

# 15 Watt Sine Wave Telephone Ring Generator 15REN@86Vrms to 40REN@45Vrms





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## **FEATURES**

- ◆ Support 10-40 standard North American REN
- ◆ Adjustable Output Voltage between 45-100Vrms
- ♦ Overload Control with Constant Output Power
- Output Short Circuit Protection
- Digital Frequency Selection
- Zero Crossing Synchronization Output Signal
- Input Under/Over Voltage Protection
- ♦ High Output Load Indication Signal
- ◆ Low THD Sine Wave Output
- ◆ Fully Floating Output
- 90 Davs Warrantv
- UL1950, CSA C22.2 No. 950 and EN60950 Approved

## **APPLICATIONS**

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

## **DESCRIPTION**

The PCR-SIN15V48F00 Ring Generator offers high performance with an advanced overload protection mechanism. Each unit includes an internal crystal oscillator and supports all popular ringing frequencies of 16.7, 20, 25 and 50Hz. The PCR-SIN15V48F00 can continuously support up to 40 standard North American REN loads, providing a low THD sine wave ringing signal. The output ringing signal amplitude defaults to 86Vrms and can be externally adjusted to any value ranging between 45-100Vrms

## **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 overload protection. This function allows the Ring Generator to provide continuous service to up to 40 North American REN loads.

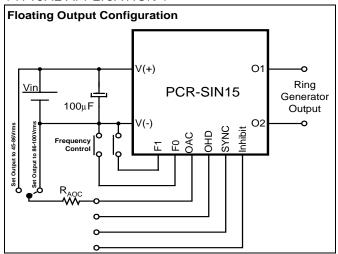
The overload protection constantly monitors the output distortion level, and will automatically reduce the output amplitude in order to maintain a low distortion level of THD≤5%. The new output amplitude will match the overload, according to the following table:

Output Ringing Amplitude	Load [1REN = 6930Ω+8μF]
100Vrms	10REN
90Vrms	13REN
86Vrms	15REN
75 Vrms	20REN
65 Vrms	25REN
55 Vrms	35REN
45 Vrms	40REN
Short Circuit Protection Active	>> 40REN

## **Output Short Circuit Protection**

Loads that excessively exceed 40REN trigger an internal protection that monitors the unit's input current. When the input current threshold is exceeded for approximately 600mSec, the protection automatically shuts off the output. After the output has been off for 5 seconds, normal operation will automatically resume, depending on the existing load conditions.

# **TYPICAL APPLICATION 1**



# High Load Indication

The OHD output terminal provides indication of output High Load when the output power exceeds approximately 11 Watt. At High Load, the OHD terminal will provide an High 5V TTL Logic Level signal referenced to the V(-) terminal. This signal will remain at a High Level until the High Load condition is removed. This indication can be useful in order to keep the ring generator within a certain output voltage specifications by managing the output load.

# Inhibit Control

The Inhibit terminal functions to shut down the output and reduce the unit's current consumption to an idling level. It 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.

Negatively fed devices, where V(+) connects to the system's GND, and V(-) to negative 48Vdc, may require a few more components to match voltage levels between the telecom system's logic and the Inhibit control. Recommended connection is illustrated on INHIBIT CONTROL FOR NEGATIVE FED CONFIGURATION.

An internal synchronization circuitry activates a delay between the inhibit command and shuts off the unit until the sine wave output signal reaches the zero crossing. This assures that the output will always turn on and shut off at zero voltage. Note that the Inhibit control can be used to generate the ringing signal's on/off intervals. Inhibit control eliminates the need for additional external components in cadence implementation.

# **Output Amplitude Control**

The output amplitude nominal value can be adjusted in the range of 45-100Vrms and defaults to 86Vrms @ 15 North American REN load, when the OAC terminal is left unconnected. Output amplitudes in the range of 86-100Vrms can be set by connecting an external resistor,  $R_{\rm OAC}$ , between the OAC terminal and V(-). Output amplitudes in the range of 45-86Vrms can be set by connecting an external resistor,  $R_{\rm OAC}$ , between the OAC terminal and V(+). For setting the  $R_{\rm OAC}$  value, refer to the OUTPUT AMPLITUDE ADJUSTMENT graphs on page 24. Each output amplitude value is designed to support a certain nominal REN load according to the above table.



