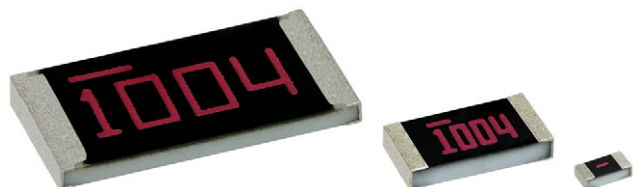


Anti-Surge, Thick Film Chip Resistors



LINKS TO ADDITIONAL RESOURCES



The anti-surge thick film chip resistor series combines a significantly higher power rating and pulse load performance as compared to standard chip resistors.

FEATURES

- Increased surge pulse capability compared to standard CRCW series
- High power rating
- AEC-Q200 qualified
- PFAS-free series
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912



RoHS
COMPLIANT
HALOGEN
FREE

APPLICATIONS

- Automotive
- Industrial
- Telecommunications

TECHNICAL SPECIFICATIONS

DESCRIPTION	RCS0402-T e3	RCS0603-T e3	RCS0805-T e3	RCS1206-T e3	RCS1210-T e3	RCS2010-T e3	RCS2512-T e3
Imperial size	0402	0603	0805	1206	1210	2010	2512
Metric size code	RR1005M	RR1608M	RR2012M	RR3126M	RR3225M	RR3246M	RR6332M
Resistance range	1 Ω to 1 M Ω						
Resistance tolerance	$\pm 5\%$; $\pm 1\%$						
Temperature coefficient	± 200 ppm/K; ± 100 ppm/K						
Rated dissipation, P_{70} ⁽¹⁾	0.2 W	0.33 W	0.4 W	0.5 W	0.5 W	1.0 W	1.5 W
Operating voltage, U_{max} . AC _{RMS} /DC	50 V	75 V	150 V	200 V	200 V	200 V	200 V
Permissible film temperature, ϑ_F max. ⁽¹⁾	155 °C						
Operating temperature range	-55 °C to +155 °C						

Note

⁽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.



TEMPERATURE COEFFICIENT AND RESISTANCE RANGE				
TYPE / SIZE	TCR	TOLERANCE	RESISTANCE	E-SERIES
RCS0402-T e3	± 100 ppm/K	± 5 %	10 Ω to 1 M Ω	E24
	± 100 ppm/K	± 1 %	10 Ω to 1 M Ω	E24; E96
RCS0603-T e3	± 200 ppm/K	± 5 %	1 Ω to 9.1 Ω	E24
	± 100 ppm/K	± 5 %	10 Ω to 1 M Ω	E24
	± 200 ppm/K	± 1 %	1 Ω to 9.76 Ω	E24; E96
	± 100 ppm/K	± 1 %	10 Ω to 1 M Ω	E24; E96
RCS0805-T e3	± 200 ppm/K	± 5 %	1 Ω to 9.1 Ω	E24
	± 100 ppm/K	± 5 %	10 Ω to 1 M Ω	E24
	± 200 ppm/K	± 1 %	1 Ω to 9.76 Ω	E24; E96
	± 100 ppm/K	± 1 %	10 Ω to 1 M Ω	E24; E96
RCS1206-T e3	± 200 ppm/K	± 5 %	1 Ω to 9.1 Ω	E24
	± 100 ppm/K	± 5 %	10 Ω to 1 M Ω	E24
	± 200 ppm/K	± 1 %	1 Ω to 9.76 Ω	E24; E96
	± 100 ppm/K	± 1 %	10 Ω to 1 M Ω	E24; E96
RCS1210-T e3	± 200 ppm/K	± 5 %	1 Ω to 9.1 Ω	E24
	± 100 ppm/K	± 5 %	10 Ω to 1 M Ω	E24
	± 200 ppm/K	± 1 %	1 Ω to 9.76 Ω	E24; E96
	± 100 ppm/K	± 1 %	10 Ω to 1 M Ω	E24; E96
RCS2010-T e3	± 200 ppm/K	± 5 %	1 Ω to 9.1 Ω	E24
	± 100 ppm/K	± 5 %	10 Ω to 1 M Ω	E24
	± 200 ppm/K	± 1 %	1 Ω to 9.76 Ω	E24; E96
	± 100 ppm/K	± 1 %	10 Ω to 1 M Ω	E24; E96
RCS2512-T e3	± 200 ppm/K	± 5 %	1 Ω to 9.1 Ω	E24
	± 100 ppm/K	± 5 %	10 Ω to 1 M Ω	E24
	± 200 ppm/K	± 1 %	1 Ω to 9.76 Ω	E24; E96
	± 100 ppm/K	± 1 %	10 Ω to 1 M Ω	E24; E96

