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DATE: Jul.06.2011 APPROVED BY: H.TANIGUCHI <i>H. Taniguchi</i>		ISSUE: Jul.06.2011  PAGE  REPRESENTATIVE DIVISION ENGINEERING DEPARTMENT CRYSTALLINE PV DIVISION

SPECIFICATION FOR  
SOLAR MODULE  
MODEL No. ND-R240A5

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CUSTOMER'S APPROVAL

DATE \_\_\_\_\_

BY \_\_\_\_\_

PRESENTED

BY *H. Taniguchi*  
H.TANIGUCHI

Department General Manager  
Engineering Department



## 1. SCOPE

This document describes the specifications of solar module ND-R240A5.

## 2. APPLICATION STANDARD

This module is designed to meet the requirements of the following standards.

- IEC61215 (ed.2), EN61215:2005-08  
Crystalline silicon terrestrial photovoltaic (PV) modules-Design qualification and type approval
- IEC61730-1(ed.1), EN61730-1:2007-05  
Photovoltaic (PV) module Safety qualification  
Part 1: Requirements for construction
- IEC61730-2(ed.1), EN61730-2:2007-05  
Photovoltaic (PV) module Safety qualification  
Part 2: Requirements for testing  
Crystalline silicon terrestrial photovoltaic (PV) modules-Design

## 3. NORMATIVE REFERENCES

This module is based on the following reference documents. All normative documents are subject to revision and, if necessary, SHARP may apply later edition without any prior notice.

- IEC60904-1:1987  
Photovoltaic Device, Part 1: Measurement of Photovoltaic Current-Voltage Characteristics
- IEC60904-3:1989  
Measurement principles for terrestrial Photovoltaic(PV) solar devices with reference spectrum irradiance data

## 4. SPECIFICATION

### 4.1. Application class and Fire rating

#### 4.1.1 Application class

This module is classified as application class A in accordance with IEC61730(EN61730).

#### 4.1.2 Fire rating

This module is rated as "Fire safety class C" in accordance with IEC61730.

## 4.2. Materials

The materials used for the module shall comply with this specification and unless otherwise specified, shall fully meet the requirement of this specification in all case.

### 4.2.1. Solar photovoltaic cells

Solar photovoltaic cells is made of poly-crystalline silicon.

### 4.2.2. Bus bars (Cell connector and String connector)

Bus bars shall be solder coated copper or solder coated clad alloy with copper.

### 4.2.3. Encapsulation materials

Encapsulation materials shall be transparent EVA (Ethylene Vinyl Acetate) resin.

### 4.2.4. Superstrate glasses

Superstrate glasses shall be low iron tempered glasses, whose minimum thickness is 3mm.

### 4.2.5. Frames

Frames shall be anodized aluminum alloy.

### 4.2.6. Back sheet

Back sheet is a weatherproof film.

### 4.2.7. Junction Box

The termination shall be lead wire system. The main material of the junction box shall be PPE/PPO resin.

### 4.2.8. Bypass diode

The bypass diode shall be installed in the junction box.

## 4.3. Mechanical design

### 4.3.1. General

The module is designed to be suitable for long-term operation under general open-air climates.

### 4.3.2. Interconnection of solar cells

All solar cells shall be interconnected in series using the bus bars described in 4.2.2.

### 4.3.3. Termination

The termination is a lead wire type of 4.0mm<sup>2</sup>. Connector is SMK connector (Model No.CCT9901-2361F,CCT9901-2451F).

### 4.3.4. Mass

The typical mass of module is shown in the data sheet.

### 4.3.5. Dimension

The tolerance of the dimensions of the module is shown in Fig.1 and Fig.2.

## 4.4. Identification and product marking

The nameplate label for identification and product marking is shown in Fig.3.

#### 4.5. Appearance

Following items shall be considered as major visual defects.

- 1) Broken, cracked, or torn external surfaces, including front cover, frames and junction box.
- 2) Bent or misaligned external surfaces, including front cover, frames and junction box to the extent that the installation and/or operation of the module would be impaired.
- 3) A crack propagation in a cell which could spread over/reaches/influence more than 10 % of the cell's area from the electrical circuit of the module.
- 4) Bubbles or delaminations forming a continuous path between any part of the electrical circuit and the edge of the module;
- 5) Loss of mechanical integrity, to the extent that the installation and/or operation of the module would be impaired.