# 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 to a 50Hz ringing frequency, 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 can be superimposed on negative or positive DC voltage. When the DC biasing option is utilized (see Typical Application 2), a series protection resistor should be added in to each port (i.e. telephone extension). This resistor should limit the potential DC current through the unit's output stage should the output be shorted. The recommended minimum values for these serial resistors are proportionate to the DC bias.

Output DC Bias	Series Protection Resistor
± 12Vdc	47Ω
± 24Vdc	100Ω
± 48Vdc	200Ω
± 75Vdc	350Ω

In the event that high frequency switching noise from the ring generator input reflects on the output via the Talk Battery line, a filter of a 22-100 $\mu$ F capacitor and a 10-20 $\Omega$  resistor should be added. When the Inhibit terminal is enabled, no AC/DC voltage exists on the Ring Generator's output.

# Input Voltage Supply

The PCR-SIN15V48F00 ring generator features a wide range of input voltage capabilities. These capabilities are achieved by utilizing a sophisticated feed forward topology, which continuously samples the input voltage. The units output amplitude is then regulated for line changes. Low frequency ripple on the input may be interpreted as line changes and reflect on the output. Therefore, it is essential to restrain the input's ripple. Acceptable levels are specified in the PERFORMANCE/FUNCTIONAL SPECIFICATIONS.

Connecting an input capacitor, as illustrated in the Typical Applications may reduce high frequency ripple on the input, which originates from the units internal 100kHz switching frequency. Case Shielding

The SHIELD terminal is connected to the device's metal case. The terminal may be connected to grounded systems in order to reduce radiated EMI.

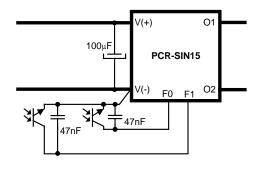
#### **Output Frequency Control**

Each PCR-SIN15V48F00 ring generator supports all four popular output frequencies: 16.7, 20, 25 and 50Hz. The frequency selection is controlled by TTL levels, referenced to V(-), or by jumpering the F0 and F1control pins to the V(-), according to the following table:

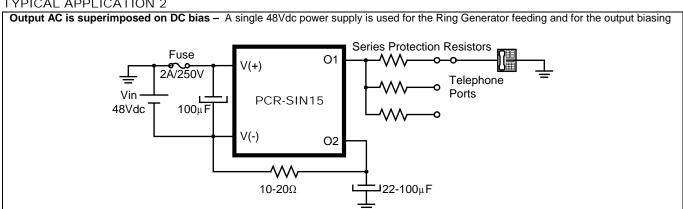
Frequency	F1	F0
16.7Hz	"0" or tied to V(-)	"1" or disconnected
20Hz	"1" or disconnected	"1" or disconnected
25Hz	"1" or disconnected	"0" or tied to V(-)
50Hz	"0" or tied to V(-)	"0" or tied to V(-)

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.

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.



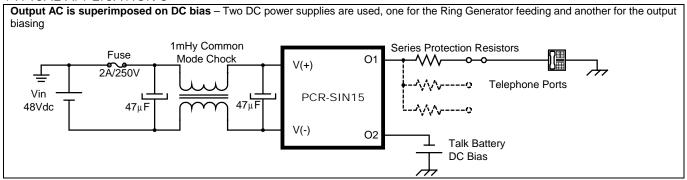
# **TYPICAL APPLICATION 2**



Note: A 0.1μF ceramic capacitor on each output line from the PCR-SIN15V48F00 Ring Generator prevents the possibility of the high switching frequencies causing interference down the line.

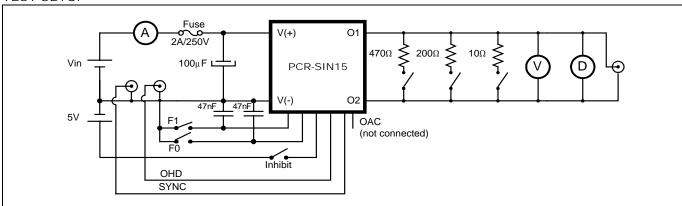


## TYPICAL APPLICATION 3

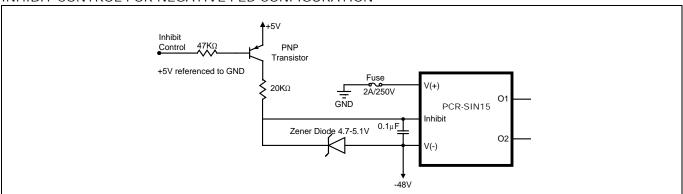


Note: A  $0.1\mu F$  ceramic capacitor on each output line from the PCR-SIN15V48F00 Ring Generator prevents the possibility of the high switching frequencies causing interference down the line.

