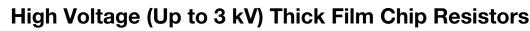
RCV e3

RoHS

COMPLIANT





www.vishay.com

LINKS TO ADDITIONAL RESOURCES



The RCV e3 high voltage thick film chip resistors series is the perfect choice for modern electronics with high voltage requirements. Typical applications include E-meter, AC power supplies, lighting ballasts and inverters for industrial drives, aircons, and white good.

FEATURES

- High operating voltage (up to 3 kV)
- Low voltage coefficient of resistance (VCR): 25 ppm/V
- UL 1676 recognition for RCV2010 e3 and RCV2512 e3 only; UL file no. E526561
- IEC 62368-1 ed. 3 compliant for RCV2010 e3 and RCV2512 e3 only
- Material categorization: for definitions of compliance please see <u>www.vishay.com/doc?99912</u>

APPLICATIONS

- E-meter
- Inverters for industrial drives, aircons, and white good
- AC power supplies
- Lighting ballasts

TECHNICAL SPECIFICATIONS					
DESCRIPTION	RCV0805 e3	RCV1206 e3	RCV2010 e3	RCV2512 e3	
Imperial size	0805	1206	2010	2512	
Metric size code	RR2012M	RR3216M	RR5025M	RR6332M	
Resistance range	100 kΩ 1	to 10 MΩ	100 kΩ to	ο 100 MΩ	
Resistance tolerance		± 5 %	; ±1%		
Temperature coefficient		± 200 ppm/K	; ± 100 ppm/K		
Voltage coefficient		25 p	pm/V		
Rated dissipation, P ₇₀ ⁽¹⁾	0.125 W	0.33 W	0.75 W	1 W	
Operating voltage, Umax. ACRMS/DC	400 V	800 V	2000 V	3000 V	
Permissible film temperature, $\vartheta_{\rm F max.}^{(1)}$		15	5 °C		
Operating temperature range		-55 °C to	o +155 °C		
Max. resistance change at P_{70} for resistance range, $ \Delta R/R $ after:					
1000 h	≤ 1.0 %	≤ 1.0 %	≤ 2.0 %	≤ 2.0 %	
Approval UL 1676 recognition file			E520	6561	
Approval IEC 62368-1	-	-	Ed. 3 approved		
Permissible voltage against ambient (insulation):					
1 min, U _{ins}		50	0 V		

Notes

· Application-specific safety requirements may set limitations to the applicability of the specified voltage

⁽¹⁾ Please refer to APPLICATION INFORMATION below

APPLICATION INFORMATION

When the resistor dissipates power, a temperature rise above the ambient temperature occurs, dependent on the thermal resistance of the assembled resistor together with the printed circuit board. The rated dissipation applies only if the permitted film temperature is not exceeded.

These resistors do not feature a limited lifetime when operated within the permissible limits. However, resistance value drift increasing over operating time may result in exceeding a limit acceptable to the specific application, thereby establishing a functional lifetime.

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DCV/1006 -2				
RCV1206 e3	± 100 ppm/K	±1%	100 k Ω to 10 M Ω	E24; E96
RCV2010 e3	± 200 ppm/K	±5 %	100 k Ω to 100 M Ω	E24
RCV2010 03	± 100 ppm/K	±1%		E24; E96
	± 200 ppm/K	±5 %	100 k Ω to 100 M Ω	E24
RCV2512 e3	± 100 ppm/K	±1%	100 kΩ to 10 MΩ	E24; E96

