

Lead Free Thin Film Chip Fuse

Document No TCF-XXOS028D

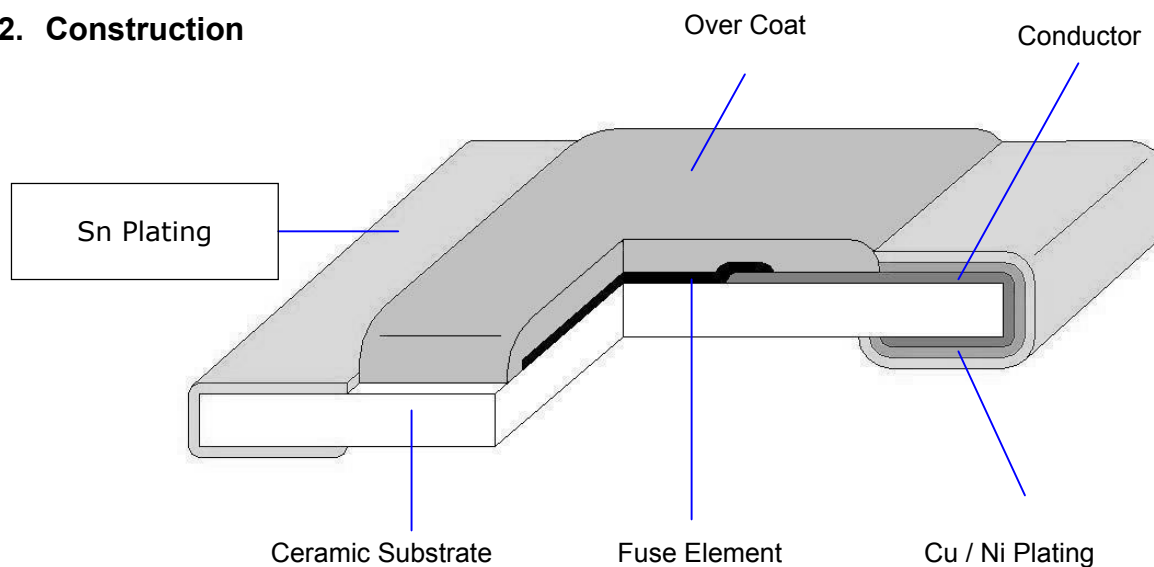
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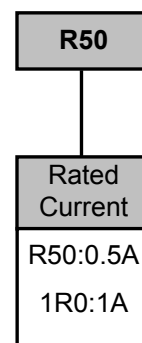
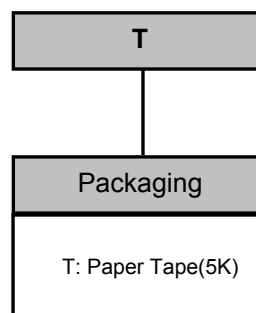
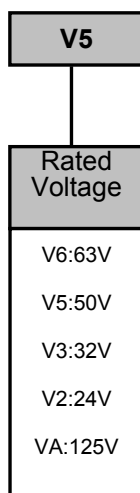
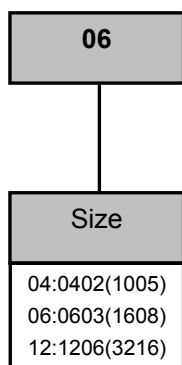
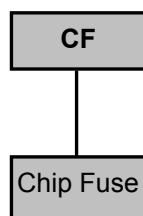
1. Scope

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

2. Construction



3. Type Designation



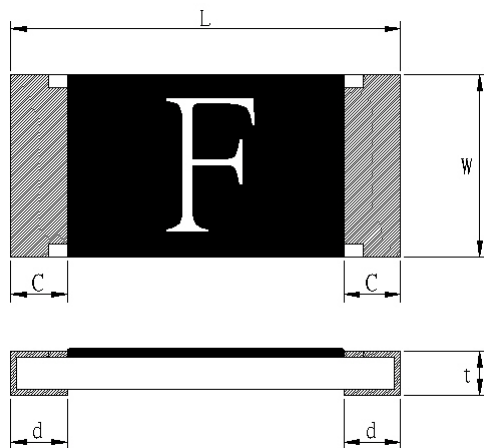
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4. Dimensions



Unit: mm

Type (Inch Size code)	Dimensions (mm)				
	L	W	C	d	t
CF04V (0402)	1.0±0.1	0.52±0.05	0.2±0.1	0.25±0.1	0.35±0.05
CF06V (0603)	1.6±0.1	0.8±0.1	0.3±0.2	0.35±0.2	0.45±0.1
CF12V (1206)	3.1±0.1	1.55±0.1	0.5±0.3	0.5±0.2	0.6±0.1

5. Applications and ratings

Part Designation	Marking	Rated Current	Fusing Time	Resistance (mΩ) Typ.*	Rated Voltage	Breaking Capacity	Body Temperature rising
CF04V2TR50	F	0.50A	Open within 1min.at200% rated current	320	DC 24V	DC24V 35A	<75°C at 100% rated current
CF04V2TR80	K	0.80A		120			
CF04V2T1R0	L	1.00A		90			
CF04V2T1R25	M	1.25A		67			
CF04V2T1R50	P	1.50A		51			
CF04V2T1R60	N	1.60A		46			
CF04V2T2R0	S	2.00A		33			
CF04V2T2R50	T	2.50A		25			
CF04V2T3R00	3	3.00A		20			
CF04V2T3R15	U	3.15A		19			
CF04V2T4R0	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) Typ.*	Rated Voltage	Breaking Capacity	Body Temperature rising
CF06V5TR50	F	0.50A	Open within 1min.at200% rated current	250	DC 50V	DC50V 50A	<75℃ at 100% rated current
CF06V3TR63	I	0.63A		173	DC 32V	DC32V 50A	
CF06V3TR80	K	0.80A		115			
CF06V3T1R0	L	1.00A		88			
CF06V3T1R25	M	1.25A		63			
CF06V3T1R50	P	1.50A		45			
CF06V3T1R60	N	1.60A		42			
CF06V3T2R0	S	2.00A		33			
CF06V2T2R50	T	2.50A		24	DC 24V	DC24V 50A	
CF06V2T3R00	3	3.00A		21			
CF06V2T3R15	U	3.15A		19	DC 32V	DC32V 50A	
CF06V3T4R0	W	4.00A		15			
CF06V3T5R0	Y	5.00A		12			

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

Part Designation	Marking	Rated Current	Fusing Time	Resistance (mΩ) Typ.*	Rated Voltage	Breaking Capacity	Body Temperature rising
CF12V6TR50	F	0.50A	Open within 1min.at200% rated current	590	DC 63V	DC63V 50A	<75℃ at 100% rated current
CF12V6TR80	K	0.80A		225			
CF12V6T1R0	L	1.00A		130			
CF12V6T1R25	M	1.25A		88			
CF12V6T1R50	P	1.50A		65			
CF12V6T2R0	S	2.00A		38			
CF12V3T2R50	T	2.50A		32	DC 32V	DC32V 50A	
CF12V3T3R00	3	3.00A		23			
CF12V2T4R0	W	4.00A		15	DC 24V	DC24V 50A	
CF12V2T5R0	Y	5.00A		11			
CF12V2T7R0	Z	7.00A		7			

