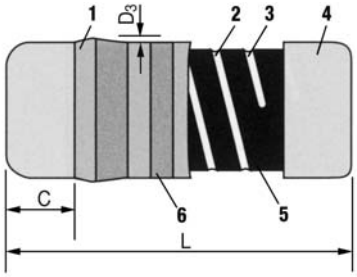
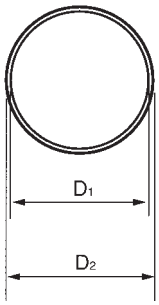
MELF TYPE

METAL FILM • JUMPER
RN41 • CC





STRUCTURE RN41

1 Protective coating
2 Trimming cut
3 Ceramic rod
4 Cap (iron solder plated)
5 Metal film
6 Marking

IDENTIFICATION

TYPE	COATING COLOR	MARKING
RN41 2DS	Clear	4 bands (E24); 5 bands (E96) color code
RN41 2A	Blue	3 bands color code
RN41 2ES	Blue (TCR 50)[a]	5 bands color code (TCR50)[b]
RN41 2E	Blue	3 bands (E24); 4 bands (E96) color code
RN41 2H		3 bands (E24) color code
RN41 3AS	Blue (TCR 50, 1%)[c]	5 bands color code (TCR50,1%)[c]
CC10M	Clear	One black band
CC10 • CC12	Brown	None
CC12M • CC25		
CC25M	Green	One black band

STRUCTURE CC

1 Protective coating
2 No trimming cut
3 Ceramic rod
4 Cap (iron solder plated)
5 Copper film
6 Marking (see identification)

a TCR25 (pink), TCR15 (violet); TCR10 and TCR5 (dark green)
b other TCR's: 4 bands (E24); 5 bands (E96) color code
c other TCR's and tolerances have green coating with 4 bands (E24) or 5 bands (E96) color code

Products with Pb-free terminations meet RoHS requirements

TYPE DESIGNATION (HOW TO ORDER)

RN41-SERIES

RN41	2ES	T	TE	1002	F	50
PRODUCT CODE	STYLE	TERMINATION SURFACE MATERIAL T: Sn (lead free)	TAPING TE: 7" reel (4 mm pitch) 3000 pcs. (sizes 0102, 0204) 1500 pcs. (size 0207) TEB: 13" reel (4mm pitch) 9000 pcs. (size 0204 only)	NOMINAL RESISTANCE B,C,D,F: 4 digits G,J: 3 digits	RESISTANCE TOLERANCE B, C, D, F, G, J	T.C.R. Unit: ppm/K (see below)

CC-SERIES

CC25M	T	TE
PROD. CODE	TERMINATION SURFACE MATERIAL T: Sn (lead free)	TAPING TE: 7" reel (4 mm pitch) 3000 pcs. (CC10, CC12) 1500 pcs. (CC25) TEB: 13" reel (4mm pitch) 6000 pcs. (CC25 only)

FEATURES

- High grade oxide ceramic core
- Higher electrode strength and lower current noise ratio than flat chip resistors
- Operating temperature range: - 55° C ... + 125° C (+155°C)
- High stability in short and long term tests
- Rated ambient temperature: + 70° C
- Standard size: 0102 (MICRO – MELF)
  0204 (MINI – MELF)
  0207 (MELF)
- Suitable for reflow, wave and iron soldering
- Lab Kit available

DIMENSIONS (mm)

SIZE	TYPE	L	C	D_1	D_2	D_3
0102	RN41 2DS • CC10M	2.2 +0/-0.1	0.35 ~ 0.45	1.1 +0/-0.1	1.10 Max.	0.00 Max.
–	RN41 2A • CC10	2.0 ± 0.1	0.3 Min.	1.25 ± 0.05	1.35 Max.	0.07 Max.
0204	RN41 2ES • CC12M	3.5 ± 0.2	0.5 ~ 0.9	1.4 ± 0.15	1.55 Max.	0.10 Max.
	CC12		0.5 Min.	1.45 ± 0.1		
0207	RN41 3AS • CC25M	5.8 ± 0.3	0.5 ~ 1.45	2.15 ± 0.15	2.40 Max.	0.15 Max.
	RN41 2E/2H • CC25	5.9 ± 0.2	0.5 Min.	2.2 ± 0.1		

