

# Specification

(Reference)

Title: CHIP FUSE; RECTANGULAR TYPE

Style: FCC10,16,20,32, FHC10,16,20,32

RoHS COMPLIANCE ITEM

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**釜屋電機株式會社**  
**KAMAYA ELECTRIC CO., LTD.**

Issue Dept.: Research & Development Department Hokkaido Research Center

1. Scope

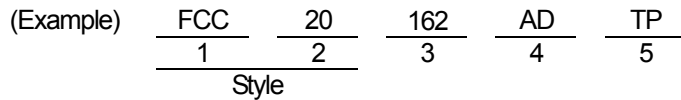
1.1 This specification covers the detail requirements for chip fuses; rectangular type, style of FCC10,16,20,32, FHC10,16,20,32.

1.2 Applicable documents

- UL248-1-2000 Low-Voltage Fuses-Part1: General Requirements
- UL248-14-2000 Low-Voltage Fuses-Part14: Supplemental Fuses
- CSA C22.2 No.248.1-2000 Low-Voltage Fuses-Part1: General Requirements
- CSA C22.2 No.248.14-2000 Low-Voltage Fuses-Part14: Supplemental Fuses
- IEC60127-1 Miniature fuses-part 1: Definitions for miniature fuses and general requirements for miniature fuse-links
- IEC60127-4 Miniature fuses-Part4: Universal modular fuse-links (UMF)

2. Classification

Type designation shall be the following form.



1 Chip fuses; rectangular type Style

2 Size

3 Rated current Example: 162 → 1.6 (A)

4 Optional code

| Symbol | Content  |
|--------|----------|
| AB     | Standard |
| AD     |          |

5 Packaging form

3. Safety standard approval

- UL248-1 and UL248-14
  - CSA C22.2, No. 248.1-00 and CSA C22.2, No. 248.14-00
- The file number to be designated by UL and C-UL shall be as follows: E176847

4. Rating

The ratings shall be in accordance with Table-1.

4.1 Optional code: AB

Table-1(1)

| Style | Rated current |       |                | Internal resistance value (mΩ max.) | Rated voltage (V) | Breaking capacity (A) | Time / current characteristic |                 |
|-------|---------------|-------|----------------|-------------------------------------|-------------------|-----------------------|-------------------------------|-----------------|
|       | Symbol        | (A)   | Marking symbol |                                     |                   |                       | Current                       | Pre-arcing time |
| FCC10 | 201           | 0.2   | Z              | 2400                                | DC30              | 35                    | 200%                          | 5 s max.        |
|       | 251           | 0.25  | C              | 1000                                |                   |                       |                               |                 |
|       | 321           | 0.315 | D              | 750                                 |                   |                       |                               |                 |
|       | 401           | 0.4   | E              | 620                                 |                   |                       |                               |                 |
|       | 501           | 0.5   | F              | 340                                 |                   |                       |                               |                 |
|       | 631           | 0.63  | I              | 290                                 |                   |                       |                               |                 |
|       | 751           | 0.75  | A              | 220                                 |                   |                       |                               |                 |
|       | 801           | 0.8   | K              | 210                                 |                   |                       |                               |                 |
|       | 102           | 1.0   | L              | 150                                 |                   |                       |                               |                 |
|       | 132           | 1.25  | M              | 120                                 |                   |                       |                               |                 |
|       | 152           | 1.5   | H              | 100                                 |                   |                       |                               |                 |
| FHC10 | 162           | 1.6   | N              | 90                                  | DC24              |                       |                               |                 |
|       | 202           | 2.0   | S              | 55                                  |                   |                       |                               |                 |
|       | 252           | 2.5   | T              | 40                                  |                   |                       |                               |                 |