TOLERANCE

±5%

±1%

±5%

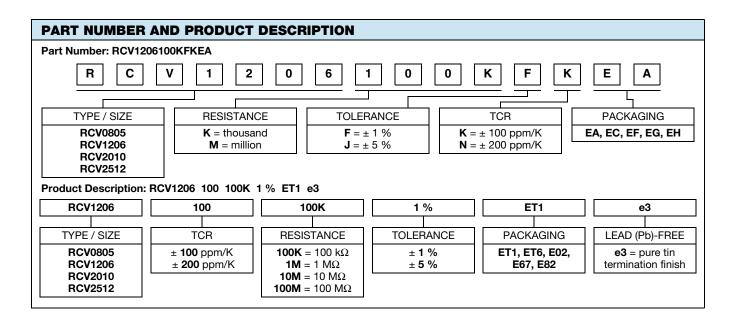
RESISTANCE

100 k Ω to 10 M Ω

100 k Ω to 10 M Ω

100 k Ω to 51 M Ω

PACKAGING								
TYPE / SIZE	CODE	QUANTITY	PACKAGING STYLE	WIDTH	РІТСН	PACKAGING DIMENSIONS		
RCV0805 e3	EA = ET1	5000			8 mm 4 mm	Ø 180 mm / 7"		
	EC = ET6	20 000	Paper tape according to IEC 60286-3, type 1a	8 mm		Ø 330 mm / 13"		
	EA = ET1	5000				Ø 180 mm / 7"		
RCV1206 e3	EC = ET6	20 000				Ø 330 mm / 13"		
RCV2010 e3	EF = E02	4000			4 mm	Ø 180 mm / 7"		
RCV2512 e3	EG = E67	2000	Blister tape according to IEC 60286-3. type 2a	Blister tape according to IEC 60286-3, type 2a	12 mm	8 mm	Ø 180 mm / 7"	
	EH = E82	4000			4 mm			



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E-SERIES

E24

E24; E96

E24

RCV e3



TYPE / SIZE

RCV0805 e3

www.vishay.com

TEMPERATURE COEFFICIENT AND RESISTANCE RANGE

TCR

± 200 ppm/K

± 100 ppm/K

± 200 ppm/K

Vishay Draloric



DESCRIPTION

Production is strictly controlled and follows an extensive set of instructions established for reproducibility. A cermet film layer and a glass-over are deposited on a high grade (Al_2O_3) ceramic substrate. Specially designed inner contacts are deposited on both sides. A special laser is used to achieve the target value by smoothly fine trimming the resistive layer without damaging the ceramics. The resistor elements are covered by a protective coating designed for electrical, mechanical, and climatic protection. The terminations receive a final pure matte tin on nickel plating. The result of the determined production is verified by an extensive testing procedure on 100 % of the individual chip resistors. Only accepted products are laid directly into the tape in accordance with IEC 60286-3 type 1a and 2a (1).

ASSEMBLY

The resistors are suitable for processing on automatic SMD assembly systems. They are suitable for automatic soldering using wave, reflow or vapor phase as shown in IEC 61760-1 (1). The encapsulation is resistant to all cleaning solvents commonly used in the electronics industry, including alcohols, esters, and aqueous solutions. The suitability of conformal coatings, potting compounds and their processes, if applied, shall be qualified by appropriate means to ensure the long-term stability of the whole system.

The resistors are RoHS-compliant, the pure matte tin plating provides compatibility with lead (Pb)-free and lead-containing soldering processes. Solderability is specified for 2 years after production or requalification. The permitted storage time is 20 years. The immunity of the plating against tin whisker growth has been proven under extensive testing.

MATERIALS

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

- IEC 62474, Material Declaration for Products of and for the Electrotechnical Industry, with the list of declarable substances given therein (2)
- The Global Automotive Declarable Substance List (GADSL) ⁽³⁾
- The REACH regulation (1907/2006/EC) and the related list of substances with very high concern (SVHC) ⁽⁴⁾ for its supply chain

The products do not contain any of the banned substances as per IEC 62474, GADSL, or the SVHC list, see www.vishay.com/how/leadfree.

Hence the products fully comply with the following directives:

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

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

APPROVALS

Where applicable, the resistors are tested in accordance with EN 140401-802 which refers to EN 60115-1, EN 60115-8 and the variety of environmental test procedures of the IEC 60068 (1) series.

Products RCV2010 e3 and RCV2512 e3 only, are additionally tested in accordance with UL 1676 and IEC 62368-1, ed. 3.

Recognition by Underwriter Laboratories Inc. is indicated by the UL logo on the package label.

