DATA SHEET

SMW02/03/05
SMF02/03/05
Stand-up miniature power resistors

Product specification
Supersedes data of 7th August 2000
File under BCcomponents, BC08

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BC COMPONENTS

Stand-up miniature power resistors

SMW02/03/05
SMF02/03/05

FEATURES

- High power dissipation in small volume
- High pulse load handling capabilities
- 2e pitch mounting
- Designed in stand-up configuration for stand-up mounting.

APPLICATIONS

- Ballast switching
- Power supplies
- Shunts.

DESCRIPTION

SMW: The resistor element is a resistive wire which is wound in a single layer on a ceramic rod. Metal caps are pressed over the ends of the rod. The ends of the resistance wire and the leads are connected to the caps by welding.

SMF: The resistor element is a metal film resistor consisting of a metal layer deposited over a high grade ceramic rod. The resistive film is adjusted to final value by means of a helical groove. The leads are connected to the caps by welding.

SMW/SMF: Tinned copper-clad iron leads with poor heat conductivity are employed permitting the use of relatively short leads to obtain stable mounting without overheating the solder joint.

The resistor body and lead ends are housed within a rectangular ceramic case which is non-flammable, will not melt even at high overloads and is resistant to most commonly used cleaning solvents, in accordance with *"MIL-STD-202E, method 215"* and *"IEC 60068-2-45"*.

QUICK REFERENCE DATA

DESCRIPTION	VALUE					
	SMW02	**SMF02**	**SMW03**	**SMF03**	**SMW05**	**SMF05**
Resistance range; note 1	0.1 to 200 Ω	220 Ω to 47 kΩ	0.1 to 560 Ω	620 Ω to 47 kΩ	0.1 to 560 Ω	620 Ω to 47 kΩ
Resistance tolerance	±5%; E24 series					
Maximum permissible body temperature	300 °C					
Rated dissipation at T_{amb} = 70 °C	2 W		3 W		5 W	
Climatic category (IEC 60068)	40/200/56					
Basic specification	IEC 60115-1					
Stability after:						
load, 1000 hours	ΔR/R max.: ±5% + 0.1 Ω					
climatic tests	ΔR/R max.: ±3% + 0.1 Ω					
short time overload	ΔR/R max.: ±2% + 0.1 Ω					
Insulation voltage	>2000 V					

Note

1. Higher values are available on request.

ORDERING INFORMATION

Table 1 Ordering code indicating resistor type and packaging

TYPE	ORDERING CODE 2306 34. .....
	LOOSE IN BOX
	500 units
SMW02	0 03...
SMF02	5 03...
SMW03	1 03...
SMF03	6 03...
SMW05	2 03...
SMF05	7 03...

Ordering code (12NC)

- The resistors have a 12-digit ordering code starting with 2306 34
- The subsequent 3 digits indicate the resistor type and packaging; see Table 1.
- The remaining 3 digits indicate the resistance value:
  - The first 2 digits indicate the resistance value.
  - The last digit indicates the resistance decade in accordance with Table 2.

Table 2 Last digit of 12NC

RESISTANCE DECADE	LAST DIGIT
0.1 to 0.91 Ω	7
1 to 9.1 Ω	8
10 to 91 Ω	9
100 to 910 Ω	1
1 to 9.1 kΩ	2
10 to 47 kΩ	3

ORDERING EXAMPLE

The ordering code of a SMW02 resistor, value 47 Ω, supplied loose in box of 500 units is: 2306 340 03479.

FUNCTIONAL DESCRIPTION

Product characterization

Standard values of nominal resistance are taken from the E24 series for resistors with a tolerance of ±5%.
The values of the E24 series are in accordance with *"IEC publication 60063"*.

Limiting values

TYPE	LIMITING VOLTAGE(1) (V)	LIMITING POWER (W)
SMW02	$V = \sqrt{P_n \times R}$	2
SMF02	350	
SMW03	$V = \sqrt{P_n \times R}$	3
SMF03	350	
SMW05	$V = \sqrt{P_n \times R}$	5
SMF05	600	

Note

1. The maximum voltage that may be continuously applied to the resistor element, see *"IEC publication 60266"*.

DERATING

The power that the resistor can dissipate depends on the operating temperature; see Fig.1.

