

**4 Watt Sine Wave
Telephone Ring Generator**
4REN@86Vrms to 12REN@45Vrms



PCR-SIN06 Series

- ◇ PCR-SIN06V12F00
- ◇ PCR-SIN06V24F00
- ◇ PCR-SIN06V48F00
- ◇ PCR-SIN06V12F00-L



FEATURES

- ◆ Support 4-12 standard North American REN
- ◆ Adjustable Output Voltage between 45-86Vrms
- ◆ Wide DC Voltage Input range
- ◆ Overload Control with Constant Output Power
- ◆ Output Short Circuit Protection
- ◆ Digital Frequency Selection (16.7, 20, 25, 50Hz)
- ◆ Zero Crossing Synchronization Output Signal
- ◆ High Output Load Indication Signal
- ◆ Low THD Sine Wave Output
- ◆ Fully Floating Output
- ◆ UL1950, CSA C22.2 No. 950 & EN60950 Approved
- ◆ Five Year Warranty
- ◆ Open Frame Package

APPLICATIONS

- ◆ PBX, PABX, DLC and Key Systems
- ◆ Rural Telephony Systems
- ◆ Wireless Local Loop Systems
- ◆ Satellite Telephone and VSAT Terminal
- ◆ Integrated Access Devices
- ◆ VoIP Gateways
- ◆ Test Equipment
- ◆ Short/Long Loop Applications

DESCRIPTION

The PCR-SIN06 Ring Generator Series offers a line of high performance, low cost ring generators with an advanced constant output power driving stage. The series consists of ring generators for input voltages of 12, 24 and 48Vdc, and each unit supports all popular ringing frequencies: 16.7, 20, 25 and 50Hz. The PCR-SIN06 Ring Generator can continuously support up to 12 standard North American REN loads, providing a low THD sine wave ringing signal.

Overload Protection

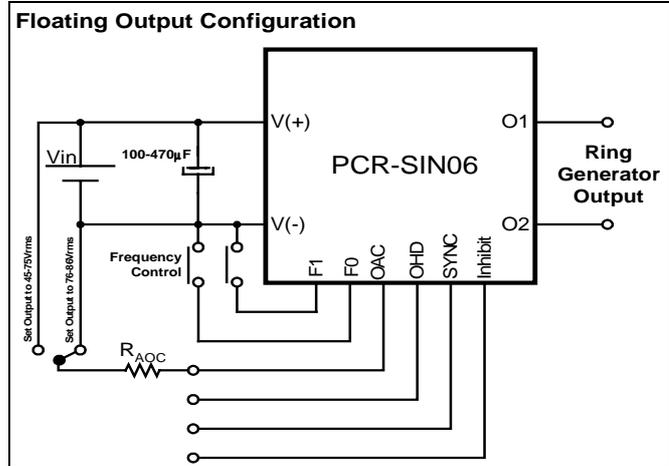
Loads that exceed the number of REN that the unit is set to support, according to the preset output voltage, will momentarily clamp the output sine wave, and trigger the ring generator's overload protection. The overload protection constantly monitors the output distortion level, and automatically reduces the output amplitude in order to maintain a low distortion level. This function allows the Ring Generator to provide continuous service to up to 12 North American REN loads. The new output amplitude will match the load, according to the following table:

Output Ringing Amplitude	Load [1REN = 6930Ω+8μF]
86 Vrms	4REN
75 Vrms	5REN
70 Vrms	6REN
60 Vrms	8REN
50 Vrms	10REN
45 Vrms	12REN
Short Circuit Protection Active	>>12REN

Output Short Circuit Protection

Loads that excessively exceed 12REN trigger an internal protection that monitors the ring generator input current. When the input current threshold is exceeded for approximately 600mSec, the protection automatically shuts off the ring generator's output. After the output has been off for 5 seconds, normal operation will automatically resume, depending on the existing load condition.

TYPICAL APPLICATION 1



Output Amplitude Control

The output ringing signal amplitude nominal value can be adjusted in the range of 45-86Vrms and defaults to 75Vrms @ 5 North American REN load, when the OAC terminal is left unconnected. Each nominal output amplitude is designed to support a certain nominal REN load according to the above table. Output amplitudes in the range of 75-86Vrms can be set by connecting an external resistor, R_{OAC} , between the OAC terminal and V(-). Output amplitudes in the range of 45-75Vrms can be set by connecting an external resistor, R_{OAC} , between the OAC terminal and V(+). For the R_{OAC} value, refer to the OUTPUT AMPLITUDE ADJUSTMENT graphs on page 16.