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

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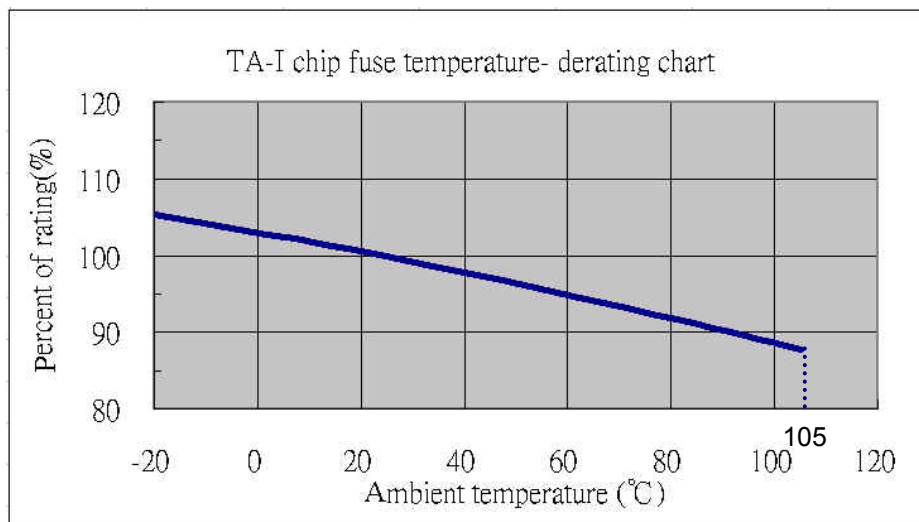
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6.Temperatuer Derating Curve

6.1 Normal Ambient Temperature: 25°C

6.2 Operating Temperature: -20°C~105°C,whit proper Derating factor as below:



7.Reliability Tests

Parameter	Requirement	Test Method	Reference standard
Carrying capacity	No fusing	Rated current ,4hr	UL-248-14
Fusing Time	Within 1 minute	200% of its rated current	UL-248-14
Interrupting Ability	No mechanical damages	After the fuse is interrupted ,rated voltage applied for 30sec again	UL-248-14
Bending Test	No mechanical damages	Distance between holding points: 90mm, Bending:3mm,1time ,30sec	JIS-C5202-6.1
Resistance to solder Heat	±20%	260°C±5°C ,10seconds ±1second	JIS-C5202-6.10
Solderability	95% coverage minimum	235°C±5°C , 2±0.5second 245°C±5°C , 2±0.5second (Lead Free)	JIS-C5202-6.11
Temperature Rise	<75°C	100% of its rated current, Measure of surface temperature	UL-248-14
Resistance to Dry Heat	±20%	105°C±5°C ,1000 hrs	JIS-C5202-7.2
Resistance to Solvent	No evident damages on protective coating and marking	23°C±5°C of Isopropyl alcohol 90second	JIS-C5202-6.4
Residual Resistance	10kΩ and more	Measure DC resistance after fusing	
Thermal Shock	△R< 10 %	-20°C/ +25°C/+125°C/+25°C , 10 cycles	JIS-C5202-7.2

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8. Marking

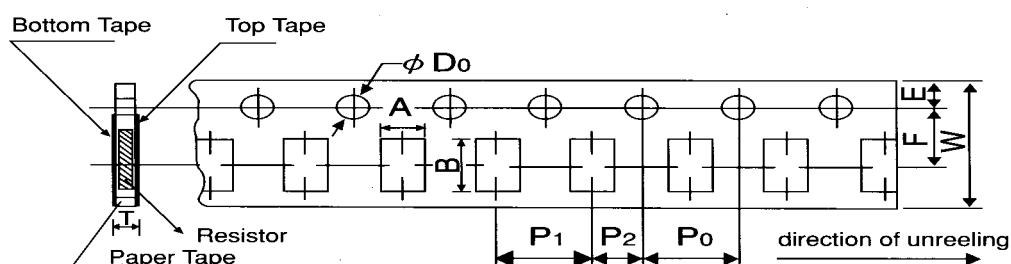
Symbol for Rating Current

Symbol	F	I	K	L	<u>M</u>	P	N	S	T	3	U	W	Y	Z
Rating Current(A)	0.5	0.63	0.8	1	1.25	1.5	1.6	2	2.5	3	3.15	4	5	7

9. Taping & Reel

9.1 Taping Dimensions

4mm pitch paper



Packing	Type	A	B	W	F	E	P ₁	P ₂	P ₀	D ₀	T
Paper Tape	CF04V	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	CF06V	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	CF12V	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
CF	04V	10000

Type series		Paper Tape
		4 mm pitch
		180mm/R
CF	06V	5000
CF	12V	5000

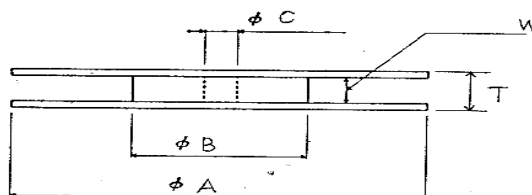
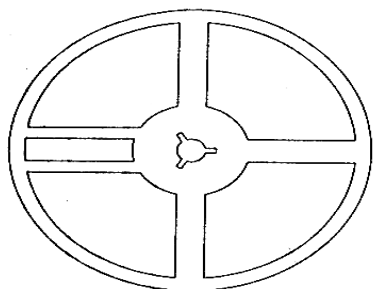
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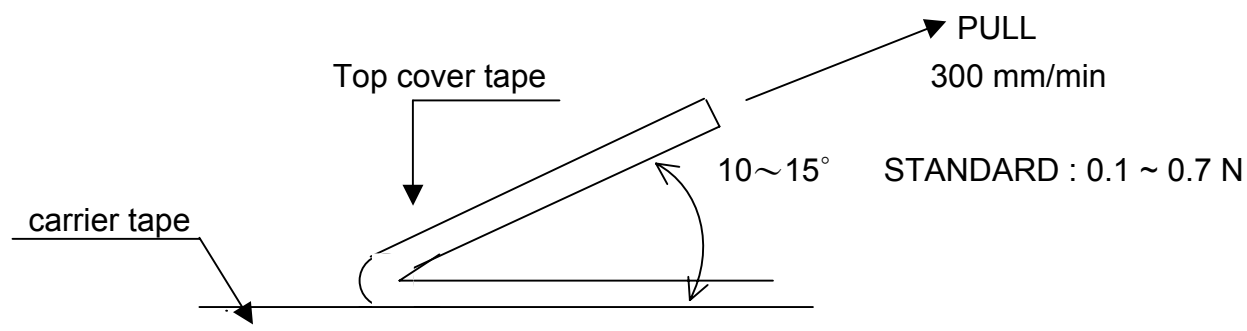
9.2 Reel Specifications



Unit: mm

Series	ϕA	ϕB	ϕC	W	T
CF04V CF06V CF12V	180^{+0}_{-3}	60 min	13.0 ± 1.0	9.0 ± 1.0	11.4 ± 2.0

