

PREPARED BY: DATE K. KATOHNO Aug 8 .2003 <i>K. Katohno</i>	SHARP SHARP CORPORATION 282-1 HAJIKAMI, SHINJO-CHO, KITAKATSURAGI-GUN, NARA, 639-2198, JAPAN	SPEC No. TG4959
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	SPECIFICATION	REPRESENTATIVE DIVISION ENGINEERING DEPT. II SOLAR SYSTEMS DIV.

SPECIFICATION FOR
SOLAR MODULE

MODEL No. NT-S5E3E

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2. Please obey the instructions mentioned below for actual use of this module.
 - (1) Main applications of the modules as follows.

Telemeter system, Microwave repeater station, Other telecommunication system (Terminal), Village electrification, Monument, Toy, etc.

 - (2) Please take proper steps in order to maintain reliability and safety, in case this module is used for the uses mentioned below which require high reliability.

Unit concerning control and safety of a vehicle (air plane, train, automobile, etc.), Traffic signal, Road sign, Security system, Other safety system, etc.

 - (3) Please don't use for the uses mentioned below which required extremely high reliability.

Space equipment, Telecommunication system (Trunk), Nuclear control system, Medical system (relating to any fatal element), etc.

CUSTOMER'S APPROVAL

DATE _____

BY _____

PRESENTED

BY *H. Yoshioka*

H. YOSHIOKA

Department General Manager

Engineering Dept. II

1. SCOPE

This document describes the specifications of solar module NT-S5E3E.

2. NORMATIVE REFERENCES

The following normative documents contain provisions which, through reference in this text, constitute provisions of this specifications. At the time of publication, the editions indicated were valid. All normative documents are subject to revision, and parties to agreements based on this specifications are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below.

- IEC 1215 Crystalline silicon terrestrial photovoltaic (PV) modules—Design qualification and type approval
- IEC 904-1 Photovoltaic Device, Part1:Measurement of Photovoltaic Current—Voltage Characteristics
- IEC 904-3 Measurement principles for terrestrial photovoltaic(PV) solar devices with reference spectral irradiance data
- SS-S(SHARP Standard—Solar)Inspection 1000 Reference Photovoltaic Module Rule
- TMSSE03463 SOLAR MODULE (Front View) NT-S5E3E
(Provided as Fig. 1)
- TMSSE03464 SOLAR MODULE (Back View) NT-S5E3E
(Provided as Fig. 2)

3. REQUIREMENTS

3.1 Materials

Modules shall consist of the materials provided in this specifications. The materials not provided shall be consisted by modules which shall be satisfied with performance requirements.

3.1.1 Solar cells

Solar cells shall be produced from single crystalline silicon.

3.1.2 Interconnectors

Interconnectors shall be solder coated copper or solder coated Cu-Invar-Cu.

3.1.3 Filling materials

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

3.1.4 Front cover

Front cover shall be low iron tempered glasses with not less than 3mm thickness.

3.1.5 Frames

Frames shall be aluminum alloy.

3.1.6 Back cover

Back cover shall be resistant films for weather.

3.1.7 Terminal box

The termination shall be lead wire system. The main material of the terminal box shall be Xyron 540Z resin.

3.1.8 Bypass diode

The bypass diode shall be installed in the terminal box.

3.2 Mechanical design

3.2.1 General

The design of module is suitable for long-term operation in general open-air climates.

3.2.2 Interconnection of solar cells

The all solar cells shall be interconnected in serial using the interconnectors described in 3.1.2.

3.2.3 Termination

The termination shall be lead wire type. Connector is Multi Contact connector (Model No. PV-KBT3 II, PV-KST3 II).

3.2.4 Mass

The typical mass of modules is shown in the appended data sheet.

3.2.5 Dimension

The permissible deviation in dimension of modules is shown in Fig. 1 and Fig. 2.

3.3 Identification and product marking

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

3.4 Appearance

The following shall be considered to be major visual defects:

- 1) broken or cracked windows;
- 2) a crack in a cell whose propagation could remove more than 10% of that cell's area from the electrical circuit of the modules;
- 3) bubbles or delamination forming a continuous path between any part of the electrical circuit and the edge of the module;
- 4) loss of mechanical integrity, to the extent that the installation and/or operation of the module would be impaired.

3.5 Performance characteristics

3.5.1 Environmental requirement

3.5.1.1 Storage temperature

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

3.5.1.2 Operating temperature of solar cells

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

3.5.1.3 Storage humidity

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

3. 5. 2 Electrical performance

3. 5. 2. 1 Electrical output

The electrical characteristics of the module under standard test conditions (irradiance of 1000W/m² with IEC904-3 reference solar spectral irradiance distribution, AM1.5 spectrum and cell temperature of 25°C) in accordance with IEC904-1, shall be in compliance with the following table. When the maximum power is 185 W, the electrical characteristics (open circuit voltage, maximum power voltage, short circuit current, maximum power current, maximum power) are shown in the appended data sheet. Detail procedure of measurement shall be done in accordance with SS-S Inspection 1000.

Table. electrical characteristics

Characteristic	Symbol	Min.	Unit
Maximun power	Pm	175. 8	W

The above electical characteristics are based on the result of the production line test.