Inhibit Control

The Inhibit terminal functions to shut down the output and reduces the ring generator's current consumption to an idling level. The Inhibit terminal is operated by 5V TTL logic levels referenced to the V(-) terminal. When this input is disconnected or tied to a TTL low level, the output is enabled. An internal synchronization circuitry delays the Inhibit action until the sine wave output signal crosses the zero level. Note that the Inhibit control can be used to generate the ringing signal's on/off intervals. In negatively fed applications, where the ring generator's V(+) input is attached to the system's ground, and the V(-) input is attached to a negative 12V, 24V or 48V, the inhibit terminal should need a negative 7V, 19V or 43V (5V in reference to V(-)) to operate. Please refer to Typical Application 3, which illustrates a suggested circuit for converting the system digital 5V level to the appropriate negative voltages. In cases where the Inhibit is operated via a long conductor, which may pickup radiated noise, a 0.1μF filtering capacitor should be connected between the Inhibit and the V(-) terminals. The filtering capacitor should be physically placed as close as possible to the ring generator module. Inhibit control eliminates the need for additional external components in cadence implementation.



4REN@86Vrms to 12REN@45Vrms SINE WAVE TELEPHONE RING GENERATOR

Zero Crossing Synchronization Output

The SYNC output provides a high TTL level pulse to indicate the AC output voltage zero crossing, relative to the output sine wave. This is useful for prolonging relay life by timing switching with the ringing signal zero crossing. The SYNC signal rises to a high TTL level, referenced to V(-), 2.5mSec prior to the zero crossing and remains at high level for about 5mSec. When the unit is set at a ringing frequency of 50Hz, the SYNC signal rises to a high TTL level 2.0mSec prior to the zero crossing and remains at high level for 4mSec.

Output DC Biasing

The ring generator's output is isolated and floating and may be superimposed on negative or positive DC voltage. When this DC bias option is utilized (see Typical Application 2), a series protection resistor should be added in series to each port (i.e. telephone extension). This assures that the DC current through the ring generator output stage is limited to 160mA maximum should the output be shorted. The recommended minimum value for these series resistors is proportionate to the DC bias.

Output DC Bias	Protection Series Resistor
± 12Vdc	82Ω
± 24Vdc	150Ω
± 48Vdc	300Ω
± 75Vdc	470Ω

When using the same power supply output for powering the Ring Generator and for biasing the output ringing signal, high frequency switching noise from the ring generator input may be conducted to the load via the Talk Battery line. In this event, an optional filter consisting of a 22-100μF capacitor and a 10-20Ω resistor should be added.

Input Voltage Supply

The PCR-SIN06 Series Ring Generator has a wide range of input voltage capabilities. These capabilities are achieved by utilizing a sophisticated fit forward topology, which continuously samples the ring generator input voltage. The internal switching power supply is regulated, based on the input voltage samples, in order to produce accurate and stable output amplitude. In order to prevent input voltage ripple from contaminating the ring generator's output, it is essential that the input's low frequency ripple be restrained. Acceptable ripple levels for each input voltage are indicated in the Electrical Specifications table.

High frequency input ripple, originated by the 100kHz internal switching power supply, can be reduced by connecting an input capacitor, as illustrated in the typical applications.

High Load Indication

The OHD output terminal provides indication of output overload. This feature is useful for implementation of low cost Off-Hook detection in a single port per ring generator application. When the output signal is activated and the output is loaded by more than 3Watt, the OHD terminal will provide a high TTL logic level, referenced to V(-). This signal will remain as high level until the overload condition is removed. This indication can be useful in order to keep the ring generator within certain output voltage specifications by managing the output load.

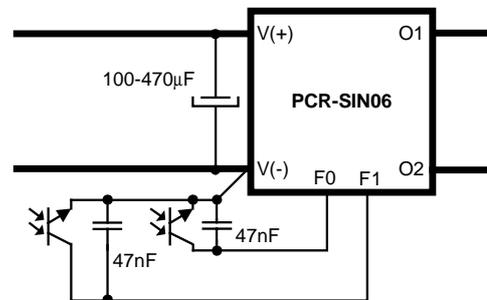
Output Frequency Control

Each PCR-SIN06 ring generator supports four popular output frequencies: 16.7, 20, 25 and 50Hz. The frequency selection is controlled by jumpering the F0 and F1 control pins to V(-), according to the following table:

