ.Max.Max.Min.Typ.Max.Max.Sine,Square, Factor South CycleVarianMax.Sine,Square, Factor South CycleVarianMax.Min.Typ.Max.Max.Min.Typ.Max.Max.Sine,Square, Factor South CycleVarianMax.Min.Max.Max.Max.Min.Max.Max.Max.Min.Max.Max.Max.Min.Max.Max.Max.Min.Max.Max.Max. </td	

Burst								
Parameter	Min.	Тур.	Max.	Unit	Condition & Note			
Carrier	Sine, Square, Ra	mp, Pulse, Noise,	Arb					
Туре	Count (1-100000	Count (1-1000000 periods), Infinite, Gated						
Carrier frequency	2m		BW	Hz	BW is the max. output frequency			
Start/Stop phase	0		360	0				
Internal period	1µ		1000	S				
Trigger source	Internal, Externa	Internal, External, Manual						
Gated source	Internal/Externa	Internal/External						
Trigger delay			100	S				

Sweep									
Parameter	Min.	Тур.	Max.	Unit	Condition & Note				
Carrier	Sine, Square, Ra	Sine, Square, Ramp, Arb							
Туре	Linear, Logarithn	nic							
Direction	Linear: Up, Down, Up & Down Logarithmic: Up, Down								
Carrier frequency	1µ		BW	Hz	BW is the max. output frequency				
Sweep time	1m		500	S					
Trigger source	Internal, External, Manual								

#### SDG6000X Pulse/Arbitrary Waveform Generator

Frequency Counter								
Parameter	Min.	Тур.	Max.	Unit	Condition & Note			
Function	Frequency, Perio	d, Positive/Negati	ve Pulse Width, Du	uty Cycle				
Coupling mode	AC, DC, HF REJ							
Frequency range	100m		400M	Hz	DC coupling			
	1		400M	Hz	AC coupling			
	100mVrms		±2.5V		DC coupling , < 100 MHz			
	200mVrms		±2.5V		DC coupling , 100 MHz $\sim$ 200MHz			
Input amplitude	500mVrms		±2.5V		DC coupling , Above 200 MHz			
	100mVrms		5 Vpp		AC coupling , < 100 MHz			
	200mVrms		5 Vpp		AC coupling , 100 MHz $\sim$ 200MHz			
	500mVrms		5 Vpp		AC coupling , Above 200 MHz			
Input impedance		1M		Ω				

Reference Clock								
10MHz Input								
Parameter	Min.	Тур.	Max.	Unit	Condition & Note			
Frequency	9.999M	10M	10.001M	Hz				
Amplitude	1.4			Vpp				
Input impedance	5			kΩ	AC coupling			
10MHz Output								
Parameter	Min.	Тур.	Max.	Unit	Condition & Note			
Frequency		10M		Hz	Synchronized to internal reference clock			
Amplitude	2	3.3		Vpp	HiZ load			
Output impedance		50		Ω				

# Auxiliary In/Out

Trigger Input								
Parameter	Min.	Тур.	Max.	Unit	Condition & Note			
V <sub>IH</sub>	2		5.5	V				
V <sub>IL</sub>	-0.5		0.8	V				
Input impedance	100			kΩ				
Pulse width	100			ns				
Posponso timo			100	ns	Sweep			
Response unie			600	ns	Burst			
Trigger Output								
Parameter	Min.	Тур.	Max.	Unit	Condition & Note			
V <sub>OH</sub>	3.8			V	$I_{OH} = -8 \text{ mA}$			
V <sub>OL</sub>			0.44	V	$I_{oL} = 8 \text{ mA}$			
Output impedance		100		Ω				
Frequency			1	MHz				

#### Sync Out Parameter Min. Тур. Max. Unit Condition & Note ٧ 3.8 $V_{\text{OH}}$ $I_{OH} = -8 \text{ mA}$ v $\rm V_{\rm OL}$ 0.44 $I_{OL} = 8 \text{ mA}$ Output impedance 100 Ω Pulse width 26.7 ns Jitter 3.3 ns Peak to peak Frequency 10 MHz **Modulation Input** Unit Parameter Min. Тур. Max. Condition & Note 0 50 kHz Frequency Input impedance 10 kΩ Amplitude @100% 11 12 13 Vpp modulation depth

General							
Power							
Parameter	Min	Typ	May	Unit	Condition		
randificter	100 - 240 Vrmc	(+ 10%) 50 / 60	Hz	onic	Condition		
Voltage	100 - 120 Vrms	(± 10%), 307 00 (± 10%), 400 Hz	112				
Power consumption		32.5	50	W	Dual channels, Sine, 1kHz, 10Vpp, 50 $\Omega$ load		
Display							
Parameter	Min.	Тур.	Max.	Unit	Condition & Note		
Color depth		24		bit			
Contrast Ratio		350:1					
Luminance		300		cd/m <sup>2</sup>			
Touch Screen Type		Resi	stive				
Environment							
Parameter	Min.	Тур.	Max.	Unit	Condition & Note		
Operating temperature	0		40	C			
Storage temperature	-20		60	C			
	5		90	%	≤ 30 °C		
Operating numicity	5		50	%	40 °C		
Non -operating humidity	5		95	%			
Operating altitude			3048	m	≤ 30 ℃		
Non –operating altitude			15000	m			
Calibration							
Parameter	Min.	Тур.	Max.	Unit	Condition & Note		
Calibration interval		1		year			
Mechanical							
Parameter	Min.	Тур.	Max.	Unit	Condition & Note		
Dimensions	$W \times H \times D = 260.$	3mm×107.2mm×	295.7mm				
Net weight		3.5		kg			
Gross weight		4.6		kg			
Compliance							
LVD	IEC 61010-1:20	10					
EMC	EN61326-1:2013	3					

SDG6000X Pulse/Arbitrary Waveform Generator

#### **Ordering Information**

-					
Product Description					
SDG6052X	500 MHz, 2-CH, 2.4 GSa/s, 16-bit				
SDG6032X	350 MHz, 2-CH, 2.4 GSa/s, 16-bit				
SDG6022X	200 MHz, 2-CH, 2.4 GSa/s, 16-bit				
Standard Configuratio	ns				
Quick start ×1					
Power cord ×1					
Calibration certificate $\times 1$					
USB cable ×1					
BNC coaxial cable x2					
<b>Optional Configuration</b>	15				
SPA1010	10W Power Amplifier				
ATT-20dB	20 dB Attenuator				
USB-GPIB	USB-GPIB Adapter				
SDG-RMK	Single Instrument Rack Mount Kit				
SDG-6000X-IQ	IQ Signal Generator Function				

# SDG6000X Series Pulse/Arbitrary Waveform Generator



#### 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, function/arbitrary waveform generators, digital multimeters, DC power supplies, spectrum analyzers, isolated handheld oscilloscopes and other general purpose test instrumentation. Since its first oscilloscope, the ADS7000 series, 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.

#### Headquarter:

SIGLENT TECHNOLOGIES CO., LTD. Add: Bldg No.4 & No.5, Antongda Industrial Zone, 3rd Liuxian Road, Bao'an District, Shenzhen, 518101, China. Tel: + 86 755 3661 5186 Fax: + 86 755 3359 1582 Email: sales@siglent.com; Website: http://www.siglent.com/ens/

#### USA:

SIGLENT Technologies America, Inc 6557 Cochran Rd Solon, Ohio 44139 Tel: 440-398-5800 Toll Free: 877-515-5551 Fax: 440-399-1211 Email: info@siglent.com Website: www.siglentamerica.com

#### **Europe:**

SIGLENT TECHNOLOGIES EUROPE GmbH ADD: Liebigstrasse 2-20, Gebaeude 14, 22113 Hamburg Germany Tel: +49(0)-819-95946 Fax: +49(0)-819-95947 Email: info-eu@siglent.com Website: www.siglenteu.com Follow us on Facebook: SiglentTech



# SDG2000X Series Function/Arbitrary Waveform Generator



DataSheet-2017.05



SIGLENT TECHNOLOGIES CO., LTD

# SDG2122X SDG2082X SDG2042X

#### **Overview**

SIGLENT'S SDG2000X is a series of dual-channel function/arbitrary waveform generators with specifications of up to 120MHz maximum bandwidth, 1.2GSa/s sampling rate and 16-bit vertical resolution. The proprietary TrueArb & EasyPulse techniques help to solve the weaknesses inherent in traditional DDS generators when generating arbitrary, square and pulse waveforms. With advantages above, SDG2000X can provide users with a variety of high fidelity and low jitter signals, which can meet the growing requirements of complex and extensive applications.

#### **Key Features**

- Dual-channel, 120MHz maximum bandwidth, 20Vpp maximum output amplitude, high fidelity output with 80dB dynamic range
- High-performance sampling system with 1.2GSa/s sampling rate and 16-bit vertical resolution. No detail in your waveforms will be lost
- Innovative TrueArb technology, based on a point-by-point architecture, supports any 8pts~8Mpts Arb waveform with a sampling rate in range of 1µSa/s~75MSa/s
- Innovative EasyPulse technology, capable of generating lower jitter Square or Pulse waveforms, brings a wide range and extremely high precision in pulse width and rise/fall times adjustment
- Plenty of analog and digital modulation types: AM、DSB-AM、 FM、PM、FSK、ASK、PSK and PWM
- Harmonic function
- 196 built-in arbitrary waveforms
- 🜆 High precision Frequency Counter
- Standard interfaces: USB Host, USB Device (USBTMC), LAN (VXI-11)
- 🜆 Optional interface: GPIB
- 4.3" touch screen display for easier operation



# **Models and Key Specifications**

Product Model	SDG2042X	SDG2082X	SDG2122X				
Bandwidth	40MHz	80 MHz	120 MHz				
Sampling rate	1.2 GSa/s (4X Interpolation)						
Vertical resolution	16 bit						
Num. of channels	2						
Max. amplitude	±10V						
Display	4.3" touch screen display, 480 x 272 x RGB	4.3" touch screen display, 480 x 272 x RGB					
Interface	Standard: USB Host, USB Device, LAN Optional: GPIB (USB-GPIB adaptor)						

# Characteristics

#### High-performance Sampling System

Benefiting from a 1.2GSa/s and 16-bit sampling system, SDG2000X achieves extremely high accuracy performance in both time domain and amplitude, which results in more accurately reconstructed waveforms and lower distortion.



# Characteristics

#### Excellent Analog Channel Performance



The bandwidth of analog channels proves to be greater than 120MHz, via doing a frequency response test with white noise.



 High fidelity sine output. Almost no spurious observed @60MHz, 0dBm.

Capacity of outputting large signal at high frequency. Dual-channel, 20 Vpp amplitude can be guaranteed even @20 MHz.



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				SDG2000X		SD	G2000X -	2mV outpu	ut for a second s
<u>.</u>	and the second second second								and the second second
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C1 07570 I	2 020	3 820				Othe	Products:	2mV outpu	Tringer Fille
1.00 mWdiv 1.3 mV offset	1.00 mV/div -2.0 mV ofst	1.00 mV/div 3.2 mV offset						500 µs/di 10.0 kS 2.00 MS/	v Auto -250 µ s Edge Positiv

Low noise floor, improves signal-noise ratio.

#### Innovative EasyPulse Technology



EasyF	Pulse					
1.001MHz	Pulse		— Pei = 64.	riod Jitter 6ps rms		
dese ire	P1-neriod(C1)	P2:0/sh+(C1)				
lue	998.999 ns	1.6 %				
ean	998.99657 ns	1.4326 %				
	998.810 ns	841 m%				
	999.192 ns	2.2 %				
ev	64.64 ps	261.5 m%				
im	502	502				
1 0050 Z1	zoom(C1)			1	imebase -502 ni	Trigger 🔜
100 mV/div 0.0 mV offset	100 mV/div 10.0 ns/div			e	200 ns/di .00 kS 4.00 GS/	vAuto On sEdge Positi

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. SDG2000X EasyPulse technology successfully overcomes this weakness in DDS designs and helps to produce low jitter Square/Pulse waveforms.



