

| Document No.:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | EPS-CC12M                                                                                                                             |                      |              |           |          |      |                      |      |     |        |       |   |                           |         |        |           |    |   |                                           |        |        |           |    |   |                                                                                                                                       |        |        |           |    |   |                                        |         |         |           |          |    |                 |         |     |  |  |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------|----------------------|--------------|-----------|----------|------|----------------------|------|-----|--------|-------|---|---------------------------|---------|--------|-----------|----|---|-------------------------------------------|--------|--------|-----------|----|---|---------------------------------------------------------------------------------------------------------------------------------------|--------|--------|-----------|----|---|----------------------------------------|---------|---------|-----------|----------|----|-----------------|---------|-----|--|--|
| Title:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | CC12M Engineering Product Specification                                                                                               |                      |              |           |          |      |                      |      |     |        |       |   |                           |         |        |           |    |   |                                           |        |        |           |    |   |                                                                                                                                       |        |        |           |    |   |                                        |         |         |           |          |    |                 |         |     |  |  |
| Created By:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | M. Joiner                                                                                                                             | Engineering Approval | V. Kalra     |           |          |      |                      |      |     |        |       |   |                           |         |        |           |    |   |                                           |        |        |           |    |   |                                                                                                                                       |        |        |           |    |   |                                        |         |         |           |          |    |                 |         |     |  |  |
| Date:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Sept 1, 2006                                                                                                                          |                      | Sheet 1 of 9 |           |          |      |                      |      |     |        |       |   |                           |         |        |           |    |   |                                           |        |        |           |    |   |                                                                                                                                       |        |        |           |    |   |                                        |         |         |           |          |    |                 |         |     |  |  |
| <div><br/>114 Old State Rd. Ellisville, MO 63021</div> <p><b>COPYRIGHT - Cooper Industries, Inc.</b> This is an unpublished work. Further dissemination or disclosure to the public is PROHIBITED. This unpublished work is protected by Federal Copyright law and all rights thereunder are reserved by Cooper Industries, Inc.</p> <p><b>CONFIDENTIAL</b> - The information contained in this document is the property of Cooper Industries, Inc. It is not for public disclosure. Possession of the information does not convey any right to loan, sell or disclose the information. Unauthorized reproduction or use of the information is prohibited. This document is to be returned to Cooper Industries, Inc. upon completion of the purposes for which it is loaned or upon request.</p> <table><tr><th>Rev.</th><th>Revision Description</th><th>Date</th><th>ECN</th><th>Author</th><th>Appr.</th></tr><tr><td>D</td><td>Added CC12M10A , CC12M12A</td><td>8/17/07</td><td>H07083</td><td>Jian.Gong</td><td>SD</td></tr><tr><td>C</td><td>Added the tolerance of dimension, item5.2</td><td>6/7/07</td><td>H07028</td><td>Jian.Gong</td><td>SD</td></tr><tr><td>B</td><td>Added ' Lead-Free' description, item 2.0 ; Changed the resistance and I<sup>2</sup>t, item 6.1 ; Updated Agency Approvals, item 7.0</td><td>4/6/07</td><td>H07024</td><td>Jian.Gong</td><td>SD</td></tr><tr><td>A</td><td>Added CC12M15A, changed voltage to 24V</td><td>9/01/06</td><td>SB06315</td><td>M. Joiner</td><td>V. Kalra</td></tr><tr><td>--</td><td>Initial Release</td><td>12/9/05</td><td>n/a</td><td></td><td></td></tr></table> |                                                                                                                                       |                      |              |           |          | Rev. | Revision Description | Date | ECN | Author | Appr. | D | Added CC12M10A , CC12M12A | 8/17/07 | H07083 | Jian.Gong | SD | C | Added the tolerance of dimension, item5.2 | 6/7/07 | H07028 | Jian.Gong | SD | B | Added ' Lead-Free' description, item 2.0 ; Changed the resistance and I <sup>2</sup> t, item 6.1 ; Updated Agency Approvals, item 7.0 | 4/6/07 | H07024 | Jian.Gong | SD | A | Added CC12M15A, changed voltage to 24V | 9/01/06 | SB06315 | M. Joiner | V. Kalra | -- | Initial Release | 12/9/05 | n/a |  |  |
| Rev.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Revision Description                                                                                                                  | Date                 | ECN          | Author    | Appr.    |      |                      |      |     |        |       |   |                           |         |        |           |    |   |                                           |        |        |           |    |   |                                                                                                                                       |        |        |           |    |   |                                        |         |         |           |          |    |                 |         |     |  |  |
| D                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Added CC12M10A , CC12M12A                                                                                                             | 8/17/07              | H07083       | Jian.Gong | SD       |      |                      |      |     |        |       |   |                           |         |        |           |    |   |                                           |        |        |           |    |   |                                                                                                                                       |        |        |           |    |   |                                        |         |         |           |          |    |                 |         |     |  |  |
| C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Added the tolerance of dimension, item5.2                                                                                             | 6/7/07               | H07028       | Jian.Gong | SD       |      |                      |      |     |        |       |   |                           |         |        |           |    |   |                                           |        |        |           |    |   |                                                                                                                                       |        |        |           |    |   |                                        |         |         |           |          |    |                 |         |     |  |  |
| B                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Added ' Lead-Free' description, item 2.0 ; Changed the resistance and I <sup>2</sup> t, item 6.1 ; Updated Agency Approvals, item 7.0 | 4/6/07               | H07024       | Jian.Gong | SD       |      |                      |      |     |        |       |   |                           |         |        |           |    |   |                                           |        |        |           |    |   |                                                                                                                                       |        |        |           |    |   |                                        |         |         |           |          |    |                 |         |     |  |  |
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Added CC12M15A, changed voltage to 24V                                                                                                | 9/01/06              | SB06315      | M. Joiner | V. Kalra |      |                      |      |     |        |       |   |                           |         |        |           |    |   |                                           |        |        |           |    |   |                                                                                                                                       |        |        |           |    |   |                                        |         |         |           |          |    |                 |         |     |  |  |
| --                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Initial Release                                                                                                                       | 12/9/05              | n/a          |           |          |      |                      |      |     |        |       |   |                           |         |        |           |    |   |                                           |        |        |           |    |   |                                                                                                                                       |        |        |           |    |   |                                        |         |         |           |          |    |                 |         |     |  |  |

