350W isolated DC-DC converter with ultra-wide, ultra-high 300 -1500VDC input for Renewable Energy

RoHS

FEATURES

- Input voltage up to 1700VDC (Transient, duration: 30s)
- Ultra-wide input voltage range of 300 - 1500VDC
- Industrial grade operating temperature -40℃ to +85℃
- High I/O isolation voltage up to 4000VAC
- Support 3+1 parallel redundancy, current sharing (up to 1400W)
- High efficiency, low ripple & noise
- Input under-voltage protection, input reverse polarity protection, over-temperature protection, output short circuit, over-current, over-voltage protection
- Operating up to 5000m altitude
- Safety Class I, Class II
- Design refer to CSA-C22.2 No.107.1, IEC62477 EN/IEC/BS EN62109

PV350-29BxxR3 is a regulated DC-DC series converter with an ultra-wide and ultra-high DC input of 300-1500VDC, which design based on standard of CSA-C22.2 No.107.1, IEC62477, EN/IEC62109. The products feature high efficiency, high reliability, high insulation and a high level of safety protection. It is widely used in renewable energy industries, such as photovoltaic inverter, energy storage systems, charging pile, industrial control. The converters provide multiple protection features and guarantee stable and safe operating environments even under abnormal working conditions. For extremely harsh EMC environment, we recommend using the application circuit show in Design Reference of this datasheet.

Selection Guide

Certification	Part No.*	Output Power (W)	Nominal Output Voltage and Current (Vo/Io)	Output Voltage Adjustable Range ADJ (V)	Efficiency at 1100VDC (%) Typ.	Capacitive Load (μF) Max.
/	PV350-29B12R3	240	12V/20.0A	12-15	90	10000
	PV350-29B24R3	350.4	24V/14.6A	24-29	92	5000
	PV350-29B28R3		28V/12.5A	28-32	92	5000
	PV350-29B48R3		48V/7.3A	48-58	93	2000

Note: *When using the parallel, current sharing function for all models, do not directly increase the load on the system beyond the rated load of a single prototype when the power is turned on for the first time.

Input Specifications

Item	Operating Conditions		Min.	Typ.	Max.	Unit
Input Voltage Range	Transient (30s)		--	--	1700	VDC
			300	--	1500	
Input Current	300VDC		--	--	1.5	A
	1500VDC		--	--	0.4	
Inrush Current	800VDC	Cold start	--	200	--	
	1500VDC		--	300	--	
Input Under-voltage Protection	Lockout activation range		250	--	270	VDC
	Lockout deactivation range		270	--	290	
Input Reverse Polarity Protection			Available			
External Input Fuse			1500VDC/6A, required (brand: Adler models: A851600b00 base models: BH300)			
Hot Plug			Unavailable			

Output Specifications

Item	Operating Conditions		Min.	Typ.	Max.	Unit
Output Voltage Accuracy	All load range		--	±1	±2	%
Line Regulation	Rated load		--	±0.5	--	
Load Regulation	1100VDC		--	±1	±1.5	
Stand-by Power Consumption	1500VDC		--	--	3	W
Ripple & Noise*	20MHz bandwidth (peak-to-peak value)	12V	--	--	120	mV
		24V/28V	--	--	240	
		48V	--	--	300	
Temperature Coefficient			--	±0.02	--	%/℃
Over-current Protection	All input voltage range		110% - 330% Io, constant current mode when output voltage > 70%, automatic recover after fault condition is removed			
Short Circuit Protection			Hiccup, continuous, self-recovery			
Over-voltage Protection	12V		≤20V	Output voltage clamp or hiccup		
	24V		≤35V			
	28V		≤40V			
	48V		≤63V			
Over-temperature Protection**			Output voltage turn off, self-recovery			
Minimum Load			0	--	--	%
Hold-up Time	Room temperature, full load	1200VDC input	--	10	--	ms
Start-up Delay Time***			--	1	3	s

Note: *The " Tip and barrel method" is used for ripple and noise test, please refer to PV Converter Application Notes for specific information;
**Output voltage turn off, self-recovery after fault conditions is removed;
***Full input voltage / output load range (The cooling-time between input power-off and power-on again is greater than 15s).