3. 5. 2. 2 Insulation

When the module shall be applied 3000V-DC (maximum system voltage: 1000V-DC) by the tester during 1min, the module shall not break down regarding the insulation.

3. 5. 3 Mechanical performance

3. 5. 3. 1 Withstanding mechanical load

After the front of the module shall be loaded with 2400Pa, there shall be no major visual defects of the module described in 3. 4.

3. 5. 3. 2 Withstanding twist

After the module shall be presented the twist described in IEC 1215, there shall be no major visual defects of the module described in 3. 4.

3. 5. 3. 3 Withstanding the impact of hailstone

After a steel ball having a mass of 227±2g, a diameter of about 38mm and smooth surface shall be dropped from a height of 1m, without applying any force, on the center of the front cover, there shall be no the major visual defects of the module described in 3. 4.

3. 5. 3. 4 Robustness of termination

The termination of the module have enough strength against external forces described in IEC1215.

4. SHIPPING TEST

Each shipping lot shall successfully pass shipping test.

4.1 Sample size and rejection

Sample size and rejection shall be in compliance with LTPD 30 per test lot.

4.2 Test items

Test items shall be the dimension, the appearance and the maximum power (P_m).

5. PREPARATION FOR DELIVERY

The shipping container specification is shown in Fig. 4 and Fig. 5.

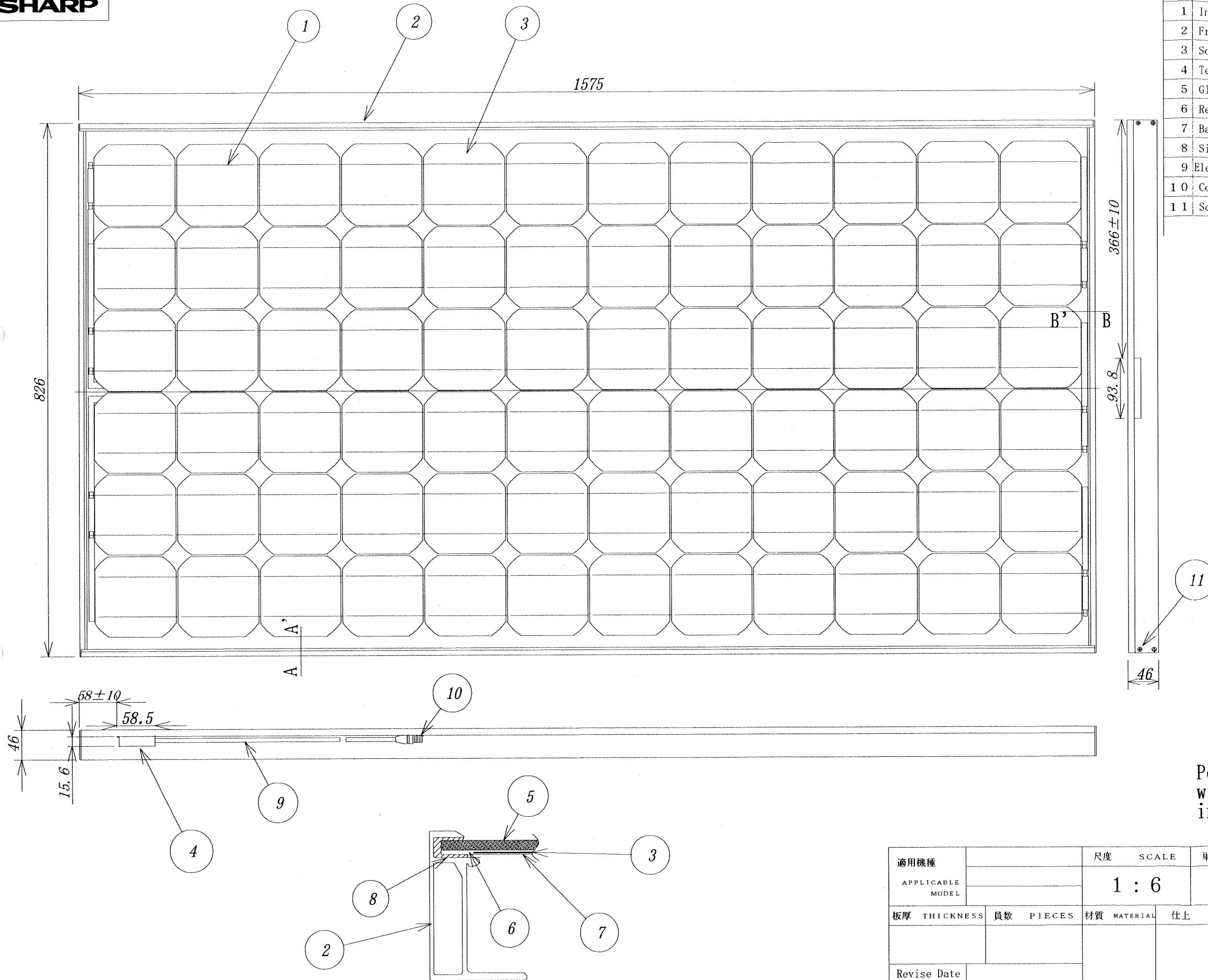
6. WARNING

The items regarding the warning are shown in the appended data sheet.

7. OTHERS

Any doubt as to this specification shall be determined in good faith upon mutual consultation of the both parties.