Form 202B-TGW01-IPS, Rev. 3/04

# Engineering Product Specification

## CC12M Series VRM Overcurrent Protection

Table of Contents

| Section | Title                                |
|---------|--------------------------------------|
| 1.0     | Scope                                |
| 2.0     | General Information                  |
| 3.0     | Manufacturer and Production Facility |
| 4.0     | Part Numbering System                |
| 5.0     | Mechanical Requirements              |
| 6.0     | Electrical Specifications            |
| 7.0     | Agency Requirements                  |
| 8.0     | Marking Specification                |
| 9.0     | Soldering Recommendations            |
| 10.0    | Packaging Specification              |
| 11.0    | Temperature De-Rating                |
| 12.0    | Process Flow Chart                   |
| 13.0    | Environmental Requirements           |
| 14.0    | End                                  |

|                      |              |                    |          |
|----------------------|--------------|--------------------|----------|
| <b>Document No.:</b> | EPS-CC12M    |                    |          |
| <b>Title:</b>        | CC12M        |                    |          |
| <b>Created By:</b>   | M. Joiner    | <b>Eng./Appr.:</b> | V. Kalra |
| <b>Date:</b>         | Sept 1, 2006 | Sheet 2 of 9       |          |

## 1.0 Scope

This Engineering Product Specification (EPS) is intended to provide end customers with information regarding Bussmann's CC12M VRM Overcurrent Protection Product Series overcurrent protection devices.

## 2.0 General Information

The Bussmann CC12M VRM Overcurrent Protection Device is a RoHS compliant & Lead-Free, one-time fuse based on Bussmann's SolidMatrix technology. It is designed to provide superior protection from short circuit overcurrent events common to high-current Voltage Regulator Module (VRM) equipment. This device is designed to be compatible with wave and IR soldering processes and allow end users to protect their VRM circuits.

