

Lead (Pb)-Free Thick Film, Rectangular Chip Resistors



FEATURES

- Stability $\Delta R/R = 1\%$ for 1000 h at 70 °C
- Pure tin solder contacts on Ni barrier layer provides compatibility with lead (Pb)-free and lead containing soldering processes
- Metal glaze on high quality ceramic
- Compliant to RoHS Directive 2002/95/EC
- Halogen-free according to IEC 61249-2-21 definition
- AEC-Q200 qualified, rev. C compliant



RoHS
COMPLIANT
HALOGEN
FREE

STANDARD ELECTRICAL SPECIFICATIONS								
MODEL	SIZE		RATED DISIPATION $P_{70^\circ\text{C}}$ W	LIMITING ELEMENT VOLTAGE $U_{\text{max. AC/DC}}$	TEMPERATURE COEFFICIENT ppm/K	TOLERANCE %	RESISTANCE RANGE Ω	SERIES
	INCH	METRIC						
CRCW0201	0201	RR 0603M	0.05	30	± 100 ± 200	± 1 ± 1 ± 5	47R to 1M0	E24; E96
							10R to 1M0	E24
Zero-Ohm-Resistor: $R_{\text{max.}} = 50\text{ m}\Omega$, $I_{\text{max.}}$ at 70 °C = 1.0 A								
D10/CRCW0402	0402	RR 1005M	0.063	50	± 100 ± 200	± 1 ± 5	1R0 to 10M	E24; E96
								E24
Zero-Ohm-Resistor: $R_{\text{max.}} = 20\text{ m}\Omega$, $I_{\text{max.}}$ at 70 °C = 1.5 A								
D11/CRCW0603	0603	RR 1608M	0.10	75	± 100 ± 200	± 1 ± 5	1R0 to 10M	E24; E96
								E24
Zero-Ohm-Resistor: $R_{\text{max.}} = 20\text{ m}\Omega$, $I_{\text{max.}}$ at 70 °C = 2.0 A								
D12/CRCW0805	0805	RR 2012M	0.125	150	± 100 ± 200	± 1 ± 5	1R0 to 10M	E24; E96
								E24
Zero-Ohm-Resistor: $R_{\text{max.}} = 20\text{ m}\Omega$, $I_{\text{max.}}$ at 70 °C = 2.5 A								
D25/CRCW1206	1206	RR 3216M	0.25	200	± 100 ± 200	± 1 ± 5	1R0 to 10M	E24; E96
								E24
Zero-Ohm-Resistor: $R_{\text{max.}} = 20\text{ m}\Omega$, $I_{\text{max.}}$ at 70 °C = 3.5 A								
CRCW1210	1210	RR 3225M	0.5	200	± 100 ± 200	± 1 ± 5	1R0 to 10M	E24; E96
								E24
Zero-Ohm-Resistor: $R_{\text{max.}} = 20\text{ m}\Omega$, $I_{\text{max.}}$ at 70 °C = 5.0 A								
CRCW1218	1218	RR 3246M	1.0	200	± 100 ± 200	± 1 ± 5	1R0 to 2M2	E24; E96
								E24
Zero-Ohm-Resistor: $R_{\text{max.}} = 20\text{ m}\Omega$, $I_{\text{max.}}$ at 70 °C = 7.0 A								
CRCW2010	2010	RR 5025M	0.75	400	± 100 ± 200	± 1 ± 5	1R0 to 10M	E24; E96
								E24
Zero-Ohm-Resistor: $R_{\text{max.}} = 20\text{ m}\Omega$, $I_{\text{max.}}$ at 70 °C = 6.0 A								
CRCW2512	2512	RR 6332M	1.0	500	± 100 ± 200	± 1 ± 5	1R0 to 10M	E24; E96
								E24
Zero-Ohm-Resistor: $R_{\text{max.}} = 20\text{ m}\Omega$, $I_{\text{max.}}$ at 70 °C = 7.0 A								

Notes

- 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.
- Marking: See data sheet "Surface Mount Resistor Marking" (document number 20020).
- Power rating depends on the max. temperature at the solder point, the component placement density and the substrate material.

