



Vishay Intertechnology, Inc.

# THICK FILM RESISTORS

## D2TO



AEC-Q200 High-Power SMD,  
20 W and 35 W

## RCEC 400 500 750



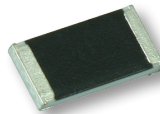
High Power in a  
Reduced Space,  
Possibility of Two  
or Three Resistors  
in the Same  
Package

## CRHV



High-Voltage Chip  
Resistors with  
Voltage Handling  
up to 3 kV

## RCWP NON-MAGNETIC



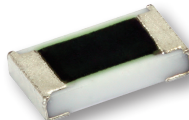
Sulfur-  
Impervious Chips  
Manufactured  
Using Non-  
Magnetic  
Materials

## RCL e3



Enhanced Power  
Rating and  
Thermo Cycling  
Performance

## RCV e3



High Operating  
Voltage up to 500 V

**ES COMPONENTS**  
108 PRATTS JUNCTION ROAD  
STERLING, MA 01564  
PHONE: (978) 422-7641  
FAX: (978) 422-0011  
[www.escomponents.com/resistors-high-power](http://www.escomponents.com/resistors-high-power)



[www.vishay.com](http://www.vishay.com)



# THICK FILM RESISTORS

## Focus Products

Power Resistors									
	Resistance Range	Power Rating	Nominal Voltage	Temperature Range	Thermal Resistance	Inductance	Overload Capacity Short Duration	Dielectric Strength	Package
<b>RPS</b>	0.24 Ω to 1 MΩ	250 W and 500 W	5000 V <sub>RMS</sub>	-55 °C to +125 °C	RPS250 = 0.22 °C/W RPS500 = 0.11 °C/W	< 50 nH	RPS250 = 4 PR / 10 s RPS500 = 2 PR / 10 s	L: 7000 V H: 12 000 V	n/a
Two models within range; custom designs available; connections: M4 screw; lead (Pb)-free and RoHS-compliant available									
<b>LPS</b>	0.3 Ω to 900 kΩ	300 W, 600 W, 800 W, and 1100 W	5000 V <sub>RMS</sub>	-55 °C to 200 °C	0.039 °C to 0.112 °C/W	≤ 0.1 μH	LPS300 = 4 PR / 10 s, LPS600 = 2 PR / 10 s, LPS800 = 1.5 PR / 10 s, LPS1100 = 1.6 PR / 10 s	12 000 V <sub>RMS</sub>	n/a
Four models within range; connections: M4 screw; RoHS-compliant; weight: 79 g to 83 g									
<b>RTOP</b>	0.046 Ω to 1 MΩ	50 W to 200 W	500 V to 1500 V <sub>RMS</sub>	-55 °C to +125 °C	0.5 °C/W to 1 °C/W	≤ -0.1 μH	2.5 PR / 5 s	2500 V	SOT-227 B
Four models within range; custom designs available; connections: screw or shunt; lead (Pb)-free and RoHS-compliant									
<b>RTQ</b>	0.010 Ω to 1 MΩ	20 W and 50 W	250 V to 300 V <sub>RMS</sub>	-55 °C to +155 °C	RTQ20 = 6.5 °C/W RTQ50 = 2.6 °C/W	< 0.1 μH	2 PR / 5 s < 2 Ω 1.6 PR / 5 s ≥ 2 Ω	2000 V	TO-220
Two models within range; custom designs available; through-hole and SMD; lead (Pb)-free and RoHS available									
<b>LTO</b>	0.010 Ω to 1 MΩ	30 W to 100 W	250 V <sub>RMS</sub> to 375 V <sub>RMS</sub>	LTO 30-50: -55 °C to +150 °C LTO 100: -55 °C to +175 °C	4.2 °C/W to 1.5 °C/W	≤ 0.1 μH	1.5 PR / 5 s	1500 V	TO-220 and TO-247
Three models within range; direct mounting ceramic on heatsink; lead (Pb)-free and RoHS-compliant; custom designs available; AEC-Q200 qualified									
<b>D2TO</b>	0.010 Ω to 500 kΩ	20 W to 35 W	250 V	D2TO20: -55 °C to +155 °C D2TO35: -55 °C to +175 °C	D2TO20 = 6.5 °C/W D2TO35 = 4.2 °C/W	≤ 0.1 μH	D2TO20: 2 PR / 5 s < 2 Ω, 1.6 PR / 5 s ≥ 2 Ω D2TO35: 1.7 PR / 5 s < 2 Ω, 1.4 PR / 5 s ≥ 2 Ω	2000 V	TO-263 style (D*PAK)
Two models within range; standard package for SMD; lead (Pb)-free and RoHS-compliant; solder reflow secure at 270 °C / 10 s; AEC-Q200 qualified									
<b>DT025</b>	0.015 Ω to 700 kΩ	25 W	200 V	-55 °C to +150 °C	5 °C/W	≤ 0.1 μH	1.5 PR / 5 s	1500 V	TO-252 style (D*PAK)
Standard package for SMD; lead (Pb)-free and RoHS-compliant; solder reflow secure at 270 °C / 10 s; AEC-Q200 in preparation									
<b>RCEC 500 750</b>	1 Ω to 1 MΩ	500 W and 750 W	5000 V <sub>RMS</sub>	RCEC 500: -55 °C to 125 °C RCEC 750: -55 °C to 150 °C	0.10 °C/W to 0.12 °C/W	≤ 0.04 μH	RCEC 500 = 1000 W / 10 s RCEC 750 = 1200 W / 10 s	5000 V <sub>RMS</sub> to 12 000 V <sub>RMS</sub>	n/a
Three models within range; connections: M4 or M5 screw; RoHS-compliant; creeping distance up to 75 mm for HV									
<b>RCEC 400</b>	1 Ω to 1 MΩ	400 W	4000 V <sub>RMS</sub>	-55 °C to 150 °C	0.1875 °C/W	≤ 0.04 μH	800 W / 10 s	6000 V <sub>RMS</sub>	n/a
Possibility of one, two, or three resistors; same footprint as RCEC 500									
<b>RCMC 500</b>	0.75 Ω to 18 Ω	500 W	5000 V <sub>RMS</sub>	-55 °C to 125 °C	0.18 °C/W	≤ 0.04 μH	1000 W / 10 s	5000 V <sub>RMS</sub> to 12 000 V <sub>RMS</sub>	n/a
High pulse energy for snubbers 25 J / 50 μs									

