

# Specification

(Reference)

Title: CHIP FUSE; RECTANGULAR TYPE

Style: FMC10, 16

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

Issue Dept.: Research & Development Department Hokkaido Research Center

Title: CHIP FUSES; RECTANGULAR TYPE  
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## 1. Scope

1.1 This specification covers the detail requirements for chip fuses; rectangular type, style of FMC10, 16.

## 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

## 2. Classification

Type designation shall be the following form.

(Example) 

|     |    |     |    |    |
|-----|----|-----|----|----|
| FMC | 16 | 202 | AB | TP |
| 1   | 2  | 3   | 4  | 5  |

1 Chip fuses; rectangular type

2 Size

3 Rated current Example: 202 → 2.0 (A)

4 Optional code

| Symbol | Optional code |
|--------|---------------|
| AB     | Standard      |
| WB     |               |
| WH     |               |

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<br>(mΩ max.) | Rated voltage<br>(V) | Breaking capacity<br>(A) | Time / current characteristic |                                    |
|-------|---------------|------|----------------|----------------------------------------|----------------------|--------------------------|-------------------------------|------------------------------------|
|       | Symbol        | (A)  | Marking symbol |                                        |                      |                          | Current                       | Pre-arcing time                    |
| FMC10 | 501           | 0.5  | F              | 240                                    | DC24                 | 35                       | 100%<br>200%<br>300%          | 4 h min.<br>5 s max.<br>0.2 s max. |
|       | 751           | 0.75 | A              | 140                                    |                      |                          |                               |                                    |
|       | 102           | 1.0  | L              | 95                                     |                      |                          |                               |                                    |
|       | 132           | 1.25 | M              | 73                                     |                      |                          |                               |                                    |
|       | 152           | 1.5  | H              | 60                                     |                      |                          |                               |                                    |
|       | 202           | 2.0  | S              | 41                                     |                      |                          |                               |                                    |
|       | 252           | 2.5  | T              | 32                                     |                      |                          |                               |                                    |
|       | 302           | 3.0  | R              | 25                                     |                      |                          |                               |                                    |

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4.2 Optional code: WB

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                    |
| FMC16 | 501           | 0.5  | F              | 260                                    | DC32                 | 35                       | 100%<br>200%<br>300%          | 4 h min.<br>5 s max.<br>0.2 s max. |
|       | 751           | 0.75 | A              | 140                                    |                      |                          |                               |                                    |
|       | 102           | 1.0  | L              | 110                                    |                      |                          |                               |                                    |
|       | 132           | 1.25 | M              | 80                                     |                      |                          |                               |                                    |
|       | 152           | 1.5  | H              | 65                                     |                      |                          |                               |                                    |
|       | 202           | 2.0  | S              | 45                                     |                      |                          |                               |                                    |
|       | 252           | 2.5  | T              | 32                                     |                      |                          |                               |                                    |
|       | 302           | 3.0  | R              | 26                                     |                      |                          |                               |                                    |
|       | 402           | 4.0  | X              | 18                                     |                      |                          |                               |                                    |
|       | 502           | 5.0  | Y              | 14                                     |                      |                          |                               |                                    |

4.3 Optional code: WH

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                    |
| FMC10 | 501           | 0.5  | <u>F</u>       | 250                                    | DC24                 | 35                       | 100%<br>200%<br>300%          | 4 h min.<br>5 s max.<br>0.2 s max. |
|       | 751           | 0.75 | <u>A</u>       | 150                                    |                      |                          |                               |                                    |
|       | 102           | 1.0  | <u>L</u>       | 100                                    |                      |                          |                               |                                    |
|       | 132           | 1.25 | <u>M</u>       | 70                                     |                      |                          |                               |                                    |
|       | 152           | 1.5  | <u>H</u>       | 60                                     |                      |                          |                               |                                    |
|       | 202           | 2.0  | <u>S</u>       | 40                                     |                      |                          |                               |                                    |
|       | 252           | 2.5  | <u>T</u>       | 30                                     |                      |                          |                               |                                    |
|       | 302           | 3.0  | <u>R</u>       | 25                                     |                      |                          |                               |                                    |
|       | 322           | 3.15 | <u>U</u>       | 24                                     |                      |                          |                               |                                    |
|       | 402           | 4.0  | <u>X</u>       | 18                                     |                      |                          |                               |                                    |
| FMC16 | 502           | 5.0  | <u>Y</u>       | 14                                     | DC32                 | 35                       | 100%<br>200%<br>300%          | 4 h min.<br>5 s max.<br>0.2 s max. |
|       | 501           | 0.5  | OF             | 400                                    |                      |                          |                               |                                    |
|       | 631           | 0.63 | OI             | 300                                    |                      |                          |                               |                                    |
|       | 751           | 0.75 | OA             | 210                                    |                      |                          |                               |                                    |
|       | 801           | 0.8  | OK             | 180                                    |                      |                          |                               |                                    |
|       | 102           | 1.0  | OL             | 115                                    |                      |                          |                               |                                    |
|       | 132           | 1.25 | OM             | 90                                     |                      |                          |                               |                                    |
|       | 152           | 1.5  | OH             | 70                                     |                      |                          |                               |                                    |
|       | 162           | 1.6  | ON             | 60                                     |                      |                          |                               |                                    |
|       | 202           | 2.0  | OS             | 50                                     |                      |                          |                               |                                    |
|       | 252           | 2.5  | OT             | 37                                     |                      |                          |                               |                                    |
|       | 302           | 3.0  | OR             | 28                                     |                      |                          |                               |                                    |
|       | 322           | 3.15 | OU             | 26                                     |                      |                          |                               |                                    |
|       | 402           | 4.0  | OX             | 18                                     |                      |                          |                               |                                    |
|       | 502           | 5.0  | OY             | 14                                     |                      |                          |                               |                                    |

