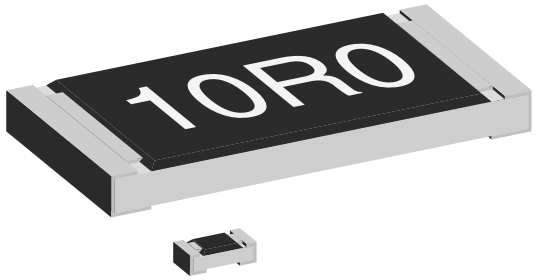
Lead (Pb)-free Thick Film, Rectangular Chip Resistors



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	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}	$0.3 \bullet 10^{-9}$							
Weight/1000 pcs	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[1)]

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

MODEL	VALUE	TOLERANCE	TCR	PACKAGING[2)]	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[2)]	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

1. Preferred way for ordering products is by use of the PART NUMBER
2. Please refer to table PACKAGING, see next page

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

PACKAGING

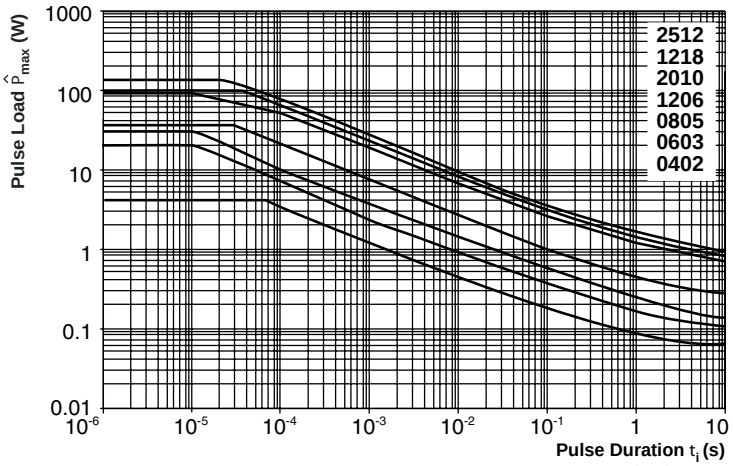
MODEL	REEL								BULK		
	TAPE WIDTH	DIAMETER	PITCH	PIECES/ REEL	PACKAGING CODE				PIECES	PACKAGING CODE	
					PART NUMBER		PRODUCT DESC.			PART NUMBER	PRODUCT DESC.
					PAPER	BLISTER	PAPER	BLISTER			
CRCW0201	8 mm	180 mm/7"	2 mm	10 000	ED		ET7				
		330 mm/13"	2 mm	50 000	EE		EF4				
D10/CRCW0402	8 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

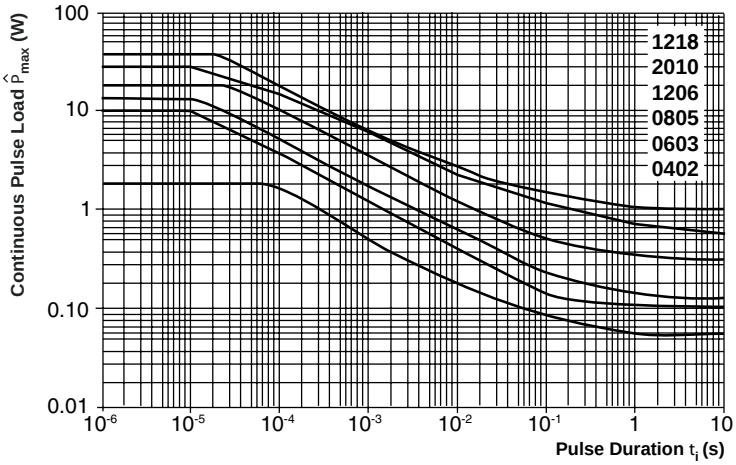
FUNCTIONAL PERFORMANCE

Single Pulse



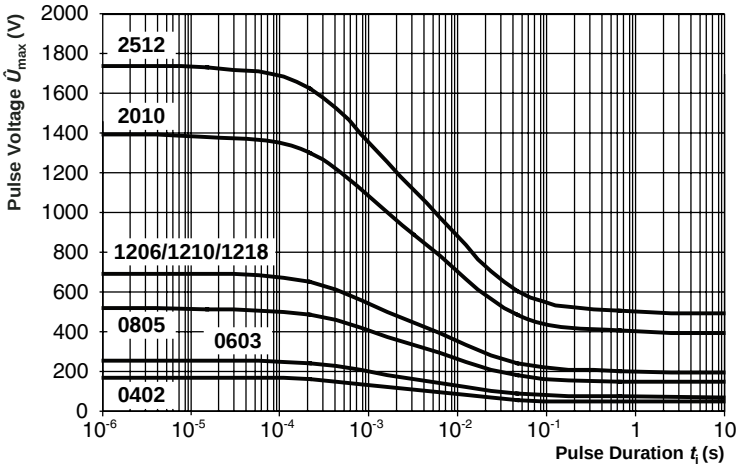
Maximum pulse load, single pulse; applicable if $\bar{P} \rightarrow 0$ and $n \leq 1000$ and $\hat{U} \leq \hat{U}_{max}$;
for permissible resistance change equivalent to 8000 h operation

