

SCG2000 Series Synchronous Clock Generators



PLL

2111 Comprehensive Drive
Aurora, Illinois 60505
Phone: 630-851-4722
Fax: 630-851-5040
www.conwin.com



Application

The Connor-Winfield SCG2000 Series provides high precision phase lock loop frequency translation for the telecommunication applications.

SCG2000 Series is well suited for use in line cards, service termination cards and similar functions to provide reliable reference, phase locked, synchronization and low phase gain for TDM, PDH, SONET and SDH network equipment. The SCG2000 Series provides a jitter filtered, wander following output signal synchronized to a superior Stratum or peer input reference signal.

Features

- **3.3V High Precision PLL**
- **Tri-State Capability**
- **Active Alarms**
- **Guaranteed Free Run ± 20 ppm**
- **1 Sec. Acquisition Time**

Bulletin	SG035
Page	1 of 20
Revision	00
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General Description

The SCG2000 Series provides high precision phase lock loop frequency translation for the telecommunication applications. The SCG2000 products generate a CMOS output from an intrinsically low jitter, voltage controlled crystal oscillator. Most models provide a jitter attenuated, internal reference that is connected to a Reference Output pin.

SCG2000 Series is well suited for use in line cards, service termination cards and similar functions to provide reliable reference, phase locked, synchronization for TDM, PDH, SONET and SDH network equipment . The SCG2000 Series provides a low phase gain (<0.2dB), jitter filtered, wander following output signal synchronized to a superior Stratum or peer input reference signal.

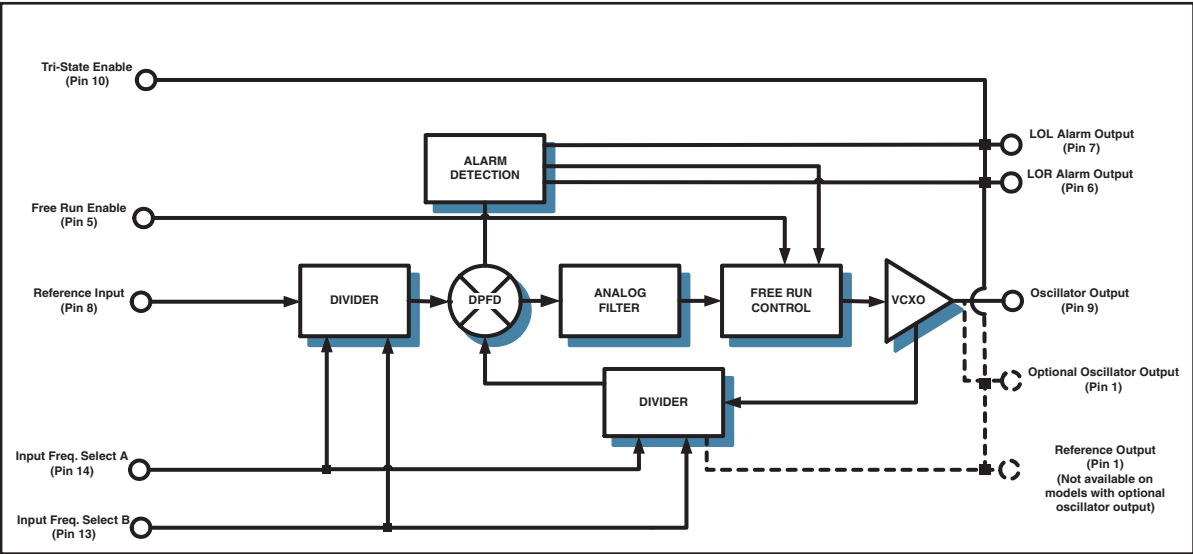
The SCG2000 Series include the following features: Free Run, Tri-state and alarm outputs for Loss-of-Reference, (LOR), Loss-of-Lock, (LOL). During the LOR alarm, the SCG2000 will

also enter a Free Run state which will guarantee a 20 ppm accurate output. Additionally the Free Run mode may be entered manually by asserting a high signal to the Free Run Enable pin. The outputs, except the oscillator output, may be put into the tri-state high impedance condition for external testing purposes by asserting a high signal to the Tri-State Enable pin.

The SCG2000 Series are 3.3 Volt components that typically draw less than 100 mA. All models have an acquisition time of approximately 1.0 second and can be used in applications that require temperature rating of 0° - 70° C. All models have a 33Ω resistor in series with the oscillator output. The SCG2000 maximum package dimensions are .78" x .83" x .35" on a six layer FR4 board with surface mount pins. Parts are assembled using high temperature solder to withstand surface mount reflow process.

Functional Block Diagram

Figure 1



Model Comparison Table

Table 1

Model	Input Ref Freq	Max Duty Cycle	Reference Output (Pin #1)	Oscillator Output (Pin #9)	Notes
SCG2000	8-64 kHz	40/60	= Input Ref Freq.	1.544 MHz to 125.0 MHz	Basic Model
SCG2010	19.44 MHz	40/60	8 kHz	19.44 MHz	
SCG2020	19.44 MHz	40/60	19.44 MHz	77.76 MHz	
SCG2030	8-64 kHz	45/55	= Input Ref Freq.	1.544 MHz to 125.0 MHz	Tight Duty Cycle
SCG2050	8-64 kHz	40/60	19.44 MHz	77.76 MHz	
SCG2070	19.44 MHz	40/60	51.84 MHz, 77.76 MHz	51.84 MHz, 77.76 MHz	Ref Output = Osc Output

*Features which differentiate a model from the base model (SCG2000) are highlighted in boldface color and in the notes column.

