

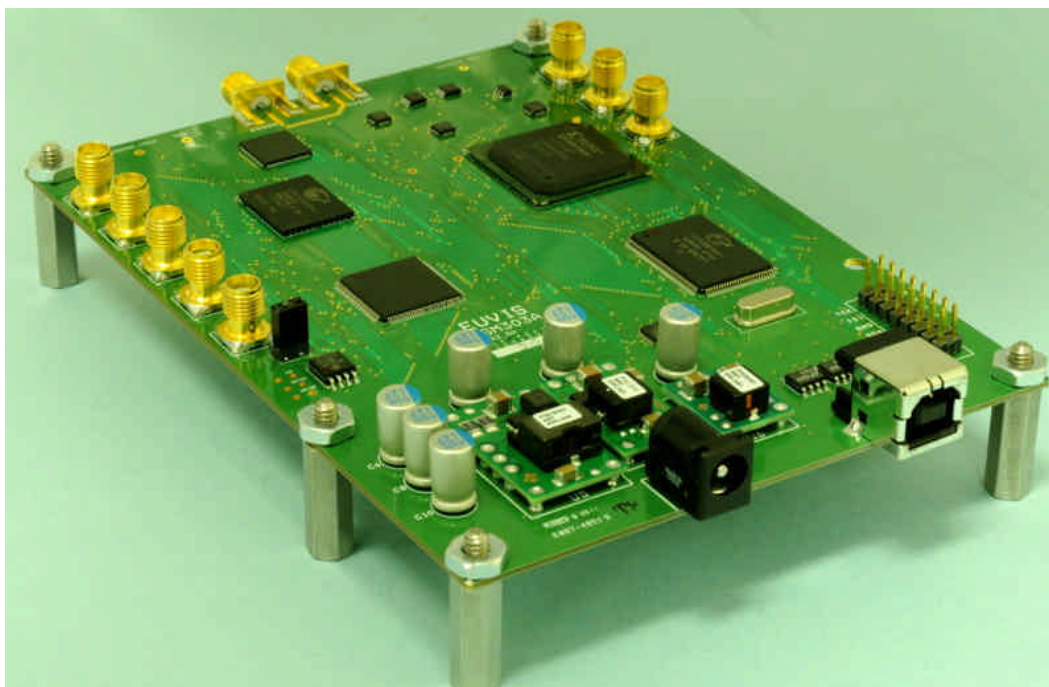
DSM303 – 3.0 GHz Arbitrary Programmable Frequency Chirping Source Module

PRODUCT DESCRIPTION

The DSM303 module generates arbitrary frequency chirping CW with frequency update rates up to 312.5 updates/microsecond (1/8 of the clock rate). The on-board SRAM provides 450K 32-bit data memory. The DSM303 can be controlled by a PC or can work alone with pre-stored chirping waveform. The sole RF input is the clock source DDSCK at 2.5 GHz with minimum power of -3 dBm. The outputs of the module consist of a pair of differential analog outputs, DDSOP/DDSON.

KEY FEATURES:

- 11-bit amplitude and 13-bit phase resolution ROM
- Clock rate up to 3.0 GHz for static operation
- Clock rate up to 2.5 GHz for arbitrary chirping
- 450K 32-bit words memory depth with multi-page configuration
- Minimum waveform lengths of 256 ns in Triggered Burst Mode
- Up to 1.47 millisecond chirping waveform at 2.5 GHz clock rate
- Programmable cyclic length
- Accepts external triggers and generates marker signals (programmable)
- Master and Slave options for multi-board synchronization
- USB 2.0 compliant interface (other interfaces available upon request)
- 12 W power consumption (at 2.5 GHz clock)
- User-friendly input data formats and various built-in chirping waveforms
- Companion API and software drivers for easy system development



DETAILED SPECIFICATIONS

GENERAL

DDS Frequency Resolution	32 bits
Amplitude Resolution	11 bits
Phase Resolution	13 bits
Frequency Update Rate	1/8 of input clock
Running Modes	Free Run Mode Triggered Free Run Mode (Master and Slave) Triggered Burst Mode (Master and Slave)
User Interface	Windows XP Graphical User Interface, USB
API	CLR-Support Languages <ul style="list-style-type: none"> • Visual C++ • Visual C# • Visual Basic • Visual J#
Options	User Created Startup Waveforms

