



MHP-TA Resettable TCO for Lithium Battery Protection



Lithium Cell Protection Device Requirements are Changing

- Higher cell capacities & larger cell surface areas
 - Lower thermal cut-off temperatures (<90C) required
 - Improved margin of safety needed
- Higher battery discharge rates
 - Hold currents above 6A required
 - Multiple series and parallel pack configurations
- Small & thin protection devices required



MHP-TA Resettable Thermal Cut-Off (TCO)

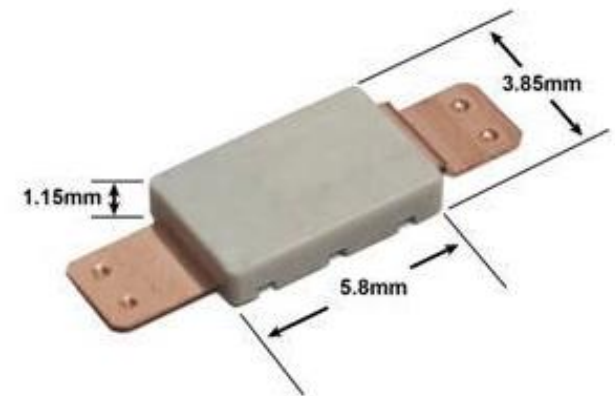
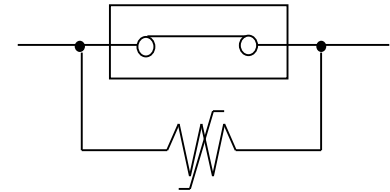
❖ What is the MHP-TA Device?

↳ Metal Hybrid PPTC - Thermal Activation Device

- Combines a Polymer PTC with a Bi-metal in parallel
- Over-temperature protection device
- Resettable activation

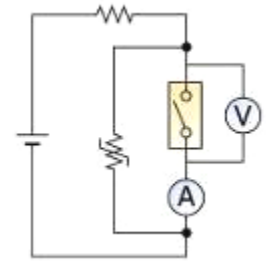
❖ Application:

- Protection for rechargeable Lithium cells
 - ✓ Lithium Polymer
 - ✓ Li-ion Prismatic
- Other applications that require a resettable TCO
- Resistance or laser welded to cell terminals
- Nickel lead extensions and taping also available



The MHP-TA Technology Principle

- A hybrid circuit protection device that combines a Polymer PTC (polymeric positive temperature coefficient) with a Bi-metal in parallel
- The MHP-TA technology incorporates the best features of a bimetal breaker and PPTC and reduces the downside of each technology.



	Advantage	Disadvantage
Bimetal	<ul style="list-style-type: none"> ▪ Low resistance ▪ High operating current ▪ Good temperature sensing 	<ul style="list-style-type: none"> ▪ Non-Latching ▪ Mechanical contact
PPTC	<ul style="list-style-type: none"> ▪ Latches ▪ No mechanical contact 	<ul style="list-style-type: none"> ▪ Thermal derating size for operating current

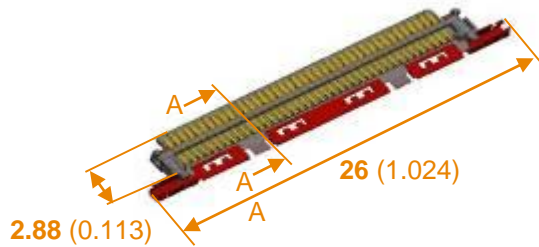
Combine

Metal Hybrid PPTC (MHP) – Thermal Activation

MHP-TA Technology Leverages TE Strengths

- TE strengths in high precision, miniature molded connector products
- TE extensive experience in polymer PTCs and battery circuit protection

