

SCG2000 Series Synchronous Clock Generators



PLL

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

General Description

The SCG2000 Series provides high precision phase lock loop frequency translation for 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.

The 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.



Features

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



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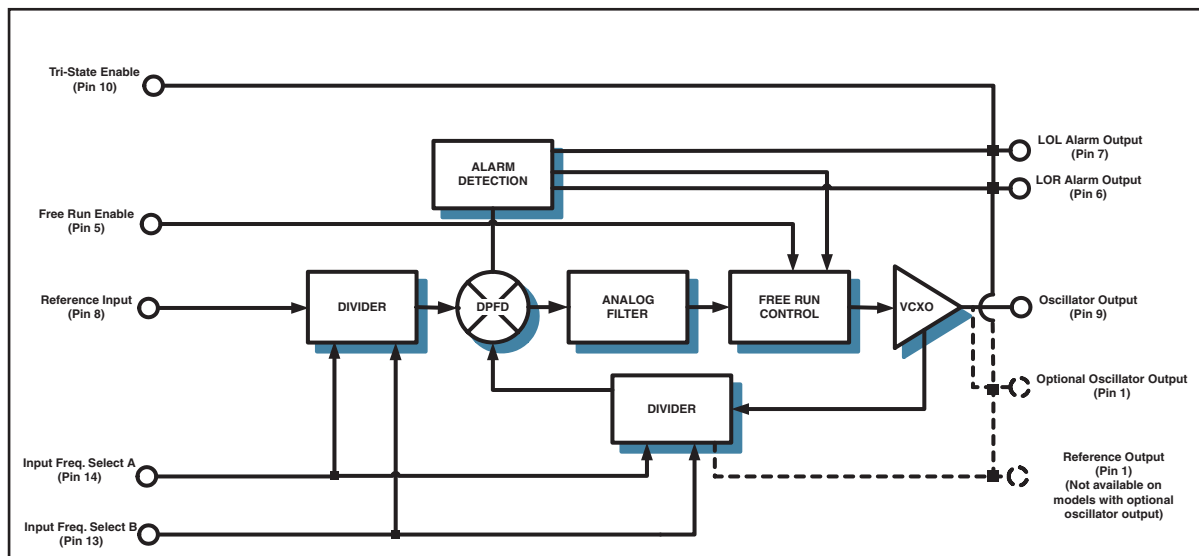
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Functional Block Diagram

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

Pin Description

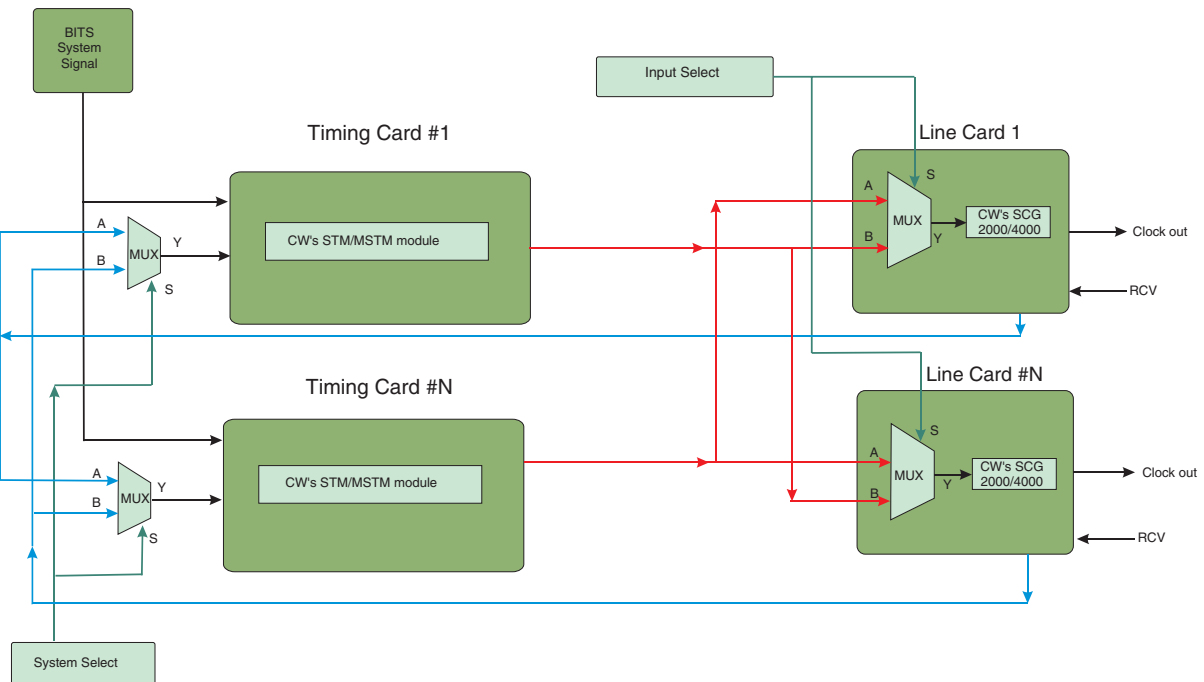
All SCG2000 Models

Table 2

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 $\pm 20\text{ppm}$. 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 ±5%	1
Current	100 mA Typical	
Temperature Range	0 to 70°C	
Input Jitter Tolerance	≥31.25us Typical (SCG2000, SCG2030, SCG2050)	
<i>(Input Jitter Frequencies ≥ 10 Hz)</i>	>1 us Typical (SCG2010, SCG2015, SCG2020, SCG2070)	
Jitter Bandwidth	<15 Hz	
Acquisition Time	Approx 1.0 second	2
Capture/Pull-in Range	±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	±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	≤ 8 ns	
Static Offset	± 26 ns Maximum	3
Dynamic Offset	± 20 ns Maximum	4

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 _{LO}	Low Level Output Voltage I _{OL} = 8mA			0.4	V _{CC} Max.	
T _{IR}	Input Reference Signal Pulse Width	30			nS	

- NOTES:
- 1: Requires external regulation
 - 2: From a 20 ppm offset in reference frequency
 - 3: Offset between Reference Input and Reference Output @ room temp.
 - 4: Offset change between Reference Input and Reference Output over temperature range from room temperature.

