



Engineering Product Specification

TCP™ Telecom Circuit Protector

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Rev. #	Revision Description	Date	Author	Appr
L	Redraw the Maximum Offset of Tube to make it legible. Correct the minimum tube size from .103"SQ to .101"SQ. Add comment to indicate the cap and tube SQ sizes are minimum dimensions. Update UL card to indicate 2A. Remove the ink color from the alpha mark spec. Add the alpha mark designations for the China and Costa Rica facilities. Update mfg info.	2/21/01	VK	DB
K	Rename TCP1.251A product to TCP2A. No change in electrical characteristics. Add China facility.	8/23/00	VK	DB
J	Add 1.251A version. Add ISO registration information. Change alpha code: 500mA from A to F and 1.25A from B to J.	6/8/00	DR	EC
I	Detail marking specification in section 7.	4/28/00	DR	EC
H	Add maximum total clearing I ² t in section 5.5.	1/19/00	DR	EC
G	Added nickel flash. Added cold resistance for TCP-500mA (min 0.541, typ 0.614, max. 0.686) Added typ. Melt I ² t (500mA=1.3a ² sec, 1.25A=22.2 a ² sec). Added typ. Voltage drop on 500mA(471mV), changed voltage drop of 1.25A to 205mV. Added TCC for both ratings. Changed max. temp from 85°C to 125°C. Added max. tube offset drawing.	10/99	CR	EC
F	5.2.1 Changed .500mA 600v int. rating to 40A; 5.4 Added DC cold resistance for TCP1.25 min-0.107, type -0.128, max. -0.150; 5.6 Added 0.205 typ voltage drop to TCP 1.25A; 6.1 Added UL Recognition card; 6.2 Added CSA component acceptance card; 12 Removed copper from wire, plate end plates and mark in flow chart.	9/99	CR	EC
E	Changed area code, removed Nickel flash on post plating, removed marking of fuse	6/99	CR	EC
D	Changed Interrupting Rating to 60A, changed Time vs. Current requirement for 1.25A, & removed specification data results.	4/99	DG	EC
C	Added new logo and disclaimer	1/99	DG	EC
B	Final for prerelease	3/98	EC	EC
A	Original	2/18	EC	EC

Title: Engineering Product Specification Telecom Circuit Protector	Revision: L
Printed on: 7/14/2003	Sheet 2 of 18

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1.SCOPE

1.1 This Specification applies to Bussmann TCP series protectors.

2. MANUFACTURER AND PRODUCTION FACILITY

2.1 Manufacturer Cooper Electronic Technologies
3601 Quantum Boulevard
Boynton Beach, FL 33426
Phone: (561) 752-5000
Fax: (561) 742-0134

2.2 Production Facility	1) Bussmann 114 Old State Road Ellisville, MO 63021 (USA)	2) NO. 59-12, 9 Lin Ta Tsuo Li, Chu Nan Chen Mia LiHsien, Taiwan, R.O.C
	3) Xin Min Industrial Estate Changan DongGuan Guangdong Province China	4) 1K M Al Este Del Aeropuerto Juan Santamarita, Zona Franca Saret, Edificio B-05 Rio Segundo Alajuela, Costa Rica

2.3 ISO Registration	1) ISO 9002, File Number A4916	2) ISO 9001, File Number A6444
	3) ISO 9002, Certificate No. Q2273	4) ISO 9002, File Number A7346

3. CATALOG SYMBOL AND PART NUMBERING SYSTEM

3.1 Catalog Symbol

3.1.1 Example TR1/TCP500mA

<u>TR1/</u>	<u>TCP</u>	<u>500mA</u>
↓	↓	↓
1	2	3

1. Packaging Code:	TR1/
2. Series Number:	TCP
3. Ampere Rating:	500mA

3.2 Part Numbering System

3.2.1 Packaging Code

Packaging Code	Description
SP1/	10 Fuses in Tape in a Plastic Bag (Engineering Samples)
SP2/	50 Fuses in Tape with a Leader and Trailer in a Plastic Box (Engineering Samples)
TR1/	1000 Fuses in Tape and Reel (13 inch [330 mm] reel)
TR2/	2500 Fuses in Tape and Reel (13 inch [330 mm] reel)

