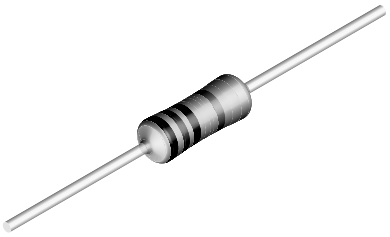
High Voltage Surge Metal Glaze Leaded Resistor



A metal glazed film is deposited on a high grade ceramic body. After that caps are applied to the rods and tinned 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 IEC 60068-2-45.

FEATURES

- High pulse-loading (10 kV as specified) capability (flashes)
- Good replacement for carbon-composite resistors
- Lead (Pb)-free solder contacts
- Pure Tin plating provides compatibility with lead (Pb)-free and lead containing soldering processes
- Compliant to RoHS directive 2002/95/EC

RoHS COMPLIANT

APPLICATIONS

- Application in overload and high voltage pulse hazard circuits (TV-sets, monitors), high power electronic ballasts

TECHNICAL SPECIFICATIONS

DESCRIPTION	VALUE	
Resistance Range (1)	220 Ω to 910 Ω	1 kΩ to 10 kΩ
Resistance Tolerance and Series	± 10 %; ± 20 %; E12 series	
Rated Dissipation, P_{70}	0.5 W	
Thermal Resistance, R_{th}	120 K/W	
Temperature Coefficient	0 ppm/K to + 600 ppm/K	- 600 ppm/K to + 200 ppm/K
Voltage Coefficient	0 to + 350 ppm/V	± 50 ppm/V
Maximum Permissible Voltage $U_{max.}$	$V = \sqrt{Pn \times R}$	
Dielectric Withstanding Voltage of the Insulation for 1 Min	700 V	
Basic Specifications	IEC 60115-1	
Climatic Category (IEC 60068-1)	55/155/56	
Stability After:		
Load (1000 h, P_{70})	ΔR max.: ± (3.0 % R + 0.10 Ω)	
Long Term Damp Heat Test (56 Days)	ΔR max.: ± (3.0 % R + 0.10 Ω)	
Soldering (10 s, 260 °C)	ΔR max.: ± (1.0 % R + 0.10 Ω)	
High Voltage Test for R-Value > 3.3 kΩ, 10 kV; 1 nF; 50 x 12/Min	$\Delta R/R$ max.: ± 20 % (typical value ± 10 %)	
ESD Contact Discharge 12 kV; 100 Pulses	$\Delta R/R$ max.: ± 20 % (typical value: ± 10 %)	

Note
(1) R values below 220 Ω are available on request

PART NUMBER

PART NUMBER: LSR3700001002KA100

L	S	R	3	7	0	0	0	0	1	0	0	2	K	A	1	0	0

MODEL/SIZE	VARIANT	TCR/MATERIAL	VALUE	TOLERANCE	PACKAGING (1)	SPECIAL
LSR3700	**0** = Neutral **Z** = Value overflow (Special)	**0** = Standard	**3 digit value** **1 digit multiplier** MULTIPLIER **9** = $*10^{-1}$ **0** = $*10^{0}$ **1** = $*10^{1}$ **2** = $*10^{2}$	**K** = ± 10 % **M** = ± 20 %	**A1** **R5**	The 2 digits are used for all special parts. **00** = Standard

PRODUCT DESCRIPTION: LSR37 10 % A1 10K

LSR37	10 %	A1	10K
MODEL/SIZE	TOLERANCE	PACKAGING (1)	RESISTANCE VALUE
LSR37	± **10** % ± **20** %	**A1** **R5**	**220R** = 220 Ω **1K2** = 1.2 kΩ

Notes

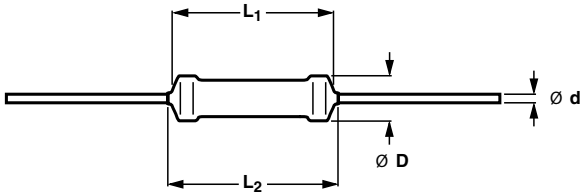
(1) Please refer to table PACKAGING

- The PART NUMBER is shown to facilitate the introduction of a unified part numbering system for ordering products

PACKAGING

MODEL	TAPING	AMMO PACK		REEL	
		PIECES	CODE	PIECES	CODE
LSR37	Axial, 52 mm	1000	A1	5000	R5

DIMENSIONS



Outline

DIMENSIONS - resistor type and relevant physical dimensions

TYPE	Ø $D_{max.}$	$L_{1\ max.}$	$L_{2\ max.}$	Ø d
LSR37	4.0	9.0	10.0	0.7 ± 0.03

MASS PER UNIT	
TYPE	**MASS (mg)**
LSR37	457

MARKING

The nominal resistance and tolerance are marked on the resistor using colored bands in accordance with IEC 60062, marking codes for resistors and capacitors.

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 % 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 60294).

FUNCTIONAL PERFORMANCE

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 60063.