## 3.0 Manufacturer and Production Facility

### Manufacturer

Cooper Bussmann, Inc.  
P.O. Box 14460  
St. Louis, MO 63178-4460

### Production Facilities

- A) Cooper Electronic Shanghai, Ltd  
955 Sheng Li Road  
Pudong, Shanghai, China
  
- B) Silver Victory (Donguan) Plant  
Xin Min Industrial Estate  
Changang Donguan  
Guangdong Province, China

This bulletin is intended to clearly present comprehensive product data and provide technical information that will help the end user with design applications. Bussmann reserves the right, without notice, to change design or construction of any products and to discontinue or limit distribution of any products. Bussmann also reserves the right to change or update, without notice, any technical information contained in this bulletin. Once a product has been selected, it should be tested by the user in all possible applications.

|                      |              |                    |          |
|----------------------|--------------|--------------------|----------|
| <b>Document No.:</b> | EPS-CC12M    |                    |          |
| <b>Title:</b>        | CC12M        |                    |          |
| <b>Created By:</b>   | M. Joiner    | <b>Eng./Appr.:</b> | V. Kalra |
| <b>Date:</b>         | Sept 1, 2006 | Sheet 3 of 9       |          |

## 4.0 Part Numbering System

### 4.1.1 Catalog Symbol

Example: CC12M20A

|           |           |          |            |
|-----------|-----------|----------|------------|
| <u>CC</u> | <u>12</u> | <u>M</u> | <u>20A</u> |
| 1         | 2         | 3        | 4          |

- |                |                           |
|----------------|---------------------------|
| 1) Technology  | CC (Ceramic CHIP™Fuse)    |
| 2) Footprint   | 12 (1206)                 |
| 3) Family:     | M (VRM Protection Device) |
| 4) Amp Rating: | 20A                       |

### 4.1.2 Available Amperage Ratings

| Catalog Symbol | Amperage Rating |
|----------------|-----------------|
| CC12M10A       | 10A             |
| CC12M12A       | 12A             |
| CC12M15A       | 15A             |
| CC12M20A       | 20A             |

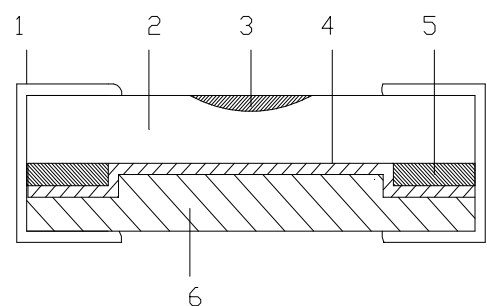
**Note: Amperage rating established in test conditions using 10 AWG wire. Thermal management in end-use application must be taken into consideration.**

This bulletin is intended to clearly present comprehensive product data and provide technical information that will help the end user with design applications. Bussmann reserves the right, without notice, to change design or construction of any products and to discontinue or limit distribution of any products. Bussmann also reserves the right to change or update, without notice, any technical information contained in this bulletin. Once a product has been selected, it should be tested by the user in all possible applications.

|               |              |              |          |
|---------------|--------------|--------------|----------|
| Document No.: | EPS-CC12M    |              |          |
| Title:        | CC12M        |              |          |
| Created By:   | M. Joiner    | Eng./Appr.:  | V. Kalra |
| Date:         | Sept 1, 2006 | Sheet 4 of 9 |          |

5.0 Mechanical Requirements

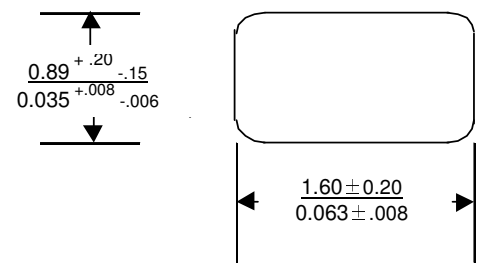
5.1 Construction (not to scale)



- 1. End Termination
  - a. Nickel Undercoat
  - b. Tin Overcoat
- 2. Ceramic Substrate (white)
- 3. Numeric Ampere Rating
- 4. Metal Film Fusible Element
- 5. Silver Termination Pad
- 6. Fused Glass Cover (green)