The Pulse width can be fine-tuned to the minimum of 16.3ns with the adjustment step as small as 100ps.



The rise/fall times can be set independently to the minimum of 8.4ns at any frequency and to the maximum of 22.4s. The adjustment step is as small as 100 ps.

#### Innovative TrueArb Technology

For arbitrary waveforms, TrueArb not only has all the advantages of traditional DDS, but also eliminates the probability that DDS may cause serious jitter and distortion.



TrueArb generates arbitrary waveforms point by point, never skips any point so that it can reconstruct all the details of the waveform as defined.



As with EasyPulse, TrueArb effectively overcomes the defect that DDS may cause the one-clock-jitter in arbitrary waveforms.

# Characteristics

#### Modulation

CH1:Si	ne.OFF.HiZ	. Mod	CH2:Sir	ne.OFF.500	2
	$\mathbb{N}$	K,	Frequency Amplitude Offset Phase	<ul> <li>1.00000</li> <li>6.000 ∨i</li> <li>0.000 ∨i</li> <li>0.0 °</li> </ul>	OkHz op dc
AM Depth AM Freq	12 <mark>0.0 %</mark> 100.000	6 0000 Hz	Load Output	HiZ OFF	
AM	FM	РМ	FSK	ASK	DSB-AM

SDG2000X supports plenty of modulation types, such as AM, FM, PM, FSK, ASK, PSK, DSB-AM, and so on. The modulation source can be configured as "Internal" or "External".

#### Sweep

CH1:Si	ne.OFF.HiZ	Sweep	CH2:Squ	are.OFF.H	iZ Mod
	HAAH	<b>.</b>	Frequency Amplitude Offset Phase	7 10.0000 6.000 ∀r 0.000 ∀r 0.000 ∀r	00kHz op dc
Sweep Tii	ne <mark>1.00000</mark>	)0 s			
Start Freq	0.00000	)0 Hz	Load	HiZ	
Stop Freq 20.000000kHz			Output	OFF	문 <mark>문</mark>
Sweep	StartFreq	StopFreq	Source	Trig Out	Page
Time	CenterFreq	FreqSpan	Internal	Off	1/2 ⊨

SDG2000X supports two Sweep modes, "Linear" and "Log". Two Sweep directions, "Up" and "Down" and three Sweep sources, "Internal", "External" and "Manual".

#### 4.3" Touch Screen Display



4.3" touch screen display, makes operation much more convenient.

#### 🚣 Burst

CH1:Si	ne.OFF.HiZ	Burst	CH2:Squ	are.OFF.H	iZ Mod
			Frequency Amplitude Offset Phase	10.0000 6.000 V) 0.000 V0 0.0 °	00kHz op dc
Start Phas Cycles Burst Per	se 0.0 ° 100000 iod 100.000	0 <mark>Cycle</mark> )001 s	Load Output	HiZ OFF	5
NCycle Gated	Cycles Infinite	Start Phase	Burst Period	Source Internal	Page 1/2 ►

SDG2000X supports two Burst modes, "N cycle" and "Gated". The Burst source can be configured as "Internal", "External" or "Manual"

#### Frequency Counter



High precision Frequency Counter with an input frequency range of  $0.1 \text{Hz} \sim 200 \text{MHz}.$ 



#### Arbitrary Waveform Software EasyWave

EasyWave is a powerful arbitrary waveform editing software that supports several ways to generate arbitrary waveform such as manual drawing, line-drawing, equation-drawing, coordinate-drawing, etc. It is quite convenient for users to edit their own arbitrary waveforms through EasyWave.

All specifications apply to both channels. Unless otherwise stated, all specifications are not guaranteed unless the following conditions are met:

- The generator is within calibration period of validity
- The generator has been working continuously for at least 30 minutes at a specified temperature (18 % ~ 28 % ).

Frequency Characteristics								
Parameter	Min.	Тур.	Max.	Unit	Condition			
Resolution			1μ	Hz				
Initial accuracy	-1		+1	ppm	<b>25</b> ℃			
	-2		+2	ppm	0~40℃			
1 <sup>st</sup> -year aging	-1		+1	ppm	<b>25℃</b>			
10-year aging	-3.5		+3.5	ppm	<b>25</b> ℃			

Sine Characteristics										
Parameter	Min.	Тур.	Max.	Unit	Condition					
Frequency	1μ		120M	Hz	SDG2122X					
	1μ		80M	Hz	SDG2082X					
	1μ		40M	Hz	SDG2042X					
Harmonic distortion			-65	dBc	0 dBm, 0~10 MHz (Included)					
			-60	dBc	0 dBm, 10~20 MHz (Included)					
			-55	dBc	0 dBm, 20~40 MHz (Included)					
			-50	dBc	0 dBm, 40~60 MHz (Included)					
			-45	dBc	0 dBm, 60~80 MHz (Included)					
			-40	dBc	0 dBm, 80~100 MHz (Included)					
			-38	dBc	0 dBm, 100~120 MHz (Included)					
Total Harmonic Distortion			0.075	%	0 dBm, 10 Hz ~ 20 kHz					
Non-harmonic spurious			-70	dBc	≤50 MHz					
			-65	dBc	>50 MHz					

Square Characteristics									
Parameter	Min.	Тур.	Max.	Unit	Condition				
Frequency	1µ		25M	Hz					
Rise/fall times			9	ns	10% ~ 90%, 1 Vpp, 50ΩLoad				
Overshoot			3	%	100 kHz, 1 Vpp, 50ΩLoad				
Duty cycle	0.001		99.999	%	Limited by frequency setting				
Jitter (rms), Cycle to cycle			150	ps	1 Vpp, 50Ω Load				

Pulse Characteristics								
Parameter	Min.	Тур.	Max.	Unit	Condition			
Frequency	1μ		25M	Hz				
Pulse width	16.3			ns				
Pulse width accuracy			±(0.01%+0.3ns)					
Rise/fall times	8.4n		22.4	S	$10\% \sim 90\%,  1$ Vpp, $50\Omega$ Load, Subject to pulse width limits			
Overshoot			3	%	100 kHz, 1 Vpp			
Duty cycle	0.001		99.999	%	Limited by frequency setting			
Duty cycle resolution	0.001			%				
Jitter (rms) cycle to cycle			150	ps	1 Vpp, 50Ω Load			

Noise Characteristics								
Parameter	Min.	Тур.	Max.	Unit	Condition			
-3dB bandwidth	120			MHz				
Adjustable bandwidth range	20		120	MHz				

Ramp Characteristics							
Parameter	Min.	Тур.	Max.	Unit	Condition		
Frequency	1μ		1M	Hz			
Symmetry	0		100	%			
Linearity			1	%	Percentage of peak-peak output, 1kHz, 1Vpp, 100% symmetry		
Arbitrary Wave characteristics							
Parameter	Min.	Тур.	Max.	Unit	Condition		
Frequency	1μ		20M	Hz			
Waveform length	8		8M	pts			
Sampling rate	1μ		75M	Sa/s	TrueArb mode		
	300			MSa/s	DDS mode		
Vertical solution	16			bit			
jitter (rms)			150	ps	1 Vpp, 50 $\Omega$ Load, TrueArb mode		
DC Characteristics							
Parameter	Min.	Тур.	Max.	Unit	Condition		
Range	-10		10	V	HiZ load		
	-5		5	V	50Ωload		
Accuracy	±(1%+2mV)				HiZ load		
Harmonic Output Chara	cteristics						
Parameter	Min.	Тур.	Max.	Unit	Condition		
Order			10				
Туре	Even, Odd, All						
Output Characterisics							
Parameter	Min.	Тур.	Max.	Unit	Condition		
Range	2m		20	Vpp	≤20MHz, HiZ load		
(Note 1)	2m		10	Vpp	>20MHz, HiZ load		
Accuracy	±(1%+1mVpp)				10 kHz sine, 0 V offset		
Amplitude flatness	-0.3		+0.3	dB	$0{\sim}100$ MHz (Included), $50\Omega$ load, 2.5Vpp, compare to 10kHz Sine		
	-0.4		+0.4	dB	100~120 MHz (Included), 50 $\Omega$ load, 2.5Vpp, compare to 10kHz Sine		
Output impedance	49.5	50	50.5	Ω	10kHz sine		
Output current	-200		200	mA			
Crosstalk			-60	dBc	CH1 - CH2/CH2 - CH1		

Note 1: The specification will be divided by 2 while applied to a  $50\Omega$  load.

# **Modulation Characteristics**

AM							
Parameter	Min.	Тур.	Max.	Unit	Condition		
Carrier	Sine, Square, Ram	ıp, Arb					
Modulation Source	Internal/External						
Modulating wave	Sine, Square, Ram	Sine, Square, Ramp, Noise, Arb					
Modulation depth	0		120	%			
Modulation frequency	1m		1M	Hz	While modulation source is "Internal"		
FM							
Parameter	Min.	Тур.	Max.	Unit	Condition		
Carrier	Sine, Square, Ram	ip, Arb					
Modulation Source	Internal/External						
Modulating wave	Sine, Square, Ram	ip, Noise, Arb					
Frequency deviation	0		0.5*BW		$\ensuremath{BW}$ is the max. output frequency Limited by frequency setting		
Modulation frequency	1m		1M	Hz	While modulation source is "Internal"		

Modulation Characteristics					
РМ					
Parameter	Min.	Тур.	Max.	Unit	Condition
Carrier	Sine, Square, Ram	ıp, Arb			
Modulation Source	Internal/External				
Modulating wave	Sine, Square, Ram	ıp, Noise, Arb			
Phase deviation	0		360	0	
Modulation frequency	1m		1M	Hz	While modulation source is "Internal"
ASK					
Parameter	Min.	Тур.	Max.	Unit	Condition
Carrier	Sine, Square, Ram	ıp, Arb			
Modulation Source	Internal/External				
Modulating wave	Square with 50%	duty cycle			
Keying frequency	1m		1M	Hz	Limited by frequency setting while modulation source is "Internal"
FSK					
Parameter	Min.	Тур.	Max.	Unit	Condition
Carrier	Sine, Square, Ram	ıp, Arb			
Modulation Source	Internal/External				
Modulating wave	Square with 50%	duty cycle			
Modulation frequency	1m		1M	Hz	While modulation source is "Internal"
PSK					
Parameter	Min.	Тур.	Max.	Unit	Condition
Carrier	Sine, Square, Ram	ıp, Arb			
Modulation Source	Internal/External				
Modulating wave	Square with 50%	duty cycle			
Modulation frequency	1m		1M	Hz	While modulation source is "Internal"
PWM					
Parameter	Min.	Тур.	Max.	Unit	Condition
Carrier	Pulse				
Modulation Source	Internal/External				
Modulating wave	Sine, Square, Ram	ip, Noise, Arb			
Modulation frequency	1m		1M	Hz	While modulation source is "Internal"
Pulse width deviation resolution	6.67			ns	

Burst Characteristics						
Parameter	Min.	Тур.	Max.	Unit	Condition	
Carrier	Sine, Square, Ram	np, Pulse, Noise, Ar	b			
Туре	Count(1-1000000	cycles), Infinite, Ga	ted			
Carrier frequency	2m		BW	Hz	BW is the max. output frequency	
Start/Stop phase	0		360	0		
Internal period	1μ		1000	S		
Trigger source	Internal, External,	Manual				
Gated source	Internal/External					
Trigger delay			100	S		
Sweep Characteristics						
Parameter	Min.	Тур.	Max.	Unit	Condition	
Carrier	Sine, Square, Ram	ıp, Arb				
Туре	Linear, Log					
Direction	Up, Down					
Carrier frequency	1μ		BW	Hz	BW is the max. output frequency	
Sweep time	1m		500	S		
Trigger source	Internal, External,	Manual				

