

Vol. 14

Thermal Protector

Thermal Protector Overview

1 Feature

- Thermal protector is to protect overheat and over current for batteries, circuits and components.
- Takano's products are available with variety options and high current capacity: KT1 series
- Products can conduct high current even with small size: Mini Protectors – ST series, LiB series

2 Operating method

- Non run electricity method (=current is not applied to a bi-metal.)
- Contact point is a Single Pole Single Throw switch and is normally closed circuit (conducting).
- Bi-metal is in direct physical contact with a movable contact plate (ARM) on which to flow current, and it generates heat when current flows, then bi-metal trips (open). Also, when an ambient temperature have bi-metal reach to the trip (open) temperature, the protector breaks the circuit.
- For reset from open state, there are two types of method. One is an automatic reset type which automatically returns to conducting state when temperature decreases. Another is a manual reset type which keeps the break circuit state, and it is so-called a self holding type. Please use either automatic reset type or self holding type, depending on your application and /or circuit.

■ Automatic reset type

After breaking circuit by trip, current does not flow, and protector's inside temperature starts decreasing. Contact point closes (reset) and makes a circuit when bi-metal down to reset temp.

■ Self holding type (built-in PTC)

After breaking circuit by trip, current does not flow, however, the protector holds open state. Takano's protector has a built-in PTC heater, the movable contact plate touches to the PTC same time as contact point opens. Utilizing heat of PTC by applied voltage, the bi-metal keeps open state. It can be reset as inside temp down after intentional break of circuit. During the self holding state, minute current (leakage current)flows via PTC.

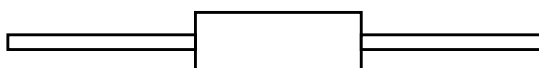
Type	KT1	LiB	ST
Automatic reset type	○	○	-
Self holding type (built-in PTC type)	○	○	○

3 Direction of external terminals

One side structure



Both sides structure



Direction of external terminals	KT1	LiB	ST
One side structure	○	-	-
Both side structure	○	○	○

4 Agency certification

Standard		KT1	LiB	ST
UL, cUL	UL 60730	○	○	○
	CAN/CSA-E60730	○	○	○
TUV	EN 60730-2-9	○	○	○
	IEC 60730-2-9	-	○	○

ST Series (Mini Protector)

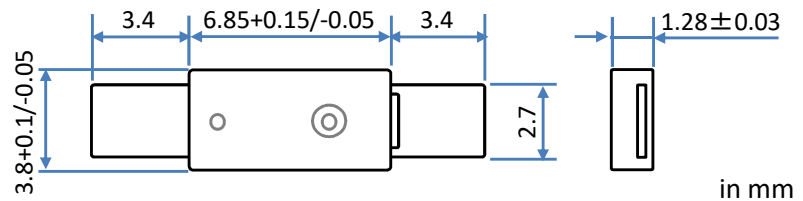
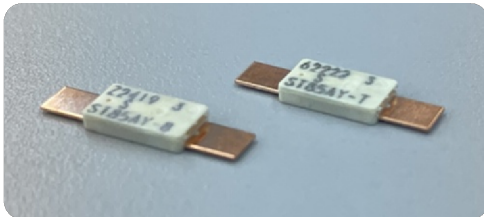
Features

- High current capacity with small size
- **New** series: large conduct type ST-T (High U/T)
- Available to conduct 18A at 60°C

Applications

- Heat protection, over current protection for batteries
- Laptop PCs, Gaming PCs
- Tablet PCs, Buck-up batteries

Dimensions



Specifications

add New series : ST-T (High U/T current type)

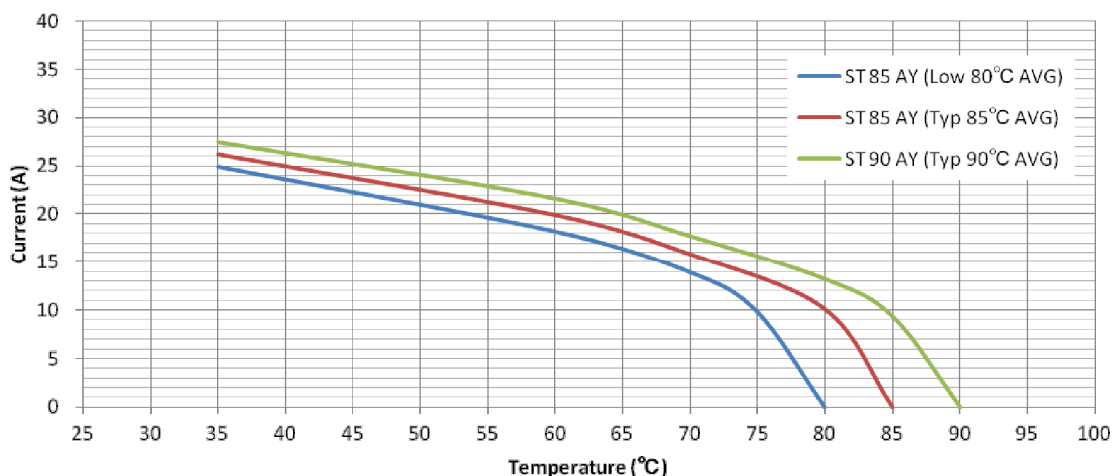
Specification item	ST□□AY シリーズ			
	ST85AY-8	ST90AY-8	ST85AY-T New	ST90AY-T New
Trip temperature(※)	85±5°C	90±5°C	85±5°C	90±5°C
Reset temperature	40°C min.		40°C min.	
Difference between trip and reset temp	7°C min.		7°C min.	
Resistance	5 mΩ max.		2.5 mΩ max.	
Non trip current (U/T current)	12A min.	14A min.	15A min.	16A min.
Current sensitivity	40A within 60sec			
Contact rating	DC9V / 35A or DC20V / 8A			
Maximum breaking current	70A (DC5V)			
Maximum voltage	DC28V			
Minimum holding voltage	DC3.5V @25°C for 48h			
Maximum leakage current	200mA max.			