Plug



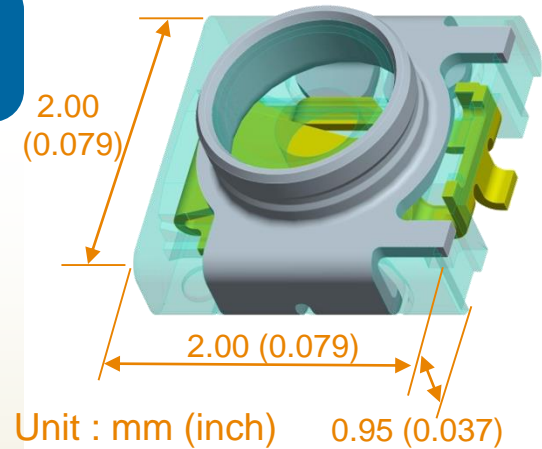
Unit : mm (inch)



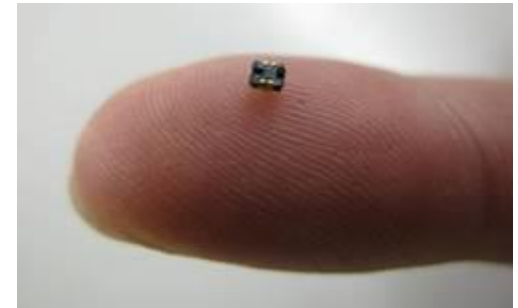
TE Connectivity Core Competencies

- Precision molding
- Precision stamping
- Miniaturization
- High speed assembly

RF Switch

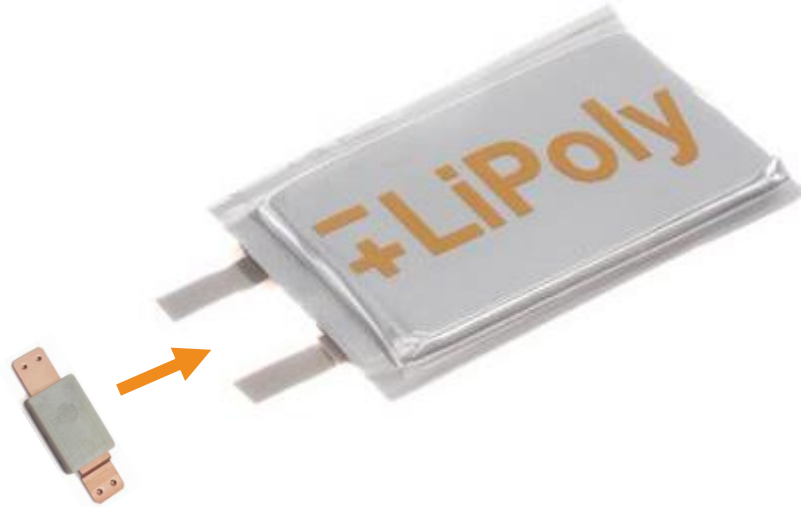


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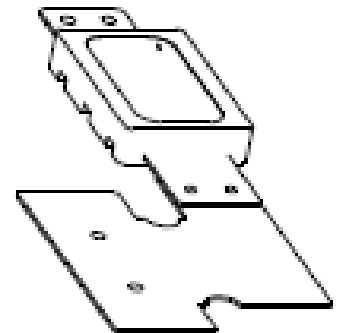


MHP-TA Application

Cell protection – added directly to the Li-polymer cell



- Resistance or laser welded to cell terminals
- Can also be added to prismatic cells
- Nickel lead extensions and taping also available