RELATED PRODUCTS

For high voltage, automotive thick film products, please refer to latest edition of RCV-AT e3, High Voltage (Up to 3 kV) Thick Film Chip Resistors datasheet, www.vishav.com/doc?20082.

For high voltage thin film products, please refer to latest edition of TNPV e3, High Voltage Thin Film Chip Resistors datasheet, www.vishay.com/doc?28881.

For products with professional specification, please refer to latest edition of MMA0204 HV, MMB0207 HV, Professional High Voltage Thin Film MELF Resistors datasheet, www.vishay.com/doc?28880.

For tighter precision specification, automotive high voltage thin film, please refer to latest edition of MMA 0204 HV AT, MMB 0207 HV AT, Precision Automotive High Voltage Thin Film MELF Resistors datasheet, www.vishay.com/doc?28951.

- ⁽¹⁾ The quoted IEC standards are also released as EN standards with the same number and identical contents
- (2) The IEC 62474 list of declarable substances is maintained in a dedicated database, which is available at http://std.iec.ch/iec62474
- The Global Automotive Declarable Substance List (GADSL) is maintained by the American Chemistry Council and available at www.gadsl.org
- ⁽⁴⁾ The SVHC list is maintained by the European Chemical Agency (ECHA) and available at <u>http://echa.europa.eu/candidate-list-table</u>

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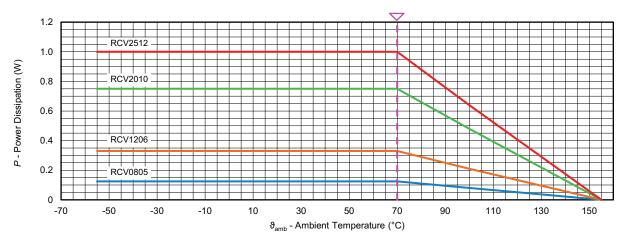
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Notes

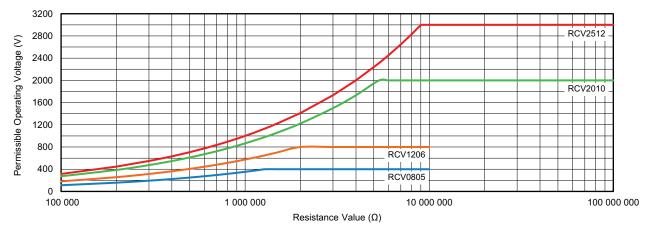
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RCV e3 Vishay Draloric

DERATING



NOMINAL OPERATING VOLTAGE





TESTS AND REQUIREMENTS

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

EN 60115-1, generic specification

EN 60115-8, sectional specification

EN 140401-802, detail specification

IEC 60068-2-xx, test methods

UL 1676 - Conductive-Path and Discharge-Path Resistors

IEC 62368-1 Audio / Video, Information and Communication Technology Equipment, Part 1: Safety Requirements ed. 3

The parameters stated in the "Test Procedures and Requirements" table are based on the required tests and permitted limits of EN 140401-802. The table presents only the most important tests, for the full test schedule refer to the documents listed above. However, some additional tests and a number of improvements against those minimum requirements have been included.

The testing also covers most of the requirements specified by EIA/IS-703 and JIS-C-5201-1.

The tests are carried out under standard atmospheric conditions in accordance with IEC 60068-1, 4.3, whereupon the following values are applied:

Temperature: 15 °C to 35 °C

Relative humidity: 25 % to 75 %

Air pressure: 86 kPa to 106 kPa (860 mbar to 1060 mbar)

A climatic category LCT / UCT / 56 is applied, defined by the lower category temperature (LCT), the upper category temperature (UCT), and the duration of exposure in the damp heat, steady state test (56 days).



