TEXAS INSTRUMENTS

KLIXON®

MM Family Series Battery Pack - Overcharge and Short Circuit Protection

- *Ability to provide both overcharge and short circuit protection*
- *Small size with chamfered edges allows "no space" fit with A & AA cells*
- *High quality and reliability*
- *Low nominal resistance (see table)*
- *Fast thermal and current response*
- *Comprehensive agency approval (see table)*
- *Nylon case provides insulated exterior*
- *Standard termination - nickel strip leads with or without insulation*

MM Series

The Texas Instruments MM Series protectors provide battery pack protection for notebook computers, cellular phones, camcorders, portable tools and more. By protecting against overcharge and limited short circuit, the MM Series can in many cases replace two devices, thus providing a significant total cost of ownership advantage.

Operation

The MM Series protectors use the same snap-action principle of other KLIXON protectors. The bi-metal disc senses both heat and current from the battery pack. When the temperature of the disc reaches a predetermined calibration point, the disc snaps open the contacts, thus breaking the current path. When the battery returns to a normal operating range, the MM protector resets (closes circuit) automatically.

Overcharge & Short Circuit Protection

Overcharge - The MM protector senses heat buildup in the battery pack, characteristic of an overcharge condition, and the disc snaps open the contacts at the predetermined calibration point. The wide differential between the open and closing temperature of the disc causes the MM protector to cycle slowly during a prolonged fault condition. This ensures the average temperature of the battery will be kept within safe limits, also adding to the overall life of the pack.

Short Circuit - For the 4MM, current passes from the lead through the current sensitive arm. During a short circuit condition, the rapid increase in current will generate I^2R heating in the arm. Materials are available with varying resistances which control the current sensitivity of the device (see table). The non-current carrying bi-metal disc senses this heat through convection and snaps open the contacts thus breaking the circuit. When the fault condition is removed and the current returns to a normal level, the disc will reset the circuit to its normally closed position.

For the 6MM and 7MM, current flows through the bimetallic disc, so that I^2R heating occurs in the disc. This generally results in a faster response. Additionally, the 7MM protector, because it contains an integral Positive Temperature Coefficient (PTC) element, is designed to latch open within a limited number of cycles.

Technical Characteristics

Dielectric Strength
1500 VAC / 1 Min

Maximum Breaking Current of Battery
4MM: Up to 120 amps, 12 VDC
6MM: Up to 80 amps, 12 VDC
7MM: Up to 80 amps, 12 VDC

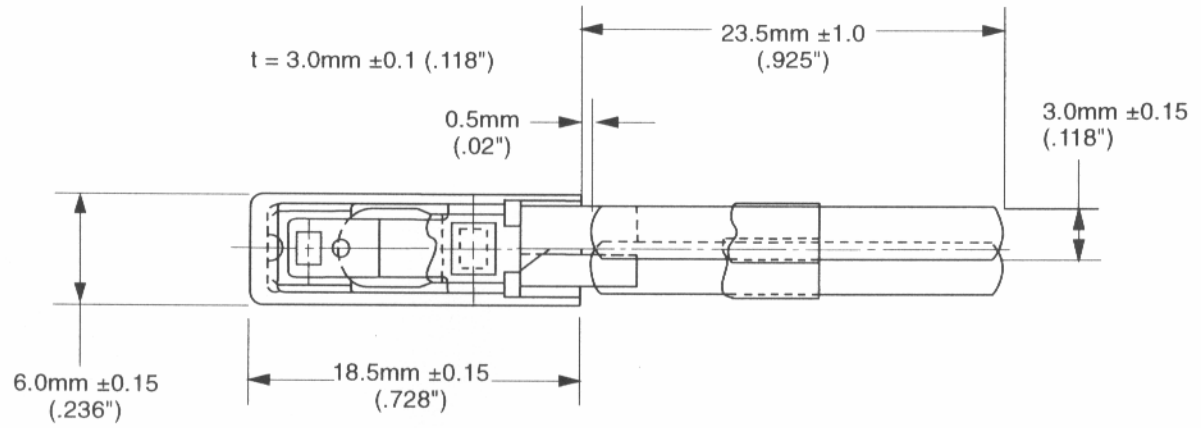
Operating Temperatures

	4MM	6MM /7MM
OpenTemp*	45° - 95°C	70° - 95°C
Tolerance	±5°C	±8°C
Reset**	>35°C	>35°C