RATING

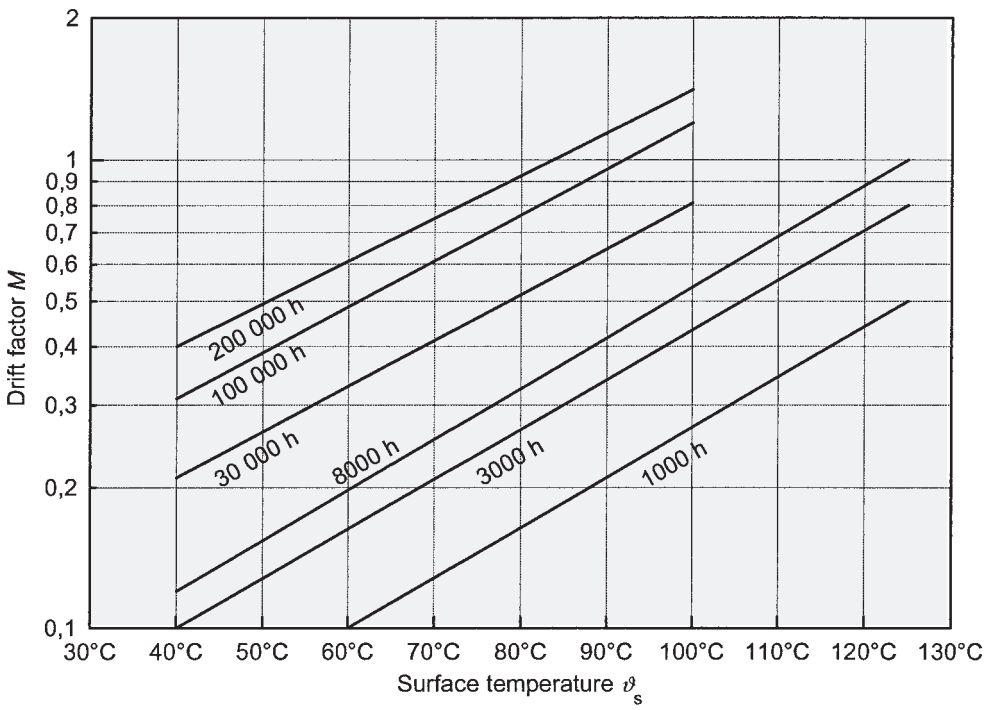
SIZE	TYPE	T.C.R. (ppm/K)	POWER RATING*	MAX. WORKING VOLTAGE	RESISTANCE RANGE AND TOLERANCE					
					B (±0.1%) E24 • E96	C (± 0.25%) E24 • E96	D (± 0.5%) E24 • E96	F (± 1%) E24 • E96	G (± 2%) E24	J (± 5%) E24
0102	RN41 2DS	± 15	0.2 W	150 V	100Ω...100kΩ	100Ω...100kΩ	100Ω...100kΩ	—	—	—
		± 25				100Ω...221kΩ	47Ω...221kΩ	10Ω...221kΩ		
		± 50			—	—		10Ω...2.21MΩ	1Ω...9.1Ω	0.22Ω ...0.91Ω
—	RN41 2A	± 100	0.125 W	100 V			—	100Ω...100kΩ	—	—
0204	RN41 2ES	± 5			100Ω...100kΩ	100Ω...100kΩ		—		
		± 10			100Ω...221kΩ	100Ω...221kΩ				
		± 15	0.25 W	200 V	43Ω...221kΩ	22Ω...221kΩ	10Ω...221kΩ			
		± 25			43Ω...511kΩ	22Ω...511kΩ	100Ω...604kΩ			
		± 50				—	—	1Ω...5.11MΩ		0.22Ω...0.91Ω
0207	RN41 2E	± 25		250 V	—	100Ω...100kΩ	100Ω...1MΩ	—	—	—
		± 50				—		10Ω...1MΩ		
	RN41 2H	± 200	0.5 W				—			0.22Ω...100kΩ
	RN41 3AS	± 5	0.4 W		100Ω...100kΩ	100Ω...100kΩ		—		
		± 10								
		± 15			100Ω...511kΩ	100Ω...511kΩ				
		± 25					100Ω...511kΩ			
		± 50	1 W	400 V	—	—	1Ω...2.21MΩ	1Ω...1MΩ		0.1Ω...0.91Ω
0102 / -	CC10M • CC10	≤ 20 mΩ JUMPER			(max. current 2A for CC10 and CC12) (max. current 5A for CC25)					
0204	CC12M • CC12									
0207	CC25M • CC25									