(※) Other trip temperature products are available from 77°C to 90°C.

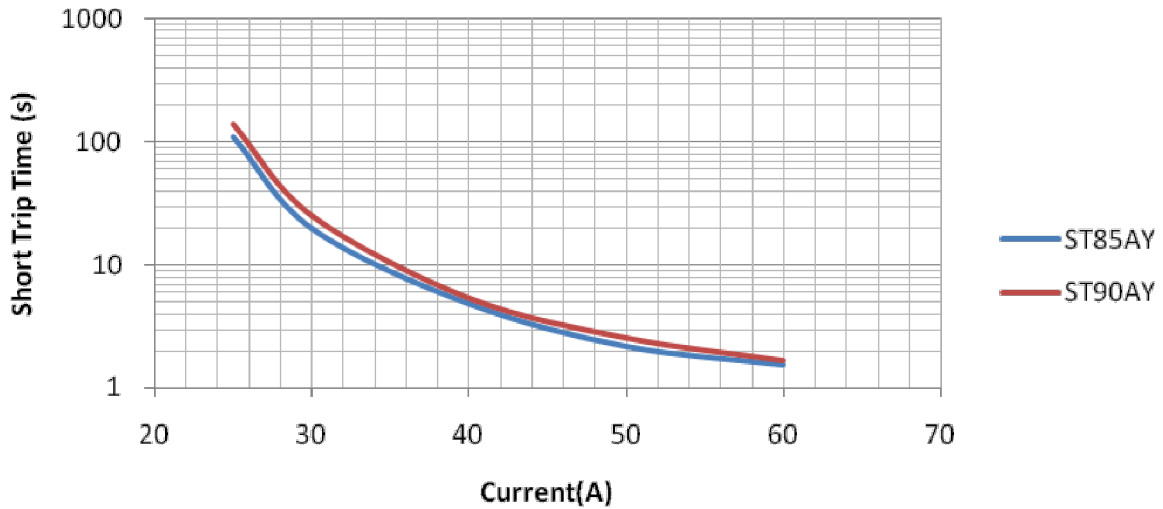
Typical performance

Current vs Temperature curves (U/T curves) ST-AY type

Current vs Temperature Curve - ST85/90AY



Short Trip Time ST-AY type



Part numbering

ST 85 A Y - 8
 I II III IV V

- I . Model name: ST
- II . Trip temperature (Celsius)
- III . Current sensitivity type number
 *Current sensitivity performance depends on part number, please contact us for detail.
- IV . Reset method : Y – Self holding type (built-in PTC)
- V . Custom option: Serial number
 * 8 – standard, T – High U/T current type(High non-trip current type)

Certification, Conformity

Agency / Standard / File No.		Hazardous substance regulation	
UL, cUL	TUV	RoHS 2.0	Halogen Free
UL 60730 CAN/CSA-E60730	EN 60730-2-9 IEC 60730-2-9	○※1	○
File No: E 194576	File No: R 5043683		

Halogen Free : Br is 900ppm or less, Cl is 900ppm or less, total Br+Cl is 1,500ppm or less.

※1: Although ceramic of PTC contains Lead, it is exemption in RoHS directive.

Others

■ In ST series, there is no Ni plate terminal welded option, however, it is possible to be considered depending on your necessary quantity and plate shape/size requirement, whether it can be assembled by automatic machine or not. Please contact us if you need.

LiB Series (Mini Protector)