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

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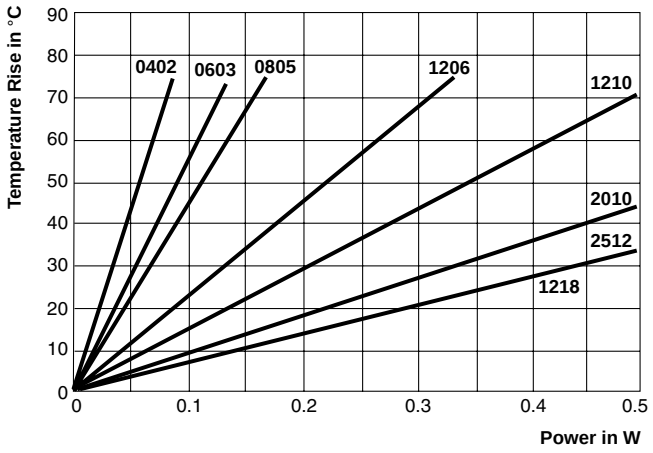
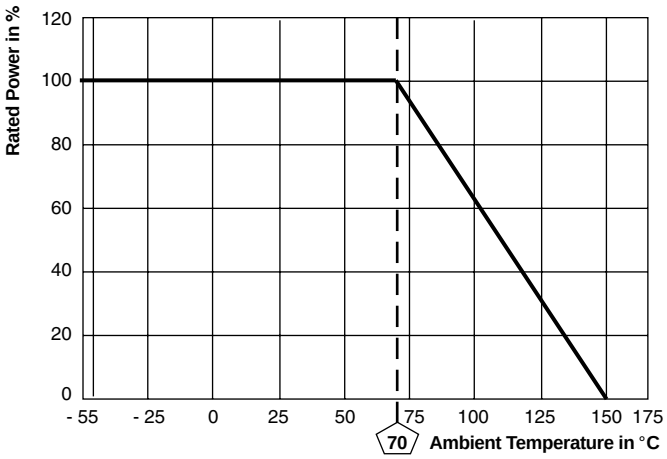
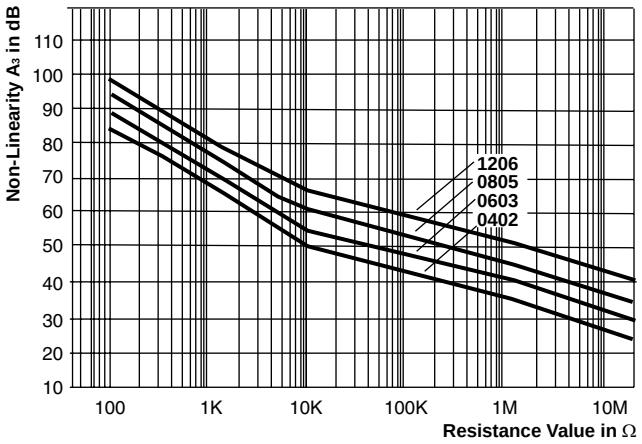


