

DATE: Sep.13.2005 PREPARED BY: Y.SUZUKI <i>Y. Suzuki</i>	<h1>SHARP</h1> <p>SHARP CORPORATION 282-1 HAJIKAMI, KATSURAGI-SHI, NARA, 639-2198, JAPAN</p> <h2>SPECIFICATION</h2>	SPEC No. TSF0129
DATE: Sep.13.2005 CHECK BY: H.MAEDA <i>H. Maeda</i>		FILE No.
DATE: Sep.13.2005 APPROVED BY: T.MACHIDA <i>T. Machida</i>		ISSUE: Sep.13.2005
		PAGE
		REPRESENTATIVE DIVISION ENGINEERING DEPT. SOLAR SYSTEMS DIV.

SPECIFICATION FOR
SOLAR MODULE
MODEL NT-L7E4EZ

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

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

PRESENTED

DATE _____

BY *T. Machida* _____

BY _____

T.MACHIDA

Department General Manager

Engineering Dept.

Revision Record

[illegible]

1. SCOPE

This document describes the specifications of solar module NT-L7E4EZ.

2. NORMATIVE REFERENCES

The following normative documents contain provisions which, through reference in this text, constitute provisions of this specification. At the time of publication, the editions indicated were valid. All normative documents are subject to revision, and parties to agreements based on this specification 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, Part 1: Measurement of Photovoltaic Current-Voltage Characteristics
- IEC 904-3 Measurement principles for terrestrial Photovoltaic(PV) solar devices with reference spectrum irradiance data
- SS-S Inspection 1000 Reference Photovoltaic module Rule
(SHARP Standard-Solar)
- TMSSF05412 SOLAR MODULE (Front View)
(Provided as Fig.1)
- TMSSF05413 SOLAR MODULE (Back View)
(Provided as Fig.2)

3. REQUIREMENTS

3.1 Materials

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

3.1.1 Solar cells

Solar cells shall be produced from single-crystalline silicon.

3.1.2 Interconnectors

Interconnectors shall be solder coated copper.

3.1.3 Filling materials

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

3.1.4 Front cover

Front cover shall be a low iron tempered glass whose thickness is not less than 3mm.

3.1.5 Frames

Frames shall be aluminum alloy.

3.1.6 Back cover

Back cover shall be a resistant film for weather.

3.1.7 Terminal box

The termination shall be lead wire system. The main material of the terminal box shall be Alloy-Poly Phenylene Oxide 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 series 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 tolerance 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) In case of the possibility that the crack may presumably deteriorate more than 10% of the effective area of the cell, which may result in the loss of power generation;
- 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.

The following shall not be considered to be visual defects:

- 5) The frostlike by degradation that can be seen on the glass surface especially in the edge space;
- 6) Faded or uneven color of frames, scores or dents of frames that the installation and/or operation of the module would not be impaired;
- 7) Formal rectangular hollows of the back surface.
- 8) Some of gradual or acute swelling that can be seen in the back surface.

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 $1000\text{W}/\text{m}^2$ 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 127.0W, 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
Maximum power	Pm	120.6	W

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

REMARKS

The result provided on the flash data sheet of the output measurement has been achieved applying IEC 60904, using calibrated SHARP equipment and well documented procedures. The output measurement is subject to quality control within the given tolerance by IEC 60904. This tolerance is not including the calibration uncertainty of a primary reference cell and a secondary reference cell which had been calibrated by the public organization. The output power data is provided only for simplifying PV module array design by the customer, but not for other purpose.

3.5.2.2 Insulation

When the module shall be applied 2080V-DC (maximum system voltage: 540V-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 $227 \pm 2\text{g}$, 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 major visual defects of the module described in 3.4.

3.5.3.4 Robustness of termination

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

4. SHIPPING TEST

Each shipping lot shall successfully pass shipping test.

4.1 Test items

The maximum power (P_m), open circuit voltage (V_{oc}), and short circuit current (I_{sc}) are confirmed as an electrical characteristic in the production line process.

5. PREPARATION FOR DELIVERY

5.1 The shipping carton box specification

The shipping carton box specification is shown in Fig.4 and Fig.5

5.2 Identification of serial number

The serial number label is indicated in one place of front glass and is stuck to carton box.