INPUT CLOCK

Type	Single Ended Sinusoidal or Square Wave			
Termination	50 Ohms			
Connector	SMA			
	Min	Typ	Max	Units
Frequency Range Static	200		3000	MHz
Frequency Range Chirping	500		2500	MHz
Power Level	-3	0	+10	dBm
Return Loss		13		dB

OUTPUT

Type	Differential or Single-Ended			
Termination	50 Ohms			
Connectors	SMA			
	Min	Typ	Max	Units
Frequency Range Static	100		1500	MHz
Frequency Range Chirping	250		1250	MHz
Voltage Level	-635		0	mV
Power Level	-4		0	dBm
Residual Phase Noise @ 1 kHz from Carrier			-145	dBc / Hz
Return Loss		15		dB

WAVEFORMS

Max Waveform Length	458,752 frequency words
Max Number of Pages	7
Minimum Waveform Length	64 frequency words in Free Run or Triggered Free Run modes 256 ns in Burst Mode Multi-Loop (number of frequency words depends on input clock and frequency update rate)

TRIGGER

Connector	SMA		
Source	External or Software		
Trigger Input Threshold Levels	Min	Max	Units
V_{IL}	0	0.8	V
V_{IH}	2.0	3.3	V

MARKER

Number of Markers	1			
Marker Length	User defined			
Minimum Marker Length	4 words			
Marker Output Levels	Min	Typ	Max	Units
V_{OL}	0	0	0.4	V
V_{OH}	2.9	3.3	3.3	V

OPERATING CHARACTERISTICS

	Min	Typ	Max	Units
Operating Temperature	-40	25	85	° C
Power Supply Voltage	+11.5	+12.0	+12.5	V
Power Supply Current @ 2.5 GHz		1000		mA
Power Dissipation @ 2.5 GHz		12		W

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.

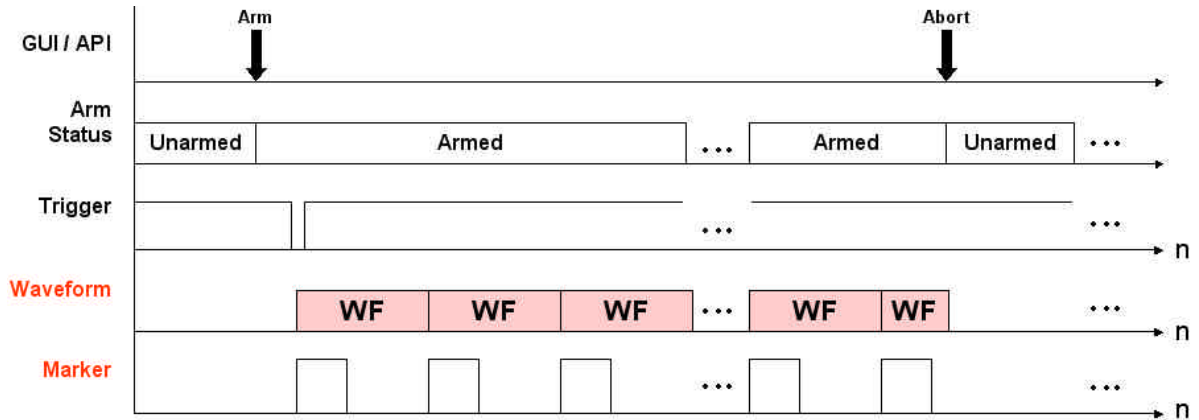
Free Run Mode

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.



