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SHARP

OPTO-ELECTRONIC DEVICES DIVISION
ELECTRONIC COMPONENTS GROUP
SHARP CORPORATION

SPECIFICATION

DEVICE SPECIFICATION FOR

PHOTOTRIAC COUPLER

MODEL No.

4SF21

(Business dealing name : PC4SF21YVZBF)

Specified for

Enclosed please find copies of the Specifications which consists of 15 pages including cover.
After confirmation of the contents, please be sure to send back copies of the Specifications
with approving signature on each.

CUSTOMER'S APPROVAL

DATE

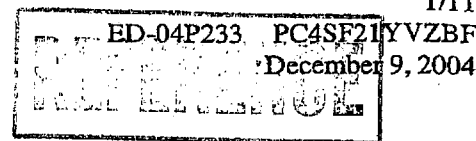
BY

PRESENTED

DATE Dec. 9, 2004

BY *H. Imanaka*

H. Imanaka,
Department General Manager of
Engineering Dept. II
Opto-Electronic Devices Div.
ELECOM Group
SHARP CORPORATION



Product name : PHOTOTRIAC COUPLER

Model No. : 4SF21

(Business dealing name : PC4SF21YVZBF)

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2. When using this product, please observe the absolute maximum ratings and the instructions for use outlined in these specification sheets, as well as the precautions mentioned below. Sharp assumes no responsibility for any damage resulting from use of the product which does not comply with the absolute maximum ratings and the instructions included in these specification sheets, and the precautions mentioned below.

(Precautions)

- (1) This product is designed for use in the following application areas ;

| | | |
|--|--------------------------|-------------------|
| · OA equipment | · Audio visual equipment | · Home appliances |
| · Telecommunication equipment (Terminal) | · Measuring equipment | |
| · Tooling machines | · Computers | |

If the use of the product in the above application areas is for equipment listed in paragraphs (2) or (3), please be sure to observe the precautions given in those respective paragraphs.

- (2) Appropriate measures, such as fail-safe design and redundant design considering the safety design of the overall system and equipment, should be taken to ensure reliability and safety when this product is used for equipment which demands high reliability and safety in function and precision, such as ;

| |
|--|
| · Transportation control and safety equipment (aircraft, train, automobile etc.) |
| · Traffic signals · Gas leakage sensor breakers · Rescue and security equipment |
| · Other safety equipment etc. |

- (3) Please do not use this product for equipment which require extremely high reliability and safety in function and precision, such as ;

| | |
|-----------------------------------|---|
| · Space equipment | · Telecommunication equipment (for trunk lines) |
| · Nuclear power control equipment | · Medical equipment etc. |

- (4) Please contact and consult with a Sharp sales representative if there are any questions regarding interpretation of the above three paragraphs.

3. Please contact and consult with a Sharp sales representative for any questions about this product.

1. Application

This specification applies to the outline and characteristics of phototriac coupler Model No. 4SF21 (Apply line voltage 200V AC).

2. Outline

Refer to the attached sheet, page 4.

3. Ratings and characteristics

Refer to the attached sheet, page 5, 6.

4. Reliability

Refer to the attached sheet, page 7.

5. Outgoing inspection

Refer to the attached sheet, page 8.

6. Supplement

- 6.1 The business dealing name used for this product applied to products as option (Attachment 1-1 to 1-3) when ordered or delivered shall be PC4SF21YVZBF, and the following selection shall be made as to the critical rate of rise of off-state voltage (dv/dt) in para. 3.2 Critical rate of rise of off-state voltage (dv/dt) selection

$$dv/dt \geq 5kV/\mu s \quad [\text{Test conditions}] V_D = 1/\sqrt{2} \cdot V_{DRM}, T_a = 25^\circ C$$

6.2 Package specification

Refer to the attached sheet, page 9 to 11.

6.3 Isolation voltage shall be measured in the following method.

- (1) Short between pins 1 to 3 on the primary side and between pins 4 to 6 on the secondary side.
- (2) The dielectric withstanding tester with zero-cross circuit shall be used.
- (3) The wave form of applied voltage shall be a sine wave.


(It is recommended that the isolation voltage be measured in insulation oil.)

6.4 This Model is approved by UL, CSA.

Approved Model No. : 4SF21

UL file No. : E64380

CSA file No. : CA95323

CSA approved mark "  " shall be indicated on minimum unit package.

6.5 This product is approved by BSI, SEMKO, DEMKO and FIMKO

Approved Model No. : 4SF21

BSI Certificate No. : 6690/7421 (BS EN60065/BS EN60950)

SEMKO Certificate No. : 0033029

DEMKO Certificate No. : 310107

FIMKO Certificate No. : 15795

6.6 This product is not designed against irradiation.

This product is assembled with electrical input and output.

This product incorporates non-coherent light emitting diode.

6.7 ODS materials

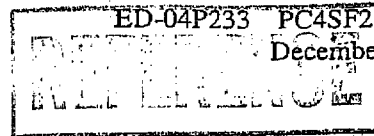
This product shall not contain the following materials.

Also, the following materials shall not be used in the production process for this product.

Materials for ODS : CFC_s, Halon, Carbon tetrachloride, 1,1,1-Trichloroethane (Methylchloroform)

6.8 Brominated flame retardants

Specific brominated flame retardants such as the PBBO_s and PBB_s are not used in this device at all.