PACKAGING						
TYPE / SIZE	CODE	QUANTITY	PACKAGING STYLE	WIDTH	PITCH	PACKAGING DIMENSIONS
RCS0402-T e3	ED = ET7	10 000	Paper tape acc. to IEC 60286-3, Type 1a	8 mm	2 mm	Ø 180 mm / 7"
RCS0603-T e3	EA = ET1	5000			4 mm	
RCS0805-T e3	EA = ET1	5000				
RCS1206-T e3	EA = ET1	5000				
RCS1210-T e3	EA = ET1	5000				
RCS2010-T e3	EF = E02	4000	Blister tape acc. to IEC 60286-3, Type 2a	12 mm	4 mm	
RCS2512-T e3	EH = E82	4000				



PART NUMBER AND PRODUCT DESCRIPTION

Part Number: RCS06031K00FKEAT

R	C	S	0	6	0	3	1	K	0	0	F	K	E	A	T
MODEL			RESISTANCE			TOLERANCE		TCR		PACKAGING		SPECIAL			
RCS0402 RCS0603 RCS0805 RCS1206 RCS1210 RCS2010 RCS2512			R = decimal K = thousand M = million			F = $\pm 1\%$ J = $\pm 5\%$		K = ± 100 ppm/K N = ± 200 ppm/K		EA, ED, EF, EH		T = Vishay special digit			

Product Description: RCS0603-T 100 1K0 1 % ET1 e3

RCS0603-T	100	1K0	1 %	ET1	e3
MODEL	TCR	RESISTANCE	TOLERANCE	PACKAGING	LEAD (Pb)-FREE
RCS0402-T RCS0603-T RCS0805-T RCS1206-T RCS1210-T RCS2010-T RCS2512-T	± 100 ppm/K ± 200 ppm/K	1R = 1 Ω 10R = 10 Ω 1K = 1 k Ω 1M = 1 M Ω	$\pm 1\%$ $\pm 5\%$	ET1, ET7, E02, E82	e3 = pure tin termination finish

MARKING
RCS0402-T components:

RCS0603-T to RCS2512-T components in $\pm 5\%$ tolerance:

The nominal resistance is expressed in three digits; the first two digits represent the significant figures of nominal resistance in Ω , and the third digit represents exponent for base of 10, e.g. $\bar{1}00 = 10 \times 10^0 = 10 \Omega$


RCS0805-T to RCS2512-T components in $\pm 1\%$ tolerance:

The nominal resistance is expressed in four digits; the first three digits represent the significant figures of nominal resistance in Ω , and the fourth digit represents exponent for base of 10, e.g. $\bar{1}000 = 100 \times 10^0 = 100 \Omega$


RCS0603-T components in $\pm 1\%$ tolerance:

For RCS0603-T 1 % tolerance a 4-digit marking code is not feasible; instead the marking consists of a 2-digit symbol coding the E96 resistance and one digit coding the multiplier

Symbol for E96 series nominal resistance value

SYMBOL	E96	SYMBOL	E96	SYMBOL	E96	SYMBOL	E96
01	100	25	178	49	316	73	562
02	102	26	182	50	324	74	576
03	105	27	187	51	332	75	590
04	107	28	191	52	340	76	604
05	110	29	196	53	348	77	619
06	113	30	200	54	357	78	634
07	115	31	205	55	365	79	649
08	118	32	210	56	374	80	665
09	121	33	215	57	383	81	681
10	124	34	221	58	392	82	698
11	127	35	226	59	402	83	715
12	130	36	232	60	412	84	732
13	133	37	237	61	422	85	750
14	137	38	243	62	432	86	768
15	140	39	249	63	442	87	787
16	143	40	255	64	453	88	806
17	147	41	261	65	464	89	825
18	150	42	267	66	475	90	845
19	154	43	274	67	487	91	866
20	158	44	280	68	499	92	887
21	162	45	287	69	511	93	909
22	165	46	294	70	523	94	931
23	169	47	301	71	536	95	953
24	174	48	309	72	549	96	976

MARKING
Symbol for multipliers

SYMBOL	A	B	C	D	E	F	G	H	X	Y	Z
Multipliers	10 ⁰	10 ¹	10 ²	10 ³	10 ⁴	10 ⁵	10 ⁶	10 ⁷	10 ⁻¹	10 ⁻²	10 ⁻³

E.g. $\bar{0}1A = 100 \times 10^0 = 100 \Omega$



When the resistance is not in E96 series, three digitals with underline in E24 series is used as a mark,
e.g. 0603, 120 Ω , $\pm 1\%$ - marking is 121



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 with its prepared inner contacts on both sides. A special laser is used to achieve the target value and the desired power dissipation performance 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 ⁽¹⁾ and Type 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**. 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 Substances Directive (RoHS) with amendment 2015/863/EU
- 2012/19/EU Waste Electrical and Electronic Equipment Directive (WEEE)

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

APPROVALS

The resistors are qualified according to AEC-Q200.

