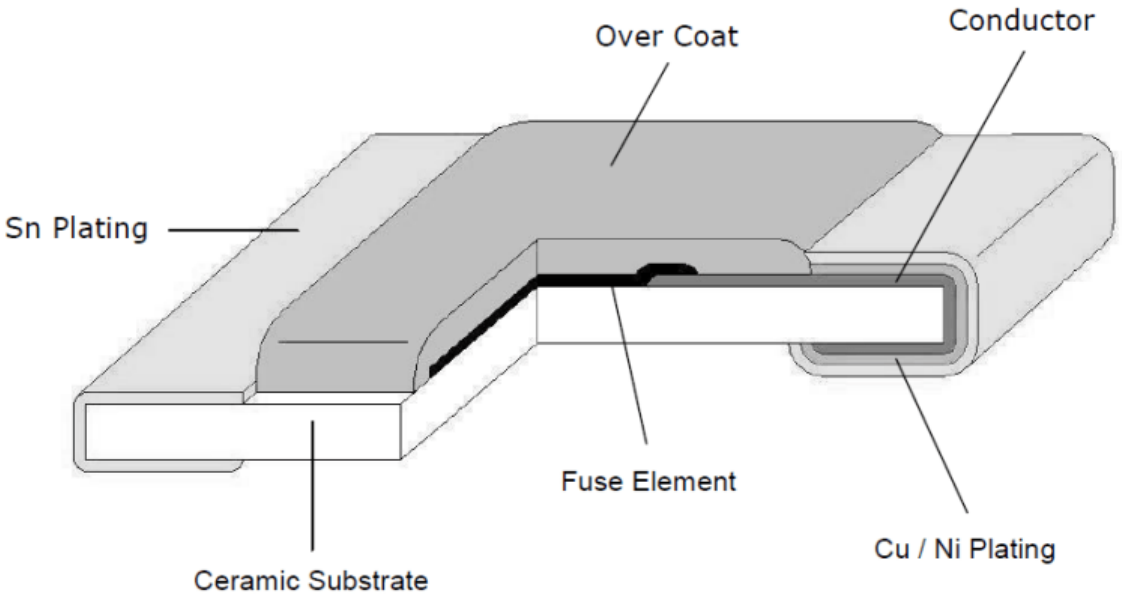
## 1. Scope

This specification applies for the fuse series of thin film chip fuse made by TA-I.

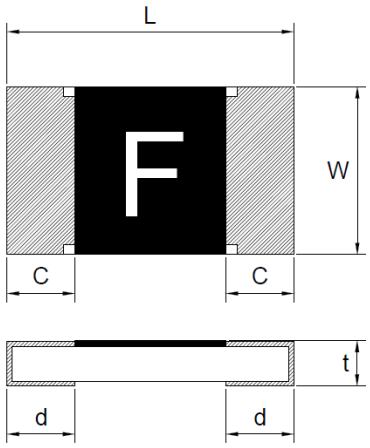
## 2. Construction




## 3. Type Designation

| CP | 06 | V5 | T | R50 |
|---|---|---|---|---|
| Chip Fuse | Size | Rate Voltage | Packaging | Rate Current |
| | 04:0402(1005)<br>06:0603(1608)<br>12:1206(3216) | V6:63V<br>V5:50V<br>V3:32V | T: Paper Tape<br>(5K/10K) | R50:0.5A<br>1R0:1A |

## 4. Dimensions




Unit: mm

| Type (Inch Size code) | Dimensions (mm) | | | | |
|---|---|---|---|---|---|
| | L | W | C | d | t |
| CP04 (0402) | 1.0±0.1 | 0.52±0.05 | 0.2±0.1 | 0.25±0.1 | 0.35±0.05 |
| CP06 (0603) | 1.6±0.1 | 0.80±0.10 | 0.3±0.2 | 0.35±0.2 | 0.45±0.10 |
| CP12 (1206) | 3.1±0.1 | 1.55±0.10 | 0.5±0.3 | 0.50±0.2 | 0.60±0.10 |

## 5. Applications and ratings

| Part Designation | Marking | Rated Current | Fusing Time | Resistance (mΩ) Tolerance±25% | Rated Voltage | Breaking Capacity | Body Temperature rising |
|---|---|---|---|---|---|---|---|
| CP04V3TR50 | F | 0.50A | Open within 5sec.at 200% rated current | 380 | DC 32V | DC32V 35A | <75℃ at 100% rated current |
| CP04V3TR80 | K | 0.80A | | 120 | | | |
| CP04V3T1R0 | L | 1.00A | | 95 | | | |
| CP04V3T1R25 | M | 1.25A | | 67 | | | |
| CP04V3T1R50 | P | 1.50A | | 51 | | | |
| CP04V3T1R60 | N | 1.60A | | 46 | | | |
| CP04V3T2R0 | S | 2.00A | | 33 | | | |
| CP04V3T2R50 | T | 2.50A | | 22.5 | | | |
| CP04V3T3R0 | 3 | 3.00A | | 20 | | | |
| CP04V3T3R15 | U | 3.15A | | 19 | | | |
| CP04V3T4R0 | W | 4.00A | | 16 | | | |

*Resistance valve was measured with less than 10% of rated current

| Part Designation | Marking | Rated Current | Fusing Time | Resistance (mΩ) Tolerance± 25% | Rated Voltage | Breaking Capacity | Body Temperature rising |
|---|---|---|---|---|---|---|---|
| CP06V5TR50 | F | 0.50A | Open within 5sec.at 200% rated current | 260 | DC 50V | DC50V 50A | <75℃ at 100% rated current |
| CP06V3TR63 | I | 0.63A | | 218 | AC/DC 32V | AC/DC32V 50A | |
| CP06V3TR80 | K | 0.80A | | 132 | | | |
| CP06V3T1R0 | L | 1.00A | | 84.5 | | | |
| CP06V3T1R25 | M | 1.25A | | 63 | | | |
| CP06V3T1R50 | P | 1.50A | | 50.5 | | | |
| CP06V3T1R60 | N | 1.60A | | 46 | | | |
| CP06V3T2R0 | S | 2.00A | | 32 | | | |
| CP06V3T2R50 | T | 2.50A | | 25.5 | | | |
| CP06V3T3R00 | 3 | 3.00A | | 20 | | | |
| CP06V3T3R15 | U | 3.15A | | 19 | | | |
| CP06V3T4R0 | W | 4.00A | | 13 | | | |
| CP06V3T5R0 | Y | 5.00A | | 10 | | | |