9.3 Peel –off force :



10. Storage Conditions:

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

11. Shelf Life:

2 years from manufacturing date

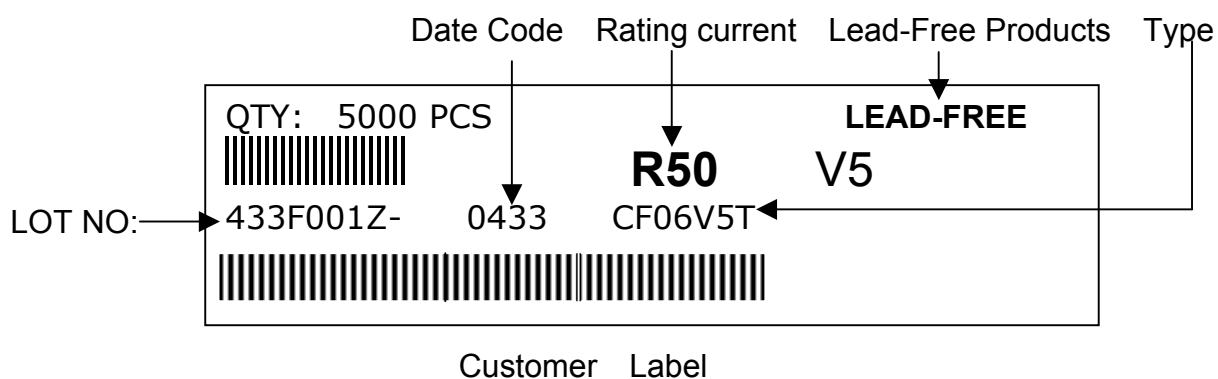
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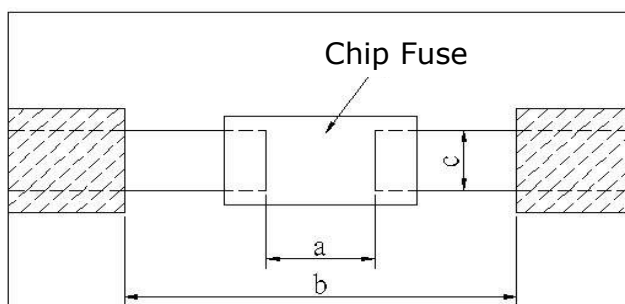
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12. Label



13. Recommended land patterns

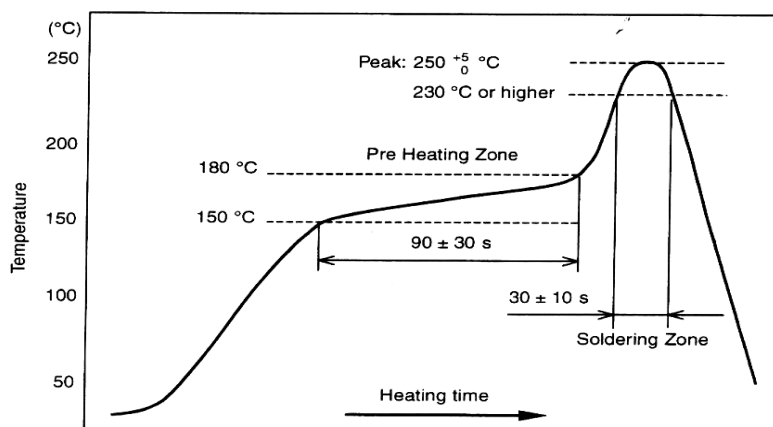


Type	Land pattern Size	Dimension		
		a	b	c
CF	04 (0402)	0.5~0.6	1.4~1.6	0.4~0.6
CF	06 (0603)	0.7~0.9	2.0~2.2	0.8~1.0
CF	12 (1206)	2.0~2.4	4.4~5.0	1.2~1.8

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



Peak : $250 \begin{smallmatrix} +5 \\ -0 \end{smallmatrix}^{\circ}\text{C}$, 5 sec

Pre – heat Zone : 150 to 180 °C, 90±30 sec

Soldering Zone : 230°C or higher , 30±10 sec

15. Approval by UL248-14

The fuses have been approved by UL.

File No. of UL Recognition is E241710

16. 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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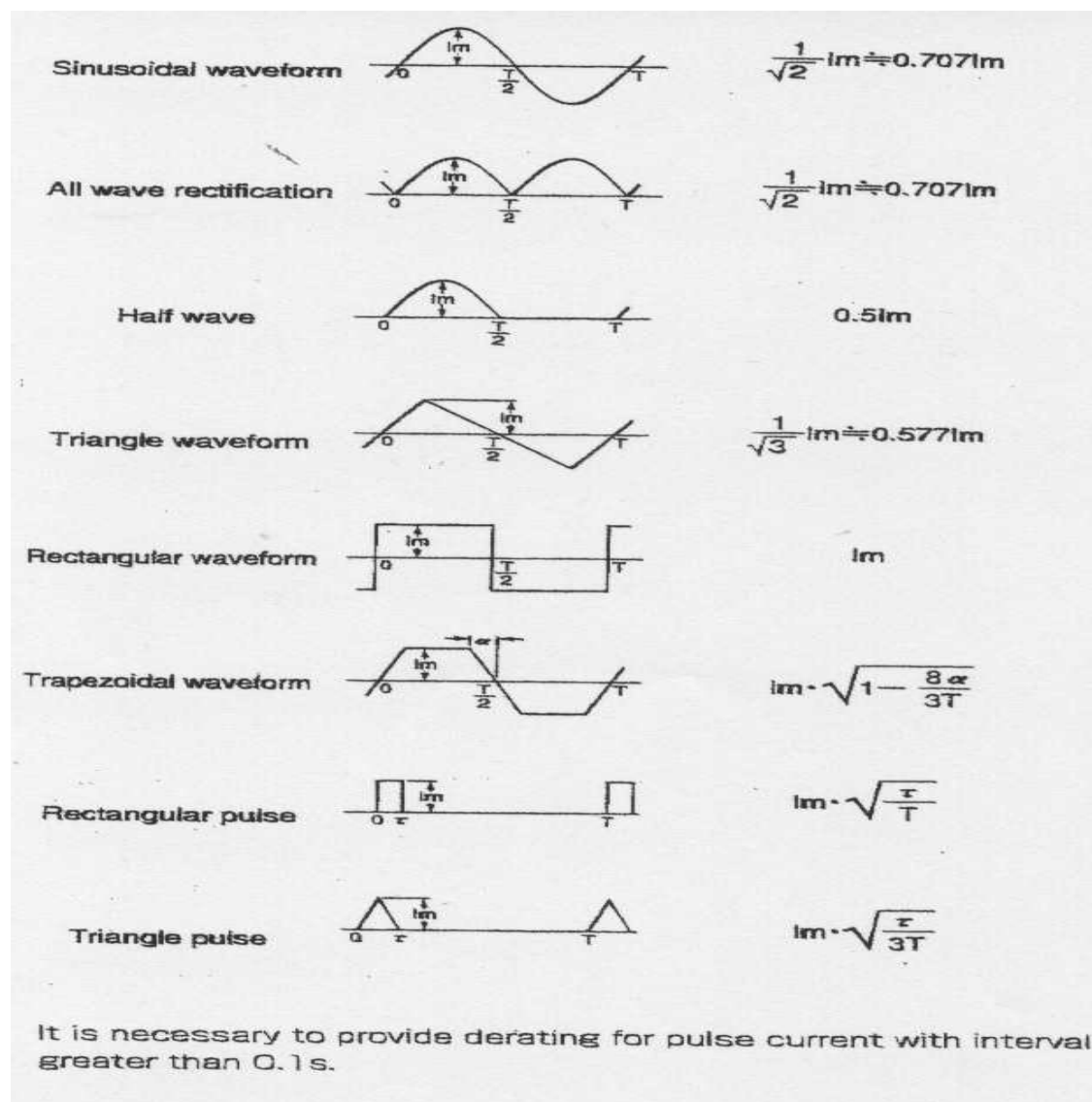
★ Selection Guideline of Fuse:

■ 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



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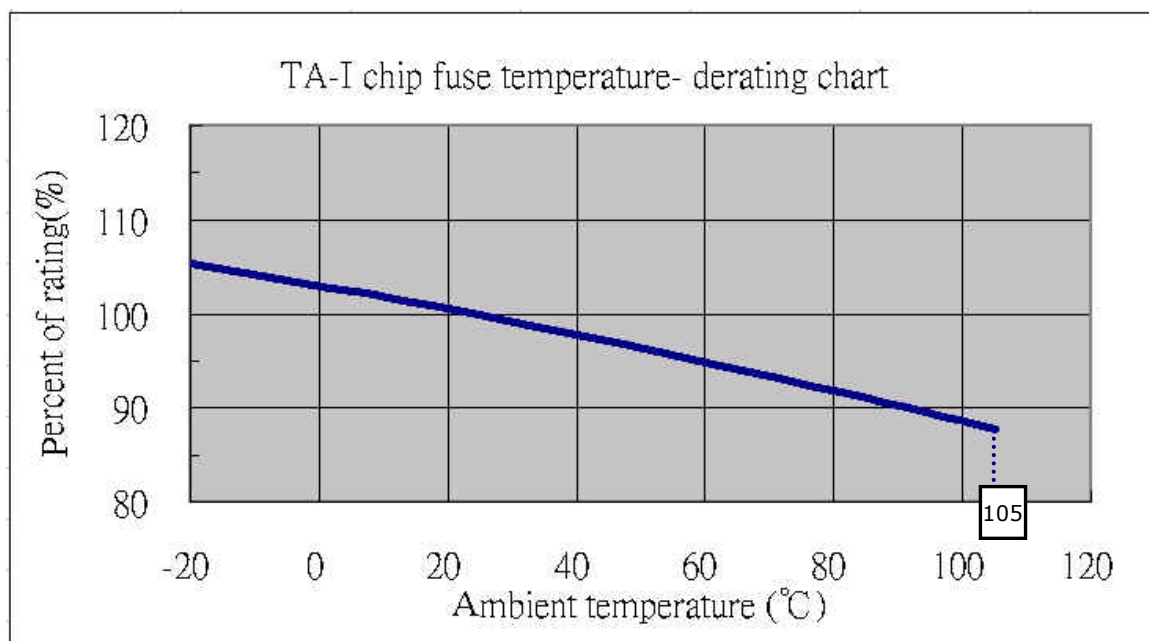
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Derating ratio for different ambient Temperature

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

e.g., Ambient temperature is 60 degree C

the derating ratio $\approx$ 0.95



Calculating the required rating of fuse needed .

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

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

↓
↓
Safety coefficient
Ambient temperature

e.g.,

Condition : Normal operating current =1.5 A

Ambient temperature 40 °C : Derating ratio $\approx$ 0.95

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

2.255 < rating current of fuse

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■ 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 CF06V2T2R50 .

Part Designation	Marking	Rated Current	Rated Voltage	Part Designation	Marking	Rated Current	Rated Voltage	Part Designation	Marking	Rated Current	Rated Voltage
CF04V2TR50	F	0.5A	24V	CF06V5TR50	F	0.5A	50V	CF12V6TR50	F	0.50A	63V
CF04V2TR80	K	0.80A	24V	CF06V3TR63	I	0.63A	32V	CF12V6TR80	K	0.80A	63V
CF04V2T1R0	L	1.00A	24V	CF06V3TR80	K	0.80A	32V	CF12V6T1R0	L	1.00A	63V
CF04V2T1R25	<u>M</u>	1.25A	24V	CF06V3T1R0	L	1.00A	32V	CF12V6T1R25	<u>M</u>	1.25A	63V
CF04V2T1R50	P	1.50A	24V	CF06V3T1R25	<u>M</u>	1.25A	32V	CF12V61R50	P	1.50A	63V
CF04V2T1R60	N	1.60A	24V	CF06V3T1R50	P	1.50A	32V	CF12V6T2R0	S	2.00A	63V
CF04V2T2R0	S	2.00A	24V	CF06V3T1R60	N	1.60A	32V	CF12V3T2R50	T	2.50A	32V
CF04V2T2R50	T	2.50A	24V	CF06V3T2R0	S	2.00A	32V	CF12V3T3R00	3	3.00A	32V
CF04V2T3R00	3	3.00A	24V	CF06V2T2R50	T	2.50A	24V	CF12V2T4R0	W	4.00A	24V
CF04V2T3R15	U	3.15A	24V	CF06V2T3R00	3	3.00A	24V	CF12V2T5R0	Y	5.00A	24V
CF04V2T4R0	W	4.00A	24V	CF06V2T3R15	U	3.15A	24V	CF12V2T7R0	Z	7.00A	24V
				CF06V3T4R0	W	4.00A	32V				
				CF06V3T5R0	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 .
- ◆ Confrim with us

e.g., choosing 0603 Fuse

Condition :

1. Rectangular Wave , $I_p = 4$ A , $t = 1$ (ms) ,

$$\text{Calculate } I_p^2t = 4^2 \times 1 \times 10^{-3} \text{ (A)} = 0.016 \text{ (A}^2\text{s)}$$

2. Choosing CF06V2T2R5 ($I^2t = 0.055$ (A²s))  **Page 12 index-table**

3. Inrush shock : 100,000 times (≈ 0.35)  **Inrush derating ratio**

Calculating :

 **Inrush 100,000 times**

1. Choosing fuse's I^2t (A²s) value X Derating ratio > calculate I^2t (A²s) value

$$2. 0.055 \times 0.35 = 0.01925 \text{ (A}^2\text{s)}$$

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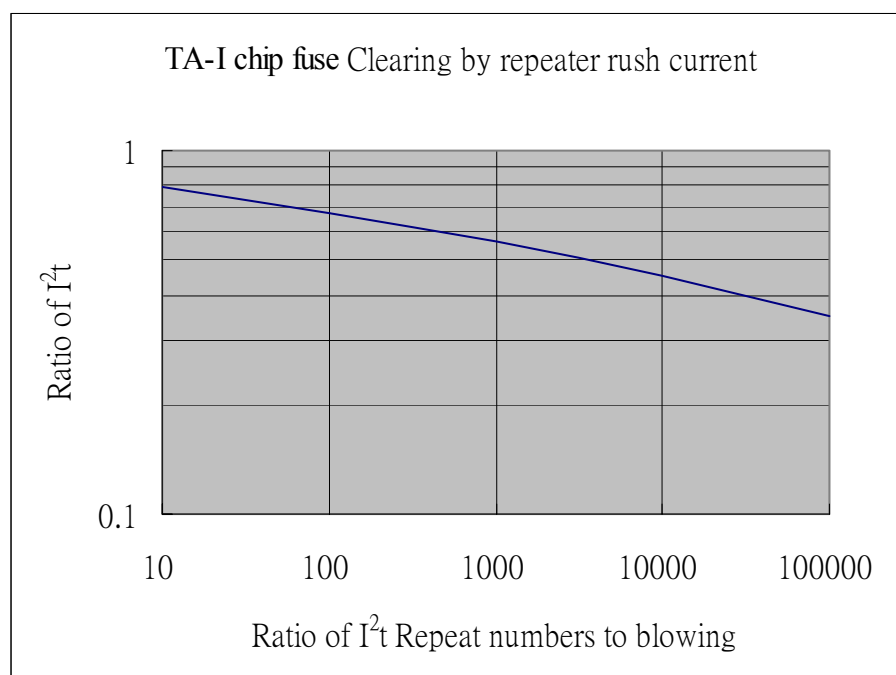
4. $0.01925 > 0.016$

