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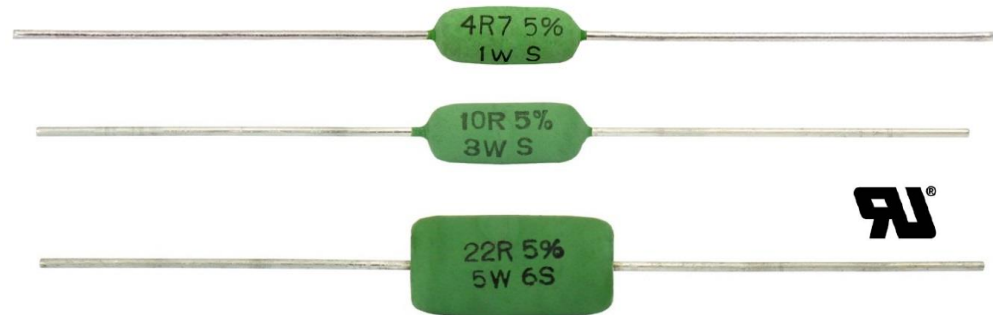
# AC-CS Axial Cemented Fusible Leaded Wirewound Safety Resistors

## Product Overview

OCT-12-2020

# INTRODUCTION

- Purpose
  - Overview of the AC01-CS, AC03-CS and AC05-CS fusible wirewound safety resistors
- Objectives
  - Present an overview of this product's special electrical parameters
  - Discuss product features
  - Discuss product advantages



Welcome to the Vishay AC-CS fusible wirewound safety resistors product overview. This tutorial will present an overview of the AC01-CS, AC03-CS and AC05-CS products. The electrical parameters of the safety resistor series will be discussed as well as features, benefits and applications.

# MAIN FEATURES OF THE AC-CS SERIES

- UL 1412 recognized fusible wirewound safety resistors (UL File No. E362452)



- Rated power,  $P_{40}$ 

AC01-CS	AC03-CS	AC05-CS
1.1W	3W	5W

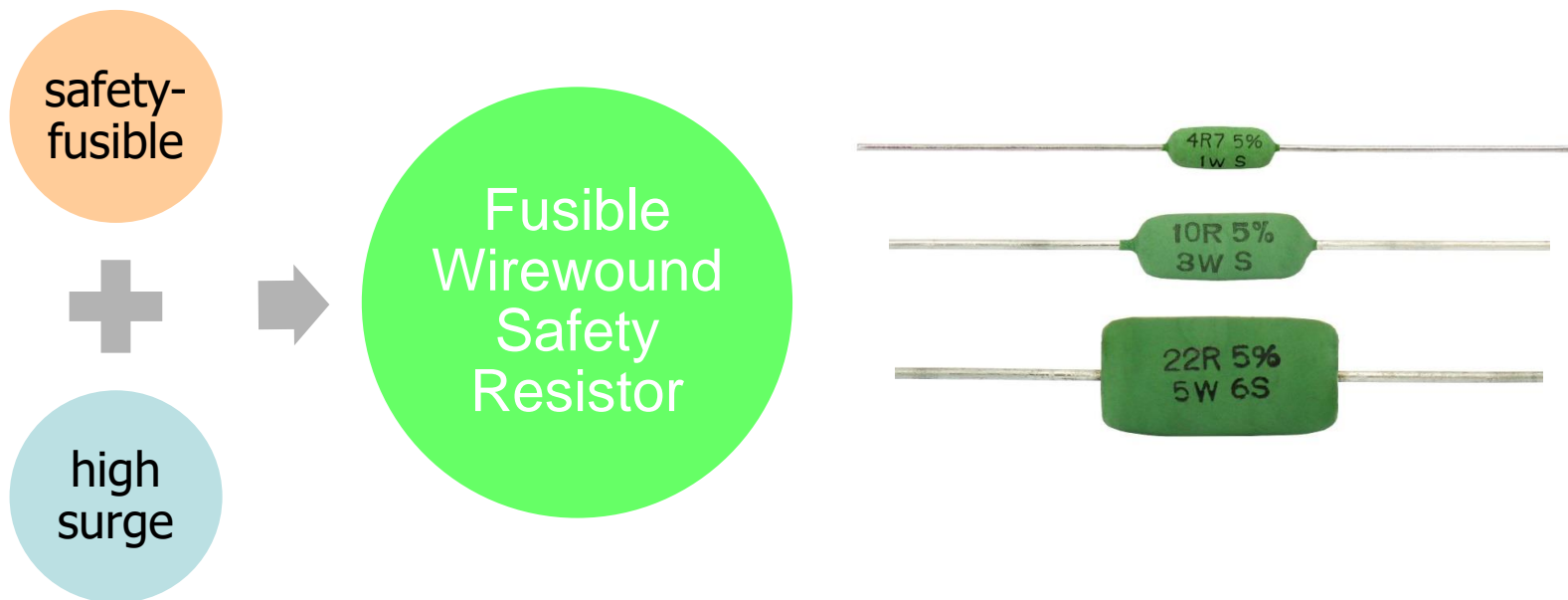
	RATED POWER, $P_{40}$	SURGE VOLTAGE MAX.	FUSING TIME	OHMIC RANGE	DIAMETER	LENGTH
AC01-CS	1.1 W	0.7 kV to 3.2 kV	< 30 s for 30 W overload	3 $\Omega$ to 100 $\Omega$ , 5 %	5 mm	11 mm
AC03-CS	3 W	2 kV to 4 kV	< 25 s for 45 W overload	4.7 $\Omega$ to 100 $\Omega$ , 5 %	6 mm	13 mm
AC05-CS	5 W	4 kV (10 $\Omega$ to 20 $\Omega$ ) 6 kV (22 $\Omega$ to 100 $\Omega$ )	< 45 s for 100 W overload	10 $\Omega$ to 100 $\Omega$ , 5 %	10 mm	17 mm