5.2 Nominal Dimensions

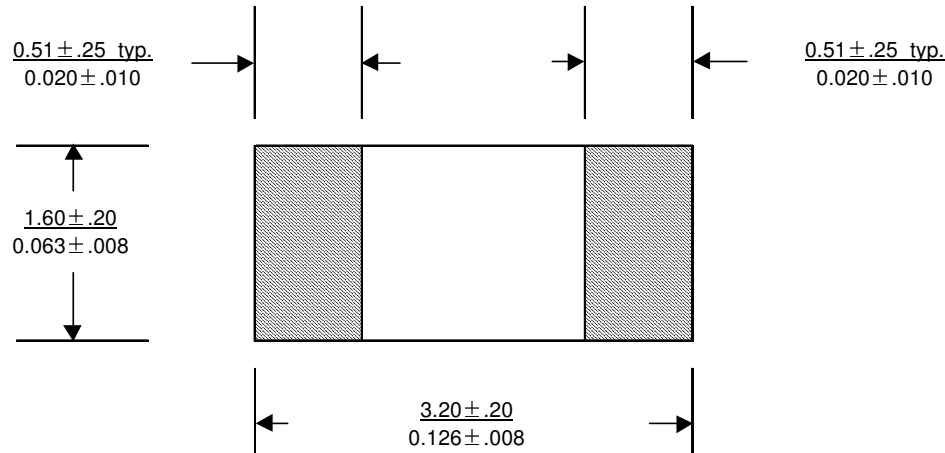
5.2.1 End View (mm/inches)



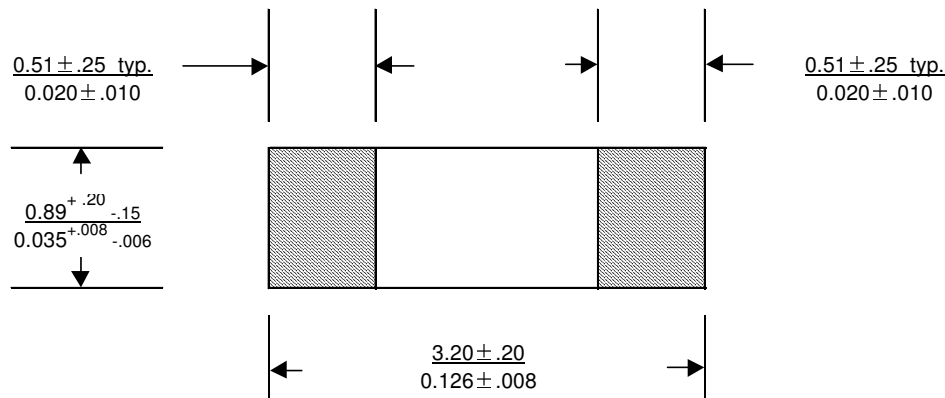
This bulletin is intended to clearly present comprehensive product data and provide technical information that will help the end user with design applications. Bussmann reserves the right, without notice, to change design or construction of any products and to discontinue or limit distribution of any products. Bussmann also reserves the right to change or update, without notice, any technical information contained in this bulletin. Once a product has been selected, it should be tested by the user in all possible applications.

|               |              |              |          |
|---------------|--------------|--------------|----------|
| Document No.: | EPS-CC12M    |              |          |
| Title:        | CC12M        |              |          |
| Created By:   | M. Joiner    | Eng./Appr.:  | V. Kalra |
| Date:         | Sept 1, 2006 | Sheet 5 of 9 |          |

### 5.2.2 Top View (mm/inches)



### 5.2.3 Side View (mm/inches)



## 6.0 Electrical Specifications

### 6.1 Table of Electrical Specifications

| Catalog Number | Ampere Rating | Voltage Rating | Interrupting Rating* | Typical Resistance** (ohms) | Typical I <sup>2</sup> T |
|----------------|---------------|----------------|----------------------|-----------------------------|--------------------------|
| CC12M10A       | 10A           | 24Vdc          | 150A                 | 0.0045                      | 2.0                      |
| CC12M12A       | 12A           | 24vdc          | 150A                 | 0.0039                      | 7.0                      |
| CC12M15A       | 15A           | 24Vdc          | 150A                 | 0.0031                      | 25.5                     |
| CC12M20A       | 20A           | 24Vdc          | 150A                 | 0.0018                      | 48.6                     |

\*Measured at designated voltage, rise time of less than 50 microseconds, battery source

\*\*Measured at  $\leq 10\%$  of rated current

This bulletin is intended to clearly present comprehensive product data and provide technical information that will help the end user with design applications. Bussmann reserves the right, without notice, to change design or construction of any products and to discontinue or limit distribution of any products. Bussmann also reserves the right to change or update, without notice, any technical information contained in this bulletin. Once a product has been selected, it should be tested by the user in all possible applications.

