350MHz Dual-Channel Arbitrary / Function / Pulse Generator

WAVE STANDARD SERIES



PRELIMINARY

MODEL WS8352

- Dual-channel Arbitrary / Pulse / Function Generator
- Differential outputs configured as separate or synchronized
- 350MHz sine and 250MHz square waves
- 14-Bit, 2GS/s, 512Kpoint arbitrary waveforms
- 4Vp-p into 50Ω (8Vp-p differential), double into open circuit
- 10 built-in waveforms: sine, square, pulse, triangle, ramp (saw-tooth), sinc, gaussian, exponential , DC, repetitive or white noise
- AM, FM, FSK, PSK and Sweep modulations
- Continuous, triggered, gate and burst modes
- Powerful pulse/pattern composer for analog, digital and mixed signals, device tests
- User friendly 4" color LCD display
- Remote control through LAN, USB and GPIB
- Store/recall capability on disk-on-key or 1GB internal memory
- Free ArbConnection software, IVI and MATLAB drivers
- LXI Class C compliant

Tabor's WS8352 is a 350MHz dual channel generator with the functionality of a function, arbitrary, modulation and pulse/pattern generator, all in one easy to use, high performance, compact stand alone bench top, which enables engineers to test analog, digital and mixed signals devices with a single instrument.

Standard Waveforms

The WS8352 has 10 built-in functions for quick and easy waveform generation. Front panel operations allows for easy selection and editing of all waveform parameters. All the standard waveforms can reach up to 125MHz with Sine and Square going as high as 350MHz and 250MHz respectively.

User Defined Waveforms

For more advanced users the WS8352 with its 14-bit vertical resolution offers a standard 512Kpoint memory depth and a 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.

Common or Separate Clocks

Need a dual channel unit, a single channel unit… why choose? With the new WS8352 you can have it both ways. The WS8352 has two differential output channels, which operate either independently, or synchronized. As two separate channels, one has the advantage of having two separate instruments in one box, each having the ability to be programmed to output different function shapes, frequency, amplitude levels and even in different run modes. Alternatively, the advantage of having two synchronized channels with less than 10ps skew and skew control is very significant in applications that require an accurate and controlled phase between the two channels.

Pulse / Pattern Creation

Generating complex pulse trains has never been easier. The Pulse Composer is a powerful built-in tool that converts the WS8352 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, initialization or preamble pattern definition, arbitrary bit design, 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. Moreover, all the WS8352 advanced trigger modes are applicable, hence one can choose to use the "step" mode to advance every bit independently or the "once" mode to advance a complete data block in one trigger event, enabling even more applications, such as trigger, clock and data protocols.

Multi-Level and PAM(n) Signals

The WS8352's pulse composer enables up to 350Mbit/s data rate generation, utilizing either NRZ and RZ modes (minimum transition times) which is ideal especially for multi level and PAM(n) applications such as, LED (light-emitting diodes), CAN, QPHY, FlexRay or simulating and testing Ethernet environment, whether it's 100Mbit/s (100BASE-T), the later gigabit Ethernet (1000BASE-T) or even the latest 802.3an standard (10GBASE-T), which utilizes PAM-16.

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Modulated Waveforms
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 WS8352 can also do standard modulation schemes such as AM, FM, FSK, PSK, sweep and chirp without sacrificing the power of the instrument control and output run modes.

Accuracy and Stability
As standard, the instrument is equipped with an internal frequency reference that has 1ppm accuracy and stability over a period of 1 year. An external frequency reference is provided on the rear panel for applications requiring greater accuracy or stability, supported by the instrument's 14 digits resolution.

Easy to Use
Large and user-friendly 4" backlit color LCD display facilitates browsing though 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.

Remote Control
Model WS8352 comes standard with a variety of interfaces: Ethernet, USB and GPIB allowing the user to freely select the interface best suited to his individual requirements. The included ArbConnection software is a powerful editorial tool for designing waveforms and provides the user with full control of instrument functions, modes and features.

Multiple Environments to Write Your Code
In addition to the included ArbConnection software, the WS8352 comes with a complete set of drivers, allowing you to write your application in various environments such as: Labview, CVI, C++, VB, MATLAB. You may also link the supplied dll to other Windows based API's or, use low level SCPI commands (Standard Commands for Programmable Instruments) to program the instrument, regardless if your application is written for Windows, Linux or Macintosh operating systems.

Automated External Calibration
Leading-edge technology is implemented to allow calibration from any interface, USB, GPIB or LAN and calibration factors are stored in a flash memory thus eliminating the need to open instrument covers.

Service and Support
Beyond providing precision Test & Measurement instruments, Tabor Electronics provides unparalleled service and support, and is continuously finding new ways to bring added value to its customers.