General Specifications

Item		Operating Conditions	Min.	Typ.	Max.	Unit
Isolation	Input - output	Electric Strength Test for 1min., leakage current ＜10mA	4000	--	--	VAC
	Input - Shell		4000	--	--	
	Output - Shell		2000	--	--	
Insulation Type			Primary and secondary, primary and shell meet reinforced insulation			
Insulation Resistance	Input - output	Testing voltage: 500VDC	100	--	--	MΩ
	Input - Shell					
	Output - Shell					
Operating Temperature			-40	--	+85	℃
Storage Temperature			-40	--	+85	
Storage Humidity			--	--	95	%RH
Vibration Resistance			10-500Hz,2g,threedirectionsofX,Y,Zaxis,1H;GB/T 2423.10			
Output Power Derating		+55℃ to +80℃	2.4	--	--	%/℃
		+80℃ to +85℃	4.0	--	--	
		300-400VDC	0.2	--	--	%/VDC
		3000- 5000m	10.0	--	--	%/Km
Safety Standard			Design refer to CSA-C22.2 No.107.1-16, IEC62477, EN/IEC/BS EN62109-1			
Safety Class			CLASS I, CLASS II			
MTBF		MIL-HDBK-217F@25℃	≥300,000 h			

Mechanical Specifications

Case Material	Metal
Dimensions	234.50 x 81.00 x 42.00mm
Weight	1000g (Typ.)
Cooling Method	Free air convection

Electromagnetic Compatibility (EMC)

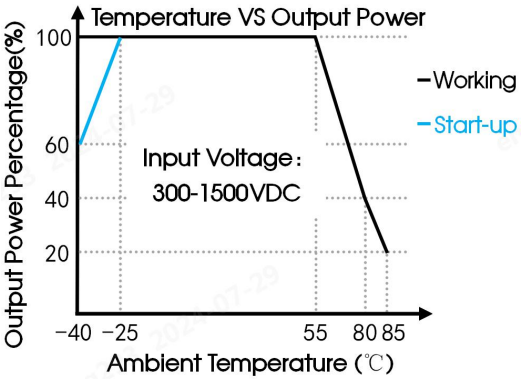
Emissions	CE	CISPR32/EN55032 CLASS A		
	RE	CISPR32/EN55032 CLASS A		
	EN61000-6-4			
Immunity	ESD	IEC/EN61000-4-2	Contact ±6KV/Air ±8KV	Perf. Criteria A
	RS	IEC/EN61000-4-3	10V/m	Perf. Criteria A
	EFT	IEC/EN61000-4-4	±4KV	Perf. Criteria A
	Surge*	IEC/EN61000-4-5	Line to line ±1KV/ line to shell ±2KV	Perf. Criteria A
		IEC/EN61000-4-5	Line to line ±2KV/ line to shell ±4KV (See Fig. 2 for recommended circuit)	
	CS	IEC/EN61000-4-6	10Vr.m.s	Perf. Criteria A
	PFMF	IEC/EN61000-4-8	30A/m	Perf. Criteria A
	EN55035、EN61000-6-2			

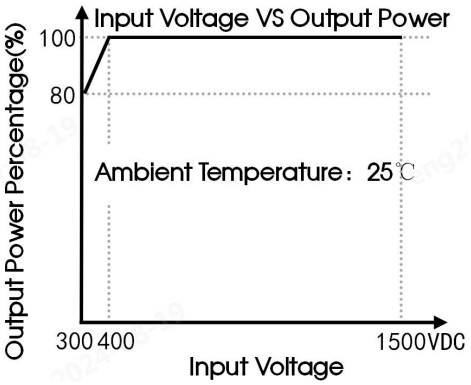
Note: *CLASS II applications do not need to test the line to shell.

