



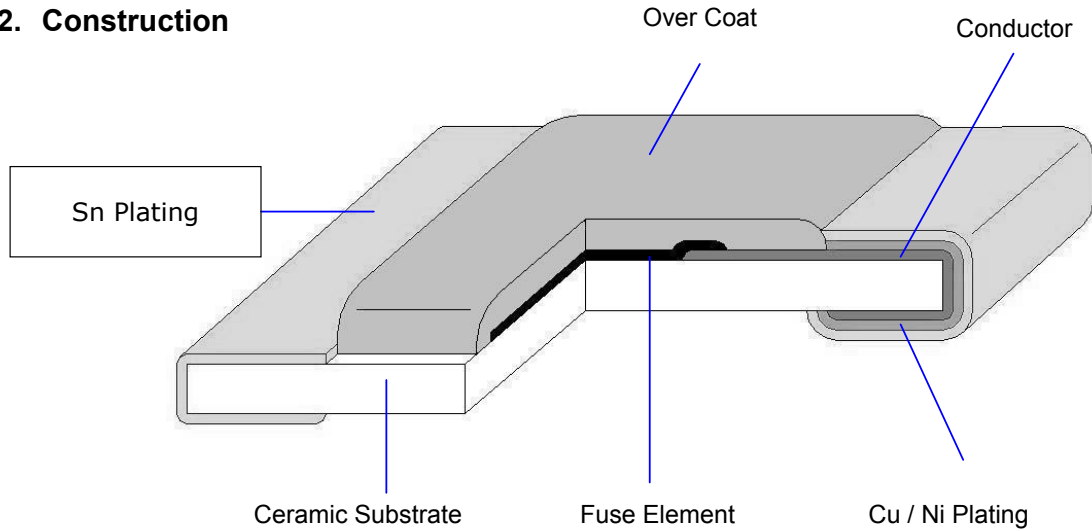
Lead Free Thin Film Chip Fuse

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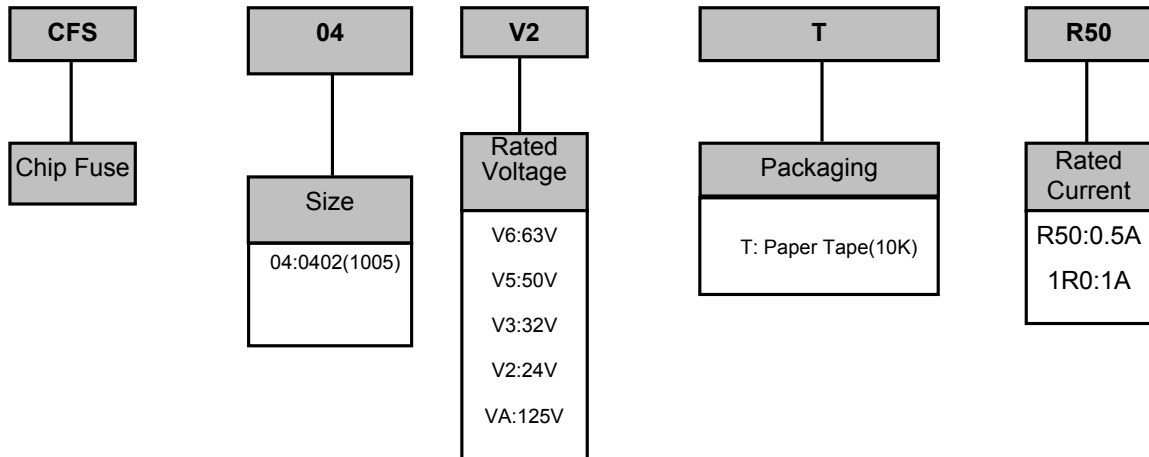
1. Scope

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

2. Construction

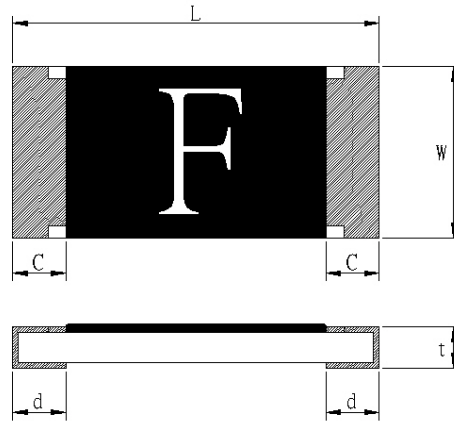


3. Type Designation





4. Dimensions



Unit: mm

Type (Inch Size code)	Dimensions (mm)				
	L	W	C	d	t
CFS04V (0402)	1.0±0.1	0.52±0.05	0.2±0.1	0.25±0.1	0.35±0.05