* For resistors operated at an ambient temperature of +70°C or above, the power rating shall be derated.

DRIFT NOMOGRAMM

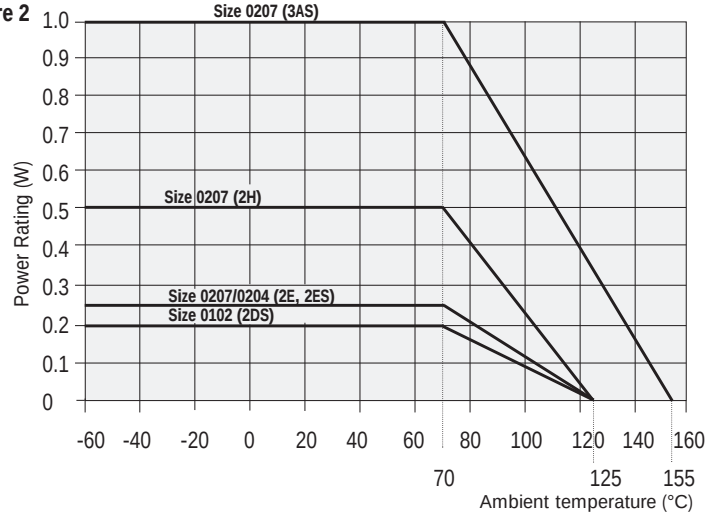
For a different lifetime and surface temperature the expected drift of the resistance value may be calculated $\Delta R\ (t,\ \vartheta_s) \leq M \cdot \Delta R$ (8000 h, 125 °C) with drift factor *M* to be determined from the diagramm below.

