Z – LEAD SURFACE MOUNT SPECIFICATION
AC AXIAL CEMENTED WIREWOUND RESISTOR
& PR POWER METAL FILM RESISTORS

FEATURES

- Surface mounted version
- Low cost alternative for SMD molded resistor
- High power dissipation in small volume
- High pulse load handling capabilities
- High temperature silicone coating

TECHNOLOGY

Wire wound resistor AC03 / AC05
The resistor element is a resistive wire, which is wound, in a single layer on a ceramic rod. Metal caps are pressed over the ends of the rod. The ends of the resistance wire and tinned copper-clad leads are connected to the caps by welding. The resistor is coated with green silicon cement which is non-flammable, will not drip even at high overloads and is resistant to most commonly used cleaning solvents, in accordance with “MIL-STD-202E, method 215” and “IEC 60068-2-45”.

Metal film power resistor PR03
A homogenous film of metal alloy is deposited on a high-grade ceramic core. The leads are welded on this caps and a helical groove has been cut in the resistive layer. The resistor is coated with red silicon cement which is non-flammable, will not drip even at high overloads and is resistant to most commonly used cleaning solvents, providing electrical, mechanical and climatic protection.

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QUICK REFERENCE DATA

DESCRIPTION	PR03		AC03	AC05
Resistance range (1)	0.33 Ω - 1 MΩ	1 Ω - 1 MΩ	0.1 Ω - 5.1 kΩ	0.1 Ω - 8.2 kΩ
Tolerance and series	±5%, E24	±1%, E24/E96	±5% and ±1%, E24/E96	
Maximum dissipation at T_{amb} = 25 °C	3 W		3 W	5 W
Limiting voltage (DC or RMS)	750 V		-	-
Rated voltage (2)	$\sqrt{Pn \times R}$			
Temperature coefficient (3)	±250 ppm/°C		R < 10 Ω: 0 to 600 ppm/°C R ≥ 10 Ω: - 80 to + 140 ppm/°C (2)	
Basic specification	IEC 60115-1 and 60115-4		IEC60 115-1	
Climatic category (IEC 60068)	55/155/56		40/200/56	
Stability $\Delta R/R_{max}$ after:				
Load	±5% + 0.1 Ω	±1% + 0.1 Ω	±5% + 0.1 Ω	±5% + 0.1 Ω
Climatic tests	±3% + 0.1 Ω	±1% + 0.1 Ω	±1% + 0.05 Ω	±1% + 0.05 Ω
Resistance to soldering heat	±1% + 0.05 Ω	±0.5% + 0.05 Ω	±0.5% + 0.05 Ω	±0.5% + 0.05 Ω

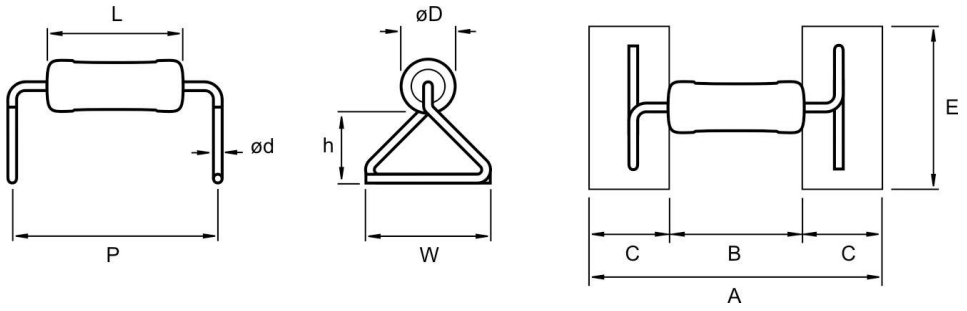
(1) Special resistive values available on request

(2) Maximum rated voltage is the limiting voltage

(3) Temperature coefficient 30, 50 and 90 ppm/°C available on request

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MECHANICAL DATA



Standard pad sizes

Table 1.