*Resistance valve was measured with less than 10% of rated current

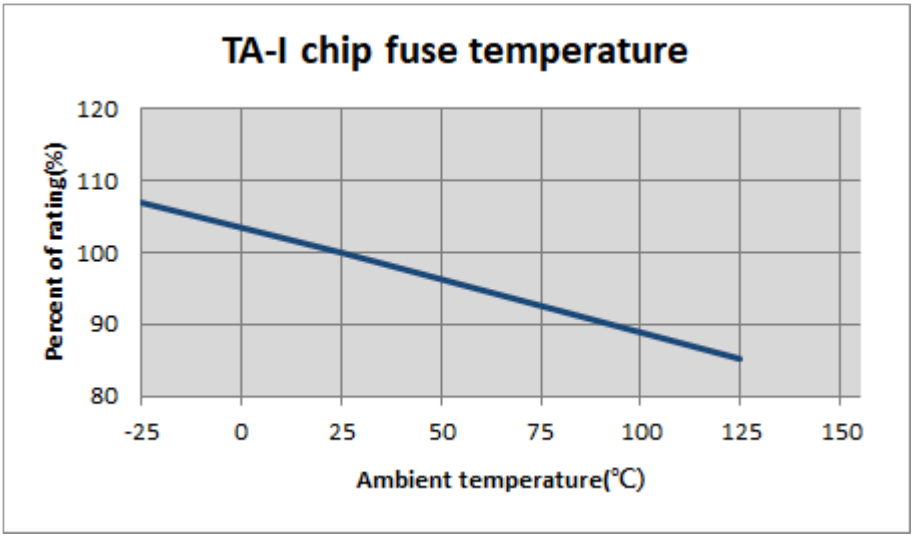
| Part Designation | Marking | Rated Current | Fusing Time | Resistance (mΩ) Tolerance±25% | Rated Voltage | Breaking Capacity | Body Temperature rising |
|---|---|---|---|---|---|---|---|
| CP12V6TR50 | F | 0.50A | Open within 5sec.at 200% rated current | 527.5 | DC 63V | DC63V 50A | <75℃ at 100% rated current |
| CP12V6TR80 | K | 0.80A | | 211 | | | |
| CP12V6T1R0 | L | 1.00A | | 145.5 | | | |
| CP12V6T1R25 | M | 1.25A | | 90 | | | |
| CP12V6T1R50 | P | 1.50A | | 83 | | | |
| CP12V6T2R0 | S | 2.00A | | 57 | | | |
| CP12V3T2R50 | T | 2.50A | | 37 | DC 32V | DC32V 50A | |
| CP12V3T3R00 | 3 | 3.00A | | 26 | | | |
| CP12V3T4R0 | W | 4.00A | | 18 | | | |
| CP12V3T5R0 | Y | 5.00A | | 13 | | | |
| CP12V3T7R0 | Z | 7.00A | | 9 | | | |

*Resistance valve was measured with less than 10% of rated current

## 6 Temperature Derating Curve

6.1 Normal Ambient Temperature: 25℃

6.2 Operating Temperature: -25℃~125℃, with proper derating factor as below:



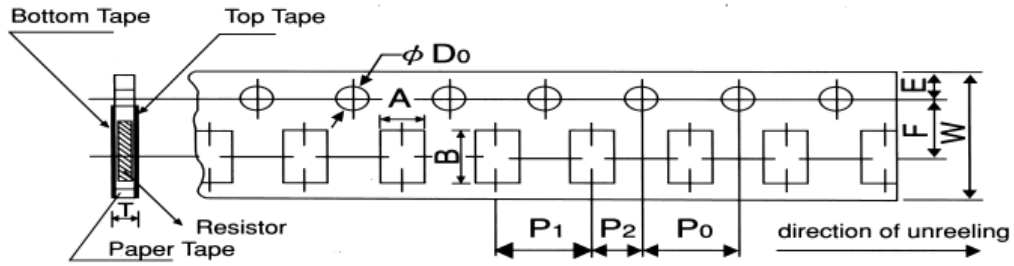

## 7 Reliability Tests

| Parameter | Requirement | Test Method |
|---|---|---|
| Carrying capacity | No fusing | Rated current ,4hr |
| Fusing Time | Within 5 seconds | 200% of its rated current |
| Interrupting Ability | No mechanical damages | After the fuse is interrupted, rated voltage applied for 30sec again |
| Bending Test | No mechanical damages | Distance between holding points: 90mm, Bending:3mm,1time ,30sec |
| Resistance to solder Heat | ±20% | 260℃±5℃,10±1second |
| Solderability | 95% coverage minimum | 235℃±5℃, 2±0.5second<br>245℃±5℃, 2±0.5second (Lead Free) |
| Temperature Rise | <75℃ | 100% of its rated current, Measure of surface temperature |
| Resistance to Dry Heat | ±20% | 105℃±5℃,1000 hrs |
| Resistance to Solvent | No evident damages on protective coating and marking | 23℃±5℃ of Isopropyl alcohol 90second |
| Residual Resistance | 10kΩ and more | Measure DC resistance after fusing |
| Thermal Shock | △R< 10 % | -25℃/+25℃/+125℃/+25℃, 10 cycles |

# 8 Taping & Reel

## 8.1 Taping Dimensions

4mm pitch paper



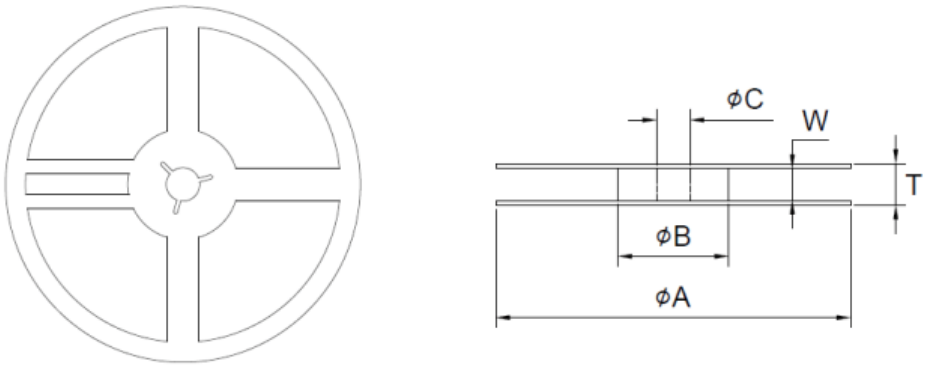

| Packing | Type | A | B | W | F | E | $P_1$ | $P_2$ | $P_0$ | $D_0$ | T |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Paper Tape | CP04 | 0.7±0.05 | 1.2±0.05 | 8.0±0.2 | 3.5±0.05 | 1.75±0.1 | 2.0±0.1 | 2.0±0.05 | 4.0±0.1 | $\phi$ 1.5 +0.1 0 | 0.45±0.1 |
| Paper Tape | CP06 | 1.1±0.1 | 1.9±0.1 | 8.0±0.2 | 3.5±0.05 | 1.75±0.1 | 4.0±0.1 | 2.0±0.05 | 4.0±0.1 | $\phi$ 1.5 +0.1 -0 | 0.64±0.1 |
| Paper Tape | CP12 | 2.0±0.15 | 3.6±0.2 | 8.0±0.2 | 3.5±0.05 | 1.75±0.1 | 4.0±0.1 | 2.0±0.05 | 4.0±0.1 | $\phi$ 1.5 +0.1 -0 | 0.84±0.1 |

Unit: mm

| Type Size | | Paper Tape |
|---|---|---|
| | | 2 mm pitch |
| | | 180mm/R |
| CP | 04 | 10000 |

| Type series | | Paper Tape |
|---|---|---|
| | | 4 mm pitch |
| | | 180mm/R |
| CP | 06 | 5000 |
| CP | 12 | 5000 |

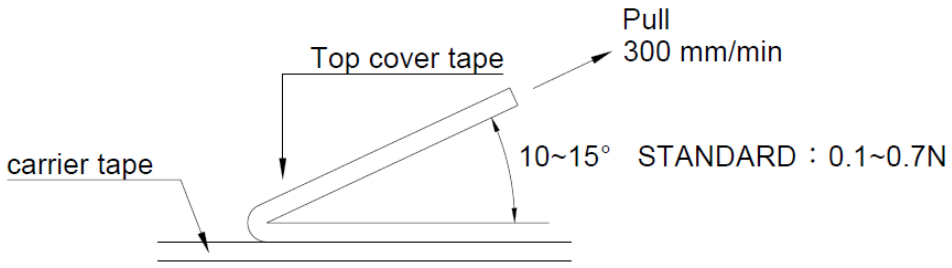
8.2 Reel Specifications




Unit: mm

| Series | ϕ A | ϕ B | ϕ C | W | T |
|---|---|---|---|---|---|
| CP04<br>CP06<br>CP12 | 178 ±2.0 | 60.0±1.0 | 13.0±1.0 | 9.0±1.0 | 11.4±2.0 |

