

## 3000W Single-Phase Power Factor Correction Converters

### Description

Harmonic current distortion is a common power quality problem. Its adverse effects include degradation of system voltage waveforms, reduction of power factor, etc. The 3000W single-phase ac-dc converter with Power Factor Correction (PFC) is designed to reduce harmonic currents and achieve near unity power factor in single-phase systems with frequency ranging from 45 Hz to 65Hz. The 3000W PFC converter is composed of a rectifier bridge followed by a boost dc-dc converter employing average current control.

### Features

- Single-phase AC input, 180VAC ~ 265VAC input voltage, 45Hz ~ 65 Hz input frequency
- 395VDC output voltage
- Up to 3000W output power
- 50kHz switching frequency
- Near unity power factor
- Maximum 6% total harmonic current distortion at 220VAC, 3000W
- Over voltage, under voltage, over temperature protection, and instantaneous input current protection.
- Base plate rated to 100 °C

### Block Diagram

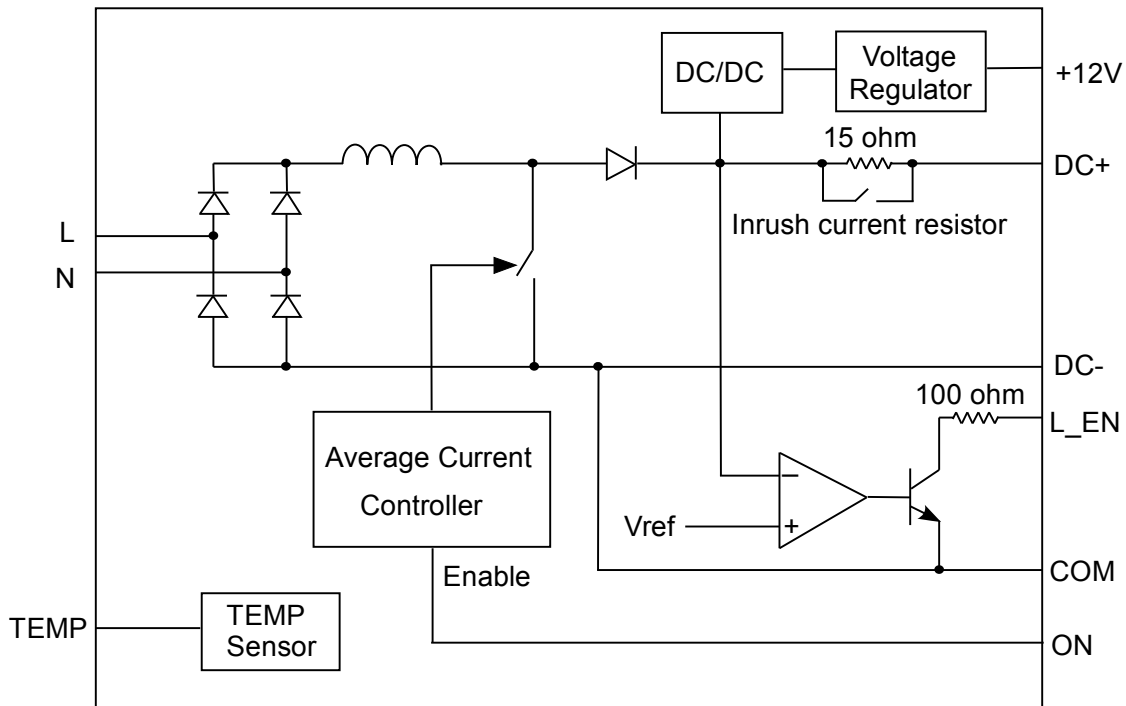


Figure 1 Block diagram of 3000W single-phase PFC Converter

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**Table 1 Electrical Characteristics ( $T_A=25^\circ\text{C}$ , unless otherwise specified)**