Output Jitter Specifications

Table 6

All SCG2000 Models

Frequency (MHz)	Jitter BW 10 Hz - 20 MHz		SONET Jitter BW 12 KHz - 20 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

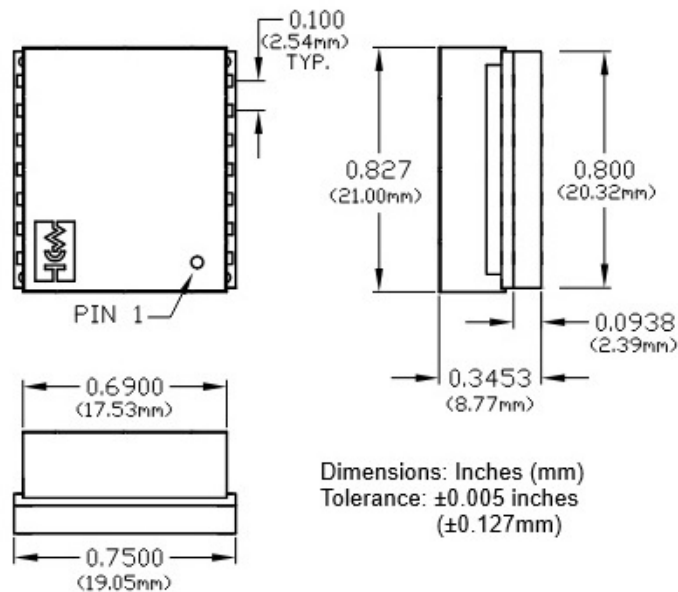
Table 8

All SCG2000 Models

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

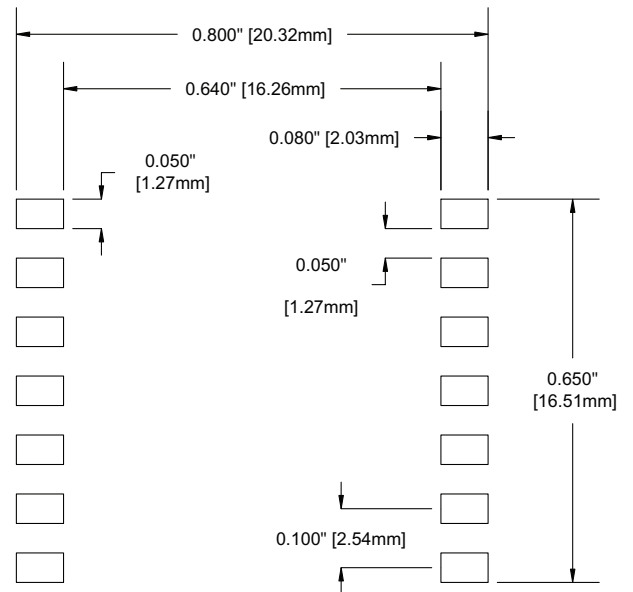
Package Dimensions

Figure 3



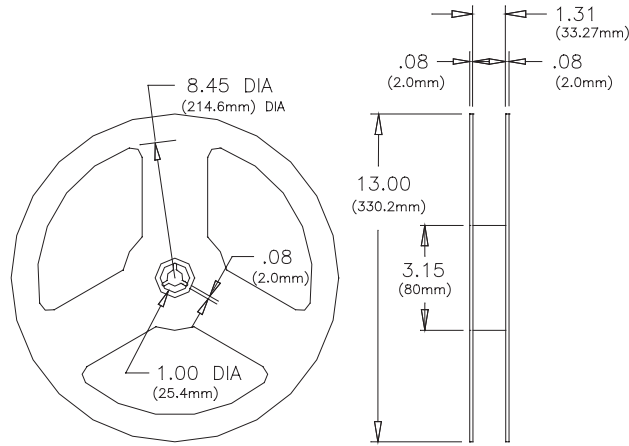
Recommended Footprint Dimensions

Figure 4

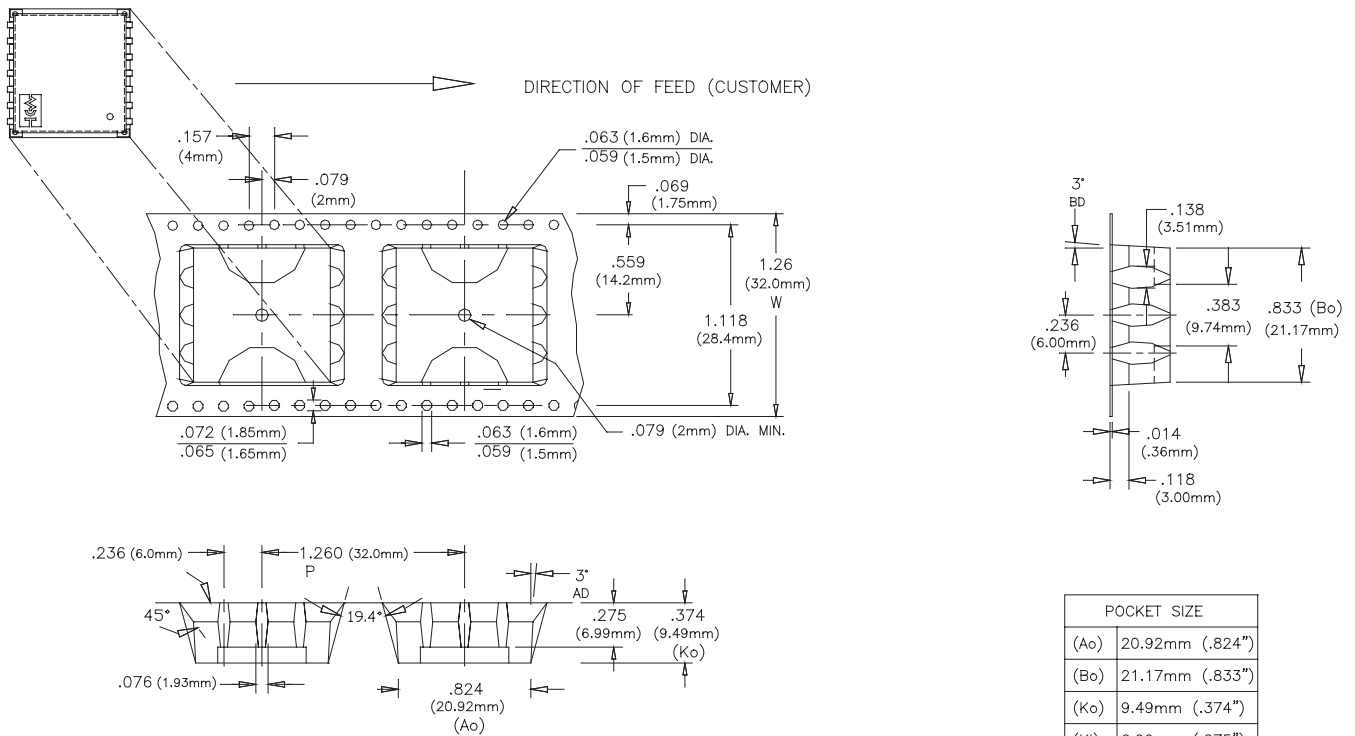


Tape and Reel Dimensions

Figure 5



250 PCS/REEL MAXIMUM

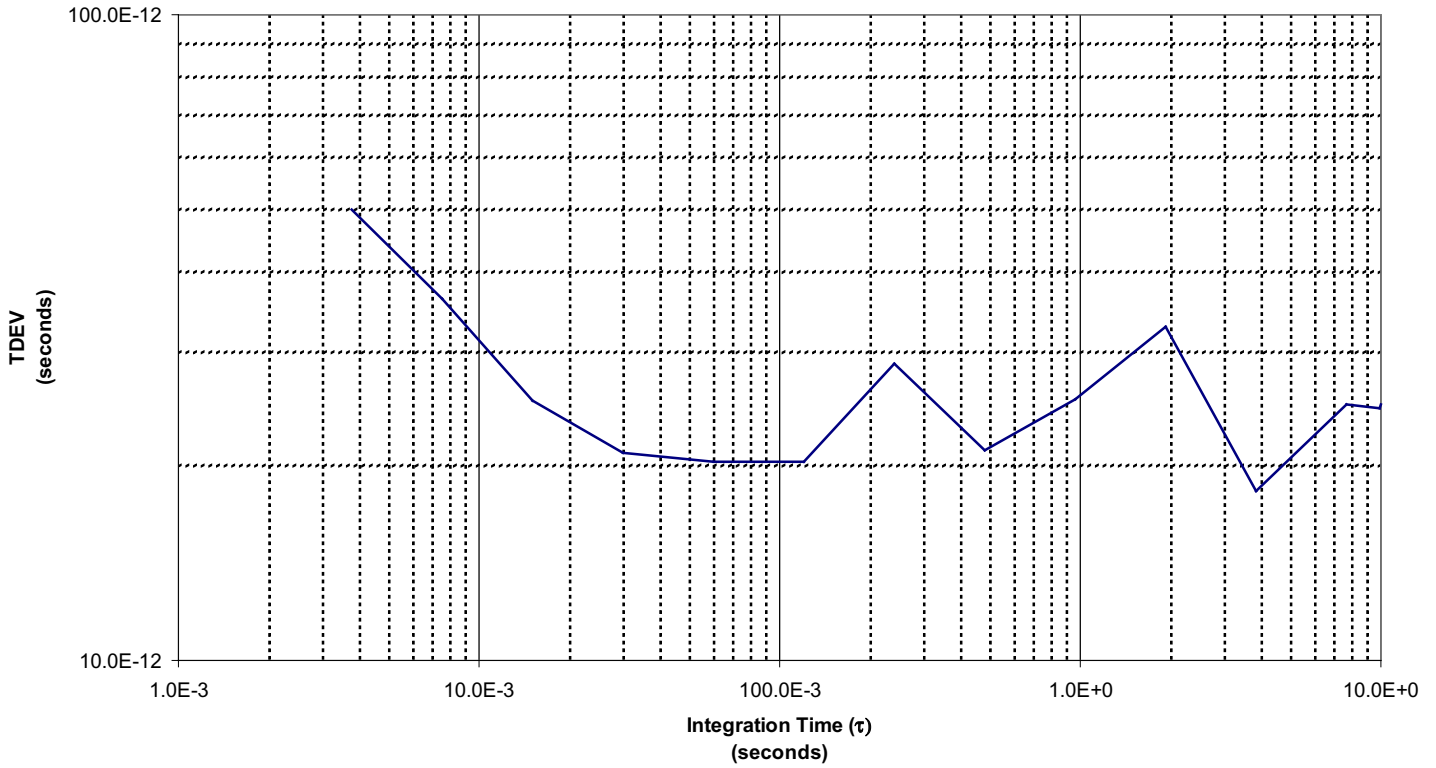


POCKET SIZE	
(Ao)	20.92mm (.824")
(Bo)	21.17mm (.833")
(Ko)	9.49mm (.374")
(Kl)	6.99mm (.275")