Pin Description

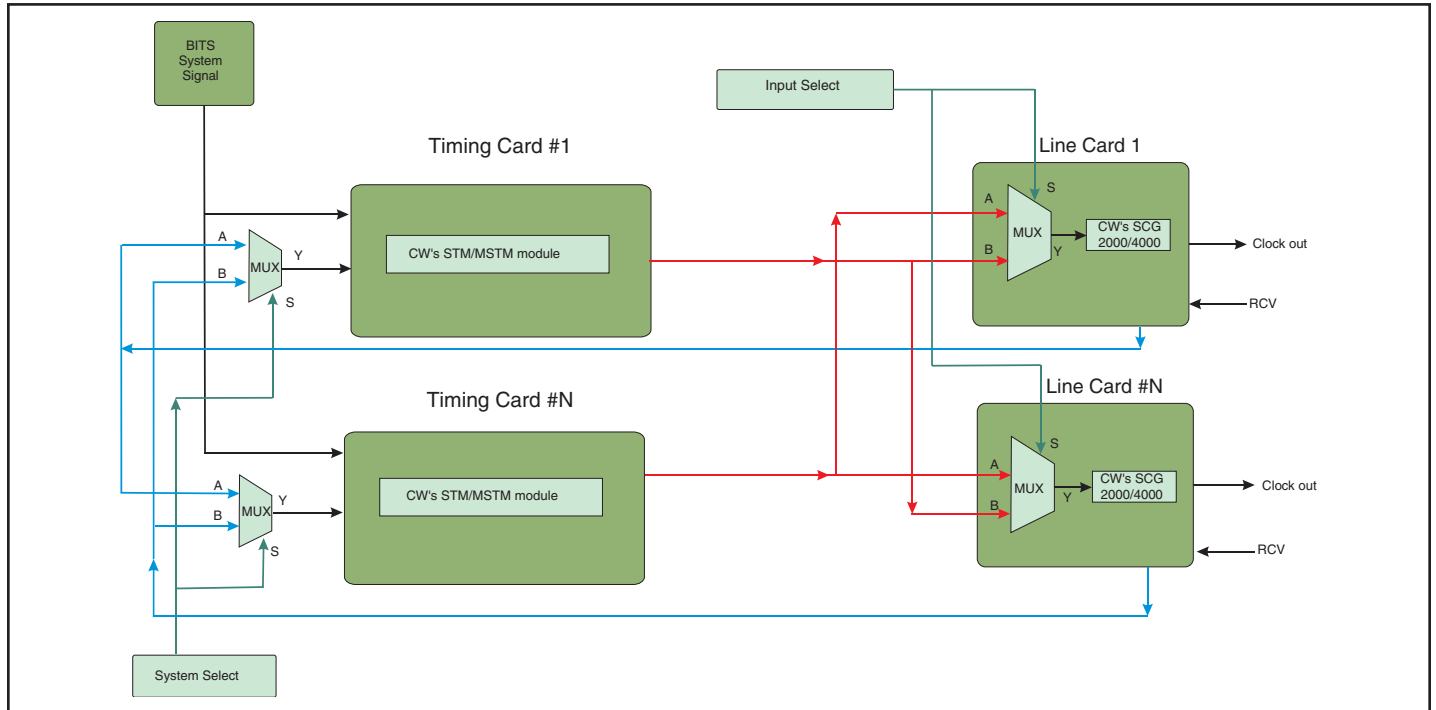
Table 2

All SCG2000 Models

Pin #	Connection	Description
1	Reference Output	Output frequency is dependent on SCG model
2	TCK	JTAG pin that is used only by Connor-Winfield for programming. Do not connect
3	TMS	JTAG pin that is used only by Connor-Winfield for programming. Do not connect
4	Ground	Ground
5	Free Run Enable/TDI	Free Run enable pin. 1 = Free Run at nominal frequency ± 20 ppm. Input is pulled to GND
6	Loss of Reference (LOR)	Alarm indicator. 1 = The reference has been lost.
7	Loss of Lock (LOL)	Alarm indicator. 1 = Phase lock has been lost
8	Reference Input	Input reference frequency
9	Oscillator Output	Output frequency is dependent on SCG model
10	Tri-State enable	Tri State control for all outputs except Oscillator Output. 1 = Hi-Z, 0 = normal. Input is pulled to GND.
11	Vcc	3.3V Supply Voltage.
12	TDO	JTAG pin that is used only by Connor-Winfield for programming. Do not connect
13	Input Freq. Select B	Control pin B used to select input frequency. Input is pulled to GND.
14	Input Freq. Select A	Control pin A used to select input frequency. Input is pulled to GND.

Typical Application

Figure 2



Absolute Maximum Rating

Table 3

All SCG2000 Models

Symbol	Parameter	Minimum	Nominal	Maximum	Units	Notes
V _{cc}	Power Supply Voltage	-0.5		4	Volts	
V _I	Input Voltage	-0.5		5.5	Volts	
T _s	Storage Temperature	-65		150	deg. C	

Specifications

Table 4

All SCG2000 Models

Parameter	Specifications	Notes
Voltage	3.3V $\pm$ 5%	1.0
Current	100 mA Typical	
Temperature Range	0 to 70°C	
Input Jitter Tolerance (Input Jitter Frequencies $\geq$ 10 Hz)	$\geq$ 31.25us Typical (SCG2000, SCG2030, SCG2050) >1 us Typical (SCG2010, SCG2015, SCG2020, SCG2070)	
Jitter Bandwidth	<15 Hz	
Acquisition Time	Approx 1.0 second	2.0
Capture/Pull-in Range	$\pm$ 25 ppm Minimum	
Output Duty Cycle	40/60 % Min/Max @ 50% Level	
Output Rise and Fall Time	3 ns @ 20% to 80% output level	
Output Load	30 pF	
Alarms	LOR, LOL Status on separate outputs	
Free Run Accuracy	$\pm$ 20 ppm	
Package	Fr4 SM 0.78" x .83" x 0.35" (maximum)	
TDEV	60 ps Typical	
MTIE	750 ps Typical	
Reference Output/Oscillator Output Offset	$\leq$ 8 ns	
Static Offset	$\pm$ 26 ns Maximum	3.0, 5.0
Dynamic Offset	$\pm$ 20 ns Maximum	4.0, 5.0

Input And Output Characteristics

Table 5

All SCG2000 Models

Symbol	Parameter	Minimum	Nominal	Maximum	Units	Notes
V _{IH}	High Level Input Voltage	2		5.5	V	
V _{IL}	Low Level Input Voltage	0		0.8	V	
T _{IO}	I/O to Output Valid			10	nS	
C _O	Output Capacitance			10	pF	
V _{HO}	High Level Output Voltage I _{OH} = -4mA	2.4				V _{cc} Min.
V _{IO}	Low Level Output Voltage I _{OL} = 8mA			0.4		V _{cc} Max.
T _{IR}	Input Reference Signal Pulse Width	30			nS	

NOTES: 1.0: Requires external regulation
 2.0: From a 20 ppm offset in reference frequency
 3.0: Offset between Reference Input and Reference Output @ room temp.
 4.0: Offset change between Reference Input and Reference Output over temperature range from room temperature.
 5.0: The SCG2015 will maintain an offset/skew, between the reference input and the oscillator output, of X $\pm$ 1ns. X is TBD.

Output Jitter Specifications

Table 6

All SCG2000 Models

Jitter BW 10 Hz - 20 MHz			SONET Jitter BW 12 KHz - 20 MHz	
Frequency (MHz)	pS (RMS)	m UI	pS (RMS)	m UI
1.544	30 Typ.	0.046 Typ.	4 Typ.	0.006
2.048	30 Typ.	0.061 Typ.	4 Typ.	0.008
8.448	10 Typ.	0.084 Typ.	1 Max., 0.5 Typ.	0.008 Max.
16.384	10 Typ.	0.164 Typ.	1 Max., 0.5 Typ.	0.016 Max.
19.44	10 Typ.	0.194 Typ.	1 Max., 0.5 Typ.	0.019 Max.
20.48	10 Typ.	0.205 Typ.	1 Max., 0.5 Typ.	0.020 Max.
37.056	10 Typ.	0.371 Typ.	1 Max., 0.5 Typ.	0.037 Max.
44.736	10 Typ.	0.457 Typ.	1 Max., 0.5 Typ.	0.045 Max.
49.152	10 Typ.	0.492 Typ.	1 Max., 0.5 Typ.	0.049 Max.
51.84	10 Typ.	0.518 Typ.	1 Max., 0.5 Typ.	0.052 Max.
77.76	10 Typ.	0.778 Typ.	1 Max., 0.5 Typ.	0.078 Max.
125.0	10 Typ.	1.25 Typ.	1 Max., 0.5 Typ.	0.125 Max.

* Note: These jitter specs only apply to version 2 models

Output Programming

Table 7

All SCG2000 Models

Tristate	Free Run	Output
0	0	Locked to reference selected (default)
1	X	Hi-Z Tristate condition
0	1	Free run at nominal frequency

Alarm Status

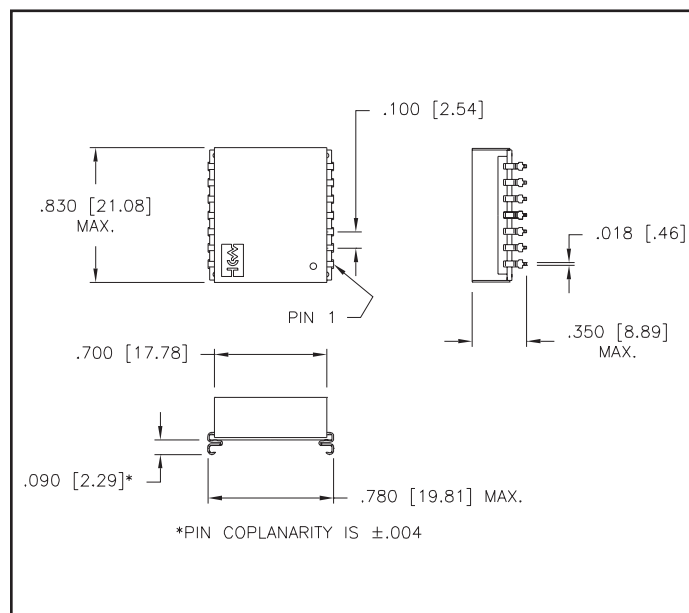
Table 8

All SCG2000 Models

LOL Output	LOR Output	Alarm Output
0	0	No alarm
1	0	Loss-of-Lock
X	1	Loss-of-Reference