8.3 Peel –off force:



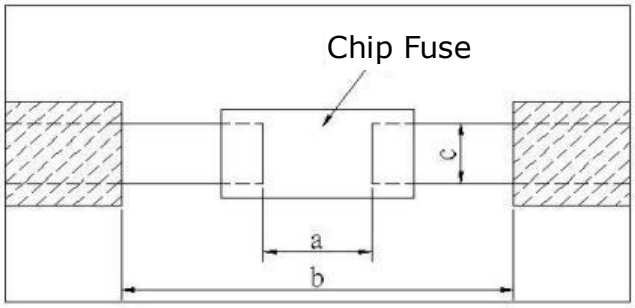

## 9 Storage Conditions:

Temperature: 5℃~35℃,Humidity:40%~75%

## 10 Shelf Life:

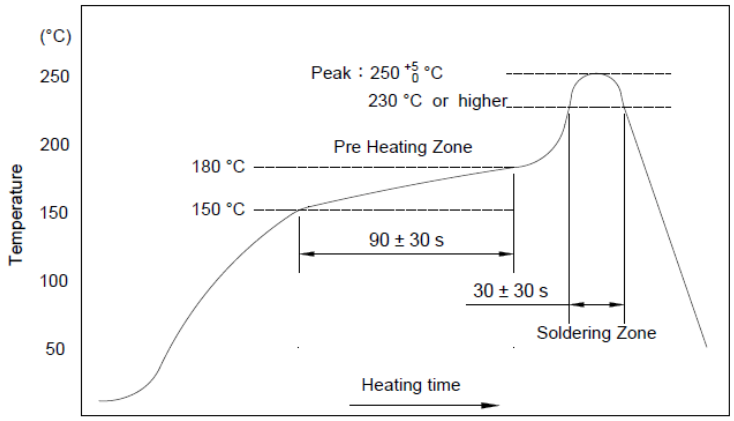
2 years from manufacturing date

## 11 Recommended land patterns




| Land pattern / Type | Size | Dimension a | b | c |
|---|---|---|---|---|
| CP | 04 (0402) | 0.55~0.65 | 1.40~1.60 | 0.74~0.94 |
| CP | 06 (0603) | 0.85~0.95 | 2.00~2.20 | 1.50~1.70 |
| CP | 12 (1206) | 0.95~1.05 | 4.40~5.00 | 2.30~2.50 |

## 12. Recommend IR – Reflow profile: (solder: Sn96.5 / Ag3 / Cu0.5)




Peak : 250+5/-0℃,5 sec.
Pre–heat Zone : 150 to 180 ℃, 90±30 sec
Soldering Zone : 230℃ or higher , 30±10 sec

## 13. Approval by UL248-14

The fuses have been approved by UL.
File No. of UL Recognition is E241710

## 14. ECN

Engineering Change Notice: The customer will be informed with ECN if there is significant modification on the characteristics and materials described in Approval Sheet.

## 15. Manufacturing Country & City:

TA-I TECHNOLOGY CO., LTD. (Taiwan– Tao Yuan)

Tel: (+886) 3-3246169 Fax: (+886) 3-3246167

### Associated companies:

(1) TA-I TECHNOLOGY (SU ZHOU) CO., LTD. (China – Su Zhou)

Tel: (+86) 512-63457879 Fax: (+86) 512-63457869

(2) TA-I TECHNOLOGY ELECTRONIC (DONGGUAN) CO., LTD. (China –Dongguan)

Tel: (+86) 769-8339-4790～3 Fax : (+86) 769-8339-4794

(3) FORTUNE TASK RESISTOR FACTORY (China – Dongguan)

Tel: (+86) 769-8339-4790～3 Fax : (+86) 769-8339-4794

(4) TAI OHM ELECTRONICS (M) SDN. BHD. (Malaysia – Penang)

Tel: (+60) 4- 3900480 Fax: (+60) 4-3901481

## 16. Selection Guideline of Fuse:

■ Checklist of selection factors

◎Normal operating current

◎Normal operating voltage ( AC or DC )

◎Ambient Temperature

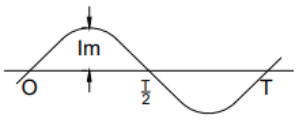
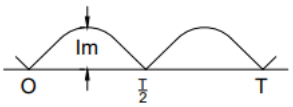
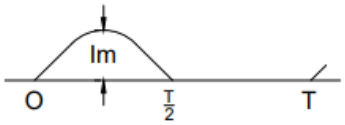
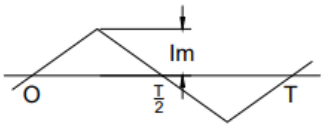
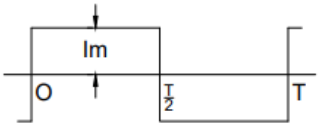
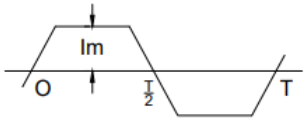
◎Overload current and length of time in which the fuse must open .

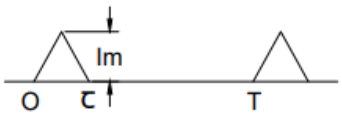
◎Type of fuse ( SMD or Tube ) and physical size limitation ( 0603 or 1206 )

◎Agency Approval required ( e.g., UL248-14)

■ Normal operating current

e.g., Rectangular Wave, If I p = 1.5 A, Normal operating current = 1.5 A

| No. | Type | Waveform | Formula |
|---|---|---|---|
| 1 | Sinusoidal Waveform |  | $\frac{1}{\sqrt{2}} I_m \fallingdotseq 0.707 I_m$ |
| 2 | All Wave Rectification |  | $\frac{1}{\sqrt{2}} I_m \fallingdotseq 0.707 I_m$ |
| 3 | Half Wave |  | $0.5 I_m$ |
| 4 | Triangle Waveform |  | $\frac{1}{3} I_m \fallingdotseq 0.577 I_m$ |
| 5 | Rectangular Waveform |  | $I_m$ |
| 6 | Trapezoidal Waveform |  | $I_m \sqrt{1 - \frac{8\alpha}{3T}}$ |

