MM_ / SMM

THIN FILM MELF RESISTORS
PRODUCT OVERVIEW

DRALORIC BEYSCHLAG RESISTORS

A WORLD OF SOLUTIONS

INTRODUCTION

Purpose

- Introduction of the Vishay MM and SMM Thin Film MELF Resistor Series

Objectives

- Present an overview of this product's special performance properties
- Explain product design and features
- Discuss product advantages
- Present typical applications

0207:
MMB 0207 & SMM0207

0204:
MMA 0204 & SMM0204

0102:
MMU 0102 & SMM0102

Welcome to the Vishay MM and SMM Thin Film MELF Resistors product overview. This tutorial will provide an overview of the MM and SMM Thin Film MELF resistor families. The key functional performance parameters of these MELF resistor series will be discussed as well as design, features, and benefits. A selection of potential applications from typical market segments will be presented.

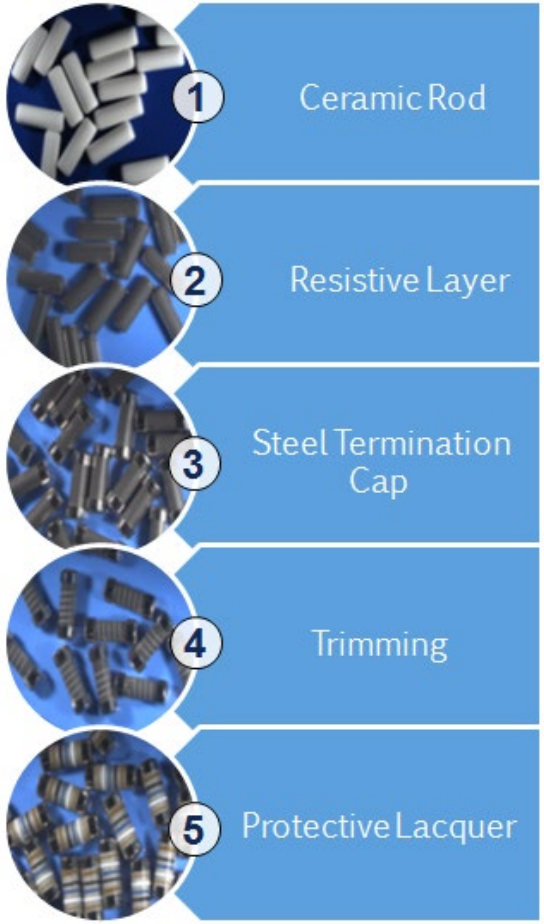
FUNCTIONAL PERFORMANCE OF THE MM AND SMM SERIES

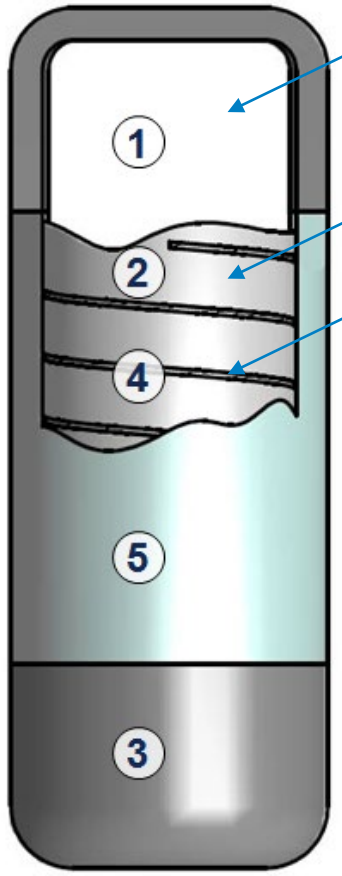
Key Properties

- Superior long term stability (down to ≤ 0.05% after 1000 h life test)
- Best in class pulse load capability up to 230 W for single pulses
- High power dissipation P_{70} up to 1 W for case size 0207
- Tolerance down to ±0.1% and TCR down to ±15 ppm/K
- Broad resistance range from 0.1 Ω to 15 MΩ
- Operating temperature up to 155 °C
- AEC-Q200 qualified
- Approved according to EN 140401 – 803
- Intrinsic sulfur resistance