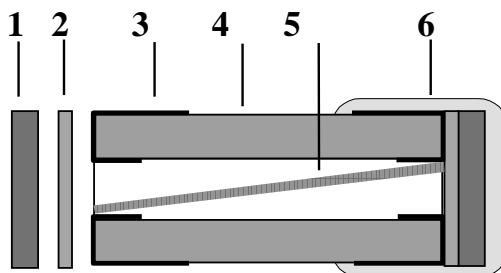
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3.2.2 Ampere Rating

Catalog Symbol	Description
TCP500mA	500mA Fuse
TCP1.25A	1.25A Fuse
TCP2A	2A Fuse

4. MECHANICAL SPECIFICATIONS

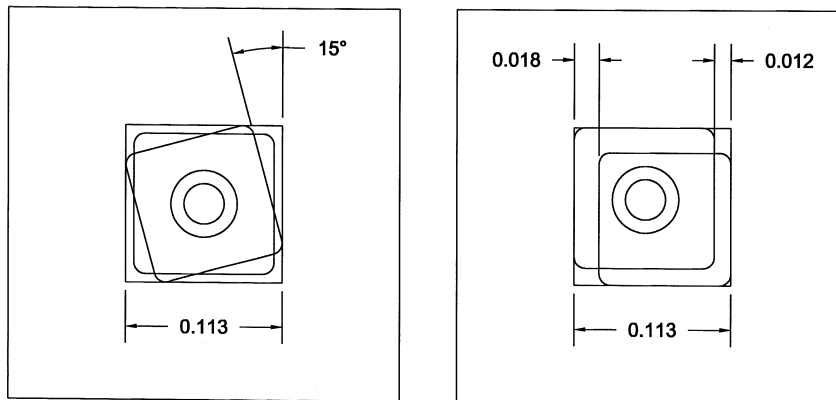
4.1 Construction (drawing not to scale)



- 1. End plate
- 2. High temperature solder preform
- 3. Metallization of ceramic body
- 4. Ceramic body
- 5. Fuse element
- 6. End termination overcoat on both ends (Nickel Flash, Tin/Lead Overcoat)

4.1.2 Maximum Offset of Tube

MINIMUM MATERIAL CONDITIONS
 FIXTURE OPENING .112±.001

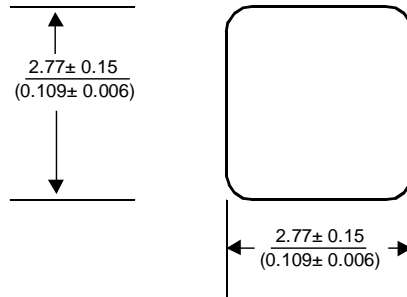


CAP SIZE IS .095"SQ. MINIMUM
 TUBE SIZE IS .101"SQ. MINIMUM

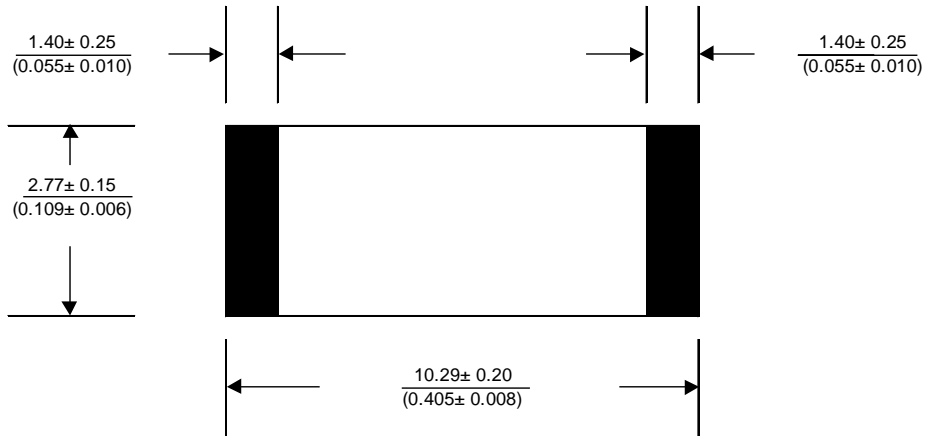
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4.2 Dimensions (drawings not to scale)