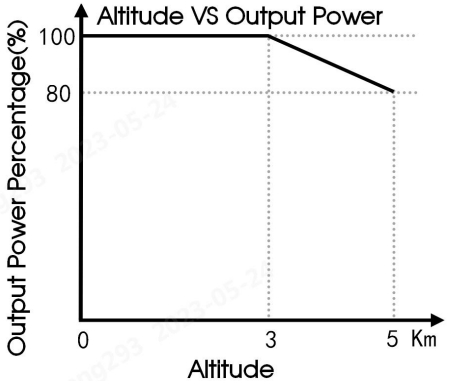
Functional Specifications

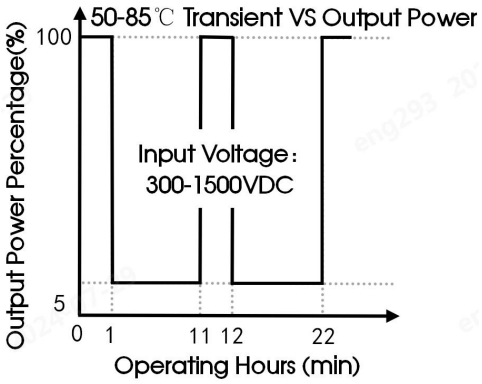
Item	Operating Conditions	Min.	Typ.	Max.	Unit
Parallel Redundancy		Support direct parallel use, achieve 3+1 parallel redundancy			
Current Sharing Accuracy (parallel)	Full input voltage range, when units in parallel, each power supply needs to carry a rated load of more than 50%	-5	--	+5	%

Product Characteristic Curve

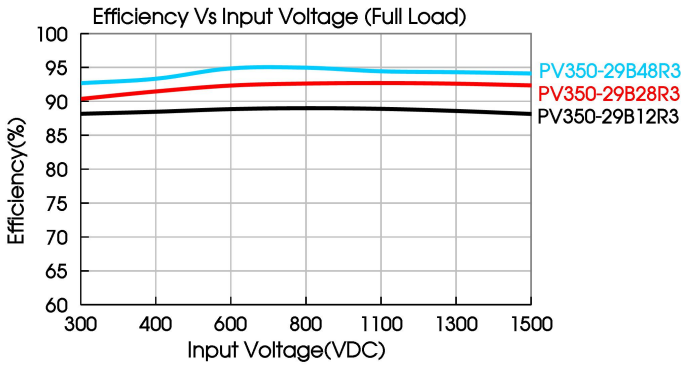


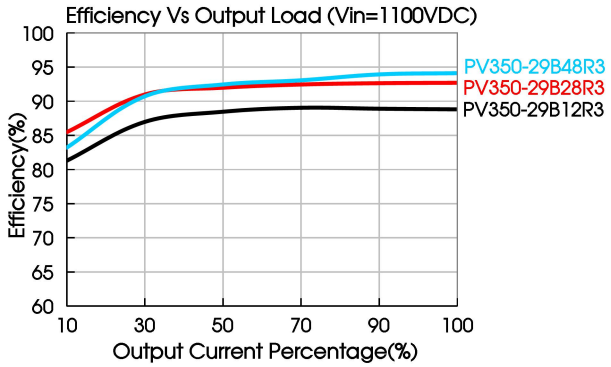






Note: 1.With an DC input between 300-400VDC, the output power must be derated as per temperature derating curves;
2.The product meets the transient full load operation at high temperature 55-85℃ (input voltage derating is required when the transient operation mode is used);
3.This product is suitable for applications using natural free air cooling; for applications in closed environment please consult Mornsun FAE.





Design Reference

1. Typical application circuit

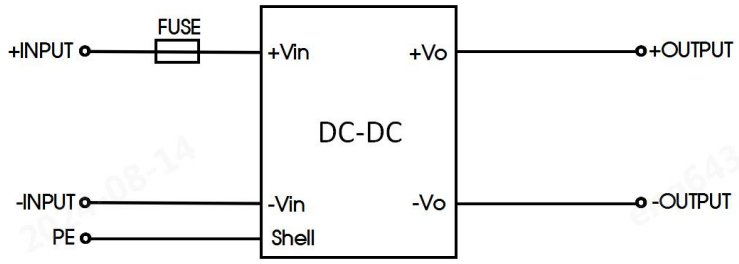


Fig. 1

Model	Recommended value
FUSE	1500VDC/6A, required (brand: Adler models: A851600b00 base models: BH300)
Note: No PE connection is required for CLASS II application.	

