



Lead Free Thin Film Chip Fuse

Document No TCF-06OS030D

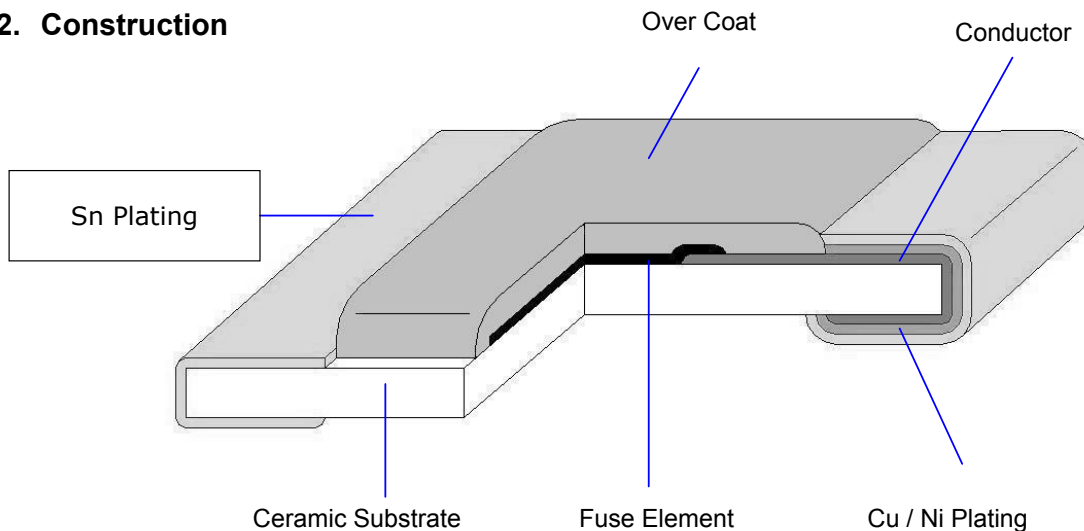
Issued date 2007/7/25

Page 1/15

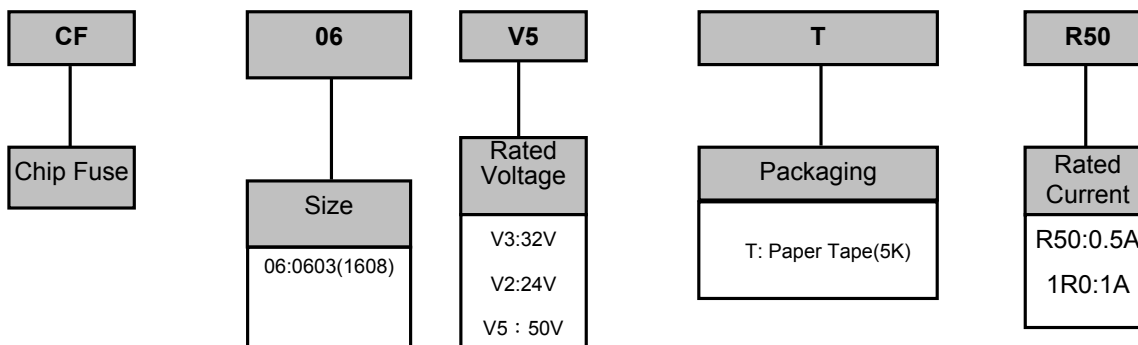
1. Scope

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

2. Construction



3. Type Designation





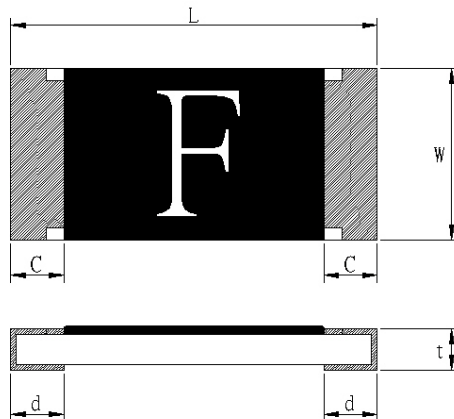
Lead Free Thin Film Chip Fuse

Document No TCF-06OS030D

Issued date 2007/7/25

Page 2/15

4. Dimensions



Unit: mm

Type (Inch Size code)	Dimensions (mm)				
	L	W	C	d	t
CF06V (0603)	1.6±0.1	0.8±0.1	0.3±0.2	0.35±0.2	0.45±0.1