The resistors are qualified according to AEC-Q200. (www.aecouncil.com/Documents/AEC_Q200_Rev_E_Base_Document.pdf)

RELATED PRODUCTS

For surge components with higher power dissipation and long term pulse performance, please refer to latest edition of RCS e3, Anti-Surge, High Power Thick Film Chip Resistors datasheet (www.vishay.com/doc?20065).

The CRCW-HP e3 product series is designed for those applications where both enhanced power rating and superior pulse loading performance is required. For ordering CRCW-HP e3 please refer to latest edition of datasheet (www.vishay.com/doc?20043).

Notes

⁽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>.

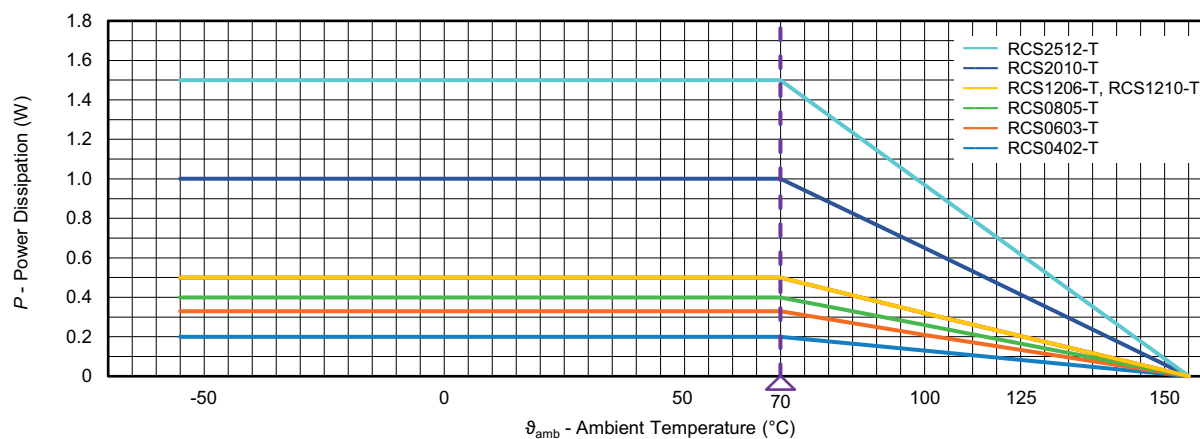
⁽³⁾ The Global Automotive Declarable Substance List (GADSL) is maintained by the American Chemistry Council and available at www.gadsl.org

⁽⁴⁾ The SVHC list is maintained by the European Chemical Agency (ECHA) and available at <http://echa.europa.eu/candidate-list-table>

