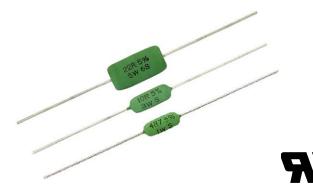
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Vishay Draloric

# **Axial Cemented Fusible Leaded Wirewound Safety Resistors**



### **ADDITIONAL RESOURCES**



ACxx-CS series wirewound safety resistors are designed to be used as fusible safety resistors (or AC mains input resistors). The resistor fuses "without a bang" when AC mains voltage is applied. At the same time, it acts as an in-rush current limiting resistor for normal operation. The specially developed lacquer coating has superior thermal and electrical insulating properties. This allows designers to more easily meet the requirements of safety approval, whilst eliminating the need to put additional fuses in series with the input resistor.

# **FEATURES**

- UL1412 recognized; UL file no. E362452
- Surge voltage handling capability (up to 6 kV) (1.2 / 50 µs pulse in IEC 61000-4-5)
- Silent and safe fusing
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912



RoHS COMPLIANT HALOGEN FREE GREEN (5-2008)

# APPLICATIONS

- Energy meters
- LED drivers
- White goods
- Power supplies

STANDARD ELECTRICAL SPECIFICATIONS							
ТҮРЕ	POWER RATING P <sub>40</sub>	POWER RATING P <sub>70</sub>	LIMITING VOLTAGE U <sub>max.</sub> V	RESISTANCE RANGE <sup>(1)</sup>	TOLERANCE	TEMPERATURE COEFFICIENT	
AC01-CS	1.1 W	1 W	$\sqrt{P \times R}$	3 $\Omega$ to 100 $\Omega$	± 5 %	± 200 ppm/K	
AC03-CS	3 W	2.5 W	$\sqrt{P \times R}$	4.7 $\Omega$ to 100 $\Omega$	± 5 %	± 200 ppm/K	
AC05-CS	5 W	4.5 W	$\sqrt{P \times R}$	10 $\Omega$ to 100 $\Omega$	± 5 %	± 200 ppm/K	

Note

<sup>(1)</sup> Resistance value to be selected for  $\pm 5$  % from E24 series

TECHNICAL SPECIFICATIONS						
DESCRIPTION	AC01-CS	AC03-CS	AC05-CS			
Operating temperature range	-40 °C to 200 °C					
Max. resistance change for 116 % of $P_{70}$ , $\Delta R$ max., after 1000 h:	± (5 % <i>R</i> + 0.1 Ω)					

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PART NUMBER AND PRODUCT DESCRIPTION								
Part Number: AC03000	Part Number: AC03000002209JACCS							
	A C 0 3 0 0 0 0 2 2 0 9 J A C C S							
TYPE	VERSION TO	R/MATERIAL	RESIS	TANCE	TOLERAN	CE	PACKAGING	SPECIAL
	radial taped A (A fo	0 = neutral (0 option for C01-CS and AC03-CS) A = 4 kV $B = 6 kV$ and B option or AC05CS) AC G63 CDxxxx	1 digit n MULT 8 = ' 9 = ' 0 = ' 1 = '	*10 <sup>0</sup>	<b>J</b> = ± 5 9	%	AC 6B 6F R1 RB	CS = Safety
AC03-CS	22R	5 %	0		AC		G63	CDxxxx
TYPE AC01-CS AC03-CS AC05-CS	RESISTANCE		-	PAC	KAGING AC 6B 6F R1 RB	Т	APE WIDTH G63 G83 G93	SPECIAL

PACKAGING						
TYPE	CODE	QUANTITY	PACKAGING STYLE	WIDTH	PITCH	DIMENSIONS
AC01-CS	AC	500	Taped acc. to IEC 60286-1 fan-folded in a box	63 mm	5 mm	85 mm x 72 mm x 260 mm
ACUT-CS	R1	1000	Taped acc. to IEC 60286-2 on a reel	-	-	-
AC03-CS	AC	500	Taped acc. to IEC 60286-1 fan-folded in a box	63 mm	5 mm	85 mm x 120 mm x 270 mm
AU03-US	R1	1000	Taped acc. to IEC 60286-2 on a reel	-	-	-
	6B	250	Taped acc. to IEC 60286-1 fan-folded in a box	83 mm	10 mm	110 mm x 87 mm x 325 mm
AC05-CS	6F	250	Taped acc. to IEC 60286-1 fan-folded in a box	93 mm	iu mm	120 mm x 87 mm x 325 mm
	RB	250	Taped acc. to IEC 60286-2 on a reel	-	-	-



# DESCRIPTION

ACxx-CS wirewound safety resistor series is designed to be used as fusible safety resistor (or, AC mains input resistors). It uses specially selected resistive winding wire and special non-flammable silicon cement coating material to ensure safe and silent fusing operation in overload conditions.