Our after-sales services are comprehensive. They include all types of repair and calibration, and a single point of contact that you can turn to whenever you need assistance. As part of our extensive support, we offer individualized, personal attention Help Desk, both online and offline, via e-mail, phone or fax.

Tabor Electronics maintains a complete repair and calibration lab as well as a standards laboratory in Israel and USA. Service is also available at regional authorized repair/calibration facilities.

Contact Tabor Electronics for the address of service facilities nearest you.

Applications
For expert technical assistance with your specific needs and objectives, contact your local sales representative or our in-house applications engineers.

Manuals, Drivers, and Software Support
Every instrument comes equipped with a dedicated manual, developer libraries, IVI drivers, and software. However, if your specific manual is lost or outdated, Tabor Electronics makes it possible to log-on to its Download Center and get the latest data "in a click".

Product Demonstrations
If your application requires that you evaluate an instrument before you purchase it, a hands-on demonstration can be arranged by contacting your local Tabor Electronics representative or the Sales Department at our Corporate Headquarters.

Three-year Warranty
Every instrument from the Wave Standard series comes with a Three-year warranty. Each one has full test results, calibration certificate, and CD containing product's manual and complete software package. Our obligation under this warranty is to repair or replace any instrument or part thereof which, within Three years after shipment, proves defective upon examination. To exercise this warranty, write or call your local Tabor representative, or contact Tabor Headquarters and you will be given prompt assistance and shipping instructions.

Specification
350MHz Dual-Channel Arbitrary / Function / Pulse Generator

Model WS8352



STANDARD WAVEFORMS

Type:	Sine, triangle, square, ramp (saw-tooth), pulse, sinc, exponential (rise/decay), DC, gaussian, and repetitive or white noise.
Frequency Range:	
Sine	10kHz to 350MHz
Square, Pulse	10kHz to 250MHz
All others	10kHz to 125MHz

SINE

Start Phase Range: 0 to 360°

Harmonics Distortion (typ.):

1MHz to 10MHz	<-44dBc
10MHz to 350MHz	<-40dBc

Non-Harmonics Distortion (typ.):

1MHz to 100MHz	<-80dBc
100MHz to 350MHz	<-75dBc

SSB Phase Noise (10kHz offset):

1MHz Carrier	<-120dBc
10MHz Carrier	<-118dBc
100MHz Carrier	<-115dBc
250MHz Carrier	<-108dBc
350MHz Carrier	<-100dBc

TRIANGLE

Start Phase Range: 0 to 360°

SQUARE

Duty cycle Range:	1.0% to 99.9%
Resolution:	0.1%
Rise/Fall time:	1ns (typically <900ps)
Overshoot, typical:	<5%
Jitter (rms):	10 ps

RAMP (SAW-TOOTH)

Delay, Rise/Fall Time:	Adjustable with resolution of 0.01% of the period interval

SINC (Sine(x)/x)

"0 Crossings"	4 to 100 cycles

GAUSSIAN

Time Constant	10 to 200

EXPONENTIAL PULSE

Type:	Rise or Decay, selectable
Time Constant:	-100 to 100

NOISE

Type:	Repetitive or white, selectable
Bandwidth:	125MHz

DC

Range:	-2V to +2V

PULSE

Pulse State:	On/Off
Pulse Mode:	Single or double, programmable
Polarity:	Normal, inverted or complemented
Period:	2ns to 1.6Sec
Resolution:	500ps
Pulse Width:	1 ns to 1.6Sec
Rise/Fall Time:	
Fast	1ns (typical < 900ps)
Linear	1ns to 1.6Sec
Delay:	1ns to 1.6Sec
Double Pulse Delay:	1ns to 1.6Sec
Amplitude:	
Range	50mVp-p to 4Vp-p into 50Ω
Levels	
Low Level	-2V to +1.95V
High Level	-1.95V to +2V

NOTES:

1. All pulse parameters, except rise and fall times, may be freely programmed within the selected pulse period provided that the ratio between the period and the smallest incremental unit does not exceed the ratio of 16,000,000 to 1.
2. Rise and fall times, may be freely programmed provided that the ratio between the rise/fall time and the smallest incremental unit does not exceed the ratio of 1,000,000 to 1.
3. The sum of all pulse parameters must not exceed the pulse period setting.

