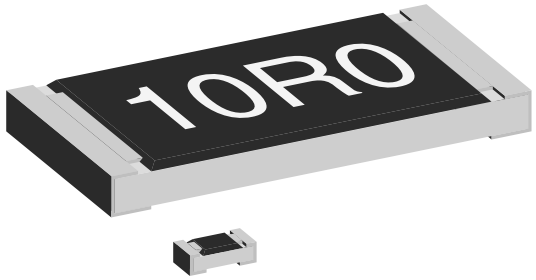
Lead (Pb)-free Thick Film, Rectangular Chip Resistors



FEATURES

- High volume product suitable for commercial and special applications
- Excellent stability ($\Delta R/R \leq 1$ % for 1000 h at 70 °C)
- Compliant with "Restriction of the use of Hazardous Substances" (RoHS) directive 2002/95/EC (issue 2004)
- Lead (Pb)-free solder contacts on Ni barrier layer
- Pure tin plating provides compatibility with lead (Pb)-free and lead containing soldering processes
- Metal glaze on high quality ceramic
- Protective overglaze

STANDARD ELECTRICAL SPECIFICATIONS

MODEL	SIZE		POWER RATING $P_{70\,°C}$ W	LIMITING ELEMENT VOLTAGE MAX. V ≅	TEMPERATURE COEFFICIENT ppm/K	TOLERANCE %	RESISTANCE RANGE Ω	E-SERIES
	INCH	METRIC						
CRCW0201	0201	0525	0.05	30	± 100 ± 200	± 1 ± 1 ± 5	47R - 1M0 10R - 1M0 10R - 1M0	24 + 96 24 + 96 24
			Zero-Ohm-Resistor: $R_{max.}$ = 50 mΩ, $I_{max.}$ at 70 °C = 1.0 A					
D10/CRCW0402	0402	1005	0.063	50	± 100 ± 200	± 1 ± 5	1R0 - 10M	24 + 96 24
			Zero-Ohm-Resistor: $R_{max.}$ = 20 mΩ, $I_{max.}$ at 70 °C = 1.5 A					
D11/CRCW0603	0603	1608	0.10	75	± 100 ± 200	± 1 ± 5	1R0 - 10M	24 + 96 24
			Zero-Ohm-Resistor: $R_{max.}$ = 20 mΩ, $I_{max.}$ at 70 °C = 2.0 A					
D12/CRCW0805	0805	2012	0.125	150	± 100 ± 200	± 1 ± 5	1R0 - 10M	24 + 96 24
			Zero-Ohm-Resistor: $R_{max.}$ = 20 mΩ, $I_{max.}$ at 70 °C = 2.5 A					
D25/CRCW1206	1206	3216	0.25	200	± 100 ± 200	± 1 ± 5	1R0 - 10M	24 + 96 24
			Zero-Ohm-Resistor: $R_{max.}$ = 20 mΩ, $I_{max.}$ at 70 °C = 3.5 A					
CRCW1210	1210	3225	0.33	200	± 100 ± 200	± 1 ± 5	1R0 - 10M	24 + 96 24
			Zero-Ohm-Resistor: $R_{max.}$ = 20 mΩ, $I_{max.}$ at 70 °C = 4.0 A					
CRCW1218	1218	3246	1.0	200	± 100 ± 200	± 1 ± 5	1R0 - 2M2	24 + 96 24
			Zero-Ohm-Resistor: $R_{max.}$ = 20 mΩ, $I_{max.}$ at 70 °C = 7.0 A					
CRCW2010	2010	5025	0.50	400	± 100 ± 200	± 1 ± 5	1R0 - 10M	24 + 96 24
			Zero-Ohm-Resistor: $R_{max.}$ = 20 mΩ, $I_{max.}$ at 70 °C = 5.0 A					
CRCW2512	2512	6332	1.0	500	± 100 ± 200	± 1 ± 5	1R0 - 10M	24 + 96 24
			Zero-Ohm-Resistor: $R_{max.}$ = 20 mΩ, $I_{max.}$ 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 and packaging: see appropriate catalog or web pages
- 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 at 70 °C (3)	W	0.05	0.063	0.10	0.125	0.25	0.33	1.0	0.5	1.0
Limiting Element Voltage (2)	V≅	30	50	75	150	200	200	200	400	500
Insulation Voltage (1 min)	V_{peak}	50	> 75	> 100	> 200	> 300	> 300	> 300	> 300	> 300
Thermal Resistance (1)	K/W		≤ 870	≤ 550	≤ 440	≤ 220	≤ 140	≤ 65	≤ 88	≤ 65
Insulation Resistance	Ω	$> 10^9$								
Category Temperature Range	°C	- 55/+ 125 (+ 155)								
Failure Rate	h^{-1}	1.10^{-9}	0.3×10^{-9}							
Weight/1000 pieces	g	0.17	0.65	2	5.5	10	16	29.5	25.5	40.5

