

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 μ Vpp 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**

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!

DS360 Low Distortion Function Generator

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 μ Vpp to 80.0 Vpp (balanced) and 10.0 μ Vpp to 40.0 Vpp (unbalanced). Chassis ground and output common banana jacks are also provided.

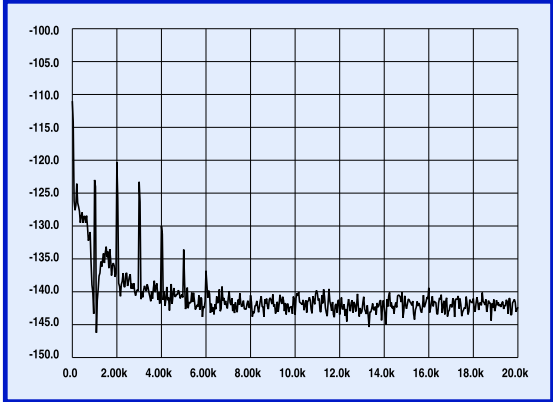
Sweeps and Bursts

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.

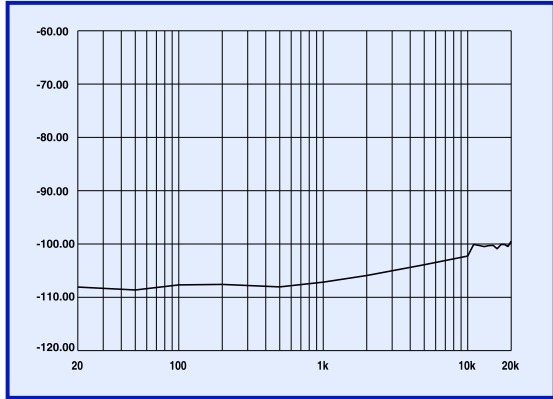
Computer Control

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 (<i>1 Vrms unbalanced, 2 Vrms balanced</i>) | |
| <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 (<i>10 Vrms unbalanced, 20 Vrms balanced</i>) | |
| <5.0 kHz) | -109 dB (typ.), -105 dB (max.) |
| (5 to 20 kHz) | -103 dB (typ.), -99 dB (max.) |
| (20 to 40 kHz) | -98 dB (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 μ s |
| 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 μ s to 599.9 s |
| Repetition time | 20 μ s 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 | \pm 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 μ Vpp to 14.4 Vpp (50 Ω load) 5.0 μ Vpp to 20.0 Vpp (600 Ω load) 10.0 μ Vpp to 40.0 Vpp (Hi-Z load) |
| Balanced outputs | 10 μ Vpp to 28.8 Vpp (50 Ω load) 10 μ Vpp to 28.8 Vpp (150 Ω load) 10 μ Vpp to 40.0 Vpp (600 Ω load) 20 μ Vpp to 80.0 Vpp (Hi-Z load) |
| Resolution | 4 digits or 1 μ V, whichever is greater (Vpp or Vrms), 0.1 dB (dBm or dBV) |
| Accuracy | |
| Sine and Square | \pm 0.1 dB (1%) |
| Two-tone | \pm 0.1 dB (1%) |
| White noise | \pm 0.175 dB (2%) |
| Pink noise | \pm 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 + offset > 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

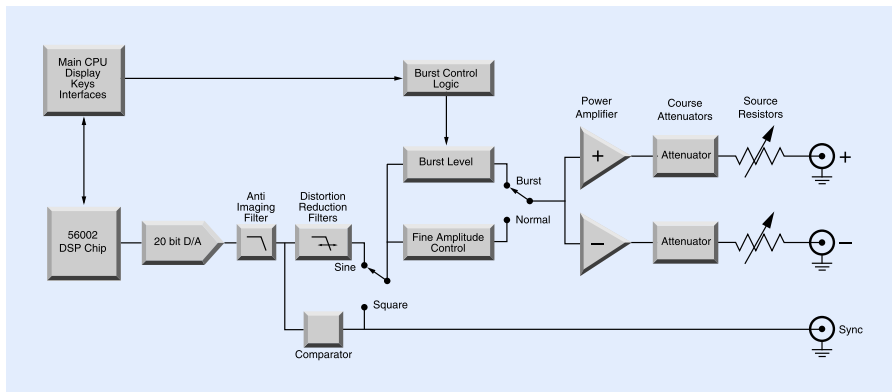
| | |
|-----------------|--|
| Sync | TTL level (same frequency and phase as output) |
| Burst out | TTL pulse marks burst (TTL high for ON time) |
| Trigger/gate in | TTL pulse starts sweep or burst |
| Sweep | TTL high activates gated burst |
| | TTL pulse marks beginning of sweep |

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 |
| Option 03 | 10 MHz reference input |
| O360RM | Rack mount kit |



DS360 block diagram