TECHNICAL SPECIFICATIONS										
PARAMETER	UNIT	CRCW0201	D10/ CRCW0402	D11/ CRCW0603	D12/ CRCW0805	D25/ CRCW1206	CRCW1210	CRCW1218	CRCW2010	CRCW2512
Rated dissipation P_{70} ⁽¹⁾	W	0.05	0.063	0.1	0.125	0.25	0.5	1.0	0.75	1.0
Limiting element voltage $U_{max. AC/DC}$	V	30	50	75	150	200	200	200	400	500
Insulation voltage U_{ins} (1 min)	V	50	> 75	> 100	> 200	> 300	> 300	> 300	> 300	> 300
Insulation resistance	Ω	> 10^9								
Category temperature range	$^{\circ}\text{C}$	- 55 to + 155								
Failure rate	h^{-1}	1×10^{-9}	< 0.1×10^{-9}							
Weight	mg	0.17	0.65	2	5.5	10	16	29.5	25.5	40.5

Note

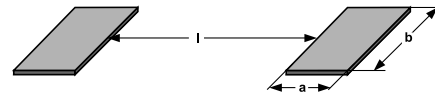
⁽¹⁾ The power dissipation on the resistor generates a temperature rise against the local ambient, depending on the heat flow support of the printed-circuit board (thermal resistance). The rated dissipation applies only if the permitted film temperature of 155 °C is not exceeded.

PART NUMBER AND PRODUCT DESCRIPTION																	
Part Number: CRCW0603562RFKEC ⁽²⁾																	
C	R	C	W	0	6	0	3	5	6	2	R	F	K	E	C		
MODEL	VALUE	TOLERANCE	TCR	PACKAGING	SPECIAL												
CRCW0201 CRCW0402 CRCW0603 CRCW0805 CRCW1206 CRCW1210 CRCW1218 CRCW2010 CRCW2512	R = Decimal K = Thousand M = Million 0000 = Jumper	F = ± 1.0 % J = ± 5.0 % Z = Jumper	K = ± 100 ppm/K N = ± 200 ppm/K 0 = Jumper S = Special	EA, EB, EC, ED, EE, EF, EG, EH, EK	Up to 2 digits												
Product Description: D11/CRCW0603 100 562R 1 % ET6 e3																	
D11/CRCW0603	100	562R	1 %	ET6	e3												
MODEL	TCR	RESISTANCE VALUE	TOLERANCE	PACKAGING	LEAD (Pb)-FREE												
CRCW0201 D10/CRCW0402 D11/CRCW0603 D12/CRCW0805 D25/CRCW1206 CRCW1210 CRCW1218 CRCW2010 CRCW2512	± 200 ppm/K ± 100 ppm/K	10R = 10 Ω 562R = 562 Ω 10K = 10 k Ω 1M = 1 M Ω 0R0 = Jumper	± 5 % ± 1 %	ET1, ET5, ET6, ET7, EF4, E02, E67, E82, ET9	e3 = Pure tin termination finish												

Note

⁽²⁾ Preferred way for ordering products is by use of the PART NUMBER.

PACKAGING							
MODEL	UNIT	PAPER TAPE ON REEL ACC. TO IEC 60286-3, TYPE I			BLISTER TAPE ON REEL ACC. TO IEC 60286-3, TYPE II		
		QUANTITY	PART NUMBER	PRODUCT DESC.	QUANTITY	PART NUMBER	PRODUCT DESC.
CRCW0201	180 mm/7"	10 000	ED	ET7			
	330 mm/13"	50 000	EE	EF4			
D10/CRCW0402	180 mm/7"	10 000	ED	ET7			
	330 mm/13"	50 000	EE	EF4			
D11/CRCW0603	180 mm/7"	5000	EA	ET1			
	285 mm/11.25"	10 000	EB	ET5			
	330 mm/13"	20 000	EC	ET6			
D12/CRCW0805	180 mm/7"	5000	EA	ET1			
	285 mm/11.25"	10 000	EB	ET5			
	330 mm/13"	20 000	EC	ET6			
D25/CRCW1206	180 mm/7"	5000	EA	ET1			
	285 mm/11.25"	10 000	EB	ET5			
	330 mm/13"	20 000	EC	ET6			
CRCW1210	180 mm/7"	5000	EA	ET1			
	285 mm/11.25"	10 000	EB	ET5			
	330 mm/13"	20 000	EC	ET6			
CRCW1218	180 mm/7"				4000	EK	ET9
CRCW2010	180 mm/7"				4000	EF	E02
CRCW2512	180 mm/7"				2000	EG	E67
					4000	EH	E82

