AWG272 – 2 GSPS 12-bit Dual-Channel Arbitrary Waveform Generator

PRODUCT DESCRIPTION

The **AWG272** modules generate dual-channel arbitrary CW waveforms with sampling rate at 2 GSPS. The on-board SRAMs provide 4M x 12-bit data memory to each channel. The **AWG272** can be controlled by a PC via USB interface or can work alone with pre-stored waveforms. The sole RF input is a single-ended 2 GHz clock source *CKIP* with minimum power of 6 dBm. The RF outputs of the module are comprised of two pairs of differential analog outputs, *OUTPA* and *OUTNA*, and *OUTPB* and *OUTNB*, with 50-Ω back terminations. The module accepts a high-speed trigger signal and generates synchronization outputs and three programmable marker signals. The waveform generation can be in continuous or burst/pulse mode. The waveform contents can be dynamically changed using the user page selection. A programmable profile option offers further programmatic controls of user pages, loop repetitions and auto trigger periods. The companion API provides an interface for software development.

KEY FEATURES

- Two 12-bit DACs with 10-bit linearity
- Multiple waveform generation modes including Free Run, Triggered Free Run and Triggered Burst modes
- In-phase or quadrature phase synchronization of outputs, which can be independently set
- Standard sampling rate at 2 GSPS (2 GHz clock)
- Optional: sampling rate range from 500 MSPS to 2 GSPS (500 MHz to 2 GHz clock)
- 2 x 4M x 12-bit memory depth with multi-page configuration
- Up to 2 ms waveform at 2 GHz clock rate
- Dynamic paging – seamless waveform swapping
- High-speed hardware trigger and API software trigger
- Programmable cyclic waveform repetition
- Three marker signals
- Various built-in waveforms, including pulse, multi-tone and FMCW linear chirping
- USB 2.0 compliant interface
- 19 W power consumption using on-board power modules with a 12V power supply
- 12 V AC adapter included
- Companion API and software drivers for easy system development
- Compatible with Matlab (2010a or later) and LabView

ELECTRICAL SPECIFICATIONS

Parameter	Symbol	Min	Typical	Max	Unit
Operating Temperature	T_o		25		^oC
Sampling Rate	f_{data}	0.5	2	2	GSPS
Clock Frequency	f_{CK}	0.5	2	2	GHz
Clock Input Power	P_{CK}	+3	+6	+12	dBm
Output Level[1]	V_{out}	-635		0	mV
Output Power	P_{out}	-4		0	dBm
Output Residue Phase Noise[2]	N_f			-130	dBC/Hz
Clock Port Return Loss	RL_{CK}		15		dB
Output Port Return Loss	RL_{RF}		15		dB
Power Supply[3]	*+12V*		+12		V
	I_{+12}		1.6		A

[1]If external 50 ohm loads are terminated to ground, the analog outputs will have voltage swings from ground to – 0.6 V with a common mode voltage of –0.3 V. If a positive analog output common mode level is desired, the external 50 ohm loads can be terminated to a positive voltage Vpull with a resultant analog output common mode voltage of (Vpull – 0.6)/2. Vpull should not exceed 5 V.

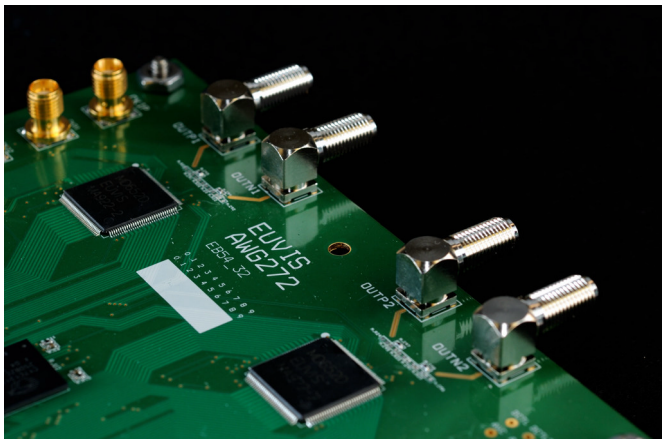
[2]10 KHz offset

[3]Current consumption of the power supply varies with clock frequency.