The MM and SMM Thin Film MELF resistor series from Vishay are an excellent choice for today's modern electronics where stability, pulse load, and power dissipation are of major concern. The series delivers a rated pulse load capability 3 times higher as compared to equivalent case size thin film chip resistors. High-reliability applications will benefit from low load life drift and AEC-Q200 qualification. Both thin film MELF resistor series offer excellent moisture resistance, sulfur resistivity, and are RoHS compliant as well as halogen free.

DESIGN OF MM AND SMM COMPONENTS





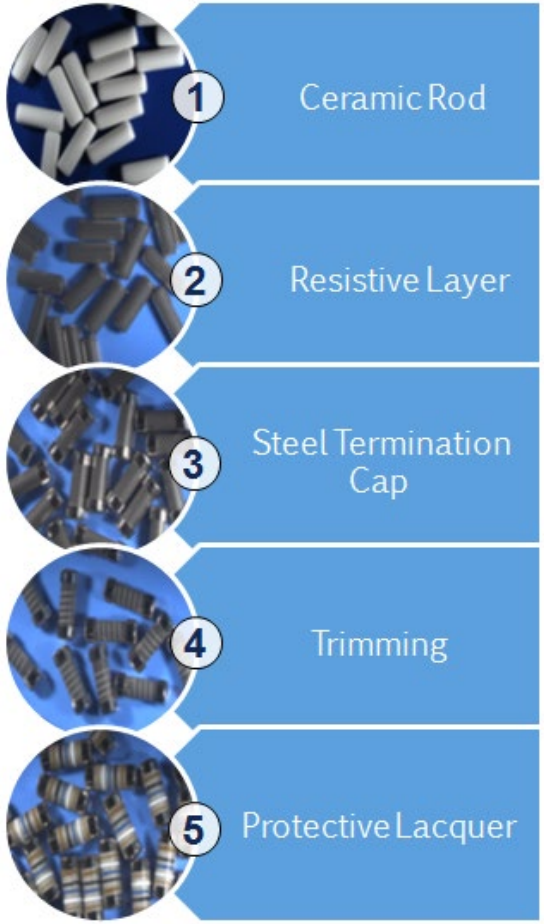
Power Dissipation
Large volume ceramic rod

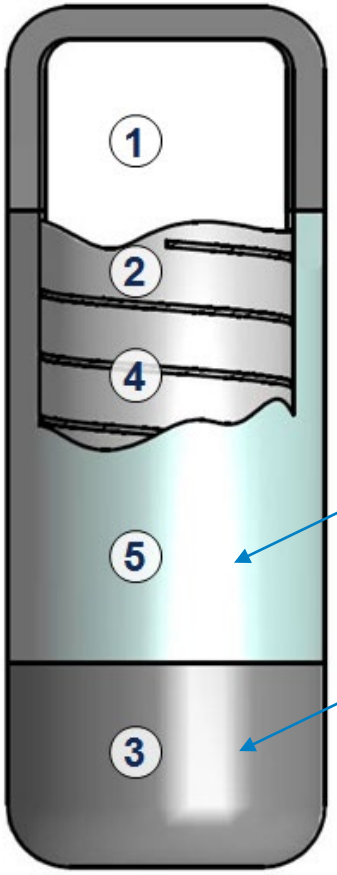
Long Term Stability
Metal film resistive layer

Pulse Load Capability
Helical trimming

The MM and SMM MELF resistor series offer significant advantages compared to thin film chip resistors. The cylindrical ceramic substrate is covered by a high-quality homogeneous metal film resistive layer. Its cylindrical shape results in a larger substrate volume and resistive element area as compared to chip resistors, allowing for a higher power dissipation. The helical laser trimming cut applied to the resistive film allows the resistor to evenly distribute thermal energy across the entire resistive element, when the resistor is in use. As a result the MELF resistors stability is enhanced and its pulse load capability increased.