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No	N A M E	PIECES	M A T E R I A L S
1	Inter-Connector		Cu or Cu/Invar/Cu
2	Frame	4	AL
3	Solar Cell	72	Si(Black Color group)
4	Terminal Box	1	Xyron 540Z
5	Glass	1	Low Iron tempered glass
6	Resin		EVA
7	Back Cover		Weatherproof Film
8	Side Seal		Rubber
9	Electric Output cable	2	4.0mm ² , l=900mm±50mm
10	Connector		TPE(Thermoplastic elastomer)
11	Screw	8	Stainless Steel (flat type)

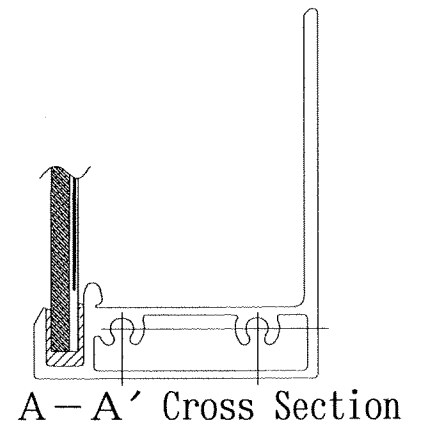


Table A

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

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

B - B' Cross Section

Fig.1

適用機種 APPLICABLE MODEL	尺度 SCALE 1 : 6	単位 UNIT mm	改訂日 DATE 03.08.08	改訂記事 REVISE First Issue	担当 CHARGE K. Katohno
板厚 THICKNESS	員数 PIECES	材質 MATERIAL	仕上 FINISH	名称 NAME Solar Module (Front View)	NT-S5E3E
設計 DESIGN	製図 DRAW	検図 CHECK	検図 CHECK	承認 APPROVE	コード CODE
SOLAR SYSTEMS DIVISION			図番 DRAWING NO. TMSSE03463		
SOLAR SYSTEMS GROUP			SHARP CORPORATION		

SHARP

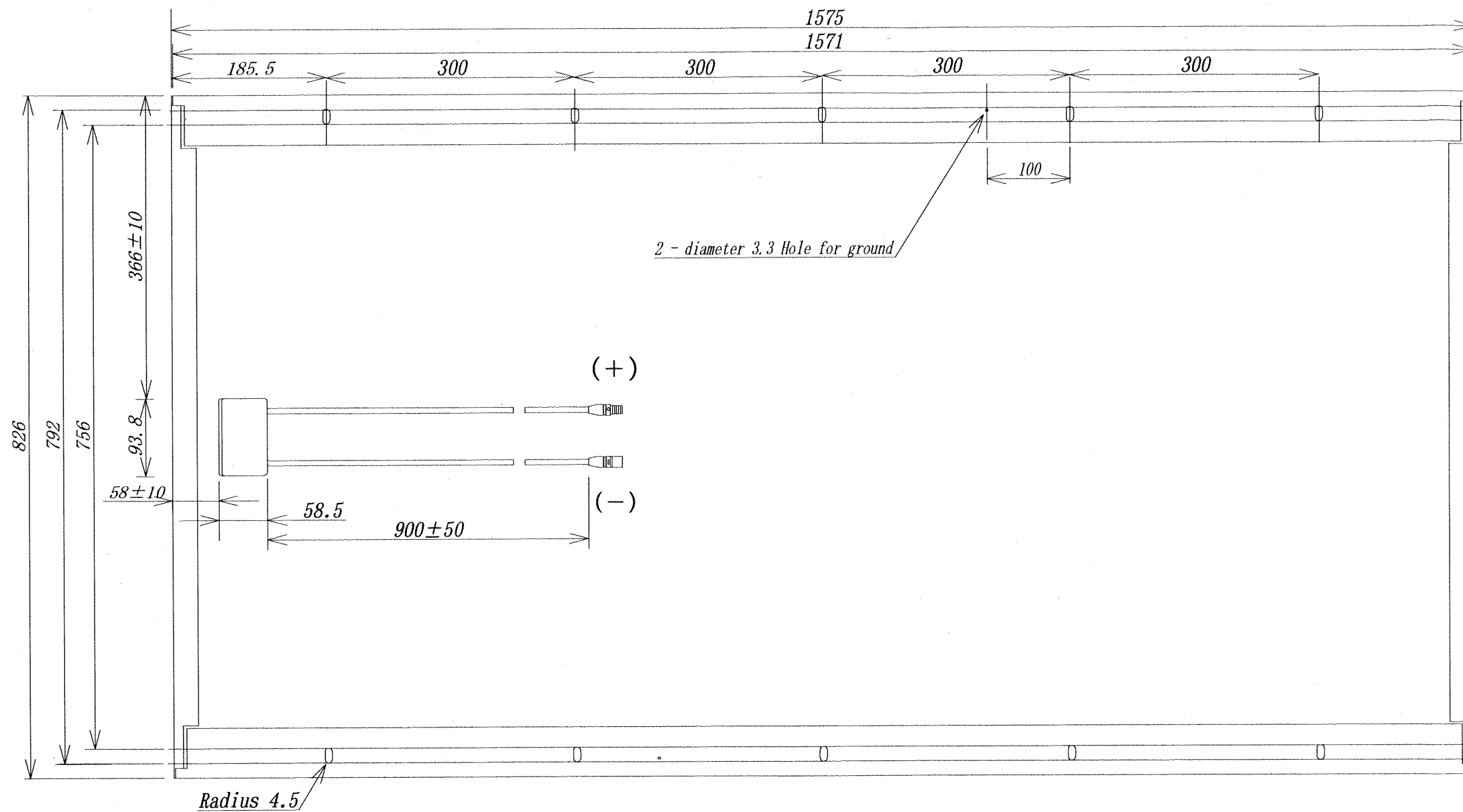


Table A

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

Permissible deviations in dimensions without tolerance indication is shown in table A