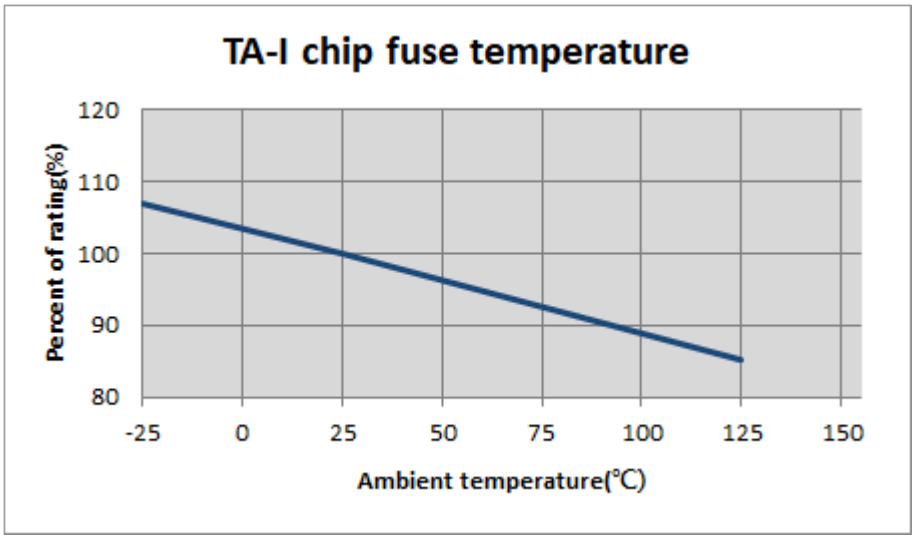
| No. | Type | Waveform | Formula |
|---|---|---|---|
| 7 | Rectangular Pulse |   | $I_m\sqrt{\frac{\tau}{T}}$ |
| 8 | Triangle Pulse |   | $I_m\sqrt{\frac{\tau}{3T}}$ |

## ■ Derating ratio for different ambient Temperature

◎ Referring to bottom figure and select the appropriate derating ratio :

e.g., Ambient temperature is 60 degree C

the derating ratio≒0.95




## ■ Calculating the required rating of fuse needed.

◎ Safety coefficient: 70% is safety coefficient from practical experience

◎ $\frac{Normal\ Operating\ Current}{0.7 \times derating\ ratio} <$ **rating current of fuse**

◎ e.g.

Condition: Normal operating current =1.5 A

Ambient temperature 40 ℃: Derating ratio≒0.95

$$\frac{1.5}{0.7 \times 0.95} < \text{rating current of fuse}$$

**2.255 <** rating current of fuse

## ■ Determination of the type of fuse

e.g.Condition:

- ◆ Calculating value =2.255 A , 2.255A < rating current of fuse
- ◆ Normal operating voltage : DC 12 V
- ◆ Following bottom index-table: suggesting use CP06V3T2R50.

| Part Designation | Marking | Rated Current | Rated Voltage | Part Designation | Marking | Rated Current | Rated Voltage | Part Designation | Marking | Rated Current | Rated Voltage |
|---|---|---|---|---|---|---|---|---|---|---|---|
| CP04V3TR50 | F | 0.50A | 32V | CP06V5TR50 | F | 0.50A | 50V | CP12V6TR50 | F | 0.50A | 63V |
| CP04V3TR80 | K | 0.80A | 32V | CP06V3TR63 | I | 0.63A | 32V | CP12V6TR80 | K | 0.80A | 63V |
| CP04V3T1R0 | L | 1.00A | 32V | CP06V3TR80 | K | 0.80A | 32V | CP12V6T1R0 | L | 1.00A | 63V |
| CP04V3T1R25 | M | 1.25A | 32V | CP06V3T1R0 | L | 1.00A | 32V | CP12V6T1R25 | M | 1.25A | 63V |
| CP04V3T1R50 | P | 1.50A | 32V | CP06V3T1R25 | M | 1.25A | 32V | CP12V6T1R50 | P | 1.50A | 63V |
| CP04V3T1R60 | N | 1.60A | 32V | CP06V3T1R50 | P | 1.50A | 32V | CP12V6T2R0 | S | 2.00A | 63V |
| CP04V3T2R0 | S | 2.00A | 32V | CP06V3T1R60 | N | 1.60A | 32V | CP12V3T2R50 | T | 2.50A | 32V |
| CP04V3T2R50 | T | 2.50A | 32V | CP06V3T2R0 | S | 2.00A | 32V | CP12V3T3R00 | 3 | 3.00A | 32V |
| CP04V3T3R0 | 3 | 3.00A | 32V | CP06V3T2R50 | T | 2.50A | 32V | CP12V3T4R0 | W | 4.00A | 32V |
| CP04V3T3R15 | U | 3.15A | 32V | CP06V3T3R00 | 3 | 3.00A | 32V | CP12V3T5R0 | Y | 5.00A | 32V |
| CP04V3T4R0 | W | 4.00A | 32V | CP06V3T3R15 | U | 3.15A | 32V | CP12V3T7R0 | Z | 7.00A | 32V |
| | | | | CP06V3T4R0 | W | 4.00A | 32V | | | | |
| | | | | CP06V3T5R0 | Y | 5.00A | 32V | | | | |

## ■ Inrush current:

- ◆ Considering inrush waveform & calculate $I^2t$ ($A^2s$) value
- ◆ Choosing fuse's $I^2t$ ($A^2s$) value > calculate $I^2t$ ($A^2s$) value
- ◆ Considering Ratio of $I^2t$ repeat numbers to blowing .
- ◆ Confirm with us.

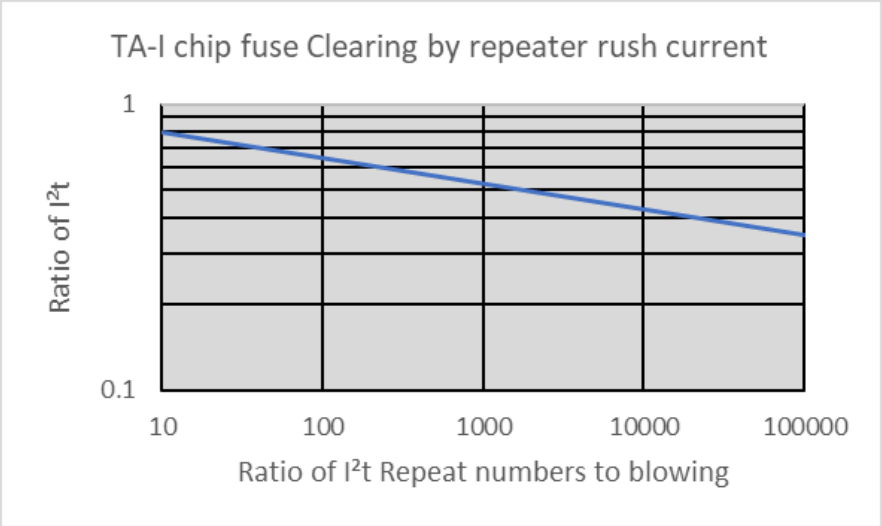
e.g., choosing 0603 Fuse

Condition:

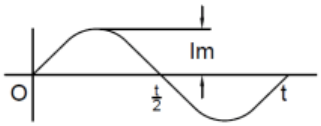
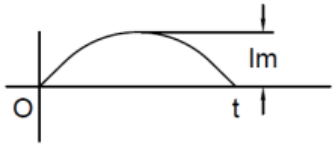
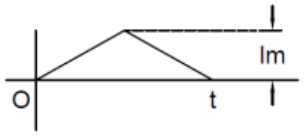
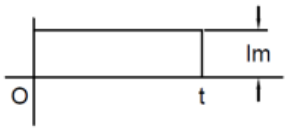
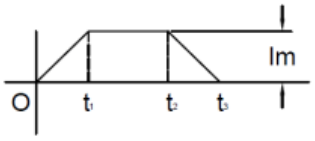
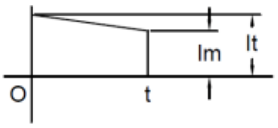
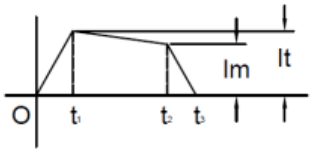
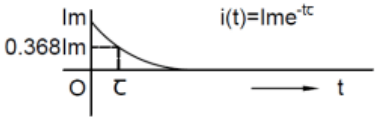
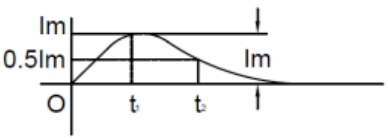
1. Rectangular Wave, Ip = 4 A, t = 1 ms , calculate $Ip^2t = 4^2 \times 1 \times 10^{-3} = 0.016$ ($A^2s$)
2. Choosing CP06V3T1R50, $I^2t = 0.0623$ ($A^2s$) → Page 12 index-table
3. Inrush shock : 100,000 times (≒0.35) → inrush ratio
4. Choosing fuse's $I^2t$ ($A^2s$) value X Derating ratio (inrush 100000 times) > calculate $I^2t$ ($A^2s$) value
5. 0.0623 x 0.35 = 0.0218 ($A^2s$) > 0.016 →CP06V3T1R50 is able to meet circuit's application