Notes:

(1) For sizes 0402 until 1206 the measuring conditions are in acc. to EN 140401-802. For all other sizes the result depends on the solder pad dimensions.

(2) Rated voltage: $\sqrt{P \times R}$

(3) 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 (4)

C	R	C	W	0	6	0	3	5	6	2	R	F	K	E	C		

MODEL	VALUE	TOLERANCE	TCR	PACKAGING (5)	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,** **EI, EK,** **EL, EY**	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 (5)	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 = 10.0 kΩ 1M = 1 MΩ 0R0 = Jumper	± 5 % ± 1 %	ET1, ET5 ET6, ET7 EF4, E02 E67, E82 EG1, ET9 E20, E27	e3 = Pure tin Termination finish

Notes:

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

(5) Please refer to table PACKAGING, see next page

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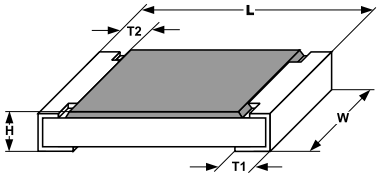
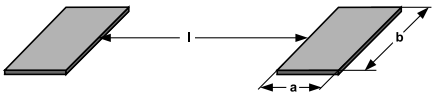
Revision: 25-Mar-08

PACKAGING

MODEL	REEL								BULK		
	TAPE WIDTH	DIAMETER	PITCH	PIECES/ REEL	PACKAGING CODE				PIECES	PACKAGING CODE	
					PART NUMBER		PRODUCT DESC.			PART NUMBER	PRODUCT DESC.
					PAPER	BLISTER	PAPER	BLISTER			
CRCW0201	8 mm	180 mm/7"	2 mm	10 000	ED		ET7				
		330 mm/13"	2 mm	50 000	EE		EF4				
D10/CRCW0402	8 mm	180 mm/7"	2 mm	10 000	ED		ET7		50 000	EY	E27
		330 mm/13"	2 mm	50 000	EE		EF4				
D11/CRCW0603	8 mm	180 mm/7"	4 mm	5000	EA	EI	ET1	EG1	25 000	EY	E27
		285 mm/11.25"	4 mm	10 000	EB		ET5				
		330 mm/13"	4 mm	20 000	EC	EL	ET6	E20			
D12/CRCW0805	8 mm	180 mm/7"	4 mm	5000	EA	EI	ET1	EG1	10 000	EY	E27
		285 mm/11.25"	4 mm	10 000	EB		ET5				
		330 mm/13"	4 mm	20 000	EC	EL	ET6	E20			
D25/CRCW1206	8 mm	180 mm/7"	4 mm	5000	EA	EI	ET1	EG1			
		285 mm/11.25"	4 mm	10 000	EB		ET5				
		330 mm/13"	4 mm	20 000	EC	EL	ET6	E20			
CRCW1210	12 mm	180 mm/7"	4 mm	5000	EA		ET1				
		285 mm/11.25"	4 mm	10 000	EB		ET5				
		330 mm/13"	4 mm	20 000	EC		ET6				
CRCW1218	12 mm	180 mm/7"	4 mm	4000		EK		ET9			
CRCW2010	12 mm	180 mm/7"	4 mm	4000		EF		E02			
CRCW2512	12 mm	180 mm/7"	8 mm	2000		EG		E67			
			4 mm	4000		EH		E82			

