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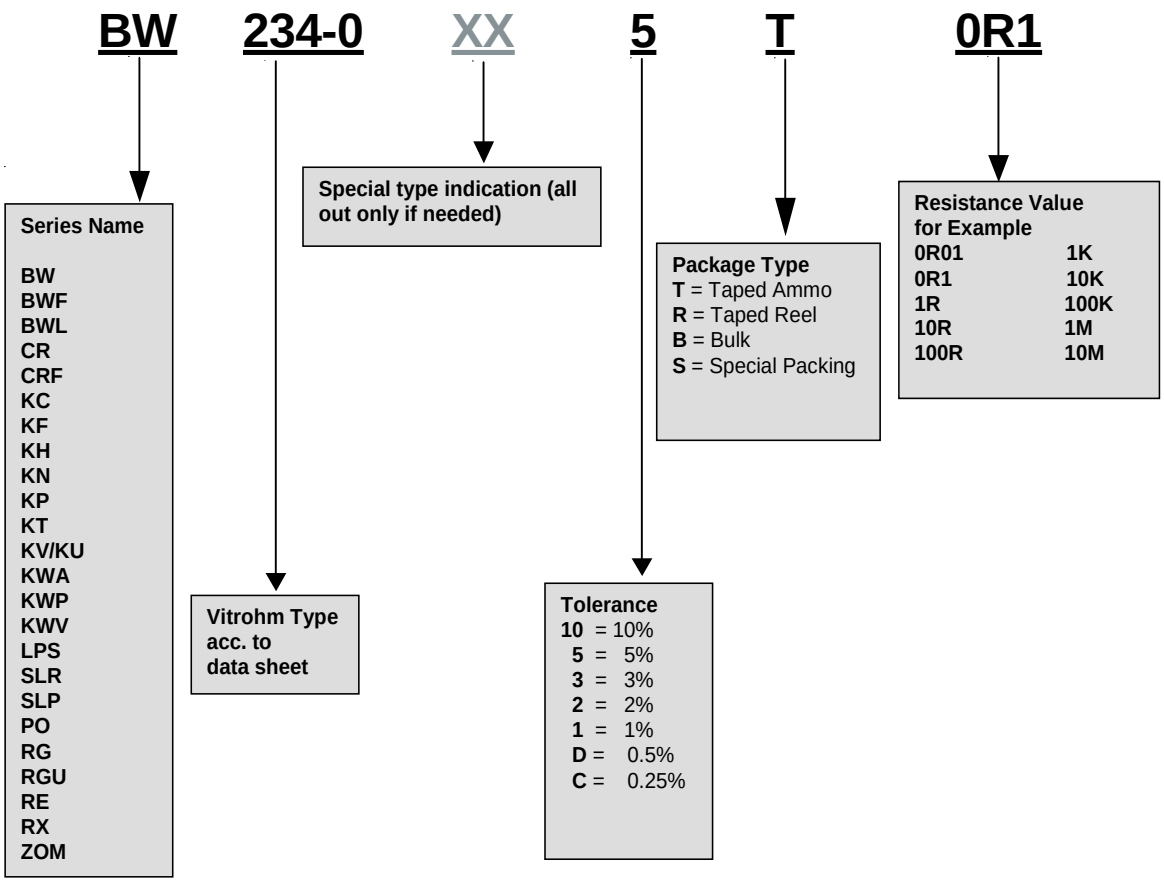
Contents by Series

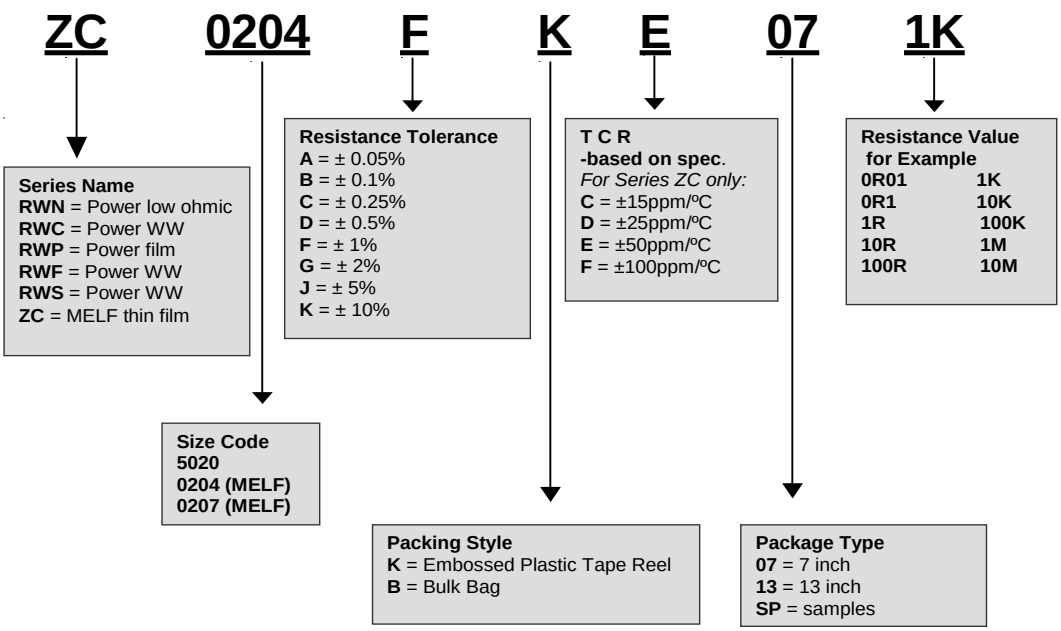
VITROHM

Explanation :

Wirewound & Film Resistor



SMD Resistors



Type

Internal Vitrohm-reference for a certain component, normally identical with the ordering-number.
IEC 115-1 clause 2.2.2

Series

Collection of types with similar constructional features and comparable technical data.

Style

Industrialized, often internationally standardized, designation with respect to the dimensions of a component, e.g. length/width, diameter/length.
IEC 115-1 clause 2.2.3

Dimensions

The accurate mechanical size of a certain type or tabular for a series. If without tolerances, refer to DIN 7168 (coarse).

Rated Power P_{70}

Electrical power defined by current and voltage a resistor can bear continuously. Commonly the value is given for 70°C ambient temperatur.
IEC 115-1 clause 2.2.13

Resistance range

Data, showing the minimum and maximum resistance value possible for a given type or series.

Series E of preferred values

Internationally standardized staggeration for resistance values within one decade, different E-series vary on the total number of values per decade. The preferred values result (approximated) from

$$\sqrt[E]{10^{n}} \qquad (n = 1, 2, 3 \ldots E)$$

IEC 115-1 clause 2.3.2 and IEC 63

Tolerances

Here admissible deviation from nominal resistance value at the moment of receiving. Possible resistance changes due to electrical, climatic or mechanical stress are not included in the nominal tolerance.

Temperature coefficient

A value, determined by materials and styles, indicating the dependency of a resistance value from temperature. Resistance changes caused by temperature coefficient are reversible.
IEC 115-1 clauser 2.2.20.2 and 4.8.4.2

Voltage coefficient

A value mainly determined by materials, indicating the dependency between resistance value and applied voltage. The voltage coefficients is negative, resulting resistance changes are reversible.
IEC 115-1 clauses 2.2.25 and 4.11

Maximum continuous working voltage

Limit for the voltage applied to a resistor. May not be exceeded, even if other limitations, e.g. rated power, are not reached. If instead of a voltage value the general equation is given, the limiting voltage is only determined by the rated power.
IEC 115-1 clause 2.2.16

Thermal resistance

A value influenced by materials and dimensions indicating the selfheating of a resistor by electrical power.

Insulation voltage

Test voltage applied for one minute between components terminals and sheathing (e.g. surface). The given value does not define continuous isolation.
IEC 115-1 clause 2.2.17

Insulation resistance

Electrical resistance between components terminals and sheathing. Given for a certain measuring voltage, e.g. 100 V or 500 V.
IEC 115-1 clauses 2.2.19 and 4.6

Climatic category

Defined in IEC 68-1, this statement establishes the lowest and highest test temperature (category temperature) as well as the duration of humidity-testing. Consequently climatic category substitutes according to the CECC- and IEC-approval-systems the former applicability classes of DIN 40040, which were almost impossible to verify by testing.

Temperature range

Limits for ambient temperature. Components may be used within the stated limits.
IEC 115-1 clause 2.2.9

Derating

Reduction of electrical power at increased ambient temperature, to avoid excess of maximum surface temperature by selfheating.
IEC 115-1 clause 2.2.24

Failure rate

Number of statistically possible defects, depending on time and quantity of components. If not stated differently, the given value refers to total-failure under nominal conditions.

Load life

Relative irreversible resistance change after a certain testing time. Normally related to rated power 70°C ambient temperature and 1000 hours testing.
IEC 115-1 clause 4.25

Damp heat, steady state

Relative irreversible resistance change after a defined climatic stress.
IEC 115-1 clause 4.24

Climatic sequence

Relative irreversible resistance change after a defined sequence of climatic stresses.
IEC 115-1 clause 4.23

Terminal strength

Relative irreversible resistance change after a defined sequence of mechanical stresses to the terminals. Test procedures according to CECC or IEC are standardized in the applicable detailed specification.

Terminal tensile strength

Limit for the tensile force applied to the terminals.

Resistance to soldering heat

Relative irreversible resistance change due to soldering. Test procedures according to CECC or IEC are standardized in the applicable detailed specification.
IEC 115-1 clause 4.18

Current noise

A voltage, having a statistical distribution of frequencies, depending on the DC-current through the resistor. Current-noise-voltage is additional to thermal noise, which depends on materials and styles.
IEC 115-1 clause 4.12

Non-linearity

A value for possible non-linearity between current through and voltage applied to an ohmic resistor.

Standards

Here enumeration of norms and standard specifications, nationally or internationally known for a given series of components. If applicable also the CECC-detailed-specification to which the given series has been approved to.

Packaging units

Quantity packed in a standard packaging unit, method of packing, in cases possibilities of selection.

Ordering-example

Necessary order processing-details for required components.

Preferred values acc. to DIN/IEC

VITROHM

E 6	E 12	E 24
1.0	1.0	1.0
		1.1
	1.2	1.2
		1.3
1.5	1.5	1.5
		1.6
	1.8	1.8
		2.0
2.2	2.2	2.2
		2.4
	2.7	2.7
		3.0
3.3	3.3	3.3
		3.6
	3.9	3.9
		4.3
4.7	4.7	4.7
		5.1
	5.6	5.6
		6.2
6.8	6.8	6.8
		7.5
	8.2	8.2
		9.1

E 48	E 96	E 192	E 48	E 96	E 192	E 48	E 96	E 192	E 48	E 96	E 192	E 48	E 96	E 192
100	100	100	162	162	162	261	261	261	422	422	422	681	681	681
		101			164			264			427			690
	102	102		165	165		267	267		432	432		698	698
		104			167			271			437			706
105	105	105	169	169	169	274	274	274	442	442	442	715	715	715
		106			172			277			448			723
	107	107		174	174		280	280		453	452		732	732
		109			176			284			459			741
110	110	110	178	178	178	287	287	287	464	464	464	750	750	750
		111			180			291			470			759
	113	113		182	182		294	294		475	475		768	768
		114			184			298			481			777
115	115	115	187	187	187	301	301	301	487	487	487	787	787	787
		117			189			305			493			796
	118	118		191	191		309	309		499	499		806	806
		120			193			312			505			816
121	121	121	196	196	196	316	316	316	511	511	511	825	825	825
		123			198			320			517			835
	124	124		200	200		324	324		523	523		845	845
		126			203			328			530			856
127	127	127	205	205	205	332	332	332	536	536	536	866	866	866
		129			208			336			542			876
	130	130		210	210		340	340		549	549		887	887
		132			213			344			556			898
133	133	133	215	215	215	348	348	348	562	562	562	909	909	909
		135			218			352			569			920
	137	137		221	221		357	357		576	576		931	931
		138			223			361			583			942
140	140	140	226	226	226	365	365	365	590	590	590	953	953	953
		142			229			370			597			965
	143	143		232	232		374	374		604	604		976	976
		145			234			379			612			988
147	147	147	237	237	237	383	383	383	619	619	619			
		149			240			388			626			
	150	150		243	243		392	392		634	634			
		152			246			397			642			
154	154	154	249	249	249	402	402	402	649	649	649			
		156			252			407			657			
	158	158		255	255		412	412		665	665			
		160			258			417			673			

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Designation of resistance values according to IEC 62 and MIL:

resist. value	IEC 62	MIL 39008
0,1 Ohm	0R1 (R10)	-
1,0 Ohm	1R (1R0)	1R0
10 Ohm	10R	100
100 Ohm	100R (K10)	101
1000 Ohm	1 K (1K0)	102
10 KOhm	10K	103
0,1 MOhm	100K (M10)	104
1,0 MOhm	1M (1M0)	105
10,0 MOhm	10M	106

4-band colour code
colour coding of resistance values and tolerances

colour	1st band= 1st digit	2nd band= 2nd digit	3rd band= multi-plier	4th band= tole-rance
without	-	-	-	±20%
silver	-	-	x 0,01 Ω	±10%
gold	-	-	x 0,1 Ω	± 5%
black	-	0	x 1,0 Ω	-
brown	1	1	x 10 Ω	± 1%
red	2	2	x 100 Ω	± 2%
orange	3	3	x 1 kΩ	-
yellow	4	4	x 10 kΩ	-
green	5	5	x 100 kΩ	-
blue	6	6	x 1 MΩ	-
violet	7	7	x 1 MΩ	-
grey	8	8		-
white	9	9		-

5-band colour code
colour coding of resistance values and tolerances

*1*st band= 1st digit	2nd band= 2nd digit	3rd band= 3rd digit	4th band= multi-plier	5th band tole-rance
-	-	-	-	
-	-	-	x 0,01 Ω	
-	-	-	x 0,1 Ω	± 5%
-	0	0	x 1,0 Ω	-
1	1	1	x 10 Ω	± 1%
2	2	2	x 100 Ω	± 2%
3	3	3	x 1 kΩ	-
4	4	4	x 10 kΩ	-
5	5	5	x 100 kΩ	±0,5%
6	6	6	x 1 MΩ	-
7	7	7	x 1 MΩ	-
8	8	8		-
9	9	9		-

:

Tolerances according to MIL:

Tolerance	MIL
10 %	K
5 %	J
2 %	G
1 %	F
0,5 %	D
0,25 %	C
0,1 %	B

Designation and coding of temperature coeff.:

100	$\frac{10^{-6}}{K}$	T0	brown
50	"	T2	red
25	"	T9	yellow
15	"	T10	orange
10	"	T13	blue
5	"	T16	violet
2	"	T18	-

Resistors in the DC-circuit:

R = resistance value [Ω] I = current [A]
U = voltage [V] P = power [W]

$$R = \frac{U}{I} \qquad I = \frac{U}{R} \qquad U = I \bullet R$$

$$P = I^2 \bullet R \qquad P = \frac{U^2}{R} \qquad P = U \bullet I$$

Resistors in series

$$R_{ges.} = R_1 + R_2 + \ldots Rn$$

Resistors in parallel

$$\frac{1}{R_{ges.}} = \frac{1}{R_1} + \frac{1}{R_2} + \ldots \frac{1}{Rn}$$

2 resistors in parallel

$$R_{ges.} = \frac{R_1 \bullet R_2}{R_1 + R_2}$$

Voltage divider R_1 in series with R_2

$$U_{ges.} = U_1 + U_2$$

$$\frac{U_1}{U_2} = \frac{R_1}{R_2}$$

Current splitting R_1 in parallel with R_2

$$I_{ges.} = I_1 + I_2$$

$$\frac{I_1}{I_2} = \frac{R_2}{R_1}$$

Temperature coefficient for wirewound resistors:

Series K

Table 1: Temperature coefficient of resistive wires used for series KC, KH, KV, KT, KF (Power wirewound resistors of Vitrohm with high pressure crimped contact)

P_{70}	Typ/*Type*	TK/*TC* $400^{\pm 50}$	TK/*TC* 0^{+40}_{-80}	TK/*TC* $0^{\pm 10}$
1W	200	0R056 - 0R2	0R22 - 300R	330R - 9K1
2W	202	0R075 - 0R43	0R47 - 620R	680R - 20K
3W	204	0R33 - 0R68	0R75 - 1K	1K1 - 30K
4W	206	0R056 - 0R2	0R22 - 300R	330R - 9K1
5W	208	0R075 - 0R3	0R33 - 470R	510R - 15K
7W	210	0R11 - 0R68	0R75 - 1K	1K1 - 30K
	212	0R075 - 0R3	0R33 - 470R	510R - 15K
9W	214	0R11 - 0R68	0R75 - 1K	1K1 - 30K
11W	216	0R15 - 1R	1R1 - 1K3	1K5 - 47K
17W	218	0R27 - 1R6	1R8 - 2K4	2K7 - 82K

TC in ppm = 10^{-6} K^{-1}

Series KP

Table 2: Temperature coefficient of resistive wires used for series KP

P_{70}	Type	TC $400^{\pm 50}$	TC 0^{+40}_{-80}	TC $0^{\pm 20}$
2 W	290	0R2 - 0R24	0R27 - 560R	620R - 7K5
4 W	292	0R3 - 0R39	0R32 - 820R	910R - 11K
5 W	294	0R47 - 0R62	0R68 - 1K3	1K5 - 20K
6,5W	296	0R68 - 0R91	1R - 1K8	2K - 27K
8 W	298	0R91 - 1R2	1R3 - 2K4	2K7 - 36K

Series BW / BWF

Table 3: Temperature coefficient of resistive wires used for series BW/BWF

234-0	0R1 . . . 0R15	TK ± 600	237-0	0R1	TK ± 1000
	0R16 . . . 0R62	TK ± 300		0R11 . . . 0R18	TK ± 600
	0R68 . . . 1K2	TK ± 150		0R2 . . . 0R68	TK ± 300
				0R75 . . . 1K	TK ± 150
235-0	0R1 . . . 0R16	TK ± 1000			
	0R18 . . . 0R68	TK ± 800	236-0	0R1	TK ± 1800
	0R75 . . . 2K4	TK ± 400		0R11 . . . 0R16	TK ± 1000
				0R18 . . . 0R68	TK ± 800
				0R75 . . . 1K	TK ± 400

Due to mechanical contacts resistive changes of ± 1,5 % are possible. This may influence results of TC-measurments.

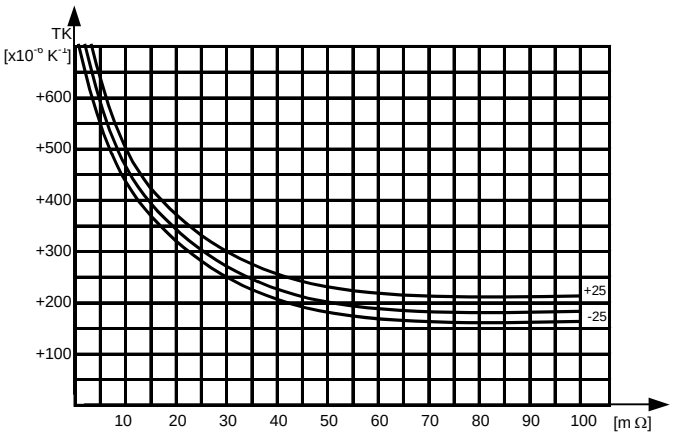


Diagram: Temperature coefficient of metal-band resistors series KN (350-354)

Pulse capability of resistors:

General information on pulse capability very often need additional explanations and do not always comply with a given application.
Please contact factory or sales office for your special requirements. For dealing with your application we need the following information:

- Pulse shape and repetition rate
- max. peak power
- Pulseduration or time constant
- max. peak voltage
- Resistance value

If already selected:

- Type or series or technology
- or preferred style

The Quality Assurance System of Vitrohm Group meets all requirements of CECC 00114 part 1, Harmonized System of Quality Assessment for Electronic Components (System of Quality Assessment for General Requirements) and meets also the requirements of DIN-ISO 9001:2000.

By this statement the General Management obliges all employees to fulfil their duties in accordance with the Quality Handbook, to assure the quality of all Vitrohm Products to meet the requirements of CECC and other standards.

All technical data given in this catalogue are based on statistical methods using equipments of modern techniques. The data are based on mass production. Therefore, testresults of singular specimens might differ from the average range of series.

All details in printed form are legally binding only after written confirmation conforming to §§ 463 and 480 II BGB.

We reserve the right to change products and specifications due to technical development.

TÜV

TÜV Rheinland Portugal, Lda.

Grupo TÜV Rheinland Berlin-Brandenburg

CERTIFICATE

The Certification Body TÜV Rheinland Portugal, Lda.

Certifies that the company

Vitrohm Portuguesa – Resistências Eléctricas, Lda
Estrada Nacional 249 – 4
Trajouce
2785-653 São Domingos de Rana
Portugal

has established and applies a Quality Management System for

Manufacturing of fixed wirewound resistors and fixed metal glaze resistors

An audit was performed, report n° 0 01 03065

Proof has been furnished that the requirements are fulfilled according to

NP EN ISO 9001:2000

This certificate is valid until 28 January 2007

Certificate Registration n° 0 01 03065

ACREDITAÇÃO IPQ

Certificação Gestão da Qualidade

ACREDITAÇÃO IPQ

Lisboa, 2004-01-29

Place, Date of emission

Responsible for the Certification Body

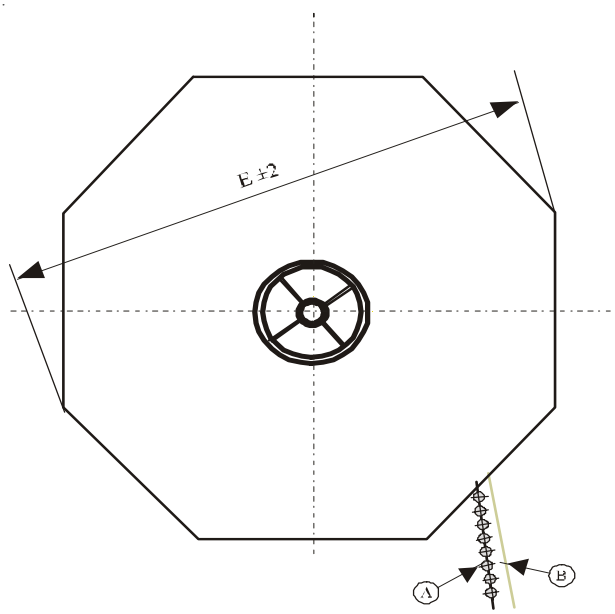
TÜV Rheinland Portugal, Lda.