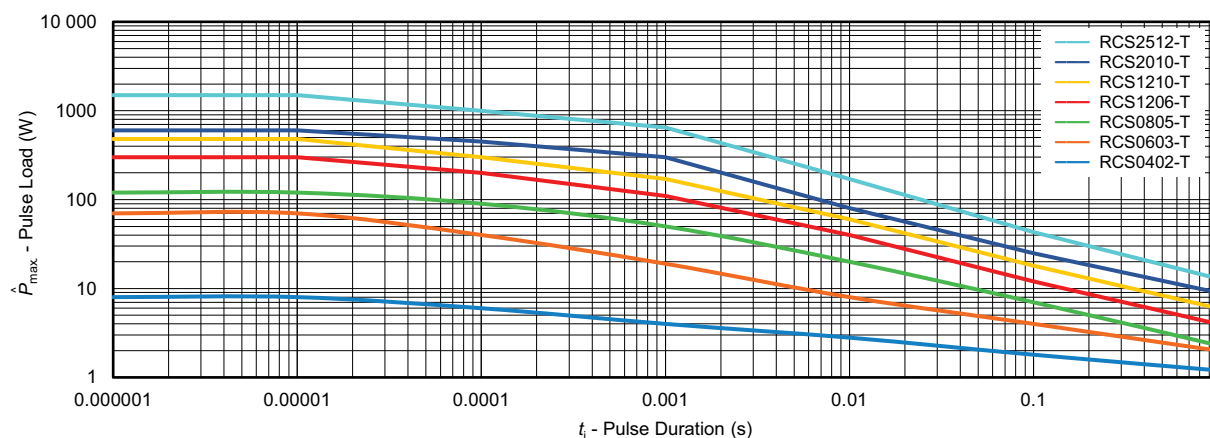


FUNCTIONAL PERFORMANCE

Derating



One-Single Pulse



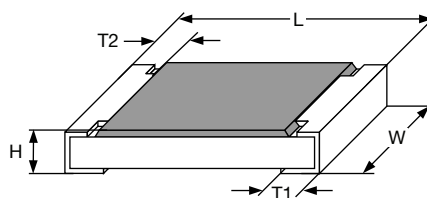
Maximum pulse load, single pulse; applicable if $\bar{P} \rightarrow 0$, $\hat{U} \leq \hat{U}_{max}$, and $n=1$;
for permissible resistance change of $\pm (1 \% R + 0.05 \Omega)$

TEST PROCEDURES AND REQUIREMENTS				
TEST	REFERENCE STANDARD	PROCEDURE	REQUIREMENTS PERMISSIBLE CHANGE (ΔR) ⁽¹⁾	
		Stability for product types:	STABILITY CLASS 1 OR BETTER	STABILITY CLASS 2 OR BETTER
		RCS-T e3	1 Ω to 1 M Ω	
Initial measurements of resistance and tolerance	IEC 60115-1 6.1	-	$\pm 1 \%$	$\pm 5 \%$
Voltage proof	IEC 60115-1 12.2	$U = 500 \text{ V}; 60 \text{ s}$	No flashover or breakdown	
Temperature coefficient of resistance	IEC 60115-1 6.2	At $+25 \text{ }^{\circ}\text{C}$ / $-55 \text{ }^{\circ}\text{C}$ and $+25 \text{ }^{\circ}\text{C}$ / $+125 \text{ }^{\circ}\text{C}$	$\pm 100 \text{ ppm/K}$	$\pm 200 \text{ ppm/K}$
Short-term overload	IEC 60115-1 8.1	2.5 x rated voltage for 5 s	$\pm (1 \% R + 0.05 \Omega)$	
High temperature exposure (storage)	AEC-Q200-REV E Test 3 MIL-STD-202 Method 108	$155 \text{ }^{\circ}\text{C} \pm 5 \text{ }^{\circ}\text{C}; 1000 \text{ h}$	$\pm (2 \% R + 0.1 \Omega)$	
Temperature cycling	AEC-Q200-REV E Test 4 JESD22 Method JA-104	1000 cycles $-55 \text{ }^{\circ}\text{C}$ to $+155 \text{ }^{\circ}\text{C}$; dwell time: 15 minutes min.; transition time: 1 minute max.	$\pm (1 \% R + 0.05 \Omega)$	
Humidity bias	AEC-Q200-REV E Test 7 MIL-STD-202 Method 103	1000 h $85 \text{ }^{\circ}\text{C}/85 \% \text{ RH}$, 10 % of operating power (not exceeding max. working voltage)	$\pm (3 \% R + 0.1 \Omega)$	
High temperature operating life	AEC-Q200-REV E Test 8 MIL-STD-202 Method 108	$U = \sqrt{P_{70} \times R} \leq U_{\text{max.}}$; 1.5 h on; 0.5 h off; $70 \text{ }^{\circ}\text{C}$, 1000 h	$\pm (3 \% R + 0.1 \Omega)$	
Resistance to solvents	AEC-Q200-REV E Test 12 MIL-STD-202 Method 215	According to the standard method	No visible damage	
Mechanical shock	AEC-Q200-REV E Test 13 MIL-STD-202 Method 213	According to method 213 condition C; peak value: 100 g; waveform: half-sine	$\pm (1 \% R + 0.05 \Omega)$	
Vibration	AEC-Q200-REV E Test 14 MIL-STD-202 Method 204	5 g's for 20 min., 12 cycles each of 3 orientations; test from 10 Hz to 2000 Hz	$\pm (1 \% R + 0.05 \Omega)$	
Resistance to soldering heat	AEC-Q200-REV E Test 15 MIL-STD-202 Method 210	Solder bath method $(260 \pm 5) \text{ }^{\circ}\text{C}$; $(10 \pm 1) \text{ s}$	$\pm (1 \% R + 0.05 \Omega)$	
ESD	AEC-Q200-REV E Test 17	ESD voltage according to the size: RCS0402-T: 500 V RCS0603-T: 800 V RCS0805-T: 1000 V RCS1206-T: 2000 V RCS1210-T to RCS2512-T: $\geq 2000 \text{ V}$	$\pm (1 \% R + 0.05 \Omega)$	
Solderability	AEC-Q200-REV E Test 18 J-STD-00	Dry heat the part for 4 h $\pm 15 \text{ min}$ at $155 \text{ }^{\circ}\text{C}$; Method B1: $245 \text{ }^{\circ}\text{C} \pm 5 \text{ }^{\circ}\text{C}$, 5 s $\pm 0.5 \text{ s}$, lead (Pb)-free solder; Method D: $260 \text{ }^{\circ}\text{C} \pm 5 \text{ }^{\circ}\text{C}$, 5 s $\pm 0.5 \text{ s}$, lead (Pb)-free solder	Good tinning ($\geq 95 \%$ covered) no visible damage	
Flammability	AEC-Q200-REV E Test 20 IEC 60695-11-5	IEC 60695-11-5; 10 s	No burning after 30 s	
Board flex	AEC-Q200-REV E Test 21	The force shall be applied for 60 s for a depth of 3 mm	$\pm (1 \% R + 0.05 \Omega)$	
Terminal strength	AEC-Q200-REV E Test 22	Apply force for 60 s; RCS0402-T: 9 N; RCS0603-T to RCS2512-T: 17.7 N	$\pm (0.5 \% R + 0.05 \Omega)$	