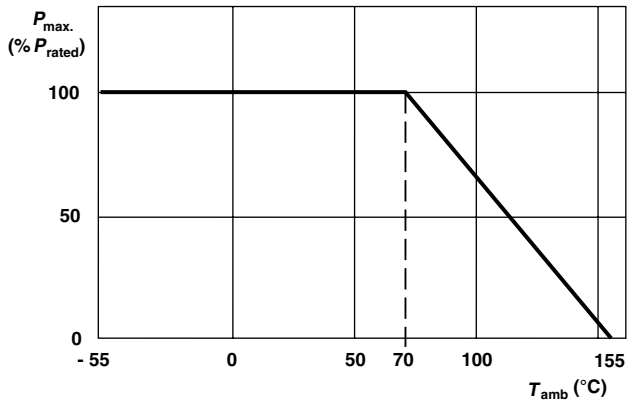
The limiting voltage DC is not applicable, because the maximum rated voltage for the maximum R_n-value of 10 kΩ at P_n = 0.5 W is only 70.7 V.

LIMITING VALUES		
TYPE	**MAXIMUM PERMISSIBLE VOLTAGE $U_{max.}$ (1) (V)**	**RATED DISSIPATION, P_{70} (W)**
LSR37	$V = \sqrt{Pn \times R}$	0.5

Notes

(1) The maximum voltage that may be continuously applied to the resistor element, see IEC 60115-1

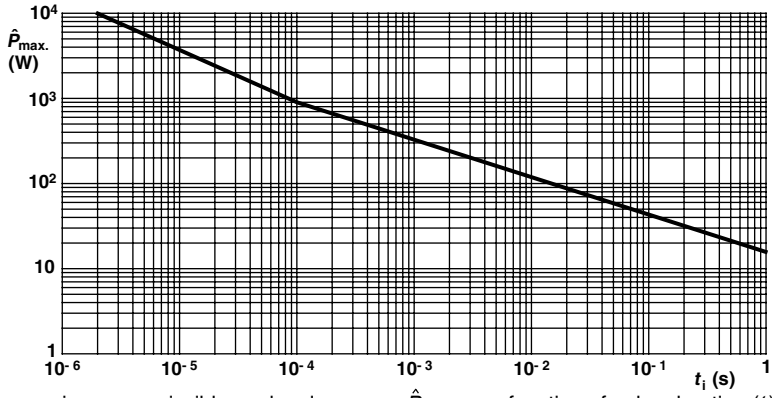
- The maximum permissible hot-spot temperature is 155 °C



Derating

The power that the resistor can dissipate depends on the operating temperature.

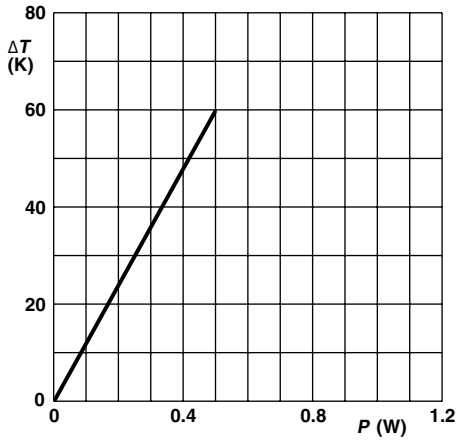
Maximum dissipation ($P_{max.}$) in percentage of rated power as a function of the ambient temperature (T_{amb}).



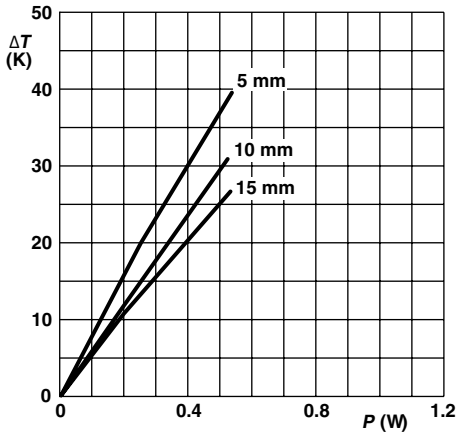
Pulse on a regular basis; maximum permissible peak pulse power $\hat{P}_{max.}$ as a function of pulse duration (t_i) for single pulse condition

Pulse Loading Capability

The resistors with straight leads are suitable for processing on automatic insersion equipment and cutting and bending machines. the minimum pitch for this type is 6e (15 mm). For temperature rise at soldering place see figures below.



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



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

Application Information

TESTS AND REQUIREMENTS

Essentially all tests are carried out in accordance with the IEC 60115-1 specifications, category LCT/UCT/56 (rated temperature range: Lower Category Temperature, Upper Category Temperature; damp heat, long term, 56 days).

The tests are carried out in accordance with IEC 60068-2-xx test method under standard atmospheric conditions according to IEC 60068-1, 5.3.

In the Test Procedures and Requirements table the tests and requirements are listed with reference to the relevant clauses of IEC 60115-1 and IEC 60068-2-xx test methods. 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.