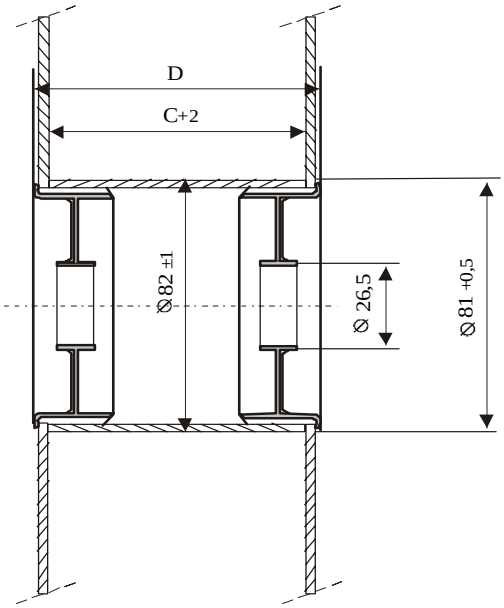
Rua Camilo Castelo Branco, 34-3° - 1050-045 Lisboa

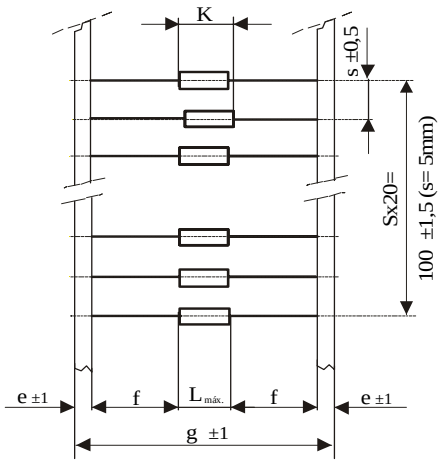
Taping Specification for axial components

Series	Type	Style	L_{max}	Taping e	Taping s	Taping g	Pieces Reel	Pieces E	Pieces Ammo
KC	200-0	0416	18,0	6	5	95	2000	356	1000*
	202-0	0424	26,0	6	5	95	2000	356	1000*
	204-0	0432	33,0	6	5	95	2000	356	1000*
KH	206-8	7x7x20	21,0	6	10	95	1000	356	-----
	208-8	7x7x25	26,0	6	10	95	1000	356	-----
	210-8	7x7x38	39,0	6	10	95	1000	356	-----
	212-8	10x10x26	26,0	6	10	95	500	356	-----
	214-8	10x10x38	39,0	6	10	95	500	356	-----
BW / F	234-0	0411	10,1	6	5	85	4000	356	1000*
	235-0	0614	14,5	6	10	85	1000	356	1000*
	236-0	0614	14,5	6	10	85	1000	356	1000*
	237-0	0411	10,1	6	5	85	4000	356	1000*
BWL	BWL 0614	0614	14,5	6	10	85	1000	356	1000*
CR / F	251-0/4	0309	9,5	6	5	65	5000	356	1000*
	253-0/4	0414	14,5	6	10	85	2000	356	1000*
	254-0/4	0612	13,5	6	10	85	1000	356	1000*
	255-0	0915	15,0	6	10	85	1000	356	500*
	256-0/4	0617	18,0	6	10	85	1000	356	1000*
	257-0/4	0918	19,0	6	10	85	1000	356	500*
	258-0	0922	23,0	6	10	85	1000	356	500*
	259-0	0927	27,0	6	10	85	1000	356	500*
KN	350-8	7x7x18	19,0	6	10	85	1000	356	-----
RG	515-0	0207	6,6	6	5	65	5000	356	1000*
	520-0	0309	8,2	6	5	65	5000	356	1000*
PO	590-0	0617	16,5	9	10	95	1000	270	1000*
	591-0	0922	20,0	9	10	95	500	270	500*
	593-0	0414	12,0	6	5	85	2500	270	1000*
	595-0	0207	6,3	6	5	65	5000	315	2000*
RX	0207 W5	0207	6,2	6	5	65	-----	-----	5000*
	0410 1W	0410	10,0	6	5	65	-----	-----	2000*
	0515 1W	0515	15,0	6	5	65	-----	-----	1000*
	0512 3W	0512	12,0	6	5	65	-----	-----	1000*
	0613 3W	0613	13,0	6	10	65	-----	-----	1000*
	0516 3W	0516	15,5	6	10	65	-----	-----	1000*
	0616 3W5	0616	16,0	6	10	65	-----	-----	1000*
	0716 3W	0716	16,0	6	10	65	-----	-----	500*
	0716 4W	0716	16,0	6	10	65	-----	-----	500*
ZOM	ZOM0207	0207	6,6	6	5	65	5000	356	2000*

*Standard







A	taped resistors
B	intermediate paper
C	inner reel width g+5
D	outer reel width g+10
E	maximum reel diametre

$L_{máx.}$ Body length

k $L_{máx.}$ +1,4 (k concentric betrween the tapes)

f	≥ 20 mm
g	taped width
s	step size
e	taped width

standard taping acc. to IEC 60286-1

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SMD Power Resistors

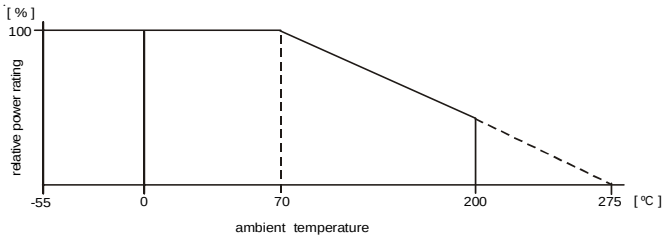
RoHS compliant

Specifications

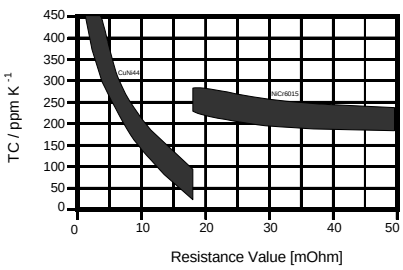
Type			RWN 5020	RWC 5020
Styles			5020	
Dimensions		mm	non inductive, no winding	wirewound on ceramic
Power rating ϑ_o = 200°C		W	P_{25} 2,2 P_{40} 2,0 P_{70} 1,6	
Single pulse	$I_{max.}$	A	50	
	$E_{i, max}$	mWs	625	
	$T_{imp, max}$	ms	5	
periodic pulse load	i_{max}	A	30 (R003 .. .R018) 40 (R022 ... R050)	
	$E_{i,per, max}$	mWs	225	
	$t_{imp, max}$	ms	5	
	t_{pause}	ms	100	
Tolerance		%	1, 2, 5 (F, G, J)	1, 2, 5 (F, G, J)
Resistance range		Ω	0R003 ... 0R050	0R051 ... 100R
Temperature coefficient		ppm K^{-1}	see diagram	± 80
E-Series			0R003, 0R005, ≥ 0R01 : E 12	E 12
			diverging values on request	
max. cont. work. voltage		V_{RMS}	$\sqrt{P \cdot R}$	
Thermal resistance		K/W	100 [1)]	
Insulation voltage (1 min.)		V_{RMS}	1000	
Insulation resistance			> 1000MΩ	
Climatic category			55/175/56	
Temperature range		°C	–55 . . . 200	
Endurance (P_{70}, 70°C, 1000h)		$[\frac{\Delta R}{R}]$ %	≤ 1,0	
Damp heat, steady state		$[\frac{\Delta R}{R}]$ %	≤ 0,25	
Resistance to soldering heat		$[\frac{\Delta R}{R}]$ %	≤ 0,25	
Short time overload (5 * P_{70}/5sec)		$[\frac{\Delta R}{R}]$ %	≤ 1%	
Temperature shock			≤ 0,25	
Board-bending-test			no interruption	
Solderability			suitble for wave and reflow soldering in acc. with CECC 0082	

[1)] Thermal data according to DIN 44050 with solder pads as on next page.

Derating:

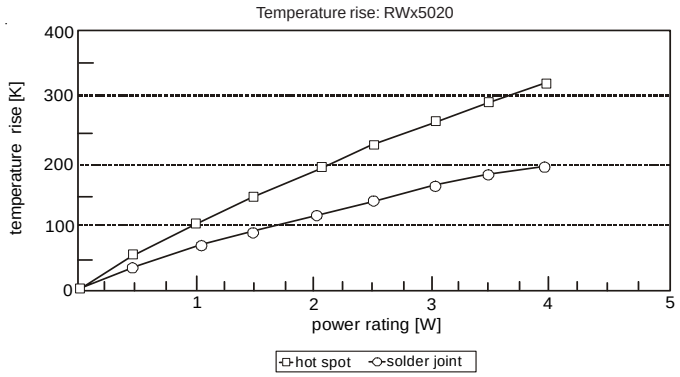


TC-Diagram (RWN 5020):

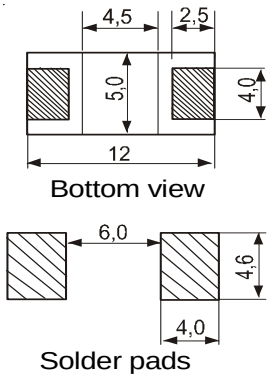


Temperature range -55 +165ºC

Temperature rise:

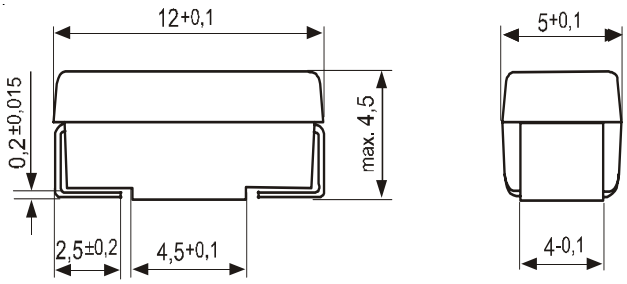


recommended solder pads:



Part mounted on FR 4, pads as recommended, copper layer 35 µm

Dimensions:



Marking:	Resistor: printed in clear: Type - Value - Tolerance					
Packaging	additional Batch-No. - Production date					
Packaging:	blistertape 24 mm antistatic / 1500 pcs. on reel 330 mm Ø					
Ordering example:	RWC 5020 Type	F tolerance	K blister tape reel	- TC	13 reel diameter	1R R-value

SMD Power Metal film resistors

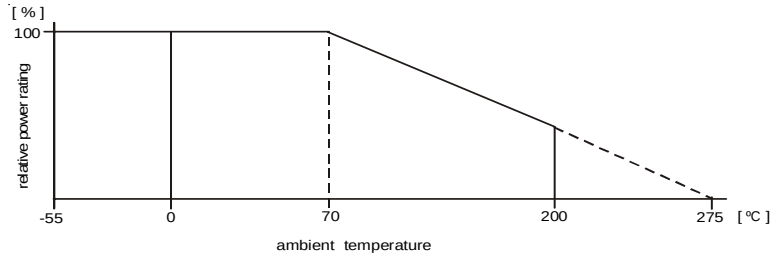
RoHS compliant

Specifications

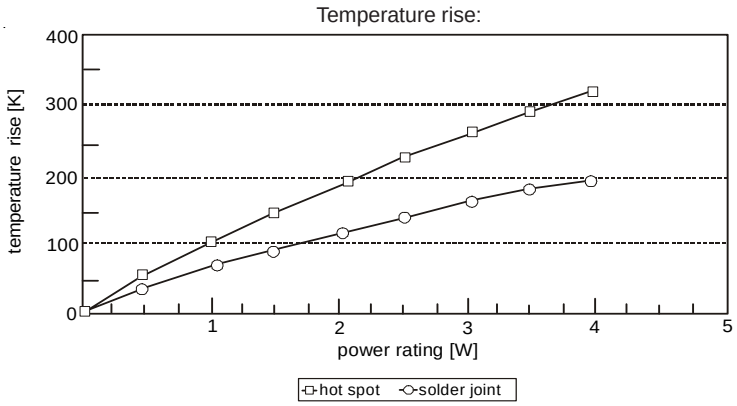
Type		RWP 5020	
Style		5020	
Power rating ϑ_o = 200°C	W	P_{25} 2,2 P_{40} 2,0 P_{70} 1,6	
		higher power depends on mounting technology	
Tolerance	%	1	5
Resistance range	Ω	10R ... 1M	1R0 ... 1M
Temperature coefficient	ppm K^{-1}	± 50	± 200
E-Series		E 96	E 12 preferred
max. cont. work. voltage	V_{RMS}	500	
Thermal resistance	K/W	90 [1)]	
Insulation voltage (1 min.)	V_{RMS}	1000	
Insulation resistance		> 1000MΩ (dry)	
Climatic category		55/175/56	
Temperature range	°C	–55 . . . 175	
Endurance (P_{70}, 70°C, 1000h, intermed.)	$[\frac{\Delta R}{R}]$ %	≤ 1,5	
Damp heat, steady state	$[\frac{\Delta R}{R}]$ %	≤ 1,5	
Resistance to soldering heat	$[\frac{\Delta R}{R}]$ %	≤ 0,25	
Short time overload (5 * P_{70}/2sec)	$[\frac{\Delta R}{R}]$ %	≤ 1%	
Temperature shock		≤ 0,25	
Board-bending-test		no interruption	
Solderability		suitble for wave and reflow soldering in acc. with CECC 0082	

[1)] Thermal data according to DIN 44050 with solder pads as on next page.

Derating:

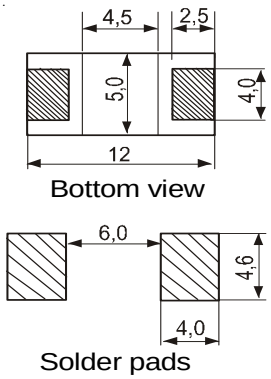


Temperature rise:

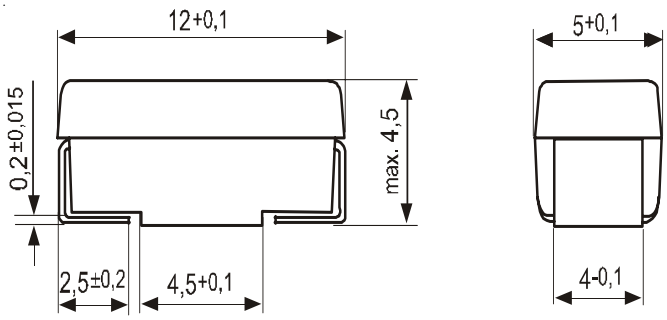


Part mounted on FR 4, pads as recommended, copper layer 35 µm

Recommended solder pads:



Dimensions in mm:



Marking: Resistor: Printed in clear: Type - Value - Tolerance
Package additional Batch-Nr. - Production date

Packaging: Blistertape 24 mm antistatic / 1.500 pcs on reel 330 mm Ø

Ordering example:	RWP 5020	F	K	-	13	10K
	Type	Tolerance	blister tape reel	TC	reel diameter	R-value

VITROHM

SMD Power Resistors
flame retardant, fusible and safety versions

RoHS compliant

Specifications

Type		RWF 5020 Fusible	RWS 5020 Safety
Styles		5020	
		wirewound on core	wirewound on ceramic
Power rating P_{70}	W	P_{25} 2,2 P_{40} 2,0 P_{70} 1,6	
Resistance range	Ω	0R1 ... 1K	1R [2] ... 100R
E-Series		Diverging values on request	
Tolerance	%	5 , 10 (J , K)	5 (J)
Temperature coefficient	$10^{-6} * K^{-1}$	± 1000	120 $^{+50}$
max. cont. work. voltage	$V_{eff/RMS}$	$\sqrt{P_{70} \cdot R}$	
Thermal resistance	K/W	100 [1]	
Climatic category		55 / 175 / 56	
Temperature range	°C	–55 . . . 175	
Endurance (P_{70}, 70°C, 1000h)	$[\frac{\Delta R}{R}]$ %	3 avg	
Damp heat, steady state	$[\frac{\Delta R}{R}]$ %	< 2	
Insulation voltage	$V_{eff/RMS}$	1000	
Insulation resistance		> 1000MΩ (dry)	
Resistance to soldering heat	$[\frac{\Delta R}{R}]$ %	≤ 0,25	
Short time overload (5 * P_{70}/5sec)	$[\frac{\Delta R}{R}]$ %	≤ 1%	
Temperature shock		≤ 0,25	
Solderability		CECC 00802 A (dip test)	
Board-bending-test		no interruption	

[1] Thermal data according to DIN 44050 with solder pads as on next page.
[2] Resistance values < 10R are flame retardant.
The interruption mechanism is not clearly defined and has to be tested in the final application!

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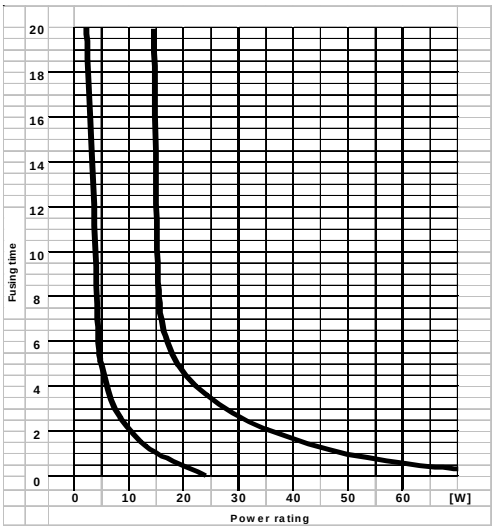
Fusing Characteristics

RWF



RWS

The special construction of resistance values >10R results in an immediate interruption when mains voltage (220/240V_{RMS}) is applied. No flames, no explosion.

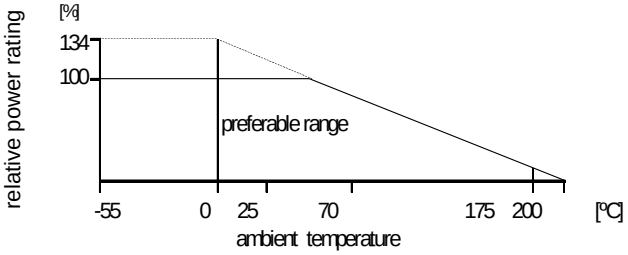
After fusing the resistance values is >100Kohm.

For other voltages test suitability in the application!

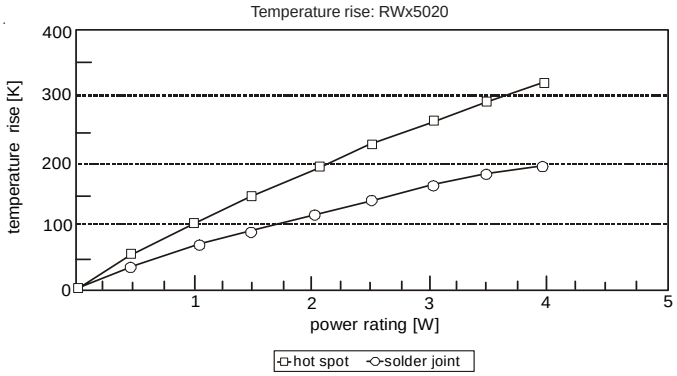
Resistance values <10R are flame retardant.

The interruption mechanism is not clearly defined and has to be tested in the final application!

Derating:

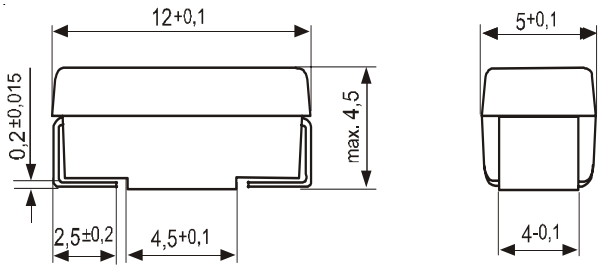


Temperature rise:

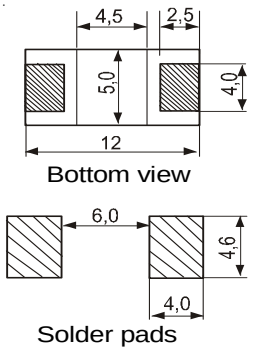


Part mounted on FR 4, pads as recommended, copper layer 35 µm

Dimensions in mm:



recommended solder pads:



Marking:	Resistor: Printed in clear: Type - Value - Tolerance Package additional Batch-Nr. - Production date
Packaging:	Blistertape 24 mm antistatic / 1.500 pcs on reel 330 mm Ø

Ordering example:	RWF5020	J	K	-	13	10R
	Type	Tolerance	blister tape reel	TC	reel diameter	R-value

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General:

VITROHM offers a range of low-ohm resistors for current sensing applications, resistance ranges typically from 1 milliohm to 100 milliohms.

These devices are of non-wound construction and made from flat resistive alloy wire.

The resistor's specification depends on the material and the choosen dimensions, namely specific-resistance, thermal conductivity and temperature coefficient are of importance.

1. Standard, leaded types, KN-family
Types KN 350 ... KN 354

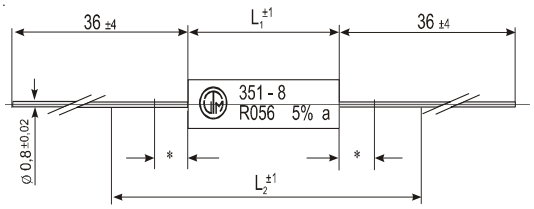
The „KN-resistors" are available in standardized sizes with choices of open-frame and ceramic cased types. Copper leads are welded to the resistive element for board assembly.

Attention should be given to the following:

- resistance value

  The value is specified over a given „measuring length". Between the two measuring points lies the element plus some copper-wire for contact purposes.

  If the actual used total length of the resistor in the application differs from this specified length, the influence of the copper wire of 0.4 mΩ per centimeter must be considered.

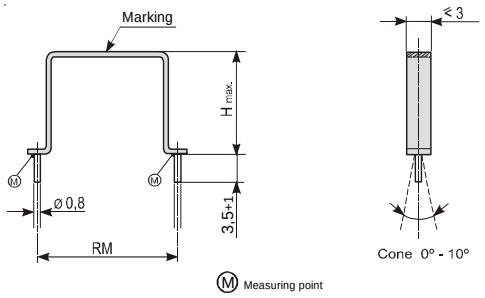


- temperature coefficient

  Typically the temperature coefficient of the resistive element ranges around 150 ppm/°C (ask factory for details). However, the copper wire is part of the effective resistance and influences the TC between the contacts.

  The lower the resistance value, the more influence of the copper leads, the higher the TC!

  If the TC is of concern in a given application, a vertical style of the KN-family should be used (type 35X-009). In this case the influence of the copper wire is almost eliminated.



- power and current rating

  The „KN-resistors" are standard products with a fixed given power rating (P_{70}). Nevertheless, current rating can be of concern, especially if overload or pulse conditions can occure.

  The current limit is defined by the current density, and 100 A per mm² are considered absolute maximum in power electronics. With a 0,8 mm diameter copper wire, the current limit is 50 A.

  With respect to reliability, the welding junction between copper and resistive alloy should not carry more than 20 A continuously.
  The 50 A limit may not be exceeded even under pulse conditions.

2. Semi-customized types, LPS-family
Types LPS 355 ... LPS 359

VITROHM provides tools to produce U-shaped low-ohm resistors for direct board mounting.

The solder-tags (1 or 2 per side) are of given dimensions, the size of the final unit is designed in accordance with the applicational requirements.

If the demand for a shunt-resistor justifies a customized solution, the LPS-family offers a variety of possibilities.

The dimensions of the part are ruled by the requested power rating, as the generated heat need to be dissipated by an appropiate surface area.

To remain within reasonable size-limits, LPS-resistors are made up to 8 W rated power.

Normally, the user defines the resistance value (1 m Ω to 60 mΩ) the requested power and size limitations, if any. According to this, VITROHM designs the part.

Again, attention must be given to some facts:

- **solder tags**

  The parts can be manufactured with 2 or 4 soldertags. 4 are used either for Kelvin-connections or for high current applications.
  Depending from the material's thickness, one solder contact can carry up to 70A, so a 4-contact part can carry 140A (ask factory).