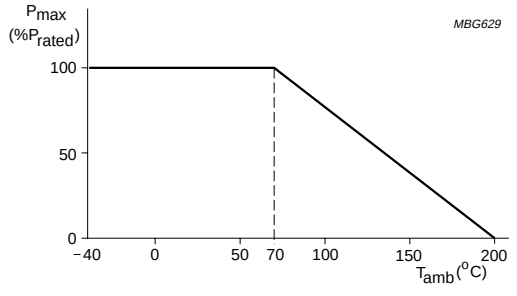


Fig.1 Maximum dissipation (P_{max}) as a function of the ambient temperature (T_{amb}).

The maximum permissible hot-spot temperature is 300 °C, and the minimum breakdown voltage of the encapsulation is 2000 V.

PULSE LOADING CAPABILITY

Detailed pulse loading information is available on request.

Application information

MOUNTING

The resistors must be mounted in such a way that no stress is exerted on the leads and that thermal expansion is possible over the temperature range. **Ensure that the temperature rise of the resistor body by conducted or convected heat, does not affect nearby components or materials.** The temperature rise at the soldering point of the leads must not reach the melting point of the solder. The temperature rise at the soldering point as a function of dissipated power is shown in Fig.2.

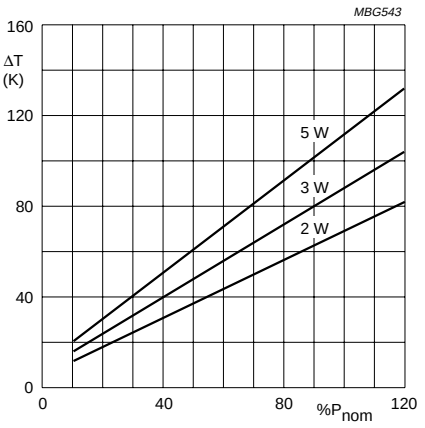


Fig.2 Solder spot temperature rise (ΔT) as a function of dissipated power.

MECHANICAL DATA

Mass per 100 units

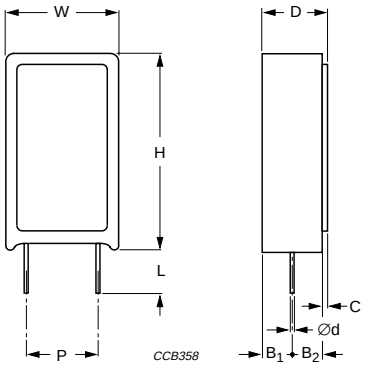
TYPE	MASS (g)
SMW02	370
SMF02	
SMW03	530
SMF03	
SMW05	640
SMF05	

Marking

The resistor is marked with the resistor type designation, the production week, nominal resistance value, the tolerance on the resistance and the rated dissipation at T_{amb} = 70 °C.

For values up to 910 Ω the R is used as a decimal point. For values of 1 kΩ or greater the letter K is used as the decimal point for the kΩ indication.

Outlines



For dimensions see Table 3.

Fig.3 Outlines.

Table 3 Resistor type and relevant physical dimensions; see Fig.3

TYPE	W (mm)	D (mm)	C (mm)	H (mm)	$\not\in B_1 - B_2 \not\in$ (mm)	L (mm)	P (mm)	∅d (mm)
SMW02	11 ±1	7 ±1	0/+1.0	20.5 ±1.5	+0.9/–0.3	4.5 ±1.5	5 ±1	0.8 ±0.03
SMF02								
SMW03	12 ±1	8 ±1	0/+1.0	25.0 ±1.5	+1.4/–0.3			
SMF03								
SMW05	13 ±1	9 ±1	0/+1.0	25.5 ±1.5	+2.3/–0.3			
SMF05								

TESTS AND REQUIREMENTS

Essentially all tests are carried out in accordance with the schedule of "*IEC publications 60115-1 and 60115-4"*, category 40/200/56 (rated temperature range –40 °C to +200 °C; damp heat, long term, 56 days). The testing also covers the requirements specified by EIA and EIAJ.