7. Notes

7.1 Circuit design

- (1) The LED used in the Phototriac coupler generally decreases the light emission power by operation. In case of long operation time, please decide I_F value as 2 times or more of the Maximum value of the Minimum triggering current at circuit design with considering the decreases of the light emission power of the LED. (50% / 5years)
- (2) Input current (I_F) at off state shall be set 0.1mA or less.
- (3) In case that L (Inductance) load such as motor etc. is used. Please use this device after confirming whether this device operates normally in actual condition since there is a case that the zero-cross circuit works and the load does not turn on thanks to the phase difference of load current.
- (4) If the voltage exceeding the repetitive peak off-state voltage (V_{DRM}) in the absolute maximum ratings is applied to the phototriac, it may cause not only faulty operation but breakdown. Make sure that the surge voltage exceeding V_{DRM} shall not be applied by using the varistor, CR.

7.2 Usage

Please use only for triggering medium and high power triac.

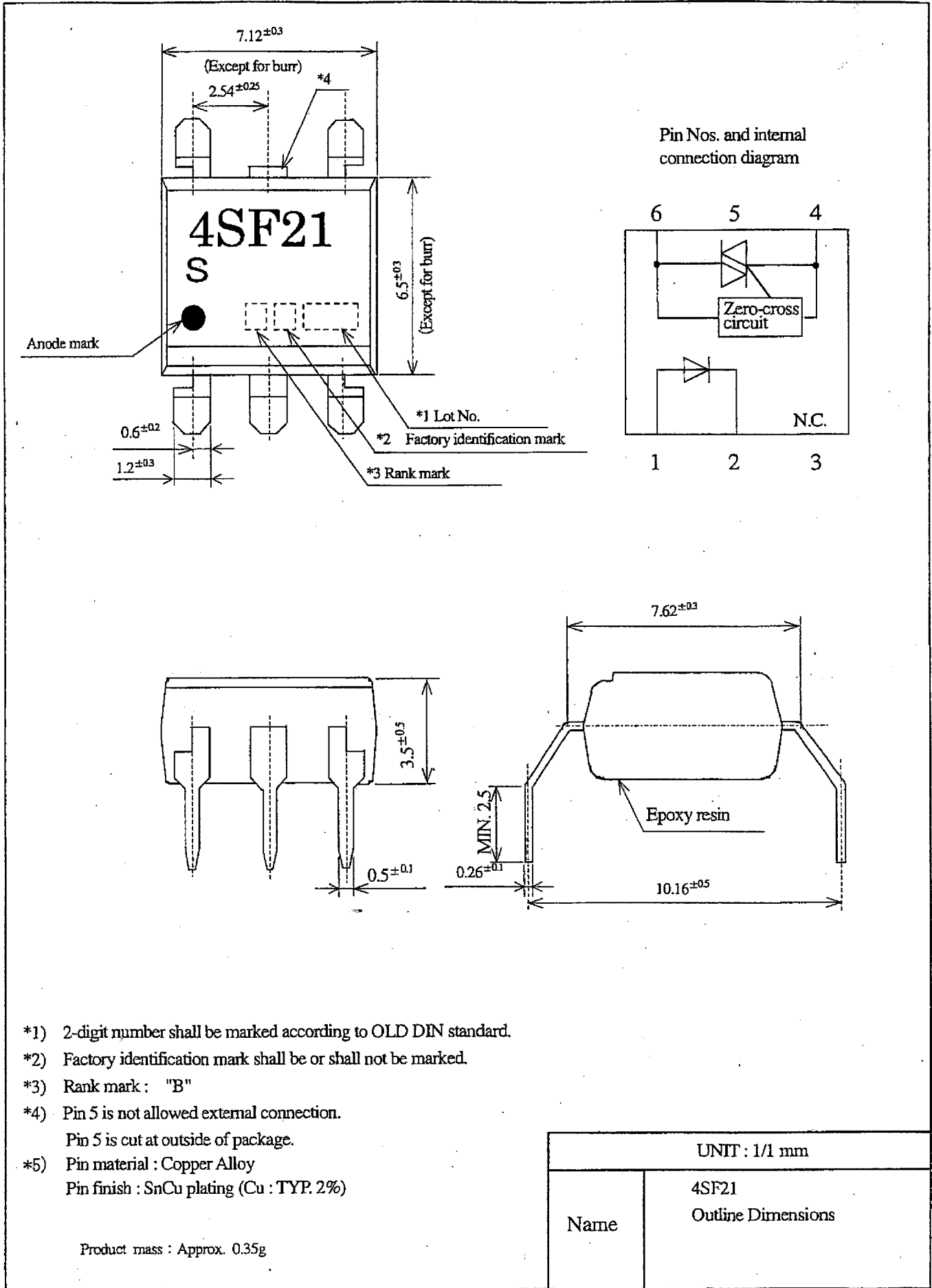
(This model shall be used on the condition under which power triac turns on.)

7.3 For cleaning

- (1) Solvent cleaning : Solvent temperature 45°C or less, Immersion for 3 min or less
- (2) Ultrasonic cleaning : The effect to device by ultrasonic cleaning differs by cleaning bath size, ultrasonic power output, cleaning time, PCB size or device mounting condition etc. Please test it in actual using condition and confirm that doesn't occur any defect before starting the ultrasonic cleaning.
- (3) Applicable solvent : Ethyl alcohol, Methyl alcohol, Isopropyl alcohol
When the other solvent is used, there are cases that the packaging resin is eroded.
Please use the other solvent after thorough confirmation is performed in actual using condition.