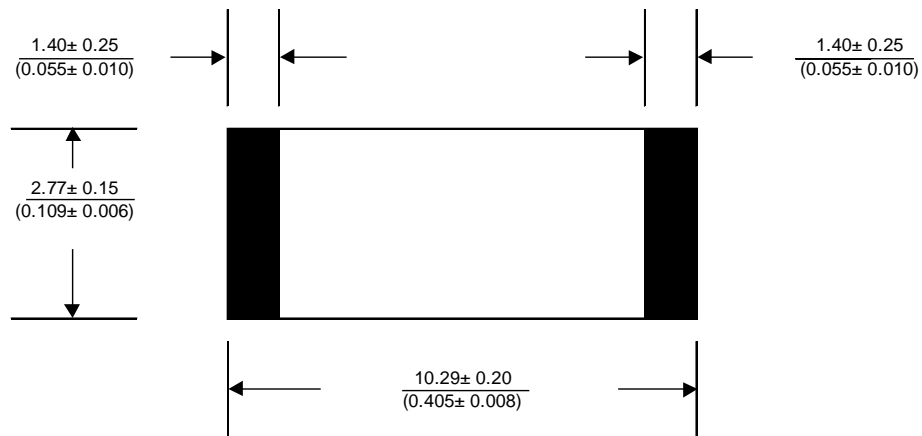
4.2.1 End View mm
(inches)



4.2.2 Top View mm
(inches)

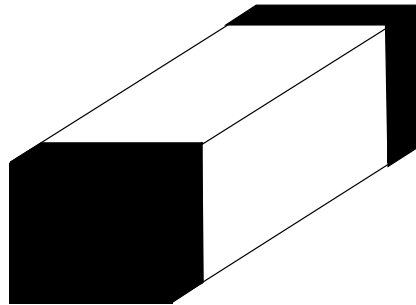


4.2.3 Side View mm
(inches)



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4.2.4 Orthogonal View



5. ELECTRICAL SPECIFICATIONS

5.1 Voltage Rating

Catalog Symbol	Voltage Rating	
	AC	
TCP500mA	250 V	
TCP1.25A	250 V	
TCP2A	250 V	

5.2 Interrupting Rating

5.2.1 AC Interrupting Rating (Measured at designated voltage, 100% power factor)

Catalog Symbol	Interrupting Rating	
	AC	
	250 V	600 V*
TCP500mA	50 A	40A
TCP1.25A	50 A	60 A
TCP2A	50 A	60 A

*600V, 60A Interrupting ratings test were performed by closing the circuit between 50° and 70° on the voltage wave.

5.3 Time vs. Current Characteristic (Measured with a Kepco constant current power supply)

5.3.1 For TCP500mA and TCP1.25A

% of Amp Rating	Opening Time
100%	4 Hours Minimum
250%	1 Second Minimum
250%	4 -10 Seconds Typical
250%	120 Seconds Maximum
300%*	10 Seconds Maximum

*If the device does not open at 250% within 120 seconds, increase current to 300% of amp rating. Device must open in 10 seconds maximum.

5.3.2 For TCP2A

Current Level	Opening Time
2.2A**	30 minutes minimum
7A	opens before Bussmann MDL-2
25A	opens before Bussmann MDL-2
40A	opens before Bussmann MDL-2

% of Amp Rating	Opening Time
100%	4 Hours Minimum
250%	1 Second Minimum
250%	4 -10 Seconds Typical
250%	120 Seconds Maximum
300%*	10 Seconds Maximum

*If the device does not open at 250% within 120 seconds, increase current to 300% of amp rating. Device must open in 10 seconds maximum.

** The TCP2A may have a maximum temperature rise of 100°C after carrying 2.2A for thirty minutes.

5.4 DC Cold Resistance (Measured at 10% of rated current)

Catalog Symbol	Resistance (ohms)		
	Min.	Typ.	Max.
TCP500mA	0.420	0.530	0.640
TCP1.25A	0.107	0.128	0.150
TCP2A	0.050	0.075	0.100

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5.5 I²t

5.5.1 Typical Melt I²t is measured with a battery bank at 60V DC, 10x-rated current, time constant of calibrated circuit less than 50 microseconds.