5. Applications and ratings

Part Designation	Marking	Rated Current	Fusing Time	Resistance (mΩ) Typ.*	Rated Voltage	Breaking Capacity	Body Temperature rising
CFS04V2TR50	F	0.50A	Open within 5sec.at250% rated current	235	DC 24V	DC24V 35A	<75°C at 100% rated current
CFS04V2TR80	K	0.80A		86			
CFS04V2T1R0	L	1.00A		64			
CFS04V2T1R25	M	1.25A		45			
CFS04V2T1R50	P	1.50A		35			
CFS04V2T1R60	N	1.60A		32			
CFS04V2T2R0	S	2.00A		24			
CFS04V2T2R50	T	2.50A		19			
CFS04V2T3R0	3	3.00A		15			
CFS04V2T3R15	U	3.15A		14			
CFS04V2T4R0	W	4.00A		10.5			

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



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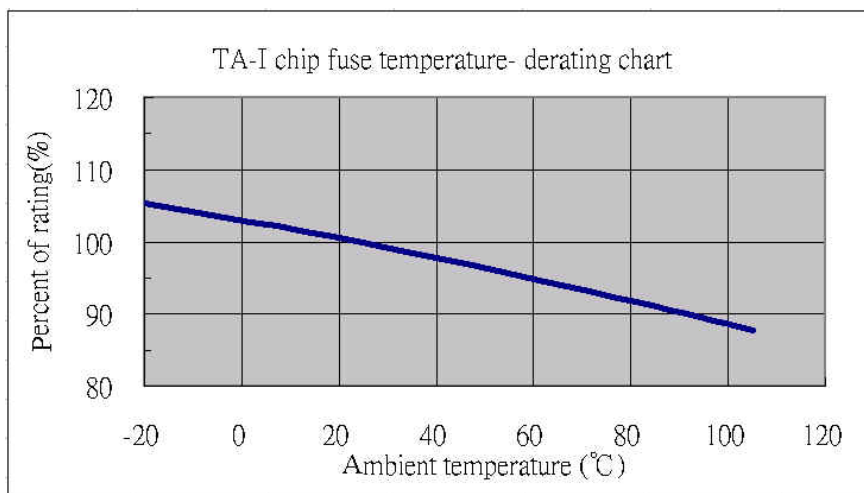
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6. Temperature Derating Curve

6.1 Normal Ambient Temperature: 25°C

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



7. Reliability Tests

Parameter	Requirement	Test Method
Carrying capacity	No fusing	Rated current ,4hr
Fusing Time	Within 5sec	250% 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, 10seconds ±1second
Solder ability	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 %	-20°C/ +25°C/+125°C/+25°C , 10 cycles



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8. Marking

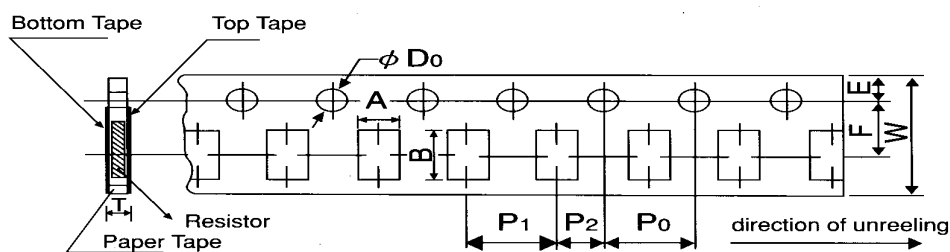
Symbol for Rating Current

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

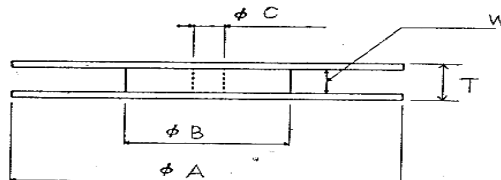
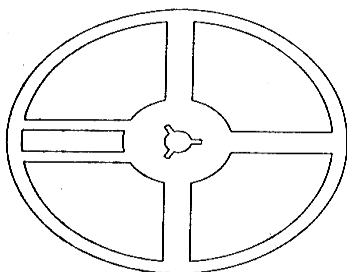