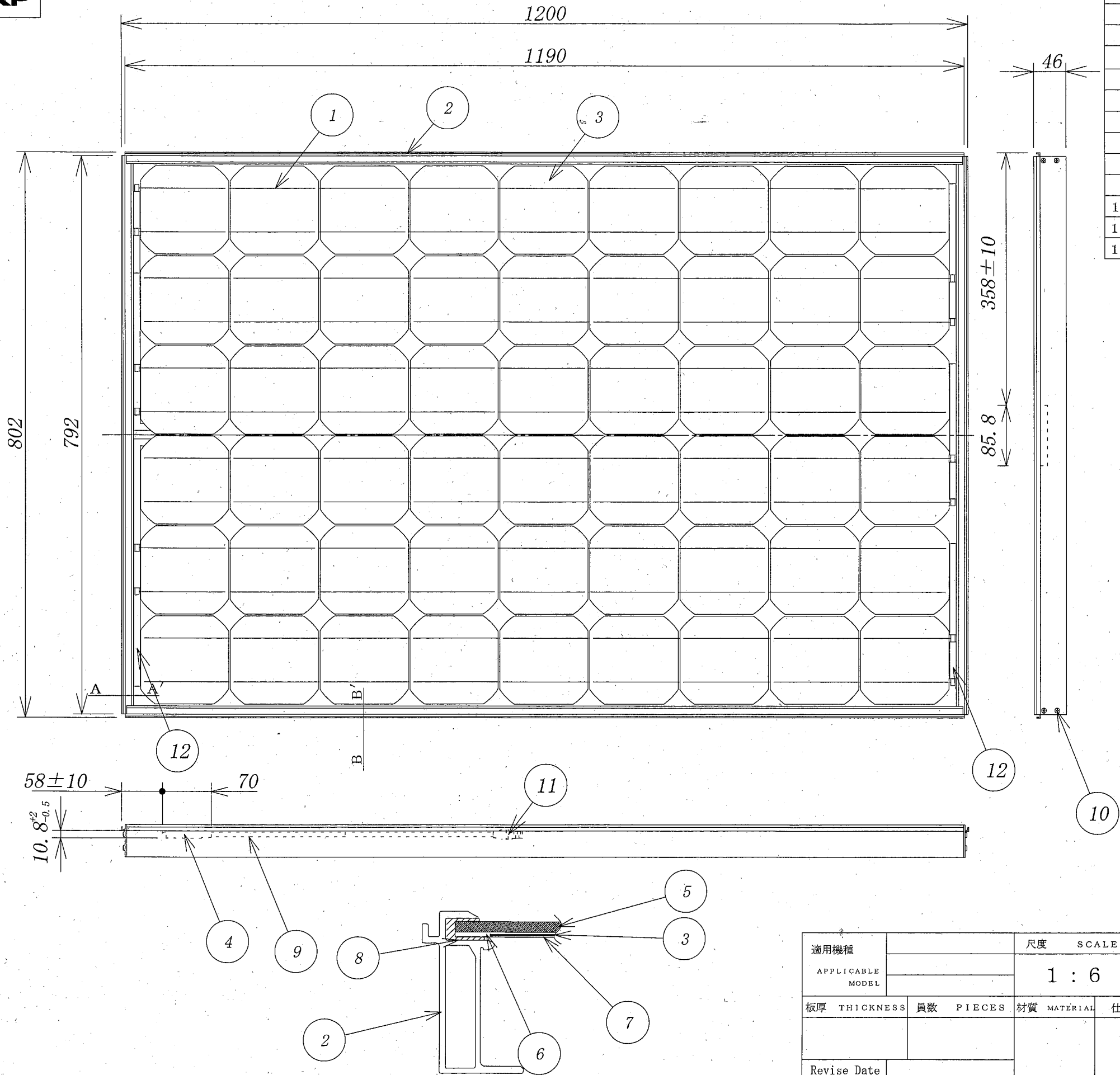
6. WARNING

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

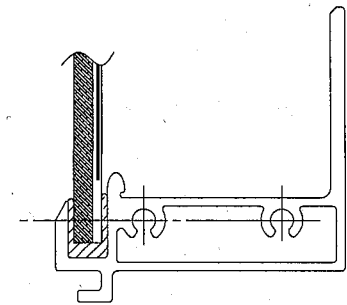
7. OTHERS

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

SHARP



No	NAME	PIECES	MATERIALS
1	Inter-Connector		Cu
2	Frame	4	AL (black color)
3	Solar Cell	54	Si
4	Terminal Box	1	Alloy-Poly Phenylene Oxide resin
5	Glass	1	Low Iron tempered glass
6	Resin		EVA
7	Back Cover		Weatherproof Film
8	Side Seal		TPE (Thermoplastic elastomer)
9	Electric Output Cable	2	CV Cable, 3.5mm ² , l=1,000mm±20mm
10	Screw	8	Stainless Steel
11	Connector		TPE (Thermoplastic elastomer)
12	Bus-bar Connector		Cu covered PET film (black color)



B-B' Cross Section

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

Fig. 1 A-A' Cross Section

適用機種 APPLICABLE MODEL		尺度 SCALE	単位 UNIT	05.08.01 First Issue Y. Suzuki	
		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 (Front View) NT-L7E4EZ
Revise Date				コード CODE	
設計 DESIGN	製図 DRAW	検図 CHECK	検図 CHECK	承認 APPROVE	SOLAR SYSYEMS DIVISION
af. Suzuki		H. Masuda		SOLAR SYSYEMS GROUP SHARP CORPORATION	
				図番 DRAWING No.	TMSSF05412