2. EMC compliance recommended circuit

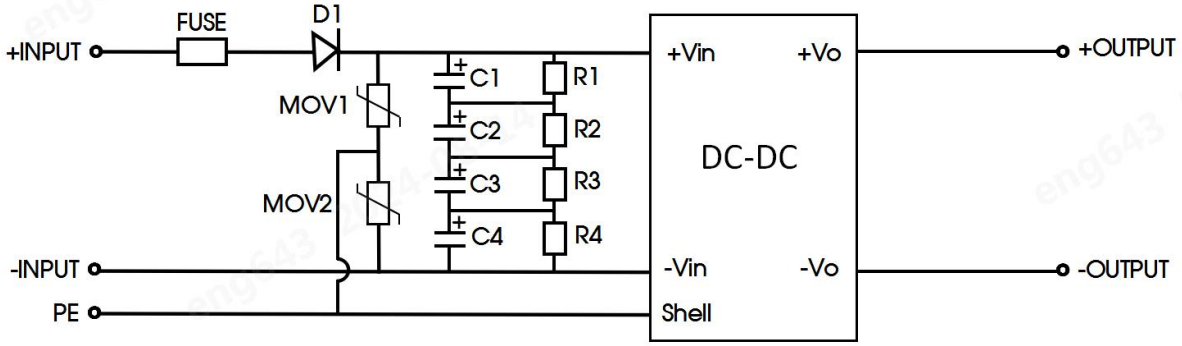


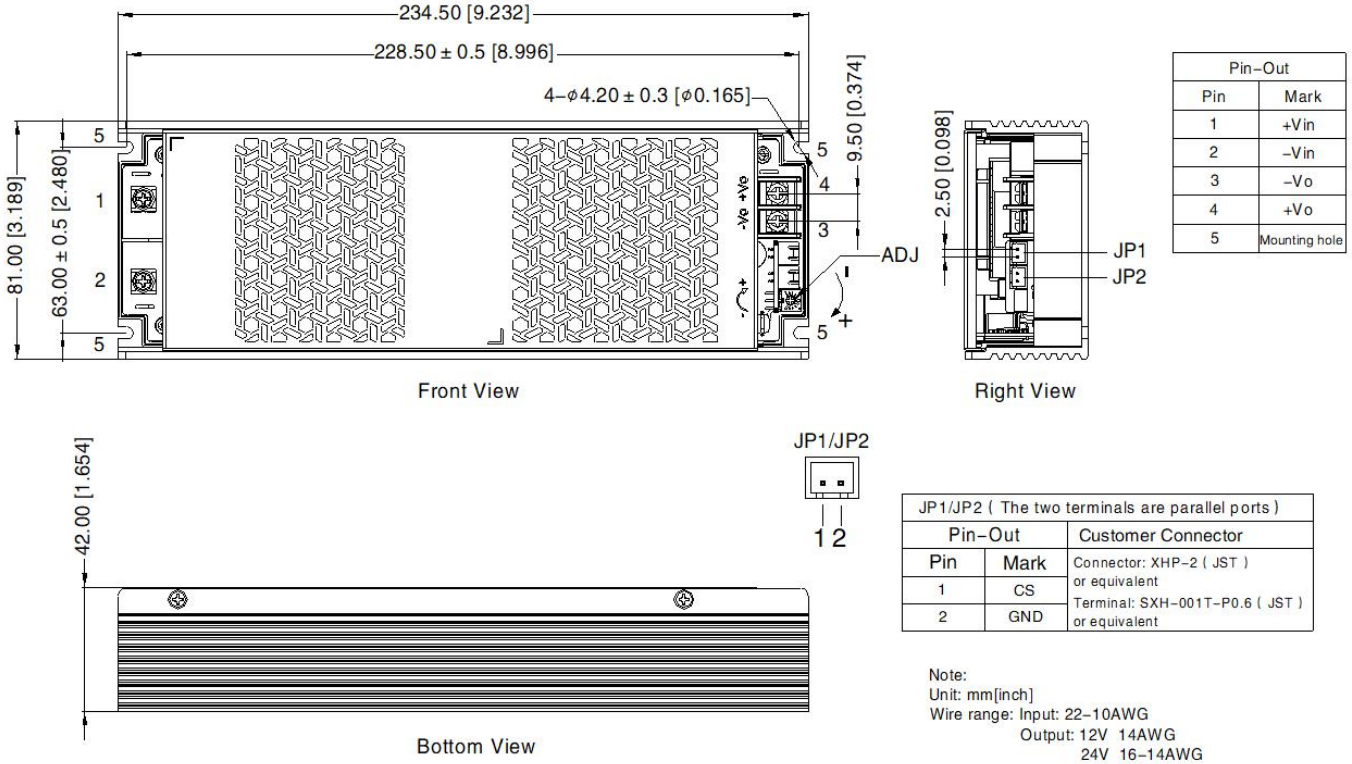
Fig. 2

Model	Recommended value
FUSE	1500VDC/6A, required (brand: Adler models: A851600b00 base models: BH300)
D1	4000V/20A (two 1000V/20A rectifier bridges in series)
C1/C2/C3/C4	100μF/450VDC
R1/R2/R3/R4	1MΩ/2W
MOV1/MOV2	182K/4500A/14D
Note: 1.For CLASS II application, no need to connect PE and no need to add the varistor (MOV1/MOV2); 2.Test the withstand voltage(input/output to PE), need to remove the varistor(MOV1/MOV2).	

3. For more information Please find the application notes on www.mornsun-power.com.

Dimensions and Recommended Layout

THIRD ANGLE PROJECTION



Pin–Out	
Pin	Mark
1	+Vin
2	–Vin
3	–Vo
4	+Vo
5	Mounting hole

JP1/JP2 (The two terminals are parallel ports)		
Pin–Out		Customer Connector
Pin	Mark	Connector: XHP–2 (JST) or equivalent Terminal: SXH–001T–P0.6 (JST) or equivalent
1	CS	
2	GND	

Note:
Unit: mm[inch]
Wire range: Input: 22–10AWG
Output: 12V 14AWG
24V 16–14AWG
28V 16–14AWG
48V 18–14AWG
Input/output terminal tightening torque: M4, 0.9N•m ± 10%
General tolerances: ± 1.00[± 0.039]

⚠WARNING:
1. CAUTION: "To reduce the risk of fire, connect only to a circuit provided with 6 amperes maximum branch-circuit over-current protection in accordance with the National Electrical Code, ANSI/NFPA70."
2. WARNING: REPLACE ONLY WITH THE SAME RATINGS AND TYPE OF FUSE.