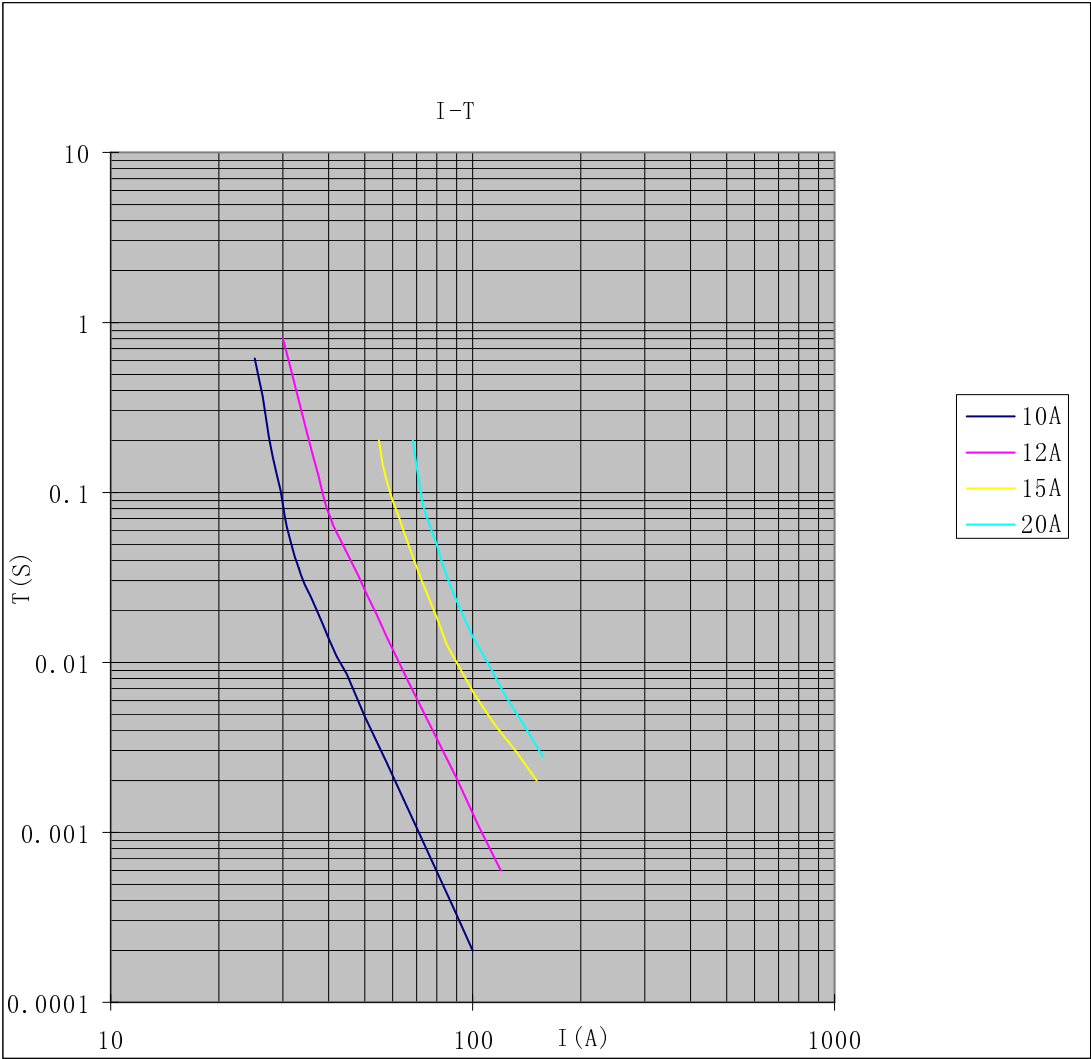
|               |              |              |          |
|---------------|--------------|--------------|----------|
| Document No.: | EPS-CC12M    |              |          |
| Title:        | CC12M        |              |          |
| Created By:   | M. Joiner    | Eng./Appr.:  | V. Kalra |
| Date:         | Sept 1, 2006 | Sheet 6 of 9 |          |

6.2 Operating Time Requirements

| % of Rated Current | Operating Time Requirement |
|--------------------|----------------------------|
| 100%               | 4 hours minimum            |
| 350%               | 5 second maximum           |

Due to the high current rating of the fuse, solder pads and trace and/or wire sizes and placement can significantly affect operating times. Application testing is required.