7.4 Precautions for Soldering Phototriac couplers

- (1) In the case of flow soldering (Whole dipping is possible.)
It is recommended that flow solder be at 270°C or less and within 10 seconds (Pre-heating : 100 to 150°C, 30 to 80seconds).
(2 times or less)
- (2) In the case of hand soldering
What is done on the following condition is recommended. (2 times or less)
Soldering iron temperature : 400°C or less
Time : 3s or less
- (3) Other precautions
Since, influence to the device is different according to reflow equipment and its condition, please use the device after confirming no damage in the actual using condition.



- *1) 2-digit number shall be marked according to OLD DIN standard.
- *2) Factory identification mark shall be or shall not be marked.
- *3) Rank mark : "B"
- *4) Pin 5 is not allowed external connection.
Pin 5 is cut at outside of package.
- *5) Pin material : Copper Alloy
Pin finish : SnCu plating (Cu : TYP. 2%)

Product mass : Approx. 0.35g

| | |
|---------------|-----------------------------|
| UNIT : 1/1 mm | |
| Name | 4SF21 Outline Dimensions |

3.1 Absolute maximum ratings

Ta=25°C

| Parameter | | Symbol | Rating | Unit |
|-----------------------|-----------------------------------|------------------------------|----------------------|------|
| Input | Forward current *1 | I_F | 50 | mA |
| | Reverse voltage | V_R | 6 | V |
| Output | RMS on-state current *1 | $I_T(\text{rms})$ | 0.1 | A |
| | Peak one cycle surge current | I_{surge} | 1.2 (50Hz sine wave) | A |
| | Repetitive peak off-state voltage | V_{DRM} | 800 | V |
| Isolation voltage *2 | | $V_{\text{iso}}(\text{rms})$ | 5 | kV |
| Operating temperature | | T_{opr} | -30 to +100 | °C |
| Storage temperature | | T_{stg} | -55 to +125 | °C |
| Soldering temperature | | T_{sol} | 270 (For 10s) | °C |

*1 The derating factors of absolute maximum rating due to ambient temperature are shown in Fig.1, 2.

*2 AC for 1min, 40 to 60%RH, f=60Hz

3.2 Electrical characteristics

Ta=25°C

| Parameter | | Symbol | MIN. | TYP. | MAX. | Unit | Conditions |
|--------------------------|--|------------------|--------------------|-----------|--------------------|------------------|--|
| Input | Forward voltage | V_F | - | 1.2 | 1.4 | V | $I_F=20\text{mA}$ |
| | Reverse current | I_R | - | - | 10^{-5} | A | $V_R=3\text{V}$ |
| Output | Repetitive peak off-state current | I_{DRM} | - | - | 3×10^{-6} | A | $V_D=V_{\text{DRM}}$ |
| | On-state voltage | V_T | - | - | 2.5 | V | $I_T=0.1\text{A}$ |
| | Holding current | I_H | 0.1 | - | 3.5 | mA | $V_D=4\text{V}$ |
| | Critical rate of rise of off-state voltage | dv/dt | 500 | 1000 | - | V/ μs | $V_D=1/\sqrt{2} \cdot V_{\text{DRM}}$ |
| | Zero-cross voltage | V_{ox} | - | - | 20 | V | R load, $I_F=15\text{mA}$ |
| Transfer characteristics | Minimum trigger current | I_{FT} | - | - | 7 | mA | $V_D=4\text{V}$ $R_L=100\Omega$ |
| | Isolation resistance | R_{ISO} | 5×10^{10} | 10^{11} | - | Ω | DC500V 40 to 60%RH |
| | Turn on time | t_{ON} | - | - | 50 | μs | $V_D=4\text{V}$, $R_L=100\Omega$, $I_F=20\text{mA}$ |