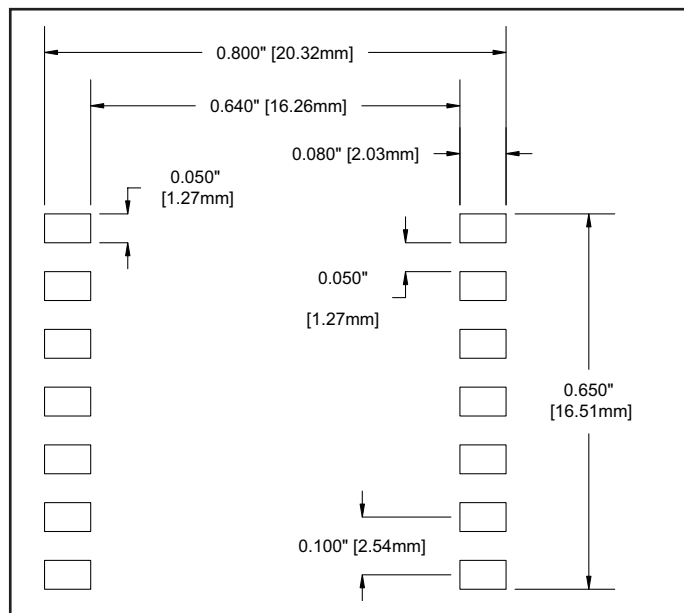
Maximum Package Dimensions

Figure 3



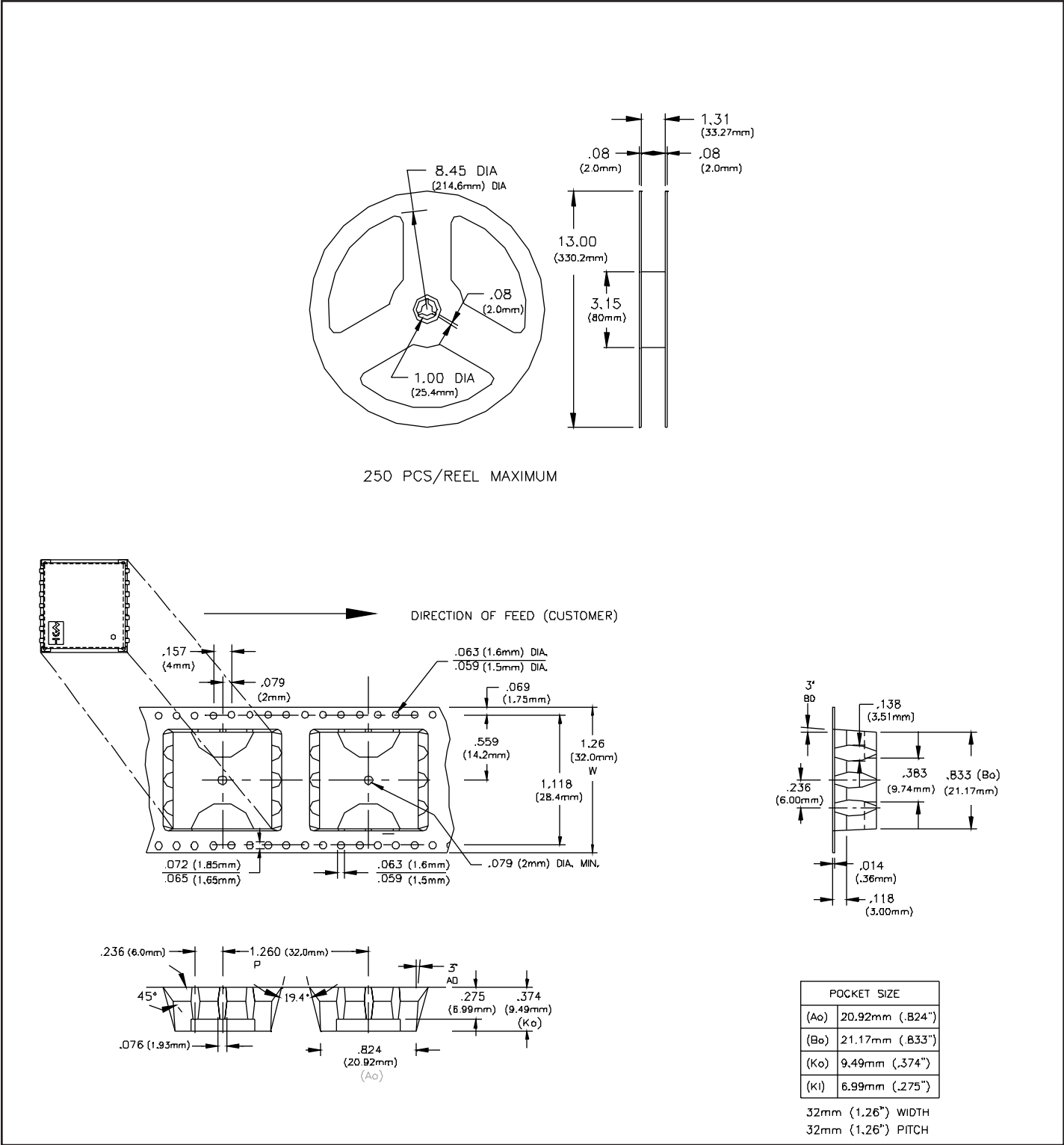
Recommended Footprint Dimensions

Figure 4



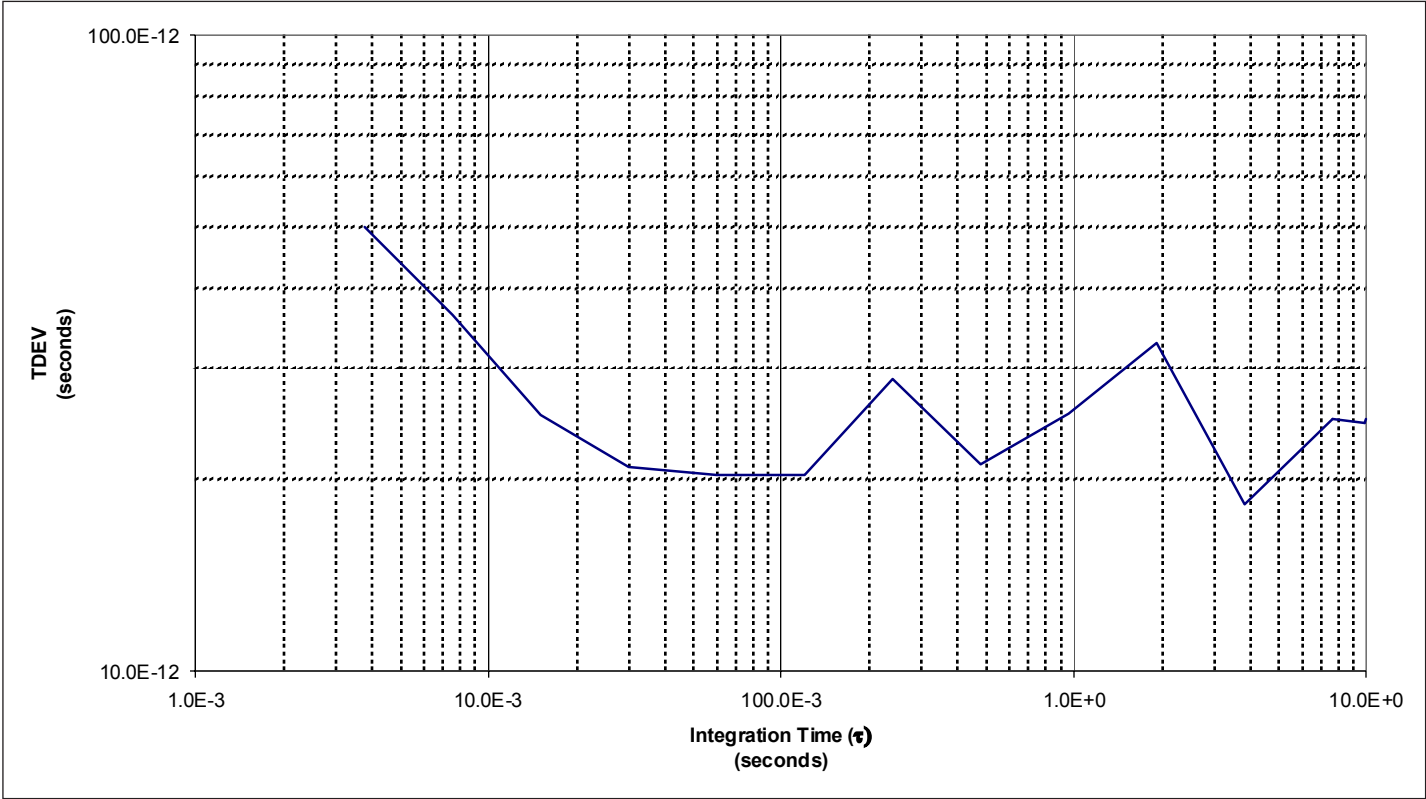