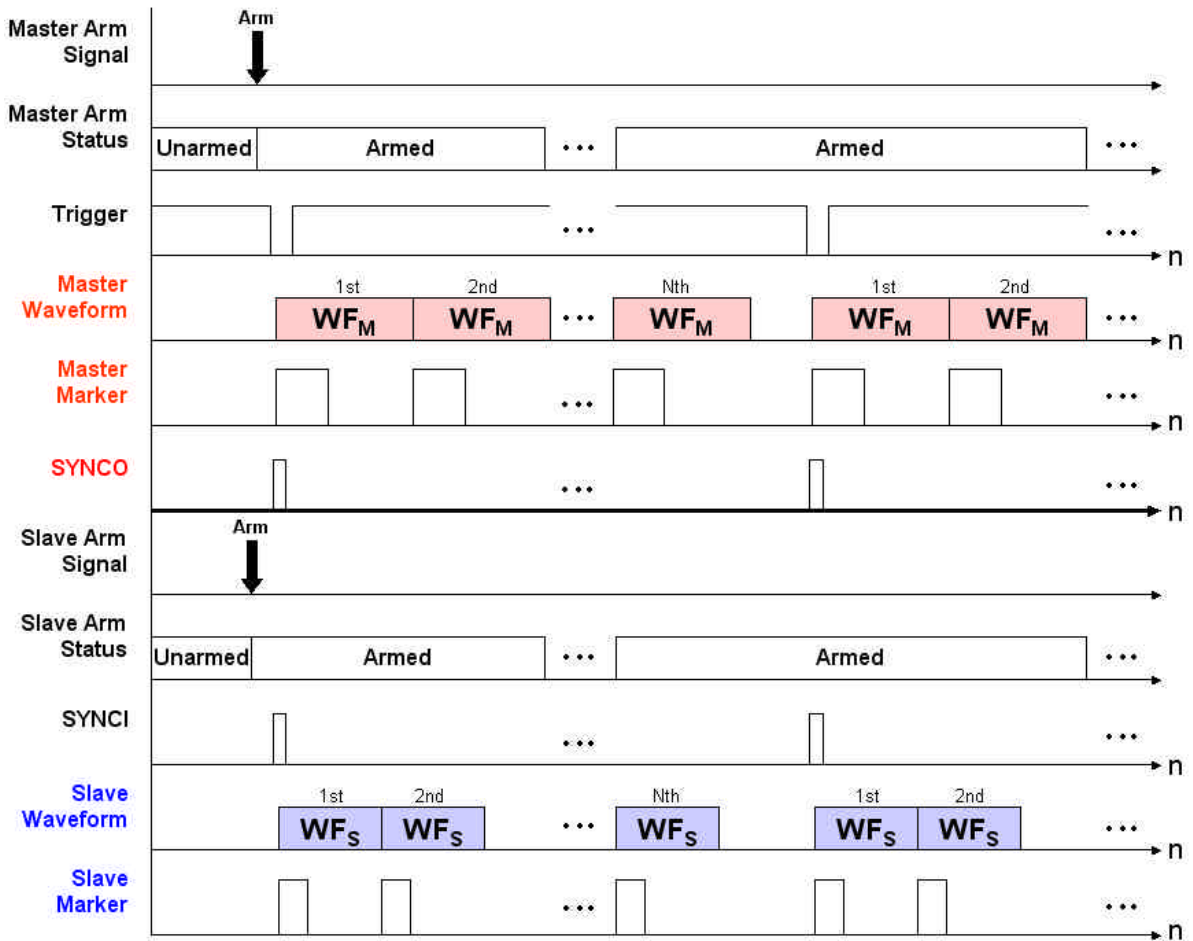
Triggered Free Run Mode

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 to 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.