Table-1(2)

| Style | Rated current |       |                | Internal resistance value<br>(mΩ max.) | Rated voltage<br>(V) | Breaking capacity<br>(A) | Time / current characteristic |                 |
|-------|---------------|-------|----------------|--|----------------------|--------------------------|-------------------------------|-----------------|
|       | Symbol        | (A)   | Marking symbol |  |                      |                          | Current                       | Pre-arcing time |
| FCC16 | 201           | 0.2   | ZB             | 3,200                                  | DC36                 | 35                       | 200%                          | 5 s max.        |
|       | 251           | 0.25  | CB             | 1,800                                  |                      |                          |                               |                 |
|       | 321           | 0.315 | DB             | 1,000                                  |                      |                          |                               |                 |
|       | 401           | 0.4   | EB             | 750                                    |                      |                          |                               |                 |
|       | 501           | 0.5   | FB             | 330                                    |                      |                          |                               |                 |
|       | 631           | 0.63  | IB             | 280                                    |                      |                          |                               |                 |
|       | 751           | 0.75  | AB             | 210                                    |                      |                          |                               |                 |
|       | 801           | 0.8   | KB             | 200                                    |                      |                          |                               |                 |
|       | 102           | 1.0   | LB             | 130                                    |                      |                          |                               |                 |
|       | 132           | 1.25  | MB             | 110                                    |                      |                          |                               |                 |
|       | 152           | 1.5   | HB             | 95                                     |                      |                          |                               |                 |
|       | 162           | 1.6   | NB             | 85                                     |                      |                          |                               |                 |
| FHC16 | 202           | 2.0   | SB             | 70                                     |                      |                          |                               |                 |
| FHC16 | 252           | 2.5   | TB             | 40                                     | DC32                 |                          |                               |                 |
| FCC20 | 501           | 0.5   | FB             | 330                                    | DC50                 | 50                       | 200%                          | 5 s max.        |
|       | 631           | 0.63  | IB             | 270                                    |                      |                          |                               |                 |
|       | 801           | 0.8   | KB             | 190                                    |                      |                          |                               |                 |
|       | 102           | 1.0   | LB             | 130                                    |                      |                          |                               |                 |
|       | 132           | 1.25  | MB             | 100                                    |                      |                          |                               |                 |
|       | 162           | 1.6   | NB             | 80                                     |                      |                          |                               |                 |
| FHC20 | 202           | 2.0   | SB             | 65                                     |                      |                          |                               |                 |
| FHC20 | 252           | 2.5   | TB             | 40                                     | DC32                 |                          |                               |                 |

4.2 Optional code: AD

Table-1(3)

| Style | Rated current |       |                | Internal resistance value<br>(mΩ max.) | Rated voltage<br>(V) | Breaking capacity<br>(A) | Time / current characteristic |                 |
|-------|---------------|-------|----------------|--|----------------------|--------------------------|-------------------------------|-----------------|
|       | Symbol        | (A)   | Marking symbol |  |                      |                          | Current                       | Pre-arcing time |
| FCC10 | 151           | 0.15  | O              | 2700                                   | DC32                 | 35                       | 250%                          | 5 s max.        |
|       | 201           | 0.2   | Z              | 1000                                   | DC30                 |                          |                               |                 |
|       | 251           | 0.25  | C              | 750                                    |                      |                          |                               |                 |
|       | 321           | 0.315 | D              | 620                                    |                      |                          |                               |                 |
|       | 401           | 0.4   | E              | 340                                    |                      |                          |                               |                 |
|       | 501           | 0.5   | F              | 290                                    |                      |                          |                               |                 |
|       | 631           | 0.63  | I              | 210                                    |                      |                          |                               |                 |
|       | 801           | 0.8   | K              | 150                                    |                      |                          |                               |                 |
|       | 102           | 1.0   | L              | 120                                    |                      |                          |                               |                 |
|       | 132           | 1.25  | M              | 90                                     |                      |                          |                               |                 |
| FHC10 | 162           | 1.6   | N              | 55                                     | DC24                 |                          |                               |                 |
|       | 202           | 2.0   | S              | 40                                     |                      |                          |                               |                 |
|       | 252           | 2.5   | T              | 36                                     |                      |                          |                               |                 |
|       | 322           | 3.15  | U              | 26                                     |                      |                          |                               |                 |