32mm (1.26") WIDTH
32mm (1.26") PITCH

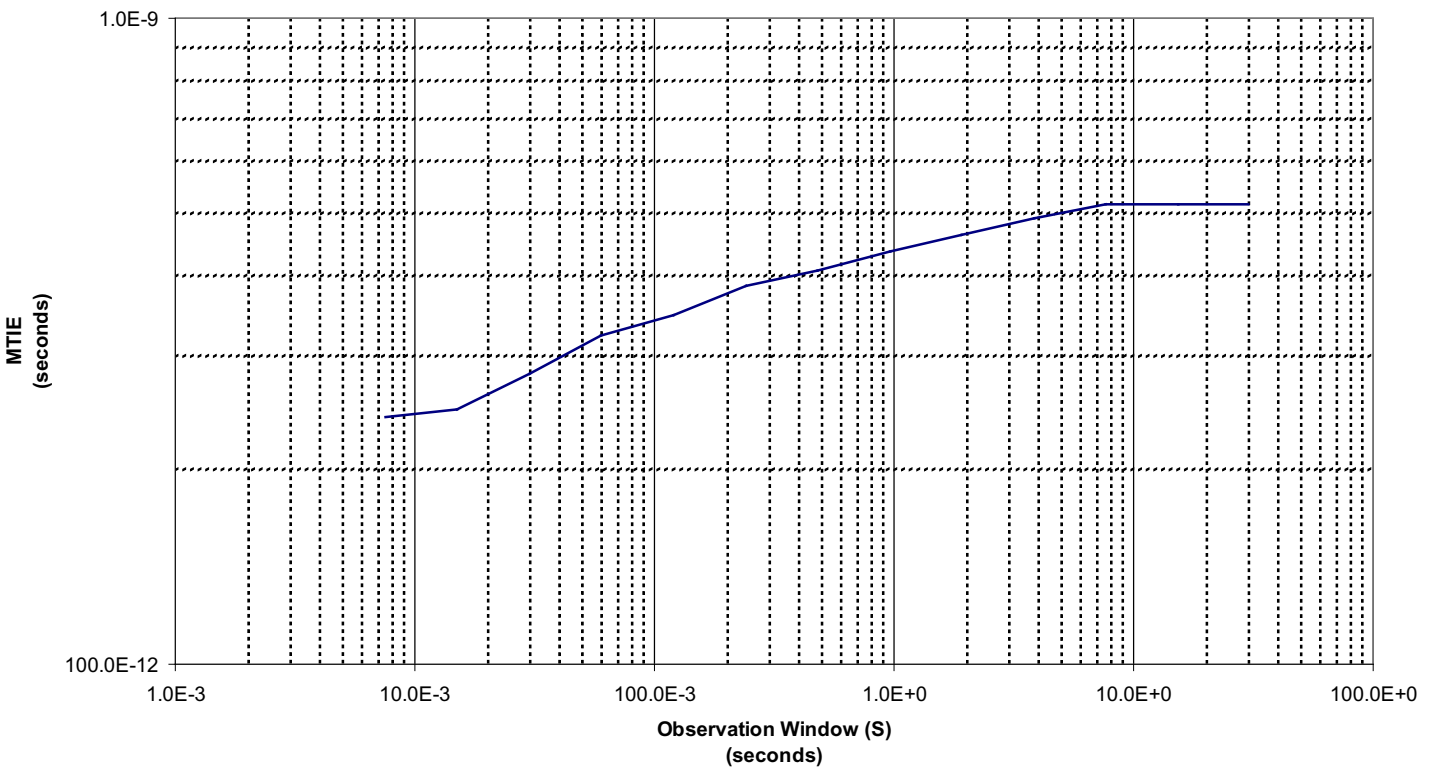
SCG2000 Typical TDEV

Figure 6



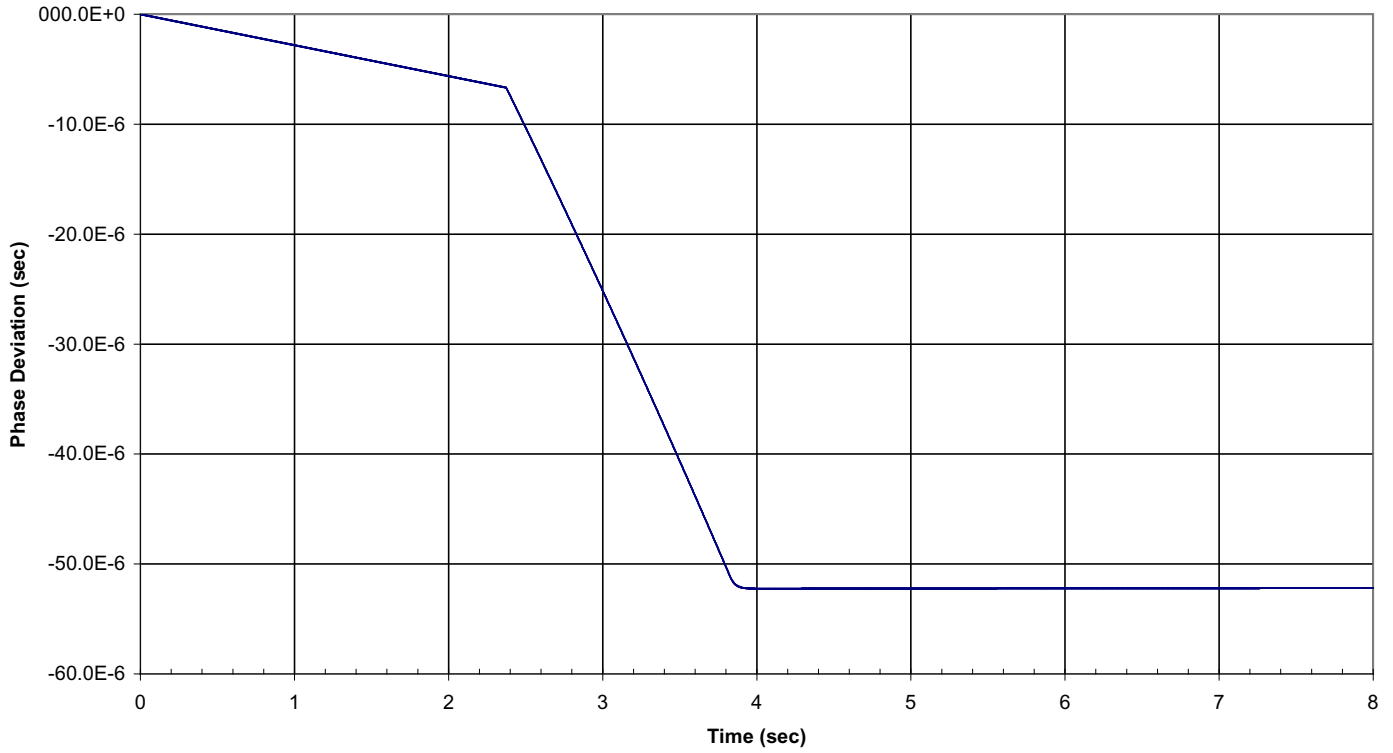
SCG2000 Typical MTIE

Figure 7



