

## SUN2000P-375 W Smart PV Optimizer

# User Manual

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# About This Document

## Purpose

This document describes the SUN2000P-375 W smart photovoltaic (PV) optimizer (SUN2000P for short) in terms of its functions, electrical properties, and structure.

Figures provided in this document are for reference only.





## Intended Audience


This document is intended for:

- Sales engineers
- Technical support engineers
- Maintenance engineers

## Symbol Conventions

The symbols that may be found in this document are defined as follows.

Symbol	Description
 <b>DANGER</b>	Indicates an imminently hazardous situation which, if not avoided, will result in serious injury or death.
 <b>WARNING</b>	Indicates a potentially hazardous situation which, if not avoided, could result in serious injury or death.
 <b>CAUTION</b>	Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.
 <b>NOTICE</b>	Indicates a potentially hazardous situation which, if not avoided, could result in equipment damage, data loss, performance deterioration, or unanticipated results. NOTICE is used to address practices not related to personal injury.

Symbol	Description
 <b>NOTE</b>	Calls attention to important information, best practices and tips.  NOTE is used to address information not related to personal injury, equipment damage, or environment deterioration.

## Change History

Changes between document issues are cumulative. The latest document issue contains all updates made in previous issues.

### Issue 01 (2017-08-01)

This issue is the first official release.

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# 1 Safety Precautions

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## General Safety

- Follow the precautions and special safety instructions provided by Huawei when operating this product. Personnel who plan to install or maintain Huawei devices must receive a thorough training, understand all necessary safety precautions, and be able to correctly perform all operations. Huawei will not be liable for any consequences that are caused by the violation of general safety regulations and device usage safety standards.
- Before performing operations, read through this manual and follow all the precautions to prevent accidents. The "DANGER", "WARNING", "CAUTION", and "NOTICE" statements in this document do not represent all the safety instructions. They are only supplements to the safety instructions.
- Operation personnel should comply with local laws and regulations. The safety instructions in this document are only supplements to local laws and regulations.
- Do not operate the product or handle cables during thunderstorms.
- Before operating the product, remove any conductors such as jewelry or watches.
- Use insulated tools during operations.
- Bolts should be tightened with a torque wrench and marked using red or blue color. Installation personnel should mark tightened bolts in blue. Quality inspection personnel should confirm if the bolts are tightened and then mark them in red. If screws or bolts used to secure the device are not tightened to the required torque, the device may fall from the mounting bracket.
- Follow specified procedures during installation and maintenance. Do not attempt to alter the device or deviate from the recommended installation procedures without prior consent from the manufacturer.
- Install the product in strict accordance with the quick guide.

## Disclaimer

Huawei shall not be liable for any consequence caused by any of the following events:

- Transportation damage
- The storage conditions do not meet the requirements specified in this document.
- Incorrect installation or use
- Installation or use by unqualified personnel
- Failure to obey the operation instructions and safety precautions in this document

- Operation in extreme environments which are not covered in this document
- The SUN2000P operates beyond specified ranges.
- Unauthorized modifications to the product or software code or removal of the product
- Device damage due to force majeure (such as lightning, fire, and storm)
- The warranty expires and the warranty service is not extended
- Installation or use in environments which are not specified in related international standards

## Personnel Requirements

Only certified electricians are allowed to install, connect cables for, maintain, troubleshoot, and replace the SUN2000P.

- Operation personnel should receive professional training.
- Operation personnel should read through this document and follow all the precautions.
- Operation personnel should be familiar with the safety specifications about the electrical system.
- Operation personnel should understand the composition and working principles of the grid-tied PV power system and local regulations.
- Operation personnel must wear proper personal protective equipment (PPE).

## Protect Labels

- Do not scrawl or damage any warning labels on the SUN2000P because these labels contain important information about safe operation.
- Do not scrawl or damage the nameplate on the back of the SUN2000P because it contains important product information.

## Installation

- Ensure that the SUN2000P is not connected to a power supply or powered on before finishing installation.
- To allow proper heat dissipation and installation, maintain appropriate clearances between the SUN2000P and other objects.

## Electrical Connections



### **DANGER**

Before connecting cables, ensure that the SUN2000P is not damaged in any way. Otherwise, electric shocks or fire may occur.

- 
- Ensure that all electrical connections comply with local electrical standards.
  - Ensure that the cables used in a grid-tied PV system are properly connected and insulated and meet all specification requirements.