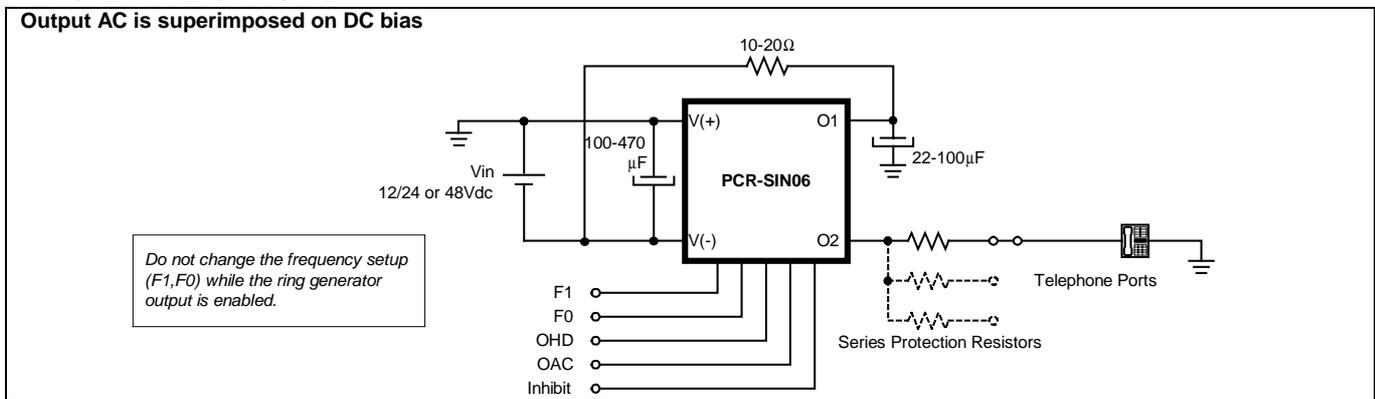
Frequency	F1	F0
16.7Hz	"0" or tied to V(-)	"1" or not connected
20Hz	"1" or not connected	"1" or not connected
25Hz	"1" or not connected	"0" or tied to V(-)
50Hz	"0" or tied to V(-)	"0" or tied to V(-)

The F0 and F1 terminals are pulled up to an internal 5V source in reference to the V(-) terminal. For digital frequency control, use either an open collector or an opto-coupler driver. When utilizing digital frequency control or frequency setup jumpers that are connected via long conductors to the ring generator, the addition of two 47nF noise filtering capacitors between F0 and the V(-) and between the F1 and the V(-) terminals is advised. The 47nF capacitors should be placed as close as possible to the terminals. Without the capacitors, the module may be subject to interference.

Frequency changes take effect at start-up by power connection or by the Inhibit control. Frequency setup changes while the output is on may disturb normal operation.