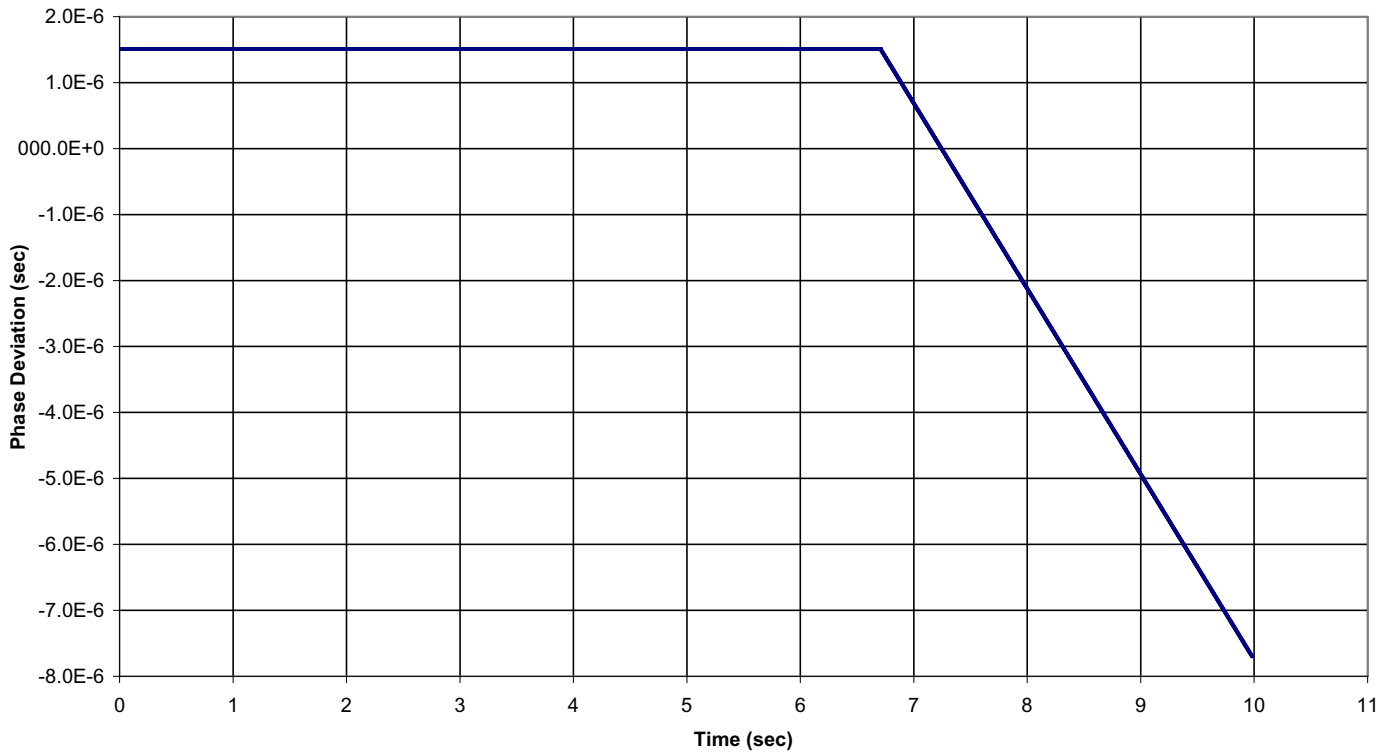
SCG2000 Switch from Free Run to a new Reference

Figure 8



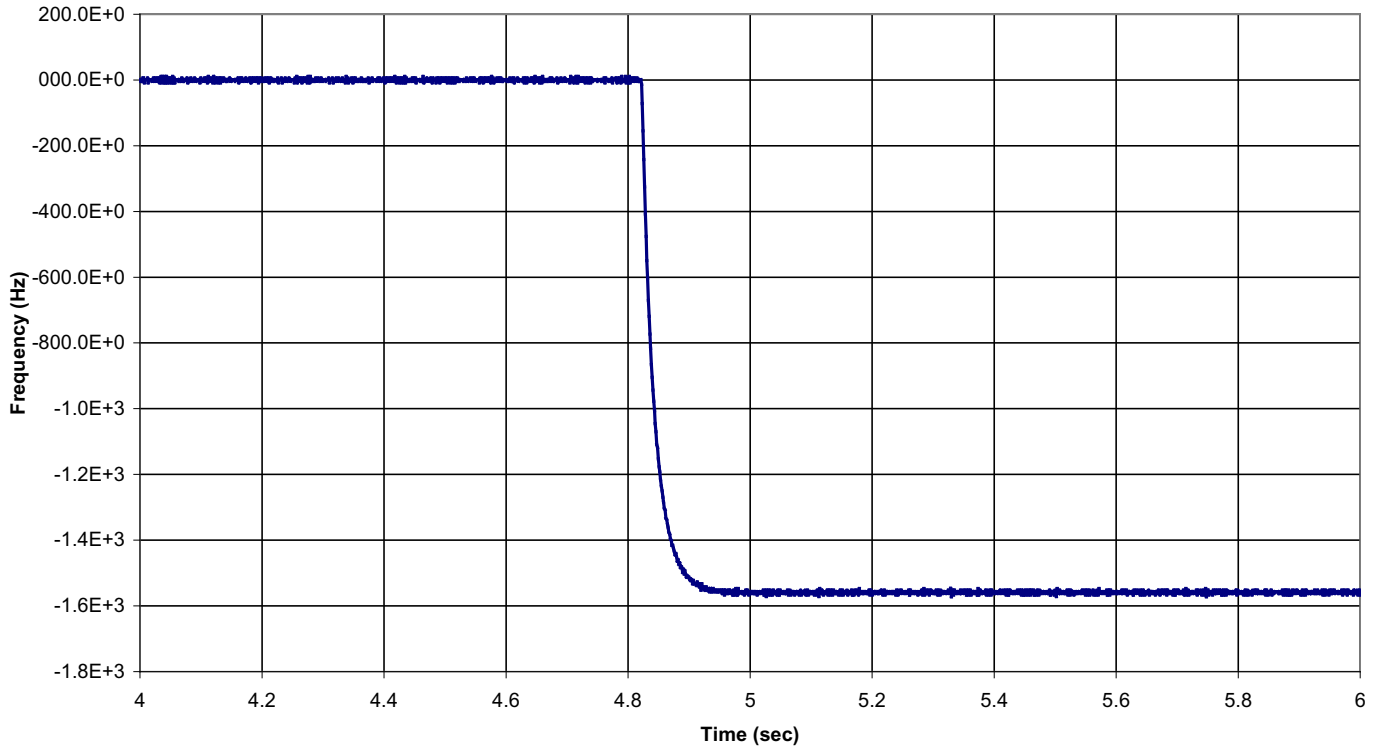
SCG2000 Switch from a Reference to Free Run