- Non-flammable silicone coating for immediate interruption without flame and explosion when mains voltage (230 VAC) is applied
  - The AC-CS is a dual function component: high surge resistor and fuse
- Note: Surge voltage capability as per 1.2/50  $\mu$ s pulse as per IEC 61000-4-5

Encapsulated by a special lacquer that exhibits superior safety fusing, the Vishay AC-CS series is UL1412 recognized. Additionally, the 1.1W(AC01-CS), 3W (AC03-CS) and 5W (AC05-CS) resistors exhibit pulse handling capabilities up to 3.2 kV, 4 kV and 6 kV respectively. The AC01-CS series is offered from 3 $\Omega$  to 100 $\Omega$ , AC03-CS series is offered from 4.7 $\Omega$  to 100 $\Omega$  while the AC05-CS series is offered from 10 $\Omega$  to 100 $\Omega$ .

# COMPETITIVE BENEFITS

- The AC-CS is a dual function component: high surge resistor and fuse



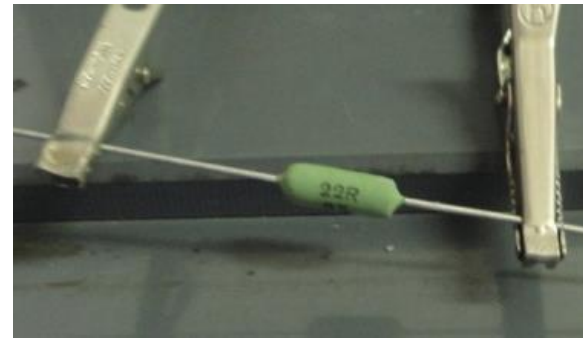
AC-CS components use specially selected resistive winding wire and a special non-flammable silicone coating material to ensure safe and silent fusing operation in overload conditions. This allows them to be used as fusible safety resistors (or AC mains voltage input resistors). Under normal operation these resistors act as an in-rush current limiting resistor with a surge capability of up to 3.2 kV for AC01-CS, 4 kV for the AC03-CS or 6 kV for the AC05-CS. Additionally, resistors from this series fuse “without a bang” when an AC mains voltage 115 VAC or 230 VAC is applied. This means that AC-CS components can be used to meet the requirements of safety approval while eliminating the need for additional fuses in series with a standard input resistor.