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

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## 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.                          | FMC10, 16   |
| TH     | Paper taping         | 8mm width, 2mm pitches | 10,000 pcs.                         | FMC10       |
| TP     | Paper taping         | 8mm width, 4mm pitches | 5,000 pcs.                          | FMC16       |

## 6. Dimensions

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

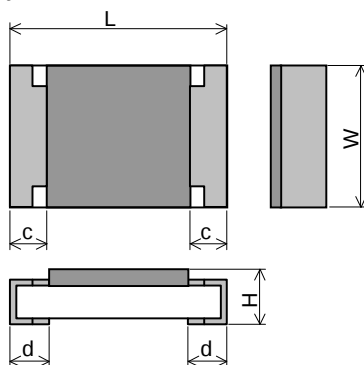


Figure-1

Table-3

Unit : mm

| Style | Optional code | L        | W                                     | H         | c        | d         |
|-------|---------------|----------|---------------------------------------|-----------|----------|-----------|
| FMC10 | WH            | 1.0±0.05 | 0.5±0.05                              | 0.35±0.05 | 0.2±0.10 | 0.25±0.10 |
|       | AB            |          |                                       | 0.38±0.05 |          |           |
| FMC16 | WB,WH         | 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   |

## 6.2 Net weight (Reference)

| Style | Net weight(mg) |
|-------|----------------|
| FMC10 | 0.6            |
| FMC16 | 2              |

## 7. Marking

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

(Example)

| Style | Optional code | Marking symbol | Content      |
|-------|---------------|----------------|--------------|
| FMC10 | AB            | S              | FMC10 202 AB |
| FMC10 | WH            | <u>S</u>       | FMC10 202 WH |
| FMC16 | WB            | S              | FMC16 202 WB |
| FMC16 | WH            | OS             | FMC16 202 WH |

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## 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  $\pm$  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   | 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.                                                                                                                                                                                                                                                                                                                                             | Current                                                                                      | Pre-arcing time |
|     |                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 100%                                                                                         | 4 h min.        |
|     |                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 200%                                                                                         | 5 s. max.       |
|     |                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 300%                                                                                         | 0.2 s max.      |
| 3   | Terminal bond strength of the face plating | <u>JIS C 60068-2-21 Ue1</u><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 $\pm$ 1 s                                                                                                                                                                                                                                                                                   | Change of internal resistance: $\pm$ 10%<br>No evidence of mechanical damage.                |                 |
| 4   | Resistance to soldering heat               | Test by a piece.<br>Temp. of solder bath: 260 °C $\pm$ 5 °C<br>Immersion time: 10 s $\pm$ 1 s<br>After immersion into solder, leaving the room temp. for 1h or more, and then measure the internal resistance.<br><br>• Reflow soldering<br>Pre-heating: 150 °C ~ 180 °C, 120 s max.<br>Peak: 260 °C $\pm$ 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. | Change of internal resistance: $\pm$ 10%<br>No evidence of appearance damage                 |                 |
| 5   | Solderability                              | <u>JIS C 60068-2-58</u><br>Test by a piece<br>Flux: Rosin-Methanol<br>Temp. of solder bath: 235 °C $\pm$ 5 °C<br>Immersion time: 2 s $\pm$ 0.5 s                                                                                                                                                                                                                                                                                                                     | The surface of terminal immersed shall be min. of 95 % covered with a new coating of solder. |                 |
| 6   | Rapid change temperature                   | <u>JIS C 60068-2-14 Na</u><br>The fuse shall be mounted on the test substrate as shown in Figure-2.<br>Lower temperature: -55 °C<br>Upper temperature: +125 °C<br>Duration of exposure at each temperature: 30 min.<br>Number of cycles: 5 cycles                                                                                                                                                                                                                    | Change of internal resistance: $\pm$ 10%<br>No evidence of appearance damage                 |                 |

