



Thin Film Chip Fuse

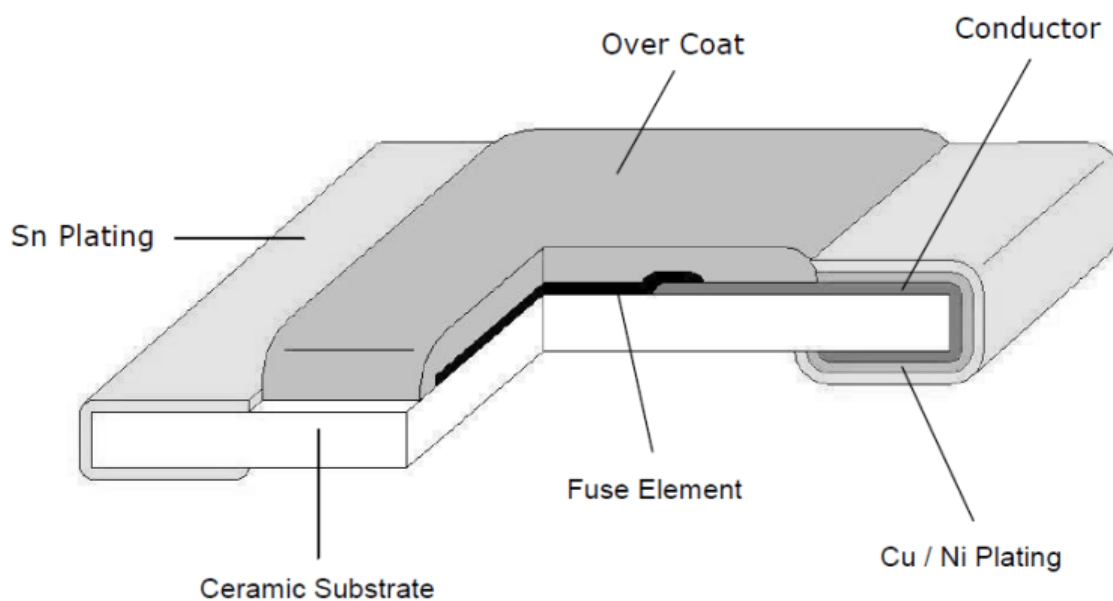


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1. Scope

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



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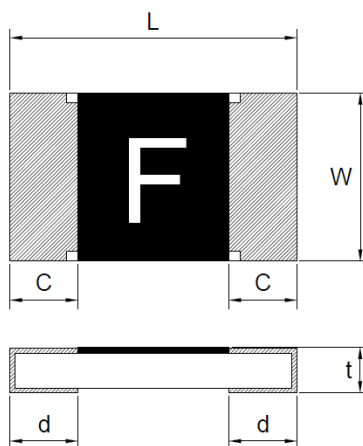


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4. Dimensions



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°C 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 value was measured with less than 10% of rated current



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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



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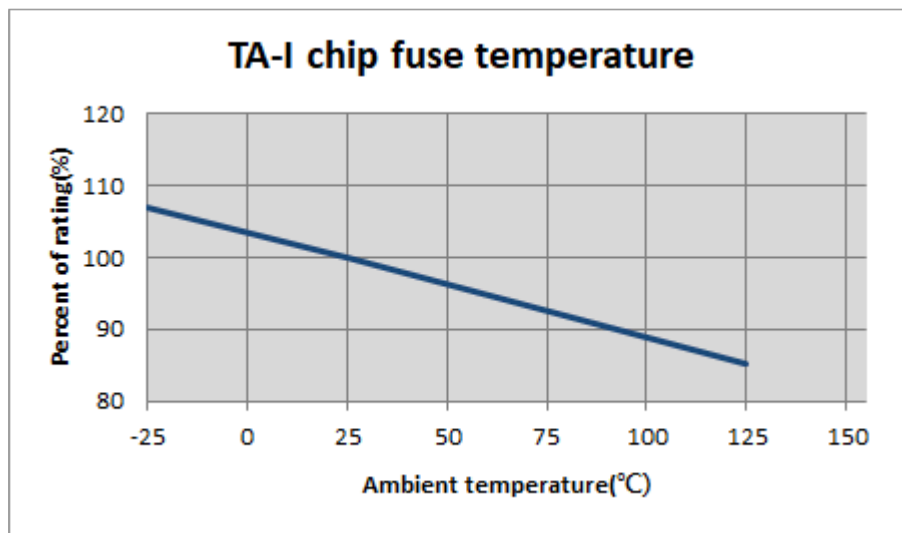


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6 Temperature Derating Curve

6.1 Normal Ambient Temperature: 25°C

6.2 Operating Temperature: -25°C~125°C, 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°C±5°C,10±1second
Solderability	95% coverage minimum	235°C±5°C, 2±0.5second 245°C±5°C, 2±0.5second (Lead Free)
Temperature Rise	<75°C	100% of its rated current, Measure of surface temperature
Resistance to Dry Heat	±20%	105°C±5°C,1000 hrs
Resistance to Solvent	No evident damages on protective coating and marking	23°C±5°C of Isopropyl alcohol 90second
Residual Resistance	10kΩ and more	Measure DC resistance after fusing
Thermal Shock	ΔR< 10 %	-25°C/+25°C/+125°C/+25°C, 10 cycles

Note: MSL= Level 1.