  However, the solder-tag represents a significant resistance if not embedded totally in solder!

  Utmost care must be given during assembly and board soldering, otherwise resistance value will be above specification and overheating at solder joint may occure.

- solderability

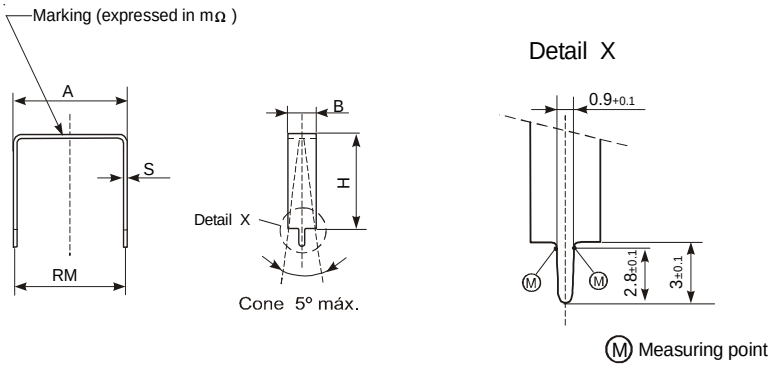
  Solder tags are made from resistive alloy to avoid falsification of temperature coefficient.

  Solderability is enhanced by special chemical cleaning of the surface after production and is preserved by special packing in nitrogene atmosphere.

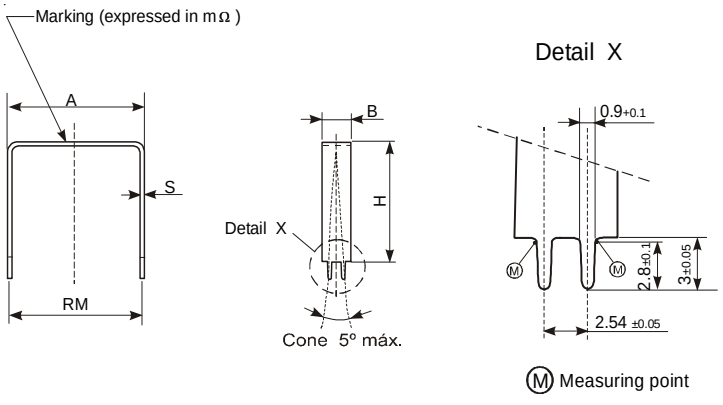
  Nevertheless, in cases, soldering parameters (temperature, time) must be adjusted for good results, as the LPS-resistor acts like a heat-sink during soldering.

Depending on value and power rating, 6 differnt solder tags are available:

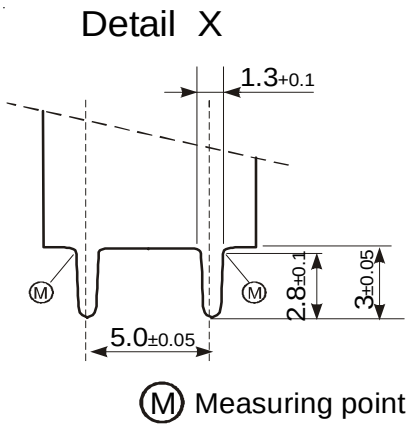
1) Standard pins: LPS 359-0XX



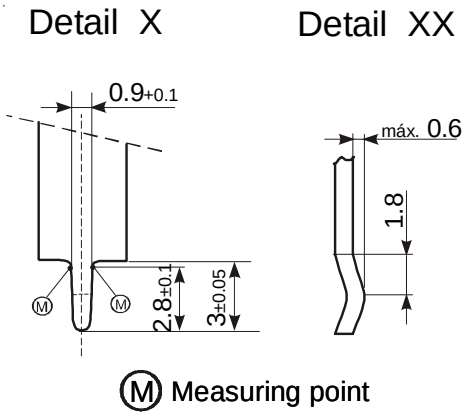
2) Special for low ohms: LPS 359-1XX



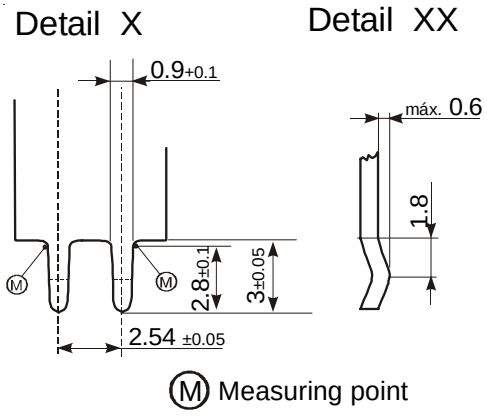
3) Special for very low ohm and high power: LPS 359-2XX



4) Same as LPS 359-0xx, but with a snap in: LPS359-3XX



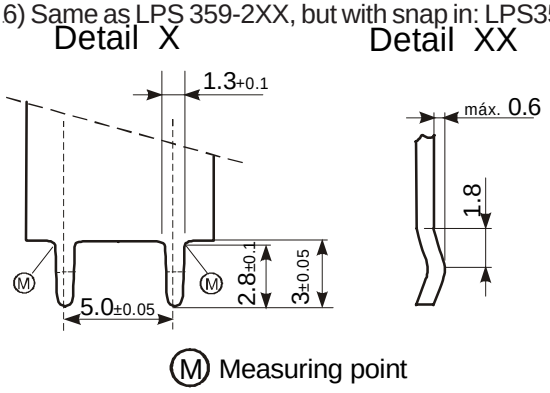
5) Same as LPS 359-1XX, but with a snap in: LPS 359-4XX



Special varieties on request.

RM: Available from 5 to 25 mm, preferably in 5 mm-steps.
H, B and S depend on material, resistance value and required rating.

6) Same as LPS 359-2XX, but with snap in: LPS359-5XX

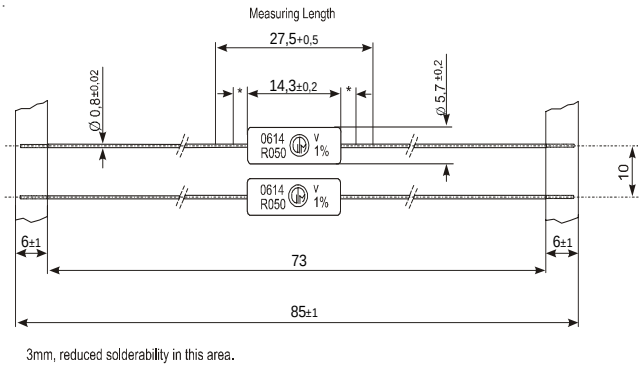


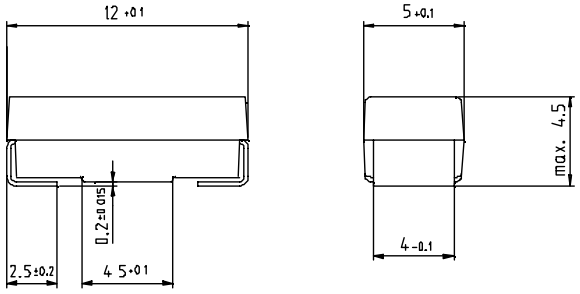
3. Low-Power, moulded types, BWL and RWN families:

If power rating is not the main concern, i.e. current ranges below 5A, a current sensing device in a standard resistor package may be suitable.

VITROHM offers a trough-hole part (BWL) as well as a SMD-version (RWN).

Both are designed for automatic PCB-assembly with either axial taping (BWL) or in blister-tape (RWN).





For the axial leaded BWL type, again „measuring length“ must be regarded in order to obtain correct resistance value on-board.

The power rating for both types is limited by the max. temperature of the moulding material.
Overheating may cause carbonizing of the plastic, short circuit may occur.

This limits also the pulse handling capacity.
50A can be carried by the internal contacts, but energy must not exceed 625 mWs.

VITROHM has the products and the knowledge.

If you need help in designing - in the right product or need more information, please contact your sales-contact for assistance.

Low Ohmic Power Resistors, low inductance, axial

RoHS compliant

Specifications

Type		KN350-0	KN351-0	KN352-0
Styles		3313	3321	3332
Power rating P_{70}	W	1	2	3
Resistance range	Ω	0R003...0R051	0R004...0R068	0R006...0R1
E-Series		E 24 > 0R01		
Tolerances	%	± 1, ± 3, ± 5		
Temperature coefficient	$10^{-6} * K^{-1}$	+ 200 ... + 1200 depends on value		
max. cont. work. voltage	V_{RMS}	$\sqrt{P_{70} \cdot R}$ for all styles		
Insulation voltage (1min.)	V_{RMS}	non insulated		
Insulation resistance	Ω	non insulated		
Derating	°C	linear 70 ... 300 (0W)		
Climatic category		55/200/56		
Temperature range	°C	- 55 ... 300		
Thermal resistance	KW^{-1}	200	100	70
Failure rate (Total, ϑ_o, max., 60% conf. lev.)	$10^{-9} * h^{-1}$	appr. 10, depends on value		
Endurance (P_{70}, @70°C, 1000h interm.)	$[\frac{\Delta R}{R}]$ %	± 3,0		
Damp heat, steady state (40°C, 93% r.h., 56d)	$[\frac{\Delta R}{R}]$ %	± 0,5		
Climatic sequence	$[\frac{\Delta R}{R}]$ %	± 0,5		
Terminal strength	$[\frac{\Delta R}{R}]$ %	± 0,5		
Terminal tensile strength	N	min. 25		
Resistance to soldering heat (260°C, 10s)	$[\frac{\Delta R}{R}]$ %	± 0,2 typ.		
Solderability	s	2,5 Flowtime, solderglobule test, IEC 60068-2-20-T		
Marking		value imprinted		

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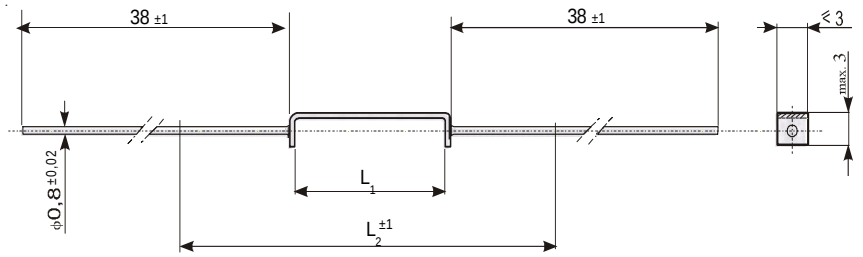
Dimensions in mm:



Type	L_1	L_2 ±1
KN350-0	12 ...14,5	40
KN351-0	17,5 ...21,5	45
KN352-0	29 ... 34	60

Measuring length L_2: Resistance value is measured over the centered length L_2 on terminals free of oxide and contaminations. Differing conditions require adequate corrections ($R_{terminal}$ = 0,4 Ω/cm)

Packaging:

Type	Packaging	Pieces	Pack.Code
KN350-0	bulk	500	B
KK351-0	bulk	500	B
KN352-0	bulk	500	B

Ordering example:

KN351-0	3	B	0R033
Type	Tolerance	Pack.-Code	R-Value

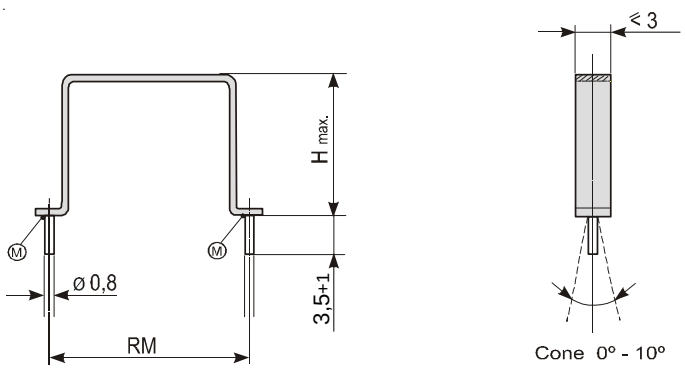
Low Ohmic Power Resistors, low inductance, radial

RoHS compliant

Specifications

Type		KN350-009	KN351-009 KN351-010	KN352-009 KN352-010 KN352-011
Power rating P_{70}	W	0,5	1,0	1,5
Resistance range	Ω	0R003...0R051	0R004...0R068	0R006...0R1
E-Series		E 24 ≥ 0R01		
Tolerances	%	± 1, ± 3, ± 5		
Temperature coefficient	$10^{-6} * K^{-1}$	+ 200 ... + 1200		
max. cont. work. voltage	V_{RMS}	for all styles		
Insulation voltage (1min.)	V_{RMS}	$\sqrt{P_{70} \cdot R}$		
Insulation resistance	Ω	non insulated		
Derating, linear	°C	70 ... 300 (0W)		
Climatic category		55/200/56		
Temperature range	°C	- 55 ... 300		
Thermal resistance	KW^{-1}	200	100	70
Failure rate (Total, ϑ_o, max., 60% conf. lev.)	$10^{-9} * h^{-1}$	ca. 10, depends on value		
Endurance (P_{70}, 70°C, 1000h interm.)	$[\frac{\Delta R}{R}]$ %	± 3,0		
Damp heat, steady state (40°C, 93% r.h., 56d)	$[\frac{\Delta R}{R}]$ %	± 0,5		
Climatic sequence	$[\frac{\Delta R}{R}]$ %	± 0,5		
Terminal strength	$[\frac{\Delta R}{R}]$ %	± 0,5		
Terminal tensile strength	N	min. 25		
Resistance to soldering heat (260°C, 10s)	$[\frac{\Delta R}{R}]$ %	± 0,2 typ.		
Solderability	s	2,5 Flowtime, solderglobule test, IEC 60068-2-20-T		
Marking		value imprinted		

Dimensions in mm:



Type	RM	Hmax.
KN350-009 KN351-009 KN352-009	10	6,5 10,5 17,0
KN351-010 KN352-010	15	8 14,5
KN352-011	20	12

Construction: The resistive elements consist of a flat metal-band. Spotwelded Cu-terminals ensure high stability of contacts. Thus, this construction results in a noninductive resistor of both high stability and overload capacity.

Packaging:

Type	Packaging	Pieces	Pack.Code
KN350-009	bulk	1000	B
KK351-009 KN351-010	bulk	1000	B
KN352-009 KN352-010 KN352-011	bulk	500	B

Ordering example:

KN350-009	5	B	0R015
Type	Tolerance	Pack.-Code	R-Value

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Low Ohmic Power Resistors, low inductance, ceramic case

RoHS compliant

Specifications

Type		KN350-8	KN351-8	KN352-8	KN353-8	KN354-8
Styles		7718	7725	7738	9925	9938
Power rating P_{70}	W	4	5	7	7	9
Resistance range	Ω	0R003 ... 0R051	0R004 ... 0R068	0R006 ... 0R1	0R004 ... 0R068	0R006 ... 0R1
E-Series		E24>0R01	E24>0R01	E24>0R01	E24>0R01	E24>0R01
Tolerances	%	± 1, ± 3, ± 5				
Temperature coefficient	$10^{-6} * K^{-1}$	+ 200 ... + 1200 depends on value				
max. cont. work. voltage	V_{RMS}	$\sqrt{P_{70} \cdot R}$ for all styles				
Insulation voltage (1min.)	V_{RMS}	2000				
Insulation resistance	Ω	> 10^4M				
Derating	°C	linear 70 ... 250 (0W)				
Climatic category		55/200/56				
Temperature range	°C	- 55 ... 250				
Thermal resistance	KW^{-1}	65	50	38	35	30
Failure rate (Total, ϑ_o, max., 60% conf. lev.)	$10^{-9} * h^{-1}$	appr. 10, depends on value				
Endurance (P_{70}, @70°C, 1000h interm.)	$[\frac{\Delta R}{R}]$ %	± 3,0 average				
Damp heat, steady state (40°C, 93% r.h., 56d)	$[\frac{\Delta R}{R}]$ %	± 0,5				
Climatic sequence	$[\frac{\Delta R}{R}]$ %	± 0,5				
Terminal strength	$[\frac{\Delta R}{R}]$ %	± 0,5				
Terminal tensile strength	N	min. 25				
Resistance to soldering heat (260°C, 10s)	$[\frac{\Delta R}{R}]$ %	± 0,2 typ.				
Solderability	s	2,5 Flowtime, solderglobule test, IEC 60068-2-20-T				
Marking		printed in clear				

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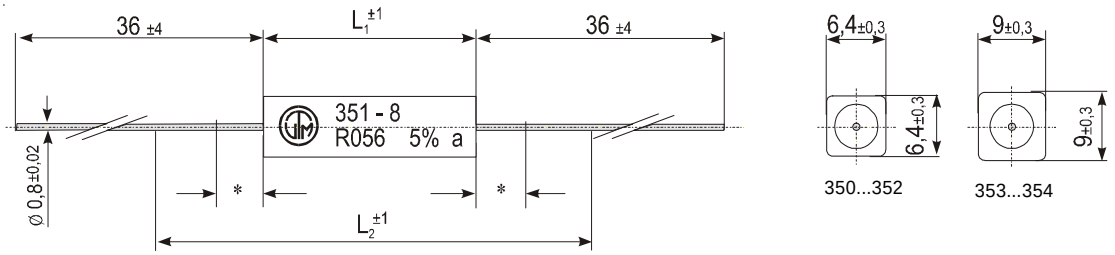
Dimensions in mm:



6mm. reduced solderability in this area

	KN350-8	KN351-8	KN352-8	KN353-8	KN354-8
L_1	18	25	38	25	38
L_2	40	45	60	45	60

Measuring length L_2: Resistance value is measured over the centered length L_2 on terminals free of oxide and contaminations. Differing conditions require adequate corrections ($R_{terminal}$ = 0,4 Ω/cm)

Packaging:

Type	Packaging	Pieces	Pack.Code
KN350-8	bulk taped	200 1000	B T
KN351-8	bulk	200	B
KN352-8	bulk	200	B
KN353-8	bulk	200	B
KN354-8	bulk	100	B

Ordering example:

KN350-8	5	B	0R015
Type	Tolerance	Pack.-Code	R-Value

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Low Ohmic Power Resistor

RoHS compliant

Specifications

Type		BWL 0614
Style		0614
Power rating P_{70}	W	1,5
Resistance range	Ω	0R005 ..... 0R062
E-Series		E 24
Tolerances	%	± 1, ± 5
Temperature coefficient	$10^{-6} * K^{-1}$	< 200 (depends on value)
max. cont. work. voltage	V_{RMS}	$\sqrt{P_{70} \cdot R}$
Insulation voltage (1min.)	V_{RMS}	1000
Insulation resistance	Ω	$> 10^4$M
Derating linear	°C	70 ... 175 (0W)
Climatic category		55/175/56
Temperature range	°C	- 55 ... 175
Thermal resistance	KW^{-1}	74 (average)
Endurance (P_{70}, 1000h)	$[\frac{\Delta R}{R}]$ %	≤0,5
Damp heat, steady state (40°C, 93% r.h., 56d)	$[\frac{\Delta R}{R}]$ %	≤ 0,5
Climatic sequence	$[\frac{\Delta R}{R}]$ %	≤ 1,0
Terminal strength	$[\frac{\Delta R}{R}]$ %	± 1,0
Terminal tensile strength	N	40
Resistance to soldering heat (260°C, 10s)	$[\frac{\Delta R}{R}]$ %	± 0,2 typ.
Solderability	s	2,5 Flowtime, solderglobule test, IEC 60068-2-20-T
Marking		printed in clear

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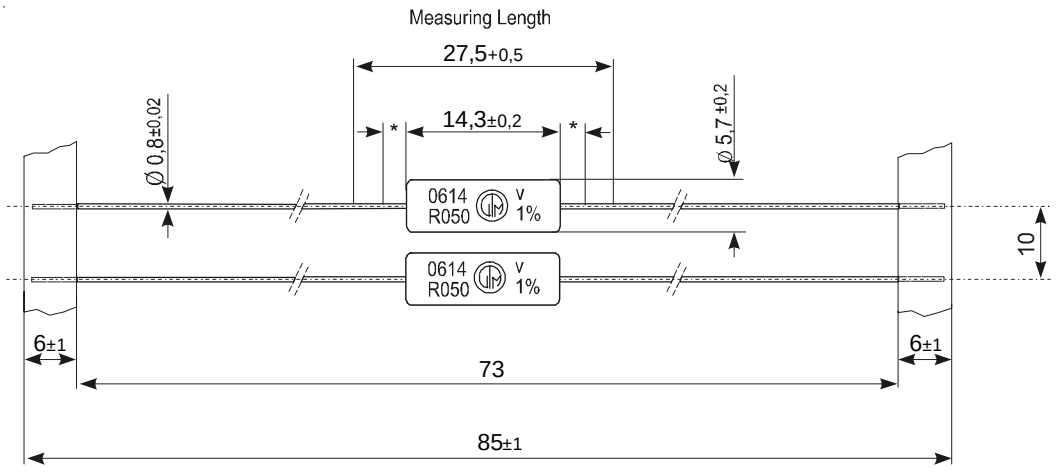
Dimensions in mm:



* 3mm, reduced solderability in this area.

