Synthesized Function Generators

DS360 — Ultra-low distortion function generator

DS360 Function Generator

- **10 mHz to 200 kHz frequency range**
- **<–100 dBc distortion (to 20 kHz)**
- **Sine, square, white and pink noise**
- **20 µVpp to 40 Vpp output range**
- **Linear and log frequency sweeps**
- **25 ppm frequency accuracy**
- **10 MHz reference input (opt.)**
- **Balanced and unbalanced outputs**
- **RS-232 and GPIB interfaces**

- **DS360 ... $3095** *(U.S. list)*

The performance of a low-distortion analog source and the precision of direct digital synthesis (DDS) is combined in the DS360. With less than 0.001 % total harmonic distortion (THD), 25 ppm frequency accuracy, and a broad range of features including sweeps and bursts, the DS360 is the ideal source for audio frequency applications.

Ultra-Low Distortion and Noise

Unlike conventional RC oscillators, the DS360 uses digital signal processing and a precision 20-bit D/A converter to provide better than –100 dB distortion over the audio frequency range. With its DDS architecture, the DS360 has the features and flexibility of a contemporary synthesized function generator. Careful shielding and board layout keep the output noise to a minimum, making the DS360 the instrument of choice for audio research and development, manufacturing, and automated testing.

Frequency Stability

Low-distortion analog sources have impressive THD specifications, but suffer with poor frequency accuracy and resolution. The DS360 delivers 0.0025 % frequency accuracy over its entire frequency range. It has 6-digit frequency resolution from 1 mHz to 200 kHz, and a steady 25 ppm frequency stability. You can actually dial in 123,456 Hz from the front panel and have it mean something!

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Waveforms

The DS360 generates clean sine waves and square waves, as well as a two-tone signal for IMD testing. The two-tone signal is defined as either two sine waves, or a sine wave and square wave. Both frequency and amplitude are independently set for the two waves allowing standard two-tone formats like SMPTE, DIM and CCIF to be generated. In addition to standard waveforms, the DS360 outputs white noise, pink noise and band-limited white noise.

Audio Outputs

All functions and parameters are easily set using the front-panel keypad and spin knob. A wide variety of amplitude units including Vrms, Vpp, dBV, dBm and dBrel can be selected. Front-panel outputs including XLR, BNC and dual banana jacks assure compatibility with any system. The outputs can be configured as balanced or unbalanced, with amplitudes from 20.0 µVpp to 80.0 Vpp (balanced) and 10.0 µVpp to 40.0 Vpp (unbalanced). Chassis ground and output common banana jacks are also provided.

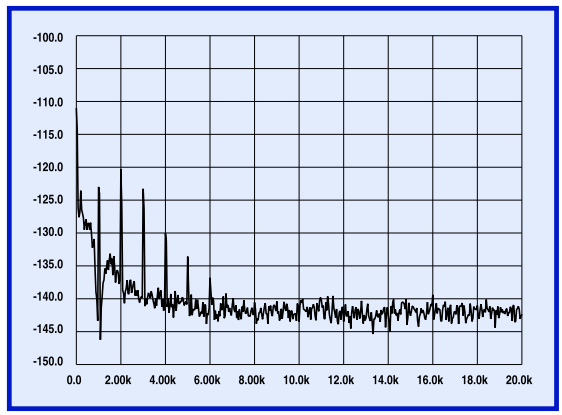
Sweeps and Bursts

Unlike single frequency analog sources, the DS360 generates low-distortion frequency sweeps over its entire frequency range. Linear and log sweeps are set between 10 mHz and 200 kHz with sweep times between 0.3 ms and 100 s. Sweeps can be single-shot or repetitive, and the instrument can sweep both up and down in frequency. The DS360 provides outstanding amplitude flatness (0.5 % up to 20 kHz) during frequency sweeps, and has a TTL level sweep marker output for synchronizing external equipment.

The DS360 also creates tone bursts of sine waves and square waves. The number of ON cycles, repetition rate, and the OFF amplitude level can all be adjusted. Sweeps and bursts may be triggered from the internal rate generator or an external trigger, or they can be externally gated.

