DATA SHEET

LSR37
Low ohmic surge resistor

Product specification
Supersedes data of 15th March 2001
File under BCcomponents, BC08

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BC COMPONENTS

Low ohmic surge resistor LSR37

FEATURES

- High pulse-loading capability (flashes)
- Good replacement for carbon-composite resistors.

APPLICATIONS

- Application for overload and high voltage pulse hazard circuits (TV-sets, monitors).

DESCRIPTION

A metal glazed film is deposited on a high grade ceramic body. After that caps are applied to the rods and electrolytic copper wires are welded to these end caps.

The resistors are coated with a light-blue lacquer which provides electrical, mechanical and climatic protection.

The encapsulation is resistant to all cleaning solvents according to *"MIL-STD 202E, method 215"* and *"IEC 60068-2-45"*.

ORDERING INFORMATION

Ordering code (12NC)

- The resistors have a 12-digit ordering code staring with 2322 245
- The subsequent 2 digits indicate the resistor type and packaging; see Table 1.
- The remaining 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.

QUICK REFERENCE DATA

DESCRIPTION	VALUE	
Resistance range	220 Ω to 910 Ω	1 kΩ to 10 kΩ
Resistance tolerance and series	±10%; ±20%; E12 series	
Maximum dissipation at T_{amb} = 70 °C	0.5 W	
Thermal resistance, R_{th}	120 K/W	
Temperature coefficient	0 to $+600 \times 10^{-6}$/K	-600 to $+200 \times 10^{-6}$/K
Voltage coefficient	0 to $+350 \times 10^{-6}$/K	$\pm 50 \times 10^{-6}$/V
Maximum permissible voltage	$V = \sqrt{P_n \times R}$	
Dielectric withstanding voltage of the insulation for 1 minute	700 V	
Basic specifications	IEC 60115-1B	
Climatic category (IEC 60068)	55/155/56	
Stability after:		
load (1000 hours)	ΔR/R max.: ±3% + 0.1 Ω	
climatic test	ΔR/R max.: ±3% + 0.1 Ω	
soldering	ΔR/R max.: ±1% + 0.1 Ω	
High voltage test for R-value > 3.3 kΩ, 10 kV; 1 nF; 50 × 12/minutes	ΔR/R max.: ±20% (typical value ±10%)	
ESD contact discharge 12 kV; 100 pulses	ΔR/R max.: ±20% (typical value: ±10%)	

Table 1 Ordering code as function of tolerance and packaging

TYPE	TOLERANCE (%)	ORDERING CODE 2322 245	
		1000 units IN AMMOPACK	5000 units ON REEL
LSR37	±10	12...	22...
	±20	11...	21...

Table 2 Last digit of 12NC

RESISTANCE DECADE	LAST DIGIT
220 to 910 Ω	1
1 to 9.1 kΩ	2
10 kΩ	3

ORDERING EXAMPLE

The ordering code for a LSR37, resistor value 1.5 kW, 10% tolerance, supplied on a bandolier of 1000 units in ammopack, is: 2322 245 12152.

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FUNCTIONAL DESCRIPTION

Product characterization

Standard values of rated resistance (nominal resistance) are taken from the E12 series with a tolerance of 10% or 20%.The values of the E12 series are in accordance with *"IEC publication 60063"*.

The limiting voltage DC is not applicable, because the maximum rated voltage for the maximum R_n-value of 10 kΩ at P_n = 0.5 W is only 70.7 V.

The maximum permissible hot-spot temperature is 155 °C.

Limiting values

TYPE	LIMITING VOLTAGE(1) (V)	LIMITING POWER (W)
LSR37	$V = \sqrt{P_n \times R}$	0.5

Note

1. The maximum voltage that may be continuously applied to the resistor element, see *"IEC publication 60115-1"*.

DERATING

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

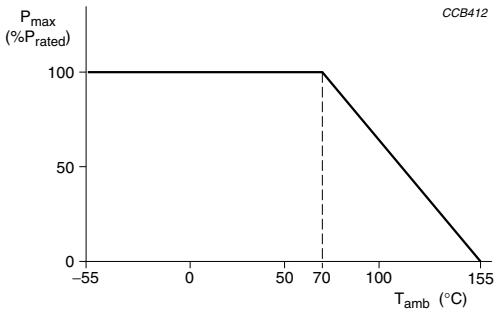

Fig.1 Maximum dissipation (P_{max}) in percentage of rated power as a function of the ambient temperature (T_{amb}).