# **TEST SETUP**



# INHIBIT CONTROL FOR NEGATIVE FED CONFIGURATION



# SAFETY INSTRUCTIONS

- For North America, input voltage (nominal 48Vdc, tolerance 36-60Vdc) must be applied by an isolated DC source complying with the earthed SELV or TNV requirements of the UL1950, Third edition.
   For other countries, 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.
- 2. DC input must be protected by a UL Listed fuse rated maximum T2A, 250V (slow-blow 2A, 250V fuse).
- 3. When applicable, protection from excessive voltage on the output should be tested in end-use equipment.
- 4. For output voltage exceeding 80Vrms, compliance with the ringing signal requirements should be tested in end-use equipment. When the output voltage is set to less than 80Vrms, the ringing signal complies with M.2 requirements of IEC950.

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# ABSOLUTE MAXIMUM RATINGS\*

Supply Voltage	 +85V
Inhibit, F1 and F0 Input Voltage	 -0.5V to +5.2V
Operating Ambient Temperature (T <sub>A</sub> )	 -40°C to +85°C
Storage Temperature	 -55°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.

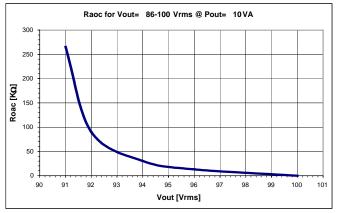
# PERFORMANCE / FUNCTIONAL SPECIFICATIONS

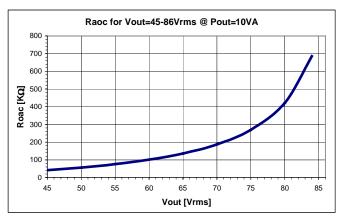
Typical at: T<sub>A</sub> = +25°C, Vin = 48Vdc, Load=470Ω resistive, Cin = 100μF, OAC not connected, according to Test Setup schematics.