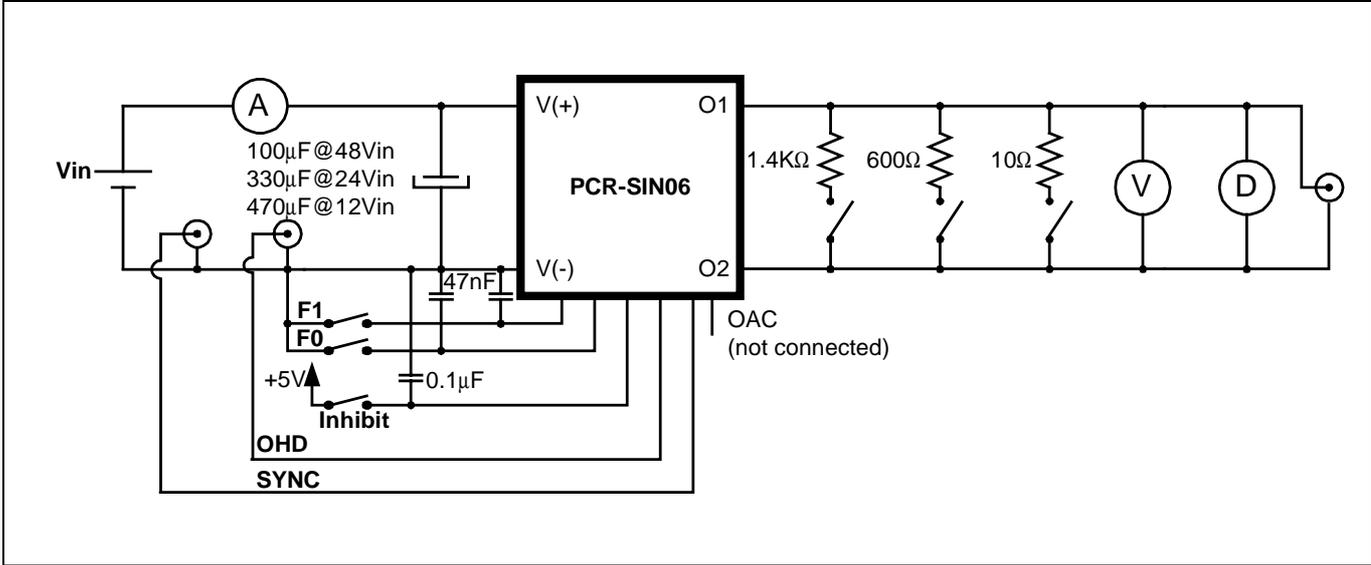


TYPICAL APPLICATION 2

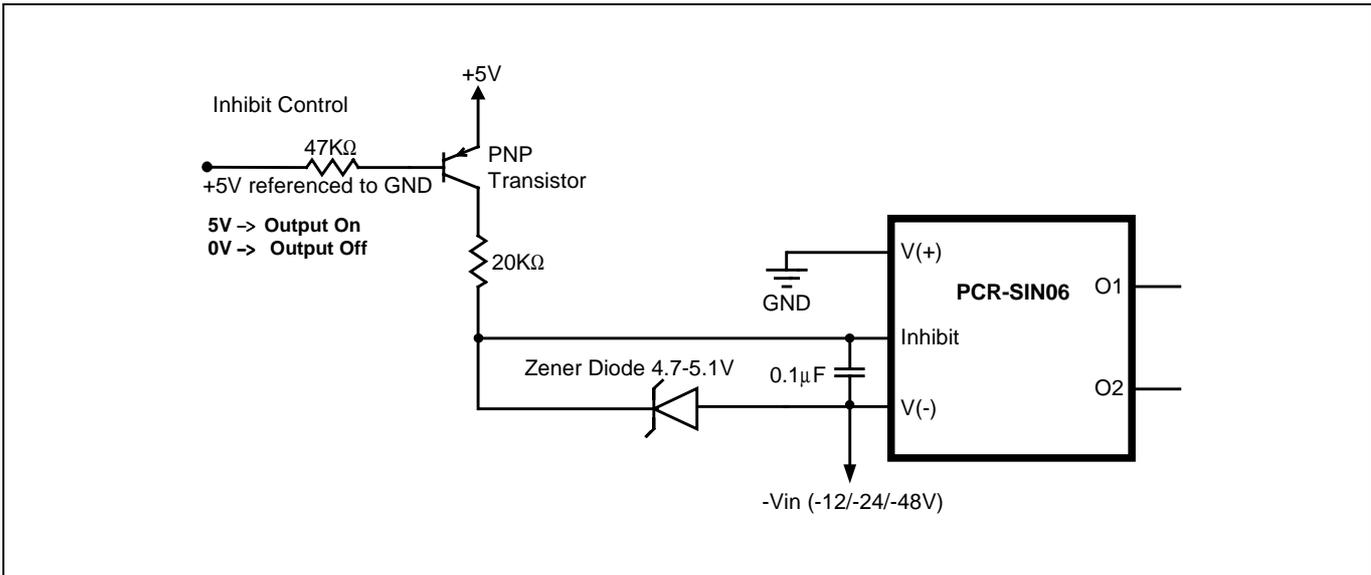




TEST SETUP



TYPICAL APPLICATION 3 - INHIBIT CONTROL FOR NEGATIVE FED CONFIGURATION



SAFETY INSTRUCTIONS

1. When applicable, protection from excessive voltage on the output should be tested in end-use equipment.
2. For output voltage exceeding 80Vrms, compliance with the ringing signal requirements should be tested in end-use equipment. When output voltage is set to less than 80Vrms, ringing signal complies with M.2 requirements of IEC950.
3. For PCR-SIN06V48F00 only: For EN60950 compliance in countries outside North America, input voltage (nominal 48Vdc, tolerance 36-72Vdc) must be supplied by an isolated DC source complying with the earthed SELV or TNV requirements of the latest version of EN60950.



**PCR-SIN06V12F00 & PCR-SIN06V12F00-L
4REN@86Vrms to 12REN@45Vrms SINE WAVE TELEPHONE RING GENERATOR**

ABSOLUTE MAXIMUM RATINGS*

Supply Voltage	.....	+18V
Inhibit, F1 and F0 Input Voltage	.....	-0.5V to +5.2V
Operating Ambient Temperature (T _A)	.....	-40°C to +85°C
Storage Temperature	.....	-40°C to +90°C
Lead Temperature (Soldering, 10 sec max.)	.....	+300°C

*These are stress ratings. Exposure of the device to any of these conditions may adversely effect long-term reliability. Proper operation other than as specified in the PERFORMANCE/FUNCTIONAL SPECIFICATIONS is not implied.

PERFORMANCE / FUNCTIONAL SPECIFICATIONS

Typical at: T_A = +25°C, Vin = 12.0Vdc, Load=1400Ω resistive, Cin = 470μF, OAC not connected, according to the Test Setup schematics.