5. Applications and ratings

Part Designation	Marking	Rated Current	Fusing Time	Resistance (mΩ) Typ.*	Rated Voltage	Breaking Capacity	Body Temperature rising
CF06V5TR50	F	0.50A	Open within 1min.at 200% rated current	250	DC 50V	DC50V 50A	<75°C 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 value was measured with less than 10% of rated current



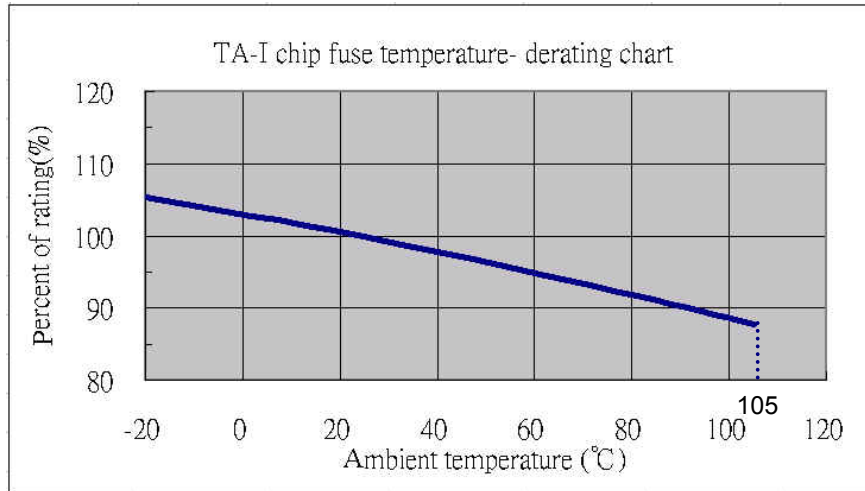
Lead Free Thin Film Chip Fuse

Document No	TCF-06OS030D
Issued date	2007/7/25
Page	3/15

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 1 minute	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, 10seconds ±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 %	-20°C / +25°C / +125°C / +25°C, 10 cycles



Lead Free Thin Film Chip Fuse

Document No	TCF-06OS030D
Issued date	2007/7/25
Page	4/15

8. Marking

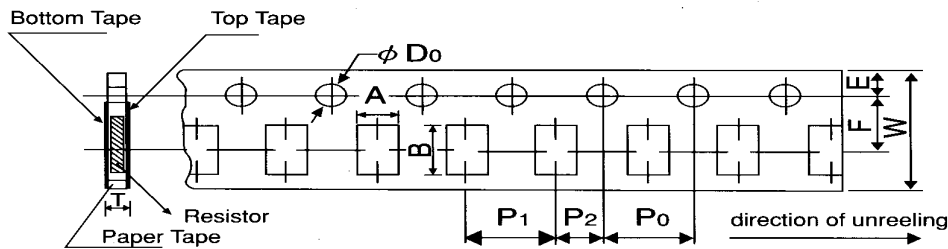
Symbol for Rating Current

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

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	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	φ 1.5 ^{+0.1} ₋₀	0.64±0.1

Unit: mm

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



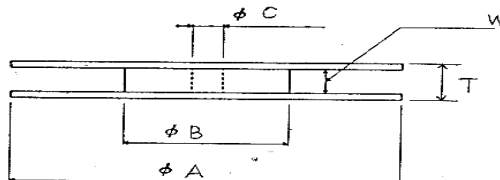
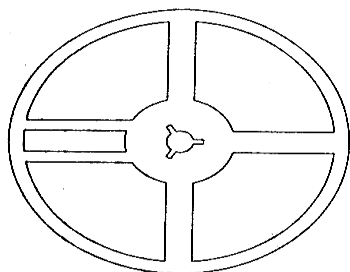
Lead Free Thin Film Chip Fuse