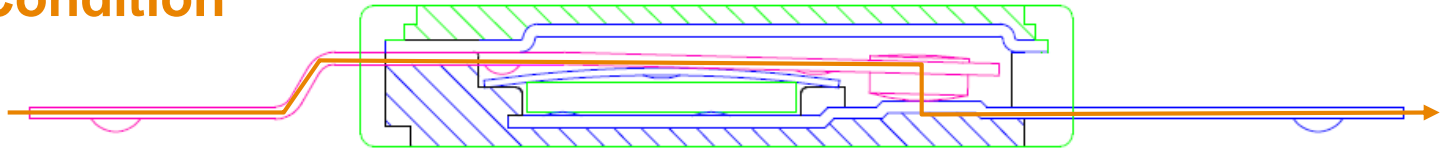
MHP-TA Technology Solves These Problems

Customer Problem	General Solution	Design Problem	Ultimate Solution
<p>Lithium cells need over temperature protection</p> <p>Thin PCs and tablets....</p> <ol style="list-style-type: none"> 1. Need higher capacity cells than a smart phone 2. Generate higher discharge currents 	<p>Thermal Cut-off (TCO)</p>	<p>One time use TCOs (thermal fuse) can have nuisance trips</p> <p>Traditional protection devices capable of higher hold currents (>6A) are not small or thin enough</p>	<p><i>Resettable thermal protection device in a low profile package (MHP-TA)</i></p>

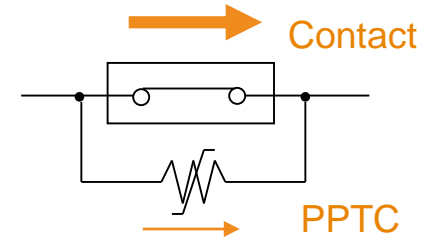
MHP-TA Operating Principle

Normal Condition

①

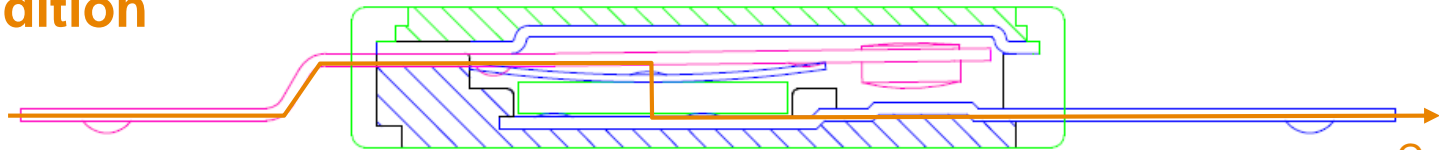


- Silver contacts carries the current
[$R_c \ll R_{ptc}$]

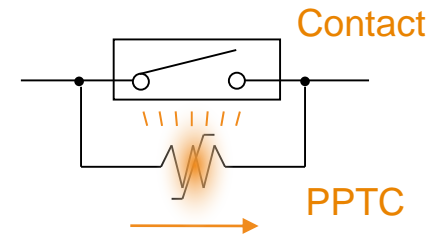


Fault Condition

②



- Contact opens
- Current goes through PPTC
- Current heats up the PPTC >>>> Resistance increases



Result:

Tripped PPTC heats the bimetal and keeps it open during a fault condition

Example of Resistance vs. Temperature Curve

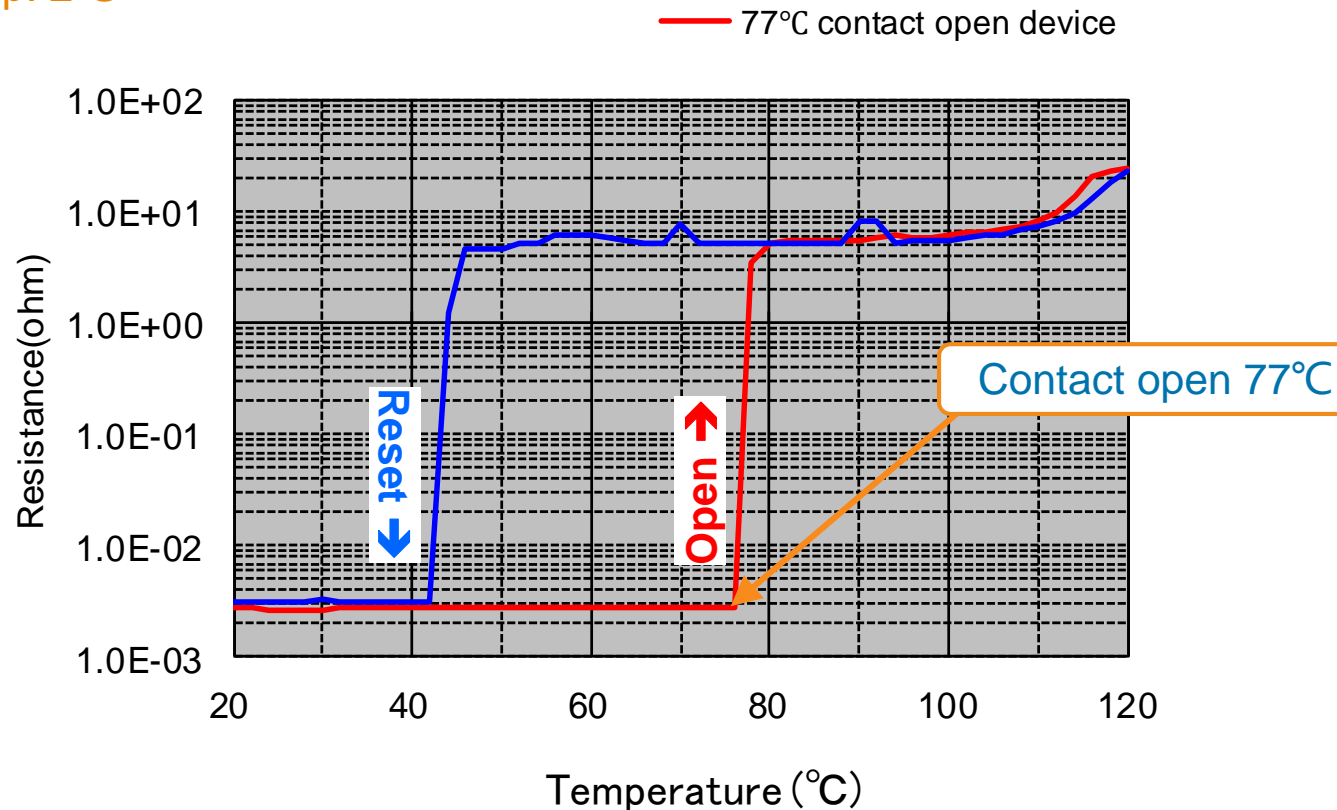
Contact open temperature test
<Test condition>