Thick Film Chip Resistors								
	Resistance min. (Ω)	Resistance max. (Ω)	Tolerance min. (± %)	Tolerance max. (± %)	TCR min. (ppm/°C)	TCR max. (ppm/°C)	Size	Power
<b>RCWP</b>	1	22M	1	10	100	300	0201 to 2512	to 1 W
Same materials and construction as fully MIL-qualified chip resistors; sulfur impervious; customizable to customer requirements								
<b>RCWP Non-Magnetic</b>	1	22M	1	10	100	300	0201 to 2512	to 1 W
Manufactured using non-magnetic materials								
<b>RCP</b>	10	2K	2	5	100	100	0505 to 2512	to 22 W
Thick film resistive element on an aluminum nitride (AlN) substrate; very high thermal conductivity in a small package size								
<b>RCWPM (Military M/D55342)</b>	1	22M	1	10	100	300	0302 to 2512	to 1 W
Military-qualified established reliability chip resistor manufactured to MIL-PRF-55342 (M/D55342); M, P, R, U, S, V, and T level failure rates; sulfur impervious								
<b>RCWP Moisture Resistant</b>	1	22M	1	10	100	300	0201 to 2512	to 1 W
Designed to be resistant to the degrading effects of moisture while under power								
<b>RC</b>	10	10M	1	20	100	200	0504 to 2010	to 0.575 W
Manufactured using special termination materials for use in epoxy-bondable or wire-bondable applications								
<b>CRCW 01005 e3</b>	1 to 1M		1, 2, 5		± 250 ppm/K, -200 ppm/K / +600 ppm/K (1 Ω to 9.76 Ω)		01005	0.031 W
Very small standard R-chip for commercial high-volume applications								
<b>CRCW 0201 e3</b>	1 to 10M		0.5, 1, 5		± 100 ppm/K, ± 200 ppm/K, -200 ppm/K / +400 ppm/K (1 Ω to 9.76 Ω)		0201	0.05 W
Standard R-chip for commercial high-volume applications								
<b>D/CRCW e3 (lead-bearing version is available)</b>	1 to 10M		1, 5		± 100 ppm/K, ± 200 ppm/K		0402 to 2512	0.063 W to 1 W
Stability ΔΔR/Rl ≤ 1 % for 1000 h at 70 °C; AEC-Q200 qualified								
<b>CRCW-HP e3</b>	1 to 1M		0.5, 1, 5		± 100 ppm/K, ± 200 ppm/K		0402 to 2512	0.125 W to 1.5 W
Enhanced power rating; excellent pulse load capability; AEC-Q200 qualified								
<b>CRCW...EN802 (lead-bearing version is available)</b>	1 to 1M		1, 5		± 50 ppm/K, ± 100 ppm/K, ± 200 ppm/K		0805 and 1206	0.125 W; 0.25 W
IECQ - CECC approval to EN 140401-802; available with established reliability, failure rate level E6 (cor. to MIL level P)								
<b>D/CRCW-P e3 (lead-bearing version is available)</b>	1 to 10M		0.25, 0.5, 1		± 50 ppm/K, ± 100 ppm/K		0402 to 2512	0.063 W to 1 W
Low temperature coefficient (50 ppm/K) and tight tolerances (± 0.25 %); AEC-Q200 qualified								
<b>CRCW-IF e3</b>	1 to 100K		5, 10		± 200 ppm/K		0402 to 2512	0.063 W to 1 W
High pulse performance; stability ΔΔR/Rl ≤ 1 % for 1000 h at 70 °C; AEC-Q200 qualified								
<b>D AP, CRCW-AP</b>	3.6 to 10M		1, 5		± 100 ppm/K, ± 200 ppm/K		0402 to 2512	0.063 W to 1 W
AgPd-terminations for conductive gluing; stability ΔΔR/Rl = 1 % for 1000 h at 70 °C; AEC-Q200 qualified								