Document No TCF-06OS030D

Issued date 2007/7/25

Page 5/15

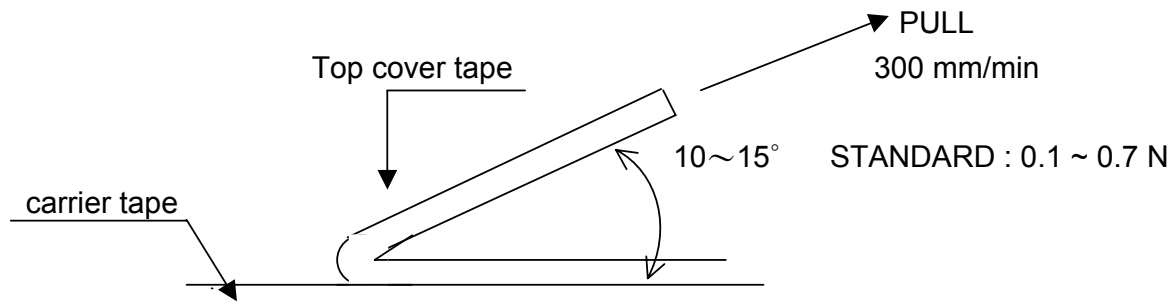
9.2 Reel Specifications



Unit: mm

Series	φ A	φ B	φ C	W	T
CF06V	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:

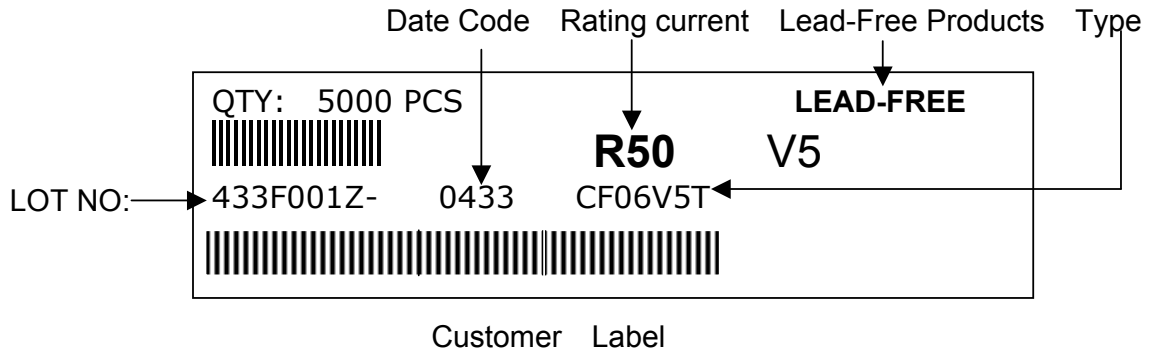
2 years from manufacturing date



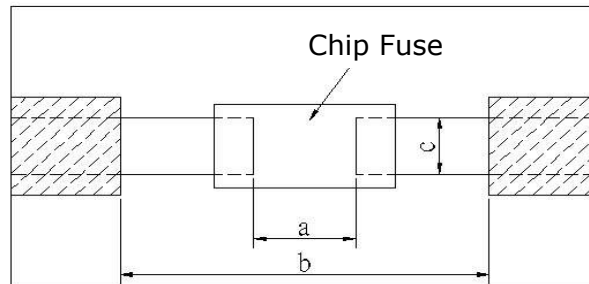
Lead Free Thin Film Chip Fuse

Document No	TCF-06OS030D
Issued date	2007/7/25
Page	6/15

12. Label



13. Recommended land patterns

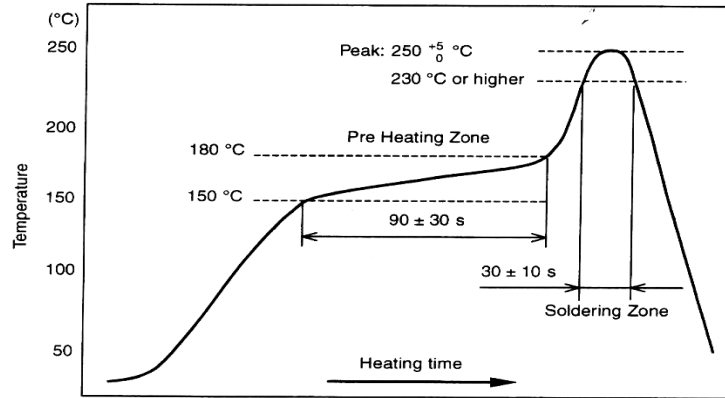


Land pattern		Dimension		
Type	Size	a	b	c
CF	06 (0603)	0.7~0.9	2.0~2.2	0.8~1.0



Document No	TCF-06OS030D
Issued date	2007/7/25
Page	7/15

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



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

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



Document No	TCF-06OS030D
Issued date	2007/7/25
Page	8/15

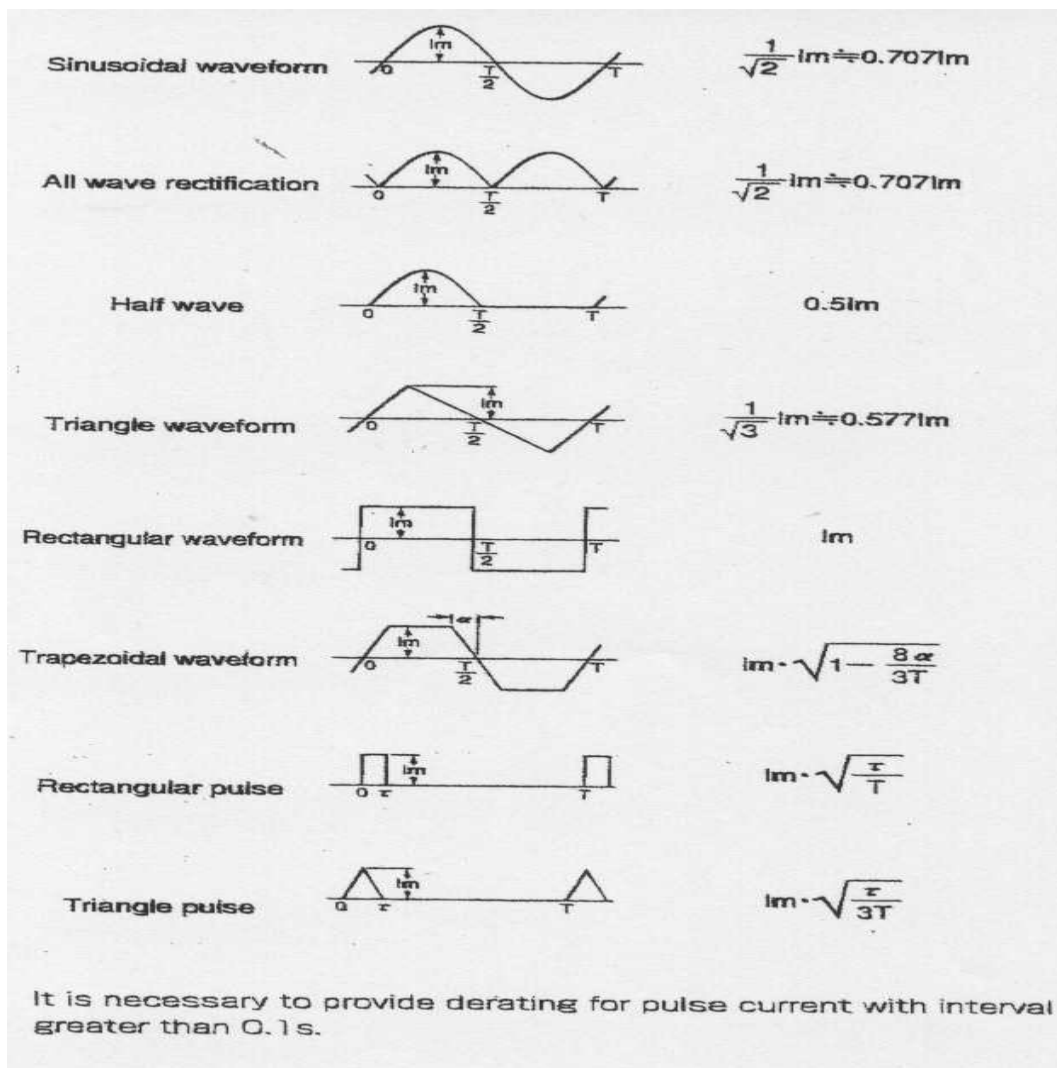
★ Selection Guideline of Fuse:

■ 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 $I_p = 1.5 A$, Normal operating current = 1.5 A





Lead Free Thin Film Chip Fuse

Document No TCF-06OS030D

Issued date 2007/7/25

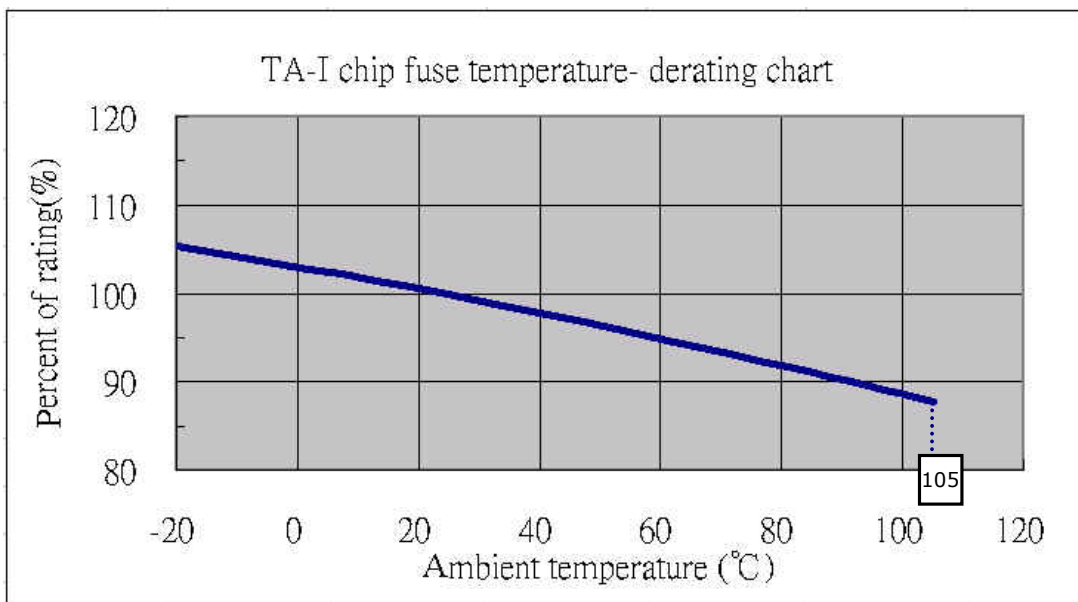
Page 9/15

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

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

\swarrow Safety coefficient \searrow 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



Lead Free Thin Film Chip Fuse

Document No	TCF-06OS030D
Issued date	2007/7/25
Page	10/15

■ 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
CF06V5TR50	F	0.5A	50V
CF06V3TR63	I	0.63A	32V
CF06V3TR80	K	0.80A	32V
CF06V3T1R0	L	1.00A	32V
CF06V3T1R25	M	1.25A	32V
CF06V3T1R50	P	1.50A	32V
CF06V3T1R60	N	1.60A	32V
CF06V3T2R0	S	2.00A	32V
CF06V2T2R50	T	2.50A	24V
CF06V2T3R00	3	3.00A	24V
CF06V2T3R15	U	3.15A	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 , $I_p = 4 \text{ A}$, $t = 1 \text{ (ms)}$,
Calculate $I_p^2t = 4^2 \times 1 \times 10^{-3} \text{ (A)} = 0.016 \text{ (A}^2\text{s)}$
2. Choosing CF06V2T2R5 ($I^2t = 0.055 \text{ (A}^2\text{s)}$) \Rightarrow Page 12 index-table
3. Inrush shock : 100,000 times (≈ 0.35) \Rightarrow Inrush derating ratio

Calculating :

\Rightarrow 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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Lead Free Thin Film Chip Fuse

