

## 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

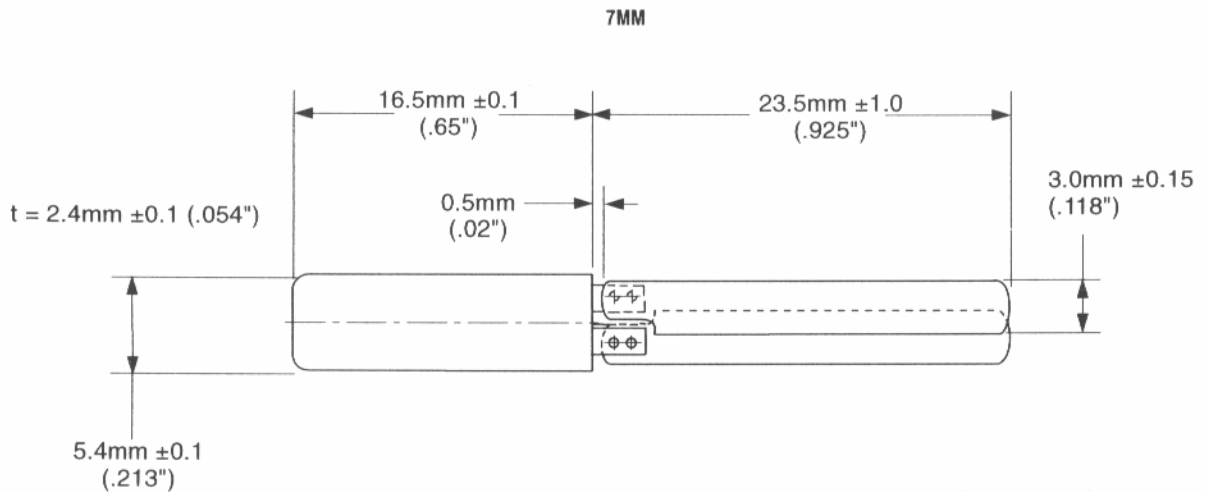
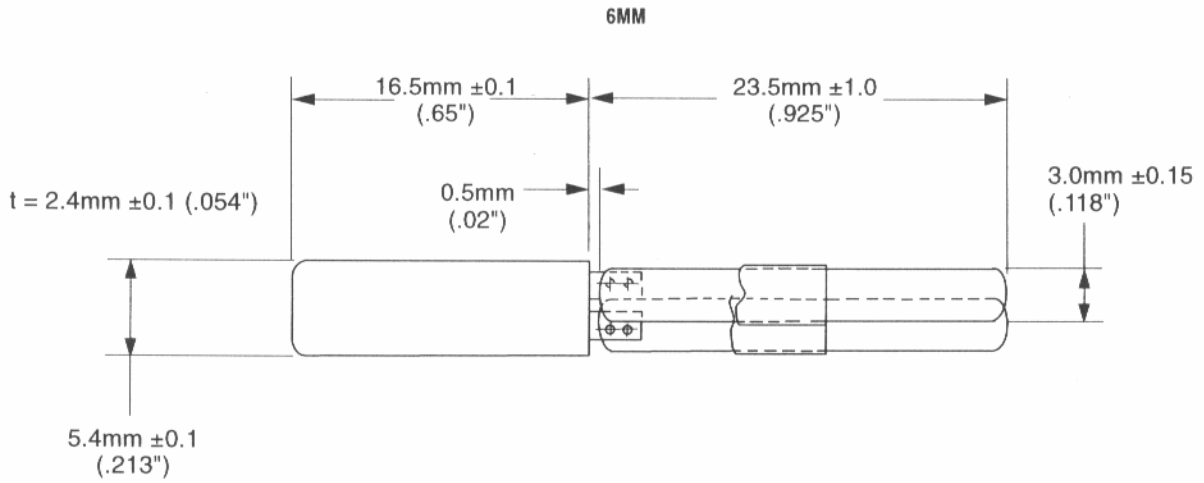
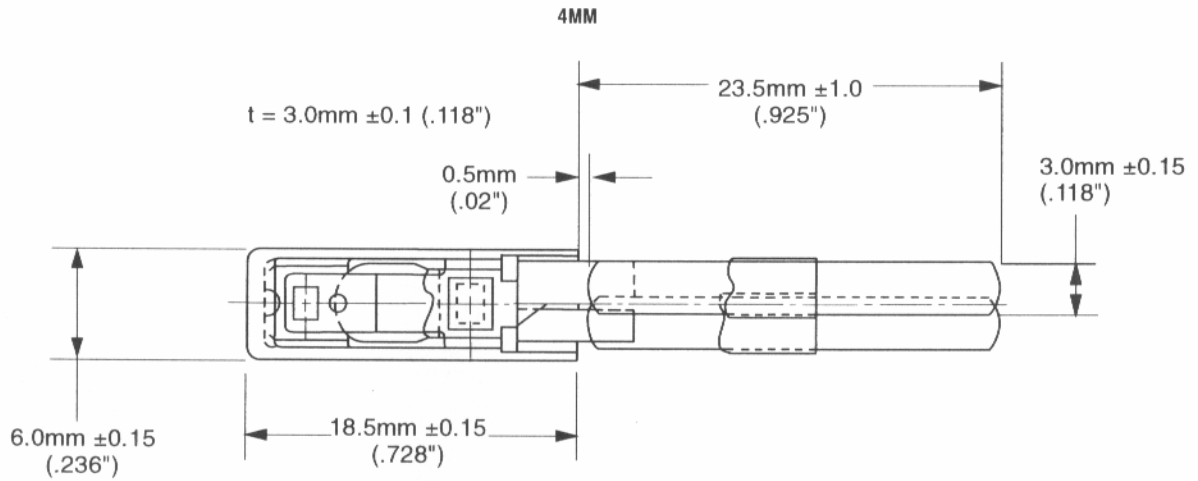
#### Operating Temperatures