# FUSING OPERATION

- Safe and silent fusing operation in overload conditions



- Fusible resistor offered by competitors fuses with spark and explosion

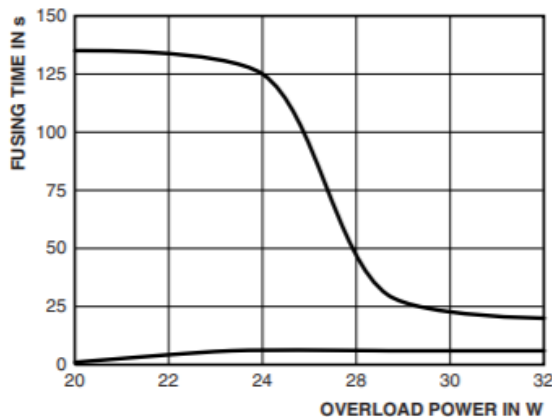


- Vishay AC-CS safety resistor fuses silently without spark or explosion

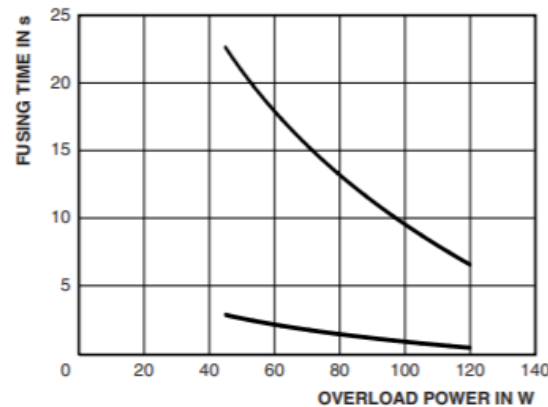
The special non-flammable silicone coating utilized in the construction of the AC-CS helps prevent flame or explosion when an AC mains voltage 115 VAC or 230 VAC is applied. To compare, fusible resistors offered by competitors produce heavy and visible sparks under similar overload conditions. In addition to being non-flammable, the specially developed lacquer coating meets the excellent thermal and electrical insulating properties of standard silicone cement coatings.

# FUSING CHARACTERISTICS

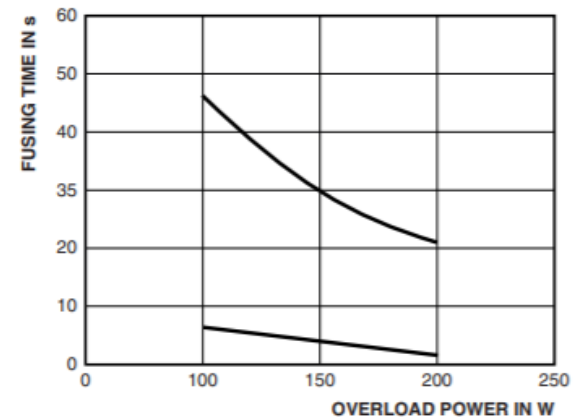
- The AC-CS has well-defined fusing characteristics when exposed to overload



FUSING CHARACTERISTICS  
OF AC01-CS:  $3.0 \Omega \leq R \leq 100 \Omega$



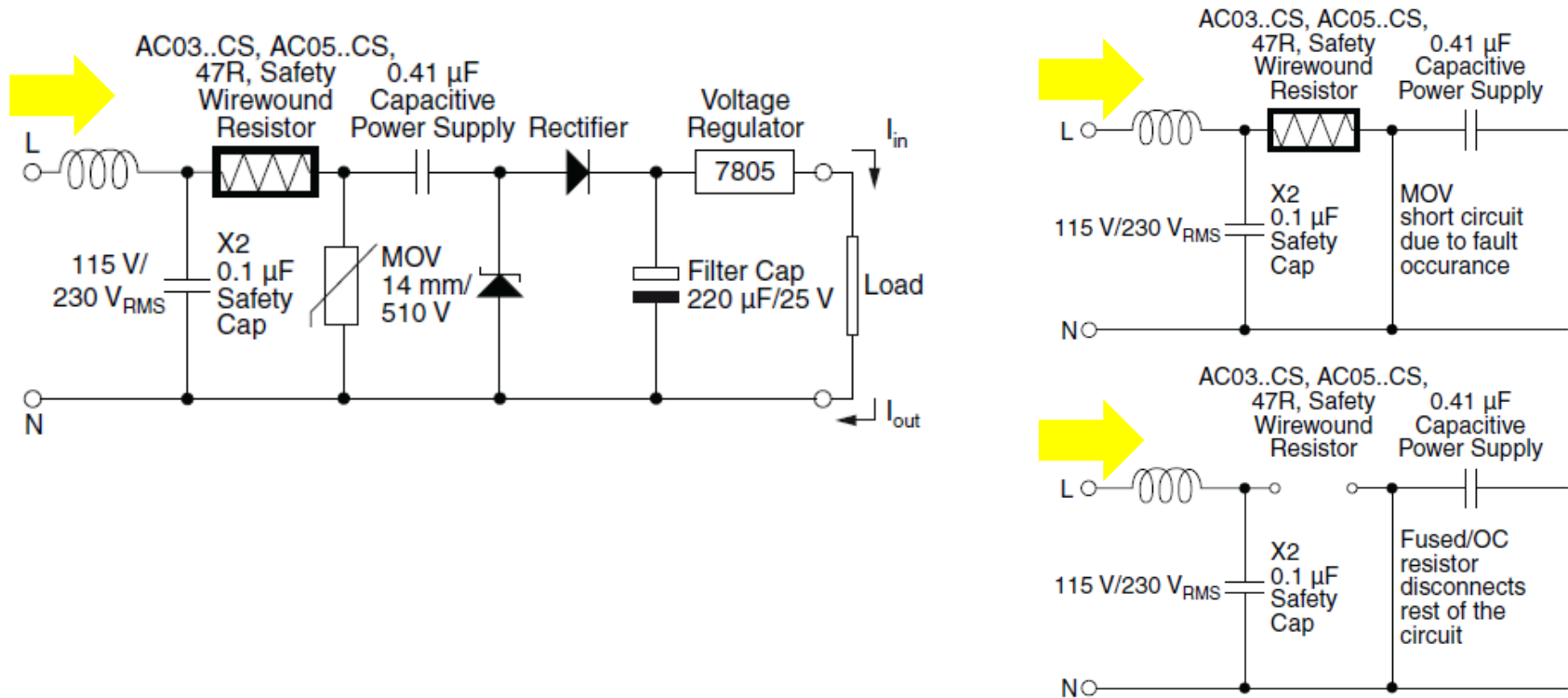
FUSING CHARACTERISTICS  
OF AC03-CS:  $4.7 \Omega \leq R \leq 100 \Omega$