Document No TCF-06OS030D

Issued date 2007/7/25

Page 11/15

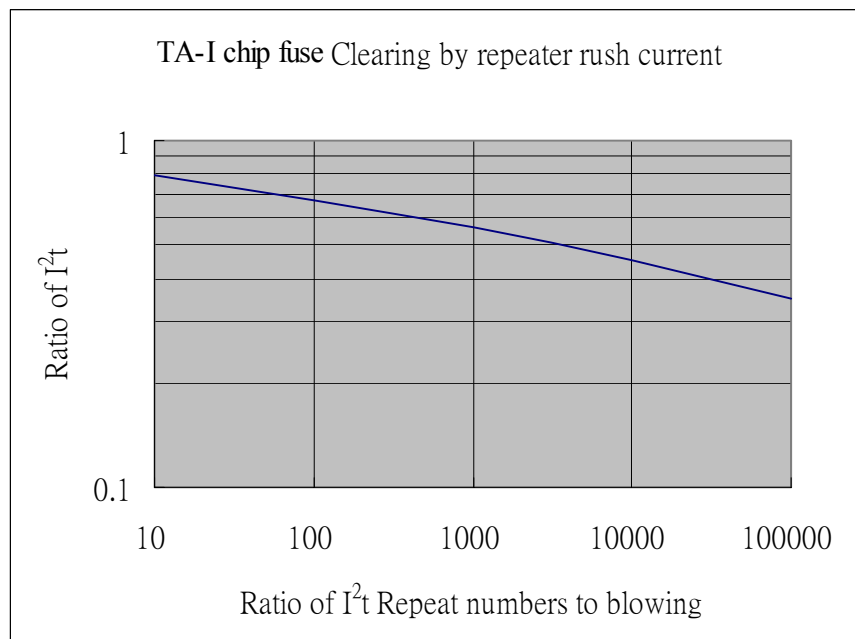
4. $0.01925 > 0.016$

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)
CF06V5TR50	0.005
CF06V3TR63	0.007
CF06V3TR80	0.014
CF06V3T1R0	0.016
CF06V3T1R25	0.027
CF06V3T1R50	0.037
CF06V3T1R60	0.041
CF06V3T2R0	0.044
CF06V2T2R50	0.055
CF06V2T3R00	0.082
CF06V2T3R15	0.089
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.