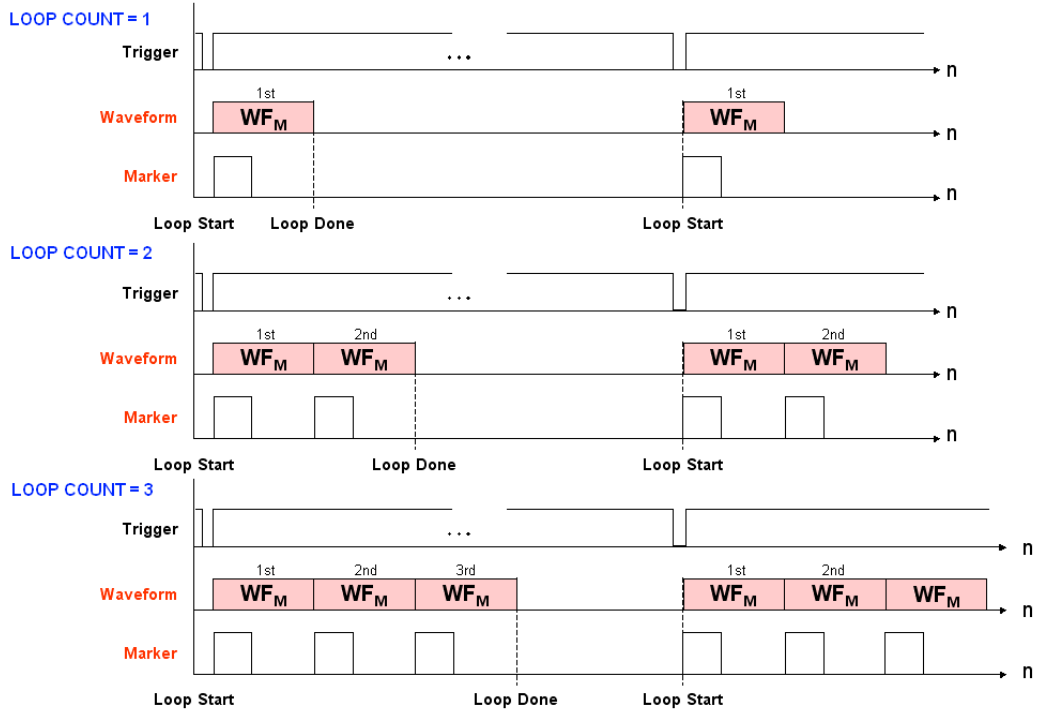


Triggered Burst Mode

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.

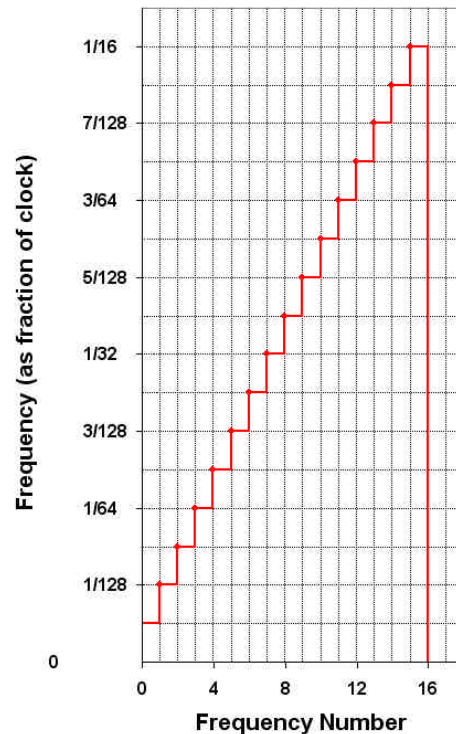


WAVEFORM DETAILS

The DSM module includes a 458,752 32-bit word memory chip so the maximum length of the waveform is 458,752 frequencies.

The minimum waveform length depends on the mode of the DSM. In Free Run or Triggered Free Run Mode, the waveform length can be as short as 16 frequencies, which translates to about 64 ns at 2.0 GHz. The minimum waveform length in Burst mode can be as short as 256 ns. Note that the minimum waveform length is defined as an absolute time in Burst mode whereas the minimum waveform length in Free Run mode is defined in number of frequencies. This means that the minimum number of frequencies that can be chirped in Burst mode will depend on your input clock. At 2.0 GHz, 256 ns translates to about 64 frequencies; at 2.5 GHz, the minimum number of frequencies is about 80; and at 1.5 GHz, the minimum number of frequencies is about 48.

