# Agilent 33250A
# Function/Arbitrary Waveform Generator

Data Sheet

- **80 MHz sine and square wave outputs**
- **Sine, square, ramp, noise and other waveforms**
- **50 MHz pulse waveforms with variable rise/fall times**
- **12-bit, 200 MSa/s, 64K-point deep arbitrary waveform**


### Standard Waveforms

The Agilent Technologies 33250A Function/Arbitrary Waveform Generator uses direct digital-synthesis techniques to create a stable, accurate output on all waveforms, down to 1 µHz frequency resolution. The benefits are apparent in every signal you produce, from the sine wave frequency accuracy to the fast rise/fall times of square waves, to the ramp linearity.

Front-panel operation of the 33250A is straightforward and user friendly. The knob or numeric keypad can be used to adjust frequency, amplitude and offset. You can even enter voltage values directly in Vpp, Vrms, dBm, or high/low levels. Timing parameters can be entered in hertz (Hz) or seconds.

### Custom Waveform Generation

Why settle for a basic function generator when you can get arbitrary waveforms at no extra cost? With the 33250A, you can generate arbitrary waveforms with 12-bit vertical resolution, 64K memory depth, and a sample rate of 200 MSa/s. You can also store up to four 64K-deep arbitrary waveforms in non-volatile memory with user-defined names to help you find the right waveform when you need it most.

The included Agilent IntuiLink software allows you to easily create, edit, and download complex waveforms using the intuiLink Arbitrary Waveform Editor. Or you can capture a waveform using IntuiLink oscilloscope or DMM and send it to the 33250A for output. For programmers, ActiveX components can be used to control the instrument using SCPI commands. IntuiLink provides the tools to easily create, download, and manage waveforms for your 33250A. To find out more about IntuiLink, visit **www.agilent.com/find/intuilink**.

### Pulse Generation

The 33250A can generate simple pulses up to 50 MHz. With variable edge time, pulse width and voltage level, the 33250A is ideally suited to a wide variety of pulse applications.

### Built-in Versatility

AM, FM and FSK capabilities make it easy to modulate waveforms with or without a separate source. Linear or logarithmic sweeps can be performed with a programmable frequency marker signal. Programmable burst count and gating allow you to further customize your signal.

For system applications, both GPIB and RS-232 interfaces are standard, and support full programmability using SCPI commands.

### Color Graphical Display

The unique design of the 33250A combines a low-profile instrument with the benefits of a color graphical display. Now you can display multiple waveform parameters at the same time. The graphical interface also allows you to modify arbitrary waveforms quickly and easily.

### Timebase Stability and Clock Reference

The 33250A TCXO timebase gives you frequency accuracy of 2 ppm for your most demanding applications. The external clock reference input/output lets you synchronize to an external 10 MHz clock, to another 33250A, or to an Agilent 33120A. Phase adjustments can be made from the front panel or via a computer interface, allowing precise phase calibration and adjustment.

## WAVEFORMS

| | |
|---|---|
| **Standard** | sine, square, pulse, ramp, noise, sin(x)/x, exponential rise, exponential fall, cardiac, DC volts |
| **Arbitrary** | |
| Waveform length | 1 to 64K points |
| Amplitude resolution | 12 bits (including sign) |
| Repetition rate | 1 µHz to 25 MHz |
| Sample rate | 200 MSa/s |
| Filter bandwidth | 50 MHz |
| Non-vol. memory | Four (4) 64K waveforms |

## FREQUENCY CHARACTERISTICS

| | |
|---|---|
| Sine | 1 µHz to 80 MHz |
| Square | 1 µHz to 80 MHz |
| Pulse | 500 µHz to 50 MHz |
| Arb | 1 µHz to 25 MHz |
| Ramp | 1 µHz to 1 MHz |
| White noise | 50 MHz bandwidth |
| Resolution | 1 µHz; except pulse, 5 digits |
| Accuracy (1 year) | 2 ppm, 18°C to 28°C<br>3 ppm, 0°C to 55°C |

## SINEWAVE SPECTRAL PURITY

**Harmonic distortion**

| | ≤ 3 Vpp[1] | > 3 Vpp |
|---|---|---|
| DC to 1 MHz | -60 dBc | -55 dBc |
| 1 to 5 MHz | -57 dBc | -45 dBc |
| 5 to 80 MHz | -37 dBc | -30 dBc |

| | |
|---|---|
| **Total harmonic distortion** | |
| DC to 20 kHz | < 0.2% + 0.1 mVrms |
| **Spurious (non-harmonic)**[2] | |
| DC to 1 MHz | -60 dBc |
| 1 to 20 MHz | -50 dBc |
| 20 80 MHz | -50 dBc + 6 dBc/octave |
| **Phase noise** (30 kHz band) | |
| 10 MHz | <-65 dBc (typical) |
| 80 MHz | <-47 dBc (typical) |