Figure 9



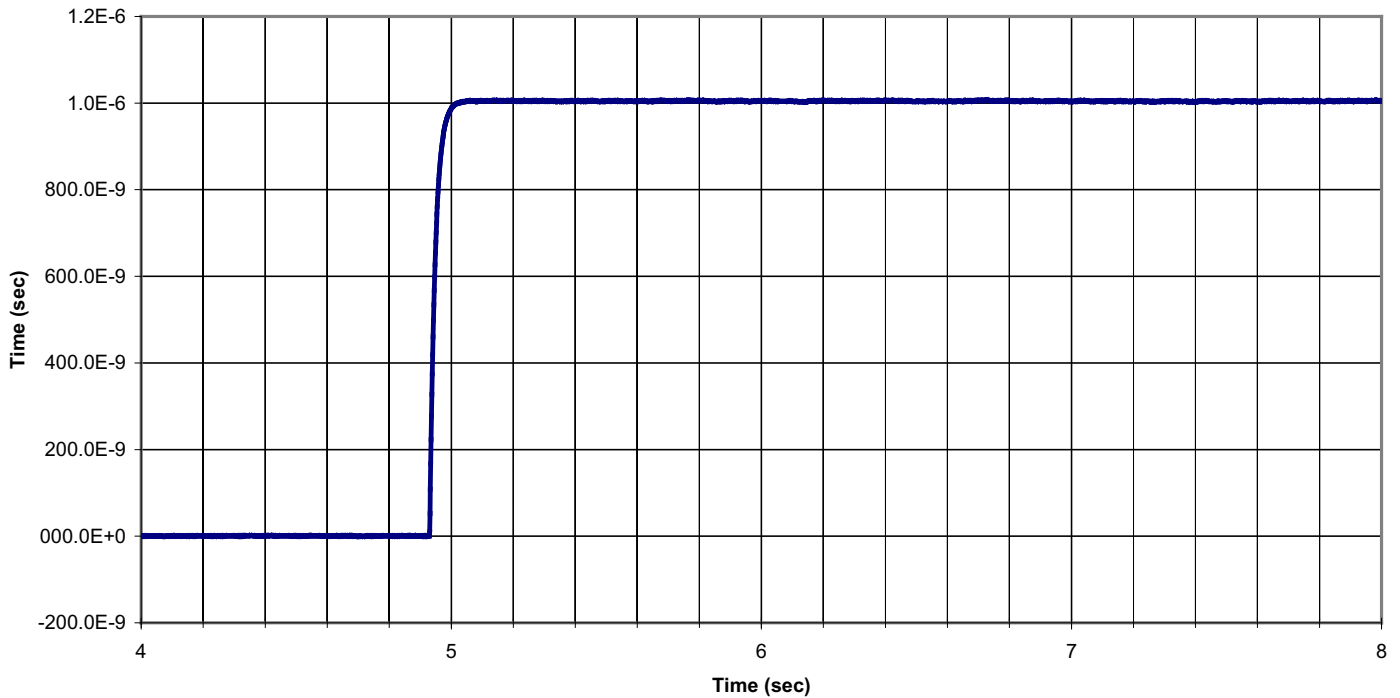
SCG2000 Step Response due to a -20ppm Freq. Step