Tape and Reel Dimensions

Figure 5



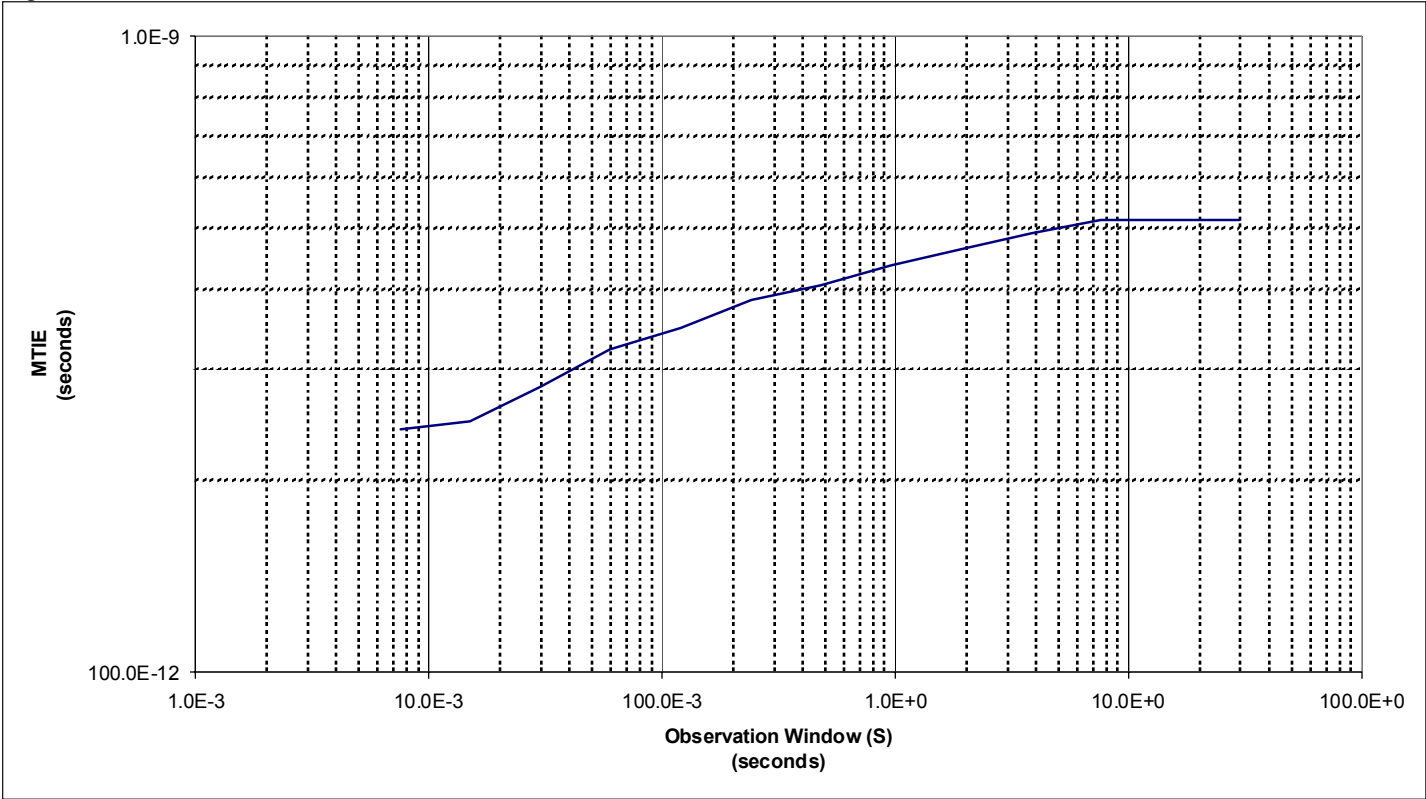
SCG2000 Typical TDEV

Figure 6



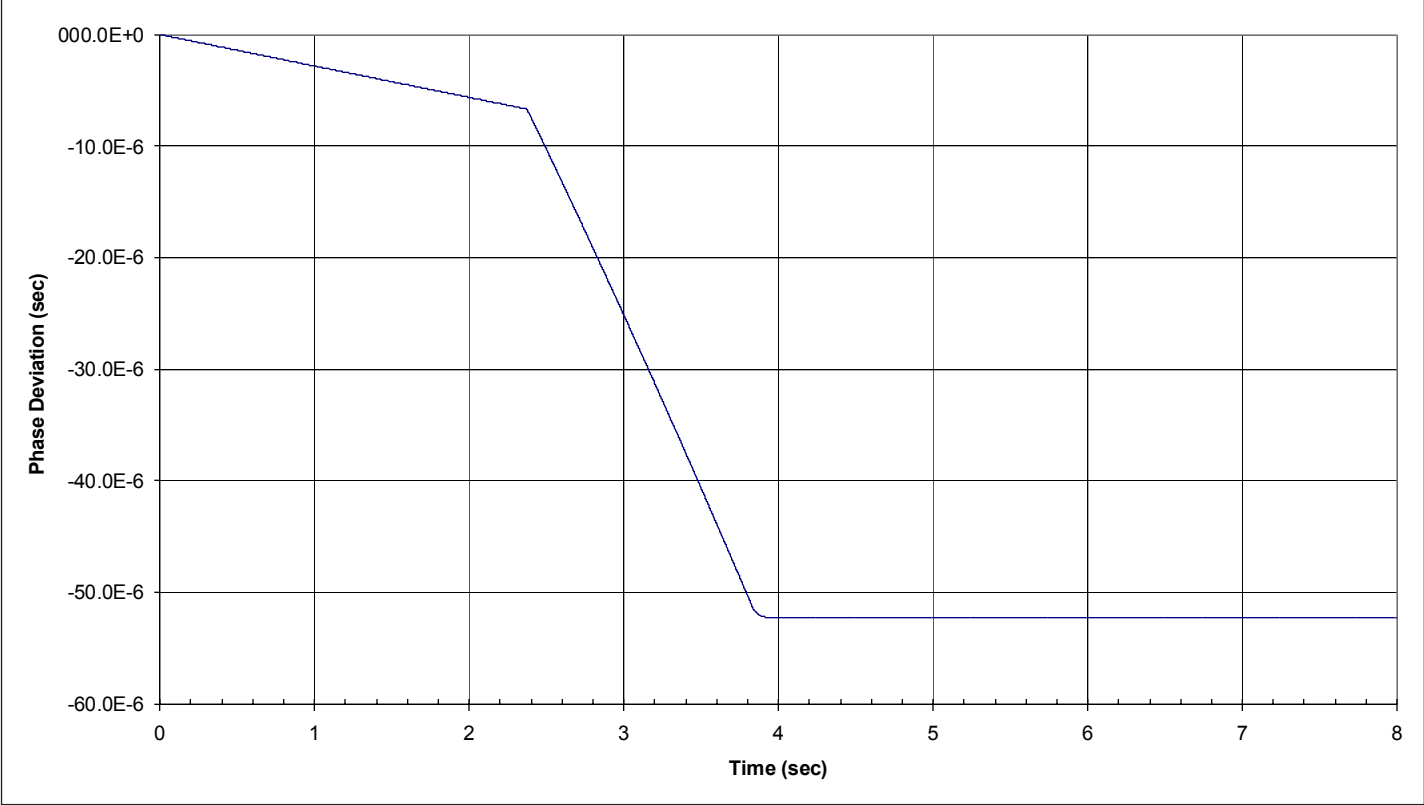
SCG2000 Typical MTIE