## SIGNAL CHARACTERISTICS

| | |
|---|---|
| **Squarewave** | |
| Rise/Fall time | < 8 ns |
| Overshoot | < 5% |
| Asymmetry | 1% of period + 1 ns |
| Jitter (rms) | |
| < 2 MHz | 0.01% + 525 ps |
| ≥ 2 MHz | 0.1% + 75 ps |
| Duty cycle | |
| ≤ 25 MHz | 20.0% to 80.0% |
| 25 to 50 MHz | 40.0% to 60.0% |
| 50 to 80 MHz | 50.0% fixed |
| **Pulse** | |
| Period | 20.00 ns to 2000.0 s |
| Pulse width | 8.0 ns to 1999.9 s |
| Variable edge time | 5.00 ns to 1.00 ms |
| Overshoot | < 5% |
| Jitter (rms) | 100 ppm + 50 ps |
| **Ramp** | |
| Linearity | < 0.1% of peak output |
| Symmetry | 0.0% - 100.0% |
| **Arb** | |
| Min. edge time | < 10 ns |
| Linearity | < 0.1% of peak output |
| Settling time | < 50 ns to 0.5% of final value |
| Jitter (rms) | 30 ppm + 2.5 ns |

## OUTPUT CHARACTERISTICS

| | |
|---|---|
| **Amplitude** (into 50Ω) | 10 mVpp to 10 Vpp |
| Accuracy (at 1 kHz, >10 mVpp, Autorange) | ± 1% of setting ± 1 mVpp |
| Flatness (sinewave relative to 1 kHz, Autorange) | |
| < 10 MHz | ± 1% (0.1 dB) |
| 10 to 50 MHz | ± 2% (0.2 dB) |
| 50 to 80 MHz | ± 5% (0.4 dB) |
| Units | Vpp, Vrms, dBm, high and low level |
| Resolution | 0.1 mV or 4 digits |
| **Offset** (into 50Ω) | ± 5 Vpk ac + dc |
| Accuracy | 1% of setting + 2 mV + 0.5% of amplitude |
| **Waveform Output** | |
| Impedance | 50Ω typical (fixed)<br>>10 MΩ (output disabled) |
| Isolation | 42 Vpk maximum to earth |
| Protection | short-circuit protected; overload automatically disables main output |

## MODULATION

| | |
|---|---|
| **AM** | |
| Carrier waveforms | sine, square, ramp, and arb |
| Mod. waveforms | sine, square, ramp, noise, and arb |
| Mod. frequency | 2 mHz to 20 kHz |
| Depth | 0.0% to 120.0% |
| Source | internal/external |
| **FM** | |
| Carrier waveforms | sine, square, ramp, and arb |
| Mod. waveforms | sine, square, ramp, noise, and arb |
| Mod. frequency | 2 mHz to 20 kHz |
| Peak deviation | DC to 80 MHz |
| Source | internal/external |
| **FSK** | |
| Carrier waveforms | sine, square, ramp, and arb |
| Mod. waveform | 50% duty cycle square |
| Internal rate | 2 mHz to 1 MHz |
| Frequency range | 1 µHz to 80 MHz |
| Source | internal/external |
| **External Modulation Input** | |
| Voltage range | ± 5 V full scale |
| Input impedance | 10 kΩ |
| Frequency | DC to 20 kHz |

## BURST

| | |
|---|---|
| Waveforms | sine, square, ramp, pulse, arb, and noise |
| Frequency | 1 µHz to 80 MHz[3] |
| Burst count | 1 to 1,000,000 cycles or infinite |
| Start/Stop phase | -360.0° to +360.0° |
| Internal period | 1 ms to 500 s |
| Gate source | external trigger |
| Trigger source | single manual trigger, internal, external trig |
| Trigger delay | |
| N-cycle, infinite | 0.0 ns to 85.000 sec |

## SWEEP

| | |
|---|---|
| Waveforms | sine, square, ramp, and arb |
| Type | linear and logarithmic |
| Direction | up or down |
| Start F/Stop F | 100 µHz to 80 MHz |
| Sweep time | 1 ms to 500 s |
| Trigger | single manual trigger, internal, external trig |
| Marker | falling edge of sync signal (programmable) |

## SYSTEM CHARACTERISTICS

**Configuration Times** (typical)

| | |
|---|---|
| Function change | |
| Standard | 100 ms |
| Pulse | 660 ms |
| Built-in arb | 220 ms |
| Frequency change | 20 ms |
| Amplitude change | 50 ms |
| Offset change | 50 ms |
| Select user arb | < 900 ms for < 16K pts. |
| Modulation change | < 200 ms |

