

 **40 Years**
Celebration



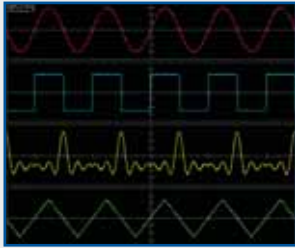
WAVE STANDARD
SERIES

Some are simply
better than others!

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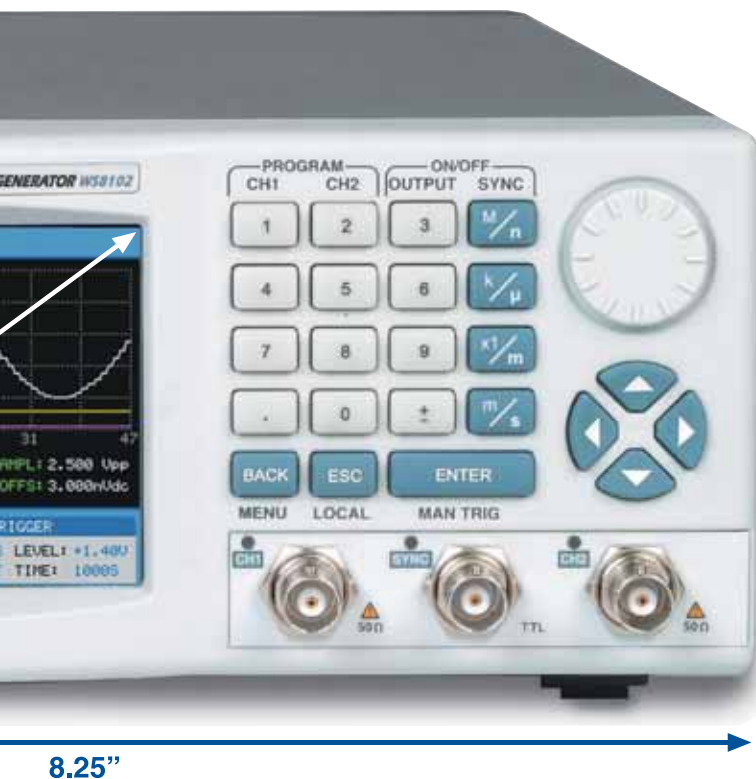
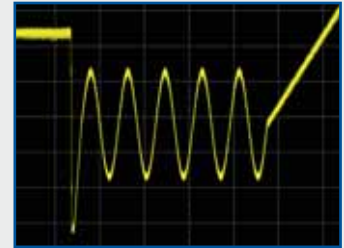
Leading the Way
In Waveform Generation


TABOR ELECTRONICS Ltd.
Since 1971



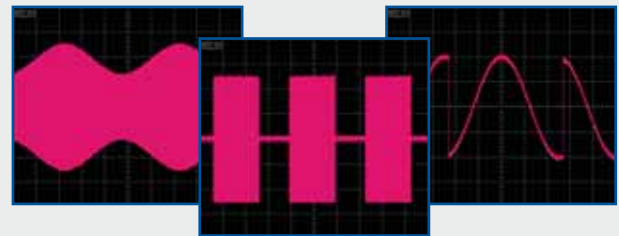
User Defined Waveforms

For more advanced users the Wave Standard Series with its up to 16 bit vertical resolution offers a standard 512k memory depth and up to 2GS/s sample clock for designing waveforms. With the ability to control and edit the value of each and every point any wave is possible. The memory can be divided into segments for storing all of the user defined waveforms.



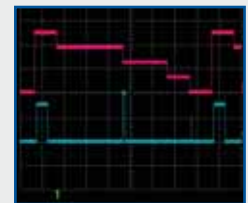
Modulation Capability

Agility and modulation capabilities open the door to diverse applications. In addition to the capability of generating any shape and style of waveform with the arbitrary waveform generation power, the Wave Standard Series can also do standard modulation schemes such as AM, FM, FSK, sweep and PSK without sacrificing the power of the instrument control and output run modes.