Figure 7



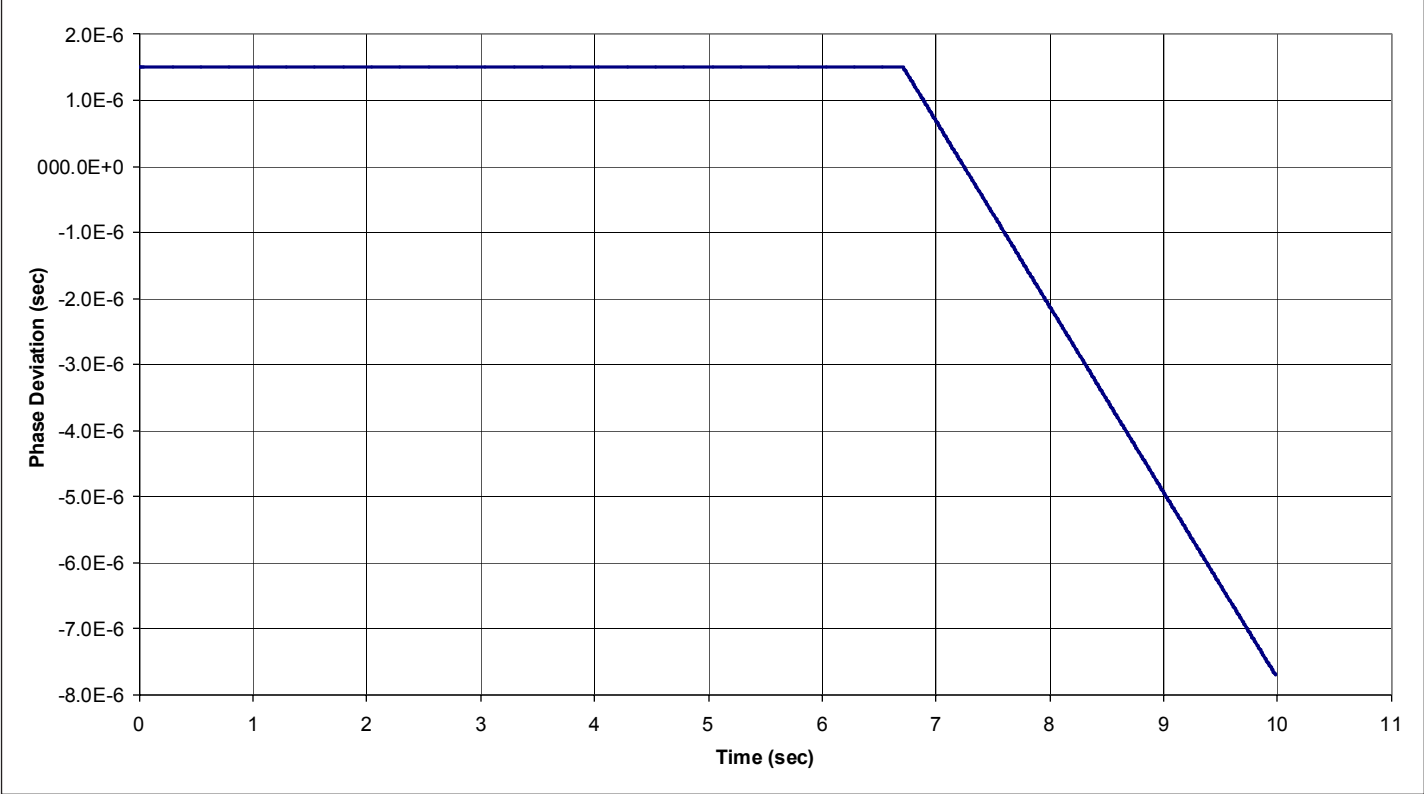
SCG2000 Switch from Free Run to a new Reference

Figure 8



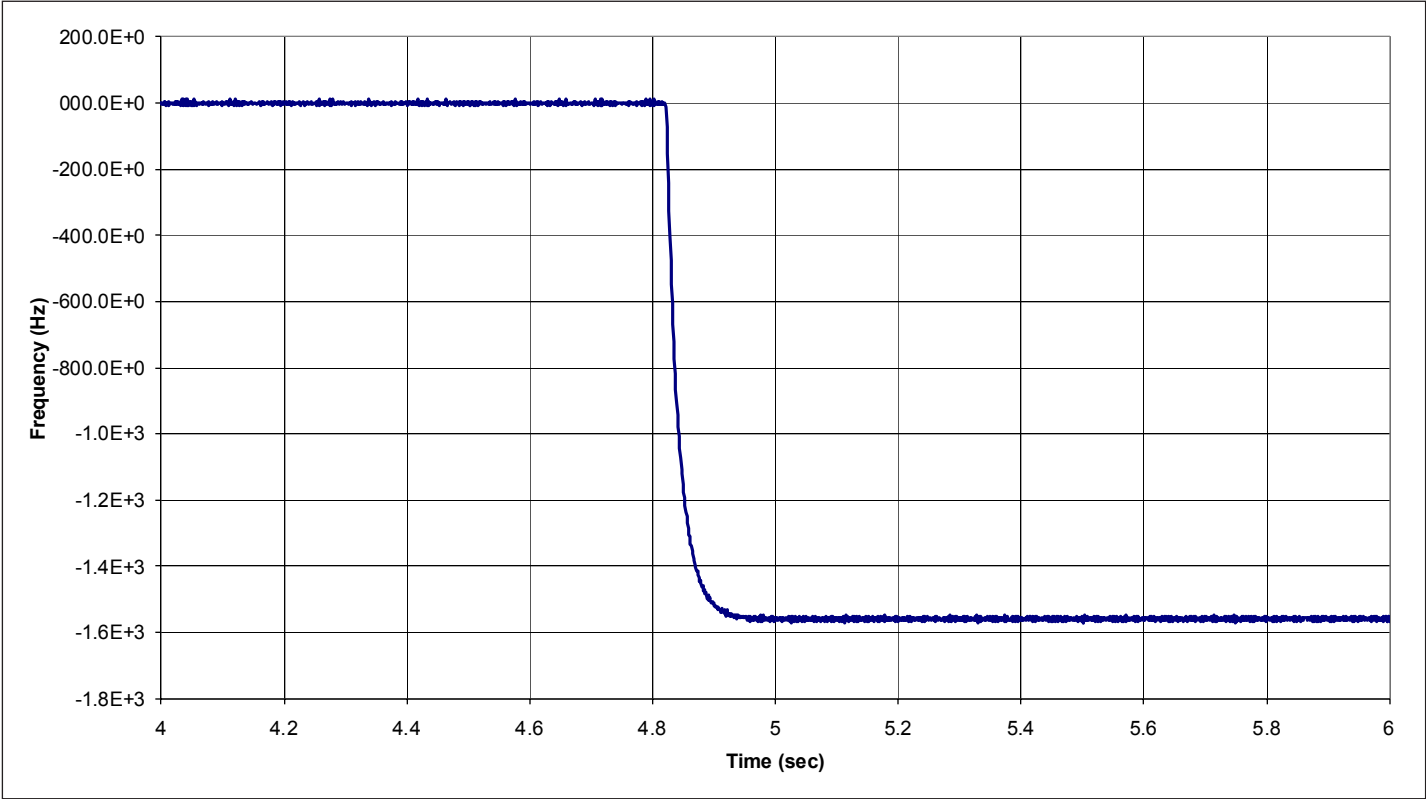
SCG2000 Switch from a Reference to Free Run