DESIGN OF MM AND SMM COMPONENTS



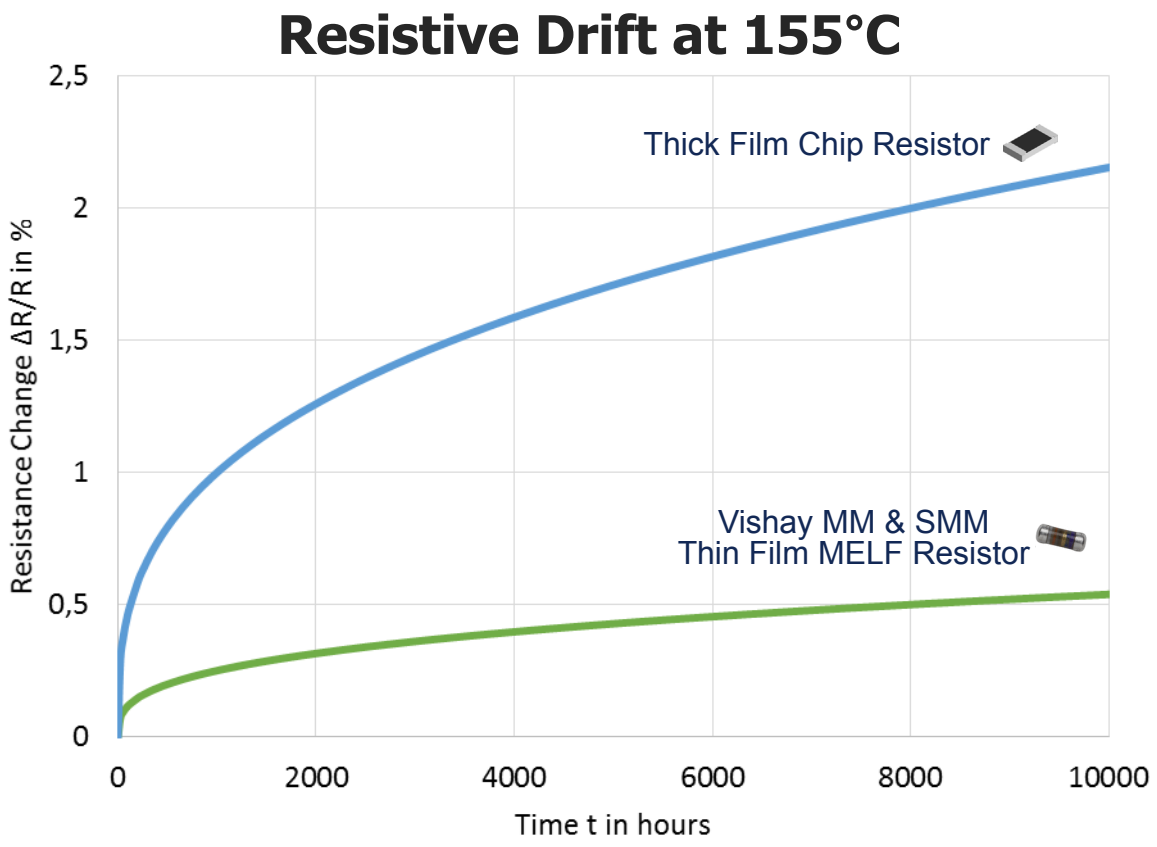


Moisture Resistivity
Protective lacquer

Excellent Solderability
Steel termination cap
plated pure tin on nickel

The MELF resistor's contacts are built from steel termination caps, plated with pure matte tin on nickel, and support excellent solderability. The protective lacquer provides the component with superior moisture resistivity, verified according to the 85°C/85 % biased humidity test for 42 days. The MELF resistors reliability has been proven in various automotive and industrial applications, in which the resistor is exposed to harsh operating environments, including high humidity and high temperature.