Pulse / Pattern Creation

Generating complex pulse trains has never been easier. The Pulse Composer is a powerful tool that converts the WS series to a very sophisticated pulse/pattern generator, allowing to create literally any complex pulse train / pattern, whether it's a single pulse, multi-level, linear-points, user-defined or even standard random patterns with programmable resolution, so it doesn't matter if your application is radar communications, nanotechnology or serial bus testing, the pulse/pattern composer is the right tool for your application.



Easy to Use

The Wave Standard Series comes with large and user-friendly 3.8" back-lit color LCD display that facilitates browsing through menus, updating parameters and displaying detailed and critical information for your waveform output. Combined with numeric keypad, cursor position control and a dial, the front panel controls simplifies the often complex operation of an arbitrary function generator. For remote use, the series is equipped with standard Ethernet, USB and GPIB allowing the user to freely select the interface best suited to his individual requirements.



Wave Standard Series

Arbitrary Function Generators

The Wave Standard Series is a family of single and dual channel arbitrary/function generators, designed to provide superior performance at a low price. The new series incorporates an easy to use built in waveform gallery and modulation schemes as well as a memory-based true arbitrary waveform generator architecture for accurate, jitter-free waveforms reaching frequencies of up to 350MHz. Packed into a compact and efficient rack mountable box, having all in one easy to use high performance unit, makes the Wave Standard series, by far, the best in its category (AFGs) for size, price and performance.

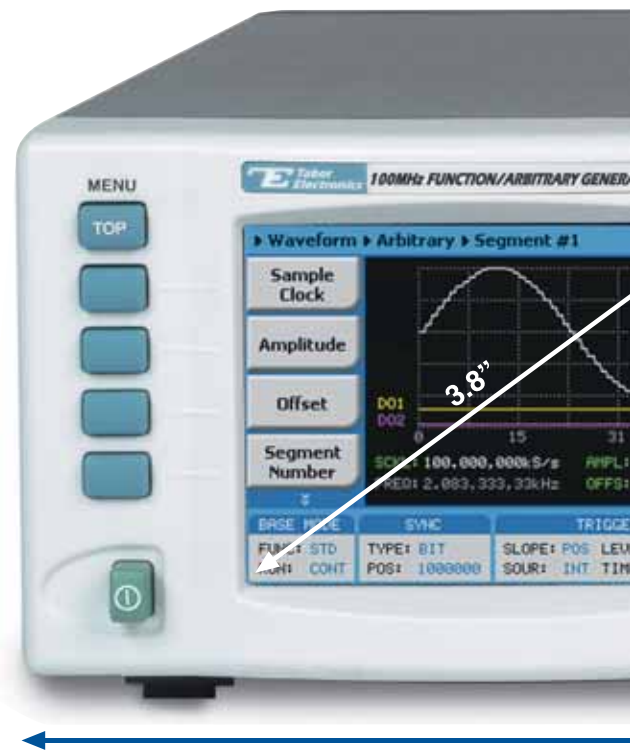
- 100, 250 and 350MHz Arbitrary Function Generators
- Single or Dual Channel Versions
- Up to 16Vp-p into 50Ω, 32Vp-p into open circuit
- Up to 2GS/s with up to 16-Bit and 512k arbitrary waveforms
- Continuous, triggered, gate and burst modes
- Powerful pulse/pattern composer for analog, digital and mixed signals
- AM, FM, FSK, and PSK modulation
- High-resolution 3.8" user-friendly color LCD display
- Ethernet, USB and GPIB interfaces