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## 9. Test substrate

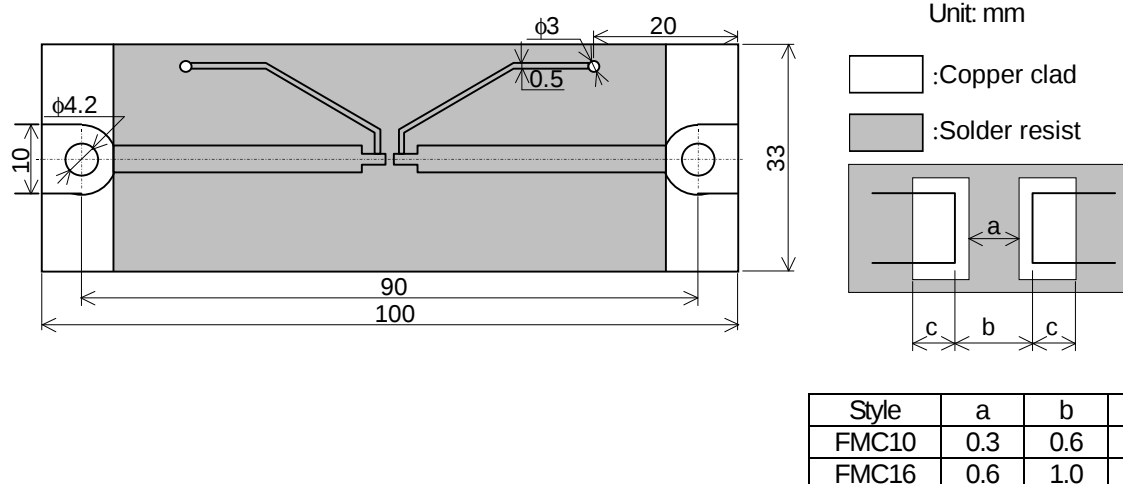


Figure-2 FMC TEST SUBSTRATE

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-7200B: 2003

10.2 Taping dimensions

10.2.1 Paper taping (8mm width, 2mm pitches)

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

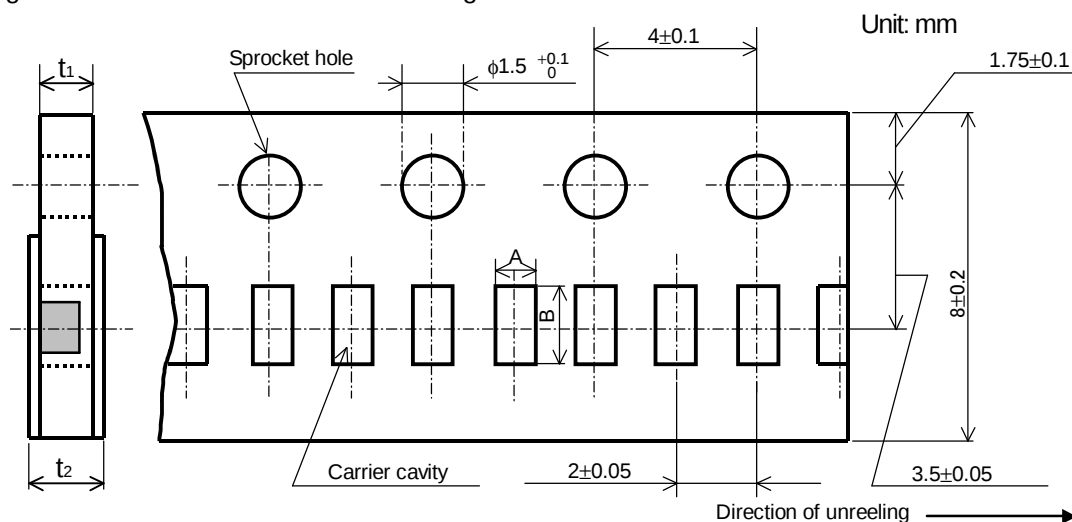


Figure-3

Table-5

Unit: mm

| Style | A                                      | B                                      | t <sub>1</sub> | t <sub>2</sub> |
|-------|----------------------------------------|----------------------------------------|----------------|----------------|
| FMC10 | 0.65 <sup>+0.05</sup> <sub>-0.10</sub> | 1.15 <sup>+0.05</sup> <sub>-0.10</sub> | 0.4±0.05       | 0.5max.        |