5.5.2 Maximum Total Clearing is measured on a 40A, 600V AC, unity power factor circuit.

Catalog Symbol	Typical Melt I ² t	Maximum Total Clearing I ² t
TCP500mA	1.3 A ² s	100 A ² s
TCP1.25A	22.2 A ² s	100 A ² s
TCP2A	30 A ² s	100 A ² s

5.6 Typical Voltage Drop (Measured at rated current after temperature stabilizes)

Catalog Symbol	Typical Voltage Drop
TCP500mA	471mV
TCP1.25A	205mV
TCP2A	205mV

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5.7 Surge Specifications

a) TCP 500mA tested to surge requirements listed below

Surge Specification	Surge	Repetitions	Waveform (μSec.)	Current (A)	Voltage (V)	Performance Requirement
FCC 47 Part 68	Longitudinal Type B	2	5x320	37.5	N/A	Fuse cannot open
FCC 47 Part 68	Metallic Type A	2	10x560	100	800	Fuse must open safely
Surge Out		25	10x160	65	N/A	Fuse cannot open

b) TCP1.25A and TCP2A tested to surge specifications listed below

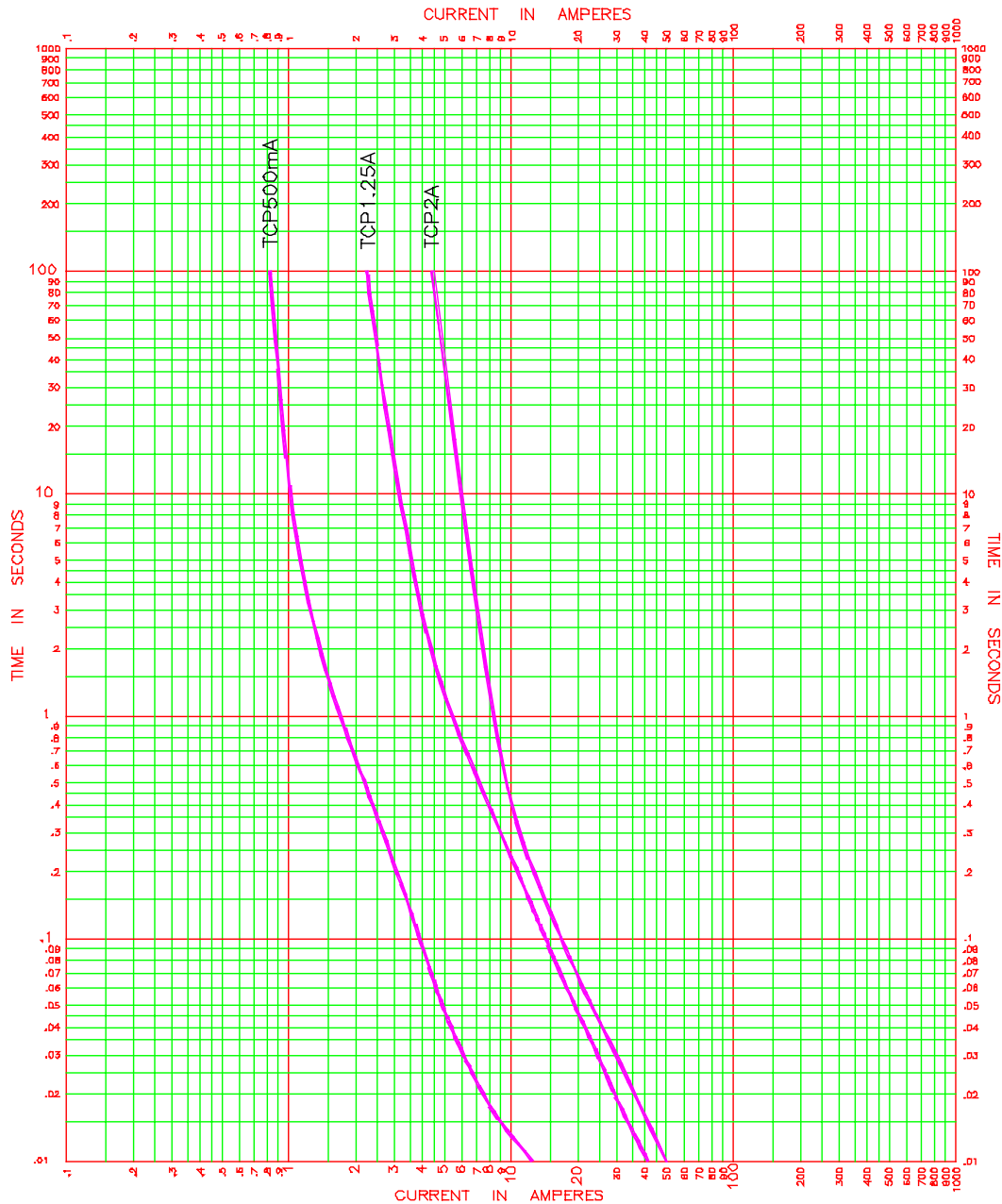
Surge Specification	Surge	Repetitions	Waveform (μSec.)	Current (A)	Voltage (V)	Performance Requirements
FCC 47 Part 68	Longitudinal Type A	2	10x160	100 per fuse	1500	Fuse cannot open
FCC 47 Part 68	Metallic Type B	2	10x560	100	800	Fuse cannot open
Bellcore GR-1089-CORE	First Level Lighting	50	10x1000	100	1000	Fuse cannot open
Bellcore GR-1089-CORE	First Level Lighting	50	2x10	500	2500	Fuse cannot open
Surge Out		1	10x160	160	N/A	Fuse cannot open
Surge Out		1	10x560	115	N/A	Fuse cannot open