Fig.1 Forward current vs. ambient temperature

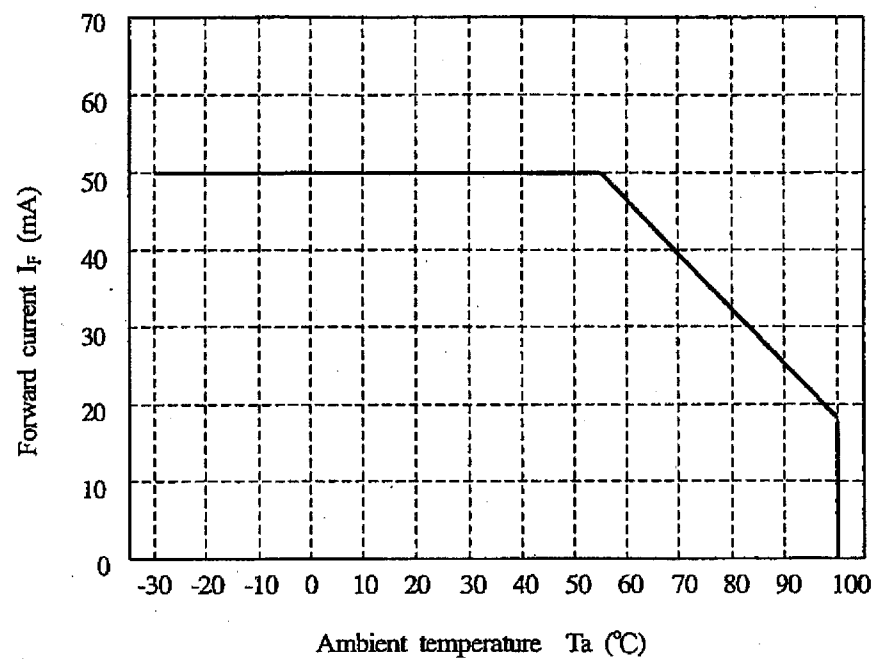
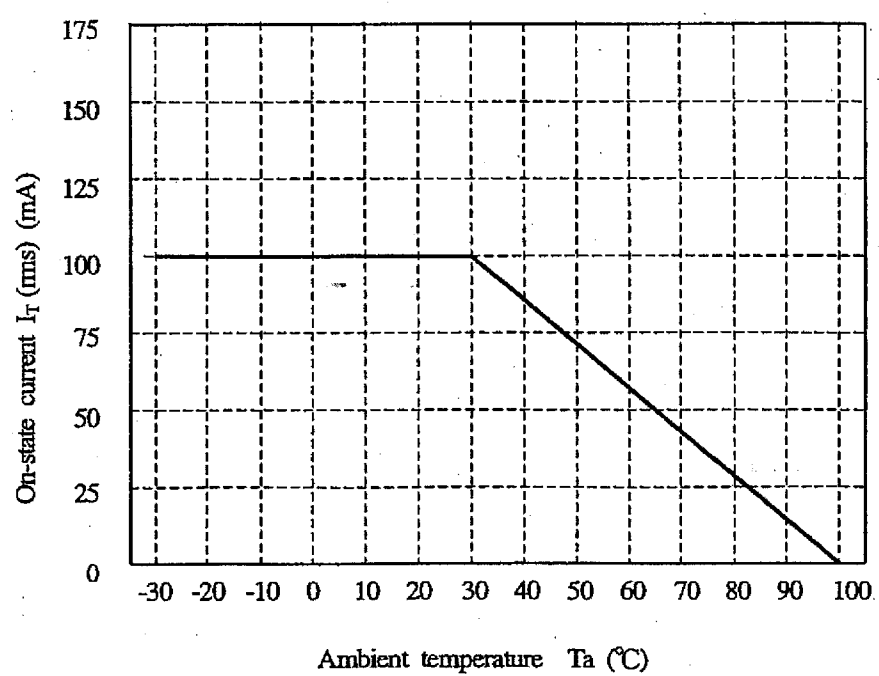


Fig.2 On-state current I_T (rms) vs. ambient temperature



4. Reliability

The reliability of products shall satisfy items listed below.

Confidence level : 90%

LTPD : 10 or 20

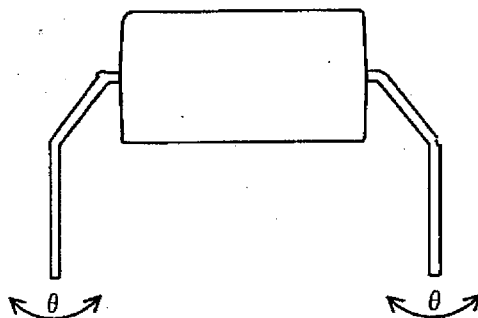
| Test Items | Test Conditions *1 | Failure Judgement Criteria | Samples (n) |
|--------------------------------------|--|---|--------------|
| | | | Defective(C) |
| Solderability *2 | 245±3°C, 5s | — | n=11, C=0 |
| Soldering heat *3 | (Flow soldering) 270°C, 10 s | $V_F > U \times 1.2$ $V_T > U \times 1.2$ $I_{FT} > U \times 1.3$ $I_R > U \times 2.0$ $I_{DRM} > U \times 2.0$ U : Upper specification limit L : Lower specification limit | n=11, C=0 |
| | (Soldering by hand) 400°C, 3 s | | n=11, C=0 |
| Terminal strength (Tension) | Weight : 5.0N | | n=11, C=0 |
| | 5 s/each terminal | | n=11, C=0 |
| Terminal strength (Bending) *4 | Weight : 2.5N | | n=11, C=0 |
| | 2 times/each terminal | | n=11, C=0 |
| Mechanical shock | 15km/s ² , 0.5ms | | n=11, C=0 |
| | 3 times/±X, ±Y, ±Z direction | | n=11, C=0 |
| Variable frequency vibration | 100 to 2000 to 100Hz/4min | | n=11, C=0 |
| | 200m/s ² 4 times/ X, Y, Z direction | | n=11, C=0 |
| Temperature cycling | 1 cycle -55°C to +125°C | n=22, C=0 | |
| | (30min) (30min) 20 cycles test Without Load | n=22, C=0 | |
| High temp. and high humidity storage | +85°C, 85%RH, 500h | n=22, C=0 | |
| High temp. storage | +125°C, 1000h | n=22, C=0 | |
| Low temp. storage | -55°C, 1000h | n=22, C=0 | |
| Operation life | I _F =50mA, I _T =100mA T _a =25°C, 1000h | n=22, C=0 | |

*1 Test method, conforms to EIAJ ED 4701.

*2 Solder shall adhere at the area of 95% or more of immersed portion of lead, and pin hole or other holes shall not be concentrated on one portion.