6.3 Time Current Curve



This bulletin is intended to clearly present comprehensive product data and provide technical information that will help the end user with design applications. Bussmann reserves the right, without notice, to change design or construction of any products and to discontinue or limit distribution of any products. Bussmann also reserves the right to change or update, without notice, any technical information contained in this bulletin. Once a product has been selected, it should be tested by the user in all possible applications.

|                      |              |                    |          |
|----------------------|--------------|--------------------|----------|
| <b>Document No.:</b> | EPS-CC12M    |                    |          |
| <b>Title:</b>        | CC12M        |                    |          |
| <b>Created By:</b>   | M. Joiner    | <b>Eng./Appr.:</b> | V. Kalra |
| <b>Date:</b>         | Sept 1, 2006 | Sheet 7 of 9       |          |

## 7.0 Agency Approvals



UL Recognition for US and Canada – File E19180

## 8.0 Marking Specification

8.1 Ampere rating to be marked on ceramic (white) side of fuse. Glass (green) side to be unmarked.

### 8.1.1 Table of device markings

| Catalog Symbol | Marking |
|----------------|---------|
| CC12M10A       | 10      |
| CC12M12A       | 12      |
| CC12M15A       | 15      |
| CC12M20A       | 20      |

## 9.0 Soldering Recommendation(s)

### 9.1 Wave Solder

9.1.1 Reservoir Temperature: 260°C (500°F)

9.1.2 Time in Reservoir: 10 second maximum

### 9.2 Infrared Reflow

9.2.1 Reservoir Temperature: 260°C (500°F)

9.2.2 Time in Reservoir: 30 second maximum

## 10.0 Packaging Specification(s)

10.1 3,000 fuses on 8mm tape and reeled on a 7 inch (178mm) reel per EIA Standard RS481.

10.2 The fuses are oriented in embossed pockets with the ceramic (white) side facing up to facilitate proper mounting. It is recommended that fuses are mounted with the ceramic (white) side facing up.

This bulletin is intended to clearly present comprehensive product data and provide technical information that will help the end user with design applications. Bussmann reserves the right, without notice, to change design or construction of any products and to discontinue or limit distribution of any products. Bussmann also reserves the right to change or update, without notice, any technical information contained in this bulletin. Once a product has been selected, it should be tested by the user in all possible applications.

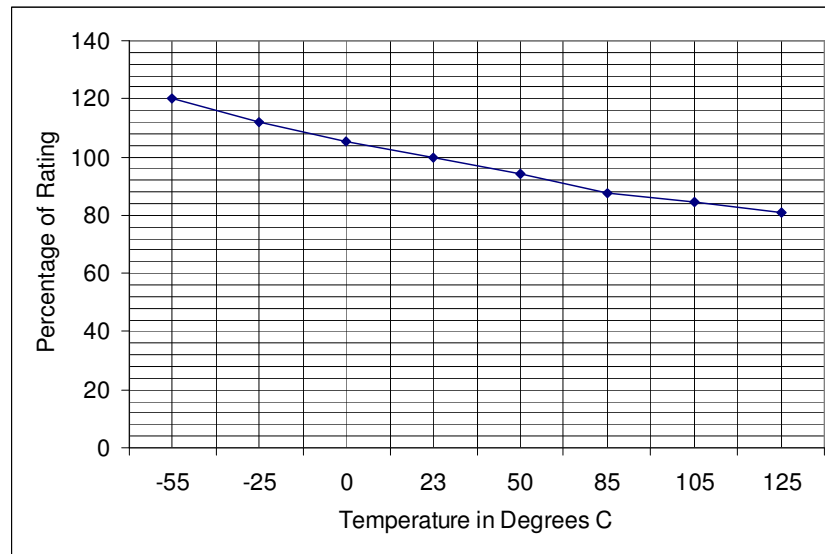
|               |              |              |          |
|---------------|--------------|--------------|----------|
| Document No.: | EPS-CC12M    |              |          |
| Title:        | CC12M        |              |          |
| Created By:   | M. Joiner    | Eng./Appr.:  | V. Kalra |
| Date:         | Sept 1, 2006 | Sheet 8 of 9 |          |