Green									
	Type	Size	Resistance Range	Rated Dissipation, P <sub>70</sub>	Maximum Voltage	Tolerance	Temperature Coefficient	Load Life Stability (1000 h at 70 °C at P <sub>70</sub> )	Operating Temp. Range
<b>RCG e3</b>	Wraparound	0402 to 1206	1 Ω to 10 MΩ	0.063 W to 0.25 W	50 V up to 200 V	± 1 %, ± 5 %	± 100 ppm/K, ± 150 ppm/K, ± 200 ppm/K	ΔΔR/Rl max.: ≤ 1.0 % ΔΔR/Rl max.: ≤ 2.0 %	-55 °C to 155 °C
Green resistor - does not use RoHS exemptions									



# THICK FILM RESISTORS

## Focus Products

### Thick Film High-Voltage Chip Resistors

	Resistance min. (Ω)	Resistance max. (Ω)	Tolerance min. (± %)	Tolerance max. (± %)	TCR min. (ppm/°C)	TCR max. (ppm/°C)	Size	Power
<b>CRMV</b>	150	75M	0.5	20	150	150	1206 to 2512	to 0.5 W
Medium-voltage chip resistors (up to 800 V); suitable for solderable, epoxy-bondable, or wire-bondable applications								
<b>CRHV</b>	2M	50G	1	20	100	500	1206 to 2512	to 1 W
High-voltage chip resistors (up to 3 kV); multiple styles, termination materials, and configurations allow wide design flexibility								
<b>CDHV</b>	20M	20G	1	20	100	500	2512	
High-voltage chip divider, with two resistive elements in the same package								
<b>RCV_e3</b>	100K to 10M		1 and 5		± 100 ppm/K, ± 200 ppm/K		0805, 1206	0.125 W, 0.25 W
Medium-voltage chip resistors (up to 500 V); suitable for solderable								

### Thick Film Chip Jumpers

	Resistance max. (Ω)	Current Rating max.	Size	Power
<b>RCWP_Jumper</b>	to 50m	to 6.3 A	0201 to 2512	to 1 W
Same materials and construction as fully MIL-qualified chip jumpers; customizable to customer requirements				
<b>RCWPM_Jumper (Military M32159)</b>	to 30m	to 6.3 A	0302 to 2512	to 1 W
Military-qualified high-reliability chip jumper manufactured to MIL-PRF-32159 (M32159); M (military grade) level failure rate				