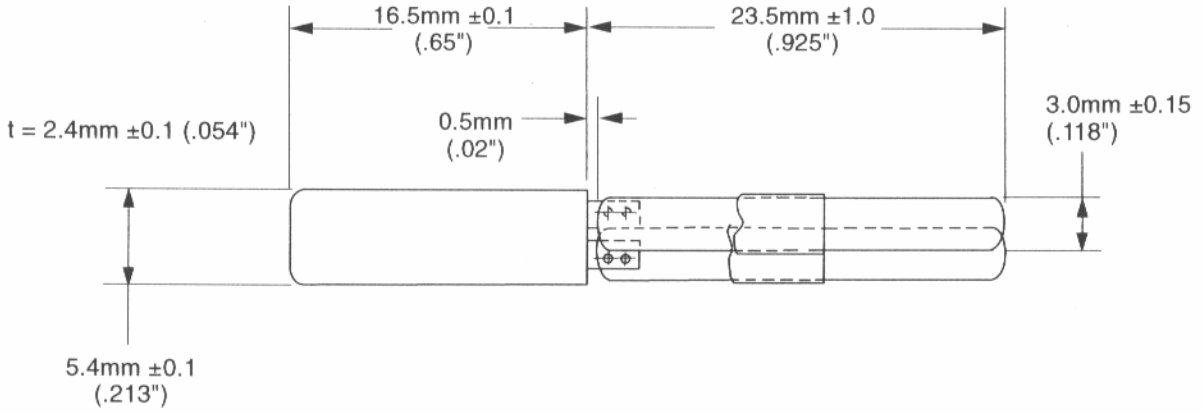
* (In 5°C increments)
** (Reset temps. vary, depending on operating temp.

Dimensional Drawings*

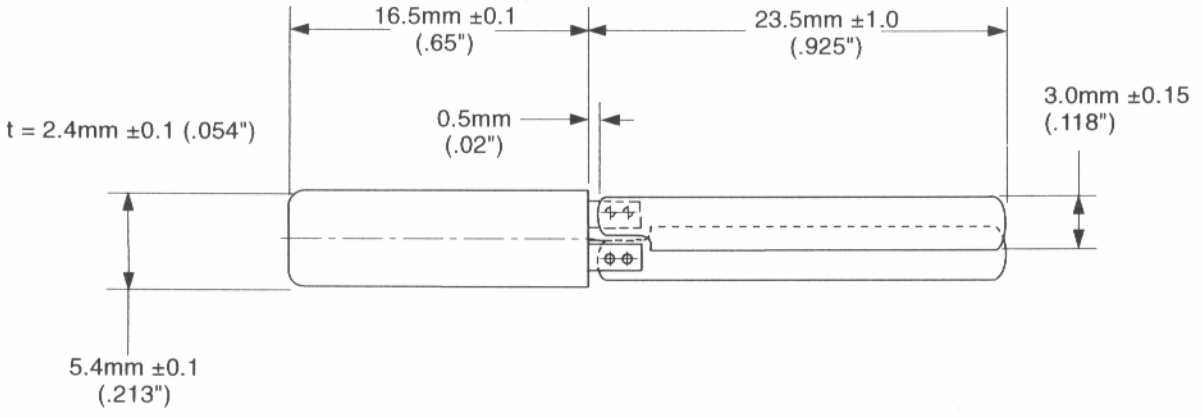
4MM



6MM



7MM



** Standard dimensions shown. Termination length may be specified. (t = thickness dimension).*

Performance Curves

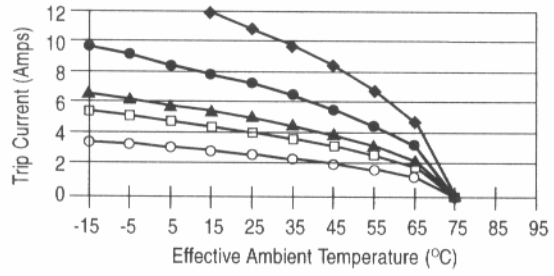
(Approximate: to be used for selecting samples only)

U/T Performance Curves

Ultimate trip current vs. protector ambient temperature.
These are approximate curves, to be used for selecting samples and for verification testing.