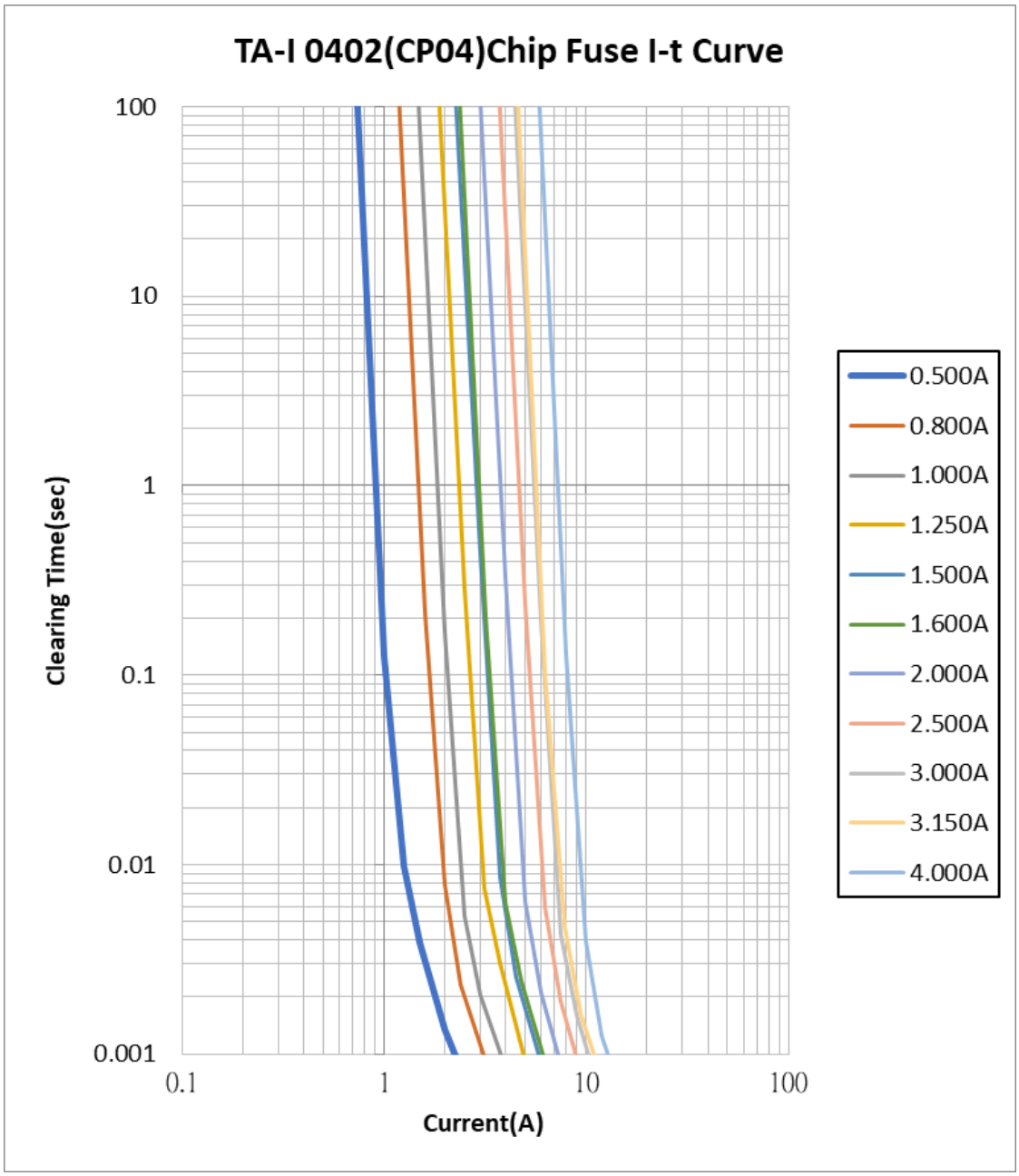
| TA-I FUSE $I^2t$ ($A^2$ s) | | | | | |
|---|---|---|---|---|---|
| Part Number | Typical $I^2t$ ($A^2$ s) | Part Number | Typical $I^2t$ ($A^2$ s) | Part Number | Typical $I^2t$ ($A^2$ s) |
| CP04V3TR50 | 0.00317 | CP06V5TR50 | 0.0088 | CP12V6TR50 | 0.015 |
| CP04V3TR80 | 0.00532 | CP06V3TR63 | 0.0125 | CP12V6TR80 | 0.040 |
| CP04V3T1R0 | 0.00724 | CP06V3TR80 | 0.0206 | CP12V6T1R0 | 0.062 |
| CP04V3T1R25 | 0.01344 | CP06V3T1R0 | 0.0211 | CP12V6T1R25 | 0.094 |
| CP04V3T1R50 | 0.01356 | CP06V3T1R25 | 0.0472 | CP12V6T1R50 | 0.141 |
| CP04V3T1R60 | 0.01672 | CP06V3T1R50 | 0.0623 | CP12V6T2R0 | 0.285 |
| CP04V3T2R0 | 0.01983 | CP06V3T1R60 | 0.0817 | CP12V3T2R50 | 0.445 |
| CP04V3T2R50 | 0.03763 | CP06V3T2R0 | 0.1176 | CP12V3T3R00 | 0.639 |
| CP04V3T3R0 | 0.05427 | CP06V3T2R50 | 0.1807 | CP12V3T4R0 | 1.109 |
| CP04V3T3R15 | 0.06304 | CP06V3T3R00 | 0.3177 | CP12V3T5R0 | 1.710 |
| CP04V3T4R0 | 0.08960 | CP06V3T3R15 | 0.3615 | CP12V3T7R0 | 3.300 |
| | | CP06V3T4R0 | 0.5348 | | |
| | | CP06V3T5R0 | 0.7726 | | |