3. DANGER — HIGH VOLTAGE.

AVERTISSEMENT:
1. Avertissement: Pour réduire le risque d'incendie, veuillez connecter uniquement à des circuits de dérivation avec protection contre les surintensités conformes au code électrique national ANSI/ NFPA 70.
2. AVERTISSEMENT : N'UTILISER QUE DES FUSIBLES DE MÊMECALIBRE ET DE MÊME TYPE QUE LE FUSIBLE DORIGINE.
3. DANGER ： HAUTE TENSION.

Note:
1. For additional information on Product Packaging please refer to www.mornsun-power.com. Packaging bag number: 58220778;
2. Unless otherwise specified, parameters in this datasheet were measured under the conditions of Ta=25℃, humidity<75% with nominal input voltage and rated output load;
3. All index testing methods in this datasheet are based on our company corporate standards;
4. We can provide product customization service, please contact our technicians directly for specific information;
5. Products are related to laws and regulations: see "Features" and "EMC";
6. The output voltage can be adjusted by the ADJ, clockwise to increase;
7. Our products shall be classified according to ISO14001 and related environmental laws and regulations, and shall be handled by qualified units;
8. If the final product application is connected to a photovoltaic array, the array needs to be grounded and the positive and negative poles of the product shall not be greater than 1500VDC.