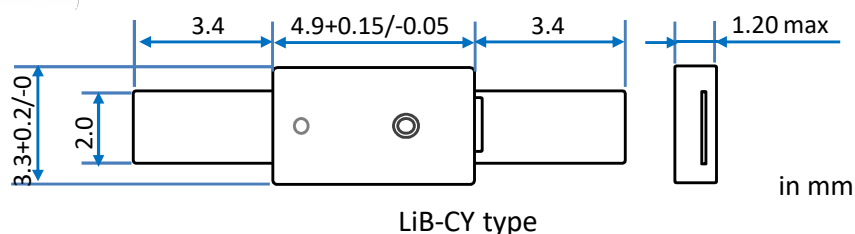
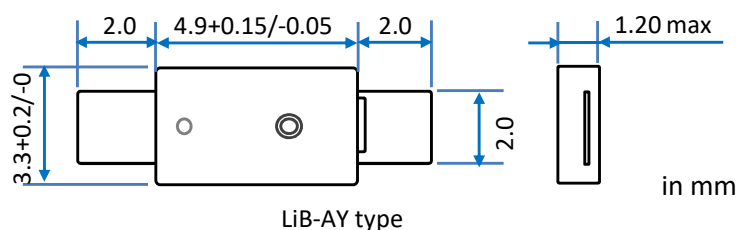
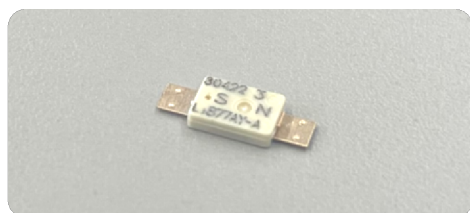
Features

- Small and slim size
- Variety of temperature selection

Applications

- Heat protection, over current protection for batteries
- Communication, Radio equipments
- Laptop/Tablet PCs ■ Other consumer device
- DC Solenoid

Dimensions



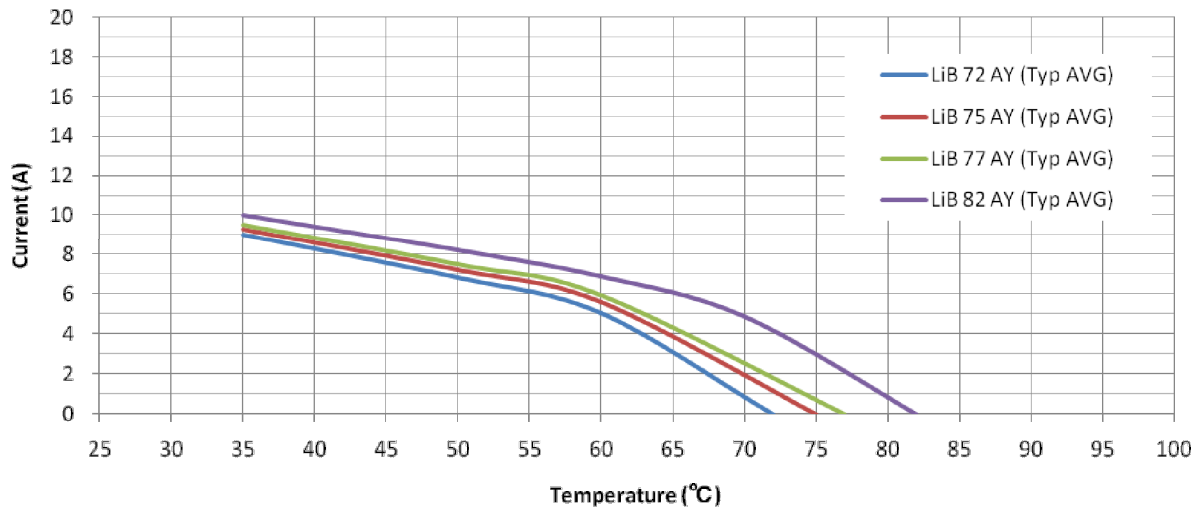
Specifications

Specification item	LiB□□AY	LiB□□CY
Trip temperature	70°C~95°C	70°C~95°C
Trip temperature tolerance	±5°C	±5°C
Reset temperature	40°C min.	40°C min.
Difference between trip and reset temp	7°C min.	7°C min.
Resistance	10 mΩ max.	7 mΩ max.
Current sensitivity	15A within 5sec	25A within 15sec
Contact rating	DC10V/12A or DC16V/7A	DC10V/12A or DC16V/7A
Maximum breaking current	40A (DC5V)	60A (DC5V)
Maximum voltage	DC28V	DC28V
Minimum holding voltage	DC2.0V @25°C for 48h	DC2.5V @25°C for 48h
Maximum leakage current	150mA	150mA

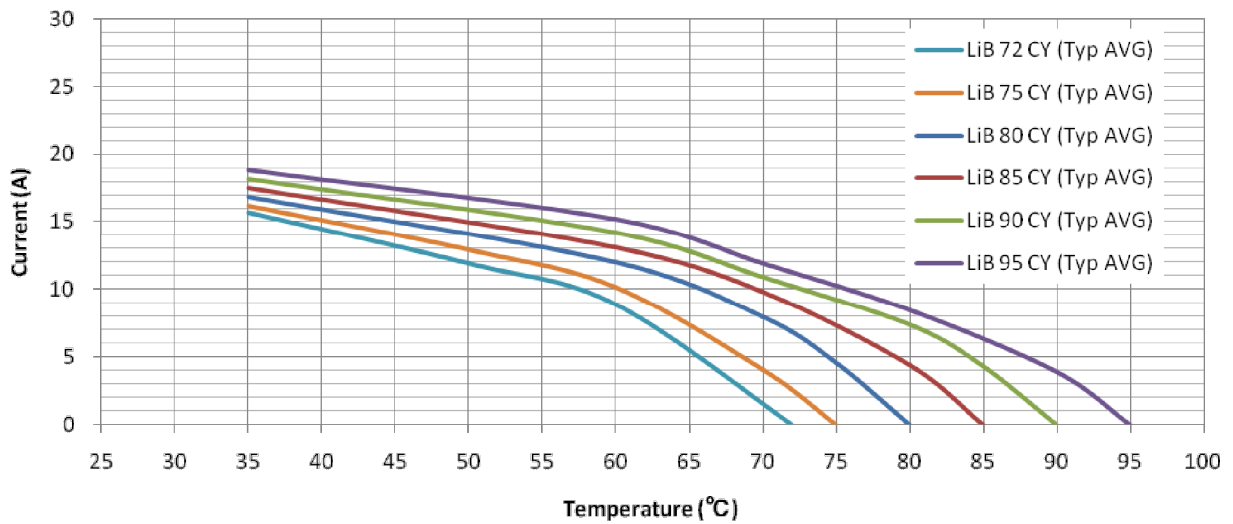
※ No built-in PTC type (LiB-AN type) is available.