Figure 1



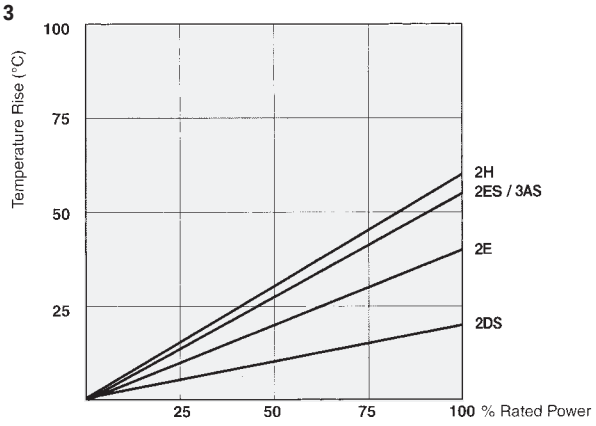
POWER DERATING

Figure 2



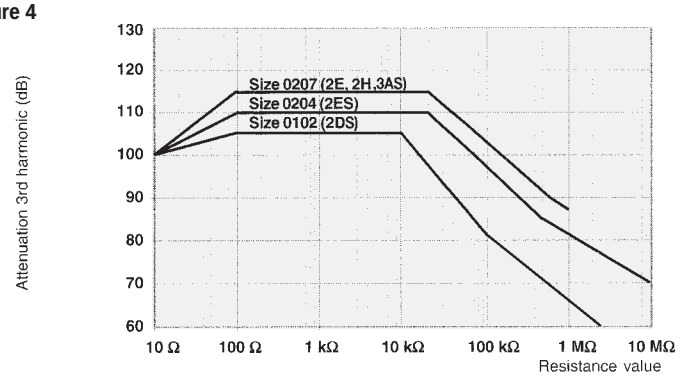
TEMPERATURE RISE

Figure 3



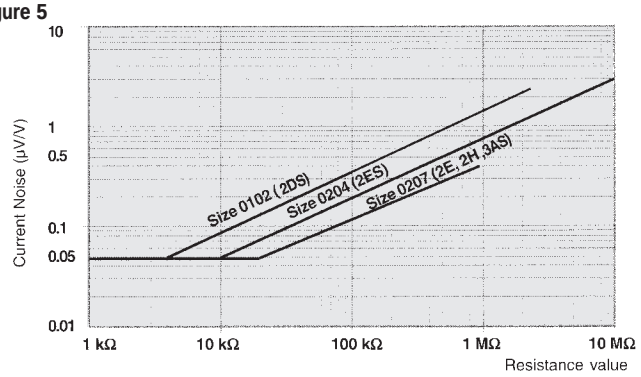
NONLINEARITY

Figure 4



CURRENT NOISE

Figure 5



PULSE LOAD CAPABILITY

Figure 6

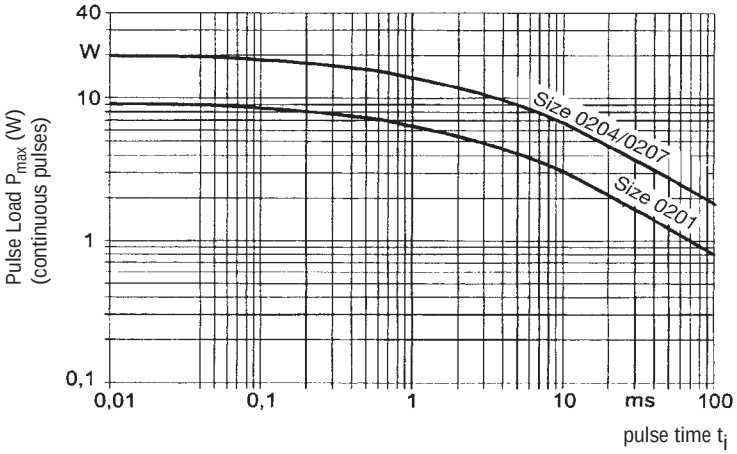


Figure 7

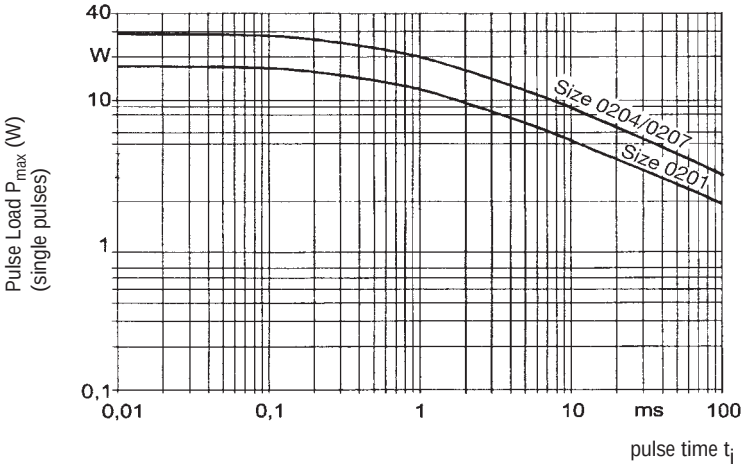
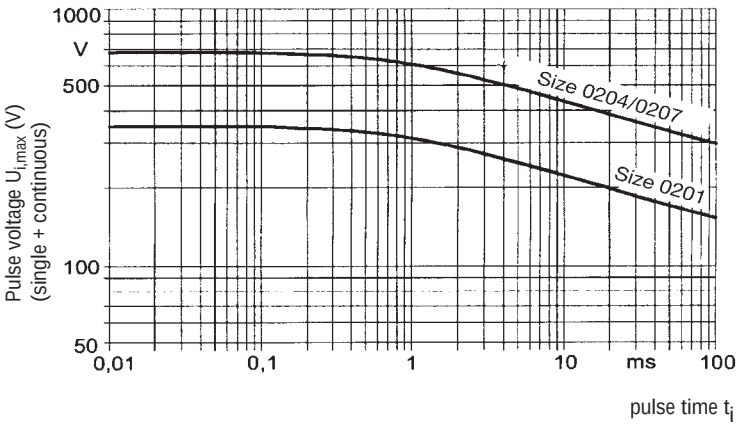