TECHNICAL ADVANTAGE: RESISTIVE DRIFT

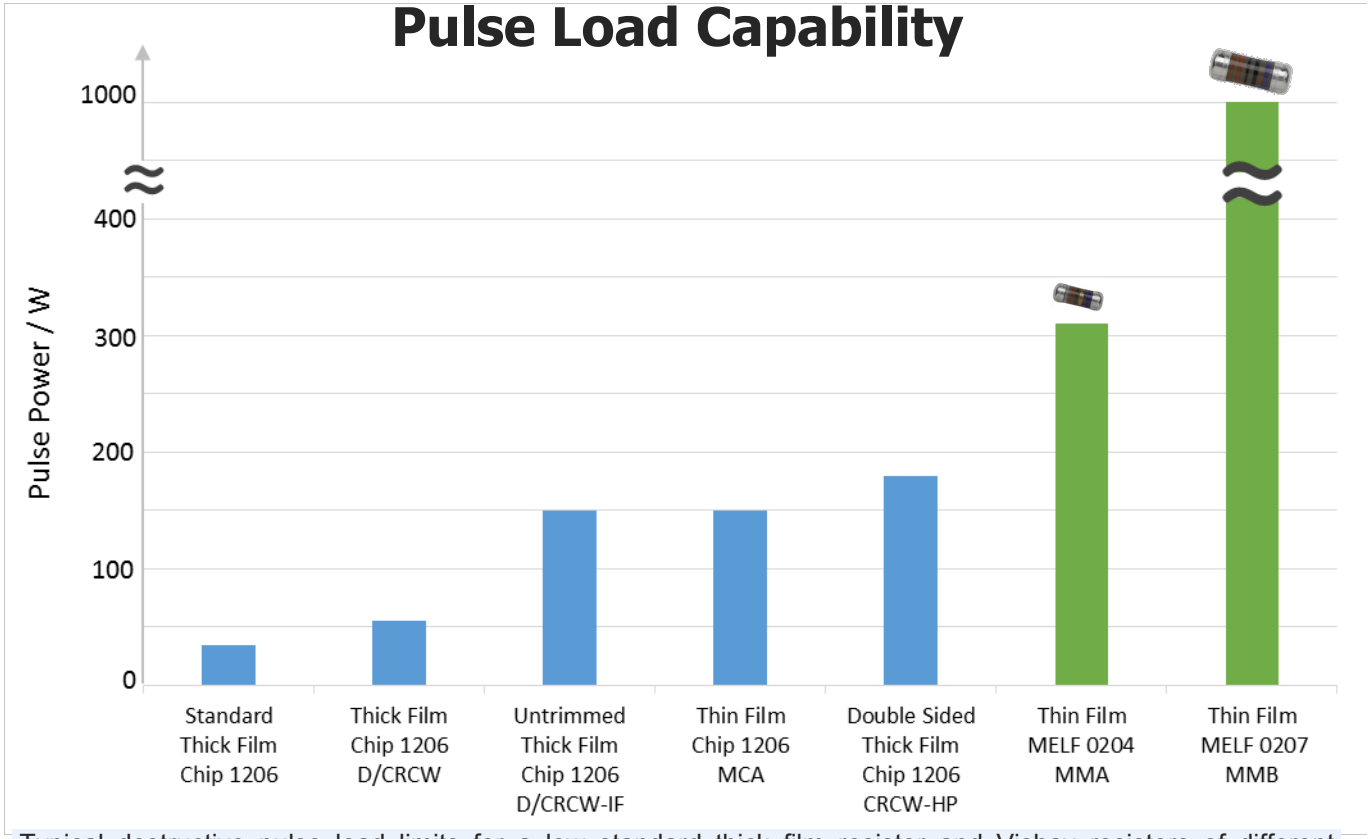


Resistor Type	Maximum Resistive Drift after 1000 hours	Maximum Resistive Drift after 8000 hours
Vishay – MM & SMM Thin Film MELF Resistor	**±0.25%**	**±0.5%**
Thick Film Chip Resistor	±1%	±2%

Resistive drifts shown are considering endurance specification in product datasheets for operation at rated dissipation, resulting in a film temperature of 155 °C. For the thick film chip resistor a typical specification of 1% resistance drift after 1000h operation at rated dissipation has been taken into account.