Packaging:

Type	Packaging	Pieces	Pack.Code
BWL 0614	taped/Ammopack	1000	T

Ordering example:

BWL 0614	5	T	0R01
Type	Tolerance	Pack.-Code	R-Value

Ceramic Metal Plate Resistors
Low value , low inductance

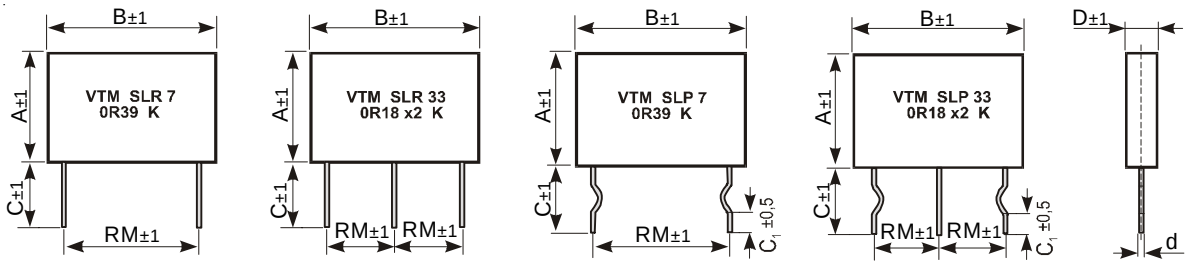
RoHS compliant

Specifications

Type		SLR2 SLP2	SLR3 SLP3	SLR5 SLP5	SLR5B SLP5B	SLR7 SLP7	SLR7B SLP7B	SLR10 SLP10	SLR10A SLP10A	SLR22B SLP22B	SLR33 SLP33	SLR33B SLP33B	SLR55 SLP55
Power rating P_{70}	W	see next page											
Resistance range	Ω	see next page											
Tolerances	%	10% (K) standard 5% (J) on request											
Temperature coefficient	$10^{-6}*K^{-1}$	± 250											
max. cont. work. voltage	V_{RMS}	$\sqrt{P_{70} \cdot R}$											
Insulation voltage	V_{RMS}	> 700 V											
Insulation resistance	Ω	≥ 1G											
Derating linear	°C	70 ... 200											
Climatic category		25 / 200 / 21											
Temperature range	°C	- 25 ~ 200											
Short time overload	$[\frac{\Delta R}{R}]$ %	± (1% R+0.05Ω)											
Load Life $P_{70°c}$ (70°C 1000h, 1.5h "ON", 0.5h "OFF")	$[\frac{\Delta R}{R}]$ %	± (5% R+0.1Ω)											
Damp heat, steady state (40°C, 95% r.h., 21d)	$[\frac{\Delta R}{R}]$ %	± (5% R+0.1Ω)											
Terminal tensile strength	$[\frac{\Delta R}{R}]$ %	± (1% R+0.05Ω)											
Resistance to soldering heat (350°C, 3.5s)		± (1% R+0.05Ω) .											
Solderability IEC 60068-2-20 260 °C , Solder bath	s	2 ± 0.5											
Marking		printed in clear											

Ordering example: SLR2 (Type) 10 (Tolerance) B (Pack.-Code) 0R1 (R-Value)

Dimensions in mm:



Type	Rated power $P_{70°C}$	Resistance range		Dimensions (mm								Packaging	
		Min.	Max.	A	B	C (SLR)	C (SLP)	C_1 (SLP)	D	d	RM	Pieces / Box	
												SLR	SLP
SLR2 / SLP2	2	0R1	0R68	8	13	12	10	4	5	0.6	9	270	290
SLR3 / SLP3	3	0R05	1R	13	13	12	10	4	5	0.6	8	210	230
SLR5 / SLP5	5	0R05	3R3	18	14	12	10	4	5	0.6	10	170	190
SLR5B / SLP5B	5	0R05	3R3	10	26	12	10	4	5	0.8	20	160	170
SLR7 / SLP7	7	0R05	3R3	18	26	12	10	4	5	0.8	20	100	110
SLR7B / SLP7B	7	0R05	3R3	13	26	12	10	4	5	0.8	20	120	130
SLR10 / SLP10	10	0R05	3R3	20	26	12	10	4	5	0.8	20	100	100
SLR10A / SLP10A	10	0R05	3R3	19	26	12	10	4	5.5	0.8	20	80	90
SLR22B / SLP22B	2+2	0R1+0R1	0R33+0R33	10	26	12	10	4	5	0.8	10	160	170
SLR33 / SLP33	3+3	0R1+0R1	0R5+0R5	18	26	12	10	4	5	0.8	10	100	100
SLR33B / SLP33B	3+3	0R1+0R1	0R5+0R5	13	26	12	10	4	5	0.8	10	130	130
SLR55 / SLP55	5+5	0R1+0R1	1R8+1R8	20	26	12	10	4	5	0.8	10	100	100

Low Ohmic Power Standard Resistors
current sensor

RoHS compliant

Specifications

Type		*LPS 355-0, LPS 356-0, LPS 357-1 special varieties LPS 359 - xxx
Style		Existing styles upon request
Power rating P_{70}	W	Depends on styles
Resistance range	Ω	R0005 ... R068
Tolerances	%	± 5 others upon request
Temperature coefficient	$10^{-6} * K^{-1}$	<-80 . . . +40 / for CuNi44 others upon request
max. cont. work. voltage	V_{RMS}	$\sqrt{P_{70} \cdot R}$
Insulation voltage (1min.)	V_{RMS}	not insulated
Insulation resistance	Ω	not insulated
Derating linear	°C	70 ... 235 (0W)
Climatic category		55/350/56
Temperature range	°C	- 55 ... 350
Thermal resistance	KW^{-1}	280° C / P_{70}
Failure Rate (Total ϑ_o, max, 60% conf. lev.)	$10^{-9} * h^{-1}$	< 0,1
Endurance (P_{70}, 1000h)	$[\frac{\Delta R}{R}]$ %	< 0,3
Damp heat, steady state (40°C, 93% r.h., 56d)	$[\frac{\Delta R}{R}]$ %	± 0,5
Climatic sequence	$[\frac{\Delta R}{R}]$ %	±0,5
Terminal strength	$[\frac{\Delta R}{R}]$ %	n. a.
Terminal tensile strength	N	n. a.
Resistance to soldering heat (260°C, 10s)	$[\frac{\Delta R}{R}]$ %	± 0,2 typ.
Solderability	s	Restricted suitable for wave-soldering
Marking		Value imprinted

Construction: These components are made directly from alloys. Standard are CuNi44 and CuNi23 Mn, others upon request.

* For special varieties pls. see „Design Notes for Current-Sense Resistors“ page 20 to 23 or contact VITROHM sales.

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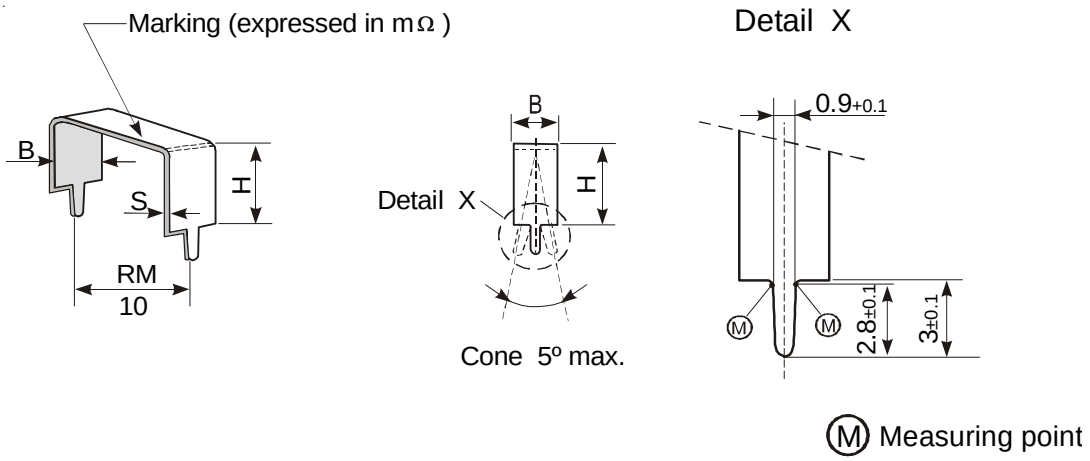
RoHS compliant

Dimensions in mm:

Type LPS 355-0



R-Value	Material	Dimension B S	H ±2 [mm]	P [W]
0R005	CuNi44	5 x 0,7	12,5	2,2
0R0068		4 x 0,8	16,5	2,1
0R01		4 x 0,5	15	2,0
0R015		4 x 0,3	13	1,8
0R022		4 x 0,2	13	1,8
0R033		3 x 0,2	15	1,5
0R047		2 x 0,2	14	1,0
0R051		2 x 0,2	15,5	1,0
0R068		2 x 0,2	22,5	1,4

Packaging: bulk, depends on size and type
B = bulk packing 1000 pieces

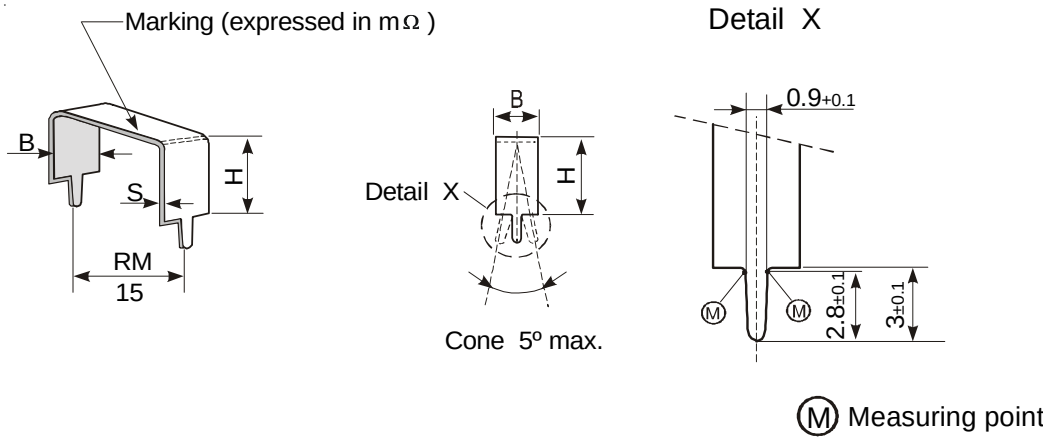
Ordering example:

LPS 355-0	5	B	0R01
Type	Tolerance	Pack.-Code	R-Value

Dimensions in mm:

RoHS compliant

Type LPS 356-0



R-Value	Material	Dimension B S	H ±2 [mm]	P [W]
0R005	CuNi44	5 x 0,7	10	2,2
0R0068		4 x 0,8	14	2,1
0R01		4 x 0,5	12,5	2,0
0R015		4 x 0,3	10,5	1,8
0R022		4 x 0,2	10,5	1,8
0R033		3 x 0,2	12,5	1,5
0R047		2 x 0,2	11,5	1,0
0R051		2 x 0,2	13	1,0
0R068		2 x 0,2	20	1,4

Packaging: bulk, depends on size and type
B = bulk packing 1000 pieces

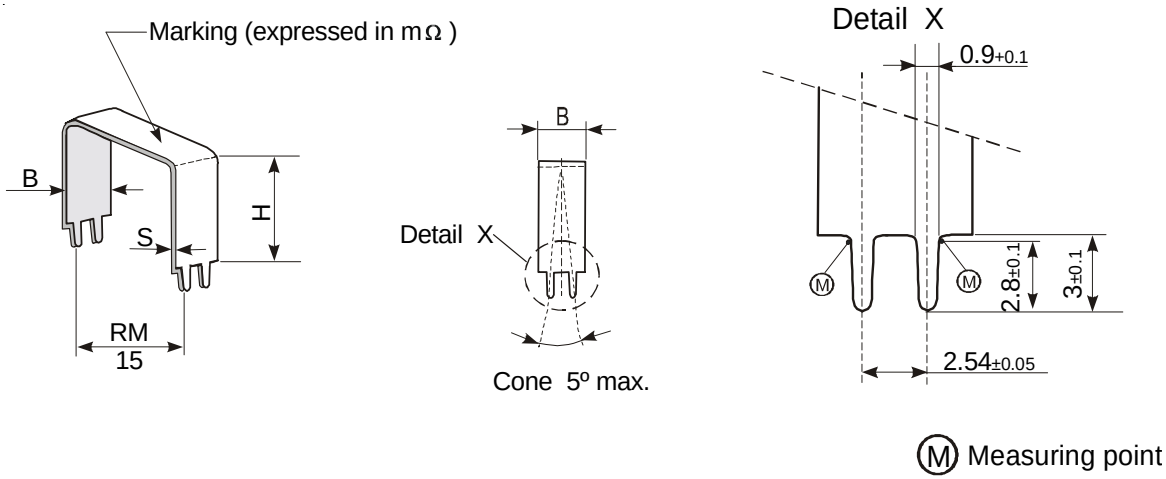
Ordering example:

LPS 356-0	5	B	0R01
Type	Tolerance	Pack.-Code	R-Value

Dimensions in mm:

RoHS compliant

Type LPS 357-1



R-Value	Material	Dimension B S	H ±2 [mm]	P [W]
0R001	CuNi23 Mn	10 x 0,8	10	3,7
0R0022		10 x 0,8	22	7,0
0R0033	CuNi44	10 x 0,5	12	4,6
0R005		5 x 0,8	13	2.6
0R0068		5 x 0,7	22	3,4
0R01		9 x 0,2	14	4,5
0R015		7 x 0,2	15,5	4,0
0R022		4 x 0,2	11,5	1,9
0R033		4 x 0,2	21	2,8

Packaging: bulk, depends on size and type
B = bulk packing 500 pieces

Ordering example:	LPS 357-1	5	B	0R01
	Type	Tolerance	Pack.-Code	R-Value

Insulated Wirewound Resistors, moulded

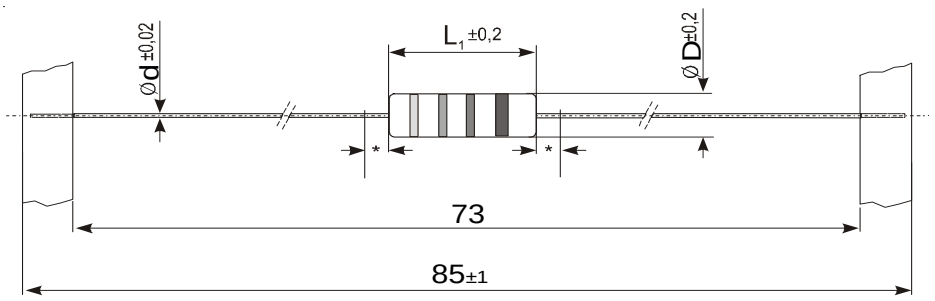
RoHS compliant

Specifications

Type		BW234-0	BW235-0
Style		0411	0614
Power rating P_{70}	W	0,75 (P_{50} = 1,0)	1,5 (P_{25} = 2,0)
Resistance range	Ω	0R1 ... 1K2	0R1 ... 2K4
E-Series		E 24, E 12	
Tolerances	%	± 5, ± 10	
Temperature coefficient	$10^{-6} * K^{-1}$	see table next page	
max. cont. work. voltage	V_{RMS}	$\sqrt{P_{70} \cdot R}$	
Insulation voltage (1min.)	V_{RMS}	700	1000
Insulation resistance	Ω	> 10^4M	
Derating linear	°C	70 ... 175 (0W)	
Climatic category		55/175/56	
Temperature range	°C	- 55 ... 175	
Thermal resistance	KW^{-1}	140	80
Failure rate (Total, ϑ_o max., 60% conf. lev.)		appr. 100, depends on value	
Endurance (P_{70}, 1000h)	$[\frac{\Delta R}{R}]$ %	± 5,0 average	
Damp heat, steady state (40°C, 93% r.h., 56d)	$[\frac{\Delta R}{R}]$ %	± 2,0	
Climatic sequence	$[\frac{\Delta R}{R}]$ %	± 2,0	
Terminal strength	$[\frac{\Delta R}{R}]$ %	± 1	
Terminal tensile strength	N	40	
Resistance to soldering heat (260°C, 10s)	$[\frac{\Delta R}{R}]$ %	± 0,2 typ.	
Solderability	s	2,5 Flowtime, solderglobule test, IEC 60068-2-20-T	
Marking		DIN-IEC-colour code, 4 bands	

RoHS compliant

Dimensions in mm:



*3mm, reduced solderability in this area.

Temperature coefficient

Typ	resistance Value	TC * $10^{-6}K^{-1}$
BW234-0	0R1 ... 0R15	± 600
	0R16 ... 0R62	± 300
	0R68 ... 1K2	± 150
BW235-0	0R1 ... 0R16	± 1000
	0R18 ... 0R68	± 800
	0R75 ... 2K4	± 400

Type	L ± 0,2	ØD ± 0,2	Ød ± 0,02	Tape step
BW234-0	9,9	3,6	0,8	5
BW235-0	14,3	5,7	1,0*	10

*Special lead diameter 0,8 mm available, type BW 235-006

Packaging:

Type	Packaging	Pieces	Pack.Code
BW234-0	taped/Ammopack	1000	T
BW235-0	taped/Ammopack	1000	T

Ordering example:

BW 234-0	5	T	1K
Type	Tolerance	Pack.-Code	R-Value

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Insulated Wirewound Resistors, moulded flame retardant, failsafe

RoHS compliant

Specifications

Type		BWF237-0	BWF236-0
Style		0411	0614
Power rating P_{70}	W	0,75 (P_{50} = 1,0)	1,5 (P_{25} = 2,0)
Resistance range	Ω	0R1 ... 1K	0R1 ... 1K
E-Series		E 24, E 12	
Tolerances	%	± 5, ± 10	
Temperature coefficient	$10^{-6} * K^{-1}$	- 400 ... + 1000, see table next page	
max. cont. work. voltage	V_{RMS}	$\sqrt{P_{70} \cdot R}$	
Insulation voltage (1min.)	V_{RMS}	700	1000
Insulation resistance	Ω	> 10^4M	
Derating linear	°C	70 ... 175 (0W)	
Climatic category		55/175/56	
Temperature range	°C	- 55 ... 175	
Thermal resistance	KW^{-1}	140	80
Failure rate (Total, ϑ_o max., 60% conf. lev.)		appr. 100, depends on value	
Endurance (P_{70}, 1000h)	$[\frac{\Delta R}{R}]$ %	± 5,0 average	± 10,0 average
Damp heat, steady state (40°C, 93% r.h., 56d)	$[\frac{\Delta R}{R}]$ %	± 2,0	
Climatic sequence	$[\frac{\Delta R}{R}]$ %	± 2,0	
Terminal strength	$[\frac{\Delta R}{R}]$ %	± 1	
Terminal tensile strength	N	40	
Resistance to soldering heat (260°C, 10s)	$[\frac{\Delta R}{R}]$ %	± 0,2 typ.	
Solderability	s	2,5 Flowtime, solderglobule test, IEC 60068-2-20-T	
Marking		DIN-IEC-colour code, 5 bands (5th band (blue) for failsafe version)	

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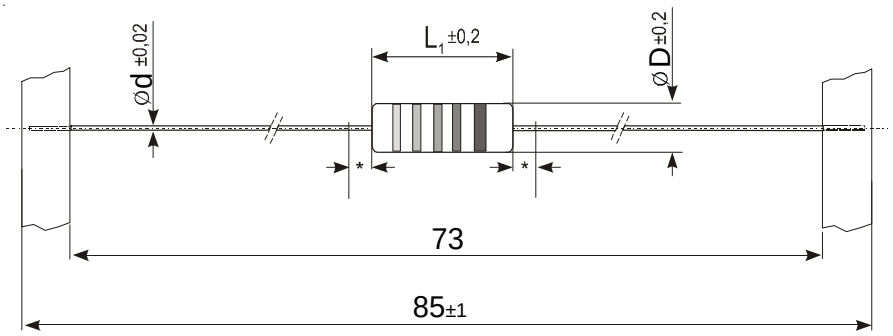
Dimensions in mm:



* 3mm, reduced solderability in this area.

Temperature coefficient

Typ	resistance Value	TC * $10^{-6}K^{-1}$
BW237-0	0R1	± 1000
	0R11 ... 0R18	± 600
	0R2 ... 0R68	± 300
	0R75 ... 1K	± 150
BW236-0	0R1	± 1800
	0R11 ... 0R16	± 1000
	0R18 ... 0R68	± 800
	0R75 ... 1K	± 400

Type	L ± 0,2	ØD ± 0,2	Ød ± 0,02	Tape step
BWF237-0	9,9	3,6	0,8	5
BWF236-0	14,3	5,7	1,0*	10

*Special lead diameter 0,8 mm available, type BWF 236-006

Packaging:

Type	Packaging	Pieces	Pack.Code
BWF236-0	taped/Ammopack	1000	T
BWF237-0	taped/Ammopack	1000	T

Ordering example: BWF 237-0 (Type) 5 (Tolerance) T (Pack.-Code) 1K (R-Value)

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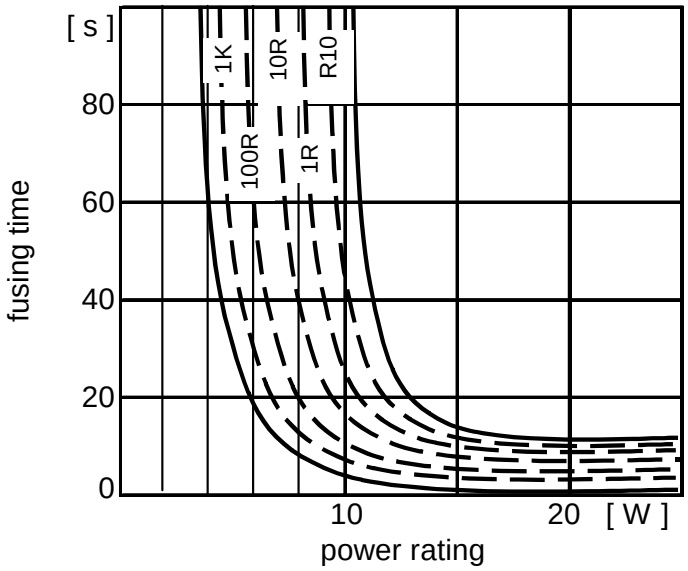
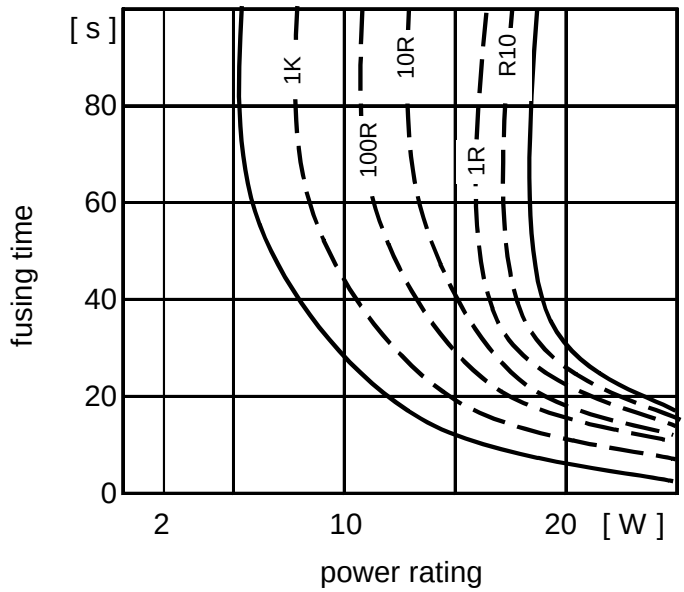
Type BWF 237-0

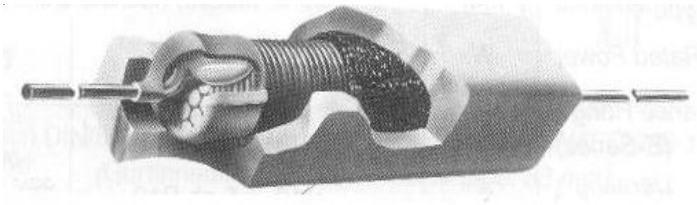


Type BWF 236-0

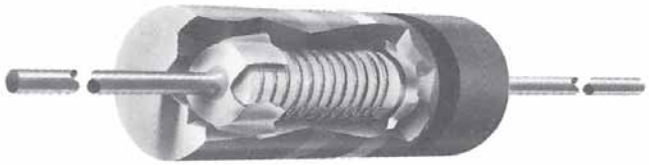


Wirewound Resistors

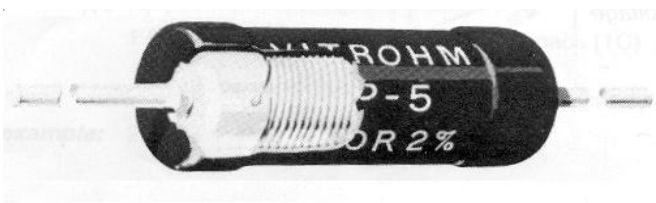
Resistors of Series K, wound on fibre glass core, have a special internal direct contact to virtually eliminate resistance changes caused by varying, often high temperatures.



Series BW and BWF, wound on fibre glass core and capped in an special process, suit all requirements for automatic insertion due to moulded case.
The accurate fusing characteristic of Series BWF reliably protects circuits from overload.