TERMINAL DESCRIPTION

Name	Function	I/O	Signal
GND	Ground		DC
+12V	Power, +12 V		DC
OUTPA	Waveform Output Channel A Positive	O	RF
OUTNA	Waveform Output Channel A Negative	O	RF
OUTPB	Waveform Output Channel B Positive	O	RF
OUTNB	Waveform Output Channel B Negative	O	RF
CKIP	Input Clock Source	I	RF
TRIG	Trigger	I	
SYNCI	Optional Synchronize Input	I	
SYNCO	Optional Synchronize Output	O	
MARKER	Marker #1	O	
MARKER2	Marker #2	O	
MARKER3	Marker #3	O	

[1]Used without on-board 12V power modules



DETAILED SPECIFICATIONS

General	
Output Amplitude Resolution	12 bits per channel
Running Modes	Continuous Triggered Continuous Triggered Burst
User Interface	Windows Graphical User Interface, USB
Input Clock	
Type	Single-ended, 50-Ω terminated
Connector Type	SMA
Frequency Range	Standard: 2 GHz Optional: 500 MHz to 2 GHz
Power Level	3 dBm to 9 dBm (6 dBm typical)
Return Loss	15 dB
Output	
Type	Two independent differential channels, 50-Ω terminated
Synchronization	In-phase, Quadrature or Arbitrary phase 16-bit Amplitude adjustment
Connector Type	SMA
Data Rate Range	Standard: 2 GSPS Optional: 500 MSPS to 2 GSPS
Output Level	-635 mV to 0 V
Output Power	-4 dBm to 0 dBm
Output Phase Noise	Max. –130 dBc/Hz at 10 KHz offset
Output Return Loss	15 dB
Trigger	
Connector	SMA
Source	External or Software
Recommended External Trigger	LVCMOS/LVTTL 3.3 V

DETAILED SPECIFICATIONS, (CONTINUED)

Waveform	
Max Waveform Length, per channel	4,161,600
Minimum Waveform Length	128 samples in Free Run/Continuous 768 samples in Burst mode
Waveform Length Incremental Step	32 samples
Built-In Waveforms	Sine
	Sine A/B
	Ramp
	Pulse
	2 tones
	Multiple tones
	Phase coherent linear chirping
	Phase continuous linear chirping
User-Defined Waveform	User Defined Amplitude, markers
Marker	
Number of Markers	3
Marker Length	User defined
Minimum Marker Length	32 samples
Marker #1 Level	LVCMOS/LVTTL 1.8V
Marker #2 Level	LVCMOS/LVTTL 3.3V
Marker #2 Additional Features	Polarity, Enable, Marker Filter
Marker #3 Level	LVCMOS/LVTTL 3.3V
Marker #3 Additional Features	Polarity, Enable
API	
CLR (Common Language Runtime) support languages targeting the runtime, such as C++/CLI, C#, Visual Basic, Jscript, and J#. Compatible with Matlab 2010a and LabView	
GUI	
Available for Windows XP, Windows Vista and Windows 7	
Options	
Programmable profiles Variable Clock Frequency Range from 500 MHz to 2 GHz	

SWITCHING CHARACTERISTICS

PARAMETER	DESCRIPTION	MIN	TYP	MAX	UNITS
$\overline{TRIG}$: LVCMOS 3.3V Logic					
V_{IH}	Input Voltage High	2		3.3	V
V_{IL}	Input Voltage Low	0		0.8	V
I	Input driving current		4		mA
t_a	Active time	64			ns
t_s	Settling time			16	ns
MARKER1: CMOS 1.8V TTL Logic					
V_{OH}	Output Voltage High	1.6		1.8	V
V_{OL}	Output Voltage Low	0		0.2	V
t_s	Settling time			1	ns
MARKER2, MARKER3, SYNCO: CMOS 3.3V LVTTL Logic					
V_{OH}	Output Voltage High	2.9		3.3	V
V_{OL}	Output Voltage Low	0		0.4	V
t_s	Settling time			5	ns

WAVEFORM GENERATION MODES

The module can be operated in three waveform generation modes: ***Free Run/Continuous*** mode, ***Triggered Free Run*** mode and ***Triggered Burst*** mode.