The oscilloscope photos below demonstrate some of the capabilities of the DSM. In each waveform segment, the DSM is chirping from 1/256 of the input clock frequency to 1/16 of the input clock frequency in steps of 1/256 of the input clock frequency. The beginning of each waveform has reset on for the first 12 frequencies and therefore the frequency is 0.



The input clock in the following photos is 2.0 GHz, so for each segment of the waveform, the DSM is chirping from 7.8125 MHz all the way up to 125 MHz in 7.8125 MHz steps for a total of 16 frequencies per segment. There are 12 frequencies at the beginning of each waveform that is used for reset.

The signal at the bottom of each photo is the Marker and goes high at the beginning of the waveform and stays high for the first 12 frequencies before going back low again.

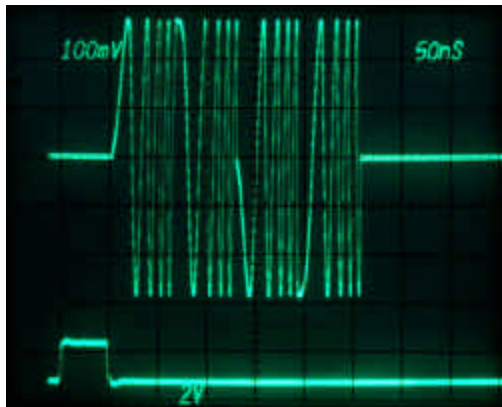


Photo 1

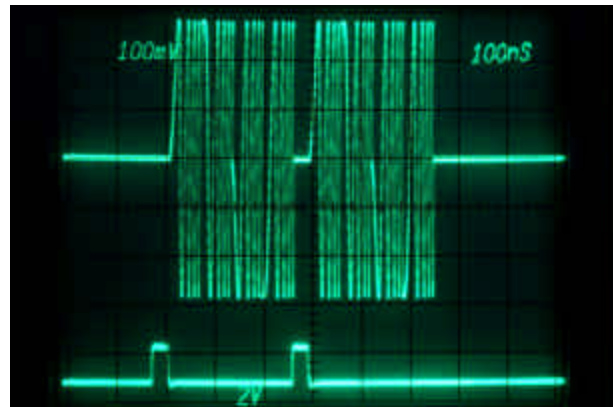
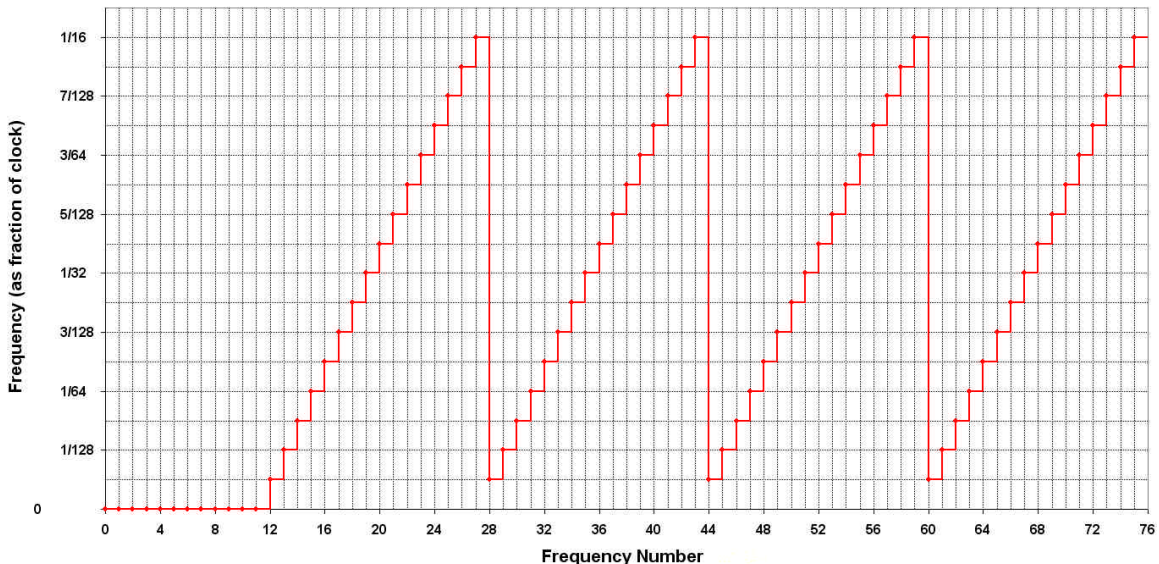