#### 4.6. Performance characteristics

##### 4.6.1. Environmental requirement

###### 4.6.1.1. Operating temperature of solar cells

The operating temperature of solar cells shall be from  $-40^{\circ}\text{C}$  to  $+90^{\circ}\text{C}$ .

###### 4.6.1.2. Storage temperature

The storage temperature of the modules shall be from  $-40^{\circ}\text{C}$  to  $+90^{\circ}\text{C}$ .

###### 4.6.1.3. Storage humidity

The storage humidity of the modules shall be less than 90% of relative humidity.

**NOTE:**

If by any chance the module is to be stored outdoor, put an appropriate cover so it would not be hit by rain directly. Do not store the module in a storage where condensation may occurs.

##### 4.6.2. Electrical performance

###### 4.6.2.1. Electrical output

The electrical characteristics of the module under standard test conditions (irradiance of  $1000\text{W}/\text{m}^2$  with IEC60904-3 reference solar spectral irradiance distribution, AM1.5 spectrum and cell temperature of  $25^{\circ}\text{C}$  ) in accordance with IEC60904-1, shall be in compliance with the data sheet. When the maximum power is 240W, the electrical characteristics (open circuit voltage, voltage at point of maximum power, short circuit current, current at point of maximum power, maximum power) are shown in the data sheet.

###### 4.6.2.2. Insulation

When 6000 V-DC (maximum system voltage: 1000V-DC) is applied to the module by a tester for 1minute, the insulation properties of the module shall not break down.

### 4.6.3. Mechanical performance

#### 4.6.3.1. Withstanding mechanical load

After the module is loaded with 2400Pa in accordance with IEC61215 (mounting methods are shown in the data sheet and installation manual), there shall be no major visual defects of the module(, as described in 4.5. )

#### 4.6.3.2. Withstanding the impact of hailstone

After hail test in accordance with IEC61215, there shall be no major visual defects of the module described in 4.5.

#### 4.6.3.3. Robustness of termination

The termination part of the module passes robustness of terminations test and wet leakage current test in accordance with IEC61215.

## 5. SHIPPING TEST

Each shipping lot shall successfully pass the shipping tests below.

### 5.1. Total inspection

#### 5.1.1. Sampling method

All shipping lot is inspected.

#### 5.1.2. Inspection items

The maximum power (Pmax) is measured in the production line process by flasher data report (power measurement tolerance:  $\pm 3\%$ ).

### 5.2. Sampling inspection

#### 5.2.1. Sampling method

Sampling is conducted by extracting 8 modules randomly from every 500 produced modules.

#### 5.2.2. Inspection items

Sampling inspection consists of: dimension measurement, visual inspection (refer to 4.5), and insulation measurement (refer to 4.6.2.2).

## 6. PREPARATION FOR DELIVERY

### 6.1. The shipping specification

The module is packaged with carton box specifically designed by SHARP.

### 6.2. Identification of serial number

Labels which describe module's serial number are stuck on the front glass and on the name plate label.

## 7. WARNING

Please obey the instructions mentioned below for actual use of this module.

(1) Main applications of the modules as follows.

- Grid-connected PV systems on house roofs or for large scale PV-installations
- Telemeter system(terminal)      •Village electrification      , etc.

- (2) Please take proper steps in order to maintain reliability and safety, in case the module is installed for applications or in areas mentioned below, which require high reliability.
- Snowing area
  - Extremely cold area
  - Area located over water body
  - Strong wind area
  - Continuously inundated / wet area
  - Salt water damage area
  - Small island
  - Desert area
  - Unit which concerns a vehicle's control and safety (air plane, train, automobile, etc.)
  - On the vehicle (air plane, train, automobile, boat, etc.)
  - Traffic signal
  - Road sign
  - Security system
  - Other safety system , etc .
- (3) Please do not use the module for applications mentioned below, which require extremely high reliability.
- Space equipment
  - Telecommunication system (trunk)
  - Nuclear control system
  - Medical system (relating to any fatal element) , etc.
- (4) Please do not connect the modules directly to the loads such as motor since the variation of the output power depending on the solar irradiation causes the damage for the connected motor.
- 1: In case of brush-less motor, the lock function gets active and the hall IC is most likely to be damaged.
  - 2: In case of the motor with brush, the coil is most likely to be damaged.