適用機種 APPLICABLE MODEL		尺度 SCALE	単位 UNIT	△	03.08.08	First Issue	K. Katohno
		1 : 6	mm		改訂日 DATE	改訂記事 REVISE	担当 CHARGE
板厚 THICKNESS	員数 PIECES	材質 MATERIAL	仕上 FINISH		名称 NAME	Solar Module (Back View)	
					コード CODE	NT-S5E3E	
設計 DESIGN	製図 DRAW	検閲 CHECK	検閲 CHECK	承認 APPROVE	図番 DRAWING No.	TMSSE03464	
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Fig.2


 SHARP SOLAR MODULE NT-S5E3E		
NOMINAL RATINGS:		
MAXIMUM POWER	(Pmax)	185.0W
OPEN CIRCUIT VOLTAGE	(Voc)	44.9V
SHORT CIRCUIT CURRENT	(Isc)	5.60A
MAXIMUM POWER VOLTAGE	(Vpm)	36.21V
MAXIMUM POWER CURRENT	(Ipm)	5.11A
MAXIMUM SYSTEM VOLTAGE		1000V
(IRRADIANCE OF 1000W/m ² , AM1.5 SPECTRUM AND CELL TEMPERATURE OF 25°C)		
Ser. No.		
MADE IN JAPAN		