Inrush Waveform

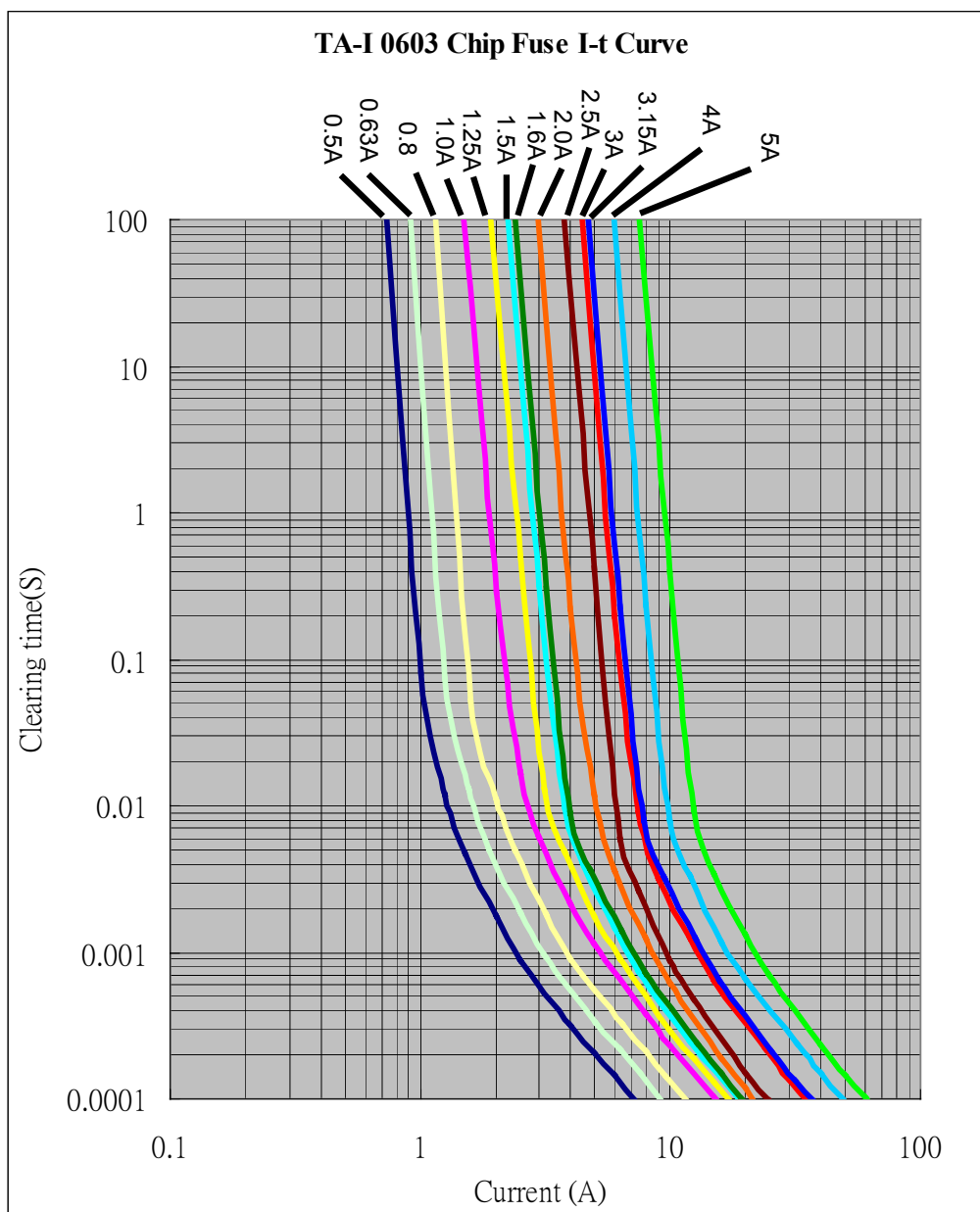
Sinusoidal waveform (1cycle)		$\frac{1}{2} Im^2 t$
Sinusoidal waveform (1/2cycle)		$\frac{1}{2} Im^2 t$
Triangle waveform		$\frac{1}{3} Im^2 t$
Rectangular waveform		$Im^2 t$
Trapezoidal waveform		$\frac{1}{3} Im^2 t_1 + Im^2 (t_2 - t_1) + \frac{1}{3} Im^2 (t_2 - t_2)$
Various waveform 1		$h_1 h_2 t + \frac{1}{3} (h_1 - h_2)^2 t$
Various waveform 2		$\frac{1}{3} h_1^2 t_1 + \{h_1 h_2 + \frac{1}{3} (h_1 - h_2)^2\} (t_2 - t_1) + \frac{1}{3} h_2^2 (t_2 - t_2)$
Charge/Discharge waveform		$\frac{1}{2} Im^2 \tau$
Lightning surge waveform		$Im^2 \{t_1/3 + 0.721(t_2 - t_1)\}$