## 8. OTHERS

- 1) This module uses anti-reflective coating glass. Small color variation may appear on the individual module, however will not cause any impacts on output power and/or quality of module.
- 2) Please refer to installation manual for instructions and precautions regarding Handling, Installation and Operation of the module.
- 3) Any query about this specification should be resolved in good faith and mutual understanding of all concerned parties.

SHARP	No	NAME	PIECES	MATERIALS	9	Electric Output Cable	2	CE 4.0mm <sup>2</sup> , L=900±50mm
	1	Bus Bar		Cu or Clad Metal with Copper	10	Connector		SMK Co. : No. CCT9901-2361F(-) CCT9901-2451F(+)
	2	Frame	4	Al(Silver Color)				
	3	Solar Cell	60	Si(Dark Blue Color Group)	11	Screw	10	Stainless Steel
	4	Junction Box	1	PPE/PPD	12	Support Bar	1	Al(Silver Color)
	5	Superstrate Glass	1	Low Iron Tempered Glass	13	Cushion		EPDM
	6	Encapsulation Material		EVA	14	Serial Number label	1	Label
	7	Back Sheet		Weather-proof Film	15	Name plate label	1	Label
8	Side Seal		Rubber					

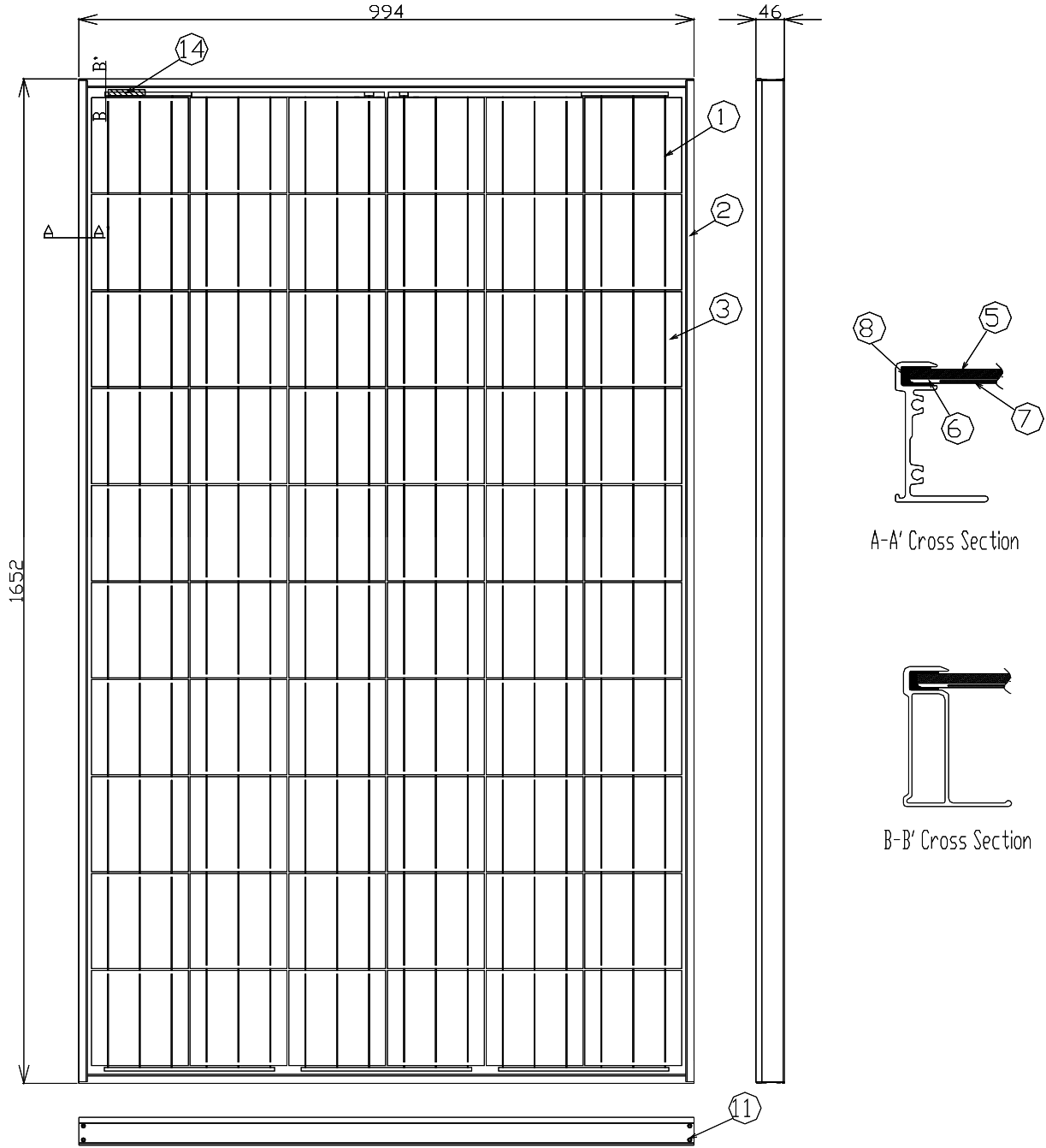


Fig.1

Permissible deviations in dimensions without tolerance indication is shown in Table A.

Table A

Dimension ; L	Permissible Deviation	Dimension ; L	Permissible Deviation
0.5 ≤ L ≤ 3	± 0.2	120 < L ≤ 400	± 1.2
3 < L ≤ 6	± 0.3	400 < L ≤ 1000	± 2
6 < L ≤ 30	± 0.5	1000 < L ≤ 2000	± 3
30 < L ≤ 120	± 0.8	2000 < L ≤ 4000	± 4

Fig.1 Front View (ND-R240A5)

3G60SK10F-110509

SHARP	No	NAME	PIECES	MATERIALS	9	Electric Output Cable	2	CE 4.0mm <sup>2</sup> , L=900±50mm
	1	Bus Bar		Cu or Clad Metal with Copper	10	Connector		SMK Co. : No. CCT9901-2361F(-) CCT9901-2451F(+)
	2	Frame	4	Al(Silver Color)				
	3	Solar Cell	60	Si(Dark Blue Color Group)	11	Screw	10	Stainless Steel
	4	Junction Box	1	PPE/PPD	12	Support Bar	1	Al(Silver Color)
	5	Superstrate Glass	1	Low Iron Tempered Glass	13	Cushion		EPDM
	6	Encapsulation Material		EVA	14	Serial Number label	1	Label
	7	Back Sheet		Weather-proof Film	15	Name plate label	1	Label
8	Side Seal		Rubber					