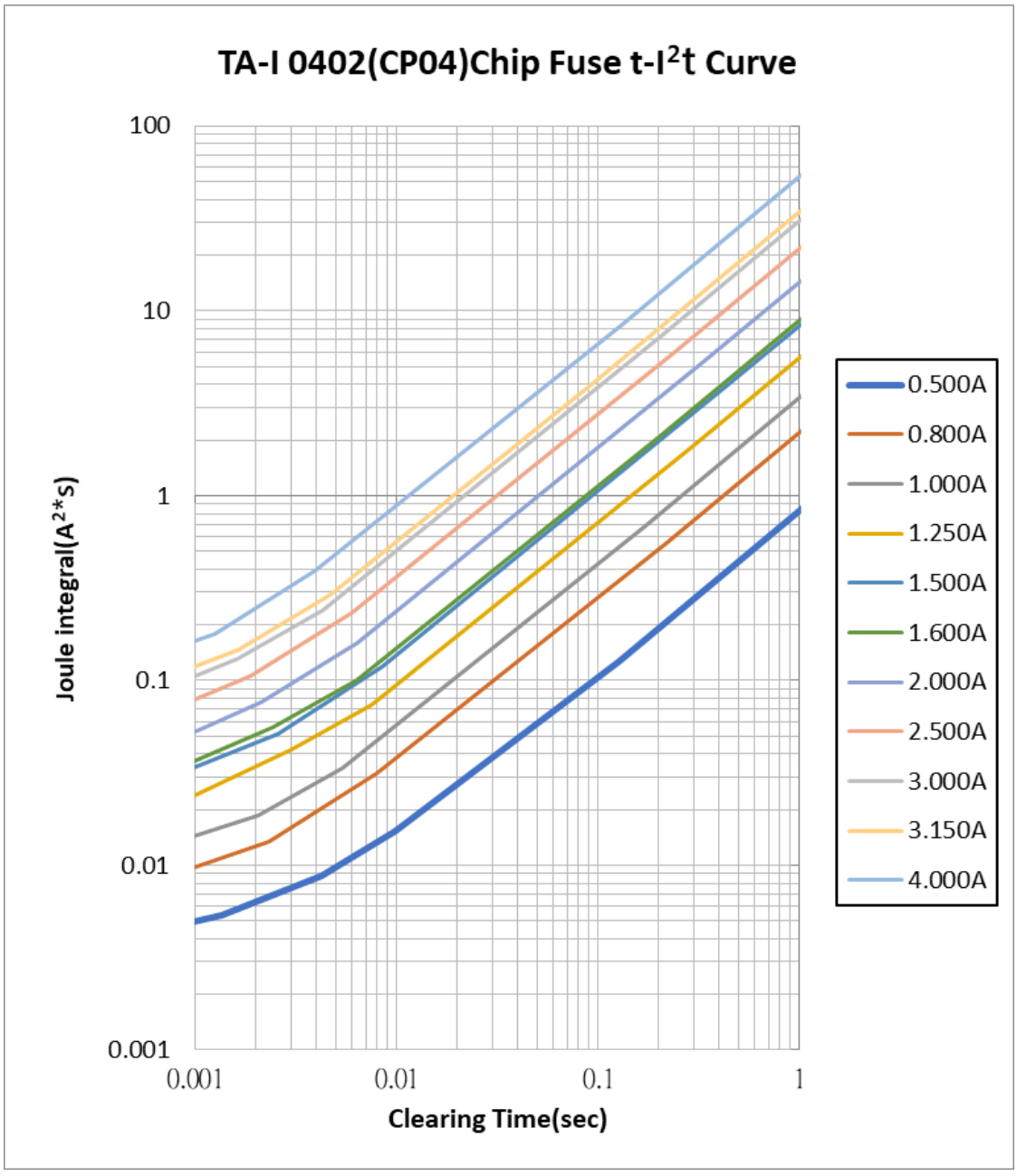
Note*: Typical $I^2t$ value is measured at 10x-rated current, Application with surge over 10x-rated current. Please confirm with us.