5.8 Maximum Temperature Rise (Measured at rated current after temperature stabilizes)

Catalog Symbol	Maximum Temperature Rise
TCP500mA	≤ 75 °C (135°F)
TCP1.25A	≤ 75 °C (135°F)
TCP2A	≤ 75 °C (135°F)

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5.9 Time Current Curve:




AVERAGE MELTING TIME-CURRENT CHARACTERISTIC CURVE

For BUSS TCP

BASIS FOR DATA Standards _____ Dated _____

1. Tests made at CONSTANT CURRENT POWER SUPPLY

2. Curves are plotted to _____ Test points so variations should be _____



St. Louis, MO 63178

38348

No. 50991 Rev. ---

Date 6-8-00

ECN No. E99112 (12-9-99)

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6. STANDARDS and APPROVALS

6.1 UL Recognition Card (JDYX2 / E19180)

Underwriters Laboratories Inc.

Cat. No. SFT, 0-5A, 125 ac/dc; Cat. No. SFT, 5.1-10A, 60 V ac/90 V dc; Cat. No. SFT, 12.5A, 48 V ac.
Cat. No. 3216FF, 1/4-3A, 32 V ac, 63 V dc; Cat. No. 3216FF, 4-7.5A V ac/dc; Cat. No. 3216LV, 0-1.5A, 125 V ac/dc; Cat. No. 3216-1J0289,
rated 0.2A, 125 V ac/dc; Cat. Nos. 1206CP, 1206FA, rated 0.25-3A, 32 V dc.
Cat. No. 1608FF, 250 ma-4A, 24 V dc.
Cat. No. 0603FA, 0.25-5A, 24 V dc.
Circuit protectors. Cat. No. 3216CP, 1/4-5A, 24 V dc, 4-5A, 32 V ac, 32 dc.
Cat. No. ETF, 0.080-6.3A, 250 V ac.
Micro. Cat. No. EFF, 0.05-6.3A, 250 V ac.
Cat. No. TEL, 350 MA, 600 V dc.
Telecom circuit protectors. Cat. No. TCP, rated 500 mA-1.25A, 250 V ac 600 V ac; Cat. No. TCP2A, rated 2A, 250V ac, 600V ac.
+These fuses may be provided with the suffix letter "B" after the catalog number and before the amp rating.
Marking: Company name or trademark "Buss", rating and catalog or type designation on smallest shipping container.

See General Information Preceding These Recognitions

For use only in equipment where the acceptability of the combination is determined by Underwriters Laboratories Inc.

579980001

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JDYX2/E19180
January 2, 2001

6.1.1 Marking The UL Recognition symbol appears on the label affixed to the packaging container.

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6.2 CSA Component Acceptance Card (500mA and 1.25A)
2A is approved, but the card has not been updated



Certification Record No: 053787 C 000

Class No: 1422 30

TCP	0.500mA - 1.25A 600V ac max	250% - 2 min	IR250-50A, 1.0pF IR600-40A, 1.0pF
KAA	0-30A, 130V ac	-	IR130-80kA

Notes:

1. NOT FOR BRANCH CIRCUIT WIRING OR PROTECTION. Must be evaluated in the end use application.
2. Short circuit ratings are or may be other than those found in Table 4 of CSA Std No 59.2.

Raj

DQD No. 548-Rev B

Page 3

6.2.1 Marking The CSA symbol appears on the label affixed to the packaging container

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7. MARKING SPECIFICATION

7.1 A two letter alpha code will be marked on the body of the fuse.

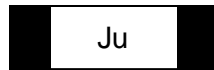
The first letter will indicate the ampere rating. The second letter will indicate the manufacturing facility.