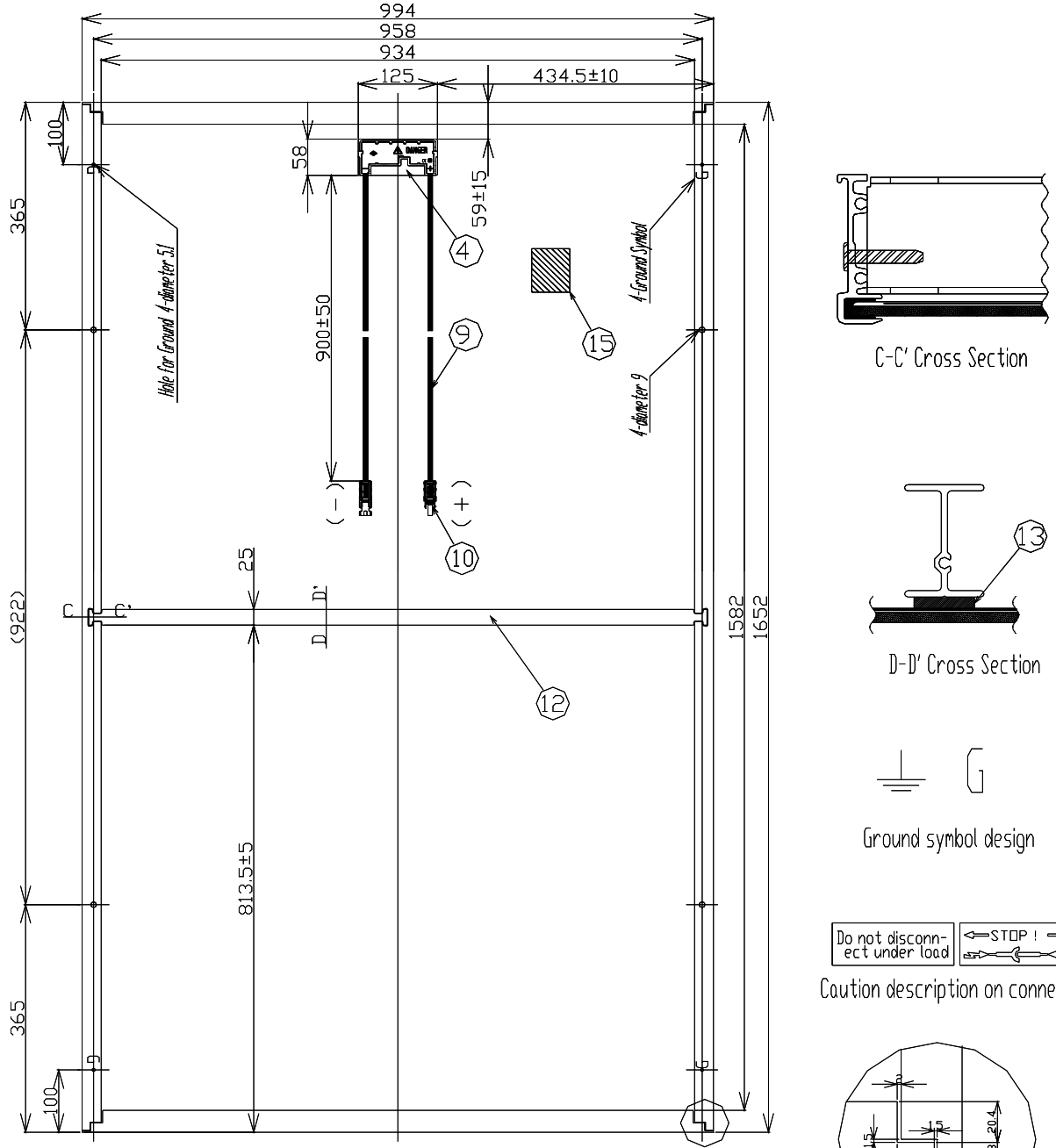


Fig.2

Permissible deviations in dimensions without tolerance indication is shown in Table A.

Dimension ; L	Permissible Deviation	Dimension ; L	Permissible Deviation
0.5 ≤ L ≤ 3	± 0.2	120 < L ≤ 400	± 1.2
3 < L ≤ 6	± 0.3	400 < L ≤ 1000	± 2
6 < L ≤ 30	± 0.5	1000 < L ≤ 2000	± 3
30 < L ≤ 120	± 0.8	2000 < L ≤ 4000	± 4

Fig.2 Back View (ND-R240A5)

3G60SK10B-110509








<b>SHARP SOLAR MODULE</b>				
<b>ND-R240A5</b>				
				
<b>NOMINAL RATINGS:</b>				
MAXIMUM POWER (+5%/-0%)	(Pmax)	240W		
OPEN-CIRCUIT VOLTAGE	(Voc)	37.2V		
SHORT-CIRCUIT CURRENT	(Isc)	8.57A		
VOLTAGE AT POINT OF MAXIMUM POWER (Vmpp)		30.4V		
CURRENT AT POINT OF MAXIMUM POWER (Impp)		7.90A		
MAXIMUM SYSTEM VOLTAGE		1000V		
OVER-CURRENT PROTECTION		15A		
(IRRADIANCE OF 1000W/m <sup>2</sup> , AM1.5 SPECTRUM AND CELL TEMPERATURE OF 25°C)				
<b>APPLICATION CLASS</b>		<b>A</b>		
				
<b>Ser. No.</b>				
				
caution Potential electrical hazard				

Fig.3 Name plate label for identification and product marking

《APPENDED I》

Data Sheet

## I -1. SCOPE

This data sheet describes the standard information (not guaranteed items) except specifications for the detail design and work. Users shall consider the other information.