※ Non trip current (U/T current) specifications depend on series and trip temperature, please contact us for detail.

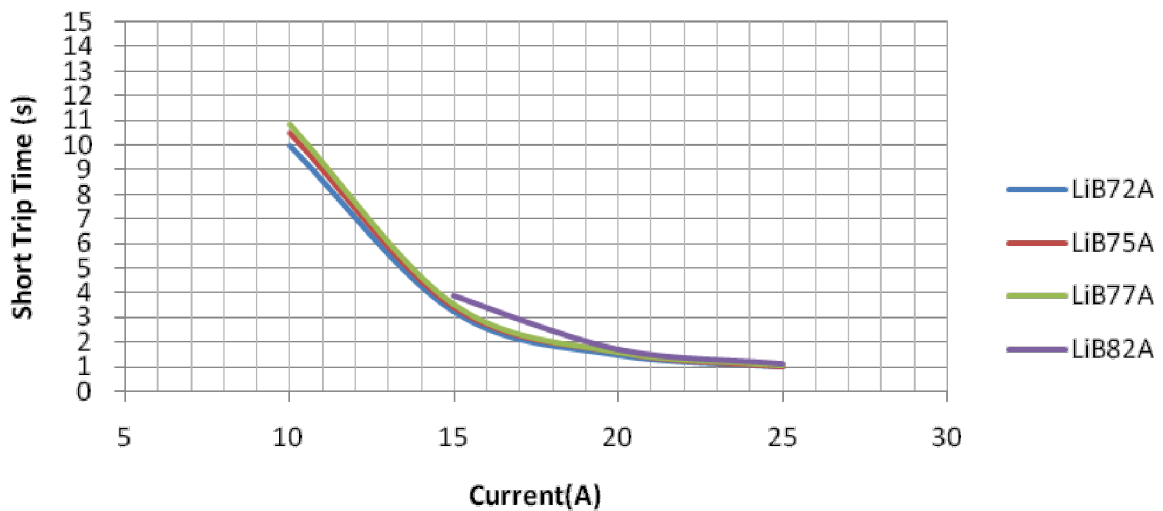
Current vs Temperature Curve - LiB-AY



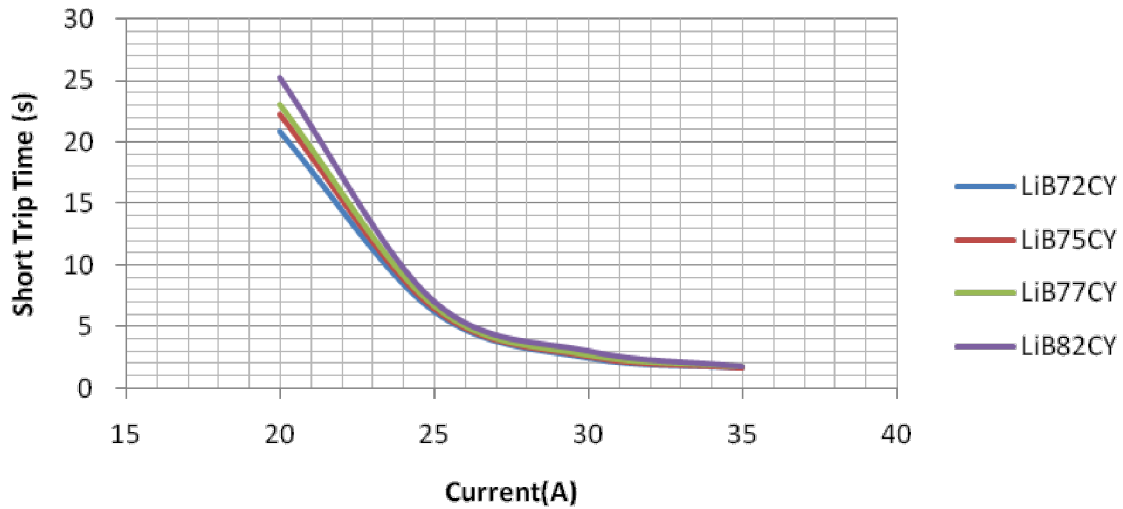
Current vs Temperature Curve - LiB-CY



Short Trip Time LiB-AY type



Short Trip Time LiB-CY type



Part numbering

LiB 77 A Y - H
 I II III IV V

- I . Model name: LiB
- II . Trip temperature (Celsius)
- III . Current sensitivity type number
 *Current sensitivity performance depends on part number, please contact us for detail.
- IV . Reset method : N – Automatic reset type(not built-in PTC), Y – Self holding type (built-in PTC)
- V . Custom option: Serial number