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

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

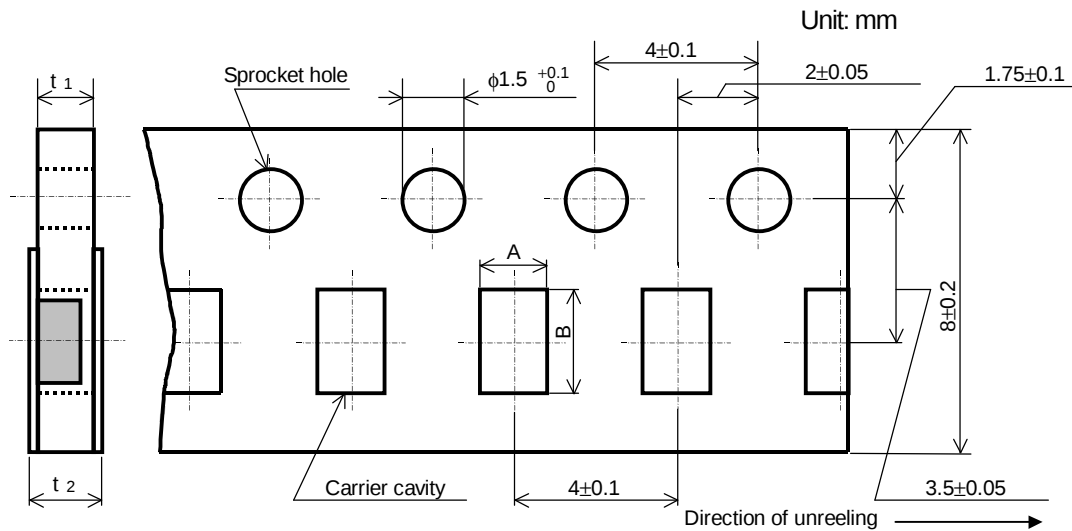


Figure-4

Table-6

Unit : mm

| Style | A               | B             | $t_1$         | $t_2$    |
|-------|-----------------|---------------|---------------|----------|
| FMC16 | $1.15 \pm 0.15$ | $1.9 \pm 0.2$ | $0.6 \pm 0.1$ | 0.8 max. |

- 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  $\pm 0.2$ mm.
- 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 Figure-5.
- 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.

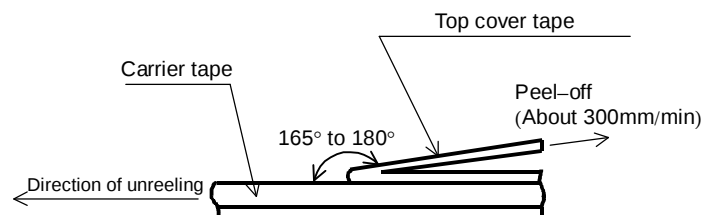


Figure-5

### 10.3 Reel dimension

Reel dimensions shall be in accordance with the following Figure-6 and Table-7.

Plastic reel (Based on EIAJ ET-7200B)