The resistor fuses "without a bang" when AC mains voltage is applied. At the same time, it acts as an in-rush current limiting resistor for the normal operation.

The specially developed lacquer coating has superior thermal and electrical insulating properties. This allows designers to more easily meet the requirements of safety approval, whilst eliminating the need to put additional fuses in series with the input resistor.

Production is strictly controlled and follows an extensive set of instructions established for reproducibility. Plated steel termination caps are firmly pressed on the ceramic rods. Connecting wires of electrolytic copper plated with 100 % pure tin are welded to the termination caps. Suitable resistive wire is selected as a winding material. An optimized number of windings are wound on a high grade ceramic body. The resistor elements are covered by a green protective coating designed for electrical, mechanical and climatic protection. The special coating provides ideal and silent fusing of the component in overload condition, without burning or explosion.

The ohmic value, tolerance, rated dissipation is stamp marked. Also "S" is marked for safety version and "4S" and "6S" is marked for AC05-CS 4 kV and 6 kV version respectively.

The result of the determined production is verified by an extensive testing procedure performed on 100 % of the individual resistors. Only accepted products are stuck directly on the adhesive tapes in accordance with **IEC 60286-1**.

# MATERIALS

Vishay acknowledges the following systems for the regulation of hazardous substances:

- IEC 62474, Material Declaration for Products of and for the Electrotechnical Industry, with the list of declarable substances given therein <sup>(1)</sup>
- The Global Automotive Declarable Substance List (GADSL) (2)
- The REACH regulation (1907/2006/EC) and the related list of substances with very high concern (SVHC) <sup>(3)</sup> for its supply chain

The products do not contain any of the banned substances as per IEC 62474, GADSL, or the SVHC list, see <u>www.vishay.com/how/leadfree</u>. Hence the products fully comply with the following directives:

- 2000/53/EC End-of-Life Vehicle Directive (ELV) and Annex II (ELV II)
- 2011/65/EU Restriction of the Use of Hazardous Substances Directive (RoHS) with amendment 2015/863/EU
- 2012/19/EU Waste Electrical and Electronic Equipment Directive (WEEE)

Vishay pursues the elimination of conflict minerals from its supply chain, see the Conflict Minerals Policy at <u>www.vishay.com/doc?49037</u>.

### ASSEMBLY

The resistors are suitable for processing on automatic insertion equipment and cutting and bending machines. Excellent solderability is proven, even after extended storage. They are suitable for automatic soldering using wave or dipping.

The resistors are completely lead (Pb)-free, the pure tin plating provides compatibility with lead (Pb)-free and lead-containing soldering processes. The immunity of the plating against tin whisker growth, in compliance with IEC 60068-2-82, has been proven under extensive testing.

The encapsulant is resistant to cleaning solvent specified in IEC 60115-1 <sup>(4)</sup>. The suitability of conformal coatings, if applied, shall be qualified by appropriate means to ensure the long-term stability of the whole system.

### **APPROVALS**

These resistors (AC03-CS and AC05-CS) have UL1412 approval (UL file no. E362452).

### **RELATED PRODUCTS**

For a correlated range of wirewound resistors with high pulse handling capability, please see:

Z300-Cxx series

"High Surge Axial Cemented Wirewound Resistors" www.vishay.com/doc?21027

For a correlated range of standard wirewound resistors, please see:

#### Z300 series

"Industrial Axial Cemented Wirewound Resistors" www.vishay.com/doc?21007

and Z300-C00 series

"Commercial Axial Cemented Wirewound Resistors" www.vishay.com/doc?21047

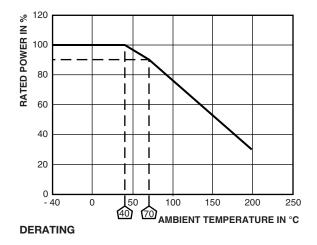
#### Notes

(1) The IEC 62474 list of declarable substances is maintained in a dedicated database, which is available at http://std.iec.ch/iec62474