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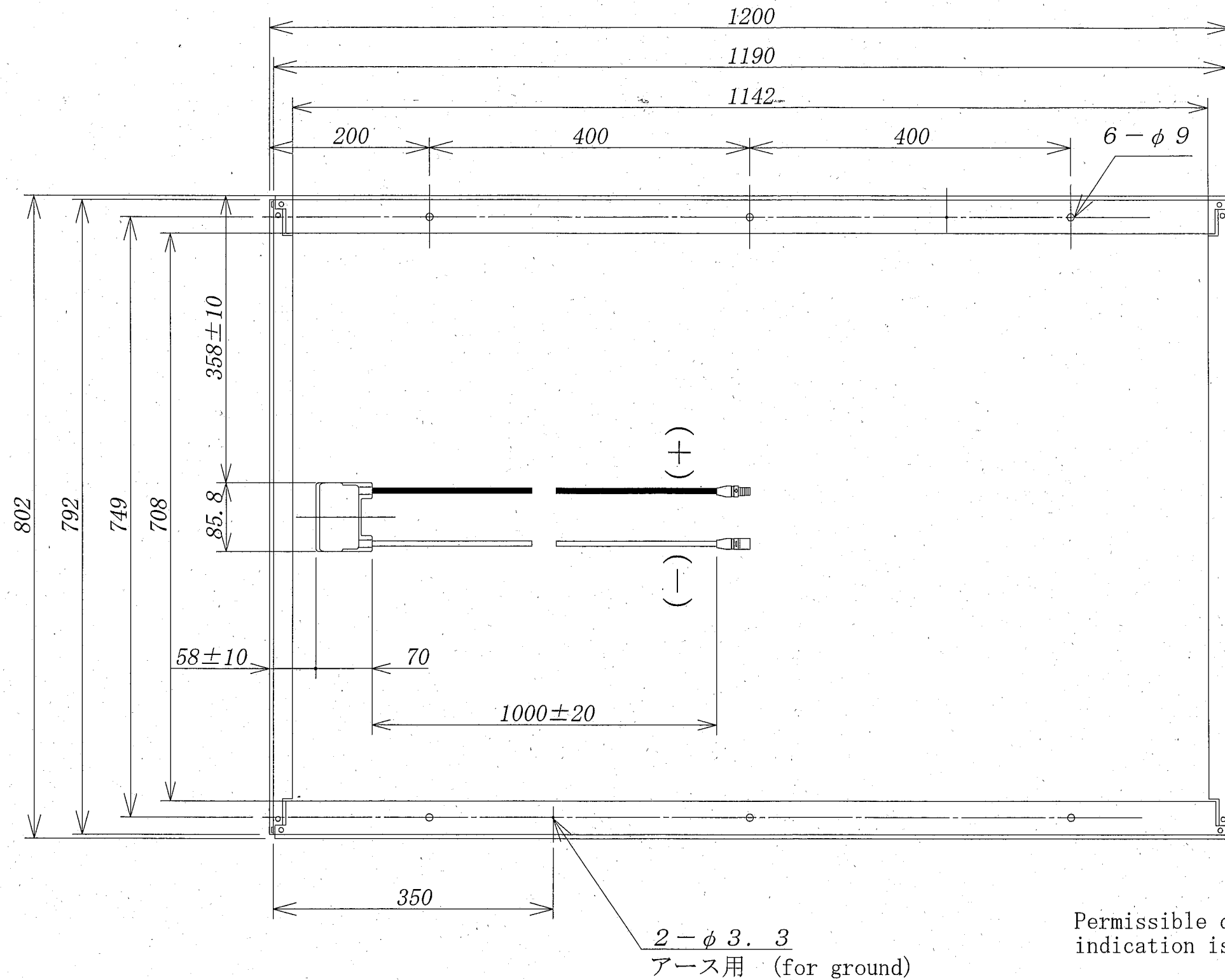


Table A

Dimension ; L	Permissible Deviation
$0.5 \leq L < 3$	± 0.2
$3 < L < 6$	± 0.3
$6 < L \leq 30$	± 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

適用機種				尺度 SCALE		単位 UNIT							
APPLICABLE MODEL				1 : 6		mm		05.08.01		First Issue		Y. Suzuki.	
								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		Solar Module (Back View)			
								NAME		NT-L7E4EZ			
Revise Date								コード					
設計 DESIGN	製図 DRAW	検図 CHECK	検図 CHECK	承認 APPROVE	SOLAR SYSYEMS DIVISION				CODE				
H. Suzuki				H. Masuda		SOLAR SYSYEMS GROUP				図番		TMSSF05413	
				SHARP CORPORATION				DRAWING No.					