Table-1(4)

| Style | Rated current |       |                | Internal resistance value<br>(mΩ max.) | Rated voltage<br>(V) | Breaking capacity<br>(A) | Time / current characteristic |                 |
|-------|---------------|-------|----------------|--|----------------------|--------------------------|-------------------------------|-----------------|
|       | Symbol        | (A)   | Marking symbol |  |                      |                          | Current                       | Pre-arcing time |
| FCC16 | 151           | 0.15  | OD             | 4000                                   | DC50                 | 35                       | 250%                          | 5 s max.        |
|       | 201           | 0.2   | ZD             | 1800                                   |                      |                          |                               |                 |
|       | 251           | 0.25  | CD             | 1000                                   |                      |                          |                               |                 |
|       | 321           | 0.315 | DD             | 750                                    |                      |                          |                               |                 |
|       | 401           | 0.4   | ED             | 330                                    |                      |                          |                               |                 |
|       | 501           | 0.5   | FD             | 280                                    |                      |                          |                               |                 |
|       | 631           | 0.63  | ID             | 200                                    |                      |                          |                               |                 |
|       | 801           | 0.8   | KD             | 130                                    |                      |                          |                               |                 |
|       | 102           | 1.0   | LD             | 110                                    |                      |                          |                               |                 |
|       | 132           | 1.25  | MD             | 85                                     |                      |                          |                               |                 |
|       | 162           | 1.6   | ND             | 70                                     |                      |                          |                               |                 |
|       | 202           | 2.0   | SD             | 55                                     |                      |                          |                               |                 |
| FHC16 | 252           | 2.5   | TD             | 45                                     | DC32                 | 50                       | 250%                          | 5 s max.        |
|       | 322           | 3.15  | UD             | 26                                     | DC24                 |                          |                               |                 |
| FCC20 | 401           | 0.4   | 401            | 330                                    | DC50                 | 50                       | 250%                          | 5 s max.        |
|       | 501           | 0.5   | 501            | 270                                    |                      |                          |                               |                 |
|       | 631           | 0.63  | 631            | 190                                    |                      |                          |                               |                 |
|       | 801           | 0.8   | 801            | 130                                    |                      |                          |                               |                 |
|       | 102           | 1.0   | 102            | 100                                    |                      |                          |                               |                 |
|       | 132           | 1.25  | 132            | 80                                     |                      |                          |                               |                 |
|       | 162           | 1.6   | 162            | 65                                     |                      |                          |                               |                 |
|       | 202           | 2.0   | 202            | 55                                     |                      |                          |                               |                 |
| FHC20 | 252           | 2.5   | 252            | 40                                     | DC32                 | 50                       | 250%                          | 5 s max.        |
|       | 322           | 3.15  | UD             | 26                                     |                      |                          |                               |                 |
|       | 402           | 4.0   | XD             | 19                                     |                      |                          |                               |                 |
| FCC32 | 502           | 5.0   | YD             | 14                                     | DC64                 | 50                       | 250%                          | 5 s max.        |
|       | 201           | 0.2   | 201            | 1800                                   |                      |                          |                               |                 |
|       | 251           | 0.25  | 251            | 1000                                   |                      |                          |                               |                 |
|       | 321           | 0.315 | 321            | 750                                    |                      |                          |                               |                 |
|       | 401           | 0.4   | 401            | 350                                    |                      |                          |                               |                 |
|       | 501           | 0.5   | 501            | 295                                    |                      |                          |                               |                 |
|       | 631           | 0.63  | 631            | 200                                    |                      |                          |                               |                 |
|       | 801           | 0.8   | 801            | 140                                    |                      |                          |                               |                 |
|       | 102           | 1.0   | 102            | 110                                    |                      |                          |                               |                 |
|       | 132           | 1.25  | 132            | 85                                     |                      |                          |                               |                 |
|       | 152           | 1.5   | 152            | 78                                     |                      |                          |                               |                 |
|       | 162           | 1.6   | 162            | 75                                     |                      |                          |                               |                 |
| FHC32 | 202           | 2.0   | 202            | 65                                     | DC32                 | 50                       | 250%                          | 5 s max.        |
|       | 252           | 2.5   | 252            | 45                                     |                      |                          |                               |                 |
|       | 322           | 3.15  | UD             | 26                                     |                      |                          |                               |                 |
| FHC32 | 402           | 4.0   | XD             | 19                                     | DC32                 | 50                       | 250%                          | 5 s max.        |
|       | 502           | 5.0   | YD             | 14                                     |                      |                          |                               |                 |

4.3 Working temperature range: -55 to +125(°C)

5. Packaging form

The standard packaging form shall be in accordance with Table-2.