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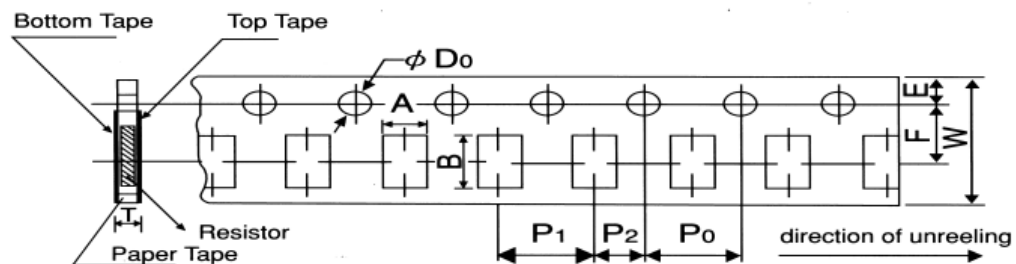


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8 Taping & Reel

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

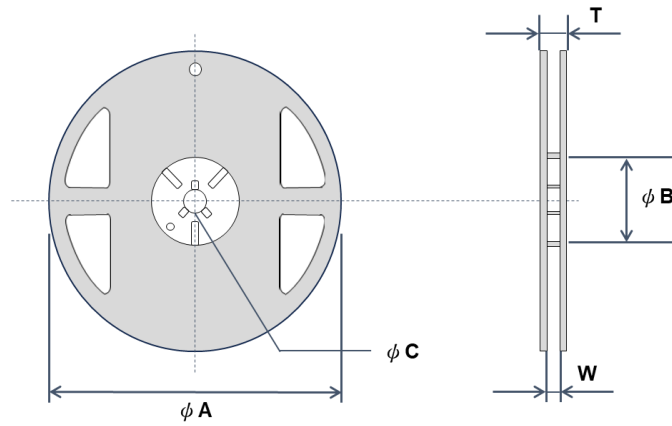


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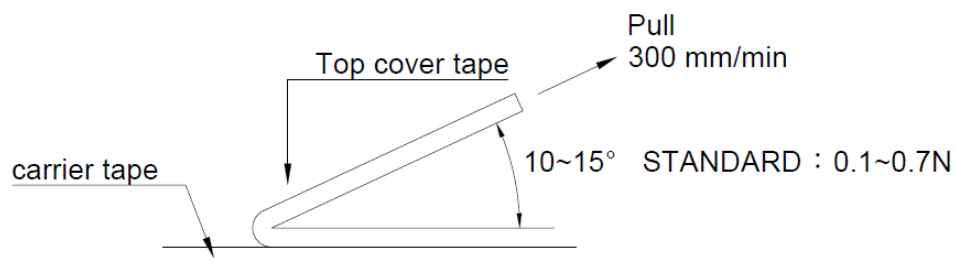
8.2 Reel Specifications



Unit: mm

Series	ϕA	ϕB	ϕC	W	T
CP04 CP06 CP12	178 $\pm$ 2.0	60.0 $\pm$ 1.0	13.0 $\pm$ 1.0	9.0 $\pm$ 1.0	11.4 $\pm$ 2.0

8.3 Peel –off force:



9 Storage Conditions:

Temperature: 5°C~35°C, Humidity: 40%~75%

10 Shelf Life:

2 years from manufacturing date



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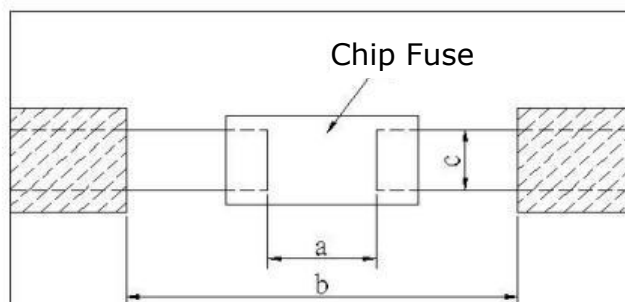


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11 Recommended land patterns