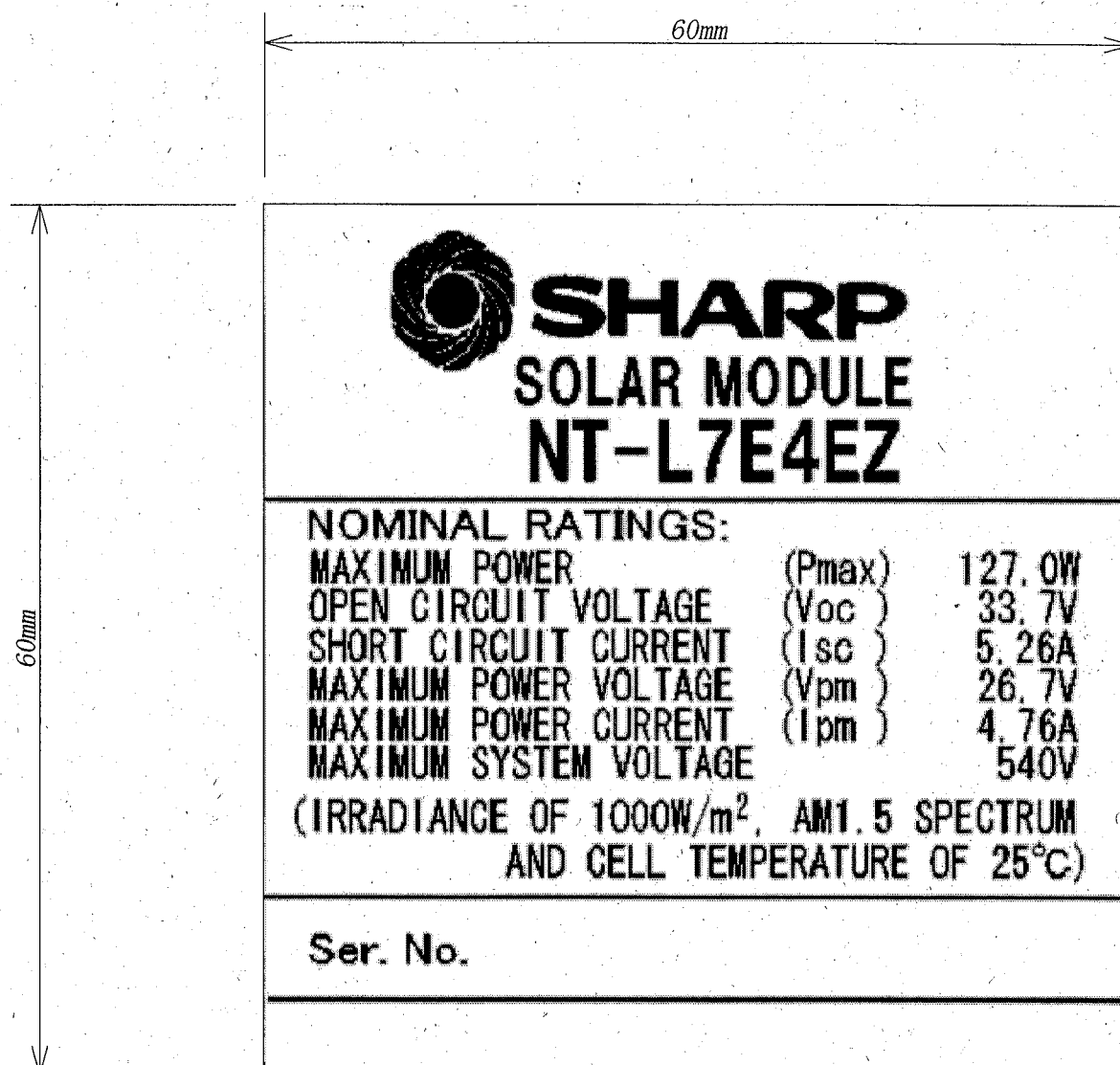


Fig. 3

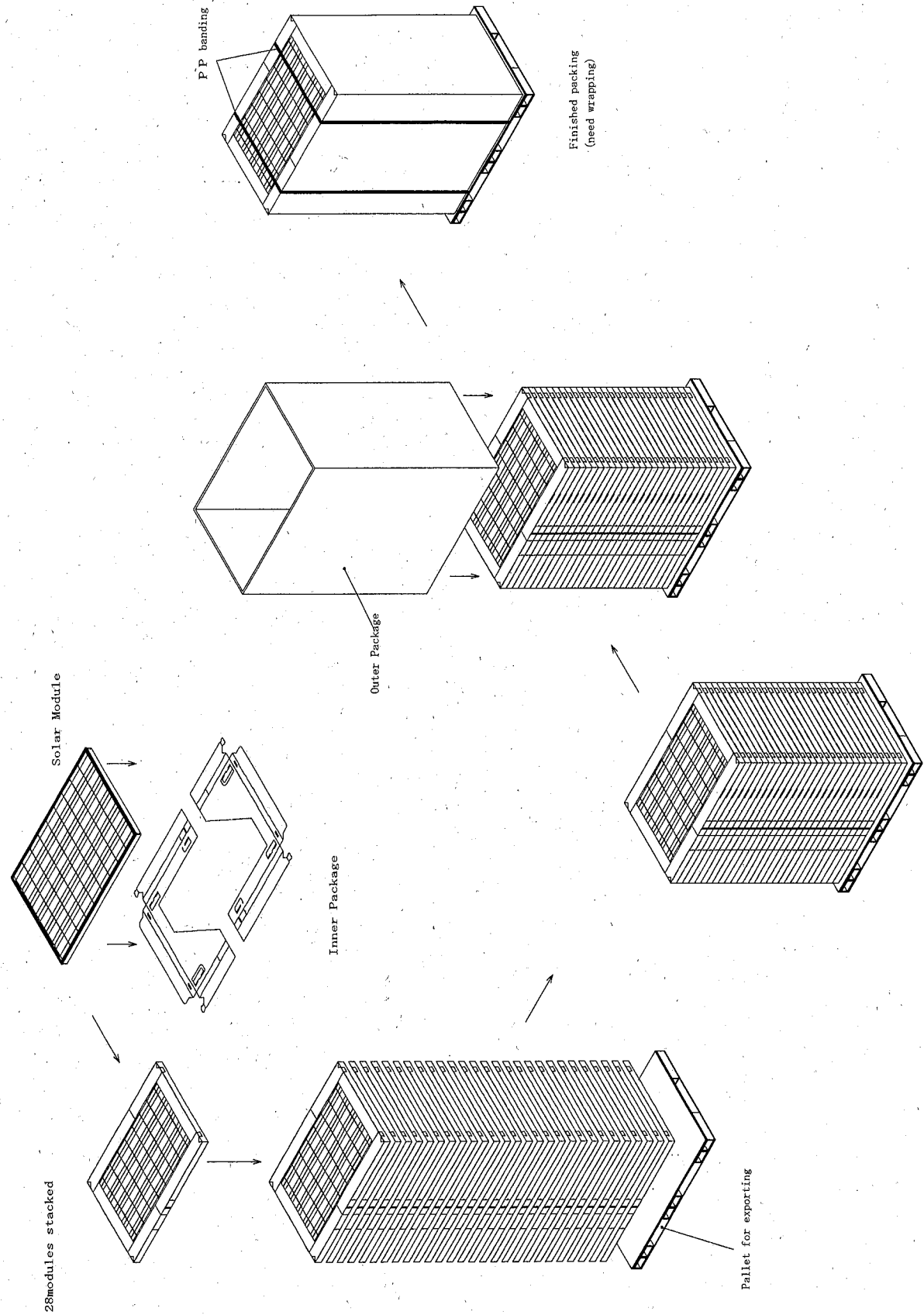
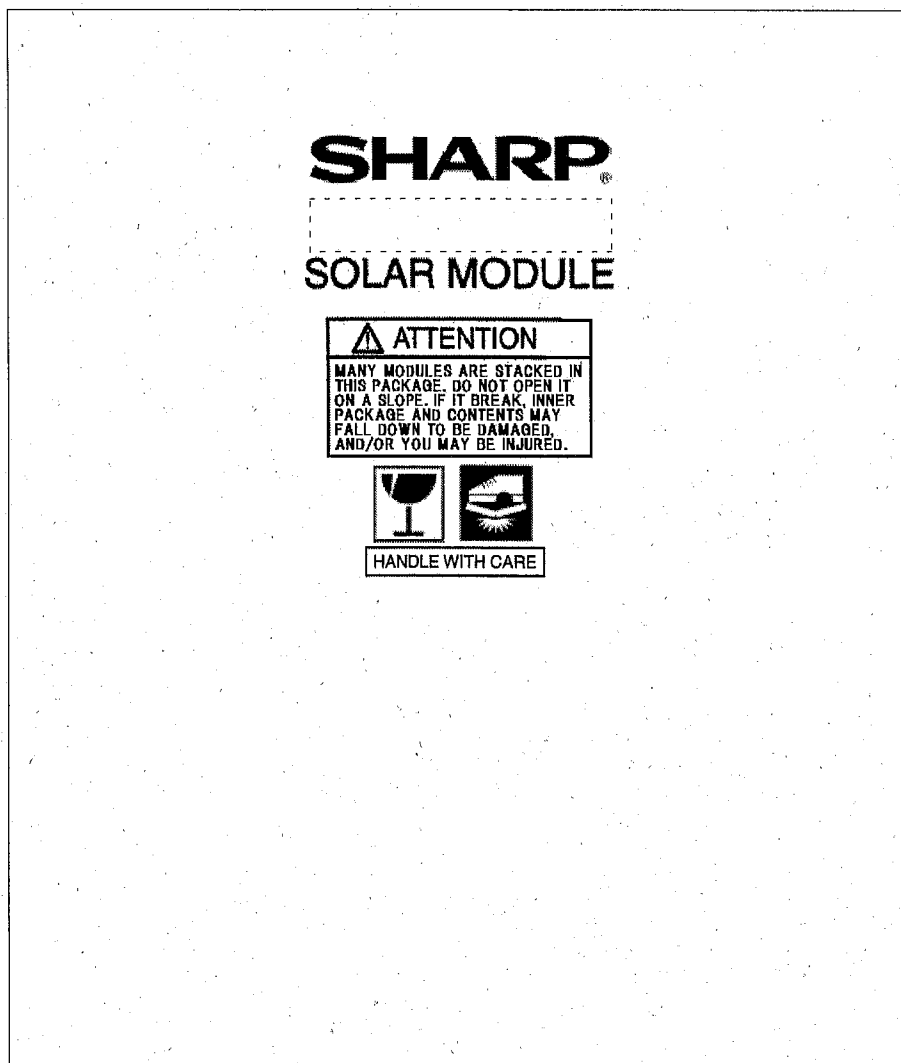


Fig. 4



This printing design is set in 4 sides of outer package surrounded. The dotted lined square in this drawing shows the place you can put a model name plate on.

Fig. 5

《APPENDIX 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 consider the other information.

I-2. MASS

The typical mass of the module is 12.5 kg.

I-3. ELECTRICAL OUTPUT

When the maximum power is 127.0 W, the electrical characteristics of the module under standard test conditions are shown in the following table.

Table. electrical characteristics

Characteristics	Symbol	@127.0W	Unit
Open circuit voltage	Voc	33.7	V
Maximum power voltage	Vpm	26.7	V
Short circuit current	Isc	5.26	A
Maximum power current	Ipm	4.76	A
Maximum power	Pm	127.0	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 are 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.
- (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.