MODEL	8101 8102	8251	8351 8352
Channels	1 2	1	1 2*
Waveform Type	Standard, Arbitrary, Pulse and Modulated		Standard, Arbitrary, Pulse, Pattern, PAM and Modulated
Max Frequency (Sine/Square/others)	100MHz / 62.5MHz / 31.25MHz	250MHz / 150MHz / 50MHz	350MHz / 250MHz / 125MHz
Max. Sample Clock Rate	250MS/s	625MS/s	2GS/s
Memory Size	512k	512k	512k
Vertical Resolution	16 bits	12 bits	14 bits
Modulation	AM, FM, FSK, PSK, Sweep	FM, FSK, PSK, Sweep	AM, FM, ASK, Amp. Hop, FSK, Freq. Hop, Sweep, Chirp
Max Amplitude (into 50Ω)	16Vp-p	4Vp-p	4Vp-p
Transition Time (typ.)	<4ns	<1ns	<1ns
Run Modes	Continuous, Triggered, Burst, Gated		Continuous, Self armed, Armed, Triggered, Burst, Normal, Override & Gated
Display	User Friendly 3.8" color LCD Display		4" Color LCD
Storage	-		1GB Internal Flash and USB host
Remote Programming	Full IVI-C driver (C++, CVI, LabView), MATLAB and ArbConnection		Full IVI-COM & IVI-C driver (C++, CVI, LabView), MATLAB and ArbConnection
Connectivity	LAN, USB, GPIB		LAN, USB, GPIB and LXI-C compliant

* Fully independent or synchronized with 10ps resolution control

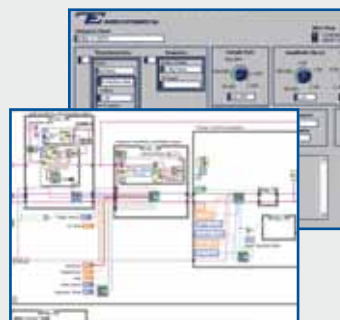
High Speed Function Generator

The Wave Standard Series has 11 built in functions for quick and easy wave generation. Front panel operations allows for easy selection of waveform and editing of all wave parameters. All of the standard waves can reach up to 50MHz with Sine and Square going as high as 350MHz.



Multiple Environments to Write Your Code

The Wave Standard Series comes with a complete set of drivers, allowing you to write your application in various environments including Labview, CVI, C++, VB and MATLab. You may also link the supplied dll to other Windows-based API's or use low-level SCPI commands to program the instrument, regardless of whether your application is written for Windows, Linux or Macintosh operating systems.



ArbConnection

ArbConnection is a powerful software package that allows you to easily design any type of waveform and control the instrument functions, modes and features via a graphical user interface (GUI). Whether you need to generate output using a built-in waveform, a hand sketched or played back waveform, a pulse pattern, a serial data string, a modulated carrier or even an equation, ArbConnection provides you the editing tools which makes virtually any application possible.