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



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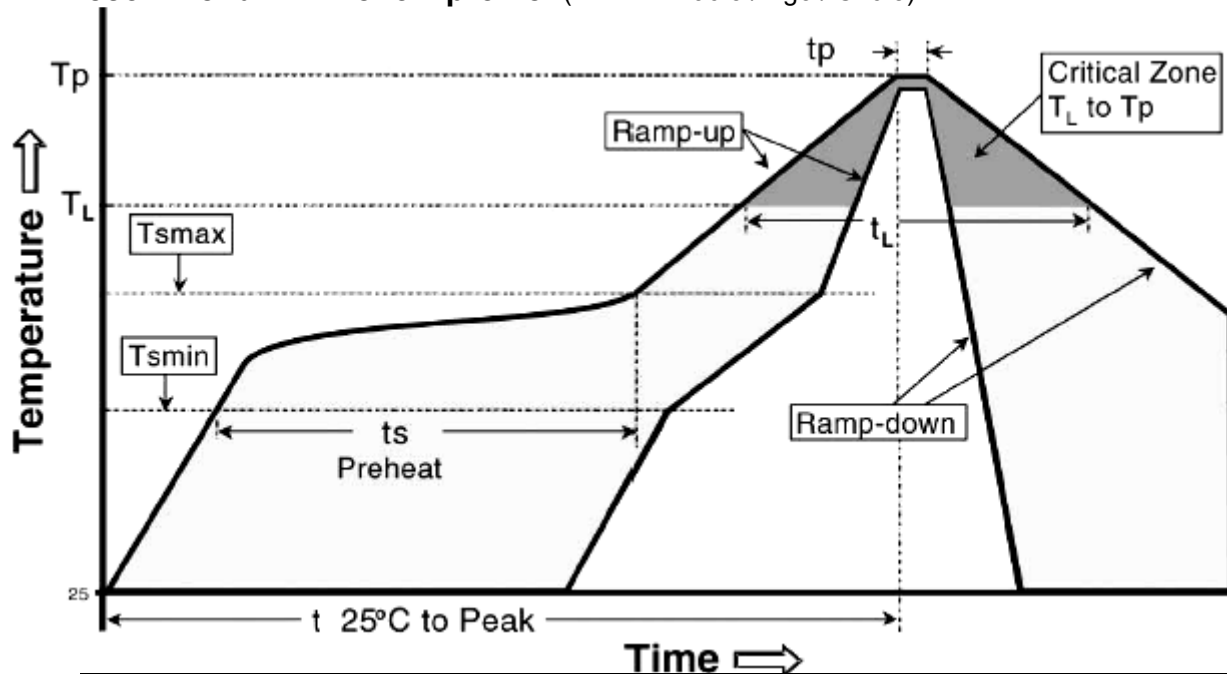


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12. Recommend IR – Reflow profile: (solder: Sn96.5 / Ag3 / Cu0.5)



Profile Feature	Lead (Pb)-Free Assembly
Average ramp-up rate (Tsmax to Tp)	3°C / second max.
Preheat - Temperature Min (Tsmin) - Temperature Max (Tsmax) - Time (Tsmin to Tsmax) (ts)	150°C 200°C 60 -120 seconds
Time maintained above: - Temperature (Tl) - Time (Tl)	217°C 60-150 seconds
Peak Temperature (Tp)	MAX:260°C
Time within $\begin{matrix} +0 \\ -5 \end{matrix}$ °C of actual Peak Temperature (tp) ²	30 seconds
Ramp-down Rate	6°C/second max.
Time 25°C to Peak Temperature	8 minutes max.

Allowed Re-flow times: 3 times

Remark: To avoid discoloration phenomena of chip on terminal electrodes, please use N2 Re-flow furnace.



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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.



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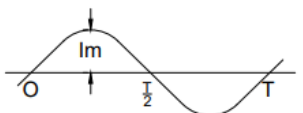
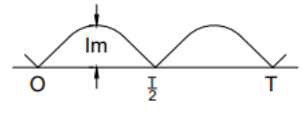
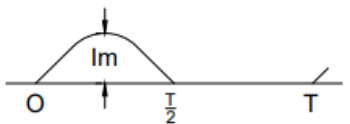
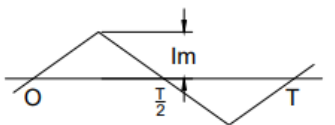
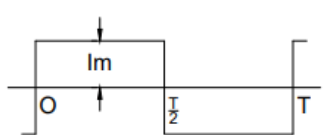
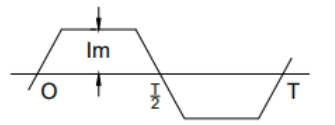
15. Selection Guideline of Fuse:

■ 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 $I_p = 1.5 \text{ A}$, Normal operating current = 1.5 A