Photo 2

In Photo 1, the DSM is chirping 4 segments back to back for one waveform. The loop count is set to 1 so the DSM runs the complete waveform one time when it senses a trigger. At the end of the waveform, the module stops output and waits for the next trigger. The total waveform length is 76 frequencies (12 reset frequencies + 4 * (16 frequencies per cycle) = 76), which translates to about 304 ns.



In Photo 2, the DSM is chirping the same complete waveform as in Photo 1 but this time the loop count is set to 2. When the module senses a trigger, it will run the complete waveform two times in succession and at the end of the second complete waveform, the DSM will stop output and wait for the next trigger. The total waveform length is about 608 ns.

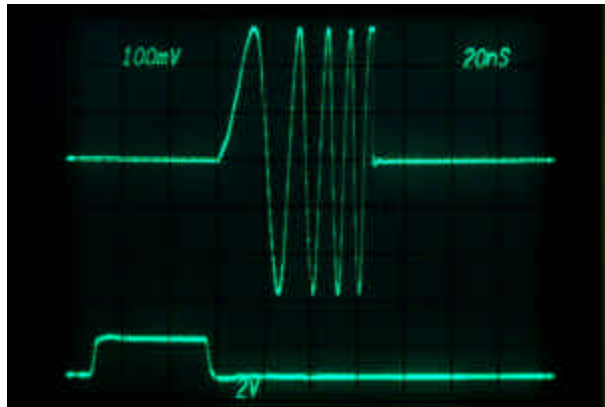
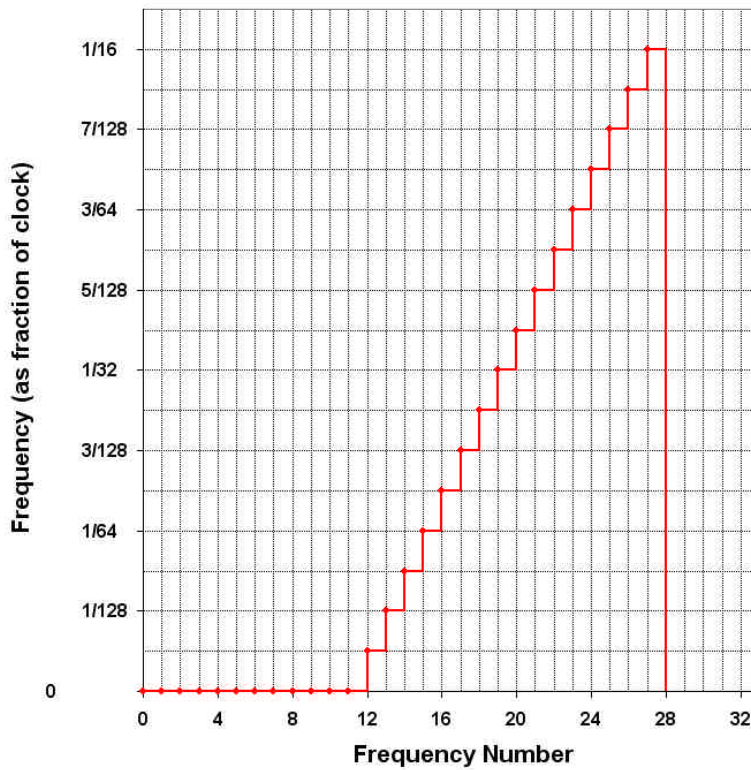
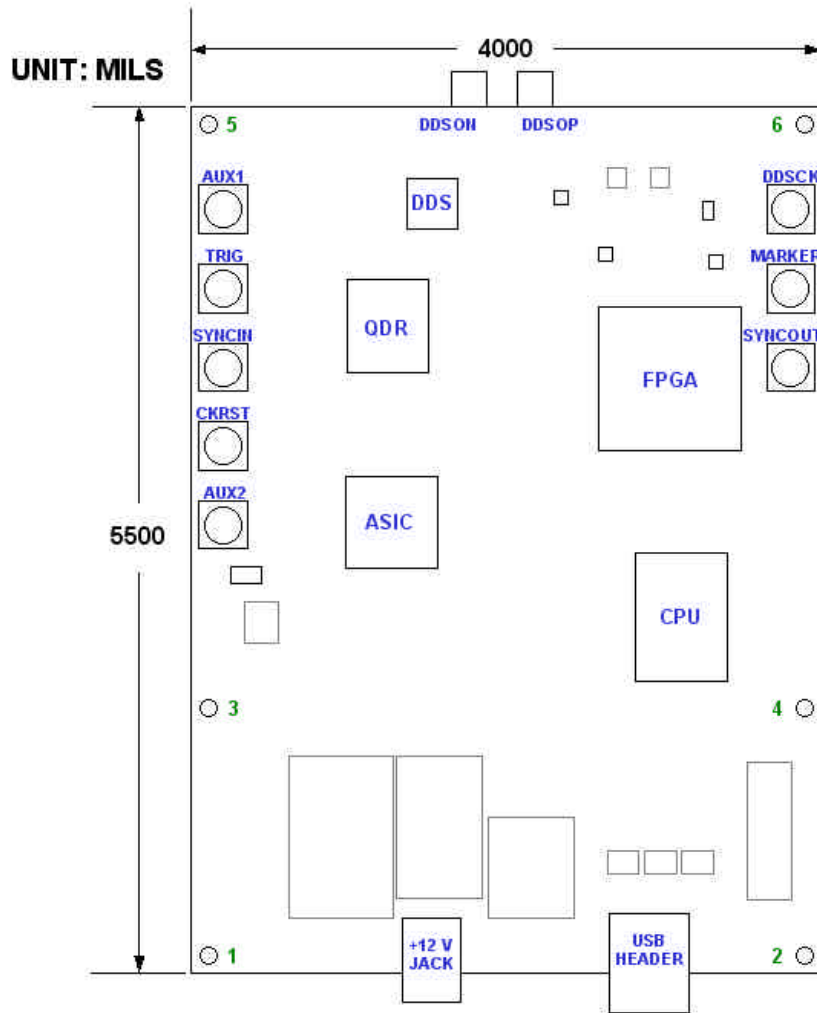