PULSE / PATTERN COMPOSER

Modes:	Multi-level, linear-points, arbitrary bit design, PAM

MULTI-LEVEL

Number of Levels:	1 to 1000
Dwell Time:	1ns to 10Sec
Amplitude Resolution:	4 digits
Time Resolution:	1ns

LINEAR-POINTS

Number of Points:	1 to 1000
Memory:	100k
Amplitude Resolution:	4 digits
Time Resolution:	1ns

ARBITRARY BIT DESIGN

Data Rate:	TBD
Pattern Memory:	16 Mbit
Resolution:	TBD
Pattern Source:	PRBS or user-defined
Trigger Mode:	Auto, step, once
Modulation:	TBD

PAM (PULSE AMPLITUDE MODULATION)

Data Rate:	10Mbit/s to 1Gbit/s
PAM Range:	2 to 1000
Pattern Memory:	16 Mbit
Resolution:	1 bit (TBD)

ARBITRARY WAVEFORMS

Sample Rate:	10MS/s to 2.0GS/s
Vertical Resolution:	14 bits
Waveform Memory:	512k points standard
Min. Segment Size:	384 points
Resolution:	32 points size increments
No. of Segments:	1 to 1k
Waveform Granularity:	1 point

MODULATION

COMMON CHARACTERISTICS

Carrier Waveform:	Sine, square, triangle
Carrier Frequency:	10kHz to 350MHz
Modulation Source:	Internal

AM

Modulation Shape:	Sine, square, triangle and ramp
Modulation Freq.:	(CW/9) > (M.F) > (CW/50e^{3})
Modulation Depth:	0.1 to 100%
Double Sideband Suppressed Carrier:	On/Off, selectable

FM

Modulation Shape:	Sine, square, triangle and ramp
Modulation Freq.:	(CW/6) > (M.F) > (30e^{-6}xCW)
Deviation Range:	CW/2

FSK

Hop Type:	Fast or Linear
Dwell Time Mode:	Fixed or programmable per step
Dwell Time:	2ns to 1Sec
Dwell Time Resolution:	2ns

PSK

Hop Type:	Fast or Linear
Dwell Time Mode:	Fixed or programmable per step
Carrier phase:	0 to 360° (Up to 125MHz)
Baud Rate Range:	DC to 10Mbits/sec

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ASK

Hop Type:	Fast or Linear
Dwell Time Mode:	Fixed or programmable per step
Dwell Time:	2ns to 1Sec
Dwell Time Resolution:	2ns
Resolution:	Maximum amplitude/4096

SWEEP / CHIRP

Sweep Type:	Linear, log or Arb
Sweep Direction:	Up or down
Sweep Time:	$(9/\text{High Freq.}) > (S.T) > (50e^3/\text{High Freq.})$
Modulation Shape:	Pulse
Pulse Repetition:	
Range	100ns to 2Sec
Resolution	3 digits
Accuracy	100 ppm

COMMON CHARACTERISTICS

FREQUENCY

Resolution:	8 digits
Accuracy and Stability:	Same as reference

10MHz REFERENCE CLOCK

Internal	0.0001% (1 ppm TCXO) 1ppm/year
External	10 MHz TTL, 50% 2%, duty cycle

AMPLITUDE

Range:	
Single-ended	100mVp-p to 4Vp-p
Differential	200mVp-p to 8Vp-p (Double into high impedance)
Resolution:	4 digits
Accuracy:	±(3% +5 mV), offset = 0V
Rise/Fall Time:	1ns (typically <900ps)
Overshoot:	5%, typical
OFFSET	
Control:	Common mode, specified into 50Ω , levels double into high Z
Range:	-1.5V to + 1.5V
Resolution:	4 digits
Accuracy:	±(5% +5 mV)

OUTPUTS

MAIN OUTPUTS

Coupling:	DC-coupled
Type:	Single-ended or differential
Connectors:	Front panel SMAs
Impedance:	50Ω nominal, each output
Protection:	Protected against temporary short to case ground

SYNC OUTPUT

Connector:	Front panel SMA
Source:	Channel 1 or channel 2
Type:	Single ended
Waveform Type:	Pulse (32 points width), WCOM
Impedance:	50Ω
Amplitude:	1 V; doubles into high impedance
Variable Position Control:	
Range	0 to segment length
Resolution	32 points
Rise/Fall Time	2ns, typical
Variable Width control:	
Range	32 points to segment length
Resolution	32 points

INPUTS

TRIGGER INPUT

Connector:	Rear panel SMA
Input Impedance:	10 kΩ
Polarity:	Positive, negative, or both
Damage Level:	±20Vdc
Frequency Range:	0 to 15MHz
Trigger Level Control:	
Range	-5V to 5V
Resolution	12 bit (2.5mV)
Accuracy	±(5% of setting + 2.5mV)
Sensitivity	0.2Vp-p
Pulse Width:	10ns, minimum