Packing	Type	A	B	W	F	E	P ₁	P ₂	P ₀	D ₀	T
Paper Tape	CFS04V	0.7±0.05	1.2±0.05	8.0±0.2	3.5±0.05	1.75±0.1	2.0±0.1	2.0±0.05	4.0±0.1	$\phi 1.5^{+0.1}_0$	0.45±0.1

Unit: mm

Type	Size	Paper Tape
CFS	04V	2 mm pitch
		180mm/R
		10000

9.2 Reel Specifications



Unit: mm

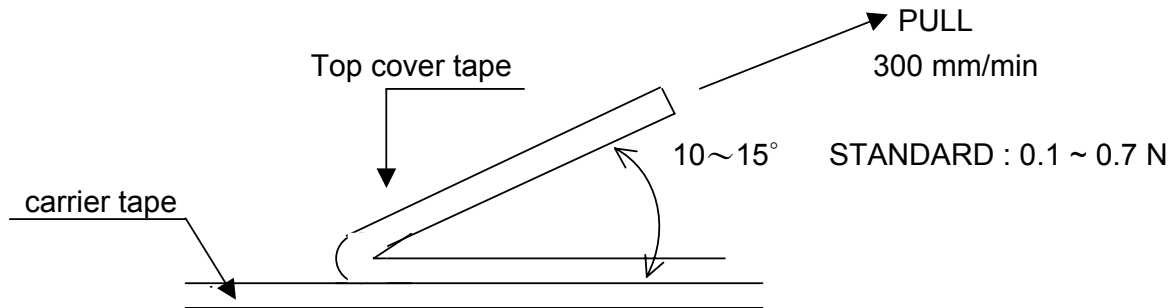


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Series	ϕA	ϕB	ϕC	W	T
CFS04V	180 ⁺⁰ ₋₃	60 min	13.0±1.0	9.0±1.0	11.4±2.0

9.3 Peel –off force :



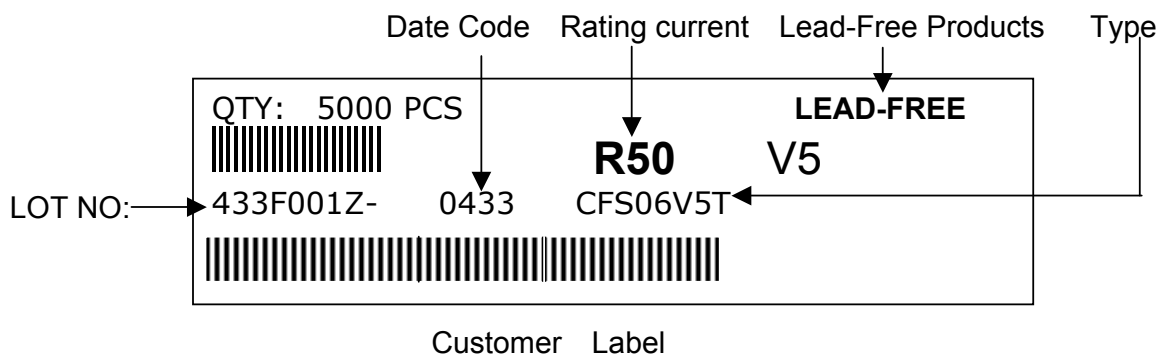
10. Storage Conditions:

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

11. Shelf Life:

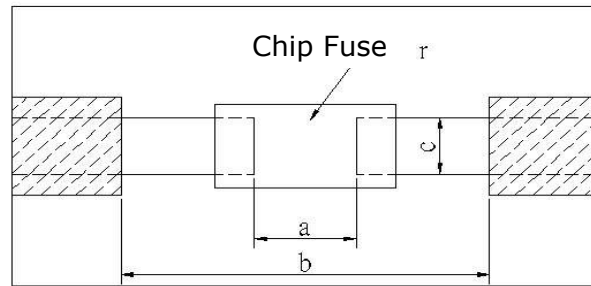
2 years from manufacturing date

12. Label



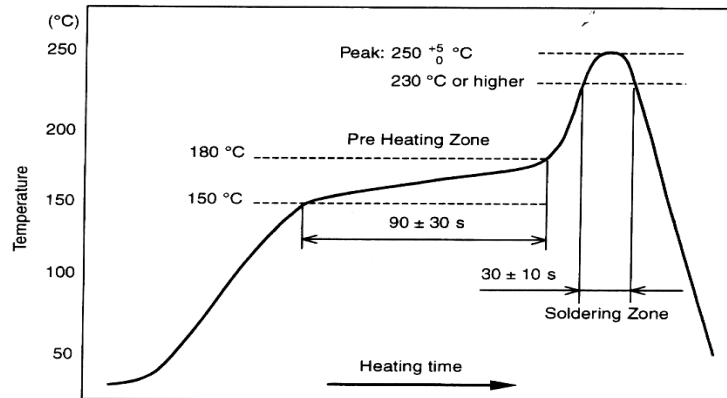


13. Recommended land patterns



Land pattern		Dimension		
Type	Size	a	b	c
CFS	04 (0402)	0.5~0.6	1.4~1.6	0.4~0.6

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



Peak : 250^{+5}_{-0} °C , 5 sec

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

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



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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.

17. Manufacturing Country & City :

TA-I TECHNOLOGY CO., LTD. (Taiwan – Tao Yuan)
Tel: 886-3-3246169 Fax : 886-3-3247410

Associated companies :

- (1) FORTUNE TASK RESISTOR FACTORY (China – Dong Guan)
Tel : 86-769-83394790 Fax : 86-769-83394794
- (2) TA-I TECHNOLOGY (SU ZHOU) CO., LTD. (China – Su Zhou)
Tel :86- 512-63457879 Fax : 86-512-63457869
- (3) TAI OHM ELECTRONICS (M) SDN. BHD. (Malaysia – Pulaupinang)
Tel :604- 3900480 Fax : 604-3901481
- (4) P.T.TAI ELECTRONICS Indonesia (Indonesia – Jakarta)
Tel :002-62-21-44820254 Fax : 002-62-21-44820256

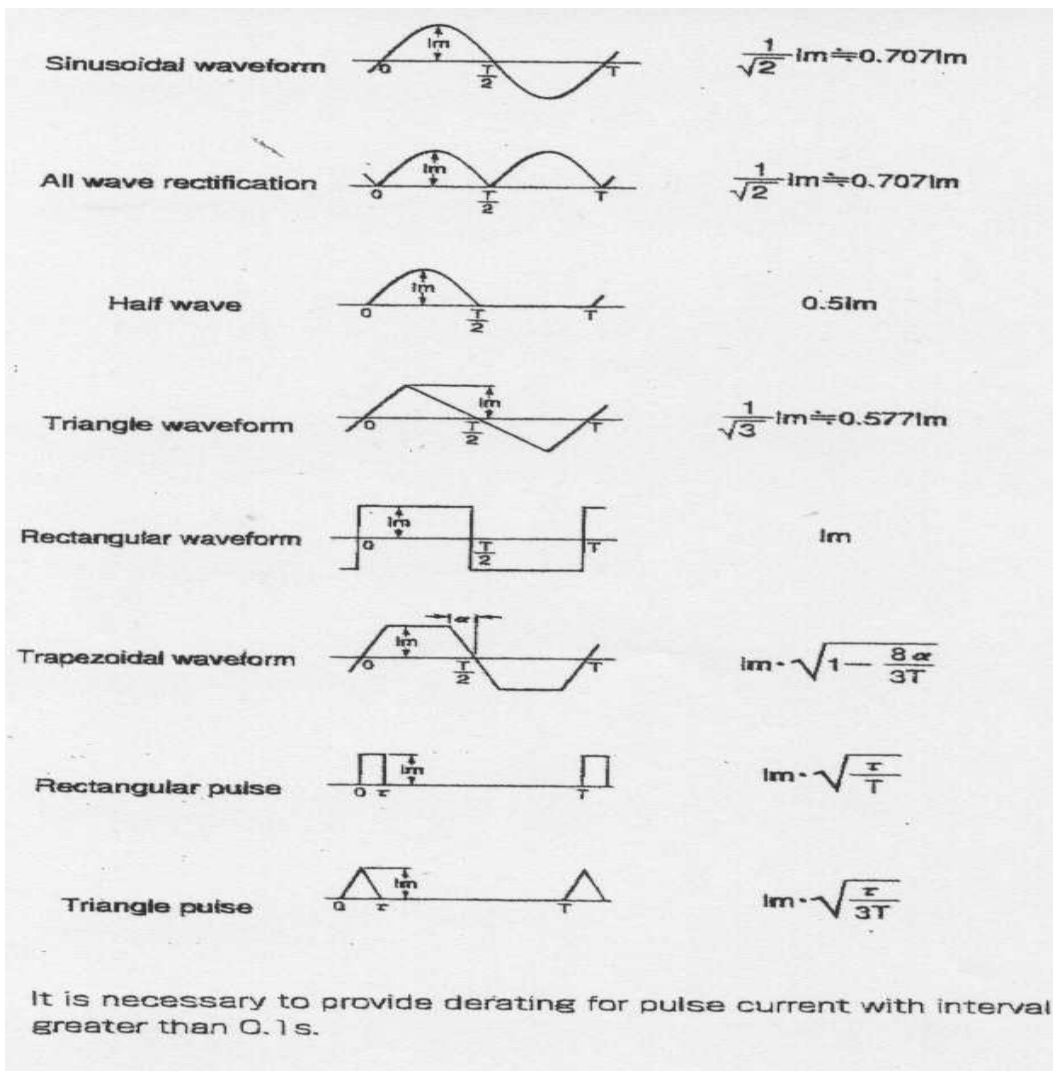
★ Selection Guideline of Fuse:

■ 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



Derating ratio for different ambient Temperature

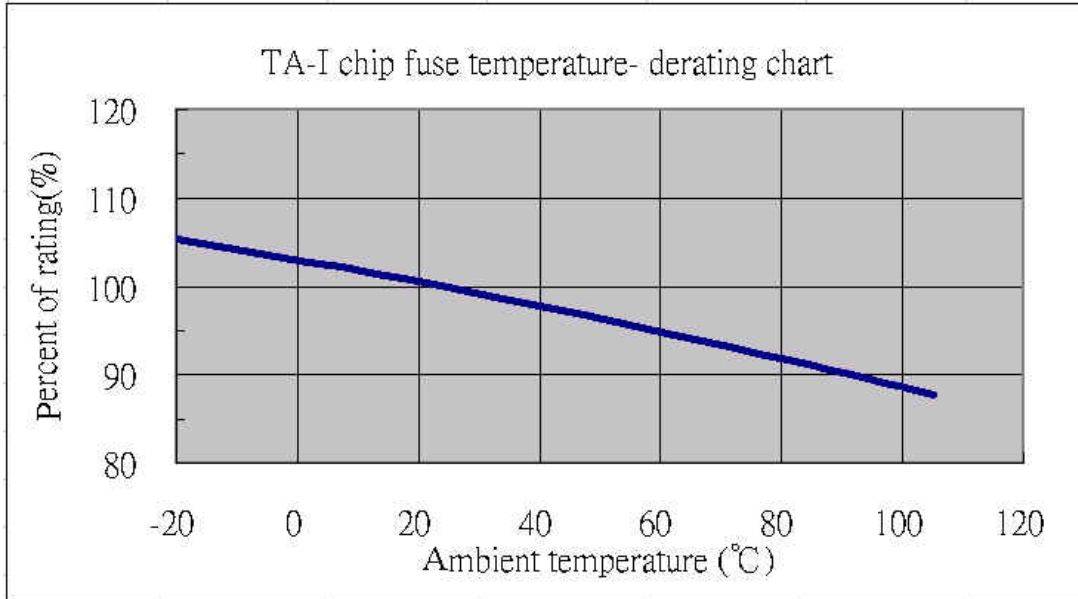
⊙ Referring to bottom figure and select the appropriate derating ratio :

e.g., Ambient temperature is 60 degree C

the derating ratio \approx 0.95



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■ 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 ≈ 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 :



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Suggesting use CFS06V3T2R50 .

Part Designation	Marking	Rated Current	Rated Voltage
CFS04V2TR50	F	0.5A	24V
CFS04V2TR80	K	0.80A	24V
CFS04V2T1R0	L	1.00A	24V
CFS04V2T1R25	<u>M</u>	1.25A	24V
CFS04V2T1R50	P	1.50A	24V
CFS04V2T1R60	N	1.60A	24V
CFS04V2T2R0	S	2.00A	24V
CFS04V2T2R50	T	2.50A	24V
CFS04V2T3R0	3	3.00A	24V
CFS04V2T3R15	U	3.15A	24V
CFS04V2T4R0	W	4.00A	24V

■ 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
- ◆ Confrim with us

e.g., choosing 0603 Fuse

Condition :

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

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

2. Choosing CFS06V3T2R5 ($I^2t = 0.200 (A^2s)$) \Rightarrow Page 12 index-table

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

Calculating :