Figure 10



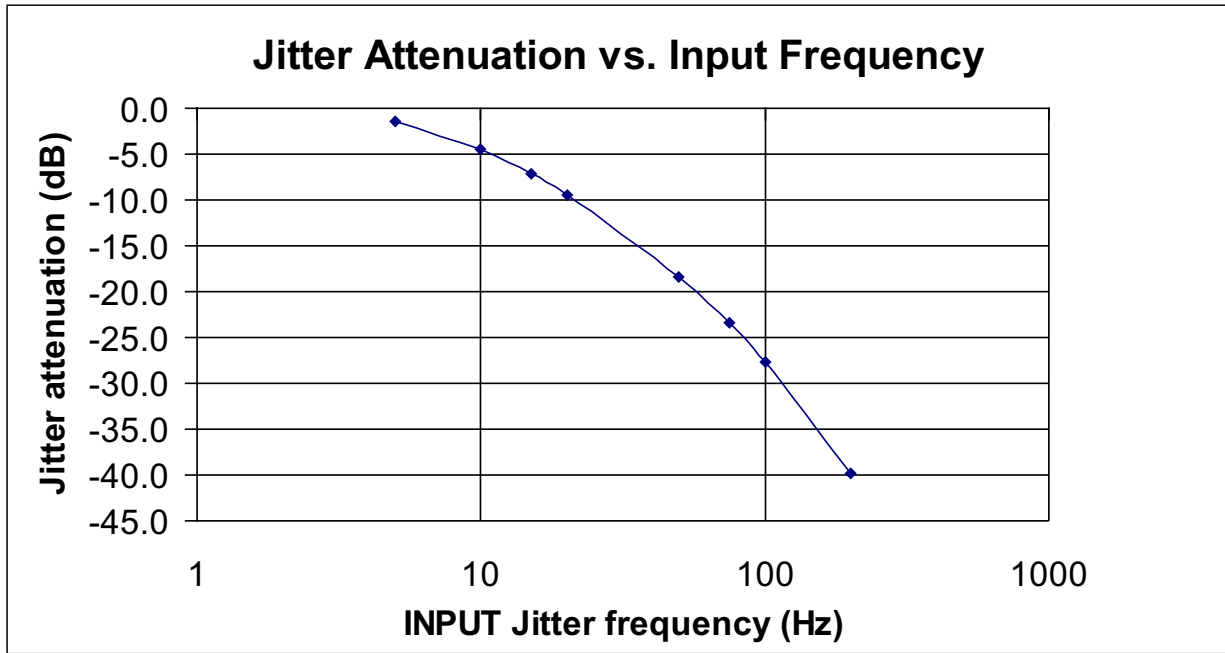
SCG2000 1µs Phase Transient Response

Figure 11



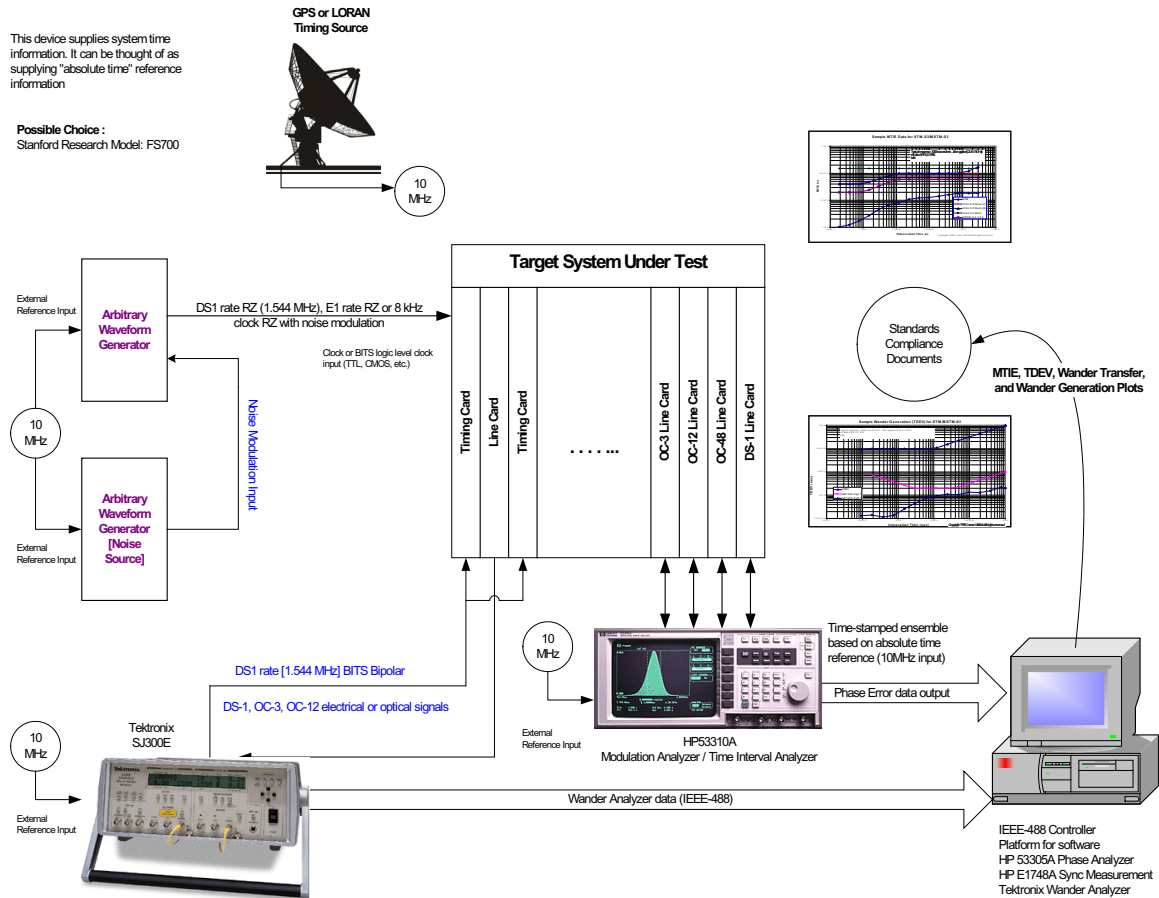