	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\*



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

# Performance Curves

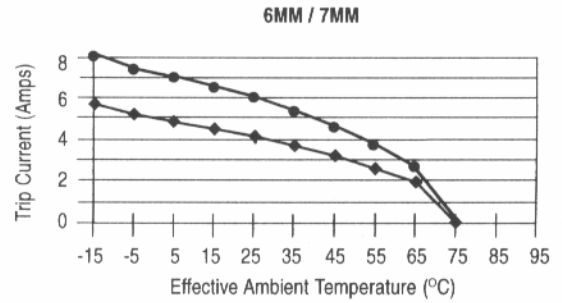
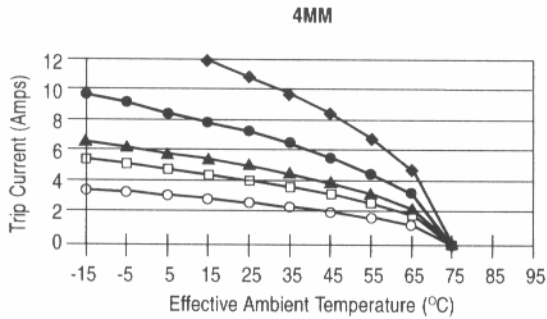
( Approximate: to be used for selecting samples only)

## 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.

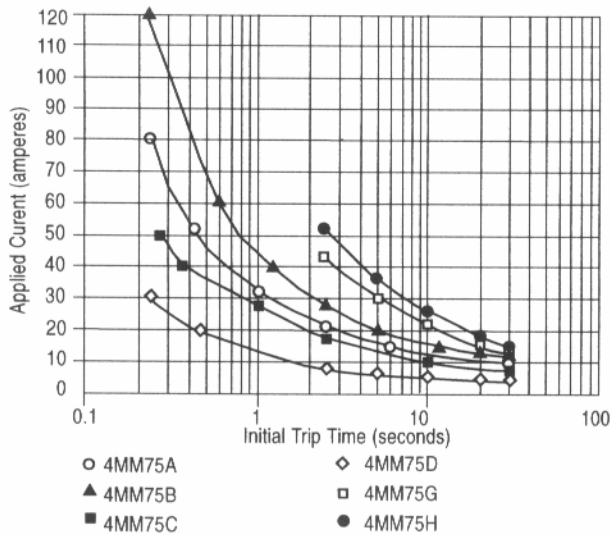
### 75°C Device Open Temperature



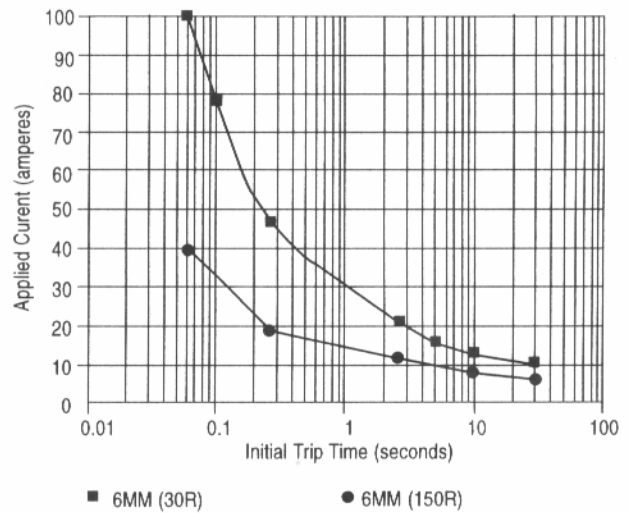
- ◆ 'G' ARM / 'H' ARM
- 'B' ARM
- ▲ 'A' ARM
- 'C' ARM
- 'D' ARM

- 30R
- ◆ 150R

### 4MM S/T Curves



### 6MM S/T Curves



- 4MM75A
- ▲ 4MM75B
- 4MM75C
- ◇ 4MM75D
- 4MM75G
- 4MM75H

- 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

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**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

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