Figure 9



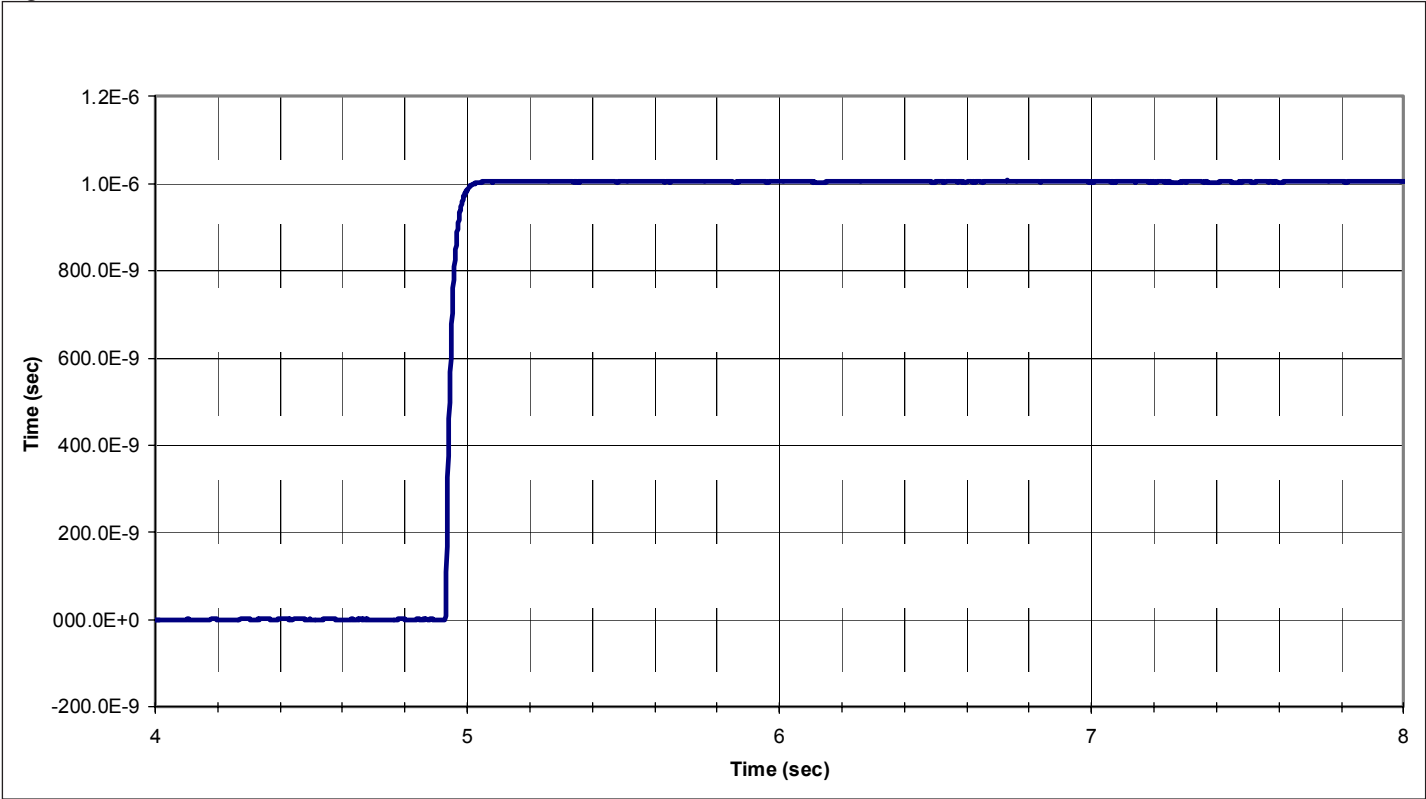
SCG2000 Step Response due to a -20ppm Freq. Step