7.1.1 Table of alpha code marking

Ampere Rating	1st position alpha code
TCP500mA	F
TCP1.25A	J
TCP2A	N

Manufacturing Facility Location	2nd position alpha code
USA	u
Taiwan	t
China	s
Costa Rica	c

7.1.2 Example of a TCP1.25A manufactured in the USA.



J = 1.25A

u = manufactured in USA

8. SOLDERING METHOD

8.1 Wave Immersion

8.1.1 Reservoir Temperature: 260° C (500°F)

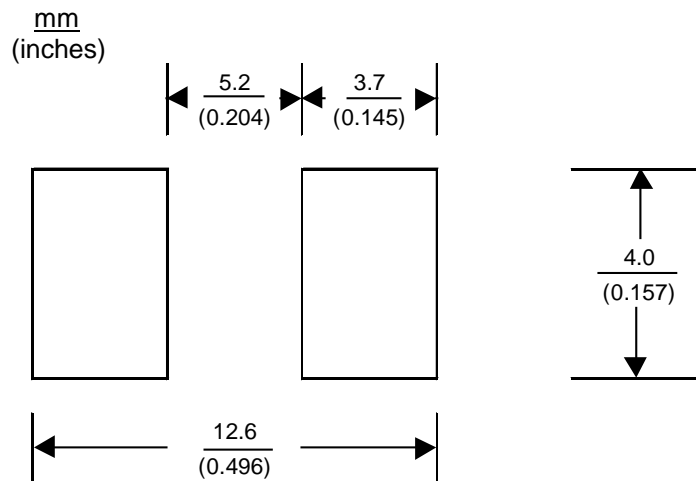
8.1.2 Time in Reservoir: 3 Seconds Maximum