Mornsun Guangzhou Science & Technology Co., Ltd.
Address: No.8 Nanyun 4th Road, Huangpu District, Guangzhou, China
Tel: 86-20-38601850 Fax: 86-20-38601272 E-mail: info@mornsun.cn www.mornsun-power.com

PV350-29BxxR3 Series Parallel Redundancy and Current Sharing Application Notes

Parallel Operating

1. Redundancy

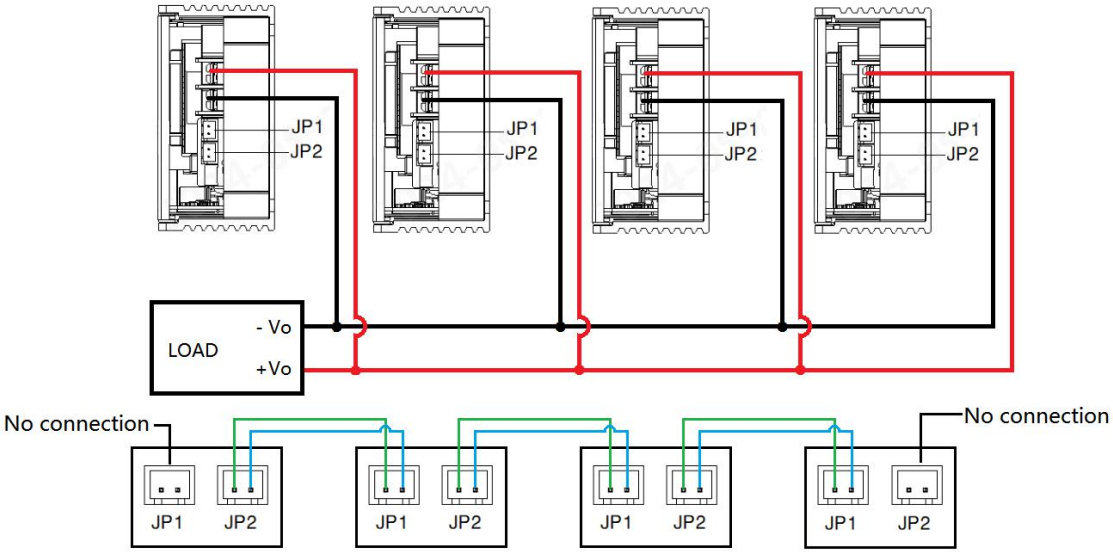
The output of the power module can be connected in parallel to achieve redundancy, thereby improving system reliability. The maximum power of the redundant system needs to be derated to ensure that the redundant system can still meet the rated load requirements when a power module fails. At present, the common practice is to build a redundant system using the N+1 method, that is, N+1 power supplies are connected in parallel. It supports the maximum load current N*Iomax, where Iomax is the rated output current of each power supply, for example, the rated output current of each power supply is 12.5A, and 3+1 are only connected in parallel to build a 3*12.5A=37.5A redundant system.

The power modules support 3+1 parallel redundant operation. When any power module in the parallel connection fails, other power modules can continue to work.

Note: When used in parallel, the maximum load current cannot exceed the maximum output current of a single power module at startup, otherwise the entire parallel power supply system will not be able to start and work normally. Maximum (N+1)*Iomax output can be achieved in parallel if no redundancy is required.

2. Current Sharing

The each power module has a current sharing connection terminal (JP1 and JP2). If the current sharing function is required, the current sharing terminals of all power modules must be connected together when working in parallel. The wiring method of the current sharing function for the 3+1 redundancy system is shown in the figure below:



Note: 1,The JP1 and JP2 ports of each power module have the same function, and there is no sequence.

2,The output voltage of each power module will affect the accuracy of current sharing. In practical applications, if the output voltage value needs to be adjusted, the output voltages of all parallel-connected power modules need to be adjusted to the same voltage. The recommended voltage range is: target voltage value ±50mV.

After the output load of each power module is greater than 50% of the rated load, the current sharing accuracy is required to be ±5%. The formula for calculating the average current is:

$$\text{Current Sharing Accuracy}=\frac{Iomax-Iomin}{Iomax+Iomin}*100\%$$

Iomax: The maximum output current value of the power modules connected in parallel
Iomin: The minimum output current value of the power modules connected in parallel