Frequency Counter Characteristics								
Parameter	Min.	Тур.	Max.	Unit	Condition			
Function	Frequency, Period,	Frequency, Period, Positive/Negative pulse width, Duty cycle						
Coupling mode	AC, DC, HF REJ	AC, DC, HF REJ						
Frequency range	100m		200M	Hz	DC coupling			
	10		200M	Hz	AC coupling			
Input amplitude	100mVrms		±2.5V		DC coupling, < 100 MHz			
	200mVrms		±2.5V		DC coupling, 100 MHz ~ 200MHz			
	100mVrms		5 Vpp		AC coupling, < 100 MHz			
	200mVrms		5 Vpp		AC coupling, 100 MHz ~ 200MHz			
Input impedance		1M		Ω				

# Reference Clock Input/Output

Reference Clock Input							
Parameter	Min.	Тур.	Max.	Unit	Condition		
Frequency		10M		Hz			
Amplitude	1.4			Vpp			
Input impedance	5			kΩ	AC coupling		
Reference Clock Output							
Parameter	Min.	Тур.	Max.	Unit	Condition		
Frequency		10M		Hz	Synchronized to internal reference clock		
Amplitude	2	3.3		Vpp	HiZ load		
Output impedance		50		Ω			

## Auxiliary In/Out Characteristics

Trigger Input						
Parameter	Min.	Тур.	Max.	Unit	Condition	
V <sub>IH</sub>	2		5.5	V		
V <sub>IL</sub>	-0.5		0.8	V		
Input impedance	100			kΩ		
Pulse width	100			ns		
Response time			100	ns	Sweep	
			600	ns	Burst	
Trigger Output						
Parameter	Min.	Тур.	Max.	Unit	Condition	
V <sub>OH</sub>	3.8			V	$I_{OH} = -8 \text{ mA}$	
V <sub>OL</sub>			0.44	V	$I_{OL} = 8 \text{ mA}$	
Output impedance		100		Ω		
Frequency			1	MHz		
Sync Output						
Parameter	Min.	Тур.	Max.	Unit	Condition	
V <sub>OH</sub>	3.8			V	$I_{OH} = -8 \text{ mA}$	
V <sub>oL</sub>			0.44	V	$I_{OL} = 8 \text{ mA}$	
Output impedance		100		Ω		
Pulse width		50		ns		
Frequency			10	MHz		
Modulation Input						
Parameter	Min.	Тур.	Max.	Unit	Condition	
Frequency	0		50	kHz		
Input impedance	10			kΩ		
Amplitude@ 100% Modulation depth	11	12	13	Vpp		

General Characteristics						
Power						
Parameter	Min.	Тур.	Max.	Unit	Condition	
Voltage	100 - 240 Vrms (± 100 - 120 Vrms (±	⊧ 10%), 50 / 60 Hz ⊧ 10%), 400 Hz				
Power consumption		25.5	50	W	Dual channels, Sine, 1kHz, 10Vpp, 50 $\Omega$ load	
Display						
Parameter	Min.	Тур.	Max.	Unit	Condition	
Color depth		24		bit		
Contrast ratio		350:1				
Luminance		300		cd/m <sup>2</sup>		
Touch panel type	Resistive					
Environment						
Parameter	Min.	Тур.	Max.	Unit	Condition	
Operating temperature	0		40	C		
Storage temperature	-20		60	C		
Operating humidity	5		90	%	≤ 30 ℃	
	5		50	%	<b>40</b> ℃	
Non-operating humidity	5		95	%		
Operating altitude			3048	m	≤ 30 °C	
Non-operating altitude			15000	m		
Calibration						
Parameter	Min.	Тур.	Max.	Unit	Condition	
Calibration interval		1		year		
Mechanical						
Parameter	Min.	Тур.	Max.	Unit	Condition	
Dimensions	$W \times H \times D = 260.3r$	nm×107.2mm×295	.7mm			
Net weight		3.43		kg		
Gross weight		4.42		kg		
Compliance						
LVD	IEC 61010-1:2010					
EMC	EN61326-1:2013					

# **Ordering Information**

Product Description	SDG2000X Series Function/Arbitrary Waveform Generator
Product code	SDG2122X 120MHz
	SDG2082X 80MHz
	SDG2042X 40MHz
Standard configurations	A Quick Start $\hfill A$ Power Cord $\hfill A$ USB Cable $\hfill A$ Calibration Certificate, A BNC Coaxial Cable
Optional configurations	USB-GPIB adapter 20dB Attenuator SPA1010 10W Power Amplifier

# SDG2000X Series Function/Arbitrary Waveform Generator



#### 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, function/arbitrary waveform generators, digital multimeters, DC power supplies, spectrum analyzers, isolated handheld oscilloscopes and other general purpose test instrumentation. Since its first oscilloscope, the ADS7000 series, 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.

#### **Headquarter:**

SIGLENT TECHNOLOGIES CO., LTD. Add: Blog No.4 & No.5, Antongda Industrial Zone, 3rd Liuxian Road, Bao'an District, Shenzhen, 518101, China. Tel: + 86 755 3661 5186 Fax: + 86 755 3359 1582 Email: sales@siglent.com; Website: http://www.siglent.com/ens/

#### USA:

SIGLENT Technologies America, Inc 6557 Cochran Rd Solon, Ohio 44139 Tel: 440-398-5800 Toll Free: 877-515-5551 Fax: 440-399-1211 Email: info@siglent.com Website: www.siglentamerica.com

#### **Europe:**

SIGLENT TECHNOLOGIES EUROPE GmbH ADD: Liebigstrasse 2-20, Gebaeude 14, 22113 Hamburg Germany Tel: +49(0)-819-95946 Fax: +49(0)-819-95947 Email: info-eu@siglent.com Website: www.siglenteu.com Follow us on Facebook: SiglentTech



# SDG1000X Series Function/Arbitrary

Waveform Generator



DataSheet-2019.03

SIGLENT SDG 1062X Easy Pulse 60 MHz 150 MSa/s 7 8 9 CH2:Sine.ON.500 CH1:Sine.ON.HiZ 4 5 6 Frequency 1.000 000kHz 6.000 Vpp Amplitude 0.000 Vdc Offset 0.00 ° Phase Mod Sweep Burst 10<mark>0</mark>.0 % AM Depth HiZ Load 100.000 000 Hz AM Freq ON Output Para-meter Utility Store Recall AM Freq Shap AM Dept Source Ch1/C Sine Waveforms Inter CC SIGLENT TECHNOLOGIES CO.,LTD

# SDG1062X SDG1032X

#### **Overview**

SIGLENT's SDG1000X is a series of dual-channel function/arbitrary waveform generators with specifications that include up to 60 MHz maximum bandwidth, 150 MSa/s sampling rate and 14-bit vertical resolution. The proprietary EasyPulse & TrueArb technique helps to solve the weaknesses inherent in traditional DDS generators when generating pulse and arbitrary waveforms, and the special square generator is capable of generating square waveforms up to 60 MHz in frequency with low jitter. With these advantages, the SDG1000X can provide users with a variety of high fidelity / low jitter signals while meeting the growing requirements of a wide range of complex and varied applications.

#### **Key Features**

- Dual-channel, with bandwidth up to 60 MHz, and amplitude up to 20 Vpp
- 150 MSa/s sampling rate, 14-bit vertical resolution, and 16 kpts waveform length
- Innovative EasyPulse technology, capable of generating lowerjitter Pulse waveforms, brings a wide range and extremely high precision in pulse width and rise/fall times adjustment
- Innovative TrueArb technology, based on a point-by-point architecture, supports any 2 pts ~ 16 kpts Arb waveform with a sampling rate in range of 1 µSa/s ~ 30 MSa/s
- Special circuit for Square wave function, can generate Square waves up to 60 MHz with jitter less than 300 ps+0.05 ppm of period
- Plenty of analog and digital modulation types: AM, DSB-AM, FM, PM, FSK, ASK, PSK and PWM
- Sweep and Burst functions
- Harmonics Generator function
- Maveform Combining function
- IIII High precision Frequency Counter
- Standard interfaces: USB Host, USB Device (USBTMC), LAN (VXI-11)
- 📕 4.3" TFT-LCD display



## **Models and Key Specifications**

Product Model	SDG1062X	SDG1032X			
Bandwidth	60 MHz	30 MHz			
Sampling rate	150 MSa/s				
Vertical resolution	14-bit				
Waveform Length	16 kpts				
Num. of channels	2				
Max. amplitude	±10 V				
Display	4.3" display, 480 x 272 x RGB				
Interface	Standard: USB Host, USB Device, LAN				

# Characteristics

#### Identical dual output-channels with high performance

Capable of outputting large signals at high frequencies. dual-channels, 20 Vpp amplitude can be guaranteed at up to 10 MHz.



#### Low Distortion Output

With 0 dBm output, the THD (Total Harmonic Distortion) is less than 0.075%. Harmonics and spurs are less than -40 dBc throughout the entire bandwidth.



#### Innovative EasyPulse Technology





When a Pulse waveform is generated by a common DDS generator, there will be a one-clock-jitter if the sampling rate is not an integer-related multiple of the output frequency. SDG1000X EasyPulse technology successfully overcomes this weakness in DDS designs and helps to produce low jitter Pulse waveforms.





The rise/fall times can be set independently to the minimum of 16.8 ns at any frequency and to the maximum of 22.4 s. The adjustment step is as small as 100 ps. The Pulse width can be fine-tuned to the minimum of 32.6 ns with the adjustment step as small as 100ps.

#### High performance Square Waves



Benefitting from a special square-wave generating circuitry, the Square from the SDG1000X breaks the 60 MHz bandwidth barrier, reaching rise/fall times of less than 4.2 ns, and frequencies up to 60 MHz.

Low Jitter 100kHz Square

The Square wave exhibits the same excellent jitter performance as the Pulse waveform.

#### Innovative TrueArb Technology

For arbitrary waveforms, TrueArb not only has all the advantages of traditional DDS, but also eliminates the probability that DDS may cause serious jitter and distortion.



TrueArb generates arbitrary waveforms point by point, never skips any point so that it can reconstruct all the details of the waveform as defined.

#### Modulation



Multiple modulation types: AM, DSB-AM, FM, PM, FSK, ASK, PSK and PWM. The modulation source can be configured as "Internal" or "External".

#### 🜆 Sweep

CH1:S	ine.ON.HiZ	Sweep	CH2:Sir	ne.OFF.500	2
			Frequency10.000 000klAmplitude2.000 VppOffset0.000 VdcPhase0.00 °		00kHz op dc
Sweep Ti	me <mark>1.000 0</mark>	00 s			
Start Freq	9.500 0	00kHz	Load	HiZ	
Stop Freq 10.500 000kHz			Output	ON	5 <sup>0</sup> 8
Sweep	StartFreq	StopFreq	Source	Edge	Page
Time	CenterFreq	FreqSpan	External	Up	1/2 ►

Two Sweep modes, "Linear" and "Log". Two Sweep directions, "Up" and "Down" and three Sweep sources, "Internal", "External" and "Manual".



As with EasyPulse, TrueArb effectively overcomes the defect that DDS may cause the one-clock-jitter in arbitrary waveforms.

#### 🚣 Burst

CH1:S	ine.ON.Hiz	Burst	CH2:Sir	ne.OFF.500	2
		4	Frequency Amplitude Offset Phase	<ul> <li>10.000 0</li> <li>2.000 V)</li> <li>0.000 V</li> <li>180.00 °</li> </ul>	00kHz op dc
Start Pha	se 180.00	•			
Cycles	1 000 0	0 <mark>0</mark> Cycle	Load	HiZ	
			Output	ON	동 <mark>8</mark>
NCycle Gated	Cycles Infinite	Start Phase		Source External	Page 1/2 ►

Two Burst modes, "N cycle" and "Gated". The Burst source can be configured as "Internal", "External" or "Manual".

#### Frequency Counter

			Count	er:ON		
Value Mean Min Max Sdev Num	Fr 9.9 9.9 9.9 9.9 51 46	equency 999 980 2MHz 999 980 7MHz 999 979 8MHz 999 982 3MHz 5.388 20mHz	Pwidth 50.5ns 50.4ns 39.2ns 61.9ns 2.4ns 46	Duty 50.5 % 50.4 % 39.2 % 61.9 % 2.4 % 46	Freq Dev -1.981pp -1.928pp -2.021pp -1.767pp 0.049ppn 46	/ m m m n
Ref Fr	eq	<mark>[1</mark> 0	.000 000MHz			
State On		Frequency Period	Pwidth Nwidth	RefFreq TrigLev	Setup	Clear

High precision Frequency Counter with an input frequency range of 0.1 Hz  $\sim$  200 MHz.