## I -2. MECHANICAL CHARACTERISTICS

Solar photovoltaic cell type	156.5mm square, poly crystalline silicon
Frame material	Anodized aluminum alloy (Color: Silver)
Superstrate glasses material	Low iron tempered glasses
Encapsulation material	EVA(Ethylene Vinyl Acetate) resin
Back sheet material	weatherproof films.
Dimension	Length: 1652mm Width: 994mm Depth: 46mm
Weight	19.0kg
Solar photovoltaic cell strings	60 in series (6 strings)
Junction box	Length: 58mm Width: 125mm Depth: 15mm Material:PPE/PPO resin IP-rating 65 (at live parts with the silicone potting)
Bypass Diode	The three bypass diodes shall be installed in the terminal box.
Cable	CE cable 4.0mm sq. / Length 900mm DC1000V, -40°C~110°C
Connector	SMK CCT9901-2361F/2451F (Catalog No. P51-7H/R51-7) IP-rating 67

## I -3. ELECTRICAL OUTPUT AND THERMAL CHARACTERISTICS

Rated electrical characteristics are within  $\pm 10$  percent of the indicated values of  $I_{sc}$ ,  $V_{oc}$ , and  $+5/-0$  percent of  $P_{max}$  (power measurement tolerance:  $\pm 3\%$ ), under STC (standard test conditions) (irradiance of  $1000W/m^2$ , AM 1.5 spectrum, and a cell temperature of  $25^\circ C$  ( $77^\circ F$ )). The warranty conditions are specified elsewhere in the specification.

Table I -1. Electrical characteristics (at STC:ND-R240A5)

Characteristic	TYP	(Max.)	(Min.)	Unit
Maximum Power (Pmax)	240.0	252.0	240.0	W
Open-Circuit Voltage (Voc)	37.2	40.9	33.5	V
Short-Circuit Current (Isc)	8.57	9.42	7.72	A
Voltage at Point of Maximum Power (Vmpp)	30.4	—	—	V
Current at Point of Maximum Power (Impp)	7.90	—	—	A
Maximum System Voltage	1000			V
Over-Current Protection	15			A
Application Class	A			
Fire Rating	C			
Temperature Coefficient of Pmax	-0.440			%/°C
Temperature Coefficient of Voc	-0.329			%/°C
Temperature Coefficient of Isc	0.038			%/°C

Above electrical characteristics (Pmax,Voc, Isc,Vmpp,Imp) are based on the result of the production line test. Each module have individual characteristics and the value might be different from the rated electrical characteristics described in the name plate label. There electrical characteristic of the module under not standard test condition is shown in the following.

- (1) Fig. I -1: Open circuit voltage Voc, short circuit current Isc, versus Irradiance characteristics.
- (2) Fig. I -2 Current , Power , versus. Voltage Characteristics

Table I-2. Electrical characteristics (at low irradiance condition)

	200W/m <sup>2</sup>	400W/m <sup>2</sup>	600W/m <sup>2</sup>	800W/m <sup>2</sup>	1000W/m <sup>2</sup>
Voc[V]	34.43	35.21	36.00	36.79	37.20
Isc[A]	1.73	3.44	5.15	6.86	8.57
Vpm[V]	29.16	29.57	29.99	30.40	30.40
Ipm[A]	1.56	3.15	4.73	6.32	7.90
Pmax[W]	45.52	94.33	143.14	191.95	240.00
Efficiency[%]	13.9	14.4	14.5	14.6	14.6

Above values are calculated based on measurements on some modules.

**NOTE:**

Under normal conditions, a photovoltaic module is likely to produce more current and/or voltage than reported at Standard Test Conditions. Accordingly, the values of Isc and Voc marked on this module should be multiplied by a factor of 1.25 in accordance with IEC-61730 when determining component voltage ratings, conductor capacities, fuse sizes and size of controls connected to the module output.