EVENT INPUT

Operation:	Used for branching in or out from a sequence loop. Also used for enabling or disabling the output in armed mode.
Connector:	Rear panel BNC
Input Impedance:	10kΩ
Polarity:	Positive, negative or either
Damage Level:	±20 Vdc
Frequency Range:	0 to 15MHz
Trigger Level Control:	
Range	-5V to 5V
Resolution	12 bit (2.5mV)
Accuracy	±(5% of setting + 2.5mV)
Sensitivity	0.2 Vp-p minimum
Pulse Width:	10 ns, minimum

EXTERNAL REFERENCE INPUT

Connector:	Rear panel BNC
Input Frequency:	10MHz to 100MHz
Input Impedance:	50Ω
Input Voltage Swing:	-5dBm to 5dBm
Damage Level:	10dBm

RUN MODES

Continuous	A selected output function shape is output continuously.
Self armed	No start commands are required to generate waveforms.
Armed	The output dwells on a dc level and waits for an enable command and then the output waveform is output continuously; An abort command turns off the waveform.
Triggered	A trigger signal activates a single-shot or counted burst of output waveforms and then the instrument waits for the next trigger signal.
Normal mode	The first trigger signal activates the output; consecutive triggers are ignored for the duration of the output waveform.
Override mode	The first trigger signal activates the output; consecutive triggers restart the output waveform regardless if the current waveform has been completed or not.
Gated	A waveform is output when a gate signal is asserted. The waveform is repeated until the gate signal is de-asserted. Last period is always completed.

TRIGGER CHARACTERISTICS

EXTERNAL

Source:	Channel 1, channel 2, or both
Connector:	SMA
Input Impedance:	10 kΩ
Polarity:	Positive, negative, or both
Damage Level:	±20 Vdc
Frequency Range:	0 to 15 MHz
Trigger Level Control:	
Range	-5V to 5V
Resolution	12 bit (2.5 mV)
Accuracy	±(5% of setting + 2.5mV)
Sensitivity	0.2Vp-p
Pulse Width:	10ns, minimum
System Delay:	200 sample clock periods + 50ns, typical (Trigger to Output)
Trigger Delay:	Separate for each channel
Range	0 to 8,000,000 sclk periods
Resolution	8 points
Accuracy	Same as sample clock accuracy
Smart Trigger:	Detects a unique pulse width range
Conditioned trigger	< pulse width, > pulse width or <>pulse width
Pulse Width Range	50ns to 2Sec
Resolution	2ns
Accuracy	±(5% of setting +20ns)

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Trigger Holdoff:	Ignores triggers for a holdoff duration
Holdoff range	100ns to 2Sec
Resolution	2ns
Accuracy	±(5% of setting +20 ns)
Trigger jitter:	8 sampling periods

INTERNAL

Source:	Common or separate
Modes:	
Timer	Waveform start to waveform start
Delayed	Waveform stop to waveform start
Timer:	
Range	100ns to 2Sec
Resolution	3 digits
Accuracy	100 ppm
Delay	
Range	152 to 8,000,000 sclk periods
Resolution	Even numbers, divisible by 8

MANUAL

Source:	Soft trigger command through the front panel or external interface

INTER-CHANNEL SKEW CONTROL

COURSE TUNING

Initial skew:	200ps
Control:	
Range	0 to waveform-length points
Resolution	8 points
Accuracy:	Same as sample clock accuracy

FINE TUNING

Initial skew:	200ps
Control:	
Range	-3ns to +3ns
Resolution	10ps
Accuracy:	(10% of setting + 20ps)

GENERAL

Voltage Range:	100 VAC to 240 VAC
Frequency Range:	50 Hz to 60 Hz
Power Consumption:	150 VA
Display Type:	TFT LCD, back-lit
Size	4 “
Resolution	320 x 240 pixels
Interfaces:	
USB 2.0	1 x front, USB host, (A type); 1 x rear, USB device, (B type)
LAN	1000/100/10 BASE-T
GPIB	IEEE 488.2 standard interface
Segment control	2 x D-sub, 9 pin
Dimensions:	
With feet	315 x 102 x 395 mm (WxHxD)
Without feet	315 x 88 x 395 mm (WxHxD)
Weight:	
Without package	4.5 kg
Shipping weight	6 kg
Operating temperature:	0°C to 40°C
Storage temperature:	-40°C to 70°C
Humidity:	85% RH, non condensing
Safety:	CE Marked, IEC61010-1
EMC:	IEC 61326-1:2006
Calibration:	2 years
Warranty:	3 years standard

ORDERING INFORMATION

MODEL	**WS8352**
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ACCESSORIES

S-Rack mount:	19" Single Rack Mounting Kit
Case Kit:	Professional Carrying Bag

Note: Options and Accessories must be specified at the time of your purchase.