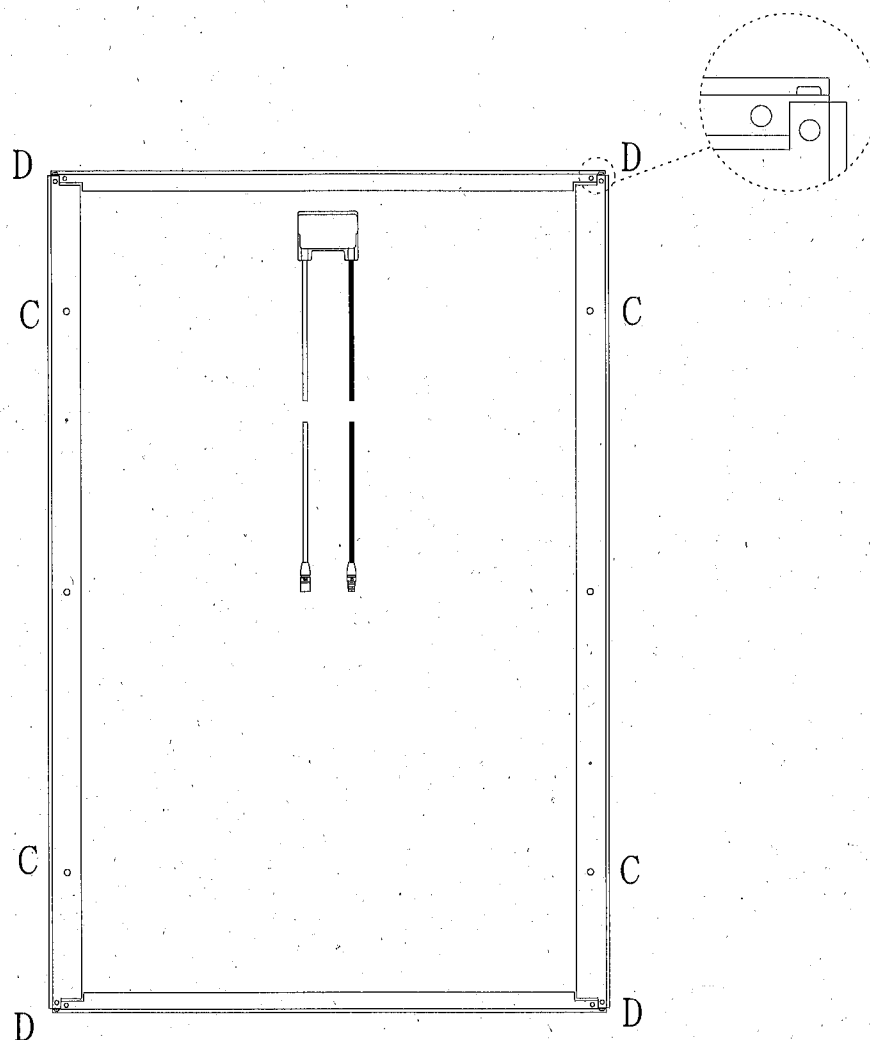
I -4.2 Handling

- (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.
- (4) Please do not do additional processing (by way of example only, it processes a hole into the frames) to a module. When you did processing, we cannot guarantee this specifications contents.

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 4C-holes with M8-bolts for withstanding load 2400Pa.
- (9) Please do not block up D-holes on the establishment.



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-L7E4EZ
(Cell Temperature: 25°C)