*3 Dip into the position of 1.0mm from the resin part.

*4 Terminal bending direction is shown below.



5. Outgoing inspection**5.1 Inspection items****(1) Electrical characteristics** $V_F, I_R, I_{DRM}, V_T, I_{FT}, R_{ISO}, V_{ISO}$ **(2) Appearance****5.2 Sampling method and Inspection level**

A single sampling plan, normal inspection level II based on ISO 2859 is applied.

The AQL according to the inspection items are shown below.

| Defect | Inspection item | AQL (%) |
|--------------|--|---------|
| Major defect | Electrical characteristics Unreadable marking | 0.065 |
| Minor defect | Appearance defect except the above mentioned. | 0.25 |

6.2 Package specification

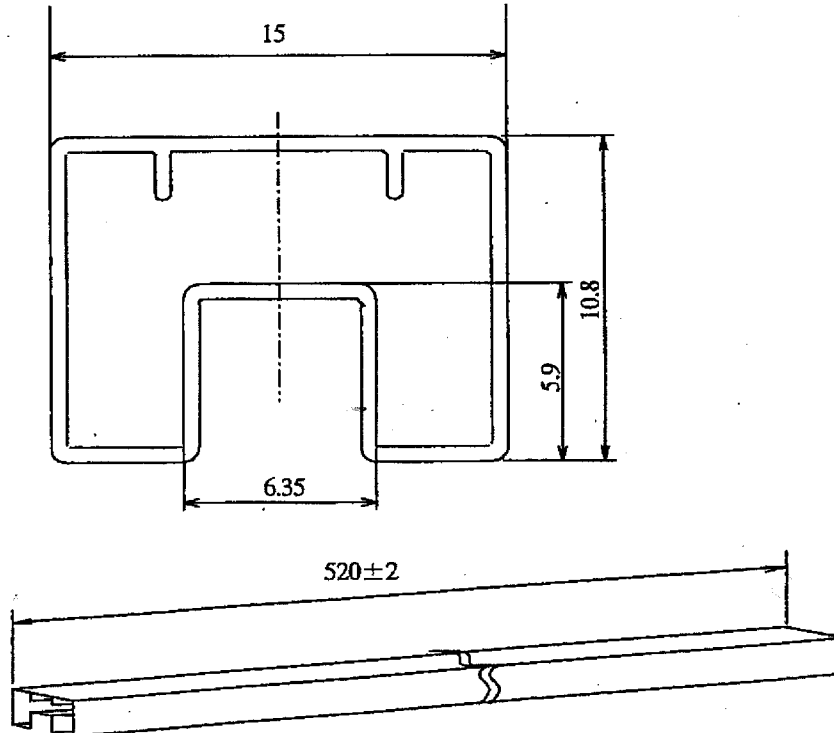
6.2.1 Package materials

| No. | Name | Materials | Purposes |
|-----|--------------|---|--|
| ① | Sleeve | HIPS with preventing static electricity | Products packaged |
| ② | Stopper | Styrene-Elastomer | Products fixed |
| ③ | Packing case | Corrugated cardboard | Sleeve packaged |
| ④ | Moltplane | Urethane | Sleeve fixed |
| ⑤ | Kraft tape | Paper | Lid of packaged case fixed |
| ⑥ | Label | Paper | Model No., quantity, inspection date and lot No. specified |

6.2.2 Package method

- (1) MAX. 50pcs. of products shall be packaged in a sleeve ① and both of sleeve edges shall be fixed by stoppers ②.
- (2) MAX. 20 sleeves (product : 1000pcs.) above shall be packaged in a packing case ③ and pack a sheet of Moltplane ④ at one side.
- (3) Model No., quantity, inspection date and lot No. shall be marked on the label ⑥ and this label shall be put on the side of the packing case.
- (4) Case shall be closed with the lid and enclosed with kraft tape ⑤.