#### Harmonics Function

*CH1:S	ine.ON. <mark>50</mark> ۵	2	CH2:Si	ne.ON.50Ω	2
		<b>_</b> *	Frequency Amplitude Offset Phase Harm Type Harm Orde Harm Amp	<ul> <li>1.000 00</li> <li>4.000 V(</li> <li>0.000 V(</li> <li>0.00 °</li> <li>All</li> <li>all</li> <li>800.0mV</li> </ul>	00kHz op dc
1 2 3 4 5 6 7 8 9 10 F			Harm Phas	se 0.00°	문물
Туре	Order	Harmonic Ampl	Harmonic Phase		Cancel

Up to 16 harmonics may be generated. Amplitude and phase of each harmonic can be set independently

#### 🜆 Waveform Combining



Capable of combining the waveforms of 2 channels from internal, providing more flexible tools to generate complex waveforms.



#### Arbitrary Waveform Software EasyWave

EasyWave is a powerful arbitrary waveform editing software program that supports several ways to generate arbitrary waveform such as manual drawing, linedrawing, equation-drawing, coordinate-drawing, etc. It is quite convenient for users to edit their own arbitrary waveforms through EasyWave.

All specifications apply to both channels. Unless otherwise stated, all specifications are not guaranteed unless the following conditions are met:

- The generator is within calibration period of validity
- The generator has been working continuously for at least 30 minutes at a specified temperature (18°C ~ 28°C ).

Frequency Characteristics								
Parameter	Min.	Тур.	Max.	Unit	Condition			
Resolution			1μ	Hz				
Initial accuracy	-25		+25	ppm	1 <sup>st</sup> year, 0~40°C			

Sine Characteristics									
Parameter	Min.	Тур.	Max.	Unit	Condition				
Frequency	1μ		60 M	Hz	SDG1062X				
			30 M		SDG1032X				
			-60	dBc	0 dBm, 0~10 MHz ( included )				
Harmonic distortion			-50	dBc	0 dBm, 10~30 MHz ( included )				
			-40	dBc	0 dBm, 30~60 MHz				
Total Harmonic Distortion			0.075		0 dBm, 10 Hz ~ 20 kHz				
Non harmonic courious			-65	dBc	0 dBm, 0~10 MHz ( included )				
Non-narmonic spurious			-55	dBc	0 dBm, 10~30 MHz ( included )				
			-40	dBc	0 dBm, 30~60 MHz				

Square Characteristics								
Parameter	Min.	Тур.	Max.	Unit	Condition			
Frequency	1μ		60 M	Hz	SDG1062X			
			30 M		SDG1032X			
Rise/fall times			4.2	ns	10% ~ 90%, 1 Vpp, 50 $\Omega$ load			
			3.8	ns	10% $\sim$ 90%, 2.5 Vpp, 50 $\Omega$ load			
Overshoot			3	%	100 kHz, 1 Vpp, 50 $\Omega$ load			
Duty cycle	0.001		99.999	%	Limited by frequency setting			
Jitter (rms), Cycle to cycle			300 ps + 0.05 ppm of period		1 Vpp, 50 $\Omega$ load			

Pulse Characteristics								
Parameter	Min.	Тур.	Max.	Unit	Condition			
Frequency	1μ		12.5 M	Hz				
Pulse width	32.6			ns				
Pulse width accuracy			±(0.01%+1 ns)					
Rise/fall times	16.8 n		22.4	S	$10\% \sim 90\%,  1$ Vpp, 50 $\Omega$ load , Subject to pulse width limits			
Overshoot			3	%	100 kHz, 1 Vpp			
Duty cycle	0.001		99.999	%	Limited by frequency setting			
Duty cycle resolution	0.001			%				
Jitter (rms) cycle to cycle			300 ps + 0.05 ppm of period	ps	1 Vpp, 50 Ω load			

Noise Characteristics								
Parameter	Min.	Тур.	Max.	Unit	Condition			
-3 dB bandwidth	60			MHz				

Ramp Characteristics					
Parameter	Min.	Тур.	Max.	Unit	Condition
Frequency	1μ		500 k	Hz	
Symmetry	0		100	%	
Linearity			1	%	Percentage of peak-peak output, 1 kHz, 1 Vpp, 50%

Arbitrary Wave characteristics								
Parameter	Min.	Тур.	Max.	Unit	Condition			
Frequency	1μ		6 M	Hz	DDS mode			
Waveform length	16 k			pts	DDS mode			
Wavelorm length	2		16 k	pts	TrueArb mode			
Sampling rate	150 M			Sa/s	DDS mode			
Sampling face	1μ		30 M	Sa/s	TrueArb mode			
Vertical solution	14			bit				
Jitter		6.7		ns	DDS mode, pk-pk			
			300	ps	TrueArb mode, cycle-cycle rms, 2 pts, 20.1 MSa/s			
Types of built-in Arb	196							

DC Characteristics								
Parameter	Min.	Тур.	Max.	Unit	Condition			
Range	-10		10	V	HiZ load			
	-5		5	V	50 Ω load			
Accuracy	±(1%+3 mV)				HiZ load			

Harmonic Output Characteristics								
Parameter	Min.	Тур.	Max.	Unit	Condition			
Order			16					
Туре	Even, Odd, All							

Output Characterisics								
Parameter	Min.	Тур.	Max.	Unit	Condition			
Range (Specified)	4 m		20	Vpp	$\leq$ 10 MHz, HiZ load			
(Note 1)	4 m		10	Vpp	>10 MHz, HiZ load			
Range (Setting)	2 m		20	Vpp	$\leq$ 10 MHz, HiZ load			
(Note 1)	2 m		10	Vpp	>10 MHz, HiZ load			
Accuracy	±(1%+1 mVpp)				10 kHz sine, 0 V offset			
Amplitude flatness	-0.3		+0.3	dB	$50\;\Omega$ load , 2.5 Vpp, compare to 10 kHz sine,			
Output impedance	49.5	50	50.5	Ω	10 kHz sine			
Output current	-200		200	mA				
Crosstalk (CH1 - CH2 / CH2 - CH1)			-60	dBc	CH1= CH2= 0 dBm, Sine, 50 $\Omega$ load			

Note 1: The specification will be divided by 2 when applied to a 50  $\boldsymbol{\Omega}$  load.

Modulation Characteristics						
АМ						
Parameter	Min.	Тур.	Max.	Unit	Condition	
Carrier	Sine, Square, Ram	np, Arb				
Modulation Source	Internal/External					
Modulating wave	Sine, Square, Ram	Sine, Square, Ramp, Noise, Arb				
Modulation depth	0		120	%		
Modulation frequency	1 m		20 k	Hz	While modulation source is "Internal"	
FM						
Parameter	Min.	Тур.	Max.	Unit	Condition	
Carrier	Sine, Square, Ram	np, Arb				
Modulation Source	Internal/External	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		20 k	Hz	While modulation source is "Internal"	

Modulation Characteristics						
РМ	РМ					
Parameter	Min.	Тур.	Max.	Unit	Condition	
Carrier	Sine, Square, Ram	ıp, Arb				
Modulation Source	Internal/External					
Modulating wave	Sine, Square, Ram	ıp, Noise, Arb				
Phase deviation	0		360	0		
Modulation frequency	1 m		20 k	Hz	While modulation source is "Internal"	
ASK						
Parameter	Min.	Тур.	Max.	Unit	Condition	
Carrier	Sine, Square, Ram	Sine, Square, Ramp, Arb				
Modulation Source	Internal/External	Internal/External				
Modulating wave	Square with 50%	duty cycle				
Keying frequency	1 m		50 k	Hz	Limited by frequency setting while modulation source is "Internal"	
FSK						
Parameter	Min.	Тур.	Max.	Unit	Condition	
Carrier	Sine, Square, Ram	ıp, Arb				
Modulation Source	Internal/External					
Modulating wave	Square with 50%	duty cycle				
Modulation frequency	1 m		50 k	Hz	While modulation source is "Internal"	
PWM						
Parameter	Min.	Тур.	Max.	Unit	Condition	
Carrier	Pulse					
Modulation Source	Internal/External	Internal/External				
Modulating wave	Sine, Square, Ram	Sine, Square, Ramp, Noise, Arb				
Modulation frequency	1 m		1 M	Hz	While modulation source is "Internal"	
Pulse width deviation resolution	6.67			ns		

Burst Characteristics						
Parameter	Min.	Тур.	Max.	Unit	Condition	
Carrier	Sine, Square, Ram	np, Pulse, Noise, Ar	ъ			
Туре	Count(1-1000000	Count(1-1000000cycles), Infinite, Gated				
Carrier frequency	2 m		BW	Hz	BW is the max. output frequency	
Start/Stop phase	0		360	o		
Internal period	1μ		1000	S		
Trigger source	Internal, External, Manual					
Gated source	Internal/External	internal/External				
Trigger delay			100	S		

#### SDG1000X Series Function/Arbitrary Waveform Generator

Sweep Characteristics						
Parameter	Min.	Тур.	Max.	Unit	Condition	
Carrier	Sine, Square, Ram	Sine, Square, Ramp, Arb				
Туре	Linear, Log	Linear, Log				
Direction	Up, Down	Up, Down				
Carrier frequency	1μ		BW	Hz	BW is the max. output frequency	
Sweep time	1 m 500 s					
Trigger source	Internal, External,	nternal, External, Manual				

# Frequency Counter Characteristics

Parameter	Min.	Тур.	Max.	Unit	Condition	
Function	Frequency, Period	, Positive/Negative	pulse width, Duty	cycle		
Coupling mode	AC, DC, HF REJ	C, DC, HF REJ				
Frequency range	100m		200 M	Hz	DC coupling	
	10		200 M	Hz	AC coupling	
	100 mVrms		±2.5 V		DC coupling, < 100 MHz	
Input amplituda	200 mVrms		±2.5 V		DC coupling, 100 MHz ~ 200 MHz	
Input amplitude	100 mVrms		5 Vpp		AC coupling, < 100 MHz	
	200 mVrms		5 Vpp		AC coupling, 100 MHz $\sim$ 200 MHz	
Input impedance		1 M		Ω		

#### **Reference Clock Input/Output**

Reference Clock Input					
Parameter	Min.	Тур.	Max.	Unit	Condition
Frequency		10 M		Hz	
Amplitude	1.4			Vpp	
Input impedance	5			kΩ	AC coupling
Reference Clock Output					
Parameter	Min.	Тур.	Max.	Unit	Condition
Frequency		10 M		Hz	Synchronized to internal reference clock
Amplitude	2	3.3		Vpp	HiZ load
Output impedance		50		Ω	

# Auxiliary In/Out Characteristics

Trigger Input					
Parameter	Min.	Тур.	Max.	Unit	Condition
V <sub>IH</sub>	2		5.5	V	
V <sub>IL</sub>	-0.5		0.8	V	
Input impedance	100			kΩ	
Pulse width	100			ns	
Perpense time			100	ns	Sweep
Response time			600	ns	Burst
Trigger Output					
Parameter	Min.	Тур.	Max.	Unit	Condition
V <sub>OH</sub>	3.8			V	$I_{OH} = -8 \text{ mA}$
V <sub>OL</sub>			0.44	V	$I_{OL} = 8 \text{ mA}$
Output impedance		100		Ω	
Frequency			1	MHz	
Sync Output					
Parameter	Min.	Тур.	Max.	Unit	Condition
V <sub>OH</sub>	3.8			V	$I_{OH} = -8 \text{ mA}$
V <sub>OL</sub>			0.44	V	$I_{OL} = 8 \text{ mA}$
Output impedance		100		Ω	
Pulse width		500		ns	
Frequency			10	MHz	
Jitter (pk-pk)		6.7		ns	