SCG2000 Jitter Attenuation

Figure 12



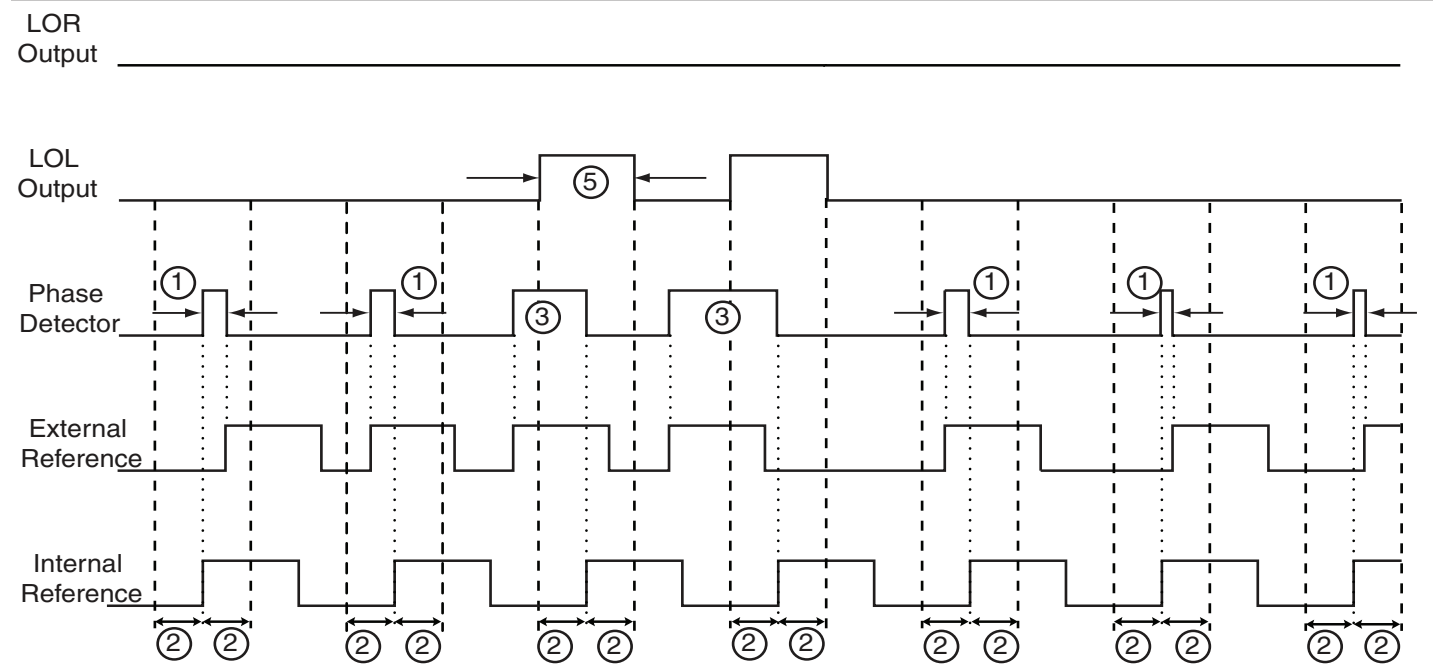
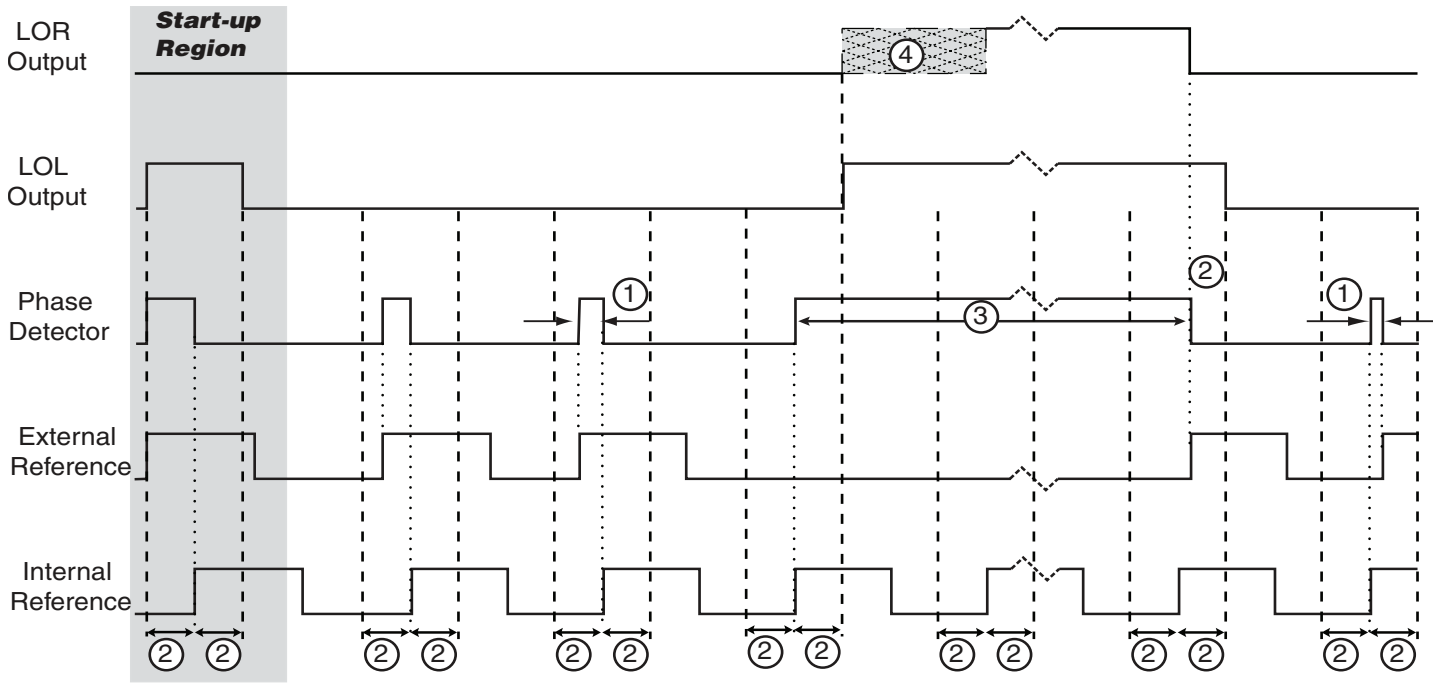
Typical System Test Setup