\curvearrowright Inrush 100,000 times

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

2. $0.200 \times 0.35 = 0.070 (A^2s)$

4. $0.070 > 0.016$



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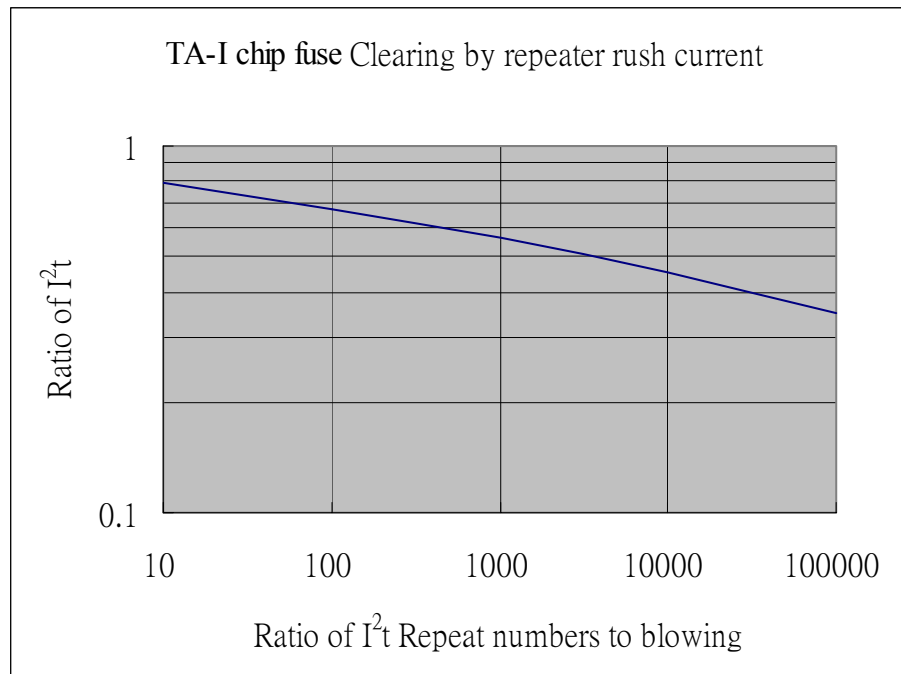
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The fuse is able to meet circuit 's application

TA-I FUSE I^2t (A ² s)	
Part Number	Typical I^2t (A ² s)
CFS04V2TR50	0.00370
CFS04V2TR80	0.00947
CFS04V2T1R0	0.01479
CFS04V2T1R25	0.02310
CFS04V2T1R50	0.02400
CFS04V2T1R60	0.03734
CFS04V2T2R0	0.04040
CFS04V2T2R50	0.06760
CFS04V2T3R0	0.09860
CFS04V2T3R15	0.10868
CFS04V2T4R0	0.11450