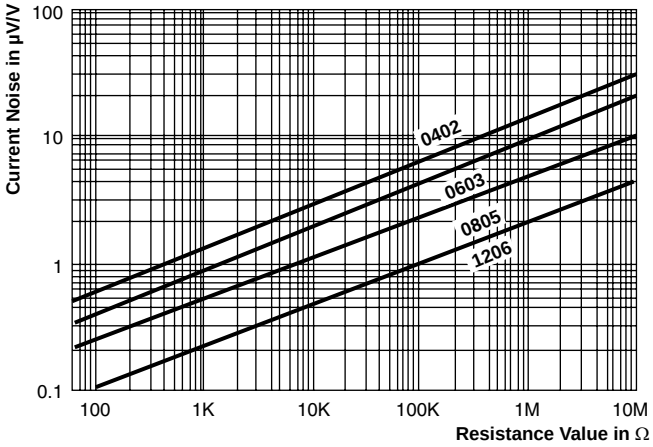
Temperature Rise



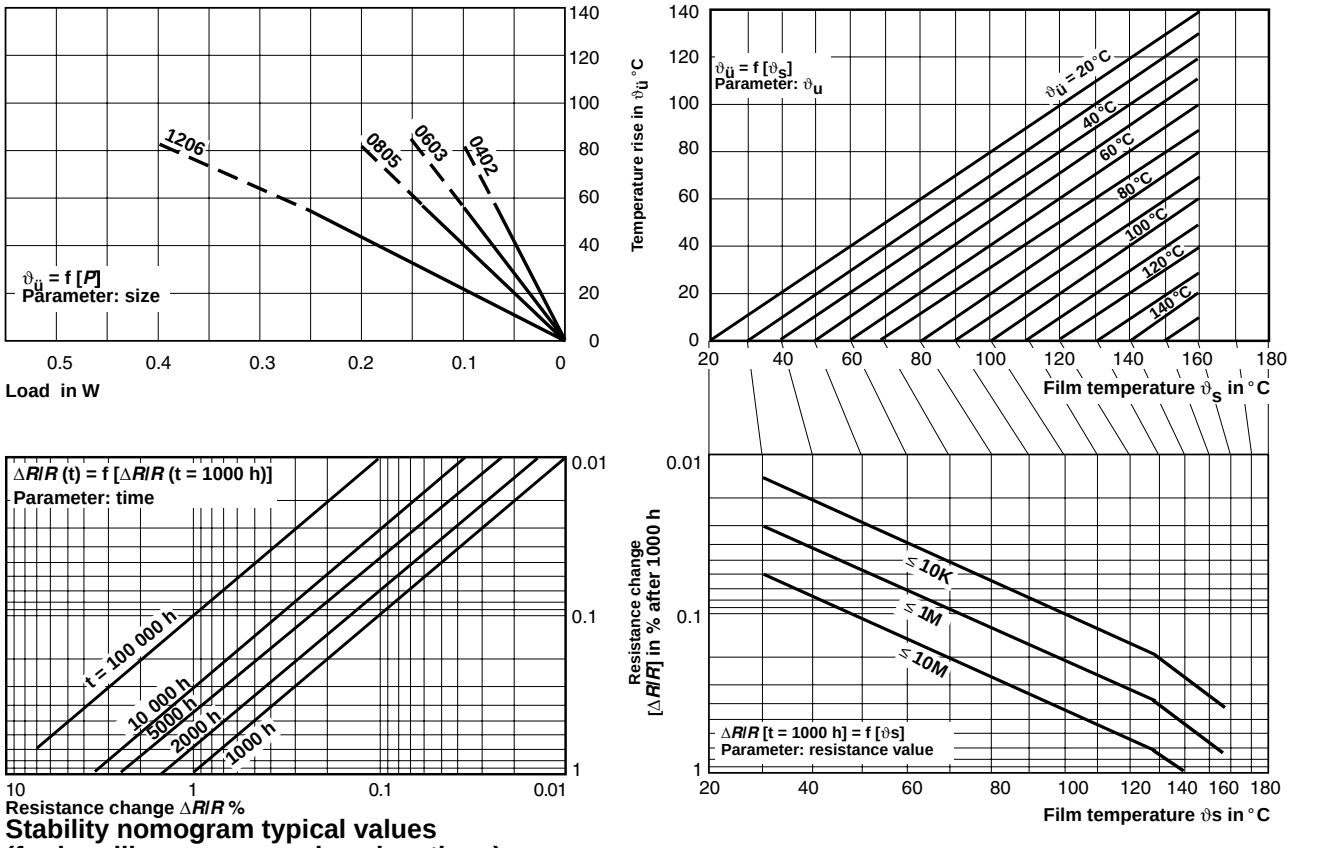
Derating



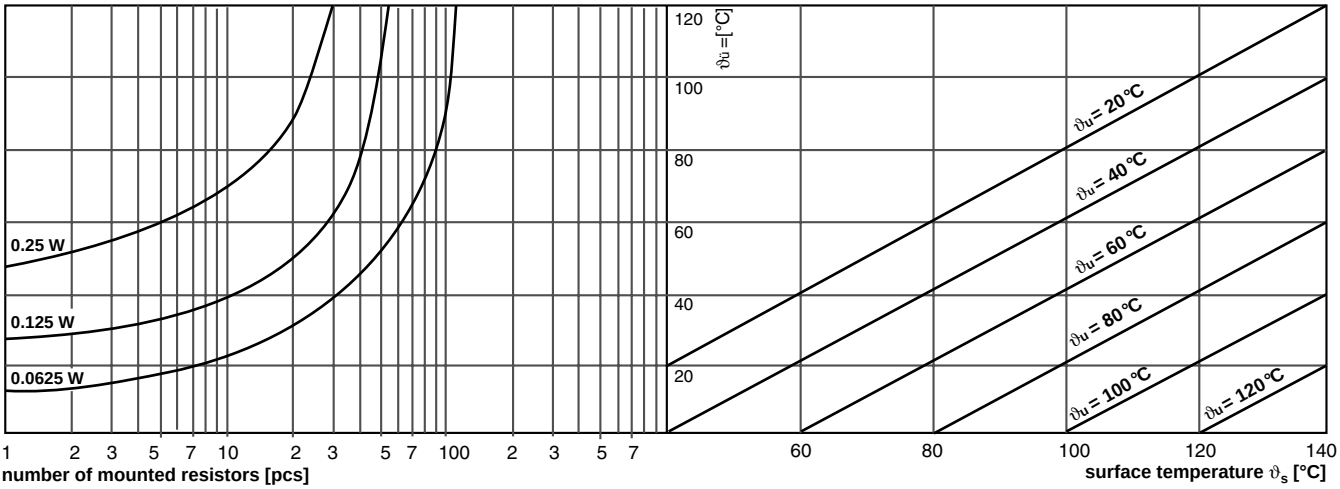
Non-Linearity



Current Noise



Stability nomogram typical values (for handling see general explanations)



Power rating as a function of packaging density (guideline)

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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 Solder 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 hours	± (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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