Certification, Conformity

Agency / Standard / File No.		Hazardous substance regulation	
UL, cUL	TUV	RoHS 2.0	Halogen Free
UL 60730 CAN/CSA-E60730	EN 60730-2-9 IEC 60730-2-9	O※1	O
File No: E 194576	File No: R 50240345		

Halogen Free : Br is 900ppm or less, Cl is 900ppm or less, total Br+Cl is 1,500ppm or less.

※1: Although ceramic of PTC contains Lead, it is exemption in RoHS directive.

Others

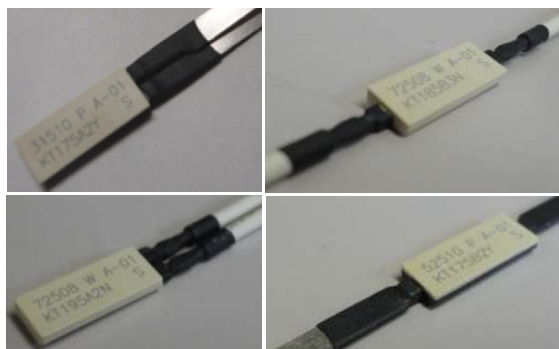
■ In LiB series, there is no Ni plate terminal welded option, however, it is possible to be considered depending on your necessary quantity and plate shape/size requirement, whether it can be assembled by automatic machine or not. Please contact us if you need.

KT1 Series

Features

Variety option

- Variety of external terminal option
Direction, Length, Ni-plate, Lead wire
- Current sensitivity option
- Automatic reset type, Self holding type



Applications

Heat protection, over current protection for batteries

- Medical device battery, Communication device battery, backup battery for infrastructure
- Consumer device battery, Lighting device battery
- DC motor, Solenoid, etc.

Specifications

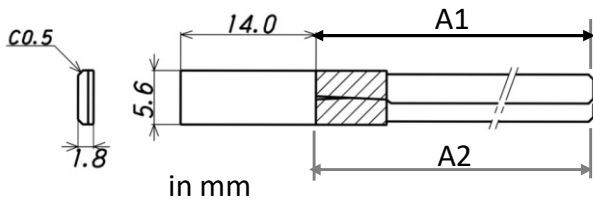
Specification item		KT1□□A/B□Y (with PTC)	KT1□□A/B□N
Trip temperature		60°C ~ 95°C	
Trip temperature tolerance		±5°C	
Reset temperature		40°C min. (※1)	
Difference between trip and reset temp		7°C min.	
Resistance		10 mΩ, 15 mΩ, 20mΩ, 25mΩ, 30mΩ max. (※2)	
Current sensitivity (※3)	Type 1	25A, 10sec max.	
	Type 2	25A, 15sec max.	
	Type 3	25A, 15sec max.	
	Type 4	25A, 5sec max.	
	Type 5	25A, 10sec max.	
Contact rating	Type 1	DC12V / 5A	
	Type 2	DC13C / 10A	
	Type 3	DC18V / 15A	
	Type 4	DC13V / 12A	
	Type 5	DC24V / 5A	
Maximum breaking current		120A (DC24V)	
Maximum voltage		DC24V	
Minimum holding voltage		DC2V	-
Maximum leakage current		150mA	-

※1: Rest temp is 35°C min. with 60°C trip temp product

※2: Resistance depends on length of lead wire/Ni plate and current sensitivity type, etc.

※3: Current sensitivity data are shown in "Typical performance" part

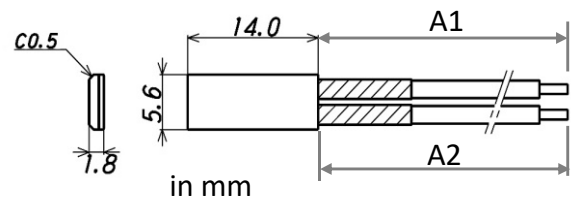
KT1□□A (Ni-Plate, one side)



Example of terminal length

A1	A2
22.0	22.0
23.0	23.0
23.5	23.5
25.0	25.0
28.0	28.0
31.0	31.0
38.0	38.0

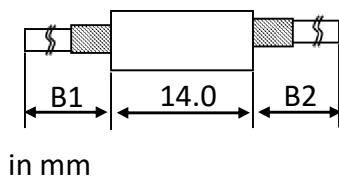
KT1□□A-W (Lead wire, one side)



Example of terminal length

A1	A2
36.0	36.0
37.0	37.0
45.0	45.0
55.0	55.0
60.0	60.0
86.0	86.0
100.0	100.0

KT1□□B (Ni-Plate, both sides)