Table I -2. Electrical characteristics (at NOCT:ND-R240A5)

Maximum Power	(Pmax)	173.0	W
Open-Circuit Voltage	(Voc)	36.4	V
Short-Circuit Current	(Isc)	6.92	A
Voltage at Point of Maximum Power	(Vmpp)	27.2	V
Nominal Operating Cell Temperature	(NOCT)	47.5	°C

NOCT: Module operation temperature at 800W/m<sup>2</sup> irradiance in the plane of module, air temperature 20°C, wind speed of 1m/s and under open circuit

**MODEL No. ND-R240A5**  
(Cell Temperature : 25°C)

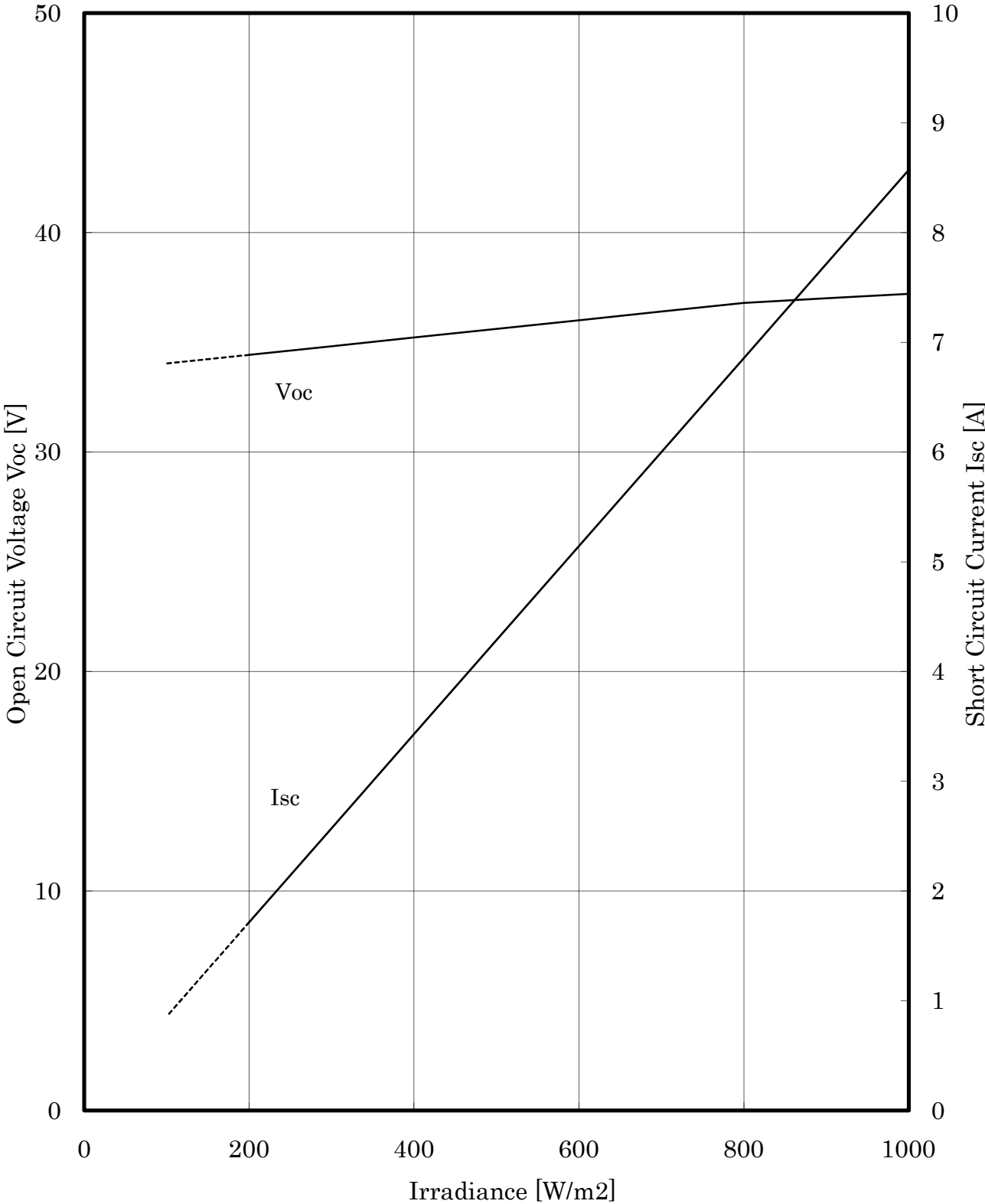


Fig. I -1: Open circuit voltage Voc, short circuit current Isc, versus Irradiance characteristics.