Continuous Mode

In ***Free Run*** mode, the module starts waveform generation by a *Restart* command from the GUI or API-based applications. Once the waveform starts, the module repeats the waveform continuously. There is no latency between two consecutive waveforms. The following waveform starts right after the end of the preceding waveform. The waveform generation can be aborted by an *Abort* command from the GUI or API-based applications.

Triggered Continuous Mode

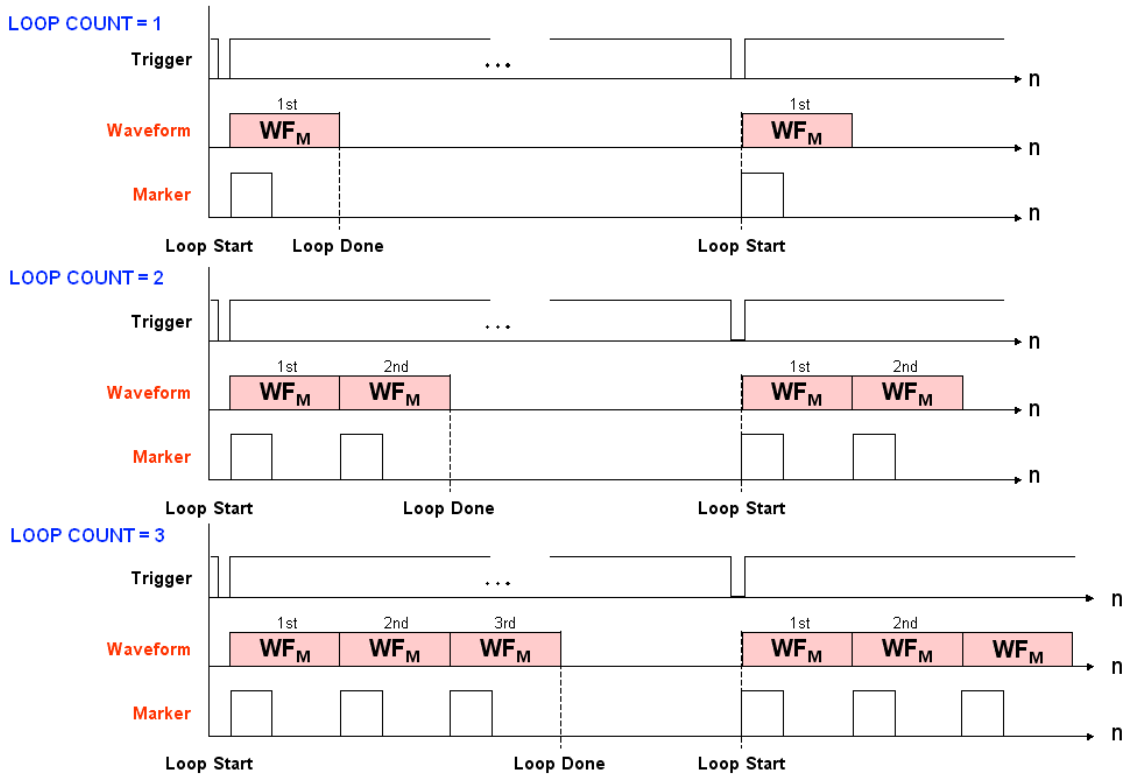
In ***Triggered Free Run*** mode, the operation manner is similar to that in *Free Run* mode except for the start of waveform. The waveform generation is initiated by a trigger signal. In order to accept the upcoming trigger signals, the module has to be *armed* prior the instance of the trigger signals. Trigger signals happening before the module is armed will be ignored. An *Arm* command from the GUI or API-based applications can be used to arm the module. Once the module is armed, it waits for the trigger signal. The waveform generation starts after the falling edge of the trigger signal. The trigger signal can be mainly applied via the TRIGGER SMA connector or provided by a command *Trigger* via the GUI or API-based applications.