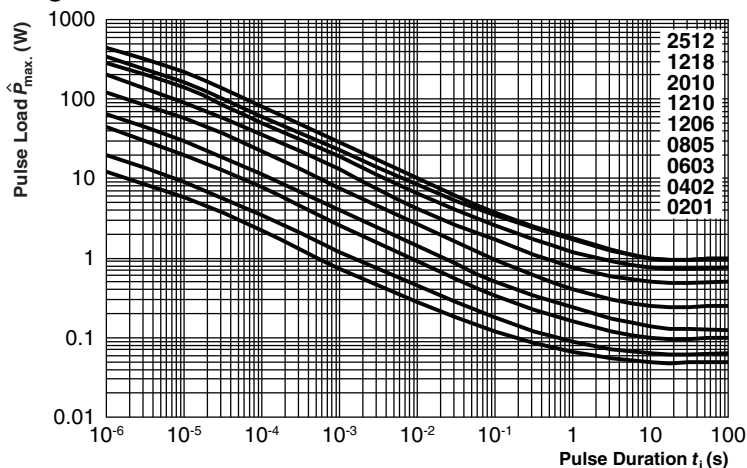
DIMENSIONS


SIZE		DIMENSIONS in millimeters					SOLDER PAD DIMENSIONS in millimeters					
							REFLOW SOLDERING			WAVE SOLDERING		
INCH	METRIC	L	W	H	T1	T2	a	b	l	a	b	l
0201	0525	0.6 ± 0.05	0.3 ± 0.05	0.23 ± 0.05	0.15 ± 0.05	0.15 ^{+0.05} / _{-0.10}	0.28	0.43	0.23			
0402	1005	1.0 ± 0.05	0.5 ± 0.05	0.35 ± 0.05	0.25 ± 0.05	0.2 ± 0.1	0.4	0.6	0.5			
0603	1608	1.55 ^{+0.10} / _{-0.05}	0.85 ± 0.1	0.45 ± 0.05	0.3 ± 0.2	0.3 ± 0.2	0.5	0.9	1.0	0.9	0.9	1.0
0805	2012	2.0 ^{+0.20} / _{-0.10}	1.25 ± 0.15	0.45 ± 0.05	0.3 ^{+0.20} / _{-0.10}	0.3 ± 0.2	0.7	1.3	1.2	0.9	1.3	1.3
1206	3216	3.2 ^{+0.10} / _{-0.20}	1.6 ± 0.15	0.55 ± 0.05	0.45 ± 0.2	0.4 ± 0.2	0.9	1.7	2.0	1.1	1.7	2.3
1210	3225	3.2 ± 0.2	2.5 ± 0.2	0.55 ± 0.05	0.45 ± 0.2	0.4 ± 0.2	0.9	2.5	2.0	1.1	2.5	2.2
1218	3246	3.2 ^{+0.10} / _{-0.20}	4.6 ± 0.15	0.55 ± 0.05	0.45 ± 0.2	0.4 ± 0.2	1.05	4.9	1.9	1.25	4.8	1.9
2010	5025	5.0 ± 0.15	2.5 ± 0.15	0.6 ± 0.1	0.6 ± 0.2	0.6 ± 0.2	1.0	2.5	3.9	1.2	2.5	3.9
2512	6332	6.3 ± 0.2	3.15 ± 0.15	0.6 ± 0.1	0.6 ± 0.2	0.6 ± 0.2	1.0	3.2	5.2	1.2	3.2	5.2