For more information or to schedule a demo, call today

	WS8101/2	WS8251	WS8351/2
REPETITIVE NOISE			
Bandwidth:	50MHz	62.5MHz	125MHz
DC			
Range:	-8V to +8V ⁽³⁾	-3V to +3V ⁽³⁾	-2V to +2V ⁽³⁾
PULSE			
Pulse Mode:	Single or double, programmable	Single or double, programmable	Single or double, programmable
Polarity:	Normal, inverted or complement	Normal, inverted or complement	Normal, inverted or complement
Period:	16ns to 1000s	4ns to 1000s	4ns to 1.6s
Resolution:	4ns	1ns	1ns
Pulse Width:	8ns to 1000s	2ns to 1000s	2ns to 1.6s
Rise/Fall Time:			
Fast (typ.)	<4ns	<600ps	<1ns
Linear	4ns to 1000s	1ns to 1000s	1ns to 1.6s
High Time, Delay & Double Pulse Delay:	4ns to 1000s	1ns to 1000s	1ns to 1.6s
Impedance:	50Ω	50Ω	50Ω
Amplitude Window:	16mVp-p to 16Vp-p ⁽³⁾	50mVp-p to 4Vp-p ⁽³⁾	100mVp-p to 4Vp-p ⁽³⁾
Levels			
Low Level	-8V to +7.992V ⁽³⁾	-3V to +2.975V ⁽³⁾	-2V to +1.95V ⁽³⁾
High Level	-7.992V to +8V ⁽³⁾	-2.975V to +3V ⁽³⁾	-1.95V to +2V ⁽³⁾
PULSE / PATTERN COMPOSER			
Type:	-	-	Multi-level, linear-points, PAM
ARBITRARY WAVEFORMS			
Sample Rate:	1.5S/s to 250MS/s	50kS/s to 625MS/s	10MS/s to 2GS/s
Vertical Resolution:	16 bits	12 bits	14 bits
Waveform Memory:	512k points	512k points	512k points standard
Min. Segment Size:	16 points	64 points	384 points
Resolution:	4 points	16 points	16 points
No. of Segments:	1 to 1k	1 to 1k	1 to 16k
Waveform Granularity:	1 point	1 point	1 point
MODULATION			
COMMON CHARACTERISTICS			
Carrier Waveform:	Sine	Sine	Sine
Carrier Frequency:	1μHz to 100MHz	1Hz to 250MHz	10kHz to 350MHz
Source:			
Internal	AM, ASK, FM, FSK, Sweep	FM, Arbitrary FM, Sweep	AM, ASK, FM, FSK, PSK, Sweep/Chirp
External	-	FSK, PSK	-
AM			
Envelope Waveform:	Sine, square, triangle, ramp	-	Sine, square, triangle, ramp
Envelope Freq.:	1mHz to 100kHz	-	(CW/9) > (M.F) > (CW/50e ³)
Modulation Depth:	0% to 100%	-	0.1 to 100%
FM			
Modulating Shape:	Sine, square, triangle, ramp	Sine, square, triangle, ramp	Sine, square, triangle, ramp
Modulating Freq.:	1μHz to 100kHz	1mHz to 100kHz	(CW/6) > (M.F) > (30e ⁻⁶ xCW)
Peak Deviation:	Up to 100MHz	Up to 249MHz	CW/2
ASK/FSK/PSK			
Baud Rate:	1bit/s to 10Mbits/s	1bit/s to 10Mbits/s	1bit/s to 250Mbits/s
Data Bits Length:	2 to 4,000	2 to 4000	2 to 4000
Carrier Phase:	0 to 360°	0 to 360°	0 to 360°
SWEEP			
Sweep Step:	Linear or log	Linear or log	Linear or log
Sweep Direction:	Up or Down	Up or down	Up or down
Sweep Time:	1μs to 500s	1ms to 1000s	(9/High Freq.) > (S.T) > (50e ³ /High Freq.)
CHIRP			
Modulation Shape:	-	-	Pulse
Pulse Repetition:			
Range	-	-	100ns to 2s
Resolution	-	-	3 digits
Accuracy	-	-	100ppm