Due to the asynchronous timing between the upcoming trigger signal and the module clocking, there will be some uncertain delay/latency between the trigger and the waveform generation. However, the waveform generation is synchronized with respect to the module clock.

Triggered Burst Mode

In ***Triggered Burst*** mode, the module starts waveform generation when it is armed and receives the trigger signal as in the *Triggered Free Run* mode. Instead of repeating continuously, the waveform starts, repeats, and stops after finite repetitions. The number of the repetitions can be specified by a property *Loop Count* via the GUI or the API-based applications. The *Loop Count* can be set from 1 to 255. Similarly, trigger signals happening before the waveform stops will be ignored. Once the waveform stops, the module will arm itself automatically and wait for the next trigger signal.

The following figure shows waveform generation for different *Loop Counts:* 1, 2, and 3.

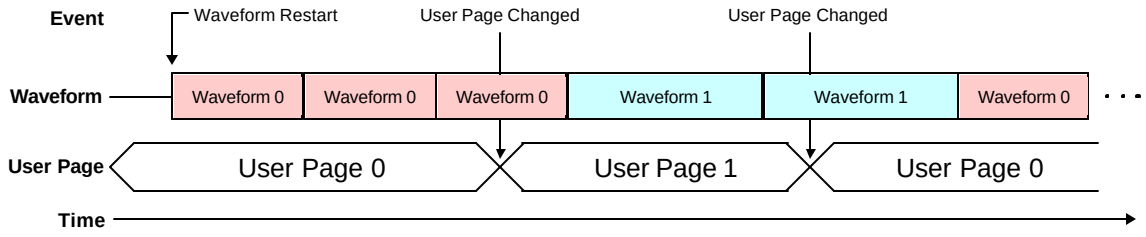


USER PAGES AND DYNAMIC WAVEFORM PAGING

User Page—For users, the waveform is stored in a *User Page*. To download a waveform to the AWG, you need to select a user page and set up the waveform parameters if the built-in waveforms are used. After download, in the GUI, the user page information is automatically updated under the waveform tab. In the API, the user page information, such as how many user pages are used, can be derived via API properties. The maximum number of user pages is 255.

Dynamic Paging

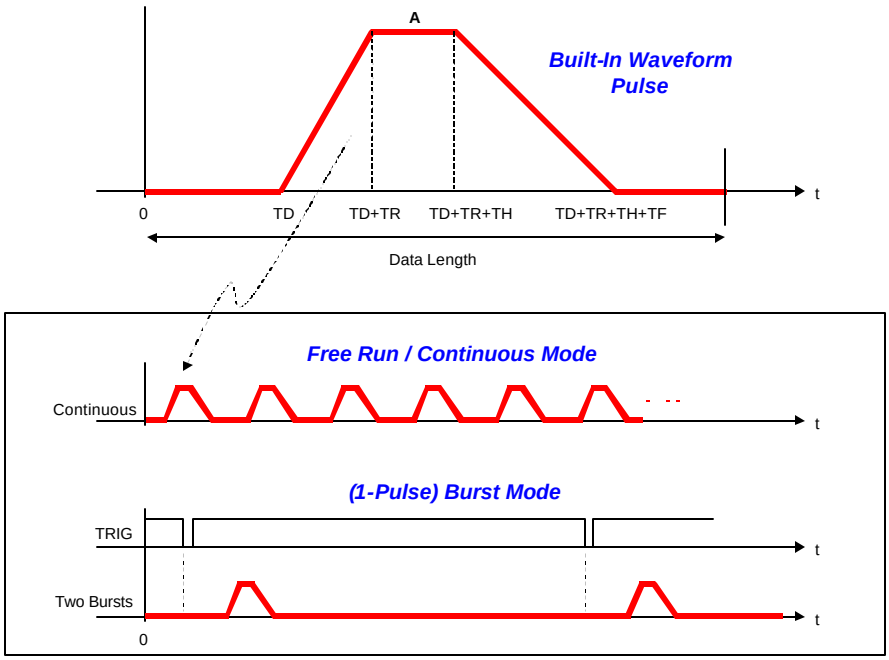
Once the users have downloaded waveforms onto the user pages, the waveforms can be selected and generated dynamically without restarting the AWG. The newly selected waveform will follow the previous one without latency. The new waveform starts right after the end of the preceding one. The user page selection can happen any time. As long as the user page is selected (altered) before the current waveform ends, the newly selected waveform will be generated right after the end of the current waveform. Otherwise, the subsequent waveform remains the same as specified in the current user page.