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



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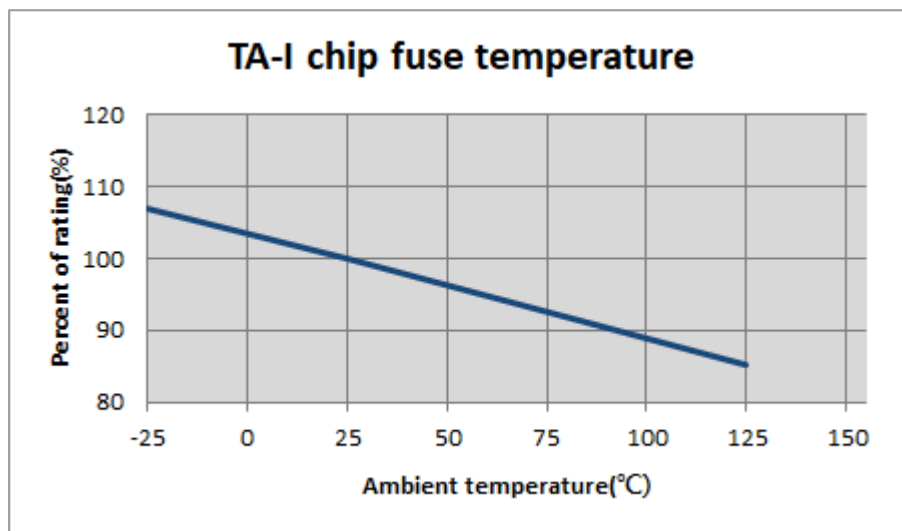
No.	Type	Waveform	Formula
7	Rectangular Pulse		$I_m \sqrt{\frac{\tau}{T}}$
8	Triangle Pulse		$I_m \sqrt{\frac{\tau}{3T}}$

■ 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

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

◎ e.g.

Condition: Normal operating current = 1.5 A

Ambient temperature 40 °C: Derating ratio ≈ 0.95



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

$$2.255 < \text{rating current of fuse}$$

■ 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 (A²s) value
- ◆ Choosing fuse's I^2t (A²s) value > calculate I^2t (A²s) value
- ◆ Considering Ratio of I^2t repeat numbers to blowing .
- ◆ Confirm with us.

e.g., choosing 0603 Fuse

Condition:

1. Rectangular Wave, $I_p = 4$ A, $t = 1$ ms , calculate $I_p^2t = 4^2 \times 1 \times 10^{-3} = 0.016$ (A²s)
2. Choosing CP06V3T1R50, $I^2t = 0.0623$ (A²s) → Page 12 index-table
3. Inrush shock : 100,000 times ($\div 0.35$) → inrush ratio
4. Choosing fuse's I^2t (A²s) value X Derating ratio (inrush 100000 times) > calculate I^2t (A²s) value
5. $0.0623 \times 0.35 = 0.0218$ (A²s) > 0.016 → CP06V3T1R50 is able to meet circuit's application