PARAMETER		SYMBOL	MIN	TYP	MAX	UNIT	
<b>INPUT</b>							
Input Voltage		$V_{in}$	180		265	VAC	
Input Frequency		f	45		65	Hz	
Startup Input Voltage				160		V	
Soft Start Time $I_0=0$ A, Output filter capacitor = 1400 $\mu$ F			0.7		1.5	sec	
Inrush Current $I_0=0$ A				22	50	A	
<b>OUTPUT</b>							
Output Voltage	$I_0=0.8$ A	$V_0$	390	395	400	V	
	$I_0=8.0$ A		380	385	390	V	
Output Power (See note 1)		$P_0$			3000	W	
<b>PROTECTION</b>							
Over Output Voltage Protection (Latching)				460		VDC	
Over Instantaneous Input Current Protection (Auto Recovery)				59		A	
Thermal Protection (Auto Recovery)				100		$^\circ\text{C}$	
<b>MISCELLANEOUS</b>							
Operating Temperature (See note 2)		$T_A$	-55		100	$^\circ\text{C}$	
Thermal Resistance (Junction to Case)		$R_{\theta jc}$		0.09		$^\circ\text{C}/\text{W}$	
Isolation (Input to Case)					1500	VAC	
<b>ELECTRICAL PERFORMANCE</b>							
Power Factor		PF		0.99			
Total Harmonic Current Distortion (See note 1)	$I_0=4$ A	$V_{in}=180$ VAC	ATHD	4	6	%	
		$V_{in}=220$ VAC		4	6		
		$V_{in}=265$ VAC		6	7		
	$I_0=8$ A	$V_{in}=180$ VAC		ATHD	5	6	%
		$V_{in}=220$ VAC					
		$V_{in}=265$ VAC					
Efficiency	$I_0=4$ A	$V_{in}=180$ VAC	$\eta$		92	%	
		$V_{in}=220$ VAC			93		
		$V_{in}=265$ VAC			94		
	$I_0=8$ A	$V_{in}=180$ VAC		$\eta$	90	%	
		$V_{in}=220$ VAC			92		
		$V_{in}=265$ VAC			93		

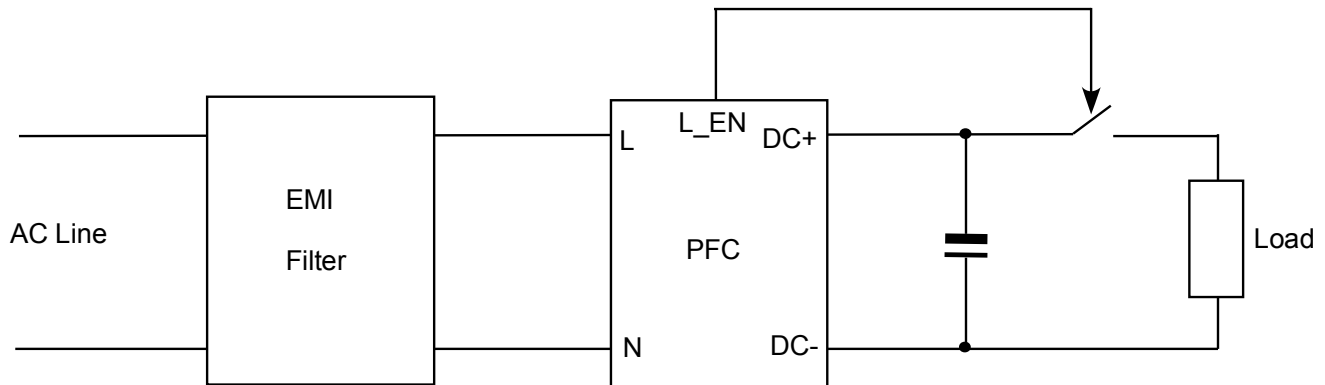
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Note: 1) When the output power is below 10% of the rated power, the input current will be significantly distorted. However, the output voltage remains in regulation.  
2) Not tested on actual units. Ensured by design.

**PIN Description**

SYMBOL	DESCRIPTION
N, L	AC line inputs
DC+, DC-	DC outputs
L_EN	Load enable pin. Open collector output with an internal 100 ohm resistor. Maximum collector current is 100mA. When Vo is lower than 365V, L_EN is shorted to "COM".
ON	PFC enable pin. When "ON" pin is connected to COM, PFC is enabled. Otherwise, PFC is disabled and Vo is the rectified AC input voltage.
COM	Control Signal Reference. Connected to "DC-" internally.
12V	Bias Voltage Supply. Output current up to 20mA.
TEMP	Substrate temperature sensor output. 10mV/Kelvin Or $(TEMP \times 100 - 273) ^\circ C$