Photo 3

Photo 3 demonstrates how short a waveform can be. This time, only one segment of the waveform described originally (1/256 of clock to 1/16 of clock in 1/256 of clock steps) is output as opposed to the 4 cycles in Photo 1 and Photo 2. The first 12 frequencies consists of resets while the next 16 frequencies are part of the waveform. The total length is therefore 28 frequencies, which is only about 112 ns at 2.0 GHz.



BOARD DIAGRAM



DIMENSIONS

Length	5.5 inches
Width	4.0 inches
Height	0.7 inches with heatsink (nominal) 0.6 inches without heatsink (nominal)

MOUNTHOLE LOCATIONS

		X mils	Y mils
	1	125	125
	2	3875	125
Mountholes Origin at Bottom Left Corner	3	125	1700
	4	3875	1700
	5	125	5375
	6	3875	5375

TERMINAL DESCRIPTION

	Function	I/O	Signal
+12 V JACK	Power Jack for +12 V DC	Power	DC
DDSCK	Module Clock Input	Input	RF
DDSOP	Waveform Output Positive	Output	RF
DDSON	Waveform Output Negative	Output	RF
TRIG	Trigger; Used in Master Mode	Input	
SYNCIN	Synchronize In; Used in Slave Mode	Input	
CKRST	ASIC Clock Reset	Input	
MARKER	Marker	Output	
SYNCOUT	Synchronize Out; Used in Master Mode	Output	
AUX1	Auxiliary 1	Output	
AUX2	Auxiliary 2	Output	
USB HEADER	USB Control	Bidirectional	

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