Specification

	WS8101/2	WS8251	WS8351/2
CONFIGURATION			
Output Channels	1/2, semi-independent	1	1/2, Synchronized/fully separated
STANDARD WAVEFORMS			
Type:	Sine, Triangle, Square, Pulse, Ramp, Sine(x)/x, Gaussian, Exponential, Repetitive Noise, DC		
Frequency Range:			
Sine	1µHz to 100MHz	50Hz to 250MHz	10kHz to 350MHz
Square	1µHz to 62.5MHz	50Hz to 150MHz	10kHz to 250MHz
All Others	1µHz to 31.25MHz	50Hz to 50MHz	10kHz to 125MHz
SINE			
Start Phase:	0-360°	0 to 360°	0 to 360°
Phase Resolution:	0.01°	0.1°	0.1°
Harmonics Distortion (1Vp-p, typ.):			
1MHz to 5MHz	<-60dBc	<-50dBc	<-40dBc
5MHz to 10MHz	<-57dBc	<-47dBc	<-40dBc
10MHz to 25MHz	<-55dBc	<-47dBc	<-40dBc
25MHz to 50MHz	<-50dBc	<-47dBc	<-40dBc
50MHz to 100MHz	<-45dBc	<-45dBc	<-40dBc
100MHz to 200MHz	-	<-35dBc	<-40dBc
200MHz to 250MHz	-	<-35dBc	<-50dBc ⁽¹⁾
250MHz to 350MHz ⁽¹⁾	-	-	<-50dBc ⁽¹⁾
Non-Harmonic Distortion (1Vp-p, typ.):			
1MHz to 25MHz	<-70dBc	<-65dBc	<-80dBc
25MHz to 50MHz	<-65dBc	<-65dBc	<-80dBc
50MHz to 100MHz	<-60dBc	<-63dBc	<-80dBc
100MHz to 200MHz	-	<-55dBc	<-75dBc
200MHz to 250MHz	-	<-45dBc	<-75dBc
250MHz to 350MHz	-	-	<-70dBc
Total Harmonic Distortion (typ.):			
DC to 100kHz	0.10%	0.30%	0.25%
Flatness (1MHz, 1Vp-p, typ.):			
1MHz to 25MHz	<0.5dBc	<0.25dBc	±0.5dBc ⁽²⁾
25MHz to 50MHz	<1dB	<0.5dBc	±0.5dBc ⁽²⁾
50MHz to 100MHz	<2dB	<0.5dBc	±0.5dBc ⁽²⁾
100MHz to 250MHz	-	<1dBc	±0.5dBc ⁽²⁾
SSB Phase Noise (10kHz offset, typ.):			
1MHz Carrier	<-115dBc	<-115dBc	<-120dBc/Hz
10MHz Carrier	<-100dBc	<-108dBc	<-118dBc/Hz
100MHz Carrier	<-80dBc	<-90dBc	<-115dBc/Hz
250MHz Carrier	-	<-85dBc	<-108dBc/Hz
350MHz Carrier	-	<-80dBc	<-100dBc/Hz
TRIANGLE / RAMP			
Start Phase:	0-360°	0 to 360°	0 to 360°
Phase Resolution:	0.01°	0.1°	0.1°
Timing Range:	0%-99.9% of period	0%-99.9% of period	1.0% to 99.9% of period
SQUARE			
Duty Cycle Range:	1.0% to 99.9%	1.0% to 99.9%	1.0% to 99.9%
Resolution:	0.10%	0.10%	0.10%
Rise/Fall Time (typ.):	<4ns	<1ns	<1ns
Overshoot (typ.):	<5%	<5%	<5%
Jitter (rms):	<100ps	<10ps	<10ps
SINC (Sine(x)/x)			
"0 Crossings":	4 to 100 cycles	4 to 100 cycles	4 to 100 cycles
GAUSSIAN			
Time Constant:	10 to 200	10 to 200	10 to 200
EXPONENTIAL PULSE			
Type:	Rise or Decay, selectable	Rise or Decay, selectable	Rise or Decay, selectable
Time Constant:	-100 to 100	-100 to 100	-100 to 100