**Arb Download Times** GPIB/RS-232 (115Kbps)

| Arb Length | Binary | ASCII Integer | ASCII Real |
|---|---|---|---|
| 64K points | 48 sec | 112 sec | 186 sec |
| 16K points | 12 sec | 28 sec | 44 sec |
| 8K points | 6 sec | 14 sec | 22 sec |
| 4K points | 3 sec | 7 sec | 11 sec |
| 2K points | 1.5 sec | 3.5 sec | 5.5 sec |

## TRIGGER CHARACTERISTICS

**Trigger input**

| | |
|---|---|
| Input level | TTL compatible |
| Slope | rising or falling, selectable |
| Pulse width | > 100 ns |
| Input impedance | 10 kΩ, DC coupled |
| Latency | |
| Burst | < 100 ns (typical) |
| Sweep | < 10 µs (typical) |
| Jitter (rms) | |
| Burst | 1 ns; except pulse, 300 ps |
| Sweep | 2.5 µs |

**Trigger output**

| | |
|---|---|
| Level | TTL compatible into 50Ω |
| Pulse width | > 450 ns |
| Maximum rate | 1 MHz |
| Fanout | ≤ 4 Agilent 33250A's |

## CLOCK REFERENCE

**Phase Offset**

| | |
|---|---|
| Range | -360° to +360° |
| Resolution | 0.001° |

**External Reference Input**

| | |
|---|---|
| Lock range | 10 MHz ± 35 kHz |
| Level | 100 mVpp to 5 Vpp |
| Impedance | 1 kΩ nominal, ac coupled |
| Lock time | < 2 s |

**Internal Reference Output**

| | |
|---|---|
| Frequency | 10 MHz |
| Level | 632 mVpp (0 dbm), nominal |
| Impedance | 50 Ω nominal, ac coupled |

## SYNC OUTPUT

| | |
|---|---|
| Level | TTL compatible into > 1 kΩ |
| Impedance | 50 Ω nominal |

## GENERAL

| | |
|---|---|
| Power supply | 100-240 V, 50-60 Hz<br>100-127 V, 50-400 Hz |
| Power consumption | 140 VA |
| Operating temp. | 0°C to 55°C |
| Storage temp. | -30°C to 70°C |
| Stored states | 4 named user configurations |
| Power on state | default or last |
| Interface | IEEE-488 and RS-232 std. |
| Language | SCPI-1997, IEEE-488.2 |
| Dimensions (WxHxD) | |
| Bench top | 254 x 104 x 374 mm |
| Rackmount | 213 x 89 x 348 mm |
| Weight | 4.6 kg |
| Safety designed to | EN61010-1, CSA1010.1, UL-311-1 |
| EMC tested to | IEC-61326-1 |
| | IEC-61000-4-3 criteria B |
| | IEC-61000-4-6 criteria B |
| Vibration and shock | MIL-T-28800E, Type III, Class 5 |
| Acoustic noise | 40 dBA |
| Warm-up time | 1 hour |
| Calibration interval | 1 year |
| Warranty | 1 year |

[1] Harmonic distortion at low amplitudes is limited by a -70 dBm floor

[2] Spurious noise at low amplitudes is limited by a -75 dBm floor

[3] Sine and square waveforms above 25 MHz only with infinite burst count

## Ordering Information

**Agilent 33250A**
80 MHz Function/Arbitrary
Wavefrom Generator

**Accessories included**
Operating manual, service manual, quick reference guide, IntuiLink waveform editor software, test data, RS-232 cable, and power cord (see language option).

**Options**

| | |
|---|---|
| **Opt. 0B0** | Delete manual |
| **Opt. 1CM** | Rackmount kit (also sold as Agilent 34190A) |
| **Opt. A6J** | ANSI Z540 calibration |
| **Opt. AB0** | Taiwan: Chinese manual |
| **Opt. AB1** | Korea: Korean manual |
| **Opt. AB2** | China: Chinese manual |
| **Opt. ABA** | English: English manual |
| **Opt. ABD** | Germany: German manual |
| **Opt. ABF** | France: French manual |
| **Opt. ABJ** | Japan: Japanese manual |

**Other Accessories**

| | |
|---|---|
| **34131A** | Carrying case |
| **34161A** | Accessory pouch |
| **34190A** | Rackmount kit* |

*For racking two 33250As side-by-side, order the following items: Lock-link kit (p/n 5061-9694), Flange kit (p/n 5063-9212)

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**Agilent's IO Libraries Suite** ships with the 33250A to help you quickly establish an error-free connection between your PC and instruments—regardless of the vendor. It provides robust instrument control and works with the software development environment you choose.

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