## Operation



### **DANGER**

High voltage may cause an electric shock, which results in serious injury, death, or serious property damage from the SUN2000P in operation. Strictly comply with the safety precautions in this document and associated documents when operating the SUN2000P.

- Do not touch an energized SUN2000P because it has a high temperature.
- Follow local laws and regulations when operating the device.

## Maintenance and Replacement



### **DANGER**

High voltage may cause an electric shock, which results in serious injury, death, or serious property damage from the SUN2000P in operation. Therefore, before maintenance, power off the SUN2000P and strictly comply with the safety precautions in this document and associated documents to operate the SUN2000P.

- Maintain the SUN2000P with sufficient knowledge of this document and proper tools and testing devices.
- Temporary warning signs or fences must be placed to prevent unauthorized people from entering the site.
- The SUN2000P can be powered on only after all faults are rectified. Failing to do so may escalate faults or damage the device.
- During the maintenance, observe ESD precautions and wear ESD gloves.

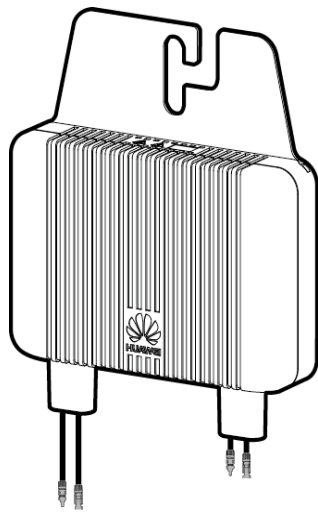


# 2 Overview

## 2.1 Product Overview

The SUN2000P is a DC-DC converter installed on the back of PV modules in a PV system. It tracks the maximum power point (MPP) of each PV module to improve the energy yield of the PV system, and performs the functions of module-level shutdown, module-level monitoring, automatic positioning, I-V curve diagnosis, and escape in case of a fault.

**Figure 2-1** SUN2000P



HV01W00035

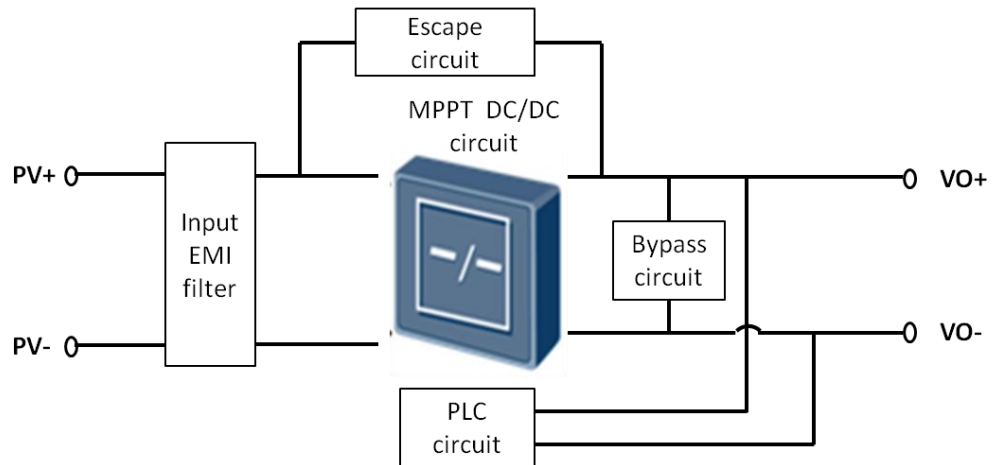
## 2.2 Working Principles

### Conceptual Diagram

The input port of the SUN2000P connects to the PV module. Through a DC/DC circuit, the PV input voltage is converted into a required voltage and the maximum power point tracking (MPPT) function is implemented.

The power line communication (PLC) circuit is used for PLC communication, and the escape circuit enables the SUN2000P to bypass itself due to a fault.