Figure 13



Alarm Timing Diagram

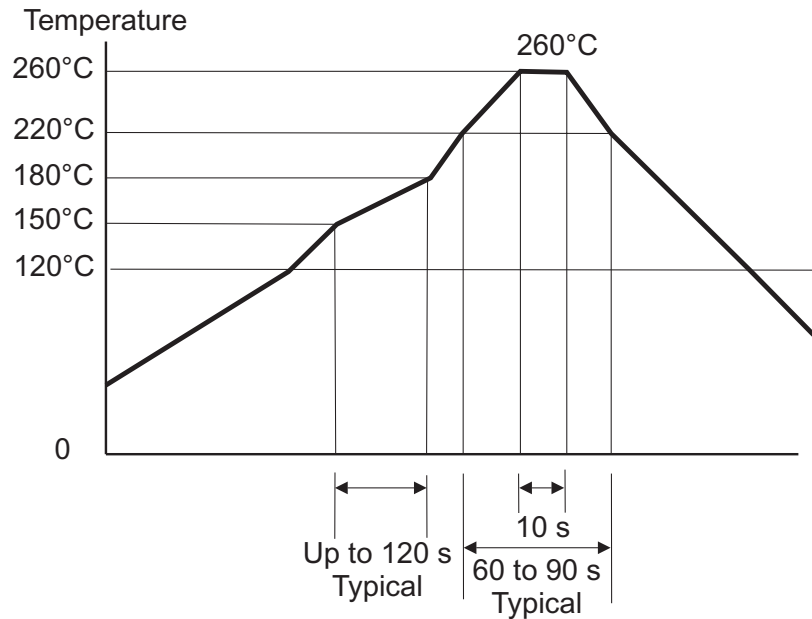
Figure 14



	19.44 MHz & 77.76 MHz Reference Input Units	8 kHz Reference Input Units
①	< 1 μsec	< 31.25 μsec
②	1 μsec	31.25 μsec
③	> 1 μsec	> 31.25 μsec
④	LOR is active when LOL is active	125 μsec wide range
⑤	Minimum pulse width = 2 μsec	Minimum pulse width = 62.5 μsec
Start-up Region	During Start-up, The LOL Alarm will pulse during the first second of operation	

Solder Profile

Figure 15



Meets IPC/JEDEC J-STD-020C

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 Description:

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)

Notes:

Note 4: Not available with 19.44 MHz output.

SCG2000 Individual Features:

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

Reference and Output Availability

Table 10 SCG2000

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

SCG2010

SCG2010 Description:

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

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.

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 Description:

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.

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.

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 Description:

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

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

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)

Notes:

Note 4: Not available with 19.44 MHz output.

Reference and Output Availability

Table 18

SCG2030

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

SCG2050

SCG2050 Description:

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

SCG2050 Individual Features:

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

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 Description:

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.

SCG2070 Individual Features:

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

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

SCG2000 Synchronous Clock Generator



2111 Comprehensive Drive
Aurora, Illinois 60505
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Fax: 630-851-5040
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Revision History

Revision	Date	Note
00	08/23/04	Final Release
01	11/18/25	Update package drawing, RoHS status and solder profile.