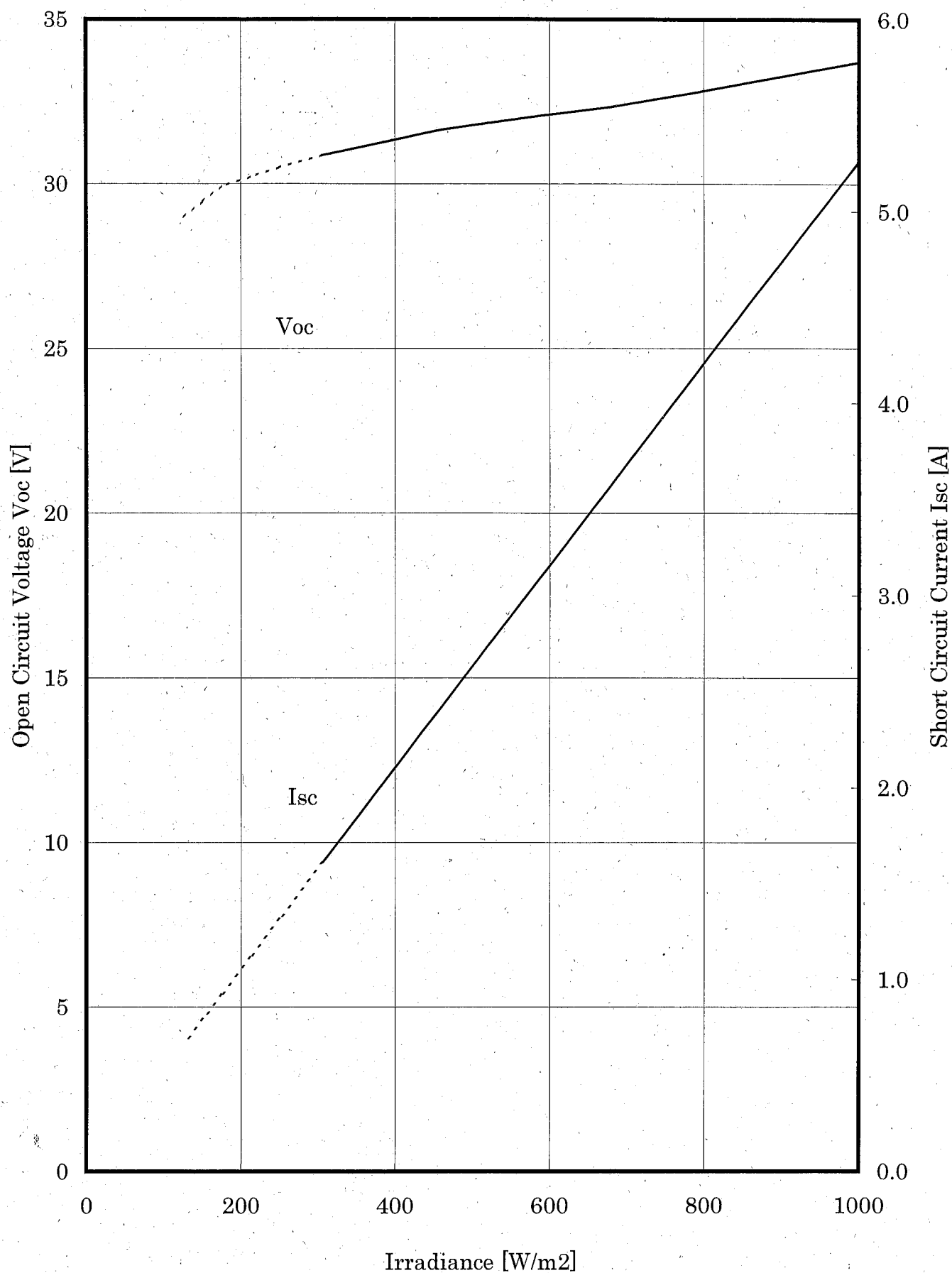


Fig. I -1 Open Circuit Voltage , Short Circuit Current vs. Irradiance Characteristics

Model: NT-L7E4EZ
(Cell Temperature: 25°C)