### Thick Film Low-Resistance Chip Resistors

	Resistance min. (Ω)	Resistance max. (Ω)	Tolerance min. (± %)	Tolerance max. (± %)	TC min. (ppm/°C)	TC max. (ppm/°C)	Size	Power
<b>RCWE_e3</b>	0.01	0.976	0.5	5	100	700	0402 to 2512	0.125 W to 2 W
Extremely low resistance values down to 0.01 Ω; enhanced power rating on some sizes due to long side terminal construction; suitable for current sensing and shunts								
<b>RCWL_e3</b> (lead-bearing version is available)	0.1	0.91	5	5	200	600	0402 to 2512	0.063 W to 1 W
Low resistance values down to 0.1 Ω; suitable for current sensing and shunts								
<b>RCWP_Low Value</b>	0.0499	0.999	1	10	100	300	0402 to 2512	to 1 W
Extremely low resistance values down to 0.0499 Ω; manufactured to DLA land and maritime (former DSCC) drawings for military low-value chip resistors								

### Thick Film Array

	Type	Dimensions l x w (mm)	Resistance Range	Rated Dissipation, P <sub>70</sub>	Maximum Voltage	Tolerance	Temperature Coefficient	Load Life Stability (1000 h at 70 °C at P <sub>70</sub> )	Operating Temp. Range
<b>CRA04P</b>	Wraparound concave	2.0 x 1.0	1 Ω to 1 MΩ	0.063 W	50 V	± 2 %, ± 5 %	± 100 ppm/K ± 200 ppm/K	ΔR/R max.: ≤ 2.0 %	-55 °C to 155 °C
Array with square corners									
<b>CRA04S</b>	Wraparound convex	1.0 x 1.0 (4 pins) 2.0 x 1.0 (8 pins)	10 Ω to 1 MΩ	0.063 W	50 V	± 1 %, ± 2 %, ± 5 %	± 100 ppm/K ± 200 ppm/K	ΔR/R max.: ≤ 1.0 % ΔR/R max.: ≤ 2.0 %	-55 °C to 155 °C
Array with square corners									
<b>CRA06P</b>	Wraparound concave	1.6 x 1.6 (4 pins) 3.2 x 1.6 (8 pins)	10 Ω to 1 MΩ	0.063 W	50 V	± 1 %, ± 2 %, ± 5 %	± 100 ppm/K ± 200 ppm/K	ΔR/R max.: ≤ 1.0 % ΔR/R max.: ≤ 2.0 %	-55 °C to 155 °C
Array with square corners									
<b>CRA06E, CRA06S</b>	Wraparound convex	1.6 x 1.5 (4 pins) 3.2 x 1.5 (8 pins)	10 Ω to 1 MΩ	0.063 W	50 V	± 1 %, ± 2 %, ± 5 %	± 100 ppm/K ± 200 ppm/K	ΔR/R max.: ≤ 1.0 % ΔR/R max.: ≤ 2.0 %	-55 °C to 155 °C
Available with either scalloped corners (E version) or square corners (S version)									
<b>CRA12E, CRA12S</b>	Wraparound convex	5.8 x 3.05 (8 pins) 6.4 x 3.05 (10 pins)	10 Ω to 1 MΩ	0.100 W	50 V	± 1 %, ± 2 %, ± 5 %	± 100 ppm/K ± 200 ppm/K	ΔR/R max.: ≤ 1.0 % ΔR/R max.: ≤ 2.0 %	-55 °C to 155 °C
Available with either scalloped corners (E version) or square corners (S version)									

### Trimmable

	Type	Size	Resistance Range	Rated Dissipation, P <sub>70</sub>	Maximum Voltage	Tolerance	Temperature Coefficient	Load Life Stability (1000 h at 70 °C at P <sub>70</sub> )	Operating Temp. Range
<b>D/CRCW-TR_e3</b> (lead-bearing version is available)	Wraparound	0402 to 2512	0.47 Ω to 10 MΩ	0.063 W to 1.0 W	50 V up to 500 V	10 %, 15 %, 20 %, +0/-10, +0/-20, +0/-30	± 100 ppm/K ± 200 ppm/K	ΔR/R max.: ≤ 2.0 %	-55 °C to 155 °C
Customer trimmable, for applications in precision circuitry where relative tolerances can be compensated by trimming									