**Figure 2-2** Conceptual diagram



## Functions

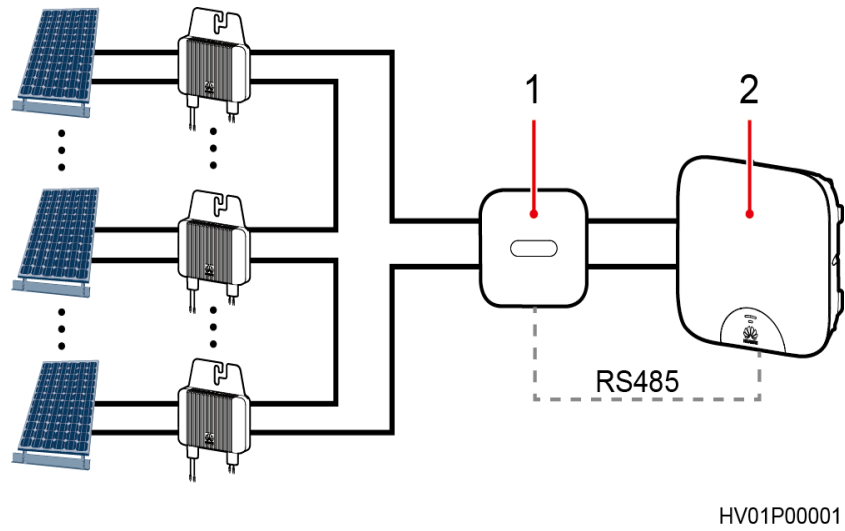
- **Module-level MPPT:** The SUN2000P improves the energy yield of the PV system by continuously tracking the MPP of each PV module.
- **Module-level shutdown:** The SUN2000P cuts off the voltage of each PV module.
- **Module-level monitoring:** The SUN2000P monitors the operating status of each PV module.
- **Automatic positioning and I-V curve diagnosis:** The SUN2000P scans the PV module for I-V curve diagnosis and determines the PV module status by interacting with the automatic positioning function.
- **Escape in case of a fault:** The SUN2000P bypasses itself when detecting an internal fault, so that upstream PV modules can still feed energy to the inverter.

## 2.3 Application Scenarios

Scenario 1: The SUN2000P is mandatory and used for all PV modules. It performs the functions of MPPT, module-level shutdown, module-level monitoring, automatic positioning, and I-V curve diagnosis.

The SUN2000P and inverter communicate with each other over the smart PV safety box.

**Figure 2-3** SUN2000Ps configured for all PV modules

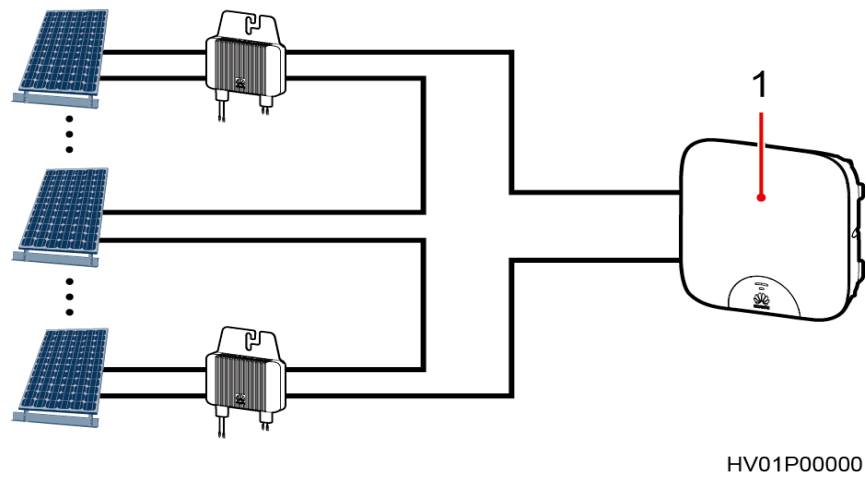


(1) Smart PV safety box

(2) Inverter

Scenario 2: The SUN2000P is optional and used for shaded PV modules. It performs the MPPT function and does not communicate with the inverter.

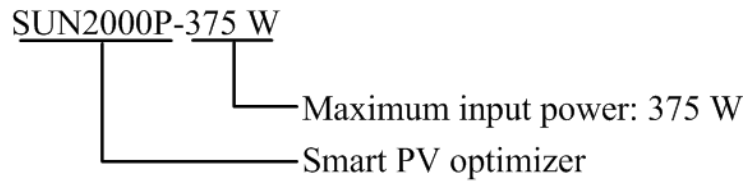
**Figure 2-4** SUN2000Ps configured for shaded PV modules