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PULSE LOADING CAPABILITY

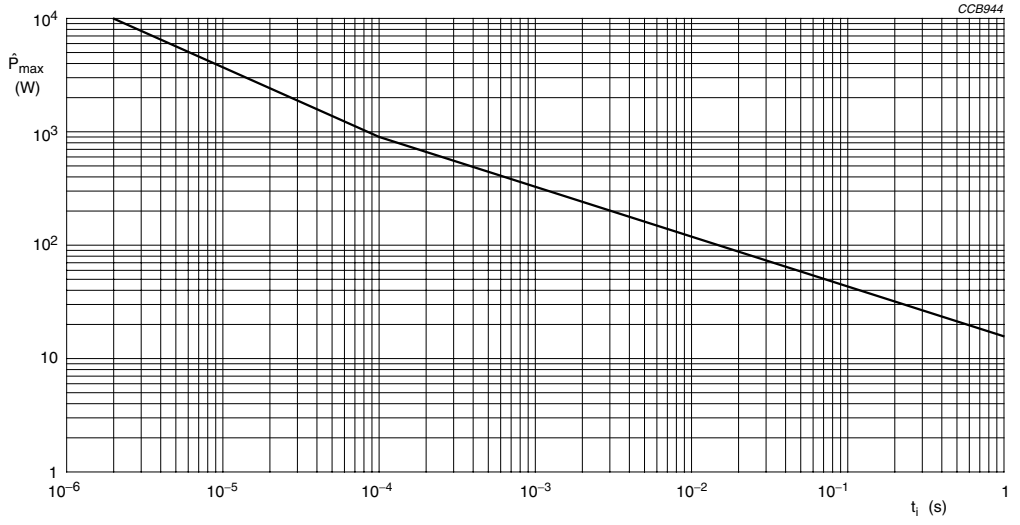

Fig.2 Pulse on a regular basis; maximum permissible peak pulse power $\hat{P}_{max}$ as a function of pulse duration (t_i) for single pulse condition.

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Application information

The resistors with straight leads are suitable for processing on automatic insertion equipment and cutting and bending machines.The minimum pitch for this type is 6e (15.0 mm).

For temperature rise at soldering place see Fig.4.

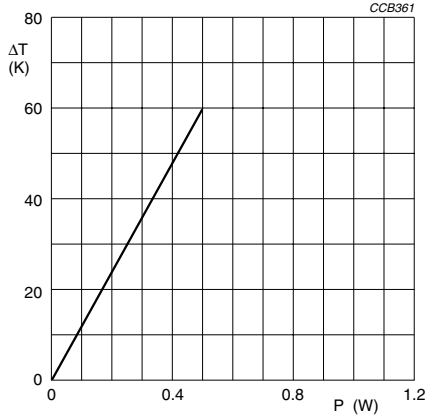

Fig.3 Hot-spot temperature rise (ΔT) as a function of dissipated power.

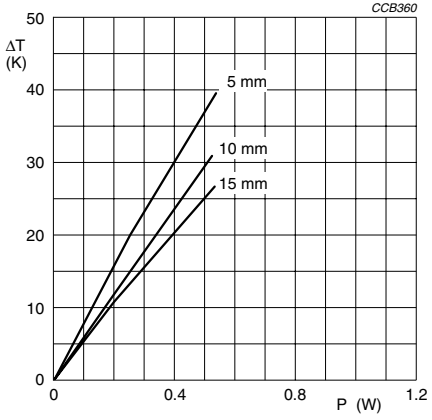

Fig.4 Temperature rise (ΔT) at the lead end (soldering point) as a function of dissipated power at various lead lengths after mounting.

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MECHANICAL DATA

Mass per 100 units

TYPE	MASS (g)
LSR37	53.2

Marking

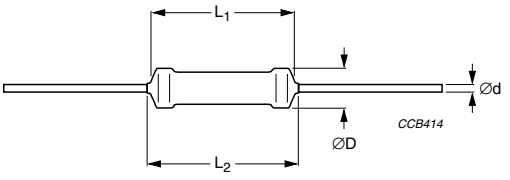
The nominal resistance and tolerance are marked on the resistor using coloured bands in accordance with IEC publication 60062 *"Colour codes for fixed resistors"*.

Three bands are used for 20% tolerance with no indication for the tolerance. Four bands are used for 10% tolerance.

Grey is used instead of silver for 10% and yellow is used instead of gold for 5% because metal particles in the lacquer could affect high-voltage properties.

Outlines

The length of the body (L_1) is measured by inserting the leads into holes of two identical gauge plates and moving these plates parallel to each other until the resistor body is clamped without deformation *("IEC publication 60294")*.



For dimensions see Table 3.