#### Auxiliary In/Out Characteristics **Modulation Input** Parameter Min. Тур. Max. Unit Condition 0 Frequency 50 kHz Input impedance 10 kΩ Amplitude@ 100% Modulation 11 12 13 Vpp depth

General Characteristics						
Power						
Parameter	Min.	Тур.	Max.	Unit	Condition	
Voltage	100 - 240 Vrms (± 100 - 120 Vrms (±	100 - 240 Vrms (± 10%), 50 / 60 Hz 100 - 120 Vrms (± 10%), 400 Hz				
Power consumption		21	50	W	Dual channels, Sine, 1kHz, 10Vpp, 50 $\Omega$ load	
Display						
Parameter	Min.	Тур.	Max.	Unit	Condition	
Color depth		24		bit		
Contrast ratio		350:1				
Luminance		300		cd/m <sup>2</sup>		
Environment						
Parameter	Min.	Тур.	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		
Calibration						
Parameter	Min.	Тур.	Max.	Unit	Condition	
Calibration interval		1		year		
Mechanical						
Parameter	Min.	Тур.	Max.	Unit	Condition	
Dimensions	$W \times H \times D = 260.3$	mm×107.2 mm×29	95.7 mm			
Net weight		3.43		kg		
Gross weight		4.35		kg		
Compliance						
LVD	IEC 61010-1:2010					
EMC	EN61326-1:2013					

# **Ordering Information**

Product Description	
60 MHz, 2 CH, 150 MSa/s, 14 bit	SDG1062X
30 MHz, 2 CH, 150 MSa/s, 14 bit	SDG1032X
Standard Configurations	
Quick Start -1	
Power Cord-1	
Calibration Certificate -1	
USB Cable -1	
Optional Configurations	
BNC Coaxial Cable	SDG-BNC
20 dB Attenuator	ATT-20dB
10W Power Amplifier	SPA1010

# **Data Sheet**

# Function/Arbitrary Waveform Generator

- DDS technology, dual-channel output
- 125MSa/s sample rate, 14bit vertical resolution.
- 5 types of standard output waveform, built-in 46 arbitrary waveforms(include DC)
- Complete set of modulation functions: AM, FM, PM, FSK, ASK, PWM, linear/logarithmic sweep, burst
- Abundant input/output: waveform output, Synchronous signal output, External modulation source input, 10MHz clock input, external trigger input, internal trigger output etc
- Channel duplication function
- Built-in accurate frequency counter enables to measure ranges 100mHz-200MHz (single channel)
- Standard interfaces: USB Device, USB Host, Optional interface: GPIB
- Supplied with powerful arbitrary editing software
- Remote control support

# Reasonable price & Outstanding

## performance

SDG1000 series Function/Arbitrary Waveform Generator is a new family member of SIGLENT with friendly design: 3.5 inch TFT-LCD display; Built-in Chinese/English language; Online help function; Support USB and internal storage, facilitate files management; Special connection terminal for grounding.



# Application fields:

- Analog sensor
- Simulation environment signals
- Circuit function test
- IC test
- Researching and training

# Edit arbitrary waveform

Enables edition of 14-bit 16kpts arbitrary output waveforms, Arbitrary editing software EasyWave provides 9 standard waveforms: Sine, Square, Ramp, Pulse, ExRise, ExpFall, Sinc, Noise and DC, which meets all engineers' basic needs; In addition, it provides plenty of ways of manual drawing, point-to-point line drawing and arbitrary point drawing. It facilitates to create complex waveforms; Multi-file screen management helps users to edit multiple-waveform simultaneously. It provides 10 Storage in non-volatile RAM. You can edit and store more waveforms by EasyWave.



#### SIGLENT TECHNOLOGIES CO.,LTD

## Arbitrary waveform output

Built-in 46 arbitrary waveforms (include DC), including math, engineering and other commonly-used waveforms.

# Complete set of modulation functions, sweep output,

#### burst output

- Complete set of modulation functions: AM, DSB-AM, FM, PM, FSK, ASK, PWM, the modulation waveform can be observed directly, which it is suitable for education and training;
- Sweep output: change output frequency from starting frequency to ending one within sweeping time, Sweeping time range: 1ms~500s. The carrier can be Sine, Square, Triangle and Arbitrary waveforms.
- Burst output: It can periodically generate pulse sequence. Internal counter and external control signal are available to control burst output.

# **Dual-channel**

# **Duplicating function**

Channel duplicating: allows to duplicate parameters from one channel to the other.

# **Built-in frequency counter**

Wide frequency range: 100mHz~200MHz. Measurable parameters: frequency, period, duty-cycle, positive pulse width, negative pulse width Setting: it can set DC/AC coupling, trigger

level and high frequency rejection.



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Model	SDG1010	SDG1025	SDG1050		
Max. output	10MHz	25MHz	50MHz		
frequency					
Output channels	2				
Sample rate	125MSa/s				
Arbitrary waveform	16kptc				
length	τοκρις				
Frequency resolution 1µHz					
vertical resolution 14bits					
Wayoform	Sine, Square, Ramp, Pulse, Gaussian Noise. 46 built-in arbitrary				
Waveloitti	waveforms (include DC)				
Modulation	AM, DSB-AM, FM, PM	/, FSK, ASK, PWM, Sweep, Burst			
Frequency counter Frequency range:100mHz~200MHz					
Standard interface USB Host & Device					
Dimension	W x H x D=229mm x	105mm x 281mm			

# Attention:

All these specifications apply to the SDG1000 Series Function/Arbitrary Waveform Generator unless otherwise explanation. To satisfy these specifications, the following conditions must be met first:

- 1. The instrument has been operating continuously for more than 30 minutes within specified operating temperature range (18°C~28°C).
- 2. The temperature variation does not exceed  $5^{\circ}$ C.

Note: all specifications are guaranteed unless where noted 'typical'.



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Frequency Specification					
	SDG1010	SDG1025	SDG1050		
Waveform	Sine, Square, Ramp, F	Pulse, Noise, Arbitrary			
Sine	1µHz ~ 10MHz	1µHz ~ 25MHz	1µHz ~ 50MHz		
Square	1µHz ~ 10MHz	1µHz ~ 25MHz	1µHz ~ 25MHz		
Pulse	500µHz ~ 5MHz	500µHz ~ 5MHz	500µHz ~ 5MHz		
Ramp/Triangula	1µHz ~ 300kHz	1µHz ~ 300kHz	1µHz ~ 300kHz		
r					
Gaussian white	>10MHz (-3dB)	>25MHz (-3dB)	50MHz (-3dB)		
noise					
Arbitrary	1µHz ~ 5MHz	1µHz ~ 5MHz	1µHz ~ 5MHz		
Resolution	1µHz				
Accuracy	Within 90days: ±50ppm; within 1 year: ±100ppm 18°C~28°C				
Temperature	-Enom/ºC				
coefficient	<pre>&gt;&gt;ppn/*C</pre>				

Sine Spectrum Purity			
Harmonic Distortion	CH1/CH2		
DC~1MHz	-60dBc		
1MHz~5MHz	-53dBc		
5MHz~25MHz	-35dBc		
25MHz~50MHz	-32dBc		
Total harmonic waveform	DC~20kHz,1Vpp<0.2%		
distortion			
Sourious signal(non harmonic)	DC~1MHz<-70dBc		
Spundus signal(non-narmonic)	1MHz~10MHz<-70dBc+6dB/octave		
Phase noise	10kHz Offset,-108dBc/Hz (typical value)		

Square		
Rise/fall time		<12ns (10% ~ 90%)
Overshoot		<5% (typical,1kHz,1Vpp)
Duty Cycle	1µHz ~10MHz	20%~80%
	10MHz~20MHz	40%~60%
	20MHz~25MHz	50%
Asymmetric(50% Duty Cycle)		1% of period+20ns (typical,1kHz,1Vpp)
Jitter		0.1% of period (typical,1kHz,1Vpp)

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# SDG1000 Series DataSheet



Ramp/Triangle		
Linearity	<0.1% of Peak value output	
	(typical,1kHz,1Vpp,100% symmetric)	
Symmetry	0%~100%	

Pulse	
Pulse width	1998s, Max. 16ns, Min. 1ns resolution
Rise/Fall time (10% ~	7ns
90%,typical,1 kHz,1Vpp)	
Duty Cycle	0.1% Resolution
Overshoot	<5%
Jitter (pk-pk)	8ns

Arbitrary		
Waveform length	16k points	
Vertical resolution	14bits	
Sample rate	125MSa/s	
Min. Rise/Fall time	7ns (typical)	
Jitter(pk-pk)	8ns (typical)	
Storage in non-volatile RAM	10 waveforms	
memory (10 in total)		

Output Specification		
Output	CH1	CH2
	2mVpp~10Vpp (50Ω, ≤10MHz)	
Amplitudo	2mVpp~5Vpp (50Ω, >10MHz)	2mVpp~3Vpp (50Ω)
Amplitude	4mVpp~20Vpp (HiZ, ≤10MHz)	4mVpp~6Vpp (HiZ)
	4mVpp~10Vpp (HiZ, >10MHz)	
Vertical accuracy	±(0.3dB+1mVpp of	±(0.3dB+1mVpp of
(100 kHz sine)	setting value)	setting value)
Amplitude flatness		
(compared to 100	±0.3 dB	
kHz sine,5Vpp)		
Channel phase		
deviation	deviation <400ps (classic value,sine,50MHz,4vpp)	
Cross talk	<-70	)dBc

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# **SIGLENT**

# **SDG1000 Series DataSheet**

DC Offset		
Range(DC)	±5V (50Ω)	±1.5V (50Ω)
	±10V (high impedance)	±3V (high impedance)
Offset accuracy	±( setting offset	±( setting offset
	value *1%+3mV)	value *1%+3mV)

Waveform Output		
Impedance	50Ω (typical)	50Ω (typical)

AM Modulation(CH1/CH2)		
Carrier	Sine, Square, Ramp, Arbitrary (except DC)	
Source	Internal/External	
Modulation	Sine, Square, Ramp, Noise, Arbitrary (2mHz ~ 20kHz)	
waveform		
Modulation depth	0% ~ 120%	
FM Modulation(Cl	H1/CH2)	
Carrier	Sine, Square, Ramp, Arbitrary (except DC)	
Source	Internal/External	
Modulation	Sine, Square, Ramp, Noise, Arbitrary (2mHz~20kHz)	
waveform		
Frequency deviation	0 ~0.5*bandwidth 1mHz resolution	
PM Modulation(CH1/CH2)		
Carrier	Sine, Square, Ramp, Arbitrary (except DC)	
Source	Internal/External	
Modulation	Sina Squara Rama Naisa Arbitrany (2mHz 20kHz)	
waveform	Sine, Square, Ramp, Noise, Arbitrary (Zmiriz~Zokriz)	
Phase Deviation	0~360°,0.1°Resolution	
FSK Modulation(C	CH1/CH2)	
Carrier	Sine, Square, Ramp, Arbitrary (except DC)	
Source	Internal/External	
Modulation	E00/ duty avela aquara wavefarm (2ml la E01/1a)	
waveform	30% duty-cycle square wavelonn (zmi iz~30ki iz)	
ASK Modulation(CH1/CH2)		
Carrier	Sine, Square, Ramp, Arbitrary (except DC)	
Source	Internal/External	
Modulation	50% duty cyclo square wayoform ( $2mHz$ $50kHz$ )	
waveform	50%auty-cycle square waveform (2mHz~50kHz)	
PWM Modulation(CH1/CH2)		
Frequency	500µHz~20kHz	



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# SDG1000 Series DataSheet

SDG 1000 Series	DataSheet SIGLENT
Source	Internal/External
Modulation	Sina Squara Rama Arbitrary (avcont DC)
waveform	Sille, Square, Ramp, Arbitrary (except DC)
External Modulation	61/ +61/ (maximum width deviation)
range	
Sweep(CH1/CH2)	
Carrier	Sine, Square, Ramp, Arbitrary (except DC)
Туре	linear/logarithmic
Direct	Up/down
Sweep time	1ms~500s
Trigger source	Manual, external, internal
Burst(CH1/CH2)	
Waveform	Sine, Square, Ramp, Pulse, Arbitrary (except DC)
Туре	Count (1~50,000 periods), infinite, Gated
Start/Stop phrase	0°~+360°
Internal period	1µs~500s
Gated source	External trigger
Trigger source	Manual, External or Internal

-- -

--

Rear Panel Connector		
External modulation	$\pm 6V = 100\%$ modulation $>5k\Omega$ input impedance	
External trigger	TTL compatible	
Note: The external input voltage can't be over $\pm 6V$ , otherwise instrument gets damaged.		