6.2.3 Sleeve package ① outline dimensions



Note 1) Thickness : 0.5 ± 0.2 mm

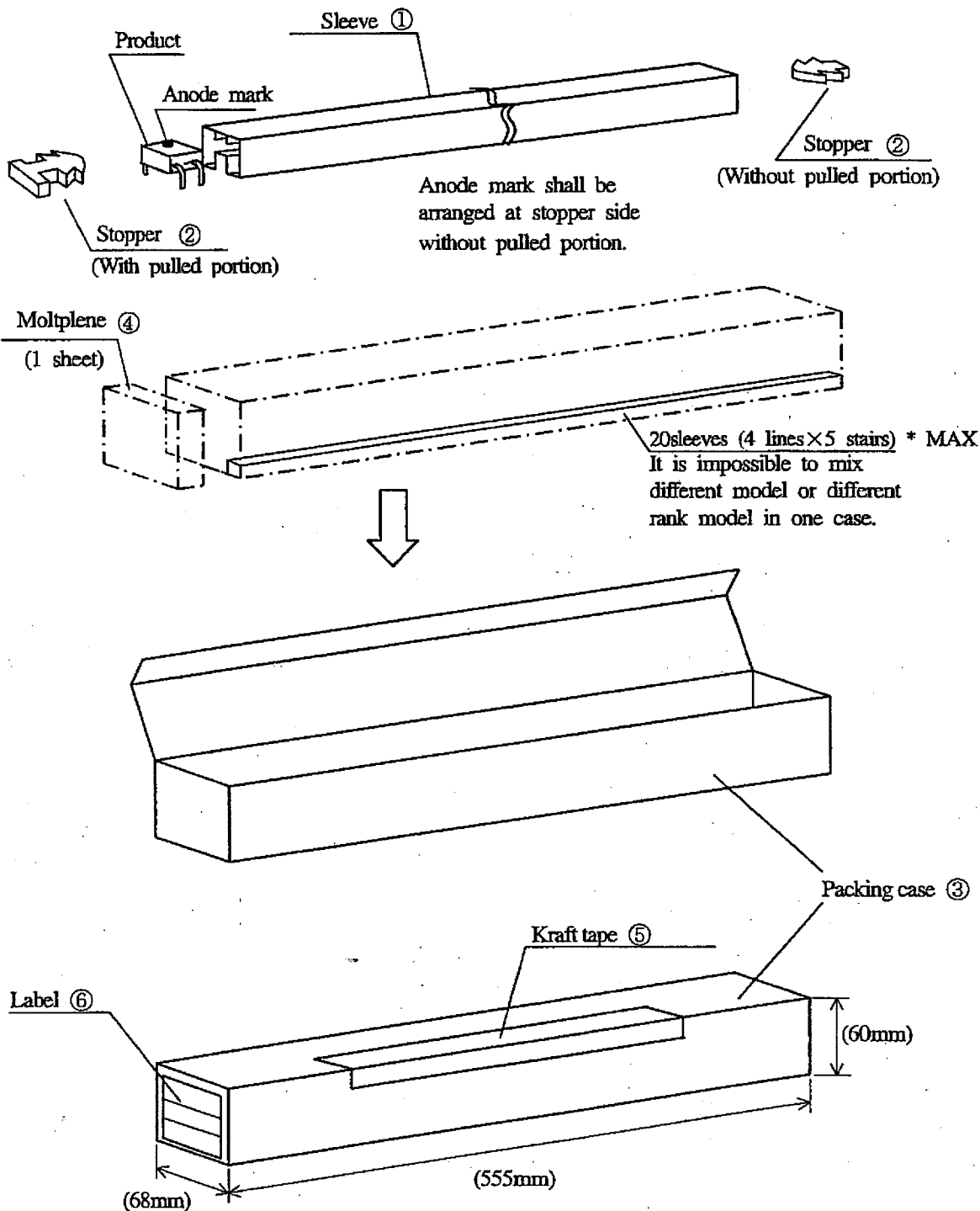
2) Outer R: 0.5mm

3) Process with applying antistatic treatment.

4) Unless otherwise specified tolerances shall be ± 0.5 mm.

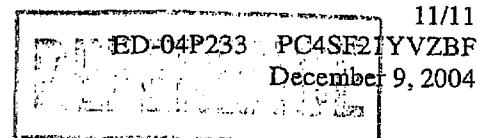
(However except for deformation due to the rubber stopper in sleeve.)

6.2.4. Packing case outline dimensions



() : Reference value

Regular packing mass : Approx. 800g



6.2.5 Marking

(1) Label of model No., Lot No. and quantity

| | | | |
|---|-------------------------|--|--|
| S H A R P Electronic Components | | NO CFCs used In this packaging MADE IN JAPAN | |
| TYPE | 4SF21 (PC4SF21YVZBF) | | |
| QUANTITY | 1000 | | |
| LOT (DATE) | ***** - ** | | |
| | SD | | |

- Label dimensions 60mm × 42mm
- Indications
 - 4SF21 Model No.
 - TYPE : (PC4SF21YVZBF) Business dealing name
 - QUANTITY : 1000 For cartons (1000)
 - LOT (DATE) : *****-** Packing lot No.
 - ** Mark date code

(2) Bar code label

| | |
|-----------------------------|--------|
| MODEL NUMBER : PC4SF21YVZBF | |
| | |
| QUANTITY | : 1000 |
| | |
| PRODUCTION DATE CODE : SD | |
| | |

- Label dimensions 65mm × 45mm
- Bar coding method
Code 39
- Indications
 - Model No. : PC4SF21YVZBF Business dealing name
 - QUANTITY : 1000 For cartons (1000)
 - Production date code : SD Mark date code

6.2.6 Storage condition

- Taped products shall be stored at the temperature 5 to 30°C and the humidities lower than 70%RH.

6.2.7 Safety protection during shipping

- There shall be no deformation of component or degradation of electrical characteristics due to shipping.

1. This specification shall be applied to photocoupler, Model No. 4SF21 series as an option.

2. Applicable Models (Business dealing name)

PC4SF21YVZBF

3. The relevant models are the models Approved by VDE according to DIN EN 60747-5-2.

Up to date code "RD" (December 2003), the relevant models are approved by VDE according to DIN VDE0884/08.87.

Model No. : 4SF21

VDE approved No. : 40008189 (According to the specification DIN EN 60747-5-2)

- Operating isolation voltage $U_{IORM(PEAK)}$: 1140V
- Transient voltage : 9000V
- Pollution : 2
- Clearances distance (Between input and output) : 8.0mm (MIN.)
- Creepage distance (Between input and output) : 8.0mm (MIN.)
- Isolation thickness between input and output : 0.40mm (MIN.)
- Tracking-proof : CTI 175
- Safety limit values
 - Current (Isi) : 200mA (Diode side)
 - Power (Psi) : 400mW (Phototriac side)
 - Temperature (Tsi) : 150°C

In order to keep safety electric isolation of photocoupler, please set the protective circuit to keep within safety limit values when the actual application equipment troubled.