The fuse 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)
CF04V2TR50	0.00317	CF06V5TR50	0.005	CF12V6TR50	0.011
CF04V2TR80	0.00532	CF06V3TR63	0.007	CF12V6TR80	0.031
CF04V2T1R0	0.00724	CF06V3TR80	0.014	CF12V6T1R0	0.034
CF04V2T1R25	0.01344	CF06V3T1R0	0.016	CF12V6T1R25	0.062
CF04V2T1R50	0.01356	CF06V3T1R25	0.027	CF12V6T1R50	0.144
CF04V2T1R60	0.01672	CF06V3T1R50	0.037	CF12V6T2R0	0.181
CF04V2T2R0	0.01983	CF06V3T1R60	0.041	CF12V3T2R50	0.351
CF04V2T2R50	0.03763	CF06V3T2R0	0.044	CF12V3T3R00	0.501
CF04V2T3R00	0.05427	CF06V2T2R50	0.055	CF12V2T4R0	0.954
CF04V2T3R15	0.06304	CF06V2T3R00	0.082	CF12V2T5R0	0.966
CF04V2T4R0	0.0896	CF06V2T3R15	0.089	CF12V2T7R0	3.25
		CF06V3T4R0	0.239		
		CF06V3T5R0	0.433		

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

Please confirm with us.



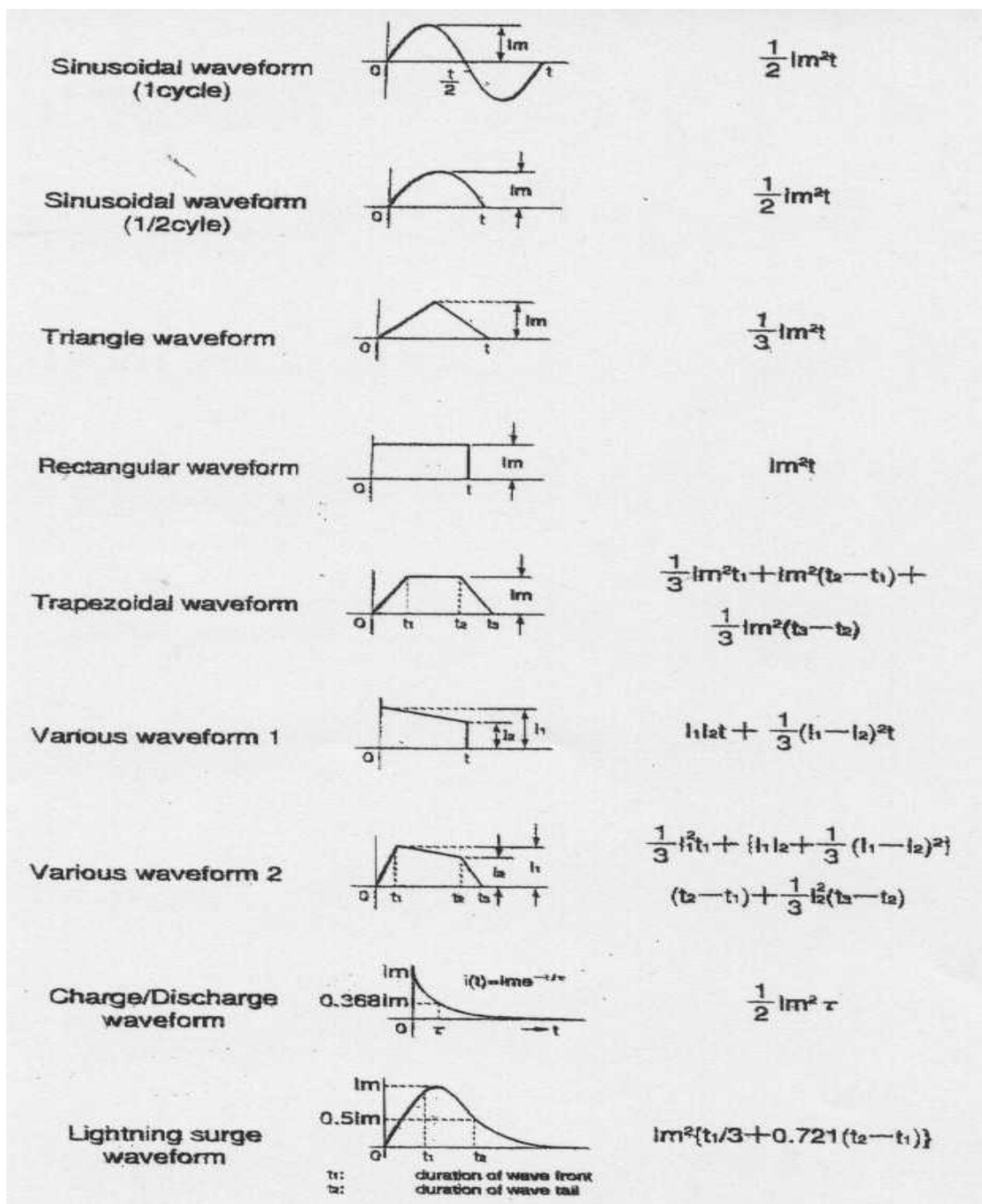
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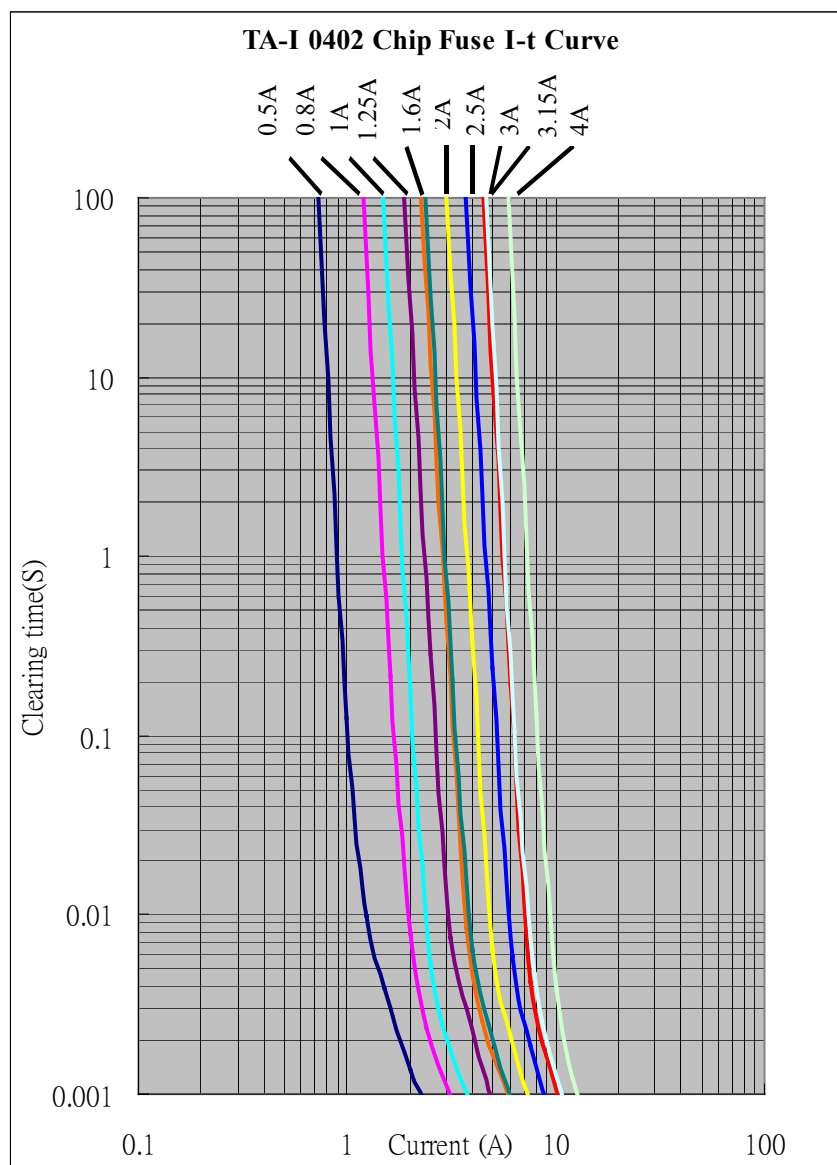
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Inrush Waveform