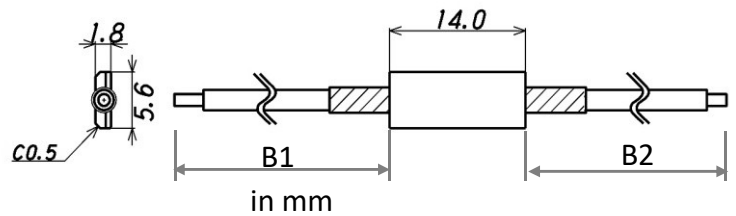


in mm

Example of terminal length

B1	B2
23.0	23.0
28.0	28.0

KT1□□B-W (Lead wire, both sides)



in mm

Example of terminal length

B1	B2
48.5	66.5

KT1 90 A 3 N - 01W

I II III IV V VI

I . Model name : KT1

II . Trip temperature (Celsius)

III . Direction of external terminals: A – One side, B – Both sides

IV . Current sensitivity type number

*Current sensitivity performance depends on part number, please contact us for detail.

V . Reset method : N – Automatic reset type(not built-in PTC), Y – Self holding type (built-in PTC)

VI . Custom option

*Serial number (not marked on product)

Certification, Conformity

Agency / Standard / File No.		Hazardous substance regulation	
UL, cUL	TUV	RoHS 2.0	Halogen Free
UL 60730 CAN/CSA-E60730	EN 60730-2-9	○※1	○※2
File No: E 302419	File No (with PTC): J 50078648 File No (without PTC): R 50078464		

Halogen Free considered: Br is 900ppm or less, Cl is 900ppm or less, total Br+Cl is 1,500ppm or less.

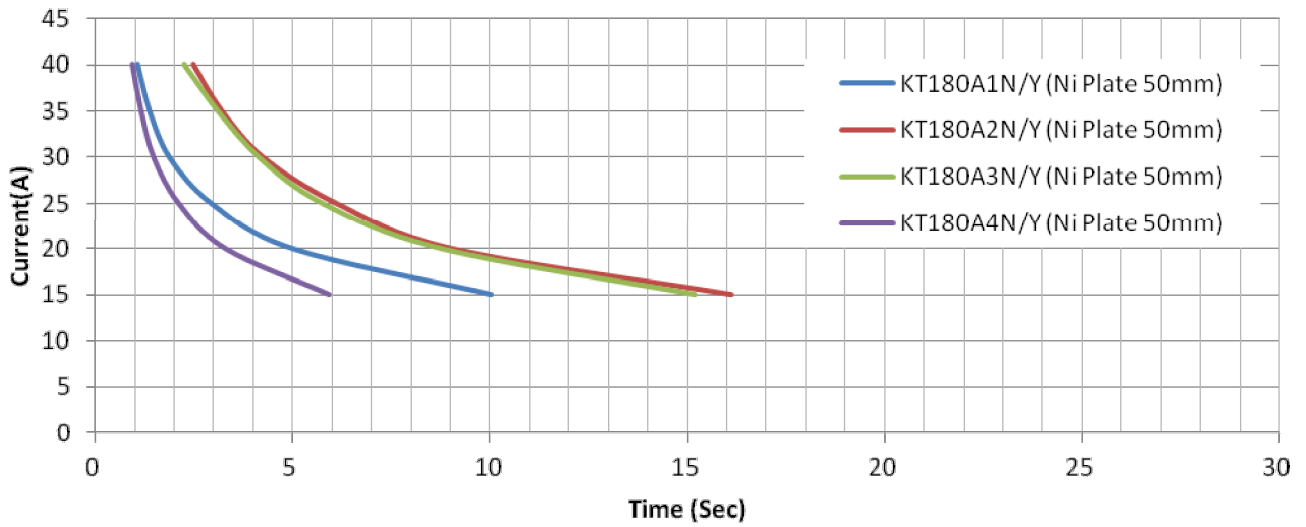
※1: Although ceramic of PTC contains Lead, it is exemption in RoHS directive.

※2: Some legacy part numbers do not meet Halogen free with above criteria as some tube type are not Halogen free. Please contact us for detail.

Caution!) As for TUV file numbers, Takano also has J50078650 (with PTC) and R50078646 (without PTC); however, please use file numbers in above table for your NEW product approval.

■ Current sensitivity data (80°C trip product, Ni Plate 50mm, by current sensitivity type)

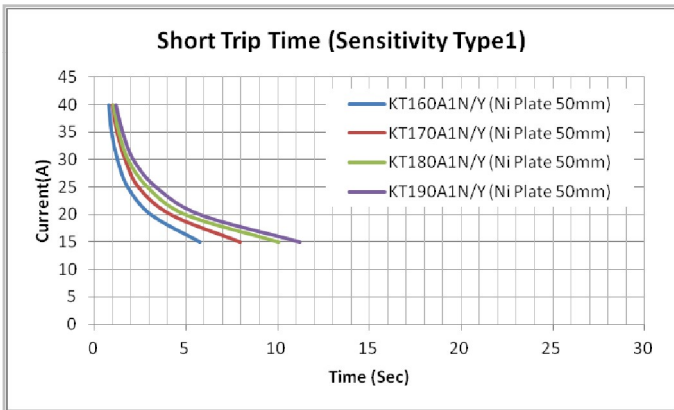
Short Trip Time (80°C operating product by current sensitivity type)