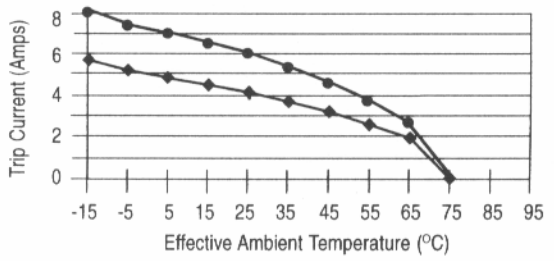
75°C Device Open Temperature

4MM



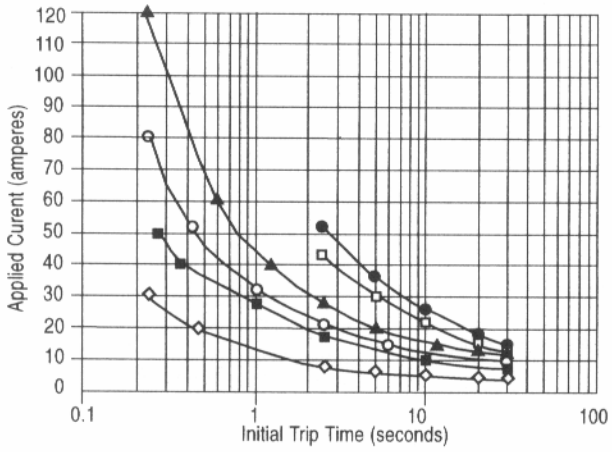
- ◆ 'G' ARM / 'H' ARM
- ● 'B' ARM
- ▲ 'A' ARM
- □ 'C' ARM
- ○ 'D' ARM

6MM / 7MM



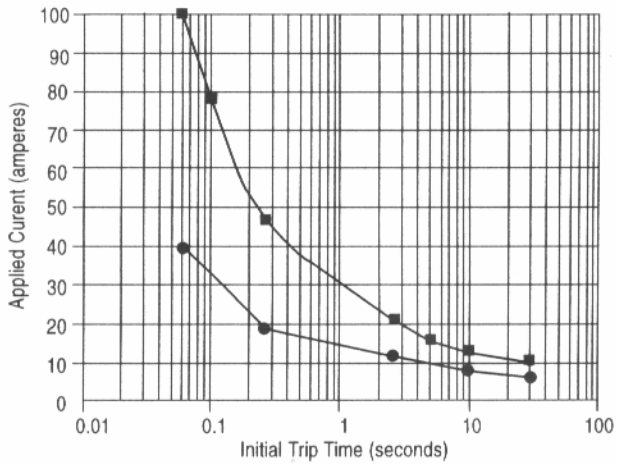
- ● 30R
- ◆ 150R

4MM S/T Curves



- ○ 4MM75A
- ▲ 4MM75B
- ■ 4MM75C
- ◇ 4MM75D
- □ 4MM75G
- ● 4MM75H

6MM S/T Curves



- ■ 6MM (30R)
- ● 6MM (150R)

Coding

Attribute	Code	4MMXXZ-ZZ	6MMXXYY-ZZ	7MMXXYZ-ZZ
Opening Temp. °C	XX	Temperature Value	2 digit number for opening temp bimetal type combination	Temperature Value
Internal Components	Z	Arm Material (A,B,C,D,G,H)		PTC Type (1-9)
Bimetal Type	Y			R or S
Termination Type	YY		AA = Ni Plate BB = Ni Bar	
Termination	ZZ	2 digit part number	2 digit part number	2 digit part number (numbers same as 6MM)

Examples:

4MM75C-01 4MM, 75°C opening temperature, NiCu arm material, 23.5mm nickel strip termination
6MM06AA-02 6MM, 70°C opening temperature, 23.5mm nickel strip termination
7MM75R4-02 7MM, 75°C opening temperature, Bimetal type R, PTC type 4, 23.5mm nickel strip termination