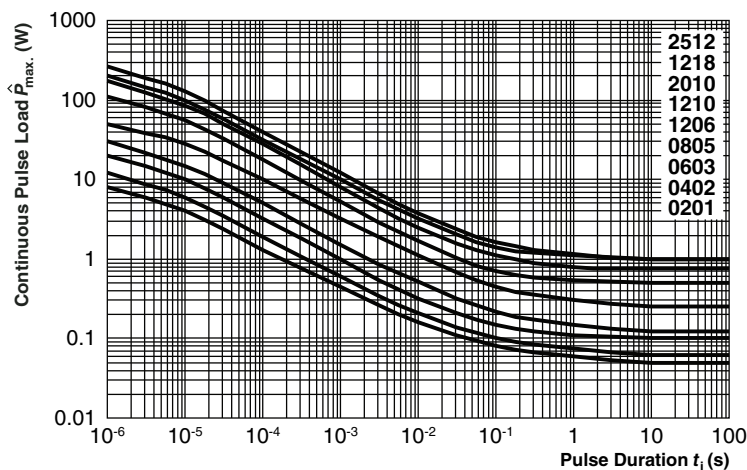
FUNCTIONAL PERFORMANCE

Single Pulse



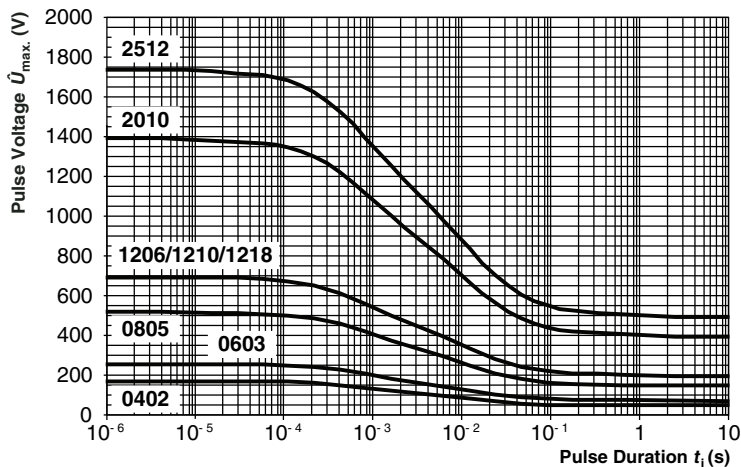
Maximum pulse load, single pulse; applicable if $\bar{P} \rightarrow 0$ and $n < 1000$ and $\bar{U} \leq \bar{U}_{max}$; for permissible resistance change equivalent to 8000 h operation

Continuous Pulse



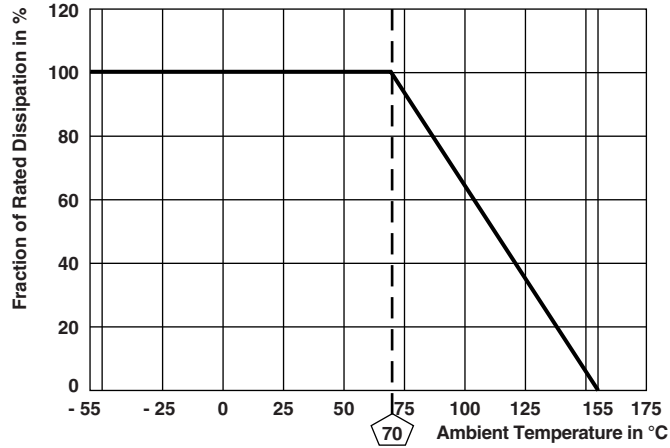
Maximum pulse load, continuous pulses; applicable if $\bar{P} \leq P(9_{amb})$ and $\bar{U} \leq \bar{U}_{max}$; for permissible resistance change equivalent to 8000 h operation

Pulse Voltage



Maximum pulse voltage, single and continuous pulses; applicable if $\hat{P} \leq \hat{P}_{max}$; for permissible resistance change equivalent to 8000 h operation