Resistors of Series CR are wound on ceramic carriers, all-welded contacts. Coated, the resistors comply with all requirements for precision and high ratings.



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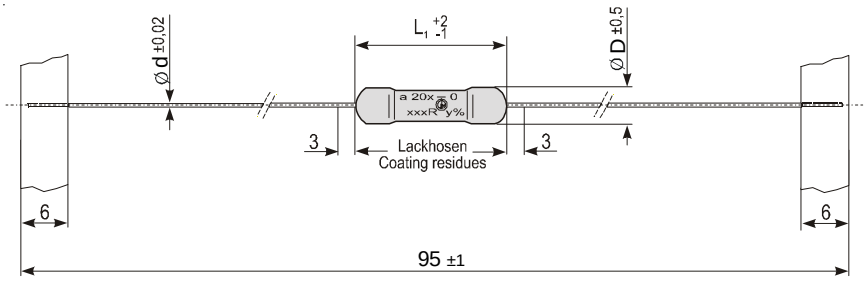
Power Wirewound Resistors
axial, coated, fibre glass core

RoHS compliant

Specifications

Type		KC 200-0	KC202-0	KC204-0
Style		0416	0424	0432
Power rating P_{70}	W	1,0	2,0	3,0
Resistance range	Ω	0R056 ...9K1	0R075 ...20K	0R33 ... 30K
E-Series		E 24 (5%), E 12 (10%)		
Tolerances	%	± 10; R ≥ 0R1 ± 5%		
Temperature coefficient	$10^{-6} * K^{-1}$	- 80 ... + 500		
max. cont. work. voltage	V_{RMS}	$\sqrt{P_{70} \cdot R}$		
Insulation voltage (1min.)	V_{RMS}	max. 75		
Insulation resistance	Ω	not insulated		
Derating linear	°C	70 ... 350 (0W)		
Climatic category		55/200/56		
Temperature range	°C	- 55 ... 350		
Thermal resistance	KW^{-1}	200	125	125
Failure rate (Total, ϑ_o max., 60% conf. lev.)		appr. 100, depends on value		
Endurance (P_{70}, 1000h)	$[\frac{\Delta R}{R}]$ %	± 3,0 average		
Damp heat, steady state (40°C, 93% r.h., 56d)	$[\frac{\Delta R}{R}]$ %	± 2,0		
Climatic sequence	$[\frac{\Delta R}{R}]$ %	± 2,0		
Terminal strength	$[\frac{\Delta R}{R}]$ %	± 1,0		
Terminal tensile strength	N	50		
Resistance to soldering heat (260°C, 10s)	$[\frac{\Delta R}{R}]$ %	± 0,2 typ.		
Solderability	s	2,5 Flowtime, solderglobule test, IEC 60068-2-20-T		
Marking		printed in clear		

Dimensions in mm:



Typ	L1	ØD	Ød
KC200-0	16	4,5 ± 0,5	0,8 ± 0,02
KC202-0	24	4,5 ± 0,5	0,8 ± 0,02
KC204-0	32	4,5 ± 0,5	0,8 ± 0,02

Packaging:

Type	Packaging	Pieces	Pack.Code
KC200-0	taped/Ammopack	1000	T
KC202-0	taped/Ammopack	1000	T
KC204-0	taped/ammopack	1000	T

Ordering example:

KC 200-0	5	T	1R
Type	Tolerance	Pack.-Code	R-Value

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Power Wirewound Resistors
radial, fibre glass core, coated

RoHS compliant

Specifications

Type		KP290	KP292	KP294	KP296	KP298
Styles		0518	0523	0533	0543	0553
Power rating P_{70}	W	2,0	4,0	5,0	6,5	8,0
Resistance range	Ω	0R1 ... 7K5	0R15 ... 11K	0R27 ... 20K	0R39 ... 27K	0R47 ... 36K
E-Series		E 24/E 12	E 24/E 12	E 24/E 12	E 24/E 12	E 24/E 12
Tolerances	%	± 10 ±5 ≥0R2	± 10 ±5 ≥0R3	± 10 ±5 ≥0R47	± 10 ±5 ≥0R68	± 10 ±5 ≥0R91
Temperature coefficient	$10^{-6} * K^{-1}$	- 80 ... + 500				
max. cont. work. voltage	V_{RMS}	$\sqrt{P_{70} \cdot R}$ for all styles				
Insulation voltage (1min.)	V_{RMS}	max 75				
Insulation resistance	Ω	not insulated				
Derating linear	°C	70 ... 350 (0W)				
Climatic category		55/200/56				
Temperature range	°C	- 55 ... 350				
Thermal resistance	KW^{-1}	110	70	60	50	40
Failure rate (Total, ϑ_o, max., 60% conf. lev.)	$10^{-9} * h^{-1}$	appr. 100, depends on value				
Endurance (P_{70}, 70°C, 1000)	$[\frac{\Delta R}{R}]$ %	± 3,0 average				
Damp heat, steady state (40°C, 93% r.h., 56d)	$[\frac{\Delta R}{R}]$ %	± 2,0				
Climatic sequence	$[\frac{\Delta R}{R}]$ %	± 2,0				
Terminal strength	$[\frac{\Delta R}{R}]$ %	± 1,0				
Terminal tensile strength	N	40				
Resistance to soldering heat (260°C, 10s)	$[\frac{\Delta R}{R}]$ %	± 0,2 typ.				
Solderability	s	solderable according to IEC 60068-2-20 Ta				
Marking		on termination; value 3 digits, Tolerance, Production date code				

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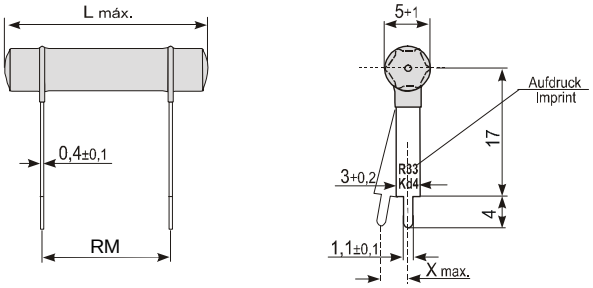
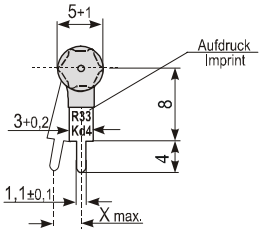
RoHS compliant

Dimensions in mm:

Type 290-0... 298-0



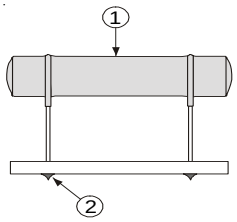
Type 290-1... 298-1

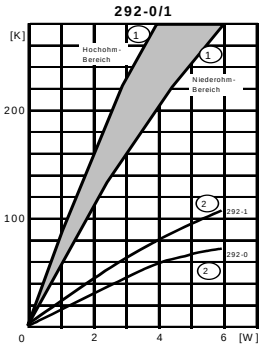


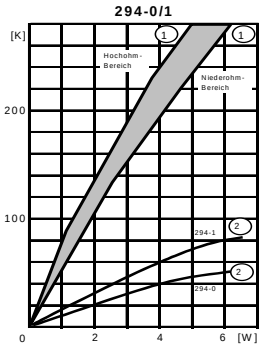
Type	L	RM
KP290-0/1	18,2	10
KP292-0/1	23,3	15
KP294-0/1	33,4	25
KP296-0/1	43,5	35
KP298-0/1	53,7	45

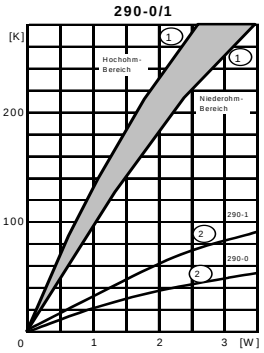
Type	RM Tolerance	Xmax.
KP29x-0	+1,0	3,0
KP29x-1	+0,8	1,7

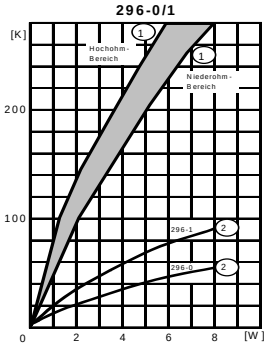
Temperature rise:
(solder joints)

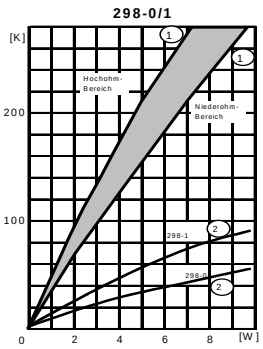












Packaging:

Type	Packaging	Pieces	Pack.-Code
KP290-0	bulk	500	B
KP290-1		1000	
KP292-0	bulk	500	B
KP292-1		1000	
KP294-0	bulk	250	B
KP294-1		500	
KP296-0	bulk	250	B
KP296-1		500	
KP298-0	bulk	250	B
KP298-1		250	

Ordering example: KP294-1 (Type) 5 (Tolerance) B (Pack.-Code) 1K3 (R-Value)

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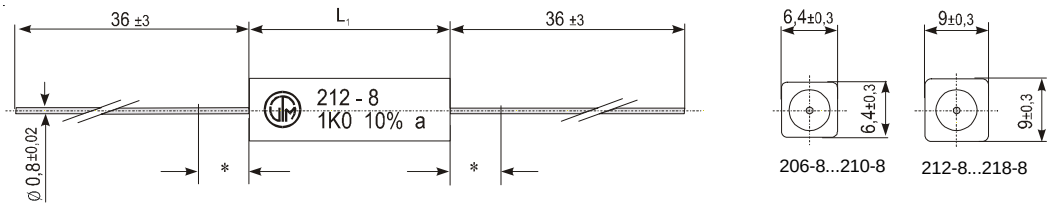
Power Wirewound Ceramic Resistors, axial

RoHS compliant

Specifications

Type		KH206-8	KH208-8	KH210-8	KH212-8	KH214-8	KH216-8	KH218-8
Power rating P_{70}	W	4	5	7	7	9	11	17
Resistance range	Ω	see page 2						
E-Series		E 24 (5%), E 12 (10%)						
Tolerances	%	± 5, ± 10						
Temperature coefficient	$10^{-6} * K^{-1}$	depends on value see table 3						
max. cont. work. voltage	V_{RMS}	$\sqrt{P_{70} \cdot R}$ for all styles						
Insulation voltage (1min.)	V_{RMS}	2000						
Insulation resistance	Ω	> 10^4						
Derating linear	°C	linear 70 ... 350 (0W)						
Climatic category		55/200/21						
Temperature range	°C	- 55 ... 350						
Thermal resistance	KW^{-1}	65	50	40	40	30	25	15
Failure rate (Total, ϑ_o, max., 60% conf. lev.)	$10^{-9} * h^{-1}$	appr. 100, depends on value						
Endurance (P_{70}, 70°C, 1000h)	$[\frac{\Delta R}{R}]$ %	± 3,0 average						
Damp heat, steady state (40°C, 93% r.h., 56d)	$[\frac{\Delta R}{R}]$ %	± 2,0						
Climatic sequence	$[\frac{\Delta R}{R}]$ %	± 2,0						
Terminal strength	$[\frac{\Delta R}{R}]$ %	± 1,0						
Terminal tensile strength	N	50						
Resistance to soldering heat (260°C, 10s)	$[\frac{\Delta R}{R}]$ %	± 0,2 typ.						
Solderability	s	2,5 Flowtime; solderglobule test IEC 60068-2-20-T						
Standards		CECC 40202-001 and -005 applicable DIN 45921 T 202						
Marking		Printed in clear						

Dimensions in mm:



* 6mm, reduced solderability in this area

Type	Resistance range			L_1
	Min		Max	
	10%	5%		
KH206-8	0R056	0R1	9K1	20 ±1,0
KH208-8	0R075	0R15	15K	25 ±1,0
KH210-8	0R11	0R33	33K	38 ±1,0
KH212-8	0R075	0R15	15K	25 ±1,0
KH214-8	0R11	0R33	33K	38 ±1,0
KH216-8	0R15	0R51	47K	50 ±1,5
KH218-8	0R27	0R91	82K	75 ±2,0

Temperature coefficient:

Type	TC +400 ±50 ppm K^{-1}	TC 0 ±40 ppm K^{-1}	TC 0 ±10 ppm K^{-1}
KH206	0R056 ...0R2	0R22 ... 300R	330R ... 9K1
KH208	0R075 ... 0R3	0R33 ... 470R	510R ... 15K
KH210	0R11 ... 0R68	0R75 ... 910R	1K0 ... 33K
KH212	0R075 ... 0R3	0R33 ... 470R	510R ... 15K
KH214	0R11 ... 0R68	0R75 ... 910R	1K0 ... 33K
KH216	0R15 ... 1R	1R1 ... 1K3	1K5 ... 47K
KH218	0R27 ... 1R6	1R8 ... 2K4	2K7 ... 82K

Packaging:

Type	Packaging	Pieces	Pack.-Code
KH206-8	bulk taped	200 1000	B R
KH208-8	bulk taped	200 1000	B R
KH210-8	bulk taped	200 1000	B R
KH212-8	bulk taped	200 500	B R
KH214-8	bulk taped	100 500	B R
KH216-8	bulk	100	B
KH218-8	bulk	100	B

Ordering example:

KH206-8	5	B	9R1
Type	Tolerance	Pack.-Code	R-Value

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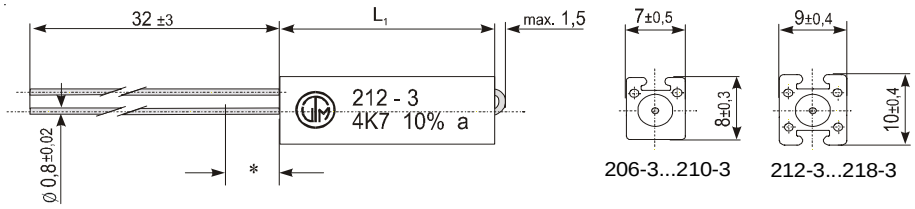
Power Wirewound Ceramic Resistors, vertical

RoHS compliant

Specifications

Type		KV206-3	KV208-3	KV210-3	KV212-3	KV214-3	KV216-3	KV218-3
Power rating P_{70}	W	4	5	7	7	9	11	17
Resistance range	Ω	see page 2						
E-Series		E 24 (5%), E 12 (10%)						
Tolerances	%	± 5, ± 10						
Temperature coefficient	$10^{-6} * K^{-1}$	depends on value see table 3						
max. cont. work. voltage	V_{RMS}	$\sqrt{P_{70} \cdot R}$ for all styles						
Insulation voltage (1min.)	V_{RMS}	2000						
Insulation resistance	Ω	> 10^4						
Derating linear	°C	linear 70 ... 350 (0W)						
Climatic category		55/200/21						
Temperature range	°C	- 55 ... 350						
Thermal resistance	KW^{-1}	65	50	40	40	30	25	15
Failure rate (Total, ϑ_o, max., 60% conf. lev.)	$10^{-9} * h^{-1}$	appr. 100, depends on value						
Endurance (P_{70}, 70°C, 1000h)	$[\frac{\Delta R}{R}]$ %	± 3,0 average						
Damp heat, steady state (40°C, 93% r.h., 56d)	$[\frac{\Delta R}{R}]$ %	± 2,0						
Climatic sequence	$[\frac{\Delta R}{R}]$ %	± 2,0						
Terminal strength	$[\frac{\Delta R}{R}]$ %	± 1,0						
Terminal tensile strength	N	50						
Resistance to soldering heat (260°C, 10s)	$[\frac{\Delta R}{R}]$ %	± 0,2 typ.						
Solderability	s	2,5 Flowtime; solderglobule test IEC 60068-2-20-T						
Standards		CECC 40202-001 and -005 applicable DIN 45921 T 202						
Marking		Printed in clear						

Dimensions in mm:



* 6mm, reduced solderability in this area

Type	Resistance range		Max	L_1
	Min 10%	5%		
KV206-3	0R056	0R1	9K1	20 ±1,0
KV208-3	0R075	0R15	15K	25 ±1,0
KV210-3	0R11	0R33	33K	38 ±1,0
KV212-3	0R075	0R15	15K	25 ±1,0
KV214-3	0R11	0R33	33K	38 ±1,0
KV216-3	0R15	0R51	47K	50 ±1,5
KV218-3	0R27	0R91	82K	75 ±2,0

Temperature coefficient:

Type	TC +400 ±50 ppm K^{-1}	TC 0 ±40 ppm K^{-1}	TC 0 ±10 ppm K^{-1}
KV206	0R056 ...0R2	0R22 ... 300R	330R ... 9K1
KV208	0R075 ... 0R3	0R33 ... 470R	510R ... 15K
KV210	0R11 ... 0R68	0R75 ... 910R	1K0 ... 33K
KV212	0R075 ... 0R3	0R33 ... 470R	510R ... 15K
KV214	0R11 ... 0R68	0R75 ... 910R	1K0 ... 33K
KV216	0R15 ... 1R	1R1 ... 1K3	1K5 ... 47K
KV218	0R27 ... 1R6	1R8 ... 2K4	2K7 ... 82K

Packaging:

Type	Packaging	Pieces	Pack.-Code
KV206-3	bulk	200	B
KV208-3	bulk	200	B
KV210-3	bulk	200	B
KV212-3	bulk	200	B
KV214-3	bulk	200	B
KV216-3	bulk	200	B
KV218-3	bulk	100	B

Ordering example:

KV206-3	5	B	1K3
Type	Tolerance	Pack.-Code	R-Value

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Power Wirewound Resistors, vertical, circuit breaker, fibre glass core, ceramic case

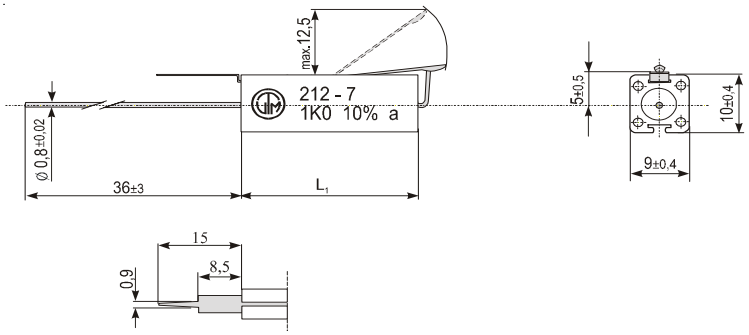
RoHS compliant

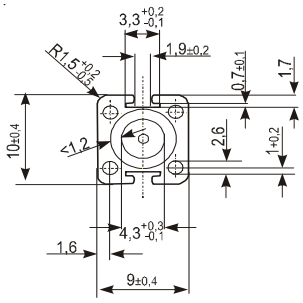
Specifications

Type		KT212-7	KT214-7	KT216-7	KT218-7
Power rating P_{70}	W	2	2,5	3,5	4,5
Resistance range	Ω	see below			
E-Series		E 24 (5%), E 12 (10%)			
Tolerances	%	± 5, ± 10			
Temperature coefficient	$10^{-6} * K^{-1}$	- 80 ... + 500			
max. cont. work. voltage	V_{RMS}	$\sqrt{P_{70} \cdot R}$			
Insulation voltage (1min.)	V_{RMS}	2000			
Insulation resistance	Ω	> 10^4M			
Derating linear	°C	see diagram next page			
Climatic category		55/150/56			
Temperature range	°C	- 55 ... 150			
Failure rate (Total, ϑ_o, max., 60% conf. lev.)	$10^{-9} * h^{-1}$	appr. 100, depends on value			
Endurance (P_{70}, 70°C, 1000h)	$[\frac{\Delta R}{R}]$ %	± 3,0 average			
Damp heat, steady state (40°C, 93% r.h., 56d)	$[\frac{\Delta R}{R}]$ %	± 2,0			
Climatic sequence	$[\frac{\Delta R}{R}]$ %	± 2,0			
Terminal strength	$[\frac{\Delta R}{R}]$ %	± 1,0			
Terminal tensile strength	N	50			
Resistance to soldering heat (260°C, 10s)	$[\frac{\Delta R}{R}]$ %	± 0,2 typ.			
Solderability	s	2,5 Flowtime; solderglobule test IEC 60068-2-20-T			
Marking		Printed in clear			

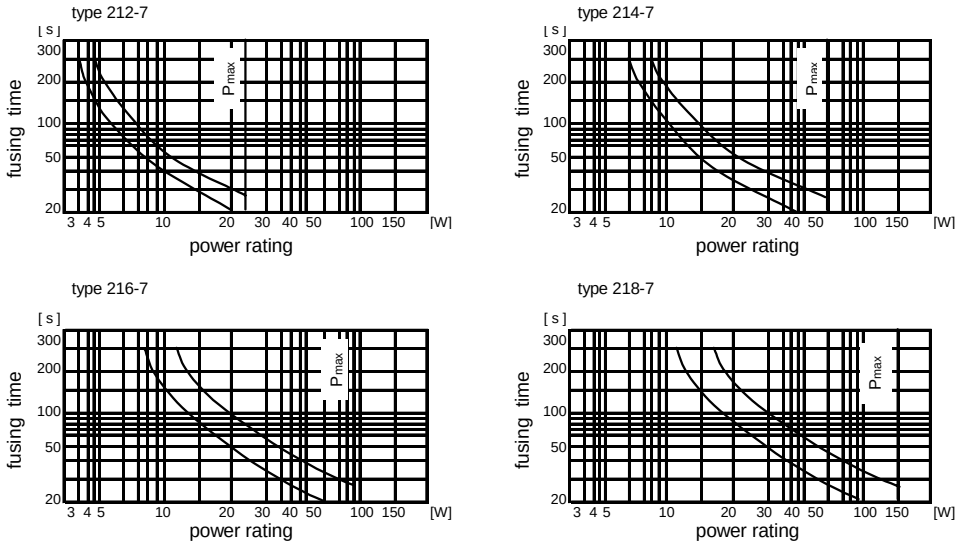
Type	Resistance range Min 10%	Min 5%	Max	L_1
KT212-7	0R075	0R15	15K	25 ±1,0
KT214-7	0R11	0R33	33K	38 ±1,0
KT216-7	0R15	0R51	47K	50 ±1,0
KT218-7	0R27	0R91	82K	75 ±1,0

Dimensions in mm





Fusing times vs. load:



Packaging:

Type	Packaging	Pieces	Pack.-Code
KT212-7	bulk	200	B
KT214-7	bulk	200	B
KT216-7	bulk	200	B
KT218-7	bulk	100	B

Ordering example:	KT212-7	5	B	1K5
	Type	Tolerance	Pack.-Code	R-Value

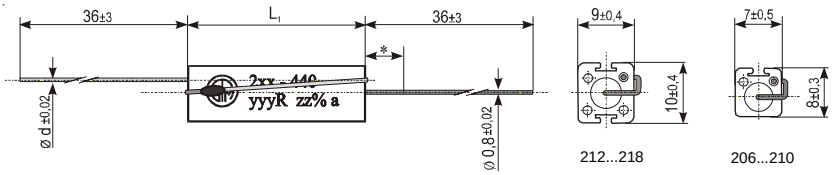
Power Wirewound Resistors
axial, circuit breaker, ceramic case, fibre glass core