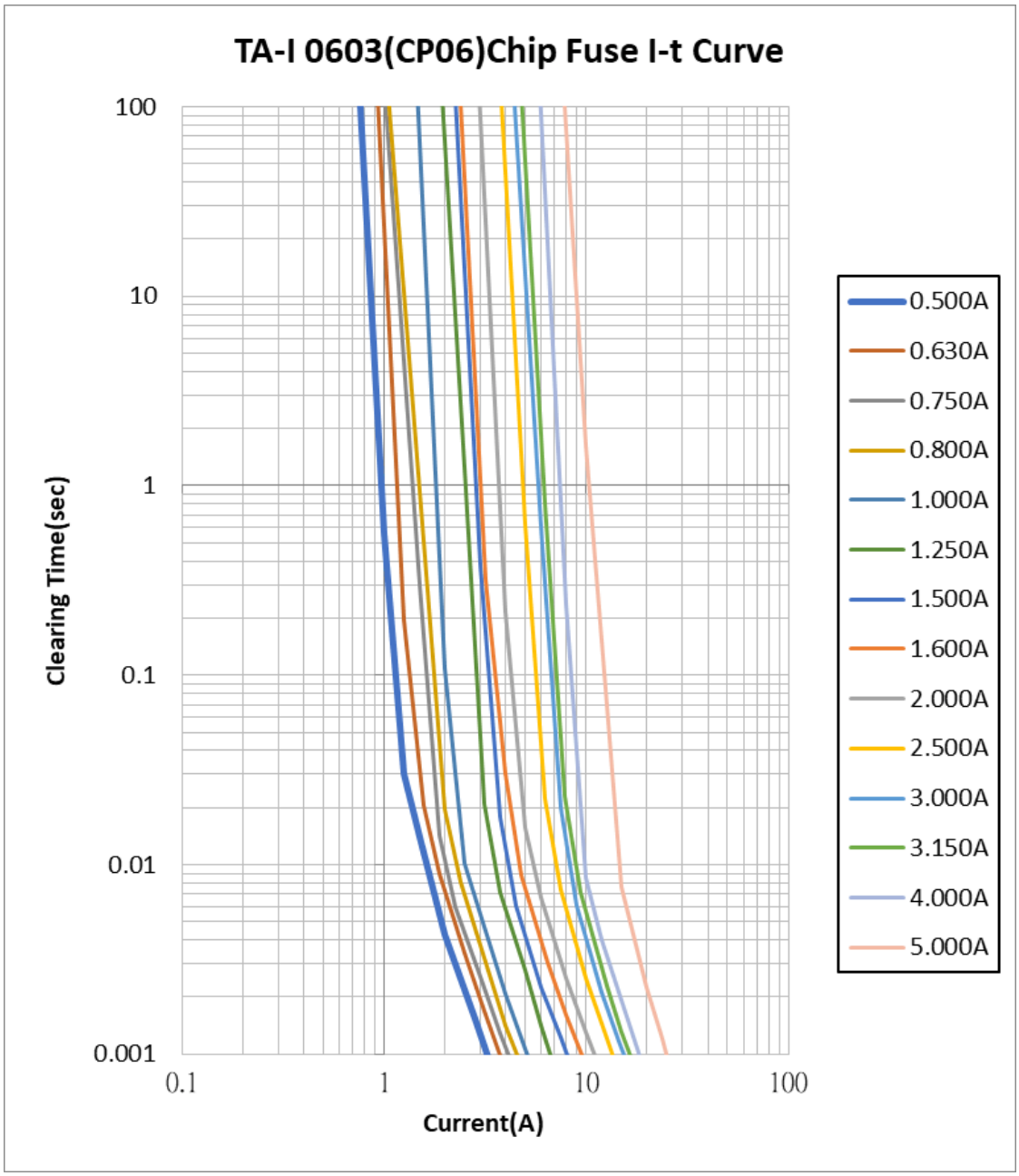


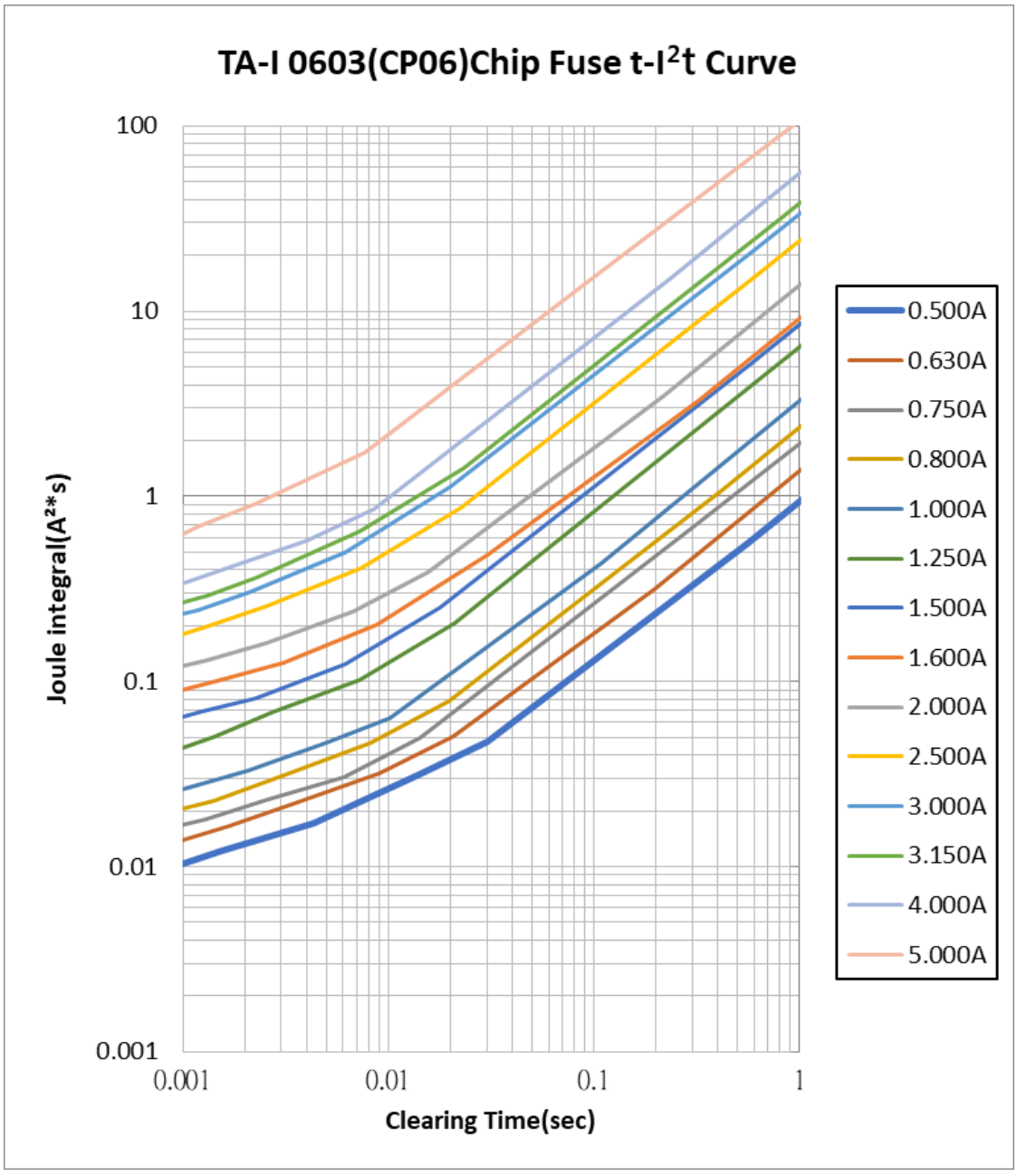

| No. | Type | Waveform | Formula |
|---|---|---|---|

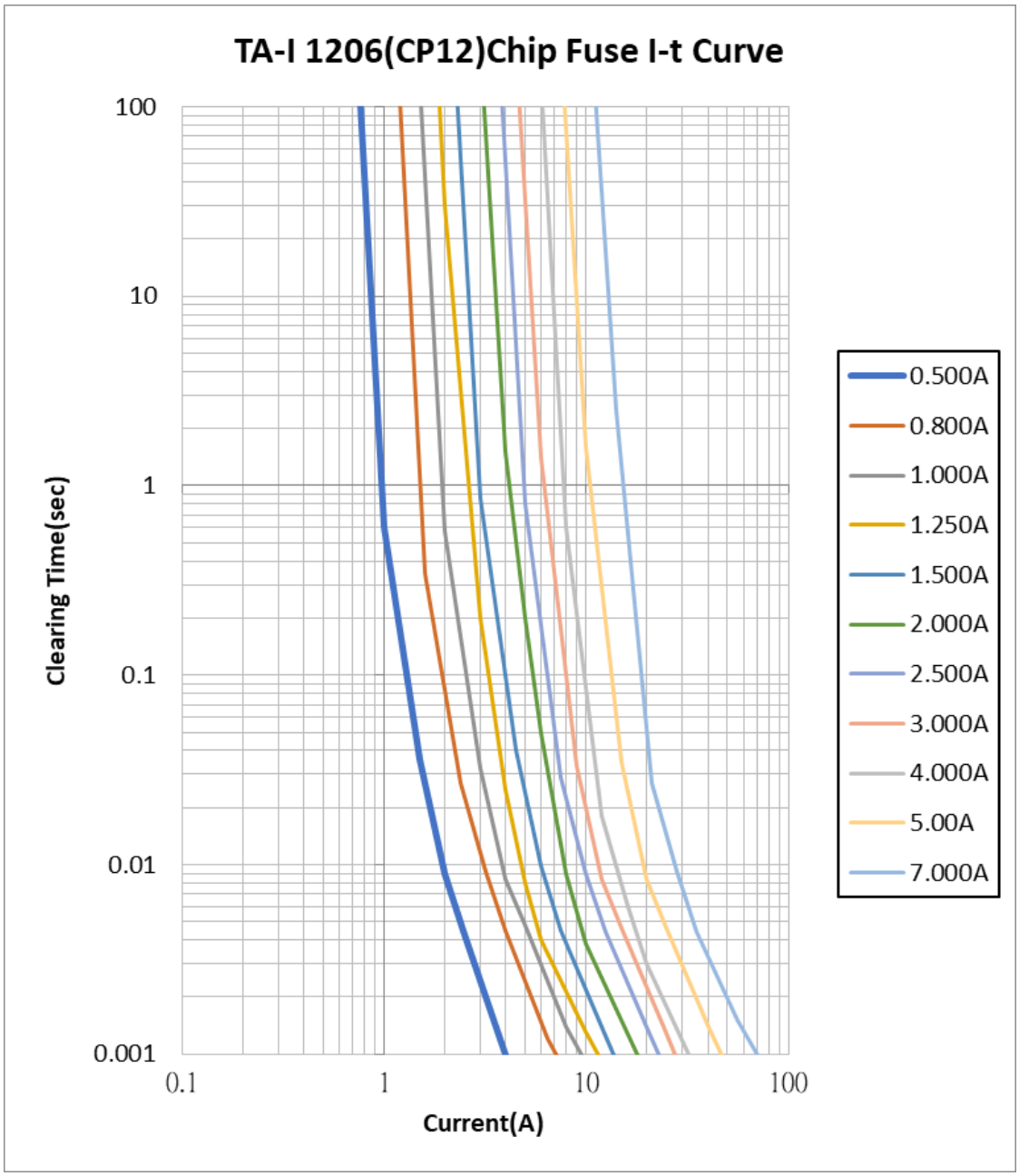
| | | | |
|---|---|---|---|
| 1 | **Sinusoidal Waveform (1 Cycle)** |  | $\frac{1}{2}{I_m}^2 t$ |
| 2 | **Sinusoidal Waveform (1/2 Cycle)** |  | $\frac{1}{2}{I_m}^2 t$ |
| 3 | **Triangle Waveform** |  | $\frac{1}{3}{I_m}^2 t$ |
| 4 | **Rectangular Waveform** |  | ${I_m}^2 t$ |
| 5 | **Trapezoidal Waveform** |  | $\frac{1}{3}{I_m}^2 t + {I_m}^2(t_1 - t_2) + \frac{1}{3}{I_m}^2(t_2 - t_3)$ |
| 6 | **Various Waveform 1** |  | $I_1 I_2 t + \frac{1}{3}(I_1 - I_2)^2 t$ |
| 7 | **Various Waveform 2** |  | $I_1 I_2 t + \left[I_1 I_2 t + \frac{(I_1 - I_2)^2}{3}\right] * (t_2 - t_1) + \frac{1}{3}(I_2)^2(t_3 - t_2)$ |
| 8 | **Charge/Discharge Waveform** |  | $\frac{1}{2}({I_m}^2 \tau)$ |
| 9 | **Lightning Surge Waveform** |  | ${I_m}^2\left[\frac{t_1}{3} + 0.721(t_2 - t_1)\right]$ |