Table-2

| Symbol | Packaging form                     |                        | Standard packaging quantity / units | Application                    |
|--------|------------------------------------|------------------------|-------------------------------------|--------------------------------|
| B      | Bulk (loose package)               |                        | 1,000 pcs.                          | FCC10,16,20,32, FHC10,16,20,32 |
| PA     | Press pocket taping (paper taping) | 8mm width, 2mm pitches | 10,000 pcs.                         | FCC10, FHC10                   |
| TP     | Paper taping                       | 8mm width, 4mm pitches | 5,000 pcs.                          | FCC16,20,32, FHC16,20,32       |

6. Dimensions

6.1 The resistor shall be of the design and physical dimensions in accordance with Figure-1 and Table-3.



Figure-1  
Table-3

| Style        | L        | W                                     | H         | c        | d         | Unit:mm |
|--------------|----------|---------------------------------------|-----------|----------|-----------|---------|
| FCC10, FHC10 | 1.0±0.05 | 0.5±0.05                              | 0.4±0.05  | 0.2±0.1  | 0.25±0.10 |         |
| FCC16, FHC16 | 1.6±0.1  | 0.8 <sup>+0.15</sup> <sub>-0.05</sub> | 0.45±0.10 | 0.3±0.15 | 0.3±0.1   |         |
| FCC20, FHC20 | 2.0±0.1  | 1.25±0.10                             | 0.6±0.1   | 0.4±0.2  | 0.4±0.2   |         |
| FCC32        | 3.2±0.2  | 1.6±0.15                              | 0.6±0.1   | 0.5±0.25 | 0.5±0.25  |         |
| FHC32        |          |                                       | 0.65±0.10 |          |           |         |

6.2 Net weight (Reference)

| Style        | Net weight(mg) |
|--------------|----------------|
| FCC10, FHC10 | 0.8            |
| FCC16, FHC16 | 2              |
| FCC20, FHC20 | 6              |
| FCC32        | 10             |
| FHC32        | 11             |

7. Marking

The Marking symbol of Sub-clause 4.1 shall be marked on over coat side.

(Example)

| Style | Optional code | Marking symbol | Content      |
|-------|---------------|----------------|--------------|
| FCC10 | AB            | N              | FCC10 162 AB |
| FHC10 |               | T              | FHC10 322 AD |
| FCC16 |               | SB             | FCC16 202 AB |
| FHC16 |               | TB             | FHC16 252 AB |
| FCC20 |               | SB             | FCC20 202 AB |
| FHC20 |               | TB             | FHC20 252 AB |
| FCC10 | AD            | N              | FCC10 162 AD |
| FHC10 |               | U              | FHC10 322 AD |
| FCC16 |               | ND             | FCC16 162 AD |
| FHC16 |               | UD             | FHC16 322 AD |
| FCC20 |               | 162            | FCC20 162 AD |
| FHC20 |               | UD             | FHC20 322 AD |
| FCC32 |               | 162            | FCC32 162 AD |
| FHC32 |               | UD             | FHC32 322 AD |

8. Performance

8.1 Unless otherwise specified, the standard range of atmospheric conditions for tests is as follows;

Ambient temperature: 5 °C to 35 °C, Relative humidity: 45 % to 85 %, Air pressure: 86 kPa to 106 kPa

If there is any doubt the results, measurements shall be made within the following:

Ambient temperature: 20 °C ± 2 °C, Relative humidity: 60 % to 70 %, Air pressure: 86 kPa to 106 kPa