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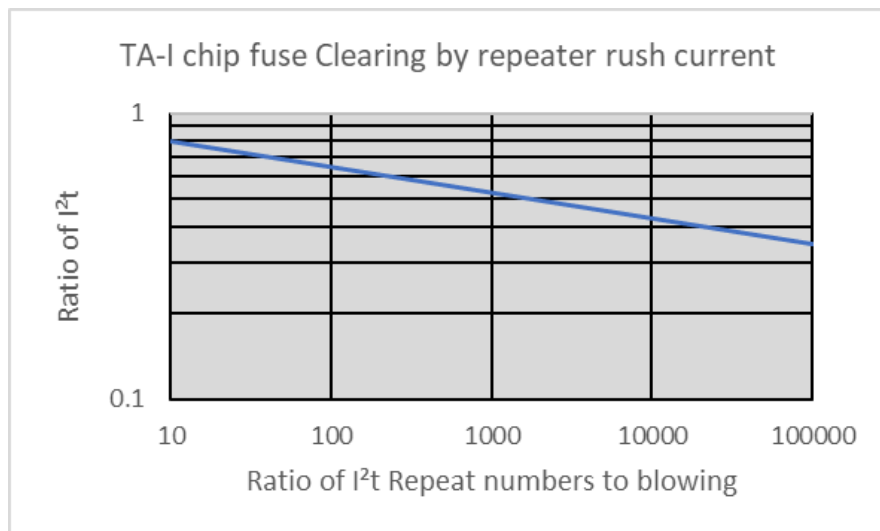
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TA-I FUSE I^2t ($A^2 s$)					
Part Number	Typical I^2t ($A^2 s$)	Part Number	Typical I^2t ($A^2 s$)	Part Number	Typical I^2t ($A^2 s$)
CP04V3TR50	0.00317	CP06V5TR50	0.0088	CP12V6TR50	0.015
CP04V3TR80	0.00532	CP06V3TR63	0.0125	CP12V6TR80	0.040
CP04V3T1R0	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
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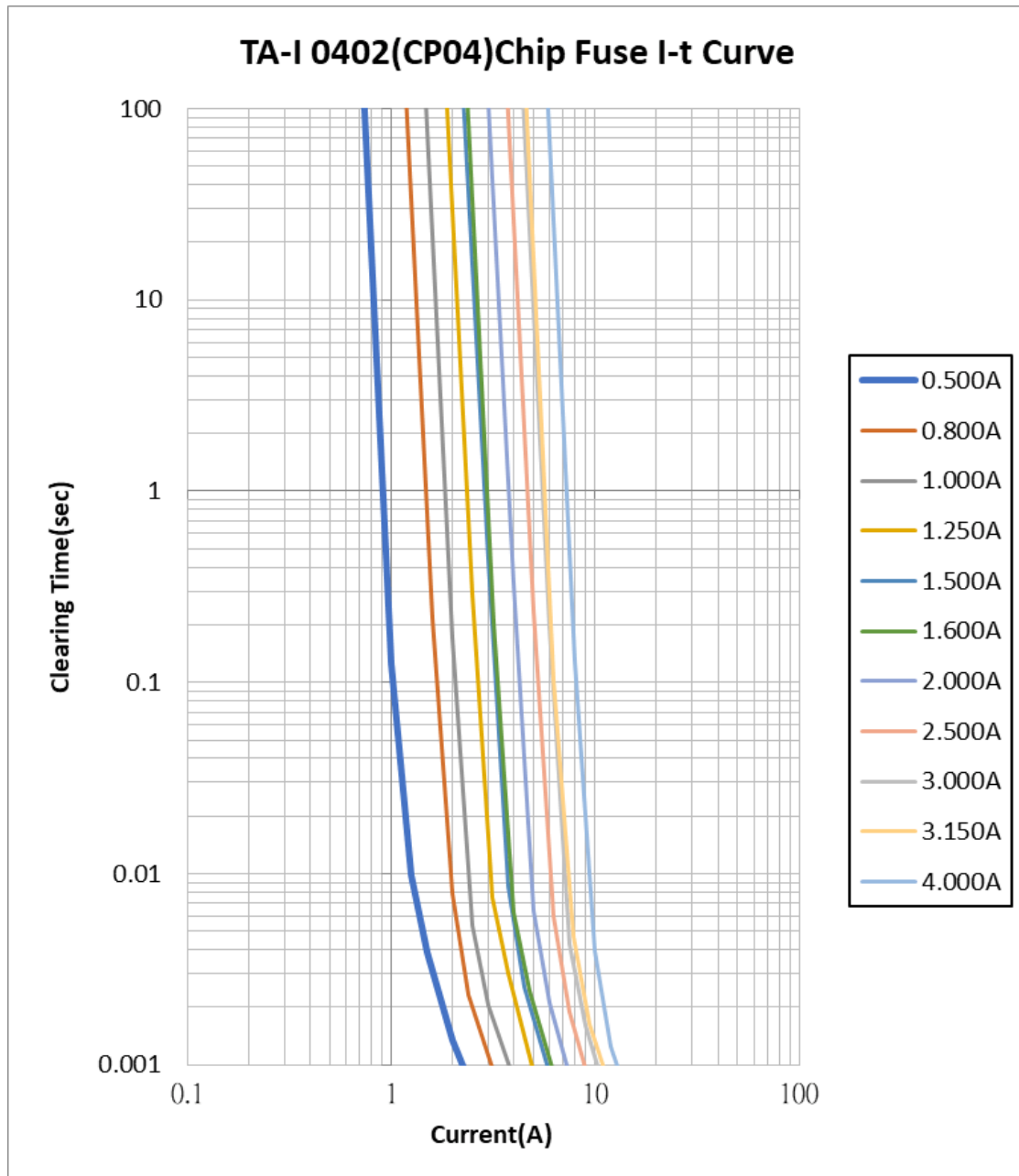
1	Sinusoidal Waveform (1 Cycle)		$\frac{1}{2} I_m^2 t$
2	Sinusoidal Waveform (1/2 Cycle)		$\frac{1}{2} I_m^2 t$
3	Triangle Waveform		$\frac{1}{3} I_m^2 t$
4	Rectangular Waveform		$I_m^2 t$
5	Trapezoidal Waveform		$\frac{1}{3} I_m^2 t + I_m^2 (t_1 - t_2) + \frac{1}{3} I_m^2 (t_2 - t_3)$
6	Various Waveform 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		$I_m^2 \left[\frac{t_1}{3} + 0.721 (t_2 - t_1) \right]$