Supply         Supply         Supply Obtage (Vin)         Supply Obtage (Vin)         36.0         48.0         72.0         Vdc	Parameters	Load=470 $\Omega$ resistive, Cin = 100 $\mu$ F, OAC not connected, as <b>Conditions</b>	Min	Typ	Max	Units
Supply Voltage (Vin)         36.0         48.0         72.0         Vdc           Supply Voltage Ripple         1.00-120Hz, 36.0≤Vin≤72.0, @ Pout=15VA         36.0         48.0         72.0         Vdc           Current Consumption         Device Inhibited         4         mA         MA         mA           No Load         Full Load         Load=470Ω, @ Vin,mm=36V         60         70         mA           Peak Current         Load=470Ω, @ Vin,mm=36V         28.0         36.0         Vdc           Input Under Voltage Protection         72.0         85.0         Vdc           Input Under Voltage Protection         Pout = 15W         75         80         0         Vdc           Efficiency         Pout = 15W         75         80         0         Vdc		Conditions		196	IIIUX	Oilles
Supply Voltage Ripple         100-120Hz, 36.0 ≤Vin≤72.0, @ Pout=15VA         I.0         Vp-p           Current Consumption         A         mA           Device Inhibited         No Load         4         mA           Full Load         Load=470Ω, @ Vin=m=36V         60         70         mA           Peak Current         Load=470Ω, @ Vin=m=36V         28.0         36.0         Vdc           Input Under Voltage Protection Input Over Voltage Protection         72.0         85.0         Vdc           Efficiency         Pout = 15W         75         80         %           Output Pewer         Continuous Loading         0         16         VA           Power Factor         O.5         Inco p         Icos pl           Output Voltage         Pout=10VA         80         86         92         Vrms           Output Frequency         According for Fo, F1 setting         16.7, 20         Hz         45-100         Vrms           Frequency Accuracy         36.0≤Vin≤72.0Vdc, 0≤Pout≤15W, 40°C ≤ T <sub>A</sub> ≤+85°C         25, 50         ±3         %           Frequency Accuracy         36.0≤Vin≤72.0Vdc, 0≤Pout≤15W, 40°C ≤ T <sub>A</sub> ≤+85°C         5         5         2         Vdc           Disable Voltage V <sub>IL</sub> Referenced to the V(			36.0	48 O	72 N	\/dc
Current Consumption         Δ 4 mA           Device Inhibited         4 mA           No Load         60 70 mA           Full Load         Load=470Ω, @ Vin <sub>min</sub> =36V         1.4 A           Input Under Voltage Protection         72.0         85.0         Vdc           Input Under Voltage Protection         72.0         85.0         Vdc           Input Under Voltage Protection         Pout = 15W         75         80         Vdc           Cutput Voltage Protection         Pout = 15W         75         80         Vdc           Power Pactor         Continuous Loading         0 5         16         VA           Cutput Voltage OAC not connected Roac & V(+)/V(-)         See graphs on OUTPUT AMPLITUDE ADJUSTMENT         80         86         92         Vrms           Coutput Frequency         According to F0, F1 setting         16.7, 20, 445-100         45-100         Yrms           Cutput Frequency         According to F0, F1 setting         16.7, 20, 445-100         25, 50         ±3         %           Inhibit Control Input Distable Voltage V <sub>II</sub> Referenced to the V(-) Terminal         3.5         5         5         2         Vdc           Enable Voltage V <sub>II</sub> V <sub>II</sub> = 0V         3.5         5         5.2         Vdc		100 120Hz 26 0<\/in<72.0 @ Pout-15\/A	30.0	40.0		
Device Inhibited No Load No Load No Load No Load No Load A Load=470Ω, @ Vin <sub>min</sub> =36V		100-120H2, 36.05VIII572.0, @ POUL=15VA			1.0	vp-p
No Load   Full Load   Load=470Ω, @ Vin,mi=36V   750   mA	•				4	Л
Full Load   Load=470Ω, @ Vin_mm=36V   750 mA   1.4				60	-	
Peak Current   Load≤47ΩΩ, @ Vin <sub>min</sub> =36V				60		
Input Under Voltage Protection   28.0   36.0   Vdc   Number Voltage Protection   72.0   85.0   Vdc   Number Voltage Protection   75   80   85.0   Vdc   Vdc   Number Voltage Protection   75   80   %   Vdc   V						
Input Over Voltage Protection		Load≤470Ω, @ Vin <sub>min</sub> =36V				