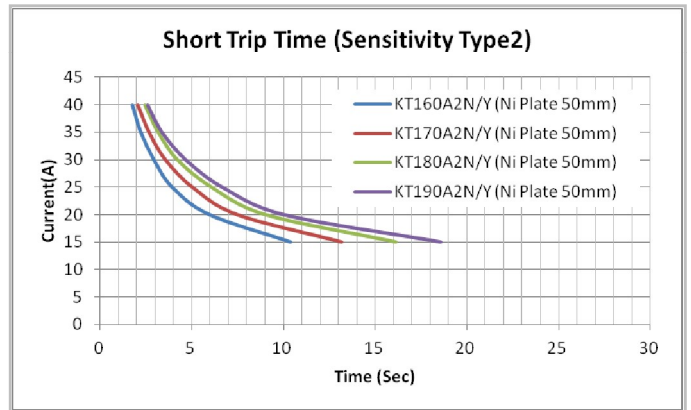
※Type5(KT1□□A5N/Y) is same current sensitivity as Type2.

■ Current sensitivity data (by current sensitivity type, Ni Plate 50mm, by 60/70/80/90°C trip)

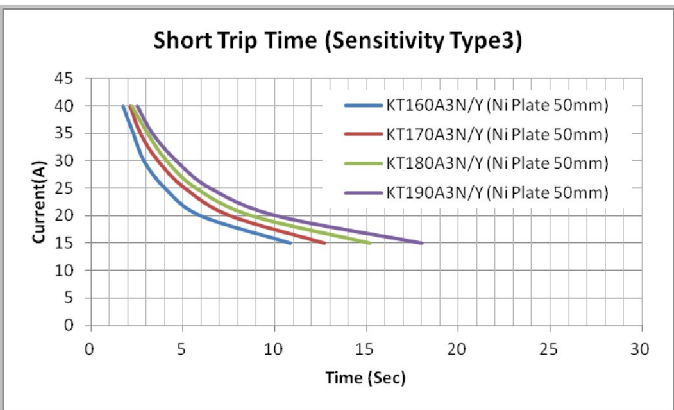
Current sensitivity Type1 (60/70/80/90°C)



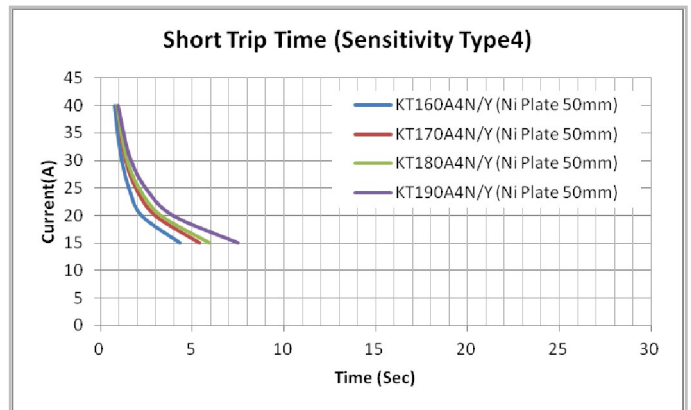
Current sensitivity Type2 (60/70/80/90°C)



Current sensitivity Type3 (60/70/80/90°C)



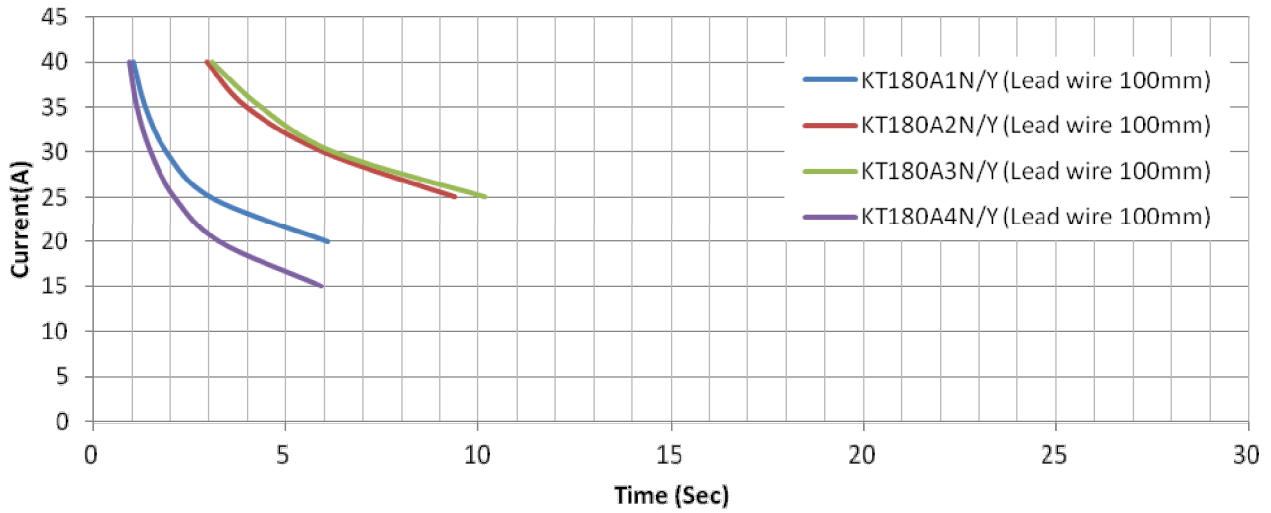
Current sensitivity Type4 (60/70/80/90°C)



※Type5(KT1□□A5N/Y) is same current sensitivity as Type2.