(1) Inverter

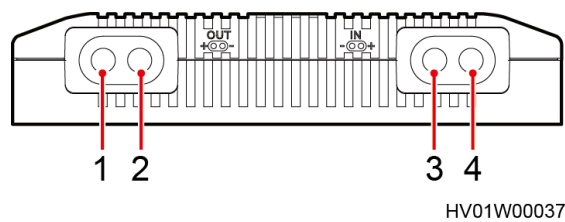
## 2.4 Model Naming Conventions

Figure 2-5 Model naming conventions



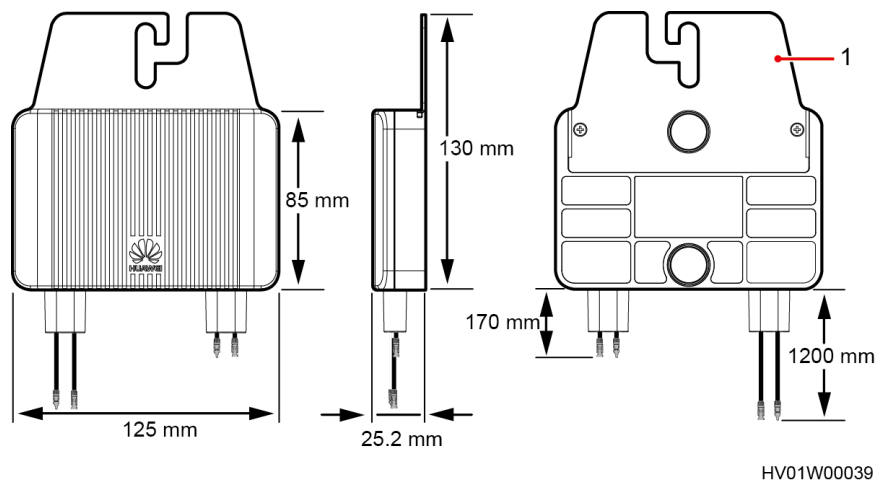
## 2.5 Product Structure

Figure 2-6 Ports



- (1) Output port (positive)
- (2) Output port (negative)
- (3) Input port (negative)
- (4) Input port (positive)

Figure 2-7 Product dimensions



- (1) Mounting ear

# 3 System Maintenance

## 3.1 Troubleshooting

**Table 3-1** Common alarms and troubleshooting measures

Alarm Name	Possible Cause	Measures
PV module abnormal	The PV module output voltage exceeds the SUN2000P maximum input voltage.	Check the PV module and ensure that the PV module output voltage is within the SUN2000P input voltage range.
Device abnormal	An internal error occurs in the SUN2000P.	Contact the installation vendor to rectify the fault.
Overtemperature	The ambient temperature exceeds the upper threshold or the SUN2000P is not installed as required.	Check that the SUN2000P ambient temperature is within the specified range. Check that the SUN2000P installation position meets the requirement in the installation guide.
Short circuit	A short circuit occurs on the output of the SUN2000P.	Check the output and eliminate short circuits.
Communication abnormal	The device communications cable is not properly connected.	Check the device connection.



**NOTE**

Contact the installation vendor if all failure analysis procedures listed above are completed and the fault still exists.

## 3.2 Identifying Faulty Components

If the system is not configured with a smart PV safety box and the SUN2000P fault needs to be identified locally, you can measure the voltage of the SUN2000P output terminal to judge whether the SUN2000P is faulty.

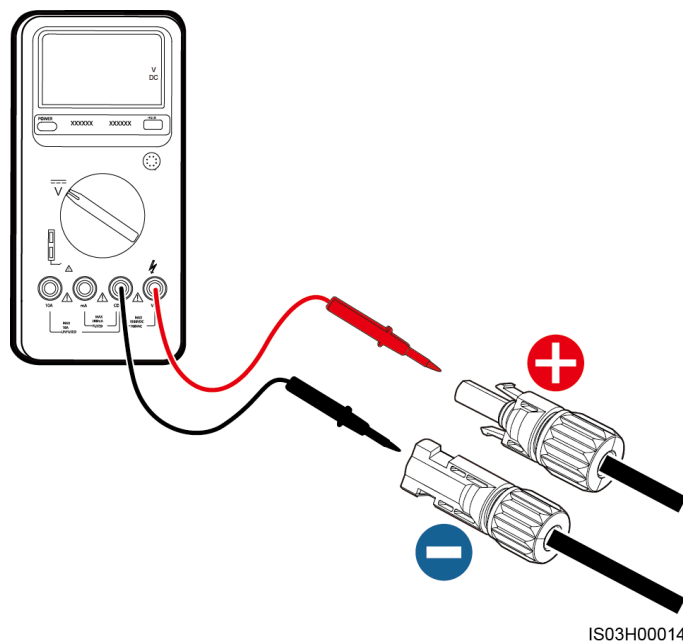
### Prerequisites

- The input power cable properly connects to the SUN2000P and the PV module output parameters are normal.
- Preparations for fault identification: Put on PPE (such as protective gloves) and prepare a multimeter (measurement range: at least 80 V DC) that can be used to measure DC voltage.

