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DATA SHEET 4158, REV. E

1500W 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 1500W 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 1500W PFC converter is composed of a rectifier bridge followed by a boost dc-dc converter employing average current control.

Features

- Single-phase AC input, 85VAC ~ 265VAC input voltage, 45Hz ~ 65 Hz input frequency
- 395VDC output voltage
- Up to 1500W output power
- 50kHz switching frequency
- Near unity power factor
- Maximum 6% total harmonic current distortion at 220VAC, 1500W
- Over voltage, under voltage, over temperature protection, and instantaneous input current protection.
- Base plate rated to 100℃

Block Diagram

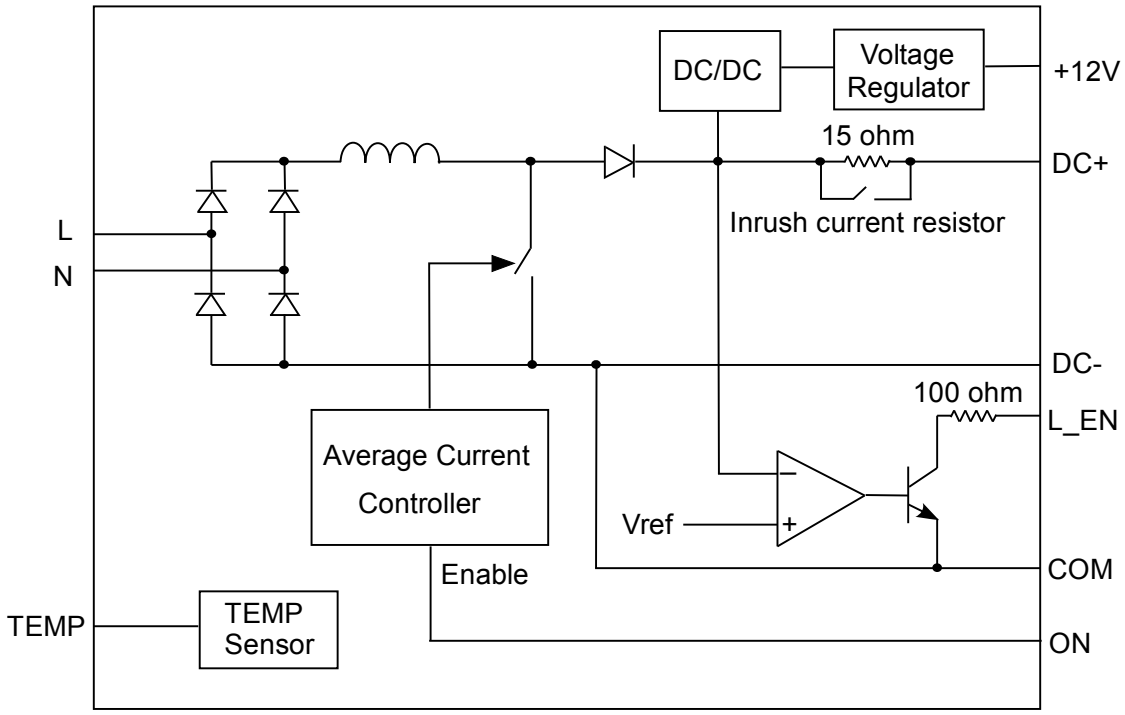

Figure 1 Block diagram of 1500W single-phase PFC Converter

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Table 1 Electrical Characteristics (T_A=25 °C, unless otherwise specified)

PARAMETER			SYMBOL	MIN	TYP	MAX	UNIT
INPUT							
Input Voltage			V_{in}	85		265	VAC
Input Frequency			f	45		65	Hz
Startup Input Voltage				75	80	85	V
Soft Start Time	I_0=0 A, Output filter capacitor = 1400µF			0.7		1.5	sec
Inrush Current	I_0=0 A				22	50	A
OUTPUT							
Output Voltage	I_0=0.4A		V_0	390	395	400	V
	I_0=4.0A			376	380	383	V
Output Power (See note 1)			P_0			1500	W
PROTECTION							
Over Output Voltage Protection (Latching)					460		VDC
Over Instantaneous Input Current Protection (Auto Recovery)					59		A
Thermal Protection (Auto Recovery)					100		°C
MISCELLANEOUS							
Operating Temperature (See note 2)			T_A	-55		100	°C
Thermal Resistance (Junction to Case)			R_{ejc}		0.09		°C/W
Isolation (Input to Case)						1500	VAC
ELECTRICAL PERFORMANCE							
Power Factor			PF		0.99		
Total Harmonic Current Distortion (See note 1)	I_0=2 A	V_{in}= 85VAC	ATHD		3	4	%
		V_{in}= 220VAC			3	4	
		V_{in}= 265VAC			4	7	
	I_0=4 A	V_{in}= 85VAC			3	6	%
		V_{in}= 220VAC					
		V_{in}= 265VAC					
Efficiency	I_0=2 A	V_{in}= 85VAC	η		88		%
		V_{in}= 220VAC			92		
		V_{in}= 265VAC			93		
	I_0=4 A	V_{in}= 85VAC			84		%
		V_{in}= 220VAC			93		
		V_{in}= 265VAC			94		