Figure 8



The pulse load capability defines the ability of a resistor to withstand short overloads within the provided working period. The pulse load capability is limited by the maximum pulse load $P_{i,\,max}$ and the maximum pulse voltage $U_{i,\,max}$ both depending on a given pulse duration t_i. The following condition shall be considered:

1
Pulse power P_{max}
The average pulse load P_{avg} shall not exceed the rated dissipation P_{70}. For resistance values above the critical resistance the rated dissipation is given by the resistance value and the limiting element voltage U_{max}. The average pulse load calculates to

$$P_{avg} = \frac{1}{t_p \cdot R} \int_{t_1}^{t_2} u^2(t)\,dt$$

with $t_i = t_2 - t_1$.

a) Rectangular pulse
For rectangular pulses the average pulse load calculates to:

$$P_{avg} = \frac{1}{t_p \cdot R} \cdot U_{i,peak}^2 \cdot t_i$$

b) Exponential pulse
For exponential pulses the average pulse load calculates to:

$$P_{avg} = \frac{1}{t_p \cdot R} \cdot U_{i,peak}^2 \cdot \frac{\tau_e}{2}$$

with $\tau_e = R \cdot C$ or $\tau_e = L/R$.

Figures 9a and 9b give a further explanation of the pulse parameter.

c) Other pulse shapes
Other pulse shape should be converted into a rectangular pulse having the same energy at given peak voltage.

d) Continuous pulses
For $P_{i,max}$ on continuous pulses see Figure 6.

e) Single pulse
For single pulses $P_{avg} \rightarrow 0$. Hence, a higher pulse load $P_{i,max}$ is accepted (see Figure 7).

2
Pulse voltage
For high ohmic resistors the pulse load capability is limited by the maximum pulse voltage depending on the pulse duration according to the following equation:

$$U_{i,\,peak} = \frac{2.5 \cdot U_{max}}{1 + t_i \cdot K} + U_{max}$$

with K = 100 s^{-1}.

For $U_{i,\,max}$ see Figure 8.

3
Permitted change in resistance at pulse loads
The permissible pulse load is determined by a resistance change that is in average less than 1%.