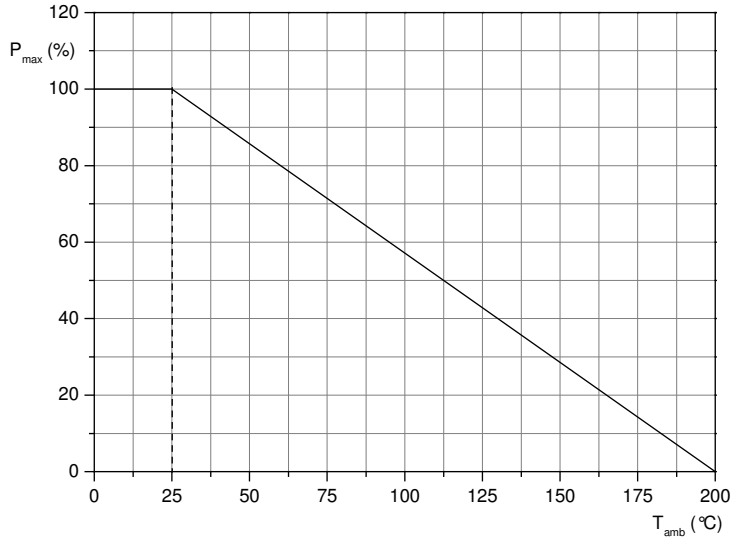
TYPE	L max	ØD max	Ød	P ± 1 (1) (± 0.039)	h max (1) (2)	W max (1)	A min (1)	B max (1)	C min	E min
PR03	16.5 (0.650)	5.2 (0.205)	0.8 FeCu (0.031)	21.0 (0.827)	5.0 (0.197)	7.5 (0.295)	24.5 (0.965)	17.5 (0.689)	3.5 (0.138)	8.0 (0.315)
AC03	12.5 (0.492)	5.5 (0.22)	0.8 FeCu (0.031)	16.5 (0.649)	5.0 (0.197)	7.5 (0.295)	20.0 (0.787)	13.0 (0.512)	3.5 (0.138)	8.0 (0.315)
AC05	17.0 (0.669)	7.5 (0.295)	0.8 FeCu (0.031)	21.0 (0.827)	5.0 (0.197)	7.5 (0.295)	24.5 (0.965)	17.5 (0.689)	3.5 (0.138)	8.0 (0.315)

Dimensions in mm (inches)
(1) Other dimensions available under request
(2) Dimensions to be confirmed

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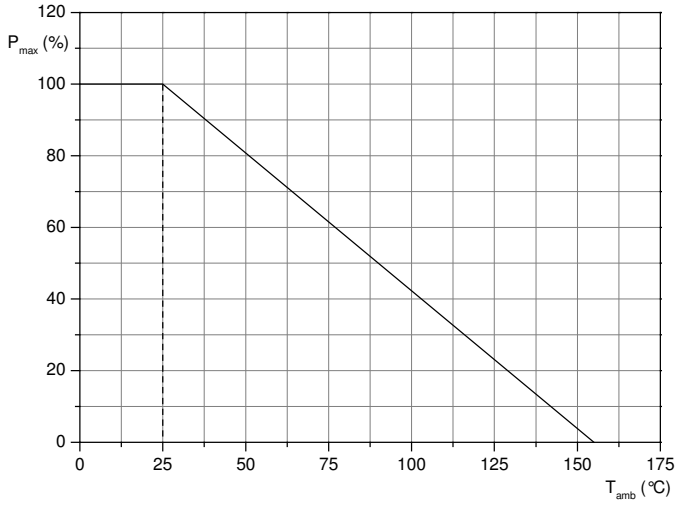
ELECTRICAL CHARACTERISTICS

DERATING: AC03 AND AC05



Maximum dissipation (P_{max}) in percentage of rated power as a function of ambient temperature (T_{amb})

DERATING: PR03



Maximum dissipation (P_{max}) in percentage of rated power as a function of ambient temperature (T_{amb})

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MARKING

WIRE WOUND RESISTOR

The resistor is marked with the nominal resistance value, the tolerance on the resistance and the rated dissipation at T_{amb} = 25 ºC.
For values up to 910 Ω, the R is used as the decimal point.
For values of 1 KΩ and upwards, the letter K is used as the decimal point for the KΩ indication.
Example:

6K8 5%
5W

FILM RESISTOR

The nominal resistance and tolerance are marked on the resistor using four or five colored bands in accordance with IEC publication 60062 “color code for fixed resistors”.
Standard values of nominal resistance are taken from the E24/E96 series for resistors with a tolerance of ±5% or 1%. The values of the E24/E96 series are in accordance with “IEC publication 60063”.

ORDERING INFORMATION

Table 2. Ordering code.

TYPE	LEAD Ø	TOLERANCE	QUANTITY (pcs)	PACKAGING	ORDERING CODE
PR03	0.80 FeCu (0.031)	±1%	200	IN BOX	Under request
		±5%			2306 199 55xxx
AC03		±1%	200		Under request
		±5%			2306 326 55xxx
AC05		±1%	200		Under request
		±5%			2306 321 55xxx

Dimensions unless specified in mm (inches)

The resistors have a 12 digit ordering code starting with 2306.
The subsequent 6 or 7 digits indicate the resistor type and packaging see table 2.
For 5% tolerance the remaining 3 digits indicate the resistance value;
- The first 2 digits indicate the resistance value.
- The last digit indicates the resistance decade in accordance with table 3.

For 1% tolerance the remaining 4 digits indicate the resistance value;
- The first 3 digits indicate the resistance value.
- The last digit indicates the resistance decade in accordance with table 3.