⁽¹⁾ Measured with 500MHz lowpass filter

⁽²⁾ AC Path

⁽³⁾ Double into high impedance

	WS8101/2	WS8251	WS8351/2
RUN MODES	Continuous, Triggered, Gated, Burst	Continuous, Triggered, Gated, Burst	Continuous, Self Armed, Armed, Triggered, Gated, Normal & Override Mode, Burst
TRIGGER CHARACTERISTICS			
EXTERNAL			
Trigger Jitter:	±1 SCLK period	±1 SCLK period	2ns at max. SCLK (4 SCLK)
System Delay:	6 SCLK + 150ns	1 SCLK + 100ns	200 SCLK periods + 50ns
Trigger Delay:			
Range	[(0: 200ns to 20s)+system delay]	0 to 512k SCLK periods	0 to 8,000,000 SCLK periods
Resolution	20ns	1 sample clock	4 points
Accuracy	Same as SCLK accuracy	Same as SCLK accuracy	Same as SCLK accuracy
INTERNAL / TIMER			
Range:	200ns to 20s	0.1µs to 100s	400ns to 2s
Resolution:	20ns	4 digits, limited by 0.1µs	3 digits
Accuracy:	-	0.10%	100ppm
MANUAL			
Source:	Soft trigger command from the front panel or remote	Soft trigger command from the front panel or remote	Soft trigger command from the front panel or remote
INTER-CHANNEL SKEW CONTROL			
COURSE TUNING			
Initial skew:	<1ns (Max. error: 1 SCLK)	-	200ps
Control:			
Range	0 to 512k	-	0 to waveform-length points
Resolution	1 point	-	4 points
Accuracy:	Same as SCLK accuracy	-	Same as SCLK accuracy
FINE TUNING			
Initial skew:	-	-	200ps
Control:			
Range	-	-	-3ns to +3ns
Resolution	-	-	10ps
Accuracy:	-	-	(10% of setting + 20ps)
GENERAL			
Voltage Range:	85 to 265VAC	85 to 265 VAC	100VAC to 240VAC
Frequency Range:	48-63 Hz	47-63 Hz	50-60 Hz
Power Consumption:	60W	60W	150VA
Display Type:	Reflective Color LCD, back-lit	Reflective Color LCD, back-lit	TFT LCD, back-lit
Size	3.8"	3.8"	4"
Resolution	320 x 240 pixels	320 x 240 pixels	320 x 240 pixels
Interfaces:			
USB			
Host	-	-	1 x front, USB host, (A type);
Device	1 x rear, (A type)	1 x rear, (A type)	1 x rear, USB device, (B type)
LAN	100/10 BASE-T	100/10 BASE-T	1000/100/10 BASE-T
GPIB	IEEE 488.2 standard interface	IEEE 488.2 standard interface	IEEE 488.2 standard interface
Dimensions:			
With Feet	212 x 102 x 415 mm (WxHxD)	212 x 102 x 415 mm (WxHxD)	315 x 102 x 395 mm (WxHxD)
Without Feet	212 x 88 x 415 mm (WxHxD)	212 x 88 x 415 mm (WxHxD)	315 x 88 x 395 mm (WxHxD)
Weight:			
Without Package	3.5 kg	3.5 kg	4.5 kg
Shipping Weight	4 kg	4 kg	6 kg
Temperature:			
Operating	0°C - 50°C	0°C - 50°C	0°C - 40°C
Storage	-40°C to + 70°C.	-40°C to + 70°C.	-40°C to + 70°C
Humidity:	85% RH, non condensing	85% RH, non condensing	85% RH, non condensing
Safety:	CE Marked, IEC61010-1	CE Marked, IEC61010-1	CE Marked, IEC61010-1
Calibration:	1 year	1 year	2 years
Warranty:	3 years standard	3 years standard	5 years standard

ORDERING INFORMATION

MODEL DESCRIPTION

WS8101	100MHz Single Channel Arbitrary Function Generator
WS8102	100MHz Dual Channel Arbitrary Function Generator
WS8251	250MHz Single Channel Arbitrary Function Generator
WS8351	350MHz Single Channel Arbitrary Function Generator
WS8352	350MHz Dual Channel Arbitrary Function Generator

ACCESSORIES

S-Rack Mount:	19" Single Rack Mounting Kit
D-Rack Mount:	19" Dual Rack Mounting Kit
Case Kit:	Professional Carrying Bag
Note:	Options and Accessories must be specified at the time of your purchase.