8.2 The performance shall be satisfied in Table-4.

Table-4(1)

| No. | Test items                                 | Condition of test   | Performance requirements  |         |                 |
|-----|--|---|---|---------|-----------------|
| 1   | Temperature rise                           | The fuse shall be mounted on the test substrate as shown in Figure-2.<br>Measurement temp.: 10 °C to 30 °C<br>Test current: Rated current<br>The temperature at the hottest point on the surface of the fuse shall be measured after temperature equilibrium has been attained. | 75 °C max.  |         |                 |
| 2   | Current carrying capacity                  | The fuse shall be mounted on the test substrate as shown in Figure-2.<br>Test current: 110 % of Rated current<br>Test temp.: 70 °C ± 2 °C<br>Test period: 1h  | Without opening   |         |                 |
| 3   | Time / current characteristic              | The fuse shall be mounted on the test substrate as shown in Figure-2.<br>Test current shall be applied for continuously.  | Optional code   | Current | Pre-arcing time |
|     |  |   | AB  | 200%    | 5 s max.        |
|     |  |   | AD  | 250%    | 5 s max.        |
| 4   | Terminal bond strength of the face plating | JIS C 60068-2-21 Ue1<br>The fuse shall be mounted on the test substrate as shown in Figure-2.<br>Bending value: 3 mm (Among the fulcrums: 90 mm)<br>Duration: 10 s ± 1 s  | Change of internal resistance: ±3%<br>No evidence of mechanical damage. |         |                 |

Table-4(2)

| No. | Test items                   | Condition of test  | Performance requirements   |
|-----|------------------------------|--|--|
| 5   | Resistance to soldering heat | <p>Test by a piece.<br/>Temp. of solder bath: 260 °C ± 5 °C<br/>Immersion time: 10 s ± 1 s<br/>After immersion into solder, leaving the room temp. for 1h or more, and then measure the internal resistance.</p> <p>• Reflow soldering<br/>Pre-heating: 150 °C ~ 180 °C, 120 s max.<br/>Peak: 260 °C ± 5 °C, 10 s max.<br/>Reflow cycle: 2 times<br/>After immersion into solder, leaving the room temp. for 1h or more, and then measure the internal resistance.</p> | <p>Change of internal resistance: ±10%<br/>No evidence of appearance damage</p>  |
| 6   | Solderability                | <p>JIS C 60068-2-58<br/>Test by a piece<br/>Flux: Rosin-Methanol<br/>Temp. of solder bath: 235 °C ± 5 °C<br/>Immersion time: 2 s ± 0.5 s</p>   | <p>The surface of terminal immersed shall be min. of 95 % covered with a new coating of solder.</p>                                  |
| 7   | Rapid change temperature     | <p>JIS C 60068-2-14 Na<br/>The fuse shall be mounted on the test substrate as shown in Figure-2.<br/>Upper temperature: +125 °C<br/>Lower temperature: -55 °C<br/>Duration of exposure at each temperature: 30 min.<br/>Number of cycles: 5 cycles</p>   | <p>Change of internal resistance: ±10%<br/>No evidence of appearance damage</p>  |
| 8   | Endurance test               | <p>The fuse shall be mounted on the test substrate as shown in Figure-2.<br/>Test condition: Nominal ambient temp. and Relative humidity.<br/>Test potential:<br/>1. Cycle of 1 h "ON" and 15 min. "OFF" at 1.05 times rated current for 100 cycles.<br/>2. After above the test , 1.25 times rated current for 1h.</p>  | <p>The voltage drop across the fuse after the test shall not have increased by more than 10 % of the value measured before test.</p> |

9. Test substrate



Figure-2 FCC, FHC TEST SUBSTRATE

Remark 1). Material: Epoxide woven glass  
Thickness: 1.6mm Thickness of copper clad: 0.035mm

10. Taping

10.1 Applicable documents JIS C 0806-3: 1999, EIAJ ET-7103: 2004, EIAJ ET-7200B: 2003

10.2 Taping dimensions

10.2.1 Press pocket taping(8mm width, 2mm pitches)

Taping dimensions shall be in accordance with Figure-3 and Table-5.