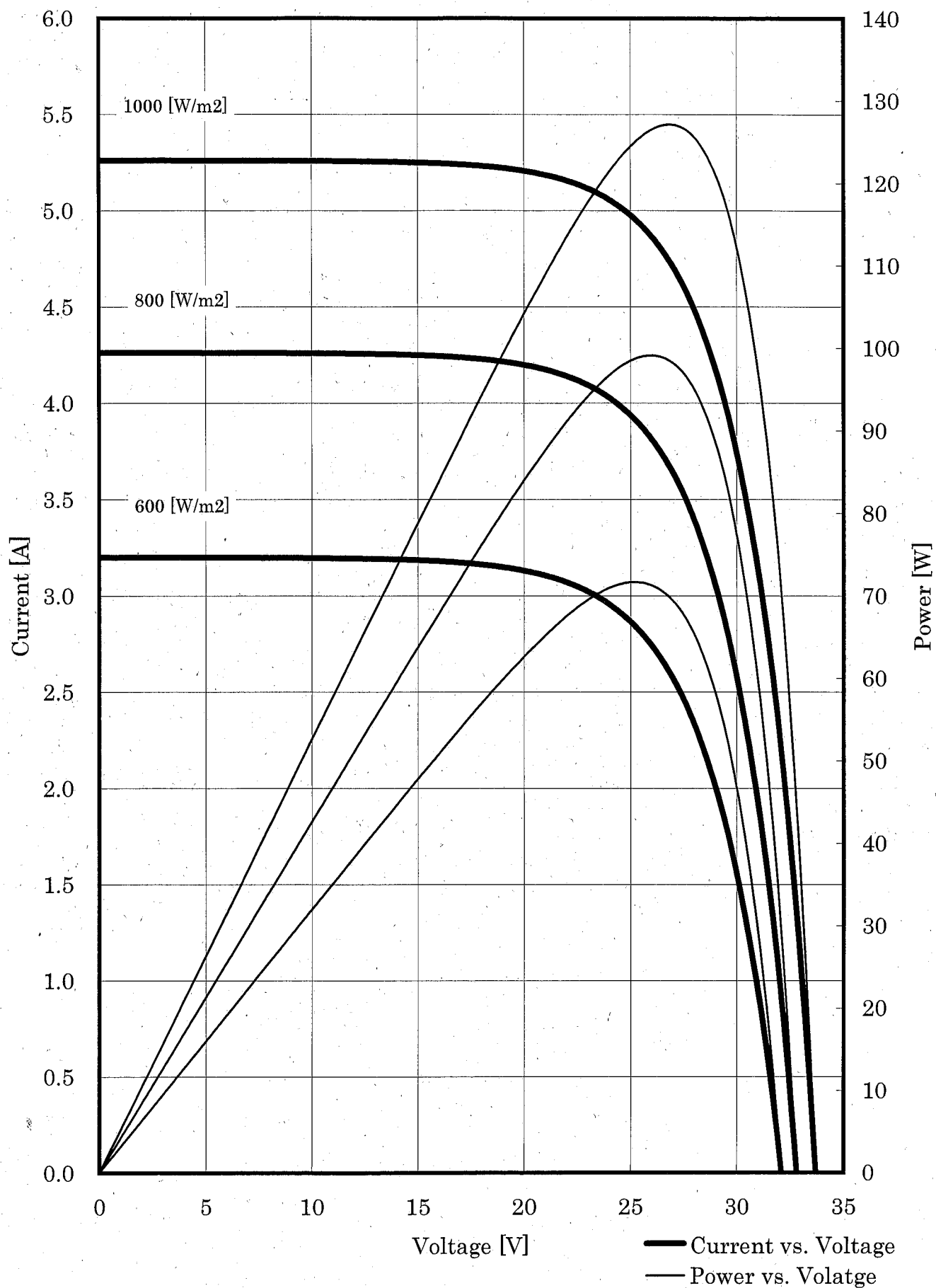


Fig. I -2 Current , Power , vs. Voltage Characteristics

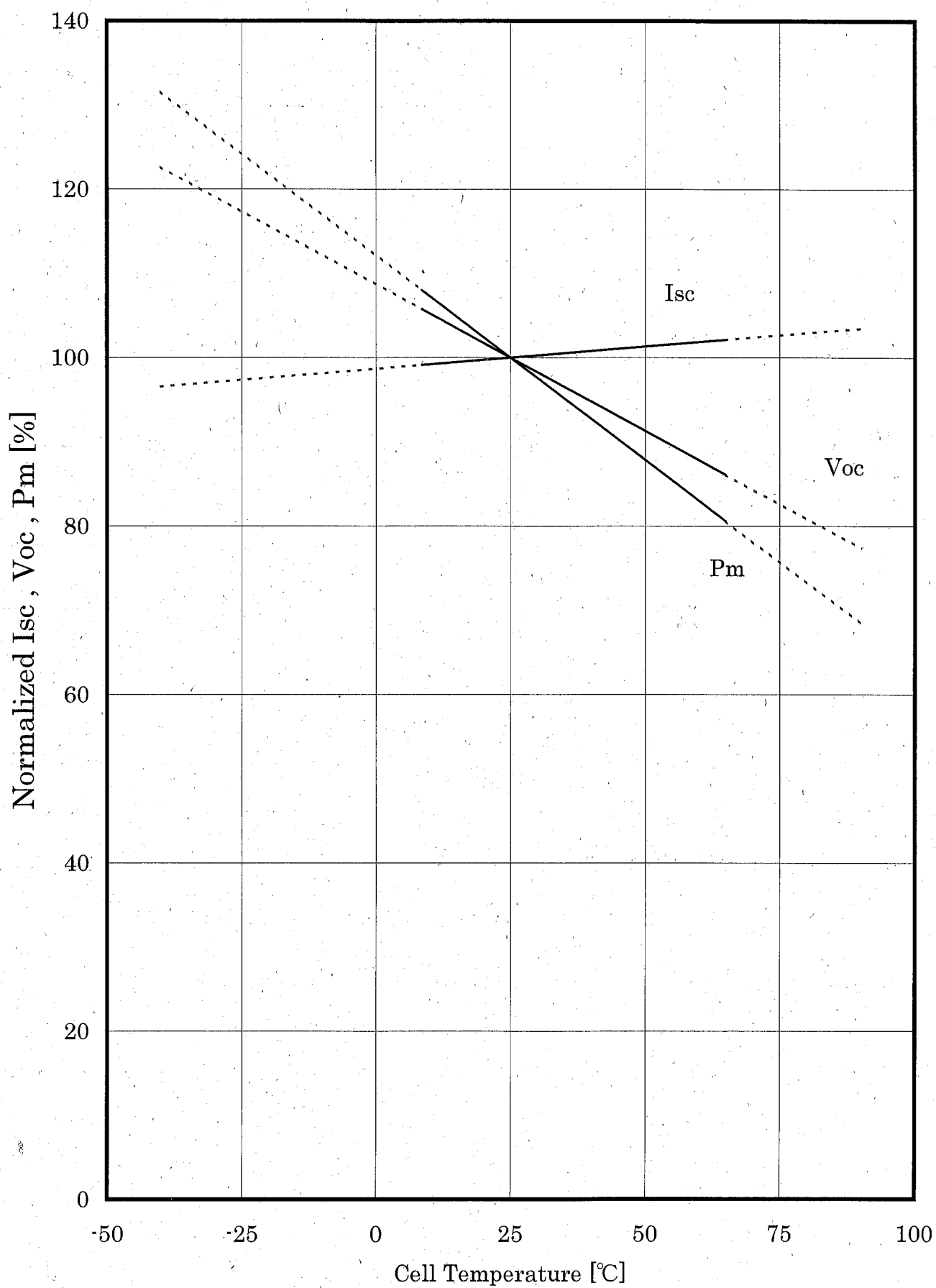
Model: NT-L7E4EZ

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