Figure 10



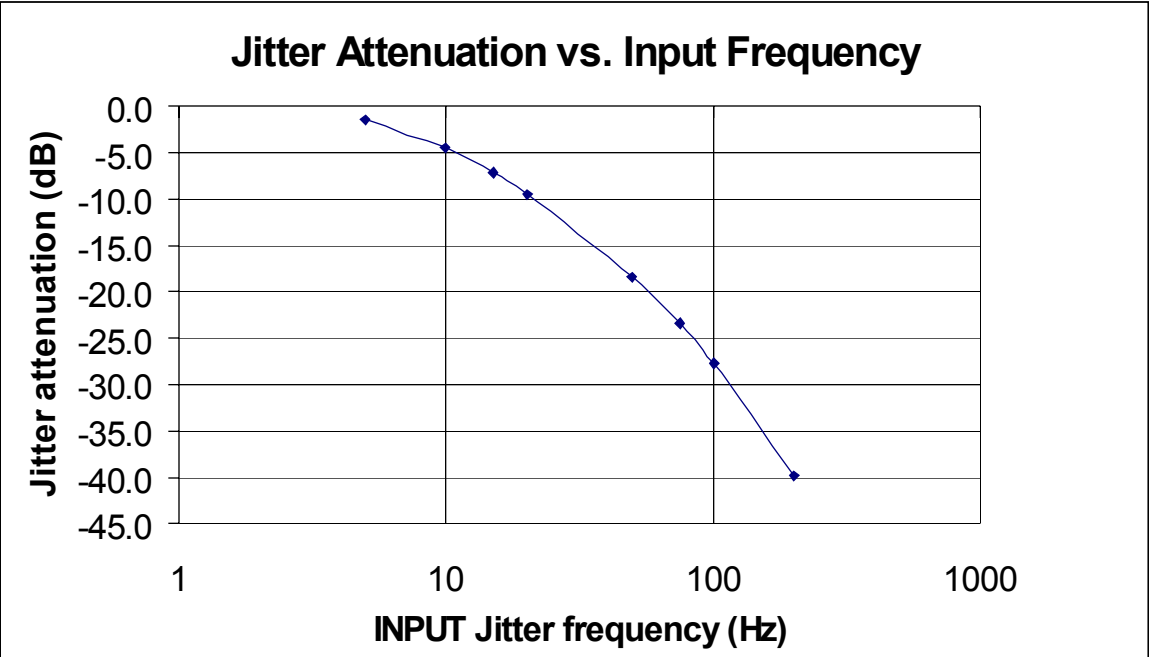
SCG2000 1μs Phase Transient Response

Figure 11



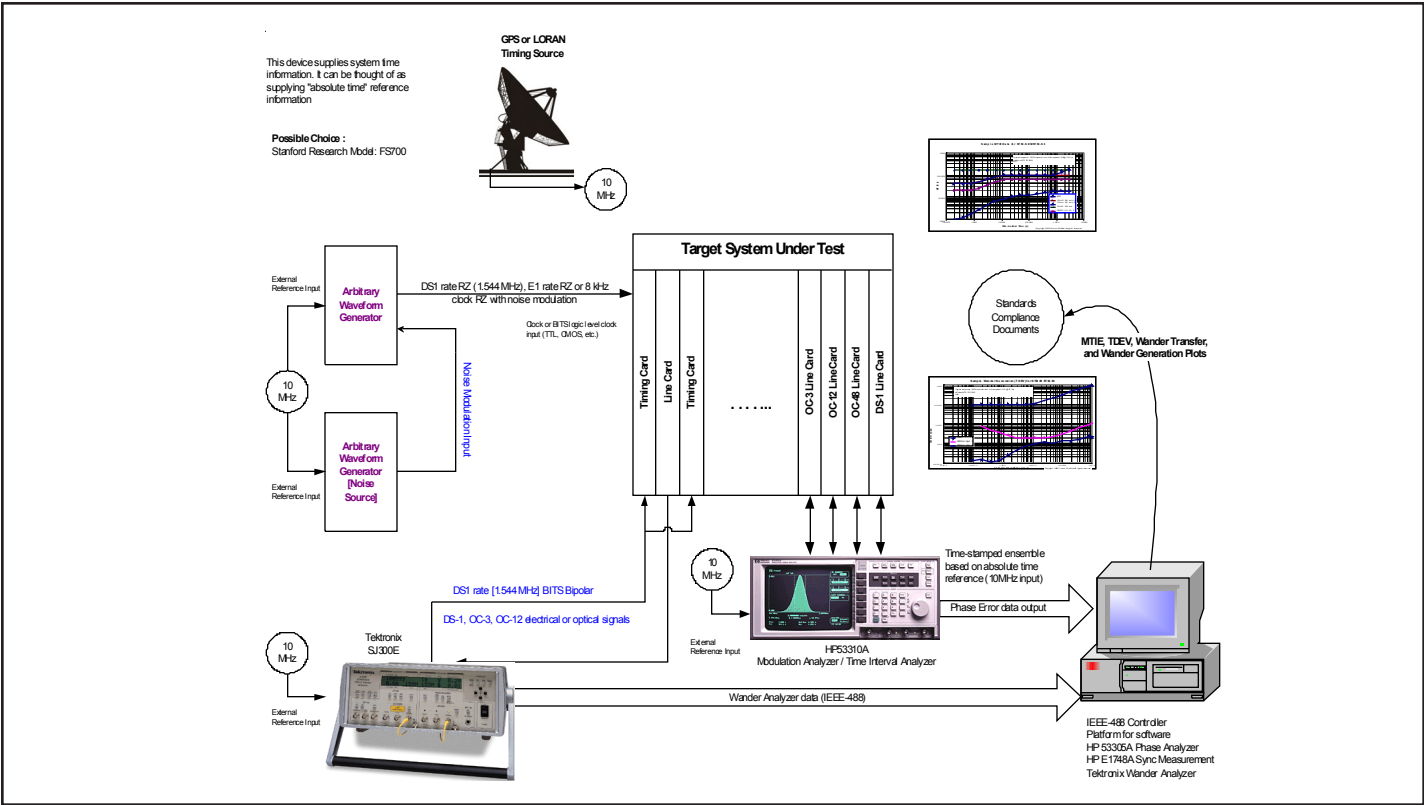
SCG2000 Jitter Attenuation

Figure 12



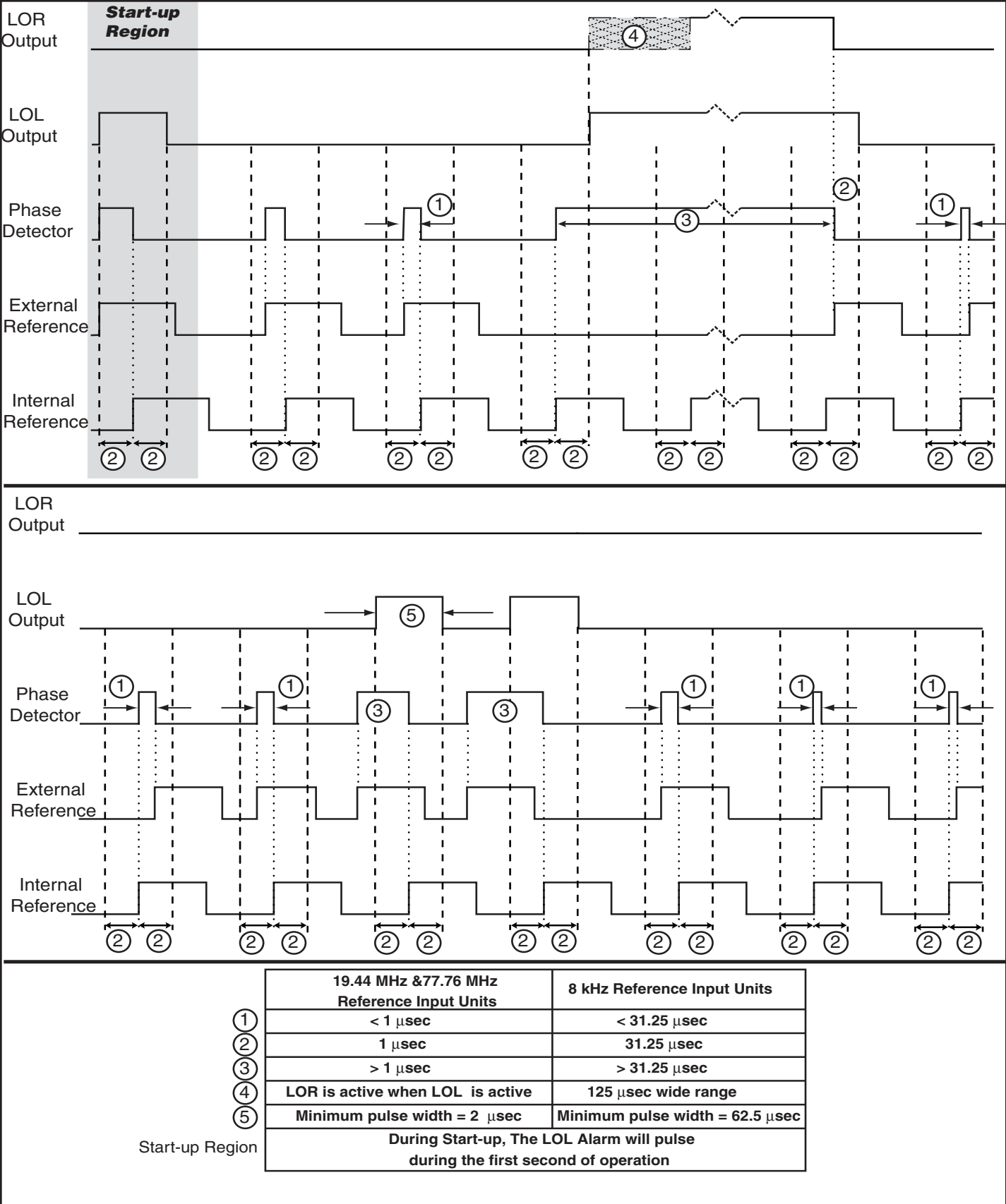
Typical System Test Setup

Figure 13



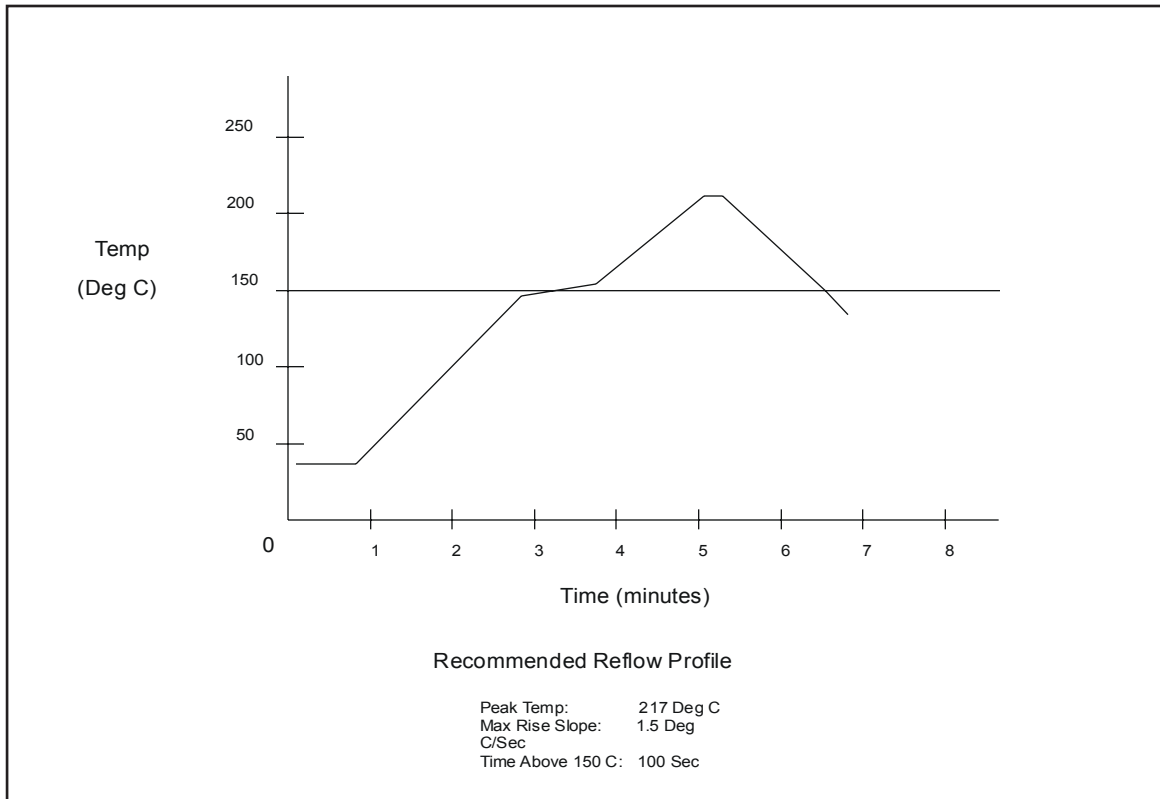
Alarm Timing Diagram

Figure 14



Solder Profile

Figure 15



Ordering Information

SCG{XXXX}-{FFF.FFF}{M}

XXXX equals a specific model (2000, 2010, 2020, 2030, 2050, 2070)