Figure-3

Table-5

Unit:mm

| Style        | A        | B        | t <sub>1</sub> | t <sub>2</sub> | t <sub>3</sub> |
|--------------|----------|----------|----------------|----------------|----------------|
| FCC10, FHC10 | 0.65±0.1 | 1.15±0.1 | 0.6±0.05       | 0.7max.        | 0.5±0.05       |



10.2.2 Paper taping (8mm width, 4mm pitches)

Taping dimensions shall be in accordance with Figure-4 and Table-6.

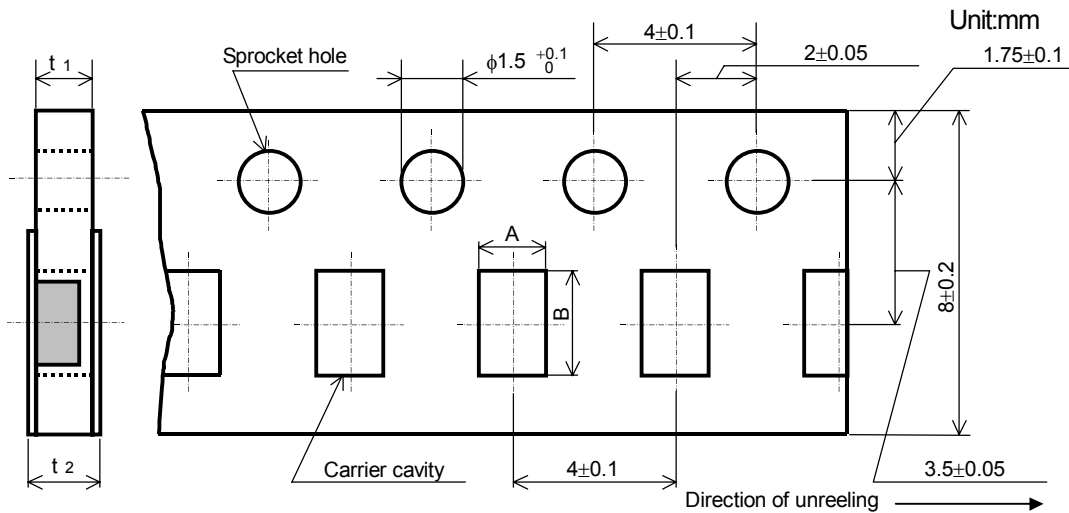


Figure-4

Table-6

Unit:mm

| Style        | A         | B       | t <sub>1</sub> | t <sub>2</sub> |
|--------------|-----------|---------|----------------|----------------|
| FCC16, FHC16 | 1.15±0.15 | 1.9±0.2 | 0.6±0.1        | 0.8 max.       |
| FCC20, FHC20 | 1.65±0.15 | 2.5±0.2 | 0.8±0.1        | 1.0 max.       |
| FCC32, FHC32 | 2.0±0.15  | 3.6±0.2 |                |                |

- 1). The cover tapes shall not cover the sprocket holes.
- 2). Tapes in adjacent layers shall not stick together in the packing.
- 3). Components shall not stick to the carrier tape or to the cover tape.
- 4). Pitch tolerance over any 10 pitches ±0.2mm.
- 5). The peel strength of the top cover tape shall be within 0.1N to 0.5N on the test method as shown in the following  
FCC10:Figure-5,FCC16,20,32: Figure-6.
- 6). When the tape is bent with the minimum radius for 25 mm, the tape shall not be damaged and the components shall maintain their position and orientation in the tape.
- 7). In no case shall there be two or more consecutive components missing.  
The maximum number of missing components shall be one or 0.1%, whichever is greater.
- 8). The fuses shall be faced to upward at the over coating side in the carrier cavity.