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Table 3. Last digit of ordering code.

RESISTANCE DECADE (5%)	RESISTANCE DECADE (1%)	LAST DIGIT
0.1 - 0.91 Ω	-	7
1 - 9.1 Ω	1 - 9.76 Ω	8
10 - 91 Ω	10 - 97.6 Ω	9
100 - 910 Ω	100 - 976 Ω	1
1 - 9.1 kΩ	1 - 9.76 kΩ	2
10 - 91 kΩ	10 - 97.6 kΩ	3
100 - 910 kΩ	100 - 976 kΩ	4
1 MΩ	1 MΩ	5

Example:
PR03, 15000 Ω, ±5% is **2306 199 55153**

PACKAGING

200 pieces per box

TESTS AND REQUIREMENTS

WIRE WOUND RESISTOR (AC03 AND AC05)

Essentially all tests are carried out in accordance to the schedule of IEC publications 60115 – 1, category 40/200/56 (rated temperature range – 40 to + 200 ℃; damp heat, long term, 56 days and along the lines of IEC publications 60068-2); “Recommended basic climatic and mechanical robustness testing procedure for electronic components” and under standard atmosphere conditions according to IEC 60068-1 subclause 5.3, unless otherwise specified.
In some instances deviations from IEC applications were necessary for our method specified.

Table 5. Test and requirements.

IEC 60115-1 CLAUSE	IEC 60068-2 TEST METHOD	TEST	PROCEDURE	REQUIREMENTS
4.8	-	Temperature coefficient	Between - 40 ℃ and + 200 ℃: R < 10 Ω R ≥ 10 Ω	 0 to 600 ppm/℃ - 80 to +140 ppm / ℃

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IEC 60115-1 CLAUSE	IEC 60068-2 TEST METHOD	TEST	PROCEDURE	REQUIREMENTS
4.13	-	Short time overload	Room temperature; dissipation 10 x Pn; 5 s (voltage not more than 1000 V / 25 mm)	$\Delta R/R_{max}$ ±2% + 0.1 Ω
4.16	21(U)	Robustness of terminations:		No visual damage $\Delta R/R_{max}$ ±0.5% + 0.05 Ω
4.16.2	21(Ua)	Tensile all samples	Load 10 N; 10 s	
4.16.3	21(Ub)	Bending half number of samples	Load 5 N; 4 x 90°	
4.16.4	21(Uc)	Torsion other half number of samples	2 x 180° in opposite directions	
4.17	20(Ta)	Solderability (after ageing)	16 h at 155 °C; leads immersed in flux 600, leads immersed 2 mm for 2 ±0.5 s in a solder bath at 235 ±5 °C	Good tinning; (≥ 95% covered) no visible damage
4.18	20(Tb)	Resistance to soldering heat	Thermal shock: 3 s; 350 ±10 °C; 2.5 mm from body	$\Delta R/R_{max}$ ±0.5% + 0.05 Ω
4.19	14(Na)	Rapid change of temperature	30 minutes at - 40 °C and 30 minutes at + 200 °C; 5 cycles	No visible damage $\Delta R/R_{max}$ ±1% + 0.05 Ω
4.22	6(Fc)	Vibration	Frequency 10 to 500 Hz 0.75 mm or acceleration 10 g, three directions; total 6 h (3 x 2 h)	No visible damage $\Delta R/R_{max}$ ±0.5% + 0.05 Ω
4.23		Climatic sequence		$\Delta R/R_{max}$ ±1% + 0.05 Ω
4.23.2	2(Ba)	Dry heat	16 h; + 200 °C	
4.23.3	30(Db)	Damp heat (accelerated) 1st cycle	24 h; 25 ºC to 55 °C; 90 to 100% R.H.	
4.23.4	1(Aa)	Cold	2 h; - 40 °C	
4.23.6	30(Db)	Damp heat (accelerated) remaining cycles	5 days; 25 °C to 55 °C; 90 to 100% R.H.	
4.24	3(Ca)	Damp heat (steady state)	56 days; 40 °C; 90 to 95% R.H.; loaded with 0.01Pn	No visible damage $\Delta R/R_{max}$ ±1% + 0.05 Ω
4.25.1	-	Endurance (at 25 °C)	1000 h load with 0.9 Pn; 1.5 h ON and 0.5 h OFF.	No visible damage $\Delta R/R_{max}$ ±5% + 0.1 Ω

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IEC 60115-1 CLAUSE	IEC 60068-2 TEST METHOD	TEST	PROCEDURE	REQUIREMENTS
4.29	45 (Xa)	Component solvent resistance	Isopropyl alcohol followed by brushing in accordance with MIL STD 202	No visible damage

FILM RESISTOR (PR03)

Essentially all tests are carried out in accordance to the schedule of IEC publications 60115 – 1, category 55/155/56 (rated temperature range - 55 ℃ to + 155 ℃; damp heat, long term, 56 days and along the lines of IEC publications 60068-2); "Recommended basic climatic and mechanical robustness testing procedure for electronic components" and under standard atmosphere conditions according to IEC 60068-1 subclause 5.3, unless otherwise specified.
In some instances deviations from IEC applications were necessary for our method specified.