Parameters	Conditions	Min	Typ	Max	Units
Supply					
Supply Voltage (Vin)		7.2	12.0	15.0	Vdc
Input Reflected Ripple	100-120Hz, 9.6≤Vin≤15.0Vdc			1.0	Vp-p
Current Consumption					
Average Current	Device Inhibited			25	mA
Average Current	No Load		120	160	mA
Average Current	Load=1400Ω, @ Vin=9.6Vdc			650	mA
Peak Current	Load≤1400Ω, @ Vin=9.6Vdc			1.2	A
Efficiency	Load=1400Ω	63	70		%
Output					
Power	Continuous Loading	0		4	VA
Power Factor		0.7			|cos ρ|
Output Voltage	Pout=3VA, 9.6≤Vin≤15.0Vdc				
OAC not connected		70	75	82	Vrms
R _{OAC} between OAC & V(-)	See graph on page 16		75-86		Vrms
R _{OAC} between OAC & V(+)	See graph on page 16		45-75		Vrms
Output Frequency	According to F0, F1 setting		16.7, 20, 25, 50		Hz
Frequency Accuracy	9.6≤Vin≤15.0Vdc, 0≤Pout≤4VA, -40°C ≤T _A ≤+85°C			±3	%
THD	9.6≤Vin≤15.0Vdc, 0≤Pout≤4VA, -40°C ≤T _A ≤+85°C			5	%
Inhibit Control Input					
Disable Voltage V _{IH}		3.5	5	5.2	Vdc
Enable Voltage V _{IL}		-0.5	0	1.0	Vdc
Iin Source	V _{IL} = 0V			50	μA
Iin Sink	V _{IH} = 5V			700	μA
F0, F1 Control Input	According to F0, F1 setting				
V _{IH}		3.5		5.2	Vdc
V _{IL}		-0.5		1.0	Vdc
Iin Source	V _{IL} = 0V			700	μA
Timing					
Inhibit Response					
Time to Turn-On		30		50	ms
Time to Turn-Off				35	ms
Overload Protection Response					
Time to Turn-Off	Output Overloaded	200	600	800	ms
Time to Turn-On	Load reverts to Normal, 0≤Pout≤4VA		5		s
General					
Insulation	500 Vdc Input to Output	40			MΩ
Switching Frequency			96		kHz
Environment					
Relative Humidity	Non-Condensing, Per IEC 68-2-56			93	%
Ambient Temperature (T _A)	Without Derating	-40		+50	°C
	Derated from +50°C by 0.1W/°C	-40		+85	°C
Reliability					
Calculated MTBF	Continuous Operation@40°C Ambient Temperature Calculation method: Relex Bellcore Software Ver5.30	2,039,305			Hours
Sync Output Timing					
SYNC Pulse Width	Output Frequency=16.7,20, 25 Hz	4.5		5.5	ms
	Output Frequency=50 Hz	3.6		4.4	ms
OHD Output Timing					
Off-Hook Response Time	Output Overloaded			40	ms
OHD, Sync Output					
V _{OH}	Referenced to V(-) Terminal Output Source Current 2mA	4.2		5.3	Vdc
V _{OL}	Output Sink Current 2mA	0		0.8	Vdc
V _{OL}	Output Sink Current 5mA	0		1.2	Vdc



4REN@86Vrms to 12REN@45Vrms SINE WAVE TELEPHONE RING GENERATOR

ABSOLUTE MAXIMUM RATINGS*

Supply Voltage	.....	+35V
Inhibit, F1 and F0 Input Voltage	.....	-0.5V to +5.2V
Operating Ambient Temperature (T _A)	.....	-40°C to +85°C
Storage Temperature	.....	-40°C to +90°C
Lead Temperature (Soldering, 10 sec max.)	.....	+300°C

*These are stress ratings. Exposure of the device to any of these conditions may adversely effect long-term reliability. Proper operation other than as specified in the PERFORMANCE/FUNCTIONAL SPECIFICATIONS is not implied.

PERFORMANCE / FUNCTIONAL SPECIFICATIONS

Typical at: T_A = +25°C, V_{in} = 24.0Vdc, Load=1400Ω resistive, C_{in} = 330μF, OAC not connected, according to the Test Setup schematics.

Parameters	Conditions	Min	Typ	Max	Units
Supply					
Supply Voltage (V _{in})		19.2	24.0	30.0	Vdc
Input Reflected Ripple	100-120Hz, 19.2≤V _{in} ≤30.0Vdc			1.5	Vp-p
Current Consumption					
Average Current	Device Inhibited			24	mA
Average Current	No Load		80	100	mA
Average Current	Load=1400Ω, @ V _{in} =19.2Vdc			370	mA
Peak Current	Load≤1400Ω, @ V _{in} =19.2Vdc			800	mA
Efficiency		64	72		%
Output					
Power	Continuous Loading	0		5	VA
Power Factor		0.7			[cos ρ]
Output Voltage	P _{out} =3VA, 19.2≤V _{in} ≤30.0Vdc				
OAC not connected		70	75	82	Vrms
R _{OAC} between OAC & V(-)	See graph on page 16		75-86		Vrms
R _{OAC} between OAC & V(+)	See graph on page 16		45-75		Vrms
Output Frequency	According to F0, F1 setting		16.7, 20, 25, 50		Hz
Frequency Accuracy	19.2≤V _{in} ≤30.0Vdc, 0≤P _{out} ≤5VA, -40°C ≤T _A ≤+85°C			±3	%
THD	19.2≤V _{in} ≤30.0Vdc, 0≤P _{out} ≤5VA, -40°C ≤T _A ≤+85°C			5	%
Inhibit Control Input					
Disable Voltage V _{IH}		3.5	5	5.2	Vdc
Enable Voltage V _{IL}		-0.5	0	1.0	Vdc
I _{in} Source	V _{IL} = 0V			50	μA
I _{in} Sink	V _{IH} = 5V			700	μA
F0, F1 Control Input	According to F0, F1 setting				
V _{IH}		3.5		5.2	Vdc
V _{IL}		-0.5		1.0	Vdc
I _{in} Source	V _{IL} = 0V			700	μA
Timing					
Inhibit Response					
Time to Turn-On		30		50	ms
Time to Turn-Off				35	ms
Overload Protection Response					
Time to Turn-Off	Output Overloaded	200	600	800	ms
Time to Turn-On	Load reverts to Normal; 0≤P _{out} ≤5VA		5		s
General					
Insulation	500 Vdc Input to Output	40			MΩ
Switching Frequency			96		kHz
Environment					
Relative Humidity	Non-Condensing, Per IEC 68-2-56			93	%
Ambient Temperature (T _A)	Without Derating	-40		+50	°C
	Derated from +50°C by 0.1W/°C	-40		+85	°C
Reliability					
Calculated MTBF	Continuous Operation@30°C Ambient Temperature Calculation method: Relex Bellcore Software Ver5.30	2,039,305			Hours
Sync Output Timing					
SYNC Pulse Width	Output Frequency=16.7,20, 25 Hz	4.5		5.5	ms
	Output Frequency=50 Hz	3.6		4.4	ms
OHD Output Timing					
Off-Hook Response Time	Output Overloaded			40	ms
OHD, Sync Output					
V _{OH}	Referenced to V(-) Terminal	4.2		5.3	Vdc
V _{OL}	Output Source Current 2mA	0		0.8	Vdc
V _{OL}	Output Sink Current 2mA	0		1.2	Vdc
	Output Sink Current 5mA	0			Vdc