Derating



Non-Linearity



Current Noise



TEST PROCEDURES AND REQUIREMENTS						
EN 60115-1 CLAUSE	IEC 60068-2 TEST METHOD	TEST	PROCEDURE	REQUIREMENTS PERMISSIBLE CHANGE (ΔR)		
				SIZE 0402 to 2512		SIZE 0201
				STABILITY CLASS 1 OR BETTER	STABILITY CLASS 2 OR BETTER	REQUIREMENTS PERMISSIBLE CHANGE ($\Delta R/R$)
			Stability for product types:			
			D/CRCW e3	1 Ω to 10 M Ω	1 Ω to 10 M Ω	10 Ω to 1 M Ω
4.5	-	Resistance	-	$\pm 1\%$	$\pm 5\%$	$\pm 1\%$; $\pm 5\%$
4.7	-	Voltage proof	$U = 1.4 \times U_{ins}$; 60 s	No flashover or breakdown		
4.13	-	Short time overload	$U = 2.5 \times \sqrt{P_{70} \times R} \leq 2 \times U_{max.}$; duration: Acc. to style	$\pm (0.25\% R + 0.05 \Omega)$	$\pm (0.5\% R + 0.05 \Omega)$	$\pm (1\% R + 0.05 \Omega)$
4.17.2	58 (Td)	Solderability	Solder bath method; Sn60Pb40 non activated flux; (235 \pm 5) $^{\circ}$ C (2 \pm 0.2) s	Good tinning ($\geq 95\%$ covered) no visible damage		
			Solder bath method; Sn96.5Ag3Cu0.5 non-activated flux; (245 \pm 5) $^{\circ}$ C (3 \pm 0.3) s	Good tinning ($\geq 95\%$ covered) no visible damage		
4.8.4.2	-	Temperature coefficient	(20/- 55/20) $^{\circ}$ C and (20/125/20) $^{\circ}$ C	± 100 ppm/K	± 200 ppm/K	± 100 ppm/K, ± 200 ppm/K
4.32	21 (Uu ₃)	Shear (adhesion)	RR 1608 and smaller: 9 N RR 2012 and larger: 45 N	No visible damage		
4.33	21 (Uu ₁)	Substrate bending	Depth 2 mm; 3 times	No visible damage, no open circuit in bent position $\pm (0.25\% R + 0.05 \Omega)$ $\pm (0.5\% R + 0.05 \Omega)$		
4.19	14 (Na)	Rapid change of temperature	30 min. at - 55 $^{\circ}$ C; 30 min. at 125 $^{\circ}$ C			
			5 cycles 1000 cycles	$\pm (0.25\% R + 0.05 \Omega)$ $\pm (1\% R + 0.05 \Omega)$	$\pm (0.5\% R + 0.05 \Omega)$ $\pm (1\% R + 0.05 \Omega)$	$\pm (0.5\% R + 0.05 \Omega)$ $\pm (1\% R + 0.05 \Omega)$
4.23	-	Climatic sequence:	-			
4.23.2	2 (Ba)	Dry heat	125 $^{\circ}$ C; 16 h			
4.23.3	30 (Db)	Damp heat, cyclic	55 $^{\circ}$ C; $\geq 90\%$ RH; 24 h; 1 cycle			
4.23.4	1 (Aa)	Cold	- 55 $^{\circ}$ C; 2 h	$\pm (1\% R + 0.05 \Omega)$	$\pm (2\% R + 0.1 \Omega)$	$\pm (2\% R + 0.1 \Omega)$
4.23.5	13 (M)	Low air pressure	1 kPa; (25 \pm 10) $^{\circ}$ C; 1 h			
4.23.6	30 (Db)	Damp heat, cyclic	55 $^{\circ}$ C; $\geq 90\%$ RH; 24 h; 5 cycles			
4.23.7	-	DC load	$U = \sqrt{P_{70} \times R}$			
4.25.1	-	Endurance at 70 $^{\circ}$ C	$U = \sqrt{P_{70} \times R} \leq U_{max.}$; 1.5 h on; 0.5 h off;			
			70 $^{\circ}$ C; 1000 h	$\pm (1\% R + 0.05 \Omega)$	$\pm (2\% R + 0.1 \Omega)$	$\pm (2\% R + 0.1 \Omega)$
			70 $^{\circ}$ C; 8000 h	$\pm (2\% R + 0.1 \Omega)$	$\pm (4\% R + 0.1 \Omega)$	$\pm (4\% R + 0.1 \Omega)$