FUSING CHARACTERISTICS  
OF AC05-CS:  $10 \Omega \leq R \leq 100 \Omega$

The AC-CS resistor series is designed with specially selected resistive wire and multilayer coating allowing for well-defined fusing behavior when exposed to overload power. For example, the AC01-CS has a fusing time lower than 30s for 30W overload, the AC03-CS series has a fusing time of less than 25s when exposed to a 45W overload condition while the AC05-CS series has a fusing time of less than 45s when exposed to 100W.

# INRUSH CURRENT CONTROL



In the schematic shown above (on the left), the AC-CS safety resistor is being used to limit inrush current. The ohmic value should be carefully chosen to avoid dissipating too much power while being large enough to limit inrush current. When the MOV is short-circuited during a fault condition (as shown in the top right image), the mains voltage 115 VAC or 230 VAC appears across the safety resistor, drawing a high current and eventually fusing the resistor. This creates an open circuit (as shown in the bottom right image). In this design, the resistor helps to protect the other circuit sections during a voltage surge, all without creating a flame, spark or explosion.



# APPLICATIONS



## Alternative Energy

- Power Meter
- Gas Meter
- Smart Grid Solutions



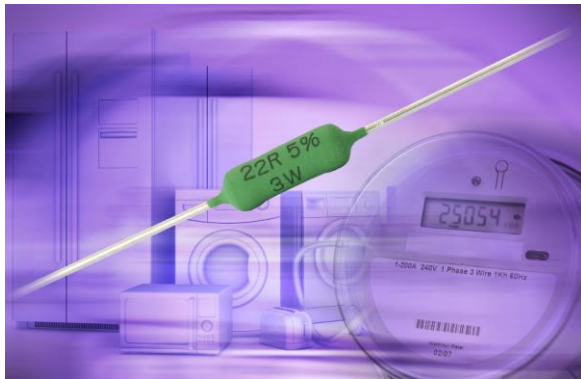
## Consumer

- Domestic Appliances
  - Washing Machine
  - Dishwasher
- Battery Chargers



## Industrial

- Arc Fault Breaker
- Fire Control Systems
- Power Supply



These wirewound resistor series are especially designed for industrial applications like energy meters. Also due to its safety features it is used in applications like washing machines, dishwasher, and battery chargers. The AC-CS series from Vishay may be used in applications of different market segments, from consumer to industrial segment. There is a place for the AC-CS in a variety of circuitry types where safety requirements and high surge voltage are required.



## SUMMARY AC01-CS, AC03-CS, AC05-CS

- Dual function component: high surge resistor and safety fusible
- Safe fusing without “spark” or “explosion”
- UL1412 recognized
- Inrush current limiting and circuit protection
- Perfect choice for designing energy meters and power supplies

In summary, Vishay AC01-CS, AC03-CS and AC05-CS series are the most suitable products recommended in applications specifically with safety concerns. The products are UL certified which makes them ideal to be used in power applications, power supplies, and power meters.