

## Standard Thick Film Chip Resistors



### FEATURES

- Stability  $\Delta R/R = 1\%$  for 1000 h at 70 °C
- 2 mm pitch packaging option for 0603 size
- 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
- AEC-Q200 qualified
- Material categorization: For definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



**RoHS**  
COMPLIANT  
HALOGEN  
**FREE**

### STANDARD ELECTRICAL SPECIFICATIONS

MODEL	SIZE		RATED DISSIPATION $P_{70^\circ\text{C}}$ W	LIMITING ELEMENT VOLTAGE $U_{\text{max. AC/DC}}$	TEMPERATURE COEFFICIENT ppm/K	TOLERANCE %	RESISTANCE RANGE $\Omega$	SERIES
	INCH	METRIC						
D10/CRCW0402	0402	RR 1005M	0.063	50	$\pm 100$ $\pm 200$	$\pm 1$ $\pm 5$	1R0 to 10M	E24; E96 E24
D11/CRCW0603	0603	RR 1608M	0.10	75	$\pm 100$ $\pm 200$	$\pm 1$ $\pm 5$	1R0 to 10M	E24; E96 E24
D12/CRCW0805	0805	RR 2012M	0.125	150	$\pm 100$ $\pm 200$	$\pm 1$ $\pm 5$	1R0 to 10M	E24; E96 E24
D25/CRCW1206	1206	RR 3216M	0.25	200	$\pm 100$ $\pm 200$	$\pm 1$ $\pm 5$	1R0 to 10M	E24; E96 E24
CRCW1210	1210	RR 3225M	0.5	200	$\pm 100$ $\pm 200$	$\pm 1$ $\pm 5$	1R0 to 10M	E24; E96 E24
CRCW1218	1218	RR 3246M	1.0	200	$\pm 100$ $\pm 200$	$\pm 1$ $\pm 5$	1R0 to 2M2	E24; E96 E24
CRCW2010	2010	RR 5025M	0.75	400	$\pm 100$ $\pm 200$	$\pm 1$ $\pm 5$	1R0 to 10M	E24; E96 E24
CRCW2512	2512	RR 6332M	1.0	500	$\pm 100$ $\pm 200$	$\pm 1$ $\pm 5$	1R0 to 10M	E24; E96 E24

#### 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.



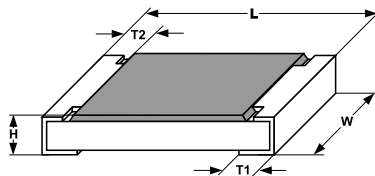
TECHNICAL SPECIFICATIONS									
PARAMETER	UNIT	D10/ CRCW0402	D11/ CRCW0603	D12/ CRCW0805	D25/ CRCW1206	CRCW1210	CRCW1218	CRCW2010	CRCW2512
Rated dissipation $P_{70}$ <sup>(1)</sup>	W	0.063	0.1	0.125	0.25	0.5	1.0	0.75	1.0
Limiting element voltage $U_{max. AC/DC}$	V	50	75	150	200	200	200	400	500
Insulation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

**Note**

<sup>(1)</sup> 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  $^{\circ}C$  is not exceeded.

PART NUMBER AND PRODUCT DESCRIPTION																	
Part Number: CRCW0603562RFKEC																	
C	R	C	W	0	6	0	3	5	6	2	R	F	K	E	C		
MODEL		VALUE		TOLERANCE		TCR		PACKAGING		SPECIAL							
CRCW0402 CRCW0603 CRCW0805 CRCW1206 CRCW1210 CRCW1218 CRCW2010 CRCW2512		R = Decimal K = Thousand M = Million 0000 = Jumper		F = $\pm 1.0\%$ J = $\pm 5.0\%$ Z = Jumper		K = $\pm 100$ ppm/K N = $\pm 200$ ppm/K 0 = Jumper		EA, EB, EC, ED, EE, EF, EG, EH, EI, EL, 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							
D10/CRCW0402 D11/CRCW0603 D12/CRCW0805 D25/CRCW1206 CRCW1210 CRCW1218 CRCW2010 CRCW2512		$\pm 200$ ppm/K $\pm 100$ ppm/K		10R = 10 $\Omega$ 562R = 562 $\Omega$ 10K = 10 k $\Omega$ 1M0 = 1 M $\Omega$ 0R0 = Jumper		$\pm 5\%$ $\pm 1\%$		ET1, ET2, ET3, ET4, ET5, ET6, ET7, ET8, ET9, EF4, E02, E67, E82		e3 = Pure tin termination finish							