PowerD sine Ltd. Tel: +972-9-775-5100 • Fax: +972-9-775-5111 • Email: sales@powersd sine.com
 PowerD sine, Inc. Tel: +1-631-756-4680 • Fax: +1-631-756-4691 • Email: sales@powersd sineusa.com
 PowerD sine Europe Tel: +49-6187-900-849 • Fax: +49-6187-292848 • Email: europe@powersd sine.com



PCR-SIN06V48F00

4REN@86Vrms to 12REN@45Vrms SINE WAVE TELEPHONE RING GENERATOR

ABSOLUTE MAXIMUM RATINGS*

Supply Voltage	+75V
Inhibit, F1 and F0 Input Voltage	-0.5V to +5.2V
Operating Ambient Temperature (T _A)	-40°C to +85°C
Storage Temperature	-40°C to +90°C
Lead Temperature (Soldering, 10 sec max.)	+300°C

*These are stress ratings. Exposure of the device to any of these conditions may adversely effect long-term reliability. Proper operation other than as specified in the PERFORMANCE/FUNCTIONAL SPECIFICATIONS is not implied.

PERFORMANCE / FUNCTIONAL SPECIFICATIONS

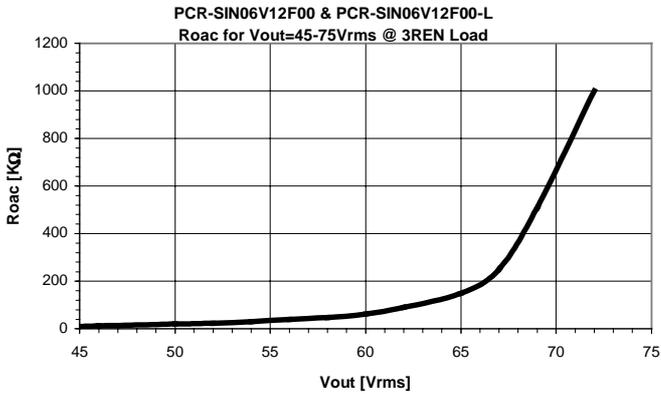
Typical at: T_A = +25°C, Vin = 48.0Vdc, Load=1400Ω resistive, Cin = 100μF, OAC not connected, according to the Test Setup schematics.