TEST PROCEDURES AND REQUIREMENTS

IEC 60115-1 CLAUSE	IEC 60068-2-xx TEST METHOD	TEST	PROCEDURE	REQUIREMENTS
4.16	21 (U)	Robustness of terminations:		
4.16.2	21 (Ua1)	Tensile all samples	Ø 0.7 mm; load 10 N; 10 s	Number of failures < 10 x 10^{-6}
4.16.3	21 (Ub)	Bending half number of samples	Ø 0.7 mm; load 5 N; 4 x 90°	Number of failures < 10 x 10^{-6}
4.16.4	21 (Uc)	Torsion other half of samples	3 x 360° in opposite directions	No damage ΔR max.: ± (1.0 % R + 0.10 Ω)
4.17	20 (Ta)	Solderability	2 s; 235 °C: Solder bath method; SnPb40 3 s; 245 °C: Solder bath method; SnAg3Cu0.5	Good tinning; no damage
4.18	20 (Tb)	Resistance to soldering heat	Thermal shock: 10 s; 260 °C; 3 mm from body	ΔR max.: ± (1.0 % R + 0.10 Ω)
4.19	14 (Na)	Rapid change of temperature	30 min at - 55 °C and 30 min at + 155 °C; 5 cycles	ΔR max.: ± (1.0 % R + 0.10 Ω)
4.20	29 (Eb)	Bump	3 x 1500 bumps in 3 directions; 40 g	No damage ΔR max.: ± (1.0 % R + 0.10 Ω)
4.22	6 (Fc)	Vibration	Frequency 10 Hz to 500 Hz; displacement 1.5 mm or acceleration 10 g; 3 directions; total 6 h (3 x 2 h)	No damage ΔR max.: ± (1.0 % R + 0.10 Ω)
4.23		Climatic sequence:		
4.23.2	2 (Ba)	Dry heat	16 h; 155 °C	
4.23.3	30 (Db)	Damp heat (accelerated) 1st cycle	24 h; 55 °C; 90 % to 100 % RH	R_{ins} min.: 10^3 MΩ
4.23.4	1 (Aa)	Cold	2 h; - 55 °C	ΔR max.: ± (3.0 % R + 0.10 Ω)
4.23.5	13 (M)	Low air pressure	2 h; 8.5 kPa; 15 °C to 35 °C	
4.23.6	30 (Db)	Damp heat (accelerated) remaining cycles	5 days; 55 °C; 95 % to 100 % RH	
4.24.2	78 (Cab)	Damp heat (steady state)	56 days; 40 °C; 90 % to 95 % RH; dissipation 0.01 P_{70}; limiting voltage $U_{max.}$ 100 V_{DC}	ΔR max.: ± (3.0 % R + 0.10 Ω)
4.25.1		Endurance	1000 h at 70 °C; P_{70} or $U_{max.}$	ΔR max.: ± (3.0 % R + 0.10 Ω)
4.8		Temperature coefficient	220 Ω to 910 Ω	0 to + 600 ppm/K
			1 kΩ to 10 kΩ	- 600 to + 200 ppm/K
4.7		Voltage proof on insulation	U_{RMS} = 700 V during 1 min; V-block method	No breakdown
4.6.1.1		Insulation resistance	U = 500 V_{DC} during 1 min; V-block method	R_{ins} min.: 10^4 MΩ

TEST PROCEDURES AND REQUIREMENTS				
IEC 60115-1 CLAUSE	**IEC 60068-2-xx TEST METHOD**	**TEST**	**PROCEDURE**	**REQUIREMENTS**
4.13		Short time overload	Room temperature; dissipation 6.25 x P_{70}; 10 cycles; 5 s ON and 45 s OFF	ΔR max.: ± (2.5 % R + 0.10 Ω)
		High voltage pulse 10 kV; 1 nF; 50 x 12/min	For R_n > 3.3 kΩ	$\Delta R/R$ max.: ± 20 % (typical value ± 10 %)
		12 kV ESD test; 100 pulses	ESD contact discharge	$\Delta R/R$ max.: ± 20 % (typical value: ± 10 %)
4.26		Active flammability "cheese-cloth test"	Steps of: 5/10/16/25/40 x P_{70} duration 5 min	No flaming of gauze cylinder
4.35		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

12NC INFORMATION FOR HISTORICAL CODING REFERENCE

- The resistors have a 12-digit numeric code starting with 2322 245
- The subsequent 2 digits indicate the resistor type and packing
- The remaining digits indicate the resistance value:
  - The first 2 digits indicate the resistance value
  - The last digit indicates the resistance decade

Last Digit of 12NC Indicating Resistance Decade

RESISTANCE DECADE	LAST DIGIT
47 Ω to 82 Ω	9
100 Ω to 820 Ω	1
1 kΩ to 9.1 kΩ	2
10 kΩ	3

12NC Example

The 12NC for a LSR37, resistor value 1.5 kΩ, 10 % tolerance, supplied on a bandolier of 1000 units in ammopack, is: 2322 245 12152.

12NC - Resistor type and packaging			
TYPE	**TOLERANCE (%)**	**2322 245 .....**	
		1000 UNITS IN AMMOPACK	**5000 UNITS ON REEL**
LSR37	± 10	12...	22...
	± 20	11...	21...

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