FFF.FFF equals the Oscillator Output frequency (001.544, 002.048, 008.448, 016.384, 019.44, 020.48, 037.056, 044.736, 049.152, 051.84, 077.76, 125.0)

M equals MHZ and is added to all part numbers

Example: To order an SCG2000 with an Oscillator Output of 77.76 MHz,
Order part number SCG2000-077.76M

Please contact Connor-Winfield for other frequencies that may be available.

SCG2000

SCG2000 Individual Features:

- Four selectable References:
8, 16, 32, and 64 kHz.
- Oscillator Output Available:
1.544 MHz to 125.0 MHz.

The SCG2000 is Connor-Winfield's base model for the SCG2000 Series product line. The SCG2000 can lock to one of four input reference frequencies from 8 to 64 kHz which is selectable using two input control pins.

Input Reference Selection

Table 9 SCG2000

Input Sel A (Pin #14)	Input Sel B (Pin #13)	Reference Frequency (Pin #8)
0	0	8 kHz (default)
1	0	16 kHz
0	1	32 kHz (see note 4.0)
1	1	64 kHz (see note 4.0)

Reference and Output Availability

Table 10 SCG2000

Input Reference (Pin #8)	Oscillator Output (Pin #9)	Reference Output (Pin #1)
8 kHz 16 kHz	19.44 MHz	8 kHz 16 kHz
8 kHz 16 kHz 32 kHz	38.88 MHz	8 kHz 16 kHz 32 kHz
8 kHz 16 kHz 32 kHz 64 kHz	1.544, 2.048, 16.384 20.48, 37.056, 44.736, 49.152, 51.84 and 77.76 MHz	8 kHz 16 kHz 32 kHz 64 kHz
8 kHz	125.0 MHz	8 kHz

Notes:

Note 4.0: Not available with 19.44 MHz output.

SCG2010

SCG2010 Individual Features:

- Input References (Pin #8) at 19.44 MHz.
- Oscillator Output (Pin #9) at 19.44 MHz.
- Reference Output (Pin #1) at 8 kHz.

The SCG2010 is designed as a clean-up PLL with the input reference frequency (Pin #8) equal to the oscillator output (Pin #9). The reference output frequency (Pin #1) is 8 kHz. The LOL alarm is designed to tolerate 1 μ s p-p of jitter on the reference. Jitter greater than 1 μ s p-p will result in LOL alarm pulses.

Input Reference Selection

Table 11

SCG2010

Input Sel A (Pin #14)	Input Sel B (Pin #13)	Reference Frequency (Pin #8)
X	X	19.44 MHz (Default)

X= Don't Care

Reference and Output Availability

Table 12

SCG2010

Input Reference (Pin #8)	Oscillator Output (Pin #9)	Reference Output (Pin #1)
19.44 MHz	19.44 MHz	8 kHz

SCG2020

SCG2020 Individual Features:

- Input References (Pin #8) at 19.44 MHz.
- Oscillator Output (Pin #9) at 77.76 MHz.
- Reference Output (Pin #1) at 19.44 MHz.

The SCG2020 accepts a 19.44 MHz Input Reference (Pin #8) and provides a 19.44 MHz Output Reference (Pin #1) and a 77.76 MHz signal output on Output #2. The LOL alarm is designed to tolerate 1 μ s p-p of jitter on the reference. Jitter greater than 1 μ s p-p will result in LOL alarm pulses.

Input Reference Selection

Table 15

SCG2020

Input Sel A (Pin #14)	Input Sel B (Pin #13)	Reference Frequency (Pin #8)
X	X	19.44 MHz (Default)
X= Don't Care		

Reference and Output Availability

Table 16

SCG2020

Input Reference (Pin #8)	Oscillator Output (Pin #9)	Reference Output (Pin #1)
19.44 MHz	77.76 MHz	19.44 MHz

SCG2030

SCG2030 Individual Features:

- Four selectable References:
8, 16, 32, and 64 kHz.
- Oscillator Output Available:
1.544 MHz to 125.0 MHz.
- Tight Duty cycle

The SCG2030 is similar to the SCG2000 but with a tighter duty cycle of 45/55.

Input Reference Selection

Table 17 SCG2030

Input Sel A (Pin #14)	Input Sel B (Pin #13)	Reference Frequency (Pin #8)
0	0	8 kHz (default)
1	0	16 kHz
0	1	32 kHz (see note 4.0)
1	1	64 kHz (see note 4.0)

Reference and Output Availability

Table 18 SCG2030

Input Reference (Pin #8)	Oscillator Output (Pin #9)	Reference Output (Pin #1)
8 kHz 16 kHz	19.44 MHz	8 kHz 16 kHz
8 kHz 16 kHz 32 kHz 64 kHz	1.544, 2.048, 8.448, 16.384, 17.408 MHz 1.544, 2.048, 8.448, 20.48, 37.056 MHz 8.448, 16.384, 44.736, 49.152 MHz 8.448, 51.84 and 77.76 MHz	8 kHz 16 kHz 32 kHz 64 kHz
8 kHz	125.0 MHz	8 kHz

Notes:

Note 4.0: Not available with 19.44 MHz output.

SCG2050

SCG2050 Individual Features:

- Four selectable References:
8, 16, 32, and 64 kHz.
- Oscillator Output Available:
77.76 MHz only

The SCG2050 can use any 1 of 4 selectable Input Reference frequencies with an Oscillator output of 77.76 MHz and a Reference Output of 19.44 MHz

Input Reference Selection

Table 19

SCG2050

Input Sel A (Pin #14)	Input Sel B (Pin #13)	Reference Frequency (Pin #8)
0	0	8 kHz (default)
1	0	16 kHz
0	1	32 kHz
1	1	64 kHz

Reference and Output Availability

Table 20

SCG2050

Input Reference (Pin #8)	Oscillator Output (Pin #9)	Reference Output (Pin #1)
8 kHz	77.76 MHz	19.44 MHz
16 kHz	77.76 MHz	19.44 MHz
32 kHz	77.76 MHz	19.44 MHz
64 kHz	77.76 MHz	19.44 MHz

SCG2070

SCG2070 Individual Features:

- Input References (Pin #8) at 19.44 MHz.
- Oscillator Output (Pin #9) equals Reference Output (Pin #1)

The SCG2070 is designed to provide two output frequencies that are equal. The Reference Output is actually a second Oscillator Output. SCG2070 is available with either 77.76 MHz outputs or with 51.84 MHz outputs. The LOL alarm is designed to tolerate 1 μ s p-p of jitter on the reference. Jitter greater than 1 μ s p-p will result in LOL alarm pulses.

Input Reference Selection

Table 21 SCG2070

Input Sel A (Pin #14)	Input Sel B (Pin #13)	Reference Frequency (Pin #8)
X	X	19.44 MHz (Default)

X= Don't Care

Reference and Output Availability

Table 22 SCG2070

Input Reference (Pin #8)	Oscillator Output (Pin #9)	Reference Output (Pin #1)
19.44 MHz	77.76 MHz	77.76 MHz
19.44 MHz	51.84 MHz	51.84 MHz



2111 Comprehensive Drive
Aurora, Illinois 60505
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00	8/23/04	Final Release