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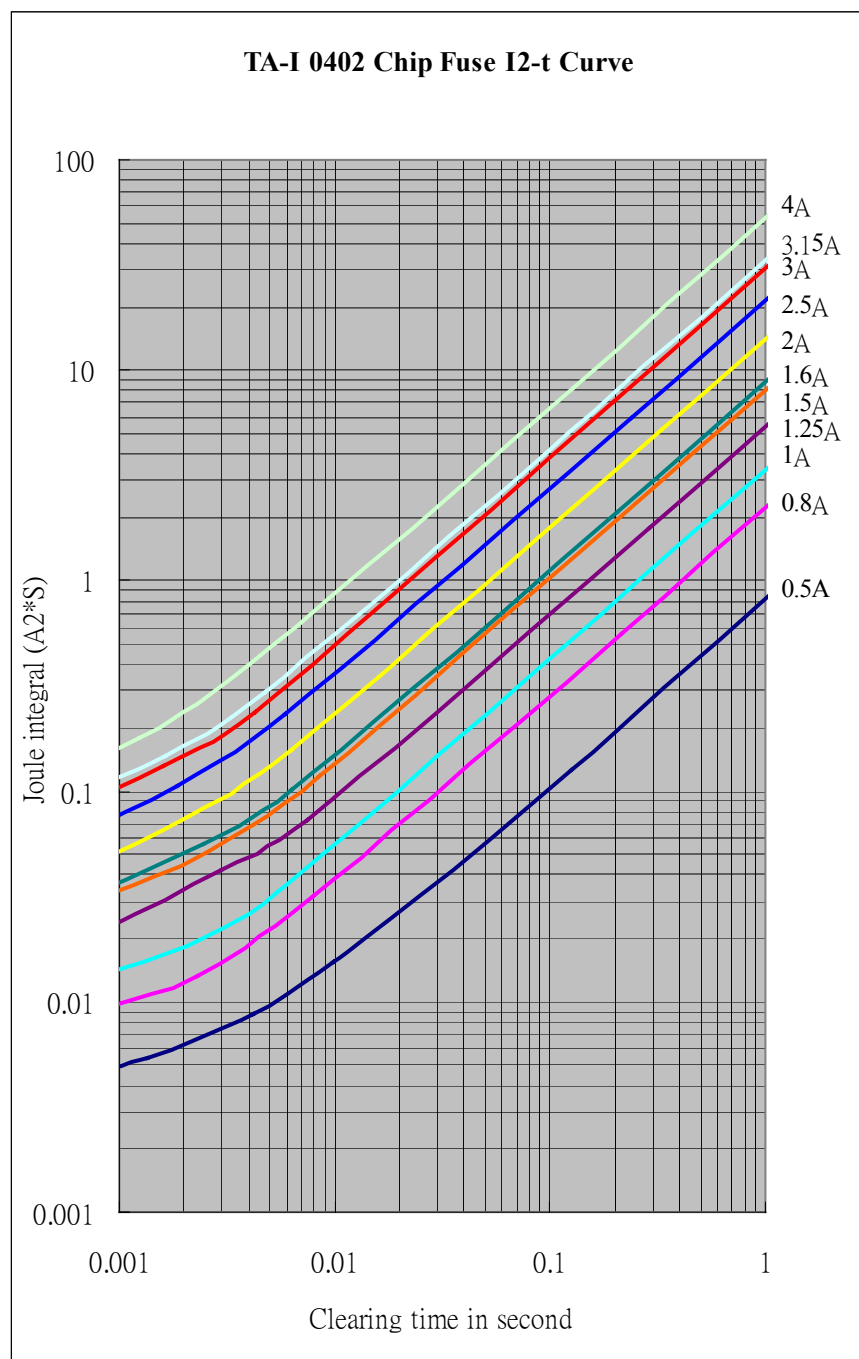


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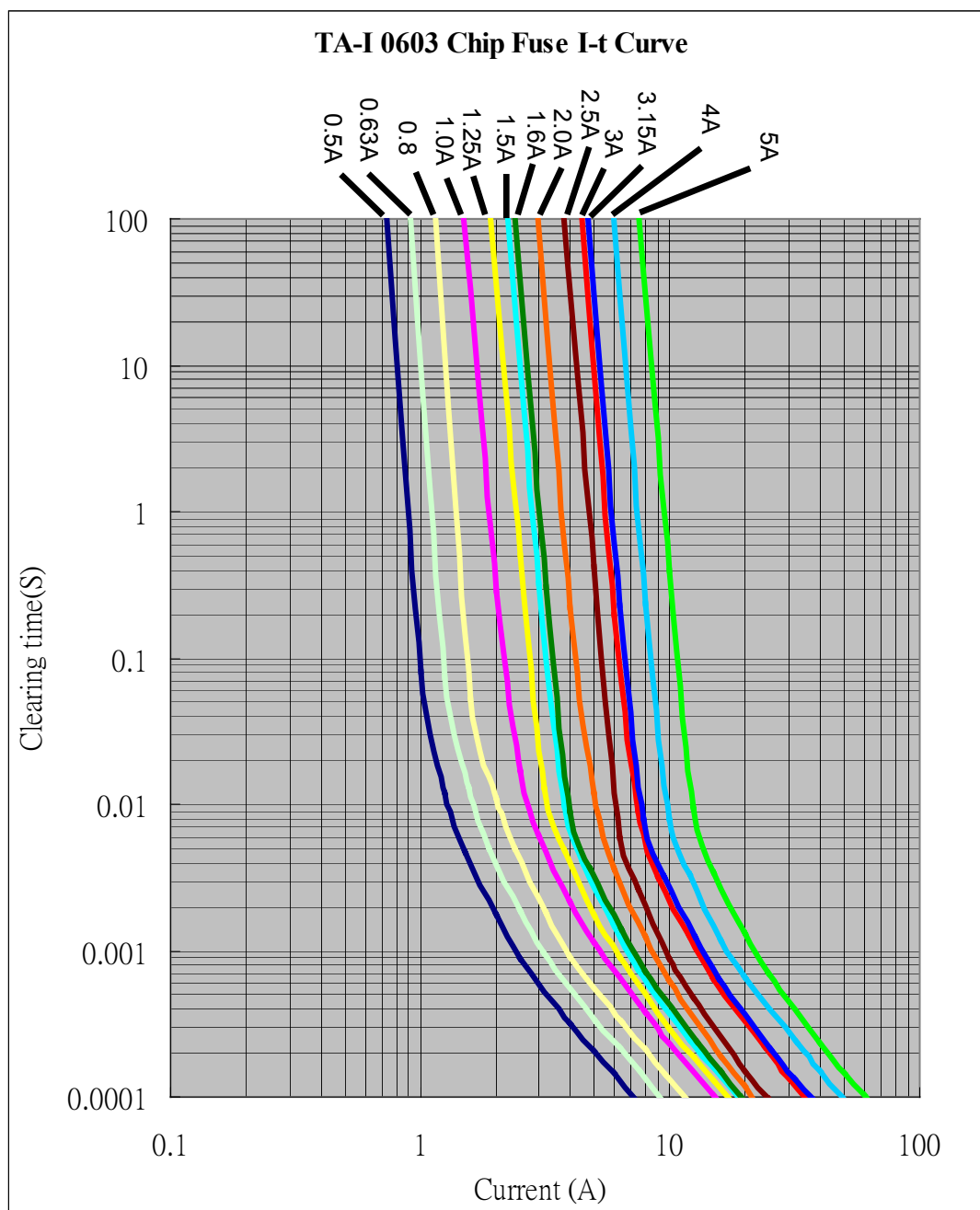