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 $\times 100 - 273$) °C

TYPICAL APPLICATION

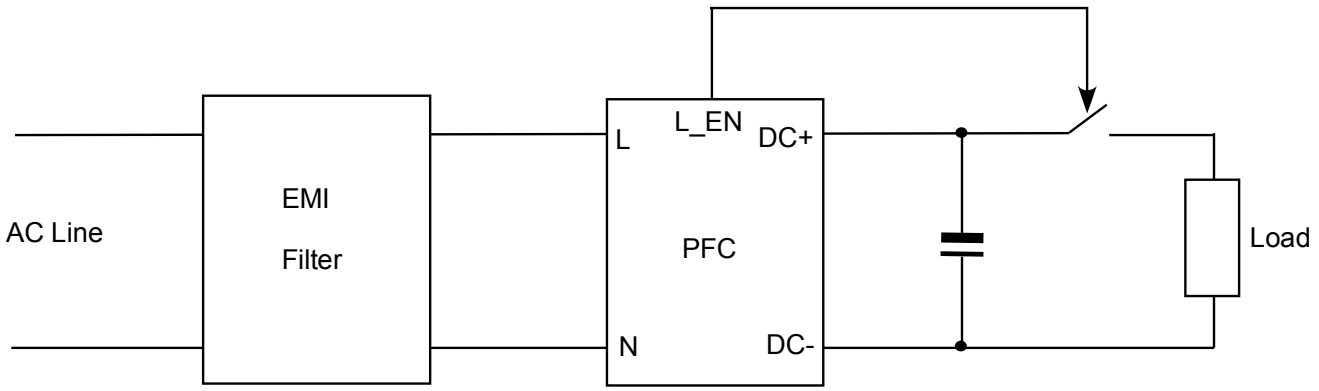

Figure 2. Typical application of 1500W single-phase PFC converter

Figure 2 illustrates the configuration of 1500W 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 2nd 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.

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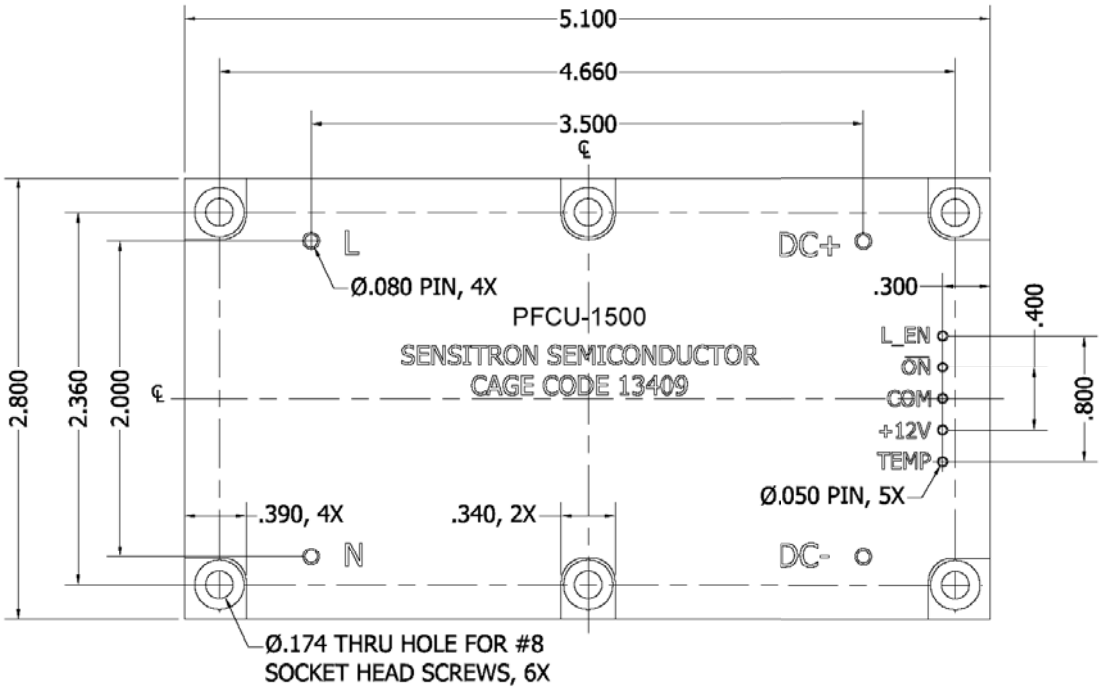
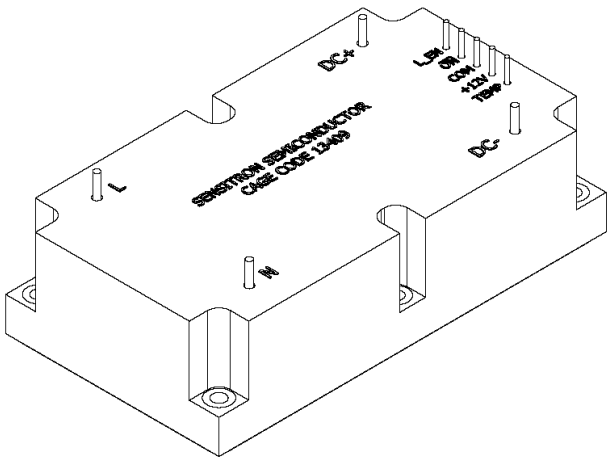
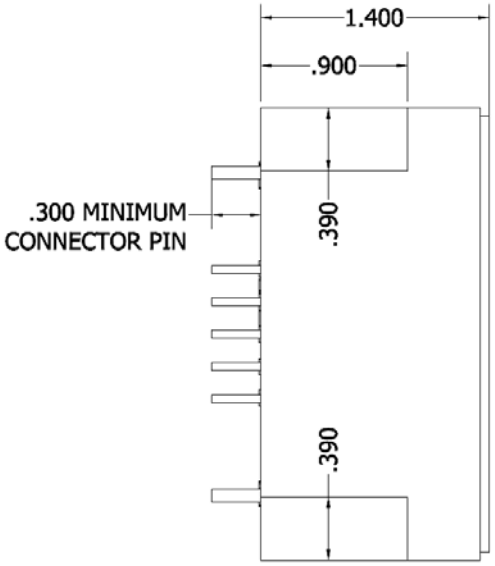
MECHANICAL OUTLINE







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