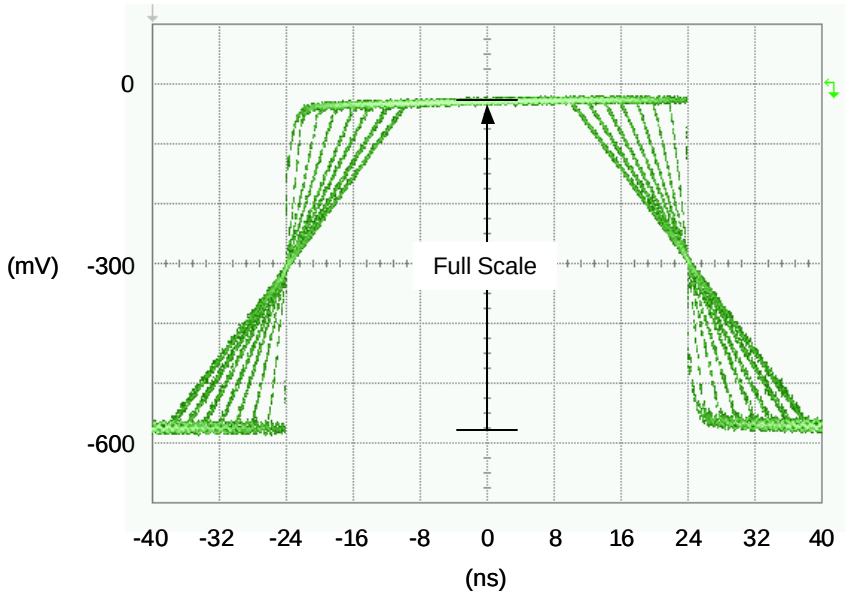
The above figure shows an example of how the waveforms change dynamically according to the user page selections, which can be made via the GUI or the API. Two different waveform, waveform 0 and waveform 1, are stored in the user page 0 and 1, respectively, using download operations. The AWG waveform generation mode in the example is free run continuous mode. The user page 0 is selected at the beginning. Once the AWG restarts, waveform 0 is generated repeatedly. In the third waveform generation, the user page is changed to user page 1 by the user. Waveform 0 will continue to its end, and the following waveform generated is waveform 1 according to the new user page selection. In the fifth waveform, the user page is changed again back to user page 0. The sixth waveform will be waveform 0 accordingly. Dynamic paging gives the ability to generate compound waveforms as combinations of basic waveforms.