Unit: mm

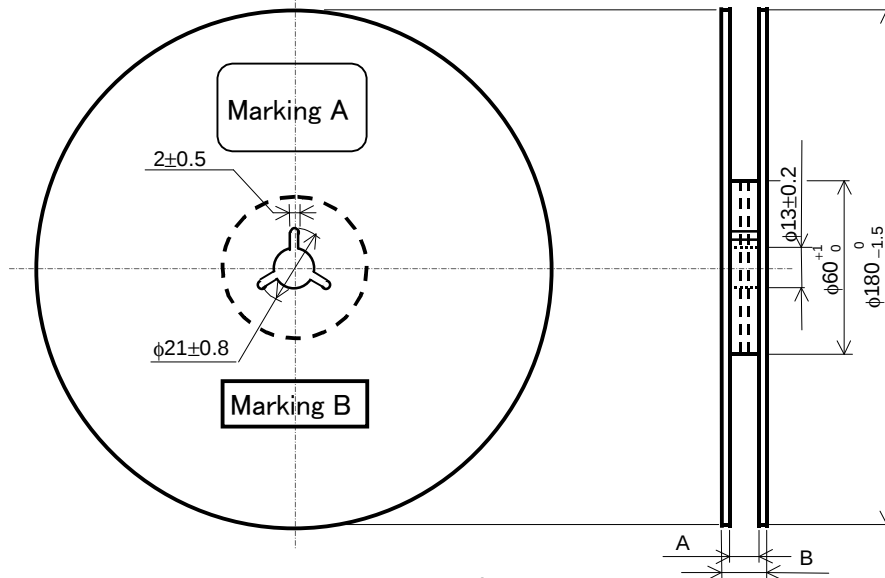


Figure-6

Table-7

Unit: mm

| Style     | A                              | B        | Note              |
|-----------|--------------------------------|----------|-------------------|
| FMC10, 16 | 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)

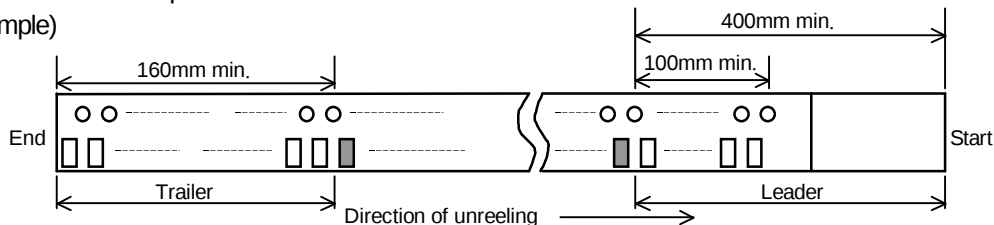


Figure-7

## 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  
(4) Manufacturer's name or trade mark (5) UL and /or C-UL recognized component mark (6) Others

### 11.2 Marking B (KAMAYA Control label)

## 12. Recommended Derating for Rated Current

This fuse will recommend use by the current reduction value according to the following derating curve.

- Nominal Derating

Nominal Derating  $\leq 75\%$  of Rated Current

\*FMC10 Optional code: WH, Rated current  $\geq 3.15A$  : Nominal Derating  $\leq 70\%$  of Rated Current

- Temperature Derating

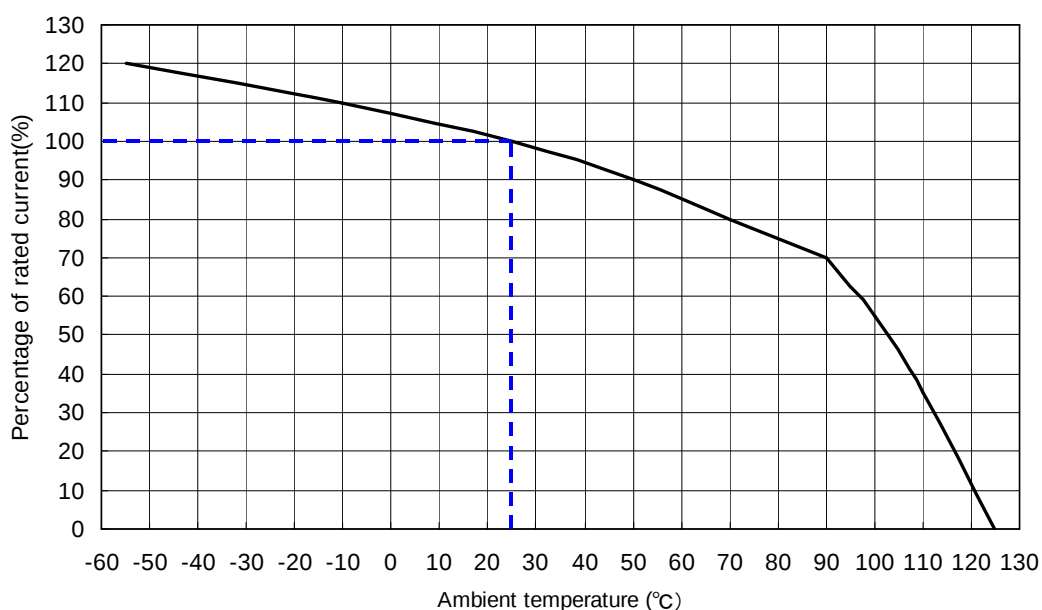
Please refer to the following graph regarding the current derating value for ambient temperature.

Ex.) If FMC16 202WH (Rated Current 2.0A) is used under ambient temperature 70°C,

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

Rated Current :  $2.0A \times (\text{Nominal Derating} : 75\% \times \text{Temperature Derating} : 80\%) = 1.2A$

Derating curve



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