### Procedure

- Step 1** Turn off the DC switch on the inverter to power off the inverter.
- Step 2** Disconnect the output power cable from the SUN2000P and measure the output voltage.
- If the output voltage is greater than or equal to 4 V DC, go to step 3.
  - If the output voltage is less than 4 V DC, the SUN2000P is faulty. Replace the SUN2000P.

**Figure 3-1** Measuring the SUN2000P output voltage



- Step 3** Interconnect the positive and negative output terminals of the SUN2000P to short-circuit the output, disconnect the output terminals after 30 seconds, and then measure the voltage of the SUN2000P output terminal using a multimeter within 10 minutes to judge the SUN2000P status.
- If the output voltage is greater than or equal to 4 V DC, the SUN2000P is normal. Reconnect the output power cable to the SUN2000P.

- If the output voltage is less than 4 V DC, the SUN2000P is faulty. Replace the SUN2000P.

**Step 4** Judge the status of other SUN2000Ps in turn by performing steps 2 and 3.

**Step 5** Check that the site environment meets the requirement for inverter power-on, and then turn on the DC switch on the inverter.

----End

## 3.3 Replacing a SUN2000P

### Prerequisites

- The protective gloves and socket wrench are available.
- A new SUN2000P is available.

### Procedure

**Step 1** Put on the protective gloves.

**Step 2** Power off the inverter.

**Step 3** Disconnect the input terminal of the SUN2000P.

**Step 4** Remove the faulty SUN2000P.

1. Record the cable connection positions on the SUN2000P and disconnect the cables.
2. Unscrew the SUN2000P.

**Step 5** Install the new SUN2000P.

1. Secure the new SUN2000P to the appropriate position, and tighten the bolt.
2. Connect the cables to the new SUN2000P based on the recorded information.

**Step 6** Power on the inverter.

**Step 7** Take off the protective gloves.

----End

### Follow-up Procedure

Pack the faulty component and send it to the local Huawei warehouse.

# A Technical Specifications

## A.1 Environmental Specifications

Table A-1 Environmental specifications

Item	Specifications
Operating temperature	-40 °C to +85 °C
Storage temperature	-40 °C to +85 °C
Relative humidity	0%–100% RH
Altitude	0–4000 m (When the altitude ranges from 2000 m to 4000 m, the ambient temperature decreases by 0.7 °C for each additional 100 m.)

## A.2 Electrical Specifications

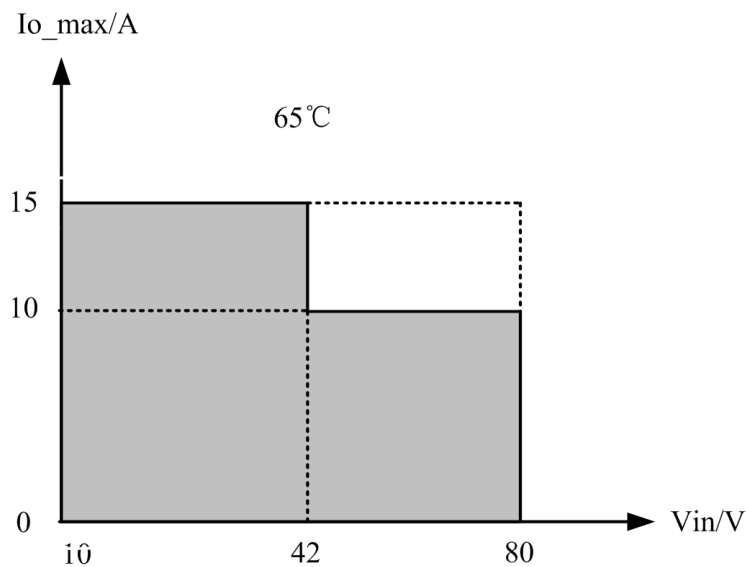
Table A-2 Electrical specifications

Item	Specifications	
DC input	Input voltage	10–80 V DC
	Maximum input current	12 A
	Maximum input power	375 W
DC output	Output voltage range	4–80 V DC
	Maximum output current	15 A (The maximum output current is 10 A by default, and can be set to 15 A over the inverter.)
Efficiency	Maximum efficiency	99.6%