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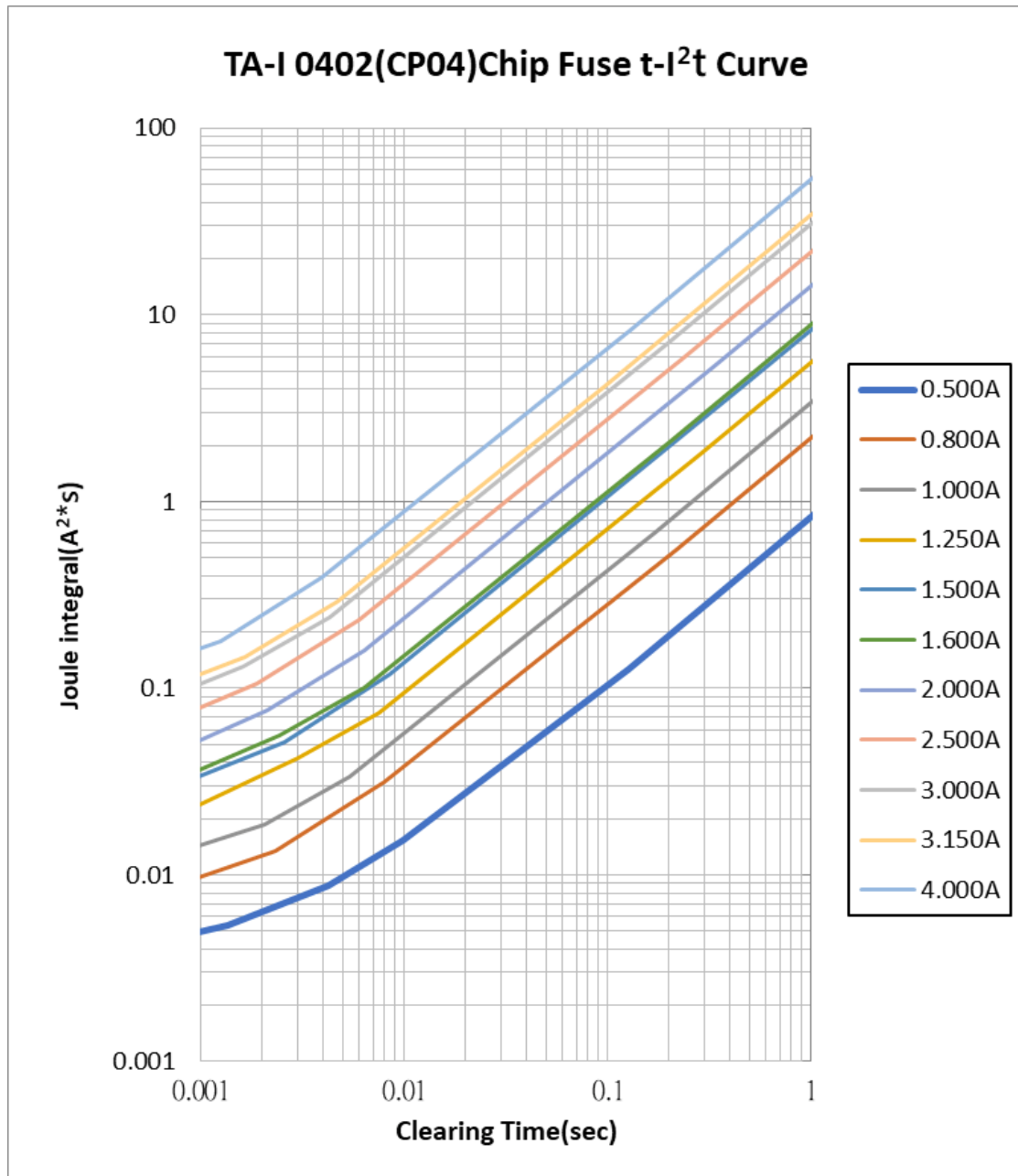