PULSE PARAMETER FOR RECTANGULAR AND EXPONENTIAL PULSES

Figure 9a

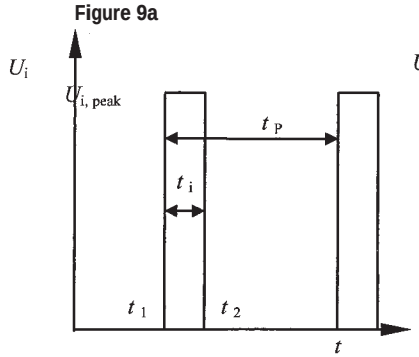
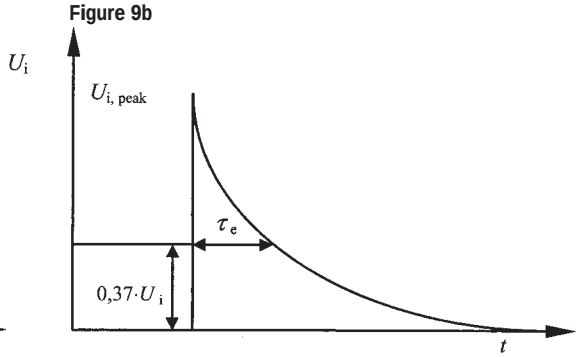


Figure 9b



MECHANICAL PERFORMANCE TESTS

NAME	ACCORDING TO IEC		TEST CONDITIONS	REQUIREMENTS PERMISSIBLE CHANGE $\|\Delta R/R_N\|$	
	60115-1 clause	60068-2- (Test)		LIMIT	TYPICAL
Resistance to soldering heat	4.18.2	58 (Td)	Solder bath method; (260 ± 5)°C; (10 ± 1)s	No visible damage 0.5% + 0.05 Ω	0.3% + 0.05 Ω
Solderability	4.17.2	58 (Td)	Solder bath method (230 ± 5)°C; (3 ± 0.5)s	Good tinning (≥ 95% covered); no visual damage	
Component solvent resistance	4.29	45 (XA)	Isopropyl alcohol; 23°C; toothbrush method	Marking legible; no visible damage	
Vibration	4.22	6 (Fc)	10-55 Hz / 1.5 mm (196m/s²) / 6 hours	No visible damage 0.5% + 0.05 Ω	0.3% + 0.05 Ω

ELECTRICAL PERFORMANCE TESTS

NAME	ACCORDING TO IEC		TEST CONDITIONS	REQUIREMENTS PERMISSIBLE CHANGE $\|\Delta R/R_N\|$	
	60115-1 clause	60068-2- (Test)		LIMIT	TYPICAL
Temperature coefficient	4.8.4.2	—	Measurement points at (20/-55/20/125/20)°C	Within specified T.C.R.	
Short time overload	4.13	—	Room temperature; $U = 2.5 \times \sqrt{P_{70} \times R}$ ≤ 2 x U_{max} ; 5s	No visible damage 0.5% + 0.05 Ω	0.3% + 0.05 Ω
Periodic -pulse high-voltage overload test	4.28	—	2.5 x U_{nom}/1000 cycles t_{pulse} = 1s / t_{rep} = 26s	No visible damage 1% + 0.05 Ω	0.6% + 0.05 Ω

ENVIRONMENTAL TESTS

NAME	ACCORDING TO IEC		TEST CONDITIONS	REQUIREMENTS PERMISSIBLE CHANGE $\|\Delta R/R_N\|$	
	60115-1 clause	60068-2- (Test)		LIMIT	TYPICAL
Endurance at 70°C	4.25.1	—	70°C / 1000h P_{nom} for 1.5h on / 0.5h off	No visible damage 0.5% + 0.05 Ω 3% (size 2A) 5% (size 2H)	0.3% + 0.05 Ω 1.5% (size 2A) 3% (size 2H)
Endurance at 125°C	4.25.3	—	125°C / 1000h No load	No visible damage 1% + 0.05%	0.75% + 0.05%
Rapid change of temperature	4.19	14(Na)	5 cycles between -55/125°C 30 min at each temperature level	No visible damage 0.5% + 0.05 Ω 1% (size 2H)	0.3% + 0.05 Ω 0.7% (size 2H)
Damp heat, steady state	4.24	3(Ca)	(40 ± 2)°C / 90% r.h. ; 1000h; P_{nom} for 1.5h on / 0.5h off	No visible damage 1% + 0.05 Ω 3% (size 2A) 5% (size 2H)	0.75% + 0.05 Ω 1.5% (size 2A) 3% (size 2H)