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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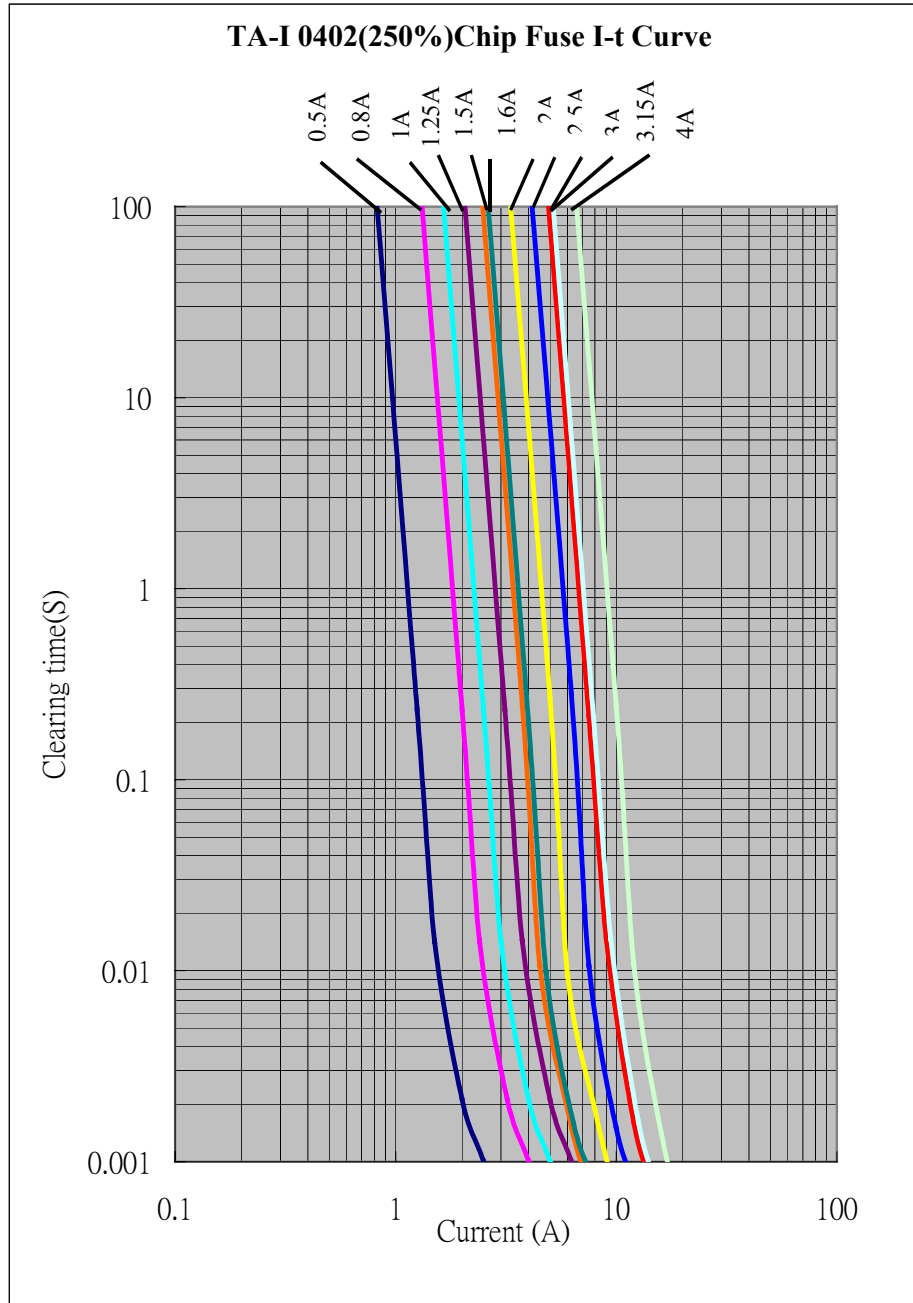
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Sinusoidal waveform (1 cycle)		$\frac{1}{2} I_m^2 t$
Sinusoidal waveform (1/2 cycle)		$\frac{1}{2} I_m^2 t$
Triangle waveform		$\frac{1}{3} I_m^2 t$
Rectangular waveform		$I_m^2 t$
Trapezoidal waveform		$\frac{1}{3} I_m^2 t_1 + I_m^2 (t_2 - t_1) + \frac{1}{3} I_m^2 (t_3 - t_2)$
Various waveform 1		$I_1 I_2 t + \frac{1}{3} (I_1 - I_2)^2 t$
Various waveform 2		$\frac{1}{3} I_1^2 t_1 + (I_1 I_2 + \frac{1}{3} (I_1 - I_2)^2) (t_2 - t_1) + \frac{1}{3} I_2^2 (t_3 - t_2)$
Charge/Discharge waveform		$\frac{1}{2} I_m^2 \tau$
Lightning surge waveform		$I_m^2 \{t_1/3 + 0.721 (t_2 - t_1)\}$