## 11.0 Temperature De-Rating Curve

11.1 Normal Ambient Temperature:  $23^{\circ}\text{C} \pm 3^{\circ}\text{C}$  ( $74^{\circ}\text{F} \pm 3.6^{\circ}\text{F}$ )

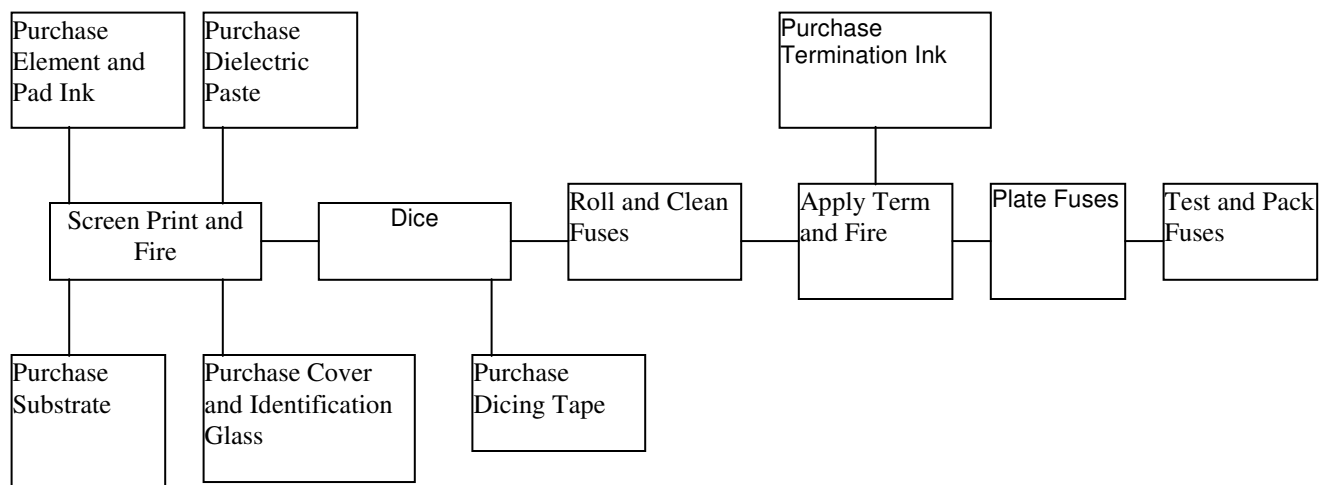
11.2 Operating Temperature:  $-55^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ , with proper correction factor applied

### 11.2.1 Chart of Correction Factor



11.3 Storage Temperature:  $-55^{\circ}\text{C}$  to  $125^{\circ}\text{C}$

## 12 Process Flow Chart



This bulletin is intended to clearly present comprehensive product data and provide technical information that will help the end user with design applications. Bussmann reserves the right, without notice, to change design or construction of any products and to discontinue or limit distribution of any products. Bussmann also reserves the right to change or update, without notice, any technical information contained in this bulletin. Once a product has been selected, it should be tested by the user in all possible applications.

|                      |              |                    |          |
|----------------------|--------------|--------------------|----------|
| <b>Document No.:</b> | EPS-CC12M    |                    |          |
| <b>Title:</b>        | CC12M        |                    |          |
| <b>Created By:</b>   | M. Joiner    | <b>Eng./Appr.:</b> | V. Kalra |
| <b>Date:</b>         | Sept 1, 2006 | Sheet 9 of 9       |          |

### 13 Environmental (Reliability) Data (based on CHIP Fuse Qualification Program)

13.1 Thermal Shock - MIL-STD-202, Method 107, Test Condition B (-65°C to 125°C)

13.2 Vibration - MIL-STD-202, Method 204, Test Condition C (55 to 2000 Hz, 10G)

13.3 Moisture Resistance - MIL-STD-202, Method 106, 10 day cycle

13.4 Solderability - ANSI/J-STD-002, Test B

14 End

This bulletin is intended to clearly present comprehensive product data and provide technical information that will help the end user with design applications. Bussmann reserves the right, without notice, to change design or construction of any products and to discontinue or limit distribution of any products. Bussmann also reserves the right to change or update, without notice, any technical information contained in this bulletin. Once a product has been selected, it should be tested by the user in all possible applications.