DIMENSIONS

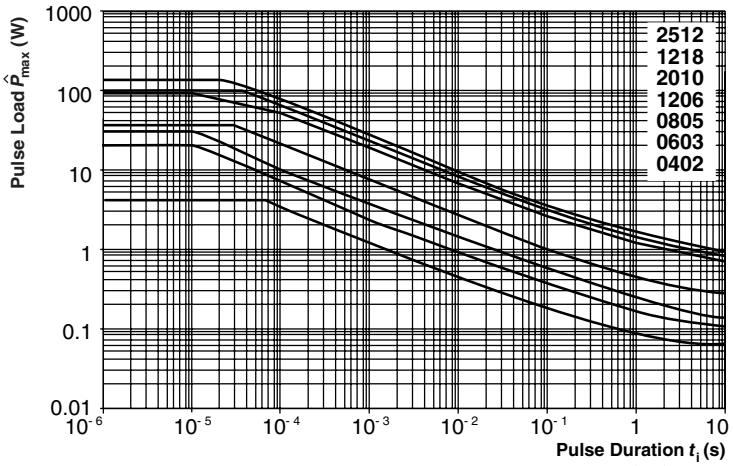




SIZE		DIMENSIONS [in millimeters]					SOLDER PAD DIMENSIONS [in millimeters]					
							REFLOW SOLDERING			WAVE SOLDERING		
INCH	METRIC	L	W	H	T1	T2	a	b	l	a	b	l
0201	0525	0.6 ± 0.05	0.3 ± 0.05	0.23 ± 0.05	0.15 ± 0.05	0.15 $^{+0.05}_{-0.10}$	0.28	0.43	0.23			
0402	1005	1.0 ± 0.05	0.5 ± 0.05	0.35 ± 0.05	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

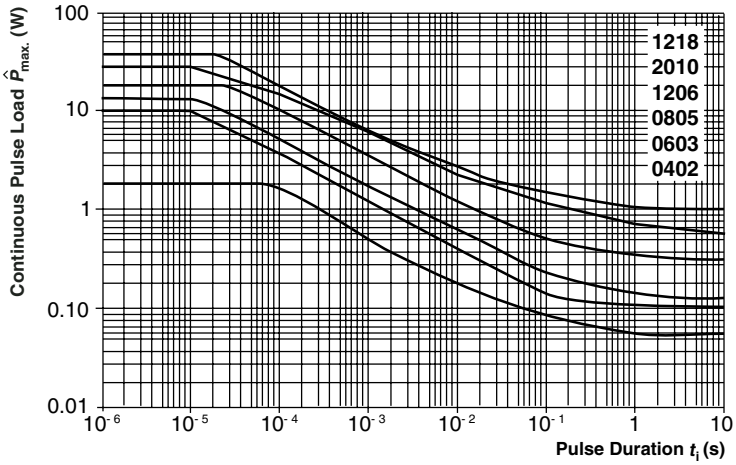
FUNCTIONAL PERFORMANCE

Single Pulse



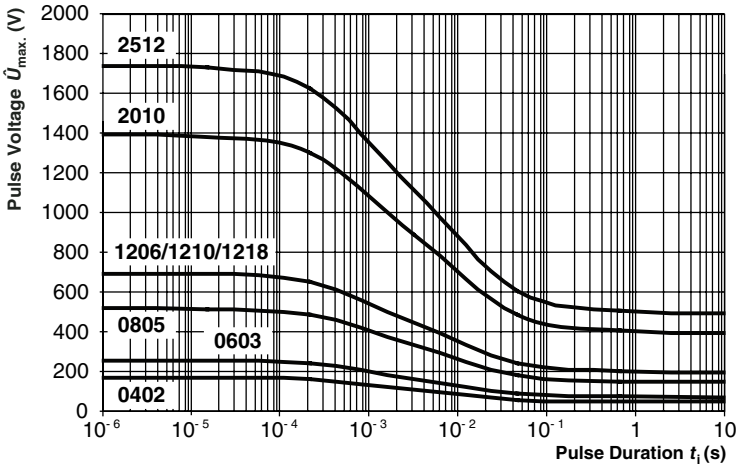
Maximum pulse load, single pulse; applicable if $\bar{P} \rightarrow 0$ and $n \leq 1000$ and $\hat{U} \leq \hat{U}_{max.}$; for permissible resistance change equivalent to 8000 h operation