Note

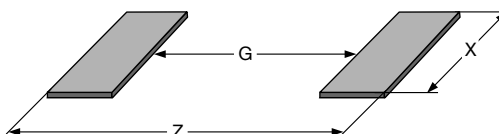
⁽¹⁾ The quoted IEC standards are also released as EN standards with the same number and identical contents

DIMENSIONS



DIMENSIONS AND MASS						
TYPE / SIZE	L (mm)	W (mm)	H (mm)	T1 (mm)	T2 (mm)	MASS (mg)
RCS0402-T e3	1.00 ± 0.10 / - 0.05	0.50 ± 0.05	0.32 ± 0.05	0.25 ± 0.10	0.20 ± 0.10	0.52
RCS0603-T e3	1.60 ± 0.10	0.80 ± 0.10	0.45 ± 0.10	0.30 ± 0.20	0.30 ± 0.20	2
RCS0805-T e3	2.00 ± 0.10	1.25 ± 0.10	0.50 ± 0.10	0.40 ± 0.20	0.40 ± 0.20	4.5
RCS1206-T e3	3.10 ± 0.10	1.55 ± 0.10	0.55 ± 0.10	0.40 ± 0.20	0.50 ± 0.30	9
RCS1210-T e3	3.10 ± 0.10	2.55 ± 0.10	0.60 ± 0.10	0.40 ± 0.20	0.50 ± 0.30	15
RCS2010-T e3	5.00 ± 0.15	2.50 ± 0.15	0.60 ± 0.10	0.50 ± 0.25	0.60 ± 0.30	23
RCS2512-T e3	6.30 ± 0.20	3.20 ± 0.20	0.60 ± 0.10	0.50 ± 0.25	0.60 ± 0.30	38

SOLDER PAD DIMENSIONS



RECOMMENDED SOLDER PAD DIMENSIONS			
TYPE / SIZE	REFLOW SOLDERING		
	G (mm)	X (mm)	Z (mm)
RCS0402-T e3	0.5 to 0.6	0.4 to 0.6	1.4 to 1.6
RCS0603-T e3	0.7 to 0.9	0.8 to 1.0	2.0 to 2.2
RCS0805-T e3	1.0 to 1.4	0.9 to 1.4	3.2 to 3.8
RCS1206-T e3	2.0 to 2.4	1.2 to 1.8	4.4 to 5.0
RCS1210-T e3	2.0 to 2.4	2.3 to 3.5	4.4 to 5.0
RCS2010-T e3	3.3 to 3.7	2.3 to 3.5	5.7 to 6.5
RCS2512-T e3	3.6 to 4.0	2.3 to 3.5	7.6 to 8.6

REVISION HISTORY	
REVISION DATE	DESCRIPTION
08-Sep-2026	Introduction of new datasheet