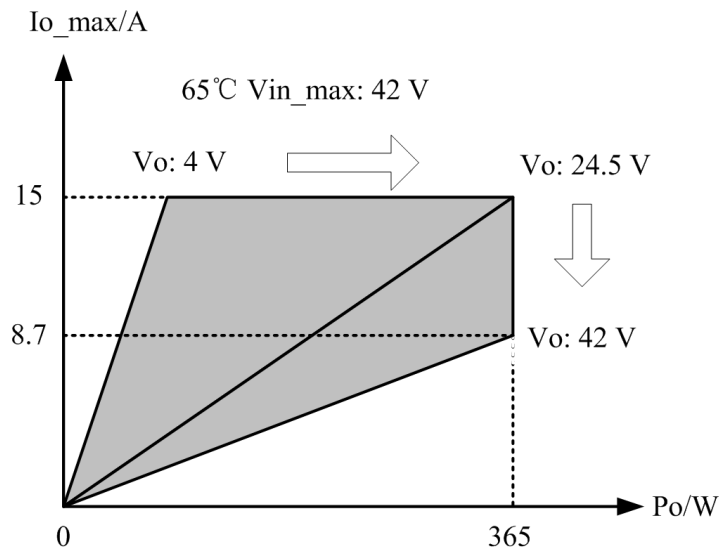


Item	Specifications	
DC input protection	Input overvoltage protection threshold	82–87 V DC
	Input overvoltage recovery threshold	81–86 V DC
	Input undervoltage protection threshold	7–9 V DC
	Input undervoltage recovery threshold	8–10 V DC
DC output protection	Output overvoltage protection threshold	85–90 V DC
	Output overcurrent protection	Supported
Reliability	Mean time between failures (MTBF)	3,000,000 hours (Telcordia SR-332 Method 1)
	Design life	25 years
Ingress Protection Rating	IP68	
Regulatory	Complying with IEC62109-1	

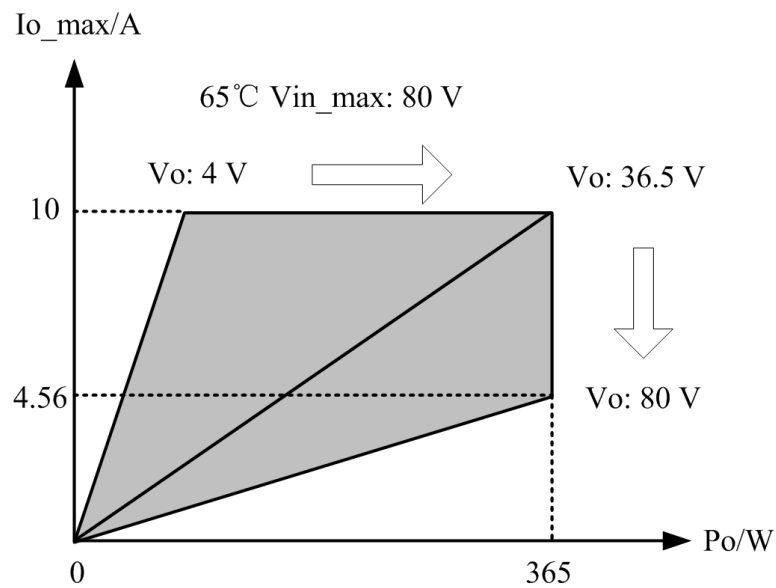
Figure A-1  $I_{o\_max}$ - $V_{in}$  relationship curve (65 °C)