Trigger Input	
Input Level	TTL compatible
Slope	Up or down (optional)
Pulse width	>100ns
Input impedance	>5kΩ, DC coupling

Trigger Output		
Voltage level	TTL compatible	
Pulse width	>400ns	
Output impedance	50Ω (typical)	
Max. frequency	1MHz	

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# SIGLENT

# **SDG1000 Series DataSheet**

# Reference Frequency InputVoltage level5 Vpp ~ 5.5 VppFrequency range10MHz±1kHzInput impedance>5kΩ,AC coupling

# **SYNC** Output

•	
Voltage level	TTL compatible
Pulse width	>50ns
Output impedance	50Ω (typical)
Max. frequency	2MHz

Frequency Counter				
Measurement	Frequency	Frequency, Period, Positive/negative pulse width, duty cycle		
Frequency range	Single Cha	nnel:100mHz~200MHz		
Frequency resolution	6bits/s			
Voltage range (non-m	odulated sig	inal)		
		DC offset range	±1.5VDC	
	coupling	100mHz~100MHz	50mVrms~±2.5V	
Manual	couping	100MHz~200MHz	100mVrms~±2.5V	
A	AC	1Hz~100MHz	50mVrms~5Vpp	
	coupling	100MHz~200MHz	100mVrms~5Vpp	
Pulse width and				
duty-cycle	1Hz~10MHz (50mVrms~5Vpp)			
measurement				
	Input impedance Coupling mode High-frequency rejection		1ΜΩ	
Input adjustment			AC,DC	
			ON/OFF	
Trigger level range	-3V~ +1.8\	/		



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# **General Specification**

Display	
Display type	3.5 inch TFT-LCD
Resolution	320×RGB×240
Color depth	24bit
Contrast Ratio	350:1 (typical)
Luminance	300cd/m <sup>2</sup> (typical)
Power	
Voltago	100~240 VAC <sub>RMS</sub> , 50/60Hz
vollage	100~120 VAC <sub>RMS</sub> , 440Hz
Consumption	50W Max
Fuse	1.25A, 250V
Environment	
Temperature	Operation:0°C~40°C
Temperature	Storage:-20°C~60°C
Humidity range	Below +35℃:≤90% relative humidity
	+35℃~+40℃:≤60% relative humidity
Altitude Operation: below 3,000 meters	
Allitude	Storage: below 15,000 meters
	2004/108/EC Directive
Electromagnetic	Applicable standards EN 61326-1:2006
Compatibility	EN 61000-3-2:2006 + A2:2009
	EN 61000-3-3:2008
	2006/95/EC Low Voltage Directive
Safety	EN 61010-1:2010/EN 61010-031:2002+A1:2008
Salety	UL 61010-1:2012,CAN/CSA-C22.2 No.61010-1:2012
	UL 61010-2-030:2012,CAN/CSA-C22.2 No.61010-2-030:2012
Others	
	Width:229mm
Dimension	Height:105mm
	Depth:281mm
Weight	N.W: 2.6Kg
	G.W: 3.4Kg
IP protection	
IP20	
Calibration Cycle	
1year	





## **Ordering Information**

#### **Product Name**

SDG1000 Series Function/Arbitrary Waveform Generator

Models:

SDG1050 50MHz

SDG1025 25MHz

SDG1010 10MHz

#### **Standard Accessories**

- A Quick Start
- A Calibration Certificate
- A Power Cord that fits the standard of destination country
- A USB Cable

#### **Optional Accessories**

- BNC cable
- GPIB-USB Adapter

# **Contact SIGLENT**

#### SIGLENT TECHNOLOYIES CO., LTD

Address: 3/F, No.4 BULIDING, 3<sup>rd</sup> LIUXIAN Rd, ANTONGDA INDUSTRY GARDEN, BAO'AN DISTRICT, SHENZHEN, CHINA

Tel: +86-755-36615186 Fax: +86-755-33591582 Post Code: 518101 E-mail:sales@siglent.com http://www.siglent.com



# **Data Sheet**

# SDG800 Series Function/Arbitrary Waveform Generator

- DDS technology, Single-channel output
- 125MSa/s sample rate, 14bit vertical resolution.
- 5 types of standard output waveform, built-in 46 arbitrary waveforms(include DC)
- Complete set of modulation functions: AM, DSB-AM, FM, PM, FSK, ASK, PWM, Sweep, Burst
- Abundant input/output: waveform output,
   Synchronous signal output, , external trigger input.
- Standard interfaces: USB Device, USB Host.
- Supplied with powerful arbitrary editing software
- Support remote control

# Reasonable price & outstanding performance

SDG800 series Function/Arbitrary Waveform Generator is a new family member of SIGLENT with friendly design: 3.5 inch TFT-LCD display; Built-in Chinese/English language; Online help function; Support U dick and internal storage, facilitative files management.

# **Application fields:**

- Analog sensor
- Simulation environment signals
- Circuit function test
- IC test
- Researching and training



# Edit arbitrary waveform

Enables edition of 14-bit 16kpts arbitrary output waveforms, Arbitrary editing software EasyWave provides 9 standard waveforms: Sine, Square, Ramp, Pulse, ExRise, ExpFall, Sinc, Noise and DC, which meets all engineers' basic needs; In addition, it provides plenty of ways of manual drawing, point-to-point line drawing and arbitrary point drawing. It facilitates to create complex waveforms; Multi-file screen management helps users to edit multiple-waveform simultaneously. It provides 10 Storage in non-volatile RAM. You can edit and store more waveforms by EasyWave.

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# Arbitrary waveform output

Built-in 46 arbitrary waveforms(include DC), including math, engineering and other commonly-used waveforms.

# Complete set of modulation functions, sweep output, burst output

- Complete set of modulation functions: AM, DSB-AM, FM, PM, FSK, ASK, PWM, the modulation waveform can be observed directly, which it is suitable for education and training;
- Sweep output: change output frequency from starting frequency to ending one within sweeping time, Sweeping time range: 1ms~500s. The carrier can be Sine, Square, Triangle and Arbitrary waveforms.
- Burst output: It can periodically generate pulse sequence. Internal counter and external control signal are available to control burst output.



2



Model	SDG805	SDG810	SDG830
Max. output	5 MH7	10 MHz	30 MHz
frequency	5 1011 12		30 WI 12
Output channels	1		
Sample rate	125MSa/s		
Arbitrary waveform	16kpto		
length	Τοκρις		
Frequency resolution	1µHz		
vertical resolution	14bits		
Moveform	Sine, Square, Ramp,	Pulse, Gaussian Nois	e. 46 built-in arbitrary
waveloim	waveforms(include D	C)	
Modulation	AM, DSB-AM, FM, PM, FSK, ASK, PWM, Sweep, Burst		
Standard interface	USB Host & USB Device		
Dimension	W x H x D=229mm x 105mm x 281mm		

# **Attention:**

All these specifications apply to the SDG800 Series Function/Arbitrary Waveform Generator unless otherwise explanation. To satisfy these specifications, the following conditions must be met first:

- 1. The instrument has been operating continuously for more than 30 minutes within specified operating temperature range (18°C~28°C.
- 2. The temperature variation does not exceed  $5^{\circ}$ C.

Note: all specifications are guaranteed unless where noted 'typical'.



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# SIGLENT

# **SDG800 Series DataSheet**

Frequency Specification				
Model	SDG805	SDG810	SDG830	
Waveform	Sine, Square, Ra	Sine, Square, Ramp, Pulse, Noise, Arbitrary		
Sine	1µHz ~ 5MHz	1µHz ~ 10MHz	1µHz ~ 30MHz	
Square	1µHz ~ 5MHz	1µHz ~ 10MHz	1µHz ~ 10MHz	
Pulse	500µHz ~ 5MHz			
Ramp/Triangular	1µHz ~ 300kHz			
Gaussian white noise	>5MHz (-3dB)	>10MHz (-3dB)	>30MHz (-3dB)	
Arbitrary	1µHz ~ 5MHz			
Resolution	1µHz			
Accuracy	Within 90days ±5	50ppm within 1 year	±100ppm	
Temperature coefficient	<5ppm/°C			

Sine Wave		
	DC~1MHz <-60dBc	
Harmonic Distortion	1MHz~10MHz <-55dBc	
	10MHz~30MHz <-50dBc	
Total harmonic waveform	$DC_{-}20kHz$ 1/pp=0.2%	
distortion	DC~20K12,1 Vpp<0.2 /0	
	DC~1MHz<-70dBc	
Spurious signal(non-harmonic)	1MHz~10MHz<-60dBc	
	10MHz~30MHz<-55dBc	
Phase noise	10kHz Offset,-108dBc/Hz(typical value)	

Square Wave	
Rise/fall time	<24ns(10% ~ 90%)
Overshoot	<5%(typical,1kHz,1Vpp)
Duty Cycle	20%~80%
Asymmetric(50% Duty Cycle)	1% of period+20ns(typical,1kHz,1Vpp)
Jitter	500ps + 0.001% of period

Ramp/Triangle Wave	
Linearity	<0.1% of Vpp(typical,1kHz,1Vpp,100% symmetric)
Symmetry	0%~100%

Pulse Wave	
Pulse width	16ns, Min. 1ns resolution
Rise/Fall time (10% ~ 90%,typical)	20ns~1.6ks
Duty Cycle	0.1% Resolution
Overshoot	<5%
Jitter(pk-pk)	500ps + 0.001% of period



# **SDG800 Series DataSheet**

Arbitrary Wave	
Waveform length	16k points
Vertical resolution	14bits
Sample rate	125MSa/s
Min. Rise/Fall time	8ns(typical)
Jitter(pk-pk)	8ns(typical)
Storage in non-volatile RAM memory (10 in total)	10 waveforms

Output Specification		
Amplitude	2mVpp~10Vpp(50Ω,≤10MHz)	
	2mVpp~5Vpp(50Ω,>10MHz)	
	4mVpp ~ 20 Vpp (High impedance, <10MHz)	
	4mVpp ~ 10Vpp (High impedance,>10MHz)	
Vertical accuracy (100 kHz sine)	±(1mVpp +0.3dB of setting value)	
Amplitude flatness (compared to 100 kHz sine,5Vpp)	±0.3 dB	
Impedance	50Ω	
Protection	short-circuit protection	

DC Offset	
Bango(DC)	±5V(50Ω)
Range(DC)	±10V(High-Z)
Offset accuracy	±( setting offset value *1%+3mV)

AM Modulation	
Carrier	Sine, Square, Ramp, Arbitrary(except DC)
Modulation waveform	Sine, Square, Ramp, Noise, Arbitrary (2mHz ~
	20kHz)
Modulation depth	0% ~ 120%
DSB-AM Modulation	
Carrier	Sine, Square, Ramp, Arbitrary(except DC)
Modulation waveform	Sine, Square, Ramp, Noise, Arbitrary (2mHz ~
	20kHz)
Modulation depth	0% ~ 120%
FM Modulation	
Carrier	Sine, Square, Ramp, Arbitrary(except DC)
Modulation waveform	Sine, Square, Ramp, Noise,
	Arbitrary(2mHz~20kHz)
Frequency deviation	0 ~0.5*bandwidth 1mHz resolution



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# **SDG800 Series DataSheet**