• Indication of VDE approval "  " prints on minimum unit package.

4. Outline

Refer to the attachment-1-2.

5. Isolation specification according to EN 60747-5-2

| Parameter | Symbol | Conditions | Rating | Unit | Remark |
|--|------------------|--------------------------------------|----------------|----------|---|
| Class of environmental test | - | - | 40/100/21 | - | Refer to the Diagram 1, 2 (Attachment -2-3) |
| Pollution | - | - | 2 | - | |
| Maximum operating isolation voltage | $U_{IORM(PEAK)}$ | - | 1140 | V | |
| Partial discharge test voltage (Between input and output) | Diagram 1 | $t_p=10\text{ s}, q_c < 5\text{ pC}$ | 1710 | V | |
| | Diagram 2 | $t_p=1\text{ s}, q_c < 5\text{ pC}$ | 2140 | V | |
| Maximum over-voltage | $U_{IOTM(PEAK)}$ | $t_{DI}=60\text{ s}$ | 9000 | V | |
| Safety maximum ratings | | | | | |
| 1) Case temperature | Tsi | $I_f=0, P_c=0$ | 150 | °C | Refer to Fig.1, 2 (Attachment -2-3) |
| 2) Input current | Isi | $P_c=0$ | 200 | mA | |
| 3) Electric power (Output or Total power dissipation) | Psi | - | 400 | mW | |
| Isolation resistance (Test voltage between input and output ; DC 500V) | R_{ISO} | Ta=Tsi | MIN. 10^9 | Ω | |
| | | Ta=Topr (MAX.) | MIN. 10^{11} | | |
| | | Ta=25°C | MIN. 10^{12} | | |

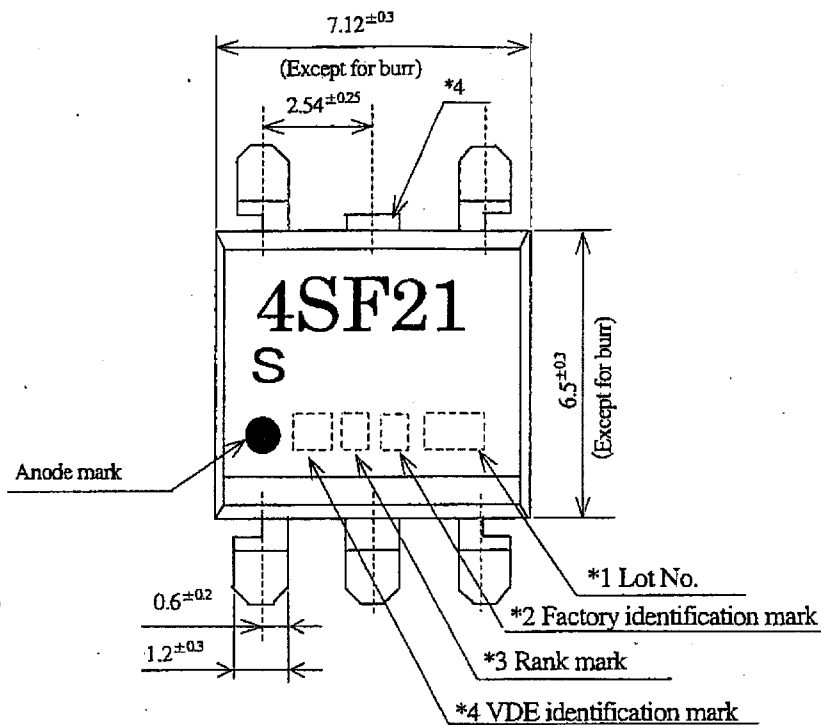
6. Precautions in performing isolation test

6.1 Partial discharge test methods shall be the ones according to the specifications of EN 60747-5-2

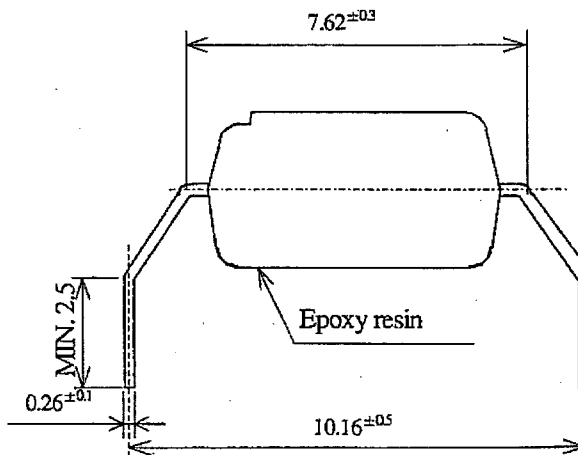
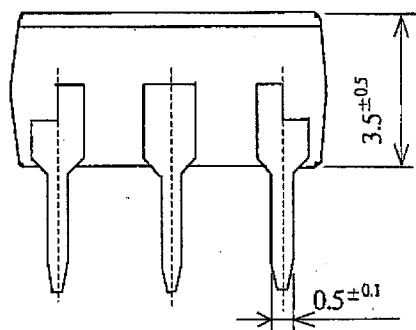
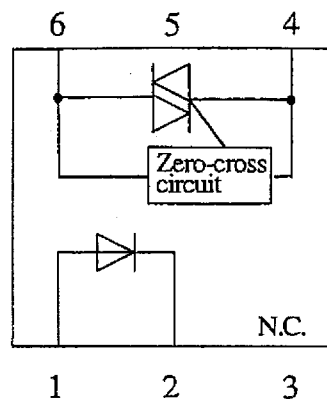
6.2 Please don't carry out isolation test (Viso) over U_{IOTM} .