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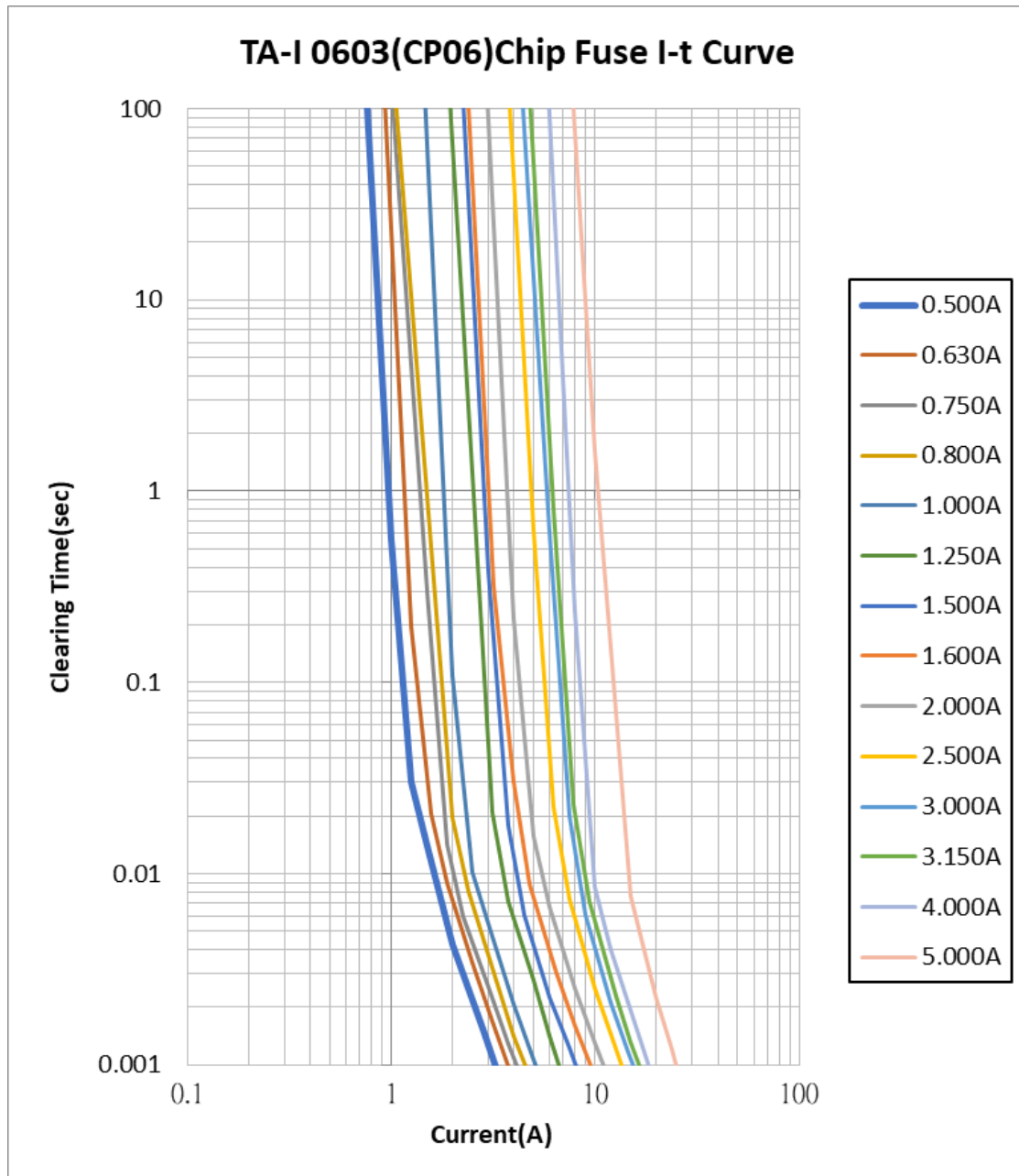




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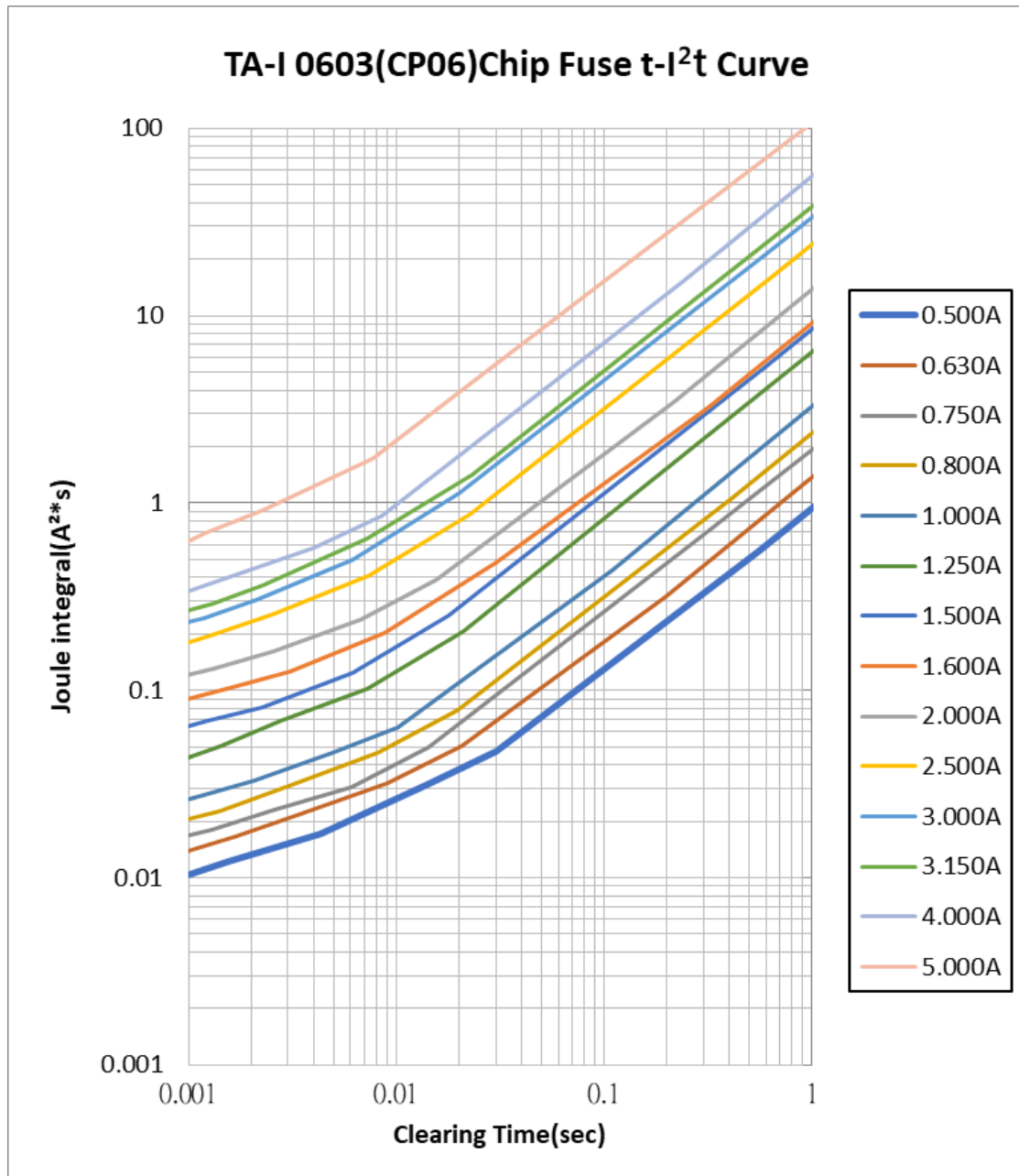