TEST PROCEDURES AND REQUIREMENTS						
EN 60115-1 CLAUSE	IEC 60068-2 TEST METHOD	TEST	PROCEDURE	REQUIREMENTS PERMISSIBLE CHANGE (ΔR)		
				SIZE 0402 to 2512		SIZE 0201
				STABILITY CLASS 1 OR BETTER	STABILITY CLASS 2 OR BETTER	REQUIREMENTS PERMISSIBLE CHANGE ($\Delta R/R$)
			Stability for product types:			
			D/CRCW e3	1 Ω to 10 M Ω	1 Ω to 10 M Ω	10 Ω to 1 M Ω
4.18.2	58 (Td)	Resistance to soldering heat	Solder bath method (260 \pm 5) $^{\circ}$ C; (10 \pm 1) s	\pm (0.25 % R + 0.05 Ω)	\pm (0.5 % R + 0.05 Ω)	\pm (1 % R + 0.05 Ω)
4.35	-	Flamability, needle flame test	IEC 60695-11-5; 10 s	No burning after 30 s		
4.24	78 (Cab)	Damp heat, steady state	(40 \pm 2) $^{\circ}$ C; (93 \pm 3) % RH; 56 days	\pm (1 % R + 0.05 Ω)		\pm (2 % R + 0.1 Ω)
4.25.3	-	Endurance at upper category temperature	155 $^{\circ}$ C, 1000 h	\pm (1 % R + 0.05 Ω)	\pm (2 % R + 0.1 Ω)	\pm (2 % R + 0.1 Ω)
4.40	-	Electrostatic discharge (human body model)	IEC 61340-3-1; 3 pos. + 3 neg. discharges; ESD voltage acc. to size	\pm (1 % R + 0.05 Ω)		
4.29	45 (XA)	Component solvent resistance	Isopropyl alcohol; 50 $^{\circ}$ C; method 2	No visible damage		
4.30	45 (XA)	Solvent resistance of marking	Isopropyl alcohol; 50 $^{\circ}$ C; method 1, toothbrush	Marking legible, no visible damage		
4.22	6 (Fc)	Vibration, endurance by sweeping	f = 10 Hz to 2000 Hz; x, y, z \leq 1.5 mm; A \leq 200 m/s ² ; 10 sweeps per axis	\pm (0.25 % R + 0.05 Ω)	\pm (0.5 % R + 0.05 Ω)	\pm (0.5 % R + 0.05 Ω)
4.37	-	Periodic electric overload	$U = \sqrt{15 \times P_{70} \times R}$ $\leq 2 \times U_{max.}$; 0.1 s on; 2.5 s off; 1000 cycles	\pm (1 % R + 0.05 Ω)		
4.27	-	Single pulse high voltage overload, 10 μ s/700 μ s	$\dot{U} = 10 \times \sqrt{P_{70} \times R}$ $\leq 2 \times U_{max.}$; 10 pulses	\pm (1 % R + 0.05 Ω)		

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

- EN 60115-1, generic specification
- EN 140400, sectional specification
- EN 140401-802, detail specification
- IEC 60068-2, environmental test procedures

Packaging of components is done in paper or blister tapes according to IEC 60286-3.



Disclaimer

All product specifications and data are subject to change without notice.

Vishay Intertechnology, Inc., its affiliates, agents, and employees, and all persons acting on its or their behalf (collectively, "Vishay"), disclaim any and all liability for any errors, inaccuracies or incompleteness contained herein or in any other disclosure relating to any product.

Vishay disclaims any and all liability arising out of the use or application of any product described herein or of any information provided herein to the maximum extent permitted by law. The product specifications do not expand or otherwise modify Vishay's terms and conditions of purchase, including but not limited to the warranty expressed therein, which apply to these products.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted by this document or by any conduct of Vishay.

The products shown herein are not designed for use in medical, life-saving, or life-sustaining applications unless otherwise expressly indicated. Customers using or selling Vishay products not expressly indicated for use in such applications do so entirely at their own risk and agree to fully indemnify Vishay for any damages arising or resulting from such use or sale. Please contact authorized Vishay personnel to obtain written terms and conditions regarding products designed for such applications.

Product names and markings noted herein may be trademarks of their respective owners.