6MM Temperature X-Reference

Type	Open °C
6MM 01 YY - ZZ	75 ±8
6MM 02 YY - ZZ	70 +10 / -5
6MM 03 YY - ZZ	80 +5 / -7
6MM 04 YY - ZZ	75 ±8
6MM 05 YY - ZZ	95 ±8
6MM 06 YY - ZZ	70 ±8
6MM 07 YY - ZZ	80 ±8
6MM 81 YY - ZZ	70 ±8
6MM 82 YY - ZZ	75 ±8

Termination X Reference

4MM Terminations*				
	Nickel Strip		Insulation	
4MMXXZ-	L1 (mm)	L2 (mm)	L3 (mm)	L4 (mm)
None	-	-	-	-
-01	23.5	23.5	-	-
-06	23.5	23.5	13	13
-24	25	25	15	-
6MM / 7MM Terminations*				
	Nickel Strip		Insulation	
6MMXXYY-	L1 (mm)	L2 (mm)	L3 (mm)	L4 (mm)
None	-	-	-	-
-02	23.5	23.5	-	-
-03	23.5	23.5	13	13
-23	25	25	-	15

* Only the most popular ratings are listed: other lengths and combinations are available.

Agency Recognition

Agency	File Number	Product Recognition
UL	E 34618	4MM: 24V, 3A (5K cycles) 12V, 200A (short circuit) 6MM: 12V, 3A (5K cycles) 7MM: 24V, 3A (5K cycles) 120A (short circuit)
CSA	LR31093	4MM: 24V, 3A (5K cycles) 12V, 200A (short circuit) 6MM: 12V, 3A (5K cycles) 7MM: 24V, 3A (5K cycles) 120A (short circuit)
VDE	4464.12 - 4510 -1003	4MM: 12V, 5A (10K cycles)
TUV	R9451286	4MM: 24V, 3A (5K cycles) 6MM: 12V, 3A (5K cycles)

* Includes both current and pending filings

Cycle Life* (amps @ 12VDC)

Type	100 Cycles	5K Cycles
4MMXXA	80A	50A
4MMXXB	120A	50A
4MMXXC	70A	50A
4MMXXD	50A	40A
4MMXXG	120A	50A
4MMXXH	80A	50A
6MM	80A	50A**
7MM	150A	50A**

* Recommended maximum usage
** 6MM - 2K cycles
7MM - 2K cycles under min self load voltage

Arm Material Specifications

Type	Arm Material	Resistance*
A	Ti-Cu	20 milliohms
B	Be-Cu	20 milliohms
C	Ni-Cu	30 milliohms
D	S-S	60 milliohms
G	Be-Cu	20 milliohms
H	Be-Cu	20 milliohms

* Without Leads

For further information write or call:

North America
Texas Instruments Incorporated
34 Forest Street
MS 2-3
Attleboro, MA 02703
Phone: (508) 236-1937
Fax: (508) 236-1949

Japan
Texas Instruments Japan Ltd.
305 Tanagashira, Oyama-Cho
Sunto-Gun, Shizuoka-Ken
Oyama Plant
Japan 410-13
Phone: 81-550-781211
Fax: 81-550-780331

Korea
Texas Instruments Korea Ltd.
29th Floor Trade Tower
159 Samsung-dong, Kangnam-ku
Trade Center P.O. Box 45
Seoul, Korea 135-729
Phone: 822-5512928
Fax: 822-5512889

Holland
Texas Instruments Holland, B.V.
Kolthofsingel 8,
P.O. Box 43
7600 AA Almelo, Holland
Phone: 31-5468-79555
Fax: 31-5468-64429

Hong Kong
Texas Instruments Hong Kong, Ltd
15th Floor, Tower 2 The Gateway
25 - 27 Canton Road
Kowloon, Hong Kong
Phone: 852-2956-7317
Fax: 852-2956-2200

Singapore
Texas Instruments Singapore (Pte) Ltd
990 Bendemeer Road
Singapore 1233
Phone: (65) 3907-124
Fax: (65) 3907-063

Taiwan
Texas Instruments Taiwan Ltd
Taipei Branch
26F, 216, Sec 2, TunHua S. Road
Taipei, Taiwan, ROC
Phone: 866-2-3762571
Fax: 866-2-3772717