8.2 Infrared

8.2.1 Temperature: 240° C (464 °F)

8.2.2 Time: 30 Seconds Maximum

9. LAND PATTERN

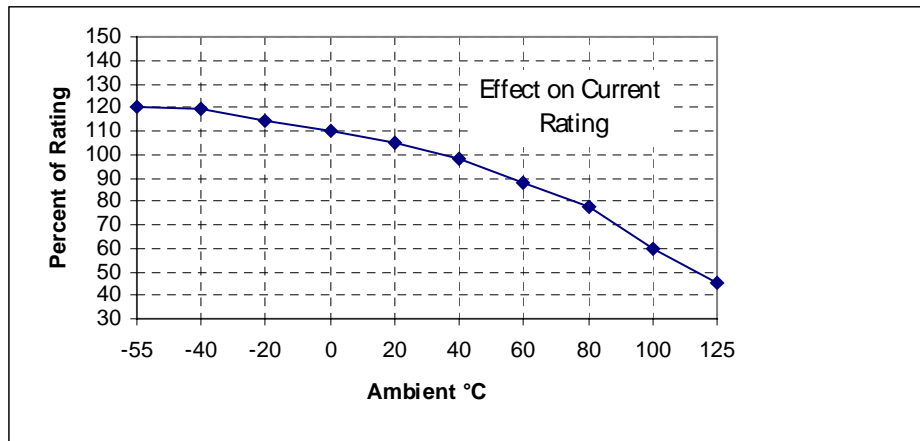


10. TEMPERATURE DERATING CURVE

10.1 Normal Operating Temperature: 25°C ± 2°C (77 °F ± 3.6 °F)

10.2 Maximum Operating Temperature: -55°C to 125°C with proper correction factor applied

10.2.2 Chart of correction factor for TCP500mA and TCP1.25A



10.2.3 Chart of correction factor for TCP2A to be created

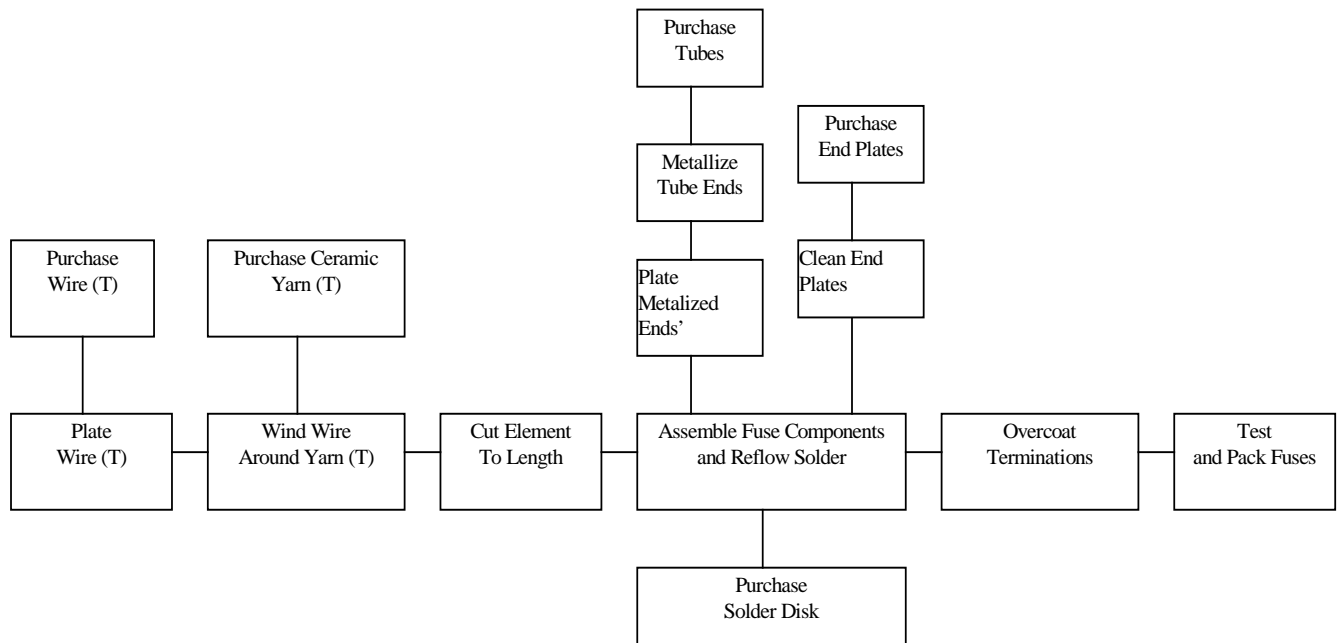
10.3 Storage Temperature: -55°C to 125°C (-67° F to 185°F)

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11. PACKAGING SPECIFICATION

- 11.1 SP1/: 10 pieces of fuses on 24mm tape, 8 mm pitch per EIA Standard 481, packaged in a plastic bag
- 11.2 SP2/: 50 pieces of fuses on 24mm tape, 8 mm pitch per EIA Standard 481, packaged in a plastic box
- 11.3 TR1/: 1000 pieces of fuses on 24mm tape and reeled on a 13 inch (330 mm) reel per EIA Standard 481, 8 mm pitch
- 11.4 TR2/: 2500 pieces of fuses on 24mm tape and reeled on a 13 inch (330 mm) reel per EIA Standard 481, 8 mm pitch

12. PROCESS FLOW CHART



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13. ENVIRONMENTAL (RELIABILITY / QUALIFICATION) DATA

13.1 Life Test:

MIL-STD-202, Method 108A, Test Condition D

13.2 Load Humidity Test:

MIL-STD-202, Method 103B except:

13.2.1 Environmental chamber 85%±2% relative humidity at 85°C±2°C

13.2.2 100% of rated DC current, at any voltage less than or equal to rated voltage for 1000 hours

13.2.3 At 168h, 504h, and completion of test, the power is turned off. Resistance readings are taken after temperature stabilization. Change in resistance from the original value is calculated and recorded. $\Delta R < 10\%$.

13.2.4 After 1000 hours is completed, samples are split into two equal lots.

13.2.5 One group is tested to the non-destructive 100% Current Carry Test. After current carry test is complete, half of the samples are subjected to the Maximum Current Carry Test with the remaining samples subjected to the Time Current Characteristic Curve Generation.

13.2.6 The other group is tested to the destructive Current Overload Test.

13.3 Moisture Resistance Test:

MIL-STD-202, Method 106E except:

13.3.1 Samples are placed in a temperature/moisture chamber and subjected to 50 cycles.

13.3.2 Temperature and humidity measurements are recorded at 0 cycles, 25 cycles, and 50 cycles.

13.3.3 At the completion of 50 cycles.

Samples are stabilized at 25°C±5°C for a minimum of 15 minutes and a maximum of 24 hours.