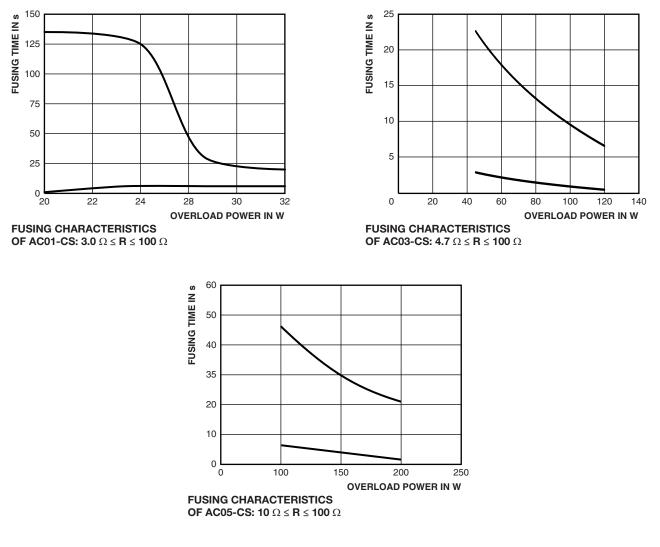
- (2) The Global Automotive Declarable Substance List (GADSL) is maintained by the American Chemistry Council and available at www.gadsl.org
- <sup>(3)</sup> The SVHC list is maintained by the European Chemical Agency (ECHA) and available at <u>http://echa.europa.eu/candidate-list-table</u>
- <sup>(4)</sup> Other cleaning solvents with aggressive chemicals should be evaluated in actual cleaning process for their suitability



# FUNCTIONAL PERFORMANCE



#### Fusing time window defined against overload power applied.

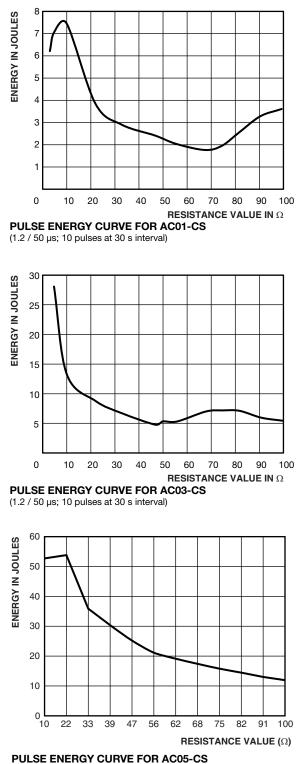


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# FUNCTIONAL PERFORMANCE

Pulse energy curve defined against the offered ohmic range.



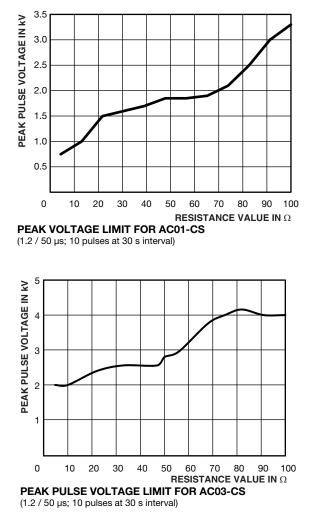
(1.2 / 50 µs; 10 pulses at 30 s interval)





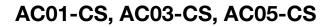
# FUNCTIONAL PERFORMANCE

Peak Voltage (1.2 / 50 µs) graph defined against offered ohmic range.



#### PEAK PULSE VOLTAGE LIMIT FOR AC05-CS

(1.2 / 50 μs; 10 pulses at 30 s interval)
4 kV (10 Ω to 20 Ω) and 6 kV (22 Ω to 100 Ω)





### **TESTS PROCEDURES AND REQUIREMENTS**

All tests are carried out in accordance with the following specifications:

• IEC 60115-1, generic specification (includes tests)

The test and requirements table contains only the most important tests. For the full test schedule refer to the documents above.

The tests are carried out in accordance with IEC 60068-2-xx test method and under standard atmospheric conditions in accordance with IEC 60068-1, 5.3.

Climatic category -40 / 200 / 56 (rated temperature range: lower category temperature, upper category temperature; damp heat, steady state, test duration: 56 days) is valid. Unless otherwise specified the following values apply:

- Temperature: 15 °C to 35 °C
- Relative humidity: 45 % to 75 %
- Air pressure: 86 kPa to 106 kPa (860 mbar to 1060 mbar)

For performing some of the tests, the components are mounted on a test board in accordance with IEC 60115-1, 4.31.

In test table below, only the relevant and commonly referred tests and related clauses of IEC 60115-1 and IEC 60068-2-xx test methods are mentioned.