PM Modulation	
Carrier	Sine, Square, Ramp, Arbitrary(except DC)
Modulation waveform	Sine, Square, Ramp, Noise, Arbitrary
	(2mHz~20kHz)
Phase Deviation	0~360°,0.1°Resolution
FSK Modulation	
Carrier	Sine, Square, Ramp, Arbitrary(except DC)
Modulation waveform	50% duty-cycle square waveform(2mHz~50kHz)
ASK Modulation	
Carrier	Sine, Square, Ramp, Arbitrary(except DC)
Modulation waveform	50%duty-cycle square waveform(2mHz~50kHz)
PWM Modulation	
Frequency	500µHz~20kHz
Modulation waveform	Sine, Square, Ramp, Arbitrary(except DC)
Sweep	
Carrier	Sine, Square, Ramp, Arbitrary(except DC)
Туре	linear/logarithmic
Direct	Up/down
Sweep time	1ms~500s
Trigger source	Manual, external, internal
Burst	
Waveform	Sine, Square, Ramp, Pulse, Arbitrary(except DC)
Туре	Count(1~50,000 periods), infinite, Gated
Start/Stop phrase	0°~360°
Internal period	1µs~500s
Gated source	External trigger
Trigger source	Manual, External or Internal

Trigger Input				
Input Level	TTL compatible			
Slope	Up or down			
Pulse width	>100ns			
Input impedance	>5kΩ,DC coupling			

SYNC Output				
Voltage level	TTL compatible			
Pulse width	>50ns			
Output impedance	50Ω(typical)			
Max. frequency	2MHz			

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# **General Specification**

Display	
Display type	3.5 inch TFT-LCD
Resolution	320×RGB×240
Color depth	24bit
Contrast Ratio	350:1 (typical)
Luminance	300cd/m <sup>2</sup> (typical)
Power	
Voltoro	100~240 VAC <sub>RMS</sub> , 50/60Hz
vollage	100~120 VAC <sub>RMS</sub> , 440Hz
Consumption	<30W
Fuse	1.25A, 250V
Environment	
Tomporaturo	Operation:0°C~40°C
Temperature	Storage:-20°C~60°C
Humidity range	Below +35℃:≤90% relative humidity
Furnitity range	+35℃~+40℃:≤60% relative humidity
Altitudo	Operation: below 3,000 meters
	Storage: below 15,000 meters
	2004/108/EC Directive
Electromagnetic	Applicable standards EN 61326-1:2006
Compatibility	EN 61000-3-2:2006 + A2:2009
	EN 61000-3-3:2008
Safaty	2006/95/EC Low Voltage Directive
Salety	EN 61010-1:2010
Others	
	Width:229mm
Dimension	Height:105mm
	Depth:281mm
Woight	N.W: 2.6Kg
weight	G.W: 3.4Kg
IP protection	
IP2X	
Calibration Cycle	
1 year	



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# SIGLENT

# **Ordering Information**

#### **Product Name**

SDG800 Series Function/Arbitrary Waveform Generator

Models:

SDG805 5MHz

SDG810 10MHz

SDG830 30MHz

#### **Standard Accessories**

- A Quick Start
- A Calibration Certificate
- A Power Cord that fits the standard of destination country
- A USB Cable

#### **Optional Accessories**

- BNC cable
- GPIB-USB Adapter

# **Contact SIGLENT**

SIGLENT TECHNOLOGIES CO., LTD Address: 3/F, No.4 BULIDING, 3<sup>rd</sup> LIUXIAN Rd, ANTONGDA INDUSTRY GARDEN, BAO'AN DISTRICT, SHENZHEN, CHINA

Tel: +86-755-36615186 Fax: +86-755-33591582 Post Code: 518101 E-mail:sales@siglent.com http://www.siglent.com



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# SSG3000X Series RF Generator





SIGLENT TECHNOLOGIES CO.,LTD

SSG3032X SSG3021X SSG3032X-IQE SSG3021X-IQE

#### **General Description**

SIGLENT'S SSG3000X series of signal generators have a frequency range of 9 kHz to 2.1 GHz/3.2 GHz. They provide normal analog modulation such as AM, FM, and PM. They also provide pulse modulation and pulse train generator. In addition, when used with baseband generator such as SDG6000X, They can generate IQ modulated signals. With their high accuracy and pure outputs, the SSG3000X series are the right choice for R&D, education, and manufacturing.

#### **Features and Benefits**

- Frequency up to 2.1 GHz/3.2 GHz
- ✤ 0.01 Hz frequency setting resolution
- Level output from -110 dBm to +13 dBm
- Maximum level up to +20 dBm (typ.)
- Phase Noise: -110 dBc/ Hz @ 1 GHz , 20 kHz offset (typ.)
- I Level accuracy ≤0.7 dB (typ.)
- Provides AM, FM, &PM analog modulation with internal, external or Int+Ext source
- Image: Pulse modulation, on/off ratio ≥70 dBc
- Pulse train generator (option)
- External IQ modulation with SDG6000X as the baseband IQ signal
- J- USB-power meter measurement
- 5 inch TFT capacitive touch screen, mouse and keyboard supported
- Meb browser remote control on PC and mobile terminals
- Standard interface include USB Host, USB Device (USB TMC), LAN (VXI-11, Socket, Telnet). Optional interface: GPIB

## **Model and Main index**

Model	SSG3032X	SSG3021X	SSG3032X-IQE	SSG3021X-IQE		
Frequency Range	CW MODE 9 kHz~3.2 GHz	CW MODE 9 kHz~2.1 GHz	CW MODE 9 kHz~3.2 GHz	CW MODE 9 kHz~2.1 GHz		
			IQ MODE 10 MHz~3.2 GHz	IQ MODE 10 MHz~2.1 GHz		
Frequency Resolution	0.01 Hz					
Amplitude Resolution	0.01 dB					
Level accuracy	0.7 dB (typ.)					
Phase noise	-110 dBc/Hz @1 GHz ,offset 20 kHz (typ.)					
Display	5 inch capacitance touch screen, RGB (800*480)					

#### **Design Features**

5 inch touch screen, keyboard and mouse support



Maximum output level up to +20 dBm



In the second second





#### Example for auto level control



## **Design Features**

Power output display using USB power

LOCAL LF MOD RF	<b>2</b> 60
Freq 3.200 000 000 00 G	Hz Level 0.00 dBm
Sensor Info Agilent Technologies_U2004A	Sensor State
Measurement	Level Control
Statistics	
Auto Zero	
Disabled ~	
☆ ▷ 🏹 🛛 FREQ	LEVEL SWEEP SENSOR

Power output control using USB power sensor

_	LOCAL	LF MOD	RF						50
Freq	3.20	0 0 00	000 00	G	Hz	Lev	<sup>el</sup> - 5.0	)4	dBm
Sens	sor State								5
Mea		nt O	-5.0023 dE	ßm	Target	t Level	-	•5.0	)0 dBm
Leve	el Limit		2.00 dB	m					
Cato	h Range		20.00 dB						
б С		$\overline{\varphi}$	FRE	Q	LEV	EL	SWEE	Ρ	SENSOR

External IQ modulation using the SDG6000X as the baseband source





Provides double-tone signal with IQ modulation, easily do TOI testing



# SPECIFICATIONS

Specifications are valid under the following condition: The instrument is within the calibration period, has been stored between 0 and 50°C for at least 2 hours prior to use, and has been powered on and warmed up for at least 40 minutes. The specifications include the measurement uncertainty, unless otherwise noted. **Specifications:** All products are guaranteed to meet published specifications when operating temperatures from 5 to 45°C, unless otherwise noted. **Typical(typ.):** Performance deemed typical implies that 80 percent of the measurement results will meet the typical published performance with a 95th percentile confidence level at room temperature (approximately 25°C). Typical performance is not warranted and does not include measurement uncertainty. **Nominal(nom.):** This value indicate the expected mean or average performance, or an attribute whose performance is by design, such as the 50 ohm connector.

Frequency characteristics					
Frequency					
_	SSG3032X	CW MODE 9 kHz~3.2 GHz			
Frequency range	SSG3021X	CW MODE 9 kHz~2.1 GHz			
	SSG3032X-IQE	CW MODE 9 kHz~3.2 GHz	IQ MODE 10 MHz~3.2 GHz		
	SSG3021X-IQE	CW MODE 9 kHz~2.1 GHz	IQ MODE 10 MHz~2.1 GHz		
Frequency resolution	0.01 Hz				
Setting time	<5 ms (typ.), ALC ON <10 ms (typ.), ALC OFF (S&H)				
Resolution of phase offset setting	0.1°				
Frequency Band <sup>[1]</sup>					
Band	Frequency range	Ν			
1	9 kHz≤f≤1 MHz	0.25			
2	1 MHz <f≤250 mhz<="" td=""><td>0.5</td><td></td></f≤250>	0.5			
3	250 MHz <f≤500 mhz<="" td=""><td>0.125</td><td></td></f≤500>	0.125			
4	500 MHz <f<1000 mhz<="" td=""><td>0.25</td><td></td></f<1000>	0.25			
5	1000 MHz≤f<2000 MHz	0.5			
6	2000 MHz≤f≤3200 MHz	z≤f≤3200 MHz 1			
[1] N is a factor used to help de	fine certain specifications with the document				
<b>Frequency Reference</b>					
Reference frequency	10.000000 MHz				
Initial calibration accuracy	<0.2 ppm				
Temperature stability	<1 ppm/year, $0^{\circ}$ C ~50°C				
Frequency aging rate	<0.5 ppm/first year, 3.0 ppm/20 years				
Frequency sweep					
Sweep type	frequency step (linear or logarithmic step) arbitrary list				
Sweep range	full frequency range				
Sweep sheep	triangle, saw-tooth				
Sweep mode	single, continuous				
Step spacing	linear, logarithmic				
Number of points	step sweep	2~65535			
Number of points	list sweep	2~500			
Dwell time range	10 ms~100 s				
Dwell time setting resolution	0.1 ms				
Trigger source	auto, keyboard, external connector, bus				
Trig slop	positive, negative when trigger source is external				

# Level characteristics

ALC modes

The SSG3000X series offer three ALC modes:

ALC STATE AUTO : The best suited ALC mode is set automatically.

ALC STATE ON: The level control loop is closed. This mode is suitable for CW, FM and PM.

ALC STATE SAMPLE & HOLD (S&H) : At every frequency and level change, The level control loop is closed about 3 ms and the level control voltage is sampled. The level control voltage is the clamped. This mode is used internally while in ALC state AUTO for pulse modulation, AM modulation.