Continuous Pulse

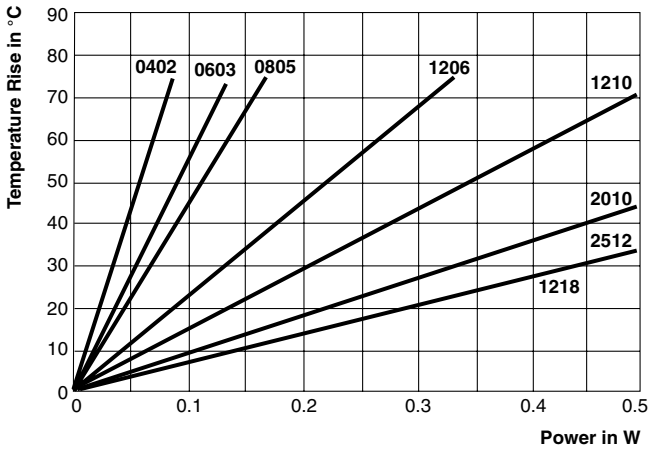


Maximum pulse load, continuous pulses; applicable if $\bar{P} \leq P\ (\vartheta_{amb})$ and $\hat{U} \leq \hat{U}_{max.}$; for permissible resistance change equivalent to 8000 h operation

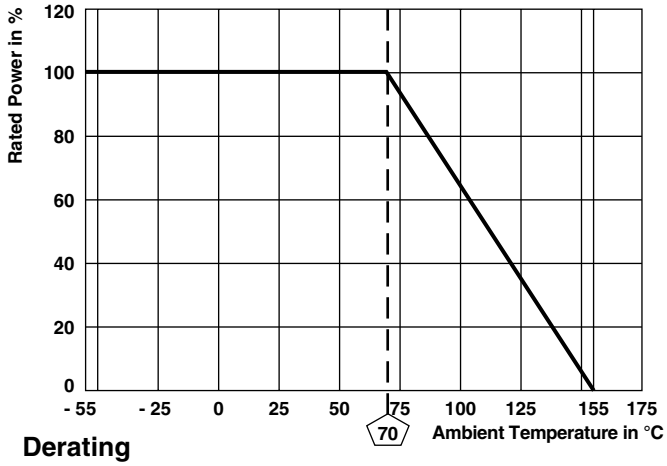
Pulse Voltage



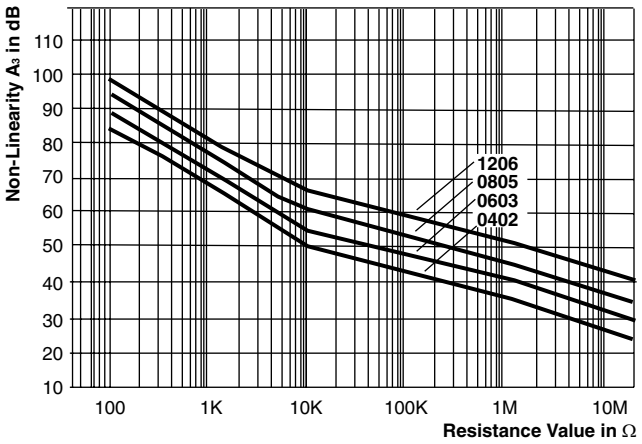
Maximum pulse voltage, single and continuous pulses; applicable if $\hat{P} \leq \hat{P}_{max.}$; for permissible resistance change equivalent to 8000 h operation