RoHS compliant

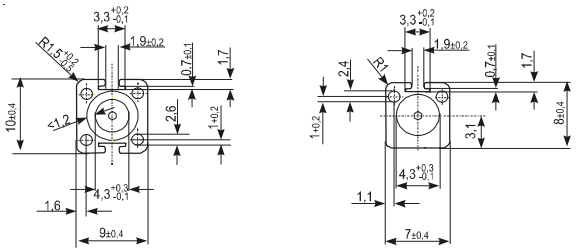
Specifications

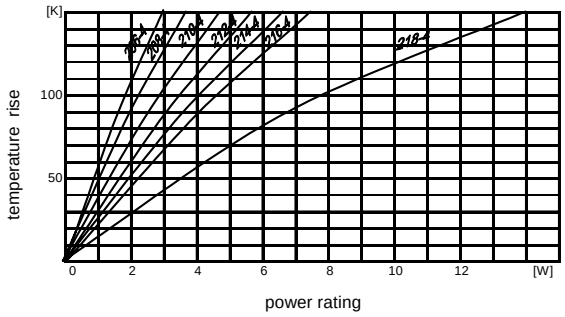
Type			KF206-4	KF208-4	KF210-4	KF212-4	KF214-4	KF216-4	KF218-4
Power rating	P_{25} P_{70}	W	2,5 1,2	3,0 1,5	4,5 2,5	3,5 2,0	5,0 3,0	7,0 4,0	11 6,0
Resistance range		Ω	see page 2						
E-Series			E 24 (5%), E 12 (10%)						
Tolerances		%	± 5, ± 10						
Temperature coefficient		$10^{-6} * K^{-1}$	- 80 ... + 500						
max. cont. work. voltage		V_{RMS}	$\sqrt{P_{70} \cdot R}$ for all styles						
Insulation voltage (1min.)		V_{RMS}	2000						
Insulation resistance		Ω	> 10^4M						
Derating linear		°C	see Table Temperature rise of solder joints						
Climatic category			55/150/56						
Temperature range		°C	- 55 ... 150						
Failure rate (Total, ϑ_o, max., 60% conf. lev.)		$10^{-9} * h^{-1}$	appr. 100, depends on value						
Endurance (P_{70}, 70°C, 1000h)		$[\frac{\Delta R}{R}]$ %	± 3,0 average						
Damp heat, steady state (40°C, 93% r.h., 56d)		$[\frac{\Delta R}{R}]$ %	± 2,0						
Climatic sequence		$[\frac{\Delta R}{R}]$ %	± 2,0						
Terminal strength		$[\frac{\Delta R}{R}]$ %	± 1,0						
Terminal tensile strength		N	50						
Resistance to soldering heat (260°C, 10s)		$[\frac{\Delta R}{R}]$ %	± 0,2 typ.						
Solderability		s	2,5 Flowtime; solderglobule test IEC 60068-2-20-T						
Marking			Printed in clear						

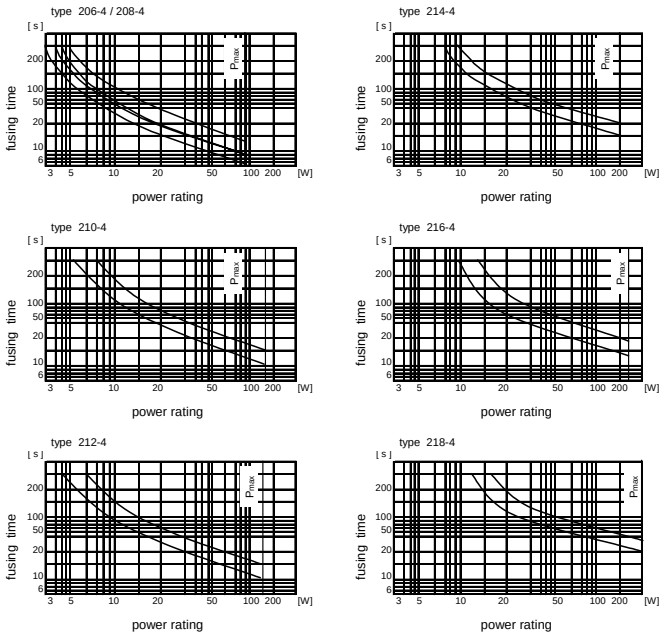
Dimensions in mm:



* 6mm, reduced solderability in this area







Type	Resistance range		L_1	Ød
	Min	Max		
KF206-4	0R1	9K1	20 ±1,0	0,6
KF208-4	0R15	15K	25 ±1,0	0,6
KF210-4	0R33	33K	38 ±1,0	0,8
KF212-4	0R15	15K	25 ±1,0	0,6
KF214-4	0R33	33K	38 ±1,0	0,8
KF216-4	0R51	47K	50 ±1,5	0,8
KF218-4	0R91	82K	75 ±2,0	0,8

Packaging:

Type	Packaging	Pieces	Pack.-Code
KF206-4	bulk	100	B
KF208-4	bulk	100	B
KF210-4	bulk	100	B
KF212-4	bulk	100	B
KF214-4	bulk	100	B
KF216-4	bulk	100	B
KF218-4	bulk	100	B

Ordering example:

KF212-4	5	B	1K
Type	Tolerance	Pack.-Code	R-Value

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Power Wirewound Resistors, ceramic case, AMP contacts

RoHS compliant

Specifications

Type		KWA 15	KWA 20	KWA 30	KWA 40
Style		1348	1364	1975	1990
Power rating P_{70}	W	15	20	30	40
Resistance range	Ω	0R51...10K	0R51...10K	0R62...10K	0R62...10K
E-Series		E 24			
Tolerances	%	± 5			
Temperature coefficient	$10^{-6} * K^{-1}$	± 250			
max. cont. work. voltage	V_{RMS}	$\sqrt{P_{70} \cdot R}$			
Insulation voltage (1min.)	V_{RMS}	2000			
Insulation resistance	Ω	> 10M			
Derating linear	°C	linear 70 ... 350°C (0W)			
Climatic category		55/200/21			
Temperature range	°C	- 55 ... 350			
Failure rate (Total, ϑ_o, max., 60% conf. lev.)	$10^{-9} * h^{-1}$	ca. 100 depends on value			
Endurance (P_{70}, 70°C, 1000h)	$[\frac{\Delta R}{R}]$ %	± 5,0			
Damp heat, steady state (40°C, 93% r.h., 56d)	$[\frac{\Delta R}{R}]$ %	± 5,0			
Resistance to soldering heat (360°C, 3,5s)	$[\frac{\Delta R}{R}]$ %	± 1,0			
Solderability	s	2,5 Flowtime; solderglobule test IEC 60068-2-20-T			
Marking		Printed in clear			

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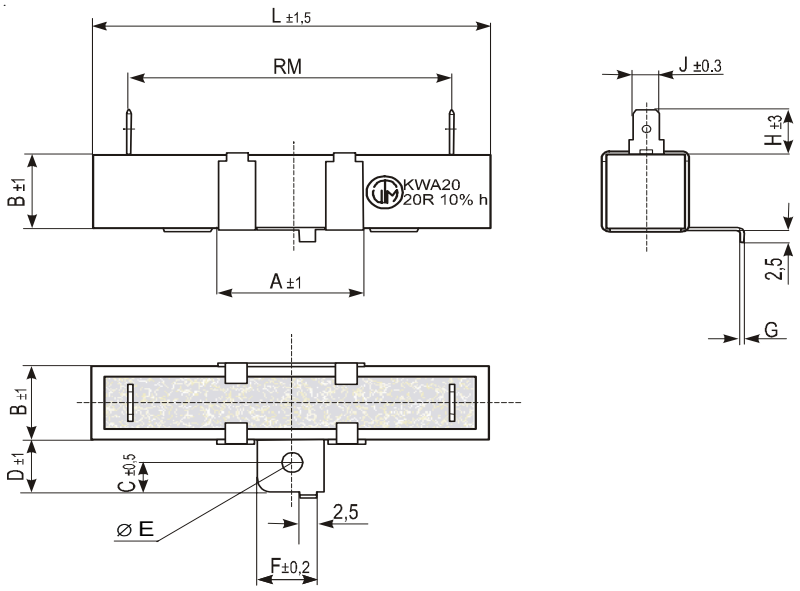
Dimensions in mm



Type	L ±1,5	RM	B ±1	A ±1	C ±0,5	D ±1	E	F ±0,2	G	H ±3	J ±0,3
KWA15	48,0	34,0	13	25	6	12,5	4	12	0,6	9	4,8
KWA20	63,5	48,0	13	25	6	12,5	4	12	0,6	9	4,8
KWA30	75,0	56,0	19	40	8	18,0	4,2	18	0,8	12	6,3
KWA40	90,0	71,0	19	40	8	18,0	4,2	18	0,8	12	6,3

Type	Packaging	Pieces	Pack.-Code
KWA15	bulk	70	B
KWA20	bulk	60	B
KWA30	bulk	14	B
KWA40	bulk	14	B

Ordering example:

KWA40	5	B	3K6
Type	Tolerance	Pack.-Code	R-Value

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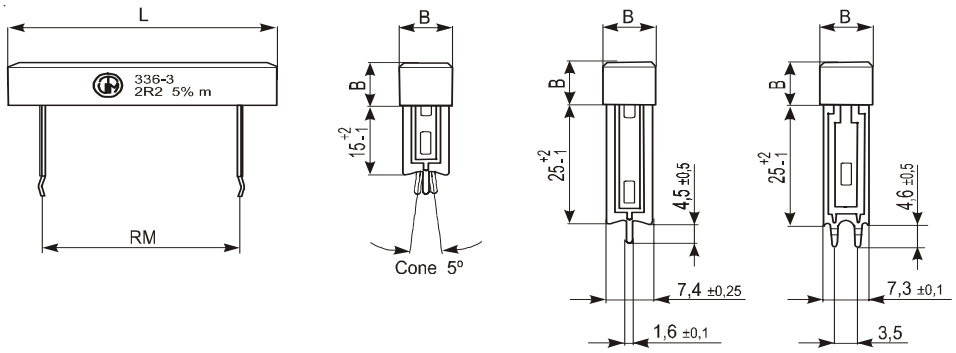
Power Wirewound Resistors, ceramic case, radial

RoHS compliant

Specifications

Type		KWP 330-3/5/7	KWP 331-3/5/7	KWP 332-3/5/7	KWP 333-3/5-7	KWP 335-3/5/7	KWP 336-3/5/7	KWP 337-3/5/7	KWP 338-3/5/7
Power rating P_{25} P_{70}	W	3,0 2,0	4,0 2,2	5,0 2,5	7,0 3,0	9,0 4,5	10,0 4,5	15,0 5,5	20,0 8,0
Resistance range	Ω	0R2... 2K4	0R22... 3K	0R3... 3K6	0R43... 4K7	0R56... 5K6	0R68... 6K8	0R62... 7K5	0R91... 10K
E-Series		E 24 (5%). E 12 (10%)							
Tolerances	%	± 5 , ± 10							
Temperature coefficient	$10^{-6} * K^{-1}$	- 80 ... + 500 depends on value							
max. cont. work. voltage	V_{RMS}	$\sqrt{P_{70} \cdot R}$ for all styles							
Insulation voltage (1min.)	V_{RMS}	2000							
Insulation resistance	Ω	> 10^4M							
Derating linear	°C	linear 70 ... 275 (0W)							
Climatic category		55/200/56							
Temperature range	°C	- 55 ... 275							
Thermal resistance	KW^{-1}	37	35	35	35	35	30	20	14
Failure rate (Total, ϑ_o, max., 60% conf. lev.)	$10^{-9} * h^{-1}$	ca. 100 depends on value							
Endurance (P_{70}, 70°C, 1000h)	$[\frac{\Delta R}{R}]$ %	± 3,0 average							
Damp heat, steady state (40°C, 93% r.h., 56d)	$[\frac{\Delta R}{R}]$ %	± 2,0							
Resistance to soldering heat (360°C, 3,5s)	$[\frac{\Delta R}{R}]$ %	± 0,5							
Solderability	s	2,5 s Flowtime; solderglobule test IEC 60068-2-20-T							
Marking		Printed in clear							

Dimensions in mm



33X-3 33X-5 33X-7

Type	L	B	RM
KWP330-3/5/7	23	10	10
KWP331-3/5/7	25	10	12,5
KWP332-3/5/7	28	10	15
KWP333-3/5/7	35,5	10	22,5
KWP335-3/5/7	43	10	30
KWP336-3/5/7	48	10	35
KWP337-3/5/7	50	13	32,5
KWP338-3/5/7	65	13	47,5

Packaging:

Type	Packaging	Pieces	Pack.-Code
KWP330-3/5/7	bulk	144	B
KWP331-3/5/7	bulk	100	B
KWP332-3	bulk	112	B
KWP332-5/7	bulk	128	B
KWP333-3	bulk	120	B
KWP333-5/7	bulk	100	B
KWP335-3	bulk	150	B
KWP335-5/7	bulk	105	B
KWP336-3	bulk	80	B
KWP336-5/7	bulk	100	B
KWP337-3	bulk	128	B
KWP337-5/7	bulk	50	B
KWP338-3	bulk	100	B
KWP338-5/7	bulk	50	B

Ordering example:

KWP333-3	5	B	0R43
Type	Tolerance	Pack.-Code	R-Value

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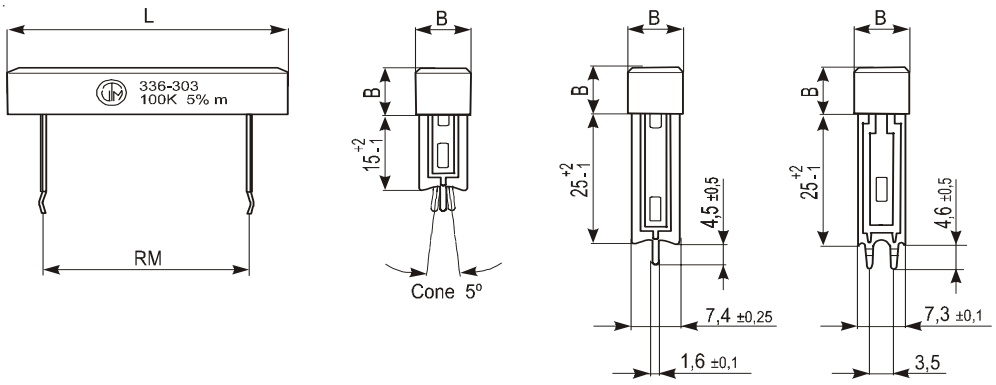
Power Resistors, Metox Element ceramic case, radial

RoHS compliant

Specifications

Type		KWP 330-303 330-503 330-703	KWP 331-303 331-503 331-703	KWP 332-303 332-503 332-703	KWP 333-303 333-503 333-703	KWP 335-303 335-503 335-703	KWP 336-303 336-503 336-703
Power rating P_{25} / P_{70}	W	3,0 / 2,0	4,0 / 2,2	5,0 / 2,5	7,0 / 3,0	9,0 / 4,5	10,0 / 4,5
Resistance range	Ω	390R... 100K	680R... 100K	680R... 100K	1K... 100K	1K... 100K	1K... 100K
E-Series		E 24 (5%)					
Tolerances	%	± 250 ppm					
Temperature coefficient	$10^{-6} * K^{-1}$						
max. cont. work. voltage	V_{RMS}		350			500	
Insulation voltage (1min.)	V_{RMS}	2000					
Insulation resistance	Ω	> 10^4M					
Derating linear	°C	linear 70 ... 235 (0W)					
Climatic category		55/155/21					
Temperature range	°C	- 55 ... 235					
Thermal resistance	KW^{-1}	37	35	35	35	35	30
Failure rate (Total, ϑ_o, max., 60% conf. lev.)	$10^{-9} * h^{-1}$	1					
Endurance (P_{70}, 70°C, 1000h)	$[\frac{\Delta R}{R}]$ %	± 5 average					
Damp heat, steady state (40°C, 93% r.h., 56d)	$[\frac{\Delta R}{R}]$ %	± 5					
Resistance to soldering heat (360°C, 3,5s)	$[\frac{\Delta R}{R}]$ %	± 1					
Solderability	s	2,5 Flowtime; solderglobule test IEC 60068-2-20-T					
Marking		Printed in clear					

Dimensions in mm



33X-303 33X-503 33X-703

Type	L	B	RM
KWP330-303/503/703	23	10	10
KWP331-303/503/703	25	10	12,5
KWP332-303/503/703	28	10	15
KWP333-303/503/703	35,5	10	22,5
KWP335-303/503/703	43	10	30
KWP336-303/503/703	48	10	35

Packaging:

Type	Packaging	Pieces	Pack.-Code
KWP330-303/503/703	bulk	144	B
KWP331-303/503/703	bulk	100	B
KWP332-303	bulk	112	B
KWP332-503/703	bulk	128	B
KWP333-303	bulk	120	B
KWP333-503/703	bulk	100	B
KWP335-303	bulk	150	B
KWP335-503/703	bulk	105	B
KWP336-303	bulk	80	B
KWP336-503/703	bulk	100	B

Ordering example:

KWP336-303	5	B	100K
Type	Tolerance	Pack.-Code	R-Value

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Power Wirewound Resistors ceramic case, vertical

RoHS compliant

Specifications

Type		KWV302-3	KWV304-3	KWV306-3	KWV308-3	KWV310-3
Power rating P_{70}	W	2	3	5	7	10
Resistance range	Ω	0R2...1K	0R2...4K7	0R2...4K7	0R22...10K	0R47...16K
E-Series		E 24	E 24	E 24	E 24	E 24
Tolerances	%	± 5	± 5	± 5	± 5	± 5
Temperature coefficient	$10^{-6} * K^{-1}$	- 80 ... + 500 (depends on value)				
max. cont. work. voltage	V_{RMS}	$\sqrt{P_{70} \cdot R}$ for all styles				
Insulation voltage (1min.)	V_{RMS}	2000				
Insulation resistance	Ω	> 10^4M				
Derating linear	°C	70 ... 275 (0W)				
Climatic category		55/200/21				
Temperature range	°C	- 55 ... 275				
Thermal resistance	KW^{-1}	100	68	40	30	20
Failure rate (Total, ϑ_o, max., 60% conf. lev.)	$10^{-9} * h^{-1}$	appr. 100, depends on value				
Endurance (P_{70}, 70°C, 1000)	$[\frac{\Delta R}{R}]$ %	± 3,0				
Damp heat, steady state (40°C, 93% r.h., 56d)	$[\frac{\Delta R}{R}]$ %	± 2,0				
Climatic sequence	$[\frac{\Delta R}{R}]$ %	± 2,0				
Terminal strength	$[\frac{\Delta R}{R}]$ %	± 2,0				
Resistance to soldering heat (260°C, 10s)	$[\frac{\Delta R}{R}]$ %	± 0,5				
Solderability	s	2,5 Flowtime, solderglobule test, IEC 60068-2-20T				
Marking		Printed in clear				

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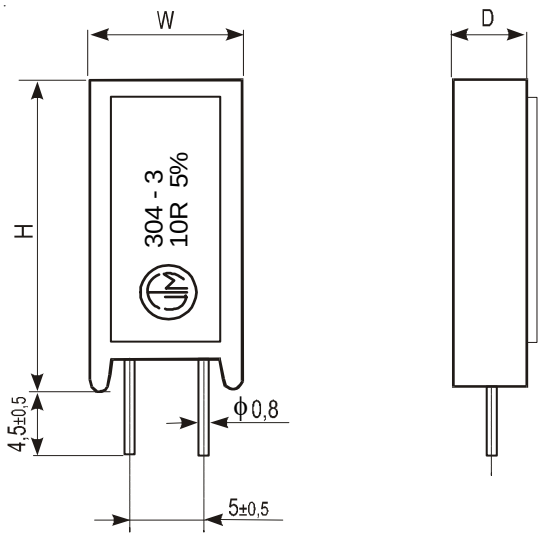
Dimensions in mm:



Type	H ±1	W ±1	D ±1
KWV302-3	20,5	11	7
KWV304-3	25	12	8
KWV306-3	26	13	9
KWV308-3	39	13	9,5
KWV310-3	51	13	9,5

Packaging:

Type	Packaging	Pieces	Pack.-Code
KWV302-3	bulk	250	B
KWV304-3	bulk	204	B
KWV306-3	bulk	176	B
KWV308-3	bulk	108	B
KWV310-3	bulk	120	B

Ordering example: KWV304-3 (Type) 5 (Tolerance) B (Pack.-Code) 100R (R-Value)

Power Resistors, Metox Element ceramic case, vertical

RoHS compliant

Specifications

Type		KWV302-303	KWV304-303	KWV306-303	KWV308-303	KWV310-303
Power rating P_{70} W	W	2	3	5	7	10
Resistance range	Ω	390R...100K	680R...100K	680R...100K	1K ...100K	1K ...100K
E-Series		E 24	E 24	E 24	E 24	E 24
Tolerances	%	± 5	± 5	± 5	± 5	± 5
Temperature coefficient	$10^{-6} * K^{-1}$	± 250				
max. cont. work. voltage	V_{RMS}	350	350	350	500	500
Insulation voltage (1min.)	V_{RMS}	700				
Insulation resistance	Ω	> 1 GM				
Derating linear	°C	70 ... 235 (0W)				
Climatic category		55/155/21				
Temperature range	°C	- 55 ... 235				
Thermal resistance	KW^{-1}	100	68	40	30	20
Failure rate (Total, ϑ_o, max., 60% conf. lev.)	$10^{-9} * h^{-1}$	appr. 100, depends on value				
Endurance (P_{70}, 70°C, 1000)	$[\frac{\Delta R}{R}]$ %	± 5,0				
Damp heat, steady state (40°C, 93% r.h., 56d)	$[\frac{\Delta R}{R}]$ %	± 5,0				
Climatic sequence	$[\frac{\Delta R}{R}]$ %	± 5,0				
Terminal strength	$[\frac{\Delta R}{R}]$ %	± 1,0				
Resistance to soldering heat (260°C, 10s)	$[\frac{\Delta R}{R}]$ %	± 1,0				
Solderability	s	2,5 Flowtime, solderglobule test, IEC 60068-2-20T				
Marking		Printed in clear				

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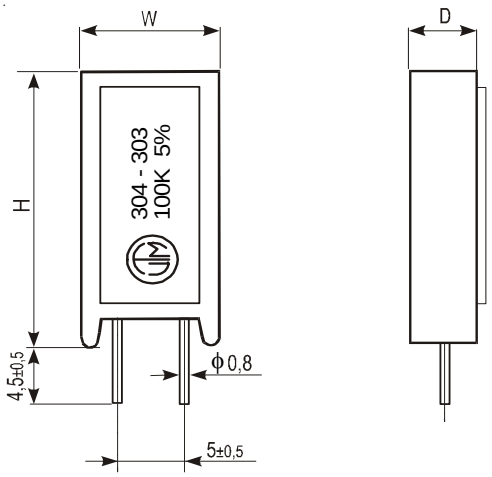
Dimensions in mm:



Type	H ±1	W ±1	D ±1
KWV302-303	20,5	11	7
KWV304-303	25	12	8
KWV306-303	26	13	9
KWV308-303	39	13	9,5
KWV310-303	51	13	9,5

Packaging:

Type	Packaging	Pieces	Pack.-Code
KWV302-303	bulk	250	B
KWV304-303	bulk	204	B
KWV306-303	bulk	176	B
KWV308-303	bulk	108	B
KWV310-303	bulk	120	B

Ordering example:

KWV304-303	5	B	100K
Type	Tolerance	Pack.-Code	R-Value

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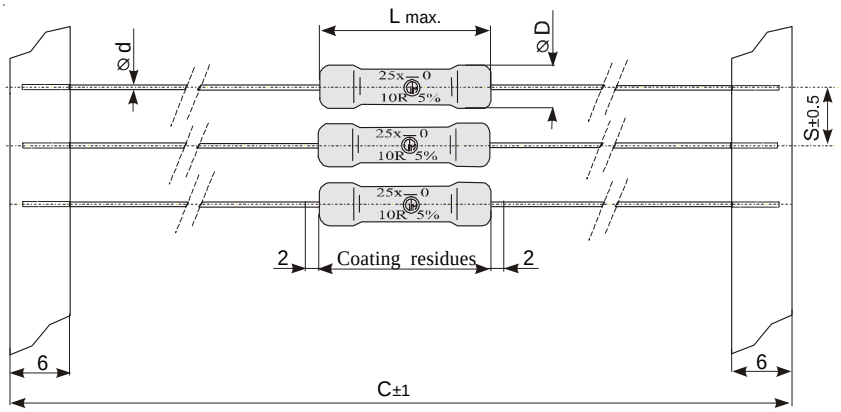
Precision Power Wirewound Resistors, ceramic carrier, coated, axial

RoHS compliant

Specifications

Type		CR 251-0	CR 253-0	CR 254-0	CR 255-0	CR 256-0	CR 257-0	CR 258-0	CR 259-0
Power rating P_{40} ϑ_o, P_{70}	W	1,1 1,0	2,5 2,0	3,0 2,5	3,3 3,0	4,0 3,5	5,0 4,3	5,5 5,0	7,2 6,5
Resistance range	Ω	see next page							
Tolerances	%	Rmin. ... Rmax.: ±5, ±2, ±1; R≥1R: ±0,5							
Temperature coefficient	$10^{-6} * K^{-1}$	0 ± 20							
max. cont. work. voltage	V_{RMS}	$\sqrt{P_{70} \cdot R}$							
Insulation voltage (1min.)	V_{RMS}	max 75V							
Insulation resistance	Ω	not insulated							
Derating linear	°C	70 ... 350 (0W)							
Climatic category		55/200/56							
Temperature range	°C	- 55 ... 350							
Thermal resistance	KW^{-1}	280	140	112	94	80	65	56	43
Failure rate (Total, ϑ_o, max., 60% conf. lev.)	$10^{-9} * h^{-1}$	appr. 100 depends on value							
Endurance (P_{70}, 70°C, 1000h)	$[\frac{\Delta R}{R}]$ %	± 3,0 average							
Damp heat, steady state (40°C, 93% r.h., 56d)	$[\frac{\Delta R}{R}]$ %	± 1,0							
Climatic sequence (IEX 115-1/23)	$[\frac{\Delta R}{R}]$ %	± 1,0							
Terminal strength	$[\frac{\Delta R}{R}]$ %	± 0,2							
Terminal tensile strength	N	50							
Resistance to soldering heat (260°C, 3,5s)	$[\frac{\Delta R}{R}]$ %	± 0,2 typ.							
Solderability	s	2,5 Flowtime; solderglobule test, IEC 60068-2-20-T							
Marking		Printed in clear							

Dimensions in mm



Type	Resistange range		Temperature Coefficient (-20°C to 120°C)			
	min	max	CuNi44 0±20 ppm/K		NiCr20AlSi 0±10 ppm/K	
CR251-0	0R1	100R	0R1	<16R	≥ 16R	≤ 100R
CR253-0	0R1	360R	0R1	<51R	≥ 51R	≤ 360R
CR254-0	0R1	360R	0R1	<51R	≥ 51R	≤ 360R
CR255-0	0R1	470R	0R1	<75R	≥ 75R	≤ 470R
CR256-0	0R1	750R	0R1	<150R	≥ 150R	≤ 750R
CR257-0	0R2	1K1	0R2	<160R	≥ 160R	≤ 1K1
CR258-0	0R2	1K3	0R2	<180R	≥ 180R	≤ 1K3
CR259-0	0R3	2K	0R3	<200R	≥ 200R	≤ 2K

Type	L max.	ØD* max.	Ød
CR251-0	9,0	3,0	0,65
CR253-0	14,5	4,0	0,65
CR254-0	12,6	5,5	0,80
CR255-0	15,0	8,5	0,80
CR256-0	17,0	5,5	0,80
CR257-0	18,0	8,5	0,80
CR258-0	22,0	8,5	0,80
CR259-0	27,0	8,5	0,80

*R ≤ 1R0 Dmax. +1

Packaging:

Type	Packaging	Pieces	Pack.-Code	C	S
CR251-0	taped	1000	T	65	5
CR253-0	taped	1000	T	85	10
CR254-0	taped	1000	T	85	10
CR255-0	taped	500	T	85	10
CR256-0	taped	1000	T	85	10
CR257-0	taped	500	T	85	10
CR258-0	taped	500	T	85	10
CR259-0	taped	500	T	85	10

Ordering example: CR259-0 Type | 1 Tolerance | T Pack.-Code | 10R R-Value

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Power Wirewound Resistors
flame retardant, safety version

RoHS compliant

Specifications

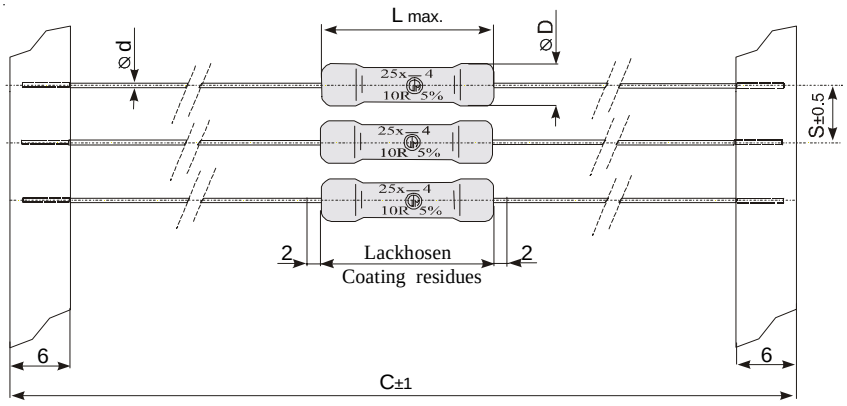
Type		CRF251-4	CRF253-4	CRF254-4	CRF256-4	CRF257-4
Power rating P_{40} P_{70}	W	1,1 1,0	2,2 2,0	3,0 2,5	4,0 3,5	5,0 4,3
Resistance range	Ω	see next page				
E-Series		E 24				
Tolerances	%	± 5				
Temperature coefficient	$10^{-6} * K^{-1}$	120 $^{\pm 50}$				
max. cont. work. voltage	V_{RMS}	$\sqrt{P_{70} \cdot R}$				
Insulation voltage (1min.)	V_{RMS}	max 75V				
Insulation resistance	Ω	not insulated				
Derating linear	°C	70 ... 350 (0W)				
Climatic category		55/350/56				
Temperature range	°C	- 55 ... 350				
Thermal resistance	KW^{-1}	280	140	112	80	65
Failure rate (Total, ϑ_o, max., 60% conf. lev.)	$10^{-9} * h^{-1}$	appr. 10, depends on value				
Endurance (P_{70}, 70°C, 1000)	$[\frac{\Delta R}{R}]$ %	± 5,0 average				
Damp heat, steady state (40°C, 93% r.h., 56d)	$[\frac{\Delta R}{R}]$ %	± 5,0				
Climatic sequence	$[\frac{\Delta R}{R}]$ %	± 2,0				
Terminal strength	$[\frac{\Delta R}{R}]$ %	± 0,2				
Terminal tensile strength	N	50				
Resistance to soldering heat (260°C, 10s)	$[\frac{\Delta R}{R}]$ %	± 0,5				
Solderability	s	2,5 Flowtime, solderglobule test, IEC 60068-2-20				
Marking		printed in clear				

Type	Resistance range	
	min.	max.
CRF251-4	*1R0	100R
CRF253-4	*1R0	330R
CRF254-4	*1R0	330R
CRF256-4	*1R0	330R
CRF257-4	*1R0	330R

Note: The special construction of resistance values >10R results in an immediate interruption (<1s, 200ms typical) when mains voltage (220V/240V_{RMS}) is applied. No flames, no explosion. After fusing, the resistance value is >100KOhm.
For other voltages test suitability in the application!
* Resistance values < 10R are flame retardant.
The interruption mechanism is not clearly defined and has to be tested in the final application!

Type max.	L max.	ØD	Ød
CRF251-4	9,0	3,0	0,65
CRF253-4	14,5	4,0	0,65
CRF254-4	12,6	6,0	0,80
CRF256-4	17,0	6,0	0,80
CRF257-4	18,0	8,5	0,80

Dimensions in mm:



Packaging:

Type	Packaging	Pieces	Pack.- Code	C	S
CRF251-4	taped/Ammopack	1000	T	65	5
CRF253-4	taped/Ammopack	1000	T	85	10
CRF254-4	taped/Ammopack	1000	T	85	10
CRF256-4	taped/Ammopack	1000	T	85	10
CRF257-4	taped/Ammopack	1000	T	85	10

Ordering example:

CRF254-4	5	T	15R
Type	Tolerance	Pack.-Code	R-Value

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Power Wirewound Resistors, flameproof, coated, axial

RoHS compliant

Specifications

Type		RX0207W5	RX04101W	RX05151W	RX05123W	RX06133W	RX05163W	RX07163W	RX06163W5	RX07164W	RX09265W	RX10266W	RX10348W	RX103410W	RX104010W	RX104012W	RX104812W
Power rating P_{70}	W	0,5	1,0	1,0	3,0	3,0	3,0	3,0	3,5	4,0	5,0	6,0	8,0	10,0	10,0	12,0	12,0
Power rating P_{40}		0,6	1,1	1,1	3,4	3,4	3,4	3,4	4,0	4,5	5,7	6,8	9,0	11,0	11,0	13,5	13,5
Resistance range	Ω	see next page															
E-Series		E 24															
Tolerances	%	±1%, ± 5%															
Temperature coefficient	$10^{-6}*K^{-1}$	0R1 - 4R9 -400 / +1000 5R0 - 9R9 ± 700 ≥10R ± 250															
Max. cont. work. voltage	V_{RMS}	$\sqrt{P_{70} \cdot R}$															
Temperature range	°C	- 55 ... +155															
Failure rate (Total, ϑ_o, max. 60% conf. lev.)	$10^{-9}*h^{-1}$	100															
Endurance (P_{70}, 70°C, 1000)	$[\frac{\Delta R}{R}]$ %	± 5															
Damp heat, steady state (40°C, 93% r.h., 56d)	$[\frac{\Delta R}{R}]$ %	± 5															
Climatic sequence	$[\frac{\Delta R}{R}]$ %	± 5															
Terminal strength	$[\frac{\Delta R}{R}]$ %	± 1															
Surface temp. Rise	°C	< 250															
Terminal tensile strength	N	10															
Resistance to soldering heat (260°C, 10s)	$[\frac{\Delta R}{R}]$ %	± 2															
Solderability		min. 95% coverage															
Coating Color		Grey															
Marking		0207 ... 0716 Color code / 0926 ... 1048 printed in clear															

Ordering example:	RX06133W	5	T	100R
	Type	Tolerance	Pack.-Code	R-Value

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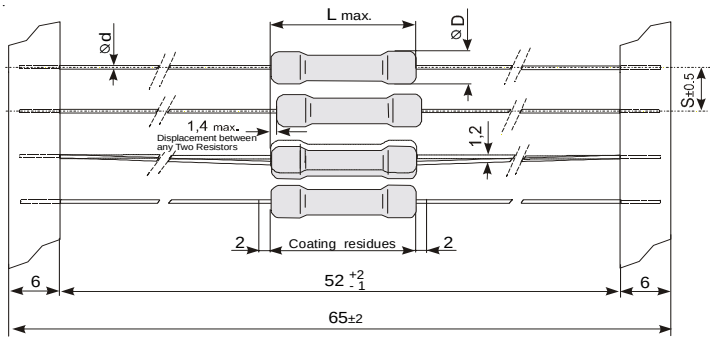
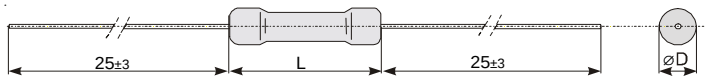
Type	Resistance range			L	Dimensions ØD	Ød
	5% (J)	1% (F)		max.	± 1,0	± 0,05
RX0207W5	0R1 ... 43R	1R ...43R		6,2	2,3	0,56
RX04101W	0R1 ... 68R	1R ... 68R		10,0	3,5	0,80
RX05151W	0R1 ... 220R	1R ... 220R		15,0	4,5	0,80
RX05123W	0R1 ... 220R	1R ... 220R		12,0	4,5	0,80
RX06133W	0R1 ... 220R	1R ... 220R		13,0	5,5	0,80
RX05163W	0R1 ... 220R	1R ... 220R		15,5	5,0	0,80
RX07163W	0R1 ... 2K2	1R ... 2K2		16,0	6,5	0,80
RX06163W5	0R1 ... 220R	1R ... 220R		16,0	5,7	0,80
RX07164W	0R1 ... 2K2	1R ... 2K2		16,0	6,5	0,80
RX09265W	0R33 ... 4K7	1R ... 4K7		26,0	9,0	0,80
RX10266W	0R33 ... 4K7	1R ... 4K7		26,0	9,5	0,80
RX10348W	0R47 ... 10K	1R ... 10K		34,0	10,0	1,0
RX103410W	0R47 ... 10K	1R ... 10K		34,0	10,0	1,0
RX104010W	0R68 ... 22K	1R ... 22K		40,0	10,0	1,0
RX104012W	0R68 ... 22K	1R ... 22K		40,0	10,0	1,0
RX104812W	1R ... 30K	1R ... 30K		48,0	10,0	1,0

RX0207..RX 0716



RX0926...RX 1048



Type	Packaging	Taping (s)	Pieces	Pack.-Code
RX0207W5	taped	5	5000	T
RX04101W	taped	5	2000	T
RX05151W	taped	5	1000	T
RX05123W	taped	5	1000	T
RX06133W	taped	10	1000	T
RX05163W	taped	10	1000	T
RX07163W	taped	10	500	T
RX06163W5	taped	10	1000	T
RX07164W	taped	10	500	T
RX09265W	bulk		100	B
RX10266W	bulk		100	B
RX10348W	bulk		100	B
RX103410W	bulk		100	B
RX104010W	bulk		100	B
RX104012W	bulk		100	B
RX104812W	bulk		100	B

Wirewound Resistors, Aluminium Housed, Chassis Mount

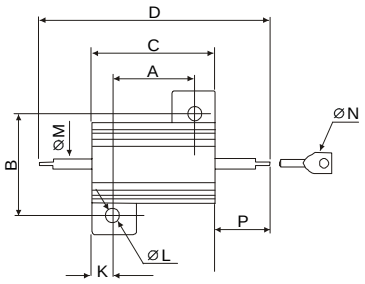
RoHS compliant

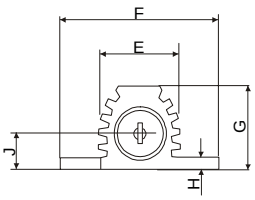
Specifications

Type		RE 605	RE 605N	RE 610	RE 610N	RE 615	RE 615N	RE 630	RE 630N	RE 640	RE 640N	RE 650	RE 650N
Power rating P_{40}	W	see next page											
Resistance range	Ω	see next page											
Tolerances	%	see next page											
Temperature coefficient	$10^{-6} * K^{-1}$	0R1-0R99 ± 100 1R0-9R9 ± 50 ≥10 R ± 20											
max. cont. work. voltage	V_{RMS}	$V\overline{P_{70} \cdot R}$											
Insulation voltage (1min.)	V_{RMS}	1000						2000		4500			
Insulation resistance	Ω	> 10M											
Derating linear	°C	70 ... 250 (0W)											
Climatic category		55/200/56											
Temperature range	°C	- 55 ... 250											
Failure rate (Total, ϑ_o, max., 60% conf. lev.)	$10^{-9} * h^{-1}$	appr. 10, depends on value											
Endurance (P_{70}, 70°C, 1000)	$[\frac{\Delta R}{R}]$ %	± 5,0 average											
Damp heat, steady state (40°C, 93% r.h., 56d)	$[\frac{\Delta R}{R}]$ %	± 5,0											
Climatic sequence	$[\frac{\Delta R}{R}]$ %	± 2,0											
Terminal strength	$[\frac{\Delta R}{R}]$ %	± 0,5											
Terminal tensile strength	N	50											
Resistance to soldering heat (260°C, 10s)	$[\frac{\Delta R}{R}]$ %	± 0,5											
Solderability	s	2,5 Flowtime, solderglobule test, IEC 60068-2-20											
Marking		printed in clear											

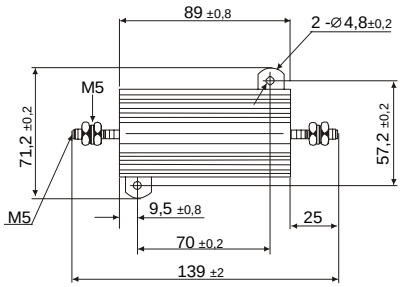
Features:
Molded construction for enviromental protection. Complete welded construction. Meets applicable requirements of MIL-PRF-18546. Available in non-inductive styles with Aryton Perry winding for lowest reactive components (affix N). Mounts on Chassis to uilize heat-sink effect. Excellent stability in operation.

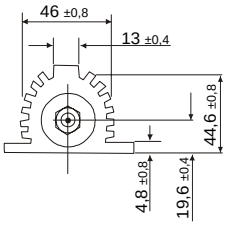
RE605,610,615,630
RE605N,610N,615N,630N



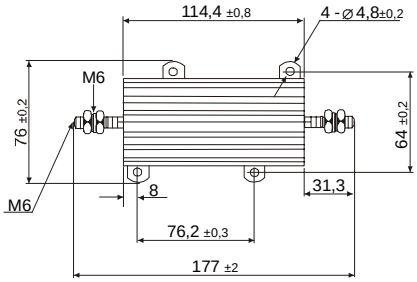


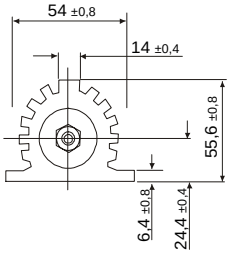
RE640,640N





RE650,650N





Dimensions (mm)

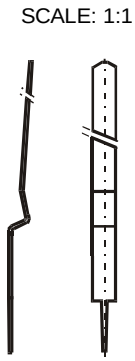
Type	A ±0,1	B ±0,1	C ±0,5	D ±1,5	E ±0,4	F ±0,1	G ±0,4	H ±0,2	J ±0,2	K ±0,2	L ±0,1	M ±0,02	N ±0,1	P ±0,1
RE605	11,2	12,5	15,2	28,6	8,5	16,4	8,1	1,7	3,8	2	2,4	1,5	1,3	6,7
RE610	14,2	15,9	19	34,9	10,7	20,3	9,9	1,9	4,2	2,4	2,4	2	2,2	7,95
RE615	18,2	19,8	27	49,2	14	27,4	13,9	1,9	5,9	4,4	3,2	2	2,2	11,1
RE630	40	21,4	50	70,6	16	29	15,5	2,2	6,6	5	3,2	2	2,2	10,3

Type	MIL-reference	Rated power (W)		Resistance range		
	Type	Civil	Military	± 0,25%	± 0,5%	±1%, ±5%, ±10%
RE605	RE60G	7,5 (5)	5	0R5 ...1K2	0R1 ... 1K2	0R1 ... 3K32
RE605N	RE60N	7,5 (5)	5	1R ... 200R	1R ... 860R	1R... 1K65
RE610	RE65G	12,5 (10)	10	0R5 ... 2K7	0R1 ... 2K7	0R1 ... 5K62
RE610N	RE65N	12,5 (10)	10	1R ... 1K2	1R ... 1K2	1R ... 2K8
RE615	RE70G	25	20	0R1 ... 3K9	0R1 ... 3K0	0R1 ... 12K1
RE615N	RE70N	25	20	1R0 ... 2K7	1R ... 2K7	1R ... 6K04
RE630	RE75G	50	30	0R1 ... 5K6	0R1 ... 5K6	0R1 ... 39K2
RE630N	RE75N	50	30	1R0 ... 3K9	1R ... 3K9	1R ... 19K6
RE640	RE77G	100	75	0R5 ... 8K2	0R5 ... 12K	0R5 ... 29K4
RE640N	RE77N	100	75	1R ... 5K6	1R ... 5K6	1R ... 14K7
RE650	RE80G	250	120	0R1 ... 27K	0R1 ... 27K	0R1 ... 35K7
RE650N	RE80N	250	120	1R ... 9K2	1R ... 8K2	1R ... 17K4

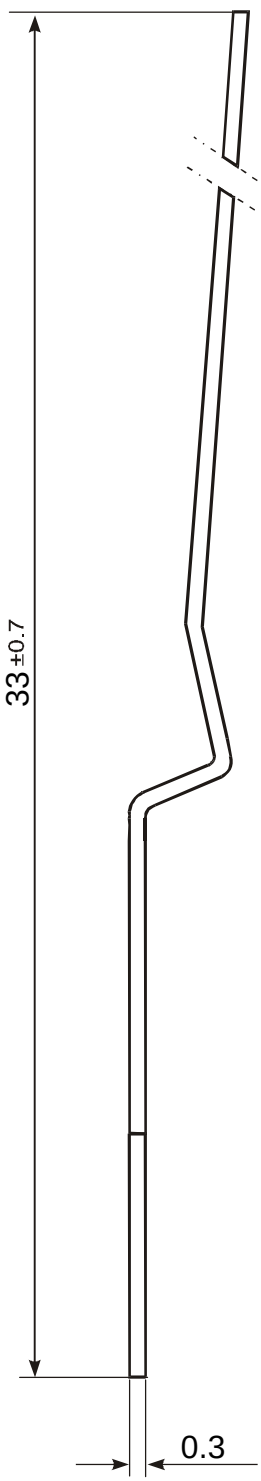
Note: Figures in parenthese on RE605 and RE610 indicate wattage printed on parts, new construction allows these resistors to be rated at higher wattage.