Level characteristics						
Level setting						
	9 kHz≤f<100 kHz	-110 dBm~+9 dBm				
Level setting range	100 kHz≤f<1 MHz	-110 dBm~+15 dBm				
	1 MHz≤f≤3.2 GHz	-110 dBm~+20 dBm				
Resolution of setting	0.01 dB					
Level of performance range						
	9 kHz≤f<100 kHz	-110 dBm~+7 dBm				
	100 kHz≤f<1 MHz	-110 dBm~+10 dBm				
	1 MHz≤f≤3.2 GHz	-110 dBm~+13 dBm				
Level error (ALC on, t	emperature is 20 °C ~30 °C )					
× ,	+13 dBm~-50 dBm	-50 dBm~-90 dBm	-90 dBm~-110 dBm			
9 kHz≤f<100 kHz	≤0.9 dB	<1.1 dB	<1.1 dB			
	≤0.7 dB (typ.)	≤0.7 dB (typ.)	≤0.7 dB (typ.)			
100 kHz≤f≤3.2 GHz	≤0.7 dB	≤0.7 dB	≤1.1 dB			
	≤0.5 dB (typ.)	≤0.5 dB (typ.)	≤0.7 dB (typ.)			
Additional level error	ALC State Off (S&H)	<0.2 dB				
VSWR						
level ≤0 dBm, ALC State ON						
VSWR	1 MHz≤f≤3.2 GHz	≤1.8 (nom.)				
Level setting						
Level setting time	Level deviation <0.1 dB from final value, with GUI update stopped, temperature range from 20 °C ~30 °C ALC state ON <5		<5 ms			
			<5 ms			
	ALC state S&H		<10 ms			
Reverse power						
Maximum permissible DC voltage	50 V					
Maximum reverse input power	1 MHz≤f≤3.2 GHz		+30 dBm			
Level step sweep						
	amplitude step (linear or logarithmic step),	, arbitrary list				
Sweep type	full specified level range					
Sweep shape	triangle, saw-tooth					
Sweep range	the device output range					
Trigger mode	free run, single					
Step spacing	linear					
	step sweep		2~65535			
Sweep points	list sweep	1~500				
Dwell time setting range	10 ms~100 s					
Dwell time setting resolution	0.1 ms					
Trigger source	auto, keyboard, external connector, bus					
Trigger Slop	positive, negative					

SSG3000X RF Generator datasheet



Maximum output power versus frequency,  $f \ge 1 \text{ MHz}$ 



Maximum output power versus frequency, f <1 MHz



Measured level error versus frequency, Level = +12 dBm



Measured level error versus frequency, Level = +2 dBm



Measured level error versus frequency, Level = -24 dBm



Measured level error versus frequency, Level = -8 dBm



Measured level error versus frequency, Level = -72 dBm



Measured level error versus frequency, Level = -100 dBm

Spectral purity		
Harmonics	CW mod, 1 MHz <f<math>\leq3.2 GHz, Level <math>\leq</math> +13 dBm</f<math>	<-30 dBc
Sub harmonics	CW mod, 1 MHz <f<math>\leq3.2 GHz, offset &gt;10 kHz Level <math>\leq</math> +13 dBm</f<math>	<-45 dBc
Non-harmonics	CW mod, offset>10 kHz, Level $\leq$ +13 dBm 1 MHz <f<math>\leq1.5 GHz</f<math>	<-65 dBc
	CW mod, offset>10 kHz, Level $\leq$ +13 dBm 1.5 GHz $\leq$ f $\leq$ 3.2 GHz	<-75 dBc
	CW mod, offset=20 KHz, 1 Hz measure bandwidth	
SSB Phase noise	f=100 MHz	<-118 dBc/Hz (typ.)
	f=1 GHz	<-110 dBc/Hz (typ.)
	f=3 GHz	<-105 dBc/Hz (typ.)



0 -20 - 100Mhz • 1Ghz **SSB phase noise in dBc (1Hz)** -90-100 150 170 - 3Ghz -140 -160 10 100 1000 10000 100000 1000000 10000000 Frequency offset in Hz

Measured harmonics versus carrier frequency at level  $\leq$  +13 dBm



Measured level error versus frequency, Level = -92 dBm

Measured phase noise

WWW.SIGLENT.COM

Internal modulation generator (IE)				
Waveforms	sine wave, square wave, saw-tooth, triangle, DC			
F	sine wave	0.1 Hz~1 MHz <sup>[2]</sup>		
Trequency range	square wave, triangle, saw-tooth	0.1 Hz~20 kHz		
Resolution of frequency setting	0.01 Hz			
Frequency error	similar with RF source			
Frequency response	sine wave <0.3 dB			
Lovel Officet	setting range	min (2.5 V- <sup>1</sup> / <sub>2</sub> LEVEL, 2 V)		
Level Onset	offset resolution	0.01 V		
Output voltage range <sup>[3]</sup>	Vp at connector	1 mVpp~3 Vpp		
	resolution of amplitude setting	1 mv		
Output impedance	50 Ω (nom.)			

[2]When use modulation and LF simultaneously, the LF frequency range and wave type will be restricted. [3] The connector's load is 50  $\Omega$ .

## LF frequency sweep

Operating mode	digital sweep in discrete steps
Step spacing	linear, logarithmic
Sweep shape	saw-tooth, triangle
Sweep direction	up, down
Sweep range	0.01 Hz~1 MHz
Trigger mode	auto, keyboard, external connector, bus
Trigger slope	positive, negative
Dwell time setting range	1 ms~ 500 s
Dwell time setting resolution	0.1 ms

#### Analog modulation

Simultaneous modulation				
	Amplitude modulation	Frequency modulation	Phase modulation	Pulse modulation
Amplitude modulation		•	•	(•)
Frequency modulation	•		×	•
Phase modulation	•	×		•
Pulse modulation	(•)	•	•	
•=compatible, ×=incompatible, (•)=compatible limitations; NO specification Applies to AM distortion				
Amplitude modulation				
Modulation source	internal, external, internal+external			
AM depth setting range	0%~100%			
Resolution of setting	0.1%			
AM depth error	f-mod=1 kHz,m<80%,Level<=13dBm		<4% of setting+1%	
AM distortion	f-mod=1 kHz, m<30%, level<0 dBm		<3% (typ.)	
Modulation frequency	m<80%, 10 Hz~100 kHz		<3 dB (nom.)	

response

Frequency modulation			
Modulation source	internal, external, internal +external		
Maximum deviation	N*1 MHz (typ.)		
Resolution	0.1% of set deviation or 1 Hz, whichever is larger		
FM deviation error	Fmod=1 kHz, internal	<(2% of setting + 20 Hz)	
FM distortion	Fmod =1 kHz, deviation=N*1 MHz	<0.5% (nom.)	
Modulation frequency response	10 Hz~100 kHz	<3 dB (nom.)	
Phase modulation			
Modulation source	internal, external, internal + external		
Maximum deviation	N*5 rad		
Resolution	0.1% of set deviation or 0.01 rad, whichever is larger		
ΦM deviation error	Fmod=1 kHz, internal, deviation≤ N*5 rad	<(2% of setting + 0.05 rad)	
ΦM distortion	Fmod=1 kHz, deviation≤ N*5 rad	<0.5% (nom.)	
Modulation frequency response	10 Hz~100 kHz	<3 dB (nom.)	
Pulse modulation			
Modulation source	internal, external		
On/off ration	1 MHz <f<3.2 ghz<="" td=""><td>&gt;70 dBc</td></f<3.2>	>70 dBc	
Raise/fall time (10% / 90%)	10% to 90% of RF amplitude	<50 ns	
Pulse repetition time	setting range	40 ns~300 s	
Pulse generator			
Pulse modes	single pulse, double pulse		
Pulse source	internal, external		
Pulse polarity	normal, inverse		
	setting range	40 ns~300 s	
Pulse period	resolution of setting	10 ns	
Dulas width	setting range	20 ns~300 s	
Puise wiath	resolution of setting	10 ns	
Double pulse Delay	setting range	20 ns~300 s	
Double pulse Delay	resolution of setting	10 ns	
#2 Width	setting range	20 ns~300 s	
#2 WIGUI	resolution of setting	10 ns	
Trigger modes	auto, keyboard, external trigger, external gate trigger, bus		
Trig polarity	normal, inverse (used in external gate trigger mode)		
Trigger Slop	positive, negative (used in external trigger mode)		
External trigger delay	140 ns~300 s		
External trigger delay resolution of setting	10 ns		
Pulse train generator (	SSG3000X-PT)		
Number of pulses	1~2047		
Number of repetitions per pulse	1 to 65535		
Pulse on time and off time setting range	20 ns~300 s		
Pulse on time and off time setting resolution	10 ns		

IQ modulation feature (SSG3000X-IQE)		
Modulate source <sup>[5]</sup>	External	
Bandwidth	Base Band I or Q <100 MHz (typ.) RF (I+Q) <200 MHz (typ.)	
Full-scale input	$\int I^{2}+Q^{2}=0.5 Vrms$	
EVM	16QAM[5], root cosine filler (a=0.22), 5 MSps, level≤0 dBm	
	10 MHz <f≤1.5 (nom.)<br="" evm≤0.7%="" ghz,="">1.5 GHz<f≤3.2 (nom.)<="" evm≤1.2%="" ghz,="" td=""></f≤3.2></f≤1.5>	
	QPSK, root cosine filler (a=0.22), 5 MSps, level≤0 dBm	
	10 MHz <f≤1.5 (nom.)<br="" evm≤0.7%="" ghz,="">1.5 GHz<f≤3.2 (nom.)<="" evm≤1%="" ghz,="" td=""></f≤3.2></f≤1.5>	

[5] In this test , the baseband IQ come from SDG6000X series .

## Connectors

Front panel connectors		
RF output	impedance	50 Ω
	connector	N female
Modulation generator output	impedance	50 Ω
(LF)	connector	BNC female
Rear panel connectors		
	impedance	100 kΩ
TRIG IN / OUT	connector	BNC female
	active trigger voltage	5 V TTL
	impedance	50 Ω
EXT MOD INPUT	connector	BNC female
	impedance	100 kΩ
PULSE IN / OUT	connector	BNC
	input/output voltage	CMOS 3.3 V
	impedance	50 Ω
10 MHz IN	connector	BNC-female
	input power range	-5 dBm~ +10 dBm
	impedance	50 Ω
10 MHz OUT	connector	BNC-female
	input power range	>0 dBm
	impedance	50 Ω
SIGNAL VALID	connector	BNC-female
	output voltage range	CMOS 3.3 V
	impedance	50 Ω
I INPUT	connector	BNC-female
	impedance	50 Ω
Q INPUT	connector	BNC-female
Communication Interface		
USB host	USB-A 2.0	
USB device	USB-B 2.0	
LAN	LAN (VXI11, 10/100Base, RJ-45)	

General Specification		
Display	TFT LCD, RGB (800*480), 5 inch capacitive touch screen	
Storage	internal (Flash) 256 M Byte ,external (USB storage device)	
Source	input voltage range (AC) 100 V~240 V (±10%) AC frequency supply 100 V to 240 V, 50/60 Hz; supply 100V to 120 V, 400 Hz power consumption 35 W with all function working	
Temperature	Working temperature 0 $^\circ\text{C}$ to 50 $^\circ\text{C}$ , Storage temperature -20 $^\circ\text{C}$ to 70 $^\circ\text{C}$	
Humidity	0 °C to 30 °C , ≤95% relative humidity; 30 °C to 50 °C , ≤75% relative humidity	
Dimensions	W×H×D=338×113×369 mm	
Weight without package	contain IQ modulator board 4.84 kg	
Electromagnetic Compatibility and Safety		
EMC	EN 61326-1:2013	
Electrical safety	EN 61010-1:2010	

# **Ordering Information**

Product Description	SSG3000X Signal Generator	Order Number
Product code	Signal Conceptor, 0 kHz-2 2 CHz	SSG3032X
		SSG3032X-IQE
	Signal Generator 9 kHz~2.1 GHz	SSG3021X
		SSG3021X-IQE
Standard configurations	quick start, an USB cable, calibration certificate, power cord	
option	pulse train generator	SSG3000X-PT
	rack mount kit	SSG-RMK
	USB-GPIB adapter	USB-GPIB
	Upgrade 2.1 GHz to 3.2 GHz	SSG3000X-21BW32
	Upgrade 2.1 GHz to 3.2 GHz (with external IQ)	SSG3000X-IQE-21BW32

# SSG3000X Series RF Generator



#### 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, function/arbitrary waveform generators, digital multimeters, DC power supplies, spectrum analyzers, isolated handheld oscilloscopes and other general purpose test instrumentation. Since its first oscilloscope, the ADS7000 series, 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.

#### **Headquarter:**

SIGLENT TECHNOLOGIES CO., LTD. Add: Bldg No.4 & No.5, Antongda Industrial Zone, 3rd Liuxian Road, Bao'an District, Shenzhen, 518101, China. Tel: + 86 755 3688 7876 Fax: + 86 755 3359 1582 Email: sales@siglent.com; Website: http://www.siglent.com/ens/

#### USA:

SIGLENT Technologies America, Inc 6557 Cochran Rd Solon, Ohio 44139 Tel: 440-398-5800 Toll Free: 877-515-5551 Fax: 440-399-1211 Email: info@siglent.com Website: www.siglentamerica.com

#### **Europe:**

SIGLENT TECHNOLOGIES EUROPE GmbH ADD: Liebigstrasse 2-20, Gebaeude 14, 22113 Hamburg Germany Tel: +49(0)-819-95946 Fax: +49(0)-819-95947 Email: info-eu@siglent.com Website: www.siglenteu.com

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