■ Current sensitivity data(80°C trip product, Lead wire 100mm, by current sensitivity type)

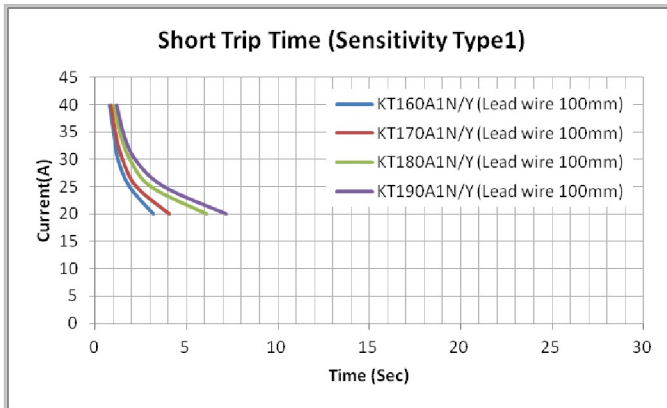
Short Trip Time (80°C operating product by current sensitivity type)



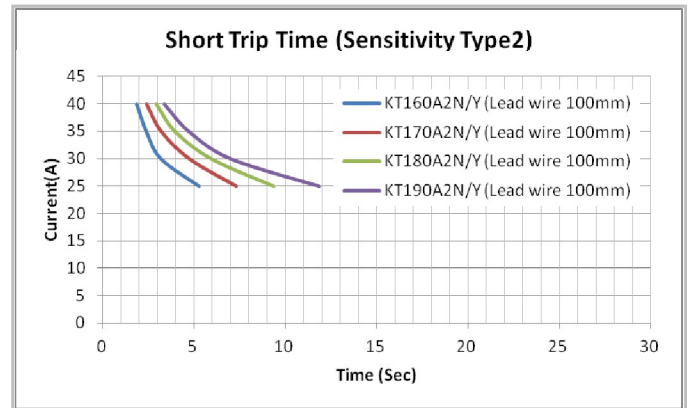
※Type5(KT1□□A5N/Y) is same current sensitivity as Type2.

■ Current sensitivity data(by current sensitivity type, Lead wire 100mm, by 60/70/80/90°C trip)

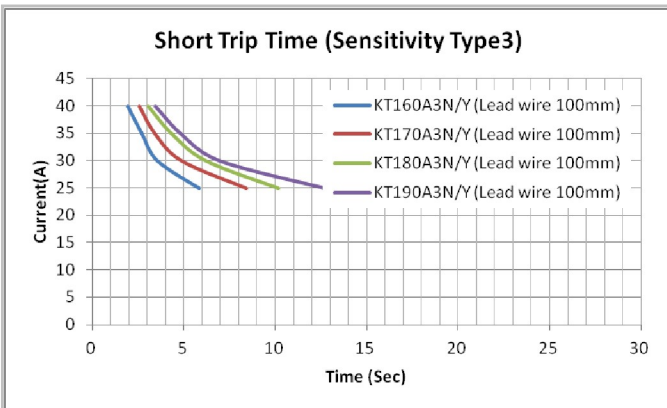
Current sensitivity Type1 (60/70/80/90°C)



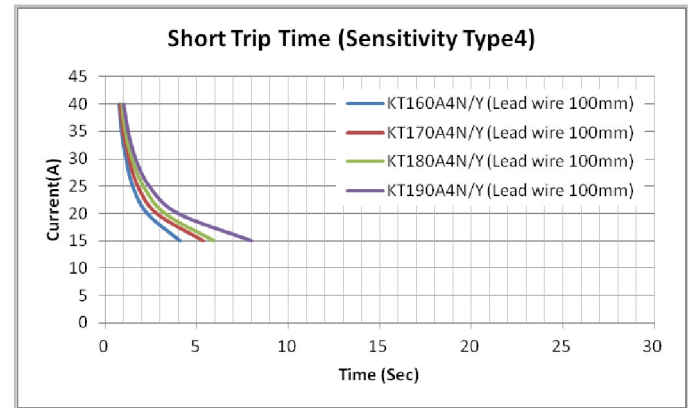
Current sensitivity Type2 (60/70/80/90°C)



Current sensitivity Type3 (60/70/80/90°C)



Current sensitivity Type4 (60/70/80/90°C)



※Type5(KT1□□A5N/Y) is same current sensitivity as Type2.



Warning

- Specifications and data described herein are subject to change without notice.
- Product performance and characteristics could vary by measurement method, circuit impedance, mounting position and so on.

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