**TYPICAL APPLICATION**

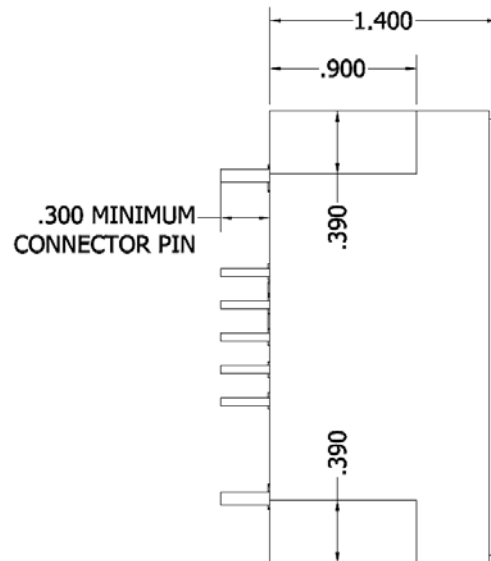
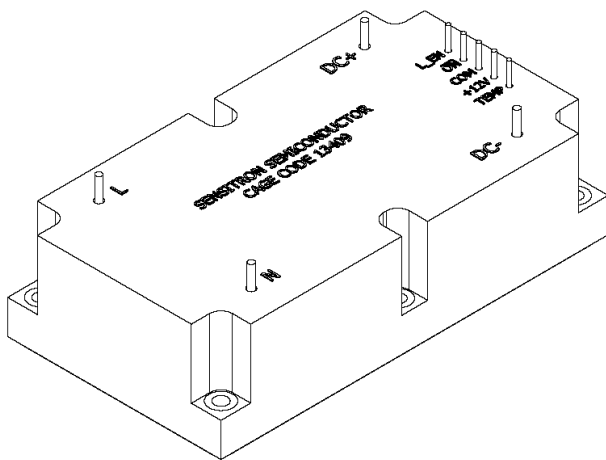
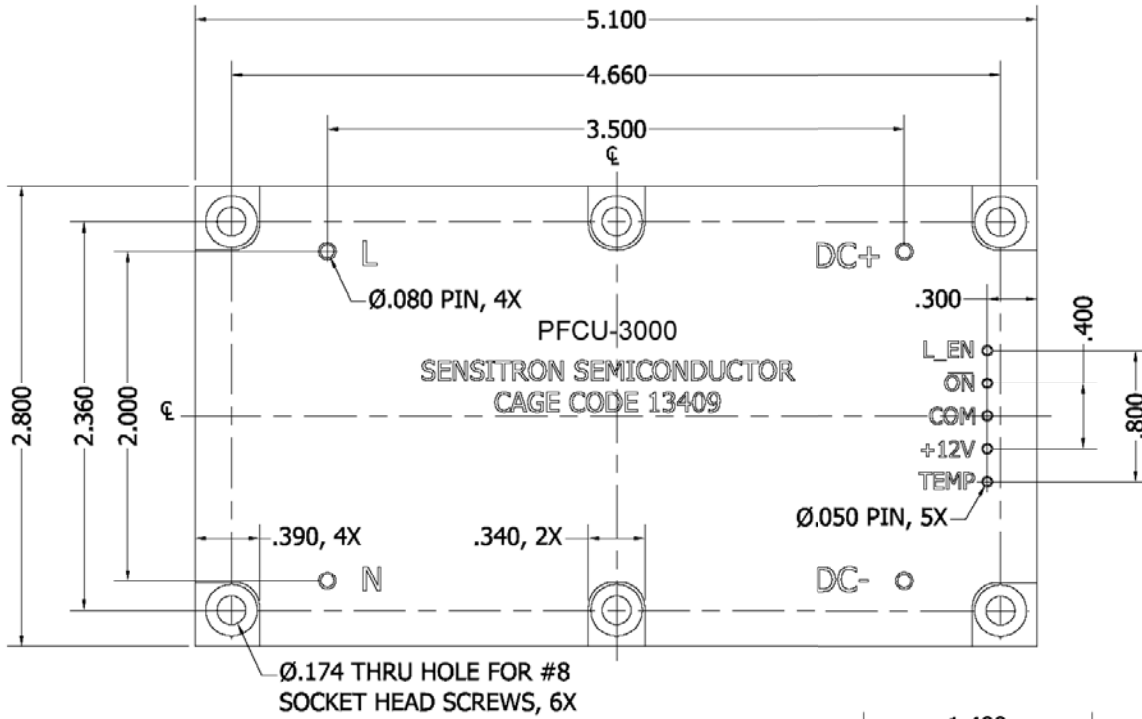


**Figure 2. Typical application of 3000W single-phase PFC converter**

Figure 2 illustrates the configuration of 3000W single-phase PFC converter in a typical application. External capacitor filter is required at the PFC converter output. Selection of the output capacitor is usually determined by the switching frequency ripple current, the second harmonic ripple current, the DC voltage, the output ripple voltage and the hold-up time. All electrical characteristics in this datasheet are tested with an output capacitor of 1400µF, which generates maximum 20V peak-peak 2<sup>nd</sup> harmonic ripple voltage.

The inrush current is limited by an internal 15 ohm surge resistor. To reduce power loss, the resistor is shorted after the PFC is powered up for 350m sec, no matter if the PFC converter is enabled. Having a heavy load connected to the PFC output during start-up time will delay the charge of the output capacitor, and may result in high input current spikes. If customer load does not have under voltage lockout, it is recommended to insert a switch (e.g. a relay), controlled by the pin "L\_EN", between the load and the output capacitor, as shown in Figure 2. "L\_EN" changes its status when the output voltage reaches 365VDC. The logic of "L\_EN" is configurable.

**MECHANICAL OUTLINE**



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