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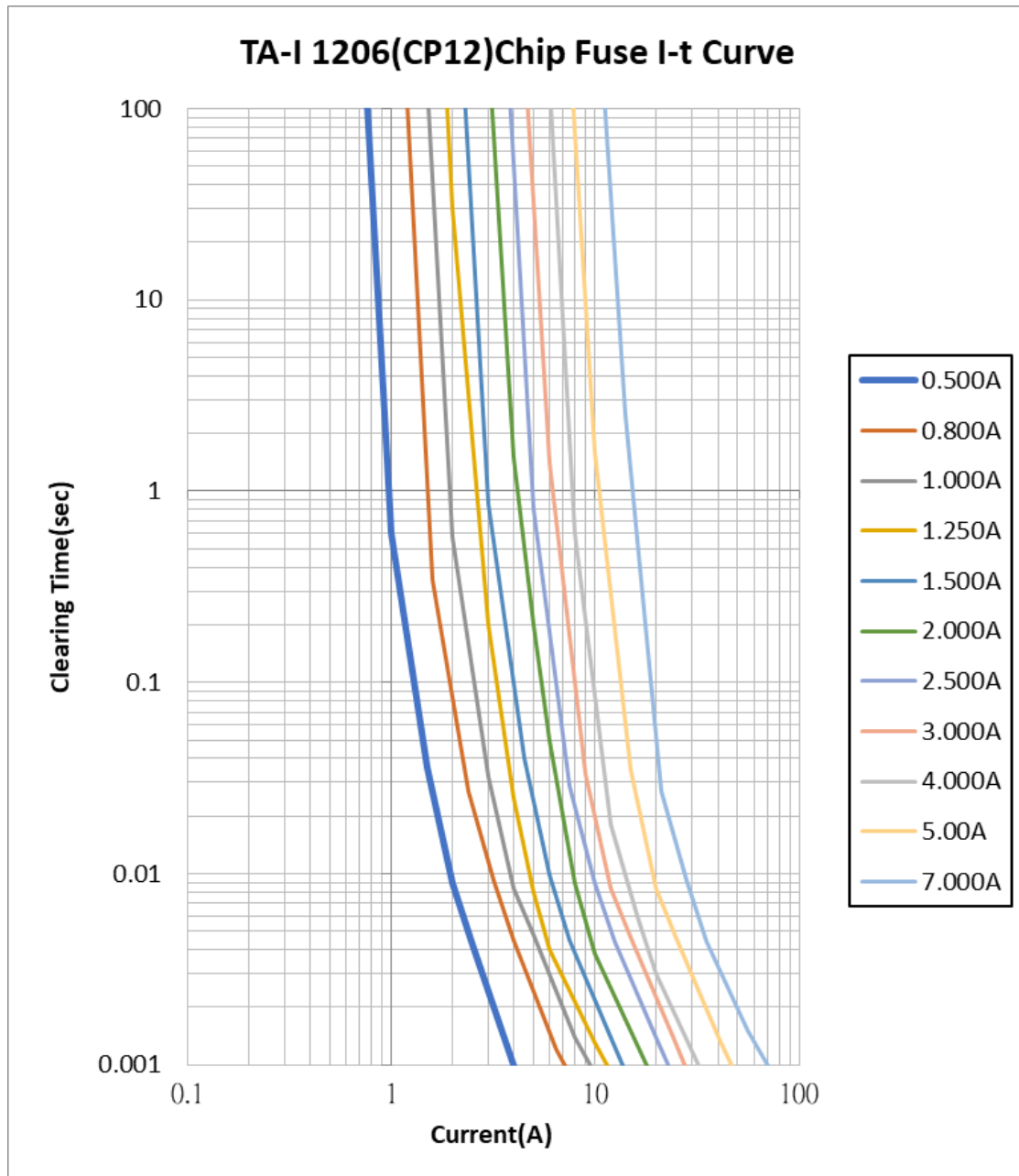




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