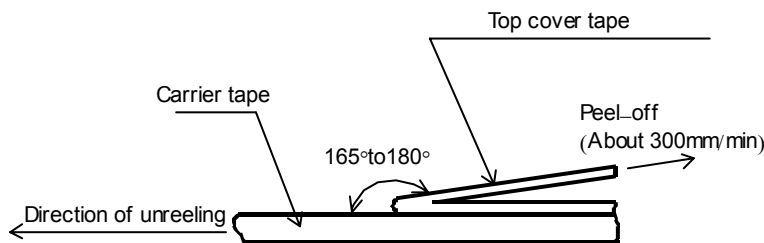


Figure-5

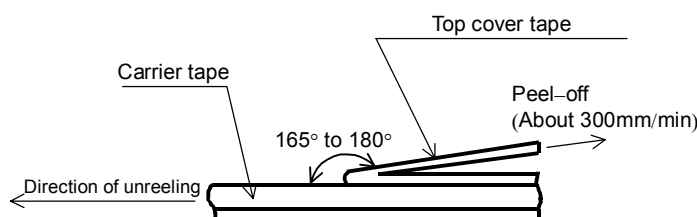


Figure-6

10.3 Reel dimension

Reel dimensions shall be in accordance with the following Figure-7 and Table-7.  
Plastic reel (Based on EIAJ ET-7200B)



Figure-7

Table-7

| Style                          | Unit:mm                          |          | Note              |
|--------------------------------|----------------------------------|----------|-------------------|
|                                | A                                | B        |                   |
| FCC10,16,20,32, FHC10,16,20,32 | 9 <sup>+1.0</sup> / <sub>0</sub> | 11.4±1.0 | Injection molding |
|                                |                                  | 13±1.0   | Vacuum forming    |

Note: Marking label shall be marked on a place of Marking A or two place of marking A and B.

10.4 Leader and trailer tape.

(Example)



Figure-8

11. Marking on package

The label of a minimum package shall be legibly marked with follows.

11.1 Marking A

- (1) Classification (Style, Rated current, Optional code, Packaging form)
- (2) Quantity
- (3) Lot number
- (5) Manufacturer's name or trade mark
- (6) UL and /or C-UL recognized component mark
- (7) Others

11.2 Marking B (KAMAYA Control label)

12. Recommended Derating for Rated Current

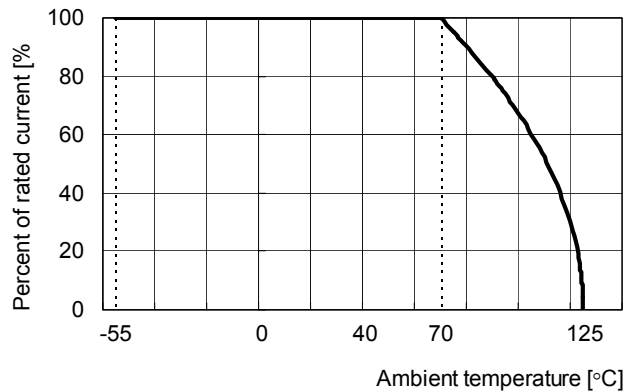
- Nominal Derating

- Option Code AB: Nominal Derating ≤ 70% of Rated Current

- Option Code AD: Nominal Derating ≤ 80% of Rated Current

- Temperature Derating

- Please refer to the following graph regarding the current derating value for ambient temperature.



Ex.) • If Optional code: AB (Rated Current:1.0A) is used under ambient temperature 70°C

Kamaya recommends, less than the current value derated as below,

Rated Current:  $1.0A \times (\text{Nominal Derating} : 70\% \times \text{Temperature Derating} : 100\%) = 0.7A$

- If Optional code: AD (Rated Current:1.0A) is used under ambient temperature 70°C

Kamaya recommends, less than the current value derated as below,

Rated Current:  $1.0A \times (\text{Nominal Derating} : 80\% \times \text{Temperature Derating} : 100\%) = 0.8A$

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- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- Лицензия ФСБ на осуществление работ с использованием сведений, составляющих государственную тайну;
- Поставка специализированных компонентов (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Aeroflex, Peregrine, Syfer, Eurofarad, Texas Instrument, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits, General Dynamics и др.);

Помимо этого, одним из направлений компании «ЭлектроПласт» является направление «Источники питания». Мы предлагаем Вам помощь Конструкторского отдела:

- Подбор оптимального решения, техническое обоснование при выборе компонента;
- Подбор аналогов;
- Консультации по применению компонента;
- Поставка образцов и прототипов;
- Техническая поддержка проекта;
- Защита от снятия компонента с производства.



#### Как с нами связаться

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