Fig. 3

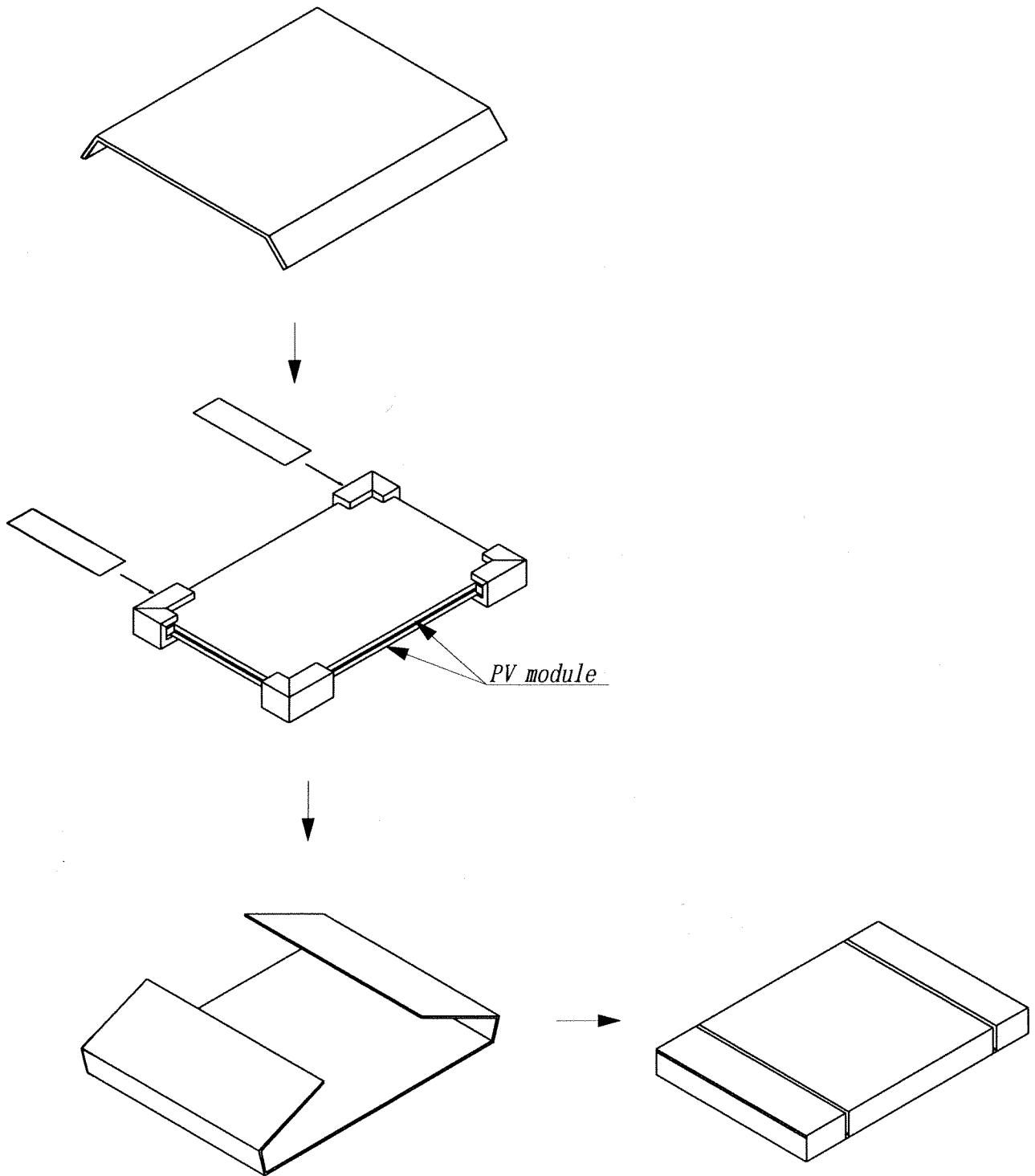


Fig.4

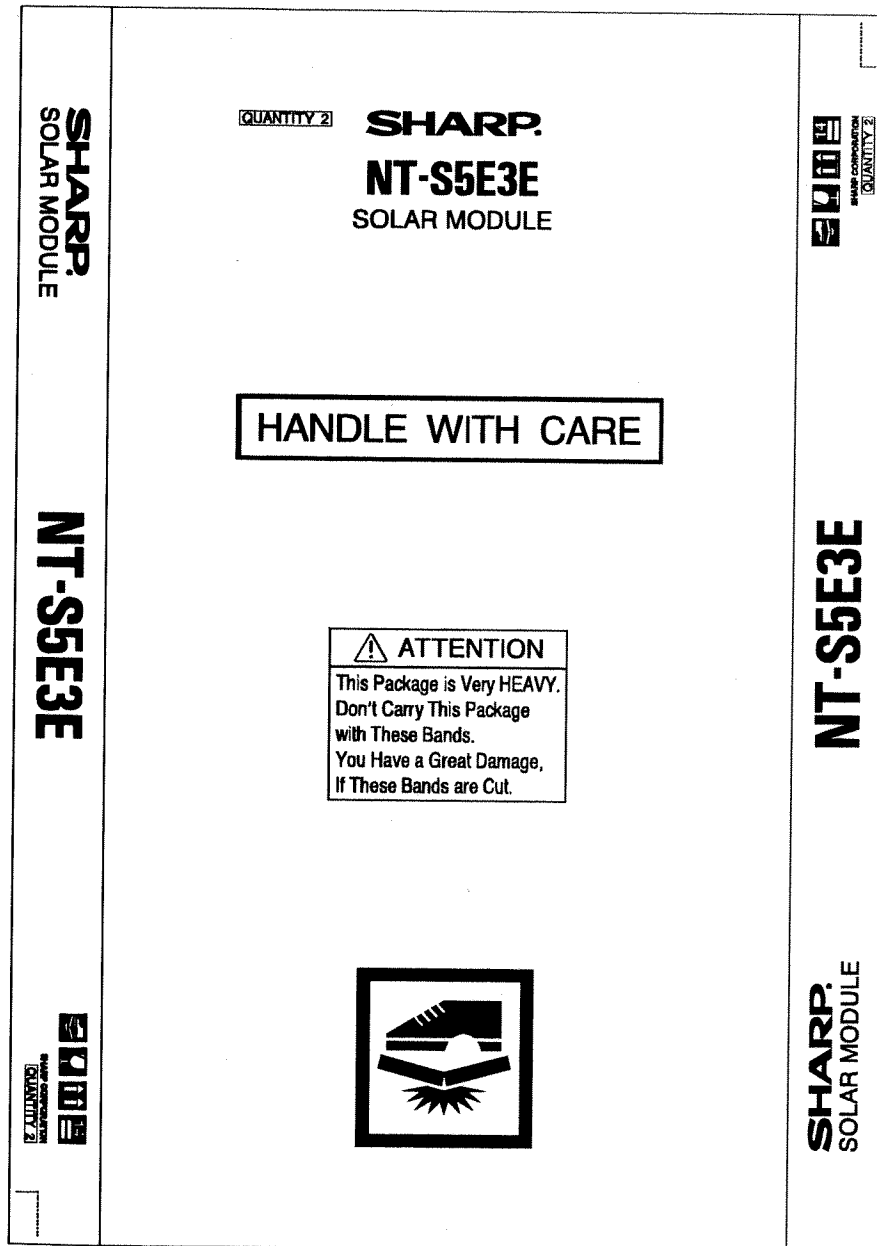


Fig.5

《APPENDED 1》

Data Sheet

I-1. SCOPE

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

I-2. MASS

The typical mass of the module is 17.0 kg.

I-3. ELECTRICAL OUTPUT

When the maximum power is 185.0 W, the electrical characteristics of the module under standard test conditions is shown in the following table.

Table. electrical characteristics

Characteristics	symbol	@185.0 W	Unit
Open circuit voltage	Voc	44.9	V
Maximum power voltage	Vpm	36.21	V
Short circuit current	Isc	5.60	A
Maximum power current	Ipm	5.11	A
Maximum power	Pm	185.0	W

The above electrical characteristics are based on the result of the production line test. These electrical characteristics are different from the rated electrical characteristics described in the name plate label. There electrical characteristics of the module under not standard test condition is shown in the following.