Pout = 15W   75   80   %   %   Output Power Factor   Continuous Loading   0   0.5     16   VA						
Output         Continuous Loading         0         16         VA   cos ρ            Power Power Power Power Power Power Factor         Power Eactor         0.5         16         VA   cos ρ            Output Voltage OAC not connected Roac between OAC & V(+)/V(-)         Power Po	Input Over Voltage Protection		72.0		85.0	Vdc
Power Power Factor         Continuous Loading         0         16         VA   cos ρ             Output Voltage OAC not connected Roac between OAC & V(+)/V(-)         Pout=10VA         80         86         92         Vrms           Output Frequency         According to F0, F1 setting         16.7, 20, 25, 50         Hz           Frequency Accuracy THD         36.0≤Vin≤72.0Vdc, 0≤Pout≤15W, -40°C ≤ Ta,≤+85°C 40.0≤Vin≤72.0Vdc, 0≤Pout≤15W, -40°C ≤ Ta,≤+85°C 5         ±3         %           Inhibit Control Input Disable Voltage V <sub>IH</sub> In Source V <sub>IL</sub> In Source V <sub>IL</sub> = 0V         Referenced to the V(-) Terminal V <sub>IH</sub> = 5V         3.5         5         5.2         Vdc put           F0, F1 Control Input V <sub>IH</sub> Source V <sub>IL</sub> In Source V <sub>IL</sub> = 0V         Referenced to the V(-) Terminal V <sub>IH</sub> = 5V         3.5         5.2         Vdc put           V <sub>IL</sub> = 0V V <sub>IL</sub> = 0V         3.5         5.2         Vdc put	Efficiency	Pout = 15W	75	80		%
Power Factor   Pout=10VA   See graphs on OUTPUT AMPLITUDE ADJUSTMENT   80   86   45-100   Vrms	Output					
Power Factor	Power	Continuous Loading	0		16	VA
Output Voltage OAC not connected R <sub>OAC</sub> between OAC & V(+)/V(-)         Pout=10VA See graphs on OUTPUT AMPLITUDE ADJUSTMENT         80         86 45·100         92         Vrms Vrms           Output Frequency         According to F0, F1 setting         16.7, 20, 25, 50         Hz           Frequency Accuracy THD         36.0≤Vin≤72.0Vdc, 0≤Pout≤15W, -40°C ≤ T <sub>A</sub> ≤+85°C 40.0≤Vin≤72.0Vdc, 0≤Pout≤15W, -40°C ≤ T <sub>A</sub> ≤+85°C         ±3 5         %           Inhibit Control Input Disable Voltage V <sub>IH</sub> Enable Voltage V <sub>IL</sub> In Source         Referenced to the V(-) Terminal         3.5 0         5         5.2 0         Vdc 700 µA           Fo, F1 Control Input V <sub>IH</sub> V <sub>IH</sub> V <sub>IL</sub> V <sub>IL</sub> Unin Source         Referenced to the V(-) Terminal V <sub>IH</sub> V <sub>IL</sub> = 0V         3.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0	Power Factor		0.5			lcos ol
OAC not connected R <sub>OAC</sub> between OAC & V(+)/V(-)         See graphs on OUTPUT AMPLITUDE ADJUSTMENT         80         86         45-100         Vrms Vrms           Output Frequency         According to F0, F1 setting         16.7, 20, 25, 50         ±3         %           Frequency Accuracy THD         36.0≤Vin≤72.0Vdc, 0≤Pout≤15W, -40°C ≤ T <sub>A</sub> ≤+85°C         ±3         %           Inhibit Control Input         Referenced to the V(-) Terminal         3.5         5         5.2         Vdc           Inable Voltage V <sub>IH</sub> Referenced to the V(-) Terminal         3.5         5         5.2         Vdc           In Sink         V <sub>IL</sub> = 0V         700         µA         700         µA           F0, F1 Control Input V <sub>IH</sub> Referenced to the V(-) Terminal V <sub>IH</sub> 3.5         5.2         Vdc           V <sub>IL</sub> = 0V         0.5         1.0         Vdc         1.0         Vdc           V <sub>IL</sub> = 0V         3.5         5.2         Vdc         1.0         Vdc           V <sub>IL</sub> = 0V         0.5         1.0         Vdc         1.0         Vdc           V <sub>IL</sub> = 0V         0.5         1.0         Vdc         1.0         Vdc           V <sub>IL</sub> = 0V         0.5         1.0         Vdc         1.0         Vdc						1000 11
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Roac between OAC & V(+)/V(-)   See graphs on OUTPUT AMPLITUDE ADJUSTMENT   45-100   Vrms			80	86	92	Vrms