### Sulfur Resistant

	Type	Size	Resistance Range	Rated Dissipation, P <sub>70</sub>	Maximum Voltage	Tolerance	Temperature Coefficient	Load Life Stability (1000 h at 70 °C at P <sub>70</sub> )	Operating Temp. Range
<b>RCA_e3</b> (lead-bearing version is available)	Wraparound	0402 to 2512	1 Ω to 10 MΩ	0.063 W to 1.0 W	50 V up to 500 V	± 0.5 %, ± 1 %, ± 0.5 %, ± 1 %, ± 1 %, ± 5 %	± 50 ppm/K ± 100 ppm/K ± 200 ppm/K	ΔR/R max.: ≤ 0.5 % ΔR/R max.: ≤ 1.0 %; (for RCA 0402)	-55 °C to 155 °C
Superior resistance against H <sub>2</sub> S-atmosphere; stability ΔR/R ≤ 1 % for 1000 h at 70 °C; AEC-Q200 qualified									

### Long Side Termination

	Type	Size	Resistance Range	Rated Dissipation, P <sub>70</sub>	Maximum Voltage	Tolerance	Temperature Coefficient	Load Life Stability (1000 h at 70 °C at P <sub>70</sub> )	Operating Temp. Range
<b>RCL_e3</b>	Wraparound	0406, 0612, 1218, 1225	1 Ω to 2.2 MΩ	0.25 W to 2.0 W	50 V up to 200 V	± 1 %, ± 5 %	± 100 ppm/K ± 200 ppm/K	ΔR/R max.: ≤ 0.5 % ΔR/R max.: ≤ 2.0 %	-55 °C to 155 °C
Enhanced power rating and thermo cycling performance in 0406 size; AEC-Q200 qualified									

### High Ohmic

	Type	Size	Resistance Range	Rated Dissipation, P <sub>70</sub>	Maximum Voltage	Tolerance	Temperature Coefficient	Load Life Stability (1000 h at 70 °C at P <sub>70</sub> )	Operating Temp. Range	
<b>D/CRCW-HR_e3</b> (lead-bearing version is available)	Wraparound	0603 to 1206	11 MΩ to 470 MΩ	0.10 W to 0.25 W	75 V up to 200 V	± 5 %	± 500 ppm/K	ΔR/R max.: ≤ 2.0 %	-55 °C to 155 °C	
High resistance values up to 470M; suitable for voltage dividers and power supplies										
<b>RCHR</b>			Resistance min. (Ω)	Resistance max. (Ω)	Tolerance min. (± %)	Tolerance max. (± %)	TC min. (ppm/°C)	TC max. (ppm/°C)	Size	Power
High resistance values up to 3 GΩ										

# VISHAY RESISTORS OFFER ROBUST AND STABLE PERFORMANCE IN MANY APPLICATIONS



## Advantages of Vishay Thick Film Resistors

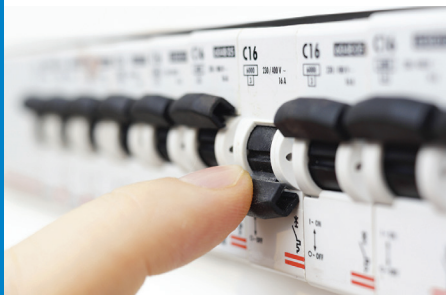
- Broad product portfolio of thick film resistors
- SMD, leaded, and screw terminal types
- Standard, AEC-Q200, and customized solutions available
- Widely recognized in military, industrial, and custom applications

## For the Following Applications

- Power supplies for industrial and automotive
- Power inverters for windmill and railway drives
- HVDC / SVC valves, large drives, and HEV / EV battery management
- Standard R-chip for commercial as well as for high-reliability applications



Custom high-voltage products are available from Vishay



Save space and increase reliability with Vishay's LPS / RCEC high-power resistors



Vishay thick film resistors offer outstanding performance to applications with high reliability requirements



## Useful Links

- Vishay Sfernice power thick film resistors [www.vishay.com/doc?49243](http://www.vishay.com/doc?49243)
- Resistors 101 - instructional guide [www.vishay.com/doc?49873](http://www.vishay.com/doc?49873)
- Vishay Draloric SMD resistor selection guide [www.vishay.com/doc?49252](http://www.vishay.com/doc?49252)



**GREEN**  
(5-2008)

**HALOGEN FREE**

**AEC-Q200 QUALIFIED**

Approved to EN 140401-802



**RoHS COMPLIANT**



**A WORLD OF SOLUTIONS**



VMN-MS6951-1409