- (1). Fig. I-1: Characteristics regarding Open circuit voltage and short circuit current versus Irradiance
- (2). Fig. I-2: Characteristics regarding Current and Power versus Voltage per Irradiance
- (3). Fig. I-3: Normalized characteristics regarding Open circuit voltage, Short circuit current and Maximum power versus Cell temperature

I-4. WARNING

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

I-4.1 Use

(1) Main applications of the modules as follows.

- Telemeter system
- Microwave repeater station
- Other telecommunication system(Terminal)
- Village electrification
- Monument
- Toy etc.

(2). Please take proper steps in order to maintain reliability and safety, in case this module is used for the uses or in areas mentioned below which require high reliability.

- Fallen snow area • Extremely cold area • Strong wind area
- Over water • Always poured water area
- Salt water damage area • Small island • Desert area
- Unit concerning control and safety of a vehicle (air plane, train, automobile etc.)
- Traffic signal • Road sign
- Security system • Other safety system etc

(3). Please don't use for the uses mentioned below which require extremely high reliability.

- Space equipment • Telecommunication system(Trunk)
- Nuclear control system • Medical system (relating to any fatal element) etc.

I-4. 2 Handling

(1). Never touch the output terminals with bare hands when the module is irradiated. Cover the surface of the module by sufficiently thick cloth or something suitable to prevent incident light, and handle the output terminals with rubber-gloved hands not to receive the electric shock.

(2). Do not drop tools or hard things on the front cover of the module. When broken the front cover of the module, never use the module.

(3). Do not scratch the back cover by hard things.

Do not wear a metallic jewelry which may become cause of the electric shock during installation.

I-4. 3 Installation

(1). When mounting the module on structure, keep the displacement of the forth corner of the module smaller than 2mm for 1000mm of the diagonal of the module after other 3 corners are placed on structure.

(2). Be careful in handling polarity of insulated output wires.

(3). Install modules and ground frames (support structure)in accordance with applicable law of each country.

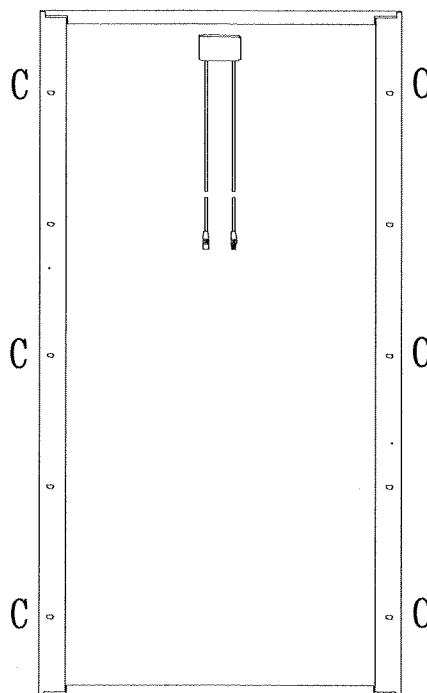
(4). Consult the government office before the installation of the modules in case that the permission of the installation is required by law.

(5). The modules shall be installed and maintained by qualified personnel.

(6). Follow safety precautions of the battery manufacture if batteries are used with modules.

(7). Consult manufacturer for proper installation on special vehicles such as boats and campers.

- (8). Module shall be fastened with 6 C-holes with M8-bolts for withstanding load 2400 Pa.



I-4.4 Operation

- (1). When a part of the modules is shadowed, the hot spot may be caused. Therefore do not shadow cells.
- (2). The modules shall be maintained by qualified personnel.
- (3). The electrical characteristics degrade when the front cover of the module becomes dirty.
- (4). Do not pour solvent on the modules when cleaning.
- (5). Do not produce sparks near flammable vapors.
- (6). Do not expose the modules to sunlight concentrated with mirrors, lenses or similar means.
- (7). Keep modules away from children.

Model : NT-S5E3E

(Cell Temperature : 25°C)