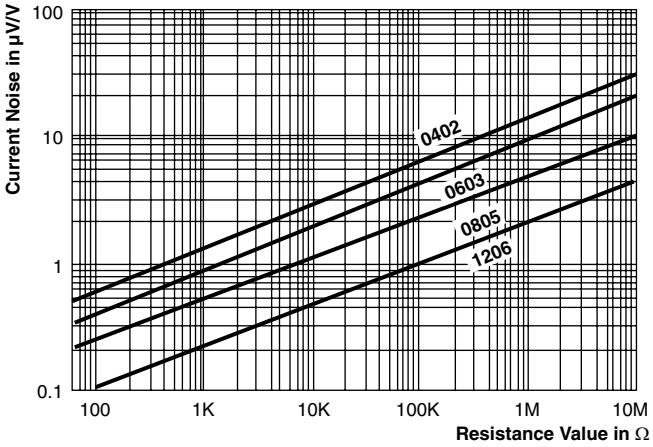
Temperature Rise



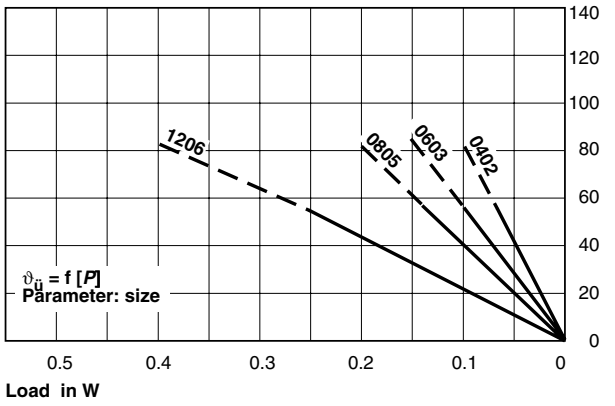
Derating

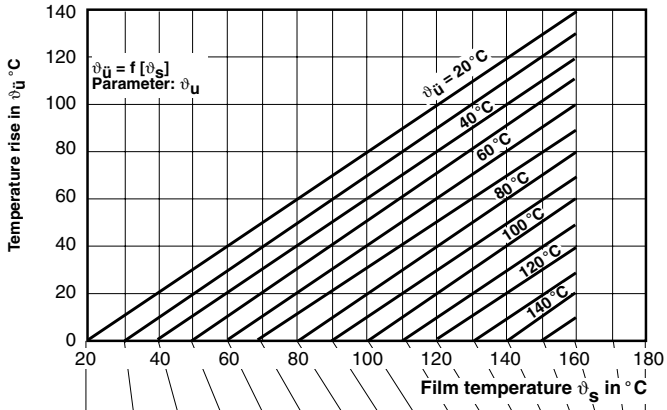


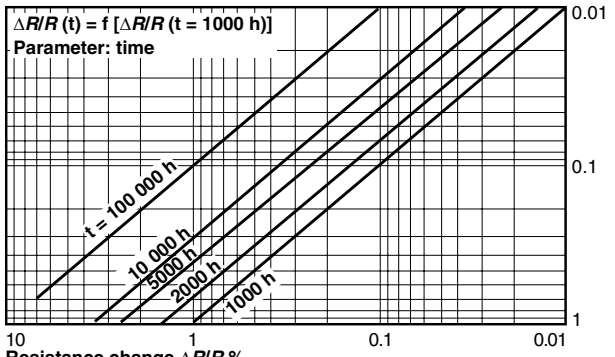
Non-Linearity

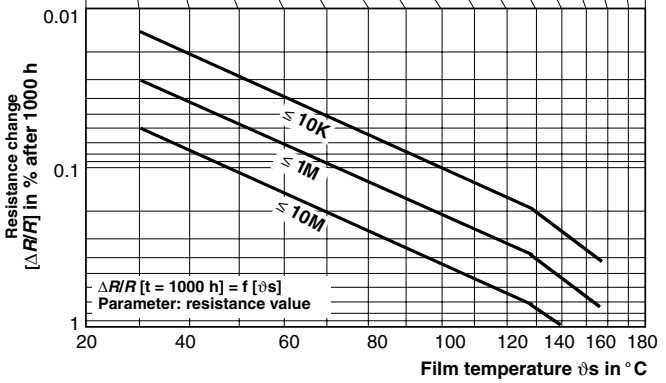


Current Noise

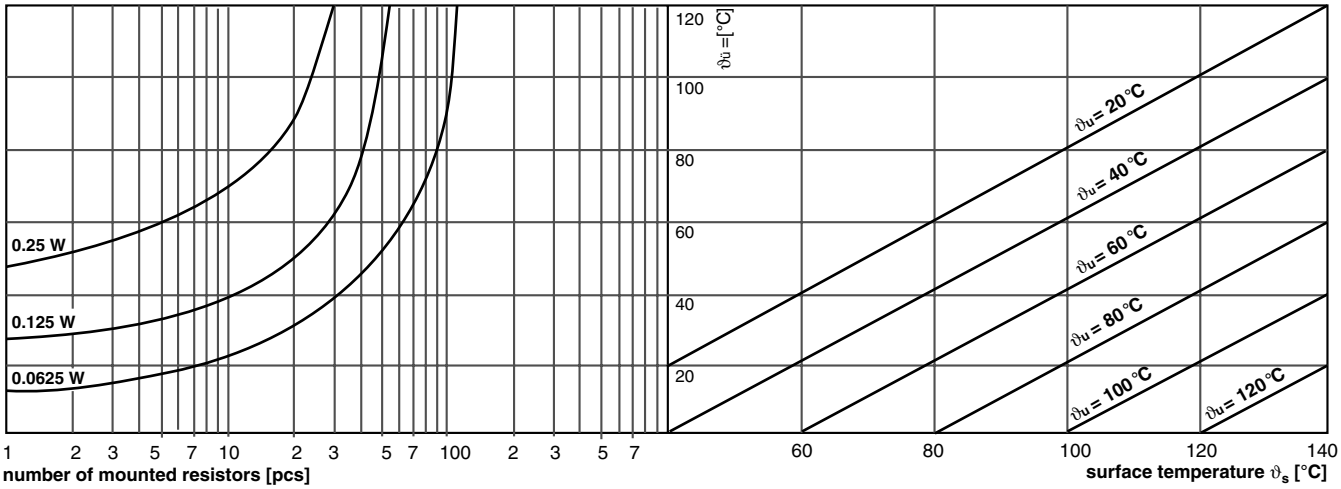








Stability nomogram typical values (for handling see general explanations)



Power rating as a function of packaging density (guideline)

For technical questions in Europe, contact: ff3cresistors@vishay.com
For technical questions in Americas/Asia, contact: ff2bresistors@vishay.com

TEST PROCEDURES AND REQUIREMENTS

EN 60115-1				SIZE 0201 ONLY
TEST (clause)	CONDITIONS OF TEST	REQUIREMENTS PERMISSIBLE CHANGE ($\Delta R/R$)		
		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 MΩ	1 Ω to 10 MΩ	10 Ω to 1 MΩ
Resistance (4.5)	-	± 1 %	± 5 %	± 1 %; ± 5 %
Temperature coefficient (4.8.4.2)	20/- 55/20 °C and 20/125/20 °C	± 100 ppm/K	± 200 ppm/K	± 200 ppm/K
Overload (4.13)	$U = 2.5 \times (P_{70} \times R)^{1/2}$ $\leq 2 \times U_{max.}$; Duration: according the style	± (0.25 % R + 0.05 Ω)	± (0.5 % R + 0.05 Ω)	± (1 % R + 0.05 Ω)
Solderability (4.17.5)	Aging 4 h at 155 °C, dryheat dolder bath method; 235 °C; 2 s visual examination	Good tinning (≥ 95 % covered) no visible damage		
