



ESL ELECTROSCIENCE

CERAMIC TAPES &
THICK-FILM MATERIALS

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CERMET RESISTOR SYSTEM

33000 SERIES

Resistor Series Designed For Surge Arrestor Applications RoHS Compliant*

The ESL 33000 Resistor Series is specially designed for applications requiring a surge arrester. The resistors are very stable against high voltage pulses. This resistor series is intended for use on 96% alumina substrate. It can be deposited on the substrate by normal screen-printing techniques then fired in a conveyor belt furnace. These resistors are normally used in a serpentine pattern. Adjacent resistance values of the series are blendable. These materials may also be used in power chip resistor applications using compatible ESL materials shown below.

PASTE DATA

RHEOLOGY:	Thixotropic, screen printable paste
VISCOSITY: (Brookfield RVT, 10 rpm, ABZ spindle, 25.5°C±0.5°C)	350±50 Pa·s
SHELF LIFE: (25°C)	6 months

PROCESSING

SCREEN MESH/EMULSION:	325/25 µm
LEVELING TIME: (25°C)	5-10 minutes
DRYING AT 125°C:	10-15 minutes
FIRING TEMPERATURE: (in air)	850°C
TIME AT PEAK TEMPERATURE:	10 minutes
RATE OF ASCENT/DESCENT:	50°C-60°C/minute
SUBSTRATE FOR CALIBRATION:	96% alumina
CALIBRATION TERMINATION:	C-964-A (Ag/Pd)
THINNER:	ESL 413

33000 Series 0611-F

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See Caution and Disclaimer on other side.

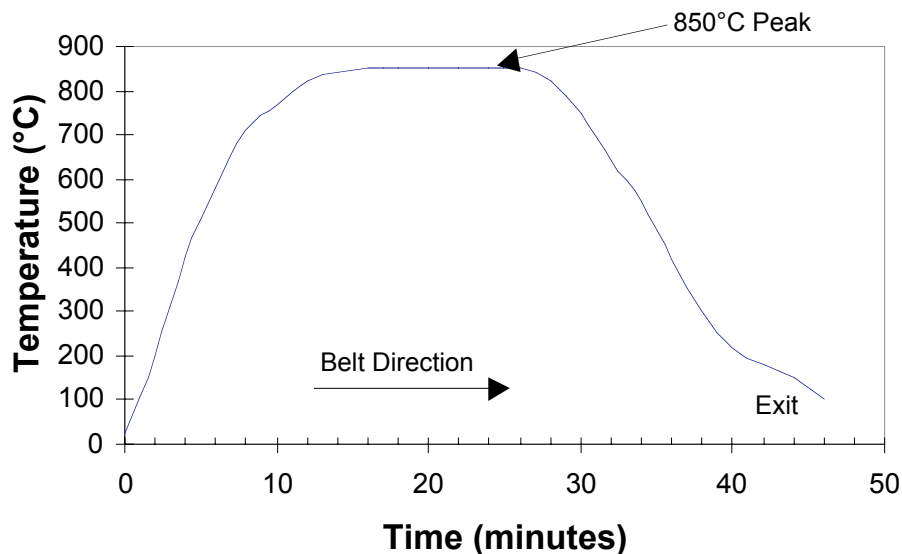
COMPATIBLE MATERIALS

Overglaze ESL G-471 (500°C), G-481 (600°C), 4612-D (850°C)
 Conductor ESL 9912-F (Ag), 9512 (Ag/Pt)

TYPICAL PROPERTIES

	<u>33002</u>	<u>33005</u>	<u>33010</u>	<u>33020</u>	<u>33050</u>	<u>33100</u>	<u>33101</u>
Resistivity, Ω /sq.	0.020	0.050	0.10	0.20	0.50	1.0	10
Tolerance, %	±30	±20	±10	±10	±10	±10	±10
Dried Thickness, μ m	22-27	22-27	18-23	18-23	18-23	18-23	18-23
HTCR, ppm/°C	+400	+200	±50	±50	±50	±50	±50
CTCR, ppm/°C	+500	+200	±100	±100	±100	±100	±100
Pulse Test, ΔR^* , %	≤ 0.1	≤ 0.1	≤ 0.1	≤ 0.1	≤ 0.1	≤ 0.1	≤ 0.1

- * Wave shape:
1. 10 μ sec. x 1,000 μ sec. / 1,000 VDC / 100 A
 2. 2 μ sec. x 10 μ sec. / 2,500 VDC / 500 A
 3. Resistors (200 square serpentine pattern, 1 mm wide) overglazed with 4612-D, fired at 850°C.

Typical 850°C Firing Profile**33000 Series 0611-F**

* None of the six substances referred to in the RoHS Directive (2002/95/EC) are used in the formulation of this product.

CAUTION: Proper industrial safety precautions should be exercised in using these products. Use with adequate ventilation. Avoid prolonged contact with skin or inhalation of any vapors emitted during use or heating of these compositions. The use of safety eye goggles, gloves or hand protection creams is recommended. Wash hands or skin thoroughly with soap and water after using these products. Do not eat or smoke in areas where these materials are used. Refer to appropriate MSDS sheet.

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