Parameters	Conditions	Min	Typ	Max	Units
Supply					
Supply Voltage (Vin)	For Vin higher than 60Vdc refer to Safety Instruction 3 on page 12.	36.0	48.0	72.0	Vdc
Input Reflected Ripple	100-120Hz, 36≤Vin≤72.0Vdc			2.0	Vp-p
Current Consumption					
Average Current	Device Inhibited			4	mA
Average Current	No Load		45	60	mA
Average Current	Load=1400Ω, @ Vin=36Vdc			180	mA
Peak Current	Load≤1400Ω, @ Vin=36Vdc			350	mA
Efficiency	Load=1400Ω	60	70		%
Output					
Power	Continuous Loading	0		4	VA
Power Factor		0.7			[cos ρ]
Output Voltage					
OAC not connected	Pout=3VA, 36.0≤Vin≤72.0Vdc	70	75	82	Vrms
R _{OAC} between OAC & V(-)	See graph on page 16		75-86		Vrms
R _{OAC} between OAC & V(+)	See graph on page 16		45-75		Vrms
Output Frequency					
	According to F0, F1 setting		16.7, 20, 25, 50		Hz
Frequency Accuracy					
	36≤Vin≤72.0Vdc, 0≤Pout≤4VA, -40°C ≤T _A ≤+85°C			±3	%
THD					
	36≤Vin≤72.0Vdc, 0≤Pout≤4VA, -40°C ≤T _A ≤+85°C			5	%
Inhibit Control Input					
Disable Voltage V _{IH}		3.5	5	5.2	Vdc
Enable Voltage V _{IL}		-0.5	0	1.0	Vdc
Iin Source	V _{IL} = 0V			50	μA
Iin Sink	V _{IH} = 5V			700	μA
F0, F1 Control Input					
	According to F0, F1 setting				
V _{IH}		3.5		5.2	Vdc
V _{IL}		-0.5		1.0	Vdc
Iin Source	V _{IL} = 0V			700	μA
Timing					
Inhibit Response					
Time to Turn-On		30		50	ms
Time to Turn-Off				35	ms
Overload Protection Response					
Time to Turn-Off	Output Overloaded	200	600	800	ms
Time to Turn-On	Load reverts to Normal; 0≤Pout≤4VA		5		s
General					
Insulation	500 Vdc Input to Output	40			MΩ
Switching Frequency			96		kHz
Environment					
Relative Humidity	Non-Condensing, Per IEC 68-2-56			93	%
Ambient Temperature (T _A)	Without Derating	-40		+50	°C
	Derated from +50°C by 0.1W/°C	-40		+85	°C
Reliability					
Calculated MTBF	Continuous Operation@30°C Ambient Temperature Calculation method: Relex Bellcore Software Ver5.30	2,039,305			Hours
Sync Output Timing					
SYNC Pulse Width	Output Frequency=16.7,20, 25 Hz	4.5		5.5	ms
	Output Frequency=50 Hz	3.6		4.4	ms
OHD Output Timing					
Off-Hook Response Time	Output Overloaded			40	ms
OHD, Sync Output					
V _{OH}	Referenced to V(-) Terminal Output Source Current 2mA	4.2		5.3	Vdc
V _{OL}	Output Sink Current 2mA	0		0.8	Vdc
V _{OL}	Output Sink Current 5mA	0		1.2	Vdc