Resistance to soldering heat (4.18.2)	Solder bath method; (260 ± 5) °C; (10 ± 1) s	± (0.25 % R + 0.05 Ω)	± (0.5 % R + 0.05 Ω)	± (1 % R + 0.05 Ω)
Rapid change of temperature (4.19)	30 min at LCT = - 55 °C; 30 min at UCT = 125 °C; 5 cycles	± (0.25 % R + 0.05 Ω)	± (0.5 % R + 0.05 Ω)	± (0.5 % R + 0.05 Ω)
Damp heat, steady state (4.24)	(40 ± 2) °C; 56 days; (93 ± 3) % RH	± (1 % R + 0.05 Ω)	± (2 % R + 0.1 Ω)	± (2 % R + 0.1 Ω)
Climatic sequence (4.23)	16 h at UCT = 125 °C; 1 cycle at 55 °C; 2 h at LCT = - 55 °C; 1 h/1 kPa at 15 °C to 35 °C; 5 cycles at 55 °C $U = (P_{70} \times R)^{1/2}$ $U = U_{max.}$; whichever is less severe	± (1 % R + 0.05 Ω)	± (2 % R + 0.1 Ω)	± (2 % R + 0.1 Ω)
Endurance at 70 °C (4.25.1)	$U = (P_{70} \times R)^{1/2}$ $U = U_{max.}$; whichever is less severe 1.5 h ON; 0.5 h OFF; 70 °C; 1000 h	± (1 % R + 0.05 Ω)	± (2 % R + 0.1 Ω)	± (3 % R + 0.1 Ω)
Extended endurance (4.25.1.8)	Duration extended to 8000 h	± (2 % R + 0.1 Ω)	± (4 % R + 0.1 Ω)	± (4 % R + 0.1 Ω)
Endurance at upper category temperature (4.25.3)	UCT = 125 °C; 1000 h	± (1 % R + 0.05 Ω)	± (2 % R + 0.1 Ω)	± (2 % R + 0.1 Ω)

APPLICABLE SPECIFICATIONS

- EN 60115-1 Generic Specification
- EN 140400 Sectional Specification
- EN 140401-802 Detail Specification
- IEC 60068-2-X Variety of environmental test procedures
- IEC 60286-3 Packaging of SMD components

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