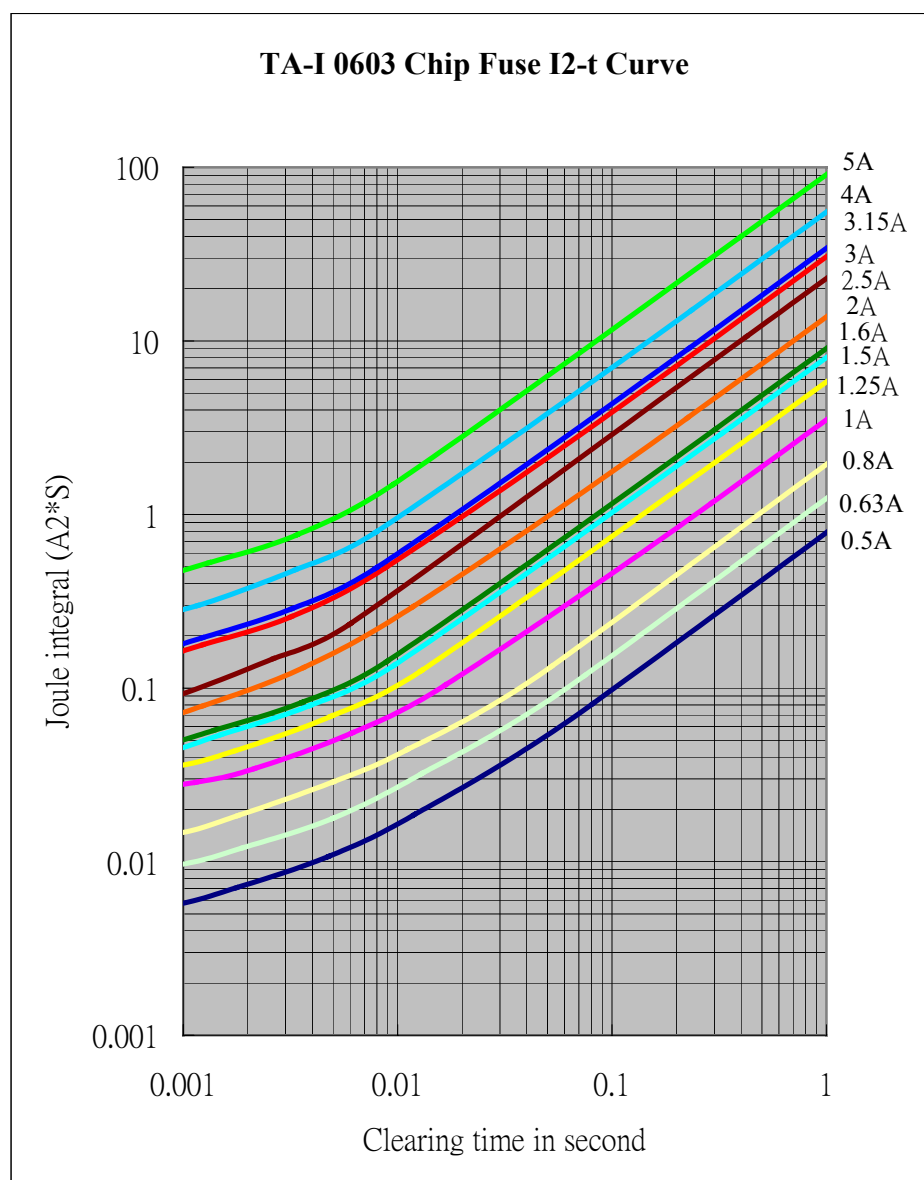
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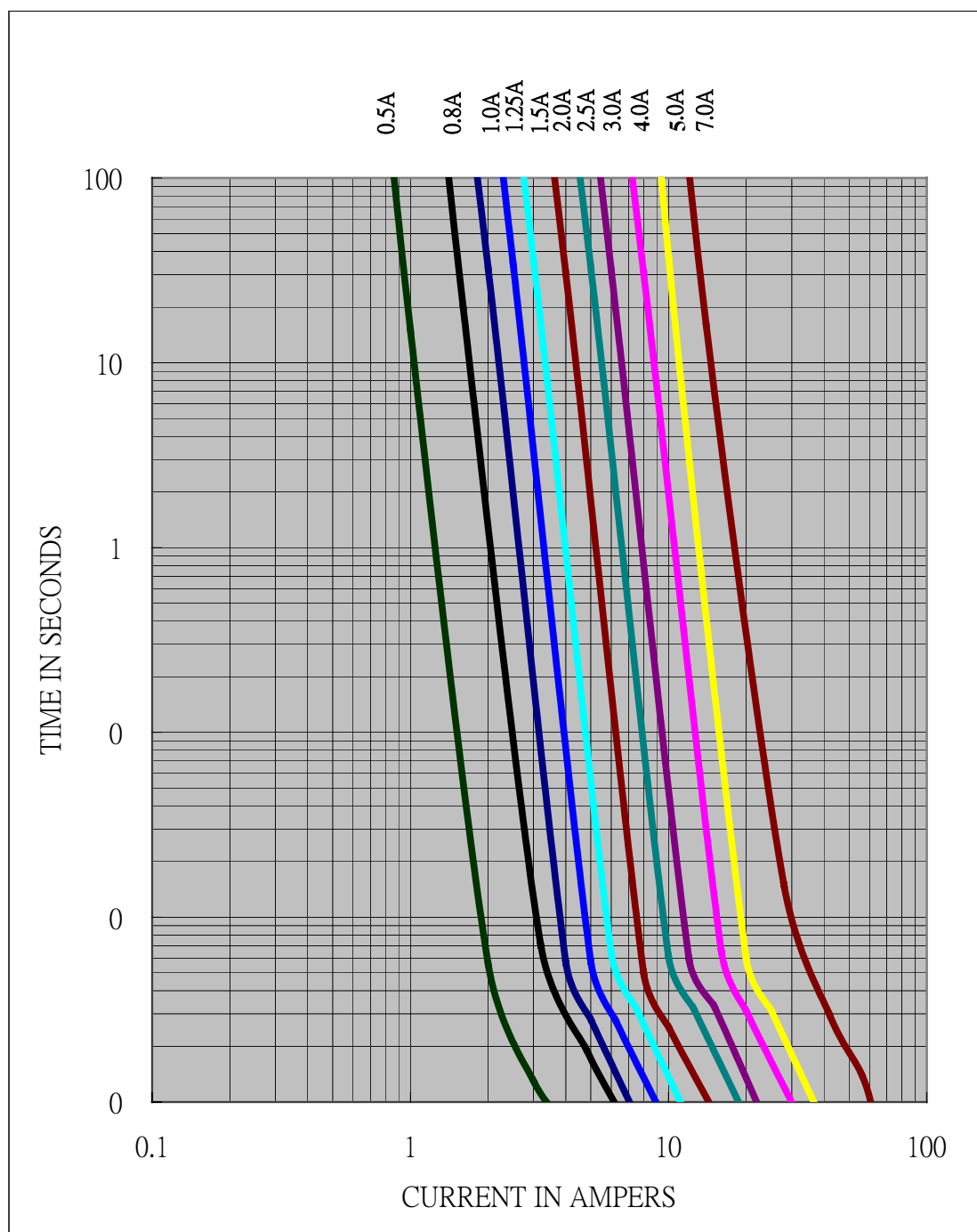
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TA-I 1206 Chip Fuse I-t Curve