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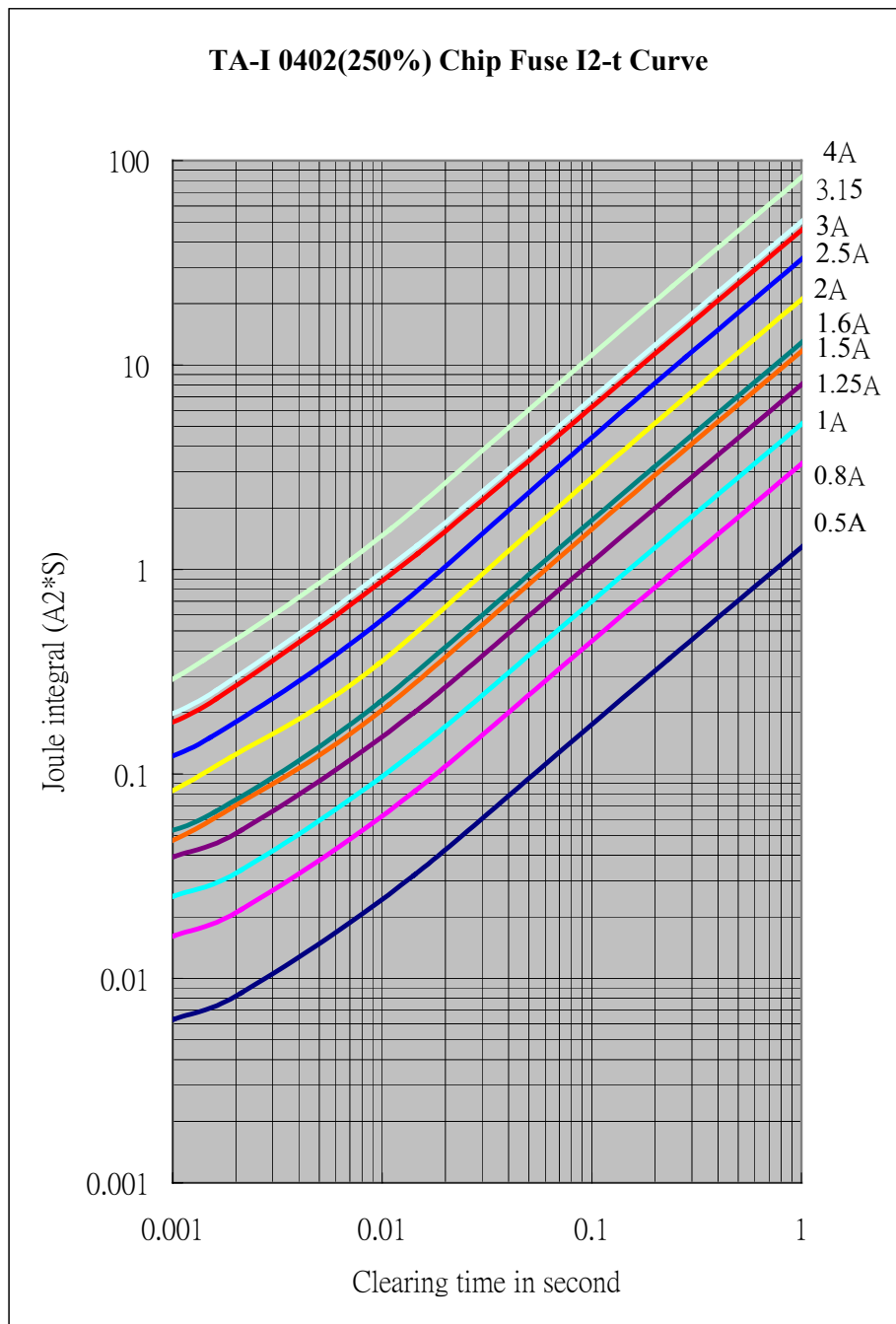
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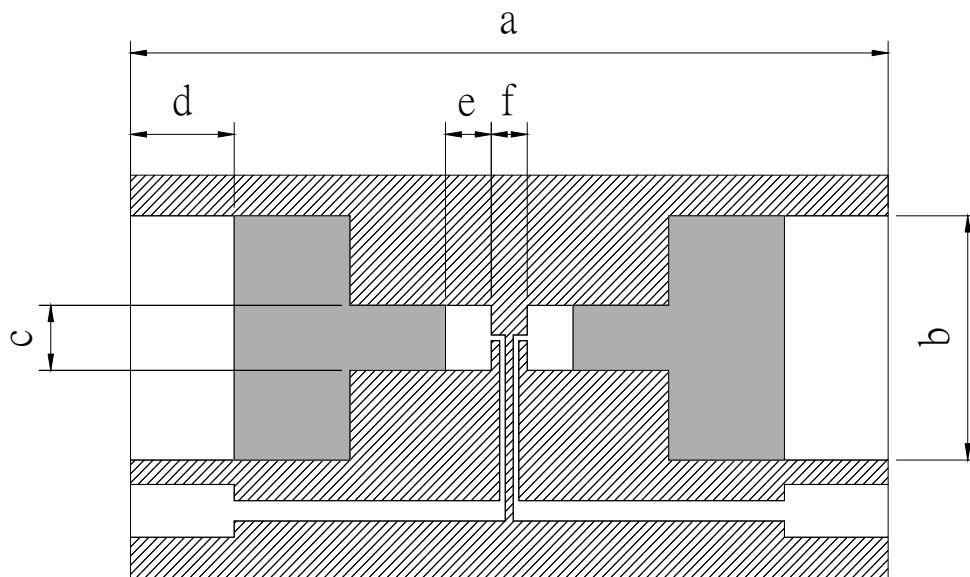




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Test Circuit Board



Type	a	b	c	d	e	f
CFS0402	19	6	0.84	2.6	0.61	0.6

Unit:mm