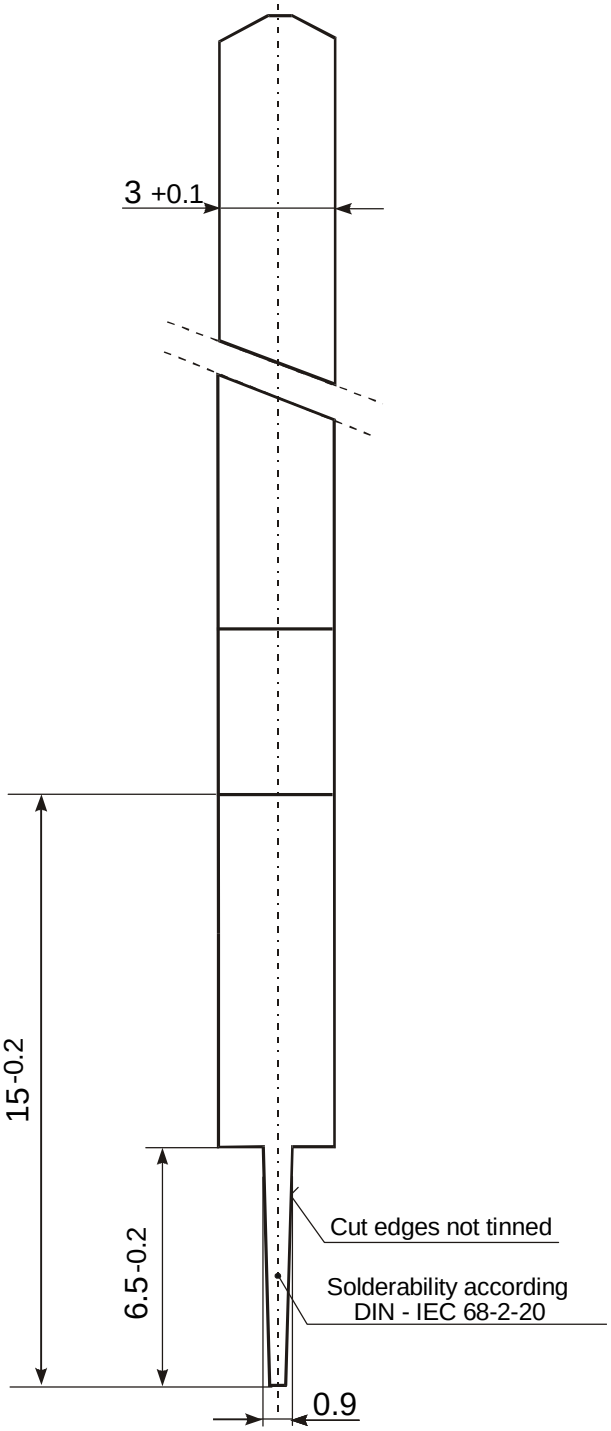
Mounting Brackets Type S18141
for Serie KH-0, KV, KU, KT and KF

RoHS compliant



SCALE: 1:1

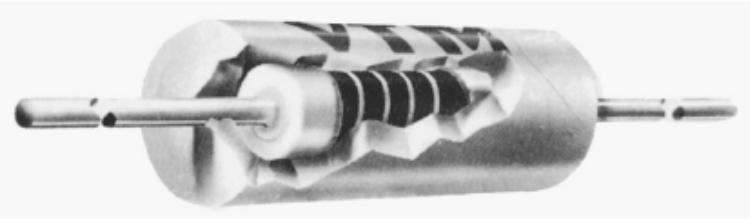




packing: 8000 pcs. bulk
Ordering example: S18141

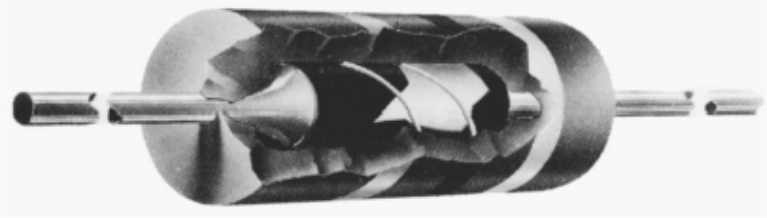
Metaloxidefilm Resistors

Metaloxidefilm-Resistors make film technology available to power applications because of their wide temperature range.
Series PO includes different styles for best lay-out-matching.



Metalglazefilm resistors

Metalglazefilm-Resistors comply with highest reliability requirements due to thickfilm elements contacted by soldering, close tolerances and low temperature coefficients. Series RG and RGU allow the choise of axial and vertical insertion.



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Power Metaloxide film resistor flame retardant

RoHS compliant

Specifications

Type		PO595-0	PO593-0	PO590-0	PO591-0
Style		0207	0414	0617	0922
Power rating P_{70}	W	1	2	3	4
Resistance range	Ω	see next page			
E-Series		see next page			
Tolerances	%	see next page			
Temperature coefficient	$10^{-6} * K^{-1}$	see next page			
max. cont. work. voltage	V_{RMS}	500		750	
Voltage coefficient	$10^{-6} V^{-1}$	< 3			
Insulation voltage (1min.)	V_{RMS}	500			
Insulation resistance	Ω	> 10^3M			
Derating	°C	linear 70 ... 250 (0W)			
Climatic category		55/200/56			
Temperature range	°C	- 55 ... 250			
Thermal resistance	KW^{-1}	<140	<130	<70	<60
Failure rate (Total, ϑ_o, max., 60% conf. lev.)	$10^{-9} * h^{-1}$	< 10			
Endurance (P_{70}, @70°C, 1000h, interm.)	$[\frac{\Delta R}{R}]$ %	± 1,5	± 1,5	± 1,5	± 1,5
Damp heat, steady state (40°C, 93% r.h., 56d)	$[\frac{\Delta R}{R}]$ %	± 1,5			
Climatic sequence	$[\frac{\Delta R}{R}]$ %	± 1,0			
Terminal strength	$[\frac{\Delta R}{R}]$ %	± 0,3			
Terminal tensile strength	N	40			
Resistance to soldering heat (260°C, 10s)	$[\frac{\Delta R}{R}]$ %	± 0,25			
Solderability	s	2,5 Flowtime; solderglobule test IEC 60068-2-20-T			
Current noise (DIN/IEC 195)	dB	R < 15K: -15 R>: 15 + 10/decade			
Nonlinearity (DIN/IEC 440)	dB	R < 15K: 110 R> 15 K: 110 -20/decade			
Marking		595/593: DIN-IEC-colour code, 4/5 bands 590/591: printed in clear			

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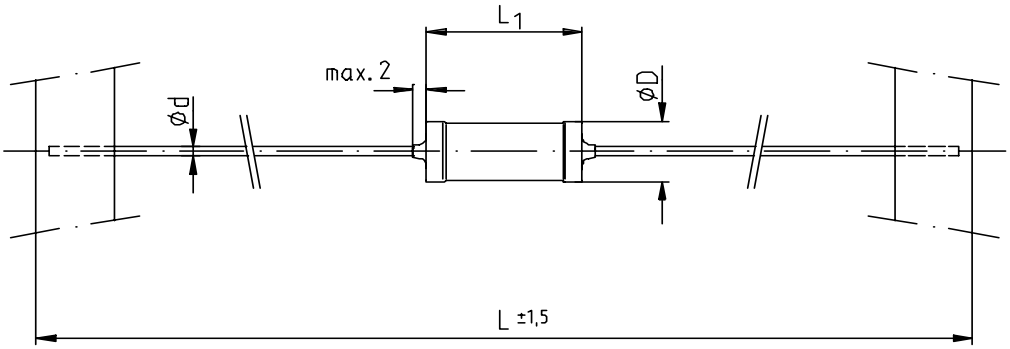
Dimensions in mm:



PO595-0 Resistance range	PO593-0 Resistance range	PO590-0 Resistance range	PO591-0 Resistance range	E-series	Tolerance	TC 10^{-6} K^{-1}
0R22 ... 10M	0R22 ... 10M	0R22 ... 560K	0R22 ... 100K	E 24	± 5%	± 200
-	1R ... 1M	1R ... 100K	1R ... 68K	E 48	±2%	± 200
1R ... 1M	-	-	-	E 96	± 1%	± 50

Type	L_1 [mm]	ØD [mm]	*Ød* [mm]	L±1,5 [mm]	Inside tape [mm]
PO595-0	6,3 –1	2,5 –0,5	0,6 ±0,02	65	52
PO593-0	12 –1,5	4,1 –0,5	0,8 ±0,02	85	73
PO590-0	16,5 –1,5	6,0 –0,5	0,8 ±0,02	95	77
PO591-0	20 –1	9,0 –0,5	0,8 ±0,02	95	77

Packaging:

Type	Packaging	Pieces	Pack.-Code
PO595-0	taped/Ammopack	2000	T
PO593-0	taped/Ammopack	1000	T
PO590-0	taped/Ammopack	1000	T
PO591-0	taped/Ammopack	500	T

Ordering example: PO593-0 (Type) 5 (Tolerance) T (Pack.-Code) 10K (R-Value)

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Metalglaze film resistors, axial, hi-temp.-solder contacts moulded uninflammable acc. to IEC 695-2-2

RoHS compliant

Specifications

Type		RG515-0	RG520-0
Style		0207	0309
Power rating P_{70}	W	0,5 ($P_{max.}$ = 0,7)	0,7 ($P_{max.}$ = 0,9)
Resistance range	Ω	see next page	
E-Series		see next page	
Tolerances	%	see next page	
Temperature coefficient	$10^{-6} * K^{-1}$	see next page	
max. cont. work. voltage	V_{RMS}	350	
Voltage coefficient	$10^{-6} * V^{-1}$	< 30	
Insulation voltage (1min.)	V_{RMS}	1000	
Insulation resistance	Ω	> 10^4	
Derating	°C	linear 70 ... 155 (0W)	
Climatic category		55/155/56	
Temperature range	°C	- 65 ... 175	
Thermal resistance	KW^{-1}	125	100
Failure rate (Total, ϑ_o max., 60% conf. lev.)	$10^{-9} h^{-1}$	< 1	
Endurance (P_{70}, @ 70°C, 1000h interm.)	$[\frac{\Delta R}{R}]$ %	± 0,5	
Damp heat, steady state (40°C, 93% r.h., 56d)	$[\frac{\Delta R}{R}]$ %	± 1,0	
Climatic sequence	$[\frac{\Delta R}{R}]$ %	± 1,0	
Terminal strength	$[\frac{\Delta R}{R}]$ %	± 0,2	
Terminal tensile strength	N	40	
Resistance to soldering heat (260°C, 10s)	$[\frac{\Delta R}{R}]$ %	± 0,1	
Solderability	s	2,5 Flowtime, solderglobule test, IEC 60068-2-20-T	
Current noise (DIN/IEC 195)	dB	R<1K0: -20 R>1K0: ± 20/decade	
Nonlinearity (DIN/IEC 440)	dB	110 - 20/decade	
Marking		Colour code: 5 resp. 6 bands (6th. band for TC) < 1R0 4 bands	

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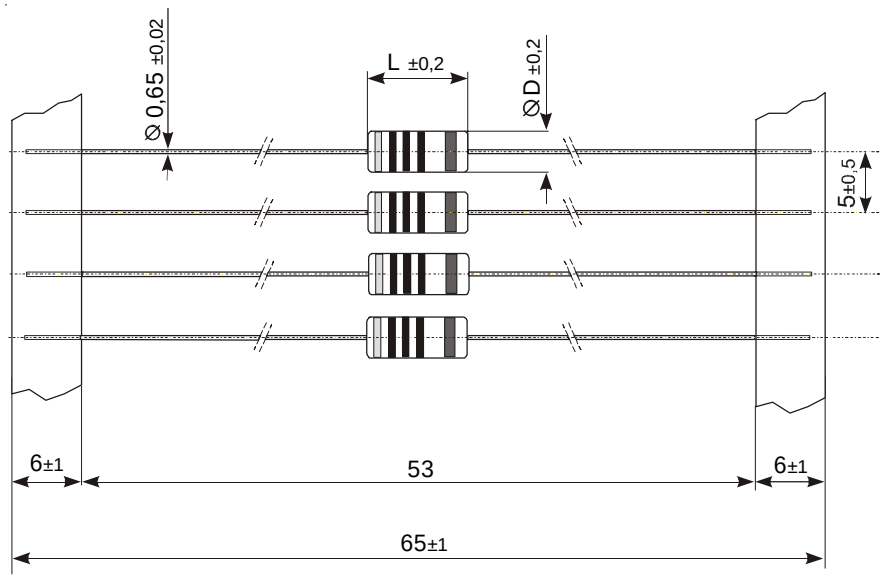
Dimensions in mm:



Resistance range	E-series	Tolerance	Temperature coefficient 10^{-6} K^{-1}
0R3 ... 3M3	E 24	± 2%	100 (T0) *
0R3 ... 9R1	E 24	± 1%	100 (T0) *
10R ... 3M32	E 96	± 1%	50 (T2)
10R ... 1M	E 96	± 0,5%	25 (T9)

* R <1R TC200

Type	L	ØD
RG515-0	6,4	2,3
RG520-0	8,0	3,2

Packaging:

Type	Packaging	Pieces	Pack.Code
RG515-0	taped/Ammopack taped/reel	1000 5000	T R
RG520-0	taped/Ammopack	1000	T

Ordering example:

RG515-0	1	T	1K
Type	Tolerance	Pack.-Code	R-Value

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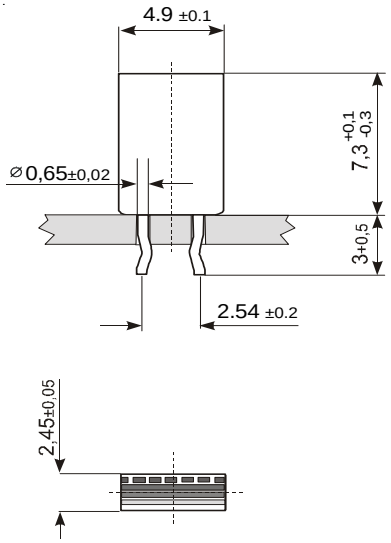
Metalglaze film resistors, moulded, vertical uninflammable acc. to IEC 695-2-2

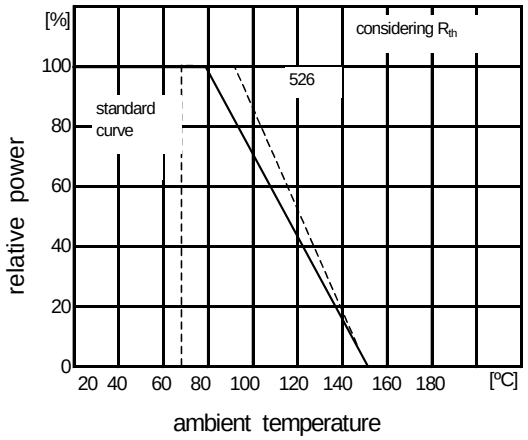
RoHS compliant

Specifications

Type		RGU 526-0
Style		04
Power rating P_{70}	W	0,5
Resistance range	Ω	see next page
E-Series		see next page
Tolerances	%	see next page
Temperature coefficient	$10^{-6} * K^{-1}$	see next page
max. cont. work. voltage	V_{RMS}	350
Voltage coefficient	$10^{-6} * V^{-1}$	< 30
Insulation voltage (1min.)	V_{RMS}	1000
Insulation resistance	Ω	> 10^4 except top surface
Derating linear	°C	see next page
Climatic category		55/155/56
Temperature range	°C	- 55 ... 175
Thermal resistance	KW^{-1}	90
Failure rate (Total, ϑ_o max., 60% conf. lev.)	$10^{-9}\ h^{-1}$	< 1
Endurance (P_{70}, @ 70°C, 1000h, interm.)	$[\frac{\Delta R}{R}]$ %	± 0,5
Damp heat, steady state (40°C, 93% r.h., 56d)	$[\frac{\Delta R}{R}]$ %	± 1,0
Climatic sequence	$[\frac{\Delta R}{R}]$ %	± 1,0
Terminal strength	$[\frac{\Delta R}{R}]$ %	± 0,2
Terminal tensile strength	N	40
Resistance to soldering heat (260°C, 10s)	$[\frac{\Delta R}{R}]$ %	± 0,1
Solderability	s	2,5 Flowtime, solderglobule test, IEC 60068-2-20-T
Current noise (DIN/IEC 195)	dB	R<1K: -20 R>1K : ±20 / decade
Nonlinearity (DIN/IEC 440)	dB	110 - 20 / decade
Marking		DIN-IEC-Color code; 4 resp. 5 Colors

Dimensions in mm:





Resistance range	E-series	Tolerance	Temperature coefficient ppm/K
0R3 ... 3M3	E 24	± 2%	100 (T0)*
10R ... 3M32	E 96	± 1%	50 (T2)
10R ... 1M	E 96	± 0,5%	25 (T9)

* R <1R : TC200

Packaging:

Type	Packaging	Pieces	Pack.Code
RGU526-0	bulk	1000	B

Ordering example:

RGU526-0	1	B	1K
Type	Tolerance	Pack.-Code	R-Value

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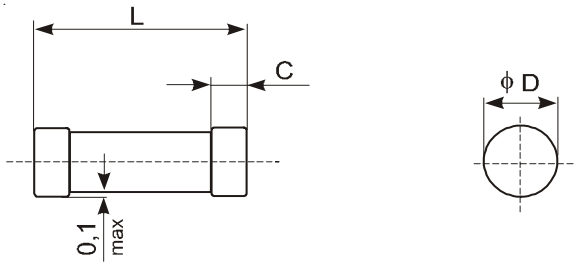
SMD-Metal Film Resistors
MELF Style

RoHS compliant

Specifications

Type		ZC0204	ZC0207
Style		0204	0207
Power rating P_{70}	W	0,25 (0,4W for min. 8.000h)	1,0
Resistance range	Ω	see next page	
E-Series		see next page	
Tolerances	%	see next page	
Temperature coefficient	$10^{-6} * K^{-1}$	see next page	
max. cont. work. voltage	V_{RMS}	200	500
Voltage coefficient	$10^{-6} * V^{-1}$	< 1	
Insulation voltage (1min.)	V_{RMS}	300	500
Insulation resistance	Ω	> 10^4 M	> 10^4 M
Derating	°C	linear 70 ... 155 (0W)	linear 70 ... 155 (0W)
Climatic category		55/155/56	55/155/56
Temperature range	°C	- 55 ... 155	- 55 ... 155
Thermal resistance	KW^{-1}	200	85
Failure rate (Total, ϑ_o max., 60% conf. lev.)	$10^{-9} h^{-1}$	< 10	< 5
Endurance (P_{70}, @ 70°C, 1000h interm.)	$[\frac{\Delta R}{R}]$ %	± 0,25	± 1,5
Damp heat, steady state (40°C, 93% r.h., 56d)	$[\frac{\Delta R}{R}]$ %	± 0,25	± 0,5
Climatic sequence	$[\frac{\Delta R}{R}]$ %	± 0,1	
Terminal strength	$[\frac{\Delta R}{R}]$ %	Board-bend test CECC 00802; 10 x 2 mm	
Resistance to soldering heat (260°C, 10s)	$[\frac{\Delta R}{R}]$ %	± 0,1	± 0,25
Solderability	s	Solder-bath test CECC 00802, 95% wetting	
Current noise (DIN/IEC 195)	dB	R<10K: -25 R>10K: - 25 + 8 / decade	
Nonlinearity (DIN/IEC 440)	dB	110	
0R0 (Jumper) Current rating		2A (R_{max} = R015)	
Marking		DIN-IEC-Colour code, 5 bands	

Dimensions in mm:



Resistance range ZC0207	Resistance range ZC0204	Tolerance	Temperature coefficient	E-Series
0R16 ... 0R2	0R22 ... 0R91	± 5%	100 · 10^{-6} K^{-1}	E 24
0R22 ... 0R91	0R51 ... 0R91	± 2%	100 · 10^{-6} K^{-1}	E 24
1R ... 10M	1R ... 10M	±1%	50 · 10^{-6} K^{-1}	E 24/E96
1R ... 2M2	10R ... 475K	± 0,5%	50 · 10^{-6} K^{-1}	E 24/E96
-	10R ... 475K	± 0,5%	25 · 10^{-6} K^{-1}	E 24/E96
-	10R ... 221K	± 0,5%	15 · 10^{-6} K^{-1}	E 24/E96
10R ... 1M	22R ... 330K	± 0,25%	25 · 10^{-6} K^{-1}	E 24/E96
-	22R ... 221K	± 0,25%	15 · 10^{-6} K^{-1}	E 24/E96
100R ... 511K	43R ... 330K	± 0,1%	25 · 10^{-6} K^{-1}	E 24/E96
-	43R ... 221K	± 0,1%	15 · 10^{-6} K^{-1}	E 24/E96

Tolerance	Coding
5%	J
2%	G
1%	F
0,5%	D
0,25%	C
0,1%	B

Temperature coefficient	Coding	Coating
100	F	light green
50	E	light green
25	D	pink
15	C	violett

Typ	L	C	ØD max.
ZC0204	3,6 -0,2	0,5 + 0,35	1,4
ZC0207	5,8 -0,3	0,9 ± 0,30	2,2

Packaging:

Type	Packaging	Pieces	Tolerance
ZC0204	8mm Blistertape 7 inch	2500 3000	1%, 2%, 5% 0,1%, 0,25%, 0,5%
	8mm Blistertape 13 inch	10000	all
ZC0207	12mm Blistertape 7inch	1500	all

Ordering example:	ZC0204	F	K	E	07	1K
0-0hm =	ZC0204	F	K	E	07	0R
	Type	Tolerance	Blister Tape	TC	Reel Diameter	R-Value

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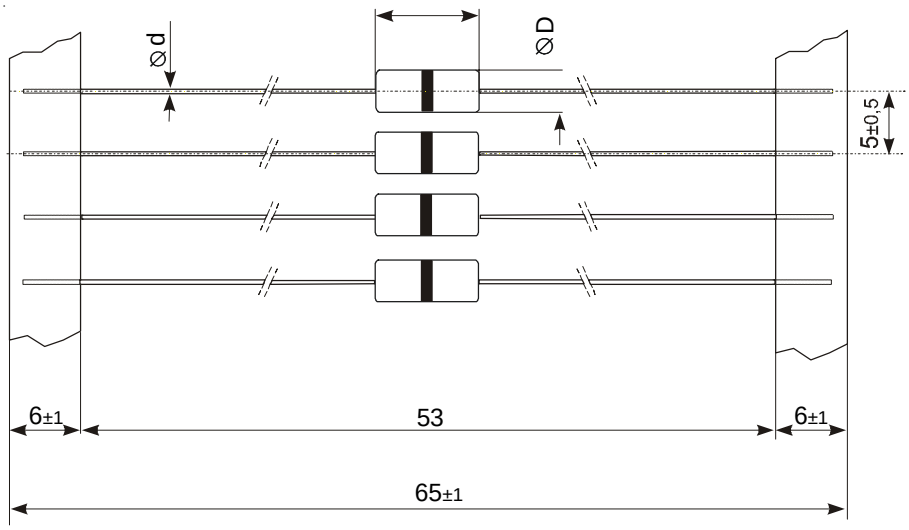
Zero-Ohm, moulded Jumper

RoHS compliant

Specifications

Type		ZOM0207
Old Type		100-902
Style		0207 moulded
Current rating	A	10
Dielectric withstanding voltage	V_{RMS}	1000
Cross-section area of conductor	mm^2	0,33
Conductor resistance	$\frac{m\Omega}{cm}$	0,54
Marketing		one colour-band: black

Dimensions in mm:



Type	L	ØD	Ød
ZOM 0207	6,4 ± 0,2	2,3 ± 0,2	0,65 ± 0,02

Packaging:

Type	Packaging	Pieces	Pack.Code
ZOM 0207	taped/Ammopack	2000	T

Ordering example: ZOM0207 (Type) T (Pack.-Code) 0R (Ohmic Value)

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