t_1 : duration of wave front
 t_2 : duration of wave tail



Lead Free Thin Film Chip Fuse

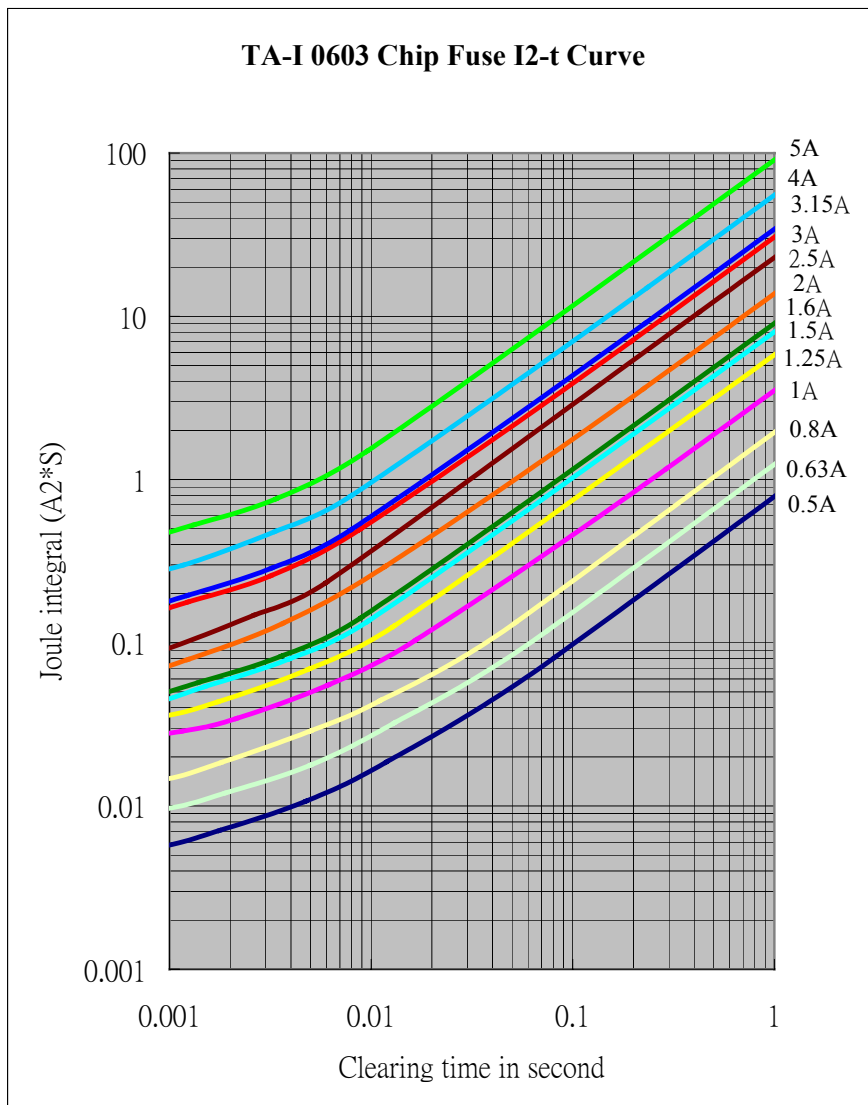
Document No	TCF-06OS030D
Issued date	2007/7/25
Page	13/15





Lead Free Thin Film Chip Fuse

Document No	TCF-06OS030D
Issued date	2007/7/25
Page	14/15





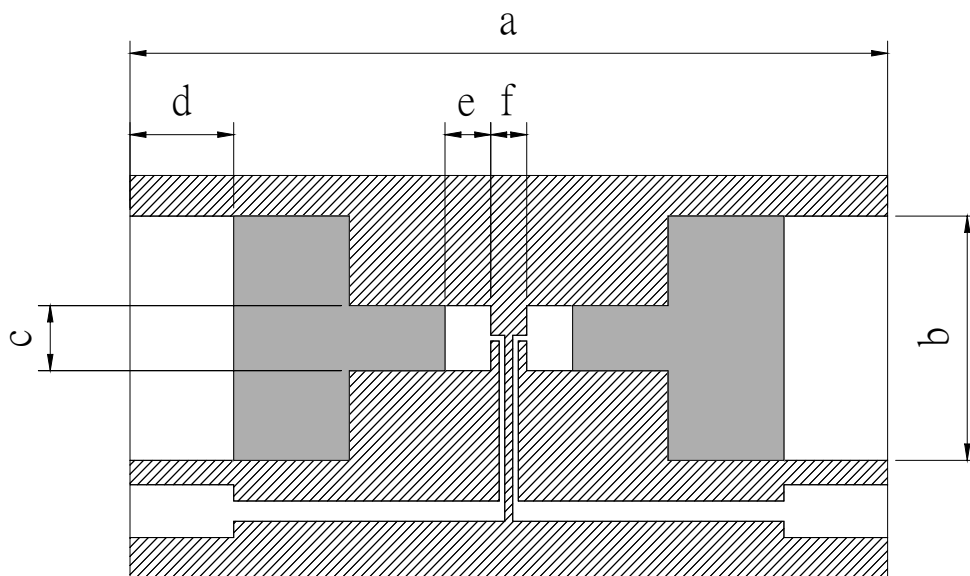
Lead Free Thin Film Chip Fuse

Document No TCF-06OS030D

Issued date 2007/7/25

Page 15/15

Tset Circuit Borad



Type	a	b	c	d	e	f
CF0603	19	6	1.6	2.6	1.15	0.9

Unit:mm