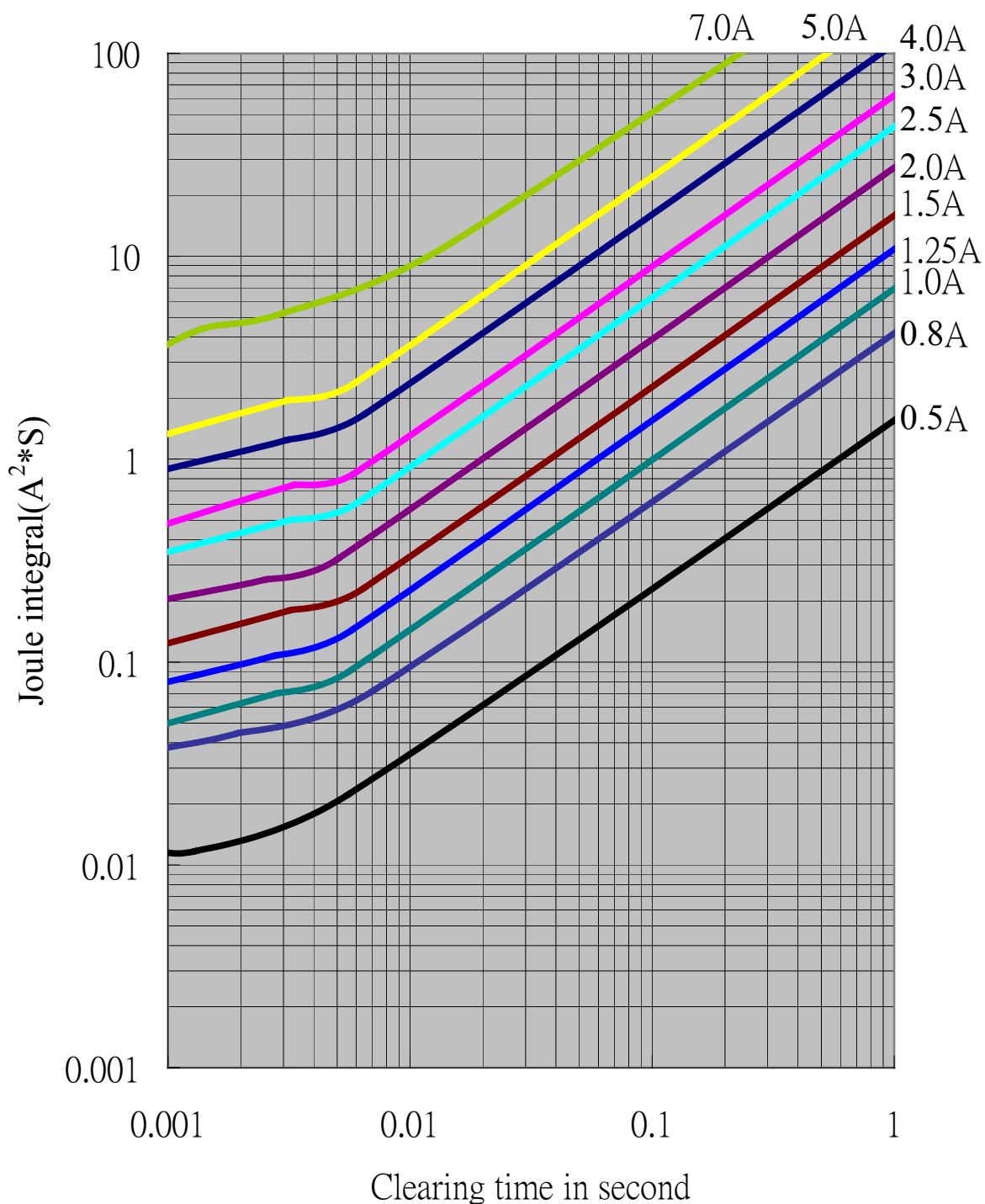
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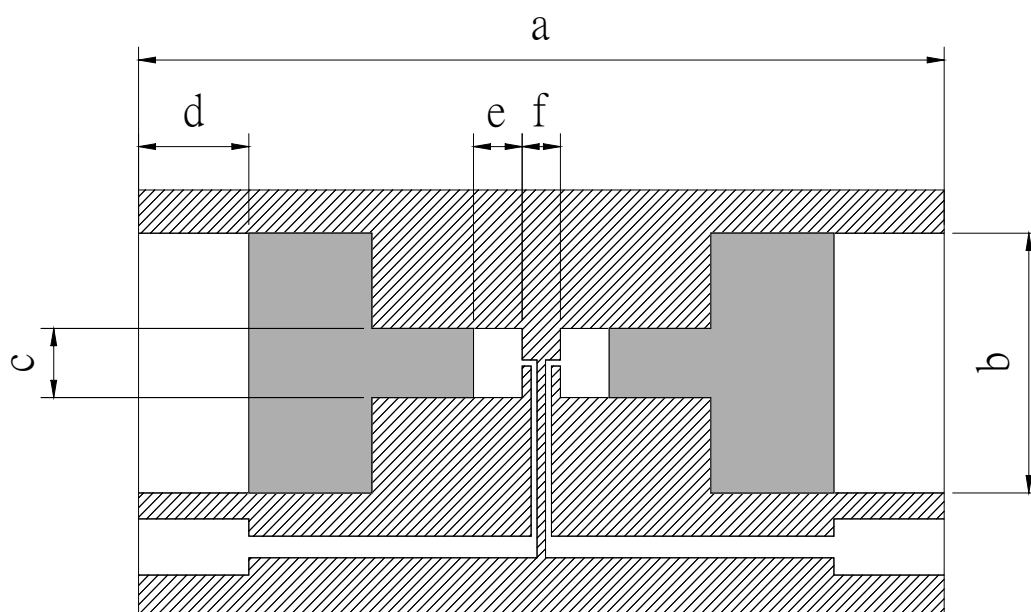
TA-I 1206 Chip Fuse I^2-t Curve



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Tset Circuit Borad



Type	a	b	c	d	e	f
CF0402	19	6	0.84	2.6	0.61	0.6
CF0603	19	6	1.6	2.6	1.15	0.9
CF1206	19	6	2.4	2.6	1.9	1

Unit:mm