TEST PROCEDURES AND REQUIREMENTS						
IEC 60115-1 CLAUSE	IEC 60068-2 TEST METHOD	TEST	PROCEDURE	REQUIREMENTS PERMISSIBLE CHANGE (∆R <sub>MAX.</sub> )		
4.13	-	Short time overload	Room temperature; 10x rated power P <sub>40</sub> ; 5 s	± (2 % <i>R</i> + 0.1 Ω)		
4.16	21 (Ua <sub>1</sub> ) 21 (Ub) 21 (Uc)	Robustness of terminations	Tensile, bending and torsion	No damage ± (0.5 % <i>R</i> + 0.05 Ω)		
4.18	20 (Tb)	Resistance to soldering heat	Unmounted components (260 $\pm$ 5) °C; (10 $\pm$ 1) s	± (0.5 % <i>R</i> + 0.05 Ω)		
4.23		Climatic sequence:				
4.23.2	2 (Ba)	Dry heat	16 h; 200 °C			
4.23.3	30 (Db)	Damp heat (accelerated) 1st cycle	24 h; 55 °C; 90 % to 100 % RH			
4.23.4	1 (Aa)	Cold	2 h; -55 °C	± (1 % <i>R</i> + 0.05 Ω)		
4.23.5	13 (M)	Low air pressure	2 h; 8.5 kPa; 15 ℃ to 35 ℃			
4.23.6	30 (Db)	Damp heat remaining cyclic	5 days; 55 °C; 95 % to 100 % RH; 5 cycles			
4.24	78 (Cab)	Damp heat, (steady state)	56 days; (40 ± 2) °C; (93 ± 5) % RH	± (5 % <i>R</i> + 0.1 Ω)		
4.25.2	-	Endurance (at room temperature)	1000 h; loaded with 116 % of <i>P</i> <sub>70</sub> ; 1.5 h ON and 0.5 h OFF	± (5 % <i>R</i> + 0.1 Ω)		
4.25.3	-	Endurance (at 200 °C)	1000 h; without load	± (5 % <i>R</i> + 0.1 Ω)		
-	-	1.2 / 50 μs surge test as defined in IEC 61000-4-5 (up to 6 kV)	Internal impedance of surge tester is 2 Ω; 10 pulses at 30 s interval	± (5 % <i>R</i> + 0.1 Ω)		
-	-	Fail safe mains fusing at 230 V <sub>AC</sub>	-	Resistance > 100 k $\Omega$ , fusing time < 2 s (fusing without flame and explosion)		

Revision: 17-Jan-2020

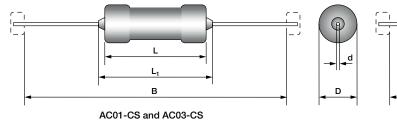
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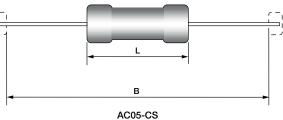
# AC01-CS, AC03-CS, AC05-CS

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# DIMENSIONS





DIMENSIONS - Leaded resistor types, mass and relevant physical dimensions						
MODEL	L <sub>max.</sub>	L <sub>1 max.</sub>	D <sub>max.</sub>	d <sub>nom.</sub>	В	MASS
AC01-CS (1)	11.0 mm	13.0 mm	5.0 mm	0.7 mm	63 mm	0.52 g
AC03-CS	13.0 mm	19.0 mm	6.0 mm	0.8 mm	63 mm	0.78 g
AC05-CS (2)	17.0 mm	17.0 mm	17.0 mm 10.0 mm	0.8 mm	83 mm	2.25 g
AC05-C3 (-)	17.0 mm	17.0 mm	10.0 mm	0.8 11111	93 mm	2.5 g

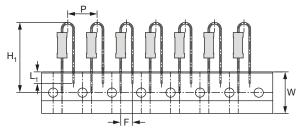
Notes

<sup>(1)</sup> For AC01-CS, dimension given is applicable for 10R to 100R; for lower ohmic values < 10R, D<sub>max</sub> might reach 5.5 mm

<sup>(2)</sup> For AC05-CS,  $L = L_1$ ; there is no lacquer on termination lead

# AC01-CS RADIAL

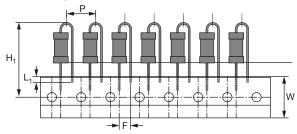
Pitch of components 5.0 mm



#### **DIMENSIONS** in millimeters Ρ Pitch of components $12.7 \pm 1.0$ Lead to lead distance F 4.8 + 0.7 / - 0 Tape width w 18 ± 0.5 Component height H<sub>1</sub> $30.0 \pm 3$ Min. lead wire (tape 2.5 $L_1$ portion) shortest lead

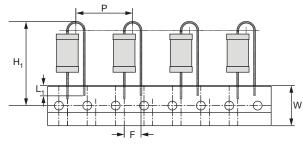
# AC03-CS RADIAL

Pitch of components 5.0 mm



# AC05-CS RADIAL

Pitch of components 7.50 mm



Revision: 1	7-Jan-2020
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<b>DIMENSIONS</b> in mil	limeters	
Pitch of components	Р	12.7 ± 1.0
Lead to lead distance	F	5.00 ± 0.5
Tape width	W	18 ± 0.5
Maximum component height	H <sub>1</sub>	34
Min. lead wire (tape portion) shortest lead	L <sub>1</sub>	2.5

DIMENSIONS in millimeters					
Pitch of components	Р	25.4 ± 1.0			
Lead to lead distance	F	7.50 ± 0.5			
Tape width	W	18 ± 0.5			
Component height	H <sub>1</sub>	37 ± 2			
Min. lead wire (tape portion) shortest lead	L <sub>1</sub>	2.5			

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