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THD         40.0≤Vin≤72.0Vdc, 0≤Pout≤15W, -40°C ≤ T <sub>A</sub> ≤+85°C         5         %           Inhibit Control Input         Referenced to the V(-) Terminal         3.5         5         5.2         Vdc           Enable Voltage V <sub>II</sub> -0.5         0         1.0         Vdc           Lin Source         V <sub>II</sub> = 0V         700         µA           V <sub>II</sub> Referenced to the V(-) Terminal         3.5         5.2         Vdc           V <sub>II</sub> Referenced to the V(-) Terminal         3.5         5.2         Vdc           V <sub>II</sub> Referenced to the V(-) Terminal         3.5         5.2         Vdc           V <sub>II</sub> Referenced to the V(-) Terminal         3.5         5.2         Vdc           V <sub>II</sub> Referenced to the V(-) Terminal         3.5         5.2         Vdc           V <sub>II</sub> Referenced to the V(-) Terminal         3.5         5.2         Vdc           V <sub>II</sub> V <sub>II</sub> 0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0 <td< td=""><td>Frequency Accuracy</td><td>36.0<vin<72.0vdc. 0<pout<15w40°c="" <="" t<sub="">A &lt;+85°C</vin<72.0vdc.></td><td></td><td>20, 00</td><td><b>⊥2</b></td><td>0/:</td></td<>	Frequency Accuracy	36.0 <vin<72.0vdc. 0<pout<15w40°c="" <="" t<sub="">A &lt;+85°C</vin<72.0vdc.>		20, 00	<b>⊥2</b>	0/:
Disable Voltage V <sub>IH</sub>	. , ,					
Disable Voltage $V_{IH}$ Enable Voltage $V_{IL}$ Brable Voltage $V_{IL}$ Br	Inhibit Control Innut				<u> </u>	70
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Time to Turn-Off Time to Turn-On	Time to Turn-Off				35	ms
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Time to Turn-On Load reverts to Normal; $0$ ≤Pout≤15VA $5$ $8$ General Insulation $6$ 500Vdc Input to Output $6$ 40 $6$ $6$ $6$ $6$ $6$ $6$ $6$ $6$ $6$ $6$	Time to Turn-Off	Output Overloaded	200	600	800	ms
	Time to Turn-On			5		S
Insulation   Switching Frequency   96   MΩ   MΩ   Switching Frequency   96   kHz						
Switching Frequency         96         kHz           Environment         Relative Humidity         Non-Condensing, Per IEC 68-2-56         93         %           Ambient Temperature (TA)         Without Derating         -40         +50         °C           Derated from +50°C by 0.3W/°C         to +85         °C           Reliability         Continuous Operation @40°C Ambient Temperature         Calculation method: Relex Bellcore Software Ver5.30         4,000,000         Hours		500Vdc Input to Output	40			MO
Environment     Relative Humidity     Non-Condensing, Per IEC 68-2-56     93     %       Ambient Temperature (TA)     Without Derating     -40     +50     °C       Derated from +50°C by 0.3W/°C     to +85     °C       Reliability     Continuous Operation@40°C Ambient Temperature     Calculation method: Relex Bellcore Software Ver5.30     4,000,000     Hours		occide input to output	40	96		
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Derated from +50°C by 0.3W/°C to +85 °C  Reliability Continuous Operation@40°C Ambient Temperature Calculated MTBF Calculation method: Relex Bellcore Software Ver5.30 4,000,000 Hours	•		40			
Reliability Continuous Operation@40°C Ambient Temperature Calculated MTBF Calculation method: Relex Bellcore Software Ver5.30 4,000,000 Hours	Ambient remperature (1 <sub>A</sub> )	9	-40			_
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Calculated MTBF Calculation method: Relex Bellcore Software Ver5.30 4,000,000 Hours  OHD, Sync Output Referenced to V(-) Terminal						
OHD, Sync Output Referenced to V(-) Terminal		Calculation method: Relex Bellcore Software Ver5.30	4,000,000			Hours
, , , , , , , , , , , , , , , , , , , ,		Referenced to V(-) Terminal				
V <sub>OH</sub> Output Source Current 2mA 4.2 5.3 Vdc	OHD, Sync Output	Troibilition to V() Torrillian				
V <sub>OL</sub> Output Sink Current 2mA 0 0.8 Vdc		Output Source Current 2mA	4.2		5.3	Vdc
Vol. Output Sink Current 5mA 0 1.2 Vdc	V <sub>OH</sub>	Output Source Current 2mA				



# **OUTPUT AMPLITUDE ADJUSTMENT**





 $R_{\text{OAC}}$  connected between the OAC and the V(-) terminals

R<sub>OAC</sub> connected between the OAC and the V(+) terminals

# MECHANICAL DETAILS

## **DIMENSIONS**

	mm	Inch
А	63.50±0.40	2.500"±0.016"
В	63.50±0.40	2.500"±0.016"
С	12.70 Max	0.500" Max
D	35.56±0.25	1.400"±0.01"
Е	40.64±0.25	1.6000"±0.01"
F	35.56±0.25	1.400"±0.01"
G	0.64±0.10 SQ	0.025"±0.004 SQ
н	3.00±0.30	0.117"±0.012"
J	5.08±0.25	0.200"±0.01"
К	13.97±0.50	0.550"±0.02"
L	1.00±0.15	0.039"±0.005"