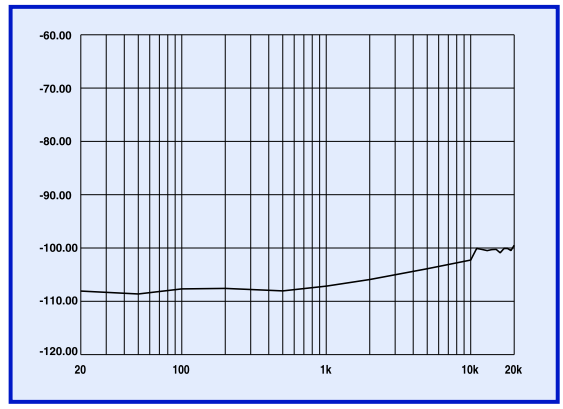
Computer Control

The DS360 is designed for benchtop use as well as automated testing. With standard IEEE-488.2 (GPIB) and RS-232 interfaces, the DS360 is fully programmable — a feature seldom found in low-distortion sources. All instrument functions can be controlled or queried through the computer interfaces.



THD vs. Frequency (Hz)

Residual distortion for a 1 kHz, 28 Vrms (balanced) sine wave after passing through a non-distorting notch filter to attenuate the fundamental.



THD + N vs. Frequency (Hz)

DS360 rear panel

Waveforms

Sine

Frequency range	0.01 Hz to 200.000 kHz
THD *(1 Vrms unbalanced, 2 Vrms balanced)*	
(<5 kHz)	–110 dB (typ.), –106 dB (max.)
(5 to 20 kHz)	–104 dB (typ.), –100 dB (max.)
(20 to 40 kHz)	–100 dB (typ.), –96 dB (max.)
(40 to 100 kHz)	–90 dB (typ.), –85 dB (max.)
(100 to 200 kHz)	–76 dB (typ.), –68 dB (max.)
THD *(10 Vrms unbalanced, 20 Vrms balanced)*	
(<5.0 kHz)	–109 dB (typ.), –105 dB (max.)
(5 to 20 kHz)	–103 dB (typ.), –99 dB (max.)
(20 to 40 kHz)	–98 B (typ.), –93 dB (max.)
(40 to 100 kHz)	–88 dB (typ.), –83 dB (max.)
(100 to 200 kHz)	–76 dB (typ.), –68 dB (max.)

Square

Frequency range	0.01 Hz to 200 kHz
Rise time	1.3 µs
Even harmonics	<–60 dBc (to 20 kHz)

White Noise

Bandwidth	DC to 200 kHz
Flatness	<1.0 dB, 1 Hz to 100 kHz
Crest factor	11 dB

Pink Noise

Bandwidth	10 Hz to 200 kHz
Flatness	<3.0 dB (20 Hz to 20 kHz) (measured using 1/3 oct. analysis)
Crest factor	12 dB

Bandwidth Limited Noise

Bandwidth	100 Hz, 200 Hz, 400 Hz, 800 Hz, 1.6 kHz, 3.2 kHz, 6.4 kHz, 12.8 kHz, 25.6 kHz, 51.2 kHz, 102.4 kHz
Center frequency	0 Hz to 200.0 kHz (200 Hz increments)
Flatness (in band)	<1.0 dB
Crest factor	
Baseband	12 dB (0 Hz center frequency)
Non-baseband	15 dB

Two-Tone

Type	Sine-sine, sine-square
Sine frequency	0.01 Hz to 200 kHz
Square frequency	0.1 Hz to 5 kHz
Square resolution	2 digits
SFDR	>90 dB

Sine or Square Burst

On cycles	0.5, 1 to 65534 cycles
Repetition rate	1 to 65535 cycles
Triggering	Internal, external, single-shot, externally gated
Off level	0.0 % to 100.0 % (of on level)
Off resolution	0.1 %
Max. off attenuation	–90 dBc (1 kHz) –70 dBc (10 kHz) –50 dBc (100 kHz)

White or Pink Noise Burst

On time	10 µs to 599.9 s
Repetition time	20 µs to 600 s
Triggering	Internal, external, single-shot, externally gated
Off level	0.0 % to 100.0 % (of on level)
Resolution	0.1 %

Sine or Square Sweep

Type	Linear or logarithmic
Range	0.01 Hz to 200.000 kHz
Rate	0.1 Hz to 3.1 kHz
Resolution	2 digits
Flatness	±0.1 dB (1 %)

Frequency

Resolution	6 digits or 10 mHz (whichever is greater)
Accuracy	25 ppm (0.0025 %) + 4 mHz (20 °C to 40 °C)