This product deteriorates isolation characteristics by partial discharge due to applying high voltage (ex. U_{IOTM}).

And there is possibility that this product occurs partial discharge in operating isolation voltage. (U_{IORM})



Pin Nos. and internal connection diagram

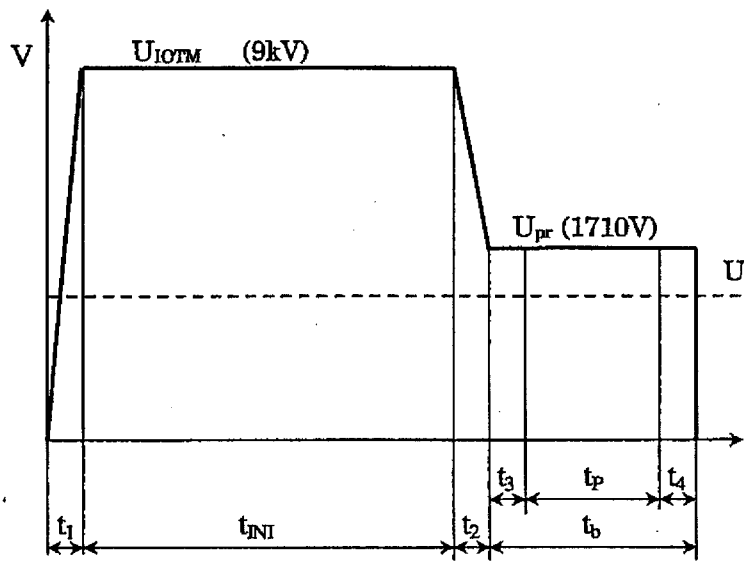


- *1) 2-digit number shall be marked according to DIN standard.
- *2) Factory identification mark shall be or shall not be marked.
- *3) Rank mark : "B"
- *4) VDE identification mark shall be marked "4"
- *5) Pin 5 is not allowed external connection.
Pin 5 is cut at outside of package.
- *6) Pin material : Copper Alloy
Pin finish : SnCu plating (Cu : TYP. 2%)

Product mass : Approx.0.35g

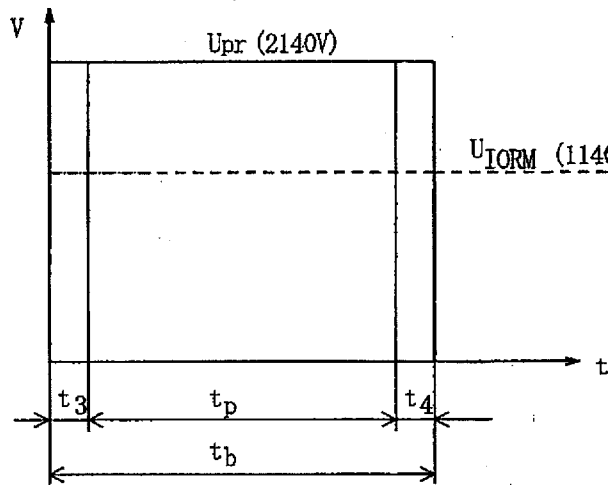
| | |
|---------------|--|
| UNIT : 1/1 mm | |
| Name | 4SF21 Outline Dimensions (Business dealing name : PC4SF21YVZBF) |

Method of Diagram 1 : Breakdown test (Apply to type test and sampling test)



- t_1, t_2 = 1 to 10 s
- t_3, t_4 = 1 s
- t_p (Partial discharge measuring time) = 10 s
- t_b = 12 s
- t_{INI} = 60 s

Method of Diagram 2 : Non breakdown test (Apply to all device test)



- t_3, t_4 = 0.1 s
- t_p (Partial discharge measuring time) = 1 s
- t_b = 1.2 s

Fig. 1 Safety maximum power dissipation vs. ambient temperature (When failed)

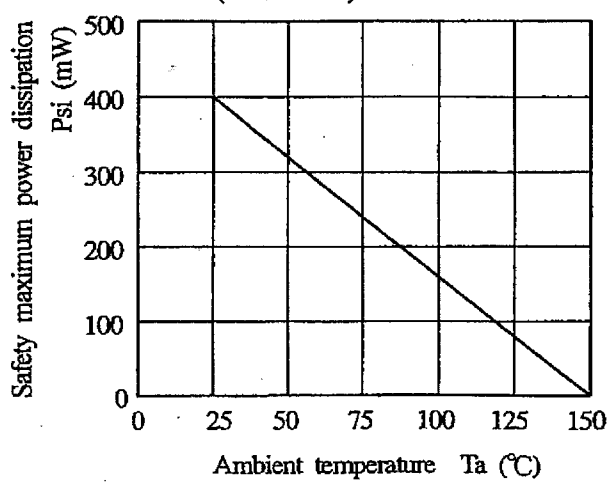


Fig. 2 Safety maximum forward current vs. ambient temperature (When failed)