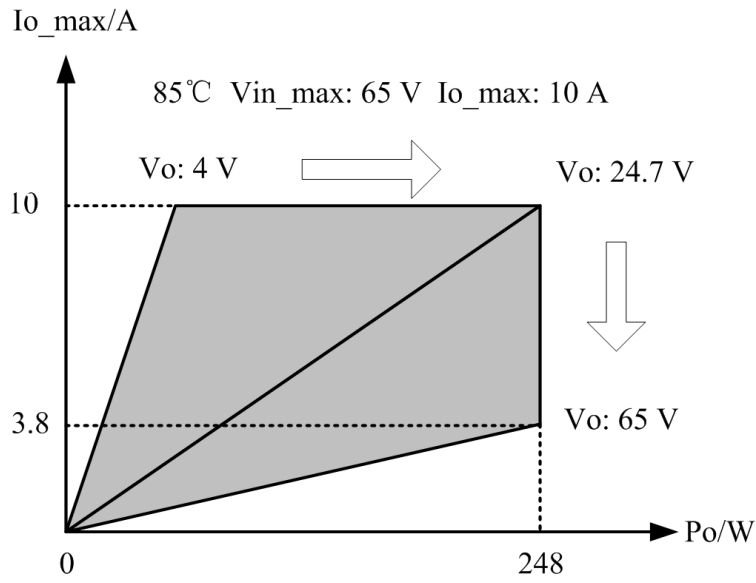
**Figure A-2**  $I_{o\_max}$ - $P_o$  relationship curve (65 °C,  $V_{in\_max} = 42$  V)



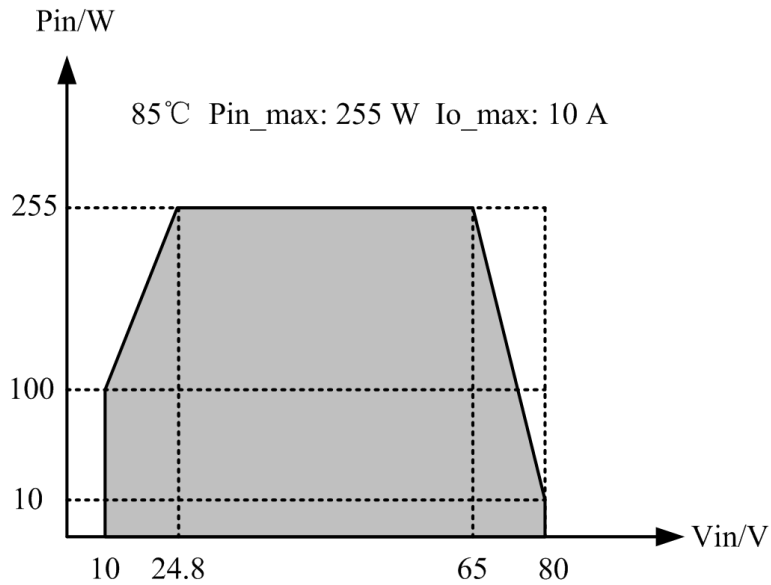
**Figure A-3**  $I_{o\_max}$ - $P_o$  relationship curve (65 °C,  $V_{in\_max} = 80$  V)



**Figure A-4**  $I_{o\_max}$ - $P_o$  relationship curve (85 °C,  $V_{in\_max} = 65$  V,  $I_{o\_max} = 10$  A)



**Figure A-5**  $P_{in}$ - $V_{in}$  relationship curve (85 °C,  $P_{in\_max} = 255$  W,  $I_{o\_max} = 10$  A)



## A.3 EMC Specifications

**Table A-3** EMC specifications

Item	Specifications	
Electromagnetic interference (EMI)	Radiated emission (RE)	Class B, complying with IEC61000-6-3
Electromagnetic susceptibility (EMS)	Electrostatic discharge (ESD)	IEC61000-4-2 Contact discharge: 4 kV, criterion C; air discharge: 8 kV, criterion A
	Electrical fast transient (EFT)	IEC61000-4-4, 2 kV, criterion B
	Radiated susceptibility (RS)	IEC61000-4-3, criterion A 10 V/m field strength
	Conducted susceptibility (CS)	IEC61000-4-6, criterion A Power port: 10 V
	Surge susceptibility (SURGE)	IEC61000-4-5

## A.4 Structure Specifications

**Table A-4** Structure specifications

Item	Specifications
Installation mode	Hung on a PV module support or PV module frame
Dimensions (H x W x D)	85 mm x 125 mm x 25.2 mm ( $\pm 0.5$ mm, excluding the mounting ear and waterproof terminal)
Weight	$\leq 0.7$ kg

# B Acronyms and Abbreviations

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## D

**DC** direct current

## E

**EFT** electrical fast transient

**EMI** electromagnetic interference

**EMS** electromagnetic susceptibility

**ESD** electrostatic discharge

## M

**MPPT** maximum power point tracking

## P

**PLC** power line communication

## R

**RE** radiated emission

**RS** radiated susceptibility