Rise from 20°C to 120°C and go back to 20°C

Temperature step: 2°C

Hold time: 1min

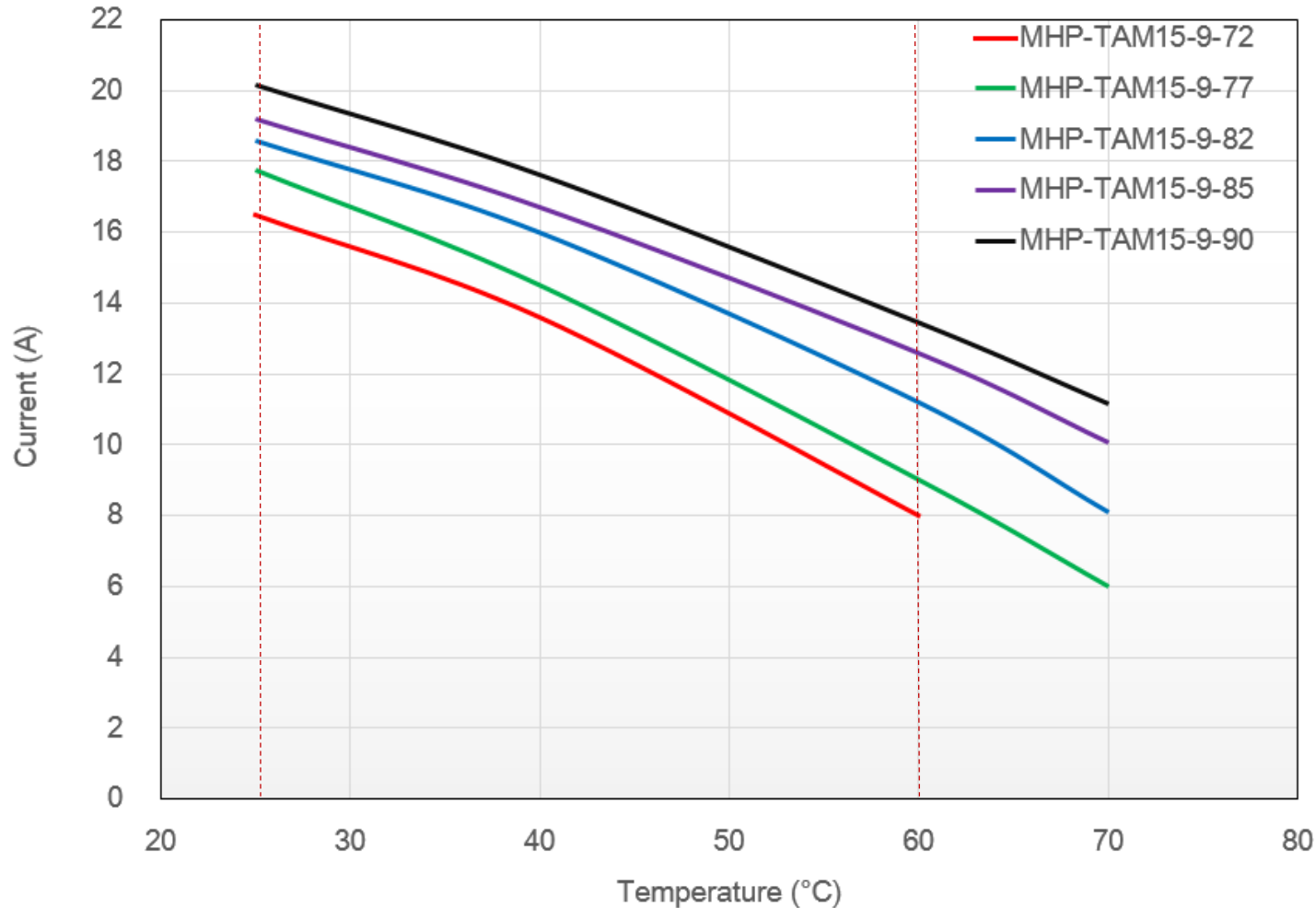
Spec: Contact open at 77°C



Contact opens at 77°C

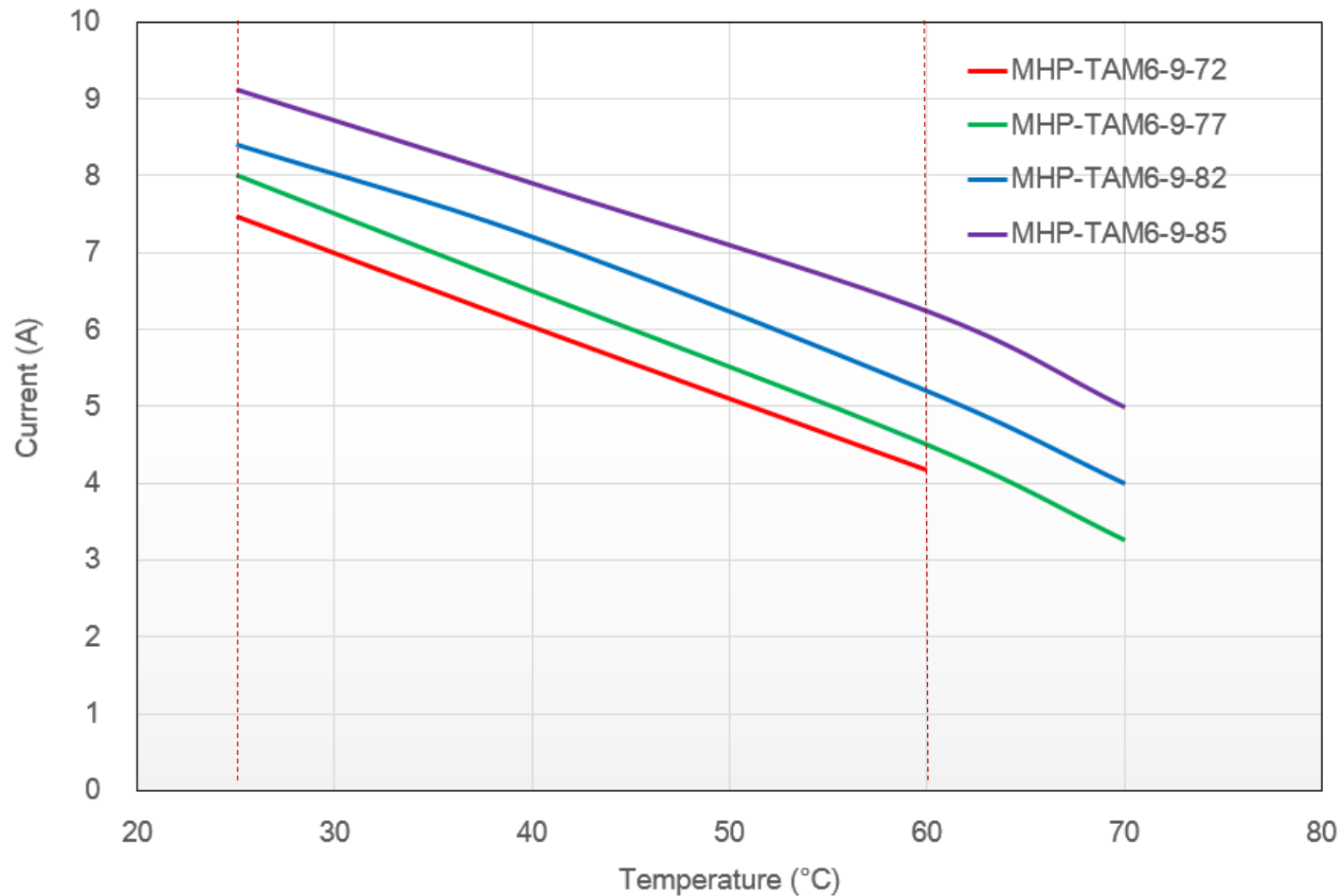
Typical Hold Current vs. Temperature Performance

MHP-TAM15 – High Current Series



Typical Hold Current vs. Temperature Performance

MHP-TAM6 – Low Current Series



MHP-TA Provides Excellent Cycle Life - Durability

Cycle test

<Test condition>

Power supply:

DC9V/25A

Temperature: 25°C

Cycle time: 6,000 cycle

Initial resistance : Typ. 2.50 mohm

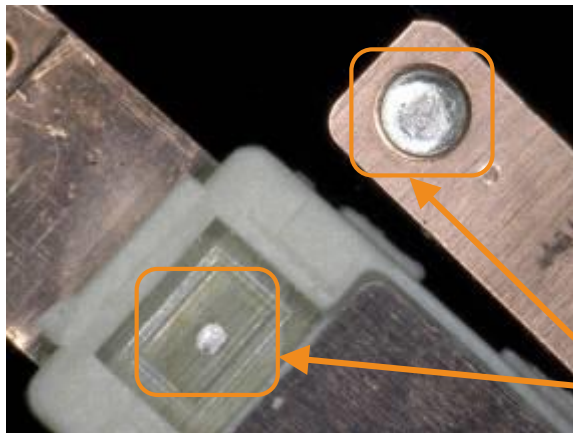
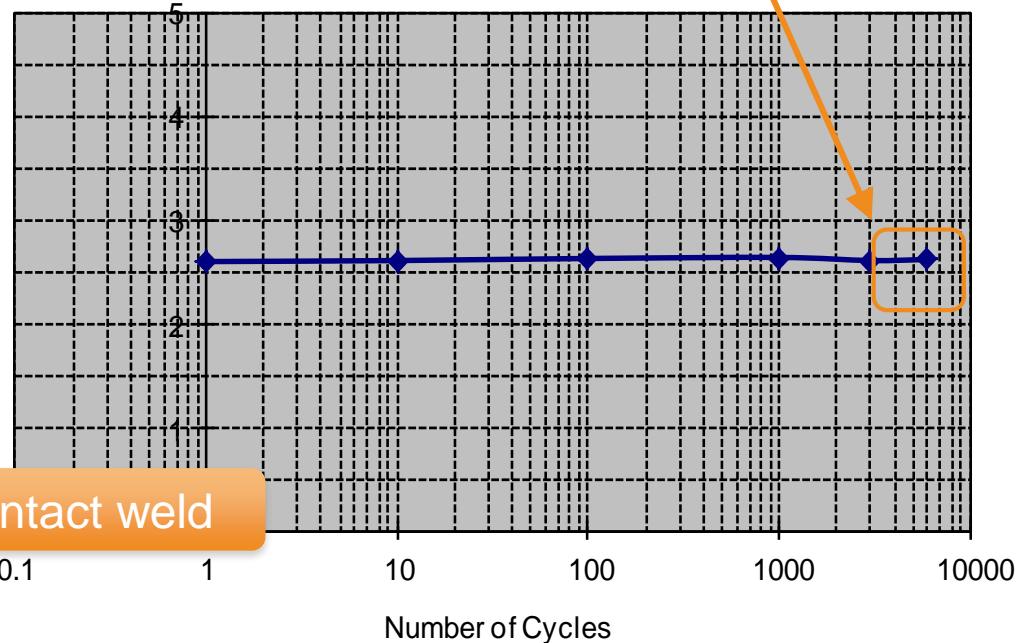
Spec:

Resistance: < 5 mohm

Open / close cycle: No contact weld

(DC 9 V / 25 A 6000 cycles)

No resistance change



After 6000 cycles

Product Line-up

Typical Electrical Rating (25°C)

Contact rating: DC9V/12A (6000 cycles)

Max. breaking current: DC5V/40A (100 cycles)

MHP-TAM6 – Low Current Series

Model Number	Rating [°C] Nominal	Operation Temperature [°C]		Reset Temperature [°C]		Reference Resistance [mohms] 25°C	
		Min	Max	Min	T1	Typ	Max
MHP-TAM6 Series							
MHP-TAM6-9-72	72	67	77	≥40	≥7	10	15
MHP-TAM6-9-77	77	72	82	≥40	≥10	10	15
MHP-TAM6-9-82	82	77	87	≥40	≥10	10	15
MHP-TAM6-9-85	85	80	90	≥40	≥10	10	15

Typical Electrical Rating (25°C)

Contact rating: DC9V/25A (6000 cycles)

Max. breaking current: DC5V/80A (100 cycles)

MHP-TAM15 – High Current Series

Model Number	Rating [°C] Nominal	Operation Temperature [°C]		Reset Temperature [°C]		Reference Resistance [mohms] 25°C	
		Min	Max	Min	T1	Typ	Max
MHP-TAM15 Series							
MHP-TAM15-9-72	72	67	77	≥40	*≥7	2.5	5
MHP-TAM15-9-77	77	72	82	≥40	*≥10	2.5	5
MHP-TAM15-9-82	82	77	87	≥40	*≥10	2.5	5
MHP-TAM15-9-85	85	80	90	≥40	*≥10	2.5	5
MHP-TAM15-9-90	90	85	95	≥40	*≥10	2.5	5

MHP-TA Technology Summary

- Combines a Polymer PTC with a Bi-metal in parallel
- Over-temperature protection device
- Resettable activation

Device Ratings

- 9VDC
 - Low current and high current versions
 - TCO: 72°C, 77°C, 82°C, 85°C, 90°C
 - UL Recognized
-
- Ideal for Lithium polymer battery designs that need a small thermal cut-off (TCO) device that can handle higher currents
 - Resettable device helps eliminate “nuisance trip” issues occurring in non-resettable thermal fuses or TCOs