Amplitude

Unbalanced outputs	5.0 µVpp to 14.4 Vpp (50 Ω load) 5.0 µVpp to 20.0 Vpp (600 Ω load) 10.0 µVpp to 40.0 Vpp (Hi-Z load)
Balanced outputs	10 µVpp to 28.8 Vpp (50 Ω load) 10 µVpp to 28.8 Vpp (150 Ω load) 10 µVpp to 40.0 Vpp (600 Ω load) 20 µVpp to 80.0 Vpp (Hi-Z load)
Resolution	4 digits or 1 µV, whichever is greater (Vpp or Vrms), 0.1 dB (dBm or dBV)
Accuracy	
Sine and Square	±0.1 dB (1 %)
Two-tone	±0.1 dB (1 %)
White noise	±0.175 dB (2 %)
Pink noise	±0.35 dB (4 %)

DS360 Specifications

Broadband Noise

(1 kHz sine wave into Hi-Z load at freq. > 1 kHz)

<12.6 mVpp	<4 nV/√Hz
12.6 mVpp to 126 mVpp	<7.5 nV/√Hz
126 mVpp to 1.26 Vpp	<15 nV/√Hz
1.26 Vpp to 10 Vpp	<100 nV/√Hz
10 Vpp to 40 Vpp	<500 nV/√Hz

Offset

Unbalanced output	0 to ±7.4 VDC (50 Ω load) 0 to ±10.0 VDC (600 Ω load) 0 to ±20.0 VDC (Hi-Z load)
Balanced output	Not active
Resolution	3 digits
Accuracy	

(all except pink noise)

1 % ± 25 mV (Vp + offset > 0.63 V)
1 % ± 2.5 mV (0.63 V > Vp + offset > 0.063 V)
1 % ± 250 µV (63 mV > Vp + offset > 6.3 mV)
1 % ± 50 µV (Vp + offset < 6.3 mV)

(pink noise)

1 % ± 200 mV (Vp + offset > 0.63 V)
1 % ± 20 mV (0.63 V > Vp + offse > 0.063 V)
1 % ± 2 mV (63 mV > Vp + offset > 6.3 mV)
1 % ± 200 µV (Vp + offset < 6.3 mV)

Outputs

Configuration	Balanced and unbalanced
Connectors	Floating BNCs, banana plugs and XLR jack
Source impedance	
Balanced	50 Ω ± 3 % 150 Ω ± 2 % 600 Ω ± 1 % Hi-Z (50 Ω ± 3 %)
Unbalanced	50 Ω ± 3 % 600 Ω ± 1 % Hi-Z (25 Ω ± 1 Ω)
Floating voltage	±40 VDC (max.)

10 MHz Reference Input (Opt. 03)

Requirements	Sine or TTL, 0.4 to 7 Vpp, 10 MHz ± 50 ppm
Stability	
Internal	±25 ppm
External	Same as stability of ext. reference
Indicators	External reference detected, Locked

Other Outputs

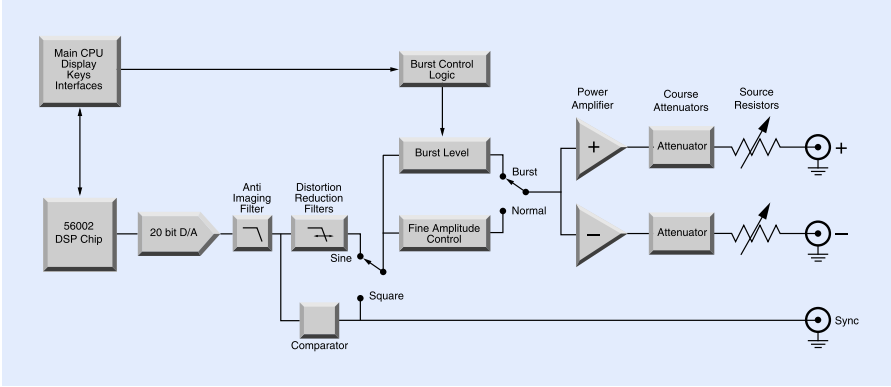
Sync	TTL level (same frequency and phase as output)
Burst out	TTL pulse marks burst (TTL high for ON time)
Trigger/gate in	TTL pulse starts sweep or burst TTL high activates gated burst
Sweep	TTL pulse marks beginning of sweep

General

Computer interfaces	GPIB and RS-232. All instrument functions can be controlled.
Size	17" × 3.5" × 16.25" (WHD)
Weight	17 lbs.
Power	50 W, 100/120/220/240 VAC, 50/60 Hz
Warranty	One year parts and labor on defects in materials and workmanship

Ordering Information

DS360	Low-distortion function generator	$3095
Option 03	10 MHz reference input	$695
O360RM	Rack mount kit	$100



DS360 block diagram