Fig.5 Outline.

Table 3 Resistor type and relevant physical dimensions; see Fig.5

TYPE	ØD MAX. (mm)	L_1 MAX. (mm)	L_2 MAX. (mm)	Ød (mm)
LSR37	4.0	9.0	10.0	0.7 ±0.03

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TESTS AND REQUIREMENTS

Essentially all tests are carried out in accordance with the schedule of *"IEC publication 60115-1"*, category **LCT/UCT/56** (rated temperature range: **L**ower **C**ategory **T**emperature, **U**pper **C**ategory **T**emperature; 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 60068-2, *"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 and 60068-2"*; 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 60068-2 TEST METHOD	TEST	PROCEDURE	REQUIREMENTS
4.16	21 (U)	robustness of terminations:		
4.16.2	21 (Ua1)	tensile all samples	∅0.7 mm; load 10 N; 10 s	number of failures $<10 \times 10^{-6}$
4.16.3	21 (Ub)	bending half number of samples	∅0.7 mm; load 5 N; 4 × 90°	number of failures $<10 \times 10^{-6}$
4.16.4	21 (Uc)	torsion other half of samples	3 × 360° in opposite directions	no damage ΔR/R max.: ±1.0% + 0.10 Ω
4.17	20 (Ta)	solderability	2 s; 235 °C	good tinning; no damage
4.18	20 (Tb)	resistance to soldering heat	thermal shock: 3 s; 350 °C; 6 mm from body	ΔR/R max.: ±1.0% + 0.10 Ω
4.19	14 (Na)	rapid change of temperature	30 minutes at −55 °C and 30 minutes at +155 °C; 5 cycles	ΔR/R max.: ±1.0% + 0.10 Ω
4.20	29 (Eb)	bump	3 × 1500 bumps in 3 directions; 40 g	no damage ΔR/R max.: ±1.0% + 0.10 Ω
4.22	6 (Fc)	vibration	frequency 10 to 500 Hz; displacement 1.5 mm or acceleration 10 g; 3 directions; total 6 hours (3 × 2 hours)	no damage ΔR/R max.: ±1.0% + 0.10 Ω
4.23		climatic sequence:		
4.23.2	2 (Ba)	dry heat	16 hours; 155 °C	
4.23.3	30 (Db)	damp heat (accelerated) 1st cycle	24 hours; 55 °C; 90 to 100% RH	
4.23.4	1 (Aa)	cold	2 hours; −55 °C	
4.23.5	13 (M)	low air pressure	2 hours; 8.5 kPa; 15 to 35 °C	
4.23.6	30 (Db)	damp heat (accelerated) remaining cycles	5 days; 55 °C; 95 to 100% RH	R_{ins} min.: 10^3 MΩ ΔR/R max.: ±3.0% + 0.1 Ω
4.24.2	3 (Ca)	damp heat (steady state)	56 days; 40 °C; 90 to 95% RH; dissipation 0.01 P_n; limiting voltage 100 V (DC)	ΔR/R max.: ±3.0% + 0.1 Ω

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IEC 60115-1 CLAUSE	IEC 60068-2 TEST METHOD	TEST	PROCEDURE	REQUIREMENTS
4.25.1		endurance	1000 hours at 70 °C; P_n or V_{max}	ΔR/R max.: ±3.0% + 0.1 Ω
4.8.4		temperature coefficient	220 Ω to 910 Ω	0 to $+600 \times 10^{-6}$/K
			1 kΩ to 10 kΩ	-600 to $+200 \times 10^{-6}$/K
4.7		voltage proof on insulation	700 V (RMS) during 1 minute; V-block method	no breakdown
4.6.1.1		insulation resistance	500 V (DC) during 1 minute; V-block method	R_{ins} min.: 10^4 MΩ
4.13		short time overload	room temperature; dissipation $6.25 \times P_n$; 10 cycles; 5 s on and 45 s off	ΔR/R max.: ±2.5% + 0.10 Ω
		high voltage pulse 10 kV; 1 nF; 50 × 12/min	for $R_n > 3.3$ kΩ	ΔR/R max.: ±20% (typical value ±10%)
		12 kV ESD test; 100 pulses	ESD contact discharge	ΔR/R max.: ±20% (typical value: ±10%)
4.26		active flammability "Cheese-cloth test"	$5 \times P_n$ (RMS) duration 5 minutes	no flaming of gauze cylinder
Other test in accordance with IEC 60695				
2.2		passive flammability "Needle-flame test"	application of test flame for 20 s	no ignition of product no ignition of under-layer burning time less than 30 s