The tests are carried out in accordance with IEC publication 60068, *"Recommended basic climatic and mechanical robustness testing procedure for electronic components"* and under standard atmospheric conditions according to *"IEC 60068-1"*, subclause 5.3.

In Table 4 the tests and requirements are listed with reference to the relevant clauses of *"IEC publications 60115-1, 60115-4 and 68"*; a short description of the test procedure is also given. In some instances deviations from the IEC recommendations were necessary for our method of specifying.

All soldering tests are performed with mildly activated flux.

Table 4 Test procedures and requirements

IEC 60115-1 CLAUSE	IEC 60068 TEST METHOD	TEST	PROCEDURE	REQUIREMENTS
Tests in accordance with the schedule of IEC publication 60115-1				
4.15		robustness of resistor body	load 200 ±10 N	no visible damage ΔR/R max.: ±0.5% + 0.05 Ω
4.16	U	robustness of terminations:		
	Ua	tensile all samples	load 10 N; 10 s	no visible damage ΔR/R max.: ±0.5% + 0.05 Ω
4.17	Ta	solderability	2 s; 235 °C	good tinning; no damage
4.18	Tb	resistance to soldering heat	thermal shock: 3 s; 350 °C; 2.5 mm from body	ΔR/R max.: ±0.5% + 0.05 Ω
4.19	14 (Na)	rapid change of temperature	30 minutes at –40 °C and 30 minutes at +200 °C; 5 cycles	no visible damage ΔR/R max.: ±1% + 0.05 Ω
4.22	Fc	vibration	frequency 10 to 500 Hz; displacement 0.75 mm or acceleration 10 g; 3 directions; total 6 hours (3 × 2 hours)	no damage ΔR/R max.: ±0.5% + 0.05 Ω
4.20	Eb	bump	4000 ±10 bumps; 390 m/s^2	no damage ΔR/R max.: ±0.5% + 0.05 Ω
4.23		climatic sequence:		
4.23.2	Ba	dry heat	16 hours; 200 °C	
4.23.3	Db	damp heat (accelerated) 1st cycle	24 hours; 55 °C; 95 to 100% RH	
4.23.4	Aa	cold	2 hours; –40 °C	
4.23.5	M	low air pressure	1 hour; 8.5 kPa; 15 to 35 °C	
4.23.6	Db	damp heat (accelerated) remaining cycles	5 days; 55 °C; 95 to 100% RH	ΔR/R max.: ±3% + 0.05 Ω

IEC 60115-1 CLAUSE	IEC 60068 TEST METHOD	TEST	PROCEDURE	REQUIREMENTS
4.24.2	3 (Ca)	damp heat (steady state)	56 days; 40 °C; 90 to 95% RH; dissipation ≤0.01 P_n	no visible damage $\Delta R/R$ max.: ±3% + 0.1 Ω
4.8.4.2		temperature coefficient	at 20/–40/20 °C, 20/200/20 °C: **SMW**: R < 10 Ω **SMW**: R ≥ 10 Ω **SMF**	 TC ≤ $\pm 600 \times 10^{-6}$/K $-80 \times 10^{-6} \leq$ TC $\leq +140 \times 10^{-6}$/K TC ≤ $+250 \times 10^{-6}$/K
4.13		short time overload	room temperature; dissipation $10 \times P_n$; 5 s O(voltage not more than 1000 V/25 mm)	$\Delta R/R$ max.: ±2% + 0.1 Ω
4.25.1		endurance (at 70 °C)	1000 hours loaded with 0.9 P_n; 1.5 hours on and 0.5 hours off	no visible damage $\Delta R/R$ max.: ±5% + 0.1 Ω
4.23.2	Ba	endurance at upper category temperature	1000 hours; 200 °C; no load	no visible damage $\Delta R/R$ max.: ±5% + 0.1 Ω