**MODEL No. ND-R240A5**  
(Cell Temperature : 25°C)

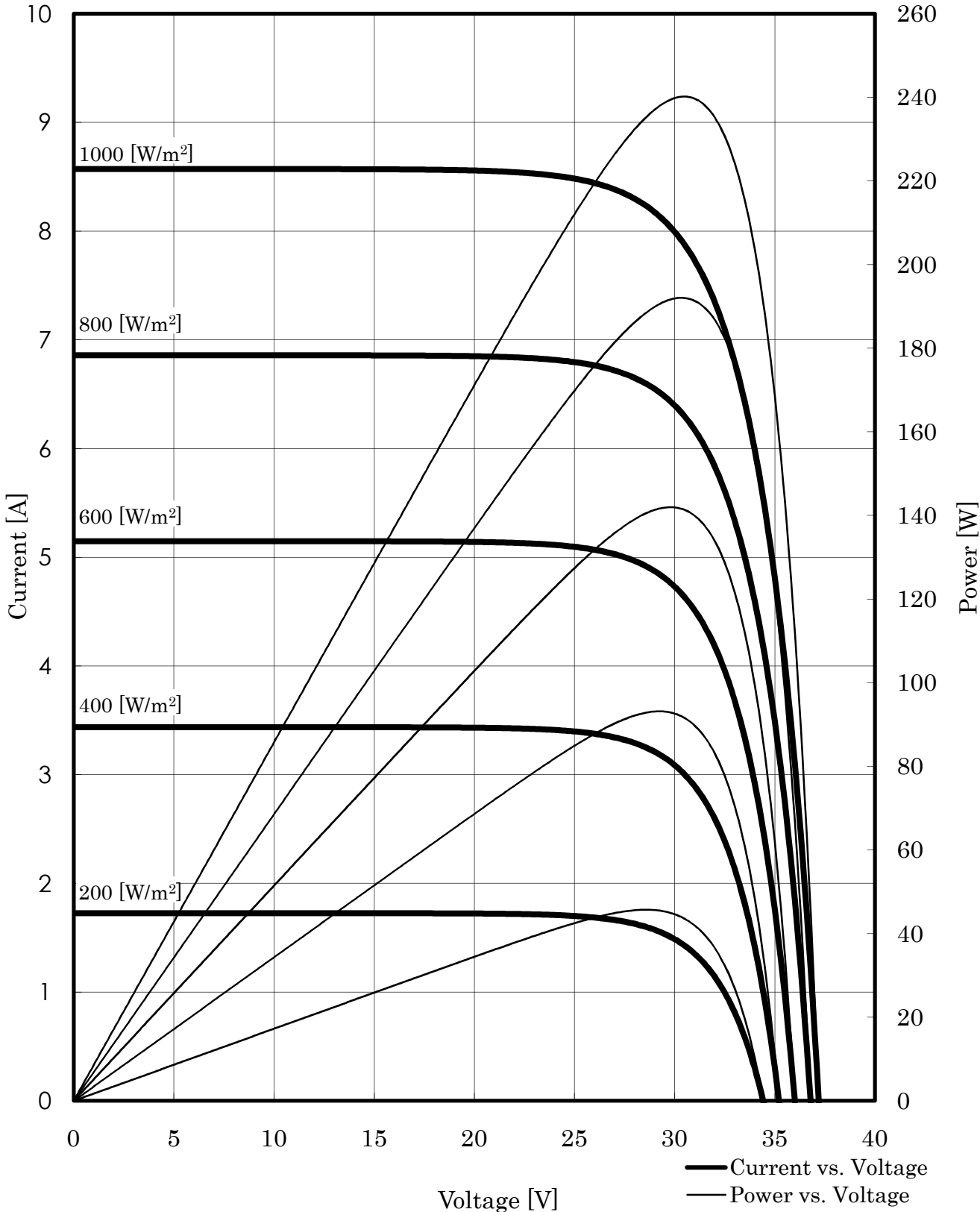


Fig. I -2 Current , Power , versus. Voltage Characteristics