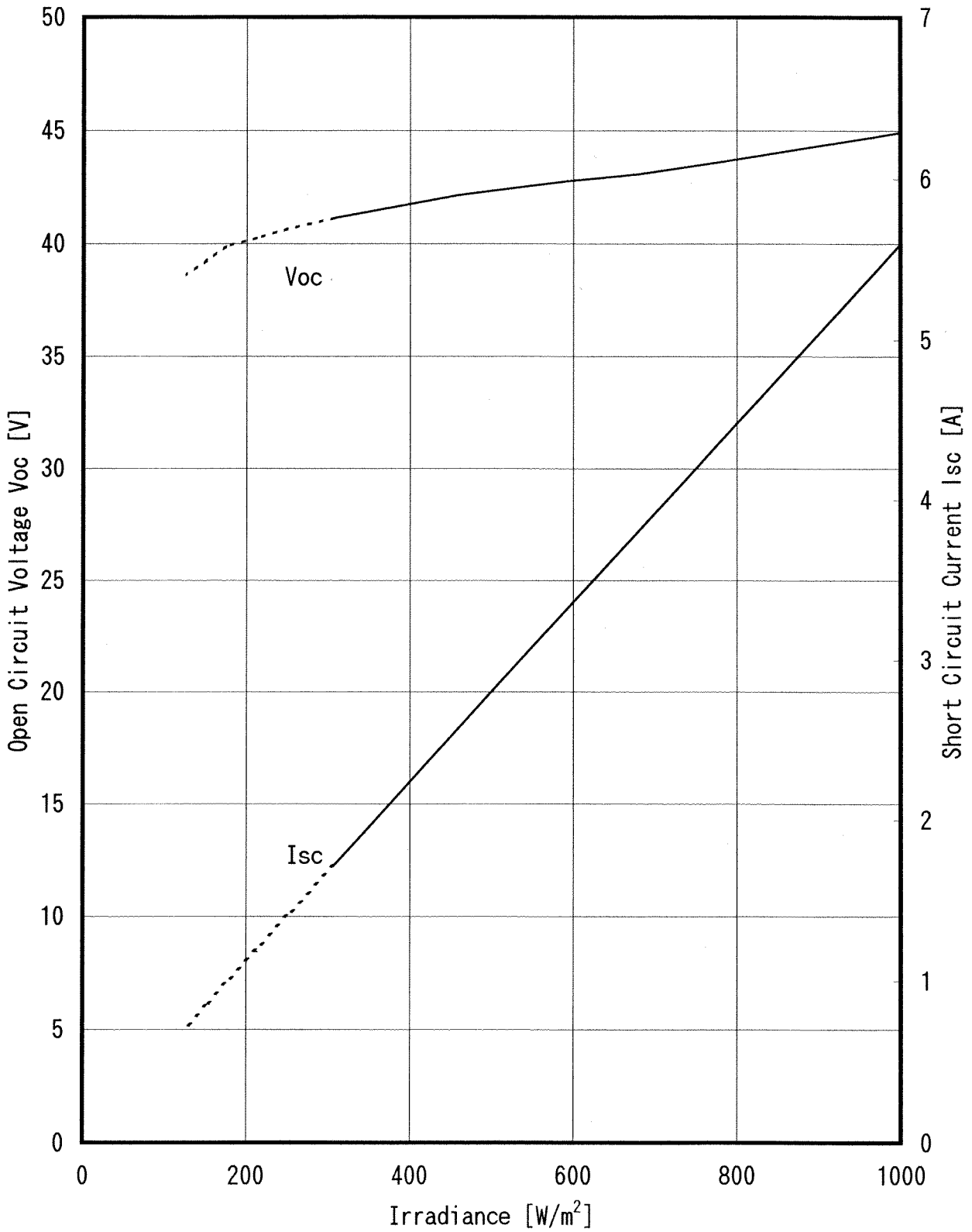


Fig. 1-1 Open Circuit Voltage, Short Circuit Current vs. Irradiance Characteristics

Model : NT-S5E3E

(Cell Temperature : 25 °C)