Vishay Draloric

TEST PROCEDURES AND REQUIREMENTS									
EN	IEC		PROCEDURE			-	S PERMISSIBLE Ge (a <i>r</i>)		
60115-1 CLAUSE	60082-2 ⁽¹⁾ TEST METHOD	TEST	Stability fo	r product ty	/pes:	STABILITY CLASS 1 OR BETTER	STABILITY CLASS 2 OR BETTER		
					RCV e3	100 kΩ to	o 100 MΩ		
6.1	-	Measurements of resistance and tolerance		-		±1%	± 5 %		
6.2	-	Temperature coefficient of resistance	At (20 / -55 / 20) °C and (20 / 155 / 20) °C			± 100 ppm/K	± 200 ppm/K		
7.1	-	Endurance at rated temperature 70 °C	$U = \sqrt{P_{70} \times R} \text{ or } U = U_{max.}$ whichever is the less severe; 1.5 h on; 0.5 h off 70 °C; 1000 h		RCV0805, RCV1206: ± (1 % <i>R</i> + 0.05 RCV2010, RCV2512: ± (2 % <i>R</i> + 0.1				
7.3	-	Endurance at maximum temperature		155 °C; 10	00 h	± (2 % F	(2 % <i>R</i> + 0.1 Ω)		
10.4	78 (Cab)	Damp heat, steady state	(40	0 ± 2) °C; 56 (93 ± 3) %		± (1 % <i>R</i> + 0.05 Ω)	± (2 % <i>R</i> + 0.1 Ω)		
10.3	-	Climatic sequence:							
10.3.4.2	2 (Bb)	Dry heat		125 °C; 10	3 h				
10.3.4.3	30 (Db)	Damp heat, cyclic	55 °C; 2	4 h; ≥ 90 %	RH; 1 cycle				
10.3.4.4	1 (Ab)	Cold		-55 °C: 2	h	\pm (1 % R + 0.05 Ω)	± (2 % <i>R</i> + 0.1 Ω)		
10.3.4.5	13 (M)	Low air pressure	8.5 k	Pa; 2 h; (25	± 10) °C				
10.3.4.6	30 (Db)	Damp heat, cyclic	55 °C; 5 days; > 90 % RH; 5 cycles						
10.3.4.7	-	DC load	$U = \sqrt{P_{70} \times R} \le U_{\text{max.}}$; 1 min						
-	1 (Aa)	Cold		-55 °C; 2	h	± (0.5 % <i>R</i> + 0.05 Ω)			
10.1	14 (Na)	Rapid change of temperature	RCV0805	5, RCV1206	0 min. at 125 °C; : 1000 cycles 2: 100 cycles	\pm (1 % R + 0.05 Ω) no visible damage			
8.1	-	Short-term overload	U = 2.5 whichev Style RCV0805 RCV1206 RCV2010 RCV2512	$\begin{array}{c} x \ / P_{70} \ x \ R \\ \text{er is the les} \\ \hline \text{Duration} \\ \hline 1 \ \text{s} \\ \hline 2 \ \text{s} \\ \hline 5 \ \text{s} \\ \hline 5 \ \text{s} \\ \hline 5 \ \text{s} \end{array}$	<pre>≤ 2 x U_{max.;} s severe; 5 s Maximum U_{OL} 800 1000 4000 6000</pre>	RCV0805, RCV1206: ± (0.25 % <i>R</i> + 0.0 RCV2010, RCV2512: ± (2.0 % <i>R</i> + 0.05			
8.2	-	Single pulse high voltage overload 10 µs / 700 µs	U = 10 x whichever is	Severity no $\overline{P_{70} \times R}$ or s the less set	$U = 2 \times U_{max.;}$ evere; 10 pulses	± (2 % F no visible	\pm (2 % R + 0.1 Ω) no visible damage		
8.4	-	Periodic electric overload	whiche	ever is the le		± (2 % <i>R</i> + 0.05 Ω) no visible damage			
8.5	-	Electrostatic discharge (human body model)	0.1 s on; 2.5 s off; 1000 cycles IEC 61340-3-1 ⁽¹⁾ ; 3 positive + 3 negative discharges; RCV0805: 1000 V RCV1206: 2000 V RCV2010: 12 kV RCV2512: 25 kV		± (1 % <i>R</i>	+ 0.05 Ω)			
9.11	6 (Fc)	Vibration	Endurance by sweeping f = 10 Hz to 2000 Hz; no resonance; $A \le 1.5$ mm ≤ 200 m/s ² ; 7.5 h			± (0.25 % <i>R</i> + 0.05 Ω) no visible damage	± (0.5 % <i>R</i> + 0.05 Ω) no visible damage		
11.1	58 (Td)	Solderability	Solder bath method, SnPb40; non-activated flux (235 ± 5) °C; (2 ± 0.2) s Solder bath method, Sn96.5Ag3Cu0.5; non-activated flux (245 ± 5) °C; (3 ± 0.3) s				95 % covered); e damage		
11.2	58 (Td)	Resistance to soldering heat		lering bath 0 ± 5) °C; (1		± (0.25 % <i>R</i> + 0.05 Ω)	\pm (0.5 % R + 0.05 Ω)		

