DuPont CF Series Buried Resistors

Technical Data Sheet

Product Description

The DuPont CF Series buried resistors are designed to be co-processed with the DuPont™ GreenTape™ 951 low temperature co-fired ceramic system as an integral component of the fired tape structure. The series is comprised of four members ranging from 10 ohms to 10k ohms per square. Adjacent members are blendable to achieve intermediate values. Due to the nature of the buried resistor applications, conventional laser trimming techniques are not applicable. The buried resistors should be positioned symmetrically within the stacked tape layers.

Processing

Terminations

The reported paste properties are based on tests using the DuPont 6142D silver conductor composition as the resistor termination material.

Printing

The resistor compositions should be thoroughly mixed prior to use. This is best achieved by slow, gentle hand stirring using a clean, burr-free spatula (flexible plastic or stainless steel) for 1 – 2 minutes. Care should be taken to avoid air entrapment. Printing should be performed in a clean, well-ventilated area where the room temperature is 20 – 23ºC. For optimum control and print reproducibility, the paste materials should be stored within this temperature range prior to use. Control of print thickness is essential to obtain predictable and reproducible fired resistor properties.

Thinner

The compositions are optimized for screen printing and thinning is not normally required. Use the recommended DuPont thinners to make slight viscosity adjustments or replace solvent losses due to evaporation. The use of too much thinner or non-recommended thinners may affect the materials' rheological and printing properties.

Table 1
Composition Properties

Test	Properties
For CF011 (SC4-14/6R, 10rpm, 25ºC)	50 –120
Viscosity (Pa.s) For CF021, CF031 and CF041 (Brookfield HAT, UC&SP, 10 rpm, 25°C)	90-160
Coverage (cm^2/g)	100 - 120
Thinner	DuPont 8250

Drying

Allow wet prints to level at room temperature; then dry in a well ventilated oven or conveyer dryer for 10 minutes at 80 – 120ºC.

Firing

Fire in a well ventilated belt or static furnace at the recommended GreenTape™ 951 850ºC profile. Air flows and extraction rates should be optimized to ensure that oxidizing conditions exist and no exhaust gases enter the room. Insufficient airflow or a polluted atmosphere within the furnace may result in shifts in resistivity or TCR values. Refer to the GreenTape™ 951 data sheet for the recommended firing profiles. Profile variations may be necessary to accommodate the size of the laminates to be cofired.

General

Performance will vary based on the care exercised during screen printing. Extra caution should be taken to ensure the composition, printing screens and other tools are kept free of extraneous metal contamination. Dust, lint and other particulates may also contribute to poor yields.

Table 2
Typical Fired Resistor Properties [1,2]

Test	Properties			
CF Series	CF011	CF021	CF031	CF041
Sheet resistance (ohms/sq)[3]	10	100	1,000	10,000
Shipping specification (%)[4]	±20	±20	±20	±20
ΔR after 1 refire (%)	+5 to 10	0 to –1	-4 to –6	-8 to –9
ΔR after 2 refires (%)	+5 to 10	0 to –1	-4 to –6	-15 to –18
ΔR after 3 refires (%)	+15 to 20	0 to –2	-4 to –6	-25 to –30
Hot TCR, (25 - 125ºC, HTCR)	±200	±200	±200	±200
Cold TCR (–55 - 25ºC, CTCR)	±200	±200	±200	±200
CTCR and HTCR w/3x refires	±200	±200	±200	±200
ESD [1 pulse at 5kV] (%)	< 0.2	-0.01	-0.01	-5.0 to –7
Quantech noise (db)	-40 to –35	-40 to –35	-25 to –20	-5 to 0
STOL (V/mm)		17 to 18	50 to 55	100 to 120

1 The above date were obtained using DuPont 6142D termination (11 to 14 mm dried thickness), with a 20mm dried resistor thickness and a resistor geometry of 1 mm x 1mm. Resistors are positioned symmetrically in the layer stack.
2 The values quoted are for untrimmed resistors
3 Resistor values are quoted as nominal decade values in ohms per square (ohms/sq)
4 Shipping specifications are 20% of nominal, i.e., > 80 and 120W for DuPont CF021 resistor

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Storage and Shelf Life

Containers should be stored, tightly sealed, in a clean, stable environment at room temperature (<25°C). Shelf life of material in unopened containers is six months from date of shipment. Some settling of solids may occur and compositions should be thoroughly mixed prior to use.

Safety and Handling

For Safety and Handling information pertaining to this product, read the Material Safety Data Sheet (MSDS).

Caution: Do not use in medical applications involving implantation in the human body or contact with internal body fluids or tissue unless the product is provided by DuPont under a formal written contract consistent with the DuPont Policy Regarding Medical Applications of DuPont Materials H-50103-2 ("Medical Applications Policy") and which expressly acknowledges the contemplated use. For additional information, please request a copy of DuPont Medical Caution Statement H-50102-2 and the DuPont Medical Applications Policy.

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