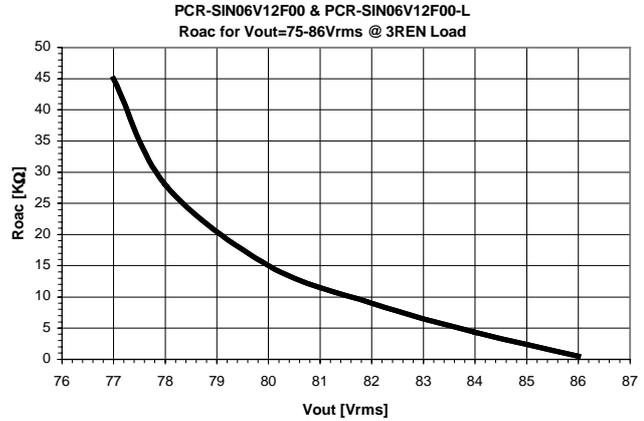


OUTPUT AMPLITUDE ADJUSTMENT

PCR-SIN06V12F00 & PCR-SIN06V12F00-L

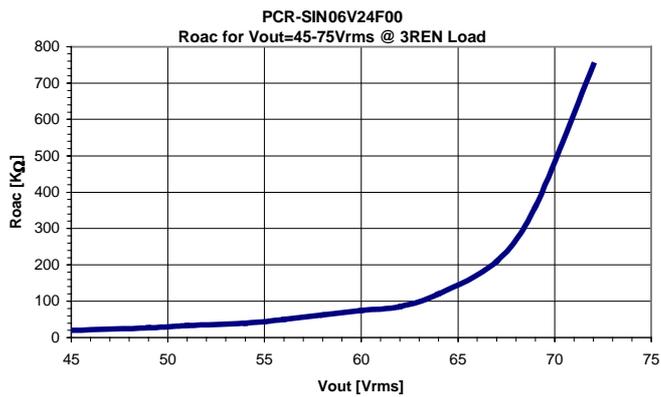


R_{AOC} connected between the OAC and the V(+) terminals

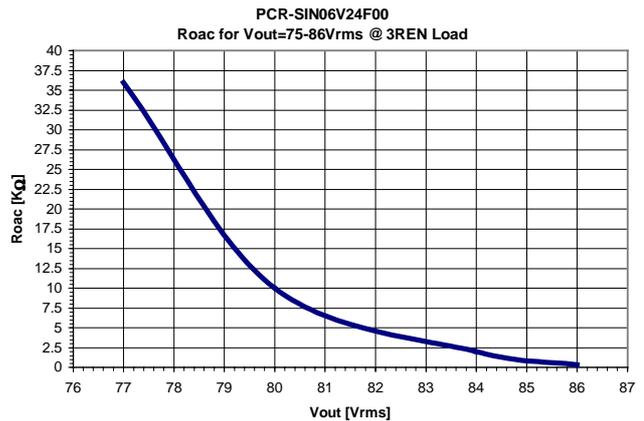


R_{AOC} connected between the OAC and the V(-) terminals

PCR-SIN06V24F00

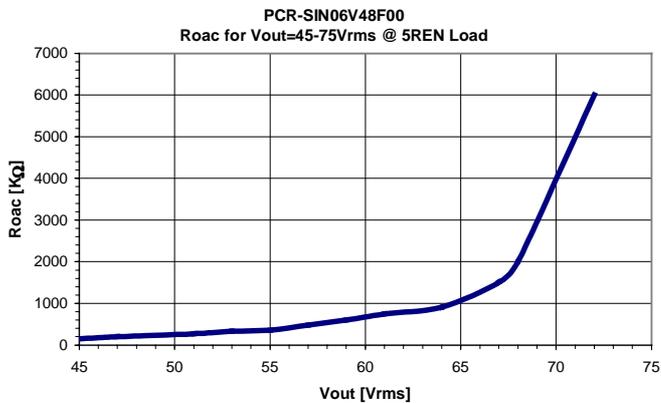


R_{AOC} connected between the OAC and the V(+) terminals

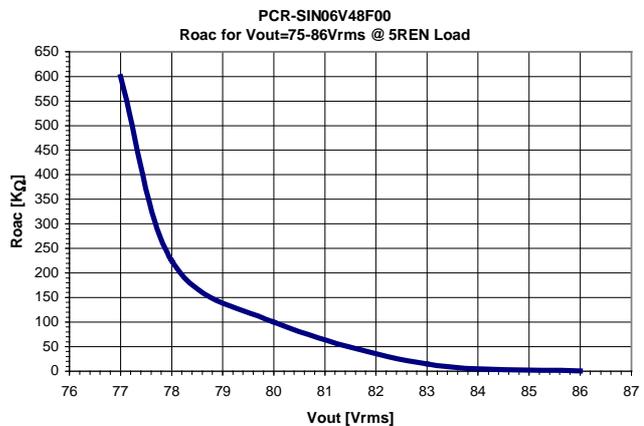


R_{AOC} connected between the OAC and the V(-) terminals

PCR-SIN06V48F00



R_{AOC} connected between the OAC and the V(+) terminals



R_{AOC} connected between the OAC and the V(-) terminals

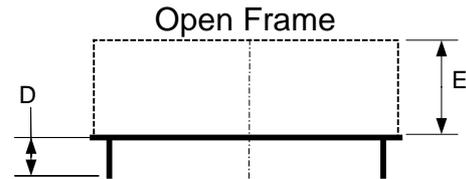


MECHANICAL DETAILS

PCR-SIN06V12F00/ PCR-SIN06V24F00/ PCR-SIN06V48F00

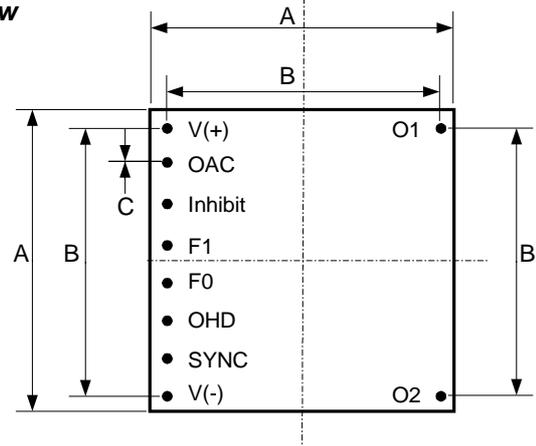
	mm	Inch
A	41.00 Max	1.61" Max
B	35.56±0.25	1.40"±0.01"
C	5.08±0.25	0.20"±0.01"
D	3.30±0.25	0.13"±0.01"
E	12.70±0.50	0.50"±0.02"

Side View



Terminals 0.035±0.0006" DIA (0.9 ±0.15mm)
Recommended PCB Drill DIA 0.05" (1.2mm)

Bottom View





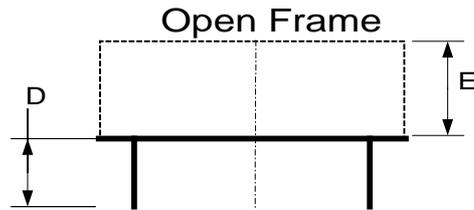
PCR-SIN06V12F00-L

4REN@86Vrms to 12REN@45Vrms SINE WAVE TELEPHONE RING GENERATOR

MECHANICAL DETAILS

PCR-SIN06V12F00-L

Side View



Terminals 0.035±0.0006" DIA (0.9 ±0.15mm)
Recommended PCB Drill DIA 0.05" (1.2mm)

	mm	Inch
A	41.00 Max	1.61" Max
B	35.56±0.25	1.40"±0.01"
C	5.08±0.25	0.20"±0.01"
D	6.76±0.1	0.27"±0.05"
E	12.70±0.50	0.50"±0.02"

Bottom View