PACKAGING						
MODEL	CODE	QUANTITY	CARRIER TAPE	WIDTH	PITCH	REEL DIAMETER
CRCW0402	ED = ET7	10 000	Paper tape acc. to IEC 60068-3 Type I	8 mm	2 mm	180 mm/7"
	EE = EF4	50 000				330 mm/13"
CRCW0603	EI = ET2	5000		8 mm	2 mm	180 mm/7"
	ED = ET3	10 000				180 mm/7"
	EL = ET4	20 000				285 mm/11.25"
	EE = ET8	50 000				330 mm/13"
	EA = ET1	5000				8 mm
EB = ET5	10 000	285 mm/11.25"				
CRCW0805	EC = ET6	20 000		8 mm	4 mm	330 mm/13"
	EA = ET1	5000				180 mm/7"
	EB = ET5	10 000				285 mm/11.25"
CRCW1206	EC = ET6	20 000		8 mm	4 mm	330 mm/13"
	EA = ET1	5000				180 mm/7"
	EB = ET5	10 000	285 mm/11.25"			
CRCW1210	EC = ET6	20 000	8 mm	4 mm	330 mm/13"	
	EA = ET1	5000			180 mm/7"	
	EB = ET5	10 000			285 mm/11.25"	
CRCW1218	EK = ET9	4000	Blister tape acc. to IEC 60068-3 Type II	12 mm	4 mm	180 mm/7"
CRCW2010	EF = E02	4000		12 mm	4 mm	180 mm/7"
CRCW2512	EG = E67	2000		12 mm	8 mm	4 mm
	EH = E82	4000				

**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
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 <sup>+0.10</sup> / <sub>-0.05</sub>	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 <sup>+0.20</sup> / <sub>-0.10</sub>	1.25 ± 0.15	0.45 ± 0.05	0.3 <sup>+0.20</sup> / <sub>-0.10</sub>	0.3 ± 0.2	0.7	1.3	1.2	0.9	1.3	1.3
1206	3216	3.2 <sup>+0.10</sup> / <sub>-0.20</sub>	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 <sup>+0.10</sup> / <sub>-0.20</sub>	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  $\dot{U} \leq \dot{U}_{max}$ ; 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  $\dot{U} \leq \dot{U}_{max}$ ; for permissible resistance change equivalent to 8000 h operation



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



TEST PROCEDURES AND REQUIREMENTS					
EN 60115-1 CLAUSE	IEC 60068-2 TEST METHOD	TEST	PROCEDURE	REQUIREMENTS PERMISSIBLE CHANGE ( $\Delta R$ )	
				SIZE 0402 to 2512	
				STABILITY CLASS 1 OR BETTER	STABILITY CLASS 2 OR BETTER
			Stability for product types:		
			<b>D/CRCW e3</b>	1 $\Omega$ to 10 M $\Omega$	
4.5	-	Resistance	-	$\pm 1\%$	$\pm 5\%$
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	$\pm (0.25\% R + 0.05 \Omega)$	$\pm (0.5\% R + 0.05 \Omega)$
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	$\pm 100$ ppm/K	$\pm 200$ ppm/K
4.32	21 (Uu <sub>3</sub> )	Shear (adhesion)	RR 1608 and smaller: 9 N RR 2012 and larger: 45 N	No visible damage	
4.33	21 (Uu <sub>1</sub> )	Substrate bending	Depth 2 mm; 3 times	No visible damage, no open circuit in bent position $\pm (0.25\% R + 0.05 \Omega)$	
4.19	14 (Na)	Rapid change of temperature	30 min. at - 55 $^{\circ}$ C; 30 min. at 125 $^{\circ}$ C  5 cycles  1000 cycles	$\pm (0.25\% R + 0.05 \Omega)$  $\pm (1\% R + 0.05 \Omega)$	$\pm (0.5\% R + 0.05 \Omega)$  $\pm (1\% R + 0.05 \Omega)$
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	$\pm (1\% R + 0.05 \Omega)$	$\pm (2\% R + 0.1 \Omega)$
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	$\pm (1\% R + 0.05 \Omega)$	$\pm (2\% R + 0.1 \Omega)$
			70 $^{\circ}$ C; 8000 h	$\pm (2\% R + 0.1 \Omega)$	$\pm (4\% R + 0.1 \Omega)$



TEST PROCEDURES AND REQUIREMENTS					
EN 60115-1 CLAUSE	IEC 60068-2 TEST METHOD	TEST	PROCEDURE	REQUIREMENTS PERMISSIBLE CHANGE ( $\Delta R$ )	
				SIZE 0402 to 2512	
				STABILITY CLASS 1 OR BETTER	STABILITY CLASS 2 OR BETTER
			Stability for product types:		
			<b>D/CRCW e3</b>	1 $\Omega$ to 10 M $\Omega$	
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 $\Omega$ )	$\pm$ (0.5 % R + 0.05 $\Omega$ )
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 $\Omega$ )	
4.25.3	-	Endurance at upper category temperature	155 $^{\circ}$ C, 1000 h	$\pm$ (1 % R + 0.05 $\Omega$ )	$\pm$ (2 % R + 0.1 $\Omega$ )
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 $\Omega$ )	
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 <sup>2</sup> ; 10 sweeps per axis	$\pm$ (0.25 % R + 0.05 $\Omega$ )	$\pm$ (0.5 % R + 0.05 $\Omega$ )
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 $\Omega$ )	
4.27	-	Single pulse high voltage overload, 10 $\mu$ s/700 $\mu$ s	$\hat{U} = 10 \times \sqrt{P_{70} \times R}$ $\leq 2 \times U_{max.}$ ; 10 pulses	$\pm$ (1 % R + 0.05 $\Omega$ )	

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-x, environmental test procedures

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



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