Table 7. Test and requirements.

IEC 60115-1 CLAUSE	IEC 60068-2 TEST METHOD	TEST	PROCEDURE	REQUIREMENTS	
				PR03 Tol 5%	PR03 Tol 1%
4.6.1.1	-	Insulation resistance	500 V (DC) during 1 minute, V-block method	$R_{ins\ min}$ 10^4 MΩ	
4.7	-	Voltage proof on insulation	500 V (RMS) during 1 minute, V-block method.	No breakdown or flashover	
IEC 60115-1 CLAUSE	**IEC 60068-2 TEST METHOD**	**TEST**	**PROCEDURE**	**REQUIREMENTS**	
				PR03 Tol 5%	PR03 Tol 1%
4.8	-	Temperature coefficient	Between - 55 ℃ and + 155 ℃	± 250 ppm/℃	
4.16	21(U)	Robustness of terminations:			
4.16.2	21(Ua1)	Tensile all samples	Load 10 N; 10 s	No damage $\Delta R/R_{max}$ ±0.5% + 0.05 Ω	
4.16.3	21(Ub)	Bending half number of samples	Load 5 N; 4 x 90°		
4.16.4	21(Uc)	Torsion other half of samples	3 x 360° in opposite directions		

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IEC 60115-1 CLAUSE	IEC 60068-2 TEST METHOD	TEST	PROCEDURE	REQUIREMENTS	
				PR03 Tol 5%	PR03 Tol 1%
4.17	20(Ta)	Solderability (after ageing)	16 h at 155 °C; immersed in flux 600, leads immersed 2 mm for 2 ±0.5 s in a solder bath at 235 ±5 °C	Good tinning (≥95% covered) No damage	
4.18	20(Tb)	Resistance to soldering heat	Thermal shock: 3 s; 350 °C; 6 mm from body	$\Delta R/R_{max}$ ±1% + 0.05 Ω	$\Delta R/R_{max}$ ±0.5% + 0.05 Ω
4.19	14(Na)	Rapid change of temperature	30 minutes at - 55 °C and 30 minutes at + 155 °C; 5 cycles	No visual damage	
				$\Delta R/R_{max}$ ±2%+0.05 Ω	$\Delta R/R_{max}$ ±1%+0.05 Ω
IEC 60115-1 CLAUSE	**IEC 60068-2 TEST METHOD**	**TEST**	**PROCEDURE**	**REQUIREMENTS**	
				PR03 Tol 5%	PR03 Tol 1%
4.22	6(Fc)	Vibration	Frequency 10 to 500 Hz, displacement 1.5 mm or acceleration 10g; three directions; total 6 h (3 x 2 h)	No damage $\Delta R/R_{max}$ ±0.5% +0.05 Ω	
4.23		Climatic sequence:		$R_{ins\ min}$ 10^3 MΩ	
4.23.2	2(Ba)	Dry heat	16 h; 155 °C		
4.23.3	30(Db)	Damp heat (accelerated) 1st cycle	24 h; 25 °C to 55 °C; 90 to 100% RH		
4.23.4	1(Aa)	Cold	2 h; - 55 °C		
4.23.6	30(Db)	Damp heat (accelerated) remaining cycles	5 days; 25 °C to 55 °C; 90 to 100% R.H.	$\Delta R/R_{max}$ ±3% + 0.05 Ω	$\Delta R/R_{max}$ ±1% + 0.05 Ω
4.24	3(Ca)	Damp heat (steady state)	56 days; 40 °C; 90 to 95% R.H.; loaded with 0.01 Pn	$R_{ins\ min}$ 10^3 MΩ	
				$\Delta R/R_{max}$ ±3% + 0.05 Ω	$\Delta R/R_{max}$ ±1% + 0.05 Ω
4.25.1	-	Endurance (at 25 °C)	1000 h loaded with Pn or V_{max}, 1.5 h ON and 0.5 h OFF.	$\Delta R/R_{max}$ ±5% + 0.05 Ω	$\Delta R/R_{max}$ ±1% + 0.05 Ω
4.29	45(Xa)	Component solvent resistance	Isopropyl alcohol followed by brushing MIL STD 202	No visual damage	

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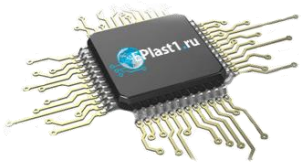
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