The MM and SMM MELF resistors with cylindrical design and helical trimming cut offer an excellent resistive drift as low as 0.25% after 1000 h of operation at full rated power. This is also known as endurance at 70°C test as described in the product datasheet. The chart and table here illustrate the MELF resistors specified resistive drift over time compared to a standard thick film chip resistor.

TECHNICAL ADVANTAGE: PULSE LOAD CAPABILITY



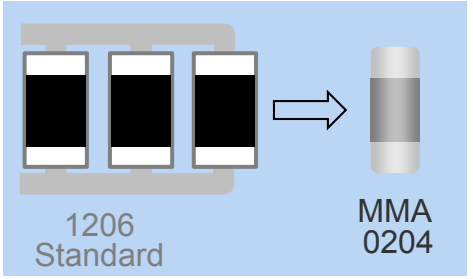
Typical destructive pulse load limits for a low standard thick film resistor and Vishay resistors of different technologies (R = 1KΩ). Pulses were applied by capacitor discharge, with a pulse length corresponding to a 3 ms rectangular pulse.

The MM and SMM MELF resistors cylindrical design offers the largest effective resistive film area of equivalent case size components. In addition, the resistors helical trimming cut avoids locally enhanced current densities. Thereby a uniform and efficient distribution of the heat generated by the pulse load can be attained. Both, MM and SMM MELF resistors offer best in class pulse load capability. The diagram illustrates their destructive pulse load limit compared to thin and thick film chip resistors.

COMMERCIAL BENEFITS

MM and SMM Thin Film MELF Resistor Series allow the user to…

- reduce the number of components in pulse load applications
  1 MELF resistor can replace up to 3 chip resistors of equivalent case size
- save board space or increase PCB integration density
- reduce pick and place costs
- increase application reliability by reducing the number of solder joints



Example

The MM and SMM Thin Film MELF Resistor Series from Vishay offer significantly higher pulse load capability as compared to thin and thick film chip resistors of equivalent case size. This allows for a reduction of component count by replacing up to three devices of equivalent case size, consequently saving board space and lowering costs. The MM and SMM Thin Film MELF Resistor series thus enable engineers to design cost-sensitive, accurate and reliable applications.

APPLICATIONS

Reliable Professional Electronics

Automotive

- LED lighting
- Battery management systems
- Engine Control Units
- ABS

Industrial

- Drives
- DC/DC converters
- PWM applications
- Programmable logic controllers

Alternative Energy

- Inverter
- Power Meters

Today, various applications require components with excellent long-term stability, high pulse load capability or advanced power rating. The Vishay MM and SMM MELF resistor series combine the advantages of thin film technology with enhanced pulse load capability, making the devices suited for a variety of pulse load applications. From automotive electronics to industrial appliances, the MM and SMM Thin Film MELF Resistors are the perfect choice for a wide variety of power circuitry types where precision, reliability, and power dissipation are of major concern.

SUMMARY

- One of the best in class pulse load capability
- Superior load life stability down to ≤ 0.05% after 1000 h life test
- MM and SMM MELF resistor series feature up to 1 W power rating in case size 0207
- Significantly reduces component counts and saves board space
- Excellent choice for most fields of modern power electronics where increased power dissipation, high operating temperatures or space restrictions are of major concern

In summary, the Vishay MM and SMM Thin Film MELF Resistor series offer one of the best in class pulse load capability and a high power rating up to 1 W in case size 0207. This allows for a reduction in component counts and replacement of larger case sizes to save board space and lower costs in power electronics circuits. Important high-reliability applications will benefit from AEC-Q200 qualification as well as from the superior load life stability, excellent moisture and sulfur resistivity. Combining the advantage of thin film technology with high pulse load capability in one device, the MM and SMM series are the perfect choice for most fields of today's and tomorrow's emerging high power electronics.