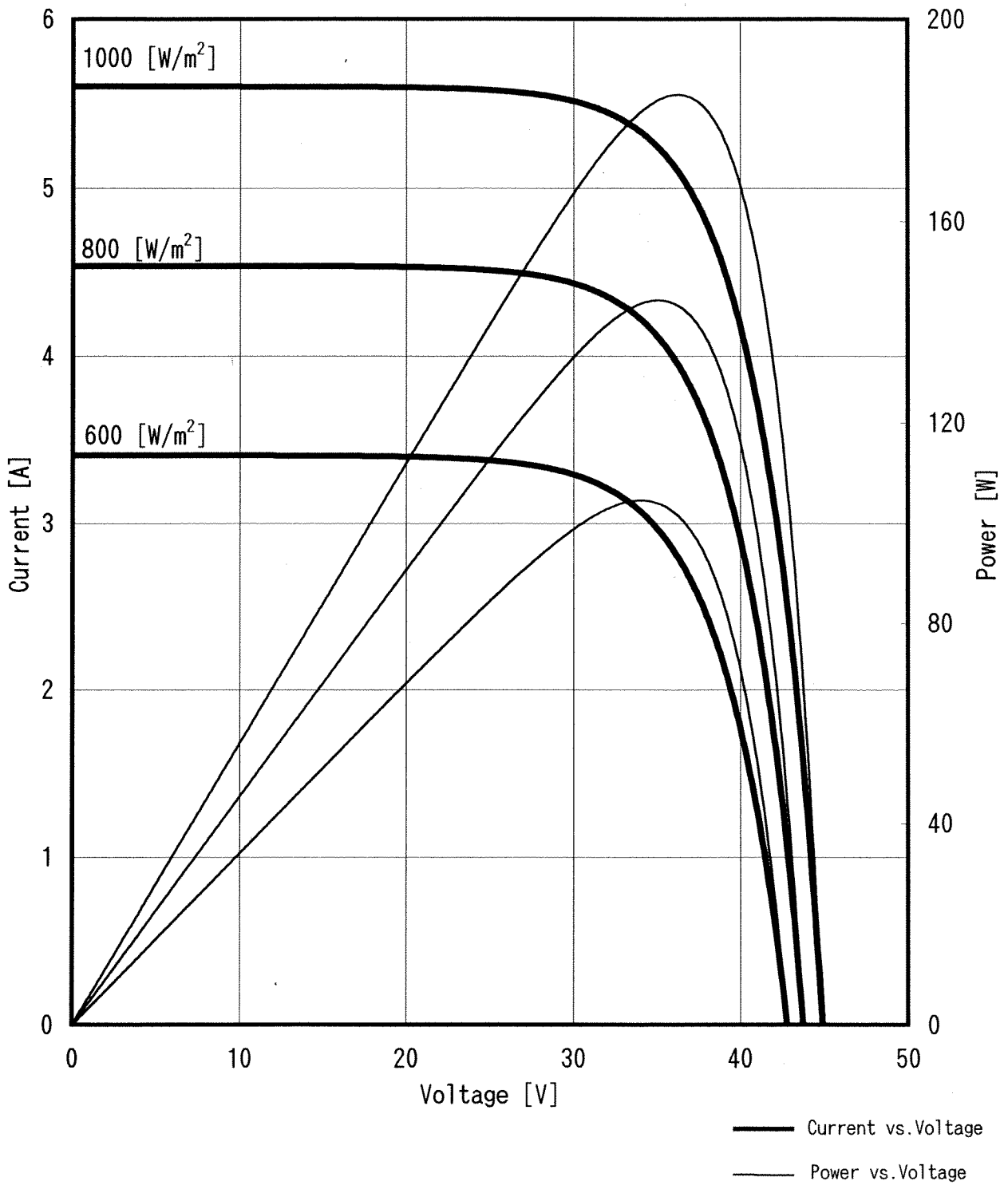


Fig. 1 -2 Current, Power, vs. Voltage Characteristics

Model: NT-S5E3E

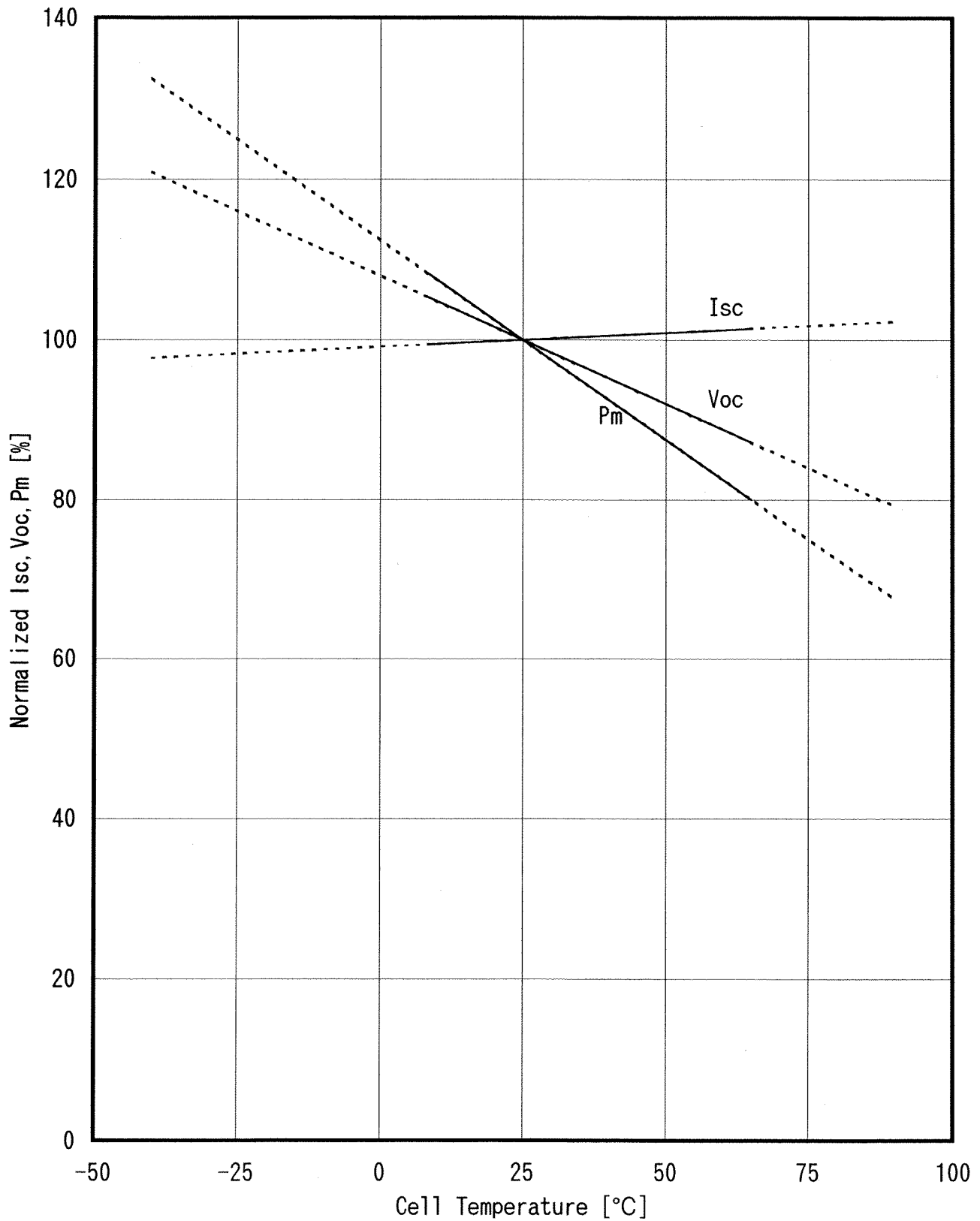


Fig. 1-3 Normalized Isc, Voc, Pm vs. Cell Temperature Characteristics