Specification

	WS8101/2	WS8251	WS8351/2
COMMON CHARACTERISTICS			
FREQUENCY			
Resolution:	14 digits (limited by 1μHz)	9 digits	8 digits
Accuracy/Stability:	Same as reference	Same as reference	Same as reference
ACCURACY REFERENCE CLOCK			
Internal	1 ppm from 19°C to 29°C; 1ppm/°C below 19°C or above 29°C; 1 ppm/year aging rate	1 ppm from 19°C to 29°C; 1ppm/°C below 19°C or above 29°C; 1 ppm/year aging rate	1 ppm from 19°C to 29°C; 1ppm/°C below 19°C or above 29°C; 1 ppm/year aging rate
External	10MHz TTL, 50% ±2% or 50Ω ±5% 0dBm	0MHz TTL, 50% ±2% or 50Ω ±5% 0dBm	-5dBm to 5dBm, 50Ω
AMPLITUDE			
Range:			
Single-ended	10mV to 16Vp-p ⁽³⁾	50 mV to 4Vp-p ⁽³⁾	50mVp-p to 4Vp-p ⁽³⁾
Differential	-	-	100mVp-p to 8Vp-p ⁽³⁾
Resolution:	4 digits	4 digits	4 digits
Accuracy (1kHz):	±(1% + 50mV)	±(3% + 5mV)	±(3% + 5mV)
Rise/Fall Time (typ.):	<4ns	<1ns	<1ns
Overshoot (typ.):	5%	5%	5%
OFFSET			
Range:	0 to ±7.992V, into 50Ω	0 to ±2V, into 50Ω	-1.5V to + 1.5V into 50Ω
Resolution:	1mV	4 digits	4 digits
Accuracy:	±(1%+1% of Amplitude + 5mV)	±(3% + 50mV)	±(5% + 5mV)
OUTPUTS			
MAIN OUTPUT			
Coupling:	DC coupled	DC coupled	DC-coupled
Connector:	Front panel BNC	Front panel SMA	Front panel SMAs
Type:	Single-ended	Single-ended	Single-ended or differential
Impedance:	50Ω ±1%	50Ω ±1%	50Ω ±1%
Protection:	Short Circuit to Ground, 10s max	Short Circuit to Ground, 10s max	Short Circuit to Ground, 10s max
SYNC OUTPUT			
Connector:	Front panel BNC	Front panel SMA	Front panel SMA
Source:	Common	Channel 1	Channel 1 or channel 2
Type:	Single ended	Single ended	Single ended
Waveform Type:	BIT (4 points wide)	BIT (16 points wide)	BIT (16 points wide) or WCOM
Impedance:	50Ω	50Ω	50Ω
Amplitude:	TTL	2V into 50Ω	1V into 50Ω
Variable Position Control:			
Range	0 to segment length	0 to segment length	0 to segment length
Resolution	4 points	16 points	16 points
Variable Width control:	-	-	16 points to segment length
INPUTS			
TRIGGER INPUT			
Connector:	Rear panel BNC	Front panel SMA	Rear panel SMA
Input Frequency:	DC to 2.5MHz	DC to 10MHz	0 to 15MHz
Slope:	Positive, negative, or both	Positive, negative, or both	Positive, negative, or both
Trigger Level:	-5V to 5V	-5V to 5V	-5V to 5V
Sensitivity:	100mVp-p	250mVp-p	200mVp-p
Damage Level:	±12V	±8V	±20VDC
Impedance:	10kΩ	50Ω, ±2%	10kΩ
Min. Pulse Width:	10ns	20ns	10 ns
EXTERNAL REFERENCE INPUT			
Connector:	Rear panel SMB	Rear panel BNC	Rear panel BNC
Input Frequency:	10MHz	10MHz	10MHz to 100MHz
Impedance & Level:	10kΩ ±2% or 50Ω ±5%	10kΩ ±2% or 50Ω ±5%	50Ω
Voltage Swing:	TTL, 50% ±2% or 0dBm Sinewave	TTL, 50% ±2% or 0dBm Sinewave	-5dBm to 5dBm
FILTERS			
Type:	25MHz, 50MHz, 60MHz, 120MHz	50MHz, 125MHz	500MHz (AC path)

⁽¹⁾ Measured with 500MHz lowpass filter

⁽²⁾ AC Path

⁽³⁾ Double into high impedance

Setting the Standard in High-Speed Arbitrary Function Generators!



**WAVE STANDARD
SERIES**



For more details
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In Waveform Generation

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