The change in resistance from the original value is calculated and recorded. $\Delta R < 10\%$,

13.3.4 One cycle is:

1) Start at 90-100% RH and 25°C±2°C

2) Ramp up to 65°C±2°C within 2 ½ hours

3) Remain at 65°C±2°C for 3 hours

4) Ramp down to 25°C±2°C within 2 ½ hours with 80-100% RH

5) Ramp back up to 65°C±2°C within 2 ½ hours with 90-100% RH

6) Remain at 65°C±2°C for 3 hours

7) Ramp down to 25°C±2°C within 2 ½ hours with 80-100% RH

8) Remain at 25°C±2°C for 8 hours with 90-100% RH

13.3.5 Samples are split into two equal lots

13.3.6 One set is tested to the non-destructive 100% Current Carry Test. After completion, the samples are subjected to the Time Current Characteristic Curve Generation.

13.3.7 The other set is subjected to the destructive Current Overload Test

13.4 Terminal Strength Test:

Downward force is applied to cause a 1mm deflection for 1 minute (no physical evidence of mechanical or physical damage, change in resistance < 5%)

13.5 Thermal Shock Test:

MIL-STD-202, Method 107D, air-to-air except:

13.5.1 Samples are placed in a temperature chamber and subjected to 200 air-to-air cycles of the following:

- 1) Hold $-55^{\circ}\text{C}\pm 2^{\circ}\text{C}$ for 30 ± 5 minutes
- 2) Transfer to $125^{\circ}\text{C}\pm 2^{\circ}\text{C}$ within 0.5 minutes
- 3) Hold $125^{\circ}\text{C}\pm 2^{\circ}\text{C}$ for 30 ± 5 minutes
- 4) Transfer to $-55^{\circ}\text{C}\pm 2^{\circ}\text{C}$ within 0.5 minutes
- 5) Repeat cycle 200 times

13.5.2 At completion of 200 cycles, resistance readings taken after temperature stabilization ($25^{\circ}\text{C}\pm 5^{\circ}\text{C}$ for 15 minutes minimum to 24 hours maximum)

13.5.3 Samples divided into two equal lots of twenty

13.5.4 One set is tested to the non-destructive 100% current carry test. After completion, the samples are subjected to the Time Current Characteristic Curve Generation.

13.5.5 The other set is subjected to the destructive Current Overload Test.

13.6 Maximum Current Carry Test

13.6.1 Performed after the non-destructive Load Humidity and 100% Current Carry Tests (same samples used)

13.6.2 At the completion of the 100% Current Carry Test, the current is increased by 10% of the current rating of the fuse. Increase occurs every 15 minutes until the fuse opens. Temperature is monitored constantly.

13.7 Case Resistance Test

EIS/IS-722

13.8 Resistance to Dissolution of Metallization Test

ANSI J-STD-002, Test D

13.9 Mechanical Shock Test

MIL-STD-202, Method 213B, Test Condition A, except:

13.9.1 Test boards mounted to a shock test fixture, which in turn was mounted to the table of the shock machine.

13.9.2 Shock machine calibrated for the required shock pulse.

13.9.3 Samples subjected to eighteen impacts, three impacts in each of the three mutually perpendicular axis. Each shock pulse approximated a half-sine wave shape with a magnitude of 50 g's for 11 ± 1 milliseconds.

13.9.4 High frequency vibration test is performed after the mechanical shock test is completed.

After the high-frequency vibration test, the samples undergo the 100% current carry test and the Current overload tests.

13.10 High Frequency Vibration Test

MIL-STD-202, Method 204D, Test Condition D, except:

13.10.1 Test boards mounted to a shock test fixture, which in turn was mounted to the table of the shock machine.

13.10.2 Samples subjected to a simple harmonic motion having an amplitude of 20g peak \pm 20%.

13.10.3 Vibration frequency is varied logarithmically from 10 to 2,000 Hz.

13.10.4 Cycle is performed 12 times in each of the three mutually perpendicular directions.

13.10.5 At the completion of the last cycle, resistance readings are taken after temperature stabilization. The change in resistance from the original value is calculated and recorded.

13.10.6 After the vibration test is completed, the samples undergo the non-destructive 100% current carry test and then the destructive Current Overload Test.

13.11 Resistance to Solvents Test

MIL-STD-202, Method 215A

Note:

Due to the similarities of constructions for TCP1.25A and TCP2A, environmental tests were performed on TCP1.25A only.

14. END