TYPICAL PULSE RESPONSE

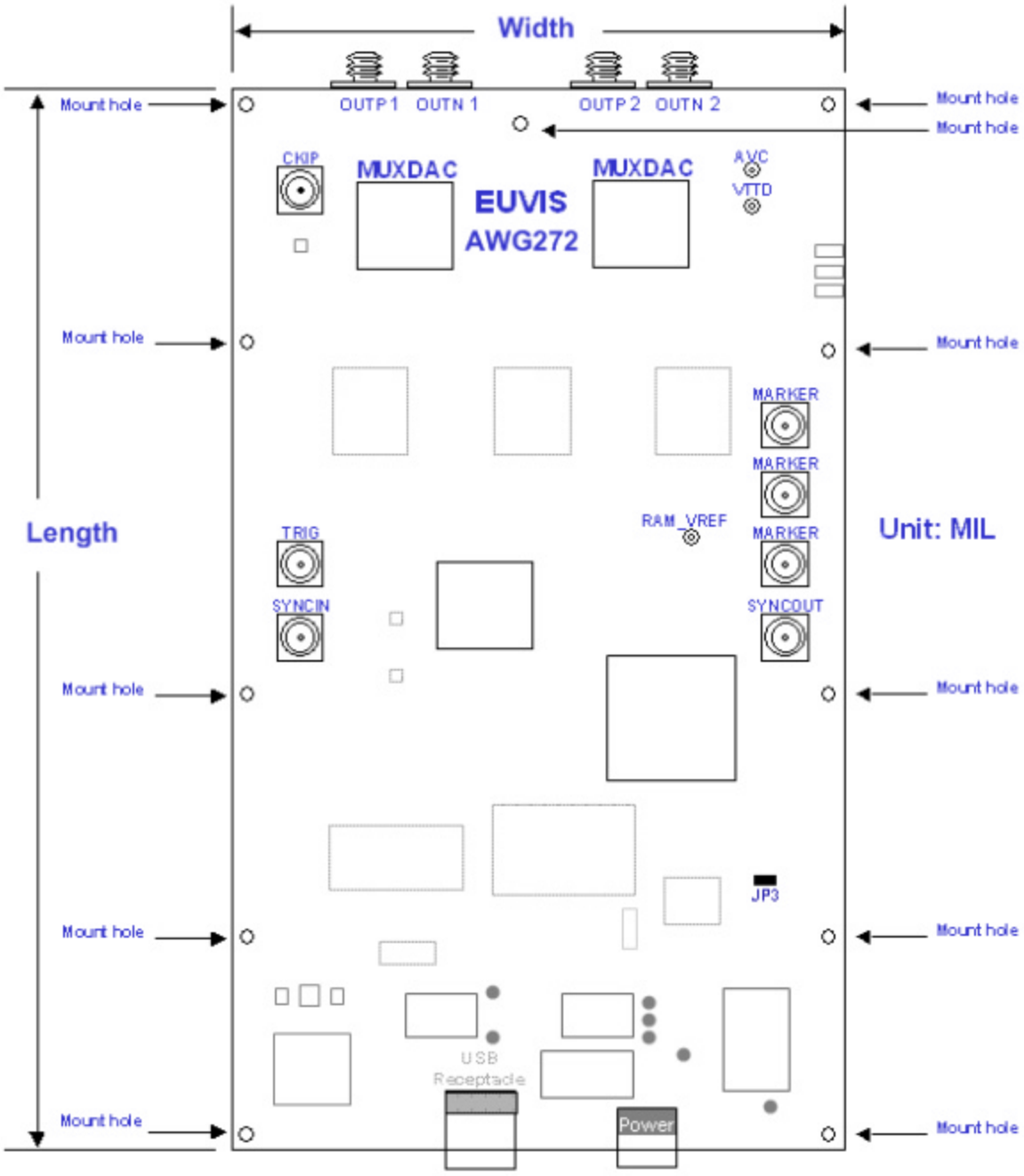
Pulses waveforms can be generated using the built-in waveform parameters, which are Amplitude (A), Delay (TD), Rise Time (TR), Hold Time (TH), and Fall Time (TF).



The following screen shot shows typical responses for 8 different slew rates at 2 GSPS for one channel. The amplitudes of the waveforms are full scale and the fastest slew rate is 1 sample, that is, full-scale jump in single sample point (0.5 ns). The remaining slew rates vary by increments of 8 sample points (4 ns) in this example.



BOARD DIAGRAM



DIMENSIONS AND MOUNT HOLES LOCATION

Length	9 inches
Width	5.5 inches
Height	1.75 inches with heat sinks (0.6 inches without heat sinks)
Weight	Less than 1 lb
12 Mount Hole Locations (mil)	250, 250 250, 2000 250, 4500 250, 6750 250, 8750 5250, 250 5250, 2000 5250, 4500 5250, 6750 5250, 8750 2625, 8625 3125, 250

Euvis

Ordering Information:

Email to: Sales@euvis.com
Or call: (805) 583-9888 x108 Sales Department
Or fax: (805) 583-9889

The information contained in this document is based on measured results. Characteristic data and other specifications are subject to change without notice. Customers are advised to confirm information in this advanced datasheet prior to using this information or placing the order.

Euvis Inc. does not assume any liability arising from the application or use of any product or circuit described herein, neither does it convey any license under its patents or any other rights.