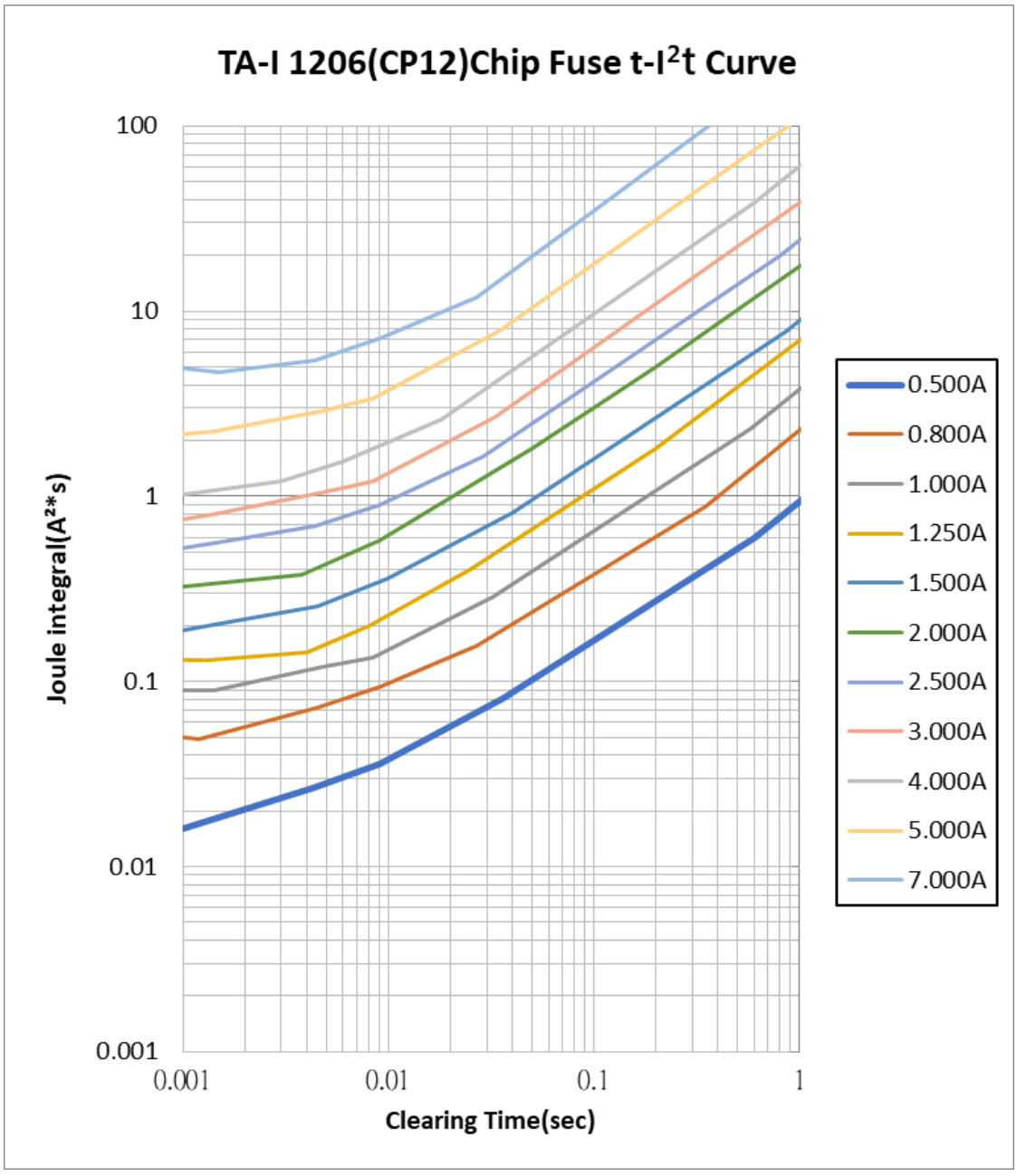

TA-I 0402(CP04)Chip Fuse I-t Curve
Clearing Time(sec)
100
10
1
0.1
0.01
0.001
0.1
1
10
100
Current(A)
0.500A
0.800A
1.000A
1.250A
1.500A
1.600A
2.000A
2.500A
3.000A
3.150A
4.000A


TA-I 0402(CP04)Chip Fuse t-I²t Curve
Joule integral(A²*S)
100
10
1
0.1
0.01
0.001
0.001
0.01
0.1
1
Clearing Time(sec)
0.500A
0.800A
1.000A
1.250A
1.500A
1.600A
2.000A
2.500A
3.000A
3.150A
4.000A


TA-I 0603(CP06)Chip Fuse I-t Curve
Clearing Time(sec)
100
10
1
0.1
0.01
0.001
0.1
1
10
100
Current(A)
0.500A
0.630A
0.750A
0.800A
1.000A
1.250A
1.500A
1.600A
2.000A
2.500A
3.000A
3.150A
4.000A
5.000A


TA-I 0603(CP06)Chip Fuse t-I²t Curve
Joule integral(A²*s)
100
10
1
0.1
0.01
0.001
0.001
0.01
0.1
1
Clearing Time(sec)
0.500A
0.630A
0.750A
0.800A
1.000A
1.250A
1.500A
1.600A
2.000A
2.500A
3.000A
3.150A
4.000A
5.000A


TA-I 1206(CP12)Chip Fuse I-t Curve
Clearing Time(sec)
100
10
1
0.1
0.01
0.001
0.1
1
10
100
Current(A)
0.500A
0.800A
1.000A
1.250A
1.500A
2.000A
2.500A
3.000A
4.000A
5.00A
7.000A


TA-I 1206(CP12)Chip Fuse t-I²t Curve
Joule integral(A²*s)
100
10
1
0.1
0.01
0.001
0.001
0.01
0.1
1
Clearing Time(sec)
0.500A
0.800A
1.000A
1.250A
1.500A
2.000A
2.500A
3.000A
4.000A
5.000A
7.000A