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RCV e3

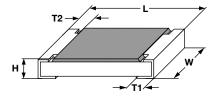
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TEST PROCEDURES AND REQUIREMENTS								
EN	IEC		PROCEDURE	REQUIREMENTS PERMISSIBLE CHANGE (∆ <i>R</i>)				
60115-1 CLAUSE		TEST	TEST Stability for product types:		STABILITY CLASS 2 OR BETTER			
			RCV e3	100 kΩ to	o 100 MΩ			
11.3	45 (XA)	Component solvent resistance	lsopropyl alcohol; +50 °C; method 2	No visible damage				
9.7	21 (Uu ₃)	Shear (adhesion)	17.7 N	No visible damage				
9.8	21 (Uu ₁)	Substrate bending	Depth 2 mm; 3 times	RCV0805, RCV1206: ± (0.25 % <i>R</i> + 0.05 RCV2010, RCV2512: ± (1 % <i>R</i> + 0.05 no visible damage, no open circuit in bent position				
12.2	-	Voltage proof	<i>U</i> = 1.4 x <i>U</i> _{ins} ; 60 s	No flashover or breakdown				
12.4	-	Flammability, needle flame test	IEC 60695-11-5 ⁽¹⁾ ; 10 s	No burning after 30 s				

Note

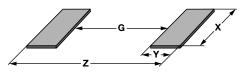
⁽¹⁾ The quoted IEC standards are also released as EN standards with the same number and identical contents

DIMENSIONS



DIMENSIONS AND MASS								
TYPE / SIZE	L (mm)	W (mm)	H (mm)	T1 (mm)	T2 (mm)	MASS (mg)		
RCV0805 e3	2.0 + 0.20 / - 0.10	1.25 ± 0.15	0.5 ± 0.10	0.3 + 0.20 / - 0.10	0.3 ± 0.20	5.5		
RCV1206 e3	3.2 + 0.10 / - 0.20	1.6 ± 0.15	0.55 ± 0.05	0.45 ± 0.20	0.4 ± 0.20	10		
RCV2010 e3	5.0 ± 0.15	2.5 ± 0.15	0.6 ± 0.10	0.6 ± 0.20	0.45 ± 0.20	25.5		
RCV2512 e3	6.3 ± 0.20	3.15 ± 0.15	0.6 ± 0.10	0.6 ± 0.20	0.45 ± 0.20	42		

SOLDER PAD DIMENSIONS



RECOMMENDED SOLDER PAD DIMENSIONS									
TYPE / SIZE		WAVE SC	DLDERING		REFLOW SOLDERING				
	G (mm)	Y (mm)	X (mm)	Z (mm)	G (mm)	Y (mm)	X (mm)	Z (mm)	
RCV0805 e3	0.90	1.30	1.60	3.50	1.00	0.95	1.45	2.90	
RCV1206 e3	1.40	1.40	1.95	4.20	1.50	1.05	1.80	3.60	
RCV2010 e3	3.60	1.65	2.85	6.90	3.70	1.20	2.70	6.10	
RCV2512 e3	4.90	1.60	3.50	8.10	5.00	1.25	3.35	7.50	

Note

 Utilization of the full specified operating voltage may require special considerations on the creepage and clearance distance between conductors at different potential levels

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Vishay

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